WP5 - X-Ray Polarimetry Explorers

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

NEWS - Scientific Board Meeting - 25/6/2018

European Commission

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OUTLINE

- NEWS WP5 Status
- IXPE Mission Status
- Development of polarization sensitive detectors (GPD)
- GPD readout Electronics systems
- Software Developments

WP5 Objectives and Deliverables

- **Significant progress in all areas**
- **On track for all project milestones**

Objectives

O5.1: Build a fully functional lab prototype of a Gas Pixel Detector (GPD) for the focal plane of an X-ray polarimetric mission.
O5.2: Study and design the basic components of a space-grade data acquisition system for the GPD.
O5.3: Optimize event reconstruction and classification.
O5.4: Implement an observation-simulation framework for the X-ray polarimetry explorers.
O5.5: Define and implement science analysis tools for the X-ray polarimetry explorers.

List of deliverables

Deliverable Number[14]	Deliverable Title	Lead beneficiary	Type[15]	Dissemination level[16]	Due Date (in months)[17]
D5.1	Design Report of a Space Grade GPD and Associated Data Acquisition System	1 - INFN	Report	Public	36
D5.2	Simulation and Science Analysis Framework for X-Ray Polarimetry	7 - UNIPI	Report	Public	48

WP5 Milestones

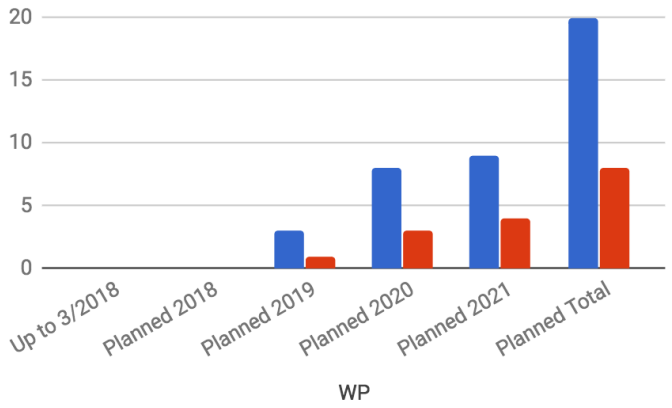
- **Essentially completed**
  - **see charts on GPD construction**

Schedule of relevant Milestones				
Milestone number[18]	**Milestone title**	**Lead beneficiary**	**Due Date (in months)**	**Means of verification**
MS6	Gas Pixel Detector Prototype	1 - INFN	24	The Gas Pixel Detector prototype will be built, thoroughly tested and characterized and will serve as a base for the design and definition of the assembly procedure of the future flight models.

WP5 Secondment Status

- First secondment concluded in April 2018
  - Participation to IXPE Payload PDR by E. Cavazzuti
  - all key people and interfaces exercised, good to go!
- Plan presented at March General Meeting still valid

5. X-ray Polarimetry	20	8	28	Rationale
Up to 3/2018	0	0	0	Mission phase B activities
Planned 2018	0	0	0	Mission phase B activities
Planned 2019	3	1	4	Calibrations at x-ray facilities
Planned 2020	8	3	11	Calibrations and Integration support
Planned 2021	9	4	13	Support to launch and science prep
Planned Total	*20*	*8*	*28*	



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IXPE Mission - Instrument Status

- Instrument Design frozen
  - interfaces defined (mechanical, thermal, electrical)
- Completing qualifications (phase B)
  - Thermal tests
    - Detector Unit Thermal Model
    - GPD Performance vs temperature
  - GPD Environmental tests
- Moving to construction (phase C)
  - streamlining procurement

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IXPE Milestones

- **Instrument level (on IT team at IT agencies)**
  - ✓System Requirement, 12/2017
  - ✓Preliminary Design, 3/2018
  - ✓Critical Design, 5/2018
- **Other subsystem and mission level**
  - ✓spacecraft PDR, 3/2018
  - ✓Payload PDR, 4/2018
  - ➡ Mission PDR, 6/2018
  - ➡ Key decision point for mission adoption, 8/2018

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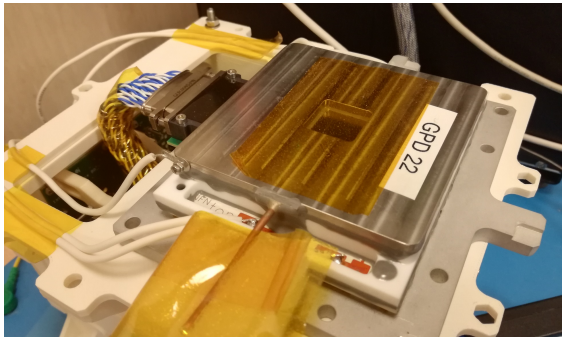
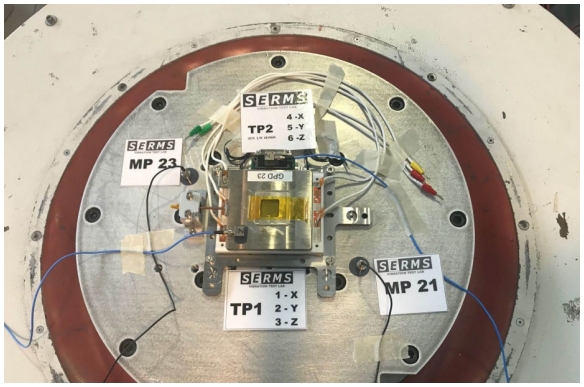
GAS PIXEL DETECTORS DEVELOPMENT - O5.1

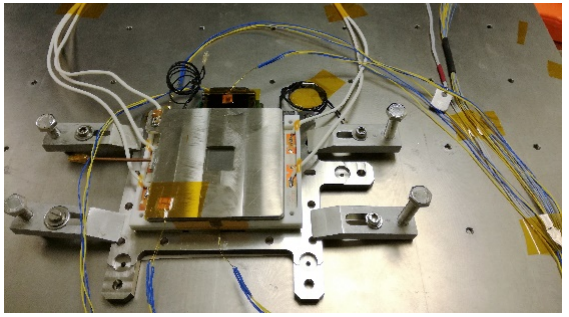
- **Built 3 flight-like engineering models for IXPE**
  - **GDP-22 - operated 9 months w/o performance change**
  - **GDP-23/24 - environmentally tested w/o change**
- **Identified remaining issues in production flow**
  - **bad supplier of mechanical parts (GPD23)**
  - **error in gas filling operations(GPD24)**



GPD22 Long term tests



GPD23 Vibrations setup



GPD24 TVAC test

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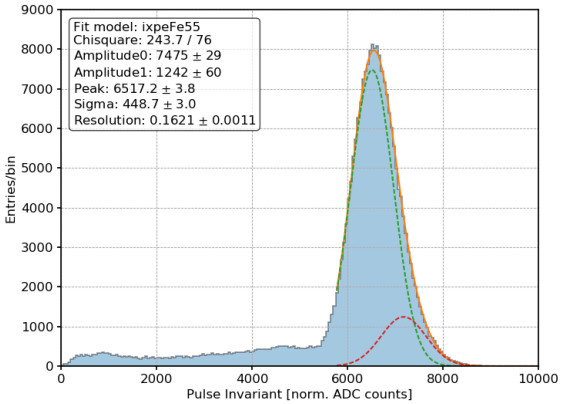
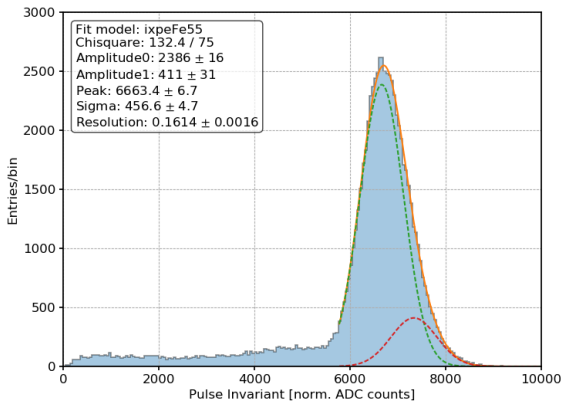
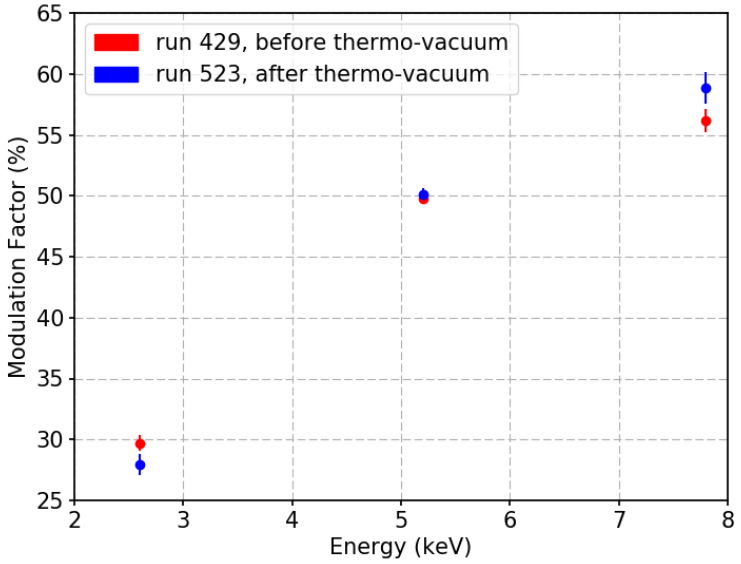
GPD Performance results

Environmental tests produce no performance change





GPD23 energy resolution before / after vibrations



GPD23 modulation factor before / after TVAC

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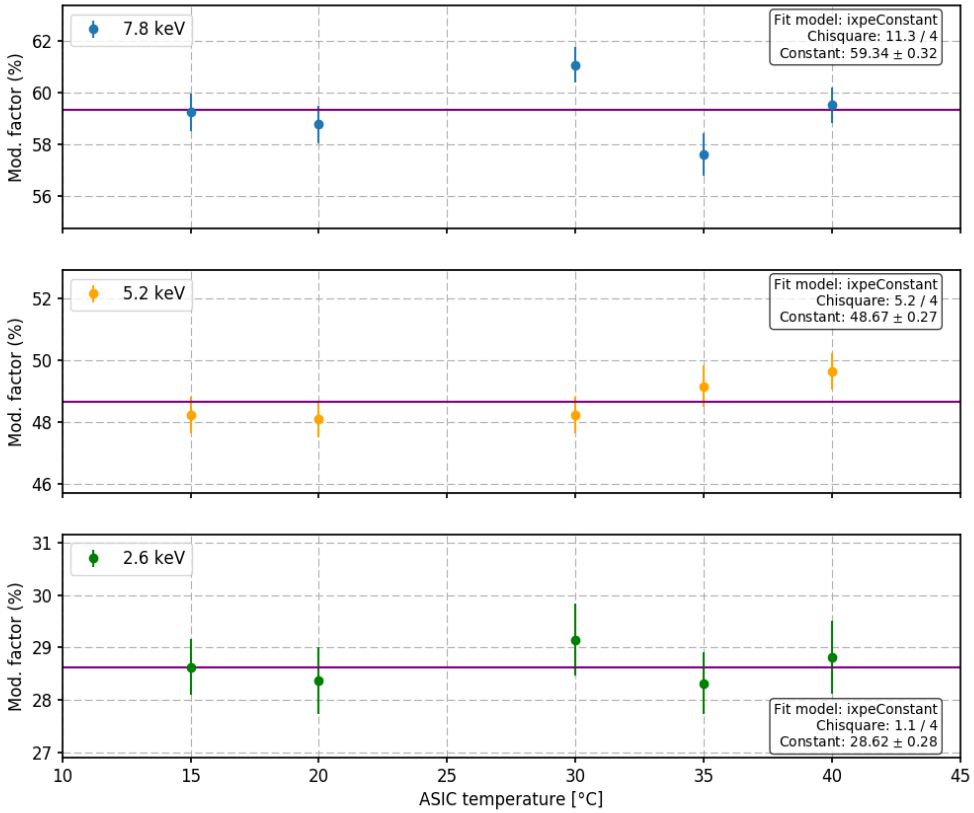
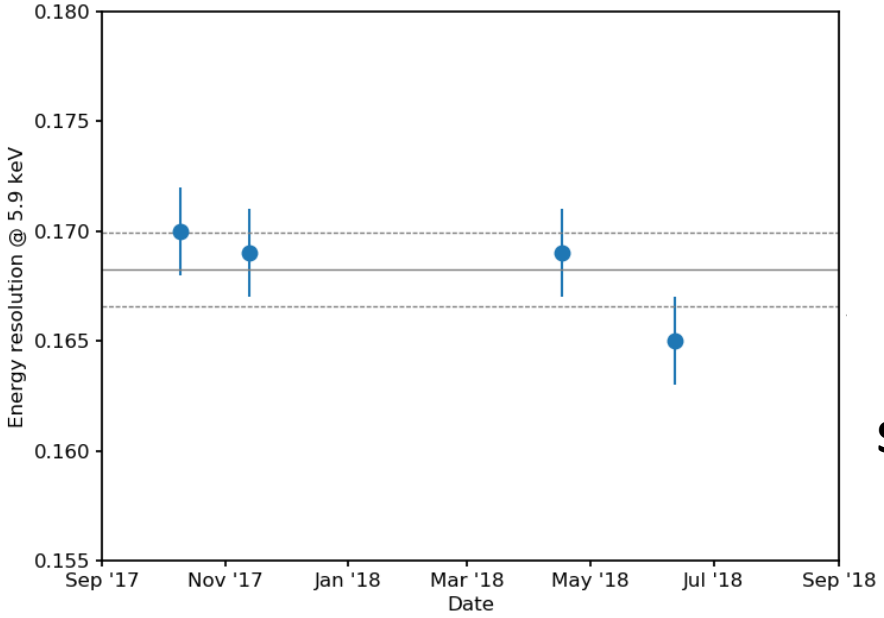
GPD Performance Results

Stable across extended temperature range (15-40C)

GPD22 modulation factor vs temperature





Stable over long term operations

GPD22 energy resolution is stable within +/- 1% over 9 months

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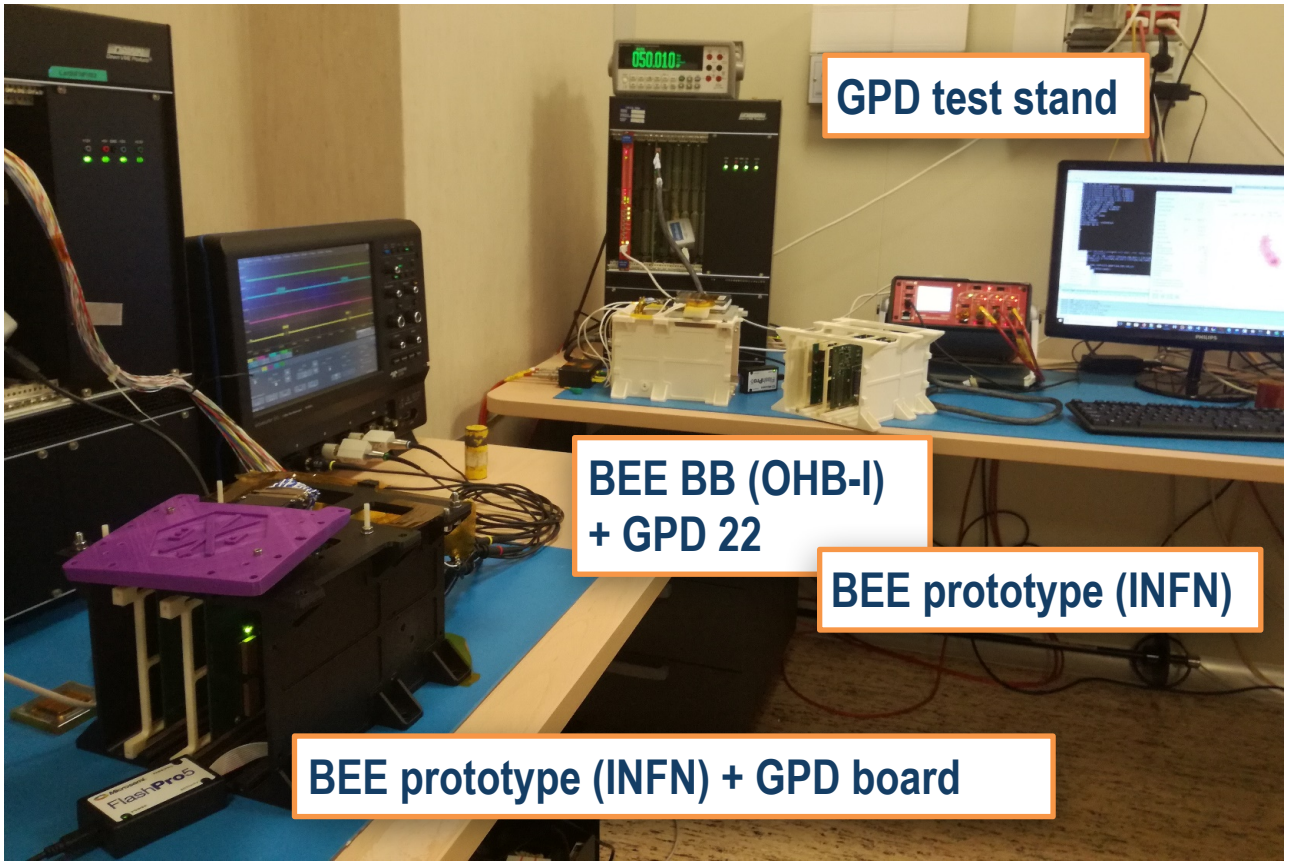
BACK END ELECTRONICS

- **Full DAQ and power (HV, LV) board set available**
- **Engineering Model set being produced**



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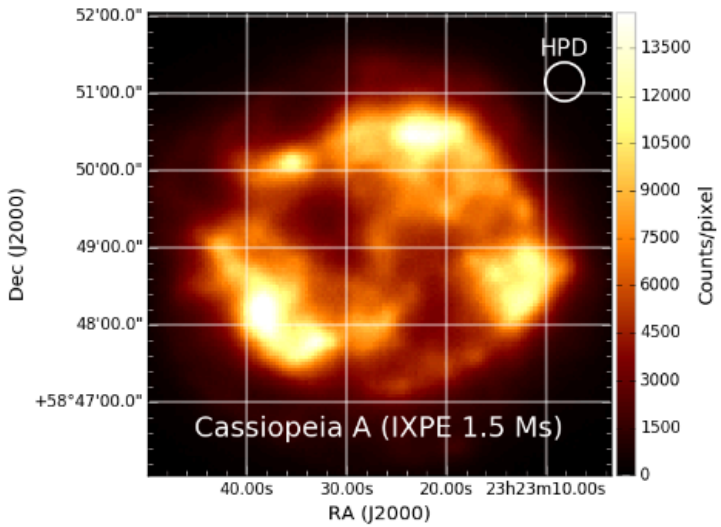
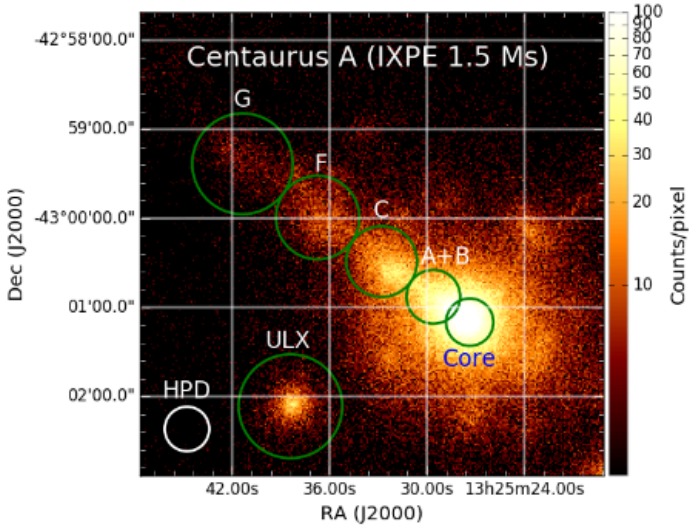
SOFTWARE DEVELOPMENTS

- **Active development of Science Analysis Software**
  - **IXPE dedicated group started in April, 3 meetings so far**
  - **one international school on polarimetry**
    - https://www2.pd.infn.it/astro/pers/asiago2018/index.html
- **Science groups building science cases with observation simulator**





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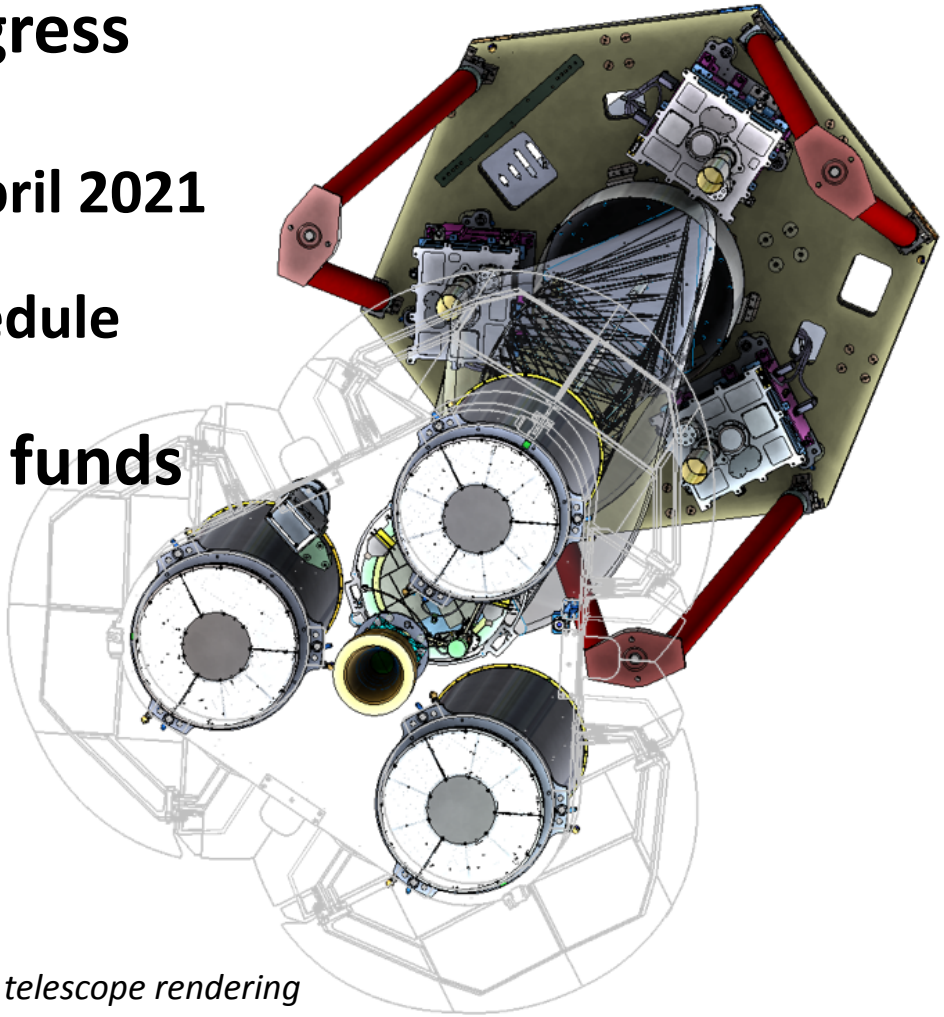
CONCLUSIONS

- **All areas see much progress**
- **IXPE launch planned for April 2021 well in line with NEWS schedule**
- **Secondments on NEWS funds have started**

Detector Unit on the IXPE focal plane



IXPE telescope rendering