SENER
Aeroespacial

Technological Challenges on the development of the PDD FUV MCP detector for WSO-UV Mission

WSO-UV/ NUVA October 2022

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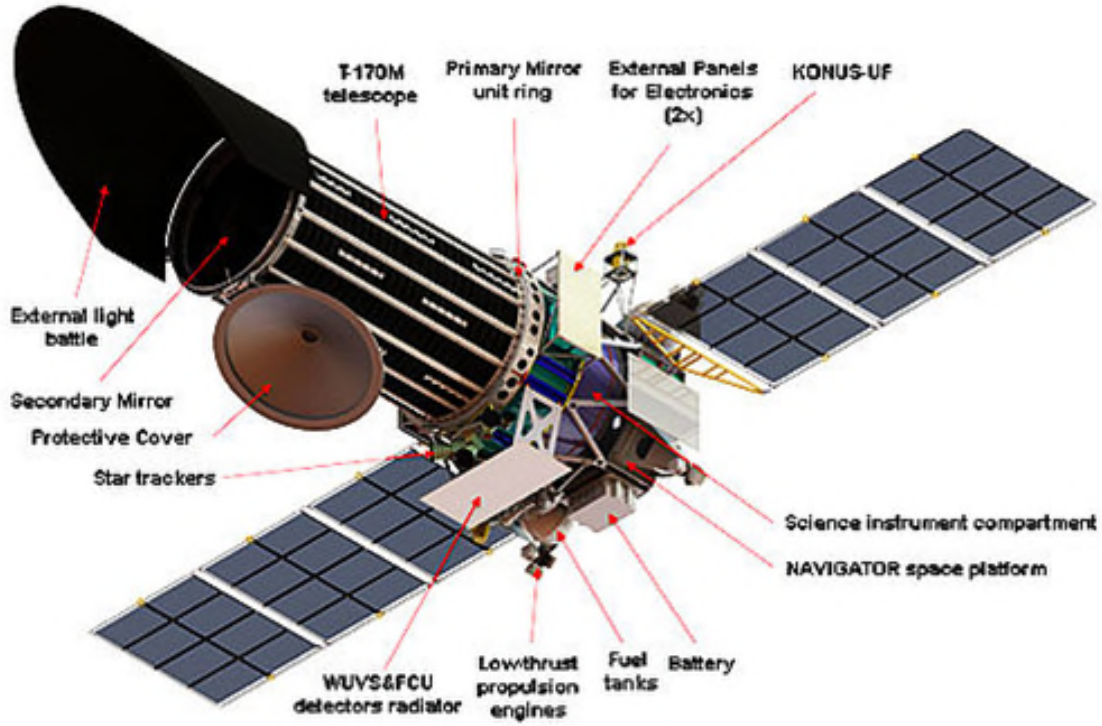
0 – WSO, THE MISSION

WSO-UV is an international space-based observatory mission, within the Russian Scientific Space Program. The spacecraft's primary scientific payload includes a telescope gathering and guiding the space emissions to the Field Camera Unit, which development is leaded by Institute of Astronomy of the Russian Academy of Sciences. Sener Aeroespacial is in charge of designing, manufacturing and testing the Photon Detector Device for the Far Ultraviolet channel at the FCU. Universidad Complutense de Madrid develops all the scientific aspects, including processing algorithms.



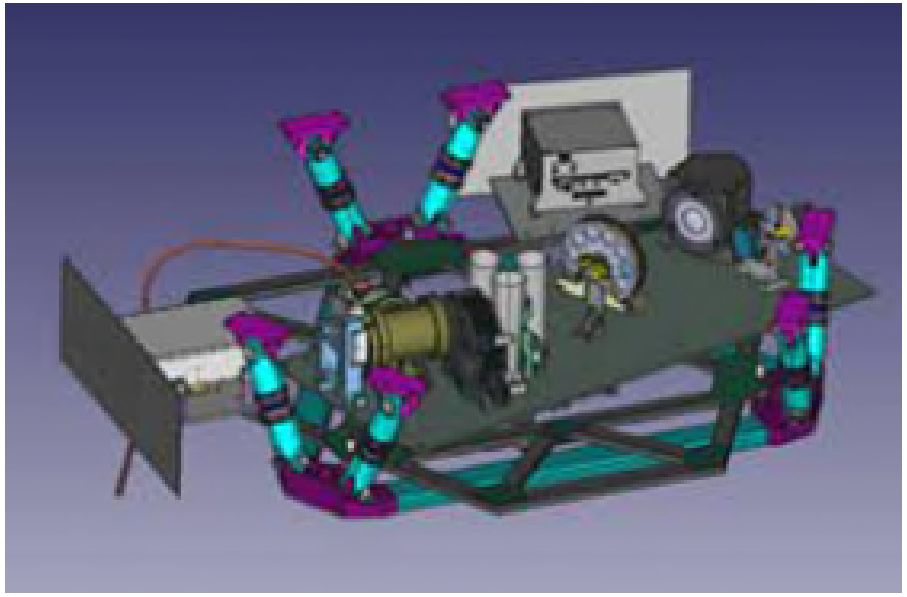
1 – WSO PDD FUV SUBSYSTEM

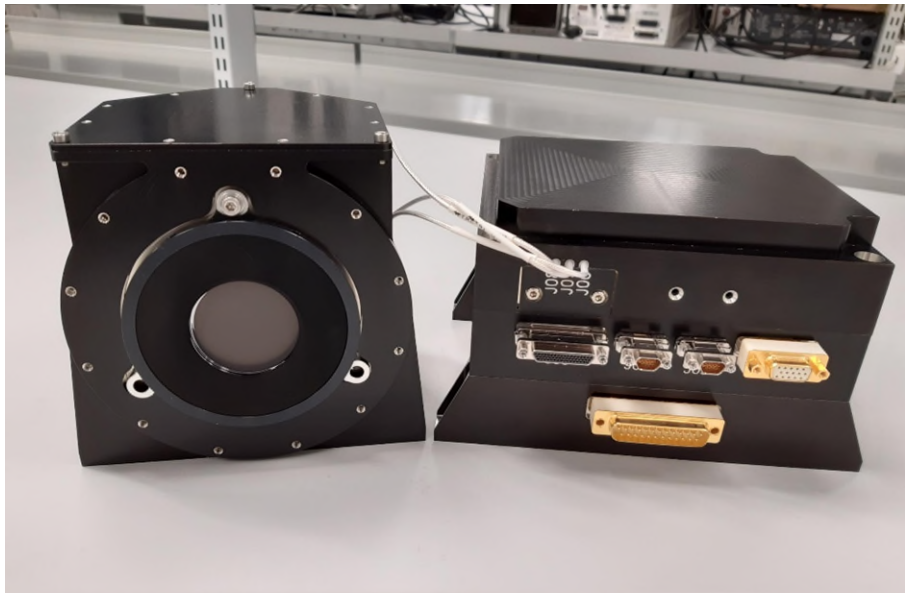
The Photon Detection Device (PDD) of the FUV channel instrument is composed by:

Radiation Receiver (RR): Houses an MCP, a CMOS sensor, and the conversion PCA to detect and convert far ultraviolet radiation in the 115-175 nm range to digital signals.

Electrical Unit (EU): Gathers, process and transmits the information detected by the RR to the Central Control Unit. Additionally, powers the MCP with the required high voltage inputs.

Inter Unit Cable Assembly (IUCA): Harnesses for data and power transmission between the RR and the EU.





2 – THE RADIATION RECEIVER CHALLENGES

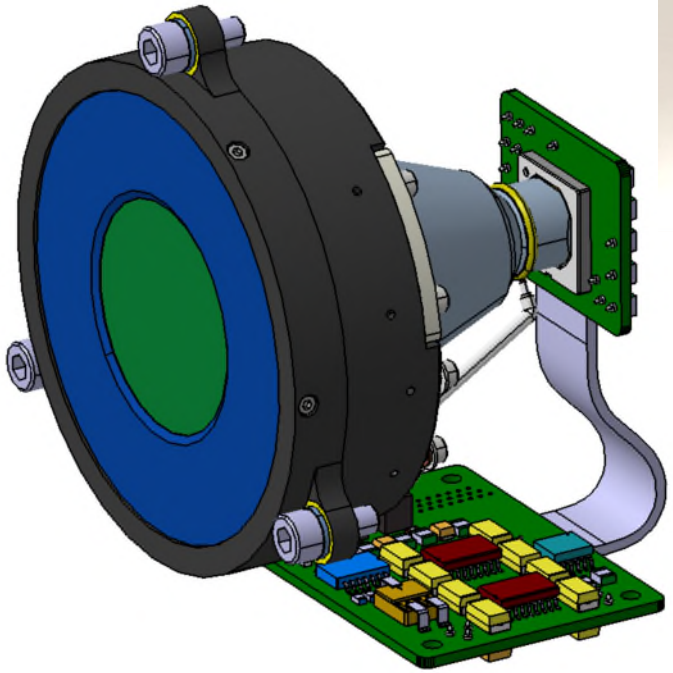
Failures during encapsulation.

MCP detector very sensitive to high temperatures.

Sensor bonded to detector through a fiber optic taper.

Connection to PCA must be soldered.

DETECTOR AND SENSOR ASSEMBLY TO THE ELECTRONICS



2 – THE RADIATION RECEIVER CHALLENGES

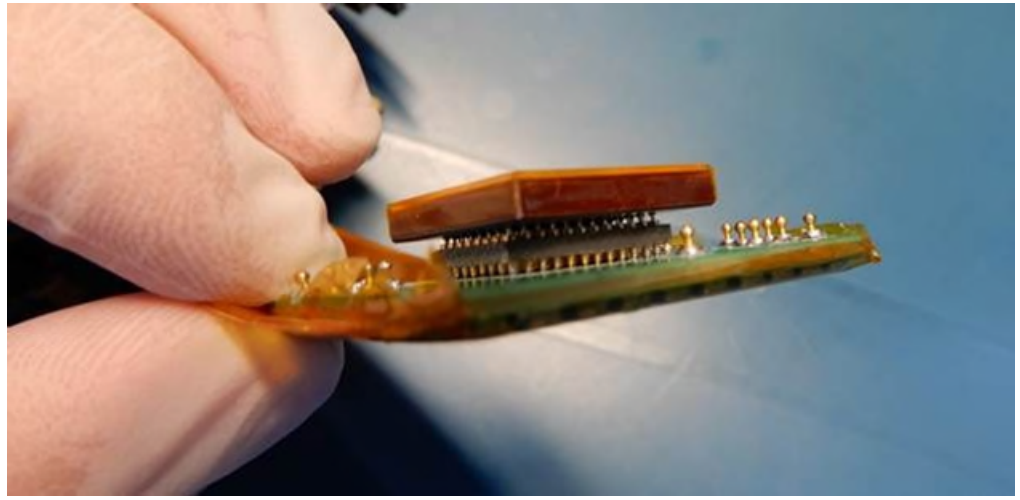
MCP detector very sensitive to high temperatures.

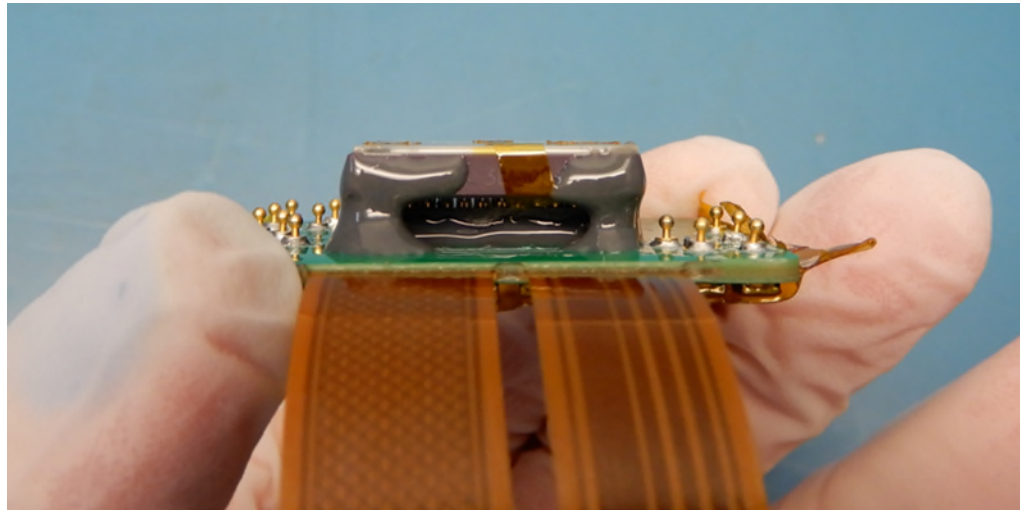
Sensor bonded to detector through a fiber optic part.

Connection to PCA must be soldered.

Implementation of a mechanical joint to avoid potential risks at assembly → custom designed socket + structural adhesive (EEE heritage).

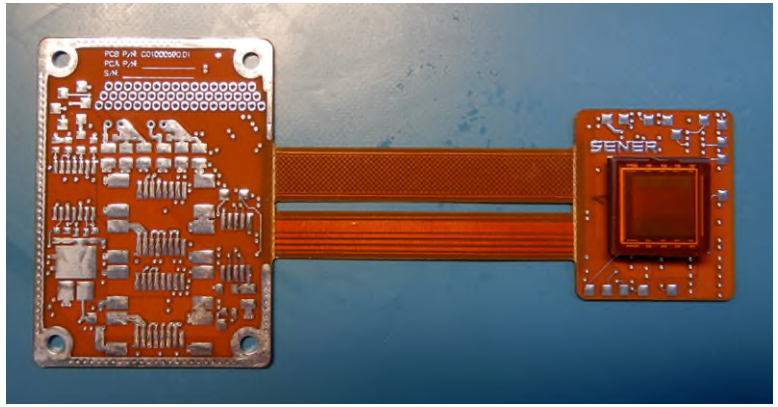
DETECTOR AND SENSOR ASSEMBLY TO THE ELECTRONICS



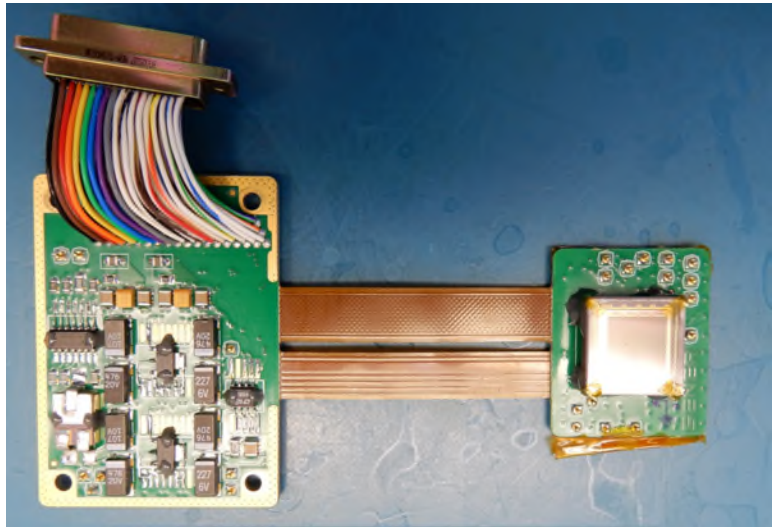


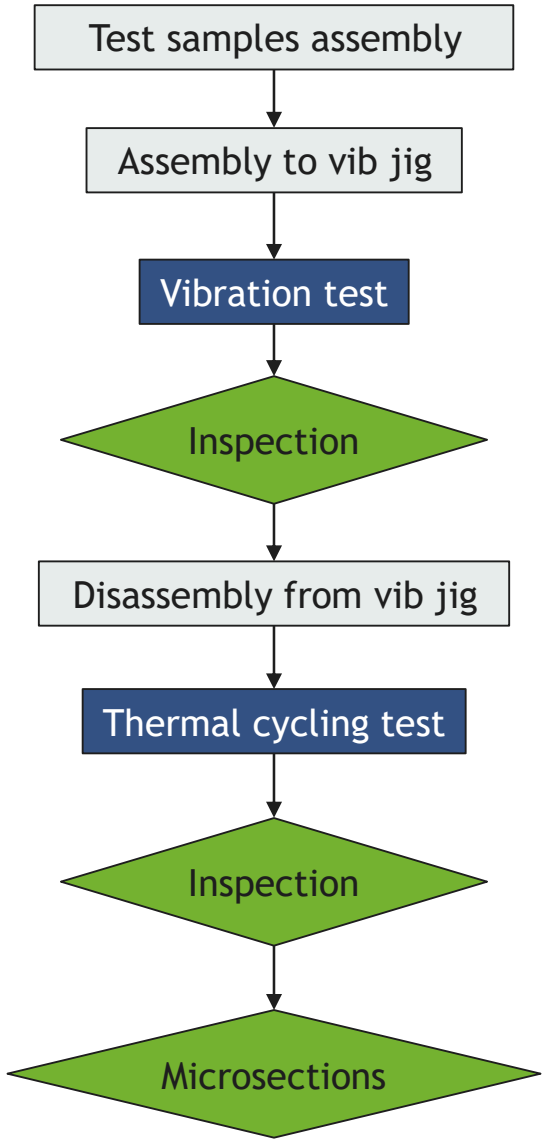
3 – DERISKING CAMPAIGN

FPA DUMMY



FPA EM LAB

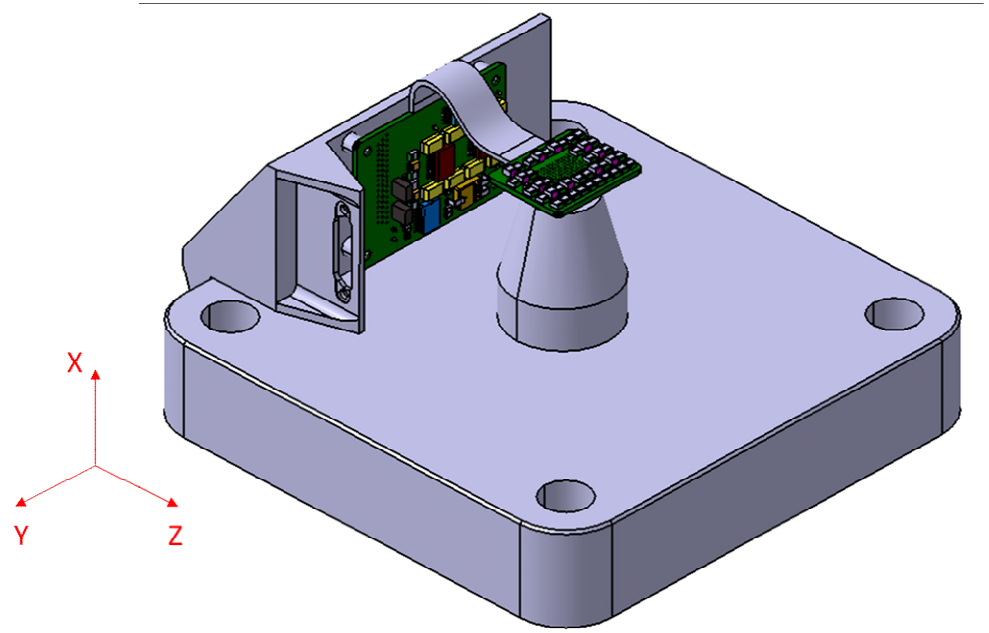


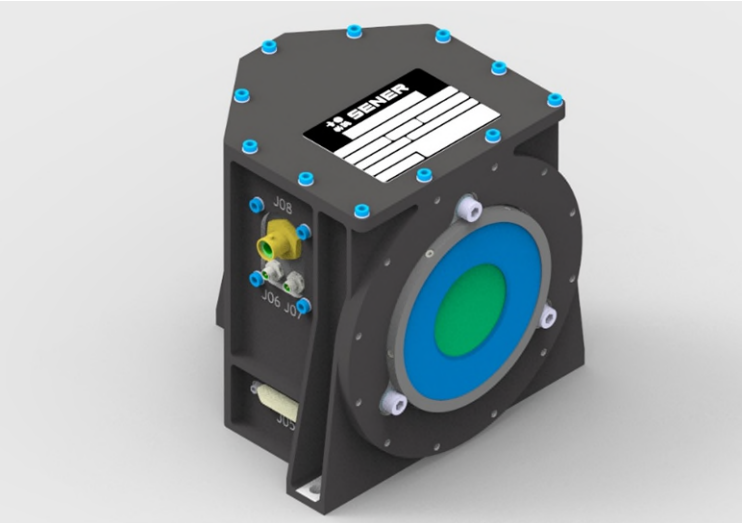


5 – VIBRATION TEST

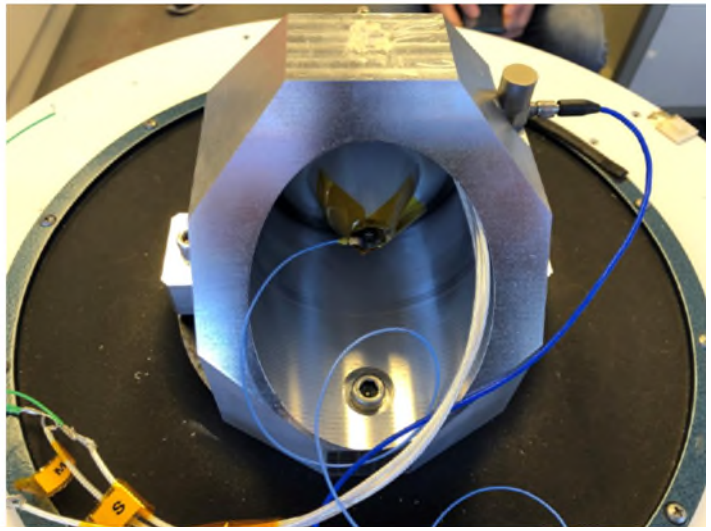
Vibration jig designed to:

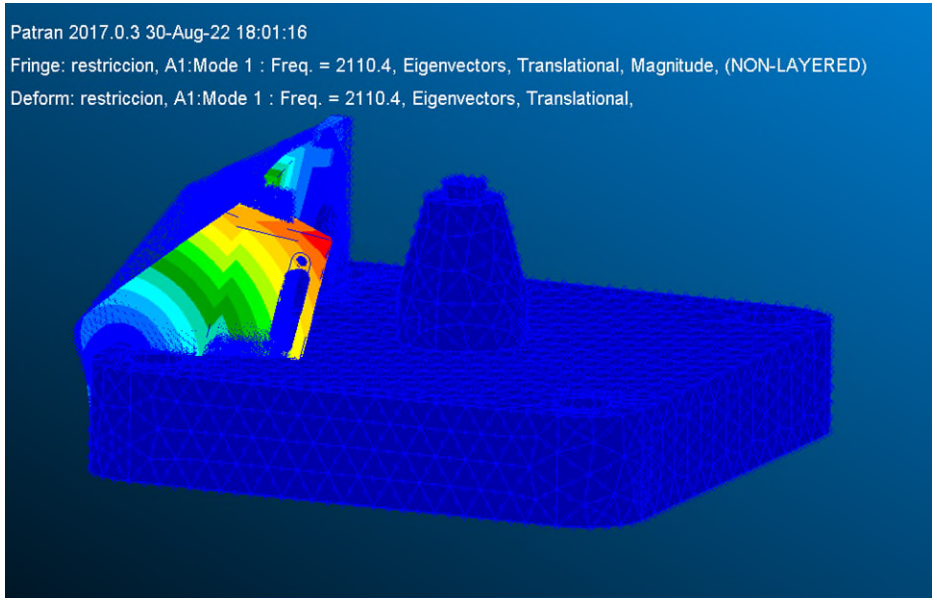
- Support the sensor in a similar configuration to the FM one.
- Be ‘transparent’ to the vibration loads.





Y Axis

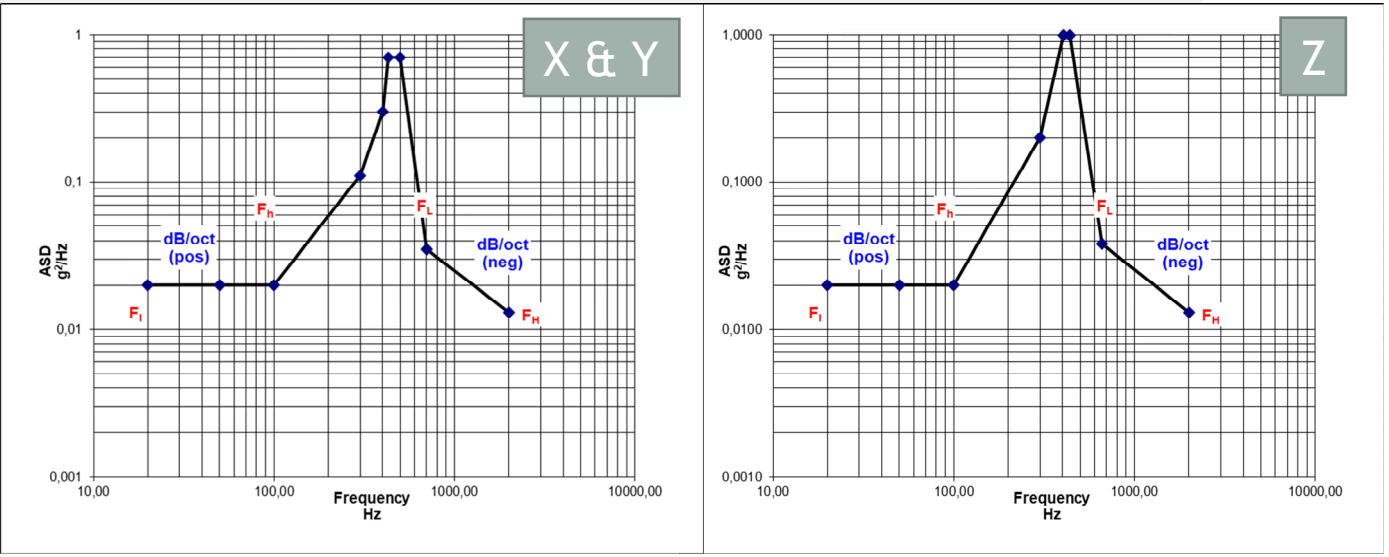


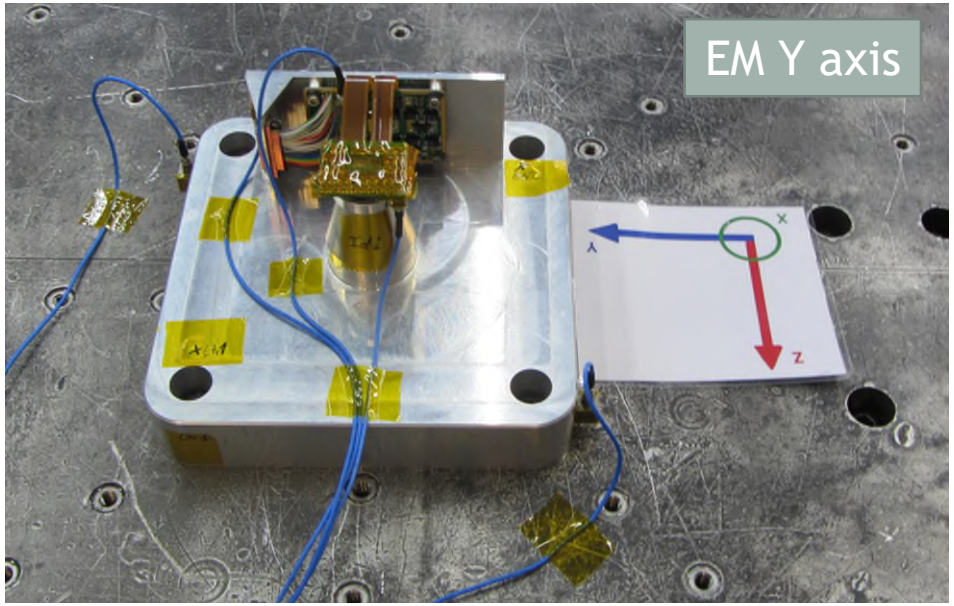


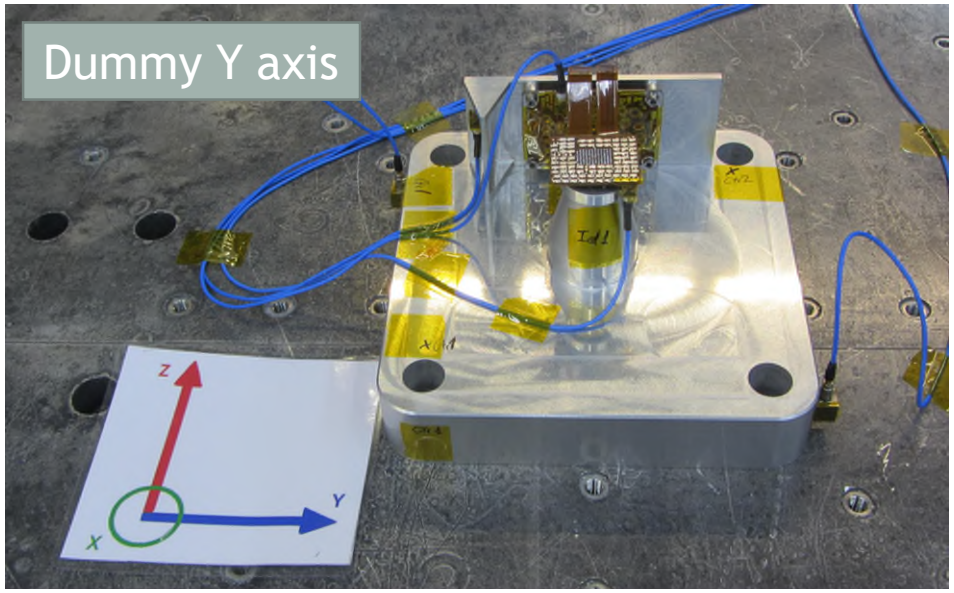
5 – VIBRATION TEST

Loads according to MCP detector qualification campaign. 3 axes.

- Sine low level (sine sweep).
- Random intermediate.
- Random full.
- Sine low level (sine sweep).







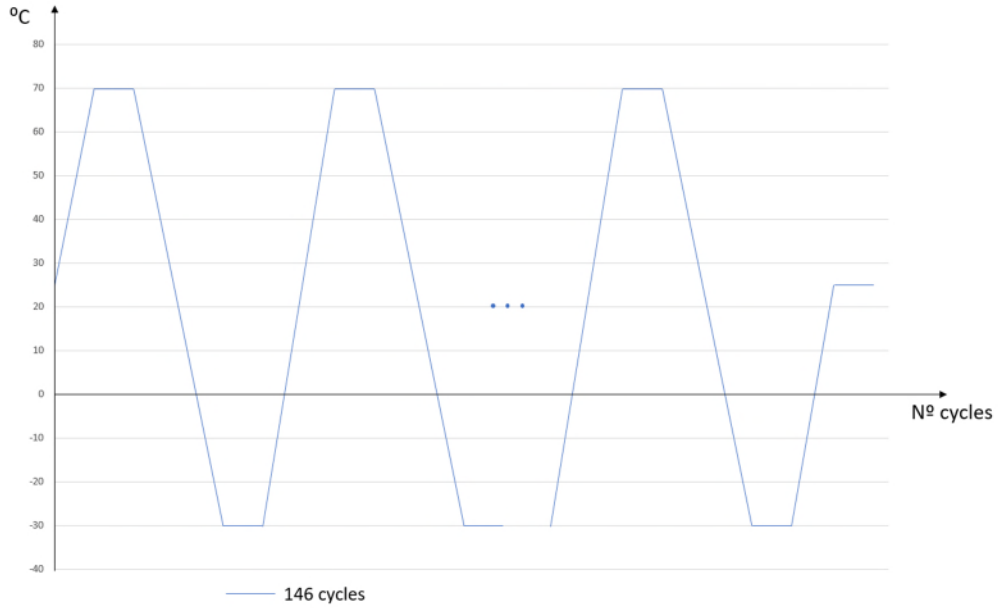
6 – THERMAL CYCLING TEST

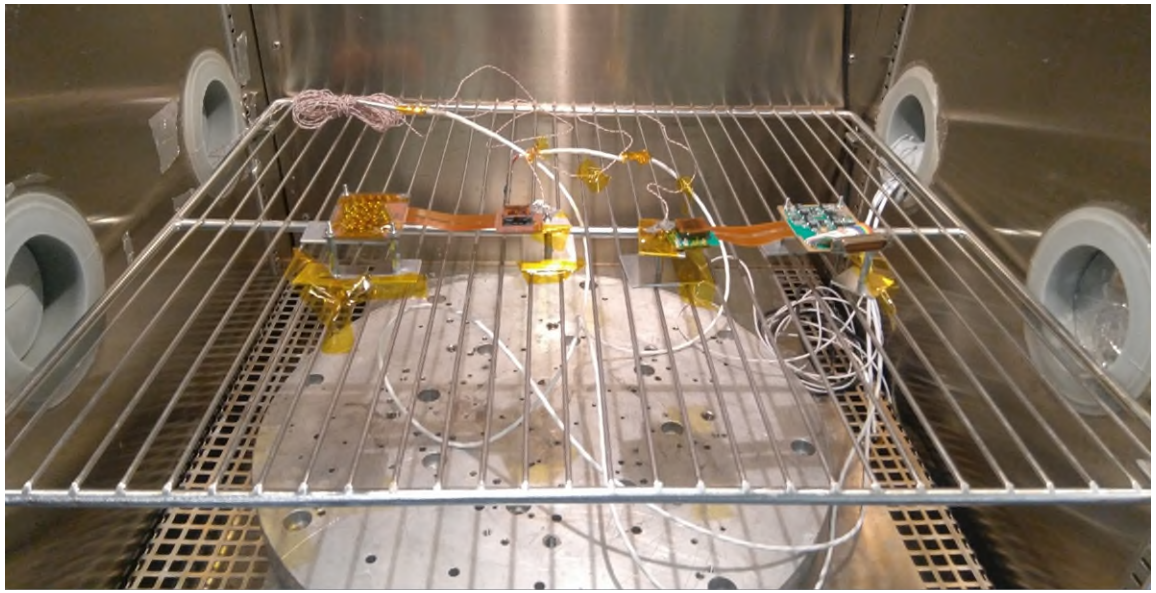
Induce thermal stress to the joints between the sensor and the PCA.

Thermal cycling profile derived from project general soldering verification campaign: To induce the equivalent mission stress on the samples, Norris Landzberg (modified Coffin-Manson) method has been implemented.

Parameters:

- Temperature: [-30, +70]
- Number of cycles: 146
- Max rate: 10ºC/min
- Stabilization: 15min

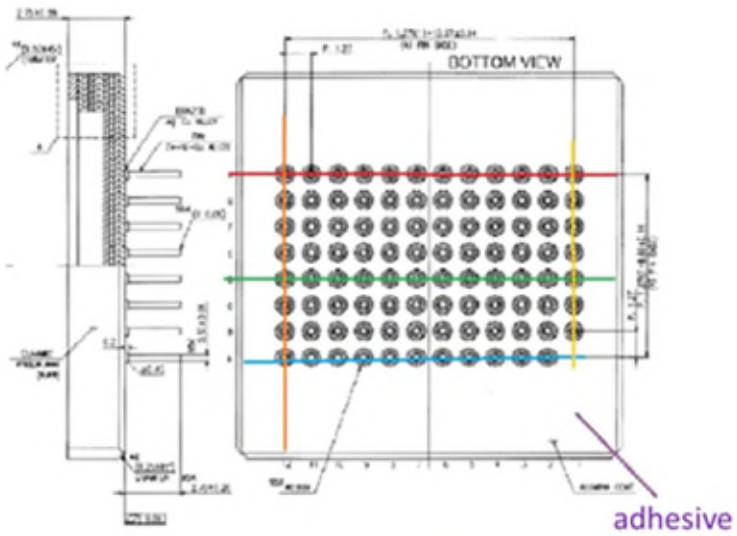


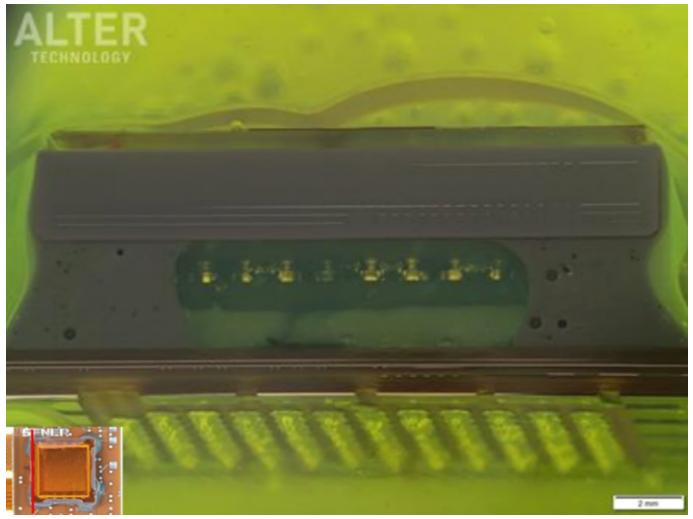


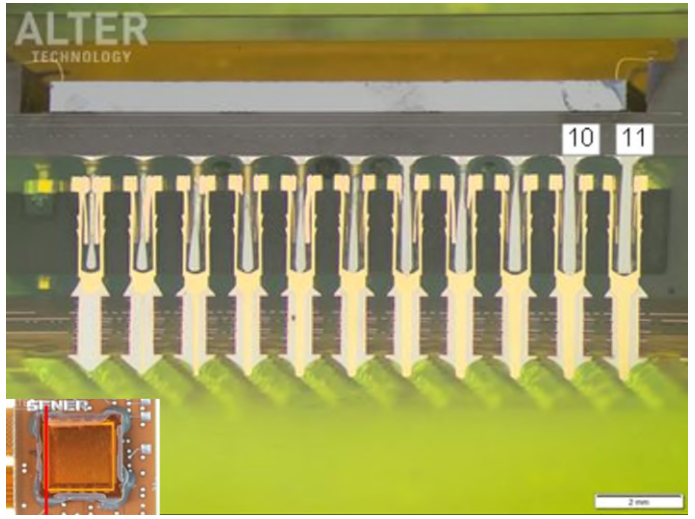
7 – MICROSECTIONS ON DUMMY SAMPLE

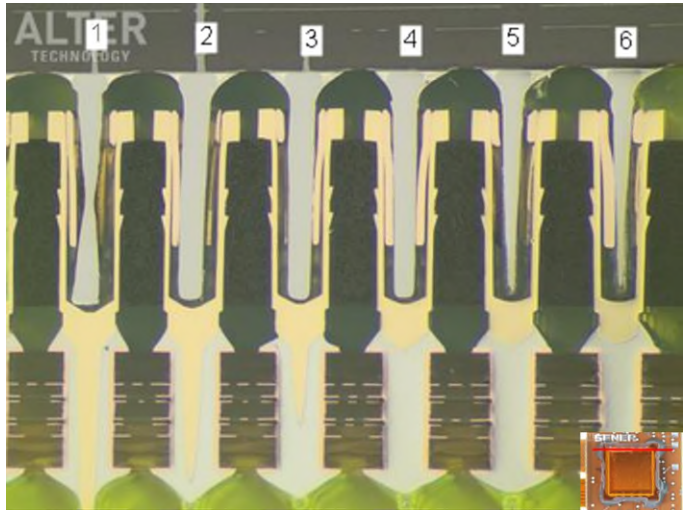
Performed based on ECSS standards by a certified laboratory to check the integrity of the solder joints socket-PCB, adhesive bonding and mechanical joints CMOS-socket.

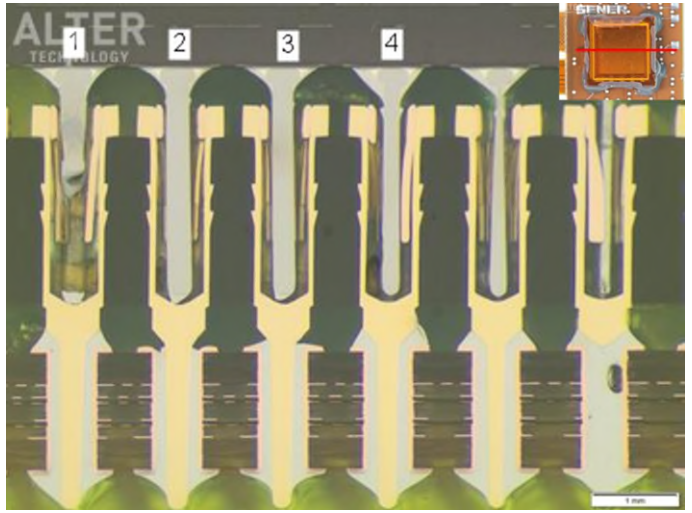
No issue found → Assembly integrity asured.











8 – CONCLUSIONS

After the campaign that submitted the assembly to the expected mission loads (vibration, thermal) the assembly proved to be reliable showing good results in latest inspections (microsection, testing).

This assembly is implemented for the EQM model and then, for the FM models.

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THANKS

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