Copernicus POD Service

Impact Analysis of multiple LRR onboard CRISTAL

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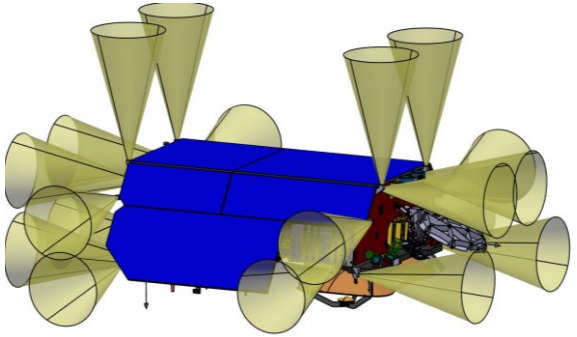
MOTIVATION

- CRISTAL: Copernicus Polar Ice and Snow Topography Altimeter
  - It would carry a dual-frequency radar altimeter and microwave radiometer to measure and monitor sea-ice thickness and overlying snow depth.
  - Launch planned in 2027.
  - Some requirements (⚠ under analysis @ ESA):
    - The usable LRR field-of-view will range between *90º (±45º)* and 50º (±25º) (90º seems to be already discarded in favour of 50º)
    - The LRRs shall be mounted at least 1 m (TBC) and at most TBD m from each other, per face
    - Four (4) LRR shall be mounted on each face of the satellite, except on the nadir pointing face
  - It would carry up to **20 LRR** to support space debris removal
  - It would carry as well a LRR to support precise orbit determination
- Questions:
  - How this design will interfere the SLR tracking?
  - How this design will interfere the POD?



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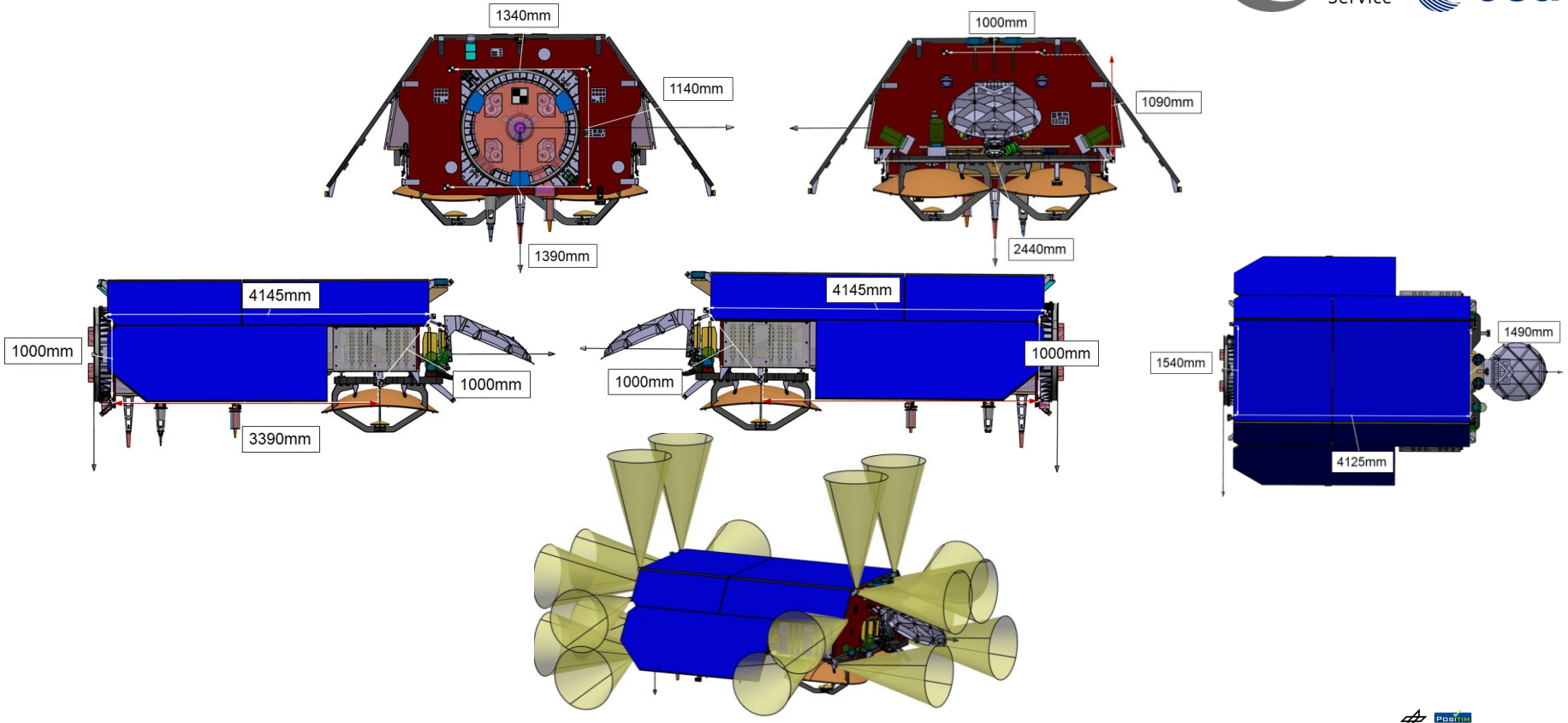
SATELLITE DESCRIPTION



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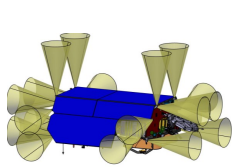
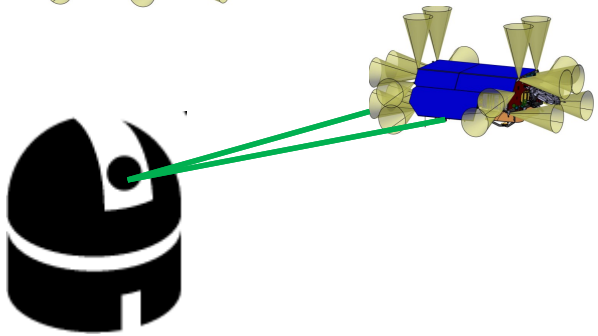
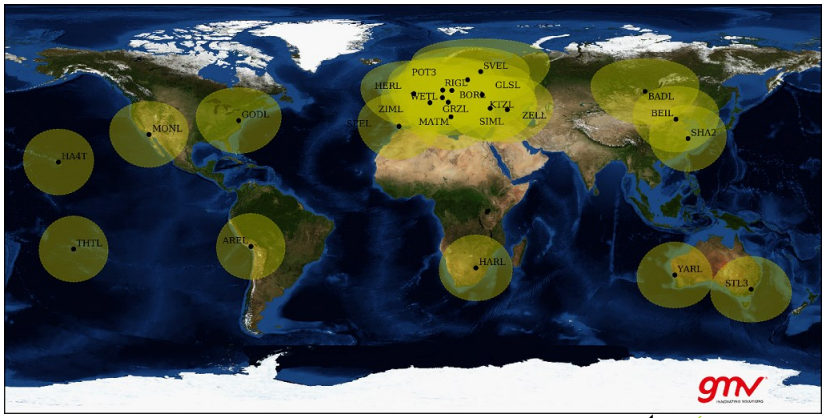
ANALISYS





- Lateral SLR tracking as function of station cut-off elevation angle:
  - How much lateral SLR tracking would be obtained as a function of station´s cut-off angle
  - Analysis done with ±45º.
  - @700 km altitude, a FoV of ±25º would not a problem.

- SLR residuals analysis
  - In case we get lateral SLR tracking form a ±45º FoV, which residuals would be obtained?
  - Is it possible to filter it with a cm-accuracy level orbit?



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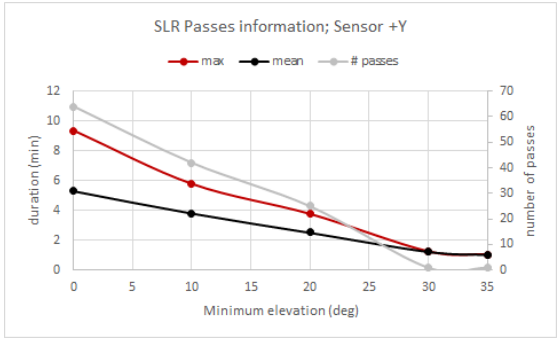
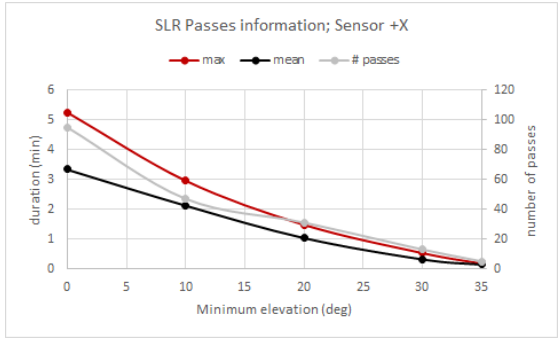
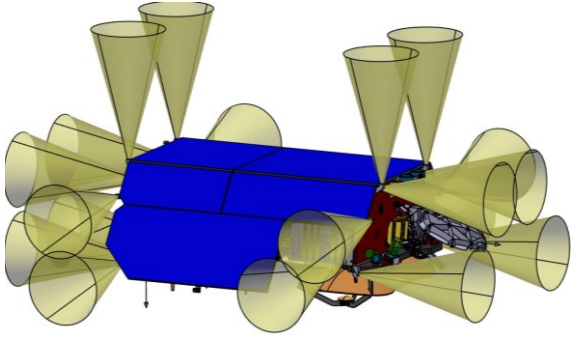
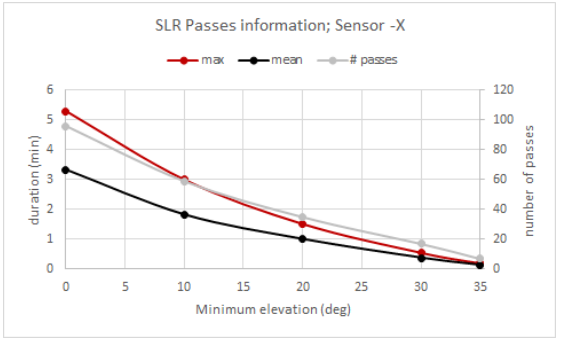
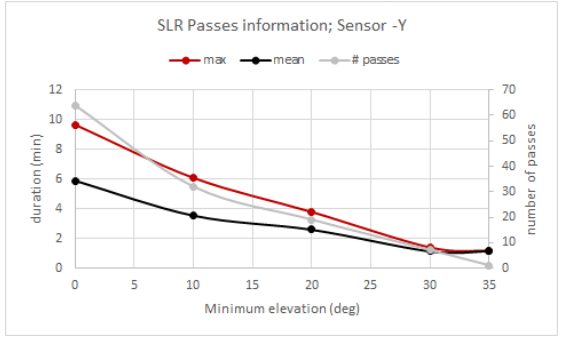
LATERAL TRACKING METRICS











- Analysis done using ±45º FoV
- Above 35° of station elevation, there is no lateral tracking → too much?
- Above 20°of station elevation, up to 4 minute passes!

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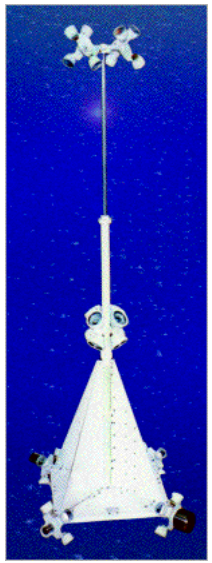
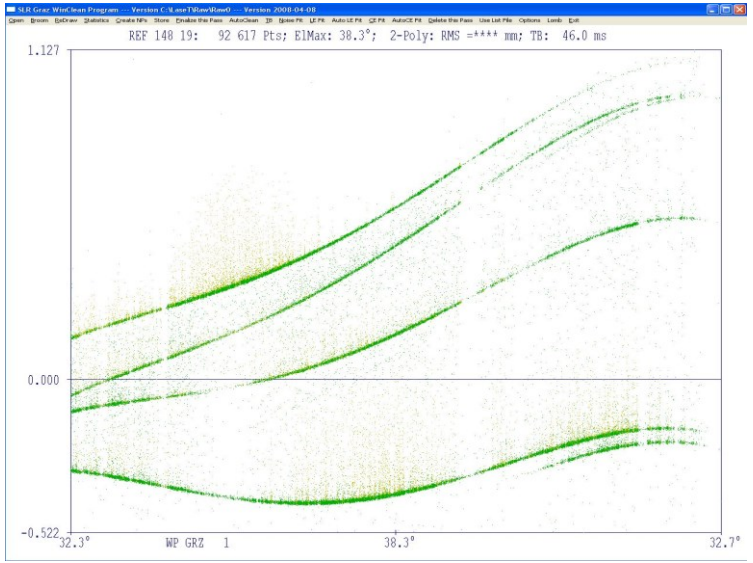
IMPACT ON SLR TRACKING

- In case there are multiple reflexions from multiple LRR, what would be the impact on the SLR station´s processing?

REFLECTOR: Retro-reflector Ensemble For Laser Experiments, Calibration, Testing & Optical Research





SLR residuals allows attitude MOTION determination

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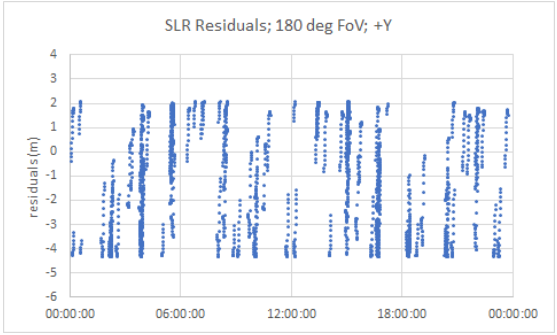
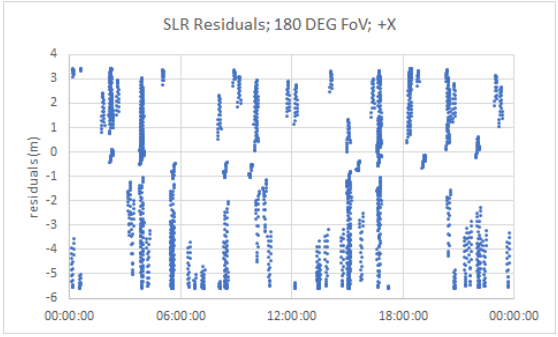
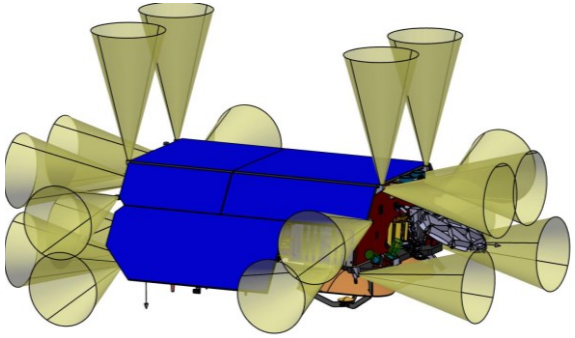
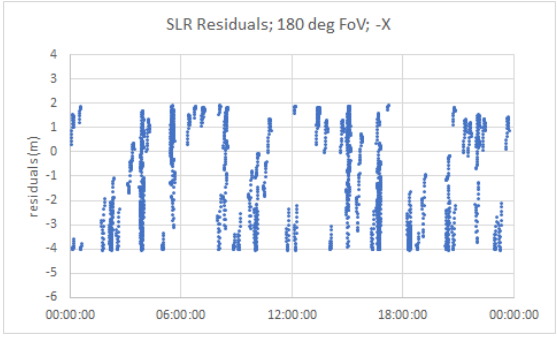
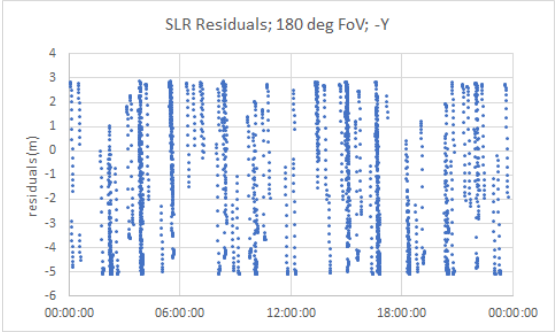
LATERAL SLR RESIDUALS











This analysis has not taken into account the FoV of the sensors.

Passes from 2-3 metres crossing the zero!

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NEXT STEPS

- In order to eliminate the reflexions from the lateral LRR, ESA is working on several potential modifications, including:
  - The FoV is reduced from 90º to 50º.
  - To remove the LRR on the ±X and ±Y directions.
  - The LRRs on ±X / ±Y would be titled in the anti-nadir direction by an angle of 45 degrees.

- Is there any recommendation from ILRS?

Thank you

Copernicus POD Service

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