

The BepiColombo/SERENA package: Serena Integrated Test campaign

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Abstract

The activities related to the BepiColombo/MPO/SERENA Integrated Test (SIT, held in February-March 2017 inside the thermal vacuum facility at the University of Bern, Phys. Inst.) are presented. This campaign has been a unique opportunity to test the experiment performances, with all the four flight-spare instruments of SERENA (ELENA, STROFIO, PICAM, and MIPA, simultaneously operated by the System Control Unit (SCU), in a fully operational configuration.

1. Introduction

The test is focused on the On-Board Commanding Procedure and on the Science Operation Basic Procedure, with the goal of providing a comprehensive picture of the on-board S/W facility both in nominal and more resource demanding conditions. Such a test is a powerful tool for allowing SERENA to perform the best possible observation of the particle populations surrounding Mercury.

2. SERENA package and SIT

SERENA (Search for Exospheric Refilling and Emitted Natural Abundances) [1] is an experiment on board the BepiColombo ESA/JAXA cornerstone mission to Mercury (to be launched in October 2018). It's the only particle instrument suite on board the Mercury Planetary Orbiter – MPO (400-1500 km). It addresses major scientific objectives of the BepiColombo mission, like solar-planet interaction processes and exospheric dynamics and composition.

The interaction between energetic plasma particles, solar radiation and micrometeorites with the Hermean surface gives rise to both thermal and energetic neutral particle populations in the near-planet space; such populations will be recorded by the SERENA Neutral Particle Analysers (NPA): the neutral particle imager ELENA (Emitted Low Energetic Neutral Atoms) and the exosphere mass spectrometer Strofio (Start from a Rotating Field mass spectrometer).

The photo-ionised or charged component of the surface release processes as well as the precipitating and circulating plasma in the Hermean magnetosphere will be recorded by the SERENA ion spectrometers (IS): the planetary ion sensor PICAM (Planetary Ion CAMera) and precipitating ion sensor MIPA (Miniature Ion Precipitation Analyser). SERENA will provide information on the Hermean environment particle circulation and on the dynamical processes induced by the surface-exosphere-magnetosphere system when interacting with the solar wind and the interplanetary medium. Concerning these crucial aspects, joint measurements with similar instrumentation on board the Bepicolombo/MMO will allow to derive a comprehensive picture of the complex phenomena surrounding the planet.

The SIT is the first SERENA test performed with all the Flight Models in full functionality with real data. To perform full SERENA test is necessary to have all the units in high vacuum condition to switch on high voltage and detectors inside the instruments. A specific chamber with the requested conditions has been identified at Physic Institute in Bern. Ad-hoc configuration has been realized to have all the units

in vacuum condition (inside chamber) connected to the MIS and to the Instrument Ground Segment Equipment. The particular set-up (see Figure 1) for this important test was carried out with the support of several people of the SERENA team.

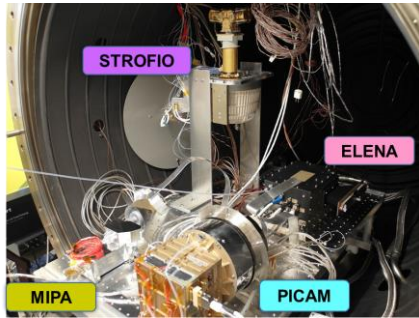


Figure 1: SERENA set-up inside the vacuum chamber.

The objectives of the SIT test are:

- to have all the 4 units running and generating real data (in vacuum condition);
- to verify OBCP command not performed during previous system tests (with HV on);
- to perform selected operation scenarios and investigate demanding cases in terms of telemetry, power and SCU resource constraints.

3. Summary and Conclusions

Thanks to this campaign all the units have been operated in science mode with real data. Several critical items have been pointed out and faced. An updated SERENA-SCU Flight software has been done and validated before the delivery to ESA. Thanks to the software update we demonstrate that the four units can be operated also in demanding configurations.

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References

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