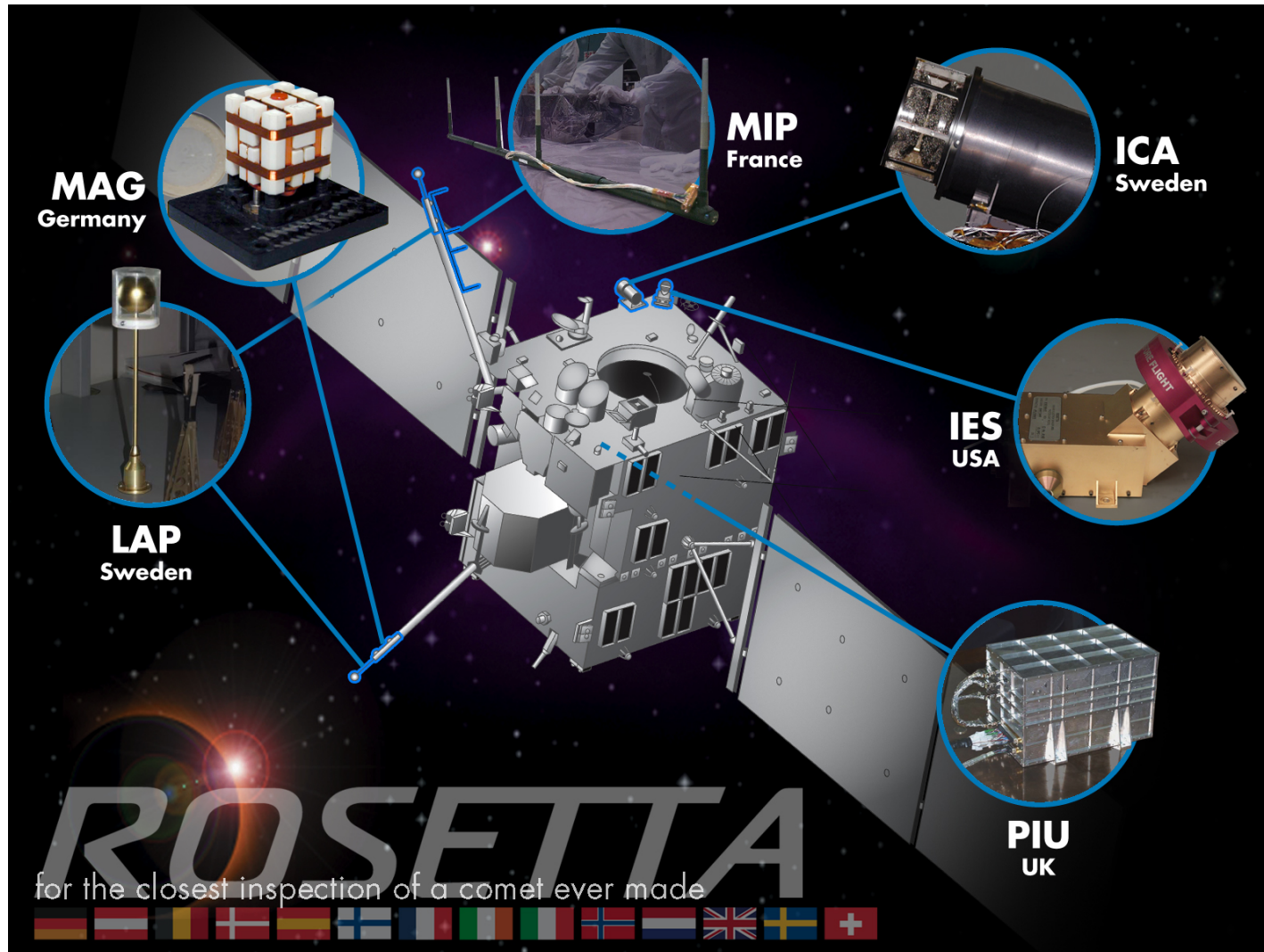
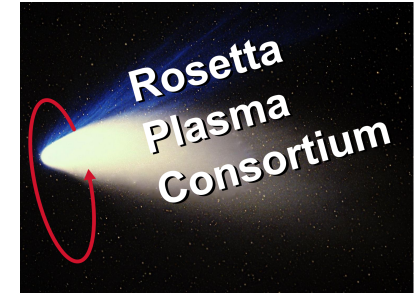
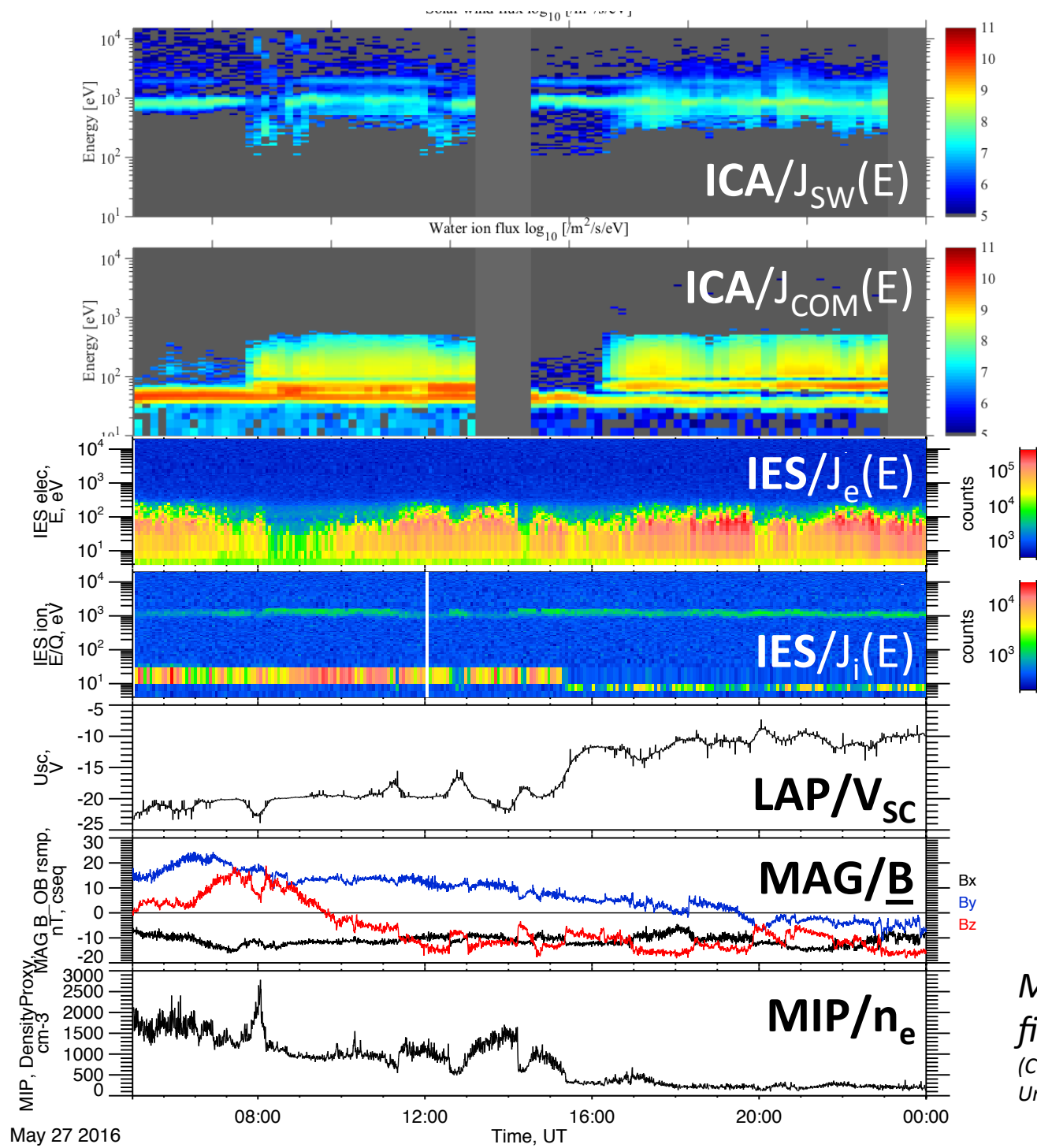
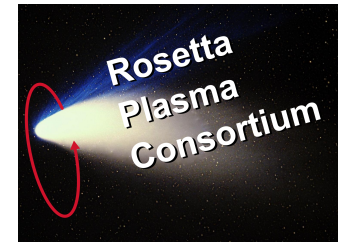




RPC dataset: On the science user end



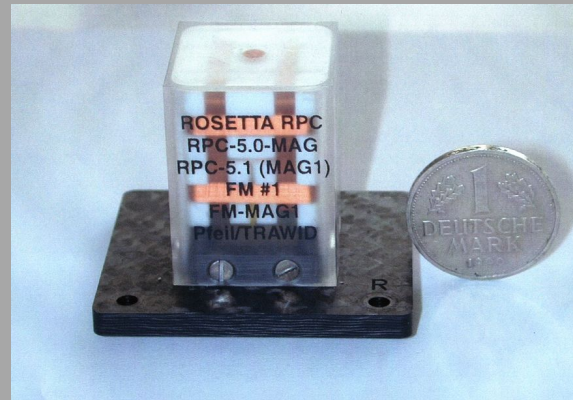


*MIP, MAG, LAP, IES overview
figure generated with AMDA*

*(Credit: CDPP/CNRS/CNES /Obs. Paris,
Univ. P.Sabatier Toulouse)*

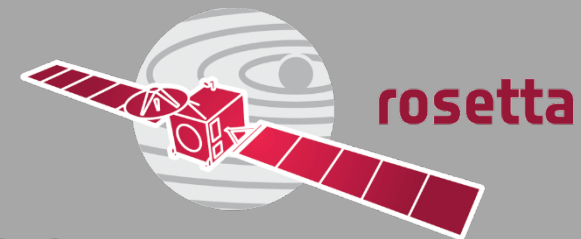


Technische
Universität
Braunschweig



How to use the RPC-MAG Archive

Ingo Richter & MAG-Team



November, 2017, SWT-Meeting, ESAC

Archive: General Structure

Index von <ftp://psa.esac.esa.int/pub/mirror/INTERNATIONAL-ROSETTA-MISSION/RPCMAG/>













RO-A-RPCMAG-2-AST1-RAW-V3.0
RO-A-RPCMAG-2-AST2-RAW-V3.0
RO-A-RPCMAG-3-AST1-CALIBRATED-V3.0
RO-A-RPCMAG-3-AST2-CALIBRATED-V3.0
RO-A-RPCMAG-4-AST1-RESAMPLED-V3.0
RO-A-RPCMAG-4-AST2-RESAMPLED-V3.0
RO-C-RPCMAG-2-ESC1-RAW-V5.0
RO-C-RPCMAG-2-ESC1-RAW-V6.0
RO-C-RPCMAG-2-ESC2-RAW-V5.0
RO-C-RPCMAG-2-ESC2-RAW-V6.0
RO-C-RPCMAG-2-ESC3-RAW-V6.0
RO-C-RPCMAG-2-ESC4-RAW-V6.0
RO-C-RPCMAG-2-EXT1-RAW-V6.0
RO-C-RPCMAG-2-EXT2-RAW-V6.0

What is the meaning of the number after RPC-MAG?

- Data ordered by DATASETS
- 3 Levels per MISSIONPHASE (AST1, ESC2..)
- Levels: RAW, CALIBRATED, RESAMPLED
- RAW: HK+Science, ADCcounts, URF
- CALIBRATED: HK+Science ,
calibrated physical units
various coordinate systems
- RESAMPLED:- averaged science data
1s & 60 s

Archive: Dataset Content












/RO-SS-RPCMAG-3-PRL-CALIBRATED-V6.0/

	Name
	 AAREADME.TXT
	 CALIB
	 CATALOG
	 DATA
	 DOCUMENT
	 ERRATA.TXT
	 INDEX
	 VOLDESC.CAT

Archive : CATALOGS

/RO-SS-RPCMAG-3-PRL-CALIBRATED-V6.0/CATALOG/

Name

-   CATINFO.TXT
-  DATASET.CAT
-  ROSETTA_INSTHOST.CAT
-  ROSETTA_MISSION.CAT
-  ROSETTA_REF.CAT
-  ROSETTA_TARGET.CAT
-   RPCMAG_INST.CAT
-  RPCMAG_PERS.CAT
-  RPCMAG_SOFTWARE.CAT

ARCHIVE : DATA , General Structure

/RO-SS-RPCMAG-3-PRL-CALIBRATED-V6.0/

Calibration_Level

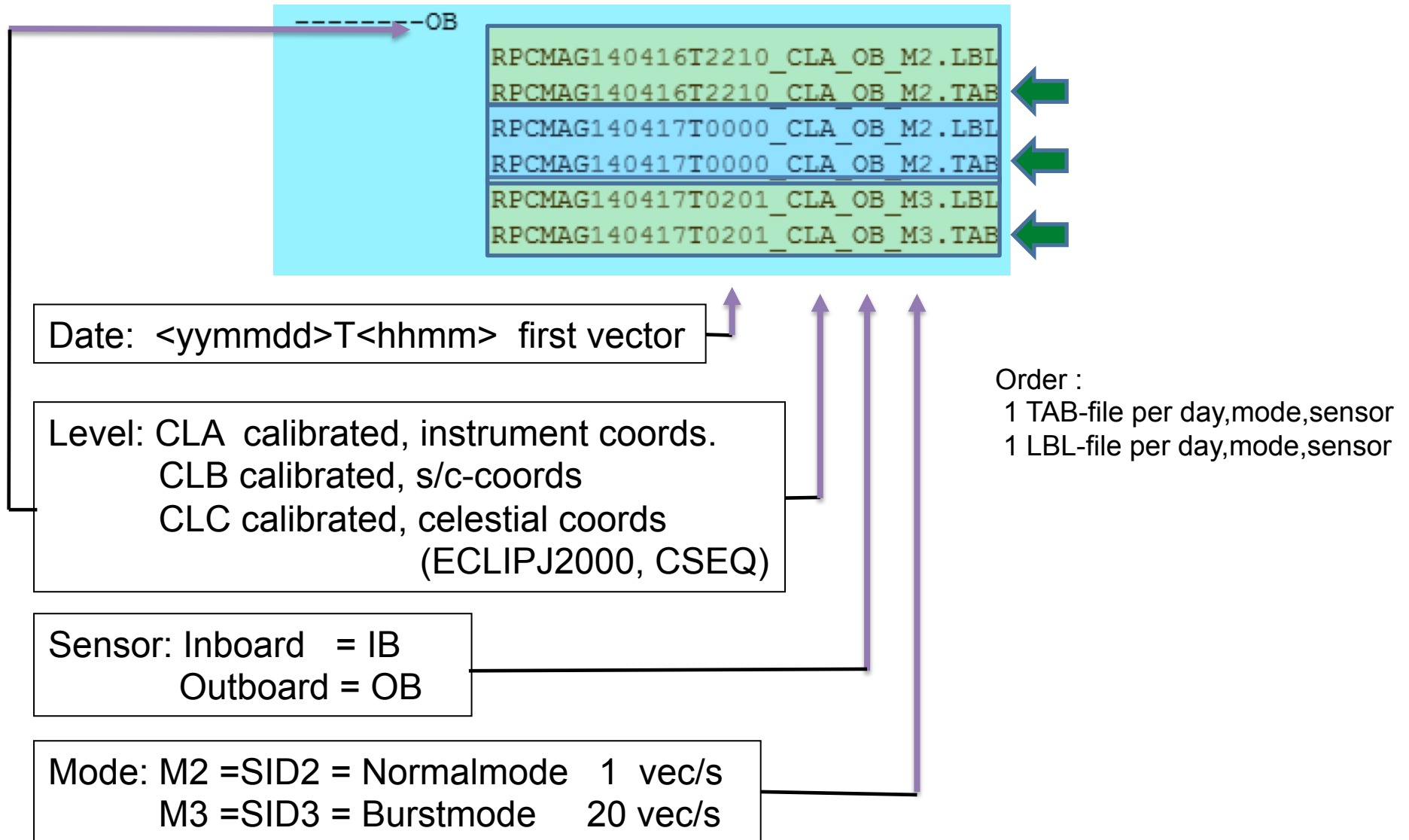
LEVEL_A: Instrument-coords
LEVEL_B: s/c-coords.
LEVEL_C: celestial-coords. (ECLIPJ2000, CSEQ)

```
---DATA
| :---CALIBRATED
| :---2014
| :---APR
| :---AUG
| :---JUL
| :---JUN
| :---MAR
| :---MAY
| :---NOV
| :---OCT
| :---SEP
```

```
---APR
| :---LEVEL_A
| :---HK
| :---IB
| :---OB
| :---LEVEL_B
| :---IB
| :---OB
| :---LEVEL_C
| :---IB
| :---OB
```

```
-----LEVEL_A
| :---HK
| RPCMAG140416T2202_CLA_HK.LBL
| RPCMAG140416T2202_CLA_HK.TAB
|
| :---IB
| RPCMAG140416T2210_CLA_IB_M2.LBL
| RPCMAG140416T2210_CLA_IB_M2.TAB
|
| :---OB
| RPCMAG140416T2210_CLA_OB_M2.LBL
| RPCMAG140416T2210_CLA_OB_M2.TAB
```

RPCMAG : Filename Convention



RPCMAG : TAB files content

RPCMAG140417T0000_CLC_OB_M2.TAB

2014-04-17T00:00:41.077980	356313576.07578	2694384.52	-1758894.4	-538312.14	0.63	-0.33	2.48	xx4x1003
2014-04-17T00:00:42.078929	356313577.07641	2694383.85	-1758894.02	-538312	0.59	-0.34	2.5	xx4x1003
2014-04-17T00:00:43.079879	356313578.07703	2694383.19	-1758893.64	-538311.87	0.56	-0.35	2.52	xx4x1003
2014-04-17T00:00:44.080828	356313579.07765	2694382.52	-1758893.26	-538311.73	0.55	-0.36	2.54	xx4x1003
2014-04-17T00:00:45.081778	356313580.07827	2694381.85	-1758892.88	-538311.59	0.55	-0.36	2.54	xx4x1003
2014-04-17T00:00:46.082727	356313581.07890	2694381.19	-1758892.5	-538311.46	0.59	-0.35	2.52	xx4x1003
2014-04-17T00:00:47.083676	356313582.07952	2694380.52	-1758892.12	-538311.32	0.6	-0.37	2.49	xx4x1003
2014-04-17T00:00:48.084626	356313583.08014	2694379.85	-1758891.74	-538311.18	0.59	-0.34	2.5	xx4x1003
2014-04-17T00:00:49.085575	356313584.08076	2694379.19	-1758891.36	-538311.05	0.56	-0.34	2.49	xx4x1003
2014-04-17T00:00:50.086525	356313585.08139	2694378.52	-1758890.98	-538310.91	0.56	-0.31	2.5	xx4x1003

Time
UTC

OBT
s.frac
frac:0-65535

POSX
km

POSY
km

POSZ
km

BX
nT

BY
nT

BZ
nT

QFLAGS
x, 0-9

RPCMAG: LBL File Content - I

RPCMAG140417T0000_CLC_OB_M2.LBL

```
PDS_VERSION_ID          = PDS3                               9
LABEL_REVISION_NOTE     = "V1.0"                             9
RECORD_TYPE              = FIXED_LENGTH                       9
RECORD_BYTES            = 125                                 9
FILE_RECORDS            = 7168                               9
DATA_SET_ID              = "RO-SS-RPCMAG-3-PRL-CALIBRATED-V6.0" 9
DATA_SET_NAME           = "ROSETTA-ORBITER SW RPCMAG 3 PRL CALIBRATED V6.0" 9
PRODUCT_ID              = "RPCMAG140417T0000_CLC_OB_M2"      9
PRODUCT_CREATION_TIME   = 2016-04-21T11:41:00                9
PRODUCT_TYPE            = "RDR"                              9
MISSION_ID               = "ROSETTA"                          9
MISSION_NAME             = "INTERNATIONAL ROSETTA MISSION"    9
MISSION_PHASE_NAME      = "PRELANDING"                        9
OBSERVATION_TYPE        = "COMMISSIONING"                     9
INSTRUMENT_HOST_ID      = "RO"                                9
INSTRUMENT_HOST_NAME    = "ROSETTA-ORBITER"                   9
INSTRUMENT_ID           = "RPCMAG"                            9
INSTRUMENT_NAME         = "ROSETTA PLASMA CONSORTIUM - FLUXGATE MAGNETOMETER" 9
INSTRUMENT_TYPE         = "MAGNETOMETER"                      9
INSTRUMENT_MODE_ID      = "SID2"                              9
INSTRUMENT_MODE_DESC    = ""                                  9
  NORMAL MODE: 32 PRIMARY & 1 SECONDARY VECTORS PER 32 SECONDS" 9
TARGET_NAME             = "CHECKOUT"                          9
TARGET_TYPE              = "N/A"                              9
START_TIME               = 2014-04-17T00:00:41.077           9
STOP_TIME                = 2014-04-17T02:00:39.891           9
COORDINATE_SYSTEM_CENTER_NAME = "CHURYUMOV-GERASIMENKO"      9
SPACECRAFT_CLOCK_START_COUNT = "1/356313576.07578"           9
SPACECRAFT_CLOCK_STOP_COUNT = "1/356320774.60737"            9
```

RPCMAG: LBL File Content – III

RPCMAG140417T0000_CLC_08_M2.LBL

```
DATA_QUALITY_DESC           = "                                9
ONLY 'GOOD' RAW DATA HAVE BEEN PROCESSED AND STORED"           9
PROCESSING_LEVEL_ID         = "3"                                9
DESCRIPTION                  = "                                9
THIS FILE CONTAINS CALIBRATED MAGNETIC FIELD VECTOR DATA OBTAINED BY THE 9
OUTBOARD MAGNETOMETER ABOARD THE ROSETTA S/C. GROUND CALIBRATION RESULTS HAVE 9
BEEN APPLIED TO THE RAW DATA. FIELD IS ROTATED TO 67P/C-G_CSEQ COORDINATES. 9
THE S/C POSITION IS GIVEN IN 67P/C-G_CSEQ COORDINATES AS WELL."    9
FLIGHT_SOFTWARE_VERSION_ID  = "FIL:V1.0"                        9
PLATFORM_OR_MOUNTING_DESC   = "MAGNETOMETER_BOOM: DEPLOYED"    9
NOTE                         = "                                9
a)                             9
MAGNETIC_COORDINATE_SYSTEM : 67P/C-G_CSEQ                       9
b)                             9
THE VALUES OF THE KEYWORDS SC_SUN_POSITION_VECTOR,             9
SC_TARGET_POSITION_VECTOR AND SC_TARGET_VELOCITY_VECTOR,        9
ARE RELATED TO THE ECLIPJ2000 REFERENCE FRAME.                   9
SUB_SPACECRAFT_LATITUDE AND SUB_SPACECRAFT_LONGITUDE            9
ARE NORTHERN LATITUDE AND EASTERN LONGITUDE IN THE STANDARD    9
PLANETOCENTRIC IAU <TARGET_NAME> FRAME. ALL VALUES ARE COMPUTED 9
FOR THE TIME T= START_TIME.                                     9
DISTANCES ARE GIVEN IN <KM> VELOCITIES IN <KM/S>, ANGLES IN <DEG> 9
c)                             9
LBL & TAB FILE HAVE BEEN GENERATED BY S/W: GEN_CAL_DATA, VERSION V20160408 9
d)                             9
GROUND CALIBRATION FILE: RPCMAG_GND_CALIB_FSDPU_FMOB.ASC        9
e)                             9
INFLIGHT CALIBRATION FILE: RPCMAG_CVP2_008_CALIB_OB.ASC         9
f)                             9
TIMESTAMPS (UTC) OF PRIMARY SENSOR VECTORS HAVE BEEN SHIFTED BY 8.20 S AND 9
TIMESTAMPS (UTC) OF SECONDARY SENSOR VECTORS HAVE BEEN SHIFTED BY 31.95 S 9
IN ORDER TO CORRECT DIGITAL FILTER TRANSFER FUNCTION.           9
```



RPCMAG: LBL File Content – III

```
^TABLE          = "RPCMAG140417T0000_CLC_OB_M2.TAB"  1
OBJECT          = TABLE                             1
NAME            = "RPCMAG-OB-SID2-CLC"               1
INTERCHANGE_FORMAT = ASCII                           1
ROWS            = 7168                               1
COLUMNS        = 9                                  1
ROW_BYTES       = 125                                1
OBJECT          = COLUMN                             1
NAME            = "TIME.UTC"                         1
DATA_TYPE       = TIME                              1
START_BYTE      = 1                                  1
BYTES           = 26                                  1
DESCRIPTION     = "UTC TIME OF OBSERVATION: YYYY-MM-DDTHH:MM:SS.FFFFFFFF" 1
END_OBJECT      = COLUMN                             1
OBJECT          = COLUMN                             1
NAME            = "TIME.OBT"                         1
DATA_TYPE       = ASCII_REAL                         1
START_BYTE      = 28                                  1
BYTES           = 15                                  1
DESCRIPTION     = "S/C CLOCK AT OBSERVATION TIME,SECONDS SINCE 00:00 AT 1
1.1.2003: SSSSSSSS.FFFFFF"                          1
END_OBJECT      = COLUMN                             1
OBJECT          = COLUMN                             1
NAME            = "POSITION.X"                       1
DATA_TYPE       = ASCII_REAL                         1
START_BYTE      = 44                                  1
BYTES           = 13                                  1
UNIT            = "KILOMETER"                        1
UNIT_ID         = "km"                               1
DESCRIPTION     = "SPACECRAFT POSITION, X COMPONENT, 67P/C-G_CSEQ" 1
END_OBJECT      = COLUMN                             1
```



RPCMAG: LBL File Content – IV

```
DESCRIPTION          = "  
These flags describe the quality of the magnetic field data.  
The quality is coded in a 8 byte string. Each character can have  
the following values:  
VALUE:      MEANING:  
  x         property described by flag is still unknown  
  0         no disturbance, good quality  
  1..9     specific disturbance/problems, see below  
  
Description of the specific flags:  
  
FLAG-STRING FLAG DESCRIPTION  
87654321  
: : : : :----- 1 IMPACT OF REACTION WHEELS  
: : : : :          x = impact not assessed  
: : : : :          0 = no disturbance  
: : : : :          1 = disturbance eliminated during data analysis  
: : : : :          2 = disturbance elimination failed  
: : : : :          3 = data disturbed  
: : : : :  
: : : : :----- 2 IMPACT OF LANDER HEATER CURRENTS:  
: : : : :          x = impact not assessed  
: : : : :          0 = no disturbance  
: : : : :          1 = disturbance eliminated during data analysis  
: : : : :          2 = disturbance elimination failed  
: : : : :          3 = data disturbed  
: : : : :  
: : : : :----- 3 BOOM DEPLOYMENT:  
: : : : :          0 = boom deployed  
: : : : :          1 = boom stowed  
: : : : :          2 = boom deployment ongoing. Data only valid in  
: : : : :             instrument coordinates  
: : : : :          3 = pyros fired for boom release
```



Archive: Documents

/RO-SS-RPCMAG-3-PRL-CALIBRATED-V6.0/DOCUMENT/

---DOCUMENT

```
| DOCINFO.TXT  
| LOGBOOK_20140323_20141121.ASC  
| LOGBOOK_20140323_20141121.LBL  
| RPCMAG_INSTRUMENT.LBL  
| RPCMAG_INSTRUMENT.PDF
```

:---ARCHIVING

```
| RO_IGEP_TR0009_EAICD.LBL  
| RO_IGEP_TR0009_EAICD.PDF
```

:---CALIBRATION

```
| RO_IGEP_TR0028_CALPROC.LBL  
| RO_IGEP_TR0028_CALPROC.PDF  
| RO_IGM_TR0002_CAL_REPORT.LBL  
| RO_IGM_TR0002_CAL_REPORT.PDF  
| RO_IGM_TR0003_CAL_ANALYSIS.LBL  
| RO_IGM_TR0003_CAL_ANALYSIS.PDF  
| RO_IWF_TR0001_AC_ANALYSIS.LBL  
| RO_IWF_TR0001_AC_ANALYSIS.PDF
```

:---FLIGHT_REPORTS

```
RO_IGEP_TR0013_MCRR.LBL  
RO_IGEP_TR0013_MCRR.PDF  
RO_IGEP_TR0038_DATA_SUMMARY.LBL  
RO_IGEP_TR0038_DATA_SUMMARY.PDF
```



Must read !

Perfect data overview

DOCUMENTS : LOGBOOK

```
#####
#
#
#           2014-06-17
#
#
#####
#
# TIME (UTC)          EVENT          COMMAND  DESCRIPTION          REMARK  #
#
#####
@ 2014-06-17T03:38:46.3  Warning          EC_MAG_MissedSamples
@ 2014-06-17T03:38:46.3  Warning          EC_MAG_CounterUnsync
@ 2014-06-17T09:28:59.0          ZSKA8096  START RPC Mode Control 2 OBCP          ModeMAG:= Quiet
@ 2014-06-17T09:43:59.0          ZSKA8092  START RPC Power Off OBCP
#####
#
#
#           2014-06-20
#
#
#####
#
# TIME (UTC)          EVENT          COMMAND  DESCRIPTION          REMARK  #
#
#####
@ 2014-06-20T02:30:02.0          ZSKA8091  START RPC Power On OBCP
@ 2014-06-20T02:30:46.1  Normal          EC_PiuAlive
@ 2014-06-20T02:31:49.2  Normal          EC_SoftReboot
@ 2014-06-20T02:31:58.1  Normal          EC_PiuAlive
@ 2014-06-20T02:45:05.0          ZSKA809B  MAG Mode Control          ModeMAG:= SID3
@ 2014-06-20T09:39:00.0          ZAC20188  AOCMS-WOL Swicth ON Wheel Off-Load Man          T_OUT[s]= 1430
#####
```



DOCUMENTS: Overview & Data Quality Assessment

R O S E T T A
FLIGHT REPORTS
of RPC-MAG

RO-IGEP-TR-0038

Issue: 1 Revision: 1

May 7, 2015

OVERVIEW OF
AVAILABLE RPCMAG DATA
AND
DATA QUALITY ASSESSMENT

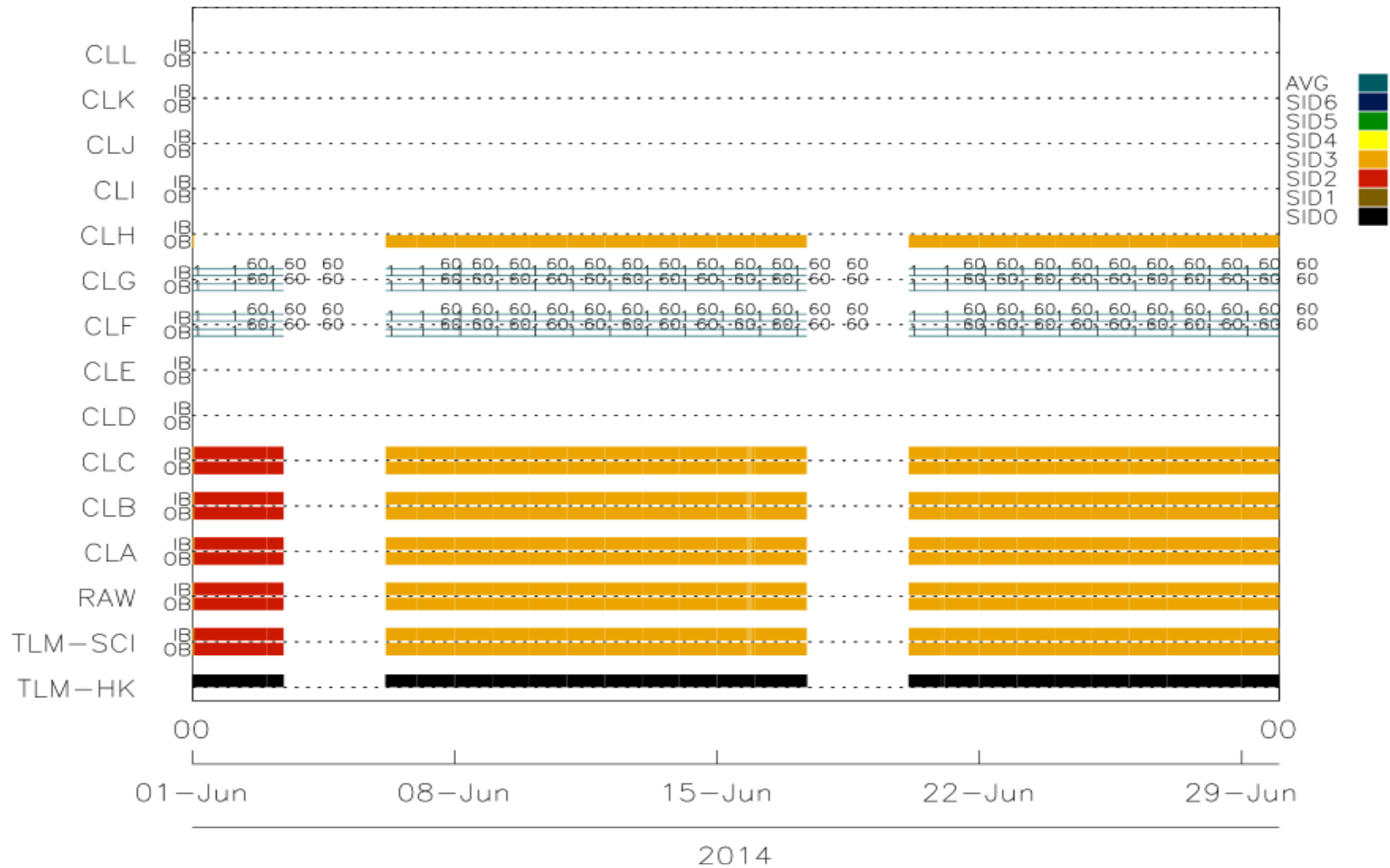
Mission Phase: PRL
Time: 23.March 2014 - 21.November 2014

Ingo Richter

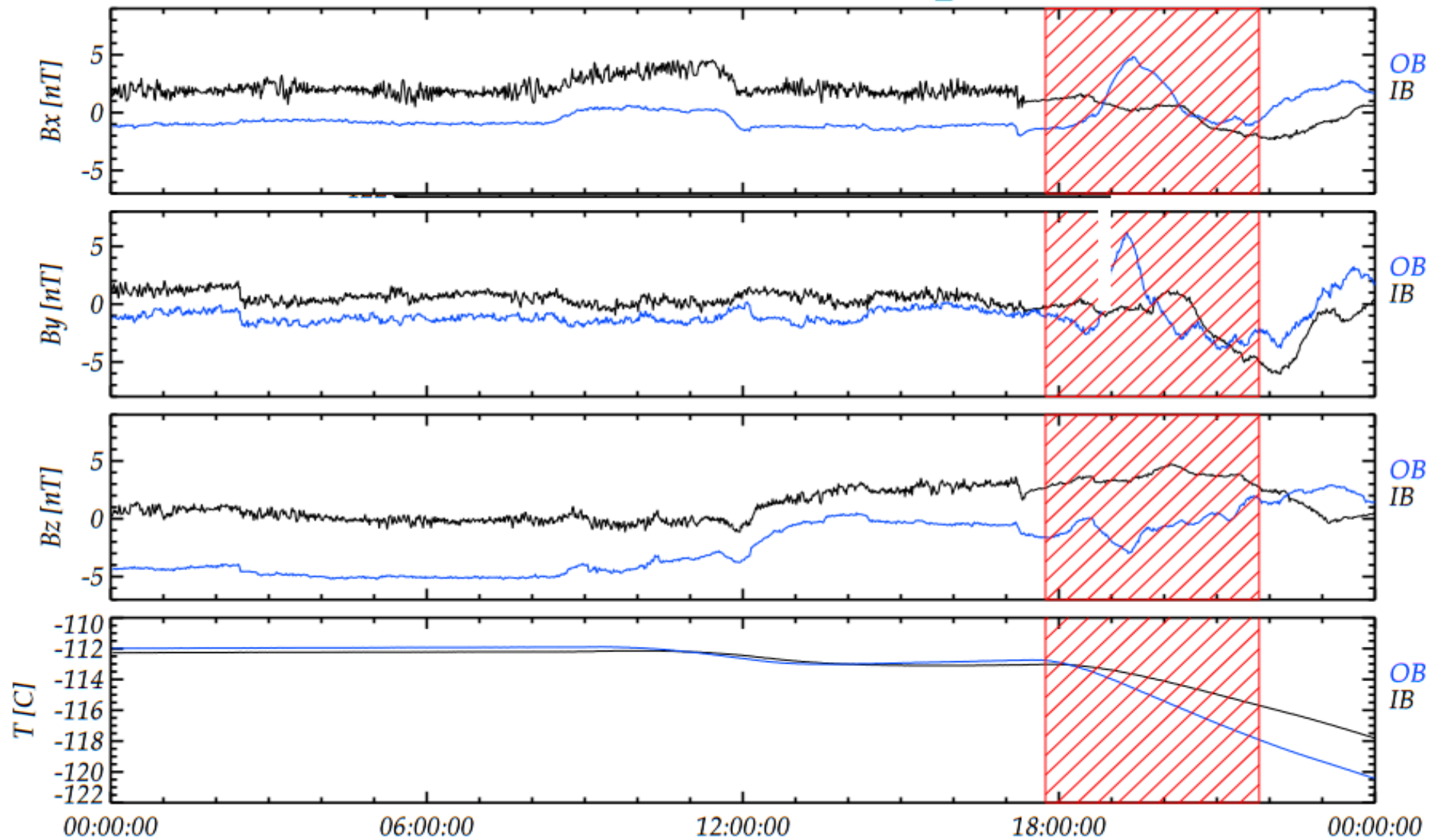
Institut für Geophysik und extraterrestrische Physik
Technische Universität Braunschweig
Mendelssohnstraße 3, 38106 Braunschweig
Germany

FLIGHTREPORTS - Overview & Data Quality Assessment

RPCMAG_DATA_AVAILABILITY_2014_JUN



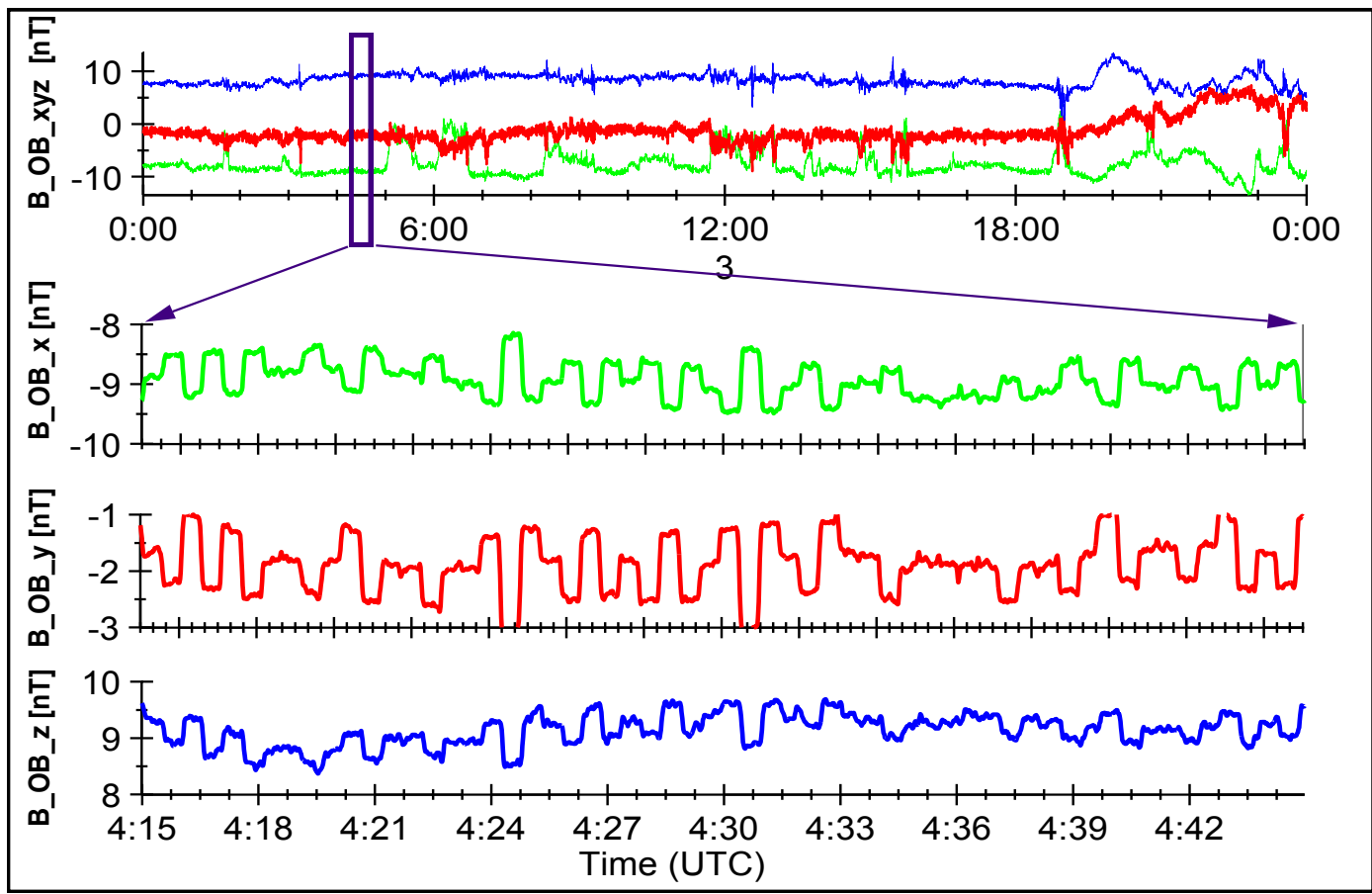
OB vs. IB 2014-05-18 LEVEL_F



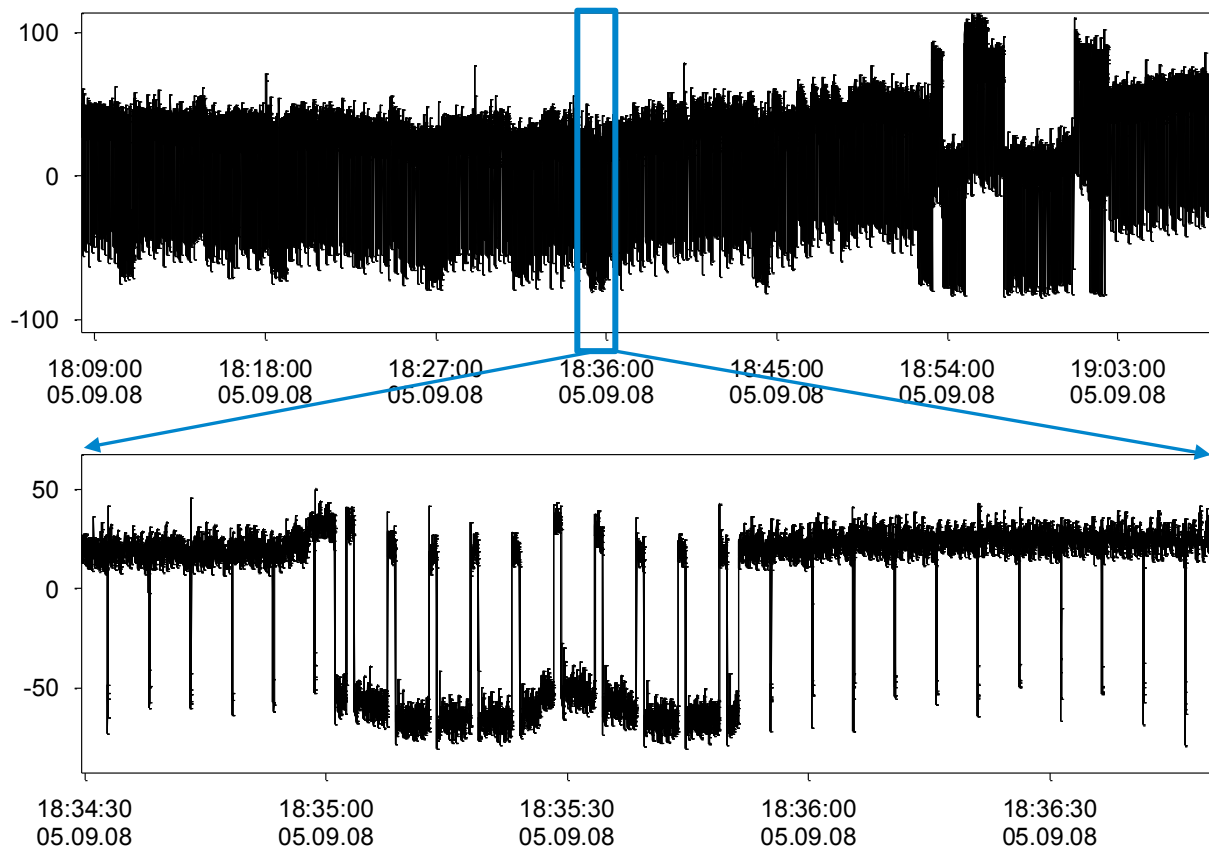
Disturbance of the Magnetic Field Observations

Disturbance Sources :

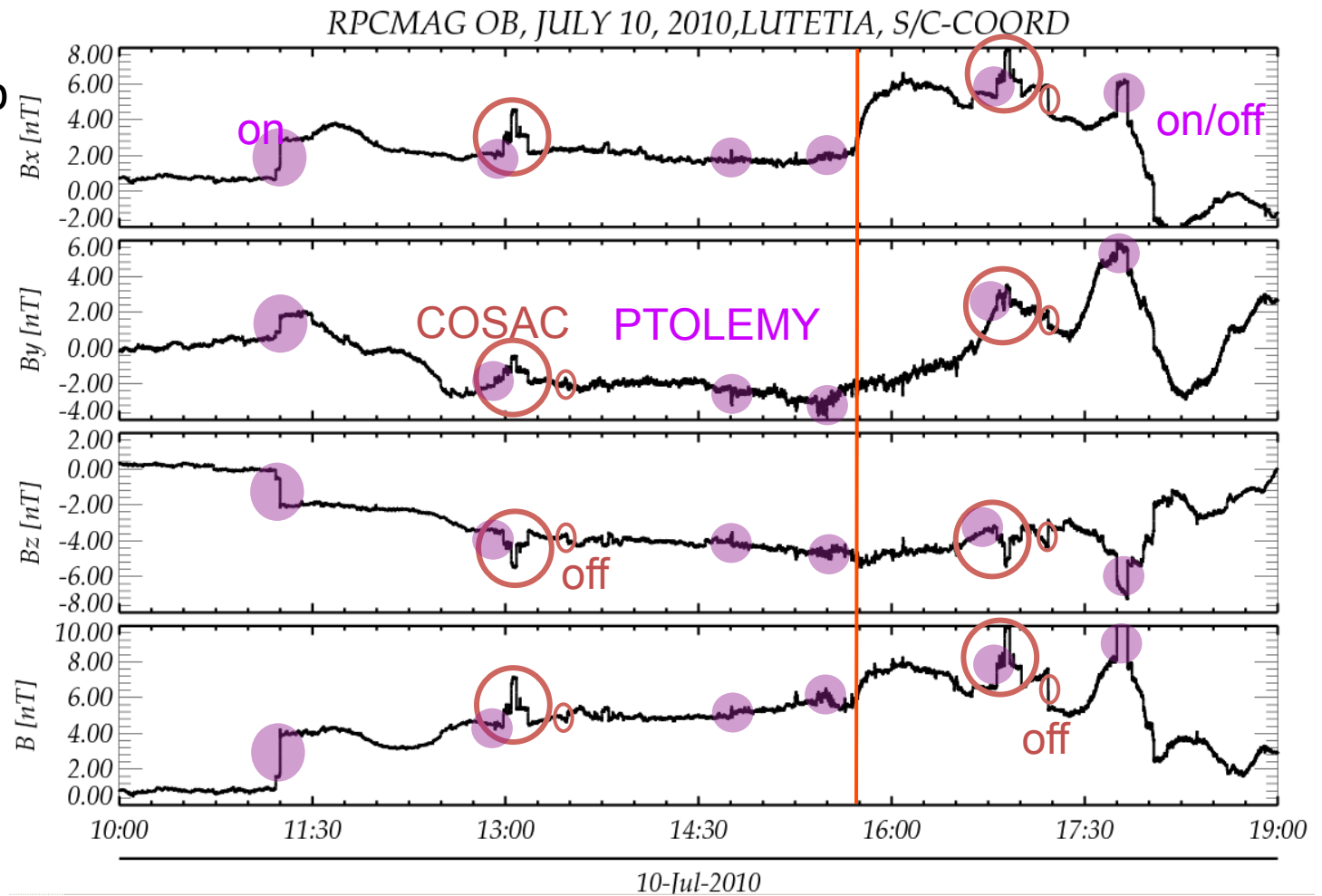
- Currents: → Heaters
 - P/L , S/C-S/S
 - PHILAE
 - ...
- Movable magnetic parts: → Thrusters
 - Reaction Wheels
 - PHILAE
 - ...
- Temperature effects → RPCMAG-Sensors
 - ...

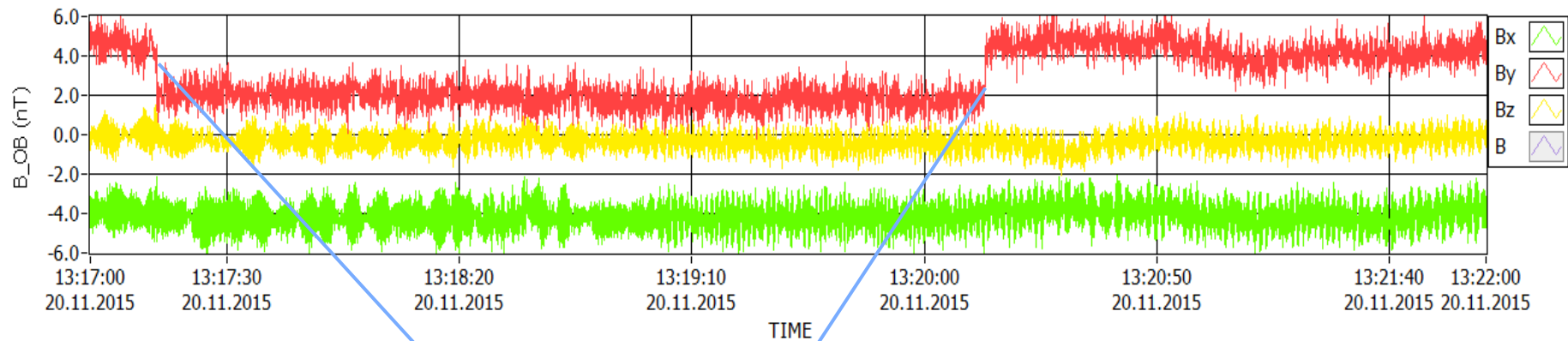


2005-03-01



Disturb



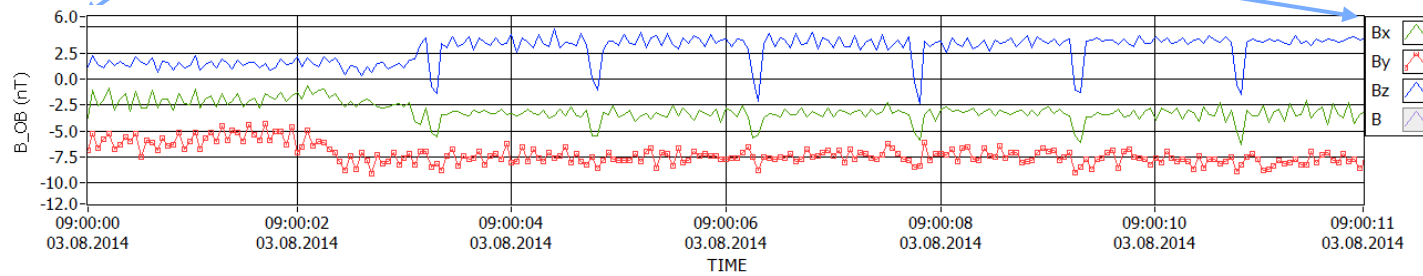
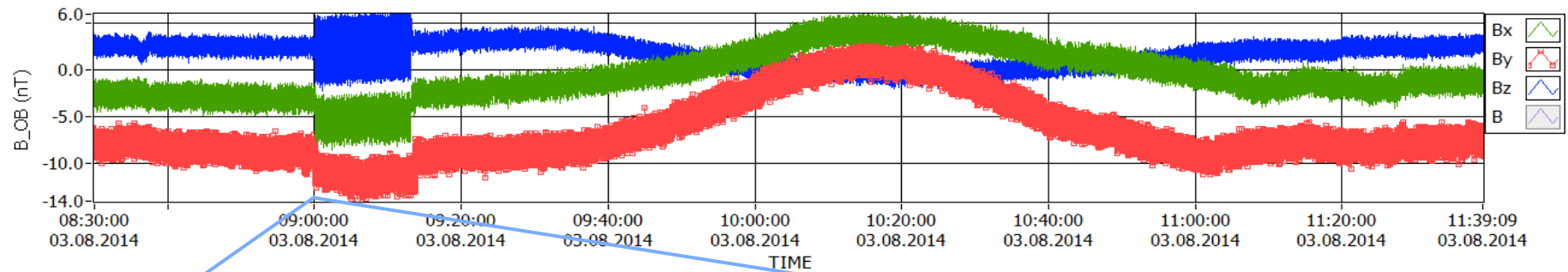


WOL : ZAC20188 @ t0= 2015-11-20T13:17:09

MAG-Disturbance: START: t0+5s, Delta By = -3nT

END: t0+184s, Delta By= +3nT

Steep Transitions 50ms – 100ms



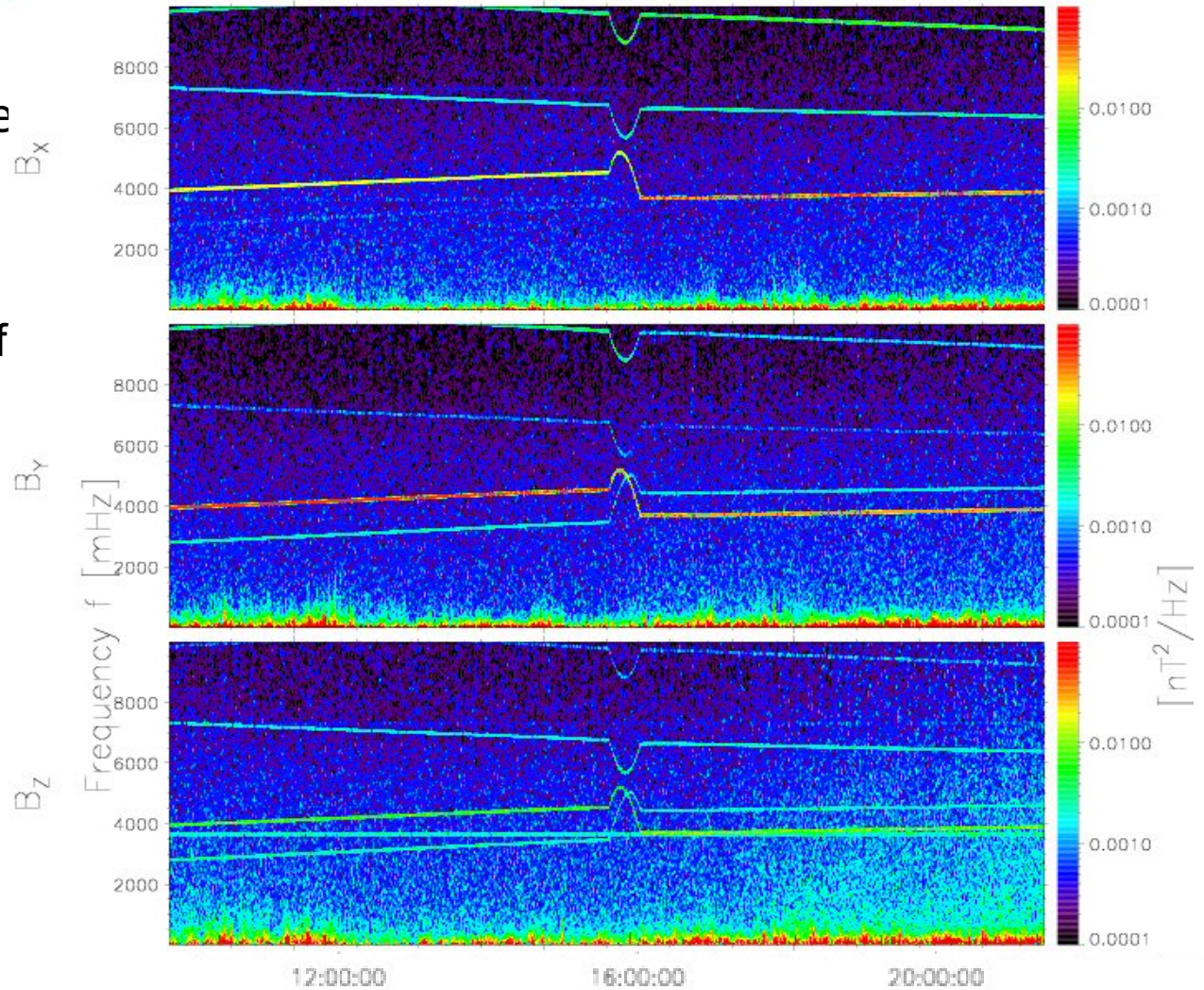
DC – Jumps $\sim -2\text{nT}$ on Bx, $\sim +3\text{nT}$ Bz
AC - $\sim 6\text{nT}_{pp}$ Spikes, $\sim 625\text{ mHz}$, $\sim 200\text{ ms}$ width
not correctable automatically! (HK max resolution 32 s)



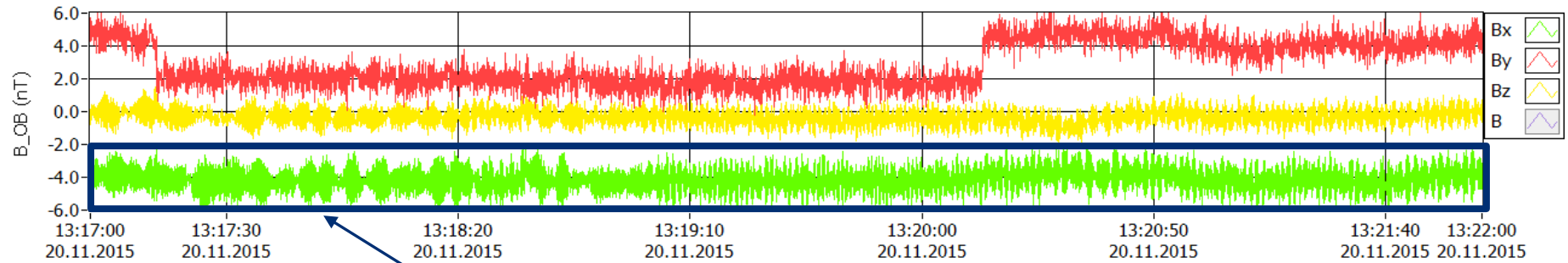
Disturbance

Four variably rotating
Reaction Wheels
are causing disturbance of

$$B_{pp} \sim 2\text{nT} \quad @1-10 \text{ Hz}$$

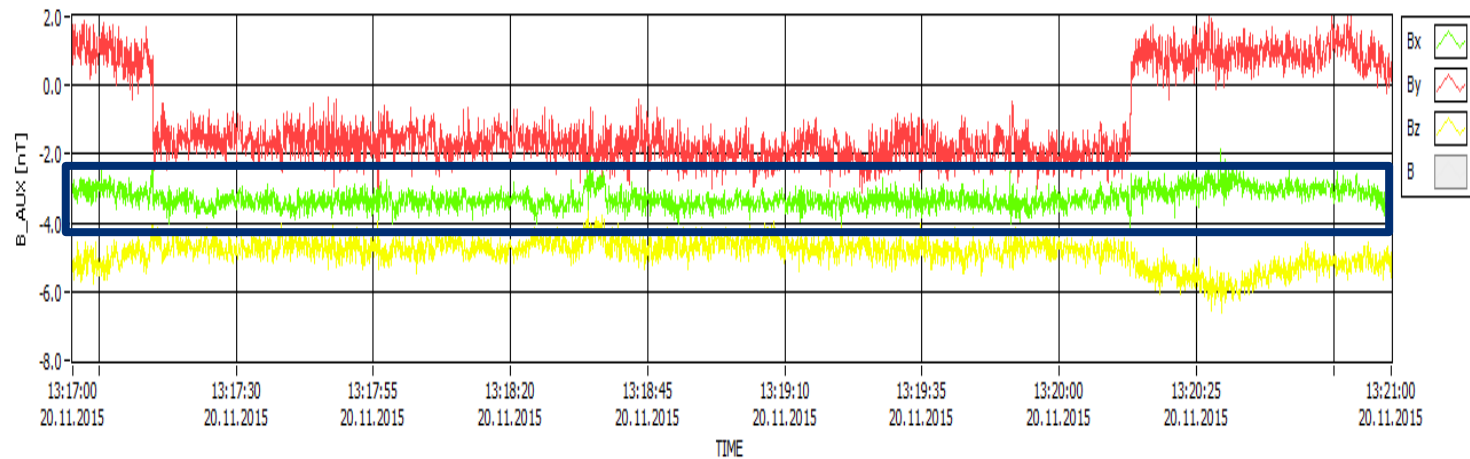


LEVEL_C : CALIBRATED Data



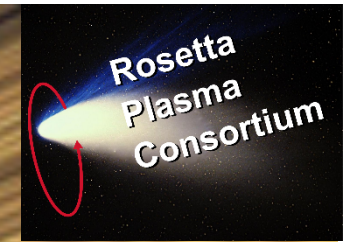
Plasmawaves ? - No !! → RW-Disturbance

LEVEL_H: RESAMPLED, Reaction Wheel Corrected data



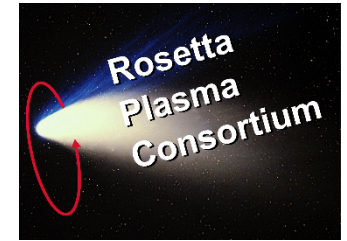
Take away Message // “Checklist for proper Usage”

- Read documentation !!!!!!!
 - EAICD, Instrument-Paper, Inst.cat, Dataset.cat, Logbook, Aareadme, *.LBL-files
- Check Quality Flags
 - Do not use heavily flagged data
- In case of doubt:
 - Check s/c attitude change
 - Check sensor temperature change
 - Check thruster activation state (WOL, OCM)
 - Compare IB / OB signatures
- For „High frequency“ research (>1Hz):
 - Check actual RW frequencies
- Don't trust offset+sc-residual field dependent quantities @ small fields
 - $|B| = \sqrt{\sum_i (B_i + Off_i)^2}$
 - $\alpha = \arctan\left(\frac{B_i + Off_i}{B_j + Off_j}\right)$
- For remaining questions & Publications:
 - Contact MAG-Team (i.richter@tu-bs.de)



- *Thanks for using*
- *MAG-Data.....*

Contact us
(i.richter@tu-bs.de)



RPC-ICA

How to use the data

RPC-ICA data in PSA

- L2 for all phases delivered
- Philosophy: As complete as possible
- File Types
 - Data RPCICAYYYMMDDTHH_000_96L2.TAB
 - Housekeeping RPCICAYYYMMDDTHH_000_HK.TAB
 - Geometry RPCICAYYYMMDDTHH_000_GEOM.TAB
- <ftp://psa.esac.esa.int/pub/mirror/INTERNATIONAL-ROSETTA-MISSION/RPCICA/>
 - **RO-C-RPCICA-2-EXT1-RAW-V1.0/DATA/EDITED/2016/FEB/D24/**
- Each line is an energy spectrogram for a mass channel, azimuth sector and time

RPC-ICA data in PSA

L2 and L3 data can give you

Flux of solar wind and cometary ions with direction, energy

Can be used to calculate moments

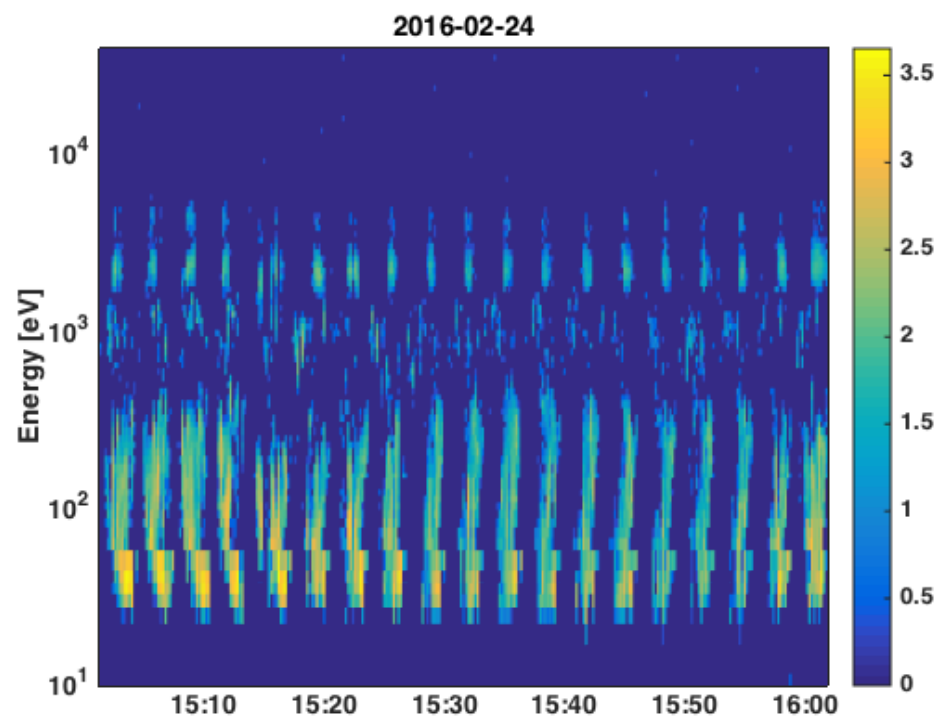
Density, Velocity, Temperature

How to use ICA PSA data, the very first steps:

Read energy spectra, create a 4 or 5 dimensional matrix

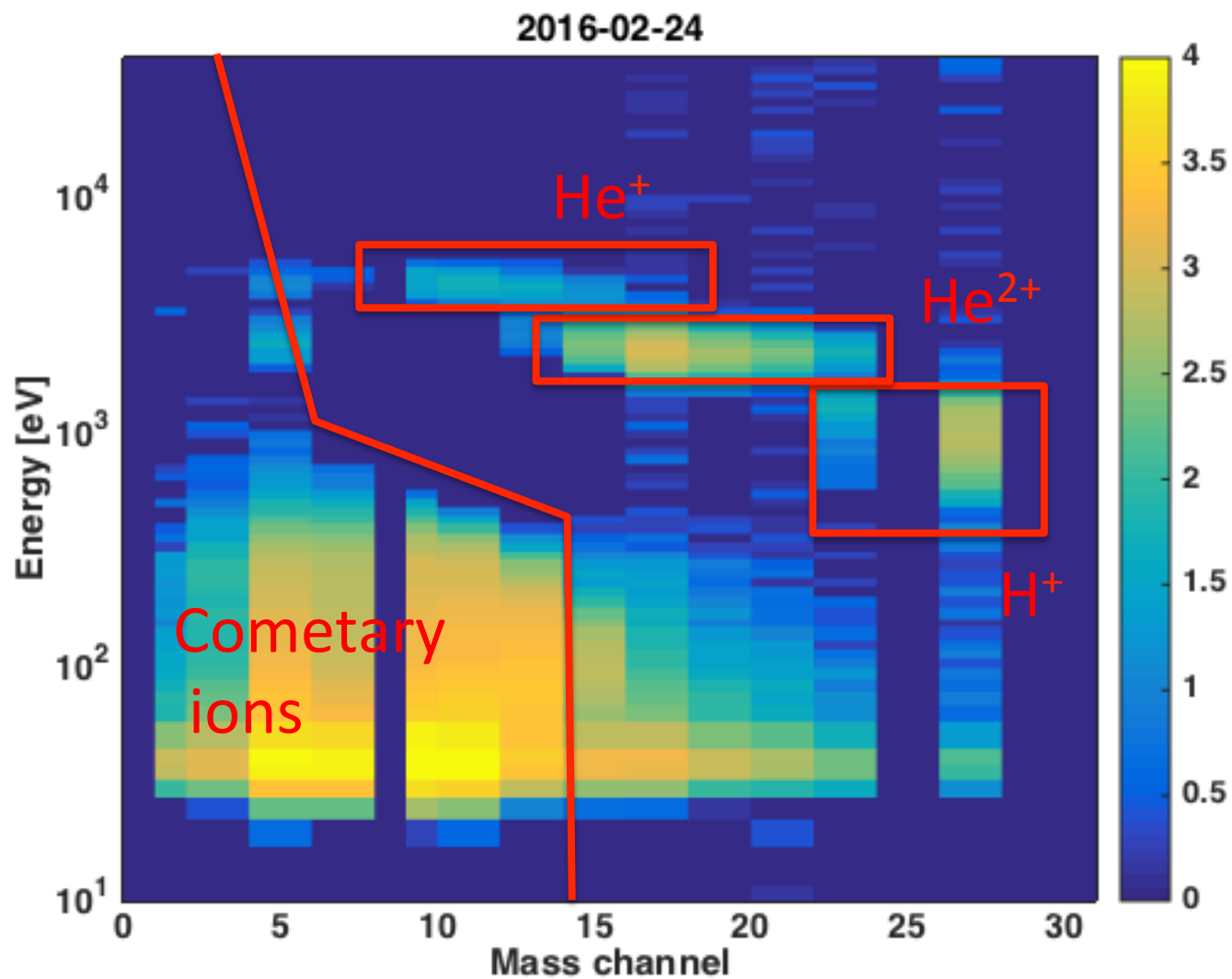
Azimuth x Energy x Mass channel x Time

Sum into two dimensional matrix for first look

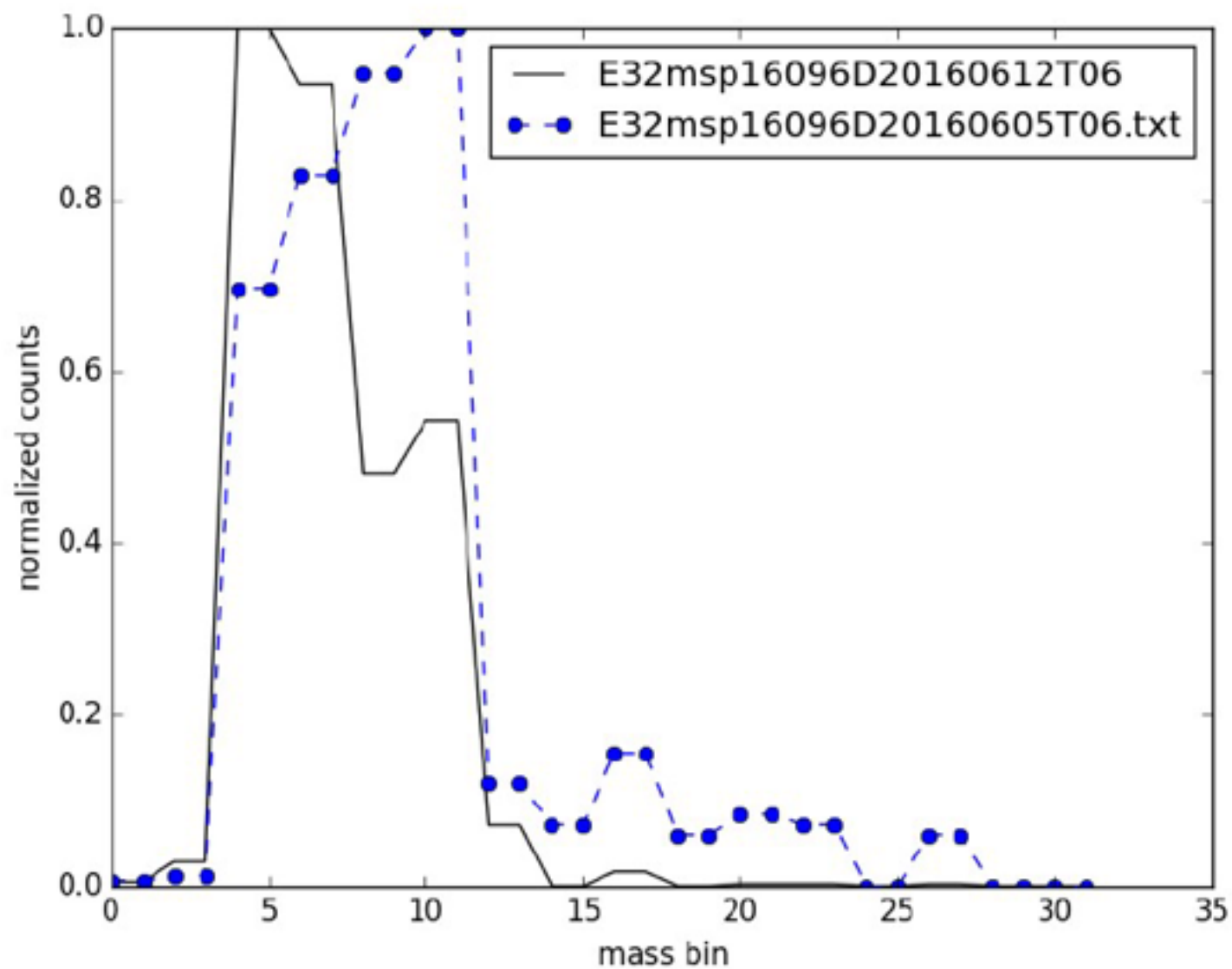


Sum over azimuth and time to obtain mass matrix

Lighter masses to the right, all move to left for higher energy



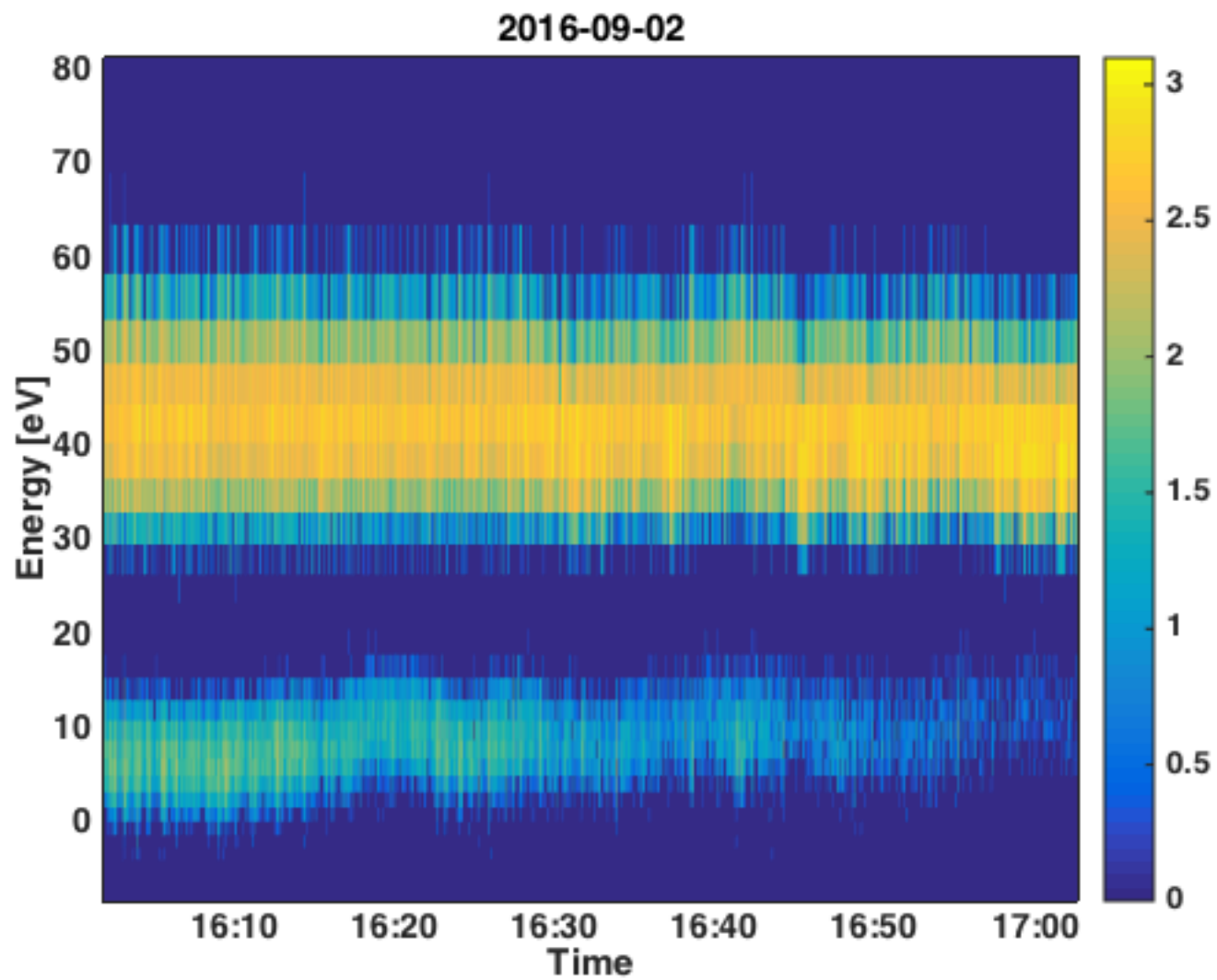
Separating cometary ions into water group and CO₂ mass groups



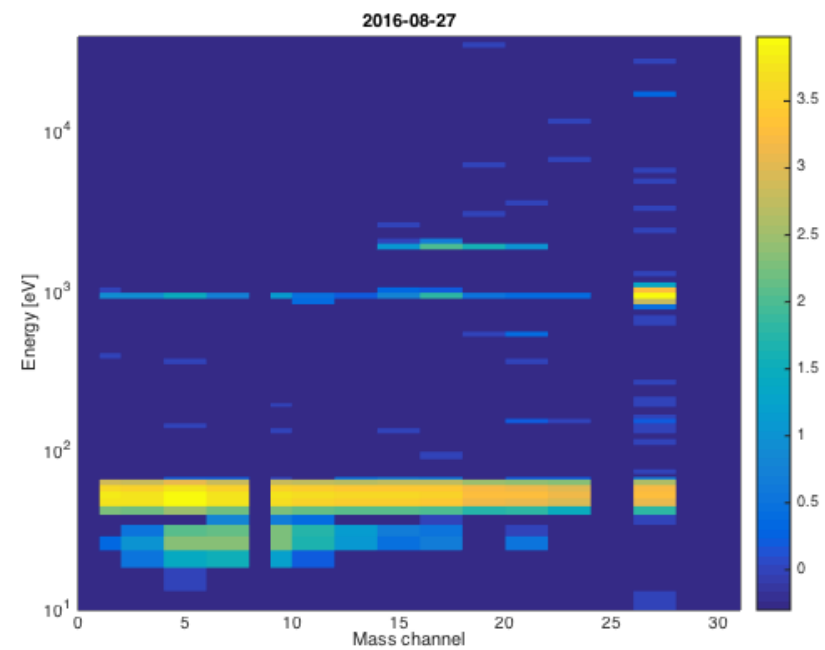
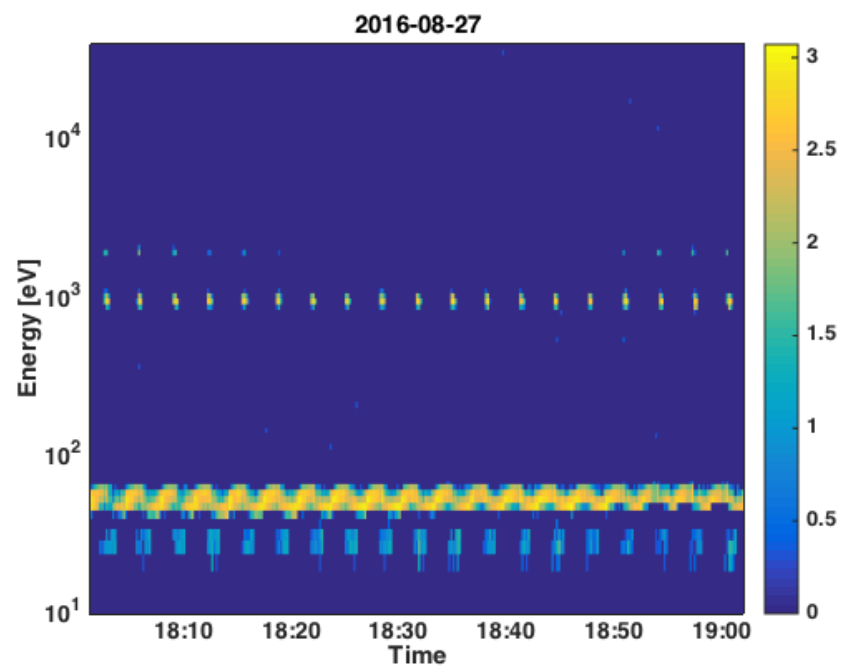
CAVEATS

...or rather a gallery of strange things in the data

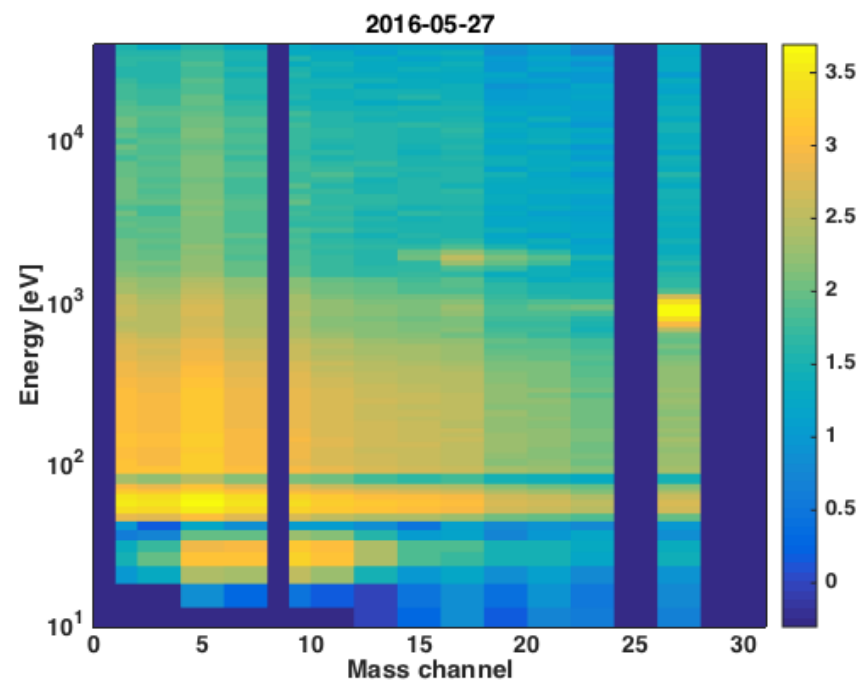
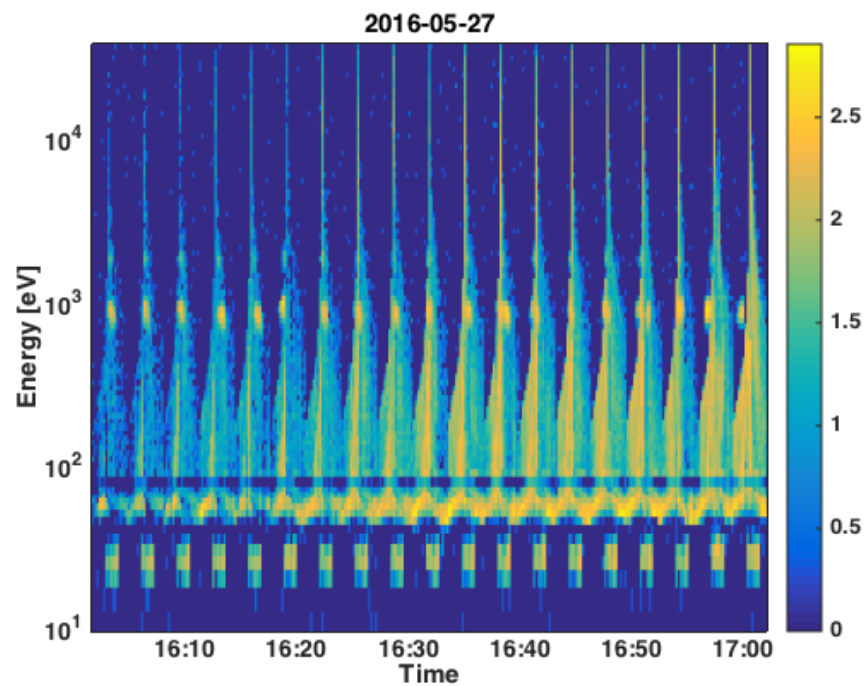
Ions below the spacecraft potential



Strong signal above the “usual signal”, wide in mass channels, different sector / elevation signal as compared to usual signal



Strong signal above the “usual signal”, seen for all energy channels, only few elevations, different sector distribution as compared to usual signal



Using RPC-ICA data

- Most data understood in terms of instrument response (not all in terms of cometary physics...)
- Some data show the instrument response to a specific comet environment, but cannot be interpreted straight off
- Ionization sources on the spacecraft, effects of dust grains, effect of dense neutral atmosphere – there may be explanations involving things of interest for other teams

The RPC-ICA Enhanced Archive provides:

Data cleaned from cross-talk (as far as possible)

Anode response compensation

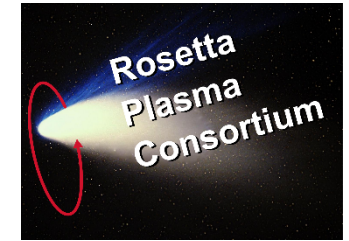
Consistent noise removal

Confidence interval

Data separated into main ion species

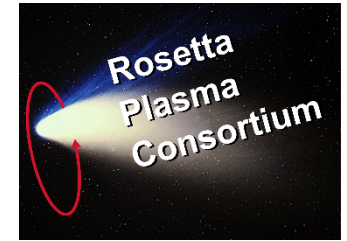
Moments

Cross-calibrated low energy data



RPC-ICA: Final note

- If you have any questions:
 - Refer to the EAICD, and the RPC and RPC-ICA user guides, in the DOCUMENT directory of each data set...
 - Contact us (*hans.nilsson@irf.se*)



RPC-IES

How to use the data

PSA & PDS:

Data Delivered to Date for RPC-IES

- L2 and L3: All mission phases
- L3 to be redelivered with improved background subtraction
- Some IES/ICA cross calibration data to be delivered

Accessing the RPC-IES Data

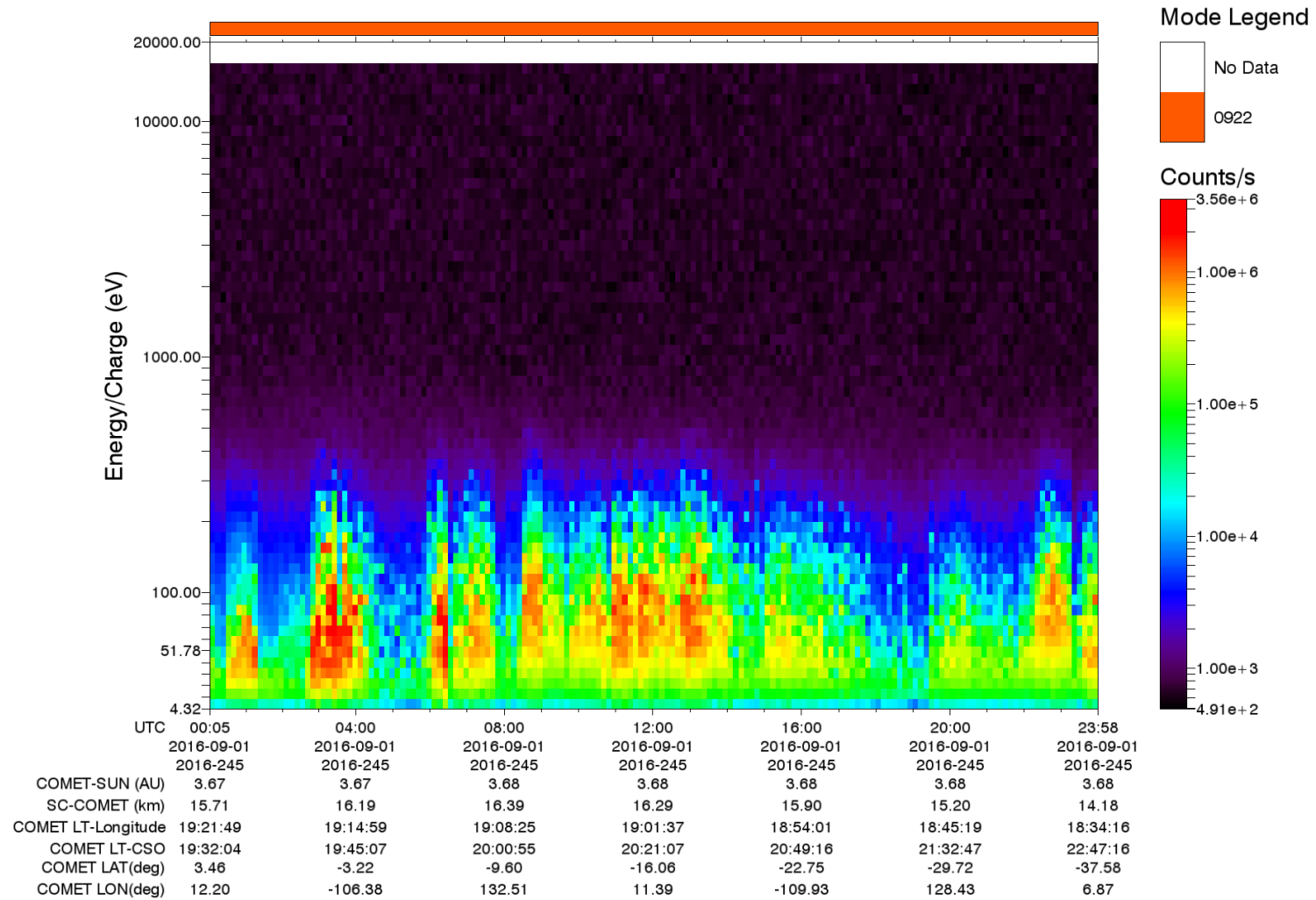
- IES data are accessible from both the ESA (PSA) and NASA (PDS) web sites.
- There is an electron and an ion data file for each day, e.g.:
 - **RPCIES2016245_ELC_V3.TAB** for L2
 - **RPCIES2016245_L3ELC_FLUX_V1.TAB** for L3are electron files for the day 1 Sept. 2016, which can be found at:
<ftp://psa.esac.esa.int/pub/mirror/INTERNATIONAL-ROSETTA-MISSION/RPCIES/>
- These files can be read directly with any favorite software (e.g. IDL) to produce other products, such as energy distribution plots.

RPC-IES Data Illustration

- All data files are in columns of ASCII (See EIACD)
- L2: ion and electron counts/s
- L3: ion and electron differential energy flux
 - UTC, Mode, Start energy step, stop energy step, start elevation angle step, end elevation angle step, azimuthal angle 00...to 15, quality flags.

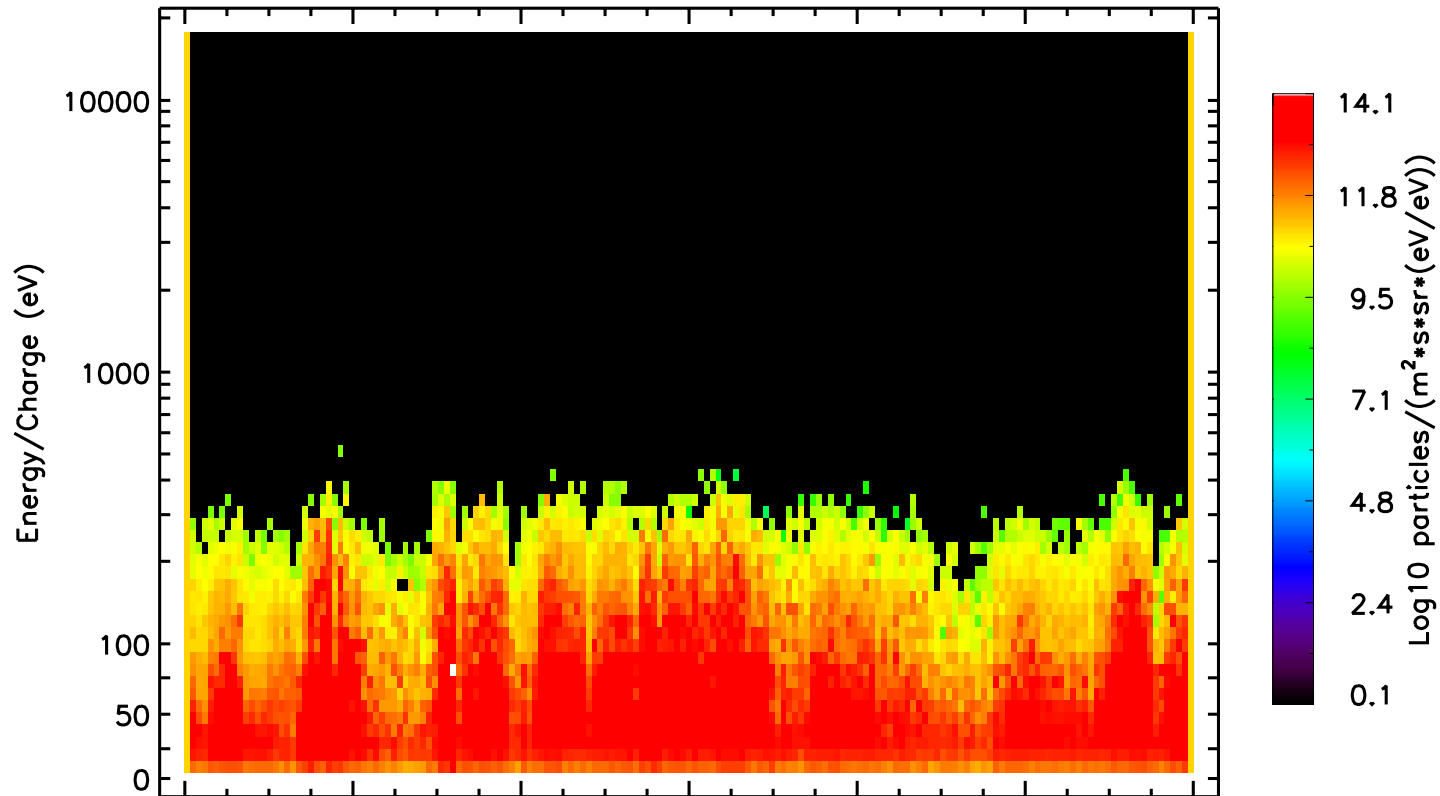
RPC-IES Data Illustration (L2)

September 1, 2016: Electron Counts
 Counts have been summed over Elevations and Azimuth



RPC-IES Data Illustration (L3)

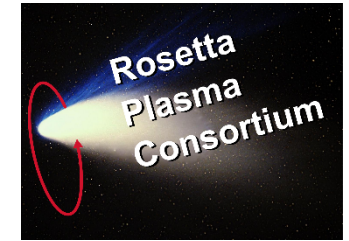
IES Electrons DEF Sep 01, 2016
 EI(00-08) An(00-01) Mode: 0922



UTC(HH:MM)	00:00	04:00	08:00	12:00	16:00	20:00	24:00
COMET-SUN(AU)	3.67	3.67	3.68	3.68	3.68	3.68	3.68
SC-COMET(km)	15.69	16.19	16.39	16.29	15.89	15.19	14.17
LT-Longitude	19:21	19:14	19:08	19:01	18:54	18:45	18:34
LT-CSO	19:31	19:45	20:00	20:21	20:49	21:32	22:47
LAT(deg)	3.61	-3.22	-9.61	-16.06	-22.75	-29.72	-37.62
LON(deg)	14.76	-106.41	132.48	11.36	-109.97	128.39	6.19

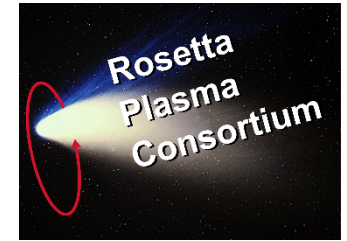
RPC-IES Caveats

- Throughout the mission there are periods of little or no useful IES data resulting from less than optimum S/C pointing.
- As noted in the EIACD a few MCP anodes experience intermittent noise, indicated by the quality flags.
- There are occasional periods of high background due to penetrating radiation. These are noted in the quality flags.



RPC-IES: Final note

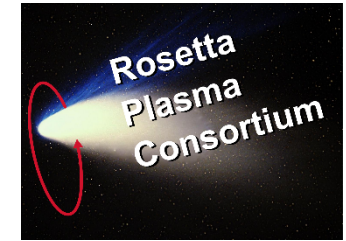
- If you have any questions:
 - Refer to the EAICD and RPC user guide...
 - Contact us (*rgoldstein@swri.edu*)



RPC-MIP

How to use the data

RPC-MIP data currently available on PSA



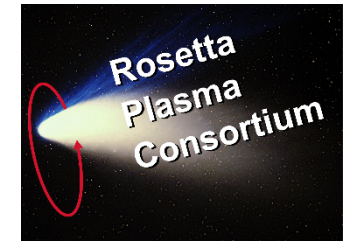
RPC-MIP@PSA:

<ftp://psa.esac.esa.int/pub/mirror/INTERNATIONAL-ROSETTA-MISSION/RPCMIP/>

Current content:

- all **L3 products** by mission phase (e.g. RO-C-RPCMIP-3-ESC4-V1.0)
 - L3 archives = calibrated **RPC-MIP E-field spectra**
 - one file per operational mode (several active and passive modes)
 - for each file, one line = one spectrum at a given time: n frequencies, n amplitude/phase values
- **Browse files**
 - 24-h **quicklook images** showing several L3 RPC-MIP products (to ease fast data selection)

RPC-MIP browse files



RPC-MIP daily summary - 20160803

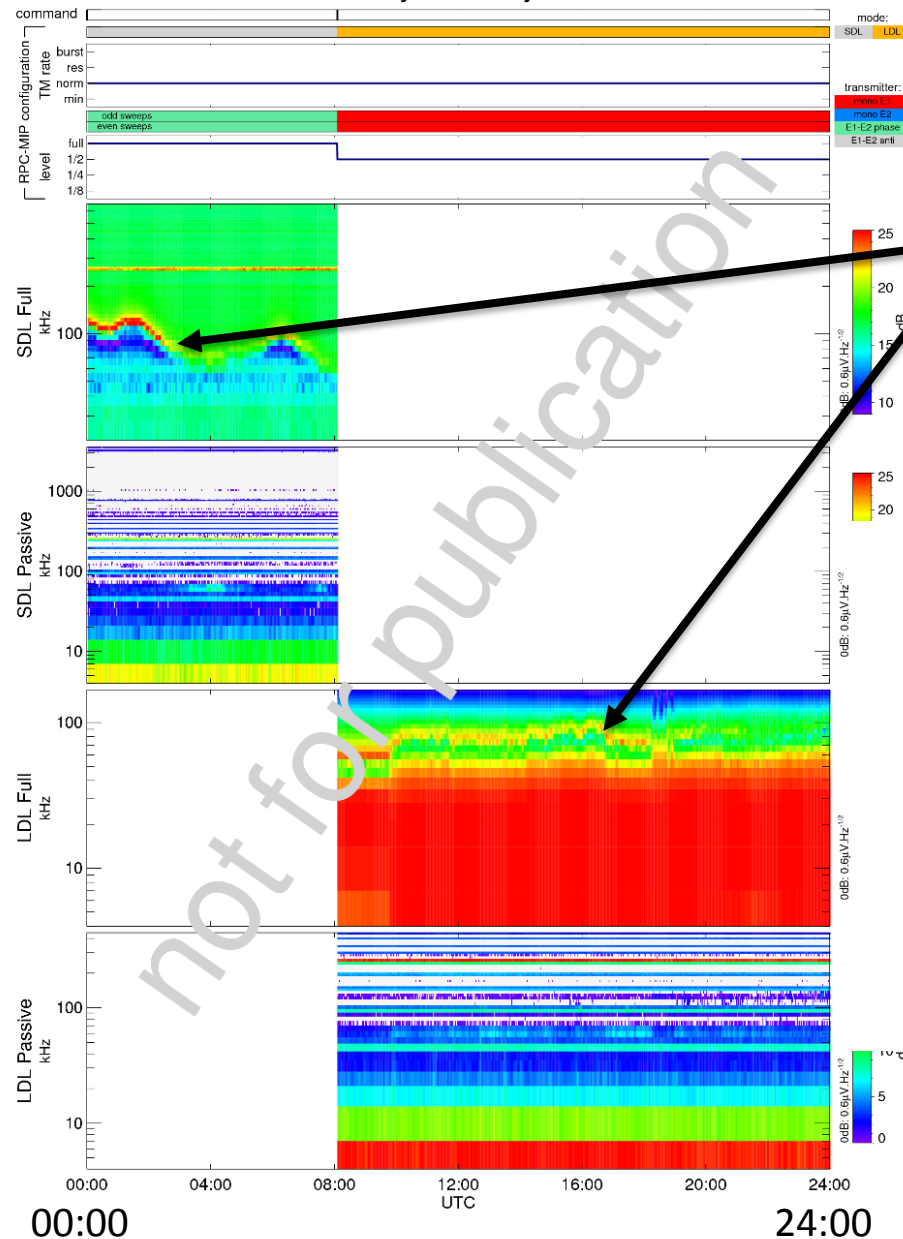
RPCMIPS3XXX*.TAB
(operational parameters)

RPCMIPS3WSF*.TAB
(E-field power spectra in active SDL mode)

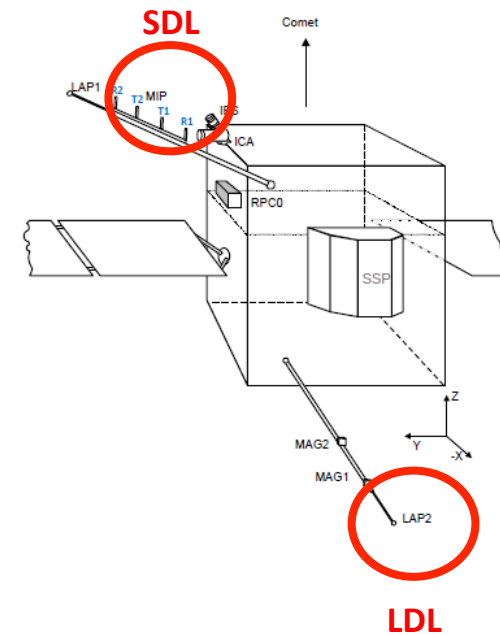
RPCMIPS3ESF*.TAB
(E-field power spectra in passive SDL mode)

RPCMIPS3WLF*.TAB
(E-field power spectra in active LDL mode)

RPCMIPS3WLF*.TAB
(E-field power spectra in passive LDL mode)

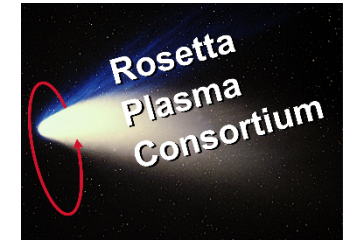


Plasma frequency line
→ plasma (electron)
density
→ Level 5

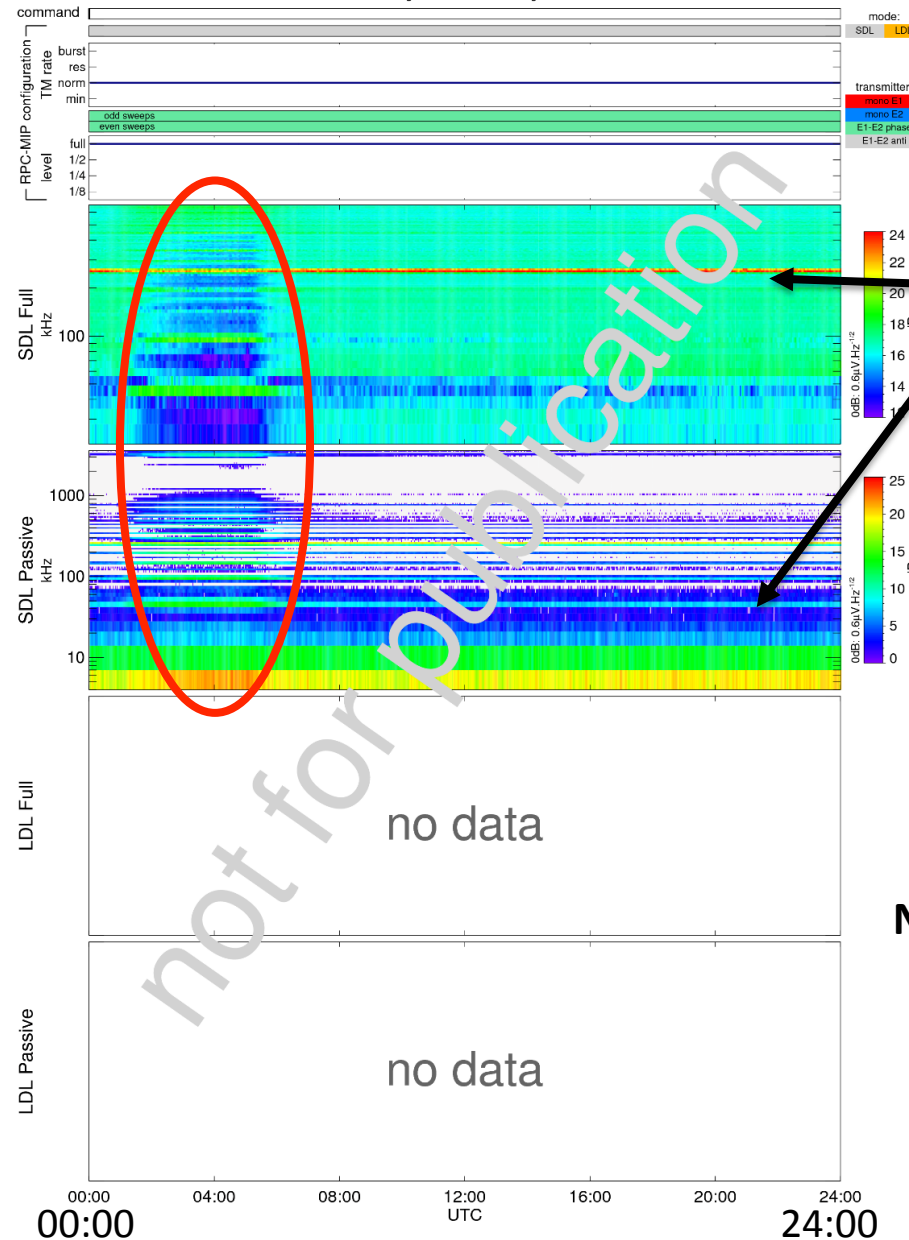


RPC-MIP L3 caveats: instrumental effects

RPC-MIP daily summary - 20160731



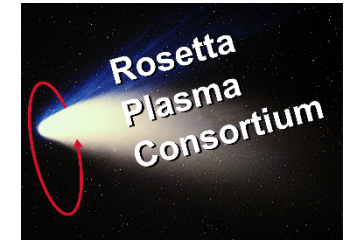
Temperature effect on
preamplifier response
during manoeuvre
(RPC-MIP in shadow)



Interferences

No LDL operation that day

Upcoming RPC-MIP data in PSA



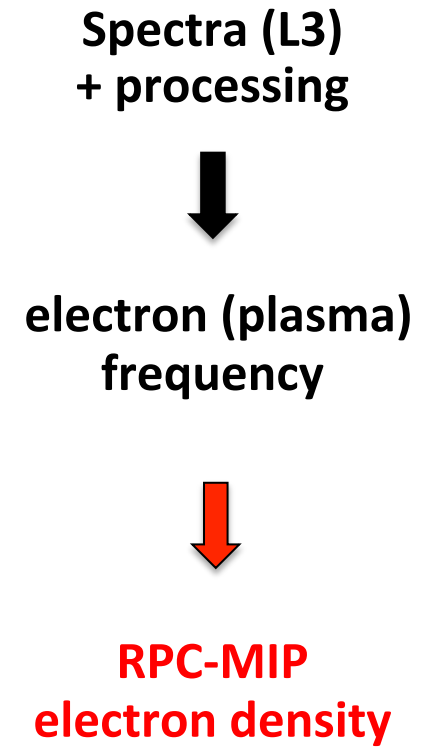
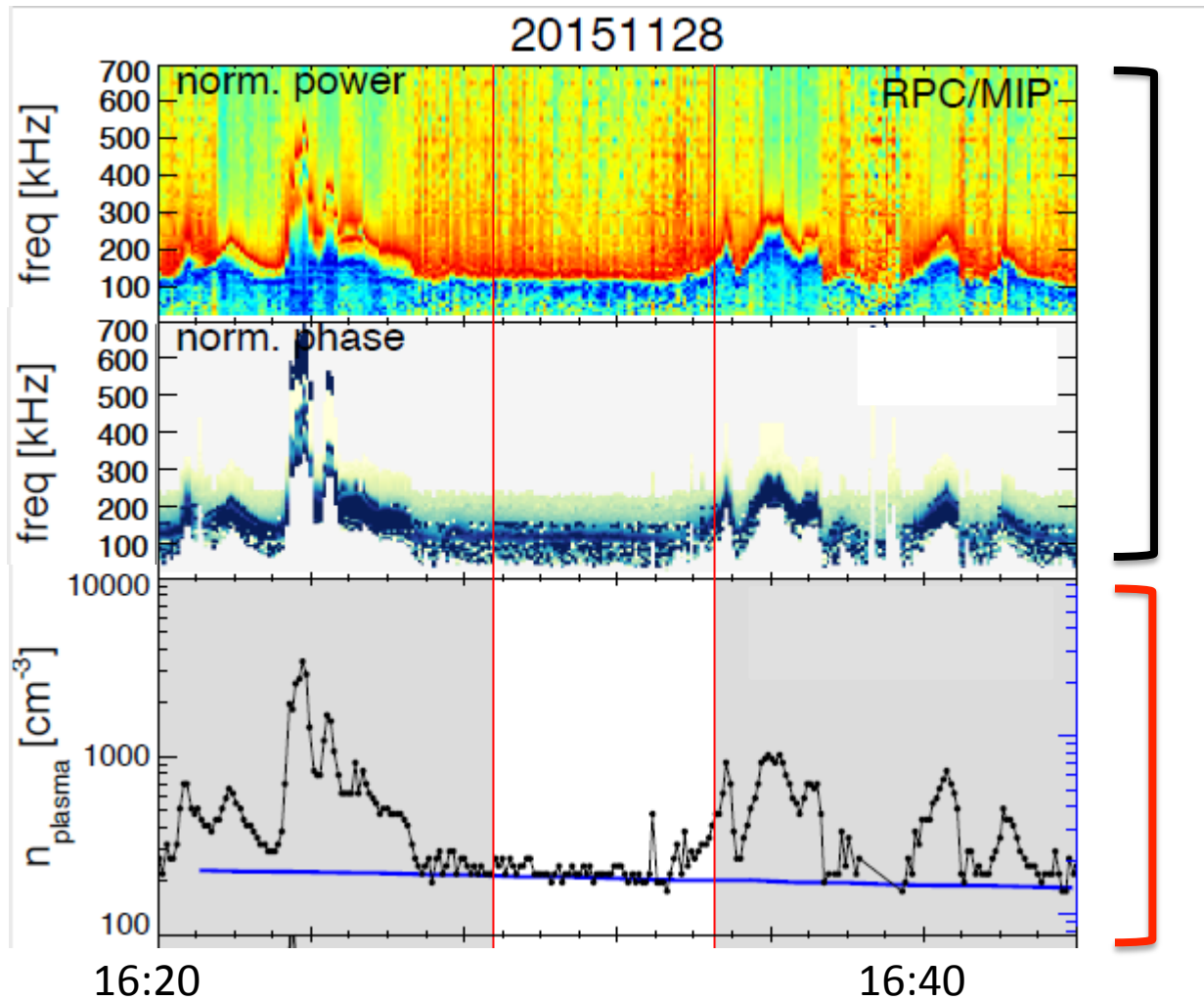
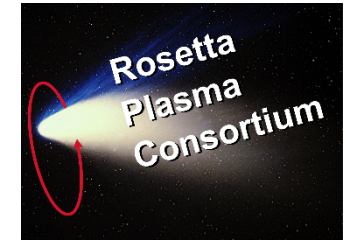
Additional products:

- **L5** products by mission phase
 - **RPC-MIP electron density**
 - **RPC-MIP/LAP x-calibrated electron density**
(higher time resolution over specific time intervals)
 - one file per day
 - for each file, one line = time, *in situ* electron density, uncertainty, ...

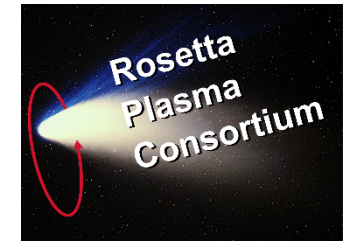
Preliminary density dataset exists → input to RPC science, X-cal, ...

- Working on improving data quality and covered
- Not yet on PSA but available on-demand to MIP team

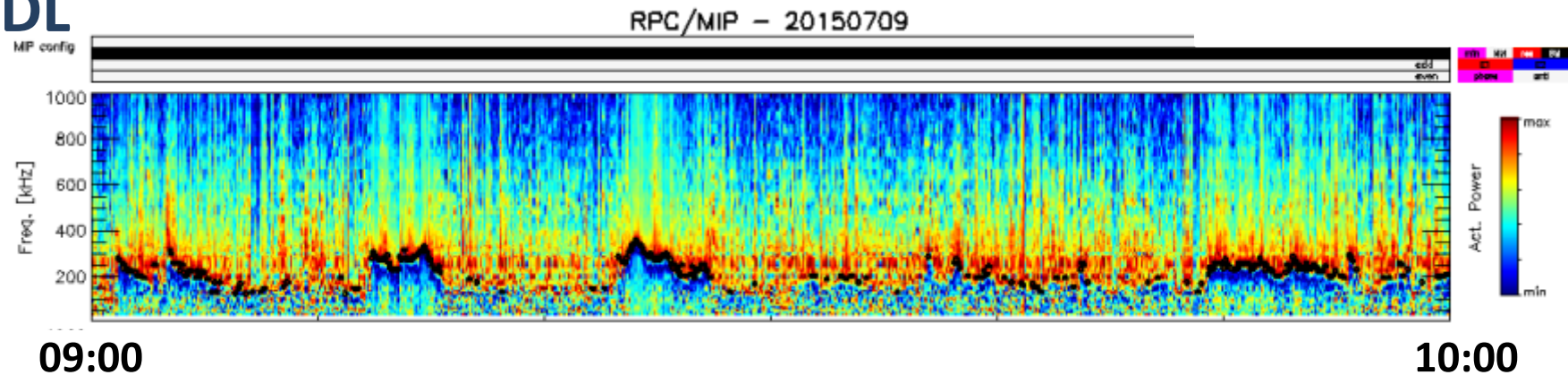
RPC-MIP electron density (example)



RPC-MIP out-of-bound effects on electron density

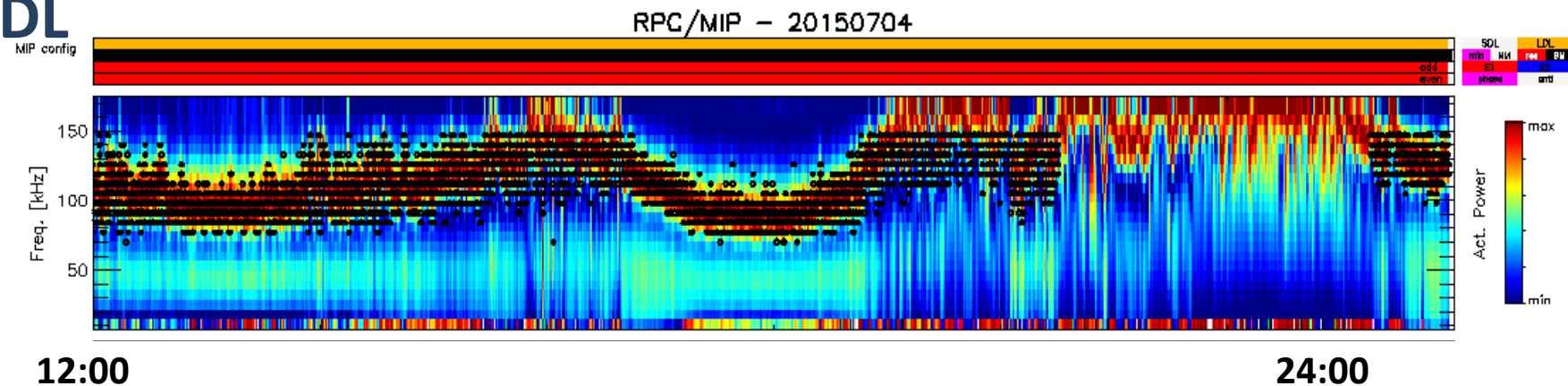


SDL



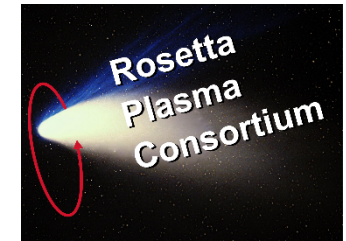
→ missing **lower part** of the plasma frequency temporal variations (instrumental response limit)

LDL



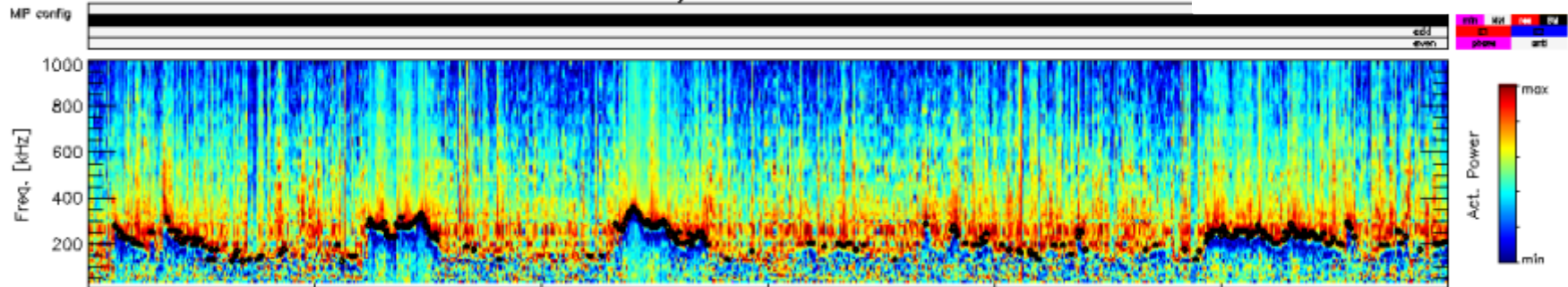
→ missing **upper part** of the plasma frequency temporal variations (out of frequency range)

RPC-MIP out-of-bound effects on electron density

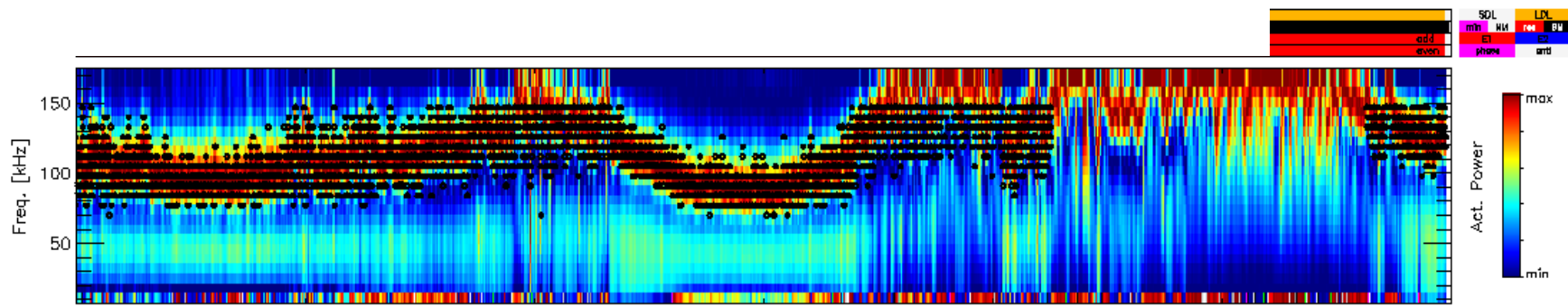


SDL

RPC/MIP - 20150709



caution when averaging

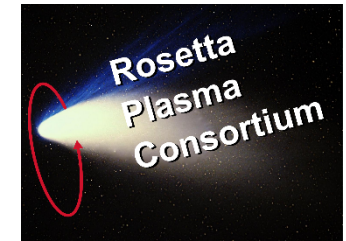


12:00

24:00

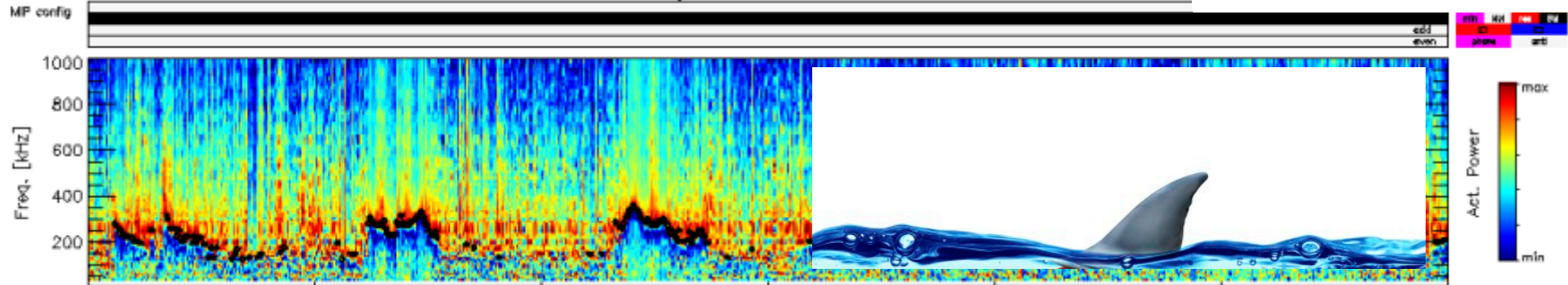
→ missing **upper part** of the plasma frequency temporal variations (out of frequency range)

RPC-MIP out-of-bound effects on electron density

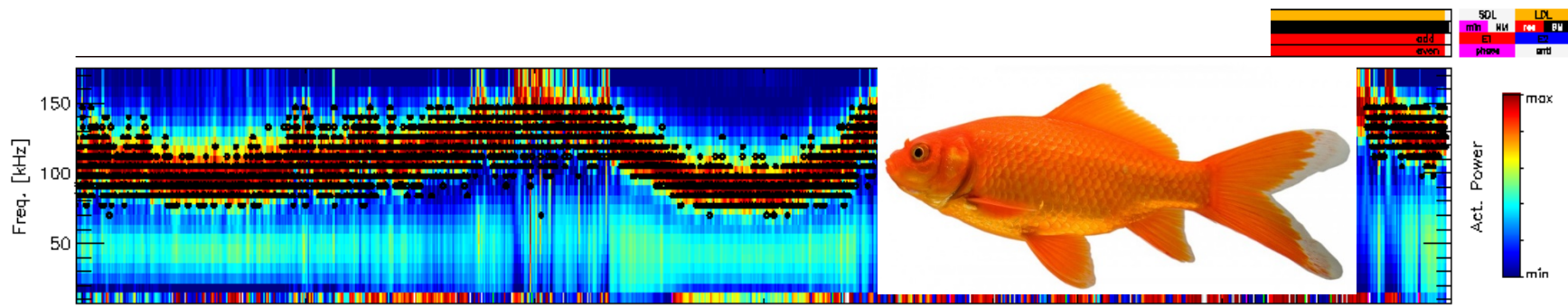


SDL

RPC/MIP - 20150709



caution when averaging
you may end up with 2 different visions

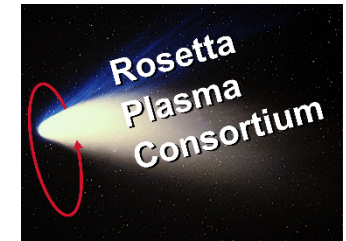


12:00

24:00

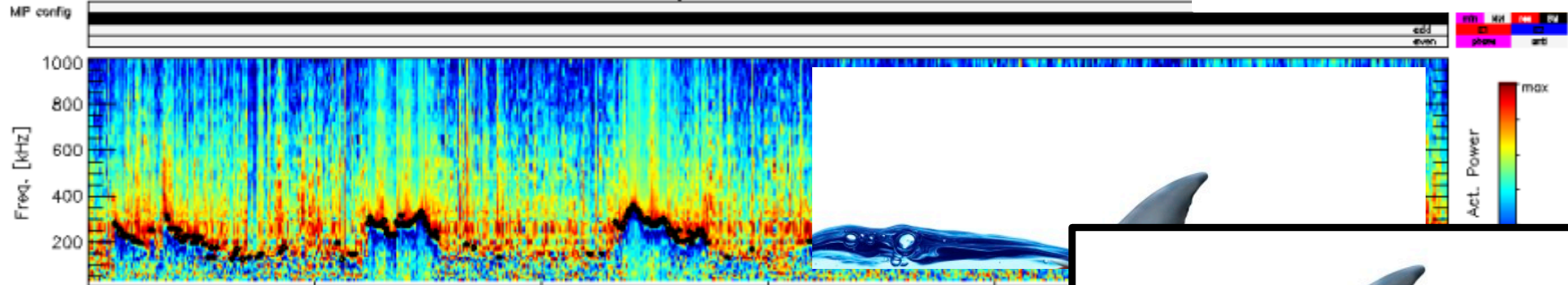
→ missing **upper part** of the plasma frequency temporal variations (out of frequency range)

RPC-MIP out-of-bound effects on electron density

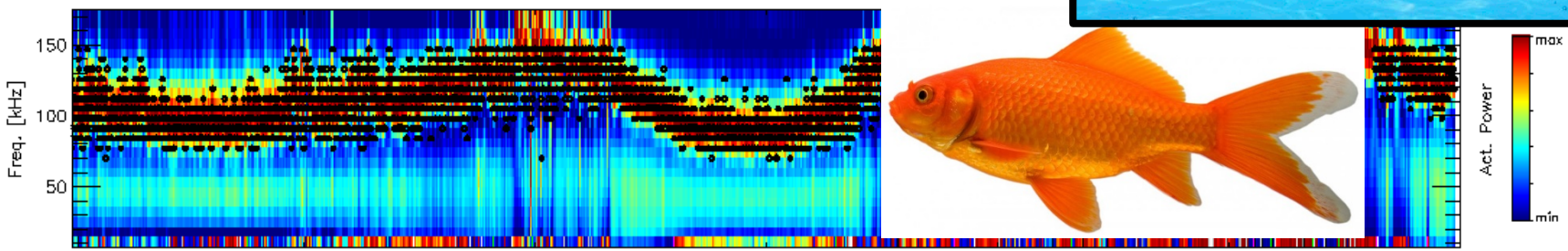
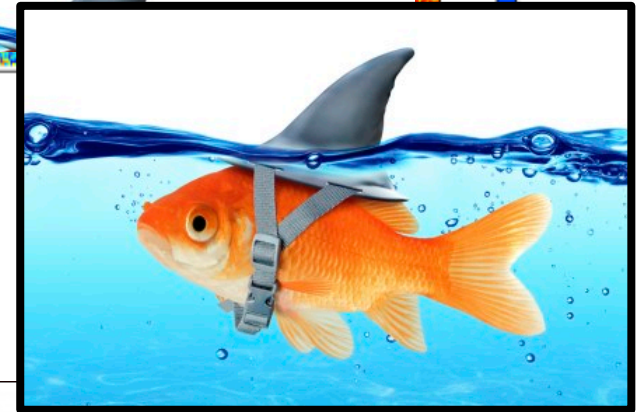


SDL

RPC/MIP - 20150709



caution when averaging
when the real world is like that...

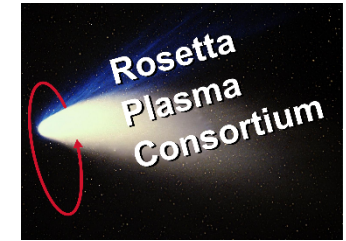


12:00

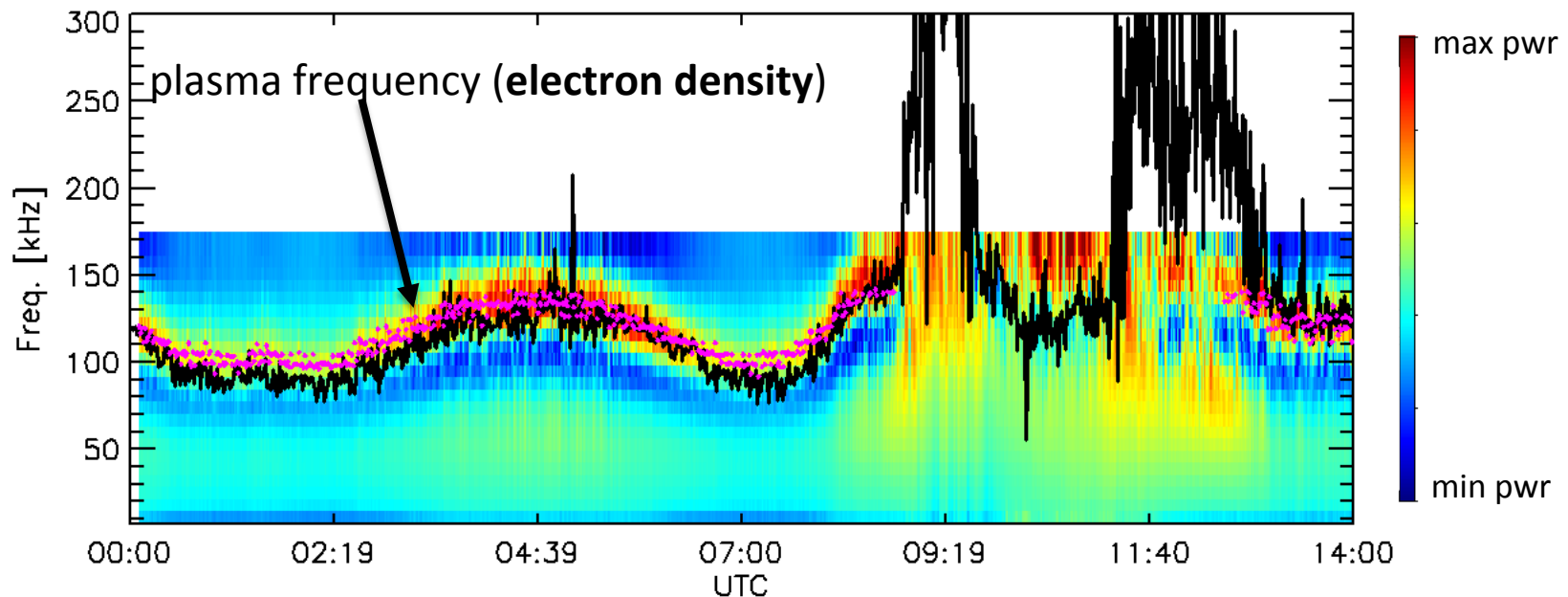
24:00

→ missing **upper part** of the plasma frequency temporal variations
(out of frequency range)

RPC-MIP/LAP cross-calibrated products



To overcome RPC-MIP out-of-bound effects and also to increase time resolution,
Enhanced archive activity at LPC2E and IRFU focuses on
cross-calibration of RPC-MIP and RPC-LAP datasets

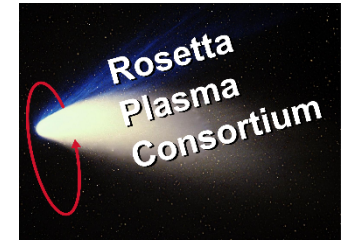


From RPC-MIP spectra

From RPC-LAP I/V sweeps

[see Anders's presentation]

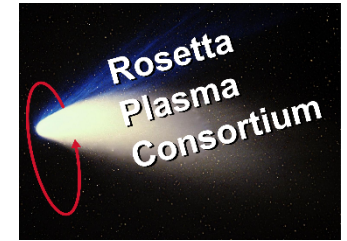
RPC-MIP: Final notes



RPC-MIP → E-field spectra & electron density

If you have any questions:

- Refer to the **RPC-MIP user guide** and the **RPC user guide**
- Contact us (*pierre.henri@cnr-orleans.fr*)



RPC-LAP

How to use the data

RPC-LAP Archive Data

- In PSA now (level 3, calibrated):
 - Measured probe currents and voltages, instrument offsets removed, full time resolution, all data
 - Well described in EAICD
- Upcoming in enhanced archive effort
 - e- density: x-cal with MIP
 - Vsc: x-cal with ICA done (Odelstad et al, MNRAS 2017)
 - Te: LAP only and x-derived with MIP
 - Ion speed estimate (MIP/LAP)
 - Photoemission current (integrated UV flux)

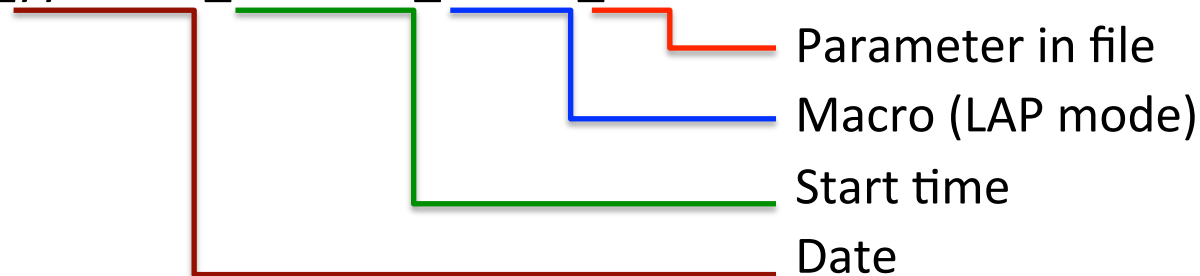
Accessing the RPC-LAP Data

- From:
<ftp://psa.esac.esa.int/pub/mirror/INTERNATIONAL-ROSETTA-MISSION/RPCLAP/>

- Data files cover time span a particular mode is run (macro block)

- File names (see following examples):

RPCLAP_yyddmm_hhmmss_MMM_xxx.TAB

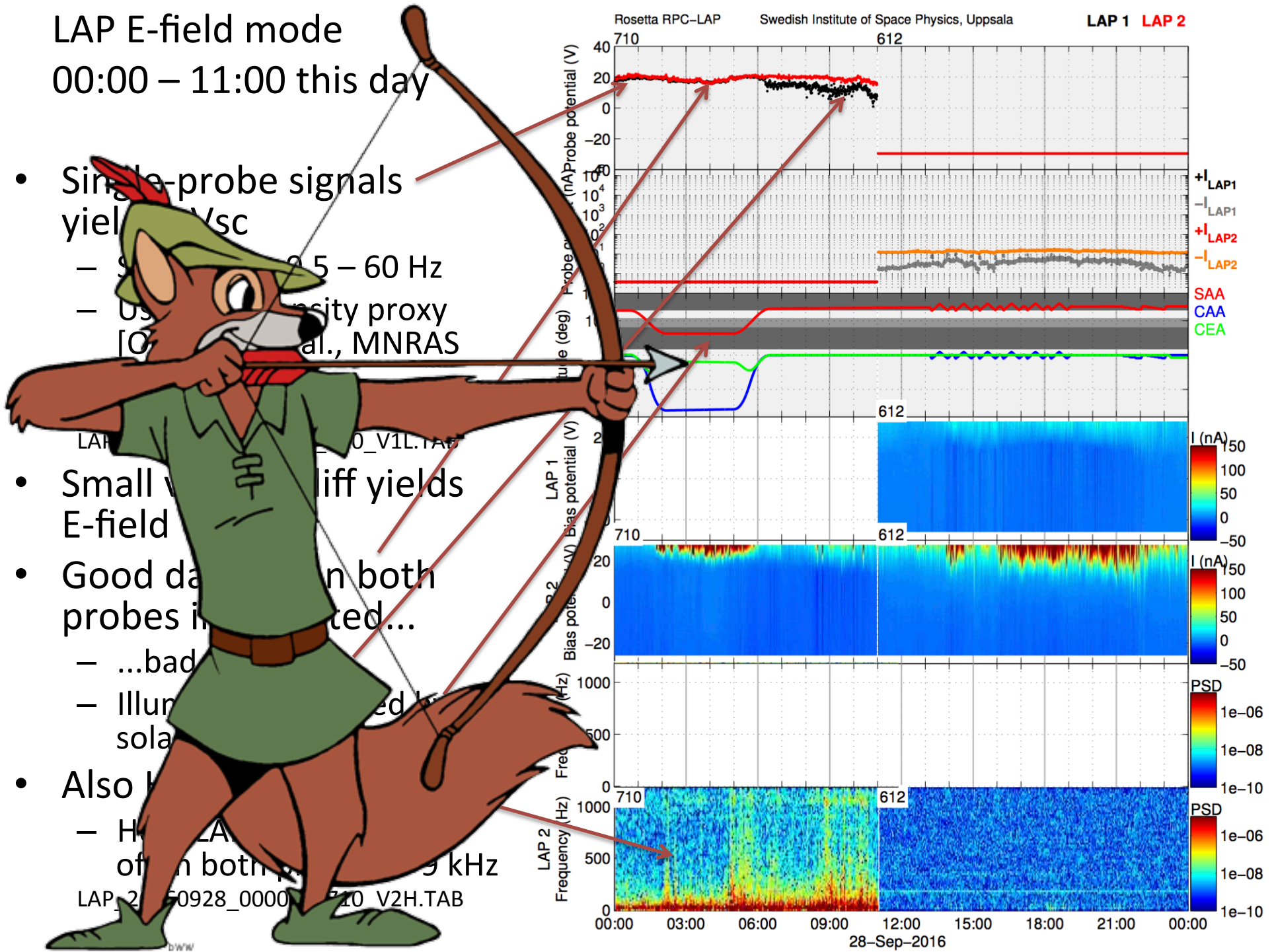


Corresponding label files (.LBL) describe TAB file content

LAP E-field mode

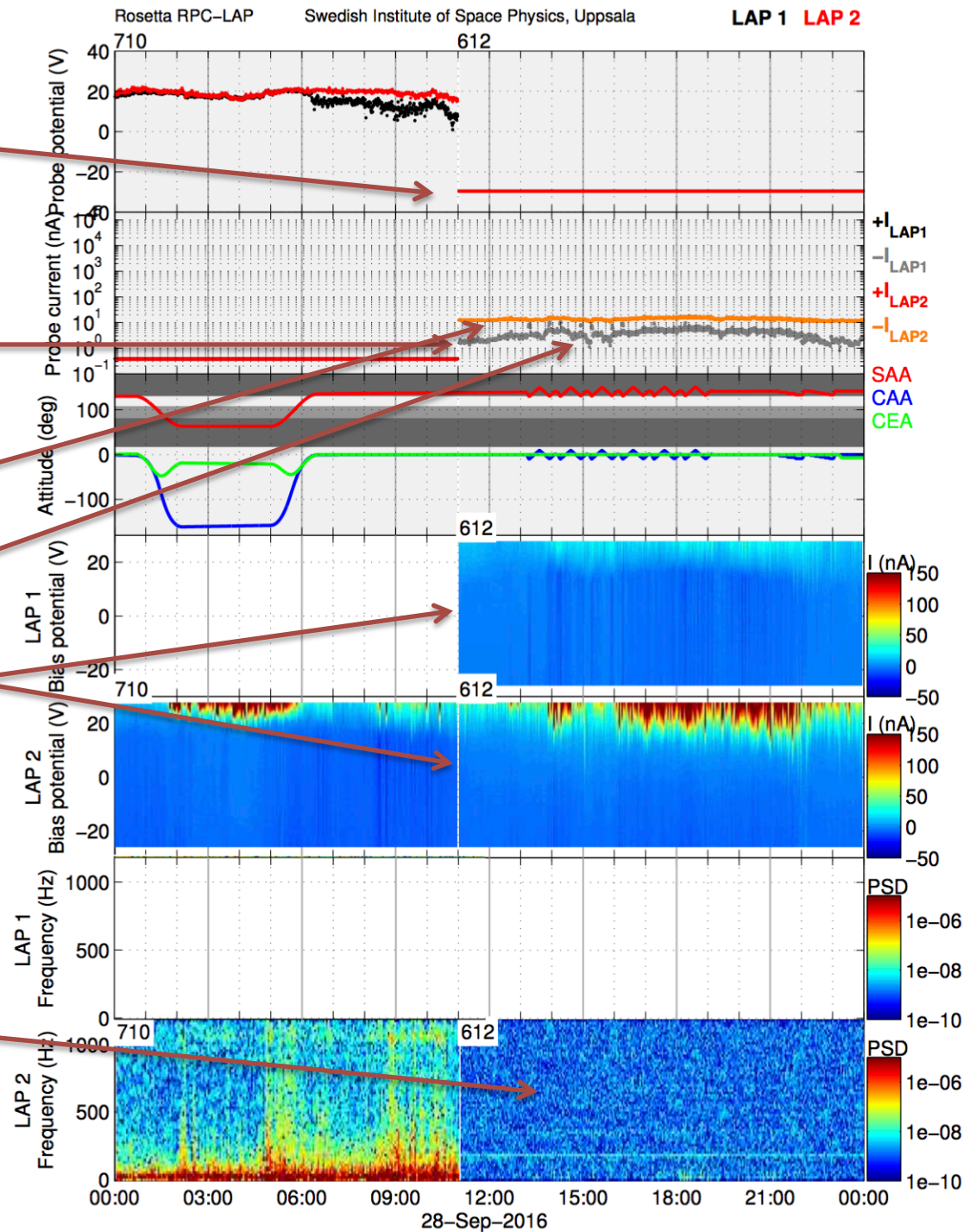
00:00 – 11:00 this day

- Single-probe signals yield ~ 1 Vsc
 - $\sim 0.5 - 60$ Hz
 - Use as density proxy (Ogilby et al., MNRAS)
- Small voltage diff yields E-field
- Good data in both probes in ...
 - ...bad
 - Illuminated by solar
- Also ...
 - High ...
 - off in both ... 5 kHz



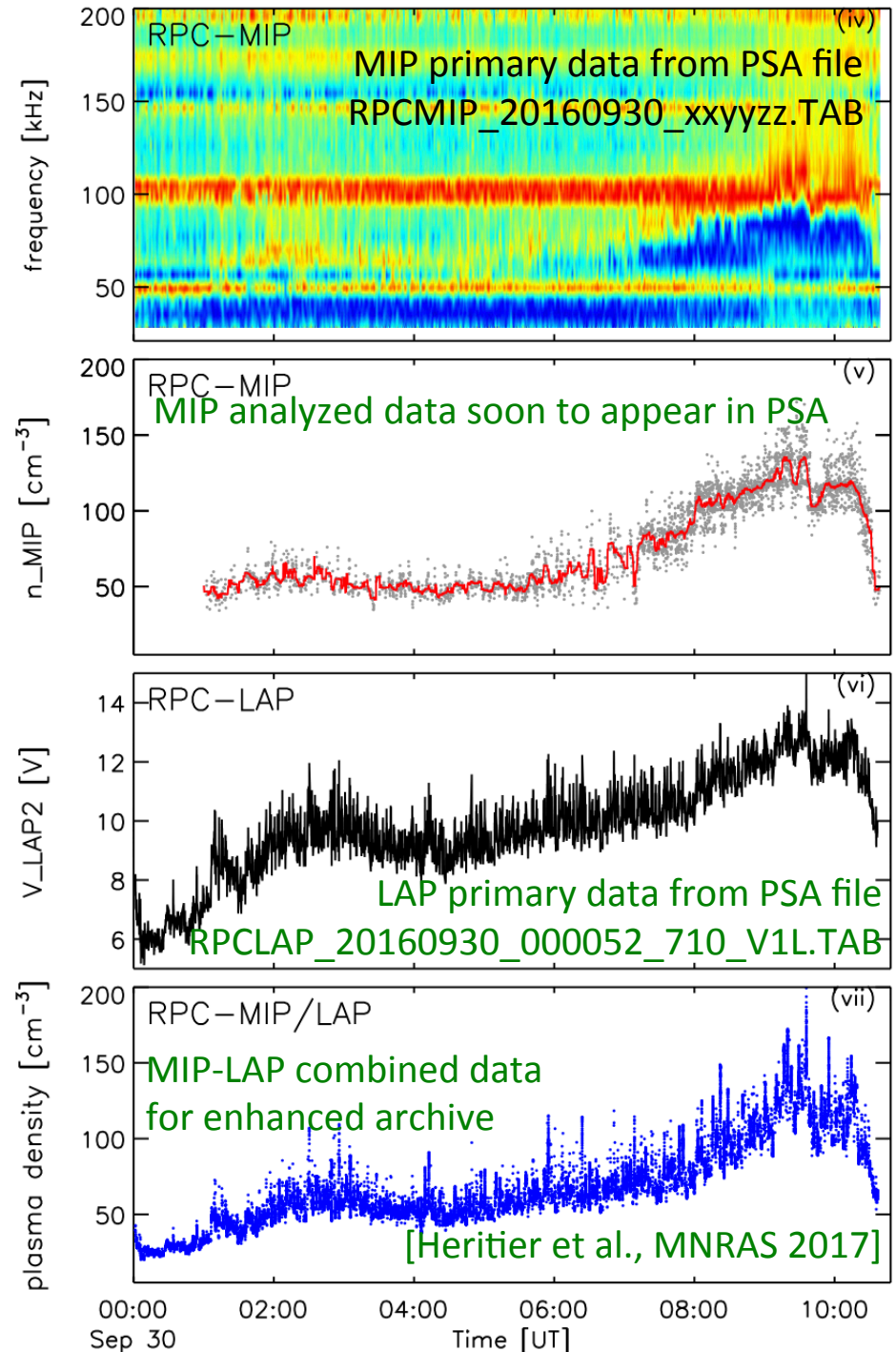
bww

- LAP current mode
 - 11:00 – 24:00 this day
 - Negative bias voltage to collect ions
 - Current usually sampled at 0.5 – 60 Hz
 - Probe in shadow: current follows density
 - LAP_20160928_110212_612_I2L.TAB
 - Sunlight adds photocurrent
 - LAP_20160928_110212_612_I1L.TAB
 - Watch out for illumination changes!
- Probe bias sweeps give more complete info ($\Delta t \sim$ minutes)
 - Derived n_e , T_e , V_{sc} , I_{ph0} , v_i under validation
 - LAP_20160928_110212_612_B1S.TAB
 - LAP_20160928_110212_612_I1S.TAB
 - LAP_20160928_110212_612_B2S.TAB
 - LAP_20160928_110212_612_I2S.TAB
- Also HF data to kHz range
 - Less sensitive than E-field mode
 - LAP_20160928_110212_612_V2H.TAB

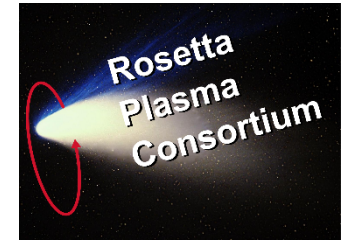


RPC Plasma Density

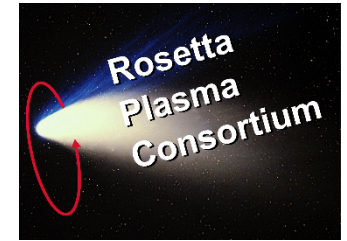
- Above about 50-100 cm^{-3} , MIP provides good absolute density
- Caution: too low density => data gap => risk e.g. when averaging
- LAP density estimates...
 - ...cover wider range...
 - ...with higher cadence...
 - ...but based on model fit and so with a larger absolute error.
- ICA and IES moments important particularly at lowest densities (e.g. solar wind and excursions)
- Cross-calibrated data cover full range at good cadence
 - As yet only for events (EoM example at right)
 - Huge ongoing task: mission-wide consistent database
 - Also Te and other parameters



RPC-LAP: Final note



- Refer to the EAICD and upcoming RPC user guide
- Contact us (*Anders.Eriksson@irfu.se*)



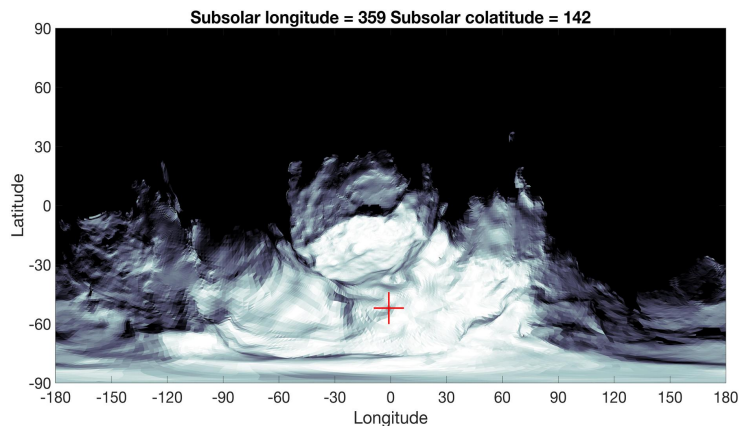
RPC-PIU

New products: Illumination maps

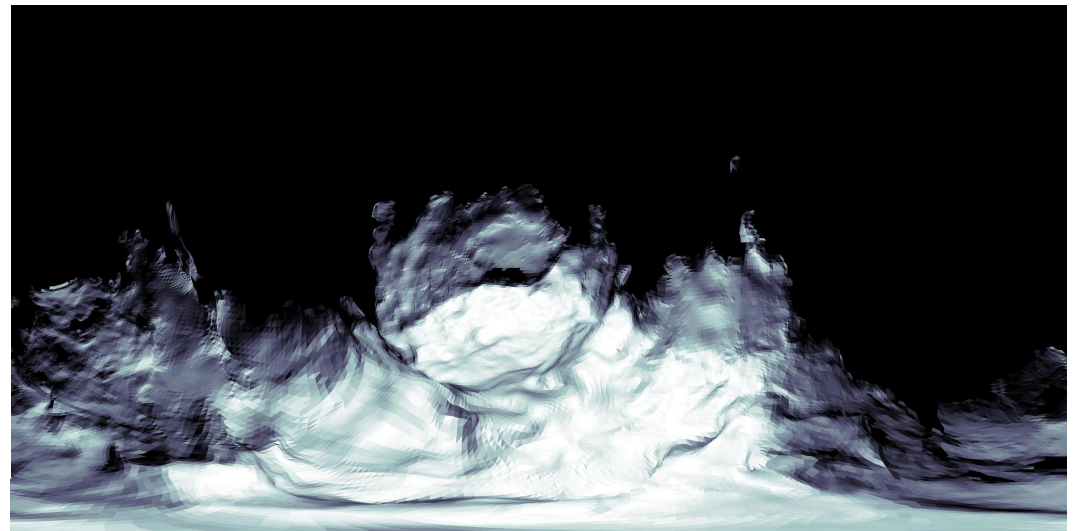
Illumination maps of 67P (RPC-PIU)

- Generated for each position of the subsolar longitude/colatitude (1 degree step) in the rotating frame of 67P (37800 maps)
- Based on shape model CSHP_DV_130_01_LORES_OBJ.OBJ (104192 faces)
- **Available** on: **VESPA** (<http://vespa.obspm.fr/planetary/data/epn/query/all/>)
→ 67P → ILLU67P
and in the future, on the **PSA**.
- **Products:** 1 .LBL txt file, 1 .TAB txt file, 1 low and 1 high resolution 2D maps
→ .LBL: Header with relevant information
→ .TAB: Cosine of the angle between the Sun direction and the normal for each face

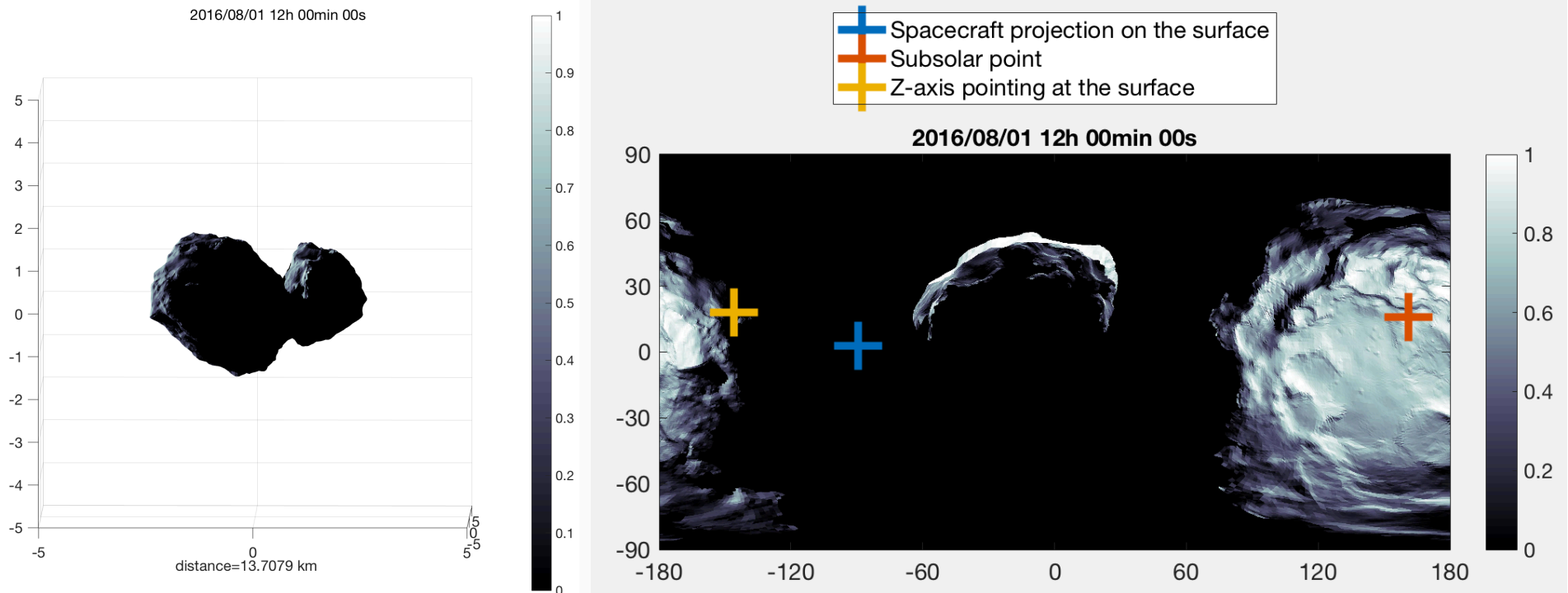
359-142-preview.jpg



359-142-map.jpg

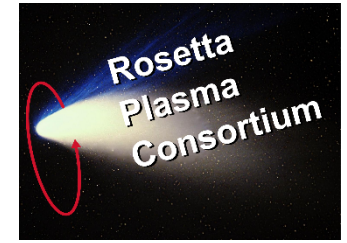


- With the .TAB file + shape model:
 - Rebuild the comet with the corresponding illumination in 3D
- PSA will allow to link time to the subsolar position
- MATLAB script available soon to generate the following products:



[Courtesy of A. Beth]

RPC-PIU: Final note

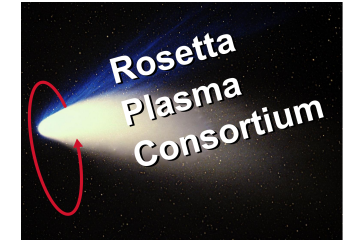


- Contact us:

- a.beth@imperial.ac.uk (*illumination maps*)

- m.galand@imperial.ac.uk (*RPC-PIU, RPC coordination*)

RPC Science User Guide



1. Brief overview of the sensors
2. Brief summary of operational modes linked to science data produced
3. Science data produced linked to science goals
4. Typical scientific analysis that can be performed on the data
5. Description of the data present in the PSA
6. Recommended software for visualisation/analysis of the RPC science data
7. Guide on how to process the data including calibrations to be applied
8. Example dataset
9. List of caveats – problems with data contents, format
10. List of science papers where further information can be found