

Planck HFI Instrument FM User Manual

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Planck HFI Instrument User Manual

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This document is the HFI user manual to properly operate the FM instrument from early Instrument Level Test to in-flight fully operational observation mode.

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Draft	00	September 30, 2003	N/A	Creation
Draft	01	October 2, 2003	N/A	Cosmetic corrections
Draft	02	April 30th, 2004		Sections re-ordered as per ESOC requirement Update and increase of provided data
Draft	03	May 4, 2004		Modifications from R.PONS Pages : 46
Draft	04	July 13, 2004		General update in compliance with IID-B revision proposal submitted this month to Alcatel and ESA
Draft	05	Sept. 30, 2004		General review and update This issue should be followed soon by new inputs from instrument CQM ILT
1	0	Jan. 15, 2006		First FM orientated issue General review and update, including changes triggered by ESOC comments on previous issue An updated TM/TC list is provided separately as well as preliminary CQM command sequences derived from HFI CSL test.
1	1	March 2006		Figure 5.2.1-1 updated Table 13.3-1 updated (+1.021kg for DPU harnesses) Table 13.4-1 updated
1	2	September 06		General update
1	3	November 06		New General update (FDIRs) as shown by change tracking tool + Power dissipation tables 13.1-1 & 13.4-1 and Mass table 13.3-1
1	4	14 Dec. 06		Reference to HFI CQM deleted General update Chapter 8 (FDIR) deleted
1	5	April 07		General update Add Flight Operation Procedures
2	0	December 07		General update
2	1	October 08		ALL correction are in red or ~~red~~ - Slight modification of flight procedure following SVT1: * NXTF_HFI_STARTUP_RETURN and 4SWR_HFI_4K_SW_RESET for which the reception of TM(1,8) + LSL and SW ERROR are normal * 4SWR_HFI_4K_SW_RESET, 4COB_HFI_4K_CONTINUE_BOOT and HFI_4K_REU_FREQUENCY_CHANGE to increase the delay at 2mn15s between the 2

				procedures * NMON_HFI_BOOT_TO_STARTUP: Add note about expeted reception of event (5,2) REUFpgaOn * NMOF_HFI_NOMINAL_SWITCH_OFF and RMOF_HFI_NOMINAL_SWITCH_OFF : Add note about expected reception of event (5,2) 4KRestartOn, DCERestartOn and REUFpgaOn - NTSN_HFI_STARTUP_TO_STANDBY : Add check about expeted reception of event (5,2) REUFpgaOff - remove the following procedures : MACRO :procedures HFI_PID_4K_SETUP_AND_ACTIVATION_NOM HFI_PID_4K_SETUP_AND_ACTIVATION_RED HFI_PID_1_6K_SETUP_AND_ACTIVATION_NOM HFI_PID_1_6K_SETUP_AND_ACTIVATION_RED HFI_PID_DILU_SETUP_AND_ACTIVATION_NOM HFI_PID_DILU_SETUP_AND_ACTIVATION_RED HFI_PID_BOLO_SETUP_AND_ACTIVATION_NOM HFI_PID_BOLO_SETUP_AND_ACTIVATION_RED Elementary procedures not used in flight: HFI_STANDBY_TO_4K_MAINTENANCE HFI_4K_MAINTENANCE_TO_STANDBY 4SRS_HFI_4K_DO_SRT_FROM_STANDBY - Rename macro procedure HFI_OPTIM_FINE_ALL_BOLO in HFI_OPTIM_ALL_BOLO_1_2_and_FINAL - Add maco procedures : HFI_ELEC_CHECK_100K_and_1K, HFI_ELEC_CHECK_300mK, HFI_ELEC_CHECK_100mK, HFI_RAW_72 - Add procedures to restart only the DPU or only the REU : HFI_DPU_NOMINAL_RESTART HFI_DPU_REDUNDANT_RESTART HFI_DPU_NOMINAL_RESTART HFI_DPU_REDUNDANT_RESTART - Add procedures to reset the REU analog belts: HFI_REU_FPGA_RESET - replacement of the word "eventually" by the word "possibly" due to a wrong French interpretation of the meaning of eventually in

				English ! - correction of wrong HDxxx280 for cernox's resistance in HSK description - Modifications of some monitoring limits - Modification of the DPU RAW mode description - add an indication of the behaviour of the DPU in case of CDMU reset or switchover (7.2.1.7) - Modification of the runcooler TC start condition in the TC description (was OK in the procedure) - Place the table that indicates in which modes HFI different memories can be patched, checked or dumped in the correct § Memory Management - add complementary info in §9.2 OBSW Physical description ROM / RAM, and memory areas definition - modify the DPU, REU and 4K ASW load procedure (§11.1) - modification of the cooling down and commissioning sequence following CSL FM test lessons learned - modification of the ground launch campaign operationnal constrainst - update and corrections in §2.2.8 "The Dilution Cooler Subsystem" following the CSL test - Add complements descriptions for the REU PID's command - Add contingency and recovery description

Distribution List

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HFI Consortium	HFI Web
ESOC/MOC/	
THALES	
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Acronyms

ABCL	As Built Configuration List
AD	Applicable Document
AO	Announcement of Opportunity
API	Application Programming Interface
AIT	Assembly Integration & Test
AIV	Assembly Integration & Verification
AVM	Avionics Model
BOL	Begin Of Life
CC	Configuration Control
CCB	Configuration Control Board
CCS	Central Checkout System
CEA	Commissariat à l'Energie Atomique
CESR	Centre d'Etudes Spatiales des Rayonnement
CIDL	Configuration Item Data List
CIT	California Institute of Technology
CMB	Cosmic Microwave background
CMP	Configuration Management Plan
CNES	Centre National d'Etudes Spatiales
COBRAS	COsmic Background Anisotropy Satellite
Co-I	Co-Investigator
COTS	Commercial Off The Shelf Software
CPAC	Cambridge Planck Analysis Center
CQM	Cryogenic Qualification Model
CRTBT	Centre de Recherche sur les Très Basses Températures
CS	(HFI science data) Compression Slice
CWG	Commonality Working Group
DCCU	Dilution Cooler Control Unit
DCE	Dilution Cooler Electronics
DCP	Dilution Cooler Pipes
DMS	Document Management System
DPC	Data Processing Centres
DPCM	Data Processing Centres Manager
DPU	Data Processing Unit
DSN	Demie Somme Numérique
DSP	Digital Signal Processing
DSRI	Danish Space Research Institute
ECR	Engineering Change Request
EGSE	Electric Ground Support Equipment
EOL	End Of Life
EP	Entrance Pupil
ESA	European Space Agency
ESOC	European Space Operations Centre
ESTEC	European Space Technology and Research Centre
EVL	Event Logger
FINDAS	FIRST Integrated Network And Data Archive System
FIRST	Far InfraRed and Sub-millimetre Telescope
FOG	Fiber Optic Gyroscope
FOV	Field-Of-View
FPA	Focal Plane Assembly
FPDA	Focal Plane Detection Assembly
FPGA	Field Programmable Gate Array
FPS	Focal Plane Structure
FPU	Focal Plane Unit
FS	Flight Spares
GSU	Gas Storage Unit
HEMT	High Electron Mobility Transistor
HFI	High Frequency Instrument
HK	House-Keeping
HSL	High Speed Link
HTML	Hyper Text Mark-up Language
HTTP	Hyper Text Transport Protocol
H/W	Hardware
HWCI	Hardware Configuration Item
IAS	Institut d'Astrophysique Spatiale
IC	Imperial College
ICD	Interface Control Document
IDIS	Integrated Data and Information System
IDIS-DT	IDIS Development Team
IDIS-MT	IDIS Management Team
IDOC	IAS Data and Operation Center
IID-A	Instrument Interface Document, Part A
IID-B	Instrument Interface Document, Part B
ILT	Instrument Level Test
IN2P3	Institut National de Physique Nucléaire et de Physique des Particules
IS	Instrument Scientist
ISDC	Integral Science Data Center
ISSS	Isotopes Supply & Storage System (PGSE)
ISU	Isotopes Supply Unit
IUM	Instrument User Manual
IWS	Instrument Work Station
JPL	Jet Propulsion Laboratory
LAL	Laboratoire de l'Accélérateur Linéaire
LAN	Local Area Network
LCL	Latching Current Limitor
LEOP	Launch & Early Orbit Phase
LFI	Low Frequency Instrument
LM	Local Manager
LOS	Line Of Sight
LPCC	Laboratoire de Physique Corpusculaire et Cosmologie
LSL	Low Speed Link
MCS	Mission Control System
ME	Main Electronics
MIB	Mission Information base
MGSE	Mechanic Ground Support Equipment
MLI	Multi Layer Insulation
MOC	Mission Operations Centre
MOS	Margin Of Safety
MPA	Max Planck Institut für Astrophysik
MRB	Material Review Board
MSTK	Manual Stack
N/A	Not Applicable
NCR	Non Conformance Report
NIR	Near Infra Red
NTD	Neutron Transmuted Doped
OAT	Osservatorio Astronomico di Trieste
OBC	On-Board Clock
OBCP	On-Board Control Procedure
OBSW	On Board Software
OIRD	Operations Interface Requirement Document
OGS	Operational Ground Segment
OGSE	Optics Ground Support Equipment
OOL	Out Of Limit
PA	Product Assurance
PAU	Pre Amplifier Unit (of HFI)
PDF	Portable Document Format (Adobe Acrobat)
PFM	Proto-Flight Model
PGSE	Pneumatic Ground Support Equipment
PI	Principal Investigator
PLM	Payload Module
PM	Project Manager
POSDAC	Paris Orsay Data Analysis Centre
PPL	Preference Part List
PPLM	Planck Payload Module
PR	Public Relations
PS	Project Scientist
PSF	Point-Spread-Function
PSU	Power Supply Unit
QA	Quality Assurance
QLA	Quick Look Analysis
QMW	Queen Mary and Westfield College
QPL	Qualified Part List
RAL	Rutherford Appleton Laboratory
RD	Reference Document
REU	Readout Electronic Unit
RFW	Request For Waiver
RH	Relative Humidity
RMS	Root Mean Square
RTA	Real Time Analysis
RTK	Real Time Kernel
S/C	Spacecraft
SAMBA	Satellite for Measurement of Background Anisotropies
SCMP	Software Configuration Management Plan
SE	System Engineer
SIP	Science Implementation Plan
SMT	(HFI) Science Modelling Team
SPMP	Software Project Management Plan
SQAP	Software Quality Assurance Plan
SRR	Software Requirements Review
SS	Survey Scientist
SSD	Space Science Department (ESTEC)
SVM	Service Module
S/W	Software
SWCI	Software Configuration Item
TBC	To Be Confirmed
TBD	To Be Determined
TBN	To Be Nominated
TBW	To Be Written
TC	Tele-Command
TM	TeleMetry
TMP	Telemetry Packet
TMPH	Telemetry Packet History
TRB	Test Review Board
UM	User Manual
URD	User Requirements Document
WFE	Wave Front Error
WP	Work Package
WU	Warm Unit(s)

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1 INTRODUCTION

1.1 Purpose and scope

There are two main controlled sources of information used to operate HFI Flight Model:

- the HFI Database that is delivered to Thales for validation, use during ground testing and finally transmit to Planck Mission Operation Center at ESOC,
- the present Instrument User Manual (IUM).

The IUM and the TM/TC MIB files (database) are self-contained documents including all the information necessary to properly operate the FM instrument from early Instrument Level Test to in-flight fully operational observation mode.
In case of discrepencies between the information given in the IUM and the reference documents, the information of the IUM always prevail.
In case of discrepencies between the information given in the TM/TC MIBS files and the reference documents, the information of the TM/TC MIBS always prevail.

Data not included

This IUM, is not a user manual for the HFI mechanical and electrical integration. As a consequence, information such as pin allocations, harness interconnexion, mechanical interfaces, , are not given in this document. These information can be found in the different ICD's given as reference documents.
This IUM is only relevant for the flight model and not for the CQM and AVM model.
This IUM is not a user manual for HFI integration.

1.2 Documents

1.2.1 Applicable Documents

AD1: “FIRST/Planck Instrument Interface Document IID Part A”
PT-IID-A-04624
AD2: “HFI Instrument Documentation Template“
TE-PH111-100058-IAS“

1.2.2 Reference Documents

RD1 : “HFI TCP & TMP List (For PFM and FS)”
LI-PH921-500630-IAS V4.5
RD2 : “ME Interface Control Document”
IC-PHB293-300039-LAL V2.5
RD3 : “ME OBSW ICD A”
IC-PHB293-200031-LAL V3.7
RD4 : “ME OBSW ICD B”
IC-PHB293-400152-LAL V3.2
RD5 : “ASW architectural design”
IC-PHB293-400147-LAL V3.2
RD6 : “BSW architectural design”
IC-PHB293-300094-LAL V2.5

RD7 : “REU user manual”
UM-PHCB280-400129-CESR V1.4
RD8 : “HFI Readout Electronics Unit Interface Control Document (ICD)”
IF-PHCBC282-200050-CESR V4.0
RD9 : “HFI REU-DPU I/F SPECIFICATIONS”
IF-PHCB280-100017-CESR V2.3
RD10 : “Isotope supply unit dilution cooler electronic unit interface document”
IF-PHEBB-300236-AIRL V1.0
RD11 : “Dilution cooler ICD”
IC-PHEBB-600892-LPSC V1.0
RD12 : “Dilution Cooler Electronics FPGA”
TD-PHEBB-300102-ISN V1.2

RD13 : “4KCCR Pre-regulator User Manual”
CDE-MA-CRS-0039 V1.0
RD14 : “Planck HFI 4KCDE TM/TC list”
LI-PHDC-000014-SEA V5.0
RD15 : “Planck HFI 4KCDESoftware User Manual”
UM-PHDC-000056-SEA V2.0

1.2.3 Normative References

NR1 Herschel/Planck Operations Interface Requirements Document (SCI-PT-RS-07360)

1.2.4 Informative References

2 HFI DESCRIPTION

2.1 HFI Scientific objectives

The Planck High-Frequency Instrument (HFI) is designed to carry out high-sensitivity, multi-frequency microwave measurements of the diffuse sky radiation in the frequency range 83-1000GHz.
These measurements will be used, together with those from the Low-Frequency Instrument (LFI), to produce a map over most of the sky of the anisotropies of the Cosmic Microwave Background (CMB). This map will in turn be used to constrain the main parameters that determine the large scale structure of the Universe.
The accuracy with which the cosmological parameters can be determined from CMB anisotropies measurements increases rapidly with angular resolution and the accuracy of the measurements. New sub-Kelvin bolometer technology allows to perform such measurements through the whole range of spatial frequencies containing cosmological information and with an accuracy limited only by fundamental limits (photon noise and the understanding of the foregrounds). These goals set the requirements on the HFI instrument: coverage in frequency from 83GHz where the ratio of CMB intensity to foregrounds is largest up to 1000GHz where the dust emission foreground dominates and can be mapped to be subtracted at lower frequencies. The angular resolution is 5 arc minutes and an almost full sky coverage is required to insure both sensitivity of CMB measurements and good understanding of the galactic emission. It has been shown that the HFI foreseen polarization measurements are extremely important to further constrain cosmological models and to introduce an independent check that no undetected systematic effect has affected the conclusions derived from the intensity measurements.

The heart of the HFI - the detectors - are bolometers, solid-state devices in which the incoming radiation dissipates its energy as heat that increases the temperature of a thermometer. The instrument Flight Model total number of bolometers is 52, split into 6 channels at central frequencies of 100, 143, 217, 353, 545, and 857GHz.
The placement of the channels in frequency space has been optimised, not only to remove the foregrounds (mainly dust emission at these high frequencies) and recover the CMB, but also for the detection of the Sunyaev-Zeldovich effect. Thirty two of these bolometers are polarization sensitive allowing a map of the CMB polarisation to be built.
The characteristics and expected capabilities of the HFI channels are described in Table 2.2.1-4.

2.2 Hardware Description

2.2.1 The Focal Plane Unit (FPU)

The function of this unit is the detection at 0.1K. It is the most sensitive part of the instrument in terms of thermal radiation and electromagnetic field. The detection subsystem integrates feed-horns, spectral filters, and solid states detectors (bolometers). It also includes the following cold end units of the cooling system: "18K", "4K", "1.6K" and "0.1K".
The description of heat switches for the cryo-cooling chain is to be found in section 2.2.8.2.

One has also to mention the presence at the “rear” of the FPU of a venting hole which is composed of charcoal inserted between two sintered material filters. The charcoal “trap” proved very useful on ground to trap possible residual Helium present in the test facilities. Should this device become saturated by accumulated Helium, it can be regenerated by heating the whole FPU inner stages up to about 12K or more while the FPU is under vacuum. This can be obtained by proper management of the cooling system.

2.2.1.1 Cold Optics (General)

The FPU is one of the critical parts of the HFI. To achieve the required sensitivity and speed of response HFI uses ‘state of the art’ bolometric detectors cooled to 100 mK. Emission from foreground objects will be removed from the sky maps by measuring over a wide frequency range to discern the spectral nature of point like sources and thus authorising their removal. HFI is therefore a multi-band instrument with 6 bands centred between 100 and 850 GHz. Further, the critical cosmological information is contained within the cleaned spatial maps. To obtain complete spatial sampling it is therefore necessary that the HFI contain sufficient pixels at each frequency to ensure that complete sky coverage is maintained in the cross-scan direction as the satellite attitude is incremented to map the sky.

In addition, all the critical CMB channels (between 100 GHz and 357 GHz) use Polarization Sensitive Bolometers (PSBs) which allow simultaneous detection of the orthogonal polarization signals from a single sky horn. To enable the degree and direction of any polarized emission to be determined it is necessary that a neighbouring channel(s) be configured to detect the polarized emission at 45 degrees to this pair. The focal plane is therefore a complex configuration of 36 sky horns with 52 detectors that provides the polarization, spectral and spatial coverage required to fulfill all the scientific requirements. Figures 2.2.1.1-1 and 2.2.1.1-2 show schematics of the HFI focal plane concept and layout.

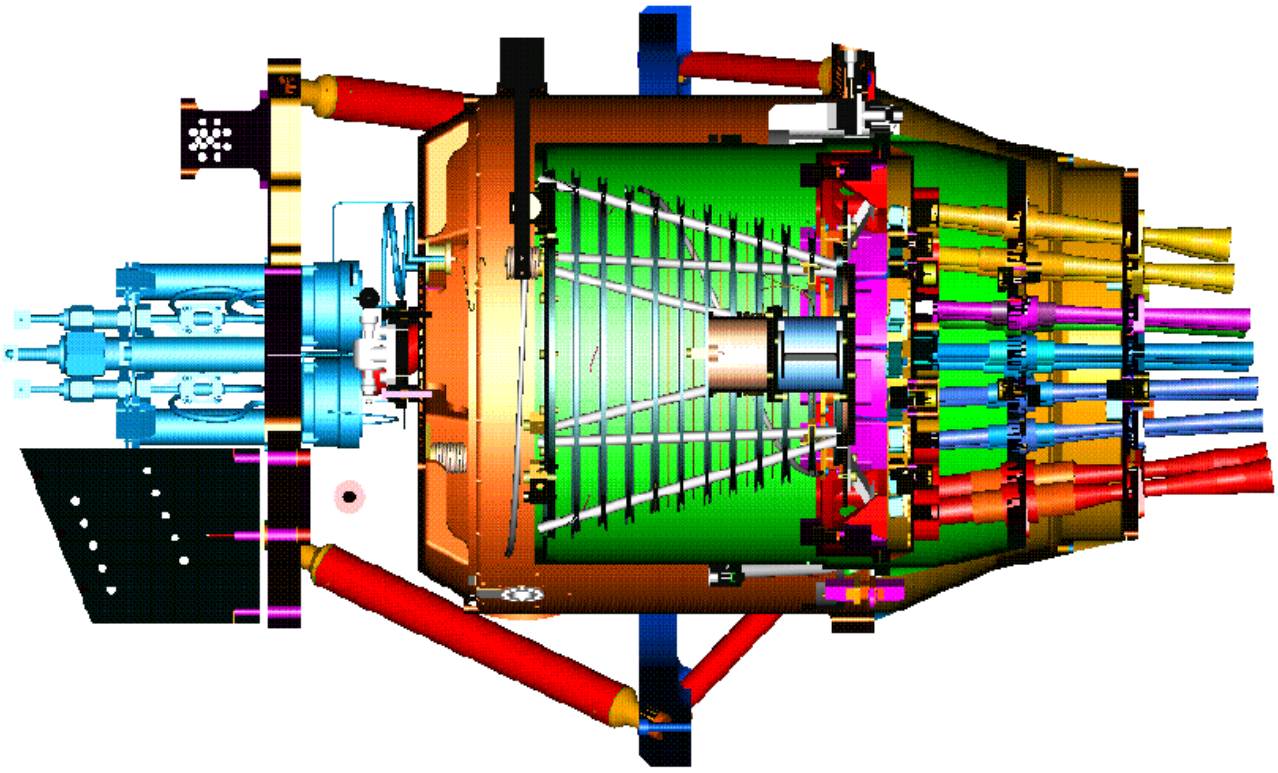


Figure 2.2.1.1-1: HFI Focal Plane Unit concept

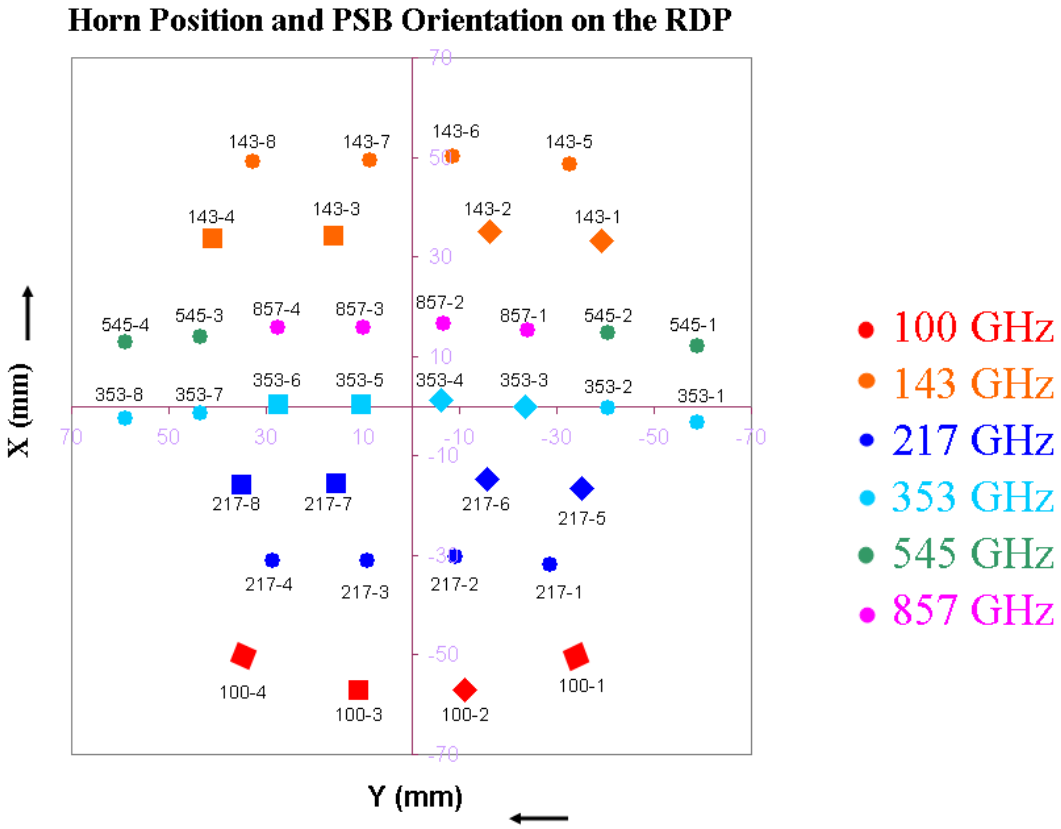


Figure 2.2.1.1-2: HFI Feed-horns repartition in Telescope Focal Plane

2.2.1.2 Beam definition : Horns

To detect anisotropies at a level of $1:10^6$ in the CMB it is essential that the sensitivity of HFI to unwanted scattered or diffracted energy is minimised. To achieve this the field of view of the HFI detectors is determined by naked horns in the FPU which have a well determined angular response thereby allowing control of the stray fields whilst coupling efficiently to the wanted energy. It is important that no apertures or filter components are placed in front of these horns as these structures will diffract radiation and enhance the side-lobe response. To spectrally filter the radiation it is then necessary to use a second horn to create a beam-waist where quasi-optical metal mesh filters can be employed. This is then followed by a third horn that feeds the radiation to the absorbing web in the detector cavity. Figure 2.2.1.2-1 shows a schematic of this triple horn feed concept for a single channel. This design naturally offers thermal breaks between the 100mK detectors, the filters and the focal plane horns as can be seen in the figure. To minimise the heat load on the detectors the filters will be mounted to an intermediate shield at a temperature of 1.6 K whilst the front end back-to-back horn pair will be mounted to the “4 K” shield.

Sub-millimetric radiation absorbing material is present locally between the 1.6K plate and the 100mK one in order to eliminate straylight due to multiple reflections inside the Focal Plane Unit enclosure.

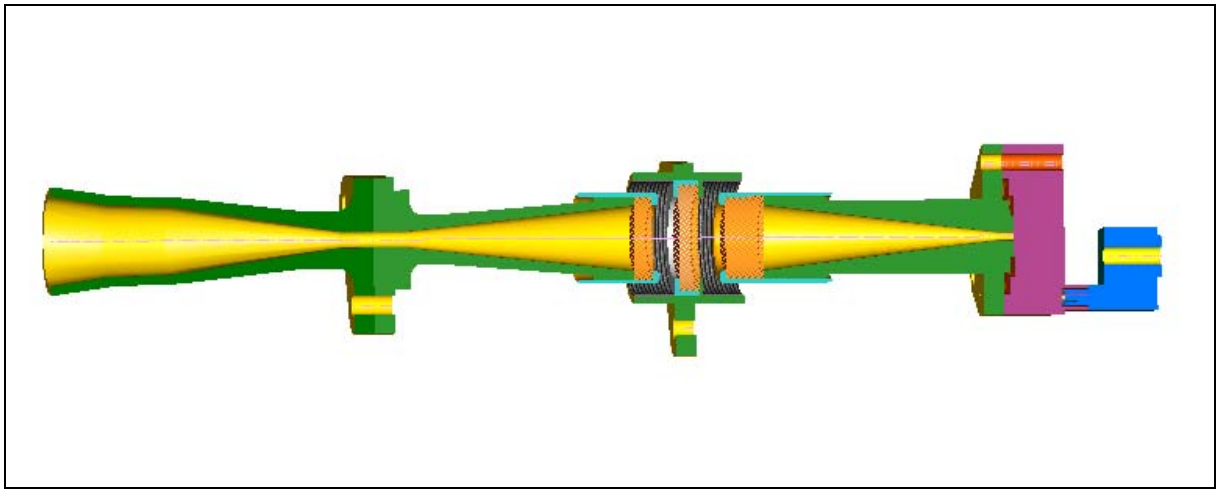


Figure 2.2.1.2-1: HFI FPU single channel optics.

All the horns are corrugated, which gives excellent control of beam pattern whilst maintaining high coupling efficiency and minimizing any cross-polarization effects in the optical feeds.

2.2.1.3 Bandpass definition : Filters

The spectral pass-band of the system is defined by a combination of wave-guide cut-off and quasi-optical metal mesh filters. For all the CMB channels (100 GHz to 357 GHZ) the wave-guide between the front and back horn pair determines the long-wave cut-off with metal mesh filters determining the short-wave cut-off. The two highest frequency channels (547 GHz and 857 GHz) require that the beam-width on the sky is maintained at 5arcmin to enable full sky sampling. To achieve this the wave-guide between the front and back horn pair is widened to allow more wave-guide modes to

propagate and hence widen the beam on the sky. The long-wave cut-off for both these channels is effected using a high-pass quasi-optical metal mesh filter in the stack.

All the channels have additional metal-mesh blocking filters to reject small high frequency leaks in the system. The total rejection achieved is ~10^9 which meets with the requirements in the NIR/optical regions.

2.2.1.4 Detectors

The detectors are semi-conducting NTD thermistor bolometers. They are mounted either on an absorbing spider-web of metallised silicon nitride or on a parallel absorbing grid of metallised silicon nitride for the PSB modules. The detectors operate at a temperature close to 100 mK, while the filters are distributed on the 100mK, 1.6 K, and 4 K stages in such a way that the heat load on the coldest stages is minimized to limit the heat load on the detectors as already mentioned and marginally to decrease the heat lift requirement and thus enhance the mission lifetime. It is also important that the self-emission of the 4K stage is minimised to limit the photon noise contribution on the detectors from the instrument.

Finally, as already mentioned, HFI FPU accommodates sub-millimiter absorbing material in order to decrease the scattering inside it.

Central Frequency (GHz)	857	545	353	217	143	100
Centre Wavelength (mm)	0.35	0.55	0.85	1.38	2.1	3.0
Bandwidth (GHz)	283	180	116	72	47	33
Number of unpolarised bolometers	4	4	4	4	4	0
Number of polarised bolometers	0	0	8	8	8	8
Angular resol. (FWHM, arcmin)	5	5	5	5	7.1	9.5
dT/T CMB Sensitivity (Intensity) microK/K	6700	147	14.7	4.8	2.2	2.5
dT/T Sensitivity (U&Q) polarised	-	-	29.8	9.8	4.2	4.0
Flux sensitivity per pixel (mJy)	49	43	27	14	10	12

Table 2.2.1.4: Characteristics and Sensitivity of the HFI different FM channels

Bolometers do not provide relevant data at ambient temperature. This is why besides bolometers the FPU is equipped with a few high impedance devices simulating at room temperature the behaviour and susceptibility to EMI of the bolometers. Signal from these “dummy” detectors are processed by J-FETs and readout electronics identical to that of the bolometers and provide telemetry data at the same rate as the fast bolometric channels.

2.2.2 The J-FETs Box

The bolometers and high sensitivity cryo-thermistors are read out via J-FETs which must be located close to them, but must at the same time be thermally insulated from them. They are enclosed in a 50/60K box (the J-FETs must operate at approx. 120 K).

The J-FETs provide for the impedance matching with the following stages of amplification which are located farther from the detectors.

- For bolometers, belts 0 to 8, the injection capacitors are 4.7pF
- For thermometers, 9 to 11, the injection capacitors 27pF
- For resistor and capacitor channels, belts 10-0 & 10-1, the injection capacitors are 4.7pF.

Note also that all channels have 40 Gohm discharging resistors but for channels 10-0 and 10-1 (resistor and capacitor channels) that have 1Gohm.

The J-FETs and bolometers are located into a common Faraday cage.

The JFETs are insulated from the 50/60K environment by means of low conductivity supports integrated in the printed circuit board. All the electrical connections are made with small cross-section manganin wires, while radiative transfer is reduced by means of multi-layer super-insulation.

Dedicated heaters and calibrated thermometers allow the control (by the REU) of the JFETs‘ temperature in the optimal range

The J-FETs are not redundant, a pair of J-FETs is however dedicated to each 72 bolometer/thermometer differential measurement. Twelve JFET modules with six differential channels per module are present to provide current amplification for all the bolometers and the high sensitivity cryo-temperature sensors. The noise introduced by the JFETs is less than 4 $nV/Hz^{1/2}$, the input impedance is much larger than 1Gohm and the output impedance is of the order of a few hundred ohms. Cross-talk between channels in the same module is $<10^{-3}$. Special care has been taken to reduce EMI in the J-FET box by means of careful RF sealing of the box and of the connectors.

2.2.3 The Pre Amplifier Unit

The PAU preamplifies (gain ≈ 1020) the signals coming from the JFET box and provides them, after removing the residual modulation component, to the REU through an interconnecting harness about 3.5 meters long.
The PAU provides also the polarisation to the detectors via the JFET box.
The PAU consists in 12 identical 6 channels analog modules.

2.2.4 The Readout Electronic Unit

The readout electronics of the bolometers and of the cryo-thermometers is based on a system able to cover the frequency range needed for HFI, i.e. 0.016 Hz to about 100Hz. This system uses a differential AC square bias current and has a uniform noise

performance: 5nV/Hz $^{1/2}$, i.e. less than the Johnson noise of the bolometers, over most of the useful frequency range.

This system allows a full control of the current and voltage of the measured resistor, so that in-flight optimisation of the bias voltage is possible.
Dedicated thermometers and heaters allow the knowledge of the different FPU stages temperature. For that, the Readout Electronics have to manage the 0.1K stage temperature measurements at bolometer and dilution plates, the 1.6K stage temperature measurements and the 4K stage temperature measurements.

Each bolometer/thermistor is handled by its own Modulation/Amplifier circuit. Groups of 6 such modules are digitally interfaced to a programmable circuit (FPGA component) which controls the modulation/amplifier parameters and performs the demodulation of the AC signal. For the HFI PFM a main processor handles 12 such modules for a total of 72 measurement chains: 52 bolometers, 2 dark-bolometers, 1 test impedance and 1 10Mohm resistor (to allow system tests at room temperature) and 16 thermometers.

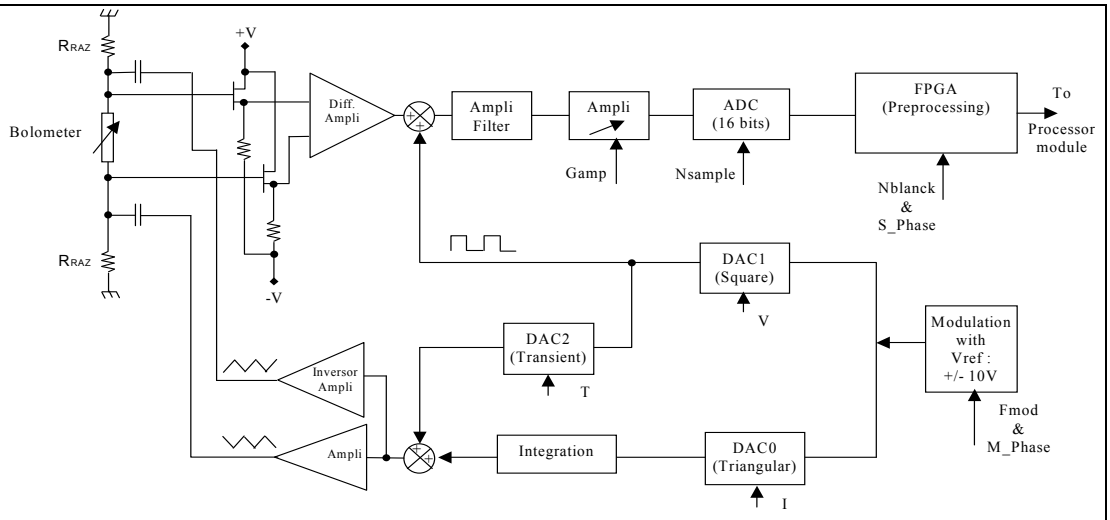


Figure 2.2.4-1: Functional scheme of a measurement channel (Differential system)

The Readout Electronics is splitted in two units used in series: the Pre-Amplifier Unit (PAU) and the Readout Electronic Unit (REU).

The full PFM PAU and REU are composed of 12 analog modules which are numbered 0 to 11 (Nbelt) and in each module there are 6 devices numbered 0 to 5 (Nchannel). On top of these 12 analog “belts” the REU includes 2 redundant “processor” belts.

These 12 blocks are connected to a processor module which manages the whole readout electronics.

The other functions of the Readout Electronics Unit are:

- to decode dedicated commands sent by the DPU and to control the various parameters of the Modulation/Amplifier card and the Digital pre-processing,
- to decode the commands received from the DPU for the parameters of the 5 PIDs used for the FPU temperature control,

- to compute 5 PIDs' commands from thermometer measurements and to adjust the heater current within a time delay compatible with the thermometer time response,
- in a commanded mode : to adjust the working point for each measurement chain,
- in a commanded mode : to measure for all bolometers, V(I) by incrementing I in a given range,
- to collect data from all bolometers and thermometers, and send them at modulation rate to the DPU, as well as housekeeping parameters of the Readout electronics,
- to monitor the raw signal from each measurement channel,
- to monitor the cooling down and warm-up processes with 12 cryo-thermometers,
- to control the general functioning of the Readout and generate a number of different general housekeeping words,
- to control the 4K – 1.6K Heat Switch,
- to power and heat, the JFET Box and read its temperature sensors,
- to supply and adjust the modulation frequency for the 72 channels,
- to supply the 4K cooler synchronization clocks.

For test purpose the REU is also able to substitute transmition to the DPU of known content default science data in place of nominal one if required by command.
In this mode, the READOUT send science data telemetry to the DPU. The science data fields are replaced by :

$$RawSignal(t) = Belt_ID * 6 + Channel_ID + t$$
$$DSN_{+} = 32768 + 100 * (Belt_ID * 6 + Channel_ID)$$
$$DSN_{-} = 32768 - 100 * (Belt_ID * 6 + Channel_ID)$$

t is the number of sample (0 to 90)
(DSN going for "Demie Somme Numérique" in french).

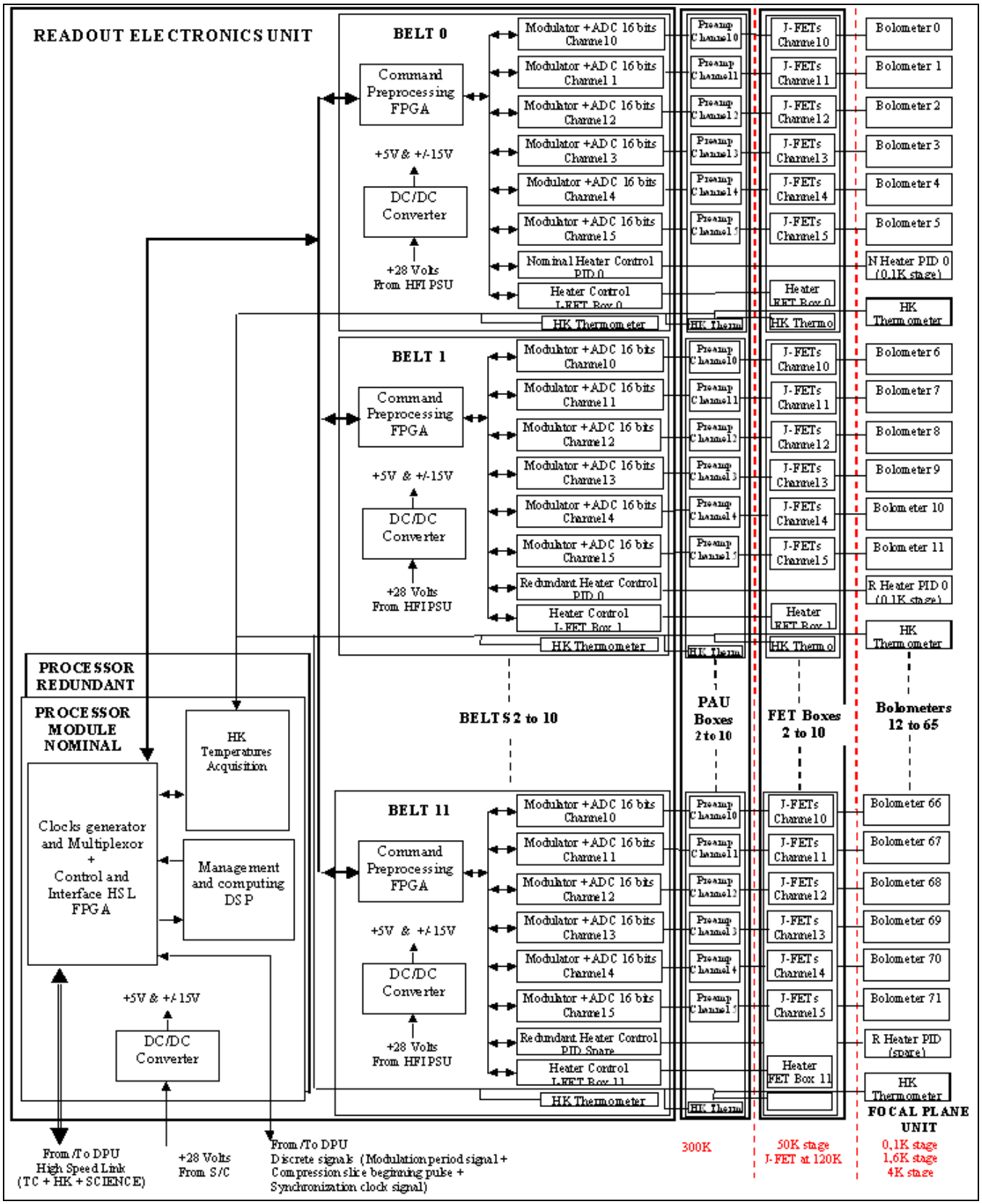


Fig 2.2.4 – 2: READOUT electronics architecture layout

Nbelt / Nchannel	0	1	2	3	4	5
0	100-1a	100-1b	143-1a	143-1b	217-1	353-1
1	143-5	217-5a	217-5b	353-2	545-1	Dark 1
2	100-2a	100-2b	217-2	353-3a	353-3b	857-1
3	143-2a	143-2b	353-4a	353-4b	545-2	857-2
4	100-3a	100-3b	143-6	217-6a	217-6b	353-7
5	143-3a	143-3b	217-3	353-5a	353-5b	545-3
6	143-7	217-7a	217-7b	353-6a	353-6b	857-3
7	143-8	217-8a	217-8b	545-4	857-4	Dark 2
8	100-4a	100-4b	143-4a	143-4b	217-4	353-8
9	Thermo_ 0.1K N°1	Thermo_ PID BOLO Nom	Thermo_ PID DILU Nom	Thermo_ 1.6K N°1	Thermo_ PID1.6 Nom	Thermo_ PID4 K Nom
10	10Mohm resistor	Capacitor	Thermo_ 0.1K N°2	Thermo_ 1.6K N°2	Thermo_ 4K N°1	Thermo_ 4KL N°1
11	Thermo_ PID BOLO Red	Thermo_ PID DILU Red	Thermo_ PID1.6K Red	Thermo_ PID 4K Red	Thermo_ 4KH N°2	Thermo_ 4KL N°2

Note : In reference documents, PID DILU can also be named PID1 and PID BOLO can also be named PID2

Table 2.2.4 – 3: HFI PFM Readout Channels configuration

	Band I 100 GHz	Band II 143 GHz	Band III 217 GHz	Band IV 353 GHz	Band V 545 GHz	Band VI 857 GHz	Dark Bolo BOLO PLATE	Capa + Resis. BOLO PLATE	Ther 0.1K BOLO PLATE	Ther 0.1K BOLO PLATE PID2	Ther 0.1K DILU PLATE PID1	Ther 1.6K STAGE	Ther 1.6K STAGE PID1.6	Ther 4K STAGE PID4	Ther 4K STAGE	Heater PID DAC 0 DAC 1	Heater JFET DAC 2	HK Cryo Cernox	HK JFET Ther	HK PAU Ther
Module 0	1 (P)	1 (P)	1	1												PID BOLO N	1	0.1K Dilu N	1	1
Module 1		1	1 (P)	1	1		1									PID DILU N	1	1.6K Stage N	1	1
Module 2	1 (P)		1	1 (P)		1										PID 1.6K N	1	4K Stage N	1	1
Module 3		1 (P)		1 (P)	1	1										PID 4K N	1	4K Th Sw N	1	1
Module 4	1 (P)	1	1 (P)	1												Th Switch 4K-1.6K N	1	18K Stage N	1	1
Module 5		1 (P)	1	1 (P)	1											NC	1	50K Stage N	1	1
Module 6		1	1 (P)	1 (P)		1										PID BOLO R	1	0.1K Dilu R	1	1
Module 7		1	1 (P)		1	1	1									PID DILU R	1	1.6K Stage R	1	1
Module 8	1 (P)	1 (P)	1	1												PID 1.6K R	1	4K Stage R	1	1
Module 9									1	1 (N)	1 (N)	1	1 (N)	1 (N)		PID 4K R	1	4K Th Sw R	1	1
Module 10								1 + 1	1			1			1 Horn 1 4KLFI	Th Switch 4K-1.6K R	1	18K Stage R	1	1
Module 11										1 (R)	1 (R)		1 (R)	1 (R)	1 Horn 1 4KLFI	NC	1	50K Stage R	1	1

Table 2.2.4 – 4: HFI PFM PAU modules affectation

2.2.5 FPU thermometers and Heaters localisation

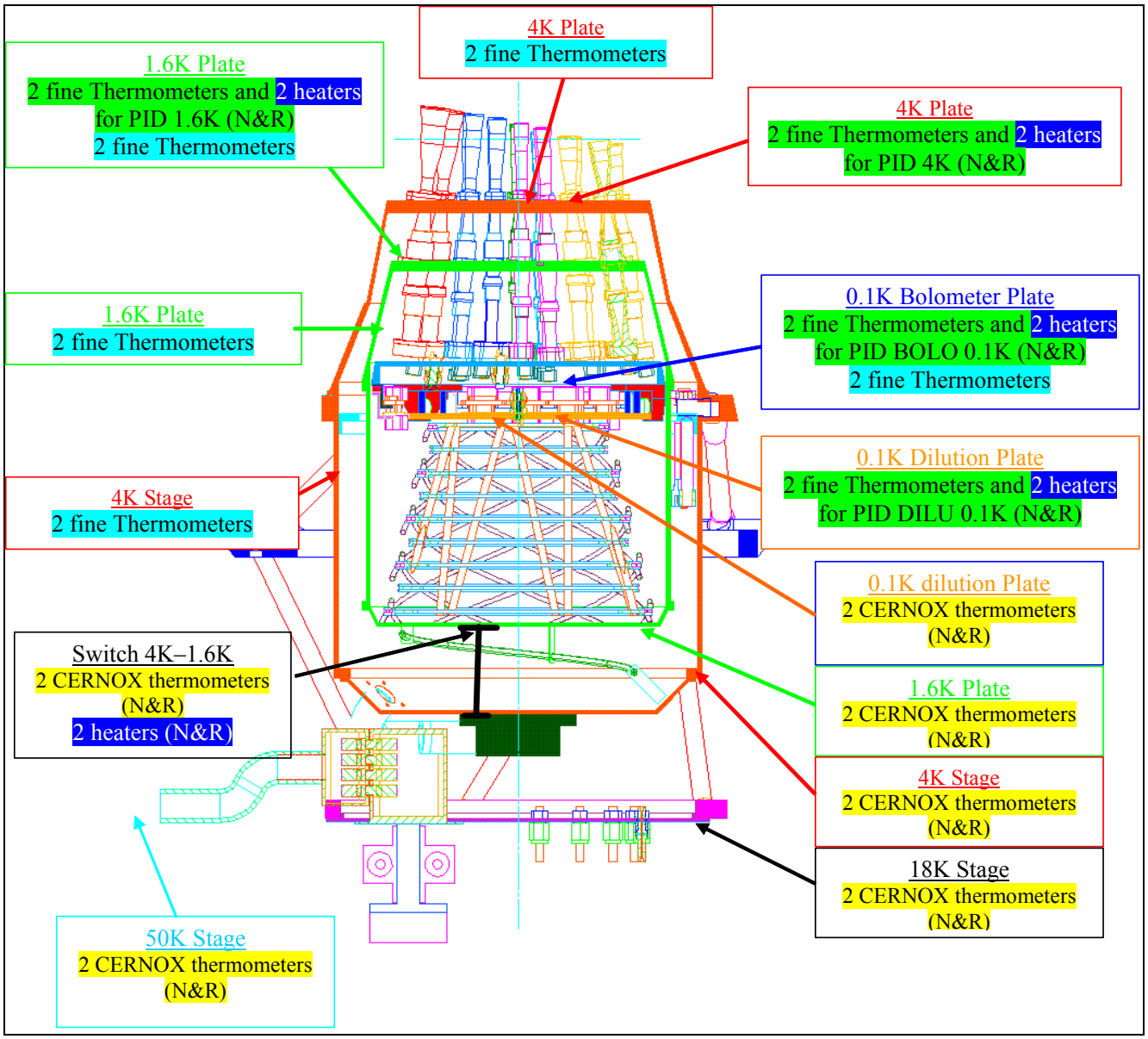


Figure 2.2.5-1 FPU thermometers and heaters location

2.2.6 The Cryo-harness

HFI Cryo-harness is composed of two different parts:
- the cryo-harness that links the FPU different detectors and cryo-thermistors to the JFET Box. Its part located outside of the “4K Box” is enclosed into a stainless steel bellow, as a continuation of the 4K Box Faraday cage. Inside the 4K Box it is thermalised along the so-called” heat exchanger”.
- the PAU to JFET Box cryo-harness.

The last one is also embedded into stainless steel bellows that complete the continuity of the HFI detection system Faraday cage, joining and including the FPU at one end and the PAU at the other one.

The PAU end of PAU-JFET Box cryo-harness has 96 MWDM 9S connectors: 8 for each of the 12 belts of the PAU. While the JFET Box end carries 24 connectors, 2 per belt, i.e. one MWDM 25S and one MWDM 37S. It is composed of 216 low noise twisted shielded pair cables.

The JFET end of FPU to JFET Box cryo-harness has 10 MWDM 9P connectors (one for each JFET Box belt but for number 5 and 11) and 12 MWDM 25P: one of each for each of the 12 belts of the JFET Box. This harness is composed of 104 low noise twisted shielded pair cables.

2.2.7 The Data Processing Unit (also referred as Main Electronics “ME”)

The main functions of this unit are:
- to drive all the subsystems of the instrument and to get their data (bolometer readouts, cryogenics readouts, temperature and pressure sensors, and various active device status),
- to tag accurately the measurements with the On-Board Time,
- to compress the detectors data to fit in the science telemetry allocation,
- to produce the HFI various science and different types of housekeeping telemetry packets,
- to receive the commands from the S/C, acknowledge and execute them, or transmit them to other HFI units for execution (“deputed commands”),
- to receive on-board software uploads and to download all or part of the on-board software.

The DPU is linked to the spacecraft through the Mil-Std-1553B bus, and to the other HFI sub-systems through home-made synchronous serial lines:
- an High Speed Link (HSL running at 2MHz) for the REU,
- and Low Speed Links (LSL running at 100 kHz) for the DCE and the 4KCDE.

The HFI science data flow contains, in routine operation, all the information necessary for flight observation data reduction: bolometers, dark bolometers, thermometers, etc... In test mode, it will contain data sets from selected channels, in a more verbose format.

The housekeeping flow contains all context parameters and event messages, including detectors selected readings and “essential data”, regularly transmitted at low rates.

A possible breakdown of the science data rate is given in the table hereafter as an example. The assumptions are that 2.6 samples per beams are collected, and that a compression factor of 3.8 is achieved, which reduces 16bits words to 4.2bits. The described uncompressed science channel data rate is about 184kbits/s.
The required HFI mean data rate is defined in §13.2.

	Number of Channels	Frequency (Hz)	Measures per second	Bits/sec (16 bits meas)	Bits/sec (4.2 bits meas)
100GHz	8	182	1456	23296	6116
143GHz	12	182	2184	34944	9173
217GHz	12	182	2184	34944	9173
353GHz	12	182	2184	34944	9173
545GHz	4	182	728	11648	3058
857GHz	4	182	728	11648	3058
EMCs	4	182	728	11648	3058
High rate 0.1K temperatures	6 *	182	1092	17472	4586
Other cryogenic temperatures	10 **	12	120	1920	504
High Frequency measures	1	90	90	1440	378
Science total				183904	48277
Margins 20%					9655
Sub total					57932
Encapsulation 7%					4055
Grand TOTAL					61987

Table 2.2.7-1: HFI FM science data rate breakdown example

* The six “high rate 0.1K temperatures” are :
- the 2 Platinum thermistors located on the 0.1K plate,
- the 2 Platinum thermistors located on the 1.6K plate,
- the 2 Platinum thermistors located on the 4K plate.

** The ten “other cryogenic temperatures” are :
- the two “PID DILU”, also called “PID1” (Nominal and Redundant) are located on the “dilution” plate,

- the two “PID BOLO”, also called “PID2” (Nominal and Redundant) are located on the 100mK plate,
- the two “PID 1.6K” (Nominal and Redundant) have their thermometers accommodated on the 1.6K plate and the heaters on the 1.6K box body,
- the two “PID 4K” (Nominal and Redundant) are located on the 4K plate internal side,
- the two 4K reference loads (for LFI) thermistors located on the 4K box internal surface.

Sampling rate for these channels can be selected by command.

The DPU/PDP (Power Distribution Part) includes a DC/DC converter providing stabilized voltages for DPU own use. Furthermore, it distributes the 28V to the 12 REU analogic belts, two by two, (not the processor ones). The DPU/PDP having no relays does not allow to power ON or OFF the REU, only the S/C LCL can do that.

It is the general rule that each HFI subsystem provides the DC/DC conversion from the spacecraft 28V bus for its own needs.

The DPU is a redundant unit. Each DPU unit (nominal and redundant) is electrically interfaced with:

- both Planck CDMUs,
- both HFI Readout Electronic processors,
- the 4K Cooler Drive Electronics (not redunded),
- the HFI Dilution Cooler Electronics (not redunded).

The DPU and the REU can not be crosstrapped. The REU nominal must be activated with the DPU nominal only and the REU redundant must be activated with the DPU redundant only). **The DPU nominal and redundant must not b e powered simultaneously. The REU nominal and redundant must not b e powered simultaneously.**

2.2.8 The Dilution Cooler Subsystem

The Dilution Cooler subsystem is mainly composed of two units:

- the Focal Plane Structure (FPS): the FPS is an assembly, part of the Focal Plane Unit (FPU), providing the bolometers’ stage with the required cooling power to achieve 100 mK,
- the Isotope Supply Unit (ISU), the ISU is the subsystem providing the FPS with the 3He and 4He isotopes in the proper conditions and conducting the final mixture to space.

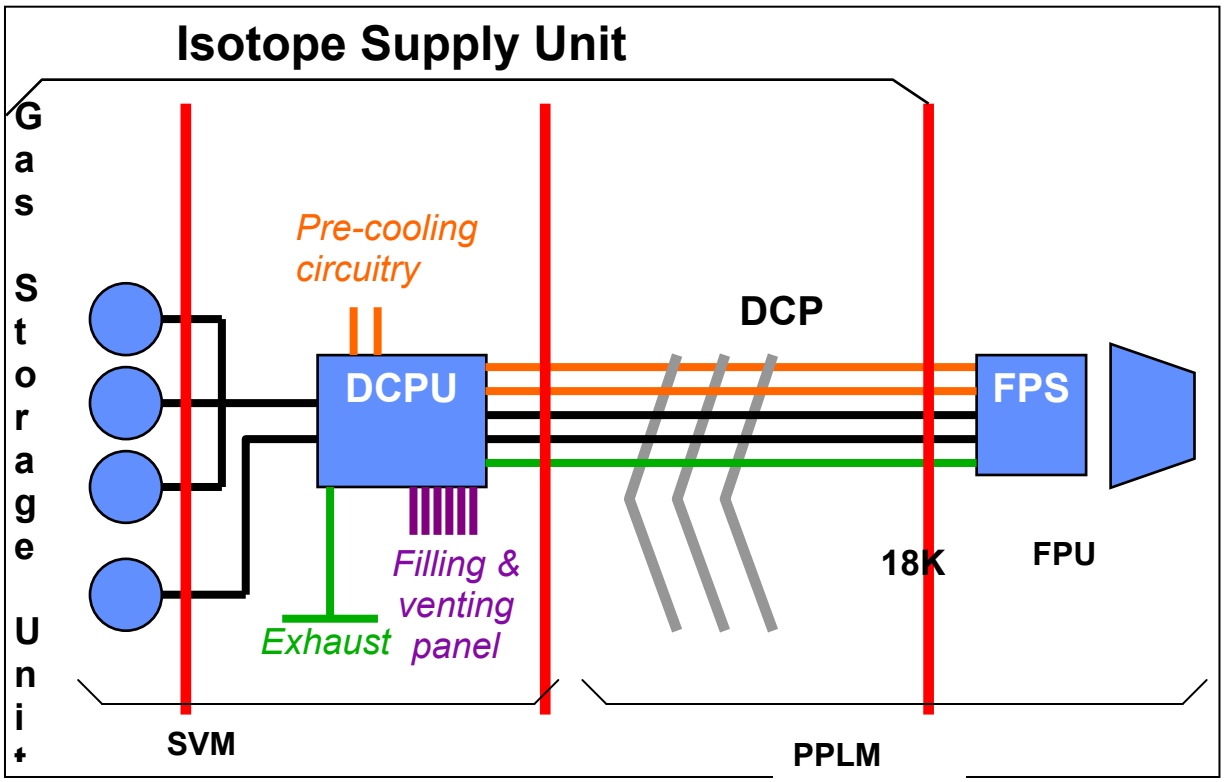


Figure 2.2.8 - 1

2.2.8.1 The Focal Plane Structure

The 0.1K Cooler uses endothermic property of the dilution of 3Helium in 4Helium into proper proportions in small capillary tubes in an open cycle. The gas mixture is then re-used in a Joule-Thomson expander providing extra cooling at 1.6 K.
The 0.1 K plate supports the bolometers with horns and attached optical filters, 1 resistor and 1 capacitor, blind bolometers, thermometers, heaters and is fixed at the cold end of the dilution heat exchanger. The mechanical and thermal link is made with Holmium-Yttrium alloy material used as a very low frequency pass thermal filter. A pair of PID regulators ("PID DILU" and "PID BOLO") cut the high thermal frequencies generated by the dilution phenomenon.
Thermometers (using same readout electronics as the bolometers) and redundant heaters are used to regulate the 0.1 K plate temperature.

The 1.6 K stage is cooled by the Joule-Thomson expander located in the mixture circuit. It accommodates the 1.6 K optical filters plate, with heaters and thermometers. This intermediate stage supports and provides positioning for the 100 mK stage.

The 4K stage is the external part of the FPU; the lower part is the interface with the 1.6 K stage supported by struts. It provides the global positioning in between HFI cold optics and LFI FPU "Main Frame". The upper part supports the 4 K plate populated with the horns that collect the astronomical signal. This stage is cooled by the cold end of the 4K cooler. It also accommodates the LFI "4K reference loads" radiatively connected to LFI detection systems.

Note : In order to decrease the HFI Focal Plane Unit cooling-down duration during ground testing: a specific pre-cooling loop is included in the Dilution Cooler Cold end Unit. This loop is composed of a counter flow heat exchanger coming from the warm parts of the dilution cooler, with thermalisation points on the upper temperature levels. Pre-cooling Helium is provided when needed by the Dilution Cooler ISSS-PGSE.

2.2.8.2 Heat switches

To make easier and manageable the cool-down phase, two heat switches have been implemented at the HFI FPS level. These two heat switches are gas gap ones controlled by a small power on a charcoal pump.
A Heat Switch “18K-4K” (may also be called “HS2”) is located in between the 18 K stage and the 4K stage.
It will be ON all along the cool-down to 20 K of the 4K stage. It will be OFF when the cooling process by the 4K cooler will start. It is controlled by the Dilution Cooler Electronics.
A Heat Switch “4K-1.6K” (may also be called “HS3”) is located inside the FPS in between the 4K stage and the 1.6 K stage. This heat switch control is performed through the Read-out Electronic Unit.
Following the CSL FM test, this switch will not be activated in flight during the cooling down.
~~It will be ON all along the cool-down to 4 K of the 1.6 K stage. It will be turned OFF when the cooling process by the dilution cooler will start.~~

2.2.8.3 The Isotope Supply Unit (ISU)

The Isotope Supply Unit is composed of different units:
- the Gas Storage Unit (GSU),
- the Dilution Cooler Control Unit (DCCU) composed of two parts:
  - the Dilution Cooler Pneumatic Unit (DCPU),
  - and the Dilution Cooler Electronics (DCE),
- the Dilution Cooler Piping (DCP).

2.2.8.3.1 The Gas Storage Unit (GSU)

The Gas Storage Unit is designed to store the volume of isotopes for the whole mission. The nominal set point has been fixed for a flow of 4He three to four times higher than the 3He flow. The storage volumes have thus been chosen close to that proportion.
Three 51 liters tanks for 4He and one for 3He at the nominal pressure of 295 bars provide the mission required duration with margin. Note that the three 4He tanks are interconnected and cannot be isolated from each other.
The tanks are fixed on the SVM and connected for purging, filling and feeding the dilution cooler to the DCCU by means of high pressure pipes. These pipes are part of the GSU.
The temperature of each tank is precisely measured with an accuracy allowing to perform isotope leak evaluation promptly, and to measure the gas stored volume. The associated harness is routed from the tanks to the DCCU along the high pressure pipes.

2.2.8.3.2 The Dilution Cooler Control Unit

The DCPU (and DCE) are located on a single panel gathering the pneumatic components and the electronic box dedicated to the control/command of the whole dilution cooler.

2.2.8.3.2.1 The Dilution Cooler Pneumatic Unit (DCPU)

The Dilution Cooler Pneumatic Unit controls and commands the flow and pressure of isotope supply. It houses the different pneumatic components allowing to permanently flush the cooler at necessary small flow rate and to perform the optimal cooling of the inner stages of the HFI FPU.
It includes, as can be seen on the lower part of figure 2.2.8.3.2.1-1:
on the upper access panel:

- fill and drain valves,
- connectors for ground operations,
- VCR connectors for the access to the pre-cooling loop,

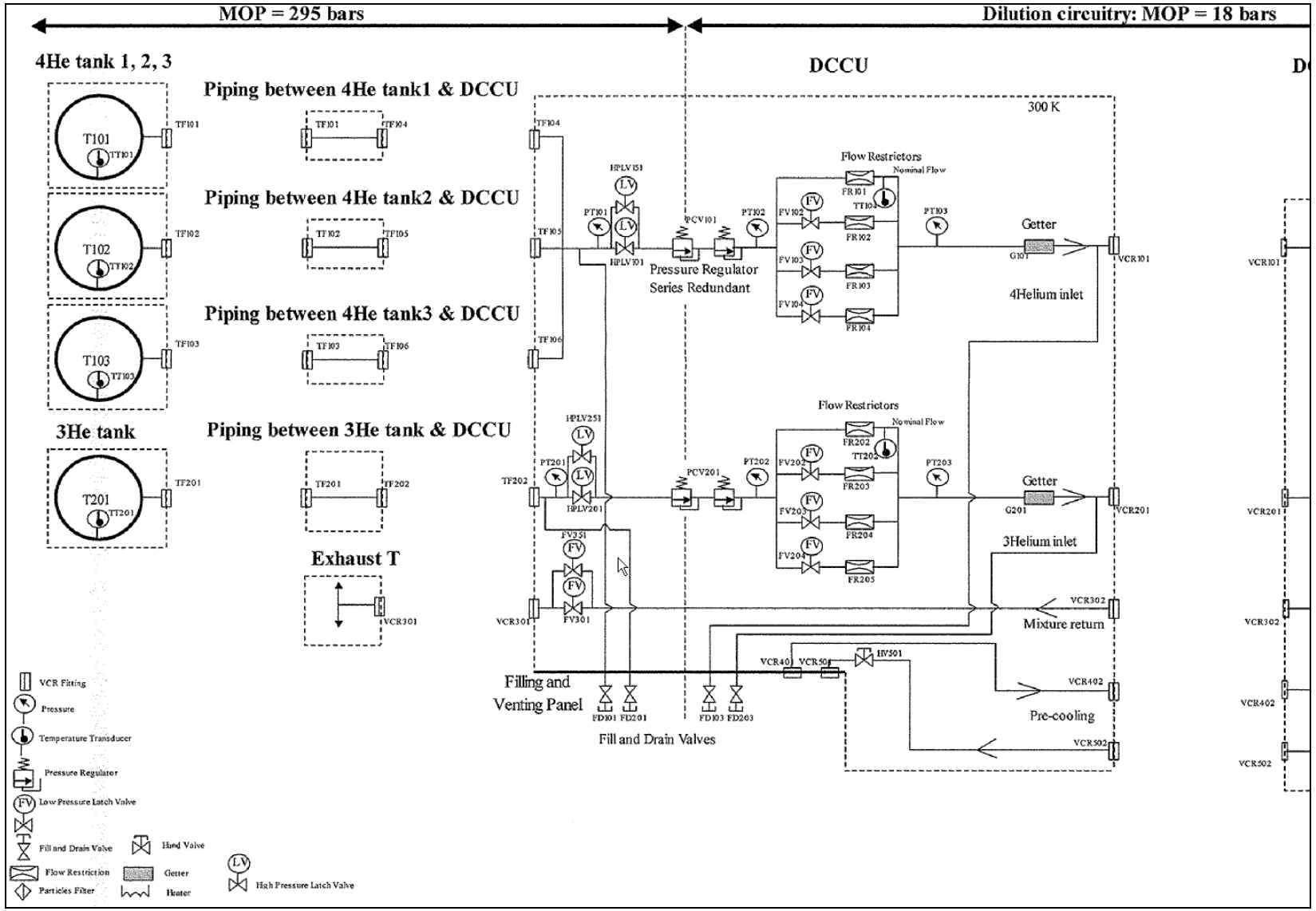
on the main panel:

- redundant high pressure latch valves,
- pressure regulators decreasing the stored helium pressure down to 20 bars in nominal operation case and used as lock up pressure valve when necessary,
- two sets of flow constrictors associated to latch valves allowing the adjustment of the isotopes mixture proportion for the different operating modes,
- gas cleaning filters,
- pressure sensors (from which shall also be derived flow measurements),
- getters activated only on ground before launch, on each isotope circuit,
- the exhaust of the mixture is done through a hole in Planck SVM lateral panel supporting the DCCU by two symmetric pipes allowing very low resultant couple.

The foreseen nominal flow rates are:

- 2 micromoles/s for each isotopes during cleanliness maintenance flushing,
- 5,6 micromoles/s and 17,1micromole/s (Fmin), as a goal respectively for 3He and 4He in observation mode

~~6.3 micromoles/s and 18 micromole/s, have been measured on the Development Model respectively for 3He and 4He also in observation mode.~~


MOP = 295 bars
Dilution circuitry: MOP = 18 bars
4He tank 1, 2, 3
DCCU
Piping between 4He tank1 & DCCU
Piping between 4He tank2 & DCCU
Piping between 4He tank3 & DCCU
3He tank
Piping between 3He tank & DCCU
Exhaust T
300 K
Flow Restrictors
Nominal Flow
Pressure Regulator
Series Redundant
Getter
4Helium inlet
3Helium inlet
Mixture return
Pre-cooling
Filling and
Venting Panel
Fill and Drain Valves
VCR Fitting
Pressure
Temperature Transducer
Pressure Regulator
Low Pressure Latch Valve
Fill and Drain Valve
Hand Valve
Flow Restriction
Getter
Particles Filter
Heater
High Pressure Latch Valve

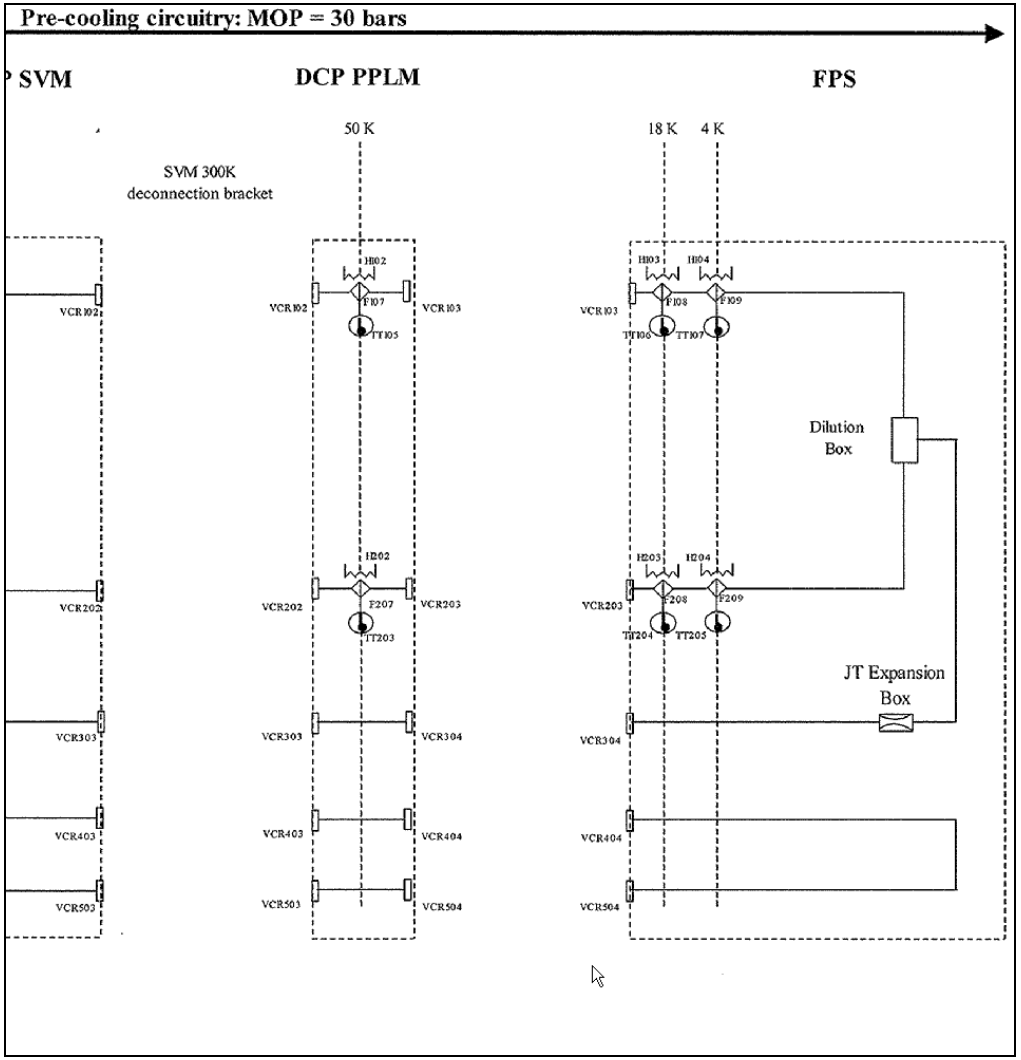


Figure 2.2.8.3.2.1-1 : 0.1K Dilution Cooler Pneumatic Unit Block Diagram

2.2.8.3.2.2 The Dilution Cooler Electronics (DCE)

Mounted on the DCPU, the DCE has no mechanical interface with Planck SVM. Interfacing the spacecraft only for power line, the DCE is linked to the HFI DPU and is in charge of the process of the Dilution cooler. It is connected to the DCPU and includes its own DC/DC converter. It is also connected to the Dilution Cooler to insure its proper monitoring and commanding.

Valves command :
The DCE perform the activation of 12 valves of the DCPU and reports the status of these valves. Note that the 6 injection valves have no status line and therefore the DCE cannot report on their status. All valves are latch type ones and are driven by 80 ms pulses of 31V (secondary voltage) or 28V (primary voltage). Valve description, operating voltage and status availability are given in table 2.2.8.3.2.2 - 1 below.

Item	TC valve ID	Site	Type	Manufacturer	Voltage (V)	Power Max (W)	Comments
HPLV101	1	He4 pipe	51E325	MOOG	31V	17	
HPLV 151	0	He4 pipe	51E325	MOOG	31V	17	Redundant
HPLV 201	3	He3 pipe	51E325	MOOG	31V	17	
HPLV 251	2	He3 pipe	51E325	MOOG	31V	17	Redundant
FV102	4	He4 flow filter 1	51E324	MOOG	31V	16.57	No Status line
FV103	5	He4 flow filter 2	51E324	MOOG	31V	16.57	No Status line
FV104	6	He4 flow filter 3	51E324	MOOG	31V	16.57	No Status line
FV202	7	He3 flow filter 1	51E324	MOOG	31V	16.57	No Status line
FV203	8	He3 flow filter 2	51E324	MOOG	31V	16.57	No Status line
FV204	9	He3 flow filter 3	51E324	MOOG	31V	16.57	No Status line
FV301	11	Mixture return pipe	51E323	MOOG	28V	24	
FV351	10	Mixture return pipe	51E323	MOOG	28V	24	Redundant

Table 2.2.8.3.2.2 - 1 : Valve description

Heaters Commands :
The DCE can warm resistive heaters and control the temperature of the 3 filter stages of the DCP (Dilution Cooler Piping) and of the 18K thermal switch by command. The temperature of the filter stages (and thermal switch) is controlled by a simple on/off regulation around the set point temperature. The command parameters are the duration of the heating (between 0 and 4369 minutes by increments of 4 s), the temperature set point of the regulation, the heating power (3%, 10%, 30% or 100% of the max power), and the target heater. The heaters description are given in table 2.2.8.3.2.2 - 2.

Item	Site	Function	R*(Ω)	Input (Vdc)	Power, Max. (W)	Comments
H102	50K	He3 50K filter	470	31V	2.0	
H103	18K	He3 18K filter	1K	15V	0.15	
H104	4K	He3 4K filter	9K	15V	0.025	
H202	50K	He4 50K filter	470	31V	2.0	~~Redundant~~
H203	18K	He4 18K filter	1K	15V	0.15	~~Redundant~~
H204	4K	He4 4K filter	9K	15V	0.025	~~Redundant~~
H301	18K	Thermal Switch	10K	31V	0.1	
H302	18K	Thermal Switch	10K	31V	0.1	~~Redundant~~

Table 2.2.8.3.2.2 - 2 : Heaters description

Temperature sensors :

The DCE monitors 14 temperature sensors. 6 Cernox sensors are used by the de-clogging system of the DCP and 2 for the 18K thermal switch activation, 4 PT100 sensors are used to monitor the GSU temperature (3He and 4He tanks) and 2 PT100 sensors monitor the temperature of the 3He and 4He nominal flow lines of the DCPU (see Table 2.2.8.3.2.2 - 3).

Item	Location	Range	Accuracy	Type *	Input Signal
TT105	50 K 4He inlet	20>300 K	5 K	Cernox 1080	10µA
TT203	50 K 3He inlet	20>300 K	5 K	Cernox 1080	10µA
TT106	18 K 4He inlet	4>100 K	2 K	Cernox 1070	10µA
TT204	18 K 3He inlet	4>100 K	2 K	Cernox 1070	10µA
TT107	4 K 4He inlet	4>100 K	2 K	Cernox 1070	10µA
TT205	4 K 3He inlet	4>100 K	2 K	Cernox 1070	10µA
TT301	Therm. Switch	18>100 K	2 K	Cernox 1070	10µA
TT302	Therm. Switch	18>100 K	2 K	Cernox 1070	10µA
TT201	3He tank 1	-10>40 ºC	0.02 ºC	PT100	1mA
TT101	4He tank1	-10>40 ºC	0.02 ºC	PT100	1mA
TT102	4He tank2	-10>40 ºC	0.02 ºC	PT100	1mA
TT103	4He tank3	-10>40 ºC	0.02 ºC	PT100	1mA
TT104	4He Nom Flow	-10>40 ºC	0.02 ºC	PT100	1mA
TT202	3He Nom Flow	-10>40 ºC	0.02 ºC	PT100	1mA

Table 2.2.8.3.2.2 - 3 : Temperature sensors decription

Pressure sensors:

The DCE monitors the 6 pressure of the DCPU. The description of those pressure sensors is given in table 2.2.8.3.2.2 - 4.

Item	Location	Function	Range	Accuracy	Type *
PT101	4He inlet 1	P abs	0>330 bar	0.02 bar	Bradford HP
PT201	3He inlet	P abs	0>330 bar	0.02 bar	Bradford HP
PT102	4He expander	P abs	0>40bar	0.1 bar	Bradford LP
PT202	3He expander	P abs	0>40bar	0.1 bar	Bradford LP
PT103	Operational 4He	P abs	0>40bar	0.1 bar	Bradford LP
PT203	Operational 3He	P abs	0>40bar	0.1 bar	Bradford LP

Table 2.2.8.3.2.2 - 4 : Pressure sensors description

2.2.8.3.3 The Dilution Cooler Piping (DCP)

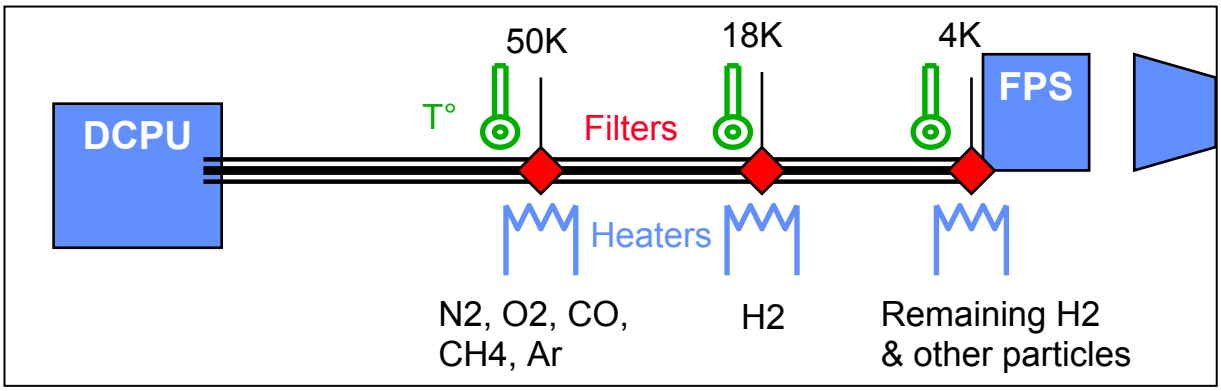


Figure 2.2.8.3.3-1 : Dilution Cooler Piping

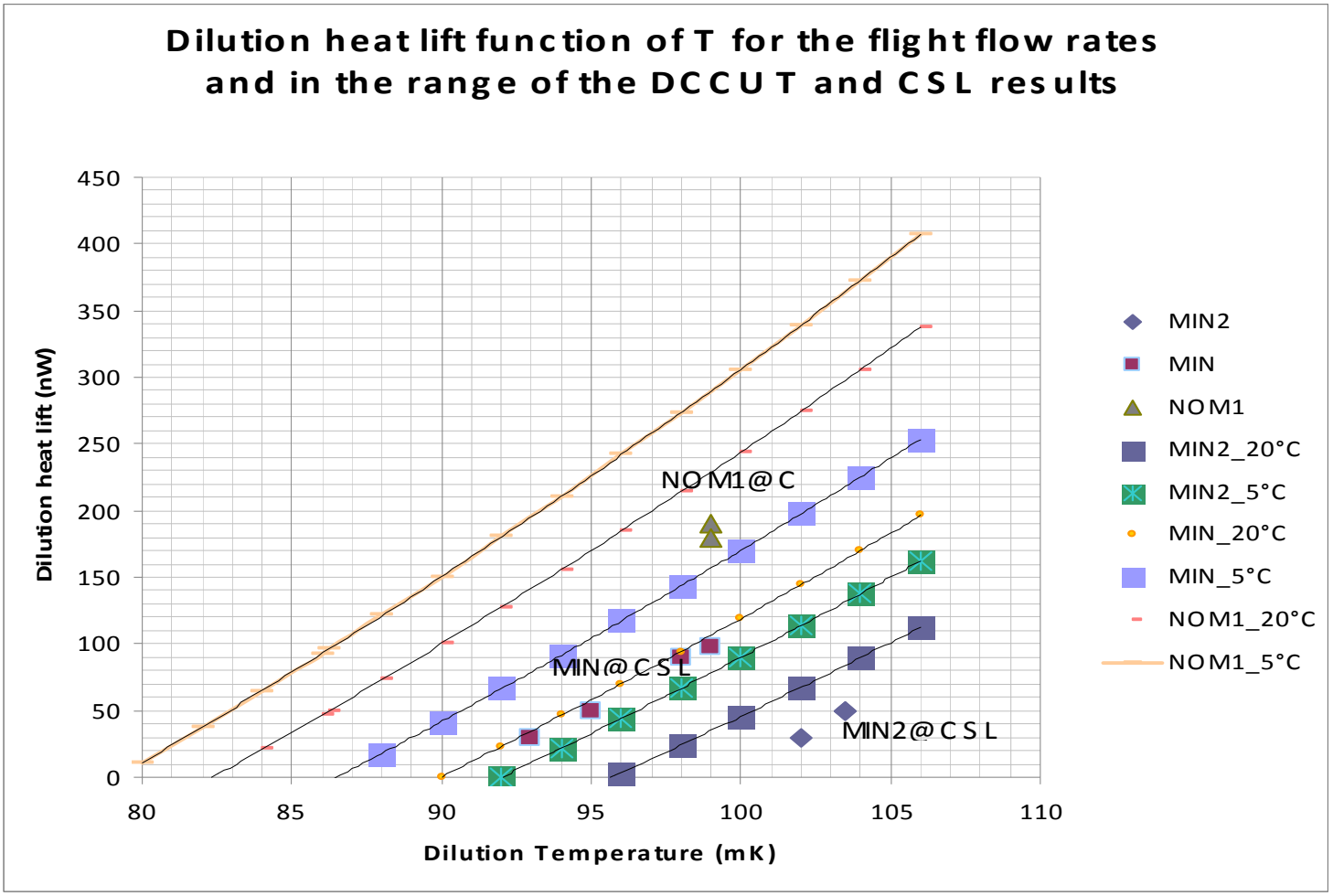
The Dilution Cooler Piping is composed of counter-flow heat exchangers transporting the isotopes from the DCCU to the FPS. Thanks to a suitable thermalisation located on the 3rd V-groove (as well as on 2d and 1st V-groove to limit the heat load on the 3d one) and the 18 K stage it is also aimed to cool down to this temperature the isotopes before entering the FPS. It is the same for the pre-cooling loop. Although the management of isotope purity is done to avoid in nominal conditions any clogging due to condensation of pollutants, the part of the pipes located just before the filters can be heated up to a temperature depending on the considered stage, this allows unclogging and obviously the non clogging of the next step of filtering. The thermometers and heaters are monitored by the DCE. This unclogging mode is a degraded temporary mode for the Dilution Cooler.
The DCP and the Dilution Cooler Cryo-Harness are routed together from the SVM to the FPU on the PPLM through the V-grooves. They are composed of two different segments linking:

- the DCCU to the spacecraft Sub Platform,
- the Sub Platform to the FPU.

The Dilution Cooler pipework is thermalised on all three V-grooves, and includes a filter accommodated on all 3 Planck V-grooves.

2.2.8.3.4 The Dilution Cooler performance

Following the CSL test, the dilution heat lift function of the 3He/4He flowrates is given on the following figure.



The valves to be open for the different flowrates are :

	4He valve	3He valve
FMIN2	ALL OFF	ALL OFF
FMIN	FV204	FV104
FNOM1	FV204+203	FV103
FNOM2	FV202	FV104+FV103

2.2.9 The 4K Cooler Subsystem

One of the stages in the HFI cooling chain is at “4K”. This is required for pre-cooling the Dilution Cooler isotopes and the focal plane unit. The “4K” temperature will be achieved by the use of a He^4 Joule Thomson (JT) system. A helium JT system requires pre-cooling to a temperature well below the inversion temperature of the working gas which, in this case, is Helium-4. Pre-cooling of the system to “18K” will be achieved by the use of the Planck Hydrogen Sorption Cooler. Additional cooling at an intermediate (50-60K) temperature is also required to reduce the load on the 18K cooler.

The JT compressors, Ancillary panel and Low Vibration Drive Electronics are all mounted on the SVM +Y lateral panel fairly close to each other. The connecting pipework leads from this panel to the Planck Sub Platform where the cold plumbing starts. The cold plumbing leads from this point into the radiation shields interfacing at the “60K” radiation shield, the sorption cooler interface at “18K” and the focal plane unit where the cooling occurs at a temperature of around 4.5K.

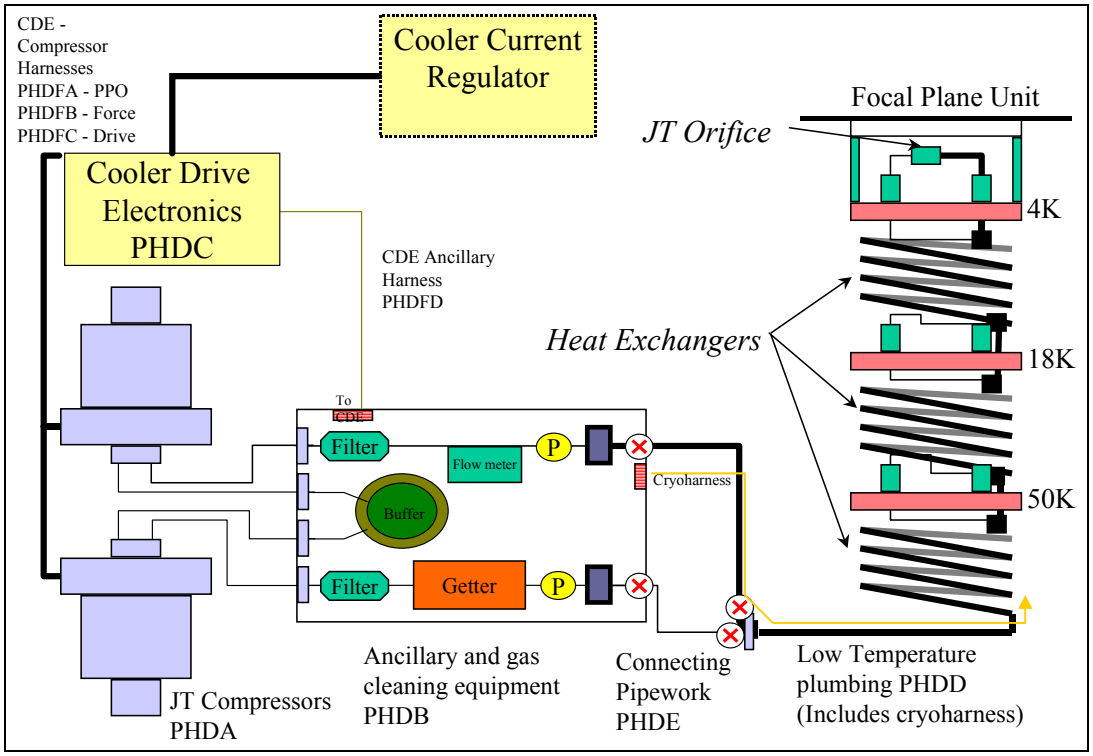


Figure 2.2.9-1 : The major components of the 4K system.

The main components of the 4K system for Planck are the following ones:

2.2.9.1 The Compressor Unit

The JT compressors of the Compressor Unit (4KCCU) give two stages of compression from around 1 bar to approximately 9-10bar. The temperature that the cooler can achieve is dependent on the pressure on the effluent side of the JT orifice. The ultimate temperature that can be achieved depends on the overall fill pressure in the system and the stroke amplitude on the JT compressors. The compressors are reciprocating devices operating in the frequency region 35-45Hz. There are two compressors in a head to head configuration mounted off force transducers. The head to head configuration provides a degree of momentum compensation. The force transducers are used with the Cooler Drive Electronics (CDE) to provide fine momentum compensation. The CDE senses the out of balance forces and actively feeds back to the mechanisms signals to null the vibration. The aim is to keep all harmonics below 40mN up to the 7^{th} harmonic of the fundamental frequency (320Hz with a fundamental frequency at 40Hz)

2.2.9.2 The Ancillary Unit

The Ancillary Unit (4KCAU) and gas cleaning panel contains part of the gas purification system, a filter, a flow meter and pressure transducers. The gas purity is maintained by the use of a hot reactive getter. The use of the getter is necessary for several reasons. The components in the JT compressors contain some organic resins that retain moisture over long periods. This moisture needs to be removed from the system. The other major contaminant is Hydrogen. This is evolved from the metal components in a time independent manner and is difficult to remove by cold trapping. The flow meter and pressure transducers provide information on the health of the system and will help to rapidly diagnose any problems should they occur. A filter is incorporated into the hot reactive getter in order to minimise the risk of particle migration. Additional sintered metal filters are used to protect the JT compressor reed valves. The instrumentation on the panel and the cold plumbing is monitored through the Cooler Drive Electronics.

2.2.9.3 The Connecting Pipework

The Connecting Pipework joins the Ancillary panel to the cold plumbing and is simply a pair of pipes that run from the lateral panel on which the cooler components are situated, to the start of the cold plumbing near the LFI Back End Unit. These are attached to the SVM and PPLM. The cryo-harness runs along, and is attached to this pipework.

2.2.9.4 The Low Temperature Plumbing

The Low Temperature Plumbing incorporates counter-current heat exchangers between the stages and filters and gas purifiers on the stages (see figure 2.2.9-1). The function of the stages are to transfer heat from the circulating gas to that stage. The heat transferred is minimised by the high efficiency heat exchangers. The 4K stage contains a reservoir for the liquid helium. There will also be a small wiring harness with the cold pipe-work that connects to the temperature housekeeping sensors and heater(s).

2.2.9.5 The Cooler Drive Electronics

The Cooler Drive Electronics (4KCDE) provides drive to the compressors as well as controlling the hot reactive getter and conditioning the housekeeping sensors and thermometers on the 4K system. The unit provides active cancellation of the vibrations from the units over a wide frequency range up to the 7th harmonic of the normal operating frequency. The degree of compensation that can be achieved depends on the amplitude of the mechanisms as the gas spring is highly non-linear. The electronics interfaces to the JT Compressors and the Ancillary panel on one hand and to the Current Regulator, the spacecraft PDU and the DPUs on the other one. The low temperature wiring harnesses interfaces to the ancillary panel and through that to the Cooler Drive Electronics.

2.2.9.6 The Current Regulator

The 4K Cooler Current Regulator (4KCCR) also sometimes referred as “Pre-regulator” function is to “smooth” the interface between the 4KCDE compressor drive and its S/C primary power source. Thus protecting the spacecraft power bus from low frequency ripples that might be injected by the cooler in nominal mode and/or from large spikes (with a duration of some hundreds of microsecond) that might be introduced by active clamping of the compressor during launch environment.

2.3 HFI units interconnection diagram; Electronic architecture

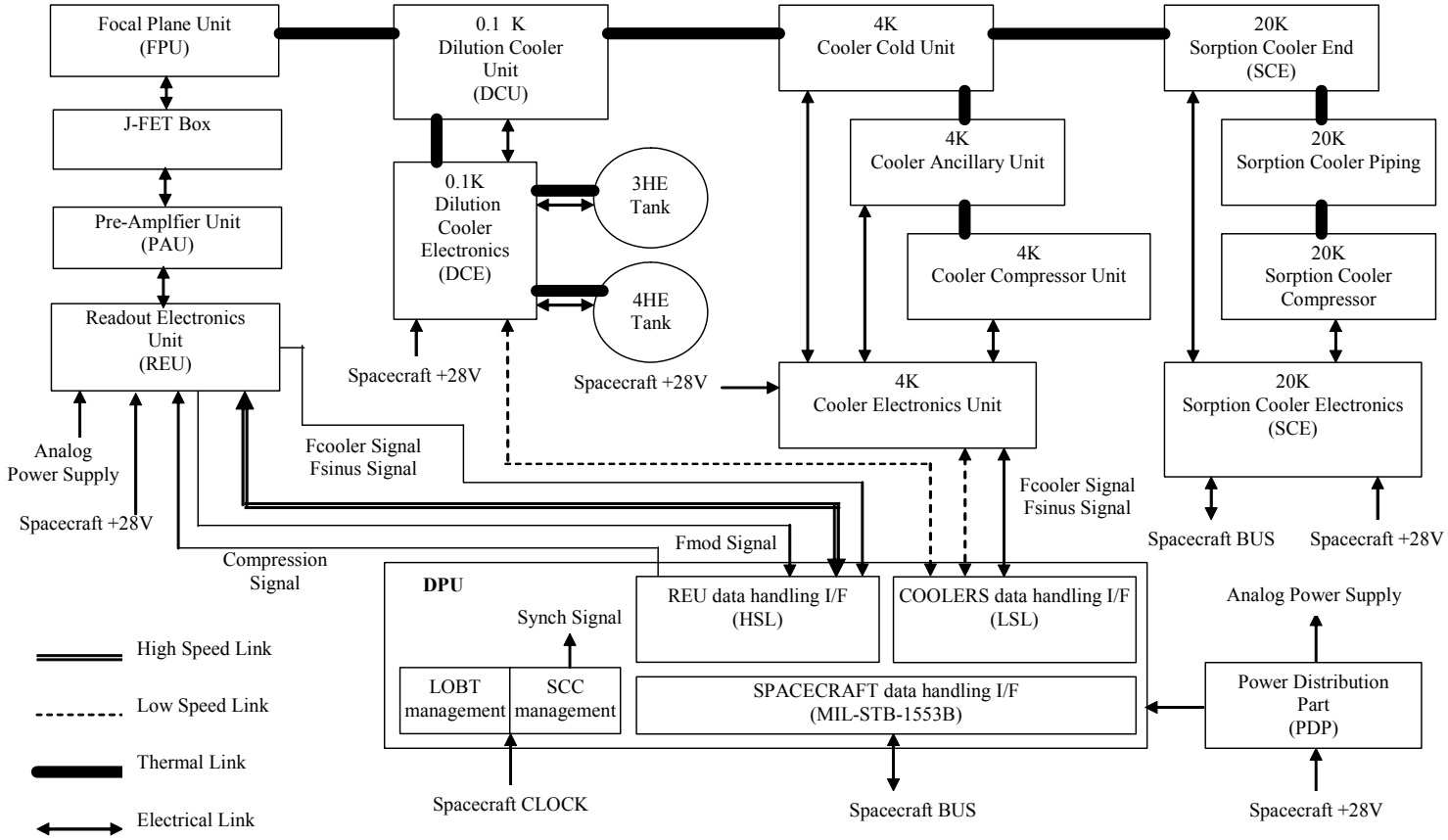
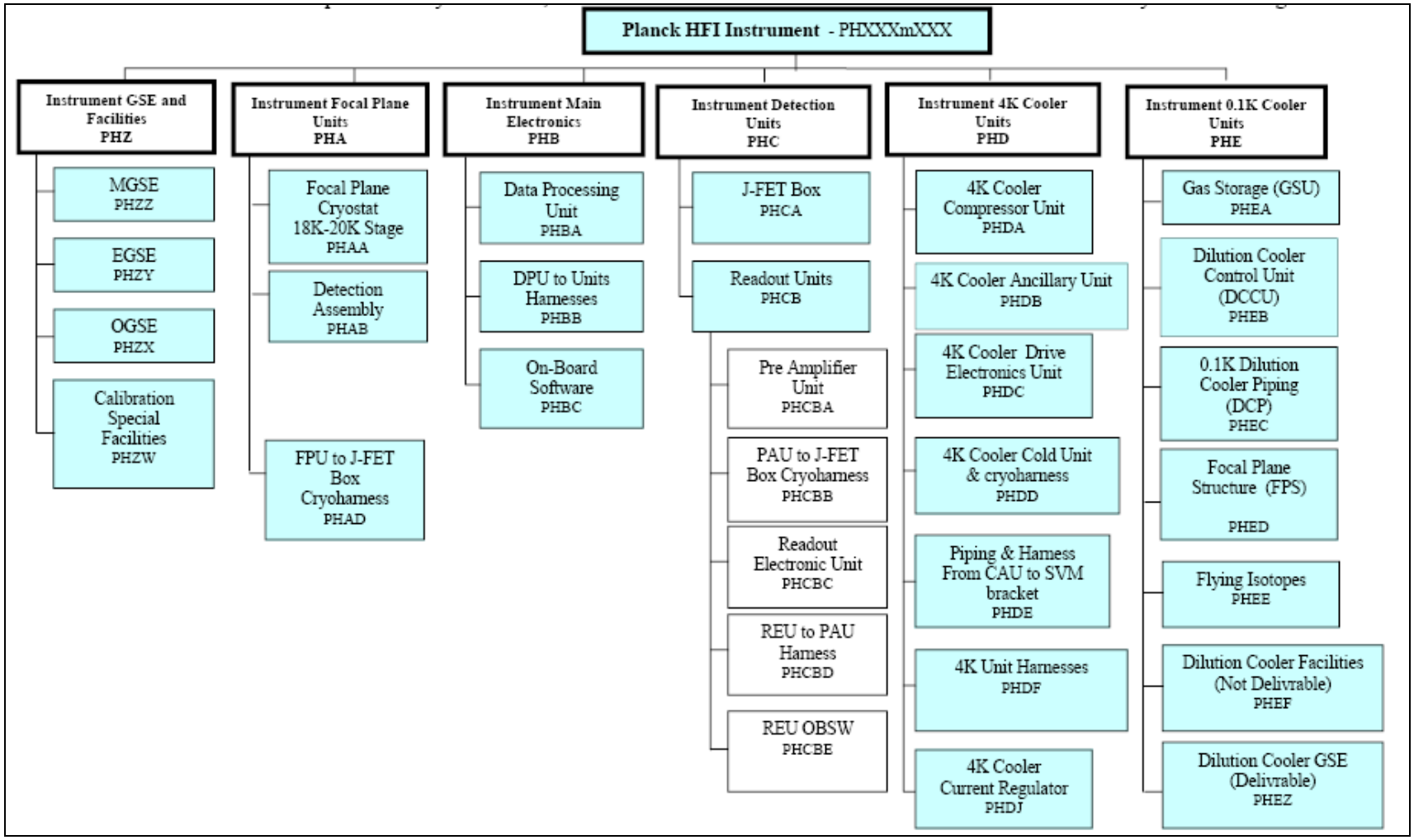


Figure 2.3-1 GENERAL ELECTRONIC ARCHITECTURE OF HFI

3 HFI CONFIGURATION

3.1 HFI product tree



3.2 HFI redundancies

The HFI redundancies condern only :

- the DPU
- the REU processor belt
- the 6 Cernox thermometers (each Cernox is associated to one REU analog belt; the REU analog belts are NOT redunded)
- the 0.1K, 1.6K and 4K fine temometers for PID control (the nominal ones are on REU analog belt N°9 and the redundant ones are on belt N°B; the REU analog belts are NOT redunded)
- the 0.1K, 1.6K, 4K and the switch 4K-1.6K PID heaters (each Cernox is associated to one REU analog belt; the REU analog belts are NOT redunded)
- the 3He and 4He high pressure vaves and the dilution exhaust valves.

ALL the others HFI items are NOT redunded.

- The DPU nominal and redundant must not be ON simultaneously
- The REU processor belt nominal and redundant must not be ON simultaneously
- The DPU and the REU must not be crosstrapped. The REU/DPU nominal and the REU/DPU redundant must be always associated.
- The non redunded 4KCDE and DCE can communicate to both DPU nominal or redundant via nominal and redundant LSL lines that are Y connected inside the non redunded equipments.
- The non redunded 4KCDE, 4KCCR and DCE receive power from the spacecraft via nominal and redundant power lines that are Y connected inside the non redunded equipments.

3.3 Accommodation on Planck spacecraft

3.3.1 The Focal Plane Unit

HFI Focal Plane Unit (FPU) is embedded into LFI one.
HFI FPU mechanical revolution axis is located into Planck X – Z plane.
Collecting horns phase centres are theoretically in the telescope focal plane.

3.3.2 JFET Box

HFI JFET Box is accommodated on the –Z face of the telescope Primary Reflector rear panel, in +X direction compared to HFI/LFI FPU location.

3.3.3 JFET – PAU Cryo-harness

The JFET – PAU cryo-harness in its bellow is routed along the cryo-struts of the PPLM and the Rear Panel of the Telescope baffle.

3.3.4 HFI Pre-Amplifier Unit (PAU)

HFI PAU is accommodated onto Planck PLM Sub-platform, under V-Groove 1, roughly in -Y-Z direction, close to LFI BEU.

3.3.5 PAU – REU Harness

This is an about 3.5 meters loop between Sub-platform and +Y SVM panel.

3.3.6 Readout Electronic Unit (REU)

HFI Readout Electronic Unit is mounted on +Y SVM Lateral Panel, in +X+Z part of it. This panel also accommodates the 4K Cooler Compressor, Ancillary and Electronic units.

3.3.7 REU to DPUs Harnesses

Divided in three different parts, these harnesses are routed respectively on these units allocated SVM lateral panels (+Z and +Y respectively) and on the SVM lower platform, around SVM cone.

3.3.8 DPUs

Both Nominal and Redundant HFI DPUs are to be found on +X “top part” of SVM +Z Lateral Panel, (while both Planck Star Trackers are on the –X part of it).

3.3.9 4K Cooler Warm Units

The 4K Cooler Compressor Unit, Ancillary Unit and Drive Electronics Unit are accommodated onto SVM +Y Lateral Panel (together with the HFI REU).

The 4K Current Regulator Unit is mounted on a shear web panel located between +Y SVM Lateral Panel +Z end and the SVM central cone. On this shear web are also accommodated the FOG Gyro and the SREM.

3.3.10 4K Cooler to Sub-platform piping and harness connection

The 4K Cooler to Sub-platform piping is mounted on SVM cone. The harness is routed along and attached to the pipes.

3.3.11 4K Cooler Cold hardware

The 4K Cooler Cold hardware is mounted between Sub-platform and HFI FPU. It is attached to all 3 V-Grooves.

3.3.12 DPU to 4K Cooler Harness

Divided in three different parts, these harnesses are routed respectively on these units allocated SVM lateral panels (+Z and +Y respectively) and on the SVM lower platform, around SVM cone.

3.3.13 Dilution Cooler Gas Storage

HFI Dilution Cooler Helium storage tanks are located respectively:
- on SVM +Z axis for the 3Helium one,
- and on the three other orthogonal directions:+Y, -Y and –Z, for the 4Helium ones.

Pipes and harnesses between these 4 tanks and the Dilution Cooler Control Unit (DCCU) are routed / attached to SVM central cone.

3.3.14 Dilution Cooler Control Unit

HFI Dilution Cooler Control Unit (DCCU) is located on +Y side of +Y+Z SVM Lateral Panel. It shares this panel with LFI redundant REBA units.

3.3.15 DPU to DCE harness

Divided in three different parts, these harnesses are routed respectively on these units allocated SVM lateral panels and on the SVM lower platform, around SVM cone.

3.3.16 Dilution Cooler Control Unit to Sub-platform piping and harness connection

The Diluton Cooler to Sub-platform piping is mounted on SVM cone. The harness is routed along and attached to the pipes.

3.3.17 Dilution Cooler Cold hardware

The Dilution Cooler Cold hardware is mounted between Sub-platform and HFI FPU. It is attached to all 3 V-Grooves.

4 HFI FUNCTIONS

This is described in the previous and next paragraphs.

5 HFI INTERFACES

5.1 External Interfaces (with S/C)

5.1.1 Power

HFI different units are all powered through spacecraft PCDU LCLs. HFI has no commanding possibility of these LCLs, powering ON and OFF HFI units belongs to Planck SVM.
The LCLs dedicated to HFI are listed in Table 5.1.1-1.
There is no Keep Alive Line for HFI.

N° LCL	Power Line Name	Nominal Configuration Status
29	DPU (Nom)	On
11	REU Proc (Nom)	On
37	4KCDE (Nom)	On
59	4K Drive bus (Nom)	On
60	4K Drive bus (Nom)	On
30	DPU (Red)	Off
12	REU Proc (Red)	Off
38	4KCDE (Red)	Off
61	4K Drive bus (Red)	Off
62	4K Drive bus (Red)	Off
36	DCE	On
39	REU* analog belts 0 & 1	On
40	REU* analog belts 2 & 3	On
41	REU* analog belts 4 & 5	On
42	REU* analog belts 6 & 7	On
43	REU* analog belts 8 & 9	On
44	REU* analog belts 10 & 11	On

Table 5.1.1-1 HFI LCL affectation and configuration during nominal opperation

- Please note that LCLs powering a pair of “REU analog belts” powers in cascasde the associated PAU and JFET belts and the components connected to them.
- During launch, all the HFI LCL’s are OFF excepted all the 4K drive bus LCL’s.
- The DPU nominal and redundant LCL’s must not be ON simultaneously
- The REU processor belt nominal and redundant LCL’s must not be ON simultaneously
- The DPU and the REU must not be crosstrapped. The REU/DPU nominal and the REU/DPU redundant LCL’s must be always associated.
- There is no constraint for the 4K CDE and the 4K drive bus LCL’s nominal or redundant LCL’s activation (4K not redunded).

5.1.2 Data

There is a single 1553 B bus (long stub configuration) operating at a time between powered HFI DPU, Nominal or Redundant, and spacecraft CDMU. The interface circuits are those procured for all Planck and Herschel instruments through the ESA Project Common Purchase system.
Data packets originating from nominal and redundant DPUs have different APIDs, even for the nominal ones and odd for the redundant ones.
Different HFI data packets are defined, prepared, used and fetched by the CDMU as defined by the applicable Planck/Herschel PSICD.

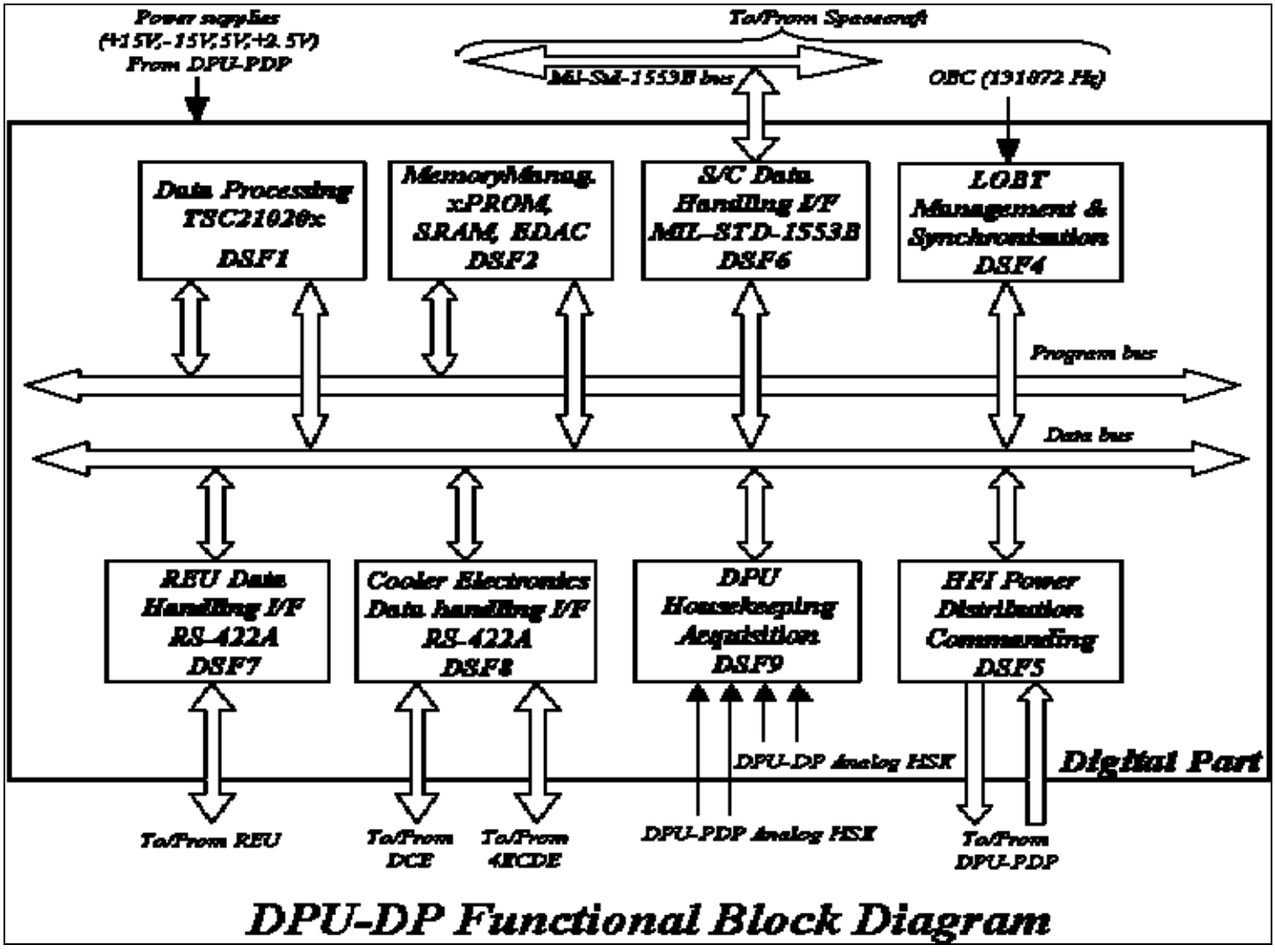


Figure 5.1.2-1 DPU Data processing functional diagram

5.1.3 Control

HFI is controlled by commands up-loaded to the spacecraft and transmitted by Planck CDMU to operating instrument DPU. Commands are identical whatever is the powered DPU: nominal or redundant. Therefore there is no way to send a command specifically to one specific DPU (which by consequence makes it impossible to have them both ON simultaneously).
Commands are transmitted to HFI through the spacecraft 1553 bus, the same apply to spacecraft 48 bits On-Board Time, as well as to the spacecraft 131 072Hertz clock used to drive HFI Local On-Board Time.
Commands format is compliant with Herschel-Planck PSICD.
The DPU is the instrument unit that acknowledge the reception of commands towards the spacecraft.
Maximum rate of commands is one telecommand per 2 seconds which is not a constraint. Indeed in routine observation mode the goal is to maintain the instrument as stable as possible and the data collection as perfectly continous as possible, and therefore to avoid changing modes or setting.
As mentioned earlier, in order to maintain HFI data production within allocation it is foreseen that it will receive an “end-of-slew” command after each spacecraft attitude change related to the sky scanning.

5.1.4 Mechanical

HFI Focal Plane Unit is integrated into LFI Front End Unit and has no direct mechanical interface with the PPLM.
The mechanical accommodation is given in §3.2 “accommodation on Planck spacecraft”

5.1.5 Thermal

5.1.5.1 Cryo-chain operability and performance

Both HFI and LFI rely on spacecraft-instruments cryo-chain to properly secure scientific sensitivity.
The first elements of this cryo-chain are the spacecraft passive ones, SVM and PPLM, having an impact upon the 1st cryo-chain active element i.e. the Sorption Cooler. Both the “warm radiator” on which the Sorption Cooler compressors, and electronics, are mounted and the 3d V-groove pre-cooling temperature shall impact directly on its performances / stability and consequently on the overall chain’s ones. Having both these stages cold enough will contribute to lower the cooler cold end temperature, which is good, and incidentally, for the 3d V-groove one, will impact on the ageing speed of the cooler (the colder the better). Warm Radiator temperature has a direct impact on the SCS Cold End absolute temperature, while 3rd V-Groove influences more the cooling power. The SCS will always be run to meet the requirements with the longest cycle time allowed by the 3rd V-Groove conditions in order to save life time. Both radiators behaviour can have an impact on the cold end T stability

The HFI 4K Cooler will also obviously benefit from a “cold” environment both at the level of compressors panel and 3d V-groove temperature. The hard limit existing on compressors maximum running temperature above which piston striction can occur should not be forgotten.

5.1.5.2 Thermal stability

HFI detectors response are extremely sensitive to their working temperature. In other terms any temperature variation have a very strong impact on their performance / transfer function, and on their optimal setting.

This means that once the detections chains have been optimised for in-flight survey operation any activity / change having an impact on their temperature shall be limited as much as possible. It is insisted on the fact that, on purpose to increase stability, HFI detectors time constant is extremely long (days), which also means that recovery from disturbances shall take a long time.

Changes having a potential impact includes:

- Spacecraft and instrument units power dissipation changes,
- Thermal control setting changes,
- Spacecraft attitude changes (solar aspect angle changes, possibly related to orbit, maintenance activities or “small” gap recovery),
- Moon eclipses or / and compensation activities.

Another aspect is related to the self generated disturbances created by the Sorption Cooler “bed “ order of actuation which impact on the “warm” radiator thermal behaviour.

5.1.5.3 Temperature knowledge

HFI units, and their environment, temperature knowledge shall be accessed through both spacecraft and instruments thermistors data (only spacecraft ones when the instruments are not powered).

Temperature knowledge has different uses:

- temperatures shall be used to check that instrument units are maintained within foreseen thermal environment or correct it,
- temperatures shall also be used for instrument health monitoring (out of foreseen range measurements usually reflects units problems, or identifying source of anomaly; it also helps to know if a unit temperature change comes from the unit itself or from its environment),
- ultimately short term and long seasonal temperature changes may affect instrument science data and their knowledge may have to be used to “clean” detectors data prior to scientific interpretation.

5.1.5.4 Compensation Heaters

HFI dissipation changes occur mainly at instrument start-up or switch-off. The other changes that can affect the instrument units dissipation are:

- a change in 4K Cooler compressors stroke amplitude (not a foreseen frequent change),
- contingency situations such as the need to switch OFF of a pair of REU-PAU analogic belts in case of problem affecting the rest of the instrument.

These are probably the only foreseen cases compatible with the continuation of a nearly nominal survey continuation.

SVM powered compensation heaters dissipation shall need to be adjusted to maintain the spacecraft, and instruments units, in proper temperature range in coordination with instruments or spacecraft units dissipation status or solar captured energy.

5.1.6 Optical

5.1.6.1 Telescope « Optical » Emission

HFI will monitor and possibly use telescope reflectors and baffle temperature evolution during flight to correct instrument science data. Relevant spacecraft HSK packets and associated databased informations such as transfer functions shall be made accessible to HFI team for that purpose.

5.1.6.2 Pointing data

Ultimate HFI goal is to build sky maps at detectors sensitivity frequencies. This obviously requests to associate to each instrument detection channel data relevant pointing information. Data from Planck AOCS shall be provided to HFI accordingly.
It has to be noted that besides scientific need for maps construction, the AOCS data will be used by HFI QLA for data quality assessment. Indeed these data shall be used to withdraw from raw detectors data the theoretical models derived expected “sky signal” in order to monitor remaining “noise”.

5.1.6.3 Alignment Control

HFI FPU accommodates, for ground testing, a “reference horn” with an associated modulating diode to be used during so-called RF tests.
On the other hand HFI 4K “plate” bears an optical alignment set (a cube and a ball) that materialises its optical references.

5.2 Internal Interfaces

5.2.1 Power

HFI different units are all powered through spacecraft PCDU LCLs. HFI has no commanding possibility of these LCLs, powering ON and OFF HFI units belongs to Planck SVM. Table 5.1.1-1 provides HFI dedicated LCLs distribution.
As a general rule each HFI unit is providing its own specific DC/DC converter for its own use. Figure 2.3-1 gives the HFI internal powering distribution:

A single LCL is used to power a pair of REU+PAU+JFET analog belts. For each LCL exists a single line going to one or other DPU into which it is passively splitted into two different lines, one for each “belt” of the considered pair.
LCLs for analog belt 0 to 5 are connected to the nominal DPU, while LCLs for analog belts 6 to 11 are connected to redundant DPU. Interconnection between both DPUs allow to power any analog belts pair independently of the DPU which is in use (this strange configuration is due to historical reasons: in the past a set of relays located in the DPU permitted to operate individually each detection system analog belt instead of by pair as dictated by the number of allocated LCLs).

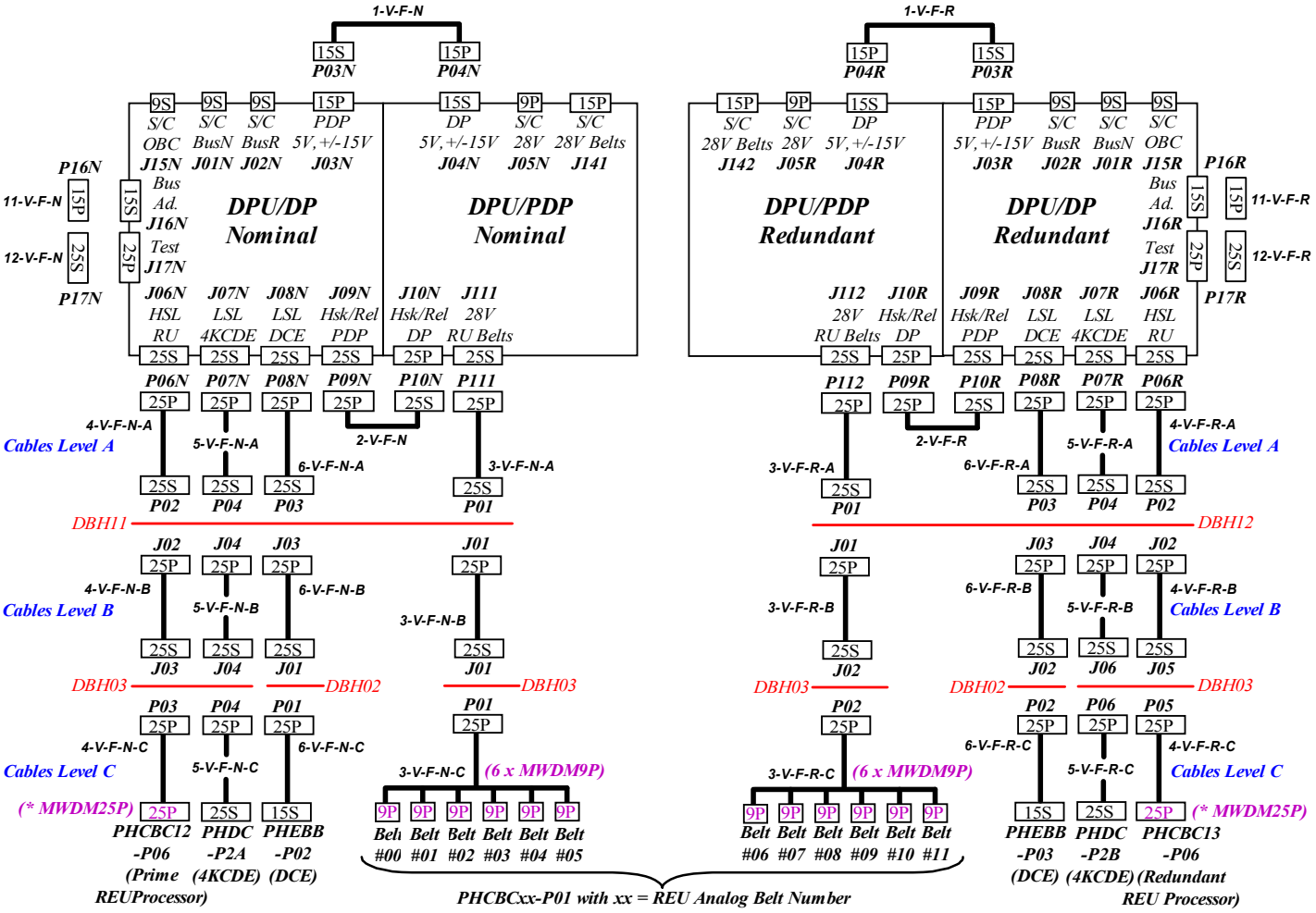


Figure 5.2.1-1 DPU detailed interconnexion

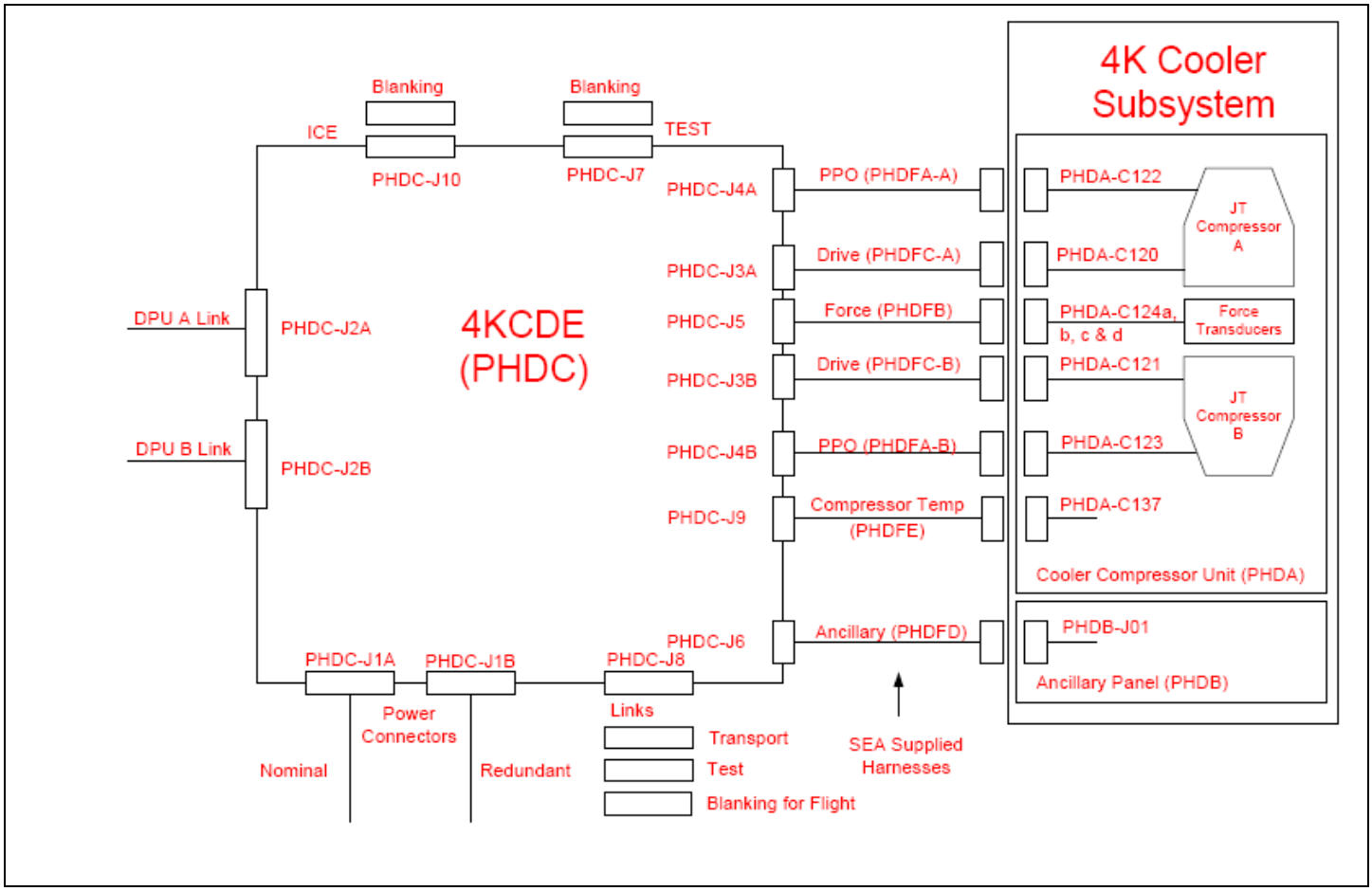


Figure 5.2.1-2 4K interconnexion

5.2.2 Data

All instrument data are emitted by the active HFI DPU through the spacecraft CDMU 1553 bus.

Data can be coming either locally from the instrument DPU itself, or coming from the REU active digital module, the 4KCDE or the DCE, in order to provide information on all HFI sub-systems:
- the DPU,
- the detections chains and the 4K – 1.6K heat-switch,
- the 4K Cooler,
- the Dilution Cooler and the 20K-4K heat-switch.

Data are routed from the REU to the DPU through the High Speed Link interconnecting them, from the 4KCDE and the CDE to the DPU through their respective interconnecting Low Speed Link.

The active REU digital module collects data from all REU analog belts, and through them that of the PAU and the JFET Box ones as well as that from the Focal Plane Units components.

5.2.3 Control

All instrument commands are received by the active HFI DPU through the spacecraft CDMU 1553 bus.

Commands can be addressed specifically for “local” use by the instrument DPU, or for the “deputed” ones to be forwarded to the REU active digital module, the 4KCDE or the DCE, in order to control these three sub-systems:
- the detections chains and the 4K – 1.6K heat-switch,
- the 4K Cooler,
- the Dilution Cooler and the 20K-4K heat-switch.

Commands are routed from the DPU to the REU through the High Speed Link interconnecting them, from the DPU and the 4KCDE and the CDE through their respective interconnecting Low Speed Link.

The active REU digital module controls all REU analog belts, and through them the PAU and JFET Box ones as well as the Focal Plane Units components.

5.2.4 Mechanical

The mechanical accommodation is given in §3.2 “accommodation on Planck spacecraft”

5.2.5 Thermal

Relying on spacecraft temperature, overall and local, thermal control, there is no “global” thermal control at HFI units level.

However due to the need to have the instrument JFET located as close as possible to the instruments detectors, i.e. in the PPLM “50-60K” area, it is necessary to heat these electronic components up to their optimum working temperature of about 130K. Each JFET Box “belt” temperature is thus measured and maintained at the proper level by the associated REU analog belt heater control system. These heaters provide the power dissipation complementing that of the JFET board dissipation itself. PI control law is used and work at a 1Hz frequency.

Besides units general temperature control, HFI includes a number of heaters used for different purposes:
- PIDs systems can be used to stabilise the different focal plate “stages”: 100mK, 1.6K and 4K,
- Heater are used to heat the 4K Cooler Getter at proper operating temperature,
- Various heaters can be used to “unplug” 4K and Dilution coolers in case of need.

To these heaters can be added those of the Heat-switches used to shorten the instrument initial cool-down.

All these systems are operated through ground command control.

5.2.6 Optical

Besides on-ground alignment dedicated hardware previously described in § 5.1.6.3, each HFI detector is associated to a set of collecting / filtering optical elements as described in section 2.2.1. No other optical elements exist in the instrument.

6 HFI PERFORMANCE

6.1 Detectors

See table 2.2.1.4

6.2 Thermometry

Calibrated transfer functions shall be found into HFI MIB database.

6.3 FM Dilution Cooler performances

6.3.1 FM Dilution Cooler available flow rates

As shown on DCCU pneumatic scheme (figure 2.2.7-2) there exist for each isotope 4 different restrictions that can be used to select used flow rate:

- one restriction, FR101 for 4He and FR202 for 3He, is permanently open and defines the minimum operational flow rate,
- three restrictions having respectively the permanent one conductance multiplied by about 1/7, 2/7 and 4/7, each of them can be used in addition to each other by use of three associated bistable valves.

Please note that these injection valves, FV102, 103 and 104 for 4He and FV202, 203 and 204 for 3He, do not include any position reading device that can be included in the telemetry.

Following tables provide the flow rates expected for each valves combination for each isotope when the Cooler Joule Thompson (JT) is in cold condition.

Flow	Open valves	µmoles / sec
Minimum	None	15,1
Mini + 1/7	PV104	17,1
Mini + 2/7	PV103	19,8
Mini + 3/7	PV104 + PV103	21,9
Mini + 4/7	PV102	24,0
Mini + 5/7	PV102 + PV104	26,1
Mini + 6/7	PV102 + PV103	28,8
Mini + 7/7	PV102 + PV103 + PV104	30,8

Figure 6.3.1 -1 4He available flow rates

Flow	Open valves	µmoles / sec
Minimum	None	5,0
Mini + 1/7	PV204	5,6
Mini + 2/7	PV203	5,9
Mini + 3/7	PV204 + PV203	6,5
Mini + 4/7	PV202	7,5
Mini + 5/7	PV202 + PV204	8,1
Mini + 6/7	PV202 + PV203	8,4
Mini + 7/7	PV202 + PV203 + PV204	9,0

Figure 6.3.1 -2 3He available flow rates

When the 1.6K JT is not cold (> 20K) it will limit both isotopes flow rate to about 2µmoles/sec.

6.3.2 Isotope maximum volumes

The isotopes are stored in four 51litre high pressure tanks (3 for 4He and 1 for 3He). Supposing an initial pressure of 295Bar and a final pressure of 19Bar at 40°C, the available usable volume is 10641 LNTP per tank. Note that the 19 Bars limit is by construction the FM high pressure regulators minimum opening pressure.

So the initial maximum usable stored volumes are:
- 10641L for 3He
- 31923 for 4He.

To obtain this it is necessary to load each tank with 11610 litres of Helium, so the total LNTP need is 11610 litres of 3Helium and 34830 liters of 4Helium.

6.3.3 Dilution Cooler autonomy

Knowing the initial usable volume for each isotope the autonomy is obtained by dividing this volume by the flow rate.

With CQM values used during CSL cryo test, i.e. 6.7 and 20.4 µmoles per second for respectively 3He and 4He: the number of months available are respectively 26.98 and 26.58.

Observation autonomy predictions are derived from these durations by substracting the duration equivalent to consumption due to initial purging at 2µmole/sec rate.
As an example for 2 months of purging the remaining observation autonomy is:
- 26.32 months for 3He
- 26.38 months for 4He,
- to be compared to 15 months requirement corresponding to 2 full sky surveys.

7 HFI OPERATIONS MODES

Among the different HFI electronic units, only the DPU, the REU and the 4KCDE are "intelligent" units that can be run in different modes. The other ones are not (only mode are ON and OFF).

Any mode of HFI is thus a combination of modes of the 3 intelligent units.

As it will be seen, as a "survey instrument" HFI has a single routine observation mode, which can be tuned to some extent in order to optimize detection performance or to face contingency situations. Other modes shall be used, either on ground or in flight, to bring and return the instrument to the best possible observation condition.

7.1 HFI "OFF" Modes

In all the following "OFF" modes, only the satellite monitoring can report on the HFI status (thermal or drive bus LCL current during Launch mode).

7.1.1 HFI in Storage mode

This is not applicable for flight conditions. In ground storage, HFI is not powered, it cannot receive any command, it generates no data. Instrument dedicated non-op substitution heaters are not powered, neither are so-called "spacecraft powered thermistors" installed close to HFI units. The instrument can stay safely in this situation without limitation of duration when stored on ground at ambient temperature.

7.1.2 HFI in Launch mode

During Launch all HFI LCL's are OFF excepted the four 4K drive bus LCL's (59, 60, 61 & 62). This Launch Power is used to electro-mechanically lock moving parts of the 4K compressors for the duration of the vibrations generated during the propulsion phases of the rocket (note that power dissipation varies with vibration level).

7.1.3 HFI in OFF Mode

When HFI is powered OFF in flight, the SVM is in charge to guaranty non operational temperatures limits for all HFI items (no HFI thermostat survival lines for exemple).
The measurement data will be included into spacecraft housekeeping telemetry packets including "essential" ones.

7.2 HFI "ON" MODES

Here, ALL HFI items are switched ON and therefore instrument telemetry can report on partial or complete HFI status.

The HFI nominal switch ON procedure is :

- SWITCH ON THE DPU nominal (LCL29) or redundant (LCL30), then wait 5s minimum
- SWITCH ON THE 4K CDE LCL nominal (LCL 37) or redundant (LCL 38) , then wait 5s minimum
- SWITCH ON THE 4K DRIVE LCL nominal (LCL59) or redundant (LCL61), then wait 5s minimum
- SWITCH ON THE 4K DRIVE LCL nominal (LCL60) or redundant (LCL62) , then wait 5s minimum
- SWITCH ON THE DCCU LCL nominal (LCL 36), then wait 5s minimum
- SWITCH ON THE REU PROC nominal (LCL 11) or redundant (LCL 12), then wait 30s minimum
- SWITCH ON THE REU BELTS 0&1 (LCL 39), then wait 5s minimum
- SWITCH ON THE REU BELTS 2&3 (LCL 40), then wait 5s minimum
- SWITCH ON THE REU BELTS 4&5 (LCL 41), then wait 5s minimum
- SWITCH ON THE REU BELTS 6&7 (LCL 42), then wait 5s minimum
- SWITCH ON THE REU BELTS 8&9 (LCL 43), then wait 5s minimum
- SWITCH ON THE REU BELTS A&B (LCL 44) then wait 5s minimum

Following the HFI switch ON, the DPU, the REU and the 4KCDE shall be in BOOT mode, but only the DPU mode telemetry is reported.

7.2.1 DPU MODES

The DPU possible modes are :

DPU OBSW Mode Name	ID
STARTUP	0
STANDBY	1
4K_MAINTENANC	3
CONFIGURATION	4
OBSERVATION	5
OPTIMIZATION	6
VI_MEASUREMENT	7
COMP_VALID	8
WITHOUT_COMPR	9
HOT_4K_MAINTCE	10
RAWSIGNAL_MODE	12
DUMMY_REU	13
BOOT	20

The DPU OBSW Modes are managed according to Fig 7.2.2-1.
The transition between 2 DPU OBSW Modes:

- is triggered by an unified TCP or automatically (Auto)
- enables or disables (E: and D) automatically packet type production
- tests a condition, when applicable, (C: to allow crossing a transition.

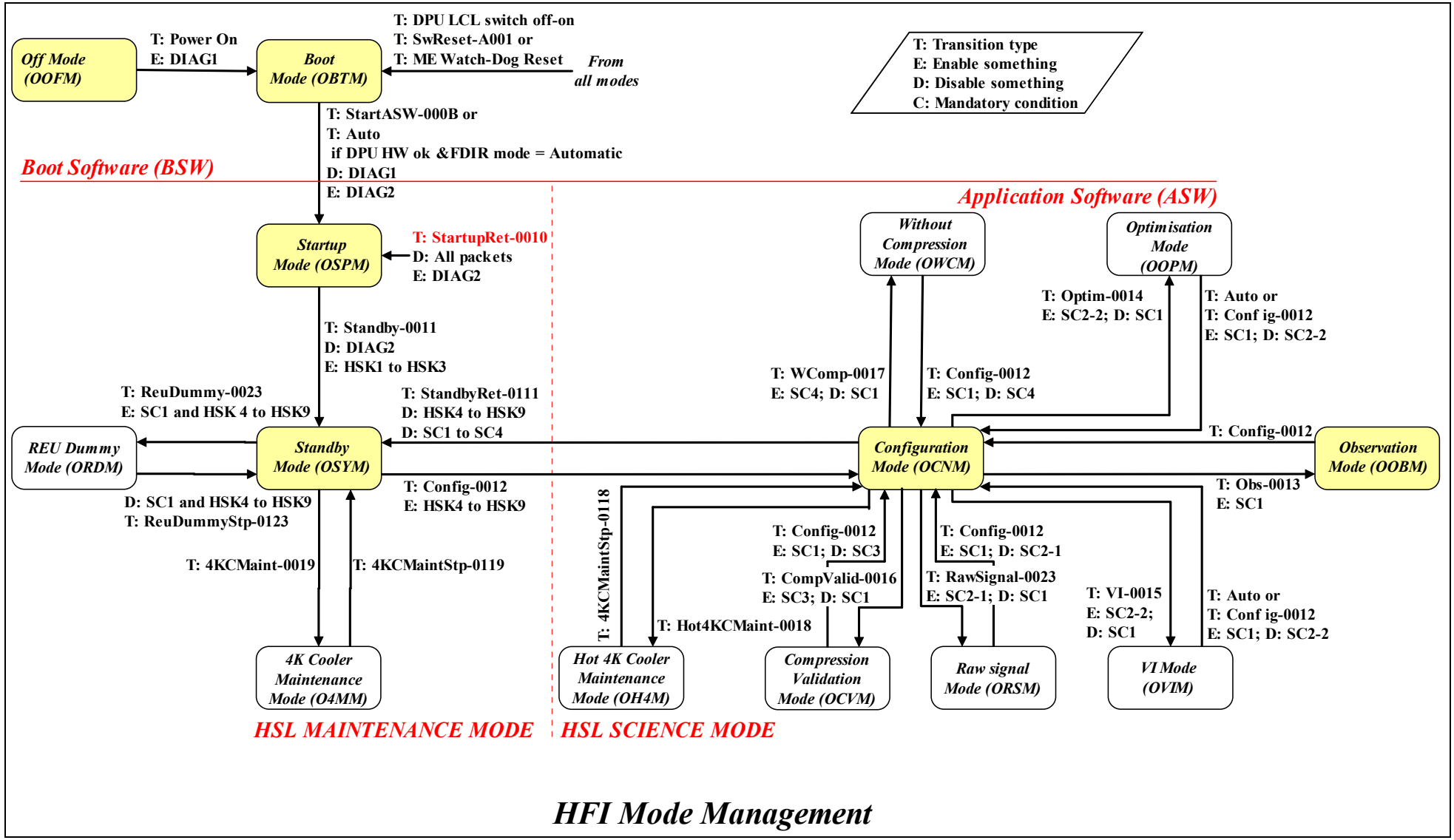


Fig 7.2.2-1 DPU mode diagram

7.2.1.1 DPU Boot Mode (BOOT)

DPU nominal, or redundant is powered ON by use of proper spacecraft LCL and enters automatically in boot mode. The DPU can also enter in boot mode from any mode if the DPU software command is sent (TCDPU-SwReset-A001).

The DPU BSW checks the DPU hardware and sends periodically, one each minute, the DIAG1 TMP. If a major DPU hardware failure is detected, the BSW goes in idle state and waits for ground command.

When the boot mode is completed (less than 90s):

- if the FDIR mode is “DPU automatic” or “HFI automatic”, the DPU goes automatically to Start-up Mode
- if the FDIR mode is “manual” or “desynchronized”, the BSW goes in idle state and waits for ground command.

Note : For the first DPU power ON in flight, the FDIR mode (store in the DPU EEPROM) will be “desynchronized” such that the DPU does not go automatically to Start-up Mode.

There are no prerequisites or operation constraints to start the DPU but that for the DPU to be in the appropriate temperature range.

It is however important to make sure that the DPU power will not be interrupted during the Boot of the DPU as the ASW recorded in EEPROM could be corrupted. Should this occur, the ASW will have to be reloaded (patched). So it is absolutely forbidden to switch OFF the DPU immediately after switching ON: a 90 seconds wait between power ON and power OFF shall be enforced.
Relevant non-op heater(s) shall be adjusted either shortly before or after DPU power-up.

7.2.1.2 DPU Start-up Mode (STARTUP)

This mode is used to monitor the start of the REU, 4KCDE and DCE.

REU (processor and analog belts), 4KCDE and DCE shall be switched on before entering in this mode.

Transition from BOOT mode to STARTUP mode is obtained by command (TCDPU-LoadASW-A003-0 or TCDPU-LdASWwithAd-A003 followed by TCDPU-StartASW-A00B).

Transition from any modes to STARTUP mode can be obtained by command (TCOBSW-StartupRet-0010 without parameters).

After 90 seconds, approximately every 70 seconds a “Diag2” HSK packet reports on REU, 4KCDE and DCE hardware status. No other TM packets are produced.

Then, the REU and the 4KCDE wait a command to go in Standby Mode (could be automatic or by ground command depending of the FDIR mode)**.**

Instrument units non-op heaters directly powered by the spacecraft SVM shall be adjusted accordingly.

7.2.1.3 DPU Standby Mode (STANDBY)

This mode is mainly used to setup 4K or REU parameters such as REU/4K frequencies. DCCU valves commanding can also be done in this mode.

Transition from STARTUP mode to STANDBY mode is obtained by command (TCOBSW-Standby-0011 without parameters).

Transition from CONFIGURATION mode to STANDBY mode (TCOBSW-StandbyRet-0111 without parameters) stops the DPU to produce Science data.

Transition from DUMMY_REU mode to STANDBY mode is obtained by command (TCOBSW-REUdummyStp-0124 without parameters).

Only Housekeeping telemetry packets (HSK1 (about 25/mn), HSK2 (about 1/mn) and HSK3(about 4/mn)) are produced in this mode.

Both for the 4KCDE and for the REU, the RAM's are tested and the main application softwares and the configuration parameters are loaded from EEPROM into the RAM's.
The REU starts the computing of PID and JFET PI algorithms.
The 4K com:pressors are not running.

7.2.1.4 DPU 4K Cooler Maintenance Mode (4K_MAINTENANC)

This mode is used to realize the "maintenance" of the 4K :

- do a 4K system response test
- patch data in RAM

Transition from STANDBY mode to 4K MAINTENANCE mode is obtained by command (TCOBSW-4KCMaint-0019 without parameters).

Transition from 4K MAINTENANCE mode to STANDBY mode is obtained by command (TCOBSW-4KCMaintStp-0119 without parameters).

Only Housekeeping telemetry packets (HSK1 (about 25/mn), HSK2 (about 1/mn) and HSK3(about 4/mn)) are produced in this mode.

note : the 4K system response test must be preferably done when the 4K is running in nominal mode in order to avoid a return in standby and then stop the cooling power.

This mode is is associated to 4K "MAINTENANCE" and "SYS_RESP_TEST" modes.

7.2.1.5 DPU "REU Dummy Mode" (DUMMY_REU)

This mode is used to test science data production by REU and its transfer to the DPU by use of a predefined data matrix stored in REU memory (see chapter 2.2.4).

Transition from STANDBY mode to DUMMY_REU mode is obtained by command (TCOBSW-REUdummy-0024 without parameter).

Transition from DUMMY_REU mode to STANDBY mode is obtained by command (TCOBSW-REUdummyStp-0124 without parameters).

The raw signal is not managed. Therefore, the raw signal down-loaded in SC1 shall be ignored and the TCREU-RsigSetup-4007 has no effect.

All detection chains parameters setting have no effect on the output data.

No Optimisation or V(I) is possible.

HSK1 to HSK9 housekeeping telemetry and SC1 science packets are produced.

This mode is is associated to REU "Test mode".

7.2.1.6 DPU Configuration mode (CONFIGURATION)

This mode is mainly used to setup REU or 4K parameters such as FPU channels, PID's, JFET setup, Cernox setup, the 4K limits configurations, to run or stop the 4K cooler, , or to command the DCCU valves.

Transition from STANDBY mode to CONFIGURATION mode is obtained by command (TCOBSW-Config-0012 without parameter).

From CONFIGURATION mode to all the HFI "observation" modes is obtained by command : OBSERVATION (TCOBSW-Observ-0013), OPTIMIZATION (TCOBSW-Optim-0014), VI_MEASUREMENT (TCOBSW-VI-0015), COMP_VALID (TCOBSW-CompValid-0016), WITHOUT_COMPR (TCOBSW-WoutComp-0017), RAWSIGNAL_MODE (TCOBSW-RawSignal-0023).

Transition from all the "observation" modes to CONFIGURATION mode is obtained by command (TCOBSW-Config-0012 without parameter).

Transition from OPTIMIZATION and VI_MEASUREMENT to CONFIGURATION is automatic at the end of the optimization and V(I) process.

This mode is associated to REU Configuration mode.

HSK1 to HSK9 housekeeping telemetry are produced. SC1 science packets are produced if Observation mode has been reached one time previously and that no return to STANDBY mode has been done.

7.2.1.7 DPU Observation Mode (OBSERVATION)

HFI has one single Observation Mode during which all detectors measurements are collected, while the spacecraft spinning movement and attitude variation programme provide the required progressive scan of the sky. As the sun direction must stay within a 10 degree half-cone angle from the spacecraft spinning axis: a given part of the sky is observable for a maximum duration of twenty days at most, and this once each six months. This has consequences on the scanning strategy and on HFI data collection continuity requirements.

It is foreseen :

- to scan at least 1 degree of sky each day to stay “on-time” with the spacecraft seasonal rotation around the sun,
- to store HFI data into the Planck Solid State Recorder for at least 2 days,
- to dump each day the oldest 24 hours of data plus, if needed, a new copy of part of the data packets that could not be received on ground during the previous days.

During routine Observation it is expected to have at least a single “3 hours” DTCP telemetry session during which simultaneously last day(s)' recorded data as well as Real Time Data shall be collected in order to perform Instrument Real Time Assessment and quickly react in case of problem and obviously in case of starting warm-up of the instruments focal plane unit, whatever is the origin, spacecraft or payload, of such an anomaly.

The baseline is to keep HFI science data collection unchanged during routine sky scanning spacecraft attitude slew.

HFI Observation Mode produces the SC1 packets with the compressed, averaged and continuous data for all detectors. Each compression slice (i.e. compression period), a raw signal is added to one of the SC1 packets corresponding to the slice. SC1 are sent at full science data rate.

To summarize: this mode is used to perform sky survey observation measurements for a given detection chain set-up (no set-up change is accepted in Observation mode, to change it, it is necessary to return to Configuration mode).

Transition from CONFIGURATION mode to OBSERVATION mode is obtained by command (TCOBSW-Observ-0013 without parameter).

Return to CONFIGURATION mode is obtained by command (TCOBSW-Config-0012 without parameter).

DPU OBSERVATION mode is associated to REU OBSERVATION.

This mode enables the DPU to produce Science data packets..

Each minute 26 HSK1, 1 HSK2 and 3 “essential” HSK3 plus 1 HSK4 to HSK9 packets are produced. About 8 SC1 packets per second (compressed data of all channels + one raw signal per compression slice) are also produced.

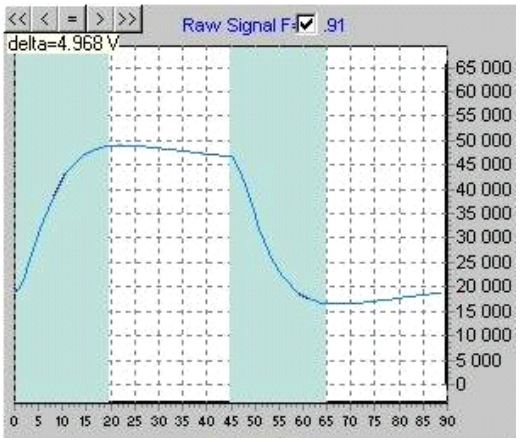
Note : In case of CDMU reset or switchover, the DPU will fill its data buffer with all the HFI produced data (HSK, science, event,...), but this buffer will be full in typically 2s to 4s in OBSERVATION mode (depending of the actual datarate). This will generate some Software error indicating "DPU buffer full". This will also generate Hardware errors indicating the loss of the On Board Clock. At the restart of the communication, the data of the DPU buffer are transmitted to the CDMU at high speed (more than 110Kbit/s) which possibly lead to satellite VC1 buffer full. The 4K and the REU are not affected.

Then, unless HFI loss of data, a CDMU reset or switchover should not affect HFI and no HFI reconfiguration is needed.

7.2.1.8 DPU Optimization Mode (OPTIMIZATION)

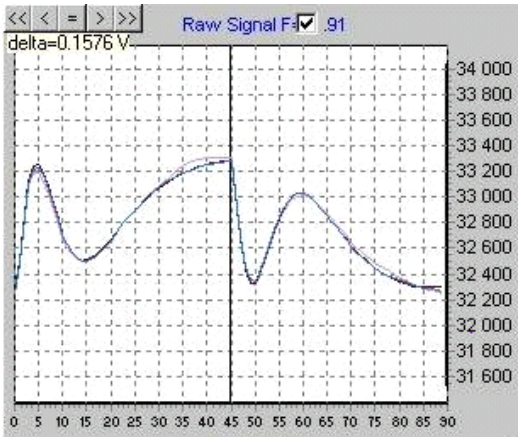
This mode is used to perform the optimization of one or several FPU detection chain(s) selected by command (TCREU-VIOSelect-4072) and to download the optimized channel(s) bridge equilibrium data (V, I, T, raw signal,). To do this, the REU finds, for each selected detection chain, from the Current value (I), the Voltage value (V) and the Transient value (T) that gives a minimum output signal and the minimum output transient. The optimization is done only by the tuning with one of the two parameters at a time (V or T).

Raw signal before optimization

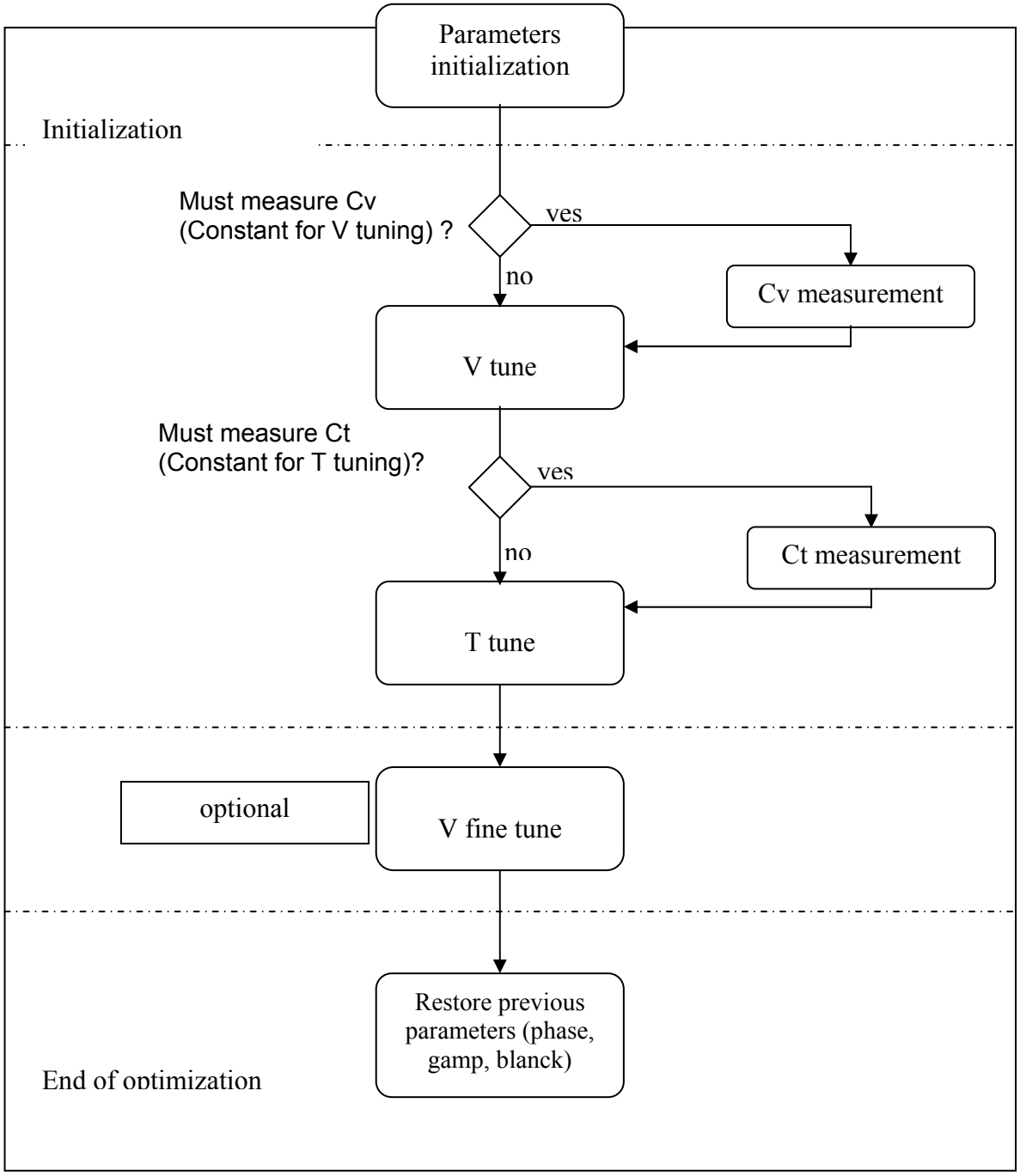


channel optimization =>

Raw signal after optimization



The following diagram describes the main stages of the channel optimization:


Parameters initialization
Initialization
Must measure Cv (Constant for V tuning) ?
ves
no
Cv measurement
V tune
Must measure Ct (Constant for T tuning)?
ves
no
Ct measurement
T tune
optional
V fine tune
Restore previous parameters (phase, gamp, blanck)
End of optimization

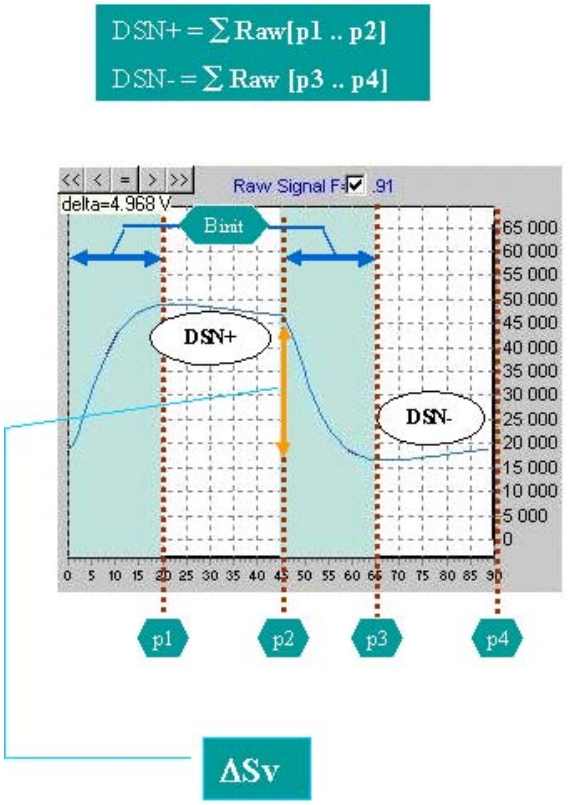
- **Initialization :**

To perform the optimization, some channel parameters must be set to a specific value before starting the process:

- Blanck = B init (to perform the V tune or Cv measurement)
- Mphase is set to 0
- Sphase is set to 0
- T can be set to a specified value (T init)
- Gamp can be set to a specified value (Gamp init)

- **Cv measurement**

Cv (Constant for V tuning) is the signal variation for one step of V value. This measurement is processed if requested (see TCOBSW-Optim-0014).



$\Delta S_{v0} = (DSN_+ - DSN_-)$ with I =0, V=0 and T=Tinit

$\Delta S_v = (DSN_+ - DSN_-)$ with I =0, V= DeltaV and T=Tinit

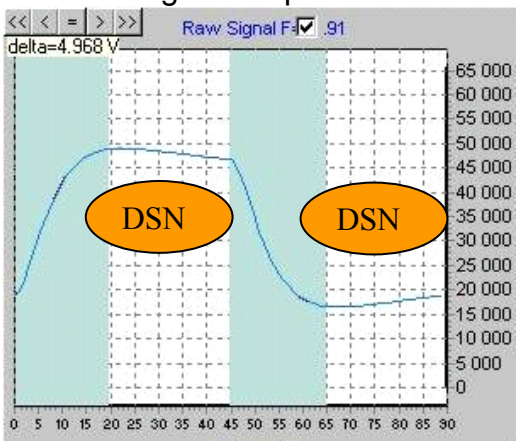
$$C_v = \frac{\Delta S_v - \Delta S_{v0}}{\Delta V}$$

configurable parameters

- **V tune**

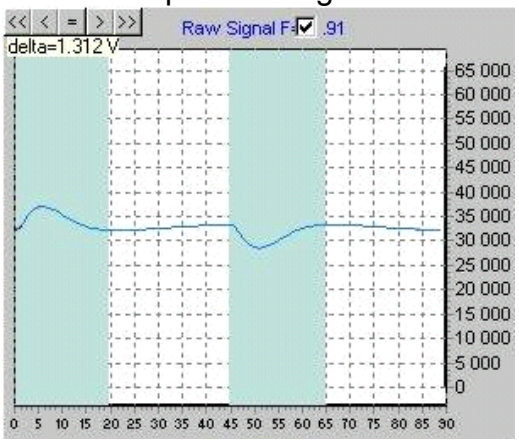
This stage allows tuning the current V to adjust the signal DSN+ and DSN- to the same level.

Signal to optimize



V tune
=>

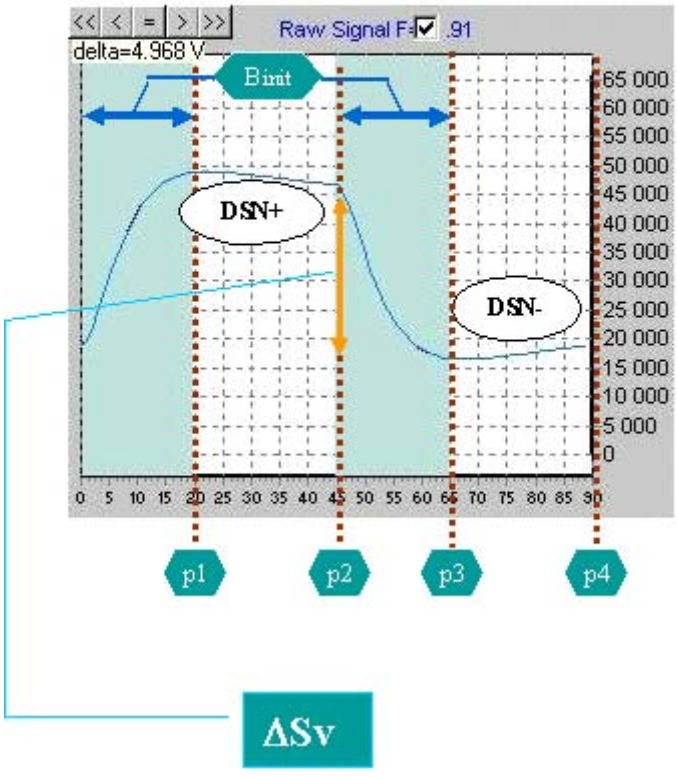
Optimized signal

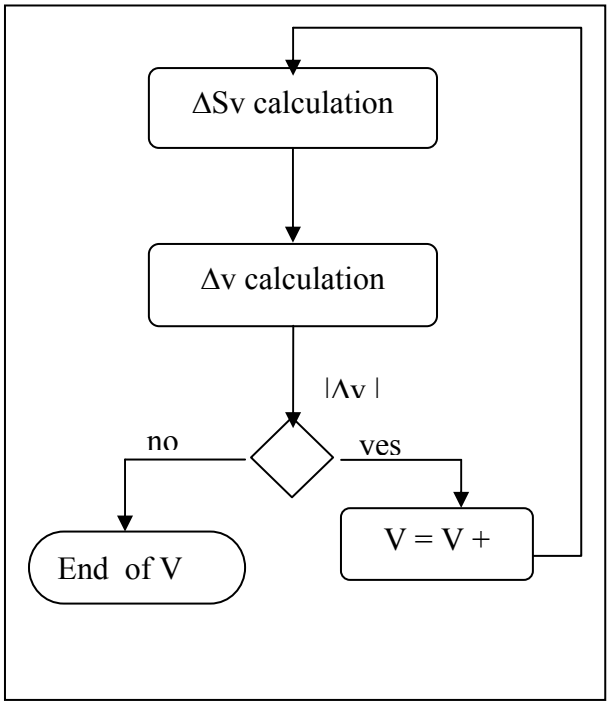


The V tune uses the following algorithm :

$DSN+ = \sum Raw[p1 .. p2]$

$DSN- = \sum Raw\ [p3 .. p4]$



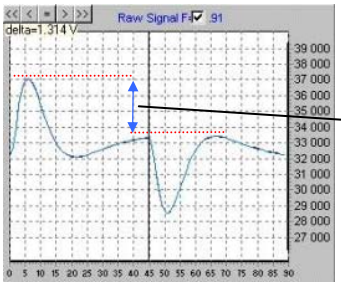


With
- $\Delta S_{v0} = (DSN_+ - DSN_-)$
- $\Delta v = -\frac{\Delta S_v}{C_v}$

- **Ct measurement**

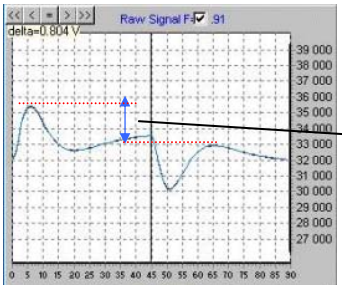
Ct (Constant for T tuning) is the transient signal variation for one step of T value.
This measurement is processed if requested (see TCOBSW-Optim-0014).

T =Tinit



ΔSt1

T=Tinit + DeltaT



ΔSt2

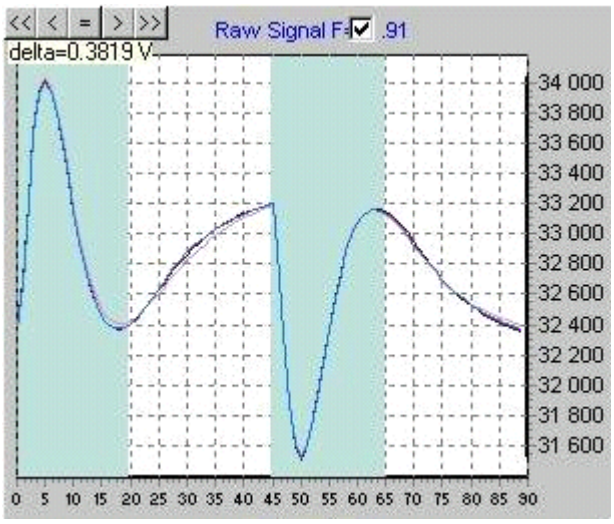
$$C_t = \frac{\Delta S_{t2} - \Delta S_{t1}}{\Delta T}$$

configurable parameters

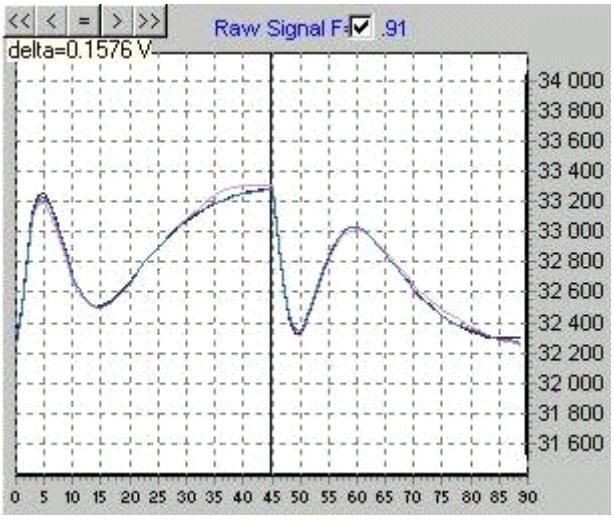
- **T tune**

This stage allows tuning the transient T to adjust the raw signal by reducing the transient effect at the beginning of each raw signal half period.

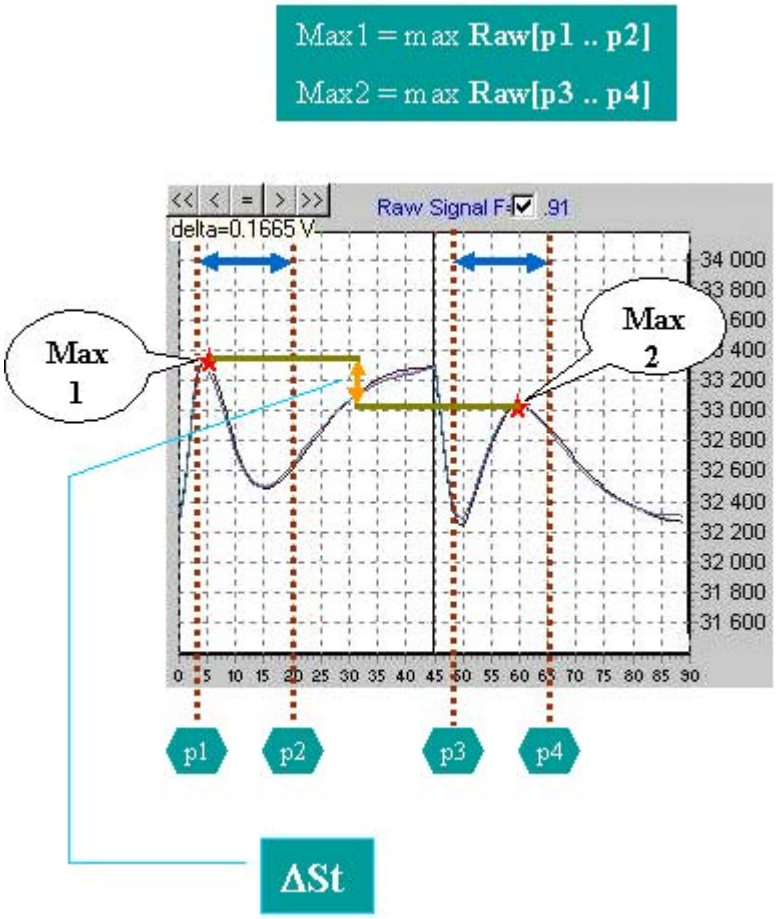
Before T tune

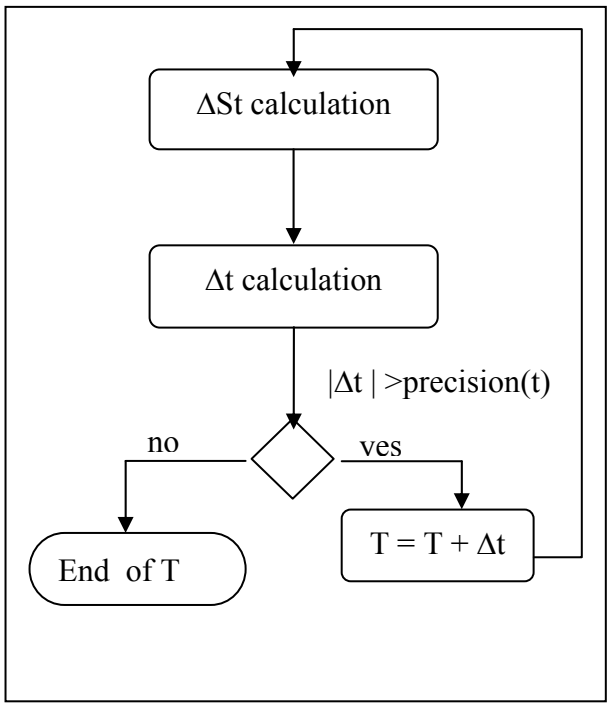


After T tune



The T tuning uses the following algorithm :





With • ΔSt = Max1 – Max2

• $\Delta t = -\frac{\Delta S_t}{C_t}$

- **End of optimization**

After the optimization process, the Mphase, Sphase, gamp, and blanck values will be restored with the values before the optimization.

FPU channels must be configured thanks to TCREU-OptConf-4070-ij before to enter into OPTIMIZATION mode (then into CONFIGURATION mode).

Transition from CONFIGURATION mode to OPTIMIZATION mode is obtained by command (TCOBSW-Optim-0014 with parameters).

Return to CONFIGURATION mode is automatic at the end of the optimization process.

Return to CONFIGURATION mode can also be obtained by command (TCOBSW-Config-0012 without parameter).

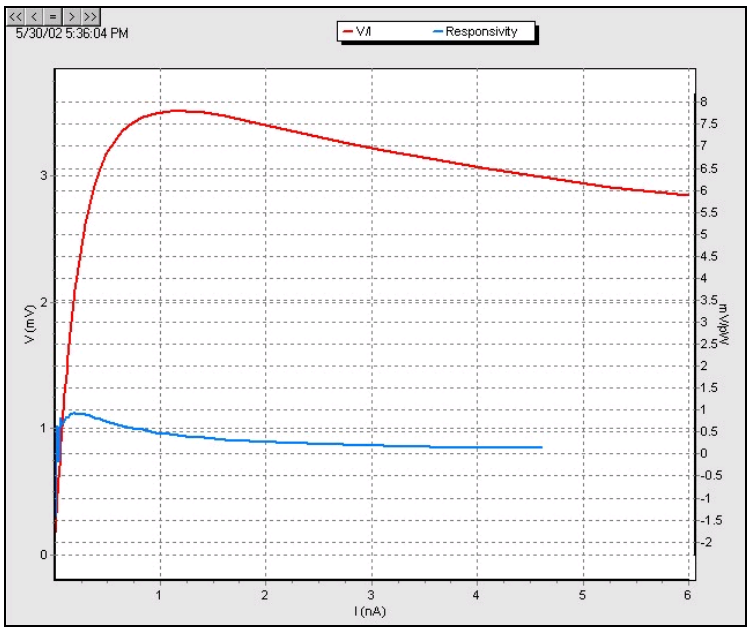
HSK1 to HSK9 housekeeping telemetry and SC2-2 science are produced.

The activation of the Science packets has to be done beforehand (OBSERVATION mode).

This mode is associated to REU OPTIMIZATION mode.

7.2.1.9 DPU V(I) Mode (VI_MEASUREMENT)

This mode is used to perform a V(I) measurement of one or several FPU detection chain(s) selected by command (TCREU-VIOSelect-4072) and to download the optimized channel(s) bridge equilibrium data (V, I, T, raw signal,).for each optimization step of the V(I) measurement.



The REU measures step by step V(I) by incrementing the current I in the selected range and finding for each "I" the value of V where the output signal is minimum (electronic optimization).

V(I) parameters must be configured thanks to TCREU-VIconf-4071 before to enter in VI_MEASUREMENT (then in CONFIGURATION mode).

Transition from CONFIGURATION mode to VI_MEASUREMENT mode is obtained by command (TCOBSW-VI-0015 with parameters).

Return to CONFIGURATION mode is automatic at the end of the V(I) process.

Return to CONFIGURATION mode can also be obtained by command (TCOBSW-Config-0012 without parameter).

This mode produces voltage-current data arranged within the SC2-2 science packet type which is down-loaded at full data rate.

HSK1 to HSK9 housekeeping telemetry and SC2-2 science are produced.

The activation of the Science packets has to be done beforehand (OBSERVATION mode).

This mode is associated to REU V_I_MEASURE mode.

7.2.1.10 HFI Raw Signal Mode (RAWSIGNAL_MODE)

This mode is used to download raw signal of one or several FPU channels (2x Number of Sample data per channel for each sampling period).

Transition from CONFIGURATION mode to RAWSIGNAL_MODE mode is obtained by command (TCOBSW-RawSignal-0023 without parameter).

Return to CONFIGURATION mode is obtained by command (TCOBSW-Config-0012 without parameter).

DPU RAWSIGNAL_MODE mode is associated to REU CONFIGURATION mode.

HSK1 to HSK9 housekeeping telemetry and SC2-1 science are produced.

The activation of the Science packets has to be done beforehand (OBSERVATION mode).

The 2 commands TCOBSW-36CompCtrl-2001-1, TCOBSW-36CompCtrl-2001 have no impact on the data downloaded by the DPU.

In this mode, the datarate is quite significantly above the specified one of 75Kbit/s as it is around 120Kbit/s for a modulation frequence of 90Hz. This datarate cannot be reduced. Loss of HFI science packet must be considered as normal in this mode. This mode must not be used during Real Time DTCP (otherwise HFI and LFI will loose real time packets due to VC1 full).

~~Due to the HFI datarate allocation, a limited number of channels can be downloaded in this mode. The downloaded channels must be selected before going into this mode using TCOBSW-36CompCtrl-2001-1, TCOBSW-36CompCtrl-2001-2 commands.~~

~~For Nsample = 36 (72 word per sampling period), **only 52 channels** (TBC) (bolometers and or thermometers) can be to downloaded at the same time.~~

~~For Nsample = 40 (80 word per sampling period), **only 48 channels** (TBC) (bolometers and or thermometers) can be to downloaded at the same time.~~

~~For Nsample = 45 (90 word per sampling period), **only 40 channels** (TBC) (bolometers and or thermometers) can be to downloaded at the same time.~~

~~If all the selected FPU channels cannot be transferred during the Compression Slice, the DPU ASW will restart with the data of the next Compression Slice of the first channel not transferred.~~

In this mode, the Compression Cize Slice is equal to 72. It is automatically modified by executing this mode and takes its previous value on return in the configuration mode.

The Raw Signal Setup (TCREU-RsigSetup-4007) can be set to different values in order to download:

- one FPU channel raw signal continuously,
- one FPU channel raw signal continuously during a Compression Slice and switch to the next Channel during the next one,
- one FPU channel raw signal during one Modulation Period and switch to the next Channel during the next one,
- the CERNOX raw signal. In this case the same raw signals of the two last selected bolometers are downloaded during all this phase.

7.2.1.11 DPU Compression Validation Mode (COMP_VALID)

This mode is used to validate the HFI Data Compression Scheme of one or several FPU channels. Compressed and uncompressed data are download.

Transition from CONFIGURATION mode to COMP_VALID mode is obtained by command (TCOBSW-CompValid-0016 without parameter).

Return to CONFIGURATION is obtained by command (TCOBSW-Config-0012 without parameter).

This mode produces one set of averaged data coded on 22 bits and the same set of data compressed. Both are arranged within SC3 science packets. Different channels are selected from one SC3 packet to another. The SC3 packets are down-loaded at full data rate.

HSK1 to HSK9 housekeeping telemetry and SC3 science are produced.

The activation of the Science packets has to be done beforehand (OBSERVATION mode).

Due to the HFI datarate allocation, a limited number of channels can be downloaded in this mode. The downloaded channels must be selected before going into this mode using TCOBSW-36CompCtrl-2001-1, TCOBSW-36CompCtrl-2001-2 commands. **Only 10** (TBC) **channels** (bolometers and or thermometers) can be downloaded at the same time.

If all the selected FPU channels cannot be transferred during the Compression Slice, the DPU ASW will restart with the data of the next Compression Slice of the first channel not transferred.

The activation of the Science packets has to be done beforehand (OBSERVATION mode).

This mode is associated to REU CONFIGURATION mode.

7.2.1.12 DPU Without Compression Mode (WITHOUT_COMPR)

This mode is used to download uncompressed data coded on 22 bits of one or several FPU channels.

Transition from CONFIGURATION mode to WITHOUT_COMPR mode is obtained by command (TCOBSW-WoutComp-0017 without parameter).

Return to CONFIGURATION mode is obtained by command (TCOBSW-Config-0012 without parameter).

HSK1 to HSK9 housekeeping telemetry and SC4 science are produced.

The activation of the Science packets has to be done beforehand (OBSERVATION mode).

Due to the HFI datarate allocation, a limited number of channels can be downloaded in this mode. The downloaded channels must be selected before going into this mode using TCOBSW-36CompCtrl-2001-1, TCOBSW-36CompCtrl-2001-2 commands. **Only 12** (TBC) **channels** (bolometers and or thermometers) can be downloaded at the same time.

If all the selected FPU channels cannot be transferred during the Compression Slice, the DPU ASW will restart with the data of the next Compression Slice of the first channel not transferred.

This mode is associated to REU CONFIGURATION.

7.2.1.13 HOT 4K COOLER MAINTENANCE MODE (HOT_4K_MAINTCE)

This mode is used to realize the “maintenance System response Test” of the 4K while the 4K is running nominally (no need to stop the cooler to do a 4K SRT).
Transition from CONFIGURATION mode to HOT_4K_MAINTCE mode is obtained by command (TCOBSW-Hot4KCMaint-0018 without parameters).

Transition from HOT_4K_MAINTCE mode to STANDBY mode is obtained by command (TCOBSW-Hot4KCMntStp-0118 without parameters).

There is no modification of the production of the housekeeping and science data with regard to the production during the last CONFIGURATION mode.

This mode is is associated to 4K “NOMINAL_SRT” mode.

7.2.2 READOUT ELECTRONIC (REU) MODES

The REU possible modes are :

REU Mode Name	ID
BOOT	1
STANDBY	2
CONFIGURATION	4
OBSERVATION	8
OPTIMIZATION	16
V_I_MEASURE	32
TEST_MODE	64

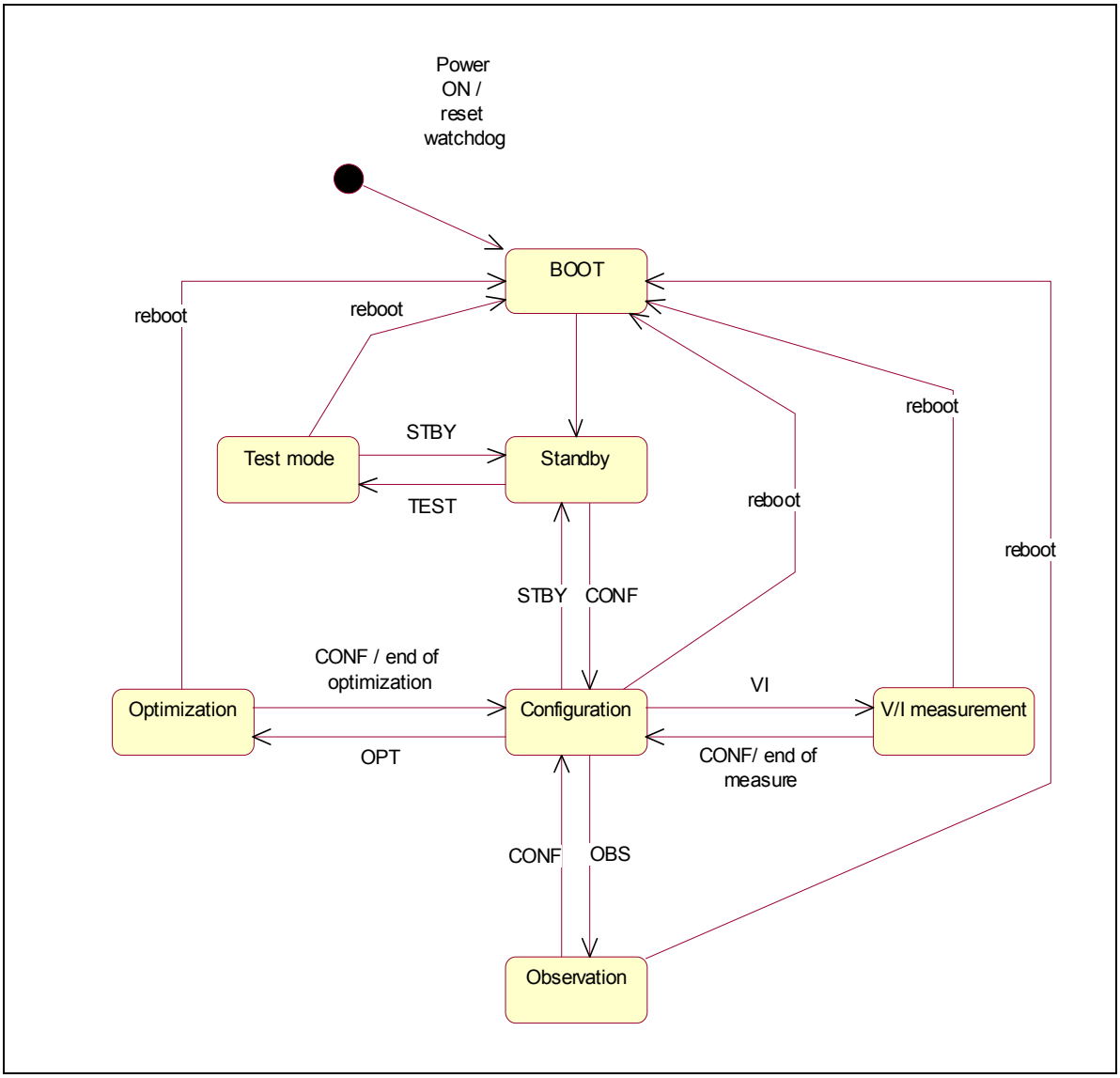


Figure 7.2.3-2 REU Modes Diagram

7.2.2.1 REU Boot mode (BOOT)

HFI DPU Boot has to be completed before REU Boot can be initiated.
Nominal, or Redundant, REU LCL is first closed by a spacecraft command to power up the REU Digital Belt connected to the (nominal or redundant) powered DPU.
Non-op spacecraft powered substitution heaters shall be adjusted according to the new dissipation repartition.

REU Boot operates at Switch-ON or Reset watchdog of the Readout DSP. In this mode, the REU on-board software runs in PROM memory and performs in this order :

. full auto-test of Program Memory RAM and Data Memory RAM,
. calculation of checksums for the contents of PROM and EEPROM,
. performs a context of commands stored in EEPROM Flash memory:
. default values for Fmod, Nsample, and PID parameters,
. I, V and T, Nblanck, Phase, Gamp parameters for each measurement channel.
. waits commands from DPU.

REU Boot is controlled by the unit Boot Software (BSW) all other modes are controlled by the REU “Scientific Application Software”.

REU Boot duration is less than 20 seconds.

It is important to make sure that the REU power will not be interrupted during the Boot of the REU (20s) as the ASW recorded in EEPROM could be corrupted. Should this occur the ASW will have to be reloaded (patched).

7.2.2.2 REU Stand-By mode (STANDBY)

This mode is associated to the DPU STANDBY mode (see the DPU corresponding paragraph).

7.2.2.3 REU Configuration mode (CONFIGURATION)

This mode is associated to the DPU CONFIGURATION mode (see the DPU corresponding paragraph)

7.2.2.4 REU Observation mode (OBSERVATION)

This mode is associated to the DPU OBSERVATION mode (see the DPU corresponding paragraph).

7.2.2.5 REU Optimization mode (OPTIMIZATION)

This mode is associated to the DPU OPTIMIZATION mode (see the DPU corresponding paragraph).

7.2.2.6 REU V(I) measurements mode (V_I_MEASURE)

This mode is associated to the DPU VI_MEASUREMENT mode (see the DPU corresponding paragraphe).

7.2.2.7 REU Test Mode (TEST_MODE)

This mode is associated to the DUMMY_REU mode (see the DPU corresponding paragraph).

7.2.3 4K COOLER MODES

The 4KCDE possible modes are :

4K Mode Name	ID
FREEWHEEL	0
RUNDOWN_1	1
RUNDOWN_2	2
NOMINAL	3
RUNUP_1	4
RUNDOWN_3	5
CHANG_AMPL	6
STANDBY	7
MAINTENANCE	8
RUNUP_2	9
RUNDOWN_4	10
SYS_RESP_TEST	11
NOMINAL_SRT	12
BOOT	99

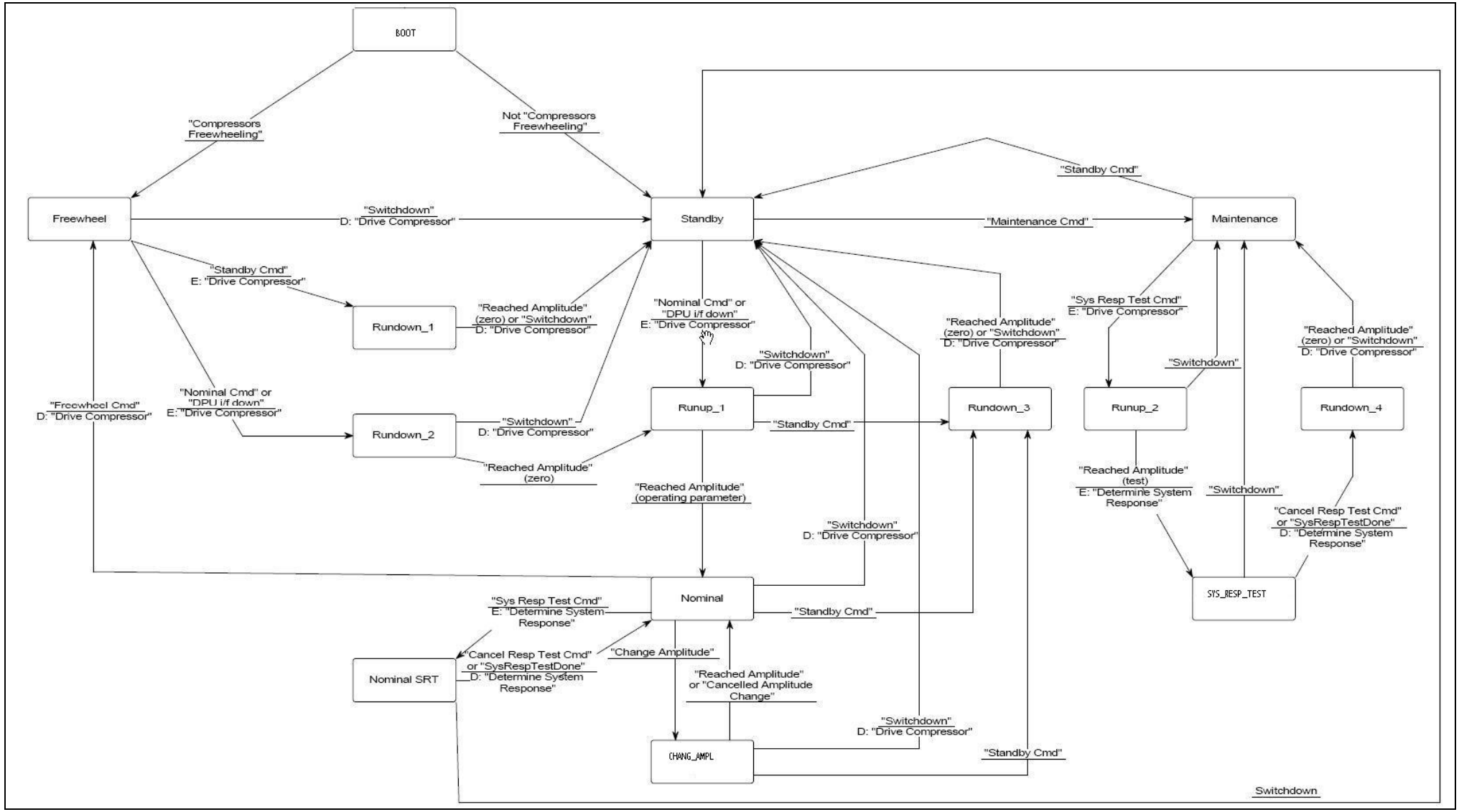


Figure 7.2.4-1 4KCDE Modes Diagram

7.2.3.1 " Launch mode"

During launch the pistons in the compressors are required to be clamped in their mid-positions to prevent damage. This is achieved by activating the 4K drive bus LCL's ONLY. This is not identified as a mode within the software as the 4K electronic is OFF.

7.2.3.2 Boot mode (BOOT)

System is booting up following a coldstart or a warmstart (TCOBSW-StartupRet-0010 or TC4K-Reset-800F). The boot program is executing.
The boot process is initiated by a processor reset which can occur for the following reasons:

- Power on.
- Software hung (resulting in a reset caused by watchdog timer expiry).
- A Reset Command is sent by the DPU (either to the application program or boot program).
- A processor error (floating point error, illegal instruction, illegal address etc) has occurred and been trapped by the application software.

If an unsolicited 4KCDE reset occurs, the DPU can detect this, since the boot program responds to the HskDataReq command with a Boot Report Packet rather than a Housekeeping Data Packet. The boot program does not generate any Housekeeping data. The format of a boot report data packet is documented in paragraph 10 (HFI TELEMETRY).
The boot program proceeds sequentially through the following states, except the Failure state which is entered if a serious error is detected.

- Init – initializes processor hardware registers. Resets and enables the LSL interface to the DPU. Disables the Getter and Orifice Heaters. If at least one compressor drive amplifier is enabled, but the waveform buffer hardware has not been "toggled" (indicating that software has written to the waveform buffers), then the compressor drive amplifiers are both disabled. Updates the warmstart count and reset time "boot parameters" in EEPROM.

- Notify – A fixed period of 30 seconds designed to notify the DPU that the 4KCDE system is booting or re-booting. Any DPU command packet detected during this period is responded to with a boot report data packet. At this stage, the boot report data packet will have the Sequence Counter and Command Packet Type fields set to zero. This is because the boot program does not extract any information from the command. Its processing is very simple at this stage, as it cannot yet use any memory.

- RAM testing - the boot program then executes non-destructive tests on the Program and Data RAM. If any failing memory blocks are found, these are compared to a "failed memory blocks mask" parameter that resides in EEPROM. If there are failing blocks not flagged by this mask, then the RAM test is deemed to have failed. If the failed blocks are all accounted for in the "mask", then the test has passed. The purpose of the "mask" parameter in EEPROM is to allow failing memory blocks to be recognized, which allows the boot program to continue, rather than go into the Failure state. The mask can be "patched" from the DPU in the Wait or Failure states. If the memory test has passed the boot program continues into the Wait state, otherwise it

goes into Failure state. The 4KCDE cannot respond to any DPU commands during this period ie any commands sent will time out.

Wait – allows time for the DPU to upload new application code, intial values of operating parameters or limit parameters, and to patch/dump areas of memory to support analysis of a problem which resulted in a processor reset. All uploads are performed with the Patch command. Application code upload will require multiple Patch commands of maximum size Command Packets. An area of Data RAM or Dual Port RAM, depending on the results of the RAM test, is used by the boot program for buffering patch data and storing "variables". This state will timeout if a DPU command has not been received for 10 minutes in order to support autonomous 4KCDE operation if the LSL is down. A "ContinueBoot" command from the DPU will also cause this state to be exited. A "Reset" command will reset the processor, starting the boot program again. While in this state the boot program will respond to any DPU command other than Continue Boot, Dump, Patch or Reset, with a boot report data packet. Continue Boot, Patch and Reset are always responded to with an Acknowledge data packet. Dump is responded to with a memory dump data packet, or no packet if an error is detected in the command. Error data packets are not returned by the boot program, but error information may be obtained from a boot report packet Error codes (paragraph 10 :HFI TELEMETRY).

• Load Application Code – the boot program reads the application code memory segments and checksums from EEPROM. If there is a checksum failure the boot program enters Failure state. Otherwise the boot program loads the application code into Program RAM.

• 'C' Setup – The 'C' library functions ___lib_setup_hardware, ___lib_setup_processor and ___lib_setup_environment are called to setup the 'C' runtime environment and control is passed to the application program's main() function.

• Failure - in failure state the DPU has the opportunity to modify/examine memory contents by means of the Patch/Dump commands, or to get boot status. This state can only be exited by a Reset command from the DPU or a power off/on cycle.

From BOOT mode, the 4KCDE can go in :

- STANDBY mode (TC4K-ContinueBoot-8001 or TCOBSW-Standby-0011) in case of 4K cold start
- FREEWHEELMODE (TC4K-ContinueBoot-8001 or TCOBSW-Standby-0011) in case of 4KCDE warm restart from previous NOMINAL mode

7.2.3.3 Standby mode (STANDBY)

In this mode, the compressor drive amplifiers are disabled, so that the compressor is not being driven.
The 4K goes into STANDBY mode when :

- During a 4KCDE cold start, from the 4K BOOT wait state, a TC4K-ContinueBoot-8001 or a TCOBSW-Standby-0011 are sent. The 4K boot program loads the application code out of EEPROM into RAM. The transition

from BOOT to STANDBY takes approximately 1mn, during which time the 4KCDE cannot respond to any DPU commands.

- From NOMINAL, CHANG_AMP, FREEWHEEL, NOM_SRT and MAINTENANCE, a stop cooler is requested (TC4K-StopCooler-8003) or a standby return request (TCOBSW-StandbyRet-0111). Note that the 4K goes in to transient RUNDOWN_i mode before to enter into the STANDBY mode (excepted from MAINTENANCE). The time taken to ramp down the compressor from the maximum amplitude (5mm) to zero, is (128*45)/F0 seconds, where F0 is the compressor frequency in Hz. That is 128 seconds at the maximum compressor frequency of 45Hz, and 165 seconds at the minimum compressor frequency of 35Hz.
- From any mode, in case of an an autonomous switchdown resulting from a 4K error condition. In this case, there is no RUNDOWN_i transient and the 4K compressors stop immediatly. The limits subjected to immediate switchdown are the following:

  HM126260: 4K limit value for positive Displacement Comp A (micron)
  HM127260 :4K limit value for negative Displacement Comp A (micron)
  HM128260: 4K limit value for positive Displacement Comp B (micron)
  HM129260: 4K limit value for negative Displacement Comp B (micron)
  HM132260: 4K limit value 3 for Drive Intensity (A)
  HM134260: 4K limit value 2 for Comp A Temperature (°C)
  HM135260: 4K limit value 2 for Comp B Temperature (°C)
  HM137260: 4K limit value for positive Comp A Intensity (A)
  HM138260: 4K limit value for negative Comp A Intensity (A)
  HM139260: 4K limit value for positive Comp B Intensity (A)
  HM140260: 4K limit value for negative Comp B Intensity (A)
  HM271260: 4K Limit Exceed Force >5N
  HM254260: 4K Limit Exceed Program Amp Difference >2mm

- From the 4K BOOT mode if, after 10mn, there is no dialog with the DPU. The 10 minute timeout is to support autonomous operation of the 4K in order to produce cooling power when the DPU interface has failed.

From STANDBY mode, the 4KCDE can go in:

- NOMINAL mode via RUNUP_1 mode when running the cooler is requested (TC4K-RunCooler-8004)
- MAINTENANCE mode when the maintenance mode is requested (TCOBSW-4KCMaint-0019)
- BOOT in case of 4K software reset (TCOBSW-StartupRet-0010 or TC4K-Reset-800F)

All 4K operating parameters can be set in this mode.
The 4K housekeeping (HSK1 to HSK3) are produced and is not stopped for any mode until the 4K return in BOOT mode.

7.2.3.4 Nominal mode (NOMINAL)

In this mode, the compressors are nominally being maintained at the commanded amplitude.
The 4K goes into NOMINAL mode when :

- From STANDBY (via RUNUP_1) or from FREEWHEEL mode (via RUNDOWN_2 & RUNUP_1), the TC4K-RunCooler-8004 is sent. The maximum duration to be in NORMAL mode is 165 seconds from STANDBY and 330 seconds from FREEWHEEL.
- From CHANG_AMP mode, when the ramp up or ramp down is completed following a TC4K-CompAmplDemand-8002 sent in NOMINAL mode.
- From NOMINAL_SRT, when the SRT is finished.
- From 4K STANDBY mode if, after 10mn, there is no dialog with the DPU. The 10 minute timeout is to support autonomous operation of the 4K in order to produce cooling power when the DPU interface has failed.

The drive amplitude is nominally not changed in this mode, but the drive waveform shape can be changing if the vibration cancellation has been turned on. The HCT (Harmonic Correction Table) defines the harmonic components in the drive waveforms. It is initialised from the copy in EEPROM when the system is booted, and updated by the Vibration Cancellation System. The EEPROM copy is not updated. The objective of the VCS is to reduce the 4K compressors exported forces to a level below 20mK up to the 7^{th} harmonics (HM086260 to HM093260)

In this mode, it is possible to setup the frequency harmonic selection to be used by the Vibration Cancellation System (TC4K-FreqImbCancel-8002 with parameter from 0 to 255), BUT not the VCS activation / desactivation (TC4K-VcsCtrl-800B) or the force transducer selection (TC4K-ForceTransdSel-8002). Getters and orifice can be activated / desactivated.

In case of limit exceed on the compressor temperature or on the drive bus current consumption, a limiting amplitude with regard to the requested one can be used as the following :

- For the drive bus current consumption, if Limit 1 (HM130260) is exceeded the amplitude demand is reduced by 10%, if Limit 2 (HM131260) is exceeded the amplitude demand is reduced by 20% (if Limit 3 (HM132260) is exceeded an instant shutdown into Standby Mode is the result).
- For the compressor temperature, should the Compressor Head A (HM133260) or Compressor Head B (HM135260) temperature exceed Limit 1 the following will occur:

  a. “Frequency select for vibration cancellation” will be set to zero to prevent vibration cancellation taking place on any of the harmonic frequencies. This will prevent divergence of the driving waveform if the drive amplitude is reduced to a value that is not compatible with the present System Response Test mapping.

  b. The Demanded Drive Amplitude will be reduced by 10% to reduce the power input to the compressors in an attempt to bring the temperature below Limit 1.

  c. The Limit 1 action will be suspended for 10 minutes to give the compressors a chance to reduce in temperature with the new lower Amplitude Demand.

  d. After the above 10 minute suspension of Limit 1 action, checking of Limit 1 will again commence and the whole process b, c and d will be repeated should Limit 1 be exceeded.

From NOMINAL mode, the 4KCDE can go in:

- NOMINAL mode via CHANG_AMPL mode when an modification of the amplitud demand is requested (TC4K-CompAmplDemand-8002)
- STANDBY via RUNDOWN_3 when it is requested to stop the cooler (TC4K-StopCooler-8003 or TCOBSW-StandbyRet-0111)
- STANDBY directly due to a switch down
- BOOT in case of 4K software reset (TCOBSW-StartupRet-0010 or TC4K-Reset-800F)

7.2.3.5 Change amplitude mode (CHANG_AMPL)

The 4K goes into CHANG_AMPL mode when, from NOMINAL mode, a new amplitude demand is requested (TC4K-CompAmplDemand-8002). When the final amplitude is obtained, the 4K goes automatically in NOMINAL mode.
From CHANG_AMPL mode, the 4KCDE can go in:

- NOMINAL when the ramp up or ramp down is completed (TC4K-CompAmplDemand-8002)
- STANDBY via RUNDOWN_3 when it is requested to stop the coole (TC4K-StopCooler-8003 or TCOBSW-StandbyRet-0111)
- STANDBY directly due to a switch down
- BOOT in case of 4K software reset (TCOBSW-StartupRet-0010 or TC4K-Reset-800F)

7.2.3.6 Freewheel mode (FREEWHEEL)

In this mode, the compressors are being driven by the hardware, but the software is not modifying the drive waveform. The waveform strored in the DPRAM is used.
The 4KCDE goes into FREEWHEEL mode when, during a warm 4KCDE restart from NOMINAL mode (TC4K-Reset-800F send when the 4KCDE is in NOMINAL mode), the continue boot command (TC4K-ContinueBoot-8001) is sent when the 4KCDE is in BOOT mode.
Note that when a 4KCDE software reset is requested or that it autonomously occurs when the 4K is running in NOMINAL mode, the 4KCDE goes in BOOT mode BUT the compressors goes in FREEWHEEL but that this compressor FREEWHEEL mode is not visible in the HFI telemetry. It is only after the TC4K-ContinueBoot-8001 that the 4KCDE goes in FREEWHEEL mode and repport this mode in the telemetry.
Software patches can be applied in this mode without stopping the 4K cooling power production.
From FREEWHEEL mode, the 4KCDE can go in:

- NOMINAL mode via RUNDOWN_2 & RUNUP_1 modes when it is requested to run the cooler in NOMINAL mode for VCS activation or change the amplitude (TC4K-RunCooler-8004)
- STANDBY via RUNDOWN_1 when it is requested to stop the cooler (TC4K-StopCooler-8003 or TCOBSW-StandbyRet-0111)
- STANDBY directly due to a switch down
- BOOT in case of 4K software reset (TCOBSW-StartupRet-0010 or TC4K-Reset-800F)

7.2.3.7 Maintenance mode (MAINTENANCE)

This mode is used to start a 4K System Response Test from STANDBY mode or to patch memories.
The 4KCDE goes into MAINTENANCE mode when TCOBSW-4KCMaint-0019 is sent from STANDBY mode.
The 4KCDE return automatically into MAINTENANCE mode when the System Response Test is finished
From MAINTENANCE mode, the 4KCDE can go in:

- SYS_RESP_TEST mode via RUNUP_2 mode when it is requested to strat the SRT (TC4K-SysRespTest-800C)
- STANDBY when it is requested to return into STANDBY mode (TCOBSW-4KCMaintStp-0119)
- BOOT in case of 4K software reset (TCOBSW-StartupRet-0010 or TC4K-Reset-800F)

7.2.3.8 System response test mode (SYS_RESP_TEST)

This mode indicates that a System Response Test is being carried out and that this SRT has been requested from MAINTENANCE mode.
The 4KCDE goes into SYS_RESP_TEST, via RUNUP_2, when a SRT is requested (TC4K-SysRespTest-800C) from MAINTENANCE mode.
This process takes approximately 25 minutes to complete the SRT. Test harmonic components are injected at different amplitudes and phases, and the resulting change in vibration analysed. The analysis results in an updated SRT (System Response Table) in EEPROM. The SRT is used by the Vibration Cancellation component.
From SYS_RESP_TEST mode, the 4KCDE can go in:

- MAINTENANCE mode via RUNDOWN_4 mode automatically when the SRT test is complete
- MAINTENANCE mode via RUNDOWN_4 when a cancellation of SRT is requested (TC4K-CancelSysRespTest)
- MAINTENANCE mode in case of switch down during SRT.

7.2.3.9 Nominal SRT mode (NOMINAL_SRT)

This mode indicates that a System Response Test is being carried out and that this SRT has been requested from NOMINAL mode.
The 4KCDE goes into NOMINAL_SRT when when a SRT is requested (TC4K-SysRespTest-800C) from NOMINAL mode.
This process takes approximately 25 minutes to complete. Test harmonic components are injected at different amplitudes and phases, and the resulting change in vibration analysed. The analysis results in an updated SRT (System Response Table) in EEPROM. The SRT is used by the Vibration Cancellation component.
From NOMINAL_SRT mode, the 4KCDE can go in:

- NOMIBNAL mode automatically when the SRT test is complete
- NOMINAL mode when a cancellation of SRT is requested (TC4K-CancelSysRespTest)
- STANDBY mode in case of switch down during SRT.

7.2.3.10 Runup_1 mode

In this transient mode, the compressors are being ramped up to the target amplitude. At the end of the ramp up, the 4K goes automatically in NOMINAL mode.
The maximum duration of this transient mode is 165s.

7.2.3.11 Runup_2 mode

In this transient mode, the compressors are being ramped up to the target amplitude required for the system response test. At the end of the ramp up, the 4K goes automatically in SYS_RESP_TEST mode.
The maximum duration of this transient mode is 165s.

7.2.3.12 Rundown_1

In this transient mode, the compressor, freewheeling, is being rundown gradually to zero in order to enter into STANDBY mode.
The maximum duration of this transient mode is 165s.

7.2.3.13 Rundown_2

In this transient mode, the compressor, freewheeling, is being rundown gradually to zero with the same drive waveform shape that it had in the FREEWHEEL state.
The maximum duration of this transient mode is 165s.

7.2.3.14 Rundown_3

In this transient mode, the compressor, running nominally, is being rundown gradually to zero amplitude in order to enter into STANDBY mode.
The maximum duration of this transient mode is 165s.

7.2.3.15 Rundown_4

In this transient mode, he compressor, performing SRT, is being rundown gradually to zero amplitude in order to enter into MAINTENANCE mode.
The maximum duration of this transient mode is 165s.

7.2.4 DPU, REU, 4K COOLER MODES COMBINATION

During « normal » HFI operations, the possible DPU, REU and 4K mode combinations are given in the following table.

DPU Mode Name	REU Mode Name	4KCDE Mode Name
OFF	OFF	OFF
BOOT	OFF	OFF
STARTUP	BOOT	BOOT
STANDBY	STANDBY	STANDBY or FREEWHEEL
CONFIGURATION	CONFIGURATION	STANDBY, NOMINAL, FREEWHEEL, RUNDOWN's, RUNUP's, CHANG_AMPL
OBSERVATION	OBSERVATION	STANDBY, NOMINAL, FREEWHEEL
OPTIMIZATION	OPTIMIZATION	STANDBY, NOMINAL, FREEWHEEL
VI_MEASUREMENT	V_I_MEASURE	STANDBY, NOMINAL, FREEWHEEL
RAWSIGNAL_MODE	CONFIGURATION	STANDBY, NOMINAL, FREEWHEEL
COMP_VALID	CONFIGURATION	STANDBY, NOMINAL, FREEWHEEL
WITHOUT_COMPR	CONFIGURATION	STANDBY, NOMINAL, FREEWHEEL
DUMMY_REU	TEST_MODE	STANDBY
HOT_4K_MAINTCE	CONFIGURATION	NOMINAL, NOMINAL_SRT
4K_MAINTENAN	CONFIGURATION or STANDBY	MAINTENANCE, SYS_RESP_TEST

Table 7.2.5-1 : DPU, REU and 4K mode combinations

In case of anomaly (4K switchdown, DPU, REU or 4K software reset,), many others mode combinations are possible.

7.3 Other HFI DPU "ON" Modes

7.3.1 HFI "Lossy mode"

As an introduction it is reminded that the spacecraft CDMU already imposes a command selectable "hard limit" to the amount of data HFI can store / download through the number of packets it will fetch in the instrument DPU.
If for any reason HFI science in-flight data compression rate foreseen performance are not reached, instrument "Lossy" Observation modes are available to maintain as far as possible a full sky exploration coverage while keeping the instrument down-loaded data within allocation. One implemented possibility to cope with this situation is to limit the number of science packets emitted by the HFI DPU between two successive Planck spin axis slews (typically 45-60 minutes).
For that purpose it has been decided that Planck on-board Time Line shall include "end of slew" commands to be sent to the instrument at the end of each sky scanning manoeuvre slew (typically 5 minutes after the start of the slew, this value shall be selected in agreement with ESOC Planck operation team after spacecraft in-flight commissioning). Each of these commands shall include as a first parameter the programmed duration before the following end of slew, and as a second parameter the TM allocation for this coming dwell period duration. If for any reason the TM produced by the instrument reaches this allocation before the following "end of slew" command is received, the production of science packet shall be suspended. Note that if we are over this limit by a small amount the observations collected during spacecraft slewing duration shall be lost first.
If at the end of the announced dwell duration no new "end of slew" command is received, this data production control will stop to operate.
Like many other HFI software features this one can be disabled by command.

If HFI, or LFI, in-flight observations prove to be perturbated during the Daily Telecommunication Periods it could also be decided to re-affect the data science share between instruments, or to increase the mean data collection rate during the rest of the day (3 hours out of 24 represents about 12% of the daily science data volume).

From the OBSW point of view, HFI Lossy Modes and Observation Mode are identical. Only the data rate allowed to the DPU during the Observation Mode shall be adjusted in adequation with CDMS bus profile (i.e. sub-frames allocated to science packets).

These modes do not require any specific resources or change of resources.

7.3.2 HFI "Partner mode"

This mode can be used when HFI data is given a higher priority than LFI one, for example when LFI is not present, during instrument sequential early in-flight commissioning or ground testing. LFI being in OFF Mode or Standby Mode, HFI could use the science packets allocated to both instruments. Possible applications are: faster commissioning, faster validation of data compression scheme.

Obviously LFI should be able to take benefit from the equivalent of HFI science packets allocation when HFI is absent, OFF or in Stand-by mode.

From the OBSW point of view, HFI Partner Mode is not properly a distinct mode, only the data rate allocated to the DPU in different modes shall be adjusted in adequation with S/C simulator or CDMS bus profile (i.e. number of sub-frames allocated to science packets).

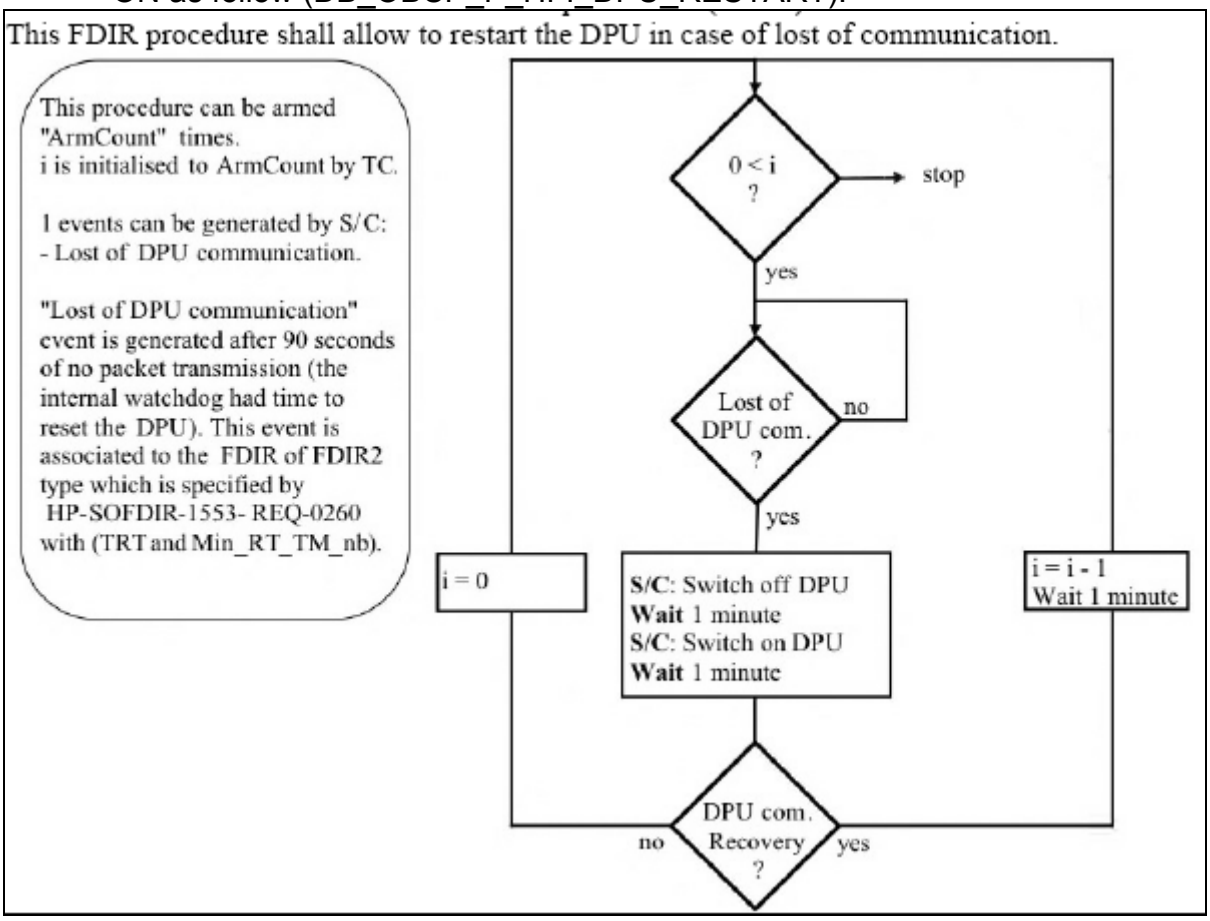
8 HFI FAILURES (FDIR)

This section deals with mechanisms which allow detecting failures and trying to recover from them. In other words, it details the autonomy functions which may generate some corrective actions on HFI at different level (REU, 4KCDE, DPU and S/C). These FDIR can be separated in 2 types:

8.1 FDIR MANAGED BY CDMS

There are only 2 cases for which HFI request CDMS actions in case of anomaly :

- The lost of 1553 DDL: In this case, it is requested to switch OFF the DPU, the REU processor and analogue belts (DB_OBCP_P_HFI_OFF). To recover the situation, it is to ground to decide.
- The lost of 1553 TFL TM : In this case, it is requested to reset the DPU that is ON as follow (DB_OBCP_P_HFI_DPU_RESTART):



8.2 FDIR INTERNALLY MANAGED BY HFI

The internal HFI FDIR options are managed with TCDPU-FDIRmode-A002
Four options are possible:

- Manual (0) :
  In this case, there is NO automatic action taken by the DPU whatever is the situation. In case of anomaly (4K switchdown, DPU, REU or 4K software reset,), the HFI reconfiguration must be done by ground commands.
  The DPU / REU and 4K "synchronisation" modes are respected. For example, when the 4K is in NOMINAL mode and the DPU/REU are in CONFIGURATION mode, the DPU goes in STANDBY mode on a standby return request (TCOBSW-StandbyRet-0111) only when both REU and 4K are in STANDBY which takes time as the 4K need to ramp down (RUNDOWN_3).

- DPU automatic (1) :
  In this case, if a DPU anomaly occurs (reset), the DPU will automatically try to return in mode for which the anomaly occurred. For the REU and the 4K, NO automatic action are taken by the DPU whatever is the situation.

- HFI automatic (2) :
  The Mode Re-synchronisation mechanism implemented in the DPU allows detecting a mode de-synchronisation and sending a TCP to the corresponding sub-system up to its resynchronisation with the others. It has been designed only to detect simple de-synchronisations (only one sub-system is de-synchronised at a time) associated to HFI steady state (i.e. mode STANDBY, CONFIGURATION and OBSERVATION).
  The HFI synchonized modes are :

DPU Mode Name	REU Mode Name	4KCDE Mode Name
STANDBY	STANDBY	STANDBY
CONFIGURATION	CONFIGURATION	NOMINAL
OBSERVATION	OBSERVATION	NOMINAL

Table 8.2-1 HFI synchonized modes table

The re-synchronisation table is stored in the EEPROM and given in Annex and are reported in the telemetry (HM516240 to HM637240)

- Desynchronisation (3) :
  This option is identical to the Manual one with the difference that HFI mode desynchronisation are allowed (DPU in STANDBY and 4K in RUNDOWN_3 for example).

The summary of the different FDIR option is given in the following table:

FDIR Mode	**HFI mode synchronisation**	**BSW state transition**	**DPU mode Re-synchronisation**	**REU or 4KCDE mode Re-synchronisation**
Desynchronisation	No	Only by TC	Only by TC	Only by TC
Manual	Yes	Only by TC	Only by TC	Only by TC
DPU automatic	Yes	Automatic	Automatic	Only by TC
HFI automatic	Yes	Automatic	Automatic	Automatic

Table 8.2-2 FDIR options table

9 HFI ON-BOARD SOFTWARE

9.1 Functional Description, tasks definition,

The function of the DPU, REU and 4KCDE software are classical ones :

4K OBSW : It receive TC's from DPU, it manage the 4K subsystem and it provide housekeeping telemetry to the DPU.

REU OBSW : It receive TC's from DPU, it manage the REU, PAU, JFET, FPU (bolometers, thermometers, PID's), Cernox's, and it provide housekeeping and uncompressed science telemetry to the DPU.

DPU OBSW : It receive TC's from the CDMU, it put in form and transmit these TC's to the REU, the 4K and the the DCE (FPGA), it manage the DPU hardware subsystem, it manage the global HFI modes and the FDIR, it realise the compression of the science data coming from the REU, and provide ALL the HFI housekeeping and science science data to the CDMU.
4 DPU software versions are stored in the DPU EEPROM. The 4 possible start address are 0x0, 0x20000, 0x40000 and 0x60000.
When the ASW is loaded with TCDPU-LoadASW-A003, the default start address stored in the EEPROM (at 0x3ED00) is used.
It is possible to load a software stored at a specific address using TCDPU-LdASWwithAd-A003 (start adress).
The default start address stored in the EEPROM (at 0x3ED00) can be modified using TCDPU-ASWstore-A004 ((start adress).
The start address is reported in Diag1 telemetry HM415250.

9.2 OBSW Physical description ROM / RAM, and memory areas definition

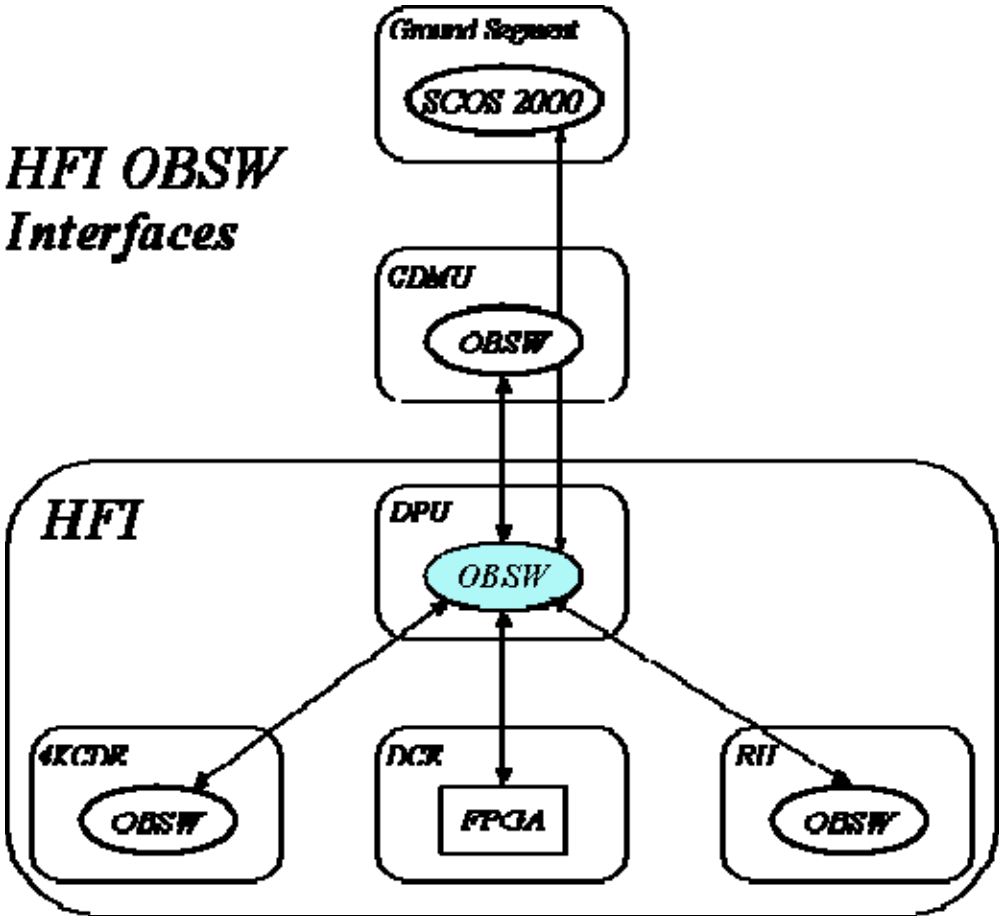


Figure 9.2-1

The 4KCDE EEPROM mapping is given in the following tables:

EEPROM	Start Address
Boot Parameters: Failed Program RAM blocks (4) Failed Data RAM blocks (4) Number of warm starts (1) System time of last coldstart or counted warm start (2)	0x00000
Not Used (48)	0x0000B
Initial values: Operating Parameters (12) Limit Values (15) Limit Control Mask (2) Limit Action Mask (2) HCT: Harmonic Correction Tables (24) SRT: System Response Table (16)	0x00040
Not Used (121)	0x00087
Possible gap before first segment (0+)	0x00100
Seg_pmco:	
Sync pattern- identifies start of segment (2)	
PM address – where to load segment (1)	
Size of PM data in 32-bit words (1)	
PM data - packed as in Figure 2-3 (2+)	
CRC	
Possible gap between segments (0+)	
Seg_init:	
Sync pattern- identifies start of segment (2)	
PM address – where to load segment (1)	
Size of PM data in 32-bit words (1)	
PM data - packed as in Figure 2-3 (2+)	
CRC	
Not Used	

Operating Parameter	EEPROM address
Internal F180 clock period	0x00040
External F0 clock, maximum period limit	0x00041
External F0 clock, minimum period limit	0x00042
External F0 clock, maximum period variation	0x00043
External F180 clock, maximum period limit	0x00044
External F180 clock, minimum period limit	0x00045
Compressor Amplitude Demand	0x00046
Compressor A/B Select	0x00047
Max compressor amplitude demand	0x00048
Frequency select for vibration cancellation	0x00049
Getter Element Select	0x0004A
Force transducer selector	0x0004B

Limit Parameter	EEPROM address
Comp A pos displacement limit	0x0004C
Comp A neg displacement limit	0x0004D
Comp B pos displacement limit	0x0004E
Comp B neg displacement limit	0x0004F
peak drive bus current limit 1	0x00050
peak drive bus current limit 2	0x00051
peak drive bus current limit 3	0x00052
Comp A drive current pos peak limit	0x00053
Comp A drive current neg peak limit	0x00054
Comp B drive current pos peak limit	0x00055
Comp B drive current neg peak limit	0x00056
Comp A head temp limit 1	0x00057
Comp A head temp limit 2	0x00058
Comp B head temp limit 1	0x00059
Comp B head temp limit 2	0x0005A

Limit Control Mask		EEPROM address
Most significant 16 bits: SPARE (currently unused)		0x0005B
Least significant 16 bits:		0x0005C
LIM_B_HEAD_TEMP_2	0x8000	
LIM_B_HEAD_TEMP_1	0x4000	
LIM_A_HEAD_TEMP_2	0x2000	
LIM_A_HEAD_TEMP_1	0x1000	
LIM_B_DRIVE_I_NEG	0x0800	
LIM_B_DRIVE_I_POS	0x0400	
LIM_A_DRIVE_I_NEG	0x0200	
LIM_A_DRIVE_I_POS	0x0100	
LIM_DRIVE_BUS_I_3	0x0080	
LIM_DRIVE_BUS_I_2	0x0040	
LIM_DRIVE_BUS_I_1	0x0020	
LIM_B_NEG_DISPL	0x0010	
LIM_B_POS_DISPL	0x0008	
LIM_A_NEG_DISPL	0x0004	
LIM_A_POS_DISPL	0x0002	

Limit Action Mask		EEPROM address
Most significant 16 bits: SPARE (currently unused)		0x0005D
Least significant 16 bits:		0x0005E
LIM_B_HEAD_TEMP_2	0x8000	
LIM_A_HEAD_TEMP_2	0x2000	
LIM_B_DRIVE_I_NEG	0x0800	
LIM_B_DRIVE_I_POS	0x0400	
LIM_A_DRIVE_I_NEG	0x0200	
LIM_A_DRIVE_I_POS	0x0100	
LIM_DRIVE_BUS_I_3	0x0080	
LIM_B_NEG_DISPL	0x0010	
LIM_B_POS_DISPL	0x0008	
LIM_A_NEG_DISPL	0x0004	
LIM_A_POS_DISPL	0x0002	

Harmonic Correction Table	EEPROM address
HCT0 (Compressor 0)	
F1 Amplitude (floating point)	0x0005F
F1 coarse phase (integer)	0x00060
F1 fine phase (floating point)	0x00061
F3 Amplitude (floating point)	0x00062
F3 coarse phase (integer)	0x00063
F3 fine phase (floating point)	0x00064
F5 Amplitude (floating point)	0x00065
F5 coarse phase (integer)	0x00066
F5 fine phase (floating point)	0x00067
F7 Amplitude (floating point)	0x00068
F7 coarse phase (integer)	0x00069
F7 fine phase (floating point)	0x0006A
HCT1 (Compressor 1)	
F0 Amplitude (floating point)	0x0006B
F0 coarse phase (integer)	0x0006C
F0 fine phase (floating point)	0x0006D
F2 Amplitude (floating point)	0x0006E
F2 coarse phase (integer)	0x0006F
F2 fine phase (floating point)	0x00070
F4 Amplitude (floating point)	0x00071
F4 coarse phase (integer)	0x00072
F4 fine phase (floating point)	0x00073
F6 Amplitude (floating point)	0x00074
F6 coarse phase (integer)	0x00075
F6 fine phase (floating point)	0x00076

System Reponse Table	EEPROM address
F0 gain factor	0x00077
F0 phase shift	0x00078
F1 gain factor	0x00079
F1 phase shift	0x0007A
F2 gain factor	0x0007B
F2 phase shift	0x0007C
F3 gain factor	0x0007D
F3 phase shift	0x0007E
F4 gain factor	0x0007F
F4 phase shift	0x00080
F5 gain factor	0x00081
F5 phase shift	0x00082
F6 gain factor	0x00083
F6 phase shift	0x00084
F7 gain factor	0x00085
F7 phase shift	0x00086

The REU memory mapping is given in the following tables:

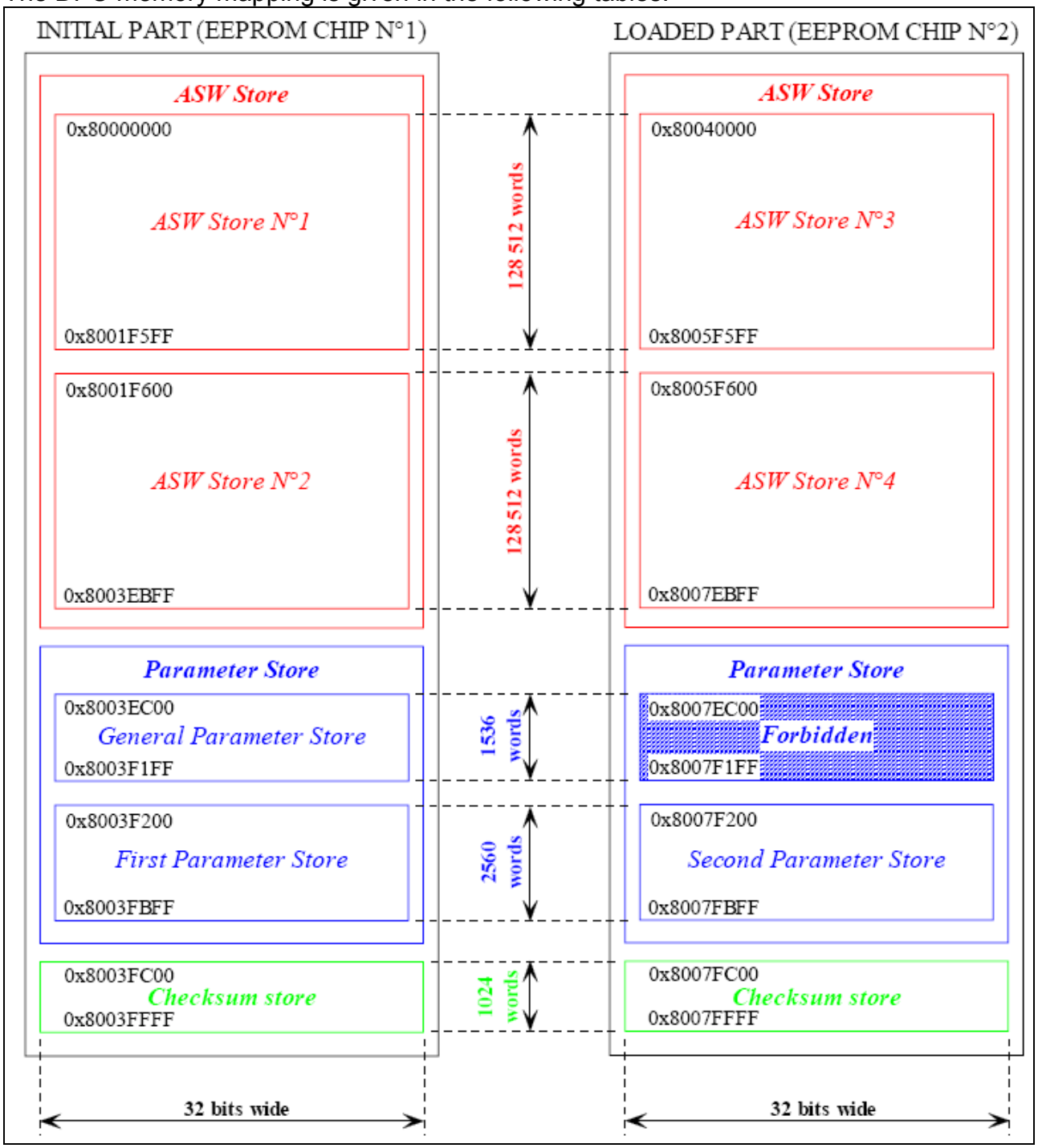
Type	Use	Relative Address		Absolute addresses	
		Start	Stop	Start	Stop
RAM	System initialization code and vector handlers	0x000000	0x0000FF	0x000000	0x0000FF
RAM	code	0x000100	0x00569A	0x000100	0x00569A
RAM	System initialization data	0x00569B	0x0053A4	0x00569B	0x0053A4
RAM	Not used	0x0056A5	0x01FFFF	0x0056A5	0x01FFFF

ASW: Program memory

Type	Use	Relative Address		Absolute addresses	
		Start	Stop	Start	Stop
RAM	Data memory global variables	0x00000000	0x00014FEF	0x00000000	0x00014FEF
RAM	Not used	0x00014FF0	0x00014FF0	0x00014FF0	0x00014FF0
RAM	Boot general parameters backup	0x00014FF1	0x00014FFF	0x00014FF1	0x00014FFF
RAM	Runtime stack	0x00015000	0x0001FFFF	0x00015000	0x0001FFFF
EEPROM	Sc. Application	0x00000000	0x000095FF	0x20000000	0x200095FF
EEPROM	Conf 0	0x00009600	0x00009CAE	0x20009600	0x20009CAE
EEPROM	Conf 1	0x00009CAF	0x0000A35D	0x20009CAF	0x2000A35D
EEPROM	Conf 2	0x0000A35E	0x0000AA0E	0x2000A35E	0x2000AA0E
EEPROM	Not used	0x0000AA0F	0x0000FFFF	0x2000AA0F	0x2000FFFF
EEPROM	Spare Sc. Application	0x00010000	0x000195FF	0x20010000	0x200195FF
EEPROM	Not used	0x00019600	0x0001FFFF	0x20019600	0x2001FFFF

ASW: Data memory

The DPU memory mapping is given in the following tables:



The ASW store is used to store 4 different versions.
The Parameter Store is used to store:

- OBSW configuration parameters (used by DPU BSW or/and ASW) stored in the General Parameter Store and not duplicated.
  When it starts, the ASW loads the parameters of the First or the Second Parameter Store according to the value of the “Parameter store” parameter written at 0x8003EE00.

- ASW configuration parameters stored in the First or the Second Parameter Store.

The Checksum Store is used to store the result of the checksum of each 256 x 32bits block of the ASW and Parameter Stores.

When BSW and ASW have to write into EEPROM (write associated to a TCP(8,4) or TCP(6,2)), they recalculate the checksum of each block concerned by the change.
When BSW or ASW have to read words from the EEPROM, they verify the checksum of the corresponding blocks. If a checksum error is detected, they do not use the read value and go on their execution with the default values. Additionally, they signal to ground that the EEPROM is corrupted, the BSW in updating the corresponding DIAG1 parameter and the ASW in setting an error status and in generating its associated event packet of type TMP(5,1).

All the DPU, REU and 4K memories

Name	MID	SAU (bits)	Size (bits)	Bus	Max TCP(6,2) Length (SAU)	Max TMP(6,6) Length (SAU)
HFI REU PROM	40h	48	32k x 48	PM	-	165
HFI REU PRAM	41h	48	128k x 48	PM	33	165
HFI REU DRAM	42h	32	128k x 32	DM	50	248
HFI REU EEPROM	43h	32	128k x 32	DM	50	248
HFI 4KCDE PROM	84h	48	32k x 8	PM	-	STARTUP: 165 – OTHERS: 42
HFI 4KCDE PRAM	86h	48	512k x 48	PM	33	STARTUP: 165 – OTHERS: 42
HFI 4KCDE DRAM	80h	32	512k x 32	DM	50	STARTUP: 248 – OTHERS: 64
HFI 4KCDE EEPROM	85h	32	256k x 32	PM	50	STARTUP: 248 – OTHERS: 64
HFI Dual Port RAM	82h	16	8k x 16	DM	101	STARTUP: 497 – OTHERS: 64
HFI 4KCDE Processor Support FPGA Registers	81h	32	17 x 32	DM	50	STARTUP: 248 – OTHERS: 64
HFI 4KCDE Cooler Interface FPGA Registers	83h	32	19 x 32	DM	50	STARTUP: 248 – OTHERS: 64
HFI DPU PROM	3Eh	48	32k x 48	PM	-	165
HFI DPU PRAM	3Fh	48	128k x 48	PM	33	165
HFI DPU DRAM	3Dh	32	128k x 32	DM	50	248
HFI DPU EEPROM	39h	32	512k x 32	DM	50	248
HFI DPU 1553 DRAM	3Bh	16	16k x 16	DM	-	497
HFI DPU 1553 Register	3Ch	32	24 x 32	DM	-	248
HFI DPU FPGA Register	3Ah	32	148 x 32	DM	50	248

The DPU, REU and 4KCDE are built around the TSC21020 which owns 2 buses:
a Program bus (24 bit Address Bus, 48 bit Data Bus): PM
a Data bus (32 bit Address Bus, 40 bit Data Bus): DM.
Only the most significant 32 bits of the Data Management Bus are used (on a total of 40 bits).

9.3 OBSW operations, task monitoring & control, error handling

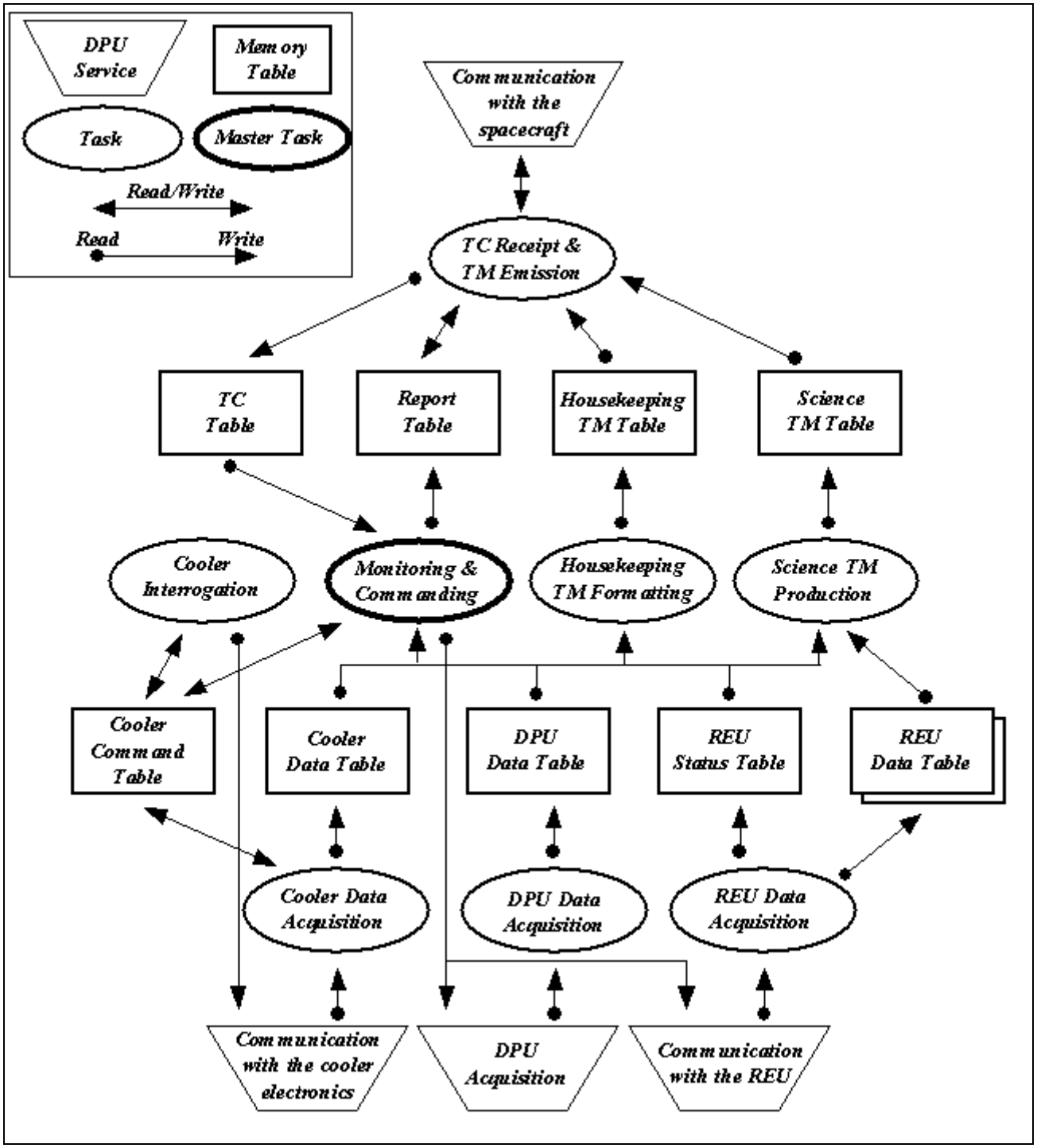


Figure 9.3-1

10 HFI CONTROL : TELEMETRY

10.1 General overview

The different telemetry packets produced by HFI is given in the following table.

N°	Service Type and subtype	TCP	TMP	APID
1	**Telecommand Verification**			
	Telecommand Acceptance Report – Success		TMP(1,1)	1408 or 1409
	Telecommand Acceptance Report – Failure		TMP(1,2)	1408 or 1409
	Telecommand Execution Report – Success		TMP(1,7)	1408 or 1409
	Telecommand Execution Report – Failure		TMP(1,8)	1408 or 1409
3	**Housekeeping & Diagnostic Data Reporting**			
	Housekeeping Parameter Report		TMP(3,25)	1410 or 1411
	Diagnostic Parameter Report		TMP(3,26)	1410 or 1411
5	**Event reporting**			
	Event Report		TMP(5,1)	1408 or 1409
	Exception Report		TMP(5,2)	1408 or 1409
	Error/Alarm Report		TMP(5,4)	1408 or 1409
6	**Memory Management**			
	Load Memory Using Absolute Addresses	TCP(6,2)		1408
	Dump Memory Using Absolute Addresses	TCP(6,5)		1408
	Memory Dump, Absolute Addresses		TMP(6,6)	1408 or 1409
	Check Memory Using Absolute Addresses	TCP(6,9)		1408
	Memory check Report, Absolute Addresses		TMP(6,10)	1408 or 1409
8	**Function Management**			
	Perform Activity of Function	TCP(8,4)		1408
9	**Time Management**			
	Enable Time Synchronisation	TCP(9,4)		1408
	Enable Time Verification	TCP(9,7)		1408
	Time Verification Report		TMP(9,9)	1408 or 1409
14	**Packet Transmission Control**			
	Enable Transmission of Telemetry Packets	TCP(14,1)		1408
	Disable Transmission of Telemetry Packets	TCP(14,2)		1408
	Report Enabled Telemetry Packets	TCP(14,3)		1408
	Enabled Telemetry Packets Report		TMP(14,4)	1408 or 1409
17	**Test Service**			
	Perform Connection Test	TCP(17,1)		1408
	Link Connection Report		TMP(17,2)	1408 or 1409
21	**Science Data Transfer**			
	Nominal Science Data Report		TMP(21,1)	1412 or 1413
	Science Type B Data Report		TMP(21,2)	1414 or 1415
	Diagnostic Science Data Report		TMP(21,3)	1414 or 1415
	Auxiliary Science Data Report		TMP(21,4)	1414 or 1415

Table 10-1 : TCP and TMP type

The HFI telemetry packet category is summarized in the following table:

Packet Category	Packet Name	HP-PSICD service	Data Type	Nominal datarate
Diagnostic	Diag1	TM(3,26)	DPU hardware status	1/mn
	Diag2	TM(3,26)	DPU ASW, REU and 4KCDE hardware status	1/mn
Housekeeping	Hsk1	TM(3,25)	Main housekeeping parameters	24/mn
	Hsk2	TM(3,25)	Main configuration parameters	1/mn
	Hsk3	TM(3,25)	= Hsk1 (Essential Housekeeping Packet)	2.5/mn
Housekeeping (Science)	Hsk4	TM(3,25)	Science configuration and raw data (belt 0 and 1)	1/mn
	Hsk5	TM(3,25)	Science configuration and raw data (belt 2 and 3)	1/mn
	Hsk6	TM(3,25)	Science configuration and raw data (belt 4 and 5)	1/mn
	Hsk7	TM(3,25)	Science configuration and raw data (belt 6 and 7)	1/mn
	Hsk8	TM(3,25)	Science configuration and raw data (belt 8 and 9)	1/mn
	Hsk9	TM(3,25)	Science configuration and raw data (belt A and B)	1/mn
Science	Sc1	TM(21,1)	(Compressed data + one raw signal) per CS	8/second
	Sc2-1	TM(21,2) SID 1	Set of raw signals	8/second
	Sc2-2	TM(21,2) SID 2	(Compressed data + one raw signal + V,I,T) per CS	8/second
	Sc3	TM(21,3)	Set of summed data + same set of compressed data	8/second
	Sc4	TM(21,4)	Set of summed data + one raw signal	8/second

Table 10-1 : HFI telemetry summary

DIAG1 packet overview :

DIAG1 (sent each minutes) is composed mainly of DPU hardware checks:
General status parameters (FDIR mode, BSW state, etc),
EEPROM checks,
Program SRAM checks.

DIAG1 are produced when the DPU is in BOOT mode only

DIAG2 packet overview :

DIAG2 (sent each minutes) is composed mainly of REU and 4KCDE hardware checks:
DPU ASW status, REU status, 4KCDE status, 4KCDE Program SRAM checks, 4KCDE Data SRAM checks.
Comment: The first Diag2 packet sent by ASW will have all parameters coming from EEPROM set to 0 because they are not yet been read, and all parameter coming from subsystem set to 0 because they are not yet interrogated. The second and third Diag2 packet will have all parameter coming from EEPROM read, but not yet parameter coming from subsystem. One should wait the fourth Diag2 packet to have all the correct values.

DIAG2 are produced when the DPU is in STARTUP mode, REU and 4K are in BOOT mode only.

HSK1 and HSK3 packets overview :

HSK1 (sent each 2,4 seconds) or HSK3 (sent each 14 seconds) are mainly composed of HFI sensors evolutive telemetry:
Modes, warm unit temperatures, warm unit consumption measurements (Voltage, Current), 4K compressors parameters, housekeeping cryogenic temperatures (REU and JFET Cernox, DCE and 4KCDE), heater power (REU and JFET PIDs, DCE defrost), REU optimisation parameters, Science diagnostic OCfij-CalCSAve.

HSK1 and HSK3 are produced when the DPU is in any mode but STARTUP and BOOT

HSK2 packet overview :

HSK2 (sent each minute) is composed mainly of HFI configuration parameters:
REU HCT configuration parameters, REU VIO configuration parameters, 4KCDE Limit Monitoring parameters, 4K Compressor System Response Test, DPU Raw Signal filter, DPU Resynchronisation Table, REU HCT (Cernox) raw signal.
HSK1 and HSK3 are produced when the DPU is in any mode but STARTUP and BOOT

HSK4 to HSK9 packets overview:

HSK4 to HSK9 (sent each minute) provide analog belt data:
HSK4 reports data of belt #0 and belt #1,
HSK5 reports data of belt #2 and belt #3,
HSK6 reports data of belt #4 and belt #5,
HSK7 reports data of belt #6 and belt #7,
HSK8 reports data of belt #8 and belt #9,

HSK9 reports data of belt #A and belt #B.

Each pair of analog belts data are composed of:
12 FPU channel configuration parameters (V, I, T, etc),
1 FPU PID configuration parameters,
2 JFET PI configuration parameters,
12 Compression control parameters (under-sampling, sigma/q and sigma),
12 Science diagnostic OCfij-CalSigma,
12 Science diagnostic OCfij-AvMaxMin,
12 FPU Raw signals.

HSK4 to HSK9 are produced when the DPU is in CONFIGURATION, OBSERVATION, OPTIMIZATION, VI_MEASUREMENT, COMP_VALID, WITHOUT_COMPR, RAWSIGNAL_MODE, DUMMY_REU, HOT_4K_MAINTCE

SC1 packets overview:

This is the nominal Science Data Report (see §10.3)

SC1 are produced when the DPU is in OBSERVATION and in CONFIGURATION (only after a first transition to OBSERVATION).

SC2-1 packets overview:

This is the RAW Science Data when the DPU is in RAWSIGNAL_MODE (see §10.3).

SC2-2 packets overview:

This is the Science Data ((Compressed data + one raw signal + V,I,T) per CS) when the DPU is in OPTIMIZATION and VI_MEASUREMENT (see §10.3).

SC3 packets overview:

This is the Science Data (Set of summed data + same set of compressed data) when the DPU is in COMP_VALID (see §10.3).

SC4 packets overview:

This is the Science Data (Set Set of summed data + one raw signal) when the DPU is in WITHOUT_COMPR (see §10.3).

10.2 HOUSKEEPING TELEMETRY DESCRIPTION

10.2.1 HSK and DIAGNOSTIC TELEMETRY (TMP(2,25) & TMP(3,26))

The HFI housekeeping telemetries are named in S2K by HMnnnddd or HDnnnddd with:

nnn belongs to 001 to 999,
ddd = 240 for a DPU ASW telemetry,
ddd = 250 for a DPU HW telemetry,
ddd = 260 for a 4K telemetry,
ddd = 270 for a DCE telemetry,
ddd = 280 for a REU telemetry.

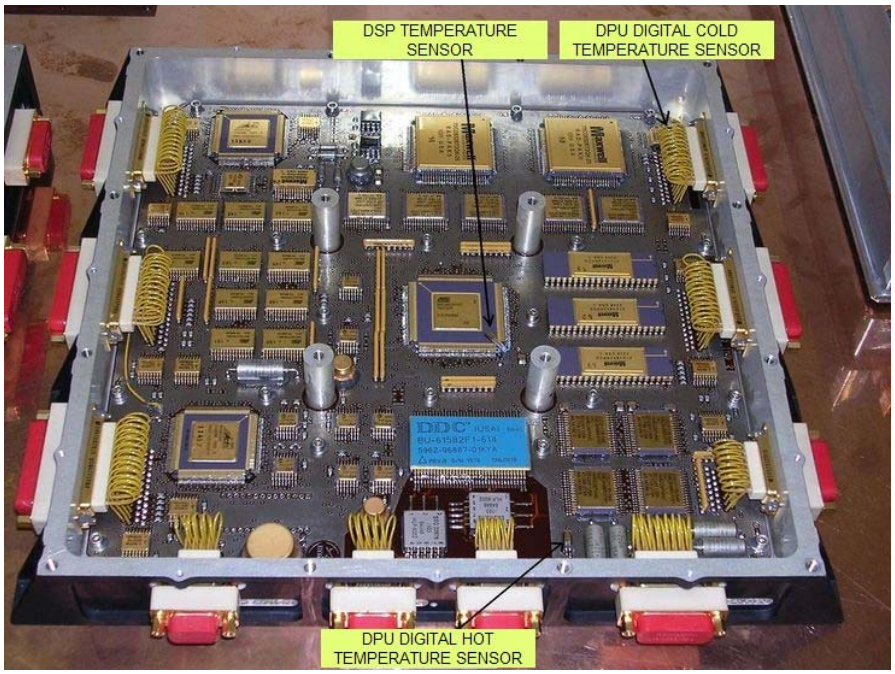
In the paragraphs 10.2.1.1 to 10.2.1.10, the analog telemetries are ordered, for each HFI equipment or function, by measurement type (temperature, voltage, intensity, pressure,). The unit of the engeniering telemetry value is given in bracket (°C, K, Bar, V, I,).

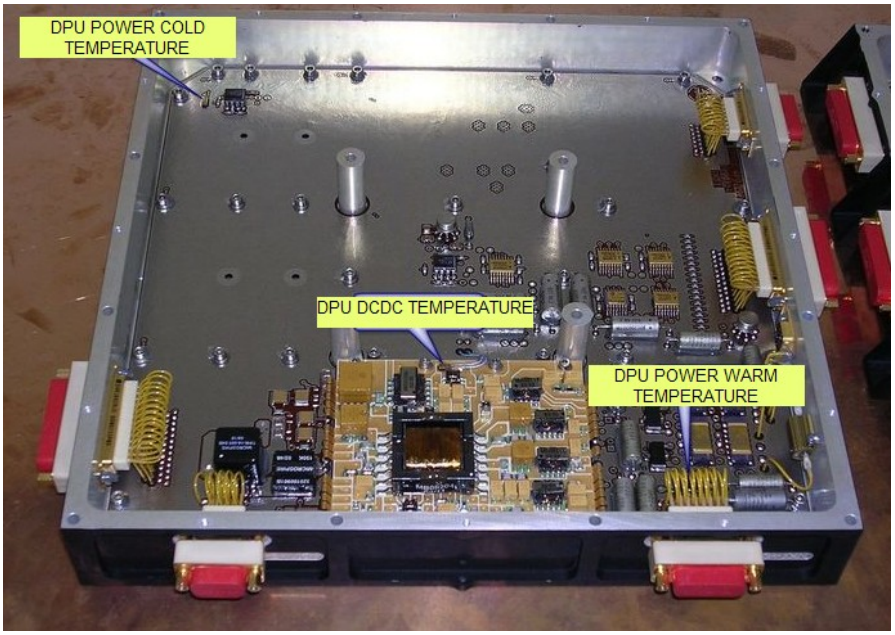
The paragraphs 10.2.1.11 to 10.2.1.17 present the digital telemetries that define the HFI equipment or function configuration (bolometers setup, 4K setup,)

The paragraphs 10.2.1.18 to 10.2.1.20 present the digital DPU, REU and 4K error telemetries.

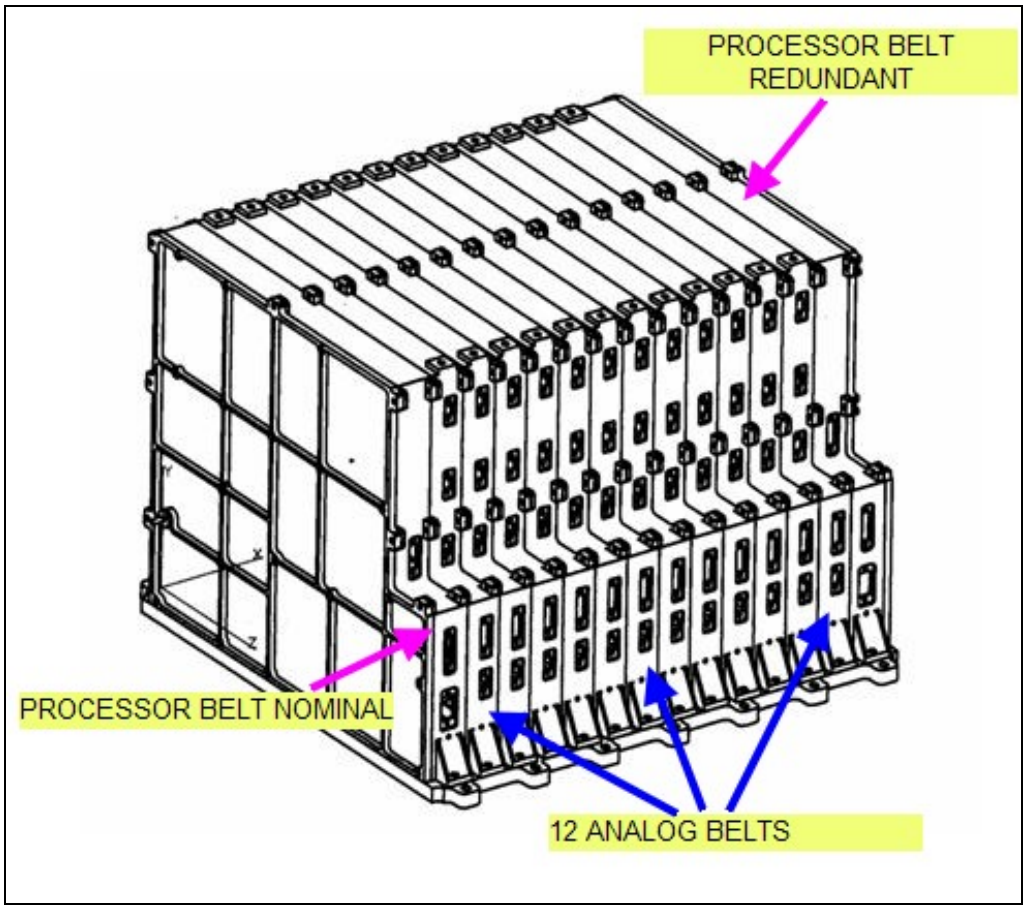
In ANNEX D, ALL the DPU ASW, DPU HW, 4K, DCE and REU HSK telemetries are ordered by ascendind S2K name.

The following photo and pictures presents the main sensor location for different HFI equipments.


DSP TEMPERATURE SENSOR
DPU DIGITAL COLD TEMPERATURE SENSOR
DPU DIGITAL HOT TEMPERATURE SENSOR


DPU POWER COLD TEMPERATURE
DPU DCDC TEMPERATURE
DPU POWER WARM TEMPERATURE

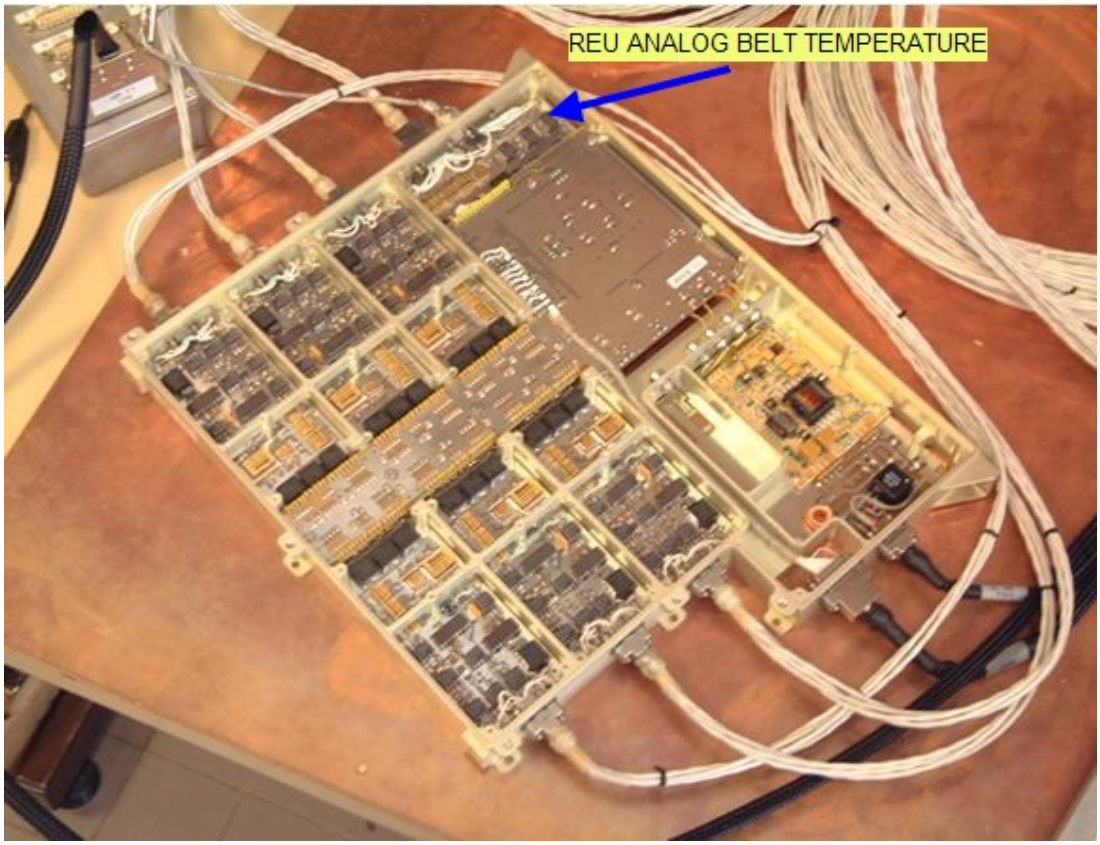
DPU



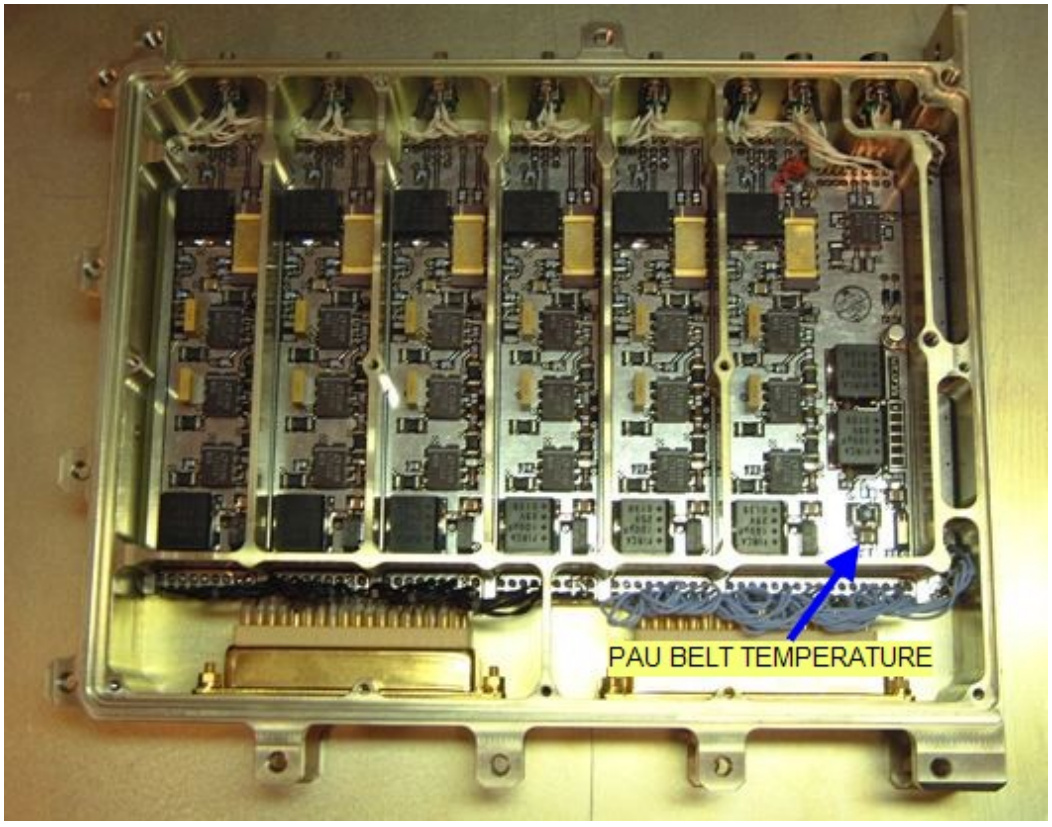
REU BELTS disposition



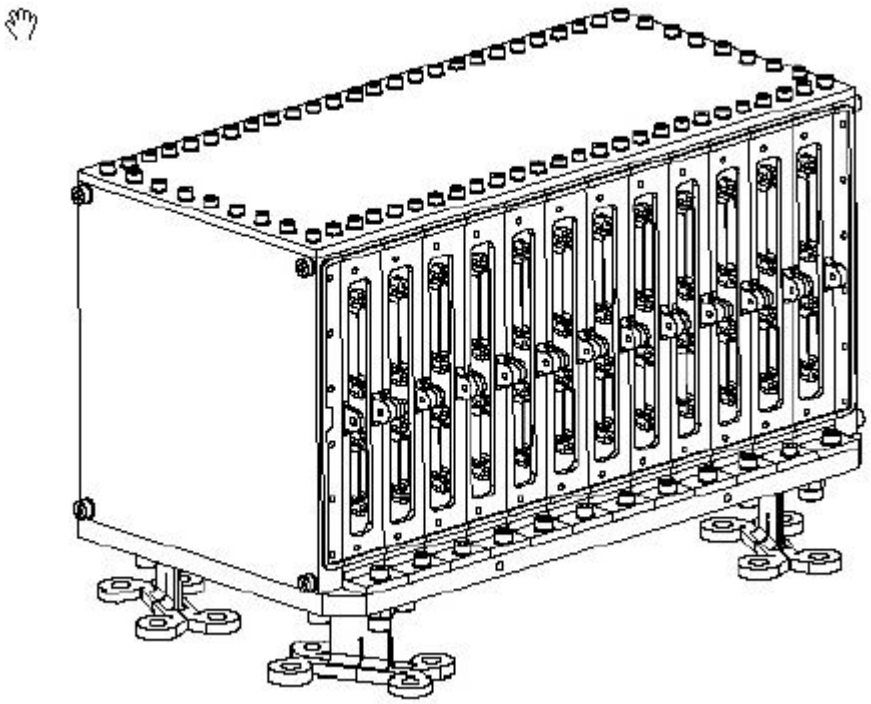
Fig : REU PROCESSOR BELT



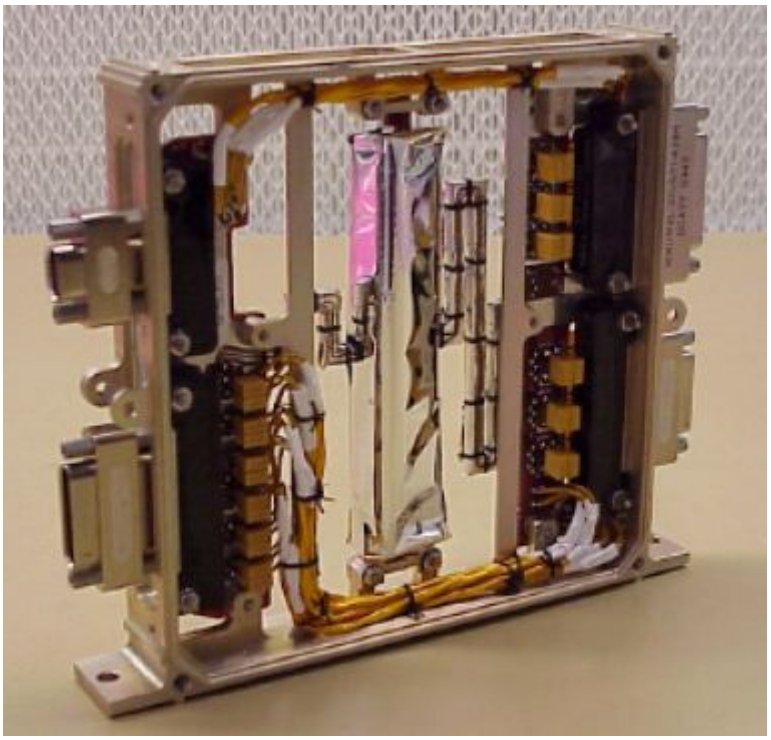
REU ANALOG BELT



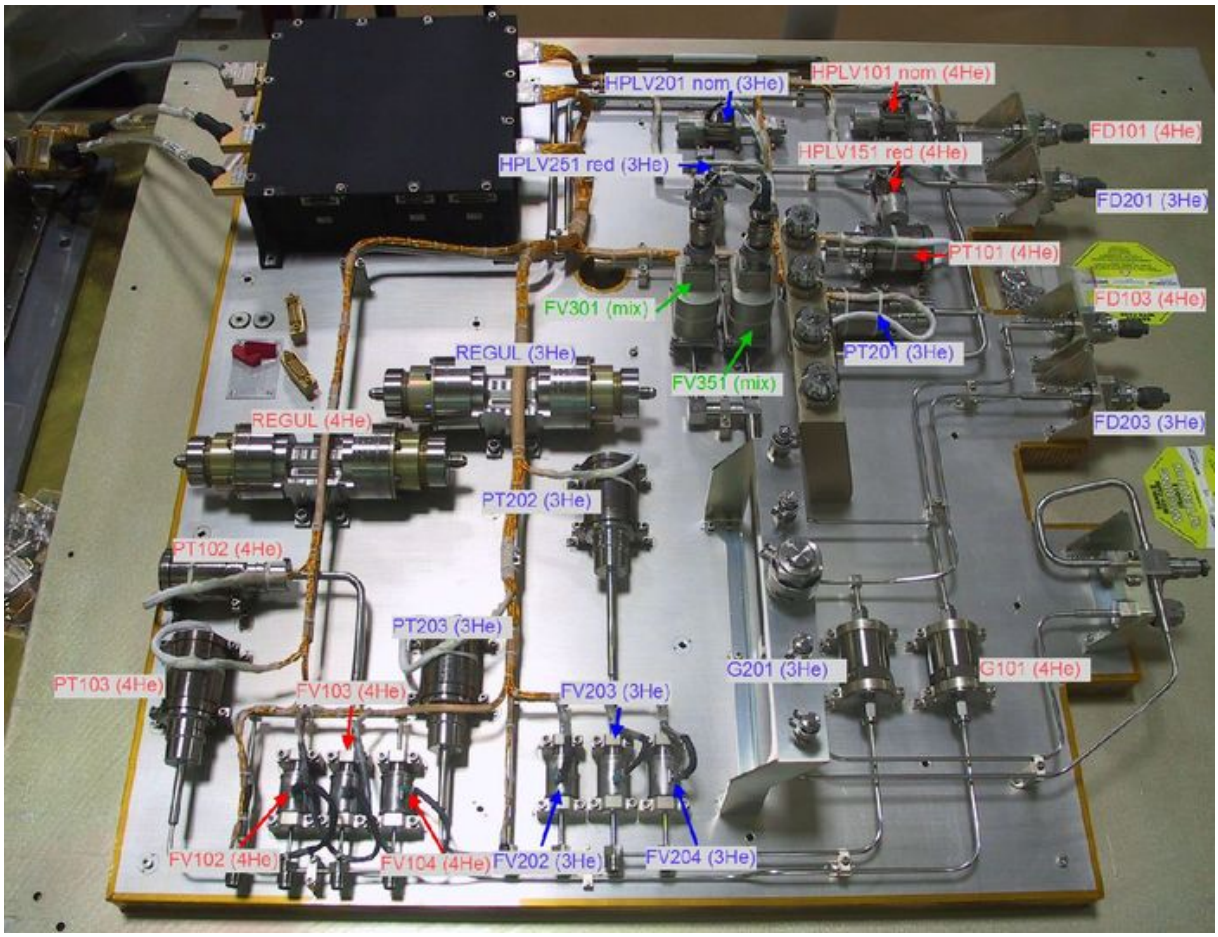
PAU ANALOG BELT



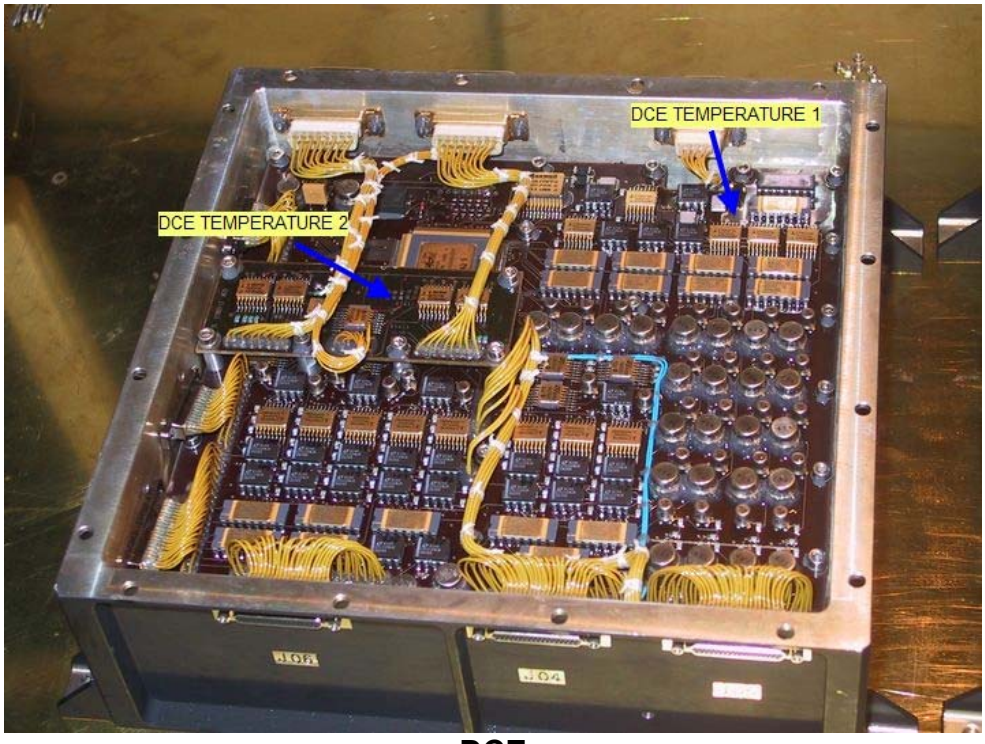
JFET general view



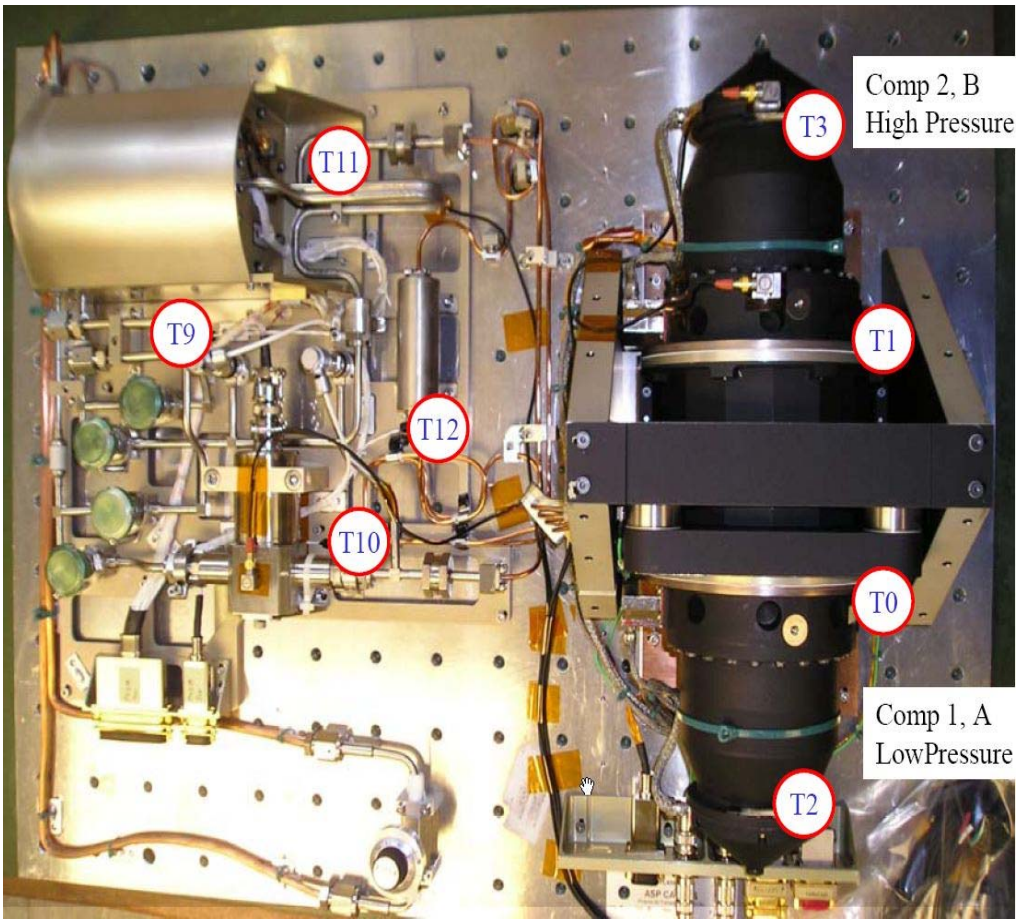
JFET 1 modul


HPLV201 nom (3He)
HPLV101 nom (4He)
FD101 (4He)
HPLV251 red (3He)
HPLV151 red (4He)
FD201 (3He)
PT101 (4He)
FV301 (mix)
FD103 (4He)
REGUL (3He)
PT201 (3He)
FV351 (mix)
REGUL (4He)
FD203 (3He)
PT202 (3He)
PT102 (4He)
PT203 (3He)
G201 (3He)
G101 (4He)
PT103 (4He)
FV103 (4He)
FV203 (3He)
FV102 (4He)
FV104 (4He)
FV202 (3He)
FV204 (3He)

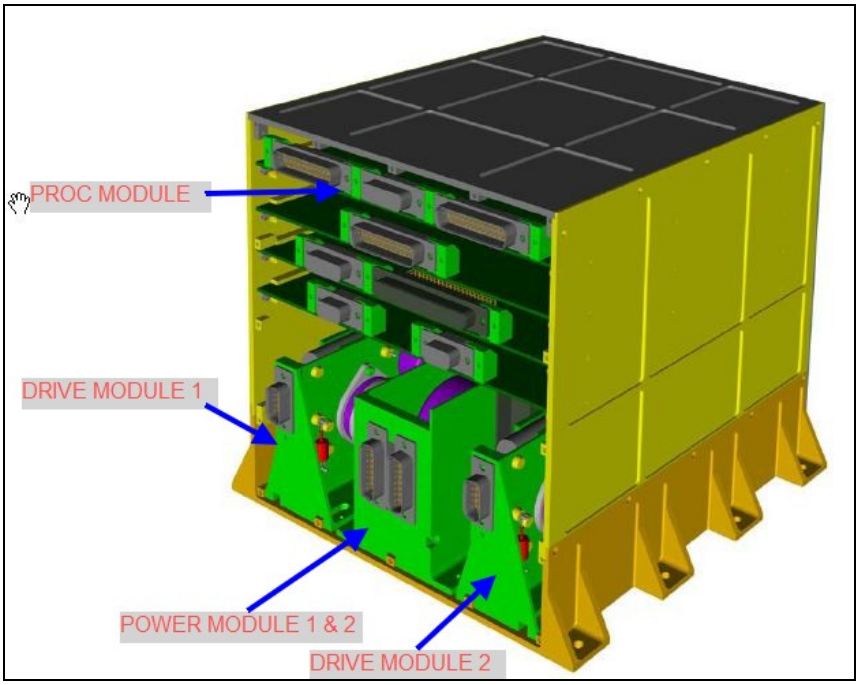
DCCU


DCE TEMPERATURE 1
DCE TEMPERATURE 2

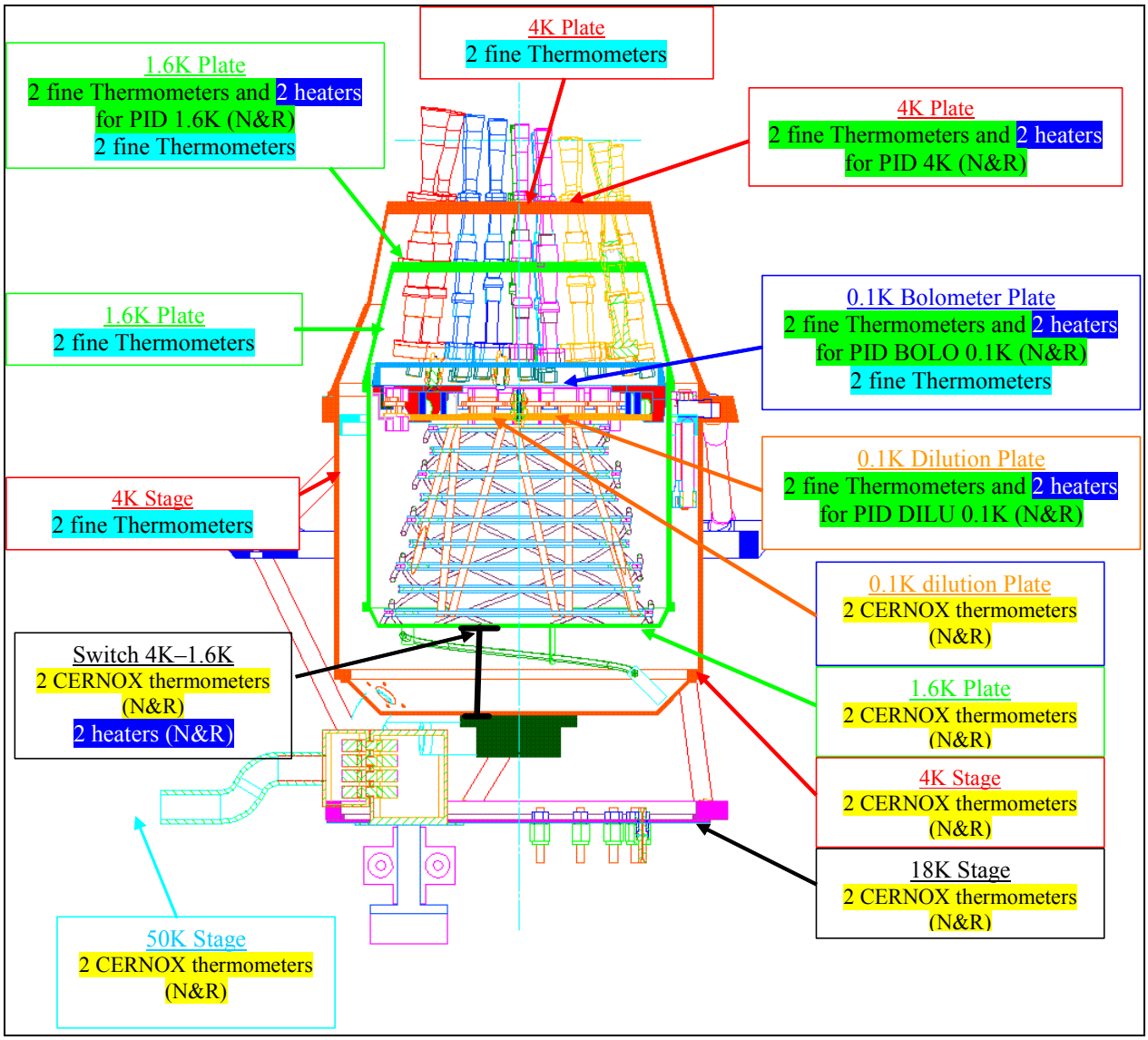
DCE



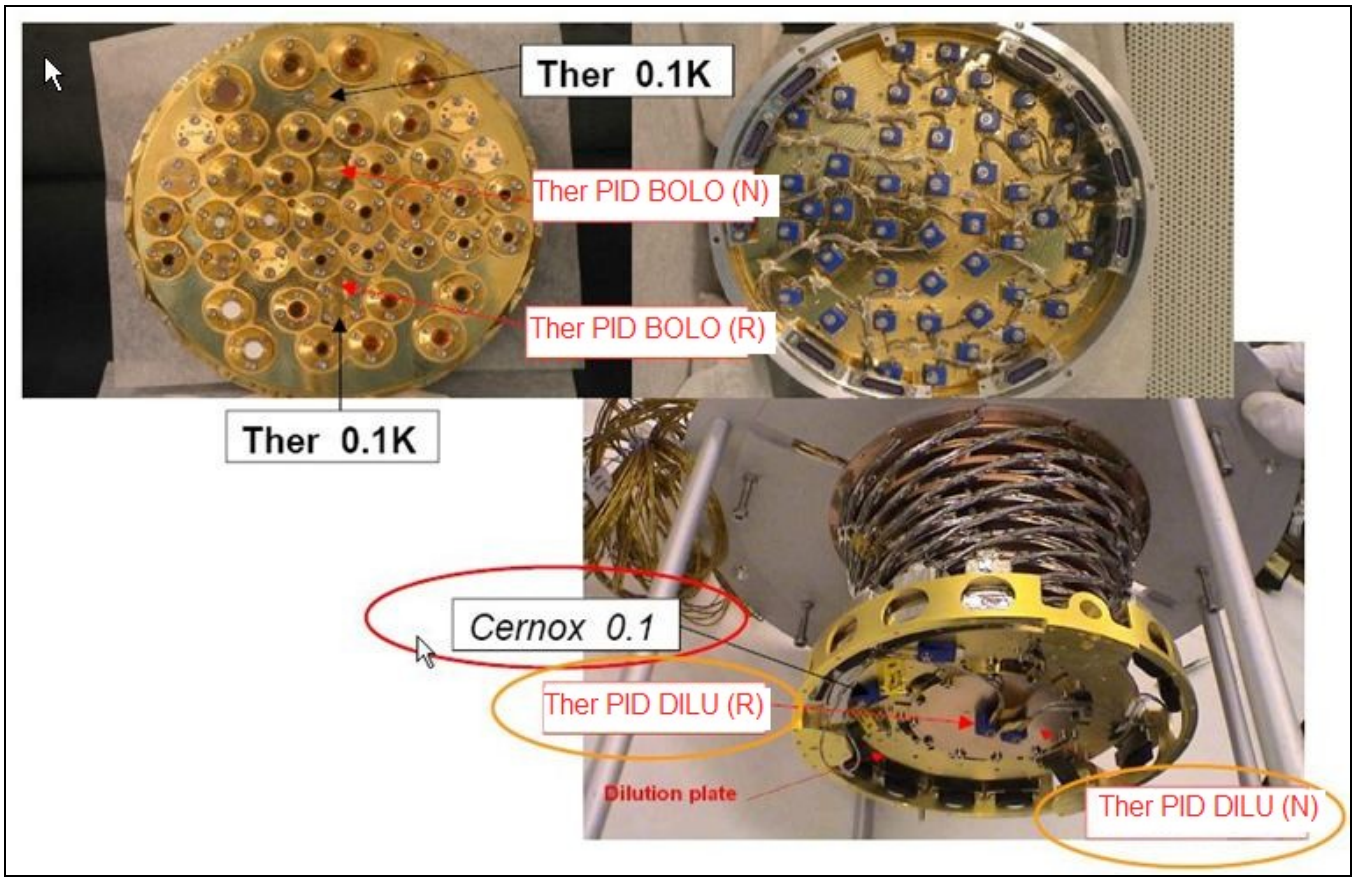
4K Compressors and ancillary unit sensors



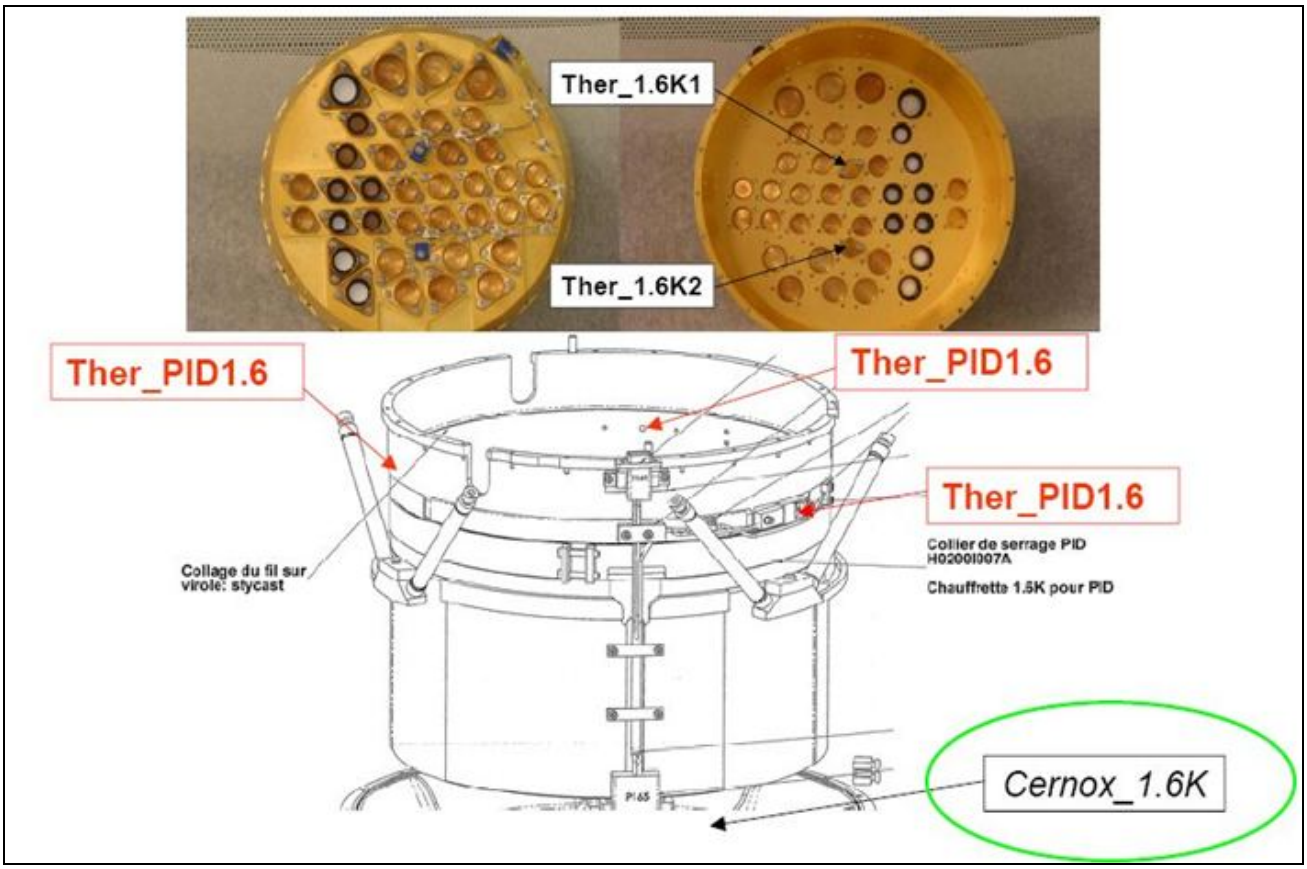
4KCDE general



CERNOX, PID and fine thermometers sensors



THERMO and PID 0.1K DILU and BOLO plate



THERMO and PID 1.6K

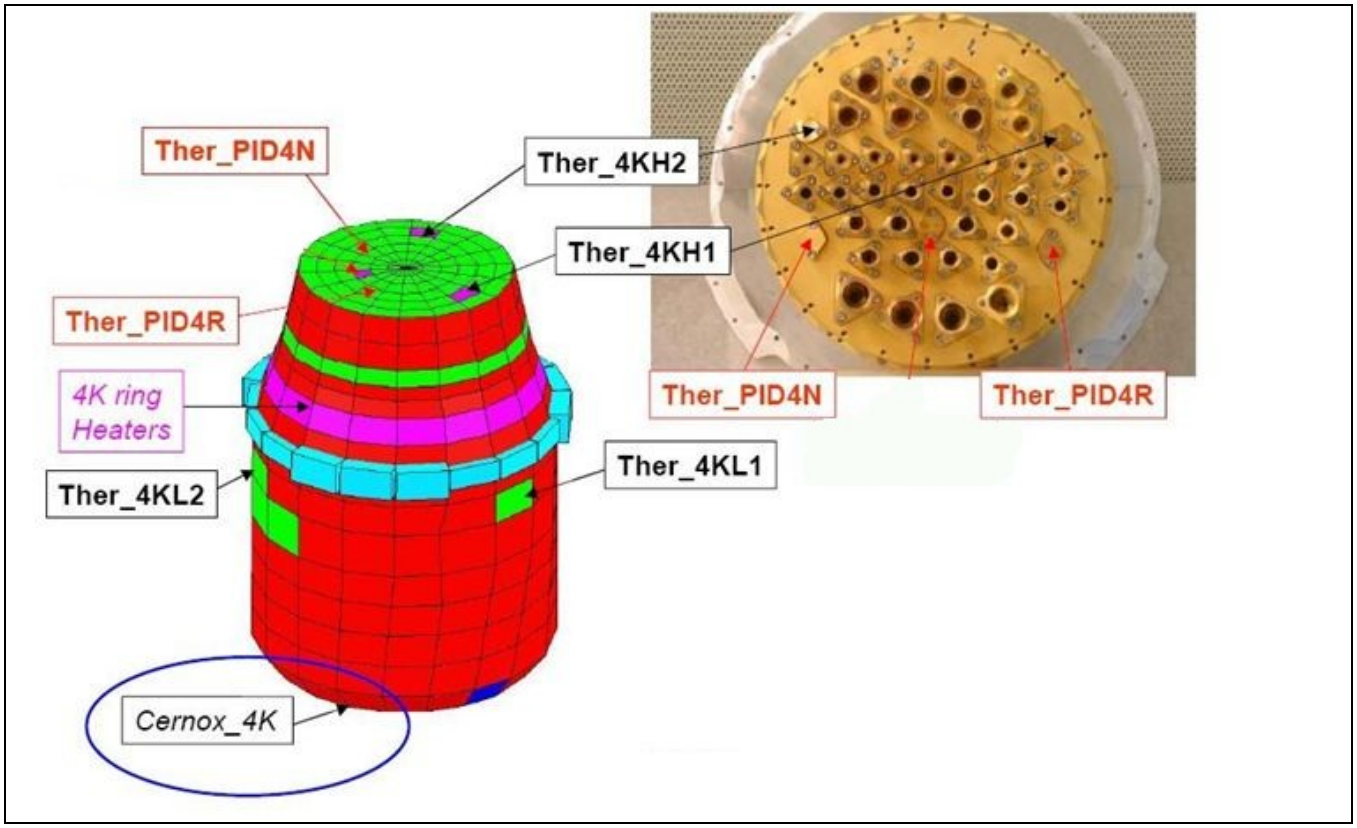


Fig : THERMO and PID 4K

Nbelt / Nchannel	0	1	2	3	4	5
0	100-1a	100-1b	143-1a	143-1b	217-1	353-1
1	143-5	217-5a	217-5b	353-2	545-1	Dark 1
2	100-2a	100-2b	217-2	353-3a	353-3b	857-1
3	143-2a	143-2b	353-4a	353-4b	545-2	857-2
4	100-3a	100-3b	143-6	217-6a	217-6b	353-7
5	143-3a	143-3b	217-3	353-5a	353-5b	545-3
6	143-7	217-7a	217-7b	353-6a	353-6b	857-3
7	143-8	217-8a	217-8b	545-4	857-4	Dark 2
8	100-4a	100-4b	143-4a	143-4b	217-4	353-8
9	THERMO 0.1K (1)	THERMO PID BOLO (N)	THERMO PID DILU (N)	THERMO PID 1.6K (N)	THERMO 1.6K (1)	THERMO PID 4K (N)
10	Resistor	Capa 2	THERMO 0.1K (2)	THERMO PID 1.6K (R)	THERMO 4KH (1)	THERMO 4KL (1)
11	THERMO PID BOLO (R)	THERMO PID DILU (R)	THERMO 1.6K (2)	THERMO PID 4K (R)	THERMO 4KH (2)	THERMO 4KL (2)

Focal Plan channels repartition

10.2.1.1 DPU ANALOG TELEMETRY

S2K	Description	Type of packet
HM003250	DPU POWER cold PCB Temperature (°C)	HSK1, HSK3
HM004250	DPU DCDC Temperature (°C)	HSK1, HSK3
HM005250	DPU POWER warm PCB Temperature (°C)	HSK1, HSK3
HM010250	DPU DIGITAL cold PCB Temperature (°C)	HSK1, HSK3
HM011250	DPU Processor Temperature (°C)	HSK1, HSK3
HM012250	DPU DIGITAL warm PCB Temperature (°C)	HSK1, HSK3
HM013250	DPU + 5V (V)	HSK1, HSK3
HM014250	DPU - 15V (V)	HSK1, HSK3
HM015250	DPU +15V (V)	HSK1, HSK3
HM016250	DPU +2.5V (V)	HSK1, HSK3
HM006250	DPU Intensity of +5V (mA)	HSK1, HSK3
HM007250	DPU Intensity of -15V (mA)	HSK1, HSK3
HM008250	DPU Intensity of +15V (mA)	HSK1, HSK3
HM009250	DPU Intensity of +25V (mA)	HSK1, HSK3

HM640240	Counter Diag2	Diag2
HM641240	Counter Hsk1	HSK1
HM642240	Counter Hsk2	HSK2
HM643240	Counter Hsk3	HSK3
HM644240	Counter Hsk4	HSK4
HM645240	Counter Hsk5	HSK5
HM646240	Counter Hsk6	HSK6
HM647240	Counter Hsk7	HSK7
HM648240	Counter Hsk8	HSK8
HM649240	Counter Hsk9	HSK9

10.2.1.2 REU PROCESSOR BELT ANALOG TELEMETRY

HM551280	REU Temp Processor (°C)	HSK1, HSK3
HM564280	REU Voltage Processor (V)	HSK1, HSK3

10.2.1.3 REU ANALOG BELTS ANALOG TELEMETRY

HM552280	REU Voltage Belt 0 (V)	HSK1, HSK3
HM553280	REU Voltage Belt 1 (V)	HSK1, HSK3
HM554280	REU Voltage Belt 2 (V)	HSK1, HSK3
HM555280	REU Voltage Belt 3 (V)	HSK1, HSK3
HM556280	REU Voltage Belt 4 (V)	HSK1, HSK3
HM557280	REU Voltage Belt 5 (V)	HSK1, HSK3
HM558280	REU Voltage Belt 6 (V)	HSK1, HSK3
HM559280	REU Voltage Belt 7 (V)	HSK1, HSK3
HM560280	REU Voltage Belt 8 (V)	HSK1, HSK3
HM561280	REU Voltage Belt 9 (V)	HSK1, HSK3
HM562280	REU Voltage Belt A (V)	HSK1, HSK3
HM563280	REU Voltage Belt B (V)	HSK1, HSK3

HM539280	REU Temp Belt 0 (°C)	HSK1, HSK3
HM540280	REU Temp Belt 1 (°C)	HSK1, HSK3
HM541280	REU Temp Belt 2 (°C)	HSK1, HSK3
HM542280	REU Temp Belt 3 (°C)	HSK1, HSK3
HM543280	REU Temp Belt 4 (°C)	HSK1, HSK3
HM544280	REU Temp Belt 5 (°C)	HSK1, HSK3
HM545280	REU Temp Belt 6 (°C)	HSK1, HSK3
HM546280	REU Temp Belt 7 (°C)	HSK1, HSK3
HM547280	REU Temp Belt 8 (°C)	HSK1, HSK3
HM548280	REU Temp Belt 9 (°C)	HSK1, HSK3
HM549280	REU Temp Belt A (°C)	HSK1, HSK3
HM550280	REU Temp Belt B (°C)	HSK1, HSK3

10.2.1.4 REU CERNOX's ANALOG TELEMETRY

HD492280	Cernox Temp HFI 0.1K Nom (K)	HSK1, HSK3
HD493280	Cernox Temp HFI 1.6K Nom (K)	HSK1, HSK3
HD494280	Cernox Temp HFI 4K Nom (K)	HSK1, HSK3
HD495280	Cernox Temp HFI 4-1.6KT Nom (K)	HSK1, HSK3
HD496280	Cernox Temp HFI 18K Nom (K)	HSK1, HSK3
HD497280	Cernox Temp HFI 50K Nom (K)	HSK1, HSK3

HD498280	Cernox Temp HFI 0.1K Red (K)	HSK1, HSK3
HD499280	Cernox Temp HFI 1.6K Red (K)	HSK1, HSK3
HD500280	Cernox Temp HFI 4K Red (K)	HSK1, HSK3
HD501280	Cernox Temp HFI 4-1.6KT Red (K)	HSK1, HSK3
HD502280	Cernox Temp HFI 18K Red (K)	HSK1, HSK3
HD503280	Cernox Temp HFI 50K Red (K)	HSK1, HSK3

HM295280	Cernox 0.1K Nom RAW Pos	HSK1, HSK3
HM297280	Cernox 0.1K Nom RAW Neg	HSK1, HSK3
HD528280	Cernox Volt 0.1K Nom (V)	HSK1, HSK3
HD442280	Cernox Res 0.1K Nom (Ohm)	HSK1, HSK3

HM301280	Cernox 1.6K Nom RAW Pos	HSK1, HSK3
HM303280	Cernox 1.6K Nom RAW Neg	HSK1, HSK3
HD529280	Cernox Volt 1.6K Nom (V)	HSK1, HSK3
HD444280	Cernox Res 1.6K Nom (Ohm)	HSK1, HSK3

HM307280	Cernox 4K Nom RAW Pos	HSK1, HSK3
HM309280	Cernox 4K Nom RAW Neg	HSK1, HSK3
HD530280	Cernox Volt 4K Nom (V)	HSK1, HSK3
HD446280	Cernox Res 4K Nom (Ohm)	HSK1, HSK3

HM313280	Cernox 4-1.6KT Nom RAW Pos	HSK1, HSK3
HM315280	Cernox 4-1.6KT Nom RAW Neg	HSK1, HSK3
HD531280	Cernox Volt 4-1.6KT Nom (V)	HSK1, HSK3
HD448280	Cernox Res 4-1.6KT Nom (Ohm)	HSK1, HSK3

HM319280	Cernox 18K Nom RAW Pos	HSK1, HSK3
HM321280	Cernox 18K Nom RAW Neg	HSK1, HSK3
HD532280	Cernox Volt 18K Nom (V)	HSK1, HSK3
HD450280	Cernox Res 18K Nom (Ohm)	HSK1, HSK3

HM325280	Cernox 50K Nom RAW Pos	HSK1, HSK3
HM327280	Cernox 50K Nom RAW Neg	HSK1, HSK3
HD533280	Cernox Volt 50K Nom (V)	HSK1, HSK3
HD452280	Cernox Res 50K Nom (Ohm)	HSK1, HSK3

HM331280	Cernox 0.1K Red RAW Pos	HSK1, HSK3
HM333280	Cernox 0.1K Red RAW Neg	HSK1, HSK3
HD534280	Cernox Volt 0.1K Red (V)	HSK1, HSK3
HD454280	Cernox Res 0.1K Red (Ohm)	HSK1, HSK3

HM337280	Cernox 1.6K Red RAW Pos	HSK1, HSK3
HM339280	Cernox 1.6K Red RAW Neg	HSK1, HSK3
HD535280	Cernox Volt 1.6K Red (V)	HSK1, HSK3
HD456280	Cernox Res 1.6K Red (Ohm)	HSK1, HSK3

HM343280	Cernox 4K Red RAW Pos	HSK1, HSK3
HM345280	Cernox 4K Red RAW Neg	HSK1, HSK3
HD536280	Cernox Volt 4K Red (V)	HSK1, HSK3
HD458280	Cernox Res 4K Red (Ohm)	HSK1, HSK3

HM349280	Cernox 4-1.6KT Red RAW Pos	HSK1, HSK3
HM351280	Cernox 4-1.6KT Red RAW Neg	HSK1, HSK3
HD537280	Cernox Volt 4-1.6KT Red (V)	HSK1, HSK3
HD460280	Cernox Res 4-1.6KT Red (Ohm)	HSK1, HSK3

HM355280	Cernox 18K Red RAW Pos	HSK1, HSK3
HM357280	Cernox 18K Red RAW Neg	HSK1, HSK3
HD538280	Cernox Volt 18K Red (V)	HSK1, HSK3
HD462280	Cernox Res 18K Red (Ohm)	HSK1, HSK3

HM361280	Cernox 50K Red RAW Pos	HSK1, HSK3
HM363280	Cernox 50K Red RAW Neg	HSK1, HSK3
HD539280	Cernox Volt 50K Red (V)	HSK1, HSK3
HD464280	Cernox Res 50K Red (Ohm)	HSK1, HSK3

Only the nominal REU processor can read the 6 nominal HCT (Cernox). Only the redundant REU processor can read the 6 redundant HCT.
However the DPU ASW reports the 12 values. Ground user shall read only the 6 nominal HCT or the 6 redundant HCT according to the selection of the REU processor.

10.2.1.5 REU PID ANALOG TELEMETRY

HM371280	PID BOLO Nom Heat Power LW	HSK1, HSK3
HM372280	PID BOLO Nom Heat Power MW	HSK1, HSK3
HM382280	PID DILU Nom Heat Power LW	HSK1, HSK3
HM383280	PID DILU Nom Heat Power MW	HSK1, HSK3
HM393280	PID 1.6K Nom Heat Power LW	HSK1, HSK3
HM394280	PID 1.6K Nom Heat Power MW	HSK1, HSK3
HM404280	PID 4K Nom Heat Power LW	HSK1, HSK3
HM405280	PID 4K Nom Heat Power MW	HSK1, HSK3
HM415280	PID Switch 1.6-4K Nom Heat Power LW	HSK1, HSK3
HM416280	PID Switch 1.6-4K Nom Heat Power MW	HSK1, HSK3
HM373280	PID BOLO Red Heat Power LW	HSK1, HSK3
HM374280	PID BOLO Red Heat Power MW	HSK1, HSK3
HM384280	PID DILU Red Heat Power LW	HSK1, HSK3
HM385280	PID DILU Red Heat Power MW	HSK1, HSK3
HM395280	PID 1.6K Red Heat Power LW	HSK1, HSK3
HM396280	PID 1.6K Red Heat Power MW	HSK1, HSK3
HM406280	PID 4K Red Heat Power LW	HSK1, HSK3
HM407280	PID 4K Red Heat Power MW	HSK1, HSK3
HM417280	PID Switch 1.6-4K Red Heat Power LW	HSK1, HSK3
HM418280	PID Switch 1.6-4K Red Heat Power MW	HSK1, HSK3
HD612280	PID BOLO Nom Power (W)	HSK1, HSK3
HD613280	PID DILU Nom Power (W)	HSK1, HSK3
HD614280	PID 1.6K Nom Power (W)	HSK1, HSK3
HD615280	PID 4K Nom Power (W)	HSK1, HSK3
HD616280	PID Switch 1.6-4K Nom Power (W)	HSK1, HSK3
HD618280	PID BOLO Red Power (W)	HSK1, HSK3
HD619280	PID DILU Red Power (W)	HSK1, HSK3
HD620280	PID 1.6K Red Power (W)	HSK1, HSK3
HD621280	PID 4K Red Power (W)	HSK1, HSK3
HD622280	PID Switch 1.6-4K Red Power (W)	HSK1, HSK3

10.2.1.6 PAU ANALOG TELEMETRY

HM527280	PAU Temp Belt 0 (°C)	HSK1, HSK3
HM528280	PAU Temp Belt 1 (°C)	HSK1, HSK3
HM529280	PAU Temp Belt 2 (°C)	HSK1, HSK3
HM530280	PAU Temp Belt 3 (°C)	HSK1, HSK3
HM531280	PAU Temp Belt 4 (°C)	HSK1, HSK3
HM532280	PAU Temp Belt 5 (°C)	HSK1, HSK3
HM533280	PAU Temp Belt 6 (°C)	HSK1, HSK3
HM534280	PAU Temp Belt 7 (°C)	HSK1, HSK3
HM535280	PAU Temp Belt 8 (°C)	HSK1, HSK3
HM536280	PAU Temp Belt 9 (°C)	HSK1, HSK3
HM537280	PAU Temp Belt A (°C)	HSK1, HSK3
HM538280	PAU Temp Belt B (°C)	HSK1, HSK3

10.2.1.7 JFET ANALOG TELEMETRY

HD504280	JFET Temp Belt 0 (K)	HSK1, HSK3
HM432280	JFET Temp Belt 0 (V)	HSK1, HSK3
HD505280	JFET Temp Belt 1 (K)	HSK1, HSK3
HM440280	JFET Temp Belt 1 (V)	HSK1, HSK3
HD506280	JFET Temp Belt 2 (K)	HSK1, HSK3
HM448280	JFET Temp Belt 2 (V)	HSK1, HSK3
HD507280	JFET Temp Belt 3 (K)	HSK1, HSK3
HM456280	JFET Temp Belt 3 (V)	HSK1, HSK3
HD508280	JFET Temp Belt 4 (K)	HSK1, HSK3
HM464280	JFET Temp Belt 4 (V)	HSK1, HSK3
HD509280	JFET Temp Belt 5 (K)	HSK1, HSK3
HM472280	JFET Temp Belt 5 (V)	HSK1, HSK3
HD510280	JFET Temp Belt 6 (K)	HSK1, HSK3
HM480280	JFET Temp Belt 6 (V)	HSK1, HSK3
HD511280	JFET Temp Belt 7 (K)	HSK1, HSK3
HM488280	JFET Temp Belt 7 (V)	HSK1, HSK3
HD512280	JFET Temp Belt 8 (K)	HSK1, HSK3
HM496280	JFET Temp Belt 8 (V)	HSK1, HSK3
HD513280	JFET Temp Belt 9 (K)	HSK1, HSK3
HM504280	JFET Temp Belt 9 (V)	HSK1, HSK3
HD514280	JFET Temp Belt A (K)	HSK1, HSK3
HM512280	JFET Temp Belt A (V)	HSK1, HSK3
HD515280	JFET Temp Belt B (K)	HSK1, HSK3
HM520280	JFET Temp Belt B (V)	HSK1, HSK3
HM438280	Heater Power JFET 0 Raw	HSK1, HSK3
HD600280	Heater Power JFET 0 (W)	HSK1, HSK3
HM446280	Heater Power JFET 1 Raw	HSK1, HSK3
HD601280	Heater Power JFET 1 (W)	HSK1, HSK3
HM454280	Heater Power JFET 2 Raw	HSK1, HSK3
HD602280	Heater Power JFET 2 (W)	HSK1, HSK3
HM462280	Heater Power JFET 3 Raw	HSK1, HSK3
HD603280	Heater Power JFET 3 (W)	HSK1, HSK3
HM470280	Heater Power JFET 4 Raw	HSK1, HSK3
HD604280	Heater Power JFET 4 (W)	HSK1, HSK3
HM478280	Heater Power JFET 5 Raw	HSK1, HSK3
HD605280	Heater Power JFET 5 (W)	HSK1, HSK3
HM486280	Heater Power JFET 6 Raw	HSK1, HSK3
HD606280	Heater Power JFET 6 (W)	HSK1, HSK3
HM494280	Heater Power JFET 7 Raw	HSK1, HSK3
HD607280	Heater Power JFET 7 (W)	HSK1, HSK3
HM502280	Heater Power JFET 8 Raw	HSK1, HSK3
HD608280	Heater Power JFET 8 (W)	HSK1, HSK3
HM510280	Heater Power JFET 9 Raw	HSK1, HSK3
HD609280	Heater Power JFET 9 (W)	HSK1, HSK3
HM518280	Heater Power JFET A Raw	HSK1, HSK3
HD610280	Heater Power JFET A (W)	HSK1, HSK3
HM526280	Heater Power JFET B Raw	HSK1, HSK3
HD611280	Heater Power JFET B (W)	HSK1, HSK3

10.2.1.8 4K ANALOG TELEMETRY

HD028260	4K JT Temperature (K)	HSK1, HSK3
HD029260	4K I/F 18K Temperature (K) (sec axis)	HSK1, HSK3
HM018260	4K Gas Pressure HP (bar)	HSK1, HSK3
HM019260	4K Gas Pressure LP (bar)	HSK1, HSK3
HM017260	4K Gas FlowRate (mg/s)	HSK1, HSK3
HM033260	Compressor LP Head Temp (°C)	HSK1, HSK3
HM034260	Compressor HP Head Temp (°C)	HSK1, HSK3
HM035260	Compressor LP PPO Temp (°C)	HSK1, HSK3
HM036260	Compressor HP PPO Temp (°C)	HSK1, HSK3
HM020260	4K Getter Temperature 1 (°C)	HSK1, HSK3
HM021260	4K Getter Temperature 2 (°C)	HSK1, HSK3
HM046260	4K Getter Bracket Temp T11 (°C)	HSK1, HSK3
HM016260	Getter Pwm (0-255) (sec axis)	HSK1, HSK3
HM037260	Power Module Temp T4 (°C)	HSK1, HSK3
HM041260	Power Module Temp T6 (°C)	HSK1, HSK3
HM038260	Drive Module A Temp T5 (°C)	HSK1, HSK3
HM042260	Drive Module B Temp T7 (°C)	HSK1, HSK3
HM043260	4KCDE Case Temp T8 (°C)	HSK1, HSK3
HM044260	Ancillary Panel Temp T9 (°C)	HSK1, HSK3
HM045260	Ancillary Panel Temp T10 (°C)	HSK1, HSK3
HM049260	Buffer Volume Temp T12 (°C)	HSK1, HSK3
HM077260	Compressor Amplitude Set (um)	HSK1, HSK3
HM098260	Comp A amplitude positive Max (um)	HSK1, HSK3
HM099260	Comp A amplitude positive Min (um)	HSK1, HSK3
HM102260	Comp B amplitude positive Max (um)	HSK1, HSK3
HM103260	Comp B amplitude positive Min (um)	HSK1, HSK3
HM100260	Comp A amplitude negative Max (um)	HSK1, HSK3
HM101260	Comp A amplitude negative Min (um)	HSK1, HSK3
HM104260	Comp B amplitude negative Max (um)	HSK1, HSK3
HM105260	Comp B amplitude negative Min (um)	HSK1, HSK3
HM106260	Comp A drive current positive Max (A)	HSK1, HSK3
HM107260	Comp A drive current positive Min (A)	HSK1, HSK3
HM108260	Comp A drive current negative Max (A)	HSK1, HSK3
HM109260	Comp A drive current negative Min (A)	HSK1, HSK3
HM110260	Comp B drive current positive Max (A)	HSK1, HSK3
HM111260	Comp B drive current positive Min (A)	HSK1, HSK3
HM112260	Comp B drive current negative Max (A)	HSK1, HSK3
HM113260	Comp B drive current negative Min (A)	HSK1, HSK3
HM082260	Force transducer 1 filtered (Nrms)	HSK1, HSK3
HM083260	Force transducer 2 filtered (Nrms)	HSK1, HSK3
HM084260	Force transducer 3 filtered (Nrms)	HSK1, HSK3
HM085260	Force transducer 4 filtered (Nrms)	HSK1, HSK3
HM086260	Modulus of Imbalance F0 (N)	HSK1, HSK3
HM087260	Modulus of Imbalance F1 (N)	HSK1, HSK3
HM088260	Modulus of Imbalance F2 (N)	HSK1, HSK3
HM089260	Modulus of Imbalance F3 (N)	HSK1, HSK3
HM090260	Modulus of Imbalance F4 (N)	HSK1, HSK3
HM091260	Modulus of Imbalance F5 (N)	HSK1, HSK3
HM092260	Modulus of Imbalance F6 (N)	HSK1, HSK3
HM093260	Modulus of Imbalance F7 (N)	HSK1, HSK3

HM094260	Comp A average drive power Max (W)	HSK1, HSK3
HM095260	Comp A average drive power Min (W)	HSK1, HSK3
HM096260	Comp B average drive power Max (W)	HSK1, HSK3
HM097260	Comp B average drive power Min (W)	HSK1, HSK3
HM078260	Average drive bus power (W)	HSK1, HSK3
HM079260	Average processor bus current (A)	HSK1, HSK3
HM022260	Processor Bus Current (A)	HSK1, HSK3
HM064260	Drive bus current (A)	HSK1, HSK3
HM080260	Peak drive bus current Max (A)	HSK1, HSK3
HM081260	Peak drive bus current Min (A)	HSK1, HSK3
HM027260	4K Processor -15V (V)	HSK1, HSK3
HM059260	4K DRIVE - 15V (V)	HSK1, HSK3
HM062260	4K PPO - 15V (V)	HSK1, HSK3
HM030260	4K Processor +2.5V (V)	HSK1, HSK3
HM025260	4K Processor +5V (V)	HSK1, HSK3
HM057260	4K DRIVE +5V (V)	HSK1, HSK3
HM060260	4K PPO +10V (V)	HSK1, HSK3
HM026260	4K PROC +15V (V)	HSK1, HSK3
HM058260	4K DRIVE +15V (V)	HSK1, HSK3
HM061260	4K PPO +15V (V)	HSK1, HSK3
HM063260	4K Drive bus 28V (V)	HSK1, HSK3
HM050260	4K Reference Voltage (V)	HSK1, HSK3
HM039260	Mux 1 Ref Voltage (V)	HSK1, HSK3
HM047260	Mux 2 Ref Voltage (V)	HSK1, HSK3
HM055260	Mux 3 Ref Voltage (V)	HSK1, HSK3
HM023260	Mux 4 Ref Voltage (V)	HSK1, HSK3
HM031260	Mux 5 Ref Voltage (V)	HSK1, HSK3
HM040260	Mux 1 Zero Voltage (V)	HSK1, HSK3
HM048260	Mux 2 Zero Voltage (V)	HSK1, HSK3
HM056260	Mux 3 Zero Voltage (V)	HSK1, HSK3
HM024260	Mux 4 Zero Voltage (V)	HSK1, HSK3
HM032260	Mux 5 Zero Voltage (V)	HSK1, HSK3
HM071260	Vib Sensor ADC Ref Voltage (V) (sec axis)	HSK1, HSK3
HM073260	Compressor A ADC Ref Voltage (V)	HSK1, HSK3
HM072260	Compressor B ADC Ref Voltage (V)	HSK1, HSK3
HM074260	Vib Sensor ADC Zero Voltage (V) (sec axis)	HSK1, HSK3
HM076260	Compressor A ADC Zero Voltage (V)	HSK1, HSK3
HM075260	Compressor B ADC Zero Voltage (V)	HSK1, HSK3
HM005260	F0 4K (micro s)	HSK1, HSK3
HM007260	F180 4K (micro s)	HSK1, HSK3
HM001260	4K-Time (ms)	HSK1, HSK3, Diag2
HM154260	HM154260_4Sw-WStartHr	HSK1, HSK3
HM155260	HM155260_4Sw-WStartHrLsw	HSK1, HSK3

10.2.1.9 DCE ANALOG TELEMETRY

HM017270	Pres. 4He HP PT101 (Bar)	HSK1, HSK3
HM018270	Pres. 3He HP PT201 (Bar)	HSK1, HSK3
HM019270	Pres. 4He Outlet Regul PT102 (Bar)	HSK1, HSK3
HM020270	Pres. 3He Outlet Regul PT202 (Bar)	HSK1, HSK3
HM021270	Pres. Dilu Inlet 4He PT103 (Bar)	HSK1, HSK3
HM022270	Pres. Dilu Inlet 3He PT203 (Bar)	HSK1, HSK3
HD001270	Temperature tank 3He T201 (°C)	HSK1, HSK3
HD002270	Temperature tank1 4He T101 (°C)	HSK1, HSK3
HD003270	Temperature tank2 4He T102 (°C)	HSK1, HSK3
HD004270	Temperature tank3 4He T103 (°C)	HSK1, HSK3
HD005270	Temperature 4He inlet (°C)	HSK1, HSK3
HD006270	Temperature 3He inlet (°C)	HSK1, HSK3
HD009270	Cernox Temp dilu 50K 4He (K)	HSK1, HSK3
HD010270	Cernox Temp dilu 18K 4He (K)	HSK1, HSK3
HD011270	Cernox Temp dilu 4K 4He (K)	HSK1, HSK3
HD012270	Cernox Temp Switch_18K4K nominal (K)	HSK1, HSK3
HD013270	Cernox Temp dilu 50K 3He (K)	HSK1, HSK3
HD014270	Cernox Temp dilu 18K 3He (K)	HSK1, HSK3
HD015270	Cernox Temp dilu 4K 3He (K)	HSK1, HSK3
HD016270	Cernox Temp Switch_18K4K redundant (K)	HSK1, HSK3
HM025270	DCE +31V (V)	HSK1, HSK3
HM026270	DCE +5V (V)	HSK1, HSK3
HM027270	DCE +15V (V)	HSK1, HSK3
HM028270	DCE -15V (V)	HSK1, HSK3
HM029270	DCE Temperature 1 (°C)	HSK1, HSK3
HM030270	DCE Temperature 2 (°C)	HSK1, HSK3
HM007270	DCE Calibration Resistor 1 (Ohm)	HSK1, HSK3
HM008270	DCE Calibration Resistor 2 (Ohm)	HSK1, HSK3
HM605270	Valve Mixture Nom (HPLV301)	HSK1, HSK3
HM604270	Valve Mixture Red (HPLV351)	HSK1, HSK3
HM601270	Valve 4He HP Nom (HPLV101)	HSK1, HSK3
HM600270	Valve 4He HP Red (HPLV151)	HSK1, HSK3
HM603270	Valve 3He HP Nom (LV201)	HSK1, HSK3
HM602270	Valve 3He HP Red (LV251)	HSK1, HSK3
HM001270	Temperature tank 3He T201 (Ohm)	HSK1, HSK3
HM002270	Temperature tank1 4He T101 (Ohm)	HSK1, HSK3
HM003270	Temperature tank2 4He T102 (Ohm)	HSK1, HSK3
HM004270	Temperature tank3 4He T103 (Ohm)	HSK1, HSK3
HM005270	Temperature 4He inlet (Ohm)	HSK1, HSK3
HM006270	Temperature 3He inlet (Ohm)	HSK1, HSK3
HM009270	Cernox dilu 50K 4He (Ohm)	HSK1, HSK3
HM010270	Cernox dilu 18K 4He (Ohm)	HSK1, HSK3
HM011270	Cernox dilu 4K 4He (Ohm)	HSK1, HSK3
HM012270	Cernox Switch_18K4K nominal (Ohm)	HSK1, HSK3
HM013270	Cernox dilu 50K 3He (Ohm)	HSK1, HSK3
HM014270	Cernox dilu 18K 3He (Ohm)	HSK1, HSK3
HM015270	Cernox dilu 4K 3He (Ohm)	HSK1, HSK3
HM016270	Cernox Switch_18K4K redundant (Ohm)	HSK1, HSK3

10.2.1.10 FOCAL PLANE ANALOG TELEMETRY

HD217280	OCf00-Ohm	HSK4
HD218280	OCf01-Ohm	HSK4
HD219280	OCf02-Ohm	HSK4
HD220280	OCf03-Ohm	HSK4
HD221280	OCf04-Ohm	HSK4
HD222280	OCf05-Ohm	HSK4
HD223280	OCf10-Ohm	HSK4
HD224280	OCf11-Ohm	HSK4
HD225280	OCf12-Ohm	HSK4
HD226280	OCf13-Ohm	HSK4
HD227280	OCf14-Ohm	HSK4
HD228280	OCf15-Ohm	HSK4
HD229280	OCf20-Ohm	HSK5
HD230280	OCf21-Ohm	HSK5
HD231280	OCf22-Ohm	HSK5
HD232280	OCf23-Ohm	HSK5
HD233280	OCf24-Ohm	HSK5
HD234280	OCf25-Ohm	HSK5
HD235280	OCf30-Ohm	HSK5
HD236280	OCf31-Ohm	HSK5
HD237280	OCf32-Ohm	HSK5
HD238280	OCf33-Ohm	HSK5
HD239280	OCf34-Ohm	HSK5
HD240280	OCf35-Ohm	HSK5
HD241280	OCf40-Ohm	HSK6
HD242280	OCf41-Ohm	HSK6
HD243280	OCf42-Ohm	HSK6
HD244280	OCf43-Ohm	HSK6
HD245280	OCf44-Ohm	HSK6
HD246280	OCf45-Ohm	HSK6
HD247280	OCf50-Ohm	HSK6
HD248280	OCf51-Ohm	HSK6
HD249280	OCf52-Ohm	HSK6
HD250280	OCf53-Ohm	HSK6
HD251280	OCf54-Ohm	HSK6
HD252280	OCf55-Ohm	HSK6
HD253280	OCf60-Ohm	HSK7
HD254280	OCf61-Ohm	HSK7
HD255280	OCf62-Ohm	HSK7
HD256280	OCf63-Ohm	HSK7
HD257280	OCf64-Ohm	HSK7
HD258280	OCf65-Ohm	HSK7
HD259280	OCf70-Ohm	HSK7
HD260280	OCf71-Ohm	HSK7
HD261280	OCf72-Ohm	HSK7
HD262280	OCf73-Ohm	HSK7
HD263280	OCf74-Ohm	HSK7
HD264280	OCf75-Ohm	HSK7

HD265280	OCf80-Ohm	HSK8
HD266280	OCf81-Ohm	HSK8
HD267280	OCf82-Ohm	HSK8
HD268280	OCf83-Ohm	HSK8
HD269280	OCf84-Ohm	HSK8
HD270280	OCf85-Ohm	HSK8
HD271280	OCf90-Kelvin	HSK8
HD272280	OCf91-Kelvin	HSK8
HD273280	OCf92-Kelvin	HSK8
HD274280	OCf93-Kelvin	HSK8
HD275280	OCf94-Kelvin	HSK8
HD276280	OCf95-Kelvin	HSK8
HD277280	OCfA0-Ohm	HSK9
HD278280	OCfA1-Volt	HSK9
HD279280	OCfA2-Kelvin	HSK9
HD280280	OCfA3-Kelvin	HSK9
HD281280	OCfA4-Kelvin	HSK9
HD282280	OCfA5-Kelvin	HSK9
HD283280	OCfB0-Kelvin	HSK9
HD284280	OCfB1-Kelvin	HSK9
HD285280	OCfB2-Kelvin	HSK9
HD286280	OCfB3-Kelvin	HSK9
HD287280	OCfB4-Kelvin	HSK9
HD288280	OCfB5-Kelvin	HSK9

HM217240	Channel 00 CS Average	HSK1, HSK3
HM218240	Channel 01 CS Average	HSK1, HSK3
HM219240	Channel 02 CS Average	HSK1, HSK3
HM220240	Channel 03 CS Average	HSK1, HSK3
HM221240	Channel 04 CS Average	HSK1, HSK3
HM222240	Channel 05 CS Average	HSK1, HSK3
HM223240	Channel 10 CS Average	HSK1, HSK3
HM224240	Channel 11 CS Average	HSK1, HSK3
HM225240	Channel 12 CS Average	HSK1, HSK3
HM226240	Channel 13 CS Average	HSK1, HSK3
HM227240	Channel 14 CS Average	HSK1, HSK3
HM228240	Channel 15 CS Average	HSK1, HSK3
HM229240	Channel 20 CS Average	HSK1, HSK3
HM230240	Channel 21 CS Average	HSK1, HSK3
HM231240	Channel 22 CS Average	HSK1, HSK3
HM232240	Channel 23 CS Average	HSK1, HSK3
HM233240	Channel 24 CS Average	HSK1, HSK3
HM234240	Channel 25 CS Average	HSK1, HSK3
HM235240	Channel 30 CS Average	HSK1, HSK3
HM236240	Channel 31 CS Average	HSK1, HSK3
HM237240	Channel 32 CS Average	HSK1, HSK3
HM238240	Channel 33 CS Average	HSK1, HSK3
HM239240	Channel 34 CS Average	HSK1, HSK3
HM240240	Channel 35 CS Average	HSK1, HSK3
HM241240	Channel 40 CS Average	HSK1, HSK3
HM242240	Channel 41 CS Average	HSK1, HSK3
HM243240	Channel 42 CS Average	HSK1, HSK3
HM244240	Channel 43 CS Average	HSK1, HSK3
HM245240	Channel 44 CS Average	HSK1, HSK3
HM246240	Channel 45 CS Average	HSK1, HSK3
HM247240	Channel 50 CS Average	HSK1, HSK3
HM248240	Channel 51 CS Average	HSK1, HSK3
HM249240	Channel 52 CS Average	HSK1, HSK3
HM250240	Channel 53 CS Average	HSK1, HSK3
HM251240	Channel 54 CS Average	HSK1, HSK3
HM252240	Channel 55 CS Average	HSK1, HSK3
HM253240	Channel 60 CS Average	HSK1, HSK3
HM254240	Channel 61 CS Average	HSK1, HSK3
HM255240	Channel 62 CS Average	HSK1, HSK3
HM256240	Channel 63 CS Average	HSK1, HSK3
HM257240	Channel 64 CS Average	HSK1, HSK3
HM258240	Channel 65 CS Average	HSK1, HSK3
HM259240	Channel 70 CS Average	HSK1, HSK3
HM260240	Channel 71 CS Average	HSK1, HSK3
HM261240	Channel 72 CS Average	HSK1, HSK3
HM262240	Channel 73 CS Average	HSK1, HSK3
HM263240	Channel 74 CS Average	HSK1, HSK3
HM264240	Channel 75 CS Average	HSK1, HSK3
HM265240	Channel 80 CS Average	HSK1, HSK3
HM266240	Channel 81 CS Average	HSK1, HSK3
HM267240	Channel 82 CS Average	HSK1, HSK3
HM268240	Channel 83 CS Average	HSK1, HSK3
HM269240	Channel 84 CS Average	HSK1, HSK3
HM270240	Channel 85 CS Average	HSK1, HSK3

HM271240	Channel 90 CS Average	HSK1, HSK3
HM272240	Channel 91 CS Average	HSK1, HSK3
HM273240	Channel 92 CS Average	HSK1, HSK3
HM274240	Channel 93 CS Average	HSK1, HSK3
HM275240	Channel 94 CS Average	HSK1, HSK3
HM276240	Channel 95 CS Average	HSK1, HSK3
HM277240	Channel A0 CS Average	HSK1, HSK3
HM278240	Channel A1 CS Average	HSK1, HSK3
HM279240	Channel A2 CS Average	HSK1, HSK3
HM280240	Channel A3 CS Average	HSK1, HSK3
HM281240	Channel A4 CS Average	HSK1, HSK3
HM282240	Channel A5 CS Average	HSK1, HSK3
HM283240	Channel B0 CS Average	HSK1, HSK3
HM284240	Channel B1 CS Average	HSK1, HSK3
HM285240	Channel B2 CS Average	HSK1, HSK3
HM286240	Channel B3 CS Average	HSK1, HSK3
HM287240	Channel B4 CS Average	HSK1, HSK3
HM288240	Channel B5 CS Average	HSK1, HSK3

HM145240	Channel 00 CalSigma	HSK4
HM146240	Channel 01 CalSigma	HSK4
HM147240	Channel 02 CalSigma	HSK4
HM148240	Channel 03 CalSigma	HSK4
HM149240	Channel 04 CalSigma	HSK4
HM150240	Channel 05 CalSigma	HSK4
HM151240	Channel 10 CalSigma	HSK4
HM152240	Channel 11 CalSigma	HSK4
HM153240	Channel 12 CalSigma	HSK4
HM154240	Channel 13 CalSigma	HSK4
HM155240	Channel 14 CalSigma	HSK4
HM156240	Channel 15 CalSigma	HSK4
HM289240	Channel 00 AvMaxMin	HSK4
HM290240	Channel 01 AvMaxMin	HSK4
HM291240	Channel 02 AvMaxMin	HSK4
HM292240	Channel 03 AvMaxMin	HSK4
HM293240	Channel 04 AvMaxMin	HSK4
HM294240	Channel 05 AvMaxMin	HSK4
HM295240	Channel 10 AvMaxMin	HSK4
HM296240	Channel 11 AvMaxMin	HSK4
HM297240	Channel 12 AvMaxMin	HSK4
HM298240	Channel 13 AvMaxMin	HSK4
HM299240	Channel 14 AvMaxMin	HSK4
HM300240	Channel 15 AvMaxMin	HSK4
HM157240	Channel 20 CalSigma	HSK5
HM158240	Channel 21 CalSigma	HSK5
HM159240	Channel 22 CalSigma	HSK5
HM160240	Channel 23 CalSigma	HSK5
HM161240	Channel 24 CalSigma	HSK5
HM162240	Channel 25 CalSigma	HSK5
HM163240	Channel 30 CalSigma	HSK5
HM164240	Channel 31 CalSigma	HSK5
HM165240	Channel 32 CalSigma	HSK5
HM166240	Channel 33 CalSigma	HSK5
HM167240	Channel 34 CalSigma	HSK5
HM168240	Channel 35 CalSigma	HSK5
HM301240	Channel 20 AvMaxMin	HSK5
HM302240	Channel 21 AvMaxMin	HSK5
HM303240	Channel 22 AvMaxMin	HSK5
HM304240	Channel 23 AvMaxMin	HSK5
HM305240	Channel 24 AvMaxMin	HSK5
HM306240	Channel 25 AvMaxMin	HSK5
HM307240	Channel 30 AvMaxMin	HSK5
HM308240	Channel 31 AvMaxMin	HSK5
HM309240	Channel 32 AvMaxMin	HSK5
HM310240	Channel 33 AvMaxMin	HSK5
HM311240	Channel 34 AvMaxMin	HSK5
HM312240	Channel 35 AvMaxMin	HSK5

HM169240	Channel 40 CalSigma	HSK6
HM170240	Channel 41 CalSigma	HSK6
HM171240	Channel 42 CalSigma	HSK6
HM172240	Channel 43 CalSigma	HSK6
HM173240	Channel 44 CalSigma	HSK6
HM174240	Channel 45 CalSigma	HSK6
HM175240	Channel 50 CalSigma	HSK6
HM176240	Channel 51 CalSigma	HSK6
HM177240	Channel 52 CalSigma	HSK6
HM178240	Channel 53 CalSigma	HSK6
HM179240	Channel 54 CalSigma	HSK6
HM180240	Channel 55 CalSigma	HSK6
HM313240	Channel 40 AvMaxMin	HSK6
HM314240	Channel 41 AvMaxMin	HSK6
HM315240	Channel 42 AvMaxMin	HSK6
HM316240	Channel 43 AvMaxMin	HSK6
HM317240	Channel 44 AvMaxMin	HSK6
HM318240	Channel 45 AvMaxMin	HSK6
HM319240	Channel 50 AvMaxMin	HSK6
HM320240	Channel 51 AvMaxMin	HSK6
HM321240	Channel 52 AvMaxMin	HSK6
HM322240	Channel 53 AvMaxMin	HSK6
HM323240	Channel 54 AvMaxMin	HSK6
HM324240	Channel 55 AvMaxMin	HSK6
HM181240	Channel 60 CalSigma	HSK7
HM182240	Channel 61 CalSigma	HSK7
HM183240	Channel 62 CalSigma	HSK7
HM184240	Channel 63 CalSigma	HSK7
HM185240	Channel 64 CalSigma	HSK7
HM186240	Channel 65 CalSigma	HSK7
HM187240	Channel 70 CalSigma	HSK7
HM188240	Channel 71 CalSigma	HSK7
HM189240	Channel 72 CalSigma	HSK7
HM190240	Channel 73 CalSigma	HSK7
HM191240	Channel 74 CalSigma	HSK7
HM192240	Channel 75 CalSigma	HSK7
HM325240	Channel 60 AvMaxMin	HSK7
HM326240	Channel 61 AvMaxMin	HSK7
HM327240	Channel 62 AvMaxMin	HSK7
HM328240	Channel 63 AvMaxMin	HSK7
HM329240	Channel 64 AvMaxMin	HSK7
HM330240	Channel 65 AvMaxMin	HSK7
HM331240	Channel 70 AvMaxMin	HSK7
HM332240	Channel 71 AvMaxMin	HSK7
HM333240	Channel 72 AvMaxMin	HSK7
HM334240	Channel 73 AvMaxMin	HSK7
HM335240	Channel 74 AvMaxMin	HSK7
HM336240	Channel 75 AvMaxMin	HSK7

HM193240	Channel 80 CalSigma	HSK8
HM194240	Channel 81 CalSigma	HSK8
HM195240	Channel 82 CalSigma	HSK8
HM196240	Channel 83 CalSigma	HSK8
HM197240	Channel 84 CalSigma	HSK8
HM198240	Channel 85 CalSigma	HSK8
HM199240	Channel 90 CalSigma	HSK8
HM200240	Channel 91 CalSigma	HSK8
HM201240	Channel 92 CalSigma	HSK8
HM202240	Channel 93 CalSigma	HSK8
HM203240	Channel 94 CalSigma	HSK8
HM204240	Channel 95 CalSigma	HSK8
HM337240	Channel 80 AvMaxMin	HSK8
HM338240	Channel 81 AvMaxMin	HSK8
HM339240	Channel 82 AvMaxMin	HSK8
HM340240	Channel 83 AvMaxMin	HSK8
HM341240	Channel 84 AvMaxMin	HSK8
HM342240	Channel 85 AvMaxMin	HSK8
HM343240	Channel 90 AvMaxMin	HSK8
HM344240	Channel 91 AvMaxMin	HSK8
HM345240	Channel 92 AvMaxMin	HSK8
HM346240	Channel 93 AvMaxMin	HSK8
HM347240	Channel 94 AvMaxMin	HSK8
HM348240	Channel 95 AvMaxMin	HSK8
HM205240	Channel A0 CalSigma	HSK9
HM206240	Channel A1 CalSigma	HSK9
HM207240	Channel A2 CalSigma	HSK9
HM208240	Channel A3 CalSigma	HSK9
HM209240	Channel A4 CalSigma	HSK9
HM210240	Channel A5 CalSigma	HSK9
HM211240	Channel B0 CalSigma	HSK9
HM212240	Channel B1 CalSigma	HSK9
HM213240	Channel B2 CalSigma	HSK9
HM214240	Channel B3 CalSigma	HSK9
HM215240	Channel B4 CalSigma	HSK9
HM216240	Channel B5 CalSigma	HSK9
HM349240	Channel A0 AvMaxMin	HSK9
HM350240	Channel A1 AvMaxMin	HSK9
HM351240	Channel A2 AvMaxMin	HSK9
HM352240	Channel A3 AvMaxMin	HSK9
HM353240	Channel A4 AvMaxMin	HSK9
HM354240	Channel A5 AvMaxMin	HSK9
HM355240	Channel B0 AvMaxMin	HSK9
HM356240	Channel B1 AvMaxMin	HSK9
HM357240	Channel B2 AvMaxMin	HSK9
HM358240	Channel B3 AvMaxMin	HSK9
HM359240	Channel B4 AvMaxMin	HSK9
HM360240	Channel B5 AvMaxMin	HSK9

HM602280	RS00-RawSignal	HSK4
HM603280	RS01-RawSignal	HSK4
HM604280	RS02-RawSignal	HSK4
HM605280	RS03-RawSignal	HSK4
HM606280	RS04-RawSignal	HSK4
HM607280	RS05-RawSignal	HSK4
HM608280	RS10-RawSignal	HSK4
HM609280	RS11-RawSignal	HSK4
HM610280	RS12-RawSignal	HSK4
HM611280	RS13-RawSignal	HSK4
HM612280	RS14-RawSignal	HSK4
HM613280	RS15-RawSignal	HSK4
HM614280	RS20-RawSignal	HSK5
HM615280	RS21-RawSignal	HSK5
HM616280	RS22-RawSignal	HSK5
HM617280	RS23-RawSignal	HSK5
HM618280	RS24-RawSignal	HSK5
HM619280	RS25-RawSignal	HSK5
HM620280	RS30-RawSignal	HSK5
HM621280	RS31-RawSignal	HSK5
HM622280	RS32-RawSignal	HSK5
HM623280	RS33-RawSignal	HSK5
HM624280	RS34-RawSignal	HSK5
HM625280	RS35-RawSignal	HSK5
HM626280	RS40-RawSignal	HSK6
HM627280	RS41-RawSignal	HSK6
HM628280	RS42-RawSignal	HSK6
HM629280	RS43-RawSignal	HSK6
HM630280	RS44-RawSignal	HSK6
HM631280	RS45-RawSignal	HSK6
HM632280	RS50-RawSignal	HSK6
HM633280	RS51-RawSignal	HSK6
HM634280	RS52-RawSignal	HSK6
HM635280	RS53-RawSignal	HSK6
HM636280	RS54-RawSignal	HSK6
HM637280	RS55-RawSignal	HSK6
HM638280	RS60-RawSignal	HSK7
HM639280	RS61-RawSignal	HSK7
HM640280	RS62-RawSignal	HSK7
HM641280	RS63-RawSignal	HSK7
HM642280	RS64-RawSignal	HSK7
HM643280	RS65-RawSignal	HSK7
HM644280	RS70-RawSignal	HSK7
HM645280	RS71-RawSignal	HSK7
HM646280	RS72-RawSignal	HSK7
HM647280	RS73-RawSignal	HSK7
HM648280	RS74-RawSignal	HSK7
HM649280	RS75-RawSignal	HSK7

HM650280	RS80-RawSignal	HSK8
HM651280	RS81-RawSignal	HSK8
HM652280	RS82-RawSignal	HSK8
HM653280	RS83-RawSignal	HSK8
HM654280	RS84-RawSignal	HSK8
HM655280	RS85-RawSignal	HSK8
HM656280	RS90-RawSignal	HSK8
HM657280	RS91-RawSignal	HSK8
HM658280	RS92-RawSignal	HSK8
HM659280	RS93-RawSignal	HSK8
HM660280	RS94-RawSignal	HSK8
HM661280	RS95-RawSignal	HSK8
HM662280	RSA0-RawSignal	HSK9
HM663280	RSA1-RawSignal	HSK9
HM664280	RSA2-RawSignal	HSK9
HM665280	RSA3-RawSignal	HSK9
HM666280	RSA4-RawSignal	HSK9
HM667280	RSA5-RawSignal	HSK9
HM668280	RSB0-RawSignal	HSK9
HM669280	RSB1-RawSignal	HSK9
HM670280	RSB2-RawSignal	HSK9
HM671280	RSB3-RawSignal	HSK9
HM672280	RSB4-RawSignal	HSK9
HM673280	RSB5-RawSignal	HSK9

10.2.1.11 DPU CONFIGURATION TELEMETRY

HM361240	DPU ASW Version	Diag1, Diag2
HM364240	DPU BSW Version	Diag1, Diag2
HM018250	DPU Nb of Start	Diag1
HM415250	DPU ASW Start Address	Diag1
HM419250	DPU 1553 Address	Diag1
HM017250	DPU SW state during boot (1,9,8)	Diag1
HM423250	DPU bad ASW Start Adress (1=error)	Diag1
HM424250	DPU EEPROM checksum error (1=error)	Diag1
HM425250	DPU checksun error (number of start zone) (1=error)	Diag1
HM420250	DPU MSR FPGA status error 1	Diag1
HM421250	DPU MIR FPGA status error	Diag1
HM422250	DPU MSR FPGA status error 2	Diag1
HM426250	DPU ASW loading error (1=error)	Diag1
HM427250	DPU Watchdog (1=active)	Diag1
HM428250	DPU BSW/ASW transition (0=Automatic; 1=by TC)	Diag1
HM429250	DPU general check hardware (0=all OK)	Diag1
HM368240	HM368240_OSw_ResyncNb	Diag2
HM363240	DPU Mode	HSK1, HSK3, Diag1, Diag2
HM362240	DPU FDIR mode	HSK1, HSK3, Diag1, Diag2
HM367240	DPU Compression Slice Size	HSK2
HM001250	DPU Glitch Algo (1=active)	HSK2, Diag2
HM373240	Raw Sig Filter 45L 1 to 16	HSK2
HM374240	Raw Sig Filter 45 17 to 32	HSK2
HM375240	Raw Sig Filter 45M 33 to 45	HSK2
HM376240	Raw Sig Filter 40L 1 to 16	HSK2
HM377240	Raw Sig Filter 40 17 to 32	HSK2
HM378240	Raw Sig Filter 40M 33 to 40	HSK2
HM379240	Raw Sig Filter 36L 1 to 16	HSK2
HM380240	Raw Sig Filter 36 17 to 32	HSK2
HM381240	Raw Sig Filter 36M 33 to 36	HSK2
HM810240	Apid_of-packet	HSK1, HSK3

The DPU ASW under-samples the raw signals sent by the REU in order to send them in HSK4 to HSK9. It keeps 32 samples out of the 90, 80 or 72 initial ones according to the 9 raw signal filter words described in the following table:

Structure	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
Raw Sig Filter 45L 1 to 16	1	1	0	1	0	0	1	0	0	1	0	0	1	0	0	1
Raw Sig Filter 45 17 to 32	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Raw Sig Filter 45M 33 to 45	0	1	0	0	1	0	0	1	0	0	1	0	0	X	X	X
Raw Sig Filter 40L 1 to 16	1	1	1	1	0	0	1	0	0	1	0	0	1	0	0	1
Raw Sig Filter 40 17 to 32	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Raw Sig Filter 40M 33 to 40	0	1	0	0	1	0	0	1	X	X	X	X	X	X	X	X
Raw Sig Filter 36L 1 to 16	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	1
Raw Sig Filter 36 17 to 32	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	0
Raw Sig Filter 36M 33 to 36	0	1	0	0	X	X	X	X	X	X	X	X	X	X	X	X

The previous filters are applied on the first and second half period.
The 2^{15} of the Less Significant Word is applied on the first sample of the half period.
A 1 indicates that the samples are kept.

X	Ignored by the DPU ASW

DPU RESYNCHRONISATION TABLE

HM383240	OSw0_RsynREUMo	HSK1, HSK3, Diag2
HM384240	OSw0_Rsyn4KMo	HSK1, HSK3, Diag2
HM385240	OSw0_RsyncTCLen	HSK1, HSK3, Diag2
HM386240	OSw0_RsyncTCId	HSK1, HSK3, Diag2
HM387240	OSw0_RsyncTCSid	HSK1, HSK3, Diag2
HM388240	OSw0_RsyncTCP1	HSK1, HSK3, Diag2
HM389240	OSw0_RsyncTCP2	HSK1, HSK3, Diag2
HM390240	OSw1_RsynDPUMo	HSK1, HSK3, Diag2
HM391240	OSw1_RsynREUMo	HSK1, HSK3, Diag2
HM392240	OSw1_Rsyn4KMo	HSK1, HSK3, Diag2
HM393240	OSw1_RsyncTCLen	HSK1, HSK3, Diag2
HM394240	OSw1_RsyncTCId	HSK1, HSK3, Diag2
HM395240	OSw1_RsyncTCSid	HSK1, HSK3, Diag2
HM396240	OSw1_RsyncTCP1	HSK1, HSK3, Diag2
HM397240	OSw1_RsyncTCP2	HSK1, HSK3, Diag2
HM398240	OSw2_RsynDPUMo	HSK1, HSK3, Diag2
HM399240	OSw2_RsynREUMo	HSK1, HSK3, Diag2
HM400240	OSw2_Rsyn4KMo	HSK1, HSK3, Diag2
HM401240	OSw2_RsyncTCLen	HSK1, HSK3, Diag2
HM402240	OSw2_RsyncTCId	HSK1, HSK3, Diag2
HM403240	OSw2_RsyncTCSid	HSK1, HSK3, Diag2
HM404240	OSw2_RsyncTCP1	HSK1, HSK3, Diag2
HM405240	OSw2_RsyncTCP2	HSK1, HSK3, Diag2
HM406240	OSw3_RsynDPUMo	HSK1, HSK3, Diag2
HM407240	OSw3_RsynREUMo	HSK1, HSK3, Diag2
HM408240	OSw3_Rsyn4KMo	HSK1, HSK3, Diag2
HM409240	OSw3_RsyncTCLen	HSK1, HSK3, Diag2
HM410240	OSw3_RsyncTCId	HSK1, HSK3, Diag2
HM411240	OSw3_RsyncTCSid	HSK1, HSK3, Diag2
HM412240	OSw3_RsyncTCP1	HSK1, HSK3, Diag2
HM413240	OSw3_RsyncTCP2	HSK1, HSK3, Diag2
HM414240	OSw4_RsynDPUMo	HSK1, HSK3, Diag2
HM415240	OSw4_RsynREUMo	HSK1, HSK3, Diag2
HM416240	OSw4_Rsyn4KMo	HSK1, HSK3, Diag2
HM417240	OSw4_RsyncTCLen	HSK1, HSK3, Diag2
HM418240	OSw4_RsyncTCId	HSK1, HSK3, Diag2
HM419240	OSw4_RsyncTCSid	HSK1, HSK3, Diag2
HM420240	OSw4_RsyncTCP1	HSK1, HSK3, Diag2
HM421240	OSw4_RsyncTCP2	HSK1, HSK3, Diag2
HM422240	OSw5_RsynDPUMo	HSK1, HSK3, Diag2
HM423240	OSw5_RsynREUMo	HSK1, HSK3, Diag2
HM424240	OSw5_Rsyn4KMo	HSK1, HSK3, Diag2
HM425240	OSw5_RsyncTCLen	HSK1, HSK3, Diag2
HM426240	OSw5_RsyncTCId	HSK1, HSK3, Diag2
HM427240	OSw5_RsyncTCSid	HSK1, HSK3, Diag2
HM428240	OSw5_RsyncTCP1	HSK1, HSK3, Diag2
HM429240	OSw5_RsyncTCP2	HSK1, HSK3, Diag2
HM430240	OSw6_RsynDPUMo	HSK1, HSK3, Diag2
HM431240	OSw6_RsynREUMo	HSK1, HSK3, Diag2
HM432240	OSw6_Rsyn4KMo	HSK1, HSK3, Diag2
HM433240	OSw6_RsyncTCLen	HSK1, HSK3, Diag2
HM434240	OSw6_RsyncTCId	HSK1, HSK3, Diag2
HM435240	OSw6_RsyncTCSid	HSK1, HSK3, Diag2
HM436240	OSw6_RsyncTCP1	HSK1, HSK3, Diag2
HM437240	OSw6_RsyncTCP2	HSK1, HSK3, Diag2
HM438240	OSw7_RsynDPUMo	HSK1, HSK3, Diag2
HM439240	OSw7_RsynREUMo	HSK1, HSK3, Diag2
HM440240	OSw7_Rsyn4KMo	HSK1, HSK3, Diag2

HM441240	OSw7_RsyncTCLen	HSK1, HSK3, Diag2
HM442240	OSw7_RsyncTCId	HSK1, HSK3, Diag2
HM443240	OSw7_RsyncTCSid	HSK1, HSK3, Diag2
HM444240	OSw7_RsyncTCP1	HSK1, HSK3, Diag2
HM445240	OSw7_RsyncTCP2	HSK1, HSK3, Diag2
HM446240	OSw8_RsynDPUMo	HSK1, HSK3, Diag2
HM447240	OSw8_RsynREUMo	HSK1, HSK3, Diag2
HM448240	OSw8_Rsyn4KMo	HSK1, HSK3, Diag2
HM449240	OSw8_RsyncTCLen	HSK1, HSK3, Diag2
HM450240	OSw8_RsyncTCId	HSK1, HSK3, Diag2
HM451240	OSw8_RsyncTCSid	HSK1, HSK3, Diag2
HM452240	OSw8_RsyncTCP1	HSK1, HSK3, Diag2
HM453240	OSw8_RsyncTCP2	HSK1, HSK3, Diag2
HM454240	OSw9_RsynDPUMo	HSK1, HSK3, Diag2
HM455240	OSw9_RsynREUMo	HSK1, HSK3, Diag2
HM456240	OSw9_Rsyn4KMo	HSK1, HSK3, Diag2
HM457240	OSw9_RsyncTCLen	HSK1, HSK3, Diag2
HM458240	OSw9_RsyncTCId	HSK1, HSK3, Diag2
HM459240	OSw9_RsyncTCSid	HSK1, HSK3, Diag2
HM460240	OSw9_RsyncTCP1	HSK1, HSK3, Diag2
HM461240	OSw9_RsyncTCP2	HSK1, HSK3, Diag2
HM462240	OSw10_RsynDPUMo	HSK1, HSK3, Diag2
HM463240	OSw10_RsynREUMo	HSK1, HSK3, Diag2
HM464240	OSw10_Rsyn4KMo	HSK1, HSK3, Diag2
HM465240	OSw10_RsyncTCLn	HSK1, HSK3, Diag2
HM466240	OSw10_RsyncTCId	HSK1, HSK3, Diag2
HM467240	OSw10_RsynTCSid	HSK1, HSK3, Diag2
HM468240	OSw10_RsyncTCP1	HSK1, HSK3, Diag2
HM469240	OSw10_RsyncTCP2	HSK1, HSK3, Diag2
HM470240	OSw11_RsynDPUMo	HSK1, HSK3, Diag2
HM471240	OSw11_RsynREUMo	HSK1, HSK3, Diag2
HM472240	OSw11_Rsyn4KMo	HSK1, HSK3, Diag2
HM473240	OSw11_RsyncTCLn	HSK1, HSK3, Diag2
HM474240	OSw11_RsyncTCId	HSK1, HSK3, Diag2
HM475240	OSw11_RsynTCSid	HSK1, HSK3, Diag2
HM476240	OSw11_RsyncTCP1	HSK1, HSK3, Diag2
HM477240	OSw11_RsyncTCP2	HSK1, HSK3, Diag2
HM478240	OSw12_RsynDPUMo	HSK1, HSK3, Diag2
HM479240	OSw12_RsynREUMo	HSK1, HSK3, Diag2
HM480240	OSw12_Rsyn4KMo	HSK1, HSK3, Diag2
HM481240	OSw12_RsyncTCLn	HSK1, HSK3, Diag2
HM482240	OSw12_RsyncTCId	HSK1, HSK3, Diag2
HM483240	OSw12_RsynTCSid	HSK1, HSK3, Diag2
HM484240	OSw12_RsyncTCP1	HSK1, HSK3, Diag2
HM485240	OSw12_RsyncTCP2	HSK1, HSK3, Diag2
HM486240	OSw13_RsynDPUMo	HSK1, HSK3, Diag2
HM487240	OSw13_RsynREUMo	HSK1, HSK3, Diag2
HM488240	OSw13_Rsyn4KMo	HSK1, HSK3, Diag2
HM489240	OSw13_RsyncTCLn	HSK1, HSK3, Diag2
HM490240	OSw13_RsynTCId	HSK1, HSK3, Diag2
HM491240	OSw13_RsynTCSid	HSK1, HSK3, Diag2
HM492240	OSw13_RsyncTCP1	HSK1, HSK3, Diag2
HM493240	OSw13_RsyncTCP2	HSK1, HSK3, Diag2
HM494240	OSw14_RsynDPUMo	HSK1, HSK3, Diag2
HM495240	OSw14_RsynREUMo	HSK1, HSK3, Diag2
HM496240	OSw14_Rsyn4KMo	HSK1, HSK3, Diag2
HM497240	OSw14_RsyncTCLn	HSK1, HSK3, Diag2
HM498240	OSw14_RsyncTCId	HSK1, HSK3, Diag2
HM499240	OSw14_RsynTCSid	HSK1, HSK3, Diag2

HM500240	OSw14_RsyncTCP1	HSK1, HSK3, Diag2
HM501240	OSw14_RsyncTCP2	HSK1, HSK3, Diag2
HM502240	OSw15_RsynDPUMo	HSK1, HSK3, Diag2
HM503240	OSw15_RsynREUMo	HSK1, HSK3, Diag2
HM504240	OSw15_Rsyn4KMo	HSK1, HSK3, Diag2
HM505240	OSw15_RsyncTCLn	HSK1, HSK3, Diag2
HM506240	OSw15_RsyncTCId	HSK1, HSK3, Diag2
HM507240	OSw15_RsynTCSid	HSK1, HSK3, Diag2
HM508240	OSw15_RsyncTCP1	HSK1, HSK3, Diag2
HM509240	OSw15_RsyncTCP2	HSK1, HSK3, Diag2
HM510240	OSw16_RsynDPUMo	HSK1, HSK3, Diag2
HM511240	OSw16_RsynREUMo	HSK1, HSK3, Diag2
HM512240	OSw16_Rsyn4KMo	HSK1, HSK3, Diag2
HM513240	OSw16_RsyncTCLen	HSK1, HSK3, Diag2
HM514240	OSw16_RsyncTCId	HSK1, HSK3, Diag2
HM515240	OSw16_RsyncTCSid	HSK1, HSK3, Diag2
HM516240	OSw16_RsyncTCP1	HSK1, HSK3, Diag2
HM517240	OSw16_RsyncTCP2	HSK1, HSK3, Diag2
HM518240	OSw17_RsynDPUMo	HSK1, HSK3, Diag2
HM519240	OSw17_RsynREUMo	HSK1, HSK3, Diag2
HM520240	OSw17_Rsyn4KMo	HSK1, HSK3, Diag2
HM521240	OSw17_RsyncTCLen	HSK1, HSK3, Diag2
HM522240	OSw17_RsyncTCId	HSK1, HSK3, Diag2
HM523240	OSw17_RsyncTCSid	HSK1, HSK3, Diag2
HM524240	OSw17_RsyncTCP1	HSK1, HSK3, Diag2
HM525240	OSw17_RsyncTCP2	HSK1, HSK3, Diag2
HM526240	OSw18_RsynDPUMo	HSK1, HSK3, Diag2
HM527240	OSw18_RsynREUMo	HSK1, HSK3, Diag2
HM528240	OSw18_Rsyn4KMo	HSK1, HSK3, Diag2
HM529240	OSw18_RsyncTCLen	HSK1, HSK3, Diag2
HM530240	OSw18_RsyncTCId	HSK1, HSK3, Diag2
HM531240	OSw18_RsyncTCSid	HSK1, HSK3, Diag2
HM532240	OSw18_RsyncTCP1	HSK1, HSK3, Diag2
HM533240	OSw18_RsyncTCP2	HSK1, HSK3, Diag2
HM534240	OSw19_RsynDPUMo	HSK1, HSK3, Diag2
HM535240	OSw19_RsynREUMo	HSK1, HSK3, Diag2
HM536240	OSw19_Rsyn4KMo	HSK1, HSK3, Diag2
HM537240	OSw19_RsyncTCLen	HSK1, HSK3, Diag2
HM538240	OSw19_RsyncTCId	HSK1, HSK3, Diag2
HM539240	OSw19_RsyncTCSid	HSK1, HSK3, Diag2
HM540240	OSw19_RsyncTCP1	HSK1, HSK3, Diag2
HM541240	OSw19_RsyncTCP2	HSK1, HSK3, Diag2
HM542240	OSw20_RsynDPUMo	HSK1, HSK3, Diag2
HM543240	OSw20_RsynREUMo	HSK1, HSK3, Diag2
HM544240	OSw20_Rsyn20KMo	HSK1, HSK3, Diag2
HM545240	OSw20_RsyncTCLen	HSK1, HSK3, Diag2
HM546240	OSw20_RsyncTCId	HSK1, HSK3, Diag2
HM547240	OSw20_RsyncTCSid	HSK1, HSK3, Diag2
HM548240	OSw20_RsyncTCP1	HSK1, HSK3, Diag2
HM549240	OSw20_RsyncTCP2	HSK1, HSK3, Diag2
HM550240	OSw21_RsynDPUMo	HSK1, HSK3, Diag2
HM551240	OSw21_RsynREUMo	HSK1, HSK3, Diag2
HM552240	OSw21_Rsyn4KMo	HSK1, HSK3, Diag2
HM553240	OSw21_RsyncTCLen	HSK1, HSK3, Diag2
HM554240	OSw21_RsyncTCId	HSK1, HSK3, Diag2
HM555240	OSw21_RsyncTCSid	HSK1, HSK3, Diag2
HM556240	OSw21_RsyncTCP1	HSK1, HSK3, Diag2
HM557240	OSw21_RsyncTCP2	HSK1, HSK3, Diag2
HM558240	OSw22_RsynDPUMo	HSK1, HSK3, Diag2

HM559240	OSw22_RsynREUMo	HSK1, HSK3, Diag2
HM560240	OSw22_Rsyn4KMo	HSK1, HSK3, Diag2
HM561240	OSw22_RsyncTCLen	HSK1, HSK3, Diag2
HM562240	OSw22_RsyncTCId	HSK1, HSK3, Diag2
HM563240	OSw22_RsyncTCSid	HSK1, HSK3, Diag2
HM564240	OSw22_RsyncTCP1	HSK1, HSK3, Diag2
HM565240	OSw22_RsyncTCP2	HSK1, HSK3, Diag2
HM566240	OSw23_RsynDPUMo	HSK1, HSK3, Diag2
HM567240	OSw23_RsynREUMo	HSK1, HSK3, Diag2
HM568240	OSw23_Rsyn4KMo	HSK1, HSK3, Diag2
HM569240	OSw23_RsyncTCLen	HSK1, HSK3, Diag2
HM570240	OSw23_RsyncTCId	HSK1, HSK3, Diag2
HM571240	OSw23_RsyncTCSid	HSK1, HSK3, Diag2
HM572240	OSw23_RsyncTCP1	HSK1, HSK3, Diag2
HM573240	OSw23_RsyncTCP2	HSK1, HSK3, Diag2
HM574240	OSw24_RsynDPUMo	HSK1, HSK3, Diag2
HM575240	OSw24_RsynREUMo	HSK1, HSK3, Diag2
HM576240	OSw24_Rsyn4KMo	HSK1, HSK3, Diag2
HM577240	OSw24_RsyncTCLen	HSK1, HSK3, Diag2
HM578240	OSw24_RsyncTCId	HSK1, HSK3, Diag2
HM579240	OSw24_RsyncTCSid	HSK1, HSK3, Diag2
HM580240	OSw24_RsyncTCP1	HSK1, HSK3, Diag2
HM581240	OSw24_RsyncTCP2	HSK1, HSK3, Diag2
HM582240	OSw25_RsynDPUMo	HSK1, HSK3, Diag2
HM583240	OSw25_RsynREUMo	HSK1, HSK3, Diag2
HM584240	OSw25_Rsyn4KMo	HSK1, HSK3, Diag2
HM585240	OSw25_RsyncTCLen	HSK1, HSK3, Diag2
HM586240	OSw25_RsyncTCId	HSK1, HSK3, Diag2
HM587240	OSw25_RsyncTCSid	HSK1, HSK3, Diag2
HM588240	OSw25_RsyncTCP1	HSK1, HSK3, Diag2
HM589240	OSw25_RsyncTCP2	HSK1, HSK3, Diag2
HM590240	OSw26_RsynDPUMo	HSK1, HSK3, Diag2
HM591240	OSw26_RsynREUMo	HSK1, HSK3, Diag2
HM592240	OSw26_Rsyn4KMo	HSK1, HSK3, Diag2
HM593240	OSw26_RsyncTCLn	HSK1, HSK3, Diag2
HM594240	OSw26_RsyncTCId	HSK1, HSK3, Diag2
HM595240	OSw26_RsynTCSid	HSK1, HSK3, Diag2
HM596240	OSw26_RsyncTCP1	HSK1, HSK3, Diag2
HM597240	OSw26_RsyncTCP2	HSK1, HSK3, Diag2
HM598240	OSw27_RsynDPUMo	HSK1, HSK3, Diag2
HM599240	OSw27_RsynREUMo	HSK1, HSK3, Diag2
HM600240	OSw27_Rsyn4KMo	HSK1, HSK3, Diag2
HM601240	OSw27_RsyncTCLn	HSK1, HSK3, Diag2
HM602240	OSw27_RsyncTCId	HSK1, HSK3, Diag2
HM603240	OSw27_RsynTCSid	HSK1, HSK3, Diag2
HM604240	OSw27_RsyncTCP1	HSK1, HSK3, Diag2
HM605240	OSw27_RsyncTCP2	HSK1, HSK3, Diag2
HM606240	OSw28_RsynDPUMo	HSK1, HSK3, Diag2
HM607240	OSw28_RsynREUMo	HSK1, HSK3, Diag2
HM608240	OSw28_Rsyn4KMo	HSK1, HSK3, Diag2
HM609240	OSw28_RsyncTCLn	HSK1, HSK3, Diag2
HM610240	OSw28_RsyncTCId	HSK1, HSK3, Diag2
HM611240	OSw28_RsynTCSid	HSK1, HSK3, Diag2
HM612240	OSw28_RsyncTCP1	HSK1, HSK3, Diag2
HM613240	OSw28_RsyncTCP2	HSK1, HSK3, Diag2
HM614240	OSw29_RsynDPUMo	HSK1, HSK3, Diag2
HM615240	OSw29_RsynREUMo	HSK1, HSK3, Diag2
HM616240	OSw29_Rsyn4KMo	HSK1, HSK3, Diag2
HM617240	OSw29_RsyncTCLn	HSK1, HSK3, Diag2

HM618240	OSw29_RsynTCId	HSK1, HSK3, Diag2
HM619240	OSw29_RsynTCSid	HSK1, HSK3, Diag2
HM620240	OSw29_RsyncTCP1	HSK1, HSK3, Diag2
HM621240	OSw29_RsyncTCP2	HSK1, HSK3, Diag2
HM622240	OSw30_RsynDPUMo	HSK1, HSK3, Diag2
HM623240	OSw30_RsynREUMo	HSK1, HSK3, Diag2
HM624240	OSw30_Rsyn4KMo	HSK1, HSK3, Diag2
HM625240	OSw30_RsyncTCLn	HSK1, HSK3, Diag2
HM626240	OSw30_RsyncTCId	HSK1, HSK3, Diag2
HM627240	OSw30_RsynTCSid	HSK1, HSK3, Diag2
HM628240	OSw30_RsyncTCP1	HSK1, HSK3, Diag2
HM629240	OSw30_RsyncTCP2	HSK1, HSK3, Diag2
HM630240	OSw31_RsynDPUMo	HSK1, HSK3, Diag2
HM631240	OSw31_RsynREUMo	HSK1, HSK3, Diag2
HM632240	OSw31_Rsyn4KMo	HSK1, HSK3, Diag2
HM633240	OSw31_RsyncTCLn	HSK1, HSK3, Diag2
HM634240	OSw31_RsyncTCId	HSK1, HSK3, Diag2
HM635240	OSw31_RsynTCSid	HSK1, HSK3, Diag2
HM636240	OSw31_RsyncTCP1	HSK1, HSK3, Diag2
HM637240	OSw31_RsyncTCP2	HSK1, HSK3, Diag2
		HSK1, HSK3, Diag2

10.2.1.12 REU CONFIGURATION TELEMETRY

HM565280	REU Mode	HSK1, HSK3, Diag2
HM678280	Raw Signal Mode	HSK1, HSK3
HM676280	F Div (raw)	HSK1, HSK3
HM677280	N Sample (per half modulation period)	HSK1, HSK3
HD002280	REU modulation frequency (Hz)	HSK1, HSK3
HM574280	REU belts status (12bit) (4095 = all active)	HSK2, Diag2
HM996280	VI or Optim list	HSK2
HM994280	VI or Optim channel	HSK2
HM995280	VI or Optim belt	HSK2
HM577280	VI or Optim Keep current Gamp	HSK2
HM999280	VI or Optim Keep current T	HSK2
HM998280	VI or Optim Cv & Ct measurement	HSK2
HM997280	VI or Optim V&T optionnal tune	HSK2
HM590280	VI Imin	HSK2
HM591280	VI Imax	HSK2
HM589280	VI Continue On Failure	HSK2
HM592280	VI Scale (0=lin; 1=log)	HSK2
HM593280	VI Nb of steps between Imin and Imax	HSK2
HM594280	VI delay	HSK2
HM595280	VI or Optim Channel 00 to 15 selection	HSK2
HM596280	VI or Optim Channel 20 to 35 selection	HSK2
HM597280	VI or Optim Channel 40 to 55 selection	HSK2
HM598280	VI or Optim Channel 60 to 75 selection	HSK2
HM599280	VI or Optim Channel 80 to 95 selection	HSK2
HM600280	VI or Optim Channel A0 to B5 selection	HSK2
HM566280	REU Last Command Executed	HSK1, HSK3, Diag2
HM679280	REU RAW Signal Belt	HSK1, HSK3
HM680280	REU RAW Signal Channel	HSK1, HSK3
HM581280	VIO Gamp Init	HSK1, HSK3
HM582280	VIO T Init	HSK1, HSK3
HM963280	VIO Delta T	HSK1, HSK3
HM964280	VIO Delta V	HSK1, HSK3
HM586280	VIO Blanck V	HSK1, HSK3
HM965280	VIO Max T Iter	HSK1, HSK3
HM966280	VIO Max V Iter	HSK1, HSK3
HM967280	VIO Accur T	HSK1, HSK3
HM968280	VIO Accur V	HSK1, HSK3
HM970280	VIO P1	HSK1, HSK3
HM969280	VIO P2	HSK1, HSK3
HM977280	VI Step (1 to 127)	HSK1, HSK3
HM973280	VIO progression (1=in progress)	HSK1, HSK3
HM974280	VI0 Step (internal Optim step)	HSK1, HSK3
HM975280	VIO end (1=end optim)	HSK1, HSK3
HM580280	VIO Channel	HSK1, HSK3
HM978280	VIO Belt	HSK1, HSK3
HM583280	VIO Cv	HSK1, HSK3
HM584280	VIO Ct	HSK1, HSK3
HM971280	VI FinTun	HSK2
HM972280	VI TuneIt	HSK2
HM579280	VI TtuneCnt	HSK2
HM992280	REU Belts Resynchronization in progress (1 in progress)	HSK2, Diag2
HM993280	REU Belts Resynchronization in Failure (1 in failure)	HSK2, Diag2
HM674280	Cernox Channel	HSK2

HM302280	Belt 0 active if =1	HSK2 Diag2
HM304280	Belt 1 active if =1	HSK2 Diag2
HM308280	Belt 2 active if =1	HSK2 Diag2
HM310280	Belt 3 active if =1	HSK2 Diag2
HM314280	Belt 4 active if =1	HSK2 Diag2
HM316280	Belt 5 active if =1	HSK2 Diag2
HM320280	Belt 6 active if =1	HSK2 Diag2
HM322280	Belt 7 active if =1	HSK2 Diag2
HM326280	Belt 8 active if =1	HSK2 Diag2
HM328280	Belt 9 active if =1	HSK2 Diag2
HM332280	Belt A active if =1	HSK2 Diag2
HM334280	Belt B active if =1	HSK2 Diag2
HM979280	REU pre proc 0 status see HM571280	HSK2 Diag2
HM980280	REU pre proc 1 status see HM571280	HSK2 Diag2
HM981280	REU pre proc 2 status see HM571280	HSK2 Diag2
HM982280	REU pre proc 3 status see HM571280	HSK2 Diag2
HM983280	REU pre proc 4 status see HM571280	HSK2 Diag2
HM984280	REU pre proc 5 status see HM571280	HSK2 Diag2
HM985280	REU pre proc 6 status see HM571280	HSK2 Diag2
HM986280	REU pre proc 7 status see HM571280	HSK2 Diag2
HM987280	REU pre proc 8 status see HM571280	HSK2 Diag2
HM988280	REU pre proc 9 status see HM571280	HSK2 Diag2
HM989280	REU pre proc A status see HM571280	HSK2 Diag2
HM990280	REU pre proc B status see HM571280	HSK2 Diag2
HM991280	REU FIFO status (1 FIFO not empty)	HSK2 Diag2

VI0 Step (internal Optim step)

VI0 Step (internal Optim step)=	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Means :	Init.	Cv Meas.	V tune	Ct Meas.	T tune	V fine tune	VI	Param. restor.

WARNING: the information associated to the optimisation and VI are under-sampled at the HSK1 production frequency. If the VIO steps are faster than this frequency, partial optimisation / VI information will be transmited in the telemetry,.

10.2.1.13 REU CERNOX CONFIGURATION TELEMETRY

HM292280	Cernox Integration Duration (RAW)	HSK2
HM291280	Mode of the 12 Cernox (12 LSB	HSK2
HM921280	Cernox 0.1K Nom Mode	HSK2
HM922280	Cernox 1.6K Nom Mode	HSK2
HM923280	Cernox 4K Nom Mode	HSK2
HM924280	Cernox 4-1.6K Nom Mode	HSK2
HM925280	Cernox 18K Nom Mode	HSK2
HM926280	Cernox 50K Nom Mode	HSK2
HM927280	Cernox 0.1K Red Mode	HSK2
HM928280	Cernox 1.6K Red Mode	HSK2
HM929280	Cernox 0.1K Red Mode	HSK2
HM930280	Cernox 4-1.6K Red Mode	HSK2
HM931280	Cernox 18K red Mode	HSK2
HM932280	Cernox 50K Red Mode	HSK2
HM909280	Cernox 0.1K Nom Nblanck	HSK2
HM897280	Cernox 0.1K Nom Gamp	HSK2
HM294280	Cernox 0.1K Nom BiasCt (RAW)	HSK2
HM910280	Cernox 1.6K Nom Nblanck	HSK2
HM898280	Cernox 1.6K Nom Gamp	HSK2
HM300280	Cernox 1.6K Nom BiasCt (RAW)	HSK2
HM911280	Cernox 4K Nom Nblanck	HSK2
HM899280	Cernox 4K Nom Gamp	HSK2
HM306280	Cernox 4K Nom BiasCt (RAW)	HSK2
HM912280	Cernox 4-1.6K Nom Nblanck	HSK2
HM900280	Cernox 4-1.6K Nom Gamp	HSK2
HM312280	Cernox 4-1.6K Nom BiasCt (RAW)	HSK2

HM913280	Cernox 18K Nom Nblanck	HSK2
HM901280	Cernox 18K Nom Gamp	HSK2
HM318280	Cernox 18K Nom BiasCt (RAW)	HSK2
HM914280	Cernox 50K Nom Nblanck	HSK2
HM902280	Cernox 50K Nom Gamp	HSK2
HM324280	Cernox 50K Nom BiasCt (RAW)	HSK2
HM915280	Cernox 0.1K Red Nblanck	HSK2
HM903280	Cernox 0.1K Red Gamp	HSK2
HM330280	Cernox 0.1K Red BiasCt (RAW)	HSK2
HM916280	Cernox 1.6K Red Nblanck	HSK2
HM904280	Cernox 1.6K Red Gamp	HSK2
HM336280	Cernox 1.6K Red BiasCt (RAW)	HSK2
HM917280	Cernox 4K Red Nblanck	HSK2
HM905280	Cernox 4K Red Gamp	HSK2
HM342280	Cernox 4K Red BiasCt (RAW)	HSK2
HM918280	Cernox 4-1.6K Red Nblanck	HSK2
HM906280	Cernox 4-1.6K Red Gamp	HSK2
HM348280	Cernox 4-1.6K Red BiasCt (RAW)	HSK2
HM919280	Cernox 18K red Nblanck	HSK2
HM907280	Cernox 18K red Gamp	HSK2
HM354280	Cernox 18K red BiasCt (RAW)	HSK2
HM920280	Cernox 50K Red Nblanck	HSK2
HM908280	Cernox 50K Red Gamp	HSK2
HM360280	Cernox 50K Red BiasCt (RAW)	HSK2
HD516280	Cernox 0.1K Nom Nom Intensity (A)	HSK2
HD517280	Cernox 1.6K Nom Intensity (A)	HSK2
HD518280	Cernox 4K Nom Intensity (A)	HSK2
HD519280	Cernox 4-1.6K Nom Intensity (A)	HSK2
HD520280	Cernox 18K Nom Intensity (A)	HSK2
HD521280	Cernox 50K Nom Intensity (A)	HSK2
HD522280	Cernox 0.1K Red Nom Intensity (A)	HSK2
HD523280	Cernox 1.6K Red Intensity (A)	HSK2
HD524280	Cernox 4K Red Intensity (A)	HSK2
HD525280	Cernox 4-1.6K Red Intensity (A)	HSK2
HD526280	Cernox 18K Red Intensity (A)	HSK2
HD527280	Cernox 50K Red Intensity (A)	HSK2

10.2.1.14 REU JFET CONFIGURATION TELEMETRY

HM951280	JFET 0 Mode	HSK4
HM433280	JFET 0 IntTime	HSK4
HM434280	JFET 0 Setpoint	HSK4
HM435280	JFET 0 PropGain	HSK4
HM436280	JFET 0 IntGain	HSK4
HM437280	JFET 0 Exponent RAW	HSK4
HD106280	JFET0 Exponent ENG	HSK4
HM952280	JFET 1 Mode	HSK4
HM441280	JFET 1 IntTime	HSK4
HM442280	JFET 1 Setpoint	HSK4
HM443280	JFET 1 PropGain	HSK4
HM444280	JFET 1 IntGain	HSK4
HM445280	JFET 1 Exponent RAW	HSK4
HD107280	JFET 1 Exponent ENG	HSK4
HM953280	JFET 2 Mode	HSK5
HM449280	JFET 2 IntTime	HSK5
HM450280	JFET 2 Setpoint	HSK5
HM451280	JFET 2 PropGain	HSK5
HM452280	JFET 2 IntGain	HSK5
HM453280	JFET 2 Exponent RAW	HSK5
HD108280	JFET 2 Exponent ENG	HSK5
HM954280	JFET 3 Mode	HSK5
HM457280	JFET 3 IntTime	HSK5
HM458280	JFET 3 Setpoint	HSK5
HM459280	JFET 3 PropGain	HSK5
HM460280	JFET 3 IntGain	HSK5
HM461280	JFET 3 Exponent RAW	HSK5
HD109280	JFET 3 Exponent ENG	HSK5
HM955280	JFET 4 Mode	HSK6
HM465280	JFET 4 IntTime	HSK6
HM466280	JFET 4 Setpoint	HSK6
HM467280	JFET 4 PropGain	HSK6
HM468280	JFET 4 IntGain	HSK6
HM469280	JFET 4 Exponent RAW	HSK6
HD110280	JFET 4 Exponent ENG	HSK6
HM956280	JFET 5 Mode	HSK6
HM473280	JFET 5 IntTime	HSK6
HM474280	JFET 5 Setpoint	HSK6
HM475280	JFET 5 PropGain	HSK6
HM476280	JFET 5 IntGain	HSK6
HM477280	JFET 5 Exponent RAW	HSK6
HD111280	JFET 5 Exponent ENG	HSK6
HM957280	JFET 6 Mode	HSK7
HM481280	JFET 6 IntTime	HSK7
HM482280	JFET 6 Setpoint	HSK7
HM483280	JFET 6 PropGain	HSK7
HM484280	JFET 6 IntGain	HSK7
HM485280	JFET 6 Exponent RAW	HSK7
HD112280	JFET 6 Exponent ENG	HSK7

HM958280	JFET 7 Mode	HSK7
HM489280	JFET 7 IntTime	HSK7
HM490280	JFET 7 Setpoint	HSK7
HM491280	JFET 7 PropGain	HSK7
HM492280	JFET 7 IntGain	HSK7
HM493280	JFET 7 Exponent RAW	HSK7
HD113280	JFET 7 Exponent ENG	HSK7
HM959280	JFET 8 Mode	HSK8
HM497280	JFET 8 IntTime	HSK8
HM498280	JFET 8 Setpoint	HSK8
HM499280	JFET 8 PropGain	HSK8
HM500280	JFET 8 IntGain	HSK8
HM501280	JFET 8 Exponent RAW	HSK8
HD114280	JFET 8 Exponent ENG	HSK8
HM960280	JFET 9 Mode	HSK8
HM505280	JFET 9 IntTime	HSK8
HM506280	JFET 9 Setpoint	HSK8
HM507280	JFET 9 PropGain	HSK8
HM508280	JFET 9 IntGain	HSK8
HM509280	JFET 9 Exponent RAW	HSK8
HD115280	JFET 9 Exponent ENG	HSK8
HM961280	JFET A Mode	HSK9
HM513280	JFET A IntTime	HSK9
HM514280	JFET A Setpoint	HSK9
HM515280	JFET A PropGain	HSK9
HM516280	JFET A IntGain	HSK9
HM517280	JFET A Exponent RAW	HSK9
HD116280	JFET A Exponent ENG	HSK9
HM962280	JFET B Mode	HSK9
HM521280	JFET B IntTime	HSK9
HM522280	JFET B Setpoint	HSK9
HM523280	JFET B PropGain	HSK9
HM524280	JFET B IntGain	HSK9
HM525280	JFET B Exponent RAW	HSK9
HD117280	JFET B Exponent ENG	HSK9

10.2.1.15 REU PID CONFIGURATION TELEMETRY

HM933280	PID BOLO Mode (1=servo ON)	HSK4
HM939280	PID BOLO Heater conf (0=nom)	HSK4
HM945280	PID BOLO Thermo conf (0=nom)	HSK4
HM366280	PID BOLO IntTime	HSK4
HM367280	PID BOLO Setpoint	HSK4
HM368280	PID BOLO PropGain	HSK4
HM369280	PID BOLO IntGain	HSK4
HM370280	PID BOLO DerivGain	HSK4
HM375280	PID BOLO Exponent RAW	HSK4
HD100280	PID BOLO Exponent ENG	HSK4
HM934280	PID DILU Mode (1=servo ON)	HSK5
HM940280	PID DILU Heater conf (0=nom)	HSK5
HM946280	PID DILU Thermo Conf (0=nom)	HSK5
HM377280	PID DILU IntTime	HSK5
HM378280	PID DILU Setpoint	HSK5
HM379280	PID DILU PropGain	HSK5
HM380280	PID DILU IntGain	HSK5
HM381280	PID DILU DerivGain	HSK5
HM386280	PID DILU Exponent RAW	HSK5
HD101280	PID DILU Exponent ENG	HSK5
HM935280	PID 1.6K Mode(1=servo ON)	HSK6
HM941280	PID 1.6K Heater conf (0=nom)	HSK6
HM947280	PID 1.6K Thermo conf (0=nom)	HSK6
HM388280	PID 1.6K IntTime	HSK6
HM389280	PID 1.6K Setpoint	HSK6
HM390280	PID 1.6K PropGain	HSK6
HM391280	PID 1.6K IntGain	HSK6
HM392280	PID 1.6K DerivGain	HSK6
HM397280	PID 1.6K Exponent RAW	HSK6
HD102280	PID 1.6K Exponent ENG	HSK6
HM936280	PID 4K Mode(1=servo ON)	HSK7
HM942280	PID 4K Heater conf (0=nom)	HSK7
HM948280	PID 4K Thermo conf (0=nom)	HSK7
HM399280	PID 4K IntTime	HSK7
HM400280	PID 4K Setpoint	HSK7
HM401280	PID 4K PropGain	HSK7
HM402280	PID 4K IntGain	HSK7
HM403280	PID 4K DerivGain	HSK7
HM408280	PID 4K Exponent RAW	HSK7
HD103280	PID 4K Exponent ENG	HSK7
HM937280	PID Switch 4K/1.6K Mode (1=servo ON)	HSK8
HM943280	PID Switch 4K/1.6K Heater conf (0=nom)	HSK8
HM949280	PID Switch 4K/1.6K Thermo conf (0=nom)	HSK8
HM410280	PID Switch 4K/1.6K IntTime	HSK8
HM411280	PID Switch 4K/1.6K Setpoint	HSK8
HM412280	PID Switch 4K/1.6K PropGain	HSK8
HM413280	PID Switch 4K/1.6K IntGain	HSK8
HM414280	PID Switch 4K/1.6K DerivGain	HSK8
HM419280	PID Switch 4K/1.6K Exponent RAW	HSK8
HD104280	PID Switch 4K/1.6K Exponent ENG	HSK8

10.2.1.16 4K CONFIGURATION TELEMETRY

HM003260	4K Mode	HSK1, HSK3, Diag2
HM316260	4K Clock selection (0=Internal)	HSK1, HSK3
HM292260	4K Comp A Drive (0=enable)	HSK1, HSK3
HM291260	4K Comp B Drive (0=enable)	HSK1, HSK3
HM004260	4K VCS (1=ON, 0=OFF)	HSK1, HSK3
HM285260	Getter 1 (1=ON, 0=OFF)	HSK1, HSK3
HM284260	Getter 2 (1=ON, 0=OFF)	HSK1, HSK3
HM283260	4K Orifice heater (1=ON, 0=OFF)	HSK1, HSK3
HM290260	4K Drive Sync Signal (1=ON)	HSK1, HSK3
HM289260	4K PSU Sync Signal (1=ON)	HSK1, HSK3
HM288260	4K Flow Meter Sync Signal (1=ON)	HSK1, HSK3
HM287260	4K Up to Pressure Comp A (0= nominal running)	HSK1, HSK3
HM286260	4K Up to Pressure Comp B (0= nominal running)	HSK1, HSK3
HM282260	4K Auto Clock Switchover (1=ON)	HSK1, HSK3
HM280260	4K IRQ2 Interrupt (1=ON)	HSK1, HSK3
HM184260	4K SRT Status (1=finished)	HSK2
HM150260	4K Comand Seq Count	HSK2
HM149260	4K Comand Packet Type (=0x80+ID)	HSK2
HM152260	4K Processor IdleTime	HSK2
HM121260	Compressor selection (must be 3)	HSK2
HM120260	Compressor Amplitude Demand (micron)	HSK2
HM122260	Compressor Amplitude MAX (micron)	HSK2
HM124260	Getter selection (1,2,3)	HSK2
HM114260	4K Internal F180 period (RAW)	HSK2
HM115260	4K External F0 max (RAW)	HSK2
HM116260	4K External F0 min (RAW)	HSK2
HM117260	4K External F0 variation (RAW)	HSK2
HM118260	4K External F180 max (RAW)	HSK2
HM119260	4K External F180 min (RAW)	HSK2
HM123260	4K Force Harmonic selection (0 to 255)	HSK2
HM125260	4K Force transducer selection (0 to 15)	HSK2
HM310260	4K Warm/cold start (0=cold)	HSK1, HSK3
HM315260	Switch S1 position	HSK1, HSK3
HM314260	Switch S3 position	HSK1, HSK3
HM313260	Switch S4 position	HSK1, HSK3
HM312260	Switch S5 position	HSK1, HSK3
HM311260	Current TM buffer	HSK1, HSK3

HM333260	EEPROM (0 = no write in progress)	HSK1, HSK3
HM332260	LSL Tx (0 => not busy)	HSK1, HSK3
HM331260	Rx FIFO (0 => not empty)	HSK1, HSK3
HM330260	Rx FIFO (0 => less than half full)	HSK1, HSK3
HM329260	Rx FIFO (0 => not full)	HSK1, HSK3
HM328260	Tx FIFO (0 => not empty)	HSK1, HSK3
HM327260	Tx FIFO (0 => less than half full)	HSK1, HSK3
HM326260	Tx FIFO (0 => not full)	HSK1, HSK3
HM320260	EEPROM write (0=write enable)	HSK1, HSK3
HM319260	LSL Reset (1=Reset)	HSK1, HSK3
HM318260	LSL Tx Start (1=transmission)	HSK1, HSK3
HM009260	CI_CR : see (HM280260 to HM292260)	HSK1, HSK3
HM012260	CI_MR : see (HM310260 to HM316260)	HSK1, HSK3
HM013260	PS_CR : see (HM318260 to HM320260)	HSK1, HSK3
HM015260	PS_MR : see(HM326260 to HM333260)	HSK1, HSK3
HM126260	4K limit val for >0 Displ Comp A (micron)	HSK2
HM127260	4K limit val for <0 Displ Comp A (micron)	HSK2
HM128260	4K limit val for >0 Displ Comp B (micron)	HSK2
HM129260	4K limit val for <0 Displ Comp B (micron)	HSK2

HM130260	4K limit val 1 for Drive Intensity (A)	HSK2
HM131260	4K limit val 2 for Drive Intensity (A)	HSK2
HM132260	4K limit val 3 for Drive Intensity (A)	HSK2
HM133260	4K limit val 1 for Comp A Temperature (°C)	HSK2
HM134260	4K limit val 2 for Comp A Temperature (°C)	HSK2
HM135260	4K limit val 1 for Comp B Temperature (°C)	HSK2
HM136260	4K limit val 2 for Comp B Temperature (°C)	HSK2
HM137260	4K limit val for >0 Comp A Intensity (A)	HSK2
HM138260	4K limit val for <0 Comp A Intensity (A)	HSK2
HM139260	4K limit val for >0 Comp B Intensity (A)	HSK2
HM140260	4K limit val for <0 Comp B Intensity (A)	HSK2
HM220260	4K Limit Control Prog Amplitude Difference	HSK2
HM221260	4K Limit Control 2 Comp B Temperature	HSK2
HM222260	4K Limit Control 1 Comp B Temperature	HSK2
HM223260	4K Limit Control 2 Comp A Temperature	HSK2
HM224260	4K Limit Control 1 Comp A Temperature	HSK2
HM225260	4K Limit Control <0 Comp B Intensity	HSK2
HM226260	4K Limit Control >0 Comp A Intensity	HSK2
HM227260	4K Limit Control <0 Comp A Intensity	HSK2
HM228260	4K Limit Control >0 Comp B Intensity	HSK2
HM229260	4K Limit 3 Control drive bus Intensity	HSK2
HM230260	4K Limit 2 Control drive bus Intensity	HSK2
HM231260	4K Limit 1 Control drive bus Intensity	HSK2
HM232260	4K Limit Control <0 Comp B Displacement	HSK2
HM233260	4K Limit Control >0 Comp B Displacement	HSK2
HM234260	4K Limit Control <0 Comp A Displacement	HSK2
HM235260	4K Limit Control >0 Comp A Displacement	HSK2
HM236260	4K Limit Control Prog Displacement	HSK2
HM237260	4K Limit action Prog Amplitude Difference	HSK2
HM238260	4K Limit action 2 Comp B Temperature	HSK2
HM239260	4K Limit action 1 Comp B Temperature	HSK2
HM240260	4K Limit action 2 Comp A Temperature	HSK2
HM241260	4K Limit action 1 Comp A Temperature	HSK2
HM242260	4K Limit action <0 Comp B Intensity	HSK2
HM243260	4K Limit action >0 Comp A Intensity	HSK2
HM244260	4K Limit action <0 Comp A Intensity	HSK2
HM245260	4K Limit action >0 Comp B Intensity	HSK2
HM246260	4K Limit 3 action drive bus Intensity	HSK2
HM247260	4K Limit 2 action drive bus Intensity	HSK2
HM248260	4K Limit 1 action drive bus Intensity	HSK2
HM249260	4K Limit action <0 Comp B Displacement	HSK2
HM250260	4K Limit action >0 Comp B Displacement	HSK2
HM251260	4K Limit action <0 Comp A Displacement	HSK2
HM252260	4K Limit action >0 Comp A Displacement	HSK2
HM253260	4K Limit action Prog Displacement	HSK2

10.2.1.17 FOCAL PLANE CONFIGURATION TELEMETRY

HM003280	Channel 00 MPhase	HSK4
HM681280	Channel 00 NBlanck	HSK4
HM753280	Channel 00 SPhase	HSK4
HM825280	Channel 00 Gamp	HSK4
HM004280	Channel 00 BiasCt	HSK4
HM005280	Channel 00 BalVt	HSK4
HM006280	Channel 00 Trans	HSK4
HM007280	Channel 01 MPhase	HSK4
HM682280	Channel 01 NBlanck	HSK4
HM754280	Channel 01 SPhase	HSK4
HM826280	Channel 01 Gamp	HSK4
HM008280	Channel 01 BiasCt	HSK4
HM009280	Channel 01 BalVt	HSK4
HM010280	Channel 01 Trans	HSK4
HM011280	Channel 02 MPhase	HSK4
HM683280	Channel 02 NBlanck	HSK4
HM755280	Channel 02 SPhase	HSK4
HM827280	Channel 02 Gamp	HSK4
HM012280	Channel 02 BiasCt	HSK4
HM013280	Channel 02 BalVt	HSK4
HM014280	Channel 02 Trans	HSK4
HM015280	Channel 03 MPhase	HSK4
HM684280	Channel 03 NBlanck	HSK4
HM756280	Channel 03 SPhase	HSK4
HM828280	Channel 03 Gamp	HSK4
HM016280	Channel 03 BiasCt	HSK4
HM017280	Channel 03 BalVt	HSK4
HM018280	Channel 03 Trans	HSK4
HM019280	Channel 04 MPhase	HSK4
HM685280	Channel 04 NBlanck	HSK4
HM757280	Channel 04 SPhase	HSK4
HM829280	Channel 04 Gamp	HSK4
HM020280	Channel 04 BiasCt	HSK4
HM021280	Channel 04 BalVt	HSK4
HM022280	Channel 04 Trans	HSK4
HM023280	Channel 05 MPhase	HSK4
HM686280	Channel 05 NBlanck	HSK4
HM758280	Channel 05 SPhase	HSK4
HM830280	Channel 05 Gamp	HSK4
HM024280	Channel 05 BiasCt	HSK4
HM025280	Channel 05 BalVt	HSK4
HM026280	Channel 05 Trans	HSK4

HM027280	Channel 10 MPhase	HSK4
HM687280	Channel 10 NBlanck	HSK4
HM759280	Channel 10 SPhase	HSK4
HM831280	Channel 10 Gamp	HSK4
HM028280	Channel 10 BiasCt	HSK4
HM029280	Channel 10 BalVt	HSK4
HM030280	Channel 10 Trans	HSK4
HM031280	Channel 11 MPhase	HSK4
HM688280	Channel 11 NBlanck	HSK4
HM760280	Channel 11 SPhase	HSK4
HM832280	Channel 11 Gamp	HSK4
HM032280	Channel 11 BiasCt	HSK4
HM033280	Channel 11 BalVt	HSK4
HM034280	Channel 11 Trans	HSK4
HM035280	Channel 12 MPhase	HSK4
HM689280	Channel 12 NBlanck	HSK4
HM761280	Channel 12 SPhase	HSK4
HM833280	Channel 12 Gamp	HSK4
HM036280	Channel 12 BiasCt	HSK4
HM037280	Channel 12 BalVt	HSK4
HM038280	Channel 12 Trans	HSK4
HM039280	Channel 13 MPhase	HSK4
HM690280	Channel 13 NBlanck	HSK4
HM762280	Channel 13 SPhase	HSK4
HM834280	Channel 13 Gamp	HSK4
HM040280	Channel 13 BiasCt	HSK4
HM041280	Channel 13 BalVt	HSK4
HM042280	Channel 13 Trans	HSK4
HM043280	Channel 14 MPhase	HSK4
HM691280	Channel 14 NBlanck	HSK4
HM763280	Channel 14 SPhase	HSK4
HM835280	Channel 14 Gamp	HSK4
HM044280	Channel 14 BiasCt	HSK4
HM045280	Channel 14 BalVt	HSK4
HM046280	Channel 14 Trans	HSK4
HM047280	Channel 15 MPhase	HSK4
HM692280	Channel 15 NBlanck	HSK4
HM764280	Channel 15 SPhase	HSK4
HM836280	Channel 15 Gamp	HSK4
HM048280	Channel 15 BiasCt	HSK4
HM049280	Channel 15 BalVt	HSK4
HM050280	Channel 15 Trans	HSK4

HM051280	Channel 20 MPhase	HSK5
HM693280	Channel 20 NBlanck	HSK5
HM765280	Channel 20 SPhase	HSK5
HM837280	Channel 20 Gamp	HSK5
HM052280	Channel 20 BiasCt	HSK5
HM053280	Channel 20 BalVt	HSK5
HM054280	Channel 20 Trans	HSK5
HM055280	Channel 21 MPhase	HSK5
HM694280	Channel 21 NBlanck	HSK5
HM766280	Channel 21 SPhase	HSK5
HM838280	Channel 21 Gamp	HSK5
HM056280	Channel 21 BiasCt	HSK5
HM057280	Channel 21 BalVt	HSK5
HM058280	Channel 21 Trans	HSK5
HM059280	Channel 22 MPhase	HSK5
HM695280	Channel 22 NBlanck	HSK5
HM767280	Channel 22 SPhase	HSK5
HM839280	Channel 22 Gamp	HSK5
HM060280	Channel 22 BiasCt	HSK5
HM061280	Channel 22 BalVt	HSK5
HM062280	Channel 22 Trans	HSK5
HM063280	Channel 23 MPhase	HSK5
HM696280	Channel 23 NBlanck	HSK5
HM768280	Channel 23 SPhase	HSK5
HM840280	Channel 23 Gamp	HSK5
HM064280	Channel 23 BiasCt	HSK5
HM065280	Channel 23 BalVt	HSK5
HM066280	Channel 23 Trans	HSK5
HM067280	Channel 24 MPhase	HSK5
HM697280	Channel 24 NBlanck	HSK5
HM769280	Channel 24 SPhase	HSK5
HM841280	Channel 24 Gamp	HSK5
HM068280	Channel 24 BiasCt	HSK5
HM069280	Channel 24 BalVt	HSK5
HM070280	Channel 24 Trans	HSK5
HM071280	Channel 25 MPhase	HSK5
HM698280	Channel 25 NBlanck	HSK5
HM770280	Channel 25 SPhase	HSK5
HM842280	Channel 25 Gamp	HSK5
HM072280	Channel 25 BiasCt	HSK5
HM073280	Channel 25 BalVt	HSK5
HM074280	Channel 25 Trans	HSK5

HM075280	Channel 30 MPhase	HSK5
HM699280	Channel 30 NBlanck	HSK5
HM771280	Channel 30 SPhase	HSK5
HM843280	Channel 30 Gamp	HSK5
HM076280	Channel 30 BiasCt	HSK5
HM077280	Channel 30 BalVt	HSK5
HM078280	Channel 30 Trans	HSK5
HM079280	Channel 31 MPhase	HSK5
HM700280	Channel 31 NBlanck	HSK5
HM772280	Channel 31 SPhase	HSK5
HM844280	Channel 31 Gamp	HSK5
HM080280	Channel 31 BiasCt	HSK5
HM081280	Channel 31 BalVt	HSK5
HM082280	Channel 31 Trans	HSK5
HM083280	Channel 32 MPhase	HSK5
HM701280	Channel 32 NBlanck	HSK5
HM773280	Channel 32 SPhase	HSK5
HM845280	Channel 32 Gamp	HSK5
HM084280	Channel 32 BiasCt	HSK5
HM085280	Channel 32 BalVt	HSK5
HM086280	Channel 32 Trans	HSK5
HM087280	Channel 33 MPhase	HSK5
HM702280	Channel 33 NBlanck	HSK5
HM774280	Channel 33 SPhase	HSK5
HM846280	Channel 33 Gamp	HSK5
HM088280	Channel 33 BiasCt	HSK5
HM089280	Channel 33 BalVt	HSK5
HM090280	Channel 33 Trans	HSK5
HM091280	Channel 34 MPhase	HSK5
HM703280	Channel 34 NBlanck	HSK5
HM775280	Channel 34 SPhase	HSK5
HM847280	Channel 34 Gamp	HSK5
HM092280	Channel 34 BiasCt	HSK5
HM093280	Channel 34 BalVt	HSK5
HM094280	Channel 34 Trans	HSK5
HM095280	Channel 35 MPhase	HSK5
HM704280	Channel 35 NBlanck	HSK5
HM776280	Channel 35 SPhase	HSK5
HM848280	Channel 35 Gamp	HSK5
HM096280	Channel 35 BiasCt	HSK5
HM097280	Channel 35 BalVt	HSK5
HM098280	Channel 35 Trans	HSK5

HM099280	Channel 40 MPhase	HSK6
HM705280	Channel 40 NBlanck	HSK6
HM777280	Channel 40 SPhase	HSK6
HM849280	Channel 40 Gamp	HSK6
HM100280	Channel 40 BiasCt	HSK6
HM101280	Channel 40 BalVt	HSK6
HM102280	Channel 40 Trans	HSK6
HM103280	Channel 41 MPhase	HSK6
HM706280	Channel 41 NBlanck	HSK6
HM778280	Channel 41 SPhase	HSK6
HM850280	Channel 41 Gamp	HSK6
HM104280	Channel 41 BiasCt	HSK6
HM105280	Channel 41 BalVt	HSK6
HM106280	Channel 41 Trans	HSK6
HM107280	Channel 42 MPhase	HSK6
HM707280	Channel 42 NBlanck	HSK6
HM779280	Channel 42 SPhase	HSK6
HM851280	Channel 42 Gamp	HSK6
HM108280	Channel 42 BiasCt	HSK6
HM109280	Channel 42 BalVt	HSK6
HM110280	Channel 42 Trans	HSK6
HM111280	Channel 43 MPhase	HSK6
HM708280	Channel 43 NBlanck	HSK6
HM780280	Channel 43 SPhase	HSK6
HM852280	Channel 43 Gamp	HSK6
HM112280	Channel 43 BiasCt	HSK6
HM113280	Channel 43 BalVt	HSK6
HM114280	Channel 43 Trans	HSK6
HM115280	Channel 44 MPhase	HSK6
HM709280	Channel 44 NBlanck	HSK6
HM781280	Channel 44 SPhase	HSK6
HM853280	Channel 44 Gamp	HSK6
HM116280	Channel 44 BiasCt	HSK6
HM117280	Channel 44 BalVt	HSK6
HM118280	Channel 44 Trans	HSK6
HM119280	Channel 45 MPhase	HSK6
HM710280	Channel 45 NBlanck	HSK6
HM782280	Channel 45 SPhase	HSK6
HM854280	Channel 45 Gamp	HSK6
HM120280	Channel 45 BiasCt	HSK6
HM121280	Channel 45 BalVt	HSK6
HM122280	Channel 45 Trans	HSK6

HM123280	Channel 50 MPhase	HSK6
HM711280	Channel 50 NBlanck	HSK6
HM783280	Channel 50 SPhase	HSK6
HM855280	Channel 50 Gamp	HSK6
HM124280	Channel 50 BiasCt	HSK6
HM125280	Channel 50 BalVt	HSK6
HM126280	Channel 50 Trans	HSK6
HM127280	Channel 51 MPhase	HSK6
HM712280	Channel 51 NBlanck	HSK6
HM784280	Channel 51 SPhase	HSK6
HM856280	Channel 51 Gamp	HSK6
HM128280	Channel 51 BiasCt	HSK6
HM129280	Channel 51 BalVt	HSK6
HM130280	Channel 51 Trans	HSK6
HM131280	Channel 52 MPhase	HSK6
HM713280	Channel 52 NBlanck	HSK6
HM785280	Channel 52 SPhase	HSK6
HM857280	Channel 52 Gamp	HSK6
HM132280	Channel 52 BiasCt	HSK6
HM133280	Channel 52 BalVt	HSK6
HM134280	Channel 52 Trans	HSK6
HM135280	Channel 53 MPhase	HSK6
HM714280	Channel 53 NBlanck	HSK6
HM786280	Channel 53 SPhase	HSK6
HM858280	Channel 53 Gamp	HSK6
HM136280	Channel 53 BiasCt	HSK6
HM137280	Channel 53 BalVt	HSK6
HM138280	Channel 53 Trans	HSK6
HM139280	Channel 54 MPhase	HSK6
HM715280	Channel 54 NBlanck	HSK6
HM787280	Channel 54 SPhase	HSK6
HM859280	Channel 54 Gamp	HSK6
HM140280	Channel 54 BiasCt	HSK6
HM141280	Channel 54 BalVt	HSK6
HM142280	Channel 54 Trans	HSK6
HM143280	Channel 55 MPhase	HSK6
HM716280	Channel 55 NBlanck	HSK6
HM788280	Channel 55 SPhase	HSK6
HM860280	Channel 55 Gamp	HSK6
HM144280	Channel 55 BiasCt	HSK6
HM145280	Channel 55 BalVt	HSK6
HM146280	Channel 55 Trans	HSK6

HM147280	Channel 60 MPhase	HSK7
HM717280	Channel 60 NBlanck	HSK7
HM789280	Channel 60 SPhase	HSK7
HM861280	Channel 60 Gamp	HSK7
HM148280	Channel 60 BiasCt	HSK7
HM149280	Channel 60 BalVt	HSK7
HM150280	Channel 60 Trans	HSK7
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HM718280	Channel 61 NBlanck	HSK7
HM790280	Channel 61 SPhase	HSK7
HM862280	Channel 61 Gamp	HSK7
HM152280	Channel 61 BiasCt	HSK7
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HM791280	Channel 62 SPhase	HSK7
HM863280	Channel 62 Gamp	HSK7
HM156280	Channel 62 BiasCt	HSK7
HM157280	Channel 62 BalVt	HSK7
HM158280	Channel 62 Trans	HSK7
HM159280	Channel 63 MPhase	HSK7
HM720280	Channel 63 NBlanck	HSK7
HM792280	Channel 63 SPhase	HSK7
HM864280	Channel 63 Gamp	HSK7
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HM793280	Channel 64 SPhase	HSK7
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HM165280	Channel 64 BalVt	HSK7
HM166280	Channel 64 Trans	HSK7
HM167280	Channel 65 MPhase	HSK7
HM722280	Channel 65 NBlanck	HSK7
HM794280	Channel 65 SPhase	HSK7
HM866280	Channel 65 Gamp	HSK7
HM168280	Channel 65 BiasCt	HSK7
HM169280	Channel 65 BalVt	HSK7
HM170280	Channel 65 Trans	HSK7

HM171280	Channel 70 MPhase	HSK7
HM723280	Channel 70 NBlanck	HSK7
HM795280	Channel 70 SPhase	HSK7
HM867280	Channel 70 Gamp	HSK7
HM172280	Channel 70 BiasCt	HSK7
HM173280	Channel 70 BalVt	HSK7
HM174280	Channel 70 Trans	HSK7
HM175280	Channel 71 MPhase	HSK7
HM724280	Channel 71 NBlanck	HSK7
HM796280	Channel 71 SPhase	HSK7
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HM178280	Channel 71 Trans	HSK7
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HM725280	Channel 72 NBlanck	HSK7
HM797280	Channel 72 SPhase	HSK7
HM869280	Channel 72 Gamp	HSK7
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HM181280	Channel 72 BalVt	HSK7
HM182280	Channel 72 Trans	HSK7
HM183280	Channel 73 MPhase	HSK7
HM726280	Channel 73 NBlanck	HSK7
HM798280	Channel 73 SPhase	HSK7
HM870280	Channel 73 Gamp	HSK7
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HM185280	Channel 73 BalVt	HSK7
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HM187280	Channel 74 MPhase	HSK7
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HM799280	Channel 74 SPhase	HSK7
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HM190280	Channel 74 Trans	HSK7
HM191280	Channel 75 MPhase	HSK7
HM728280	Channel 75 NBlanck	HSK7
HM800280	Channel 75 SPhase	HSK7
HM872280	Channel 75 Gamp	HSK7
HM192280	Channel 75 BiasCt	HSK7
HM193280	Channel 75 BalVt	HSK7
HM194280	Channel 75 Trans	HSK7

HM195280	Channel 80 MPhase	HSK8
HM729280	Channel 80 NBlanck	HSK8
HM801280	Channel 80 SPhase	HSK8
HM873280	Channel 80 Gamp	HSK8
HM196280	Channel 80 BiasCt	HSK8
HM197280	Channel 80 BalVt	HSK8
HM198280	Channel 80 Trans	HSK8
HM199280	Channel 81 MPhase	HSK8
HM730280	Channel 81 NBlanck	HSK8
HM802280	Channel 81 SPhase	HSK8
HM874280	Channel 81 Gamp	HSK8
HM200280	Channel 81 BiasCt	HSK8
HM201280	Channel 81 BalVt	HSK8
HM202280	Channel 81 Trans	HSK8
HM203280	Channel 82 MPhase	HSK8
HM731280	Channel 82 NBlanck	HSK8
HM803280	Channel 82 SPhase	HSK8
HM875280	Channel 82 Gamp	HSK8
HM204280	Channel 82 BiasCt	HSK8
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HM207280	Channel 83 MPhase	HSK8
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HM804280	Channel 83 SPhase	HSK8
HM876280	Channel 83 Gamp	HSK8
HM208280	Channel 83 BiasCt	HSK8
HM209280	Channel 83 BalVt	HSK8
HM210280	Channel 83 Trans	HSK8
HM211280	Channel 84 MPhase	HSK8
HM733280	Channel 84 NBlanck	HSK8
HM805280	Channel 84 SPhase	HSK8
HM877280	Channel 84 Gamp	HSK8
HM212280	Channel 84 BiasCt	HSK8
HM213280	Channel 84 BalVt	HSK8
HM214280	Channel 84 Trans	HSK8
HM215280	Channel 85 MPhase	HSK8
HM734280	Channel 85 NBlanck	HSK8
HM806280	Channel 85 SPhase	HSK8
HM878280	Channel 85 Gamp	HSK8
HM216280	Channel 85 BiasCt	HSK8
HM217280	Channel 85 BalVt	HSK8
HM218280	Channel 85 Trans	HSK8

HM219280	Channel 90 MPhase	HSK8
HM735280	Channel 90 NBlanck	HSK8
HM807280	Channel 90 SPhase	HSK8
HM879280	Channel 90 Gamp	HSK8
HM220280	Channel 90 BiasCt	HSK8
HM221280	Channel 90 BalVt	HSK8
HM222280	Channel 90 Trans	HSK8
HM223280	Channel 91 MPhase	HSK8
HM736280	Channel 91 NBlanck	HSK8
HM808280	Channel 91 SPhase	HSK8
HM880280	Channel 91 Gamp	HSK8
HM224280	Channel 91 BiasCt	HSK8
HM225280	Channel 91 BalVt	HSK8
HM226280	Channel 91 Trans	HSK8
HM227280	Channel 92 MPhase	HSK8
HM737280	Channel 92 NBlanck	HSK8
HM809280	Channel 92 SPhase	HSK8
HM881280	Channel 92 Gamp	HSK8
HM228280	Channel 92 BiasCt	HSK8
HM229280	Channel 92 BalVt	HSK8
HM230280	Channel 92 Trans	HSK8
HM231280	Channel 93 MPhase	HSK8
HM738280	Channel 93 NBlanck	HSK8
HM810280	Channel 93 SPhase	HSK8
HM882280	Channel 93 Gamp	HSK8
HM232280	Channel 93 BiasCt	HSK8
HM233280	Channel 93 BalVt	HSK8
HM234280	Channel 93 Trans	HSK8
HM235280	Channel 94 MPhase	HSK8
HM739280	Channel 94 NBlanck	HSK8
HM811280	Channel 94 SPhase	HSK8
HM883280	Channel 94 Gamp	HSK8
HM236280	Channel 94 BiasCt	HSK8
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HM238280	Channel 94 Trans	HSK8
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HM812280	Channel 95 SPhase	HSK8
HM884280	Channel 95 Gamp	HSK8
HM240280	Channel 95 BiasCt	HSK8
HM241280	Channel 95 BalVt	HSK8
HM242280	Channel 95 Trans	HSK8

HM243280	Channel A0 MPhase	HSK9
HM741280	Channel A0 NBlanck	HSK9
HM813280	Channel A0 SPhase	HSK9
HM885280	Channel A0 Gamp	HSK9
HM244280	Channel A0 BiasCt	HSK9
HM245280	Channel A0 BalVt	HSK9
HM246280	Channel A0 Trans	HSK9
HM247280	Channel A1 MPhase	HSK9
HM742280	Channel A1 NBlanck	HSK9
HM814280	Channel A1 SPhase	HSK9
HM886280	Channel A1 Gamp	HSK9
HM248280	Channel A1 BiasCt	HSK9
HM249280	Channel A1 BalVt	HSK9
HM250280	Channel A1 Trans	HSK9
HM251280	Channel A2 MPhase	HSK9
HM743280	Channel A2 NBlanck	HSK9
HM815280	Channel A2 SPhase	HSK9
HM887280	Channel A2 Gamp	HSK9
HM252280	Channel A2 BiasCt	HSK9
HM253280	Channel A2 BalVt	HSK9
HM254280	Channel A2 Trans	HSK9
HM255280	Channel A3 MPhase	HSK9
HM744280	Channel A3 NBlanck	HSK9
HM816280	Channel A3 SPhase	HSK9
HM888280	Channel A3 Gamp	HSK9
HM256280	Channel A3 BiasCt	HSK9
HM257280	Channel A3 BalVt	HSK9
HM258280	Channel A3 Trans	HSK9
HM259280	Channel A4 MPhase	HSK9
HM745280	Channel A4 NBlanck	HSK9
HM817280	Channel A4 SPhase	HSK9
HM889280	Channel A4 Gamp	HSK9
HM260280	Channel A4 BiasCt	HSK9
HM261280	Channel A4 BalVt	HSK9
HM262280	Channel A4 Trans	HSK9
HM263280	Channel A5 MPhase	HSK9
HM746280	Channel A5 NBlanck	HSK9
HM818280	Channel A5 SPhase	HSK9
HM890280	Channel A5 Gamp	HSK9
HM264280	Channel A5 BiasCt	HSK9
HM265280	Channel A5 BalVt	HSK9
HM266280	Channel A5 Trans	HSK9

HM267280	Channel B0 MPhase	HSK9
HM747280	Channel B0 NBlanck	HSK9
HM819280	Channel B0 SPhase	HSK9
HM891280	Channel B0 Gamp	HSK9
HM268280	Channel B0 BiasCt	HSK9
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HM270280	Channel B0 Trans	HSK9
HM271280	Channel B1 MPhase	HSK9
HM748280	Channel B1 NBlanck	HSK9
HM820280	Channel B1 SPhase	HSK9
HM892280	Channel B1 Gamp	HSK9
HM272280	Channel B1 BiasCt	HSK9
HM273280	Channel B1 BalVt	HSK9
HM274280	Channel B1 Trans	HSK9
HM275280	Channel B2 MPhase	HSK9
HM749280	Channel B2 NBlanck	HSK9
HM821280	Channel B2 SPhase	HSK9
HM893280	Channel B2 Gamp	HSK9
HM276280	Channel B2 BiasCt	HSK9
HM277280	Channel B2 BalVt	HSK9
HM278280	Channel B2 Trans	HSK9
HM279280	Channel B3 MPhase	HSK9
HM750280	Channel B3 NBlanck	HSK9
HM822280	Channel B3 SPhase	HSK9
HM894280	Channel B3 Gamp	HSK9
HM280280	Channel B3 BiasCt	HSK9
HM281280	Channel B3 BalVt	HSK9
HM282280	Channel B3 Trans	HSK9
HM283280	Channel B4 MPhase	HSK9
HM751280	Channel B4 NBlanck	HSK9
HM823280	Channel B4 SPhase	HSK9
HM895280	Channel B4 Gamp	HSK9
HM284280	Channel B4 BiasCt	HSK9
HM285280	Channel B4 BalVt	HSK9
HM286280	Channel B4 Trans	HSK9
HM287280	Channel B5 MPhase	HSK9
HM752280	Channel B5 NBlanck	HSK9
HM824280	Channel B5 SPhase	HSK9
HM896280	Channel B5 Gamp	HSK9
HM288280	Channel B5 BiasCt	HSK9
HM289280	Channel B5 BalVt	HSK9
HM290280	Channel B5 Trans	HSK9

HM001240	Channel 00 Compr Under Sampl Div	HSK4
HM660240	Channel 00 Compr Sigma/Q	HSK4
HM073240	Channel 00 Compr Sigma	HSK4
HM002240	Channel 01 Compr Under Sampl Div	HSK4
HM661240	Channel 01 Compr Sigma/Q	HSK4
HM074240	Channel 01 Compr Sigma	HSK4
HM003240	Channel 02 Compr Under Sampl Div	HSK4
HM662240	Channel 02 Compr Sigma/Q	HSK4
HM075240	Channel 02 Compr Sigma	HSK4
HM004240	Channel 03 Compr Under Sampl Div	HSK4
HM663240	Channel 03 Compr Sigma/Q	HSK4
HM076240	Channel 03 Compr Sigma	HSK4
HM005240	Channel 04 Compr Under Sampl Div	HSK4
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HM006240	Channel 05 Compr Under Sampl Div	HSK4
HM665240	Channel 05 Compr Sigma/Q	HSK4
HM078240	Channel 05 Compr Sigma	HSK4
HM007240	Channel 10 Compr Under Sampl Div	HSK4
HM666240	Channel 10 Compr Sigma/Q	HSK4
HM079240	Channel 10 Compr Sigma	HSK4
HM008240	Channel 11 Compr Under Sampl Div	HSK4
HM667240	Channel 11 Compr Sigma/Q	HSK4
HM080240	Channel 11 Compr Sigma	HSK4
HM009240	Channel 12 Compr Under Sampl Div	HSK4
HM668240	Channel 12 Compr Sigma/Q	HSK4
HM081240	Channel 12 Compr Sigma	HSK4
HM010240	Channel 13 Compr Under Sampl Div	HSK4
HM669240	Channel 13 Compr Sigma/Q	HSK4
HM082240	Channel 13 Compr Sigma	HSK4
HM011240	Channel 14 Compr Under Sampl Div	HSK4
HM670240	Channel 14 Compr Sigma/Q	HSK4
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HM012240	Channel 15 Compr Under Sampl Div	HSK4
HM671240	Channel 15 Compr Sigma/Q	HSK4
HM084240	Channel 15 Compr Sigma	HSK4
HM013240	Channel 20 Compr Under Sampl Div	HSK5
HM672240	Channel 20 Compr Sigma/Q	HSK5
HM085240	Channel 20 Compr Sigma	HSK5
HM014240	Channel 21 Compr Under Sampl Div	HSK5
HM673240	Channel 21 Compr Sigma/Q	HSK5
HM086240	Channel 21 Compr Sigma	HSK5
HM015240	Channel 22 Compr Under Sampl Div	HSK5
HM674240	Channel 22 Compr Sigma/Q	HSK5
HM087240	Channel 22 Compr Sigma	HSK5
HM016240	Channel 23 Compr Under Sampl Div	HSK5
HM675240	Channel 23 Compr Sigma/Q	HSK5
HM088240	Channel 23 Compr Sigma	HSK5
HM017240	Channel 24 Compr Under Sampl Div	HSK5
HM676240	Channel 24 Compr Sigma/Q	HSK5
HM089240	Channel 24 Compr Sigma	HSK5
HM018240	Channel 25 Compr Under Sampl Div	HSK5
HM677240	Channel 25 Compr Sigma/Q	HSK5
HM090240	Channel 25 Compr Sigma	HSK5

HM019240	Channel 30 Compr Under Sampl Div	HSK5
HM678240	Channel 30 Compr Sigma/Q	HSK5
HM091240	Channel 30 Compr Sigma	HSK5
HM020240	Channel 31 Compr Under Sampl Div	HSK5
HM679240	Channel 31 Compr Sigma/Q	HSK5
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HM680240	Channel 32 Compr Sigma/Q	HSK5
HM093240	Channel 32 Compr Sigma	HSK5
HM022240	Channel 33 Compr Under Sampl Div	HSK5
HM681240	Channel 33 Compr Sigma/Q	HSK5
HM094240	Channel 33 Compr Sigma	HSK5
HM023240	Channel 34 Compr Under Sampl Div	HSK5
HM682240	Channel 34 Compr Sigma/Q	HSK5
HM095240	Channel 34 Compr Sigma	HSK5
HM024240	Channel 35 Compr Under Sampl Div	HSK5
HM683240	Channel 35 Compr Sigma/Q	HSK5
HM096240	Channel 35 Compr Sigma	HSK5
HM025240	Channel 40 Compr Under Sampl Div	HSK6
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HM026240	Channel 41 Compr Under Sampl Div	HSK6
HM685240	Channel 41 Compr Sigma/Q	HSK6
HM098240	Channel 41 Compr Sigma	HSK6
HM027240	Channel 42 Compr Under Sampl Div	HSK6
HM686240	Channel 42 Compr Sigma/Q	HSK6
HM099240	Channel 42 Compr Sigma	HSK6
HM028240	Channel 43 Compr Under Sampl Div	HSK6
HM687240	Channel 43 Compr Sigma/Q	HSK6
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HM029240	Channel 44 Compr Under Sampl Div	HSK6
HM688240	Channel 44 Compr Sigma/Q	HSK6
HM101240	Channel 44 Compr Sigma	HSK6
HM030240	Channel 45 Compr Under Sampl Div	HSK6
HM689240	Channel 45 Compr Sigma/Q	HSK6
HM102240	Channel 45 Compr Sigma	HSK6
HM031240	Channel 50 Compr Under Sampl Div	HSK6
HM690240	Channel 50 Compr Sigma/Q	HSK6
HM103240	Channel 50 Compr Sigma	HSK6
HM032240	Channel 51 Compr Under Sampl Div	HSK6
HM691240	Channel 51 Compr Sigma/Q	HSK6
HM104240	Channel 51 Compr Sigma	HSK6
HM033240	Channel 52 Compr Under Sampl Div	HSK6
HM692240	Channel 52 Compr Sigma/Q	HSK6
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HM694240	Channel 54 Compr Sigma/Q	HSK6
HM694240	Channel 54 Compr Sigma/Q	HSK6
HM107240	Channel 54 Compr Sigma	HSK6
HM036240	Channel 55 Compr Under Sampl Div	HSK6
HM695240	Channel 55 Compr Sigma/Q	HSK6
HM108240	Channel 55 Compr Sigma	HSK6

HM037240	Channel 60 Compr Under Sampl Div	HSK7
HM696240	Channel 60 Compr Sigma/Q	HSK7
HM109240	Channel 60 Compr Sigma	HSK7
HM038240	Channel 61 Compr Under Sampl Div	HSK7
HM697240	Channel 61 Compr Sigma/Q	HSK7
HM110240	Channel 61 Compr Sigma	HSK7
HM039240	Channel 62 Compr Under Sampl Div	HSK7
HM698240	Channel 62 Compr Sigma/Q	HSK7
HM111240	Channel 62 Compr Sigma	HSK7
HM040240	Channel 63 Compr Under Sampl Div	HSK7
HM699240	Channel 63 Compr Sigma/Q	HSK7
HM112240	Channel 63 Compr Sigma	HSK7
HM041240	Channel 64 Compr Under Sampl Div	HSK7
HM700240	Channel 64 Compr Sigma/Q	HSK7
HM113240	Channel 64 Compr Sigma	HSK7
HM042240	Channel 65 Compr Under Sampl Div	HSK7
HM701240	Channel 65 Compr Sigma/Q	HSK7
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HM043240	Channel 70 Compr Under Sampl Div	HSK7
HM702240	Channel 70 Compr Sigma/Q	HSK7
HM115240	Channel 70 Compr Sigma	HSK7
HM044240	Channel 71 Compr Under Sampl Div	HSK7
HM703240	Channel 71 Compr Sigma/Q	HSK7
HM116240	Channel 71 Compr Sigma	HSK7
HM045240	Channel 72 Compr Under Sampl Div	HSK7
HM704240	Channel 72 Compr Sigma/Q	HSK7
HM117240	Channel 72 Compr Sigma	HSK7
HM046240	Channel 73 Compr Under Sampl Div	HSK7
HM705240	Channel 73 Compr Sigma/Q	HSK7
HM118240	Channel 73 Compr Sigma	HSK7
HM047240	Channel 74 Compr Under Sampl Div	HSK7
HM706240	Channel 74 Compr Sigma/Q	HSK7
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HM124240	Channel 83 Compr Sigma	HSK8
HM053240	Channel 84 Compr Under Sampl Div	HSK8
HM712240	Channel 84 Compr Sigma/Q	HSK8
HM125240	Channel 84 Compr Sigma	HSK8
HM054240	Channel 85 Compr Under Sampl Div	HSK8
HM713240	Channel 85 Compr Sigma/Q	HSK8
HM126240	Channel 85 Compr Sigma	HSK8

HM055240	Channel 90 Compr Under Sampl Div	HSK8
HM714240	Channel 90 Compr Sigma/Q	HSK8
HM127240	Channel 90 Compr Sigma	HSK8
HM056240	Channel 91 Compr Under Sampl Div	HSK8
HM715240	Channel 91 Compr Sigma/Q	HSK8
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HM058240	Channel 93 Compr Under Sampl Div	HSK8
HM717240	Channel 93 Compr Sigma/Q	HSK8
HM130240	Channel 93 Compr Sigma	HSK8
HM059240	Channel 94 Compr Under Sampl Div	HSK8
HM718240	Channel 94 Compr Sigma/Q	HSK8
HM131240	Channel 94 Compr Sigma	HSK8
HM060240	Channel 95 Compr Under Sampl Div	HSK8
HM719240	Channel 95 Compr Sigma/Q	HSK8
HM132240	Channel 95 Compr Sigma	HSK8
HM061240	Channel A0 Compr Under Sampl Div	HSK9
HM720240	Channel A0 Compr Sigma/Q	HSK9
HM133240	Channel A0 Compr Sigma	HSK9
HM062240	Channel A1 Compr Under Sampl Div	HSK9
HM721240	Channel A1 Compr Sigma/Q	HSK9
HM134240	Channel A1 Compr Sigma	HSK9
HM063240	Channel A2 Compr Under Sampl Div	HSK9
HM722240	Channel A2 Compr Sigma/Q	HSK9
HM135240	Channel A2 Compr Sigma	HSK9
HM064240	Channel A3 Compr Under Sampl Div	HSK9
HM723240	Channel A3 Compr Sigma/Q	HSK9
HM136240	Channel A3 Compr Sigma	HSK9
HM065240	Channel A4 Compr Under Sampl Div	HSK9
HM724240	Channel A4 Compr Sigma/Q	HSK9
HM137240	Channel A4 Compr Sigma	HSK9
HM066240	Channel A5 Compr Under Sampl Div	HSK9
HM725240	Channel A5 Compr Sigma/Q	HSK9
HM138240	Channel A5 Compr Sigma	HSK9
HM067240	Channel B0 Compr Under Sampl Div	HSK9
HM726240	Channel B0 Compr Sigma/Q	HSK9
HM139240	Channel B0 Compr Sigma	HSK9
HM068240	Channel B1 Compr Under Sampl Div	HSK9
HM727240	Channel B1 Compr Sigma/Q	HSK9
HM140240	Channel B1 Compr Sigma	HSK9
HM069240	Channel B2 Compr Under Sampl Div	HSK9
HM728240	Channel B2 Compr Sigma/Q	HSK9
HM141240	Channel B2 Compr Sigma	HSK9
HM070240	Channel B3 Compr Under Sampl Div	HSK9
HM729240	Channel B3 Compr Sigma/Q	HSK9
HM142240	Channel B3 Compr Sigma	HSK9
HM071240	Channel B4 Compr Under Sampl Div	HSK9
HM730240	Channel B4 Compr Sigma/Q	HSK9
HM143240	Channel B4 Compr Sigma	HSK9
HM072240	Channel B5 Compr Under Sampl Div	HSK9
HM731240	Channel B5 Compr Sigma/Q	HSK9
HM144240	Channel B5 Compr Sigma	HSK9

10.2.1.18 DPU ERROR FLAG TELEMETRY

An error is raised when the telemetry is set to 1.

HM736240	HW: OBC Lost (No clock coming from S/C)	HSK1, HSK3, Diag2
HM740240	HW: ADC Latchup	HSK1, HSK3, Diag2
HM741240	HW: Program RAM Parity Error	HSK1, HSK3, Diag2
HM742240	HW: Data RAM Parity Error	HSK1, HSK3, Diag2
HM747240	HW: TFLError (Not slot available to send TM packet)	HSK1, HSK3, Diag2
HM732240	HW: HSL State Machine 0 Error	HSK1, HSK3, Diag2
HM733240	HW: HSL State Machine 1 Error	HSK1, HSK3, Diag2
HM734240	HW: LSL State Machine 0 Error	HSK1, HSK3, Diag2
HM735240	HW: LSL State Machine 1 Error	HSK1, HSK3, Diag2
HM753240	HSL: TimeOut (No HSL packet received before expected time)	HSK1, HSK3, Diag2
HM749240	HSL: Bad Start Header	HSK1, HSK3, Diag2
HM758240	HSL: Bad Format	HSK1, HSK3, Diag2
HM756240	HSL: Bad DDL (No answer for DataDownLoad request)	HSK1, HSK3, Diag2
HM754240	HSL: Bad CRC	HSK1, HSK3, Diag2
HM755240	HSL: Bad Data Packet (Type of Data Packet unknown)	HSK1, HSK3, Diag2
HM751240	HSL: Bad Data Packet Length	HSK1, HSK3, Diag2
HM752240	HSL: Bad Data Packet Trailer	HSK1, HSK3, Diag2
HM763240	HSL: Glued Data Packet (more than one packet is present when reading FIFO)	HSK1, HSK3, Diag2
HM750240	HSL: BufferSize (Length read bigger than max buffer size)	HSK1, HSK3, Diag2
HM748240	HSL: Parity Error	HSK1, HSK3, Diag2
HM762240	HSL: Science Sequence Counter break	HSK1, HSK3, Diag2
HM759240	HSL: Command sent to REU has not been sucessfully executed	HSK1, HSK3, Diag2
HM761240	HSL: Modulation frequency lost	HSK1, HSK3, Diag2
HM757240	HSL: Invalid Start Compression (Pulse does not arrived at the right number of packet)	HSK1, HSK3, Diag2
HM760240	HSL: Start Compression Lost (pulse never arrived)	HSK1, HSK3, Diag2
HM765240	LSL: Bad Start Header	HSK1, HSK3, Diag2
HM767240	LSL: Bad Data Packet Length	HSK1, HSK3, Diag2
HM770240	LSL: Bad CRC	HSK1, HSK3, Diag2
HM779240	LSL: Glued Data Packet (more than one packet is present when reading FIFO)	HSK1, HSK3, Diag2
HM766240	LSL: Buffer Size error	HSK1, HSK3, Diag2
HM764240	LSL: Parity error	HSK1, HSK3, Diag2
HM769240	LSL: 4KCDE TimeOut (No 4K packet received before expected time)	HSK1, HSK3, Diag2
HM775240	LSL: 4KCDE no answer for Data DownLoad request	HSK1, HSK3, Diag2
HM772240	LSL: 4KCDE Bad Data Packet (ID)	HSK1, HSK3, Diag2
HM773240	LSL: 4KCDE type of Data Packet unknown	HSK1, HSK3, Diag2
HM776240	LSL: 4KCDE Command error (not executed)	HSK1, HSK3, Diag2
HM768240	LSL: DCE TimeOut (No DCE packet received before expected time)	HSK1, HSK3, Diag2
HM774240	LSL: DCE no answer for Data DownLoad request	HSK1, HSK3, Diag2
HM777240	LSL: DCE Command error (not executed)	HSK1, HSK3, Diag2
HM771240	LSL: DCE type of Data Packet unknown	HSK1, HSK3, Diag2

HM780240	SW: HK or Event Packet Buffer Full (HSK data lost)	HSK1, HSK3, Diag2
HM781240	SW: Science Buffer Packet Full (Science data lost)	HSK1, HSK3, Diag2
HM782240	SW: Real Time Overflow	HSK1, HSK3, Diag2
HM783240	SW: Compression Slice Not Finish before next science page	HSK1, HSK3, Diag2
HM784240	SW: Not resynchronisation command found	HSK1, HSK3, Diag2
HM785240	SW: DPU has automatically resynchrnoised itself	HSK1, HSK3, Diag2
HM786240	SW: Not enough TC to resynchronise subystem	HSK1, HSK3, Diag2
HM787240	SW: TC sent to 4KCDE/REU for resynchronisation	HSK1, HSK3, Diag2
HM788240	SW: Previous TC has not been acknowledged by 4KCDE	HSK1, HSK3, Diag2
HM789240	SW: Previous TC has not been acknowledged by DCE	HSK1, HSK3, Diag2
HM790240	SW: Previous TC has not been acknowledged by REU	HSK1, HSK3, Diag2
HM791240	SW: Bad Raw Filters read in EEPROM	HSK1, HSK3, Diag2
HM792240	SW: Bad OBSW parameters read in EEPROM	HSK1, HSK3, Diag2
HM793240	SW: Bad science parameters read in EEPROM (compression, ..)	HSK1, HSK3, Diag2
HM794240	SW: Error when reading Resync table in EEPROM	HSK1, HSK3, Diag2
HM795240	SW: Bad parameter read in EEPROM; Default param value taken	HSK1, HSK3, Diag2

HM019250	MMT000_DEEPROM checksum result (0=OK)	Diag1
HM020250	MMT001_DEEPROM checksum result (0=OK)	Diag1
HM021250	MMT002_DEEPROM checksum result (0=OK)	Diag1
HM022250	MMT003_DEEPROM checksum result (0=OK)	Diag1
HM023250	MMT004_DEEPROM checksum result (0=OK)	Diag1
HM024250	MMT005_DEEPROM checksum result (0=OK)	Diag1
HM025250	MMT006_DEEPROM checksum result (0=OK)	Diag1
HM026250	MMT007_DEEPROM checksum result (0=OK)	Diag1
HM027250	MMT008_DEEPROM checksum result (0=OK)	Diag1
HM028250	MMT009_DEEPROM checksum result (0=OK)	Diag1
HM029250	MMT010_DEEPROM checksum result (0=OK)	Diag1
HM030250	MMT011_DEEPROM checksum result (0=OK)	Diag1
HM031250	MMT012_DEEPROM checksum result (0=OK)	Diag1
HM032250	MMT013_DEEPROM checksum result (0=OK)	Diag1
HM033250	MMT014_DEEPROM checksum result (0=OK)	Diag1
HM034250	MMT015_DEEPROM checksum result (0=OK)	Diag1
HM035250	MMT016_DEEPROM checksum result (0=OK)	Diag1
HM036250	MMT017_DEEPROM checksum result (0=OK)	Diag1
HM037250	MMT018_DEEPROM checksum result (0=OK)	Diag1
HM038250	MMT019_DEEPROM checksum result (0=OK)	Diag1
HM039250	MMT020_DEEPROM checksum result (0=OK)	Diag1
HM040250	MMT021_DEEPROM checksum result (0=OK)	Diag1
HM041250	MMT022_DEEPROM checksum result (0=OK)	Diag1
HM042250	MMT023_DEEPROM checksum result (0=OK)	Diag1
HM043250	MMT024_DEEPROM checksum result (0=OK)	Diag1
HM044250	MMT025_DEEPROM checksum result (0=OK)	Diag1
HM045250	MMT026_DEEPROM checksum result (0=OK)	Diag1
HM046250	MMT027_DEEPROM checksum result (0=OK)	Diag1
HM047250	MMT028_DEEPROM checksum result (0=OK)	Diag1
HM048250	MMT029_DEEPROM checksum result (0=OK)	Diag1
HM049250	MMT030_DEEPROM checksum result (0=OK)	Diag1
HM050250	MMT031_DEEPROM checksum result (0=OK)	Diag1
HM051250	MMT032_DEEPROM checksum result (0=OK)	Diag1
HM052250	MMT033_DEEPROM checksum result (0=OK)	Diag1
HM053250	MMT034_DEEPROM checksum result (0=OK)	Diag1
HM054250	MMT035_DEEPROM checksum result (0=OK)	Diag1
HM055250	MMT036_DEEPROM checksum result (0=OK)	Diag1
HM056250	MMT037_DEEPROM checksum result (0=OK)	Diag1
HM057250	MMT038_DEEPROM checksum result (0=OK)	Diag1
HM058250	MMT039_DEEPROM checksum result (0=OK)	Diag1
HM059250	MMT040_DEEPROM checksum result (0=OK)	Diag1
HM060250	MMT041_DEEPROM checksum result (0=OK)	Diag1
HM061250	MMT042_DEEPROM checksum result (0=OK)	Diag1
HM062250	MMT043_DEEPROM checksum result (0=OK)	Diag1
HM063250	MMT044_DEEPROM checksum result (0=OK)	Diag1
HM064250	MMT045_DEEPROM checksum result (0=OK)	Diag1
HM065250	MMT046_DEEPROM checksum result (0=OK)	Diag1
HM066250	MMT047_DEEPROM checksum result (0=OK)	Diag1
HM067250	MMT048_DEEPROM checksum result (0=OK)	Diag1
HM068250	MMT049_DEEPROM checksum result (0=OK)	Diag1
HM069250	MMT050_DEEPROM checksum result (0=OK)	Diag1
HM070250	MMT051_DEEPROM checksum result (0=OK)	Diag1
HM071250	MMT052_DEEPROM checksum result (0=OK)	Diag1
HM072250	MMT053_DEEPROM checksum result (0=OK)	Diag1
HM073250	MMT054_DEEPROM checksum result (0=OK)	Diag1
HM074250	MMT055_DEEPROM checksum result (0=OK)	Diag1
HM075250	MMT056_DEEPROM checksum result (0=OK)	Diag1
HM076250	MMT057_DEEPROM checksum result (0=OK)	Diag1

HM077250	MMT058_DEEPROM checksum result (0=OK)	Diag1
HM078250	MMT059_DEEPROM checksum result (0=OK)	Diag1
HM079250	MMT060_DEEPROM checksum result (0=OK)	Diag1
HM080250	MMT061_DEEPROM checksum result (0=OK)	Diag1
HM081250	MMT062_DEEPROM checksum result (0=OK)	Diag1
HM082250	MMT063_DEEPROM checksum result (0=OK)	Diag1
HM083250	MMT064_DEEPROM checksum result (0=OK)	Diag1
HM084250	MMT065_DEEPROM checksum result (0=OK)	Diag1
HM085250	MMT066_DEEPROM checksum result (0=OK)	Diag1
HM086250	MMT067_DEEPROM checksum result (0=OK)	Diag1
HM087250	MMT068_DEEPROM checksum result (0=OK)	Diag1
HM088250	MMT069_DEEPROM checksum result (0=OK)	Diag1
HM089250	MMT070_DEEPROM checksum result (0=OK)	Diag1
HM090250	MMT071_DEEPROM checksum result (0=OK)	Diag1
HM091250	MMT072_DEEPROM checksum result (0=OK)	Diag1
HM092250	MMT073_DEEPROM checksum result (0=OK)	Diag1
HM093250	MMT074_DEEPROM checksum result (0=OK)	Diag1
HM094250	MMT075_DEEPROM checksum result (0=OK)	Diag1
HM095250	MMT076_DEEPROM checksum result (0=OK)	Diag1
HM096250	MMT077_DEEPROM checksum result (0=OK)	Diag1
HM097250	MMT078_DEEPROM checksum result (0=OK)	Diag1
HM098250	MMT079_DEEPROM checksum result (0=OK)	Diag1
HM099250	MMT080_DEEPROM checksum result (0=OK)	Diag1
HM100250	MMT081_DEEPROM checksum result (0=OK)	Diag1
HM101250	MMT082_DEEPROM checksum result (0=OK)	Diag1
HM102250	MMT083_DEEPROM checksum result (0=OK)	Diag1
HM103250	MMT084_DEEPROM checksum result (0=OK)	Diag1
HM104250	MMT085_DEEPROM checksum result (0=OK)	Diag1
HM105250	MMT086_DEEPROM checksum result (0=OK)	Diag1
HM106250	MMT087_DEEPROM checksum result (0=OK)	Diag1
HM107250	MMT088_DEEPROM checksum result (0=OK)	Diag1
HM108250	MMT089_DEEPROM checksum result (0=OK)	Diag1
HM109250	MMT090_DEEPROM checksum result (0=OK)	Diag1
HM110250	MMT091_DEEPROM checksum result (0=OK)	Diag1
HM111250	MMT092_DEEPROM checksum result (0=OK)	Diag1
HM112250	MMT093_DEEPROM checksum result (0=OK)	Diag1
HM113250	MMT094_DEEPROM checksum result (0=OK)	Diag1
HM114250	MMT095_DEEPROM checksum result (0=OK)	Diag1
HM115250	MMT096_DEEPROM checksum result (0=OK)	Diag1
HM116250	MMT097_DEEPROM checksum result (0=OK)	Diag1
HM117250	MMT098_DEEPROM checksum result (0=OK)	Diag1
HM118250	MMT099_DEEPROM checksum result (0=OK)	Diag1
HM119250	MMT100_DEEPROM checksum result (0=OK)	Diag1
HM120250	MMT101_DEEPROM checksum result (0=OK)	Diag1
HM121250	MMT102_DEEPROM checksum result (0=OK)	Diag1
HM122250	MMT103_DEEPROM checksum result (0=OK)	Diag1
HM123250	MMT104_DEEPROM checksum result (0=OK)	Diag1
HM124250	MMT105_DEEPROM checksum result (0=OK)	Diag1
HM125250	MMT106_DEEPROM checksum result (0=OK)	Diag1
HM126250	MMT107_DEEPROM checksum result (0=OK)	Diag1
HM127250	MMT108_DEEPROM checksum result (0=OK)	Diag1
HM128250	MMT109_DEEPROM checksum result (0=OK)	Diag1
HM129250	MMT110_DEEPROM checksum result (0=OK)	Diag1
HM130250	MMT111_DEEPROM checksum result (0=OK)	Diag1
HM131250	MMT112_DEEPROM checksum result (0=OK)	Diag1
HM132250	MMT113_DEEPROM checksum result (0=OK)	Diag1
HM133250	MMT114_DEEPROM checksum result (0=OK)	Diag1
HM134250	MMT115_DEEPROM checksum result (0=OK)	Diag1
HM135250	MMT116_DEEPROM checksum result (0=OK)	Diag1

HM136250	MMT117_DEEPROM checksum result (0=OK)	Diag1
HM137250	MMT118_DEEPROM checksum result (0=OK)	Diag1
HM138250	MMT119_DEEPROM checksum result (0=OK)	Diag1
HM139250	MMT120_DEEPROM checksum result (0=OK)	Diag1
HM140250	MMT121_DEEPROM checksum result (0=OK)	Diag1
HM141250	MMT122_DEEPROM checksum result (0=OK)	Diag1
HM142250	MMT123_DEEPROM checksum result (0=OK)	Diag1
HM143250	MMT124_DEEPROM checksum result (0=OK)	Diag1
HM144250	MMT125_DEEPROM checksum result (0=OK)	Diag1
HM145250	MMT126_DEEPROM checksum result (0=OK)	Diag1
HM146250	MMT127_DEEPROM checksum result (0=OK)	Diag1
HM147250	MMT000_PSRAM checksum result (0=OK)	Diag1
HM148250	MMT001_PSRAM checksum result (0=OK)	Diag1
HM149250	MMT002_PSRAM checksum result (0=OK)	Diag1
HM150250	MMT003_PSRAM checksum result (0=OK)	Diag1
HM151250	MMT004_PSRAM checksum result (0=OK)	Diag1
HM152250	MMT005_PSRAM checksum result (0=OK)	Diag1
HM153250	MMT006_PSRAM checksum result (0=OK)	Diag1
HM154250	MMT007_PSRAM checksum result (0=OK)	Diag1
HM155250	MMT008_PSRAM checksum result (0=OK)	Diag1
HM156250	MMT009_PSRAM checksum result (0=OK)	Diag1
HM157250	MMT010_PSRAM checksum result (0=OK)	Diag1
HM158250	MMT011_PSRAM checksum result (0=OK)	Diag1
HM159250	MMT012_PSRAM checksum result (0=OK)	Diag1
HM160250	MMT013_PSRAM checksum result (0=OK)	Diag1
HM161250	MMT014_PSRAM checksum result (0=OK)	Diag1
HM162250	MMT015_PSRAM checksum result (0=OK)	Diag1
HM163250	MMT016_PSRAM checksum result (0=OK)	Diag1
HM164250	MMT017_PSRAM checksum result (0=OK)	Diag1
HM165250	MMT018_PSRAM checksum result (0=OK)	Diag1
HM166250	MMT019_PSRAM checksum result (0=OK)	Diag1
HM167250	MMT020_PSRAM checksum result (0=OK)	Diag1
HM168250	MMT021_PSRAM checksum result (0=OK)	Diag1
HM169250	MMT022_PSRAM checksum result (0=OK)	Diag1
HM170250	MMT023_PSRAM checksum result (0=OK)	Diag1
HM171250	MMT024_PSRAM checksum result (0=OK)	Diag1
HM172250	MMT025_PSRAM checksum result (0=OK)	Diag1
HM173250	MMT026_PSRAM checksum result (0=OK)	Diag1
HM174250	MMT027_PSRAM checksum result (0=OK)	Diag1
HM175250	MMT028_PSRAM checksum result (0=OK)	Diag1
HM176250	MMT029_PSRAM checksum result (0=OK)	Diag1
HM177250	MMT030_PSRAM checksum result (0=OK)	Diag1
HM178250	MMT031_PSRAM checksum result (0=OK)	Diag1
HM179250	MMT032_PSRAM checksum result (0=OK)	Diag1
HM180250	MMT033_PSRAM checksum result (0=OK)	Diag1
HM181250	MMT034_PSRAM checksum result (0=OK)	Diag1
HM182250	MMT035_PSRAM checksum result (0=OK)	Diag1
HM183250	MMT036_PSRAM checksum result (0=OK)	Diag1
HM184250	MMT037_PSRAM checksum result (0=OK)	Diag1
HM185250	MMT038_PSRAM checksum result (0=OK)	Diag1
HM186250	MMT039_PSRAM checksum result (0=OK)	Diag1
HM187250	MMT040_PSRAM checksum result (0=OK)	Diag1
HM188250	MMT041_PSRAM checksum result (0=OK)	Diag1
HM189250	MMT042_PSRAM checksum result (0=OK)	Diag1
HM190250	MMT043_PSRAM checksum result (0=OK)	Diag1
HM191250	MMT044_PSRAM checksum result (0=OK)	Diag1
HM192250	MMT045_PSRAM checksum result (0=OK)	Diag1
HM193250	MMT046_PSRAM checksum result (0=OK)	Diag1
HM194250	MMT047_PSRAM checksum result (0=OK)	Diag1

HM195250	MMT048_PSRAM checksum result (0=OK)	Diag1
HM196250	MMT049_PSRAM checksum result (0=OK)	Diag1
HM197250	MMT050_PSRAM checksum result (0=OK)	Diag1
HM198250	MMT051_PSRAM checksum result (0=OK)	Diag1
HM199250	MMT052_PSRAM checksum result (0=OK)	Diag1
HM200250	MMT053_PSRAM checksum result (0=OK)	Diag1
HM201250	MMT054_PSRAM checksum result (0=OK)	Diag1
HM202250	MMT055_PSRAM checksum result (0=OK)	Diag1
HM203250	MMT056_PSRAM checksum result (0=OK)	Diag1
HM204250	MMT057_PSRAM checksum result (0=OK)	Diag1
HM205250	MMT058_PSRAM checksum result (0=OK)	Diag1
HM206250	MMT059_PSRAM checksum result (0=OK)	Diag1
HM207250	MMT060_PSRAM checksum result (0=OK)	Diag1
HM208250	MMT061_PSRAM checksum result (0=OK)	Diag1
HM209250	MMT062_PSRAM checksum result (0=OK)	Diag1
HM210250	MMT063_PSRAM checksum result (0=OK)	Diag1
HM211250	MMT064_PSRAM checksum result (0=OK)	Diag1
HM212250	MMT065_PSRAM checksum result (0=OK)	Diag1
HM213250	MMT066_PSRAM checksum result (0=OK)	Diag1
HM214250	MMT067_PSRAM checksum result (0=OK)	Diag1
HM215250	MMT068_PSRAM checksum result (0=OK)	Diag1
HM216250	MMT069_PSRAM checksum result (0=OK)	Diag1
HM217250	MMT070_PSRAM checksum result (0=OK)	Diag1
HM218250	MMT071_PSRAM checksum result (0=OK)	Diag1
HM219250	MMT072_PSRAM checksum result (0=OK)	Diag1
HM220250	MMT073_PSRAM checksum result (0=OK)	Diag1
HM221250	MMT074_PSRAM checksum result (0=OK)	Diag1
HM222250	MMT075_PSRAM checksum result (0=OK)	Diag1
HM223250	MMT076_PSRAM checksum result (0=OK)	Diag1
HM224250	MMT077_PSRAM checksum result (0=OK)	Diag1
HM225250	MMT078_PSRAM checksum result (0=OK)	Diag1
HM226250	MMT079_PSRAM checksum result (0=OK)	Diag1
HM227250	MMT080_PSRAM checksum result (0=OK)	Diag1
HM228250	MMT081_PSRAM checksum result (0=OK)	Diag1
HM229250	MMT082_PSRAM checksum result (0=OK)	Diag1
HM230250	MMT083_PSRAM checksum result (0=OK)	Diag1
HM231250	MMT084_PSRAM checksum result (0=OK)	Diag1
HM232250	MMT085_PSRAM checksum result (0=OK)	Diag1
HM233250	MMT086_PSRAM checksum result (0=OK)	Diag1
HM234250	MMT087_PSRAM checksum result (0=OK)	Diag1
HM235250	MMT088_PSRAM checksum result (0=OK)	Diag1
HM236250	MMT089_PSRAM checksum result (0=OK)	Diag1
HM237250	MMT090_PSRAM checksum result (0=OK)	Diag1
HM238250	MMT091_PSRAM checksum result (0=OK)	Diag1
HM239250	MMT092_PSRAM checksum result (0=OK)	Diag1
HM240250	MMT093_PSRAM checksum result (0=OK)	Diag1
HM241250	MMT094_PSRAM checksum result (0=OK)	Diag1
HM242250	MMT095_PSRAM checksum result (0=OK)	Diag1
HM243250	MMT096_PSRAM checksum result (0=OK)	Diag1
HM244250	MMT097_PSRAM checksum result (0=OK)	Diag1
HM245250	MMT098_PSRAM checksum result (0=OK)	Diag1
HM246250	MMT099_PSRAM checksum result (0=OK)	Diag1
HM247250	MMT100_PSRAM checksum result (0=OK)	Diag1
HM248250	MMT101_PSRAM checksum result (0=OK)	Diag1
HM249250	MMT102_PSRAM checksum result (0=OK)	Diag1
HM250250	MMT103_PSRAM checksum result (0=OK)	Diag1
HM251250	MMT104_PSRAM checksum result (0=OK)	Diag1
HM252250	MMT105_PSRAM checksum result (0=OK)	Diag1
HM253250	MMT106_PSRAM checksum result (0=OK)	Diag1

HM254250	MMT107_PSRAM checksum result (0=OK)	Diag1
HM255250	MMT108_PSRAM checksum result (0=OK)	Diag1
HM256250	MMT109_PSRAM checksum result (0=OK)	Diag1
HM257250	MMT110_PSRAM checksum result (0=OK)	Diag1
HM258250	MMT111_PSRAM checksum result (0=OK)	Diag1
HM259250	MMT112_PSRAM checksum result (0=OK)	Diag1
HM260250	MMT113_PSRAM checksum result (0=OK)	Diag1
HM261250	MMT114_PSRAM checksum result (0=OK)	Diag1
HM262250	MMT115_PSRAM checksum result (0=OK)	Diag1
HM263250	MMT116_PSRAM checksum result (0=OK)	Diag1
HM264250	MMT117_PSRAM checksum result (0=OK)	Diag1
HM265250	MMT118_PSRAM checksum result (0=OK)	Diag1
HM266250	MMT119_PSRAM checksum result (0=OK)	Diag1
HM267250	MMT120_PSRAM checksum result (0=OK)	Diag1
HM268250	MMT121_PSRAM checksum result (0=OK)	Diag1
HM269250	MMT122_PSRAM checksum result (0=OK)	Diag1
HM270250	MMT123_PSRAM checksum result (0=OK)	Diag1
HM271250	MMT124_PSRAM checksum result (0=OK)	Diag1
HM272250	MMT125_PSRAM checksum result (0=OK)	Diag1
HM273250	MMT126_PSRAM checksum result (0=OK)	Diag1
HM274250	MMT127_PSRAM checksum result (0=OK)	Diag1
HM275250	MMT000_DSRAM checksum result (0=OK)	Diag1
HM276250	MMT001_DSRAM checksum result (0=OK)	Diag1
HM277250	MMT002_DSRAM checksum result (0=OK)	Diag1
HM278250	MMT003_DSRAM checksum result (0=OK)	Diag1
HM279250	MMT004_DSRAM checksum result (0=OK)	Diag1
HM280250	MMT005_DSRAM checksum result (0=OK)	Diag1
HM281250	MMT006_DSRAM checksum result (0=OK)	Diag1
HM282250	MMT007_DSRAM checksum result (0=OK)	Diag1
HM283250	MMT008_DSRAM checksum result (0=OK)	Diag1
HM284250	MMT009_DSRAM checksum result (0=OK)	Diag1
HM285250	MMT010_DSRAM checksum result (0=OK)	Diag1
HM286250	MMT011_DSRAM checksum result (0=OK)	Diag1
HM287250	MMT012_DSRAM checksum result (0=OK)	Diag1
HM288250	MMT013_DSRAM checksum result (0=OK)	Diag1
HM289250	MMT014_DSRAM checksum result (0=OK)	Diag1
HM290250	MMT015_DSRAM checksum result (0=OK)	Diag1
HM291250	MMT016_DSRAM checksum result (0=OK)	Diag1
HM292250	MMT017_DSRAM checksum result (0=OK)	Diag1
HM293250	MMT018_DSRAM checksum result (0=OK)	Diag1
HM294250	MMT019_DSRAM checksum result (0=OK)	Diag1
HM295250	MMT020_DSRAM checksum result (0=OK)	Diag1
HM296250	MMT021_DSRAM checksum result (0=OK)	Diag1
HM297250	MMT022_DSRAM checksum result (0=OK)	Diag1
HM298250	MMT023_DSRAM checksum result (0=OK)	Diag1
HM299250	MMT024_DSRAM checksum result (0=OK)	Diag1
HM300250	MMT025_DSRAM checksum result (0=OK)	Diag1
HM301250	MMT026_DSRAM checksum result (0=OK)	Diag1
HM302250	MMT027_DSRAM checksum result (0=OK)	Diag1
HM303250	MMT028_DSRAM checksum result (0=OK)	Diag1
HM304250	MMT029_DSRAM checksum result (0=OK)	Diag1
HM305250	MMT030_DSRAM checksum result (0=OK)	Diag1
HM306250	MMT031_DSRAM checksum result (0=OK)	Diag1
HM307250	MMT032_DSRAM checksum result (0=OK)	Diag1
HM308250	MMT033_DSRAM checksum result (0=OK)	Diag1
HM309250	MMT034_DSRAM checksum result (0=OK)	Diag1
HM310250	MMT035_DSRAM checksum result (0=OK)	Diag1
HM311250	MMT036_DSRAM checksum result (0=OK)	Diag1
HM312250	MMT037_DSRAM checksum result (0=OK)	Diag1

HM313250	MMT038_DSRAM checksum result (0=OK)	Diag1
HM314250	MMT039_DSRAM checksum result (0=OK)	Diag1
HM315250	MMT040_DSRAM checksum result (0=OK)	Diag1
HM316250	MMT041_DSRAM checksum result (0=OK)	Diag1
HM317250	MMT042_DSRAM checksum result (0=OK)	Diag1
HM318250	MMT043_DSRAM checksum result (0=OK)	Diag1
HM319250	MMT044_DSRAM checksum result (0=OK)	Diag1
HM320250	MMT045_DSRAM checksum result (0=OK)	Diag1
HM321250	MMT046_DSRAM checksum result (0=OK)	Diag1
HM322250	MMT047_DSRAM checksum result (0=OK)	Diag1
HM323250	MMT048_DSRAM checksum result (0=OK)	Diag1
HM324250	MMT049_DSRAM checksum result (0=OK)	Diag1
HM325250	MMT050_DSRAM checksum result (0=OK)	Diag1
HM326250	MMT051_DSRAM checksum result (0=OK)	Diag1
HM327250	MMT052_DSRAM checksum result (0=OK)	Diag1
HM328250	MMT053_DSRAM checksum result (0=OK)	Diag1
HM329250	MMT054_DSRAM checksum result (0=OK)	Diag1
HM330250	MMT055_DSRAM checksum result (0=OK)	Diag1
HM331250	MMT056_DSRAM checksum result (0=OK)	Diag1
HM332250	MMT057_DSRAM checksum result (0=OK)	Diag1
HM333250	MMT058_DSRAM checksum result (0=OK)	Diag1
HM334250	MMT059_DSRAM checksum result (0=OK)	Diag1
HM335250	MMT060_DSRAM checksum result (0=OK)	Diag1
HM336250	MMT061_DSRAM checksum result (0=OK)	Diag1
HM337250	MMT062_DSRAM checksum result (0=OK)	Diag1
HM338250	MMT063_DSRAM checksum result (0=OK)	Diag1
HM339250	MMT064_DSRAM checksum result (0=OK)	Diag1
HM340250	MMT065_DSRAM checksum result (0=OK)	Diag1
HM341250	MMT066_DSRAM checksum result (0=OK)	Diag1
HM342250	MMT067_DSRAM checksum result (0=OK)	Diag1
HM343250	MMT068_DSRAM checksum result (0=OK)	Diag1
HM344250	MMT069_DSRAM checksum result (0=OK)	Diag1
HM345250	MMT070_DSRAM checksum result (0=OK)	Diag1
HM346250	MMT071_DSRAM checksum result (0=OK)	Diag1
HM347250	MMT072_DSRAM checksum result (0=OK)	Diag1
HM348250	MMT073_DSRAM checksum result (0=OK)	Diag1
HM349250	MMT074_DSRAM checksum result (0=OK)	Diag1
HM350250	MMT075_DSRAM checksum result (0=OK)	Diag1
HM351250	MMT076_DSRAM checksum result (0=OK)	Diag1
HM352250	MMT077_DSRAM checksum result (0=OK)	Diag1
HM353250	MMT078_DSRAM checksum result (0=OK)	Diag1
HM354250	MMT079_DSRAM checksum result (0=OK)	Diag1
HM355250	MMT080_DSRAM checksum result (0=OK)	Diag1
HM356250	MMT081_DSRAM checksum result (0=OK)	Diag1
HM357250	MMT082_DSRAM checksum result (0=OK)	Diag1
HM358250	MMT083_DSRAM checksum result (0=OK)	Diag1
HM359250	MMT084_DSRAM checksum result (0=OK)	Diag1
HM360250	MMT085_DSRAM checksum result (0=OK)	Diag1
HM361250	MMT086_DSRAM checksum result (0=OK)	Diag1
HM362250	MMT087_DSRAM checksum result (0=OK)	Diag1
HM363250	MMT088_DSRAM checksum result (0=OK)	Diag1
HM364250	MMT089_DSRAM checksum result (0=OK)	Diag1
HM365250	MMT090_DSRAM checksum result (0=OK)	Diag1
HM366250	MMT091_DSRAM checksum result (0=OK)	Diag1
HM367250	MMT092_DSRAM checksum result (0=OK)	Diag1
HM368250	MMT093_DSRAM checksum result (0=OK)	Diag1
HM369250	MMT094_DSRAM checksum result (0=OK)	Diag1
HM370250	MMT095_DSRAM checksum result (0=OK)	Diag1
HM371250	MMT096_DSRAM checksum result (0=OK)	Diag1

HM372250	MMT097_DSRAM checksum result (0=OK)	Diag1
HM373250	MMT098_DSRAM checksum result (0=OK)	Diag1
HM374250	MMT099_DSRAM checksum result (0=OK)	Diag1
HM375250	MMT100_DSRAM checksum result (0=OK)	Diag1
HM376250	MMT101_DSRAM checksum result (0=OK)	Diag1
HM377250	MMT102_DSRAM checksum result (0=OK)	Diag1
HM378250	MMT103_DSRAM checksum result (0=OK)	Diag1
HM379250	MMT104_DSRAM checksum result (0=OK)	Diag1
HM380250	MMT105_DSRAM checksum result (0=OK)	Diag1
HM381250	MMT106_DSRAM checksum result (0=OK)	Diag1
HM382250	MMT107_DSRAM checksum result (0=OK)	Diag1
HM383250	MMT108_DSRAM checksum result (0=OK)	Diag1
HM384250	MMT109_DSRAM checksum result (0=OK)	Diag1
HM385250	MMT110_DSRAM checksum result (0=OK)	Diag1
HM386250	MMT111_DSRAM checksum result (0=OK)	Diag1
HM387250	MMT112_DSRAM checksum result (0=OK)	Diag1
HM388250	MMT113_DSRAM checksum result (0=OK)	Diag1
HM389250	MMT114_DSRAM checksum result (0=OK)	Diag1
HM390250	MMT115_DSRAM checksum result (0=OK)	Diag1
HM391250	MMT116_DSRAM checksum result (0=OK)	Diag1
HM392250	MMT117_DSRAM checksum result (0=OK)	Diag1
HM393250	MMT118_DSRAM checksum result (0=OK)	Diag1
HM394250	MMT119_DSRAM checksum result (0=OK)	Diag1
HM395250	MMT120_DSRAM checksum result (0=OK)	Diag1
HM396250	MMT121_DSRAM checksum result (0=OK)	Diag1
HM397250	MMT122_DSRAM checksum result (0=OK)	Diag1
HM398250	MMT123_DSRAM checksum result (0=OK)	Diag1
HM399250	MMT124_DSRAM checksum result (0=OK)	Diag1
HM400250	MMT125_DSRAM checksum result (0=OK)	Diag1
HM401250	MMT126_DSRAM checksum result (0=OK)	Diag1
HM402250	MMT127_DSRAM checksum result (0=OK)	Diag1
HM403250	MMT000_DPROM checksum result (0=OK)	Diag1
HM404250	MMT001_DPROM checksum result (0=OK)	Diag1
HM405250	MMT002_DPROM checksum result (0=OK)	Diag1
HM406250	MMT003_DPROM checksum result (0=OK)	Diag1
HM407250	MMT004_DPROM checksum result (0=OK)	Diag1
HM408250	MMT005_DPROM checksum result (0=OK)	Diag1
HM409250	MMT006_DPROM checksum result (0=OK)	Diag1
HM410250	MMT007_DPROM checksum result (0=OK)	Diag1
HM411250	MMT008_DPROM checksum result (0=OK)	Diag1
HM412250	MMT009_DPROM checksum result (0=OK)	Diag1
HM413250	MMT010_DPROM checksum result (0=OK)	Diag1
HM414250	MMT011_DPROM checksum result (0=OK)	Diag1

10.2.1.19 REU ERROR FLAG TELEMETRY

HM567280	REU Complete Error STATUS 2 (see detail bellow)	HSK1, HSK3, Diag2
HM568280	REU ASW Version	Diag2
HM338280	REU EEPROM Config 0 Valid (1=valid)	Diag2
HM340280	REU EEPROM Config 1 Valid (1=valid)	Diag2
HM344280	REU EEPROM Config 2 Valid (1=valid)	Diag2
HM346280	REU EEPROM error (status 2 bit 6)	Diag2
HM350280	REU DRAM error (status 2 bit 7)	Diag2
HM352280	REU DPRAM error (status 2 bit 8)	Diag2
HM356280	REU PROM error (status 2 bit 9)	Diag2
HM358280	REU Belt Synchro error (status 2 bit 10)	Diag2
HM569280	REU PRAM status 5 Word (see detail bellow)	Diag2
HM570280	REU DRAM status 6 Word (see detail bellow)	Diag2
HM571280	REU Preprocessor status 8 Word (see detail bellow)	HSK2, Diag2
HM572280	REU EEPROM Configuration status 9 Word (see detail bellow)	Diag2
HM573280	REU FPGA version (=0x12)	Diag2
HM976280	REU VIOerror (1=eror)	HSK1, HSK3
HM352280	REU DPRAM error (1=eror)	HSK1, HSK3
HM356280	REU PROM error (1=eror)	HSK1, HSK3
HM358280	REU PPFSync error (1=eror)	HSK1, HSK3
HM346280	REU DEEPROM error (1=eror)	HSK1, HSK3
HM350280	REU DRAM error (1=eror)	HSK1, HSK3

REU STATUS word 2, word 5, word 6 and word 8 detail:

- STATUS (2) : error status of the on board software (report errors on reception and execution of commands, and some extra informations)

HSL Protocol errors : (codes 0x2000 to 0x200F)

HSL Protocol Errors	Bad start of header code (bad STX)	0x2000
	Packet length inconsistency (bad NW)	0x2001
	(not used)	0x2002
	Checksum Error	0x2003
	Bad Command Packet type (unknown ID)	0x2004
	(not used)	0x2005
	Command Buffer Full	0x2006
	Bad end of transmission (bad EOT)	0x2007
	Reserved	0x2008
		to
	Reserved	0x200F

If more than one of these protocol errors occurs, the priority of error reported are :

1	Command Buffer Full
2	Bad start of header code (bad STX)
3	Packet length inconsistency (bad NW)
4	Checksum Error
5	Bad end of transmission (bad EOT)
6	Bad Command Packet type (unknown ID)

If a bad STX or bad NW error occurs, the ID of the last command executed sent in the response is equal to 0x40BC (bad command).

Command execution errors: (codes 0x2020 to 0x202F)

Command Errors	No Error	0x2020
	Error Bad Parameter (parameters out of range)	0x2021
	Error Command not allowed (depending mode)	0x2022
	Error during command execution (command execution failed)	0x2023
	Command not executed (configuration backup in progress or MUX FIFO not empty)	0x2024

If an HSL protocol error or a command error occurs, the command is not executed.

Others information: (bits 6 to 12 used)

		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Commands in queue	No Yes	0	0	1	0 1												
First Command after RESET	No Yes	0	0	1		0 1											
PPF synchro Error	No Yes	0	0	1			0 1										
Program ROM Test Error	No Yes	0	0	1				0 1									
Program RAM Test Error	No Yes	0	0	1					0 1								
Data RAM Test Error	No Yes	0	0	1						0 1							
Data EEPROM Test Error	No Yes	0	0	1							0 1						

These bits are computed with HSL protocol errors and command execution errors.
For example : 0x2843 => Checksum Error + Data EEPROM Test Error + First Command after RESET

- STATUS(5) : Program RAM Status

STATUS		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Error Program RAM Page 0	No Yes																0 1
Error Program RAM Page 1	No Yes															0 1	
Error Program RAM Page 2	No Yes														0 1		
Error Program RAM Page 3	No Yes													0 1			
Error Program RAM Page 4	No Yes												0 1				
Error Program RAM Page 5	No Yes											0 1					
Error Program RAM Page 6	No Yes										0 1						
Error Program RAM Page 7	No Yes									0 1							
Error Program RAM Page 8	No Yes								0 1								
Error Program RAM Page 9	No Yes							0 1									
Error Program RAM Page 10	No Yes						0 1										
Error Program RAM Page 11	No Yes					0 1											
Error Program RAM Page 12	No Yes				0 1												
Error Program RAM Page 13	No Yes			0 1													
Error Program RAM Page 14	No Yes		0 1														
Error Program RAM Page 15	No Yes	0 1															

- STATUS(6) : Data RAM Status

STATUS		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Error Data RAM Page 0	No Yes																0 1
Error Data RAM Page 1	No Yes															0 1	
Error Data RAM Page 2	No Yes														0 1		
Error Data RAM Page 3	No Yes													0 1			
Error Data RAM Page 4	No Yes												0 1				
Error Data RAM Page 5	No Yes											0 1					
Error Data RAM Page 6	No Yes										0 1						
Error Data RAM Page 7	No Yes									0 1							
Error Data RAM Page 8	No Yes								0 1								
Error Data RAM Page 9	No Yes							0 1									
Error Data RAM Page 10	No Yes						0 1										
Error Data RAM Page 11	No Yes					0 1											
Error Data RAM Page 12	No Yes				0 1												
Error Data RAM Page 13	No Yes			0 1													
Error Data RAM Page 14	No Yes		0 1														
Error Data RAM Page 15	No Yes	0 1															

- STATUS(8) : Preprocessor status

STATUS		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Preprocessor 0 out of order	No Yes																0 1
Preprocessor 1 out of order	No Yes															0 1	
Preprocessor 2 out of order	No Yes														0 1		
Preprocessor 3 out of order	No Yes													0 1			
Preprocessor 4 out of order	No Yes												0 1				
Preprocessor 5 out of order	No Yes											0 1					
Preprocessor 6 out of order	No Yes										0 1						
Preprocessor 7 out of order	No Yes									0 1							
Preprocessor 8 out of order	No Yes								0 1								
Preprocessor 9 out of order	No Yes							0 1									
Preprocessor 10 out of order	No Yes						0 1										
Preprocessor 11 out of order	No Yes					0 1											
Channel order FIFO not empty	No Yes				0 1												
Resynchronization in progress	No Yes		0 1														
Resynchronization failure	No Yes	0 1															
Spares	-			0													

STATUS(9) : EEPROM Configuration status

STATUS	valid	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Configuration 0	No Yes																0 1
Configuration 1	No Yes															0 1	
Configuration 2	No Yes														0 1		
Backup in progress	No Yes												0 1				
Last configuration loaded							0 .. 4										
Spares	-	0	0	0	0	0				0	0	0		0			

With “Last configuration loaded” :

- 0 : configuration 0 loaded
- 1 : configuration 1 loaded
- 2 : configuration 2 loaded
- 3 : software configuration loaded (configuration contains in software)
- 4 : no configuration loaded

10.2.1.20 4K ERROR FLAG TELEMETRY

An error is raised when the telemetry is set to 1.

HM308260	4K ADC A clock error	HSK1, HSK3
HM307260	4K ADC A conversion error	HSK1, HSK3
HM306260	4K ADC B clock error	HSK1, HSK3
HM305260	4K ADC B conversion error	HSK1, HSK3
HM304260	4K ADC C clock error	HSK1, HSK3
HM303260	4K ADC C conversion error	HSK1, HSK3
HM302260	4K ADC D clock error	HSK1, HSK3
HM301260	4K ADC D conversion error	HSK1, HSK3
HM300260	4K ADC E clock error	HSK1, HSK3
HM299260	4K ADC E conversion error	HSK1, HSK3
HM298260	4K TM data acquisition write to DPRAM	HSK1, HSK3
HM297260	Compressor A Drive Amplifier Current Limiting	HSK1, HSK3
HM296260	Compressor B Drive Amplifier Current Limiting	HSK1, HSK3
HM295260	Getter Over Current	HSK1, HSK3
HM294260	Getter Over Temperature	HSK1, HSK3
HM293260	Invalid waveform buffer write performed	HSK1, HSK3
HM325260	4K LSL clock failure	HSK1, HSK3
HM324260	4K External F180 clock period of bounds	HSK1, HSK3
HM323260	4K External F0 clock period out of bounds	HSK1, HSK3
HM322260	4K External F0 clock period variation out of bounds	HSK1, HSK3
HM321260	4K Incorrect nb of F180 clock periods counted in F0	HSK1, HSK3
HM010260	CI_SR : see (HM293260 to HM308260)	HSK1, HSK3
HM014260	PS_SR : see (H3210260 to HM325260)	HSK1, HSK3
HM254260	4K Limit Exceed Program Amp Dif >2mm	HSK2
HM271260	4K Limit Exceed Force >5N	HSK2
HM272260	4K Limit Exceed F0	HSK2
HM273260	4K Limit Exceed F1	HSK2
HM274260	4K Limit Exceed F2	HSK2
HM275260	4K Limit Exceed F3	HSK2
HM276260	4K Limit Exceed F4	HSK2
HM277260	4K Limit Exceed F5	HSK2
HM278260	4K Limit Exceed F6	HSK2
HM279260	4K Limit Exceed F7	HSK2
HM255260	4K Limit 2 Exceed Temp Comp B	HSK2
HM256260	4K Limit 1 Exceed Temp Comp B	HSK2
HM257260	4K Limit 2 Exceed Temp Comp A	HSK2
HM258260	4K Limit 1 Exceed Temp Comp A	HSK2
HM259260	4K Limit Exceed Int Neg Comp B	HSK2
HM260260	4K Limit Exceed Int Pos Comp A	HSK2
HM261260	4K Limit Exceed Int Neg Comp A	HSK2
HM262260	4K Limit Exceed Int Pos Comp B	HSK2
HM263260	4K Limit 3 Exceed Int drive bus	HSK2
HM264260	4K Limit 2 Exceed Int drive bus	HSK2
HM265260	4K Limit 1 Exceed Int drive bus	HSK2
HM266260	4K Limit Exceed Displ Neg Comp B	HSK2
HM267260	4K Limit Exceed Displ Pos Comp B	HSK2
HM268260	4K Limit Exceed Displ Neg Comp A	HSK2
HM269260	4K Limit Exceed Displ Pos Comp A	HSK2
HM270260	4K Limit Exceed Program Displ	HSK2
HM148260	4K Software Limit Amplitud Demand	HSK2
HM145260	4K Software Error	HSK2
HM168260	4Sw0_PRAM Failed Mem Block (0=OK)	Diag2
HM169260	4Sw1_PRAM Failed Mem Block (0=OK)	Diag2
HM170260	4Sw2_PRAM Failed Mem Block (0=OK)	Diag2

HM171260	4Sw3_PRAM Failed Mem Block (0=OK)	Diag2
HM172260	4Sw4_PRAM Failed Mem Block (0=OK)	Diag2
HM173260	4Sw5_PRAM Failed Mem Block (0=OK)	Diag2
HM174260	4Sw6_PRAM Failed Mem Block (0=OK)	Diag2
HM175260	4Sw7_PRAM Failed Mem Block (0=OK)	Diag2
HM176260	4Sw0_DRAM Failed Mem Block (0=OK)	Diag2
HM177260	4Sw1_DRAM Failed Mem Block (0=OK)	Diag2
HM178260	4Sw2_DRAM Failed Mem Block (0=OK)	Diag2
HM179260	4Sw3_DRAM Failed Mem Block (0=OK)	Diag2
HM180260	4Sw4_DRAM Failed Mem Block (0=OK)	Diag2
HM181260	4Sw5_DRAM Failed Mem Block (0=OK)	Diag2
HM182260	4Sw6_DRAM Failed Mem Block (0=OK)	Diag2
HM183260	4Sw7_DRAM Failed Mem Block (0=OK)	Diag2
HM156260	4K BOOT status (<5=OK)	Diag2
HM157260	4K BOOT ERROR (0=OK)	Diag2
HM158260	4K RESET reason 1	Diag2
HM159260	4K RESET reason 2	Diag2
HM160260	4K RESET reason 3	Diag2
HM161260	4K RESET reason 4	Diag2
HM162260	4K RESET reason5	Diag2
HM163260	4K RESET reason 6	Diag2
HM164260	4K RESET reason 7	Diag2
HM165260	4K RESET reason 8	Diag2
HM166260	4K RESET reason 9	Diag2
HM167260	4K RESET reason 10	Diag2
HM151260	4K Comand Return Value	HSK2, Diag2

The 4K BSW Comand Return Value code (HM151260) are :

Return Value	Symbolic Name	Meaning
0x0001	ERR_PATCH_CMD_SIZE	Patch command packet is too short
0x0002	ERR_PATCH_CKSUM	Patch data checksum is bad
0x0003	ERR_PATCH_MEMID	Least significant 3 bits of Memory ID is out of range, in Patch command
0x0004	ERR_DUMP_CMD_SIZE	Dump command is incorrect length
0x0005	ERR_DUMP_MEMID	Least significant 3 bits of Memory ID is out of range, in Dump command

A return value at 0 indicates that the command has been successfully processed.

The 4K ASW Comand Return Value code (HM151260) are :

Return Value	Symbolic Name	Meaning
0x0001	INVALID_CMD_AID	Invalid AID (Activity Identifier) specified in command
0x0002	ILLEGAL_CMD_STATE	Command illegal in current state
0x0003	WRONG_PC_FIELD_SIZE	PC field size is incorrect
0x0004	INVALID_OPERATING_PARAMETER_ID	Undefined operating parameter id value
0x0005	ILLEGAL_OP_PARAM_STATE	Illegal to change operating parameter in current state
0x0006	OUT_OF_RANGE_OP_PARAM	Out of range Operating Parameter value in SETPARAM command
0x0007	INVALID_LIMIT_ID	Undefined limit id value
0x0008	ILLEGAL_LIMIT_VALUE_STATE	Illegal to change limit value in current state
0x0009	OUT_OF_RANGE_LIMIT_VALUE	Out of range Limit value in SETLIMITVALUES command
0x000A	ALREADY_ON_INTERNAL_CLOCK	Commanded to switch to internal clock when already on it
0x000B	ALREADY_ON_EXTERNAL_CLOCK	Commanded to switch to external clock when already on it
0x000C	PATCH_CKSUM	Patch data checksum bad
0x000D	PATCH_MEMID	Invalid memory Id in Patch command
0x000E	PATCH_LEN_SAU	Length in SAUs (parameter) inconsistent with amount of patch data
0x000F	PATCH_RANGE	Patch extends beyond end of specified memory.
0x0010	DUMP_MEMID	Invalid memory Id in Dump command
0x0011	DUMP_LEN_SAU	Length in SAUs (parameter) invalid
0x0012	DUMP_RANGE	Dump extends beyond end of specified memory.

A return value at 0 indicates that the command has been successfully processed.

The 4K BSW BOOT status code (HM156260) are :

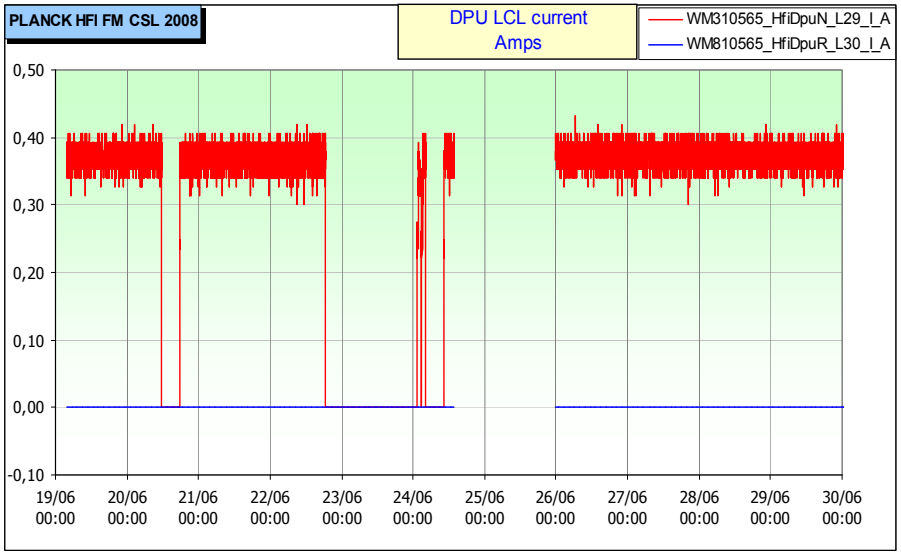
Bit #	Meaning
4	0 => Load Application Code pass 1 => Load Application Code fail
3	0 => RAM test passed 1 => RAM test fail
2-0	3-bit Boot program state: 000 = init, 001 = notify, 010 = ram_test, 011 = wait, 100 = loading_app_code, 101 = setup_c, 110 = failure

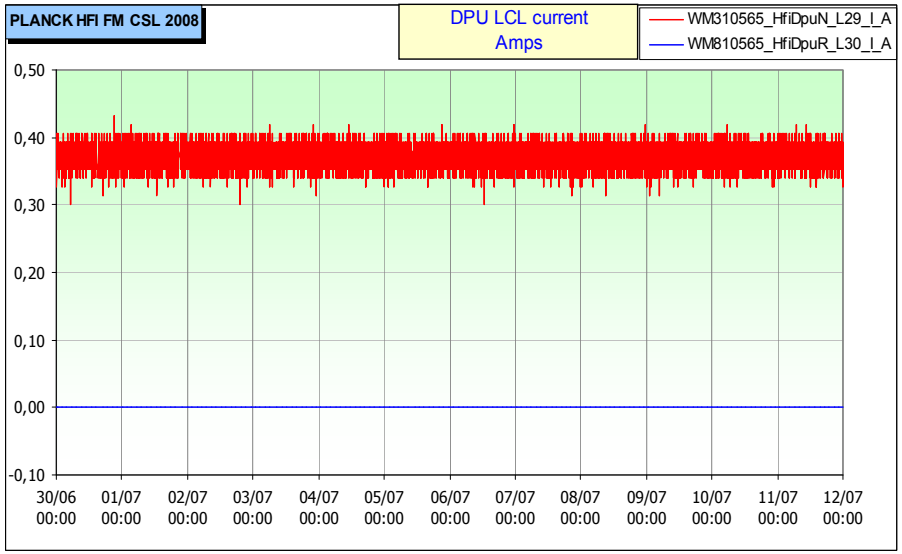
The 4K BSW BOOT error code (HM157260) are :

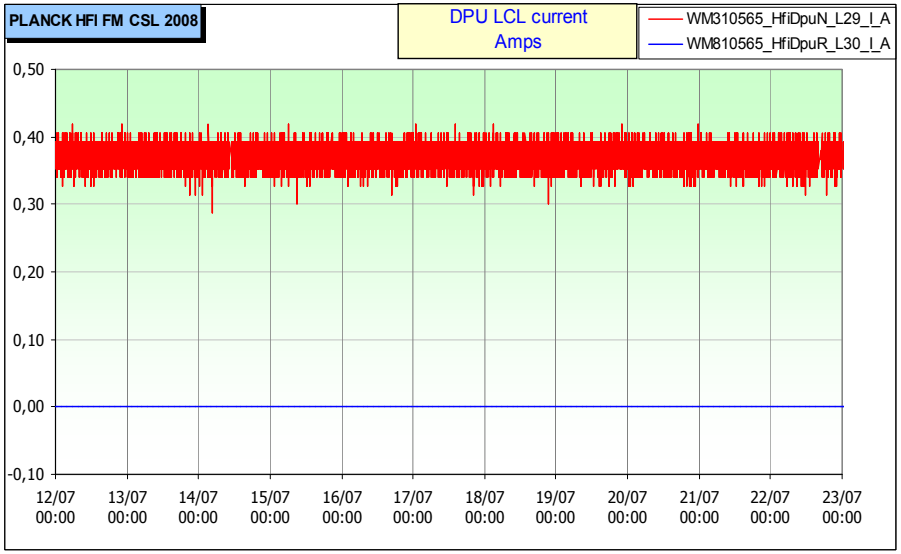
Boot Error Code	Symbolic Name	Meaning
0x0001	BERR_NO_SYNC	Sync pattern of memory segment not found while searching EEPROM.
0x0002	BERR_SEG_LEN_NEG	Segment length extracted from EEPROM memory segment is <= 0.
0x0003	BERR_SEG_LEN_ODD	Segment length extracted from EEPROM memory segment is odd (ie not a multiple of 2).
0x0004	BERR_SEG_CKSUM	Bad checksum in EEPROM memory segment

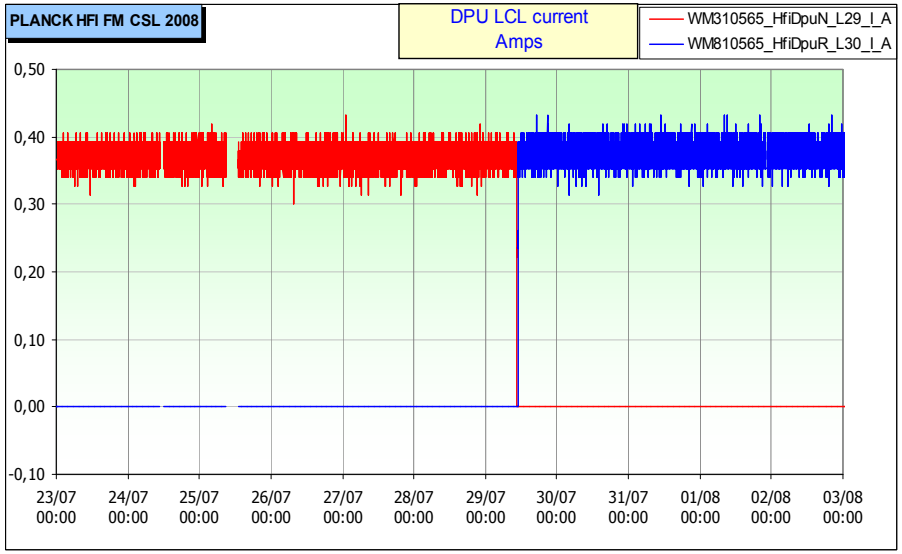
10.2.2 HSK TYPICAL PLOTS

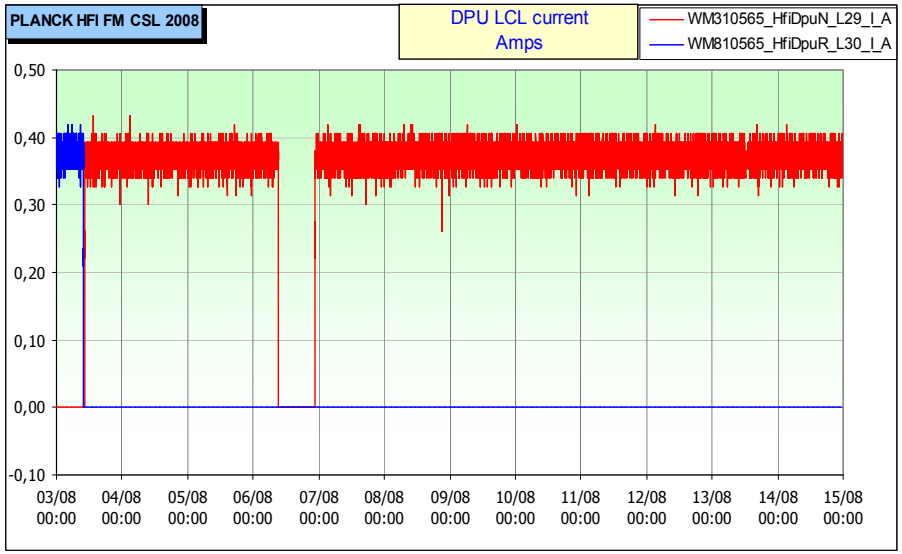
This is tipical HFI HSK plots obtained during the satellite FM CSL test during the cold phase.

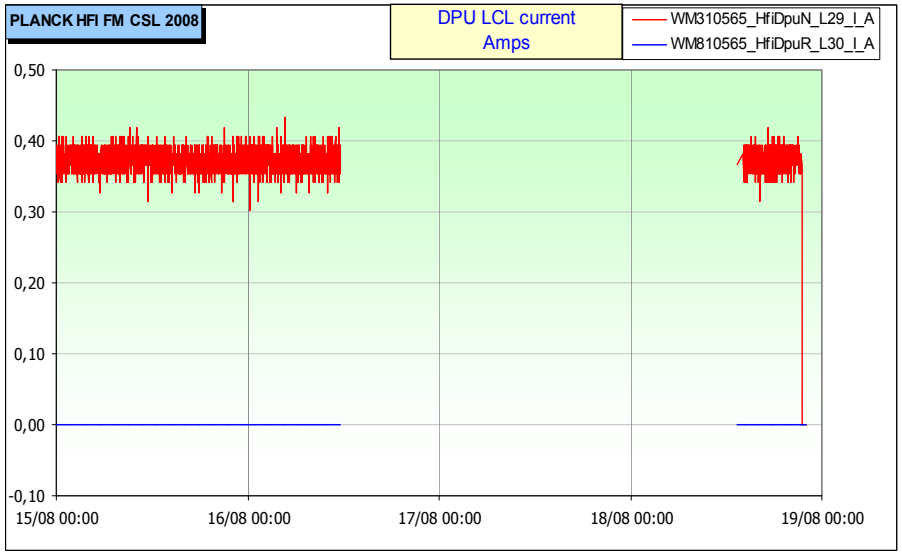

PLANCK HFI FM CSL 2008
DPU LCL current
Amps
WM310565_HfiDpuN_L29_I_A
WM810565_HfiDpuR_L30_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
25/06 00:00
26/06 00:00
27/06 00:00
28/06 00:00
29/06 00:00
30/06 00:00

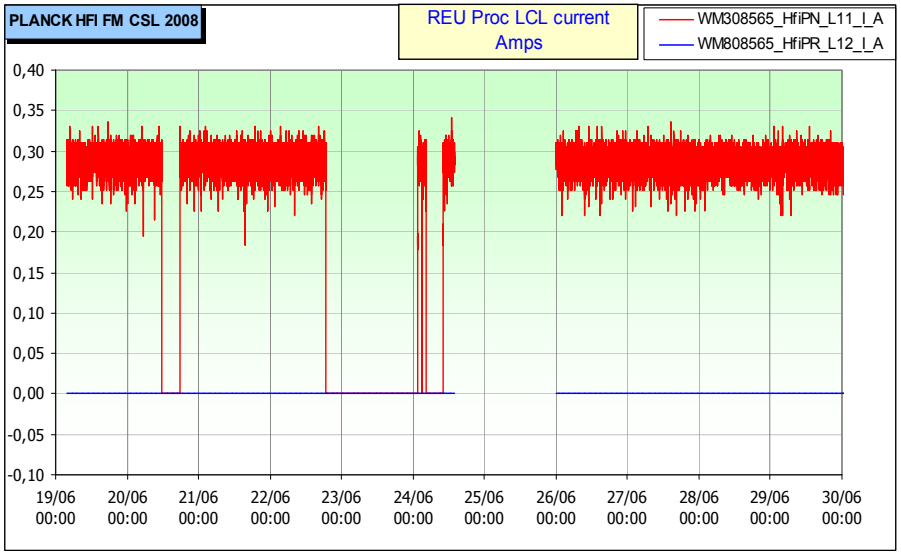

PLANCK HFI FM CSL 2008
DPU LCL current
Amps
WM310565_HfiDpuN_L29_I_A
WM810565_HfiDpuR_L30_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
06/07 00:00
07/07 00:00
08/07 00:00
09/07 00:00
10/07 00:00
11/07 00:00
12/07 00:00

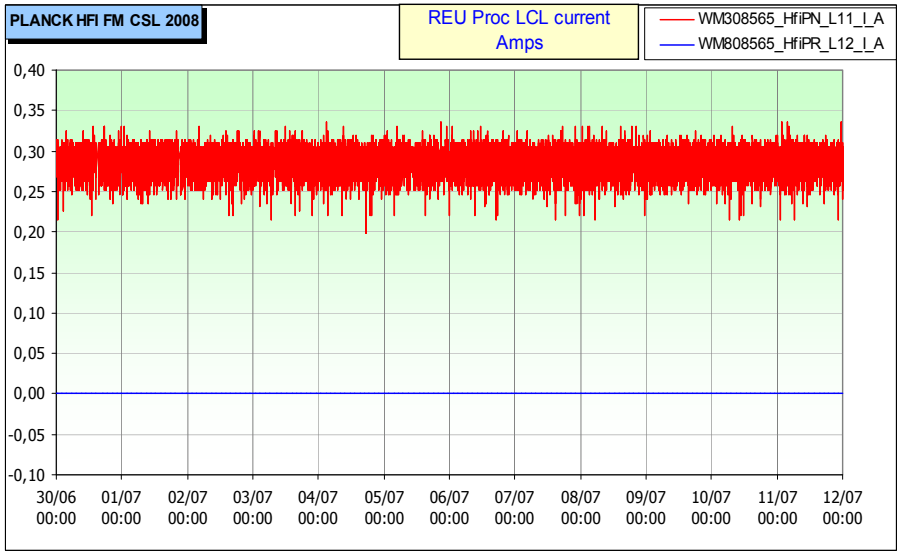

PLANCK HFI FM CSL 2008
DPU LCL current
Amps
WM310565_HfiDpuN_L29_I_A
WM810565_HfiDpuR_L30_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
18/07 00:00
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21/07 00:00
22/07 00:00
23/07 00:00

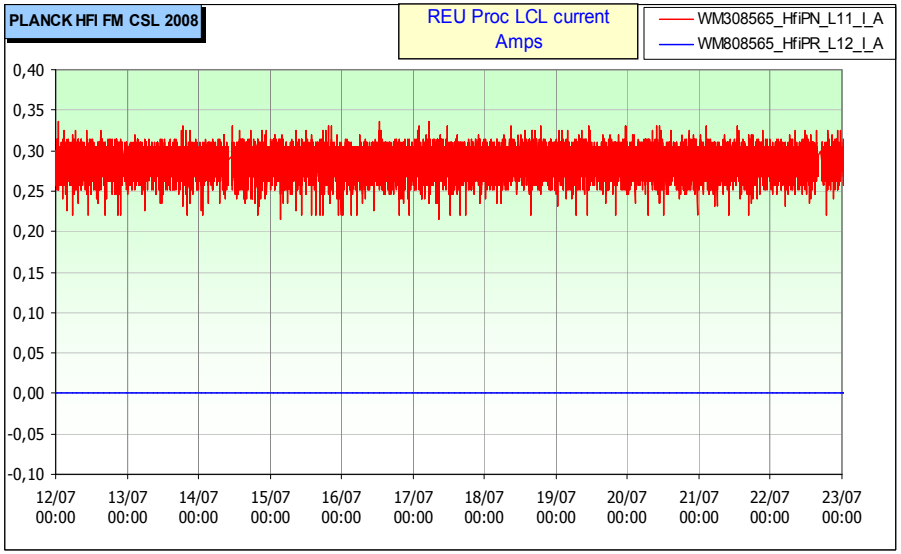

PLANCK HFI FM CSL 2008
DPU LCL current
Amps
WM310565_HfiDpuN_L29_I_A
WM810565_HfiDpuR_L30_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

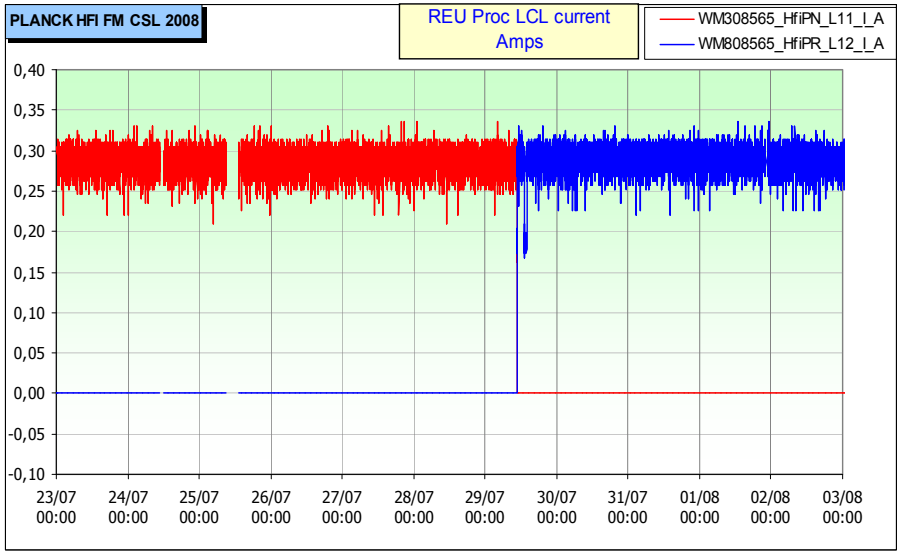

PLANCK HFI FM CSL 2008
DPU LCL current
Amps
WM310565_HfiDpuN_L29_I_A
WM810565_HfiDpuR_L30_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
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11/08 00:00
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13/08 00:00
14/08 00:00
15/08 00:00

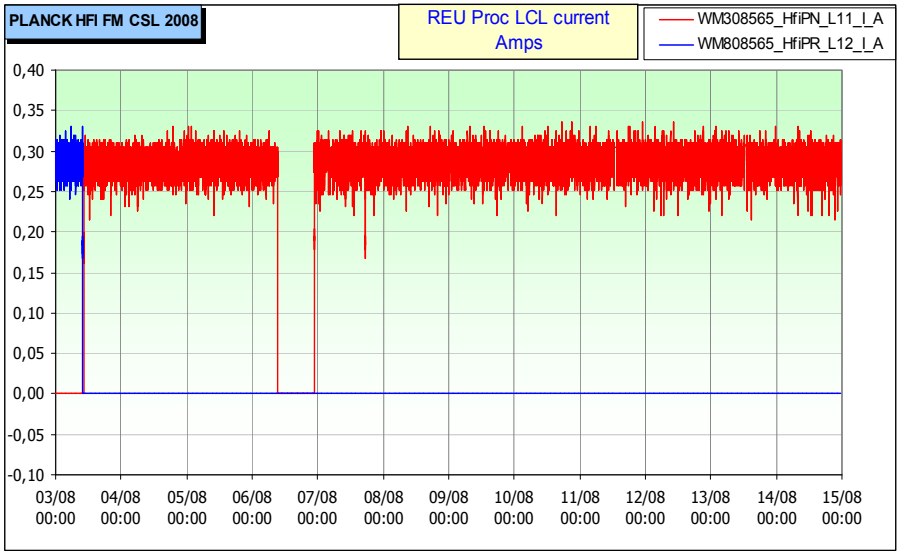

PLANCK HFI FM CSL 2008
DPU LCL current
Amps
WM310565_HfiDpuN_L29_I_A
WM810565_HfiDpuR_L30_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

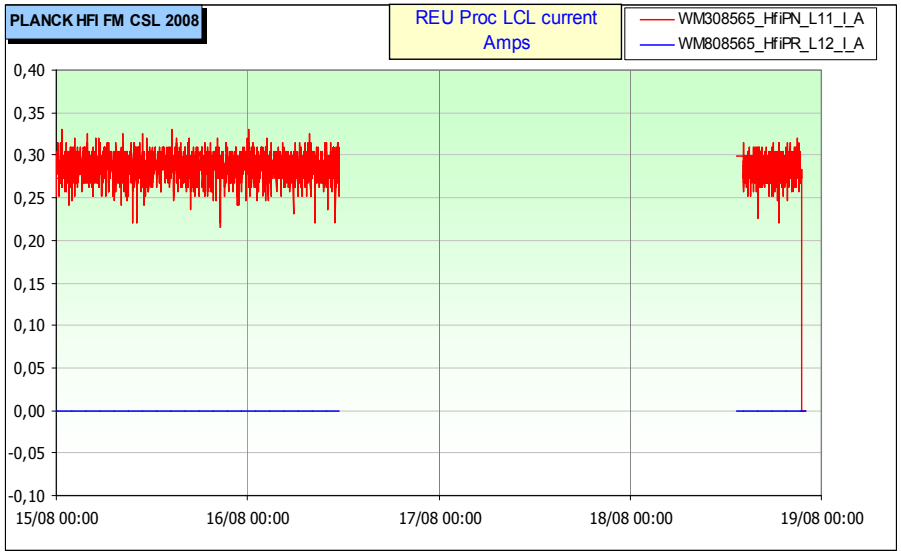

PLANCK HFI FM CSL 2008
REU Proc LCL current
Amps
WM308565_HfiPN_L11_I_A
WM808565_HfiPR_L12_I_A
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
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29/06 00:00
30/06 00:00

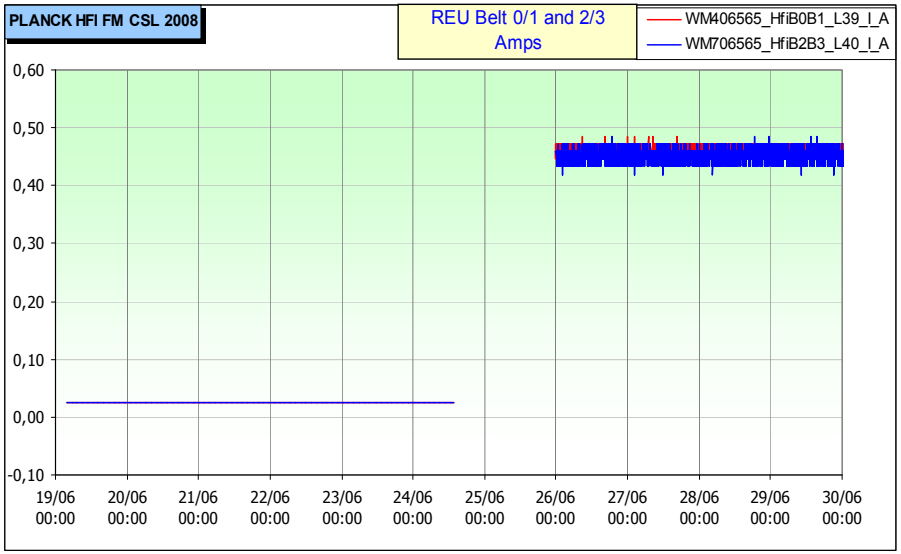

PLANCK HFI FM CSL 2008
REU Proc LCL current
Amps
WM308565_HfiPN_L11_I_A
WM808565_HfiPR_L12_I_A
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
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07/07 00:00
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10/07 00:00
11/07 00:00
12/07 00:00

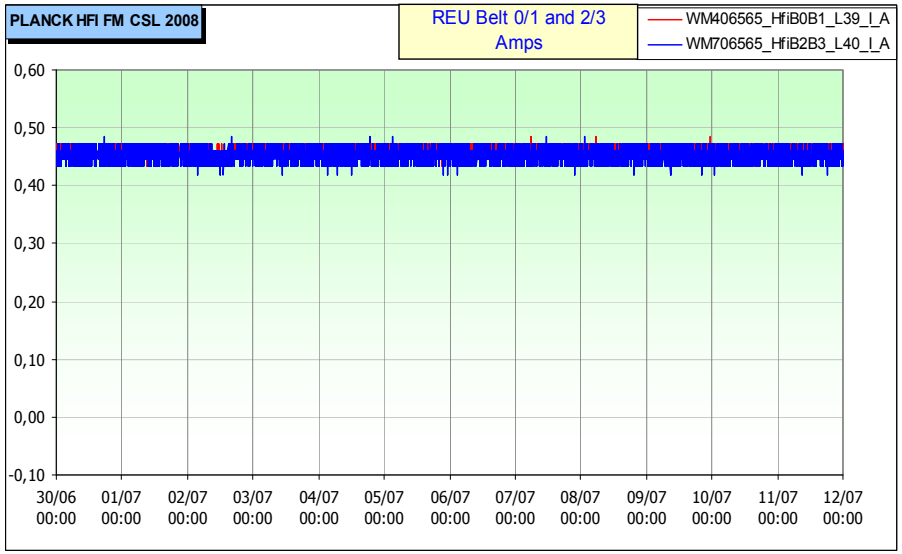

PLANCK HFI FM CSL 2008
REU Proc LCL current
Amps
WM308565_HfiPN_L11_I_A
WM808565_HfiPR_L12_I_A
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
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22/07 00:00
23/07 00:00

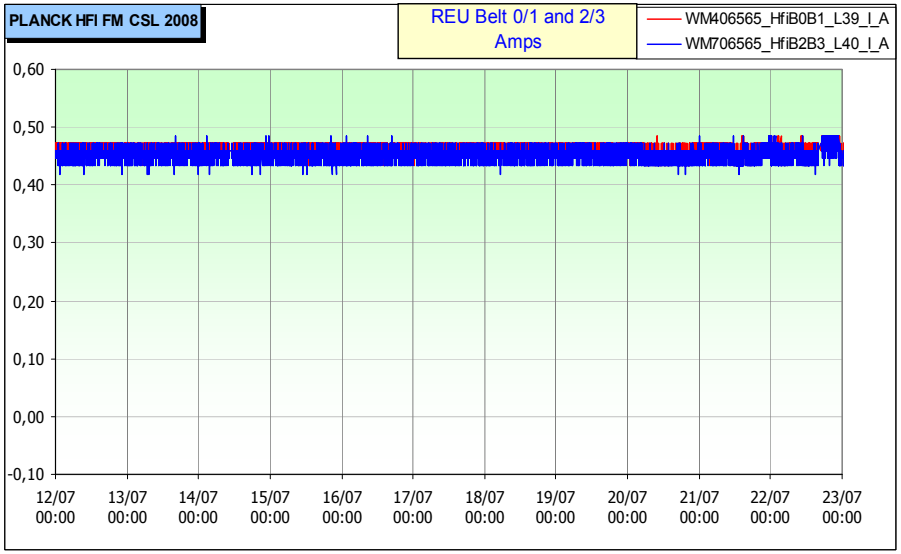

PLANCK HFI FM CSL 2008
REU Proc LCL current
Amps
WM308565_HfiPN_L11_I_A
WM808565_HfiPR_L12_I_A
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

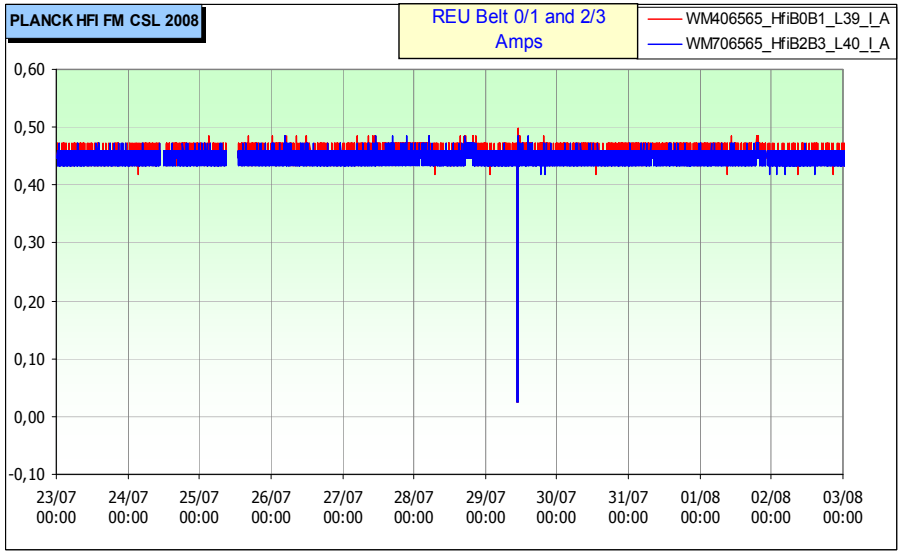

PLANCK HFI FM CSL 2008
REU Proc LCL current Amps
WM308565_HfiPN_L11_I_A
WM808565_HfiPR_L12_I_A
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
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10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00

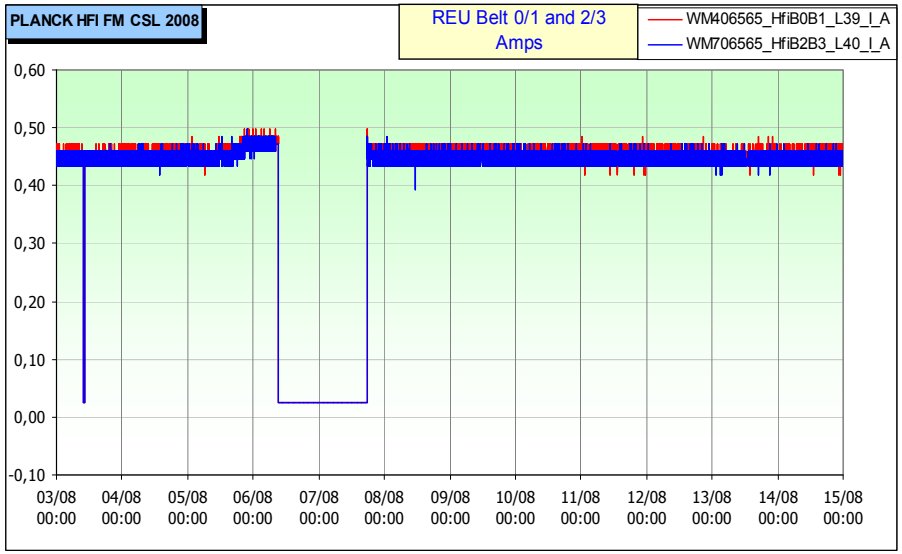

PLANCK HFI FM CSL 2008
REU Proc LCL current Amps
WM308565_HfiPN_L11_I_A
WM808565_HfiPR_L12_I_A
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
-0,05
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

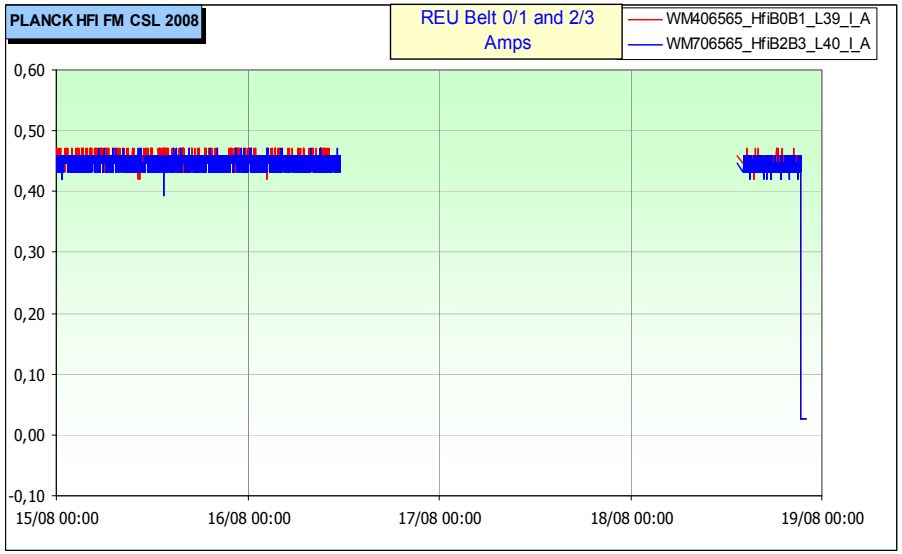

PLANCK HFI FM CSL 2008
REU Belt 0/1 and 2/3 Amps
WM406565_HfiB0B1_L39_I_A
WM706565_HfiB2B3_L40_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
25/06 00:00
26/06 00:00
27/06 00:00
28/06 00:00
29/06 00:00
30/06 00:00

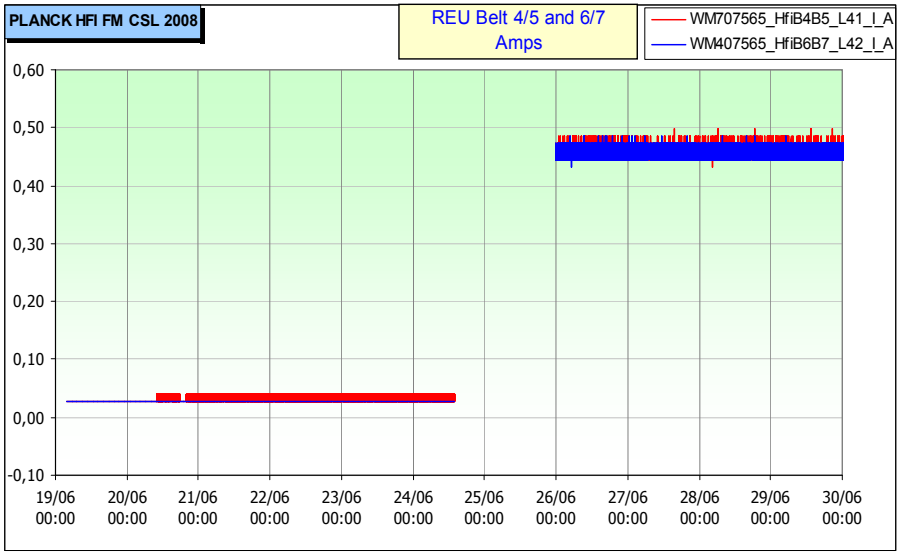

PLANCK HFI FM CSL 2008
REU Belt 0/1 and 2/3 Amps
WM406565_HfiB0B1_L39_I_A
WM706565_HfiB2B3_L40_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
06/07 00:00
07/07 00:00
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11/07 00:00
12/07 00:00

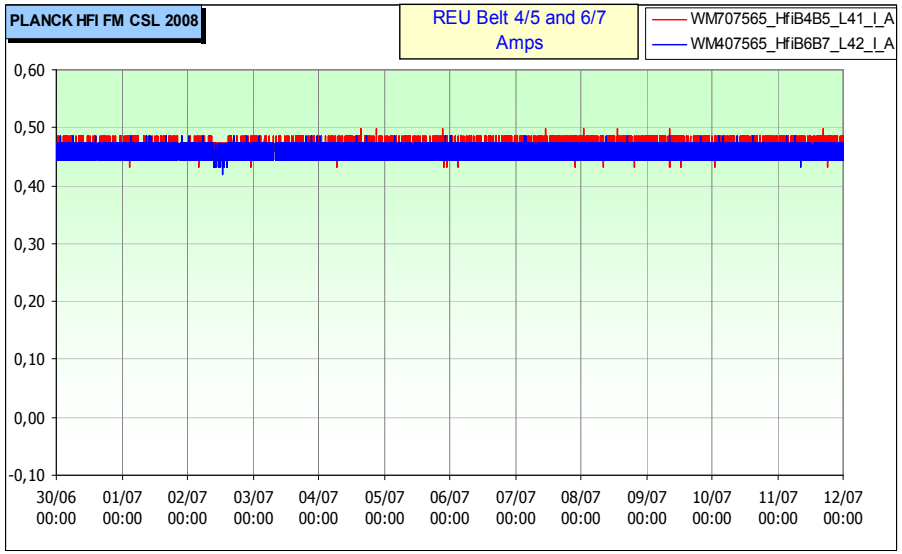

PLANCK HFI FM CSL 2008
REU Belt 0/1 and 2/3 Amps
WM406565_HfiB0B1_L39_I_A
WM706565_HfiB2B3_L40_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
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22/07 00:00
23/07 00:00

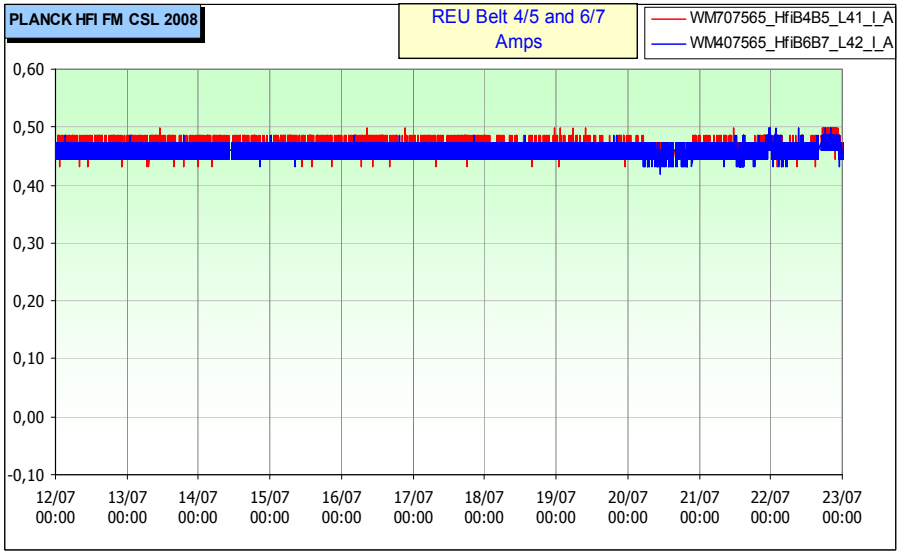

PLANCK HFI FM CSL 2008
REU Belt 0/1 and 2/3 Amps
WM406565_HfiB0B1_L39_I_A
WM706565_HfiB2B3_L40_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

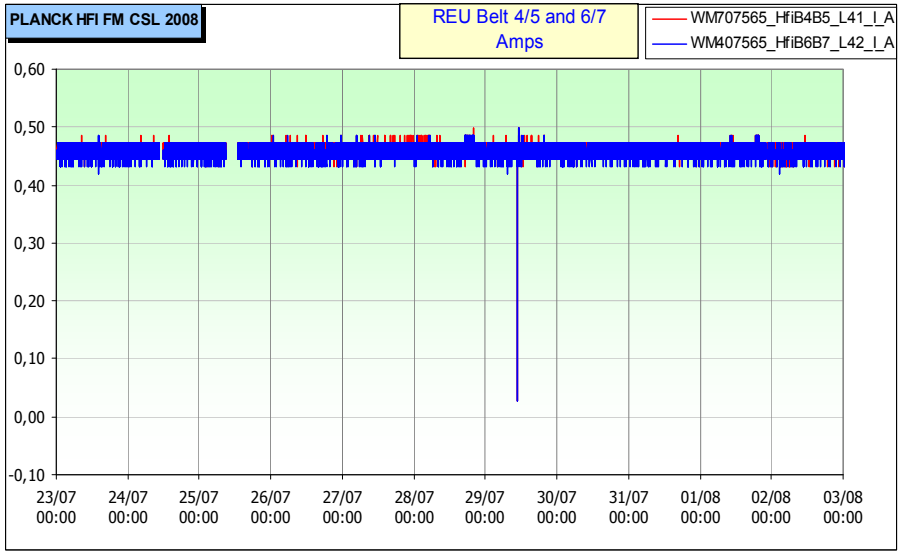

PLANCK HFI FM CSL 2008
REU Belt 0/1 and 2/3
Amps
WM406565_HfiB0B1_L39_I_A
WM706565_HfiB2B3_L40_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
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12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00

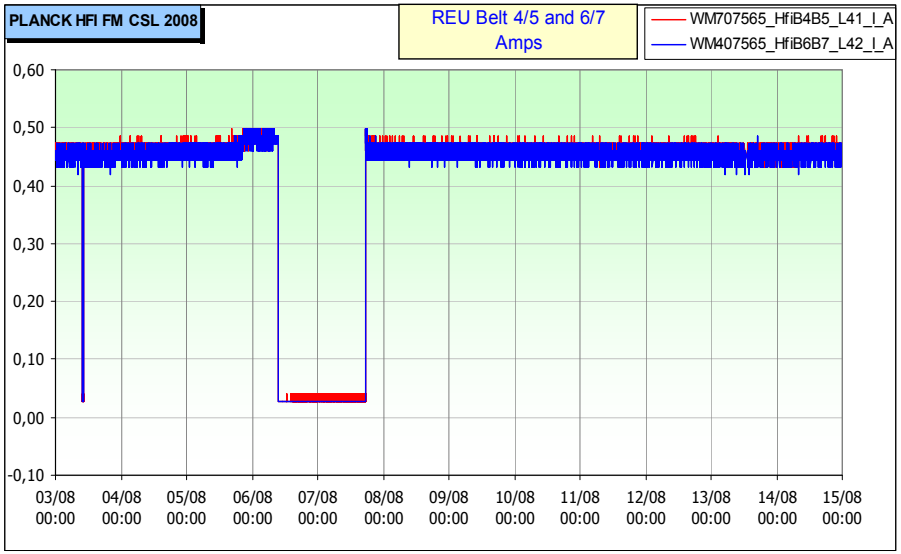

PLANCK HFI FM CSL 2008
REU Belt 0/1 and 2/3
Amps
WM406565_HfiB0B1_L39_I_A
WM706565_HfiB2B3_L40_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

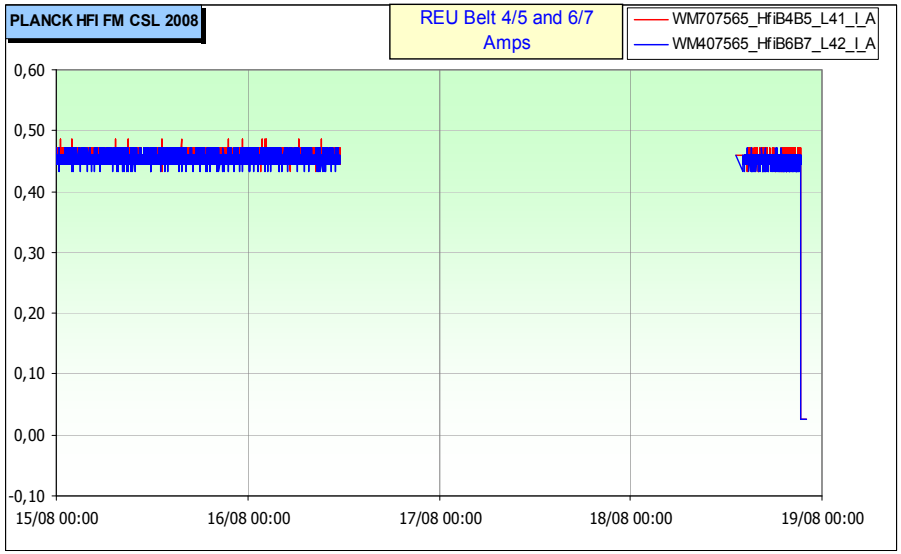

PLANCK HFI FM CSL 2008
REU Belt 4/5 and 6/7 Amps
WM707565_HfiB4B5_L41_I_A
WM407565_HfiB6B7_L42_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
25/06 00:00
26/06 00:00
27/06 00:00
28/06 00:00
29/06 00:00
30/06 00:00

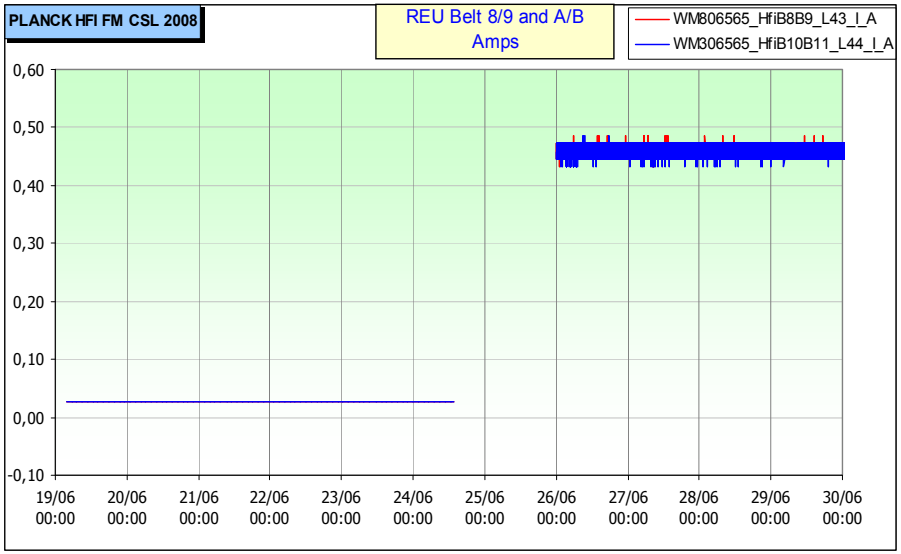

PLANCK HFI FM CSL 2008
REU Belt 4/5 and 6/7 Amps
WM707565_HfiB4B5_L41_I_A
WM407565_HfiB6B7_L42_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
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07/07 00:00
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09/07 00:00
10/07 00:00
11/07 00:00
12/07 00:00

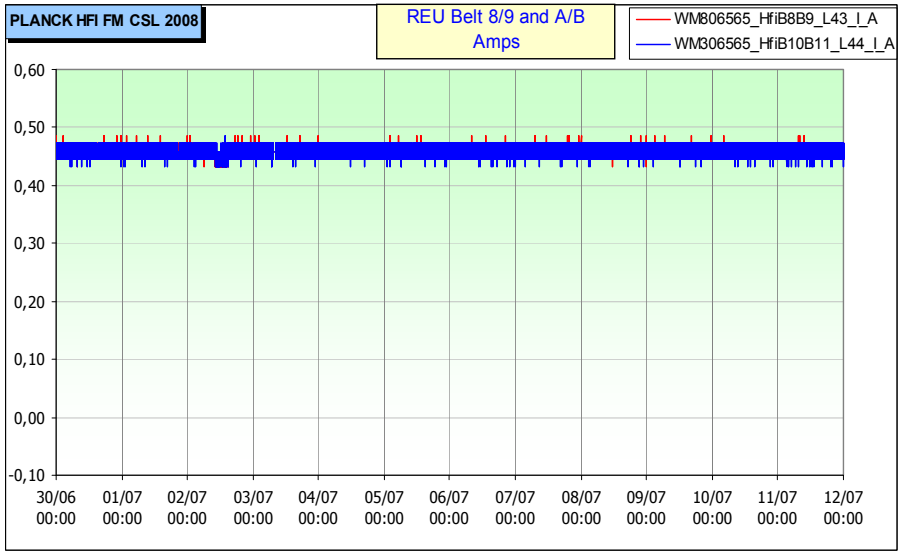

PLANCK HFI FM CSL 2008
REU Belt 4/5 and 6/7 Amps
WM707565_HfiB4B5_L41_I_A
WM407565_HfiB6B7_L42_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00

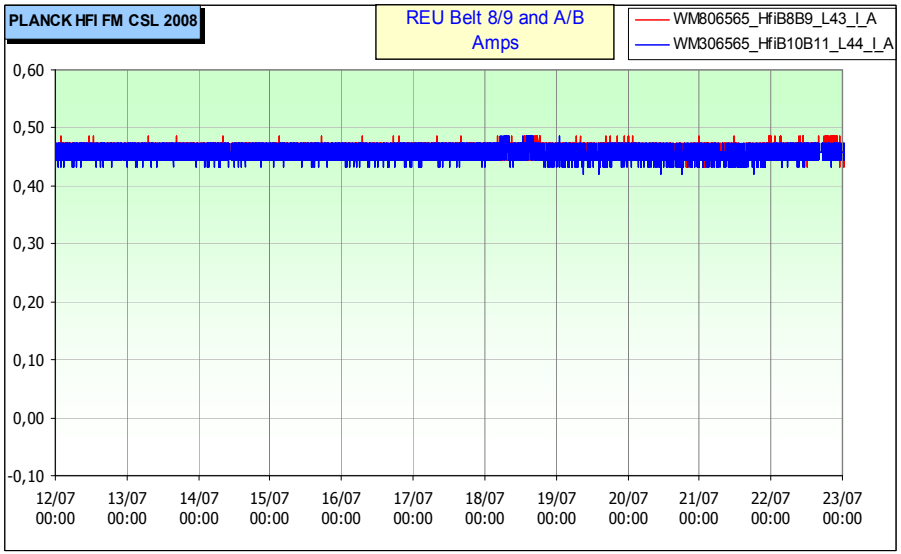

PLANCK HFI FM CSL 2008
REU Belt 4/5 and 6/7 Amps
WM707565_HfiB4B5_L41_I_A
WM407565_HfiB6B7_L42_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

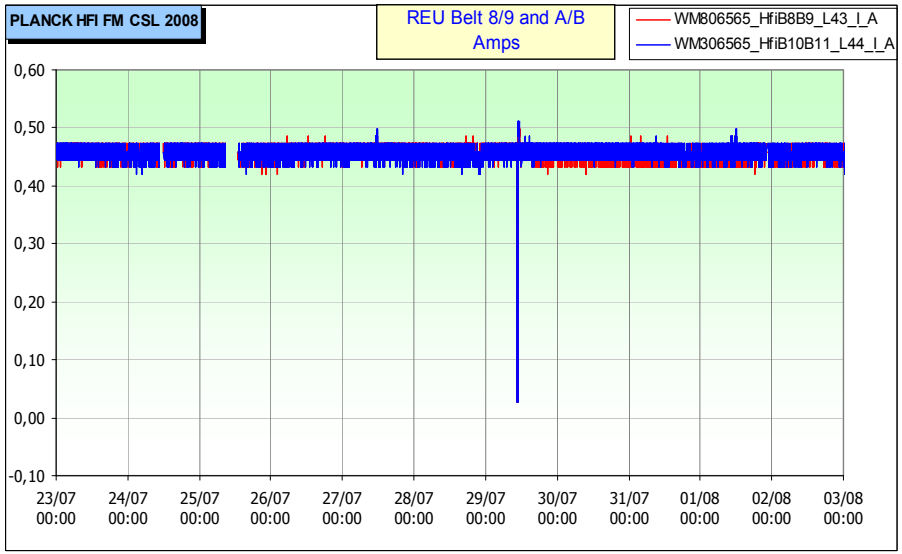

PLANCK HFI FM CSL 2008
REU Belt 4/5 and 6/7
Amps
WM707565_HfiB4B5_L41_I_A
WM407565_HfiB6B7_L42_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00

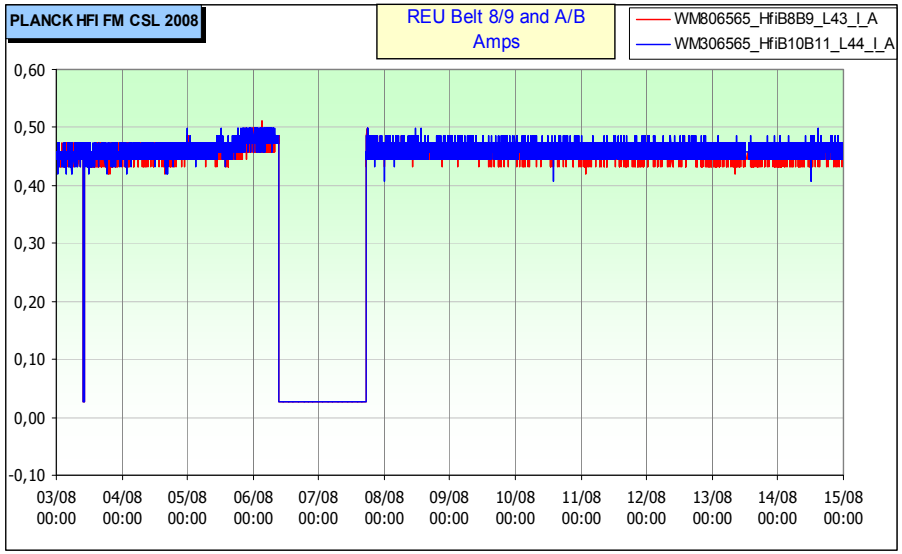

PLANCK HFI FM CSL 2008
REU Belt 4/5 and 6/7
Amps
WM707565_HfiB4B5_L41_I_A
WM407565_HfiB6B7_L42_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
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19/08 00:00

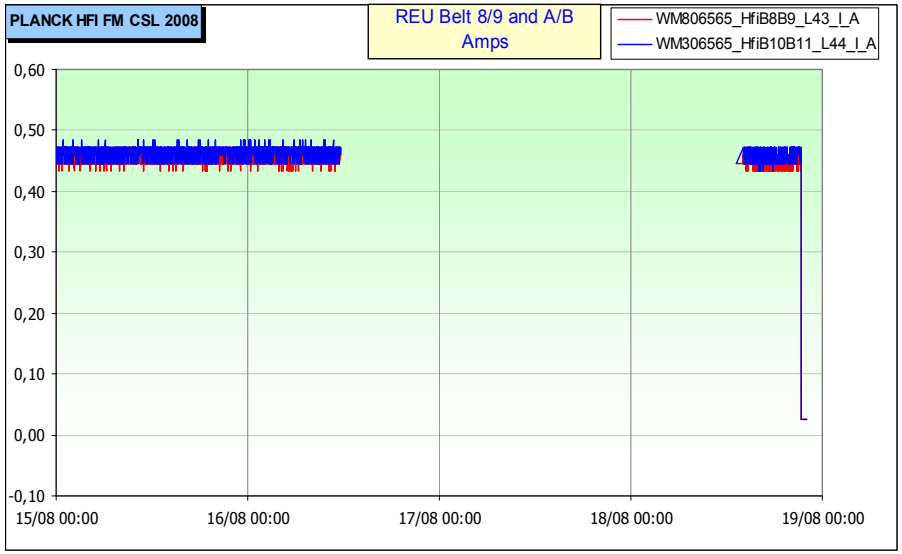

PLANCK HFI FM CSL 2008
REU Belt 8/9 and A/B Amps
WM806565_HfiB8B9_L43_I_A
WM306565_HfiB10B11_L44_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
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29/06 00:00
30/06 00:00

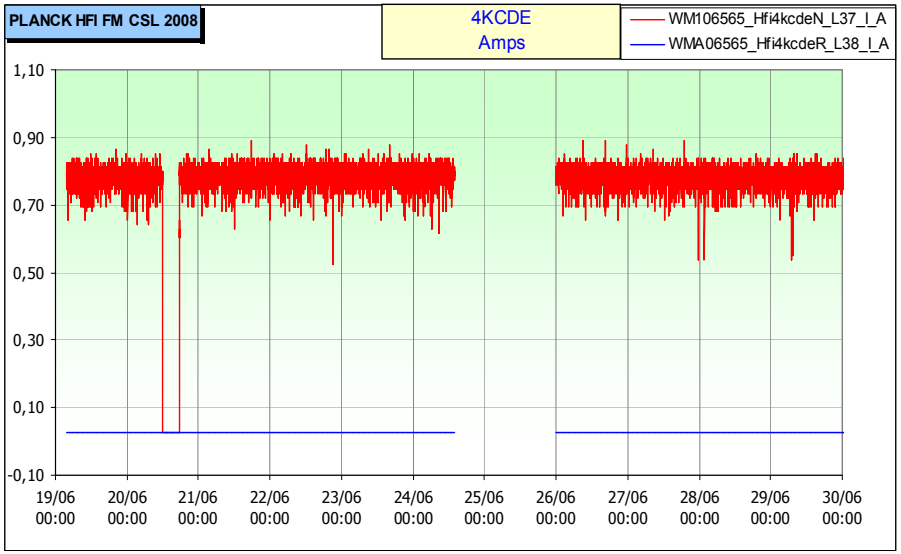

PLANCK HFI FM CSL 2008
REU Belt 8/9 and A/B Amps
WM806565_HfiB8B9_L43_I_A
WM306565_HfiB10B11_L44_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
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12/07 00:00

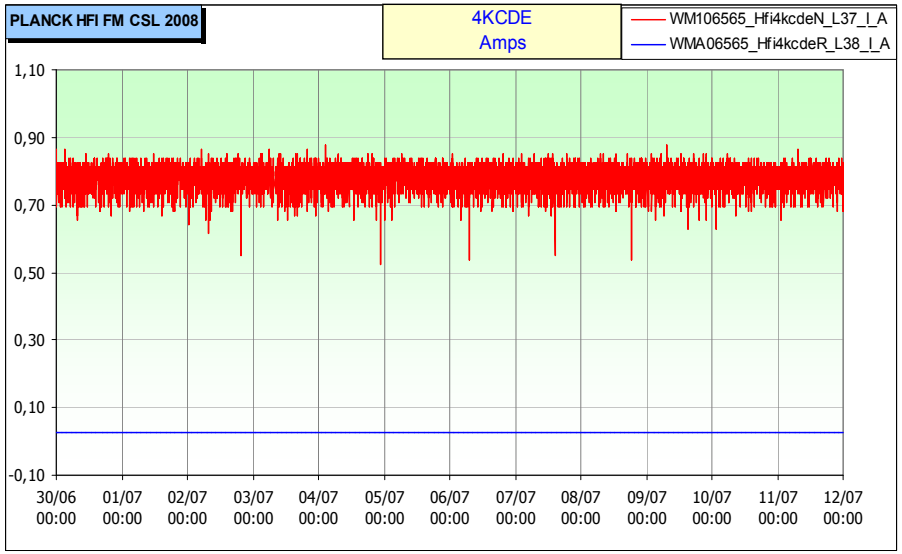

PLANCK HFI FM CSL 2008
REU Belt 8/9 and A/B Amps
WM806565_HfiB8B9_L43_I_A
WM306565_HfiB10B11_L44_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
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22/07 00:00
23/07 00:00

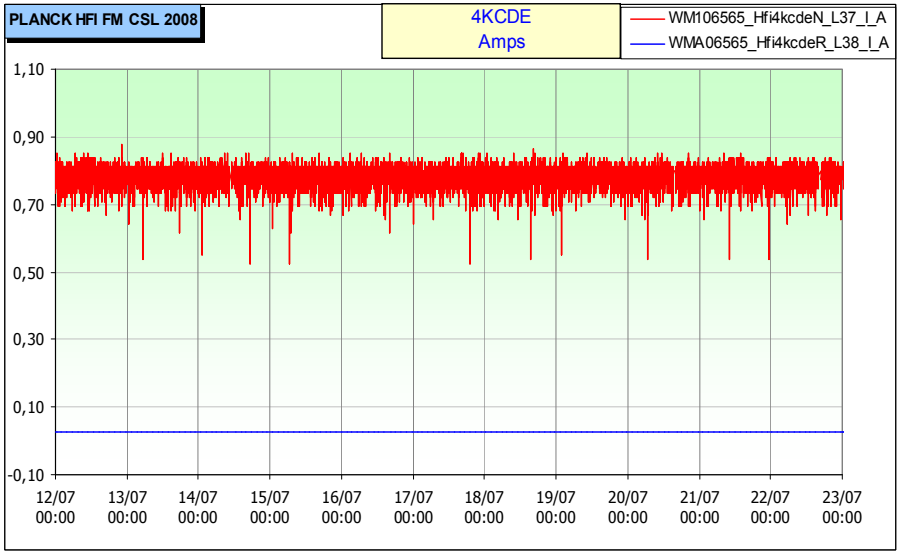

PLANCK HFI FM CSL 2008
REU Belt 8/9 and A/B Amps
WM806565_HfiB8B9_L43_I_A
WM306565_HfiB10B11_L44_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
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02/08 00:00
03/08 00:00

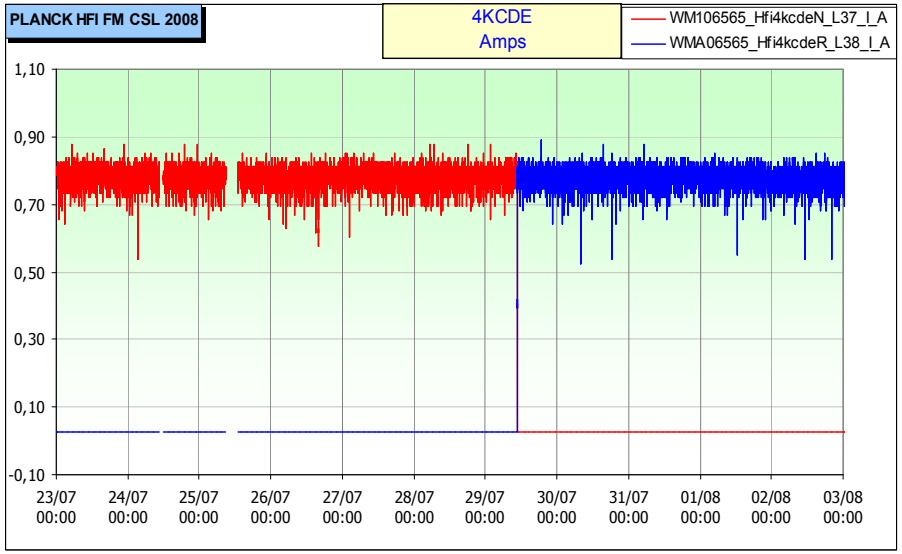

PLANCK HFI FM CSL 2008
REU Belt 8/9 and A/B Amps
WM806565_HfiB8B9_L43_I_A
WM306565_HfiB10B11_L44_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
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14/08 00:00
15/08 00:00

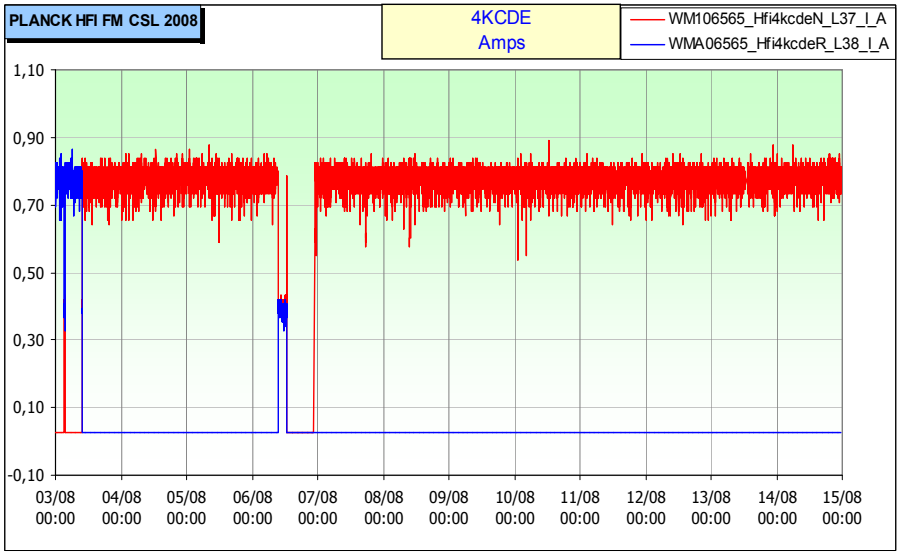

PLANCK HFI FM CSL 2008
REU Belt 8/9 and A/B Amps
WM806565_HfiB8B9_L43_I_A
WM306565_HfiB10B11_L44_I_A
0,60
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

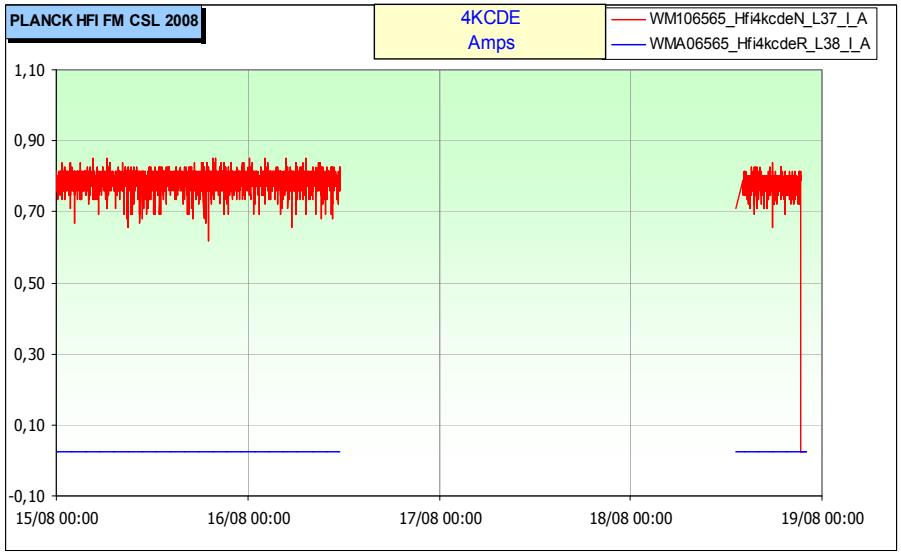

PLANCK HFI FM CSL 2008
4KCDE
Amps
WM106565_Hfi4kcdeN_L37_I_A
WMA06565_Hfi4kcdeR_L38_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
25/06 00:00
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29/06 00:00
30/06 00:00

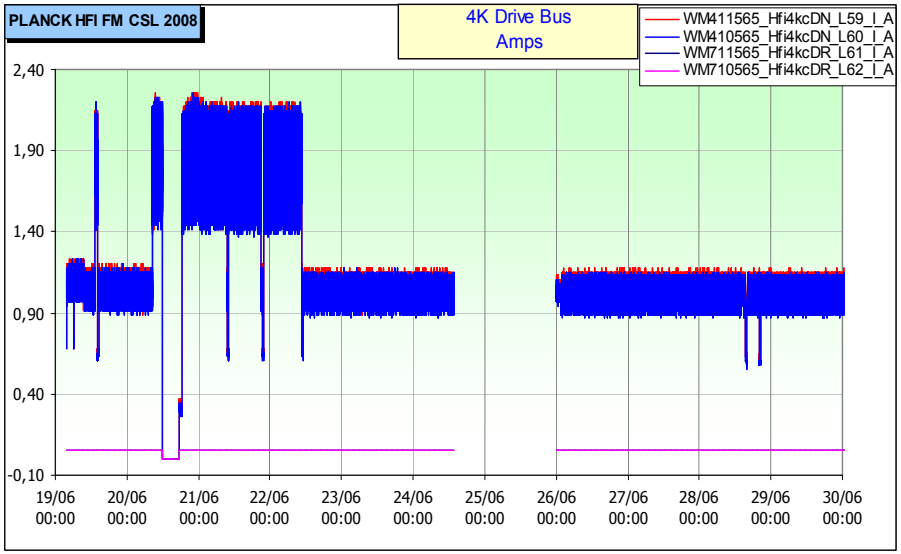

PLANCK HFI FM CSL 2008
4KCDE
Amps
WM106565_Hfi4kcdeN_L37_I_A
WMA06565_Hfi4kcdeR_L38_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
06/07 00:00
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11/07 00:00
12/07 00:00

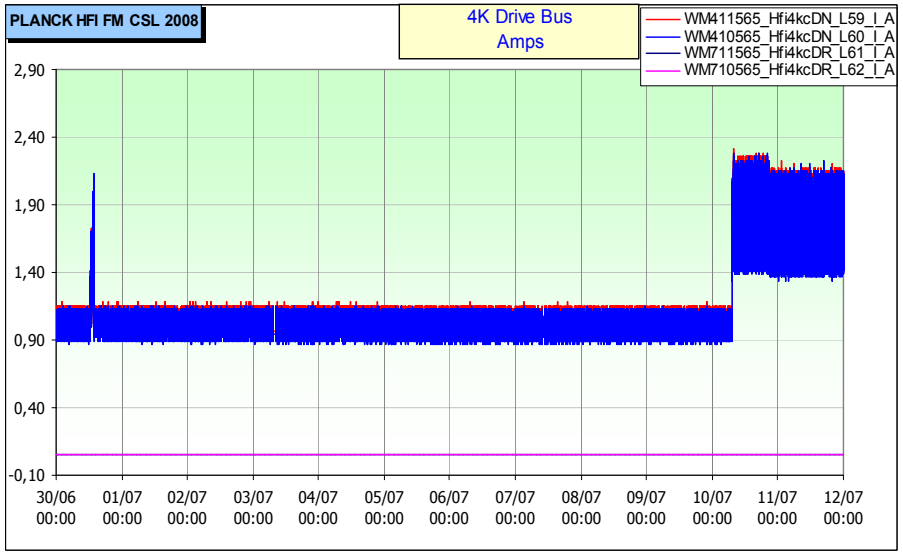

PLANCK HFI FM CSL 2008
4KCDE
Amps
WM106565_Hfi4kcdeN_L37_I_A
WMA06565_Hfi4kcdeR_L38_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
18/07 00:00
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22/07 00:00
23/07 00:00

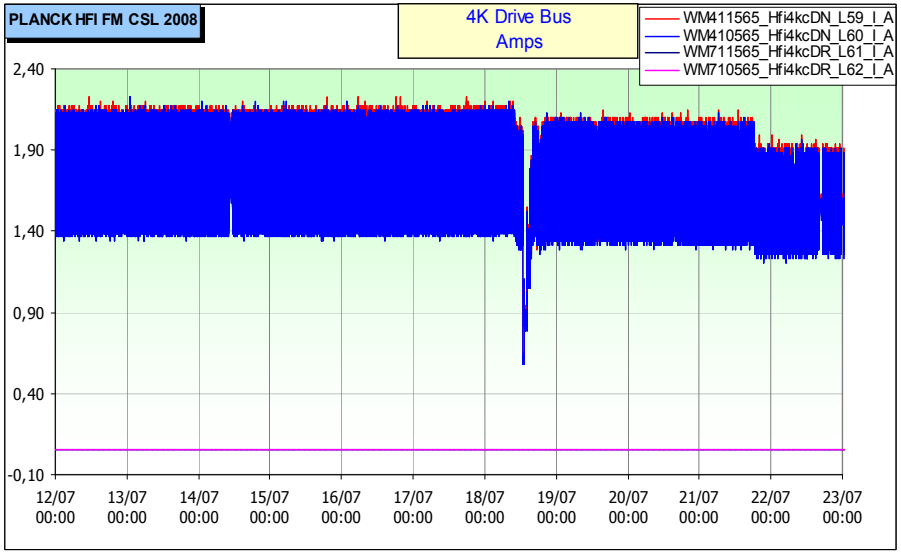

PLANCK HFI FM CSL 2008
4KCDE
Amps
WM106565_Hfi4kcdeN_L37_I_A
WMA06565_Hfi4kcdeR_L38_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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02/08 00:00
03/08 00:00

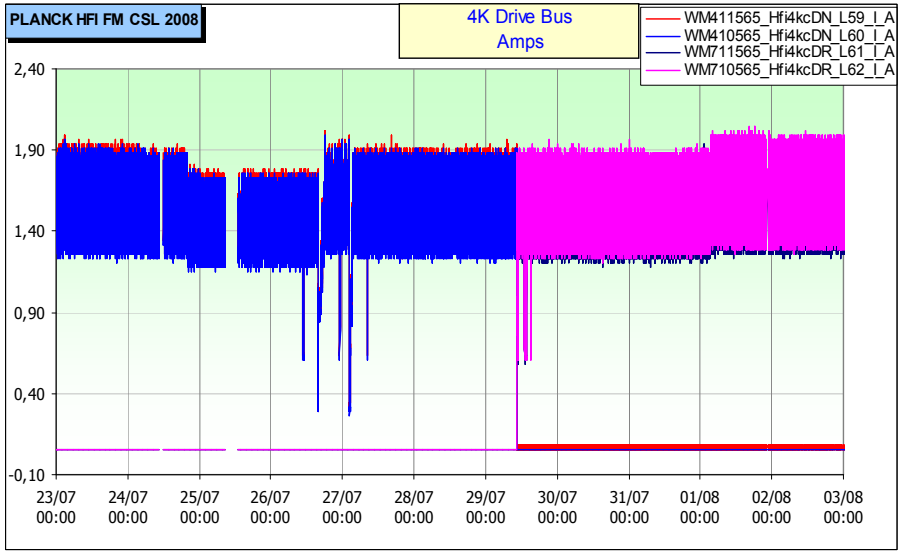

PLANCK HFI FM CSL 2008
4KCDE
Amps
WM106565_Hfi4kcdeN_L37_I_A
WMA06565_Hfi4kcdeR_L38_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
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14/08 00:00
15/08 00:00

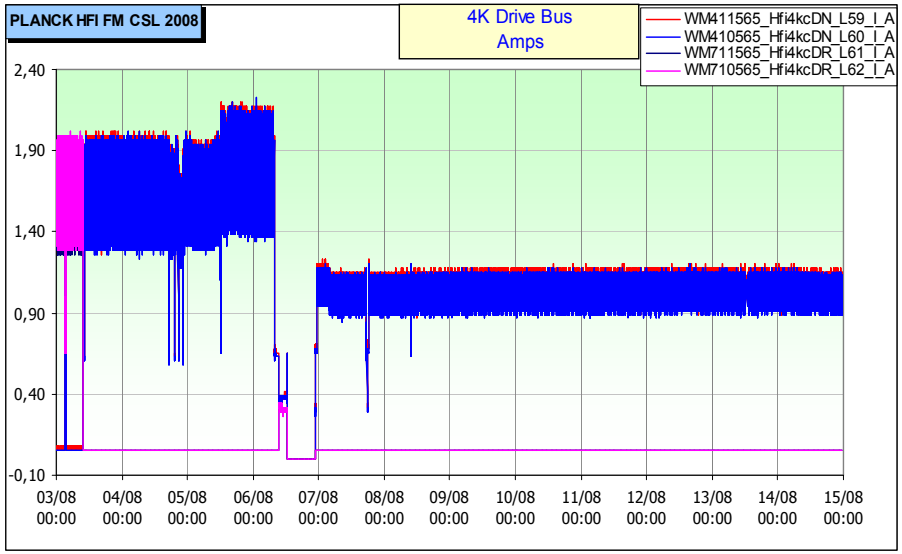

PLANCK HFI FM CSL 2008
4KCDE
Amps
WM106565_Hfi4kcdeN_L37_I_A
WMA06565_Hfi4kcdeR_L38_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

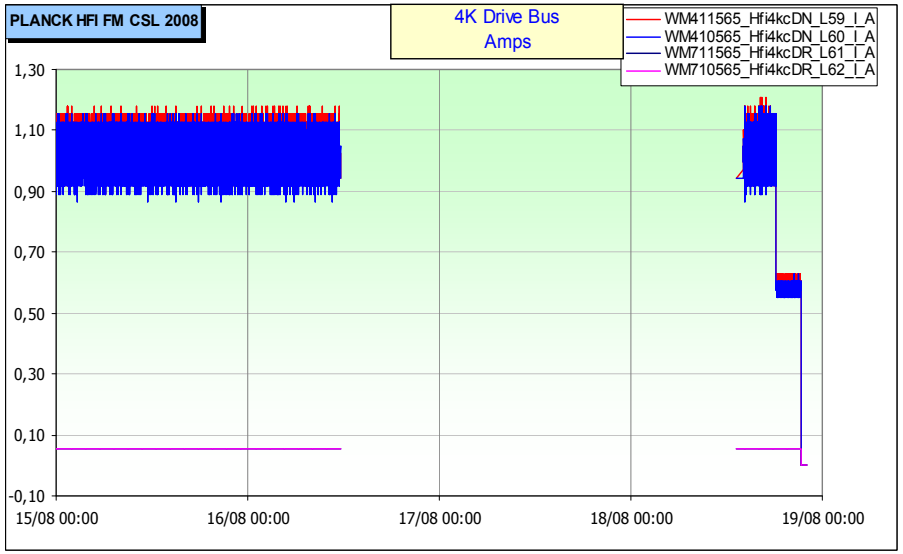

PLANCK HFI FM CSL 2008
4K Drive Bus
Amps
WM411565_Hfi4kcDN_L59_I_A
WM410565_Hfi4kcDN_L60_I_A
WM711565_Hfi4kcDR_L61_I_A
WM710565_Hfi4kcDR_L62_I_A
2,40
1,90
1,40
0,90
0,40
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
25/06 00:00
26/06 00:00
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29/06 00:00
30/06 00:00

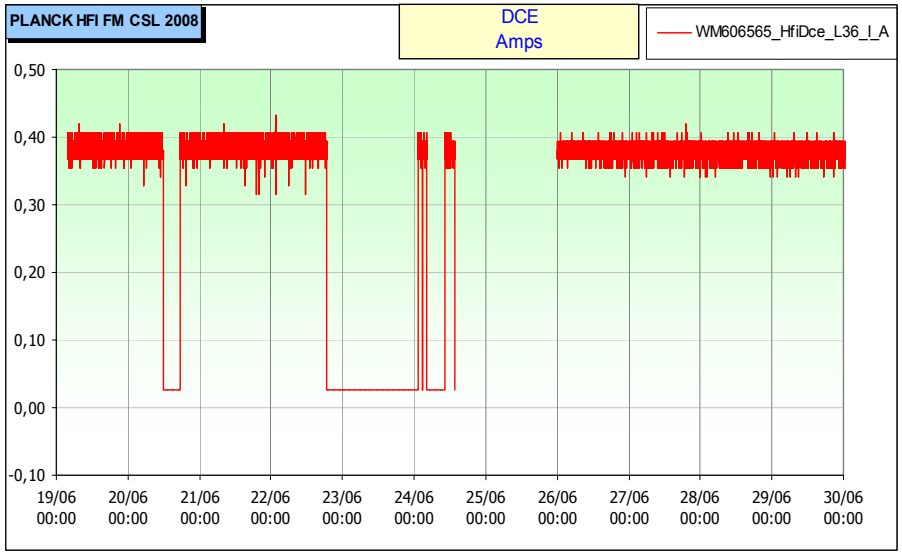

PLANCK HFI FM CSL 2008
4K Drive Bus
Amps
WM411565_Hfi4kcDN_L59_I_A
WM410565_Hfi4kcDN_L60_I_A
WM711565_Hfi4kcDR_L61_I_A
WM710565_Hfi4kcDR_L62_I_A
2,90
2,40
1,90
1,40
0,90
0,40
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
06/07 00:00
07/07 00:00
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11/07 00:00
12/07 00:00

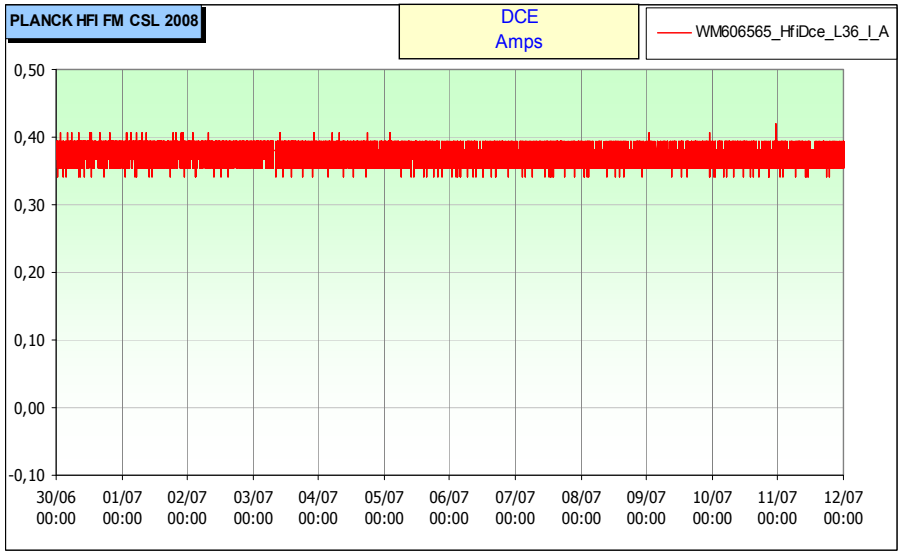

PLANCK HFI FM CSL 2008
4K Drive Bus
Amps
WM411565_Hfi4kcDN_L59_I_A
WM410565_Hfi4kcDN_L60_I_A
WM711565_Hfi4kcDR_L61_I_A
WM710565_Hfi4kcDR_L62_I_A
2,40
1,90
1,40
0,90
0,40
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
18/07 00:00
19/07 00:00
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22/07 00:00
23/07 00:00

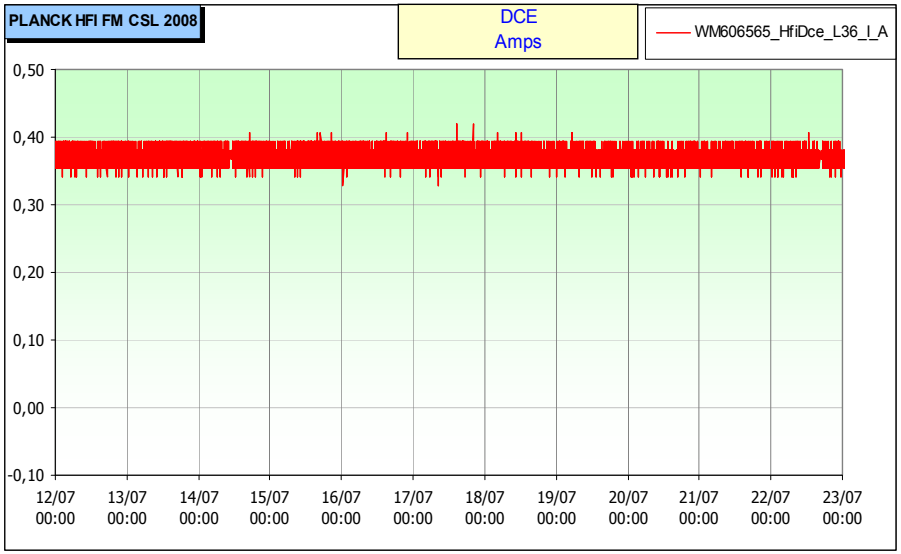

PLANCK HFI FM CSL 2008
4K Drive Bus
Amps
WM411565_Hfi4kcDN_L59_I_A
WM410565_Hfi4kcDN_L60_I_A
WM711565_Hfi4kcDR_L61_I_A
WM710565_Hfi4kcDR_L62_I_A
2,40
1,90
1,40
0,90
0,40
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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02/08 00:00
03/08 00:00

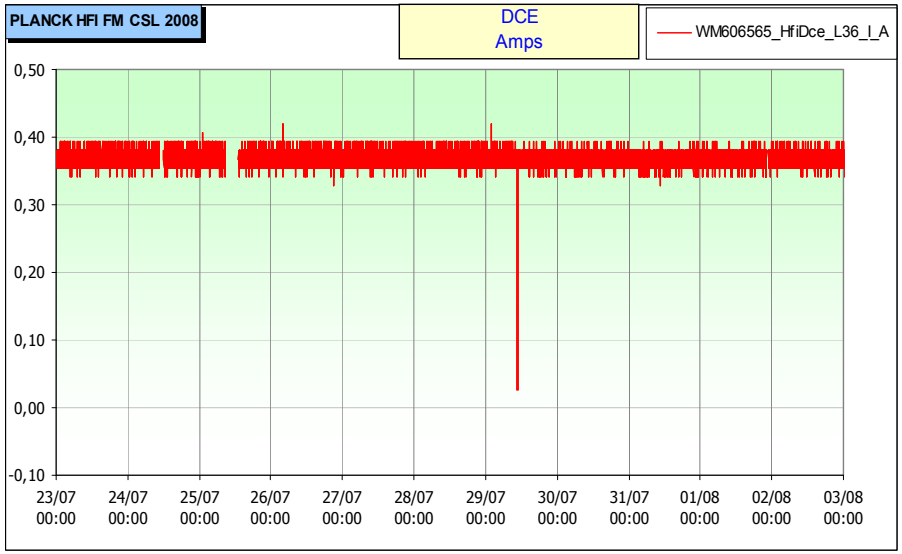

PLANCK HFI FM CSL 2008
4K Drive Bus
Amps
WM411565_Hfi4kcDN_L59_I_A
WM410565_Hfi4kcDN_L60_I_A
WM711565_Hfi4kcDR_L61_I_A
WM710565_Hfi4kcDR_L62_I_A
2,40
1,90
1,40
0,90
0,40
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
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14/08 00:00
15/08 00:00

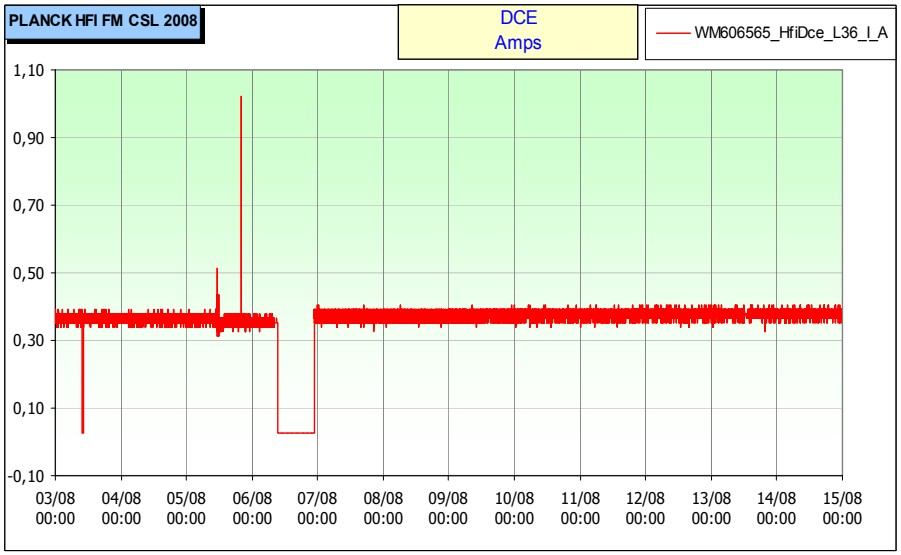

PLANCK HFI FM CSL 2008
4K Drive Bus
Amps
WM411565_Hfi4kcDN_L59_I_A
WM410565_Hfi4kcDN_L60_I_A
WM711565_Hfi4kcDR_L61_I_A
WM710565_Hfi4kcDR_L62_I_A
1,30
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

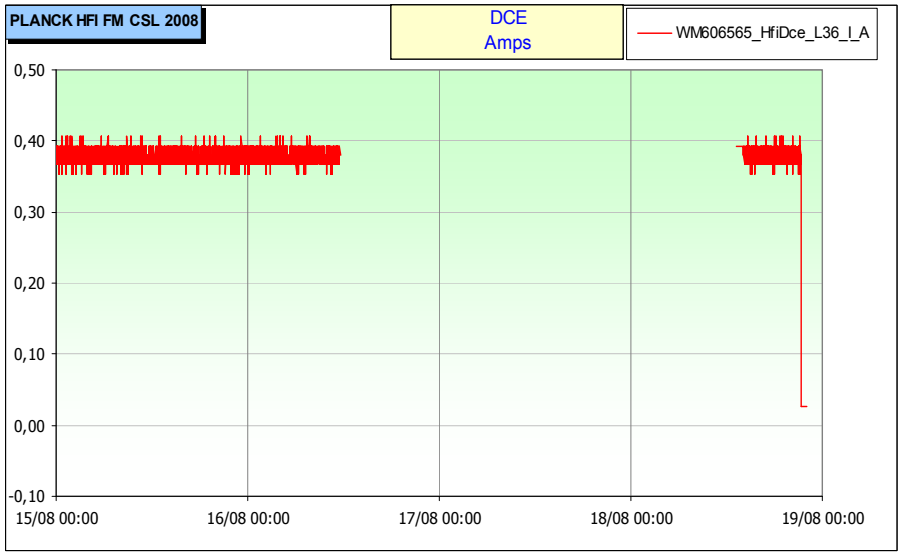

PLANCK HFI FM CSL 2008
DCE
Amps
WM606565_HfiDce_L36_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
19/06 00:00
20/06 00:00
21/06 00:00
22/06 00:00
23/06 00:00
24/06 00:00
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29/06 00:00
30/06 00:00

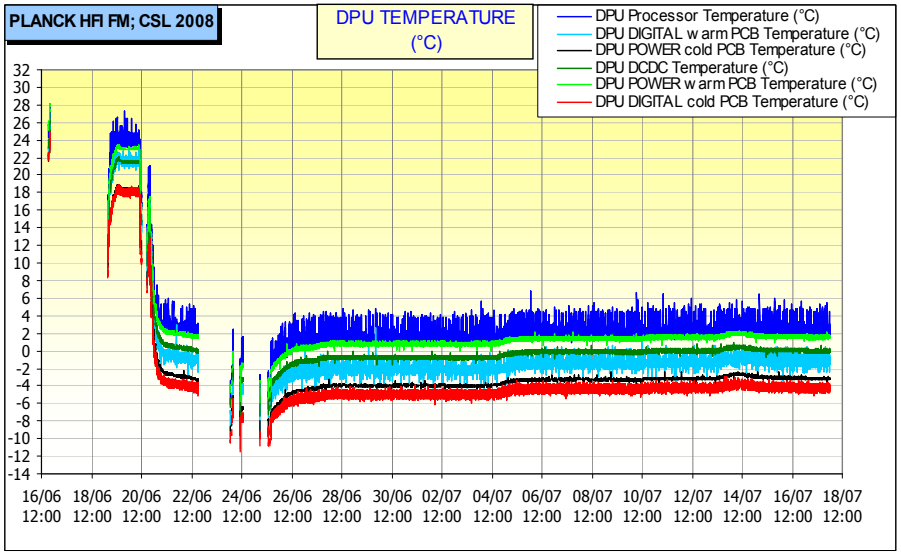

PLANCK HFI FM CSL 2008
DCE
Amps
WM606565_HfiDce_L36_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
30/06 00:00
01/07 00:00
02/07 00:00
03/07 00:00
04/07 00:00
05/07 00:00
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11/07 00:00
12/07 00:00

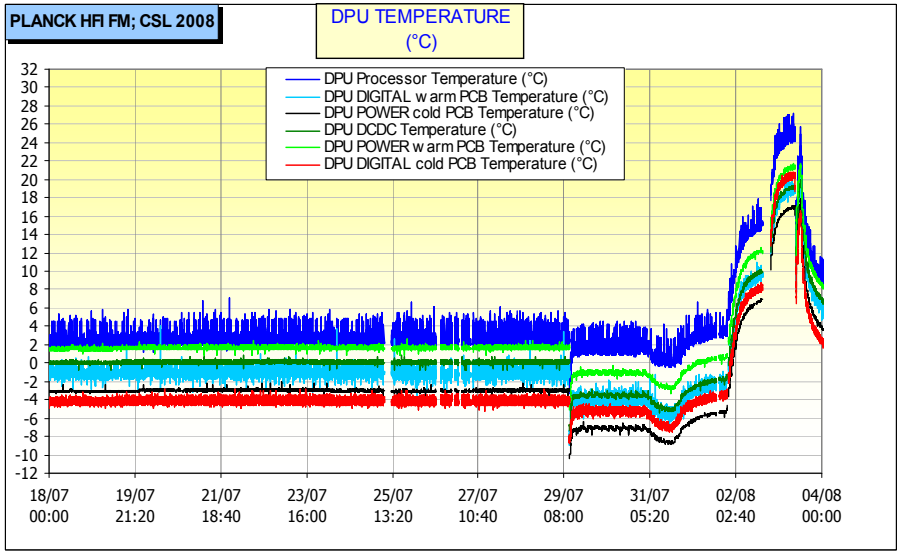

PLANCK HFI FM CSL 2008
DCE
Amps
WM606565_HfiDce_L36_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
12/07 00:00
13/07 00:00
14/07 00:00
15/07 00:00
16/07 00:00
17/07 00:00
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22/07 00:00
23/07 00:00

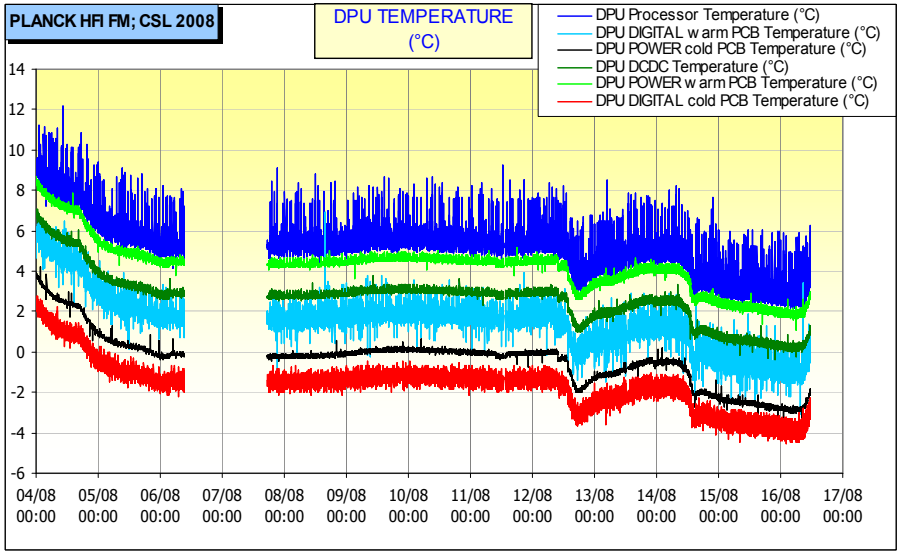

PLANCK HFI FM CSL 2008
DCE
Amps
WM606565_HfiDce_L36_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

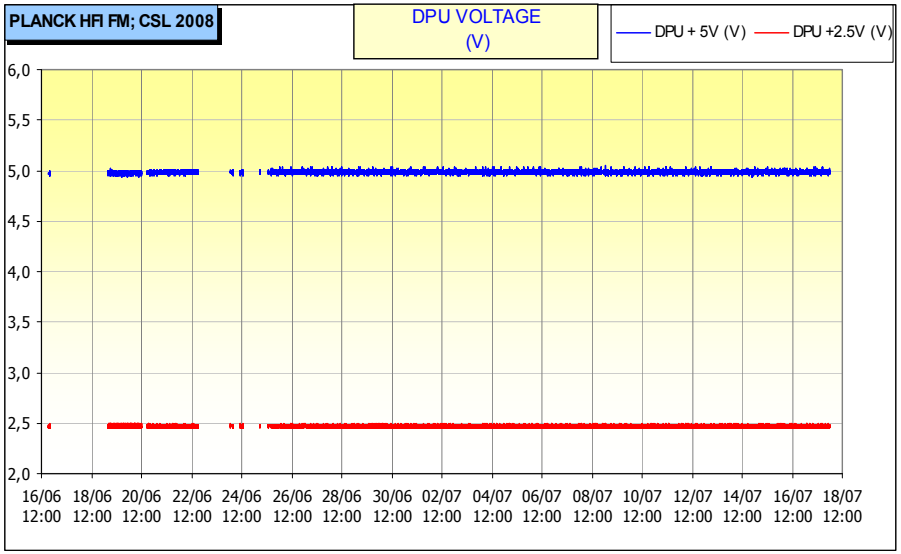

PLANCK HFI FM CSL 2008
DCE
Amps
WM606565_HfiDce_L36_I_A
1,10
0,90
0,70
0,50
0,30
0,10
-0,10
03/08 00:00
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00

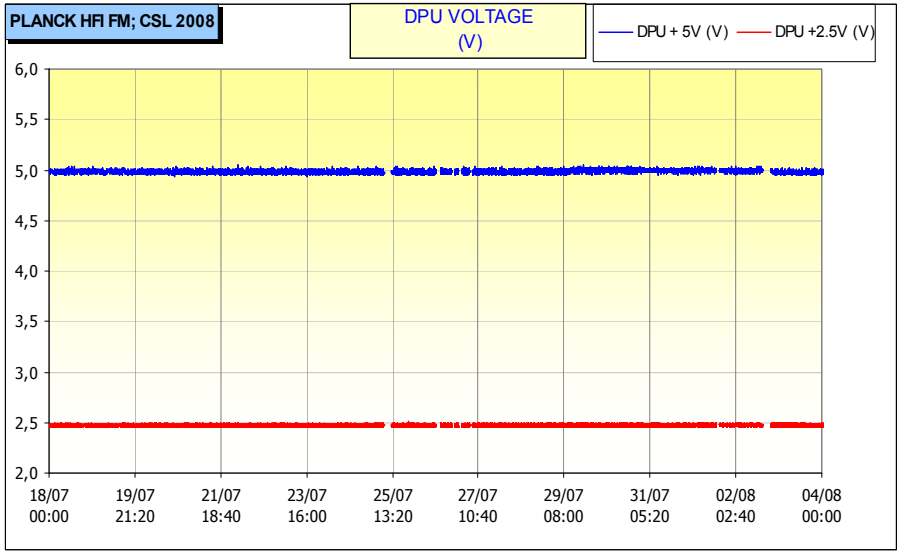

PLANCK HFI FM CSL 2008
DCE
Amps
WM606565_HfiDce_L36_I_A
0,50
0,40
0,30
0,20
0,10
0,00
-0,10
15/08 00:00
16/08 00:00
17/08 00:00
18/08 00:00
19/08 00:00

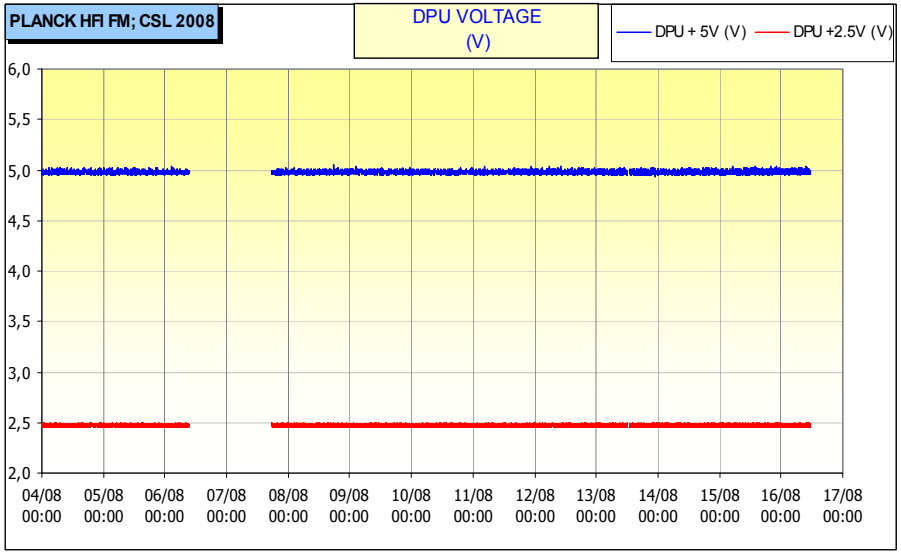

PLANCK HFI FM; CSL 2008
DPU TEMPERATURE (°C)
DPU Processor Temperature (°C)
DPU DIGITAL w arm PCB Temperature (°C)
DPU POWER cold PCB Temperature (°C)
DPU DCDC Temperature (°C)
DPU POWER w arm PCB Temperature (°C)
DPU DIGITAL cold PCB Temperature (°C)
32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10 -12 -14
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00

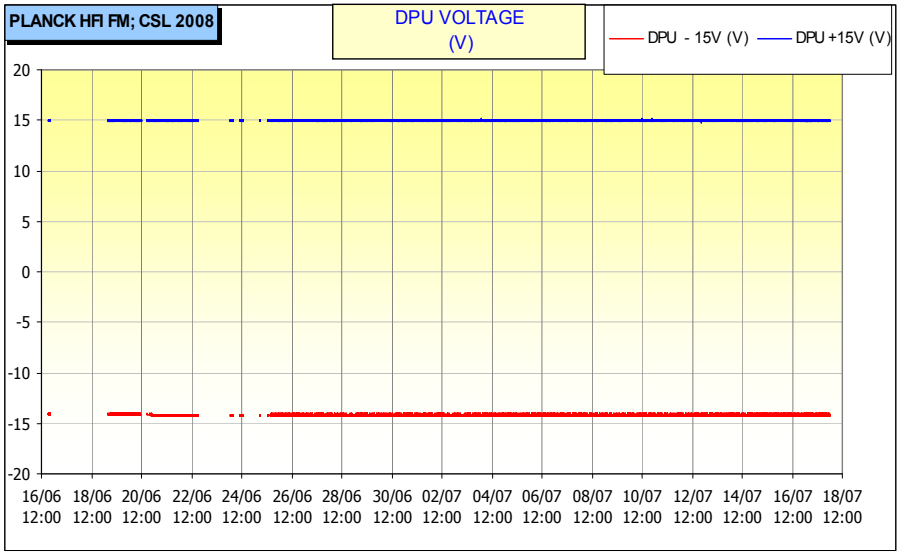

PLANCK HFI FM; CSL 2008
DPU TEMPERATURE (°C)
DPU Processor Temperature (°C)
DPU DIGITAL w arm PCB Temperature (°C)
DPU POWER cold PCB Temperature (°C)
DPU DCDC Temperature (°C)
DPU POWER w arm PCB Temperature (°C)
DPU DIGITAL cold PCB Temperature (°C)
32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0 -2 -4 -6 -8 -10 -12
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

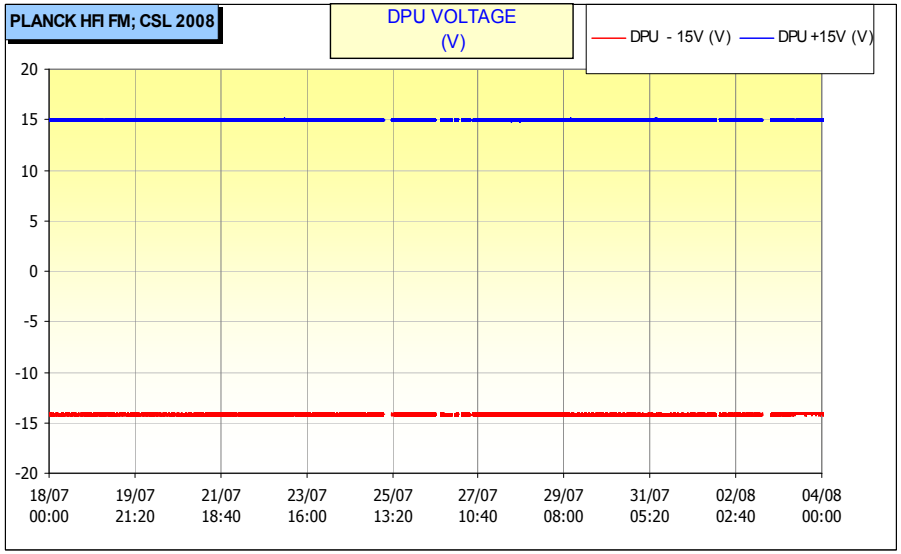

PLANCK HFI FM; CSL 2008
DPU TEMPERATURE (°C)
DPU Processor Temperature (°C)
DPU DIGITAL w arm PCB Temperature (°C)
DPU POWER cold PCB Temperature (°C)
DPU DCDC Temperature (°C)
DPU POWER w arm PCB Temperature (°C)
DPU DIGITAL cold PCB Temperature (°C)
14 12 10 8 6 4 2 0 -2 -4 -6
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

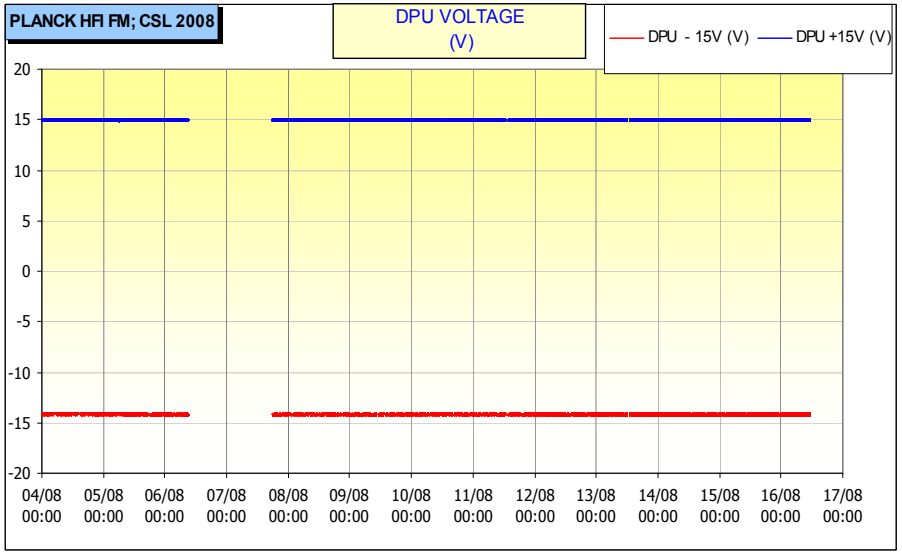

PLANCK HFI FM; CSL 2008
DPU VOLTAGE (V)
DPU + 5V (V)
DPU +2.5V (V)
6,0
5,5
5,0
4,5
4,0
3,5
3,0
2,5
2,0
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00

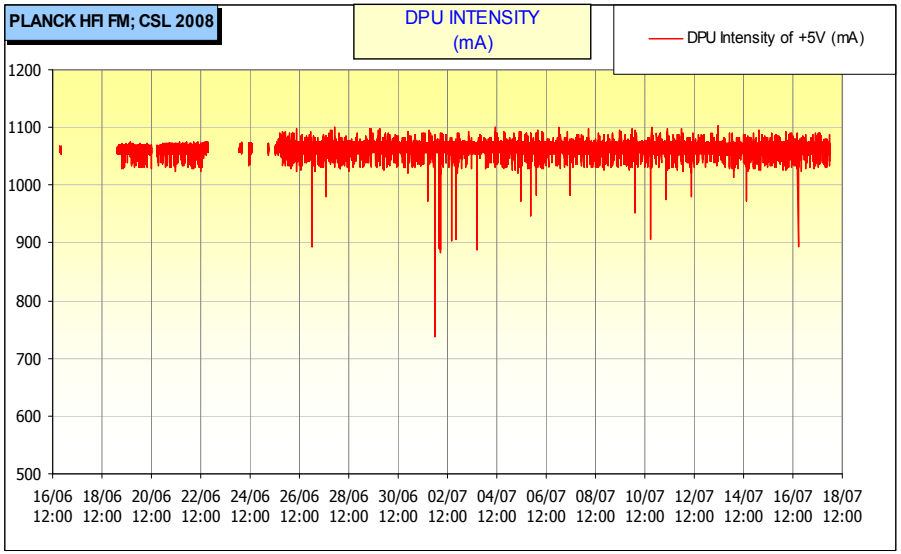

PLANCK HFI FM; CSL 2008
DPU VOLTAGE (V)
DPU + 5V (V)
DPU +2.5V (V)
6,0
5,5
5,0
4,5
4,0
3,5
3,0
2,5
2,0
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

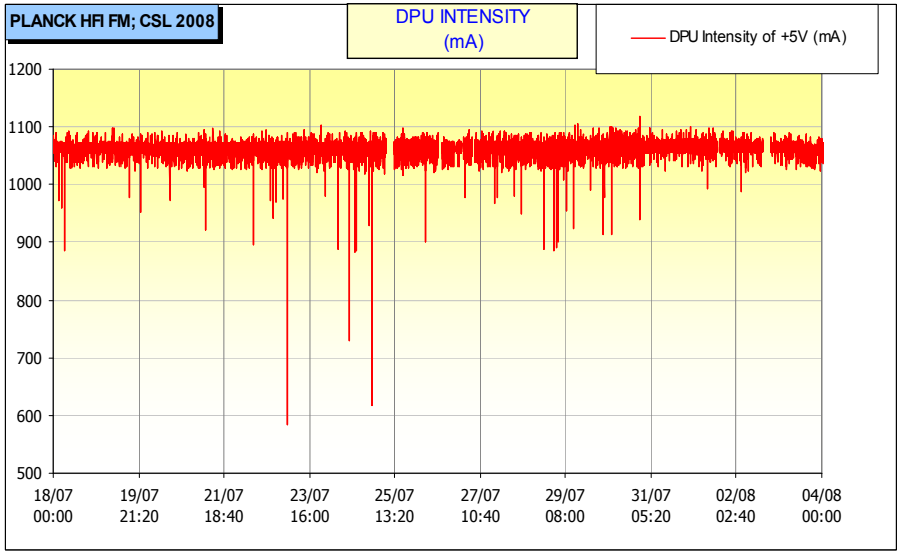

PLANCK HFI FM; CSL 2008
DPU VOLTAGE (V)
DPU + 5V (V)
DPU +2.5V (V)
6,0
5,5
5,0
4,5
4,0
3,5
3,0
2,5
2,0
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

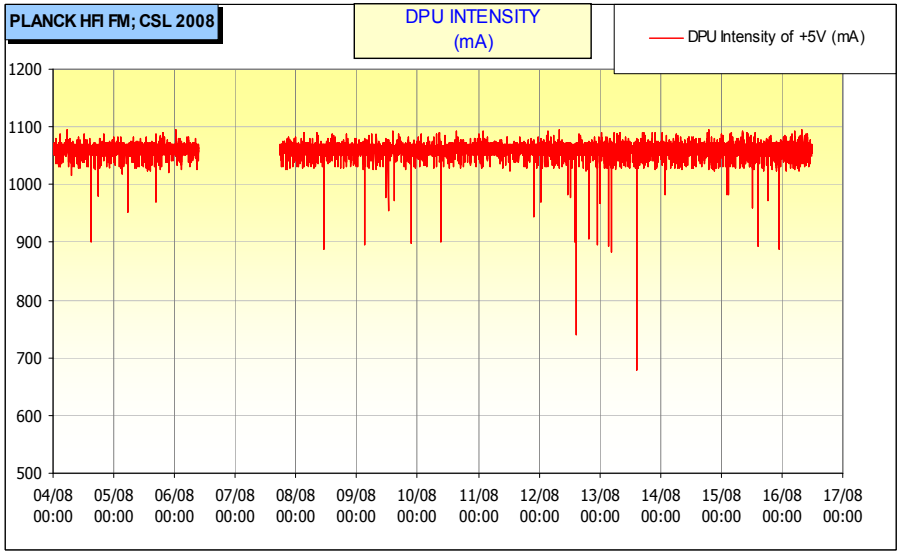

PLANCK HFI FM; CSL 2008
DPU VOLTAGE (V)
DPU - 15V (V)
DPU +15V (V)
20
15
10
5
0
-5
-10
-15
-20
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00

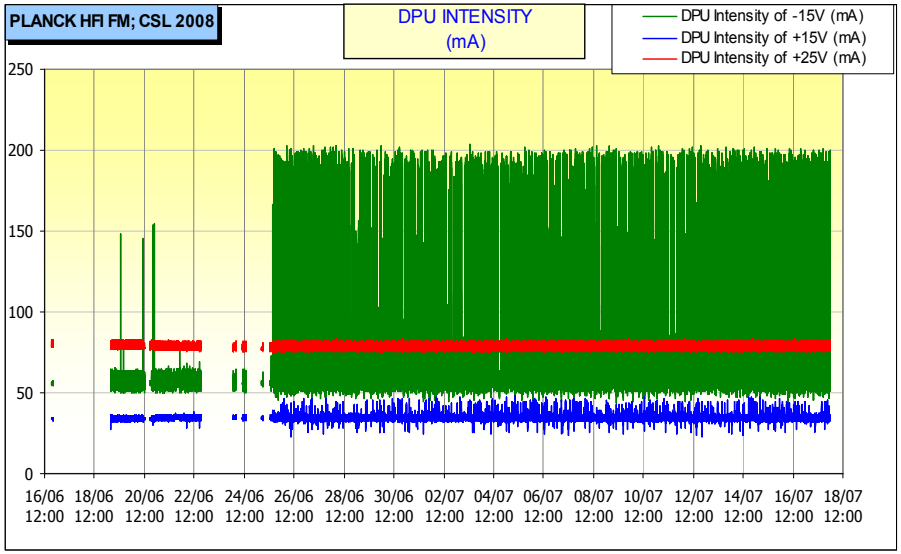

PLANCK HFI FM; CSL 2008
DPU VOLTAGE (V)
DPU - 15V (V)
DPU +15V (V)
20
15
10
5
0
-5
-10
-15
-20
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

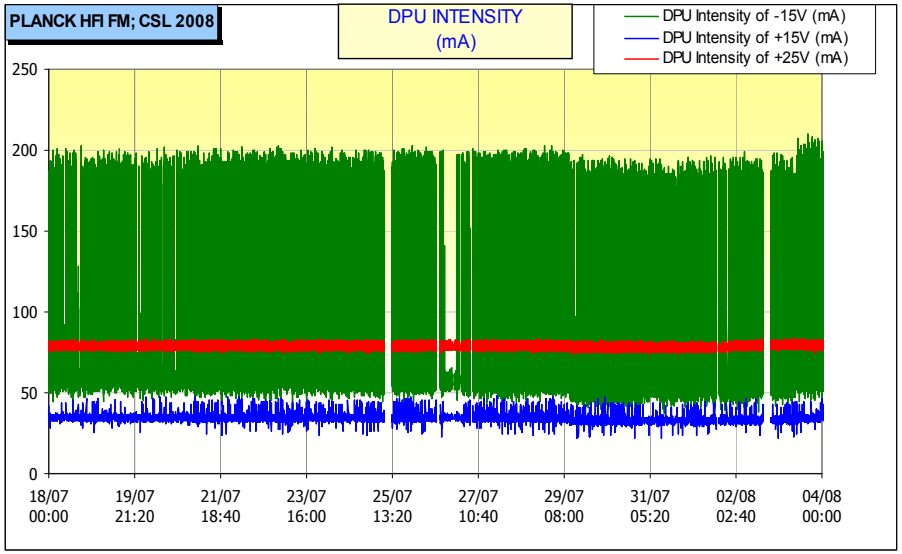

PLANCK HFI FM; CSL 2008
DPU VOLTAGE (V)
DPU - 15V (V)
DPU +15V (V)
20
15
10
5
0
-5
-10
-15
-20
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

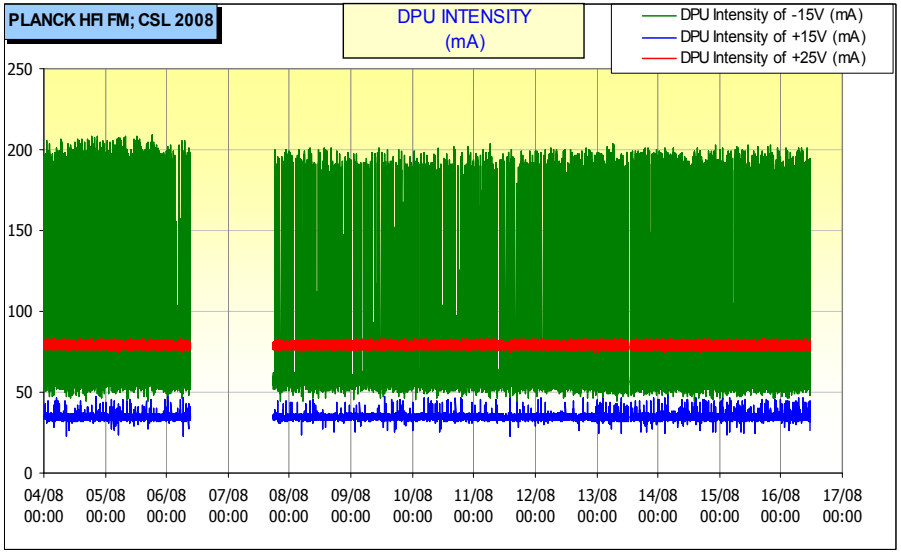

PLANCK HFI FM; CSL 2008
DPU INTENSITY (mA)
DPU Intensity of +5V (mA)
1200
1100
1000
900
800
700
600
500
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00

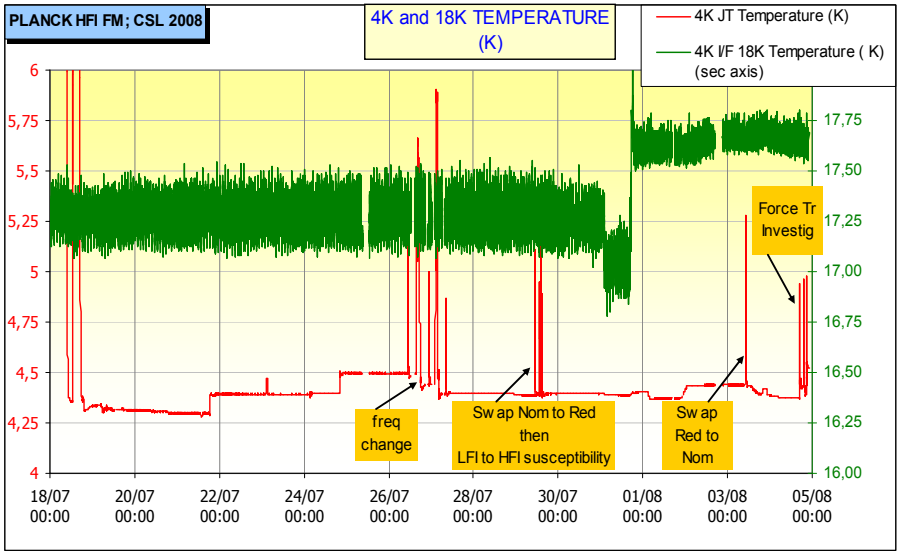

PLANCK HFI FM; CSL 2008
DPU INTENSITY (mA)
DPU Intensity of +5V (mA)
1200
1100
1000
900
800
700
600
500
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

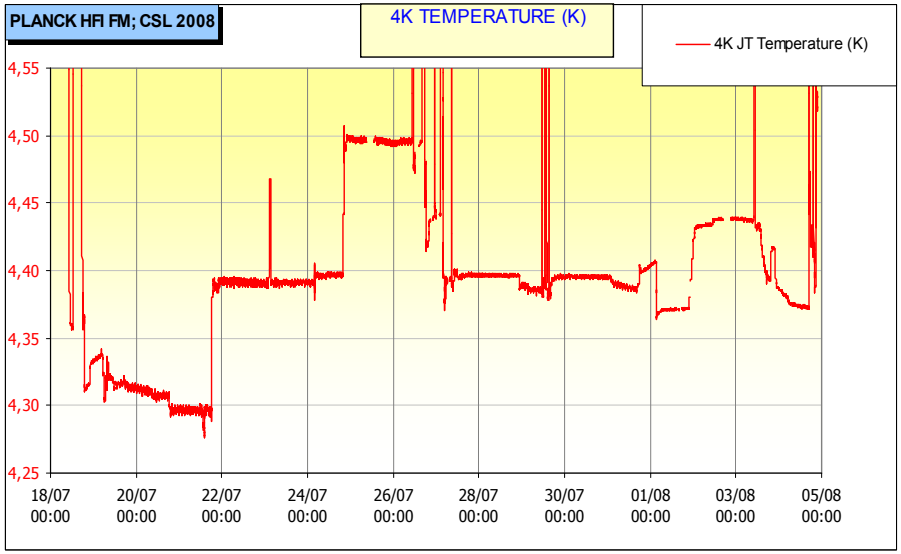

PLANCK HFI FM; CSL 2008
DPU INTENSITY (mA)
DPU Intensity of +5V (mA)
1200
1100
1000
900
800
700
600
500
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

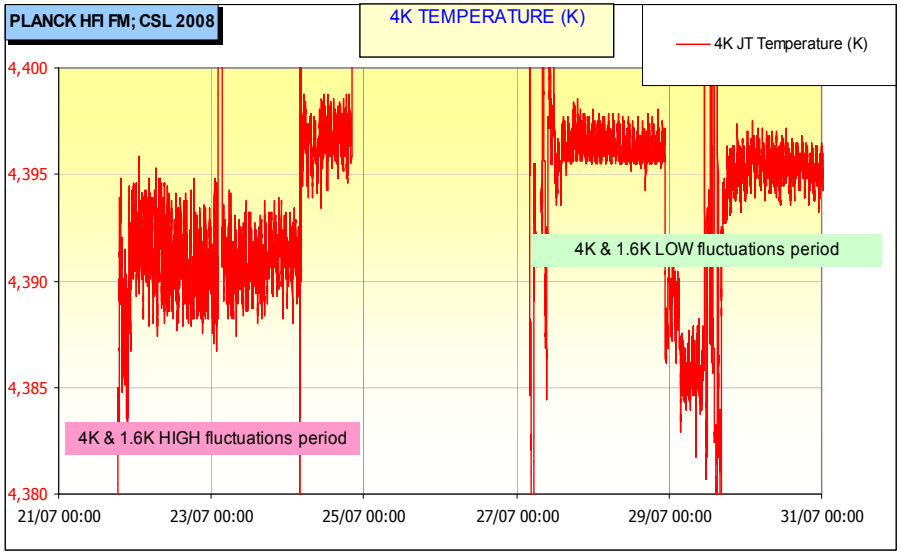

PLANCK HFI FM; CSL 2008
DPU INTENSITY (mA)
DPU Intensity of -15V (mA)
DPU Intensity of +15V (mA)
DPU Intensity of +25V (mA)
250
200
150
100
50
0
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00

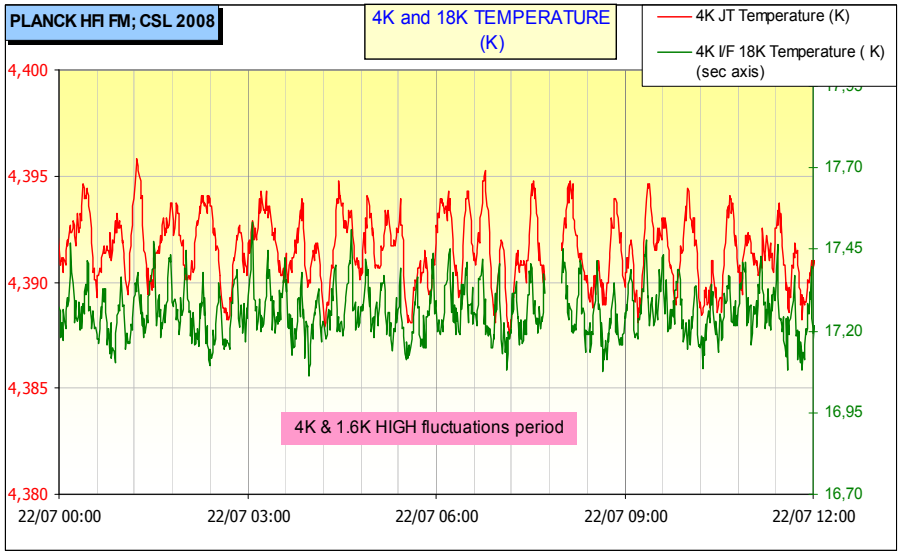

PLANCK HFI FM; CSL 2008
DPU INTENSITY (mA)
DPU Intensity of -15V (mA)
DPU Intensity of +15V (mA)
DPU Intensity of +25V (mA)
250
200
150
100
50
0
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

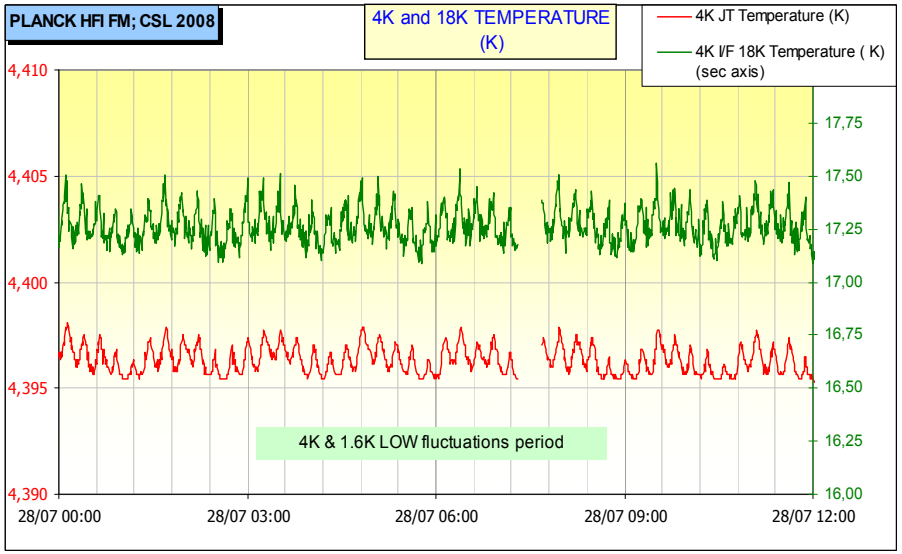

PLANCK HFI FM; CSL 2008
DPU INTENSITY (mA)
DPU Intensity of -15V (mA)
DPU Intensity of +15V (mA)
DPU Intensity of +25V (mA)
250
200
150
100
50
0
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

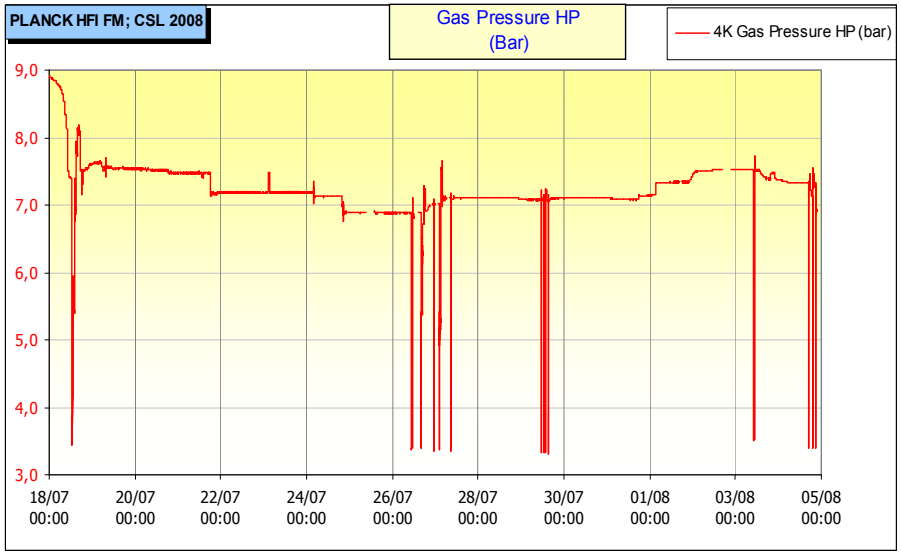

PLANCK HFI FM; CSL 2008
4K and 18K TEMPERATURE (K)
4K JT Temperature (K)
4K I/F 18K Temperature (K) (sec axis)
Force Tr Investig
freq change
Sw ap Nom to Red then LFI to HFI susceptibility
Sw ap Red to Nom
6
5,75
5,5
5,25
5
4,75
4,5
4,25
4
17,75
17,50
17,25
17,00
16,75
16,50
16,25
16,00
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

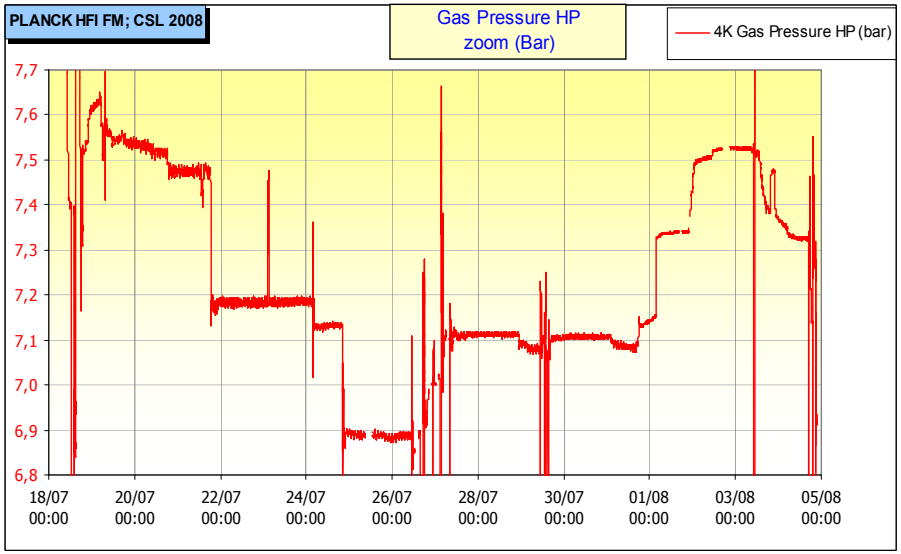

PLANCK HFI FM; CSL 2008
4K TEMPERATURE (K)
4K JT Temperature (K)
4,55
4,50
4,45
4,40
4,35
4,30
4,25
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

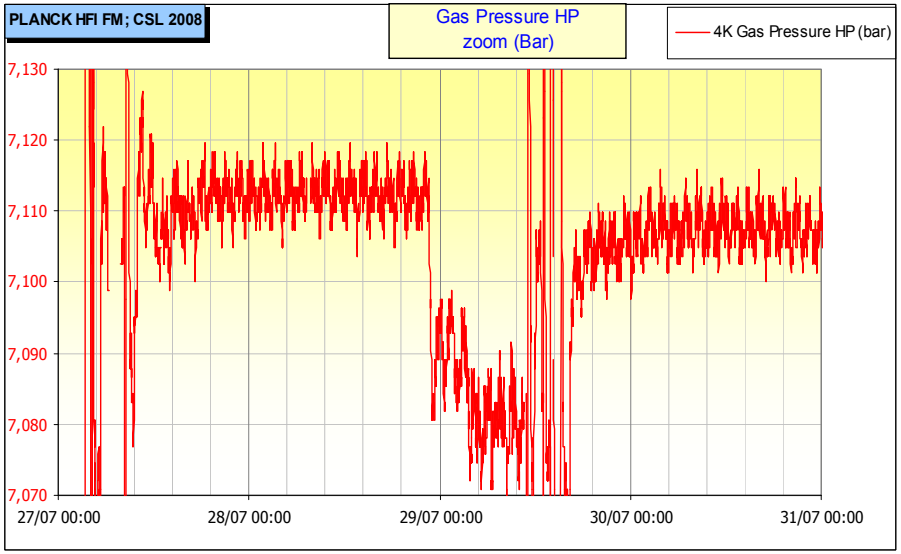

PLANCK HFI FM; CSL 2008
4K TEMPERATURE (K)
4K JT Temperature (K)
4K & 1.6K LOW fluctuations period
4K & 1.6K HIGH fluctuations period
4,400
4,395
4,390
4,385
4,380
21/07 00:00
23/07 00:00
25/07 00:00
27/07 00:00
29/07 00:00
31/07 00:00

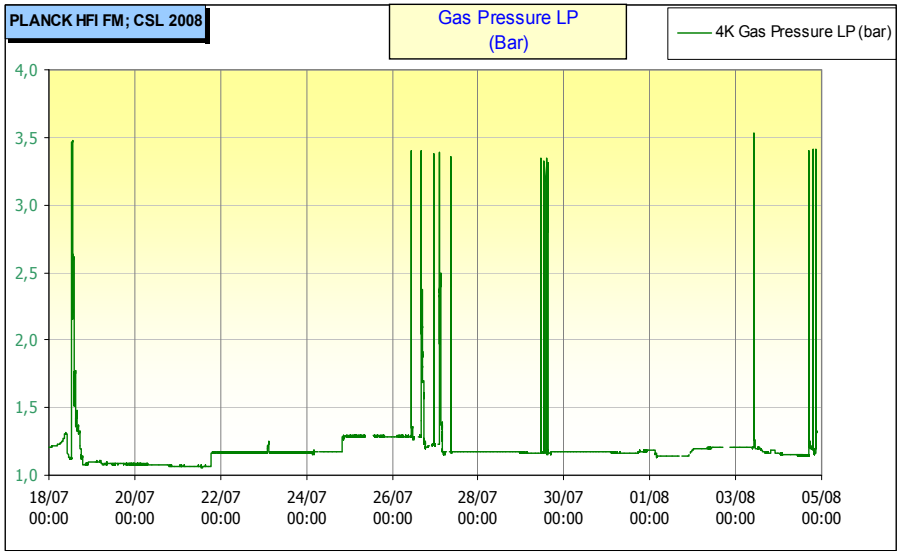

PLANCK HFI FM; CSL 2008
4K and 18K TEMPERATURE (K)
4K JT Temperature (K)
4K I/F 18K Temperature (K) (sec axis)
4,400
4,395
4,390
4,385
4,380
17,70
17,45
17,20
16,95
16,70
4K & 1.6K HIGH fluctuations period
22/07 00:00
22/07 03:00
22/07 06:00
22/07 09:00
22/07 12:00

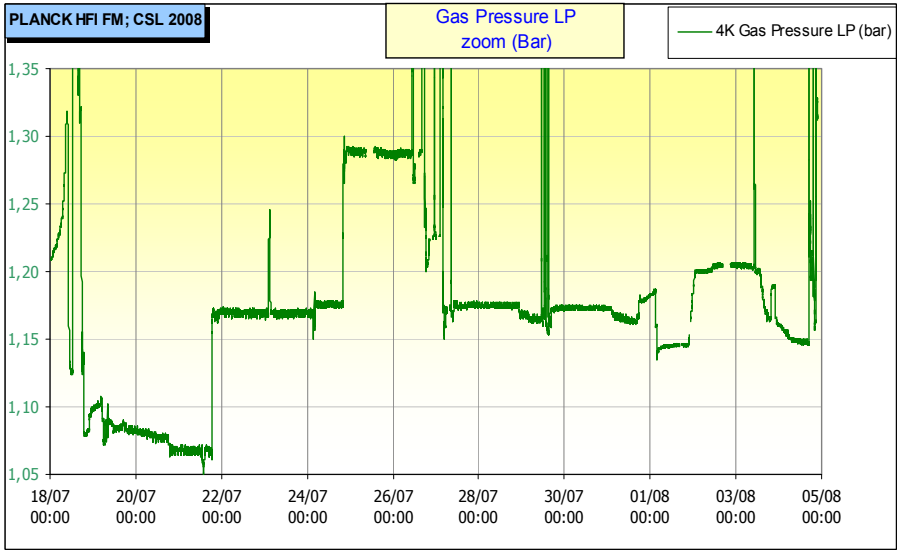

PLANCK HFI FM; CSL 2008
4K and 18K TEMPERATURE (K)
4K JT Temperature (K)
4K I/F 18K Temperature (K) (sec axis)
4,410
4,405
4,400
4,395
4,390
17,75
17,50
17,25
17,00
16,75
16,50
16,25
16,00
4K & 1.6K LOW fluctuations period
28/07 00:00
28/07 03:00
28/07 06:00
28/07 09:00
28/07 12:00

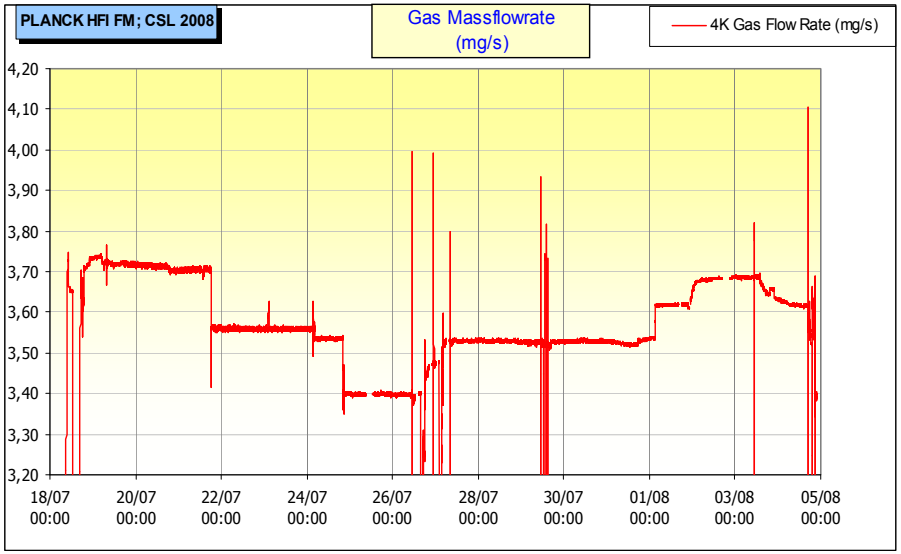

PLANCK HFI FM; CSL 2008
Gas Pressure HP (Bar)
4K Gas Pressure HP (bar)
9,0
8,0
7,0
6,0
5,0
4,0
3,0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

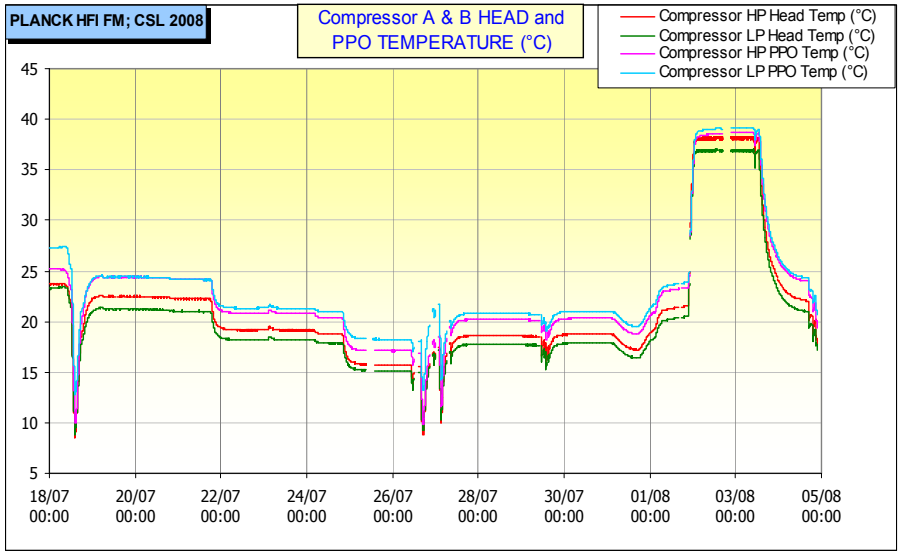

PLANCK HFI FM; CSL 2008
Gas Pressure HP zoom (Bar)
4K Gas Pressure HP (bar)
7,7
7,6
7,5
7,4
7,3
7,2
7,1
7,0
6,9
6,8
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

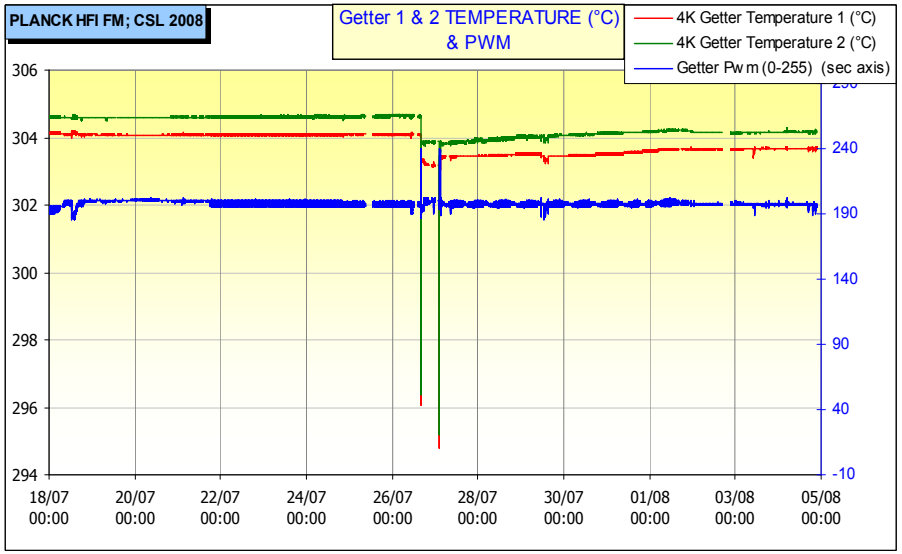

PLANCK HFI FM; CSL 2008
Gas Pressure HP zoom (Bar)
4K Gas Pressure HP (bar)
7,130
7,120
7,110
7,100
7,090
7,080
7,070
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00

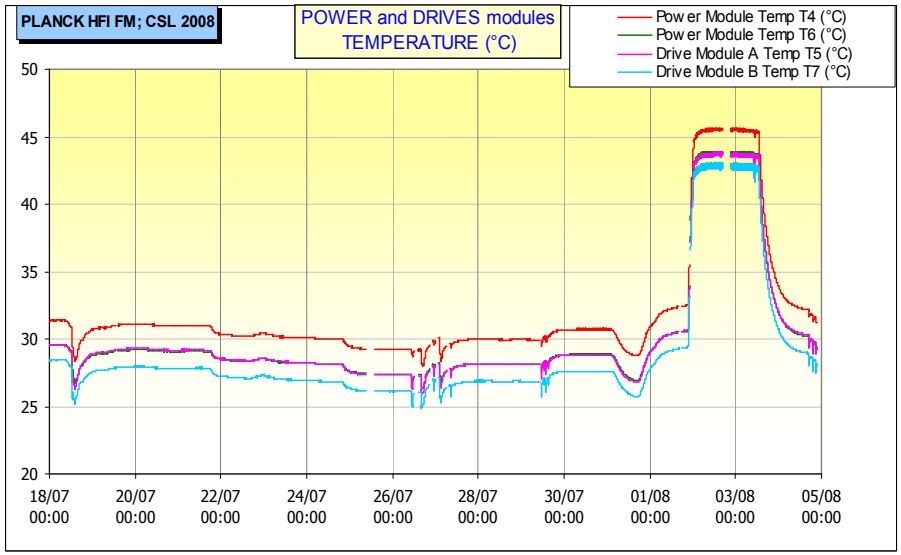

PLANCK HFI FM; CSL 2008
Gas Pressure LP (Bar)
4K Gas Pressure LP (bar)
4,0
3,5
3,0
2,5
2,0
1,5
1,0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

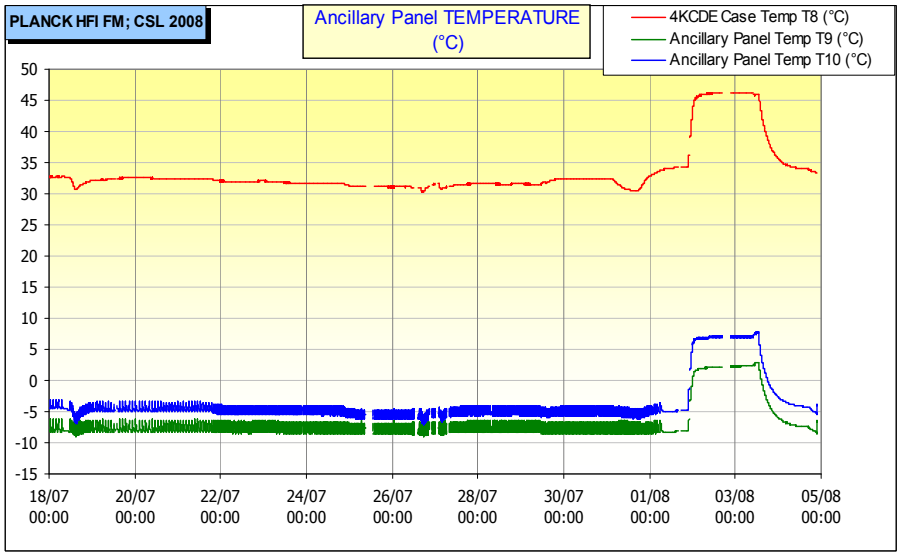

PLANCK HFI FM; CSL 2008
Gas Pressure LP zoom (Bar)
4K Gas Pressure LP (bar)
1,35
1,30
1,25
1,20
1,15
1,10
1,05
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

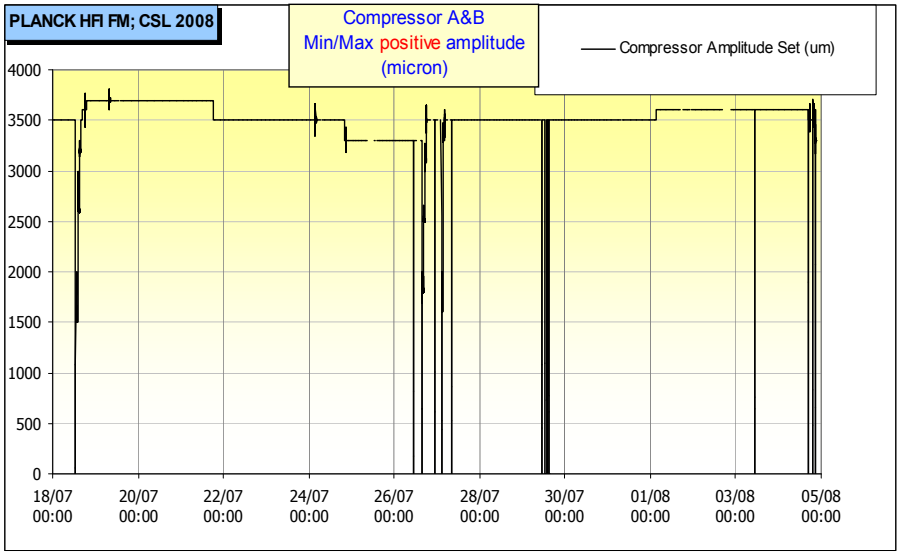

PLANCK HFI FM; CSL 2008
Gas Massflowrate (mg/s)
4K Gas Flow Rate (mg/s)
4,20
4,10
4,00
3,90
3,80
3,70
3,60
3,50
3,40
3,30
3,20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

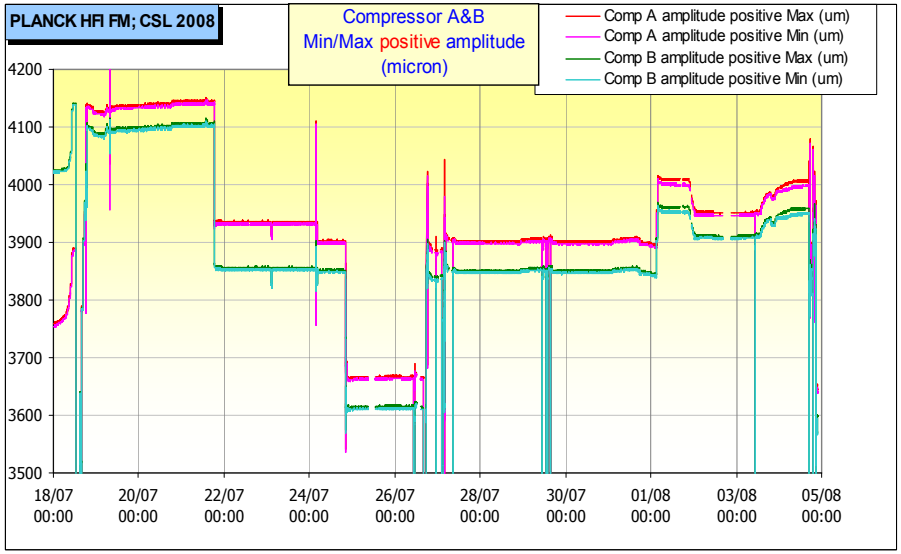

PLANCK HFI FM; CSL 2008
Compressor A & B HEAD and PPO TEMPERATURE (°C)
Compressor HP Head Temp (°C)
Compressor LP Head Temp (°C)
Compressor HP PPO Temp (°C)
Compressor LP PPO Temp (°C)
45
40
35
30
25
20
15
10
5
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

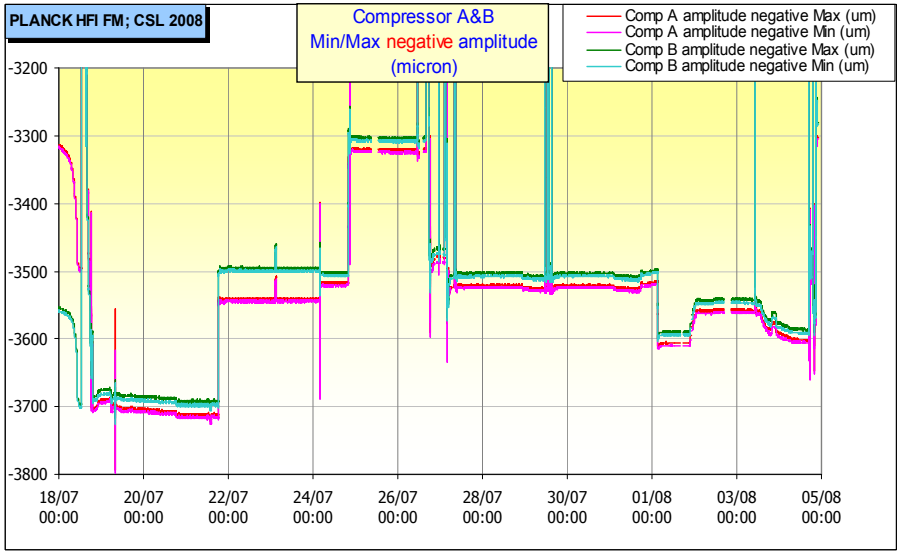

PLANCK HFI FM; CSL 2008
Getter 1 & 2 TEMPERATURE (°C) & PWM
4K Getter Temperature 1 (°C)
4K Getter Temperature 2 (°C)
Getter Pwm (0-255) (sec axis)
306
304
302
300
298
296
294
240
190
140
90
40
-10
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

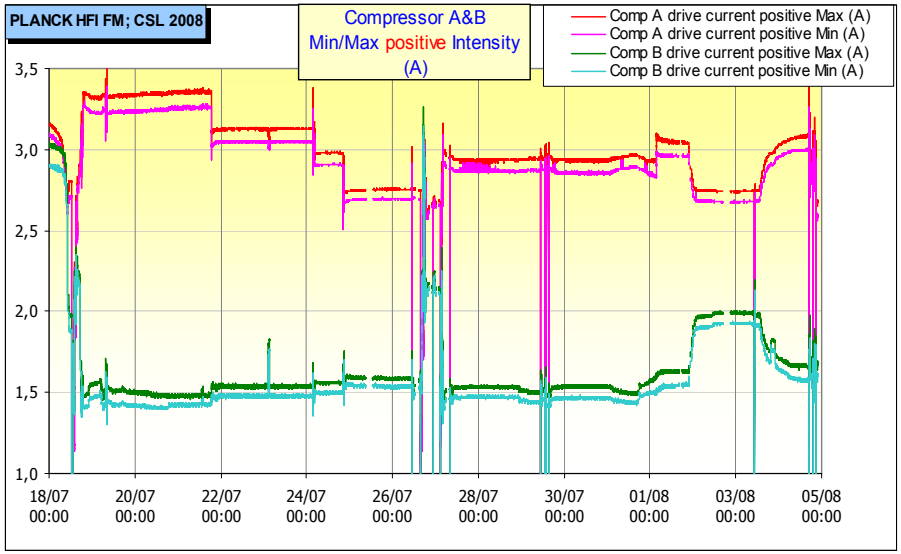

PLANCK HFI FM; CSL 2008
POWER and DRIVES modules TEMPERATURE (°C)
Power Module Temp T4 (°C)
Power Module Temp T6 (°C)
Drive Module A Temp T5 (°C)
Drive Module B Temp T7 (°C)
50
45
40
35
30
25
20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

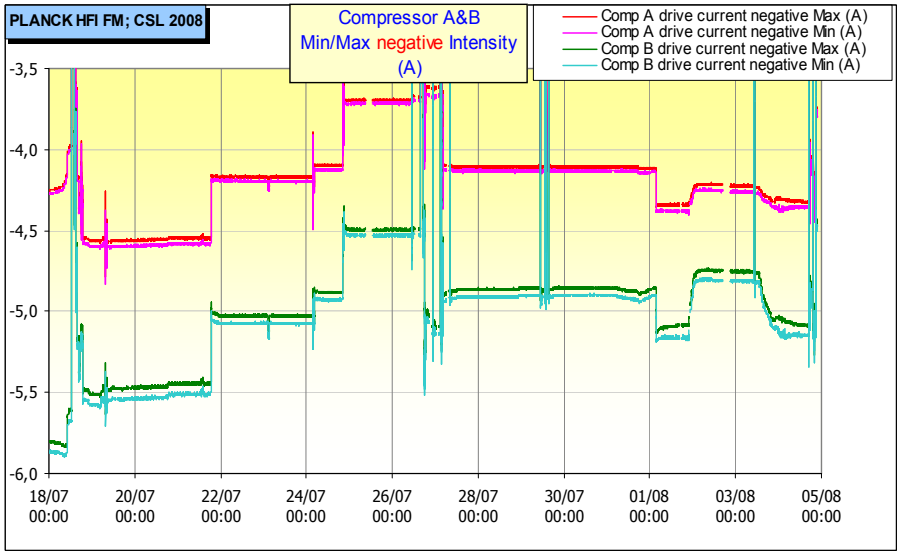

PLANCK HFI FM; CSL 2008
Ancillary Panel TEMPERATURE (°C)
4KCDE Case Temp T8 (°C)
Ancillary Panel Temp T9 (°C)
Ancillary Panel Temp T10 (°C)
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

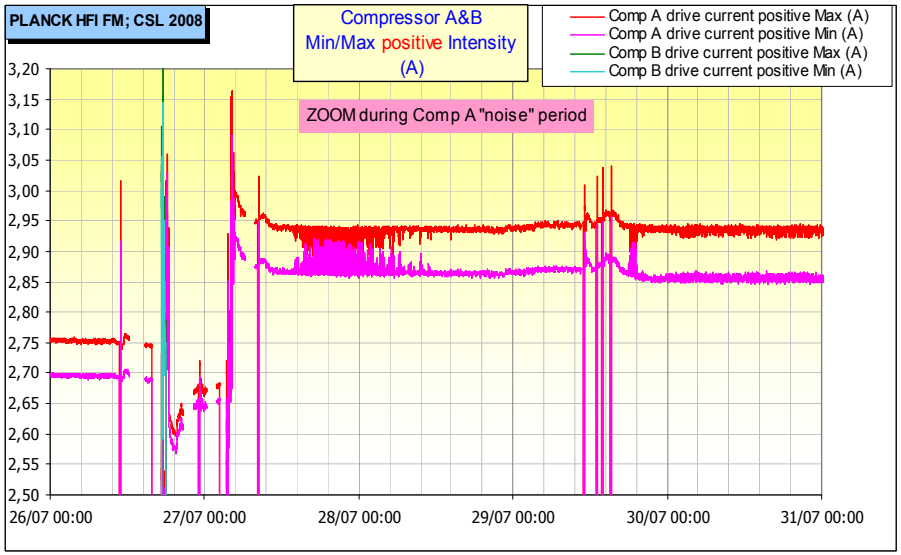

PLANCK HFI FM; CSL 2008
Compressor A&B
Min/Max positive amplitude
(micron)
Compressor Amplitude Set (um)
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

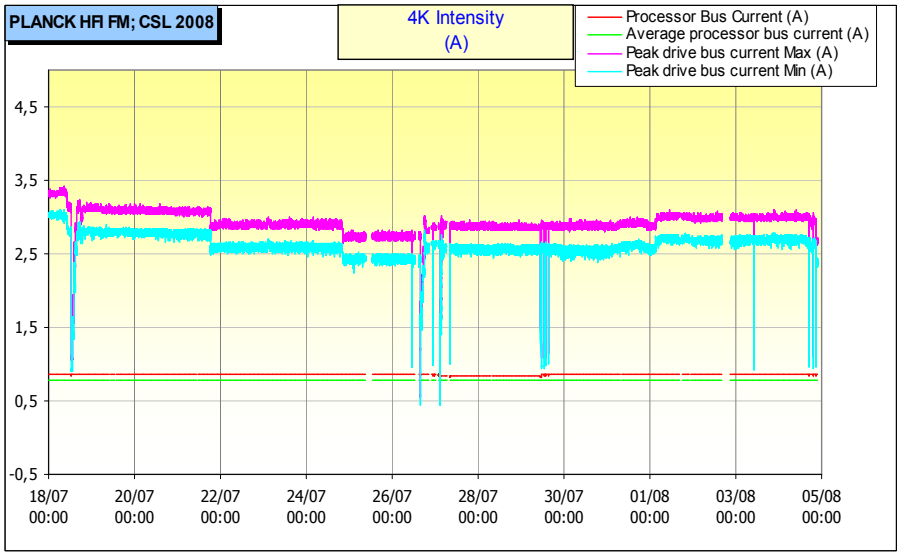

PLANCK HFI FM; CSL 2008
Compressor A&B
Min/Max positive amplitude
(micron)
Comp A amplitude positive Max (um)
Comp A amplitude positive Min (um)
Comp B amplitude positive Max (um)
Comp B amplitude positive Min (um)
4200
4100
4000
3900
3800
3700
3600
3500
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

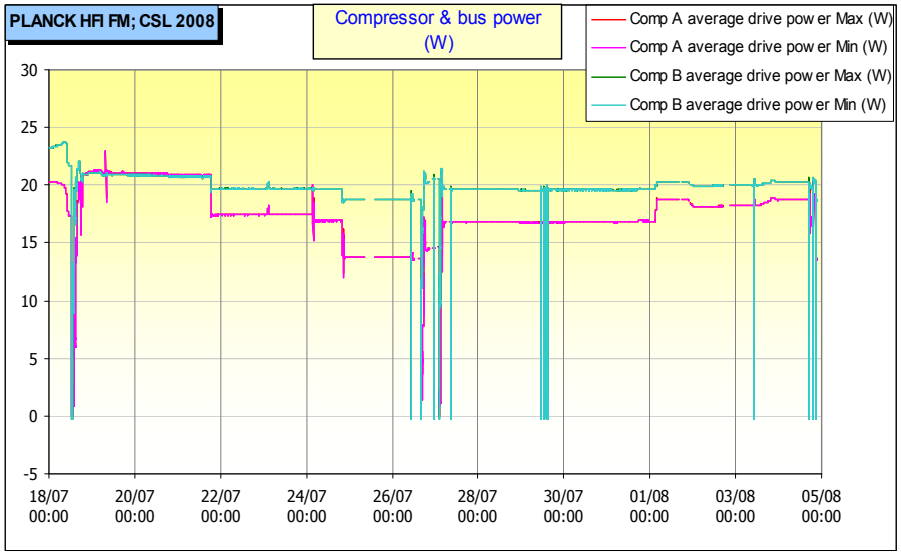

PLANCK HFI FM; CSL 2008
Compressor A&B
Min/Max negative amplitude
(micron)
Comp A amplitude negative Max (um)
Comp A amplitude negative Min (um)
Comp B amplitude negative Max (um)
Comp B amplitude negative Min (um)
-3200
-3300
-3400
-3500
-3600
-3700
-3800
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

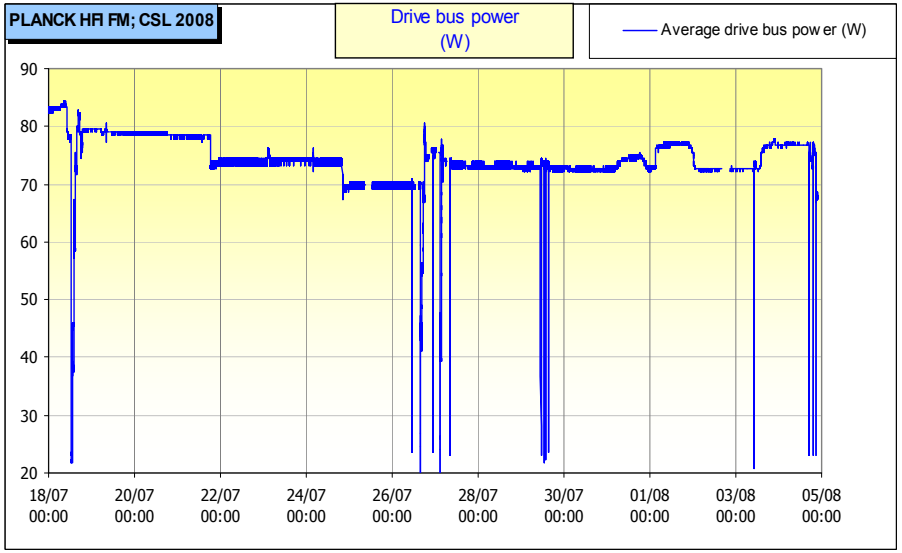

PLANCK HFI FM; CSL 2008
Compressor A&B
Min/Max positive Intensity
(A)
Comp A drive current positive Max (A)
Comp A drive current positive Min (A)
Comp B drive current positive Max (A)
Comp B drive current positive Min (A)
3,5
3,0
2,5
2,0
1,5
1,0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

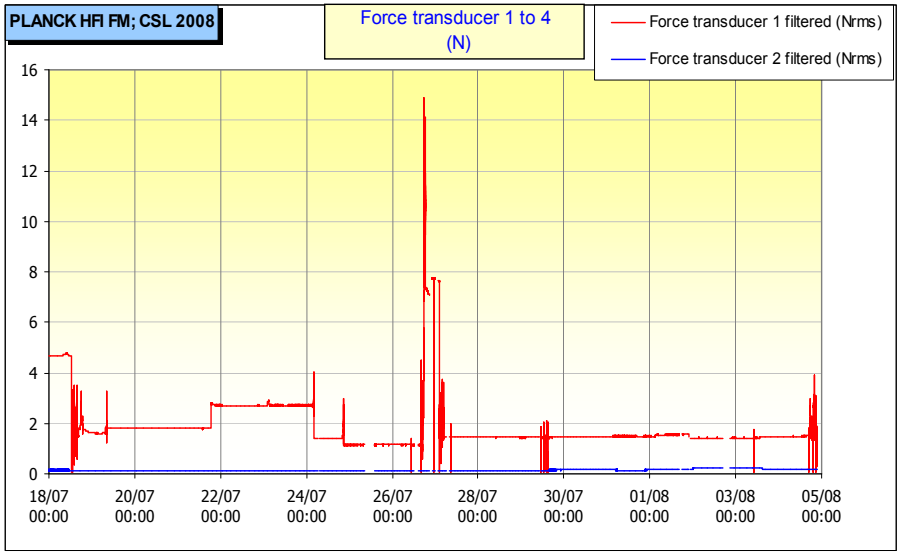

PLANCK HFI FM; CSL 2008
Compressor A&B
Min/Max negative Intensity
(A)
Comp A drive current negative Max (A)
Comp A drive current negative Min (A)
Comp B drive current negative Max (A)
Comp B drive current negative Min (A)
-3,5
-4,0
-4,5
-5,0
-5,5
-6,0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

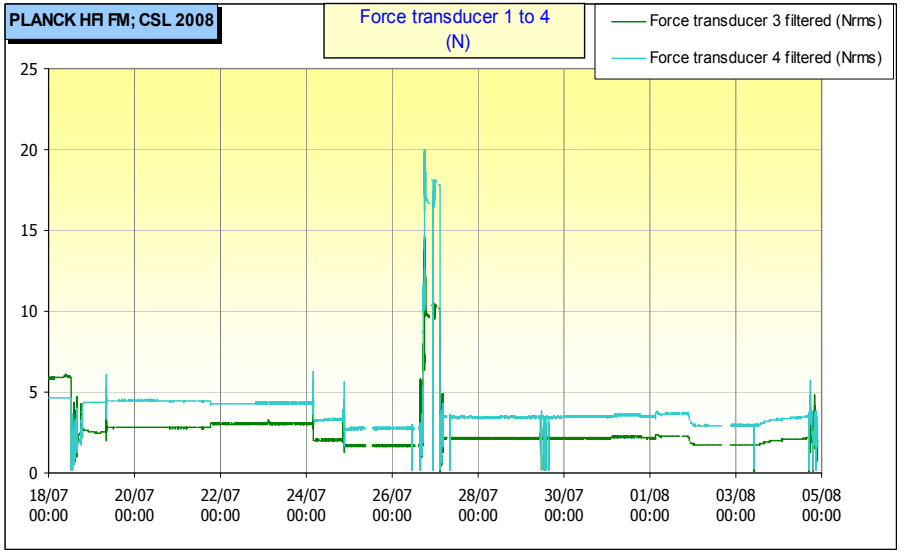

PLANCK HFI FM; CSL 2008
Compressor A&B
Min/Max positive Intensity
(A)
Comp A drive current positive Max (A)
Comp A drive current positive Min (A)
Comp B drive current positive Max (A)
Comp B drive current positive Min (A)
ZOOM during Comp A "noise" period
3,20
3,15
3,10
3,05
3,00
2,95
2,90
2,85
2,80
2,75
2,70
2,65
2,60
2,55
2,50
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00

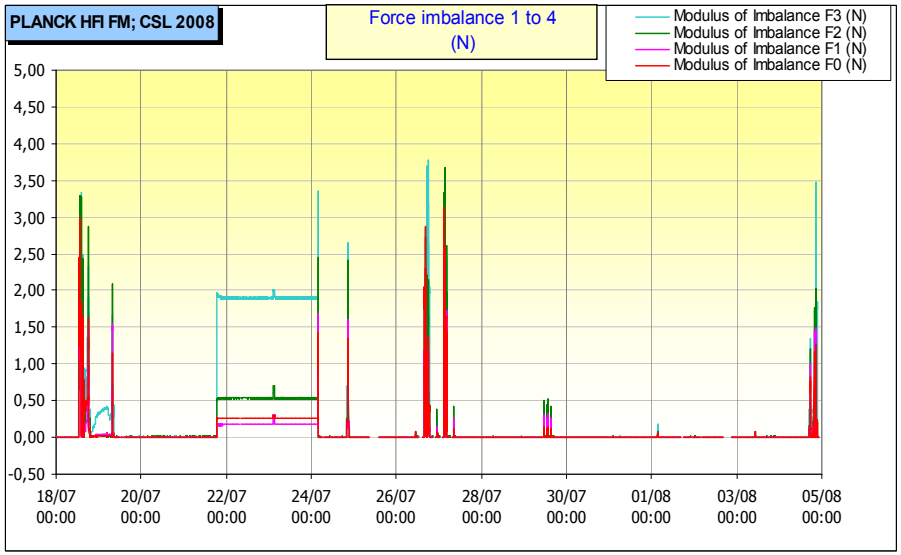

PLANCK HFI FM; CSL 2008
4K Intensity
(A)
Processor Bus Current (A)
Average processor bus current (A)
Peak drive bus current Max (A)
Peak drive bus current Min (A)
4,5
3,5
2,5
1,5
0,5
-0,5
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

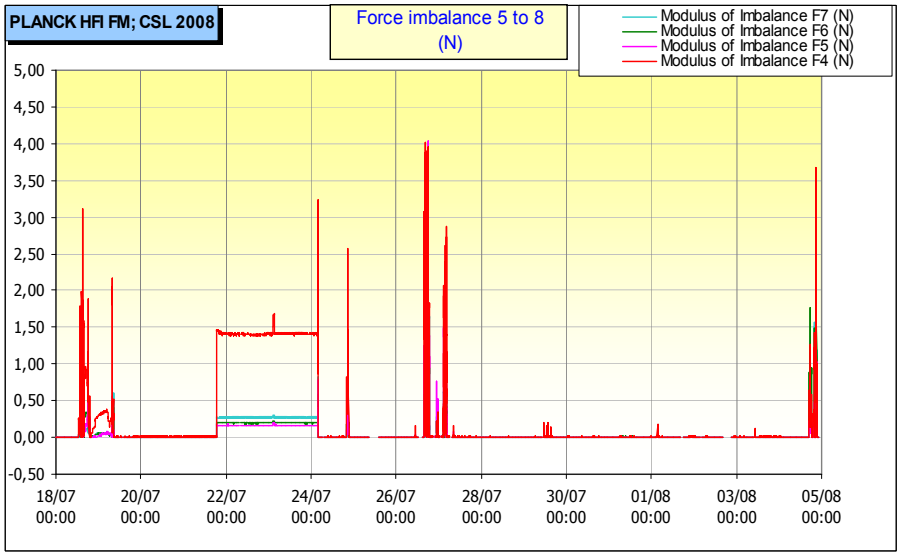

PLANCK HFI FM; CSL 2008
Compressor & bus power (W)
Comp A average drive power Max (W)
Comp A average drive power Min (W)
Comp B average drive power Max (W)
Comp B average drive power Min (W)
30
25
20
15
10
5
0
-5
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

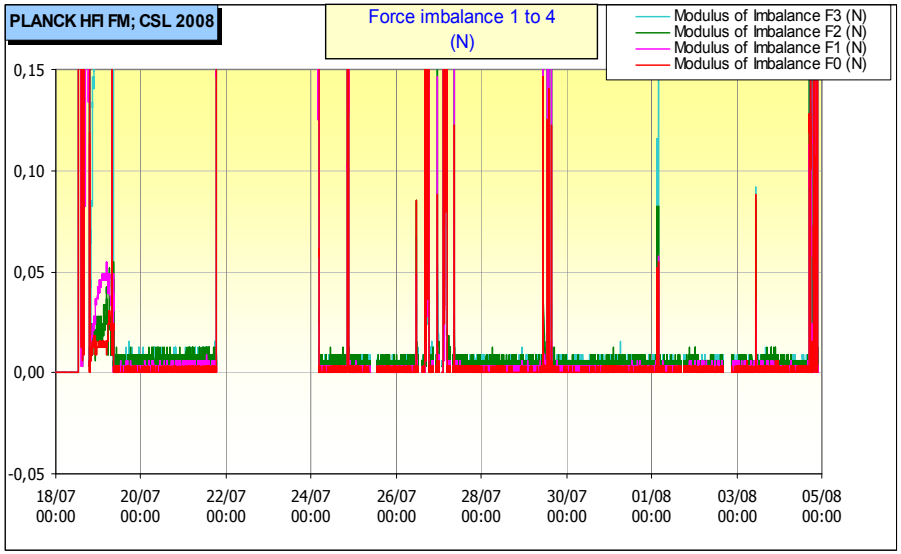

PLANCK HFI FM; CSL 2008
Drive bus power (W)
Average drive bus power (W)
90
80
70
60
50
40
30
20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

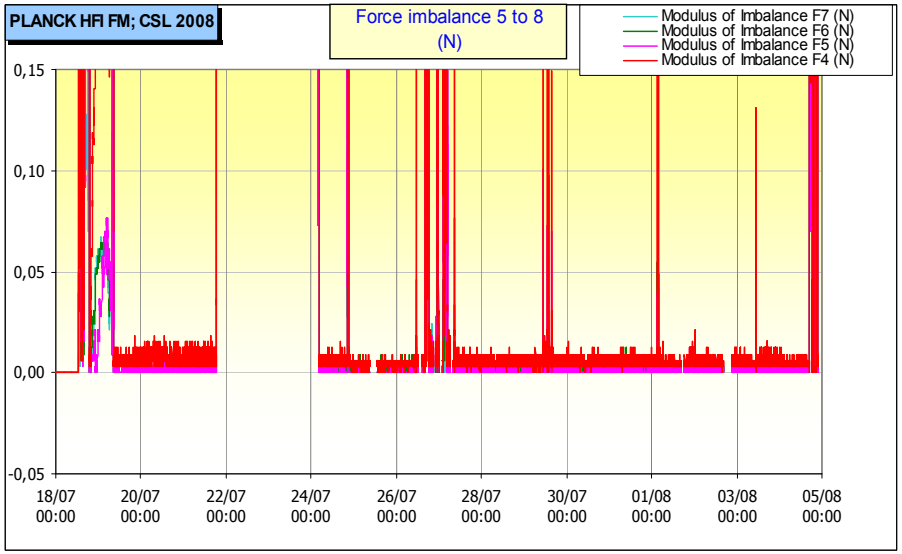

PLANCK HFI FM; CSL 2008
Force transducer 1 to 4 (N)
Force transducer 1 filtered (Nrms)
Force transducer 2 filtered (Nrms)
16
14
12
10
8
6
4
2
0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

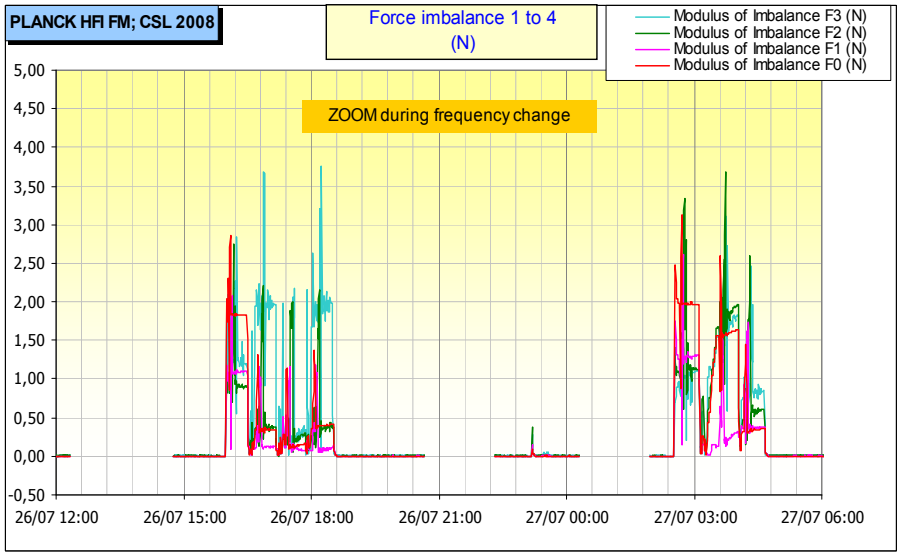

PLANCK HFI FM; CSL 2008
Force transducer 1 to 4 (N)
Force transducer 3 filtered (Nrms)
Force transducer 4 filtered (Nrms)
25
20
15
10
5
0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

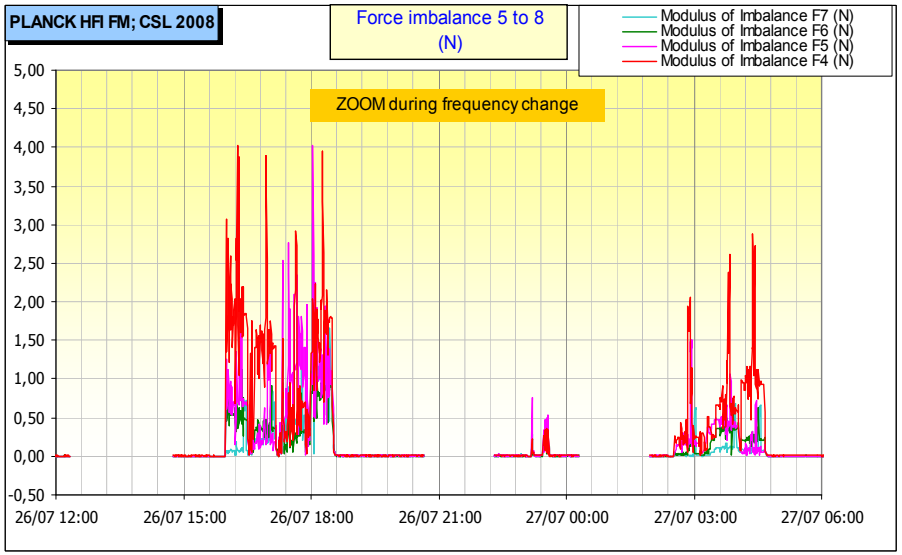

PLANCK HFI FM; CSL 2008
Force imbalance 1 to 4 (N)
Modulus of Imbalance F3 (N)
Modulus of Imbalance F2 (N)
Modulus of Imbalance F1 (N)
Modulus of Imbalance F0 (N)
5,00
4,50
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
-0,50
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

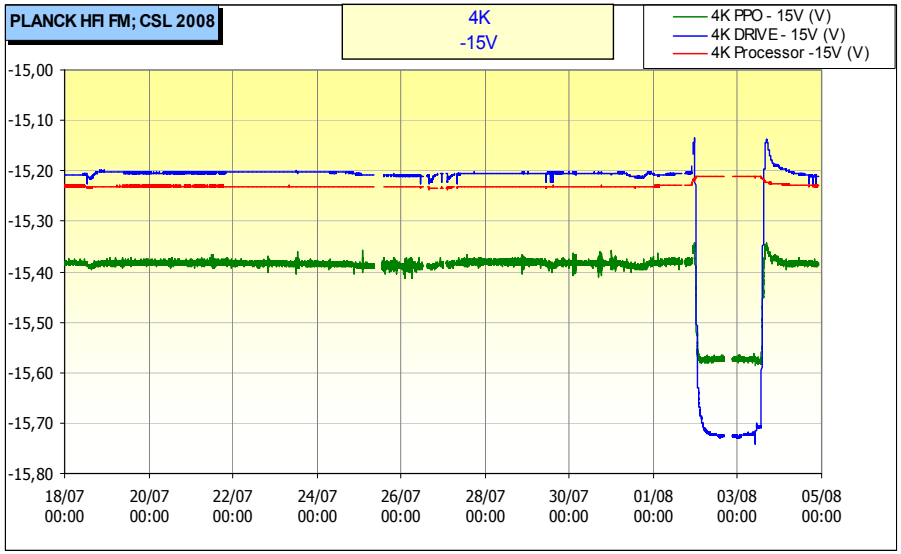

PLANCK HFI FM; CSL 2008
Force imbalance 5 to 8 (N)
Modulus of Imbalance F7 (N)
Modulus of Imbalance F6 (N)
Modulus of Imbalance F5 (N)
Modulus of Imbalance F4 (N)
5,00
4,50
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
-0,50
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

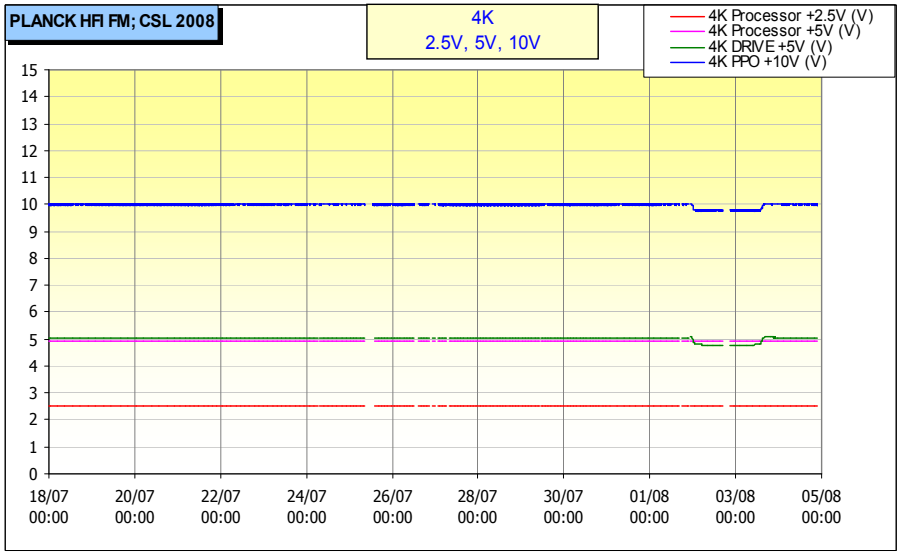

PLANCK HFI FM; CSL 2008
Force imbalance 1 to 4
(N)
Modulus of Imbalance F3 (N)
Modulus of Imbalance F2 (N)
Modulus of Imbalance F1 (N)
Modulus of Imbalance F0 (N)
0,15
0,10
0,05
0,00
-0,05
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

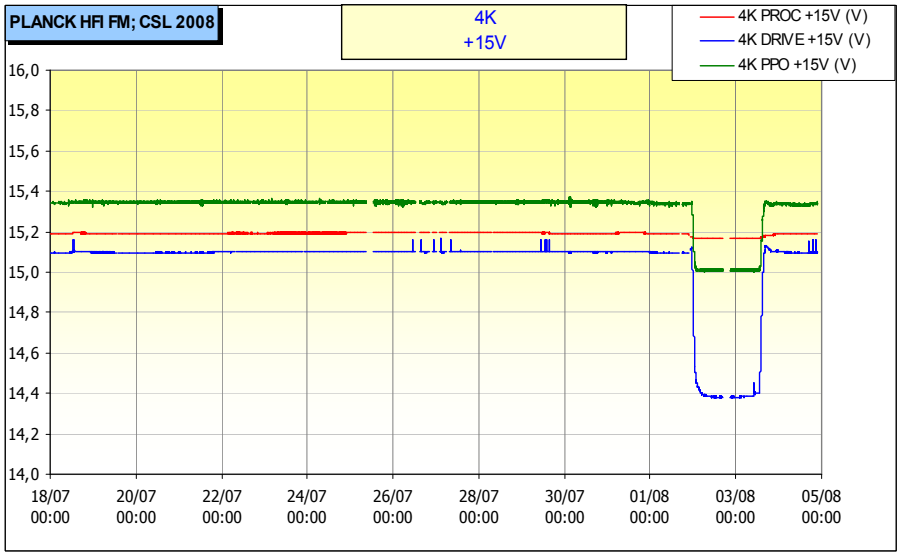

PLANCK HFI FM; CSL 2008
Force imbalance 5 to 8
(N)
Modulus of Imbalance F7 (N)
Modulus of Imbalance F6 (N)
Modulus of Imbalance F5 (N)
Modulus of Imbalance F4 (N)
0,15
0,10
0,05
0,00
-0,05
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

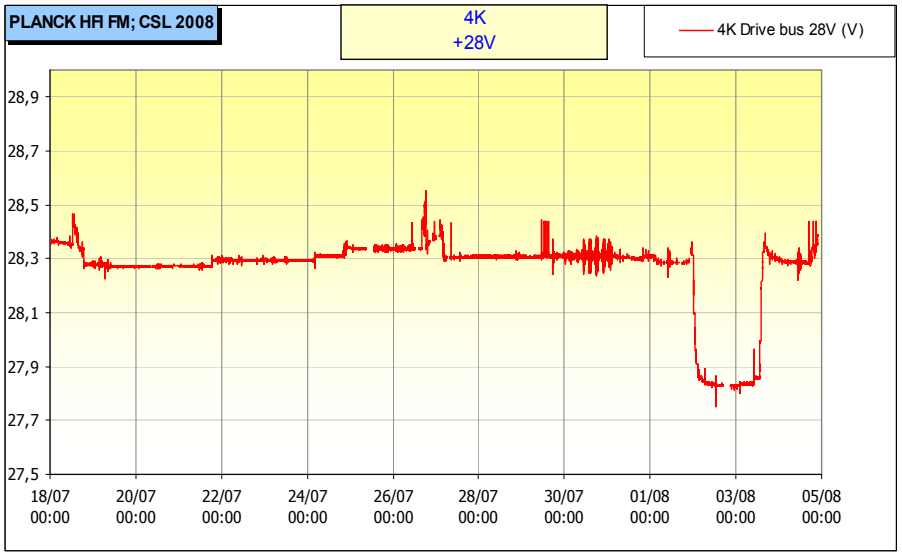

PLANCK HFI FM; CSL 2008
Force imbalance 1 to 4
(N)
Modulus of Imbalance F3 (N)
Modulus of Imbalance F2 (N)
Modulus of Imbalance F1 (N)
Modulus of Imbalance F0 (N)
ZOOM during frequency change
5,00
4,50
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
-0,50
26/07 12:00
26/07 15:00
26/07 18:00
26/07 21:00
27/07 00:00
27/07 03:00
27/07 06:00

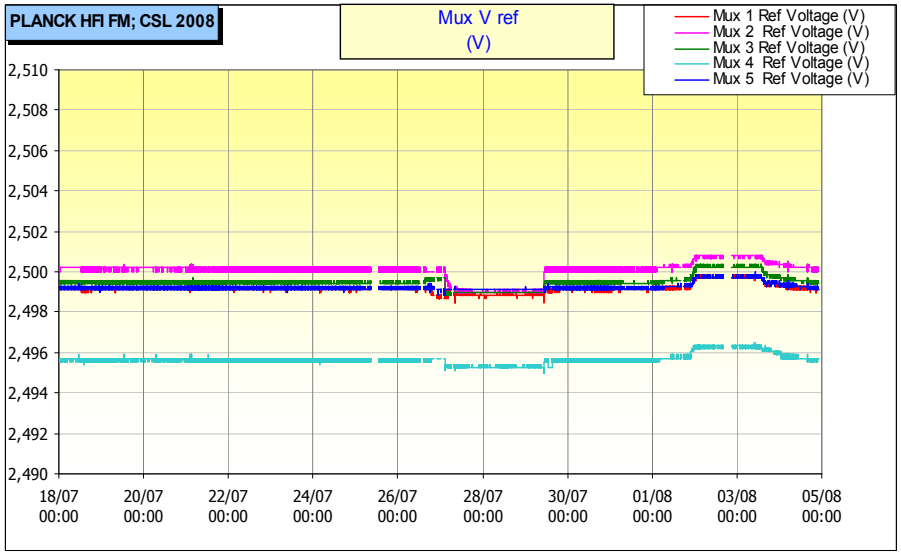

PLANCK HFI FM; CSL 2008
Force imbalance 5 to 8
(N)
Modulus of Imbalance F7 (N)
Modulus of Imbalance F6 (N)
Modulus of Imbalance F5 (N)
Modulus of Imbalance F4 (N)
ZOOM during frequency change
5,00
4,50
4,00
3,50
3,00
2,50
2,00
1,50
1,00
0,50
0,00
-0,50
26/07 12:00
26/07 15:00
26/07 18:00
26/07 21:00
27/07 00:00
27/07 03:00
27/07 06:00

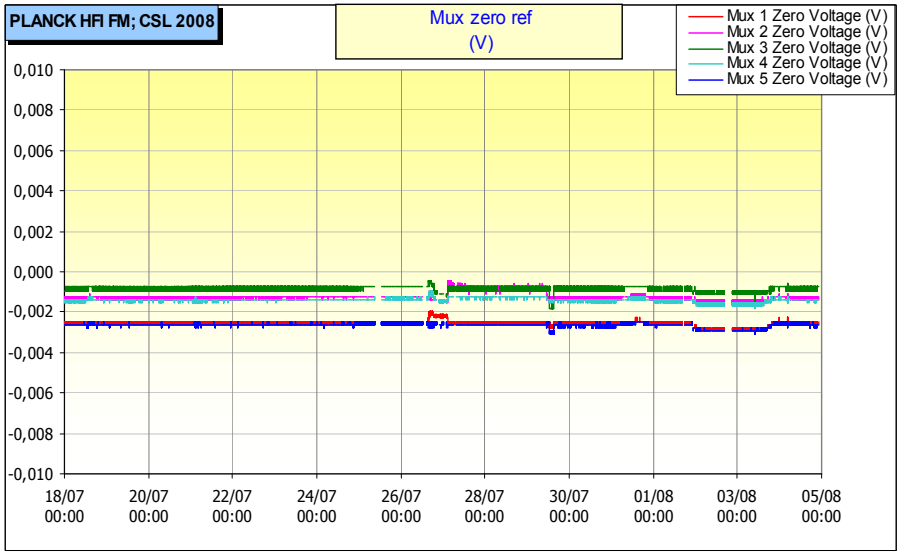

PLANCK HFI FM; CSL 2008
4K
-15V
4K PPO - 15V (V)
4K DRIVE - 15V (V)
4K Processor -15V (V)
-15,00
-15,10
-15,20
-15,30
-15,40
-15,50
-15,60
-15,70
-15,80
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

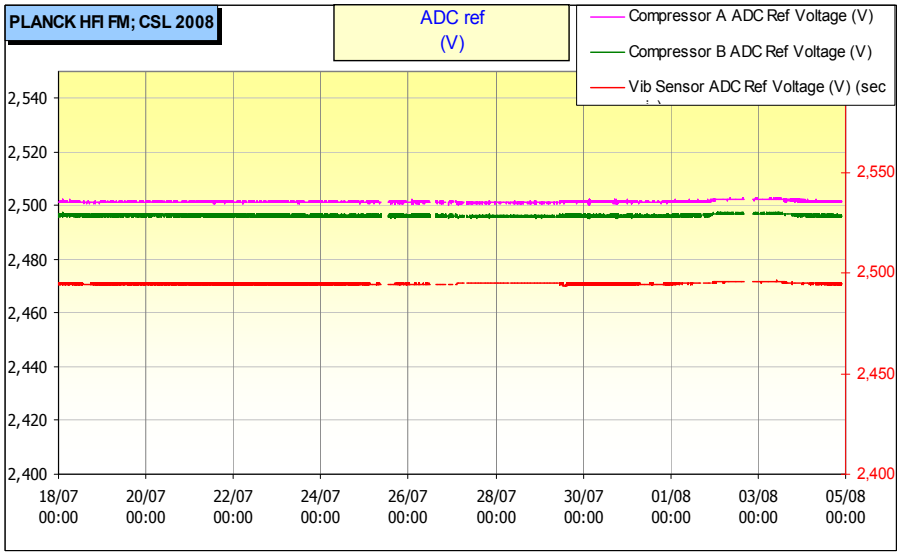

PLANCK HFI FM; CSL 2008
4K
2.5V, 5V, 10V
4K Processor +2.5V (V)
4K Processor +5V (V)
4K DRIVE +5V (V)
4K PPO +10V (V)
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

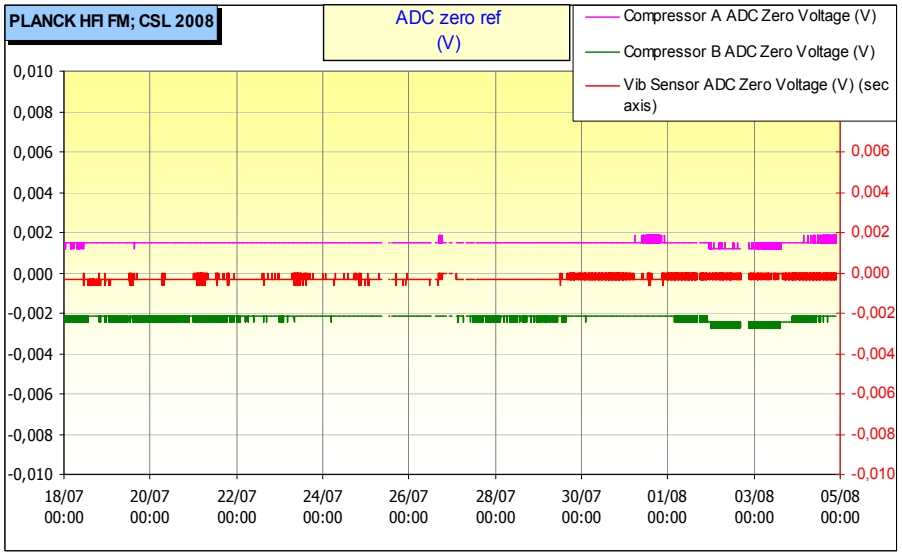

PLANCK HFI FM; CSL 2008
4K
+15V
4K PROC +15V (V)
4K DRIVE +15V (V)
4K PPO +15V (V)
16,0
15,8
15,6
15,4
15,2
15,0
14,8
14,6
14,4
14,2
14,0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

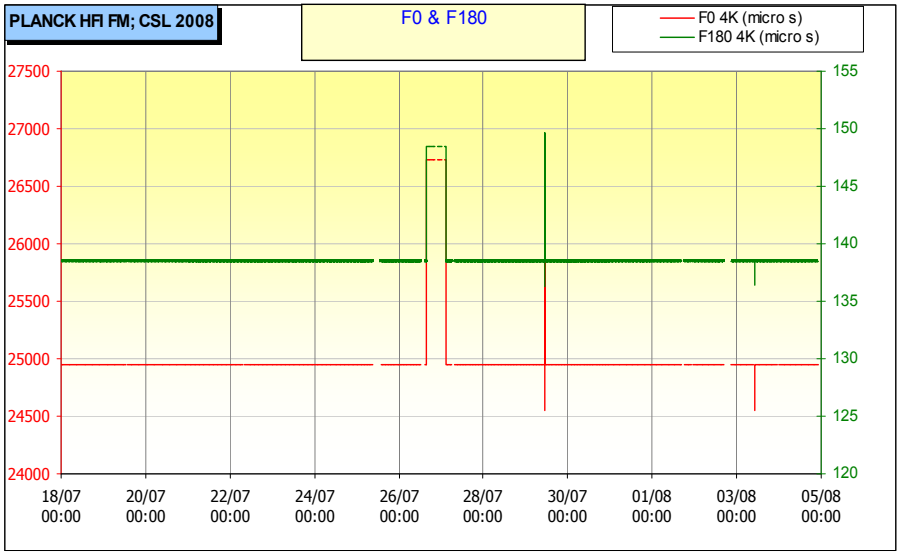

PLANCK HFI FM; CSL 2008
4K
+28V
4K Drive bus 28V (V)
28,9
28,7
28,5
28,3
28,1
27,9
27,7
27,5
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

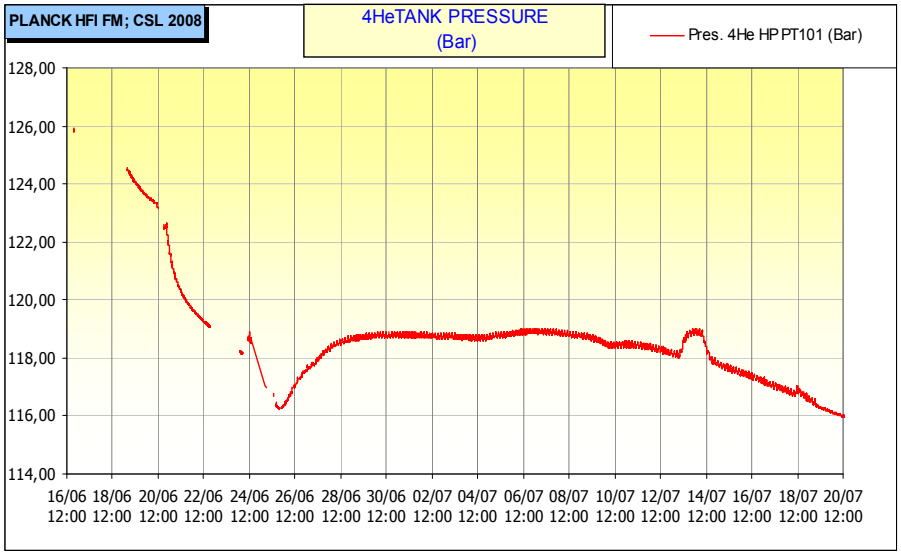

PLANCK HFI FM; CSL 2008
Mux V ref
(V)
Mux 1 Ref Voltage (V)
Mux 2 Ref Voltage (V)
Mux 3 Ref Voltage (V)
Mux 4 Ref Voltage (V)
Mux 5 Ref Voltage (V)
2,510
2,508
2,506
2,504
2,502
2,500
2,498
2,496
2,494
2,492
2,490
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

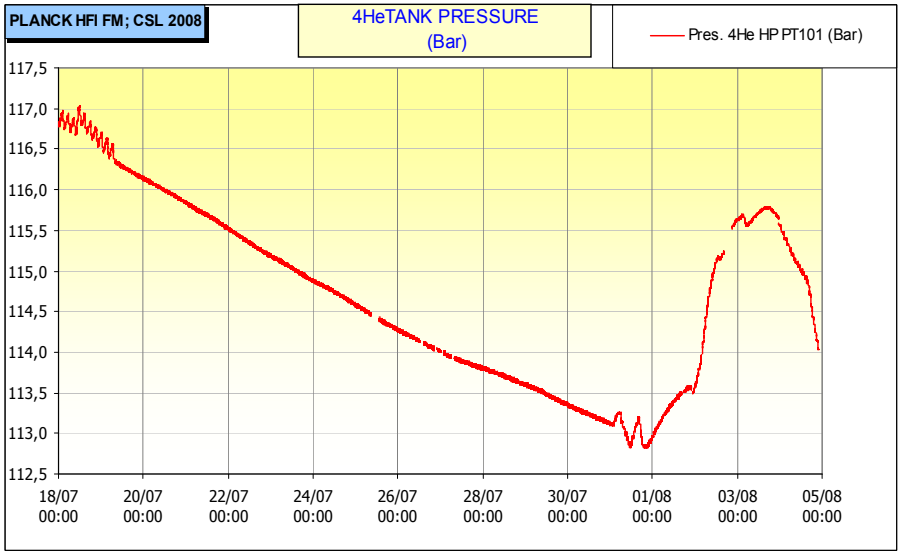

PLANCK HFI FM; CSL 2008
Mux zero ref
(V)
Mux 1 Zero Voltage (V)
Mux 2 Zero Voltage (V)
Mux 3 Zero Voltage (V)
Mux 4 Zero Voltage (V)
Mux 5 Zero Voltage (V)
0,010
0,008
0,006
0,004
0,002
0,000
-0,002
-0,004
-0,006
-0,008
-0,010
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

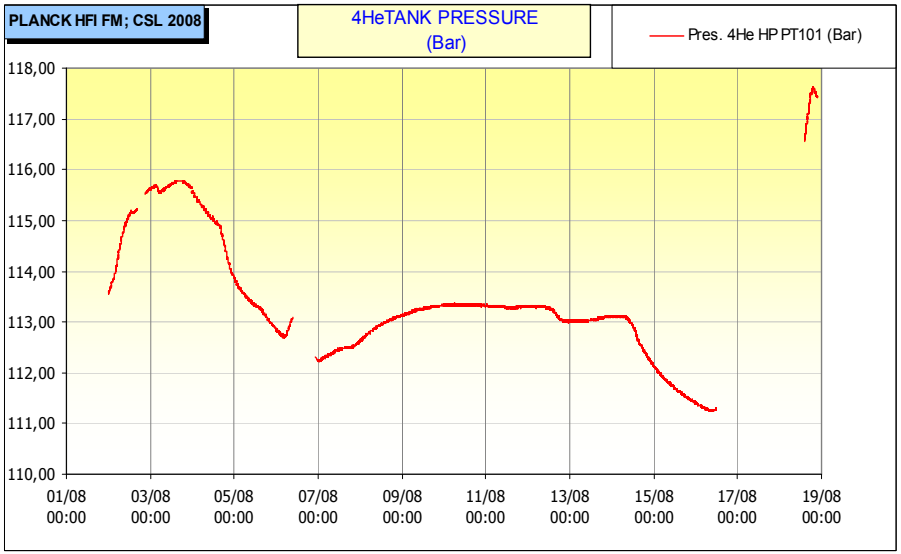

PLANCK HFI FM; CSL 2008
ADC ref
(V)
Compressor A ADC Ref Voltage (V)
Compressor B ADC Ref Voltage (V)
Vib Sensor ADC Ref Voltage (V) (sec
2,540
2,520
2,500
2,480
2,460
2,440
2,420
2,400
2,550
2,500
2,450
2,400
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

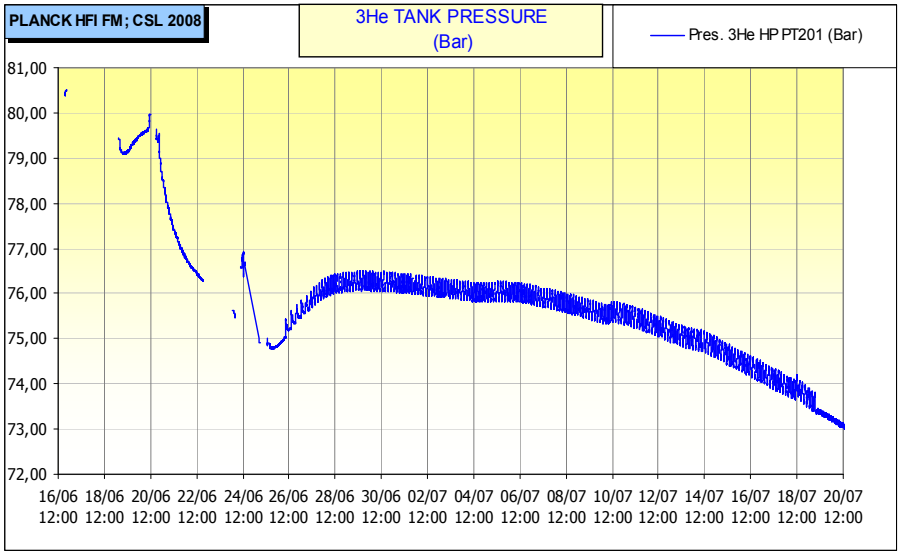

PLANCK HFI FM; CSL 2008
ADC zero ref
(V)
Compressor A ADC Zero Voltage (V)
Compressor B ADC Zero Voltage (V)
Vib Sensor ADC Zero Voltage (V) (sec axis)
0,010
0,008
0,006
0,004
0,002
0,000
-0,002
-0,004
-0,006
-0,008
-0,010
0,006
0,004
0,002
0,000
-0,002
-0,004
-0,006
-0,008
-0,010
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

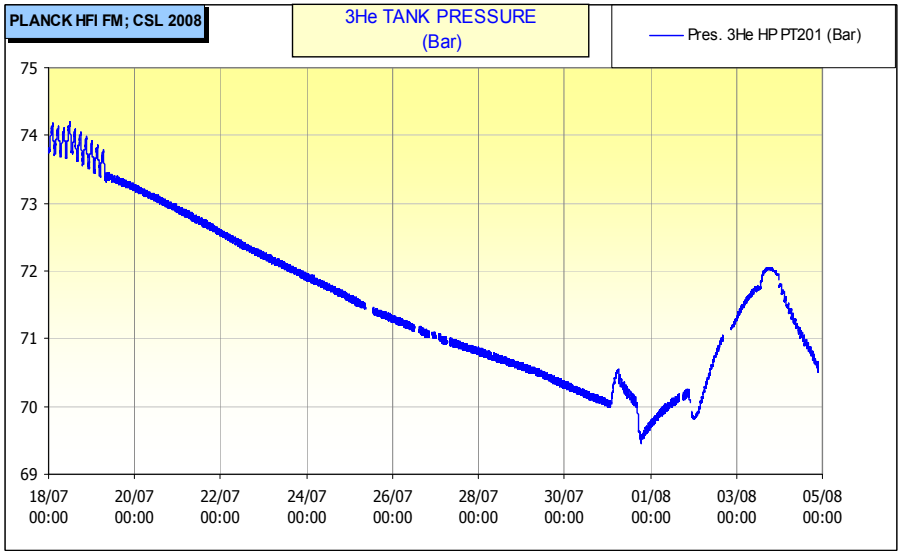

PLANCK HFI FM; CSL 2008
F0 & F180
F0 4K (micro s)
F180 4K (micro s)
27500
27000
26500
26000
25500
25000
24500
24000
155
150
145
140
135
130
125
120
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

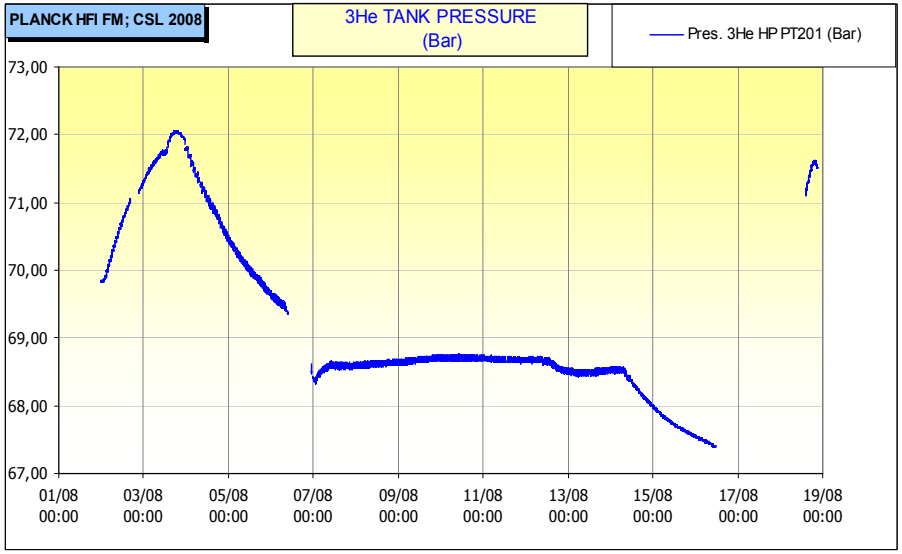

PLANCK HFI FM; CSL 2008
4HeTANK PRESSURE
(Bar)
Pres. 4He HP PT101 (Bar)
128,00
126,00
124,00
122,00
120,00
118,00
116,00
114,00
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

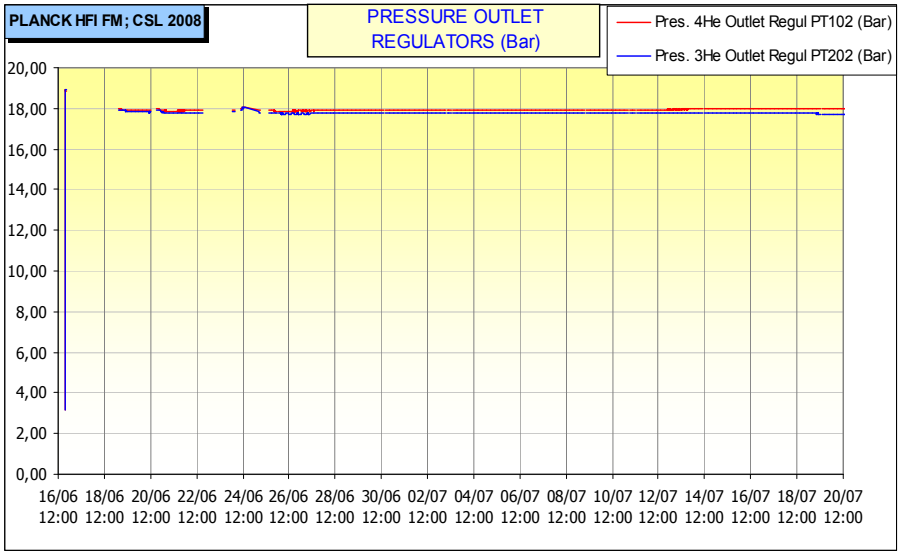

PLANCK HFI FM; CSL 2008
4HeTANK PRESSURE
(Bar)
Pres. 4He HP PT101 (Bar)
117,5
117,0
116,5
116,0
115,5
115,0
114,5
114,0
113,5
113,0
112,5
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

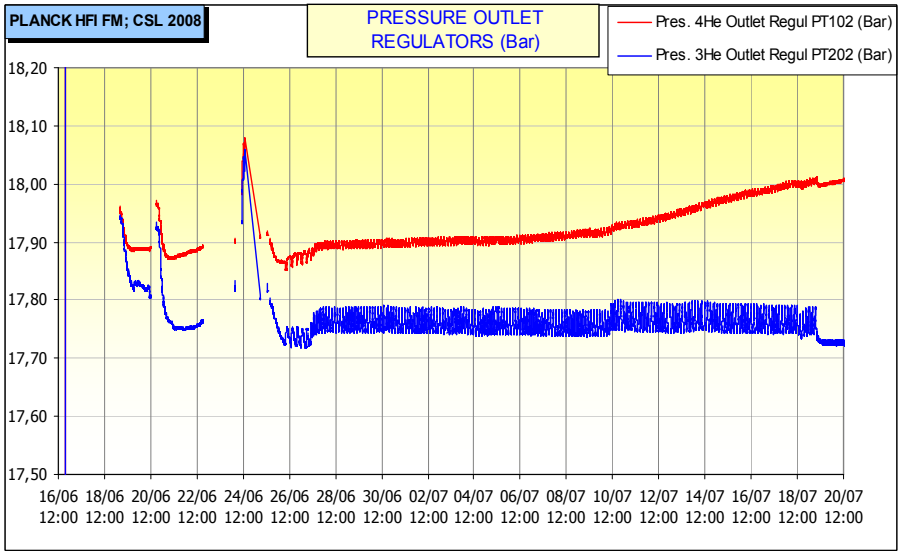

PLANCK HFI FM; CSL 2008
4HeTANK PRESSURE
(Bar)
Pres. 4He HP PT101 (Bar)
118,00
117,00
116,00
115,00
114,00
113,00
112,00
111,00
110,00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

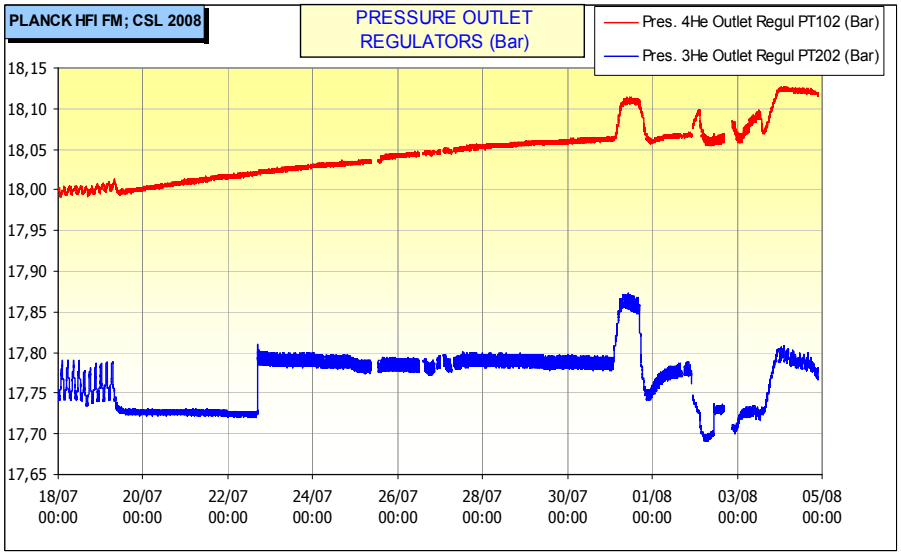

PLANCK HFI FM; CSL 2008
3He TANK PRESSURE (Bar)
Pres. 3He HP PT201 (Bar)
81,00
80,00
79,00
78,00
77,00
76,00
75,00
74,00
73,00
72,00
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

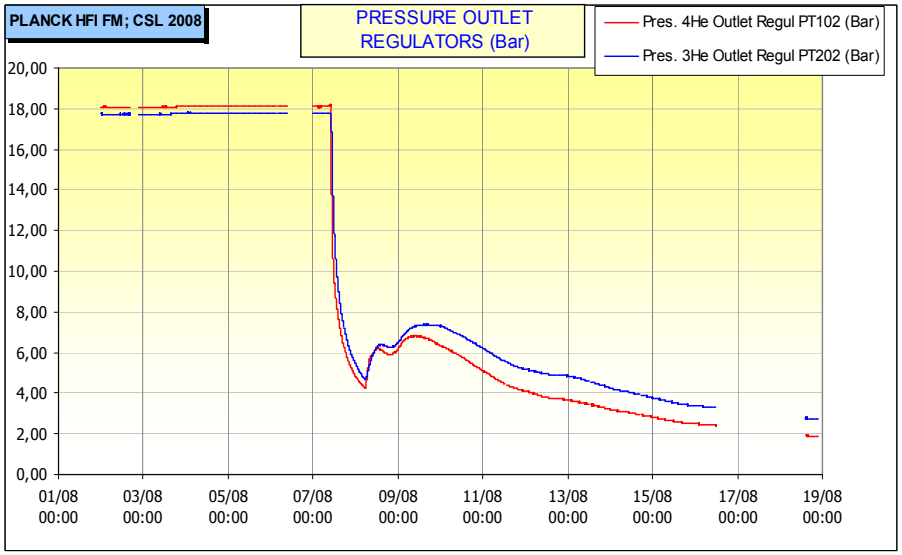

PLANCK HFI FM; CSL 2008
3He TANK PRESSURE (Bar)
Pres. 3He HP PT201 (Bar)
75
74
73
72
71
70
69
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

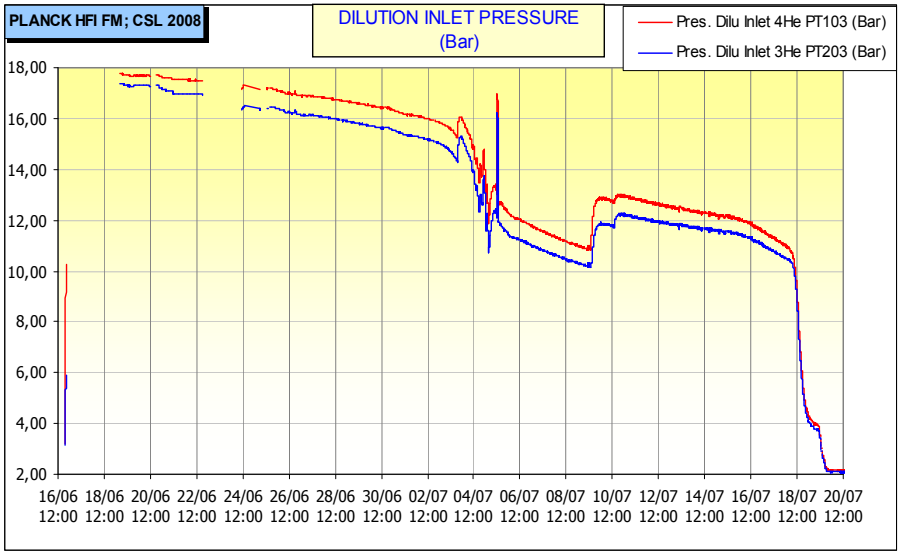

PLANCK HFI FM; CSL 2008
3He TANK PRESSURE (Bar)
Pres. 3He HP PT201 (Bar)
73,00
72,00
71,00
70,00
69,00
68,00
67,00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

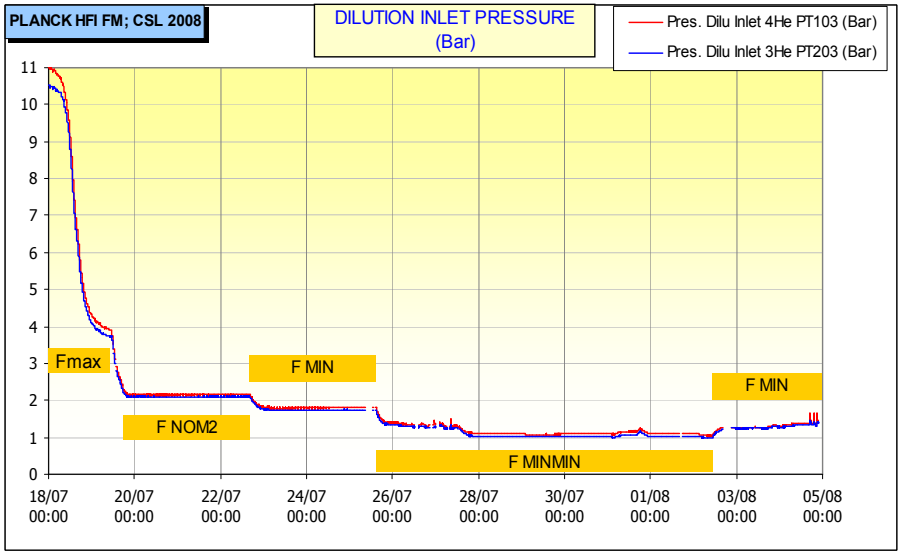

PLANCK HFI FM; CSL 2008
PRESSURE OUTLET REGULATORS (Bar)
Pres. 4He Outlet Regul PT102 (Bar)
Pres. 3He Outlet Regul PT202 (Bar)
20,00
18,00
16,00
14,00
12,00
10,00
8,00
6,00
4,00
2,00
0,00
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

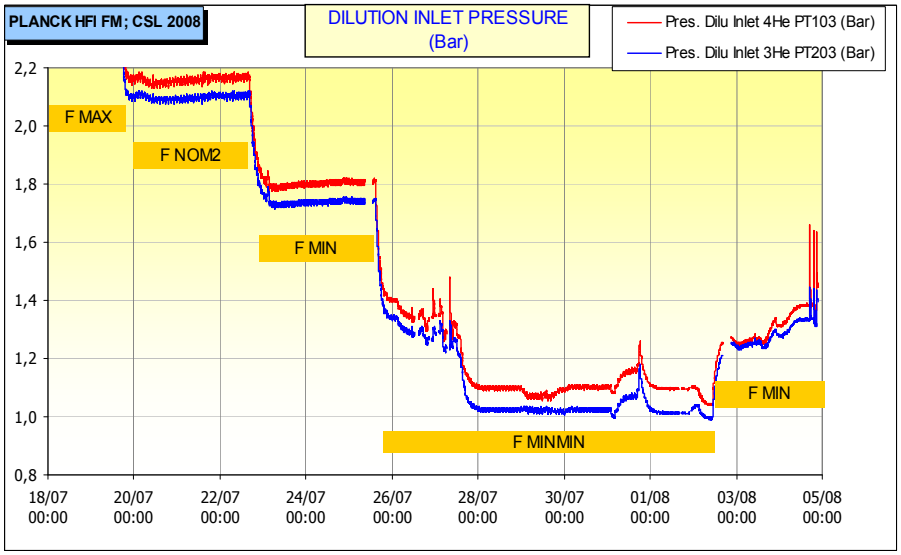

PLANCK HFI FM; CSL 2008
PRESSURE OUTLET REGULATORS (Bar)
Pres. 4He Outlet Regul PT102 (Bar)
Pres. 3He Outlet Regul PT202 (Bar)
18,20
18,10
18,00
17,90
17,80
17,70
17,60
17,50
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

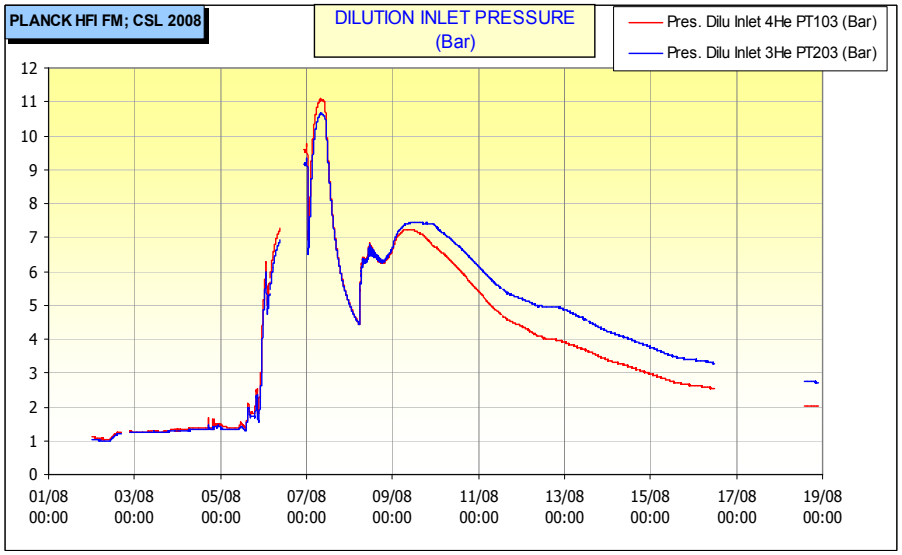

PLANCK HFI FM; CSL 2008
PRESSURE OUTLET REGULATORS (Bar)
Pres. 4He Outlet Regul PT102 (Bar)
Pres. 3He Outlet Regul PT202 (Bar)
18,15
18,10
18,05
18,00
17,95
17,90
17,85
17,80
17,75
17,70
17,65
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

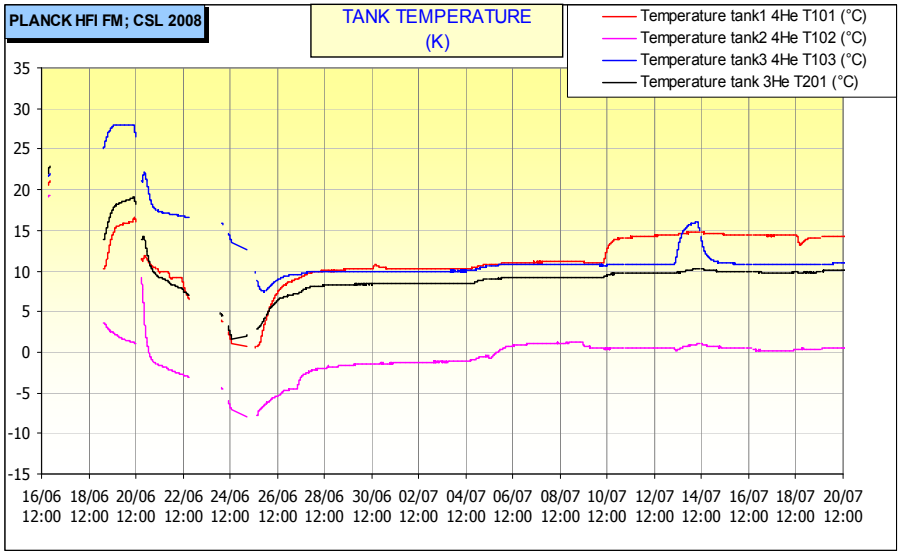

PLANCK HFI FM; CSL 2008
PRESSURE OUTLET REGULATORS (Bar)
Pres. 4He Outlet Regul PT102 (Bar)
Pres. 3He Outlet Regul PT202 (Bar)
20,00
18,00
16,00
14,00
12,00
10,00
8,00
6,00
4,00
2,00
0,00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

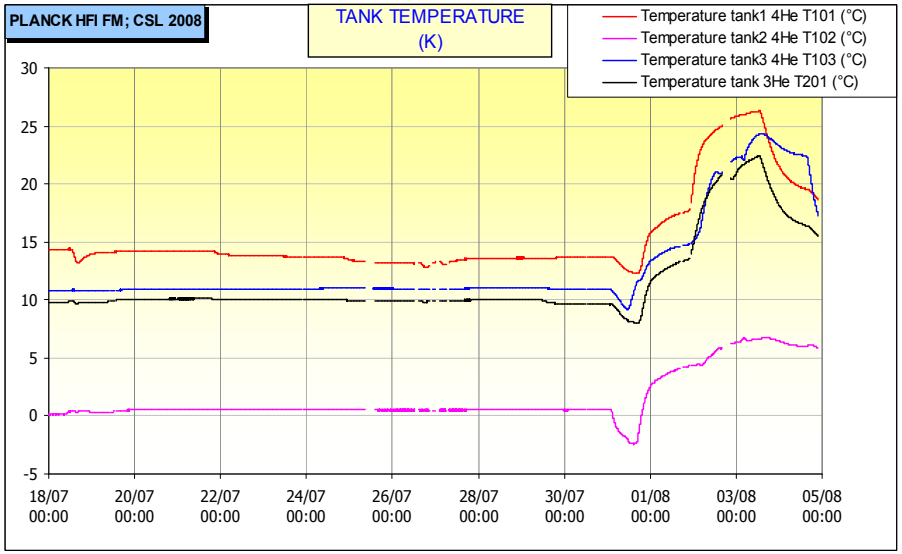

PLANCK HFI FM; CSL 2008
DILUTION INLET PRESSURE (Bar)
Pres. Dilu Inlet 4He PT103 (Bar)
Pres. Dilu Inlet 3He PT203 (Bar)
18,00
16,00
14,00
12,00
10,00
8,00
6,00
4,00
2,00
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

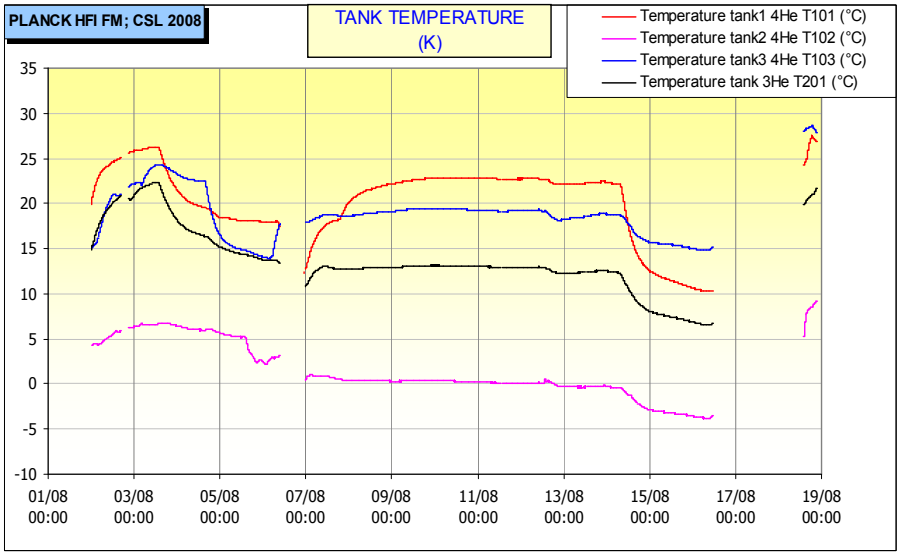

PLANCK HFI FM; CSL 2008
DILUTION INLET PRESSURE (Bar)
Pres. Dilu Inlet 4He PT103 (Bar)
Pres. Dilu Inlet 3He PT203 (Bar)
Fmax
F NOM2
F MIN
F MINMIN
F MIN
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

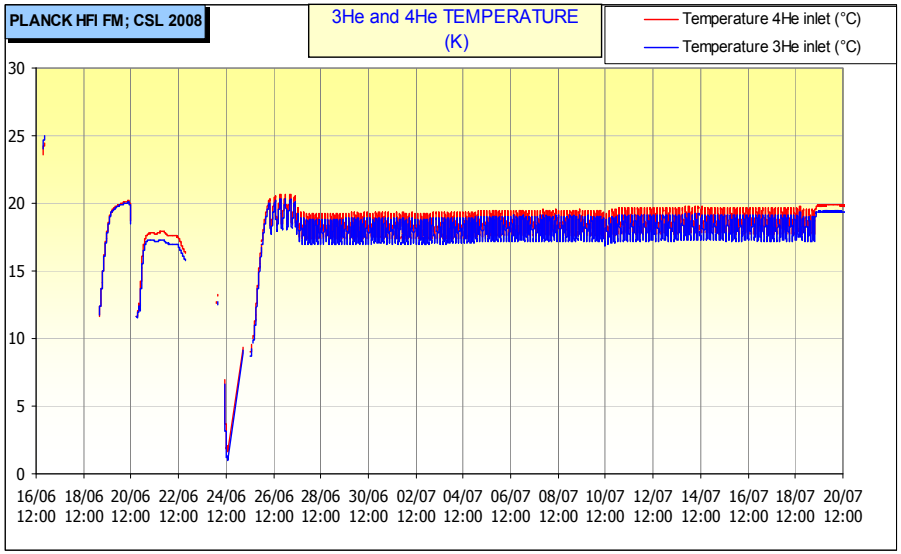

PLANCK HFI FM; CSL 2008
DILUTION INLET PRESSURE (Bar)
Pres. Dilu Inlet 4He PT103 (Bar)
Pres. Dilu Inlet 3He PT203 (Bar)
F MAX
F NOM2
F MIN
F MINMIN
F MIN
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

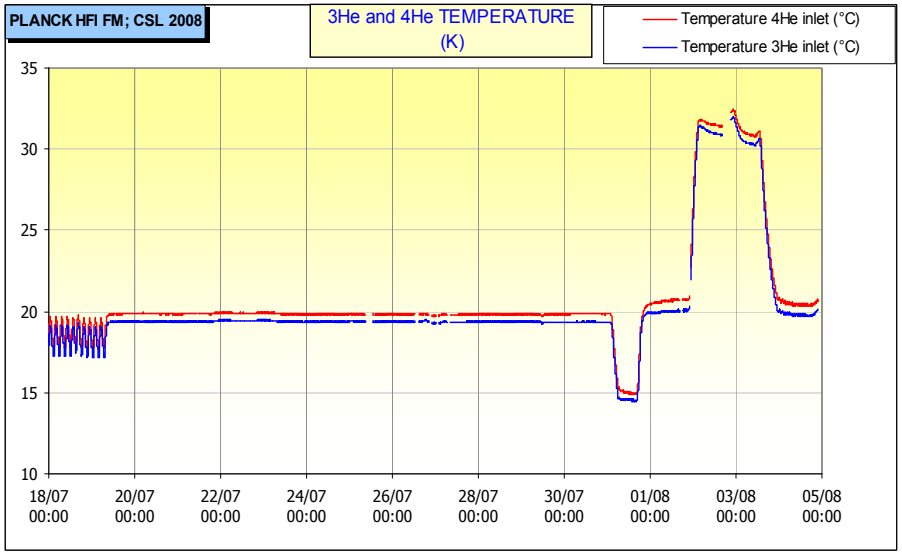

PLANCK HFI FM; CSL 2008
DILUTION INLET PRESSURE (Bar)
Pres. Dilu Inlet 4He PT103 (Bar)
Pres. Dilu Inlet 3He PT203 (Bar)
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

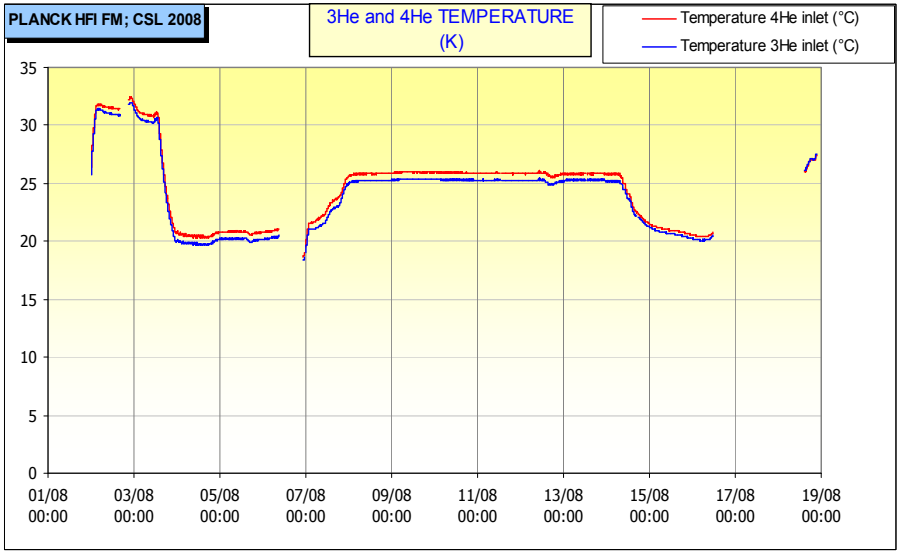

PLANCK HFI FM; CSL 2008
TANK TEMPERATURE (K)
Temperature tank1 4He T101 (°C)
Temperature tank2 4He T102 (°C)
Temperature tank3 4He T103 (°C)
Temperature tank 3He T201 (°C)
35
30
25
20
15
10
5
0
-5
-10
-15
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

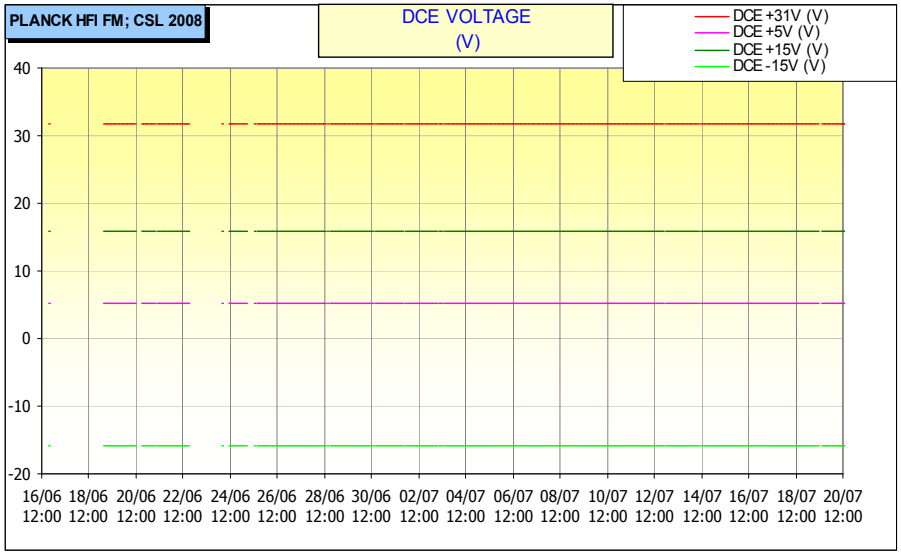

PLANCK HFI FM; CSL 2008
TANK TEMPERATURE (K)
Temperature tank1 4He T101 (°C)
Temperature tank2 4He T102 (°C)
Temperature tank3 4He T103 (°C)
Temperature tank 3He T201 (°C)
30
25
20
15
10
5
0
-5
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

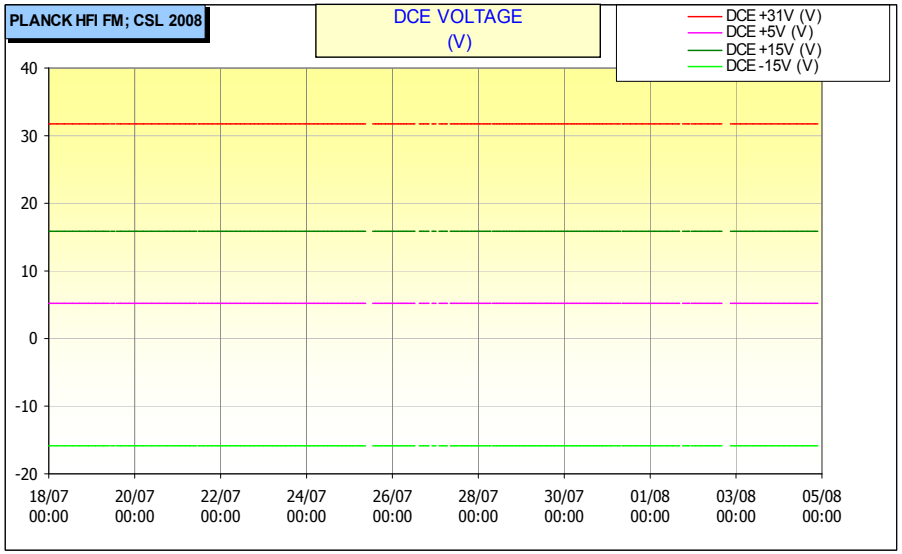

PLANCK HFI FM; CSL 2008
TANK TEMPERATURE (K)
Temperature tank1 4He T101 (°C)
Temperature tank2 4He T102 (°C)
Temperature tank3 4He T103 (°C)
Temperature tank 3He T201 (°C)
35
30
25
20
15
10
5
0
-5
-10
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

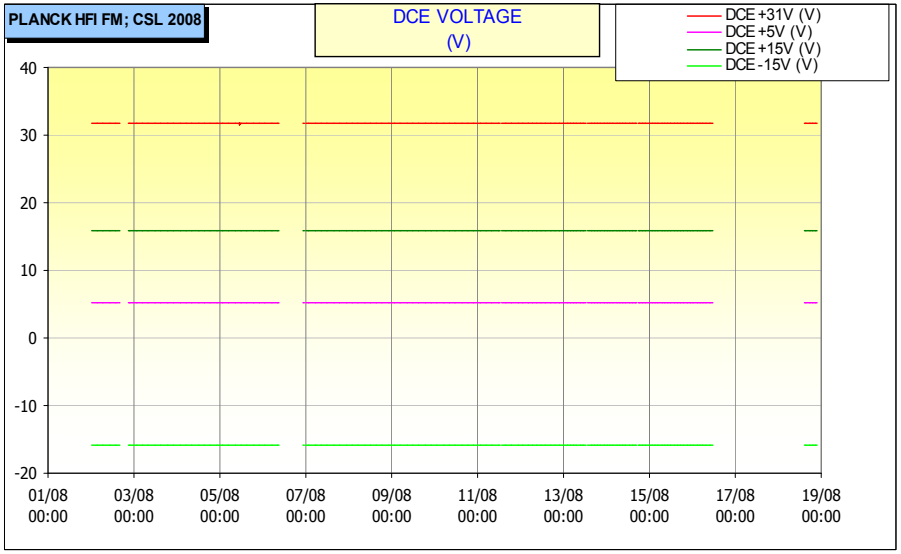

PLANCK HFI FM; CSL 2008
3He and 4He TEMPERATURE (K)
Temperature 4He inlet (°C)
Temperature 3He inlet (°C)
30
25
20
15
10
5
0
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

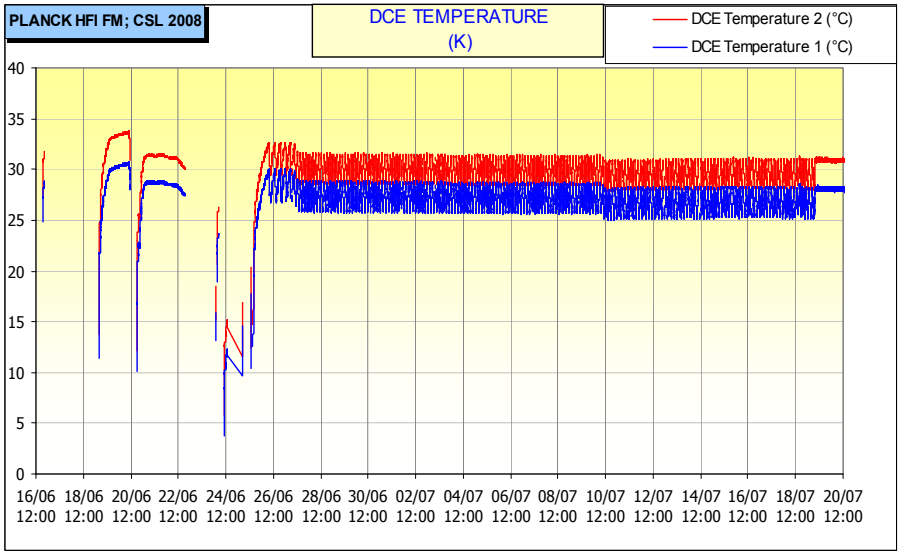

PLANCK HFI FM; CSL 2008
3He and 4He TEMPERATURE (K)
Temperature 4He inlet (°C)
Temperature 3He inlet (°C)
35
30
25
20
15
10
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

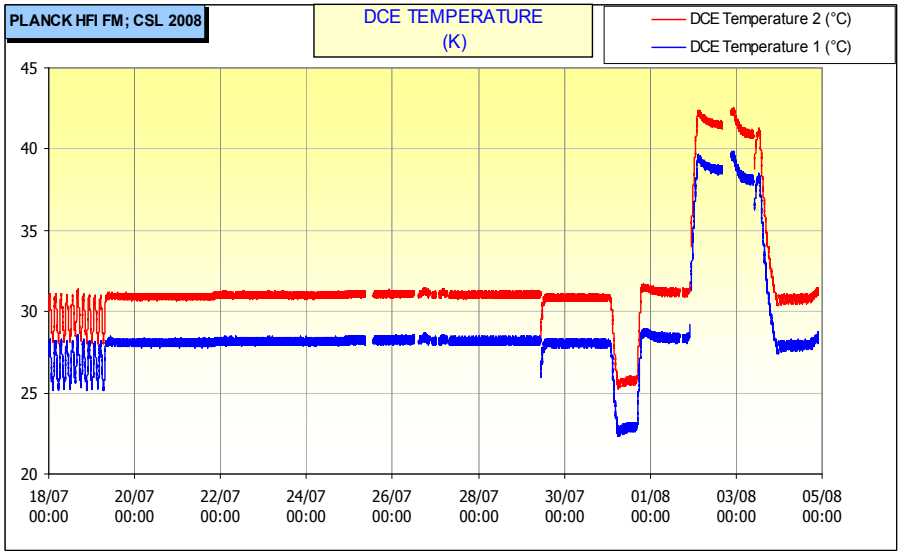

PLANCK HFI FM; CSL 2008
3He and 4He TEMPERATURE (K)
Temperature 4He inlet (°C)
Temperature 3He inlet (°C)
35
30
25
20
15
10
5
0
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

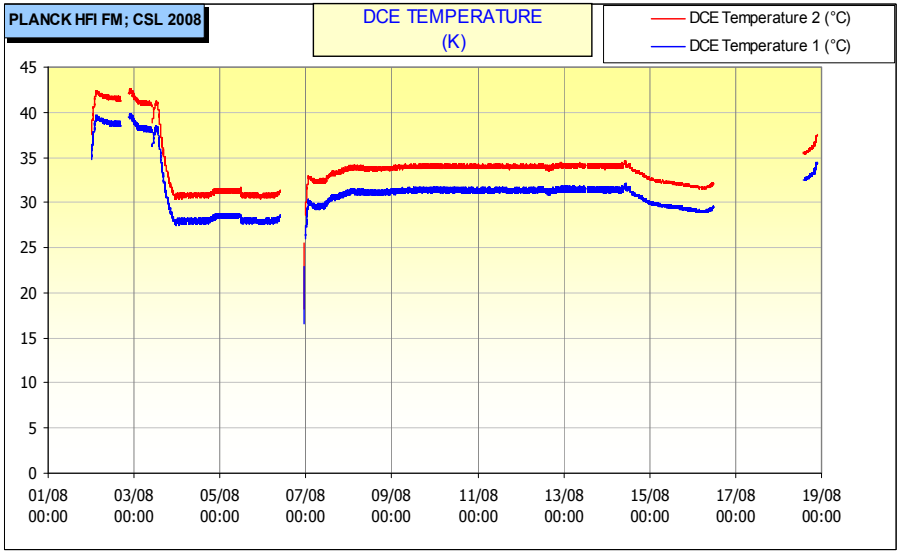

PLANCK HFI FM; CSL 2008
DCE VOLTAGE
(V)
DCE +31V (V)
DCE +5V (V)
DCE +15V (V)
DCE -15V (V)
40
30
20
10
0
-10
-20
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00


PLANCK HFI FM; CSL 2008
DCE VOLTAGE
(V)
DCE +31V (V)
DCE +5V (V)
DCE +15V (V)
DCE -15V (V)
40
30
20
10
0
-10
-20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

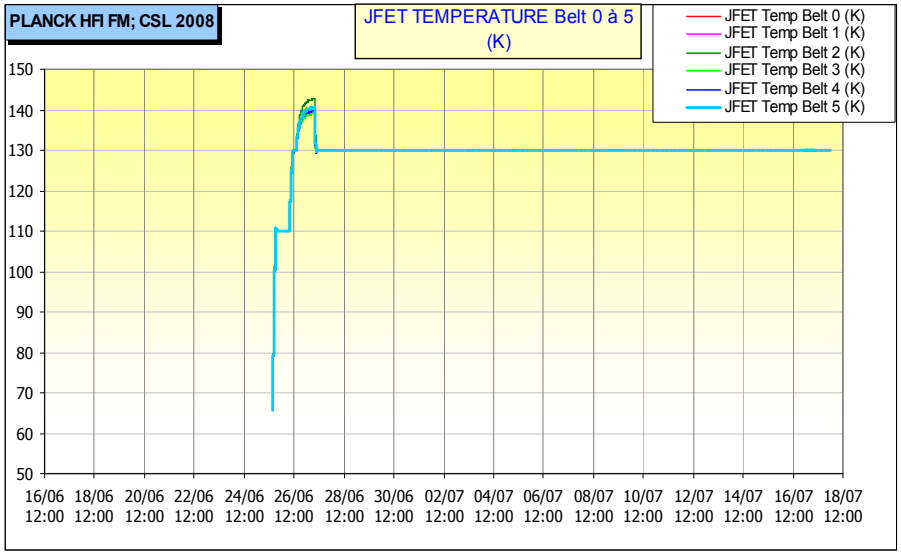

PLANCK HFI FM; CSL 2008
DCE VOLTAGE
(V)
DCE +31V (V)
DCE +5V (V)
DCE +15V (V)
DCE -15V (V)
40
30
20
10
0
-10
-20
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

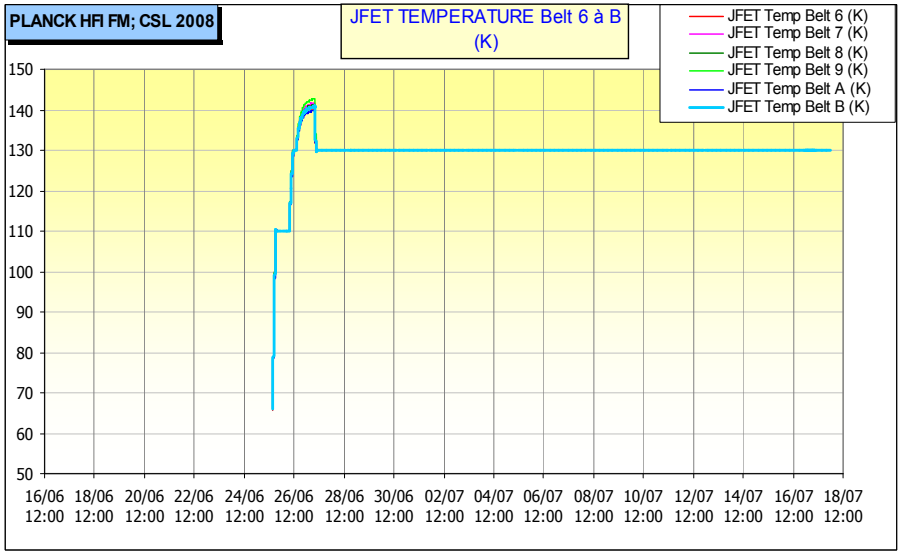

PLANCK HFI FM; CSL 2008
DCE TEMPERATURE
(K)
DCE Temperature 2 (°C)
DCE Temperature 1 (°C)
40
35
30
25
20
15
10
5
0
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

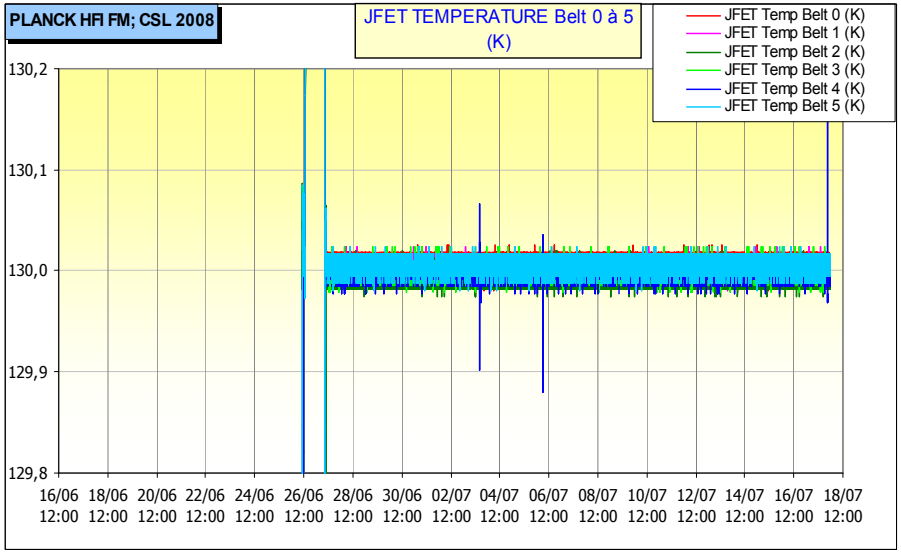

PLANCK HFI FM; CSL 2008
DCE TEMPERATURE
(K)
DCE Temperature 2 (°C)
DCE Temperature 1 (°C)
45
40
35
30
25
20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

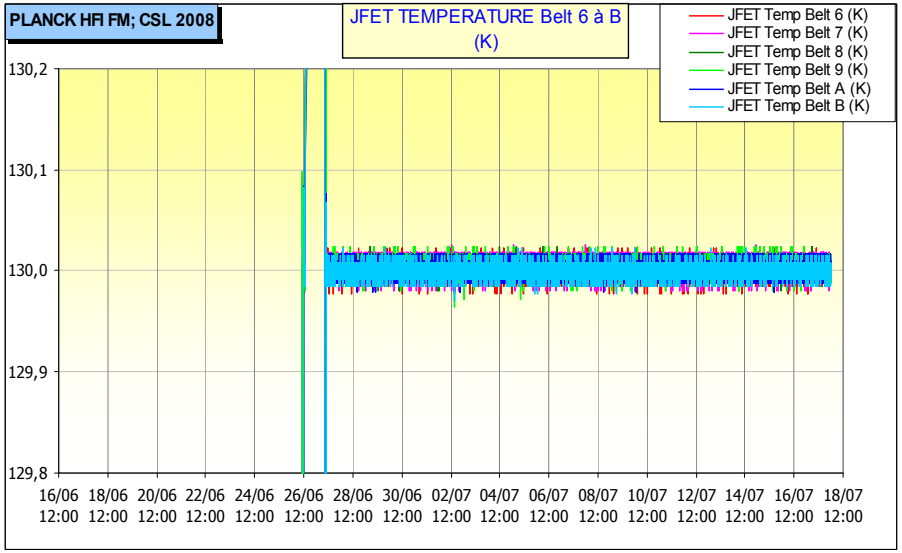

PLANCK HFI FM; CSL 2008
DCE TEMPERATURE
(K)
DCE Temperature 2 (°C)
DCE Temperature 1 (°C)
45
40
35
30
25
20
15
10
5
0
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

COOLING DOWN

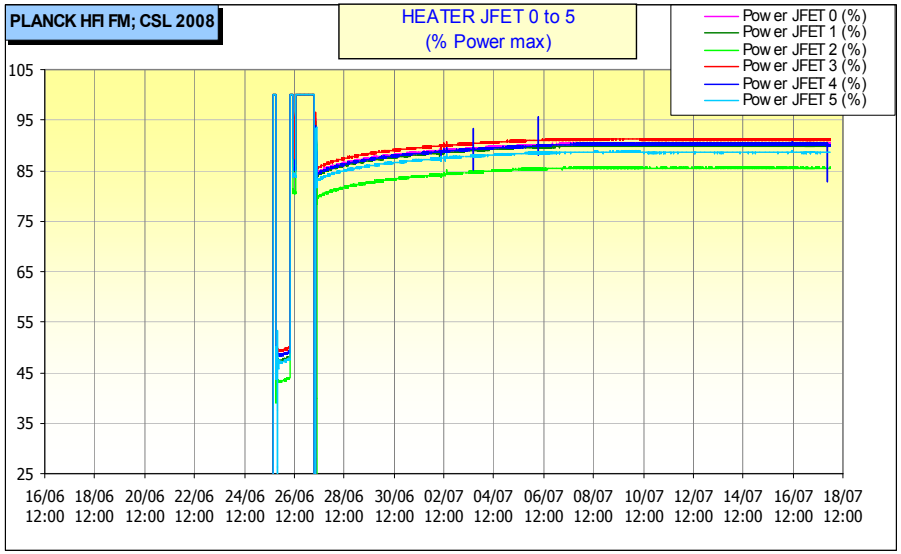


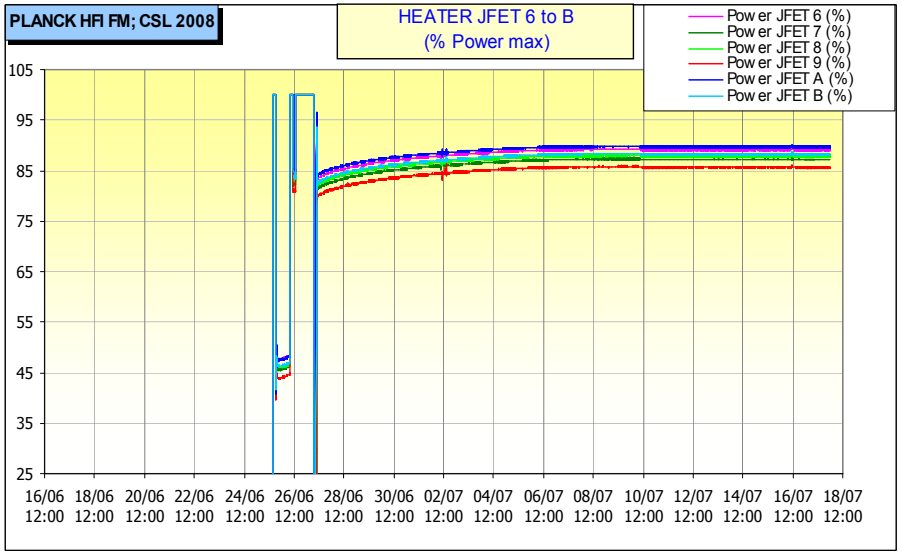


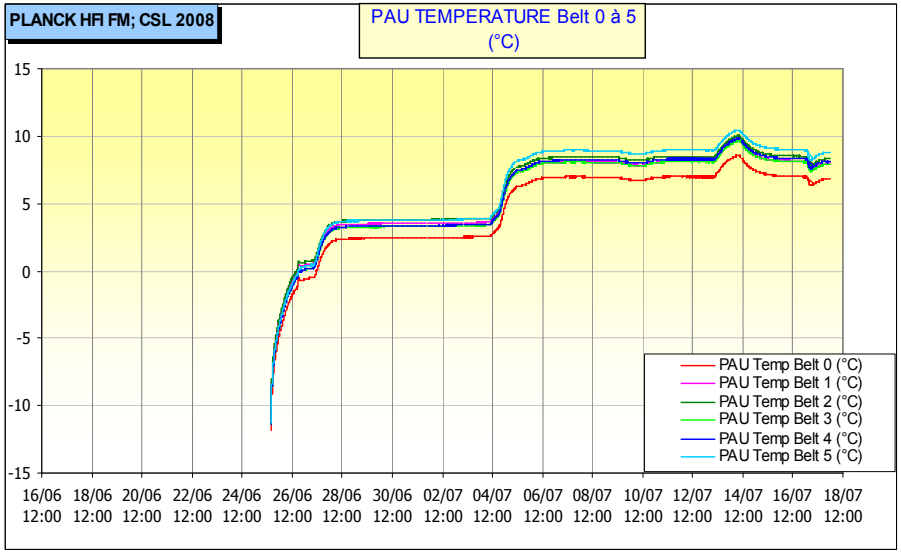


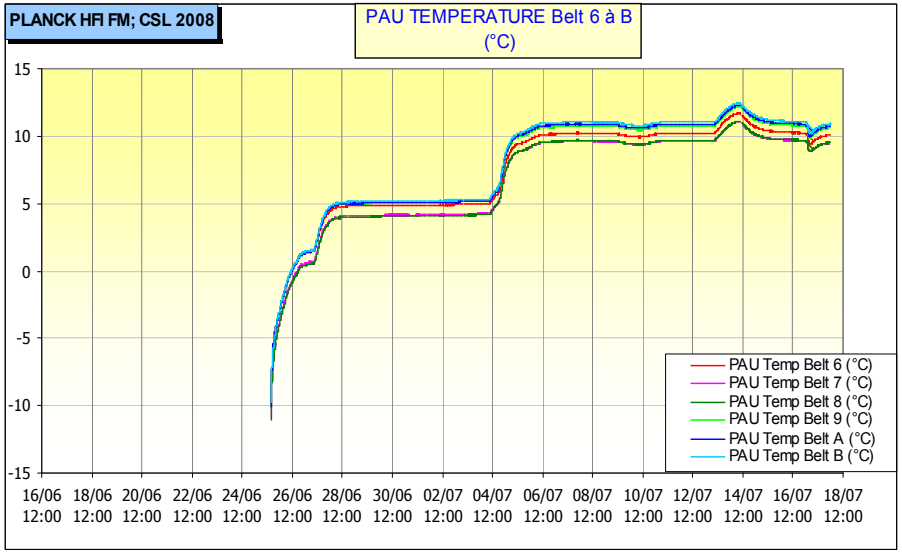


COOLING DOWN

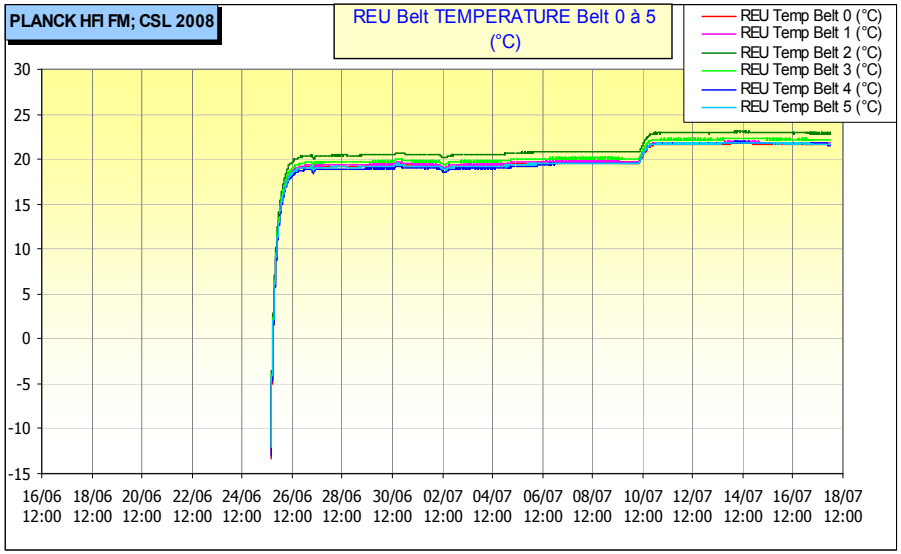


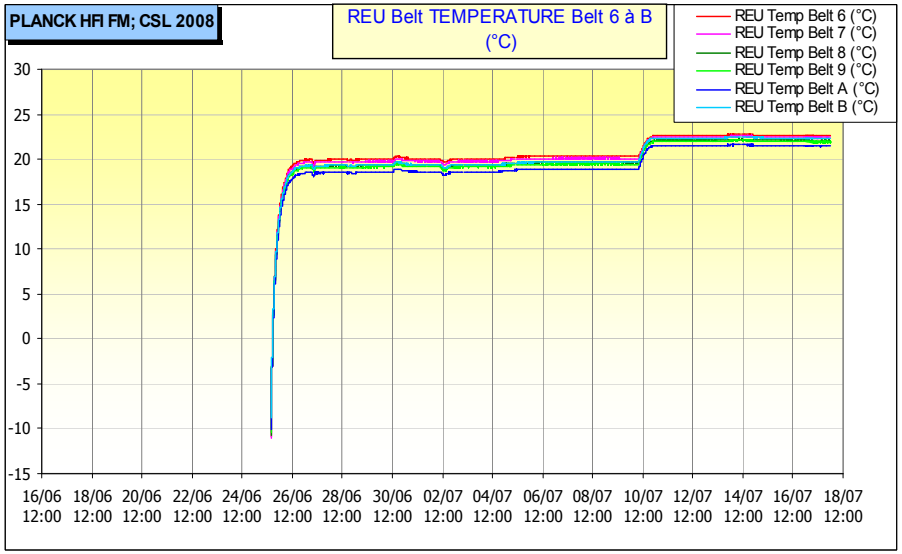


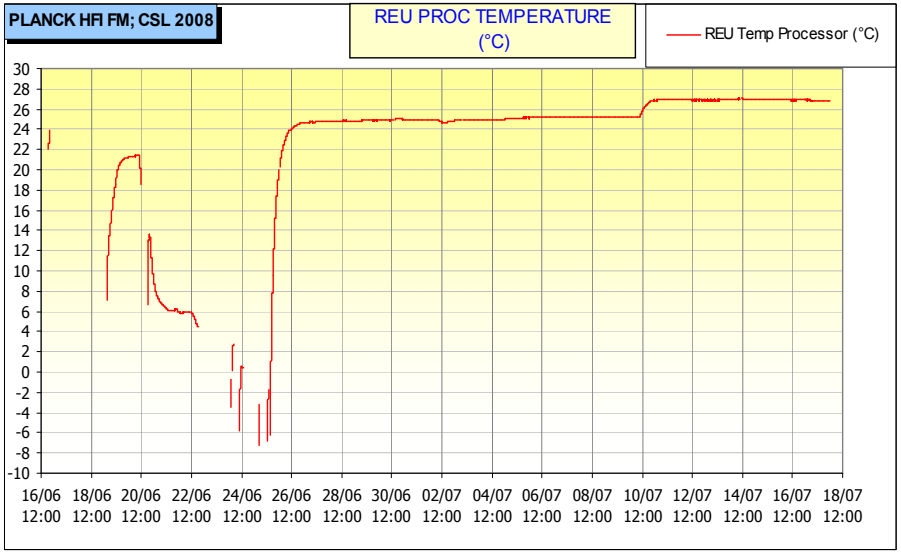




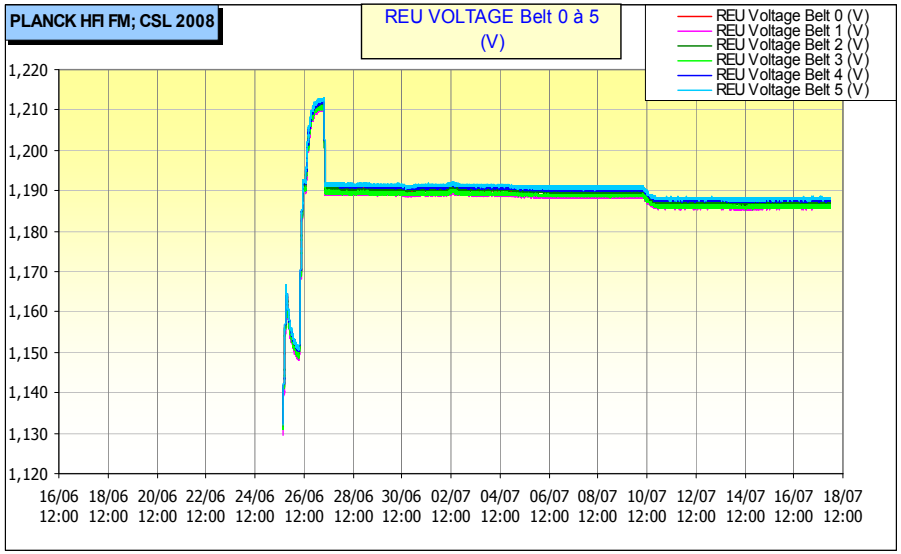
COOLING DOWN

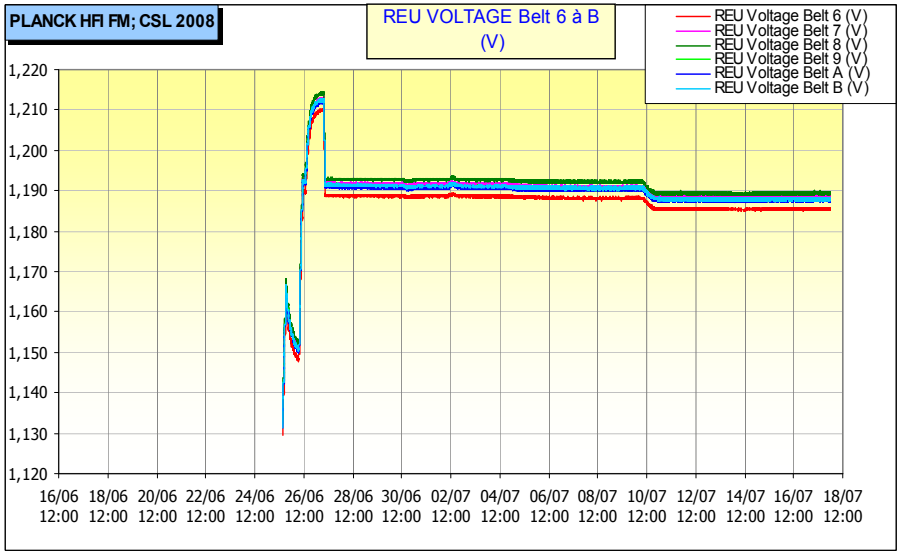


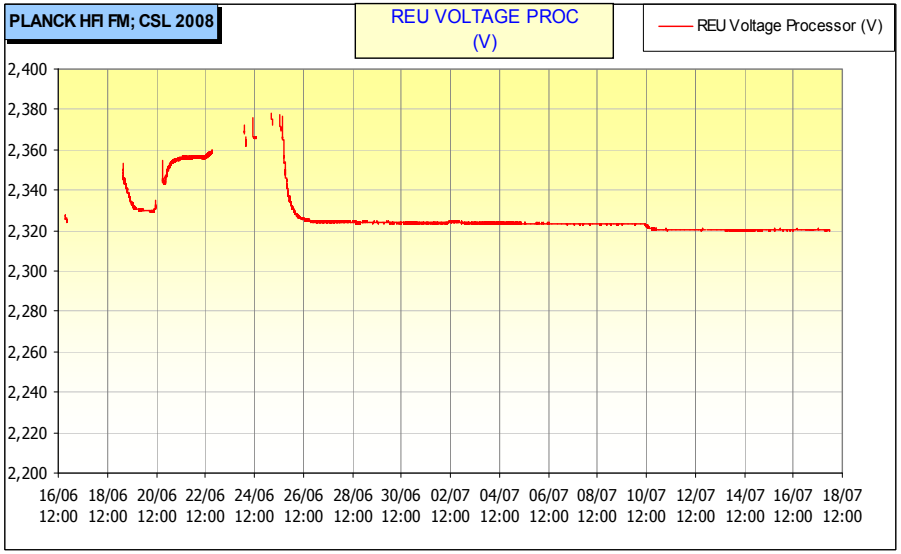




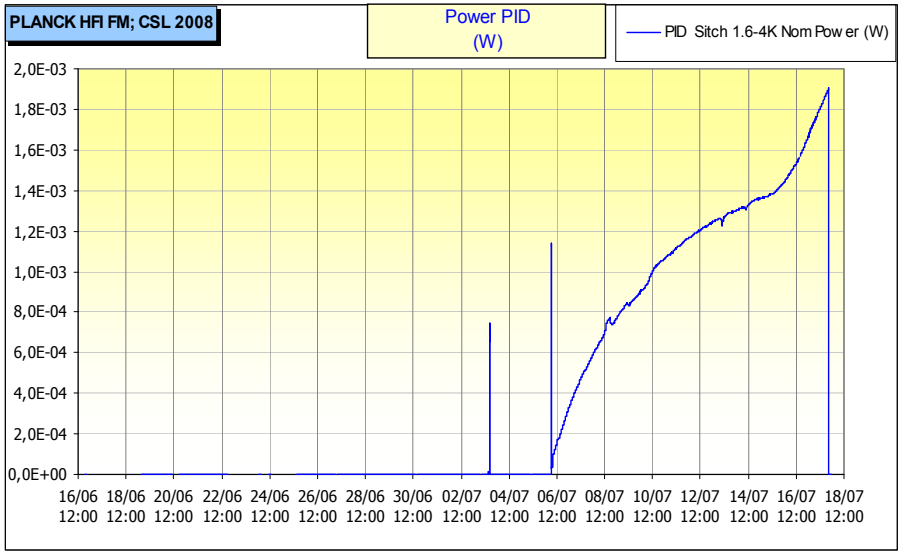
COOLING DOWN



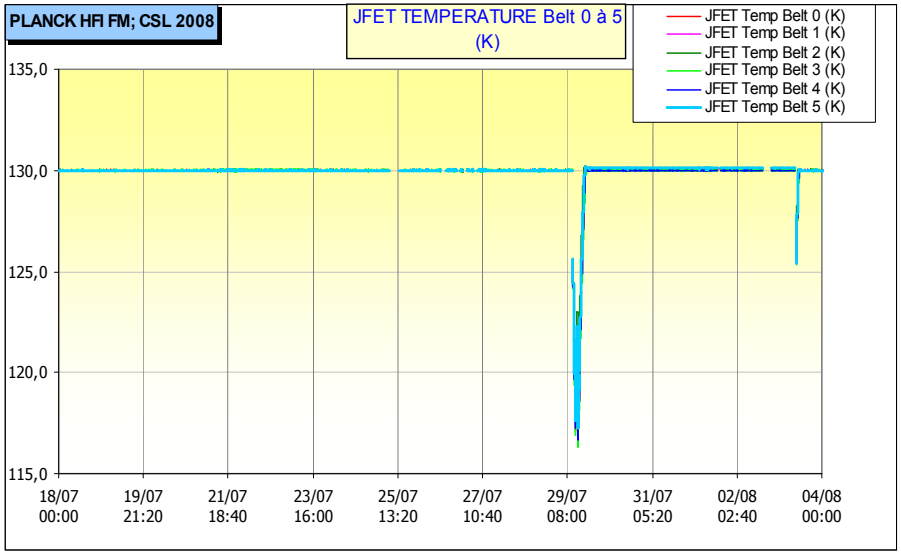


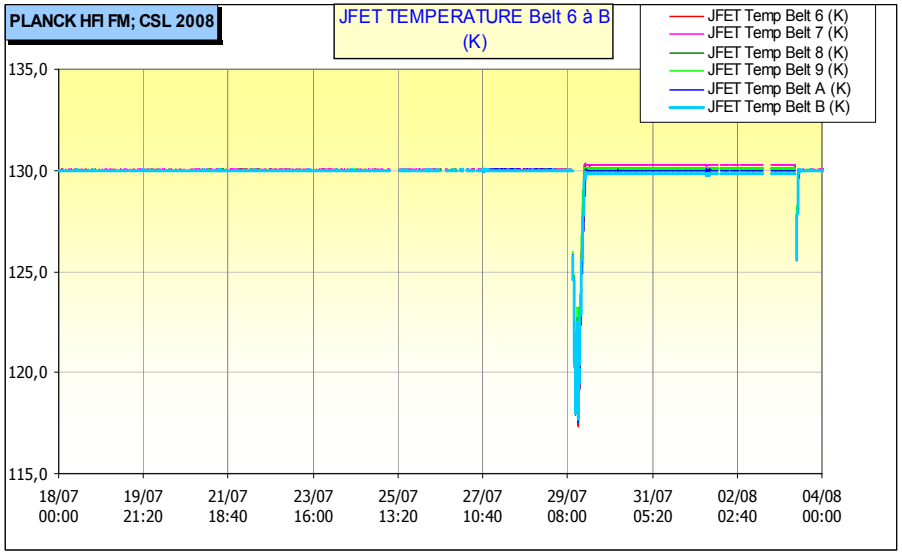


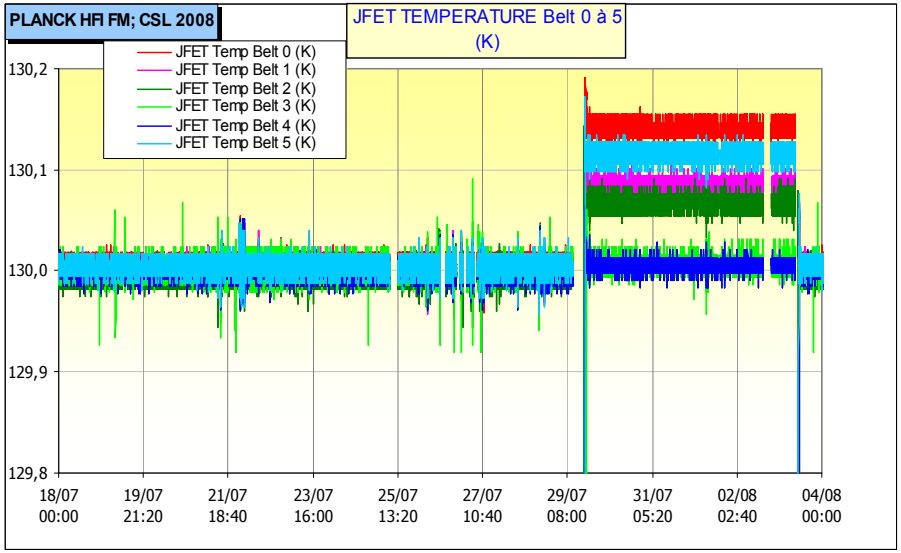
COOLING DOWN

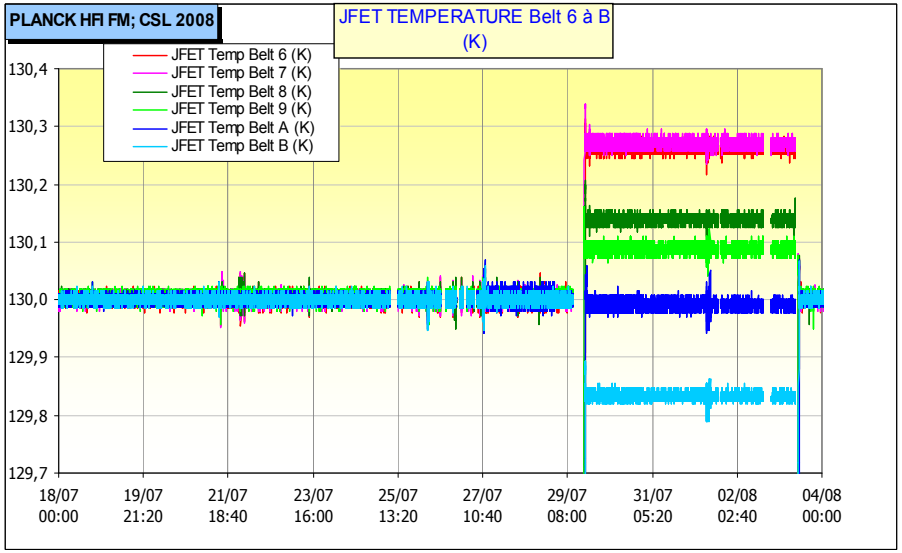


COLD PHASE

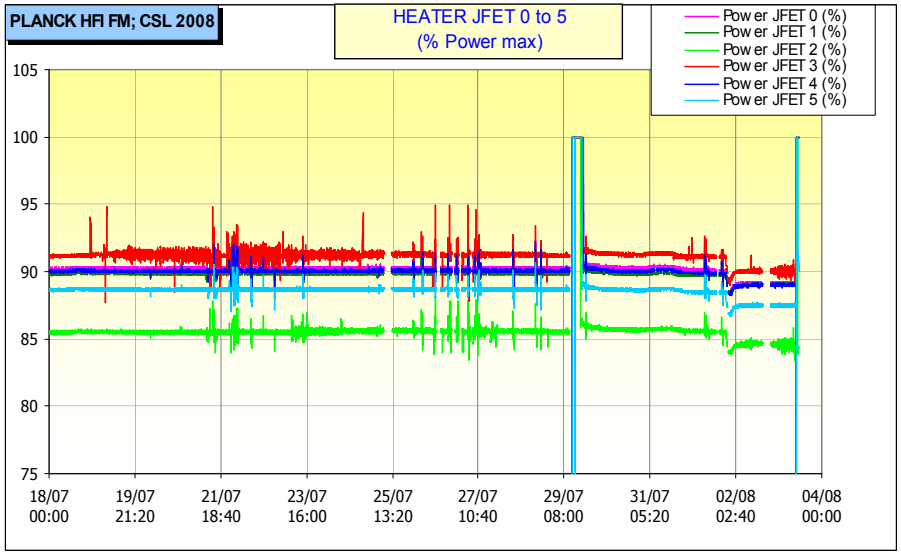

PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 0 à 5 (K)
JFET Temp Belt 0 (K)
JFET Temp Belt 1 (K)
JFET Temp Belt 2 (K)
JFET Temp Belt 3 (K)
JFET Temp Belt 4 (K)
JFET Temp Belt 5 (K)
135,0
130,0
125,0
120,0
115,0
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

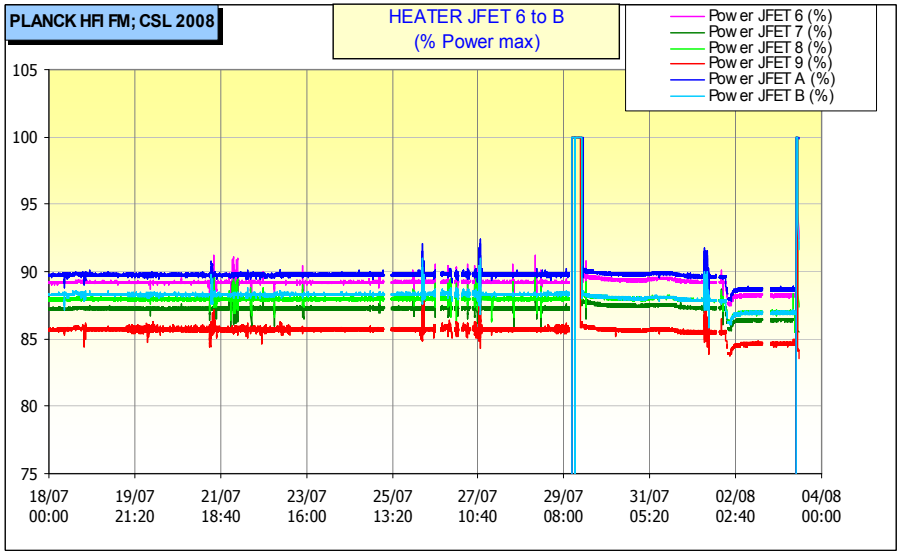

PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 6 à B (K)
JFET Temp Belt 6 (K)
JFET Temp Belt 7 (K)
JFET Temp Belt 8 (K)
JFET Temp Belt 9 (K)
JFET Temp Belt A (K)
JFET Temp Belt B (K)
135,0
130,0
125,0
120,0
115,0
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00


PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 0 à 5 (K)
JFET Temp Belt 0 (K)
JFET Temp Belt 1 (K)
JFET Temp Belt 2 (K)
JFET Temp Belt 3 (K)
JFET Temp Belt 4 (K)
JFET Temp Belt 5 (K)
130,2
130,1
130,0
129,9
129,8
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

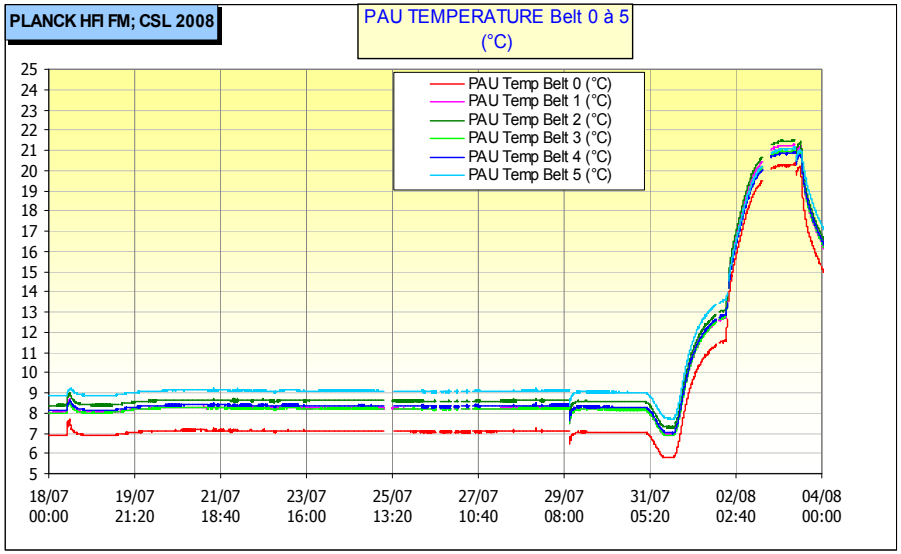

PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 6 à B (K)
JFET Temp Belt 6 (K)
JFET Temp Belt 7 (K)
JFET Temp Belt 8 (K)
JFET Temp Belt 9 (K)
JFET Temp Belt A (K)
JFET Temp Belt B (K)
130,4
130,3
130,2
130,1
130,0
129,9
129,8
129,7
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

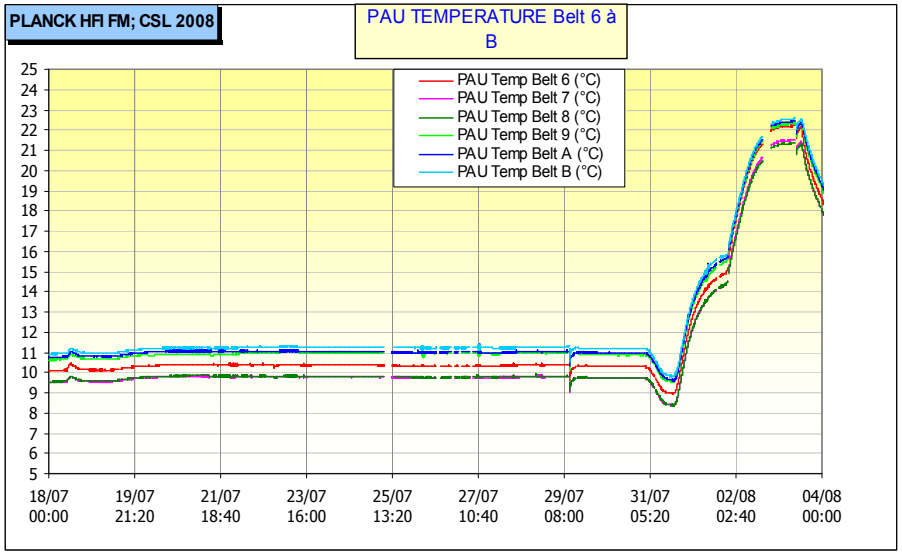
COLD PHASE

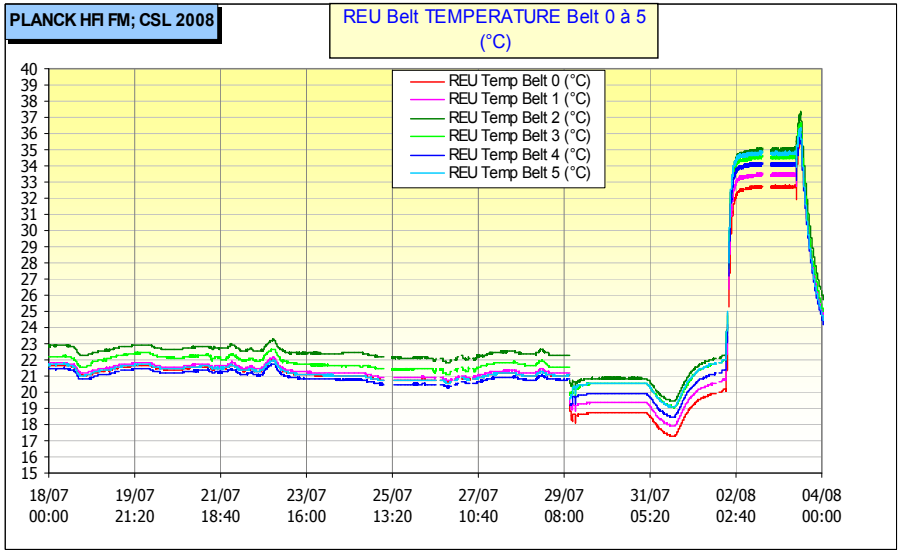

PLANCK HFI FM; CSL 2008
HEATER JFET 0 to 5
(% Power max)
Power JFET 0 (%)
Power JFET 1 (%)
Power JFET 2 (%)
Power JFET 3 (%)
Power JFET 4 (%)
Power JFET 5 (%)
105
100
95
90
85
80
75
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

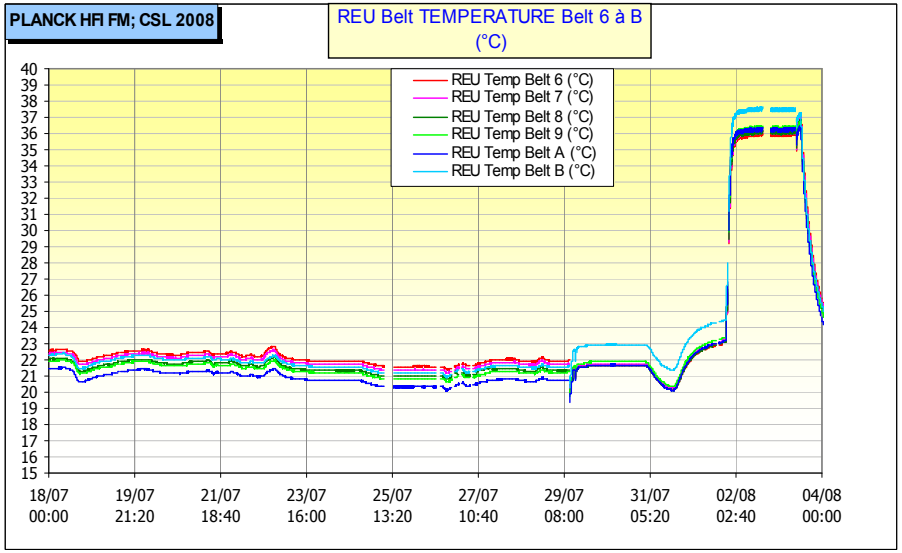

PLANCK HFI FM; CSL 2008
HEATER JFET 6 to B
(% Power max)
Power JFET 6 (%)
Power JFET 7 (%)
Power JFET 8 (%)
Power JFET 9 (%)
Power JFET A (%)
Power JFET B (%)
105
100
95
90
85
80
75
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

COLD PHASE

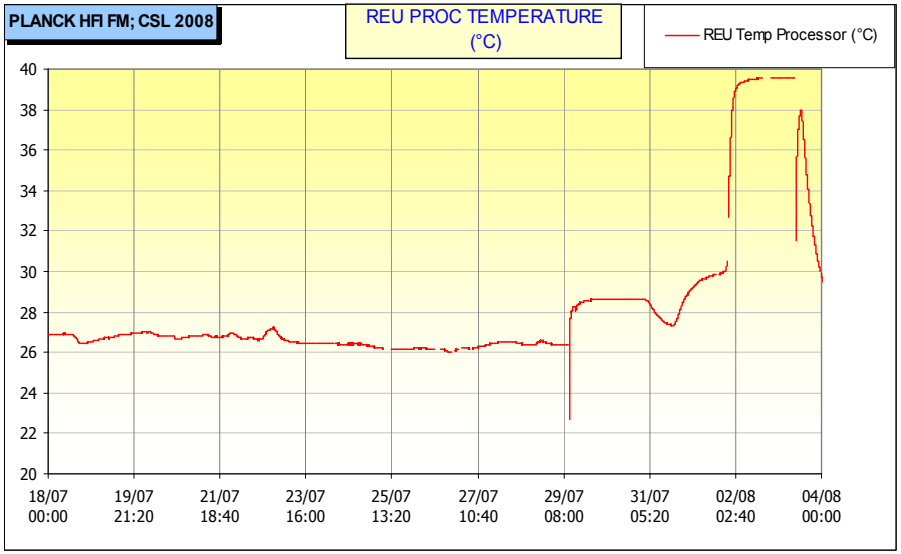

PLANCK HFI FM; CSL 2008
PAU TEMPERATURE Belt 0 à 5 (°C)
PAU Temp Belt 0 (°C)
PAU Temp Belt 1 (°C)
PAU Temp Belt 2 (°C)
PAU Temp Belt 3 (°C)
PAU Temp Belt 4 (°C)
PAU Temp Belt 5 (°C)
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00


PLANCK HFI FM; CSL 2008
PAU TEMPERATURE Belt 6 à B
PAU Temp Belt 6 (°C)
PAU Temp Belt 7 (°C)
PAU Temp Belt 8 (°C)
PAU Temp Belt 9 (°C)
PAU Temp Belt A (°C)
PAU Temp Belt B (°C)
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

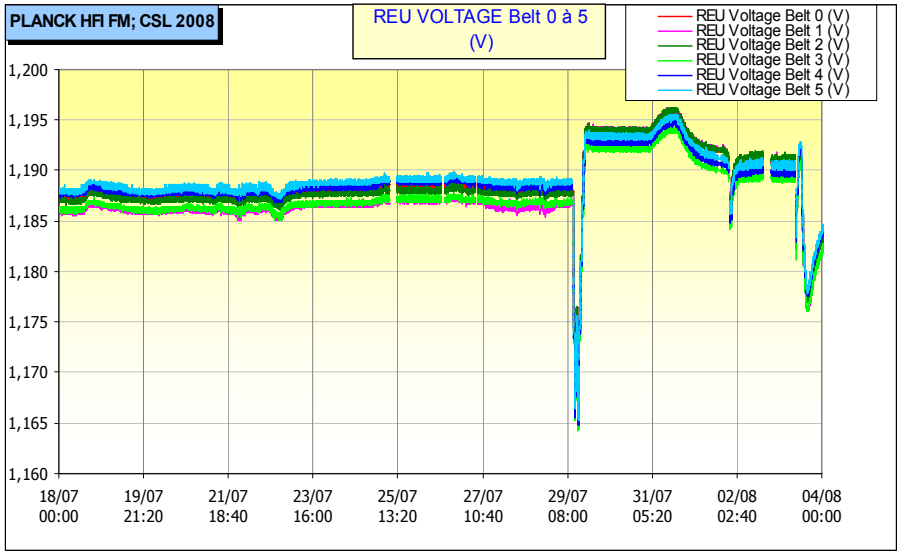

PLANCK HFI FM; CSL 2008
REU Belt TEMPERATURE Belt 0 à 5 (°C)
REU Temp Belt 0 (°C)
REU Temp Belt 1 (°C)
REU Temp Belt 2 (°C)
REU Temp Belt 3 (°C)
REU Temp Belt 4 (°C)
REU Temp Belt 5 (°C)
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

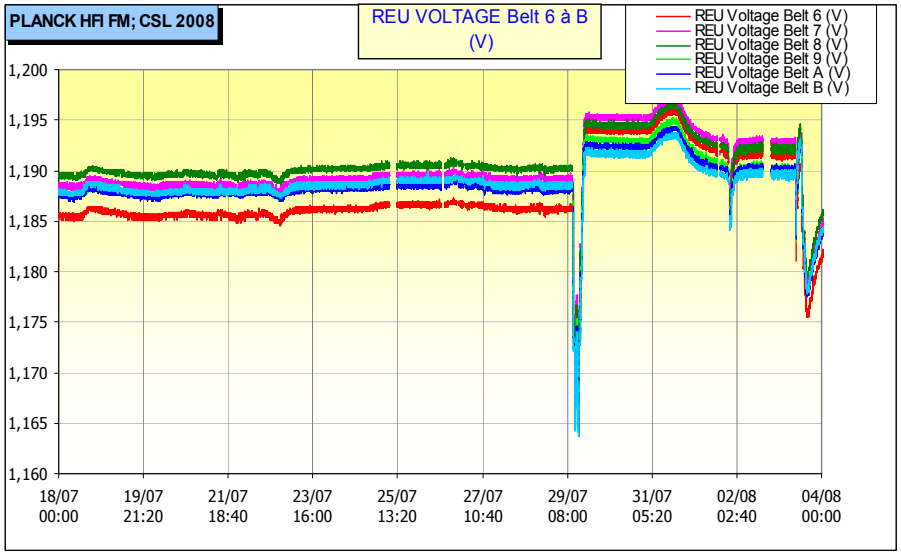

PLANCK HFI FM; CSL 2008
REU Belt TEMPERATURE Belt 6 à B (°C)
REU Temp Belt 6 (°C)
REU Temp Belt 7 (°C)
REU Temp Belt 8 (°C)
REU Temp Belt 9 (°C)
REU Temp Belt A (°C)
REU Temp Belt B (°C)
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

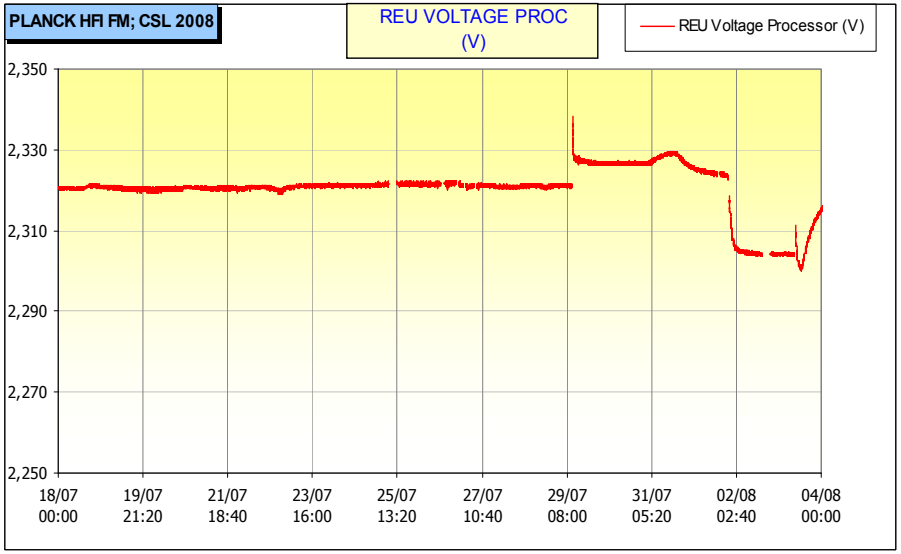
COLD PHASE


PLANCK HFI FM; CSL 2008
REU PROC TEMPERATURE (°C)
REU Temp Processor (°C)
40
38
36
34
32
30
28
26
24
22
20
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

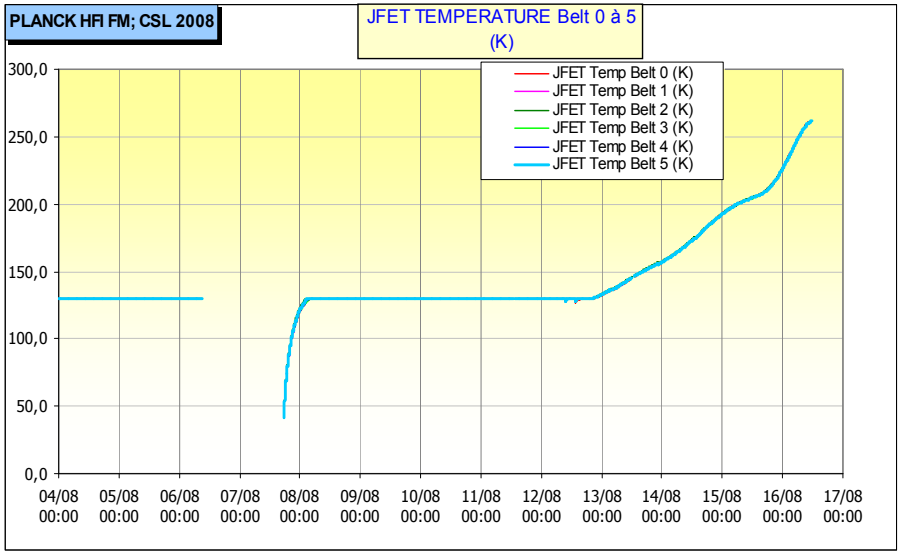
COLD PHASE

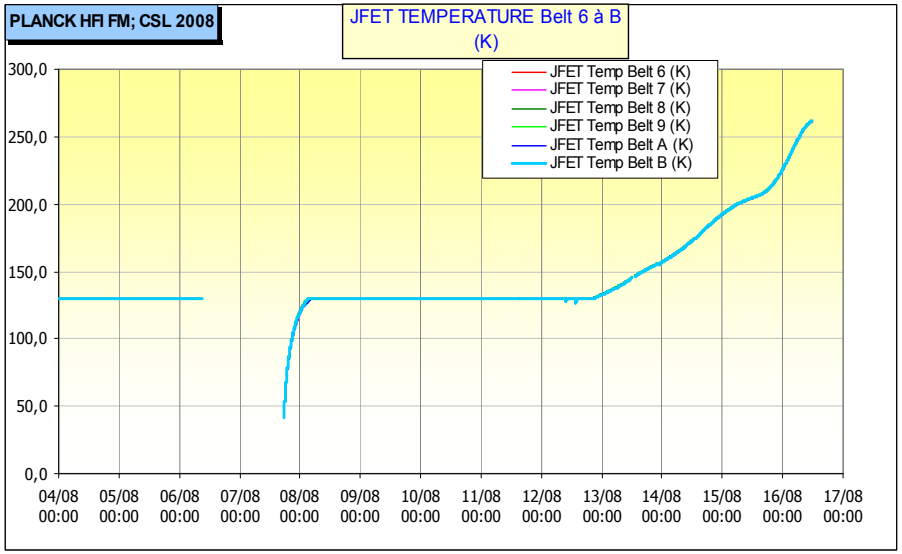

PLANCK HFI FM; CSL 2008
REU VOLTAGE Belt 0 à 5 (V)
REU Voltage Belt 0 (V)
REU Voltage Belt 1 (V)
REU Voltage Belt 2 (V)
REU Voltage Belt 3 (V)
REU Voltage Belt 4 (V)
REU Voltage Belt 5 (V)
1,200
1,195
1,190
1,185
1,180
1,175
1,170
1,165
1,160
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

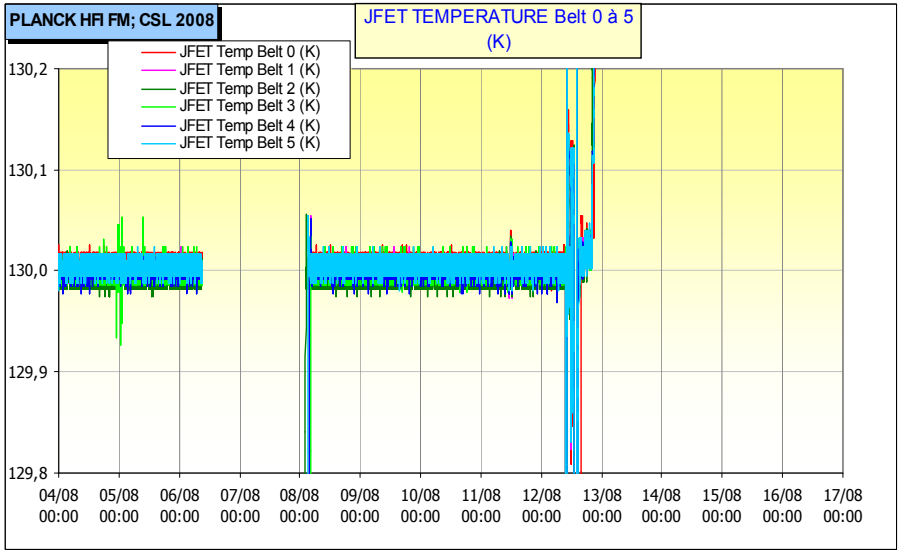

PLANCK HFI FM; CSL 2008
REU VOLTAGE Belt 6 à B (V)
REU Voltage Belt 6 (V)
REU Voltage Belt 7 (V)
REU Voltage Belt 8 (V)
REU Voltage Belt 9 (V)
REU Voltage Belt A (V)
REU Voltage Belt B (V)
1,200
1,195
1,190
1,185
1,180
1,175
1,170
1,165
1,160
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

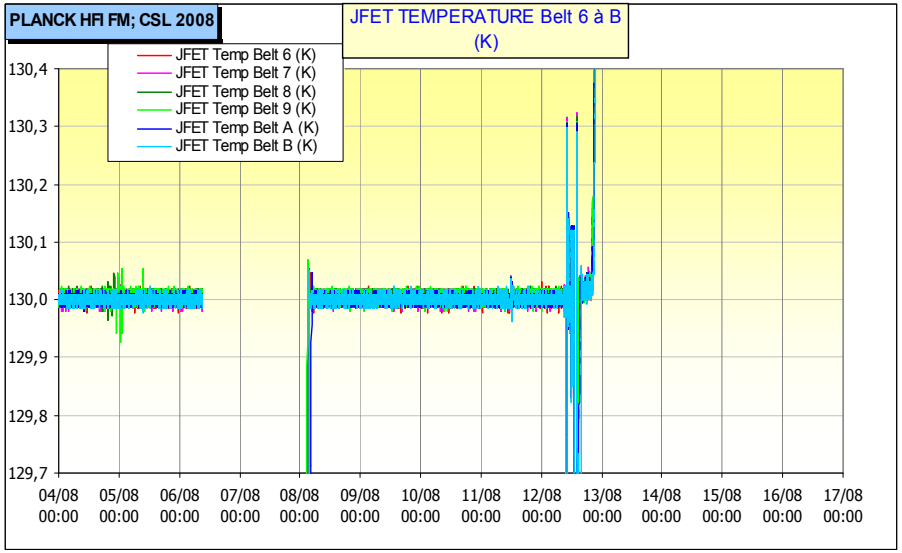

PLANCK HFI FM; CSL 2008
REU VOLTAGE PROC (V)
REU Voltage Processor (V)
2,350
2,330
2,310
2,290
2,270
2,250
18/07 00:00
19/07 21:20
21/07 18:40
23/07 16:00
25/07 13:20
27/07 10:40
29/07 08:00
31/07 05:20
02/08 02:40
04/08 00:00

WARMUP

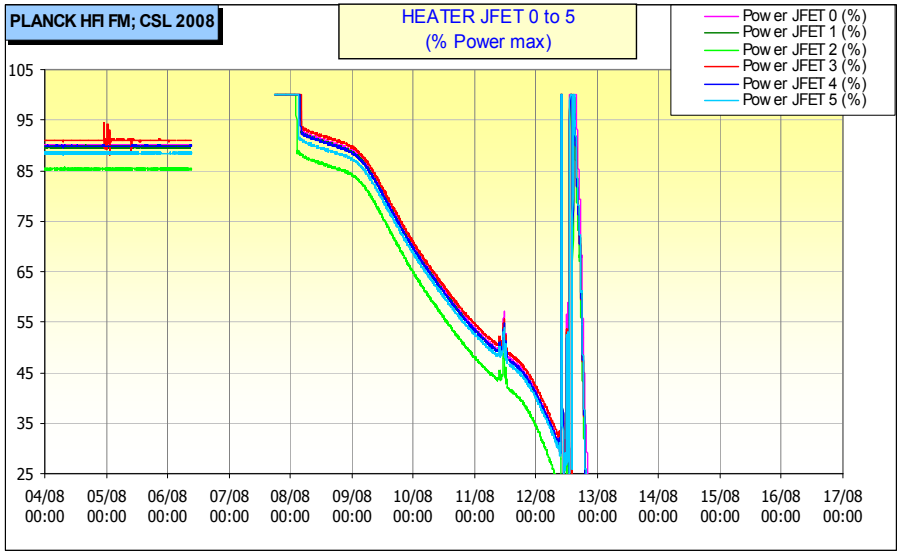

PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 0 à 5 (K)
JFET Temp Belt 0 (K)
JFET Temp Belt 1 (K)
JFET Temp Belt 2 (K)
JFET Temp Belt 3 (K)
JFET Temp Belt 4 (K)
JFET Temp Belt 5 (K)
300,0
250,0
200,0
150,0
100,0
50,0
0,0
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

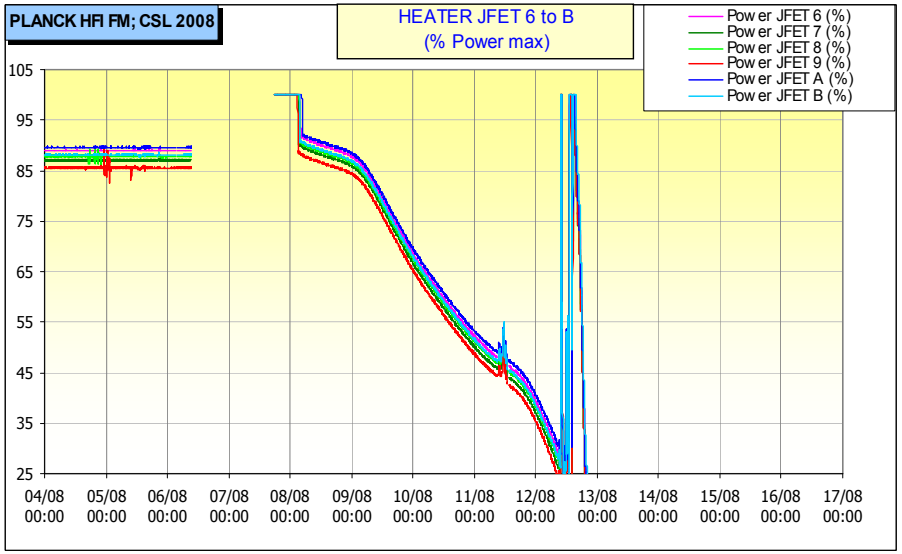

PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 6 à B (K)
JFET Temp Belt 6 (K)
JFET Temp Belt 7 (K)
JFET Temp Belt 8 (K)
JFET Temp Belt 9 (K)
JFET Temp Belt A (K)
JFET Temp Belt B (K)
300,0
250,0
200,0
150,0
100,0
50,0
0,0
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00


PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 0 à 5 (K)
JFET Temp Belt 0 (K)
JFET Temp Belt 1 (K)
JFET Temp Belt 2 (K)
JFET Temp Belt 3 (K)
JFET Temp Belt 4 (K)
JFET Temp Belt 5 (K)
130,2
130,1
130,0
129,9
129,8
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

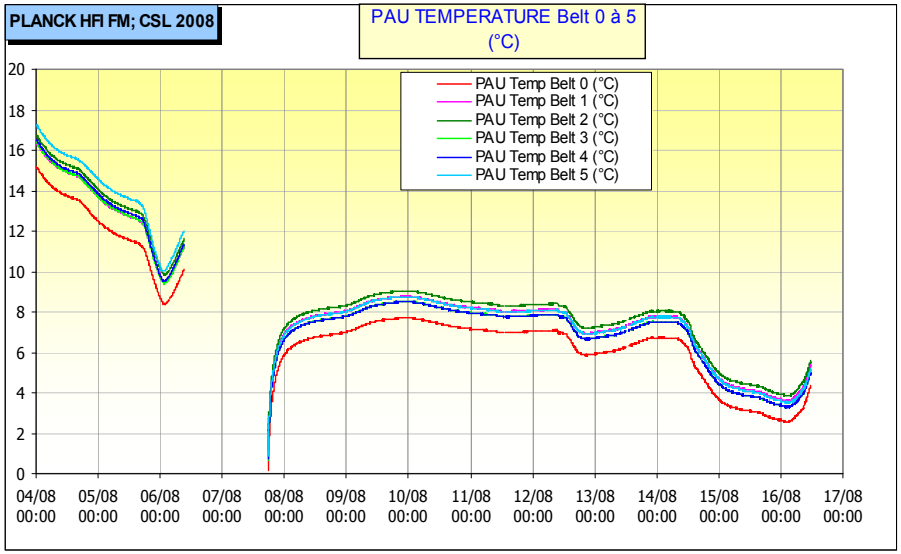

PLANCK HFI FM; CSL 2008
JFET TEMPERATURE Belt 6 à B (K)
JFET Temp Belt 6 (K)
JFET Temp Belt 7 (K)
JFET Temp Belt 8 (K)
JFET Temp Belt 9 (K)
JFET Temp Belt A (K)
JFET Temp Belt B (K)
130,4
130,3
130,2
130,1
130,0
129,9
129,8
129,7
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

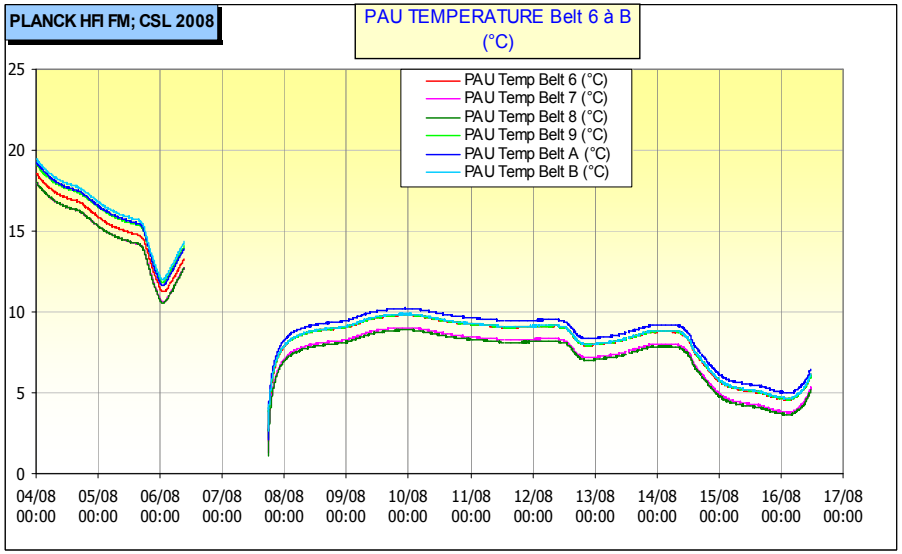
WARMUP

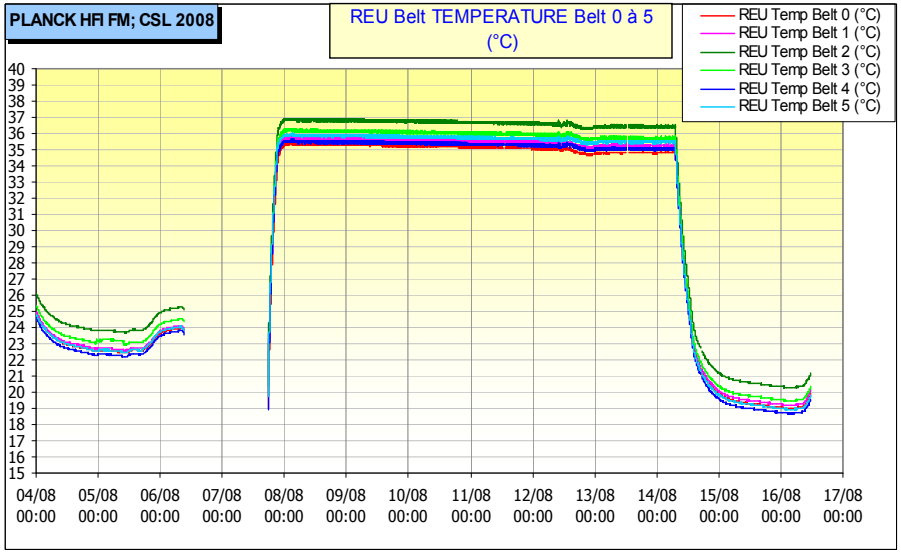

PLANCK HFI FM; CSL 2008
HEATER JFET 0 to 5
(% Power max)
Power JFET 0 (%)
Power JFET 1 (%)
Power JFET 2 (%)
Power JFET 3 (%)
Power JFET 4 (%)
Power JFET 5 (%)
105
95
85
75
65
55
45
35
25
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

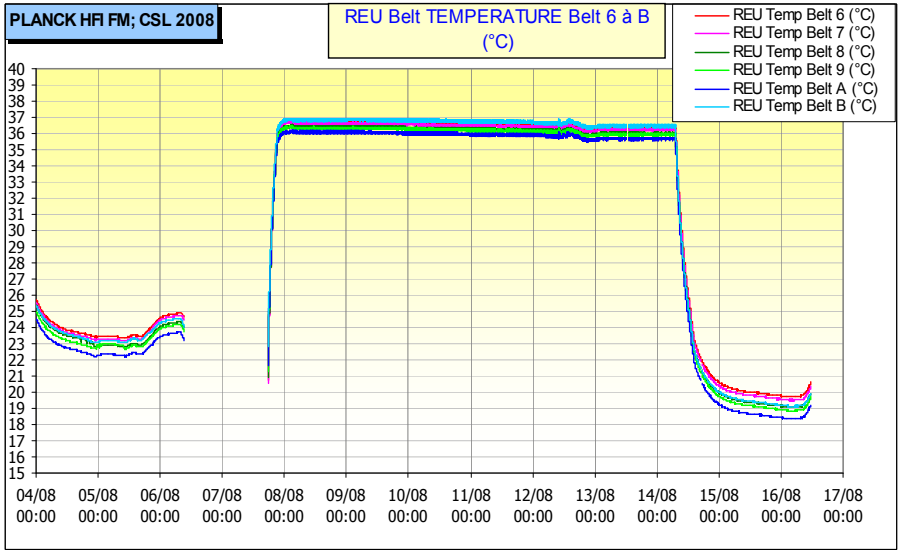

PLANCK HFI FM; CSL 2008
HEATER JFET 6 to B
(% Power max)
Power JFET 6 (%)
Power JFET 7 (%)
Power JFET 8 (%)
Power JFET 9 (%)
Power JFET A (%)
Power JFET B (%)
105
95
85
75
65
55
45
35
25
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

WARMUP

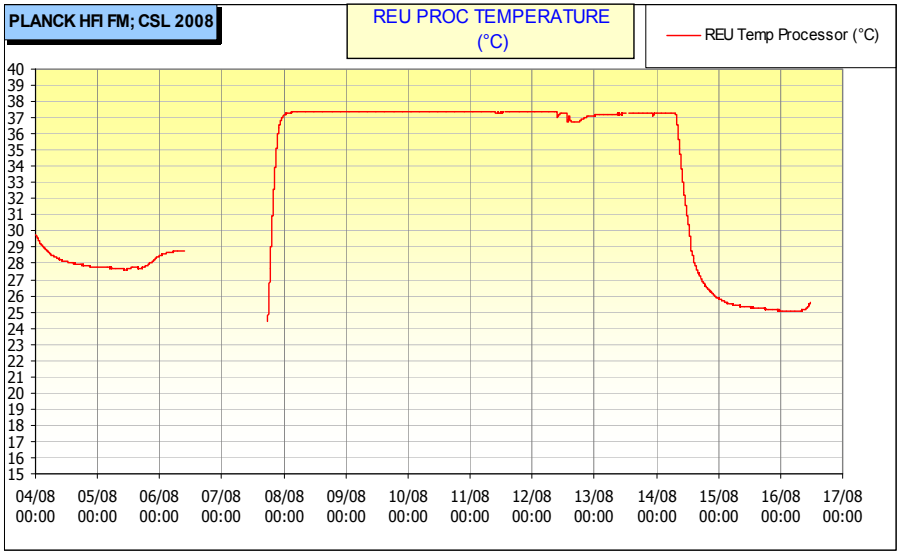

PLANCK HFI FM; CSL 2008
PAU TEMPERATURE Belt 0 à 5 (°C)
PAU Temp Belt 0 (°C)
PAU Temp Belt 1 (°C)
PAU Temp Belt 2 (°C)
PAU Temp Belt 3 (°C)
PAU Temp Belt 4 (°C)
PAU Temp Belt 5 (°C)


PLANCK HFI FM; CSL 2008
PAU TEMPERATURE Belt 6 à B (°C)
PAU Temp Belt 6 (°C)
PAU Temp Belt 7 (°C)
PAU Temp Belt 8 (°C)
PAU Temp Belt 9 (°C)
PAU Temp Belt A (°C)
PAU Temp Belt B (°C)

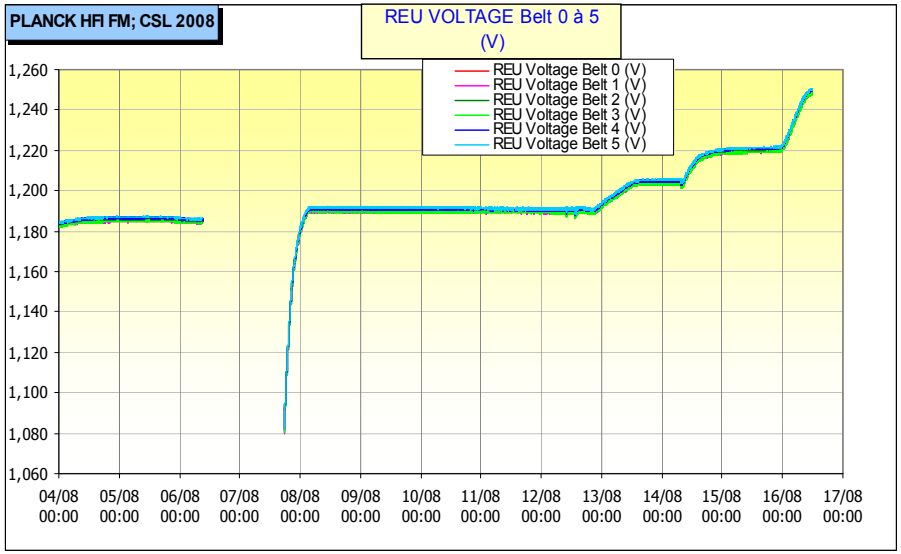

PLANCK HFI FM; CSL 2008
REU Belt TEMPERATURE Belt 0 à 5 (°C)
REU Temp Belt 0 (°C)
REU Temp Belt 1 (°C)
REU Temp Belt 2 (°C)
REU Temp Belt 3 (°C)
REU Temp Belt 4 (°C)
REU Temp Belt 5 (°C)

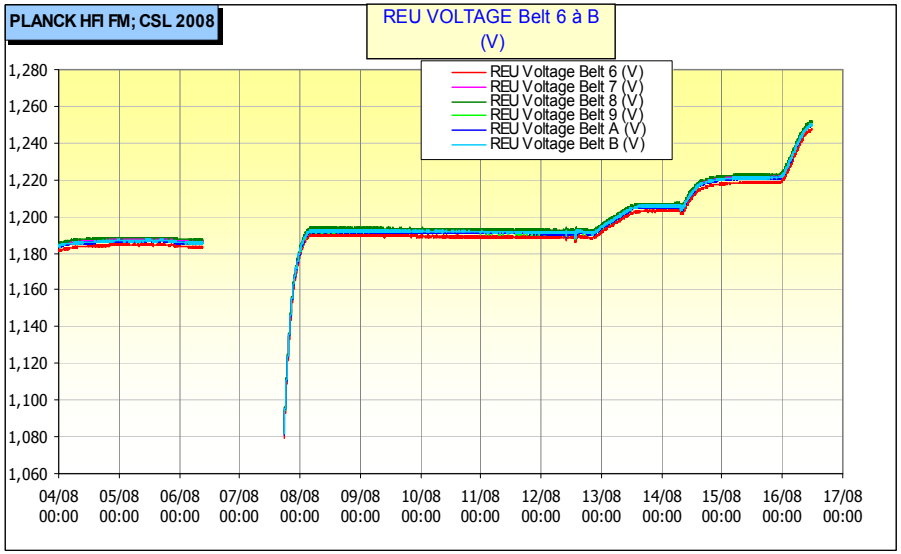

PLANCK HFI FM; CSL 2008
REU Belt TEMPERATURE Belt 6 à B (°C)
REU Temp Belt 6 (°C)
REU Temp Belt 7 (°C)
REU Temp Belt 8 (°C)
REU Temp Belt 9 (°C)
REU Temp Belt A (°C)
REU Temp Belt B (°C)

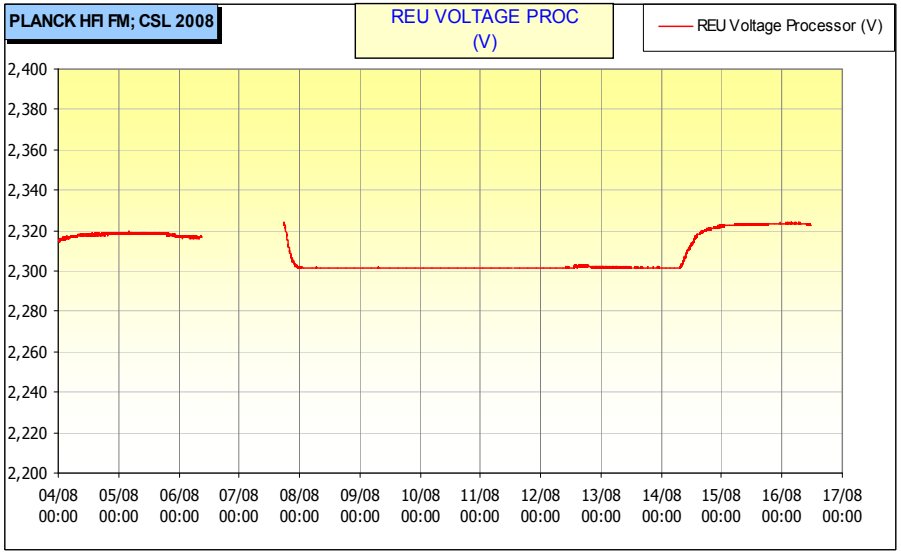
WARMUP

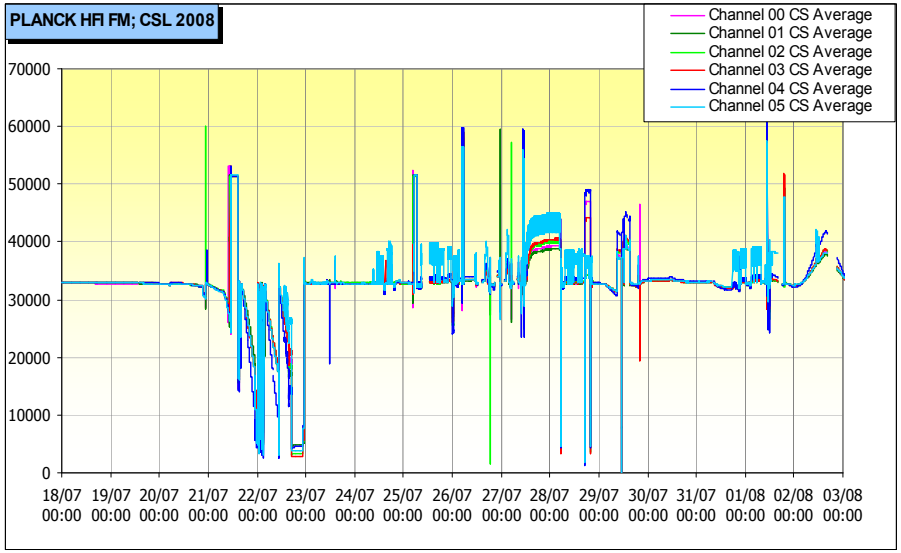

PLANCK HFI FM; CSL 2008
REU PROC TEMPERATURE (°C)
REU Temp Processor (°C)
40 39 38 37 36 35 34 33 32 31 30 29 28 27 26 25 24 23 22 21 20 19 18 17 16 15
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

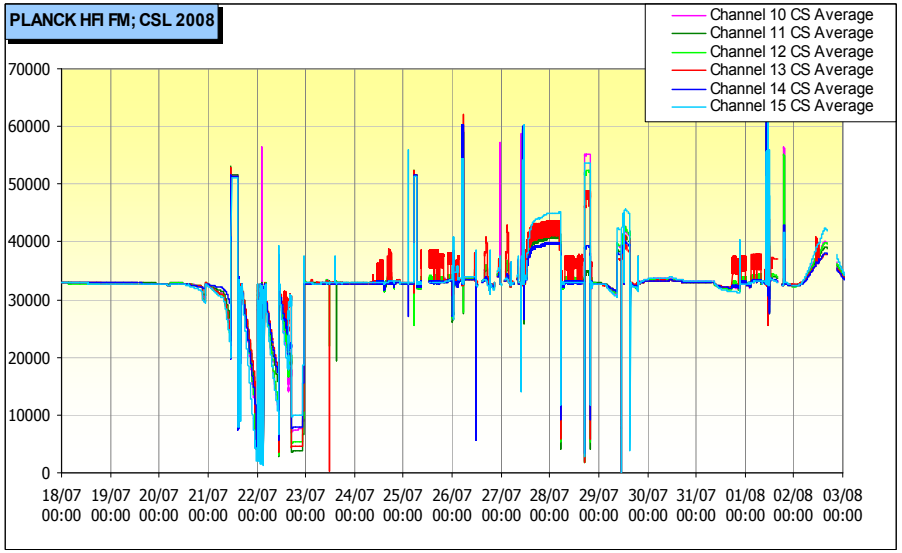
WARMUP

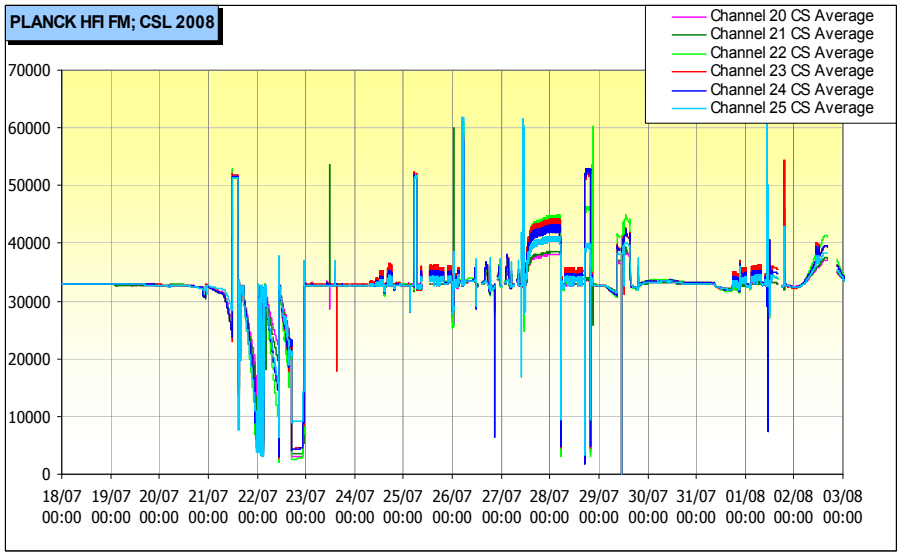

PLANCK HFI FM; CSL 2008
REU VOLTAGE Belt 0 à 5 (V)
REU Voltage Belt 0 (V)
REU Voltage Belt 1 (V)
REU Voltage Belt 2 (V)
REU Voltage Belt 3 (V)
REU Voltage Belt 4 (V)
REU Voltage Belt 5 (V)
1,260
1,240
1,220
1,200
1,180
1,160
1,140
1,120
1,100
1,080
1,060
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

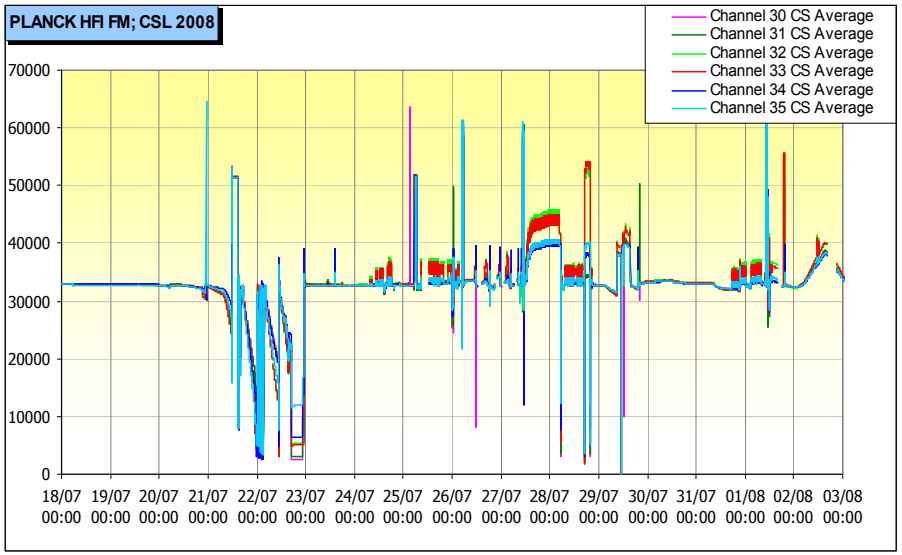

PLANCK HFI FM; CSL 2008
REU VOLTAGE Belt 6 à B (V)
REU Voltage Belt 6 (V)
REU Voltage Belt 7 (V)
REU Voltage Belt 8 (V)
REU Voltage Belt 9 (V)
REU Voltage Belt A (V)
REU Voltage Belt B (V)
1,280
1,260
1,240
1,220
1,200
1,180
1,160
1,140
1,120
1,100
1,080
1,060
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

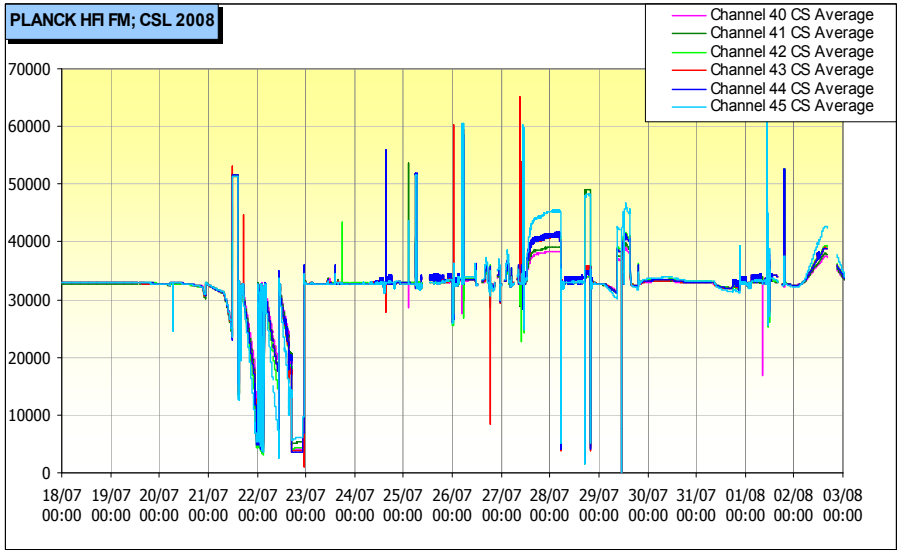

PLANCK HFI FM; CSL 2008
REU VOLTAGE PROC (V)
REU Voltage Processor (V)
2,400
2,380
2,360
2,340
2,320
2,300
2,280
2,260
2,240
2,220
2,200
04/08 00:00
05/08 00:00
06/08 00:00
07/08 00:00
08/08 00:00
09/08 00:00
10/08 00:00
11/08 00:00
12/08 00:00
13/08 00:00
14/08 00:00
15/08 00:00
16/08 00:00
17/08 00:00

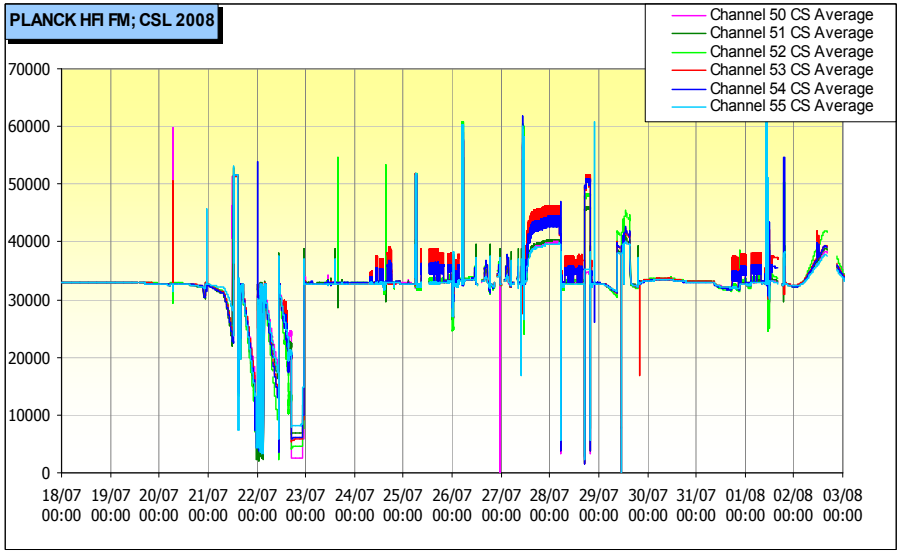

PLANCK HFI FM; CSL 2008
Channel 00 CS Average
Channel 01 CS Average
Channel 02 CS Average
Channel 03 CS Average
Channel 04 CS Average
Channel 05 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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01/08 00:00
02/08 00:00
03/08 00:00

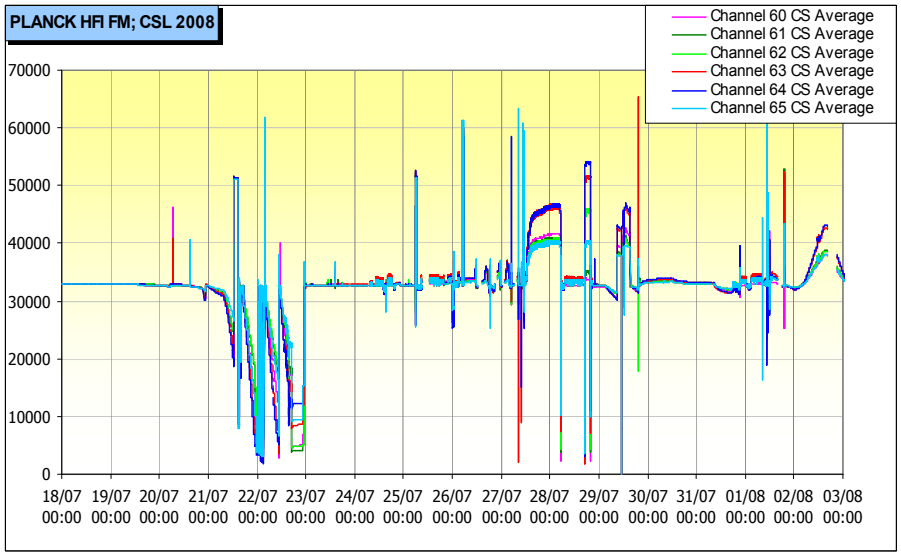

PLANCK HFI FM; CSL 2008
Channel 10 CS Average
Channel 11 CS Average
Channel 12 CS Average
Channel 13 CS Average
Channel 14 CS Average
Channel 15 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

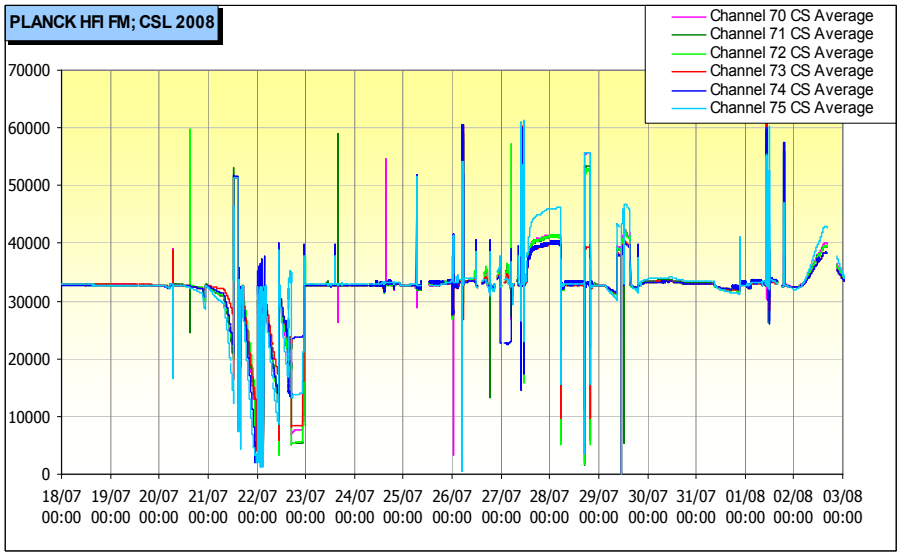

PLANCK HFI FM; CSL 2008
Channel 20 CS Average
Channel 21 CS Average
Channel 22 CS Average
Channel 23 CS Average
Channel 24 CS Average
Channel 25 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

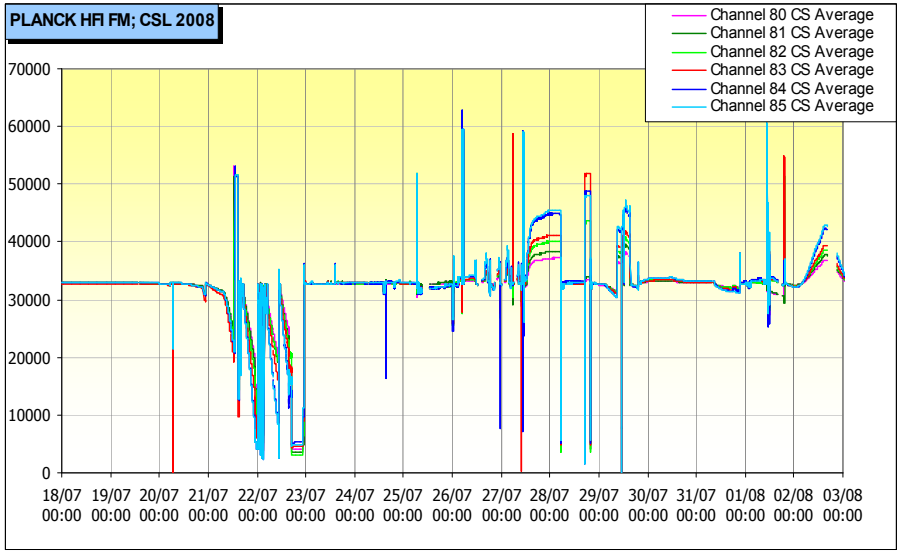

PLANCK HFI FM; CSL 2008
Channel 30 CS Average
Channel 31 CS Average
Channel 32 CS Average
Channel 33 CS Average
Channel 34 CS Average
Channel 35 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

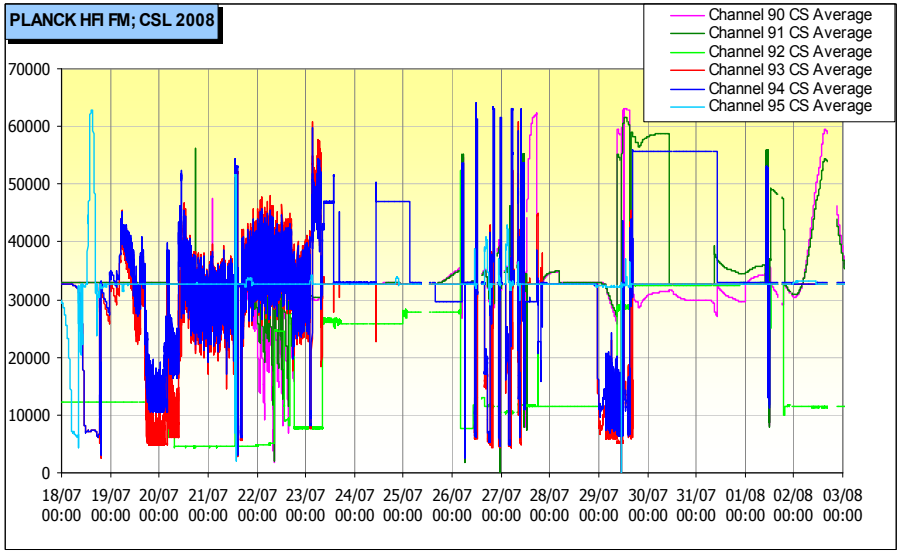

PLANCK HFI FM; CSL 2008
Channel 40 CS Average
Channel 41 CS Average
Channel 42 CS Average
Channel 43 CS Average
Channel 44 CS Average
Channel 45 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

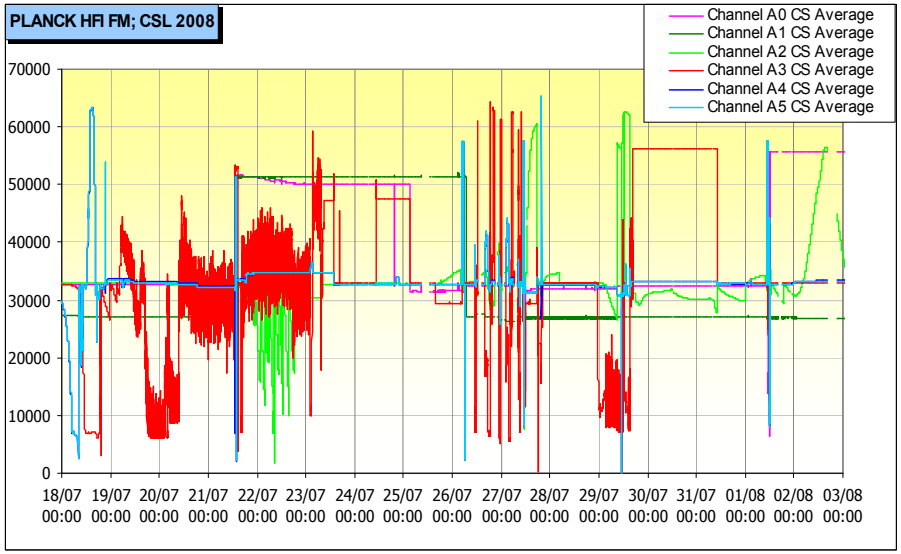

PLANCK HFI FM; CSL 2008
Channel 50 CS Average
Channel 51 CS Average
Channel 52 CS Average
Channel 53 CS Average
Channel 54 CS Average
Channel 55 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

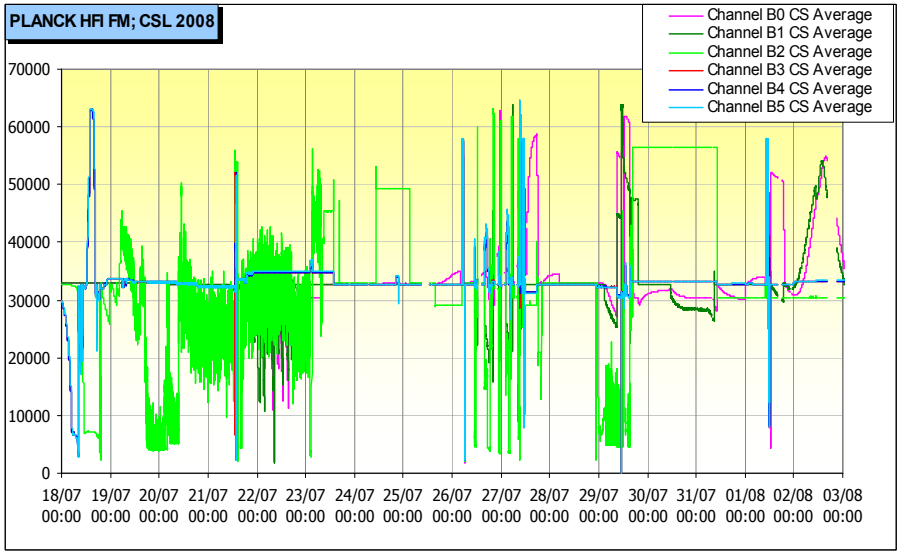

PLANCK HFI FM; CSL 2008
Channel 60 CS Average
Channel 61 CS Average
Channel 62 CS Average
Channel 63 CS Average
Channel 64 CS Average
Channel 65 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

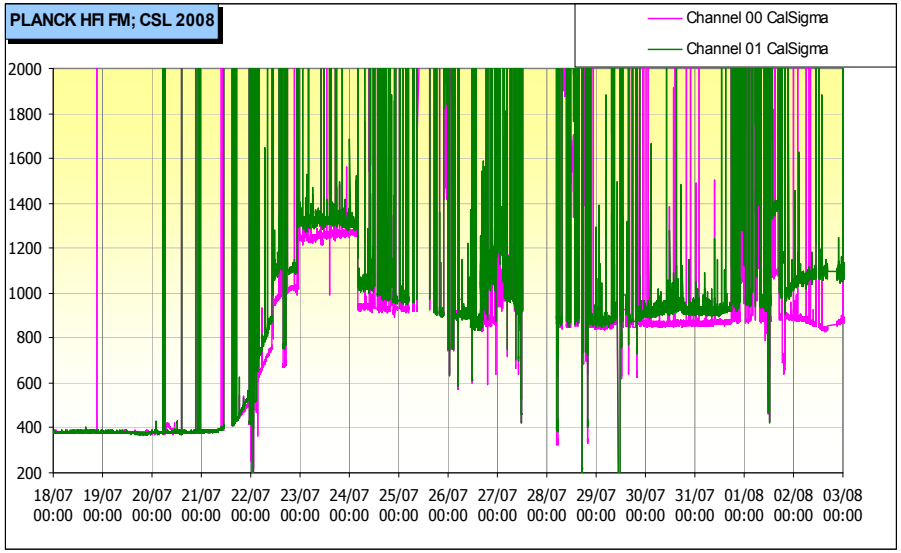

PLANCK HFI FM; CSL 2008
Channel 70 CS Average
Channel 71 CS Average
Channel 72 CS Average
Channel 73 CS Average
Channel 74 CS Average
Channel 75 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

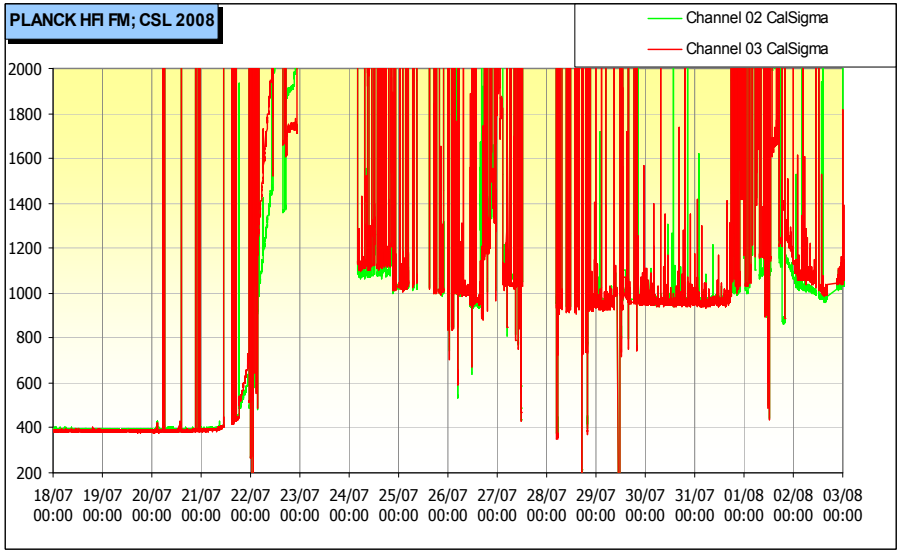

PLANCK HFI FM; CSL 2008
Channel 80 CS Average
Channel 81 CS Average
Channel 82 CS Average
Channel 83 CS Average
Channel 84 CS Average
Channel 85 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

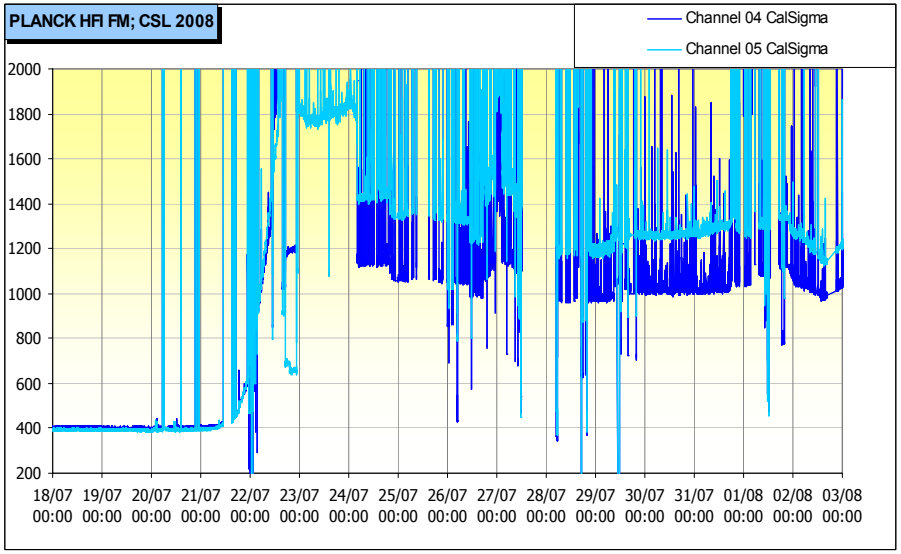

PLANCK HFI FM; CSL 2008
Channel 90 CS Average
Channel 91 CS Average
Channel 92 CS Average
Channel 93 CS Average
Channel 94 CS Average
Channel 95 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

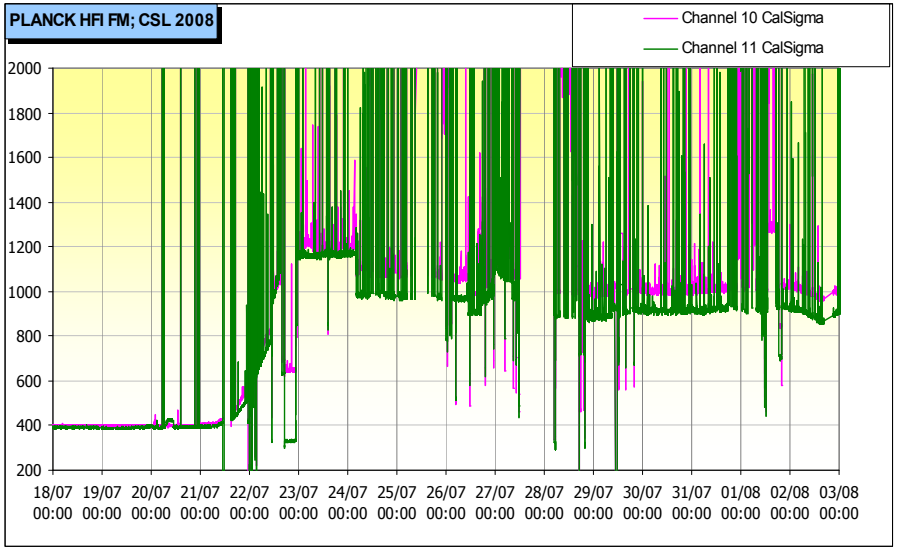

PLANCK HFI FM; CSL 2008
Channel A0 CS Average
Channel A1 CS Average
Channel A2 CS Average
Channel A3 CS Average
Channel A4 CS Average
Channel A5 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

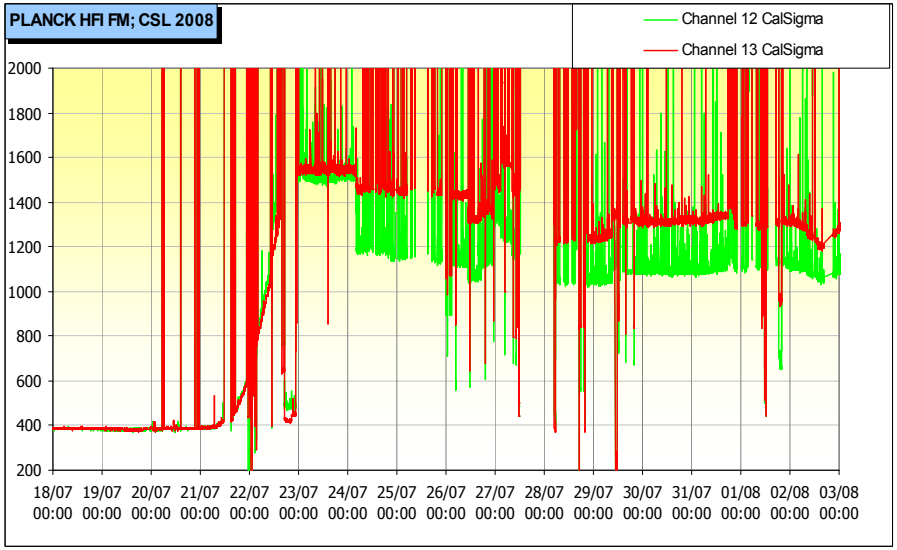

PLANCK HFI FM; CSL 2008
Channel B0 CS Average
Channel B1 CS Average
Channel B2 CS Average
Channel B3 CS Average
Channel B4 CS Average
Channel B5 CS Average
70000
60000
50000
40000
30000
20000
10000
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

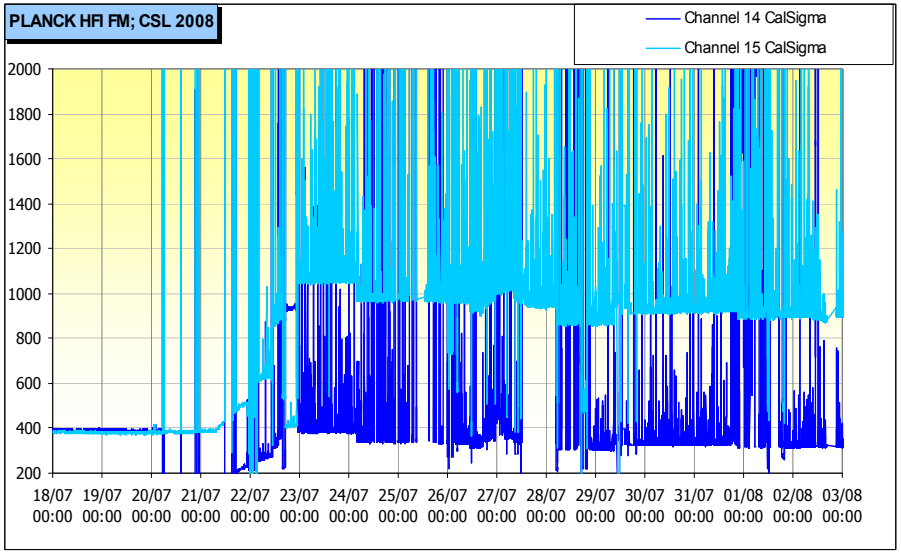

PLANCK HFI FM; CSL 2008
Channel 00 CalSigma
Channel 01 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

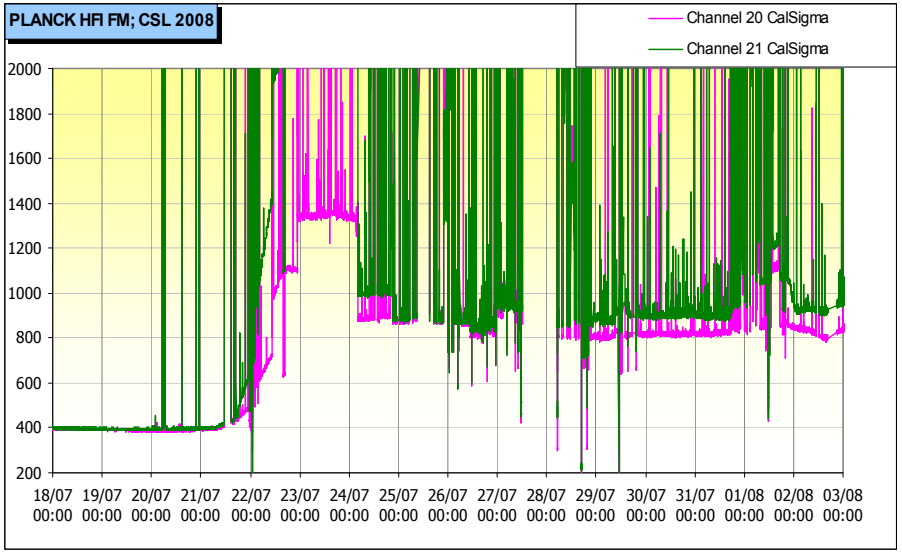

PLANCK HFI FM; CSL 2008
Channel 02 CalSigma
Channel 03 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

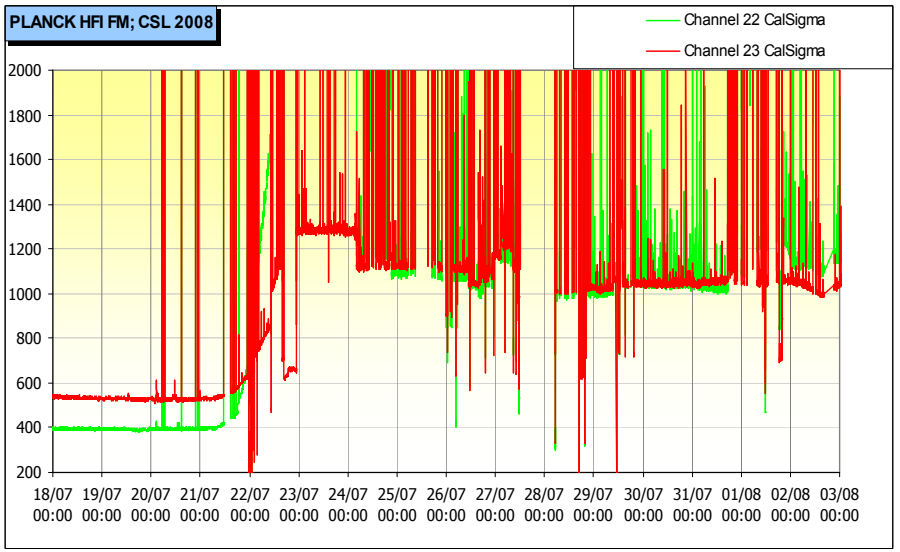

PLANCK HFI FM; CSL 2008
Channel 04 CalSigma
Channel 05 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

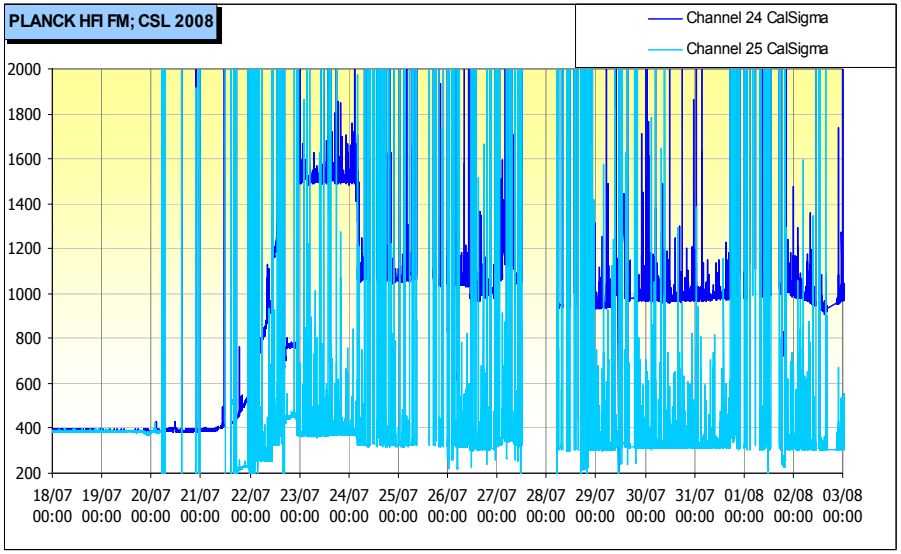

PLANCK HFI FM; CSL 2008
Channel 10 CalSigma
Channel 11 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

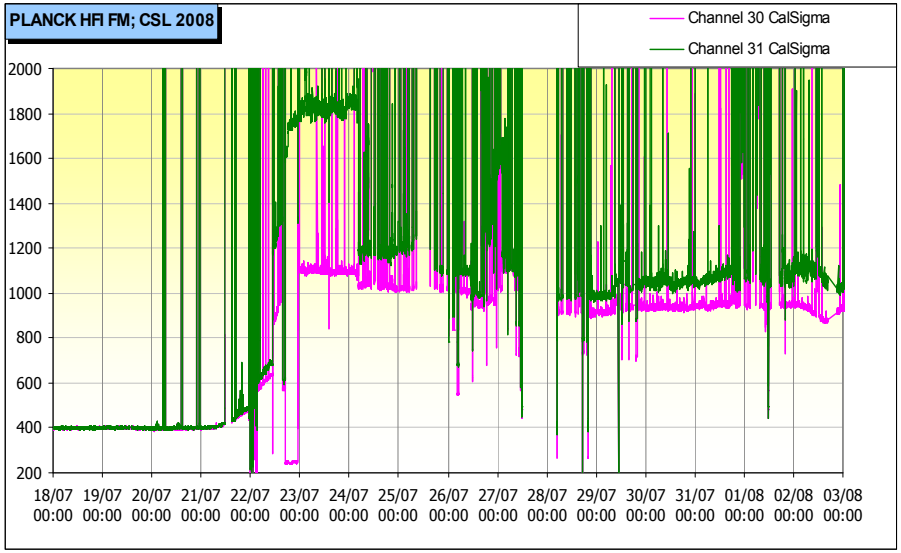

PLANCK HFI FM; CSL 2008
Channel 12 CalSigma
Channel 13 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

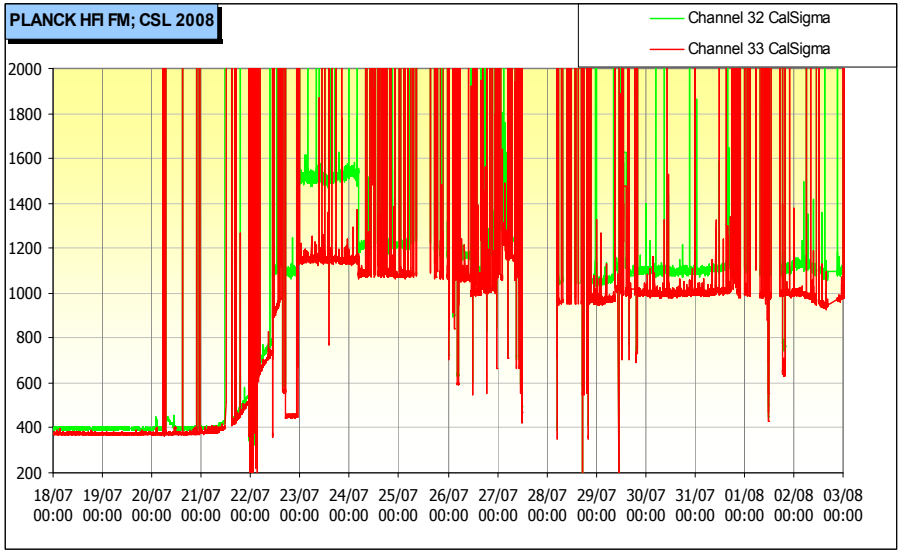

PLANCK HFI FM; CSL 2008
Channel 14 CalSigma
Channel 15 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

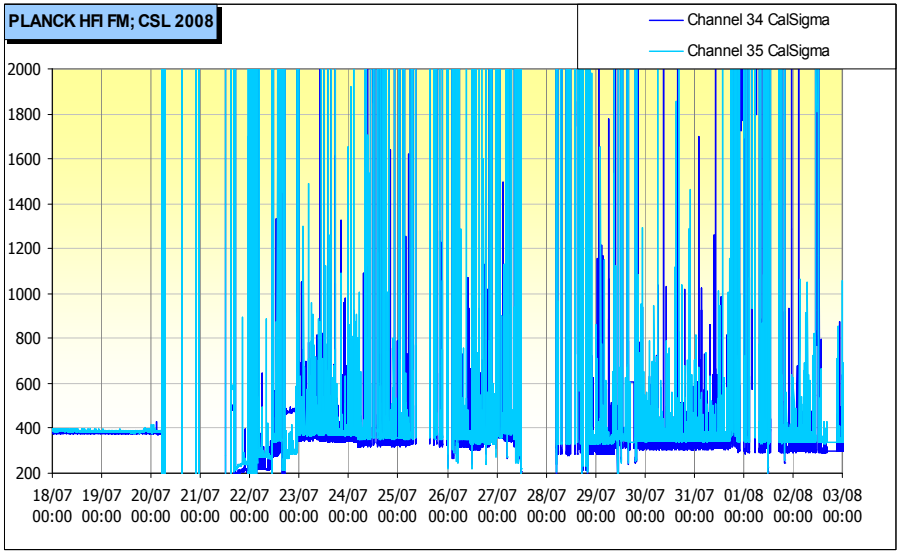

PLANCK HFI FM; CSL 2008
Channel 20 CalSigma
Channel 21 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

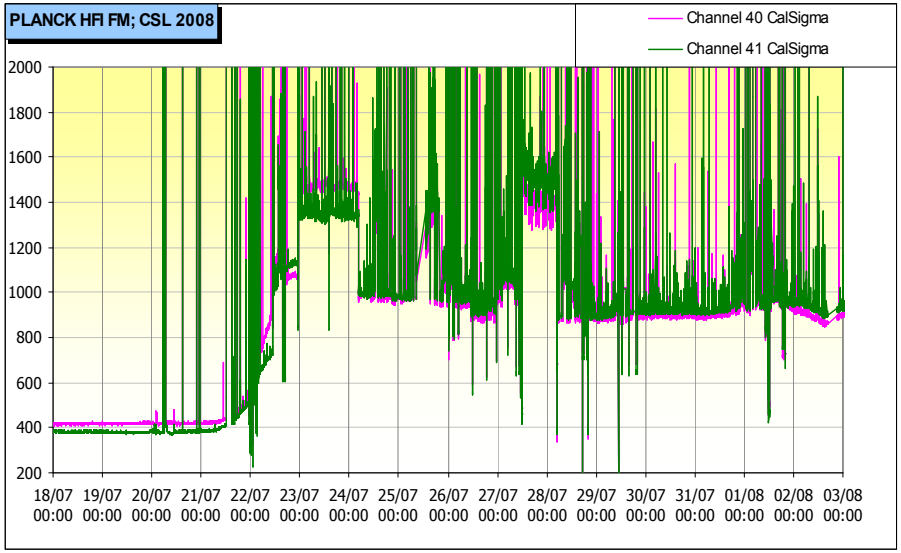

PLANCK HFI FM; CSL 2008
Channel 22 CalSigma
Channel 23 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

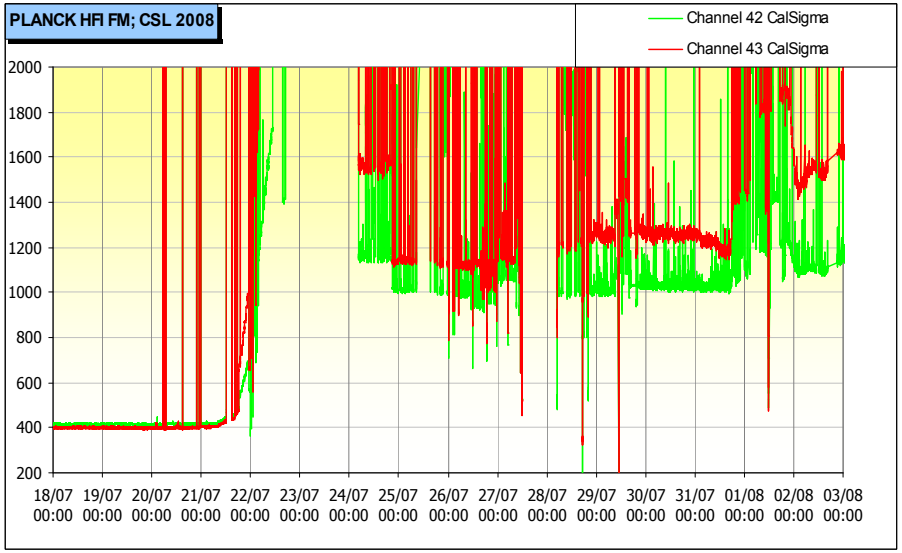

PLANCK HFI FM; CSL 2008
Channel 24 CalSigma
Channel 25 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

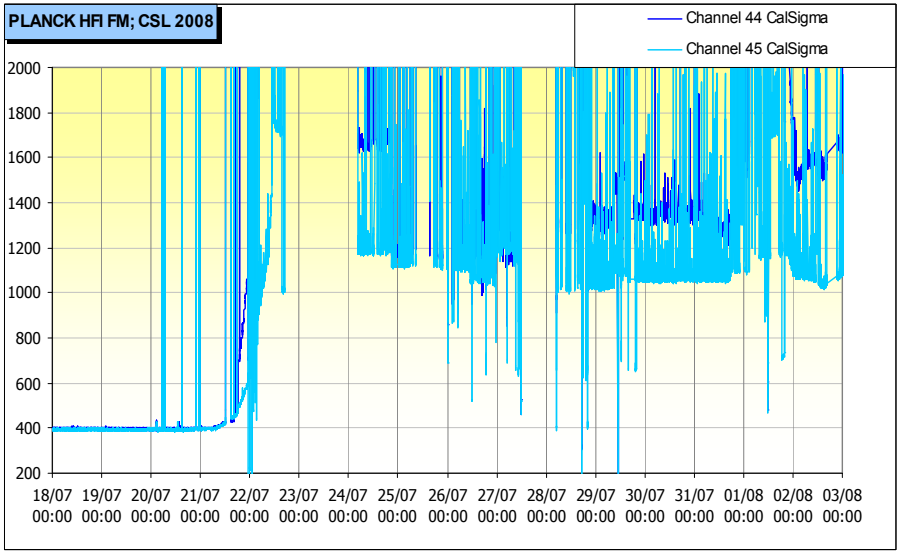

PLANCK HFI FM; CSL 2008
Channel 30 CalSigma
Channel 31 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

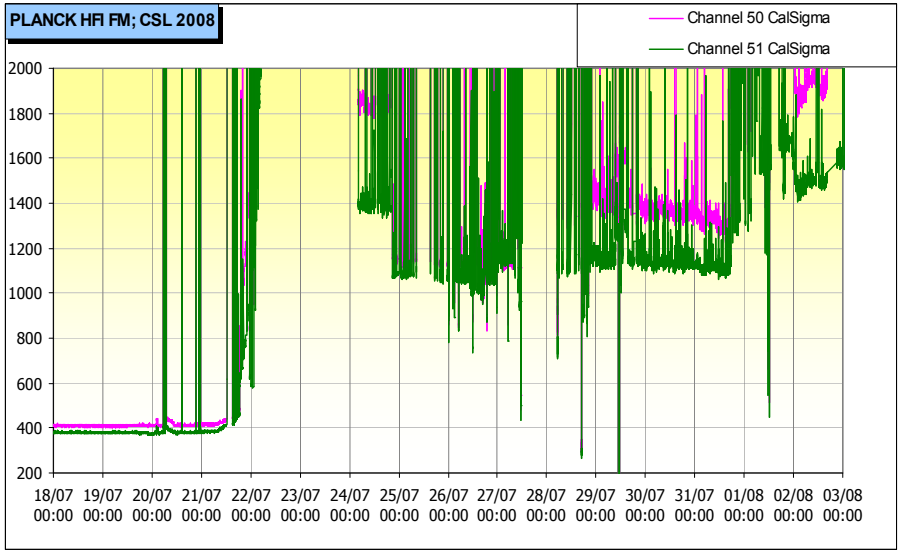

PLANCK HFI FM; CSL 2008
Channel 32 CalSigma
Channel 33 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

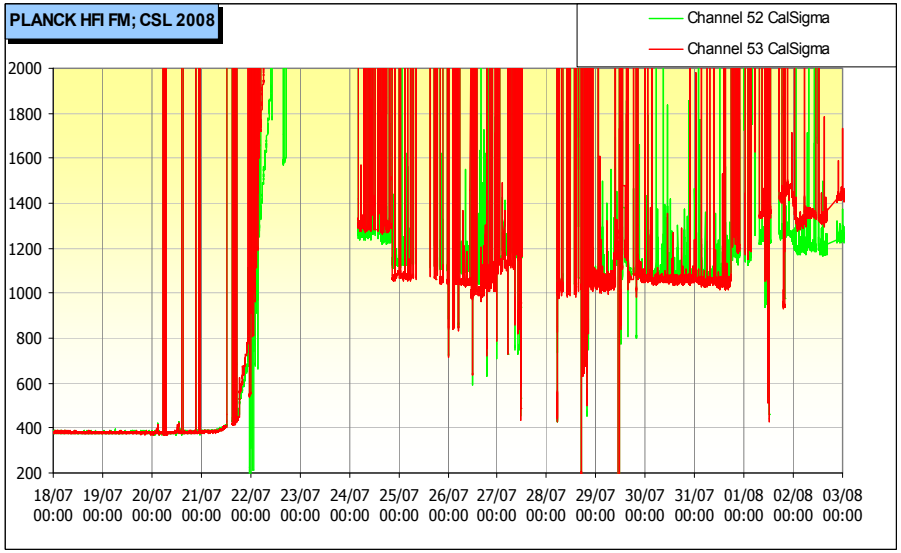

PLANCK HFI FM; CSL 2008
Channel 34 CalSigma
Channel 35 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

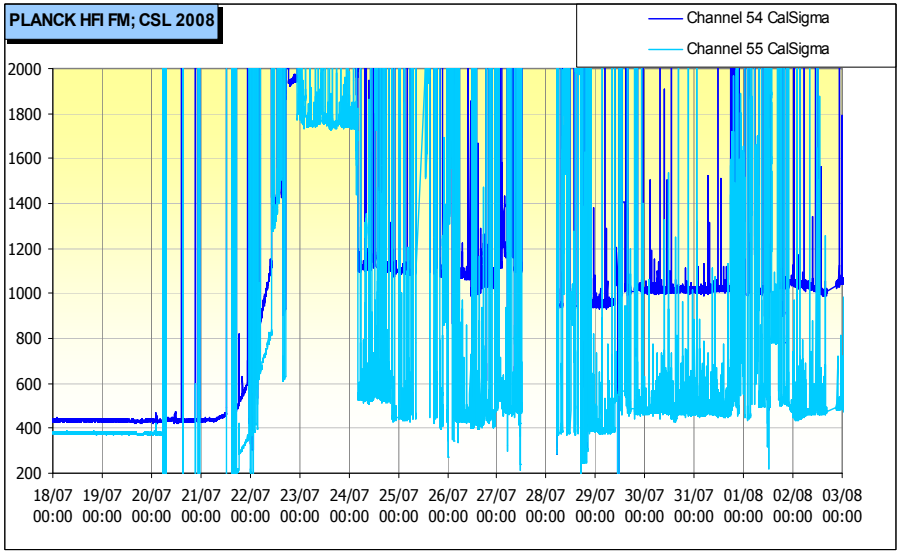

PLANCK HFI FM; CSL 2008
Channel 40 CalSigma
Channel 41 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

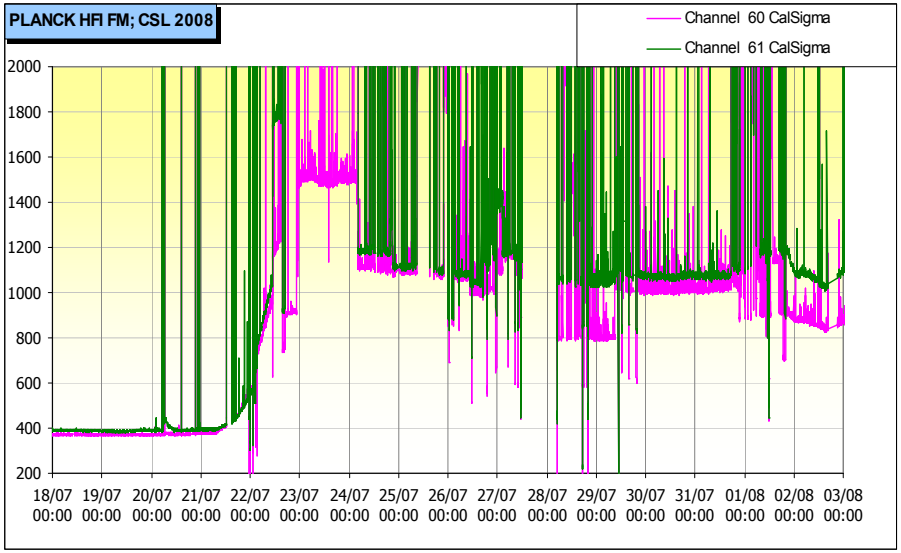

PLANCK HFI FM; CSL 2008
Channel 42 CalSigma
Channel 43 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

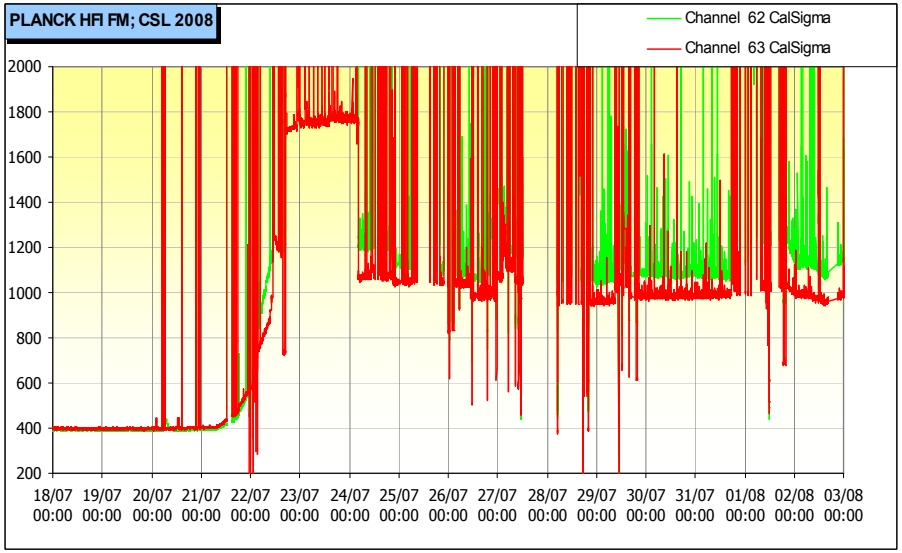

PLANCK HFI FM; CSL 2008
Channel 44 CalSigma
Channel 45 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

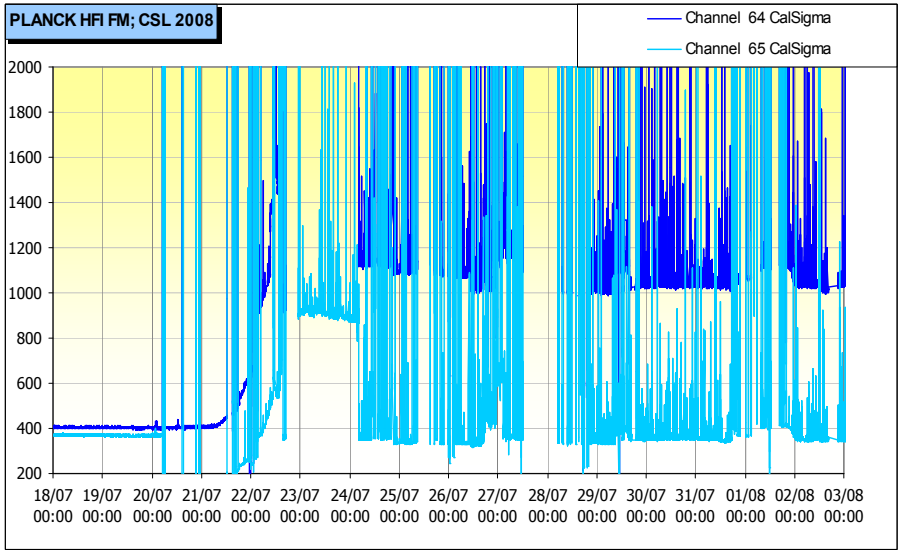

PLANCK HFI FM; CSL 2008
Channel 50 CalSigma
Channel 51 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

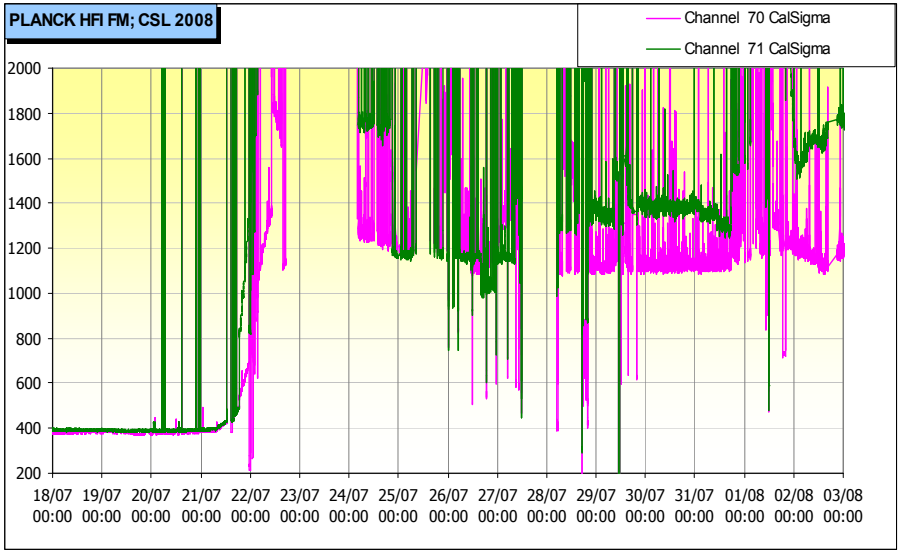

PLANCK HFI FM; CSL 2008
Channel 52 CalSigma
Channel 53 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

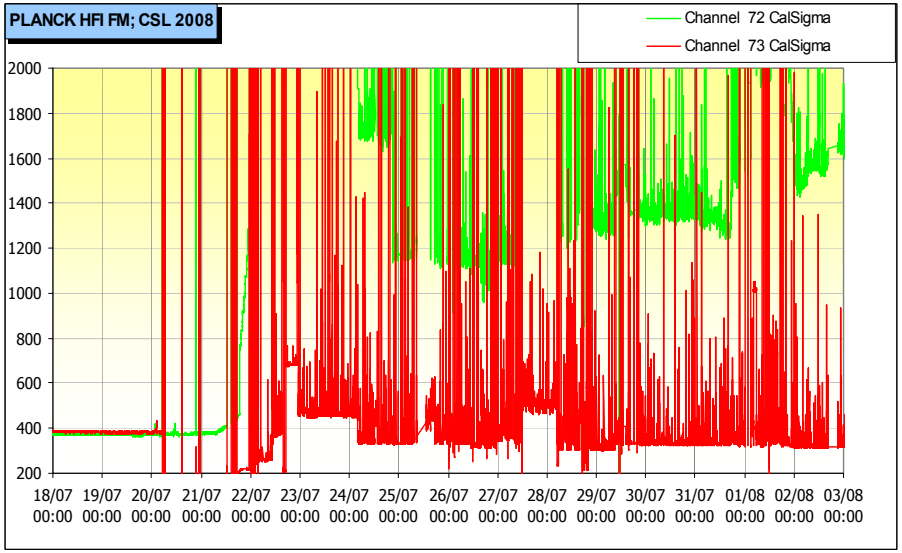

PLANCK HFI FM; CSL 2008
Channel 54 CalSigma
Channel 55 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

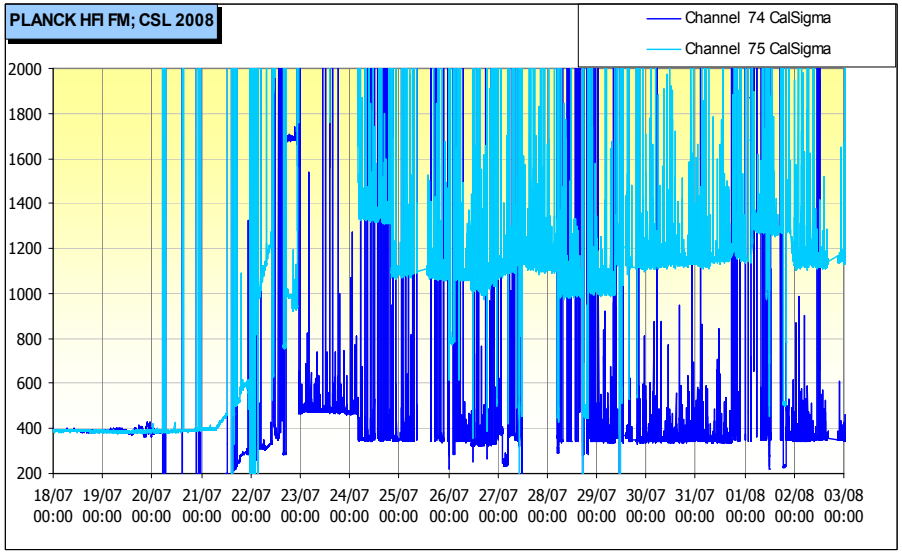

PLANCK HFI FM; CSL 2008
Channel 60 CalSigma
Channel 61 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

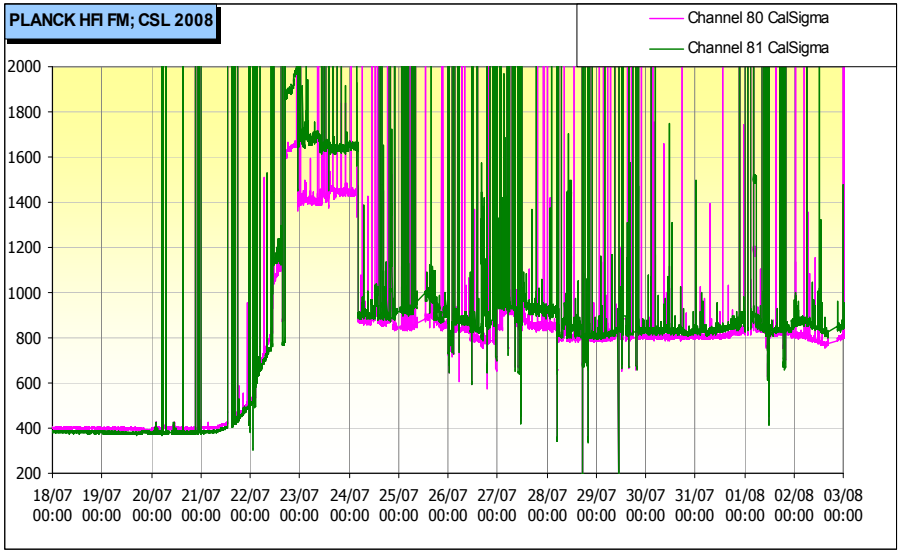

PLANCK HFI FM; CSL 2008
Channel 62 CalSigma
Channel 63 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

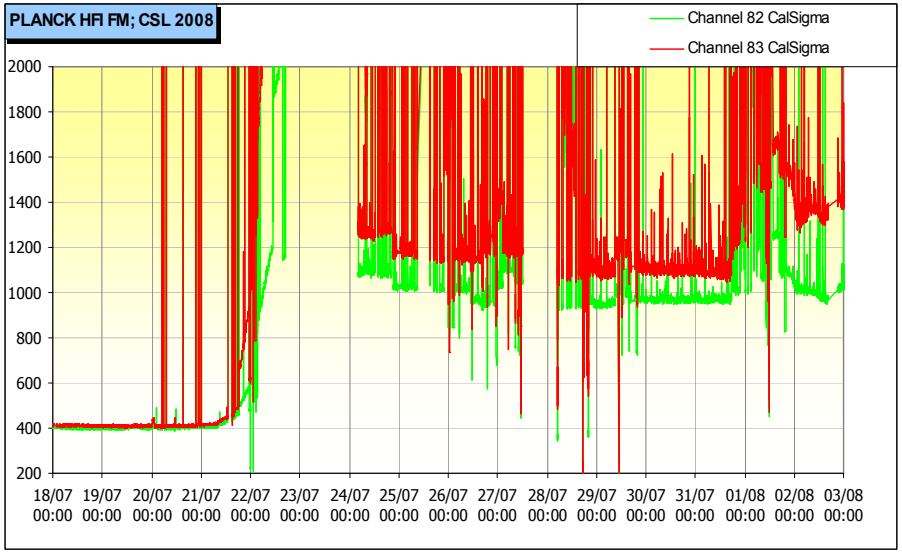

PLANCK HFI FM; CSL 2008
Channel 64 CalSigma
Channel 65 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

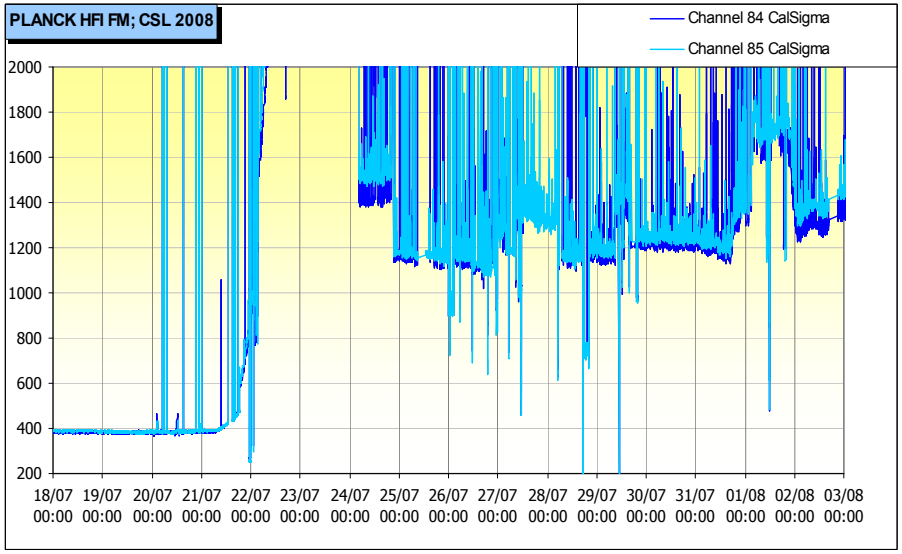

PLANCK HFI FM; CSL 2008
Channel 70 CalSigma
Channel 71 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

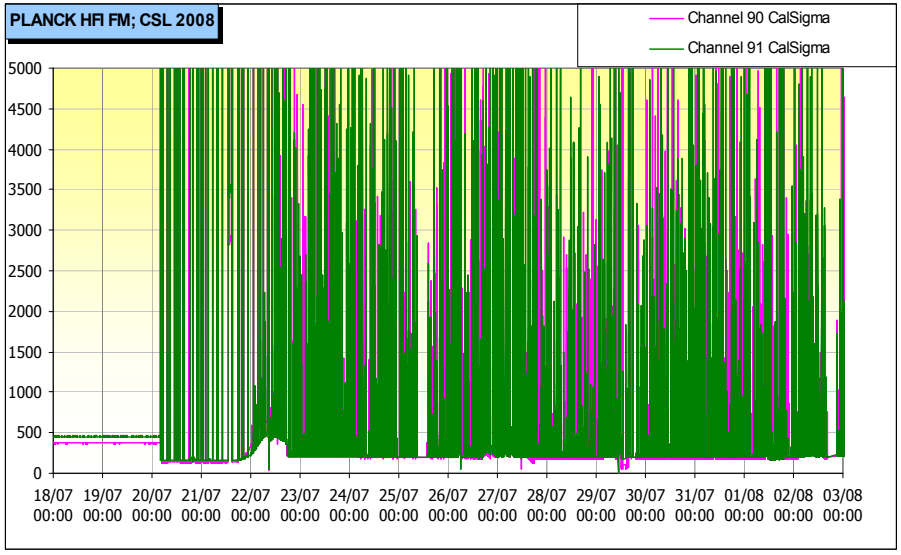

PLANCK HFI FM; CSL 2008
Channel 72 CalSigma
Channel 73 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

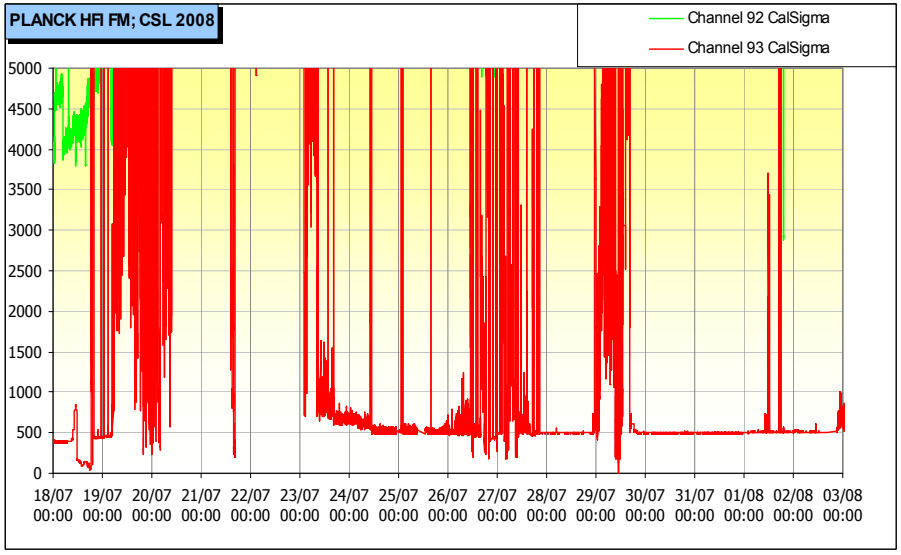

PLANCK HFI FM; CSL 2008
Channel 74 CalSigma
Channel 75 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

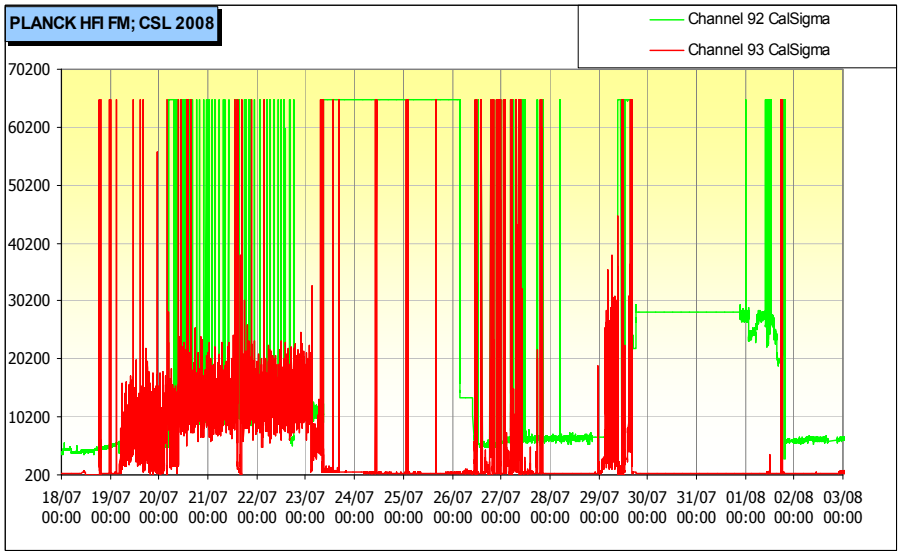

PLANCK HFI FM; CSL 2008
Channel 80 CalSigma
Channel 81 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

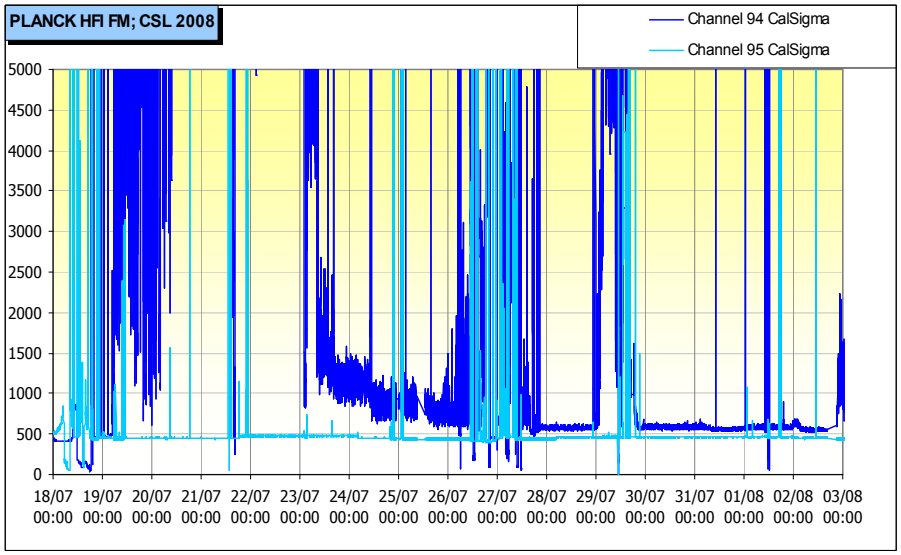

PLANCK HFI FM; CSL 2008
Channel 82 CalSigma
Channel 83 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

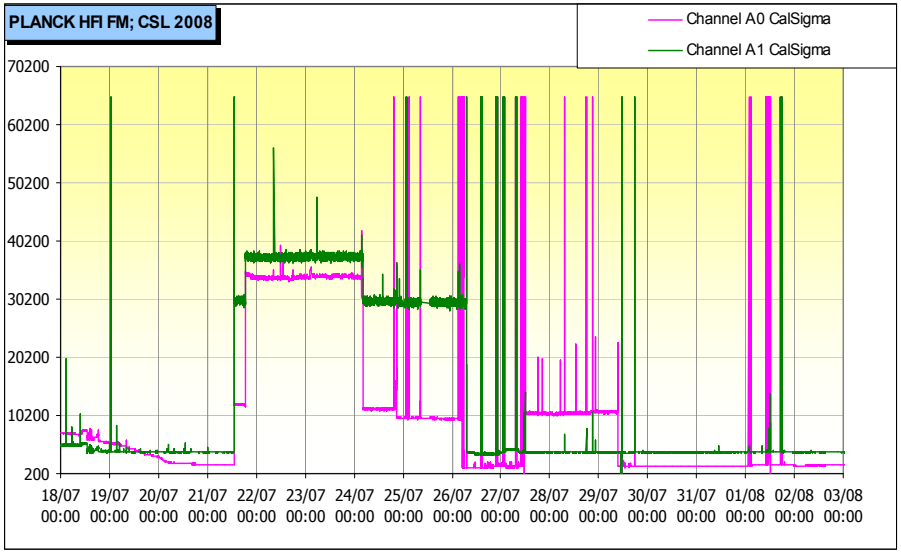

PLANCK HFI FM; CSL 2008
Channel 84 CalSigma
Channel 85 CalSigma
2000
1800
1600
1400
1200
1000
800
600
400
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

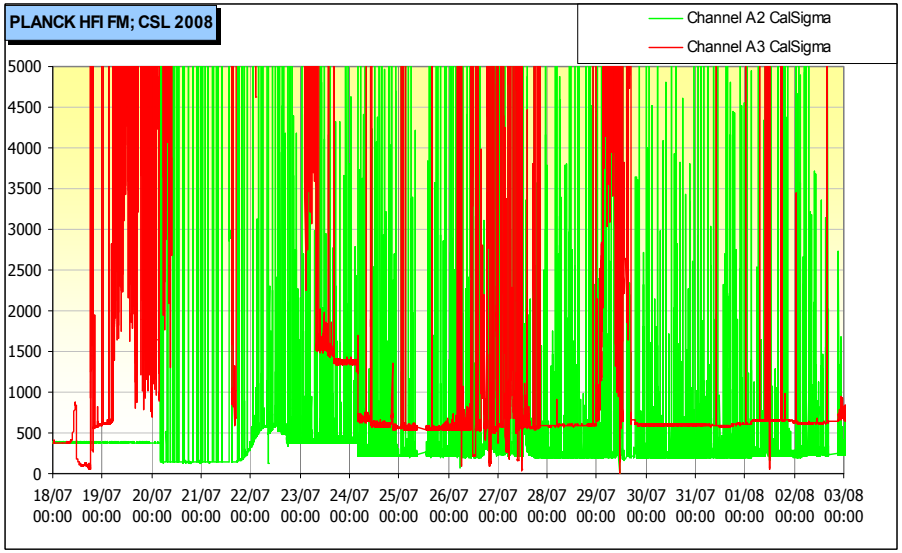

PLANCK HFI FM; CSL 2008
Channel 90 CalSigma
Channel 91 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

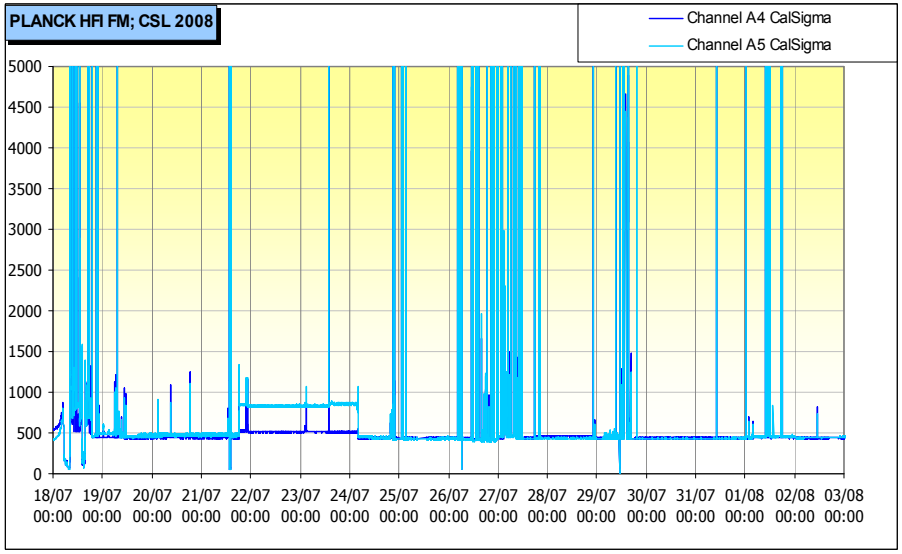

PLANCK HFI FM; CSL 2008
Channel 92 CalSigma
Channel 93 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

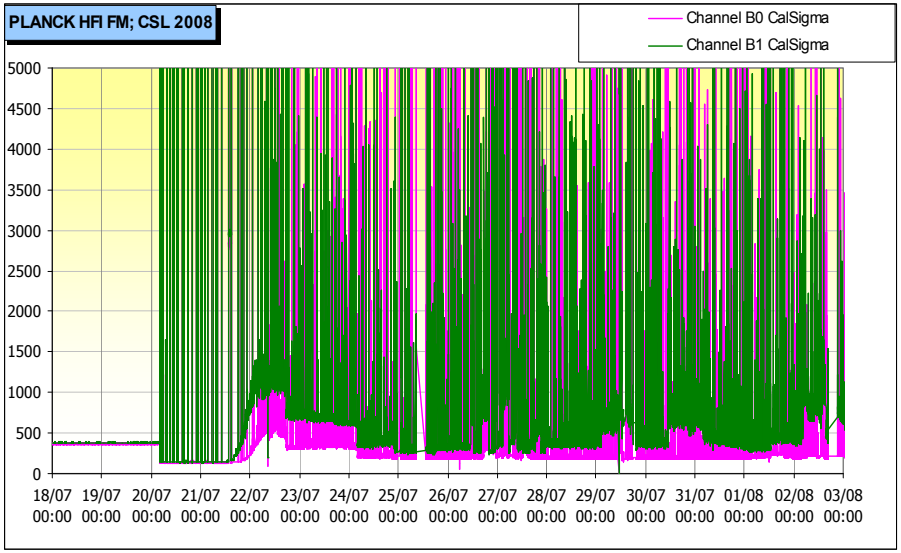

PLANCK HFI FM; CSL 2008
Channel 92 CalSigma
Channel 93 CalSigma
70200
60200
50200
40200
30200
20200
10200
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

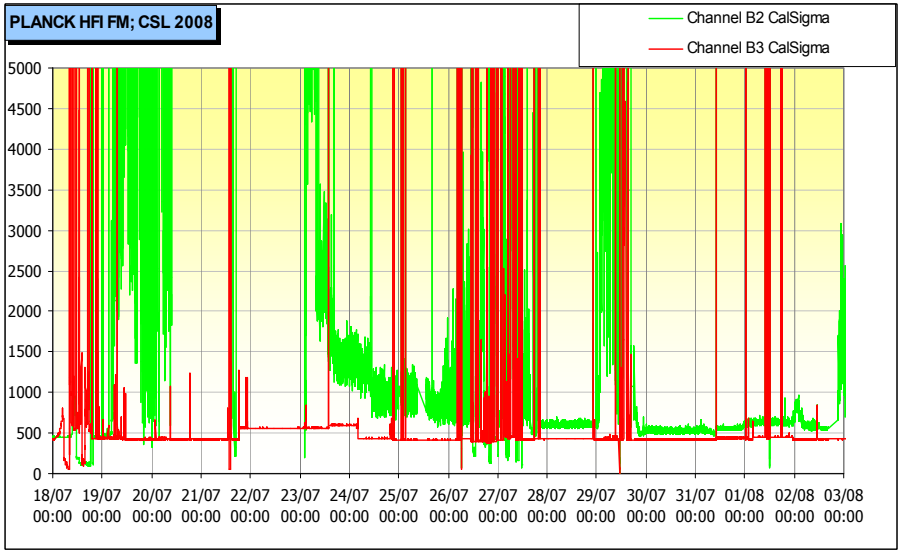

PLANCK HFI FM; CSL 2008
Channel 94 CalSigma
Channel 95 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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01/08 00:00
02/08 00:00
03/08 00:00

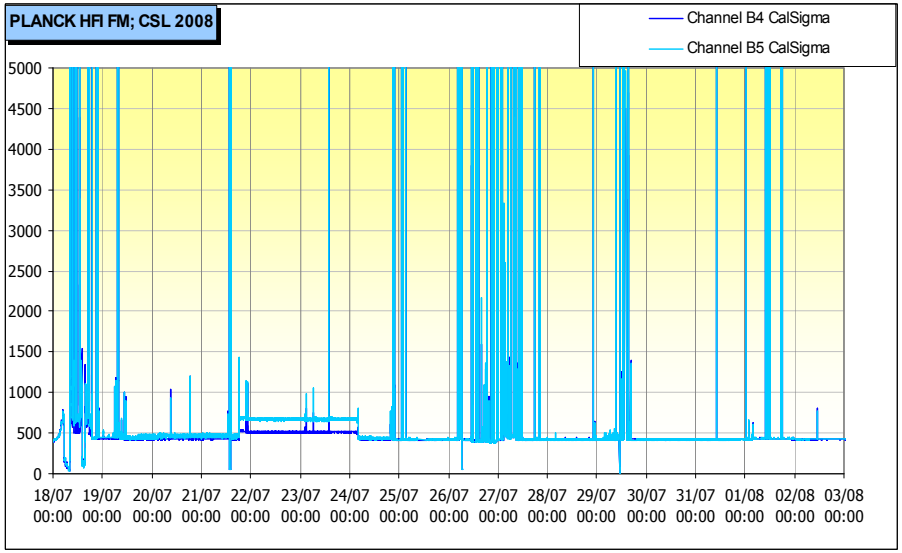

PLANCK HFI FM; CSL 2008
Channel A0 CalSigma
Channel A1 CalSigma
70200
60200
50200
40200
30200
20200
10200
200
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
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29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

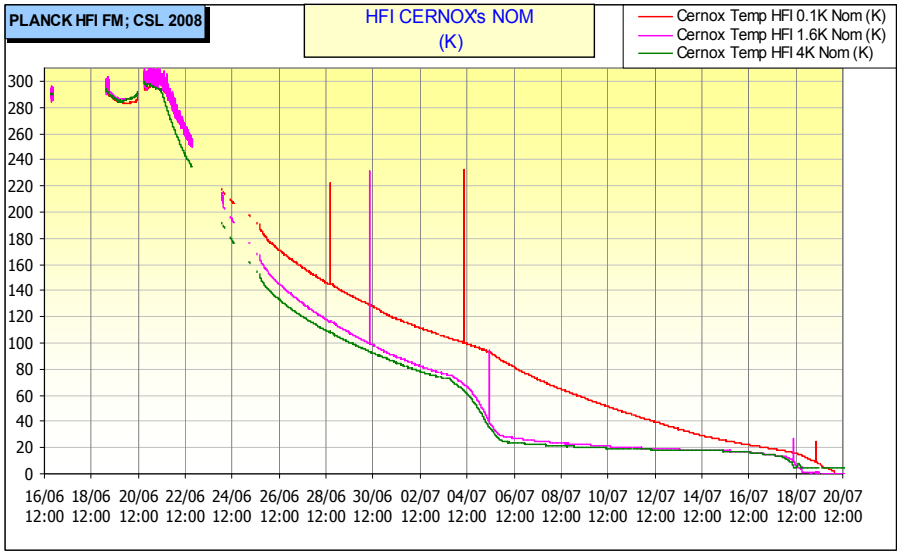

PLANCK HFI FM; CSL 2008
Channel A2 CalSigma
Channel A3 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

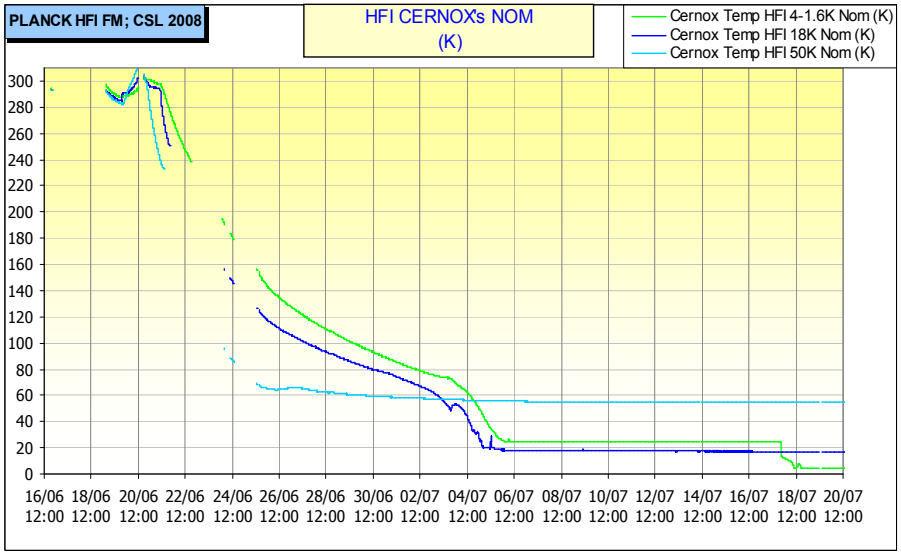

PLANCK HFI FM; CSL 2008
Channel A4 CalSigma
Channel A5 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

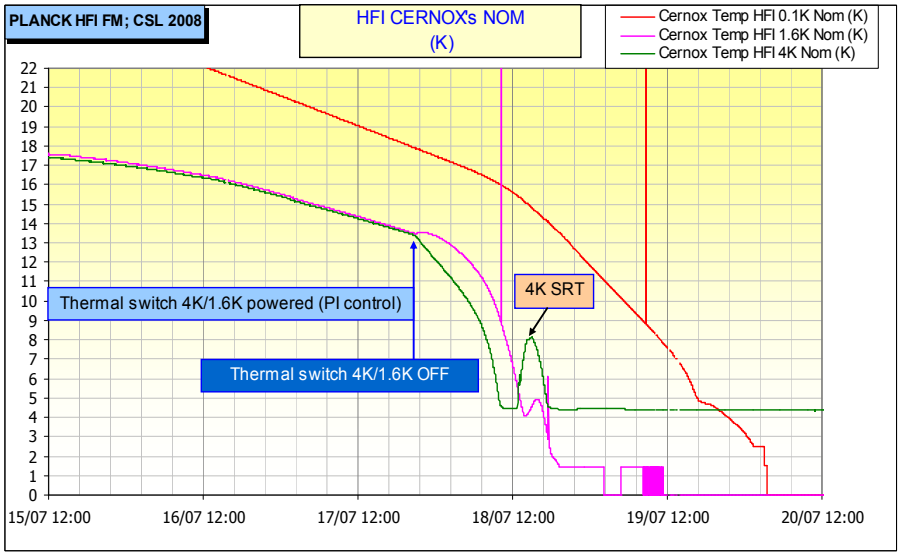

PLANCK HFI FM; CSL 2008
Channel B0 CalSigma
Channel B1 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
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31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

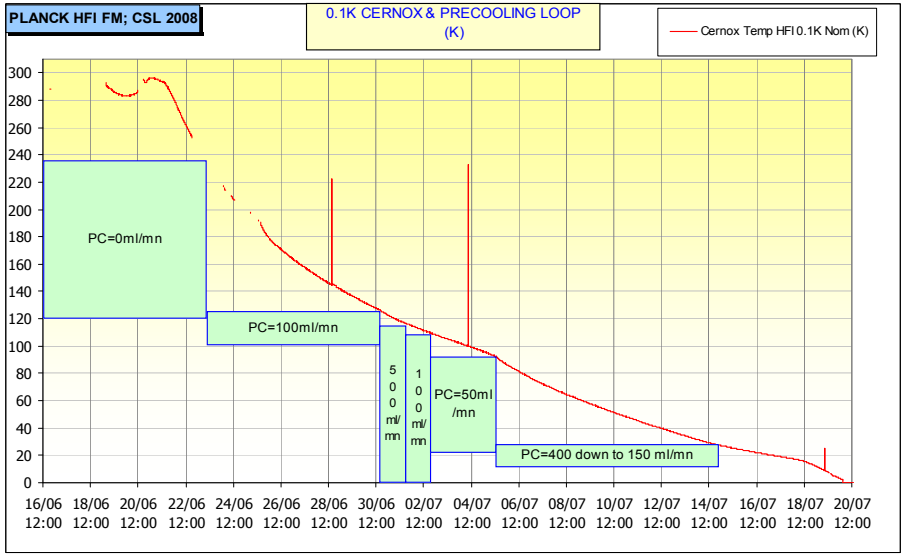

PLANCK HFI FM; CSL 2008
Channel B2 CalSigma
Channel B3 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

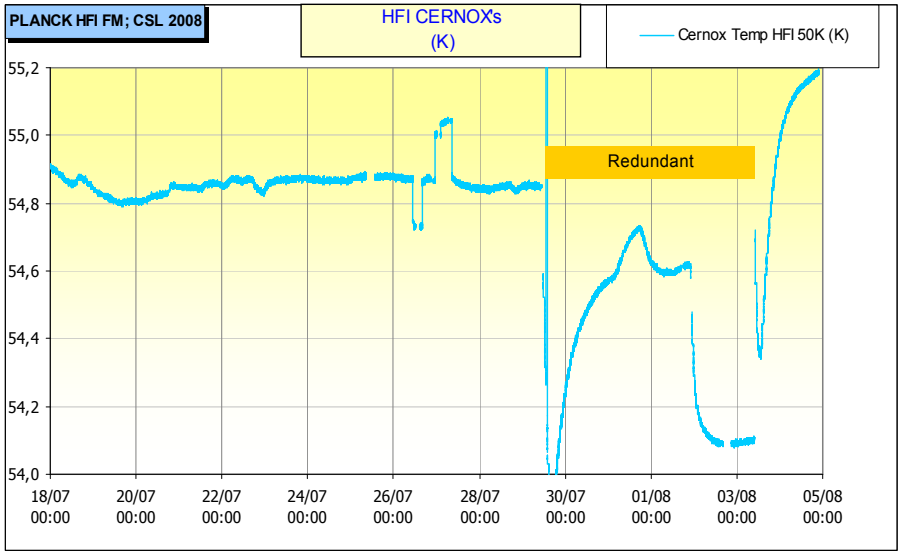

PLANCK HFI FM; CSL 2008
Channel B4 CalSigma
Channel B5 CalSigma
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

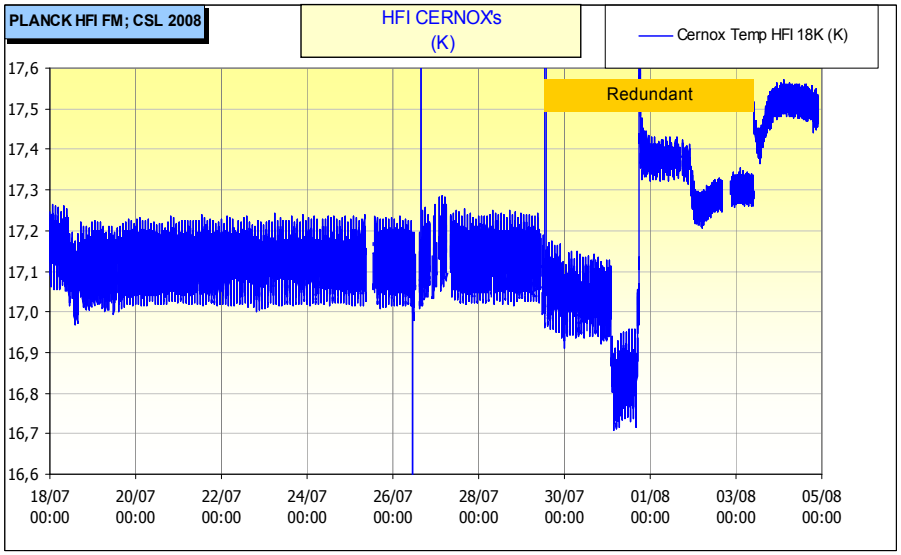

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 0.1K Nom (K)
Cernox Temp HFI 1.6K Nom (K)
Cernox Temp HFI 4K Nom (K)
300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0
16/06 12:00 18/06 12:00 20/06 12:00 22/06 12:00 24/06 12:00 26/06 12:00 28/06 12:00 30/06 12:00 02/07 12:00 04/07 12:00 06/07 12:00 08/07 12:00 10/07 12:00 12/07 12:00 14/07 12:00 16/07 12:00 18/07 12:00 20/07 12:00

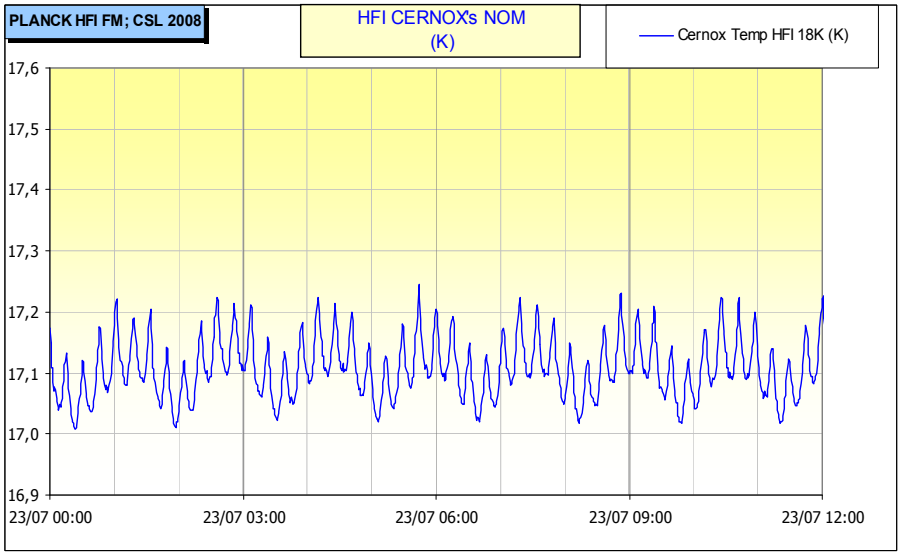

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 4-1.6K Nom (K)
Cernox Temp HFI 18K Nom (K)
Cernox Temp HFI 50K Nom (K)
300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0
16/06 12:00 18/06 12:00 20/06 12:00 22/06 12:00 24/06 12:00 26/06 12:00 28/06 12:00 30/06 12:00 02/07 12:00 04/07 12:00 06/07 12:00 08/07 12:00 10/07 12:00 12/07 12:00 14/07 12:00 16/07 12:00 18/07 12:00 20/07 12:00

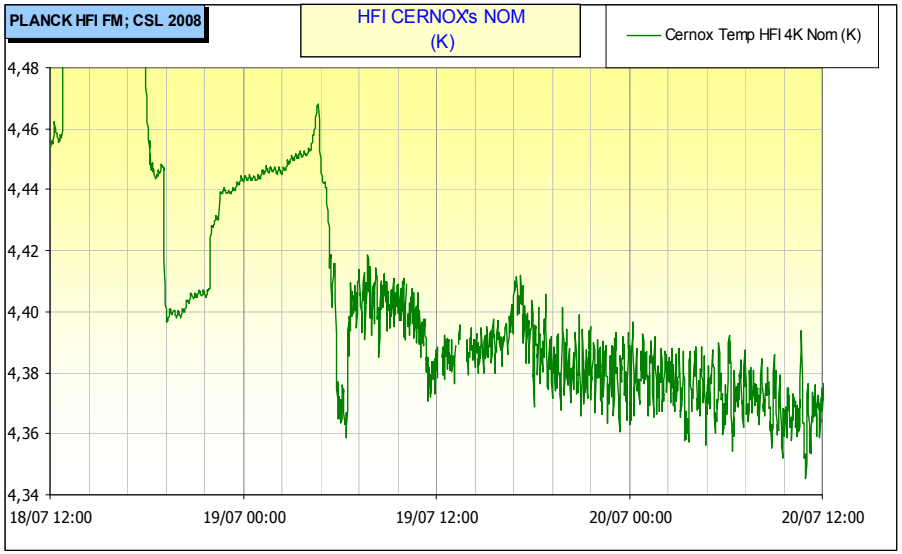

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 0.1K Nom (K)
Cernox Temp HFI 1.6K Nom (K)
Cernox Temp HFI 4K Nom (K)
22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Thermal switch 4K/1.6K powered (PI control)
4K SRT
Thermal switch 4K/1.6K OFF
15/07 12:00 16/07 12:00 17/07 12:00 18/07 12:00 19/07 12:00 20/07 12:00

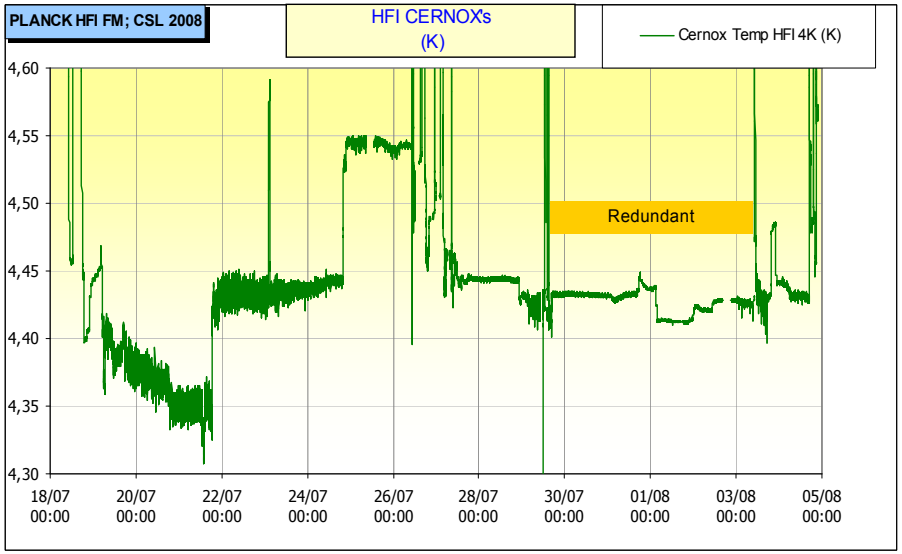

PLANCK HFI FM; CSL 2008
0.1K CERNOX & PRECOOLING LOOP (K)
Cernox Temp HFI 0.1K Nom (K)
300 280 260 240 220 200 180 160 140 120 100 80 60 40 20 0
PC=0ml/mn
PC=100ml/mn
500 ml/mn
100 ml/mn
PC=50ml /mn
PC=400 down to 150 ml/mn
16/06 12:00 18/06 12:00 20/06 12:00 22/06 12:00 24/06 12:00 26/06 12:00 28/06 12:00 30/06 12:00 02/07 12:00 04/07 12:00 06/07 12:00 08/07 12:00 10/07 12:00 12/07 12:00 14/07 12:00 16/07 12:00 18/07 12:00 20/07 12:00

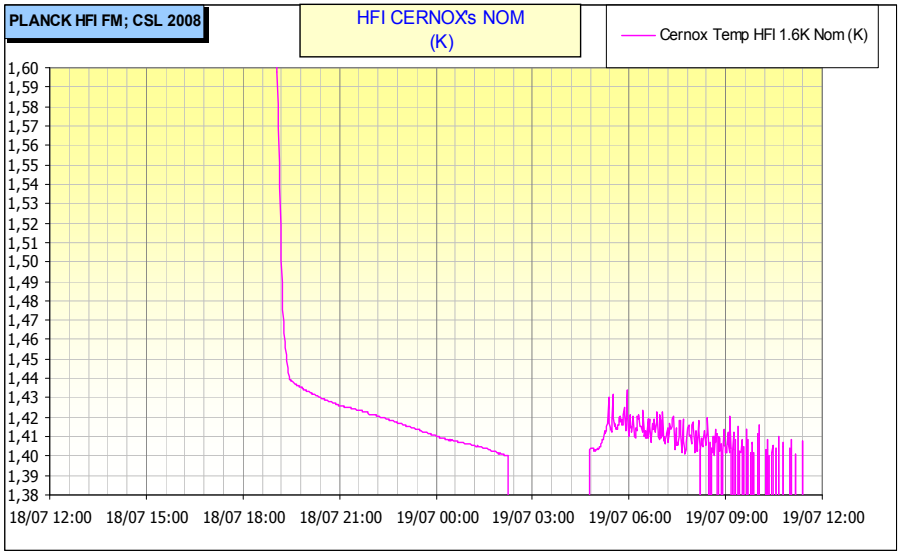

PLANCK HFI FM; CSL 2008
HFI CERNOXs
(K)
Cernox Temp HFI 50K (K)
Redundant
55,2
55,0
54,8
54,6
54,4
54,2
54,0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

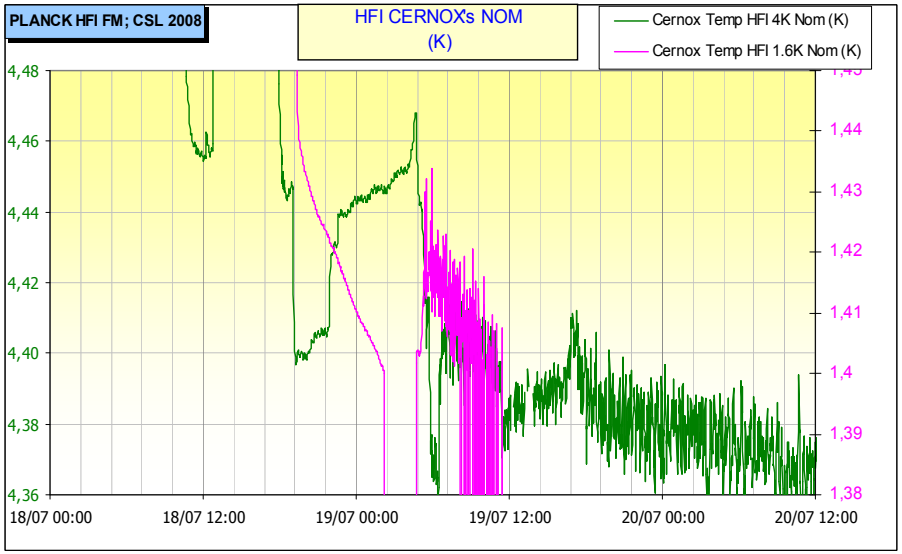

PLANCK HFI FM; CSL 2008
HFI CERNOXs
(K)
Cernox Temp HFI 18K (K)
Redundant
17,6
17,5
17,4
17,3
17,2
17,1
17,0
16,9
16,8
16,7
16,6
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

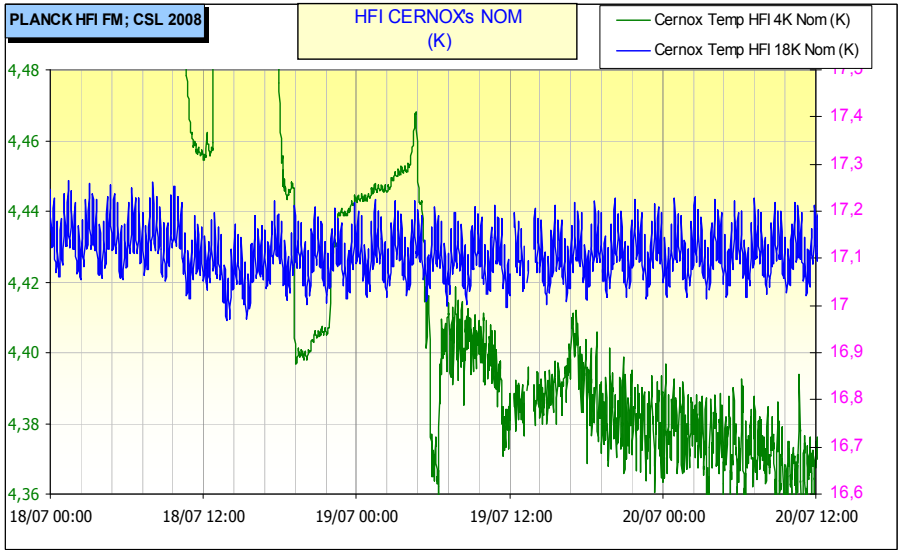

PLANCK HFI FM; CSL 2008
HFI CERNOXs NOM
(K)
Cernox Temp HFI 18K (K)
17,6
17,5
17,4
17,3
17,2
17,1
17,0
16,9
23/07 00:00
23/07 03:00
23/07 06:00
23/07 09:00
23/07 12:00

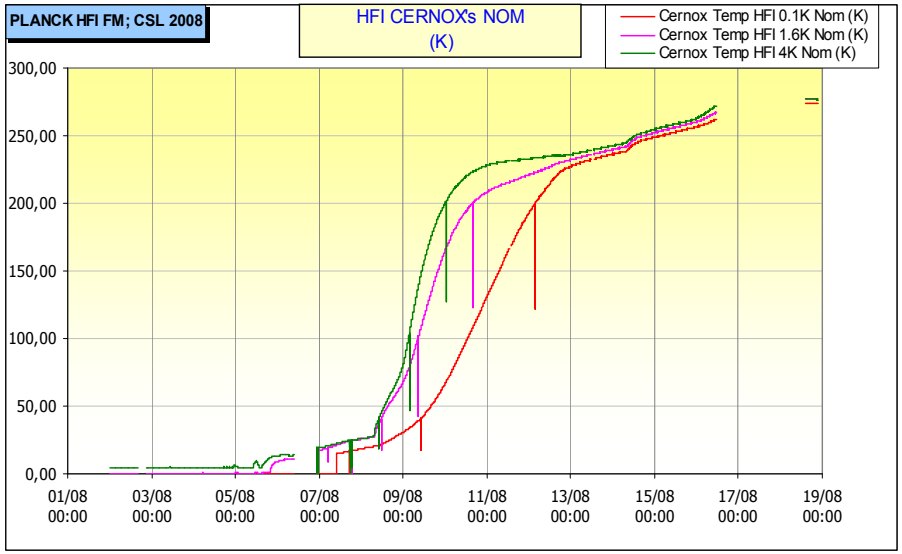

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 4K Nom (K)
4,48
4,46
4,44
4,42
4,40
4,38
4,36
4,34
18/07 12:00
19/07 00:00
19/07 12:00
20/07 00:00
20/07 12:00

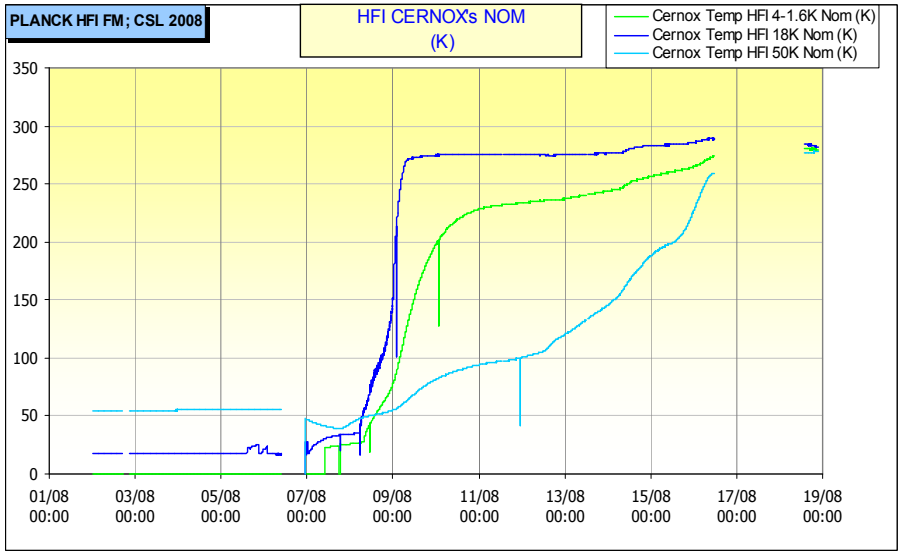

PLANCK HFI FM; CSL 2008
HFI CERNOX's (K)
Cernox Temp HFI 4K (K)
Redundant
4,60
4,55
4,50
4,45
4,40
4,35
4,30
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

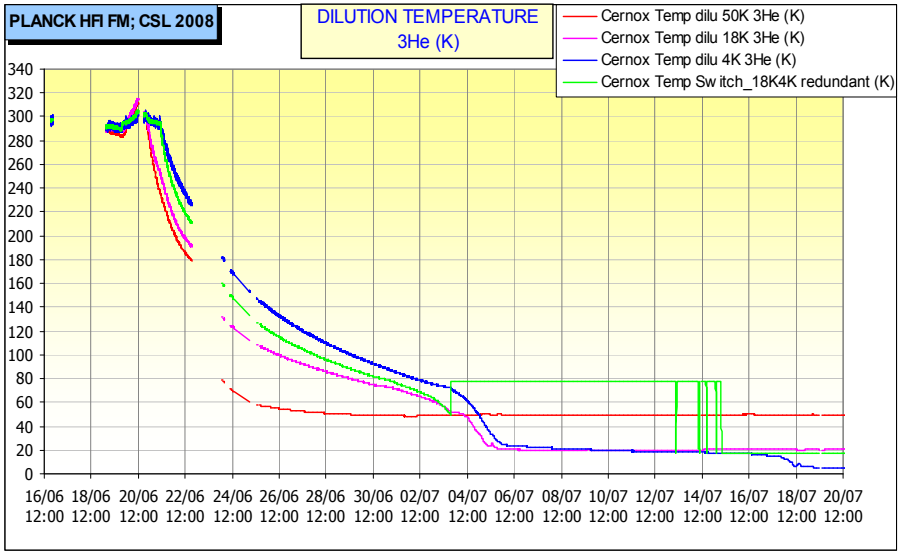

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 1.6K Nom (K)
1,60 1,59 1,58 1,57 1,56 1,55 1,54 1,53 1,52 1,51 1,50 1,49 1,48 1,47 1,46 1,45 1,44 1,43 1,42 1,41 1,40 1,39 1,38
18/07 12:00 18/07 15:00 18/07 18:00 18/07 21:00 19/07 00:00 19/07 03:00 19/07 06:00 19/07 09:00 19/07 12:00

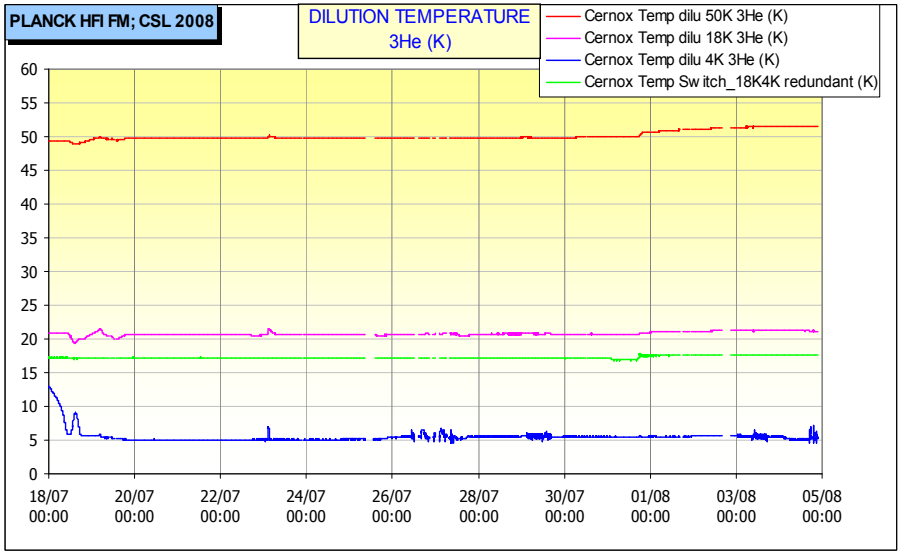

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 4K Nom (K)
Cernox Temp HFI 1.6K Nom (K)
4,48 4,46 4,44 4,42 4,40 4,38 4,36
1,44 1,43 1,42 1,41 1,4 1,39 1,38
18/07 00:00 18/07 12:00 19/07 00:00 19/07 12:00 20/07 00:00 20/07 12:00

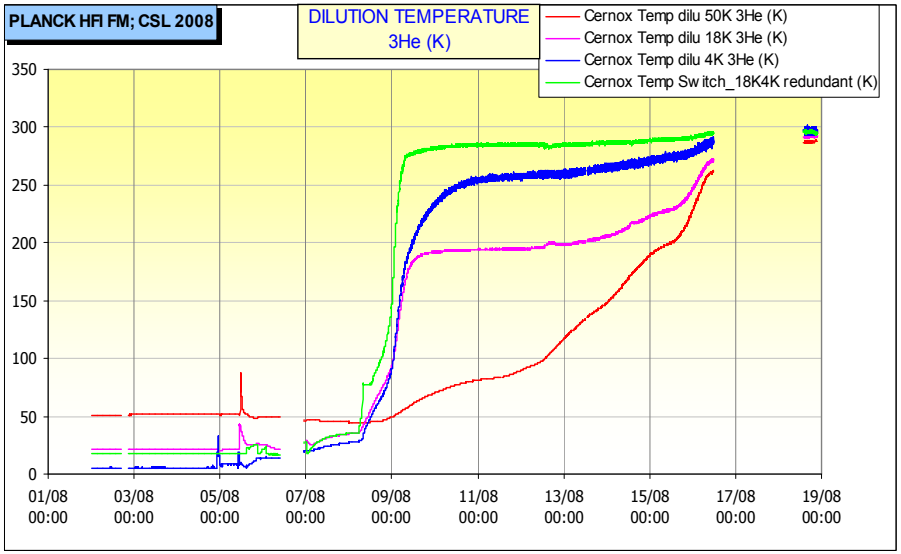

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 4K Nom (K)
Cernox Temp HFI 18K Nom (K)
4,48 4,46 4,44 4,42 4,40 4,38 4,36
17,4 17,3 17,2 17,1 17 16,9 16,8 16,7 16,6
18/07 00:00 18/07 12:00 19/07 00:00 19/07 12:00 20/07 00:00 20/07 12:00

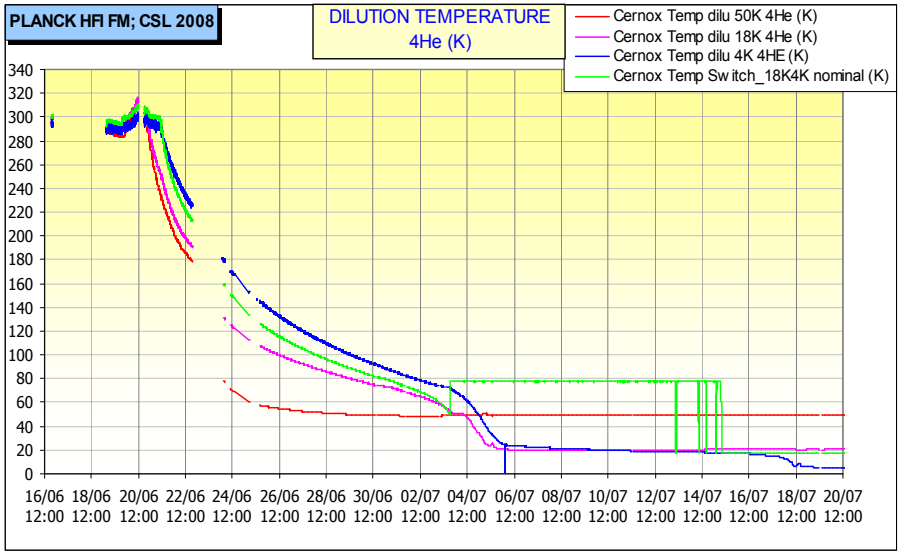

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 0.1K Nom (K)
Cernox Temp HFI 1.6K Nom (K)
Cernox Temp HFI 4K Nom (K)
300,00
250,00
200,00
150,00
100,00
50,00
0,00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

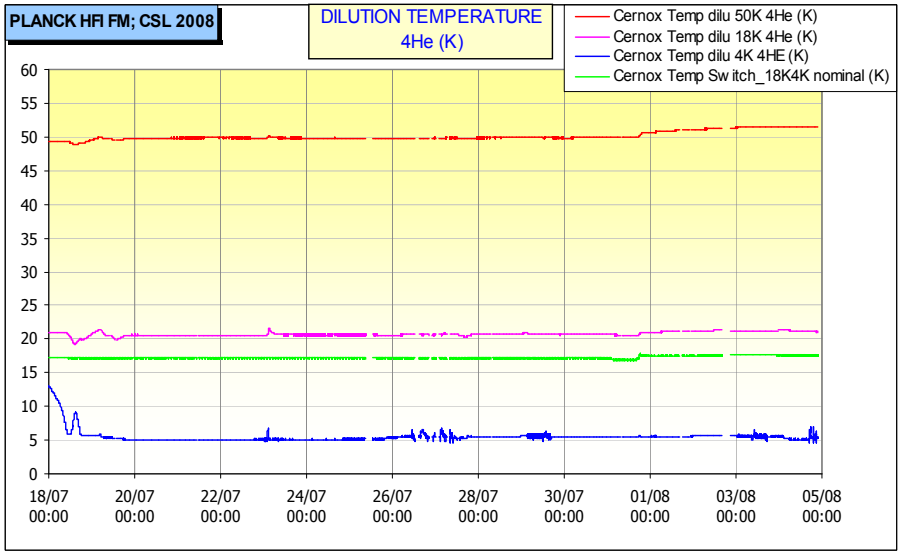

PLANCK HFI FM; CSL 2008
HFI CERNOX's NOM (K)
Cernox Temp HFI 4-1.6K Nom (K)
Cernox Temp HFI 18K Nom (K)
Cernox Temp HFI 50K Nom (K)
350
300
250
200
150
100
50
0
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

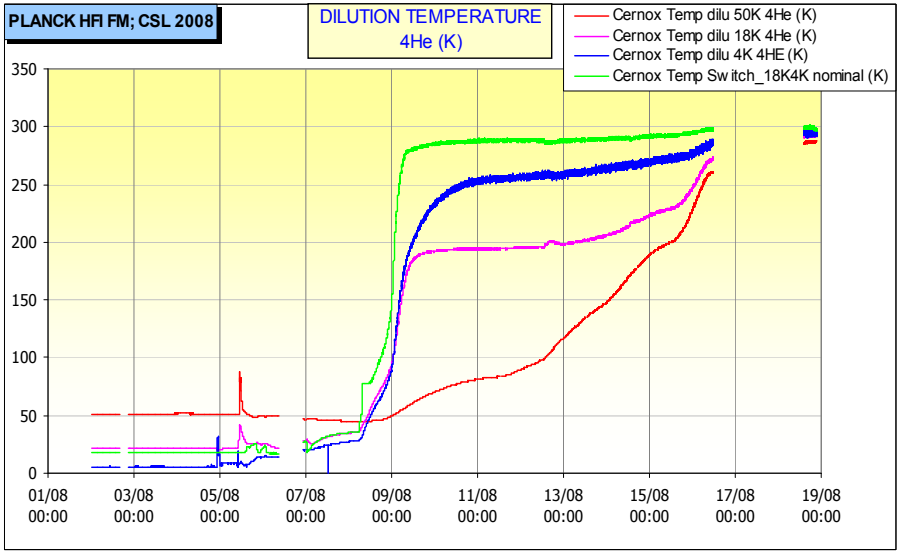

PLANCK HFI FM; CSL 2008
DILUTION TEMPERATURE
3He (K)
Cernox Temp dilu 50K 3He (K)
Cernox Temp dilu 18K 3He (K)
Cernox Temp dilu 4K 3He (K)
Cernox Temp Switch_18K4K redundant (K)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00


PLANCK HFI FM; CSL 2008
DILUTION TEMPERATURE
3He (K)
Cernox Temp dilu 50K 3He (K)
Cernox Temp dilu 18K 3He (K)
Cernox Temp dilu 4K 3He (K)
Cernox Temp Switch_18K4K redundant (K)
60
55
50
45
40
35
30
25
20
15
10
5
0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

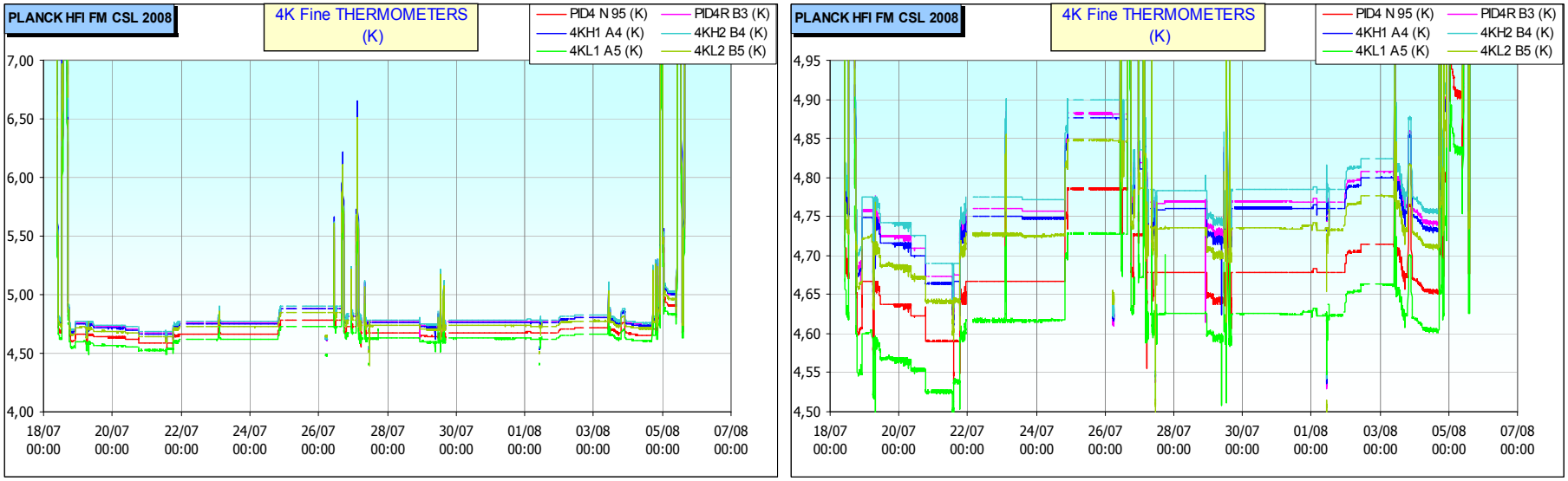

PLANCK HFI FM; CSL 2008
DILUTION TEMPERATURE
3He (K)
Cernox Temp dilu 50K 3He (K)
Cernox Temp dilu 18K 3He (K)
Cernox Temp dilu 4K 3He (K)
Cernox Temp Switch_18K4K redundant (K)
350
300
250
200
150
100
50
0
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

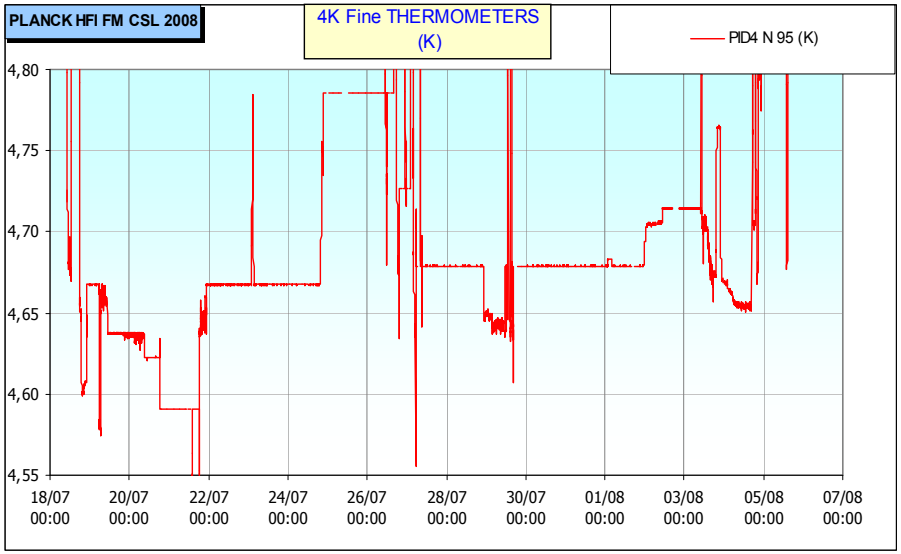

PLANCK HFI FM; CSL 2008
DILUTION TEMPERATURE
4He (K)
Cernox Temp dilu 50K 4He (K)
Cernox Temp dilu 18K 4He (K)
Cernox Temp dilu 4K 4HE (K)
Cernox Temp Switch_18K4K nominal (K)
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
16/06 12:00
18/06 12:00
20/06 12:00
22/06 12:00
24/06 12:00
26/06 12:00
28/06 12:00
30/06 12:00
02/07 12:00
04/07 12:00
06/07 12:00
08/07 12:00
10/07 12:00
12/07 12:00
14/07 12:00
16/07 12:00
18/07 12:00
20/07 12:00

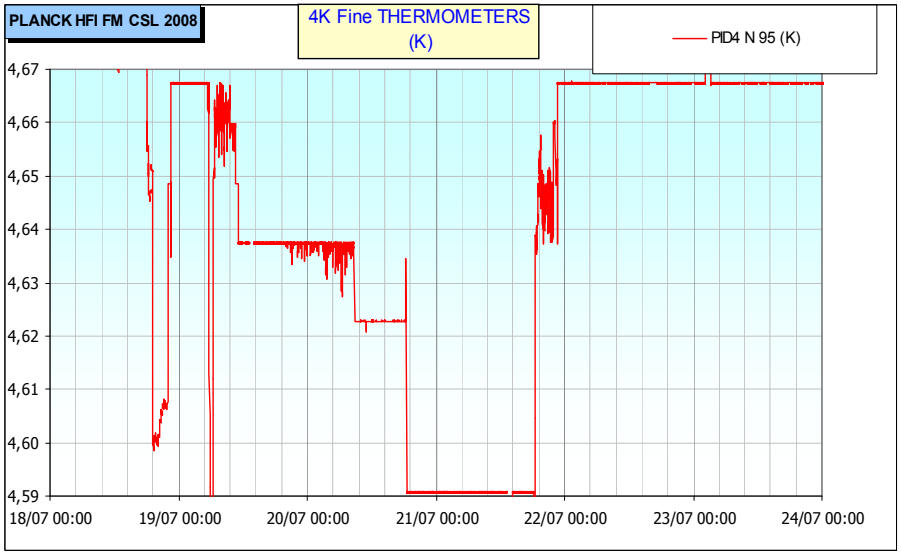

PLANCK HFI FM; CSL 2008
DILUTION TEMPERATURE
4He (K)
Cernox Temp dilu 50K 4He (K)
Cernox Temp dilu 18K 4He (K)
Cernox Temp dilu 4K 4HE (K)
Cernox Temp Switch_18K4K nominal (K)
60
55
50
45
40
35
30
25
20
15
10
5
0
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00

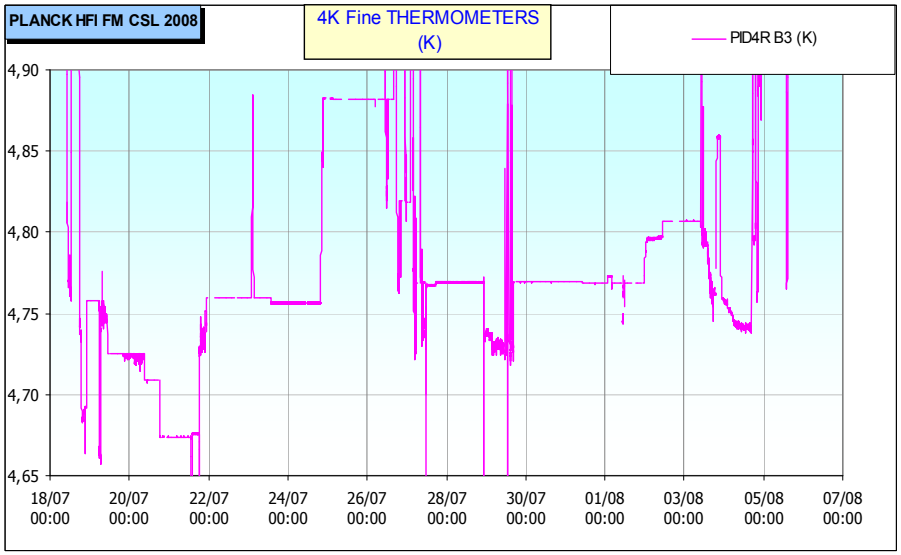

PLANCK HFI FM; CSL 2008
DILUTION TEMPERATURE
4He (K)
Cernox Temp dilu 50K 4He (K)
Cernox Temp dilu 18K 4He (K)
Cernox Temp dilu 4K 4HE (K)
Cernox Temp Switch_18K4K nominal (K)
350
300
250
200
150
100
50
0
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00
09/08 00:00
11/08 00:00
13/08 00:00
15/08 00:00
17/08 00:00
19/08 00:00

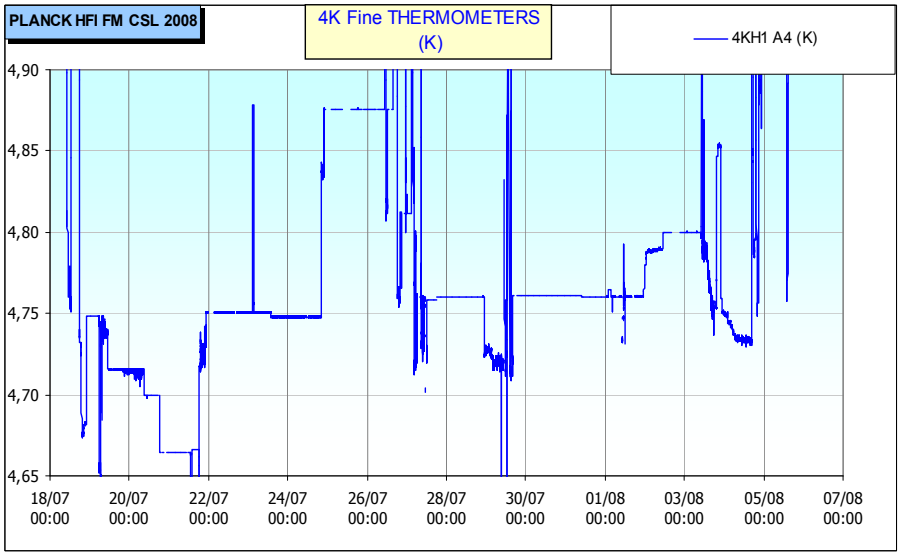
FINE THERMO 4K

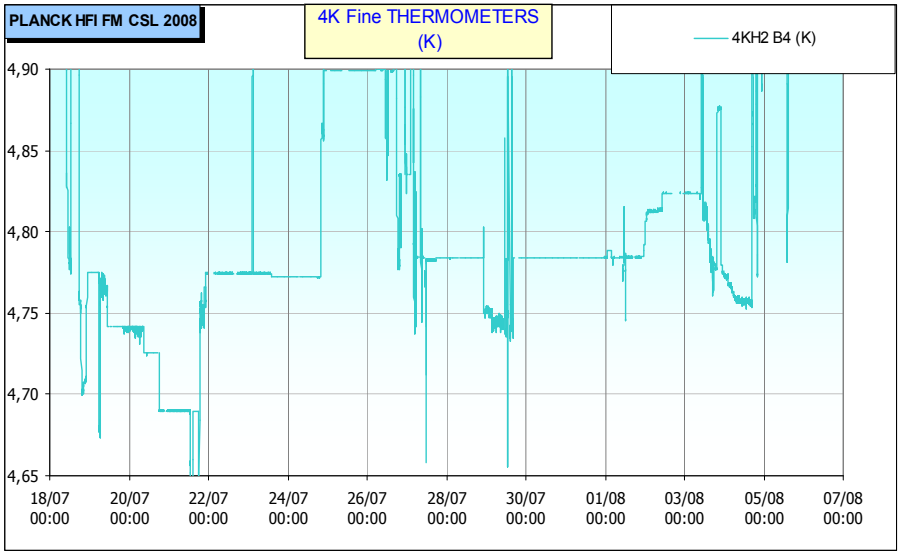


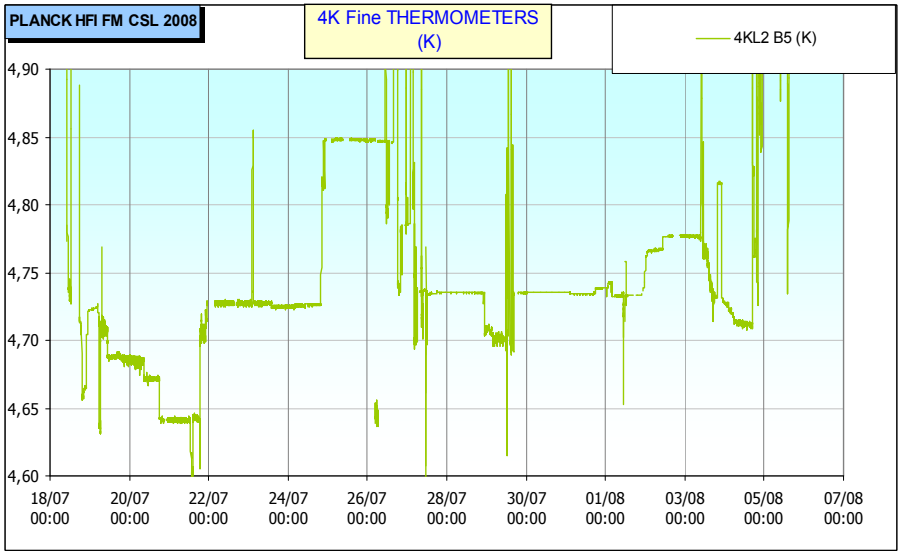

PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
PID4 N 95 (K)
4,80
4,75
4,70
4,65
4,60
4,55
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

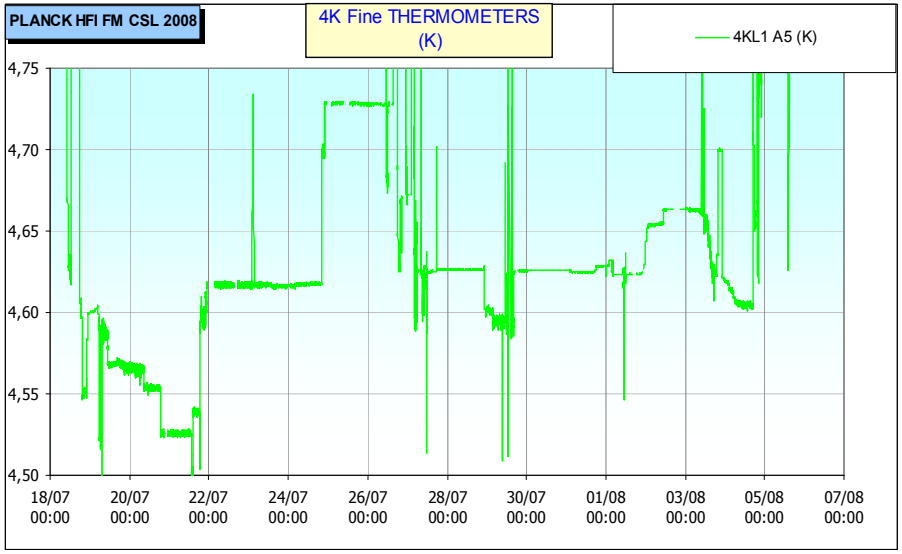

PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
PID4 N 95 (K)
4,67
4,66
4,65
4,64
4,63
4,62
4,61
4,60
4,59
18/07 00:00
19/07 00:00
20/07 00:00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00


PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
PID4R B3 (K)
4,90
4,85
4,80
4,75
4,70
4,65
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

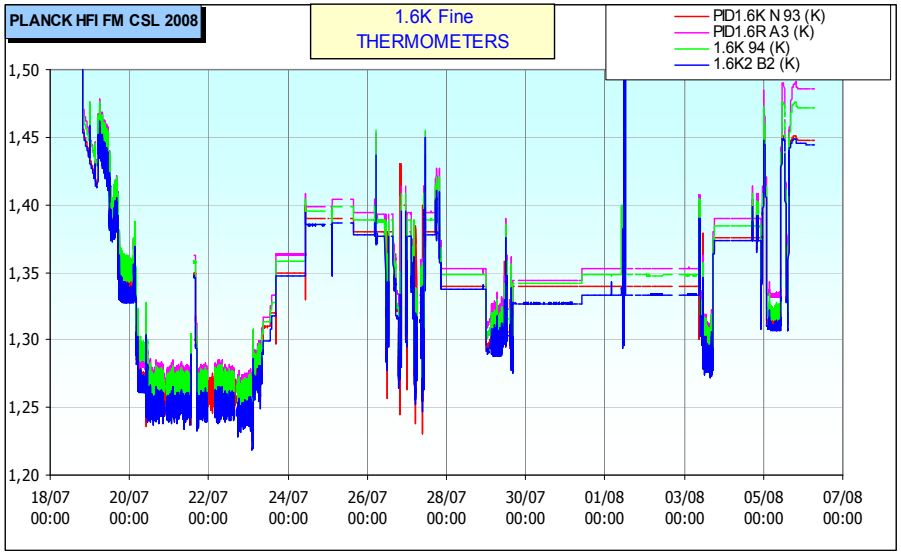

PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
4KH1 A4 (K)
4,90
4,85
4,80
4,75
4,70
4,65
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

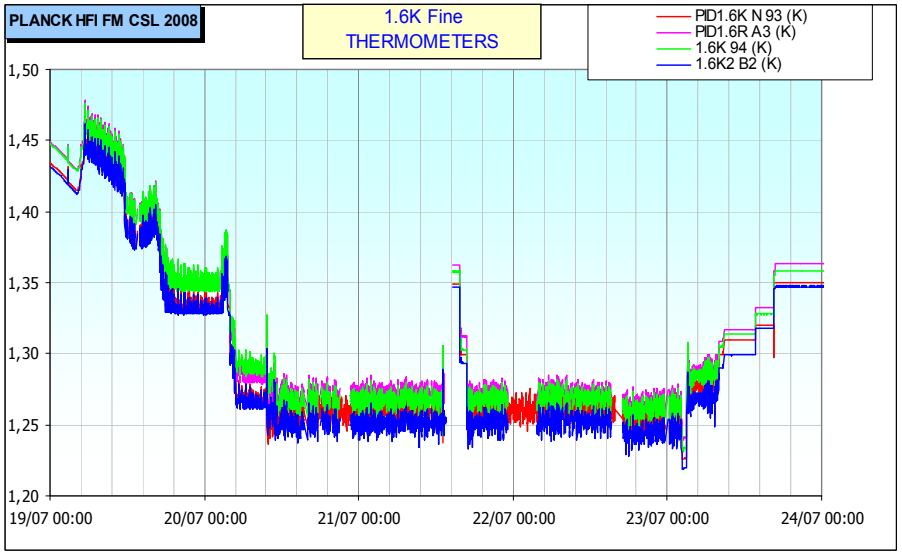

PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
4KH2 B4 (K)
4,90
4,85
4,80
4,75
4,70
4,65
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

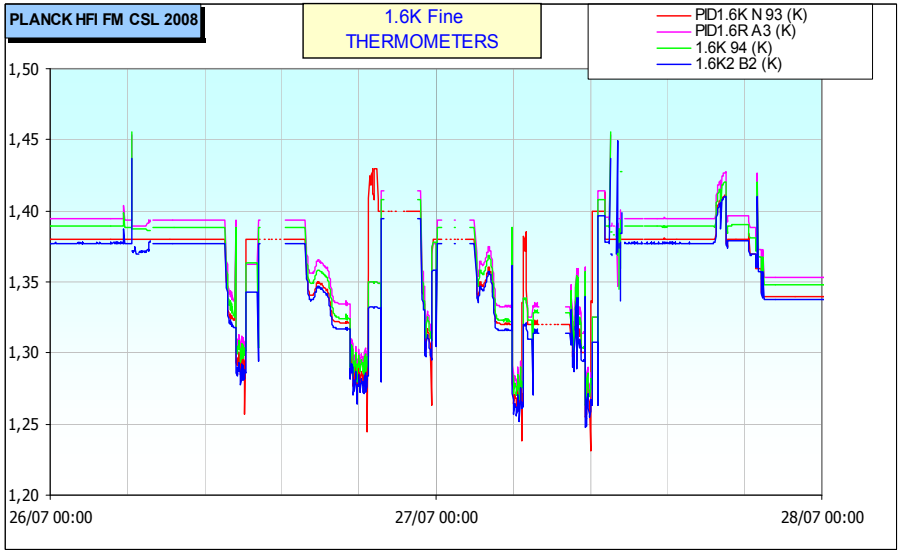

PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
4KL2 B5 (K)
4,90
4,85
4,80
4,75
4,70
4,65
4,60
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

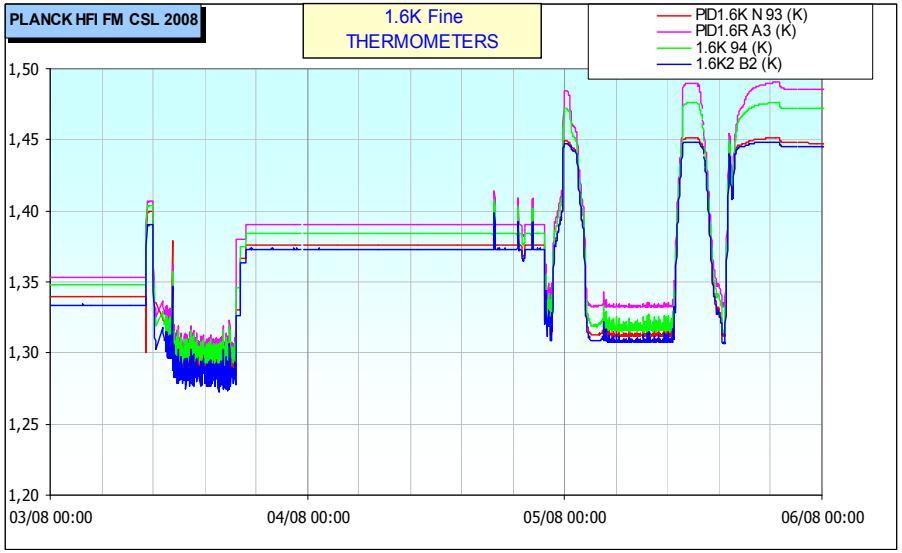

PLANCK HFI FM CSL 2008
4K Fine THERMOMETERS (K)
4KL1 A5 (K)
4,75
4,70
4,65
4,60
4,55
4,50
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

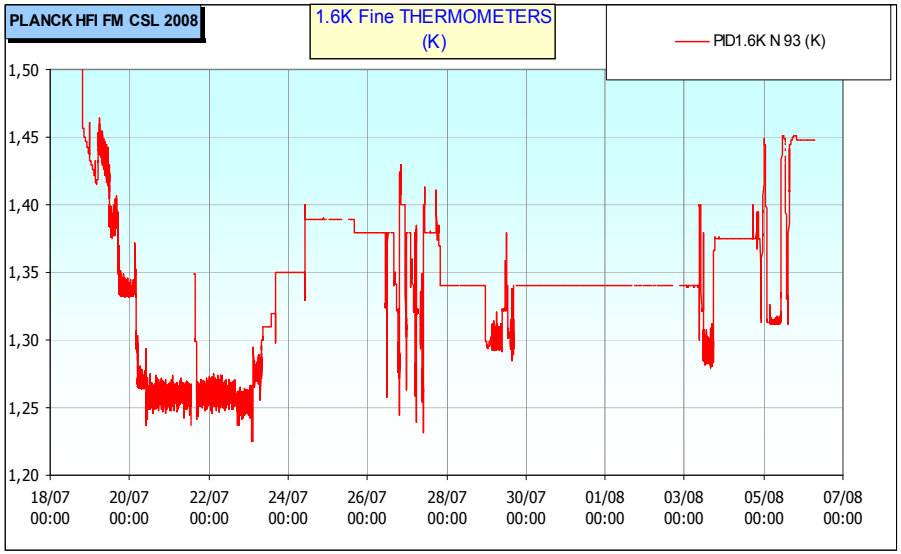
FINE THERMO 1.6K

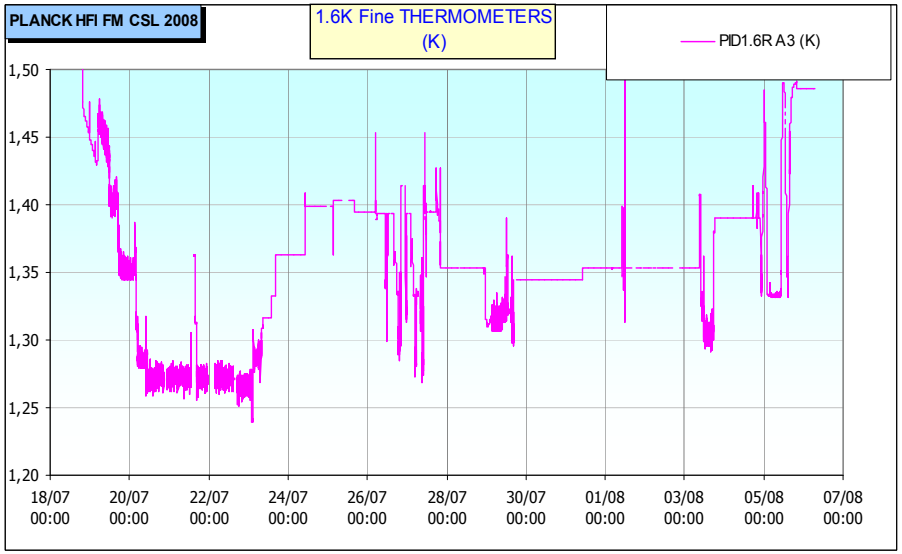


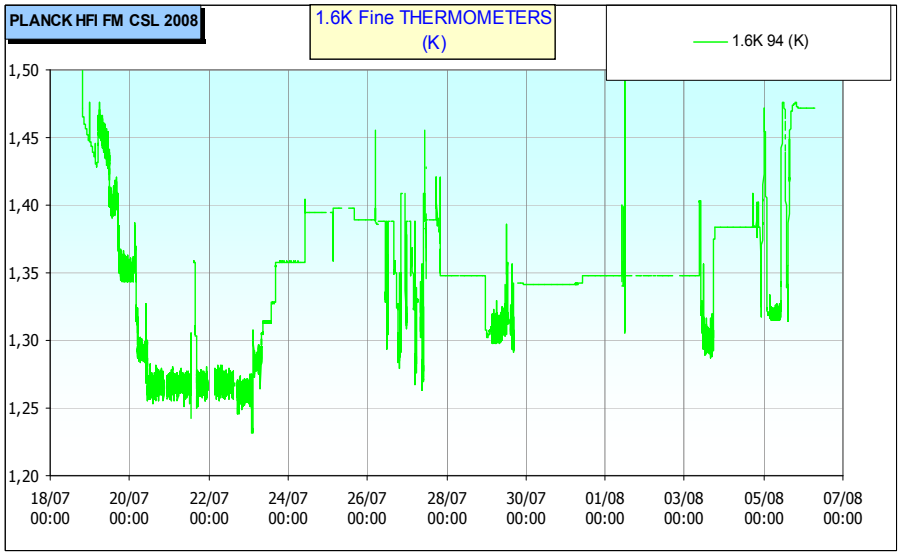


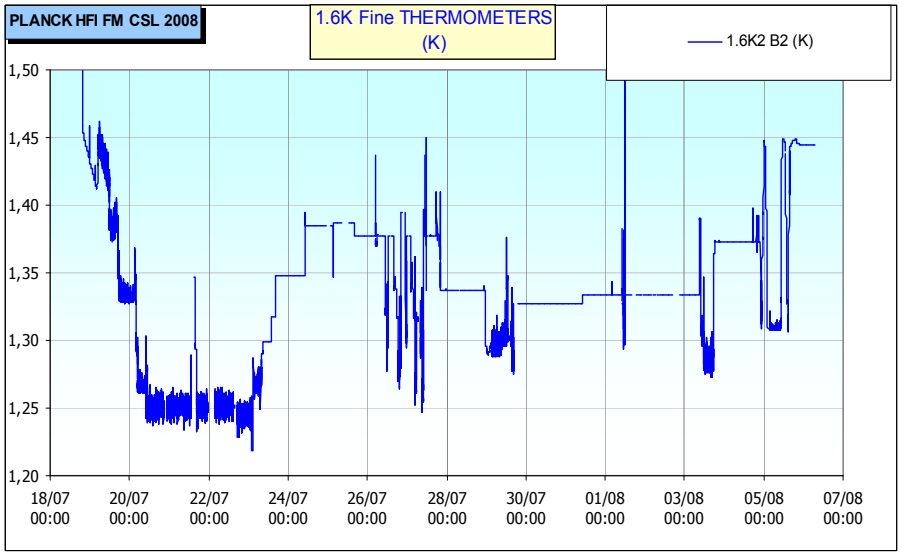


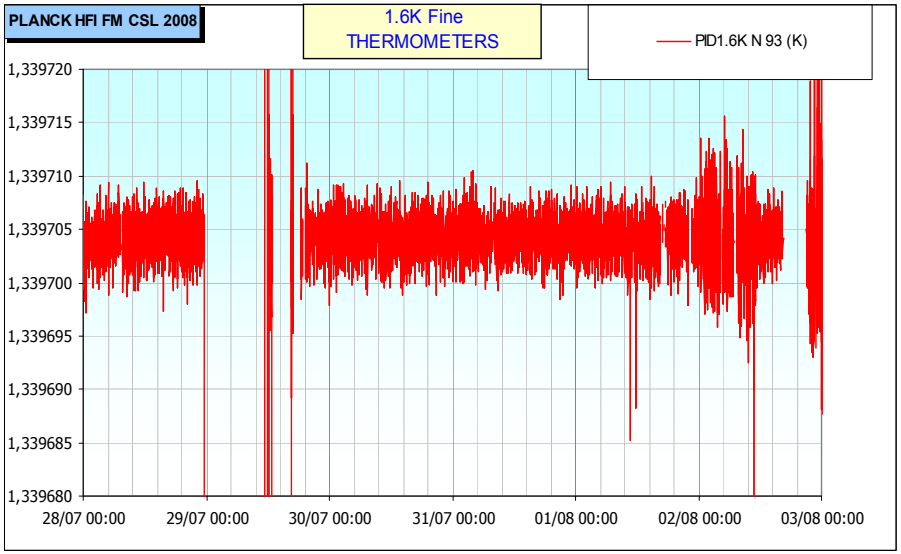



PLANCK HFI FM CSL 2008
1.6K Fine THERMOMETERS (K)
PID1.6K N 93 (K)
1,50
1,45
1,40
1,35
1,30
1,25
1,20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

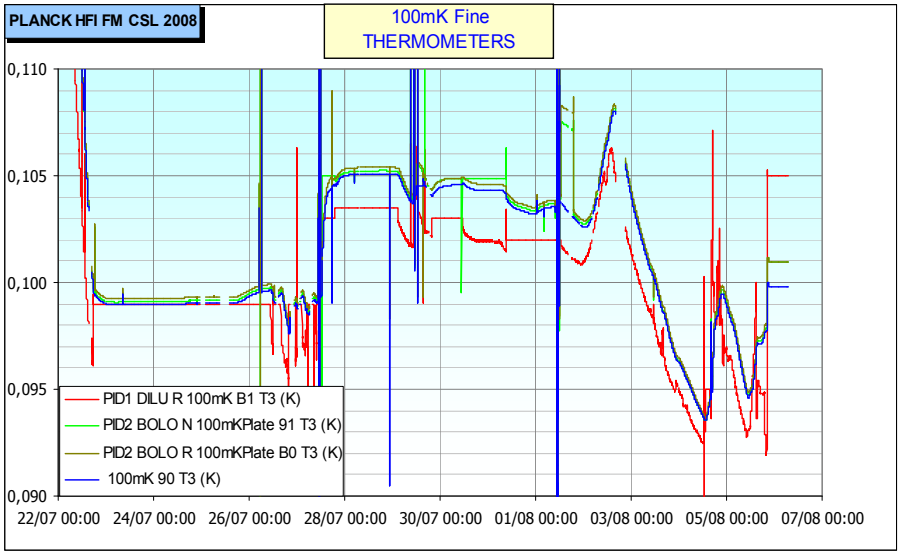

PLANCK HFI FM CSL 2008
1.6K Fine THERMOMETERS (K)
PID1.6R A3 (K)
1,50
1,45
1,40
1,35
1,30
1,25
1,20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

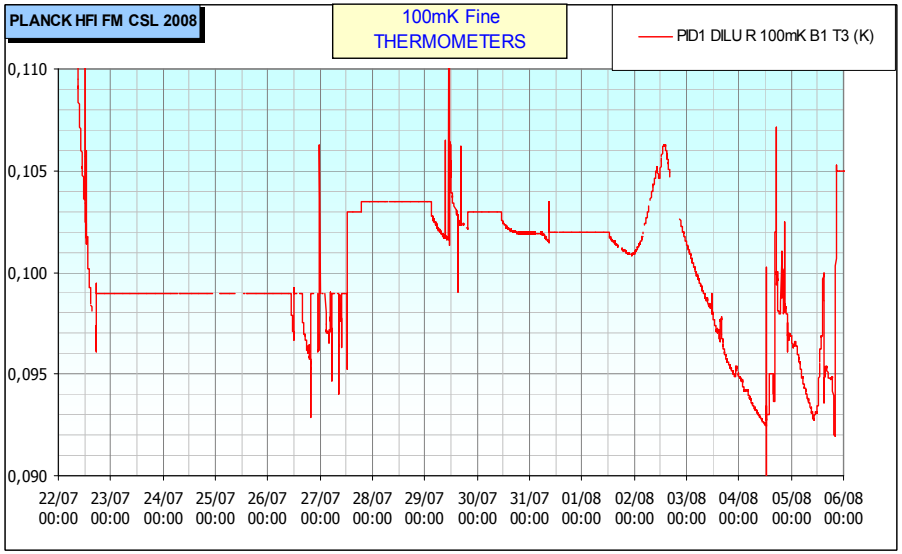

PLANCK HFI FM CSL 2008
1.6K Fine THERMOMETERS (K)
1.6K 94 (K)
1,50
1,45
1,40
1,35
1,30
1,25
1,20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
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05/08 00:00
07/08 00:00

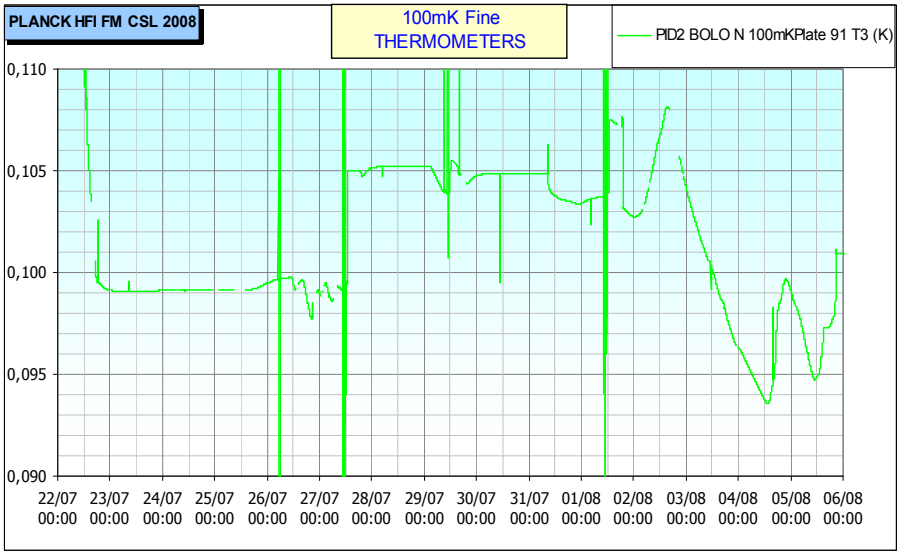

PLANCK HFI FM CSL 2008
1.6K Fine THERMOMETERS (K)
1.6K2 B2 (K)
1,50
1,45
1,40
1,35
1,30
1,25
1,20
18/07 00:00
20/07 00:00
22/07 00:00
24/07 00:00
26/07 00:00
28/07 00:00
30/07 00:00
01/08 00:00
03/08 00:00
05/08 00:00
07/08 00:00

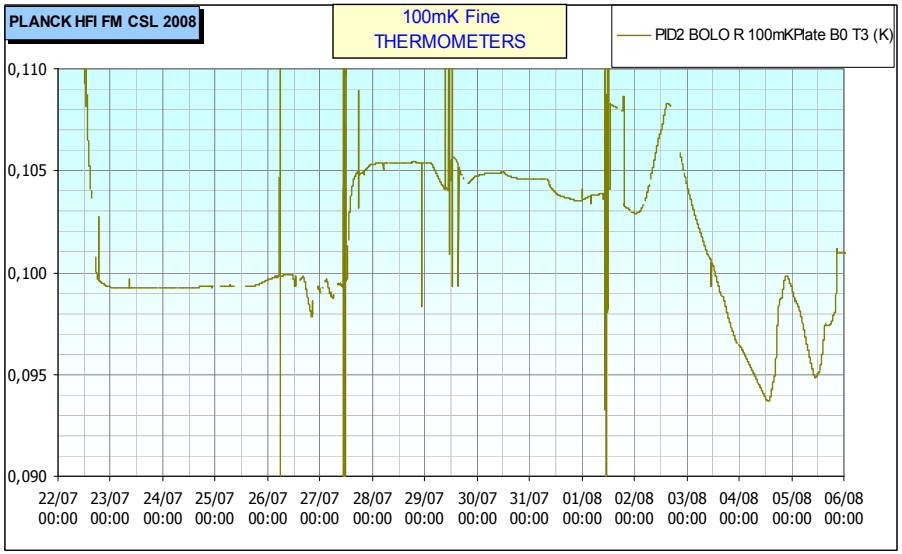

PLANCK HFI FM CSL 2008
1.6K Fine
THERMOMETERS
PID1.6K N 93 (K)
1,339720
1,339715
1,339710
1,339705
1,339700
1,339695
1,339690
1,339685
1,339680
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00

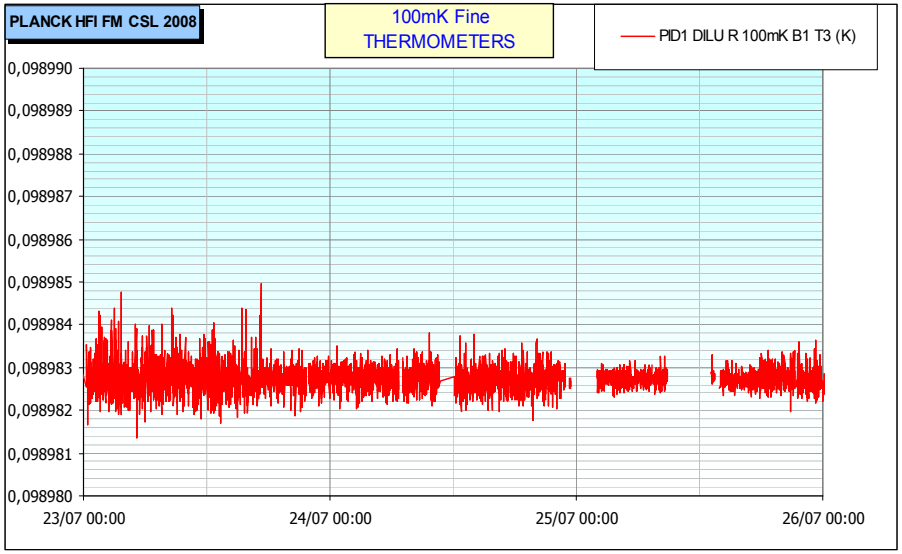
FINE THERMO 100mK

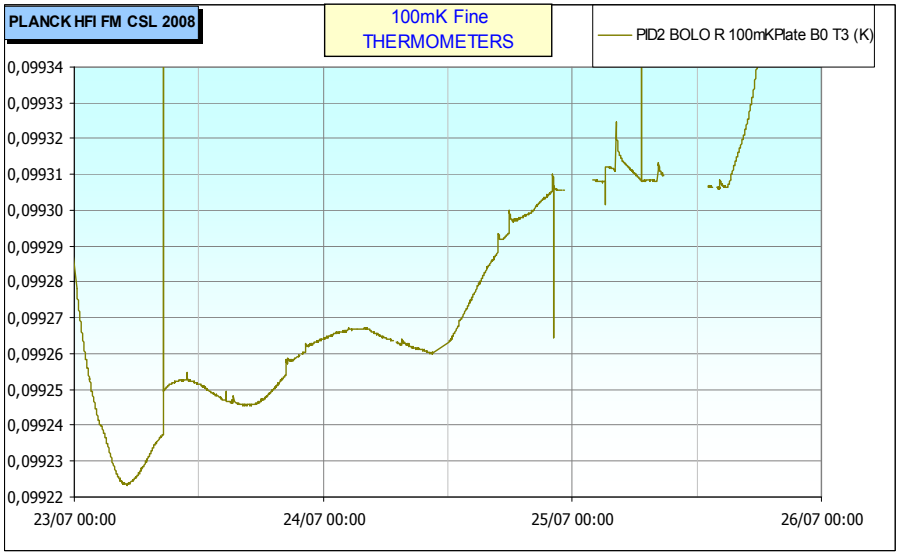




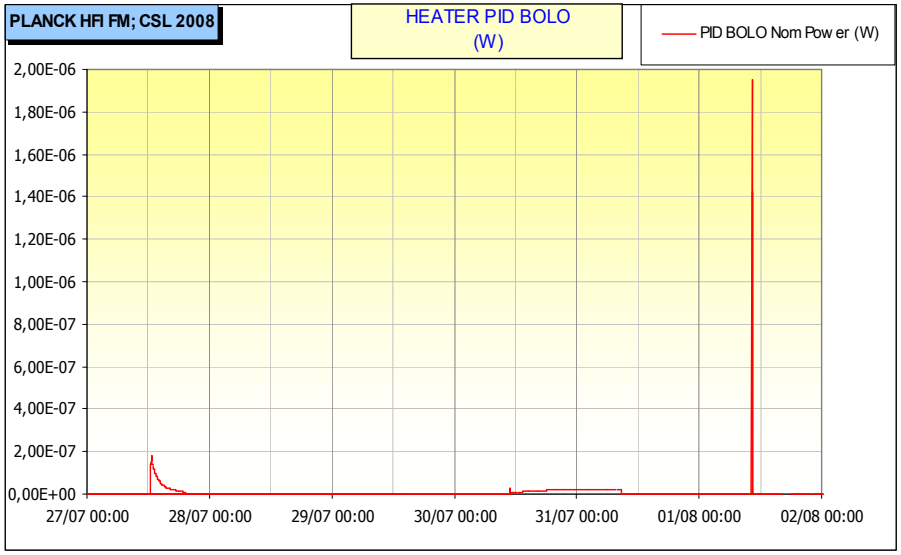


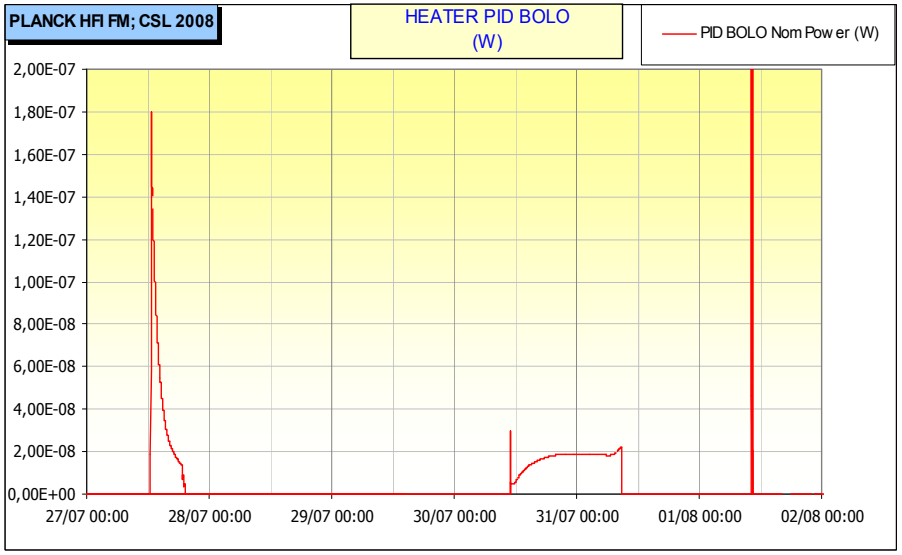


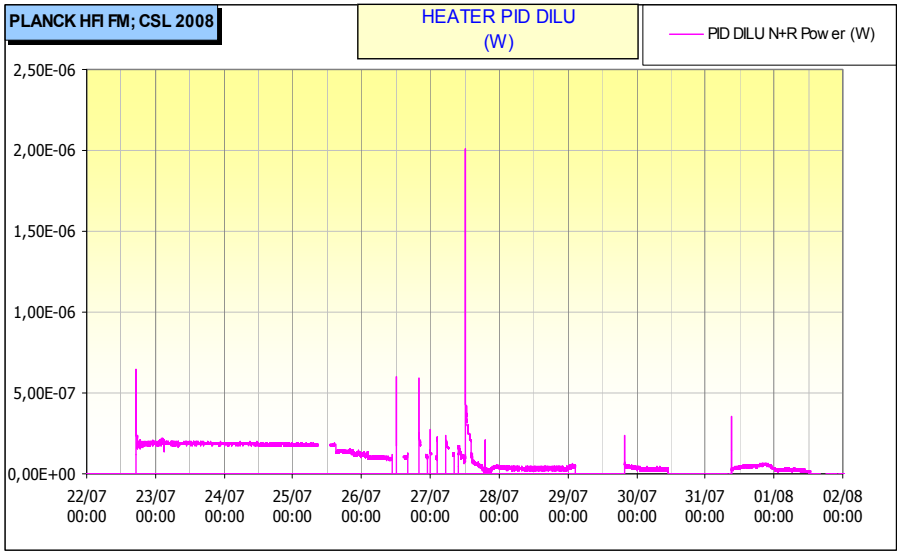

PLANCK HFI FM CSL 2008
100mK Fine
THERMOMETERS
PID1 DILU R 100mK B1 T3 (K)
0,098990
0,098989
0,098988
0,098987
0,098986
0,098985
0,098984
0,098983
0,098982
0,098981
0,098980
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00

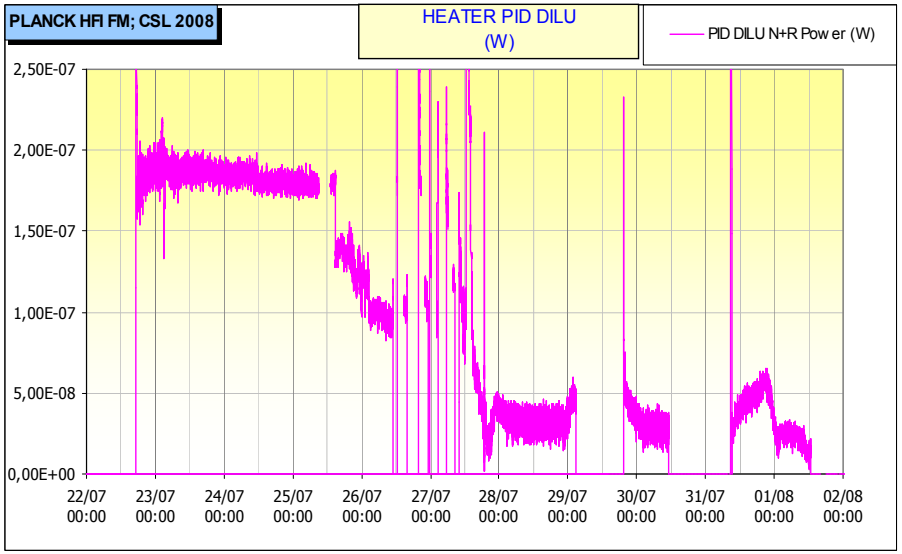

PLANCK HFI FM CSL 2008
100mK Fine
THERMOMETERS
PID2 BOLO R 100mKPlate B0 T3 (K)
0,09934
0,09933
0,09932
0,09931
0,09930
0,09929
0,09928
0,09927
0,09926
0,09925
0,09924
0,09923
0,09922
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00

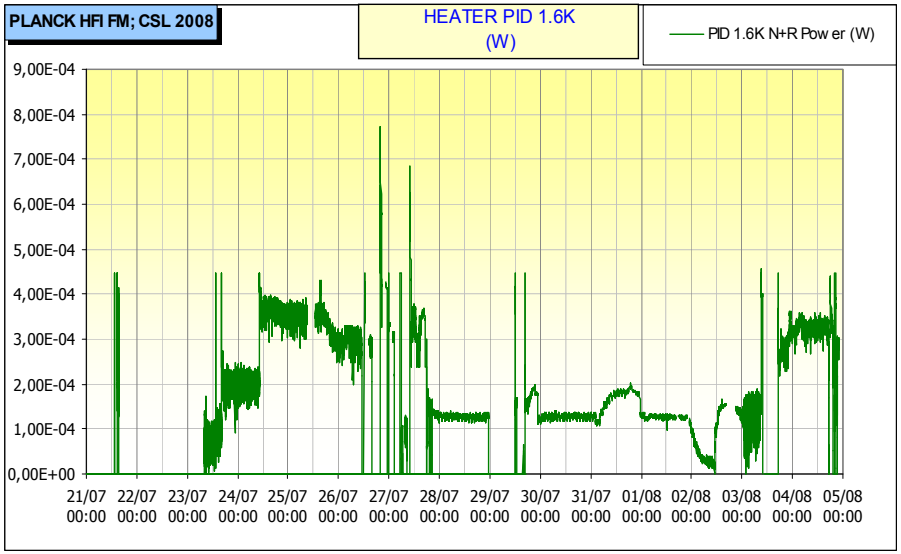
PID's TOTAL POWER

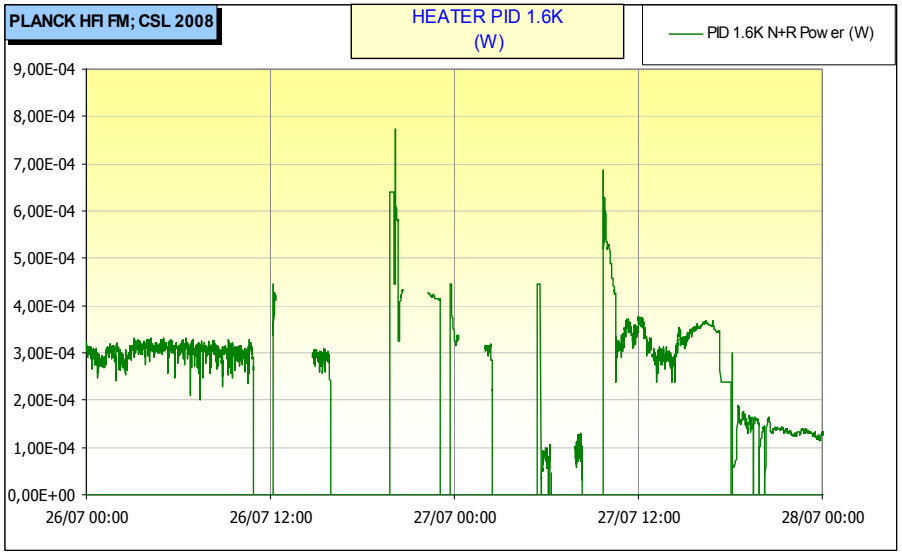


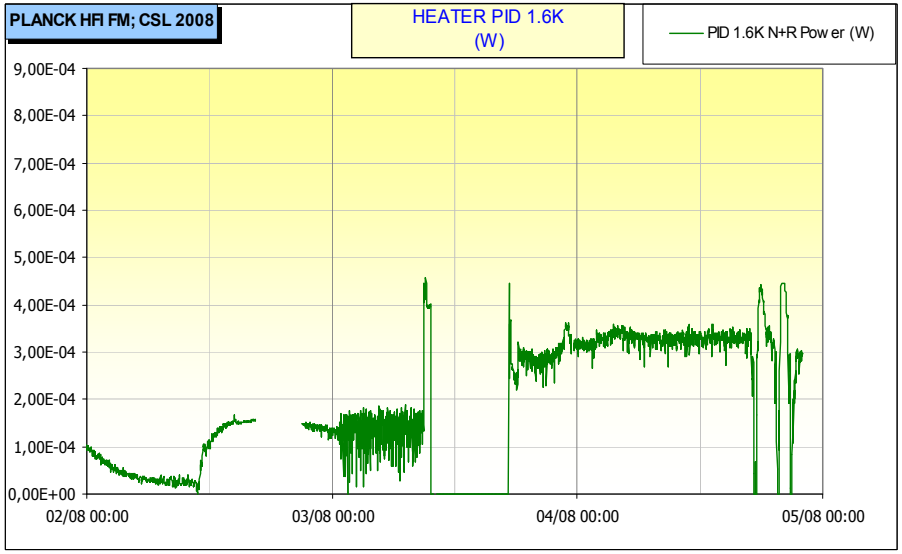


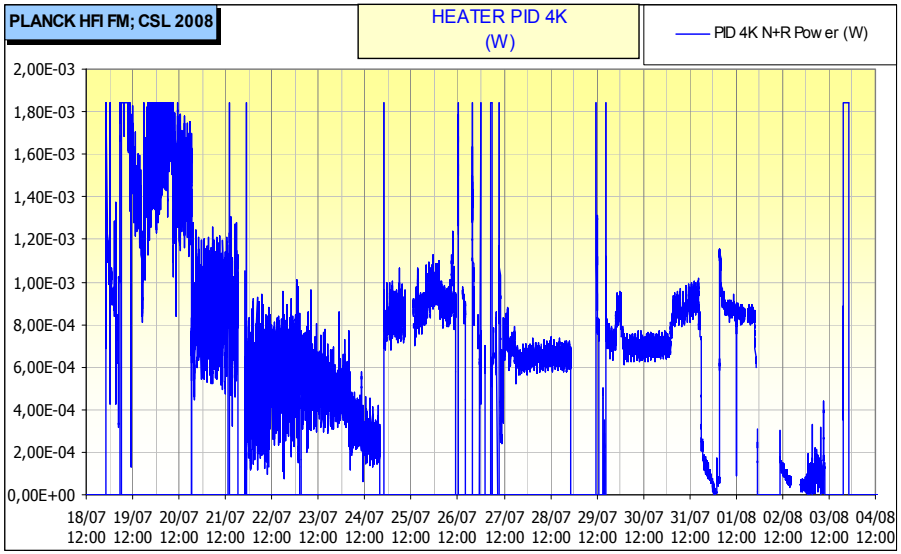

PLANCK HFI FM; CSL 2008
HEATER PID DILU (W)
PID DILU N+R Power (W)
2,50E-06
2,00E-06
1,50E-06
1,00E-06
5,00E-07
0,00E+00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00

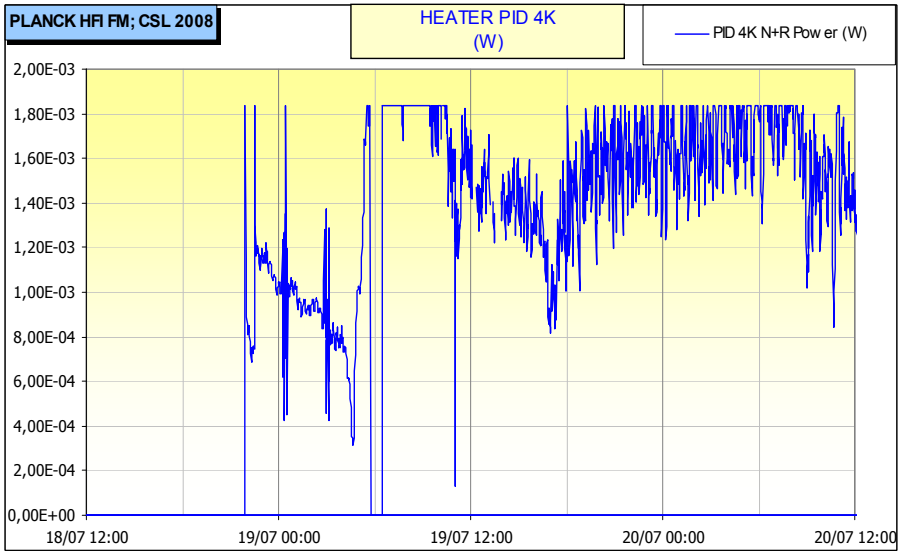

PLANCK HFI FM; CSL 2008
HEATER PID DILU (W)
PID DILU N+R Power (W)
2,50E-07
2,00E-07
1,50E-07
1,00E-07
5,00E-08
0,00E+00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00

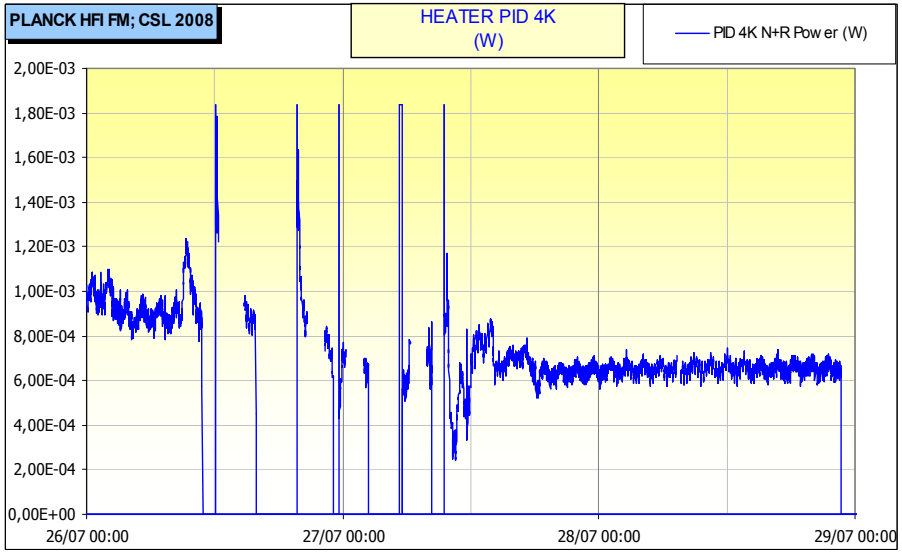

PLANCK HFI FM; CSL 2008
HEATER PID 1.6K (W)
PID 1.6K N+R Power (W)
9,00E-04
8,00E-04
7,00E-04
6,00E-04
5,00E-04
4,00E-04
3,00E-04
2,00E-04
1,00E-04
0,00E+00
21/07 00:00
22/07 00:00
23/07 00:00
24/07 00:00
25/07 00:00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00
30/07 00:00
31/07 00:00
01/08 00:00
02/08 00:00
03/08 00:00
04/08 00:00
05/08 00:00

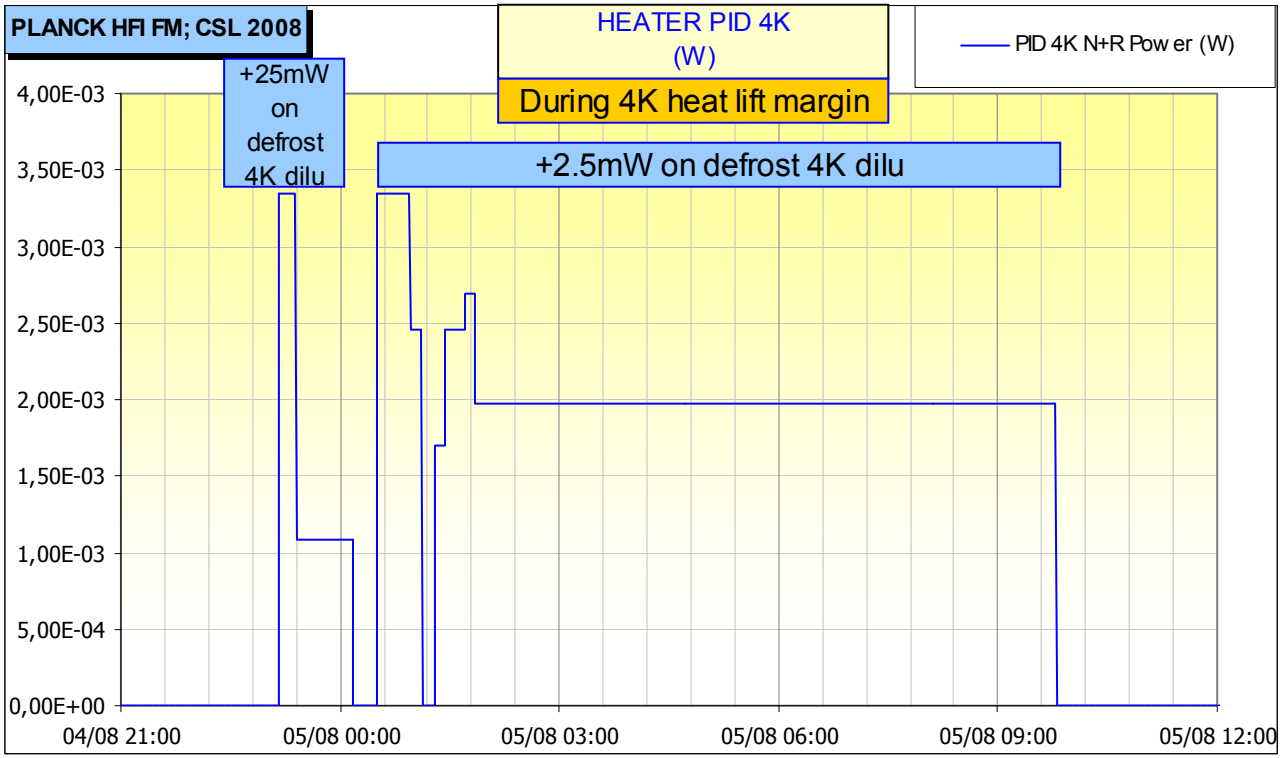

PLANCK HFI FM; CSL 2008
HEATER PID 1.6K (W)
PID 1.6K N+R Power (W)
9,00E-04
8,00E-04
7,00E-04
6,00E-04
5,00E-04
4,00E-04
3,00E-04
2,00E-04
1,00E-04
0,00E+00
26/07 00:00
26/07 12:00
27/07 00:00
27/07 12:00
28/07 00:00


PLANCK HFI FM; CSL 2008
HEATER PID 1.6K (W)
PID 1.6K N+R Power (W)
9,00E-04
8,00E-04
7,00E-04
6,00E-04
5,00E-04
4,00E-04
3,00E-04
2,00E-04
1,00E-04
0,00E+00
02/08 00:00
03/08 00:00
04/08 00:00
05/08 00:00


PLANCK HFI FM; CSL 2008
HEATER PID 4K (W)
PID 4K N+R Power (W)
2,00E-03
1,80E-03
1,60E-03
1,40E-03
1,20E-03
1,00E-03
8,00E-04
6,00E-04
4,00E-04
2,00E-04
0,00E+00
18/07 12:00
19/07 12:00
20/07 12:00
21/07 12:00
22/07 12:00
23/07 12:00
24/07 12:00
25/07 12:00
26/07 12:00
27/07 12:00
28/07 12:00
29/07 12:00
30/07 12:00
31/07 12:00
01/08 12:00
02/08 12:00
03/08 12:00
04/08 12:00


PLANCK HFI FM; CSL 2008
HEATER PID 4K (W)
PID 4K N+R Power (W)
2,00E-03
1,80E-03
1,60E-03
1,40E-03
1,20E-03
1,00E-03
8,00E-04
6,00E-04
4,00E-04
2,00E-04
0,00E+00
18/07 12:00
19/07 00:00
19/07 12:00
20/07 00:00
20/07 12:00


PLANCK HFI FM; CSL 2008
HEATER PID 4K (W)
PID 4K N+R Power (W)
2,00E-03
1,80E-03
1,60E-03
1,40E-03
1,20E-03
1,00E-03
8,00E-04
6,00E-04
4,00E-04
2,00E-04
0,00E+00
26/07 00:00
27/07 00:00
28/07 00:00
29/07 00:00


PLANCK HFI FM; CSL 2008
HEATER PID 4K
(W)
PID 4K N+R Pow er (W)
+25mW on defrost 4K dilu
During 4K heat lift margin
+2.5mW on defrost 4K dilu
4,00E-03
3,50E-03
3,00E-03
2,50E-03
2,00E-03
1,50E-03
1,00E-03
5,00E-04
0,00E+00
04/08 21:00
05/08 00:00
05/08 03:00
05/08 06:00
05/08 09:00
05/08 12:00

10.3 SCIENCE DATA

10.3.1 SCIENCE DATA TYPE

10.3.1.1 Readout Science Data Types

At the end of each modulation period, the REU provides the DPU with 2 types of science data:

- for one selected channel (see TCREU-RsigSetup-4007), the output of the ADC during the modulation period (72, 80 or 90 samples coded on 16 bits).
- for the 72 channels, the sum of the ADC output during the first half modulation period.
- for the 72 channels, the sum of the ADC output during the second half modulation period.

The first data type is called raw signal, the second and third ones are called summed data but each one is modulated data.

10.3.1.2 Raw Signal Processing

In CONFIGURATION, OBSERVATION and WITHOUT COMPRESSION Modes, the DPU ASW stores the raw signal sent each modulation period. If the “Glitch” algorithm is enable (TCOBSW-EnGlitchAlgo-2003), it compares it to the previous one following the “Glitch” algorithm. Then it keeps the more “glitched” raw signal. The last selected raw signal of the Compression Slice CS is downloaded at the end of the last SC1 or SC4 TMP of the CS.
In these modes, it is advised to change the raw signal channel each CS (i.e. TCREU-RsigSetup-4007 with Mode =3).

In OPTIMIZATION and VI Modes, the DPU ASW stores the raw signal (and the V, I, T, etc..) at each bridge equilibrium. This set of raw signals (maximum 20 per CS) is downloaded at the end of the last SC2-2 TMP of the CS.
In these modes, the TCREU-RsigSetup-4007 has no effect because the REU stays locked on the channel in VI or in Optimization.

In RAW SIGNAL Mode, the DPU ASW stores all the raw signals sent by the REU. This set of raw signals is downloaded in SC2-1 TMP.
The CS size is set at 72 and the TCREU-RsigSetup-4007 can be used to select the downloaded data: only one channel, a new channel at each CS or a new channel at each modulation period.

A subset of raw signals is also downloaded within housekeeping TMP. For that, they are under-sampled (32 samples are kept out of the 72, 80 or 90 initial ones) thanks to raw signal filters and stored at each modulation period in DPU memory before being sent into the HSK4 to HSK9 TMP.
The raw signals of the REU belts #0 and #1 are downloaded in HSK4 each minute.
The raw signals of the REU belts #2 and #3 are downloaded in HSK5 each minute.
The raw signals of the REU belts #4 and #5 are downloaded in HSK6 each minute.
The raw signals of the REU belts #6 and #7 are downloaded in HSK7 each minute.
The raw signals of the REU belts #8 and #9 are downloaded in HSK8 each minute.
The raw signals of the REU belts #A and #B are downloaded in HSK9 each minute.

In order to have a periodic update of all channels raw signal into housekeeping TMP, it is necessary to change the raw signal channel each CS (i.e. TCREU-RsigSetup-4007 with Mode =3). Otherwise, some old raw signals could be downloaded a long time after they have been stored.

10.3.1.3 Summed Data Processing

In WITHOUT COMPRESSION and COMPRESSION VALIDATION Modes, the DPU ASW stores the summed data sent by the REU and downloads them within the SC4 or SC3 TMP.

In CONFIGURATION, OBSERVATION, OPTIMIZATION, VI and COMPRESSION VALIDATION Modes, the DPU ASW demodulates and compresses the summed data according to the compression algorithm. The results of the compression process are called compressed data and are downloaded within SC1, SC2-2 or SC3 TMP.
For that, the compression algorithm calculates for each channel:

- the average of the modulated and summed data on the CS (called offset 1)
- the average of the demodulated and summed data on the CS (called average)
- the standard deviation of the demodulated and summed data on the CS (called sigma).

To monitor the compression, some science diagnostics are downloaded into housekeeping TMP:

- the average within HSK1 (called OCfij-CalCSAve)
- the average of the sigma on N CS within HSK4 to HSK9 (called OCfij-CalSigma)
- the difference between the maximum and the minimum average on N CS within HSK4 to HSK9 (called OCfij-AvMaxMin)

with i = Belt Number, j = Channel Number and N = CS Number = 60.
If the duration of the CS is equal to 1 second, the OCfij-CalSigma and the OCfij-AvMaxMin are calculated on one sky circle or very close to it.

Only the 16 most significant bits of OCfij-CalCSAve are downloaded.
Only the 16 most significant bits of OCfij-AvMaxMin are downloaded.
Only the 16 less significant bits of OCfij-CalSigma are downloaded.

10.3.1.4 Summed Data Under Sampling

In order to fit to the in flight download bandwidth, some FPU channel (low rate thermometer) shall be under sampled.
The under-sampling is controlled thanks to the TCOBSW-CompCtrl-2001-73 and TCOBSW-CompCtrl-2001-74 and the F2 field of their OCfij-CompCtrl parameter.
To perform this under sampling, the DPU ASW keeps only one sample on a set of F2 samples.
The value of the F2 field and the equivalent acquisition frequency are summarized in table 10.3.1.4-1:

F2	With Fmod=91 Hz, Equivalent Acquisition Frequency (Hz)
0 = Off	Off
1 = On	182
2	91
3	60,7
4	45,5
5	36,4
6	30,3
7	26
8	22,8
9	20,2
A	18,2
B	16,5
C	15,2
D	14
E	13
F	12,1

Table 10.3.1.4-1: Under Sampling Control

10.3.2 Science Data Time Tagging

A hardware 48 bit counter which is incremented by the OBC distributed by the S/C maintains the HFI LOBT in TAI format.
A hardware 7 bit counter which is incremented by the REU modulation signal, is initialized with the CS size. When it rolls over, it generates a pulse which:
- indicates to the REU the beginning of the new CS,
- latches the LOBT counter.

The following diagram shows the time tagging process:

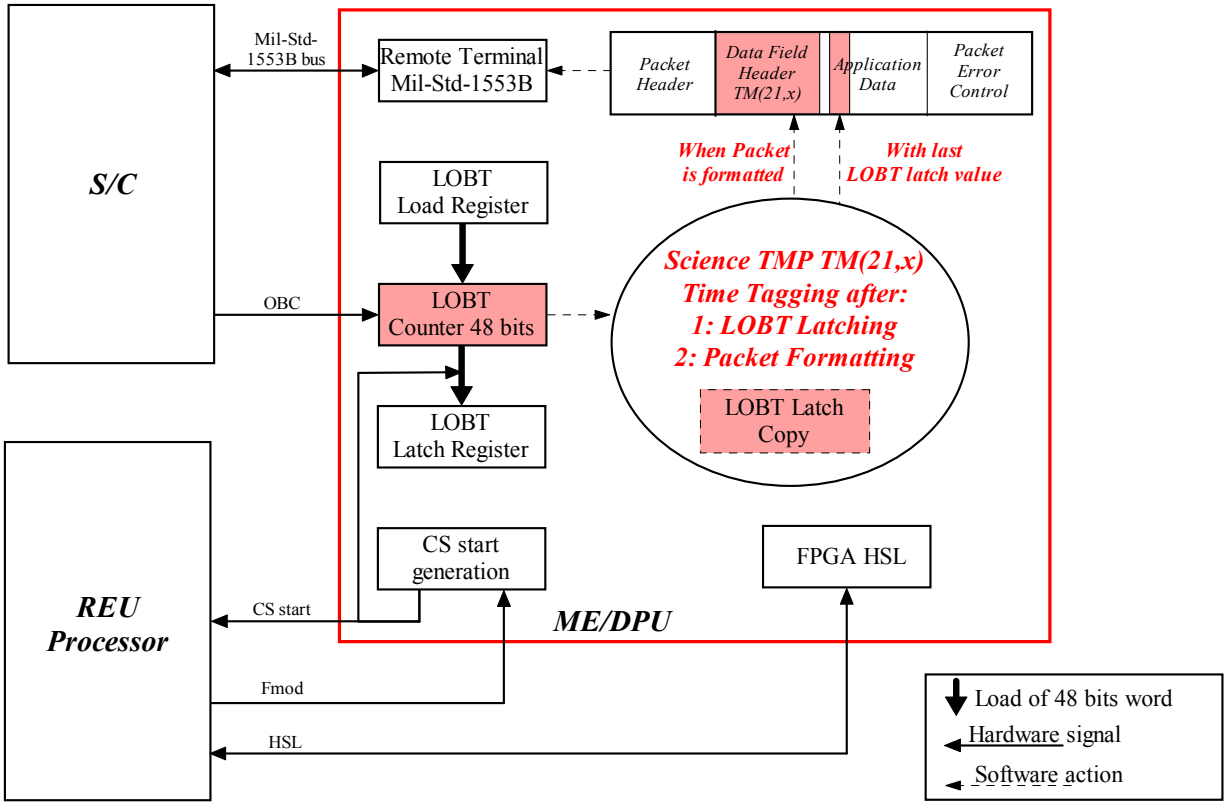


Diagram 10.3.2-1: TMP(21,x) Time Tagging

Therefore, the REU latched LOBT value gives the time of the raising edge of the first modulation period of the CS.
This LOBT value is written in the science header of all science packet types.
It stays the same for all the packets of the same CS.

Furthermore when a science packet is formatted, the DPU ASW reads the LOBT counter and puts its value in the packet header.

So, 2 time information are available in a science packet:
- the LOBT value at CS beginning in the science header,
- the LOBT value at packet formatting time in the packet header.

10.3.3 Science Data Summary

The science data are summarized in the following table:

Science Modes	**Observation**	**Configuration**	**Raw Signal**	**VI**	**Optimisation**	**Compress Validation**	**Without Compression**
Compressed Data	SC1 All C	SC1 All C		SC2-2 All C	SC2-2 All C	SC3 All/(1) C	
Summed Data						SC3 All/(1) 22 bits	SC4 All/(1) 22 bits
Raw Signal	SC1 1 2 x Ns x 16 bits	SC1 1 2 x Ns x 16 bits	SC2-1 All/(1) 2 x Ns x 16 bits	SC2-2 Max 20 2 x Ns x 16 bits	SC2-2 Max 20 2 x Ns x 16 bits		SC4 1 2 x Ns x 16 bits
HSK Raw Signal	HSK4 to 9 All/(2) 32 x 16 bits	HSK4 to 9 All/(2) 32 x 16 bits	HSK4 to 9 All/(2) 32 x 16 bits	HSK4 to 9 All/(2) 32 x 16 bits	HSK4 to 9 All/(2) 32 x 16 bits	HSK4 to 9 All/(2) 32 x 16 bits	HSK4 to 9 All/(2) 32 x 16 bits
HSK OCfij-CalCSAve	HSK1 All 16 MSBits	HSK1 All 16 MSBits		HSK1 All 16 MSBits	HSK1 All 16 MSBits		
HSK OCfij-AvMaxMin	HSK4 to 9 All 16 MSBits	HSK4 to 9 All 16 MSBits		HSK4 to 9 All 16 MSBits	HSK4 to 9 All 16 MSBits		
HSK OCfij-CalSigma	HSK4 to 9 All 16 LSBits	HSK4 to 9 All 16 LSBits		HSK4 to 9 All 16 LSBits	HSK4 to 9 All 16 LSBits		

Table 10.3.3-1: Science Data Summary

with the following information type:

SC1	Packet Name in which science data are downloaded.
All	Number of channels downloaded (if the 72 are used).
C	Data format.

C means Compressed Format.
(1) indicates that All channels can be sent if the download bandwidth is large enough.
(2) indicates that All channels can be sent if the ***RSw04-RawSigMod*** parameter is well configured.

10.3.4 Science TMP Content

10.3.4.1 Common fields

Each type of science packet is described in the following sections and begins with the same 5 parameters:

P01, P02 and P03 which provides the latched LOBT value,
P04 (F01) provides the RSw07-Fdiv parameter,
P04 (F02) provides the size of the current compression slice coded on 7 bits.

HP-PSICD service 21 allows to identify different science packet type. However, within a science packet, several science data types can be found (example: compressed and summed data for SC3).
Therefore, each channel data begins by a 16 bit word which indicates at least the science type (F03 = Science Identifier) and the channel number (F06 = Channel Identifier).
Assuming that data are always grouped by channel, the Science Identifier is given in the following table:

Science Identifier (F03)	**Used In**	**Science Data Type**
0b0000	SC1, SC3, SC2-2	Compressed data on the CS.
0b0011	SC1, SC4	One raw signal on one modulation period (with 72, 80 or 90 samples) chosen following “glitch” algorithm.
0b0101	SC2-1	Raw signal.
0b0110	SC2-2	One set of optimisation data = The raw signal after the end of the auto-balance + (V, I, T, etc)
0b1001	SC2-2	One step of the of V(I) data = The raw signal after the end of the auto-balance + (V, I, T, etc)
0b1110	SC4	Summed data on the CS (coded on 20 bits)
0b1111	SC3	Summed data on the CS (coded on 22 bits)

Table 10.3.4.1-1: Science Data Types

F06 is numerated from 0 to 71 (alignment with belt and channel number will be done on ground).

Several science packets (of a specified type) are produced from data acquired during a CS period. The segmentation flag of all science packet types are used (01 for the first, 00 for the intermediate one(s) and 10 for the last one).

10.3.4.2 SC1 = HP-PSICD service (21, 1)

Name	Nominal Science Data Report
Function	Several packets of type (21,1) are used to download the compressed data of the 72 channels AND the raw data of one selected channel

Structure	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
SID	0x1															
P01	LOBT Coarse Time MSWord															
P02	LOBT Coarse Time LSWord															
P03	LOBT Fine Time															
P04	F01								F02							
P05	F03 = 0b0000				F04	0	0	F05		F06						
P06	F07	0	0	0	F08				F09							
P07	F10															
P08	F11															
P09	F12															
P10	F13															
P11	F14															
P12	F15															
P13	F16															
P14 *To* *Pl*	F17															
To																
Pm	F03 = 0b0000				F04	0	0	F05		F06						
P(m+1)	F07	0	0	0	F08				F09							
P(m+2)	F10															
P(m+3)	F11															
P(m+4)	F12															
P(m+5)	F13															
P(m+6)	F14															
P(m+7)	F15															
P(m+8)	F16															
P(m+9) *To* *Pn*	F17															
P(n+1)	F03 = 0b0011				0	0	0	0	0	F06						
P(n+2)	F18															
P(n+3)	F19								0	0	0	0	0	0	F05	
P(n+4)	F20															
To	F20															
P(n+3+F18)	F20															

F01	Fdiv parameter sent by the REU belonging to [96;160]
F02	Compression Slice size belonging to [47;127]
F03	Science Identifier over 4 bits (Refer to Table 5.4.1-1)

F04	First sample parity: 0 = >Even; 1 => Odd
F05	Nsample with: 0 = 90 samples per modulation period 1 = 80 samples per modulation period 2 = 72 samples per modulation period 3 = 90 samples per modulation period.
F06	Channel number (0 to 71) over 7 bits
F07	Under-sampling mode = always equal to 0.
F08	Under Sampling Divisor: 0 = the channel is not downloaded 1 = the channel is compressed, downloaded and not under sampled 2 to 15 samples of the channel are averaged, compressed and downloaded.
F09	Number of science sample for the selected channel in the packet.
F10	Average of the current channel's samples (LSB)
F11	Average of the current channel's samples (MSB)
F12	Quantification step
F13	Offset 1 (LSB)
F14	Offset 1 (MSB)
F15	REU Science Sequence Counter (SSC)
F16	Offset 2 (MSB)
F17	Block of compressed data where one sample is coded on: 0: compress(sample) is –1 1: compress(sample) is 0 2: compress(sample) is +1 3: compress(sample) is outside [-1,+1] (0/1)111: compress(sample) is +2/-2 (0/1)011: compress(sample) is +3/-3 (0/1)100: compress(sample) is +4/-4 (0/1)101: compress(sample) is +5/-5 (0/1)000: compress(sample) is outside [-5,+5] & is coded over 4 bits (0/1)001: compress(sample) is outside [-5,+5] & is coded over 10 bits (0/1)010: compress(sample) is outside [-5,+5] & is coded over 16 bits (0/1)110: compress(sample) is under/over 16 bits, or this compression slice already contains 64 samples coded over bits, and is not coded.
F18	Number of raw samples (for the specified channel) within the packet belonging to [1;90]
F19	Raw sample modulation period index belonging to [0;F02] (To know when it is acquired during the compression slice).
F20	Raw data sample

Comment 1	A white line with the "To" indicator separates several blocks of F03=0x0000 type. Parameter index (l,m and n) relationship is variable (due mainly to the compression slice size and the compression algorithm efficiency).

Comment 2	The room taken by one compressed data channel is not constant and depends of compression algorithm efficiency.
Comment 3	Only the last packet of the compression slice contains the raw data of the selected channel.

10.3.4.3 SC2-1 = HP-PSICD service (21, 2) and SID = 1

Name	Raw data (Type B1) Science Data Report
Function	Used to download raw data of several channels

Structure	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
SID	0x1															
P01	LOBT Coarse Time MSWord															
P02	LOBT Coarse Time LSWord															
P03	LOBT Fine Time															
P04	F01								F02							
P05	F03 = 0b0101				0	0	0	0	0	F06						
P06	F18															
P07	F19								0	0	0	0	0	0	F05	
P08	F20															
To	F20															
P(07+F18)	F20															
To																
PI	F03 = 0b0101				0	0	0	0	0	F06						
P(I+1)	F18															
P(I+2)	F19								0	0	0	0	0	0	F05	
P(I+3)	F20															
To	F20															
P(I+2+F18)	F20															

F01	Fdiv parameter sent by the REU belonging to [96;160]
F02	Compression slice size belonging to [47;127]
F03	Science Identifier over 4 bits (Refer to Table 5.4.1-1)
F05	Nsample with: 0 = 90 samples per modulation period 1 = 80 samples per modulation period 2 = 72 samples per modulation period 3 = 90 samples per modulation period.
F06	Channel number (0 to 71) over 7 bits
F18	Number of raw samples (for the specified channel) within the packet belonging to [1;90]
F19	Raw sample modulation period index belonging to [0;F02] (To know when it is acquired during the compression slice).
F20	Raw data sample

Comment 1	A white line with the “To” indicator separates several blocks of F03=0x0101 type. Parameter index (I) is variable (due mainly to the CS size).
Comment 2	The raw signal downloaded in SC2-1 has the same format that one downloaded in SC1 but the selection of the raw signal channel is done by the REU (according to the RSw04-RawMode).
Comment 3	In any case, the DPU will try to download each raw signal sent by the REU if:

	• the CS size is lower or equal to 72 • the instantaneous data rate allocated to HFI is adjusted to the need.
Comment 4	The HFI nominal data rate does not allow transferring all the SC2-1 packets.

10.3.4.4 SC2-2 = HP-PSICD service (21, 2) and SID = 2

Name	VI or Optimisation (Type B2) Science Data Report															
Function	Used to download sensor (I, V, T, raw signal) of a V(I) or an Optimisation.															
Structure	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
SID	0x2															
P01	LOBT Coarse Time MSWord															
P02	LOBT Coarse Time LSWord															
P03	LOBT Fine Time															
P04	F01								F02							
P05	F03 = 0b0000				F04	0	0	F05		F06						
P06	F07	0	0	0	F08				F09							
P07	F10															
P08	F11															
P09	F12															
P10	F13															
P11	F14															
P12	F15															
P13	F16															
P14 *To* *Pl*	F17															
To																
Pm	F03 = 0b0000				F04	0	0	F05		F06						
P(m+1)	F07	0	0	0	F08				F09							
P(m+2)	F10															
P(m+3)	F11															
P(m+4)	F12															
P(m+5)	F13															
P(m+6)	F14															
P(m+7)	F15															
P(m+8)	F16															
P(m+9) *To* *Pn*	F17															
P(n+1)	F03 (0b0110 or 0b1001)				0	0	0	0	0	F06						
P(n+2)	F18															
P(n+3)	F21								0	0	0	0	0	0	F05	
P(n+4)	F22															
P(n+5)	F23															
P(n+6)	F24															
P(n+7)	F25															
P(n+8)	F26															
P(n+9)	F27															

P(n+10)	F20													
To	F20													
P(n+9+F18)	F20													
To														
Po	F03 (0b0110 or 0b1001)	0	0	0	0	0	F06							
P(o+1)	F18													
P(o+2)	F21						0	0	0	0	0	0	F05	
P(o+3)	F22													
P(o+4)	F23													
P(o+5)	F24													
P(o+6)	F25													
P(o+7)	F26													
P(o+8)	F27													
P(o+9)	F20													
To	F20													
P(o+8+F18)	F20													

F01 to F18	See field definition of service (21,1)
F21	= V(I) step or 1 in case of Optimisation
F22	Optimisation and V(I) status
F23	V tune iteration counter
F24	T tune iteration counter
F25	I value
F26	V value
F27	T value
F20	Raw Data sample

Comment 1	A white line with the “To” indicator separates several blocks of F03=0x0000 type. Parameter index (l,m and n) relationship is variable (due mainly to the CS size and the compression algorithm efficiency).
Comment 2	A white line with the “To” indicator separates several blocks of F03=0x0110 or 0x1001 type. Parameter index (o) is variable (due mainly to the number of optimisation points).
Comment 3	F03 field of VIO data (Parameters P(n+1) to P(o+8+F18)) takes the value 0x110 for Optimisation or 0x1001 for V (I).
Comment 4	As for SC1, only the last packets of the compression slice contain the VIO data (Parameters P(n+1) to P(o+8+F18).
Comment 5	The DPU is able to transfer 20 blocks of VIO data at a maximum.
Comment 6	The HFI (nominal and averaged) data rate does not allow transferring all the SC2-2 packets with 20 blocks of VIO data.
Comment 7	In any case, the DPU will try to download the SC2-2 packets if the instantaneous data rate allocated to HFI is adjusted to the need.

10.3.4.5 SC3 = HP-PSICD service (21, 3)

Name	Compression validation (Diagnostic) Science Data Report															
Function	*Used to download a set of summed data and the same set of compressed data.*															
Structure	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
SID	0x1															
P01	LOBT Coarse Time MSWord															
P02	LOBT Coarse Time LSWord															
P03	LOBT Fine Time															
P04	F01								F02							
P05	F03 = 0b1111				0	0	0	F05		F06						
P06	F07	0	0	0	F08				F09							
P07 *to* *Pl*	F28															
to																
Pm	F03 = 0b1111				0	0	0	F05		F06						
P(m+1)	F07	0	0	0	F08				F09							
P(m+2) *To* *Pn*	F28															
P(n+1)	F03 = 0b0000				F04	0	0	F05		F06						
P(n+2)	F07	0	0	0	F08				F09							
P(n+3)	F10															
P(n+4)	F11															
P(n+5)	F12															
P(n+6)	F13															
P(n+7)	F14															
P(n+8)	F15															
P(n+9)	F16															
P(n+10) *To* *Po*	F17															
To																
Pp	F03 = 0b0000				F04	0	0	F05		F06						
P(p+1)	F07	0	0	0	F08				F09							
P(p+2)	F10															
P(p+3)	F11															
P(p+4)	F12															
P(p+5)	F13															
P(p+6)	F14															
P(p+7)	F15															

P(p+8)	F16
P(p+9)	F17
To	
Pq	

F01 to F17	See field definition of service (21,1)
F28	Block of compressed data where one sample is coded on 22 bits

Comment 1	A white line with the “To” indicator separates several blocks of F03=0x1111 type. Parameter index (l, m and n) relationship is variable (due mainly to the CS size).
Comment 2	A white line with the “To” indicator separates several blocks of F03=0x0000 type. Parameter index (n, o, p and q) relationship is variable (due mainly to the CS size and the compression algorithm efficiency).
Comment 3	The HFI nominal data rate does not allow transferring all the SC3 packets.
Comment 4	In any case, the DPU will try to download the SC3 packets if the instantaneous data rate allocated to HFI is adjusted to the need.

10.3.4.6 SC4 = HP-PSICD service (21, 4)

Name	Without compression (Auxilliary) Science Data Report															
Function	Several packets of type (21,4) are used to download the summed data of the 72 channels AND the raw data of one selected channel.															
Structure	2^{15}	2^{14}	2^{13}	2^{12}	2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}
SID	0x1															
P01	LOBT Coarse Time MSWord															
P02	LOBT Coarse Time LSWord															
P03	LOBT Fine Time															
P04	F01								F02							
P05	F03 = 0b1110				0	0	0	F05		F06						
P06	F07	0	0	0	F08				F09							
P07	F28															
to																
Pl																
to																
Pm	F03 = 0b1110				0	0	0	F05		F06						
P(m+1)	F07	0	0	0	F08				F09							
P(m+2)	F28															
To																
Pn																
P(n+1)	F03 = 0b0011				0	0	0	0	0	F06						
P(n+2)	F18															
P(n+3)	F19								0	0	0	0	0	0	F05	
P(n+4)	F20															
To	F20															
P(n+3+F18)	F20															

F01 to F20	See field definition of service (21,1)
F28	Block of compressed data where one sample is coded on 22 bits

Comment 1	A white line with the “To” indicator separates several blocks of F03=0x1111 type. Parameter index (I, m and n) relationship is variable (due mainly to the CS size).
Comment 2	As for SC1, only the last packets of the compression slice contain the Raw signal data (Parameters P(n+1) to P(n+3+F18)).
Comment 3	The HFI nominal data rate does not allow transferring all the SC4 packets.
Comment 4	In any case, the DPU will try to download the SC4 packets if the instantaneous data rate allocated to HFI is adjusted to the need.

10.4 TC ACCEPTANCE REPORT SUCCESS – TMP(1,1)

In response to a telecommand packet, the reception of this telemetry packet indicates that the telecommand has been ACCEPTED by HFI.

10.5 TC ACCEPTANCE REPORT FAILURE – TMP(1,2)

In response to a telecommand packet, the reception of this telemetry packet indicates that the telecommand has NOT been ACCEPTED.

The structure of this packet and the failure code is :

Id	Ctrl	Length	Type	Sub type	LOBT	LOBT	LOBT	TCP Id	TCP Ctrl	Failure Code	Check sum
0x0d80	16bit	0x0011	0x0001	0x0200	16bit	16bit	16bit	0x1d80	16bit	16bit	16bit

TMP(1,2) Failure	BSW and ASW Failure Code
ILLEGAL_APID	0x8000
INVALID_LENGTH	0x8001
INCORRECT_CHECKSUM	0x8002
ILLEGAL_TYPE	0x8003
ILLEGAL_SUBTYPE	*0x8004*

10.6 TC EXECUTION REPORT COMPLETED – TMP(1,7)

In response to a telecommand packet, the reception of this telemetry packet indicates that the telecommand has been EXCECUTED.

10.7 TC EXECUTION REPORT FAILURE – TMP(1,8)

In response to a telecommand packet, the reception of this telemetry packet indicates that the telecommand has NOT been EXCECUTED.

10.7.1 TMP(1,8) structure in case of DEPUTED TCP(8,4)

The structure of this packet is :

Id	Ctrl	Length	Type	Subtype	LOBT	LOBT	LOBT	TCP Id	TCP Ctrl
0x0d80	16bit	0x0019	0x0001	0x0800	16bit	16bit	16bit	0x1d80	16bit

Failure Code	REU Failure Code	4KCDE Failure Code	DPU Failure Code	DCE Failure Code	Check sum
16bit	0x0000	0x0000	0x0000	0x0000	16bit

10.7.1.1 Deputed DPU TCP(8,4) TMP(1,8) failure code

The Failure Code field is :

Deputed DPU TCP(8,4) – TMP(1,8) Failure	**Failure Meaning**	**Failure Code**	***Level (Task)***
TC_BAD_PUS_SERVICE	Bad HP-PSICD service	0x8010	*DPU (Monitoring)*
TC_BAD_FID_AID	Unknown DPU TCP	0x8020	*DPU (Monitoring)*
TC_BAD_FDIR_MODE	DPU Bad FDIR Mode value	0x8021	*DPU (Monitoring)*
UNFINISHED_PATCH	FDIR Mode not updated in EEPROM	0x802A	*DPU (Monitoring)*
TC_BAD_CS_SIZE	*DPU Bad CS size value*	*0x8022*	*DPU (Monitoring)*

10.7.1.2 Deputed REU, DCE or 4KCDE TCP(8,4) TMP(1,8) failure code

The Failure Code field is :

REU, DCE or 4KCDE Deputed TCP(8,4) Failure Meaning	**Failure Code**	***Level (Task)***
Bad HP-PSICD service	0x8010	*DPU (Monitoring)*
ME/DPU Sub-system Buffer Full (after10 tries)	0x8011	*DPU (Monitoring)*
TCP forbidden in the current mode	0x802B	*DPU (Monitoring)*
HSL or LSL bad TMP acknowledge	0x8006	*DPU (AcquisitionS)*
HSL or LSL TMP Sequence Counter Break	0x8007	*DPU (AcquisitionS)*
HSL or LSL no response	0x8008	*DPU (UnitInt)*
Packet Length Inconsistency	0x800A	*DPU (PUS)*
Packet Checksum Error	0x800B	*DPU (PUS)*
Bad Data Packet Type	0x800C	*DPU (PUS)*
Bad Memory ID	0x8012	*DPU (PUS)*
Bad Patch Length	0x8014	*DPU (PUS)*
Bad Patch Checksum	0x8015	*DPU (PUS)*
Bad Dump Length	0x8016	*DPU (PUS)*
Bad Checksum Length	0x8017	*DPU (PUS)*
TC Bad FID	0x8018	*DPU (Monitoring)*
TC Bad AID	0x8019	*DPU (Monitoring)*
TM (1,8) Unified Report Error	0x801A	*DPU (Monitoring)*
Mode Transition not referenced	0x801B	*DPU (Monitoring)*
Mode Transition not allowed	0x801C	*DPU (Monitoring)*
Bad SID Nb Private TC	0x801D	*DPU (Monitoring)*
Previous Mode Transition not processed	0x801F	*DPU (Monitoring)*
TC Bad FID AID	0x8020	*DPU (Monitoring)*
TC Bad FDIR Mode	0x8021	*DPU (Monitoring)*
TC Bad CS Size	0x8022	*DPU (Monitoring)*
TC Bad CP Ctrl SID	0x8023	*DPU (Monitoring)*

TC Bad Number of Service	0x8024	*DPU (PUS)*
TC Bad Service Type	0x8025	*DPU (PUS)*
TC Bad Subservice Type	0x8026	*DPU (PUS)*
TC Bad Packet ID Type	0x8027	*DPU (PUS)*
System Modes No Synchronized	0x8029	*DPU (PUS)*
Bad Write EEPROM	0x8030	*DPU (PUS)*
Bad Update Check	0x8032	*DPU (PUS)*
Bad Start Of Header Code	0x0001	*4KCDE*
Packet Length Inconsistency	0x0002	*4KCDE*
Sequence Counting Break	0x0003	*4KCDE*
Checksum or Parity Error	0x0004	*4KCDE*
Bad Command Packet Type FID	0x0005	*4KCDE*
Data download failed	0x0006	*4KCDE*
Command Buffer Full	0x2006 *	*REU*
Bad start of header code (bad STX)	0x2000 *	*REU*
Packet length inconsistency (bad NW)	0x2001 *	*REU*
Checksum Error	0x2003 *	*REU*
Bad end of transmission (bad EOT)	0x2007 *	*REU*
Bad Command Packet type (unknown ID)	0x2004 *	*REU*
Error Bad Parameter (parameters out of range)	0x2021 *	*REU*
Error Command not allowed (depending mode)	0x2022 *	*REU*
Error during command execution (command execution failed)	0x2023 *	*REU*
Command not executed (configuration backup in progress or MUX FIFO not empty)	0x2024 *	*REU*
Bad start Of header Code	0x4000	*DCE*
Packet Length Inconsistency	0x4001	*DCE*
Checksum Error	0x4003	*DCE*
Bad command packet type	0x4004	*DCE*
Bad parameter Structure	0x4005	*DCE*
Parameter out of range	0x4007	*DCE*
Parity error	*0x4008*	*DCE*

* the REU error word has the following format 001xxxxxxyyyyyy with yyyyyy gives the protocol error and xxxxxxx gives the internal REU errors. The error code given in this column assumes that xxxxxxx = 0000000.

10.7.2 TMP(1,8) structure in case of UNIFIED TCP(8,4)

The structure of this packet is :

Id	Ctrl	Length	Type	Subtype	LOBT	LOBT	LOBT	TCP Id	TCP Ctrl
0x0d80	16bit	0x0019	0x0001	0x0800	16bit	16bit	16bit	0x1d80	16bit

Failure Code	REU Failure Code	4KCDE Failure Code	DPU Failure Code	DCE Failure Code	Checksum
0x801A	16bit	16bit	16bit	16bit	16bit

The REU, 4KCDE, DPU and DCE Failure Code fields are filled with the corresponding Failure codes given in the previous REU, DCE or 4KCDE Deputed TCP(8,4) Failure table. But other Failure code dedicated to Unified TCP(8,4) can be used in the DPU Failure Code Field:

Unified TCP(8,4) – TMP(1,8) Failure	Failure Meaning	*DPU Failure Code*
PREVIOUS_MODE_TRANSITION_NOT_PROCESSED	Previous Unified TCP(8,4) in execution.	*0x801F*
TC_MODE_TRANSITION_NOT_REF	Mode Transition not referenced	*0x801B*
TC_MODE_TRANSITION_NOT_ALLOWED	Mode Transition not allowed	*0x801C*
TC_BAD_SID_NB_PRIVATE_TC	Bad Deputed TCP Number inside the unified one	*0x801D*
TC_BAD_FID	Bad Deputed TCP(8,4) FID inside the unified one	*0x8018*
SYST_MODES_NO_SYNCHRO	*DPU Mode do not reach target mode (*)*	*0x8029*

(*) only used with Unified TCP(8,4) without deputed TCP(8,4) inside.

10.7.3 TMP(1,8) structure in case of TCP(6,x)

The structure of this packet is :

Id	Ctrl	Length	Type	Subtype	LOBT	LOBT	LOBT	TCP Id	TCP Ctrl
0x0d80	16bit	0x0019	0x0001	0x0800	16bit	16bit	16bit	0x1d80	16bit

Failure Code	REU Failure Code	4KCDE Failure Code	DPU Failure Code	DCE Failure Code	Checksum
16bit	0x0000	0x0000	0x0000	0x0000	16bit

The Failure Code field is :

TCP(6,x) – TMP(1,8) Failure	Failure Meaning	*Failure Code*
TC_BAD_PUS_SERVICE	Bad HP-PSICD service	*0x8010*
TC_BUFFER_FULL	Sub-system Buffer Full	*0x8011*
DP_BAD_COM_PACKET_TYPE	Sub-system error: bad Command	*0x8006*
CMD_MSC_BREAK	Sub-system error: TCP Sequence Counter Break	*0x8007*
CMD_TIMEOUT	Sub-system no response	*0x8008*
TC_BAD_MEM_ID	Bad Memory Identifier	*0x8012*
UNFINISHED_PATCH	*TCP(6,2) not terminated*	*0x802A*

10.7.4 TMP(1,8) structure in case of TCP(14,x)

The structure of this packet is :

Id	Ctrl	Length	Type	Subtype	LOBT	LOBT	LOBT	TCP Id	TCP Ctrl
0x0d80	16bit	0x0019	0x0001	0x0800	16bit	16bit	16bit	0x1d80	16bit

Failure Code	REU Failure Code	4KCDE Failure Code	DPU Failure Code	DCE Failure Code	Check sum
16bit	0x0000	0x0000	0x0000	0x0000	16bit

The Failure Code field is :

TCP(14,x) – TMP(1,8) Failure	Failure Meaning	*Failure Code*
TC_BAD_PUS_SERVICE	Bad HP-PSICD service	*0x8010*
TC_BUFFER_FULL	Sub-system Buffer Full	*0x8011*
TC_BAD_N	Bad N	*0x8024*
TC_BAD_TYPE	Bad Packet Type	*0x8025*
TC_BAD_SUBTYPE	Bad Packet Sub-type	*0x8026*
TC_BAD_PCKT_ID	*Bad Packet SID*	*0x8027*

10.8 Event Reporting (TMP(5,x))

2 HFI event packets are associated to one failure detection. If a failure appears, one event packet “failure on” is generated, but the failure may also disappear, then the event packet “failure off” is generated.
The events list is :

Event Name	Event Subtype	Event Id	Event Meaning
EVENT_ HSL_ERROR_ON	1	2	At least one HSL error has been detected.
EVENT_ HSL_ERROR_OFF	1	3	No HSL error has been detected on a defined period.
EVENT_ LSL_ERROR_ON	1	4	At least one LSL error has been detected.

EVENT_ LSL_ERROR_OFF	1	5	No LSL error has been detected on a defined period.
EVENT_ SW_ERROR_ON	1	6	At least one SW error has been detected.
EVENT_ SW_ERROR_OFF	1	7	No SW error has been detected during a defined period.
EVENT_ SPARE_ERROR_ON	2	8	None.
EVENT_ SPARE_ERROR_OFF	2	9	None.
EVENT_ REU_FPGA_ERROR_ON	2	10	The REU FPGA synchronisation error is detected.
EVENT_ REU_FPGA_ERROR _OFF	2	11	The REU FPGA synchronisation error disappeared.
EVENT_ NEED_REU_RESTART _ON	2	12	A loss of REU communication is detected.
EVENT_ NEED_REU_RESTART _OFF	2	13	The REU communication has re-started.
EVENT_ NEED_4KCDE_RESTART _ON	2	14	A loss of 4KCDE communication is detected AND the 4K stage temperature increased.
EVENT_ NEED_4KCDE_RESTART _OFF	2	15	The 4KCDE communication has re-started.
EVENT_ NEED_DCE_RESTART _ON	2	16	A loss of DCE communication is detected using AND the 0.1K stage temperature increased.
EVENT_ NEED_DCE_RESTART _OFF	2	17	The DCE communication has restarted.
EVENT_ HW_ERROR_ON	4	18	DPU PRAM parity error or/and DRAM parity error or/and FPGA state machine error or/and OBC loss have been detected.
EVENT_ HW_ERROR_OFF	4	19	No DPU PRAM parity error and DRAM parity error and FPGA state machine error and OBC loss have been detected during a defined period.

10.8.1 TMP(5,1) and TMP(5,4) EVENTS

Each couple of event packets of sub-type 1 or 4 is associated to an error status word (coded on 16 bits) which is downloaded into HSK1, HSK3 and DIAG2.
As soon as an error is detected, the associated bit of the status word is set to 1.
As soon as it is time to generate the HSK1 (each 2,3 seconds), HSK3 or the DIAG2 (each minute), the DPU ASW:

- downloads the error status words into HSK1, HSK3 or DIAG2
- signals to its internal event manager the number of bit set to 1 (failure on) or the error status word staying at 0 (failure off)

- set to 0 all the error status words.

At initialisation, the ASW is ready to produce the event packets “failure on”. If one event packet is produced and sent, the ASW will be only able to produce and send the event packet “failure off”. Obviously, it is the same if the event packet “failure off” has been produced and sent, the ASW will be only able to produce and send again the “failure on”.

The 4 event packets of sub-type 1 or 4 are detailed in the following table:

Event Name	Failure Name	Bit N°	S2K name
HSL_ERROR ON/OFF	HSL Parity Error	0	HM748240
	HSL Bad Start Header	1	HM749240
	HSL: BufferSize (Length read bigger than max buffer size)	2	HM750240
	HSL: Bad Data Packet Length	3	HM751240
	HSL Bad Data Packet Trailer	4	HM752240
	HSL Time Out (No HSL packet received before expected time)	5	HM753240
	HSL Bad CRC	6	HM754240
	HSL Bad Data Packet (Type of Data Packet unknown)	7	HM755240
	HSL Bad DDL (No answer for DataDownLoad request)	8	HM756240
	Invalid Start Compression (Pulse does not arrived at the right number of packet)	9	HM757240
	HSL Bad Format	10	HM758240
	REU Command error (not executed)	11	HM759240
	Start Compression Lost (pulse never arrived)	12	HM760240
	Modulation frequency lost	13	HM761240
	Science Sequence Counter break	14	HM762240
	HSL Glued Data Packet (more than one packet is present when reading FIFO)	15	HM763240

Event Name	Failure Name	Bit N°	S2K name
LSL_ERROR ON/OFF	LSL Parity Error	0	HM764240
	LSL Bad Start Header	1	HM765240
	LSL Buffer Size Error	2	HM766240
	LSL Bad Data Packet Length	3	HM767240
	DCE Time Out (No DCE packet received before expected time)	4	HM768240
	4KCDE Time Out (No 4K packet received before expected time)	5	HM769240
	LSL Checksum Error	6	HM770240
	DCE type of Data Packet unknown	7	HM771240
	LSL: 4KCDE Bad Data Packet (ID)	8	HM772240
	4KCDE type of Data Packet unknown	9	HM773240
	DCE no answer for DataDownLoad request	10	HM774240
	4K no answer for DataDownLoad request	11	HM775240
	4KCDE Command Error (not executed)	12	HM776240
	DCE Command error (not executed)	13	HM777240
	LSL Glued Data Packet (more than one packet is present when reading FIFO)	15	HM779240

Event Name	Failure Name	Bit N°	S2K name
HW_ERROR ON/OFF	HSL State Machine0 Error	0	HM732240
	HSL State Machine1 Error	1	HM733240
	LSL State Machine0 Error	2	HM734240
	LSL State Machine1 Error	3	HM735240
	OBC Lost (No clock coming from S/C)	4	HM736240
	PRAM Parity Error	9	HM741240
	DRAM Parity Error	10	HM742240
	TFL Error; No slot available to send TM packet on 1553	15	HM747240

Event Name	Failure Name	Bit N°	S2K name
SW_ERROR ON/OFF	Bad parameter read in EEPROM; Default parameter value taken	0	HM795240
	Error when reading Resync table in EEPROM	1	HM794240
	Bad science parameters read in EEPROM (compression,)	2	HM793240
	Bad OBSW parameters read in EEPROM	3	HM792240
	Bad Raw Filters read in EEPROM	4	HM791240
	Previous TC has not been acknowledged by REU	5	HM790240
	Previous TC has not been acknowledged by DCE	6	HM789240
	Previous TC has not been acknowledged by 4KCDE	7	HM788240
	TC sent to 4KCDE/REU for resynchronisation (only FDIR mode = HFI auto)	8	HM787240
	Not enough TC to resynchronise subystem (only FDIR mode = HFI auto)	9	HM786240
	DPU has automatically resynchrnoised itself (only FDIRmode = DPU auto)	10	HM785240
	Not resynchronisation command found (FDIR mode = HFI auto or DPU auto)	11	HM784240
	Compression not finished before next science page arrives	12	HM783240
	Real Time overflow	13	HM782240
	Scienc Buffer packet full (Science data lost)	14	HM781240
	HSK or Event Buffer packet full (HSK data lost)	15	HM780240

Table : Association between Error Status Name and Event Packet of sub-type 1 or 4

10.8.2 TMP(5,2) EVENTS

Each couple of event packets of sub-type 2 is associated to a FDIR procedure managed by the S/C (see the HFI FDIR description in this document). The event packet “failure off” means that the detected failure has disappeared after the restart.

The TMP(5,2) production is managed by the same mechanisms presented for TMP(5,1) and TMP(5,4)

The 4 event packets “ON”of sub-type 2 are:

Event Name	Detection Condition
EVENT_ REU_FPGA_ERROR_ON	REU Analog belt syncronisation failure
EVENT_ NEED_REU_RESTART _ON	Loss of REU communication for more than 300s
EVENT_ NEED_4KCDE_RESTART _ON	Loss of 4KCDE communication for more than 300s
EVENT_ NEED_DCE_RESTART _ON	Loss of DCE communication for more than 300s

Table : Event packet of sub-type 2 description

10.9 TIME VERIFICATION REPORT – TMP(9,9)

This telemetry packet is received in response to a TC time verification (TCP(9,6). It contains the HFI time coded on 48bit.

Parameter Type	PTC	PFC	Length	Coarse Time	Fine Time	Format
Time	9	17	6 octets	4	2	CUC

The fields «Coarse Time» and «Fine Time» contain the Spacecraft Elapsed Time, consistent with the CCSDS Unsegmented Time Code (CUC) format, as defined in [AD1] without P-field. This field is **synchronised to TAI** after setting of the on-board time.

A packet end user that can not provide in telemetry a time synchronised with CRT shall flag this by setting the MSB of the Time Field to «1». **In this case the meaning of the rest of the field is user specific.**

10.10 ENABLED TELEMETRY PACKETS REPORT – TMP(14,4)

This telemetry packet is received in response to a TC(14,3) requesting the list of enabled Telemetry Packets

N	Type	Sub-Type	Packet-ID
Unsigned Integer (16 bits)	Enumerated (8 bits)	Unsigned Integer (8 bits)	Enumerated (16 bits)
	<---------- Repeated N times ---------->		

N :
The number of TM Packet definitions that follow.
Type :
The Telemetry Packet Service Type.
Sub-Type :
The Telemetry Packet Service Sub-Type for the specified Service Type.
Packet-ID :
The Packet –Identifier allows to identify specific groups of TM-packets within a certain Type/Subtype.
_ -If the structure of a certain TM-packet is fixed for all applications, the Packet Identifier field is set to Zero.
_ If all TM Packets belonging to a certain Type/Subtype shall be enabled /disabled, the Packet-ID is set to Zero.
_ For the HK & Diagnostic Service 3 the Packet-ID shall be equal to the HK Packet ID defined for that Service.
_ For the Event Reporting Service 5 the Packet-ID shall be equal to the Event ID defined for that Service.
_ For the Scientific Data Service 21 the Packet-ID shall be equal to the Structure ID defined for that Service.

10.11 LINK CONNECTION REPORT – TMP(17,2)

This telemetry packet is received in response to a TC(17,1) requesting the connection test with the DPU.

10.12 TELEMETRY MONITORING LIMITS

For each analog HFI telemetry having limit monitoring, the following information is given :

- SCOS HM/HD reference
- Description
- HARD limit Mini (red limit)
- SOFT limit Mini (yellow limit)
- SOFT limit Maxi (yellow limit)
- HARD limit Maxi (red limit)
- Unit
- Validity condition of the limits
- Action for HARD LIMIT MINI
- Action for HARD LIMIT MAXI

The rules to be applied by opperators when the limits are exeeded are the following:

- All WARNING limits :

When a WARNING limit is exceeded (minimum and maximum), the HFI nominated representative must be informed as soon as possible (an HFI representative will be contactable 24h/24h). NO action must be taken.

- Temperatures ALARM maximum :

When an ALARM maximum temperature limit is exceeded for more than 1mn, AND if the information given by the telemetry is obviously not incorrect (999K is obviously incorrect), the operator must execute the associated action given in the limit monitoring table and the HFI nominated representative must be informed as soon as possible.

- Temperatures ALARM minimum :

All actions associated to an ALARM minimum temperature are TBD satellite thermal engineering as HFI cannot do anything to warm our equipments.

- Voltage, Intensity & Pressure ALARM minimum / maximum :

When a Voltage, Intensity or Pressure ALARM minimum / maximum limit is exceeded, AND if the information given by the telemetry is obviously not incorrect (999V is obviously incorrect), the operator must execute the associated action given in the limit monitoring table and the HFI nominated representative must be informed as soon as possible.

4K :

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	LIMITS Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
~~HD028260~~	~~4K JT Temperature (K)~~	~~NO~~	~~NO~~	~~4,8~~	~~NO~~	~~K~~	~~T cernox 1.6K (HD493280 nom or HD499280 red) < 2K~~	-	-
~~HD029260~~	~~4K I/F 18K Temperature (K) (sec axis)~~	~~NO~~	~~NO~~	~~19~~	~~NO~~	~~K~~	~~T cernox 1.6K (HD493280 nom or HD499280 red) < 2K~~	-	-
HM018260	4K Gas Pressure HP (bar)	2,0	2,5	11,0	11,5	Bar		Reduce the COOLER stroke by 10%	Reduce the COOLER stroke by 10%
HM019260	4K Gas Pressure LP (bar)	0.6	0,8	6,5	7.0	Bar			
HM033260	Compressor LP Head Temp (°C)	-30	-20	60	65	°C		TBD ALCATEL thermal engeniering	Reduce the COOLER stroke by 10%
HM034260	Compressor HP Head Temp (°C)	-30	-20	60	65	°C			
HM035260	Compressor LP PPO Temp (°C)	-30	-20	60	65	°C			
HM036260	Compressor HP PPO Temp (°C)	-30	-20	60	65	°C			
HM020260	4K Getter Temperature 1 (°C)	NO	NO	60°C for air 330°C for vac	80°C for air 340°C for vac	°C			SWITCH OFF the 2 getters
HM021260	4K Getter Temperature 2 (°C)	NO	NO	60°C for air 330°C for vac	80°C for air 340°C for vac	°C			
HM037260	Power Module Temp T4 (°C)	-30	-20	55	65	°C		TBD SAT thermal engeniering	Reduce the COOLER stroke by 10%
HM041260	Power Module Temp T6 (°C)	-30	-20	50	60	°C			
HM038260	Drive Module A Temp T5 (°C)	-30	-20	50	60	°C			
HM042260	Drive Module B Temp T7 (°C)	-30	-20	50	60	°C			
HM043260	4KCDE Case Temp T8 (°C)	-30	-20	50	60	°C			4K SW RESET
HM044260	Ancillary Panel Temp T9 (°C)	-30	-20	40	50	°C			Reduce the COOLER stroke by 10%
HM045260	Ancillary Panel Temp T10 (°C)	-30	-20	40	50	°C			
HM049260	Buffer Volume Temp T12 (°C)	-30	-20	40	50	°C			
HM086260	Modulus of Imbalance F0 (N)	NO	NO	0,04 / 0,15	NO	N	4K NOMINAL mode : 0.04 when T4K (HM028260) <=6K 0.15 when T4K (HM028260) >6K		
HM087260	Modulus of Imbalance F1 (N)	NO	NO	0,04 / 0,15	NO	N			
HM088260	Modulus of Imbalance F2 (N)	NO	NO	0,04 / 0,15	NO	N			
HM089260	Modulus of Imbalance F3 (N)	NO	NO	0,04 / 0,15	NO	N			
HM090260	Modulus of Imbalance F4 (N)	NO	NO	0,04 / 0,15	NO	N			
HM091260	Modulus of Imbalance F5 (N)	NO	NO	0,04 / 0,15	NO	N			
HM092260	Modulus of Imbalance F6 (N)	NO	NO	0,04 / 0,15	NO	N			
HM093260	Modulus of Imbalance F7 (N)	NO	NO	0,04 / 0,15	NO	N			

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	LIMITS Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HM079260	Average processor bus current (A)	NO	0,4	0,8	0,9	A			4K SW RESET
HM064260	Drive bus current (A)	NO	NO	6,4	6,8	A			Reduce the COOLER stroke by 10%
HM078260	Average drive bus power (W)	NO	NO	100	104	W			Reduce the COOLER stroke by 10%
HM027260	4K Processor -15V	-17,0	-15,5	-14,5	-13,0	V		4K SW RESET	4K SW RESET
HM059260	4K DRIVE - 15V	-17,0	-16,0	-14,5	-13,0	V		Reduce the COOLER stroke by 10%	Reduce the COOLER stroke by 10%
HM062260	4K PPO - 15V	-17,0	-16,0	-14,5	-13,0	V			
HM030260	4K Processor +2.5V	2,0	2,4	2,6	3,5	V		4K SW RESET	4K SW RESET
HM025260	4K Processor +5V	4,0	4,8	5,2	6,0	V			
HM057260	4K DRIVE +5V	4,0	4,8	5,2	6,0	V		Reduce the COOLER stroke by 10%	Reduce the COOLER stroke by 10%
HM060260	4K PPO +10V	8,0	9,8	10,2	12,0	V			
HM026260	4K PROC +15V	13,0	14,5	15,5	17,0	V		4K SW RESET	4K SW RESET
HM058260	4K DRIVE +15V	13,0	14,0	15,5	17,0	V		Reduce the COOLER stroke by 10%	Reduce the COOLER stroke by 10%
HM061260	4K PPO +15V	13,0	14,5	15,5	17,0	V			
HM063260	4K Drive bus 28V	27,0	28,0	28,8	30,0	V			

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	LIMITS Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HM050260	4K Reference Voltage	NO	2,45	2,55	NO	V			
HM039260	Mux 1 Ref Voltage	NO	2,45	2,55	NO	V			
HM047260	Mux 2 Ref Voltage	NO	2,45	2,55	NO	V			
HM055260	Mux 3 Ref Voltage	NO	2,45	2,55	NO	V			
HM023260	Mux 4 Ref Voltage	NO	2,45	2,55	NO	V			
HM031260	Mux 5 Ref Voltage	NO	2,45	2,55	NO	V			
HM040260	Mux 1 Zero Voltage	NO	-0,05	0,05	NO	V			
HM048260	Mux 2 Zero Voltage	NO	-0,05	0,05	NO	V			
HM056260	Mux 3 Zero Voltage	NO	-0,05	0,05	NO	V			
HM024260	Mux 4 Zero Voltage	NO	-0,05	0,05	NO	V			
HM032260	Mux 5 Zero Voltage	NO	-0,05	0,05	NO	V			
HM071260	Vib Sensor ADC Ref Voltage (sec axis)	NO	2,4	2,6	NO	V			
HM073260	Compressor A ADC Ref Voltage	NO	2,4	2,6	NO	V			
HM072260	Compressor B ADC Ref Voltage	NO	2,4	2,6	NO	V			
HM074260	Vib Sensor ADC Zero Voltage (sec axis)	NO	-0,05	0,05	NO	V			
HM076260	Compressor A ADC Zero Voltage	NO	-0,05	0,05	NO	V			
HM075260	Compressor B ADC Zero Voltage	NO	-0,05	0,05	NO	V			
HM005260	F0 4K raw	NO	22150	28700	NO	raw			
HM007260	F180 4K raw	NO	123	159	NO	raw			

DCCU:

SCOS name	QLA HSK name	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HM017270	Pres. 4He Inlet HP PT101 (Bar)	NO	NO	300	320	Bar			TBD SAT thermal engeniering
HM018270	Pres. 3He Inlet HP PT201 (Bar)	NO	NO	300	320	Bar			
HM019270	Pres. 4He Outlet Regul PT102 (Bar)	NO	17,7	18,2	NO	Bar	Flight and CSL		
HM020270	Pres. 3He Outlet Regul PT202 (Bar)	NO	17,6	18,2	NO	Bar			
HD001270	Temperature tank 3He T201 (°C)	-20	-10	40	50	°C		TBD SAT thermal engeniering	TBD SAT thermal engeniering
HD002270	Temperature tank1 4He T101 (°C)	-20	-10	40	50	°C			
HD003270	Temperature tank2 4He T102 (°C)	-20	-10	40	50	°C			
HD004270	Temperature tank3 4He T103 (°C)	-20	-10	40	50	°C			
HD005270	Temperature 4He inlet (°C)	-30	-20	40	50	°C		TBD SAT thermal engeniering	TBD SAT thermal engeniering
HD006270	Temperature 3He inlet (°C)	-30	-20	40	50	°C			
HM025270	DCE +31V (V)	30,5	31,0	32,5	33,0	V		SWITCH OFF the DCE	SWITCH OFF the DCE
HM026270	DCE +5V (V)	4,5	5,0	5,5	6,0	V			
HM027270	DCE +15V (V)	14,5	15,0	16,5	17,0	V			
HM028270	DCE -15V (V)	-17,0	-16,5	-15,0	-15,5	V			
HM029270	DCE Temperature 1 (°C)	-30	-20	50	60	°C		TBD SAT thermal engeniering	SWITCH OFF the DCE
HM030270	DCE Temperature 2 (°C)	-30	-20	50	60	°C			

~~CRYO CERNOX:~~

~~SCOS name~~	~~QLA HSK name~~	~~HARD limit Mini~~	~~SOFT limit Mini~~	~~SOFT limit Maxi~~	~~HARD limit Maxi~~	~~Unit~~	~~Validity~~	~~Action for HARD LIMIT MINI~~	~~Action for HARD LIMIT MAXI~~
~~HD494280~~	~~Cernox Temp HFI 0.1K Nom (K)~~	~~NO~~	~~NO~~	~~4,9~~	~~NO~~	~~K~~	~~T cernox 1.6K (HD493280 nom) < 2K~~	-	-
~~HD496280~~	~~Cernox Temp HFI 4-1.6K Nom (K)~~	~~NO~~	~~NO~~	~~20~~	~~NO~~	~~K~~	~~T cernox 1.6K (HD493280 nom) < 2K~~	-	-
~~HD500280~~	~~Cernox Temp HFI 0.1K Red (K)~~	~~NO~~	~~NO~~	~~4,9~~	~~NO~~	~~K~~	~~T cernox 1.6K (HD499280 red) < 2K~~	-	-
~~HD502280~~	~~Cernox Temp HFI 4-1.6K Red (K)~~	~~NO~~	~~NO~~	~~20~~	~~NO~~	~~K~~	~~T cernox 1.6K (HD499280 red) < 2K~~	-	-

JFET :

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HD504280	JFET Temperature Belt 0 (K)	40	45	300	310	K			
HD505280	JFET Temperature Belt 1 (K)	40	45	300	310	K			
HD506280	JFET Temperature Belt 2 (K)	40	45	300	310	K			
HD507280	JFET Temperature Belt 3 (K)	40	45	300	310	K			
HD508280	JFET Temperature Belt 4 (K)	40	45	300	310	K			
HD509280	JFET Temperature Belt 5 (K)	40	45	300	310	K			
HD510280	JFET Temperature Belt 6 (K)	40	45	300	310	K			
HD511280	JFET Temperature Belt 7 (K)	40	45	300	310	K			
HD512280	JFET Temperature Belt 6 (K)	40	45	300	310	K			
HD513280	JFET Temperature Belt 9 (K)	40	45	300	310	K			
HD514280	JFET Temperature Belt A (K)	40	45	300	310	K			
HD515280	JFET Temperature Belt B (K)	40	45	300	310	K			

TBD SAT thermal engeniering

Power OFF the JFET heaters and TBD SAT thermal engeniering

PAU :

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HM527280	PAU Temp Belt 0 (C)	-20	-10	40	50	°C			
HM528280	PAU Temp Belt 1 (C)	-20	-10	40	50	°C			
HM529280	PAU Temp Belt 2 (C)	-20	-10	40	50	°C			
HM530280	PAU Temp Belt 3 (C)	-20	-10	40	50	°C			
HM531280	PAU Temp Belt 4 (C)	-20	-10	40	50	°C			
HM532280	PAU Temp Belt 5 (C)	-20	-10	40	50	°C		TBD SAT thermal engeniering	TBD SAT thermal engeniering
HM533280	PAU Temp Belt 6 (C)	-20	-10	40	50	°C			
HM534280	PAU Temp Belt 7 (C)	-20	-10	40	50	°C			
HM535280	PAU Temp Belt 8 (C)	-20	-10	40	50	°C			
HM536280	PAU Temp Belt 9 (C)	-20	-10	40	50	°C			
HM537280	PAU Temp Belt A (C)	-20	-10	40	50	°C			
HM538280	PAU Temp Belt B (C)	-20	-10	40	50	°C			

REU :

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HM539280	REU Temp Belt 0 (C)	-20	-10	50	60	°C			
HM540280	REU Temp Belt 1 (C)	-20	-10	50	60	°C			
HM541280	REU Temp Belt 2 (C)	-20	-10	50	60	°C			
HM542280	REU Temp Belt 3 (C)	-20	-10	50	60	°C			
HM543280	REU Temp Belt 4 (C)	-20	-10	50	60	°C			
HM544280	REU Temp Belt 5 (C)	-20	-10	50	60	°C		TBD SAT thermal engeniering	SWITCH OFF the REU corresponding analog belt
HM545280	REU Temp Belt 6 (C)	-20	-10	50	60	°C			
HM546280	REU Temp Belt 7 (C)	-20	-10	50	60	°C			
HM547280	REU Temp Belt 8 (C)	-20	-10	50	60	°C			
HM548280	REU Temp Belt 9 (C)	-20	-10	50	60	°C			
HM549280	REU Temp Belt A (C)	-20	-10	50	60	°C			
HM550280	REU Temp Belt B (C)	-20	-10	50	60	°C			
HM552280	REU Voltage Belt 0 (V)	0,5	1,0	2,0	3,0	V			
HM553280	REU Voltage Belt 1 (V)	0,5	1,0	2,0	3,0	V			
HM554280	REU Voltage Belt 2 (V)	0,5	1,0	2,0	3,0	V			
HM555280	REU Voltage Belt 3 (V)	0,5	1,0	2,0	3,0	V			
HM556280	REU Voltage Belt 4 (V)	0,5	1,0	2,0	3,0	V			
HM557280	REU Voltage Belt 5 (V)	0,5	1,0	2,0	3,0	V		SWITCH OFF the REU	SWITCH OFF the REU corresponding analog belt
HM558280	REU Voltage Belt 6 (V)	0,5	1,0	2,0	3,0	V			
HM559280	REU Voltage Belt 7 (V)	0,5	1,0	2,0	3,0	V			
HM560280	REU Voltage Belt 8 (V)	0,5	1,0	2,0	3,0	V			
HM561280	REU Voltage Belt 9 (V)	0,5	1,0	2,0	3,0	V			
HM562280	REU Voltage Belt A (V)	0,5	1,0	2,0	3,0	V			
HM563280	REU Voltage Belt B (V)	0,5	1,0	2,0	3,0	V			
HM551280	REU Temp PROC (C)	-20	-10	50	60	°C		TBD SAT thermal engeniering	SWITCH OFF the REU processor belt
HM564280	REU Voltage PROC (V)	1	2	3	4	V		TBD SAT thermal engeniering	SWITCH OFF the REU processor belt

DPU :

SCOS name	Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
HM003250	DPU POWER cold PCB Temperature (°C)	-20	-10	43	47	°C		TBD SAT thermal engeniering	SWITCH OFF the DPU
HM004250	DPU DCDC Temperature (°C)	-20	-10	45	49	°C			
HM005250	DPU POWER warm PCB Temperature (°C)	-20	-10	46	50	°C			
HM010250	DPU DIGITAL cold PCB Temperature (°C)	-20	-10	43	48	°C			
HM011250	DPU Processor Temperature (°C)	-20	-10	51	58	°C			
HM012250	DPU DIGITAL warm PCB Temperature (°C)	-20	-10	44	48	°C			
HM013250	DPU + 5V	NO	4,4	5,2	5,5	V		SWITCH OFF the DPU	SWITCH OFF the DPU
HM014250	DPU - 15V	-15,1	-14,5	-13,0	NO	V			
HM015250	DPU +15V	NO	13,2	15,6	17,0	V			
HM016250	DPU +2.5V	NO	2,3	2,7	2,8	V			
HM006250	DPU Intensity of +5V (mA)	NO	NO	1550	2000	mA			SWITCH OFF the DPU
HM007250	DPU Intensity of -15V (mA)	NO	NO	270	350	mA			
HM008250	DPU Intensity of +15V (mA)	NO	NO	65	85	mA			
HM009250	DPU Intensity of +2.5V (mA)	NO	NO	110	145	mA			

SATELLITE HFI LCL's MONITORING PARAMETERS

Description	HARD limit Mini	SOFT limit Mini	SOFT limit Maxi	HARD limit Maxi	Unit	Validity	Action for HARD LIMIT MINI	Action for HARD LIMIT MAXI
LCL 29 : DPU Nom	NO	NO	0,30	0,35	A	Boot (BSW)		LCL OFF
	NO	NO	0,45	0,50	A	<> Boot		LCL OFF
LCL 30 : DPU Red	NO	NO	0,30	0,35	A	Boot (BSW)		LCL OFF
	NO	NO	0,45	0,50	A	<> Boot		LCL OFF
LCL 11 : REU-Proc Nom	NO	NO	0,30	0,35	A	Boot (BSW)		LCL OFF
	NO	NO	0,35	0,40	A	<> Boot		LCL OFF
LCL 12 : REU-Proc Red	NO	NO	0,30	0,35	A	Boot (BSW)		LCL OFF
	NO	NO	0,35	0,40	A	<> Boot		LCL OFF
LCL 39 : REU-Analog (+PAU+JFET+FPU) Belt 0 & 1	NO	NO	0,55	0,60	A	all modes		LCL OFF
LCL 40 : REU-Analog (+PAU+JFET+FPU) Belt 2 & 3	NO	NO	0,55	0,60	A	all modes		LCL OFF
LCL 41 : REU-Analog (+PAU+JFET+FPU) Belt 4 & 5	NO	NO	0,55	0,60	A	all modes		LCL OFF
LCL 42 : REU-Analog (+PAU+JFET+FPU) Belt 6 & 7	NO	NO	0,55	0,60	A	all modes		LCL OFF
LCL 43 : REU-Analog (+PAU+JFET+FPU) Belt 8 & 9	NO	NO	0,55	0,60	A	all modes		LCL OFF
LCL 44 : REU-Analog (+PAU+JFET+FPU) Belt A & B	NO	NO	0,55	0,60	A	all modes		LCL OFF
LCL 36 : DCCU	NO	NO	0,45	0,50	A	all modes		LCL OFF
LCL 37 : 4KCDE nom	NO	NO	0,90	0,95	A	all modes		4K SW RESET
LCL 38 : 4KCDE red	NO	NO	0,90	0,95	A	all modes		4K SW RESET
LCL 59 : 4K DRIVE BUS nom 1	NO	NO	3,2	3,4	A	all modes		Reduce the COOLER stroke by 10%
LCL 60 : 4K DRIVE BUS nom 2	NO	NO	3,2	3,4	A	all modes		Reduce the COOLER stroke by 10%
LCL 61 : 4K DRIVE BUS red 1	NO	NO	3,2	3,4	A	all modes		Reduce the COOLER stroke by 10%
LCL 62 : 4K DRIVE BUS red 2	NO	NO	3,2	3,4	A	all modes		Reduce the COOLER stroke by 10%

Note : These limits are not part of the HFI MIBS as the LCL's currents are not part of the HFI HSK telemetry.

11 HFI CONTROL : TELECOMMANDS

11.1 HFI Commanding Concept

The TCP management is done with:

- TCP verification associated to HP-PSICD service 1,
- Unified TCP management associated to HP-PSICD service 8 sub-service 4,
- Deputed TCP management also associated to HP-PSICD service 8 sub-service 4.

The "**unified"** TCP are used to synchronise activities of the HFI 4 electronics sub-systems. Most of them are used to trigger a transition between 2 DPU OBSW Modes. They are composed of 1 to 3 deputed TCP. The unified TCP S2K name always begins by **TCOBSW-** with a TCP(8,4) **FID = 0x00** or **0x01**.

The "**deputed"** TCP are REU, DCE or 4KCDE commands which are transferred by the DPU ASW without triggering internal actions (contrarily to the unified one).
Most of HFI TCPs are deputed TCP which have a S2K name starting by and a FID equal to:

- **TCREU**- with a TCP(8,4) **FID = 0x40**
- **TCDCE**- with a TCP(8,4) **FID = 0x60**
- **TC4K**- with a TCP(8,4) **FID = 0x80**
- **TCDPU**- with a TCP(8,4) **FID = 0xA0**.

Please note that the Read-Out Unit includes in fact 2 different redundant digital belts. Each one being powered, by a spacecraft LCL, through one of the two redundant DPUs. So when in this document we mention a command to be sent to "the REU", or a data to be received from it, it means from the active digital belt. It is also worth to note that, as only a couple of DPU-REU is active at a time, whatever this couple is, the same commands and data names are kept unchanged.

11.2 TCP Verification

When a TCP is sent to the DPU, the OBSW checks its header and trailer. If no error is detected, a TMP(1,1) is sent to ground and the TCP application data is extracted. If an error is detected, the TCP is rejected and a TMP(1,2) is sent.
When a TCP has been accepted, it is decoded and executed by the OBSW according to the HP-PSICD service and the sub-service. If it is executed without error, a TMP(1,7) is produced and sent. If not, a TMP(1,8) including an execution error code is formatted, and is sent to ground.

The latter (execution report) is HP-PSICD service dependent. The 2 following sections summarizes what are the execution report mechanisms for deputed and unified commands.

11.2.1 Deputed TCP (8,4) Verification

When the TCP (8,4) has been accepted, the OBSW decodes the first 8 bit word of the application data structure in order to identify which sub-system is addressed (DPU, REU, DCE or 4KCDE).
If the DPU is addressed, the TCP is executed by OBSW and a TMP (1,7) or a TMP (1,8) is produced and sent to ground.
If the REU, DCE or 4KCDE is addressed, the TCP application data structure is HSL or LSL encapsulated and sent to the corresponding sub-system.
If the sub-system acknowledges the TCP, the DPU OBSW formats and sends a TMP (1,7). If not, the DPU ASW formats and sends a TMP (1,8) with the sub-system error code.
The following diagram gives an overview of this mechanism:

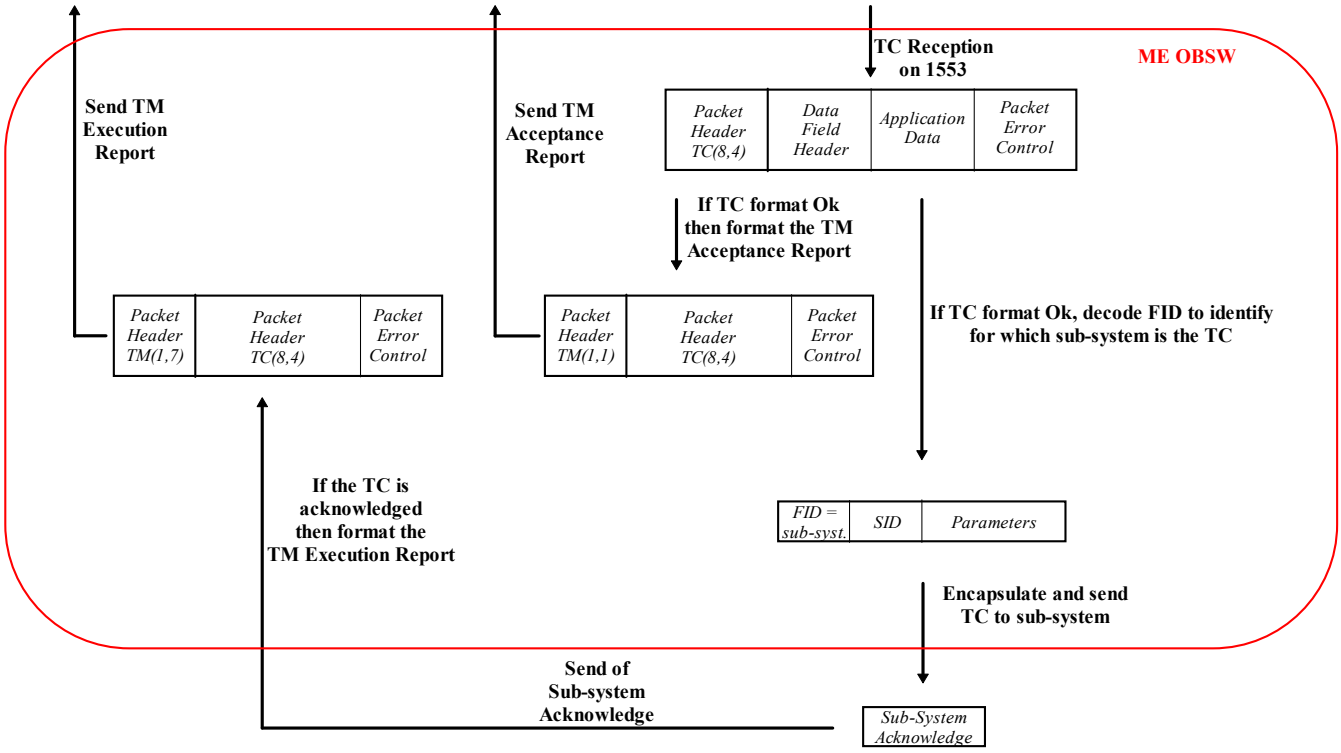


Diagram 11.2.1-1: Deputed TCP(8,4) with good execution

It is however important to note that the TMP(1,7) (Execution Success Report) has not the same meaning for the different sub-systems:

- for REU, it means that the TCP(8,4) has been well executed (except for TCREU-Hwtest-4024 which can have an execution time longer than 250 ms),
- for DCE, it means that the TCP(8,4) has been well received and accepted,
- for 4KCDE, it means that the TCP(8,4) has been well received and accepted.

For the 4KCDE, it is possible to know if the command has been well executed by looking at the “4K command return value HSK (HM151260)”.

The TMP (1,x) structures and failure codes are summarized in §10.7.

11.2.2 Unified TCP(8,4) Verification

When a unified TCP(8,4) has been accepted, the OBSW decodes the first 16 bit word of the application data structure in order to identify which is the unified TCP. Then it starts the following activities:

- extract the deputed TCP application structure,
- encapsulate these deputed TCPs,
- send to associated sub-system the deputed TCPs
- execute internal associated actions (mode change, packet production,) as soon as the subsystems have reached the requested modes.

If all sub-systems acknowledge their deputed TCP, the DPU OBSW formats and sends a TMP(1,7). If at least one sub-system do not acknowledge its deputed TCP, the DPU ASW formats and sends a TMP(1,8) with the corresponding sub-system error code.
The following diagram gives an overview of this mechanism:

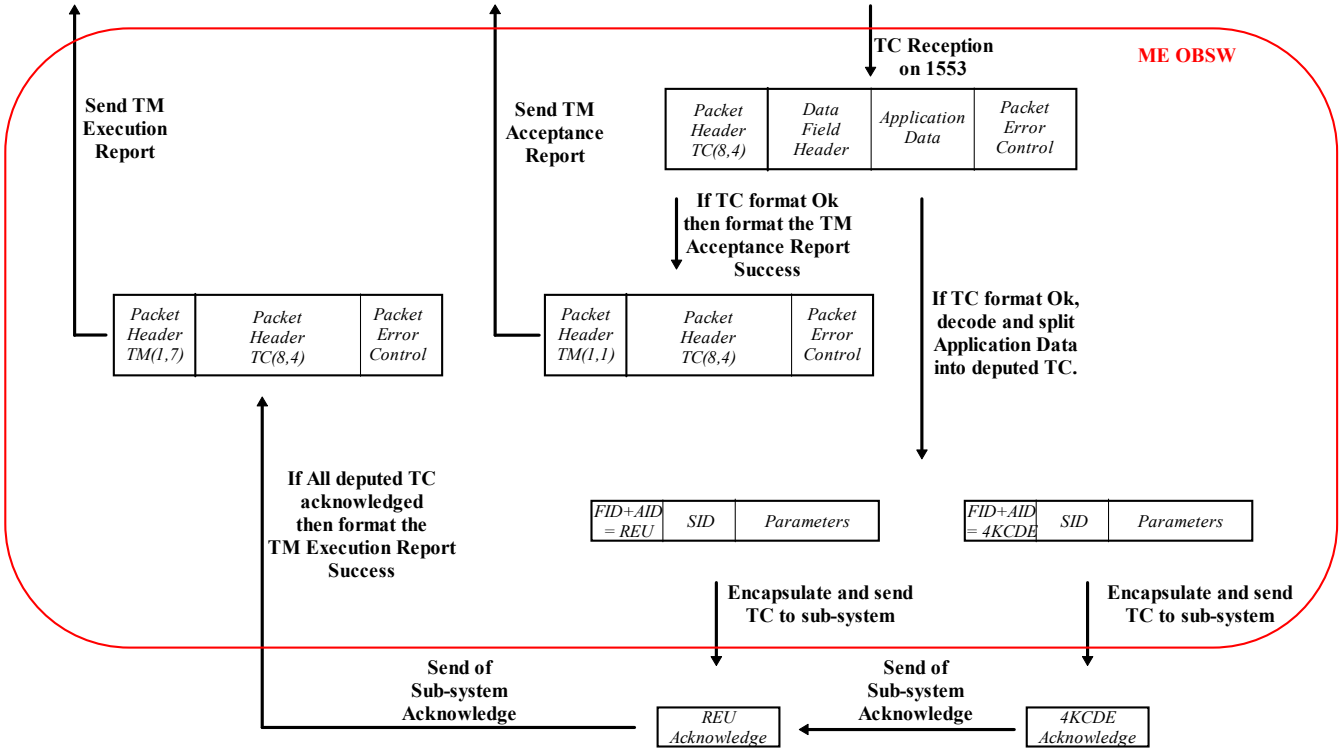


Diagram 11.2.2-1: Unified TCP(8,4) with good execution

It is also important to note that the TMP(1,7) (Execution Success Report) has not the same meaning for the different sub-system:

- for REU, it means that the TCP(8,4) has been well executed (except for TCP .),
- for DCE, it means that the TCP(8,4) has been well received and

accepted,
- for 4KCDE, it means that the TCP(8,4) has been well received and accepted.

For the 4KCDE, it is possible to know if the command has been well executed by looking at the “4K command return value HSK (HM151260)”.

The TMP(1,x) formats are summarized are summarized in §10.7.

11.3 Mode Synchronisation

One or several Deputed TCP is/are integrated inside a Unified TCP for mode changing. When the DPU ASW executes an Unified TCP for mode changing, it performs the following actions:

- it checks if the mode transition is allowed according to the Diagram 2.1-1,
- if it is, it executes the Unified TCP by dispatching the integrated Deputed TCP towards the corresponding sub-system (REU, DCE or/and 4KCDE),
- it waits for their TCP acknowledgement,
- if all the TCP are acknowledged, it produces the TMP(1,7) or the TMP(1,8) according to the Annex B.
- it waits for the update of the REU or/and 4KCDE mode parameters,
- finally, it changes its mode only if the REU or/and 4KCDE modes have reached one of the synchronisation defined cell (green box) in table 2.1-2.

But one mode de-synchronisation (red box) in table 2.1-2 may also be reached because the DPU, the REU or the 4KCDE has changed its mode “by itself”. It may happen when an unit:

- has a failure,
- executes a deputed command,
- restarts after a watchdog reset,
- restarts after switch off-on (when the others stay on).

The Automatic Mode Resynchronisation mechanism allows the DPU ASW to recover autonomously from a de-synchronisation according to the section 8.2.
As it allows recovering only the most likely de-synchronisations, there is 2 other manual ways to do that:
- The first one is to send the TCOBSW-StartupRet-0010 which forces HFI to return in STARTUP (i.e. REU and 4KCDE in BOOT mode).
- The second one is to check that the mode transition is allowed according to diagram 2.1-1 and reach directly the requested mode without waiting for REU or/and 4KCDE mode update. This is possible by setting the ***OSw-FDIRmode*** at the “De-synchronisation” value.

11.4 UNIFIED COMMAND

The table below gives an overview of the HFI unified commands:

S2K Name	DPU Mode
TCOBSW-StartupRet-0010	ALL except BOOT
TCOBSW-REUdummy-0024	STANDBY
TCOBSW-REUdummyStp-0124	DUMMY_REU
TCOBSW-Standby-0011	STARTUP
TCOBSW-StandbyRet-0111	CONFIGURATION
TCOBSW-Config-0012	STANDBY OPTIMIZATION VI_MEASUREMENT RAWSIGNAL_MODE WITHOUT_COMPR COMP_VALID OBSERVATION
TCOBSW-Observ-0013	CONFIGURATION
TCOBSW-Optim-0014	CONFIGURATION
TCOBSW-VI-0015	CONFIGURATION
TCOBSW-RawSignal-0023	CONFIGURATION
TCOBSW-CompValid-0016	CONFIGURATION
TCOBSW-WoutComp-0017	CONFIGURATION
TCOBSW-Hot4KCMaint-0018	CONFIGURATION
TCOBSW-Hot4KCMntStp-0118	HOT_4K_MAINTCE
TCOBSW-4KCMaint-0019	STANDBY
TCOBSW-4KCMaintStp-0119	4K_MAINTENANC
TCOBSW-36CompCtrl-2001-1	STANDBY CONFIGURATION OBSERVATION
TCOBSW-36CompCtrl-2001-2	
TCOBSW-CompCtrl-2001-ij	
TCOBSW-CSsize-2002	
TCOBSW-EnGlitchAlgo-2003	
TCOBSW-EndOfSlew-2005	CONFIGURATION OBSERVATION

Table 11.4-1: Unified TCP(8,4) List

The TCP can be used only in the indicated HFI Mode.
The following mnemonic are used in the S2K TCP name:

Ret = Return
Stp = Stop
Maint = Mnt = Maintenance
Ctrl = Control
Cf = Configuration
Comp = Compression
Sc = Science.

11.4.1 TCOBSW-StartupRet-0010 (HC003289)

TC Names	TCOBSW-StartupRet-0010	HC003289
Function	Put the DPU into STARTUP mode, the REU and the 4K into BOOT mode from any DPU mode and from any 4K, REU mode	
Prerequisite	DPU mode must not be BOOT	
MODE modification	DPU : YES; Transition to STARTUP REU : YES; Transition to BOOT 4K : YES; Transition to BOOT	
HFI telemetry packet modification	Stop all HFI current telemetry production Start the production of Diag2	
Parameters	NO	
Success criteria check	➢ TM(1,1) ➢ DPU mode (HM363240) = STARTUP ➢ REU mode (HM565280) = BOOT ➢ 4K mode (HM003260) = BOOT ➢ Diag2 packet production as expected	
Comment	o The data of the two first Diag2 packets must not be considered. o A maximum of 1 HSLERROR and 2 LSLERROR (ON then OFF) may be detected o It is normal to receive a TM(1,8)	

11.4.2 TCOBSW-REUdummy-0024 (HC027289)

TC Names	TCOBSW-REUdummy-0024	HC027289
Function	Put the DPU into DUMMY_REU mode and the REU into TEST_MODE mode from DPU and REU in STANDBY mode.	
Prerequisite	DPU and REU must be in STANDBY mode	
MODE modification	DPU : YES; Transition to DUMMY_REU REU : YES; Transition to TEST_MODE 4K : NO	
HFI telemetry packet modification	Enable the production of SC1, HSK4 to HSK9	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = DUMMY_REU ➢ REU mode (HM565280) = TEST ➢ HSK and science packet production as expected	
Comment	○ A maximum of 1 HSLERROR (ON then OFF), may be detected	

11.4.3 TCOBSW-REUdummyStp-0124 (HC028289)

TC Names	TCOBSW-REUdummyStp-0124	HC028289
Function	Put the DPU and the REU into STANDBY mode from DPU in DUMMY_REU and REU in TEST_MODE mode	
Prerequisite	DPU must be in DUMMY_REU mode REU must be in TEST_MODE mode	
MODE modification	DPU : YES; Transition to STANDBY REU : YES; Transition to STANDBY 4K : NO	
HFI telemetry packet modification	Disaable the production of SC1, HSK4 to HSK9	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = STANDBY ➢ REU mode (HM565280) = STANDBY	
Comment	○ A maximum of 1 HSLERROR (ON then OFF) may be detected	

11.4.4 TCOBSW-Standby-0011 (HC004289)

TC Names	TCOBSW-Standby-0011	HC004289
Function	Put the DPU from STARTUP to STANDBY mode; PUT the 4K and the REU from BOOT to STANDBY mode	
Prerequisite	DPU must be in STARTUP mode 4K and REU must be in BOOT mode	
MODE modification	DPU : YES; Transition to STANDBY REU : YES; Transition to STANDBY 4K : YES; Transition to STANDBY	
HFI telemetry packet modification	Disable the production of Diag2 Enable the production of HSK1 to HSK3	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = STANDBY ➢ REU mode (HM565280) = STANDBY ➢ 4K mode (HM003260) = STANDBY ➢ HSK packet production as expected	
Comment	o A maximum of 2HWERROR, 2 HSLERROR, 2 LSLERROR, 2 SWERROR (ON then OFF), may be detected	

11.4.5 TCOBSW-StandbyRet-0111 (HC005289)

TC Names	TCOBSW-StandbyRet-0111	HC005289
Function	Put the DPU and the REU into STANDBY from CONFIGURATION mode; Put the 4K into STANDBY from NOMINAL or FREEWHEEL mode	
Prerequisite	DPU and REU must be in CONFIGURATION mode 4K must be in NOMINAL, FREEWHEEL or STANDBY mode	
MODE modification	DPU : YES; Transition to STANDBY REU : YES; Transition to STANDBY 4K : YES; Transition to STANDBY	
HFI telemetry packet modification	Disable the production of SC1 and HSK4 to HSK9	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = STANDBY (after 2.5mn) ➢ REU mode (HM565280) = STANDBY ➢ 4K mode (HM003260) = STANDBY (after 2.5mn) ➢ HSK and science packet production as expected	
Comment	o A maximum of 2 LSLERROR (ON then OFF) may be detected o Many HSLERROR and SWERROR (ON then OFF) may possibly be detected during the 4K ramp down phase (2.5mn max) o A TM(1,8) may be received. This is “normal”.	

11.4.6 TCOBSW-Config-0012 (HC006289)

TC Names	TCOBSW-Config-0012	HC006289
Function	o Put the DPU into CONFIGURATION mode from STANDBY, OBSERVATION, VI_MEASUREMENT, OPTIMIZATION, RAWSIGNAL_MODE, WITHOUT_COMPR or COMP_VALID mode o Put the REU into CONFIGURATION mode from STANDBY, OBSERVATION, V_I_MEASURE or OPTIMIZATION mode	
Prerequisite	DPU must be in STANDBY, OBSERVATION, VI_MEASUREMENT, OPTIMIZATION, RAWSIGNAL_MODE, WITHOUT_COMPR or COMP_VALID mode REU must be in STANDBY, OBSERVATION, V_I_MEASURE or OPTIMIZATION mode	
MODE modification	DPU : YES; Transition to CONFIGURATION REU : YES; Transition to CONFIGURATION 4K : NO	
HFI telemetry packet modification	Enable the production of HSK4 to HSK9 Disable (if any) production of SC2-1, SC2-2, SC3 and SC4	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = CONFIGURATION ➢ REU mode (HM565280) = CONFIGURATION ➢ HSK and science packet production as expected	
Comment	o A maximum of 1 HSLERROR and 1 SWERROR (ON then OFF), may be detected	

11.4.7 TCOBSW-Observ-0013 (HC007289)

TC Names	TCOBSW-Observ-0013	HC007289
Function	Put the DPU and the REU in OBSERVATION from CONFIGURATION mode	
Prerequisite	DPU and REU must be in CONFIGURATION	
MODE modification	DPU : YES; Transition to OBSERVATION REU : YES; Transition to OBSERVATION 4K : NO	
HFI telemetry packet modification	Enable the production of SC1	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = OBSERVATION ➢ REU mode (HM565280) = OBSERVATION ➢ HSK and science packet production as expected	
Comment	o A maximum of 1 HSLERROR and 1 SWERROR (ON then OFF) may be detected o It is recalled that OBSERVATION mode is a "protected" mode in which no HFI modification of the configuration is allowed	

11.4.8 TCOBSW-Optim-0014 (HC008289)

TC Names	TCOBSW-Optim-0014	HC008289
Function	Perform the OPTIMIZATION of the selected channels In optimisation mode the REU finds for each selected channel the Voltage value (V) and the transient value (T) for a current value (I) that provide the smallest output signal and the minimum output Transient (V and T are optimised successively).	
Prerequisite	DPU and REU must be in CONFIGURATION	
MODE modification	DPU : YES; Transition to OPTIMIZATION and then to CONFIGURATION when the optimisation process is finish REU : YES; Transition to OPTIMIZATION and then to CONFIGURATION when the optimisation process is finish 4K : NO	
HFI telemetry packet modification	Enable the production of SC2-2 Disable production of SC1 Disable the production of SC2-1 when return in CONFIGURATION mode	
Parameters	**RCf-VIOKeepGamp : HP880280** • =0 ➔ Use Gamp value define by TCREU-OptConf-4070-ij parameter HP788280 • =1 ➔ use the current Gamp value of the channel **RCf-VIOKeepT : HP881280 :** • =0 ➔ Use Transient value define by TCREU-OptConf-4070-ij parameter HP780280 • =1 ➔ use the current Transient value of the channel **RCf-VIOCvCtMeas : HP882280 :** • =0 ➔ Compute Cv and Ct if Cv or Ct=0 only • =1 ➔ Compute Cv before V tune • =2 ➔ Compute Ct before T tune • =3 ➔ Compute Cv and Ct **RCf-VIOOptTuneT : HP883280 :** • =0 ➔ Do not compute T nor V • =1 ➔ Compute V but not T • =2 ➔ Compute T but not V • =3 ➔ Compute V and T **RCf-VIOChanSelMd : HP884280 :** • = 0 ➔ apply optimisation for the channel pointed by RCf-BeltNum & RCf-ChanNum. • = 1 ➔apply optimisation for the channels set in the “optimisation list command” TCREU-VIOSelect-4072 **RCf-BeltNum : HP903280 :** • = 0 to 11 ➔ Belt number **RCf-ChanNum : HP904280 :** • =0 to 5 ➔ Channel number	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = OPTIMIZATION and then CONFIGURATION ➢ REU mode (HM565280) = OPTIMIZATION and then CONFIGURATION ➢ HSK and science packet production as expected ➢ Quality of the optimisation for each optimised channel to be stated by HFI	
Comment	o A maximum of 2 HSLERROR and 2 SWERROR (ON then OFF) may be detected o Return to Configuration mode is automatic at the end of the Optimisation process.	

11.4.9 TCOBSW-VI-0015 (HC009289)

TC Names	TCOBSW-VI-0015	HC009289
Function	Perform the VI measurement of the selected channels While current "I" is incremented step by step in a selected range, REU V(I) mode is dedicated, for each selected detection chain, to the determination of the voltage value (V) providing the minimum detection chain output signal modulation	
Prerequisite	DPU and REU must be in CONFIGURATION	
MODE modification	DPU : YES; Transition to VI_MEASUREMENT and then to CONFIGURATION when the optimisation process is finish REU : YES; Transition to VI_MEASUREMENT and then to CONFIGURATION when the optimisation process is finish 4K : NO	
HFI telemetry packet modification	Enable the production of SC2-2 Disable production of SC1 Disable the production of SC2-1 when return in CONFIGURATION mode	
Parameters	**- RCf-VIOKeepGamp (HP880280)** • =0 ➔ Use Gamp value define by TCREU-OptConf-4070-ij parameter HP788280 • =1 ➔ use the current Gamp value of the channel **- RCf-VIOKeepT (HP881280)** • =0 ➔ Use Transient value define by TCREU-OptConf-4070-ij parameter HP780280 • =1 ➔ use the current Transient value of the channel **- RCf-VIOCvCtMeas (HP882280)** • =0 ➔ Compute Cv and Ct if needed • =1 ➔ Compute Cv before V tune • =2 ➔ Compute Ct before T tune • =3 ➔ Compute Cv and Ct **- RCf-VIOOptTuneT (HP883280)** • =0 ➔ Do not compute T nor V • =1 ➔ Compute V but not T • =2 ➔ Compute T but not V • =3 ➔ Compute V and T **- RCf-VIOChanSelMd (HP884280)** • = 0 ➔ apply optimisation for the channel pointed by RCf-BeltNum & RCf-ChanNum. • = 1 ➔apply optimisation for the channels set in the "optimisation list command" TCREU-VIOSelect-4072 **- RCf-BeltNum (HP903280)** • = 0 to 11 ➔ Belt number **- RCf-ChanNum (HP904280)** • =0 to 5 ➔ Channel number	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = VI_MEASUREMENT and then CONFIGURATION ➢ REU mode (HM565280) = VI_MEASUREMENT and then CONFIGURATION ➢ HSK and science packet production as expected ➢ Quality of the VI_MEASUREMENT for each channel to be stated by HFI	
Comment	o A maximum of 2 HSLERROR and 1 SWERROR (ON then OFF) may be detected o Return to Configuration mode is automatic at the end of the VI process.	

11.4.10 TCOBSW-RawSignal-0023 (HC012289)

TC Names	TCOBSW-RawSignal-0023	HC012289
Function	Put the DPU into RAWSIGNAL_MODE from CONFIGURATION mode This mode is used to download raw signal of one or several FPU channels (2x Number of Sample data per channel for each sampling period)	
Prerequisite	DPU and REU must be in CONFIGURATION	
MODE modification	DPU : YES; Transition to RAWSIGNAL_MODE REU : NO 4K : NO	
HFI telemetry packet modification	Enable the production of SC2-1 Disable the production of SC1	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = RAWSIGNAL_MODE ➢ HSK and science packet production as expected	
Comment	o A maximum of 1 HSLERROR and 1 SWERROR (ON then OFF) may possibly be detected o Due to the HFI datarate allocation, a limited number of channels can be downloaded in RAWSIGNAL_MODE For Nsample = 36 only 52 channels (TBC) For Nsample = 40 only 48 channels (TBC) For Nsample = 45 only 40 channels (TBC) If all the selected FPU channels cannot be transferred during the Compression Slice, the DPU ASW will restart with the data of the next Compression Slice of the first channel not transferred o In this mode, the Compression Cize Slice is equal to 72. It is automatically modified by executing this mode and takes its previous value on return in the configuration mode. o The Raw Signal Setup (TCREU-RsigSetup-4007) can be set to different values in order to download: • one FPU channel raw signal continuously, • one FPU channel raw signal continuously during a Compression Slice and switch to the next Channel during the next one, • one FPU channel raw signal during one Modulation Period and switch to the next Channel during the next one • the CERNOX raw signal. In this case the same raw signals of the two last selected bolometers are downloaded during all this phase.	

11.4.11 TCOBSW-CompValid-0016 (HC010289)

TC Names	TCOBSW-CompValid-0016	HC010289
Function	Put DPU in COMP_VALID from CONFIGURATION mode This mode is used to validate the HFI Data Compression Scheme of one or several FPU channels. Compressed and uncompressed data are download.	
Prerequisite	DPU and REU must be in CONFIGURATION	
MODE modification	DPU : YES; Transition to COMP_VALID REU : NO 4K : NO	
HFI telemetry packet modification	Enable the production of SC3 Disable the production of SC1	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = COMP_VALID ➢ HSK and science packet production as expected	
Comment	o A maximum of 1 HSLERROR and 1 SWERROR (ON then OFF) may possibly be detected o Due to the HFI datarate allocation, a limited number of channels can be downloaded in this mode. The downloaded channels must be selected before going into this mode using TCOBSW-36CompCtrl-2001-1, TCOBSW-36CompCtrl-2001-2 commands. Only 10 (TBC) channels (bolometers and or thermometers) can be downloaded at the same time	

11.4.12 TCOBSW-WoutComp-0017 (HC011289)

TC Names	TCOBSW-WoutComp-0017	HC011289
Function	Put DPU in COMP_VALID from CONFIGURATION mode This mode is used to validate the HFI Data Compression Scheme of one or several FPU channels. Compressed and uncompressed data are download	
Prerequisite	DPU and REU must be in CONFIGURATION	
MODE modification	DPU : YES; Transition to WITHOUT_COMPR REU : NO 4K : NO	
HFI telemetry packet modification	Enable the production of SC4 Disable the production of SC1	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = WITHOUT_COMPR ➢ HSK and science packet production as expected	
Comment	o A maximum of 1 HSLERROR and 1 SWERROR (ON then OFF) may possibly be detected o Due to the HFI datarate allocation, a limited number of channels can be downloaded in this mode. The downloaded channels must be selected before going into this mode using TCOBSW-36CompCtrl-2001-1, TCOBSW-36CompCtrl-2001-2 commands. Only 12 (TBC) channels (bolometers and or thermometers) can be downloaded at the same time	

11.4.13 TCOBSW-36CompCtrl-2001-1 (HC023289)

TC Names	TCOBSW-36CompCtrl-2001-1	HC023289
Function	Setup the compression parameters and the channels to be download of ALL channels of belts 0 to 5	
Prerequisite	DPU and REU must be in STANDBY, CONFIGURATION or OBSERVATION	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO (only datarate modification)	
Parameters	For i= 0 to 5 (belt) For j= 0 to 5 (channel) **- OCfij-CompMode: (HPaaa240; aaa=100 + j*5 + i*30) :** • =0 ➔ Must not be changed **- OCfij-CompCtrl : (HPaaa240; aaa=102 + (i-1)*5 + (j-1)*30)) :** **Under Sampling Divisor:** • =0 ➔ the channel is not downloaded • =1➔ the channel is compressed, downloaded and not under sampled • = [3, 5, 7, 9, 11, 13 or 15] ➔ OCfij- CompCtrl samples of the channel are averaged, compressed and downloaded. **- OCfij-Sig_qCtrl: (HPaaa240; aaa=103 + j*5 + i*30) : σ/q** • =[0 to 255] ➔ $(\sigma/Q)_{ENG} = 0.1 + (\sigma/Q)_{RAW}/10$ **- OCfij-SigmaCtrl: (HPaaa240; aaa=104 + j*5 + i*30) : σ** • =[0 to 65535] ➔ $(\sigma)_{ENG} = 0.1 + (\sigma)_{RAW}/10$ Next j Next i	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ F Compression control parameter for i=1 to 36 aaa= 001 + (i-1) bbb= 102 + (i-1)*5 HMaaa240 = HPbbb240 next i ➢ F Sigma/Q param for i=1 to 36 aaa= 660 + (i-1) bbb= 103 + (i-1)*5 HMaaa240 = HPbbb240 next i ➢ F Sigma param for i=1 to 36 aaa= 073 + (i-1) bbb= 104 + (i-1)*5 HMaaa240 = HPbbb240 next i	
Comment	The compression parameters shall change synchronously with the start of the next Compression Slice.	

11.4.14 TCOBSW-36CompCtrl-2001-2 (HC024289)

TC Names	TCOBSW-36CompCtrl-2001-2	HC024289
Function	Setup the compression parameters and the channels to be download of ALL channels of belts 6 to B	
Prerequisite	DPU and REU must be in STANDBY, CONFIGURATION or OBSERVATION	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO (only datarate modification)	
Parameters	For i= 6 to 11 (belt) For j= 0 to 5 (channel) **- OCfij-CompMode: (HPaaa240; aaa=100 + j*5 + i*30) :** • =0 ➔ Must not be changed **- OCfij-CompCtrl : (HPaaa240; aaa=102 + j*5 + i*30) :** **Under Sampling Divisor:** • =0 ➔ the channel is not downloaded • =1➔ the channel is compressed, downloaded and not under sampled • = [2 to15] ➔ OCfij- CompCtrl samples of the channel are averaged, compressed and downloaded **- OCfij-Sig_qCtrl: (HPaaa240; aaa=103 + j*5 + i*30) : σ/q** • =[0 to 255] ➔ $(\sigma/Q)_{ENG} = 0.1 + (\sigma/Q)_{RAW}/10$ **- OCfij-SigmaCtrl: (HPaaa240; aaa=104 + j*5 + i*30) : σ** • =[0 to65535] ➔ $(\sigma)_{ENG} = 0.1 + (\sigma)_{RAW}/10$ Next j Next i	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ F Compression control parameter for i=1 to 36 aaa= 037 + (i-1) bbb= 282 + (i-1)*5 HMaaa240 = HPbbb240 next i ➢ F Sigma/Q param for i=1 to 36 aaa= 696 + (i-1) bbb= 283 + (i-1)*5 HMaaa240 = HPbbb240 next i ➢ F Sigma param for i=1 to 36 aaa= 109 + (i-1) bbb= 284 + (i-1)*5 HMaaa240 = HPbbb240 next i	
Comment	The compression parameters shall change synchronously with the start of the next Compression Slice.	

11.4.15 TCOBSW-CompCtrl-2001-ij (HC030289-HC101289)

TC Names	TCOBSW-CompCtrl-2001-ij with : i = Belt Number belongs to [0;B], j = Channel Number belongs to [0;5]	HC030289-HC101289
Function	Setup the compression parameters of the channel j of the belt i	
Prerequisite	DPU and REU must be in STANDBY, CONFIGURATION or OBSERVATION	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO (only datarate modification)	
Parameters	i: belongs to [0;11] (belt number) j: belongs to [0;5] (channel number) **- OCfij-CompMode: (HPaaa240; aaa=100 + j*5 + i*30) :** • =0 ➔ Must not be changed **- OCfij-CompCtrl : (HPaaa240; aaa=102 + j*5 + i*30) :** **Under Sampling Divisor:** • =0 ➔ the channel is not downloaded • =1➔ the channel is compressed, downloaded and not under sampled • = [2 to15] ➔ OCfij- CompCtrl samples of the channel are averaged, compressed and downloaded **- OCfij-Sig_qCtrl: (HPaaa240; aaa=103 + j*5 + i*30) : σ/q** • =[0 to 255] ➔ $(\sigma/Q)_{ENG} = 0.1 + (\sigma/Q)_{RAW}/10$ **- OCfij-SigmaCtrl: (HPaaa240; aaa=104 + j*5 + i*30) : σ** • =[0 to65535] ➔ $(\sigma)_{ENG} = 0.1 + (\sigma)_{RAW}/10$	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ F Compression control parameter I_{ch}= (j+1) + 6* i aaa= 037 + (I_{ch} -1) bbb= 282 + (I_{ch} -1)*5 HMaaa240 = HPbbb240 ➢ F Sigma/Q param aaa= 696 + (I_{ch} -1) bbb= 283 + (I_{ch} -1)*5 HMaaa240 = HPbbb240 ➢ F Sigma param aaa= 109 + (I_{ch} -1) bbb= 284 + (I_{ch} -1)*5 HMaaa240 = HPbbb240	
Comment	The compression parameters shall change synchronously with the start of the next Compression Slice.	

11.4.16 TCOBSW-CSsize-2002 (HC025289)

TC Names	TCOBSW-CSsize-2002	HC025289
Function	Setup the Compression Slice Size parameter	
Prerequisite	DPU and REU must be in STANDBY, CONFIGURATION or OBSERVATION	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO (only datarate modification)	
Parameters	**- OCf-CSsize: (HP367250) :** • =[47 to 127]. ➔ is the number of modulations period during one Compression Slice	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM367240 = HP367250	
Comment	o The CS size ((and the compression parameters) shall change synchronously with the start of the next Compression Slice. o When this TC is sent in Standby, the first Compression slice will have the previous value.	

11.4.17 TCOBSW-EndOfSlew-2005 (HC102289)

TC Names	TCOBSW-EndOfSlew-2005	HC102289
Function	Activate the HFI packet production limitation (duration and quantity) Requests to limit to **OCf- Quantity** (16xkilobytes) the data produced by HFI during the **OCf- Duration** seconds that follow the spacecraft end of slew flag. If before reaching the end of the **OCf- Duration** duration, the **OCf- Quantity** data volume has been produced, the DPU shall stop making available science packets up to the end of the F1 duration.	
Prerequisite	DPU and REU must be in CONFIGURATION or OBSERVATION	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO (only datarate modification)	
Parameters	**- OCf-Duration: (HP024240) :** • = [600 to 64800] ➔ Number of seconds **- OCf-Quantity: (HP025240) :** • = [1 to 65535]➔ Number of 16x1024bytes (16 kilobytes) of HFI packets	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	o If the DPU receives a new End of Slew" before the end of execution of the previous one, the ASW shall execute the new one with its parameters (i.e. the current one is deleted). o If a new "End of Slew" command is not received at the end of the announced "dwell" duration, the HFI OBSW will automatically stop to control the adequation of produced TM to allocation	

11.4.18 TCOBSW-EnGlitchAlgo-2003 (HC026289)

TC Names	TCOBSW-EnGlitchAlgo-2003	HC026289
Function	Enable / disable the DPU glitch algorithm The Glitch algorithm calculates for each channel raw signal: - the difference between the maximum of the 45 positive samples and the minimum of the 45 negative samples, - the difference between the maximum of the 45 negative samples and the minimum of the 45 positive samples. It compares these differences with that of the previous raw signal and keeps the raw signal having the maximum difference.	
Prerequisite	DPU and REU must be in STANDBY, CONFIGURATION or OBSERVATION	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OCf-Glitch: (HP023240) :** • =1 ➔ Enable “Glitch” algorithm • =0 ➔ Disable “Glitch” algorithm	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM001250 = HP023240	
Comment		

11.4.19 TCOBSW-4KCMaint-0019 (HC015289)

TC Names	TCOBSW-4KCMaint-0019	HC015289
Function	Put the DPU into 4K_MAINTENANC mode and the 4KCDE into MAINTENANCE mode, starting from DPU and 4K in STANDBY mode	
Prerequisite	DPU and 4K must be in STANDBY	
MODE modification	DPU : YES; Transition to 4K_MAINTENANC REU : NO 4K : YES; Transition to MAINTENANCE	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = 4K_MAINTENANC ➢ 4K mode (HM003260) = MAINTENANCE	
Comment		

11.4.20 TCOBSW-4KCMaintStp-0119 (HC016289)

TC Names	TCOBSW-4KCMaintStp-0119	HC016289
Function	Put the DPU and the 4K into STANDBY mode, starting from DPU in 4K_MAINTENANC mode and 4K in MAINTENANCE mode	
Prerequisite	DPU must be in 4K_MAINTENANC mode 4K must be in MAINTENANCE mode	
MODE modification	DPU : YES; Transition to STANDBY REU : NO 4K : YES; Transition to STANDBY	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = STANDBY ➢ 4K mode (HM003260) = STANDBY	
Comment		

11.4.21 TCOBSW-Hot4KCMaint-0018 (HC013289)

TC Names	TCOBSW-Hot4KCMaint-0018	HC013289
Function	Put the DPU into HOT_4K_MAINTCE mode starting from DPU in CONFIGURATION mode and the 4K in NOMINAL mode	
Prerequisite	DPU must be in HOT_4K_MAINTCE mode 4K must be in NOMINAL mode	
MODE modification	DPU : YES; Transition to HOT_4K_MAINTCE REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = HOT_4K_MAINTCE ➢ 4K mode (HM003260) = NOMINAL	
Comment		

11.4.22 TCOBSW-Hot4KCMntStp-0118 (HC014289)

TC Names	TCOBSW-Hot4KCMntStp-0118	HC014289
Function	Put the DPU into CONFIGURATION mode, starting from DPU HOT_4K_MAINTCE mode and 4K in NOMINAL mode	
Prerequisite	DPU must be in 4K_MAINTENANC mode 4K must be in NOMINAL mode	
MODE modification	DPU : YES; Transition to CONFIGURATION REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = CONFIGURATION ➢ 4K mode (HM003260) = NOMINAL	
Comment		

11.5 DEPUTED DPU COMMAND

The table below gives an overview of the DPU deputed commands:

S2K Name	DPU Mode
TCDPU-SwReset-A001	ALL
TCDPU-FDIRmode-A002	
TCDPU-LoadASW-A003-0	BOOT
TCDPU-LdASWwithAd-A003	BOOT
TCDPU-StartASW-A00B	BOOT
TCDPU-ASWstore-A004	BOOT
TCDPU-DEEPROMtest-A006	BOOT
TCDPU-PSRAMtest-A007	
TCDPU-DSRAMtest-A008	
TCDPU-PPROMtest-A009	
TCDPU-FPGAtest-A00A	
TCDPU-ConfigWD-A005	ALL
TCDPU-SaveParam-A00E	ALL but BOOT

Table 11.5-1: DPU deputed commands

11.5.1 TCDPU-SwReset-A001 (HC191250)

TC Names	TCDPU-SwReset-A001	HC191250
Function	Do a DPU software reset (reboot the DPU)	
Prerequisite	NO	
MODE modification	DPU : YES; Transition to BOOT REU : NO 4K : NO	
HFI telemetry packet modification	Stop all HFI current telemetry production Start the production of Diag1	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ DPU mode (HM363240) = BOOT ➢ Diag1 packet production as expected	
Comment		

11.5.2 TCDPU-FDIRmode-A002 (HC192250)

TC Names	TCDPU-FDIRmode-A002	HC192250
Function	Setup the HFI FDIR parameter	
Prerequisite	DPU must be above STARTUP mode in case of FDIR desynchro requested. DPU can be in any mode for other request	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OCf-FDIRmode: (HP363250) :** • =0 ➔ Manual (NO automatic action taken by the DPU) • =1 ➔ DPU Automatic (resynchronization of DPU ONLY) • =2 ➔ HFI Automatic (resynchronization of DPU, REU and 4K) • =3 ➔ De-synchronisation (NO automatic action taken by the DPU and desynchronized mode are allowed). Option possible only above STARTUP mode	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM362240 = HP363250	
Comment		

11.5.3 TCDPU-LoadASW-A003-0 (HC193250)

TC Names	TCDPU-LoadASW-A003-0	HC193250
Function	Loads the ASW from EEPROM to SRAM (both Program and Data). The default start address stored in the EEPROM (at 0x3ED00) is used.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	The start address is reported in Diag1 telemetry HM415250.	

11.5.4 TCDPU-LdASWwithAd-A003 (HC202250)

TC Names	TCDPU-LdASWwithAd-A003	HC202250
Function	Loads the ASW from EEPROM to SRAM (both Program and Data). The start address given in parameter is used.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OCf-StartAdd: (HP368250) :** • =0x00000, 0x20000, 0x40000 or 0x60000 **- OCf-Length: (HP369250) :** • =0x10000 ➔ do not modify	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	The start address is reported in Diag1 telemetry HM415250.	

11.5.5 TCDPU-StartASW-A00B (HC201250)

TC Names	TCDPU-StartASW-A00B	HC201250
Function	Switches DPU from BSW to ASW (i.e. start of ASW)	
Prerequisite	DPU must be into STARTUP mode	
MODE modification	DPU : YES; Transition to STATUP REU : NO 4K : NO	
HFI telemetry packet modification	Stop the production of Diag1 Start the production of Diag2	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.6 TCDPU-ASWstore-A004 (HC194250)

TC Names	TCDPU-ASWstore-A004	HC194250
Function	Modifies the “ASW Start Address” and the “ASW Length” parameters in EEPROM.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OCf-StartAdd: (HP368250) :** • =0x00000, 0x20000, 0x40000 or 0x60000 **- OCf-Length: (HP369250) :** • =0x10000 ➔ do not modify	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	The start address is reported in Diag1 telemetry HM415250.	

11.5.7 TCDPU-DEEPROMtest-A006 (HC196250)

TC Names	TCDPU-DEEPROMtest-A006	HC196250
Function	Tests the DPU DATA EEPROM by use of stored checksum.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.8 TCDPU-PSRAMtest-A007 (HC197250)

TC Names	TCDPU-PSRAMtest-A007	HC197250
Function	Tests the DPU PROGRAM RAM by use of Read/Write operations.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.9 TCDPU-DSRAMtest-A008 (HC198250)

TC Names	TCDPU-DSRAMtest-A008	HC198250
Function	Tests the DPU DATA RAM by use of Read/Write operations.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.10 TCDPU-PPROMtest-A009 (HC199250)

TC Names	TCDPU-PPROMtest-A009	HC199250
Function	Tests the DPU PROGRAM PROM thanks to checksum operations.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.11 TCDPU-FPGAtest-A00A (HC200250)

TC Names	TCDPU-FPGAtest-A00A	HC200250
Function	Tests the FPGA registers thanks to Read/Write operations.	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.12 TCDPU-SaveParam-A00E (HC205250)

TC Names	TCDPU-SaveParam-A00E	HC205250
Function	Loads into EEPROM the Compression Slice size (OCf-CSsize), the compression parameters, the re-synchronisation number and the re-synchronisation table currently in RAM.	
Prerequisite	DPU must not be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.13 TCDPU-ParamStore-A00F (HC206250)

TC Names	TCDPU-ParamStore-A00F	HC206250
Function	Selects the "Parameter Store" in EEPROM. It will only be effective after the next SW Reset.	
Prerequisite	DPU must not be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OCf- ASWStore: (HP364250) :** • =0 ➔ Parameter store of EEPROM Initial part • =1 ➔ Parameter store of EEPROM Loaded part.	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.5.14 TCDPU-ConfigWD-A005 (HC195250)

TC Names	TCDPU-ConfigWD-A005	HC195250
Function	Setup the DPU watchdog	
Prerequisite	DPU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OCf-Watchdog: (HP365250) :** • =0 ➔ UNARMED • =1 ➔ ARMED	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM427250 = HP365250	
Comment		

11.6 DEPUTED REU COMMAND

The table below gives an overview of the REU deputed commands:

S2K Name	REU mode	ME/DPUMode
TCREU-FPGAreset-4054	BOOT or STANDBY	STARTUP or STANDBY
TCREU-Hwtest-4024 (0x40 to 0x44)	BOOT	STARTUP
TCREU-Hwtest-4024 (0x5y)	STANDBY	STANDBY
TCREU-ModSetup-4001	STANDBY	STANDBY
TCREU-RsigSetup-4007	STANDBY or CONFIGURATION	STANDBY or CONFIGURATION
TCREU-ChSetup-4002- 00 to B5		
TCREU-PIDsetup-4004- 0 to 4		
TCREU-JFETsetup-4005-0 to B		
TCREU-OptConf-4070- 00 to B5		
TCREU-VIconf-4071		
TCREU-VIOSelect-4072		
TCREU-HCTsetup-4003- 0 to B		
TCREU-HCTcontrol-4053		
TCREU-LoadParam-4010	BOOT or STANDBY	STARTUP or STANDBY
TCREU-SaveParam-4011	STANDBY or CONFIGURATION	STANDBY or CONFIGURATION
TCREU-CopyMemory-4084	BOOT	STARTUP
TCREU-CopyASW-4023	BOOT	STARTUP
TCREU-Reset-40A0	ALL	ALL

TCREU-6PIDsetup-4014, TCREU-12JFETsetup-4015, TCREU-24ChSetup-4012-1, TCREU-24ChSetup-4012-2, TCREU-24ChSetup-4012-3 and must not be used. Elementary procedure to configure the item by item must be used. As there is no PIDN°5 installed, TCREU-PIDsetup-4004-5 must not be used.

11.6.1 TCREU-FPGAreset-4054 (HC001280)

TC Names	TCREU-FPGAreset-4054	HC001280
Function	Specifies which analog belt(s) shall be activated and allows to restart the active analog belt FPGA and the multiplexer part of the processor belt FPGA	
Prerequisite	DPU must be into STARTUP or STANDBY mode REU must be into BOOT or STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- FPGA Reset: (HP888280) :** • =0 ➔ Modify in the processor memory the Active Belt List (ABL) according to ABL Belt 0 to ABL Belt B • =1 ➔ Restart the REU FPGA (MUX and PPF) according to the Active Belt List (i.e ABL Belt 0 to ABL Belt B). **- ABL Belt B: (HP890280) to ABL Belt 0: (HP901280): Active Belt List** • =0 ➔ Belt not active • =1 ➔ Belt active	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM302280= HP901280 ; HM304280= HP900280 ; HM308280= HP899280 ; HM310280= HP898280 ; HM314280= HP897280 ; HM316280= HP896280 ; HM320280= HP895280 ; HM322280= HP894280 ; HM326280= HP893280 ; HM328280= HP892280 ; HM332280= HP891280 ; HM334280= HP890280	
Comment		

11.6.2 TCREU-Hwtest-4024 (HC003280)

TC Names	TCREU-Hwtest-4024	HC003280
Function	Do REU hardware tests (PROM, EEPROM, DRAM, PRAM, Analog belt preprocessor)	
Prerequisite	DPU mode = STARTUP and REU mode = BOOT if PROM, EEPROM, DRAM, PRAM test, ALL analog belt hardware test is requested (param 0x44) DPU mode and REU mode = STANDBY if one Analog belt preprocessor test is requested (0x5y)	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- DeviceTbt: (HP902280) :** • =0x40➔ Verify the checksum of the ROM program (duration < 5s) • =0x41➔ Read/Write test in all PRAM memory space (duration < 5s) • =0x42➔ Read/Write test in all DRAM memory space (duration > 5s) • =0x44➔ Verify the checksum of the EEPROM (scientific program and configurations) program (duration > 5s) • =0x45➔ Check all belts (alive or not) (duration < 10s) • =0x5y➔ Check if the belt N°y is alive with 0 <= y <= B (duration < 3s)	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM346280 = 0 ➢ HM350280 = 0 ➢ HM352280 = 0 ➢ HM356280 = 0 ➢ HM358280 = 0	
Comment		

11.6.3 TCREU-ModSetup-4001 (HC006280)

TC Names	TCREU-ModSetup-4001	HC006280
Function	Sets the number of sample per half period (Ns) and the Frequency divisor for the modulation and the 4K frequency (Fdiv)	
Prerequisite	DPU, REU and 4K must be into STANDBY mode 4K must be into STANDBY or FREEWHEEL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- RSw07-Nsamp: (HP003280) : Number of sample per half period** • =0 ➔ Ns= 45 samples • =1 ➔ Ns= 40 samples • =2 ➔ Ns= 36 samples • =3 ➔ Ns= 45 samples **- RSw07-Fdiv : (HP004280) :** • =[96 to 160] The modulation frequency (Fmod) and the 4K cooler frequency (Fcooler) are given by :	

Ns 36

Fdiv	Fmod	Fcooler
96	112,73	45,09
98	111,74	44,69
100	110,76	44,30
102	109,79	43,92
104	108,85	43,54
106	107,92	43,17
108	107,00	42,80
110	106,10	42,44
112	105,22	42,09
114	104,35	41,74
116	103,49	41,40
118	102,65	41,06
120	101,82	40,73
122	101,01	40,40
124	100,21	40,08
126	99,42	39,77
128	98,64	39,46
130	97,88	39,15
132	97,13	38,85
134	96,38	38,55
136	95,65	38,26
138	94,93	37,97
140	94,23	37,69
142	93,53	37,41
144	92,84	37,14
146	92,16	36,87
148	91,49	36,60
150	90,84	36,33
152	90,19	36,08
154	89,55	35,82
156	88,92	35,57
158	88,30	35,32
160	87,68	35,07

Ns 40

Fdiv	Fmod	Fcooler
96	101,46	45,09
98	100,56	44,69
100	99,68	44,30
102	98,81	43,92
104	97,96	43,54
106	97,13	43,17
108	96,30	42,80
110	95,49	42,44
112	94,70	42,09
114	93,91	41,74
116	93,14	41,40
118	92,39	41,06
120	91,64	40,73
122	90,91	40,40
124	90,19	40,08
126	89,48	39,77
128	88,78	39,46
130	88,09	39,15
132	87,41	38,85
134	86,75	38,55
136	86,09	38,26
138	85,44	37,97
140	84,80	37,69
142	84,18	37,41
144	83,56	37,14
146	82,95	36,87
148	82,35	36,60
150	81,75	36,33
152	81,17	36,08
154	80,59	35,82
156	80,03	35,57
158	79,47	35,32
160	78,91	35,07

Ns 45

Fdiv	Fmod	Fcooler
96	90,19	45,09
98	89,39	44,69
100	88,61	44,30
102	87,83	43,92
104	87,08	43,54
106	86,33	43,17
108	85,60	42,80
110	84,88	42,44
112	84,18	42,09
114	83,48	41,74
116	82,80	41,40
118	82,12	41,06
120	81,46	40,73
122	80,81	40,40
124	80,17	40,08
126	79,54	39,77
128	78,91	39,46
130	78,30	39,15
132	77,70	38,85
134	77,11	38,55
136	76,52	38,26
138	75,95	37,97
140	75,38	37,69
142	74,82	37,41
144	74,27	37,14
146	73,73	36,87
148	73,20	36,60
150	72,67	36,33
152	72,15	36,08
154	71,64	35,82
156	71,13	35,57
158	70,64	35,32
160	70,15	35,07

Success criteria check

- TM(1,1) and TM(1,7)
- HM677280 = HP003280
- HM676280 = HP004280

Comment

11.6.4 TCREU-RsigSetup-4007 (HC007280)

TC Names	TCREU-RsigSetup-4007	HC007280
Function	Sets how the raw signal channel is selected by the REU at each modulation period (Cycle, Fixed, Fixed, CS)	
Prerequisite	DPU, REU must be into STANDBY or CONFIGURATION mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- Rsig-ModeSelect : (HP886280) : Raw signal mode** • =0 ➔ Cycle: Raw Signal channel increments of 1 automatically at each modulation period. • =1 ➔ Fixed: Raw Signal is always sent for the channel selected by **RCf-BeltNum** and **RCf-ChanNum** • 2 ➔ Cernox: the raw signal transmitted is the raw signal of the current acquired Cernox • 3 ➔ CS: Raw signal channel increases of 1 automatically at each compression period. The first raw signal transmitted is for specified **RCf-BeltNum** and **RCf-ChanNum** **- RCf-BeltNum : (HP903280) : Belt number** • =[0 to 11] ➔ Belt number **- RCf-ChanNum : (HP904280) : Channel number** • =[0 to 5] ➔ Channel number	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM678280 = HP886280	
Comment		

11.6.5 TCREU-ChSetup-4002-ij (HC008280 toHC079280)

TC Names	**TCREU-ChSetup-4002-ij** i = Belt Number belongs to [0;B], j = Channel Number belongs to [0;5]	**HC0nn280** With nn=08+6i+j (HC008280 to HC079280)
Function	Sets the electrical parameters of one single selected channel ij: Nblanck, Gamp, Sphase, Mphase, Current, Voltage, Transient.	
Prerequisite(s)	DPU mode must be in STANDBY or CONFIGURATION REU mode must be in STANDBY or CONFIGURATION	
HFI MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	i: belongs to [0;11] (belt number) j: belongs to [0;5] (channel number) **- Mphase-ij: (HPbbb280** with **bbb= 006 + 42i + 7j) : Modulation phase** • = 0 ➔ Modulation phase = 0° • = 1 ➔ Modulation phase = 90° • = 2 ➔ Modulation phase = 180° • = 3 ➔ Modulation phase = 270° **- nblanck-ij: (HPbbb280** with **bbb= 007 + 42i + 7j) : Number of samples masked at the beginning of each half period** • =[0 to Nsample-1]; (Nsample=36, 40 or 45; see TCREU-ModSetup-4001) **- Sphase-ij: (HPbbb280** with **bbb= 008 + 42i + 7j) : Phase shift** • =[0 to Nsample-1]; (Nsample=36, 40 or 45; see TCREU-ModSetup-4001) **- Gamp -ij: (HPbbb280** with **bbb= 009 + 42i + 7j) : Variable gain amplifier** • = 0 ➔ Gain = 1/3 • = 1 ➔ Gain = 1 • = 2 ➔ Gain = 3 • = 3 ➔ Gain = 8 **- Bias Current-ij: (HPbbb280** with **bbb= 010 + 42i + 7j) : Current level generated by DAC0 (tuning of square wave signal)** • =[0 to 4095] ➔ Bias current **- Bias Voltage-ij: (HPbbb280** with **bbb= 011 + 42i + 7j) : Voltage level generated by DAC1 (tuning of triangular wave signal)** • =[0 to 4095] ➔ Bias voltage **- Bias Trans-ij: (HPbbb280** with **bbb= 012 + 42i + 7j) : Transient compensation generated by DAC2** • =[0 to 4095] ➔ Tansient compensation	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ *Mphase* : HMaaa280 = HPbbb280 with, aaa= 003 + 24i + 4j ; bbb= 006 + 42i + 7j ➢ *Nblanck :* HMaaa280 = HPbbb280 with, aaa= 681 + 6i +j ; bbb= 007 + 42i + 7j ➢ *Sphase :* HMaaa280 = HPbbb280 with, aaa= 753 + 6i +j ; bbb= 008 + 42i + 7j ➢ *Gamp :* HMaaa280 = HPbbb280 with, aaa= 825 + 6i +j ; bbb= 009 + 42i + 7j ➢ *I_Bias :* HMaaa280 = HPbbb280 with, aaa= 004 + 24i + 4j ; bbb= 010 + 42i + 7j ➢ *V_Bias :* HMaaa280 = HPbbb280 with, aaa= 005 + 24i + 4j ; bbb= 011 + 42i + 7j ➢ *T_Bias :* HMaaa280 = HPbbb280 with, aaa= 006 + 24i + 4j ; bbb= 012 + 42i + 7j	

11.6.6 TCREU-OptConf-4070-ij (HC117280 to HC188280)

TC Names	**TCREU-OptConf-4070-ij** i = Belt Number belongs to [0;B], j = Channel Number belongs to [0;5]	**HCnnn280** With nnn=117+6i+j (HC117280 to HC188280)
Function	Sets the optimisation parameters of a single selected channel used during the Optimisation and the VI.	
Prerequisite(s)	DPU mode must be in STANDBY or CONFIGURATION REU mode must be in STANDBY or CONFIGURATION	
HFI MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	i: belongs to [0;11] (belt number) j: belongs to [0;5] (channel number) **- RCf-VIOGamplnit: (HP788280) : Initial Gain** • = 0 ➔ Gain = 1/3 • = 1 ➔ Gain = 1 • = 2 ➔ Gain = 3 • = 3 ➔ Gain = 8 **- RCf-VIOTinit : (HP789280) : Initial Transient** • =[0 to 4095] **- RCf-VIOCv : (HP790280) : Cv** • =[-32768 ; 32767] **- RCf-VIOCt : (HP791280) : Ct** • =[-32768 ; 32767] **- RCf-VIODeltaT : (HP792280) : Deltat T** • =[0 ; 255] **- RCf-VIODeltaV : (HP793280) : Delta V** • =[0 ; 255] **- RCf-VIOBlanckV: (HP794280) : Number of samples masked at the beginning of each half period** • =[0 ; 63] **- RCf-VIOMaxItNbT: (HP795280) : Maximum number of Iterations for T** • =[0 ; 255] **- RCf-VIOMaxItNbV: (HP796280) : Maximum number of Iterations for V** • =[0 ; 255] **- RCf-VIOAccurT : (HP797280) : Accuracy for T** • =[0 ; 255] **- RCf-VIOAccurV : (HP798280) : Accuracy for V** • =[0 ; 255] **- RCf-VIOParam2 : (HP800280) :** • =[1 ; 44] **- RCf-VIOParam1 : (HP802280) :** • =[0 ; 44]	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	There is not HSK that return the parameters of these TC	

11.6.7 TCREU-VIconf-4071 (HC189280)

TC Names	**TCREU-VIconf-4071** i = Belt Number belongs to [0;B], j = Channel Number belongs to [0;5]	**HC189280**
Function	Sets the VI parameters applied to ALL detection channels during VI_MEASUREMENT	
Prerequisite(s)	DPU mode must be in STANDBY or CONFIGURATION REU mode must be in STANDBY or CONFIGURATION	
HFI MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- RCf-VIImin : (HP803280) : Bias current I minimum for the VI exploration** • =[0 to 4094] **- RCf-VIImax : (HP804280) : Bias current I maximum for the VI exploration** • =[0 to 4095] **- RCf-VIScale : (HP805280) : Linear or Logarithmic Distribution of points between Imin and Imax** • = 0 ➔ Linear • = 1 ➔ Logarithmic **- RCf-VIStepNumber : (HP806280) : Number of points between Imin and Imax** • =[1 to 127] **- RCf-VIdelay : (HP807280) : Delay belonging taken between 2 points.** • =[0 to 65535] ➔ Delay in seconde = **RCf-VIdelay / Fmod** ; (see TCREU-ModSetup-4001 for Fmod possible value) **- RCf-VICof : (HP923280) : Continue or not in case of failure during VI_MEASUREMENT** • = 0 ➔ STOP in case of failure during VI_MEASUREMENT • = 1 ➔ CONTINUE to the next I measurement in case of failure during VI_MEASUREMENT	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HP803280= HM590280 ➢ HP804280= HM591280 ➢ HP923280= HM589280 ➢ HP805280= HM592280 ➢ HP806280= HM593280 ➢ HP807280= HM594280	
Comment		

11.6.8 TCREU-VIOselect-4072 (HC190280)

TC Names	TCREU-VIOselect-4072	HC190280
Function	Select the list of FPU channels which shall be processed by the next VI_MEASUREMENT or OPTIMISATION in case the TCOBSW-Optim-0014 or TCOBSW-VI-0015 are sent in indicating that the REU OBSW shall use this list	
Prerequisite(s)	DPU mode must be in STANDBY or CONFIGURATION REU mode must be in STANDBY or CONFIGURATION	
HFI MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- RCf00-VIOSel (HP868280) to RCfB5-VIOSel (HP879280): Channel selection for the optimisation or VI measurement** • = 0 ➔ The channel will not be optimize of VI measured • = 1 ➔ The channel will be optimize of VI measured	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	There is not HSK that return the parameters of these TC	

11.6.9 TCREU-HCTsetup-4003-i (HC117280 to HC188280)

TC Names	TCREU-HCTsetup-4003-i i = Cernox Number belongs to [0;B]	**HCnnn280** nnn = 084 + i (HC084280 to HC095280)
Function	Sets the electrical parameters of one Cernox thermistor	
Prerequisite(s)	DPU mode must be in STANDBY or CONFIGURATION REU mode must be in STANDBY or CONFIGURATION	
HFI MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	i: belongs to [0;11] (Cernox number) **- HCT(i)Nblanck: (HPnnn280** with nnn = 515 + 6 x i**) : Number of samples masked at the beginning of each half period** • =[0 ; 63] **- HCT(i)Gamp : (HPnnn280** with nnn = 516 + 6 x i**) : Variable gain amplifier and bias current divisor** • = 0 ➔ Gain = 1 ; no bias current modification • = 1 ➔ Gain = 2 ; no bias current modification • = 2 ➔ Gain = 1 ; Bias Current divided by 10 • = 3 ➔ Gain = 2 ; Bias Current divided by 10 **- HCT(i)Bias I: (HPnnn280** with nnn = 517 + 6 x i**) : Bias current** • =[0 ; 4095]	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HMaaa280 = HPnnn280; aaa = 909 + i; nnn = 515 + 6 x i ➢ HMaaa280 = HP683280; aaa = 897 + i; nnn = 516 + 6 x i ➢ HMaaa280 = HP684280; aaa = 294 + 6 x I; nnn = 517 + 6 x i	
Comment		

11.6.10 TCREU-HCTcontrol-4053 (HC083280)

TC Names	TCREU-HCTcontrol-4053	HC083280
Function	Define the Cernox Thermometers to be activated	
Prerequisite(s)	DPU mode must be in STANDBY or CONFIGURATION REU mode must be in STANDBY or CONFIGURATION	
HFI MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- HCT-Belt0 to HCT-BeltB : (HP922280 to HP911280) : Cernox's activation** • = 0 ➔ cernox NOT activate • = 1 ➔ cernox activated **- HCT0Duration : (HP511280) : Integration duration** • =[0 ; 65535] ➔ Integration duration in seconde = **HCT0Duration / Fmod** ; (see TCREU-ModSetup-4001 for Fmod possible value)	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM932280 = HP911280 ➢ HM931280 = HP912280 ➢ HM930280 = HP913280 ➢ HM929280 = HP914280 ➢ HM928280 = HP915280 ➢ HM927280 = HP916280 ➢ HM926280 = HP917280 ➢ HM925280 = HP918280 ➢ HM924280 = HP919280 ➢ HM923280 = HP920280 ➢ HM922280 = HP921280 ➢ HM921280 = HP922280 ➢ HM292280 = HP511280	
Comment	Belt 0 -> Cernox 0.1K Nominal Belt 1 -> Cernox 1.6K Nominal Belt 2 -> Cernox 4K Nominal Belt 3 -> Cernox 18K Nominal Belt 4 -> Cernox 50K Nominal Belt 5 -> Cernox 4K/1.6K switch Nominal Belt 6 -> Cernox 0.1K Redundant Belt 7 -> Cernox 1.6K Redundant Belt 8 -> Cernox 4K Redundant Belt 9 -> Cernox 18K Redundant Belt A -> Cernox 50K Redundant Belt B -> Cernox 4K/1.6K switch Redundant	
Comment	Integration duration is set for the 12 channels. The advised minimum value is about 30 seconds	

11.6.11 TCREU-JFETsetup-4005-i (HC097280 to HC101280)

TC Names	TCREU-JFETsetup-4005-i with i = JFET number belonging to [0 ; 11]	**HCnnn280** With nnn=104+i (HC104280 to HC115280)
Function	Setup and control one JFET PID heaters among the 12 JFTET PID's	
Prerequisite	DPU and REU must be into STANDBY or CONFIGURATION mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	i = 0 to 11 (JFET number) **- JPID Conf(i): (HP680280) : Mode** • =0 ➔ servo OFF (The heater power is constant) • =1 ➔ servo ON (The heater power is computed by the PI control) **- JPID IntegTime(i) : (HP683280) : Integration time:** • =[0 to 65535]. ➔ $$Freq_PID\,(Hz) = \frac{F \bmod (Hz)}{55 \times (\ \text{JPID IntegTime(i)} + 1\ )}$$ **- JPID Setpoint (i) : (HP684280) : Temperature Set Point:** • =[-32768 to 32768]. ➔ see PI algorithm. **- JPID P_Gain (i) : (HP685280) : Proportional Gain:** • =[-32768 to 32768]. ➔ see PI algorithm **- JPID I_Gain (i) : (HP686280) : Integral Gain:** • =[-32768 to 32768]. ➔ see PI algorithm **- JPID Exp (i) : (HP687280) : Exponent applied to Proportional and Integral:** • =1 ➔ 10^{-8} • =2 ➔ 10^{-7} • =4 ➔ 10^{-6} • =8 ➔ 10^{-5} • =16 ➔ 10^{-4} • =32 ➔ 10^{-3} • =64 ➔ 10^{-2} • =128 ➔ 10^{-1} • =256 ➔ 1 • =512 ➔ 10 • =1024 ➔ 10^{2} • =2048 ➔ 10^{3} • =4096 ➔ 10^{4} • =8192 ➔ 10^{5} • =16384 ➔ 10^{6} • =32768 ➔ 10^{7} **- JPID HeatPower(i) : (HP688280) : Heater Nominal power :** • =[0 to 4095]. ➔ see power heater computation	

Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HMaaa280 = HPbbb280; aaa= 951 + i ; bbb= 680 +9 x i ➢ HMaaa280 = HPbbb280; aaa= 433 + i; bbb= 683 +9 x i ➢ HMaaa280 = HPbbb280; aaa= 434 + i ; bbb= 684 +9 x i ➢ HMaaa280 = HPbbb280; aaa= 435 + i ; bbb= 685 +9 x i ➢ HMaaa280 = HPbbb280; aaa= 436 + i ; bbb= 686 +9 x i ➢ HMaaa280 = HPbbb280; aaa= 437 + i ; bbb= 687 +9 x i ➢ HMaaa280 = HPbbb280; aaa= 438 + i ; bbb= 688 +9 x i
Comment	➢ The physical injected heater power (in watt) is a linear function of the raw heater power ➢ The maximum heater power when **JPID HeatPower** is at 4095 (**JPID Conf** =0) or when the PI request 100% of power (**JPID Conf** =1) is **20mW** ➢ When a PID control is selected (**JPID Conf** =1): $Heat_Power\,(W) = P_{\text{gain}} \times E(t) + \int_0^t I_{gain} \times E(t)\,dt$ With : $Heat_Power\,(RAW) \in [0, 4095]$ t is the current time $dt = 1. / Freq_PID$ P_{gain} = **JPID Exp x JPID P_Gain** I_{gain} = **JPID Exp x JPID I_Gain** $E(t)$ = (JFET $_{\text{temperature}}$ (RAW) – **JPID SetPoint)**

11.6.12 TCREU-PIDsetup-4004-i (HC097280 to HC101280)

TC Names	TCREU-PIDsetup-4004-i with i = PID number belonging to [0 ; 4]	**HCnnn280** With nnn=097+i (HC097280 to HC101280)
Function	Setup and control one HFI focal plane PID among : 4K/1.6K switch ; 4K plate ; 1.6K plate ; 0.1K Bolometer plate ; 0.1K Dilution plate	
Prerequisite	DPU and REU must be into STANDBY or CONFIGURATION mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	i = 0 to 4 (PID number) **- PIDConfMode(i): (HP584280) : Mode** • =0 ➔ servo OFF (The heater power, given by **NHeatPwLsw**, **NHeatPwMsw, RHeatPwLsw, and RHeatPwWsw** is constant) • =1 ➔ servo ON (The heater power is computed by the PID control) **- PIDHeatConf(i) : (HP586280) : Heater configuration:** • =0 ➔ Nominal PID heater used • =1 ➔ Redundant PID heater used **- PIDTermConf(i) : (HP588280) : Thermometer configuration:** • =0 ➔ Nominal PID thermometer used • =1 ➔ Redundant PID Thermometer used • =2 ➔ Nominal & Redundant PID Thermometer used • =3 ➔ Nominal PID thermometer used **- PIDNoPID(i) : (HP589280) : PID number:** • =0 ➔ PID BOLO • =1 ➔ PID DILU • =2 ➔ PID 1.6K • =3 ➔ PID 4K • =4 ➔ PID switch 4K/1.6K **- PIDIntTime(i) : (HP590280) : Integration time:** • =[0 to 65535]. ➔ for PID number 0, 2, 3 and 4 $$Freq_PID\,(Hz) = \frac{F\bmod(Hz)}{11\times(\ PIDIntTime+1\ )}$$ • =[3 to 65535]. ➔ for PID number 1 $$Freq_PID\,(Hz) = \frac{F\bmod(Hz)}{(\ PIDIntTime+1\ )}$$ **- PIDSetPoint(i) : (HP591280) : Temperature Set Point:** • =[-32768 to 32768]. ➔ see PID algorithm. The SetPoint is generally set at	

	ZERO. It is the Voltage bias in ADU of the corresponding PID fine thermometer or cernox that is modified to adjust the PID temperature setpoint. **- PIDP-Gain(i) : (HP592280) : Proportional Gain:** • =[-32768 to 32768]. ➔ see PID algorithm **- PIDP-IGain(i) : (HP593280) : Integral Gain:** • =[-32768 to 32768]. ➔ see PID algorithm **- PIDP-DGain(i) : (HP594280) : Differential Gain:** • =[-32768 to 32768]. ➔ see PID algorithm. The differential gain is generally set at ZERO **- PIDExp(i) : (HP595280) : Exponent applied to Proportional, Integral and Differential Gain:** • =1 ➔ 10^{-8} • =2 ➔ 10^{-7} • =4 ➔ 10^{-6} • =8 ➔ 10^{-5} • =16 ➔ 10^{-4} • =32 ➔ 10^{-3} • =64 ➔ 10^{-2} • =128 ➔ 10^{-1} • =256 ➔ 1 • =512 ➔ 10 • =1024 ➔ 10^{2} • =2048 ➔ 10^{3} • =4096 ➔ 10^{4} • =8192 ➔ 10^{5} • =16384 ➔ 10^{6} • =32768 ➔ 10^{7} **- NHeatPwLsw(i) : (HP596280) : Heater Nominal LSW:** • =[0 to 4095]. ➔ see power heater computation **- NHeatPwMsw(i) : (HP597280) : Heater Nominal MSW:** • =[0 to 4095]. ➔ see power heater computation **- RHeatPwLsw(i) : (HP598280) : Heater Redundant LSW:** • =[0 to 4095]. ➔ see power heater computation **- NHeatPwLsw(i) : (HP599280) : Heater Redundant MSW:** • =[0 to 4095]. ➔ see power heater computation
Success criteria check	➢ TM(1,1) and TM(1,7) ➢

Comment

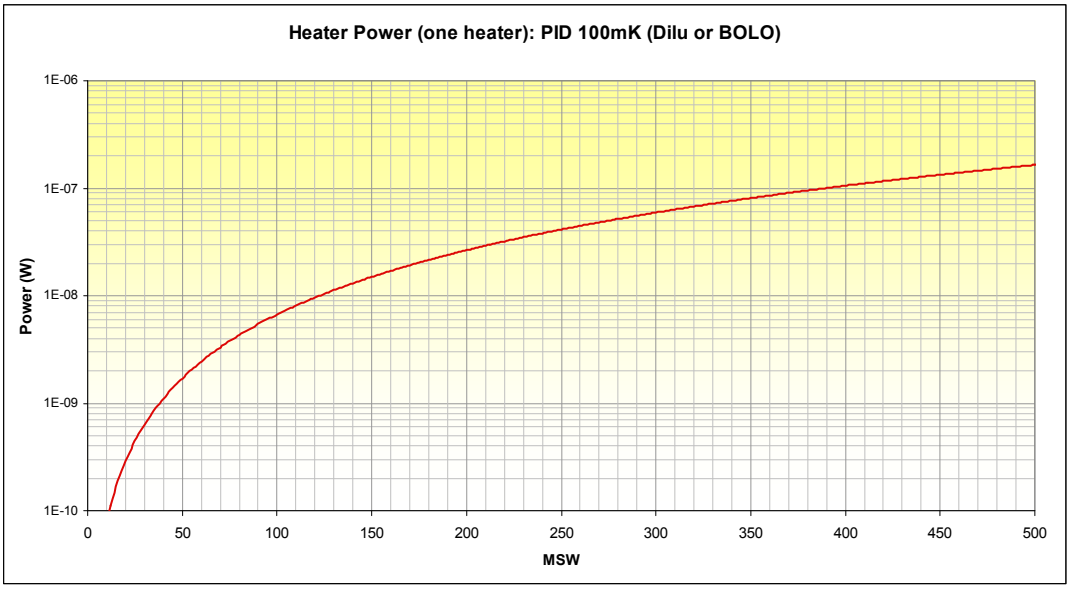
- The physical injected heater power (in watt) is a square function of the raw heater voltage given by **NHeatPwLsw + NHeatPwMsw** x 4095 + **RHeatPwLsw + RHeatPwMsw** x 4095

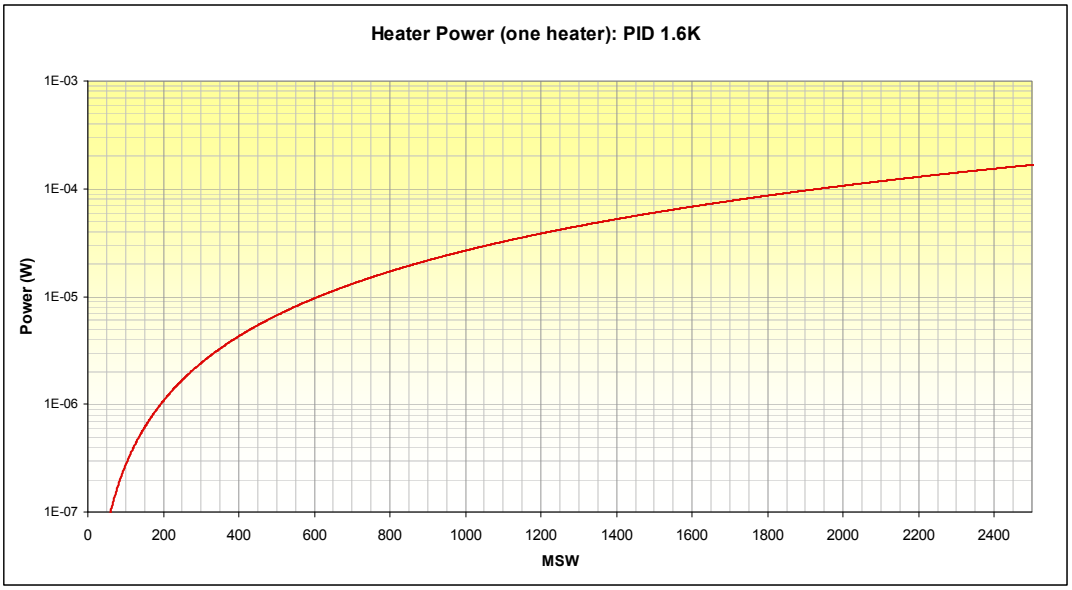
- The maximum power HeatPwMax for each PID heater (nominal or redundant) when both **HeatPwLsw and HeatPwMsw** are set at 4095 (**PIDConfMode** =0) or when the PID control request 100% of the power (**PIDConfMode** =1) are:
  - PID N°0 (BOLO) = 11 10^{-6} W
  - PID N°1 (DILU) = 11 10^{-6} W
  - PID N°2 (1.6K) = 447 10^{-6} W
  - PID N°3 (4K) = 1.8 10^{-3} W
  - PID N°4 (4K/1.6K) = 2.0 10^{-3} W
- **One HeatPwLsw** corresponds to :
  - PID N°0 (BOLO) = 0.66 10^{-12} W
  - PID N°1 (DILU) = 0.66 10^{-12} W
  - PID N°2 (1.6K) = 27 10^{-12} W
  - PID N°3 (4K) = 110 10^{-12} W
  - PID N°4 (4K/1.6K) = 123 10^{-12} W

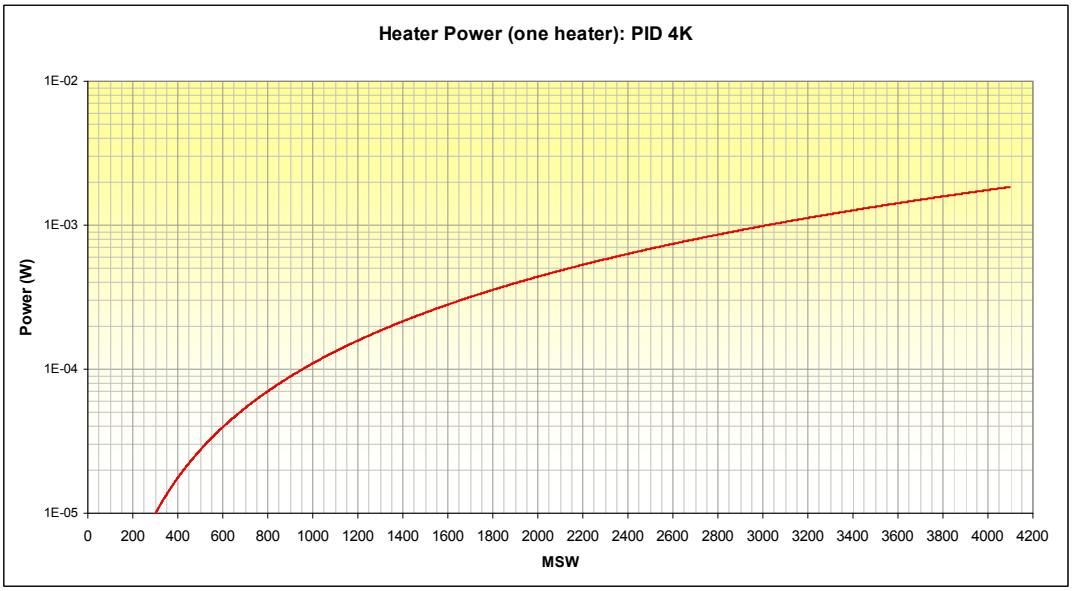
It is possible to activate both PID heater nominal and redundant.
In PIDConfMode=0 (fixed power), it is then possible to double the maximum power dissipation given above.

- When a fix heater power is selected (**PIDConfMode** =0):

Heater_voltage(RAW)= NHeatPwLsw + NHeatPwMsw x 4095 + **RHeatPwLsw + RHeatPwMsw** x 4095







➢ When a PID control is selected (**PIDConfMode** =1):

$$Heat_Voltage\,(RAW) = P_{\text{gain}} \times E(t) + \int_0^t I_{gain} \times E(t)\,dt + D_{gain} \times \frac{(E(t) - E(t-dt))}{dt}$$

With :

$Heat_Voltage\,(RAW) \in [0, 2^{24}]$

t is the current time

$dt = 1. / Freq_PID$

P_{gain} = **PIDExp x PIDP-Gain**

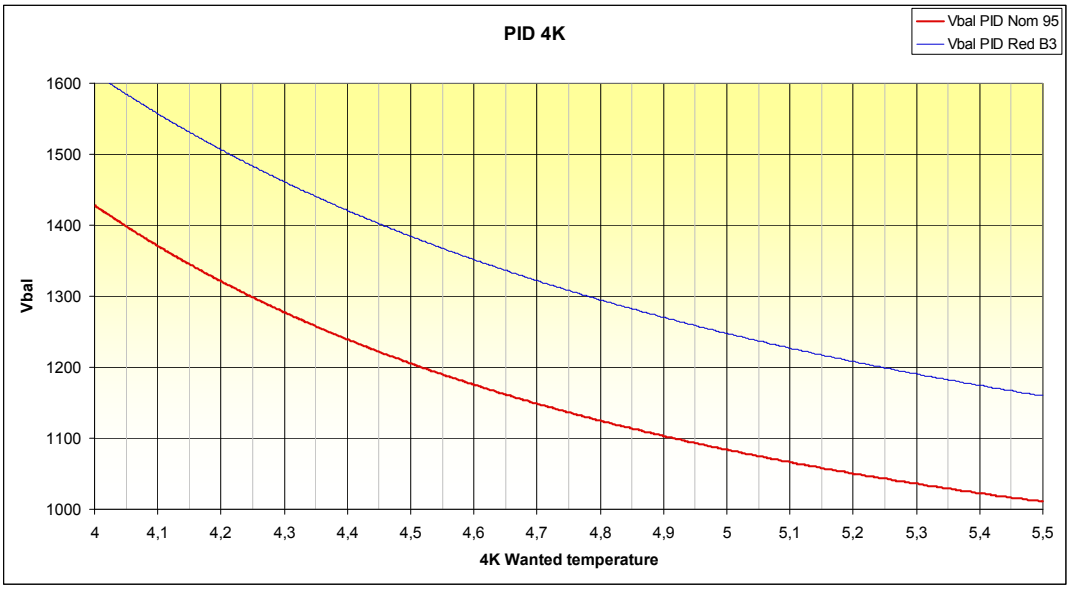
I_{gain} = **PIDExp x PID-IGain**

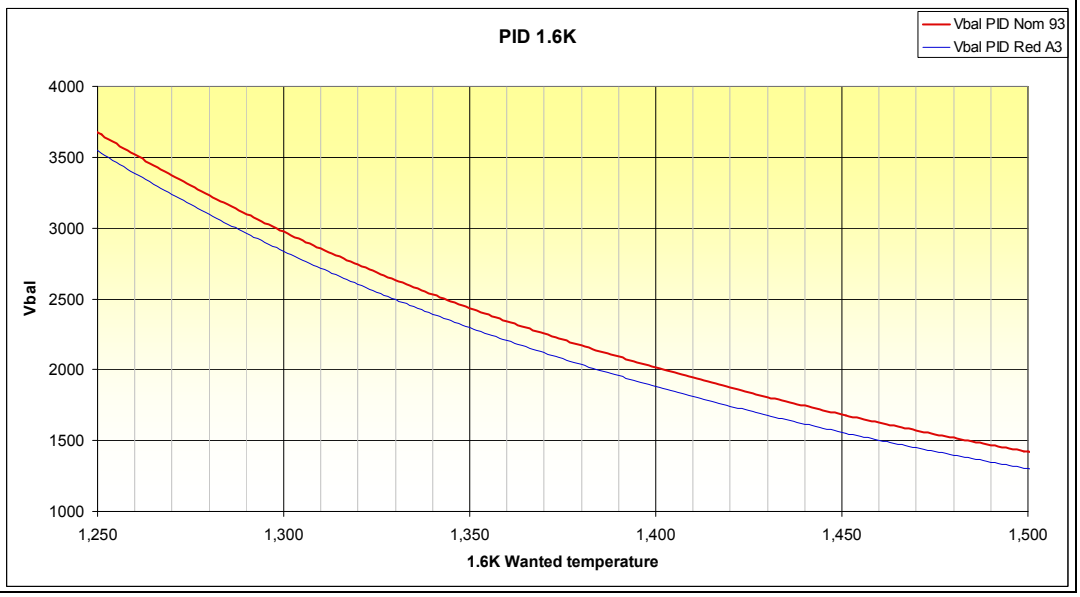
D_{gain} = **PIDExp x PID-DGain**

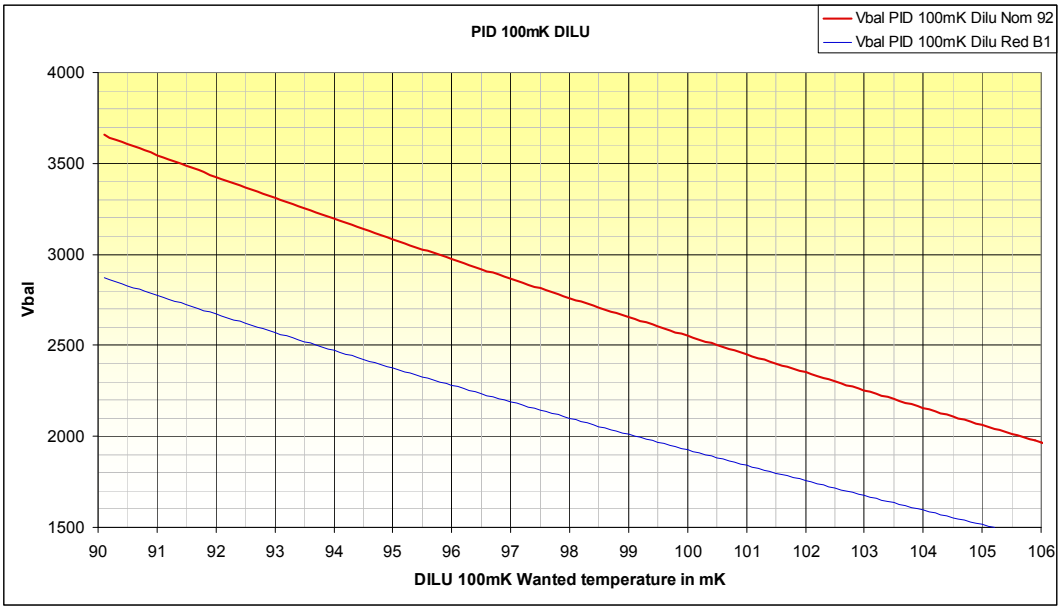
$E(t)$ = (REU measure - **PIDSetPoint)**

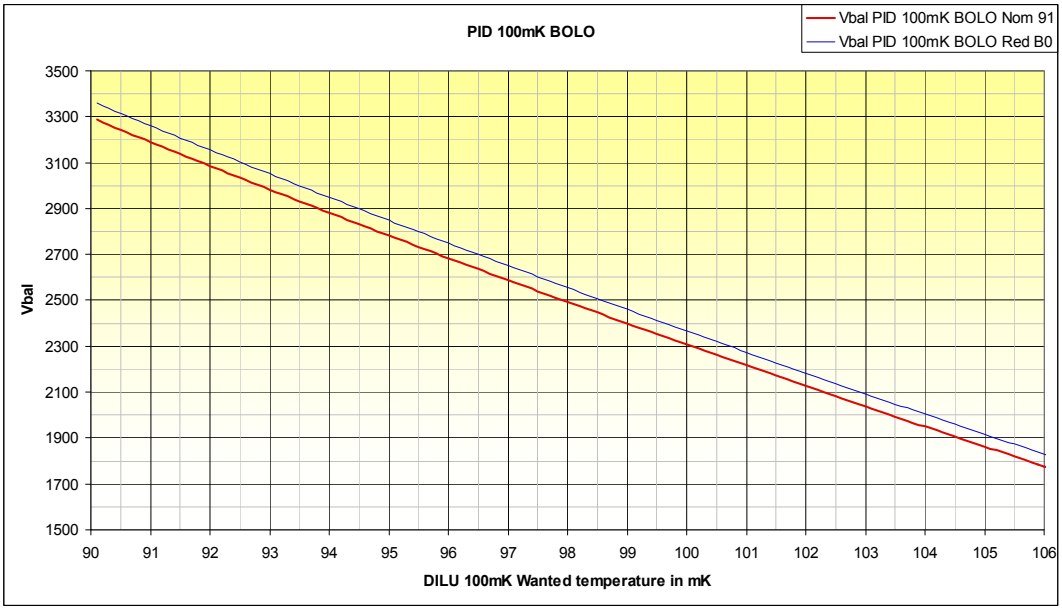
In PIDConfMode=1 (PID control), it is possible to apply a fixed power on the heater not used by the PID. The additional fixed power is given by :
NHeatPwLsw + NHeatPwMsw x 4095 or **RHeatPwLsw + RHeatPwMsw** x 4095

- The **PIDSetPoint** parameter must be set at ZERO excepted for the 4K/1.6K thermal switch (but this switch will not be used in flight). It is the Voltage bias of the corresponding PID fine thermometer that is modified to adjust the PID temperature setpoint. The correspondence between the temperature to be set in Kelvin and the bias voltage to be modified is the following :









- The fine thermometer associated to the different PID's are :
  - PID N°0 (BOLO) = 91 nominal; B0 redundant
  - PID N°1 (DILU) = 92 nominal; B1 redundant
  - PID N°2 (1.6K) = 93 nominal; B2 redundant
  - PID N°3 (4K) = 95 nominal; B3 redundant
  - PID N°4 (4K/1.6K) = Cernox 4K/1.6K (HD495280 nominal, HD501280 redundant)

11.6.13 TCREU-LoadParam-4010 (HC004280)

TC Names	TCREU-LoadParam-4010	HC004280
Function	Configures the 72 channels with the configuration parameters stored in EEPROM.	
Prerequisite	DPU must be into STARTUP or STANDBY mode REU must be into BOOT or STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- EEPROM-Load: (HP887280) : EEPROM store area to be loaded** • = 0 ➔ Store 0: Default configuration (not erasable) used if Store 1 is empty. • =1 ➔ Store 1 • =2 ➔ Store 2 • =3 ➔ Load the current on board configuration	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	As soon as a configuration has been loaded into Store 1, it becomes the default configuration.	

11.6.14 TCREU-SaveParam-4011 (HC005280)

TC Names	TCREU-SaveParam-4011	HC005280
Function	Save the configuration parameters of the 72 channels into EEPROM	
Prerequisite	DPU and REU must be into STANDBY or CONFIGURATION mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- EEPROM-Store : (HP910280) : EEPROM store area to be used for the parameter saving** • =1 ➔ Store 1 • =2 ➔ Store 2	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM346280 = 0	
Comment		

11.6.15 TCREU-CopyMemory-4084 (HC191280)

TC Names	TCREU-CopyMemory-4084	HC191280
Function	Copy a REU memory block from a source address to a target address	
Prerequisite	DPU must be into STARTUP mode REU must be into BOOT mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- RCf-MemID : (HP909280) : REU Memory Identifier of the memory source** • = 0x41 ➔ REU PRAM • = 0x42 ➔ REU DRAM • = 0x43 ➔ REU EEPROM **- RCf-SourceAdd : (HP906280) : Source start adress** **- RCf-Length : (HP906280) : Memory block length** **- RCf-MemID : (HP909280) : REU Memory Identifier of the memory target** • = 0x41 ➔ REU PRAM • = 0x42 ➔ REU DRAM • = 0x43 ➔ REU EEPROM **- RCf-DestAdd : (HP907280) : Target start adress**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM346280 = 0 ➢ HM350280 = 0 ➢ HM352280 = 0	
Comment		

11.6.16 TCREU-CopyASW-4023 (HC002280)

TC Names	TCREU-CopyASW-4023	HC002280
Function	Copy the REU ASW from EEPROM to PRAM	
Prerequisite	DPU in STARTUP; REU in BOOT	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM346280 = 0	
Comment		

11.6.17 TCREU-Reset-40A0 (HC000280)

TC Names	TCREU-Reset-40A0	HC000280
Function	Do a REU software reset	
Prerequisite	DPU in any mode but BOOT REU in any mode	
MODE modification	DPU : NO REU : YES. Transition into BOOT mode 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM346280 = 0	
Comment		

11.7 DEPUTED DCE COMMAND

The table below gives an overview of the DCE deputed commands:

S2K Name	DPUMode
TCDCE-Dummy-6000	ALL except BOOT and STARTUP
TCDCE-ValveOpen-6002	STANDBY, CONFIGURATION
TCDCE-ValveClose-6003	
TCDCE-TempServoH102-6004	
TCDCE-TempServoH103-6004	
TCDCE-TempServoH104-6004	
TCDCE-TempServoH202-6004	
TCDCE-TempServoH203-6004	
TCDCE-TempServoH204-6004	
TCDCE-TempServoTSN-6004	
TCDCE-TempServoTSR-6004	

11.7.1 TCDCE-Dummy-6000

TC Names	TCDCE-Dummy-6000	HC000270
Function	Test the DCE LSL communication with DPU	
Prerequisite	DPU in any mode except BOOT	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment		

11.7.2 TCDCE-ValveOpen-6002

TC Names	TCDCE-ValveOpen-6002	HC001270
Function	OPEN a selected dilution valve	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ValveID : (HP003270) : Valve identifier** • =0 ➔ HPLV 151 (He^4 high pressure valve redundant) • =1 ➔ HPLV101 (He^4 high pressure valve nominal) • =2 ➔ HPLV 251 (He^3 high pressure valve redundant) • =3 ➔ HPLV 201 (He^3 high pressure valve nominal) • =4 ➔ FV102 • =5 ➔ FV103 • =6 ➔ FV104 • =7 ➔ FV202 • =8 ➔ FV203 • =9 ➔ FV204 • =10 ➔ FV351 (mixture return redundant) • =11 ➔ FV301 (mixture return nominal)	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ F HM600270 = 2 if HP003270=0 ➢ F HM601270 = 2 if HP003270=1 ➢ F HM602270 = 2 if HP003270=2 ➢ F HM603270 = 2 if HP003270=3 ➢ F HM604270 = 2 if HP003270=10 ➢ F HM605270 = 2 if HP003270=11	
Comment		

11.7.3 TCDCE-ValveClose-6002

TC Names	TCDCE-ValveClose-6003	HC002270
Function	CLOSE a selected dilution valve	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ValveID : (HP003270) : Valve identifier** • =0 ➔ HPLV 151 (He^4 high pressure valve redundant) • =1 ➔ HPLV101 (He^4 high pressure valve nominal) • =2 ➔ HPLV 251 (He^3 high pressure valve redundant) • =3 ➔ HPLV 201 (He^3 high pressure valve nominal) • =4 ➔ FV102 • =5 ➔ FV103 • =6 ➔ FV104 • =7 ➔ FV202 • =8 ➔ FV203 • =9 ➔ FV204 • =10 ➔ FV351 (mixture return redundant) • =11 ➔ FV301 (mixture return nominal)	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ F HM600270 = 1 if HP003270=0 ➢ F HM601270 = 1 if HP003270=1 ➢ F HM602270 = 1 if HP003270=2 ➢ F HM603270 = 1 if HP003270=3 ➢ F HM604270 = 1 if HP003270=10 ➢ F HM605270 = 1 if HP003270=11	
Comment		

11.7.4 TCDCE-TempServoH102-6004

TC Names	TCDCE-TempServoH102-6004	HC003270
Function	Setup and control the He^4 50K filter defrost heater	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointH102 : (HP005270) : Maximum temperature for heater activation** • =[102 ; 3575] see RAW/Engineering conversion **- PowerLevelH102 : (HP006270) : Power level** • = 0 ➔ 3% of the maximum power is applied (0,06W) • = 1 ➔ 10% of the maximum power is applied (0,2W) • = 2 ➔ 30% of the maximum power is applied (0,6W) • = 3 ➔ 100% of the maximum power is applied (2W) **- ServoDurationH102 : (HP007270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationH102** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.5 TCDCE-TempServoH103-6004

TC Names	TCDCE-TempServoH103-6004	HC004270
Function	Setup and control the He^4 18K filter defrost heater	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointH103 : (HP008270) : Maximum temperature for heater activation** • =[122 ; 3776] see RAW/Engineering conversion **- PowerLevelH103 : (HP009270) : Power level** • = 0 ➔ 3% of the maximum power is applied (4,5mW) • = 1 ➔ 10% of the maximum power is applied (15mW) • = 2 ➔ 30% of the maximum power is applied (45mW) • = 3 ➔ 100% of the maximum power is applied (150mW) **- ServoDurationH103 : (HP010270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationH103** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.6 TCDCE-TempServoH104-6004

TC Names	TCDCE-TempServoH104-6004	HC005270
Function	Setup and control the He^4 4K filter defrost heater	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointH104 : (HP011270) : Maximum temperature for heater activation** • =[25 ; 3054] see RAW/Engineering conversion **- PowerLevelH104 : (HP012270) : Power level** • = 0 ➔ 3% of the maximum power is applied (0,75mW) • = 1 ➔ 10% of the maximum power is applied (2,5mW) • = 2 ➔ 30% of the maximum power is applied (7,5mW) • = 3 ➔ 100% of the maximum power is applied (25mW) **- ServoDurationH104 : (HP013270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationH104** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.7 TCDCE-TempServoH202-6004

TC Names	TCDCE-TempServoH202-6004	HC006270
Function	Setup and control the He^3 50K filter defrost heater	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointH202 : (HP014270) : Maximum temperature for heater activation** • =[202 ; 3575] see RAW/Engineering conversion **- PowerLevelH202 : (HP015270) : Power level** • = 0 ➔ 3% of the maximum power is applied (0,06W) • = 1 ➔ 10% of the maximum power is applied (0,2W) • = 2 ➔ 30% of the maximum power is applied (0,6W) • = 3 ➔ 100% of the maximum power is applied (2W) **- ServoDurationH202 : (HP016270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationH202** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.8 TCDCE-TempServoH203-6004

TC Names	TCDCE-TempServoH203-6004	HC007270
Function	Setup and control the He^3 18K filter defrost heater	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointH203 : (HP017270) : Maximum temperature for heater activation** • =[122 ; 3776] see RAW/Engineering conversion **- PowerLevelH203 : (HP018270) : Power level** • = 0 ➔ 3% of the maximum power is applied (4,5mW) • = 1 ➔ 10% of the maximum power is applied (15mW) • = 2 ➔ 30% of the maximum power is applied (45mW) • = 3 ➔ 100% of the maximum power is applied (150mW) **- ServoDurationH203 : (HP019270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationH203** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.9 TCDCE-TempServoH204-6004

TC Names	TCDCE-TempServoH204-6004	HC008270
Function	Setup and control the He^3 4K filter defrost heater	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointH204 : (HP020270) : Maximum temperature for heater activation** • =[25 ; 3055] see RAW/Engineering conversion **- PowerLevelH204 : (HP021270) : Power level** • = 0 ➔ 3% of the maximum power is applied (0,75mW) • = 1 ➔ 10% of the maximum power is applied (2,5mW) • = 2 ➔ 30% of the maximum power is applied (7,5mW) • = 3 ➔ 100% of the maximum power is applied (25mW) **- ServoDurationH204 : (HP022270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationH204** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.10 TCDCE-TempServoHS2N-6004

TC Names	TCDCE-TempServoHS2N-6004	HC009270
Function	Setup and control the 18K – 4K Heat Switch Nominal	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointTSn: (HP023270) : Maximum temperature for heater activation** • =[166 ; 3906] see RAW/Engineering conversion **- PowerLevelTSn : (HP024270) : Power level** • = 0 ➔ 3% of the maximum power is applied (3mW) • = 1 ➔ 10% of the maximum power is applied (10mW) • = 2 ➔ 30% of the maximum power is applied (30mW) • = 3 ➔ 100% of the maximum power is applied (100mW) **- ServoDurationTsn : (HP025270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationTsn** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

11.7.11 TCDCE-TempServoHS2R-6004

TC Names	TCDCE-TempServoHS2R-6004	HC010270
Function	Setup and control the 18K – 4K Heat Switch Nominal	
Prerequisite	NO	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- TempSetpointTSr: (HP026270) : Maximum temperature for heater activation** • =[249 ; 3919] see RAW/Engineering conversion **- PowerLevelTSr : (HP027270) : Power level** • = 0 ➔ 3% of the maximum power is applied (3mW) • = 1 ➔ 10% of the maximum power is applied (10mW) • = 2 ➔ 30% of the maximum power is applied (30mW) • = 3 ➔ 100% of the maximum power is applied (100mW) **- ServoDurationTsr : (HP028270) : Power level** • =[0 ; 65535] ➔ duration of heater activation is 4x **ServoDurationTsr** (s)	
Success criteria check	➢ TM(1,1) and TM(1,7)	
Comment	Sending this command when a heater is already running will rearm it	

The RAW/Engineering conversion for the temperature set point is the following.

TempSetpointH102 50K 4He	
RAW	K
102	330,211
103	326,193
106	320,222
108	315,217
111	310,204
116	300,206
122	290,182
128	280,198
135	270,195
143	260,199
151	250,191
161	240,198
171	230,198
183	220,197
196	210,196
212	200,189
229	190,189
249	180,193
272	170,183
300	160,186
332	150,194
370	140,203
417	130,210
474	120,213
544	110,409
637	100,227
692	95,241
756	90,250
831	85,259
918	80,265
1022	75,273
1146	70,286
1297	65,293
1484	60,300
1720	55,304
2023	50,312
2169	48,319
2425	45,326
2731	42,330
3107	39,336
3575	36,337

TempSetpointH103 18K 4He	
RAW	K
122	333,734
124	328,739
126	321,236
128	314,971
130	310,028
134	300,060
138	290,151
143	280,134
147	270,155
153	260,157
158	250,157
164	240,161
171	230,150
178	220,168
186	210,152
195	200,158
205	190,172
216	180,207
228	170,215
242	160,240
258	150,258
276	140,278
296	130,314
320	120,301
348	110,411
381	100,319
401	95,325
422	90,324
446	85,315
473	80,310
504	75,295
538	70,273
579	65,241
626	60,206
681	55,158
748	50,107
779	48,081
829	45,064
887	42,057
953	39,065
1030	36,082
1120	33,102
1194	31,016
1266	29,217
1338	27,610
1420	25,976
1514	24,329
1621	22,689
1743	21,075
1838	19,973
1934	18,976
2040	17,982
2160	16,989
2295	15,999
2450	15,003
2628	14,007
2838	13,008
3090	12,003
3395	10,996
3776	9,984

TempSetpointH104 4K 4He	
RAW	K
25	321,236
26	310,031
27	300,062
28	290,152
29	280,134
30	270,158
31	260,157
32	250,156
33	240,158
35	230,150
36	220,168
38	210,160
40	200,159
42	190,171
44	180,208
46	170,216
49	160,241
52	150,259
56	140,279
60	130,315
65	120,302
71	110,410
78	100,320
82	95,325
86	90,325
91	85,318
97	80,309
103	75,296
110	70,272
119	65,243
128	60,205
140	55,161
154	50,109
160	48,081
170	45,063
182	42,058
196	39,066
212	36,083
230	33,101
245	31,018
260	29,218
275	27,605
292	25,976
311	24,329
333	22,689
358	21,075
378	19,972
397	18,976
419	17,981
444	16,989
471	15,999
503	15,001
539	14,009
582	13,008
634	12,003
696	10,996
774	9,985
873	8,966
1005	7,943
1188	6,924
1395	6,112
1654	5,385
1911	4,865
2181	4,451
2376	4,208
2569	4,005
2788	3,808
3054	3,605

TempSetpointH202 50K 3He	
RAW	K
106	330,211
107	326,196
110	320,224
113	315,218
115	310,208
121	300,205
127	290,183
134	280,200
141	270,195
149	260,199
158	250,191
168	240,198
180	230,197
193	220,196
207	210,197
223	200,188
242	190,188
264	180,193
289	170,183
319	160,186
354	150,194
396	140,204
447	130,210
510	120,213
587	110,410
690	100,226
751	95,242
823	90,250
906	85,259
1004	80,265
1120	75,273
1259	70,286
1430	65,292
1642	60,299
1910	55,305
2256	50,313
2424	48,318
2717	45,326
3070	42,330
3504	39,336
4047	36,338

TempSetpointH203 18K 3He	
RAW	K
123	333,734
124	328,739
127	321,237
129	314,972
131	310,029
135	300,061
139	290,154
144	280,133
149	270,155
154	260,157
160	250,156
166	240,159
173	230,150
181	220,170
189	210,156
198	200,160
209	190,171
220	180,207
233	170,216
247	160,241
263	150,259
282	140,279
303	130,314
328	120,302
357	110,411
393	100,321
413	95,325
435	90,324
461	85,317
489	80,311
521	75,297
558	70,272
600	65,242
649	60,206
708	55,159
778	50,109
810	48,082
864	45,064
925	42,057
995	39,066
1076	36,082
1172	33,101
1250	31,019
1326	29,217
1403	27,609
1490	25,977
1590	24,330
1704	22,689
1834	21,075
1935	19,973
2037	18,976
2151	17,982
2278	16,989
2421	15,999
2587	15,002
2777	14,008
3001	13,011
3270	12,004
3598	10,996
4005	9,986

TempSetpointH204 4K 3He	
RAW	K
25	328,739
26	310,030
27	300,061
28	290,153
29	280,134
30	270,155
31	260,157
32	250,157
34	240,159
35	230,150
36	220,168
38	210,164
40	200,159
42	190,172
44	180,207
47	170,217
50	160,241
53	150,259
57	140,279
61	130,315
66	120,302
72	110,410
79	100,321
83	95,326
87	90,325
92	85,318
98	80,310
104	75,296
112	70,271
120	65,244
130	60,206
141	55,160
155	50,108
162	48,082
172	45,063
184	42,058
198	39,067
214	36,084
233	33,100
248	31,018
263	29,218
278	27,608
295	25,977
315	24,329
337	22,688
362	21,076
382	19,973
401	18,976
423	17,982
448	16,990
476	15,999
508	15,002
544	14,009
588	13,008
639	12,002
702	10,996
779	9,985
879	8,965
1011	7,943
1195	6,924
1401	6,112
1660	5,385
1917	4,865
2187	4,451
2380	4,208
2572	4,006
2791	3,808
3055	3,605

TempSetpointTSn 4K/18K Th Switch NOM	
RAW	K
166	330,041
168	326,047
172	320,045
174	315,036
177	310,032
183	300,043
190	290,044
197	280,059
205	270,052
213	260,067
222	250,063
232	240,067
243	230,071
255	220,062
269	210,069
283	200,078
300	190,079
318	180,077
339	170,080
363	160,089
390	150,097
421	140,099
457	130,091
499	120,094
550	110,116
611	100,118
647	95,119
687	90,120
732	85,130
783	80,135
841	75,143
908	70,151
986	65,154
1079	60,161
1190	55,157
1324	50,167
1387	48,167
1492	45,176
1614	42,177
1756	39,186
1925	36,186
2128	33,184
2299	31,065
2467	29,244
2640	27,617
2838	25,978
3066	24,346
3326	22,746
3628	21,171
3906	19,930

TempSetpointTSr 4K/18K Th Switch RED	
RAW	K
249	333,759
252	328,770
258	321,265
263	314,999
267	310,045
276	300,064
285	290,144
295	280,121
306	270,133
318	260,141
331	250,141
345	240,141
361	230,122
378	220,136
396	210,133
417	200,141
440	190,145
465	180,169
494	170,185
526	160,205
562	150,216
604	140,235
652	130,269
708	120,261
775	110,276
855	100,282
902	95,284
954	90,274
1012	85,261
1078	80,256
1153	75,240
1239	70,215
1339	65,187
1457	60,147
1598	55,100
1771	50,038
1851	48,012
1984	44,989
2138	41,981
2316	38,989
2526	36,007
2778	33,032
2986	30,951
3191	29,159
3400	27,560
3639	25,946
3919	24,320

11.8 DEPUTED 4K COMMAND

The table below gives an overview of the 4K deputed commands:

S2K Name	4KCDE Mode	DPU Mode
TC4K-Dummy-8000	ALL except BOOT	ALL except STARTUP & BOOT
TC4K-ContinueBoot-8001	BOOT	STARTUP, STANDBY, CONFIGURATION
TC4K-IntF180Period-8002	STANDBY	STANDBY, CONFIGURATION
TC4K-ExtF0MaxLimit-8002		
TC4K-ExtF0MinLimit-8002		
TC4K-ExtF0MaxVar-8002		
TC4K-ExtF180MaxLimt-8002		
TC4K-ExtF180MinLimt-8002		
TC4K-MaxCompAmpDem-8002		
TC4K-VcsCtrl-800B		
TC4K-SyncCtrl-8010		
TC4K-ForceTransdSel-8002		
TC4K-CompAmplDemand-8002	STANDBY, NOMINAL	STANDBY, CONFIGURATION
TC4K-FreqImbCancel-8002		
TC4K-OrifHeatCtrl-800D		
TC4K-GetterSelElt-8002		
TC4K-GetterCtrl-800E		
TC4K-CompAPosDisp-8007	ALL except BOOT	ALL except STARTUP
TC4K-CompANegDisp-8007		
TC4K-CompBPosDisp-8007		
TC4K-CompBNegDisp-8007		
TC4K-PkDrivCurrent1-8007		
TC4K-PkDrivCurrent2-8007		
TC4K-PkDrivCurrent3-8007		
TC4K-CompADrvCPosPk-8007		
TC4K-CompADrvCNegPk-8007		
TC4K-CompBDrvCPosPk-8007		
TC4K-CompBDrvCNegPk-8007		
TC4K-CompAheadTemp1-8007		
TC4K-CompAheadTemp2-8007		
TC4K-CompBheadTemp1-8007		
TC4K-CompBheadTemp2-8007		
TC4K-LimitCtrl-8008		
TC4K-LimitAction-8009		
TC4K-SysRespTest-800C	MAINTENANCE, NOMINAL	4K_MAINTENANC,HOT_4K_MAINTCE
TC4K-CancelSysRespTest	SYS_RESP_TEST, NOMINAL_SRT	4K_MAINTENANC,HOT_4K_MAINTCE
TC4K-StopCooler-8003	ALL except BOOT	ALL except STARTUP and BOOT
TC4K-RunCooler-8004	STANDBY	CONFIGURATION
TC4K-Reset-800F	ALL	ALL except BOOT

The TC's TC4K-DriveAmpCtrl-800A and TC4K-CompA/BSelect-8002 must not be used

11.8.1 TC4K-Dummy-8000

TC Names	TC4K-Dummy-8000	HC011260
Function	Test the 4K LSL communication with DPU	
Prerequisite	DPU in any mode except STARTUP and BOOT 4K in any mode except BOOT	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7)	

11.8.2 TC4K-ContinueBoot-8001

TC Names	TC4K-ContinueBoot-8001	HC050260
Function	Send to the 4K continue boot command to go into STANDBY or FREEWHEEL mode	
Prerequisite	DPU must be in STARTUP, STANDBY or CONFIGURATION mode 4K must be in BOOT mode	
MODE modification	DPU : NO REU : NO 4K : YES : STANDBY or FREEWHEEL	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM003260 = STANDBY or FREEWHEEL after 2mn	
Comment		

11.8.3 TC4K-VcsCtrl-800B

TC Names	TC4K-VcsCtrl-800B	HC043260
Function	Activate / deactivate the 4K Vibration Cancellation System	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- VCSOff_On: (HP037260) : VCS OFF or ON** • = 0 ➔ VCS is OFF • = 1 ➔ VCS is ON	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM004260 = HP037260	

11.8.4 TC4K-GetterSelElt-8002

TC Names	TC4K-GetterSelElt-8002	HC023260
Function	Select the 4K getter (nominal or redundant)	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- GetterElementSelect (HP014260) : 4K getter selection** • = 1 ➔ getter nominal is selected • = 2 ➔ getter redundant s selected	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM124260 = HP014260	

11.8.5 TC4K-GetterCtrl-800E

TC Names	TC4K-GetterCtrl-800E	HC046260
Function	POWER ON or OFF the selected 4K getter heaters	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- SelGetterOff_On: (HP039260) : 4K selected getter heater OFF or ON** • = 0 ➔ getter selected heater is OFF • = 1 ➔ getter selected heater is ON	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM284260 or / and HM285260 = HP039260 in agreement with HP014260	

11.8.6 TC4K-SyncCtrl-8010

TC Names	TC4K-SyncCtrl-8010	HC047260
Function	Select the 4K syncronisation frequency (4K : internal or REU : external)	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- SynchClockSelect : (HP040260) : 4K clock selection** • = 0 ➔ external REU clock selected • = 1 ➔ internal 4K clock selected	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM316260 = inverse of HP040260	

11.8.7 TC4K-OrifHeatCtrl-800D

TC Names	TC4K-OrifHeatCtrl-800D	HC045260
Function	POWER ON or OFF the 4K JT heater	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- OrificeHeatOff_On : (HP038260) : 4K JT orifice OFF or ON** • = 0 ➔ heater is OFF • = 1 ➔ heater is ON	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM283260= HP038260	

11.8.8 TC4K-RunCooler-8004

TC Names	TC4K-RunCooler-8004	HC048260
Function	START the 4K cooler compressors running	
Prerequisite	DPU must be in CONFIGURATION mode 4K must be in STANDBY or FREEWHEEL mode	
MODE modification	DPU : NO REU : NO 4K : YES : RUNUP_1 then NOMINAL if start in STANDBY; RUNDOW_2 then RUNUP_1 if start in FREEWHEEL	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM003260 = RUNUP_1 then NOMINAL after 165s maximum	
Comment		

11.8.9 TC4K-StopCooler-8003

TC Names	TC4K-StopCooler-8003	HC049260
Function	STOP the 4K cooler compressors running	
Prerequisite	DPU in any mode except STARTUP and BOOT 4K in any mode except BOOT	
MODE modification	DPU : NO REU : NO 4K : YES : RUNDOWN_i then STANDBY	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM003260 = RUNDOWN_i then STANDBY after 165s maximum	
Comment		

11.8.10 TC4K-SysRespTest-800C

TC Names	TC4K-SysRespTest-800C	HC044260
Function	Initiates the 4K System Response Test	
Prerequisite	DPU must be in HOT_4K_MAINTCE or 4K_MAINTENANC mode 4K must be in MAINTENANCE or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM184260 = 1	
Comment	➢ During SRT, injects harmonics into the compressor drive waveform and analyses the resulting vibration. It produces a System Response Table (SRT) which gives the gain and phase shift information necessary to null out or reduce each vibration harmonic component. ➢ The base amplitude used during the SRT is the amplitude is the one given by HM120260 ➢ The duration of a SRT is about 25mn	

11.8.11 TC4K-CancelSysRespTest-8015

TC Names	TC4K-CancelSysRespTest-8015	HC051260
Function	Cancel the execution of a 4K System Response Test	
Prerequisite	DPU must be in HOT_4K_MAINTCE or 4K_MAINTENANC mode 4K must be in MAINTENANCE or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : YES : MAINTENANCE or NOMINAL	
HFI telemetry packet modification	NO	
Parameters	NO	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM184260 = 1 ➢ HM003260 = MAINTENANCE or NOMINAL	

11.8.12 TC4K-IntF180Period-8002

TC Names	TC4K-IntF180Period-8002	HC013260
Function	Sets the current value of an Internal F180 clock period	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- IntF180ClockPeriod : (HP004260) : 4K internal clock frequency** • =[2412 ; 3266] ➔ Frequency (Hz) = 1/(50 10^{-9} x **IntF180ClockPeriod)**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM114260 = HP004260	

11.8.13 TC4K-ExtF0MaxLimit-8002

TC Names	TC4K-ExtF0MaxLimit-8002	HC014260
Function	Sets the current value of the External F0 MAximum clock Limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ExtF0ClockMaxLimit : (HP005260) : REU external F0 maximum limit** • =[21739 ; 29412] ➔ Frequency (Hz) = 1/(10^{-6} x **ExtF0ClockMaxLimit)**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM115260 = HP005260	
Comment	➢ When this limit is exceeded, the 4K automatically switches on its internal clock	

11.8.14 TC4K-ExtF0MinLimit-8002

TC Names	TC4K-ExtF0MinLimit-8002	HC015260
Function	Sets the current value of the External F0 Minimum clock Limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ExtF0ClockMinLimit : (HP006260) : REU external F0 minimum limit** • =[22126; 29412] ➔ Frequency (Hz) = 1/(10^{-6} x **ExtF0ClockMinLimit)**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM116260 = HP006260	
Comment	➢ When this limit is exceeded, the 4K automatically switches on its internal clock	

11.8.15 TC4K-ExtF0MaxVar-8002

TC Names	TC4K-ExtF0MaxVar-8002	HC016260
Function	Sets the current value of the External F0 maximum period variation clock Limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ExtF0ClockMaxVariation: (HP007260) : REU external F0 max variation limit** • =[1 ; 32767] ➔ Frequency (Hz) = 1/(10^{-6} x **ExtF0ClockMaxVariation)**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM117260 = HP007260	
Comment	➢ When this limit is exceeded, the 4K automatically switches on its internal clock	

11.8.16 TC4K-ExtF180MaxLimt-8002

TC Names	TC4K-ExtF180MaxLimt-8002	HC017260
Function	Sets the current value of the External F180 Maximum clock Limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ExtF180ClockMaxLimit: (HP008260) : REU external F180 max limit** • =[1206 ; 1633] ➔ Frequency (Hz) = 1/(10^{-7} x **ExtF180ClockMaxLimit)**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM118260 = HP008260	
Comment	➢ When this limit is exceeded, the 4K automatically switches on its internal clock	

11.8.17 TC4K-ExtF180MinLimt-8002

TC Names	TC4K-ExtF180MinLimt-8002	HC018260
Function	Sets the current value of the External F180 Minimum clock Limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ExtF180ClockMinLimit: (HP009260) : REU external F180 min limit** • =[1206 ; 1633] ➔ Frequency (Hz) = 1/(10^{-7} x **ExtF180ClockMinLimit)**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM119260 = HP009260	
Comment	➢ When this limit is exceeded, the 4K automatically switches on its internal clock	

11.8.18 TC4K-MaxCompAmpDem-8002

TC Names	TC4K-MaxCompAmpDem-8002	HC021260
Function	Sets the 4K MAXIMUM amplitude demand limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- MaxCompAmpDemand: (HP012260) : 4K amplitude demand** • =[0 ; 5000] ➔ 4K max amplitude demand (μm) = **MaxCompAmpDemand**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM122260 = HP012260	
Comment	➢ This command is to limit the 4K maximum amplitude demand request by TC4K-CompAmplDemand-8002 (HC019260). It is not to sets the 4K amplitude demand.	

11.8.19 TC4K-CompAmplDemand-8002

TC Names	TC4K-CompAmplDemand-8002	HC019260
Function	Sets the 4K amplitude demand	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : YES if the 4K is in NOMINAL mode. It will transitory be in CHANGE_AMPLITUDE mode and then return in NOMINAL mode	
HFI telemetry packet modification	NO	
Parameters	**- CompAmplDemand : (HP010260) : 4K amplitude demand** • =[0 ; 5000] ➔ 4K Amplitude demand (μm) = **CompAmplDemand**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM120260 = HP010260	
Comment	➢ The same amplitude is applied for both HP and LP compressors	

11.8.20 TC4K-FreqImbCancel-8002

TC Names	TC4K-FreqImbCancel-8002	HC022260
Function	Select the harmonic forces to be taken into account for the 4K Vibration Cancellation System	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- FreqSelVCS: (HP013260) : 4K harmonic forces selection for VCS** • =[0 ; 255] • Frequency select for vibration cancellation is an 8-bit mask. A '1' in bit position N specifies that cancellation should be performed on the vibration component at frequency FN (N=0,…,7), where F0 is the fundamental compressor frequency and FN is (N+1)F0	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM123260 = HP013260	

11.8.21 TC4K-ForceTransdSel-8002

TC Names	TC4K-ForceTransdSel-8002	HC024260
Function	Select the harmonic forces to be taken into account for the 4K Vibration Cancellation System	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- ForceTransducer0: (HP041260) : Force transducer N°1** • = 0 ➔ Force transducer not selected • = 1 ➔ Force transducer selected **- ForceTransducer1: (HP042260) : Force transducer N°2** • = 0 ➔ Force transducer not selected • = 1 ➔ Force transducer selected **- ForceTransducer2: (HP043260) : Force transducer N°3** • = 0 ➔ Force transducer not selected • = 1 ➔ Force transducer selected **- ForceTransducer3: (HP044260) : Force transducer N°4** • = 0 ➔ Force transducer not selected • = 1 ➔ Force transducer selected	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM125260 = HP041260 + 2xHP042260 + 4xHP043260 + 8xHP043260	

11.8.22 TC4K-CompAPosDisp-8007

TC Names	TC4K-CompAPosDisp-8007	HC025260
Function	Sets the limit that applies to the "Compressor A positive displacement"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompAPosDisplace: (HP017260) : Compressor A positive displacement limit** • =[0 ; 5000] ➔ 4K Amplitude limit (μm) = **CompAPosDisplace**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM126260 = HP017260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.23 TC4K- CompANegDisp -8007

TC Names	TC4K- CompANegDisp -8007	HC026260
Function	Sets the limit that applies to the "Compressor A negative displacement"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompANegDisplace: (HP018260) : Compressor A negative displacement limit** • =[0 ; 5000] ➔ 4K Amplitude limit (μm) = **CompANegDisplace**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM127260 = HP018260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.24 TC4K- CompBPosDisp -8007

TC Names	TC4K- CompBPosDisp -8007	HC027260
Function	Sets the limit that applies to the "Compressor B positive displacement"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompBPosDisplace: (HP019260) : Compressor B positive displacement limit** • =[0 ; 5000] ➔ 4K Amplitude limit (μm) = **CompBPosDisplace**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM128260 = HP019260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.25 TC4K- CompBNegDisp -8007

TC Names	TC4K- CompBNegDisp -8007	HC028260
Function	Sets the limit that applies to the "Compressor B negative displacement"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompBNegDisplace: (HP020260) : Compressor B negative displacement limit** • =[0 ; 5000] ➔ 4K Amplitude limit (μm) = **CompBNegDisplace**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM129260 = HP020260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.26 TC4K- PkDrivCurrent1-8007

TC Names	TC4K- PkDrivCurrent1-8007	HC029260
Function	Sets a first limit that applies to the “Peak drive bus current”	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- PkDriveCurrent1: (HP021260) : Peak drive bus current limit N°1** • =[0 ; 12000] ➔ current limit (mA) =**PkDriveCurrent1**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM130260 = HP021260	
Comment	➢ If this limit is exceeded, the amplitude demand is reduced by 10%	

11.8.27 TC4K- PkDrivCurrent2-8007

TC Names	TC4K- PkDrivCurrent2-8007	HC030260
Function	Sets a second limit that applies to the “Peak drive bus current”	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- PkDriveCurrent2: (HP022260) : Peak drive bus current limit N°2** • =[0 ; 12000] ➔ current limit (mA) = **PkDriveCurrent2**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM131260 = HP022260	
Comment	➢ If this limit is exceeded, the amplitude demand is reduced by 20%	

11.8.28 TC4K- PkDrivCurrent3-8007

TC Names	TC4K- PkDrivCurrent3-8007	HC031260
Function	Sets a third limit that applies to the "Peak drive bus current"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- PkDriveCurrent3: (HP023260) : Peak drive bus current limit N°3** • =[0 ; 12000] ➔ current limit (mA) = **PkDriveCurrent3**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM132260 = HP023260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.29 TC4K- CompADrvCPosPk -8007

TC Names	TC4K- CompADrvCPosPk -8007	HC032260
Function	Sets a limit that applies to the "Compressor A drive current positive peak"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompADrvCurNegPk: (HP024260) : Comp A drive current positive peak limit** • =[0 ; 12000] ➔ current limit (mA) = **CompADrvCurNegPk**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM137260 = HP024260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.30 TC4K- CompADrvCNegPk -8007

TC Names	TC4K- CompADrvCNegPk -8007	HC033260
Function	Sets a limit that applies to the "Compressor A drive current negative peak"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompADrvCurNegPk: (HP025260) : Comp A drive current negative peak limit** • =[0 ; 12000] ➔ current limit (mA) = **CompADrvCurNegPk**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM138260 = HP025260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.31 TC4K- CompBDrvCPosPk -8007

TC Names	TC4K- CompBDrvCPosPk -8007	HC034260
Function	Sets a limit that applies to the "Compressor B drive current positive peak"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompBDrvCurPosPk: (HP026260) : Comp B drive current positive peak limit** • =[0 ; 12000] ➔ current limit (mA) = **CompBDrvCurPosPk**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM139260 = HP026260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.32 TC4K- CompBDrvCNegPk -8007

TC Names	TC4K- CompBDrvCNegPk -8007	HC035260
Function	Sets a limit that applies to the "Compressor B drive current negative peak"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompBDrvCurNegPk: (HP027260) : Comp B drive current negative peak limit** • =[0 ; 12000] ➔ current limit (mA) = **CompBDrvCurNegPk**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM140260 = HP027260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.33 TC4K- CompAheadTemp1-8007

TC Names	TC4K- CompAheadTemp1-8007	HC036260
Function	Sets a first limit that applies to the "Compressor A head temperature"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompAHeadTemp1: (HP028260) : Compressor A head temperature limit N°1** • =[0 ; 100] ➔ Temperature limit (°C) = **CompAHeadTemp1**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM133260 = HP028260	
Comment	➢ If this limit is exceeded : a. "Frequency select for vibration cancellation" will be set to zero to prevent vibration cancellation taking place on any of the harmonic frequencies. This will prevent divergence of the driving waveform if the drive amplitude is reduced to a value that is not compatible with the present System Response Test mapping. b. The Demanded Drive Amplitude will be reduced by 10% to reduce the power input to the compressors in an attempt to bring the temperature below Limit 1. c. The Limit 1 action will be suspended for 10 minutes to give the compressors a chance to reduce in temperature with the new lower Amplitude Demand. d. After the above 10 minute suspension of Limit 1 action, checking of Limit 1 will again commence and the whole process b, c and d will be repeated should Limit 1 be exceeded	

11.8.34 TC4K- CompAheadTemp2-8007

TC Names	TC4K- CompAheadTemp2-8007	HC037260
Function	Sets a second limit that applies to the "Compressor A head temperature"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompAHeadTemp2: (HP029260) : Compressor A head temperature limit N°2** • =[0 ; 100] ➔ Temperature limit (°C) = **CompAHeadTemp2**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM134260 = HP029260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.35 TC4K- CompBheadTemp1-8007

TC Names	TC4K- CompBheadTemp1-8007	HC038260
Function	Sets a first limit that applies to the "Compressor B head temperature"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompBHeadTemp1: (HP030260) : Compressor B head temperature limit N°1** • =[0 ; 100] ➔ Temperature limit (°C) = **CompBHeadTemp1**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM135260 = HP030260	
Comment	➢ If this limit is exceeded : a. "Frequency select for vibration cancellation" will be set to zero to prevent vibration cancellation taking place on any of the harmonic frequencies. This will prevent divergence of the driving waveform if the drive amplitude is reduced to a value that is not compatible with the present System Response Test mapping. b. The Demanded Drive Amplitude will be reduced by 10% to reduce the power input to the compressors in an attempt to bring the temperature below Limit 1. c. The Limit 1 action will be suspended for 10 minutes to give the compressors a chance to reduce in temperature with the new lower Amplitude Demand. d. After the above 10 minute suspension of Limit 1 action, checking of Limit 1 will again commence and the whole process b, c and d will be repeated should Limit 1 be exceeded	

11.8.36 TC4K- CompBheadTemp2-8007

TC Names	TC4K- CompBheadTemp2-8007	HC039260
Function	Sets a second limit that applies to the "Compressor B head temperature"	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- CompBHeadTemp2: (HP031260) : Compressor B head temperature limit N°2** • =[0 ; 100] ➔ Temperature limit (°C) = **CompBHeadTemp2**	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ HM136260 = HP031260	
Comment	➢ If this limit is exceeded, the 4K returns automatically in STANDBY mode	

11.8.37 TC4K-LimitCtrl-8008

TC Names	TC4K-LimitCtrl-8008	HC040260
Function	Activate / desactivate the action associated to a 4K limit	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- LimitValuesID: (HP016260) :** • =1 ➔ All limits • =2 ➔ comp A positive displacement limit • =3 ➔ comp A negative displacement limit • =4 ➔ comp B pos displacement limit • =5 ➔ comp B neg displacement limit • =6 ➔ peak drive bus current limit 1 • =7 ➔ peak drive bus current limit 2 • =8 ➔ peak drive bus current limit 3 • =9 ➔ comp A drive current pos peak limit • =10 ➔ comp A drive current neg peak limit • =11 ➔ comp B drive current pos peak limit • =12 ➔ comp B drive current neg peak limit • =13 ➔ comp A head temp limit 1 • =14 ➔ comp A head temp limit 2 • =15 ➔ comp B head temp limit 1 • =16 ➔ comp B head temp limit 2 **- LimitOn_Off: (HP032260) :** • =0 ➔ Control of the limit is OFF • =1 ➔ Control of the limit is ON	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ corresponding limit control reported in HM220260 to HM236260 = HP032260	

11.8.38 TC4K- LimitAction -8009

TC Names	TC4K- LimitAction -8009	HC041260
Function	Modify the selected 4K limit control (warning or switch down)	
Prerequisite	DPU must be in STANDBY or CONFIGURATION mode 4K must be in STANDBY or NOMINAL mode	
MODE modification	DPU : NO REU : NO 4K : NO	
HFI telemetry packet modification	NO	
Parameters	**- LimitActionId: (HP033260) :** • =2 ➔ comp A positive displacement limit • =3 ➔ comp A negative displacement limit • =4 ➔ comp B pos displacement limit • =5 ➔ comp B neg displacement limit • =6 ➔ peak drive bus current limit 3 • =7 ➔ comp A drive current pos peak limit • =8 ➔ comp A drive current neg peak limit • =9 ➔ comp B drive current pos peak limit • =10 ➔ comp B drive current neg peak limit • =11 ➔ comp A head temp limit 2 • =12 ➔ comp B head temp limit 2 **- LimitAction: (HP034260) :** • =0 ➔ Action in case of limit exceed is Warning • =1 ➔ Action in case of limit exceed is Switchdown	
Success criteria check	➢ TM(1,1) and TM(1,7) ➢ corresponding limit control reported in HM237260 to HM253260 = HP034260	

11.9 Time Management (HC992240, HC999240)

When the DPU is switched on, the BSW starts and sets the LOBT counter according to the S/C OBT thanks to the value which is periodically transferred on the Mil-Std-1553B bus.
Therefore, all the packets sent by the BSW are time-tagged with the value maintained in this LOBT counter.
After having sent a TCDPU-StartASW-A00B, the BSW switches to the ASW and the value of the LOBT counter is maintained. But it is necessary to send an enable time synchronisation TCP(9,4) HC999240 (which has no parameter) to the ASW in order to resynchronise the LOBT counter with a better accuracy.
The error done by both BSW and ASW is the time between the frame synchronisation (each second) and the LOBT counter load:

BSW synchronisation error	400 µs
ASW synchronisation error	230 µs

Furthermore, it is possible to download the value of the LOBT counter in the TMP(9,9) thanks to the TCP(9,7) (which has no parameter).

To summarize the use of service 9:
When the DPU ASW reaches its STARTUP MODE, ground user shall enable the time synchronisation by use of TCP(9,4).
If needed, ground user can request a report from the DPU ASW LOBT counter by use of TCP(9,7) (and associated CDMU TCP(9,x)).

11.10 Test Service (HC996240)

This is the “no operation command” which checks only that the DPU ASW is able to accept the TCP(17,1) and answer with a TMP(1,1) and a TMP(17,2).

The normal execution of the TCP(17,1) proves only that the DPU ASW tasks associated to Mil-Std-1553B bus communication are alive.

A most adequate test is to send the sub-system dummy commands which demonstrates that:
- most of the DPU ASW tasks (except science ones) are alive
- the DPU exchanges data with REU, DCE and 4KCDE without error.

These TCP(8,4) are the following ones:
- TCREU-Hwtest-4024 with P01 = 0x40 (only in STARTUP and STANDBY)
- TCDCE-Dummy-6000 (in any mode except BOOT)
- TC4K-Dummy-8000 (in any mode except BOOT and STARTUP).

11.11 Memory Management

The service 6 allows loading (patch), dumping and checking the memory of the DPU, REU and 4KCDE.

11.11.1 Load, Dump and Check Structure

All the TCP(6,x) (see HP-PSICD) use the same fields:

MID coded on 8 bits which allows to identify any kind of memory in HFI,

Start Address coded on 24 bits which allows to identify where to begin the load/dump/check in the memory area identified by the MID,

Length in SAU (Smallest Address Unit = 48 bits, 32 bits or 16 bits) coded on 16 bits:

MID	Start Address	Length
8 bits	24 bits	16 bits

The Load, Dump, Check TC were define by ESOC for the OBSM tools in 3 words of 16 bits.

MID	Start Address	Length
8 bits MID + 8 bits of MSW Sarts Adresss	LSW of start Adress 16 bits	16 bits

The maximum value of the Length field and the packet size are summarized in next table according the SAU value:

Maximum value of \ SAU	SAU = 16 bits	SAU = 32 bits	SAU = 48 bits
TCP(6,2) Length field (SAU)	101	50	33
TCP(6,2) size (16 bits word)	117	116	115
TMP(6,6) Length field (SAU)	497	248	165
TMP(6,6) size (16 bits word)	519	518	517

11.11.2 HFI Memories patch and dump

The HFI memories characteristics are given in the following table (see also §9)

Name	MID	SAU (bits)	Size (bits)	Bus	Max TCP(6,2) Length (SAU)	Max TMP(6,6) Length (SAU)
HFI REU PROM	40h	48	32k x 48	PM	-	165
HFI REU PRAM	41h	48	128k x 48	PM	33	165
HFI REU DRAM	42h	32	128k x 32	DM	50	248
HFI REU EEPROM	43h	32	128k x 32	DM	50	248
HFI 4KCDE PROM	84h	48	32k x 8	PM	-	STARTUP: 165 – OTHERS: 42
HFI 4KCDE PRAM	86h	48	512k x 48	PM	33	STARTUP: 165 – OTHERS: 42
HFI 4KCDE DRAM	80h	32	512k x 32	DM	50	STARTUP: 248 – OTHERS: 64
HFI 4KCDE EEPROM	85h	32	256k x 32	PM	50	STARTUP: 248 – OTHERS: 64
HFI Dual Port RAM	82h	16	8k x 16	DM	101	STARTUP: 497 – OTHERS: 64
HFI 4KCDE Processor Support FPGA Registers	81h	32	17 x 32	DM	50	STARTUP: 248 – OTHERS: 64
HFI 4KCDE Cooler Interface FPGA Registers	83h	32	19 x 32	DM	50	STARTUP: 248 – OTHERS: 64
HFI DPU PROM	3Eh	48	32k x 48	PM	-	165
HFI DPU PRAM	3Fh	48	128k x 48	PM	33	165
HFI DPU DRAM	3Dh	32	128k x 32	DM	50	248
HFI DPU EEPROM	39h	32	512k x 32	DM	50	248
HFI DPU 1553 DRAM	3Bh	16	16k x 16	DM	-	497
HFI DPU 1553 Register	3Ch	32	24 x 32	DM	-	248
HFI DPU FPGA Register	3Ah	32	148 x 32	DM	50	248

REU :

The patch and dump must be done when the DPU is in STARTUP mode and the REU in BOOT mode ONLY.
Only the HFI REU PRAM (41h), HFI REU DRAM (42h) and HFI REU EEPROM (43h) may need to be patched.

DPU :

The HFI DPU PRAM (3Fh) may need to be patched or dumped when the DPU is in BOOT mode only.

The HFI DPU DRAM (3Dh) and the HFI DPU EEPROM (39h) may need to be patched or dumped when the DPU is in BOOT mode or in STARTUP mode only

4K :

The HFI 4K EEPROM (85h) may need to be patched or dumped when the DPU is in STARTUP mode and the 4K is in BOOT mode only.

The HFI 4K DRAM (80h) and the HFI 4K PRAM (86h) may need to be patched or dumped when the DPU is in 4K_MAINTENANC mode and the 4K is in MAINTENANCE mode only

The HFI 4K PROC FPGA (81h) and the HFI 4K COOL FPGA (83h) may need to be dumped when the DPU is in 4K_MAINTENANC mode and the 4K is in MAINTENANCE mode only (no patch for these memories).

Following table indicates in which modes HFI different memories can be patched, checked or dumped.

Mode	ME/DPU	BOOT	STARTUP	STARTUP	STANDBY	STANDBY	CONFIG.	OBSERV.
Mode	REU	OFF or BOOT	BOOT	BOOT	STANDBY	STANDBY	CONFIG.	OBSERV.
Mode	4KCDE	OFF or NOMINAL	BOOT	NOMINAL	FREEWHEEL	STANDBY	Whatever mode	Whatever mode
TCP(6,x) Type	Memory Type							
Patch	REU PRAM							
Patch	REU DRAM							
Patch	REU EEPROM							
Patch	4KCDE PRAM							
Patch	4KCDE DRAM							
Patch	4KCDE EEPROM							
Patch	Dual Port RAM							
Patch	4KCDE PSF Registers							
Patch	4KCDE CIF Registers							
Patch	DPU PRAM							
Patch	DPU DRAM							
Patch	DPU EEPROM							
Patch	DPU 1553 DRAM							
Patch	DPU FPGA Register							
Check	REU PROM							
Check	REU PRAM							
Check	REU DRAM							
Check	REU EEPROM							
Check	DPU PROM							
Check	DPU PRAM							
Check	DPU DRAM							
Check	DPU EEPROM							
Check	DPU 1553 DRAM							
Check	DPU 1553 Register							
Check	DPU FPGA Register							

Mode	ME/DPU	BOOT	STARTUP	STANDBY	STANDBY	CONFIG.	OBSERV.
Mode	REU	OFF	BOOT	STANDBY	STANDBY	CONFIG.	OBSERV.
Mode	4KCDE	OFF	BOOT	FREEWHEEL	STANDBY	Whatever mode	Whatever mode
TCP(6,x) Type	Memory Type						
Dump	REU PROM						
Dump	REU PRAM						
Dump	REU DRAM						
Dump	REU EEPROM						
Dump	4KCDE PROM						
Dump	4KCDE PRAM						
Dump	4KCDE DRAM						
Dump	4KCDE EEPROM						
Dump	Dual Port RAM						
Dump	4KCDE PSF Registers						
Dump	4KCDE CIF Registers						
Dump	DPU PROM						
Dump	DPU PRAM						
Dump	DPU DRAM						
Dump	DPU EEPROM						
Dump	DPU 1553 DRAM						
Dump	DPU 1553 Register						
Dump	DPU FPGA Register						

Mode	ME/DPU	4K Cooler Maintenance	Hot 4K Cooler Maintenance	Without Compression	Compression Validation	Raw Signal	Optimisation	VI
Mode	REU	STANDBY	STANDBY	CONFIG.	CONFIG.	CONFIG.	CONFIG.	CONFIG.
Mode	4KCDE	Maintenance	Maintenance	Whatever mode	Whatever mode	Whatever mode	Whatever mode	Whatever mode
TCP(6,x) Type	Memory Type							
Patch	REU PRAM							
Patch	REU DRAM							
Patch	REU EEPROM							
Patch	4KCDE PRAM							
Patch	4KCDE DRAM							
Patch	4KCDE EEPROM							
Patch	Dual Port RAM							
Patch	4KCDE PSF Registers							
Patch	4KCDE CIF Registers							
Patch	DPU PRAM							
Patch	DPU DRAM							
Patch	DPU EEPROM							
Patch	DPU 1553 DRAM							
Patch	DPU FPGA Register							
Check	REU PROM							
Check	REU PRAM							
Check	REU DRAM							
Check	REU EEPROM							
Check	DPU PROM							
Check	DPU PRAM							
Check	DPU DRAM							
Check	DPU EEPROM							
Check	DPU 1553 DRAM							
Check	DPU 1553 Register							
Check	DPU FPGA Register							
Dump	REU PROM							
Dump	REU PRAM							
Dump	REU DRAM							
Dump	REU EEPROM							
Dump	4KCDE PROM							
Dump	4KCDE PRAM							
Dump	4KCDE DRAM							
Dump	4KCDE EEPROM							
Dump	Dual Port RAM							
Dump	4KCDE PSF Registers							
Dump	4KCDE CIF Registers							
Dump	DPU PROM							
Dump	DPU PRAM							
Dump	DPU DRAM							
Dump	DPU EEPROM							
Dump	DPU 1553 DRAM							
Dump	DPU 1553 Register							
Dump	DPU FPGA Register							

11.11.3 Memory Load for a new DPU ASW

On board software are delivered as images which format fits the EGSE 3.1 OBSM tool.
Naming convention for the Images :
HFDPEEDM_XXXXYYY_PAT_YYYY_DDDThhmmss.IMG
XXXXYYY: description (DPU,CONF,version)
YYYY year
DDD julian day
T fixe field separator
hhmmss is hour, min, sec.
~~ASW is delivered in the form of three stacks of TC which could be sent by EGSE (SCOS 3.1, HP-CCS or later) with MIB PFM or later. The Memory Images (usable by OBSM see [RD2]) corresponding to the software to patch would be delivered too.~~

~~The file corresponding to the ASW code is designed under the name~~
~~HFDPEEDM_Patch_ASW_FM_NNNN_XXXXX_tt~~

~~The two files corresponding to the ASW configuration are designed under the name:~~
~~HFDPEEDM_Patch_EEPROM_Conf0_NNNN_tt~~
~~HFDPEEDM_Patch_EEPROM_Conf1_NNNN_tt~~

~~where NNNN represents the numerical identification of the ASW version and XXXXX represents the start address (in Hexa) in the EEPROM of the ASW code.~~

~~The corresponding Memory Images are named:~~
~~ASW_FM_NNNN_XXXXXX.IMG~~
~~EEPROM_Conf0_NNNN.IMG~~
~~EEPROM_Conf1_NNNN.IMG~~

Entry condition: Identified need to update/reload DPU ASW or DPU corrupted EEPROM
Prerequisite: HFI DPU must be in BOOT mode and generates Diag1 packets.
Purpose duration: ~30min
Result : HFI DPU is in “STARTUP” mode with updated DPU ASW in EEPROM

The DPU must be put in BOOT mode with the following procedure, depending of the HFI initial configuration :

- HFI is OFF :
  - Power ON the nominal or redundant DPU LCL. Do not power ON the others HFI LCL’s (4KCDE , 4K drive, REU processor and analog belts and DCE)
  - Wait for 3 diag1
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)

- HFI is ON with the 4K running and need to be kept running to produce cryocooling:
  - Put the DPU/REU in CONFIGURATION mode (if it is in OBSERVATION): HC006289 (TCOBSW-Config).

- Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)
~~- Send a 4K software reset command: HC012260 (TC4K-Reset).~~
- Send a REU software reset command: HC000280 (TCREU-Reset).
- Send a DPU Software reset command: HC191250 (TCDPU-SwReset)

- HFI is ON and the 4K can be stopped:
  - Put the DPU/REU in CONFIGURATION mode (if it is in OBSERVATION): HC006289 (TCOBSW-Config).
  - Put HFI in STANDBY mode: HC005289 (TCOBSW-StandbyRet).
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)
  - WAIT 2mn
  - Switch OFF HFI using the HFI switch OFF procedure
  - Power ON the nominal or redundant DPU LCL. Do not power ON the others HFI LCL's (4KCDE , 4K drive, REU processor and analog belts and the DCE)
  - Wait for 3 diag1

Then,

Step ID	Operation description	Command procedure script	Duration	Pass/fail Criteria
1	Load the stack of TC for upload the new ASW execute it	Rate of 1 TC/s max (~2519TC)	42 min	TM(1,7) for ALL TC's
2	Send the TCDPU-DEEPROMtest	HC196250	1 s	TM (1,7)
3	Check TM parameters MMTxx-EEPROM set to 0 (xx from 000 to 127)		1 mn	HM019250 to HM146250 set to 0
3a	Desable the FDIR SAT			
4	Load of Conf parameters ; See the different options described after			
5	Execute the command TCDPU-LoadASW	HC193250	1 s	TM (1,7)
6	Execute the command TCDPU-StartASW	HC201250	1 s	TM (1,7)
7	Wait for 4 TM (3,26,2) Diag 2		4 min	Diag2 production.
7a	Enable the FDIR SAT			
8	Time synchro TC(9,3)			TM (1,7)
9	Time verif TC(9,6)			TM (1,7) + Delta time is in spec

~~In the case "HFI is ON with the 4K running and need to be kept running to produce cryocooling" the 4K cooler should be in FREEWEEL mode after the completion of step 5. The 4 K must be reconfigured using standard procedure to be put in NOMINAL running mode with VCS ON, etc.~~

Load of the Conf parameters options :

If the complete table of configuration parameters are loaded, all the defaults values of Compression parameters are loaded so the users parameters saved by the TC HC205250 (TCDPU-SaveParam-A00E) are lost. It is however possible to load a part of the configuration parameters.

Option 1 : Load all the Conf parameters

Used to change the all the parameters stored in EEPROM.

4a	Load the 2 stack of TC for upload the new conf parameters		10s	TM (1,7) for ALL TC's Check Software version HM361240 is as expected Check Start Adress HM415250 is as expected
4b	Send the TC TCDPU-DEEPROM-TEST	HC196250	1s	TM(1,7)
4c	Check TM parameters parameters MMTxx-EEPROM set to 0			HM019250 to HM146250 set to 0 in HA034250,HA035250, HA036350

Option 2 : Load a part of the Conf parameters

In case of a load of a new ASW , if only the version of the ASW and the start address need to be changed only a part of the conf table should be loaded..

The address range for

Conf 0 is from 0x3ED00 to 0x3F300

Conf 1 is from 0x7F200 to 0x7F300

4a	Load the stack of TC for the Conf 0. Send only the TC number 1,2,3,4. Delete the others. Load the Stack of TC of the Conf1. Send only the 1st TC.		10s	TM (1,7) for ALL TC's Check Software version HM361240 is as expected Check Start Adress HM415250 is as expected
4b	Send the TC TCDPU-EEPROM-TEST	HC196250	1s	TM(1,7)
4c	Check TM parameters parameters MMTxx-EEPROM set to 0			HM019250 to HM146250 set to 0 in HA034250,HA035250, HA036350

11.11.4 Memory Load for a new REU ASW

On board software are delivered as images which format fits the EGSE 3.1 OBSM tool.
Naming convention for the Images :
HFREEEPG _XXXXYYY_PAT_YYYY_DDDThhmmss.IMG
XXXXYYY: description (REU,CONF,version)
YYYY year
DDD julian day
T fixe field separator
hhmmss is hour, min, sec.

Entry condition: Identified need to update/reload REU ASW or REU corrupted EEPROM
Prerequisite: HFI DPU must be in STARTUP mode and the REU must be in BOOT
Purpose duration: ~10min
Result : HFI DPU, REU and 4K are in “STANDBY” mode with updated REU ASW in EEPROM and RAM

The DPU must be put in STARTUP mode and the REU must be put in BOOT mode with the following procedure, depending of the HFI initial configuration:

- HFI is OFF :
  - Power ON the nominal or redundant DPU LCL.
  - Power ON the nominal or redundant REU Processor belt LCL.
  - Power ON the nominal or redundant 4KCDE LCL.
  - Power ON the nominal DCE LCL.
  - Do not power ON the others HFI LCL’s (4K drive and REU analog belts)
  - Wait for 3 diag1
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)
  - Execute the command HC193250 (TCDPU-LoadASW) and check the reception of TM(1,7)
  - Execute the command HC201250 (TCDPU-StartASW), check the reception of TM(1,7) and check the reception of diag2 packet (4 at least).

- HFI is ON with the 4K running and need to be kept running to produce cryocooling:
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)
  - Send a REU software reset command: HC000280 (TCREU-Reset).
  - Send a DPU Software reset command: HC191250 (TCDPU-SwReset)
  - ~~Send a STARTUP return command: HC003289 (TCOBSW-StartupRet).~~
  - disable the satellite FDIR
  - Execute the command HC193250 (TCDPU-LoadASW) and check the reception of TM(1,7)
  - Execute the command HC201250 (TCDPU-StartASW), check the reception of TM(1,7) and check the reception of diag2 packet (4 at least).
  - Enable the satellite FDIR
  - Send the Time synchro TC(9,3) command, check the reception of TM(1,7)

- Send the Time verif TC(9,6) command, check the reception of TM(1,7) and the delta time

- HFI is ON and the 4K can be stopped:
  - Put the DPU/REU in CONFIGURATION mode (if it is in OBSERVATION): HC006289 (TCOBSW-Config).
  - Put HFI in STANDBY mode: HC005289 (TCOBSW-StandbyRet).
  - WAIT 2mn
  - Switch OFF HFI using the satellite procedure
  - Switch ON HFI using the nominal switch ON procedure up to the DPU in STARTUP and the REU and the 4K in BOOT mode
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)

  ~~- Power ON the nominal or redundant DPU LCL.~~
  ~~- Power ON the nominal or redundant REU Processor belt LCL.~~
  ~~- Power ON the nominal or redundant 4KCDE LCL.~~
  ~~- Power ON the nominal DCE LCL.~~
  ~~- Do not power ON the others HFI LCL's (4K drive and REU analog belts)~~
  ~~- Wait for 3 diag1~~
  ~~- disable the satellite FDIR~~
  ~~- Execute the command HC193250 (TCDPU-LoadASW) and check the reception of TM(1,7)~~
  ~~- Execute the command HC201250 (TCDPU-StartASW), check the reception of TM(1,7) and check the reception of diag2 packet (4 at least).~~

Step ID	Operation description	Command procedure script	Duration	Pass/fail Criteria
1	Load the stack of TC for upload the new ASW execute it	Rate of 1 TC every 2 sec max (~768 TC)	25 min	TM (1,7) for ALL TC
2	Send TCREU-Hwtest-4024 With param = 0x43 (EEPROM)	HC003280	5 s	TM(1,7)
3	Wait the next TM(3,26,2) :Diag 2		1 min	
4	Check Status 2 RSw02-ErrorSt		1 s	HM346280 bit set to 0
5	Send the TC go to TCOBSW-Standby	HC004289	1 s	TM (1,7)

~~In the case "HFI is ON with the 4K running and need to be kept running to produce cryocooling" the 4K cooler should be in FREEWEEL mode after the completion of step 5. The 4 K must be reconfigured using standard procedure to be put in NOMINAL running mode with VCS ON, etc.~~

11.11.5 Memory Load for a new 4K ASW

On board software are delivered as images which format fits the EGSE 3.1 OBSM tool.
Naming convention for the Images :
HF_4_EEP _XXXXYYY_PAT_YYYY_DDDThhmmss.IMG
XXXXYYY: description (4CDE,CONF,version)
YYYY year
DDD julian day
T fixe field separator
hhmmss is hour, min, sec.

Entry condition: Identified need ti update/reload 4K ASW or 4K corrupted EEPROM
Prerequisite: HFI DPU must be in STARTUP mode and the 4K must be in BOOT
Purpose duration: ~10min
Result : HFI DPU, REU and 4K is in “STANDBY” mode with updated 4KCDE ASW in EEPROM and RAM

The DPU must be put in STARTUP mode and the 4K must be put in BOOT mode with the following procedure, depending of the HFI initial configuration:

- HFI is OFF :
  - Switch ON HFI using the nominal switch ON procedure up to the DPU in STARTUP and the REU and the 4K in BOOT mode
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)

  ~~- Power ON the nominal or redundant DPU LCL.~~
  ~~- Power ON the nominal or redundant REU Processor belt LCL.~~
  ~~- Power ON the nominal or redundant 4KCDE LCL.~~
  ~~- Power ON the nominal DCE LCL.~~
  ~~- Do not power ON the others HFI LCL’s (4K drive and REU analog belts)~~
  ~~- Wait for 3 diag1~~
  ~~- Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)~~
  ~~- Execute the command HC193250 (TCDPU LoadASW) and check the reception of TM(1,7)~~
  ~~- Execute the command HC201250 (TCDPU-StartASW), check the reception of TM(1,7) and check the reception of diag2 packet (4 at least).~~

- HFI is ON with the 4K running and need to be kept running to produce cryocooling:
  - Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)
  - Send a STARTUP return command: HC003289 (TCOBSW-StartupRet).

- HFI is ON and the 4K can be stopped:
  - Put the DPU/REU in CONFIGURATION mode (if it is in OBSERVATION): HC006289 (TCOBSW-Config).

- Put HFI in STANDBY mode: HC005289 (TCOBSW-StandbyRet).
- WAIT 2mn
- Switch OFF HFI using the satellite procedure
- Switch ON HFI using the nominal switch ON procedure up to the DPU in STARTUP and the REU and the 4K in BOOT mode
- Change the DPU FDIR mode to De-synchronisation if the DPU FDIR mode is in DPU AUTO or HFI AUTO : HC192250 (TCDPU-FDIRmode) with HP363250 set to De-synchronisation (3)
- ~~Power ON the nominal or redundant DPU LCL.~~
- ~~Power ON the nominal or redundant REU Processor belt LCL.~~
- ~~Power ON the nominal or redundant 4KCDE LCL.~~
- ~~Power ON the nominal DCE LCL.~~
- ~~Do not power ON the others HFI LCL's (4K drive and REU analog belts)~~
- ~~Wait for 3 diag1~~
- ~~Execute the command HC193250 (TCDPU-LoadASW) and check the reception of TM(1,7)~~
- ~~Execute the command HC201250 (TCDPU-StartASW), check the reception of TM(1,7) and check the reception of diag2 packet (4 at least).~~

Step ID	Operation description	Command procedure script	Duration	Pass/fail Criteria
1	Load the stack of TC for upload the new ASW execute it	Rate of 1 TC every 2 sec max(~463TC)	15 min	TM (1,7) for ALL TC's
3	Send the TC TCOBSW-Standby	HC004289	1 s	TM (1,7) Wait 1mn Check that 4K boot status (HM156260) is <5 Check that 4K boot error (HM157260) is set at 0

~~In the case "HFI is ON with the 4K running and need to be kept running to produce cryocooling" the 4K cooler should be in FREEWEEL mode after the completion of step 5. The 4 K must be reconfigured using standard procedure to be put in NOMINAL running mode with VCS ON, etc.~~

See document LI-PHDC-000014-SEA (Planck HFI 4KCDE TM/TC List) and UM-PHDC-000056-SEA 4KCDE OBSW SUM for more precision.
Note that due to DPU constrainst, the DPU always ask to the 4K to dump 64 SAU's whatever mode the 4K is.

HFI OPERATIONS PROCEDURES

11.12 ELEMENTARY PRODEDURES

The list of the flifht procedures, the ones used nominaly or in case of contingency and the controversial procedures during the nominal operation phase are given in the following table:

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
HFI					
NMON_HFI_NOMINAL_SWITCH_ON	POWER ON the DPU, REU, 4K and the DCE nominal LCL's	NO	NOM	NRB	To be used in case of MAJOR HFI or Satellite anomaly following NRB
RMON_HFI_REDUNDANT_SWITCH_ON	POWER ON the DPU, REU, 4K and the DCE redundant LCL's	NO	NOM	NRB	To be used in case of MAJOR HFI or Satellite anomaly following NRB
NMOF_HFI_NOMINAL_SWITCH_OFF	POWER OFF the DPU, REU, 4K and the DCE nominal LCL's	NO	NOM	NRB	To be used in case of MAJOR HFI anomaly
RMOF_HFI_REDUNDANT_SWITCH_OFF	POWER OFF the DPU, REU, 4K and the DCE redundant LCL's	NO	NOM	NRB	To be used in case of MAJOR HFI anomaly
EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	POWER ON ONE REU ANALOG BELT LCL (2 REU ANALOG belts)	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
EBOF_HFI_SWITCH_OFF_ONE_REU_ANA_BELT	POWER OFF ONE REU ANALOG BELT LCL (2 REU ANALOG belts)	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test
HFI_NOMINAL_SWITCH_ON_FLIGHT_FIRST	POWER ON the DPU, the REU processor only, the 4K and the DCE nominal LCL's for the first flight switch ON	NO	NOM	NO	Used only during the first switch ON at T0+10h
TBDMOC_HFI_DPU_NOMINAL_RESTART	POWER OFF the DPU nominal and restart it	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test
TBDMOC_HFI_DPU_REDUNDANT_RESTART	POWER OFF the DPU redundant and restart it	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test
TBDMOC_HFI_DPU_NOMINAL_RESTART	POWER OFF the REU processor nominal and restart it	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test
TBDMOC_HFI_DPU_REDUNDANT_RESTART	POWER OFF the REU processor redundant and restart it	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
DPU					
NMON_HFI_BOOT_TO_STARTUP	Put DPU from BOOT to STARTUP mode using defaulft DPU ASW start adress writen in the EEPROM	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
NOTC_HFI_BOOT_TO_STARTUP_WITH_ADRESS	Put DPU from BOOT to STARTUP mode using user defined DPU ASW start adress (0x00000, 0x20000, 0x40000, 0x60000)	PARAM	CONT	NO	Not tested at CSL but idem NMON_HFI_BOOT_TO_STARTUP
NTSN_HFI_STARTUP_TO_STANDBY	Put the DPU from STARTUP to STANDBY mode; PUT the 4K and the REU from BOOT to STANDBY mode	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
NXCN_HFI_GOTO_CONFIG	Put the DPU and the REU in CONFIGURATION from ANY modes around CONFIGURATION mode	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCON_HFI_GOTO_OBSERVATION	Put the DPU and the REU in OBSERVATION from CONFIGURATION mode	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCPN_HFI_GOTO_OPTIMISATION	Perform the OPTIMIZATION of the selected channels	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCVN_HFI_GOTO_VI	Perform the VI measurement of the selected channels	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCRN_HFI_GOTO_RAW_SIGNAL	Put the DPU into RAWSIGNAL_MODE from CONFIGURATION mode	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCWN_HFI_GOTO_WITHOUT_COMPRESS	Put DPU in WITHOUT_COMPR from CONFIGURATION mode	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCCN_HFI_GOTO_COMPRESS_VALID	Put DPU in COMP_VALID from CONFIGURATION mode	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
NCSF_HFI_STANDBY_RETURN	Put the DPU and the REU into STANDBY from CONFIGURATION mode; Put the 4K into STANDBY from NOMINAL or FREEWHEEL mode	NO	NOM	NRB	To be applied in case of MAJOR HFI anomaly. The 4K cooling will be stopped
NXTF_HFI_STARTUP_RETURN	Put the DPU into STARTUP mode, the REU and the 4K into BOOT mode from any DPU mode and from any 4K, REU mode	NO	CONT	NRB	To be applied in case of MAJOR HFI anomaly (reboot the 4Kk and the REU)
PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	Setup the compression param. and the channels to be download of ALL channels of belts 0 to 5	TPF	NOM	YES under condition	YES if this leads to increase the HFI datarate above the HFI allocation (this will be determined by HFI); NO otherwise
PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	Configure the compression param. and the channels to be download of ALL channels of belts 6 to B	TPF	NOM		
PEOS_HFI_END_OF_SLEW	Activate the HFI packet production limitation (duration and quantity)	PARAM	NOM	NO	Internal HFI DPU software configuration
PFDR_HFI_FDIR_SETUP	Setup the HFI FDIR parameter	PARAM	NOM	NO	Internal HFI DPU software configuration
PCSS_HFI_DPU_COMPRESS_SLICE_SIZE_SETUP	Setup the Compression Slice Size parameter	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
PSWR_HFI_DPU_SW_RESET	Do a DPU software reset	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test
PDSA_HFI_DPU_ASW_DEFINE_START_ADRESS	Define the DPU ASW default start adress (among 0x00000, 0x20000, 0x40000, 0x60000)	PARAM	CONT	NO	Internal HFI DPU software configuration
PPPT_HFI_DPU_PPROM_TEST	Do a DPU PROM hardware test	NO	CONT	NO	Internal HFI DPU test
PEPT_HFI_DPU_EEPROM_TEST	Do a DPU EEPROM hardware test	NO	CONT	NO	Internal HFI DPU test
PPST_HFI_DPU_PSRAM_TEST	Do a DPU PSRAM hardware test	NO	CONT	NO	Internal HFI DPU test
PDST_HFI_DPU_DSRAM_TEST	Do a DPU DSRAM hardware test	NO	CONT	NO	Internal HFI DPU test
PFPT_HFI_DPU_FPGA_TEST	Do a DPU FPGA hardware test	NO	CONT	NO	Internal HFI DPU test
PPAS_HFI_DPU_PARAM_STORE	Modify the DPU EEPROM STORE parameters area (INITIAL or LOADED part) to be used during the DPU save parameter procedure or the DPU startup	PARAM	CONT	NO	Internal HFI DPU software configuration
PPAV_HFI_DPU_PARAM_SAVE	Save the DPU parameters in EEPROM in INITIAL or LOADED part define by word 0x3EE00 of the DPU EEPROM	NO	NOM	NO	Internal HFI DPU software configuration
PGLA_HFI_DPU_GLITCH_ALGO	Enable / disable the DPU glitch algorythm	PARAM	NOM	NO	Internal HFI DPU software configuration
PHEE_HFI_DPU_HK_EMISSION_ENABLE	Enable the HFI production of selected telemetry type	PARAM	CONT	NO	NO impact on LFI as demonstrated during CSL test
PHED_HFI_DPU_HK_EMISSION_DISABLE	Disable the HFI production of selected telemetry type	PARAM	CONT	NO	NO impact on LFI as demonstrated during CSL test
PWDS_HFI_DPU_WATCHDOG_SETUP	Setup the DPU watchdog	PARAM	CONT	NO	Internal HFI DPU software configuration
PCMT_HFI_DPU_COM_TEST	Test the PDU	NO	CONT	NO	Internal HFI DPU test
~~HFI_STANDBY_TO_4K_MAINTENANCE~~	~~Put the DPU and the 4K from STANDBY to 4K MAINTENANCE mode~~	NO	CONT	NO	
~~HFI_4K_MAINTENANCE_TO_STANDBY~~	~~Put the DPU and the 4K from 4K MAINTENANCE to STANDBY mode~~	NO	CONT	NO	

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
REU					
ENSF_HFI_REU_NS_FDIV_SETUP	Sets the number of sample per half period (Ns) and the Frequency divisor for the modulation and the 4K frequency (Fdiv)	PARAM	NOM	NRB	The modification of the 4K frequency during operationnal phase is not nominal and this need to be taken during NRB taking into account the strong impacts on the 4K.
EJXP_HFI_JFET_SETUP	Setup and control one JFET PID heaters among the 12 JFTET PID's	TPF	NOM	NO	NO impact on LFI as demonstrated during CSL test
CPxx_HFI_PID_SETUP	Setup and control one HFI focal plane PID among : 4K/1.6K switch ; 4K plate ; 1.6K plate ; BOLO plate ; 0.1K Dilution plate	TPF	NOM	YES for PID 4K ONLY	YES for PID 4K : The 4K PID parameters will be changed only in case of non respect of the 4K temperature stability requirement NO for PID 1.6K, DILU and BOLO : NO impact on LFI as demonstrated during CSL test The PID 4K/1.6K will not be used
ECHS_HFI_CHANNEL_SETUP	Setup the configuration parameters of one channel among the 72 focal plane channels or of all the channels	TPF	NOM	YES for 4K PID thermo ONLY	YES for channel 95 (PID 4K nominal active) or B3 (PID 4K redundant active) : The 4K temperature setpoint will be changed only in case of PID 4K high or low saturation (then to recover 4K lost stability) NO for others channels : NO impact on LFI as demonstrated during CSL test
EOPC_HFI_OPTIM_CONFIG	Sets the Optimisation parameters of a single selected channel used during the Optimisation and the VI	TPF	NOM	NO	NO impact on LFI as demonstrated during CSL test
EVIC_HFI_VI_CONFIG	Sets the VI parameters applied to all detection channels during VI_MEASUREMENT	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	Select the list of FPU channels which shall be processed by the next VIs or Optimisations in case the TCOBSW-Optim-0014 or TCOBSW-VI-0015 are sent in indicating that the REU OBSW shall use this list	TPF	NOM	NO	NO impact on LFI as demonstrated during CSL test
ECXS_HFI_CERNOX_SETUP	Sets the electrical parameters of one Cernox thermistor	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
ECXC_HFI_CERNOX_CONTROL	Define the Cernox Thermometers to be activated	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
ERSS_HFI_REU_RAWSIGNAL_SETUP	Sets how the raw signal channel is selected by the REU at each modulation period (Cycle, Fixed, Fixed, CS)	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test

NAME	Description	Param or TPF	Nominal / Contin g	Controv . or need NRB in Nominal Oper. phase	Comment / justification
EECS_HFI_REU_SAVE_CONF_EEPROM	Save the configuration parameters of the 72 channels into the REU EEPROM	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
EECL_HFI_REU_LOAD_CONF_EEPROM	Configures the 72 channels with the configuration parameters stored in EEPROM.	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
ESWR_HFI_REU_SW_RESET	Do a REU software reset	NO	CONT	NO	NO impact on LFI as demonstrated during CSL test
EHWT_HFI_REU_HARDWARE_TEST	Do REU hardware tests	PARAM	CONT	NO	NO impact on LFI as demonstrated during CSL test
EMEM_HFI_REU_COPY_MEMORY	Copy a REU memory block from a source address to a target address	PARAM	CONT	NO	Internal HFI REU software configuration
EASW_HFI_REU_COPY_ASW	Copy the REU ASW from EEPROM to PRAM	NO	CONT	NO	Internal HFI REU software configuration
HFI_REU_FPGA_RESET	Reset the REU analog belts	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
DCE					
DVOP_HFI_DCE_VALVE_OPEN	OPEN a selected dilution valve	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
DVCL_HFI_DCE_VALVE_CLOSE	CLOSE a selected dilution valve	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
DDHC_HFI_DCE_DEFROST_HEATER_CONTROL	Setup and control one dilution defrost heater or the 4K/18K thermal switch (N or R)	PARAM	CONT	NRB	Defrost of the dilution must be decided during NRB
DDCT_HFI_DCE_COM_TEST	Test the DCE LSL communication with DPU	NO	CONT	NO	Internal HFI DCE test

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
4K					
4FIT_HFI_4K_FREQ_INT_SETUP	Sets the 4K internal frequency	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
4MAS_HFI_4K_MAX_AMPLITUDE_SETUP	Sets the 4K MAXIMUM amplitude demand limit	PARAM	NOM	NO	Internal HFI 4K software configuration
4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	Sets the 4K amplitude demand	PARAM	NOM	YES	The 4K amplitude will be changed (increase) only in case of the PID 4K power comes to 0mW in order to increase the 4K cooling power to recover 4K temperature stability for the 4K selected temperature setpoint. This need to do a 4K System Response Test. Trade off between changing the 4K amplitude or increasing the 4K temperature setpoint must be done.
4LMS_HFI_4K_LIMITS_SETUP	Sets the 4K limits (temperature, intensity and stroke)	PARAM	NOM	NO	Internal HFI 4K software configuration
4LMC_HFI_4K_LIMITS_CONTROL	Activate / desactivate the action associated to a 4K limit	PARAM	CONT	NO	Internal HFI 4K software configuration
4LMA_HFI_4K_LIMITS_ACTION	Modify the selected 4K limit control (warning or switch down)	PARAM	CONT	NO	Internal HFI 4K software configuration
4EFL_HFI_4K_FREQ_EXT_LIMITS_SETUP	Sets the 4K external frequencies limit paramers	PARAM	NOM	NO	Internal HFI 4K software configuration
4GES_HFI_4K_GETTER_SELECT	Select the 4K getter (nominal, redundant, both)	PARAM	NOM	NO	Internal HFI 4K software configuration
4GEC_HFI_4K_GETTER_CONTROL	POWER ON or OFF the all the 4K getter heaters	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
4JTH_HFI_4K_JT_HEATER_CONTROL	POWER ON or OFF the 4K JT heater	PARAM	NOM	NRB	Defrost of the 4K must be decided during NRB
4SYS_HFI_4K_SYNCHRO_SELECT	Select the 4K syncronisation frequency (4K : internal or REU : external)	PARAM	NOM	NO	Internal HFI 4K software configuration
4FTS_HFI_4K_VCS_FORCE_TRANSDUCER_SELECT	Select the force transducer to be taken into account for the 4K Vibration Cancelletion System	PARAM	NOM	NO	Internal HFI 4K software configuration
4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT	Select the harmonic forces to be taken into account for the 4K Vibration Cancelletion System	PARAM	NOM	NO	Internal HFI 4K software configuration
4VCS_HFI_4K_VCS_CONTROL	Activate / deactivate the 4K Vibration Cancellation System	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
4COR_HFI_4K_RUN_COOLER	START the 4K cooler compressors running	NO	NOM	NO	Nominal continuation in case of 4K stopcoler (submited to NRB). **In case of 4K autonomous switch down, after the analisys of the data, if HFI requires to restart the cooler, this must be done ASAP by MOC without need of NRB (NRB will be convocated later)**
4COS_HFI_4K_STOP_COOLER	STOP running the 4K cooler compressors	NO	NOM	NRB	Linked to 4K frequency change
~~4SRS_HFI_4K_DO_SRT_FROM_STANDBY~~	~~Do a 4K System Response Test from 4K in STANDBY mode~~				
4SRN_HFI_4K_DO_SRT_IN_NOMINAL	Do a 4K System Response Test from 4K in NOMINAL mode	NO	NOM	YES	This will perturbate strongly the 4K temperature stability during one hour
4SRC_HFI_4K_CANCEL_SRT	Cancel the execution of a 4K System Response Test	NO	NA	NA	Not used in flight
4SWR_HFI_4K_SW_RESET	Do a 4KCDE software reset	NO	CONT	NRB	Major 4K anomaly. To be decided in NRB
4COB_HFI_4K_CONTINUE_BOOT	Send to the 4K continue boot command to go into STANDBY or FREEWHEEL mode	NO	CONT	NO	Nominal continuation in case of 4K sofware reset (submited to NRB)
4COM_HFI_4K_COM_TEST	Test the 4K LSL communication with DPU	NO	CONT	NO	Internal HFI 4K test

NAME	Description	Param or TPF	Nominal / Conting	Controv. or need NRB in Nominal Oper. phase	Comment / justification
HFI MACRO PROCEDURE					
~~HFI_PID_4K_SETUP_AND_ACTIVATION_NOM~~	~~Setup the Nominal 4K PID and activate the servo~~				
~~HFI_PID_4K_SETUP_AND_ACTIVATION_RED~~	~~Setup the Redundant 4K PID and activate the servo~~				
~~HFI_PID_1_6K_SETUP_AND_ACTIVATION_NOM~~	~~Setup the Nominal 1.6K PID and activate the servo~~				
~~HFI_PID_1_6K_SETUP_AND_ACTIVATION_RED~~	~~Setup the Redundant 1.6K PID and activate the servo~~				
~~HFI_PID_DILU_SETUP_AND_ACTIVATION_NOM~~	~~Setup the Nominal 0.1K Dilution plate PID and activate the servo~~				
~~HFI_PID_DILU_SETUP_AND_ACTIVATION_RED~~	~~Setup the Redundant 0.1K Dilution plate PID and activate the servo~~				
~~HFI_PID_BOLO_SETUP_AND_ACTIVATION_NOM~~	~~Setup the Nominal 0.1K Bolometer plate PID and activate the servo~~				
~~HFI_PID_BOLO_SETUP_AND_ACTIVATION_RED~~	~~Setup the Redundant 0.1K Bolometer plate PID and activate the servo~~				
HFI_4K_REU_FREQUENCY_CHANGE	Change the 4K/REU frequency (Fdiv) and possibly the Number of sample (Ns)	PARAM	NOM	NRB	The modification of the 4K frequency during operationnal phase is not nominal and this need to be taken during NRB taking into account the strong impacts on the 4K.
HFI_NS_CHANGE_ONLY	Change the REU Number of sample (Ns) ONLY and not the Fdiv	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
HFI_SETUP_ALL_BOLO	SETUP of all ALL the bolometers	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
HFI_OPTIM_CONFIGURATION_ALL_BOLO	Configure the optimisation parameters for all the bolometers	NO	NOM	NO	NO impact on LFI as demonstrated during CSL test
HFI_OPTIM_AND_FAST_VI_ALL_BOLO	Do a two step optimisation and a VI measurement of ALL the bolometers	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
HFI_OPTIM_ALL_BOLO_1_2_and_FIINAL	Do a three step optimisation of ALL the bolometers	PARAM	NOM	NO	NO impact on LFI as demonstrated during CSL test
HFI_ELEC_CHECK_100K_and_1K	Do an HFI electrical verification of the bolometers and thermometers at 100K and 100mK	PARAM	NOM	NA	Not used in operationnal phase
HFI_ELEC_CHECK_300mK	Do an HFI electrical verification of the bolometers and thermometers at around 300mK	NO	NOM	NA	Not used in operationnal phase
HFI_ELEC_CHECK_100mK	Do an HFI electrical verification of the bolometers and thermometers at around 100mK	NO	NOM	NA	Not used in operationnal phase
HFI_RAW_72	Do a cycle for ALL the 72 channels in RAW mode during one minute each	NO	NOM	NA	Not used in operationnal phase

11.12.1 SWITCH ON/OFF PROCEDURES PRODEDURES

PROCEDURE NAME :	NMON_HFI_NOMINAL_SWITCH_ON
OBJECTIVES :	POWER ON the DPU, REU, 4K and the DCE nominal LCL's
START CONDITION :	ALL HFI LCL's are OFF (11, 12, 29, 30, 36 to 44, 59 to 62)
EXPECTED END CONDITION :	DPU in BOOT (production of diag1 packets), 4K and REU in BOOT
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	☞ ALL HFI LCL's are OFF (11, 12, 29, 30, 36 to 44, 59 to 62)

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (DPU Nom LCL 29)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL29 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1410; (3,26))		CALL HFI possible actions : RETRY Switch to DPU redundant
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (4KCDE Nom LCL37)	TBD SAT	> TC N°1 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL37 <1,2A (expected <1A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TBD SAT (4KC DRIVE BUS Nom LCL59)	TBD SAT	> TC N°2 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL59 <0.33A (expected 0.28A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TBD SAT (4KC DRIVE BUS Nom LCL60)	TBD SAT	> TC N°3 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL60 <0.33A (expected 0.28A)		SWITCH OFF LCL; CALL HFI
N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TBD SAT (DCE DCCU LCL36)	TBD SAT	>TC N°4 + 5s	

Check:	Packet TM(1,1) and TM(1,7)	TBD SAT
Check:	Consumption LCL36 < 0.5A (expected 0.4A)	SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TBD SAT (REU PROC Nom LCL11)	TBD SAT	> TC N°5 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL11 <0.35A (expected 0.18A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TBD SAT (REU BELTS 0&1 LCL39)	TBD SAT	> TC N°6 + 30s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL39 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
8	TBD SAT (REU BELTS 2&3 LCL40)	TBD SAT	> TC N°7 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL40 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
9	TBD SAT (REU BELTS 4&5 LCL41)	TBD SAT	> TC N°8 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL41 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
10	TBD SAT (REU BELTS 6&7 LCL42)	TBD SAT	> TC N°9 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL42 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
11	TBD SAT (REU BELTS 8&9 LCL43)	TBD SAT	> TC N°10 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL43 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
12	TBD SAT (REU BELTS A&B LCL44)	TBD SAT	> TC N°11 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL44 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

The HFI_BOOT_TO_STARTUP procedure must be excecuted and completed less than 10mn after the power ON of the 4KCDE LCL

PROCEDURE NAME :	NMOF_HFI_NOMINAL_SWITCH_OFF
OBJECTIVES :	POWER OFF the DPU, REU, 4K and the DCE nominal LCL's
START CONDITION :	ALL HFI LCL's (11, 29, 36, 37, 39 to 44, 59, 60) are ON
EXPECTED END CONDITION :	ALL HFI LCL's are OFF
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	☞ ALL HFI LCL's (11, 29, 36, 37, 39 to 44, 59, 60) are ON ☞ **The DPU LCL29, the REU processor belt LCL11 and the 4K processor bus LCL37 must be ON since more than 1mn 30s**

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (4K DRIVE BUS LCL59)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (4K DRIVE BUS LCL60)	TBD SAT	> TC N°1 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TBD SAT (4KCDE nom LCL37)	TBD SAT	> TC N°2 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY
	Note	The reception of event packets (5,2) 4KrestartOn is normal		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TBD SAT (DCE LCL36)	TBD SAT	>TC N°3 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY
	Note	The reception of event packets (5,2) DCERestartOn is normal		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TBD SAT (REU BELTS 0&1 LCL39)	TBD SAT	> TC N°4 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY
	Note	The reception of event packets (5,2) REUFpgaOn is normal		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TBD SAT (REU BELTS 2&3 LCL40)	TBD SAT	>TC N°5 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TBD SAT (REU BELTS 4&5 LCL41)	TBD SAT	> TC N°6 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
8	TBD SAT (REU BELTS 6&7 LCL42)	TBD SAT	> TC N°7 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
9	TBD SAT (REU BELTS 8&9 LCL43)	TBD SAT	> TC N°8 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
10	TBD SAT (REU BELTS A&B LCL44)	TBD SAT	> TC N°9 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
11	TBD SAT (DPU nom LCL29)	TBD SAT	> TC N°10 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
12	TBD SAT (REU nom PROC LCL11)	TBD SAT	> TC N°11 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

PROCEDURE NAME :	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT
OBJECTIVES :	POWER ON ONE REU ANALOG BELT LCL (2 REU ANALOG belts)
START CONDITION :	The corresponding LCL is OFF
EXPECTED END CONDITION :	The corresponding LCL is ON; NO DPU REU mode modification
Input parameters:	Num_LCL (39, 40, 41, 42, 43, 44)
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	The corresponding LCL is OFF

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (LCLNum_LCL)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL39 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

PROCEDURE NAME :	EBOF_HFI_SWITCH_OFF_ONE_REU_ANA_BELT
OBJECTIVES :	POWER OFF ONE REU ANALOG BELT LCL (2 REU ANALOG belts)
START CONDITION :	The corresponding LCL is ON
EXPECTED END CONDITION :	The corresponding LCL is OF; NO DPU REU mode modification
Input parameters:	Num_LCL (39, 40, 41, 42, 43, 44)
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	The corresponding LCL is ON

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (LCLNum_LCL)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

PROCEDURE NAME :	HFI_NOMINAL_SWITCH_ON_FLIGHT_FIRST
OBJECTIVES :	POWER ON the DPU, the REU processor only, the 4K and the DCE nominal LCL's for the first flight switch ON
START CONDITION :	ALL HFI LCL's are OFF (11, 12, 29, 30, 36 to 44, 59 to 62)
EXPECTED END CONDITION :	DPU in BOOT (production of diag1 packets), 4K and REU in BOOT
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	☞ ALL HFI LCL's are OFF (11, 12, 29, 30, 36 to 44, 59 to 62)

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (DPU Nom LCL 29)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL29 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1410; (3,26))		CALL HFI possible actions : RETRY Switch to DPU redundant
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (4KCDE Nom LCL37)	TBD SAT	> TC N°1 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL37 <1,2A (expected <1A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TBD SAT (4KC DRIVE BUS Nom LCL59)	TBD SAT	> TC N°2 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL59 <0.33A (expected 0.28A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TBD SAT (4KC DRIVE BUS Nom LCL60)	TBD SAT	> TC N°3 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL60 <0.33A (expected 0.28A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TBD SAT (DCE DCCU LCL36)	TBD SAT	>TC N°4 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL36 < 0.5A (expected 0.4A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TBD SAT (REU PROC Nom LCL11)	TBD SAT	> TC N°5 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL11 <0.35A (expected 0.18A)		SWITCH OFF LCL; CALL HFI

The HFI_BOOT_TO_STARTUP procedure must be excecuted and completed less than 10mn after the power ON of the 4KCDE LCL

PROCEDURE NAME :	RMON_HFI_REDUNDANT_SWITCH_ON
OBJECTIVES :	POWER ON the DPU, REU, 4K and the DCE redundant LCL's
START CONDITION :	ALL HFI LCL's are OFF (11, 12, 29, 30, 36 to 44, 59 to 62)
EXPECTED END CONDITION :	DPU in BOOT (production of diag1 packets), 4K and REU in BOOT
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	☞ ALL HFI LCL's are OFF (11, 12, 29, 30, 36 to 44, 59 to 62)

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (DPU Red LCL 30)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL30 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1411; (3,26))		
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		CALL HFI possible actions : RETRY Switch to DPU nominal

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (4KCDE Red LCL38)	TBD SAT	> TC N°1 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL38 <1,2A (expected <1A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TBD SAT (4KC DRIVE BUS Red LCL61)	TBD SAT	> TC N°2 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL61 <0.33A (expected 0.28A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TBD SAT (4KC DRIVE BUS Red LCL62)	TBD SAT	> TC N°3 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL62 <0.33A (expected 0.28A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TBD SAT (DCE DCCU LCL36)	TBD SAT	>TC N°4 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL36 < 0.5A (expected 0.4A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TBD SAT (REU PROC Red LCL12)	TBD SAT	> TC N°5 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL12 <0.35A (expected 0.18A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TBD SAT (REU BELTS 0&1 LCL39)	TBD SAT	> TC N°6 + 30s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL39 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
8	TBD SAT (REU BELTS 2&3 LCL40)	TBD SAT	> TC N°7 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL40 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
9	TBD SAT (REU BELTS 4&5 LCL41)	TBD SAT	> TC N°8 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL41 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
10	TBD SAT (REU BELTS 6&7 LCL42)	TBD SAT	> TC N°9 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL42 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
11	TBD SAT (REU BELTS 8&9 LCL43)	TBD SAT	> TC N°10 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL43 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
12	TBD SAT (REU BELTS A&B LCL44)	TBD SAT	> TC N°11 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL44 <0.70A (expected 0.50A)		SWITCH OFF LCL; CALL HFI

The HFI_BOOT_TO_STARTUP procedure must be excecuted and completed less than 10mn after the power ON of the 4KCDE LCL

PROCEDURE NAME :	RMOF_HFI_REDUNDANT_SWITCH_OFF
OBJECTIVES :	POWER OFF the DPU, REU, 4K and the DCE redundant LCL's
START CONDITION :	ALL HFI LCL's (12, 30, 36, 38, 39 to 44, 61, 62) are ON
EXPECTED END CONDITION :	ALL HFI LCL's are OFF
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	TBD SAT
PREREQUESITE CHECK :	☞ ALL HFI LCL's (12, 30, 36, 38, 39 to 44, 61, 62) are ON ☞ **The DPU LCL30, the REU processor belt LCL12 and the 4K processor bus LCL38 must be ON since more than 1mn 30s**

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (4K DRIVE BUS LCL61)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (4K DRIVE BUS LCL62)	TBD SAT	> TC N°1 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TBD SAT (4KCDE red LCL38)	TBD SAT	> TC N°2 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY
	Note	The reception of event packets (5,2) 4KrestartOn is normal		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TBD SAT (DCE LCL36)	TBD SAT	>TC N°3 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY
	Note	The reception of event packets (5,2) DCERestartOn is normal		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TBD SAT (REU BELTS 0&1 LCL39)	TBD SAT	> TC N°4 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY
	Note	The reception of event packets (5,2) REUFpgaOn is normal		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TBD SAT (REU BELTS 2&3 LCL40)	TBD SAT	>TC N°5 + 5s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TBD SAT (REU BELTS 4&5 LCL41)	TBD SAT	> TC N°6 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
8	TBD SAT (REU BELTS 6&7 LCL42)	TBD SAT	> TC N°7 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
9	TBD SAT (REU BELTS 8&9 LCL43)	TBD SAT	> TC N°8 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
10	TBD SAT (REU BELTS A&B LCL44)	TBD SAT	> TC N°9 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
11	TBD SAT (DPU red LCL30)	TBD SAT	> TC N°10 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
12	TBD SAT (REU red PROC LCL12)	TBD SAT	> TC N°11 + 3s	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

PROCEDURE NAME :	TBDMOC_HFI_DPU_NOMINAL_RESTART
OBJECTIVES :	POWER OFF the DPU nominal and restart it
START CONDITION :	HFI nominal is ON with the DPU&REU in STANDBY, CONFIGURATION or OBSERVATION but only the DPU need to be restarted
EXPECTED END CONDITION :	HFI in the same mode as for the start condition but with production of ALL HFI telemetry
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289, ZAZ1P999
PREREQUESITE CHECK :	☛ **The DPU LCL29 must be ON since more than 1mn 30s**

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (DPU nom LCL29 OFF)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (DPU Nom LCL 29 ON)	TBD SAT	Last PROC + 1mn	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL29 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1410; (3,26))		CALL HFI possible actions : RETRY Switch to DPU redundant
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		

IF the HFI internal FDIR is DPU AUTO or RESYNCH AUTO, do not continue this procedure

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TCDPU-LoadASW-A003	HC193250	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TCDPU-StartASW-A00B	HC201250	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°4 + 1mn, check produc. of diag2 packet (APID 1410; (3,26)) each minute (typically)		CALL HFI possible actions : HFI_NOM/RED_SWITCH_OFF HFI_NOM/RED_SWITCH_ON HFI_BOOT_TO_STARTUP or HFI_BOOT_TO_STARTUP_WITH_ADRESS
	Check:	At time > TC N°4 + 2mn ☞ DPU mode (HM363240) = STARTUP ☞ REU mode (HM565280) = BOOT ☞ 4K mode (HM003260) = BOOT Comment : As the SSC are reset when the ASW is started, SSC skips are "normal" during this phase for APID 1410		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TC(17,1) (test service)	HC996240	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TC(9,3) (HFI Enable time synchro)	DC40F159	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
8	TCP(9,6) (Enable time Verif)	DC41F159	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	The DPU time difference with the SAT time must be lower than 100micro second (6LSB)		TBD

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
9	TCOBSW-Standby-0011	HC004289	ASAP	
	Check:	Packet TM(1,1); TM(1,8) reception is normal		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ produc. of HSK1 packet (APID 1410; (3,25)) each 2,3s (typically) ☞ produc. of HSK2 packet (APID 1410; (3,25)) each mn (typically) ☞ produc. of HSK3 packet (APID 1408; (3,25)) each 30s (typically)		CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ DPU mode (HM363240) = STANDBY		
	Check:	☞ Consumption LCL REU PROC (LCL11) <0.35A (expected 0.25A) ☞ Consumption each LCL REU BELTS (LCL's 39 to 44) <0.7A (expected 0.5A) ☞ Consumption LCL DCE (LCL 36) <0.5A (expected 0.4A) Comment : The DPU and 4K curent consumption are monitored via HSK limits		SWITCH OFF LCL
	Check:	At time > TC N°1 + 1mn, check that a maximum of TWO HSLERROR ON then OFF (APID 1408, TM(5,1)), TWO LSLERROR ON then OFF (APID 1408, TM(5,1)), TWO HARDWARE ERROR ON then OFF (APID 1408, TM(5,4)) and TWO SOFTWARE ERROR ON then OFF (APID 1408, TM(5,1)) have possibly been detected		CALL HFI

IF the DPU was in STANDBY, do not continue this procedure		
Name of PROCEDURE	Time condition	Comments
NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in STANDBY

IF the DPU was in CONFIGURATION without production of science do not continue this procedure		
NCON_HFI_GOTO_OBSERVATION	ASAP	TM(1,8) reception is normal as the REU is not in CONFIGURATION

IF the DPU was in OBSERVATION do not continue this procedure		
NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in OBSERVATION

PROCEDURE NAME :	TBDMOC_HFI_REU_NOMINAL_RESTART
OBJECTIVES :	POWER OFF the REU processor nominal and restart it
START CONDITION :	HFI nominal is ON with the DPU&REU in STANDBY, CONFIGURATION or OBSERVATION but only the REU need to be restarted
EXPECTED END CONDITION :	HFI in the same mode as for the start condition but with production of ALL HFI telemetry
Input parameters:	NO
TPF file name:	NO
PREREQUESITE CHECK :	☞ **The REU LCL11 must be ON since more than 1mn 30s**

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (REU PROC Nom LCL11) OFF	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (REU PROC Nom LCL11) ON	TBD SAT	Last PROC + 1mn	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL29 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1410; (3,26))		CALL HFI possible actions : RETRY Switch to DPU redundant
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		

IF the HFI internal FDIR is RESYNCH AUTO, do not continue this procedure

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

Name of PROCEDURE	Time condition	Comments
If DPU mode =OBSERVATION : NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in OBSERVATION
NCSF_HFI_STANDBY_RETURN	ASAP	TM(1,8) reception is normal as the REU is not in CONFIGURATION
4SYS_HFI_4K_SYNCHRO_SELECT : SynchClockSelect=0	ASAP	
NTSN_HFI_STARTUP_TO_STANDBY	ASAP	
IF the HFI was in STANDBY, do not continue this procedure		
NXCN_HFI_GOTO_CONFIG	ASAP	
4COR_HFI_4K_RUN_COOLER	ASAP	
IF the REU&DPU was in CONFIGURATION without production of science do not continue this procedure		
NCON_HFI_GOTO_OBSERVATION	ASAP	TM(1,8) reception is normal as the REU is not in CONFIGURATION
IF the REU&DPU was in OBSERVATION do not continue this procedure		
NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in OBSERVATION

PROCEDURE NAME :	TBDMOC_HFI_DPU_REDUNDANT_RESTART
OBJECTIVES :	POWER OFF the DPU redundant and restart it
START CONDITION :	HFI redundant is ON with the DPU&REU in STANDBY, CONFIGURATION or OBSERVATION but only the DPU need to be restarted
EXPECTED END CONDITION :	HFI in the same mode as for the start condition but with production of ALL HFI telemetry
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289, ZAZ1P999
PREREQUESITE CHECK :	☛ **The DPU LCL30 must be ON since more than 1mn 30s**

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (DPU nom LCL30 OFF)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (DPU Red LCL 30 ON)	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL30 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1411; (3,26))		CALL HFI possible actions : RETRY Switch to DPU nominal
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		

IF the HFI internal FDIR is DPU AUTO or RESYNCH AUTO, do not continue this procedure

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TCDPU-LoadASW-A003	HC193250	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TCDPU-StartASW-A00B	HC201250	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°4 + 1mn, check produc. of diag2 packet (APID 1410; (3,26)) each minute (typically)		CALL HFI possible actions : HFI_NOM/RED_SWITCH_OFF HFI_NOM/RED_SWITCH_ON HFI_BOOT_TO_STARTUP or HFI_BOOT_TO_STARTUP_WITH_ADRESS
	Check:	At time > TC N°4 + 2mn ☞ DPU mode (HM363240) = STARTUP ☞ REU mode (HM565280) = BOOT ☞ 4K mode (HM003260) = BOOT Comment : As the SSC are reset when the ASW is started, SSC skips are "normal" during this phase for APID 1410		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TC(17,1) (test service)	HC996240	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TC(9,3) (HFI Enable time synchro)	DC40F159	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
8	TCP(9,6) (Enable time Verif)	DC41F159	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	The DPU time difference with the SAT time must be lower than 100micro second (6LSB)		TBD

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
9	TCOBSW-Standby-0011	HC004289	ASAP	
	Check:	Packet TM(1,1); TM(1,8) reception is normal		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ produc. of HSK1 packet (APID 1410; (3,25)) each 2,3s (typically) ☞ produc. of HSK2 packet (APID 1410; (3,25)) each mn (typically) ☞ produc. of HSK3 packet (APID 1408; (3,25)) each 30s (typically)		CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ DPU mode (HM363240) = STANDBY		
	Check:	☞ Consumption LCL REU PROC (LCL11) <0.35A (expected 0.25A) ☞ Consumption each LCL REU BELTS (LCL's 39 to 44) <0.7A (expected 0.5A) ☞ Consumption LCL DCE (LCL 36) <0.5A (expected 0.4A) Comment : The DPU and 4K curent consumption are monitored via HSK limits		SWITCH OFF LCL
	Check:	At time > TC N°1 + 1mn, check that a maximum of TWO HSLERROR ON then OFF (APID 1408, TM(5,1)), TWO LSLERROR ON then OFF (APID 1408, TM(5,1)), TWO HARDWARE ERROR ON then OFF (APID 1408, TM(5,4)) and TWO SOFTWARE ERROR ON then OFF (APID 1408, TM(5,1)) have possibly been detected		CALL HFI

IF the DPU was in STANDBY, do not continue this procedure		
Name of PROCEDURE	Time condition	Comments
NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in STANDBY

IF the DPU was in CONFIGURATION without production of science do not continue this procedure		
NCON_HFI_GOTO_OBSERVATION	ASAP	TM(1,8) reception is normal as the REU is not in CONFIGURATION

IF the DPU was in OBSERVATION do not continue this procedure		
NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in OBSERVATION

PROCEDURE NAME :	TBDMOC_HFI_REU_REDUNDANT_RESTART
OBJECTIVES :	POWER OFF the REU processor redundant and restart it
START CONDITION :	HFI redundant is ON with the DPU&REU in STANDBY, CONFIGURATION or OBSERVATION but only the REU need to be restarted
EXPECTED END CONDITION :	HFI in the same mode as for the start condition but with production of ALL HFI telemetry
Input parameters:	NO
TPF file name:	NO
PREREQUESITE CHECK :	☛ **The REU LCL11 must be ON since more than 1mn 30s**

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TBD SAT (REU PROC Nom LCL11) OFF	TBD SAT	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TBD SAT (REU PROC Nom LCL11) ON	TBD SAT	Last PROC + 1mn	
	Check:	Packet TM(1,1) and TM(1,7)		TBD SAT
	Check:	Consumption LCL29 <0.35A (expected 0.25)		SWITCH OFF LCL; CALL HFI
	Check:	At time > TC N°1 + 1mn : produc. diag1 packet (APID 1410; (3,26))		CALL HFI possible actions : RETRY Switch to DPU redundant
	Check:	At time > TC N°1 + 1mn : DPU is in BOOT (HM363240) Comment : 4K and REU mode not checkable at this time		

IF the HFI internal FDIR is RESYNCH AUTO, do not continue this procedure

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

Name of PROCEDURE	Time condition	Comments
If DPU mode =OBSERVATION : NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in OBSERVATION
NCSF_HFI_STANDBY_RETURN	ASAP	TM(1,8) reception is normal as the REU is not in CONFIGURATION
4SYS_HFI_4K_SYNCHRO_SELECT : SynchClockSelect=0	ASAP	
NTSN_HFI_STARTUP_TO_STANDBY	ASAP	
IF the HFI was in STANDBY, do not continue this procedure		
NXCN_HFI_GOTO_CONFIG	ASAP	
4COR_HFI_4K_RUN_COOLER	ASAP	
IF the REU&DPU was in CONFIGURATION without production of science do not continue this procedure		
NCON_HFI_GOTO_OBSERVATION	ASAP	TM(1,8) reception is normal as the REU is not in CONFIGURATION
IF the REU&DPU was in OBSERVATION do not continue this procedure		
NXCN_HFI_GOTO_CONFIG	ASAP	TM(1,8) reception is normal as the REU is not in OBSERVATION

11.12.2 DPU PRODEDURES

PROCEDURE NAME :	NMON_HFI_BOOT_TO_STARTUP
OBJECTIVES :	Put DPU from BOOT to STARTUP mode using defaulft DPU ASW start adress writen in the EEPROM
START CONDITION :	DPU in BOOT (production of diag1 packets); 4K and REU in BOOT
EXPECTED END CONDITION :	DPU in STARTUP (production of diag2 packets), 4K and REU in BOOT
Input parameters:	`DeviceTbt: HP902280 = 0x44`
TPF file name:	NO
DISPLAY to use (AND):	HA001289, ZAZ1P999
PREREQUESITE CHECK :	☞ DPU LCL NOMINAL (LCL29) or LCL REDUNDANT (LCL30) is ON ☞ DPU is in BOOT (HM363240) and produce diag1 packet (APID 1410 (if nom DPU) / 1411 (if red DPU); (3,26)) ☞ 3 diag 1 must have been received
	☞ if DPU LCL NOMINAL (LCL29) is ON check that REU NOMINAL PROCESSOR BELT LCL (LCL11) is ON ☞ if DPU LCL REDUNDANT (LCL30) is ON check that REU REDUNDANT PROCESSOR BELT LCL (LCL12) is ON
	4KCDE LCL NOMINAL (LCL37) or REDUNDANT (LCL38) is ON
	DCE LCL (LCL36) is ON

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TCDPU-LoadASW-A003	HC193250	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TCDPU-StartASW-A00B	HC201250	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°4 + 1mn, check produc. of diag2 packet (APID 1410; (3,26)) each minute (typically)		
	Check:	At time > TC N°4 + 2mn ☞ DPU mode (HM363240) = STARTUP ☞ REU mode (HM565280) = BOOT ☞ 4K mode (HM003260) = BOOT Comment : As the SSC are reset when the ASW is started, SSC skips are "normal" during this phase for APID 1410		CALL HFI possible actions : HFI_NOM/RED_SWITCH_OFF HFI_NOM/RED_SWITCH_ON HFI_BOOT_TO_STARTUP or HFI_BOOT_TO_STARTUP_WITH_ADRESS

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TCREU-Hwtest-4024	HC003280	> Last TC + 2mn	
	Check:	Packet TM(1,1) and TM(1,7) At time > TC N°4 + 10s ☞ HM346280 = 0 ☞ HM350280 = 0 ☞ HM352280 = 0 ☞ HM356280 = 0 ☞ HM358280 = 0		RETRY; if does not work: CALL HFI
	Note	The reception of event packets (5,2) REUFpgaOn at this stage of the HFI startup is normal.		

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TC(17,1) (test service)	HC996240	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TC(9,3) (HFI Enable time synchro)	DC40F159	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
7	TCP(9,6) (Enable time Verif)	DC41F159	> Last TC + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	The DPU time difference with the SAT time must be lower than 100micro second (6LSB)		TBD

PROCEDURE NAME :	NOTC_HFI_BOOT_TO_STARTUP_WITH_ADRESS

OBJECTIVES :	Put DPU from BOOT to STARTUP mode using user defined DPU ASW start adress (0x0, 0x20000, 0x40000, 0x60000)

START CONDITION :	DPU in BOOT (production of diag1 packets); 4K and REU in BOOT

EXPECTED END CONDITION :	DPU in STARTUP (production of diag2 packets), 4K and REU in BOOT

Input parameters:	OCf-StartAdd : HP368250 OCf-Length : HP369250 ="0x10000"

TPF file name:	NO

DISPLAY to use (AND):	HA001289, ZAZ1P999

PREREQUESITE CHECK :	☞ DPU LCL NOMINAL (LCL29) or LCL REDUNDANT (LCL30) is ON ☞ DPU is in BOOT (HM363240) and produce diag1 packet (APID 1410 (if nom DPU) / 1411 (if red DPU); (3,26))
	☞ if DPU LCL NOMINAL (LCL29) is ON check that REU NOMINAL PROCESSOR BELT LCL (LCL11) is ON ☞ if DPU LCL REDUNDANT (LCL30) is ON check that REU REDUNDANT PROCESSOR BELT LCL (LCL12) is ON
	4KCDE LCL NOMINAL (LCL37) or REDUNDANT (LCL38) is ON
	DCE LCL (LCL36) is ON

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TCDPU-LdASWwithAd-A003	HC202250	> TC N°1 + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
3	TCDPU-StartASW-A00B	HC201250	> TC N°2 + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°3 + 1mn, check produc. of diag2 packet (APID 1410; (3,26)) each minute (typically)		
	Check:	At time > TC N°3 + 2mn ☞ DPU mode (HM363240) = STARTUP ☞ REU mode (HM565280) = BOOT ☞ 4K mode (HM003260) = BOOT Comment : As the SSC are reset when the ASW is started, SSC skips are "normal" during this phase for APID 1410		CALL HFI possible actions : HFI_NOM/RED_SWITCH_OFF HFI_NOM/RED_SWITCH_ON HFI_BOOT_TO_STARTUP or HFI_BOOT_TO_STARTUP_WITH_ADRESS

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
4	TC(17,1) (test service)	HC996240	>TC N°3 + 2mn	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
5	TC(9,3) (HFI Enable time synchro)	DC40F159	> TC N°4 + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
6	TCP(9,6) (Enable time Verif)	DC41F159	> TC N°5 + ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	The DPU time difference with the SAT time must be lower than 100micro second (6LSB)		TBD

PROCEDURE NAME :	NTSN_HFI_STARTUP_TO_STANDBY

OBJECTIVES :	Put the DPU from STARTUP to STANDBY mode; PUT the 4K and the REU from BOOT to STANDBY mode

START CONDITION :	DPU in STARTUP (production of diag2 packets), 4K and REU in BOOT

EXPECTED END CONDITION :	DPU, 4K and REU in STANDBY; production of HSK1, HSK2 and HSK3

Input parameters:	FPGA Reset : HP888280 Belt B : HP890280 Belt A : HP891280 Belt 9 : HP892280 Belt 8 : HP893280 Belt 7 : HP894280 Belt 6 : HP895280 Belt 5 : HP896280 Belt 4 : HP897280 Belt 3 : HP898280 Belt 2 : HP899280 Belt 1 : HP900280 Belt 0 : HP901280

TPF file name:	NO

DISPLAY to use (AND):	HA001289, HA006280, HA006280, WALC1565, WALC2565

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STARTUP ☞ Production of diag2 packet (APID 1410; (3,26)) each minute (typically)

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-Standby-0011	HC004289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ produc. of HSK1 packet (APID 1410; (3,25)) each 2,3s (typically) ☞ produc. of HSK2 packet (APID 1410; (3,25)) each mn (typically) ☞ produc. of HSK3 packet (APID 1408; (3,25)) each 30s (typically)		CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ DPU mode (HM363240) = STANDBY ☞ REU mode (HM565280) = STANDBY ☞ 4K mode ((HM003260) = STANDBY		
	Check:	☞ Consumption LCL REU PROC (LCL11) <0.35A (expected 0.25A) ☞ Consumption each LCL REU BELTS (LCL's 39 to 44) <0.7A (expected 0.5A) ☞ Consumption LCL DCE (LCL 36) <0.5A (expected 0.4A) Comment : The DPU and 4K curent consumption are monitored via HSK limits		SWITCH OFF LCL

Check:	At time > TC N°1 + 1mn, check that a maximum of TWO HSLERROR ON then OFF (APID 1408, TM(5,1)), TWO LSLERROR ON then OFF (APID 1408, TM(5,1)), TWO HARDWARE ERROR ON then OFF (APID 1408, TM(5,4)) and TWO SOFTWARE ERROR ON then OFF (APID 1408, TM(5,1)) have possibly been detected	CALL HFI

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
2	TCREU-FPGAreset-4054	HC001280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°2 + 10s HM302280= HM304280= HM308280= HM310280= HM314280= HM316280= HM320280= HM322280= HM326280= HM328280= HM332280= HM334280= ACTIVE		CALL HFI
	Check:	At time > TC N°2 + 30s If event packets (5,2) REUFpgaOn have been received during NMON_HFI_BOOT_TO_STARTUP, check that event packets (5,2) REUFpgaOff are received now		CALL HFI

PROCEDURE NAME :	NXCN_HFI_GOTO_CONFIG
OBJECTIVES :	Put the DPU and the REU in CONFIGURATION from ANY modes around CONFIGURATION mode
START CONDITION :	DPU and REU in ANY modes around CONFIGURATION; production of HSK1, HSK2 and HSK3
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION; production of HSK1 to HSK9 and possibly science packets
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY, OBSERVATION, VI_MEASUREMENT, OPTIMIZATION, RAWSIGNAL_MODE, WITHOUT_COMPR orCOMP_VALID ☞ REU mode (HM565280) = STANDBY, OBSERVATION, V_I_MEASURE or OPTIMIZATION ☞ Production of HSK1 to HSK3

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-Config-0012	HC006289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION		CALL HFI
	Check:	At time > TC N°1 + 5s ☞ if the DPU was producing science packets before the excecution of the TC N°1, check that the production of science packets SC1(APID 1412 (21,1)) is continuing, and that the production of the other science packets is stopped		
	Check:	At time > TC N°1 + 1mn ☞ produc. of HSK2 to HSK9 packets each 30s except HSK2 each mn (typically)		
	Check:	At time > TC N°1 + 1mn, check that a maximum of ONE HSLERROR and ONE SWERROR ON then OFF (APID 1408, TM(5,1)) has possibly been detected		

PROCEDURE NAME :	NCON_HFI_GOTO_OBSERVATION
OBJECTIVES :	Put the DPU and the REU in OBSERVATION from CONFIGURATION mode
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in OBSERVATION; production of HSK1 to HSK9 and science packets
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-Observ-0013	HC007289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5s ☞ produc. Of SC1 packets (APID 1412 (21,1))		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = OBSERVATION ☞ REU mode (HM565280) = OBSERVATION		
	Check:	At time > TC N°1 + 1mn, check that a maximum of ONE HSLERROR ON and ONE SWERROR then OFF (APID 1408, TM(5,1)) has possibly been detected		

PROCEDURE NAME :	NCPN_HFI_GOTO_OPTIMISATION
OBJECTIVES :	Perform the OPTIMIZATION of the selected channels
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION; successful optimisation done
Input parameters:	RCf-VIOKeepGamp : HP880280 RCf-VIOKeepT : HP881280 RCf-VIOCvCtMeas : HP882280 RCf-VIOOptTuneT : HP883280 RCf-VIOChanSelMd : HP884280 RCf-BeltNum : HP903280 RCf-ChanNum : HP904280
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA005280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-Optim-0014	HC008289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5s ☞ produc. of SC2-2 packets (APID 1414 (21,2))		CALL HFI
	Check:	At time > TC N°1 + 5s ☞ disable produc. of SC1 packets (APID 1412 (21,1))		
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = OPTIMIZATION ☞ REU mode (HM565280) = OPTIMIZATION		
	Check:	At time > TC N°1 + 1mn HM577280= HP880280 HM999280= HP881280 HM998280= HP882280 HM997280= HP883280 HM996280= HP884280 HM995280= HP903280 HM994280= HP904280		
	Check:	At time > TC N°1 + 1mn, check that a maximum of TWO HSLERROR ON and TWO SWERROR then OFF (APID 1408, TM(5,1)) has possibly been detected		
	Check:	At time > TC N°1 + (number of channel to be optimised) x 10s ☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION ☞ disable produc. of SC2-2 packets (APID 1414 (21,2)) ☞ produc. Of SC1 packets (APID 1412 (21,1))		
	Check by HFI:	Quality of the optimisation for each optimised channel. To be stated by HFI		RECEND PROC with different parameters

PROCEDURE NAME :	NCVN_HFI_GOTO_VI
OBJECTIVES :	Perform the VI measurement of the selected channels
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION; successful VI done
Input parameters:	RCf-VIOKeepGamp : HP880280 RCf-VIOKeepT : HP881280 RCf-VIOCvCtMeas : HP882280 RCf-VIOOptTuneT : HP883280 RCf-VIOChanSelMd : HP884280 RCf-BeltNum : HP903280 RCf-ChanNum : HP904280
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA005280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-VI-0015	HC009289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5s ☞ produc. of SC2-2 packets (APID 1414 (21,2))		CALL HFI
	Check:	At time > TC N°1 + 5s ☞ disable produc. of SC1 packets (APID 1412 (21,1))		
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = VI_MEASUREMENT ☞ REU mode (HM565280) = V_I_MEASURE		
	Check:	At time > TC N°1 + 1mn HM577280= HP880280 HM999280= HP881280 HM998280= HP882280 HM997280= HP883280 HM996280= HP884280 HM995280= HP903280 HM994280= HP904280		
	Check:	At time > TC N°1 + 1mn, check that a maximum of TWO HSLERROR and TWO SWERROR ON then OFF (APID 1408, TM(5,1)) has possibly been detected		
	Check:	At time > TC N°1 + (number of channel with VI) x 30s ☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION ☞ disable produc. of SC2-2 packets (APID 1414 (21,2)) ☞ produc. of SC1 packets (APID 1412 (21,1))		
	Check by HFI:	Quality of the VI for each optimised channel		RECEND PROC with different parameters

PROCEDURE NAME :	NCRN_HFI_GOTO_RAW_SIGNAL
OBJECTIVES :	Put the DPU into RAWSIGNAL_MODE from CONFIGURATION mode
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU in RAWSIGNAL_MODE mode & REU in CONFIGURATION; production of SC2-1
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-RawSignal-0023	HC012289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5s ☞ produc. of SC2-1 packets (APID 1414 (21,2))		CALL HFI
	Check:	At time > TC N°1 + 5s ☞ disable produc. of SC1 packets (APID 1412 (21,1))		
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = RAWSIGNAL_MODE ☞ REU mode (HM565280) = CONFIGURATION		
	Check:	At time > TC N°1 + 1mn, check that a maximum of ONE HSLERROR ON then OFF (APID 1408, TM(5,1)) has possibly been detected		

PROCEDURE NAME :	NCWN_HFI_GOTO_WITHOUT_COMPRESS
OBJECTIVES :	Put DPU in WITHOUT_COMPR from CONFIGURATION mode
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU in WITHOUT_COMPRESSION mode & REU in CONFIGURATION
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-WoutComp-0017	HC011289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5s ☞ produc. of SC4 packets (APID 1414 (21,2))		CALL HFI
	Check:	At time > TC N°1 + 5s ☞ disable produc. of SC1 packets (APID 1412 (21,1))		
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = WITHOUT_COMPR ☞ REU mode (HM565280) = CONFIGURATION		
	Check:	At time > TC N°1 + 1mn, check that a maximum of ONE HSLERROR ON and ONE SWERROR then OFF (APID 1408, TM(5,1)) has possibly been detected		

PROCEDURE NAME :	NCCN_HFI_GOTO_COMPRESS_VALID
OBJECTIVES :	Put DPU in COMP_VALID from CONFIGURATION mode
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU in COMPRESSION_VALIDATION mode & REU in CONFIGURATION
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-CompValid-0016	HC010289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5s ☞ produc. of SC3 packets (APID 1414 (21,3))		CALL HFI
	Check:	At time > TC N°1 + 5s ☞ disable produc. of SC1 packets (APID 1412 (21,1))		
	Check:	At time > TC N°1 + 10s ☞ DPU mode (HM363240) = COMP_VALID ☞ REU mode (HM565280) = CONFIGURATION		
	Check:	At time > TC N°1 + 1mn, check that a maximum of ONE HSLERROR and ONE SWERROR ON then OFF (APID 1408, TM(5,1)) has possibly been detected		

PROCEDURE NAME :	NCSF_HFI_STANDBY_RETURN

OBJECTIVES :	Put the DPU and the REU into STANDBY from CONFIGURATION mode; Put the 4K into STANDBY from NOMINAL or FREEWHEEL mode

START CONDITION :	DPU & REU in CONFIGURATION , 4K in NOMINAL, FREEWHEEL or STANDBY

EXPECTED END CONDITION :	DPU, 4K and REU in STANDBY; production of HSK1, HSK2 and HSK3

Input parameters:	NO

TPF file name:	NO

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ REU mode (HM565280) = CONFIGURATION ☞ 4K mode ((HM003260) = STANDBY, NOMINAL or FREEWHEEL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-StandbyRet-0111	HC005289	ASAP	
	Check:	Packet TM(1,1) **only** A TM(1,8) may possibly be received (depending of the HFI frequency) even if the command has correctly been excecuted.		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ produc. of HSK1 packets		CALL HFI
	Check:	At time > TC N°1 + 1mn ☞ produc. of HSK2 each mn and HSK3 each 30s (typically)		
	Check:	At time > TC N°1 + 2,5mn ☞ DPU mode (HM363240) = STANDBY ☞ REU mode (HM565280) = STANDBY ☞ 4K mode ((HM003260) = STANDBY if the 4K is in NOMINAL at the start of this procedure, the 4K will transitory be in RUNDOWN_3 mode. if the 4K is in FREEWHEEL at the start of this procedure, the 4K will transitory be in RUNDOWN_1 mode.		
	Check:	At time > TC N°1 + 2,5mn, check that a maximum of TWO LSLERROR ON then OFF (APID 1408, TM(5,1)) has possibly been detected. MANY HSLERROR and SWERROR ON then OFF (APID 1408, TM(5,1)) may possibly be detected during the 4K ramp down		

PROCEDURE NAME :	NXTF_HFI_STARTUP_RETURN

OBJECTIVES :	Put the DPU into STARTUP mode, the REU and the 4K into BOOT mode from any DPU mode and from any 4K, REU mode

START CONDITION :	DPU in any mode except BOOT; REU and 4K in any mode

EXPECTED END CONDITION :	DPU in STARTUP mode (production of diag2 packets); REU and 4K in BOOT mode

Input parameters:	NO

TPF file name:	NO

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = NOT in BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-StartupRet-0010	HC003289	ASAP	
	Check:	Packet TM(1,1) ~~and TM(1,7)~~ (TM(1,8) will be received)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn, check produc. of diag2 packet (APID 1410; (3,26)) each minute (typically). The data of the two first Diag2 packets must not be considered		CALL HFI
	Check:	At time > TC N°1 + 2mn ☞ DPU mode (HM363240) = STARTUP ☞ REU mode (HM565280) = BOOT ☞ 4K mode (HM003260) = BOOT		
	Check:	At time > TC N°1 + 2mn15s, check that a maximum of ONE HSLERROR ON then OFF (APID 1408, TM(5,1)), TWO LSLERROR ON then OFF (APID 1408, TM(5,1)) and TWO SOFTWARE ERROR ON then OFF (APID 1408, TM(5,1)) have possibly been detected		

PROCEDURE NAME :	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5
OBJECTIVES :	Setup the compression param. and the channels to be download of ALL channels of belts 0 to 5
START CONDITION :	DPU and REU in STANDBY, CONFIGURATION or OBSERVATION
EXPECTED END CONDITION :	No mode change; The compression parameters and the channels to be download of ALL channels of belts 0 to 5 are correctly repported in the HSK telemetry
Input parameters:	NO
TPF file name:	PFHPCMP_CMPRBXCX_nnnn.TPF
DISPLAY to use (AND):	HA001289, HA501289 to HA506289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-36CompCtrl-2001-1	HC023289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	If DPU is in CONFIGURATION or OBSERVATION, at time > TC N°1 + 1mn30s ☞ Compression control param for i=1 to 36 aaa= 001 + (i-1) bbb= 102 + (i-1)*5 HMaaa240 = HPbbb240 next i ☞ Sigma/Q param for i=1 to 36 aaa= 660 + (i-1) bbb= 103 + (i-1)*5 HMaaa240 = HPbbb240 next i ☞ Sigma param for i=1 to 36 aaa= 073 + (i-1) bbb= 104 + (i-1)*5 HMaaa240 = HPbbb240 next i It is not possible to check the parameter when the DPU is in STANDBY mode (no HSK4 to HSK9)		CALL HFI

PROCEDURE NAME :	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B
OBJECTIVES :	Setup the compression param. and the channels to be download of ALL channels of belts 6 to B
START CONDITION :	DPU and REU in STANDBY, CONFIGURATION or OBSERVATION
EXPECTED END CONDITION :	No mode change; The compression parameters and the channels to be download of ALL channels of belts 6 to B are correctly repported in the HSK telemetry
Input parameters:	NO
TPF file name:	PFHPCMP_CMPRBXCX_nnnn.TPF
DISPLAY to use (AND):	HA001289, HA50789 to HA512289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-36CompCtrl-2001-2	HC024289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	If DPU is in CONFIGURATION or OBSERVATION, at time > TC N°1 + 1mn30s ☞ Compression control param for i=1 to 36 aaa= 037 + (i-1) bbb= 282 + (i-1)*5 HMaaa240 = HPbbb240 next i ☞ Sigma/Q param for i=1 to 36 aaa= 696 + (i-1) bbb= 283 + (i-1)*5 HMaaa240 = HPbbb240 next i ☞ Sigma param for i=1 to 36 aaa= 109 + (i-1) bbb= 284 + (i-1)*5 HMaaa240 = HPbbb240 next i It is not possible to check the parameter when the DPU is in STANDBY mode (no HSK4 to HSK9)		CALL HFI

PROCEDURE NAME :	PEOS_HFI_END_OF_SLEW
OBJECTIVES :	Activate the HFI packet production limitation (duration and quantity)
START CONDITION :	DPU and REU in CONFIGURATION or OBSERVATION
EXPECTED END CONDITION :	No mode change; Activation of the HFI packet production
Input parameters:	OCf- Duration : HP024240 OCf- Quantity : HP025240
TPF file name:	NO
DISPLAY to use (AND):	
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION or OBSERVATION ☞ REU mode (HM565280) = CONFIGURATION or OBSERVATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-EndOfSlew-2005	HC102289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	PFDR_HFI_FDIR_SETUP
OBJECTIVES :	Setup the HFI FDIR parameter
START CONDITION :	DPU must be above STARTUP mode in case of FDIR desynchro requested. DPU can be in any mode for other request
EXPECTED END CONDITION :	No mode change ; FDIR Parameter correctly repported in the HSK
Input parameters:	OCf-FDIRmode : HP363250
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-FDIRmode-A002	HC192250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM362240 = HP363250		CALL HFI

PROCEDURE NAME :	PCSS_HFI_DPU_COMPRESS_SLICE_SIZE_SETUP
OBJECTIVES :	Setup the Compression Slice Size parameter
START CONDITION :	DPU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change; Compression Slice Size Parameter correctly repported in the HSK
Input parameters:	OCf-CSsize : HP367250
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY, CONFIGURATION or OBSERVATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-CSsize-2002	HC025289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM367240 = HP367250		CALL HFI

PROCEDURE NAME :	PSWR_HFI_DPU_SW_RESET
OBJECTIVES :	Do a DPU software reset
START CONDITION :	DPU in any mode
EXPECTED END CONDITION :	DPU in BOOT mode
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-SwReset-A001	HC191250	ASAP	
	Check:	At time > TC N°1 + 2mn : produc. diag1 packet (APID 1410; (3,26))		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 2mn : DPU is in BOOT (HM363240)		CALL HFI

PROCEDURE NAME :	PDSA_HFI_DPU_ASW_DEFINE_START_ADRESS
OBJECTIVES :	Define the DPU ASW default start adress (among 0x00000, 0x20000, 0x40000, 0x60000)
START CONDITION :	DPU in BOOT mode
EXPECTED END CONDITION :	DPU in BOOT mode ;The DPU ASW start adress is correctly repported in the HSK
Input parameters:	OCf-StartAdd : HP368250 OCf-Length : HP369250 ="0x10000"
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA040250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-ASWstore-A004	HC194250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM415250 = HP368250		CALL HFI

PROCEDURE NAME :	PPPT_HFI_DPU_PPROM_TEST
OBJECTIVES :	Do a DPU PROM hardware test
START CONDITION :	DPU in BOOT mode
EXPECTED END CONDITION :	No mode change; No error detected
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA040250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-PPROMtest-A009	HC199250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 30s HM403250 to HM414250 = 0		CALL HFI

PROCEDURE NAME :	PEPT_HFI_DPU_EEPROM_TEST
OBJECTIVES :	Do a DPU EEPROM hardware test
START CONDITION :	DPU in BOOT mode
EXPECTED END CONDITION :	No mode change; No error detected
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA034250; HA035250; HA036250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-DEEPROMtest-A006	HC196250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 30s HM019250 to HM146250 = 0		CALL HFI

PROCEDURE NAME :	PPST_HFI_DPU_PSRAM_TEST
OBJECTIVES :	Do a DPU PSRAM hardware test
START CONDITION :	DPU in BOOT mode
EXPECTED END CONDITION :	No mode change; No error detected
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA036250; HA037250; HA038250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-PSRAMtest-A007	HC197250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 30s HM147250 to HM274250 = 0		CALL HFI

PROCEDURE NAME :	PDST_HFI_DPU_DSRAM_TEST
OBJECTIVES :	Do a DPU DSRAM hardware test
START CONDITION :	DPU in BOOT mode
EXPECTED END CONDITION :	No mode change; No error detected
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA038250; HA039250; HA040250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-DSRAMtest-A008	HC198250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 30s HM275250 to HM402250 = 0		CALL HFI

PROCEDURE NAME :	PFPT_HFI_DPU_FPGA_TEST
OBJECTIVES :	Do a DPU FPGA hardware test
START CONDITION :	DPU in BOOT mode
EXPECTED END CONDITION :	No mode change; No error detected
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA038250; HA039250; HA040250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-FPGAtest-A00A	HC200250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 30s HM420250=TBD HM421250=TBD HM422250=TBD		CALL HFI

PROCEDURE NAME :	PPAS_HFI_DPU_PARAM_STORE*

OBJECTIVES :	Modify the DPU EEPROM STORE parameters area (INITIAL or LOADED part) to be used during the DPU save parameter procedure or the DPU startup

START CONDITION :	DPU in any mode but BOOT

EXPECTED END CONDITION :	No mode change

Input parameters:	`param_STORE_DPU : HP364250`

TPF file name:	NO

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) is not BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-ParamStore-A00F	HC206250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	Dump word 0x3EE00 of the DPU EEPROM (MID 0x39) and check data=HP364250		CALL HFI

PROCEDURE NAME :	PPAV_HFI_DPU_PARAM_SAVE

OBJECTIVES :	Save the DPU parameters in EEPROM in INITIAL or LOADED part define by word 0x3EE00 of the DPU EEPROM

START CONDITION :	DPU in CONFIGURATION or STANDBY

EXPECTED END CONDITION :	No mode change

Input parameters:	NO

TPF file name:	NO

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-SaveParam-A00E	HC205250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	PGLA_HFI_DPU_GLITCH_ALGO

OBJECTIVES :	Enable / disable the DPU glitch algorythm
START CONDITION :	DPU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change; Glitch parameter correclty repported in the telemetry
Input parameters:	GLITCH_ALGO : HP023240
TPF file name:	NO
DISPLAY to use (AND):	HA001289; HA034250
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-EnGlitchAlgo-2003	HC026289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s HM001250 = HP023240		CALL HFI

PROCEDURE NAME :	PHED_HFI_DPU_HK_EMISSION_ENABLE
OBJECTIVES :	Enable the HFI production of selected telemetry type
START CONDITION :	DPU in any mode
EXPECTED END CONDITION :	No mode change; modification of the HFI telemetry depending of the parameter of this procedure
Input parameters:	HP992240 =1 HP993240 : service type HP994240 : service sub type HP995240 : packet_ID
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCP(14,1)	HC994240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 2mn Check that the HFI telemetry downloaded is in agreement with the request		CALL HFI

PROCEDURE NAME :	PHED_HFI_DPU_HK_EMISSION_DISABLE
OBJECTIVES :	Disable the HFI production of selected telemetry type
START CONDITION :	DPU in any mode
EXPECTED END CONDITION :	No mode change; modification of the HFI telemetry depending of the parameter of this procedure
Input parameters:	HP992240 =1 HP993240 : service type HP994240 : service sub type HP995240 : packet_ID
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCP(14,2)	HC995240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 2mn Check that the HFI telemetry downloaded is in agreement with the request		CALL HFI

PROCEDURE NAME :	PWDS_HFI_DPU_WATCHDOG_SETUP
OBJECTIVES :	Setup the DPU watchdog
START CONDITION :	DPU in any mode
EXPECTED END CONDITION :	No mode change
Input parameters:	OCf-Watchdog : HP365250
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDPU-ConfigWD-A005	HC195250	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 +10s HM427250 = HP365250		CALL HFI

PROCEDURE NAME :	PCMT_HFI_DPU_COM_TEST
OBJECTIVES :	Test the DPU communication with SAT
START CONDITION :	DPU any mode
EXPECTED END CONDITION :	No mode change
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC(17,1) (test service)	HC996240	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	HFI_STANDBY_TO_4K_MAINTENANCE -
OBJECTIVES :	Put the DPU and the 4K from STANDBY to 4K MAINTENANCE mode
START CONDITION :	DPU in STANDBY; 4K in STANDBY
EXPECTED END CONDITION :	DPU in 4K_MAINTENANC mode; 4K in MAINTENANCE mode
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-4KCMaint-0019	HC015289	ASAP	-
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM363240 = 4K_MAINTENANC ☞ HM003260 = MAINTENANCE		CALL HFI

PROCEDURE NAME :	HFI_4K_MAINTENANCE_TO_STANDBY -
OBJECTIVES :	Put the DPU and the 4K from 4K MAINTENANCE to STANDBY mode
START CONDITION :	DPU in 4K_MAINTENANC ; 4K in MAINTENANCE
EXPECTED END CONDITION :	DPU in STANDBY mode; 4K in STANDBY mode
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = 4K_MAINTENANC ☞ 4K mode (HM003260) = MAINTENANCE

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-4KCMaintStp-0119	HC016289	ASAP	-
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM363240 = STANDBY ☞ HM003260 = STANDBY		CALL HFI

11.12.3 REU PRODEDURES

PROCEDURE NAME :	ENSF_HFI_REU_NS_FDIV_SETUP
OBJECTIVES :	Sets the number of sample per half period (Ns) and the Frequency divisor for the modulation and the 4K frequency (Fdiv)
START CONDITION :	ANY
EXPECTED END CONDITION :	No mode change ; FDIV and NS Parameters correctly repported in the HSK
Input parameters:	RSw07-Nsamp : HP003280 RSw07-Fdiv : HP004280
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	F DPU mode (HM363240) = STANDBY F REU mode (HM565280) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-ModSetup-4001	HC006280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM677280 = HP003280 ☞ HM676280 = HP004280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EJXP_HFI_JFET_SETUP
OBJECTIVES :	Setup and control one JFET PID heaters among the 12 JFTET PID's
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change ; JFET PID setup is correctly repported in the HSK telemetry; Temperature evolution of the JFET
Input parameters:	`i_jfet : JFET Belt number from 0 to 11`
TPF file name:	TBD MOC
DISPLAY to use (AND):	HA001289, HA003289, HA015280, HA016280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-JFETsetup-4005-Nbelt	HCnnn280 with nnn = 104 + i_jfet	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 70s ☞ JPID Conf aaa= 951 + i_jfet; bbb= 680 +9 x i_jfet HMaaa280 = HP680280 ☞ JPID IntegTime aaa= 433 + i_jfet; bbb= 683 +9 x i_jfet HMaaa280 = HP683280 ☞ JPID Setpoint aaa= 434 + i_jfet; bbb= 684 +9 x i_jfet HMaaa280 = HP684280 ☞ JPID P_Gain aaa= 435 + i_jfet; bbb= 685 +9 x i_jfet HMaaa280 = HP685280 ☞ JPID I_Gain aaa= 436 + i_jfet; bbb= 686 +9 x i_jfet HMaaa280 = HP686280 ☞ JPID Exp aaa= 437 + i_jfet; bbb= 687 +9 x i_jfet HMaaa280 = HP687280 ☞ JPID HeatPower aaa= 438 + i_jfet; bbb= 687 +9 x i_jfet HMaaa280 = HP688280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	CPxx_HFI_PID_SETUP
OBJECTIVES :	Setup and control one HFI focal plane PID among : 4K/1.6K switch ; 4K plate ; 1.6K plate ; BOLO plate ; 0.1K Dilution plate
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change ; PID setup is correctly repported in the HSK telemetry
Input parameters:	i PID : PID number 0--> BOLO 1--> DILU 2--> 1.6K 3--> 4K 4--> SWITCH 4K/1.6K
TPF file name:	TBD MOC
DISPLAY to use (AND):	HA001289, HA003289, HA018280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-PIDsetup-4004-i_PID	HCnnn280 with nnn = 097 + i_PID	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 70s ☞ PIDConfMode aaa= 933 + i_PID; HMaaa280 = HP584280 ☞ PIDHeatConf aaa= 939 + i_PID; HMaaa280 = HP586280 ☞ PIDThermoConf aaa= 945 + i_PID; HMaaa280 = HP588280 ☞ PIDIntTime aaa= 366 + i_PID; HMaaa280 = HP590280 ☞ PIDSetPoint aaa= 367 + i_PID; HMaaa280 = HP591280 ☞ PID-PGain aaa= 368 + i_PID; HMaaa280 = HP592280 ☞ PID-IGain aaa= 369 + i_PID; HMaaa280 = HP593280 ☞ PID-DGain aaa= 370 + i_PID; HMaaa280 = HP594280 ☞ PID-Exp aaa= 371 + i_PID; HMaaa280 = HP595280 ☞ PID-NHeatPwLsw aaa= 372 + i_PID; HMaaa280 = HP596280 ☞ PID-NHeatPwMsw aaa= 373 + i_PID; HMaaa280 = HP597280 ☞ PID-RHeatPwLsw aaa= 374 + i_PID; HMaaa280 = HP598280 ☞ PID-RHeatPwMsw aaa= 375 + i_PID; HMaaa280 = HP599280		RETRY; if does not work: CALL HFI
	Check:	**To be stated by HFI**		

PROCEDURE NAME :	ECHS_HFI_CHANNEL_SETUP

OBJECTIVES :	Setup the configuration parameters of one channel among the 72 focal plane channels or of all the channels

START CONDITION :	DPU and REU in CONFIGURATION or STANDBY

EXPECTED END CONDITION :	No mode change ; Channels setup is correctly repported in the HSK telemetry

Input parameters:	`i Belt : Belt number from 0 to B` `j_Channel : Channel number from 0 to 5`

TPF file name:	PFHECHS_PROCBXCX_nnn.TPF for ALL the 72 channels PFHC(i_Belt)(j_Channel)P_PROCBXCX_nnn.TPF for 1 channel

DISPLAY to use (AND):	HA001289, HA501289 to HA512289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie PROCEDURE
1	TCREU-ChSetup-4002-ij	HCnnn280 nnn280 = 008 + 6 x i_Belt + j_Channel	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 70s ☞ Mphase-ij aaa= 003 + 24 x i_Belt + 4 x j_Channel bbb= 006 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280 ☞ Nblanck-ij aaa= 681 + 6 x i_Belt + j_Channel bbb= 007 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280 ☞ Sphase-ij aaa= 753 + 6 x i_Belt + j_Channel bbb= 008 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280 ☞ Gamp-ij aaa= 825 + 6 x i_Belt + j_Channel bbb= 009 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280 ☞ I_Bias-ij aaa= 004 + 24 x i_Belt + 4 x j_Channel bbb= 010 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280 ☞ V_Bias-ij aaa= 005 + 24 x i_Belt + 4 x j_Channel bbb= 011 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280 ☞ T_Bias-ij aaa= 006 + 24 x i_Belt + 4 x j_Channel bbb= 012 + 42 x i_Belt + 7 x j_Channel HMaaa280 = HPbbb280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EOPC_HFI_CHANNEL_OPTIM_CONF

OBJECTIVES :	Sets the Optimisation parameters of a single selected channel used during the Optimisation and the VI

START CONDITION :	DPU and REU in CONFIGURATION or STANDBY

EXPECTED END CONDITION :	No mode change ; The optimisation parameters are correctly repported in the HSK telemetry

Input parameters:	`i Belt    : Belt number from 0 to B` `j_Channel : Channel number from 0 to 5`

TPF file name:	PFHEOPC_OPTMBXCX_nnnn.TPF

DISPLAY to use (AND):	NO

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-OptConf-4070-ij	HCnnn280 nnn280 = 117 + 6 x i_Belt + j_Channel	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EVIC_HFI_VI_CONFIG
OBJECTIVES :	Sets the VI parameters applied to all detection channels during VI_MEASUREMENT
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	
Input parameters:	RCf-VIImin : HP803280 RCf-VIImax : HP804280 RCf-VICof : HP923280 RCf-VIScale : HP805280 RCf-VIStepNumber: HP806280 RCf-VIdelay : HP807280
TPF file name:	NO
DISPLAY to use (AND):	NO
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-VIconf-4071	HC189280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 70s HP803280= HM590280 HP804280= HM591280 HP923280= HM589280 HP805280= HM592280 HP806280= HM593280 HP807280= HM594280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM

OBJECTIVES :	Select the list of FPU channels which shall be processed by the next VI_MEASUREMENT or OPTIMISATION in case the TCOBSW-Optim-0014 or TCOBSW-VI-0015 are sent in indicating that the REU OBSW shall use this list

START CONDITION :	DPU and REU in CONFIGURATION or STANDBY

EXPECTED END CONDITION :	No mode change

Input parameters:	NO

TPF file name:	PFHECLS_TOPTVLIST_nnnn.TPF

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	VIOSelect-4072	HC190280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	ECXS_HFI_CERNOX_SETUP
OBJECTIVES :	Sets the electrical parameters of one Cernox thermistor
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change; the CERNOX setup parameters are correctly repported in the HSK telemetry

Input parameters:	`i : CERNOX number from 0 to 11`
	`HCT(i)Nblanck : HPnnn280 with nnn = 515 + 6 x i`
	`HCT(i)Gamp : HPnnn280 with nnn = 516 + 6 x i`
	`HCT(i)Bias I : HPnnn280 with nnn = 517 + 6 x i`

TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA017280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-HCTsetup-4003-i	HCnnn280 with nnn = 084 + i_cernox	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 70s ☞ Cernox Nblanck aaa = 909 + i_cernox nnn = 515 + 6 x i_cernox HMaaa280 = HPnnn280 ☞ Cernox Gamp aaa = 897 + i_cernox nnn = 516 + 6 x i_cernox HMaaa280 = HP683280 ☞ Cernox I_Bias aaa = 294 + 6 x i_cernox nnn = 517 + 6 x i_cernox HMaaa280 = HP684280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	ECXC_HFI_CERNOX_CONTROL
OBJECTIVES :	Define the HFI Cernox Thermometers to be activated
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change; the CERNOX activation parameters are correctly repported in the HSK telemetry
Input parameters:	HCT-BeltB : HP911280 HCT-BeltA : HP912280 HCT-Belt9 : HP913280 HCT-Belt8 : HP914280 HCT-Belt7 : HP915280 HCT-Belt6 : HP916280 HCT-Belt5 : HP917280 HCT-Belt4 : HP918280 HCT-Belt3 : HP919280 HCT-Belt2 : HP920280 HCT-Belt1 : HP921280 HCT-Belt0 : HP922280 HCT0Duration : HP511280
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA017280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-HCTcontrol-4053	HC083280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 70s HM932280 = HP911280 HM931280 = HP912280 HM930280 = HP913280 HM929280 = HP914280 HM928280 = HP915280 HM927280 = HP916280 HM926280 = HP917280 HM925280 = HP918280 HM924280 = HP919280 HM923280 = HP920280 HM922280 = HP921280 HM921280 = HP922280 HM292280 = HP511280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	ERSS_HFI_REU_RAWSIGNAL_SETUP

OBJECTIVES :	Sets how the raw signal channel is selected by the REU at each modulation period (Cycle, Fixed, Fixed, CS)

START CONDITION :	DPU and REU in CONFIGURATION or STANDBY

EXPECTED END CONDITION :	No mode change; the RAW signal parameter is correctly repported in the HSK telemetry

Input parameters:	Rsig-ModeSelect : HP886280 Belt (0 to 11) : HP903280 Channel (0 to 5) : HP904280

TPF file name:	NO

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-RsigSetup-4007	HC007280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM678280 = HP886280		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EECS_HFI_REU_SAVE_CONF_EEPROM
OBJECTIVES :	Save the configuration parameters of the 72 channels into the REU EEPROM
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change; No REU EEPROM error repported in the HSK telemetry
Input parameters:	EEPROM-Store (1 or 2) : HP910280
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-SaveParam-4011	HC005280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM346280 = 0		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EECL_HFI_REU_LOAD_CONF_EEPROM
OBJECTIVES :	Configures the 72 channels with the configuration parameters stored in EEPROM.
START CONDITION :	DPU in STARTUP or STANDBY REU in BOOT or STANDBY
EXPECTED END CONDITION :	No mode change; No REU EEPROM error repported in the HSK telemetry
Input parameters:	EEPROM-Load (0, 1 or 2) : HP887280
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ REU mode (HM565280) = STANDBY or CONFIGURATION

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-LoadParam-4010	HC004280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 5mn ☞ HFI to check if the configuration is as expected and give a go ahead to continue		RETRY or reconfigure chanels

PROCEDURE NAME :	ESWR_HFI_REU_SW_RESET
OBJECTIVES :	Do a REU software reset
START CONDITION :	DPU in any mode but BOOT and REU in any mode
EXPECTED END CONDITION :	No DPU and 4K mode change, REU in BOOT mode
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-Reset-40A0	HC000280	ASAP	
	Check:	At time > TC N°1 + 2mn, REU is in BOOT (HM565280)		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EHWT_HFI_REU_HARDWARE_TEST
OBJECTIVES :	Do REU hardware tests (PROM, EEPROM, DRAM, PRAM, Analog belt preprocessor)
START CONDITION :	DPU in STARTUP or STANDBY; REU in BOOT or STANDBY
EXPECTED END CONDITION :	No mode change; No REU error repported in the HSK telemetry
Input parameters:	DeviceTbt (0x40 to , 0x44, 0x50 to 0x5B) : HP902280
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STARTUP and REU mode (HM565280) = BOOT if PROM, EEPROM, DRAM, PRAM test, ALL analog belt hardware test is requested ☞ DPU mode (HM363240) and REU mode (HM565280) = STANDBY if one Analog belt preprocessor test is requested

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-Hwtest-4024	HC003280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s HM346280 = 0 HM350280 = 0 HM352280 = 0 HM356280 = 0 HM358280 = 0		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EMEM_HFI_REU_COPY_MEMORY
OBJECTIVES :	Copy a REU memory block from a source address to a target address
START CONDITION :	DPU in STARTUP; REU in BOOT
EXPECTED END CONDITION :	No mode change; No REU error repported in the HSK telemetry
Input parameters:	memory source ID : HP909280 source start address : HP906280 length : HP908280 memory target ID : HP909280 target_start_address : HP907280
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006280
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STARTUP ☞ REU mode (HM565280) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-CopyMemory-4084	HC191280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s HM346280 = 0 HM350280 = 0 HM352280 = 0		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	EASW_HFI_REU_COPY_ASW
OBJECTIVES :	Copy the REU ASW from EEPROM to PRAM
START CONDITION :	DPU in STARTUP; REU in BOOT
EXPECTED END CONDITION :	No mode change; No REU error repported in the HSK telemetry
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006280
PREREQUESITE CHECK :	NO

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-CopyASW-4023	HC002280	ASAP	
	Check:	At time > TC N°1 + 10s ☞ HM346280 = 0		RETRY; if does not work: CALL HFI

PROCEDURE NAME :	HFI_REU_FPGA_RESET

OBJECTIVES :	Reset the REU analog belts

START CONDITION :	DPU and REU in STANDBY

EXPECTED END CONDITION :	DPU and REU in STANDBY

Input parameters:	FPGA Reset : HP888280 Belt B : HP890280 Belt A : HP891280 Belt 9 : HP892280 Belt 8 : HP893280 Belt 7 : HP894280 Belt 6 : HP895280 Belt 5 : HP896280 Belt 4 : HP897280 Belt 3 : HP898280 Belt 2 : HP899280 Belt 1 : HP900280 Belt 0 : HP901280

TPF file name:	NO

DISPLAY to use (AND):	HA001289, HA006280, HA006280, WALC1565, WALC2565

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY ☞ REU mode (HM565280) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCREU-FPGAreset-4054	HC001280	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°2 + 10s HM302280= HM304280= HM308280= HM310280= HM314280= HM316280= HM320280= HM322280= HM326280= HM328280= HM332280= HM334280= ACTIVE		CALL HFI
	Check:	At time > TC N°2 + 30s If event packets (5,2) REUFpgaOn have been received during NMON_HFI_BOOT_TO_STARTUP, check that event packets (5,2) REUFpgaOff are received now		CALL HFI

11.12.4 4K PRODEDURES

PROCEDURE NAME :	4FIT_HFI_4K_FREQ_INT_SETUP
OBJECTIVES :	Sets the 4K internal frequency
START CONDITION :	DPU and 4K in STANDBY
EXPECTED END CONDITION :	No mode change; Internal 4K frequency correctly repported in the HSK
Input parameters:	IntF180ClockPeriod : HP004260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-IntF180Period-8002	HC013260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM114260 = HP004260		CALL HFI

PROCEDURE NAME :	4MAS_HFI_4K_MAX_AMPLITUDE_SETUP
OBJECTIVES :	Sets the 4K MAXIMUM amplitude demand limit
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY
EXPECTED END CONDITION :	No mode change; 4K maximum amplitude limit correctly repported in the HSK
Input parameters:	MaxCompAmpDemand : HP012260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-MaxCompAmpDem-8002	HC021260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM122260 = HP012260		CALL HFI

PROCEDURE NAME :	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP
OBJECTIVES :	Sets the 4K amplitude demand
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K amplitude demand correctly repported in the HSK
Input parameters:	`CompAmplDemand : HP010260`
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-CompAmplDemand-8002	HC019260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM120260 = HP010260 the 4K will transitory be in CHANGE_AMPLITUDE mode.		CALL HFI

PROCEDURE NAME :	4LMS_HFI_4K_LIMITS_SETUP
OBJECTIVES :	Sets the 4K limits (temperature, intensity and stroke)
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K limits correctly repported in the HSK
Input parameters:	CompAPosDisplace : HP017260 CompANegDisplace : HP018260 CompBPosDisplace : HP019260 CompBNegDisplace : HP020260 PkDriveCurrent1 : HP021260 PkDriveCurrent2 : HP022260 PkDriveCurrent3 : HP023260 CompADCPosPk : HP024260 CompADCNegPk : HP025260 CompBDCPosPk : HP026260 CompBDCNegPk : HP027260 CompAHeadTemp1 : HP028260 CompAHeadTemp2 : HP029260 CompBHeadTemp1 : HP030260 CompBHeadTemp2 : HP031260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA904260, HA905260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-CompAPosDisp-8007	HC025260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM126260 = HP017260		CALL HFI
2	TC4K-CompANegDisp-8007	HC026260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°2 + 1mn30s ☞ HM127260 = HP018260		CALL HFI
3	TC4K-CompBPosDisp-8007	HC027260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°3 + 1mn30s ☞ HM128260 = HP019260		CALL HFI
4	TC4K-CompBNegDisp-8007	HC028260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°4 + 1mn30s ☞ HM129260 = HP020260		CALL HFI

5	TC4K-PkDrivCurrent1-8007	HC029260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°5 + 1mn30s ☞ HM130260 = HP021260		CALL HFI
6	TC4K-PkDrivCurrent2-8007	HC030260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°6 + 1mn30s ☞ HM131260 = HP022260		CALL HFI
7	TC4K-PkDrivCurrent3-8007	HC031260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°7 + 1mn30s ☞ HM132260 = HP023260		CALL HFI
8	TC4K-CompADrvCPosPk-8007	HC032260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°8 + 1mn30s ☞ HM137260 = HP024260		CALL HFI
9	TC4K-CompADrvCNegPk-8007	HC033260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°9 + 1mn30s ☞ HM138260 = HP025260		CALL HFI
10	TC4K-CompBDrvCPosPk-8007	HC034260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°10 + 1mn30s ☞ HM139260 = HP026260		CALL HFI
11	TC4K-CompBDrvCNegPk-8007	HC035260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°11 + 1mn30s ☞ HM140260 = HP027260		CALL HFI
12	TC4K-CompAheadTemp1-8007	HC036260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°12 + 1mn30s ☞ HM133260 = HP028260		CALL HFI
13	TC4K-CompAheadTemp2-8007	HC037260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°13 + 1mn30s ☞ HM134260 = HP029260		CALL HFI
14	TC4K-CompBheadTemp1-8007	HC038260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°14 + 1mn30s ☞ HM135260 = HP030260		CALL HFI
15	TC4K-CompBheadTemp2-8007	HC039260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 5+ 1mn30s ☞ HM136260 = HP031260		CALL HFI

PROCEDURE NAME :	4LMC_HFI_4K_LIMITS_CONTROL
OBJECTIVES :	Activate / desactivate the action associated to a 4K limit
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K amplitude demand correctly repported in the HSK
Input parameters:	LimitValuesID : HP016260 LimitOn_Off : HP032260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-LimitCtrl-8008	HC040260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ corresponding limit control reported in HM220260 to HM236260 = HP032260		CALL HFI

PROCEDURE NAME :	4LMA_HFI_4K_LIMITS_ACTION
OBJECTIVES :	Modify the selected 4K limit control (warning or switch down)
START CONDITION :	DPU in STANDBY or CONFIG; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K amplitude demand correctly repported in the HSK
Input parameters:	`LimitActionId : HP033260` `LimitAction : HP034260`
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-LimitAction-8009	HC041260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ corresponding limit control reported in HM237260 to HM253260 = HP034260		CALL HFI

PROCEDURE NAME :	4EFL_HFI_4K_FREQ_EXT_LIMITS_SETUP
OBJECTIVES :	Sets the 4K external frequencies limit paramers
START CONDITION :	DPU in STANDBY or CONFIG; 4K in STANDBY
EXPECTED END CONDITION :	No mode change; 4K external frequency parameters correctly repported in the HSK
Input parameters:	ExtF0ClockMaxLimit : HP005260 ExtF0ClockMinLimit : HP006260 ExtF0ClockMaxVariation : HP007260 ExtF180ClockMaxLimit : HP008260 ExtF180ClockMinLimit : HP009260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA904260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-ExtF0MaxLimit-8002	HC014260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM115260 = HP005260		CALL HFI
2	TC4K-ExtF0MinLimit-8002	HC015260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°2 + 1mn30s ☞ HM116260 = HP006260		CALL HFI
3	TC4K-ExtF0MaxVar-8002	HC016260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°3 + 1mn30s ☞ HM117260 = HP007260		CALL HFI
4	TC4K-ExtF180MaxLimt-8002	HC017260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°4 + 1mn30s ☞ HM118260 = HP008260		CALL HFI
5	TC4K-ExtF180MinLimt-8002	HC018260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°5 + 1mn30s ☞ HM119260 = HP009260		CALL HFI

PROCEDURE NAME :	4GES_HFI_4K_GETTER_SELECT
OBJECTIVES :	Select the 4K getter (nominal, redundant)
START CONDITION :	DPU in STANDBY or CONFIG; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K getter selected correctly repported in the HSK
Input parameters:	`GetterElementSelect : HP014260`
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-GetterSelElt-8002	HC023260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM124260 = HP014260		CALL HFI

PROCEDURE NAME :	4GEC_HFI_4K_GETTER_CONTROL
OBJECTIVES :	POWER ON or OFF the all the 4K getter heaters
START CONDITION :	DPU in STANDBY or CONFIG; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K getter status correctly repported in the HSK
Input parameters:	SelGetterOff_On : HP039260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA906260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-GetterCtrl-800E	HC046260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM284260 or / and HM285260 = HP039260 in agreement with HP014260		CALL HFI

PROCEDURE NAME :	4JTH_HFI_4K_JT_HEATER_CONTROL
OBJECTIVES :	POWER ON or OFF the 4K JT heater
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K JT heater status correctly repported in the HSK
Input parameters:	OrificeHeatOff_On : HP038260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA906260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-OrifHeatCtrl-800D	HC045260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM283260 = HP038260		CALL HFI

PROCEDURE NAME :	4SYS_HFI_4K_SYNCHRO_SELECT
OBJECTIVES :	Select the 4K syncronisation frequency (4K : internal or REU : external)
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY
EXPECTED END CONDITION :	No mode change; 4K synchronisation frequency status correctly repported in the HSK
Input parameters:	`SynchClockSelect : HP040260`
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA906260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-SyncCtrl-8010	HC047260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM316260 = inverse of HP040260		CALL HFI

PROCEDURE NAME :	4FTS_HFI_4K_VCS_FORCE_TRANSDUCER_SELECT
OBJECTIVES :	Select the force transducer to be taken into account for the 4K Vibration Cancelletion System
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY
EXPECTED END CONDITION :	No mode change; 4K force transducer selection correctly repported in the HSK
Input parameters:	ForceTransducer0 : HP041260 ForceTransducer1 : HP042260 ForceTransducer2 : HP043260 ForceTransducer3 : HP044260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-ForceTransdSel-8002	HC024260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM125260 = HP041260 + 2xHP042260 + 4xHP043260 + 8xHP043260		CALL HFI

PROCEDURE NAME :	4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT
OBJECTIVES :	Select the harmonic forces to be taken into account for the 4K Vibration Cancelletion System
START CONDITION :	DPU in STANDBY or CONFIG; 4K in STANDBY or NOMINAL
EXPECTED END CONDITION :	No mode change; 4K force harmonic selection correctly repported in the HSK
Input parameters:	FreqSelVCS : HP013260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-FreqImbCancel-8002	HC022260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 1mn30s ☞ HM123260 = HP013260		CALL HFI

PROCEDURE NAME :	4VCS_HFI_4K_VCS_CONTROL
OBJECTIVES :	Activate / deactivate the 4K Vibration Cancellation System
START CONDITION :	DPU in STANDBY or CONFIGURATION; 4K in STANDBY
EXPECTED END CONDITION :	No mode change; 4K VCS selection correctly repported in the HSK
Input parameters:	VCSOff_On : HP037260
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA901260
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY or CONFIGURATION ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-VcsCtrl-800B	HC043260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM004260 = HP037260		CALL HFI

PROCEDURE NAME :	4COR_HFI_4K_RUN_COOLER
OBJECTIVES :	START the 4K cooler compressors running
START CONDITION :	DPU in CONFIGURATION; 4K in STANDBY or FREEWHEEL
EXPECTED END CONDITION :	No mode change for DPU; 4K in NOMINAL
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ 4K mode (HM003260) = STANDBY or FREEWHEEL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-RunCooler-8004	HC048260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 2.5mn ☞ HM003260 = NOMINAL if the 4K is in STANDBY at the start of this procedure, the 4K will transitory be in RUNUP_1 mode. if the 4K is in FREEWHEEL at the start of this procedure, the 4K will transitory be in RUNDOWN_2 then in RUNUP_1 mode.		CALL HFI

PROCEDURE NAME :	4COS_HFI_4K_STOP_COOLER
OBJECTIVES :	STOP running the 4K cooler compressors
START CONDITION :	DPU in CONFIGURATION , 4K in NOMINAL, FREEWHEEL
EXPECTED END CONDITION :	No mode change for DPU; 4K in STANDBY
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ 4K mode (HM003260) = NOMINAL or FREEWHEEL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-StopCooler-8003	HC049260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 2.5mn ☞ 4K mode ((HM003260) = STANDBY if the 4K is in NOMINAL at the start of this procedure, the 4K will transitory be in RUNDOWN_3 mode. if the 4K is in FREEWHEEL at the start of this procedure, the 4K will transitory be in RUNDOWN_1 mode.		CALL HFI

PROCEDURE NAME :	4SRS_HFI_4K_DO_SRT_FROM_STANDBY

OBJECTIVES :	Do a 4K System Response Test from 4K in STANDBY mode

START CONDITION :	DPU in STANDBY; 4K in STANDBY

EXPECTED END CONDITION :	No mode change; 4K SRT correctly excecuted

Input parameters:	NO

TPF file name:	NO

DISPLAY to use (AND):	HA001289

PREREQUESITE CHECK :	☞ DPU mode (HM363240) = STANDBY ☞ 4K mode (HM003260) = STANDBY

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-4KCMaint-0019	HC015289	ASAP	-
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM363240 = 4K_MAINTENANC ☞ HM003260 = MAINTENANCE		CALL HFI
2	TC4K-SysRespTest-800C	HC044260	ASAP	-
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°2 + 2.5mn ☞ HM003260 = SYS_RESP_TEST (before the SYS_RESP_TEST mode is reach the 4K transient mode will be RUNUP_2) At time > TC N°2 + 25mn ☞ WAIT for HM184260 = 1 (should be before TC N°2 + 35mn) (when the SRT is finished, the 4K transient mode will be RUNDOWN_4)		CALL HFI
3	TCOBSW-4KCMaintStp-0119	HC016289	TC N°2 + HM184260 = 1	-
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°3 + 10s ☞ HM363240 = STANDBY ☞ HM003260 = STANDBY		CALL HFI

PROCEDURE NAME :	4SRN_HFI_4K_DO_SRT_IN_NOMINAL
OBJECTIVES :	Do a 4K System Response Test from 4K NOMINAL mode
START CONDITION :	DPU in CONFIGURATION; 4K in NOMINAL
EXPECTED END CONDITION :	No mode change; 4K SRT correctly excecuted
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ 4K mode (HM003260) = NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCOBSW-Hot4KCMaint-0018	HC013289	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM363240 = HOT_4K_MAINTCE ☞ HM003260 = NOMINAL		CALL HFI
2	TC4K-SysRespTest-800C	HC044260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°2 + 10s ☞ HM003260 = NOMINAL_SRT At time > TC N°2 + 25mn ☞ WAIT for HM184260 = 1 (should be before TC N°2 + 35mn)		CALL HFI
3	TCOBSW-Hot4KCMntStp-0118	HC014289	TC N°2 + HM184260 = 1	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°3 + 10s ☞ HM363240 = CONFIGURATION ☞ HM003260 = NOMINAL		CALL HFI

PROCEDURE NAME :	4SRC_HFI_4K_CANCEL_SRT
OBJECTIVES :	Cancel the execution of a 4K System Response Test
START CONDITION :	DPU in 4K_COOLERMAINT or 4K_HOT_COOLERMAINT; 4K in MAINTENANCE_SRT or NOMINAL_SRT
EXPECTED END CONDITION :	4K mode retrurn in NOMINAL or MAINTENANCE; no DPU mode change
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = CONFIGURATION ☞ 4K mode (HM003260) = NOMINAL

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-CancelSysRespTest	HC051260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		CALL HFI
	Check:	At time > TC N°1 + 2mn ☞ HM003260 = MAINTENANCE or NOMINAL		CALL HFI

PROCEDURE NAME :	4SWR_HFI_4K_SW_RESET
OBJECTIVES :	Do a 4KCDE software reset
START CONDITION :	DPU in any mode but BOOT; 4K in any mode
EXPECTED END CONDITION :	4K in BOOT mode; no DPU mode change
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) not in BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-Reset-800F	HC012260	ASAP	
	Check:	Packet TM(1,1) ~~and TM(1,7)~~ (TM(1,8) will be received)		CALL HFI
	Check:	At time > TC N°1 + 2mn15s ☞ HM003260 = BOOT		CALL HFI
	Check:	At time > TC N°1 + 2mn15s, check that a maximum of TWO LSLERROR ON then OFF (APID 1408, TM(5,1)), and TWO SOFTWARE ERROR ON then OFF (APID 1408, TM(5,1)) have possibly been detected		CALL HFI

The 4COB_HFI_4K_CONTINUE_BOOT must not be send before 2mn15s after the 4K software reset

PROCEDURE NAME :	4COB_HFI_4K_CONTINUE_BOOT
OBJECTIVES :	Send to the 4K continue boot command to go into STANDBY or FREEWHEEL mode
START CONDITION :	DPU in any mode but BOOT; 4K in BOOT, 4SWR_HFI_4K_SW_RESET has been sent for more than 2mn 15s
EXPECTED END CONDITION :	4K in STANDBY or FREEWHEEL mode; no DPU mode change
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	HA001289
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = any mode but BOOT ☞ 4K mode (HM003260) = BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-ContinueBoot-8001	HC050260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 2mn ☞ HM003260 = STANDBY or FREEWHEEL		CALL HFI

PROCEDURE NAME :	4COM_HFI_4K_COM_TEST
OBJECTIVES :	Test the 4K LSL communication with DPU
START CONDITION :	DPU in any mode but BOOT and STARTUP; 4K in any mode but BOOT
EXPECTED END CONDITION :	No mode change
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = any mode but BOOT and STARTUP ☞ 4K mode (HM003260) = any mode but BOOT

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TC4K-Dummy-8000	HC011260	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

11.12.5 DCCU PRODEDURES

PROCEDURE NAME :	DVOP_HFI_DCE_VALVE_OPEN
OBJECTIVES :	OPEN a selected dilution valve
START CONDITION :	DPU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change & valve status correctly repported in the HSK (for valve having status)
Input parameters:	ValveID (0 to 11) : HP003270
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006270
PREREQUESITE CHECK :	

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDCE-ValveOpen-6002	HC001270	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM600270 = 1 if HP003270=0 ☞ HM601270 = 1 if HP003270=1 ☞ HM602270 = 1 if HP003270=2 ☞ HM603270 = 1 if HP003270=3 ☞ HM604270 = 1 if HP003270=10 ☞ HM605270 = 1 if HP003270=11		CALL HFI

PROCEDURE NAME :	DVCL_HFI_DCE_VALVE_CLOSE
OBJECTIVES :	CLOSE a selected dilution valve
START CONDITION :	DPU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change & valve status correctly repported in the HSK (for valve having status)
Input parameters:	ValveID (0 to 11) : HP003270
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006270
PREREQUESITE CHECK :	

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDCE-ValveClose-6003	HC002270	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 10s ☞ HM600270 = 2 if HP003270=0 ☞ HM601270 = 2 if HP003270=1 ☞ HM602270 = 2 if HP003270=2 ☞ HM603270 = 2 if HP003270=3 ☞ HM604270 = 2 if HP003270=10 ☞ HM605270 = 2 if HP003270=11		CALL HFI

PROCEDURE NAME :	DDHC_HFI_DCE_DEFROST_HEATER_CONTROL
OBJECTIVES :	Setup and control one dilution defrost heater or the 4K/18K thermal switch (N or R)
START CONDITION :	DPU in CONFIGURATION or STANDBY
EXPECTED END CONDITION :	No mode change; dilution temperature change
Input parameters:	Num defros heat (0 to 7) TempSetpoint : HPnnn270 with nnn=005 + 3 x Num defros heat Power : HPnnn270 with nnn=006 + 3 x Num defros heat Duration : HPnnn270 with nnn=007 + 3 x Num_defros_heat
TPF file name:	NO
DISPLAY to use (AND):	HA001289, HA006270
PREREQUESITE CHECK :	

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDCE-TempServoxxxx-6004	HCnnn270 with nnn=003 + Num_defros_heat	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI
	Check:	At time > TC N°1 + 2mn ☞ HM009270 and HM013270 evolution (visual inspection) if Num_defros_heat = 0 or 4 ☞ HM010270 and HM014270 evolution (visual inspection) if Num_defros_heat = 1 or 5 ☞ HM011270 and HM015270 evolution (visual inspection) if Num_defros_heat = 2 or 6 ☞ HM012270 and HM016270 evolution (visual inspection) if Num_defros_heat = 3 or 7		CALL HFI

PROCEDURE NAME :	DDCT_HFI_DCE_COM_TEST
OBJECTIVES :	Test the DCE LSL communication with DPU
START CONDITION :	DPU in any mode but BOOT and STARTUP
EXPECTED END CONDITION :	No mode change
Input parameters:	NO
TPF file name:	NO
DISPLAY to use (AND):	
PREREQUESITE CHECK :	☞ DPU mode (HM363240) = any mode but BOOT and STARTUP

SEQUENCE of COMMANDS:

N° of TC	Name of TC	SCOS name	Time condition	Action to take in case of Check anomalie
1	TCDCE-Dummy-6000	HC000270	ASAP	
	Check:	Packet TM(1,1) and TM(1,7)		RETRY; if does not work: CALL HFI

11.12.6 MACRO PRODEDURES

PROCEDURE NAME :	HFI_4K_REU_FREQUENCY_CHANGE
OBJECTIVES :	Change the 4K/REU frequency (Fdiv) and possibly the Number of sample (Ns)
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY; 4K in NOMINAL or STANDBY
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION; 4K in NOMINAL
Input parameters:	RSw07-Nsamp : HP003280 RSw07-Fdiv : HP004280 IntF180ClockPeriod : HP004260
TPF file name:	NO
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	☞ ALL HFI PID are with servo OFF : for i_PID=0 to 4 : HMaaa280=0 with aaa= 933 + i_PID ☞ ALL this procedure must be excecuted in a single visibility period

SEQUENCE of HFI PROCEDURES:

The procedure 4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT with Force_harmonic_selec : HP013260 = 0 must be ready to be sent at any time of this procedure on HFI request

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
1	NCSF_HFI_STANDBY_RETURN	NA	ASAP
2	4SWR_HFI_4K_SW_RESET	NA	ASAP
3	4COB_HFI_4K_CONTINUE_BOOT	NA	> Last proc +2mn15s
4	ENSF_HFI_REU_NS_FDIV_SETUP	RSw07-Nsamp : HP003280 RSw07-Fdiv : HP004280	> Last proc +2mn
5	4FIT_HFI_4K_FREQ_INT_SETUP	IntF180ClockPeriod : HP004260	ASAP
6	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand : HP010260 = 1500	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
7	NXCN_HFI_GOTO_CONFIG	NA	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
9	NCON_HFI_GOTO_OBSERVATION	NA	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
10	NXCN_HFI_GOTO_CONFIG	NA	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
11	4COR_HFI_4K_RUN_COOLER	NA	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
12	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand : HP010260 TBD HFI	ASAP
This step is an iterative one (not during SVT). The objective is to have all the 4K force harmonics bellow 2N before to start a 4K SRT			

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
	4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT	Force_harmonic_selec : HP013260 = 0	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
	4SRN_HFI_4K_DO_SRT_IN_NOMINAL	NA	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
	4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT	Force_harmonic_selec : HP013260 = 255	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand : HP010260 TBD HFI	ASAP
The 4 last steps steps are an iterative ones (not during SVT). The objective is to do a final SRT for the opperationnal 4K amplitude associated to the selected frequency			

PROCEDURE NAME :	HFI_NS_CHANGE_ONLY
OBJECTIVES :	Change the REU Number of sample (Ns) ONLY and not the Fdiv
START CONDITION :	DPU and REU in CONFIGURATION or STANDBY; 4K in NOMINAL or STANDBY
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION; 4K in NOMINAL
Input parameters:	Ns : HP003280 Fdiv : HP004280
TPF file name:	NO
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	☞ ALL HFI PID are with servo OFF : for i_PID=0 to 4 : HMaaa280=0 with aaa= 933 + i_PID ☞ the Fdiv parameter (HP004280) is equal to the current value Fdiv value (HM676280) ☞ ALL this procedure must be excecuted in a single visibility period

SEQUENCE of HFI PROCEDURES:

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
1	NCSF_HFI_STANDBY_RETURN	NA	ASAP
2	ENSF_HFI_REU_NS_FDIV_SETUP	Ns : HP003280 Fdiv : HP004280	ASAP
3	NXCN_HFI_GOTO_CONFIG	NA	ASAP
4	NCON_HFI_GOTO_OBSERVATION	NA	ASAP
5	NXCN_HFI_GOTO_CONFIG	NA	ASAP
6	4COR_HFI_4K_RUN_COOLER	NA	ASAP

PROCEDURE NAME :	HFI_SETUP_ALL_BOLO
OBJECTIVES :	SETUP of all ALL the bolometers
START CONDITION :	DPU and REU in CONFIGURATION or in STANDBY
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION or in STANDBY
Input parameters:	BOLO setup TPF version (identical version number for the 54 bolometers)
TPF file name:	PFHC00_PROCBXCX_(BOLO_setup_TPF_version) to PFHC85_PROCBXCX_(BOLO_setup_TPF_version)
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	

SEQUENCE of HFI PROCEDURES:

SETUP BOLOMETERS BELT 0 : Channel 00 to 05

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
1	ECHS_HFI_CHANNEL_SETUP	i_Belt=0 j_Channel=0 PFHC(i_Belt)(j_Channel)_PROCBXCX_(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
2	ECHS_HFI_CHANNEL_SETUP	i_Belt=0 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX_(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
3	ECHS_HFI_CHANNEL_SETUP	i_Belt=0 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX_(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
4	ECHS_HFI_CHANNEL_SETUP	i_Belt=0 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX_(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
5	ECHS_HFI_CHANNEL_SETUP	i_Belt=0 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX_(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
6	ECHS_HFI_CHANNEL_SETUP	i_Belt=0 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX_(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 1 : Channel 10 to 15			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
7	ECHS_HFI_CHANNEL_SETUP	i_Belt=1 j_Channel=0 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
8	ECHS_HFI_CHANNEL_SETUP	i_Belt=1 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
9	ECHS_HFI_CHANNEL_SETUP	i_Belt=1 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
10	ECHS_HFI_CHANNEL_SETUP	i_Belt=1 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
11	ECHS_HFI_CHANNEL_SETUP	i_Belt=1 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
12	ECHS_HFI_CHANNEL_SETUP	i_Belt=1 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 2 : Channel 20 to 25			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
13	ECHS_HFI_CHANNEL_SETUP	i_Belt=2 j_Channel=0 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
14	ECHS_HFI_CHANNEL_SETUP	i_Belt=2 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
15	ECHS_HFI_CHANNEL_SETUP	i_Belt=2 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
16	ECHS_HFI_CHANNEL_SETUP	i_Belt=2 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
17	ECHS_HFI_CHANNEL_SETUP	i_Belt=2 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
18	ECHS_HFI_CHANNEL_SETUP	i_Belt=2 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 3 : Channel 30 to 35			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
19	ECHS_HFI_CHANNEL_SETUP	i_Belt=3 j_Channel=0 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
20	ECHS_HFI_CHANNEL_SETUP	i_Belt=3 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
21	ECHS_HFI_CHANNEL_SETUP	i_Belt=3 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
22	ECHS_HFI_CHANNEL_SETUP	i_Belt=3 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
23	ECHS_HFI_CHANNEL_SETUP	i_Belt=3 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
24	ECHS_HFI_CHANNEL_SETUP	i_Belt=3 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 4 : Channel 40 to 45			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
25	ECHS_HFI_CHANNEL_SETUP	i_Belt=4 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
26	ECHS_HFI_CHANNEL_SETUP	i_Belt=4 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
27	ECHS_HFI_CHANNEL_SETUP	i_Belt=4 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
28	ECHS_HFI_CHANNEL_SETUP	i_Belt=4 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
29	ECHS_HFI_CHANNEL_SETUP	i_Belt=4 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
30	ECHS_HFI_CHANNEL_SETUP	i_Belt=4 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 5 : Channel 50 to 55			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
31	ECHS_HFI_CHANNEL_SETUP	i_Belt=5 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
32	ECHS_HFI_CHANNEL_SETUP	i_Belt=5 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
33	ECHS_HFI_CHANNEL_SETUP	i_Belt=5 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
34	ECHS_HFI_CHANNEL_SETUP	i_Belt=5 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
35	ECHS_HFI_CHANNEL_SETUP	i_Belt=5 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
36	ECHS_HFI_CHANNEL_SETUP	i_Belt=5 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 6 : Channel 60 to 65			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
37	ECHS_HFI_CHANNEL_SETUP	i_Belt=6 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
38	ECHS_HFI_CHANNEL_SETUP	i_Belt=6 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
39	ECHS_HFI_CHANNEL_SETUP	i_Belt=6 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
40	ECHS_HFI_CHANNEL_SETUP	i_Belt=6 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
41	ECHS_HFI_CHANNEL_SETUP	i_Belt=6 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
42	ECHS_HFI_CHANNEL_SETUP	i_Belt=6 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 7 : Channel 70 to 75			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
43	ECHS_HFI_CHANNEL_SETUP	i_Belt=7 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
44	ECHS_HFI_CHANNEL_SETUP	i_Belt=7 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
45	ECHS_HFI_CHANNEL_SETUP	i_Belt=7 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
46	ECHS_HFI_CHANNEL_SETUP	i_Belt=7 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
47	ECHS_HFI_CHANNEL_SETUP	i_Belt=7 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
48	ECHS_HFI_CHANNEL_SETUP	i_Belt=7 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

SETUP BOLOMETERS BELT 8 : Channel 80 to 85			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
49	ECHS_HFI_CHANNEL_SETUP	i_Belt=8 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
50	ECHS_HFI_CHANNEL_SETUP	i_Belt=8 j_Channel=1 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
51	ECHS_HFI_CHANNEL_SETUP	i_Belt=8 j_Channel=2 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
52	ECHS_HFI_CHANNEL_SETUP	i_Belt=8 j_Channel=3 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
53	ECHS_HFI_CHANNEL_SETUP	i_Belt=8 j_Channel=4 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
54	ECHS_HFI_CHANNEL_SETUP	i_Belt=8 j_Channel=5 PFHC(i_Belt)(j_Channel)_PROCBXCX _(BOLO_setup_TPF_version)	ASAP

PROCEDURE NAME :	HFI_OPTIM_CONFIGURATION_ALL_BOLO
OBJECTIVES :	Configure the optimisation parameters for all the bolometers
START CONDITION :	DPU and REU in CONFIGURATION or in STANDBY
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION or in STANDBY
Input parameters:	
TPF file name:	PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_nnnn
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	

SEQUENCE of HFI PROCEDURES:

PARAMETER SETUP for OPTIMISATION : BELT 0

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
1	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=0 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
2	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=0 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
3	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=0 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
4	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=0 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
5	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=0 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
6	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=0 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 1

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition

7	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=1 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
8	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=1 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
9	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=1 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
10	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=1 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
11	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=1 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
12	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=1 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 2

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
13	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=2 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
14	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=2 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
15	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=2 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
16	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=2 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
17	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=2 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
18	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=2 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 3

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
19	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=3 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
20	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=3 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
21	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=3 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
22	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=3 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
23	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=3 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
24	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=3 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 4

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
25	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=4 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
26	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=4 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
27	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=4 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
28	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=4 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
29	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=4 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
30	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=4 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 5

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
31	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=5 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
32	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=5 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
33	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=5 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
34	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=5 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
35	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=5 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
36	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=5 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 6

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
37	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=6 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
38	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=6 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
39	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=6 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
40	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=6 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
41	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=6 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
42	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=6 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 7

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
43	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=7 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
44	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=7 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
45	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=7 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
46	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=7 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
47	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=7 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
48	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=7 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PARAMETER SETUP for OPTIMISATION : BELT 8

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
49	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=8 j_Channel=0 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
50	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=8 j_Channel=1 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
51	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=8 j_Channel=2 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
52	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=8 j_Channel=3 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
53	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=8 j_Channel=4 PFHEOPC_OPTMBXCX_nnnn	ASAP

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
54	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt=8 j_Channel=5 PFHEOPC_OPTMBXCX_nnnn	ASAP

PROCEDURE NAME :	HFI_OPTIM_AND_FAST_VI_ALL_BOLO
OBJECTIVES :	Do a two step optimisation and a VI measurement of ALL the bolometers
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION
Input parameters:	
TPF file name:	PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	

SEQUENCE of HFI PROCEDURES:

PARAMETER SETUP for OPTIMISATION N°1			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
1	HFI_OPTIM_CONFIGURATION_ALL_BOLO	PFHEOPC_OPTMBXCX_0001	ASAP

Selection of ALL the bolometers for optimisation and VI			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
2	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	PFHECLS_OPTVLIST_0005	ASAP

FIRST OPTIMIZATION of ALL the BOLOMETERS: Use Gamp init, use T init, Cv before, T OFF & V OFF, List			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
3	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=1 VIOOptTuneT=0 VIOChanSelMode=1 Belt=0 Channel=0	ASAP

PARAMETER SETUP for OPTIMISATION N°2			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
4	HFI_OPTIM_CONFIGURATION_ALL_BOLO	PFHEOPC_OPTMBXCX_0002	ASAP

SECOND OPTIMIZATION of ALL the BOLOMETERS: Use Gamp init, use T init, Ct before, T ON & V ON, List			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
5	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=2 VIOOptTuneT=3 VIOChanSelMode=1 Belt=0 Channel=0	ASAP

FAST VI of ALL BOLOMETERS : Use Gamp init, use T init, CvCt if needed, T OFF& V OFF, List			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
6	NCVN_HFI_GOTO_VI	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=0 VIOOptTuneT=0 VIOChanSelMode=1 Belt=0 Channel=0	ASAP

PROCEDURE NAME :	HFI_OPTIM_ALL_BOLO_1_2_and_FINAL
OBJECTIVES :	Do a three step optimisation of ALL the bolometers
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION
Input parameters:	
TPF file name:	PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	

SEQUENCE of HFI PROCEDURES:

PARAMETER SETUP for OPTIMISATION N°1			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
1	HFI_OPTIM_CONFIGURATION_ALL_BOLO	PFHEOPC_OPTMBXCX_0001	ASAP

Selection of ALL the bolometers for optimisation and VI			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
2	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	PFHECLS_OPTVLIST_0005	ASAP

FIRST OPTIMIZATION of ALL the BOLOMETERS: Use Gamp init, use T init, Cv before, T OFF & V OFF, List			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
3	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=1 VIOOptTuneT=0 VIOChanSelMode=1 Belt=0 Channel=0	ASAP

PARAMETER SETUP for OPTIMISATION N°2			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
4	HFI_OPTIM_CONFIGURATION_ALL_BOLO	PFHEOPC_OPTMBXCX_0002	ASAP

SECOND OPTIMIZATION of ALL the BOLOMETERS: Use Gamp init, use T init, Ct before, T ON & V ON, List			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
5	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=2 VIOOptTuneT=3 VIOChanSelMode=1 Belt=0 Channel=0	ASAP

FINAL FINE OPTIMIZATION of ALL the BOLOMETERS: Use Gamp init, use T current, CvCt if needed, T ON & V ON, List			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition
6	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=1 VIOCvCtMeas=0 VIOOptTuneT=3 VIOChanSelMode=1 Belt=0 Channel=0	ASAP

PROCEDURE NAME :	HFI_ELEC_CHECK_100K_and_1K
OBJECTIVES :	Do an HFI electrical verification of the bolometers at around 100K and 1K
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION with ALL channels configured nominaly
PREREQUESITE CHECK :	NO
DISPLAY to use (AND):	see HFI called Procedures

for i_belt=0 to 8
for i_channel=0 to 5

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
(i_belt*6 + i_channel)*14+1	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = i_belt Channel : HP904280 = i_channel	ASAP	Raw Signal fixed on analyzed channel
(i_belt*6 + i_channel)*14+2	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 3000 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+3	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 3500 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	Bias Current exploration
(i_belt*6 + i_channel)*14+4	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 4000 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+5	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 50 Trans_Contl= 0	Last proc+10s	Bias Voltage exploration

(i_belt*6 + i_channel)*14+6	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+7	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+8	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 3000	Last proc+10s	Transient exploration
(i_belt*6 + i_channel)*14+9	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 3500	Last proc+10s	
(i_belt*6 + i_channel)*14+10	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 4000	Last proc+10s	
(i_belt*6 + i_channel)*14+11	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 0 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	Gamp exploration

(i_belt*6 + i_channel)*14+12	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 2 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+13	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 3 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+14	ECHS_HFI_CHANNEL_SETUP	PFHC00P_PROCBXCX_0001 to PFHC85P_PROCBXCX_0001	Last proc+10s	Setup the channel nominaly

NEXT i_channel

NEXT i_belt

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
756	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = A Channel : HP904280 = 0	ASAP	Raw Signal fixed on RESISTOR
757	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 3000 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	Bias Current exploration
758	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 3500 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
759	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 4000 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	

760	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 50 Trans_Contl= 0	Last proc+10s	
761	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 0	Last proc+10s	Bias Voltage exploration
762	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 0	Last proc+10s	
763	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 3000	Last proc+10s	
764	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 3500	Last proc+10s	Transient exploration
765	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 4000	Last proc+10s	

766	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 0 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	Gamp exploration
767	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 2 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
768	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 3 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
769	ECHS_HFI_CHANNEL_SETUP	PFHCA0P_PROCBXCX_0001	Last proc+10s	Setup the RESISTOR nominaly
770	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 3 Belt : HP903280 = 0 Channel : HP904280 = 0	ASAP	Raw Signal cycle CS
771	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=3 VIOOptTuneT=3 VIOChanSelMode=0 Belt=A Channel=0	ASAP	Optimisation of the RESISTOR

PROCEDURE NAME :	HFI_ELEC_CHECK_300mK
OBJECTIVES :	Do an HFI electrical verification of the bolometers at around 300mK
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION with ALL channels configured nominaly
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	NO

for i_belt=0 to 8
for i_channel=0 to 5

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
(i_belt*6 + i_channel)*14+1	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = i_belt Channel : HP904280 = i_channel	ASAP	Raw Signal fixed on analyzed channel
(i_belt*6 + i_channel)*14+2	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 2000 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+3	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 3000 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	Bias Current exploration
(i_belt*6 + i_channel)*14+4	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 3500 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+5	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 50 Trans_Contl= 0	Last proc+10s	Bias Voltage exploration

(i_belt*6 + i_channel)*14+6	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+7	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 150 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+8	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 1000	Last proc+10s	Transient exploration
(i_belt*6 + i_channel)*14+9	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 2500	Last proc+10s	
(i_belt*6 + i_channel)*14+10	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 4000	Last proc+10s	
(i_belt*6 + i_channel)*14+11	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 0 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	Gamp exploration

(i_belt*6 + i_channel)*14+12	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 2 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+13	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 3 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+14	ECHS_HFI_CHANNEL_SETUP	PFHC00P_PROCBXCX_0001 to PFHC85P_PROCBXCX_0001	Last proc+10s	Setup the channel nominaly
	NEXT i_channel			
	NEXT i_belt			
N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
756	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = A Channel : HP904280 = 0	ASAP	Raw Signal fixed on RESISTOR
757	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 20 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	Bias Current exploration
758	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 40 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
759	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 80 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	

760	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 20 Trans_Contl= 0	Last proc+10s	
761	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 40 Trans_Contl= 0	Last proc+10s	Bias Voltage exploration
762	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 80 Trans_Contl= 0	Last proc+10s	
763	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 500	Last proc+10s	
764	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 2500	Last proc+10s	Transient exploration
765	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 3000	Last proc+10s	

766	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 0 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	Gamp exploration
767	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 2 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
768	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 3 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
769	ECHS_HFI_CHANNEL_SETUP	PFHCA0P_PROCBXCX_0001	Last proc+10s	Setup the RESISTOR nominaly
770	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 3 Belt : HP903280 = 0 Channel : HP904280 = 0	ASAP	Raw Signal cycle CS
771	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp=0 VIOKeepT=0 VIOCvCtMeas=3 VIOOptTuneT=3 VIOChanSelMode=0 Belt=A Channel=0	ASAP	Optimisation of the RESISTOR

PROCEDURE NAME :	HFI_ELEC_CHECK_100mK
OBJECTIVES :	Do an HFI electrical verification of the bolometers at around 100mK
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION with ALL channels configured nominaly
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	NO

for i_belt=0 to 8
for i_channel=0 to 5

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
(i_belt*6 + i_channel)*14+1	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = i_belt Channel : HP904280 = i_channel	ASAP	Raw Signal fixed on analyzed channel
(i_belt*6 + i_channel)*14+2	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 20 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+3	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 40 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	Bias Current exploration
(i_belt*6 + i_channel)*14+4	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 80 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+5	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 20 Trans_Contl= 0	Last proc+10s	Bias Voltage exploration

(i_belt*6 + i_channel)*14+6	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 50 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+7	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+8	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 1000	Last proc+10s	Transient exploration
(i_belt*6 + i_channel)*14+9	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 2000	Last proc+10s	
(i_belt*6 + i_channel)*14+10	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 100 Trans_Contl= 3000	Last proc+10s	
(i_belt*6 + i_channel)*14+11	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 0 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	Gamp exploration

(i_belt*6 + i_channel)*14+12	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 2 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+13	ECHS_HFI_CHANNEL_SETUP	Nbelt= i_belt Nchannel= i_channel Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 3 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
(i_belt*6 + i_channel)*14+14	ECHS_HFI_CHANNEL_SETUP	PFHC00P_PROCBXCX_0007 to PFHC85P_PROCBXCX_0007	ASAP	Setup the channels as before QEC

NEXT i_channel

NEXT i_belt

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
756	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = A Channel : HP904280 = 0	ASAP	Raw Signal fixed on RESISTOR
757	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 20 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	Bias Current exploration
758	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 40 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	
759	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 80 BiasVoltage= 0 Trans_Contl= 0	Last proc+10s	

760	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 20 Trans_Contl= 0	Last proc+10s	Bias Voltage exploration
761	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 40 Trans_Contl= 0	Last proc+10s	
762	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 80 Trans_Contl= 0	Last proc+10s	
763	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 500	Last proc+10s	Transient exploration
764	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 2500	Last proc+10s	
765	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 1 BiasCurrent= 0 BiasVoltage= 60 Trans_Contl= 3000	Last proc+10s	

766	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 0 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	Gamp exploration
767	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 2 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
768	ECHS_HFI_CHANNEL_SETUP	Nbelt= A Nchannel= 0 Mphase= 0 Nblank= 0 Sphase= 0 Gamp= 3 BiasCurrent= 0 BiasVoltage= 18 Trans_Contl= 0	Last proc+10s	
769	ECHS_HFI_CHANNEL_SETUP	PFHCA0P_PROCBXCX_0002	Last proc+10s	Setup the RESISTOR as before QEC
770	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 3 Belt : HP903280 = 0 Channel : HP904280 = 0	ASAP	Raw Signal cycle CS

PROCEDURE NAME :	HFI_RAW_72
OBJECTIVES :	Do a cycle for ALL the 72 channels in RAW mode during one minute each
START CONDITION :	DPU and REU in CONFIGURATION
EXPECTED END CONDITION :	DPU and REU in CONFIGURATION
DISPLAY to use (AND):	see HFI called Procedures
PREREQUESITE CHECK :	NO

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
1	PHEE_HFI_DPU_HK_EMISSION_DISABLE	service_type =3 service_sub_type =25 packet_ID =1	ASAP	DISABLE production of HSK1 (EssentialHSK3 are preserved)
2	NCRN_HFI_GOTO_RAW_SIGNAL		ASAP	GO into RAW mode

for i_belt=0 to 11
for i_channel=0 to 5

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
(i_belt*6 + i_channel)+3	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 1 Belt : HP903280 = i_belt Channel : HP904280 = i_channel	Last Proc + 1mn	Raw Signal fixed on analyzed channel

NEXT i_channel
NEXT i_belt

N° of PROC	Name of HFI PROCEDURES	Input parameters:	Time condition	
75	NXCN_HFI_GOTO_CONFIG		Lasr Proc + 1mn	GO into RAW mode
76	PHED_HFI_DPU_HK_EMISSION_ENABLE	service_type =3 service_sub_type =25 packet_ID =1	ASAP	ENABLE production of HSK1
77	ERSS_HFI_REU_RAWSIGNAL_SETUP	RAW_config : HP886280 = 3 Belt : HP903280 = 0 Channel : HP904280 = 0	ASAP	Raw Signal cycle CS

11.13 HFI operational constrainst

11.13.1 General HFI operational constrainst

- DPU must not be powered OFF less than 1mn30s after it has been powered ON
- REU must not be powered OFF less than 1mn30s after it has been powered ON
- 4KCDE must not be powered OFF less than 1mn30s after it has been powered ON
- The 4KCDE LCL must not be powered OFF before the 4K drive bus LCL's power OFF
- The DPU nominal and redundant must not be powered ON simultaneously
- The REU processor belt nominal and redundant must not be powered ON simultaneously
- The DPU and the REU must not be crosstrapped. The REU/DPU nominal and the REU/DPU redundant must be always associated.
- The satellite FDIR must be disabled during the DPU BSW to ASW transition and during the DPU ASW to BSW transition (software reset).
- During air ground tests, the database must be configured for "air testing" in order that the 4K getter temperatures high limits are specifically set for air condition.
- The DPU must be in STARTUP mode and correctly dialoguate with the 4K (no permanent error on HM769240, HM775240, HM772240, HM773240) less than 10mn after the 4KCDE LCL is power ON. If not the 4K goes automaticaly in STANDBY mode and after 10mn again, it aautomatically goes in RUNNING mode).
- The alarms on the 4K harmonic forces (HM086260, HM087260, HM088260, HM089260, HM090260, HM091260, HM092260; HM093260) and the associated limit exceed flags (HM272260, HM273260, HM274260, HM275260, HM276260, HM277260, HM278260, HM279260) must be ingnored and no action must be taken in the following cases :
  - The 4K is running (nominal, freewheel or system response) with a higher stroke and with a different frequency for which the last 4K System Response Test has been done.
  - The 4K is running in nominal mode with VCS OFF or with VCS ON and all harmonic frequencies not selected.
  - After a System Respons Test, during the first 10mn during which the 4K is running with VCS ON and all harmonic frequencies selected.

In case of divergence of the 4K forces, the 4K is autonomously switched down when one of the forces goes above 5N. There is then no risk to ignore these alarms.

- The DCCU valves HPLV 101, HPLV 151, HPLV 201et HPLV 251 must not be opened if the tank pressure is lower than the DCCU pressure :

  if HM017270<HM019270 or HM021270 then
  do not open valves HPLV 101, HPLV 151
  if HM018270<HM020270 or HM022270 then
  do not open valves HPLV 201, HPLV 251

11.13.2 HFI operational constrainst during the launch campaign

- The 4K cooler must be operated at 2mm stroke, with getter OFF during a total period of 120h not more than 30 days before the launch.

- The dilution pipes (3He, 4He and exhaust) must be emptied at a residual pressure below 200mbar then filled with pure 3He and 4He coming from the high pressure tanks at a pressure around 2bar. This operation must be done not before 60 days to the launch date.

11.14 LEOP, Cooling down, Commissioning and CPV (bolometer not stabilized) phases

This paragraph covers the HFI operations until the operational day 42 of the present cooling down predicted scenario (December 07).
The HFI proposed rules for the definition of the HFI flight commissioning is to exercise, during the cooling down phase, all the **NOMINAL** HFI functions which are expected to be used during the nominal CPV and observation phases. Then, no redundancies or contingencies will be tested (this has been done on ground).
The proposed sequence is the following:

During the LEOP phase :

- **As soon as possible but not later than 10 hours after the separation**, the dilution valves (High pressure 3He (nominal) and 4He (nominal) and the exhaust low pressure valves (nominal + redundant)) must be open in order to flush the dilution pipes.

- **As soon as possible but not later than 10 hours after the separation**, the 4K must be put in NOMINAL running mode with a stroke at 2mm, a frequency at 40Hz and the nominal getter powered ON.

Indeed, the cooling down of the V-groove's is quit rapid; the V-groove N°3 is going down under 0°C approximately 4hours after the separation and below 200K approximately 12hours after the separation. Below 180K, the water is under solid ice condition whatever the partial water pressure is. Some more volatile components are under solid ice condition above 200K. Then, the earlier the 4K activation and the dilution flushing will be, the better it will be with regard to the risk of dilution and 4K clogging (but we cannot quantify this). The objective is to clean, as soon as possible the dilution and the 4K gas from condensable contaminants.

To do these operations, HFI must be switched ON (except the REU analog belts) and put in STANDBY mode. The dilution valves can be open. Then, HFI must be put in CONFIGURATION mode. The 4K must be configured and activated in NOMINAL mode with the getter powered ON. The CERNOX's must be configured for 300K temperature range.
There is no production of science data but only HSK1 to HSK3.
The duration of these operations should be less than 10mn.

After this phase, if the satellite wants to minimize the HFI power consumption, the DCCU, the DPU and the REU can be switched OFF. The 4KCDE can drive the compressors and the getter by itself without any communication with DPU. The 4KCDE LCL must not be powered OFF (otherwise the 4K compressors go into launch mode). Then, as soon as allowed by the satellite power capabilities, the DPU, the REU and the REU processor belt LCL's must be powered on again and the DPU/REU put in CONFIGURATION mode in order to recover the HFI housekeeping telemetry production.

During the cooling down :

- The Cernox's bias and gain must be adjusted depending of their temperatures (30 commands are expected for the 6 Cernox's during the cooling down). After the start of the production of science data, each day during the last hour of the operational day, until the 0.1K stage is at 1K, the raw signal mode must be set to "CERNOX raw mode" in order to check the non saturation of the Cernox raw signal. Then, the raw signal mode must be re program to CS cycle mode.

- The 4K VCS is OFF all along the 4K cooling down (passive and active). It is activated only when the 4K is stabilized at its operational temperature and that the 4K System Reponse Tests have been successfully done.

- When the JFET temperature are bellow 150K, the REU analog belts are powered ON, the FPU channels are configured for warm condition, the JFET heaters are configured to be controlled at 140K (PI) and HFI is put in OBSERVATION mode. This is then the **start of the HFI science data production**. Three JFET temperature setpoint will be tested (140K, 130K, 120K). The optimum is expected to be 130K. The duration between 2 JFET temperatures setup is 24h.

- Each hour (TBC), until the end of the mission, the End of Slew command must be send in order to possibly limit the HFI data production in case of HFI datarate uncontrolled increase.

- The DPU commissioning can be then done at any time at MOC convenience. The objective of this test is to validate all the DPU modes to be potentially used during the CPV phase.

- The thermal switch 18K-4K is activated (full power) as soon as the 4K stage is at 70K. It is powered OFF when the 4K stage is at 20K

- The thermal switch 4K-1.6K is activated (PI control) as soon as the 4K stage is at 25K. It is powered OFF when the 0.1K stage is bellow 40K AND when the 1.6K stage is bellow 5K (the 0.1K stage temperature condition should be the most constrained one).

- When the bolometer stage is around 100K, an electrical good health check of the bolometers/thermometers is done (Quick Electrical Check).

- When the 4K stage is around 20K, the 4K amplitude is increased at 3.5mm and dilution latching valves are open (TBD after CSL test).

- When the 4K stage is around 10K, the 4K amplitude is increased at the operational stroke (TBD after CSL test)

- When the 4K stage is at nominal operational temperature (around 4.5K), the 4K VCS is switched ON (need to stop the cooler presently; this constraint may disappear in a near future). All the force harmonic frequencies are not activated (the VCS is running but no force reduction is applied). 4K System Response Tests are done for different 4K strokes. The strokes must be selected by HFI in flight in order to have all the 7 harmonic forces bellow 2N before the start of each SRT. The last SRT must be done for the operational stroke of the 4K (to be defined after CSL test). After each SRT, the VCS will be activated with all the force harmonic frequencies selected in order to allow each force to be reduced bellow 20mN. 3 SRT as expected to be needed. This phase need real time interaction between HFI and MOC.

- After the last SRT and VCS activation with all forces reduced, the 4K operational set point will be chosen. The 4K thermometers will be setup, optimized, VI characterized and then the PID control will be activated (using the same PI parameter determined during CSL test). This phase need real time interaction between HFI and MOC.

- When the 4K is stabilized at its operational temperature, the 4K commissioning is done. This is a 4K functional test in order to demonstrate the correct functionality of the 4K for the range of frequency expected during CPV or observation phase (this includes SRT and VCS activation). The extreme frequency and strokes will be defined after CSL test. Three frequencies are proposed to be tested. This phase need real time interaction between HFI and MOC.

- When the 1.6K stage is at 2.2K, the 1.6K thermometers will be setup, optimized. Periodic optimisation of all the 1.6K thermometers must be done each hour until the end of the 1.6K stage cooling down. The 1.6K operational set point will be chosen. The 1.6K thermometers will be finally optimized, VI characterized and then the PID control will be activated (using the same PI parameter determined during CSL test). This phase need real time interaction between HFI and MOC.

- Then, all the 0.6K thermometers will be setup and optimized. Periodic optimisation of all the 0.1K thermometers must be done each hour until the end of the 0.1K stage cooling down.

- When the bolometers are at around 2K, they will be optimized and VI characterized. This will be repeated when they are around 1K, 500mK, 300mK, 200mK, 150mK, 130mK and 110mK. These measurements will be time tagged and there is no need of visibility.

- When the 0.1K stage is below 0.1K, the dilution plate operational temperature set point will be chosen. The 0.1K thermometers will be finally optimized, VI characterized and then the Dilution and the Bolometer PID's control will be activated (using the same PI parameter determined during CSL test). After 12h, the Bolometer PID control will be powered OFF. The bolometer will be optimized and the compression parameter will be tuned. This phase need real time interaction between HFI and MOC.

The detailed sequence is :

				version 3.0						
Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
T0 : Launch (with ALL 4KDrive bus LCL's ON)										
Switch OFF ALL 4KDrive bus LCL's										
Separ + TBD MOC				**Switch OFF ALL 4KDrive bus LCL's ON**	TBD MOC	TBD MOC	TBD MOC	***OFF***	**OFF**	**OFF**
START HFI; OPEN the dilution 3HE, 4HE and exhaust valves (minimum flow-rate); run the 4K Cooler with the getter activated										
T0+ASAP (<10h)	1	3	YES	**HFI NOMINAL switch ON excepted the REU analog belts**	HFI_NOMINAL_SWITCH_ON_FLIGHT_FIRST	none		*BOOT*	BOOT	BOOT
LAST PROC + 10s max	1	2	YES	**START DPU**	NMON_HFI_BOOT_TO_STARTUP	none		*STARTUP*	BOOT	BOOT
LAST PROC + 10s max	1	2	YES	**HFI go to STANDBY from START-UP**	NTSN_HFI_STARTUP_TO_STANDBY	none		*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**CHOOSE DPU FDIR MODE Desynchro**	PFDR_HFI_FDIR_SETUP	OCf-FDIRmode	3	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**OPEN MIXTURE NOMINAL VALVE FV301**	DVOP_HFI_DCE_VALVE_OPEN	ValveID	11	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**OPEN MIXTURE REDUNDANT VALVE FV351**	DVOP_HFI_DCE_VALVE_OPEN	ValveID	10	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**OPEN 4He NOMINAL HP VALVE HPLV101**	DVOP_HFI_DCE_VALVE_OPEN	ValveID	1	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**OPEN 3He NOMINAL HP VALVE HPLV201**	DVOP_HFI_DCE_VALVE_OPEN	ValveID	3	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**CONFIGURE REU Ns and Fdiv N sample=40 & Fdiv=124 (Fcool=40,08Hz, Fmod=90,19Hz)**	ENSF_HFI_REU_NS_FDIV_SETUP	RSw07-Nsamp RSw07-Fdiv	1 124	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**CONFIGURE 4K Internal Frequency at 40Hz**	4FIT_HFI_4K_FREQ_INT_SETUP	IntF180ClockPeriod	2772	*STDBY*	STDBY	STDBY

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + 10s max	1	0.1	YES	**CERNOX CONFIGURATION 200-300K Cernox nominal**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 (=0.1K) 15 0 3000	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES		ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 (=1.6K) 15 0 3000			
LAST PROC + 10s max	1	0.1	YES		ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	2 (=4K) 15 0 3000			
LAST PROC + 10s max	1	0.1	YES		ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	3 (=sw 4K-1.6K) 15 0 3000			
LAST PROC + 10s max	1	0.1	YES		ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	4 (=18K) 15 0 2500			
LAST PROC + 10s max	1	0.1	YES		ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	5 (=50K) 15 0 2500			
LAST PROC + 10s max	1	0.1	YES	**CERNOX activation**	ECXC_HFI_CERNOX_CONTROL	HCT-Belt0 HCT-Belt1 HCT-Belt2 HCT-Belt3 HCT-Belt4 HCT-Belt5 HCT-Belt6 HCT-Belt7 HCT-Belt8 HCT-Belt9 HCT-BeltA HCT-BeltB HCT0Duration	1 1 1 1 1 1 0 0 0 0 0 0 450	*STDBY*	STDBY	STDBY

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + 10s max	1	0.1	YES	**4K SYNCHRO : EXTERNAL**	4SYS_HFI_4K_SYNCHRO_SELECT	SynchClockSelect	0	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**Compressor amplitude demand at 2000 microns**	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand	2000	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**POWER ON 4K GETTER NOMINAL**	4GEC_HFI_4K_GETTER_CONTROL	SelGetterOff_On	1	*STDBY*	STDBY	STDBY
LAST PROC + 10s max	1	0.1	YES	**DPU & REU go to CONFIG from STANDBY**	NXCN_HFI_GOTO_CONFIG	none		*CONFIG*	STDBY	CONFIG
LAST PROC + 10s max	1	2	YES	**RUN COOLER**	4COR_HFI_4K_RUN_COOLER	none		*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
Telescope and FPU decontamination : T0 to T0+14 days										
Passive and SCS cooling: CERNOX configuration; HFI JFET configuration; HFI science data production; HFI THERMAL SWITCH activation										
When cernox 50K HD497280 < 200K		0.1	NO	**CERNOX 50K CONFIGURATION 100-200K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	5 15 0 1500	*CONFIG*	NOMINAL	CONFIG
When cernox 18K HD496280 < 200K		0.1	NO	**CERNOX 18K CONFIGURATION 100-200K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	4 15 0 1000	*CONFIG*	NOMINAL	CONFIG
When JFET's HD504280 to HD5015280 < 200K		2	YES	**HFI STANDBY RETURN**	NCSF_HFI_STANDBY_RETURN	none		*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**HFI switch ON REU analog belts 0&1**	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	Num_LCL	39	*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**HFI switch ON REU analog belts 2&3**	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	Num_LCL	40	*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**HFI switch ON REU analog belts 4&5**	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	Num_LCL	41	*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**HFI switch ON REU analog belts 6&7**	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	Num_LCL	42	*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**HFI switch ON REU analog belts 8&9**	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	Num_LCL	43	*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**HFI switch ON REU analog belts A&B**	EBON_HFI_SWITCH_ON_ONE_REU_ANA_BELT	Num_LCL	44	*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**REU FPGA RESET**	HFI_REU_FPGA_RESET_ALL			*STDBY*	STDBY	STDBY
LAST PROC + 10s max		0.1	YES	**DPU & REU go to CONFIG from STANDBY**	NXCN_HFI_GOTO_CONFIG	none		*CONFIG*	STDBY	CONFIG
LAST PROC + 10s max		2	YES	**RUN COOLER**	4COR_HFI_4K_RUN_COOLER	none		*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	YES	**JFET controled at 110K**	EJXP_HFI_JFET_SETUP	**i_jfet** **TBD_MOC_JFET_0003**	ALL TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**Compression CONTROL BELT 0 to 5 : hot FPU**	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	**PFHPCMP_CMPRBXCX_0001.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**Compression CONTROL BELT 6 to B : hot FPU**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_0001.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**RAW SIGNAL CYCLE on CHANNELS**	ERSS_HFI_REU_RAWSIGNAL_SETUP	Rsig-ModeSelect RCf-BeltNum RCf-ChanNum	3 0 0	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**DPU & REU GOTO OBSERV**	NCON_HFI_GOTO_OBSERVATION	none		*OBSERV*	NOMINAL	OBSERV
LAST PROC + ASAP		0.1	YES	**DPU & REU RETURN in CONFIG**	NXCN_HFI_GOTO_CONFIG	none		*CONFIG*	NOMINAL	CONFIG
EACH HOUR UNTIL RAW_72 test		0.1	NO	**End of SLEW test (Volume of data > allocation)**	PEOS_HFI_END_OF_SLEW	OCf-Duration OCf-Quantity:	3600 (TBC) 16480 (TBC)	*CONFIG or OBSERV*	*NOMINAL*	CONFIG or OBSERV
LAST PROC + ASAP		3	YES	**ALL CHANNEL SETUP : All channels with I_bias = 4095 but R & C**	ECHS_HFI_CHANNEL_SETUP	PFHC00P_PROCBXCX_0001 to PFHCB5P_PROCBXCX_0001	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for the FIRST OPTIMISATION of ALL bolometers**	HFI_OPTIM_CONFIGURATION_ALL_BOLO	**PFHEOPC_OPTMBXCX_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**SELECT ALL BOLOMETERS for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0005**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**FIRST OPTIMIZATION of ALL the BOLOMETERS:** **Use Gamp init, use T init, Cv before, T OFF & V OFF, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 1 0 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 4K thermometers PID Nom 95**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel **PFHEOPC_OPTMBXCX_0001**	9 5 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 4K thermometers A4**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel **PFHEOPC_OPTMBXCX_0001**	A 4 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 4K thermometers A5**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel **PFHEOPC_OPTMBXCX_0001**	A 5 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 4K thermometers PID Red B3**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel **PFHEOPC_OPTMBXCX_0001**	B 3 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 4K thermometers B4**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel **PFHEOPC_OPTMBXCX_0001**	B 4 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 4K thermometers B5**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel **PFHEOPC_OPTMBXCX_0001**	B 5 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**SELECT ALL 4K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0002**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**FIRST OPTIMIZATION of ALL the 4K thermometers : Use Gamp init, use T init, CvCt before, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 1.6K thermometers PID Nom 93**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	9 3 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 1.6K thermometers 94**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	9 4 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 1.6K thermometers PID Red A3**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	A 3 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 1.6K thermometers B2**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	B 2 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	YES	**SELECT ALL 1.6K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0003**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**FIRST OPTIMIZATION of ALL the 1.6K thermometers: Use Gamp init, use T init, CvCt before, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 0.1K thermometers 90**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	9 0 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 0.1K thermometers PID BOLO NOM 91**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	9 1 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 0.1K thermometers PID DILU NOM 92**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	9 2 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 0.1K thermometers A2**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	A 2 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 0.1K thermometers PID BOLO RED B0**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	B 0 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**PARAMETER SETUP for OPTIMISATION 0.1K thermometers PID DILU RED B1**	EOPC_HFI_CHANNEL_OPTIM_CONF	i_Belt j_Channel PFHEOPC_OPTMBXCX_0001	B 0 TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**SELECT ALL 0.1K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0004**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**FIRST OPTIMIZATION of ALL the 0.1K thermometers: Use Gamp init, use T init, CvCt before, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + ASAP		0.1	YES	**RESISTOR OPTIMIZATION**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 0 A 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
NEXT DTCP		0.1	YES	**JFET controled at 130K**	EJXP_HFI_JFET_SETUP	**i_jfet** **TBD_MOC_JFET_0004**	ALL TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Switch 4K/1.6K PID OFF**	CPxx_HFI_PID_SETUP	**i_PID = 4** **PFHCPSP_PID_4K1K_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**4K PID OFF**	CPxx_HFI_PID_SETUP	**i_PID = 3** **PFHCP4P_PID___4K_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**1.6K PID OFF**	CPxx_HFI_PID_SETUP	**i_PID = 2** **PFHCP1P_PID___1K_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**DILU PID OFF**	CPxx_HFI_PID_SETUP	**i_PID = 1** **PFHCPDP_PID_DILU_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**BOLO PID OFF**	CPxx_HFI_PID_SETUP	**i_PID = 0** **PFHCPBP_PID_BOLO_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**SAVE CONF in REU EEPROM 1**	EECS_HFI_REU_SAVE_CONF_EEPROM	EEPROM-Store	1	*CONFIG*	*NOMINAL*	*CONFIG*
When cernox 4K HD494280 < 200K		0.1	NO	**CERNOX 4K CONFIGURATION 100-200K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	3 15 0 2000	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX SW 4K-1.6K CONFIGURATION 100-200K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	2 15 0 2000	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX 1.6K CONFIGURATION 100-200K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 0 2000	*CONFIG*	NOMINAL	CONFIG
When cernox 0.1K HD492280 < 200K		0.1	NO	**CERNOX 0.1K CONFIGURATION 100-200K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 0 2000	*CONFIG*	NOMINAL	CONFIG
When cernox 18K HD496280 < 100K		0.1	NO	**CERNOX 18K CONFIGURATION 40-100K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	4 15 0 350	*CONFIG*	NOMINAL	CONFIG
When cernox 4K HD494280 < 100K		0.1	NO	**CERNOX 4K CONFIGURATION 40-100K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	3 15 0 1000	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	NO	**CERNOX SW 4K-1.6K CONFIGURATION 40-100K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	2 15 0 1000	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX 1.6K CONFIGURATION 40-100K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 0 1000	*CONFIG*	NOMINAL	CONFIG
When cernox 18K HD496280 < 40K		0.1	NO	**CERNOX 18K CONFIGURATION 19-40K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	4 15 0 100	*CONFIG*	NOMINAL	CONFIG
When cernox 18K-4K HD012270 < 70K This command must be resent every 48h (+0h/-1h) until this switch is powered OFF		0.1	YES	**Activate 18K-4K switch**	DDHC_HFI_DCE_DEFROST_HEATER_CONTROL	Num_heater TempSetpoint PowerLevel ServoDuration	6 550 3 65535	*CONFIG*	NOMINAL	CONFIG
When cernox 4K HD494280 < 40K		0.1	NO	**CERNOX 4K CONFIGURATION 19-40K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	3 15 0 500	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX SW 4K-1.6K CONFIGURATION 19-40K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	2 15 0 500	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX 1.6K CONFIGURATION 19-40K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 0 500	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
HFI Electrical Check with BOLO at 100K										
When cernox 0.1K HD492280 < 100K		0.1	NO	**CERNOX 0.1K CONFIGURATION 40-100K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 0 1000	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		180	NO	**ELCTRICAL CHECK of the BOLOMETERS at 100K**	HFI_ELEC_CHECK_100K_and_1K			*CONFIG*	NOMINAL	CONFIG
HFI 4K cooling down and 4K PID SETUP										
When cernox 4K HD494280 < 18K and LFI OK to leave 20K on the 4K		0.1	YES	**POWER OFF 18K-4K switch**	DDHC_HFI_DCE_DEFROST_HEATER_CONTROL	Num_heater TempSetpoint PowerLevel ServoDuration	6 550 0 0	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Compressor amplitude demand at 3500 microns**	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand	3500	*CONFIG*	*CONFIG*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**OPEN 4He LATCH VALVE FV104**	DVOP_HFI_DCE_VALVE_OPEN	ValveID	6	*CONFIG*	*CONFIG*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**OPEN 3He LATCH VALVE FV204**	DVOP_HFI_DCE_VALVE_OPEN	ValveID	9	*CONFIG*	*CONFIG*	*CONFIG*
LAST PROC + ASAP		0.1	NO	**CERNOX 4K CONFIGURATION 9-19K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	3 15 0 250	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX SW 4K-1.6K CONFIGURATION 9-19K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	2 15 0 250	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX 1.6K CONFIGURATION 9-19K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 0 250	*CONFIG*	NOMINAL	CONFIG
When cernox 4K HD494280 < 9K		0.1	NO	**CERNOX 4K CONFIGURATION <9K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	3 15 0 100	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	**General description**	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	NO	**CERNOX SW 4K-1.6K CONFIGURATION <9K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	2 15 0 100	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**CERNOX 1.6K CONFIGURATION 3.5-9K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 0 100	*CONFIG*	NOMINAL	CONFIG
When cernox 4K HD494280 < 4.5K		0.1	YES	**STOP COOLER**	4COS_HFI_4K_STOP_COOLER	none		*CONFIG*	STANDBY	CONFIG
LAST PROC + 10s max		0.1	YES	**4K VCS : ON**	4VCS_HFI_4K_VCS_CONTROL	VCSOff_On	1	*CONFIG*	STANDBY	CONFIG
LAST PROC + 10s max		0.1	YES	**4K Force Transducer selection**	4FTS_HFI_4K_VCS_FORCE_TRANSDUCER_SELECT	ForceTransducer1 ForceTransducer2 ForceTransducer3 ForceTransducer4	1 0 1 1	CONFIG	STANDBY	CONFIG
LAST PROC + 10s max		0.1	YES	**Compressor amplitude demand at 2000 microns**	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand	2000	*CONFIG*	*STANDBY*	*CONFIG*
LAST PROC + 10s max		2	YES	**RUN COOLER**	4COR_HFI_4K_RUN_COOLER	none		*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + 3mn To be rerun TBD HFI times		3	YES	**Compressor amplitude demand at TBD microns**	4ADM_HFI_4K_AMPLITUDE_DEMAND_SETUP	CompAmplDemand	TBD	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 10s max		30	YES	**4K MAINTENANCE in NOMINAL**	4SRN_HFI_4K_DO_SRT_IN_NOMINAL			*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 10s max		0.1	YES	**4K harmonics for VCS : SELECT ALL**	4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT	FreqSelVCS	255	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + TBD HFI (10mn max)		0.1	YES	**4K harmonics for VCS : DESELECT ALL**	4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT	FreqSelVCS	0	*CONFIG*	*NOMINAL*	*CONFIG*
ASAP		TBD	YES	**Rerun the 4 previous procedures TBD times until to reach 3500microns. MUST be done in ONE DTCP Close contact between MOC and HFI are needed during this phase**						-
NEXT DTCP		30	YES	**4K MAINTENANCE in NOMINAL optionnal**	4SRN_HFI_4K_DO_SRT_IN_NOMINAL (optionnal)			*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**4K harmonics for VCS : SELECT ALL**	4HFS_HFI_4K_VCS_HARMONIC_FORCE_SELECT	FreqSelVCS	255	*CONFIG*	*NOMINAL*	*CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers PID Nom 95**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC95P_PROCBXCX_0002**	9 5 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers A4**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCA4P_PROCBXCX_0002**	A 4 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers A5**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCA5P_PROCBXCX_0002**	A 5 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers PID Red B3**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCB3P_PROCBXCX_0002**	B 3 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers B4**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCB4P_PROCBXCX_0002**	B 4 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers B5**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCB5P_PROCBXCX_0002**	B 5 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**SELECT ALL 4K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0002**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**CONFIGURATION of the VI parameters**	EVIC_HFI_VI_CONFIG	I_min I_max COF Scale StepNumber Delay	15 4095 1 1 80 40	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		30	YES	**FAST VI of ALL the 4K thermometers : Use Gamp init, use T init, CvCt if needed, T OFF& V OFF, List**	NCVN_HFI_GOTO_VI	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 0 0 1 0 0	*VI --> CONFIG*	*NOMINAL*	*VI --> CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		15	YES	**FIRST OPTIMIZATION of ALL the 4K thermometers : Use Gamp init, use T init, CvCt before, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + 10s max		15	YES	**FINE OPTIMIZATION of ALL the 4K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
				The 2 previous procedures may need to be rerun TBD times depending of the quality of the optimisation						-
LAST PROC + ASAP		10	YES	**OPTIMISATION of the Compression parameters for ALL 4K thermometers**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 4K thermometers PID Nominal (95)**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC95P_PROCBXCX_TBD**	9 5 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		60	YES	**ACTIVATE the 4K PID control**	CPxx_HFI_PID_SETUP	**i_PID = 3** **PFHCP4P_PID___4K_0002**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 20mn		0.1	YES	**SELECT ALL 4K THERMO BUT the PID Nominal (95) for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0006**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		15	YES	**FINE OPTIMIZATION of ALL the 4K thermometers BUT the PID Nominal (95): Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
TBD HFI with the agreement of LFI			YES	**The 4 previous procedures can be rerun on HFI request during all the 100mK cooling down after the agreement of LFI. The PFHCP4P_PID___4K file can be changed.**						-
LAST PROC + ASAP		0.1	NO	**SAVE CONF in REU EEPROM 1**	EECS_HFI_REU_SAVE_CONF_EEPROM	EEPROM-Store	1	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**CHOOSE DPU FDIR MODE : HFI AUTO**	PFDR_HFI_FDIR_SETUP	OCf-FDIRmode	2	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
1.6K cooling down; 1.6K PID SETUP										
When cernox 0.1K HD492280 < 40K		0.1	NO	**CERNOX 0.1K CONFIGURATION 19-40K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 0 500	*CONFIG*	NOMINAL	CONFIG
When cernox 0.1K HD492280 < 19K		0.1	NO	**CERNOX 0.1K CONFIGURATION 9-19K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 0 250	*CONFIG*	NOMINAL	CONFIG
When cernox 0.1K HD492280 < 9K		0.1	NO	**CERNOX 0.1K CONFIGURATION 3.5-9K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 0 100	*CONFIG*	NOMINAL	CONFIG
When cernox 1.6K HD493280 < 3.5K		0.1	NO	**CERNOX 1.6K CONFIGURATION 2.2-3.5K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 2 500	*CONFIG*	NOMINAL	CONFIG
When cernox 0.1K HD492280 < 3.5K		0.1	NO	**CERNOX 0.1K CONFIGURATION 2.2-3.5K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 2 500	*CONFIG*	NOMINAL	CONFIG
When cernox 1.6K HD493280 < 2.2K		0.1	NO	**CERNOX 1.6K CONFIGURATION 1.2-2.2K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	1 15 2 200	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 1.6K thermometers PID Nom 93**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC93P_PROCBXCX_0002**	9 3 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 1.6K thermometers 94**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC94P_PROCBXCX_0002**	9 4 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 1.6K thermometers PID Red A3**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCA3P_PROCBXCX_0002**	A 3 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 1.6K thermometers B2**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCB2P_PROCBXCX_0002**	B 2 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**SELECT ALL 1.6K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0003**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		15	YES	**FIRST OPTIMIZATION of ALL the 1.6K thermometers: Use Gamp init, use T init, CvCt before, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + 10s max		15	YES	**FINE OPTIMIZATION of ALL the 1.6K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
				The 2 previous procedures may need to be rerun depending of the quality of the optimisation						-
LAST PROC + 1H UNTIL the END of the 1.6K COOLING DOWN This procedure must be sent ONLY when the DPU is in CONFIGURATION mode		0.1	NO	**SELECT ALL 1.6K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0003**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
		15	NO	**FINE OPTIMIZATION of ALL the 1.6K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
When cernox 1.6K HD493280 < 1.35K		30	YES	**FAST VI of ALL the 1.6K thermometers : Use Gamp init, use T init, CvCt if needed, T OFF& V OFF, List**	NCVN_HFI_GOTO_VI	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 0 0 1 0 0	*VI --> CONFIG*	*NOMINAL*	*VI --> CONFIG*
LAST PROC + ASAP		15	YES	**LAST FINE OPTIMIZATION of ALL the 1.6K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		10	YES	**OPTIMISATION of the Compression parameters for ALL 1.6K thermometers**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 1.6K thermometers PID Nominal (93)**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC93P_PROCBXCX_TBD**	9 3 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		60	YES	**ACTIVATE the 1.6K PID control**	CPxx_HFI_PID_SETUP	**i_PID = 2** **PFHCP1P_PID___1K_0002**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**SELECT ALL 1.6K THERMO BUT the PID Nominal (93) for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0007**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 10mn		15	YES	**FINE OPTIMIZATION of ALL the 1.6K thermometers BUT the PID Nominal (93): Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
TBD HFI			YES	**The 4 previous procedures can be rerun on HFI request during all the 100mK cooling down. The PFHCP1P_PID___1K file can be changed.**						-
LAST PROC + ASAP		0.1	NO	**SAVE CONF in REU EEPROM 1**	EECS_HFI_REU_SAVE_CONF_EEPROM	EEPROM-Store	1	*CONFIG*	*NOMINAL*	*CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
0.1K cooling down; BOLOMETERS VI at 2K, 1K, 500mK, 300mK, 200mK, 150mK, 130mK, 110mK; 100mK; 0.1K DILU and BOLO PID SETUP; BOLOMETER FINAL optimisation										
When cernox 0.1K HD492280 < 2.2K		0.1	YES	**Setup the 0.1K thermometers 90**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC90P_PROCBXCX_0002**	9 0 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 0.1K thermometers PID BOLO NOM 91**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC91P_PROCBXCX_0002**	9 1 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 0.1K thermometers PID DILU NOM 92**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC92P_PROCBXCX_0002**	9 2 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 0.1K thermometers A2**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCA2P_PROCBXCX_0002**	A 2 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 0.1K thermometers PID BOLO Red B0**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCB0P_PROCBXCX_0002**	B 0 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Setup the 0.1K thermometers PID DILU Red B1**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHCB1P_PROCBXCX_0002**	B 1 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**SELECT ALL 0.1K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0004**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		15	YES	**FIRST OPTIMIZATION of ALL the 0.1K thermometers: Use Gamp init, use T init, CvCt before, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + 10s max		15	YES	**FINE OPTIMIZATION of ALL the 0.1K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
				The 2 previous procedures may need to be rerun depending of the quality of the optimisation						-

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + 1H UNTIL the END of the BOLO COOLING DOWN to 100mK This procedure must be sent ONLY when the DPU is in CONFIGURATION mode		0.1	NO	**SELECT ALL 0.1K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0004**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
		15	NO	**FINE OPTIMIZATION of ALL the 0.1K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
When cernox 0.1K HD492280 < 2.2K		0.1	NO	**CERNOX 0.1K CONFIGURATION 1.4-2.2K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 2 200	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 2K**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005** **PFHEOPC_OPTMBXCX_0001** **PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
When cernox 0.1K HD492280 < 1.4K		0.1	NO	**CERNOX 0.1K CONFIGURATION <1.4K**	ECXS_HFI_CERNOX_SETUP	i HCT(i)Nblanck HCT(i)Gamp HCT(i)Bias I	0 15 2 100	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 2h		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 1K**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005** **PFHEOPC_OPTMBXCX_0001** **PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		180	NO	**ELCTRICAL CHECK of the BOLO / THERMO at 1K**	HFI_ELEC_CHECK_100K_and_1K			*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**Desactivation of the 0.1K cernoxCERNOX activation**	ECXC_HFI_CERNOX_CONTROL	HCT-Belt0 HCT-Belt1 HCT-Belt2 HCT-Belt3 HCT-Belt4 HCT-Belt5 HCT-Belt6 HCT-Belt7 HCT-Belt8 HCT-Belt9 HCT-BeltA HCT-BeltB HCT0Duration	0 1 1 1 1 1 0 0 0 0 0 0 450	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + 5h		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 500mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 6h		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 300mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		180	NO	**ELCTRICAL CHECK of the BOLO / THERMO at 300mK**	HFI_ELEC_CHECK_300mK			*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		3	NO	**SETUP of ALL BOLOMETERS at around 200mK**	HFI_SETUP_ALL_BOLO	PFHC00P_PROCBXCX_0002 to PFHC85P_PROCBXCX_0002	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 4h		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 200mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 1h		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 0 to 5**	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 6 to B**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 7h		3	NO	**SETUP of ALL BOLOMETERS at around 140mK**	HFI_SETUP_ALL_BOLO	PFHC00P_PROCBXCX_0003 to PFHC85P_PROCBXCX_0003	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 140mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 7h		3	NO	**SETUP of ALL BOLOMETERS at 120mK**	HFI_SETUP_ALL_BOLO	PFHC00P_PROCBXCX_0004 to PFHC85P_PROCBXCX_0004	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 120mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 1h		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 0 to 5**	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 6 to B**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	DPU FINAL MODE	4K FINAL MODE	REU FINAL MODE
LAST PROC + 9h		3	NO	**SETUP of ALL BOLOMETERS at 110mK**	HFI_SETUP_ALL_BOLO	PFHC00P_PROCBXCX_0005 to PFHC85P_PROCBXCX_0005	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 110mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 15h		3	NO	**SETUP of ALL BOLOMETERS at 100mK**	HFI_SETUP_ALL_BOLO	PFHC00P_PROCBXCX_0006 to PFHC85P_PROCBXCX_0006	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		15	NO	**OPTIMISATION 1 & 2 and FAST VI for ALL BOLOMETERS at 100mK**	HFI_OPTIM_AND_FAST_VI_ALL_BOLO	**PFHECLS_OPTVLIST_0005 PFHEOPC_OPTMBXCX_0001 PFHEOPC_OPTMBXCX_0002**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + 1h		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 0 to 5**	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 6 to B**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		3	YES	**SELECT ALL 0.1K THERMO for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0004**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		60	NO	**FAST VI of ALL the 0.1K thermometers : Use Gamp init, use T init, CvCt if needed, T OFF& V OFF, List**	NCVN_HFI_GOTO_VI	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 0 0 1 0 0	*VI --> CONFIG*	*NOMINAL*	*VI --> CONFIG*
LAST PROC + ASAP		15	NO	**LAST FINE OPTIMIZATION of ALL the 0.1K thermometers: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
				The 2 previous procedures may need to be rerun depending of the quality of the optimisation						-
LAST PROC + ASAP		0.1	YES	**Setup the PID DILU thermometers Redundant (B1)**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC93P_PROCBXCX_TBD**	B 2 TPF sheet	*CONFIG*	NOMINAL	CONFIG
				For the 3 following procedures, the procedure to power OFF the PID DILU must be ready to be send urgently in case of 0.1K temperature divergence	CPxx_HFI_PID_SETUP : to be prepare in case of divergence	**i_PID = 1 PFHCP1P_PID___1K_0001**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		2	YES	**ACTIVATE the DILU PID control**	CPxx_HFI_PID_SETUP	**i_PID = 1 PFHCP1P_PID___1K_0002**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 2mn		2	YES	**ACTIVATE the DILU PID control**	CPxx_HFI_PID_SETUP	**i_PID = 1 PFHCP1P_PID___1K_0003**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 2mn		2	YES	**ACTIVATE the DILU PID control**	CPxx_HFI_PID_SETUP	**i_PID = 1 PFHCP1P_PID___1K_0004**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 10mn		0.1	YES	**SELECT ALL 100mK THERMO BUT the PID DILU Redundant (B1) for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0008**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 10mn		15	YES	**FINE OPTIMIZATION of ALL the 0.1K thermometers BUT the PID DILU redundant (B1): Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + 10mn		0.1	YES	**SELECT ALL BOLOMETERS for OPTIMISATION**	ECLS_HFI_CHANNEL_LIST_FOR_VI_OPTIM	**PFHECLS_OPTVLIST_0005**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		30	YES	**FINAL OPTIMIZATION of ALL the BOLOMETERS: Use Gamp init, use T curent, CvCt if needed, T On & V On, List**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 1 0 3 1 0 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
				The 4 previous procedures can be rerun on HFI request during the CPV.						-
LAST PROC + ASAP		0.1	YES	**RESISTOR OPTIMIZATION**	NCPN_HFI_GOTO_OPTIMISATION	VIOKeepGamp VIOKeepT VIOCvCtMeas VIOOptTuneT VIOChanSelMode Belt Channel	0 0 3 3 0 A 0	*OPTIM --> CONFIG*	*NOMINAL*	*OPTIM --> CONFIG*
LAST PROC + 1h		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 0 to 5**	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 6 to B**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG

Time and condition	DAY / T0	Duration (mn)	DTCP Real time need	General description	HFI FLIGHT PROCEDURE	Parameter names or TPF file	Parameter value (ALL in RAW)	*DPU FINAL MODE*	4K FINAL MODE	REU FINAL MODE
LAST PROC + ASAP		0.1	YES	**Setup the PID BOLO thermometers Nominal (B1)**	ECHS_HFI_CHANNEL_SETUP	i_Belt j_Channel **PFHC93P_PROCBXCX_TBD**	9 1 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		2	YES	**ACTIVATE the BOLO PID control**	CPxx_HFI_PID_SETUP	**i_PID = 0** **PFHCP1P_PID___1K_0002**	TPF sheet	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + 2h		0.1	YES	**BOLOMETER PID OFF**	CPxx_HFI_PID_SETUP	i_PID **TBD_MOC_PID_0001**	0 TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**SAVE CONF in REU EEPROM 1**	EECS_HFI_REU_SAVE_CONF_EEPROM	EEPROM-Store	1	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		0.1	YES	**SAVE CONF in REU EEPROM 2**	EECS_HFI_REU_SAVE_CONF_EEPROM	EEPROM-Store	2	*CONFIG*	*NOMINAL*	*CONFIG*
LAST PROC + ASAP		180	NO	**ELCTRICAL CHECK of the BOLO / THERMO at 100mK**	HFI_BOLO_QUICK_ELEC_CHECK_100mK			*CONFIG*	NOMINAL	CONFIG
LAST PROC + 1h		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 0 to 5**	PCMP_HFI_COMPRESS_CTRL_BELT_0_TO_5	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**OPTIMISATION of the Compression parameters for BELT 6 to B**	PCMP_HFI_COMPRESS_CTRL_BELT_6_TO_B	**PFHPCMP_CMPRBXCX_TBD.TPF**	TPF sheet	*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	YES	**SAVE Cssize and compression param. in EEPROM**	PPAV_HFI_DPU_PARAM_SAVE			*CONFIG*	NOMINAL	CONFIG
LAST PROC + ASAP		0.1	NO	**End of SLEW test (Volume of data > allocation)**	PEOS_HFI_END_OF_SLEW	OCf-Duration OCf-Quantity:	86400 (TBD) 395520 (TBC)	*CONFIG or OBSERV*	*NOMINAL*	CONFIG or OBSERV
LAST PROC + ASAP		75	NO	**Download full RAW signal cycle of all the 72 channels during one minute each**	HFI_RAW_72			*RAW --> CONFIG*	NOMINAL	CONFIG
Last proc +22h and EACH HOUR UNTIL the END of the PLANCK mission		0.1	NO	**End of SLEW test (Volume of data > allocation)**	PEOS_HFI_END_OF_SLEW	OCf-Duration OCf-Quantity:	3600 (TBD) 16480 (TBC)	*CONFIG or OBSERV*	*NOMINAL*	CONFIG or OBSERV

11.15 CPV (bolometer at 100mK)

Not part of the UM

11.16 Observation

Not part of the UM

11.17 Contingency and recovery procedure

DPU	Recovery procedure
No diag1 packet is received after that the DPU nominal or redundant LCL is switched ON	Check that the CDMU is correctly configured. Check that the DPU LCL consumption is the expected one for boot mode (around 0.25A). Check that the REU processor belt LCL is ON. Power OFF the active DPU LCL and try another DPU switch ON. If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU / DPU (channel setup, JFET, PID, cernox, compression, …).
DPU detects EEPROM memory error during the BOOT (stay in BOOT)	Dump the EEPROM and analyse the image
No diag2 packet is received after the start ASW (DPU does not go in STARTUP and stay in BOOT mode)	Check that the CDMU is correctly configured. Check that the DPU LCL consumption is the expected one for boot mode (around 0.25A). Check that the REU processor belt LCL is ON Power OFF the active DPU LCL and try another DPU switch ON. If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU / DPU (channel setup, JFET, PID, cernox, compression, …).
No HSK packet is received when the DPU is in STANDBY mode or upper modes	Check that the DPU LCL consumption is the expected one for standby mode (around 0.37A). Check that the REU processor belt LCL is ON Send TBDMOC_HFI_DPU_NOMINAL_RESTART If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU / DPU (channel setup, JFET, PID, cernox, compression, …).
DPU cannot enter in STANDBY mode from STARTUP mode	Check that the DPU LCL consumption is the expected one for startup and higher mode (around 0.37A). Check that the REU processor belt LCL is ON Send TBDMOC_HFI_DPU_NOMINAL_RESTART If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU / DPU (channel setup, JFET, PID, cernox, compression, …).
DPU cannot reenter automatically in CONFIGURATION mode from VI or OPTIMISATION	send NXCN_HFI_GOTO_CONFIG
DPU loss of communication with CDMU	Check that the DPU LCL consumption is the expected one for standby mode and higher mode (around 0.37A). Check that the REU processor belt LCL is ON Send TBDMOC_HFI_DPU_NOMINAL_RESTART If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU / DPU (channel setup, JFET, PID, cernox, compression, …).
DPU CRASH (no communication with CDMU + DPU LCL current drop)	Check that the DPU LCL consumption is the expected one for standby mode (around 0.37A). send TBDMOC_HFI_DPU_NOMINAL_RESTART If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU / DPU (channel setup, JFET, PID, cernox, compression, …).

4K	Recovery procedure
4K detects memory error during the BOOT (stay in BOOT)	The DPU is in STARTUP mode and the 4K boot status shows error: Analyse the 4K boot report in Diag2 packet (HM156260, HM157260) If 4K BOOT status bit 4=1 (HM156260>=16) : ASW load failure Switch OFF the 4KCDE LCL Wait 1mn30s Switch ON the 4KCDE LCL Wait 2mn Analyse the 4K boot report in Diag2 packet If the error is no more present, continue the sequence. If the error is still present: DUMP the full 4KCDE EEPROM If the DUMP shows EEPROM corruption / CRC error (HM157260=4 also), patch the full 4KCDE ASW into the EEPROM. If after this patch, the ASW cannot be loaded, the problem is serious. If DUMP gives the information that the EEPROM is filled with 0 or 1, the problem is serious If 4K BOOT status bit 4=1 (HM156260>=8) : RAM test fail Switch OFF the 4KCDE LCL Wait 1mn30s Switch ON the 4KCDE LCL Wait 2mn Analyse the 4K boot report in Diag2 packet If the error is no more present, continue the sequence. If the error is still present, the problem is serious.
4K cannot enter into STANDBY mode from BOOT mode	The DPU is in STARTUP, STANDBY or CONFIG mode and the 4K cannot enter into STANDBY mode from BOOT mode following a DPU STANDBY or a CONTINUE BOOT acknowledged command (1-8): Check the 4K command return value (HM151260). A value <> 0 indicated the reason of the non execution. Send a new 4K CONTINUE BOOT command If the 4K goes into STANDBY, continue the sequence. If not: Send the STARTUP RETURN command (to put DPU in STARTUP, 4K and REU in BOOT). Wait 2mn Send the STANDBY command. If the 4K goes into STANDBY, continue the sequence. If not: Switch OFF the 4KCDE LCL Wait 1mn30s Switch ON the 4KCDE LCL Wait 2mn Analyse the 4K boot report in Diag2 packet If BOOT error is detected see “4K detects memory error during the BOOT (stay in BOOT)” contingency procedure If not: Send the STANDBY command. If the 4K goes into STANDBY, reconfigure eventually the REU and the DPU as before the STARTUP RETURN and continue the sequence. If not, switch OFF the DPU LCL. Wait 12mn. Power ON the DPU LCL Put the DPU in STARTUP. If the 4K is in STANDBY mode, send the STANDBY command, reconfigure eventually the REU and the DPU as before the STARTUP RETURN and continue the sequence. If not, the problem is serious
4K getter does not work as expected	Power off the getter Select the getter redundant Power on the getter

4K SRT cannot be successfully done (switchdown during SRT)	Analyse the force transducer measurement during the SRT. Software reset the 4KCDE and reconfigure the 4K as it was at the beginning of the SRT sequence. Rerun a complete SRT sequence
4K switch down due to the 5N limit exceed during nominal running mode	Analyse the force transducer measurement. Software reset the 4KCDE and reconfigure the 4K as it was at the beginning of the last SRT sequence. Rerun a complete SRT sequence, the reconfigure the 4K as it was before the switchdown
4K switch down due to temperature limit execced during nominal running mode	Wait 5mn, reduce the 4K amplitude demand by 10%. Run the cooler.
4K switch down due to current or amplitude limit execced during nominal running mode	Run the cooler immediately. If the switchdown comes again in the next hour, reduce the 4K amplitude demand by 10%.
4K switch down due to Current Regulator switch down	If the 4K is switching down and that this is not due to any internal 4K limit exceed (temperature, 5N, current, amplitude) this is due to the current reguralor. Switch OFF then ON the 2 active 4K drive bus LCL's. Run the cooler. If a switchdown comes again, switch OFF then ON the 2 active 4K drive bus LCL's, reduce the 4K amplitude demand by 10%. Run the cooler.
4K JT heater is not heating as expected in case of unclogging tentative	Nothing to do at 4K level. Run the cooler at 3mm, power ON the 3He and the 4He defrost heaters
4K auto software reset	Send the CONTINUE BOOT command. Stop the cooler. and reconfigure the 4K as it was before the reset. Run the cooler.
4K long time constant derive of the force harmonic (when cold)	When a force harmonic is above 2N, it will be automatically desactivated If HFI scientists state that the perturbations due to the 4K are not acceptable with deselected force harmonics, redo a 4K SRT. If the HFI scientists state that the perturbations due to the 4K are acceptable with deselected force harmonics, continue as is.
4K long time derive of the 4K JT temperature	On HFI request and after the agreement of LFI (controversial procedure), modify the 4K amplitude demand OR adjust the 4K PID setpoint temperature.
4K long time constant reduction of the massflow (when cold) : clogging	This indicates clogging. On HFI request, deactivate all force harmonics, increase the 4K amplitude, activate all force harmonics, determine if SRT is needed, do SRT if needed.

REU	Recovery procedure
REU detects memory error during the BOOT (stay in BOOT)	Dump the EEPROM and analyse the image
REU cannot enter in STANDBY mode from BOOT mode	Switch OFF nominally HFI and retry the nominal switch ON If the anomaly is still there, swap to the redundant DPU/REU and reconfigure possibly the REU (channel setup, JFET, PID, cernox, …).
4K PID does not work as expected	Use the redundant PID heater or the redundant PID thermometer (no need to swat from DPU/REU nominal to redundant)
1.6K PID does not work as expected	Use the redundant PID heater or the redundant PID thermometer (no need to swat from DPU/REU nominal to redundant)
Dilu PID does not work as expected	Use the redundant PID heater or the redundant PID thermometer (no need to swat from DPU/REU nominal to redundant)
Dilu PID power margin too low	If the power of the DILU PID is below 10nW, increase the 1.6K temperature set point
REU auto software reset	Reconfigure the REU as it was before (channel setup, JFET, PID, cernox, …). Stop the cooler, configure it to run with external frequency and run the cooler
REU CRASH (no communication with DPU + REU proc LCL current drop)	send TBDMOC_HFI_REU_NOMINAL_RESTART and reconfigure possibly the REU (channel setup, JFET, PID, cernox, …)

DILUTION	Recovery procedure
4K PID power margin too low	If the power of the 4K PID is above 1.6mW or below 0.2mW, modify the 4K PID temperature set point or modify the 4K stroke (To be define by the HFI scientists). If the 4K stroke modification is selected, modify the stroke by 25microns and evaluate is SRT is needed
1.6K PID power margin too low	If the power of the 1.6K PID is below 20microW, increase the 1.6K temperature set point
Dilu PID power margin too low	If the power of the DILU PID is below 10nW, increase the 1.6K temperature set point
Clogging of the dilution	If a clogging of the dilution is suspected (long time increase of the 100mK temperature and increase of the dilution inlet pressure) do TBD at system level as the use of the dilution defrost heaters (50K, 18K and 4K), the potential switch off of the 4K and of the SCS has a global major impact at system level

12 HFI BUDGETS

12.1 Power

The power load on the main-bus and LCL allocation for the instrument is as follows.

LCLN°	Power Line Name	Average Power W	Long Peak W	Short Peak W
29 or 30	DPU	**12**		13.86
11 or 12	REU Proc	**7.3**	**8.0**	
37 or 38	4KCDE Proc	**18.5**	**18.9**	
59/60 or 61/62	4K Drive bus	**124** (2 LCL)	**136**	
36	DCE	**16**	**16.6***	35**
39	REU belts 0 & 1	**13.8**	**15.2**	
40	REU belts 2 & 3	**13.8**	**15.2**	
41	REU belts 4 & 5	**13.8**	**15.2**	
42	REU belts 6 & 7	**13.8**	**15.2**	
43	REU belts 8 & 9	**13.8**	**15.2**	
44	REU belts 10 & 11	**13.8**	**15.2**	
	Total power	**260.6**		

Table 13.1-1

* This is during defrost / unplugging with all heaters in use
** 80ms peak for valves actuation

12.2 Datarate

HFI telemetry allocation is limited to :

- Commanding rate equal to one TCP per second (1 TCP per second for DPU load and 1 TCP every 2s maximum for REU and 4K ASW load),
- Housekeeping data rate to 4000 bit/s,
- Total data rate to 75000 bit/s over 24 hours,
- 16 S/C Data Bus Protocol (SDBP) sub-frames.

The HFI data rates are summarized in the following table.

Packet Name	Packet type	Nominal		DPU Load		REU or 4KCDE Load		DPU Dump		REU or 4KCDE Dump	
		SF/s	DR (bit/s)	SF/s	DR (bit/s)	SF/s	DR (bit/s)	SF/s	DR (bit/s)	SF/s	DR (bit/s)
Load Command	TCP(6,2)	NA	NA	1	1712	0,5	856	NA	NA	NA	NA
Other Command	TCP(x,x)	1	1808	NA	NA	NA	NA	NA	NA	NA	NA
Verification Report	TMP(1,x)	2	432	4	864	2	432	NA	NA	NA	NA
Dump Report	TMP (6,6)	NA	NA	NA	NA	NA	NA	1	8096	1	8096
Other Report	TMP (x,x)	1	592	NA	NA	NA	NA	NA	NA	NA	NA
Asynchronous Exchange		**4**	**2832**	**6**	**2576**	**3**	**1288**	**1**	**8096**	**1**	**8096**
DIAG1 or DIAG2	TMP(3,26)	NA	NA	1	120	1	20	1	120/20	1	120/20
HSK1 and HSK3	TMP(3,25)	1	2854	NA	NA	NA	NA	NA	NA	NA	NA
HSK2	TMP(3,25)		330		NA		NA		NA		NA
HSK4 to 9	TMP(3,25)		816		NA		NA		NA		NA
SC1, SC2-1, SC2-2, SC3 or SC4	TMP(21,x)	8	65536	NA	NA	NA	NA	NA	NA	NA	NA
Periodic Exchange		**9**	**69536**	**1**	**120**	**1**	**20**	**1**	**120/20**	**1**	**120/20**
Margin	Any	3	2632/5464	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
TOTAL		**16**	**75000**	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)

Table 13.2-1 HFI datarate

SF/s = SDBP Sub-frame per second - DR (bit/s) = Data Rate (bit/s) - Margin on the SDBP (sub-frame) and on download bandwidth

(1) this data rate context is used for OBSW management in BOOT for DPU and in STARTUP for REU or 4KCDE.

12.3 Mass

HFI overall allocated wet mass is 244kg. The HFI current wet mass for the FM is 229.33Kg

Project code	Instrument unit	# of	Dimensions (mm) (3)	Mass (kg)
PHA	HFI (alone) Focal Plane Unit	1	Not interfacing PPLM	19.8 (0)
PHBA-N	Data Processing Unit (DPU) Nominal	1	316x280x90 (excluding ext harness)	5.0
PHBA-R	Data Processing Unit (DPU) Redundant	1	316x280x90 (excluding ext harness)	5.0
PHCA	J-FET Box	1	250x180x160	2.447
PHCBA	Pre-Amplifier Unit (PAU)	1	446x261x217.78	12.8
PHCBC	Readout Electronics (REU)	1	410.56x410.4 x318.85	33.68
PHDA	4 K Cooler Compressor Unit	1	455x262x194	16,89
PHDB	4 K Cooler Ancillary Unit	1	384x415x127.8	6.97
PHDC	4 K Cooler Electronics Unit	1	197x190x194	6.456
PHDJ	4K Cooler Current Regulator	1	226x206x55	2.2
PHEAAA	0.1 K Dilution Cooler ^{3}He Tank+thermometer	1	Diameter : 484 at p=0 488.5 at p max	12.953
PHEAB-1 to 3	0.1 K Dilution Cooler^{4} He Tanks	3	Diameter : 484 at p=0 488.5 at p max	13.619 13.602 13.661
PHEB	0.1 K Dilution Cooler Control Unit (and DCE)	1	800X785.6X170	20.418

Project code	Instrument unit	# of	Dimensions (mm) (3)	Mass (kg)
PHBBA-N	DPU to REU signal harness Nominal	1	L =2000 (2) OD = 10	1.221
PHBBA-R	DPU to REU signal harness Redundant	1	L = 2000 (2) OD = 10	1.010
PHBBB-N	DPU to REU power harness Nominal	1	L = 2000 (2) OD = 10	0.929
PHBBB-R	DPU to REU power harness Redundant	1	L = 2000 (2) OD = 10	0.861
PHBBC-N	DPU to 0.1K signal harness Nominal	1	L = 3500 (2) OD = 10	0.638
PHBBC-R	DPU to 0.1K signal harness Redundant	1	L = 3500 (2) OD = 10	0.569
PHBBG 1	DPU Nominal to Redundant harness	1	L = 1000 OD = 10	0.038
PHBBG 2	DPU Redundant to Nominal harness	1	L = 1000 OD = 10	0.038
PHBBE-N	DPU to 4KCDE signal harness Nominal	1	L = 4500 (2) OD = 10	0.638
PHBBE-R	DPU to 4KCDE signal harness Redundant	1	L = 4500 (2) OD = 10	0.569
PHCBB	PAU to J-FET box cryo harness	1	L = 2500 (2) OD = 37	5.6
PHCBD	REU to PAU harness	12	L = 5000 (2) Each OD = 15	16.450
PHDD	4 K Cooler Cold End (CCE), piping and clamps from the SVM bracket to FPU	1	L = 2600 (2) OD harn = 6 OD pipe = see annex 7	2.586
PHDE	4 K Connecting warm pipework and clamps from the CAU to the SVM bracket	1	L = 3000 (2) OD harn = 6 OD pipe = see annex 7	1.256

Project code	Instrument unit	# of	Dimensions (mm) (3)	Mass (kg)
PHDFA-A	4KCDE to Compressor PPO A signal harness	1	L = 1000 (2) OD = 5	0.101
PHDFA-B	4KCDE to Compressor PPO B signal harness	1	L = 1000 (2) OD = 5	0.101
PHDFB	4KCDE to Compressor force harness	1	L = 1000 (2) OD = 5	0.190
PHDFC-A	4KCDE to Compressor drives A harness	1	L = 1000 (2) OD = 6	0.109
PHDFC-B	4KCDE to Compressor drives B harness	1	L = 1000 (2) OD = 6	0.109
PHDFD	4KCDE to Ancillary Unit harness	1	L = 1000 (2) OD = 14	0.460
PHDFE	4KCDE / CCU Temperature Harness	1	L = 1000 (2) OD = 6	0.135
PHDFF	4K Ancillary Unit to SVM disconnection bracket harness	1	L = ? (2) OD = 6	0.17
PHDFG	4K SVM disconnection bracket to cold stages harness	1	L = ? (2) OD = 6	0.112
PHDK	4K CDE to Regulator harness (ALS procurement)	1		N/A
PHEABA	0.1 K Cooler Pipes between ^{3}He Tank and DCCU	1	L = 1000 (2) OD = 6.35	0.75
PHEABB	0.1 K Cooler Pipes between ^{4}He Tank 1 and DCCU	1	L = 3000 (2) OD = 6.35	0.855
PHEABC	0.1 K Cooler Pipes between ^{4}He Tank 2 and DCCU	1	L = 5000 (2) OD = 6.35	1.40

Project code	Instrument unit	# of	Dimensions (mm) (3)	Nominal mass (kg)
PHEABD	0.1 K Cooler Pipes between ^{4}He Tank 3 and DCCU	1	L = 7000 (2) OD = 6.35	1.456
PHEACA to PHEACD	0.1 K Cooler harness between He Tanks and DCCU + connectors	1 set		1.660
PHECAA	0.1 K Cooler pipes + fittings assembly between DCCU and subplatform disconnection bracket	1 set		1.542
PHECB	0.1 K Cooler pipes + fittings assembly between SVM and 50K filters,....	1 set		2.277

TOTAL	**Excluding LFI FPU**		**NA**	229.330

Table 13.3-1

*, This includes a maximum of 1.54kg of He3 stored in the HFI tank located in SVM +Z direction and 2.05kg of He4 stored in each of the three other tanks (located in on SVM - Z, +Y & -Y axes).
Note that the He4 tanks shall all be used simultaneously during flight so that their respective mass shall decrease with the same profile.

12.4 Thermal

The table below shows the heat dissipation of the units mounted on the SVM.

Project code	Instrument Unit	Power dissipation W
PHBA	DPU	**12**
PHCBA	PAU	**15**
PHCBC	REU	**90**
PHDA	4K compressor unit	**62.1** (stroke dependant)
PHDJ	4K pre-regulator	**21** (stroke dependant)
PHDB	4K ancillary unit	**13**
PHDC	4K Cooler electronic unit	**46,4**
PHEB	0,1K dilution cooler control unit	**16**

Table 13.4-1

12.5 Alignment

To be written

12.6 Timing

As has been agreed, Planck scientific data analysis shall require data from both LFI and HFI, and from the S/C (AOCS pointing information, telescope and baffles temperature, ...).
This implies that relative time of data acquisition of each sample must be accurately known wherever is it source. All parties have agreed on a common way of including, a reference time issued from a single source into the telemetry packets of HFI, LFI and SVM.

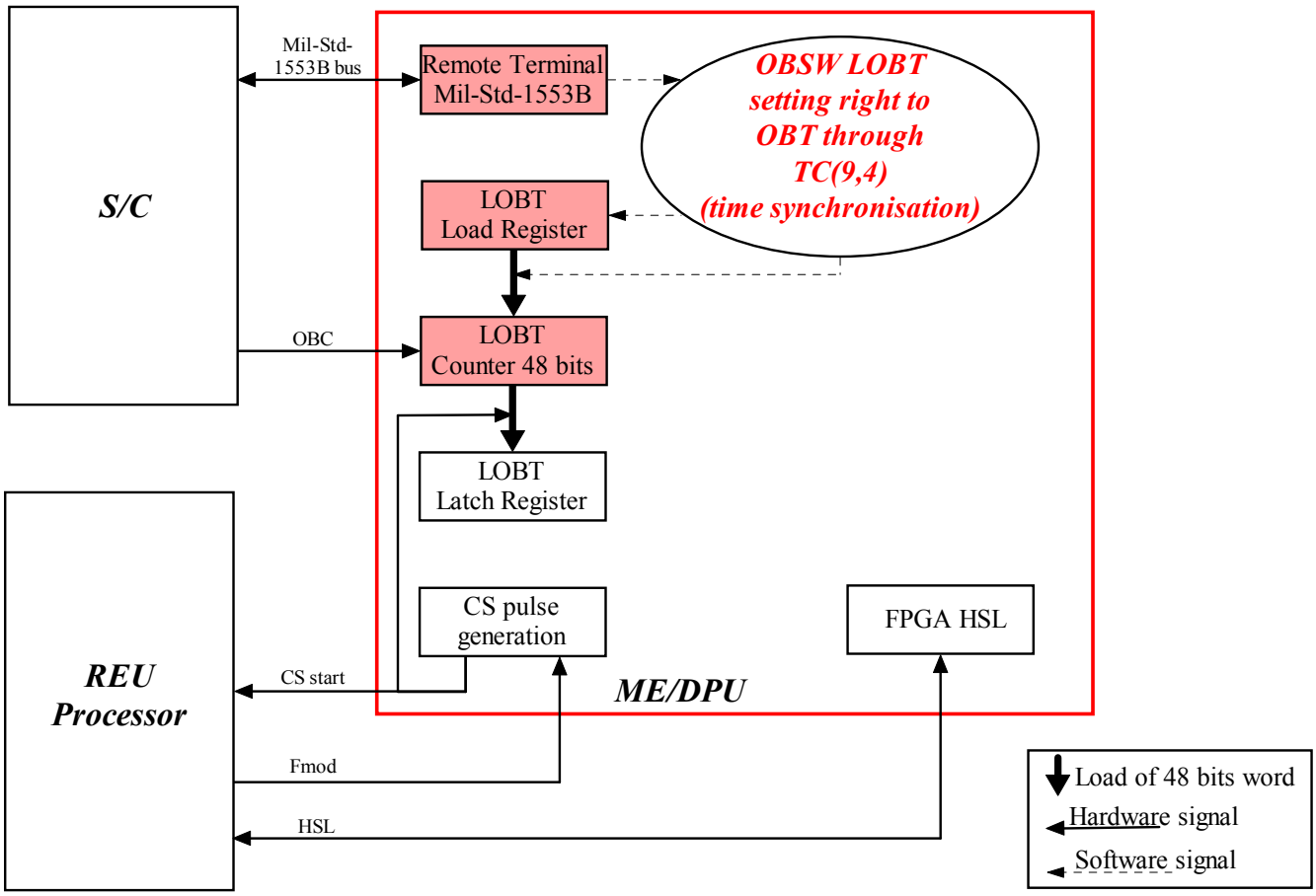


Figure 13.6-1 : LOBT setting

OBT and LOBT shall use three 16 bits words and shall be maintained in the instruments and spacecraft by use of a S/C driven and distributed clock.
This data synchronization time must not be confused with the packet reading time included into the telemetry encapsulation information which shall be used to sort the packets chronologically, and which does not require the same accuracy.
HFI, and LFI, data handling system then require as a minimum to receive from the spacecraft the following information and signals:

- the On-Board Time value on 48 bits (set by command),
- 131072 Hertz (OBC) clock signal used to drive the OBT and the LOBT with the derivated clock at 65536 Hz,
- Software synchronisation of HFI LOBT,

The relative accuracy needed for the datation process is 500 microseconds for HFI.

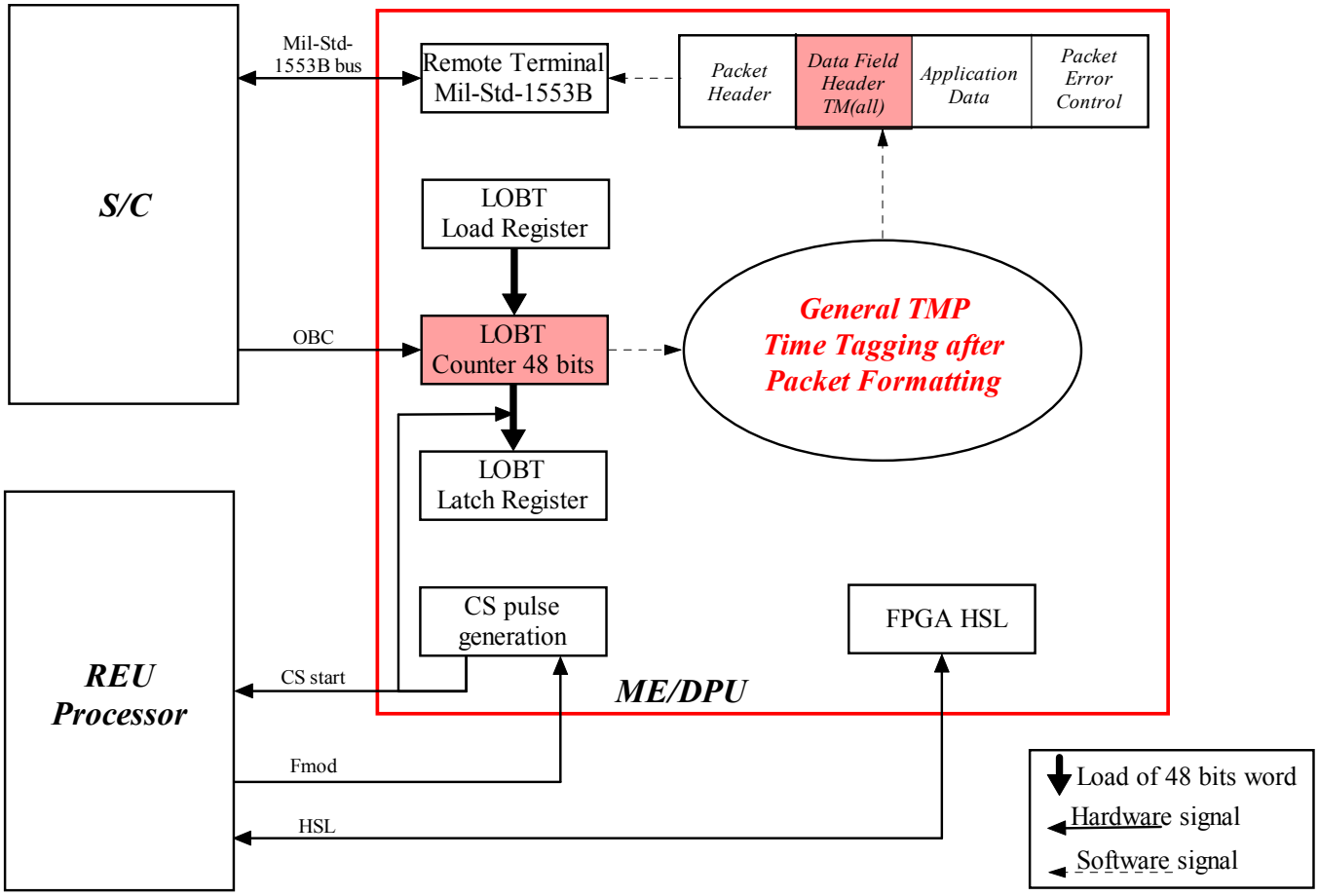


Figure 13.6-2 : General Telemetry Packets time-tagging

The HFI DPU uses the OBC only to update its LOBT.
In the case where the DPU prime is on and the DPU redundant is off, the DPU prime uses only the OBC delivered by Prime cable.
If this OBC disappears, the HFI DPU will cross to its internal clock (obtained from 20 MHz and therefore not strictly equal to 2power17 Hz).

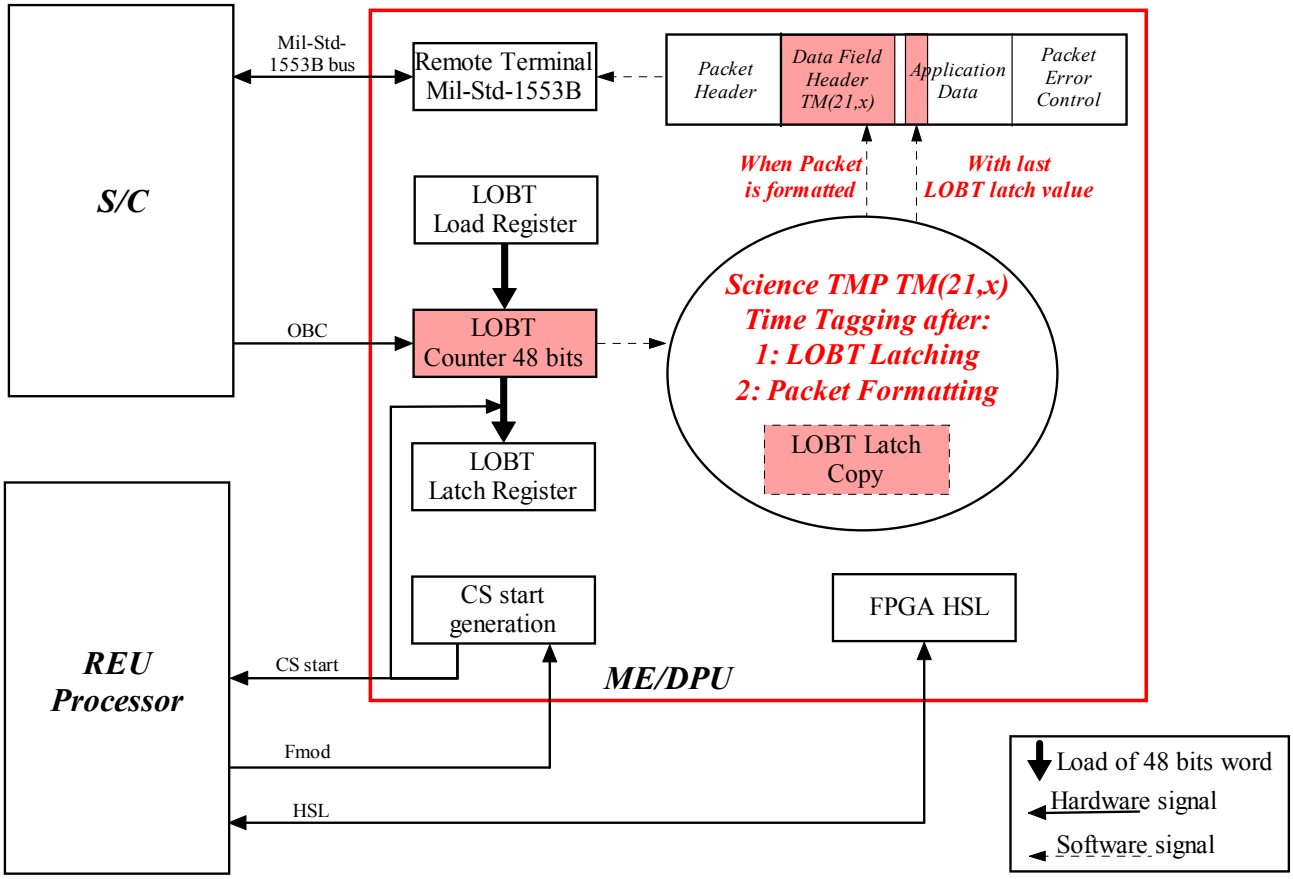


Figure 13.6-3 : Science Telemetry Packets time-tagging

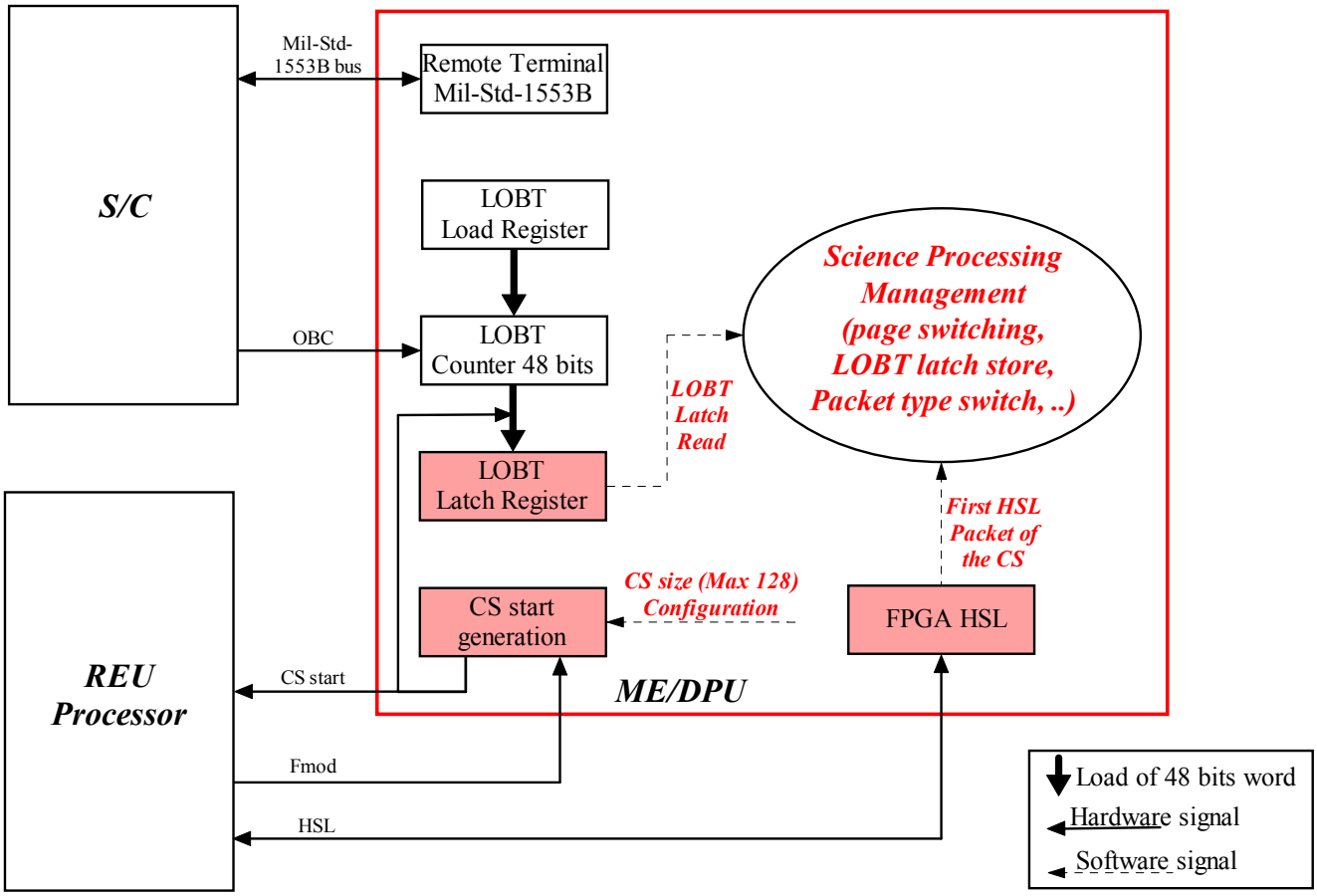


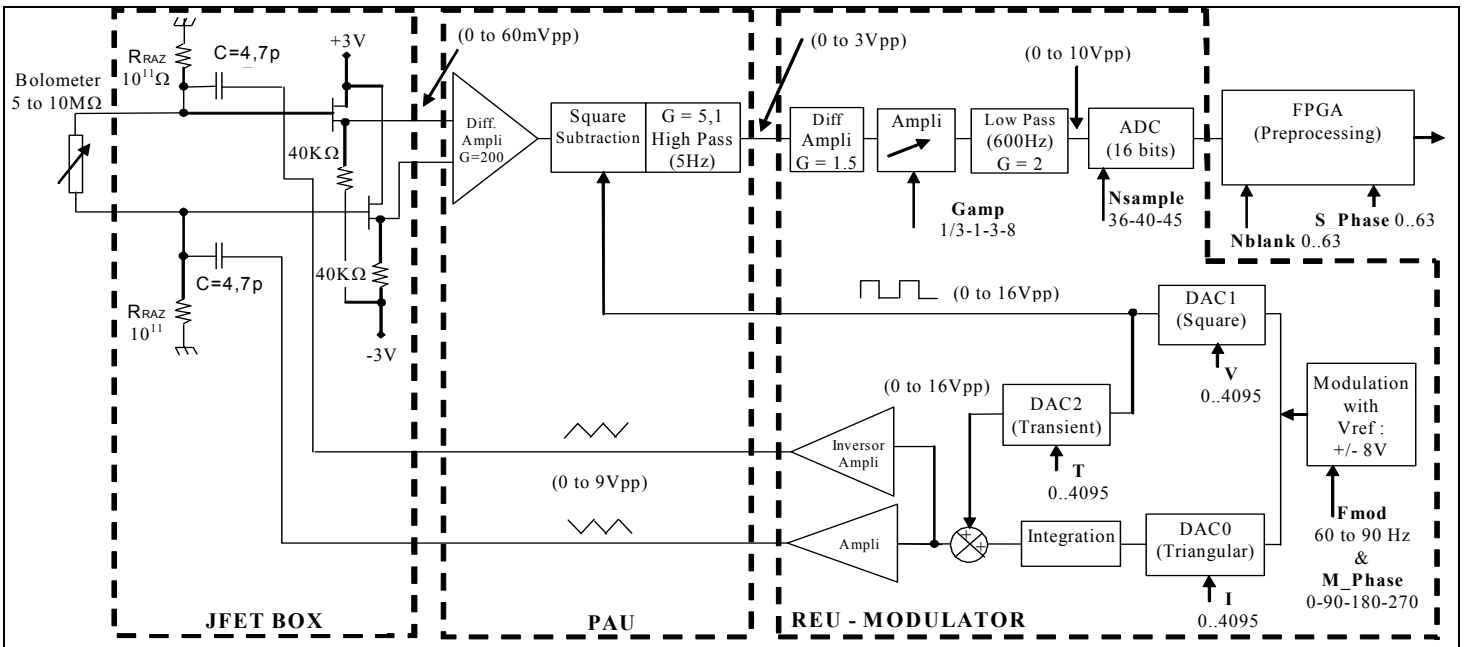
Figure 13.6-4 : Science TMP time-tagging

13 SCIENCE DATA

13.1 Sensor output data

13.1.1 Readout general scheme :

The following scheme shows a whole measurement channel of the Readout Electronics :



Notice : C = 27pF for thermometer devices

Figure 14.1.1-1 FUNCTIONING SCHEME OF A MEASUREMENT CHANNEL (DIFFERENTIAL SYSTEM)

The Readout Electronic chain can be split in 3 parts :

JFET module which :

- contains the Cbias capacitors to polarize the bolometers
- adapts the high impedance of the bolometer to a low impedance output.

PAU module which :

- amplifies the bolometer signal
- subtracts the component square
- contains differential low frequency filter to remove the high frequencies
- contains high Pass filter optimized with respect to the FET 1/f noise.

REU analog module which :

- generates and tunes the bias current (I)
- generates and tunes the square compensation (V)
- generates and tunes the transient compensation (T)
- contains differential Fixed Amplifier stage

- contains programmable amplifier stage (G = 1/3 or 1 or 3 or 8)
- contains differential Low Pass filter optimized with respect to the AD conversion
- Samples and AD conversion with 14 true bits
- Computes on (N_s – N_{blank}) valid data samples to obtain one average signal value for each half modulation period.
-

13.1.1.1 JFET module :

The J-FET box is the electrical interface between the cold components (bolometers, thermometers, high impedance devices) and the warm readout electronics REU. The purpose of the J-FET box is to provide low noise impedance matching between the bolometers (> 2 Mohm impedance) and the warm PAU differential preamplifiers (< 500ohms). The J-FETs provide an overall signal amplification (Gain ~ 1).

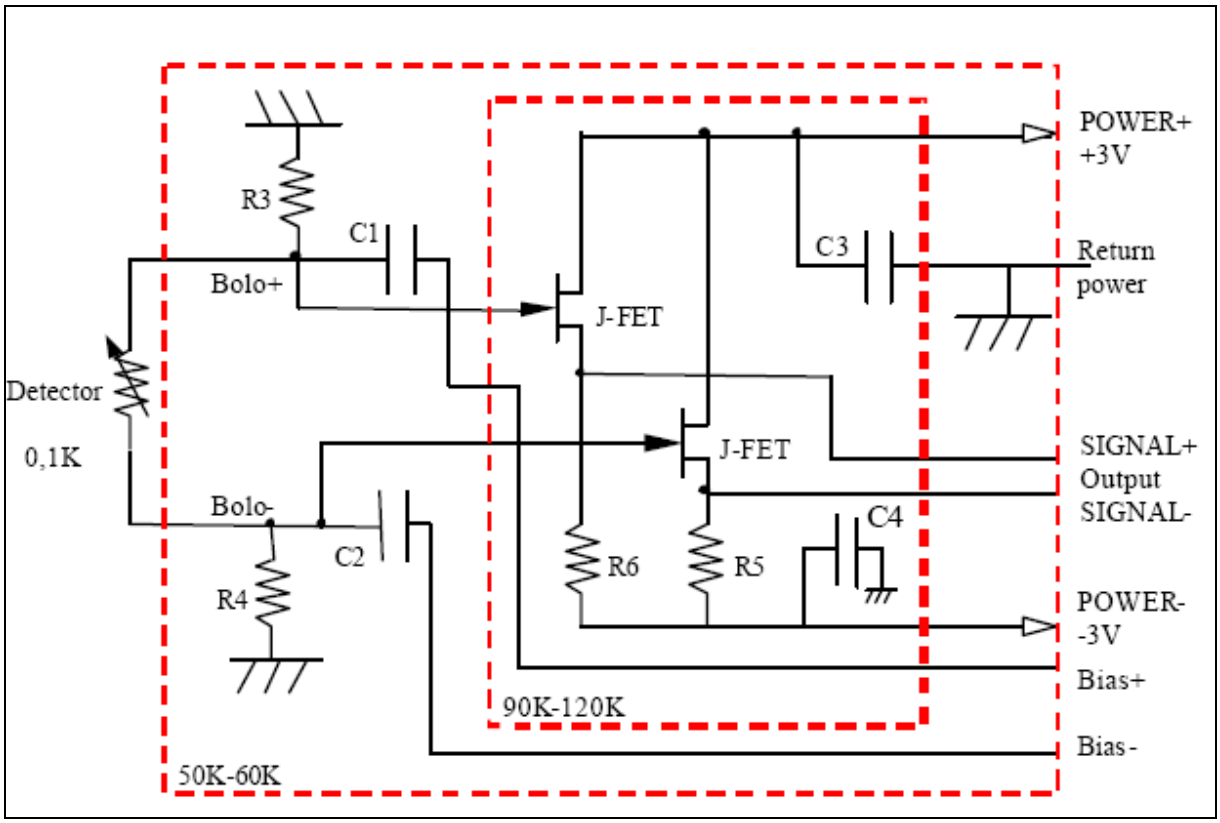


Figure 14.1.1.1-1 One JFET channel electronic scheme

13.1.1.2 PAU module :

Each PAU module (also refered as “belt”) allows :

- the amplification of 6 measurement chains and the subtraction of the square for these 6 channels.
- to provide power supply voltages (+3,1V and -3,1V) with 0,2mA per JFET channel
- the filtering of the triangular signals.

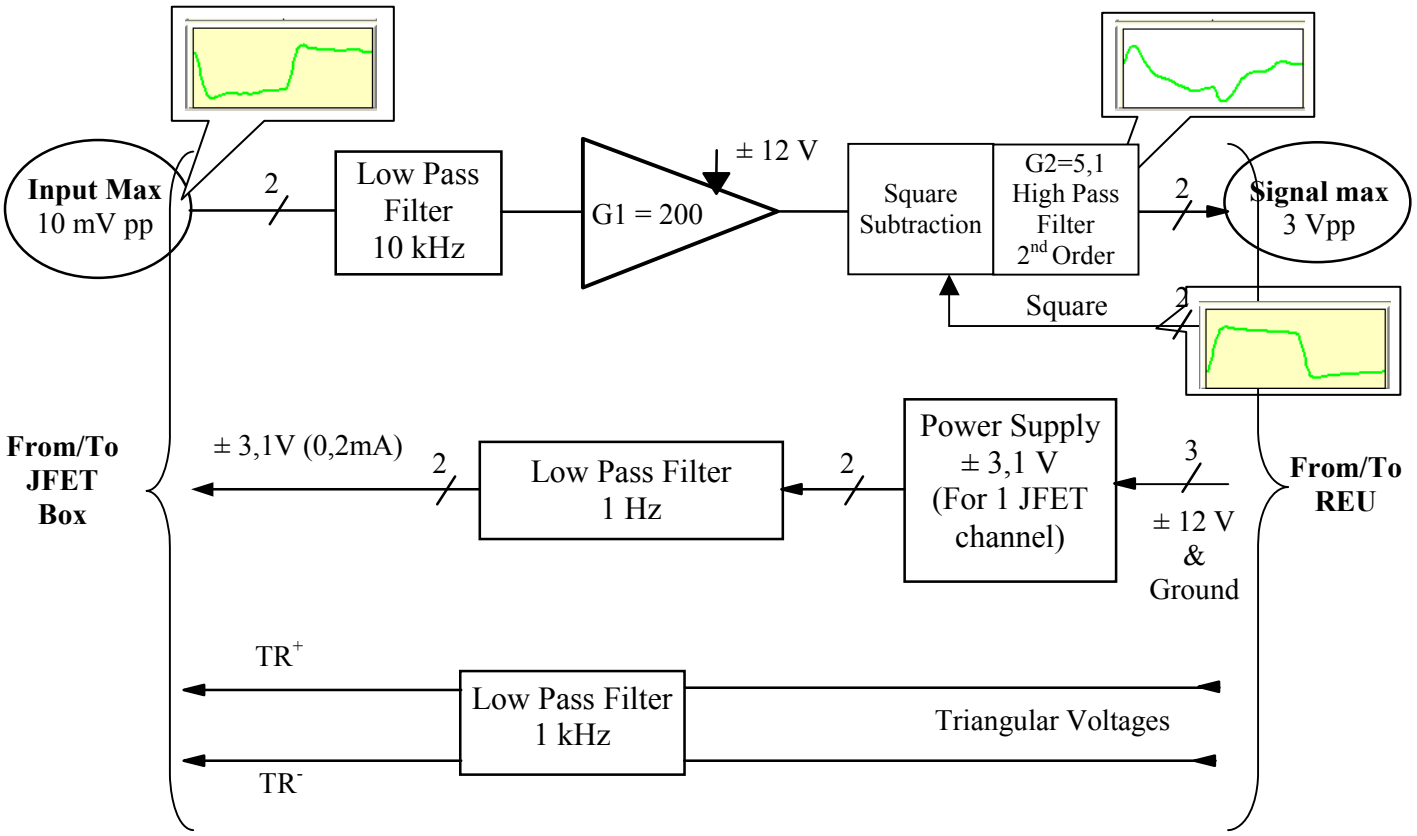


Figure 14.1.1.2-1 One PAU chanel electronic scheme

13.1.1.3 REU Analog module :

The following drawing gives a general schema of a REU Analog Module :

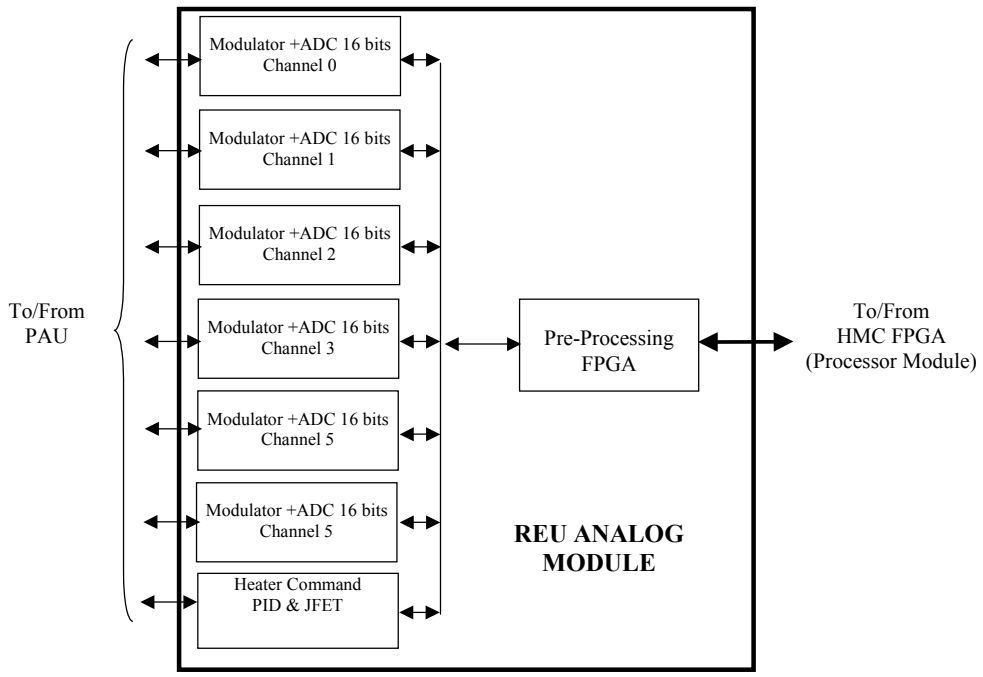


Figure 14.1.1.3-1 REU Analog chanel electronic scheme

Each REU Analog Module contains :

- 6 modulators boards which manage 6 channels,
- 1 heater command board which control the heater for 1 PID and 1 heater for 1 JFET module,
- 1 Pre-Processing and Interconnection board which allows the connections and the control of the whole REU Analog Module.

13.1.1.3.1 Modulator Board Description

The modulator board can be divided into 2 parts which are :

- **bias control** part to supply the square signals and the square signal.
- **Signal Amplification and Conversion** part to digitalize the science signal.

13.1.1.3.1.1 Bias Control

This part generates and controls the 3 modulation parameters which are the **Triangular** (or Current I), the anti-**Transient** and the **Square** (or compensation Voltage V). These 3 parameters are controlled by 3 Digital to Analog Converters (DAC) over 12 bits.

The design of this part is show by the figure hereafter :

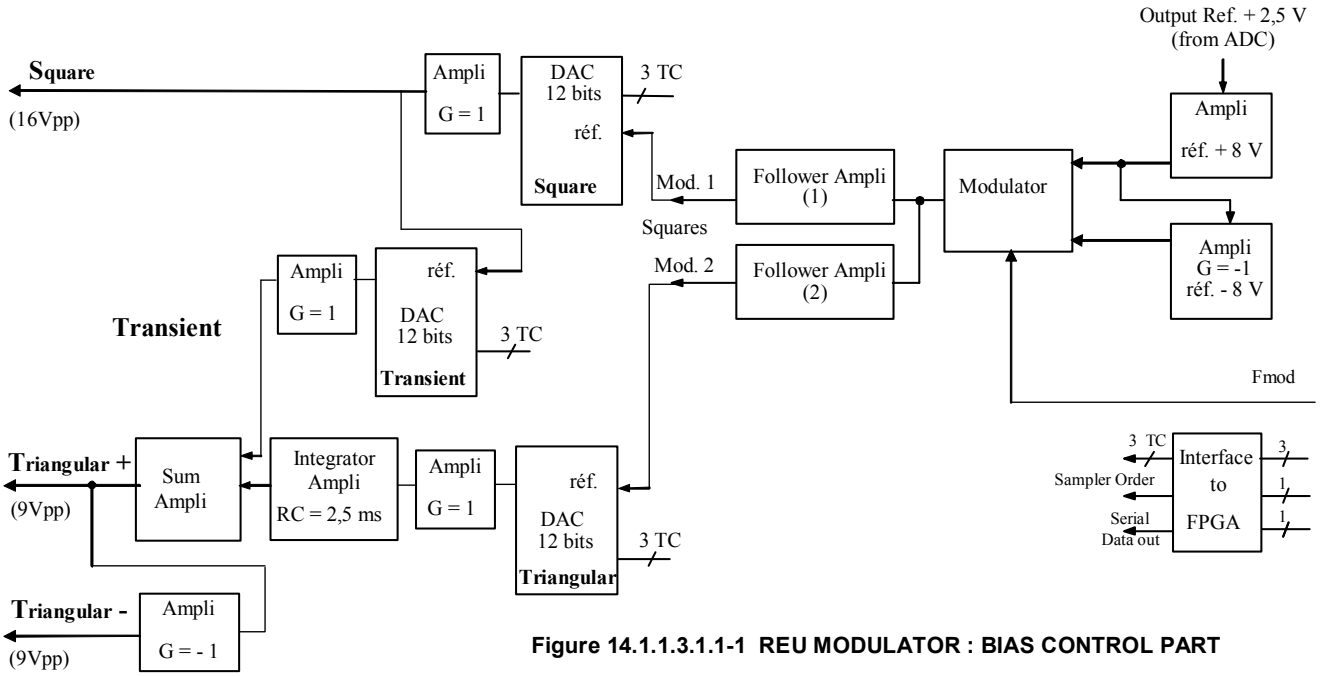


Figure 14.1.1.3.1.1-1 REU MODULATOR : BIAS CONTROL PART

The main characteristics of this parts are :

REF: reference clock, for all channels, at frequency f_{mod} with phase adjustable
70 Hz < f_{mod} < 90 Hz common for all bolometer and thermometer channels.

T+, T-: Two phase opposite triangular voltages with same amplitude Tpp (peak to peak).
Amplitude range: 0 V < Tpp < 9 V
Amplitude step: ΔTpp = 9 / 4096 = 2.2 mV
Noise requirement: < 20 nV/sqrt(Hz) from 0.1 Hz to 400 Hz.

Square & Transient: Square voltage with adjustable amplitude Spp (signal compensation) and a triangular voltage of adjustable amplitude TTpp (transient compensation).
Amplitude range: 0 V < Spp < 16 V
0 V < TTpp < 16 V
Amplitude step: ΔSpp = 16 / 4096 = 3.9 mV
ΔTT = 16 / 4096 = 3.9 mV
Noise requirement: < 100 nV/sqrt(Hz) from 0.1 Hz to 400 Hz.

13.1.1.3.1.2 Signal amplification and Conversion

The science signal from the Pre-Amplifier Unit is received through a differential amplifier, amplified with a programmable gain and is passed through a 2nd order filter before the Analog to Digital Conversion over 16 bits.

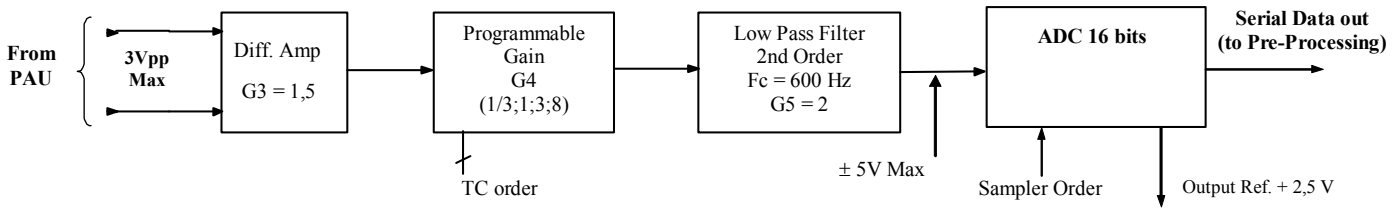


Figure 14.1.1.3.1.2-1 REU MODULATOR : Signal amplification and Conversion Part

The main characteristics of this parts are :

Differential Fixed Amplifier stage.
- Fixed gain: G3 = 1,5
- Noise requirement: < 300 nV/sqrt(Hz) from 0.1 Hz to 400 Hz

Programmable Amplifier stage
- Programmable gain: 4 values for G3 = 1/3 or 1 or 3 or 8
- Noise requirement: < 300 nV/sqrt(Hz) from 0.1 Hz to 400 Hz.

Differential Low Pass filter to be optimized with respect to the AD conversion.
- Fixed gain: G5 = 2
- Order: 2nd
- Critical frequency: 600 Hz

Sampling and Analog to Digital Conversion.:
- Number of bits: 14 true bits
- Programmable sampling: Ns = 36 or 40 or 45 (N samples per half modulation period)
- Programmable rate: $f_{sample} = 2 * N_s * f_{mod}$

Pre-Processing Board

The preprocessing consist in making the sum of the Nsample first samples of each half-period of modulation (DSN+ and DSN-).

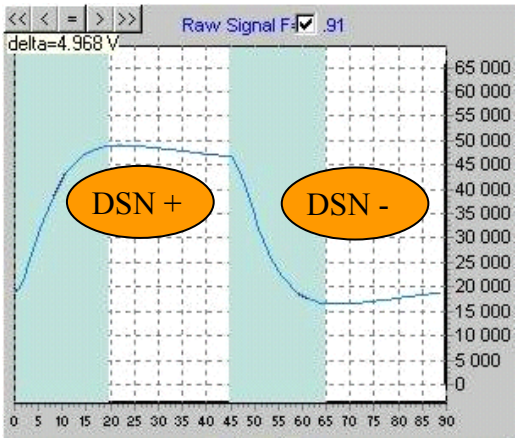


Figure 14.1.1.3.2-1

In addition, it can delete the Nblank first samples of each half-period. And, it can shift the sum by Sphase samples from the beginning of the half-period.

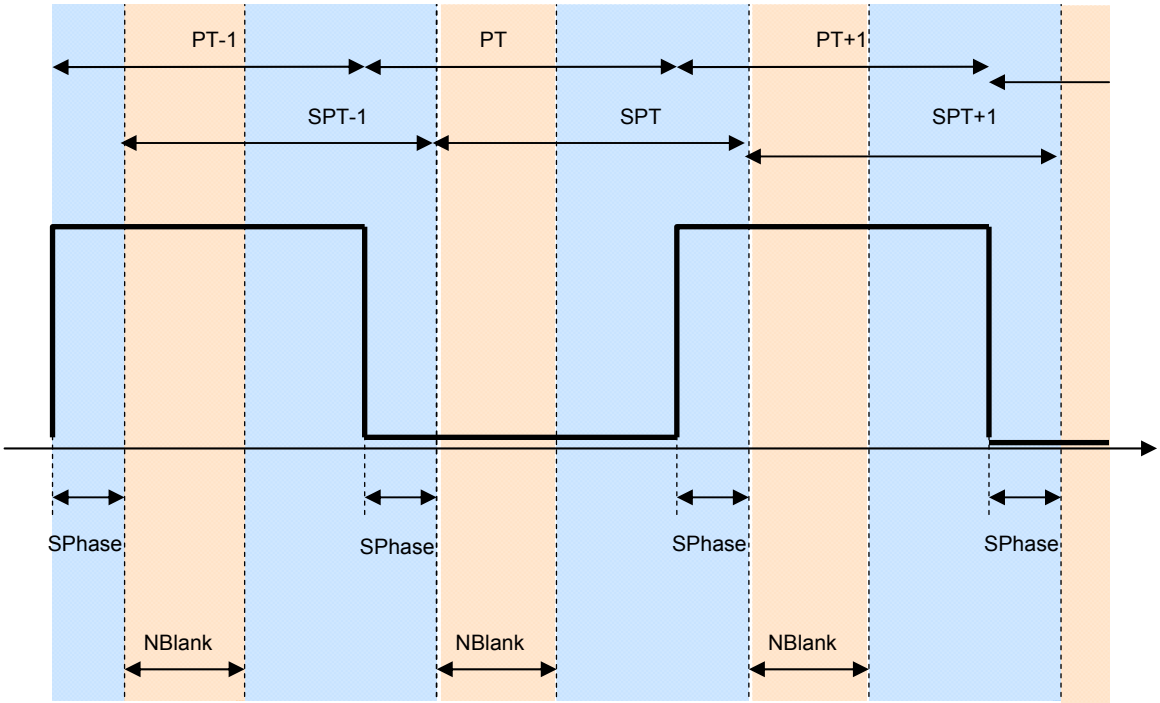


Figure 14.1.1.3.2-2

Px : Half-period number x SPx : Sum for period x

The following table summaries the pre-processing. In this table, “Si” is the sample number i, “Spt” is the sum of half-period t.

	SPhase=0	**SPhase>=1**
NBlank=0	$S_{PT} = \sum_{i=SPhase}^{NSample-1} s_i$	$S_{PT} = \sum_{i=SPhase}^{NSample-1} s_i + \sum_{i=0}^{SPhase-1} s_i$
NBlank>=1	$S_{PT} = \sum_{i=SPhase}^{NSample-1} s_i - \sum_{i=SPhase}^{i=SPhase+NBlank-1} s_i$	$S_{PT} = \sum_{i=SPhase}^{NSample-1} s_i + \sum_{i=0}^{SPhase-1} s_i - \sum_{i=SPhase}^{i=SPhase+NBlank-1} s_i$

13.2 Compression Algorithm

13.2.1 Introduction

The HFI readout electronics output is a succession of time samples of all bolometric channels plus a few cryo-thermometric channels.
In order to be compliant with the instrument telemetry allocation, with some margin, a compression factor of the order of 3.8 is needed.
It is planned to use an algorithm capable of reaching such a compression factor for signals dominated by gaussian noise, which is the case for the Planck HFI signals.
Principles
Here is described the simplest version of a possible compression algorithm. There is still room for variations and optimisation.
Data Preparation
The compression algorithm is performed on each channel separately. And for each channel, it is applied sequentially to the successive sets of *l* consecutive measurements, hereafter called the *l*-vectors *S*[*i*], where *i* runs from 1 to *l*. Each measurement is a 24 bit word. The signals are over-sampled, which means that the bit value is small compared to the rms of the photon noise.
l is a fixed parameter that can be selected by command. Its value will be the result of a compromise between the required memory size, and the compression performances obtained on simulated and real data flows, present nominal foreseen value for *l* is about 100.
Measurements from 1 to / constitute a Compression Slice (CS).
Therefore, the Data Processing Unit will first sort the incoming data, to build the *l*-vectors *S*[*i*] for each channel. These vectors are alternately written onto one of two memory pages, while the data of the other memory page are being compressed and written to the DPU output buffer.

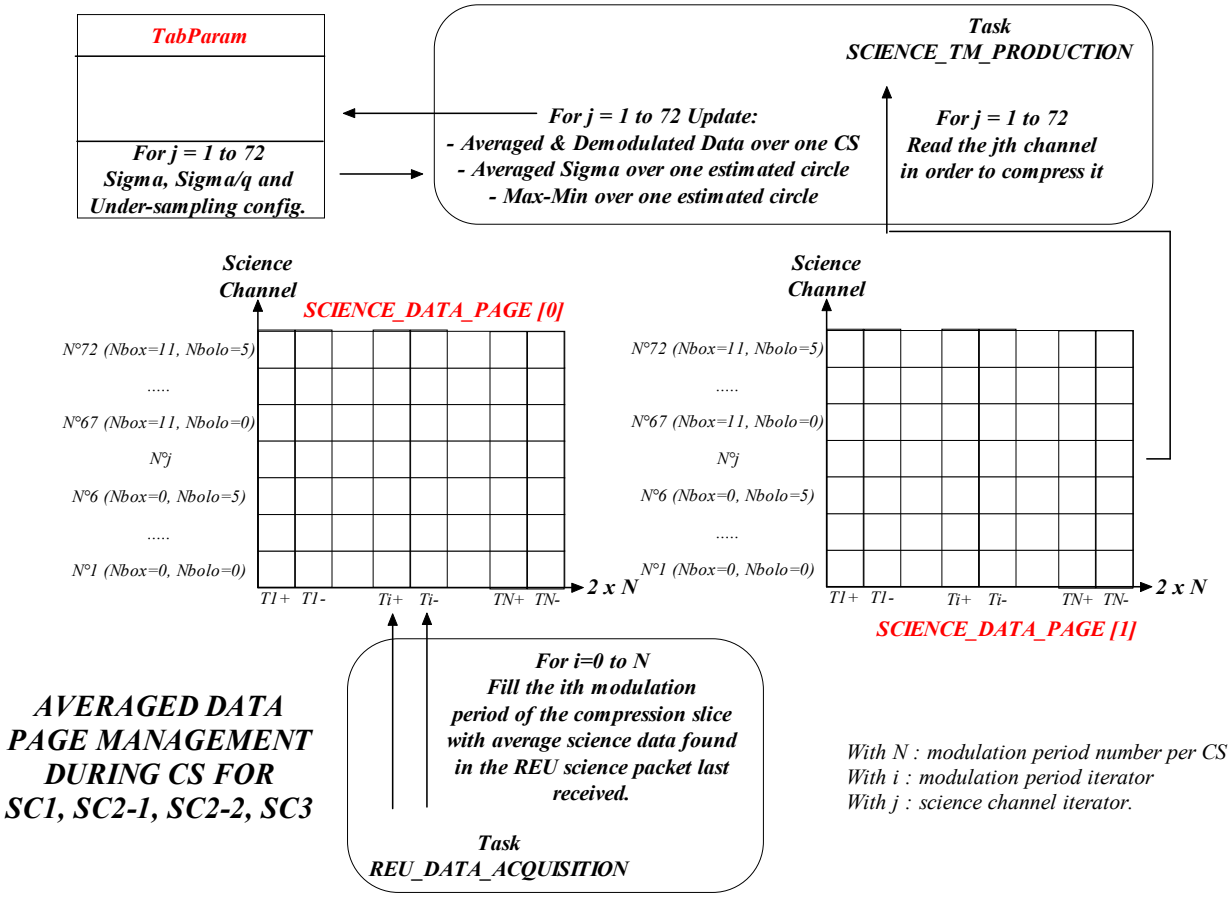


Figure 14.2-1: Compression Overview

13.2.2 Data Compression

The following operations are applied to each *l*-vector *S*[*i*] :
The mean value *Av* and standard deviation *Sd* of the vector components are computed.
Each component undergoes :
the substraction of *Av*,
the substraction of *q*/2,
and the integer division by *q*. *q* being a selectable by command fixed parameter proportional to the noise rms value □ of the processed channel.

The compressed data flow is built as follows, from the vector $Int[i] = \left[\frac{S[i] - Av - q/2}{q} \right]$

a predefined header containing general information on the processed data set is written,
Av and *q* are written,
2 bits per vector component are written, with the following values :
0 if *Int*[*i*] = –1,
1 if *Int*[*i*] = 0,
2 if *Int*[*i*] = +1,
3 if *Int*[*i*] is outside [-1,+1].

The number $N_{\bar{2}}$ of components pertaining to last case is written using as many bits as needed to digitise its maximum possible value, *l*.

Previous procedure is iterated using 4 bits for each one of these $N_{\bar{2}}$ components. At this stage, 4 bits allow to code the *Int*[*i*] values within [-7,+7], plus an over&under-flow flag. One computes the number $N_{\bar{4}}$ of the components falling outside [-7,+7], and write it.

Each one of the $N_{\bar{4}}$ components is written on *k* bits, *k* being large enough to prevent saturation. 10 is a plausible value for *k* for the HFI data.

Data Rebuilding

The encoding of each *l*-vector *Int*[*i*] allows one to retrieve its components and to build the uncompressed vector *S*'[*i*] as : $S'[i] = S[i] + q \times Int[i]$

13.2.3 Properties

The noise added by this algorithm can be considered as a white noise added to the measurement process, leading to an error increase of the order of 5% if the binning is of the order of the noise r.m.s. value. These properties are being tested both with actual HFI main Electronics software and actual data gathered during Archeops balloon flights.

Monte Carlo simulations of the compression-un-compression procedure are in progress to check these properties, and to further optimise this algorithm.

13.2.4 Compression Factor

The compression factor depends on several parameters:
the binning size *q* expressed in units of □.
the percentage of data dominated by the photon noise,
the length of the processed vectors, and the size of the header.

In a “realistic” case where 95% of the data is dominated by the photon noise and with a header of three 16bit words: a 4.7 compression factor, which is larger than the 3.8 required one, is obtained for *q* equal σ.

13.3 Ground Processing

HFI data ground processing can be performed either in real time or off-line.

Realtime processing is mainly used for monitoring specific operations such as the ones performed during instrument in-flight Commissioning, Calibration or Performance Verification phases.
During routine survey it is used for a SYSTEMATIC early assessment of the instrument health through an automatic visualisation of available HSK and Science data. One can say that it is a simplified version of the off-line processing providing less flexibility but having essentially the same steps and using the tools also used for the off-line data processing. Off-line data processing is applied to the data that have been stored in spacecraft solid state memory and are down-loaded to ground once per day during the Daily Telecommunication Period. Off-line data processing can also be applied to data acquired in realtime and that have been stored in HFI database.

13.3.1 HFI data processing by ESOC – MOC

Having collected Planck down-loaded data the MOC shall:
- sort out the received packets per categories (Events, HSK, Science,…) and by APIDs,
- HSK packets, including Events, are “opened” and processed at ESOC using SCOS2000 to detect possible anomalies and allow an early reaction as much as possible. This also applies to HFI HSK and more specifically to the parameters for which monitoring ranges have been included in the HP database. Should a parameter be confirmed out of range, an alarm shall be triggered for the benefit of MOC personnels and of Instrument Operation Team. If specified a corrective action can also be launched without delay by the MOC operator.
- In the mean time collected data is transmitted in realtime to the instrument teams via their work station located at MOC (IW@MOC). During flight “critical” phases such as Commissioning or contingency ones Instrument Operation Teams shall be represented at MOC and shall use these IW@MOC for realtime data assessment.
- Data collected at ESOC are then “consolidated” by chunks of time which duration can be choosen in agreement with instrument teams. A chunk of data is declared consolidated when either the data is continous without any lacking packet, or ESOC is convinced that the lacking packets are definitively lost and cannot be recovered. Nominally only consolidated data files are eligible for off-line delivery to the instrument teams.
- Ultimately consolidated data are archived by ESOC.

13.3.2 Instrument Realtime data processing by HFI IOT

HFI IW@MOC shall be connected to an identical deported work station located at IAS IDOC (IAS Data and Operation Center). Depending on the phase of operation both these facilities, or only IAS one, shall be used to display in realtime HFI data (when realtime data is available).

Received packets:
- are first stored,
- HSK packets are sent to a work station that displays housekeeping parameters by use of SCOS2000 software,

- In parallel all packets, Science or HSK, are “unpacked” and stored by an instance of DPC Level 1:
    - Science data is decompressed,
    - Each HSK parameters and each of the 72 HFI detection channels are separately time ordered to constitute so-called TOIs (Time Ordered Informations),
    - TOI are archived into local “Piolib” database instance,

In parallel these TOI are fed into a QLA (Quick Look Analysis) server that provides QLA clients with the data to be processed for quick look analysis.

13.3.3 Instrument data off-line processing by HFI DPC Level 1

HFI DPC Level 1 data (pre) processing is performed along the following steps:
Consolidated data are retrieved from the MOC,
They are archived into IAS database as raw data,
Science data are decompressed,
Each HSK parameters and each of the 72 HFI detection channels are separately time ordered to constitute as many TOIs,
TOI are archived at IAS IDOC (Orsay) in a “Piolib” database instance also containing corresponding transfer functions. Synchronously they are also copied in Paris IAP other Piolib database.

13.3.4 Instrument off-line data processing by HFI IOT

Starting from the TOIs saved in IAS Piolib database HFI Instrument Operation Team shall use the Quick Look Analysis software to process off-line consolidated data and possibly produce the various Data Quality, Health and Trend, daily and weekly, reports.

13.3.5 Instrument data processing by HFI DPC

Starting from the TOIs saved in IAP Piolib database HFI DPC will process the HFI data for scientific exploitation.

ANNEX A: HFI RE-SYNCHRONISATION TABLE STORED IN EEPROM

OSw0-RsynDPUMo	DPU mode	00000000	Startup Mode
OSw0-RsynREUMo	REU mode	00000002	Standby Mode
OSw0-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw0-RsyncTCLen	Tc Length	00000001	-
OSw0-RsyncTCId	Tc Identifier	0000A011	DPU go to Standby Mode
OSw0-RsyncTCSid	Tc SID	00000000	-
OSw0-RsyncTCP1	Tc Parameter 1	00000000	-
OSw0-RsyncTCP2	Tc Parameter 2	00000000	-
OSw1-RsynDPUMo	DPU mode	00000000	Startup Mode
OSw1-RsynREUMo	REU mode	00000004	Configuration Mode
OSw1-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw1-RsyncTCLen	Tc Length	00000001	
OSw1-RsyncTCId	Tc Identifier	0000A011	DPU go to Standby Mode
OSw1-RsyncTCSid	Tc SID	00000000	-
OSw1-RsyncTCP1	Tc Parameter 1	00000000	-
OSw1-RsyncTCP2	Tc Parameter 2	00000000	-
OSw2-RsynDPUMo	DPU mode	00000000	Startup Mode
OSw2-RsynREUMo	REU mode	00000004	Configuration Mode
OSw2-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw2-RsyncTCLen	Tc Length	00000001	
OSw2-RsyncTCId	Tc Identifier	0000A011	DPU go to Standby Mode
OSw2-RsyncTCSid	Tc SID	00000000	-
OSw2-RsyncTCP1	Tc Parameter 1	00000000	-
OSw2-RsyncTCP2	Tc Parameter 2	00000000	-
OSw3-RsynDPUMo	DPU mode	00000000	Startup Mode
OSw3-RsynREUMo	REU mode	00000008	Observation Mode
OSw3-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw3-RsyncTCLen	Tc Length	00000001	-
OSw3-RsyncTCId	Tc Identifier	0000A011	DPU go to Configuration Mode
OSw3-RsyncTCSid	Tc SID	00000000	-
OSw3-RsyncTCP1	Tc Parameter 1	00000000	-
OSw3-RsyncTCP2	Tc Parameter 2	00000000	-
OSw4-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw4-RsynREUMo	REU mode	00000004	Configuration Mode
OSw4-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw4-RsyncTCLen	Tc Length	00000001	-
OSw4-RsyncTCId	Tc Identifier	0000A014	DPU go to Configuration Mode
OSw4-RsyncTCSid	Tc SID	00000000	-
OSw4-RsyncTCP1	Tc Parameter 1	00000000	-
OSw4-RsyncTCP2	Tc Parameter 2	00000000	-

OSw5-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw5-RsynREUMo	REU mode	00000004	Configuration Mode
OSw5-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw5-RsyncTCLen	Tc Length	00000001	-
OSw5-RsyncTCId	Tc Identifier	0000A014	DPU go to Configuration Mode
OSw5-RsyncTCSid	Tc SID	00000000	-
OSw5-RsyncTCP1	Tc Parameter 1	00000000	-
OSw5-RsyncTCP2	Tc Parameter 2	00000000	-
OSw6-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw6-RsynREUMo	REU mode	00000008	Observation Mode
OSw6-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw6-RsyncTCLen	Tc Length	00000001	
OSw6-RsyncTCId	Tc Identifier	0000A014	DPU go to Configuration Mode
OSw6-RsyncTCSid	Tc SID	00000000	-
OSw6-RsyncTCP1	Tc Parameter 1	00000000	-
OSw6-RsyncTCP2	Tc Parameter 2	00000000	-
OSw7-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw7-RsynREUMo	REU mode	00000008	Observation Mode
OSw7-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw7-RsyncTCLen	Tc Length	00000001	-
OSw7-RsyncTCId	Tc Identifier	0000A015	DPU go to Observation Mode
OSw7-RsyncTCSid	Tc SID	00000000	-
OSw7-RsyncTCP1	Tc Parameter 1	00000000	-
OSw7-RsyncTCP2	Tc Parameter 2	00000000	-
OSw8-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw8-RsynREUMo	REU mode	00000002	Stantby Mode
OSw8-Rsyn4KMo	4KCDE mode	00000063	Boot Mode
OSw8-RsyncTCLen	Tc Length	00000001	-
OSw8-RsyncTCId	Tc Identifier	00008001	Continue Boot
OSw8-RsyncTCSid	Tc SID	00000000	-
OSw8-RsyncTCP1	Tc Parameter 1	00000000	-
OSw8-RsyncTCP2	Tc Parameter 2	00000000	-
OSw9-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw9-RsynREUMo	REU mode	00000002	Stantby Mode
OSw9-Rsyn4KMo	4KCDE mode	00000000	FreeWheel Mode
OSw9-RsyncTCLen	Tc Length	00000001	-
OSw9-RsyncTCId	Tc Identifier	00008003	Standby Mode
OSw9-RsyncTCSid	Tc SID	00000000	-
OSw9-RsyncTCP1	Tc Parameter 1	00000000	-
OSw9-RsyncTCP2	Tc Parameter 2	00000000	-

OSw10-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw10-RsynREUMo	REU mode	00000004	Configuration Mode
OSw10-Rsyn4KMo	4KCDE mode	00000063	Boot Mode
OSw10-RsyncTCLn	Tc Length	00000001	-
OSw10-RsyncTCId	Tc Identifier	00008001	Continue Boot (i.e. Standby or FreeWheel)
OSw10-RsynTCSid	Tc SID	00000000	-
OSw10-RsyncTCP1	Tc Parameter 1	00000000	-
OSw10-RsyncTCP2	Tc Parameter 2	00000000	-
OSw11-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw11-RsynREUMo	REU mode	00000004	Configuration Mode
OSw11-Rsyn4KMo	4KCDE mode	00000000	FreeWheel Mode
OSw11-RsyncTCLn	Tc Length	00000001	-
OSw11-RsyncTCId	Tc Identifier	00008004	Nominal Mode
OSw11-RsynTCSid	Tc SID	00000000	-
OSw11-RsyncTCP1	Tc Parameter 1	00000000	-
OSw11-RsyncTCP2	Tc Parameter 2	00000000	-
OSw12-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw12-RsynREUMo	REU mode	00000008	Observation Mode
OSw12-Rsyn4KMo	4KCDE mode	00000063	Boot Mode
OSw12-RsyncTCLn	Tc Length	00000001	-
OSw12-RsyncTCId	Tc Identifier	00008001	Continue Boot (i.e. FreeWheel)
OSw12-RsynTCSid	Tc SID	00000000	-
OSw12-RsyncTCP1	Tc Parameter 1	00000000	-
OSw12-RsyncTCP2	Tc Parameter 2	00000000	-
OSw13-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw13-RsynREUMo	REU mode	00000008	Observation Mode
OSw13-Rsyn4KMo	4KCDE mode	00000000	FreeWheel Mode
OSw13-RsyncTCLn	Tc Length	00000001	-
OSw13-RsynTCId	Tc Identifier	00008004	Nominal Mode
OSw13-RsynTCSid	Tc SID	00000000	-
OSw13-RsyncTCP1	Tc Parameter 1	00000000	-
OSw13-RsyncTCP2	Tc Parameter 2	00000000	-
OSw14-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw14-RsynREUMo	REU mode	00000001	Boot Mode
OSw14-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw14-RsyncTCLn	Tc Length	00000002	-
OSw14-RsyncTCId	Tc Identifier	00004023	REU go to Standby Mode
OSw14-RsynTCSid	Tc SID	00000000	-
OSw14-RsyncTCP1	Tc Parameter 1	00000000	-
OSw14-RsyncTCP2	Tc Parameter 2	00000000	-

OSw15-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw15-RsynREUMo	REU mode	00000001	Boot Mode
OSw15-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw15-RsyncTCLn	Tc Length	00000004	-
OSw15-RsyncTCId	Tc Identifier	00004023	REU go to Standby Mode
OSw15-RsynTCSid	Tc SID	00000000	-
OSw15-RsyncTCP1	Tc Parameter 1	00000004	-
OSw15-RsyncTCP2	Tc Parameter 2	00000000	-
OSw16-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw16-RsynREUMo	REU mode	00000001	Boot Mode
OSw16-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw16-RsyncTCLen	Tc Length	00000002	-
OSw16-RsyncTCId	Tc Identifier	00004023	REU go to Standby Mode
OSw16-RsyncTCSid	Tc SID	00000000	-
OSw16-RsyncTCP1	Tc Parameter 1	00000000	-
OSw16-RsyncTCP2	Tc Parameter 2	00000000	-
OSw17-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw17-RsynREUMo	REU mode	00000002	Standby Mode
OSw17-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw17-RsyncTCLen	Tc Length	00000004	-
OSw17-RsyncTCId	Tc Identifier	00004040	REU go to Configuration Mode
OSw17-RsyncTCSid	Tc SID	00000000	-
OSw17-RsyncTCP1	Tc Parameter 1	00000004	-
OSw17-RsyncTCP2	Tc Parameter 2	00000000	-
OSw18-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw18-RsynREUMo	REU mode	00000002	Standby Mode
OSw18-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw18-RsyncTCLen	Tc Length	00000004	-
OSw18-RsyncTCId	Tc Identifier	00004040	REU go to Configuration Mode
OSw18-RsyncTCSid	Tc SID	00000000	-
OSw18-RsyncTCP1	Tc Parameter 1	00000004	-
OSw18-RsyncTCP2	Tc Parameter 2	00000000	-
OSw19-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw19-RsynREUMo	REU mode	00000001	Boot Mode
OSw19-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw19-RsyncTCLen	Tc Length	00000002	-
OSw19-RsyncTCId	Tc Identifier	00004023	REU go to Standby Mode
OSw19-RsyncTCSid	Tc SID	00000000	-
OSw19-RsyncTCP1	Tc Parameter 1	00000000	-
OSw19-RsyncTCP2	Tc Parameter 2	00000000	-

OSw20-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw20-RsynREUMo	REU mode	00000002	Standby Mode
OSw20-Rsyn20KMo	4KCDE mode	00000003	Nominal Mode
OSw20-RsyncTCLen	Tc Length	00000004	-
OSw20-RsyncTCId	Tc Identifier	00004040	REU go to Configuration Mode
OSw20-RsyncTCSid	Tc SID	00000000	-
OSw20-RsyncTCP1	Tc Parameter 1	00000004	-
OSw20-RsyncTCP2	Tc Parameter 2	00000000	-
OSw21-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw21-RsynREUMo	REU mode	00000004	Configuration Mode
OSw21-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw21-RsyncTCLen	Tc Length	00000004	-
OSw21-RsyncTCId	Tc Identifier	00004040	REU go to Observation Mode
OSw21-RsyncTCSid	Tc SID	00000000	-
OSw21-RsyncTCP1	Tc Parameter 1	00000008	-
OSw21-RsyncTCP2	Tc Parameter 2	00000000	-
OSw22-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw22-RsynREUMo	REU mode	00000001	Boot Mode
OSw22-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw22-RsyncTCLen	Tc Length	00000002	-
OSw22-RsyncTCId	Tc Identifier	000040AA	REU go to Standby Mode
OSw22-RsyncTCSid	Tc SID	00000000	-
OSw22-RsyncTCP1	Tc Parameter 1	00000000	-
OSw22-RsyncTCP2	Tc Parameter 2	00000000	-
OSw23-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw23-RsynREUMo	REU mode	00000001	Boot Mode
OSw23-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw23-RsyncTCLen	Tc Length	00000004	-
OSw23-RsyncTCId	Tc Identifier	000040AA	REU go to Standby Mode
OSw23-RsyncTCSid	Tc SID	00000000	-
OSw23-RsyncTCP1	Tc Parameter 1	00000004	-
OSw23-RsyncTCP2	Tc Parameter 2	00000000	-
OSw24-RsynDPUMo	DPU mode	00000004	Configuration Mode
OSw24-RsynREUMo	REU mode	00000001	Boot Mode
OSw24-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw24-RsyncTCLen	Tc Length	00000002	-
OSw24-RsyncTCId	Tc Identifier	000040AA	REU go to Standby Mode
OSw24-RsyncTCSid	Tc SID	00000000	-
OSw24-RsyncTCP1	Tc Parameter 1	00000000	-
OSw24-RsyncTCP2	Tc Parameter 2	00000000	-

OSw25-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw25-RsynREUMo	REU mode	00000001	Boot Mode
OSw25-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw25-RsyncTCLen	Tc Length	00000002	-
OSw25-RsyncTCId	Tc Identifier	000040AA	REU go to Standby Mode
OSw25-RsyncTCSid	Tc SID	00000000	-
OSw25-RsyncTCP1	Tc Parameter 1	00000000	-
OSw25-RsyncTCP2	Tc Parameter 2	00000000	-
OSw26-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw26-RsynREUMo	REU mode	00000001	Boot Mode
OSw26-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw26-RsyncTCLn	Tc Length	00000002	-
OSw26-RsyncTCId	Tc Identifier	00004023	REU go to Standby Mode
OSw26-RsynTCSid	Tc SID	00000000	-
OSw26-RsyncTCP1	Tc Parameter 1	00000000	-
OSw26-RsyncTCP2	Tc Parameter 2	00000000	-
OSw27-RsynDPUMo	DPU mode	00000001	Standby Mode
OSw27-RsynREUMo	REU mode	00000001	Boot Mode
OSw27-Rsyn4KMo	4KCDE mode	00000003	Nominal Mode
OSw27-RsyncTCLn	Tc Length	00000002	-
OSw27-RsyncTCId	Tc Identifier	000040AA	REU go to Standby Mode
OSw27-RsynTCSid	Tc SID	00000000	-
OSw27-RsyncTCP1	Tc Parameter 1	00000000	-
OSw27-RsyncTCP2	Tc Parameter 2	00000000	-
OSw28-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw28-RsynREUMo	REU mode	00000001	Boot Mode
OSw28-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw28-RsyncTCLn	Tc Length	00000002	-
OSw28-RsyncTCId	Tc Identifier	00004023	REU go to Standby Mode
OSw28-RsynTCSid	Tc SID	00000000	-
OSw28-RsyncTCP1	Tc Parameter 1	00000000	-
OSw28-RsyncTCP2	Tc Parameter 2	00000000	-
OSw29-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw29-RsynREUMo	REU mode	00000001	Boot Mode
OSw29-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw29-RsyncTCLn	Tc Length	00000002	-
OSw29-RsynTCId	Tc Identifier	000040AA	REU go to Standby Mode
OSw29-RsynTCSid	Tc SID	00000000	-
OSw29-RsyncTCP1	Tc Parameter 1	00000000	-
OSw29-RsyncTCP2	Tc Parameter 2	00000000	-

OSw30-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw30-RsynREUMo	REU mode	00000002	Standby Mode
OSw30-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw30-RsyncTCLn	Tc Length	00000004	-
OSw30-RsyncTCId	Tc Identifier	00004040	REU go to Configuration Mode
OSw30-RsynTCSid	Tc SID	00000000	-
OSw30-RsyncTCP1	Tc Parameter 1	00000004	-
OSw30-RsyncTCP2	Tc Parameter 2	00000000	-
OSw31-RsynDPUMo	DPU mode	00000005	Observation Mode
OSw31-RsynREUMo	REU mode	00000004	Configuration Mode
OSw31-Rsyn4KMo	4KCDE mode	00000007	Standby Mode
OSw31-RsyncTCLn	Tc Length	00000004	-
OSw31-RsyncTCId	Tc Identifier	00004040	REU go to Observation Mode
OSw31-RsynTCSid	Tc SID	00000000	-
OSw31-RsyncTCP1	Tc Parameter 1	00000008	-
OSw31-RsyncTCP2	Tc Parameter 2	00000000	-

ANNEX B:

DPU DEFAULT PARAMETER VALUE STORED IN THE EEPROM INITIAL PART

Block Number	Address	Parameter Name	Modified by	Used by	Min Value	Max Value	Default Value
Block0	0x8003EC00	Number of start	Automatic	BSW	-	-	N/A
Block1	0x8003ED00	ASW Start Address	Dedicated	BSW	0	80000	TBD
	0x8003ED01	ASW Length	Dedicated	BSW	0	257023	257023
Block2	0x8003EE00	Parameter store	Dedicated	ASW	0	1	0
Block3	0x8003EF00	BSW version	Patch	BSW	-	-	N/A
	0x8003EF01	ASW Parity	Patch	BSW	0	7	3
Block5	0x8003F100	FDIR mode	Dedicated	BSW & ASW	0	2	0
Block6	0x8003F200	ASW version	Patch	ASW	-	-	N/A
Block7	0x8003F300	Resynchronisation Number	Dedicated	ASW	0	32	0
Block8	0x8003F400	Compression control for 0,0	Dedicated	ASW	0	4095	TBD
	0x8003F401	Configured Sigma for 0,0	Dedicated	ASW	0	65535	TBD
	-	-	Dedicated	ASW	-	-	-
	0x8003F48E	Compression control for 11,5	Dedicated	ASW	0	4095	TBD
	0x8003F48F	Configured Sigma for 11,5	Dedicated	ASW	0	65535	TBD
	0x8003F490	CS size	Dedicated	ASW	47	127	127
	0x8003F491	Raw Signal Filter 45 LSW	Dedicated	ASW	0	65535	0xD249
	0x8003F492	Raw Signal Filter 45	Dedicated	ASW	0	65535	0x2492
	0x8003F493	Raw Signal Filter 45 MSW	Dedicated	ASW	0	65535	0x4920
	0x8003F494	Raw Signal Filter 40 LSW	Dedicated	ASW	0	65535	0xF249
	0x8003F495	Raw Signal Filter 40	Dedicated	ASW	0	65535	0x2492
	0x8003F496	Raw Signal Filter 40 MSW	Dedicated	ASW	0	65535	0x4900
	0x8003F497	Raw Signal Filter 36 LSW	Dedicated	ASW	0	65535	0xFE49
	0x8003F498	Raw Signal Filter 36	Dedicated	ASW	0	65535	0x2492
	0x8003F499	Raw Signal Filter 36 MSW	Dedicated	ASW	0	65535	0x4000
Block9	0x8003F500	DPU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8003F501	REU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8003F502	4KCDE mode	Dedicated	ASW	N/A	N/A	N/A
	0x8003F503	Tc Length	Dedicated	ASW	N/A	N/A	N/A
	0x8003F504	Tc Identifier	Dedicated	ASW	N/A	N/A	N/A
	0x8003F505	Tc SID	Dedicated	ASW	N/A	N/A	N/A
	0x8003F506	Tc Parameter 1	Dedicated	ASW	N/A	N/A	N/A
	0x8003F507	Tc Parameter 2	Dedicated	ASW	N/A	N/A	N/A
	-	-	Dedicated	ASW	N/A	N/A	N/A
	0x8003F588	DPU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8003F599	REU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8003F5AA	4KCDE mode	Dedicated	ASW	N/A	N/A	N/A
	0x8003F5BB	Tc Length	Dedicated	ASW	N/A	N/A	N/A
	0x8003F5CC	Tc Identifier	Dedicated	ASW	N/A	N/A	N/A
	0x8003F5DD	Tc SID	Dedicated	ASW	N/A	N/A	N/A
	0x8003F5EE	Tc Parameter 1	Dedicated	ASW	N/A	N/A	N/A
	0x8003F5FF	Tc Parameter 2	Dedicated	ASW	N/A	N/A	N/A

ANNEX C:

DPU DEFAULT PARAMETER VALUE STORED IN THE EEPROM LOADED PART

Block Number	Address	Parameter Name	Modified by	Used by	Min Value	Max Value	Default Value
Block6	0x8007F200	ASW version	Patch	ASW	-	-	N/A
Block7	0x8007F300	Resynchronisation Number	Dedicated	ASW	0	32	0
Block8	0x8007F400	Compression control for 0,0	Dedicated	ASW	0	4095	TBD
	0x8007F401	Configured Sigma for 0,0	Dedicated	ASW	0	65535	TBD
	-	-	Dedicated	ASW	-	-	-
	0x8007F48E	Compression control for 11,5	Dedicated	ASW	0	4095	TBD
	0x8007F48F	Configured Sigma for 11,5	Dedicated	ASW	0	65535	TBD
	0x8007F490	CS size	Dedicated	ASW	47	127	127
	0x8007F491	Raw Signal Filter 45 LSW	Dedicated	ASW	0	65535	0xD249
	0x8007F492	Raw Signal Filter 45	Dedicated	ASW	0	65535	0x2492
	0x8007F493	Raw Signal Filter 45 MSW	Dedicated	ASW	0	65535	0x4920
	0x8007F494	Raw Signal Filter 40 LSW	Dedicated	ASW	0	65535	0xF249
	0x8007F495	Raw Signal Filter 40	Dedicated	ASW	0	65535	0x2492
	0x8007F496	Raw Signal Filter 40 MSW	Dedicated	ASW	0	65535	0x4900
	0x8007F497	Raw Signal Filter 36 LSW	Dedicated	ASW	0	65535	0xFE49
	0x8007F498	Raw Signal Filter 36	Dedicated	ASW	0	65535	0x2492
	0x8007F499	Raw Signal Filter 36 MSW	Dedicated	ASW	0	65535	0x4000
Block9	0x8007F500	DPU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8007F501	REU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8007F502	4KCDE mode	Dedicated	ASW	N/A	N/A	N/A
	0x8007F503	Tc Length	Dedicated	ASW	N/A	N/A	N/A
	0x8007F504	Tc Identifier	Dedicated	ASW	N/A	N/A	N/A
	0x8007F505	Tc SID	Dedicated	ASW	N/A	N/A	N/A
	0x8007F506	Tc Parameter 1	Dedicated	ASW	N/A	N/A	N/A
	0x8007F507	Tc Parameter 2	Dedicated	ASW	N/A	N/A	N/A
	-	-	Dedicated	ASW	N/A	N/A	N/A
	0x8007F588	DPU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8007F599	REU mode	Dedicated	ASW	N/A	N/A	N/A
	0x8007F5AA	4KCDE mode	Dedicated	ASW	N/A	N/A	N/A
	0x8007F5BB	Tc Length	Dedicated	ASW	N/A	N/A	N/A
	0x8007F5CC	Tc Identifier	Dedicated	ASW	N/A	N/A	N/A
	0x8007F5DD	Tc SID	Dedicated	ASW	N/A	N/A	N/A
	0x8007F5EE	Tc Parameter 1	Dedicated	ASW	N/A	N/A	N/A
	0x8007F5FF	Tc Parameter 2	Dedicated	ASW	N/A	N/A	N/A

ANNEX D :
HFI HOUSKEEPING TELEMETRY ORDERED BY S2K ASCENDING HM NUMBER

DPU ASW TELEMETRY ORDERED BY S2K ASCENDING HM NUMBER

S2K	Description	Type of packet
HM001240	Channel 00 Compr Under Sampl Div	HSK4
HM002240	Channel 01 Compr Under Sampl Div	HSK4
HM003240	Channel 02 Compr Under Sampl Div	HSK4
HM004240	Channel 03 Compr Under Sampl Div	HSK4
HM005240	Channel 04 Compr Under Sampl Div	HSK4
HM006240	Channel 05 Compr Under Sampl Div	HSK4
HM007240	Channel 10 Compr Under Sampl Div	HSK4
HM008240	Channel 11 Compr Under Sampl Div	HSK4
HM009240	Channel 12 Compr Under Sampl Div	HSK4
HM010240	Channel 13 Compr Under Sampl Div	HSK4
HM011240	Channel 14 Compr Under Sampl Div	HSK4
HM012240	Channel 15 Compr Under Sampl Div	HSK4
HM013240	Channel 20 Compr Under Sampl Div	HSK5
HM014240	Channel 21 Compr Under Sampl Div	HSK5
HM015240	Channel 22 Compr Under Sampl Div	HSK5
HM016240	Channel 23 Compr Under Sampl Div	HSK5
HM017240	Channel 24 Compr Under Sampl Div	HSK5
HM018240	Channel 25 Compr Under Sampl Div	HSK5
HM019240	Channel 30 Compr Under Sampl Div	HSK5
HM020240	Channel 31 Compr Under Sampl Div	HSK5
HM021240	Channel 32 Compr Under Sampl Div	HSK5
HM022240	Channel 33 Compr Under Sampl Div	HSK5
HM023240	Channel 34 Compr Under Sampl Div	HSK5
HM024240	Channel 35 Compr Under Sampl Div	HSK5
HM025240	Channel 40 Compr Under Sampl Div	HSK6
HM026240	Channel 41 Compr Under Sampl Div	HSK6
HM027240	Channel 42 Compr Under Sampl Div	HSK6
HM028240	Channel 43 Compr Under Sampl Div	HSK6
HM029240	Channel 44 Compr Under Sampl Div	HSK6
HM030240	Channel 45 Compr Under Sampl Div	HSK6
HM031240	Channel 50 Compr Under Sampl Div	HSK6
HM032240	Channel 51 Compr Under Sampl Div	HSK6
HM033240	Channel 52 Compr Under Sampl Div	HSK6
HM034240	Channel 53 Compr Under Sampl Div	HSK6
HM036240	Channel 55 Compr Under Sampl Div	HSK6
HM037240	Channel 60 Compr Under Sampl Div	HSK7
HM038240	Channel 61 Compr Under Sampl Div	HSK7
HM039240	Channel 62 Compr Under Sampl Div	HSK7
HM040240	Channel 63 Compr Under Sampl Div	HSK7
HM041240	Channel 64 Compr Under Sampl Div	HSK7
HM042240	Channel 65 Compr Under Sampl Div	HSK7
HM043240	Channel 70 Compr Under Sampl Div	HSK7
HM044240	Channel 71 Compr Under Sampl Div	HSK7
HM045240	Channel 72 Compr Under Sampl Div	HSK7
HM046240	Channel 73 Compr Under Sampl Div	HSK7
HM047240	Channel 74 Compr Under Sampl Div	HSK7
HM048240	Channel 75 Compr Under Sampl Div	HSK7
HM049240	Channel 80 Compr Under Sampl Div	HSK8
HM050240	Channel 81 Compr Under Sampl Div	HSK8
HM051240	Channel 82 Compr Under Sampl Div	HSK8
HM052240	Channel 83 Compr Under Sampl Div	HSK8

HM053240	Channel 84 Compr Under Sampl Div	HSK8
HM054240	Channel 85 Compr Under Sampl Div	HSK8
HM055240	Channel 90 Compr Under Sampl Div	HSK8
HM056240	Channel 91 Compr Under Sampl Div	HSK8
HM057240	Channel 92 Compr Under Sampl Div	HSK8
HM058240	Channel 93 Compr Under Sampl Div	HSK8
HM059240	Channel 94 Compr Under Sampl Div	HSK8
HM060240	Channel 95 Compr Under Sampl Div	HSK8
HM061240	Channel A0 Compr Under Sampl Div	HSK9
HM062240	Channel A1 Compr Under Sampl Div	HSK9
HM063240	Channel A2 Compr Under Sampl Div	HSK9
HM064240	Channel A3 Compr Under Sampl Div	HSK9
HM065240	Channel A4 Compr Under Sampl Div	HSK9
HM066240	Channel A5 Compr Under Sampl Div	HSK9
HM067240	Channel B0 Compr Under Sampl Div	HSK9
HM068240	Channel B1 Compr Under Sampl Div	HSK9
HM069240	Channel B2 Compr Under Sampl Div	HSK9
HM070240	Channel B3 Compr Under Sampl Div	HSK9
HM071240	Channel B4 Compr Under Sampl Div	HSK9
HM072240	Channel B5 Compr Under Sampl Div	HSK9
HM073240	Channel 00 Compr Sigma	HSK4
HM074240	Channel 01 Compr Sigma	HSK4
HM075240	Channel 02 Compr Sigma	HSK4
HM076240	Channel 03 Compr Sigma	HSK4
HM077240	Channel 04 Compr Sigma	HSK4
HM078240	Channel 05 Compr Sigma	HSK4
HM079240	Channel 10 Compr Sigma	HSK4
HM080240	Channel 11 Compr Sigma	HSK4
HM081240	Channel 12 Compr Sigma	HSK4
HM082240	Channel 13 Compr Sigma	HSK4
HM083240	Channel 14 Compr Sigma	HSK4
HM084240	Channel 15 Compr Sigma	HSK4
HM085240	Channel 20 Compr Sigma	HSK5
HM086240	Channel 21 Compr Sigma	HSK5
HM087240	Channel 22 Compr Sigma	HSK5
HM088240	Channel 23 Compr Sigma	HSK5
HM089240	Channel 24 Compr Sigma	HSK5
HM090240	Channel 25 Compr Sigma	HSK5
HM091240	Channel 30 Compr Sigma	HSK5
HM092240	Channel 31 Compr Sigma	HSK5
HM093240	Channel 32 Compr Sigma	HSK5
HM094240	Channel 33 Compr Sigma	HSK5
HM095240	Channel 34 Compr Sigma	HSK5
HM096240	Channel 35 Compr Sigma	HSK5
HM097240	Channel 40 Compr Sigma	HSK6
HM098240	Channel 41 Compr Sigma	HSK6
HM099240	Channel 42 Compr Sigma	HSK6
HM100240	Channel 43 Compr Sigma	HSK6
HM101240	Channel 44 Compr Sigma	HSK6
HM102240	Channel 45 Compr Sigma	HSK6
HM103240	Channel 50 Compr Sigma	HSK6
HM104240	Channel 51 Compr Sigma	HSK6
HM105240	Channel 52 Compr Sigma	HSK6
HM106240	Channel 53_Compr Sigma	HSK6
HM107240	Channel 54 Compr Sigma	HSK6
HM108240	Channel 55 Compr Sigma	HSK6
HM109240	Channel 60 Compr Sigma	HSK7

HM110240	Channel 61 Compr Sigma	HSK7
HM111240	Channel 62 Compr Sigma	HSK7
HM112240	Channel 63 Compr Sigma	HSK7
HM113240	Channel 64 Compr Sigma	HSK7
HM114240	Channel 65 Compr Sigma	HSK7
HM115240	Channel 70 Compr Sigma	HSK7
HM116240	Channel 71 Compr Sigma	HSK7
HM117240	Channel 72 Compr Sigma	HSK7
HM118240	Channel 73 Compr Sigma	HSK7
HM119240	Channel 74 Compr Sigma	HSK7
HM120240	Channel 75 Compr Sigma	HSK7
HM121240	Channel 80 Compr Sigma	HSK8
HM122240	Channel 81 Compr Sigma	HSK8
HM123240	Channel 82 Compr Sigma	HSK8
HM124240	Channel 83 Compr Sigma	HSK8
HM125240	Channel 84 Compr Sigma	HSK8
HM126240	Channel 85 Compr Sigma	HSK8
HM127240	Channel 90 Compr Sigma	HSK8
HM128240	Channel 91 Compr Sigma	HSK8
HM129240	Channel 92 Compr Sigma	HSK8
HM130240	Channel 93 Compr Sigma	HSK8
HM131240	Channel 94 Compr Sigma	HSK8
HM132240	Channel 95 Compr Sigma	HSK8
HM133240	Channel A0 Compr Sigma	HSK9
HM134240	Channel A1 Compr Sigma	HSK9
HM135240	Channel A2 Compr Sigma	HSK9
HM136240	Channel A3 Compr Sigma	HSK9
HM137240	Channel A4 Compr Sigma	HSK9
HM138240	Channel A5 Compr Sigma	HSK9
HM139240	Channel B0 Compr Sigma	HSK9
HM140240	Channel B1 Compr Sigma	HSK9
HM141240	Channel B2 Compr Sigma	HSK9
HM142240	Channel B3 Compr Sigma	HSK9
HM143240	Channel B4 Compr Sigma	HSK9
HM144240	Channel B5 Compr Sigma	HSK9
HM145240	Channel 00 CalSigma	HSK4
HM146240	Channel 01 CalSigma	HSK4
HM147240	Channel 02 CalSigma	HSK4
HM148240	Channel 03 CalSigma	HSK4
HM149240	Channel 04 CalSigma	HSK4
HM150240	Channel 05 CalSigma	HSK4
HM151240	Channel 10 CalSigma	HSK4
HM152240	Channel 11 CalSigma	HSK4
HM153240	Channel 12 CalSigma	HSK4
HM154240	Channel 13 CalSigma	HSK4
HM155240	Channel 14 CalSigma	HSK4
HM156240	Channel 15 CalSigma	HSK4
HM157240	Channel 20 CalSigma	HSK5
HM158240	Channel 21 CalSigma	HSK5
HM159240	Channel 22 CalSigma	HSK5
HM160240	Channel 23 CalSigma	HSK5
HM161240	Channel 24 CalSigma	HSK5
HM162240	Channel 25 CalSigma	HSK5
HM163240	Channel 30 CalSigma	HSK5
HM164240	Channel 31 CalSigma	HSK5
HM165240	Channel 32 CalSigma	HSK5
HM166240	Channel 33 CalSigma	HSK5

HM167240	Channel 34 CalSigma	HSK5
HM168240	Channel 35 CalSigma	HSK5
HM169240	Channel 40 CalSigma	HSK6
HM170240	Channel 41 CalSigma	HSK6
HM171240	Channel 42 CalSigma	HSK6
HM172240	Channel 43 CalSigma	HSK6
HM173240	Channel 44 CalSigma	HSK6
HM174240	Channel 45 CalSigma	HSK6
HM175240	Channel 50 CalSigma	HSK6
HM176240	Channel 51 CalSigma	HSK6
HM177240	Channel 52 CalSigma	HSK6
HM178240	Channel 53 CalSigma	HSK6
HM179240	Channel 54 CalSigma	HSK6
HM180240	Channel 55 CalSigma	HSK6
HM181240	Channel 60 CalSigma	HSK7
HM182240	Channel 61 CalSigma	HSK7
HM183240	Channel 62 CalSigma	HSK7
HM184240	Channel 63 CalSigma	HSK7
HM185240	Channel 64 CalSigma	HSK7
HM186240	Channel 65 CalSigma	HSK7
HM187240	Channel 70 CalSigma	HSK7
HM188240	Channel 71 CalSigma	HSK7
HM189240	Channel 72 CalSigma	HSK7
HM190240	Channel 73 CalSigma	HSK7
HM191240	Channel 74 CalSigma	HSK7
HM192240	Channel 75 CalSigma	HSK7
HM193240	Channel 80 CalSigma	HSK8
HM194240	Channel 81 CalSigma	HSK8
HM195240	Channel 82 CalSigma	HSK8
HM196240	Channel 83 CalSigma	HSK8
HM197240	Channel 84 CalSigma	HSK8
HM198240	Channel 85 CalSigma	HSK8
HM199240	Channel 90 CalSigma	HSK8
HM200240	Channel 91 CalSigma	HSK8
HM201240	Channel 92 CalSigma	HSK8
HM202240	Channel 93 CalSigma	HSK8
HM203240	Channel 94 CalSigma	HSK8
HM204240	Channel 95 CalSigma	HSK8
HM205240	Channel A0 CalSigma	HSK9
HM206240	Channel A1 CalSigma	HSK9
HM207240	Channel A2 CalSigma	HSK9
HM208240	Channel A3 CalSigma	HSK9
HM209240	Channel A4 CalSigma	HSK9
HM210240	Channel A5 CalSigma	HSK9
HM211240	Channel B0 CalSigma	HSK9
HM212240	Channel B1 CalSigma	HSK9
HM213240	Channel B2 CalSigma	HSK9
HM214240	Channel B3 CalSigma	HSK9
HM215240	Channel B4 CalSigma	HSK9
HM216240	Channel B5 CalSigma	HSK9
HM217240	Channel 00 CS Average	HSK1, HSK3
HM218240	Channel 01 CS Average	HSK1, HSK3
HM219240	Channel 02 CS Average	HSK1, HSK3
HM220240	Channel 03 CS Average	HSK1, HSK3
HM221240	Channel 04 CS Average	HSK1, HSK3
HM222240	Channel 05 CS Average	HSK1, HSK3
HM223240	Channel 10 CS Average	HSK1, HSK3
HM224240	Channel 11 CS Average	HSK1, HSK3

HM225240	Channel 12 CS Average	HSK1, HSK3
HM226240	Channel 13 CS Average	HSK1, HSK3
HM227240	Channel 14 CS Average	HSK1, HSK3
HM228240	Channel 15 CS Average	HSK1, HSK3
HM229240	Channel 20 CS Average	HSK1, HSK3
HM230240	Channel 21 CS Average	HSK1, HSK3
HM231240	Channel 22 CS Average	HSK1, HSK3
HM232240	Channel 23 CS Average	HSK1, HSK3
HM233240	Channel 24 CS Average	HSK1, HSK3
HM234240	Channel 25 CS Average	HSK1, HSK3
HM235240	Channel 30 CS Average	HSK1, HSK3
HM236240	Channel 31 CS Average	HSK1, HSK3
HM237240	Channel 32 CS Average	HSK1, HSK3
HM238240	Channel 33 CS Average	HSK1, HSK3
HM239240	Channel 34 CS Average	HSK1, HSK3
HM240240	Channel 35 CS Average	HSK1, HSK3
HM241240	Channel 40 CS Average	HSK1, HSK3
HM242240	Channel 41 CS Average	HSK1, HSK3
HM243240	Channel 42 CS Average	HSK1, HSK3
HM244240	Channel 43 CS Average	HSK1, HSK3
HM245240	Channel 44 CS Average	HSK1, HSK3
HM246240	Channel 45 CS Average	HSK1, HSK3
HM247240	Channel 50 CS Average	HSK1, HSK3
HM248240	Channel 51 CS Average	HSK1, HSK3
HM249240	Channel 52 CS Average	HSK1, HSK3
HM250240	Channel 53 CS Average	HSK1, HSK3
HM251240	Channel 54 CS Average	HSK1, HSK3
HM252240	Channel 55 CS Average	HSK1, HSK3
HM253240	Channel 60 CS Average	HSK1, HSK3
HM254240	Channel 61 CS Average	HSK1, HSK3
HM255240	Channel 62 CS Average	HSK1, HSK3
HM256240	Channel 63 CS Average	HSK1, HSK3
HM257240	Channel 64 CS Average	HSK1, HSK3
HM258240	Channel 65 CS Average	HSK1, HSK3
HM259240	Channel 70 CS Average	HSK1, HSK3
HM260240	Channel 71 CS Average	HSK1, HSK3
HM261240	Channel 72 CS Average	HSK1, HSK3
HM262240	Channel 73 CS Average	HSK1, HSK3
HM263240	Channel 74 CS Average	HSK1, HSK3
HM264240	Channel 75 CS Average	HSK1, HSK3
HM265240	Channel 80 CS Average	HSK1, HSK3
HM266240	Channel 81 CS Average	HSK1, HSK3
HM267240	Channel 82 CS Average	HSK1, HSK3
HM268240	Channel 83 CS Average	HSK1, HSK3
HM269240	Channel 84 CS Average	HSK1, HSK3
HM270240	Channel 85 CS Average	HSK1, HSK3
HM271240	Channel 90 CS Average	HSK1, HSK3
HM272240	Channel 91 CS Average	HSK1, HSK3
HM273240	Channel 92 CS Average	HSK1, HSK3
HM274240	Channel 93 CS Average	HSK1, HSK3
HM275240	Channel 94 CS Average	HSK1, HSK3
HM276240	Channel 95 CS Average	HSK1, HSK3
HM277240	Channel A0 CS Average	HSK1, HSK3
HM278240	Channel A1 CS Average	HSK1, HSK3
HM279240	Channel A2 CS Average	HSK1, HSK3
HM280240	Channel A3 CS Average	HSK1, HSK3
HM281240	Channel A4 CS Average	HSK1, HSK3
HM282240	Channel A5 CS Average	HSK1, HSK3

HM283240	Channel B0 CS Average	HSK1, HSK3
HM284240	Channel B1 CS Average	HSK1, HSK3
HM285240	Channel B2 CS Average	HSK1, HSK3
HM286240	Channel B3 CS Average	HSK1, HSK3
HM287240	Channel B4 CS Average	HSK1, HSK3
HM288240	Channel B5 CS Average	HSK1, HSK3
HM289240	Channel 00 AvMaxMin	HSK4
HM290240	Channel 01 AvMaxMin	HSK4
HM291240	Channel 02 AvMaxMin	HSK4
HM292240	Channel 03 AvMaxMin	HSK4
HM293240	Channel 04 AvMaxMin	HSK4
HM294240	Channel 05 AvMaxMin	HSK4
HM295240	Channel 10 AvMaxMin	HSK4
HM296240	Channel 11 AvMaxMin	HSK4
HM297240	Channel 12 AvMaxMin	HSK4
HM298240	Channel 13 AvMaxMin	HSK4
HM299240	Channel 14 AvMaxMin	HSK4
HM300240	Channel 15 AvMaxMin	HSK4
HM301240	Channel 20 AvMaxMin	HSK5
HM302240	Channel 21 AvMaxMin	HSK5
HM303240	Channel 22 AvMaxMin	HSK5
HM304240	Channel 23 AvMaxMin	HSK5
HM305240	Channel 24 AvMaxMin	HSK5
HM306240	Channel 25 AvMaxMin	HSK5
HM307240	Channel 30 AvMaxMin	HSK5
HM308240	Channel 31 AvMaxMin	HSK5
HM309240	Channel 32 AvMaxMin	HSK5
HM310240	Channel 33 AvMaxMin	HSK5
HM311240	Channel 34 AvMaxMin	HSK5
HM312240	Channel 35 AvMaxMin	HSK5
HM313240	Channel 40 AvMaxMin	HSK6
HM314240	Channel 41 AvMaxMin	HSK6
HM315240	Channel 42 AvMaxMin	HSK6
HM316240	Channel 43 AvMaxMin	HSK6
HM317240	Channel 44 AvMaxMin	HSK6
HM318240	Channel 45 AvMaxMin	HSK6
HM319240	Channel 50 AvMaxMin	HSK6
HM320240	Channel 51 AvMaxMin	HSK6
HM321240	Channel 52 AvMaxMin	HSK6
HM322240	Channel 53 AvMaxMin	HSK6
HM323240	Channel 54 AvMaxMin	HSK6
HM324240	Channel 55 AvMaxMin	HSK6
HM325240	Channel 60 AvMaxMin	HSK7
HM326240	Channel 61 AvMaxMin	HSK7
HM327240	Channel 62 AvMaxMin	HSK7
HM328240	Channel 63 AvMaxMin	HSK7
HM329240	Channel 64 AvMaxMin	HSK7
HM330240	Channel 65 AvMaxMin	HSK7
HM331240	Channel 70 AvMaxMin	HSK7
HM332240	Channel 71 AvMaxMin	HSK7
HM333240	Channel 72 AvMaxMin	HSK7
HM334240	Channel 73 AvMaxMin	HSK7
HM335240	Channel 74 AvMaxMin	HSK7
HM336240	Channel 75 AvMaxMin	HSK7
HM337240	Channel 80 AvMaxMin	HSK8
HM338240	Channel 81 AvMaxMin	HSK8
HM339240	Channel 82 AvMaxMin	HSK8
HM340240	Channel 83 AvMaxMin	HSK8

HM341240	Channel 84 AvMaxMin	HSK8
HM342240	Channel 85 AvMaxMin	HSK8
HM343240	Channel 90 AvMaxMin	HSK8
HM344240	Channel 91 AvMaxMin	HSK8
HM345240	Channel 92 AvMaxMin	HSK8
HM346240	Channel 93 AvMaxMin	HSK8
HM347240	Channel 94 AvMaxMin	HSK8
HM348240	Channel 95 AvMaxMin	HSK8
HM349240	Channel A0 AvMaxMin	HSK9
HM350240	Channel A1 AvMaxMin	HSK9
HM351240	Channel A2 AvMaxMin	HSK9
HM352240	Channel A3 AvMaxMin	HSK9
HM353240	Channel A4 AvMaxMin	HSK9
HM354240	Channel A5 AvMaxMin	HSK9
HM355240	Channel B0 AvMaxMin	HSK9
HM356240	Channel B1 AvMaxMin	HSK9
HM357240	Channel B2 AvMaxMin	HSK9
HM358240	Channel B3 AvMaxMin	HSK9
HM359240	Channel B4 AvMaxMin	HSK9
HM360240	Channel B5 AvMaxMin	HSK9
HM361240	DPU ASW Version	Diag1, Diag2
HM362240	DPU FDIR mode	HSK1, HSK3, Diag1, Diag2
HM363240	DPU Mode	HSK1, HSK3, Diag1, Diag2
HM364240	DPU BSW Version	Diag1, Diag2
HM367240	DPU Compression Slice Size	HSK2
HM368240	HM368240_OSw_ResyncNb	Diag2
HM373240	Raw Sig Filter 45L 1 to 16	HSK2
HM374240	Raw Sig Filter 45 17 to 32	HSK2
HM375240	Raw Sig Filter 45M 33 to 45	HSK2
HM376240	Raw Sig Filter 40L 1 to 16	HSK2
HM377240	Raw Sig Filter 40 17 to 32	HSK2
HM378240	Raw Sig Filter 40M 33 to 40	HSK2
HM379240	Raw Sig Filter 36L 1 to 16	HSK2
HM380240	Raw Sig Filter 36 17 to 32	HSK2
HM381240	Raw Sig Filter 36M 33 to 36	HSK2
HM383240	OSw0_RsynREUMo	HSK1, HSK3, Diag2
HM384240	OSw0_Rsyn4KMo	HSK1, HSK3, Diag2
HM385240	OSw0_RsyncTCLen	HSK1, HSK3, Diag2
HM386240	OSw0_RsyncTCId	HSK1, HSK3, Diag2
HM387240	OSw0_RsyncTCSid	HSK1, HSK3, Diag2
HM388240	OSw0_RsyncTCP1	HSK1, HSK3, Diag2
HM389240	OSw0_RsyncTCP2	HSK1, HSK3, Diag2
HM390240	OSw1_RsynDPUMo	HSK1, HSK3, Diag2
HM391240	OSw1_RsynREUMo	HSK1, HSK3, Diag2
HM392240	OSw1_Rsyn4KMo	HSK1, HSK3, Diag2
HM393240	OSw1_RsyncTCLen	HSK1, HSK3, Diag2
HM394240	OSw1_RsyncTCId	HSK1, HSK3, Diag2
HM395240	OSw1_RsyncTCSid	HSK1, HSK3, Diag2
HM396240	OSw1_RsyncTCP1	HSK1, HSK3, Diag2
HM397240	OSw1_RsyncTCP2	HSK1, HSK3, Diag2
HM398240	OSw2_RsynDPUMo	HSK1, HSK3, Diag2
HM399240	OSw2_RsynREUMo	HSK1, HSK3, Diag2
HM400240	OSw2_Rsyn4KMo	HSK1, HSK3, Diag2
HM401240	OSw2_RsyncTCLen	HSK1, HSK3, Diag2
HM402240	OSw2_RsyncTCId	HSK1, HSK3, Diag2
HM403240	OSw2_RsyncTCSid	HSK1, HSK3, Diag2

HM404240	OSw2_RsyncTCP1	HSK1, HSK3, Diag2
HM405240	OSw2_RsyncTCP2	HSK1, HSK3, Diag2
HM406240	OSw3_RsynDPUMo	HSK1, HSK3, Diag2
HM407240	OSw3_RsynREUMo	HSK1, HSK3, Diag2
HM408240	OSw3_Rsyn4KMo	HSK1, HSK3, Diag2
HM409240	OSw3_RsyncTCLen	HSK1, HSK3, Diag2
HM410240	OSw3_RsyncTCId	HSK1, HSK3, Diag2
HM411240	OSw3_RsyncTCSid	HSK1, HSK3, Diag2
HM412240	OSw3_RsyncTCP1	HSK1, HSK3, Diag2
HM413240	OSw3_RsyncTCP2	HSK1, HSK3, Diag2
HM414240	OSw4_RsynDPUMo	HSK1, HSK3, Diag2
HM415240	OSw4_RsynREUMo	HSK1, HSK3, Diag2
HM416240	OSw4_Rsyn4KMo	HSK1, HSK3, Diag2
HM417240	OSw4_RsyncTCLen	HSK1, HSK3, Diag2
HM418240	OSw4_RsyncTCId	HSK1, HSK3, Diag2
HM419240	OSw4_RsyncTCSid	HSK1, HSK3, Diag2
HM420240	OSw4_RsyncTCP1	HSK1, HSK3, Diag2
HM421240	OSw4_RsyncTCP2	HSK1, HSK3, Diag2
HM422240	OSw5_RsynDPUMo	HSK1, HSK3, Diag2
HM423240	OSw5_RsynREUMo	HSK1, HSK3, Diag2
HM424240	OSw5_Rsyn4KMo	HSK1, HSK3, Diag2
HM425240	OSw5_RsyncTCLen	HSK1, HSK3, Diag2
HM426240	OSw5_RsyncTCId	HSK1, HSK3, Diag2
HM427240	OSw5_RsyncTCSid	HSK1, HSK3, Diag2
HM428240	OSw5_RsyncTCP1	HSK1, HSK3, Diag2
HM429240	OSw5_RsyncTCP2	HSK1, HSK3, Diag2
HM430240	OSw6_RsynDPUMo	HSK1, HSK3, Diag2
HM431240	OSw6_RsynREUMo	HSK1, HSK3, Diag2
HM432240	OSw6_Rsyn4KMo	HSK1, HSK3, Diag2
HM433240	OSw6_RsyncTCLen	HSK1, HSK3, Diag2
HM434240	OSw6_RsyncTCId	HSK1, HSK3, Diag2
HM435240	OSw6_RsyncTCSid	HSK1, HSK3, Diag2
HM436240	OSw6_RsyncTCP1	HSK1, HSK3, Diag2
HM437240	OSw6_RsyncTCP2	HSK1, HSK3, Diag2
HM438240	OSw7_RsynDPUMo	HSK1, HSK3, Diag2
HM439240	OSw7_RsynREUMo	HSK1, HSK3, Diag2
HM440240	OSw7_Rsyn4KMo	HSK1, HSK3, Diag2
HM441240	OSw7_RsyncTCLen	HSK1, HSK3, Diag2
HM442240	OSw7_RsyncTCId	HSK1, HSK3, Diag2
HM443240	OSw7_RsyncTCSid	HSK1, HSK3, Diag2
HM444240	OSw7_RsyncTCP1	HSK1, HSK3, Diag2
HM445240	OSw7_RsyncTCP2	HSK1, HSK3, Diag2
HM446240	OSw8_RsynDPUMo	HSK1, HSK3, Diag2
HM447240	OSw8_RsynREUMo	HSK1, HSK3, Diag2
HM448240	OSw8_Rsyn4KMo	HSK1, HSK3, Diag2
HM449240	OSw8_RsyncTCLen	HSK1, HSK3, Diag2
HM450240	OSw8_RsyncTCId	HSK1, HSK3, Diag2
HM451240	OSw8_RsyncTCSid	HSK1, HSK3, Diag2
HM452240	OSw8_RsyncTCP1	HSK1, HSK3, Diag2
HM453240	OSw8_RsyncTCP2	HSK1, HSK3, Diag2
HM454240	OSw9_RsynDPUMo	HSK1, HSK3, Diag2
HM455240	OSw9_RsynREUMo	HSK1, HSK3, Diag2
HM456240	OSw9_Rsyn4KMo	HSK1, HSK3, Diag2
HM457240	OSw9_RsyncTCLen	HSK1, HSK3, Diag2
HM458240	OSw9_RsyncTCId	HSK1, HSK3, Diag2
HM459240	OSw9_RsyncTCSid	HSK1, HSK3, Diag2
HM460240	OSw9_RsyncTCP1	HSK1, HSK3, Diag2
HM461240	OSw9_RsyncTCP2	HSK1, HSK3, Diag2

HM462240	OSw10_RsynDPUMo	HSK1, HSK3, Diag2
HM463240	OSw10_RsynREUMo	HSK1, HSK3, Diag2
HM464240	OSw10_Rsyn4KMo	HSK1, HSK3, Diag2
HM465240	OSw10_RsyncTCLn	HSK1, HSK3, Diag2
HM466240	OSw10_RsyncTCId	HSK1, HSK3, Diag2
HM467240	OSw10_RsynTCSid	HSK1, HSK3, Diag2
HM468240	OSw10_RsyncTCP1	HSK1, HSK3, Diag2
HM469240	OSw10_RsyncTCP2	HSK1, HSK3, Diag2
HM470240	OSw11_RsynDPUMo	HSK1, HSK3, Diag2
HM471240	OSw11_RsynREUMo	HSK1, HSK3, Diag2
HM472240	OSw11_Rsyn4KMo	HSK1, HSK3, Diag2
HM473240	OSw11_RsyncTCLn	HSK1, HSK3, Diag2
HM474240	OSw11_RsyncTCId	HSK1, HSK3, Diag2
HM475240	OSw11_RsynTCSid	HSK1, HSK3, Diag2
HM476240	OSw11_RsyncTCP1	HSK1, HSK3, Diag2
HM477240	OSw11_RsyncTCP2	HSK1, HSK3, Diag2
HM478240	OSw12_RsynDPUMo	HSK1, HSK3, Diag2
HM479240	OSw12_RsynREUMo	HSK1, HSK3, Diag2
HM480240	OSw12_Rsyn4KMo	HSK1, HSK3, Diag2
HM481240	OSw12_RsyncTCLn	HSK1, HSK3, Diag2
HM482240	OSw12_RsyncTCId	HSK1, HSK3, Diag2
HM483240	OSw12_RsynTCSid	HSK1, HSK3, Diag2
HM484240	OSw12_RsyncTCP1	HSK1, HSK3, Diag2
HM485240	OSw12_RsyncTCP2	HSK1, HSK3, Diag2
HM486240	OSw13_RsynDPUMo	HSK1, HSK3, Diag2
HM487240	OSw13_RsynREUMo	HSK1, HSK3, Diag2
HM488240	OSw13_Rsyn4KMo	HSK1, HSK3, Diag2
HM489240	OSw13_RsyncTCLn	HSK1, HSK3, Diag2
HM490240	OSw13_RsynTCId	HSK1, HSK3, Diag2
HM491240	OSw13_RsynTCSid	HSK1, HSK3, Diag2
HM492240	OSw13_RsyncTCP1	HSK1, HSK3, Diag2
HM493240	OSw13_RsyncTCP2	HSK1, HSK3, Diag2
HM494240	OSw14_RsynDPUMo	HSK1, HSK3, Diag2
HM495240	OSw14_RsynREUMo	HSK1, HSK3, Diag2
HM496240	OSw14_Rsyn4KMo	HSK1, HSK3, Diag2
HM497240	OSw14_RsyncTCLn	HSK1, HSK3, Diag2
HM498240	OSw14_RsyncTCId	HSK1, HSK3, Diag2
HM499240	OSw14_RsynTCSid	HSK1, HSK3, Diag2
HM500240	OSw14_RsyncTCP1	HSK1, HSK3, Diag2
HM501240	OSw14_RsyncTCP2	HSK1, HSK3, Diag2
HM502240	OSw15_RsynDPUMo	HSK1, HSK3, Diag2
HM503240	OSw15_RsynREUMo	HSK1, HSK3, Diag2
HM504240	OSw15_Rsyn4KMo	HSK1, HSK3, Diag2
HM505240	OSw15_RsyncTCLn	HSK1, HSK3, Diag2
HM506240	OSw15_RsyncTCId	HSK1, HSK3, Diag2
HM507240	OSw15_RsynTCSid	HSK1, HSK3, Diag2
HM508240	OSw15_RsyncTCP1	HSK1, HSK3, Diag2
HM509240	OSw15_RsyncTCP2	HSK1, HSK3, Diag2
HM510240	OSw16_RsynDPUMo	HSK1, HSK3, Diag2
HM511240	OSw16_RsynREUMo	HSK1, HSK3, Diag2
HM512240	OSw16_Rsyn4KMo	HSK1, HSK3, Diag2
HM513240	OSw16_RsyncTCLen	HSK1, HSK3, Diag2
HM514240	OSw16_RsyncTCId	HSK1, HSK3, Diag2
HM515240	OSw16_RsyncTCSid	HSK1, HSK3, Diag2
HM516240	OSw16_RsyncTCP1	HSK1, HSK3, Diag2
HM517240	OSw16_RsyncTCP2	HSK1, HSK3, Diag2
HM518240	OSw17_RsynDPUMo	HSK1, HSK3, Diag2
HM519240	OSw17_RsynREUMo	HSK1, HSK3, Diag2

HM520240	OSw17_Rsyn4KMo	HSK1, HSK3, Diag2
HM521240	OSw17_RsyncTCLen	HSK1, HSK3, Diag2
HM522240	OSw17_RsyncTCId	HSK1, HSK3, Diag2
HM523240	OSw17_RsyncTCSid	HSK1, HSK3, Diag2
HM524240	OSw17_RsyncTCP1	HSK1, HSK3, Diag2
HM525240	OSw17_RsyncTCP2	HSK1, HSK3, Diag2
HM526240	OSw18_RsynDPUMo	HSK1, HSK3, Diag2
HM527240	OSw18_RsynREUMo	HSK1, HSK3, Diag2
HM528240	OSw18_Rsyn4KMo	HSK1, HSK3, Diag2
HM529240	OSw18_RsyncTCLen	HSK1, HSK3, Diag2
HM530240	OSw18_RsyncTCId	HSK1, HSK3, Diag2
HM531240	OSw18_RsyncTCSid	HSK1, HSK3, Diag2
HM532240	OSw18_RsyncTCP1	HSK1, HSK3, Diag2
HM533240	OSw18_RsyncTCP2	HSK1, HSK3, Diag2
HM534240	OSw19_RsynDPUMo	HSK1, HSK3, Diag2
HM535240	OSw19_RsynREUMo	HSK1, HSK3, Diag2
HM536240	OSw19_Rsyn4KMo	HSK1, HSK3, Diag2
HM537240	OSw19_RsyncTCLen	HSK1, HSK3, Diag2
HM538240	OSw19_RsyncTCId	HSK1, HSK3, Diag2
HM539240	OSw19_RsyncTCSid	HSK1, HSK3, Diag2
HM540240	OSw19_RsyncTCP1	HSK1, HSK3, Diag2
HM541240	OSw19_RsyncTCP2	HSK1, HSK3, Diag2
HM542240	OSw20_RsynDPUMo	HSK1, HSK3, Diag2
HM543240	OSw20_RsynREUMo	HSK1, HSK3, Diag2
HM544240	OSw20_Rsyn20KMo	HSK1, HSK3, Diag2
HM545240	OSw20_RsyncTCLen	HSK1, HSK3, Diag2
HM546240	OSw20_RsyncTCId	HSK1, HSK3, Diag2
HM547240	OSw20_RsyncTCSid	HSK1, HSK3, Diag2
HM548240	OSw20_RsyncTCP1	HSK1, HSK3, Diag2
HM549240	OSw20_RsyncTCP2	HSK1, HSK3, Diag2
HM550240	OSw21_RsynDPUMo	HSK1, HSK3, Diag2
HM551240	OSw21_RsynREUMo	HSK1, HSK3, Diag2
HM552240	OSw21_Rsyn4KMo	HSK1, HSK3, Diag2
HM553240	OSw21_RsyncTCLen	HSK1, HSK3, Diag2
HM554240	OSw21_RsyncTCId	HSK1, HSK3, Diag2
HM555240	OSw21_RsyncTCSid	HSK1, HSK3, Diag2
HM556240	OSw21_RsyncTCP1	HSK1, HSK3, Diag2
HM557240	OSw21_RsyncTCP2	HSK1, HSK3, Diag2
HM558240	OSw22_RsynDPUMo	HSK1, HSK3, Diag2
HM559240	OSw22_RsynREUMo	HSK1, HSK3, Diag2
HM560240	OSw22_Rsyn4KMo	HSK1, HSK3, Diag2
HM561240	OSw22_RsyncTCLen	HSK1, HSK3, Diag2
HM562240	OSw22_RsyncTCId	HSK1, HSK3, Diag2
HM563240	OSw22_RsyncTCSid	HSK1, HSK3, Diag2
HM564240	OSw22_RsyncTCP1	HSK1, HSK3, Diag2
HM565240	OSw22_RsyncTCP2	HSK1, HSK3, Diag2
HM566240	OSw23_RsynDPUMo	HSK1, HSK3, Diag2
HM567240	OSw23_RsynREUMo	HSK1, HSK3, Diag2
HM568240	OSw23_Rsyn4KMo	HSK1, HSK3, Diag2
HM569240	OSw23_RsyncTCLen	HSK1, HSK3, Diag2
HM570240	OSw23_RsyncTCId	HSK1, HSK3, Diag2
HM571240	OSw23_RsyncTCSid	HSK1, HSK3, Diag2
HM572240	OSw23_RsyncTCP1	HSK1, HSK3, Diag2
HM573240	OSw23_RsyncTCP2	HSK1, HSK3, Diag2
HM574240	OSw24_RsynDPUMo	HSK1, HSK3, Diag2
HM575240	OSw24_RsynREUMo	HSK1, HSK3, Diag2
HM576240	OSw24_Rsyn4KMo	HSK1, HSK3, Diag2
HM577240	OSw24_RsyncTCLen	HSK1, HSK3, Diag2

HM578240	OSw24_RsyncTCId	HSK1, HSK3, Diag2
HM579240	OSw24_RsyncTCSid	HSK1, HSK3, Diag2
HM580240	OSw24_RsyncTCP1	HSK1, HSK3, Diag2
HM581240	OSw24_RsyncTCP2	HSK1, HSK3, Diag2
HM582240	OSw25_RsynDPUMo	HSK1, HSK3, Diag2
HM583240	OSw25_RsynREUMo	HSK1, HSK3, Diag2
HM584240	OSw25_Rsyn4KMo	HSK1, HSK3, Diag2
HM585240	OSw25_RsyncTCLen	HSK1, HSK3, Diag2
HM586240	OSw25_RsyncTCId	HSK1, HSK3, Diag2
HM587240	OSw25_RsyncTCSid	HSK1, HSK3, Diag2
HM588240	OSw25_RsyncTCP1	HSK1, HSK3, Diag2
HM589240	OSw25_RsyncTCP2	HSK1, HSK3, Diag2
HM590240	OSw26_RsynDPUMo	HSK1, HSK3, Diag2
HM591240	OSw26_RsynREUMo	HSK1, HSK3, Diag2
HM592240	OSw26_Rsyn4KMo	HSK1, HSK3, Diag2
HM593240	OSw26_RsyncTCLn	HSK1, HSK3, Diag2
HM594240	OSw26_RsyncTCId	HSK1, HSK3, Diag2
HM595240	OSw26_RsynTCSid	HSK1, HSK3, Diag2
HM596240	OSw26_RsyncTCP1	HSK1, HSK3, Diag2
HM597240	OSw26_RsyncTCP2	HSK1, HSK3, Diag2
HM598240	OSw27_RsynDPUMo	HSK1, HSK3, Diag2
HM599240	OSw27_RsynREUMo	HSK1, HSK3, Diag2
HM600240	OSw27_Rsyn4KMo	HSK1, HSK3, Diag2
HM601240	OSw27_RsyncTCLn	HSK1, HSK3, Diag2
HM602240	OSw27_RsyncTCId	HSK1, HSK3, Diag2
HM603240	OSw27_RsynTCSid	HSK1, HSK3, Diag2
HM604240	OSw27_RsyncTCP1	HSK1, HSK3, Diag2
HM605240	OSw27_RsyncTCP2	HSK1, HSK3, Diag2
HM606240	OSw28_RsynDPUMo	HSK1, HSK3, Diag2
HM607240	OSw28_RsynREUMo	HSK1, HSK3, Diag2
HM608240	OSw28_Rsyn4KMo	HSK1, HSK3, Diag2
HM609240	OSw28_RsyncTCLn	HSK1, HSK3, Diag2
HM610240	OSw28_RsyncTCId	HSK1, HSK3, Diag2
HM611240	OSw28_RsynTCSid	HSK1, HSK3, Diag2
HM612240	OSw28_RsyncTCP1	HSK1, HSK3, Diag2
HM613240	OSw28_RsyncTCP2	HSK1, HSK3, Diag2
HM614240	OSw29_RsynDPUMo	HSK1, HSK3, Diag2
HM615240	OSw29_RsynREUMo	HSK1, HSK3, Diag2
HM616240	OSw29_Rsyn4KMo	HSK1, HSK3, Diag2
HM617240	OSw29_RsyncTCLn	HSK1, HSK3, Diag2
HM618240	OSw29_RsynTCId	HSK1, HSK3, Diag2
HM619240	OSw29_RsynTCSid	HSK1, HSK3, Diag2
HM620240	OSw29_RsyncTCP1	HSK1, HSK3, Diag2
HM621240	OSw29_RsyncTCP2	HSK1, HSK3, Diag2
HM622240	OSw30_RsynDPUMo	HSK1, HSK3, Diag2
HM623240	OSw30_RsynREUMo	HSK1, HSK3, Diag2
HM624240	OSw30_Rsyn4KMo	HSK1, HSK3, Diag2
HM625240	OSw30_RsyncTCLn	HSK1, HSK3, Diag2
HM626240	OSw30_RsyncTCId	HSK1, HSK3, Diag2
HM627240	OSw30_RsynTCSid	HSK1, HSK3, Diag2
HM628240	OSw30_RsyncTCP1	HSK1, HSK3, Diag2
HM629240	OSw30_RsyncTCP2	HSK1, HSK3, Diag2
HM630240	OSw31_RsynDPUMo	HSK1, HSK3, Diag2
HM631240	OSw31_RsynREUMo	HSK1, HSK3, Diag2
HM632240	OSw31_Rsyn4KMo	HSK1, HSK3, Diag2
HM633240	OSw31_RsyncTCLn	HSK1, HSK3, Diag2
HM634240	OSw31_RsyncTCId	HSK1, HSK3, Diag2
HM635240	OSw31_RsynTCSid	HSK1, HSK3, Diag2

HM636240	OSw31_RsyncTCP1	HSK1, HSK3, Diag2
HM637240	OSw31_RsyncTCP2	HSK1, HSK3, Diag2
HM640240	Counter Diag2	Diag2
HM641240	Counter Hsk1	HSK1
HM642240	Counter Hsk2	HSK2
HM643240	Counter Hsk3	HSK3
HM644240	Counter Hsk4	HSK4
HM645240	Counter Hsk5	HSK5
HM646240	Counter Hsk6	HSK6
HM647240	Counter Hsk7	HSK7
HM648240	Counter Hsk8	HSK8
HM649240	Counter Hsk9	HSK9
HM660240	Channel 00 Compr Sigma/Q	HSK4
HM661240	Channel 01 Compr Sigma/Q	HSK4
HM662240	Channel 02 Compr Sigma/Q	HSK4
HM663240	Channel 03 Compr Sigma/Q	HSK4
HM664240	Channel 04 Compr Sigma/Q	HSK4
HM665240	Channel 05 Compr Sigma/Q	HSK4
HM666240	Channel 10 Compr Sigma/Q	HSK4
HM667240	Channel 11 Compr Sigma/Q	HSK4
HM668240	Channel 12 Compr Sigma/Q	HSK4
HM669240	Channel 13 Compr Sigma/Q	HSK4
HM670240	Channel 14 Compr Sigma/Q	HSK4
HM671240	Channel 15 Compr Sigma/Q	HSK4
HM672240	Channel 20 Compr Sigma/Q	HSK5
HM673240	Channel 21 Compr Sigma/Q	HSK5
HM674240	Channel 22 Compr Sigma/Q	HSK5
HM675240	Channel 23 Compr Sigma/Q	HSK5
HM676240	Channel 24 Compr Sigma/Q	HSK5
HM677240	Channel 25 Compr Sigma/Q	HSK5
HM678240	Channel 30 Compr Sigma/Q	HSK5
HM679240	Channel 31 Compr Sigma/Q	HSK5
HM680240	Channel 32 Compr Sigma/Q	HSK5
HM681240	Channel 33 Compr Sigma/Q	HSK5
HM682240	Channel 34 Compr Sigma/Q	HSK5
HM683240	Channel 35 Compr Sigma/Q	HSK5
HM684240	Channel 40 Compr Sigma/Q	HSK6
HM685240	Channel 41 Compr Sigma/Q	HSK6
HM686240	Channel 42 Compr Sigma/Q	HSK6
HM687240	Channel 43 Compr Sigma/Q	HSK6
HM688240	Channel 44 Compr Sigma/Q	HSK6
HM689240	Channel 45 Compr Sigma/Q	HSK6
HM690240	Channel 50 Compr Sigma/Q	HSK6
HM691240	Channel 51 Compr Sigma/Q	HSK6
HM692240	Channel 52 Compr Sigma/Q	HSK6
HM693240	Channel 53 Compr Sigma/Q	HSK6
HM694240	Channel 54 Compr Sigma/Q	HSK6
HM694240	Channel 54 Compr Sigma/Q	HSK6
HM695240	Channel 55 Compr Sigma/Q	HSK6
HM696240	Channel 60 Compr Sigma/Q	HSK7
HM697240	Channel 61 Compr Sigma/Q	HSK7
HM698240	Channel 62 Compr Sigma/Q	HSK7
HM699240	Channel 63 Compr Sigma/Q	HSK7
HM700240	Channel 64 Compr Sigma/Q	HSK7
HM701240	Channel 65 Compr Sigma/Q	HSK7
HM702240	Channel 70 Compr Sigma/Q	HSK7
HM703240	Channel 71 Compr Sigma/Q	HSK7

HM704240	Channel 72 Compr Sigma/Q	HSK7
HM705240	Channel 73 Compr Sigma/Q	HSK7
HM706240	Channel 74 Compr Sigma/Q	HSK7
HM707240	Channel 75 Compr Sigma/Q	HSK7
HM708240	Channel 80 Compr Sigma/Q	HSK8
HM709240	Channel 81 Compr Sigma/Q	HSK8
HM710240	Channel 82 Compr Sigma/Q	HSK8
HM711240	Channel 83 Compr Sigma/Q	HSK8
HM712240	Channel 84 Compr Sigma/Q	HSK8
HM713240	Channel 85 Compr Sigma/Q	HSK8
HM714240	Channel 90 Compr Sigma/Q	HSK8
HM715240	Channel 91 Compr Sigma/Q	HSK8
HM716240	Channel 92 Compr Sigma/Q	HSK8
HM717240	Channel 93 Compr Sigma/Q	HSK8
HM718240	Channel 94 Compr Sigma/Q	HSK8
HM719240	Channel 95 Compr Sigma/Q	HSK8
HM720240	Channel A0 Compr Sigma/Q	HSK9
HM721240	Channel A1 Compr Sigma/Q	HSK9
HM722240	Channel A2 Compr Sigma/Q	HSK9
HM723240	Channel A3 Compr Sigma/Q	HSK9
HM724240	Channel A4 Compr Sigma/Q	HSK9
HM725240	Channel A5 Compr Sigma/Q	HSK9
HM726240	Channel B0 Compr Sigma/Q	HSK9
HM727240	Channel B1 Compr Sigma/Q	HSK9
HM728240	Channel B2 Compr Sigma/Q	HSK9
HM729240	Channel B3 Compr Sigma/Q	HSK9
HM730240	Channel B4 Compr Sigma/Q	HSK9
HM731240	Channel B5 Compr Sigma/Q	HSK9
HM732240	HW: HSL State Machine 0 Error	HSK1, HSK3, Diag2
HM733240	HW: HSL State Machine 1 Error	HSK1, HSK3, Diag2
HM734240	HW: LSL State Machine 0 Error	HSK1, HSK3, Diag2
HM735240	HW: LSL State Machine 1 Error	HSK1, HSK3, Diag2
HM736240	HW: OBC Lost (No clock coming from S/C)	HSK1, HSK3, Diag2
HM740240	HW: ADC Latchup	HSK1, HSK3, Diag2
HM741240	HW: Program RAM Parity Error	HSK1, HSK3, Diag2
HM742240	HW: Data RAM Parity Error	HSK1, HSK3, Diag2
HM747240	HW: TFLError (Not slot available to send TM packet)	HSK1, HSK3, Diag2
HM748240	HSL: Parity Error	HSK1, HSK3, Diag2
HM749240	HSL: Bad Start Header	HSK1, HSK3, Diag2
HM750240	HSL: BufferSize (Length read bigger than max buffer size)	HSK1, HSK3, Diag2
HM751240	HSL: Bad Data Packet Length	HSK1, HSK3, Diag2
HM752240	HSL: Bad Data Packet Trailer	HSK1, HSK3, Diag2
HM753240	HSL: TimeOut (No HSL packet received before expected time)	HSK1, HSK3, Diag2
HM754240	HSL: Bad CRC	HSK1, HSK3, Diag2
HM755240	HSL: Bad Data Packet (Type of Data Packet unknown)	HSK1, HSK3, Diag2
HM756240	HSL: Bad DDL (No answer for DataDownLoad request)	HSK1, HSK3, Diag2
HM757240	HSL: Invalid Start Compression (Pulse does not arrived at the right number of packet)	HSK1, HSK3, Diag2
HM758240	HSL: Bad Format	HSK1, HSK3, Diag2
HM759240	HSL: Command sent to REU has not been sucessfully executed	HSK1, HSK3, Diag2
HM760240	HSL: Start Compression Lost (pulse never arrived)	HSK1, HSK3, Diag2
HM761240	HSL: Modulation frequency lost	HSK1, HSK3, Diag2
HM762240	HSL: Science Sequence Counter break	HSK1, HSK3, Diag2
HM763240	HSL: Glued Data Packet (more than one packet is present when reading FIFO)	HSK1, HSK3, Diag2
HM764240	LSL: Parity error	HSK1, HSK3, Diag2
HM765240	LSL: Bad Start Header	HSK1, HSK3, Diag2
HM766240	LSL: Buffer Size error	HSK1, HSK3, Diag2

HM767240	LSL: Bad Data Packet Length	HSK1, HSK3, Diag2
HM768240	LSL: DCE TimeOut (No DCE packet received before expected time)	HSK1, HSK3, Diag2
HM769240	LSL: 4KCDE TimeOut (No 4K packet received before expected time)	HSK1, HSK3, Diag2
HM770240	LSL: Bad CRC	HSK1, HSK3, Diag2
HM771240	LSL: DCE type of Data Packet unknown	HSK1, HSK3, Diag2
HM772240	LSL: 4KCDE Bad Data Packet (ID)	HSK1, HSK3, Diag2
HM773240	LSL: 4KCDE type of Data Packet unknown	HSK1, HSK3, Diag2
HM774240	LSL: DCE no answer for Data DownLoad request	HSK1, HSK3, Diag2
HM775240	LSL: 4KCDE no answer for Data DownLoad request	HSK1, HSK3, Diag2
HM776240	LSL: 4KCDE Command error (not executed)	HSK1, HSK3, Diag2
HM777240	LSL: DCE Command error (not executed)	HSK1, HSK3, Diag2
HM779240	LSL: Glued Data Packet (more than one packet is present when reading FIFO)	HSK1, HSK3, Diag2
HM780240	SW: HK or Event Packet Buffer Full (HSK data lost)	HSK1, HSK3, Diag2
HM781240	SW: Science Buffer Packet Full (Science data lost)	HSK1, HSK3, Diag2
HM782240	SW: Real Time Overflow	HSK1, HSK3, Diag2
HM783240	SW: Compression Slice Not Finish before next science page	HSK1, HSK3, Diag2
HM784240	SW: Not resynchronisation command found	HSK1, HSK3, Diag2
HM785240	SW: DPU has automatically resynchrnoised itself	HSK1, HSK3, Diag2
HM786240	SW: Not enough TC to resynchronise subystem	HSK1, HSK3, Diag2
HM787240	SW: TC sent to 4KCDE/REU for resynchronisation	HSK1, HSK3, Diag2
HM788240	SW: Previous TC has not been acknowledged by 4KCDE	HSK1, HSK3, Diag2
HM789240	SW: Previous TC has not been acknowledged by DCE	HSK1, HSK3, Diag2
HM790240	SW: Previous TC has not been acknowledged by REU	HSK1, HSK3, Diag2
HM791240	SW: Bad Raw Filters read in EEPROM	HSK1, HSK3, Diag2
HM792240	SW: Bad OBSW parameters read in EEPROM	HSK1, HSK3, Diag2
HM793240	SW: Bad science parameters read in EEPROM (compression, ..)	HSK1, HSK3, Diag2
HM794240	SW: Error when reading Resync table in EEPROM	HSK1, HSK3, Diag2
HM795240	SW: Bad parameter read in EEPROM; Default param value taken	HSK1, HSK3, Diag2
HM810240	Apid_of-packet	HSK1, HSK3

DPU HW TELEMETRY ORDERED BY S2K ASCENDING HM NUMBER

S2K	Description	Type of packet
HM001250	DPU Glitch Algo (1=active)	HSK2, Diag2
HM003250	DPU POWER cold PCB Temperature (°C)	HSK1, HSK3
HM004250	DPU DCDC Temperature (°C)	HSK1, HSK3
HM005250	DPU POWER warm PCB Temperature (°C)	HSK1, HSK3
HM006250	DPU Intensity of +5V (mA)	HSK1, HSK3
HM007250	DPU Intensity of -15V (mA)	HSK1, HSK3
HM008250	DPU Intensity of +15V (mA)	HSK1, HSK3
HM009250	DPU Intensity of +25V (mA)	HSK1, HSK3
HM010250	DPU DIGITAL cold PCB Temperature (°C)	HSK1, HSK3
HM011250	DPU Processor Temperature (°C)	HSK1, HSK3
HM012250	DPU DIGITAL warm PCB Temperature (°C)	HSK1, HSK3
HM013250	DPU + 5V (V)	HSK1, HSK3
HM014250	DPU - 15V (V)	HSK1, HSK3
HM015250	DPU +15V (V)	HSK1, HSK3
HM016250	DPU +2.5V (V)	HSK1, HSK3
HM017250	DPU SW state during boot (1,9,8)	Diag1
HM018250	DPU Nb of Start	Diag1
HM019250	MMT000_DEEPROM checksum result (0=OK)	Diag1
To		
HM146250	MMT127_DEEPROM checksum result (0=OK)	Diag1
HM147250	MMT000_PSRAM checksum result (0=OK)	Diag1
To		Diag1
HM274250	MMT127_PSRAM checksum result (0=OK)	Diag1
HM275250	MMT000_DSRAM checksum result (0=OK)	Diag1
To		
HM277250	MMT002_DSRAM checksum result (0=OK)	Diag1
HM402250	MMT127_DSRAM checksum result (0=OK)	Diag1
HM403250	MMT000_DPROM checksum result (0=OK)	Diag1
To		
HM405250	MMT002_DPROM checksum result (0=OK)	Diag1
HM414250	MMT011_DPROM checksum result (0=OK)	Diag1
HM415250	DPU ASW Start Address	Diag1
HM419250	DPU 1553 Address	Diag1
HM420250	DPU MSR FPGA status error 1	Diag1
HM421250	DPU MIR FPGA status error	Diag1
HM422250	DPU MSR FPGA status error 2	Diag1
HM423250	DPU bad ASW Start Adress (1=error)	Diag1
HM424250	DPU EEPROM checksum error (1=error)	Diag1
HM425250	DPU checksun error (number of start zone) (1=error)	Diag1
HM426250	DPU ASW loading error (1=error)	Diag1
HM427250	DPU Watchdog (1=active)	Diag1
HM428250	DPU BSW/ASW transition (0=Automatic; 1=by TC)	Diag1
HM429250	DPU general check hardware (0=all OK)	Diag1

4K TELEMETRY ORDERED BY S2K ASCENDING HM NUMBER

S2K	Description	Type of packet
HD028260	4K JT Temperature (K)	HSK1, HSK3
HD029260	4K I/F 18K Temperature (K) (sec axis)	HSK1, HSK3
HM001260	4K-Time (ms)	HSK1, HSK3, Diag2
HM003260	4K Mode	HSK1, HSK3, Diag2
HM004260	4K VCS (1=ON, 0=OFF)	HSK1, HSK3
HM005260	F0 4K (micro s)	HSK1, HSK3
HM007260	F180 4K (micro s)	HSK1, HSK3
HM009260	CI_CR : see (HM280260 to HM292260)	HSK1, HSK3
HM010260	CI_SR : see (HM293260 to HM308260)	HSK1, HSK3
HM012260	CI_MR : see (HM310260 to HM316260)	HSK1, HSK3
HM013260	PS_CR : see (HM318260 to HM320260)	HSK1, HSK3
HM014260	PS_SR : see (H3210260 to HM325260)	HSK1, HSK3
HM015260	PS_MR : see(HM326260 to HM333260)	HSK1, HSK3
HM016260	Getter Pwm (0-255) (sec axis)	HSK1, HSK3
HM017260	4K Gas FlowRate (mg/s)	HSK1, HSK3
HM018260	4K Gas Pressure HP (bar)	HSK1, HSK3
HM019260	4K Gas Pressure LP (bar)	HSK1, HSK3
HM020260	4K Getter Temperature 1 (°C)	HSK1, HSK3
HM021260	4K Getter Temperature 2 (°C)	HSK1, HSK3
HM022260	Processor Bus Current (A)	HSK1, HSK3
HM023260	Mux 4 Ref Voltage (V)	HSK1, HSK3
HM024260	Mux 4 Zero Voltage (V)	HSK1, HSK3
HM025260	4K Processor +5V (V)	HSK1, HSK3
HM026260	4K PROC +15V (V)	HSK1, HSK3
HM027260	4K Processor -15V (V)	HSK1, HSK3
HM030260	4K Processor +2.5V (V)	HSK1, HSK3
HM031260	Mux 5 Ref Voltage (V)	HSK1, HSK3
HM032260	Mux 5 Zero Voltage (V)	HSK1, HSK3
HM033260	Compressor LP Head Temp (°C)	HSK1, HSK3
HM034260	Compressor HP Head Temp (°C)	HSK1, HSK3
HM035260	Compressor LP PPO Temp (°C)	HSK1, HSK3
HM036260	Compressor HP PPO Temp (°C)	HSK1, HSK3
HM037260	Power Module Temp T4 (°C)	HSK1, HSK3
HM038260	Drive Module A Temp T5 (°C)	HSK1, HSK3
HM039260	Mux 1 Ref Voltage (V)	HSK1, HSK3
HM040260	Mux 1 Zero Voltage (V)	HSK1, HSK3
HM041260	Power Module Temp T6 (°C)	HSK1, HSK3
HM042260	Drive Module B Temp T7 (°C)	HSK1, HSK3
HM043260	4KCDE Case Temp T8 (°C)	HSK1, HSK3
HM044260	Ancillary Panel Temp T9 (°C)	HSK1, HSK3
HM045260	Ancillary Panel Temp T10 (°C)	HSK1, HSK3
HM046260	4K Getter Bracket Temp T11 (°C)	HSK1, HSK3
HM047260	Mux 2 Ref Voltage (V)	HSK1, HSK3
HM048260	Mux 2 Zero Voltage (V)	HSK1, HSK3
HM049260	Buffer Volume Temp T12 (°C)	HSK1, HSK3
HM050260	4K Reference Voltage (V)	HSK1, HSK3
HM055260	Mux 3 Ref Voltage (V)	HSK1, HSK3
HM056260	Mux 3 Zero Voltage (V)	HSK1, HSK3
HM057260	4K DRIVE +5V (V)	HSK1, HSK3
HM058260	4K DRIVE +15V (V)	HSK1, HSK3
HM059260	4K DRIVE - 15V (V)	HSK1, HSK3
HM060260	4K PPO +10V (V)	HSK1, HSK3
HM061260	4K PPO +15V (V)	HSK1, HSK3
HM062260	4K PPO - 15V (V)	HSK1, HSK3
HM063260	4K Drive bus 28V (V)	HSK1, HSK3

HM064260	Drive bus current (A)	HSK1, HSK3
HM071260	Vib Sensor ADC Ref Voltage (V) (sec axis)	HSK1, HSK3
HM072260	Compressor B ADC Ref Voltage (V)	HSK1, HSK3
HM073260	Compressor A ADC Ref Voltage (V)	HSK1, HSK3
HM074260	Vib Sensor ADC Zero Voltage (V) (sec axis)	HSK1, HSK3
HM075260	Compressor B ADC Zero Voltage (V)	HSK1, HSK3
HM076260	Compressor A ADC Zero Voltage (V)	HSK1, HSK3
HM077260	Compressor Amplitude Set (um)	HSK1, HSK3
HM078260	Average drive bus power (W)	HSK1, HSK3
HM079260	Average processor bus current (A)	HSK1, HSK3
HM080260	Peak drive bus current Max (A)	HSK1, HSK3
HM081260	Peak drive bus current Min (A)	HSK1, HSK3
HM082260	Force transducer 1 filtered (Nrms)	HSK1, HSK3
HM083260	Force transducer 2 filtered (Nrms)	HSK1, HSK3
HM084260	Force transducer 3 filtered (Nrms)	HSK1, HSK3
HM085260	Force transducer 4 filtered (Nrms)	HSK1, HSK3
HM086260	Modulus of Imbalance F0 (N)	HSK1, HSK3
HM087260	Modulus of Imbalance F1 (N)	HSK1, HSK3
HM088260	Modulus of Imbalance F2 (N)	HSK1, HSK3
HM089260	Modulus of Imbalance F3 (N)	HSK1, HSK3
HM090260	Modulus of Imbalance F4 (N)	HSK1, HSK3
HM091260	Modulus of Imbalance F5 (N)	HSK1, HSK3
HM092260	Modulus of Imbalance F6 (N)	HSK1, HSK3
HM093260	Modulus of Imbalance F7 (N)	HSK1, HSK3
HM094260	Comp A average drive power Max (W)	HSK1, HSK3
HM095260	Comp A average drive power Min (W)	HSK1, HSK3
HM096260	Comp B average drive power Max (W)	HSK1, HSK3
HM097260	Comp B average drive power Min (W)	HSK1, HSK3
HM098260	Comp A amplitude positive Max (um)	HSK1, HSK3
HM099260	Comp A amplitude positive Min (um)	HSK1, HSK3
HM100260	Comp A amplitude negative Max (um)	HSK1, HSK3
HM101260	Comp A amplitude negative Min (um)	HSK1, HSK3
HM102260	Comp B amplitude positive Max (um)	HSK1, HSK3
HM103260	Comp B amplitude positive Min (um)	HSK1, HSK3
HM104260	Comp B amplitude negative Max (um)	HSK1, HSK3
HM105260	Comp B amplitude negative Min (um)	HSK1, HSK3
HM106260	Comp A drive current positive Max (A)	HSK1, HSK3
HM107260	Comp A drive current positive Min (A)	HSK1, HSK3
HM108260	Comp A drive current negative Max (A)	HSK1, HSK3
HM109260	Comp A drive current negative Min (A)	HSK1, HSK3
HM110260	Comp B drive current positive Max (A)	HSK1, HSK3
HM111260	Comp B drive current positive Min (A)	HSK1, HSK3
HM112260	Comp B drive current negative Max (A)	HSK1, HSK3
HM113260	Comp B drive current negative Min (A)	HSK1, HSK3
HM114260	4K Internal F180 period (RAW)	HSK2
HM115260	4K External F0 max (RAW)	HSK2
HM116260	4K External F0 min (RAW)	HSK2
HM117260	4K External F0 variation (RAW)	HSK2
HM118260	4K External F180 max (RAW)	HSK2
HM119260	4K External F180 min (RAW)	HSK2
HM120260	Compressor Amplitude Demand (micron)	HSK2
HM121260	Compressor selection (must be 3)	HSK2
HM122260	Compressor Amplitude MAX (micron)	HSK2
HM123260	4K Force Harmonic selection (0 to 255)	HSK2
HM124260	Getter selection (1,2,3)	HSK2
HM125260	4K Force transducer selection (0 to 15)	HSK2
HM126260	4K limit val for >0 Displ Comp A (micron)	HSK2
HM127260	4K limit val for <0 Displ Comp A (micron)	HSK2

HM128260	4K limit val for >0 Displ Comp B (micron)	HSK2
HM129260	4K limit val for <0 Displ Comp B (micron)	HSK2
HM130260	4K limit val 1 for Drive Intensity (A)	HSK2
HM131260	4K limit val 2 for Drive Intensity (A)	HSK2
HM132260	4K limit val 3 for Drive Intensity (A)	HSK2
HM133260	4K limit val 1 for Comp A Temperature (°C)	HSK2
HM134260	4K limit val 2 for Comp A Temperature (°C)	HSK2
HM135260	4K limit val 1 for Comp B Temperature (°C)	HSK2
HM136260	4K limit val 2 for Comp B Temperature (°C)	HSK2
HM137260	4K limit val for >0 Comp A Intensity (A)	HSK2
HM138260	4K limit val for <0 Comp A Intensity (A)	HSK2
HM139260	4K limit val for >0 Comp B Intensity (A)	HSK2
HM140260	4K limit val for <0 Comp B Intensity (A)	HSK2
HM145260	4K Software Error	HSK2
HM148260	4K Software Limit Amplitud Demand	HSK2
HM149260	4K Comand Packet Type (=0x80+ID)	HSK2
HM150260	4K Comand Seq Count	HSK2
HM151260	4K Comand Return Value	HSK2, Diag2
HM152260	4K Processor IdleTime	HSK2
HM154260	HM154260_4Sw-WStartHr	HSK1, HSK3
HM155260	HM155260_4Sw-WStartHrLsw	HSK1, HSK3
HM156260	4K BOOT status (<5=OK)	Diag2
HM157260	4K BOOT ERROR (0=OK)	Diag2
HM158260	4K RESET reason 1	Diag2
HM159260	4K RESET reason 2	Diag2
HM160260	4K RESET reason 3	Diag2
HM161260	4K RESET reason 4	Diag2
HM162260	4K RESET reason5	Diag2
HM163260	4K RESET reason 6	Diag2
HM164260	4K RESET reason 7	Diag2
HM165260	4K RESET reason 8	Diag2
HM166260	4K RESET reason 9	Diag2
HM167260	4K RESET reason 10	Diag2
HM168260	4Sw0_PRAM Failed Mem Block (0=OK)	Diag2
HM169260	4Sw1_PRAM Failed Mem Block (0=OK)	Diag2
HM170260	4Sw2_PRAM Failed Mem Block (0=OK)	Diag2
HM171260	4Sw3_PRAM Failed Mem Block (0=OK)	Diag2
HM172260	4Sw4_PRAM Failed Mem Block (0=OK)	Diag2
HM173260	4Sw5_PRAM Failed Mem Block (0=OK)	Diag2
HM174260	4Sw6_PRAM Failed Mem Block (0=OK)	Diag2
HM175260	4Sw7_PRAM Failed Mem Block (0=OK)	Diag2
HM176260	4Sw0_DRAM Failed Mem Block (0=OK)	Diag2
HM177260	4Sw1_DRAM Failed Mem Block (0=OK)	Diag2
HM178260	4Sw2_DRAM Failed Mem Block (0=OK)	Diag2
HM179260	4Sw3_DRAM Failed Mem Block (0=OK)	Diag2
HM180260	4Sw4_DRAM Failed Mem Block (0=OK)	Diag2
HM181260	4Sw5_DRAM Failed Mem Block (0=OK)	Diag2
HM182260	4Sw6_DRAM Failed Mem Block (0=OK)	Diag2
HM183260	4Sw7_DRAM Failed Mem Block (0=OK)	Diag2
HM184260	4K SRT Status (1=finished)	HSK2
HM220260	4K Limit Control Prog Amplitude Difference	HSK2
HM221260	4K Limit Control 2 Comp B Temperature	HSK2
HM222260	4K Limit Control 1 Comp B Temperature	HSK2
HM223260	4K Limit Control 2 Comp A Temperature	HSK2
HM224260	4K Limit Control 1 Comp A Temperature	HSK2
HM225260	4K Limit Control <0 Comp B Intensity	HSK2
HM226260	4K Limit Control >0 Comp A Intensity	HSK2
HM227260	4K Limit Control <0 Comp A Intensity	HSK2

HM228260	4K Limit Control >0 Comp B Intensity	HSK2
HM229260	4K Limit 3 Control drive bus Intensity	HSK2
HM230260	4K Limit 2 Control drive bus Intensity	HSK2
HM231260	4K Limit 1 Control drive bus Intensity	HSK2
HM232260	4K Limit Control <0 Comp B Displacement	HSK2
HM233260	4K Limit Control >0 Comp B Displacement	HSK2
HM234260	4K Limit Control <0 Comp A Displacement	HSK2
HM235260	4K Limit Control >0 Comp A Displacement	HSK2
HM236260	4K Limit Control Prog Displacement	HSK2
HM237260	4K Limit action Prog Amplitude Difference	HSK2
HM238260	4K Limit action 2 Comp B Temperature	HSK2
HM239260	4K Limit action 1 Comp B Temperature	HSK2
HM240260	4K Limit action 2 Comp A Temperature	HSK2
HM241260	4K Limit action 1 Comp A Temperature	HSK2
HM242260	4K Limit action <0 Comp B Intensity	HSK2
HM243260	4K Limit action >0 Comp A Intensity	HSK2
HM244260	4K Limit action <0 Comp A Intensity	HSK2
HM245260	4K Limit action >0 Comp B Intensity	HSK2
HM246260	4K Limit 3 action drive bus Intensity	HSK2
HM247260	4K Limit 2 action drive bus Intensity	HSK2
HM248260	4K Limit 1 action drive bus Intensity	HSK2
HM249260	4K Limit action <0 Comp B Displacement	HSK2
HM250260	4K Limit action >0 Comp B Displacement	HSK2
HM251260	4K Limit action <0 Comp A Displacement	HSK2
HM252260	4K Limit action >0 Comp A Displacement	HSK2
HM253260	4K Limit action Prog Displacement	HSK2
HM254260	4K Limit Exceed Program Amp Dif > 2mm	HSK2
HM255260	4K Limit 2 Exceed Temp Comp B	HSK2
HM256260	4K Limit 1 Exceed Temp Comp B	HSK2
HM257260	4K Limit 2 Exceed Temp Comp A	HSK2
HM258260	4K Limit 1 Exceed Temp Comp A	HSK2
HM259260	4K Limit Exceed Int Neg Comp B	HSK2
HM260260	4K Limit Exceed Int Pos Comp A	HSK2
HM261260	4K Limit Exceed Int Neg Comp A	HSK2
HM262260	4K Limit Exceed Int Pos Comp B	HSK2
HM263260	4K Limit 3 Exceed Int drive bus	HSK2
HM264260	4K Limit 2 Exceed Int drive bus	HSK2
HM265260	4K Limit 1 Exceed Int drive bus	HSK2
HM266260	4K Limit Exceed Displ Neg Comp B	HSK2
HM267260	4K Limit Exceed Displ Pos Comp B	HSK2
HM268260	4K Limit Exceed Displ Neg Comp A	HSK2
HM269260	4K Limit Exceed Displ Pos Comp A	HSK2
HM270260	4K Limit Exceed Program Displ	HSK2
HM271260	4K Limit Exceed Force >5N	HSK2
HM272260	4K Limit Exceed F0	HSK2
HM273260	4K Limit Exceed F1	HSK2
HM274260	4K Limit Exceed F2	HSK2
HM275260	4K Limit Exceed F3	HSK2
HM276260	4K Limit Exceed F4	HSK2
HM277260	4K Limit Exceed F5	HSK2
HM278260	4K Limit Exceed F6	HSK2
HM279260	4K Limit Exceed F7	HSK2
HM280260	4K IRQ2 Interrupt (1=ON)	HSK1, HSK3
HM282260	4K Auto Clock Switchover (1=ON)	HSK1, HSK3
HM283260	4K Orifice heater (1=ON)	HSK1, HSK3
HM284260	4K Getter 2 (1=ON, 0=OFF)	HSK1, HSK3
HM285260	4K Getter 1 (1=ON, 0=OFF)	HSK1, HSK3
HM286260	4K Up to Pressure Comp A (0= nominal running)	HSK1, HSK3

HM287260	4K Up to Pressure Comp B (0= nominal running)	HSK1, HSK3
HM288260	4K Flow Meter Sync Signal (1=ON)	HSK1, HSK3
HM289260	4K PSU Sync Signal (1=ON)	HSK1, HSK3
HM290260	4K Drive Sync Signal (1=ON)	HSK1, HSK3
HM291260	4K Comp B Drive (0=enable)	HSK1, HSK3
HM292260	4K Comp A Drive (0=enable)	HSK1, HSK3
HM293260	Invalid waveform buffer write performed	HSK1, HSK3
HM294260	Getter Over Temperature	HSK1, HSK3
HM295260	Getter Over Current	HSK1, HSK3
HM296260	Compressor B Drive Amplifier Current Limiting	HSK1, HSK3
HM297260	Compressor A Drive Amplifier Current Limiting	HSK1, HSK3
HM298260	4K TM data acquisition write to DPRAM	HSK1, HSK3
HM299260	4K ADC E conversion error	HSK1, HSK3
HM300260	4K ADC E clock error	HSK1, HSK3
HM301260	4K ADC D conversion error	HSK1, HSK3
HM302260	4K ADC D clock error	HSK1, HSK3
HM303260	4K ADC C conversion error	HSK1, HSK3
HM304260	4K ADC C clock error	HSK1, HSK3
HM305260	4K ADC B conversion error	HSK1, HSK3
HM306260	4K ADC B clock error	HSK1, HSK3
HM307260	4K ADC A conversion error	HSK1, HSK3
HM308260	4K ADC A clock error	HSK1, HSK3
HM310260	4K Warm/cold start (0=cold)	HSK1, HSK3
HM311260	Current TM buffer	HSK1, HSK3
HM312260	Switch S5 position	HSK1, HSK3
HM313260	Switch S4 position	HSK1, HSK3
HM314260	Switch S3 position	HSK1, HSK3
HM315260	Switch S1 position	HSK1, HSK3
HM316260	4K Clock selection (0=Internal)	HSK1, HSK3
HM318260	LSL Tx Start (1=transmission)	HSK1, HSK3
HM319260	LSL Reset (1=Reset)	HSK1, HSK3
HM320260	EEPROM write (0=write enable)	HSK1, HSK3
HM321260	4K Incorrect nb of F180 clock periods counted in F0	HSK1, HSK3
HM322260	4K External F0 clock period variation out of bounds	HSK1, HSK3
HM323260	4K External F0 clock period out of bounds	HSK1, HSK3
HM324260	4K External F180 clock period of bounds	HSK1, HSK3
HM325260	4K LSL clock failure	HSK1, HSK3
HM326260	Tx FIFO (0 => not full)	HSK1, HSK3
HM327260	Tx FIFO (0 => less than half full)	HSK1, HSK3
HM328260	Tx FIFO (0 => not empty)	HSK1, HSK3
HM329260	Rx FIFO (0 => not full)	HSK1, HSK3
HM330260	Rx FIFO (0 => less than half full)	HSK1, HSK3
HM331260	Rx FIFO (0 => not empty)	HSK1, HSK3
HM332260	LSL Tx (0 => not busy)	HSK1, HSK3
HM333260	EEPROM (0 = no write in progress)	HSK1, HSK3

DCE TELEMETRY ORDERED BY S2K ASCENDING HM NUMBER

S2K	Description	Type of packet
HD001270	Temperature tank 3He T201 (°C)	HSK1, HSK3
HD002270	Temperature tank1 4He T101 (°C)	HSK1, HSK3
HD003270	Temperature tank2 4He T102 (°C)	HSK1, HSK3
HD004270	Temperature tank3 4He T103 (°C)	HSK1, HSK3
HD005270	Temperature 4He inlet (°C)	HSK1, HSK3
HD006270	Temperature 3He inlet (°C)	HSK1, HSK3
HD009270	Cernox Temp dilu 50K 4He (K)	HSK1, HSK3
HD010270	Cernox Temp dilu 18K 4He (K)	HSK1, HSK3
HD011270	Cernox Temp dilu 4K 4He (K)	HSK1, HSK3
HD012270	Cernox Temp Switch_18K4K nominal (K)	HSK1, HSK3
HD013270	Cernox Temp dilu 50K 3He (K)	HSK1, HSK3
HD014270	Cernox Temp dilu 18K 3He (K)	HSK1, HSK3
HD015270	Cernox Temp dilu 4K 3He (K)	HSK1, HSK3
HD016270	Cernox Temp Switch_18K4K redundant (K)	HSK1, HSK3
HM001270	Temperature tank 3He T201 (Ohm)	HSK1, HSK3
HM002270	Temperature tank1 4He T101 (Ohm)	HSK1, HSK3
HM003270	Temperature tank2 4He T102 (Ohm)	HSK1, HSK3
HM004270	Temperature tank3 4He T103 (Ohm)	HSK1, HSK3
HM005270	Temperature 4He inlet (Ohm)	HSK1, HSK3
HM006270	Temperature 3He inlet (Ohm)	HSK1, HSK3
HM007270	DCE Calibration Resistor 1 (Ohm)	HSK1, HSK3
HM008270	DCE Calibration Resistor 2 (Ohm)	HSK1, HSK3
HM009270	Cernox dilu 50K 4He (Ohm)	HSK1, HSK3
HM010270	Cernox dilu 18K 4He (Ohm)	HSK1, HSK3
HM011270	Cernox dilu 4K 4He (Ohm)	HSK1, HSK3
HM012270	Cernox Switch_18K4K nominal (Ohm)	HSK1, HSK3
HM013270	Cernox dilu 50K 3He (Ohm)	HSK1, HSK3
HM014270	Cernox dilu 18K 3He (Ohm)	HSK1, HSK3
HM015270	Cernox dilu 4K 3He (Ohm)	HSK1, HSK3
HM016270	Cernox Switch_18K4K redundant (Ohm)	HSK1, HSK3
HM017270	Pres. 4He HP PT101 (Bar)	HSK1, HSK3
HM018270	Pres. 3He HP PT201 (Bar)	HSK1, HSK3
HM019270	Pres. 4He Outlet Regul PT102 (Bar)	HSK1, HSK3
HM020270	Pres. 3He Outlet Regul PT202 (Bar)	HSK1, HSK3
HM021270	Pres. Dilu Inlet 4He PT103 (Bar)	HSK1, HSK3
HM022270	Pres. Dilu Inlet 3He PT203 (Bar)	HSK1, HSK3
HM025270	DCE +31V (V)	HSK1, HSK3
HM026270	DCE +5V (V)	HSK1, HSK3
HM027270	DCE +15V (V)	HSK1, HSK3
HM028270	DCE -15V (V)	HSK1, HSK3
HM029270	DCE Temperature 1 (°C)	HSK1, HSK3
HM030270	DCE Temperature 2 (°C)	HSK1, HSK3
HM600270	Valve 4He HP Red (HPLV151)	HSK1, HSK3
HM601270	Valve 4He HP Nom (HPLV101)	HSK1, HSK3
HM602270	Valve 3He HP Red (HPLV251)	HSK1, HSK3
HM603270	Valve 3He HP Nom (HPLV201)	HSK1, HSK3
HM604270	Valve Mixture Red (LV351)	HSK1, HSK3
HM605270	Valve Mixture Nom (LV301)	HSK1, HSK3

REU TELEMETRY ORDERED BY S2K ASCENDING HM NUMBER

S2K	Description	Type of packet
HD002280	REU modulation frequency (Hz)	HSK1, HSK3
HD100280	PID BOLO Exponent ENG	HSK4
HD101280	PID DILU Exponent ENG	HSK5
HD102280	PID 1.6K Exponent ENG	HSK6
HD103280	PID 4K Exponent ENG	HSK7
HD104280	PID Switch 4K/1.6K Exponent ENG	HSK8
HD106280	JFET0 Exponent ENG	HSK4
HD107280	JFET1 Exponent ENG	HSK4
HD108280	JFET2 Exponent ENG	HSK5
HD109280	JFET3 Exponent ENG	HSK5
HD110280	JFET4 Exponent ENG	HSK6
HD111280	JFET5 Exponent ENG	HSK6
HD112280	JFET6 Exponent ENG	HSK7
HD113280	JFET7 Exponent ENG	HSK7
HD114280	JFET8 Exponent ENG	HSK8
HD115280	JFET9 Exponent ENG	HSK8
HD116280	JFETA Exponent ENG	HSK9
HD117280	JFETB Exponent ENG	HSK9
HD217280	OCf00-Ohm	HSK4
HD218280	OCf01-Ohm	HSK4
HD219280	OCf02-Ohm	HSK4
HD220280	OCf03-Ohm	HSK4
HD221280	OCf04-Ohm	HSK4
HD222280	OCf05-Ohm	HSK4
HD223280	OCf10-Ohm	HSK4
HD224280	OCf11-Ohm	HSK4
HD225280	OCf12-Ohm	HSK4
HD226280	OCf13-Ohm	HSK4
HD227280	OCf14-Ohm	HSK4
HD228280	OCf15-Ohm	HSK4
HD229280	OCf20-Ohm	HSK5
HD230280	OCf21-Ohm	HSK5
HD231280	OCf22-Ohm	HSK5
HD232280	OCf23-Ohm	HSK5
HD233280	OCf24-Ohm	HSK5
HD234280	OCf25-Ohm	HSK5
HD235280	OCf30-Ohm	HSK5
HD236280	OCf31-Ohm	HSK5
HD237280	OCf32-Ohm	HSK5
HD238280	OCf33-Ohm	HSK5
HD239280	OCf34-Ohm	HSK5
HD240280	OCf35-Ohm	HSK5
HD241280	OCf40-Ohm	HSK6
HD242280	OCf41-Ohm	HSK6
HD243280	OCf42-Ohm	HSK6
HD244280	OCf43-Ohm	HSK6
HD245280	OCf44-Ohm	HSK6
HD246280	OCf45-Ohm	HSK6
HD247280	OCf50-Ohm	HSK6
HD248280	OCf51-Ohm	HSK6
HD249280	OCf52-Ohm	HSK6
HD250280	OCf53-Ohm	HSK6
HD251280	OCf54-Ohm	HSK6
HD252280	OCf55-Ohm	HSK6
HD253280	OCf60-Ohm	HSK7

HD254280	OCf61-Ohm	HSK7
HD255280	OCf62-Ohm	HSK7
HD256280	OCf63-Ohm	HSK7
HD257280	OCf64-Ohm	HSK7
HD258280	OCf65-Ohm	HSK7
HD259280	OCf70-Ohm	HSK7
HD260280	OCf71-Ohm	HSK7
HD261280	OCf72-Ohm	HSK7
HD262280	OCf73-Ohm	HSK7
HD263280	OCf74-Ohm	HSK7
HD264280	OCf75-Ohm	HSK7
HD265280	OCf80-Ohm	HSK8
HD266280	OCf81-Ohm	HSK8
HD267280	OCf82-Ohm	HSK8
HD268280	OCf83-Ohm	HSK8
HD269280	OCf84-Ohm	HSK8
HD270280	OCf85-Ohm	HSK8
HD271280	OCf90-Kelvin	HSK8
HD272280	OCf91-Kelvin	HSK8
HD273280	OCf92-Kelvin	HSK8
HD274280	OCf93-Kelvin	HSK8
HD275280	OCf94-Kelvin	HSK8
HD276280	OCf95-Kelvin	HSK8
HD277280	OCfA0-Ohm	HSK9
HD278280	OCfA1-Volt	HSK9
HD279280	OCfA2-Kelvin	HSK9
HD280280	OCfA3-Kelvin	HSK9
HD281280	OCfA4-Kelvin	HSK9
HD282280	OCfA5-Kelvin	HSK9
HD283280	OCfB0-Kelvin	HSK9
HD284280	OCfB1-Kelvin	HSK9
HD285280	OCfB2-Kelvin	HSK9
HD286280	OCfB3-Kelvin	HSK9
HD287280	OCfB4-Kelvin	HSK9
HD288280	OCfB5-Kelvin	HSK9
HD442280	Cernox Res 0.1K Nom (Ohm)	HSK1, HSK3
HD444280	Cernox Res 1.6K Nom (Ohm)	HSK1, HSK3
HD446280	Cernox Res 4K Nom (Ohm)	HSK1, HSK3
HD448280	Cernox Res 4-1.6KT Nom (Ohm)	HSK1, HSK3
HD450280	Cernox Res 18K Nom (Ohm)	HSK1, HSK3
HD452280	Cernox Res 50K Nom (Ohm)	HSK1, HSK3
HD454280	Cernox Res 0.1K Red (Ohm)	HSK1, HSK3
HD456280	Cernox Res 1.6K Red (Ohm)	HSK1, HSK3
HD458280	Cernox Res 4K Red (Ohm)	HSK1, HSK3
HD460280	Cernox Res 4-1.6KT Red (Ohm)	HSK1, HSK3
HD462280	Cernox Res 18K Red (Ohm)	HSK1, HSK3
HD464280	Cernox Res 50K Red (Ohm)	HSK1, HSK3
HD492280	Cernox Temp HFI 0.1K Nom (K)	HSK1, HSK3
HD493280	Cernox Temp HFI 1.6K Nom (K)	HSK1, HSK3
HD494280	Cernox Temp HFI 4K Nom (K)	HSK1, HSK3
HD495280	Cernox Temp HFI 4-1.6KT Nom (K)	HSK1, HSK3
HD496280	Cernox Temp HFI 18K Nom (K)	HSK1, HSK3
HD497280	Cernox Temp HFI 50K Nom (K)	HSK1, HSK3
HD498280	Cernox Temp HFI 0.1K Red (K)	HSK1, HSK3
HD499280	Cernox Temp HFI 1.6K Red (K)	HSK1, HSK3
HD500280	Cernox Temp HFI 4K Red (K)	HSK1, HSK3
HD501280	Cernox Temp HFI 4-1.6KT Red (K)	HSK1, HSK3

HD502280	Cernox Temp HFI 18K Red (K)	HSK1, HSK3
HD503280	Cernox Temp HFI 50K Red (K)	HSK1, HSK3
HD504280	JFET Temp Belt 0 (K)	HSK1, HSK3
HD505280	JFET Temp Belt 1 (K)	HSK1, HSK3
HD506280	JFET Temp Belt 2 (K)	HSK1, HSK3
HD507280	JFET Temp Belt 3 (K)	HSK1, HSK3
HD508280	JFET Temp Belt 4 (K)	HSK1, HSK3
HD509280	JFET Temp Belt 5 (K)	HSK1, HSK3
HD510280	JFET Temp Belt 6 (K)	HSK1, HSK3
HD511280	JFET Temp Belt 7 (K)	HSK1, HSK3
HD512280	JFET Temp Belt 8 (K)	HSK1, HSK3
HD513280	JFET Temp Belt 9 (K)	HSK1, HSK3
HD514280	JFET Temp Belt A (K)	HSK1, HSK3
HD515280	JFET Temp Belt B (K)	HSK1, HSK3
HD516280	Cernox 0.1K Nom Nom Intensity (A)	HSK2
HD517280	Cernox 1.6K Nom Intensity (A)	HSK2
HD518280	Cernox 4K Nom Intensity (A)	HSK2
HD519280	Cernox 4-1.6K Nom Intensity (A)	HSK2
HD520280	Cernox 18K Nom Intensity (A)	HSK2
HD521280	Cernox 50K Nom Intensity (A)	HSK2
HD522280	Cernox 0.1K Red Nom Intensity (A)	HSK2
HD523280	Cernox 1.6K Red Intensity (A)	HSK2
HD524280	Cernox 4K Red Intensity (A)	HSK2
HD525280	Cernox 4-1.6K Red Intensity (A)	HSK2
HD526280	Cernox 18K Red Intensity (A)	HSK2
HD527280	Cernox 50K Red Intensity (A)	HSK2
HD528280	Cernox Volt 0.1K Nom (V)	HSK1, HSK3
HD529280	Cernox Volt 1.6K Nom (V)	HSK1, HSK3
HD530280	Cernox Volt 4K Nom (V)	HSK1, HSK3
HD531280	Cernox Volt 4-1.6KT Nom (V)	HSK1, HSK3
HD532280	Cernox Volt 18K Nom (V)	HSK1, HSK3
HD533280	Cernox Volt 50K Nom (V)	HSK1, HSK3
HD534280	Cernox Volt 0.1K Red (V)	HSK1, HSK3
HD535280	Cernox Volt 1.6K Red (V)	HSK1, HSK3
HD536280	Cernox Volt 4K Red (V)	HSK1, HSK3
HD537280	Cernox Volt 4-1.6KT Red (V)	HSK1, HSK3
HD538280	Cernox Volt 18K Red (V)	HSK1, HSK3
HD539280	Cernox Volt 50K Red (V)	HSK1, HSK3
HD600280	Heater Power JFET 0 (W)	HSK1, HSK3
HD601280	Heater Power JFET 1 (W)	HSK1, HSK3
HD602280	Heater Power JFET 2 (W)	HSK1, HSK3
HD603280	Heater Power JFET 3 (W)	HSK1, HSK3
HD604280	Heater Power JFET 4 (W)	HSK1, HSK3
HD605280	Heater Power JFET 5 (W)	HSK1, HSK3
HD606280	Heater Power JFET 6 (W)	HSK1, HSK3
HD607280	Heater Power JFET 7 (W)	HSK1, HSK3
HD608280	Heater Power JFET 8 (W)	HSK1, HSK3
HD609280	Heater Power JFET 9 (W)	HSK1, HSK3
HD610280	Heater Power JFET A (W)	HSK1, HSK3
HD611280	Heater Power JFET B (W)	HSK1, HSK3
HD612280	PID BOLO Nom Power (W)	HSK1, HSK3
HD613280	PID DILU Nom Power (W)	HSK1, HSK3
HD614280	PID 1.6K Nom Power (W)	HSK1, HSK3
HD615280	PID 4K Nom Power (W)	HSK1, HSK3
HD616280	PID Sitch 1.6-4K Nom Power (W)	HSK1, HSK3
HD618280	PID BOLO Red Power (W)	HSK1, HSK3
HD619280	PID DILU Red Power (W)	HSK1, HSK3
HD620280	PID 1.6K Red Power (W)	HSK1, HSK3

HD621280	PID 4K Red Power (W)	HSK1, HSK3
HD622280	PID Switch 1.6-4K Red Power (W)	HSK1, HSK3
HM003280	Channel 00 MPhase	HSK4
HM004280	Channel 00 BiasCt	HSK4
HM005280	Channel 00 BalVt	HSK4
HM006280	Channel 00 Trans	HSK4
HM007280	Channel 01 MPhase	HSK4
HM008280	Channel 01 BiasCt	HSK4
HM009280	Channel 01 BalVt	HSK4
HM010280	Channel 01 Trans	HSK4
HM011280	Channel 02 MPhase	HSK4
HM012280	Channel 02 BiasCt	HSK4
HM013280	Channel 02 BalVt	HSK4
HM014280	Channel 02 Trans	HSK4
HM015280	Channel 03 MPhase	HSK4
HM016280	Channel 03 BiasCt	HSK4
HM017280	Channel 03 BalVt	HSK4
HM018280	Channel 03 Trans	HSK4
HM019280	Channel 04 MPhase	HSK4
HM020280	Channel 04 BiasCt	HSK4
HM021280	Channel 04 BalVt	HSK4
HM022280	Channel 04 Trans	HSK4
HM023280	Channel 05 MPhase	HSK4
HM024280	Channel 05 BiasCt	HSK4
HM025280	Channel 05 BalVt	HSK4
HM026280	Channel 05 Trans	HSK4
HM027280	Channel 10 MPhase	HSK4
HM028280	Channel 10 BiasCt	HSK4
HM029280	Channel 10 BalVt	HSK4
HM030280	Channel 10 Trans	HSK4
HM031280	Channel 11 MPhase	HSK4
HM032280	Channel 11 BiasCt	HSK4
HM033280	Channel 11 BalVt	HSK4
HM034280	Channel 11 Trans	HSK4
HM035280	Channel 12 MPhase	HSK4
HM036280	Channel 12 BiasCt	HSK4
HM037280	Channel 12 BalVt	HSK4
HM038280	Channel 12 Trans	HSK4
HM039280	Channel 13 MPhase	HSK4
HM040280	Channel 13 BiasCt	HSK4
HM041280	Channel 13 BalVt	HSK4
HM042280	Channel 13 Trans	HSK4
HM043280	Channel 14 MPhase	HSK4
HM044280	Channel 14 BiasCt	HSK4
HM045280	Channel 14 BalVt	HSK4
HM046280	Channel 14 Trans	HSK4
HM047280	Channel 15 MPhase	HSK4
HM048280	Channel 15 BiasCt	HSK4
HM049280	Channel 15 BalVt	HSK4
HM050280	Channel 15 Trans	HSK4
HM051280	Channel 20 MPhase	HSK5
HM052280	Channel 20 BiasCt	HSK5
HM053280	Channel 20 BalVt	HSK5
HM054280	Channel 20 Trans	HSK5
HM055280	Channel 21 MPhase	HSK5
HM056280	Channel 21 BiasCt	HSK5
HM057280	Channel 21 BalVt	HSK5

HM058280	Channel 21 Trans	HSK5
HM059280	Channel 22 MPhase	HSK5
HM060280	Channel 22 BiasCt	HSK5
HM061280	Channel 22 BalVt	HSK5
HM062280	Channel 22 Trans	HSK5
HM063280	Channel 23 MPhase	HSK5
HM064280	Channel 23 BiasCt	HSK5
HM065280	Channel 23 BalVt	HSK5
HM066280	Channel 23 Trans	HSK5
HM067280	Channel 24 MPhase	HSK5
HM068280	Channel 24 BiasCt	HSK5
HM069280	Channel 24 BalVt	HSK5
HM070280	Channel 24 Trans	HSK5
HM071280	Channel 25 MPhase	HSK5
HM072280	Channel 25 BiasCt	HSK5
HM073280	Channel 25 BalVt	HSK5
HM074280	Channel 25 Trans	HSK5
HM075280	Channel 30 MPhase	HSK5
HM076280	Channel 30 BiasCt	HSK5
HM077280	Channel 30 BalVt	HSK5
HM078280	Channel 30 Trans	HSK5
HM079280	Channel 31 MPhase	HSK5
HM080280	Channel 31 BiasCt	HSK5
HM081280	Channel 31 BalVt	HSK5
HM082280	Channel 31 Trans	HSK5
HM083280	Channel 32 MPhase	HSK5
HM084280	Channel 32 BiasCt	HSK5
HM085280	Channel 32 BalVt	HSK5
HM086280	Channel 32 Trans	HSK5
HM087280	Channel 33 MPhase	HSK5
HM088280	Channel 33 BiasCt	HSK5
HM089280	Channel 33 BalVt	HSK5
HM090280	Channel 33 Trans	HSK5
HM091280	Channel 34 MPhase	HSK5
HM092280	Channel 34 BiasCt	HSK5
HM093280	Channel 34 BalVt	HSK5
HM094280	Channel 34 Trans	HSK5
HM095280	Channel 35 MPhase	HSK5
HM096280	Channel 35 BiasCt	HSK5
HM097280	Channel 35 BalVt	HSK5
HM098280	Channel 35 Trans	HSK5
HM099280	Channel 40 MPhase	HSK6
HM100280	Channel 40 BiasCt	HSK6
HM101280	Channel 40 BalVt	HSK6
HM102280	Channel 40 Trans	HSK6
HM103280	Channel 41 MPhase	HSK6
HM104280	Channel 41 BiasCt	HSK6
HM105280	Channel 41 BalVt	HSK6
HM106280	Channel 41 Trans	HSK6
HM107280	Channel 42 MPhase	HSK6
HM108280	Channel 42 BiasCt	HSK6
HM109280	Channel 42 BalVt	HSK6
HM110280	Channel 42 Trans	HSK6
HM111280	Channel 43 MPhase	HSK6
HM112280	Channel 43 BiasCt	HSK6
HM113280	Channel 43 BalVt	HSK6
HM114280	Channel 43 Trans	HSK6

HM115280	Channel 44 MPhase	HSK6
HM116280	Channel 44 BiasCt	HSK6
HM117280	Channel 44 BalVt	HSK6
HM118280	Channel 44 Trans	HSK6
HM119280	Channel 45 MPhase	HSK6
HM120280	Channel 45 BiasCt	HSK6
HM121280	Channel 45 BalVt	HSK6
HM122280	Channel 45 Trans	HSK6
HM123280	Channel 50 MPhase	HSK6
HM124280	Channel 50 BiasCt	HSK6
HM125280	Channel 50 BalVt	HSK6
HM126280	Channel 50 Trans	HSK6
HM127280	Channel 51 MPhase	HSK6
HM128280	Channel 51 BiasCt	HSK6
HM129280	Channel 51 BalVt	HSK6
HM130280	Channel 51 Trans	HSK6
HM131280	Channel 52 MPhase	HSK6
HM132280	Channel 52 BiasCt	HSK6
HM133280	Channel 52 BalVt	HSK6
HM134280	Channel 52 Trans	HSK6
HM135280	Channel 53 MPhase	HSK6
HM136280	Channel 53 BiasCt	HSK6
HM137280	Channel 53 BalVt	HSK6
HM138280	Channel 53 Trans	HSK6
HM139280	Channel 54 MPhase	HSK6
HM140280	Channel 54 BiasCt	HSK6
HM141280	Channel 54 BalVt	HSK6
HM142280	Channel 54 Trans	HSK6
HM143280	Channel 55 MPhase	HSK6
HM144280	Channel 55 BiasCt	HSK6
HM145280	Channel 55 BalVt	HSK6
HM146280	Channel 55 Trans	HSK6
HM147280	Channel 60 MPhase	HSK7
HM148280	Channel 60 BiasCt	HSK7
HM149280	Channel 60 BalVt	HSK7
HM150280	Channel 60 Trans	HSK7
HM151280	Channel 61 MPhase	HSK7
HM152280	Channel 61 BiasCt	HSK7
HM153280	Channel 61 BalVt	HSK7
HM154280	Channel 61 Trans	HSK7
HM155280	Channel 62 MPhase	HSK7
HM156280	Channel 62 BiasCt	HSK7
HM157280	Channel 62 BalVt	HSK7
HM158280	Channel 62 Trans	HSK7
HM159280	Channel 63 MPhase	HSK7
HM160280	Channel 63 BiasCt	HSK7
HM161280	Channel 63 BalVt	HSK7
HM162280	Channel 63 Trans	HSK7
HM163280	Channel 64 MPhase	HSK7
HM164280	Channel 64 BiasCt	HSK7
HM165280	Channel 64 BalVt	HSK7
HM166280	Channel 64 Trans	HSK7
HM167280	Channel 65 MPhase	HSK7
HM168280	Channel 65 BiasCt	HSK7
HM169280	Channel 65 BalVt	HSK7
HM170280	Channel 65 Trans	HSK7
HM171280	Channel 70 MPhase	HSK7

HM172280	Channel 70 BiasCt	HSK7
HM173280	Channel 70 BalVt	HSK7
HM174280	Channel 70 Trans	HSK7
HM175280	Channel 71 MPhase	HSK7
HM176280	Channel 71 BiasCt	HSK7
HM177280	Channel 71 BalVt	HSK7
HM178280	Channel 71 Trans	HSK7
HM179280	Channel 72 MPhase	HSK7
HM180280	Channel 72 BiasCt	HSK7
HM181280	Channel 72 BalVt	HSK7
HM182280	Channel 72 Trans	HSK7
HM183280	Channel 73 MPhase	HSK7
HM184280	Channel 73 BiasCt	HSK7
HM185280	Channel 73 BalVt	HSK7
HM186280	Channel 73 Trans	HSK7
HM187280	Channel 74 MPhase	HSK7
HM188280	Channel 74 BiasCt	HSK7
HM189280	Channel 74 BalVt	HSK7
HM190280	Channel 74 Trans	HSK7
HM191280	Channel 75 MPhase	HSK7
HM192280	Channel 75 BiasCt	HSK7
HM193280	Channel 75 BalVt	HSK7
HM194280	Channel 75 Trans	HSK7
HM195280	Channel 80 MPhase	HSK8
HM196280	Channel 80 BiasCt	HSK8
HM197280	Channel 80 BalVt	HSK8
HM198280	Channel 80 Trans	HSK8
HM199280	Channel 81 MPhase	HSK8
HM200280	Channel 81 BiasCt	HSK8
HM201280	Channel 81 BalVt	HSK8
HM202280	Channel 81 Trans	HSK8
HM203280	Channel 82 MPhase	HSK8
HM204280	Channel 82 BiasCt	HSK8
HM205280	Channel 82 BalVt	HSK8
HM206280	Channel 82 Trans	HSK8
HM207280	Channel 83 MPhase	HSK8
HM208280	Channel 83 BiasCt	HSK8
HM209280	Channel 83 BalVt	HSK8
HM210280	Channel 83 Trans	HSK8
HM211280	Channel 84 MPhase	HSK8
HM212280	Channel 84 BiasCt	HSK8
HM213280	Channel 84 BalVt	HSK8
HM214280	Channel 84 Trans	HSK8
HM215280	Channel 85 MPhase	HSK8
HM216280	Channel 85 BiasCt	HSK8
HM217280	Channel 85 BalVt	HSK8
HM218280	Channel 85 Trans	HSK8
HM219280	Channel 90 MPhase	HSK8
HM220280	Channel 90 BiasCt	HSK8
HM221280	Channel 90 BalVt	HSK8
HM222280	Channel 90 Trans	HSK8
HM223280	Channel 91 MPhase	HSK8
HM224280	Channel 91 BiasCt	HSK8
HM225280	Channel 91 BalVt	HSK8
HM226280	Channel 91 Trans	HSK8
HM227280	Channel 92 MPhase	HSK8
HM228280	Channel 92 BiasCt	HSK8

HM229280	Channel 92 BalVt	HSK8
HM230280	Channel 92 Trans	HSK8
HM231280	Channel 93 MPhase	HSK8
HM232280	Channel 93 BiasCt	HSK8
HM233280	Channel 93 BalVt	HSK8
HM234280	Channel 93 Trans	HSK8
HM235280	Channel 94 MPhase	HSK8
HM236280	Channel 94 BiasCt	HSK8
HM237280	Channel 94 BalVt	HSK8
HM238280	Channel 94 Trans	HSK8
HM239280	Channel 95 MPhase	HSK8
HM240280	Channel 95 BiasCt	HSK8
HM241280	Channel 95 BalVt	HSK8
HM242280	Channel 95 Trans	HSK8
HM243280	Channel A0 MPhase	HSK9
HM244280	Channel A0 BiasCt	HSK9
HM245280	Channel A0 BalVt	HSK9
HM246280	Channel A0 Trans	HSK9
HM247280	Channel A1 MPhase	HSK9
HM248280	Channel A1 BiasCt	HSK9
HM249280	Channel A1 BalVt	HSK9
HM250280	Channel A1 Trans	HSK9
HM251280	Channel A2 MPhase	HSK9
HM252280	Channel A2 BiasCt	HSK9
HM253280	Channel A2 BalVt	HSK9
HM254280	Channel A2 Trans	HSK9
HM255280	Channel A3 MPhase	HSK9
HM256280	Channel A3 BiasCt	HSK9
HM257280	Channel A3 BalVt	HSK9
HM258280	Channel A3 Trans	HSK9
HM259280	Channel A4 MPhase	HSK9
HM260280	Channel A4 BiasCt	HSK9
HM261280	Channel A4 BalVt	HSK9
HM262280	Channel A4 Trans	HSK9
HM263280	Channel A5 MPhase	HSK9
HM264280	Channel A5 BiasCt	HSK9
HM265280	Channel A5 BalVt	HSK9
HM266280	Channel A5 Trans	HSK9
HM267280	Channel B0 MPhase	HSK9
HM268280	Channel B0 BiasCt	HSK9
HM269280	Channel B0 BalVt	HSK9
HM270280	Channel B0 Trans	HSK9
HM271280	Channel B1 MPhase	HSK9
HM272280	Channel B1 BiasCt	HSK9
HM273280	Channel B1 BalVt	HSK9
HM274280	Channel B1 Trans	HSK9
HM275280	Channel B2 MPhase	HSK9
HM276280	Channel B2 BiasCt	HSK9
HM277280	Channel B2 BalVt	HSK9
HM278280	Channel B2 Trans	HSK9
HM279280	Channel B3 MPhase	HSK9
HM280280	Channel B3 BiasCt	HSK9
HM281280	Channel B3 BalVt	HSK9
HM282280	Channel B3 Trans	HSK9
HM283280	Channel B4 MPhase	HSK9
HM284280	Channel B4 BiasCt	HSK9
HM285280	Channel B4 BalVt	HSK9

HM286280	Channel B4 Trans	HSK9
HM287280	Channel B5 MPhase	HSK9
HM288280	Channel B5 BiasCt	HSK9
HM289280	Channel B5 BalVt	HSK9
HM290280	Channel B5 Trans	HSK9
HM291280	Mode of the 12 Cernox (12 LSB	HSK2
HM292280	Cernox Integration Duration (RAW)	HSK2
HM294280	Cernox 0.1K Nom BiasCt (RAW)	HSK2
HM295280	Cernox 0.1K Nom RAW Pos	HSK1, HSK3
HM297280	Cernox 0.1K Nom RAW Neg	HSK1, HSK3
HM300280	Cernox 1.6K Nom BiasCt (RAW)	HSK2
HM301280	Cernox 1.6K Nom RAW Pos	HSK1, HSK3
HM302280	Belt 0 active if =1	HSK2 Diag2
HM303280	Cernox 1.6K Nom RAW Neg	HSK1, HSK3
HM304280	Belt 1 active if =1	HSK2 Diag2
HM306280	Cernox 4K Nom BiasCt (RAW)	HSK2
HM307280	Cernox 4K Nom RAW Pos	HSK1, HSK3
HM308280	Belt 2 active if =1	HSK2 Diag2
HM309280	Cernox 4K Nom RAW Neg	HSK1, HSK3
HM310280	Belt 3 active if =1	HSK2 Diag2
HM312280	Cernox 4-1.6K Nom BiasCt (RAW)	HSK2
HM313280	Cernox 4-1.6KT Nom RAW Pos	HSK1, HSK3
HM314280	Belt 4 active if =1	HSK2 Diag2
HM315280	Cernox 4-1.6KT Nom RAW Neg	HSK1, HSK3
HM316280	Belt 5 active if =1	HSK2 Diag2
HM318280	Cernox 18K Nom BiasCt (RAW)	HSK2
HM319280	Cernox 18K Nom RAW Pos	HSK1, HSK3
HM320280	Belt 6 active if =1	HSK2 Diag2
HM321280	Cernox 18K Nom RAW Neg	HSK1, HSK3
HM322280	Belt 7 active if =1	HSK2 Diag2
HM324280	Cernox 50K Nom BiasCt (RAW)	HSK2
HM325280	Cernox 50K Nom RAW Pos	HSK1, HSK3
HM326280	Belt 8 active if =1	HSK2 Diag2
HM327280	Cernox 50K Nom RAW Neg	HSK1, HSK3
HM328280	Belt 9 active if =1	HSK2 Diag2
HM330280	Cernox 0.1K Red BiasCt (RAW)	HSK2
HM331280	Cernox 0.1K Red RAW Pos	HSK1, HSK3
HM332280	Belt A active if =1	HSK2 Diag2
HM333280	Cernox 0.1K Red RAW Neg	HSK1, HSK3
HM334280	Belt B active if =1	HSK2 Diag2
HM336280	Cernox 1.6K Red BiasCt (RAW)	HSK2
HM337280	Cernox 1.6K Red RAW Pos	HSK1, HSK3
HM338280	REU EEPROM Config 0 Valid (1=valid)	Diag2
HM339280	Cernox 1.6K Red RAW Neg	HSK1, HSK3
HM340280	REU EEPROM Config 1 Valid (1=valid)	Diag2
HM342280	Cernox 4K Red BiasCt (RAW)	HSK2
HM343280	Cernox 4K Red RAW Pos	HSK1, HSK3
HM344280	REU EEPROM Config 2 Valid (1=valid)	Diag2
HM345280	Cernox 4K Red RAW Neg	HSK1, HSK3
HM346280	REU EEPROM error (status 2 bit 6)	Diag2
HM346280	REU DEEPROM error (1=eror)	HSK1, HSK3
HM348280	Cernox 4-1.6K Red BiasCt (RAW)	HSK2
HM349280	Cernox 4-1.6KT Red RAW Pos	HSK1, HSK3
HM350280	REU DRAM error (status 2 bit 7)	Diag2
HM350280	REU DRAM error (1=eror)	HSK1, HSK3
HM351280	Cernox 4-1.6KT Red RAW Neg	HSK1, HSK3
HM352280	REU DPRAM error (status 2 bit 8)	Diag2

HM352280	REU DPRAM error (1=eror)	HSK1, HSK3
HM354280	Cernox 18K red BiasCt (RAW)	HSK2
HM355280	Cernox 18K Red RAW Pos	HSK1, HSK3
HM356280	REU PROM error (status 2 bit 9)	Diag2
HM356280	REU PROM error (1=eror)	HSK1, HSK3
HM357280	Cernox 18K Red RAW Neg	HSK1, HSK3
HM358280	REU Belt Synchro error (status 2 bit 10)	Diag2
HM358280	REU PPFSync error (1=eror)	HSK1, HSK3
HM360280	Cernox 50K Red BiasCt (RAW)	HSK2
HM361280	Cernox 50K Red RAW Pos	HSK1, HSK3
HM363280	Cernox 50K Red RAW Neg	HSK1, HSK3
HM366280	PID BOLO IntTime	HSK4
HM367280	PID BOLO Setpoint	HSK4
HM368280	PID BOLO PropGain	HSK4
HM369280	PID BOLO IntGain	HSK4
HM370280	PID BOLO DerivGain	HSK4
HM371280	PID BOLO Nom Heat Power LW	HSK1, HSK3
HM372280	PID BOLO Nom Heat Power MW	HSK1, HSK3
HM373280	PID BOLO Red Heat Power LW	HSK1, HSK3
HM374280	PID BOLO Red Heat Power MW	HSK1, HSK3
HM375280	PID BOLO Exposant	HSK4
HM377280	PID DILU IntTime	HSK5
HM378280	PID DILU Setpoint	HSK5
HM379280	PID DILU PropGain	HSK5
HM380280	PID DILU IntGain	HSK5
HM381280	PID DILU DerivGain	HSK5
HM382280	PID DILU Nom Heat Power LW	HSK1, HSK3
HM383280	PID DILU Nom Heat Power MW	HSK1, HSK3
HM384280	PID DILU Red Heat Power LW	HSK1, HSK3
HM385280	PID DILU Red Heat Power MW	HSK1, HSK3
HM386280	PID DILU Exposant	HSK5
HM388280	PID 1.6K IntTime	HSK6
HM389280	PID 1.6K Setpoint	HSK6
HM390280	PID 1.6K PropGain	HSK6
HM391280	PID 1.6K IntGain	HSK6
HM392280	PID 1.6K DerivGain	HSK6
HM393280	PID 1.6K Nom Heat Power LW	HSK1, HSK3
HM394280	PID 1.6K Nom Heat Power MW	HSK1, HSK3
HM395280	PID 1.6K Red Heat Power LW	HSK1, HSK3
HM396280	PID 1.6K Red Heat Power MW	HSK1, HSK3
HM397280	PID 1.6K Exposant	HSK6
HM399280	PID 4K IntTime	HSK7
HM400280	PID 4K Setpoint	HSK7
HM401280	PID 4K PropGain	HSK7
HM402280	PID 4K IntGain	HSK7
HM403280	PID 4K DerivGain	HSK7
HM404280	PID 4K Nom Heat Power LW	HSK1, HSK3
HM405280	PID 4K Nom Heat Power MW	HSK1, HSK3
HM406280	PID 4K Red Heat Power LW	HSK1, HSK3
HM407280	PID 4K Red Heat Power MW	HSK1, HSK3
HM408280	PID 4K Exposant	HSK7
HM410280	PID Switch 4K/1.6K IntTime	HSK8
HM411280	PID Switch 4K/1.6K Setpoint	HSK8
HM412280	PID Switch 4K/1.6K PropGain	HSK8
HM413280	PID Switch 4K/1.6K IntGain	HSK8
HM414280	PID Switch 4K/1.6K DerivGain	HSK8
HM415280	PID Switch 1.6-4K Nom Heat Power LW	HSK1, HSK3
HM416280	PID Switch 1.6-4K Nom Heat Power MW	HSK1, HSK3

HM417280	PID Switch 1.6-4K Red Heat Power LW	HSK1, HSK3
HM418280	PID Switch 1.6-4K Red Heat Power MW	HSK1, HSK3
HM419280	PID Switch 4K/1.6K Exposant	HSK8
HM432280	JFET Temp Belt 0 (V)	HSK1, HSK3
HM433280	JFET 0 IntTime	HSK4
HM434280	JFET 0 Setpoint	HSK4
HM435280	JFET 0 PropGain	HSK4
HM436280	JFET 0 IntGain	HSK4
HM437280	JFET 0 Exponent RAW	HSK4
HM438280	Heater Power JFET 0 Raw	HSK1, HSK3
HM440280	JFET Temp Belt 1 (V)	HSK1, HSK3
HM441280	JFET 1 IntTime	HSK4
HM442280	JFET 1 Setpoint	HSK4
HM443280	JFET 1 PropGain	HSK4
HM444280	JFET 1 IntGain	HSK4
HM445280	JFET 1 Exponent RAW	HSK4
HM446280	Heater Power JFET 1 Raw	HSK1, HSK3
HM448280	JFET Temp Belt 2 (V)	HSK1, HSK3
HM449280	JFET 2 IntTime	HSK5
HM450280	JFET 2 Setpoint	HSK5
HM451280	JFET 2 PropGain	HSK5
HM452280	JFET 2 IntGain	HSK5
HM453280	JFET 2 Exponent	HSK5
HM454280	Heater Power JFET 2 Raw	HSK1, HSK3
HM456280	JFET Temp Belt 3 (V)	HSK1, HSK3
HM457280	JFET 3 IntTime	HSK5
HM458280	JFET 3 Setpoint	HSK5
HM459280	JFET 3 PropGain	HSK5
HM460280	JFET 3 IntGain	HSK5
HM461280	JFET 3 Exponent RAW	HSK5
HM462280	Heater Power JFET 3 Raw	HSK1, HSK3
HM464280	JFET Temp Belt 4 (V)	HSK1, HSK3
HM465280	JFET 4 IntTime	HSK6
HM466280	JFET 4 Setpoint	HSK6
HM467280	JFET 4 PropGain	HSK6
HM468280	JFET 4 IntGain	HSK6
HM469280	JFET 4 Exponent RAW	HSK6
HM470280	Heater Power JFET 4 Raw	HSK1, HSK3
HM472280	JFET Temp Belt 5 (V)	HSK1, HSK3
HM473280	JFET 5 IntTime	HSK6
HM474280	JFET 5 Setpoint	HSK6
HM475280	JFET 5 PropGain	HSK6
HM476280	JFET 5 IntGain	HSK6
HM477280	JFET 5 Exponent RAW	HSK6
HM478280	Heater Power JFET 5 Raw	HSK1, HSK3
HM480280	JFET Temp Belt 6 (V)	HSK1, HSK3
HM481280	JFET 6 IntTime	HSK7
HM482280	JFET 6 Setpoint	HSK7
HM483280	JFET 6 PropGain	HSK7
HM484280	JFET 6 IntGain	HSK7
HM485280	JFET 6 Exponent RAW	HSK7
HM486280	Heater Power JFET 6 Raw	HSK1, HSK3
HM488280	JFET Temp Belt 7 (V)	HSK1, HSK3
HM489280	JFET 7 IntTime	HSK7
HM490280	JFET 7 Setpoint	HSK7
HM491280	JFET 7 PropGain	HSK7
HM492280	JFET 7 IntGain	HSK7

HM493280	JFET 7 Exponent RAW	HSK7
HM494280	Heater Power JFET 7 Raw	HSK1, HSK3
HM496280	JFET Temp Belt 8 (V)	HSK1, HSK3
HM497280	JFET 8 IntTime	HSK8
HM498280	JFET 8 Setpoint	HSK8
HM499280	JFET 8 PropGain	HSK8
HM500280	JFET 8 IntGain	HSK8
HM501280	JFET 8 Exponent RAW	HSK8
HM502280	Heater Power JFET 8 Raw	HSK1, HSK3
HM504280	JFET Temp Belt 9 (V)	HSK1, HSK3
HM505280	JFET 9 IntTime	HSK8
HM506280	JFET 9 Setpoint	HSK8
HM507280	JFET 9 PropGain	HSK8
HM508280	JFET 9 IntGain	HSK8
HM509280	JFET 9 Exponent RAW	HSK8
HM510280	Heater Power JFET 9 Raw	HSK1, HSK3
HM512280	JFET Temp Belt A (V)	HSK1, HSK3
HM513280	JFET A IntTime	HSK9
HM514280	JFET A Setpoint	HSK9
HM515280	JFET A PropGain	HSK9
HM516280	JFET A IntGain	HSK9
HM517280	JFET A Exponent RAW	HSK9
HM518280	Heater Power JFET A Raw	HSK1, HSK3
HM520280	JFET Temp Belt B (V)	HSK1, HSK3
HM521280	JFET B IntTime	HSK9
HM522280	JFET B Setpoint	HSK9
HM523280	JFET B PropGain	HSK9
HM524280	JFET B IntGain	HSK9
HM525280	JFET B Exponent RAW	HSK9
HM526280	Heater Power JFET B Raw	HSK1, HSK3
HM527280	PAU Temp Belt 0 (°C)	HSK1, HSK3
HM528280	PAU Temp Belt 1 (°C)	HSK1, HSK3
HM529280	PAU Temp Belt 2 (°C)	HSK1, HSK3
HM530280	PAU Temp Belt 3 (°C)	HSK1, HSK3
HM531280	PAU Temp Belt 4 (°C)	HSK1, HSK3
HM532280	PAU Temp Belt 5 (°C)	HSK1, HSK3
HM533280	PAU Temp Belt 6 (°C)	HSK1, HSK3
HM534280	PAU Temp Belt 7 (°C)	HSK1, HSK3
HM535280	PAU Temp Belt 8 (°C)	HSK1, HSK3
HM536280	PAU Temp Belt 9 (°C)	HSK1, HSK3
HM537280	PAU Temp Belt A (°C)	HSK1, HSK3
HM538280	PAU Temp Belt B (°C)	HSK1, HSK3
HM539280	REU Temp Belt 0 (°C)	HSK1, HSK3
HM540280	REU Temp Belt 1 (°C)	HSK1, HSK3
HM541280	REU Temp Belt 2 (°C)	HSK1, HSK3
HM542280	REU Temp Belt 3 (°C)	HSK1, HSK3
HM543280	REU Temp Belt 4 (°C)	HSK1, HSK3
HM544280	REU Temp Belt 5 (°C)	HSK1, HSK3
HM545280	REU Temp Belt 6 (°C)	HSK1, HSK3
HM546280	REU Temp Belt 7 (°C)	HSK1, HSK3
HM547280	REU Temp Belt 8 (°C)	HSK1, HSK3
HM548280	REU Temp Belt 9 (°C)	HSK1, HSK3
HM549280	REU Temp Belt A (°C)	HSK1, HSK3
HM550280	REU Temp Belt B (°C)	HSK1, HSK3
HM551280	REU Temp Processor (°C)	HSK1, HSK3
HM552280	REU Voltage Belt 0 (V)	HSK1, HSK3
HM553280	REU Voltage Belt 1 (V)	HSK1, HSK3

HM554280	REU Voltage Belt 2 (V)	HSK1, HSK3
HM555280	REU Voltage Belt 3 (V)	HSK1, HSK3
HM556280	REU Voltage Belt 4 (V)	HSK1, HSK3
HM557280	REU Voltage Belt 5 (V)	HSK1, HSK3
HM558280	REU Voltage Belt 6 (V)	HSK1, HSK3
HM559280	REU Voltage Belt 7 (V)	HSK1, HSK3
HM560280	REU Voltage Belt 8 (V)	HSK1, HSK3
HM561280	REU Voltage Belt 9 (V)	HSK1, HSK3
HM562280	REU Voltage Belt A (V)	HSK1, HSK3
HM563280	REU Voltage Belt B (V)	HSK1, HSK3
HM564280	REU Voltage Processor (V)	HSK1, HSK3
HM565280	REU Mode	HSK1, HSK3, Diag2
HM566280	REU Last Command Executed	HSK1, HSK3, Diag2
HM567280	REU Error STATUS 2 word	Diag2
HM567280	REU Complete Error STATUS 2	HSK1, HSK3
HM568280	REU ASW Version	Diag2
HM569280	REU PRAM status 5 Word	Diag2
HM570280	REU DRAM status 6 Word	Diag2
HM571280	REU Preprocessor status 8 Word	HSK2, Diag2
HM572280	REU EEPROM Configuration status 9 word	Diag2
HM573280	REU FPGA version (=0x12)	Diag2
HM574280	REU belts status (12bit) (4095 = all active)	HSK2, Diag2
HM577280	VI or Optim Keep current Gamp	HSK2
HM579280	VI TtuneCnt	HSK2
HM580280	VIO Channel	HSK1, HSK3
HM581280	VIO Gamp Init	HSK1, HSK3
HM582280	VIO T Init	HSK1, HSK3
HM583280	VIO Cv	HSK1, HSK3
HM584280	VIO Ct	HSK1, HSK3
HM586280	VIO Blanck V	HSK1, HSK3
HM589280	VI Continue On Failure	HSK2
HM590280	VI Imin	HSK2
HM591280	VI Imax	HSK2
HM592280	VI Scale (0=lin; 1=log)	HSK2
HM593280	VI Nb of steps between Imin and Imax	HSK2
HM594280	VI delay	HSK2
HM595280	VI or Optim Channel 00 to 15 selection	HSK2
HM596280	VI or Optim Channel 20 to 35 selection	HSK2
HM597280	VI or Optim Channel 40 to 55 selection	HSK2
HM598280	VI or Optim Channel 60 to 75 selection	HSK2
HM599280	VI or Optim Channel 80 to 95 selection	HSK2
HM600280	VI or Optim Channel A0 to B5 selection	HSK2

HM602280	RS00-RawSignal	HSK4
HM603280	RS01-RawSignal	HSK4
HM604280	RS02-RawSignal	HSK4
HM605280	RS03-RawSignal	HSK4
HM606280	RS04-RawSignal	HSK4
HM607280	RS05-RawSignal	HSK4
HM608280	RS10-RawSignal	HSK4
HM609280	RS11-RawSignal	HSK4
HM610280	RS12-RawSignal	HSK4
HM611280	RS13-RawSignal	HSK4
HM612280	RS14-RawSignal	HSK4
HM613280	RS15-RawSignal	HSK4
HM614280	RS20-RawSignal	HSK5
HM615280	RS21-RawSignal	HSK5
HM616280	RS22-RawSignal	HSK5
HM617280	RS23-RawSignal	HSK5
HM618280	RS24-RawSignal	HSK5
HM619280	RS25-RawSignal	HSK5
HM620280	RS30-RawSignal	HSK5
HM621280	RS31-RawSignal	HSK5
HM622280	RS32-RawSignal	HSK5
HM623280	RS33-RawSignal	HSK5
HM624280	RS34-RawSignal	HSK5
HM625280	RS35-RawSignal	HSK5
HM626280	RS40-RawSignal	HSK6
HM627280	RS41-RawSignal	HSK6
HM628280	RS42-RawSignal	HSK6
HM629280	RS43-RawSignal	HSK6
HM630280	RS44-RawSignal	HSK6
HM631280	RS45-RawSignal	HSK6
HM632280	RS50-RawSignal	HSK6
HM633280	RS51-RawSignal	HSK6
HM634280	RS52-RawSignal	HSK6
HM635280	RS53-RawSignal	HSK6
HM636280	RS54-RawSignal	HSK6
HM637280	RS55-RawSignal	HSK6
HM638280	RS60-RawSignal	HSK7
HM639280	RS61-RawSignal	HSK7
HM640280	RS62-RawSignal	HSK7
HM641280	RS63-RawSignal	HSK7
HM642280	RS64-RawSignal	HSK7
HM643280	RS65-RawSignal	HSK7
HM644280	RS70-RawSignal	HSK7
HM645280	RS71-RawSignal	HSK7
HM646280	RS72-RawSignal	HSK7
HM647280	RS73-RawSignal	HSK7
HM648280	RS74-RawSignal	HSK7
HM649280	RS75-RawSignal	HSK7
HM650280	RS80-RawSignal	HSK8
HM651280	RS81-RawSignal	HSK8
HM652280	RS82-RawSignal	HSK8
HM653280	RS83-RawSignal	HSK8
HM654280	RS84-RawSignal	HSK8
HM655280	RS85-RawSignal	HSK8
HM656280	RS90-RawSignal	HSK8
HM657280	RS91-RawSignal	HSK8

HM658280	RS92-RawSignal	HSK8
HM659280	RS93-RawSignal	HSK8
HM660280	RS94-RawSignal	HSK8
HM661280	RS95-RawSignal	HSK8
HM662280	RSA0-RawSignal	HSK9
HM663280	RSA1-RawSignal	HSK9
HM664280	RSA2-RawSignal	HSK9
HM665280	RSA3-RawSignal	HSK9
HM666280	RSA4-RawSignal	HSK9
HM667280	RSA5-RawSignal	HSK9
HM668280	RSB0-RawSignal	HSK9
HM669280	RSB1-RawSignal	HSK9
HM670280	RSB2-RawSignal	HSK9
HM671280	RSB3-RawSignal	HSK9
HM672280	RSB4-RawSignal	HSK9
HM673280	RSB5-RawSignal	HSK9
HM674280	Cernox Channel	HSK2
HM676280	F Div (raw)	HSK1, HSK3
HM677280	N Sample (per half modulation period)	HSK1, HSK3
HM678280	Raw Signal Mode	HSK1, HSK3
HM679280	REU RAW Signal Belt	HSK1, HSK3
HM680280	REU RAW Signal Channel	HSK1, HSK3
HM681280	Channel 00 NBlanck	HSK4
HM682280	Channel 01 NBlanck	HSK4
HM683280	Channel 02 NBlanck	HSK4
HM684280	Channel 03 NBlanck	HSK4
HM685280	Channel 04 NBlanck	HSK4
HM686280	Channel 05 NBlanck	HSK4
HM687280	Channel 10 NBlanck	HSK4
HM688280	Channel 11 NBlanck	HSK4
HM689280	Channel 12 NBlanck	HSK4
HM690280	Channel 13 NBlanck	HSK4
HM691280	Channel 14 NBlanck	HSK4
HM692280	Channel 15 NBlanck	HSK4
HM693280	Channel 20 NBlanck	HSK5
HM694280	Channel 21 NBlanck	HSK5
HM695280	Channel 22 NBlanck	HSK5
HM696280	Channel 23 NBlanck	HSK5
HM697280	Channel 24 NBlanck	HSK5
HM698280	Channel 25 NBlanck	HSK5
HM699280	Channel 30 NBlanck	HSK5
HM700280	Channel 31 NBlanck	HSK5
HM701280	Channel 32 NBlanck	HSK5
HM702280	Channel 33 NBlanck	HSK5
HM703280	Channel 34 NBlanck	HSK5
HM704280	Channel 35 NBlanck	HSK5
HM705280	Channel 40 NBlanck	HSK6
HM706280	Channel 41 NBlanck	HSK6
HM707280	Channel 42 NBlanck	HSK6
HM708280	Channel 43 NBlanck	HSK6
HM709280	Channel 44 NBlanck	HSK6
HM710280	Channel 45 NBlanck	HSK6
HM711280	Channel 50 NBlanck	HSK6
HM712280	Channel 51 NBlanck	HSK6
HM713280	Channel 52 NBlanck	HSK6
HM714280	Channel 53 NBlanck	HSK6
HM715280	Channel 54 NBlanck	HSK6

HM716280	Channel 55 NBlanck	HSK6
HM717280	Channel 60 NBlanck	HSK7
HM718280	Channel 61 NBlanck	HSK7
HM719280	Channel 62 NBlanck	HSK7
HM720280	Channel 63 NBlanck	HSK7
HM721280	Channel 64 NBlanck	HSK7
HM722280	Channel 65 NBlanck	HSK7
HM723280	Channel 70 NBlanck	HSK7
HM724280	Channel 71 NBlanck	HSK7
HM725280	Channel 72 NBlanck	HSK7
HM726280	Channel 73 NBlanck	HSK7
HM727280	Channel 74 NBlanck	HSK7
HM728280	Channel 75 NBlanck	HSK7
HM729280	Channel 80 NBlanck	HSK8
HM730280	Channel 81 NBlanck	HSK8
HM731280	Channel 82 NBlanck	HSK8
HM732280	Channel 83 NBlanck	HSK8
HM733280	Channel 84 NBlanck	HSK8
HM734280	Channel 85 NBlanck	HSK8
HM735280	Channel 90 NBlanck	HSK8
HM736280	Channel 91 NBlanck	HSK8
HM737280	Channel 92 NBlanck	HSK8
HM738280	Channel 93 NBlanck	HSK8
HM739280	Channel 94 NBlanck	HSK8
HM740280	Channel 95 NBlanck	HSK8
HM741280	Channel A0 NBlanck	HSK9
HM742280	Channel A1 NBlanck	HSK9
HM743280	Channel A2 NBlanck	HSK9
HM744280	Channel A3 NBlanck	HSK9
HM745280	Channel A4 NBlanck	HSK9
HM746280	Channel A5 NBlanck	HSK9
HM747280	Channel B0 NBlanck	HSK9
HM748280	Channel B1 NBlanck	HSK9
HM749280	Channel B2 NBlanck	HSK9
HM750280	Channel B3 NBlanck	HSK9
HM751280	Channel B4 NBlanck	HSK9
HM752280	Channel B5 NBlanck	HSK9
HM753280	Channel 00 SPhase	HSK4
HM754280	Channel 01 SPhase	HSK4
HM755280	Channel 02 SPhase	HSK4
HM756280	Channel 03 SPhase	HSK4
HM757280	Channel 04 SPhase	HSK4
HM758280	Channel 05 SPhase	HSK4
HM759280	Channel 10 SPhase	HSK4
HM760280	Channel 11 SPhase	HSK4
HM761280	Channel 12 SPhase	HSK4
HM762280	Channel 13 SPhase	HSK4
HM763280	Channel 14 SPhase	HSK4
HM764280	Channel 15 SPhase	HSK4
HM765280	Channel 20 SPhase	HSK5
HM766280	Channel 21 SPhase	HSK5
HM767280	Channel 22 SPhase	HSK5
HM768280	Channel 23 SPhase	HSK5
HM769280	Channel 24 SPhase	HSK5
HM770280	Channel 25 SPhase	HSK5
HM771280	Channel 30 SPhase	HSK5
HM772280	Channel 31 SPhase	HSK5

HM773280	Channel 32 SPhase	HSK5
HM774280	Channel 33 SPhase	HSK5
HM775280	Channel 34 SPhase	HSK5
HM776280	Channel 35 SPhase	HSK5
HM777280	Channel 40 SPhase	HSK6
HM778280	Channel 41 SPhase	HSK6
HM779280	Channel 42 SPhase	HSK6
HM780280	Channel 43 SPhase	HSK6
HM781280	Channel 44 SPhase	HSK6
HM782280	Channel 45 SPhase	HSK6
HM783280	Channel 50 SPhase	HSK6
HM784280	Channel 51 SPhase	HSK6
HM785280	Channel 52 SPhase	HSK6
HM786280	Channel 53 SPhase	HSK6
HM787280	Channel 54 SPhase	HSK6
HM788280	Channel 55 SPhase	HSK6
HM789280	Channel 60 SPhase	HSK7
HM790280	Channel 61 SPhase	HSK7
HM791280	Channel 62 SPhase	HSK7
HM792280	Channel 63 SPhase	HSK7
HM793280	Channel 64 SPhase	HSK7
HM794280	Channel 65 SPhase	HSK7
HM795280	Channel 70 SPhase	HSK7
HM796280	Channel 71 SPhase	HSK7
HM797280	Channel 72 SPhase	HSK7
HM798280	Channel 73 SPhase	HSK7
HM799280	Channel 74 SPhase	HSK7
HM800280	Channel 75 SPhase	HSK7
HM801280	Channel 80 SPhase	HSK8
HM802280	Channel 81 SPhase	HSK8
HM803280	Channel 82 SPhase	HSK8
HM804280	Channel 83 SPhase	HSK8
HM805280	Channel 84 SPhase	HSK8
HM806280	Channel 85 SPhase	HSK8
HM807280	Channel 90 SPhase	HSK8
HM808280	Channel 91 SPhase	HSK8
HM809280	Channel 92 SPhase	HSK8
HM810280	Channel 93 SPhase	HSK8
HM811280	Channel 94 SPhase	HSK8
HM812280	Channel 95 SPhase	HSK8
HM813280	Channel A0 SPhase	HSK9
HM814280	Channel A1 SPhase	HSK9
HM815280	Channel A2 SPhase	HSK9
HM816280	Channel A3 SPhase	HSK9
HM817280	Channel A4 SPhase	HSK9
HM818280	Channel A5 SPhase	HSK9
HM819280	Channel B0 SPhase	HSK9
HM820280	Channel B1 SPhase	HSK9
HM821280	Channel B2 SPhase	HSK9
HM822280	Channel B3 SPhase	HSK9
HM823280	Channel B4 SPhase	HSK9
HM824280	Channel B5 SPhase	HSK9
HM825280	Channel 00 Gamp	HSK4
HM826280	Channel 01 Gamp	HSK4
HM827280	Channel 02 Gamp	HSK4
HM828280	Channel 03 Gamp	HSK4
HM829280	Channel 04 Gamp	HSK4

HM830280	Channel 05 Gamp	HSK4
HM831280	Channel 10 Gamp	HSK4
HM832280	Channel 11 Gamp	HSK4
HM833280	Channel 12 Gamp	HSK4
HM834280	Channel 13 Gamp	HSK4
HM835280	Channel 14 Gamp	HSK4
HM836280	Channel 15 Gamp	HSK4
HM837280	Channel 20 Gamp	HSK5
HM838280	Channel 21 Gamp	HSK5
HM839280	Channel 22 Gamp	HSK5
HM840280	Channel 23 Gamp	HSK5
HM841280	Channel 24 Gamp	HSK5
HM842280	Channel 25 Gamp	HSK5
HM843280	Channel 30 Gamp	HSK5
HM844280	Channel 31 Gamp	HSK5
HM845280	Channel 32 Gamp	HSK5
HM846280	Channel 33 Gamp	HSK5
HM847280	Channel 34 Gamp	HSK5
HM848280	Channel 35 Gamp	HSK5
HM849280	Channel 40 Gamp	HSK6
HM850280	Channel 41 Gamp	HSK6
HM851280	Channel 42 Gamp	HSK6
HM852280	Channel 43 Gamp	HSK6
HM853280	Channel 44 Gamp	HSK6
HM854280	Channel 45 Gamp	HSK6
HM855280	Channel 50 Gamp	HSK6
HM856280	Channel 51 Gamp	HSK6
HM857280	Channel 52 Gamp	HSK6
HM858280	Channel 53 Gamp	HSK6
HM859280	Channel 54 Gamp	HSK6
HM860280	Channel 55 Gamp	HSK6
HM861280	Channel 60 Gamp	HSK7
HM862280	Channel 61 Gamp	HSK7
HM863280	Channel 62 Gamp	HSK7
HM864280	Channel 63 Gamp	HSK7
HM865280	Channel 64 Gamp	HSK7
HM866280	Channel 65 Gamp	HSK7
HM867280	Channel 70 Gamp	HSK7
HM868280	Channel 71 Gamp	HSK7
HM869280	Channel 72 Gamp	HSK7
HM870280	Channel 73 Gamp	HSK7
HM871280	Channel 74 Gamp	HSK7
HM872280	Channel 75 Gamp	HSK7
HM873280	Channel 80 Gamp	HSK8
HM874280	Channel 81 Gamp	HSK8
HM875280	Channel 82 Gamp	HSK8
HM876280	Channel 83 Gamp	HSK8
HM877280	Channel 84 Gamp	HSK8
HM878280	Channel 85 Gamp	HSK8
HM879280	Channel 90 Gamp	HSK8
HM880280	Channel 91 Gamp	HSK8
HM881280	Channel 92 Gamp	HSK8
HM882280	Channel 93 Gamp	HSK8
HM883280	Channel 94 Gamp	HSK8
HM884280	Channel 95 Gamp	HSK8
HM885280	Channel A0 Gamp	HSK9
HM886280	Channel A1 Gamp	HSK9

HM887280	Channel A2 Gamp	HSK9
HM888280	Channel A3 Gamp	HSK9
HM889280	Channel A4 Gamp	HSK9
HM890280	Channel A5 Gamp	HSK9
HM891280	Channel B0 Gamp	HSK9
HM892280	Channel B1 Gamp	HSK9
HM893280	Channel B2 Gamp	HSK9
HM894280	Channel B3 Gamp	HSK9
HM895280	Channel B4 Gamp	HSK9
HM896280	Channel B5 Gamp	HSK9
HM897280	Cernox 0.1K Nom Gamp	HSK2
HM898280	Cernox 1.6K Nom Gamp	HSK2
HM899280	Cernox 4K Nom Gamp	HSK2
HM900280	Cernox 4-1.6K Nom Gamp	HSK2
HM901280	Cernox 18K Nom Gamp	HSK2
HM902280	Cernox 50K Nom Gamp	HSK2
HM903280	Cernox 0.1K Red Gamp	HSK2
HM904280	Cernox 1.6K Red Gamp	HSK2
HM905280	Cernox 4K Red Gamp	HSK2
HM906280	Cernox 4-1.6K Red Gamp	HSK2
HM907280	Cernox 18K red Gamp	HSK2
HM908280	Cernox 50K Red Gamp	HSK2
HM909280	Cernox 0.1K Nom Nblanck	HSK2
HM910280	Cernox 1.6K Nom Nblanck	HSK2
HM911280	Cernox 4K Nom Nblanck	HSK2
HM912280	Cernox 4-1.6K Nom Nblanck	HSK2
HM913280	Cernox 18K Nom Nblanck	HSK2
HM914280	Cernox 50K Nom Nblanck	HSK2
HM915280	Cernox 0.1K Red Nblanck	HSK2
HM916280	Cernox 1.6K Red Nblanck	HSK2
HM917280	Cernox 4K Red Nblanck	HSK2
HM918280	Cernox 4-1.6K Red Nblanck	HSK2
HM919280	Cernox 18K red Nblanck	HSK2
HM920280	Cernox 50K Red Nblanck	HSK2
HM921280	Cernox 0.1K Nom Mode	HSK2
HM922280	Cernox 1.6K Nom Mode	HSK2
HM923280	Cernox 4K Nom Mode	HSK2
HM924280	Cernox 4-1.6K Nom Mode	HSK2
HM925280	Cernox 18K Nom Mode	HSK2
HM926280	Cernox 50K Nom Mode	HSK2
HM927280	Cernox 0.1K Red Mode	HSK2
HM928280	Cernox 1.6K Red Mode	HSK2
HM929280	Cernox 0.1K Red Mode	HSK2
HM930280	Cernox 4-1.6K Red Mode	HSK2
HM931280	Cernox 18K red Mode	HSK2
HM932280	Cernox 50K Red Mode	HSK2
HM933280	PID BOLO Mode (1=servo ON)	HSK4
HM934280	PID DILU Mode (1=servo ON)	HSK5
HM935280	PID 1.6K Mode(1=servo ON)	HSK6
HM936280	PID 4K Mode(1=servo ON)	HSK7
HM937280	PID Switch 4K/1.6K Mode (1=servo ON)	HSK8
HM939280	PID BOLO Heater conf (0=nom)	HSK4
HM940280	PID DILU Heater conf (0=nom)	HSK5
HM941280	PID 1.6K Heater conf (0=nom)	HSK6
HM942280	PID 4K Heater conf (0=nom)	HSK7
HM943280	PID Switch 4K/1.6K Heater conf (0=nom)	HSK8
HM945280	PID BOLO Thermo conf (0=nom)	HSK4

HM946280	PID DILU Thermo Conf (0=nom)	HSK5
HM947280	PID 1.6K Thermo conf (0=nom)	HSK6
HM948280	PID 4K Thermo conf (0=nom)	HSK7
HM949280	PID Switch 4K/1.6K Thermo conf (0=nom)	HSK8
HM951280	JFET 0 Mode	HSK4
HM952280	JFET 1 Mode	HSK4
HM953280	JFET 2 Mode	HSK5
HM954280	JFET 3 Mode	HSK5
HM955280	JFET 4 Mode	HSK6
HM956280	JFET 5 Mode	HSK6
HM957280	JFET 6 Mode	HSK7
HM958280	JFET 7 Mode	HSK7
HM959280	JFET 8 Mode	HSK8
HM960280	JFET 9 Mode	HSK8
HM961280	JFET A Mode	HSK9
HM962280	JFET B Mode	HSK9
HM963280	VIO Delta T	HSK1, HSK3
HM964280	VIO Delta V	HSK1, HSK3
HM965280	VIO Max T Iter	HSK1, HSK3
HM966280	VIO Max V Iter	HSK1, HSK3
HM967280	VIO Accur T	HSK1, HSK3
HM968280	VIO Accur V	HSK1, HSK3
HM969280	VIO P2	HSK1, HSK3
HM970280	VIO P1	HSK1, HSK3
HM971280	VI FinTun	HSK2
HM972280	VI TuneIt	HSK2
HM973280	VIO progression	HSK1, HSK3
HM974280	VI0 Step (internal Optim)	HSK1, HSK3
HM975280	VIO end	HSK1, HSK3
HM976280	REU VIOerror (1=eror)	HSK1, HSK3
HM977280	VI Step	HSK1, HSK3
HM978280	VIO Belt	HSK1, HSK3
HM979280	REU pre proc 0 status see HM571280	HSK2 Diag2
HM980280	REU pre proc 1 status see HM571280	HSK2 Diag2
HM981280	REU pre proc 2 status see HM571280	HSK2 Diag2
HM982280	REU pre proc 3 status see HM571280	HSK2 Diag2
HM983280	REU pre proc 4 status see HM571280	HSK2 Diag2
HM984280	REU pre proc 5 status see HM571280	HSK2 Diag2
HM985280	REU pre proc 6 status see HM571280	HSK2 Diag2
HM986280	REU pre proc 7 status see HM571280	HSK2 Diag2
HM987280	REU pre proc 8 status see HM571280	HSK2 Diag2
HM988280	REU pre proc 9 status see HM571280	HSK2 Diag2
HM989280	REU pre proc A status see HM571280	HSK2 Diag2
HM990280	REU pre proc B status see HM571280	HSK2 Diag2
HM991280	REU FIFO status (1 FIFO not empty)	HSK2 Diag2
HM992280	REU Belts Resynchronization in progress (1 in progress)	HSK2, Diag2
HM993280	REU Belts Resynchronization in Failure (1 in failure)	HSK2, Diag2
HM994280	VI or Optim channel	HSK2
HM995280	VI or Optim belt	HSK2
HM996280	VI or Optim list	HSK2
HM997280	VI or Optim V&T optionnal tune	HSK2
HM998280	VI or Optim Cv & Ct measurement	HSK2
HM999280	VI or Optim Keep current T	HSK2