Data Segment

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SOIM:Simulator for operation of imaging missions

Simioni and SIMBIO-SYS team

SIMBIO-SYS (Bepi-Colombo, Mercury surface): a Stereoscopic Imaging Channel(STC), a High Resolution Imaging Channel (HRIC, 6m/pxl), and a Visible and near Infrared Hyperspectral Imager (VIHI). **Goals:** Imaging Mercury surface in the near-IR and visible; 3D surface reconstruction: image selected regions at high resolution

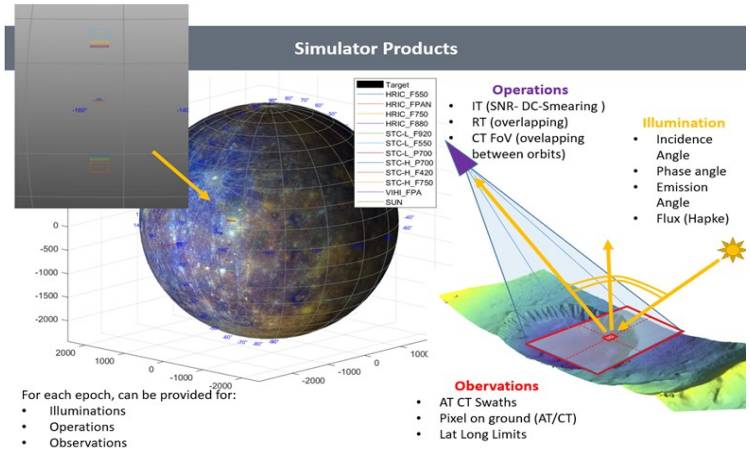
SOIM is simulating the SIMBIO-SYS channels (Slemer et al, 2015): configuration(SPICE), local DTMs and the radiometric models of the instruments and the Mercury reflectance model (Hapke) for the whole mission for observation planning.

Main goal is the optimization of SNR avoiding smearing even in the extreme cases (i.e. the polar craters of Mercury where most of the signal is due to scattering).

Output:1) the geometrical properties of the acquisitions i.e. the repetition time to be commanded; 2) the radiometric outputs, i.e. the incoming radiance depending by local surface and the signal expected on the detector; 3) the performance of each channel

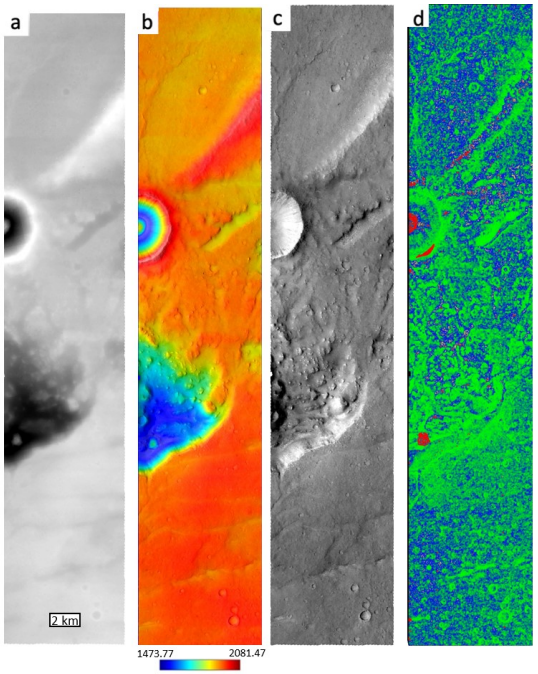
The SOIM python porting is going on to extend the

pipeline to all imaging based future instruments.



PAISP: Panoramic AI-based Stereoscopy for Planetary-exploration-I

Simioni, Pernechele et al (INAF, OAPD)



- **3DPD:** Software for photogrammetric (3D) reconstruction (Simioni,2021) from stereo images of the CaSSIS / ExoMARS2016 operating in push mode.
- It is an adaptive least squares matching pipeline responsible for the generation of 3D models (nowadays 320 DTMs).
- It will be used for the 3D Global Mapping of the Mercury Planet (BepiColombo).
- It includes:
    - the creation of the mosaiced images starting from single shots;
    - the computation of the integer disparity map defining the parallax between the images;
    - the disparity refinement at the sub-pixel level;
    - the triangulation phase

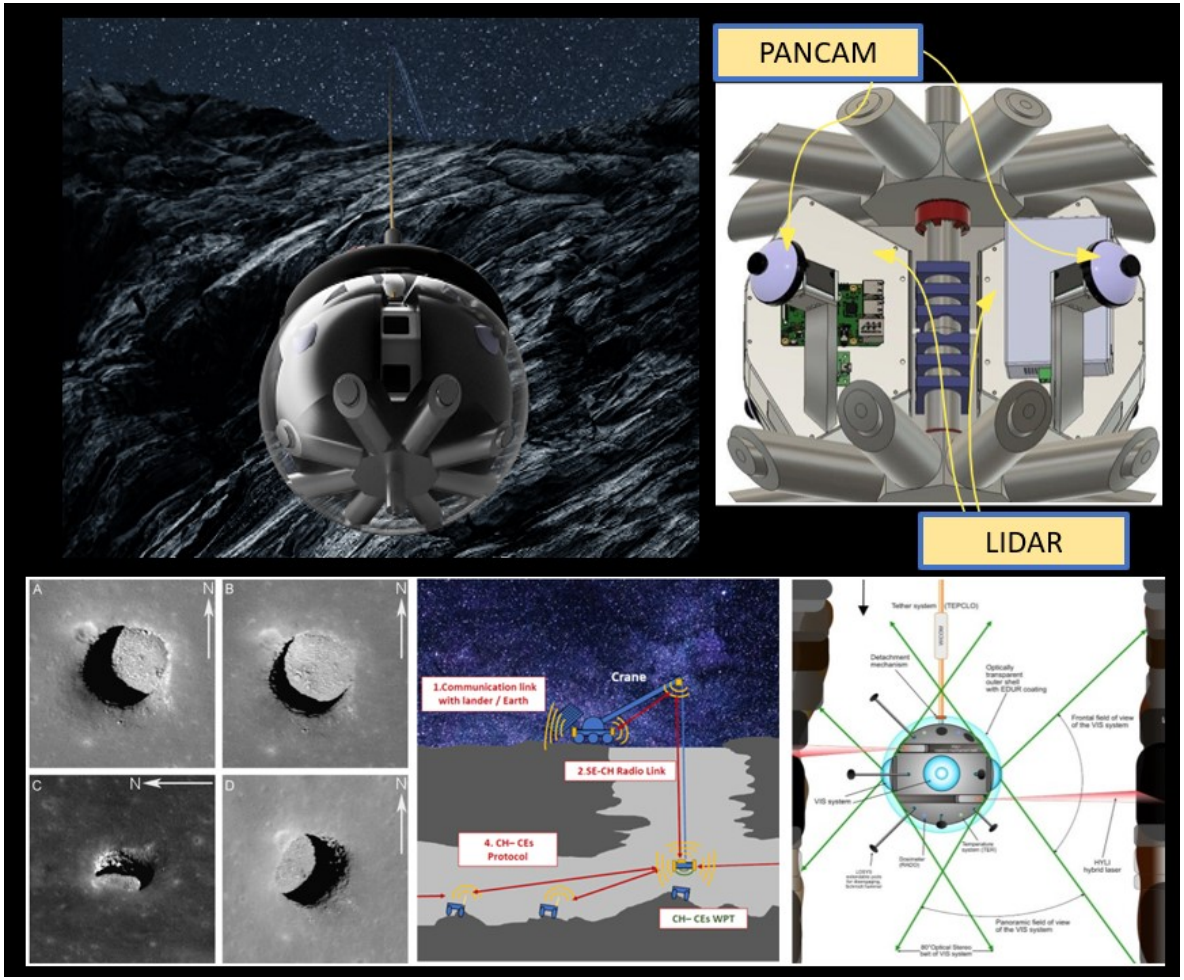
PAISP: Panoramic AI-based Stereoscopy for Planetary-exploration-II

Simioni, Pernechele et al (INAF, OAPD)

The **PAISP** project aims to managing panoramic stereoscopic images provided by PANCAM (bifocal panoramic lenses, Pernechele 2018) with a new neural network model to be exploited in the planetological exploration of Lava Tubes (ESA Daedaus mission) .

The idea is based on:

1) Photogrammetry (**INAF**);
2) SLAM (**POLIMI**);
3) deep learning for Super Resolution (Panoramic+Frontal field) (**UNINSUBRIA**)



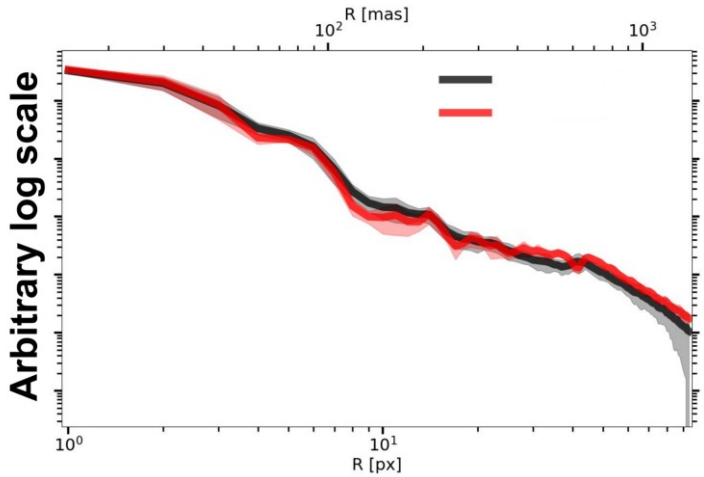
The PSF Reconstruction Service of MICADO@ELT

A. Grazian, C. Arcidiacono, M. Gullieuszik, F. Pedichini, R. Piazzesi, E. Portaluri,M. Simioni, B. Vulcani, A. Zanella (INAF) and the MICADO PSF-R Team

MICADO is the first light instrument of ELT and it will be the workhorse facility for AO-assisted NIR imaging and spectroscopy. A detailed knowledge of the PSF is required by a great number of MICADO (and AO instrumentation in general) science cases.

The PSF-R Team of MICADO has been developing a software (on the ESO EDPS environment) to reconstruct the PSF using AO WFS telemetry data only ("pure/blind" PSF reconstruction).

- Strehl ratio and FWHM of PSF-R: ~1-2% accuracy in simulations of bright star (mag~15). ~2-4% accuracy in real LBT/SOUL+LUCI data (Simioni et al. 2020, 2022).
- The PSF-R method has been described in detail in Veran(1997),Wagner et al. (2018), and Simioni et al. (2020, 2022).
- This tool will work independently of the science data, using adaptive optics telemetry data, both for Single Conjugate (SCAO) and Multi-Conjugate Adaptive Optics (MCAO), in post-processing analysis.
- The PSF-R tools can be adapted to other AO instrumentation (e.g. LUCI, ERIS, MAVIS, SHARK, NIRVANA), under the MAST&R (Math, ASTronomy and Research) initiative.



WEAVE Data Base @TNG
Lodi, Guerra, Molinari and WEAVE DB team

- **Cluster Apache Solr**
- 3 nodes (at the moment) that may be scaled up horizontally to increase the disc space and performances.
- Provides high availability, load balancing and data replication.
- 4 TB disc space per node.
- 32 GB RAM per node
- Lucene & SQL queries.
- +4,500 indexes
- Advantage: complex queries in fraction of seconds
- Drawback: Solr not working with relational tables
- Data organised as documents (json)
- Possibility to work with 5k columns and related indexes

- **Standalone Postgres DB**
- 10 TB disc space shared between different tablespaces
- Solid State Disk drives: trade-off between performance and costs
- Every tablespace has its own E/R diagram
- VO should be probably set up as separate and more powerful server