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CO2M: Copernicus mission for monitoring anthropogenic carbon dioxide from space

AC-VC22 - 04/06/26

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→ THE EUROPEAN SPACE AGENCY

CO2M Space Segment – Key Facts

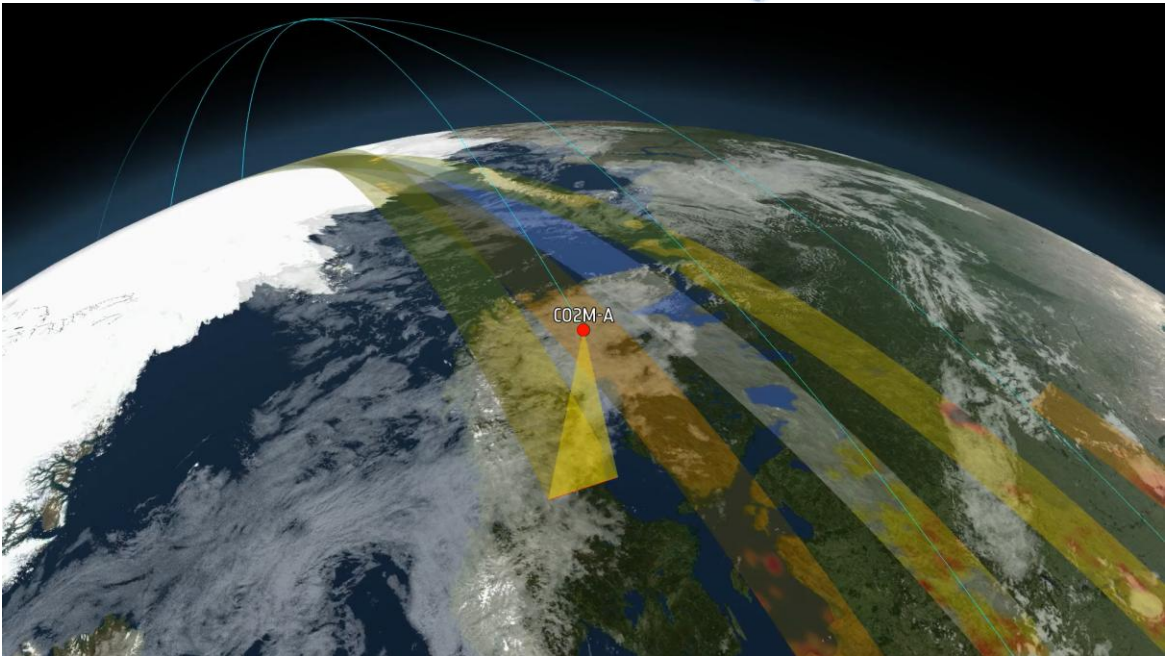
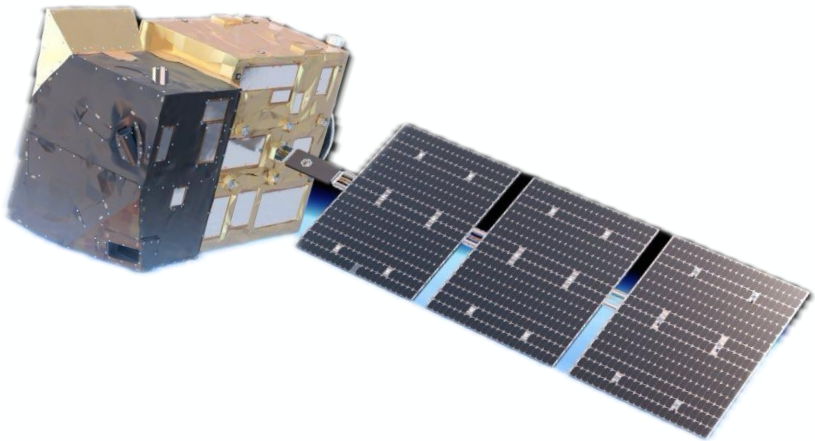


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OHB SE (Bremen, DE): space segment & platform prime
TASiF (Cannes, FR): payload & end-to-end simulator prime

Mission architecture	
Reference Orbit	Reference altitude: 735 km LTDN: 11:30
Number of satellites	CO2M-A (PFM), CO2M-B (FM2) and CO2M-C (FM3)
Repeat cycle	Global coverage in 11 days with 1 satellite, 5 days with 2 satellites 4 days with 3 satellites
Measurement data latency	Max: 3.3h, based on 1 Ka-band Ground Station per orbit
Lifetime	7.5 years (nominal), 12 years (extended)
Dimensions	Stowed Volume: 3.8 x 2.8 x 1.6 m ³ Deployed Solar array area: 10.8 m ²
Satellite Mass	1765 kg (wet mass); payload mass 620 kg
Launcher	Vega-C (single launch)



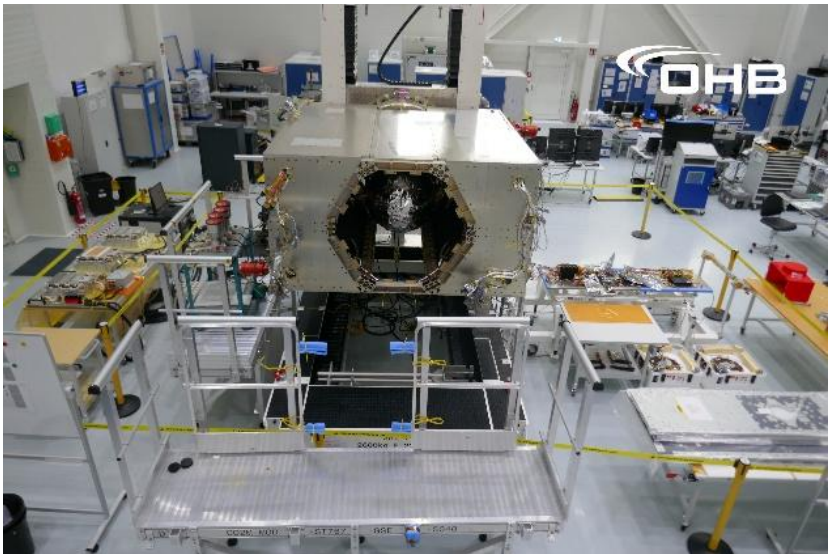
CO2M Space Segment status – Platform



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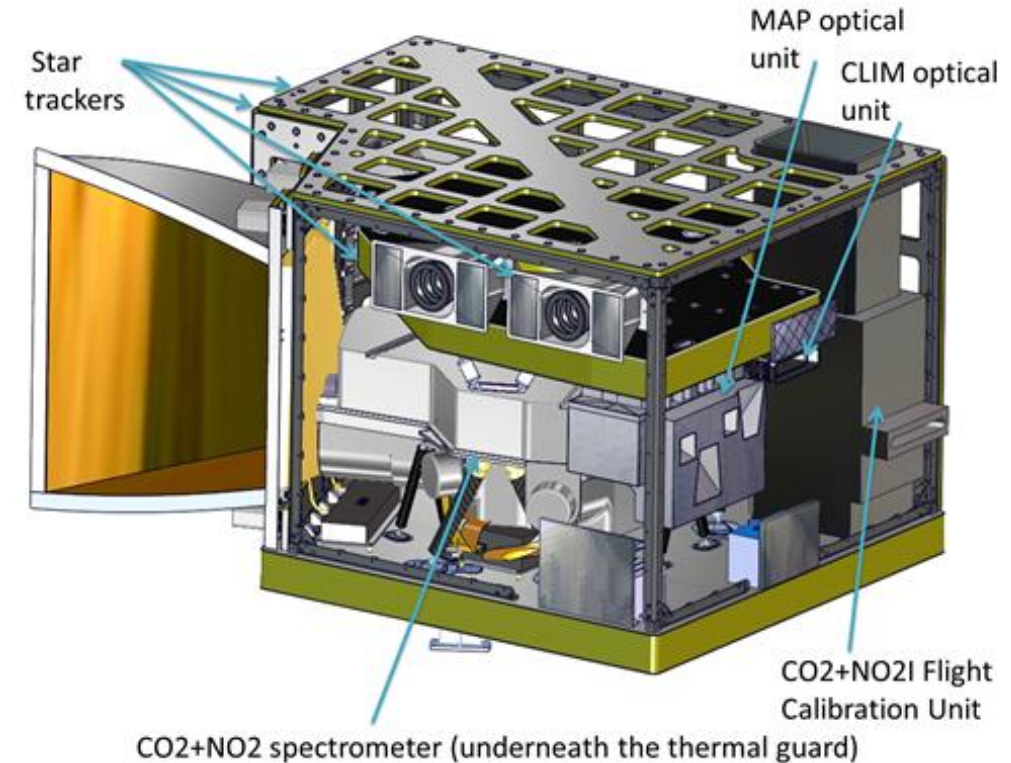


**Platform PFM
& FM2 in OHB
clean room**



CO2M Instruments

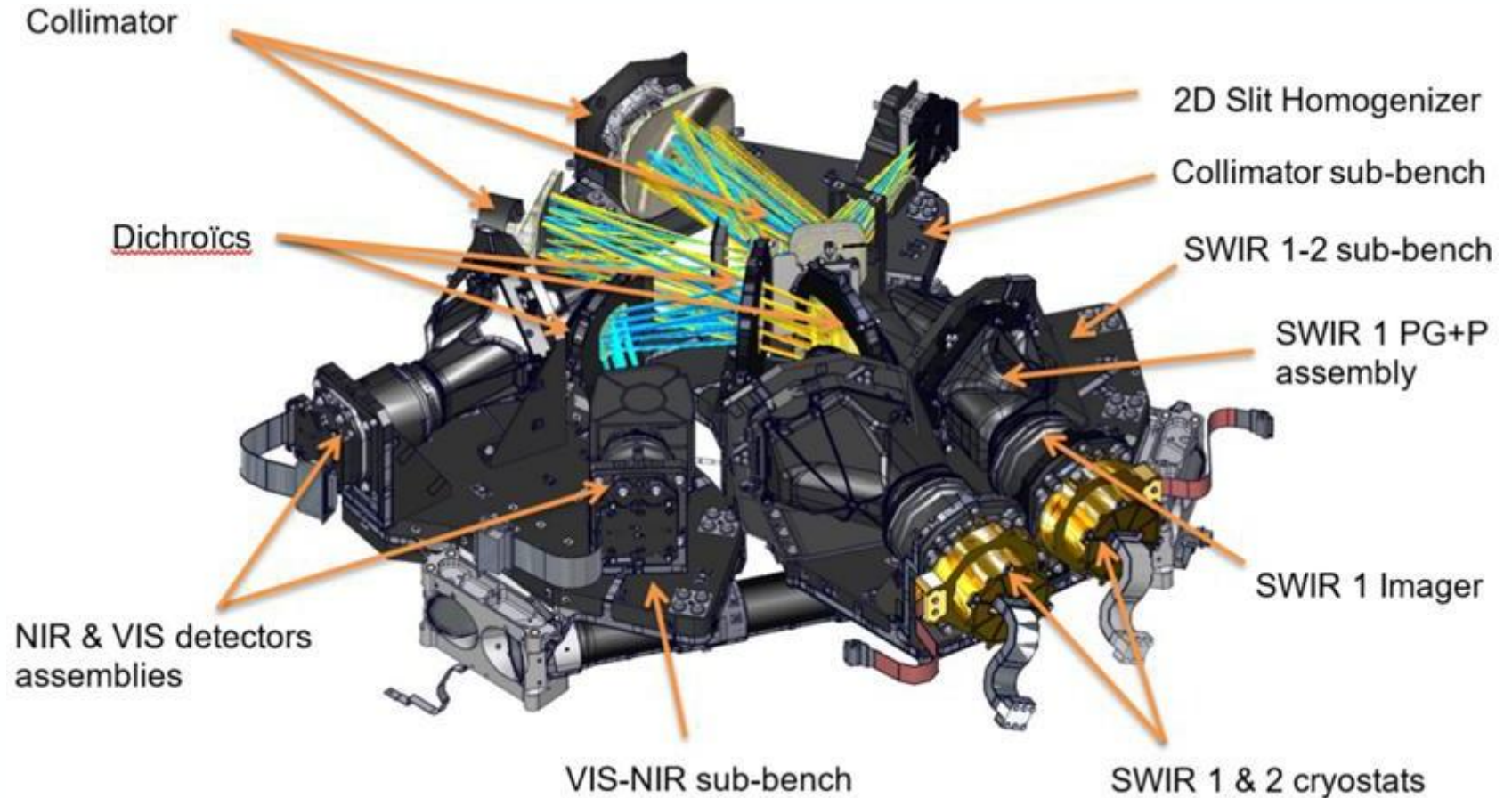
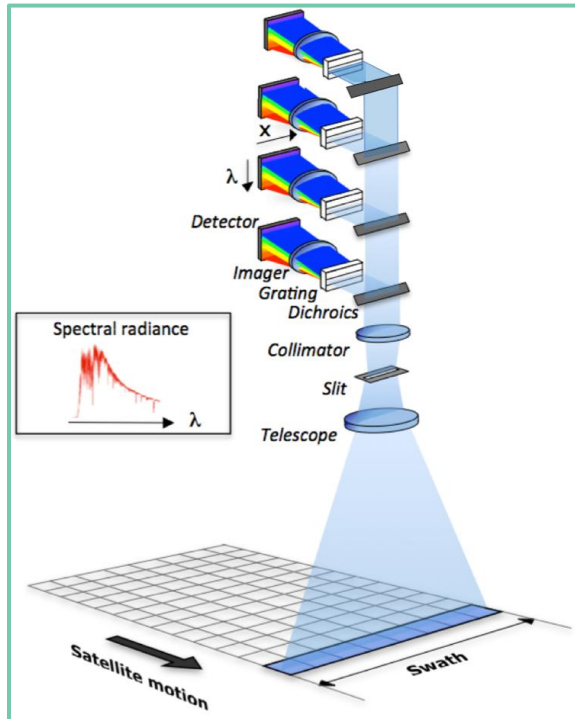
- **CO2 Imager (CO2I)**: 3 band (1 NIR, 2 SWIR) co-located push-broom imaging spectrometer, plus VIS band implemented in CO2I; **NO2 Imager (NO2I)**
- **Multi-Angle Polarimeter (MAP)** for aerosol observations
- **CLoud IMager (CLIM)** for low cloud & cirrus detection
- All payload is 620 kg, 6 m³, and 300 W



Pushbroom Imaging Spectrometer



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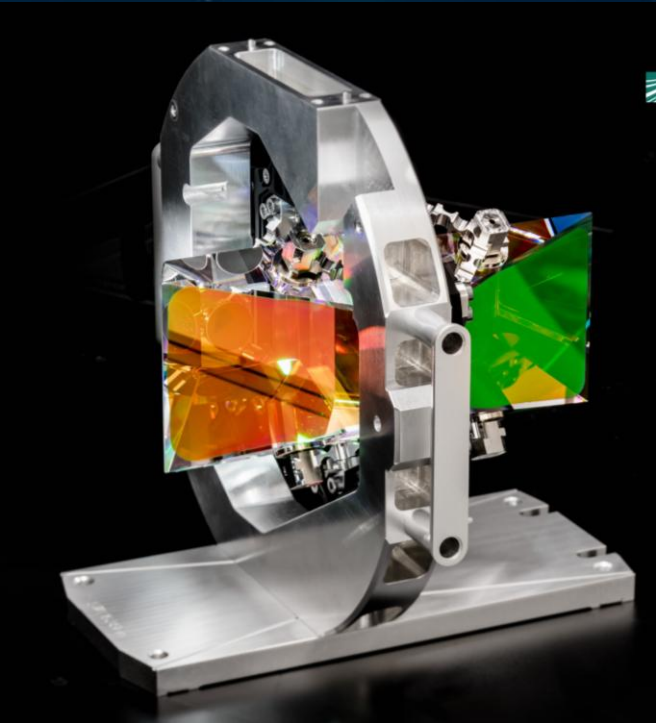


Credit Thales Alenia Space

Spectrometer components



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Prism +
Grating +
Prism

Credit IOF
Fraunhofer



Entrance
slit with
110 fibers



Credit
Optec

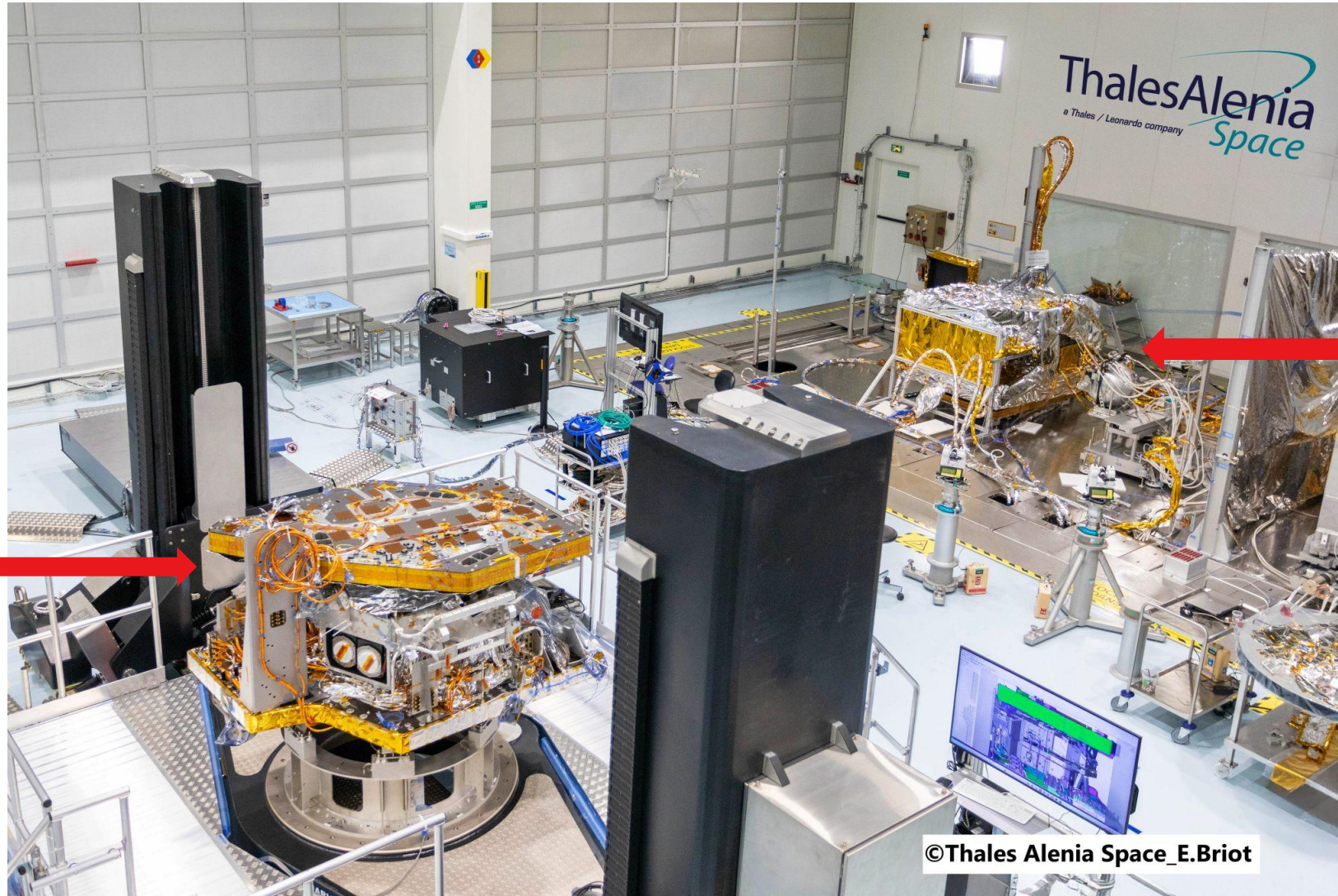


@ Thales Alenia Space

CO2/NO2 instrument

Credit Thales Alenia Space

Spectrometers integrated (!)



FM2
CO2I/NO2I
instrument

PFM
CO₂/NO₂
instrument



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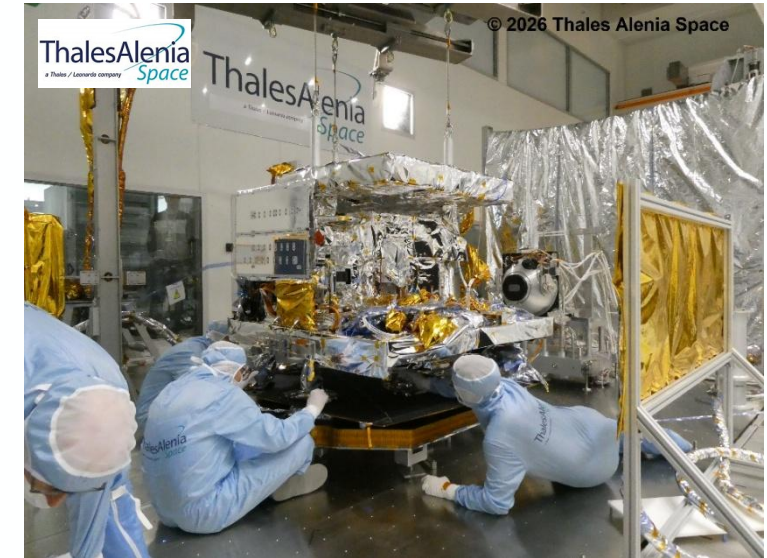


CO2I/NO2I implementation:

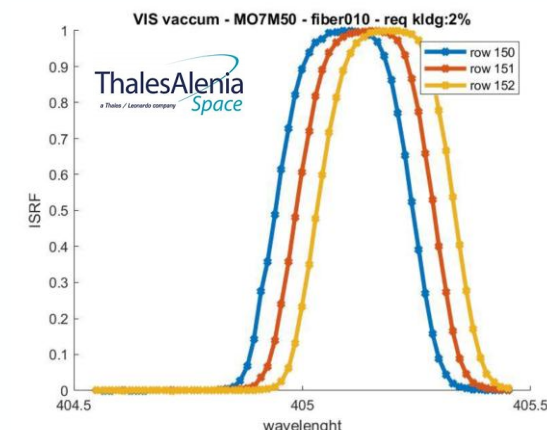
- Telescope with polarisation scrambler & 2D slit homogeniser
- Reflective collimator followed by 3 dichroic plates for spectral band separation
- 4 Prism-Grating-Prism assemblies for spectral dispersion
- Mercury-Cadmium-Telluride CMOS detectors in SWIR
- Si CMOS detector in VIS-NIR
- **PFM in alignment, FM2 in integration & FM3 units in delivery**



Vacuum chamber closure for CO₂I determination of alignment



CO2I PFM prepared for first vacuum test for determination of final alignment



CO2I PFM first ISRF under vacuum in VIS bands

CO2M Payload Status – MAP



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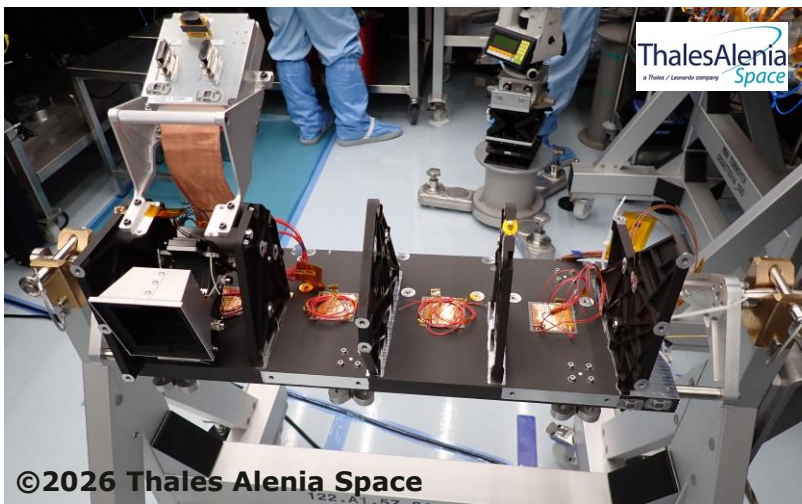
Multi-angle polarimeter (MAP) implementation:

Compact push broom imager:

- 40 viewing angles (+/- 60°) spread in 4 identical cameras
- Spatial resolution 4x4 km² and sampling < 1x1 km²

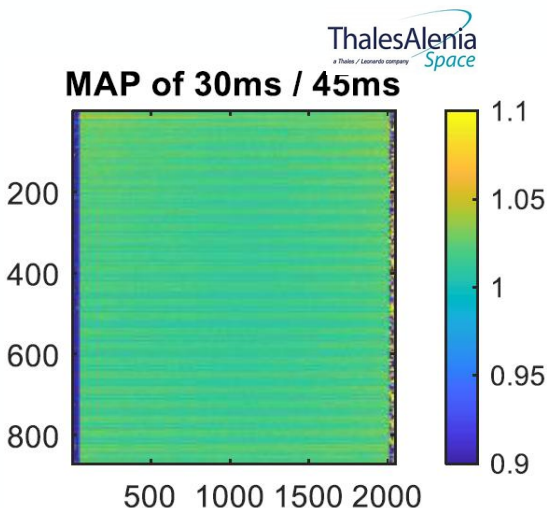
Assembly combining polarization & spectral filtering

- 6 spectral bands in VIS and NIR (+1 for co-reg with CO2I)
- 3 polarisations (0°, 60°, 120°) sampled by micro-polarizers at detector pixel-level

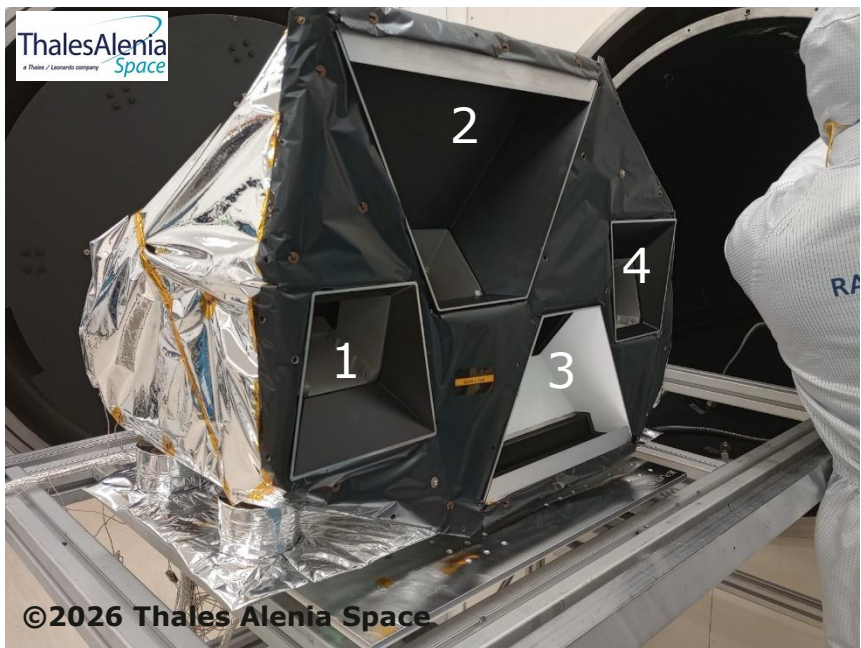


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**First camera mounted on
flight optical bench**



**First radiometric checks of
first flight camera**



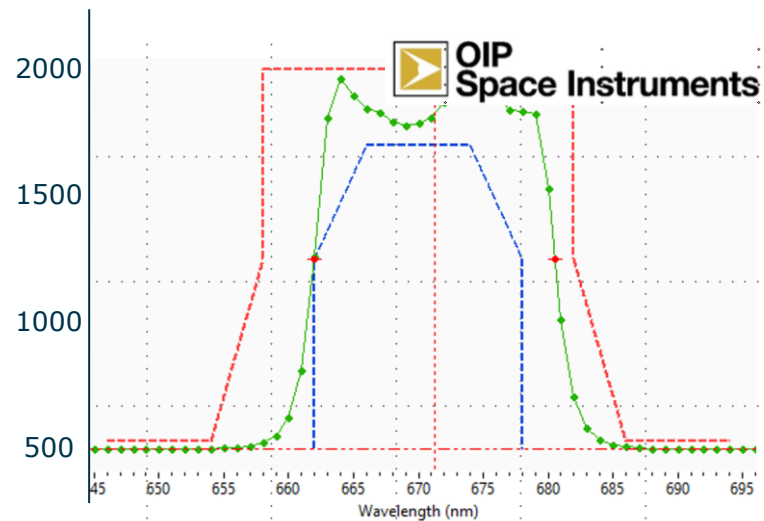
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Structural model with 4 cameras

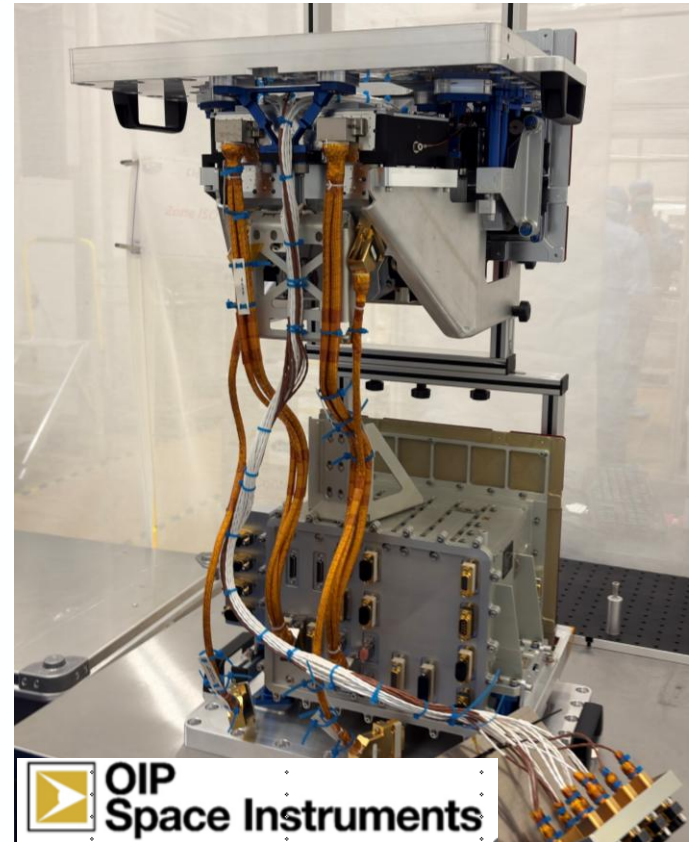
- **PFM first two cameras in testing**
- **PFM next two cameras in integration**
- **FM2/FM3 units in delivery**

Cloud IMager (CLIM) implementation:

- Based on Proba-V design
- Binning on-ground, specs @400m
- **PFM fully tested; data processing on-going**
- **FM2 & FM3 under integration**



First CLIM1 PFM ISRF in vacuum



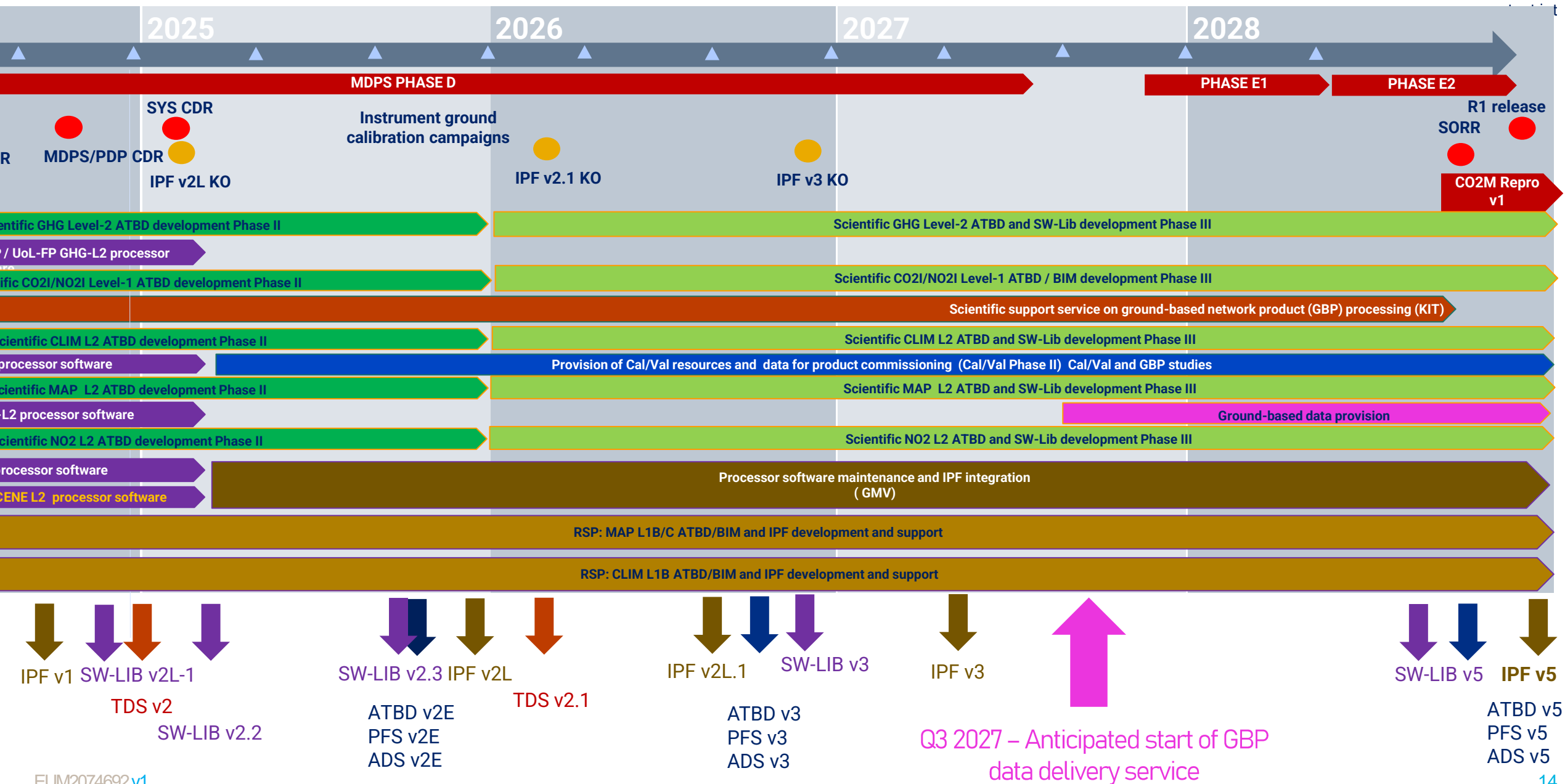
CLIM PFM in CSL facility for characterisation and calibration

Main focus of scientific work:

- Finalisation of test-data for level-1 processor development
- Development of additional scientific performance test-data re-started:
 - 4 full days of CO2M SCENE level-2 test-data
 - One year of GHG level-2 test-data (together with CAMS) for MVS testing
- GHG science support service phase 3 has re-started (15th April 2026)
- NO2 science support service phase 3 has re-started mid of March
- Meeting for provision of ground-based reference data level-1 and 2 took place on 21 April
- L2 ATBDs will soon be published on EUMETSAT web-site



EUMETSAT Mission Data Processing System science and development activities



Estimated amount of data (per orbit, per satellite):Number of observations (CO₂/NO₂): ~1.1 million

Number of clear-sky retrievals: ~200.000

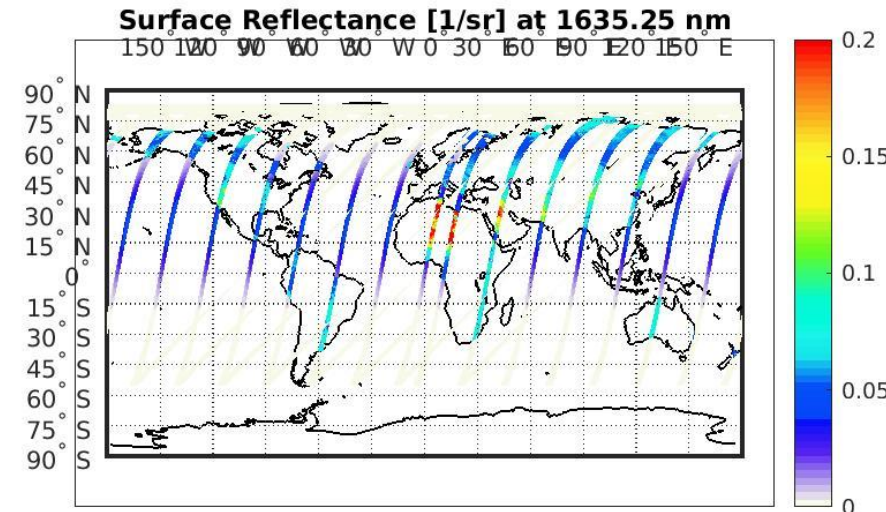
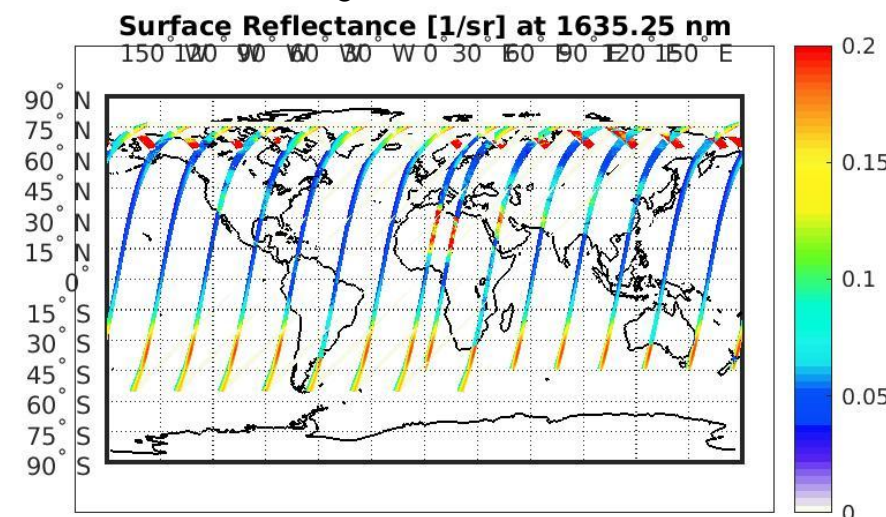
Level-1 / Level-2 product sizes: ~35 / 5 GB

All CO₂M products: ~320 GB**Estimated number of possible XCO₂/XCH₄ retrievals:****Worst case (max land) Scenario**

Orbit type	Worst case (max land) Scenario	Number of observations with surface albedo > 0.03	20 % of total (land/water) used for GHG retrieval due to cloud (<1%) and AOD<0.5
Nadir	Land	630,105	131,215
	Water (glint>0.03 albedo)	25,971	
Glint	Land	722,035	201,586
	Water (glint>0.03 albedo)	285,895	

Average (full day) Scenario

Orbit type	Average (full day) Scenario *)	Number of observations with surface albedo > 0.03	20 % of total (land/water) used for GHG retrieval due to cloud (<1%) and AOD<0.5
Nadir	Land	250,530	98,065
	Water (glint>0.03 albedo)	249,827	
Glint	Land	239,793	200,222
	Water (glint>0.03 albedo)	720,592	

*These figures are per Satellite per orbit.***“Nadir orbit” configuration****“Pitched orbit” configuration**

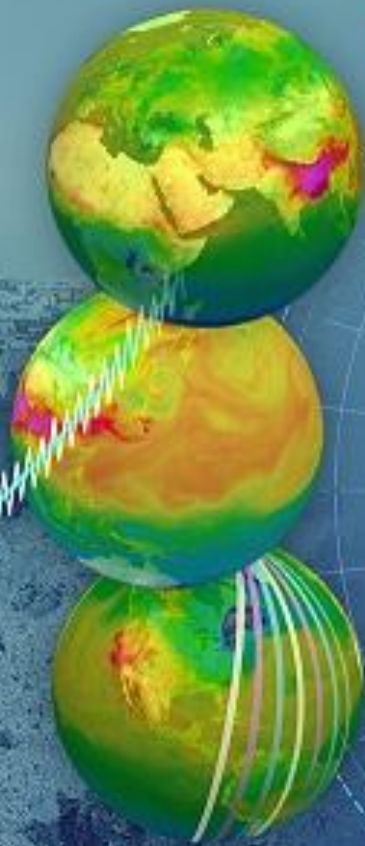




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Europe's eyes on Earth

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CO2M

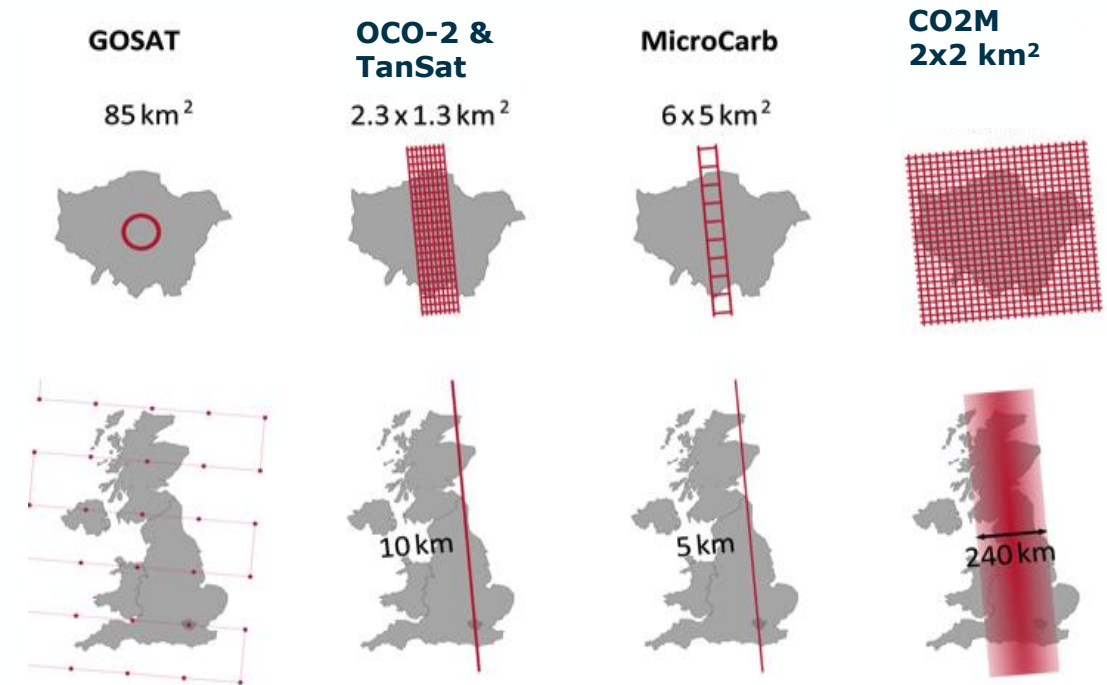
Copernicus Anthropogenic
Carbon Dioxide Monitoring

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THANK YOU

Transparency framework through national inventory reports (**Paris Agreement**, 2015) & complemented by global **anthropogenic CO₂ & CH₄ Monitoring and Verification Support Capacity**

- 1. Detecting & Monitoring hot spot emissions**
to assess reduction or increase in emissions
- 2. Assessing emission changes against local reduction targets**
to monitor impacts of the Nationally Determined Contributions
- 3. Assessing the national emissions and changes**
in 5-year time steps to estimate evolutions





Platform subsystems	
Electrical Power (EPS)	Solar Array: 3 panel wing steered by SADM Battery Li-ion with 3 modules
AOCS	Gyroless architecture, 3-axis stabilized satellite Safe mode based on magnetorque/magnetometer
Propulsion and Reaction control (RCS)	Mono-propellant in blow down with 8 Thrusters (20N) 2 Propellant Tanks with 250 kg capacity
TT&C	S-band system providing TM/TC and ranging
Data Handling	Central on-board Computer and 3 Remote Terminal Units
Data Storage	Mass Memory 3.8 Tbits (EoL)
Data Downlink	Ka-band system with ka-band steering antenna and VCM (variable coding and modulation) Single channel (1.8 Gbit/s)
Format Interface to Ground	PUS-C, File Based Operations/CFDP
Re-entry	Controlled re-entry as baseline Compatible with in-orbit satellite removal