The Copernicus Sentinel 4 & 5 mission: status and ongoing activities at EUMETSAT

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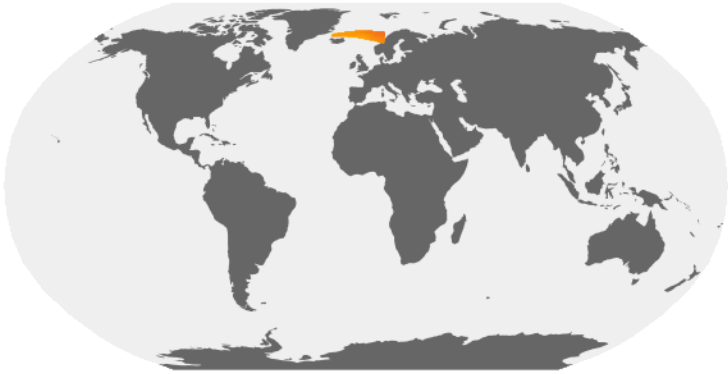
Agenda

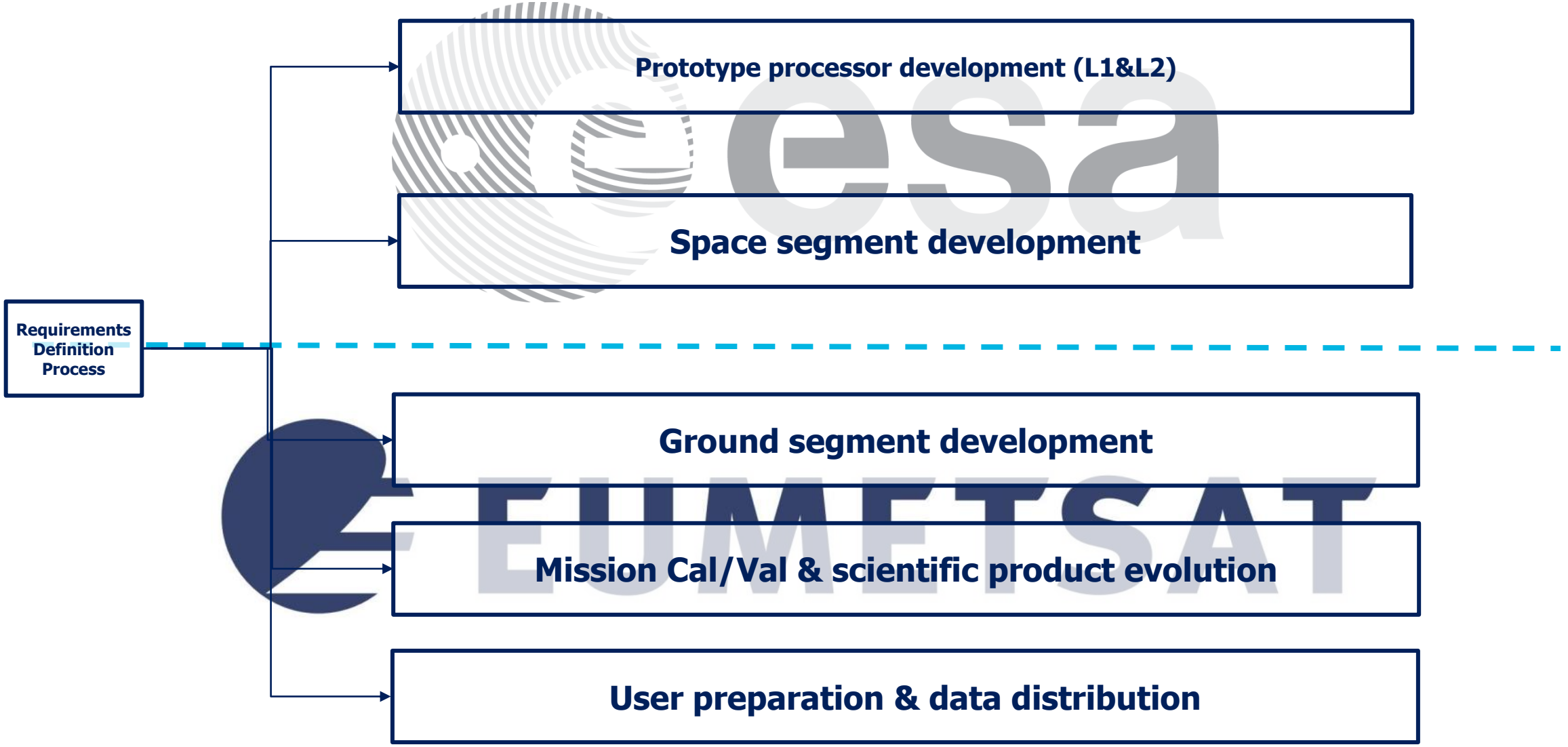
- Introduction
- Responsibilities
  - EUMETSAT´s Role in the S4/S5 Programme
- S4/S5 calibration approach
  - On-ground
  - In orbit
- Level-2 Products
- Preparation for Cal/Val and Operations

Introduction – S5 & S4 Missions

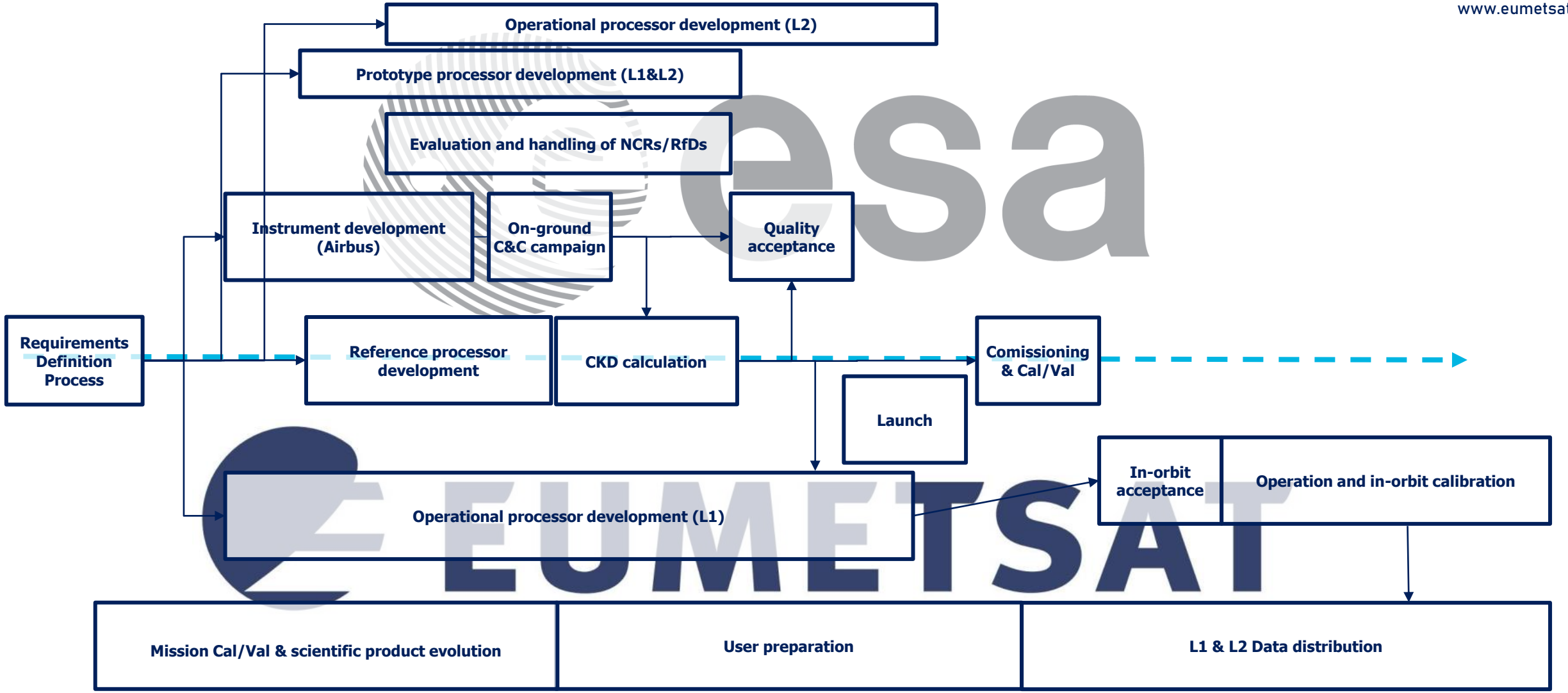
- MTG-S and EPS-SG-A platforms
  - Synergistic suite of instruments
    - FCI (clouds; high spatiotemporal sampling)
    - MetImage (clouds)
    - 3MI (aerosols)
    - Sentinel-4/5 (UVNS, AQ, trace gases)
    - IASI-NG/IRS (TIR)
  - Anticipated launch dates
    - MTG-S1: Q3 of 2025 (TBC)
    - EPS-SG-A1: Q4 of 2025 (TBC)



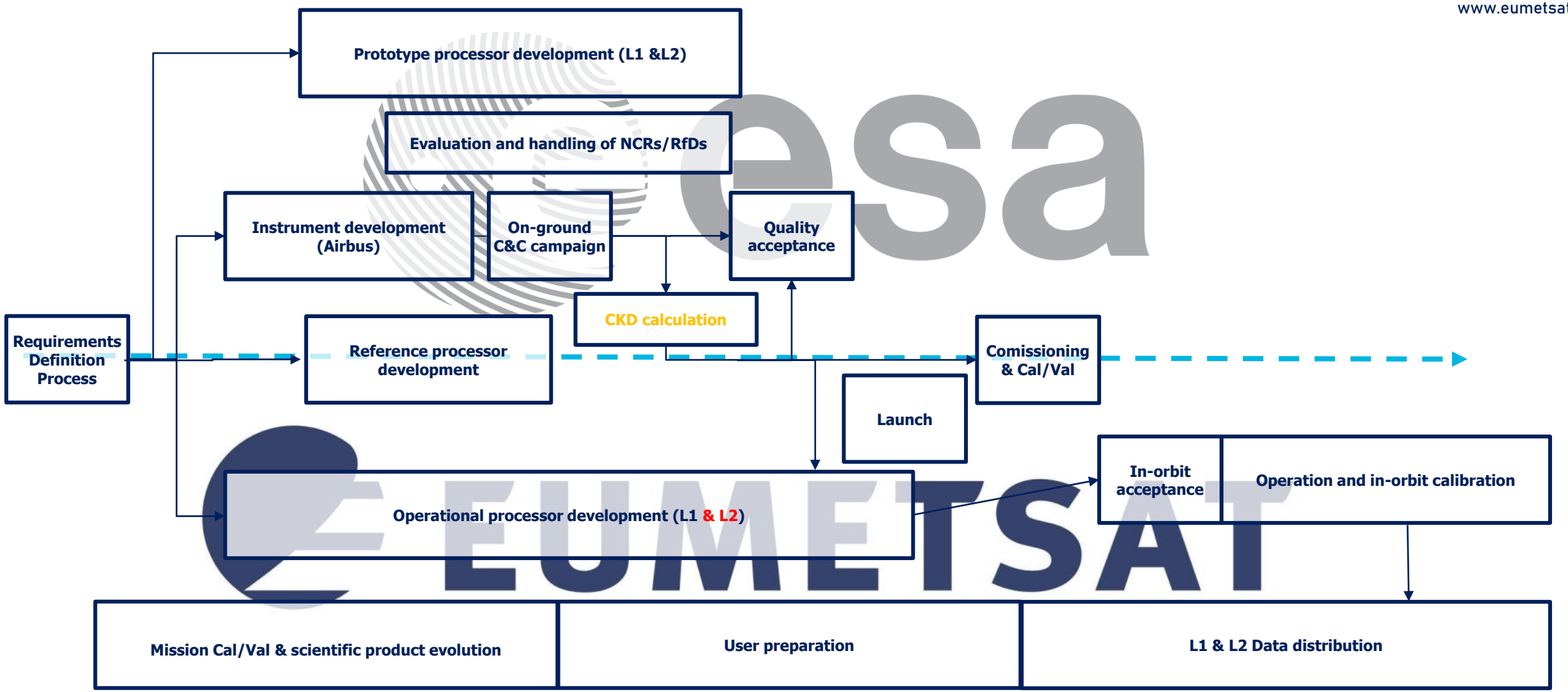
Sentinel 4 & 5 responsibilities - Overview



Sentinel 4 responsibilities – Detail

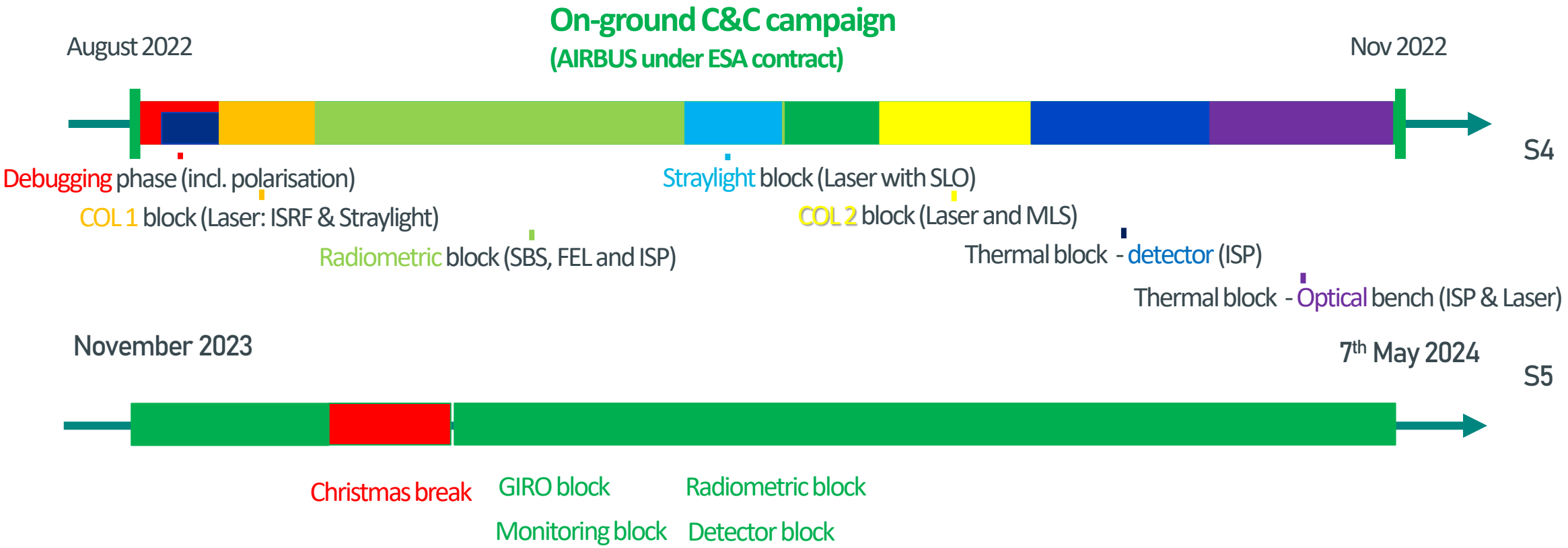


Sentinel 5 responsibilities – Detail



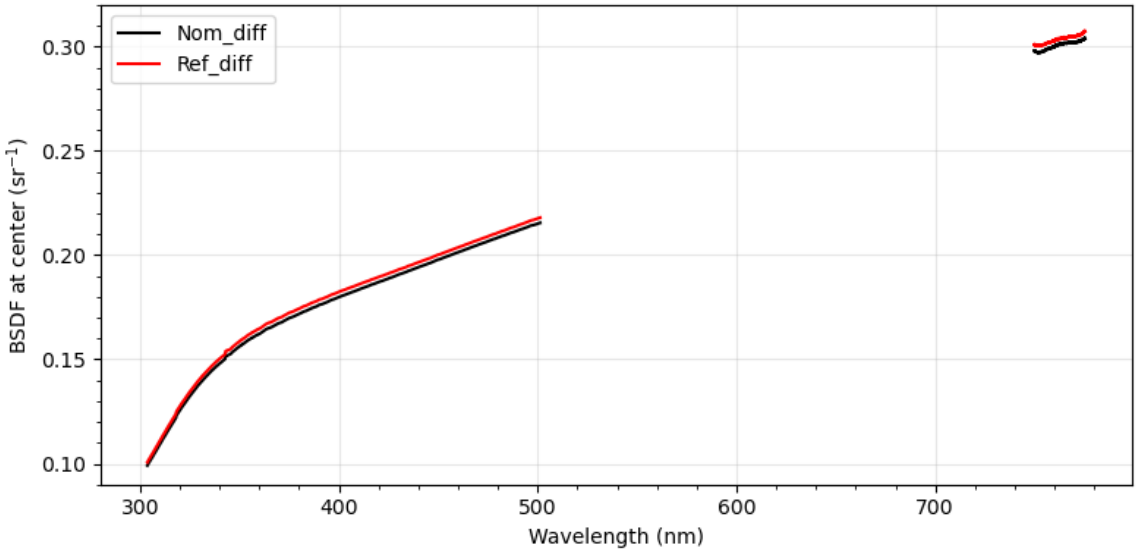
Instrument calibration approach

- Calibration Key Data (CKD) are required for L0 – L1b processors throughout the mission life cycle.
  - S4/S5 on-ground measurements conducted by Airbus at RAL (supervised by ESA)
- CKD life cycle:
  - On-ground calibration campaign (-> CKD), complemented by
  - Commissioning phase measurements (-> CKD completion & update)
  - Routine operations (CKD update)



Example Sentinel-4 CKDs derived at EUMETSAT

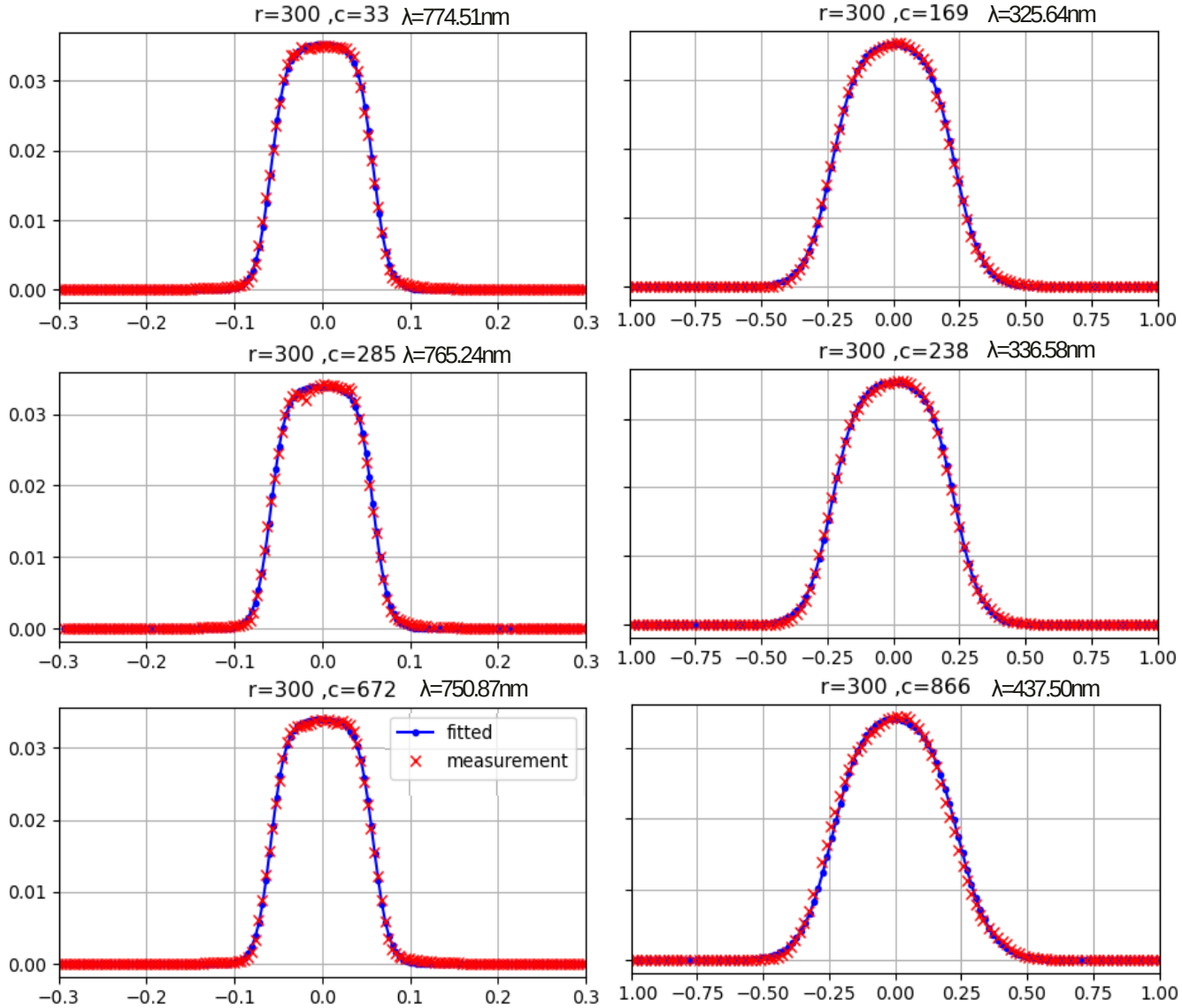
BSDF



BSDF derived at the spatial centre of the UVVIS and NIR detectors using combination of Sun Beam Simulator (SBS) and Integrated Sphere (ISP) measurements

- **BSDF** (Bidirectional Scattering Distribution Function) and **ISRF** (Instrument Spectral response function) are also important parameters for L2 retrievals

ISRF



ISRF (double sigmoid) at example wavelengths for NIR (left) and UVVIS (right) derived using Variable light source (VLS) measurements

In orbit Calibration and Performance Verification

- In orbit calibration are needed to offset the effects of temporal fluctuations and drifts at different time scales due to
  - Launch / settling effects
  - Optics / detector / diffuser contamination
  - Detector and electronics ageing/degradation

- On board calibration sources:
  - Solar diffusers, White Light Source (WLS) and LED lamps for S4 and S5
  - Spectral line sources (SLS) for S5 NIR and SWIR bands

- In orbit internal calibration measurements outside the earth radiance measurement hours
  - S4: external in-orbit geometric calibration using star measurements
  - S5: independent measure of dark current/ offset using deep space view and ISRF monitoring using SLS

Sentinel-4

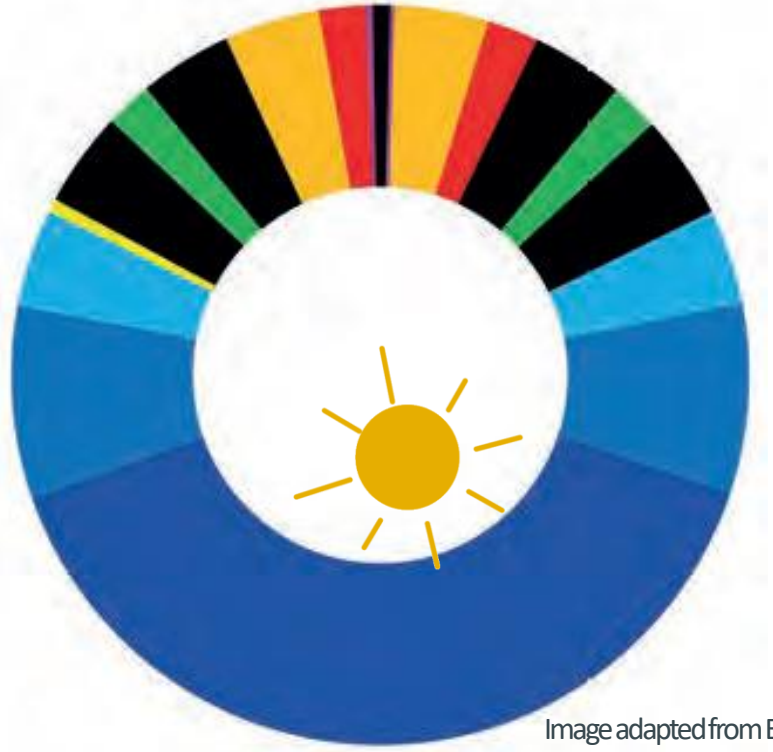


Image adapted from ESA

Example 24h measurement sequences

Earth radiance measurements
Solar irradiance measurements
Star observations
Background measurements
Dark current and detector calibration measurements
LED measurements
Idle

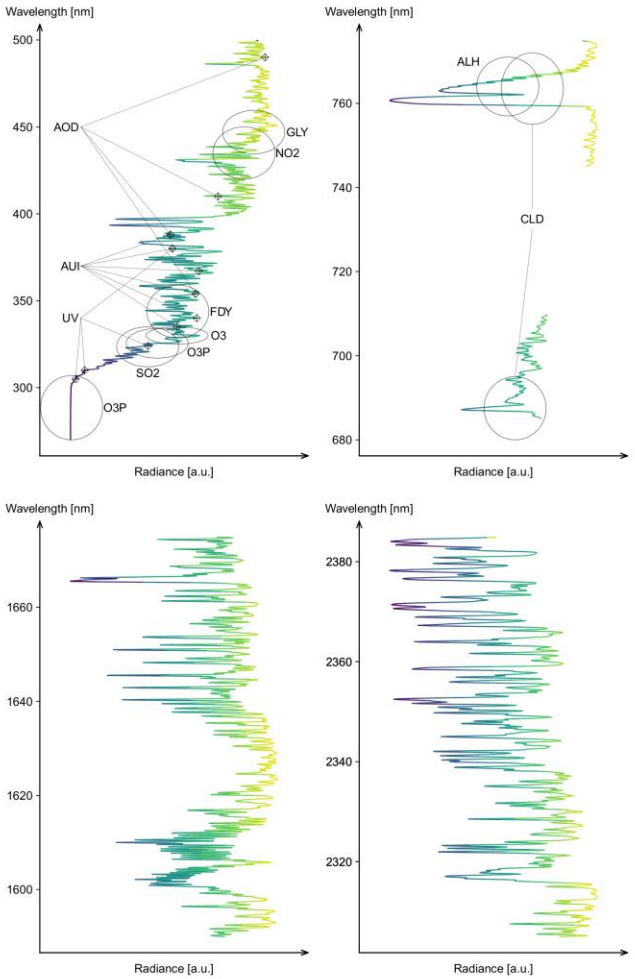
Level-2 Products

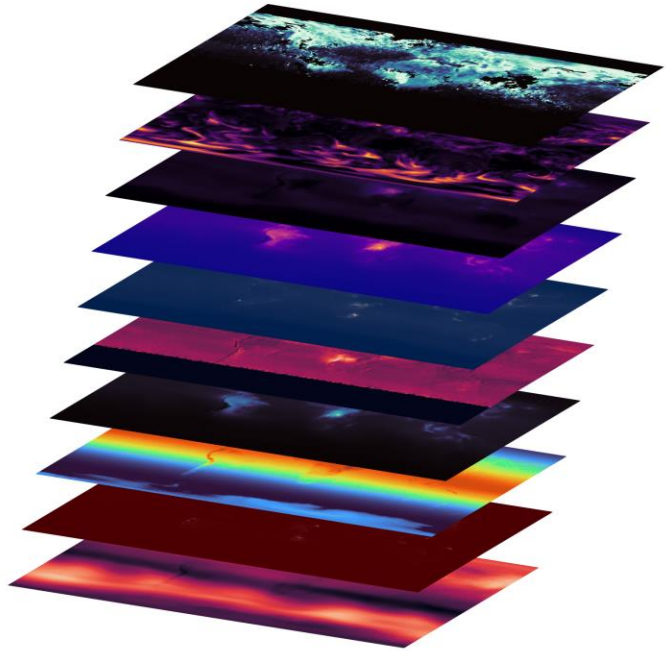
Operational Products

Sentinel-4	Common	Sentinel-5
TropO3 Surface BRDF FCI Support Products	SO2 Total O3 FDY UV AUI NO2 GLY Surf. Refl. ALH CLD	O3 Profile CH4 CO SO2 Layer Height Surface Albedo (LER) MetImage Support Products

AC-SAF Products

Sentinel-4	Common	Sentinel-5
SO2 Layer Height	Total H2O (TCWV)	Total and tropospheric BrO Total OClO





Aerosol layer height

EUMETSAT preparation for Cal/Val and Operations

- Tool development ongoing for
  - Instrument and product quality monitoring facilities utilizing a number of libraries developed in-house
  - Routine validation against external fiducial reference measurements (FRMs)
  - Data access (Satpy readers)
  - Offline calibration processing / in-orbit CKD generation
  - Radiometric vicarious and inter-calibration activities
  - Geolocation verification and monitoring activities

- Preparation of targeted support services
  - to capitalize on existing expertise in the scientific community

REMINDER: Joint ESA EUMETSAT Announcement of Opportunity (AO) CALL

Thank you!

Questions are welcome.