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SIMBIO-SYS for BepiColombo: status and issues

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Abstract.

The SIMBIO-SYS (Spectrometer and Imaging for MPO BepiColombo Integrated Observatory SYStem) is a complex instrument suite part of the scientific payload of the Mercury Planetary Orbiter for the BepiColombo mission, the last of the cornerstone missions of the European Space Agency (ESA) Horizon+ science program. The BepiColombo mission is compose by two scientific satellites on, Mercury Magnetic Orbiter-MMO, realized by the Japanese Space Agency JAXA, devoted to the study of the planet environment and the other, the Mercury Planetary Orbiter realized by ESA, devoted to the detailed study of the Hermean surface and interior.

The SIMBIOSYS instrument will provide all the science imaging capability of the Bepicolombo MPO spacecraft. It consists of three channels: the STereo imaging Channel (STC), with broad spectral band in the 400–950 nm range and medium spatial resolution (up to 50 m/px), that will provide Digital Terrain Model of the entire surface of the planet with an accuracy better than 80 m; the High Resolution Imaging Channel HRIC), with broad spectral bands in the 400–900 nm range and high spatial resolution (up to 5 m/px), that will provide high resolution images of about 20% of the surface, and the Visible and near-Infrared Hyperspectral Imaging channel (VIHI), with high spectral resolution (up to 6 nm) in the 400-2000 nm range and spatial resolution up to 100 m/px, it will provide the global covergae at 400 m/px with the spectral information.

SIMBIO-SYS will provide unprecedented high-resolution images, the Digital Terrain Model of the entire surface, and the surface composition in wide spectral range, at resolutions and coverage higher than the MESSENGER mission with a full co-alignememt of the three channels.

The main scientific objectives can be summarized as follows:

- Definition of the impact flux in the inner Solar System: based on the impact crater population records
- Understanding of the accretional model of an end member of the Solar System: based on the type and distribution of mineral species
- Reconstruction of the surface geology and stratigraphic history: based on the combination of stereo and high- resolution imaging along with compositional information coming from the spectrometer
- Relative surface age by impact craters population density and distribution: based on the global imaging including the high-resolution mode
- Surface degradation processes and global resurfacing: derived from the erosional status of the impact crater and ejecta
- Identification of volcanic landforms and style: using the morphological and compositional information
- Crustal dynamics and mechanical properties of the lithosphere: based on the identification and classification of tectonic structures from visible images and detailed DTM
- Surface composition and crustal differentiation: based on the identification and distribution of mineral species as seen by the NIR hyperspectral imager
- Soil maturity and alteration processes: based on the measure of the spectral slope derived by the hyperspectral imager and the colour capabilities of the stereo camera
- Determination of moment of inertia of the planet: the high-resolution imaging channel as landmark pairs of surface features that can be observed on the periside as support for the libration experiment
- Surface–Atmosphere interaction processes and origin of the exosphere: knowledge of the surface composition is also crucial to unambiguously identify the source minerals for each of the constituents of the Mercury.s exosphere

The instrument has been realized by Selex-ES under the contract and management of the Italian Space Agency (ASI) that have signed an MoU with CNES for the development of VIHI Proximity Electronics, the Main Electronics, and the instrument final calibration . All the realization and calibration has been carried on under the scientific supervision of the SIMBIO-SYS science team SIMBIOSYS has been delivered to ESA on April 2015 for the final integration on the BepiColombo MPO spacecraft.