Rosetta Archive Enhanced Data Review:
MIRO Instrument

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Goals

- Scientific review of high-level resampled deliveries: Level 4

- Can the science results be reproduced?

- Can the data be understood from the information provided?

- No previous RIDs raised – first review of Level 4 Version 2 (?)

→ ROSETTA'S MIRO
INSTRUMENT IN NUMBERS

MISSION: To investigate the nature of the comet's nucleus, outgassing, and development of the coma

> 1.9 billion science measurements
> 1.5 million spectra of gases in the coma
> 100 000 calibration mirror moves
> 5 700 lines of code are needed to run MIRO
> The processor in a modern cell phone runs about 750x faster than MIRO's 2.5 MHz computer
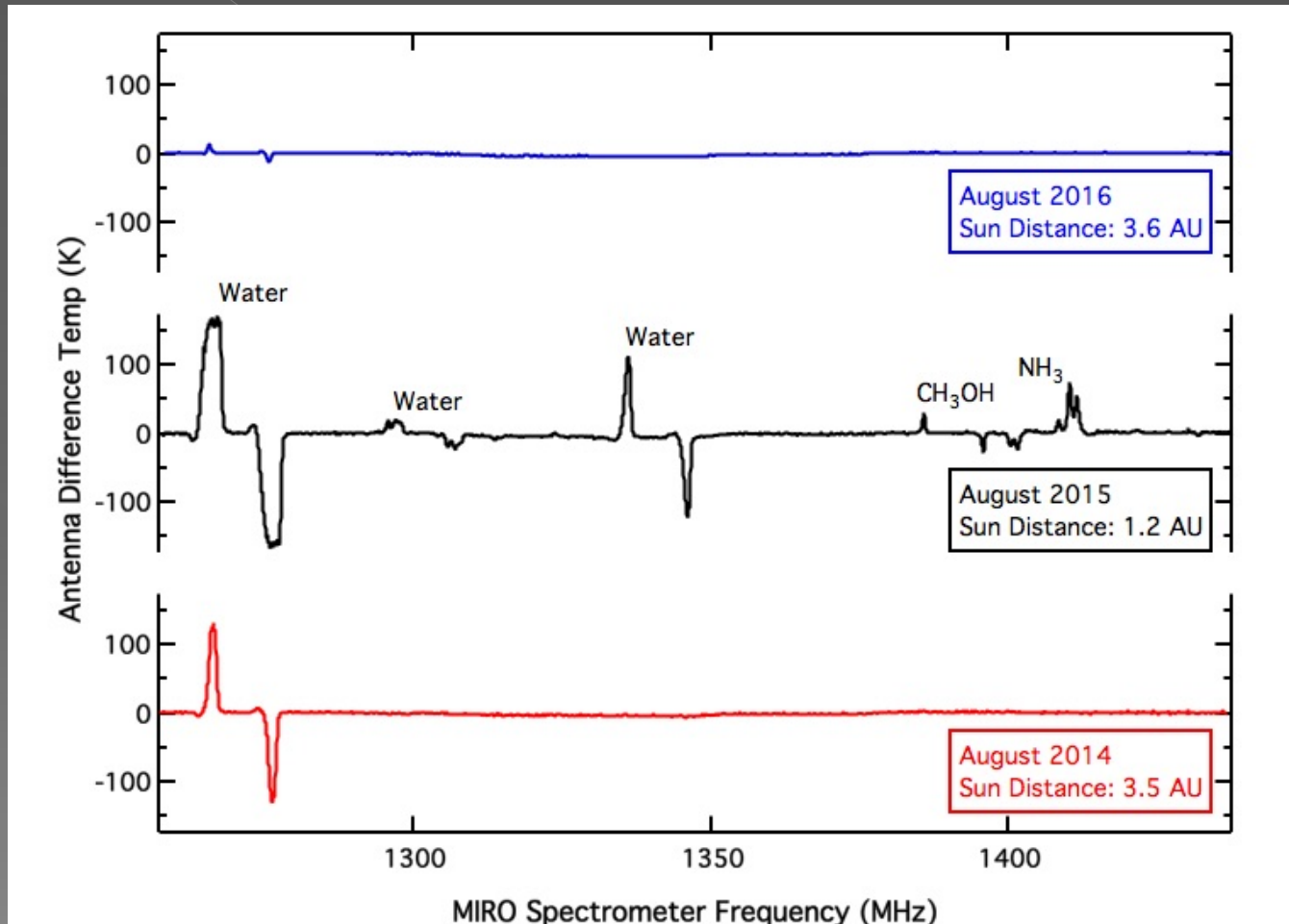
MIRO

Microwave Instrument for the Rosetta Orbiter

Based on numbers available **August 2014 – end August 2016**
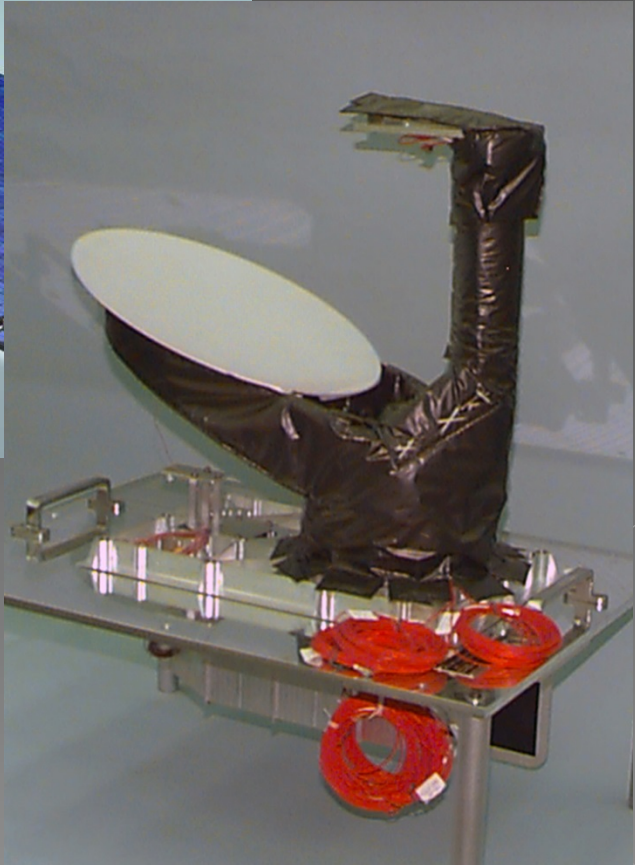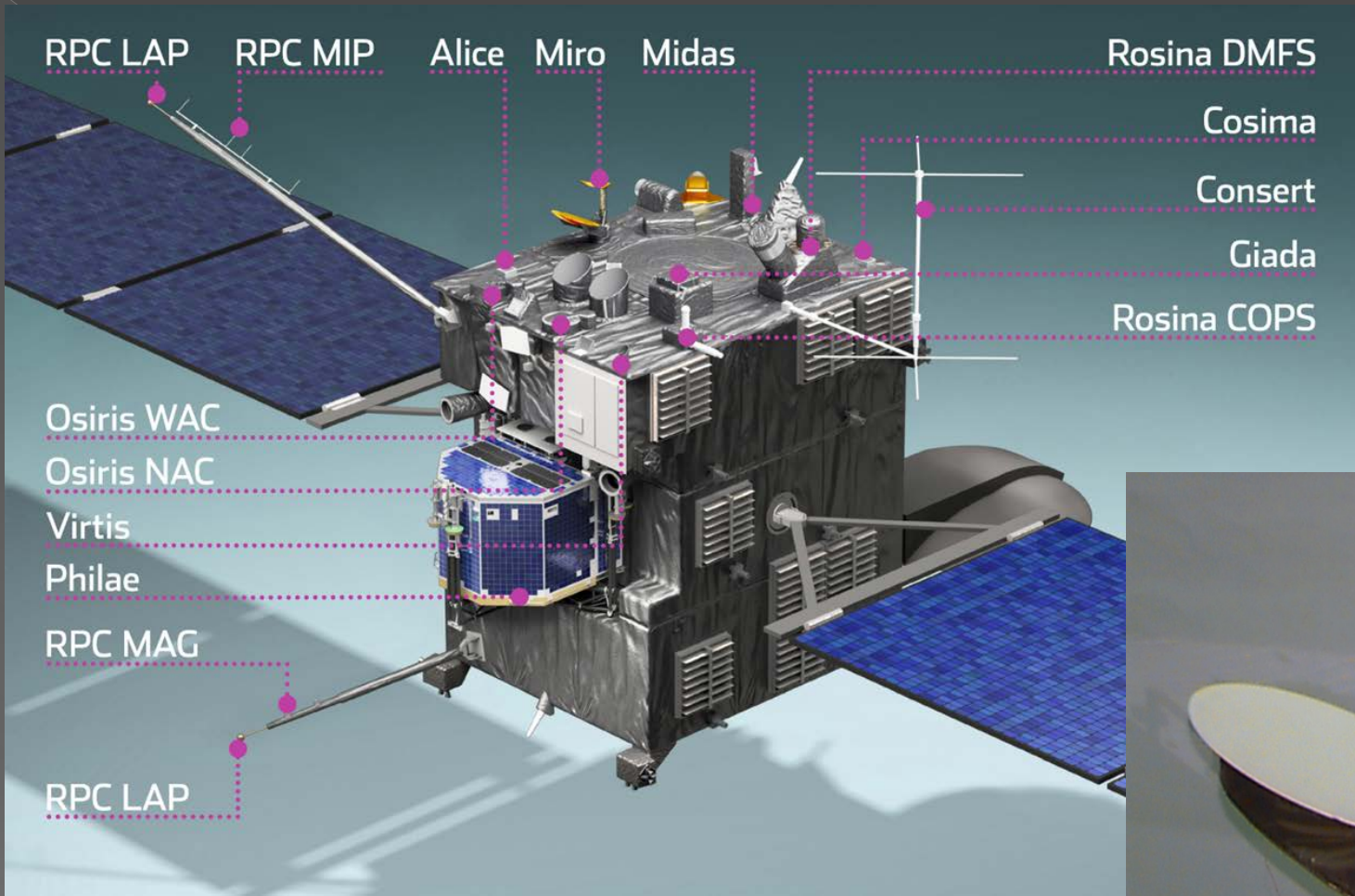
MIRO Instrument

- Continuum (mm and submm) and high spectral resolution receiver (submm only)
- Center-band operating ν of 190 GHz (1.6 mm) and 562 GHz (0.5 mm)
- Spatial resolution of 50 m when 20 km away from nucleus (at 562 GHz)
- Continuum bandwidth is 0.5 GHz (mm) and 1.0 GHz (submm)
- Spectral resolution of spectrometer is 44 kHz, bandwidth of 180 MHz
- Continuum probes temperatures to depths of ~ few cm
- Spectrometer observes H_2O (all 3 O-isotopologues), CO, CH_3OH and NH_3

Data Supplied

- "CTS folded" (chirp transform spectrometer; frequency switching substraction) spectra from the spectrometer ∝ comet-centric velocity
- mm and submm continuum data, resampled to 1-sec bins
- geometry information for both types of data products
- provided for the duration of the entire mission

Press Released Spectra

Review Item Discrepancies (RIDs) *Major*

- Science-79

In section 2.3.6. on pg. 2-12 of the "MIRO Experimenter to Planetary Science Archive Interface Control Document" (RO-MIR-EF-0001; aka EAICD document), it is explained that the continuum data have been rebinned to 1-sec bins. The reasons for this are that this is "typically more useful" than the native resolution. This is unclear to me, why the data is being degraded on purpose.

Review Item Discrepancies (RIDs) *Major*

- Science-90

Current the velocity arrays are 2D in the folded spectra. This is entirely redundant. The velocities should simply be 1D arrays with a length of number of bins covered by the band in question.

Review Item Discrepancies (RIDs) *Major*

- Science-84

The numbering of the data files is not clear, for example 'MIRO_4_CTSFOLDED_2015035.DAT', what does 2015035 imply? Please explain this better.

Review Item Discrepancies (RIDs) *Major*

- Science-91

Currently the folded spectra are provided as a function of comet-centric velocity only. This is insufficient for scientific purposes as the conversion between the comet-centric velocity and frequency is not trivial. The folded spectra must be provided as a function of frequency as well.
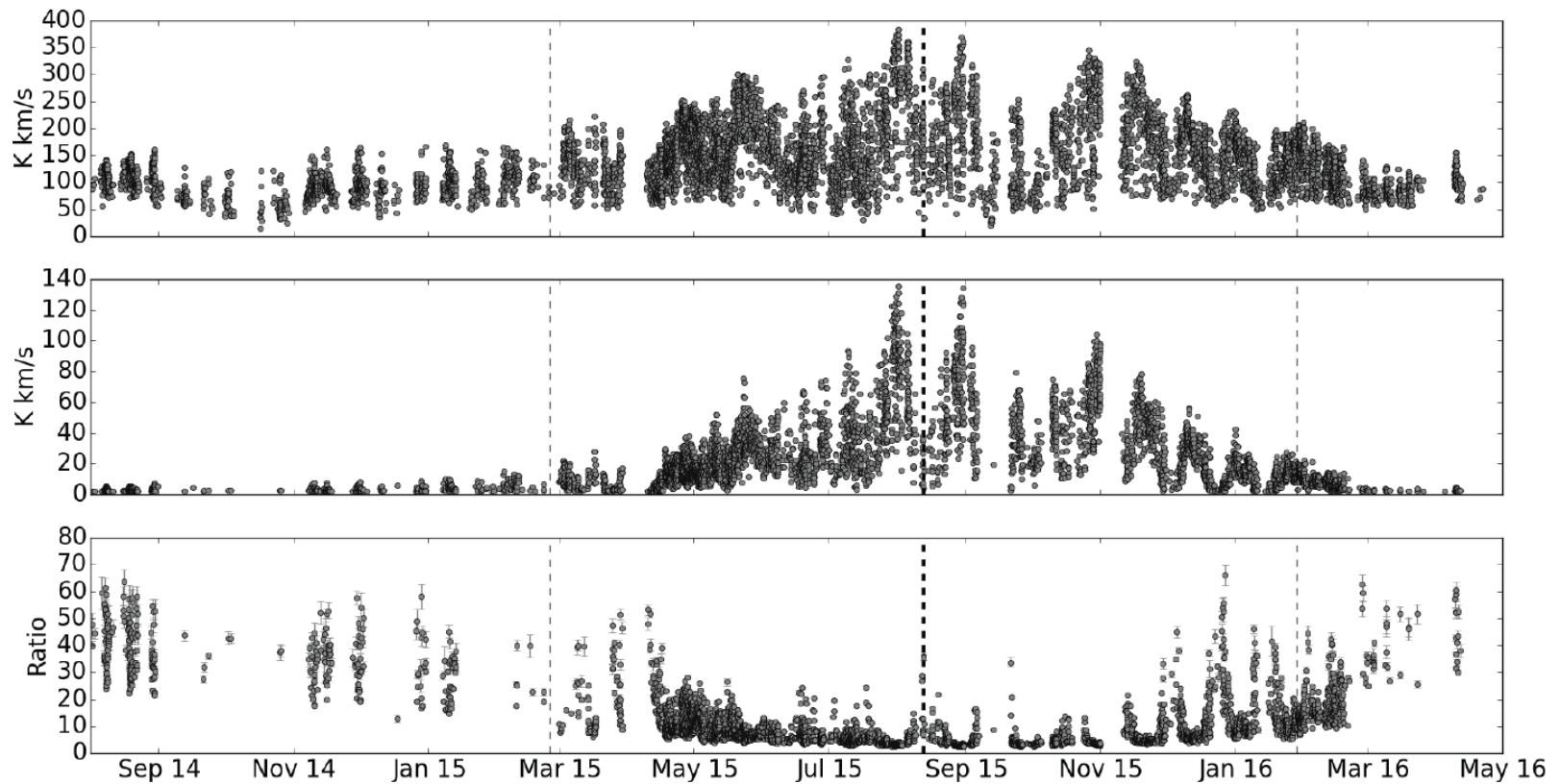
Time Evolution of Water

Fig. 1. Time evolution of the line area of $H_2^{16}O$ (*top panel*), $H_2^{18}O$ (*middle panel*), and the $H_2^{16}O/H_2^{18}O$ line area ratio (*bottom panel*) from August 2014 to April 2016. The thick dashed line represents perihelion, which occurred on August 13, 2015, and the thin dashed lines represent when 67P was 1 AU from closest approach, pre- and post-perihelion.

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