



living planet symposium

BONN
23-27 May
2022

TAKING THE PULSE
OF OUR PLANET FROM SPACE



IASI-NG INSTRUMENT DEVELOPMENT STATUS

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CENTRE NATIONAL D'ÉTUDES SPATIALES (TOULOUSE, FRANCE)



IASI-NG OVERVIEW

- Part of EUMETSAT EPS-SG
- Embarked on METOP-SG A Satellites serie developed by ESA
- Continuity of IASI first generation operational observations
- Dynamic Fourier Transform Interferometer
- Atmospheric calibrated spectra



**NUMERICAL
WEATHER
PREDICTION**



**ATMOSPHERIC
CHEMISTRY**

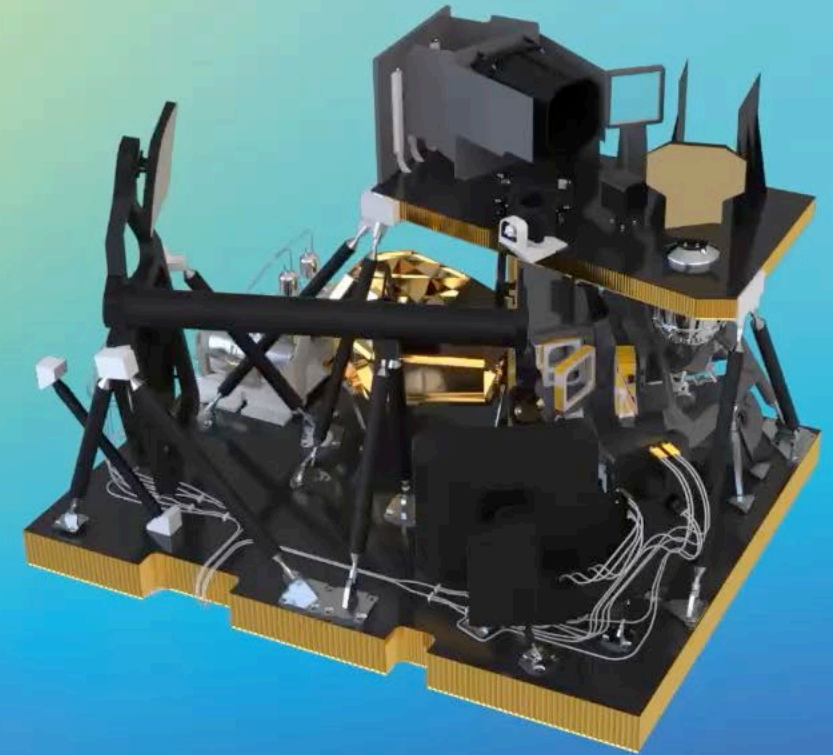


**CLIMATE
MONITORING**



IASI-NG INSTRUMENT CONCEPT

- Significant performance improvement with wider field of view (factor 4), allowed by innovative instrumental concept proposed by Airbus Defense and Space
- Associated field effects are compensated in pupil by inserting dynamically variable glass thickness
- Achieved through 2 pairs of KBr prisms, synchronized via an unique device movement
- First implementation in space of a Mertz Interferometer



Dual Swing Mechanism is patented. Frederick Pasternak from ADS is finalist of european inventor award 2022, you can vote for him until June 21th!

<https://www.epo.org/news-events/events/european-inventor/finalists/2022/pasternak.html>

OVERALL DESIGN

Afocal and Imaging Telescopes

Mertz Interferometer

Focal Plane :4 detectors for 4 spectral bands /16 sounder pixels per detector

5 metrology lasers:

-1 central metrology to give the Optical Path Difference constant triggering

-4 lateral lasers to monitor in real time the pupil effects (tilt, focus and astigmatism) for correction through on ground processing

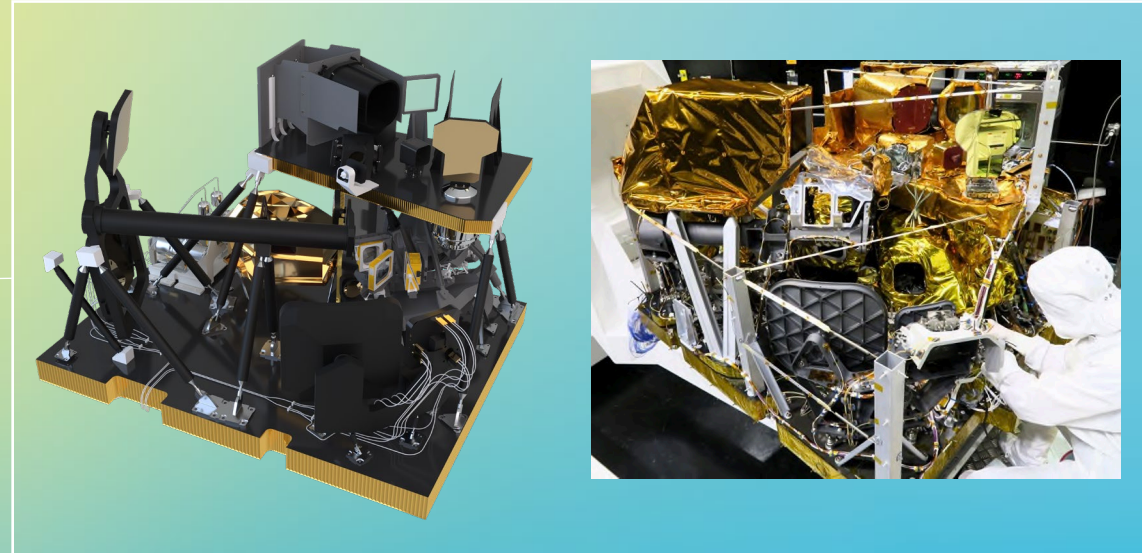
SPECIFICATIONS			
GEOMETRY	SOUNDER PIXEL SIZE	~12 km	} SAME AS IASI
	SPATIAL SAMPLING	~25 km	
	GEOLOCATION ERROR	0.5 km	
SPECTRAL	BAND	645 cm ⁻¹ to 2760 cm ⁻¹	} 2 TIMES BETTER THAN IASI
	RESOLUTION	0,25 cm ⁻¹	
	SAMPLING	0,12 cm ⁻¹	
	CALIBRATION ERROR	$d\sigma/\sigma = 5.10^{-7}$	
RADIOMETRY	CALIBRATION ERROR	0,25K @ 280 K	}
	NEDT	NedT ~0.1 K to 0.4 K within spectrum	

MAIN CHARACTERISTICS	
SWATH	~ 2000 KM
FOR	+/- 3°
PUPIL DIAMETER	~ 90 MM
ATA MAGNIFICATION	2.3
MAXIMUM OPTICAL PATH DIFFERENCE	4,2 CM
ACQUISITION DURATION	~730 MS
SCAN LINE DURATION	15.6 s : 14 EARTH VIEWS + 1BB + 1CS
CO-REGISTRATION	INTEGRATED IMAGER
SPECTRAL CALIBRATION	FABRY PEROT SOURCE

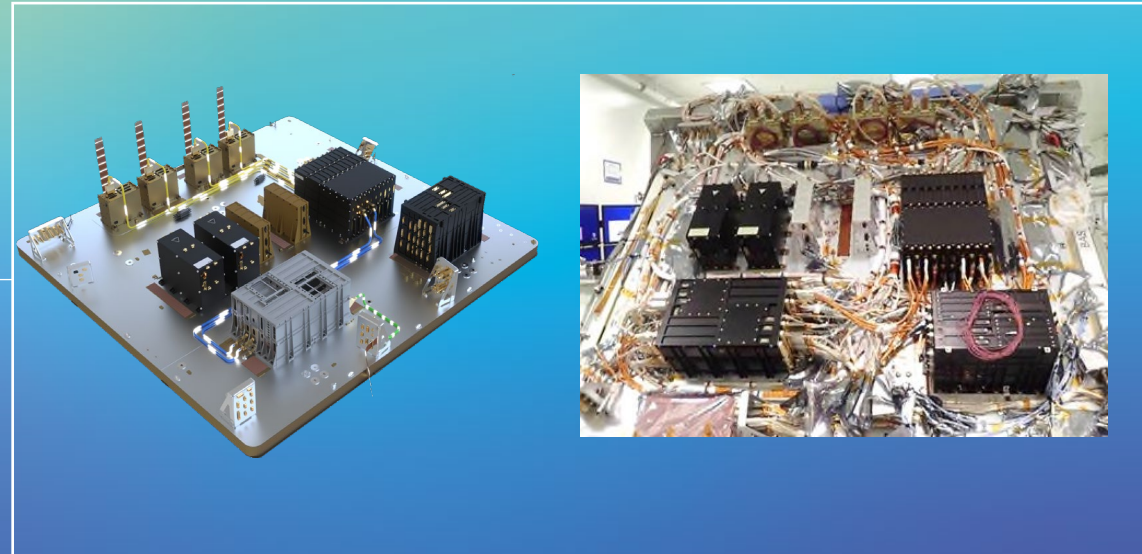
INSTRUMENT BUDGET



I-OH
(OPTICAL
MODULE)



I-EM
(ELECTRONICS
MODULE)



MASS	430 KG
POWER	~520 W
I/F DATA RATE	~6 MB/S

INSTRUMENT DEVELOPMENT

TWO MODELS IN PARALELL

EM Instrument

- Critical subunits representative of Flight Models
- Qualification of critical subunits
- Functional tests with EM SW
- EMC (conducted) qualification
- μvibration campaign for earlier end to end validation
- Procedure validation at Satellite level

PFM Instrument

- Performance assessment at subunit level
- Integration/alignment
- Mechanical qualification
- Final functional tests with PFM SW
- Performance tests at ambient
- TVAC & final performances
- EMC (radiated) qualification

EM INSTRUMENT CAMPAIGN

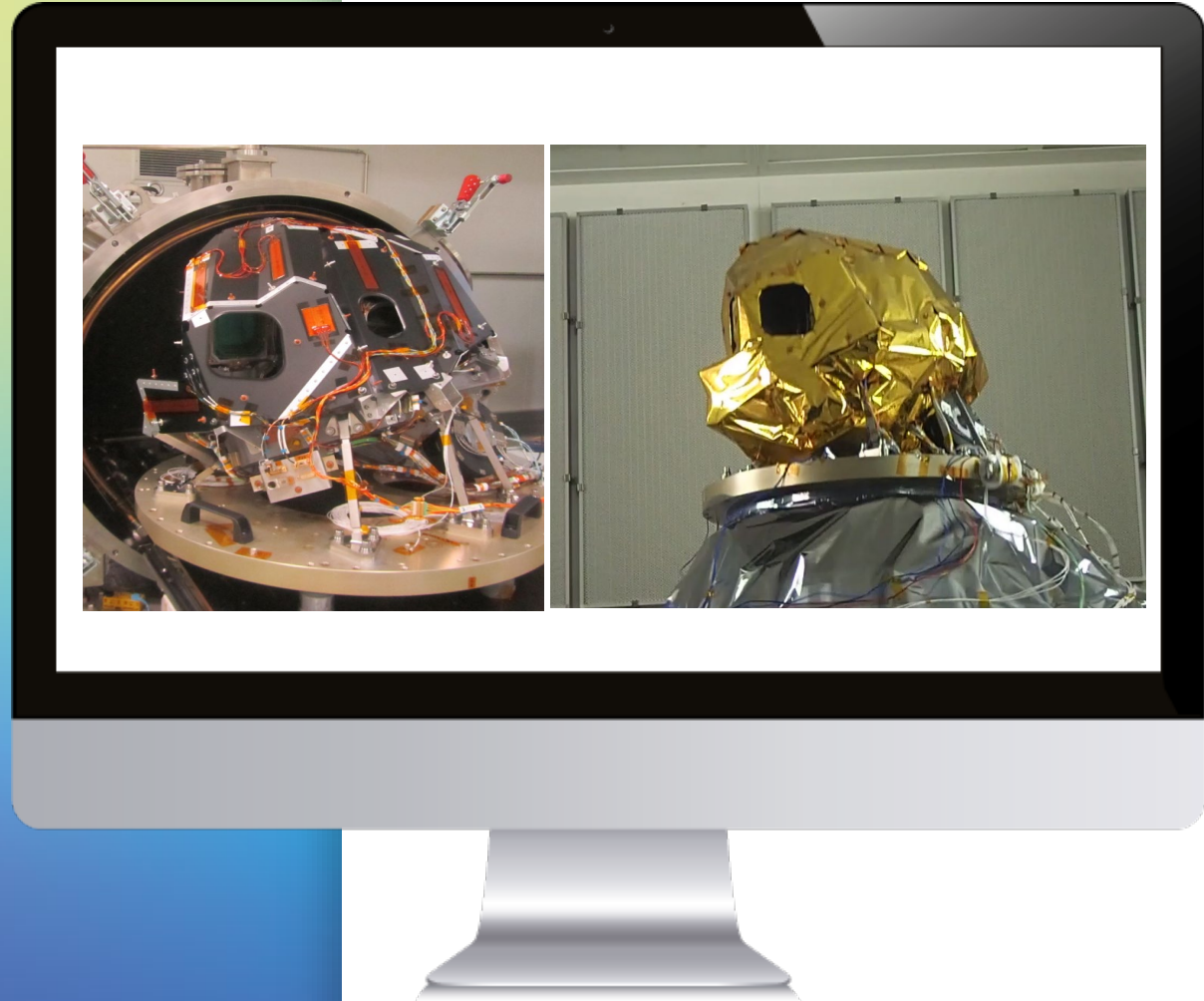
IFM EQM QUALIFICATION

Mechanical qualification

Maximum levels passed with success on sensitive parts

Thermal qualification

Temperature gradient and slopes within required range wrt. KBr



EM INSTRUMENT CAMPAIGN

IFM EQM QUALIFICATION

Mechanical qualification

Maximum levels passed with success on sensitive parts

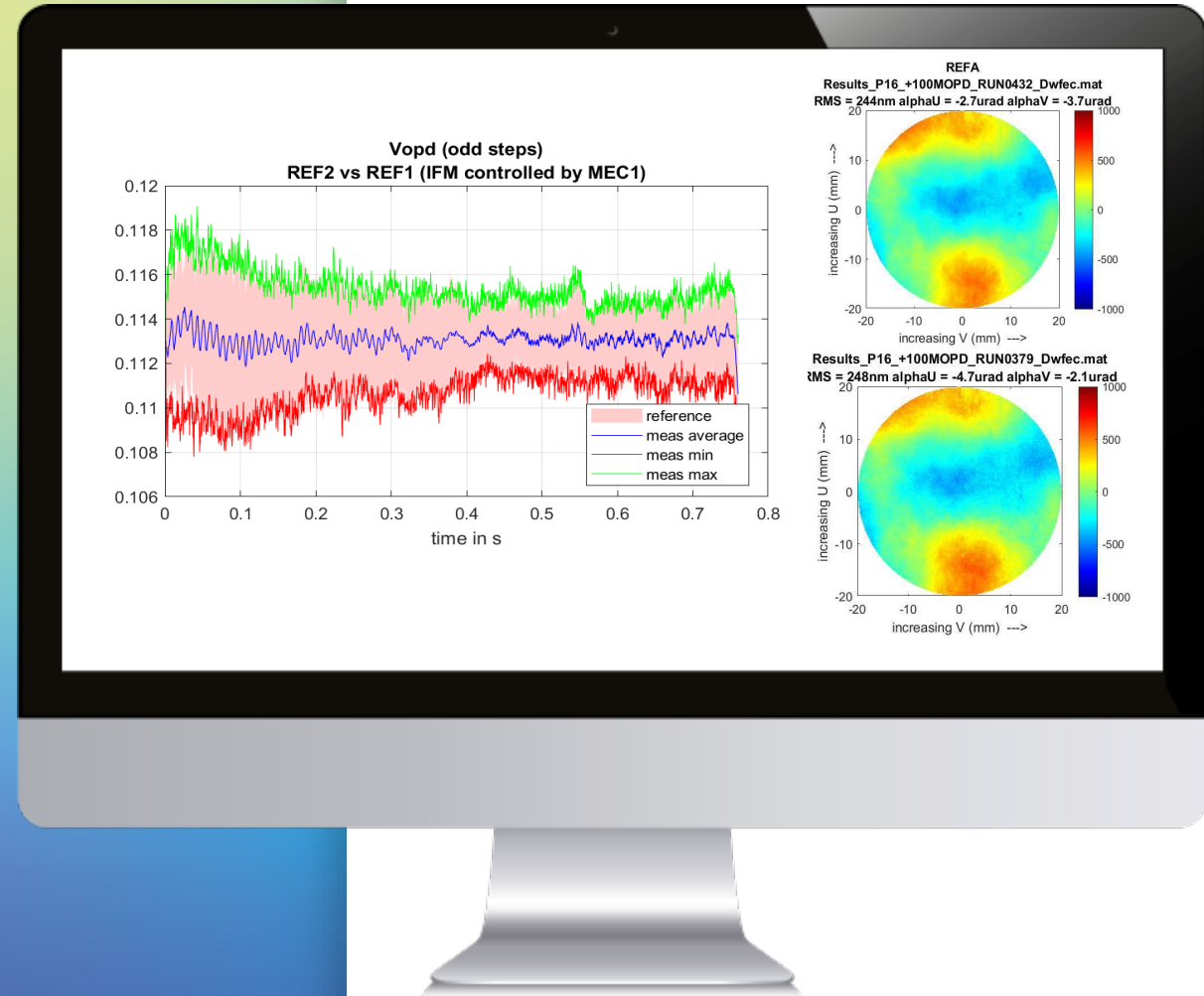
Thermal qualification

Temperature gradient and slopes within required range wrt. KBr

Reference test after qualification

Very stable optical performances after qualification

Qualification successful



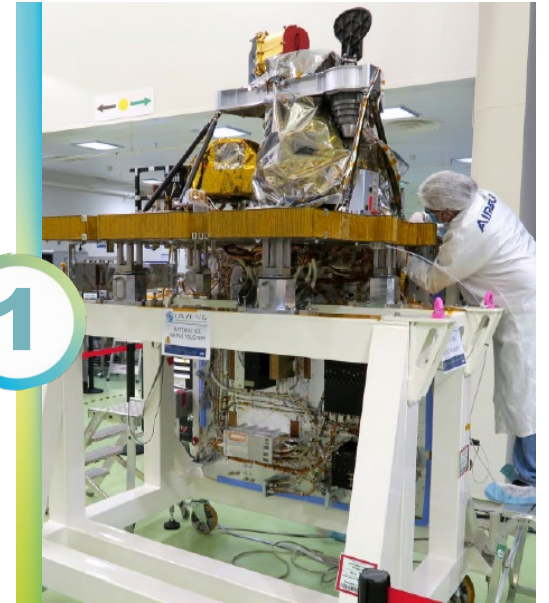
μVIBRATION CAMPAIGN

END-TO-END VALIDATION FOR THE INTERNAL CONTRIBUTORS

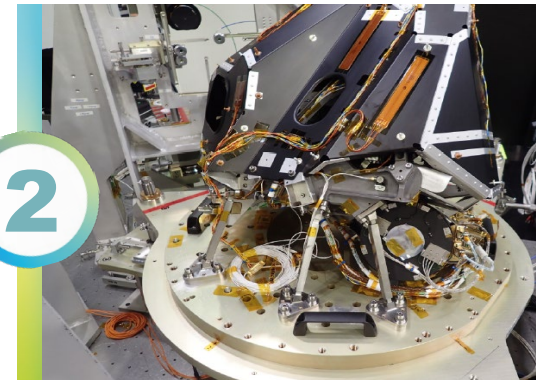
- 1 - Mechanical transfer function at IFM interface on EM instrument
- 2 - IFM sensitivity (wafer front tilt) on IFM EM
- 3 - Correction rate evaluation with sinus mode (IFA PFM)

**INTERNAL CONTRIBUTORS BUDGET
REDUCED BY A FACTOR OF 3 COMPARED TO
CDR WORST CASE STATUS**

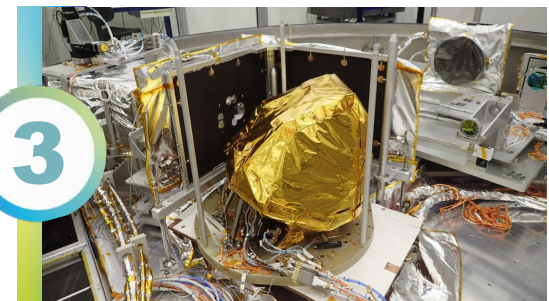
1



2



3



PFM SUBUNITS TESTING

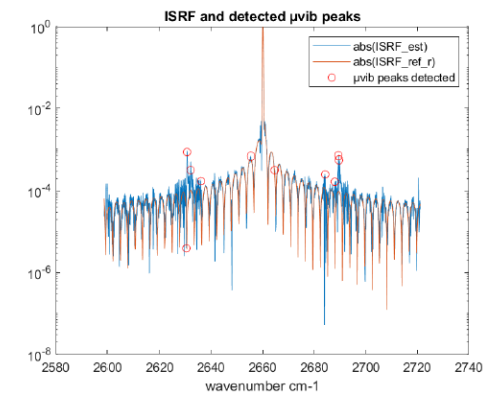
INTERFEROMETER

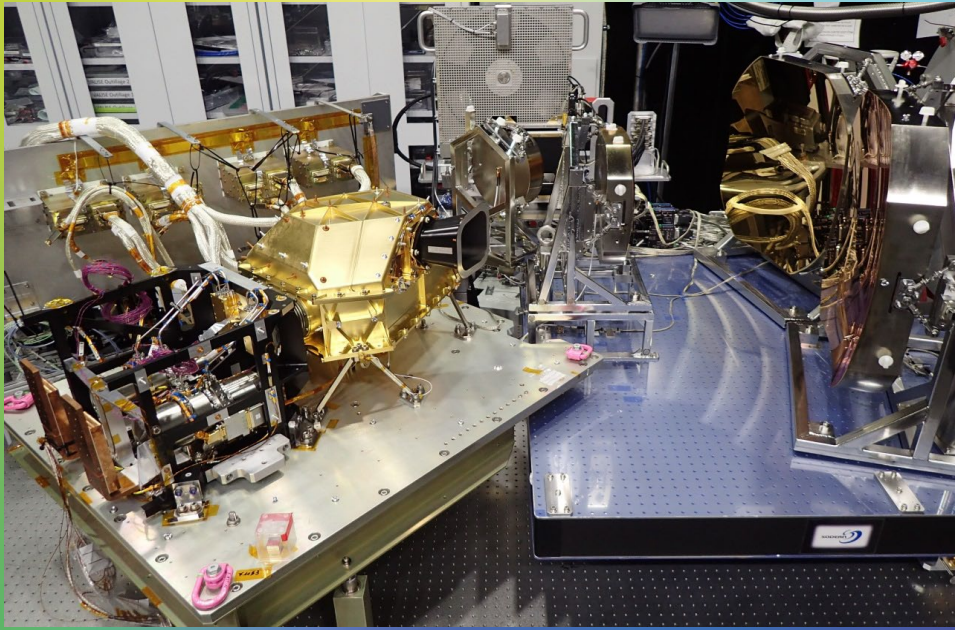
IFM and metrology assembly

Spectral performance evaluation under TVAC

First spectrum acquired with gaz cell and Fabry Perot

Performances in line with CDR budgets, spectral calibration in particular with very promising results



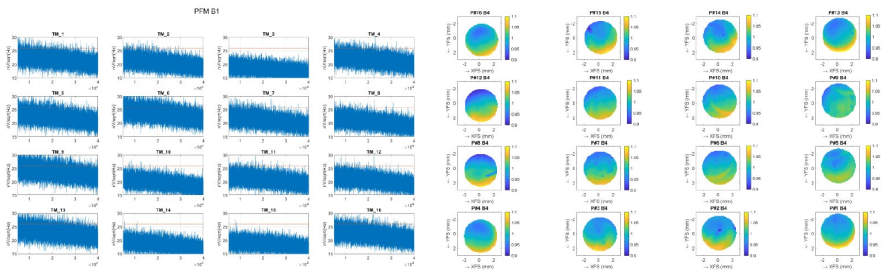


FOCAL PLANE

At room temperature, detectors cooled

Radiometric and geometric performances
assessment in line with CDR budgets

Field response characterization will be
used for on ground processing



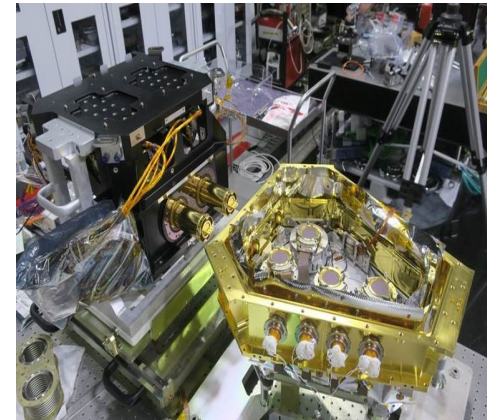
PFM INSTRUMENT

PFM INTEGRATION/ALIGNMENT ACTIVITIES

SUBUNITS LEVEL

FPCA and IFM integration and alignment

Telescopes alignment



PFM INSTRUMENT

PFM INTEGRATION/ALIGNMENT ACTIVITIES

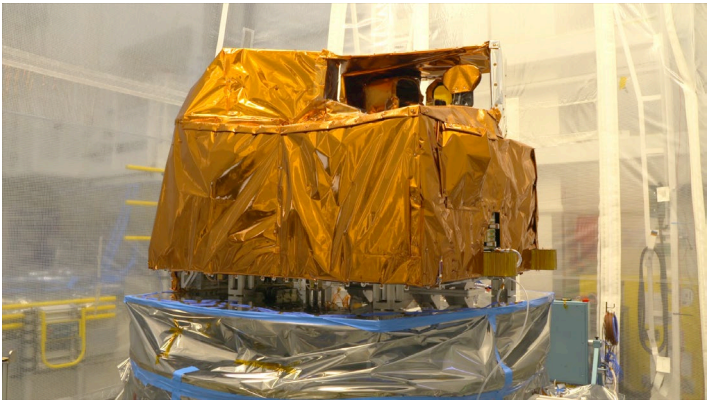
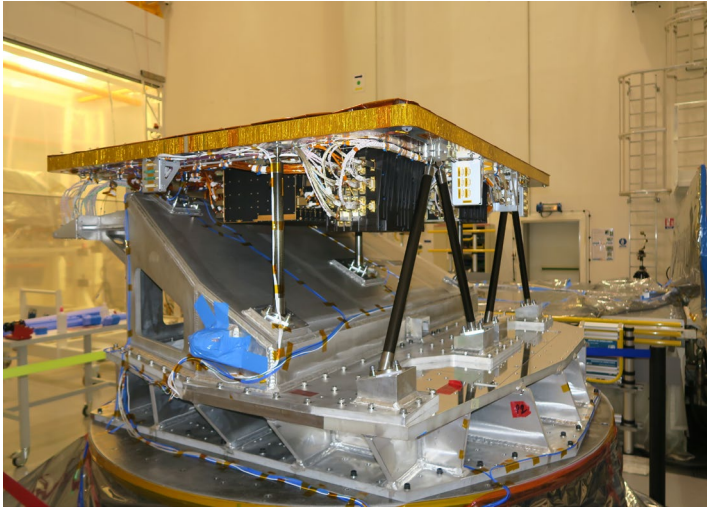
SUBUNITS LEVEL

FPCA and IFM integration and alignment
Telescopes alignment

SUBUNIT INTEGRATION ON I-OH

Step by step alignment sequence





PFM MECHANICAL QUALIFICATION

Done on I-EM and I-OH separately

Acoustic qualification successful

QS and sine qualification in line with predictions

Instrument alignment stable after environment

PFM TESTS

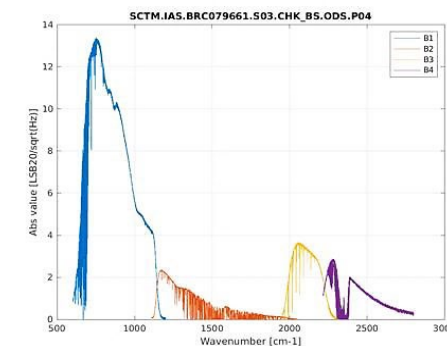
FUNCTIONNAL TESTS

AMBIANT TESTS (results under analysis)

Mainly geometric performance / calibration

Confirmation of μ vibrations low levels

First IASI-NG raw spectrum!



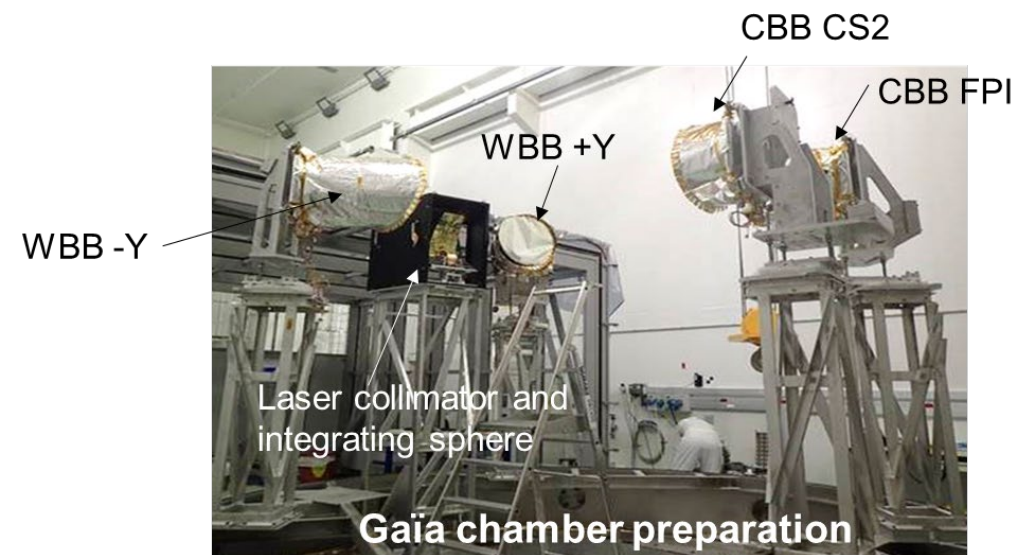
INSTRUMENT TVAC

Preparation well on-going

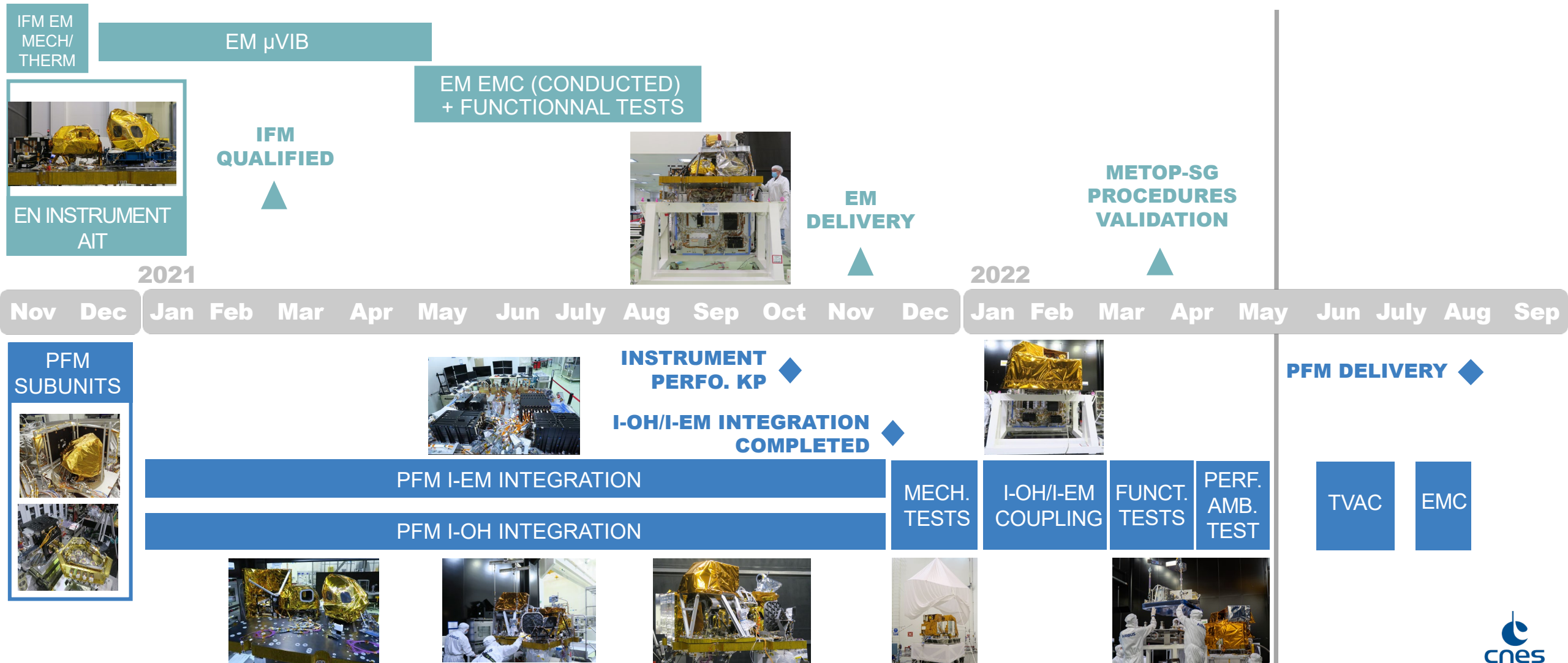
Instrument thermal qualification

Fine performances assessment through 5 external BB OGSEs, Gaz Cell and 8 lasers

Solar acquisition through dedicated optical fiber to have a first real spectrum



COMPLETED MILESTONES AND REMAINING ACTIVITIES UNTIL DELIVERY



THANK YOU FOR YOUR ATTENTION !