The ePIC Barrel Imaging Calorimeter

System Testing and Simulations

Maria Żurek
Argonne National Laboratory

5th BIC In-person Workshop
June 16-18, 2026

Green Team

GTL - System Testing and Simulations

BIC Project Management

Project Manager (and DSTC):
- Jessica Metcalfe (Argonne)

Deputy Project Manager
- Sylvester Joosten (Argonne)
- Maria Żurek (Argonne)

System Testing

System Demonstration
PoC: Henry Klest
Sites:
- Argonne
- U. Regina
- PNU

Beam Tests
PoC: Bobae Kim
Sites:
- Argonne
- U. Regina
- EIC Korea

System Calibrations
TBD

System QC
PoC: Maria Żurek
Sites:
- Argonne
- U. Regina
- BNL (EIC Project)

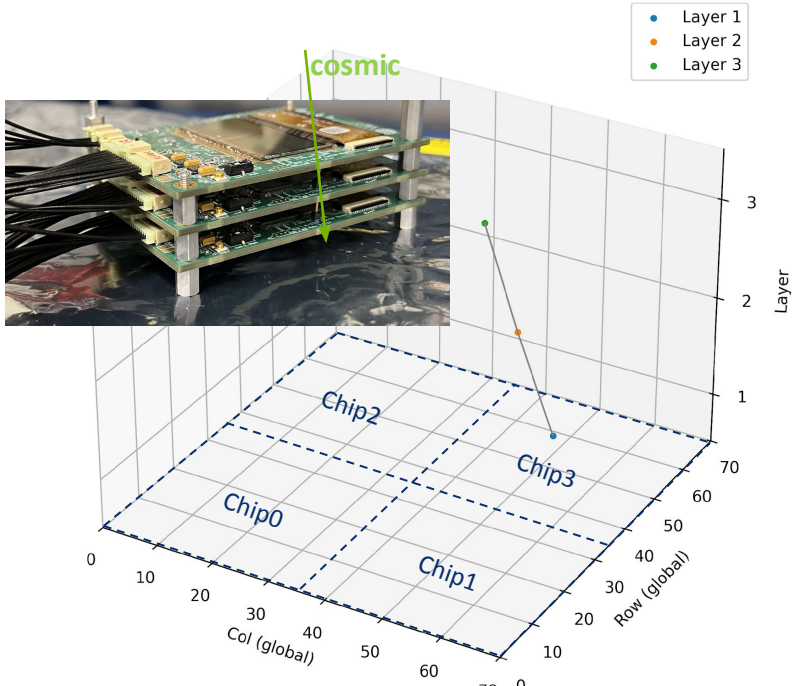
Software & Sim

Rapid Response
PoC: Maria Żurek
Sites:
- Argonne
- U. Manitoba
- PNU

Development
PoC: Chao Peng
Sites:
- Argonne
- U. Manitoba
- U. Regina
- PNU

Benchmarks
PoC: TBD
Sites:
- Argonne
- U. Manitoba
- PNU

GTL: Maria Żurek
Deputy GTL: Jeongsu Bok



Example cosmic event display from 3 layers of daisy-chained AstroPix v3 quad chips

Updates

Since last report on System Testing

Beam Test Campaigns:

- Commissioning in Hall D (low energy) and KEK
- August high-energy run with positrons (Hall D) and electrons/pions (CERN)

Test and goals for this workshop

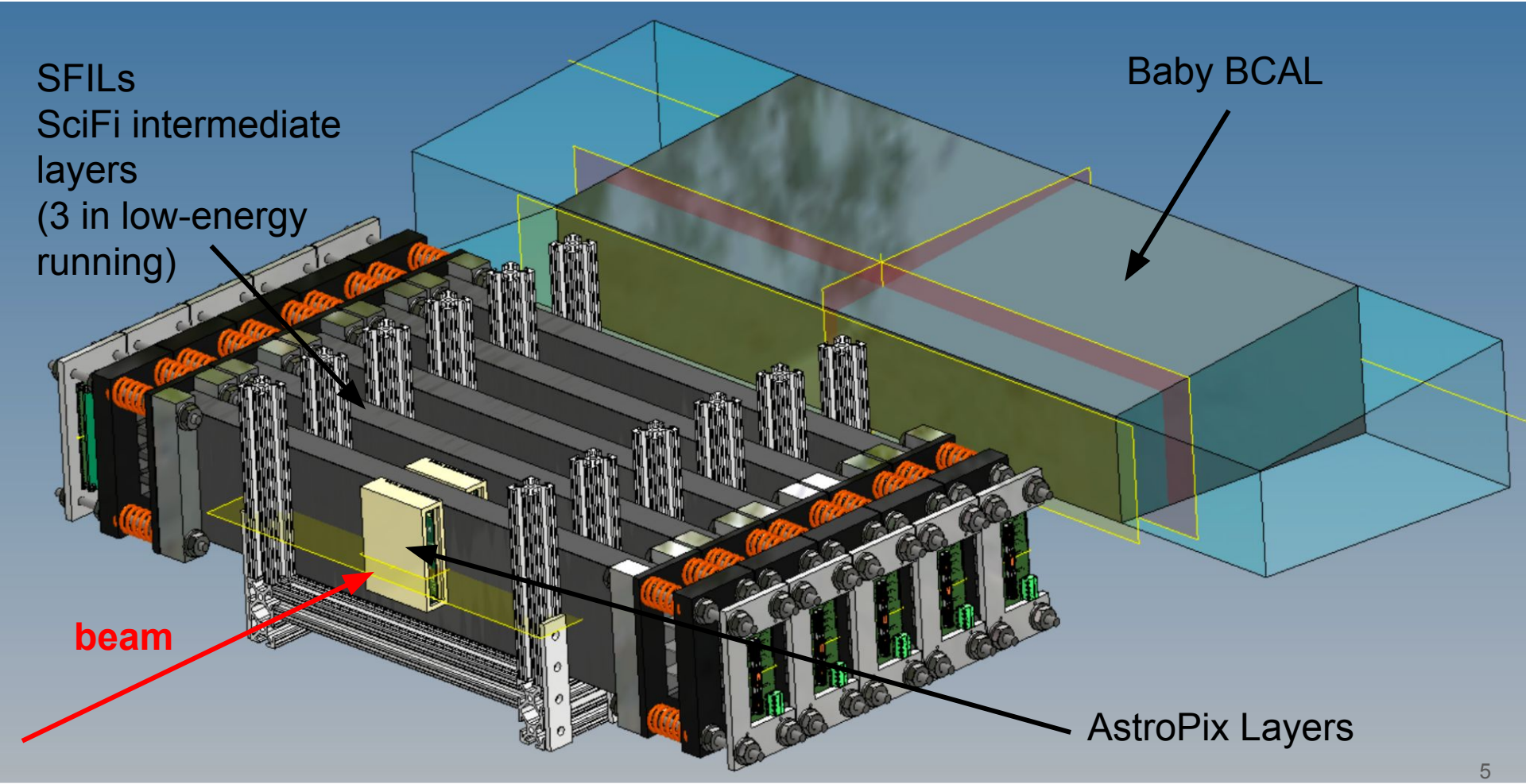
Beam Test Goals

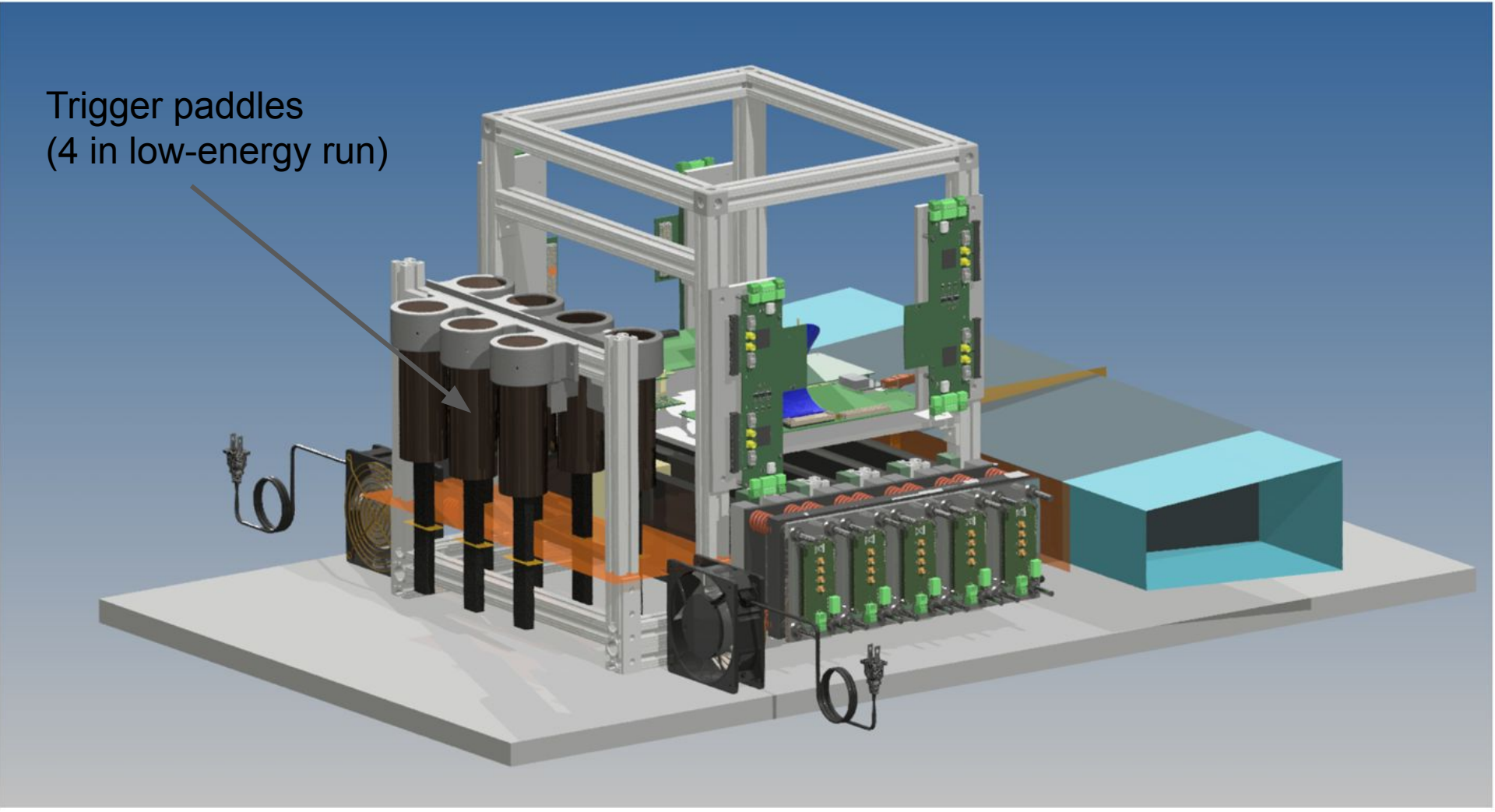
Commissioning:

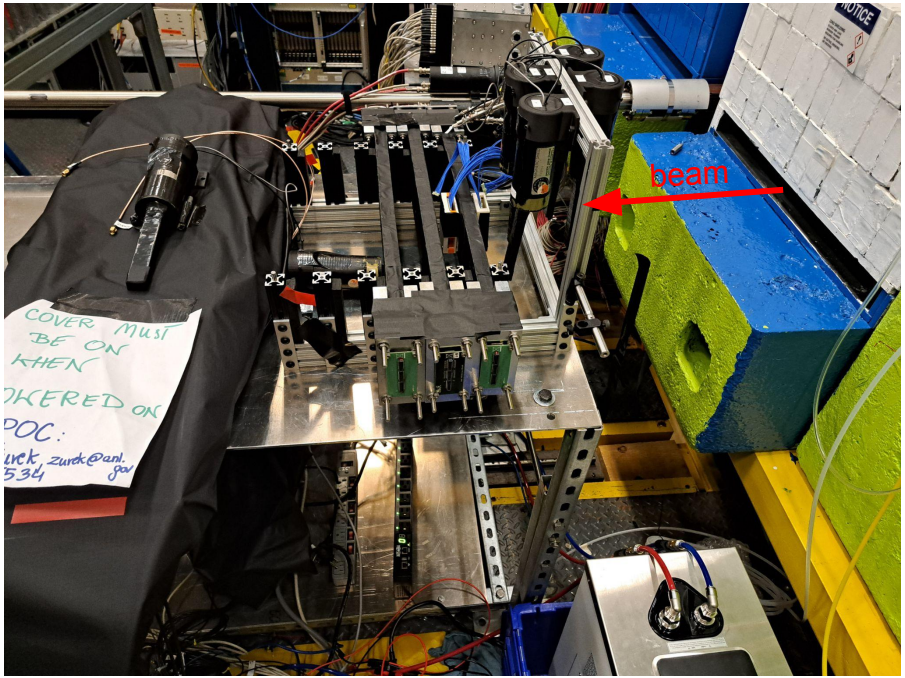
- Commission for the first time the readout with HGCROC.
- Test synchronization between AstroPix and HGCROC readout.
- Benchmark low-energy response (~0.5 GeV) within the nominal and August Beam-Test dynamic range, at different energy points (for Hall D)

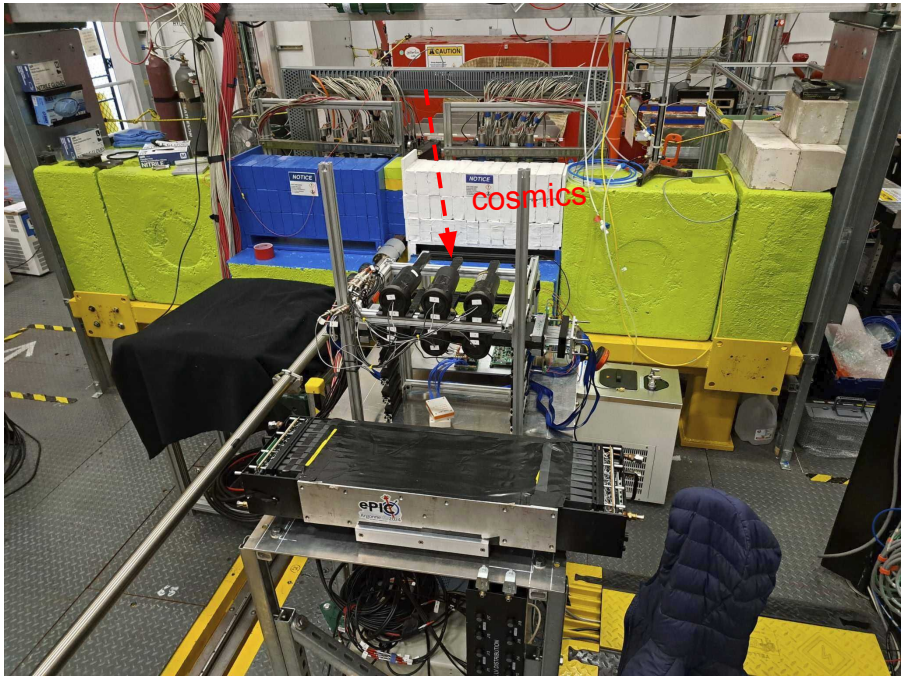
August:

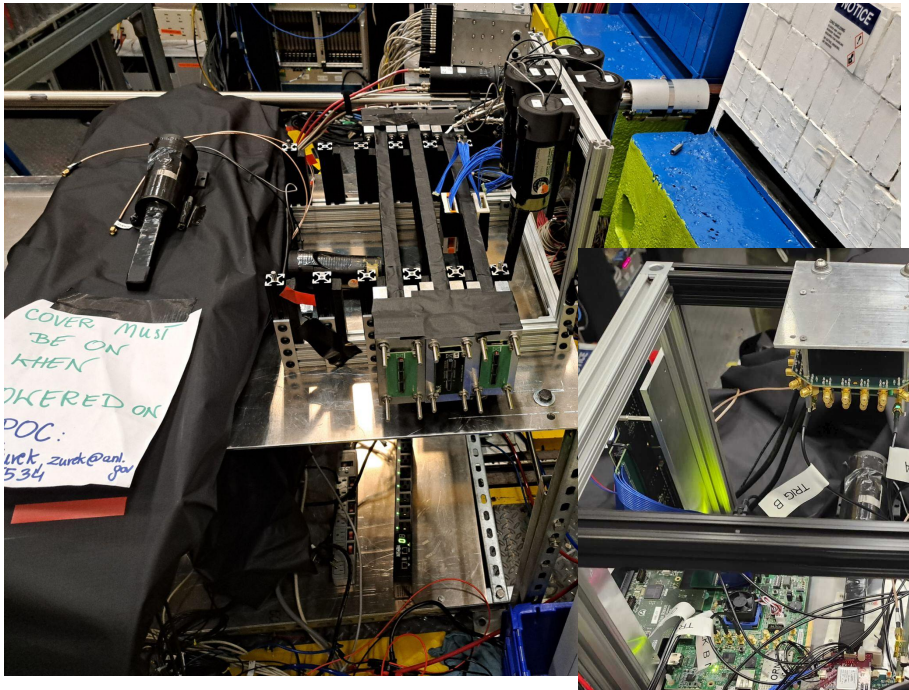
- Benchmark energy and timing resolution within 3-6 GeV energy of positrons (Hall D) and 0.5~10 GeV electron-pion mixed beam (CERN) range with full HGCROC readout and show shower imaging event by event.


SFILs
SciFi intermediate layers
(3 in low-energy running)
Baby BCAL
beam
AstroPix Layers


Trigger paddles
(4 in low-energy run)


beam
COVER MUST
BE ON
KHEN
OKERED ON
POC.:


cosmics
ePIC


NOTICE
COVER MUST
BE ON
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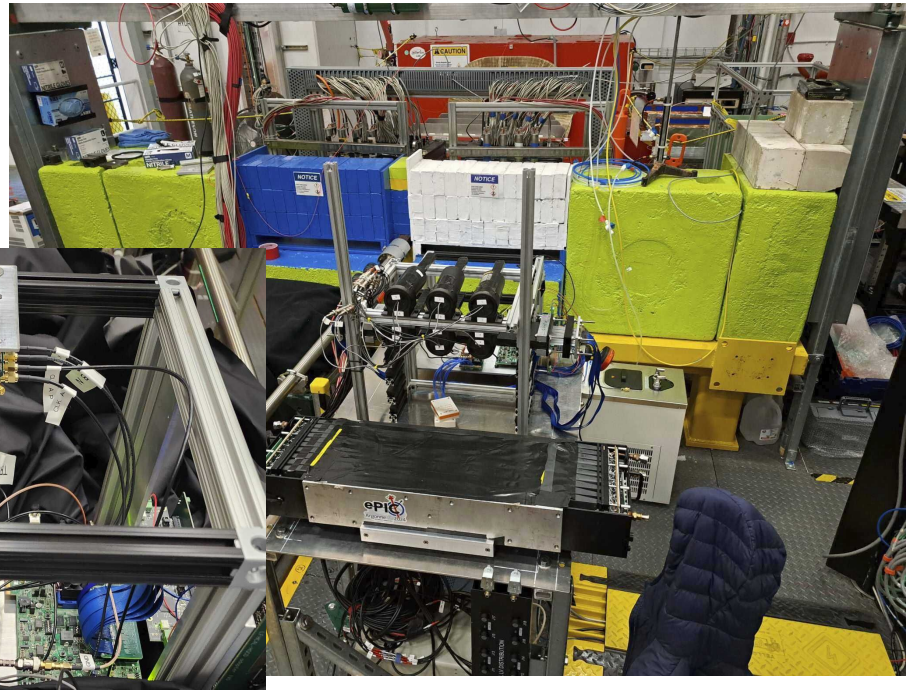
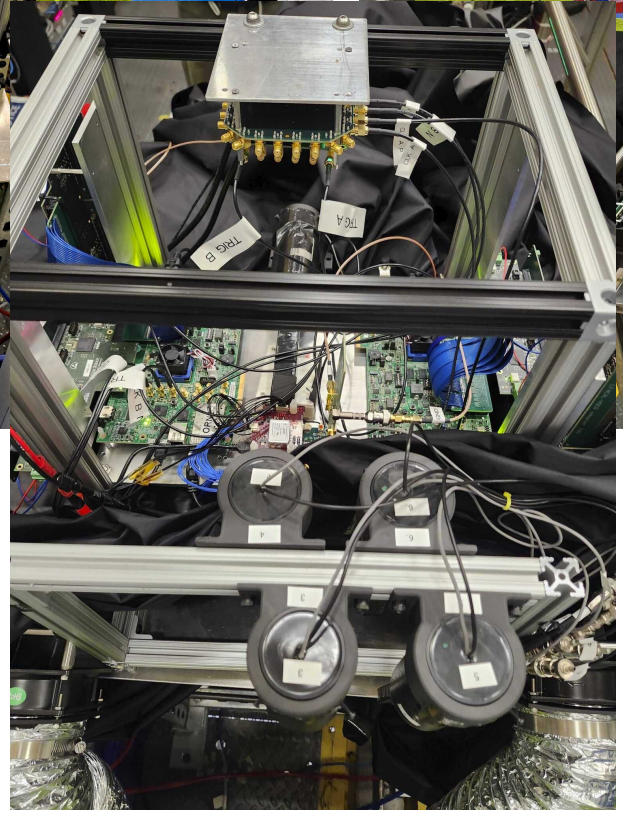
DOC.:

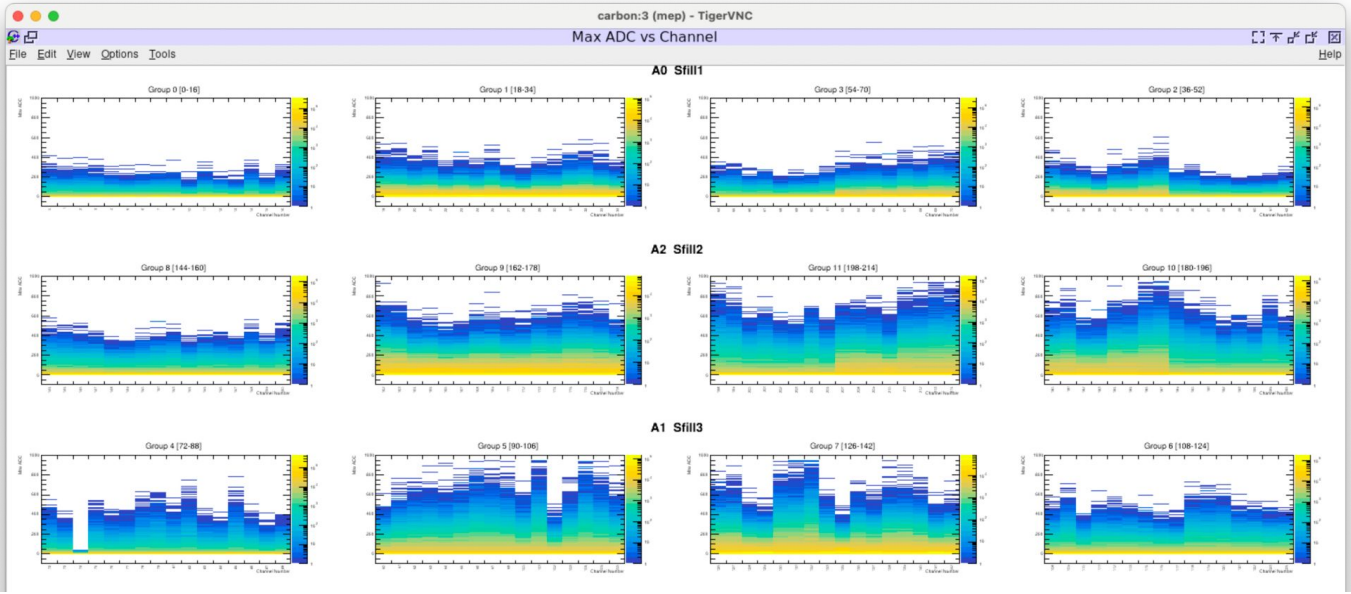

CAUTION
NOTICE
NOTICE
epic


TRG B
TRG A

First look into the data

HGCROC - SFILs with beam

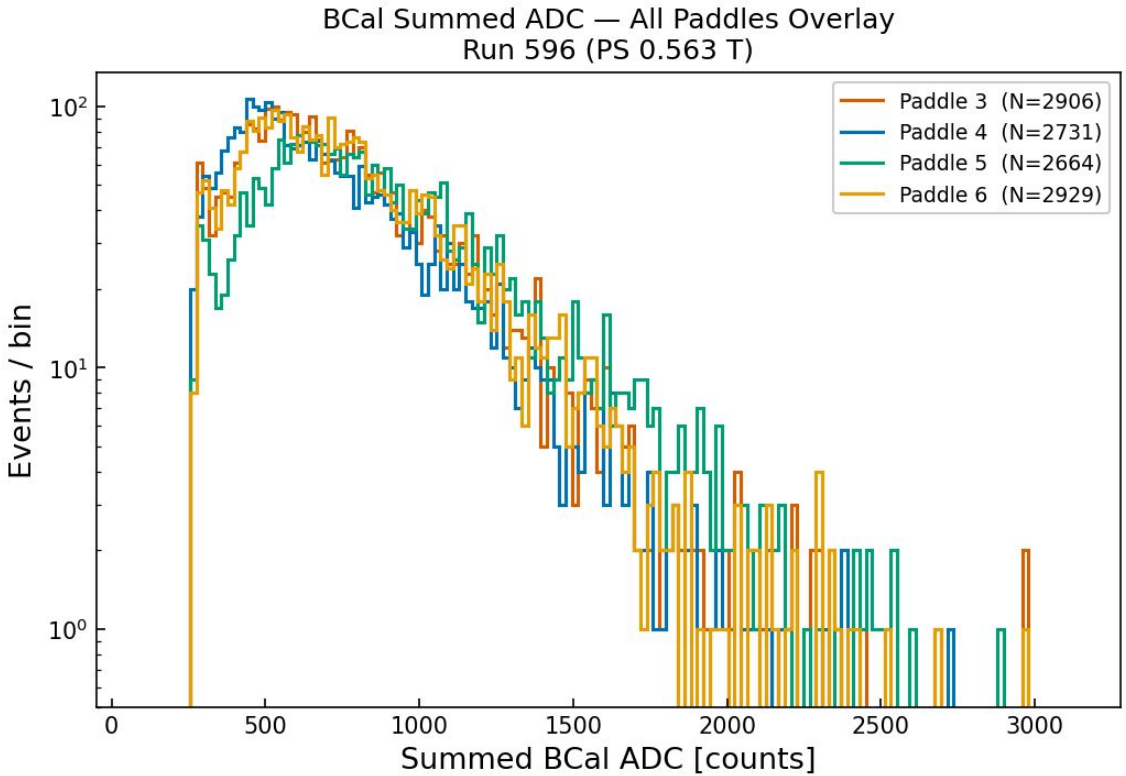
beam



Henry Klest

First look into the data

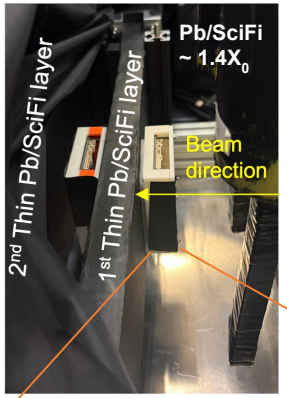
Baby BCAL

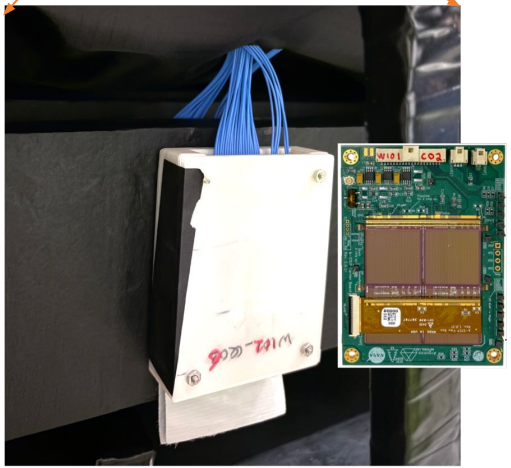


Trig 3	0.55	+- 0.01 GeV
Trig 4	0.48	+- 0.01 GeV
Trig 5	0.68	+- 0.02 GeV
Trig 6	0.57	+- 0.01 GeV

First look into the data

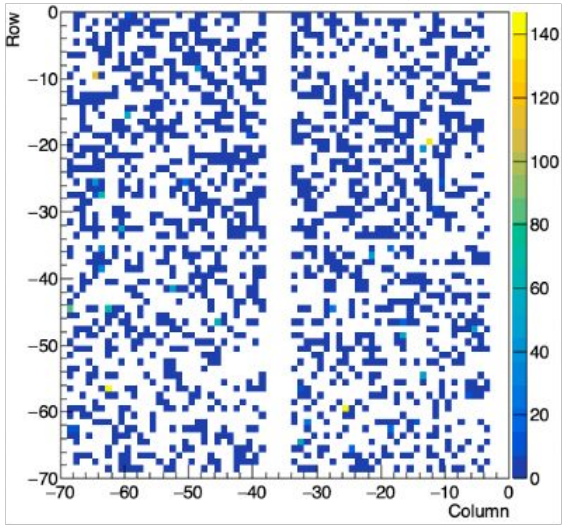
AstroPix: 1st layer of Astropix quad-chip

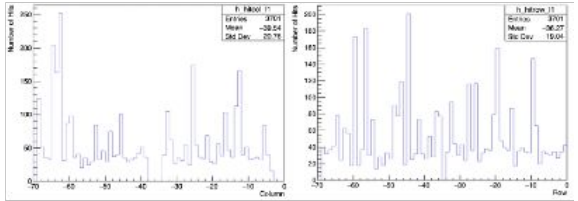




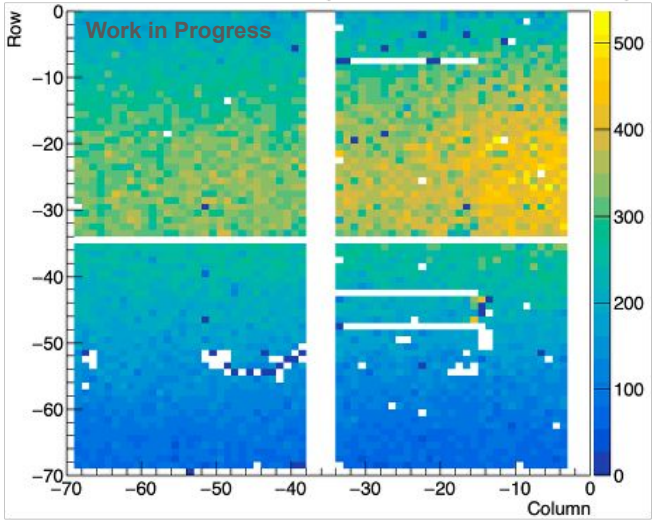
- Two Quad-chips + A-STEP (Astropix multichip/multilayer prototype readout system)
  - ✅ confirmed the stable operation up to ~1.2 kHz beam rate at KEK beam test last year; **promising stable operation under Hall D beam conditions.**

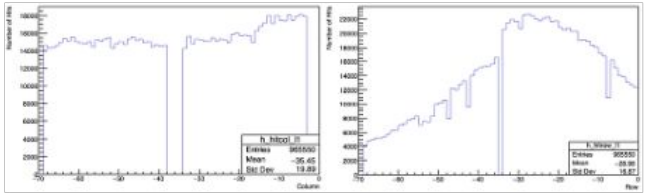
- No beam (cosmic run)





- Run1318 – 1324 (Total 61,416 events)

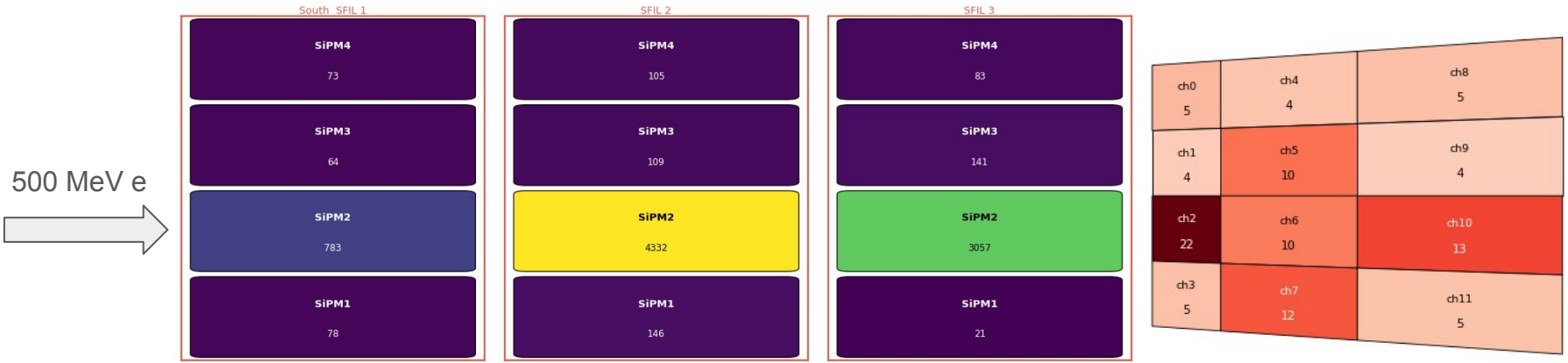




First look into the data

Synchronization

Candidate matched event display, shower in SFIL and tail in Baby BCal

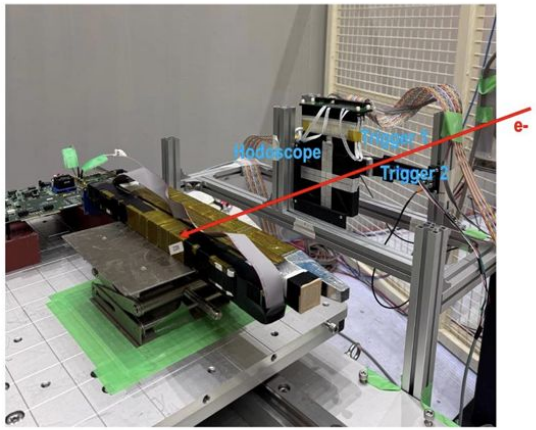


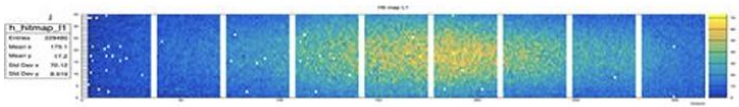
SFIL SiPMs are summed together in this display, but all 16 sub-array channels are available

KEK Beam Test

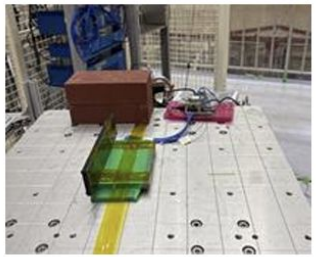
Jeongsu Bok

- electron beam at KEK PF-AR Test Beam Line
  - At 1st and 3rd 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 ~2.7kHz rate (rate at trigger in beam line)

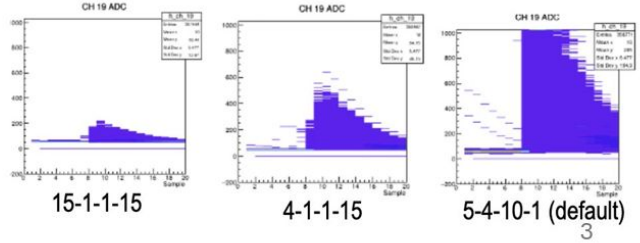




(magnet setting not optimized for focusing)



Hybrid, 1st, 3GeV



Plan for the Workshop

AstroPix Calibration

Reports on the current studies

Calibration options

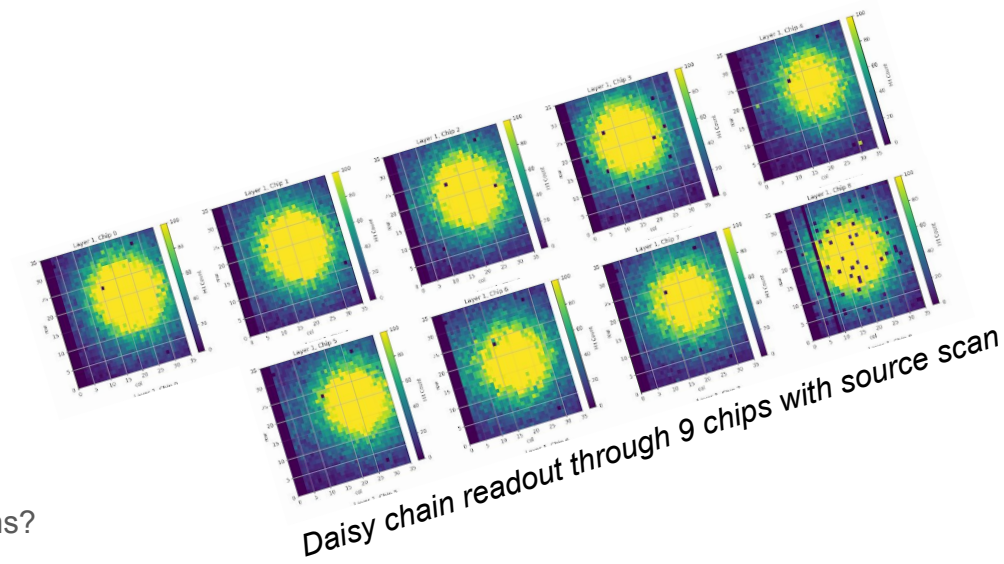
- Injection only
- Injection + source points
- Sources only
- Other methods: X-ray, IR laser, MIPs

Key questions

- How many source points are needed?
- What is the scan time?
- Module-level vs tray-level absolute calibration?
- How often do we need to recalibrate?
- How do we compare calibrations across institutions?

Planning

- Baseline procedure for August
- Available capabilities at each institution
- Follow-up measurements and responsibilities

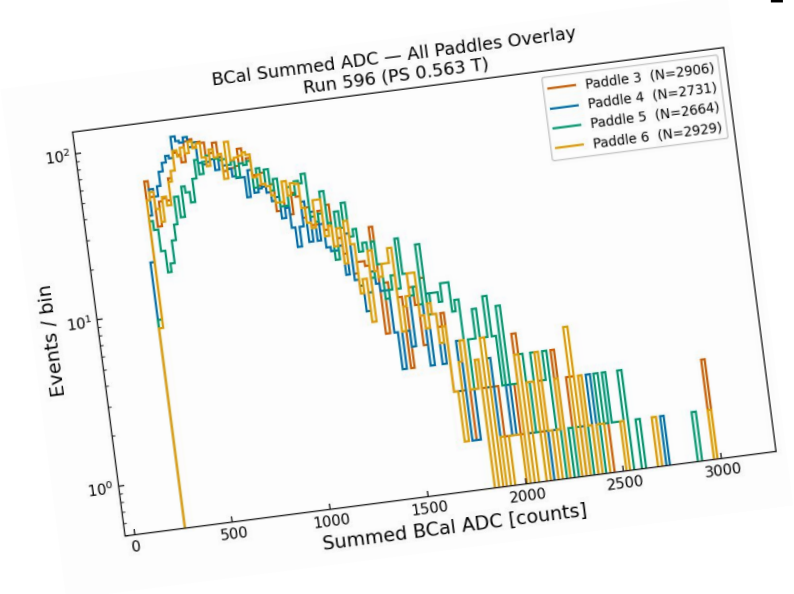


Plan for the Workshop

Hall D Beam Test: Analysis

Purpose of the workshop:

- Review status of Hall D beam-test data
- Share ongoing analysis efforts
- Identify priorities for August beam test
- Define concrete next steps



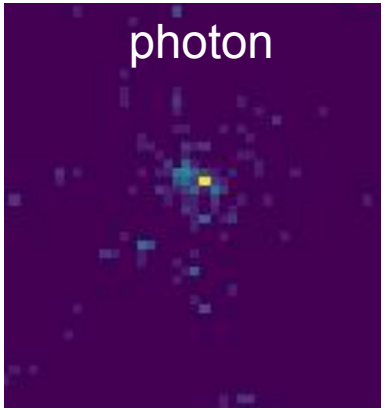
Desired outcome:

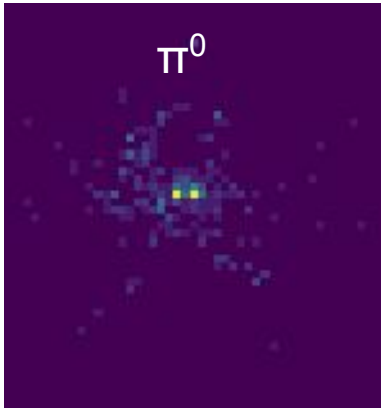
- A common understanding of what has been achieved, what remains to be done, and what should be prioritized.
- We want to leave today with a common understanding of where we are and what we need before August.

Plan for the Workshop

Simulations Reconstruction chain

- Reports on the prototype of the full reconstruction chain with attenuated responded from SciFi
- Discussion about approaches and goals
- Towards AI-enhanced BIC reconstruction: AI-ready data and plans





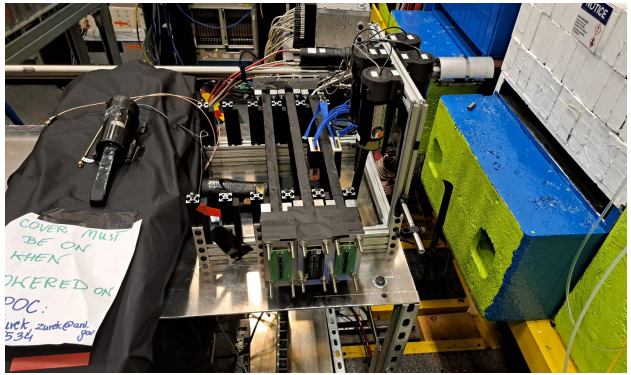
Beam Tests: Alignment of the goals

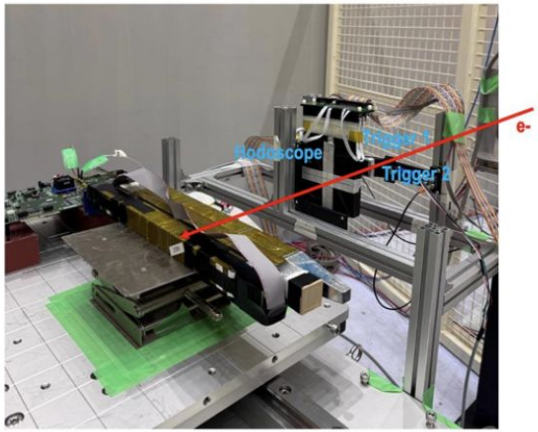
Wed session

https://docs.google.com/presentation/d/1n6_9yQt2u1xKWt5jZP4FW1QrAp9_0dNORipukuhByaQ/edit?usp=sharing

Please put in your perspectives from the sessions today (readout, cooling, sensor test and developments)

- Discussion about short term plans for accomplishing this year plans
- Bottom-up remarks from different collaboration subsystems
- Alignment of the goals and priorities





Session

Beam Test and System Testing Goals and Priorities

17 Jun 2026, 10:30
D172 (Building 241)

Conveners

Beam Test and System Testing Goals and Priorities

Maria Zurek (Argonne National Laboratory)

Description

- Lessons learned from commissioning beam tests at KEK and Hall D
- Plans moving forward and alignment if goals
- Key priorities for System Testing

Presentation materials

There are no materials yet.

	Beam Test Priorities: What have we focused on so far — *D172, Building 241*	*Maria Zurek* — 10:30 - 10:45
	Perspective on BIC Beam Test Priorities — *D172, Building 241*	*Jeongsu Bok* — 10:45 - 10:55
	ESB Perspectives — *D172, Building 241*	*Aram Teymurazyan et al.* — 10:55 - 11:00
11:00	**CALOROC Perspectives** — *D172, Building 241*	*Norbert Novitzky* — 11:00 - 11:05
	AstroPix Perspectives — *D172, Building 241*	*Manoj Jadhav et al.* — 11:05 - 11:10
	Open Perspectives and Discussion about priorities — *D172, Building 241*	11:10 - 12:00
12:00		

Thank you!