

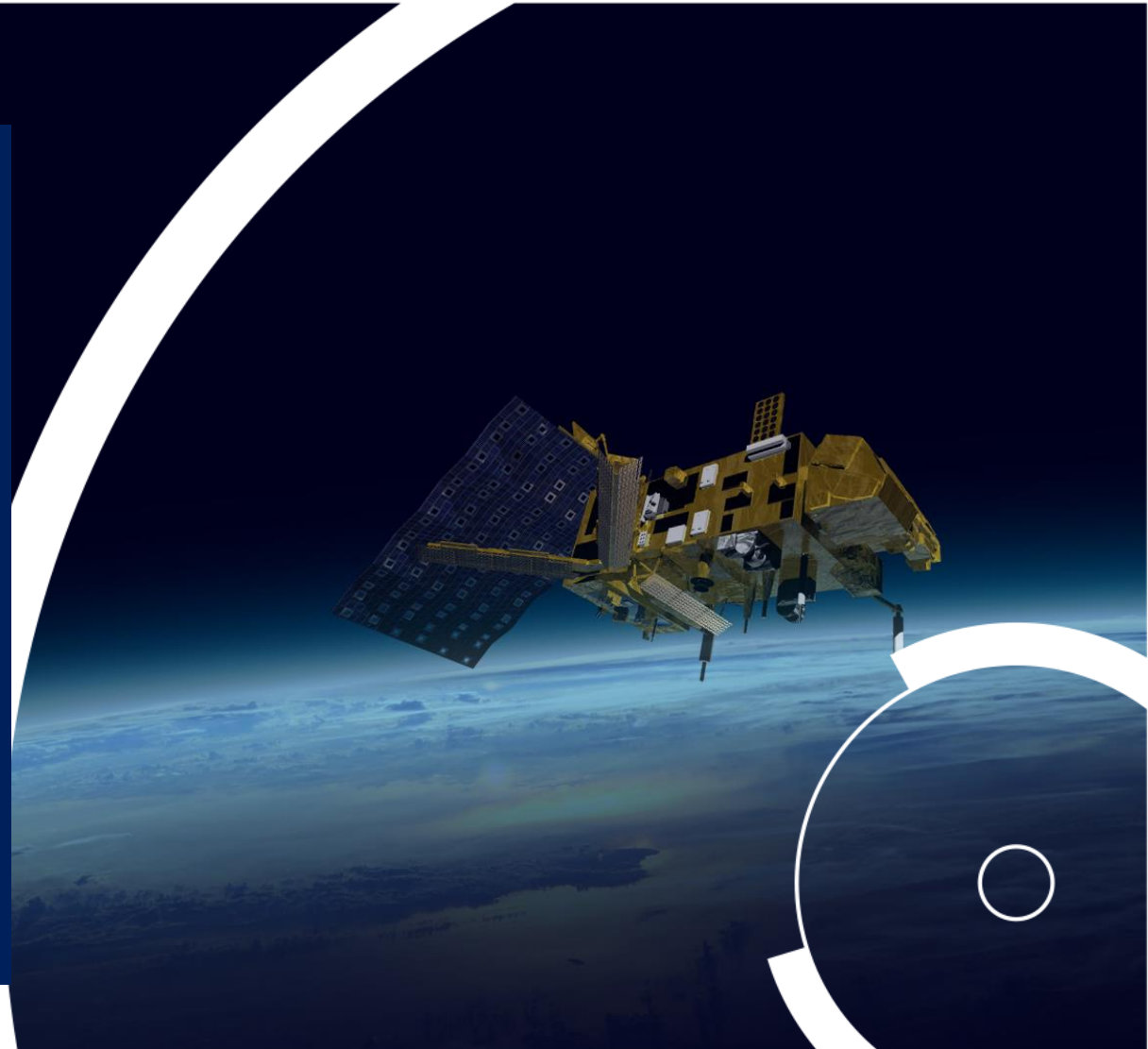
Preparing for the operations of Copernicus Sentinel-4 and Sentinel-5 missions at EUMETSAT

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Sentinel-5P Mission: 5 years anniversary, 14/October/2022





Status of MTG, EPS-SG

Launch dates

Status of S4, S5 instruments and data processing development

Instrument status

S4 C&C campaign

Data processing systems status

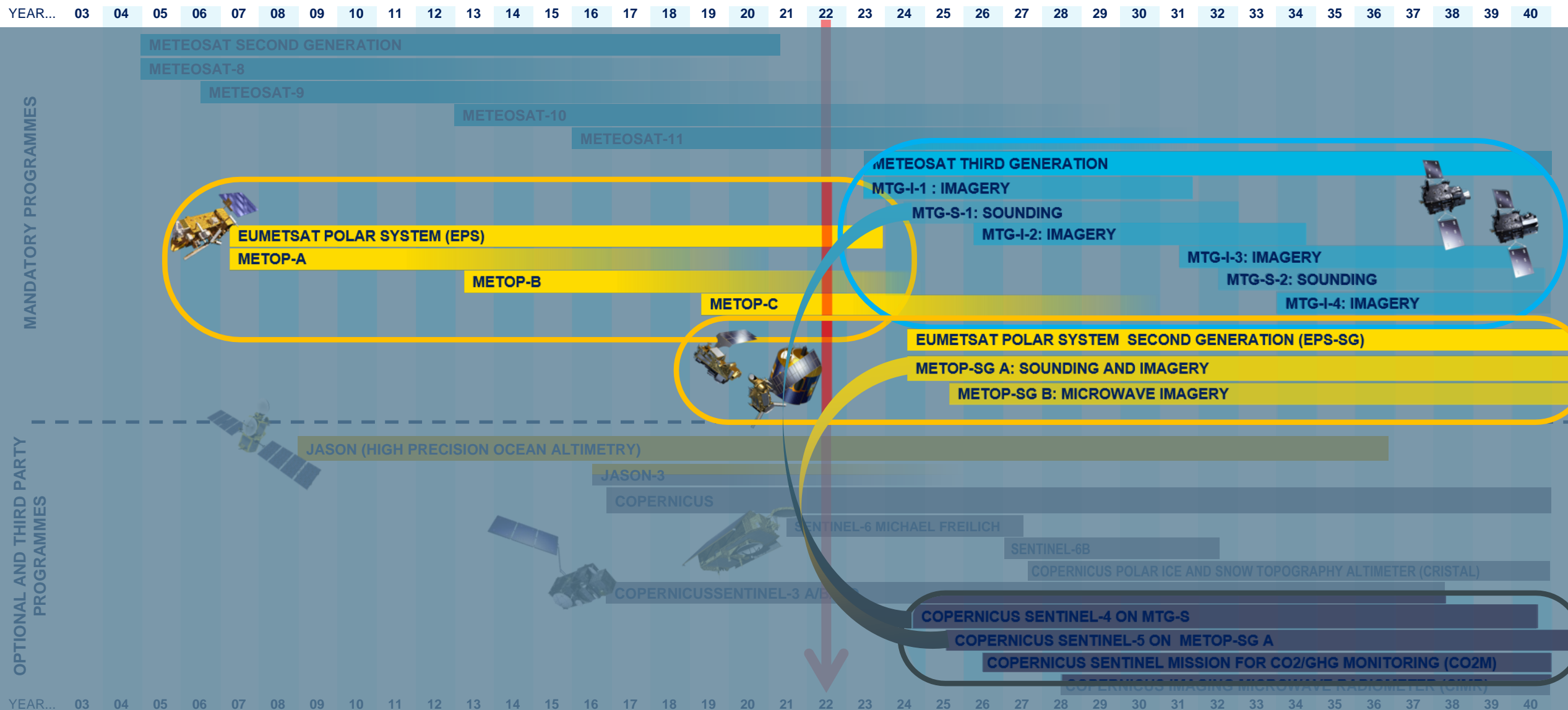
CalVal planning

AO call

Routine CalVal and monitoring at EUM



EUMETSAT mission planning - with focus on Atmospheric Chemistry



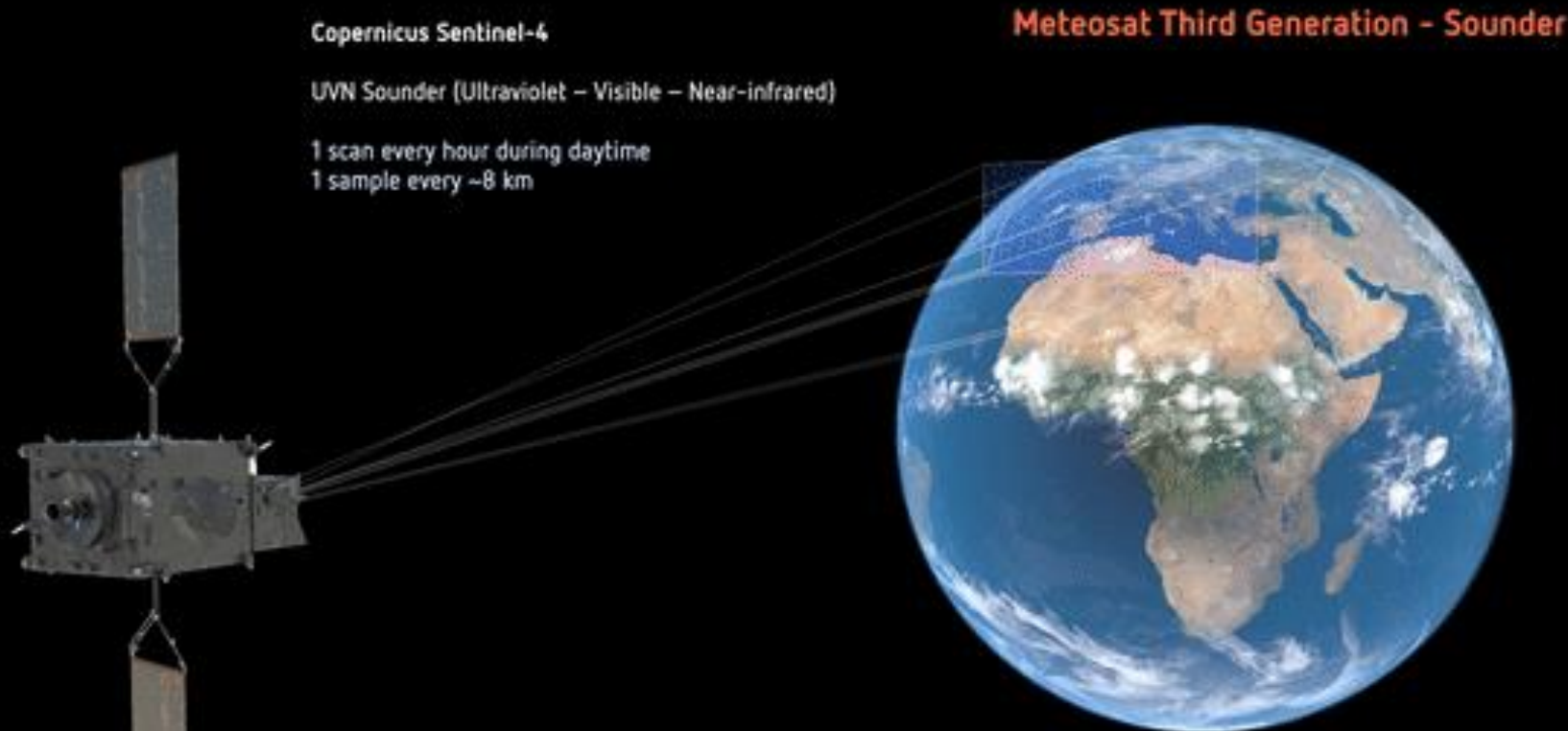


- For Copernicus S4 and S5, EUMETSAT is responsible for the operation of the Space Segment, the operational provision of the mission outputs and execution of routine CalVal activities.
- MTG-I1 (FCI, LI) launch to take place on **14 December 2022**, satellite has just arrived in Kourou.
- MTG-S1 (S4, IRS) expected to be launch-ready by end of Q2 2024. Launcher available earliest by **August 2024** (first launch with Ariane 64).
- EPS-SG A1 (S5, IASI-NG, MetImage, 3MI, MWS, RO) planned for launch not earlier than **December 2024**



- The Meteosat Third Generation – Sounder platform will carry the Copernicus Sentinel-4 payload.

- First European Air Quality mission in a geostationary orbit



The Sentinel-4 instruments are CFI provided by ESA in the framework of the Copernicus Space Component.



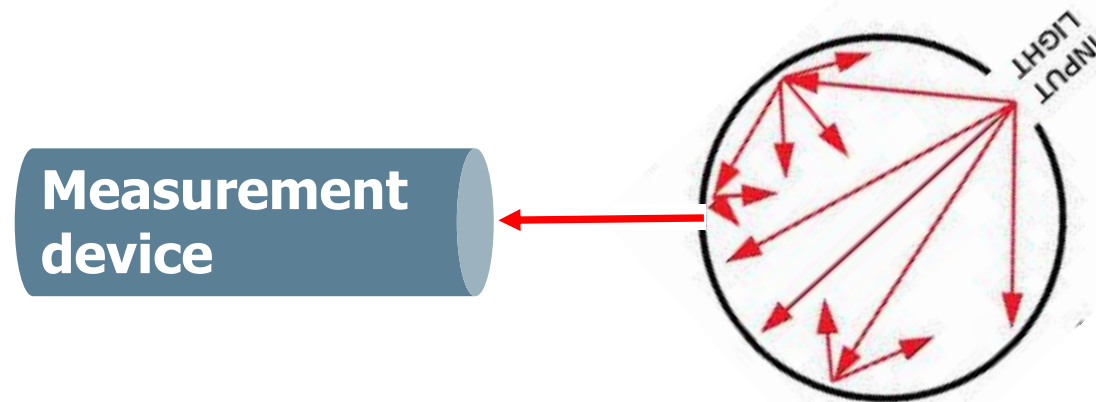
- Thermal vacuum and thermal balance (TB/TV) tests and calibration campaign in the RAL test facilities started in August 2022 and is ongoing.
- Delivery of the PFM Optical Instrument Module to OHB Bremen is planned in November 2022.
- Associated electronics have been delivered, already integrated within the MTG-S1 PFM platform.
- The FM2 instrument will complete its acceptance review about one year after the PFM delivery



Credit: ESA

Measurements are being processed and analyzed by industry and in parallel by a joint ESA-EUM team.

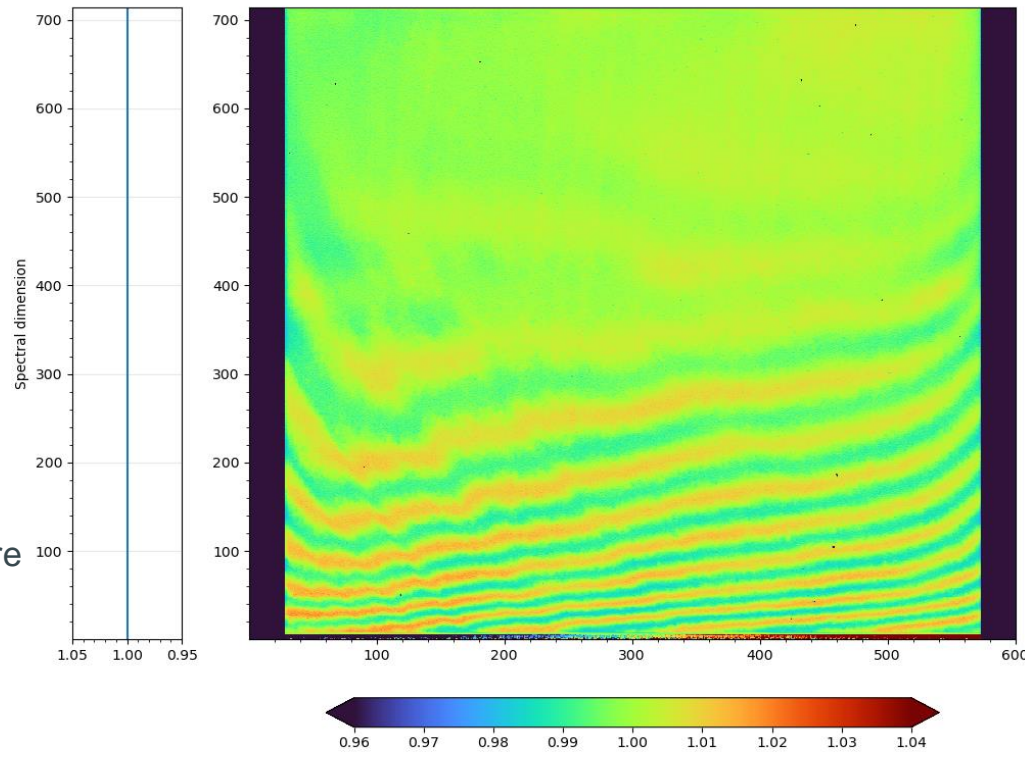
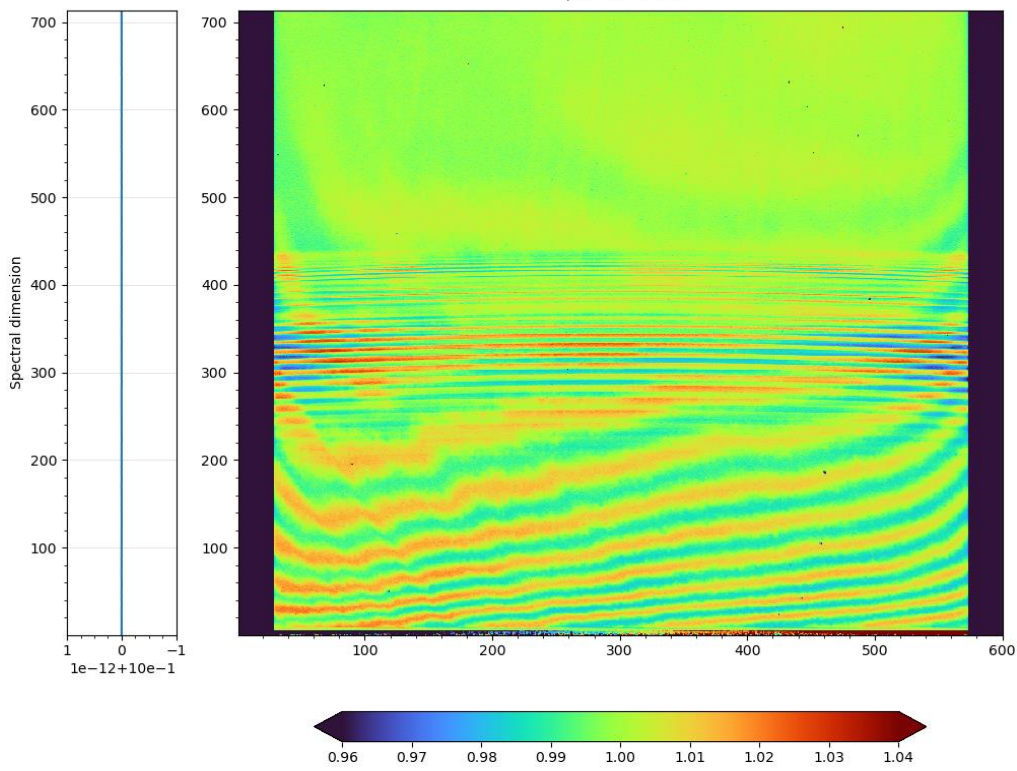
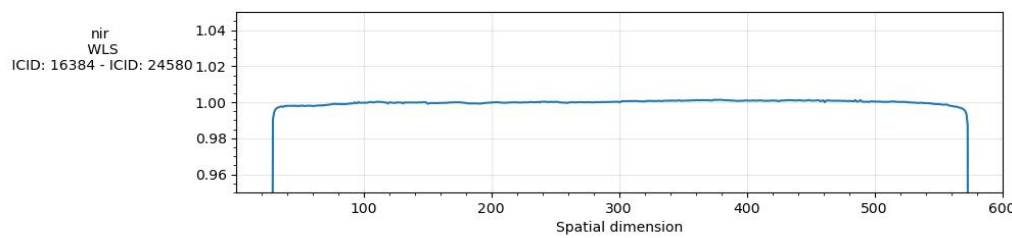
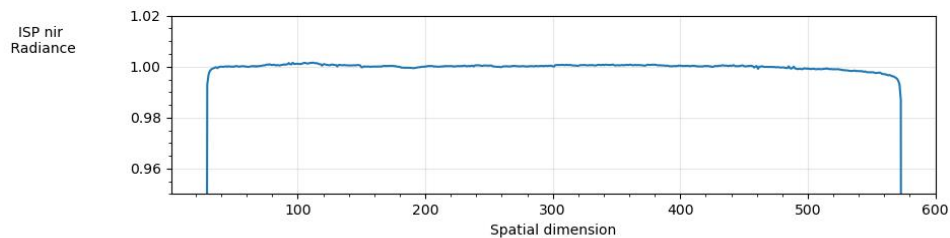
- PRNU, or relative pixel-to-pixel sensitivity is the difference in number of electrons generated between different detector pixels in case of constant illumination.
- Measured with uniform light sources, such as an integrating sphere or the white light source integrated into the instrument.





S4 C&C example: Photo response non-uniformity (PRNU)

NIR



Light pathlength inside the integrating sphere in the range of several meters
-> oxygen absorption

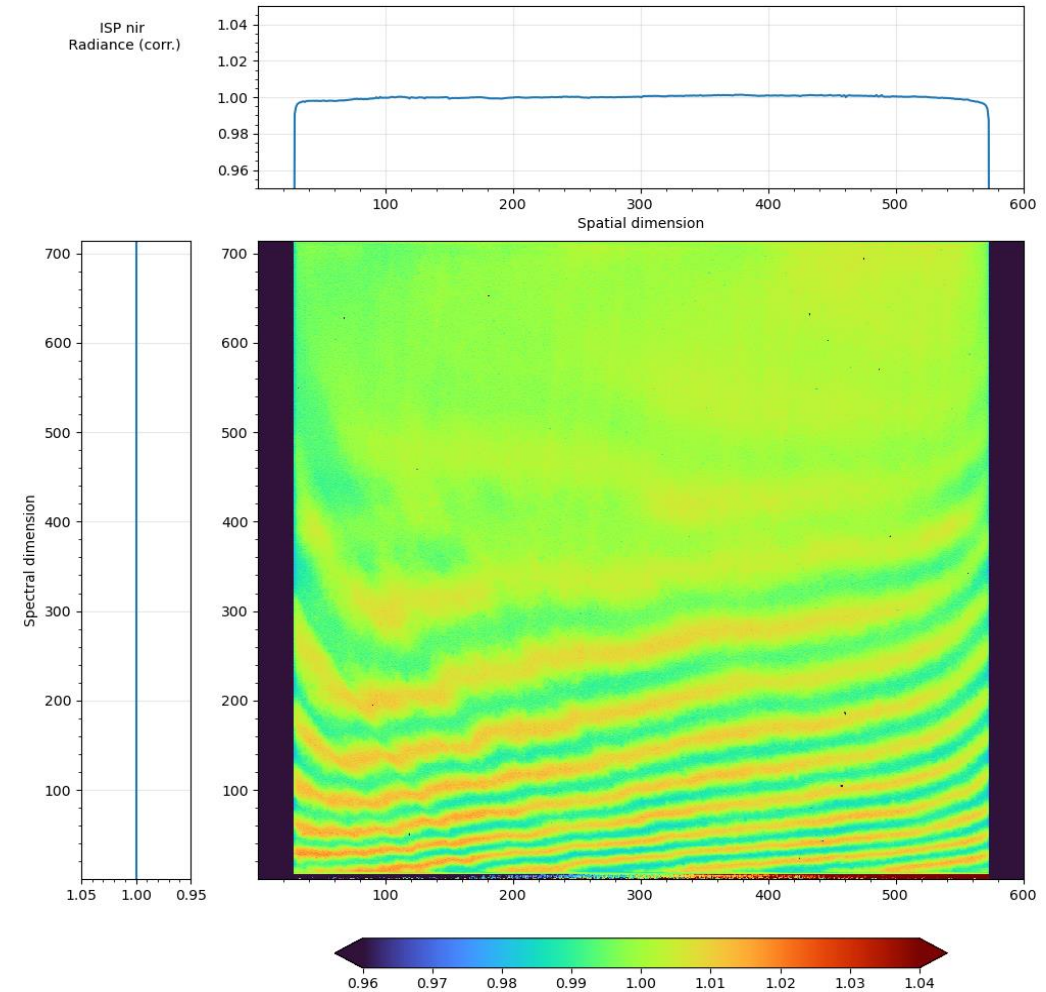
Integrating sphere (outside TV)

Vinod Kumar and the S4 C&C team

White Light Source (inside TV)



- By dividing the integrating sphere data and the WLS data, the O2A band features can be isolated
- ... and eventually removed from the Integrating sphere measurements



Intermediate results

Vinod Kumar and
the S4 C&C team

PRNU in the
NIR



- Development of the operational L0-L1 ground segment (IDPF-S) has faced difficulties – contractual setup has been adjusted to allow moving forward.
- In parallel, EUM and ESA are jointly developing a L1 Reference Processor, which will be used as gap-filler in early mission stage. This processor is in use to process campaign data, which proves to be a very valuable exercise.
- The first version of Level 2 Operational Processor for the UVN processing developed and delivered by ESA (prime: DLR) is being integrated into the L1-L2 ground segment (L2PF).



- All PFM units have been delivered and integration of the instrument is on-going:
 - All spectrometer S/S have undergone optical alignment
 - All spectrometers (SWIR S/S, NIR, UV2VIS, UV1) mechanically integrated
 - Thermal hardware including instrument radiators being installed along with final electrical integration
 - Instrument will be transferred to IABG at the end of 2022 for the environmental tests before transfer to RAL at the end of Q1 2023 for TV and C&C campaign
- Delivery to S/C end of August 2023

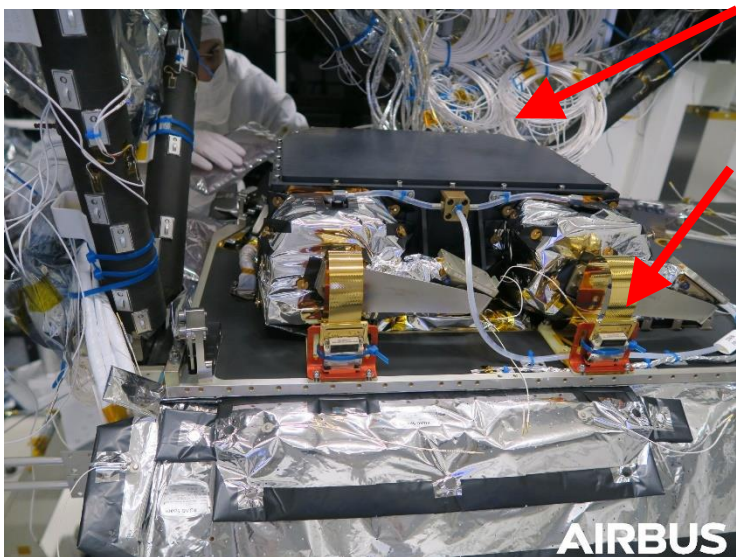
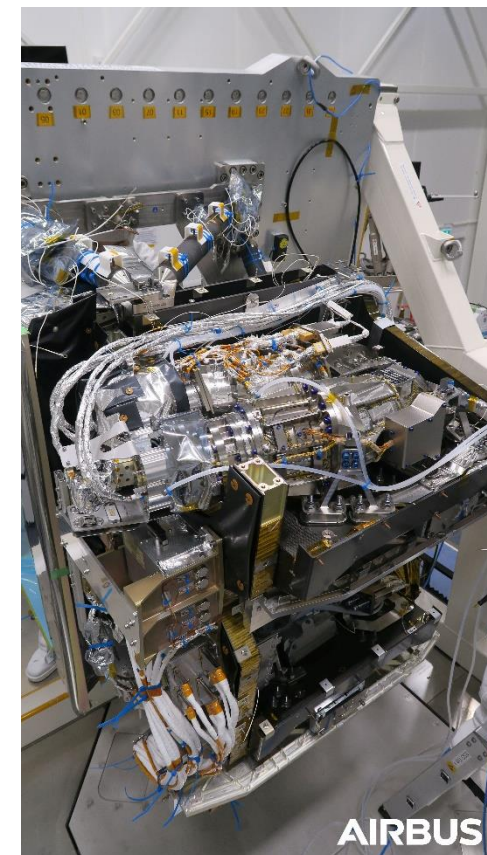


Some very recent pictures of Sentinel-5 PFM during integrat



US and VN telescopes, (with covers), UV1 (middle), FEE (bottom)

UV2VIS Sensor assembly in foreground, NIR sensor assembly in rear



SWIR cold box (black)
SWIR focal planes/detectors (foreground), tied to the cold radiators by gold thermal straps



SWIR radiator



- Delays have occurred in the development of the data processors and integration into PDAP ground segment.
- EUM & ESA follow a “Plan B” setup, which allows performing the Sentinel-5 commissioning activities using a combination of
 - the L0 Operational Processor and
 - an updated version of the L1b prototype processor, namely L1b Reference Processor Prototype (L1RPP), procured by EUM together and with support from ESA.
 - Similar concept is considered for L2 processor.
 - To be integrated in the EUMETSAT Temporary Ground Processing System (T-GPS), filling the gap until readiness of EPS-SG PDAP.

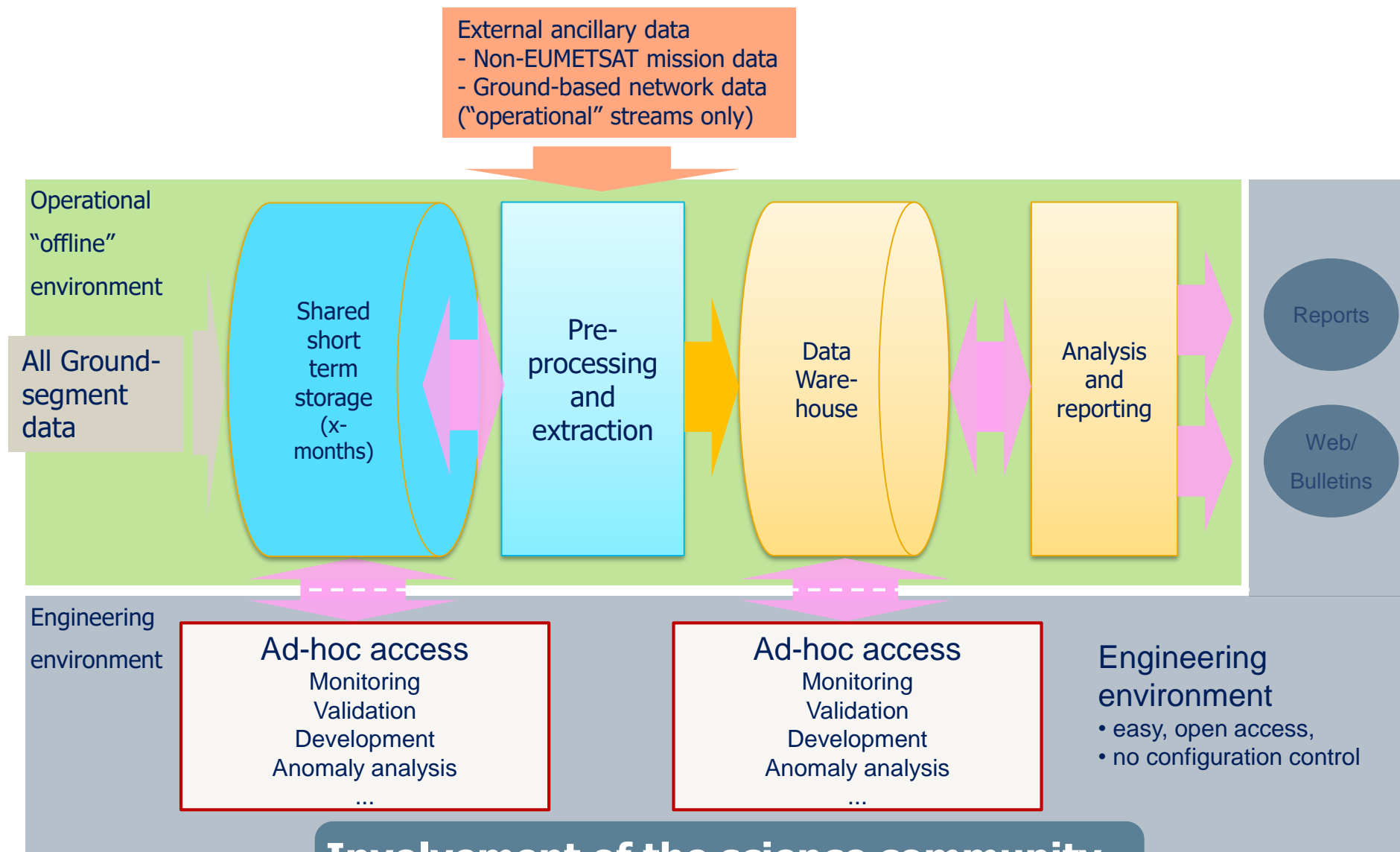


- The **Sentinel-4 and Sentinel-5 Calibration and Validation Plan** captures the different tasks to be fulfilled during commissioning and routine phases.
- Level-1 calibration:
 - Solar, on-board, and vicarious calibration targets
 - Other satellite data (GOME-2, Sentinel-5p, TEMPO/GEMS, ...)
 - via international partner collaboration, partner agencies, GSICS, CEOS AC/VC.
- Level-2 trace gas (and ancillary) product validation and verification:
 - Ground-based observations (NDACC, Pandonia, WOUDC, Eubrewnet, TCCON, ...)
 - Other satellite data (GOME-2, Sentinel-5p, TEMPO/GEMS, ...)
 - Dedicated campaigns
 - Model-based validation (CAM5)
- These Fiducial Reference Measurements (FRM) will form the basis of the absolute validation
 - Timeliness requirement: < 48h (NTC)
 - Data access & format (Easy access, data format, consistent and traceable processing approach, traceability to standard and/or community recognised best practices, high product quality)
 - Documentation
 - Long-term availability in order to cover the time of the missions
- Announcement of Opportunity (AO) Call to be released in first half of 2023, whereby ESA and EUMETSAT invite interested groups to participate in carrying out the activities defined in the CalVal plan.

Preparation of
CalVal tools &
facilities is a
primary focus
now.



Routine Cal/Val and monitoring at EUMETSAT



Involvement of the science community for in-depth validation activities



Thank you!
Questions are welcome.