

# Preparation of BIC beam test at CERN PS

June 9th 2026 TIC Meeting

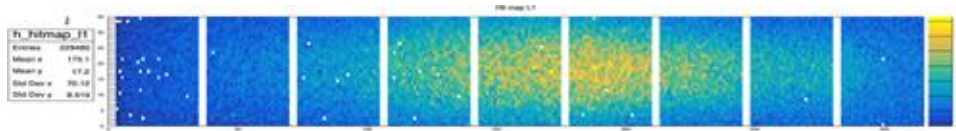
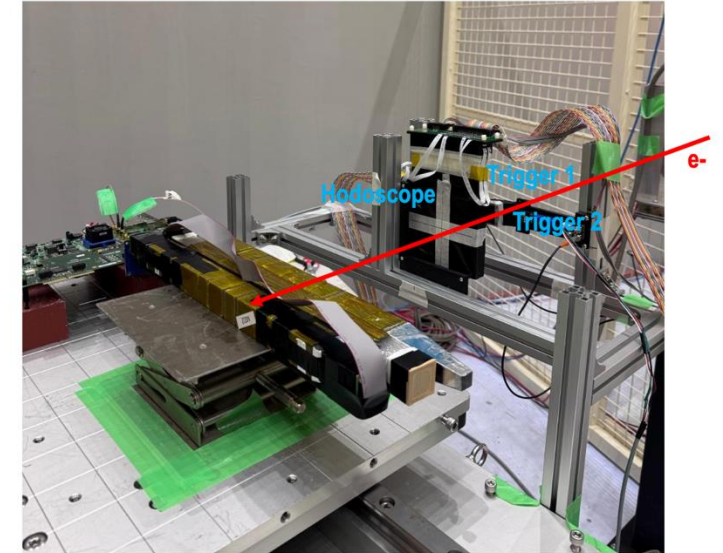
Jeongsu Bok (Pusan National University)

# Outline

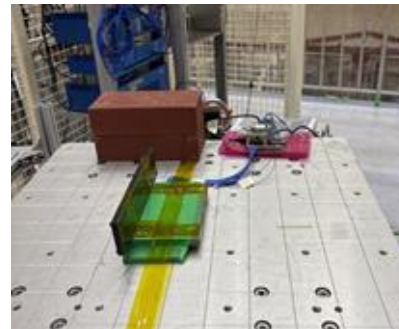
- Plan and preparation for the beam test at CERN PS T09
  - August 24~31, 2026
  - Recently beam test at KEK in May
- Answers to the Charge Questions

# Beam Test at KEK in May 2026

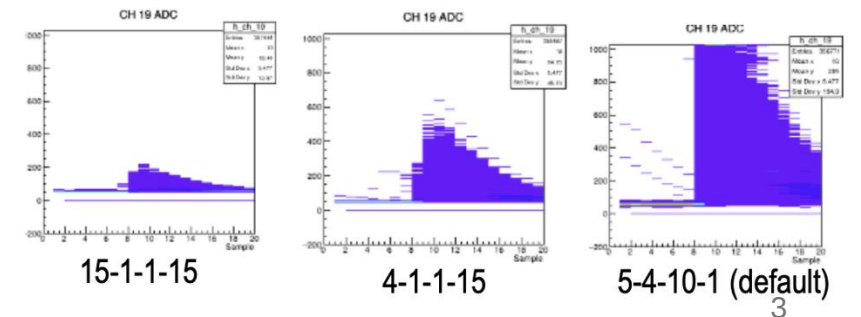
- electron beam at KEK PF-AR Test Beam Line
  - At 1<sup>st</sup> and 3<sup>rd</sup> rows in 1-5 GeV
- Individual, summing board test (Check with Flash ADC)
- Light Guide test
- DAQ integration with analog signals.
  - For Cherenkov, Hodoscope at CERN.
- AstroPix 9-chip (standalone)
  - OK in  $\sim 2.7$ kHz rate (rate at trigger in beam line)



(magnet setting not optimized for focusing)



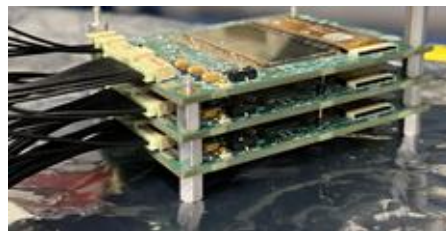
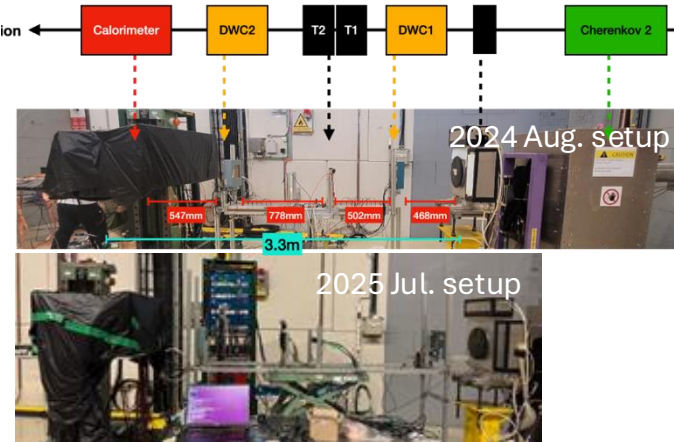
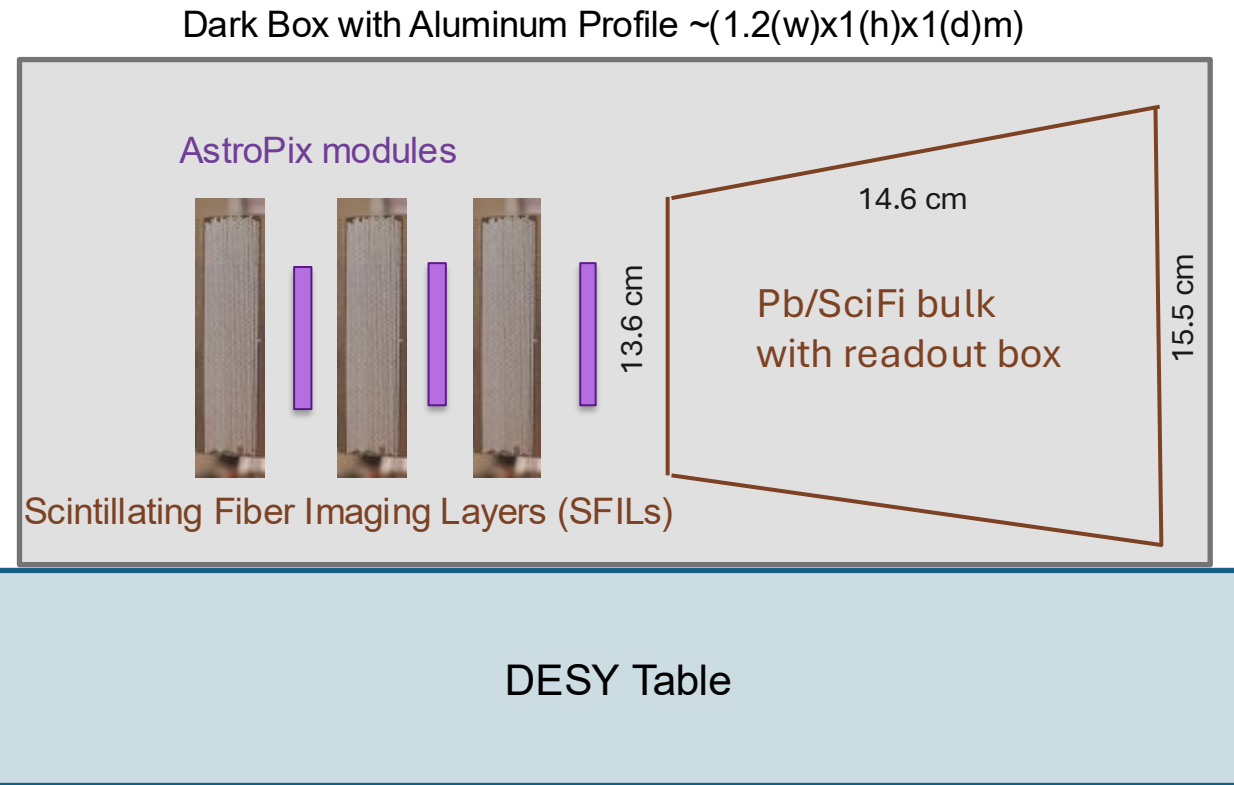
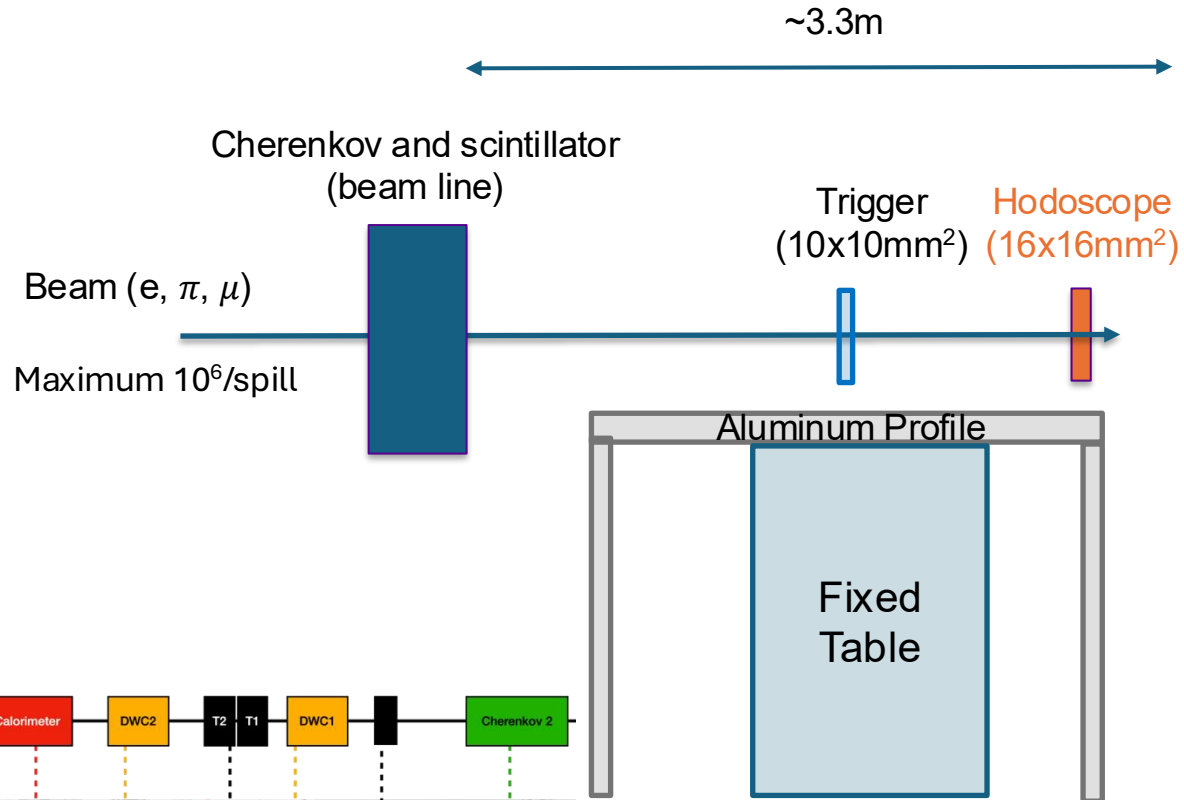
Hybrid, 1<sup>st</sup>, 3GeV



# Plan for beam test at CERN in August 2026

- Schedule: 2026.08.24~31
- Beam: 0.5~10 GeV electron-pion mixed at T09
  - In our experience at T10, e/pi separation with Cherenkov was effective below ~7 GeV
- Goals
  - Data taking with H2GCROC (crosscheck with FADC)
  - Test of long (70cm) SFILs
  - DAQ integration (H2GCROC, Cherenkov, AstroPix), from experience in the beam tests at KEK and Jlab.
  - e/pi separation
  - MIP/electron calibration

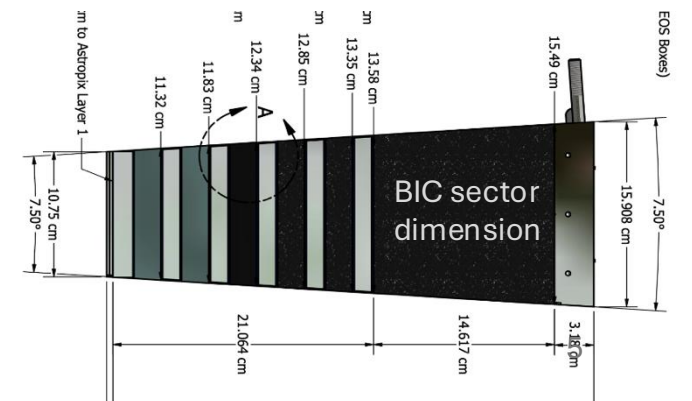
# Plan for detector setup



AstroPix quad chip modules



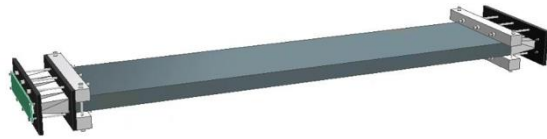
50cm-long SFIL at ANL  
(Scintillating Fiber Imaging Layer)



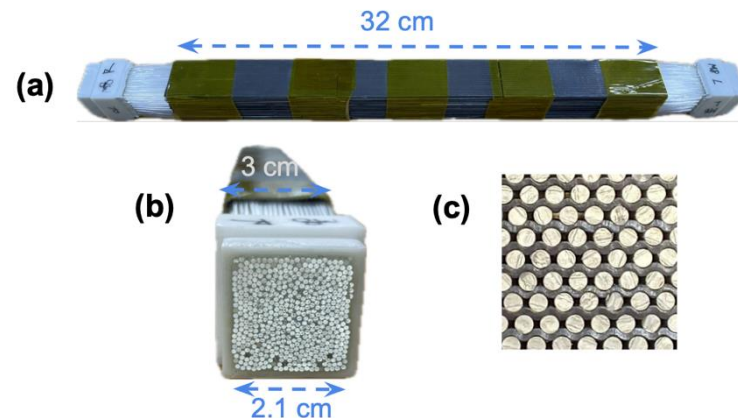


# Detector preparation before Aug. 24th

- Pb/SciFi
  - 1-3 SFIL(~70x2x15cm)s will be produced by early July
  - Bulk: ~20x15x15 will be produced by the July 31th
  - Backup: Re-configuring previous 32x3x3cm modules (32x9x15cm)
    - 3x for SFIL layers, 3x5 for bulk to cover enough depth
- Readout boards
  - The readout boards for single channel were tested in May
  - Design for readout boards and support structure are ready. The decision will be made by June 20th. Production takes 4 weeks.



Design of SFIL support structure



Previous Pb/SciFi modules as a backup

# Charge Questions

- 1) Do you have all necessary hardware (components) available, and if not what is the timeline to receive them?
- 2) Is the readout electronics and corresponding readout software running in the lab and thoroughly tested?
- 3) What type of "live QA" software do you have that helps you build confidence during the beam time that you are taking good data?
- 4) Describe your scientific goals and the specific measurements and parameter scans required to fulfill it.
- 5) What is the status of data analysis of previous beam tests? Which insights of previous beam tests are required to guarantee success of the upcoming beam test?
- 6) Which components are matched to the ePIC detector design, and which ones are being used as intermediate/ad hoc solutions?

# Charge Questions (BIC TB@ CERN PS T09)

- 1) Do you have all necessary hardware (components) available, and if not what is the timeline to receive them?
  - H2GCROC + KCU board: we have enough channels for the summing boards
  - External clock : will be ready in June.
  - Pb/SciFi Imaging layer will be produced by mid-July. Shipping by flight (<30kg)
  - Pb/SciFi bulk: we will reconfigure block type (32x3x3) modules.
  - SiPM boards: will be produced by July.
- 2) Is the readout electronics and corresponding readout software running in the lab and thoroughly tested?
  - Readout electronics and readout software were tested at KEK PF-AR Test Beam Line in May
- 3) What type of "live QA" software do you have that helps you build confidence during the beam time that you are taking good data?
  - We monitor H2GCROC results right after each run. We also run with monitor subdetectors and trigger status,

# Charge Questions (BIC TB@ CERN PS T09)

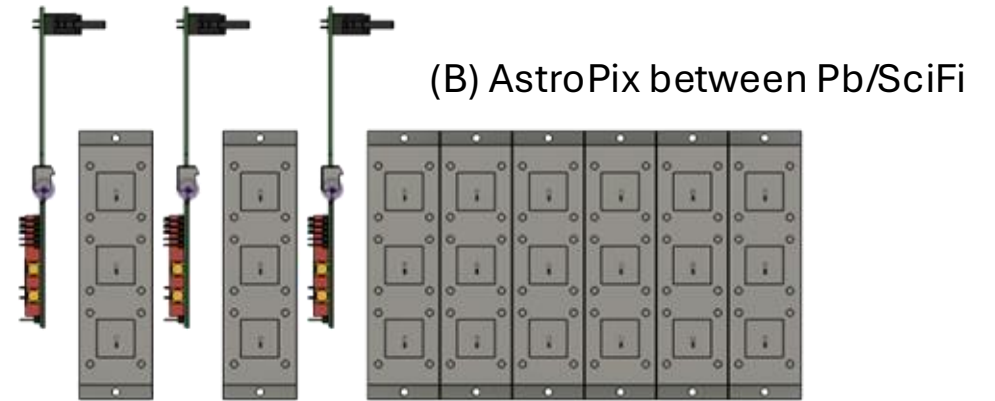
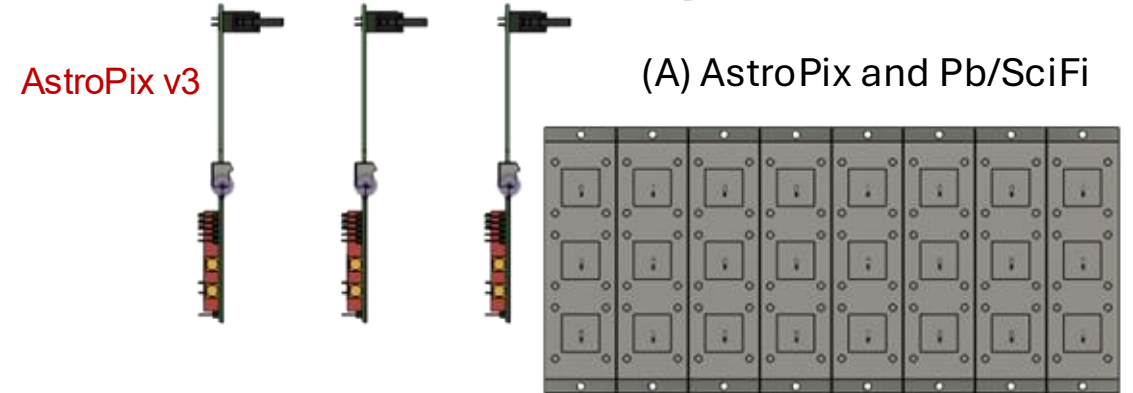
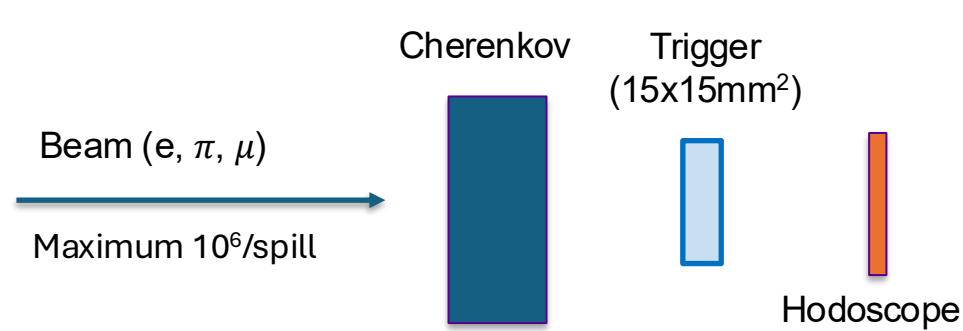
- 4) Describe your scientific goals and the specific measurements and parameter scans required to fulfill it.
  - a) Pb/SciFi Imaging layer + bulk energy resolution: beam energy scan up to 7 GeV
  - b) e/pi separation: integration of AstroPix+Pb/SciFi+Auxiliary readout
  - Technical goals
    - H2GCROC readout for electron/MIP
    - DAQ integration
- 5) What is the status of data analysis of previous beam tests? Which insights of previous beam tests are required to guarantee success of the upcoming beam test?
  - a) We found that the energy resolution fulfills the requirement ( $10\% \oplus 2\sim 3\%$ ) for 0.5~5 GeV electrons.
- 6) Which components are matched to the ePIC detector design, and which ones are being used as intermediate/ad hoc solutions?
  - a) We will crosscheck the performance of Pb/SciFi using FlashADC.

Thank You.

# Backup: previous beam tests

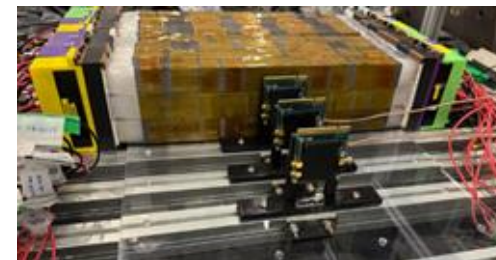
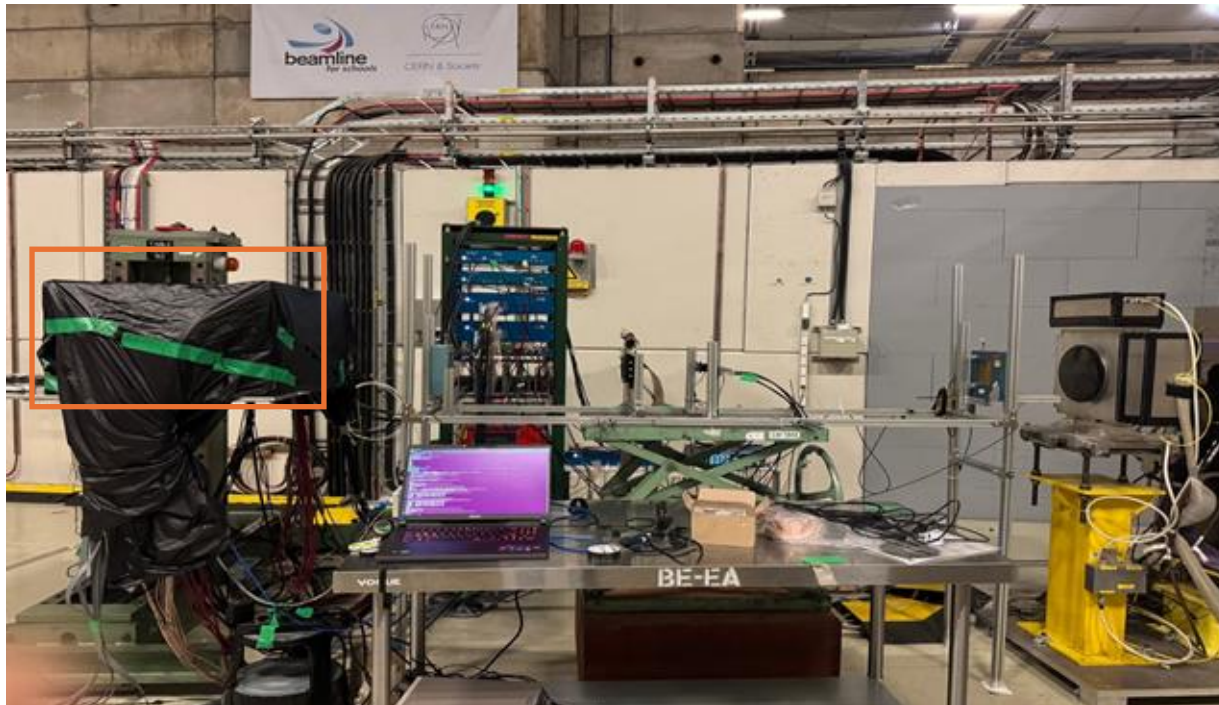
- August 2024 at CERN PS T10
  - First beam test by Korean group
- March 2025 at KEK PF-AR test beam line
  - 32x12x21cm Pb/SciFi, better energy resolution.
- June 2025 at KEK PF-AR test beam line
  - AstroPix synchronization
- July 2025 at CERN PS T10
  - Synchronized data taking with AstroPix and Pb/SciFi, but local solution.

# Backup: Setup at CERN PS T10 in July 2025

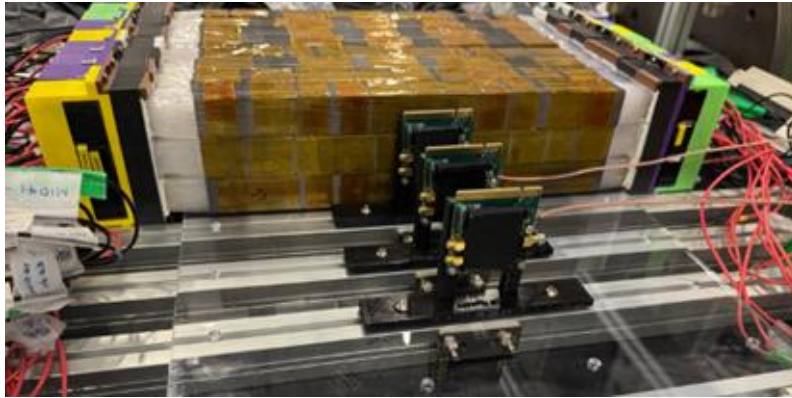


PMTs were used for Pb/SciFi

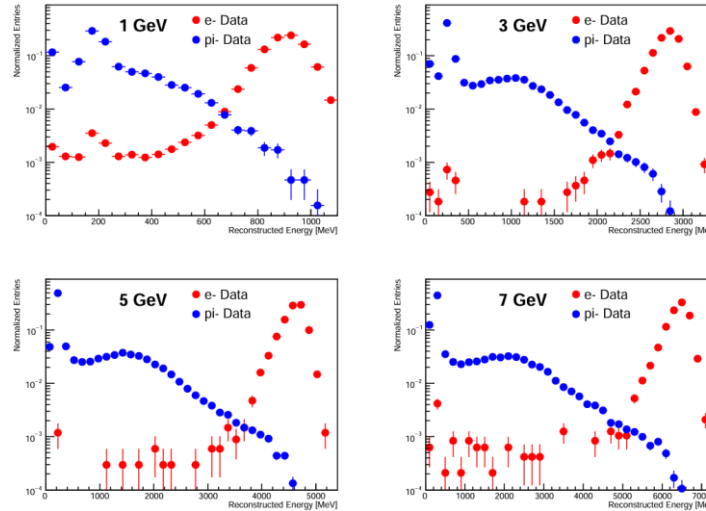
$32(w) \times 9(h) \times 24(d) \text{cm}^3$   
 $\sim 17X_0 \sim \text{BIC}$



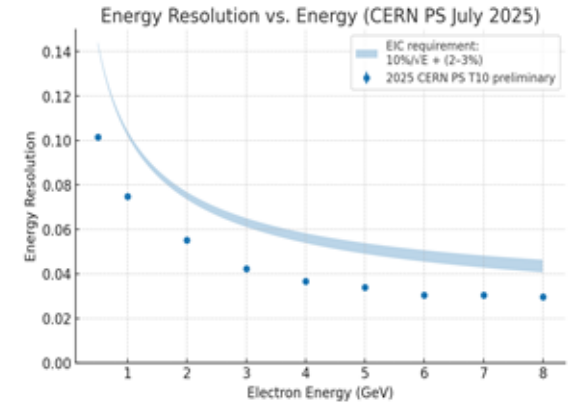
# Backup: electron/pion response at CERN PS T10 in 2025



32(w)x9(h)x24(d) cm<sup>3</sup> Pb/SciFi calorimeter



Electron/pion response  
(Work in progress)



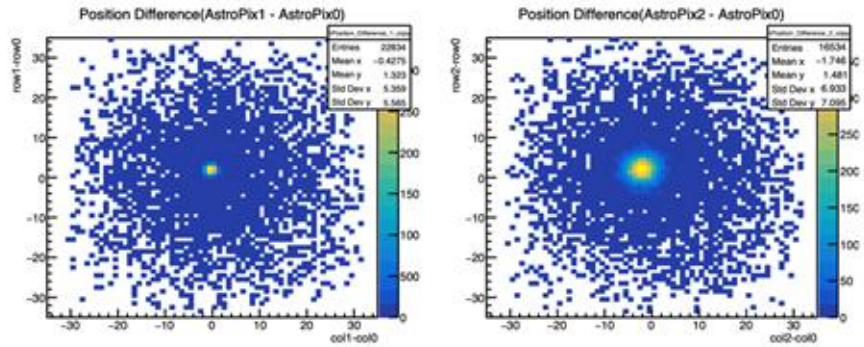
Electron energy resolution  
(Work in progress)

Total dimension is 32(w)x9(h)x24(d) cm<sup>3</sup>  
 Pb : SciFi : Air = 40:43:17,  $X_0 = 1.38\text{cm}$ , Total depth 17.4  $X_0$



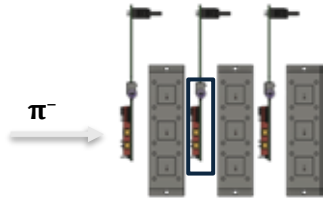
# Backup: electron/pion response: AstroPix at CERN PS T10 in 2025

## Pions

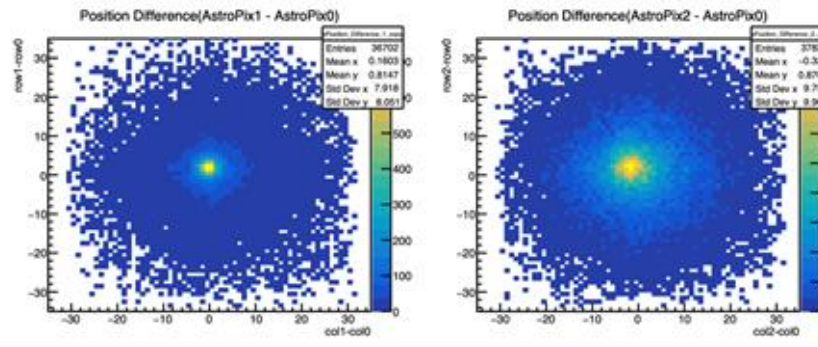


Position difference between 1st-2nd layer

Position difference between 1st-3rd layer

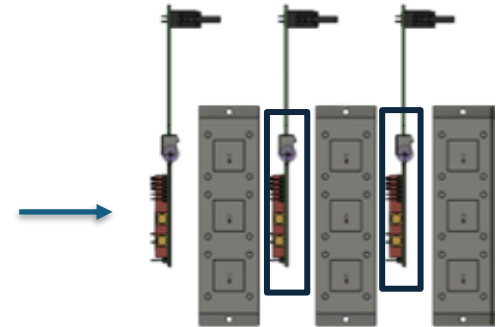
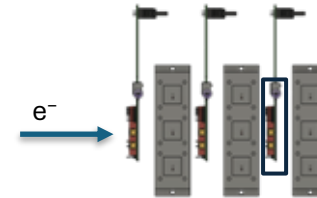
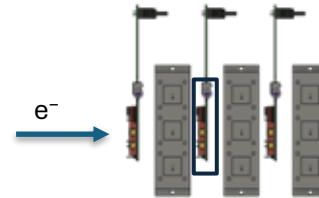


## Electrons



Position difference between 1st-2nd layer

Position difference between 1st-3rd layer



Proof-of-principle imaging of electrons and pions using synchronized setup of AstroPix (single chip) in beam environment performed.  
(Work in progress)