

UniPG & INFN-PG group

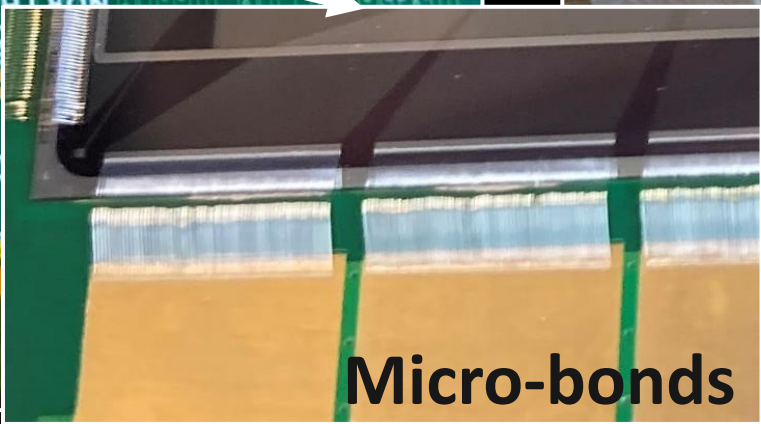
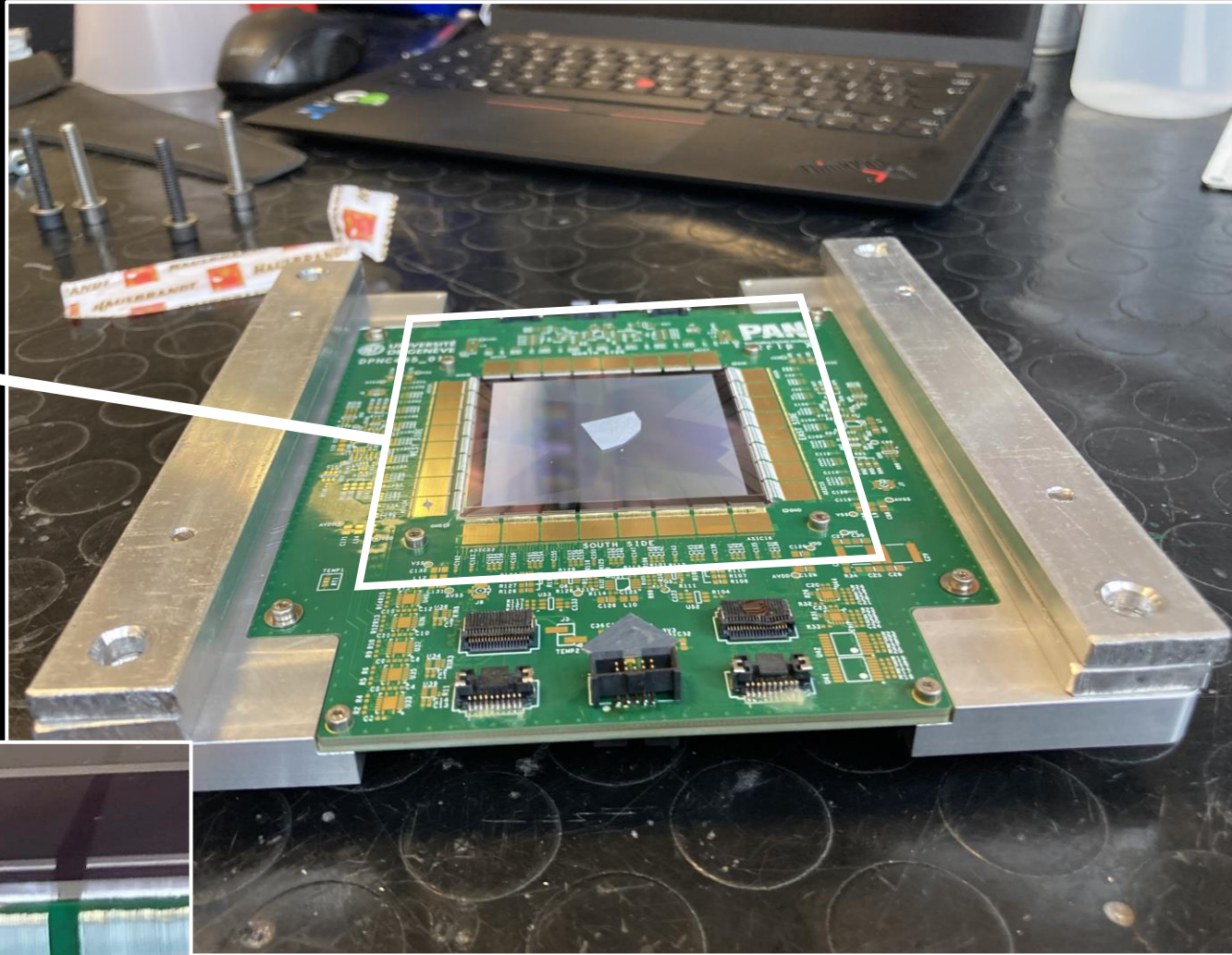
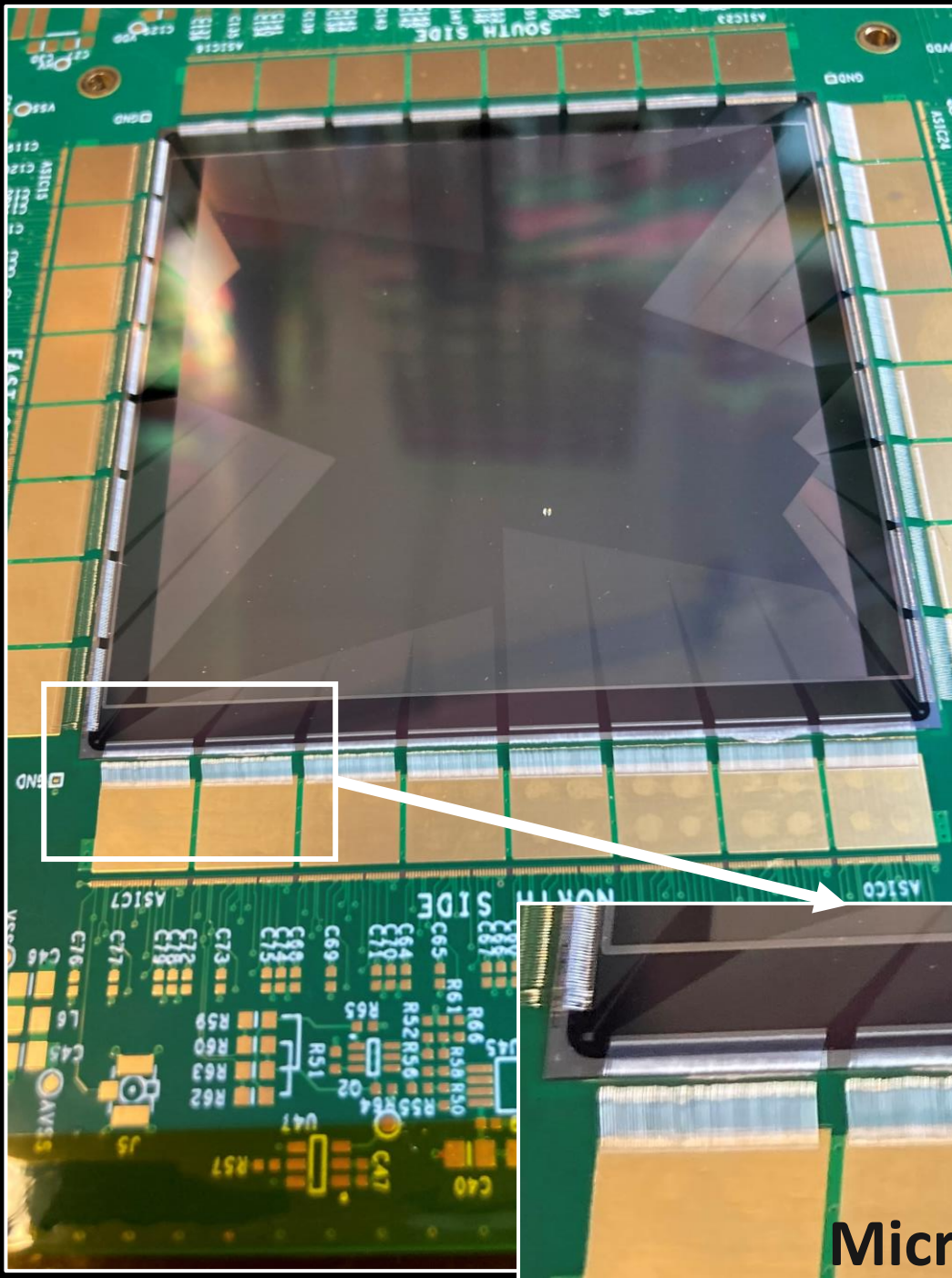
Introductory presentation

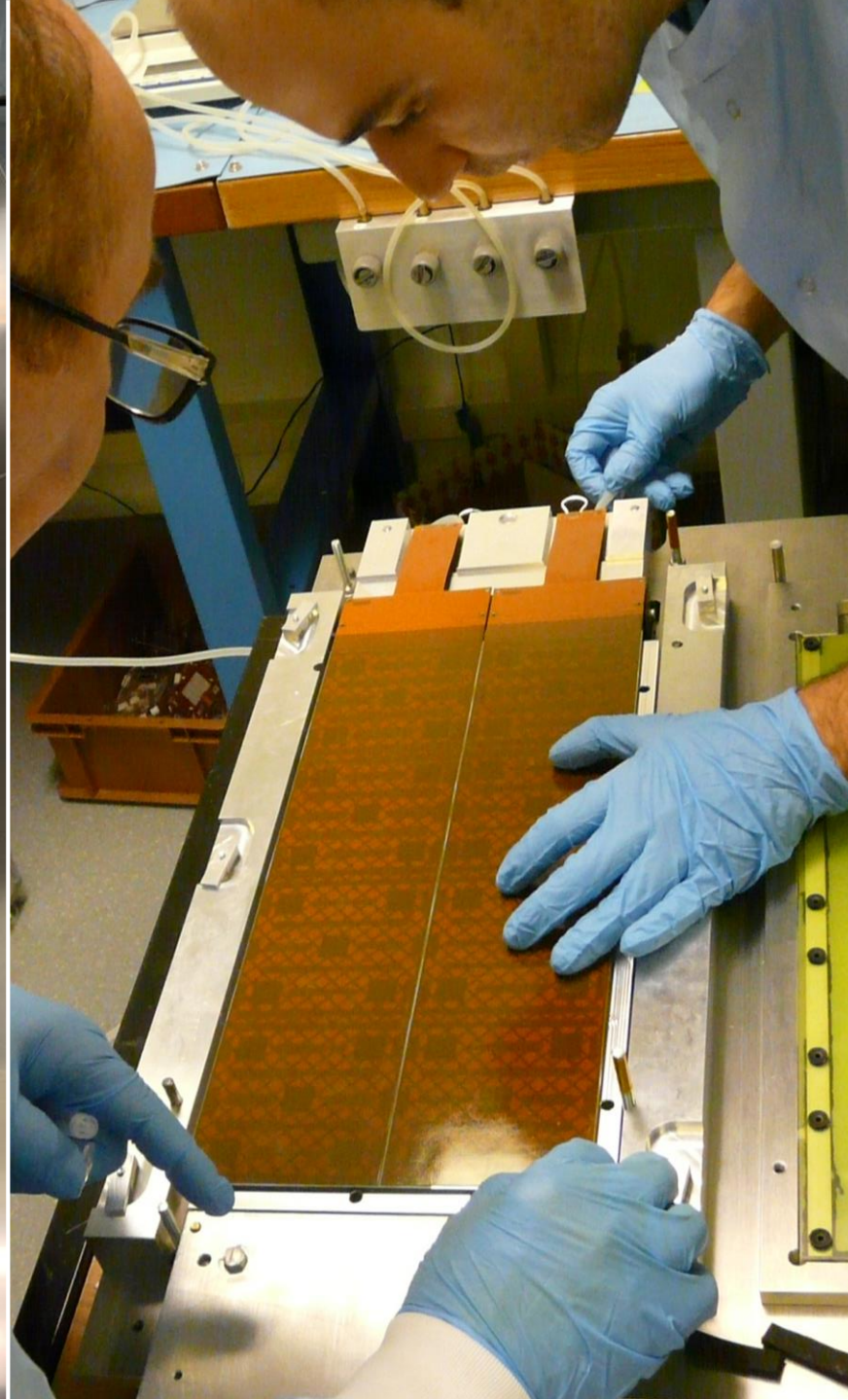
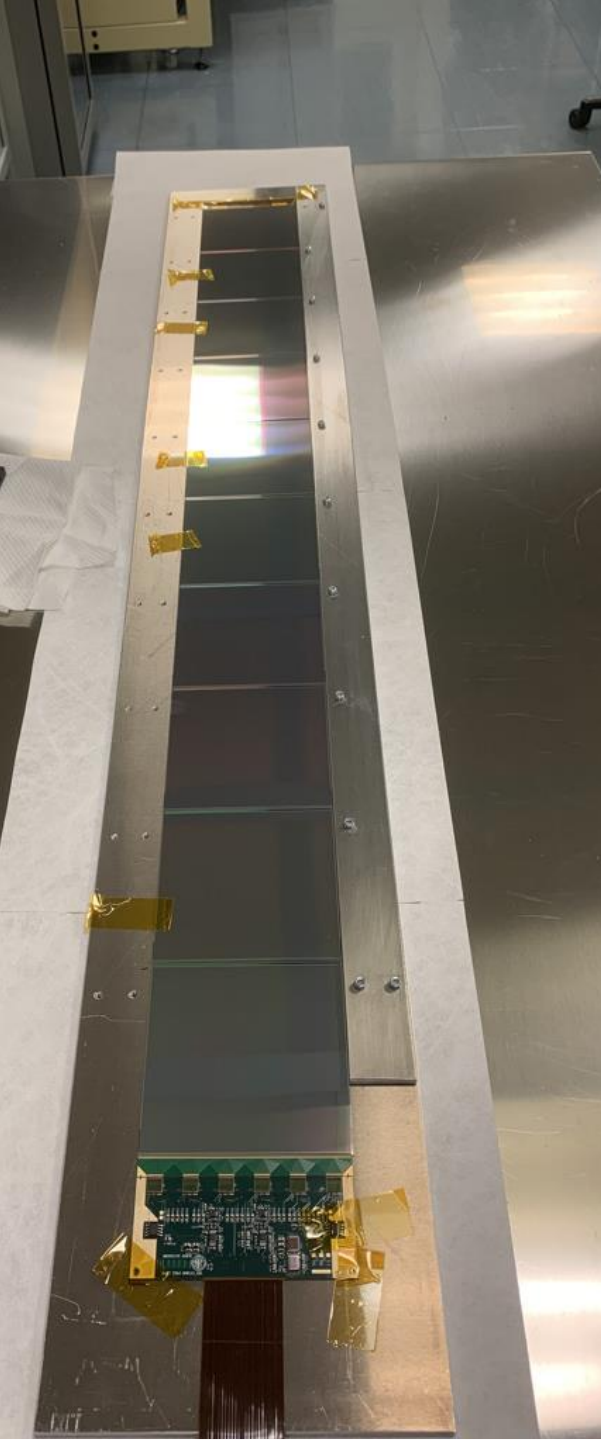
L.Mussolin, E.Mancini

Spaceborne silicon detectors

Main activity of the group lead by Giovanni Ambrosi at the INFN in Perugia

**VERY THIN (.15-.3 MM) SILICON SURFACES
BONDED TOGETHER THROUGH MICRO-BRASING**





The facilities

SERMS Laboratories



SERMS LABORATORY

THE SERMS FACILITY HOUSES EQUIPMENT FOR SPACE QUALIFICATION OF PAYLOADS

AVAILABLE EQUIPMENT:

- ELECTRODYNAMIC SHAKERS (49.5 kN & 2.9 kN + 74 kN IN ARRIVAL)
- THERMAL VACUUM CHAMBER
- CLIMATIC CHAMBER
- ALTITUDE SIMULATOR
- PYROSHOCK SIMULATOR

COLLABORATION BETWEEN UNIVERSITY OF PERUGIA,
INFN-PERUGIA AND SERMS S.R.L. (UMBRAGROUP COMPANY)

Thermal Vacuum Chamber

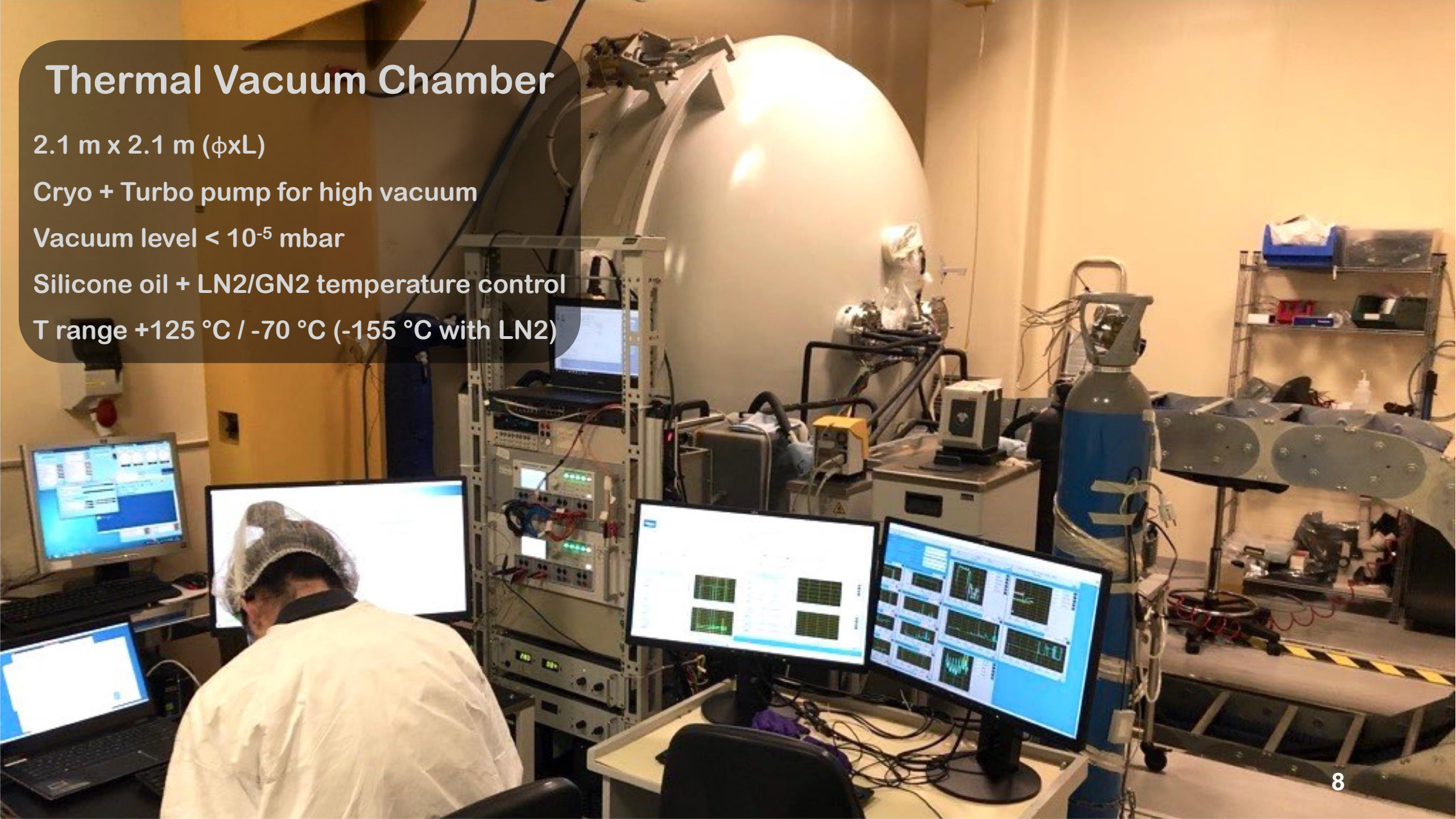
2.1 m x 2.1 m ($\phi \times L$)

Cryo + Turbo pump for high vacuum

Vacuum level $< 10^{-5}$ mbar

Silicone oil + LN2/GN2 temperature control

T range $+125$ °C / -70 °C (-155 °C with LN2)

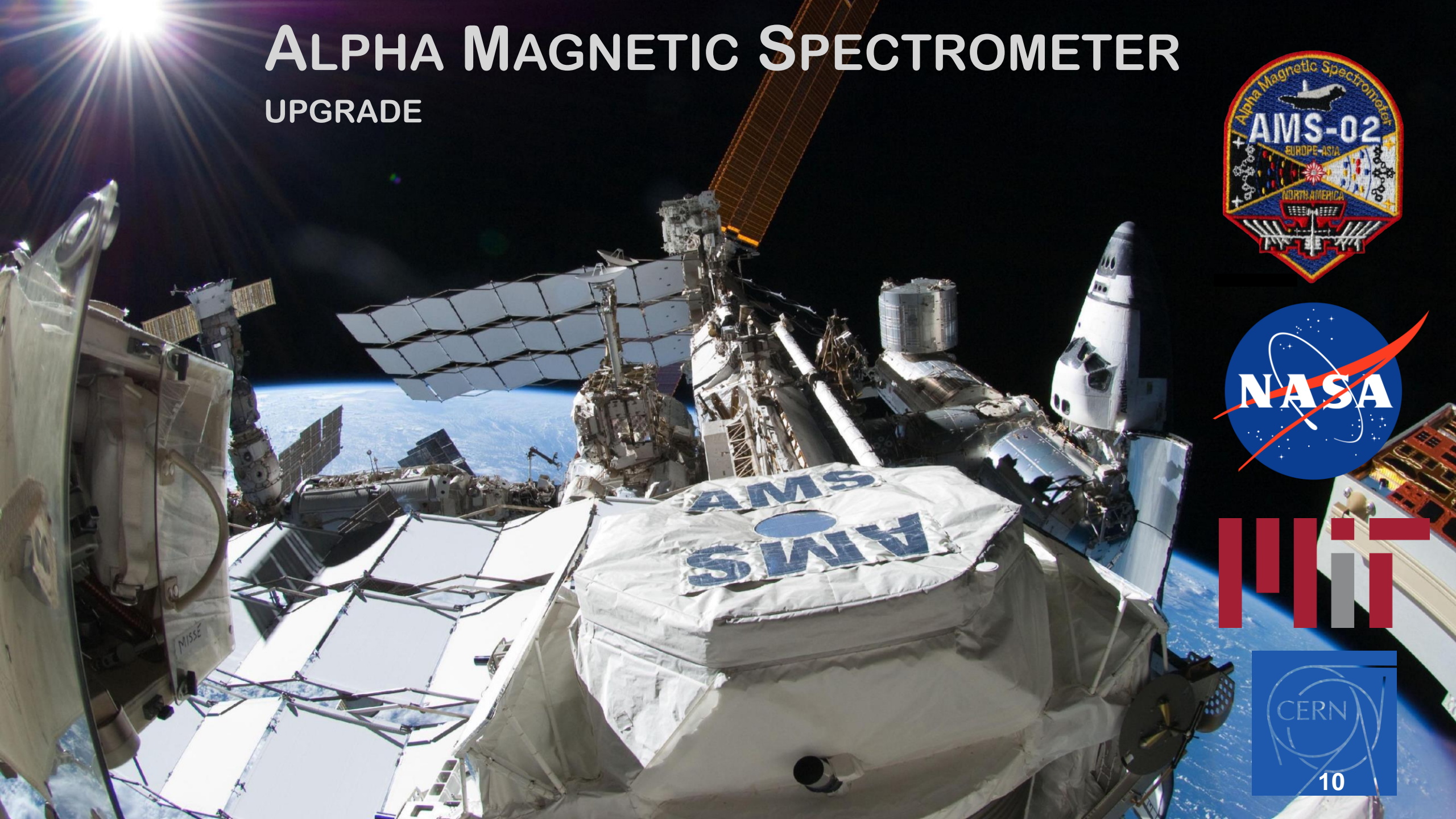


On-going projects

Space Systems Perugia group

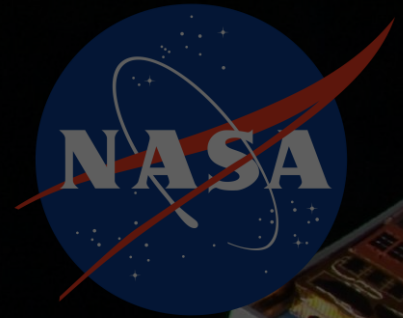
ALPHA MAGNETIC SPECTROMETER

UPGRADE



ALPHA MAGNETIC SPECTROMETER

UPGRADE



PARTICLE PHYSICS EXPERIMENT FOR MEASUREMENT OF CHARGED PARTICLES ON ORBIT

INTERNATIONAL COLLABORATION LEAD BY NOBEL LAUREATE PROF. TING
MEMBERS OF THE COLLABORATION INCLUDES NASA, MIT, CERN
OPERATING ON THE ISS SINCE MAY 2011

UNIPG AND INFN-PG INVOLVED IN THE DESIGN, CONSTRUCTION AND
SPACE QUALIFICATION AT COMPONENT AND ASSEMBLY LEVEL

UPGRADE: DEVELOPMENT OF AN ADDITIONAL DETECTIVE LAYER. FORESEEN LAUNCH DATE
2025

INVOLVEMENT OF SSP: DEVELOPMENT OF THE INTEGRATION PROCEDURE AND INTERFACES.
RESPONSIBLE OF THE SPACE QUALIFICATION (TVT, MECHANICAL, EMI/EMC)

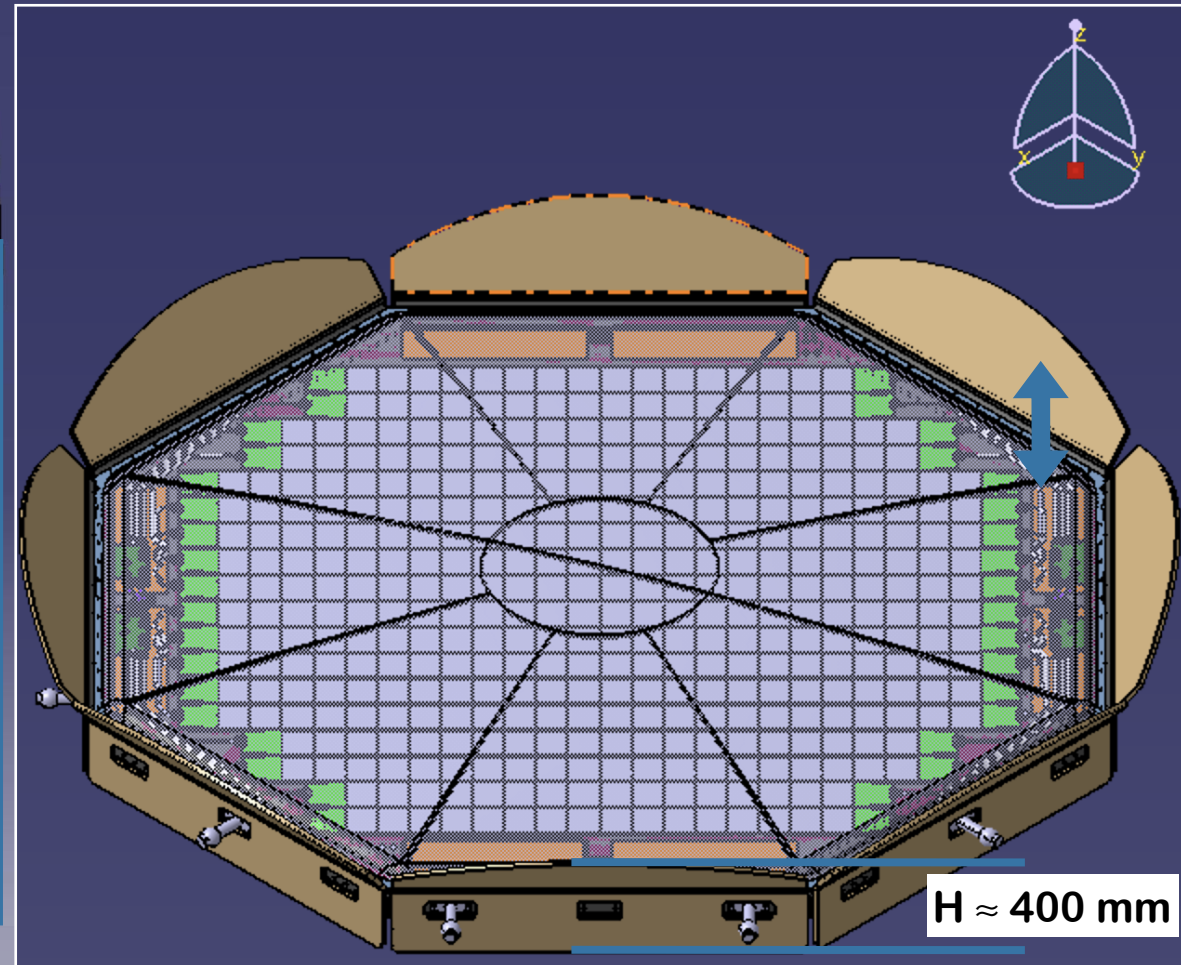
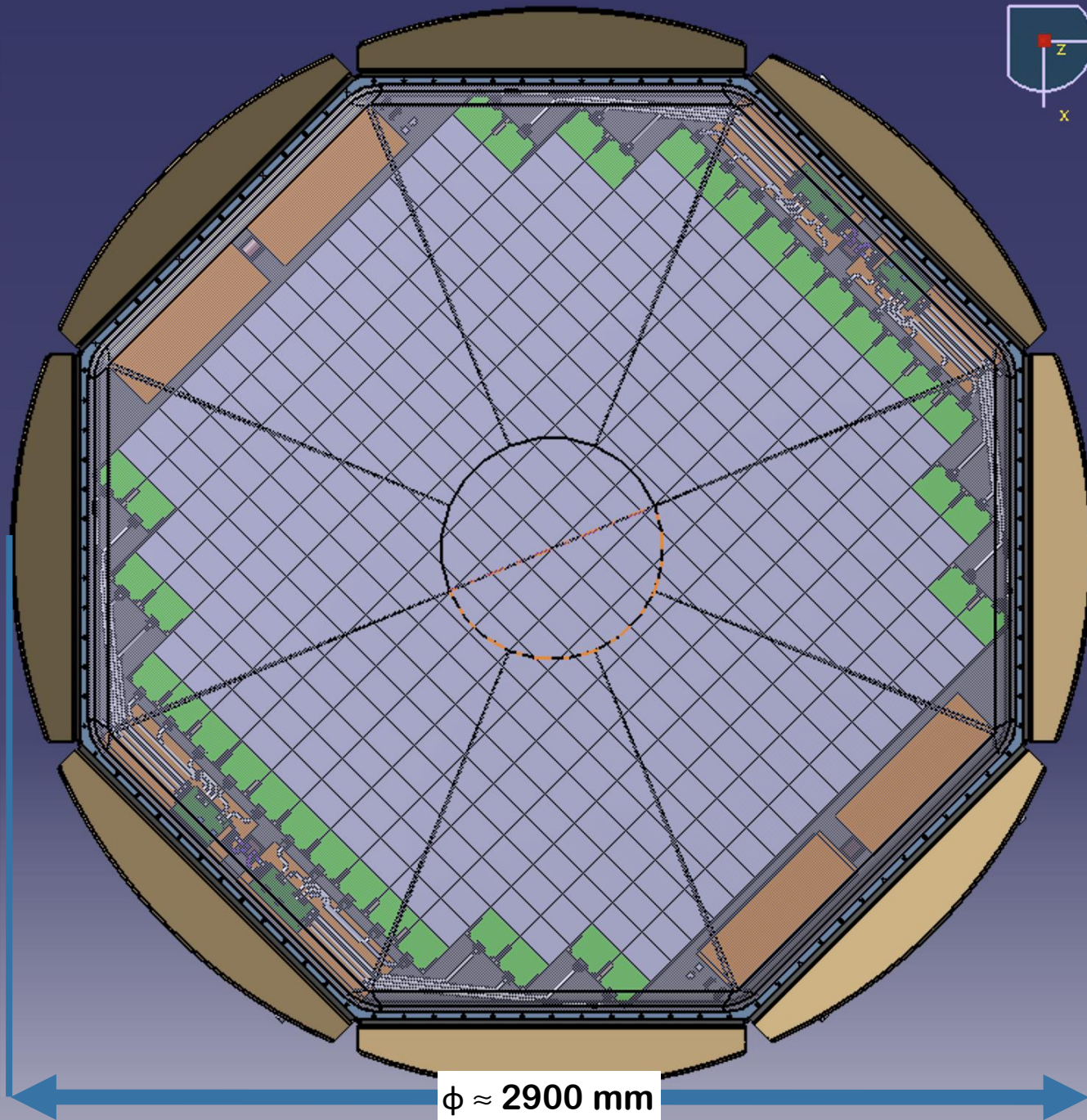
AMS 02.2 UPGRADE

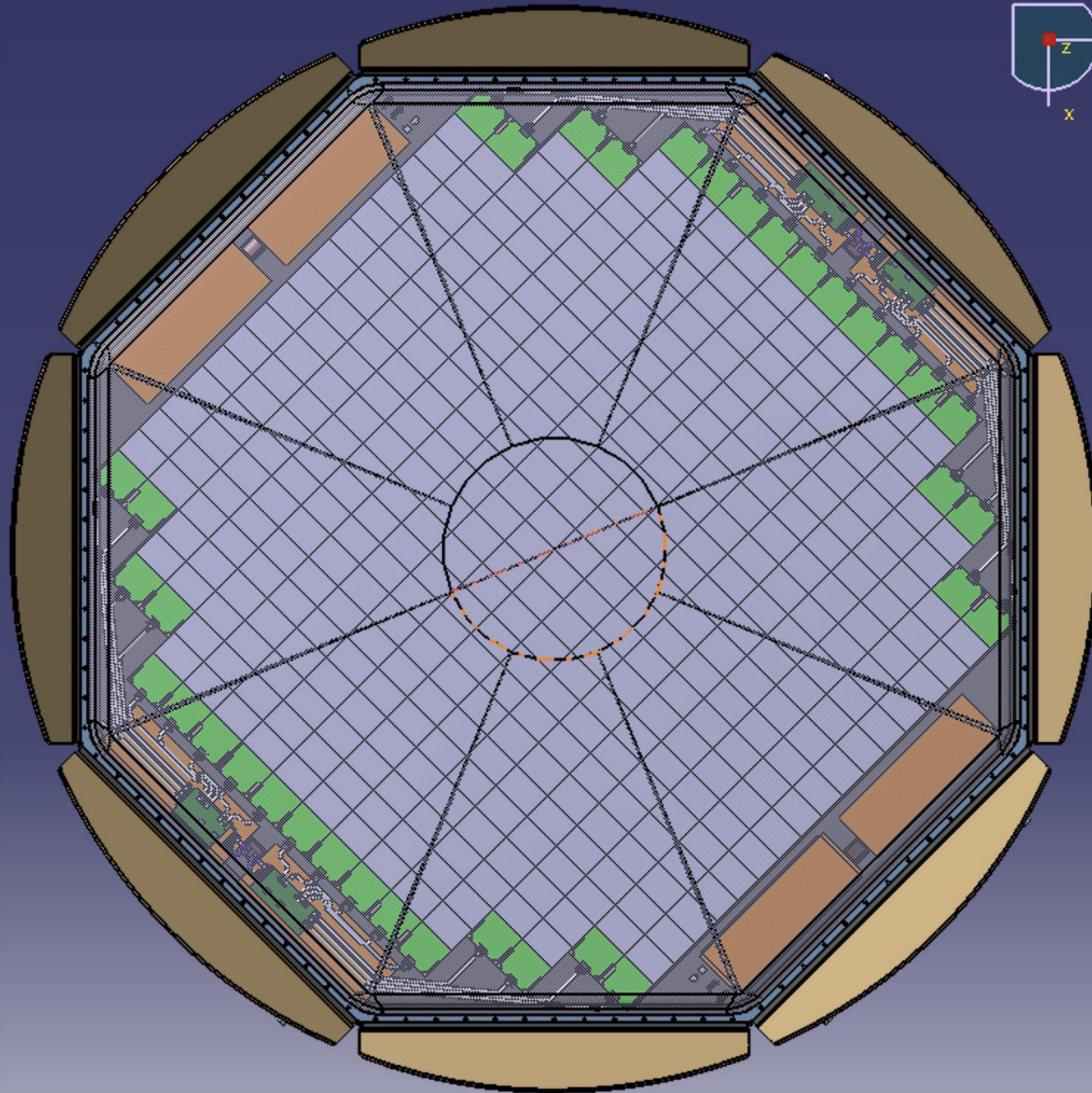
CARBON FIBER-ALUMINUM HONEYCOMB SANDWICH

SILICON STRIP DETECTOR

THERMAL VACUUM TEST OF QM AND FM

TEST PROFILE AND CHAMBER INSTALLATION TBD





AMS 02.2 RELATED ACTIVITIES

DESIGN THE LADDER-SUPPORT STRUCTURES (CATIA)

DESIGN THE INTERFACES FOR THE VIBRATION, TVT AND EMI TESTS (CATIA)

PERFORM THE VIBRATION AND TVT TESTS (IN TERNI)

MANAGE THE EMI TEST (IN TERNI)

VERIFY THE STRUCTURAL INTEGRITY OF THE DESIGNED COMPONENTS (ANSYS)

STUDY AND CHARACTERIZATION OF NON-CONVENTIONAL MATERIALS (SILICON, PEEK, GLUES...)

HERD



HERD

A 3D rendering of the HERD (High Energy and Rigorous Detection) detector, a large, cylindrical, white instrument with various ports and a yellow protective cover, mounted on the Chinese Space Station. The station is shown in orbit above Earth's blue and white atmosphere.

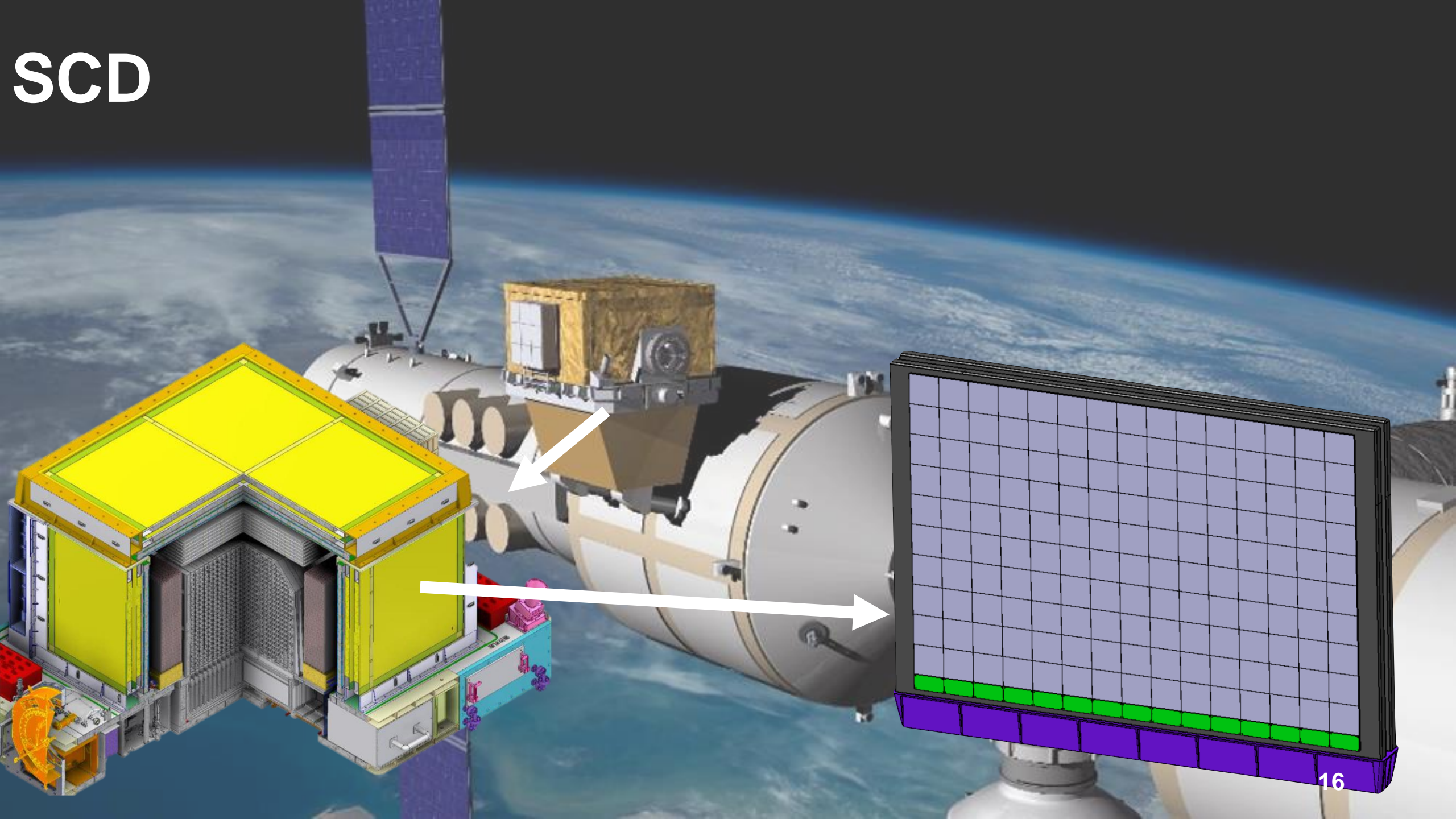
PHYSICS DETECTOR FOR THE ANALYSIS AND CHARACTERIZATION OF THE COSMIC PARTICLE FLUX

TO BE INSTALLED ON THE CHINESE SPACE STATION. ESTIMATED LAUNCH DATE 2027

INVOLVEMENT OF THE INFN: SCD DEVELOPMENT

INVOLVEMENT OF SSP: SCD DETECTOR DESIGN, MANUFACTURING, DETECTORS INSTALLATION AND SPACE QUALIFICATION

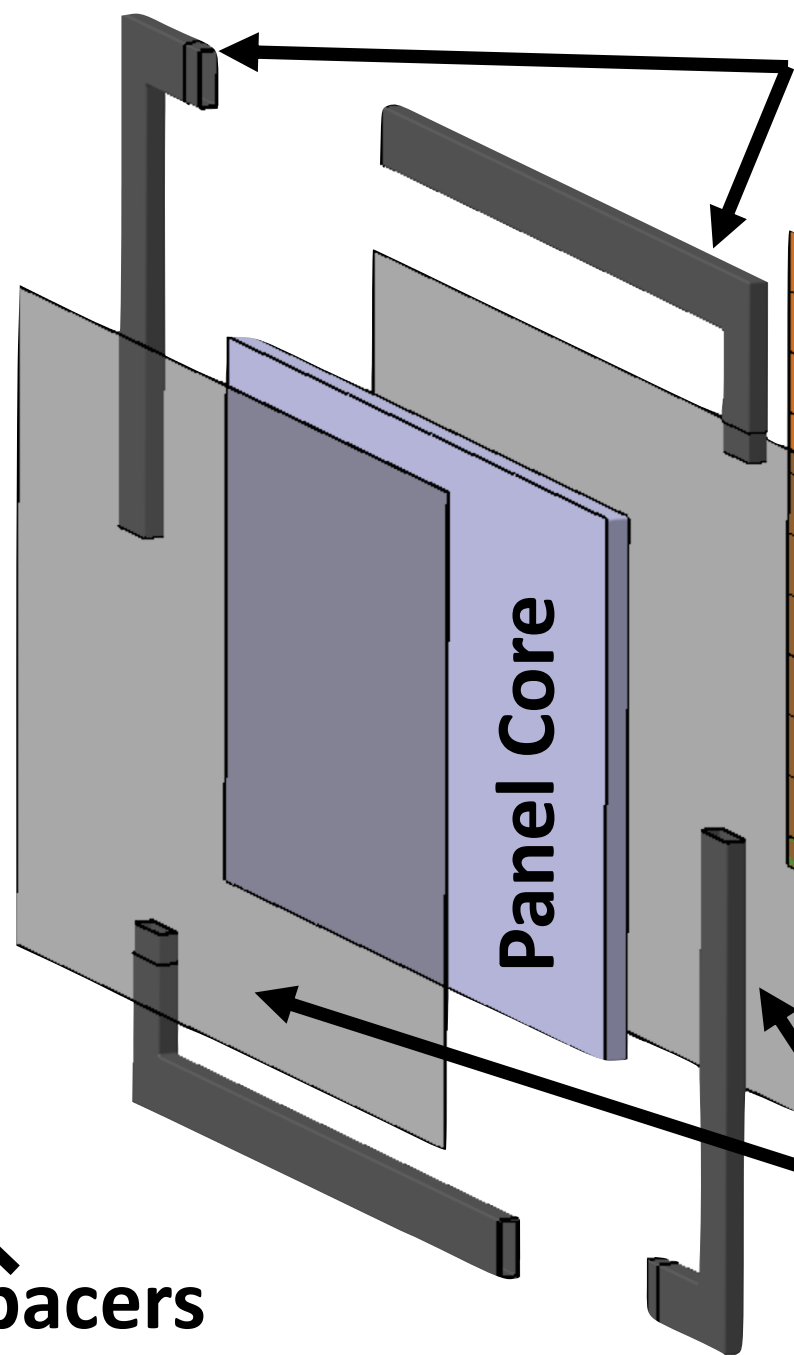
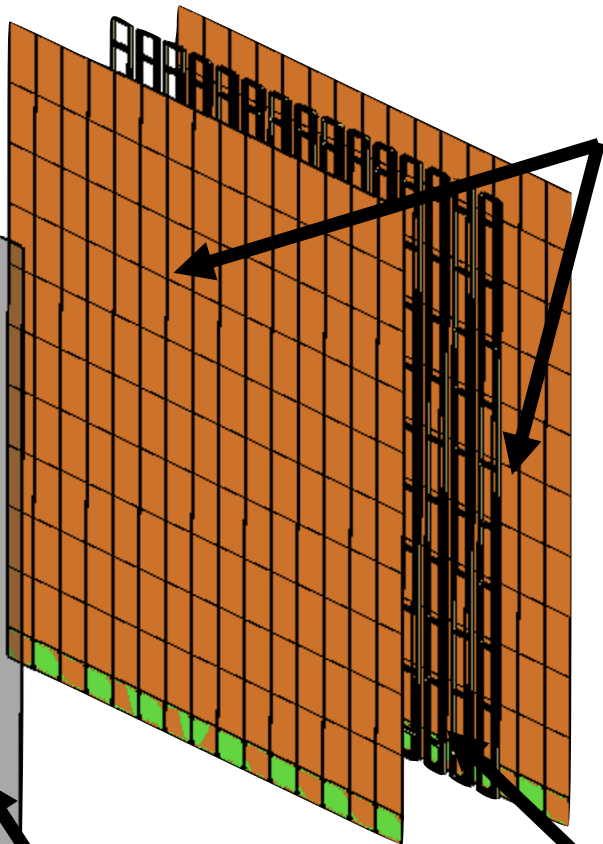
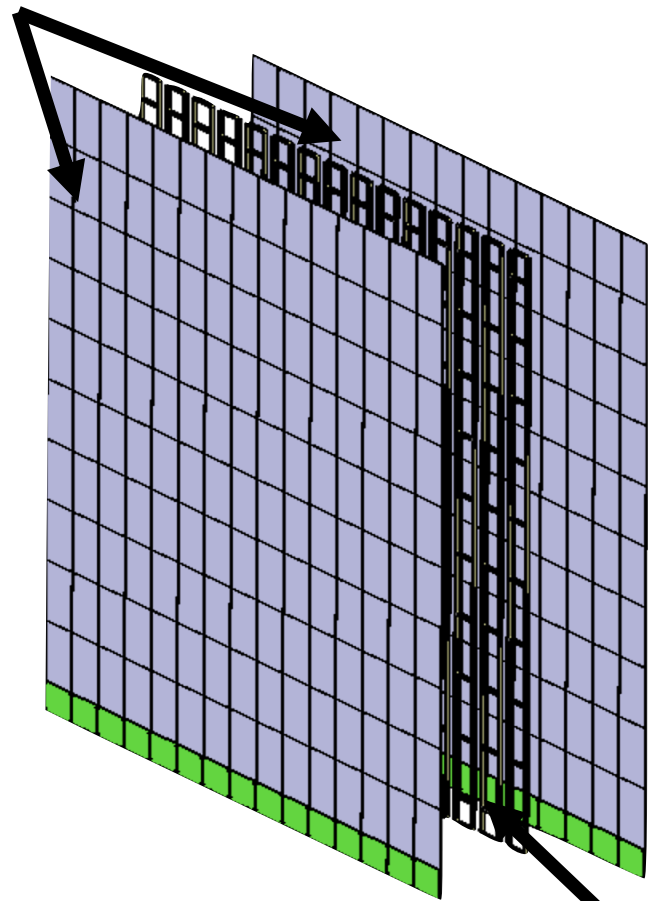
SCD



Silicon sensor layers

CF tubular frame

Silicon sensor layers



Airex spacers

Airex spacers

CF skins

HERD RELATED ACTIVITIES:

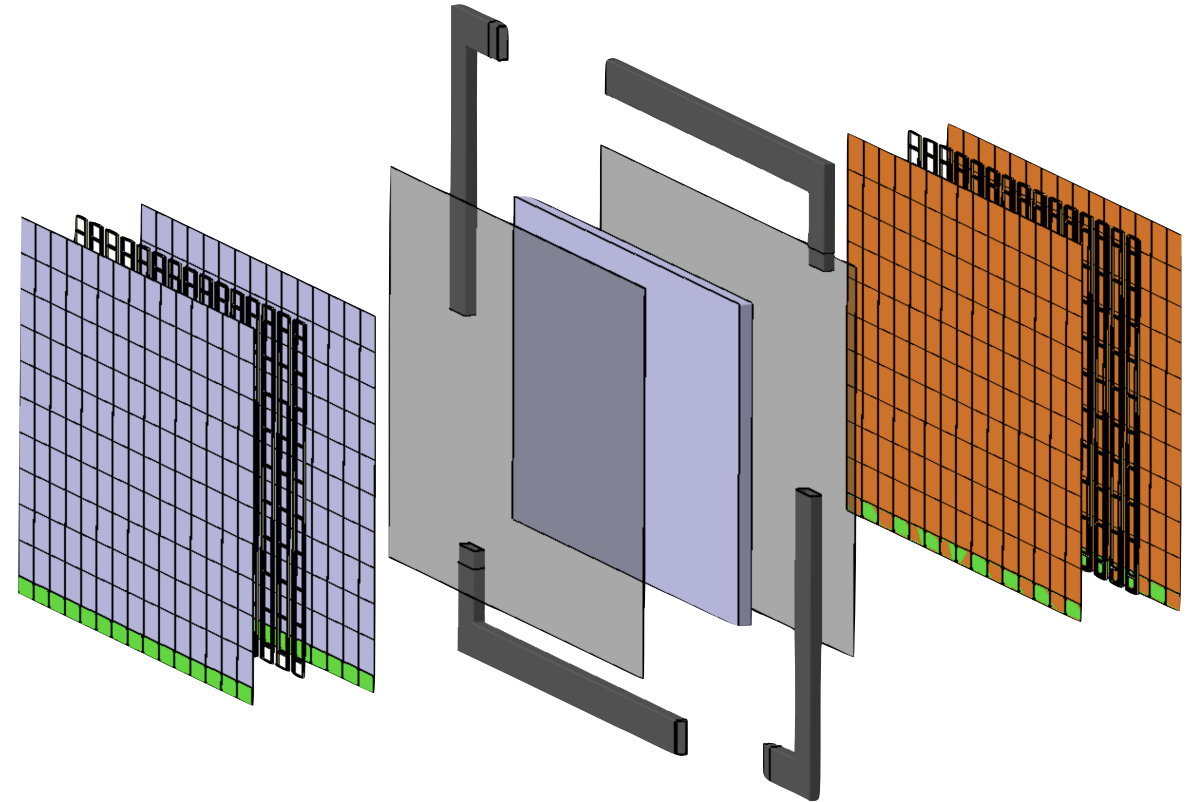
**MECHANICAL AND THERMAL DESIGN OF THE SCD
EXPERIMENT (CATIA+ANSYS+PYTHON)**

MANAGEMENT OF THE MANUFACTURING OF THE SCD

REALIZATION OF PROTOTYPES FOR MODEL VALIDATION

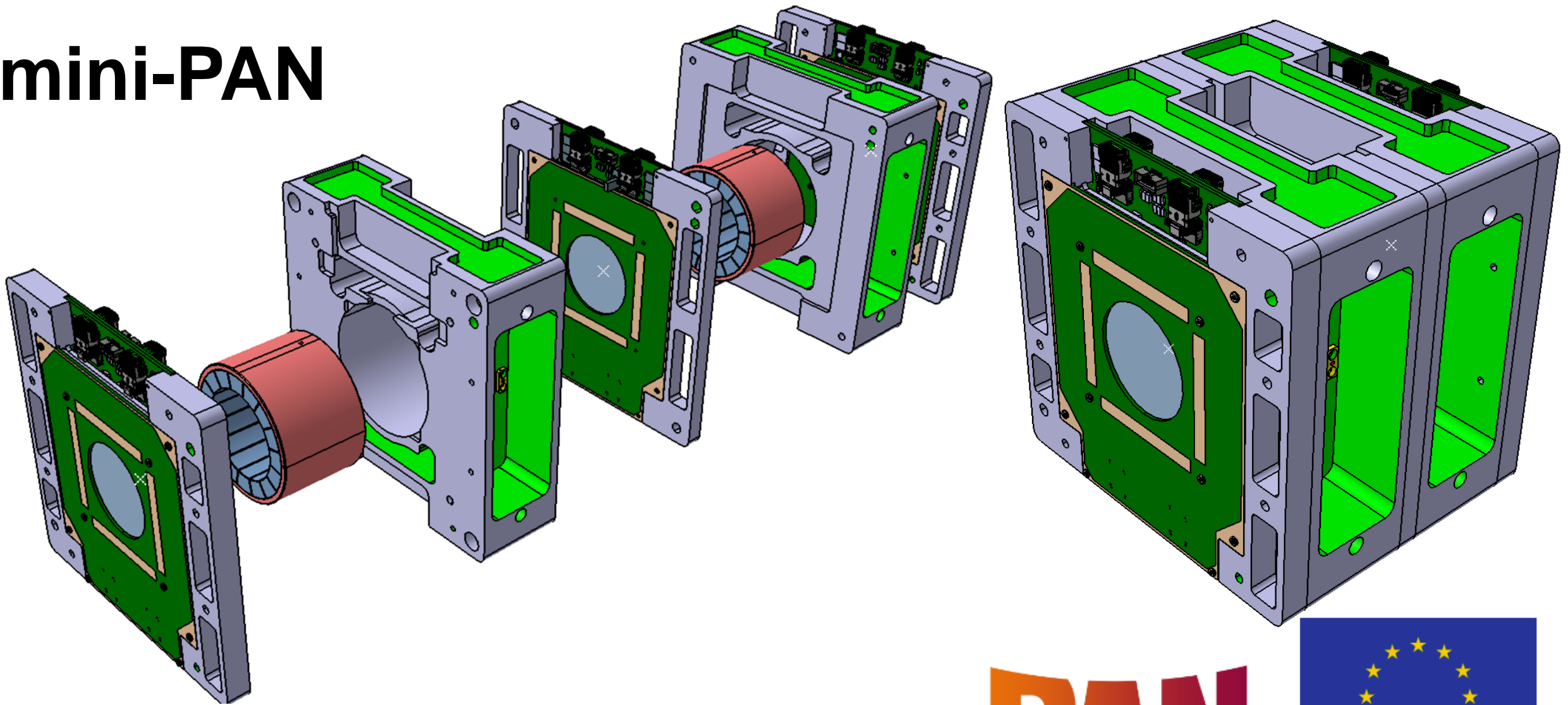
**TEST CAMPAIGN ON THE PROTOTYPES AND ON NON-
CONVENTIONAL STRUCTURES (CFRP HONEYCOMB, CFRP
ORTHOGRID – BOTH TO BE USED AS SANDWICH CORES -,
AIREX SUPPORT STRUCTURES)**

MAIT IN GENERAL

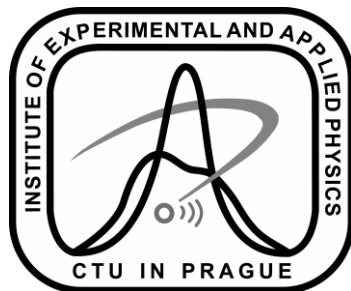


Other projects

mini-PAN



**UNIVERSITÉ
DE GENÈVE**



PAN
Penetrating Particle Analyzer



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 862044.

mini-PAN

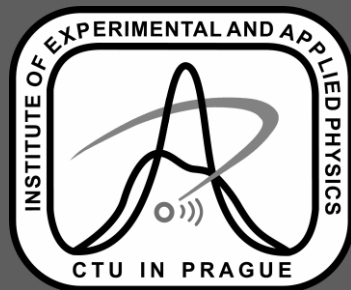
MINIATURIZED PARTICLES DETECTOR (DEMOSTRATOR)

INVOLVEMENT OF THE INFN: DETECTOR INTEGRATION AND BONDING

INVOLVEMENT OF SSP: RESPONSIBLE OF THE SPACE QUALIFICATION (TVT, MECHANICAL, ELECTROMAGNETIC)



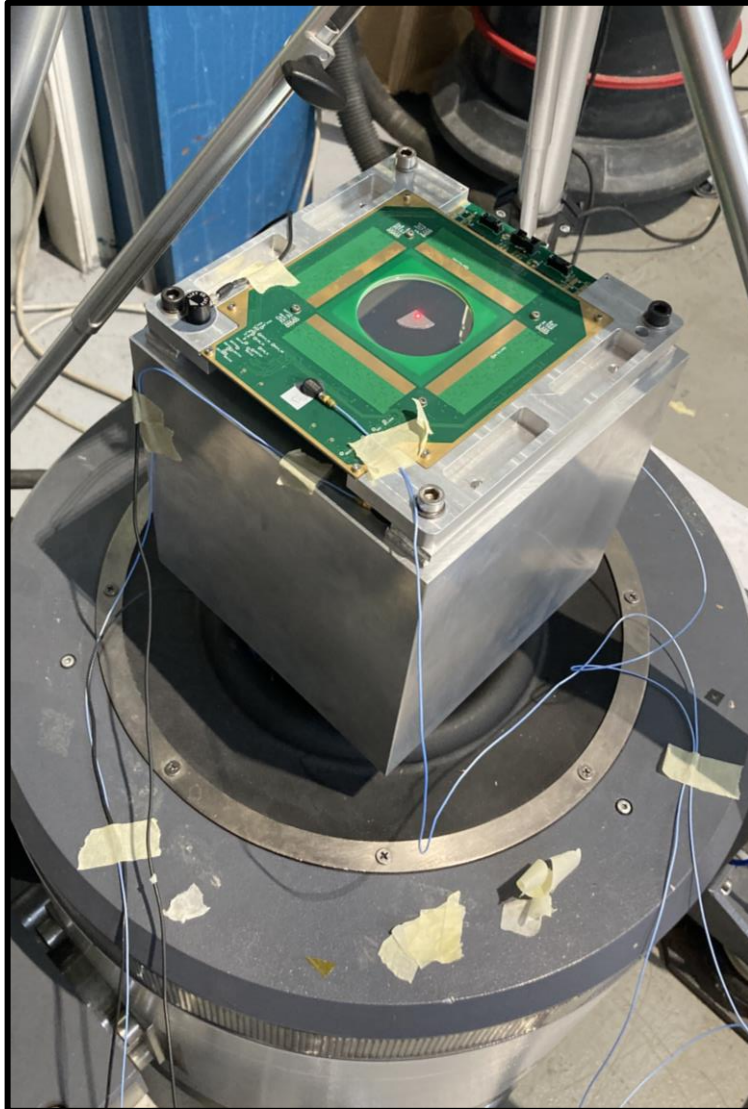
UNIVERSITÉ
DE GENÈVE



PAN
Penetrating Particle Analyzer



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 101019724.



MINI-PAN RELATED ACTIVITIES

DESIGN THE INTERFACES FOR THE VIBRATION, PYROSHOCK AND TVT TESTS (CATIA)

PERFORM THE VIBRATION, PYROSHOCK AND TVT TESTS (IN TERNI)

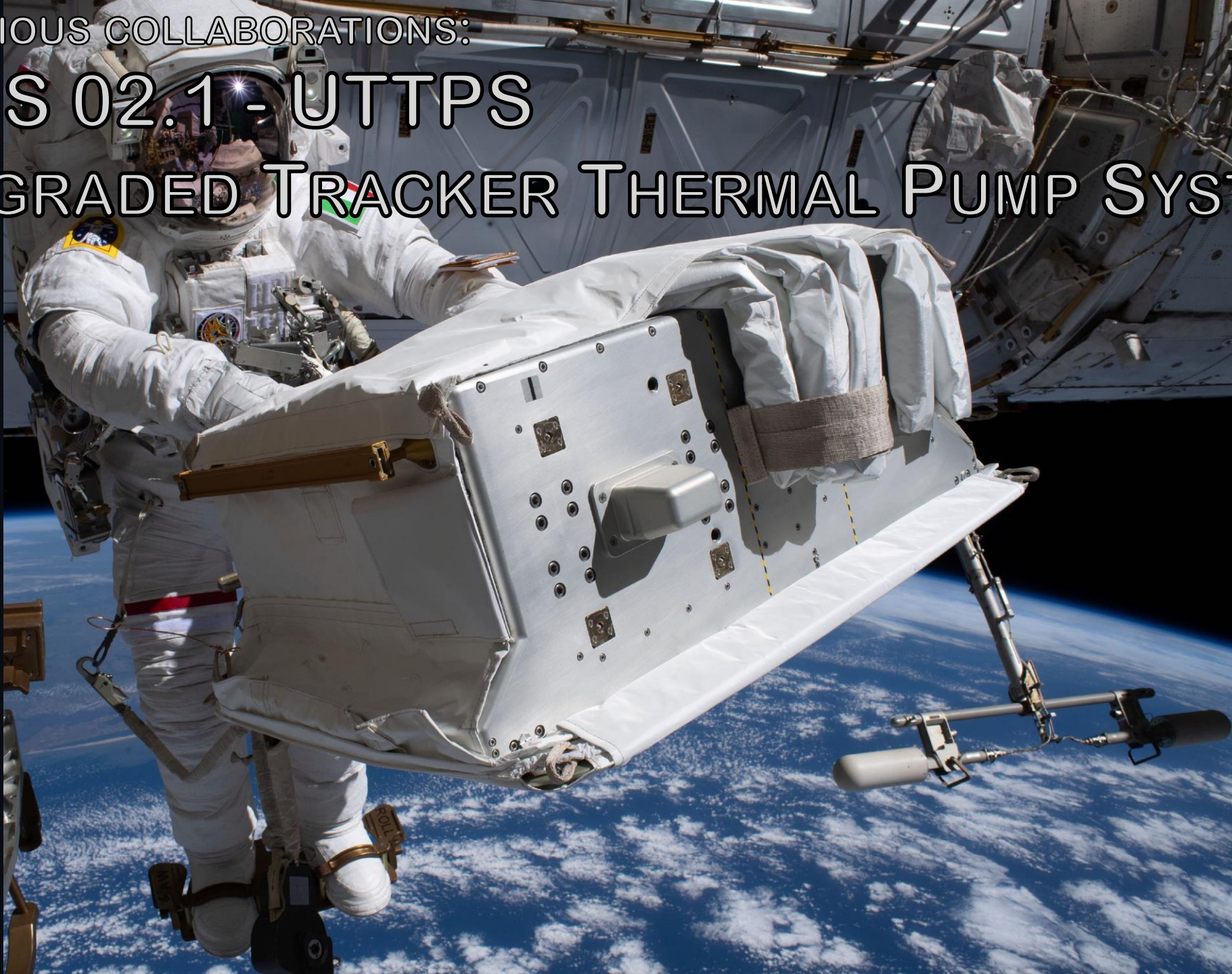
USAGE OF A LASER VIBROMETER TO ASSESS THE DYNAMIC RESPONSE OF A LOW-THICKNESS AND/OR LOW-MASS COMPONENT

PREDICT THE DYNAMIC RESPONSE OF THE SUT (ANSYS ALONE OR WITH PYTHON)

PREVIOUS COLLABORATIONS:

AMS 02.1-UTTPS

UPGRADED TRACKER THERMAL PUMP SYSTEM



PREVIOUS COLLABORATIONS:

AMS 02.1 - UTTPS

UPGRADED TRACKER THERMAL PUMP SYSTEM

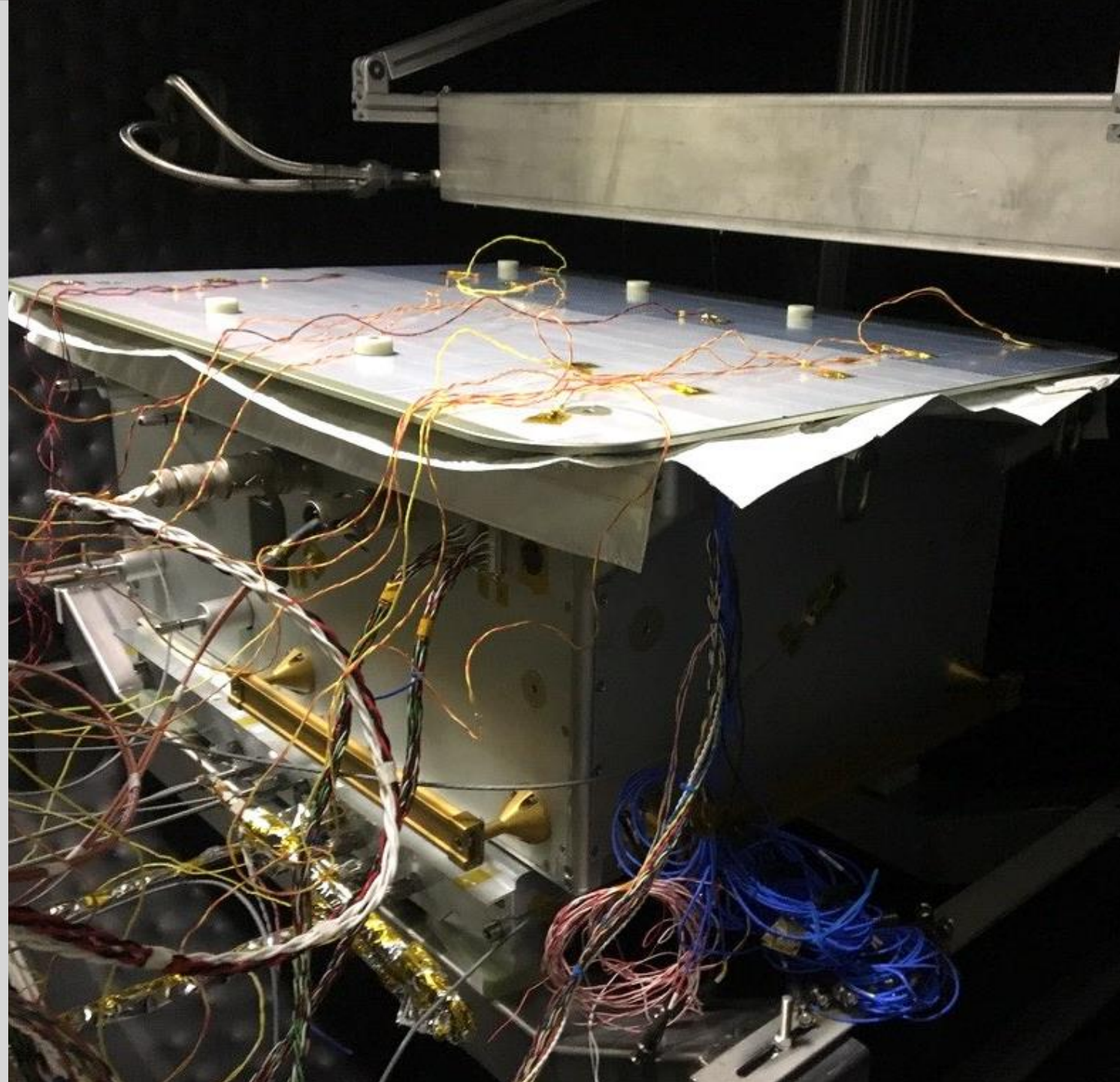
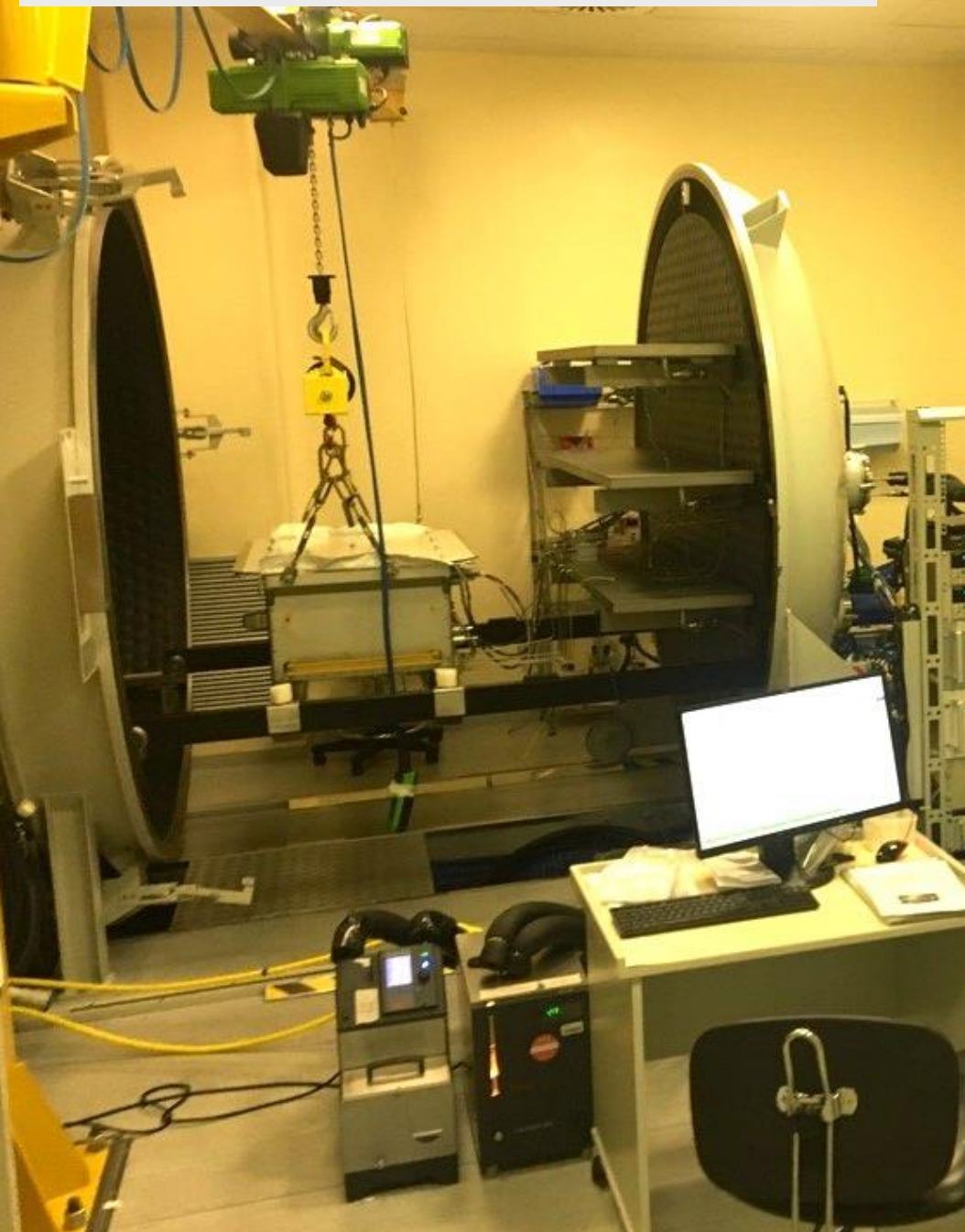
UPGRADE OF THE CO₂ BI-PHASE COOLING SYSTEM OF AMS-02 SILICON TRACKER

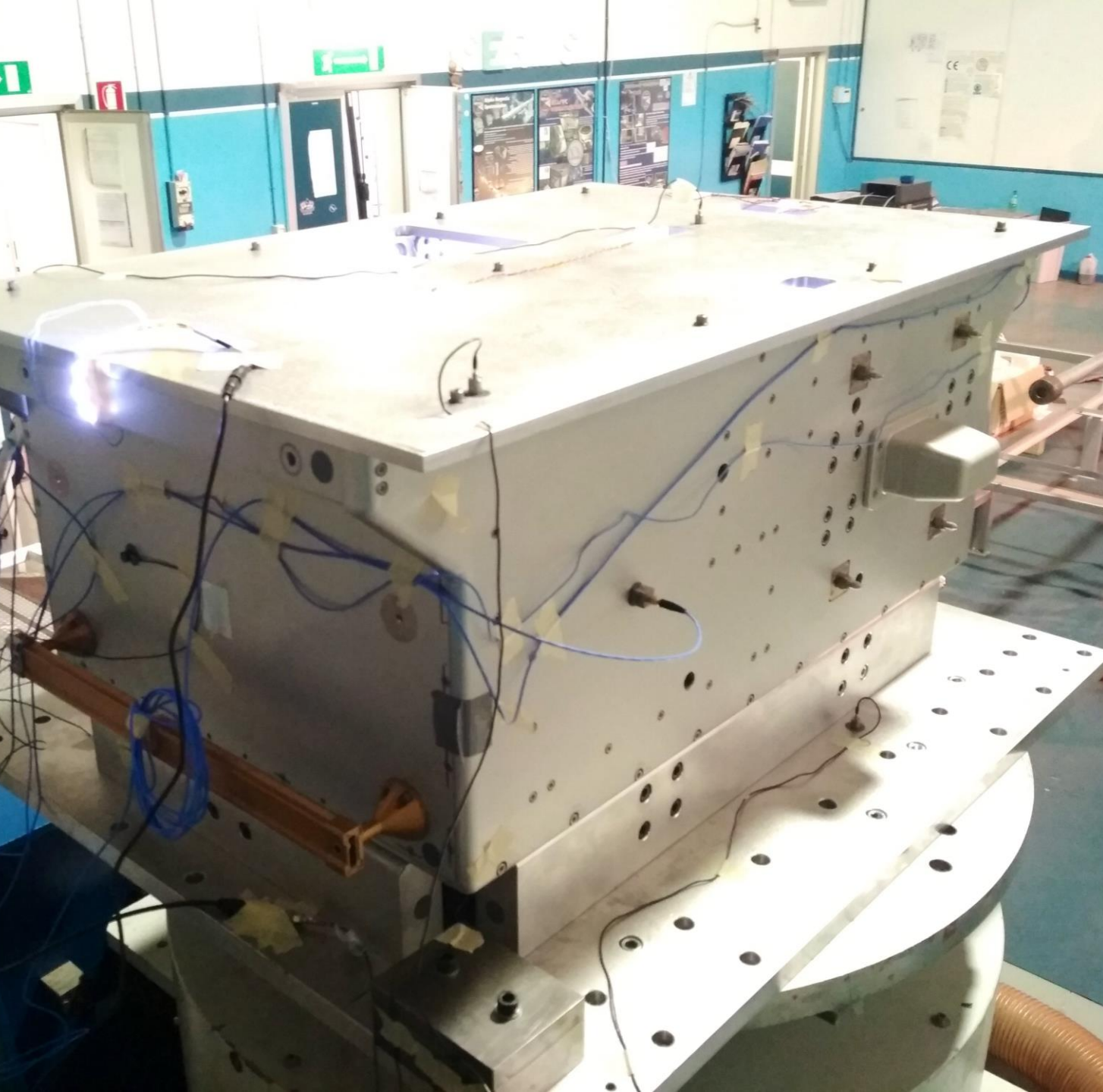
SPACE QUALIFICATION PERFORMED (VIBRATION/TVT) AT SERMS LABORATORY

INSTALLED ON AMS-02 DURING FOUR EVAS IN 2019/2020 BY
ASTRONAUTS LUCA PARMITANO (ESA) AND ANDREW MORGAN (NASA)

UNIPG AND INFN-PG INVOLVED ALSO IN THE INSTALLATION AND COMMISSIONING PHASES

UTTPS - Thermal vacuum test





UTTPS - Z axis vibration test



UTTPS - UniPG and INFN-PG personnel following the training activities for the installation of UTTPS on orbit

Thanks for the attention
