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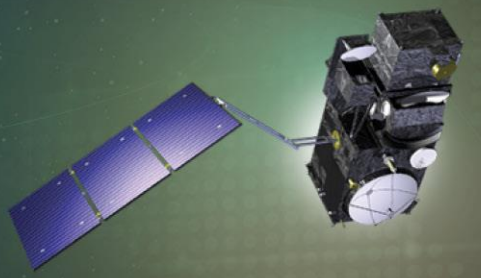

7th Sentinel-3 Validation Team Meeting 2022

18-20 October 2022 | ESA-ESRIN | Frascati (Rm), Italy

HyperInSPACE: A Community Processor for Above-Water Radiometry with FRM standards

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1: ACRI-ST
2: NPL
3: TARTU
4: EUMETSAT

FRM4SOC Community Processor

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Objectives:

- To provide a user friendly community processor that will generate above water Fiducial Rrs, namely qualified radiometry with SI-traceable uncertainty budget.
- To ensure a long-lasting community requirement for a common processing baseline.

Processor inputs:

SI-traceable and fully characterised radiometer measurements.

Acknowledgment:

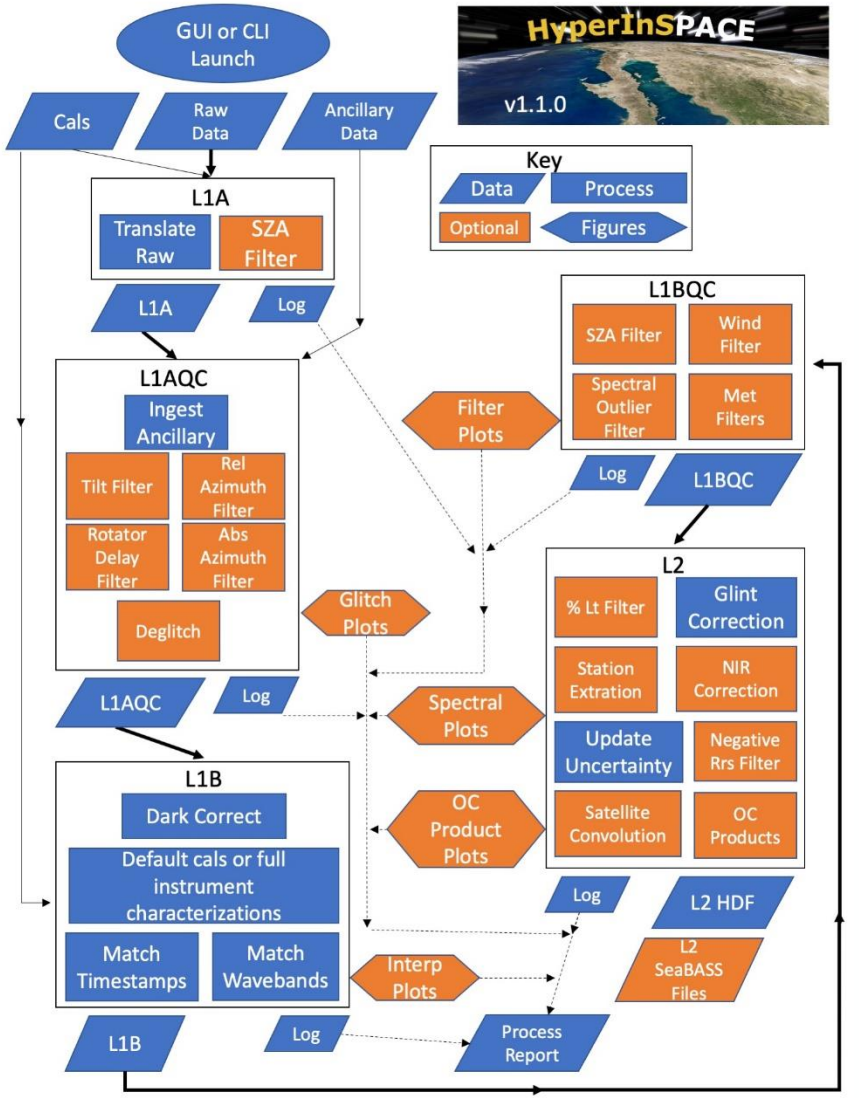
PySciDON: M. Costa, N. Vanderberg (U. Victoria)
https://ieeexplore.ieee.org/abstract/document/8121926
HyperInSPACE: D. Aurin (NASA)
https://github.com/nasa/HyperInSPACE

University of Victoria

NASA

CP additional features (with regards to nominal HyperInSpace):

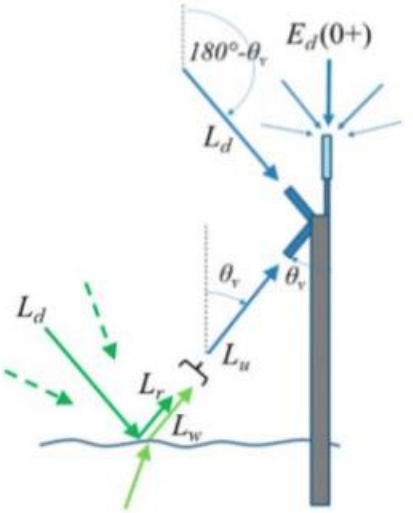
- General feature: New instrument supported (TriOS RAMSES)
- FRM feature:
  - SI-traceable uncertainty computation (supervised by NPL)
  - Additional correction for Straylight, Temperature response, non linearity, polarisation and cosine effect.

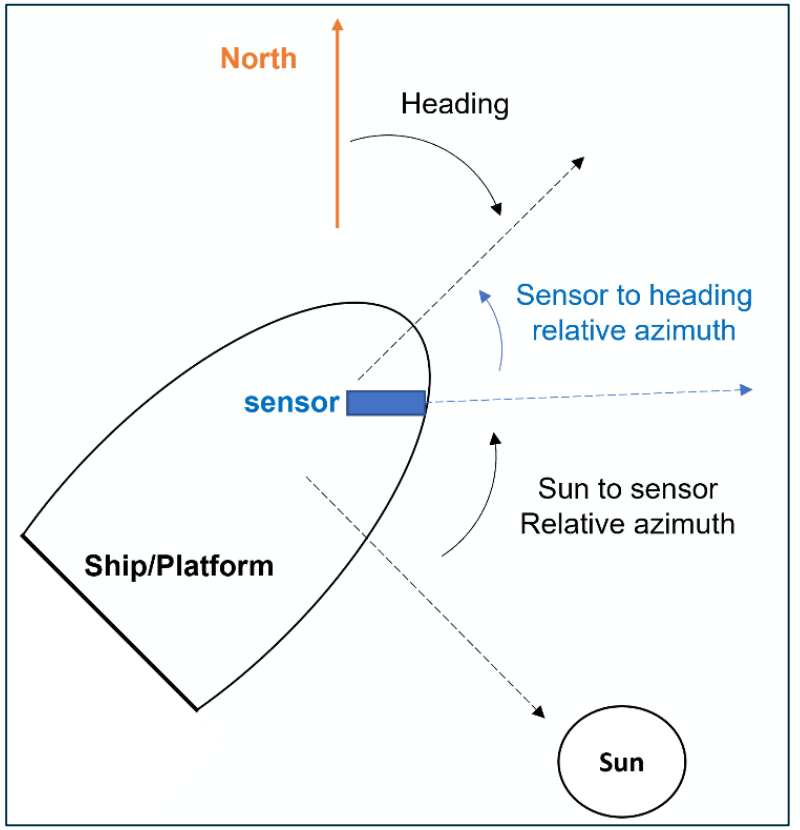


Measurement configuration

The CP is designed to process radiometric data in the following configuration:

- Three radiometers measuring
  - Ed (downward irradiance)
  - Li (inward radiance)
  - Lt (total radiance)
- Deployment configuration
  - Fixed platform
  - Research vessel





Main Processing steps

L1A

Raw radiometer data formatting in HDF file

L1AQC

Ingests and formats ancillary data
Performs 1st QC step

L1B

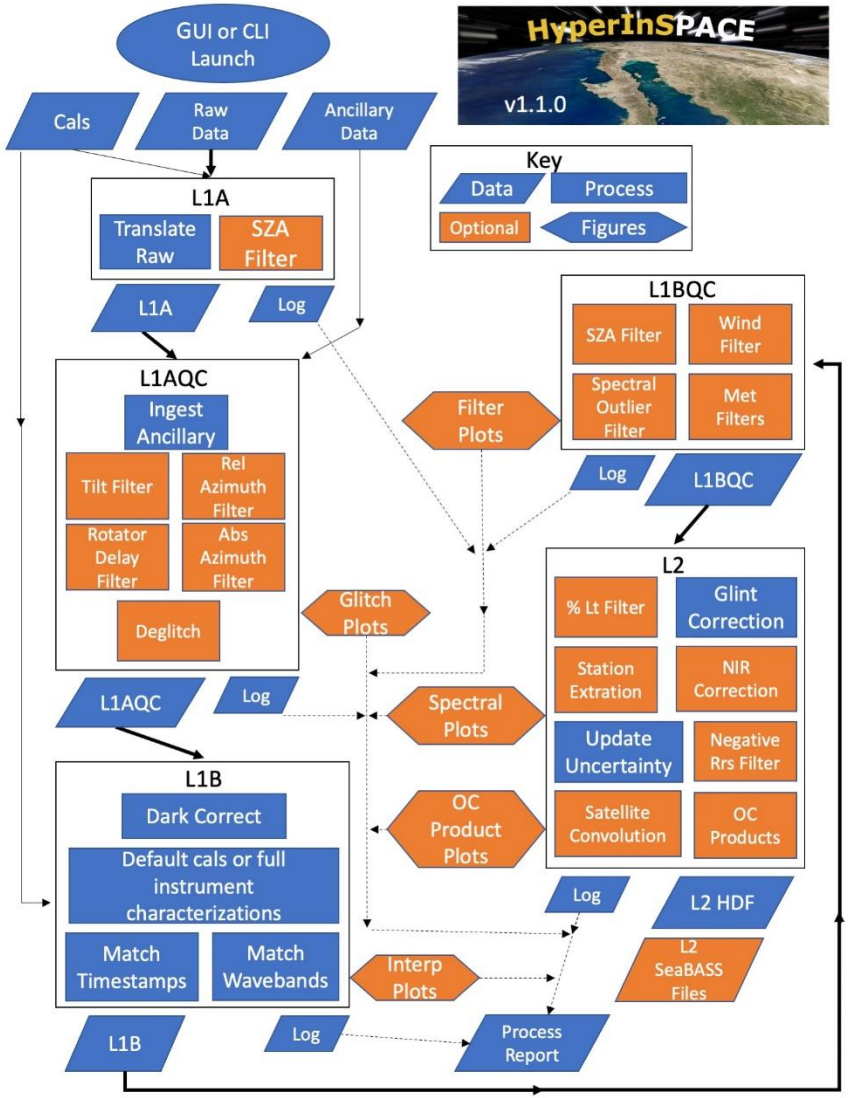
Radiometric calibration
Dark correction
Conversion to physical unit (radiance)

L1BQC

Performs 2nd QC step

L2

NIR correction
Reflectance computation
Writing output file



What's new from current HyperInSPACE

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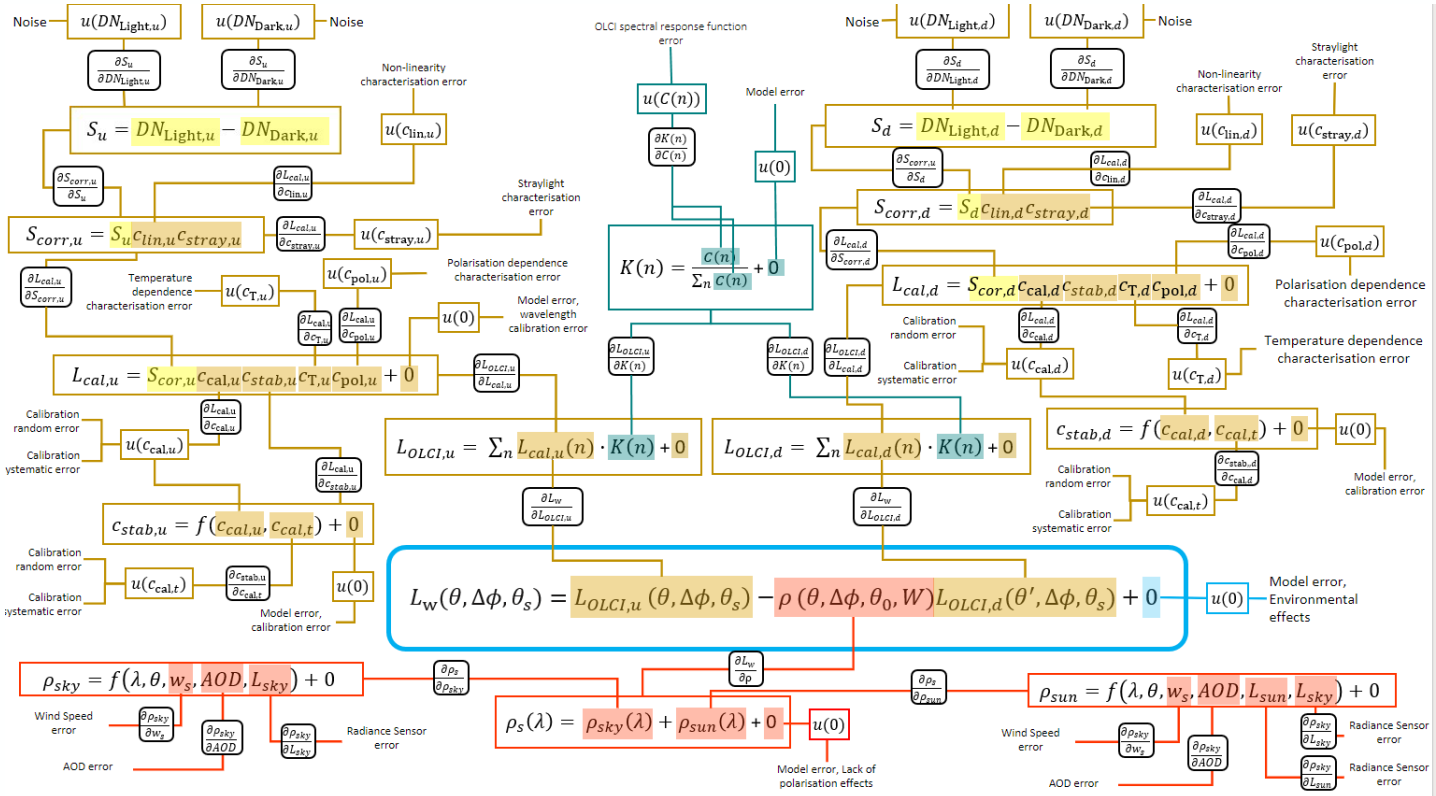
TriOS RAMSES devices are now fully supported.

Uncertainty computation following the GUM is implemented, uncertainty analysis is provided by the NPL. The following uncertainty contributors are foreseen:

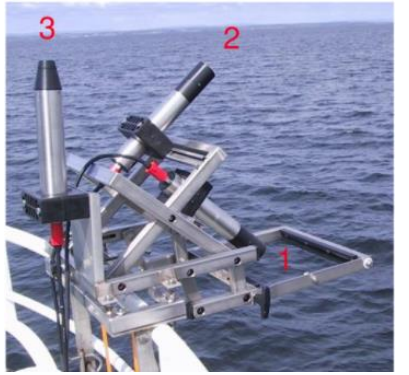
- Absolute radiometric calibration
- Spectral straylight
- Temperature sensitivity
- Polarisation sensitivity (radiance)
- Cosine response (irradiance)
- Calibration stability.
- Detector non-linearity

➔ **Next step is to correct data from those effects and to update the uncertainty computation.**



Uncertainty tree diagram for water leaving radiance Bialek et al. 2020

Inputs files



Radiometers measurements

- Seabird HyperOCR: both ".raw" and ascii export are supported.
- TriOS RAMSES: both multi-frame and single-frame acquisition are supported.

Ancillary data

GPS information, Solar angle, pointing, Station information, Meteo, …

Calibration files

Absolute calibration factor files.

Full instrument characterization is performed at TARTU laboratory

Uncertainty coefficients

- Absolute calibration factor uncertainty
- Additional uncertainty parameters : Generic Class-based coefficients available for all instruments. Or fully characterized coefficients coming from the instrument characterization.

FRM standards require uncertainty parameters for all the contributors. They are obtained thanks to the TARTU full characterization.

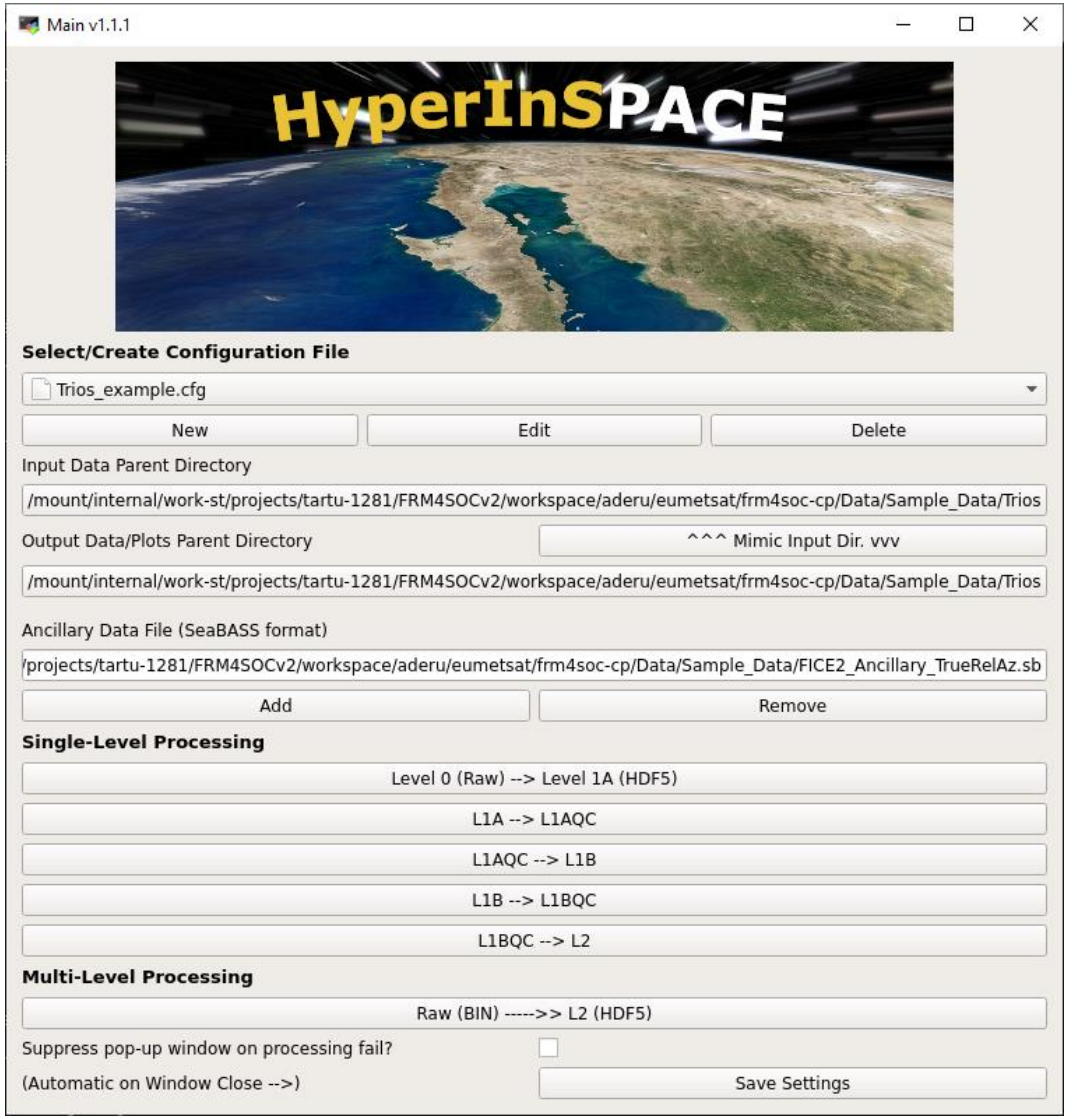
HyperInSPACE processor

Developed in Python3, for Linux computer.
Open-Source project.

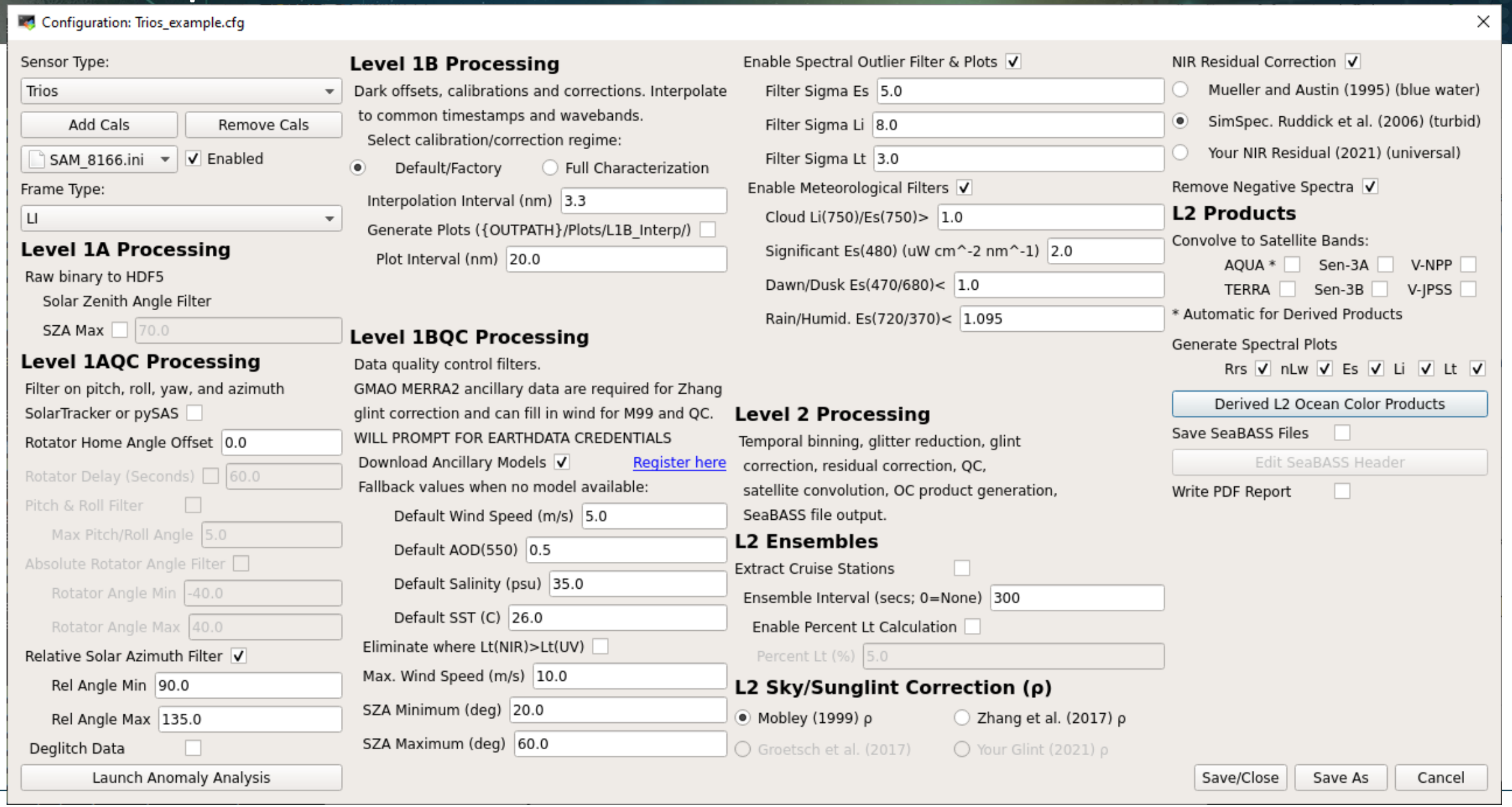
Processor can be launched with command line or with GUI
- Selection of input files.
- Selection of output directory.
- Configuration of the processing.
- step-by-step or multi-level processing.

Configuration file
- JSON file editable with the GUI or by hand.
- Per level configuration options.

The processor as been successfully tested on real data thanks to the FICE-2 participants.



HyperInSPACE processor

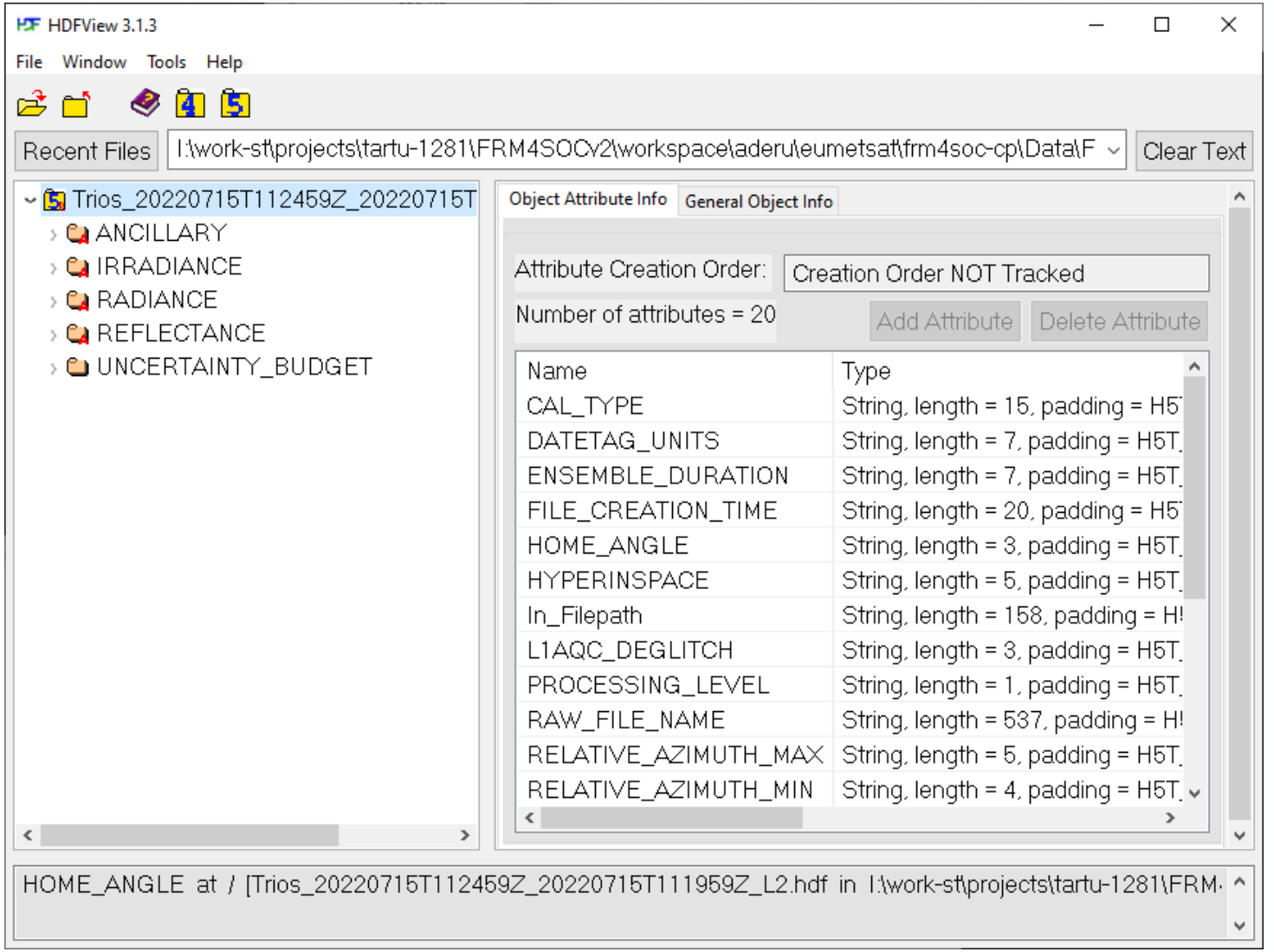


Output products

All products are in HDF5 format
At L2, groups organized as follow

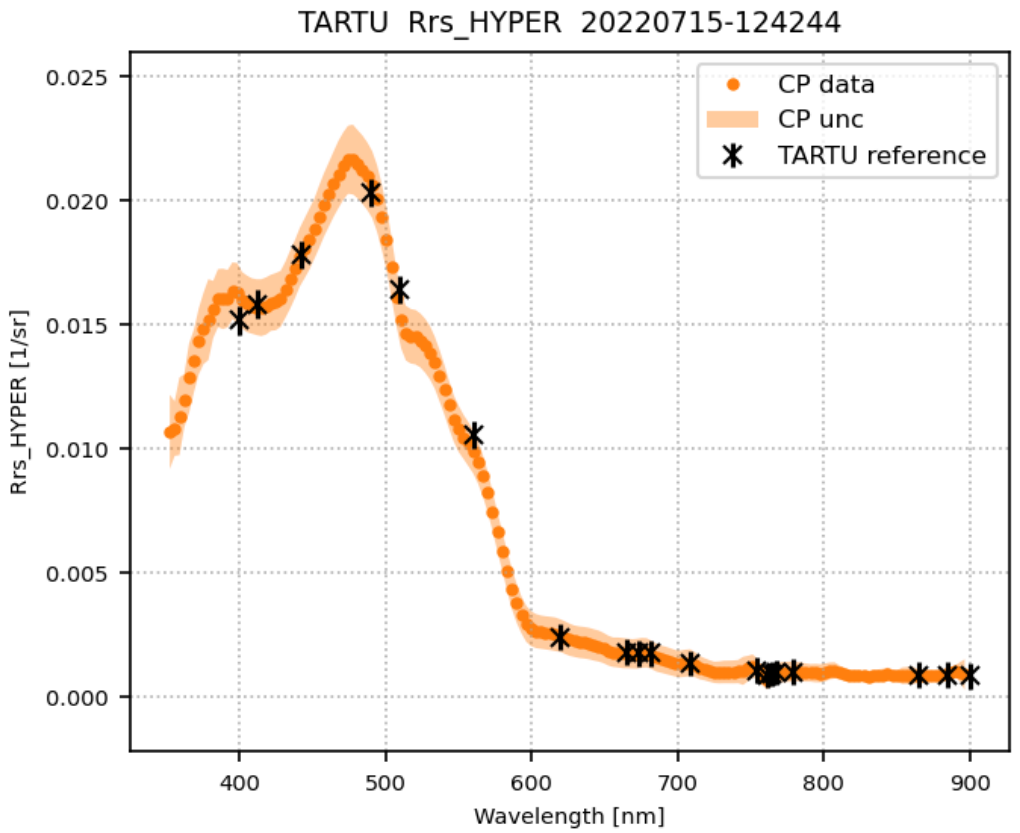
- ANCILLARY
- IRRADIANCE
- RADIANCE
- REFLECTANCE
- UNCERTAINTY_BUDGET

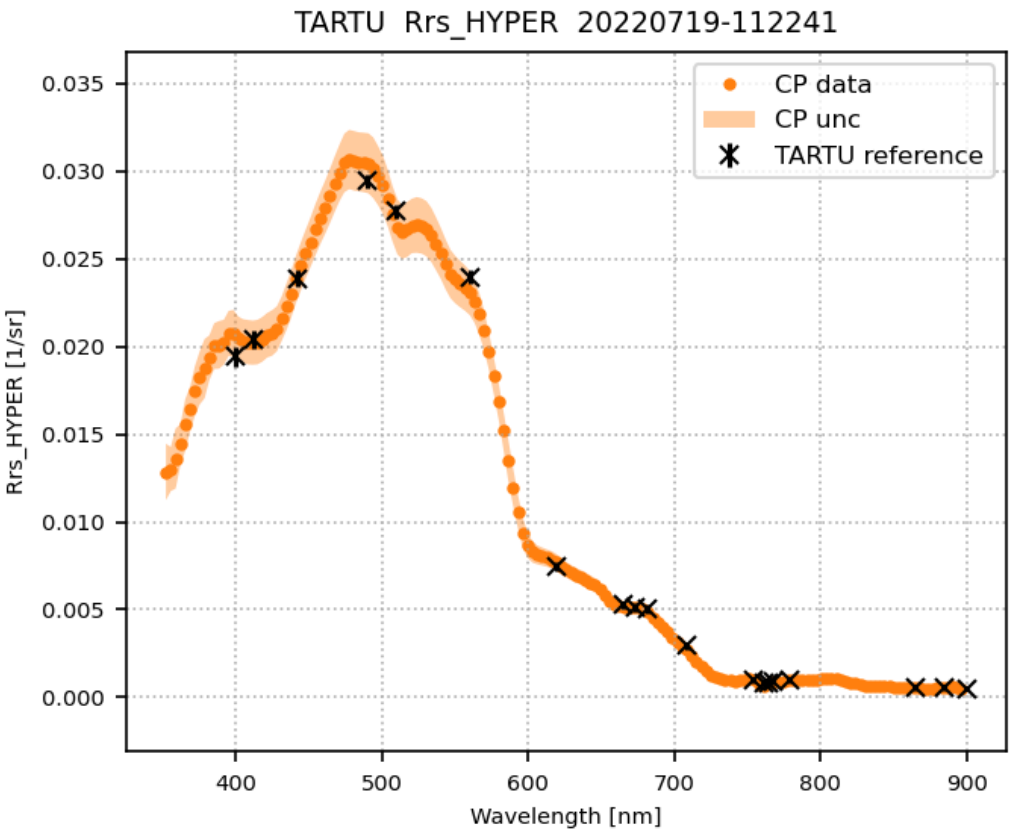
Both Seabird and TriOS data follow the same organization.



Very preliminary results from TARTU laboratory: TriOS acquisitions from the FICE-2 field experiment

Remote sensing reflectance processed by HyperInSPACE (in orange) and compare to TARTU reference (in black)





Data presented with the courtesy of Riho Vendt (TARTU)

CONCLUSION

Community processor developed in collaboration with NASA's HyperInSPACE processor

- **It now supports TriOS RAMSES instrument, in addition to the Seabird HyperOCR device.**
- **It now includes an uncertainty propagation following the GUM.**

Uncertainty computation requires additional inputs for each identified contributors.
The TARTU full instrument characterization is able to provide those additional inputs.

First tests on real field data show a good consistency with the institute processing.

Next step: Additional instrument based corrections and propagation of residual uncertainties

Thank you for listening.