

WP5 - X-Ray Polarimetry Explorers

H2020-MSCA-RISE-2016 – Grant Agreement N° 734303

NEWS - SB Meeting - 18/1/2018



European Commission

EGO - Virgo



POLITECNICO
MILANO 1863



IZDF

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Stockholm
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FARADAY
TECHNOLOGY®



OVERVIEW

- **IXPE Mission Recap & Report**
- **Polarization sensitive detectors (GPD)**
- **Software Developments**
- **Status of secondments**



Research and Technology



IXPE

Imaging
X-Ray
Polarimetry
Explorer

IXPE MISSION RECAP & REPORT



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IXPE

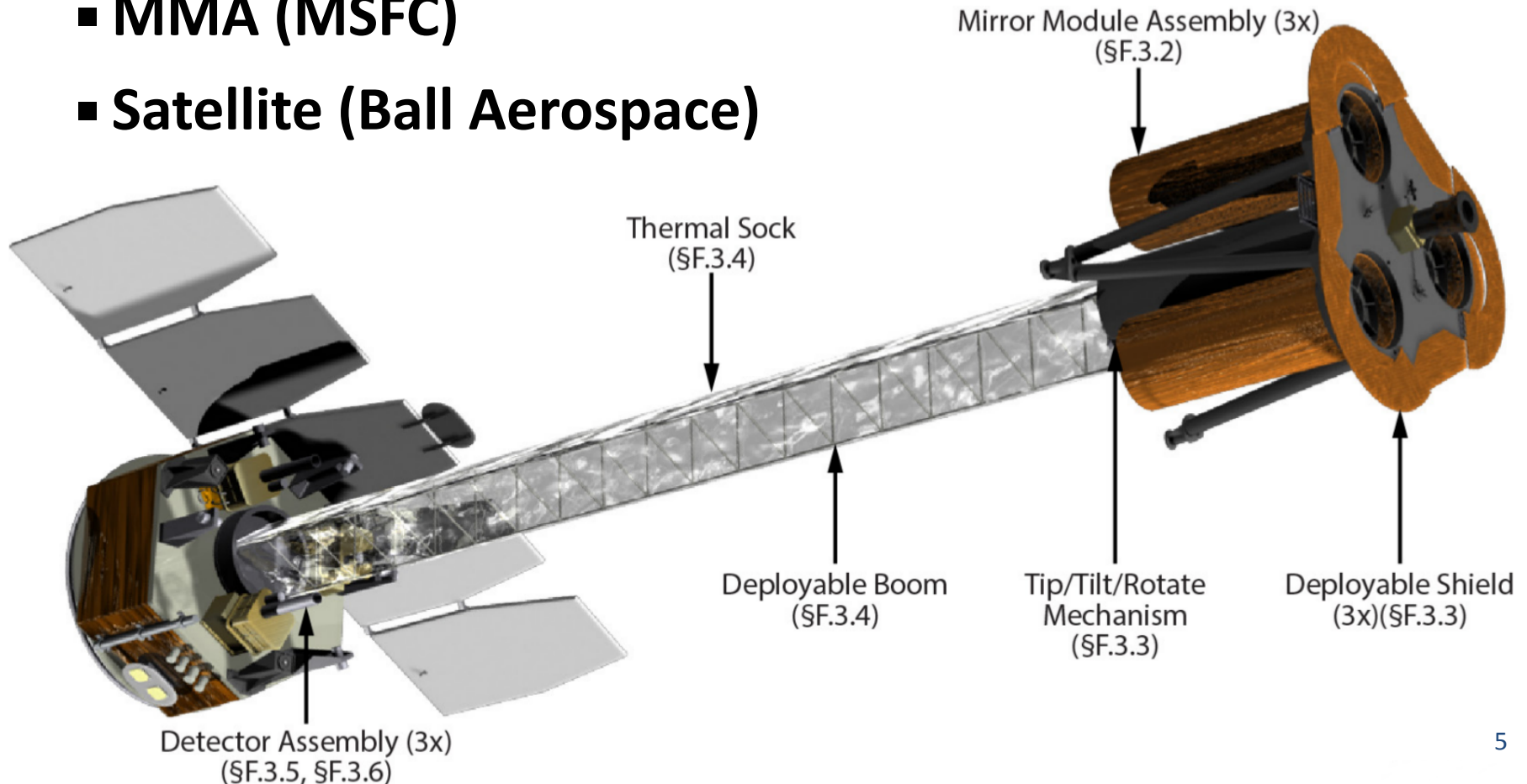
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IXPE IN A NUTSHELL

- **Selected for NASA SMEX program Jan 3 2017**
 - 180M US\$ / 5 years envelope
- **Devoted to polarimetry of 2-8 KeV x-rays**
 - through enabling Gas Pixel Detectors (GPD) from INFN-Pisa
- **Launch in April 2021**
 - aggressive schedule, including procurement
- **Italian contribution from INAF/IAPS, INFN, ASI**
 - through international agreement between ASI and NASA
- **Italian responsibility is whole focal plane**
 - Detector Units (DU) and electronics, a.k.a. Instrument
- **Unique opportunity**

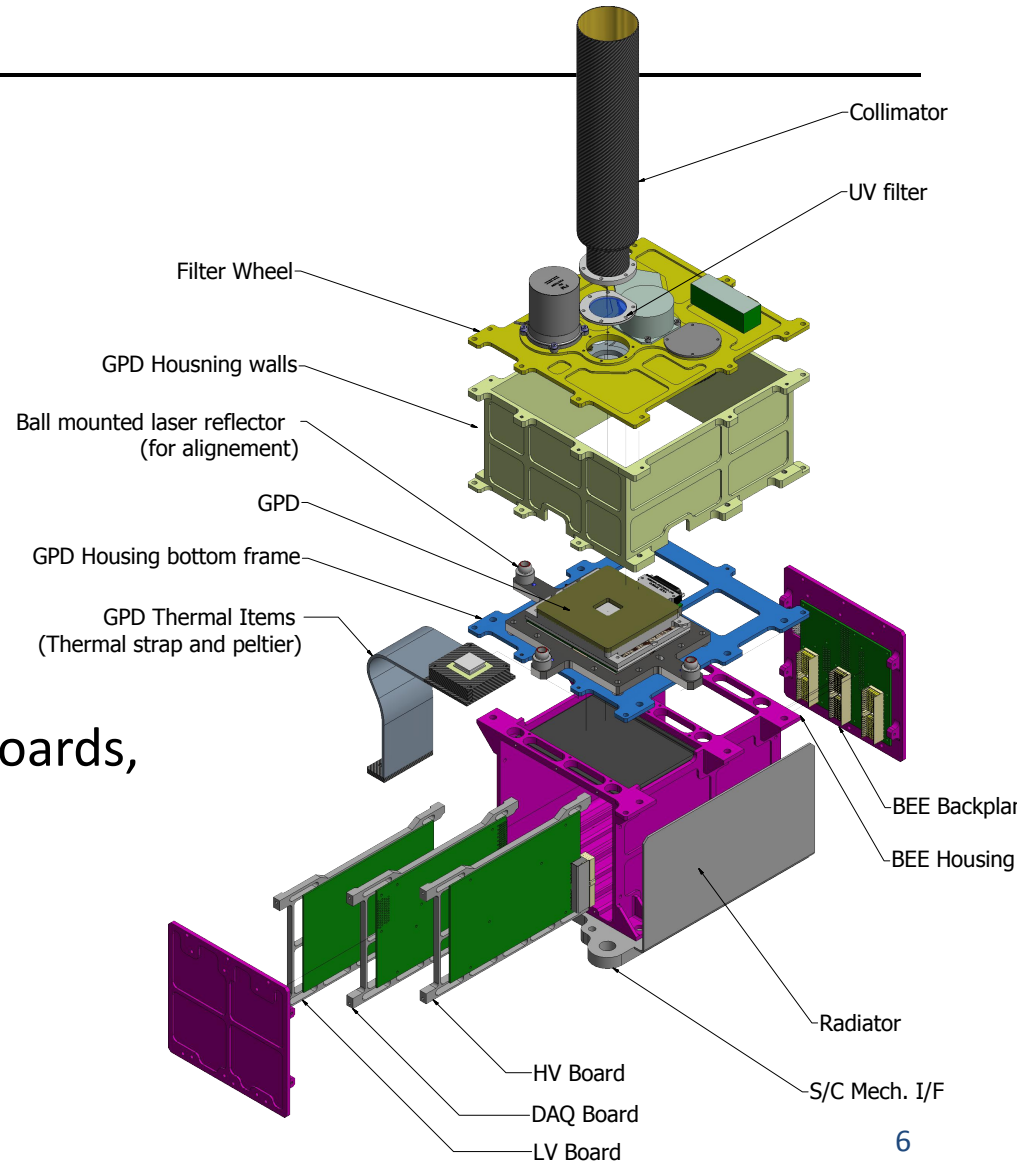
IXPE TELESCOPE ELEMENTS

- Instrument (Italy)
- MMA (MSFC)
- Satellite (Ball Aerospace)



INFN RESPONSIBILITY

- **Gas Pixel Detector (GPD)**
 - Bread-Board (BB)
 - Engineering Model (EM)
- **Detector Units (DU)**
 - 3x Proto Flight Model (PFM)
 - 1x PFM spare
- **DU Electronics Boards**
 - Low Voltage, DAQ, GPD ASIC boards, backplane, harness
- **DU Mechanical Housing**
- **DU Thermal Control System**
- **Straylight collimator**





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MISSION REVIEW MILESTONES

■ **System Requirements (scientific and engineering)**

- Mission level (M-SRR), Marshall 18-19/9/2017
- Instrument level (I-SRR), Italian Space Agency 30-31/10/2017
 - $\sim O(10)$ Instrument documents

■ **Interfaces between subsystems**

- Instrument and Spacecraft

■ **Preparing Instrument Preliminary Design Review**

- ASI 5-7/3/2018
 - $\sim O(100)$ Instrument documents



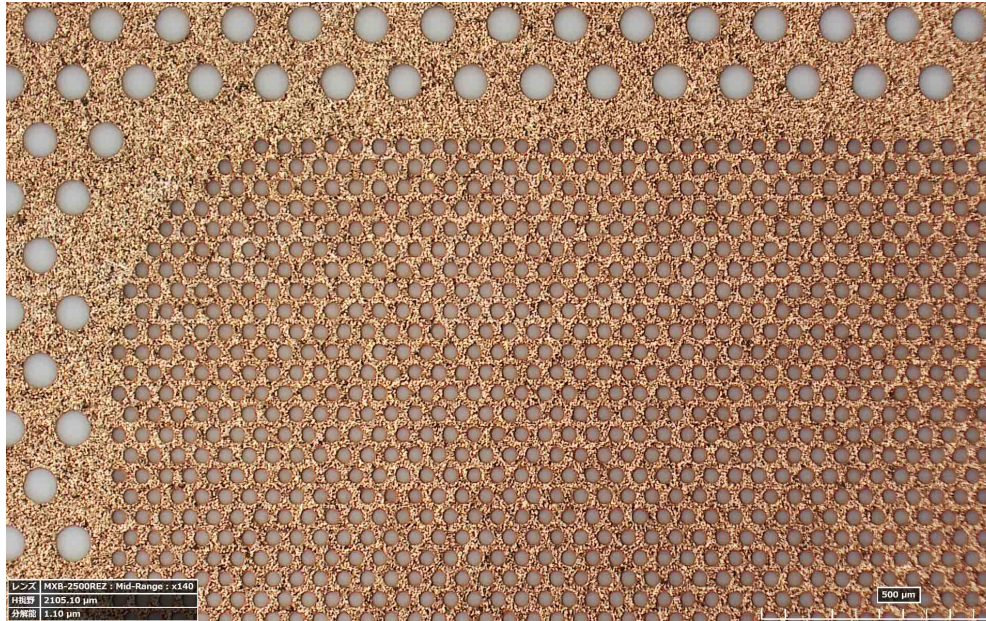
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POLARIZATION SENSITIVE DETECTORS UPDATES

- **Defined IXPE GPD assembly workflow**
 - reflects INFN technical leadership in the process
 - fine-tuning procurement for flight production
- **Flight design GPD Breadboards under test (NEWS D4.1)**
 - stable and within spec
- **Electronics breadboards and Test Equipment produced and tested (NEWS D4.2)**
- **TVAC test in prep to validate GPD thermal control**
- **DU System engineering for IXPE**
 - mass & power budget, mechanical & electrical interfaces

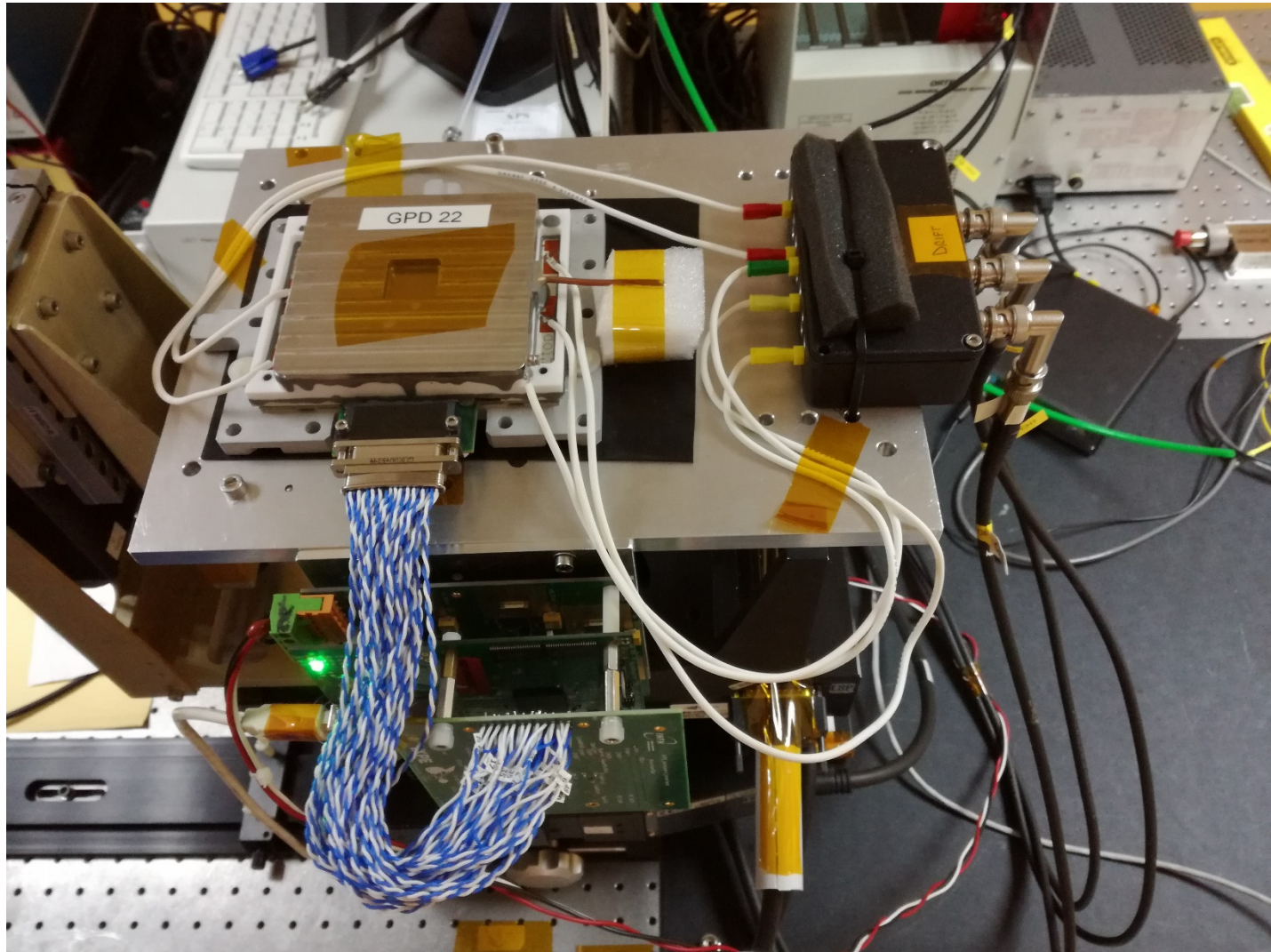
GEM FABRICATION STATUS



■ Towards completing R&D program between INFN & Riken

- Three generation of GEMs produced and tested, with progressively better uniformity of response and time stability
- The RIKEN group uniquely capable of producing 50 um thick / 50 um pitch GEM

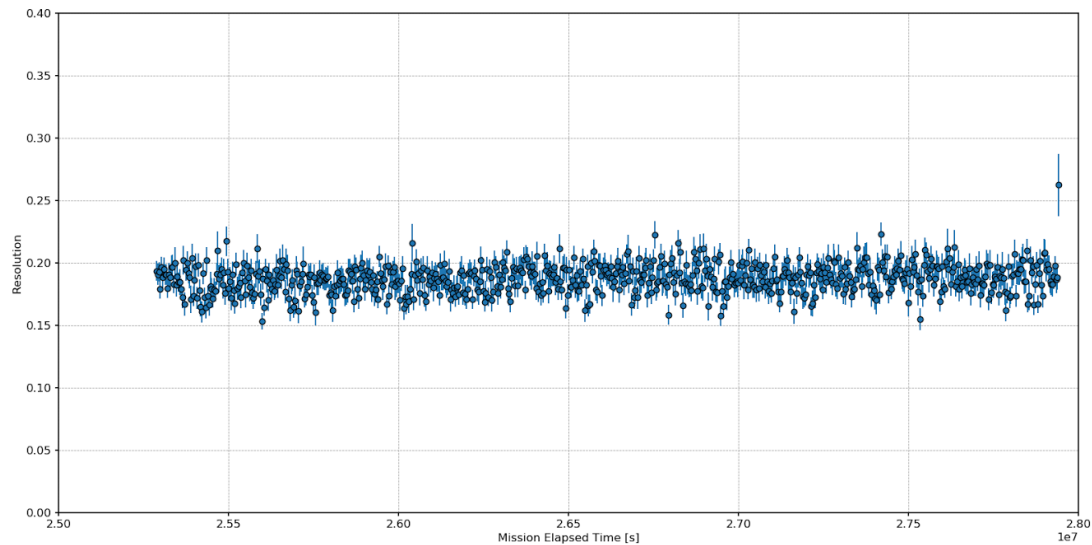
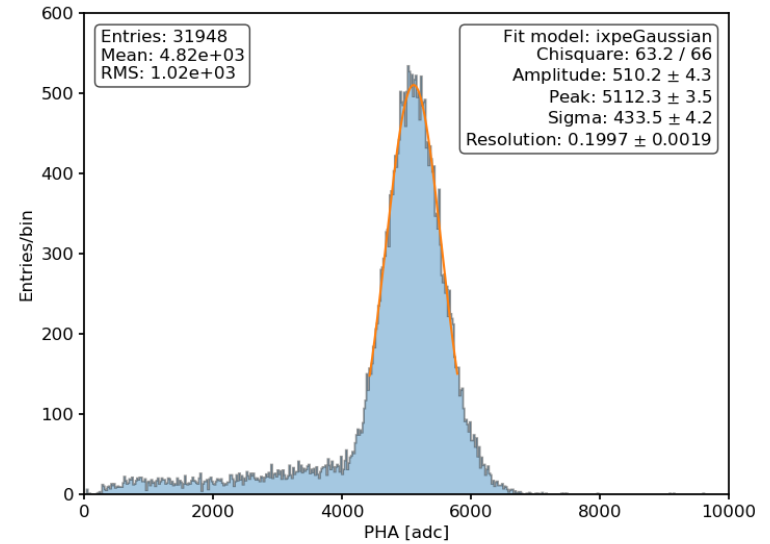
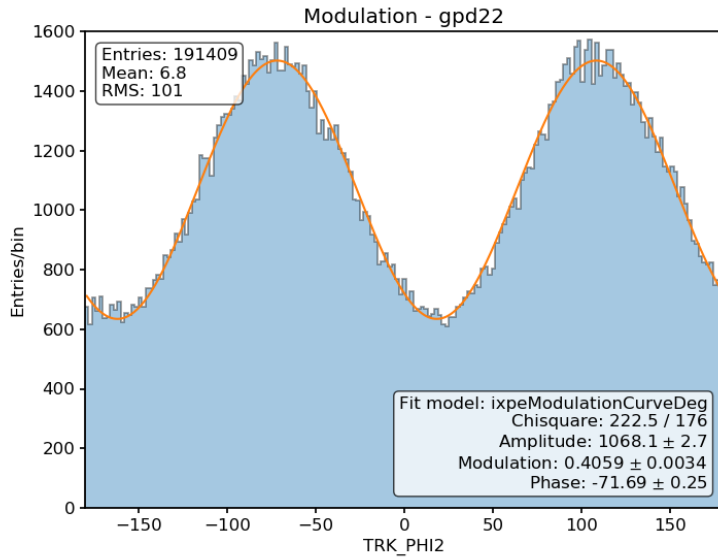
GPD BREADBOARD LABORATORY TEST





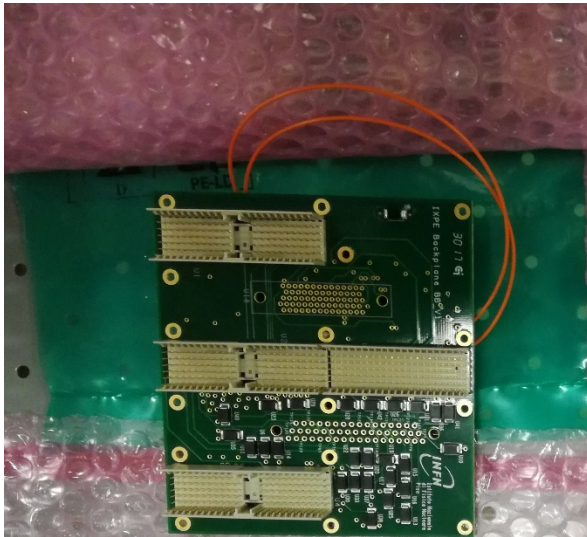
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GPD BREADBOARD LABORATORY TEST



BACK END ELECTRONICS PROTOTYPES

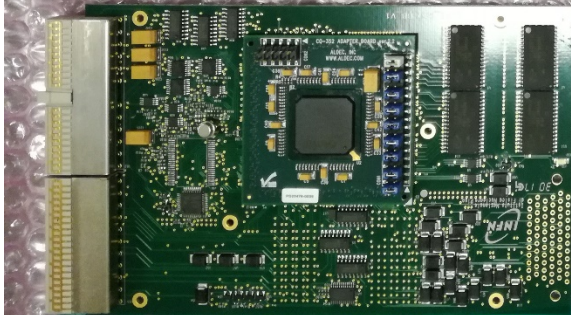
Backplane



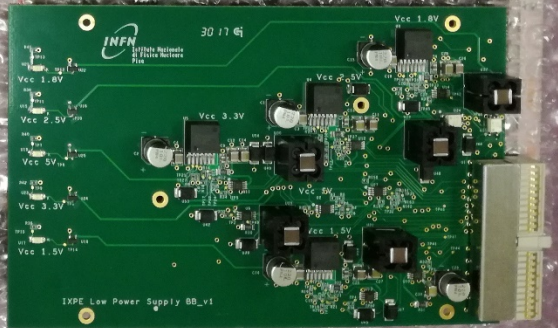
Low voltage



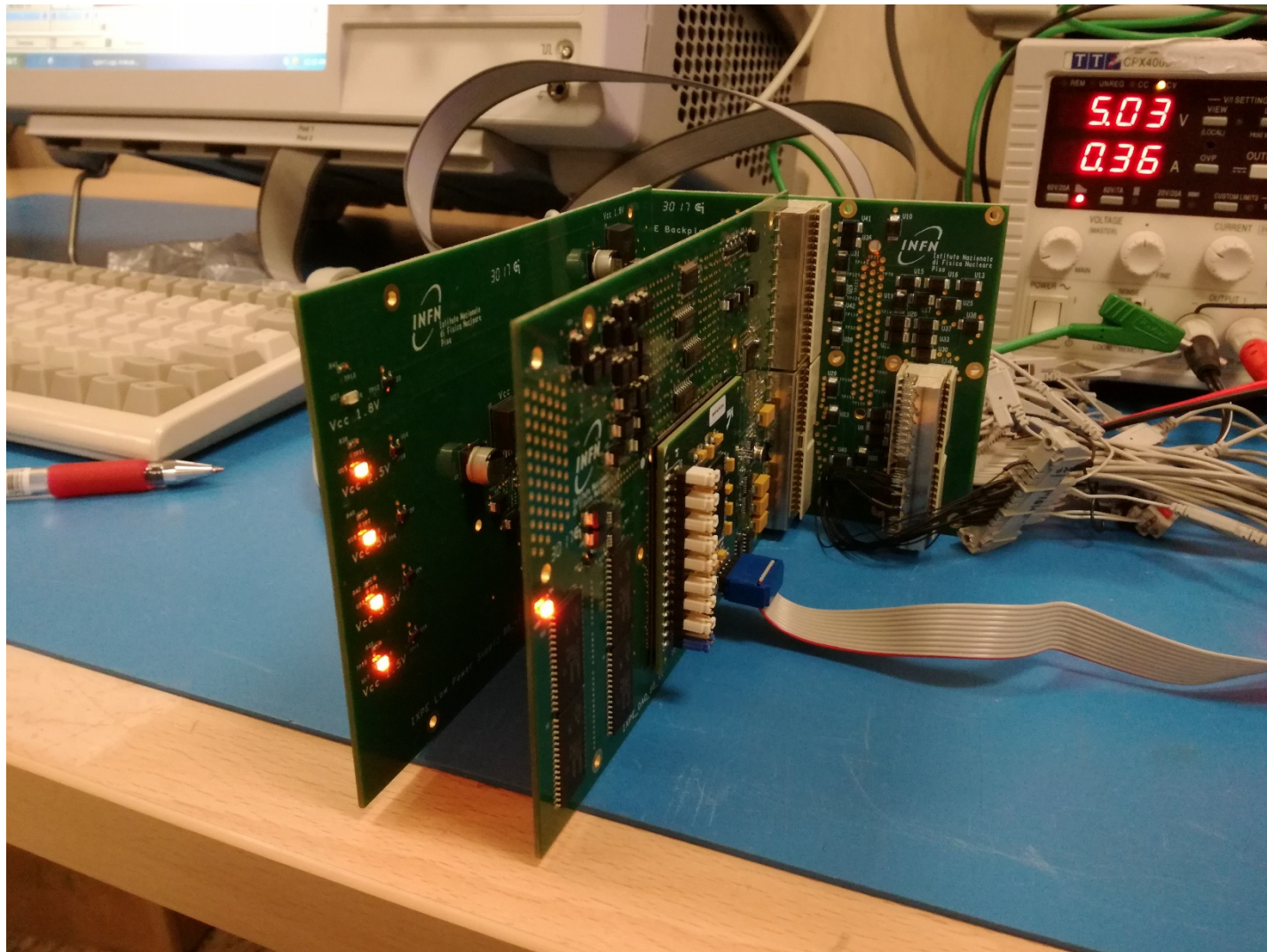
DAQ Board



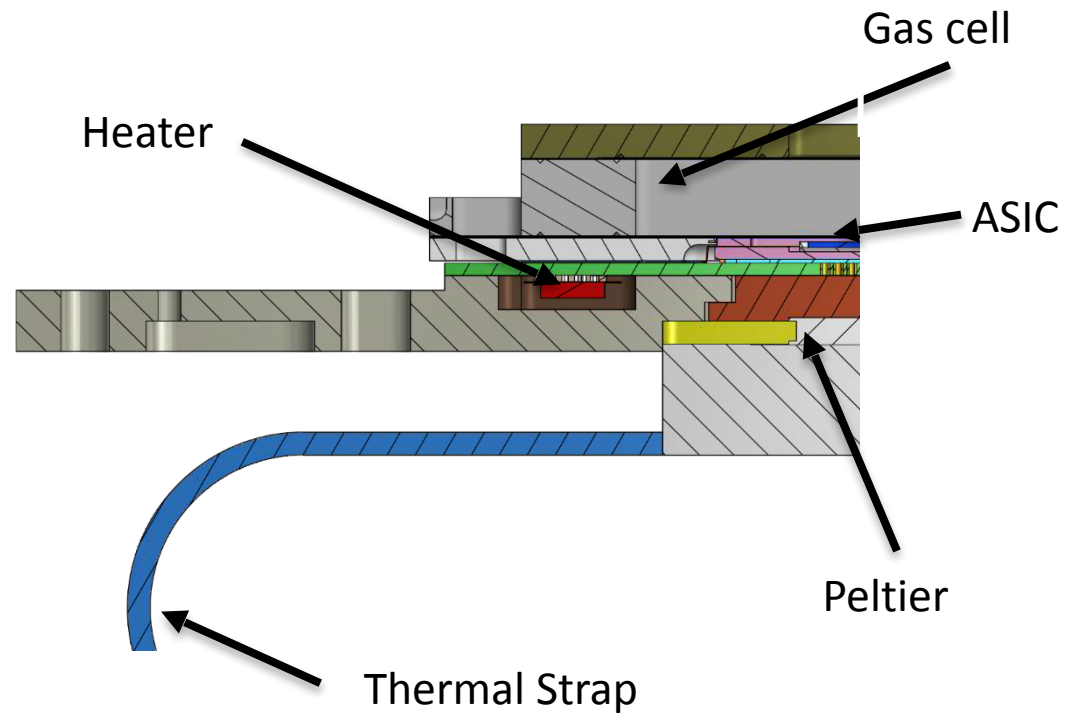
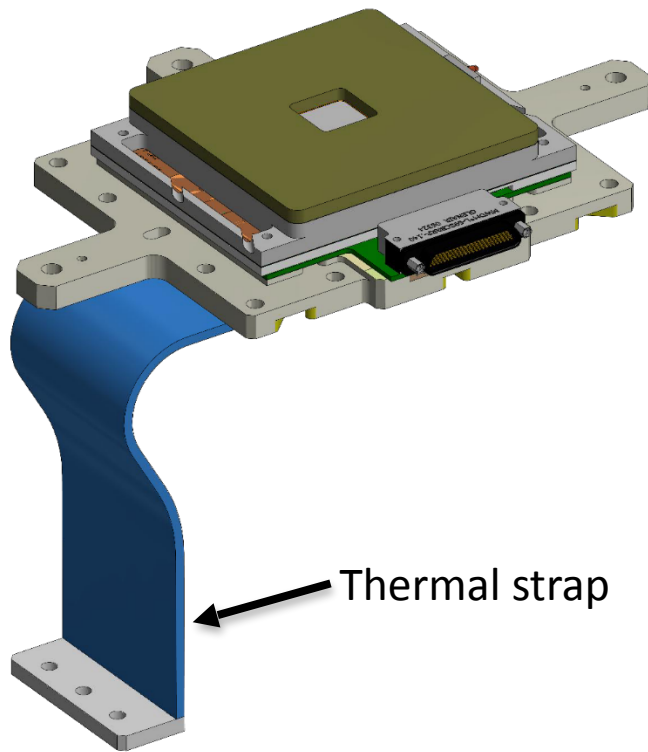
Low voltage



BACK-END ELECTRONICS BREADBOARDING



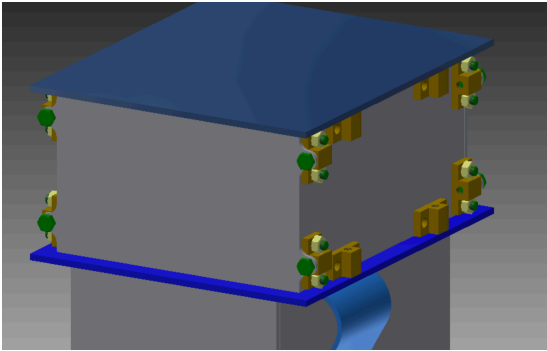
GPD THERMAL CONTROL



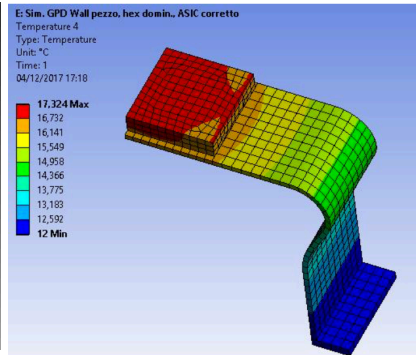


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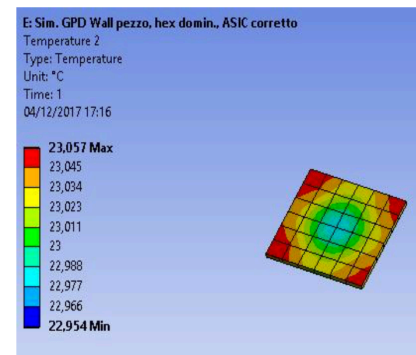
DU TVAC TESTS - THERMAL ANALYSIS



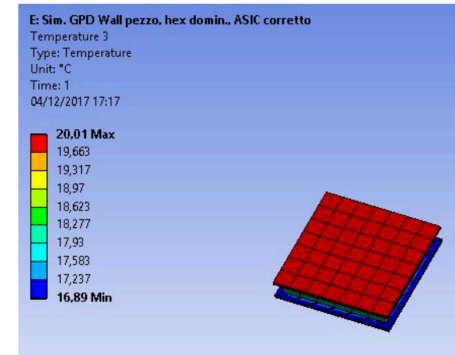
Representative DU housing built with assembled parts



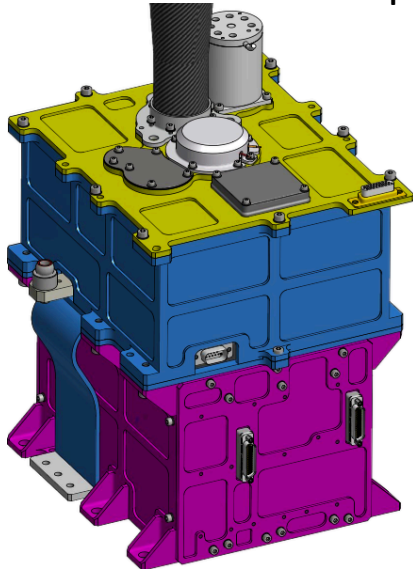
Thermal strap



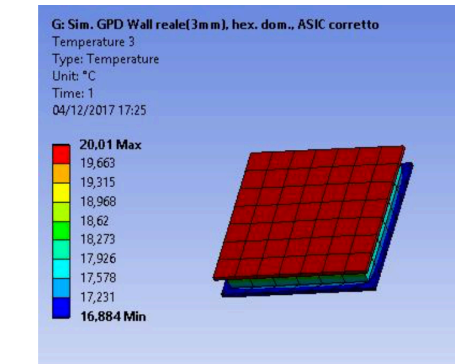
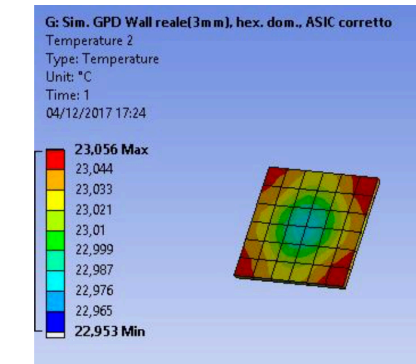
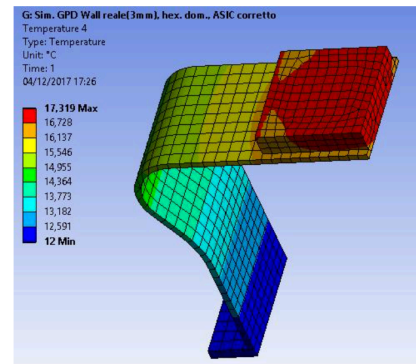
ASIC



Peltier



Flight Design DU monolithic housing





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SCIENCE SOFTWARE

- **Definition of data format for IXPE mission database**
 - science and calibration data
- **Event Reconstruction code refactored, upgraded, documented (NEWS D4.3)**
 - exploring deep-learning techniques
- **Detector Simulation being rewritten**
 - Full Geant4 detector simulation with improved data/MC performance agreement
- **Observation Simulator (NEWS D4.4) refactoring and development to support science analysis software package development (NEWS D4.5)**



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SECONDMENTS

- **Not started yet**
- **Working on a detailed plan to support upcoming activities**
 - **team events at MSFC in the next 6 months**
 - Spacecraft PDR, March 26-28 2018
 - Payload PDR, May 7-11 2018
 - Mission PDR, June 26-28 2018
 - plus prep visits