First Look of the Beam Test at CERN PS T9 in Aug 2026

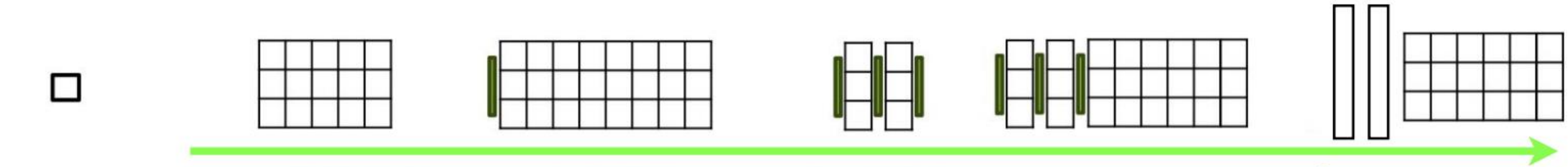
experimental setup and lessons learned

26.9.15 BIC ESB/System Testing Meeting

Jeongsu Bok

What we have done so far

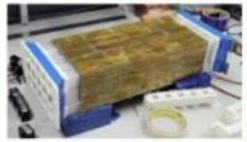
KEK in May 2026:
preparation for
CERN PS



May 2024

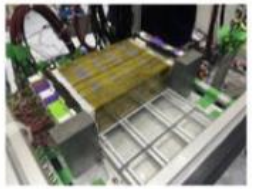
First piece

Aug 2024 CERN PS



First Pb/SciFi prototype
production in Korea
First beam test
Successful data taking

Mar 2025 KEK

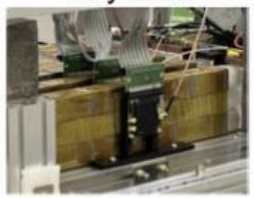


More Pb/SciFi layers
Improved energy resolution
New DAQ, Trigger,
Hodoscope, Calibration
Extension cable test

June 2025 KEK

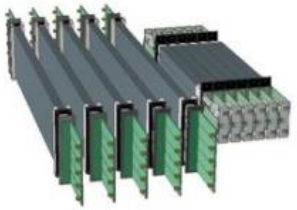
AstroPix synchronization
with trigger time

July 2025

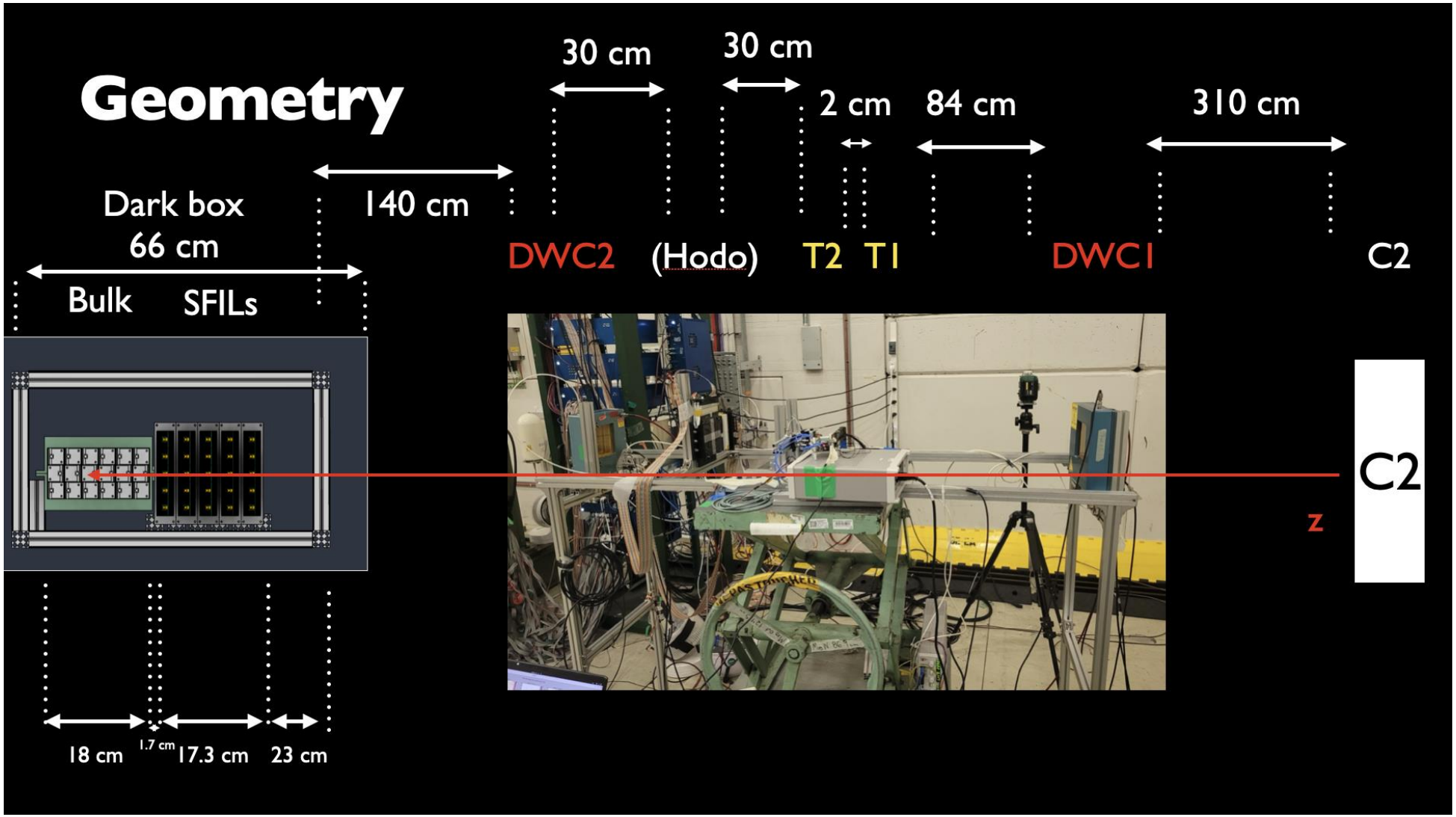


synchronized data taking of
AstroPix + Pb/SciFi
Proof-of-principle imaging of
electrons and pions
Resolution fulfill the EIC
requirement

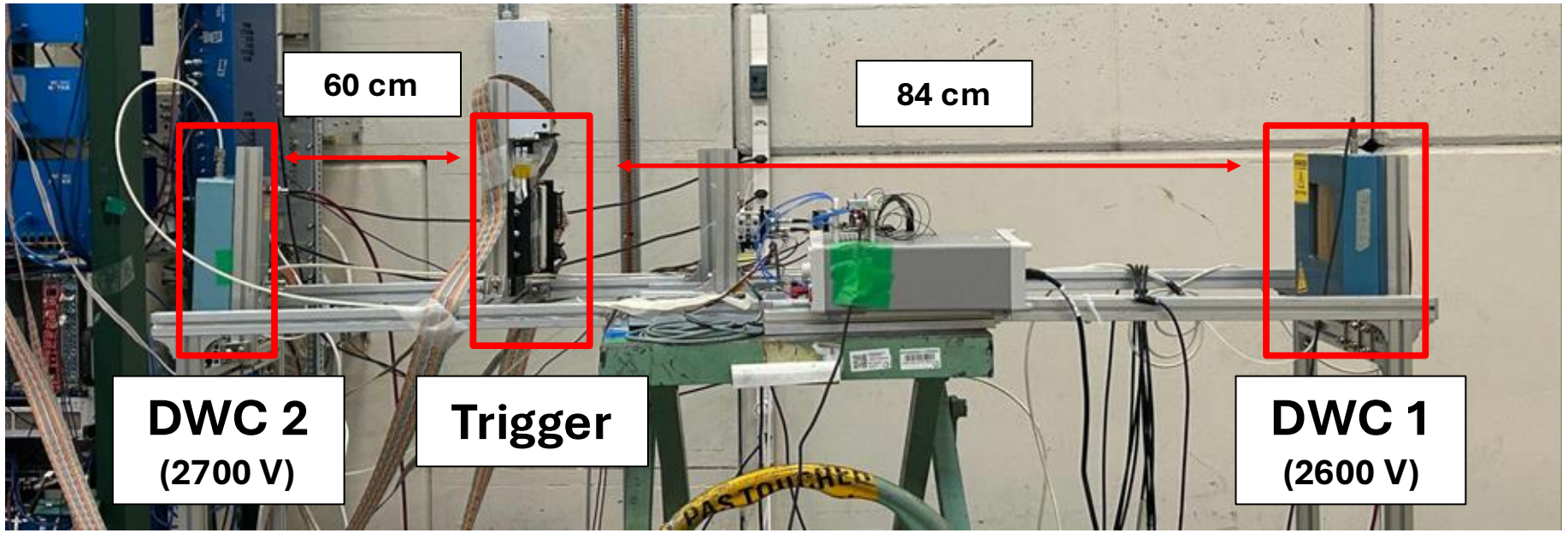
Aug 2026 CERN PS



Detector Setup

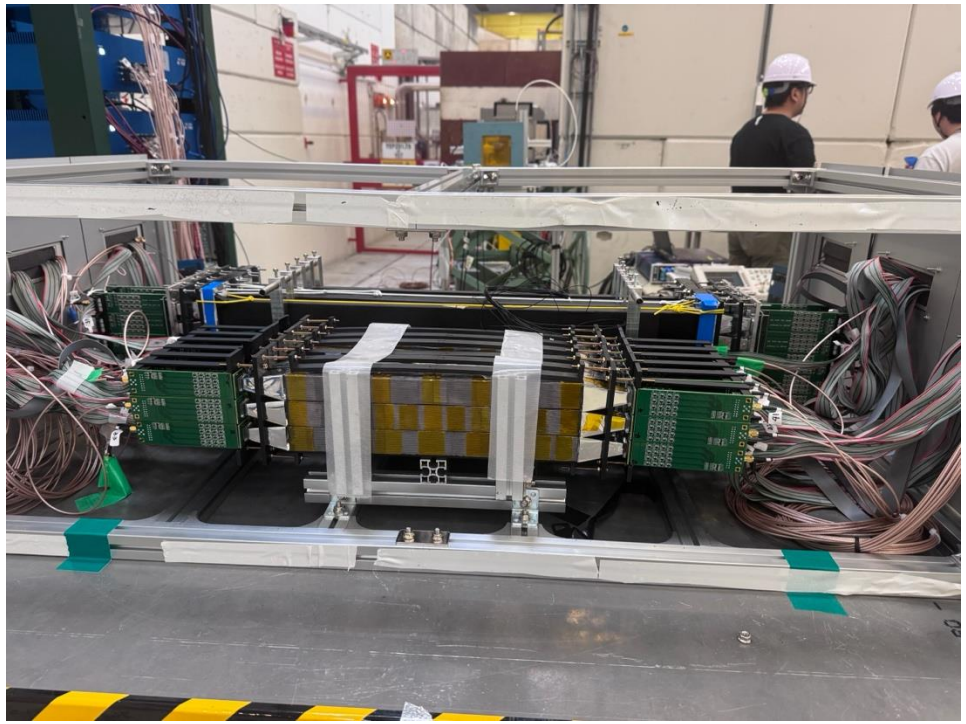


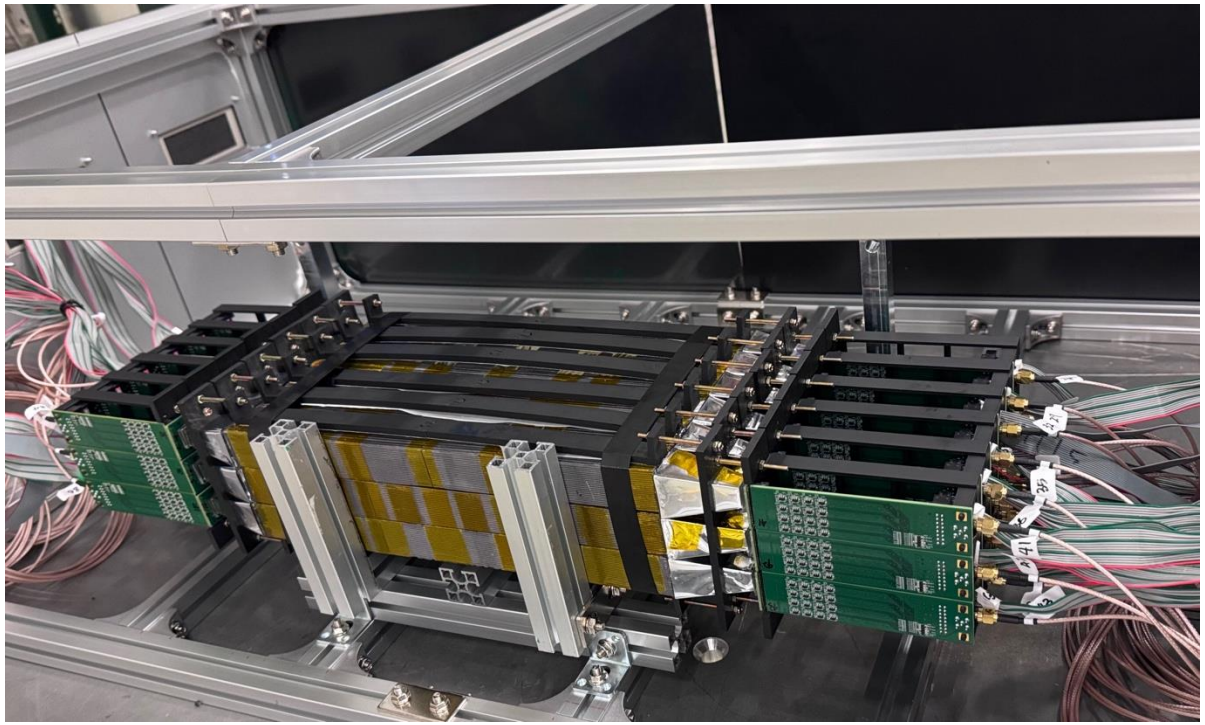
Ancillary Detectors

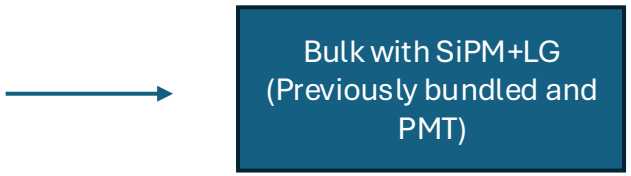


Cherenkov counter (one of two)
Scintillator for beam monitoring
are equipped along the beam line

Detector Setup: Pb/SciFi

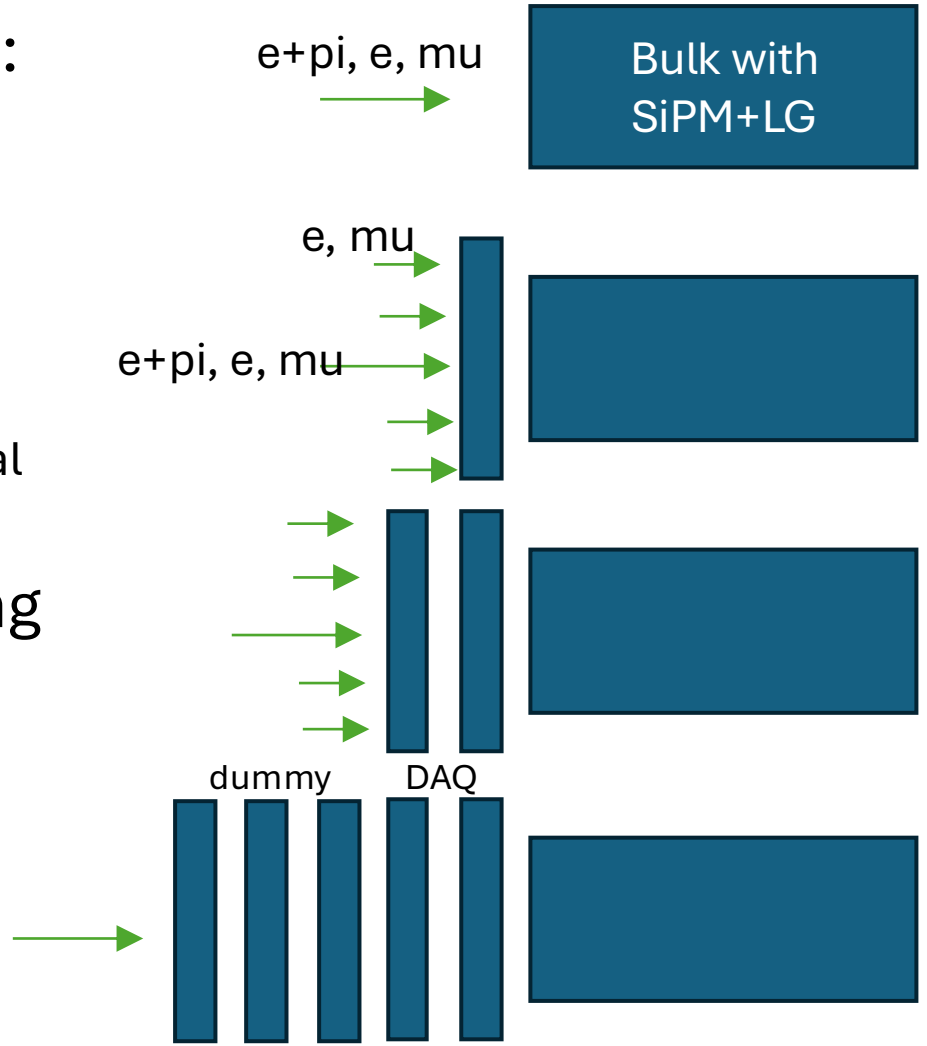






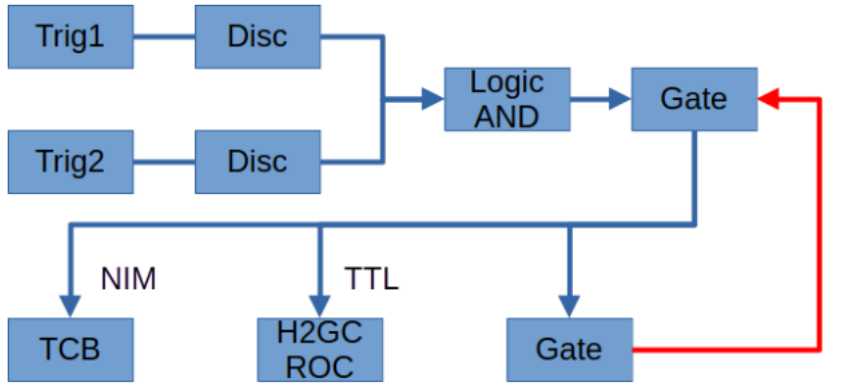
Pb/SciFi Setup

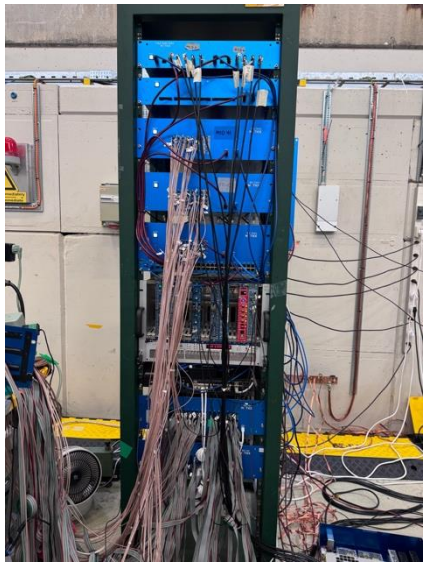
- 1) bulk: 3x6 array of 32x3x3cm unit module: 32x9x18cm
- 2) Added SFILs
  - Added one then, electron calibration
  - Added one more, electron/muon calibration
    - Different LG length between , matching trapezoidal SFIL length for a sector.
- 3) Added SFILs without readout for checking shower response for each channel
- 4) Similar beam setup for two type of DAQs
  - FADC and H2GCROC



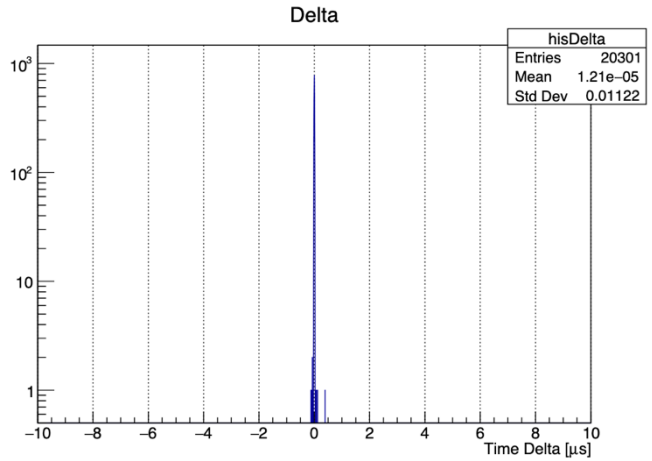
DAQ setup (Jongwon)

- Tested timestamp matching between H2GCROC timestamp and FADC in Korea (NOTICE Korea, 1us coarse&8ns fine timestamp)
- So, Cherenkov will be available for H2GCROC data, as well as we collected electron-enriched data.





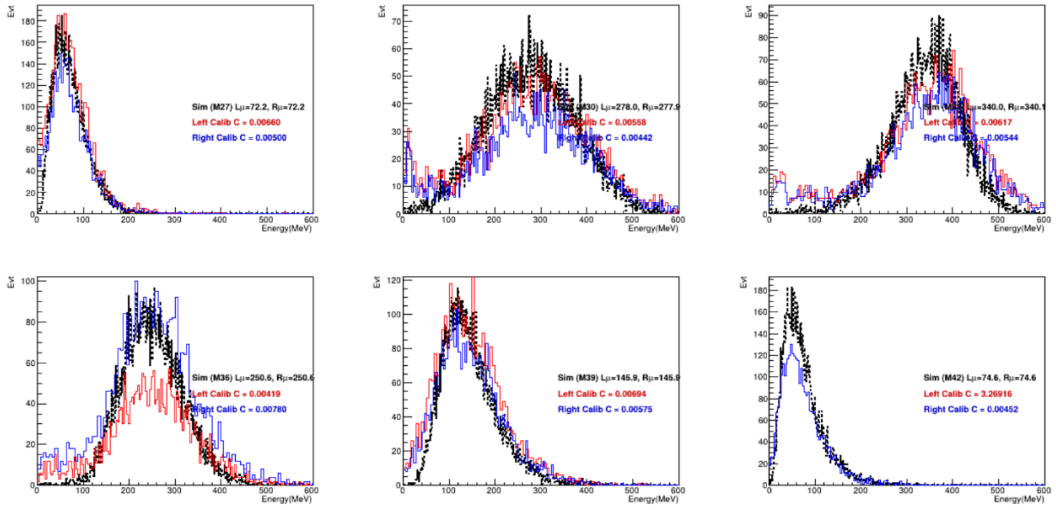
Matching events successfully based on timestamp difference with 10 ns. (NK: 20304, H2GCROC: 20312, Matched: 20301)



Prompt analysis for 3GeV electron (Notice Korea DAQ)

e- 3GeV Bulk Calibration & Compare IntADC

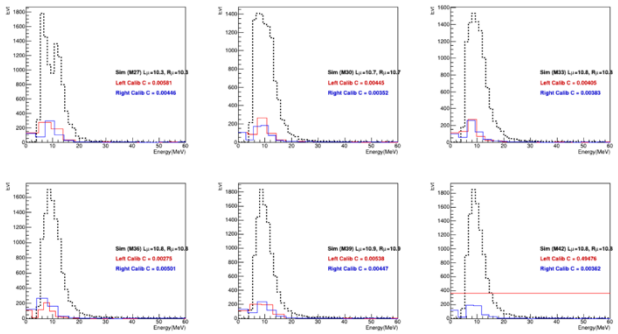
BIC Data IntADC/Simulation Edep by each Channel (2nd Row)



we had 3 bad channels at that time, we moved it to make 3x5 in one side

mu- 3GeV Bulk Calibration & Compare IntADC

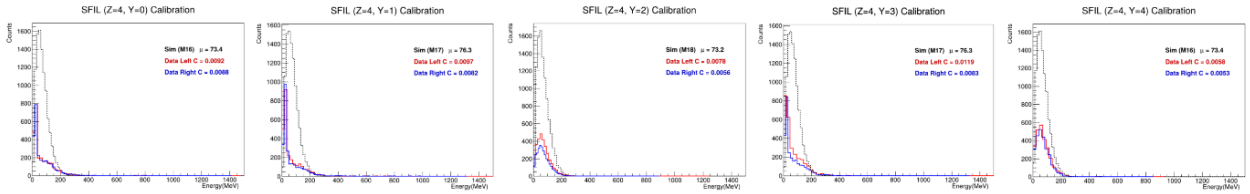
BIC Data IntADC/Simulation Edep by each Channel (2nd Row) – Run # 765



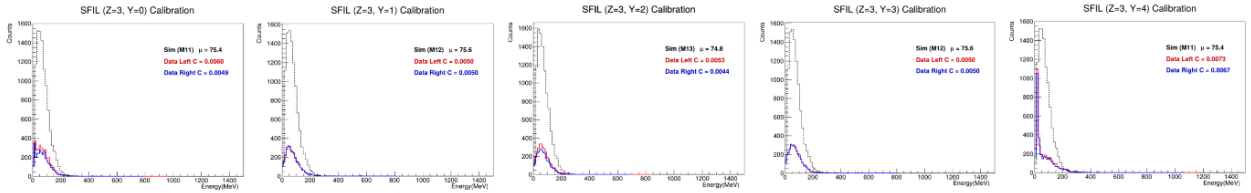
e- 3GeV SFIL Calibration & Compare IntADC

BIC Data IntADC/Simulation Edep by each Channel

SFIL 7



SFIL 6



1) Bulk: looks OK for electrons. Muons should be checked with fine binning
2) SFIL: some channels do not seem to be good even in electrons. But we need to check more.
3) Anyway, this is Prompt analysis during the beam test to check the detectors were OK

Issues during the beam test - internal :)

- Overall, we were OK at KEK in May, but we faced issues when
  - the number of channels are increased (4→86)
  - and for new detector setup (SFILs)
- Optical coupling issue in SFIL: As usual in new setup
  - 3x6 bulk looked OK, but we found issues in SFILs, so we had to test only two SFILs within the beam time
  - Some channels in SFIL seems to be bad after fixing mechanical coupling, but we need investigation.
  - We will find a solution to secure optical coupling.
- FEE/cable issue:
  - As usual in new setup
  - it turned out that the boards are OK, it was a matter of debugging during the experiment. We lost some channels, but we could do experiment.
- More preparation may prevent some issues, but we learned from the experience and we have to-do-list in our hands. We expect smooth operation for the next beam test.

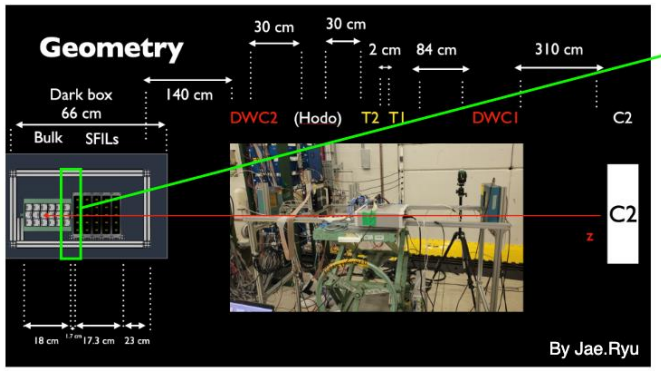
Concern for the next beam test (Pb/SciFi)

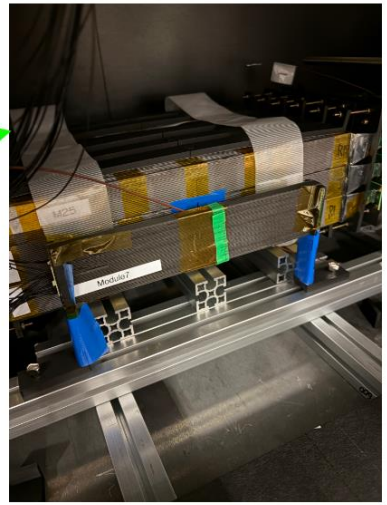
- Muon beam is not available
- Calibration for different LG coverage
  - Slightly different height may prevent good electron calibration
  - We will check the data to quantify the effect.
- Ensure optical coupling: We are collecting idea, we would appreciate any idea or advice.
- Plan for the next beam test
  - not confirmed yet, but we will begin discussion.
- KEK Application status
  - For Oct-Dec 2026 period: Applied, but we did not receive result yet.
  - We can apply Feb-Mar and May-June 2027

AstroPix 9-chip by Jinhyun and Sanghooon

- Data taken with following detector configuration (Stand-alone data taking, Run log)

  - ☑ Beam injection to each sensor - Muon 5 GeV, Mixed 3 GeV
  - ☑ Beam injection to APIX module with 1 SFIL - Muon 5 GeV, Mixed 3 GeV
  - ☑ Beam injection to APIX module with 2 SFIL - Mixed 2/3/4/5/6/7/8/10 GeV(+ collimator scan), Electron 0.2/0.3/0.4GeV
  - ☐ ~~Beam injection to APIX module with 3 SFIL~~
  - ☐ ~~Beam injection to APIX module with 4 SFIL~~
  - ☐ ~~Beam injection to APIX module with 5 SFIL~~

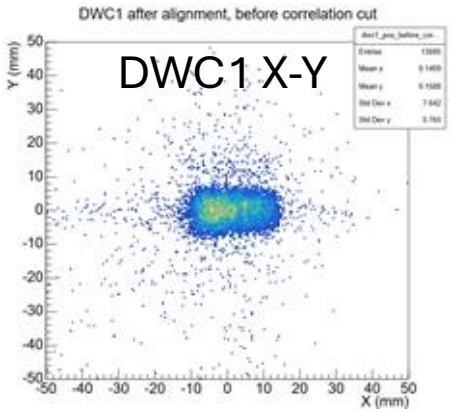


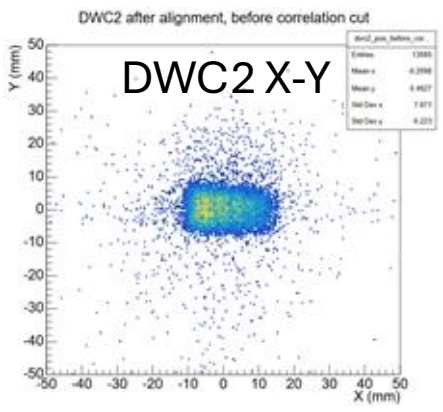


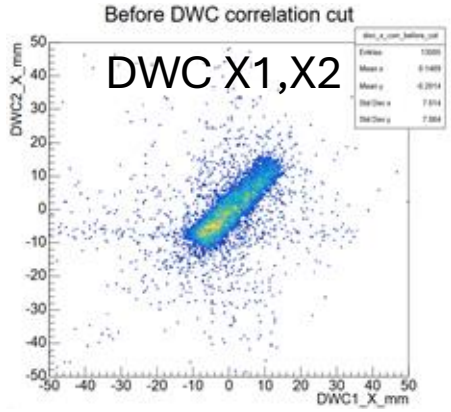
APIX module installed between bulk and SFIL

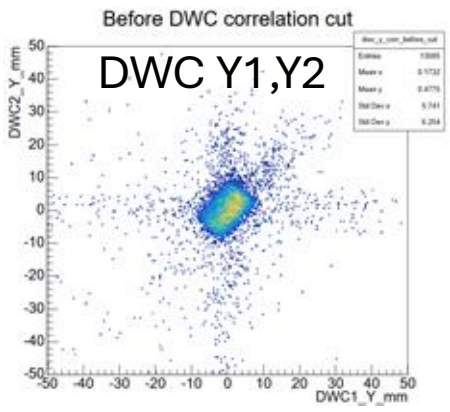
- Slide from Jinhyun, we investigated effect by increasing hit rate
- We checked column-row matching probability for 9 chips under beam condition

Beam Profile: Delay Wire Chamber

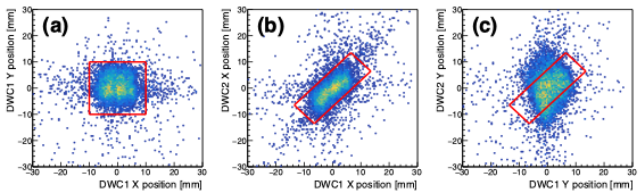








- Electron beam
- Trigger overlapping region is expected to be about 15mm x 10 mm
- DWC data shows that ~20mm x 10mm
- We will study with cuts for beam position and angle

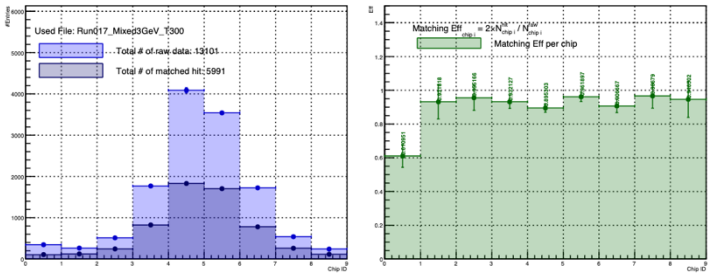


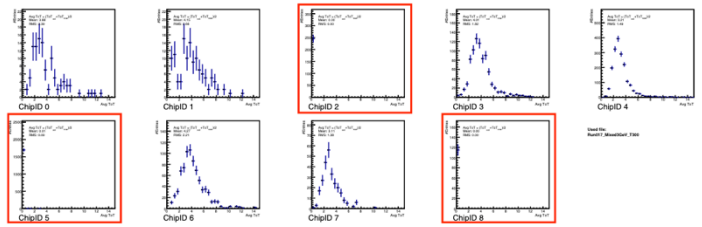
2024 Trg 1cmx1cm

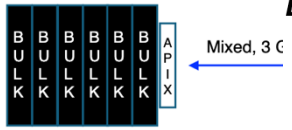
Backup: AstroPix by Jinhyun

Brief summary

column-row matching probability



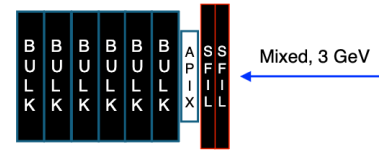


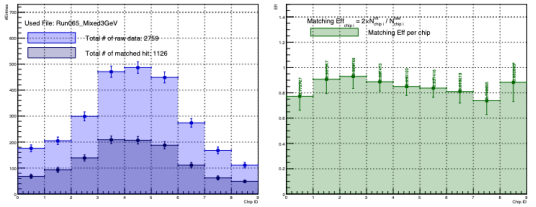


- Beam injection to center of module <u>without any SFIL</u>
- Matching efficiency among chips showed consistency(w/o chip 0)

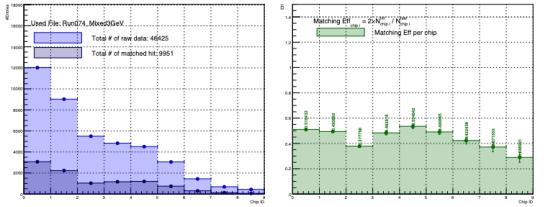
  ! Since ToT value for specific chips(2, 5, 8) showed abnormal distribution, ToT condition wasn't used for hit matching
- During preparation, abnormal behavior of ToT distribution shown randomly → Need to be investigated in the future

Brief summary(Collimator scan - Mixed 3 GeV)

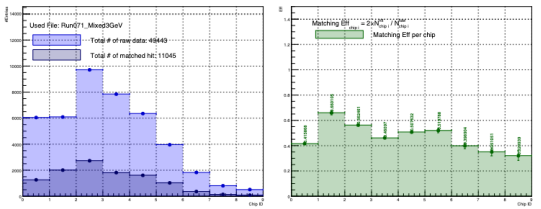




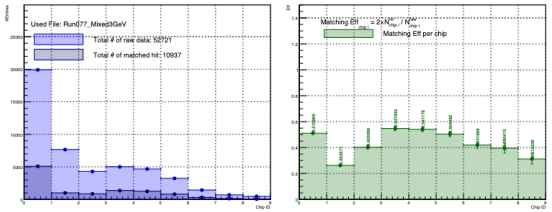
Collimator: 1.5 mm



Collimator: 14.0 mm



Collimator: 8 mm



Collimator: 20.0 mm