

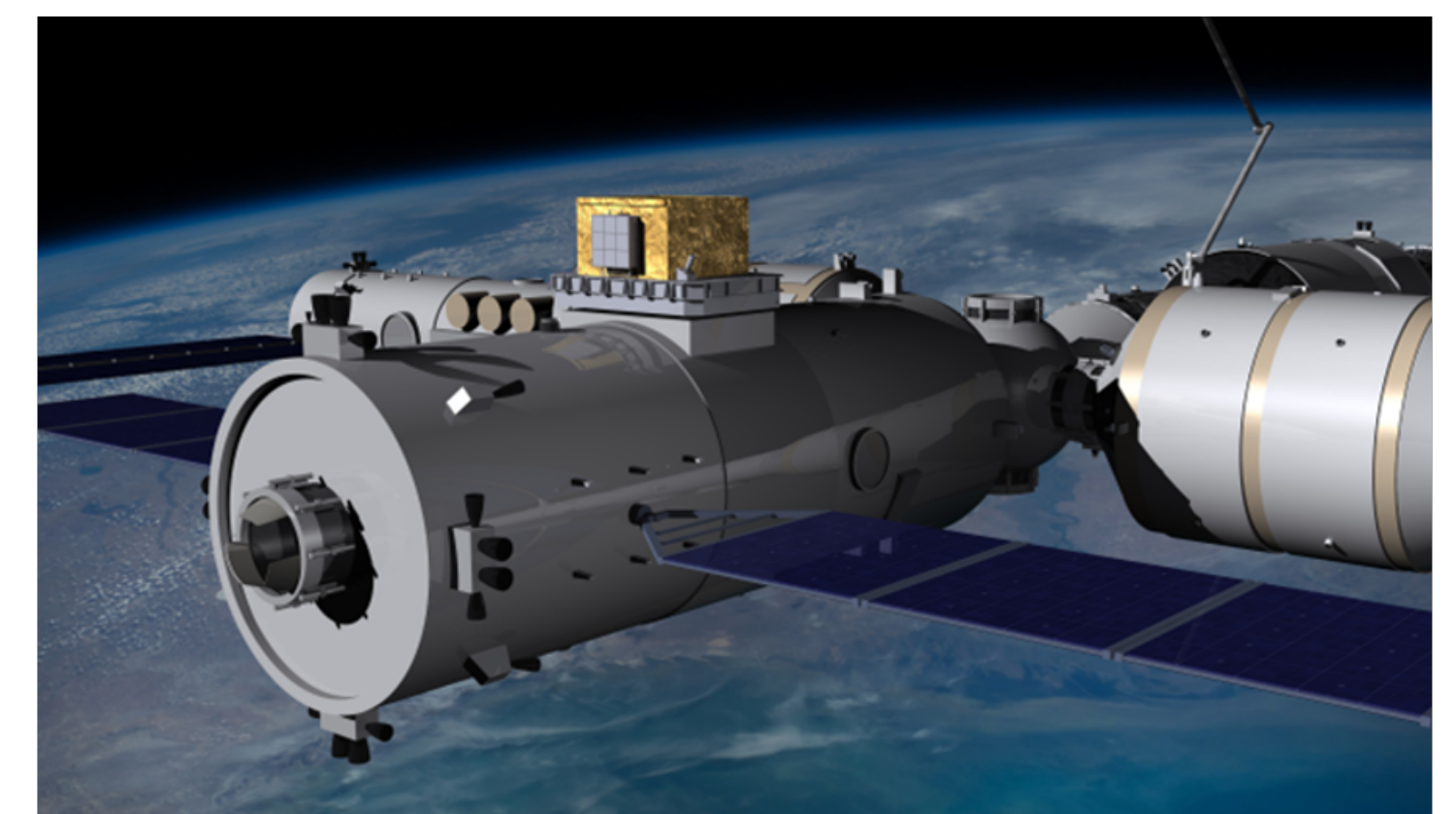
# Gamma-ray group

meeting with TDLI delegation  
IFAE May 18 2026

Javier Rico

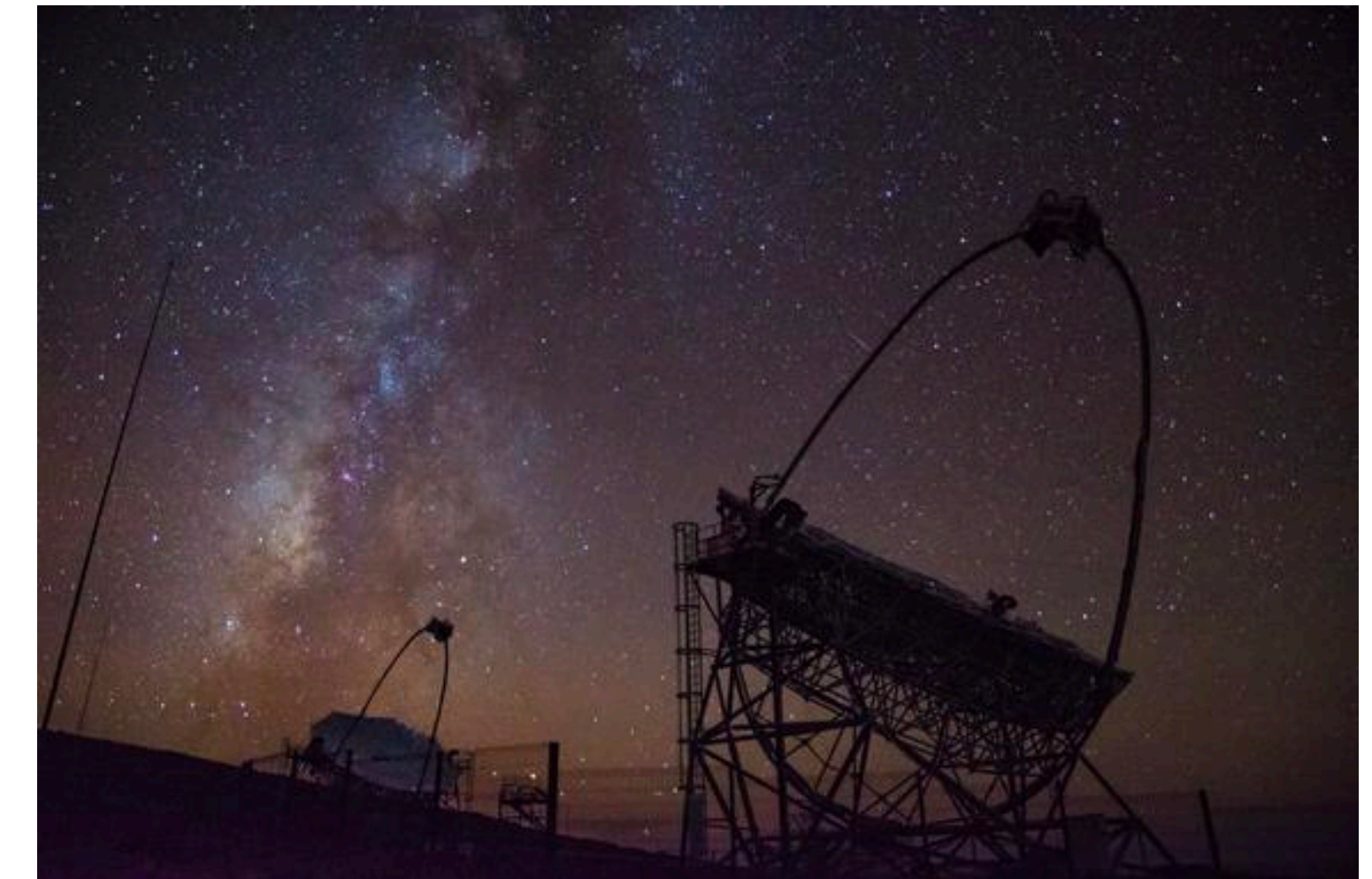
## General objectives

- ★ **Goal:** understand the **most energetic phenomena** in the Universe as well as to address **fundamental physics** topics through observations with **gamma-ray** telescopes in the  $\sim 100$  MeV to  $\sim 100$  TeV band.
- ★ **Means:** participate in/lead the design, construction, maintenance, operation and scientific exploitation of cutting edge **gamma-ray telescopes/detectors** and auxiliary **instrumentation**.
- ★ **Projects:**
  - ◆ The **MAGIC** telescopes
  - ◆ The Cherenkov Telescope Array (**CTA**)
  - ◆ Space projects (HERD, newAstrogam, FOCUS,...)



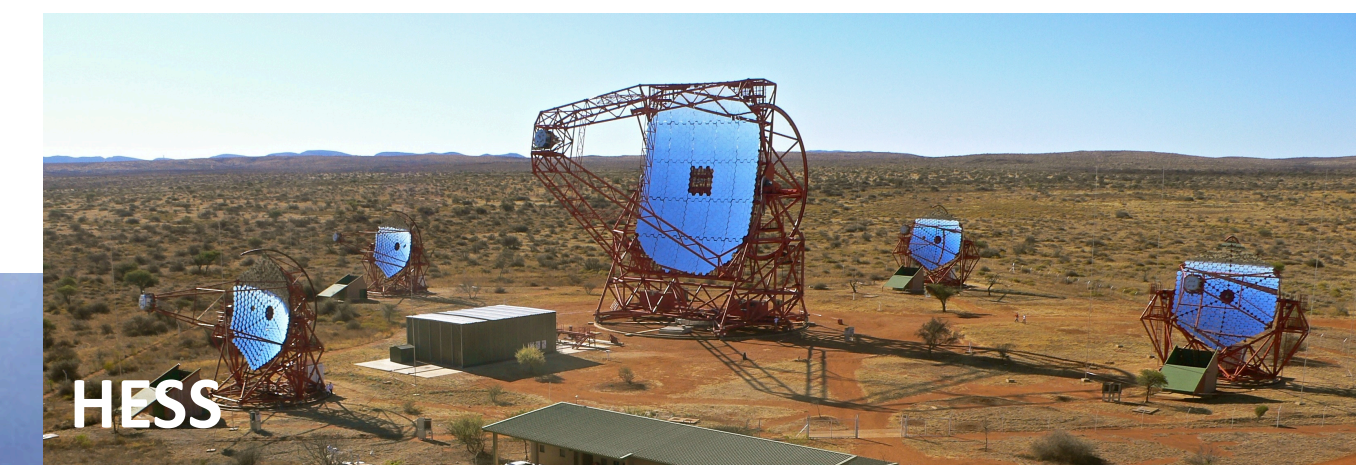
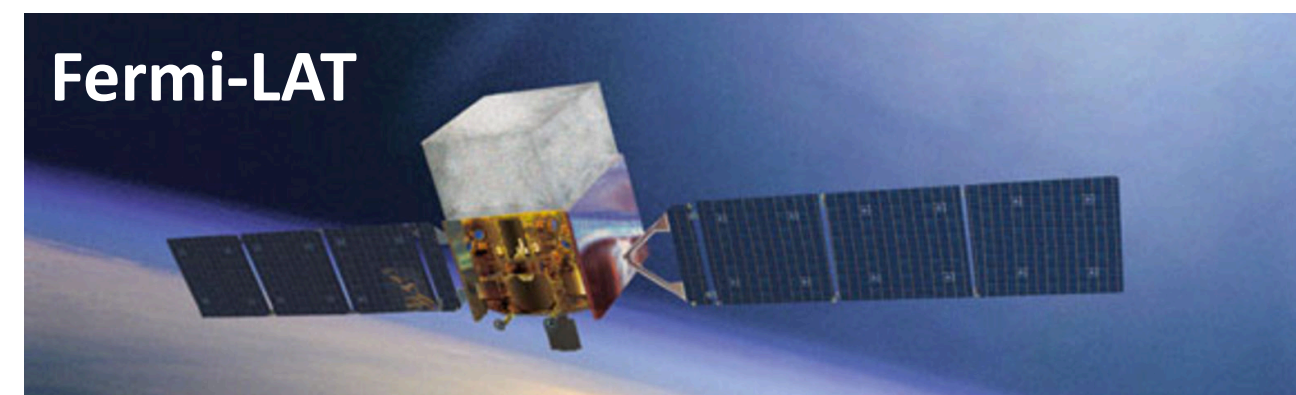
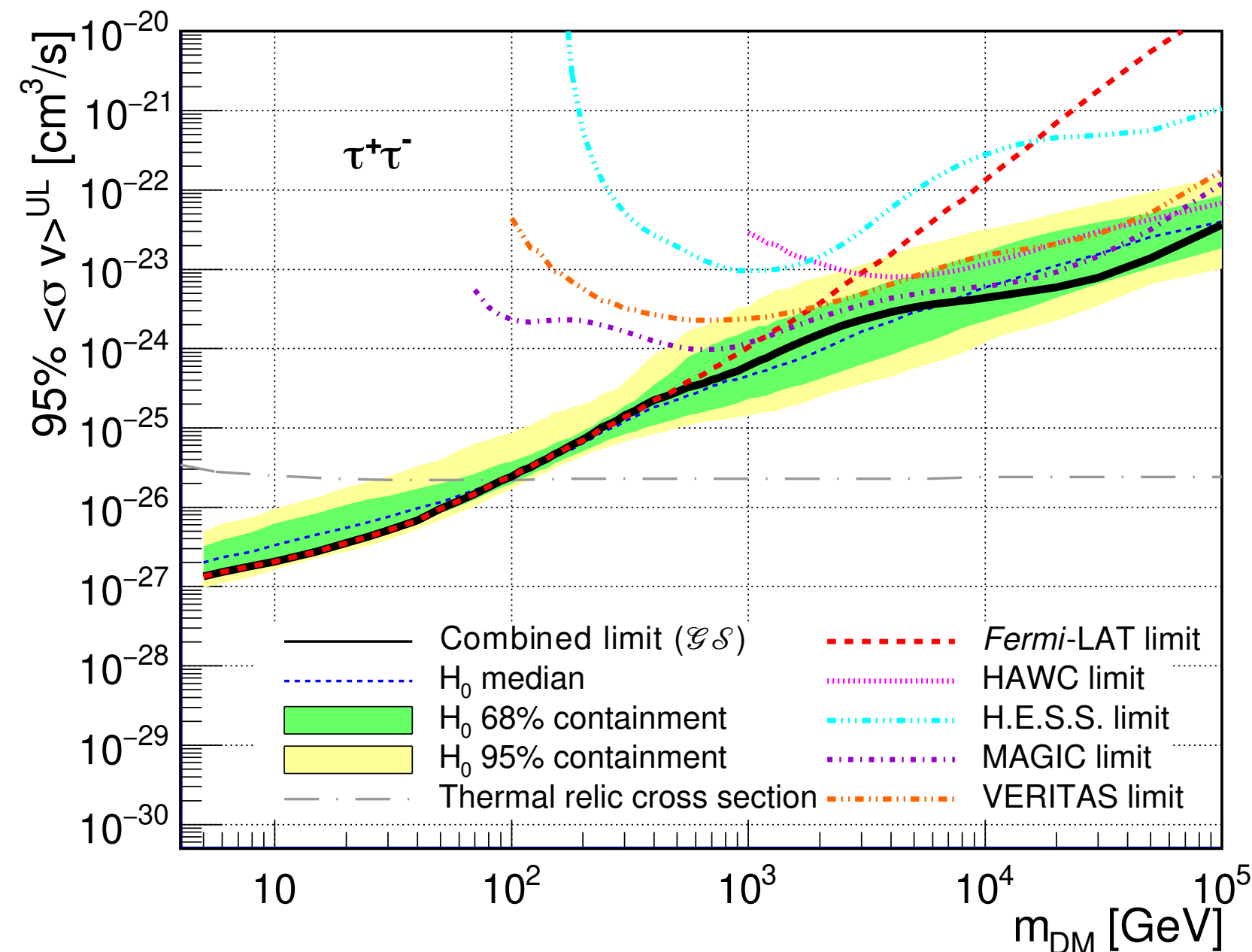
## IFAE contributions

- ★ **MAGIC**: system of 2 Cherenkov telescopes at ORM (La Palma, Spain)
- ★ Observes gamma-rays between  $\sim 50$  GeV and  $\sim 100$  TeV
- ★ Steadily **taking data** since 2004 (single telescope) / 2009 (two telescopes)
- ★ IFAE **leading** institution:
  - ◆ Camera MAGIC-1, Control house, access tower, Data Center, Central Control system, DAQ electronics, reco+analysis SW
  - ◆ About  $1/3$  of all papers with IFAE main author
  - ◆ 3 spokespersons, 3 co-spokepersons, Physics, Technical, Publications, Outreach, Safety&Operations coordinators, Chair of Collaboration Board. Many conveners of all Science Working Groups



## Recent scientific highlights: DM searches

S. Abdollahi et al JCAP (2025) in press



- ★ **Combination** of DM searches using 20 dwarf galaxies by 5 gamma instruments
- ★ **Optimized**  $\langle \sigma v \rangle$  upper limits in DM mass range 0.005 – 100 TeV
- ★ **Legacy result and methodology** from the current generation of gamma-ray instruments

# The CTA Observatory

Up to 10-fold sensitivity and energy range w.r.t current VHE observatories  
Improved angular and spectral resolution

- 2 sites at Northern and Southern Hemispheres for full sky coverage
- La Palma, Spain ( $28^{\circ}45'$  N): 13 telescopes (4 LST + 9 MST)
  - Paranal, Chile ( $24^{\circ}41'$  S): 51 telescopes (MST + SST) + 2 LST

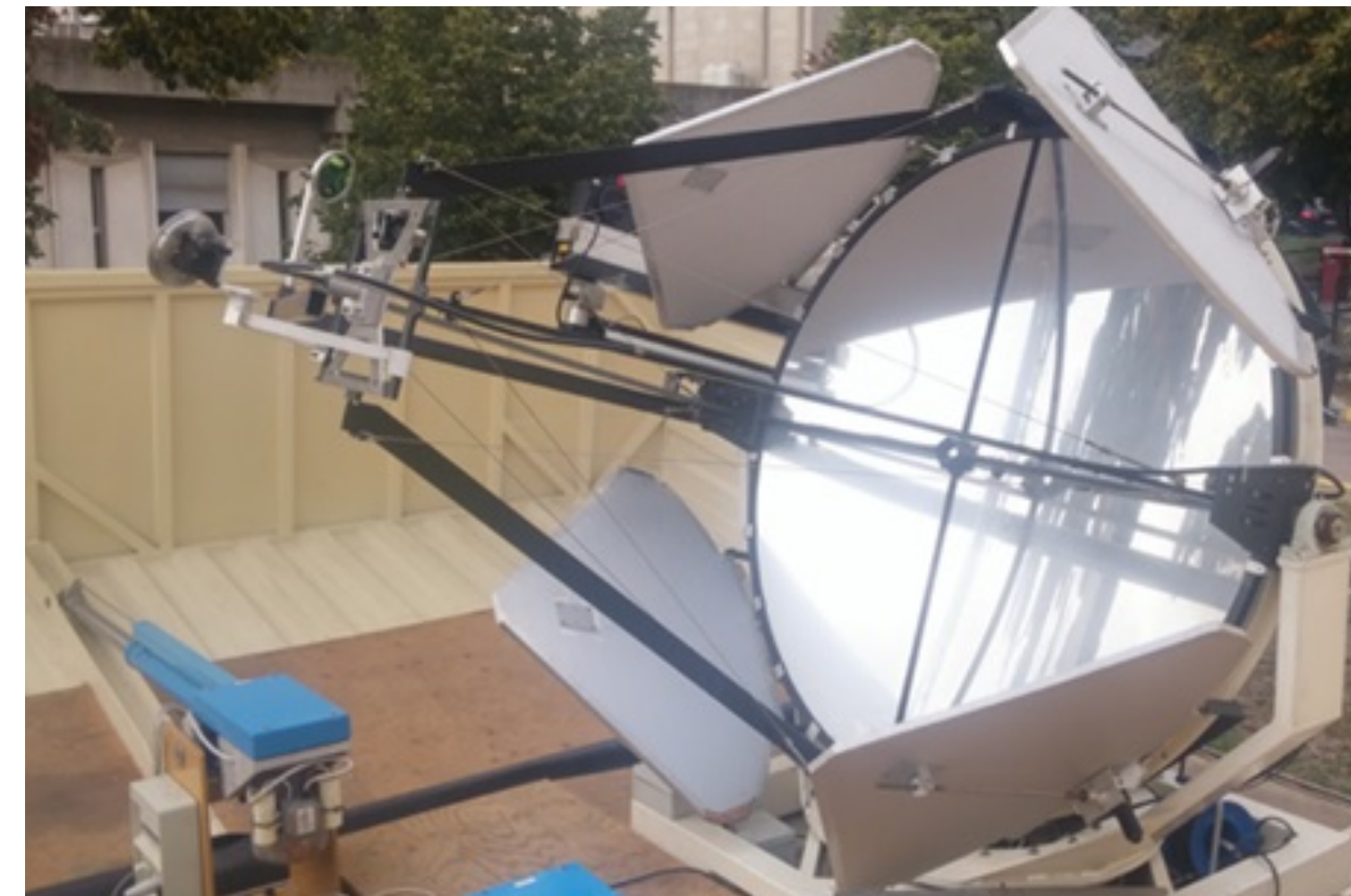
Large-sized telescopes (LSTs)  
Energy threshold  $\sim 10$  GeV

Mid-sized telescopes (MSTs)  
Peak sensitivity @ 0.1-10 TeV

Small-sized telescopes (SSTs)  
 $\sim 10$  km<sup>2</sup> effective area array @  $>10$  TeV

# IFAE Contribution

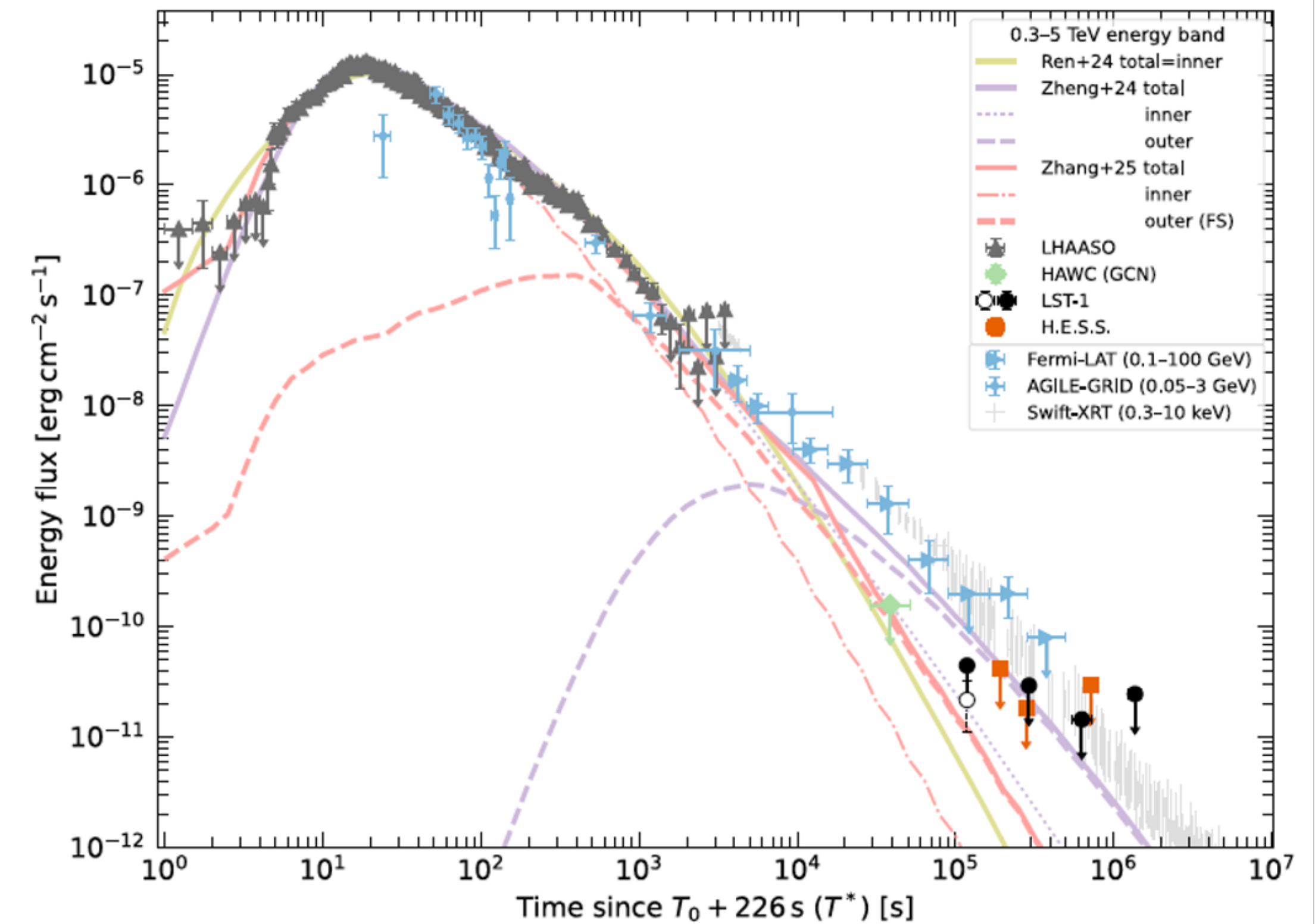
- ★ **LSTs** main priority for the IFAE group:
  - ◆ Azimuth moving system
  - ◆ Cameras
- ★ **The Raman LIDAR** for CTAO Northern site
- ★ CTAO **Data Centre** (PIC) + data management
- ★ Reconstruction and analysis **software**
- ★ **Management:**
  - ◆ LST technical coordination;
  - ◆ LST2-4 construction coordination;
  - ◆ Scientific expert at CTAO ERIC council;
  - ◆ Analysis & Software coordinator;
  - ◆ offsite IT coordinator



## LST1 scientific highlights (2/3)

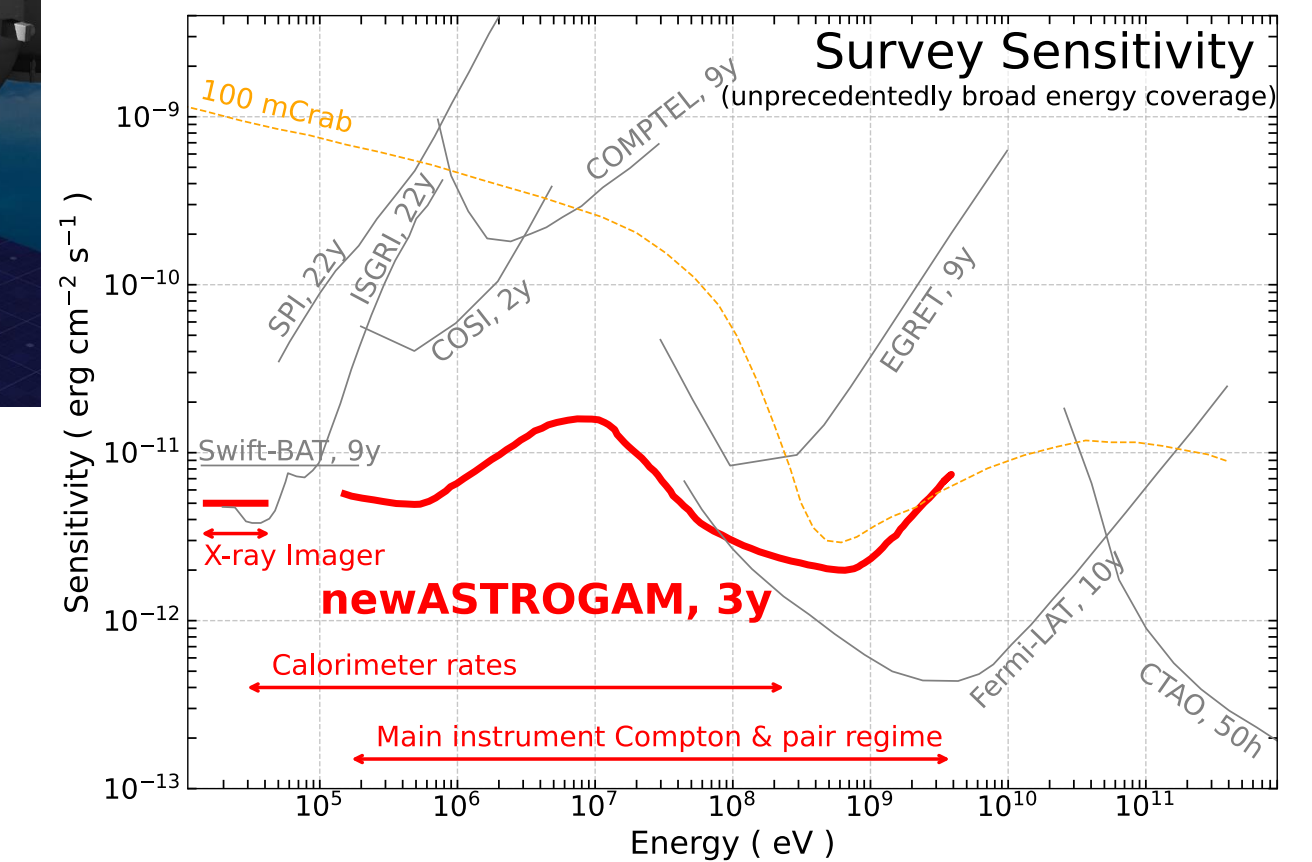
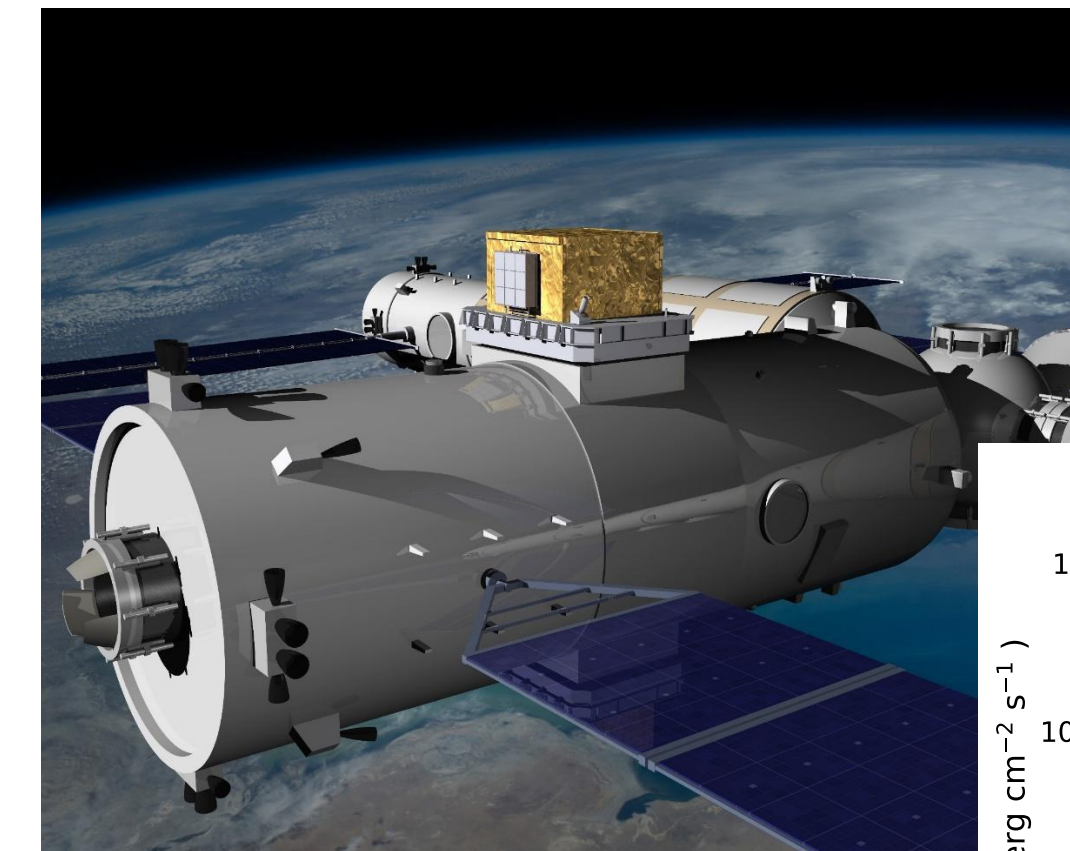
- ★ **GRB 221009A** a.k.a. **"the BOAT"**: by far, the brightest GRB ever recorded
- ★ Took place during full moon week  $\Rightarrow$  follow-up observations with LST-1 performed at  $T_0 + 32$  h (the earliest in the VHE band)
- ★ Challenging operation conditions due to scattered moonlight
- ★ **Result:**  $4.1\sigma$  hint of VHE afterglow signal
- ★ Estimated VHE flux disfavors some of the proposed emission models

K. Abe et al ApJL 988 (2025) 2



### ★ HERD

- ✦ **Cosmic-ray and gamma-ray detector for the China Space Station to start in 2029**
- ✦ **IFAE contribution:** low energy (100 MeV) gamma-ray trigger system + trigger@daq electronics + science prospects
- ✦ No construction → science exploitation

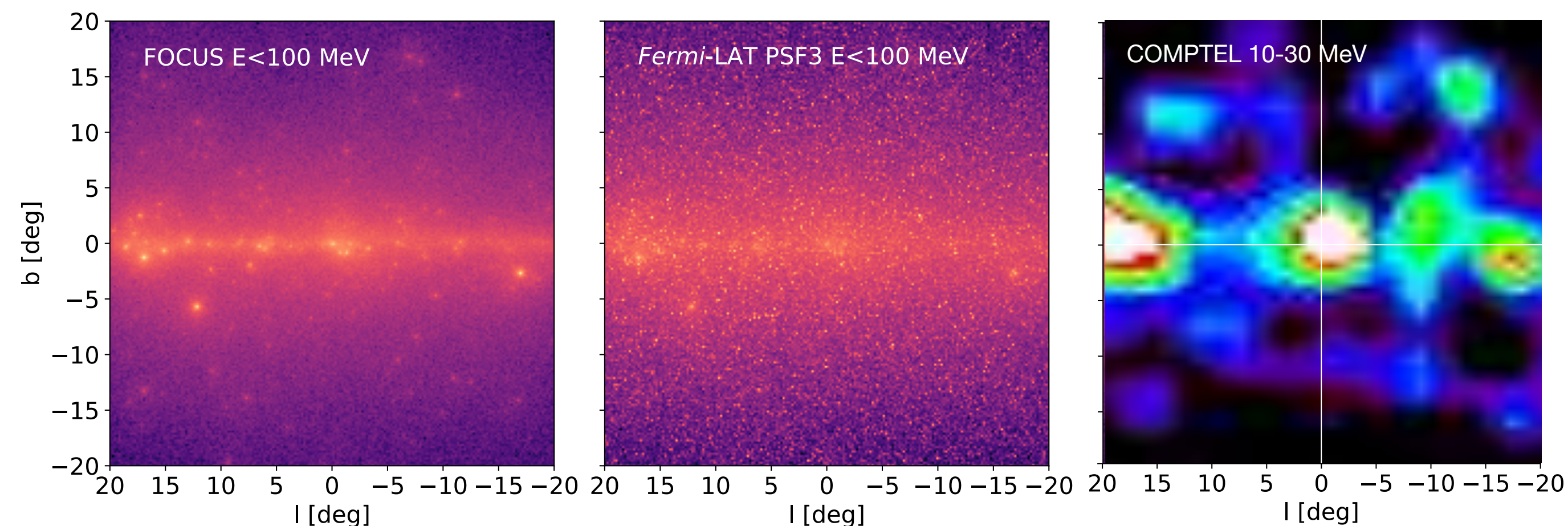


### ★ ASTROGAM

- ✦ **MeV-GeV gamma-ray** new generation mission concept submitted to M5, M7 and M8 ESA calls

### ★ FOCUS

- ✦ Proposal for new **small&fast ESA mission concept** for MeV gamma-rays focused on high resolution observations of Galactic Center and Plane. **Led by IFAE**

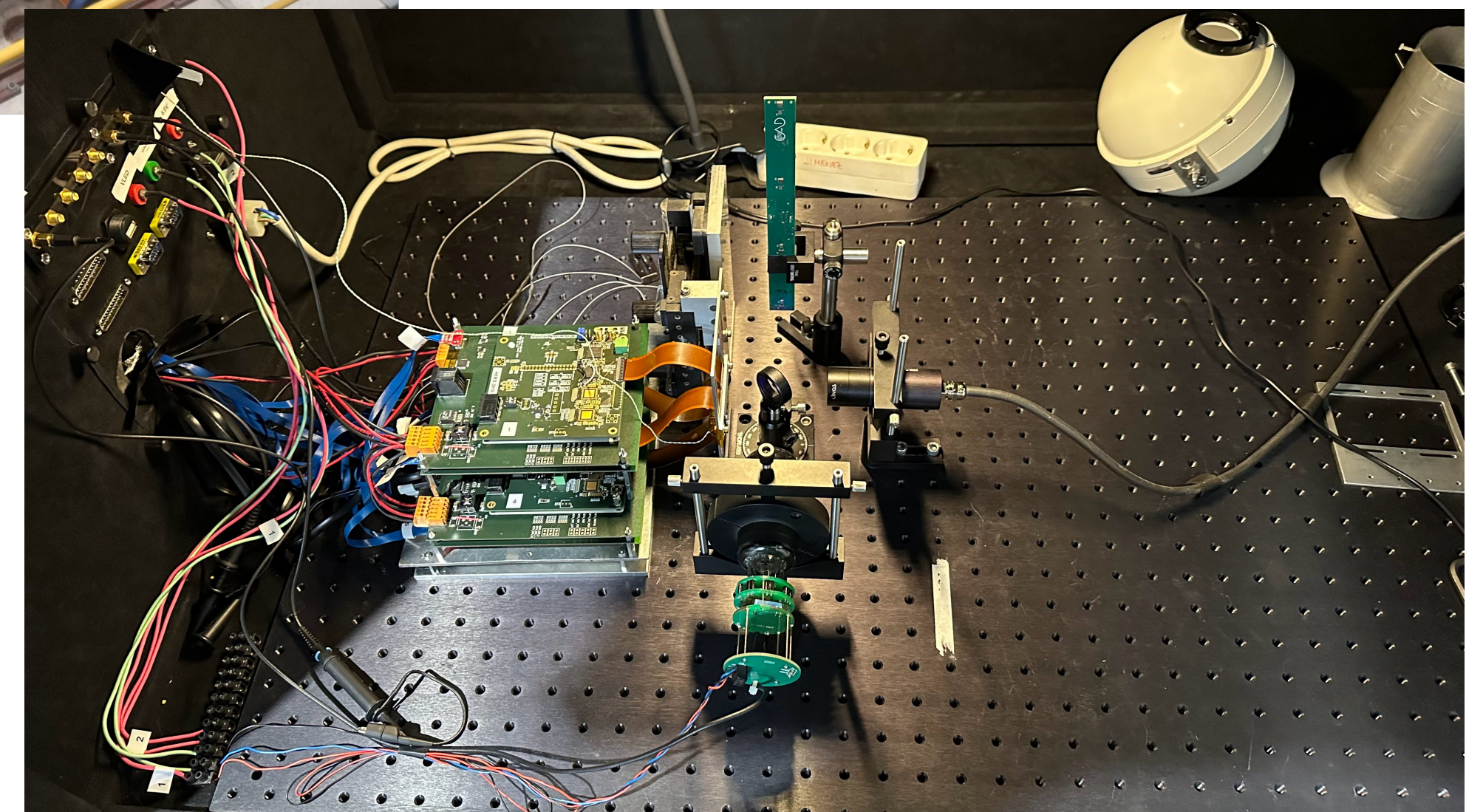
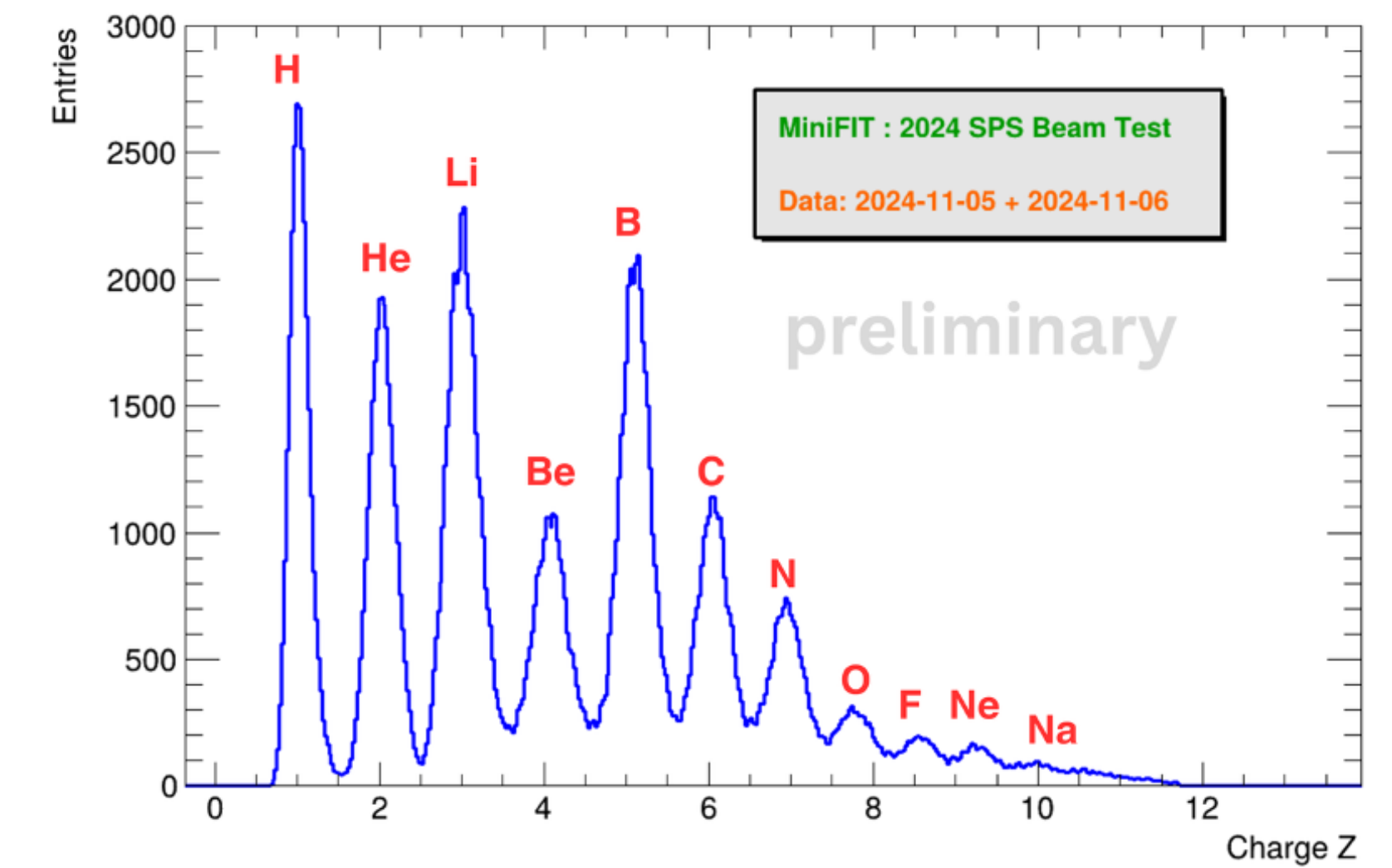


## ★ Fiber tracker (FIT)

- ◆ Collaboration with EPFL + UniGe (CH)
- ◆ Beam test campaigns (2023,24,25) at CERN SPS
- ◆ Validation of triggering, tracking and Particle ID capabilities

## ★ Characterization of sensors and electronics for space applications

- ◆ Lab calibration, optimization and performance characterization
- ◆ Irradiation tests of SiPM in UCLouvain foreseen July 2026



## ★ MAGIC

- ◆ Last years of observations
- ◆ Preparing data legacy

## ★ CTA

- ◆ near future busy with finalizing installation and commissioning of the LST array
- ◆ early science operations
- ◆ imminent taking over of MAGIC
- ◆ LIDAR validated and prepared for final production

## ★ Space

- ◆ Publish results from last years technical work
- ◆ Keep R&D for future gamma-ray space missions