

# Scintillator Detectors & Fiber Trackers with SiPM readout in Space Missions

Roberta Pillera on behalf of

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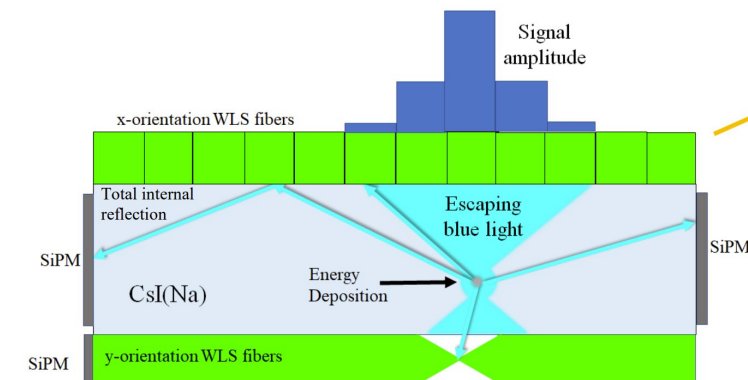
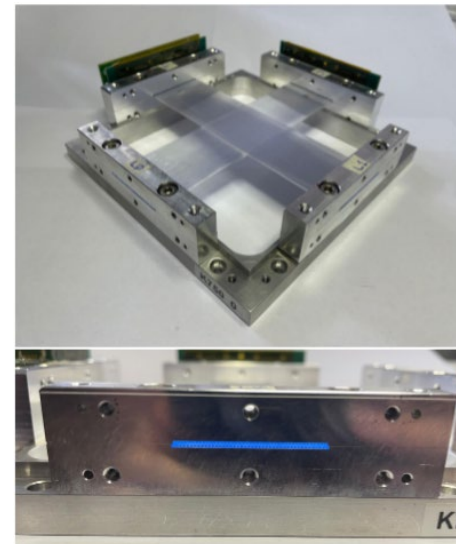
With the support of the technical staff of INFN Bari

INFN Workshop on Future Detectors

17 – 19 March 2025

# Scintillating fiber trackers with SiPM readout in space

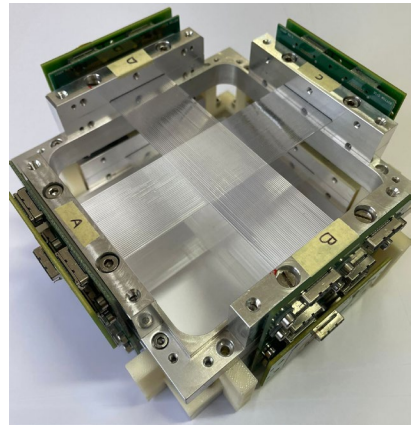
- Employed in high-energy physics experiments
  - e.g. LHCb, Mu3e, ...
- Very well suited for space deployment
- Upcoming space missions using fiber trackers
  - e.g. NUSES, HERD, APT (ADAPT)
- Advantages:
  - low cost, large instrumented area, robustness, low material budget, potentially no limitations in geometry
- Applications:
  - Tracking
    - charged CR
    - gamma-ray by pair production and/or Compton
  - Trigger
  - PID
- Many variants:
  - Scintillating fibers: ideal for large experiments, gamma-ray detection in broad energy range
  - Crystal with WLS fibers readout (better for low energy gamma-ray detection with Compton)
- Space qualification
  - Mechanics
    - Survive harsh launch and space conditions
    - Weight, size
  - Electronics
    - Power consumption limitations
    - Downlink bandwidth
      - Trigger rates
  - Radiation hardness



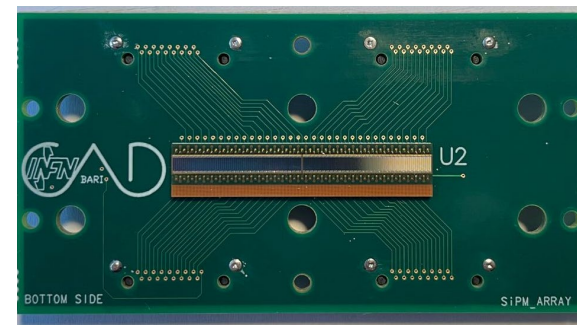
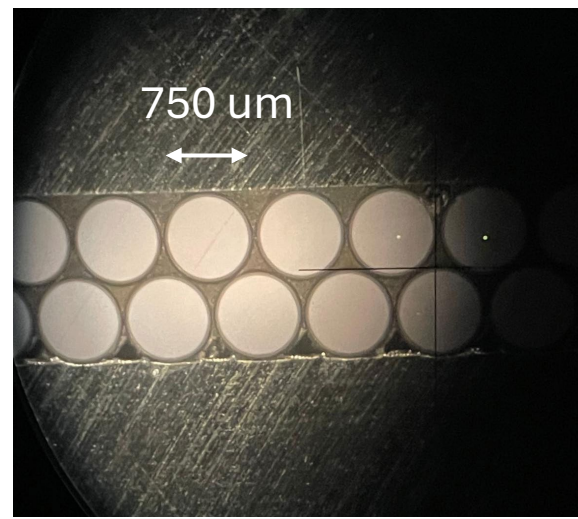
# From LAB to Space deployment

FTK tasks:

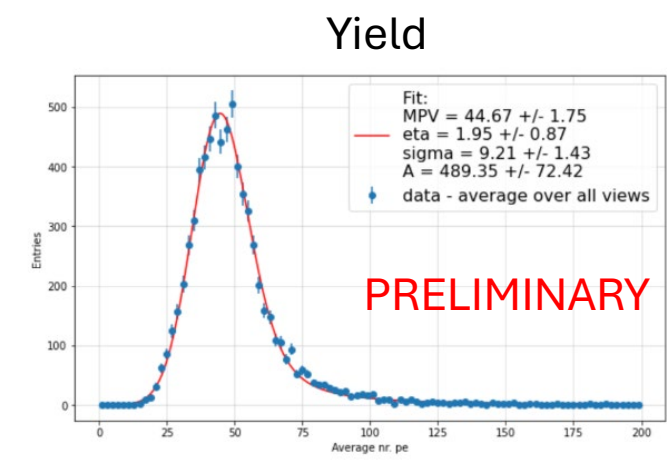
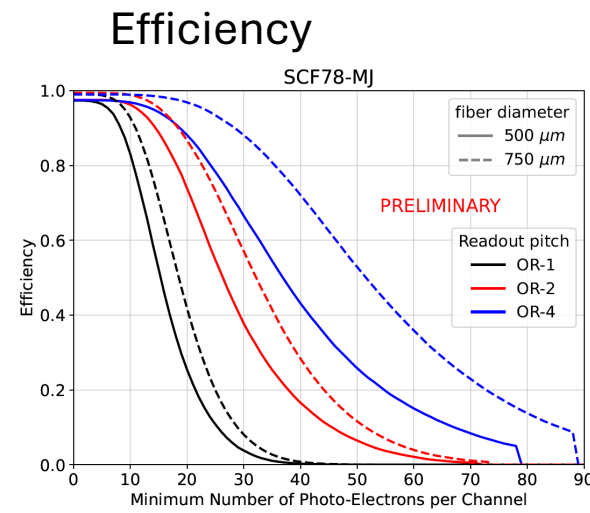
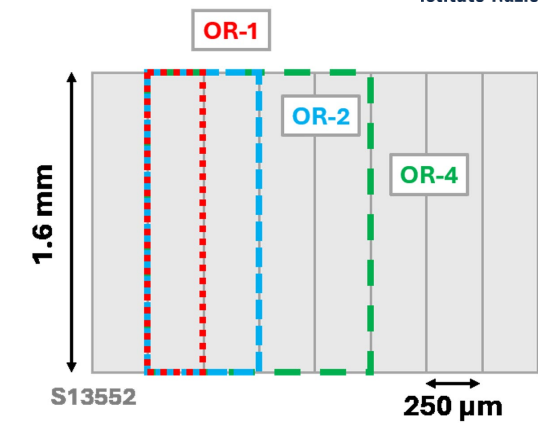
- ✓ Trigger
- ✓ Tracking
- ✓ PID



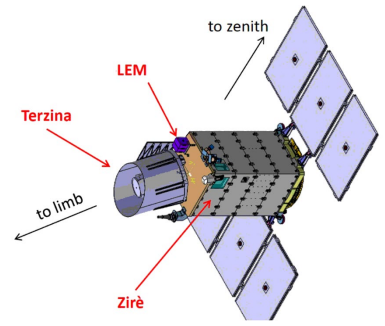
2020  
First prototypes



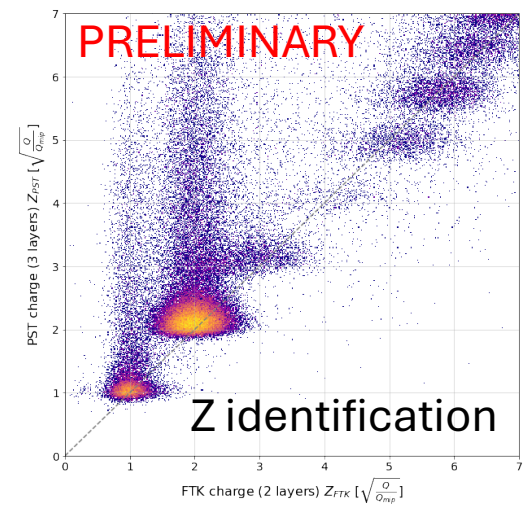
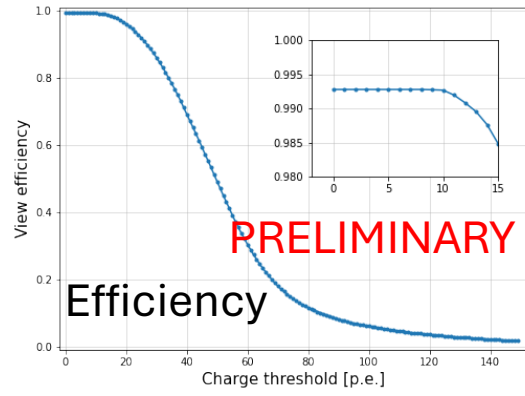
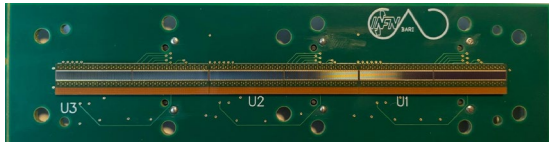
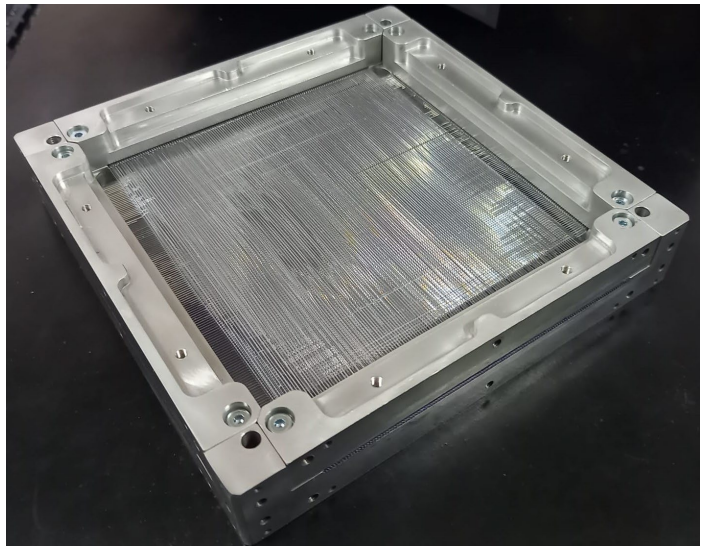
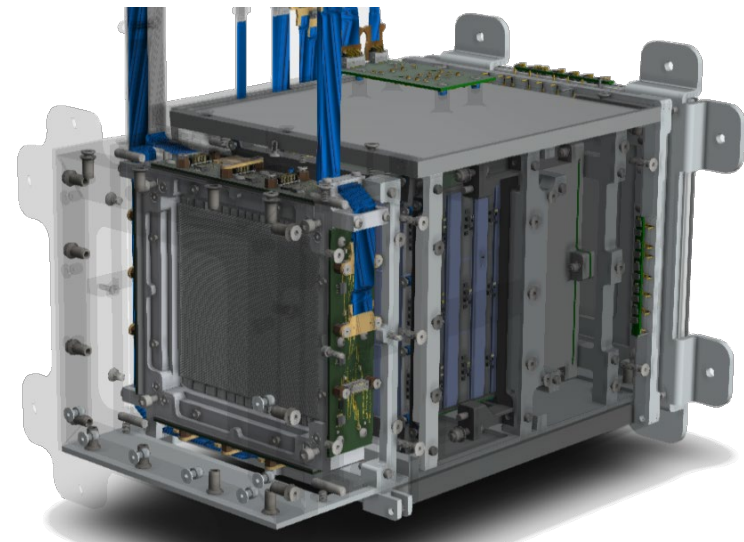
HPK-S13552 array



# From LAB to Space deployment



NUSES mission  
Ziré payload will have a Fiber Tracker onboard



2020  
First prototypes

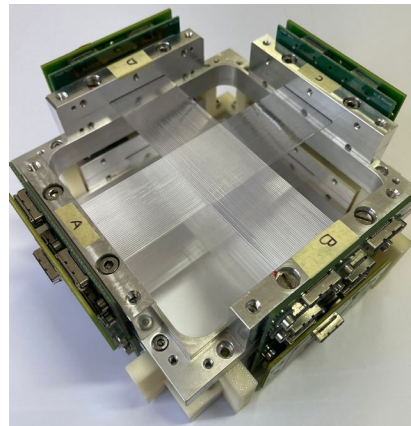
2023  
ZIRETTINO

First Ziré prototype

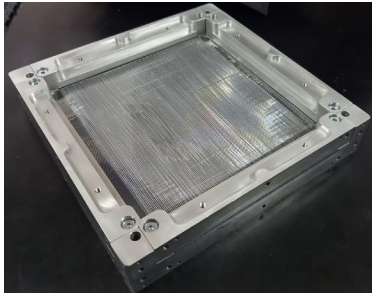
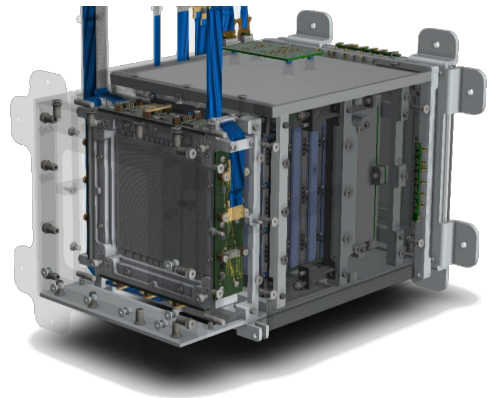


# From LAB to Space deployment

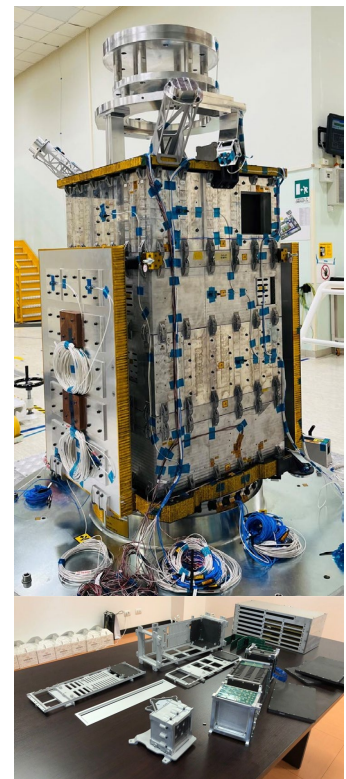
End 2026  
LAUNCH



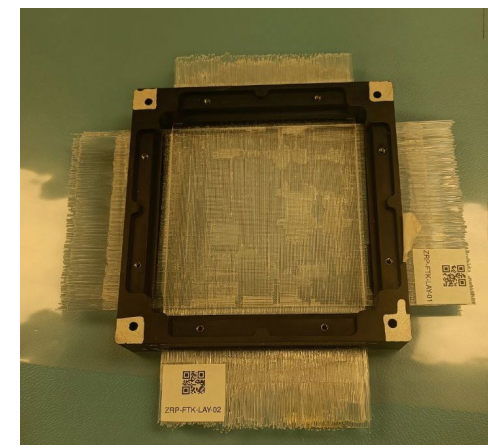
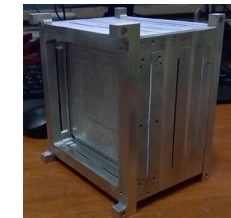
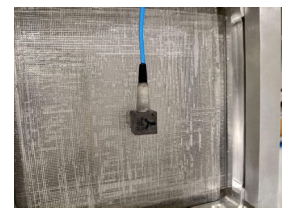
2020  
First prototypes



2023  
ZIRETTINO



2024  
SM - Dynamic tests

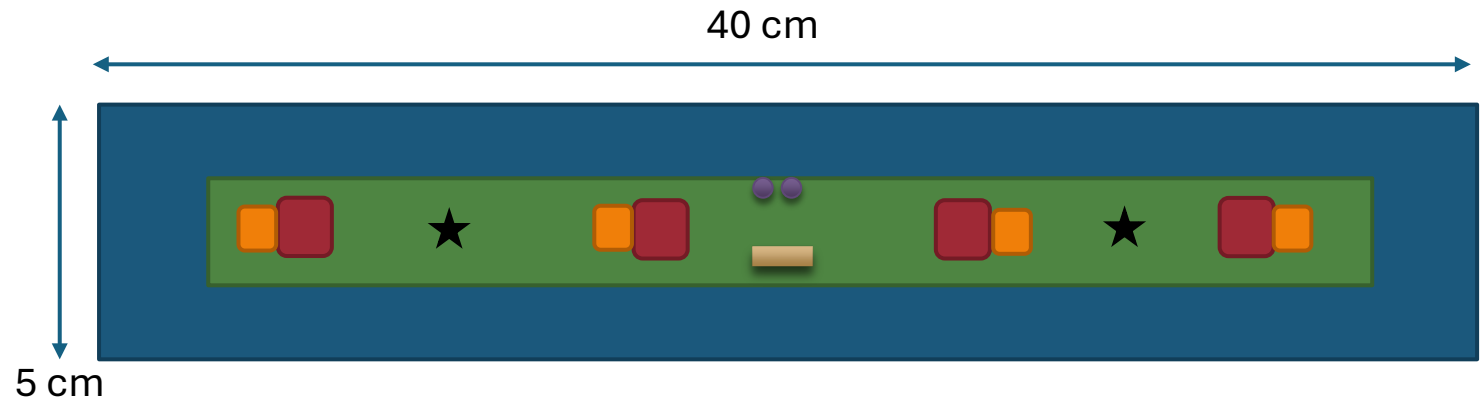
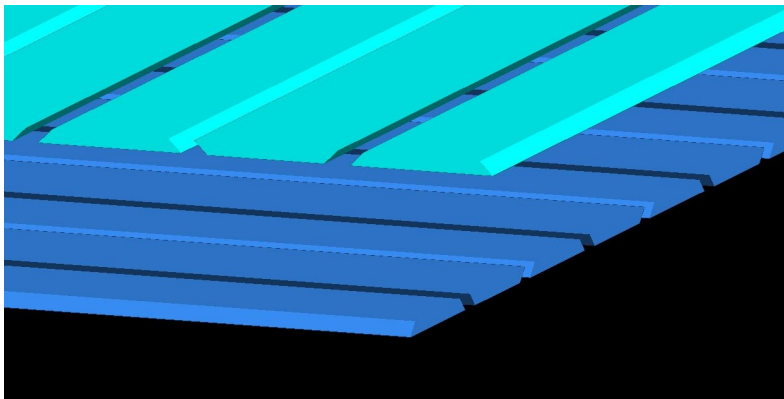
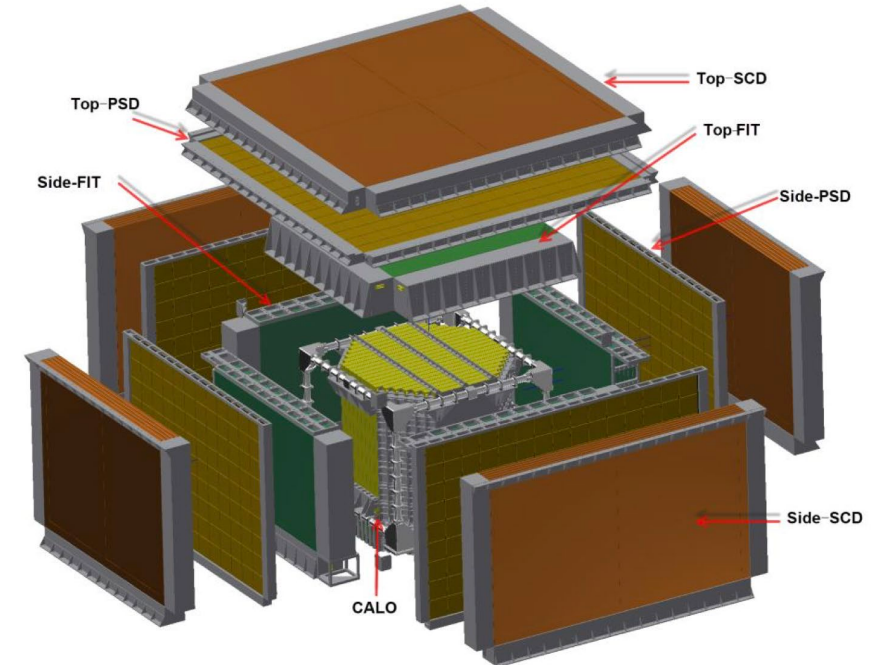


2025  
EQM - TVAC

2025-2026  
PFM delivery

# Plastic Scintillator Tiles for Anticoincidence and Ion identification in the HERD detector

- Beta ASIC -> for SiPM in space applications
  - Low power consumption
- Low/High Z SiPMs for different purposes
  - VETO for gamma-rays detection
  - Wide dynamic range for nuclei identification



# R&D highlights

- High efficiency  $> 99.99\%$
- Wide dynamic range
- Good Z resolution

