

# NAHEPaM - NewATHENA High Energy Particle Monitor

## Charting a course forward

### Planned Launch

2037  
By an Ariane 6.4 vehicle to the first Sun-Earth Lagrangian point in a halo orbit

### Adoption

2027  
By the Science Programme Committee of ESA

### Phase A

2024  
Restarting industrial activities

### Selection

2014  
Hot and Energetic Universe proposal

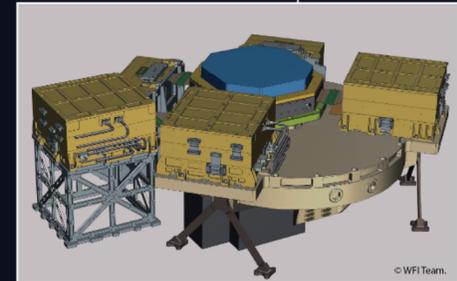
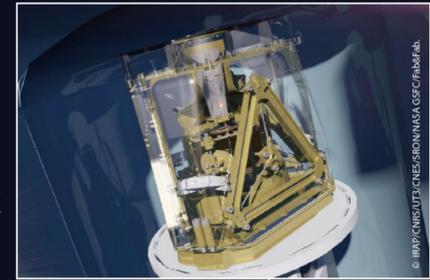
## The Athena X-ray observatory

Ariane 6  
L1 orbit  
4 years nominal mission  
+ possible extensions  
ToO response  $\leq 4$  hrs

X-ray Integral Field Unit:  
 $\Delta E$ : 2.5 eV  
Field of view: 5 arcmin  
Operating temperature: 50 mK

Silicon Pore Optics:  
1.4 m<sup>2</sup> at 1 keV  
5 arcsec HEW  
Focal length: 12 m  
Sensitivity:  $3 \cdot 10^{-17}$  erg cm<sup>-2</sup> s<sup>-1</sup>

Wide Field Imager:  
 $\Delta E$ :  $< 80$  eV at 1 keV  
Field of view: 40 arcmin  
Small/Fast detector for bright sources



© Athena mission: ESA/IRAP/CNRS/UT3/CNES/Fab&Fab. Background: pixabay (dawnydawny). Composition: ACO.

## Agata Różańska + NewATHENA.PL, CAMK PAN, 03.02.2026

# NAHEPaM - NewATHENA High Energy Particle Monitor

Should provide Non X-Ray Background knowledge to improve science cases from two main NewAthena detection systems: Wide Field Imager [WFI] and X-ray Integral Field Unit [X-IFU].

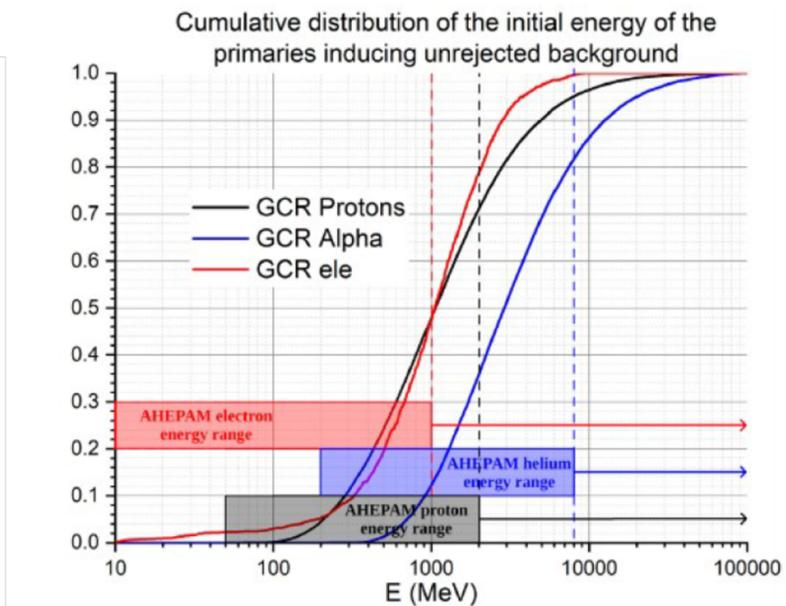
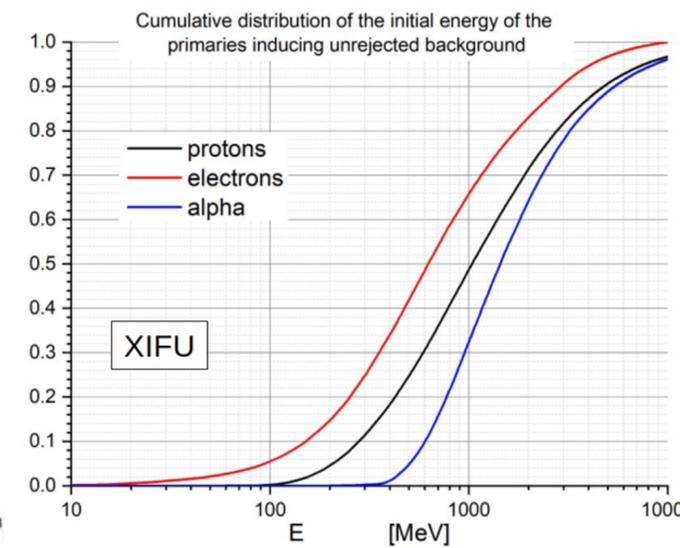
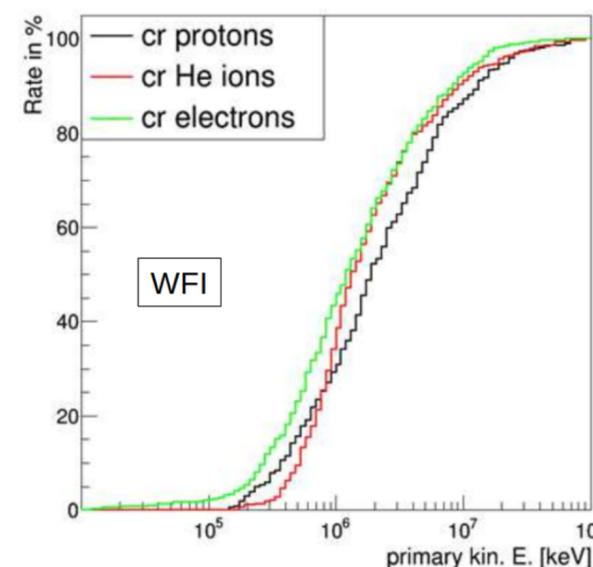
The goal is to achieve 2% absolute knowledge error (9acrmin<sup>2</sup>, 2-7keV/2-10keV, 68%cl, 100ks) of non-focused charge particle background count-rate.

## Principal aims of NAHEPaM:

- to provide an assessment on the contamination/background of XIFU and WFI induced by:
  - Galactic Cosmic Rays (GCR)
  - Solar Energetic Particles (SEP)
- Discriminate electrons from protons
- Upper energy range (penetrating particles)
- Protons: 2% accuracy in 40 ks in 5 energy bands
- Electrons: Similar relaxations, but electrons are driving the instrument design. We need to review electron particle events to show that we can further relax these requirements.
- Helium nuclei: Probably not a problem.

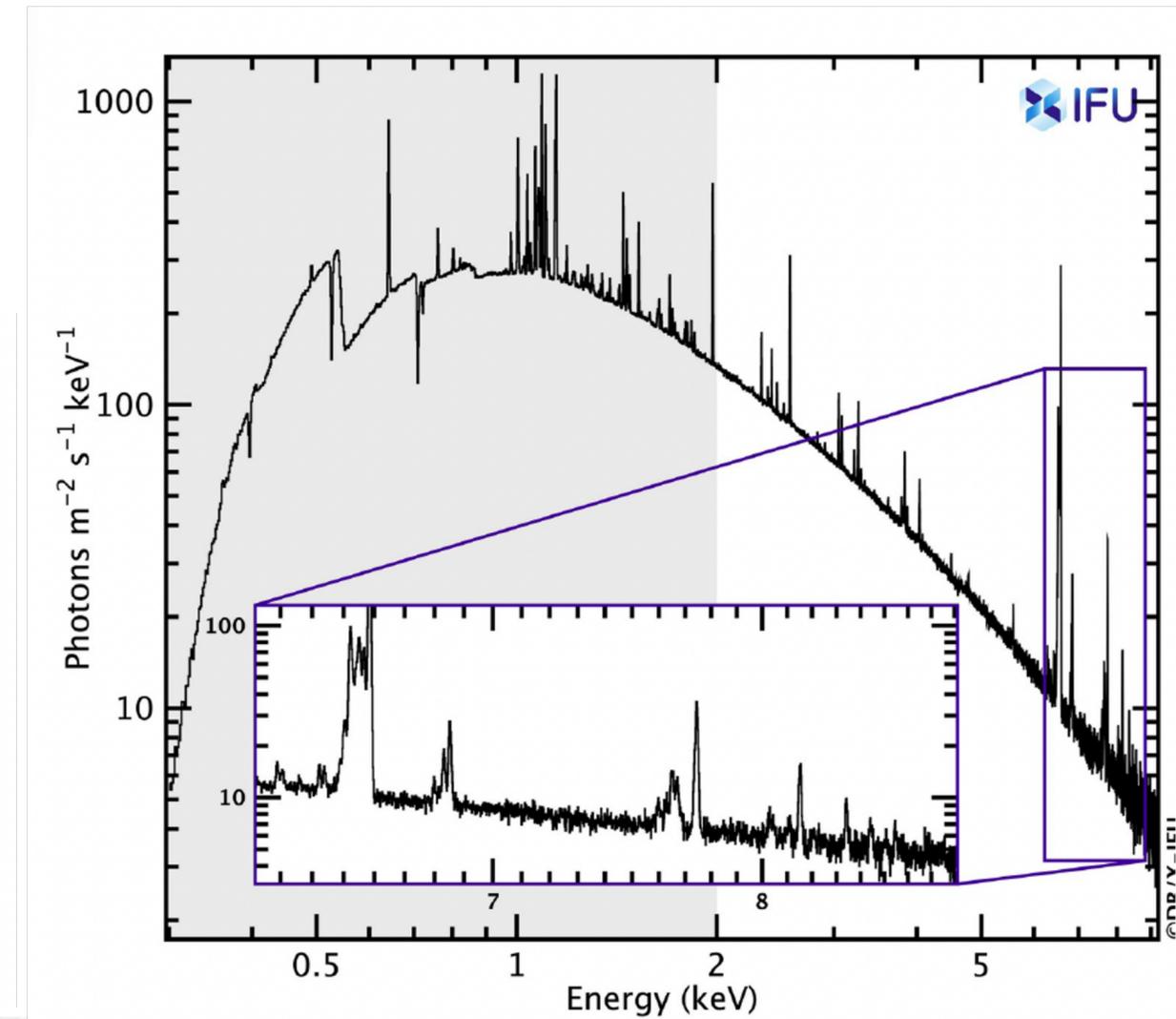
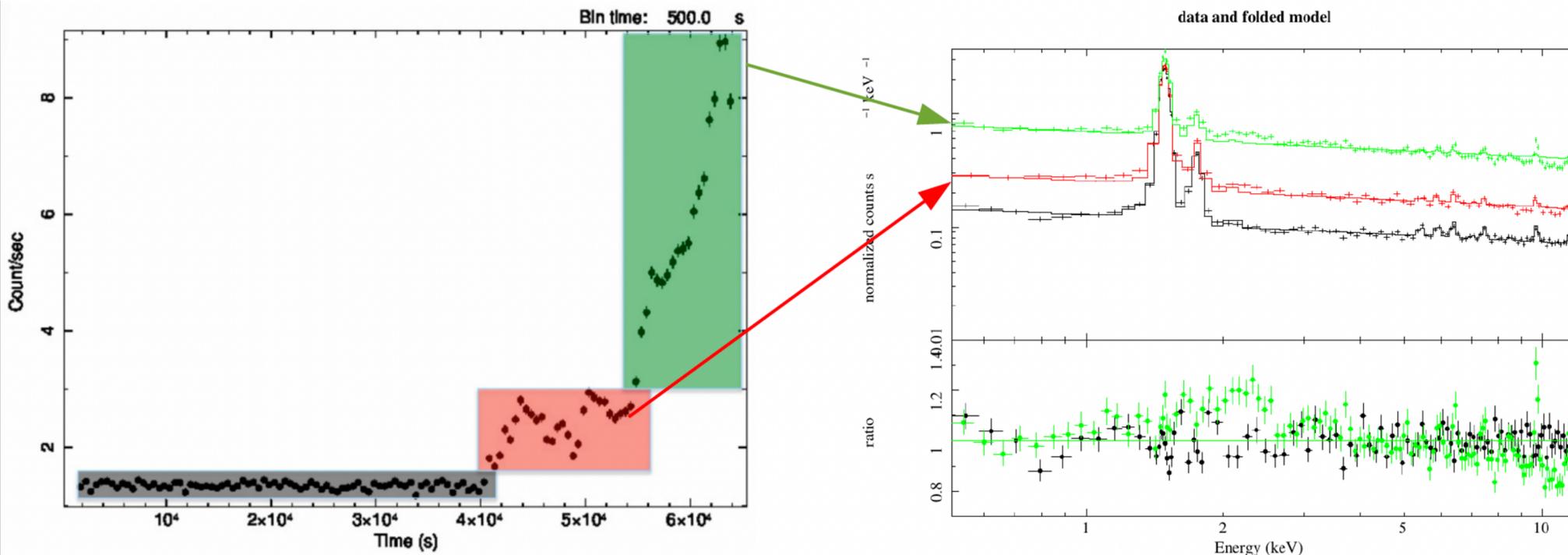
Table 2: Summary of requirements and associated motivations.

Requirement	Protons	Electrons	He ions	Motivation
Energy range	0.1-2.0 GeV	0.05-1.0 GeV	1-3 GeV	See Sect.6.1
Abs.precision	N.A.	N.A.	N.A.	Absolute calibration
Rel.precision	0.5%	1%	N.A.	Spectral shape
Rel.to prot. prec.	N.A.	2.5%	5%	Normalization
Stat.acc. >3ks	1% in 2 bands	5% in 2 bands	10% in 1 band	Temporal variations
Stat.acc. >10ks	1% in 5 bands	5% in 5 bands	N.A.	Spectro-temp. variations



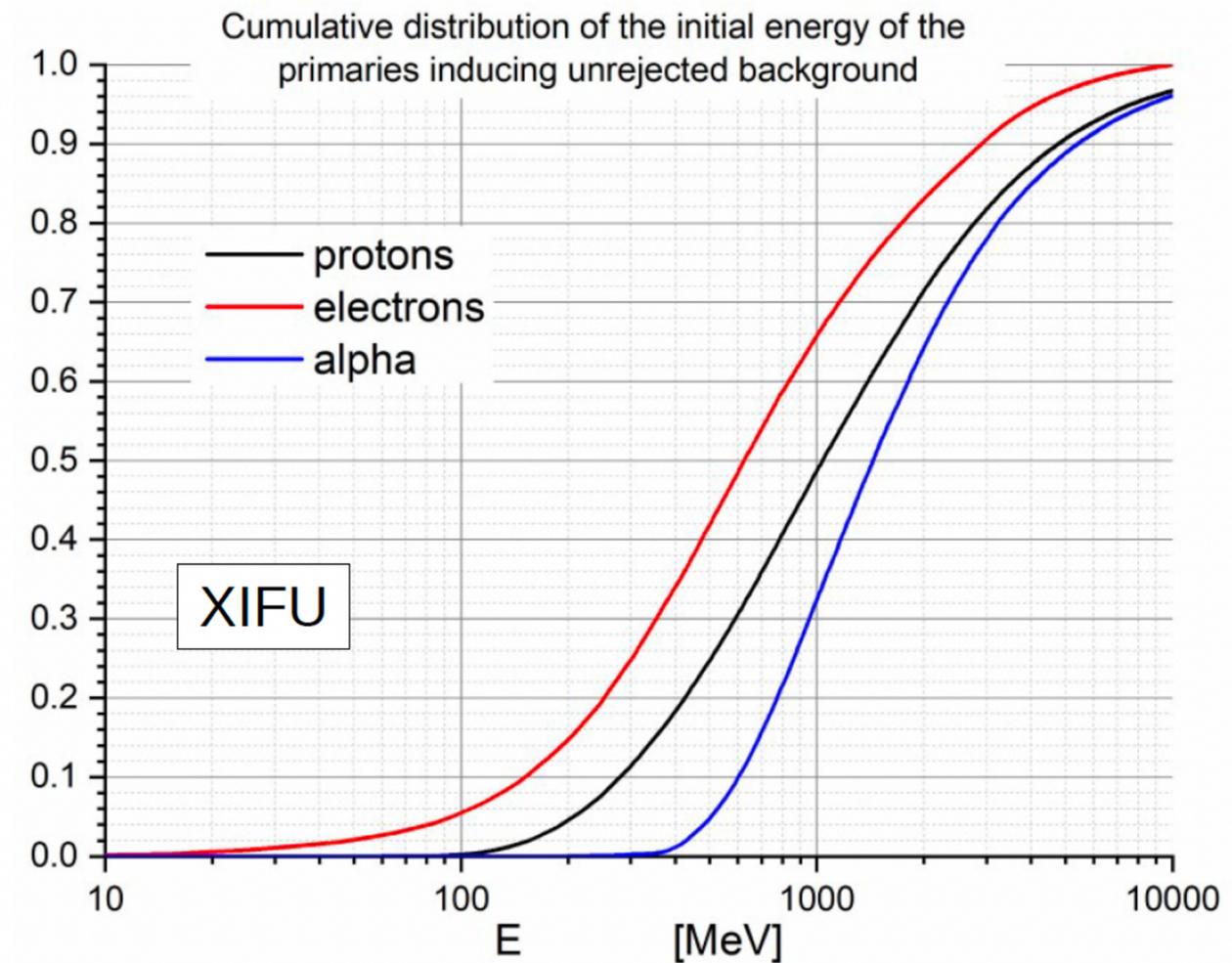
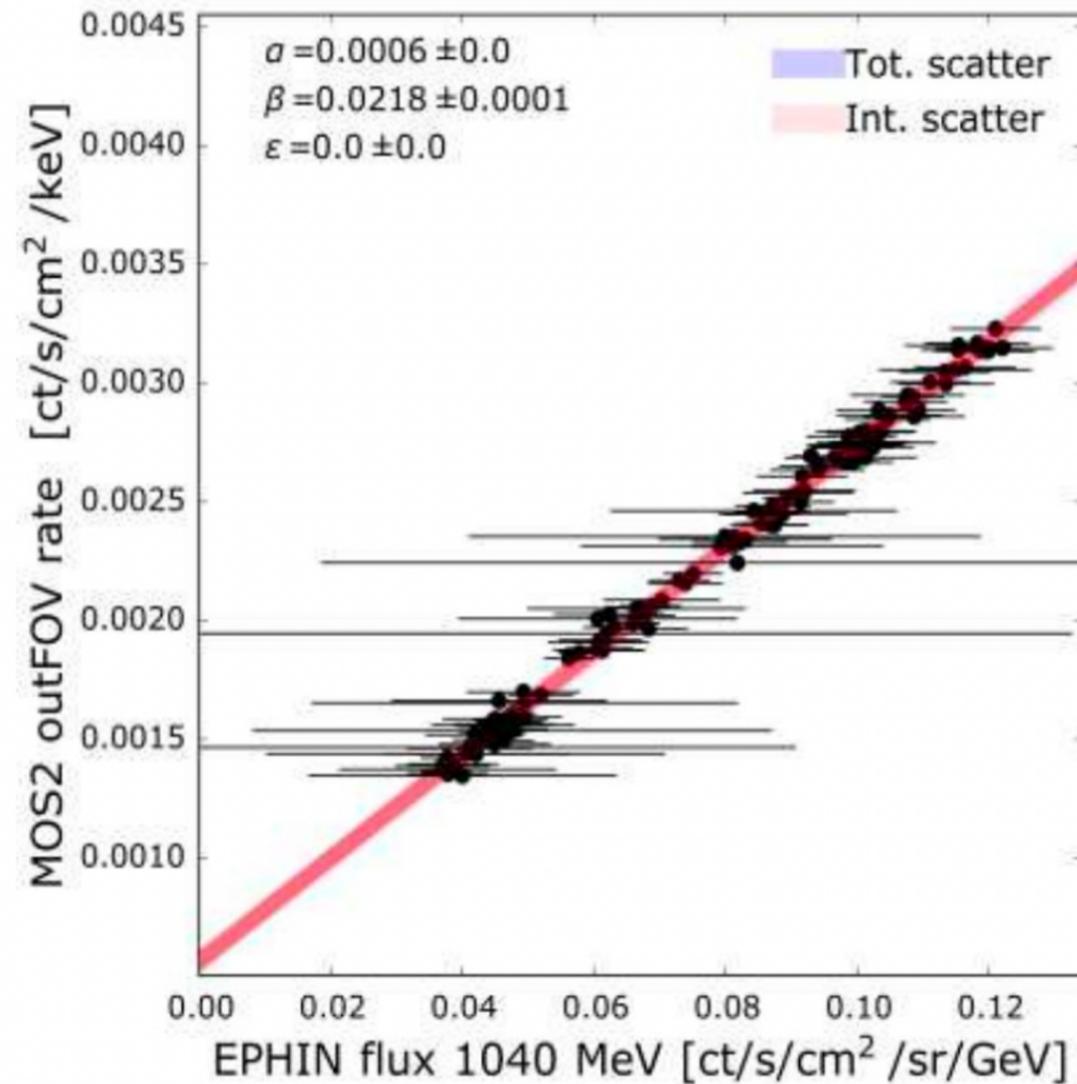
# Scientific impact by **Silvano Molendi (Milano University)** and **Robert Wimmer-Schweingruber and Patrick Kuehl (Kiel University)**

## Need to understand X-ray Background Electrons from outer radiation belt



# NAHEAPaM particle's rate by XMM-Newton CCD vs SOHO fluxes. Data spans 15 years.

## Need of AHEPaM

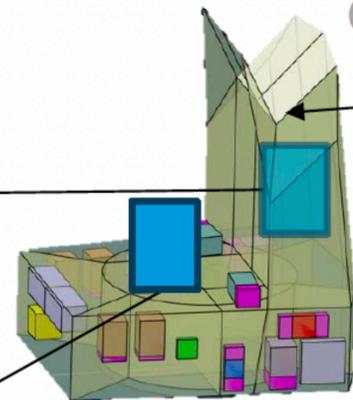
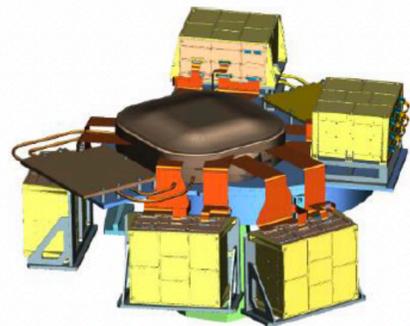


# AHEPaM on NewAthena Spacecraft



Wide Field Imager [WFI]

Payload  
Compartment [PLC]



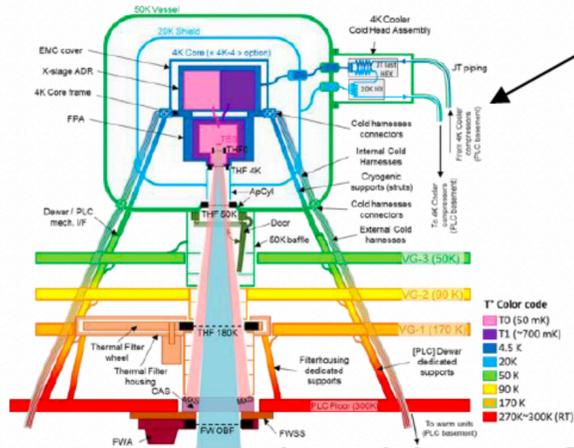
**AHEPaM**

SVM

Metering structure

## Key requirements of NAHEPaM:

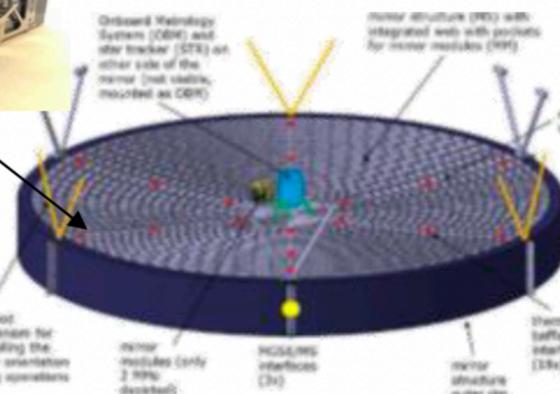
- mass <15kg
- volume < 300mm x 250mm x 200mm
- power <15W
- no s/c provided radiators
- accommodation on outside of s/c but no strong FoV constraints



X-ray Integral Field Unit [X-IFU]



One mirror module



MAM

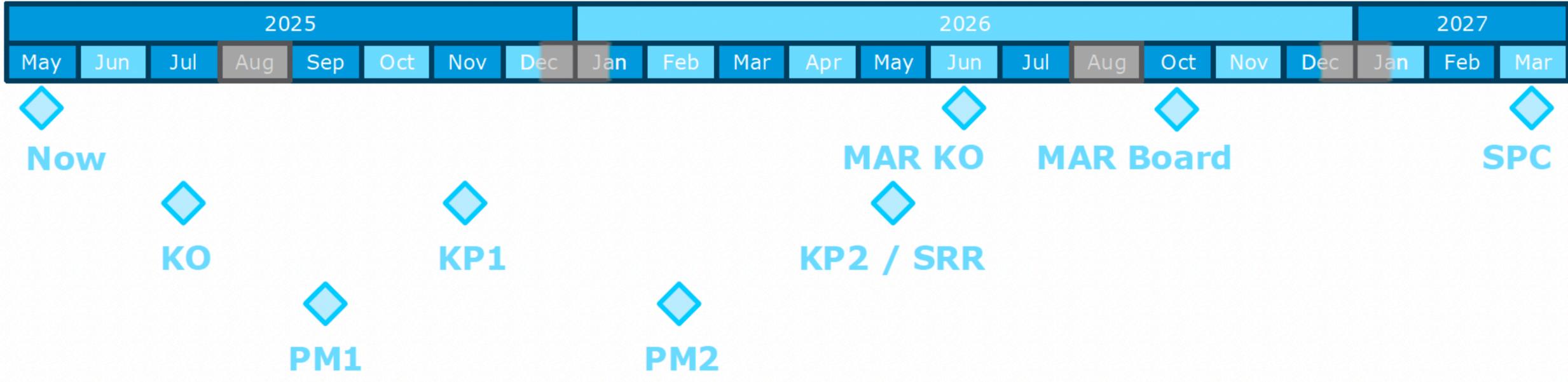
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AHEPaM Overview | 2025-05-21 | Slide 9



→ THE EUROPEAN SPACE AGENCY

# Timeline for AHEPaM until NewAthena Adoption



## Very dense workplan – high risk, high reward

One major meeting every ~2 months, short reaction time to steering inputs  
 Any de-risking activities may need to be started very early

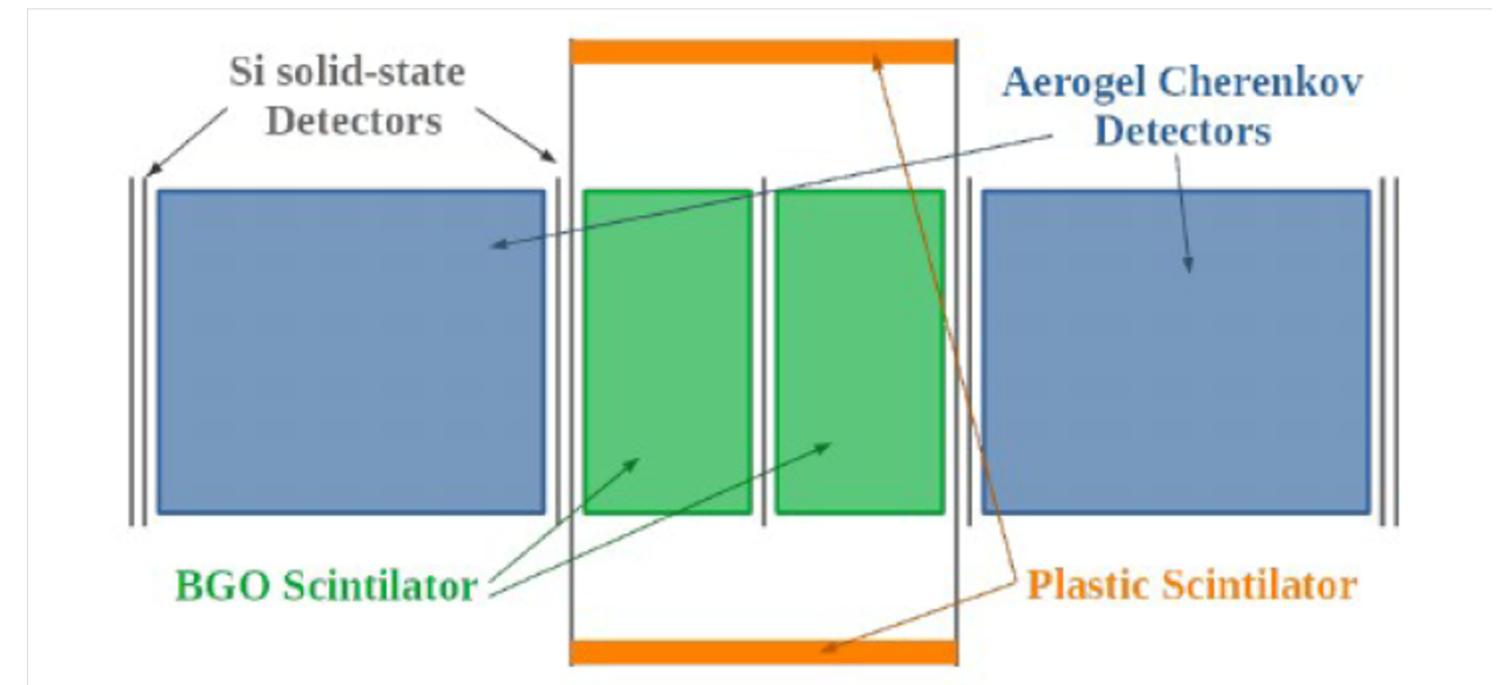
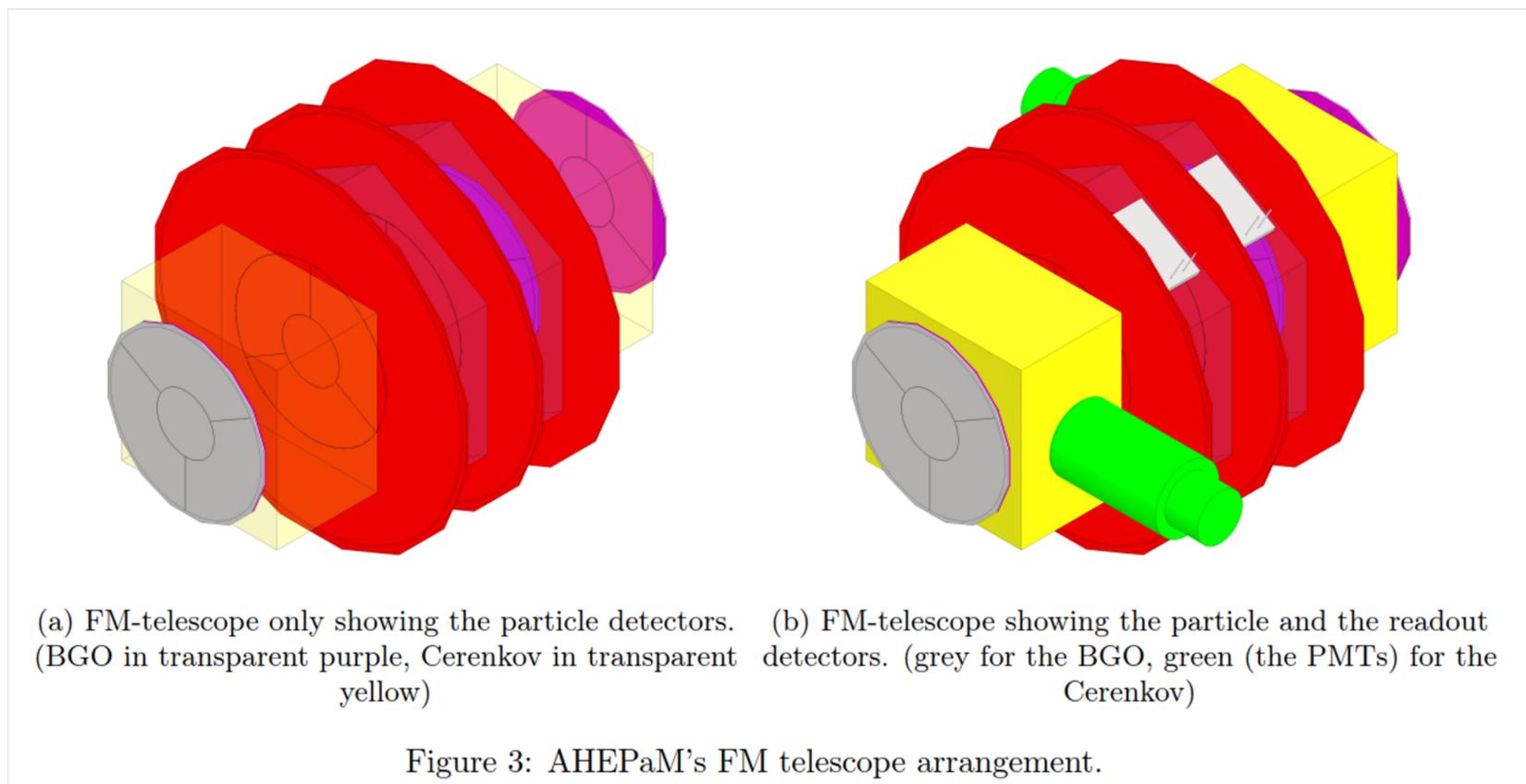
Aggressive plan to bring AHEPaM back can only work by making AHEPaM optional  
 → **ESA cannot promise AHEPaM will come back!** ←

**However, if successful, this contribution could be a groundbreaking opportunity for Poland!**

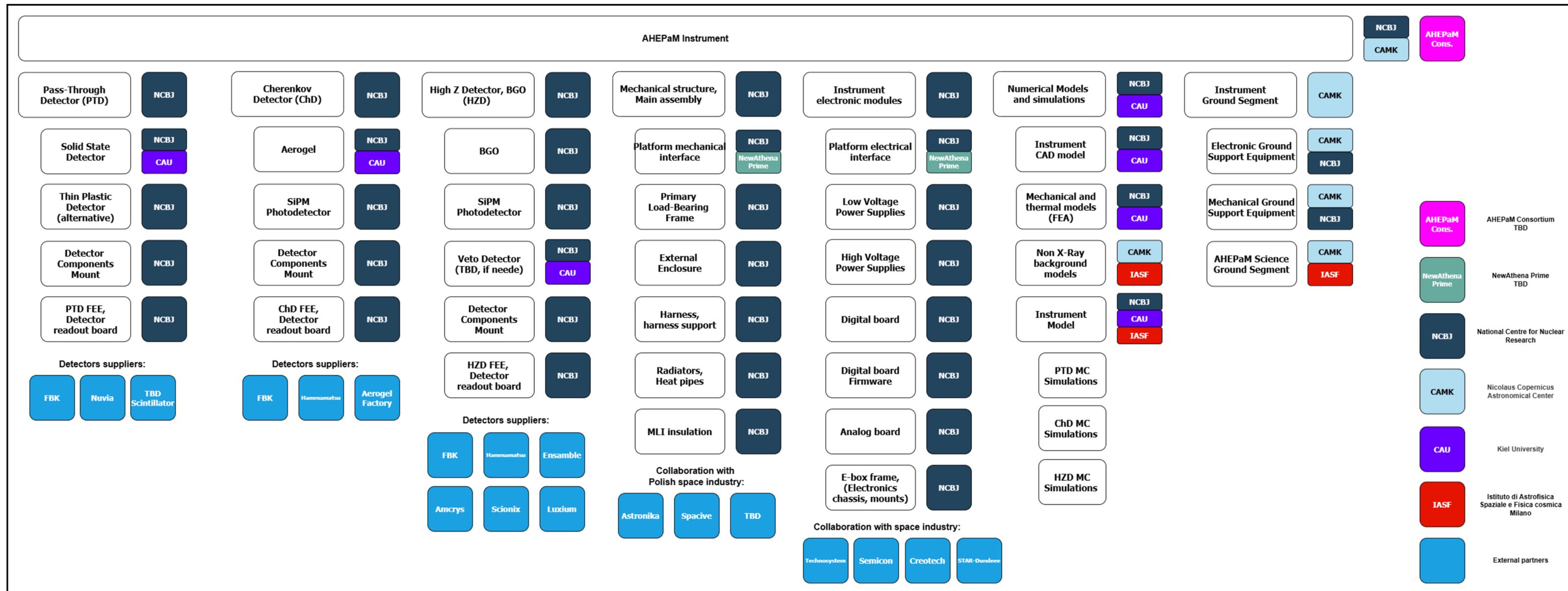


# The proposed **NAHEPaM** design (University of Kiel):

- Telescope of 5 (double) Silicon Solid-State Detectors (SSDs) with large geometric factor (the largest Si wafers of 12cm in diameter)
- utilize Cherenkov detector (aerogel) with PMT light readout
- and/or shower production of e- in multiple thick BGO scintillators
- veto plastics around the BGO crystals to reject events outside the main detector axis



# Product Tree - responsibilities



# NAHEPaM - Consortium Organization and Funds

- **ATHENA.PL** – Consortium contains 12 institutes all over Poland,
- **CAMK PAN** – science team,
- **NCBJ** – system engineers and all engineers,
- **Silvano Molendi (Milano University)** – Lol signed,
- **Robert Wimmer-Schweingruber** and **Patrick Kuehl (Kiel University)** – Lol signed.
- **NAHEPaM** will refresh **NewATHENA.PL** structure.
- Funds will be mainly from **PRODEX**, we are in contact with **Polish Delegate**.
- The project card is ready to submit.



## Already accepted funds for:

### ATHENA

Two PRODEX contracts:

WFI - contract: PEA 4000124331

X-IFU - contract: PEA 4000125155

### NewATHENA

One PRODEX contract:

WFI - contract: PEA 4000124331

## **Our team:**

**WP 1.** Project management – **Agata Różańska, Agnieszka Pollo, Dominik Rybka**

**WP 2.** Detector design – **Tomasz Szcześniak**

**WP 3.** Simulations – **Roch Kwiatkowski, Rafał Wojaczyski, Robert Wimmer-Schweingruber and his team**

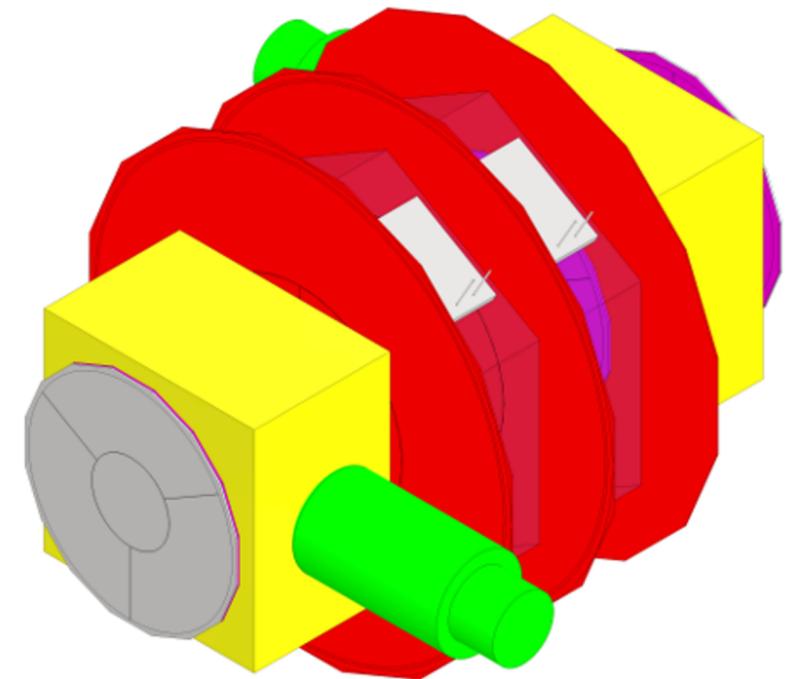
**WP 4.** Thermal-mechanical structure – **Piotr Mazerewicz**

**WP 5.** Electronics design – **Dominik Rybka**

**WP 6.** Qualification and verification – **TBD**

**WP 7.** Integration – **TBD**

**WP 8.** BKGR Simulations – **Rafał Wojaczyński, Silvano Molendi**



**Our Funds: as the first step will come from PRODEX – approx. 14.8 Mln Euro in total**