XRO (X-Ray Observatories) Status & Requests INFN-Pisa 2023

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Introduction

- XRO includes 2 space missions---replacing IXPE_INFN and extending to e-XTP

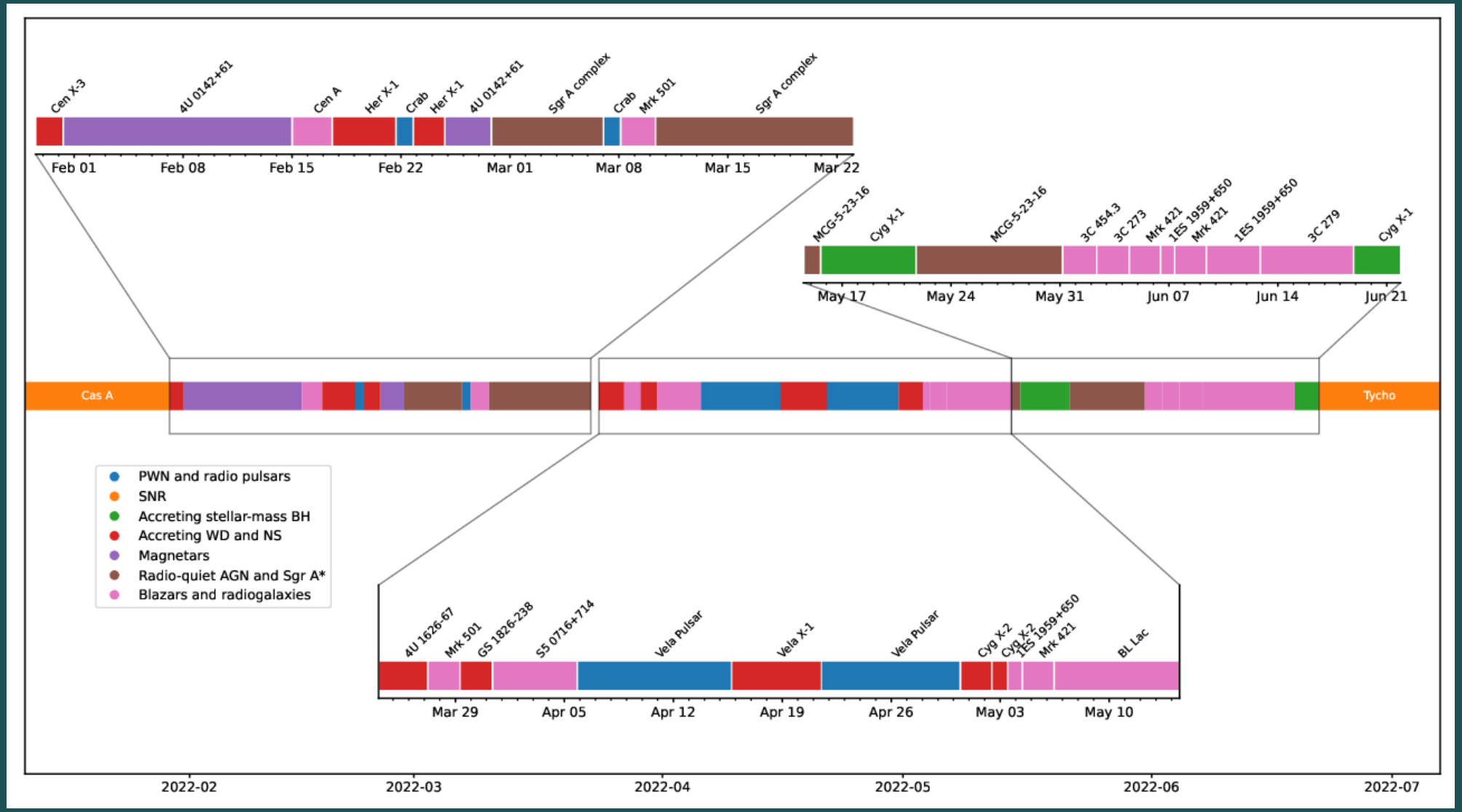
- Imaging X-ray Polarimeter Explorer (**IXPE**) mission
  - NASA Small Explorer devoted to polarimetry in 2-8 keV band
  - Gas Pixel Detector developed at INFN
  - Launched on December 8, 2021

- enhanced X-ray Timing and Polarimetry (**e-XTP**) mission
  - A flagship X-ray observatory mission, being developed by the Chinese Academy of Sciences, with a large contribution by a European Consortium
  - Pisa is involved in the Polarimetry Focusing Array (PFA), which is based on the same type of polarization-sensitive GPD
  - Other INFN sections are working on the other subsystems (LAD, WFM)
  - International situation now maximally uncertain, but the completion of phase B (end of 2023) non in discussion

IXPE: status

- Successfully launched on December 8, 2021
  - From the historical launch pad 39
  - Launcher: Space X Falcon 9
- Instrument commissioning: 1 month
  - Largely uneventful
  - Detectors working nominally
- Year 1 observing plan started on January 8, 2022

- 23 targets observed in the first 6 months
- Polarization detected with high significance for 8 (Crab at 100 sigma)
  - Papers submitted to journals or being finalized

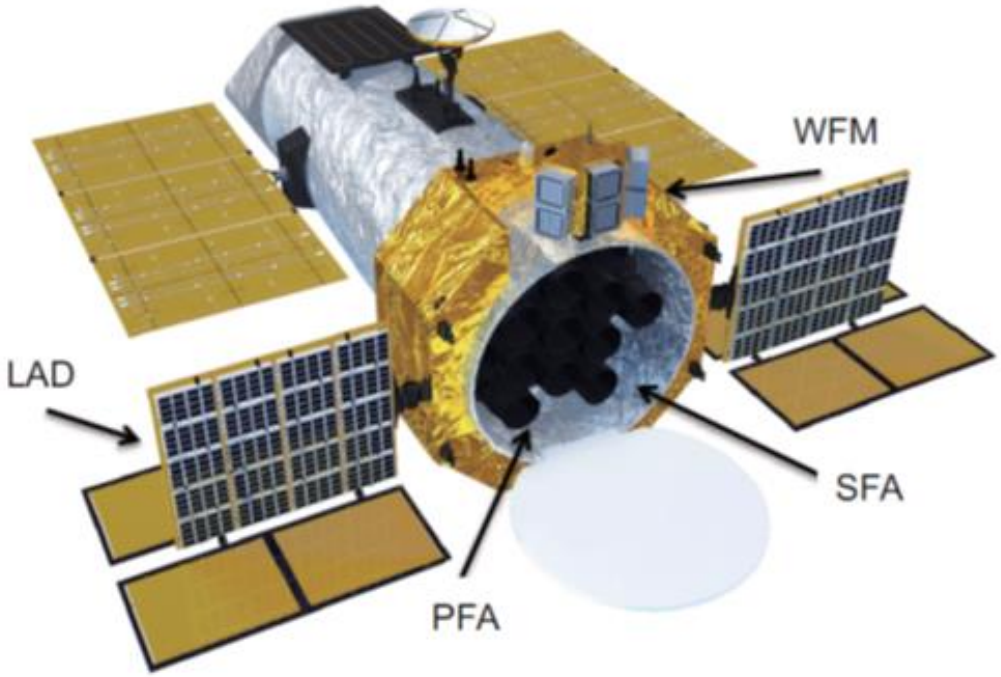


eXTP program

- SFA: Spectroscopic Focusing Array
- PFA: Polarimetry Focusing Array
- LAD: Large Area Detector
- WFM: Wide Field Monitor

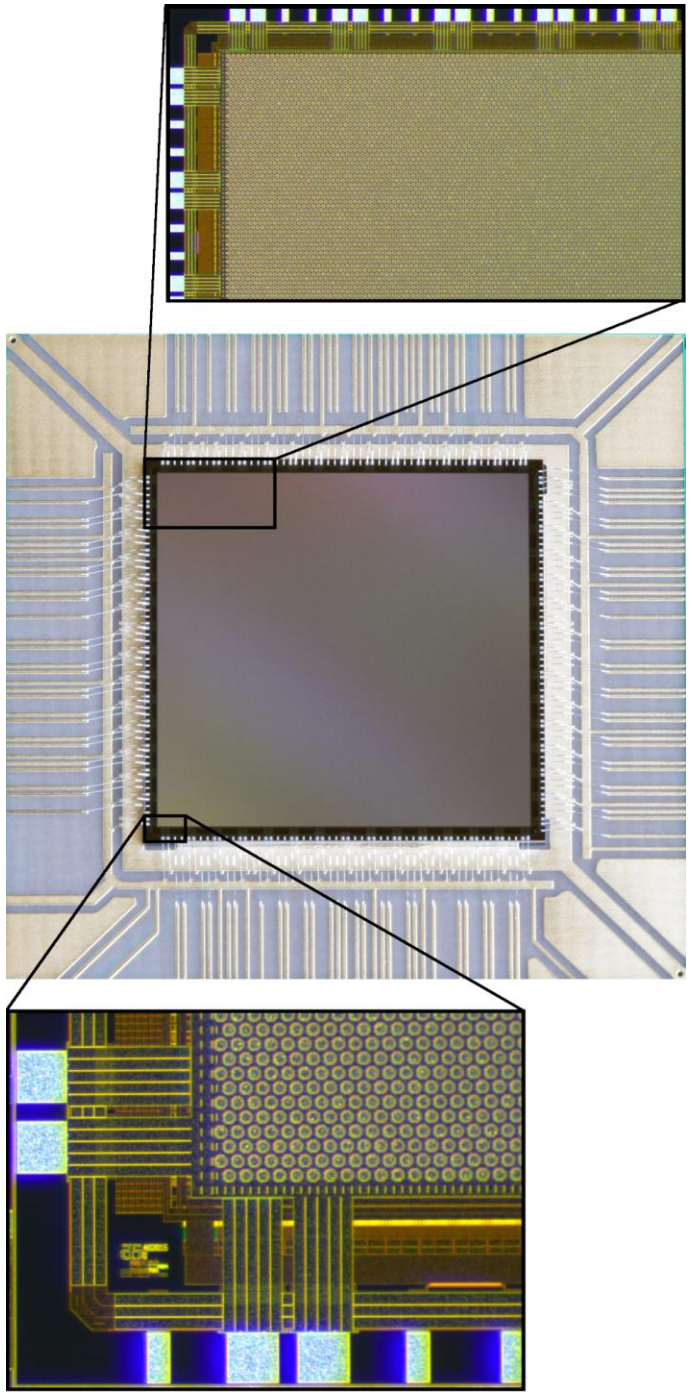
INFN key technologies

- Pisa and Torino involved in the PFA
  - Reduce deadtime (readout ASIC)
  - Reduce systematics (gain stage)
- GPD design and prototyping in Italy
- Flight production in China



Activity in Pisa: testing the new ASIC

- e-XTP features a much larger effective area than IXPE
  - Old ASIC inadequate
- XPOL III designed and produced in 2021/2022
  - Specific design changed to increase the thruput by a factor of 10
- Initial tests showing that the chip works as advertised
- Detailed characterization and long-term studies will continue in 2023

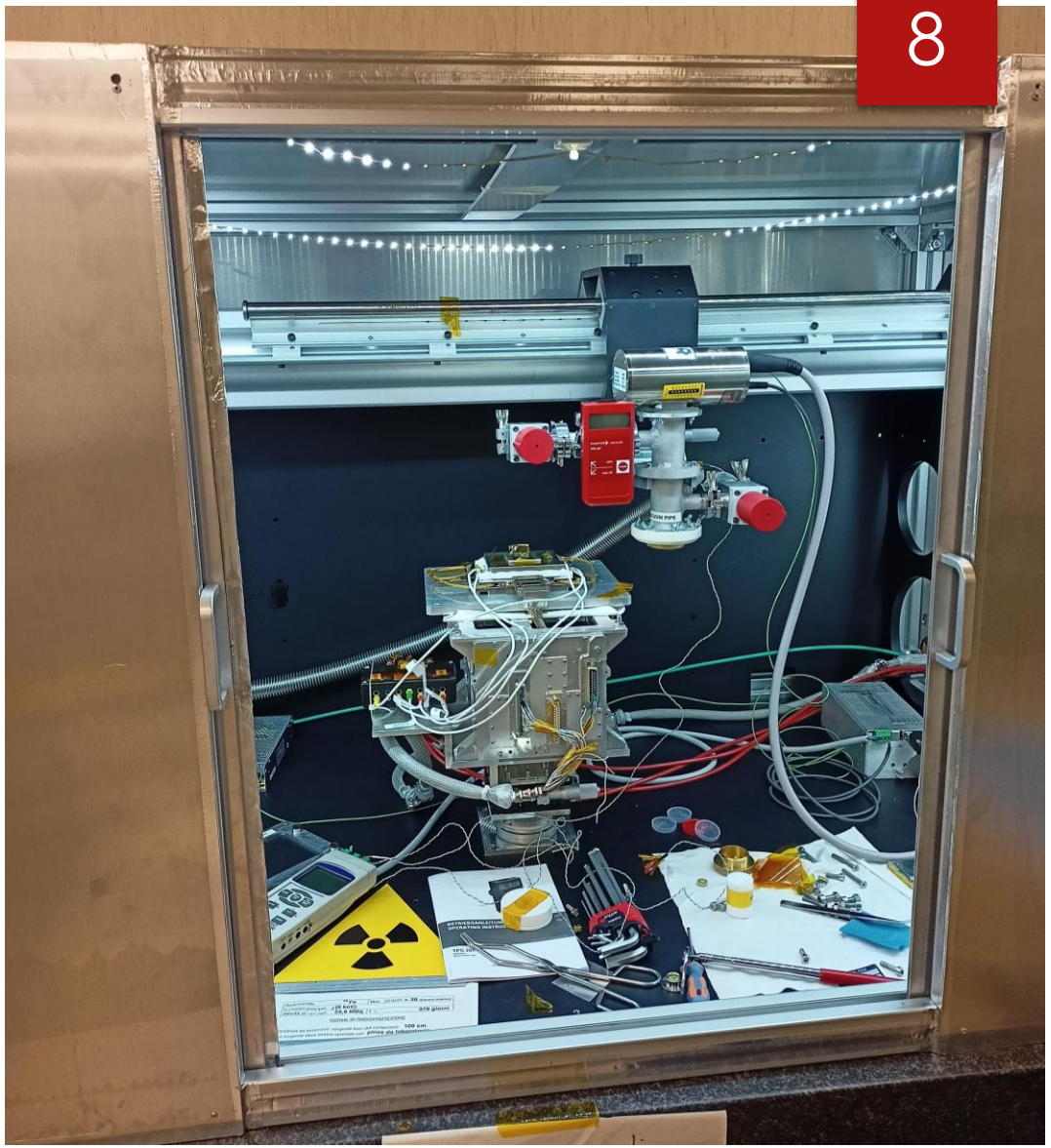


Activity in Pisa: GPD filling

- Bakeout and Filling System (**BFS**) now fully operational
  - Replaces and supersedes the facility at Oxford (Finland) used for IXPE
- All the basic functionalities successfully tested
  - Bake-out
  - Filling with Ar or DME
  - GPD functional tests

Activity in Pisa: GPD X-ray test

- X-ray testing facility now fully operational
- Tube with 2.7 keV peak
  - Direct (non-polarized) beam
  - Bragg polarizer



Attivitè e richieste per il 2022

- Supporto analisi dati scientifici
  - Missioni (incluso collaboration meetings e conferenze): 20 k
- Sviluppo GPD di nuova generazione
  - Progetto sviluppo GEM in convenzione con FBK: 10 + 5 k
  - Coating Capillary plate: 10 k
  - Sviluppo GEM ceramiche (con Techtra): 20 k
  - Consumi: 5 k

- Supporto del personale dalla Sezione:
  - Alte tecnologie: Ceccanti (15%) per incollaggi e metrologia, Profeti (10%) per microsaldatura ASIC

- Spazi e attrezzature nella camera pulita
  - Assemblaggio detector (classe 10k)
  - Test stand per sviluppo elettronica
  - Test stand per tubo raggi X
  - Stazione di bakeout e filling dei rivelatori
- Laboratorio n.13 (Fermi)

Anagrafica XRO Pisa

Nome	Affiliazione	FTE
Baldini Luca (Resp. nazionale)	Università di Pisa	0.6**
Bellazzini Ronaldo	INFN	0
Brez Alessandro	INFN	0.5
Lucchesi Leonardo	TD INFN (tecnologo)*	1
Manfreda Alberto	Assegnista INFN	1
Minuti Massimo	INFN	0.25**
Orsini Leonardo	TD INFN (tecnologo)*	1
Pesce-Rollins Melissa	INFN	0.5
Pinchera Michele	INFN	0.7
Sgro' Carmelo (Resp. locale)	INFN	0.5**
Shore Steven	Università di Pisa	0.5
Silvestri Stefano	Università di Pisa	1
Spandre Gloria	INFN	0

Nome	Affiliazione	FTE
Drago Alessandro	Universita' di Ferrara	0.1 (TBC)
Pagliara Giuseppe	Universita' di Ferrara	0.1 (TBC)

* under ASI-INFN agreement n.2017-13-H.0
** 3 mesi-uomo anno su PNRR spazio non inclusi

Total: 7.5 + 0.2 FTE

Digressione PNRR-PE 15 (Spazio)

- Partenariato esteso gestito da ASI (in attesa del bando a giorni)
- Proposta in preparazione, a guida PoliTO, con 9 spoke
- INFN leader dello spoke 4 (sensori non imaging)
  - Luca Latronico (INFN-TO) responsabile dello spoke
  - Partecipanti: INFN (lead), UNITN, INAF, UNIPI, UNINA, GSSI (co-lead), FBK
  - WP1: MAPS/LGAD, WP2: SiPM, WP3: gravimetri, WP4: progetti INAF
- Pisa espone 5 persone con 3 MU/anno ciascuna su WP1
  - Minuti, Sgrò (INFN-Pisa), Baldini, Cei, Nicolò (UNIPI)

- Offspring del PNRR: Dottorato Nazionale in Space Science and Technology (SST)
  - Coordinato da UNITN, con 7 curricula
  - Accreditato per il XXXIIX ciclo con 36 borse (di cui 3 UNIPI), bando in uscita a giorni
  - Borsa UNIPI per "Modeling and experimental study of astrophysical processes across the electromagnetic spectrum"