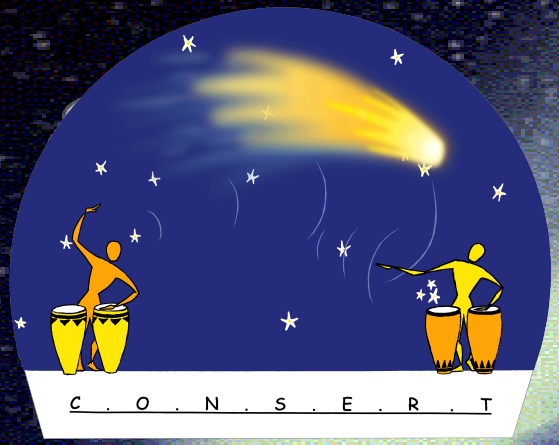
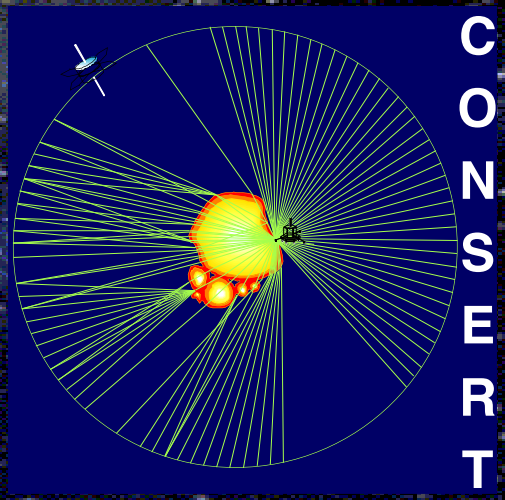
CONSERT Archive.

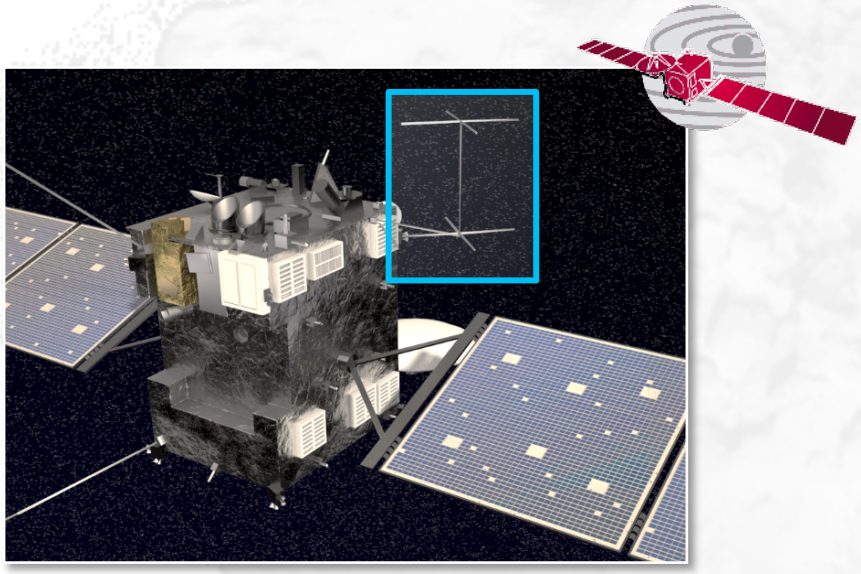


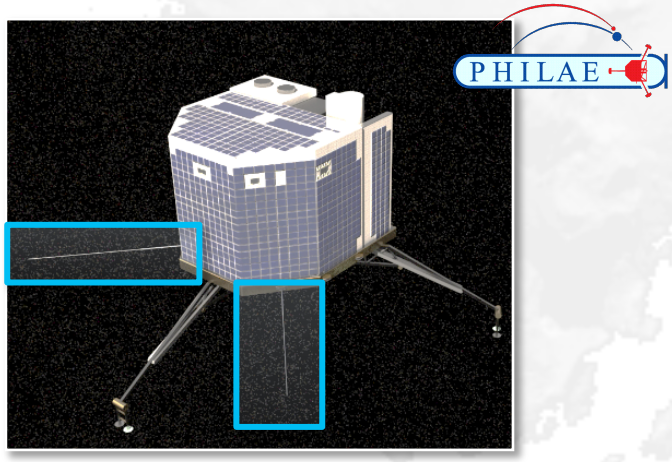


esa PHILAE DLR LATMOS IPAG Institut de Planétologie et d'Astrophysique de Grenoble cnes MPS esa Rosetta

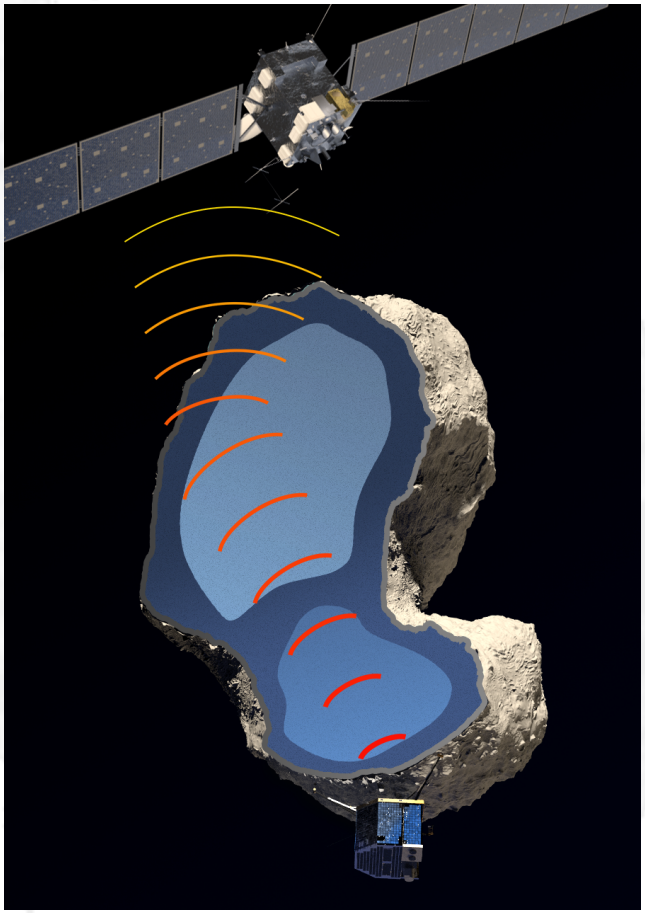
CONSERT Instrument

CONSERT was designed and built in France in collaboration with Germany.



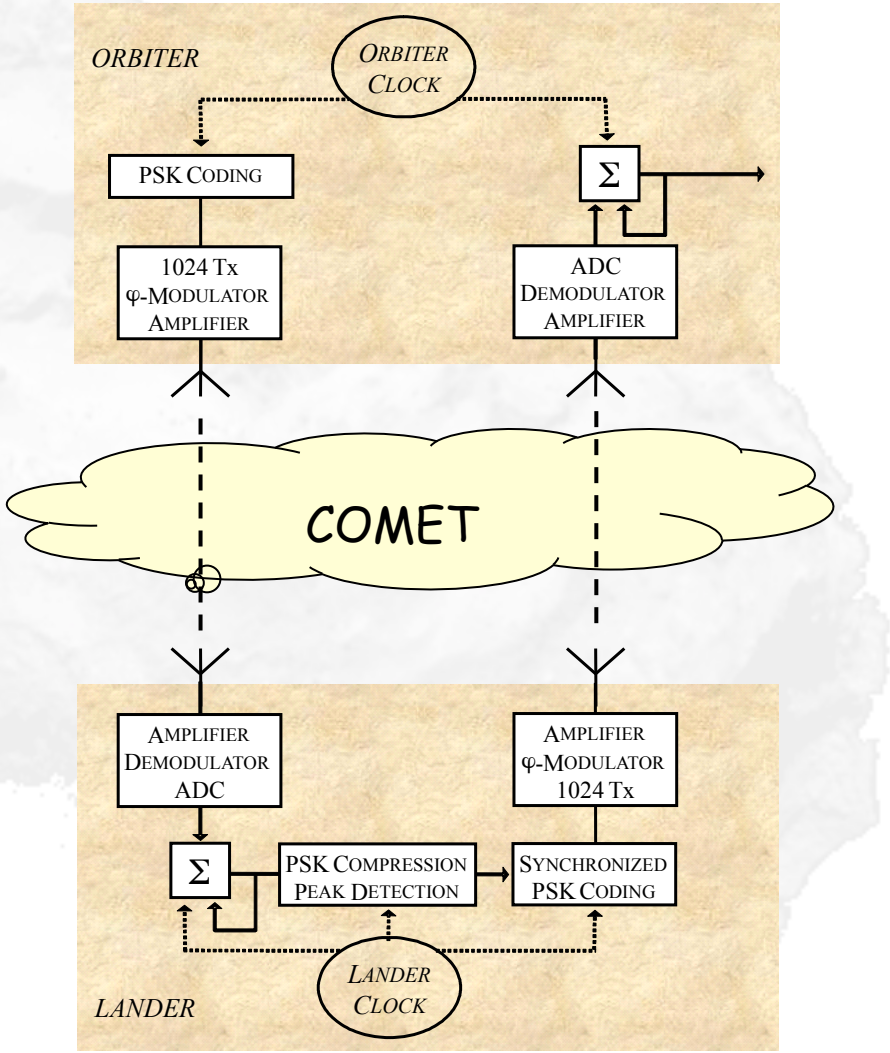


Kofman et al., ASR, 1998, SSR,2007

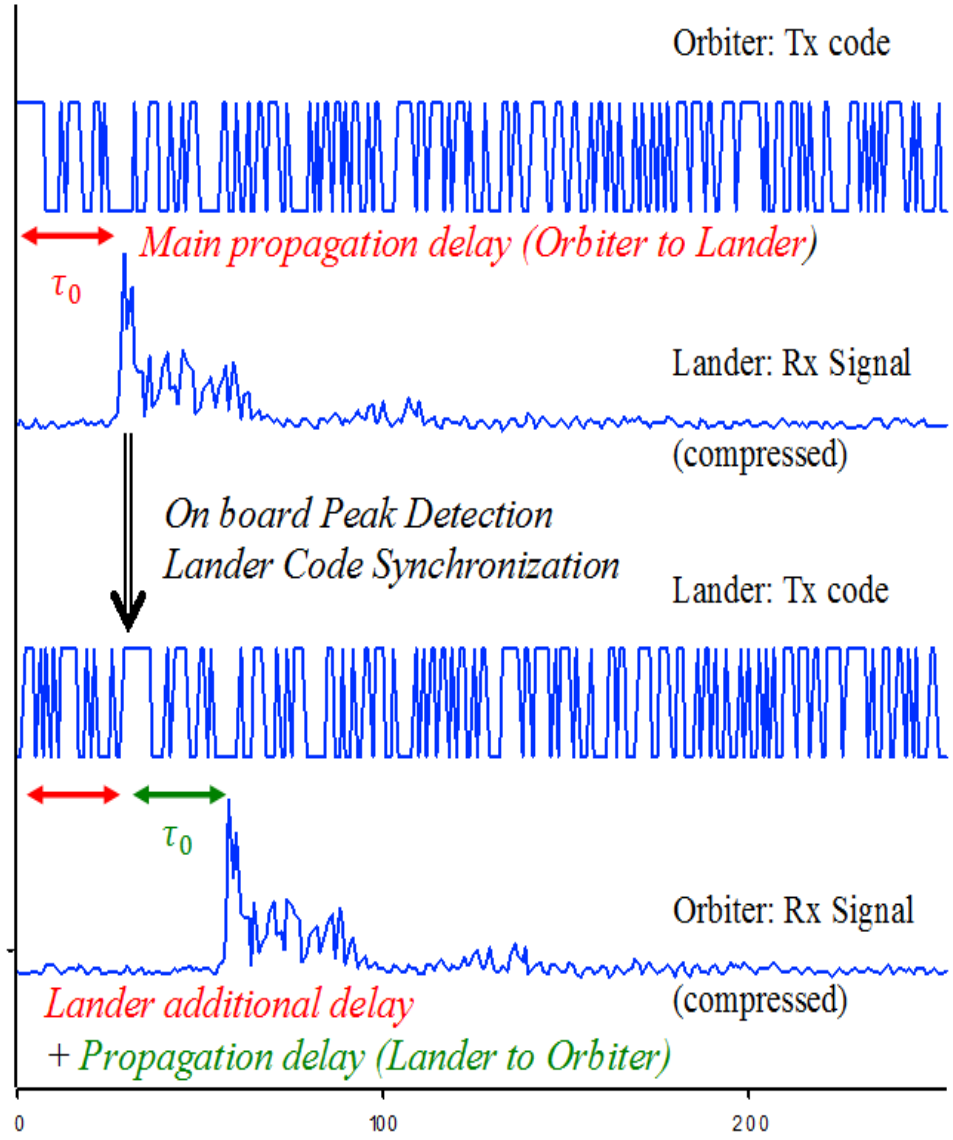


Instrument characteristics

- PSK coded Signal
  - Step 100 ns (B = 10MHz)
  - 90 MHz Modulation
  - 25,5µs per code
  - Periodic signal
  - Resolution (7-10m in ice)
- Processing
  - I,Q demodulation
  - 1024 accumulations (SNR +30 dB)
  - Matched filter (+24 dB)
  - Peak detection (maximum power)
- Measurement cycle: 0.5 s
  - Tx = 200 ms
  - Rx = 26 ms
  - Processing 200 ms



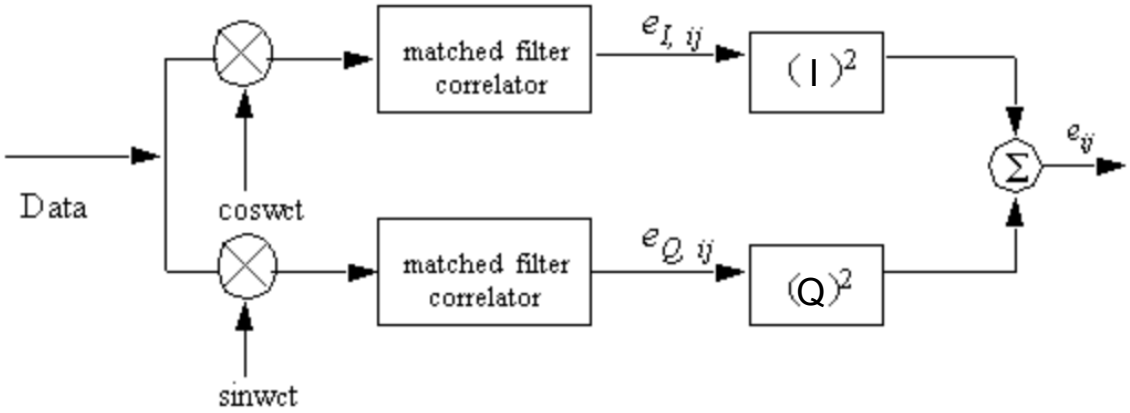
In-time transponder

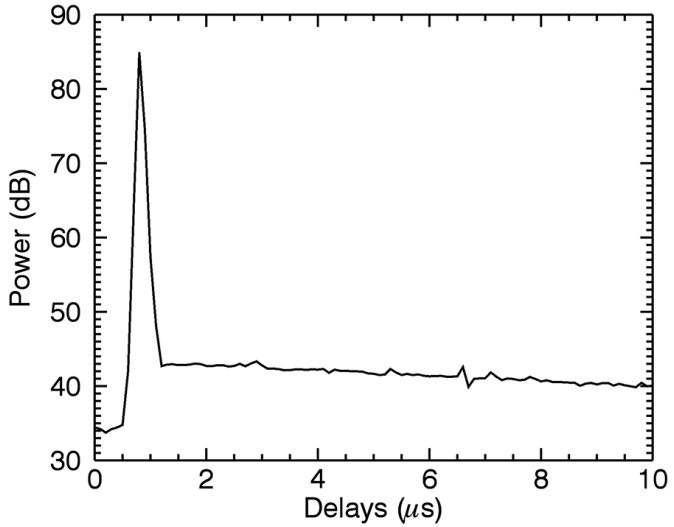


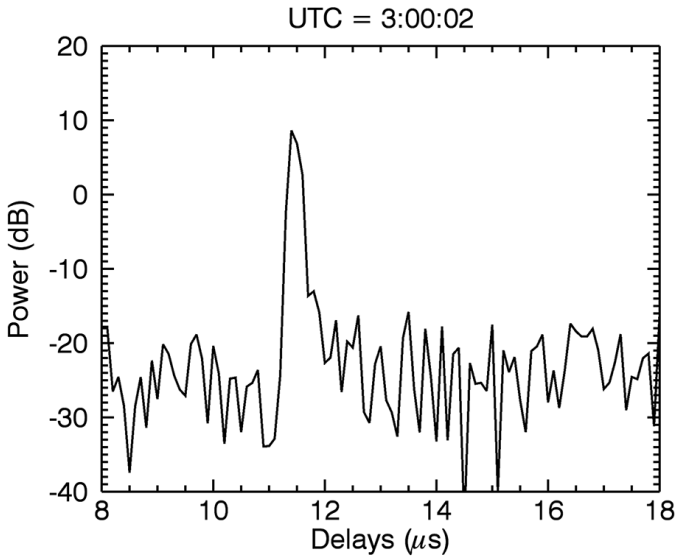
- Two ways experiment
  - One way for synchronization
  - One way for science measurement
    - Additional delay
    - Ground compensation
- Clock constraints
  - Time preservation during calculation time (ms)
  - Tx/Rx windows (ms) versus orbit
  - Phase coherence during integration
    - $\Delta f/f = \sim 10^{-7}$

Demodulation-Compression = matched filter

$S(t) = C(t)\cos(\omega t+\phi)$







Team working on archive

- Data engineering & management
  - Yves Rogez
  - Mélodie Roudaud
- Scientific supervision & documentation
  - Alain Herique
  - Wlodek Kofman

Measured parameters & data of main interest

- Geometry configuration and time
  - CONSERT sounding number
  - CONSERT internal clock time stamp
  - Precise sounding times converted to UTC
  - Position and attitude of Rosetta on orbit
  - Position and attitude reconstructions of Philae (from ROMAP, OSIRIS, CONSERT, SONC)
- Received signal
  - On CONSERT Lander (LCN), compressed short signals with 21 samples after the compression around the maximum are available for every soundings
  - On LCN, every ~5 sec. or more (depending on FIOW instrument setting) the whole (“long”) uncompressed signals with 255 samples
  - On CONSERT Orbiter (OCN) uncompressed long signals are available for every sounding.
  - Amplitude before and after compression
- Propagation time between Orbiter and Lander

Useful ancillary data

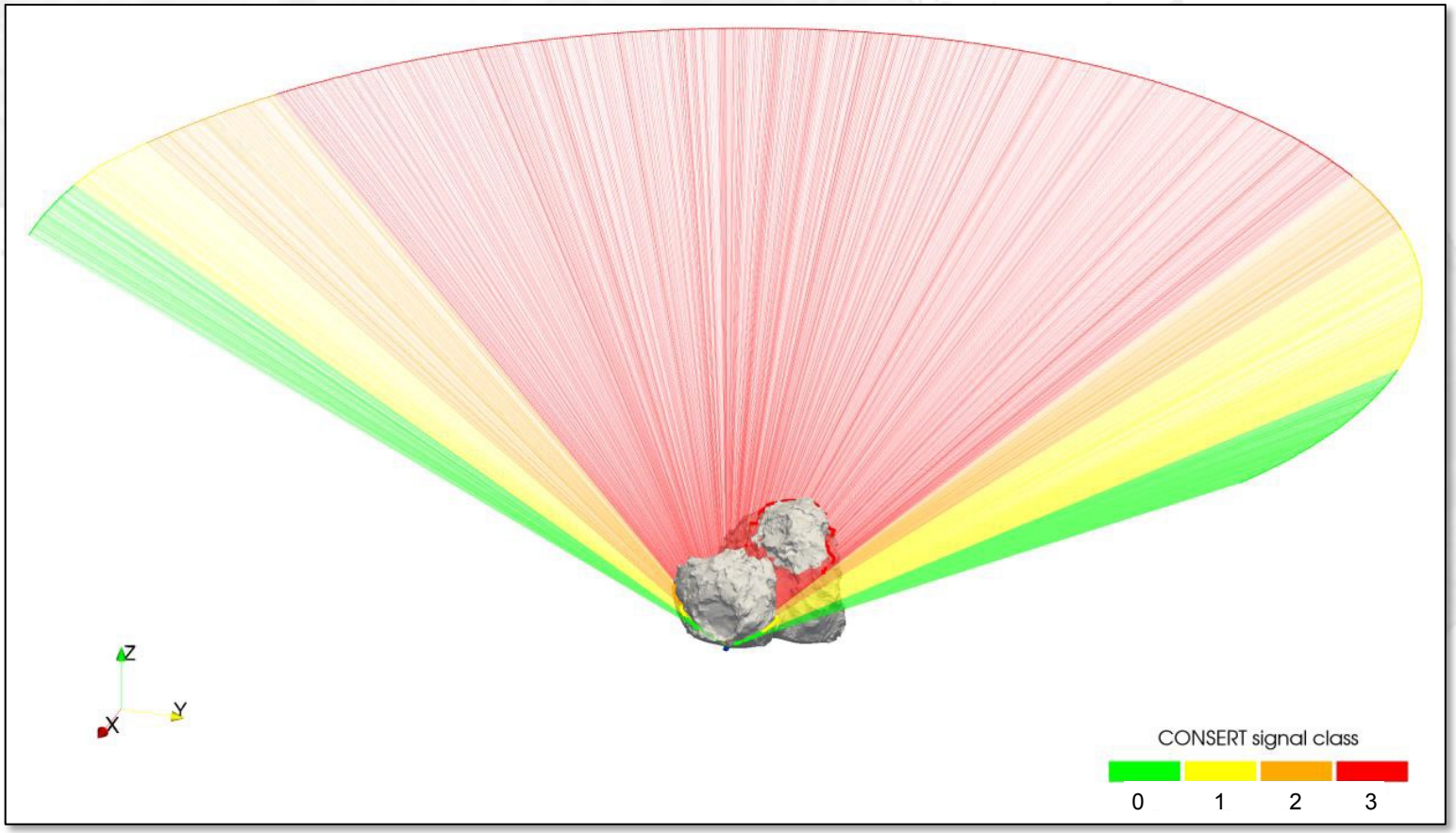
- CONSERT internal house keepings (HK)
  - OCXO tuning frequency
  - AGC setting
  - Internal temperatures on electronic boards
- Orbiter HK
  - Solar panel position angles
  - High gain antenna elevation and azimuth angles
  - CONSERT currents
  - CONSERT antenna temperatures

Available science operations

- CONSERT operated to fulfill its scientific objectives in three phases
  - PDCS, at MTP8 during operation planning for close observation phase
    on 16/10/2014 11:00 to 14:00
  - SDL and FSS phases
    from 12/11/2014 08:20 to 14:50
    from 12/11/2014 18:50 to 05:40 the next day
  - Rq: CONSERT was in wait mode between SDL and FSS

Focus on FSS data

- CONSERT signal with good synchronization and SNR has been measured during the 12/11/2014 evening and 13/11/2014 morning



FSS CONSERT signal quality classes

0 : Strong signal with good LCN/OCN transponder synchronization
1 : Positive SNR but no transponder synchronization (RF pollution on LCN)
2 : SNR close to 0 dB (statistical detection)
3 : No signal detected (for the moment…)

Signal class	OCN Sounding number	UTC time of beginning	UTC time of ending	Duration
0	9158	12/11/2014 18:56:40	12/11/2014 19:28:28	00:31:48
1	9922	12/11/2014 19:28:30	12/11/2014 19:44:58	00:16:28
2	10318	12/11/2014 19:45:00	12/11/2014 20:13:25	00:28:27
3	11001	12/11/2014 20:13:27	13/11/2014 00:44:59	04:31:35
2	17518	13/11/2014 00:45:02	13/11/2014 01:21:09	00:36:10
1	18386	13/11/2014 01:21:12	13/11/2014 02:27:45	01:06:33
0	19984	13/11/2014 02:27:47	13/11/2014 04:05:45	01:37:58

CONSERT Level 2 archive data

- L2 are edited data, after de-commutation of telemetry
  - Raw signals data for I and Q channels (255 samples each)
  - LCN includes short and long signals, OCN all long signals
  - Sounding number, on board time, UTC time of measurements on Orbiter (OCN) and Lander (LCN)
  - Signals are given uncompressed with compression code separately

- Available phases:
  - PDCS, SDL and FSS (including lander search operations)
  - Cruise and ground calibration data are to be finalized

- Internal instrument HK for each sounding in raw units
- HK from the platforms (with independent sampling rate)

- **These are raw data; only useful for anyone who wants to re-calibrate CONSERT measurements**

CONSERT Level 3 archived data

- L3 are calibrated data
  - Calibration is done on long times (precise sounding times)
  - Calibration is done on amplitudes
  - Precise correction on short times (travel time measurements) will be delivered along with L4

- Available signal data
  - Orbiter; uncompressed and compressed I and Q data with arbitrary amplitude units
  - Lander; short compressed signal and every FIOW uncompressed and compressed long I and Q

- Internal instrument HK for each sounding in physical units
- HK from the platforms (with independent sampling rate)

- Geometry using Spice kernel in B3F format (DV_254/344)
- Geometry files are given only for CONSERT science operations.

CONSERT L3 archive data

- L3 data are delivered to PSA archive for
  - PDCS, SDL and FSS phases.
  - Cruise phases
  - The ground calibration data will be delivered next year (~September 2018)

- Note : Philae localization sequences after landing are included in L3 data and can be found as “FSS ranging” operations

- Note : Data fields descriptions, extracted from EAICD are available in last slides of this presentation

CONSERT Level 4 archive data

- L4 are processed data
  - Signals are interpolated and corrected merging OCN and LCN ones
  - So they are given only as OCN ones
  - Interpolated compressed I and Q signal data (foreseen x20 factor on samples count on long signals)
  - Peak detection with an accuracy of few nanoseconds

- Refined calibrated amplitude and propagation time between Orbiter and Lander
  - Including corrections of the system delay
  - The lander peak on board detection
  - Temporal ambiguity due to periodicity of the transmitted signal (modulo 25.5 microseconds), using orbitography information

- **These values are final CONSERT data ready to physical interpretation**.

- L4 data are to be delivered in ~September 2018.

LR Orbiter data

PARAMETER	DESCRIPTION
O_SN	The CONSERT orbiter sounding number. A unique number starting at 0 and incremented by 1 identifies each sounding.
L_SN	The corresponding CONSERT lander sounding number. A unique number starting at 0 and incremented by 1 identifies each sounding. It can occur that a sounding is missing in the data, the mapping between O_SN and L_SN allows to have a correct matching between OCN and LCN data.
TEMP_OCXO	Temperature (°C) on the orbiter instrument OCXO component. Conversion function from raw data given in appendix **Erreur ! Source du renvoi introuvable.**.
TEMP_DIGI	Temperature (°C) on the orbiter instrument digital board. Conversion function from raw data given in appendix **Erreur ! Source du renvoi introuvable.**.
OCXO	Frequency (Hz) of the OCXO after the tuning phase. Conversion function from raw data given in appendix **Erreur ! Source du renvoi introuvable.**.
UTC	The corrected UTC timing of each sounding given as a character string.
CN_SECONDS	The relative number of seconds from CONSERT instrument start-up.
GCW	The automatic gain control factor in dB. Please refer to **Erreur ! Source du renvoi introuvable.** for details.
RADIOM_GCW	Placeholder for the thermal correction factor applied on linear amplitude for the automatic gain control component. This value is fixed to 1.0 in this version of the data (no thermal calibration applied).
RADIOM_THERM_RX	Placeholder for the thermal correction factor applied on linear amplitude for the instrument receiving chain. This value is fixed to 1.0 in this version of the data (no thermal calibration applied).
RADIOM_THERM_TX	Placeholder for the thermal correction factor applied on linear amplitude for the instrument transmitting chain. This value is fixed to 1.0 in this version of the data (no thermal calibration applied).
TOTAL_GAIN	The total gain factor applied on linear amplitudes. $TOTAL\_GAIN = 10^{\frac{GCW}{20}} * RADIOM\_THERM\_RX * RADIOM\_THERM\_TX$
IQ_CORR	The signal is composed of two complex components I and Q after demodulation. The electronics have an unbalanced constant error between the two components amplitudes. $I_{output} = I_{input}$ $Q_{output} = Q_{input} \times (1 + \epsilon)$ with ε equal to 5%

L3 Orbiter data

ENTROPY	Placeholder for further information and signal quality estimation.
QUALITY	For all the CONSERT sequences but FSS, quality of the signal was good, so the flag is set to 0. During the FSS science measurements are the most important ones for CONSERT, this parameter have been specifically analysed and qualitatively defined. Please refer to **Erreur ! Source du renvoi introuvable.** for the detailed definition.
INTERF_FREQ	Cancelled interference frequency line position in spectrum (Hz). This parameter exists only when interference frequency lines have been detected (actually only in FSS dataset)
INTERF_AMPLI	Cancelled interference frequency line amplitude (instrument unit). This parameter exists only when interference frequency lines have been detected (actually only in FSS dataset)
INTERF_PHASE	Cancelled interference frequency line phase (rad). This parameter exists only when interference frequency lines have been detected (actually only in FSS dataset)

L3 Lander data

PARAMETER	DESCRIPTION
L_SN	The CONSERT lander sounding number. A unique number starting at 0 and incremented by 1 identifies each sounding.
O_SN	The corresponding CONSERT orbiter sounding number. A unique number starting at 0 and incremented by 1 identifies each sounding. It can occur that a sounding is missing in the data, the mapping between L_SN and O_SN allows to have a correct matching between OCN and LCN data.
L_LONG	A flag indicating if the current sounding is a long (1) or a short signal (0). Please note that a short signal always exists, wether a long one is present or not in the data. Where no long signal is present, missing constant fills the long signal table.
TEMP_OCXO	Temperature (°C) on the lander instrument OCXO component. Conversion function from raw data given in appendix **Erreur ! Source du renvoi introuvable.**.
TEMP_DIGI	Temperature (°C) on the lander instrument digital board. Conversion function from raw data given in appendix **Erreur ! Source du renvoi introuvable.**.
OCXO	Frequency (Hz) of the OCXO after the tuning phase. Conversion function from raw data given in appendix **Erreur ! Source du renvoi introuvable.**.
GCW	The automatic gain control factor in dB. Please refer to **Erreur ! Source du renvoi introuvable.** for details.
FRAMING	The framing factor applied to the lander short signal linear amplitudes after decoding of the framing word. This factor is applied in addition to the TOTAL_GAIN factor.
RADIOM_GCW	Placeholder for the thermal correction factor applied on linear amplitude for the automatic gain control component. This value is fixed to 1.0 in this version of the data (no thermal calibration applied).
RADIOM_THERM_RX	Placeholder for the thermal correction factor applied on linear amplitude for the instrument receiving chain. This value is fixed to 1.0 in this version of the data (no thermal calibration applied).
RADIOM_THERM_TX	Placeholder for the thermal correction factor applied on linear amplitude for the instrument transmitting chain. This value is fixed to 1.0 in this version of the data (no thermal calibration applied).
TOTAL_GAIN	The total gain factor applied on linear amplitudes. $TOTAL\_GAIN = 10^{\frac{GCW}{20}} * RADIOM\_THERM\_RX * RADIOM\_THERM\_TX$
IQ_CORR	The signal is composed of two complex components I and Q after demodulation. The electronics have an unbalanced constant error between the two components amplitudes. $I_{output} = I_{input}$ $Q_{output} = Q_{input} \times (1 + \epsilon)$ with ε equal to 5%
ENTROPY	Placeholder for further information and signal quality estimation.
INTERF_FREQ	Cancelled interference frequency line position in spectrum (Hz). This parameter exists only when interference frequency lines have been detected (actually only in FSS dataset)
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