IASI-NG MISSION PERFORMANCES AND GROUND SEGMENT DEVELOPMENT STATUS

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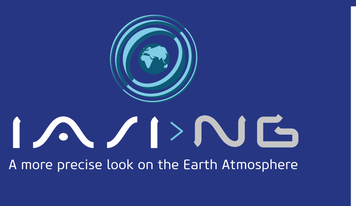
IASI-NG SYSTEM

- The main IASI-NG mission rationale is the measurement of temperature and moisture profiles in clear or partly cloudy scenes at high accuracy (1 K and 5%, respectively) at a vertical resolution in the lower troposphere of 1 km. These data are used for weather forecasting, atmospheric chemistry study and climate changes monitoring. The requirements are established on the basis of user requirements, but also taking into account the heritage from IASI. The objective of the IASI-NG system is to fulfil IASI mission by providing performance twice better than IASI for spectral resolution and radiometric noise,
- The IASI-NG geophysical products will be elaborated under EUMETSAT responsibility considering algorithms and methods developed by the scientific community, including the ISSWG (IASI Sounding Science Working Group). The IASI-NG system is in charge of providing geo-localised, calibrated (spectrally and radiometrically) and apodized radiances to be used in the elaboration of these geophysical products.



IASI-NG: IASI-NG instruments will fly aboard METOP-SG A satellites.

L1C POP: CNES provides EUMETSAT with a L1C Product Operational Processor to be included in the global Payload and Data Acquisition and Processing (PDAP) facility.

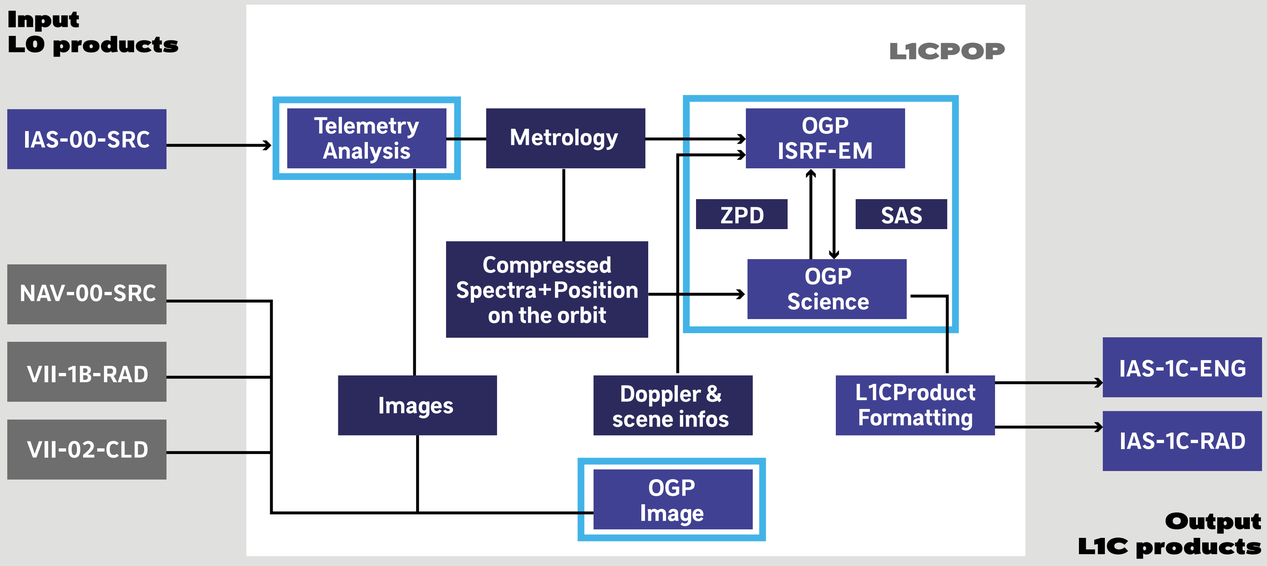
IASTEC: CNES IASI-NG technical expertise center is in charge of monitoring the performances of both the instrument and the L1C Product Operational Processor

IASI-NG L1C PGFS

IASI-NG L1C Product Generation Function

CNES provides EUMETSAT with a L1C Product Operational Processor to be included in the global Payload and Data Acquisition and Processing facility.

It is in charge of processing the IASI-NG data downlinked from the space segment and to provide users with spectra and images that are fully calibrated (radiometrically and spectrally), with all channels having a unique Instrument Response Function (ISRF) for every spectrum, and with sounding pixels geolocalized.



CNES also provides a local L1C chain (L1CLOP) to be used by the local users with the same algorithms than the global PGF.

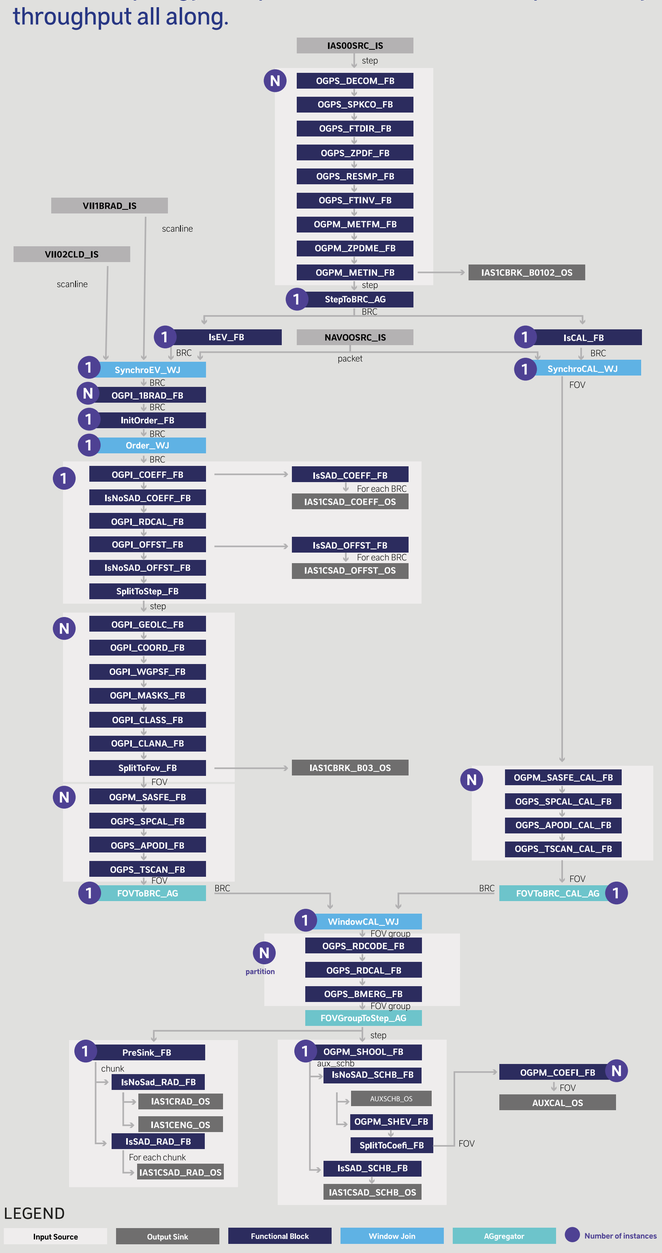
SETTING THE L1CPOP IN MUSIC

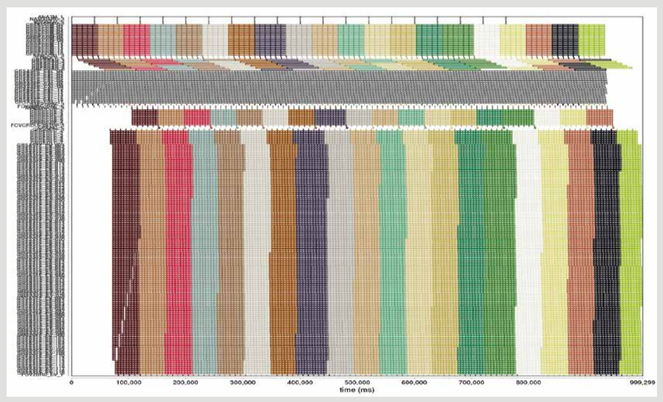
L1CPOP topology

L1CPOP is integrated in PDAP Data Processing Infrastructure (DPI) based on a streaming engine with in-memory technologies.

The L1CPOP topology setup is complex, and has to take into account in the design the desynchronization of the data input. Data are splitted into smaller data granularities for better parallelization.

L1CPOP topology is optimized in order to keep a steady throughput all along.





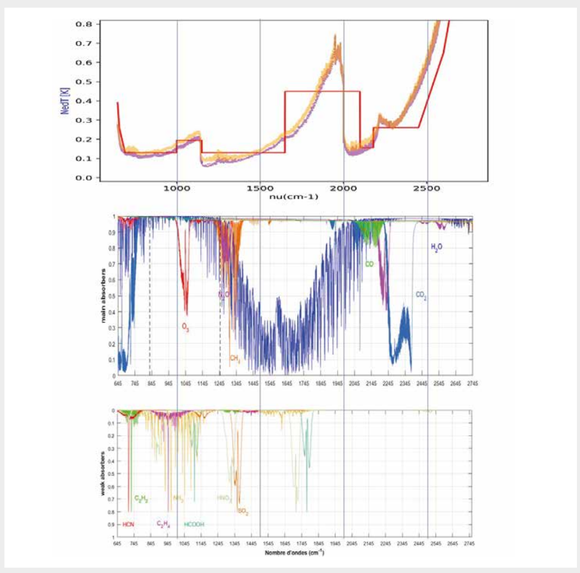
MISSION PERFORMANCES

IASI-NG mission radiometric noises

From the measurement performed during instrument TVAC, the mission radiometric noise performance has been estimated included the effects of the so-called “pseudo-noises” i.e. the effects of the instrument imperfections when looking at real atmospheric scenes. Two hypotheses have been taken into account considering two possible levels of microvibrations. As presented on the poster, it seems today that the impact of the microvibration is lower than expected. It will be conformed by a dedicated performances test during satellite TVAC in April 2023.
It appears also that the performance, in particular in B4 band, is slightly degraded with respect to the estimated budget before instrument TVAC, possibly linked to additional straylight. This phenomenon is under analysis by CNES and ADS experts.

IASI-NG spectral performances

The IASI-NG spectral performances will be refined during second instrument TVAC in 2024



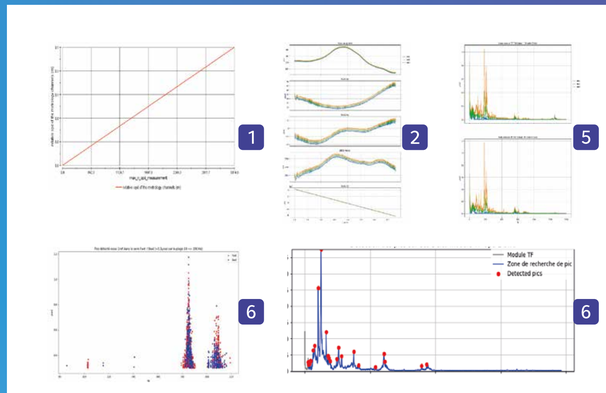
MICROVIBRATION ANALYSIS

Since the beginning of IASI-NG development the microvibration level have been seen as a key point to reach the specified performances. It has been analysed during the CDR than an emitted level lower than 10 µrad for the instrument itself and lower than 20 µrad for the complete system on the global tilt was compatible with the requirements. This level has first been checked at instrument level during the instrument TVAC, and this level has recently be compared to the one on satellite with the KA antenna on.

MICROVIBRATION CALCULATION

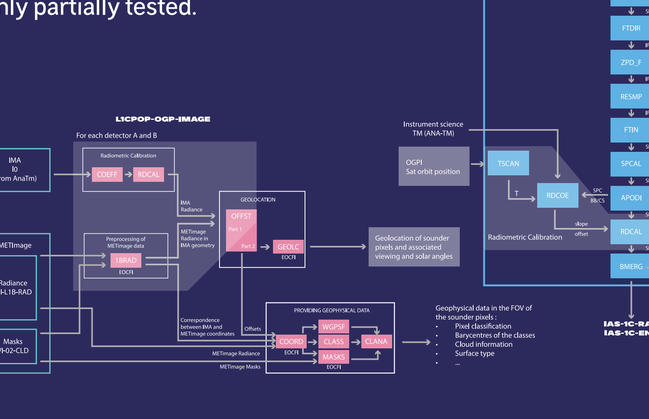
The process to calculate the microvibration is the following:

1. Projection of laser OPD on regular time grid
2. Calculation of metrology observables
3. Calculation of global tilt
4. Deletion of the 5 order fit
5. TF of the global tilt
6. Peak detection done on the TF module



RESULTS

Using the previous process we estimated the microvibration seen on IASI-NG



We made the following observation:

- The frequency peaks are similar with or without KA antenna
- The main peaks frequencies are 190 and 210 Hz
- The amplitude is lower than 1.3 µrad
- The microvibration environment on IASI-NG is better than expected during the CDR…so perfectly compatible with the performance constraints.

END TO END ALGORITHMS VALIDATION

The IASI-NG L1CPOP modules have passed the unitary validation phase by comparisons with the CNES prototype modules. Next are the End-to-End tests which are done under different scenarios.

Scenario 1 : Using a simplified simulator of the instrument a large amount of data can be produced to be used as a load test. The interfaces for the complete chain are also verified.

Scenario 2 : Real instrument data obtained during the thermal vacuum tests can be injected in the L1CPOP – the On-Ground Processing Imager chain is in a degraded case (no data). In this scenario the stability of small non-conformities between L1CPOP and the CNES prototype chain can be assessed. The spectral calibration process is only partially tested.

Scenario 3 : Real instrument data is now coupled with simulated data for the Imager algorithms. The links between the Sounder and Imager algorithms can be tested.

Scenario 4 : Using the more complex simulator of the instrument allows to test the complete chain with different scenes than those present in the TVAC measurements, which gives more robustness to the stability analysis. It also allows to test the calibration process in it’s entirety (using spectral lines from simulated atmospheric spectra).