

ALICE FoCal-E status



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ALICE FoCal

Physics Goal: unravel nucleus structure at small-x

Observables in $3.4 < \eta < 5.8$ @ LHC:

- π^0 (and other neutral mesons)
- Isolated (direct) photons
- Jets (and di-jets)

FoCal

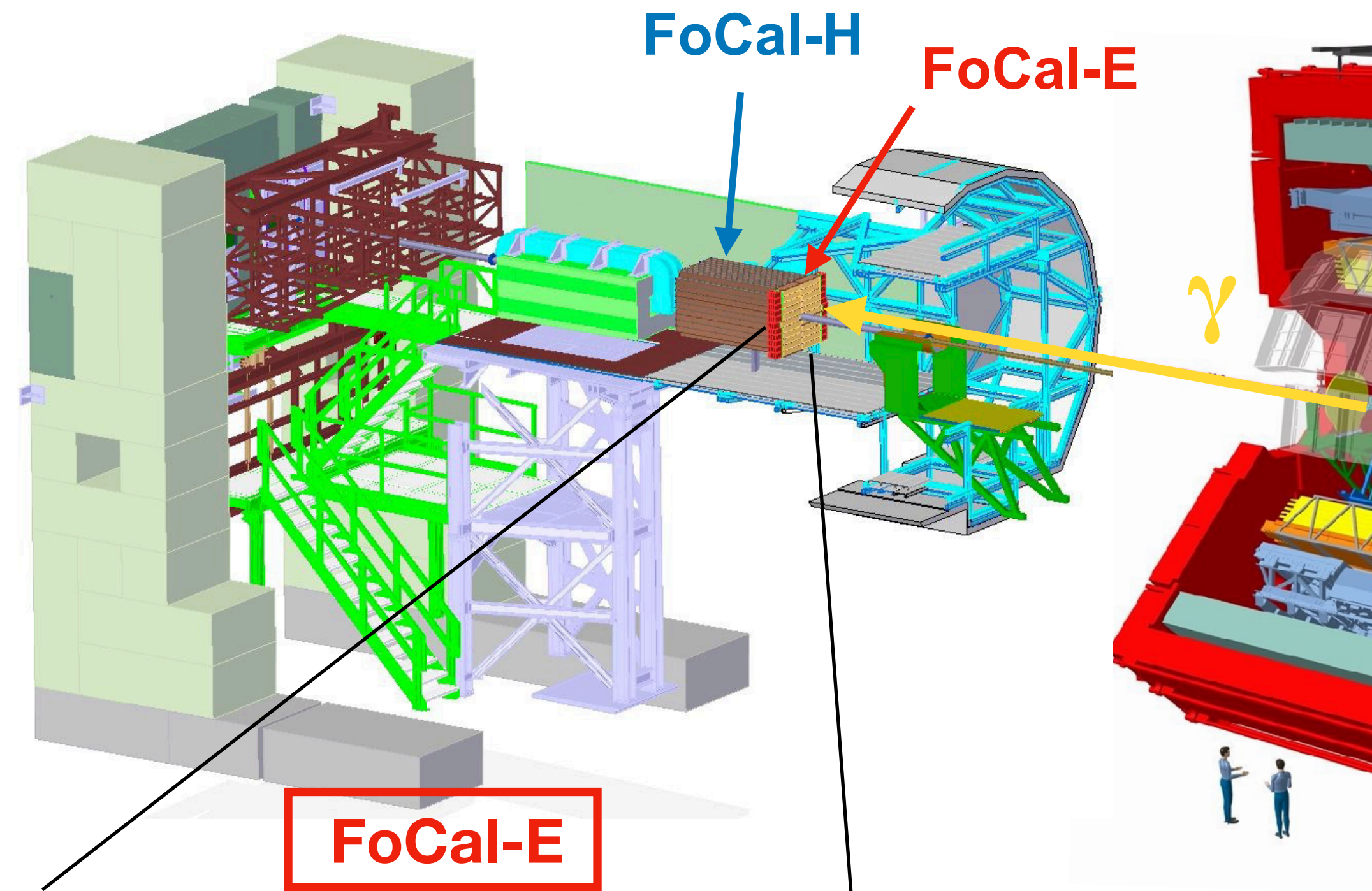
FoCal-E: high-granularity Si-W sampling calorimeter for photons and π^0

FoCal-H: conventional metal-scintillator sampling calorimeter for photon isolation and jets

FoCal Lol has been approved by LHCC on June 5, 2020

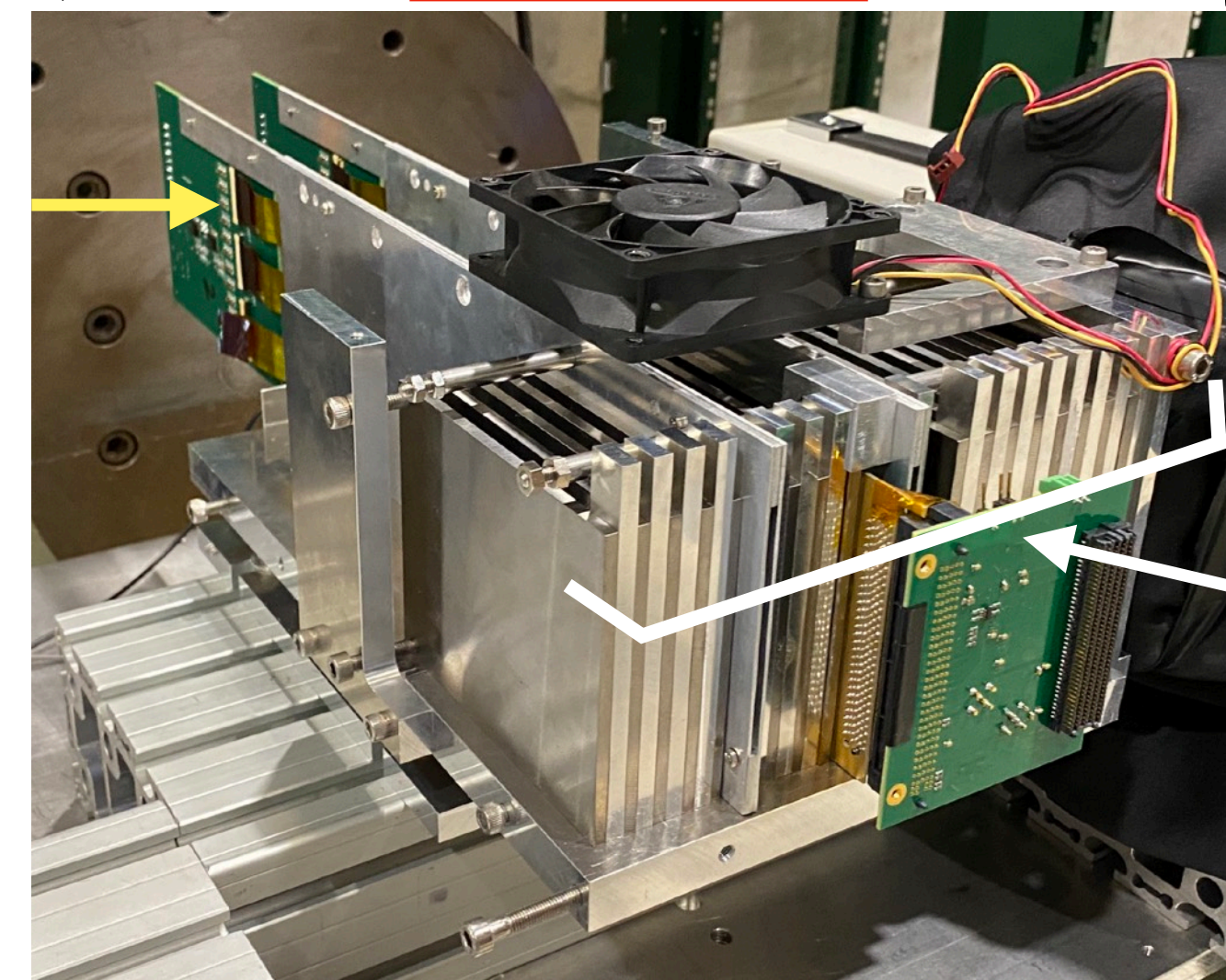
Public Note (Lol) : [CERN-LHCC-2020-009](https://cds.cern.ch/record/2781113/files/CERN-LHCC-2020-009.pdf)

- Test beam: 2021 - 2022
- TDR submission : 2022



FoCal-E

“FoCal-E PIXEL”
photon position
2 layers
cell size: 30x30 μm^2



“FoCal-E PAD”
photon energy
18 layers
cell size: 1x1 cm^2

FoCal Japan

(baseline design @ 7m from IP)

FoCal Japan and members

- **University of Tsukuba:**
 - ◆ Responsible: FoCal-E pad (all)
 - Tatsuya Chujo, Norbert Novitzky, Yasuo Miake, Abderrahmane Ghimouz, Takuya Kumaoka (D2), Yuuki Asatani (M1)
- **Tsukuba University of Technology:**
 - ◆ Responsible: FoCal-E pad electronics, IV/CV, assembly
 - Motoi Inaba
- **Hiroshima University:**
 - ◆ Responsible: Integration
 - Toru Sugitate
- **Nara Women's University:**
 - ◆ Responsible: test beam analysis, IV/CV temp dep.
 - Maya Shimomura, Takashi Hachiya, Misaki Hata (B4)
- **RIKEN:**
 - ◆ Responsible: Irradiation test, trigger simulation
 - Yuji Goto, Itaru Nakagawa, Ralf Seidl, Minho Kim(PD), Shima Shimizu (PD), (Kumaoka, JRA D2)
- **Nagasaki Institute of Applied Science:**
 - ◆ Responsible: CRU, trigger
 - Ken Oyama
- **Saga University:**
 - ◆ Responsible: CRU, trigger
 - Takahito Fusayasu



筑波大学
University of Tsukuba



広島大学



国立大学法人
筑波技術大学
National University Corporation
Tsukuba University of Technology



国立大学法人 奈良女子大学
Nara Women's University



RIKEN



長崎総合科学大学
Nagasaki Institute of Applied Science



SAGA UNIVERSITY
国立大学法人
佐賀大学

(Cooperative Institutes in Japan)

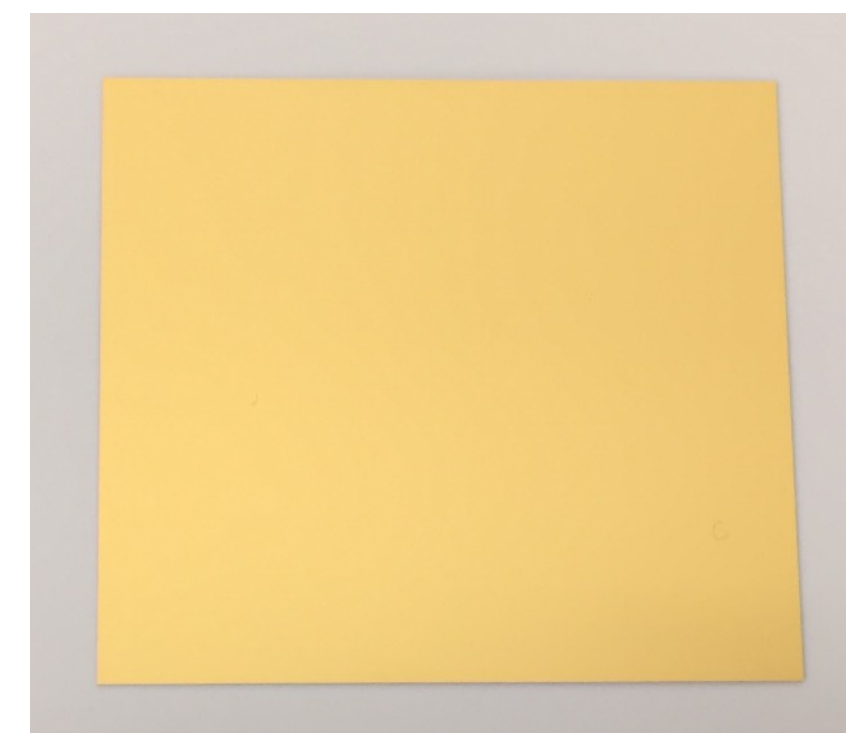
- KEK Detector Platform (B) Silicon detector : Junji Tojo, Manabu Togawa
- Kyushu Univ.: Taikan Suehara, Junji Tojo

FoCal-E PAD: main sensor (8x9, p-type, 320um)

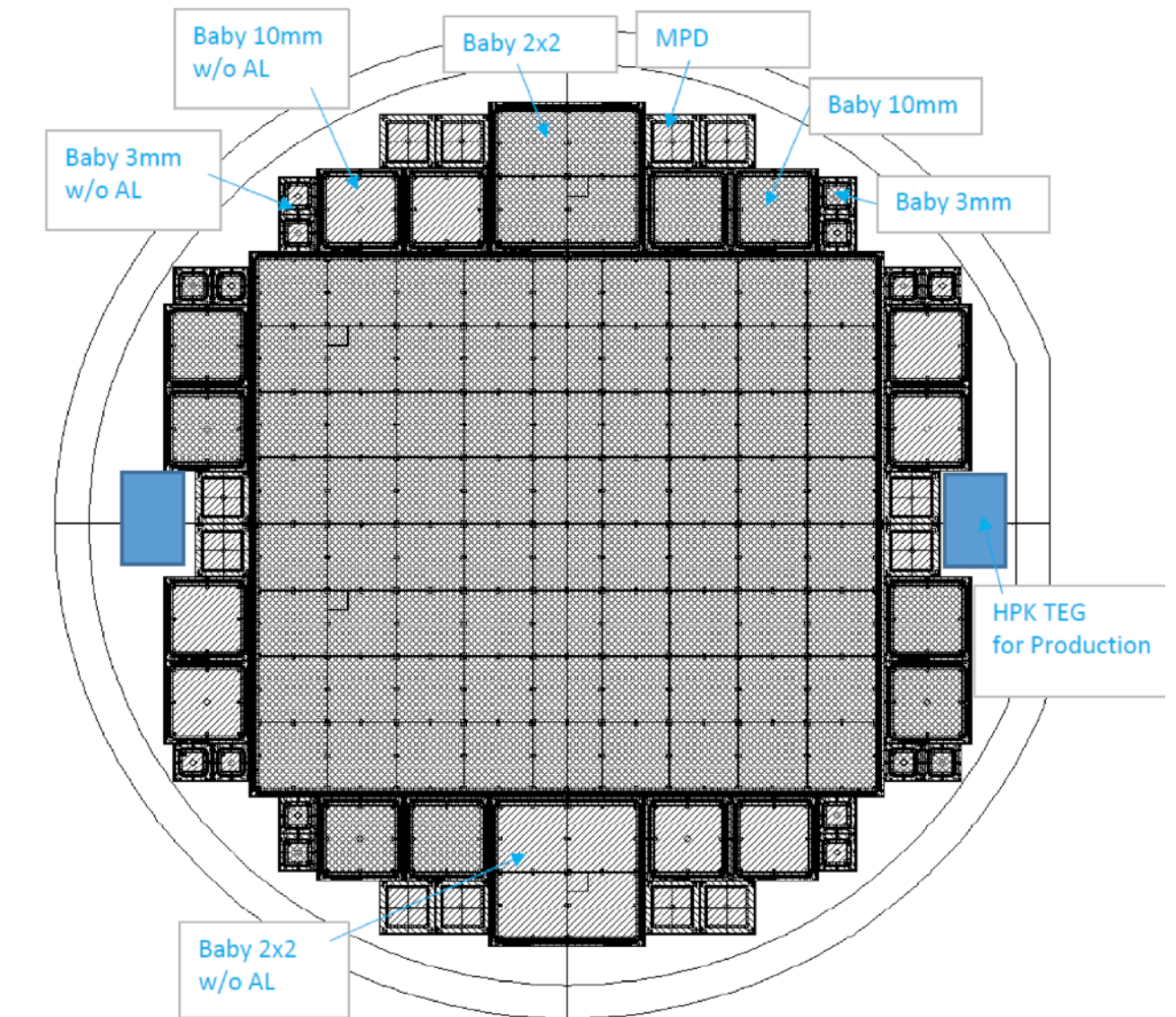


front side (w/ Al)

Hamamatsu S16211-0813
p-sub, 320 um, w/ Al,
1 cm² pad cell size



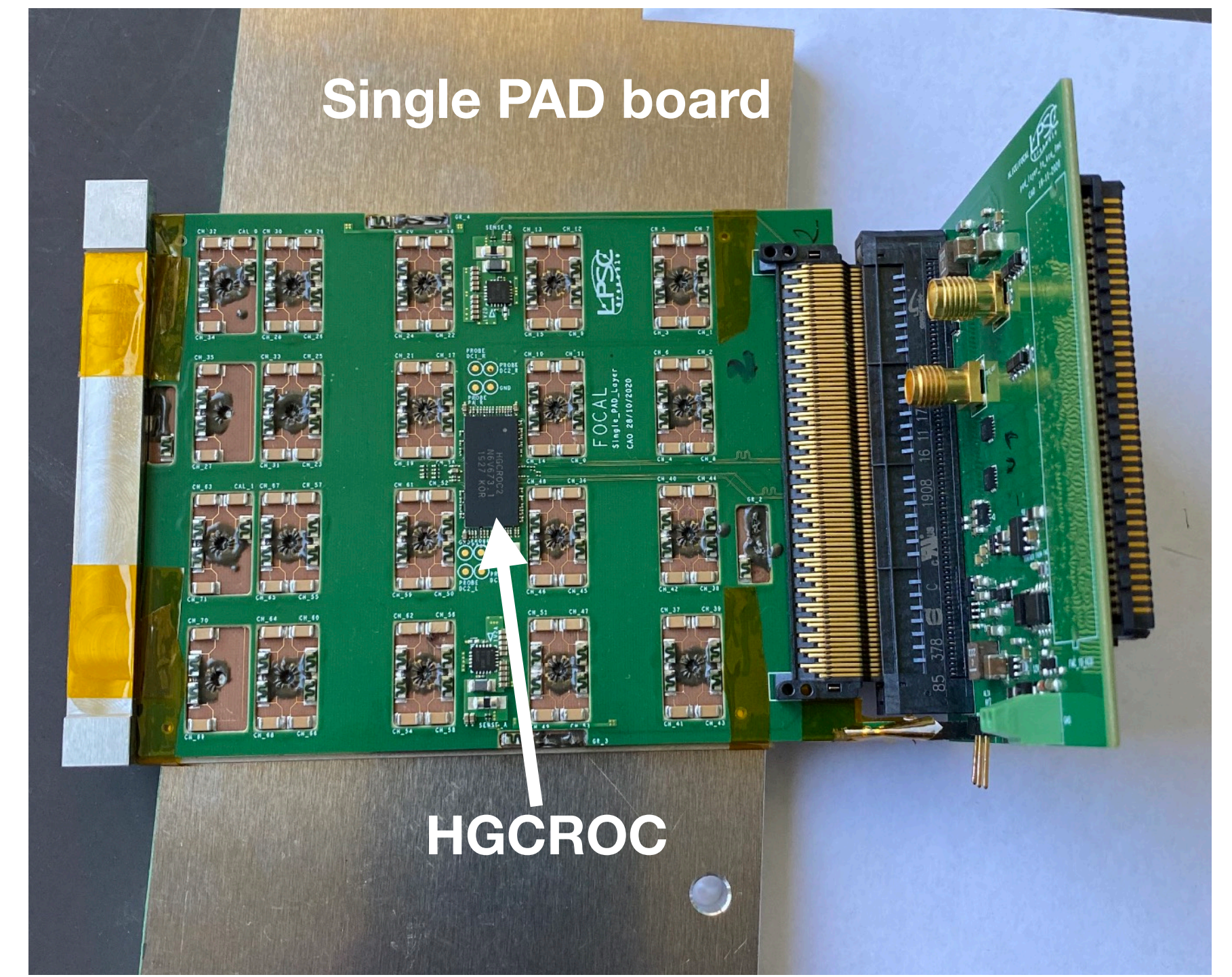
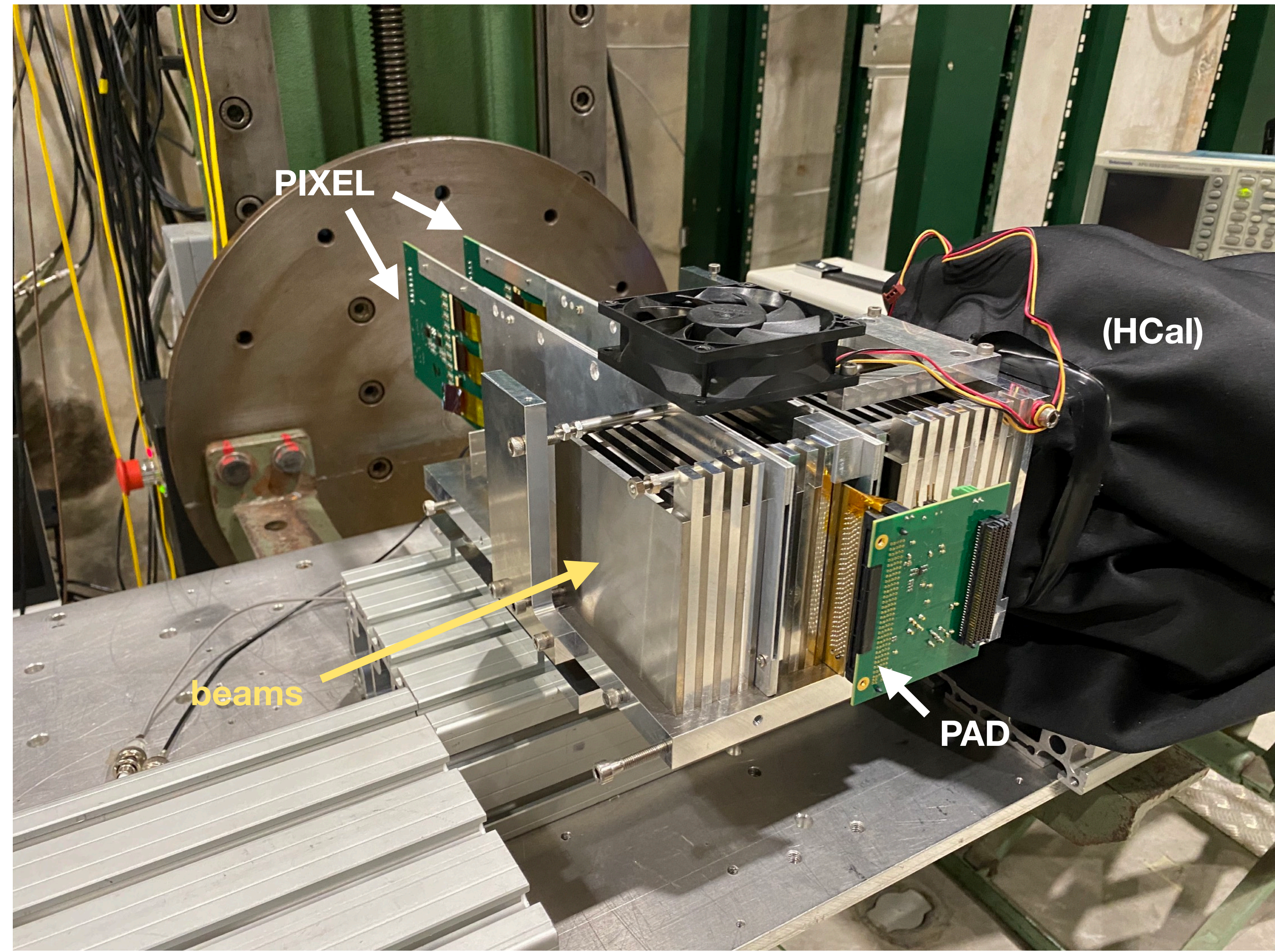
back side (Au)



First time use of p-type for FoCal

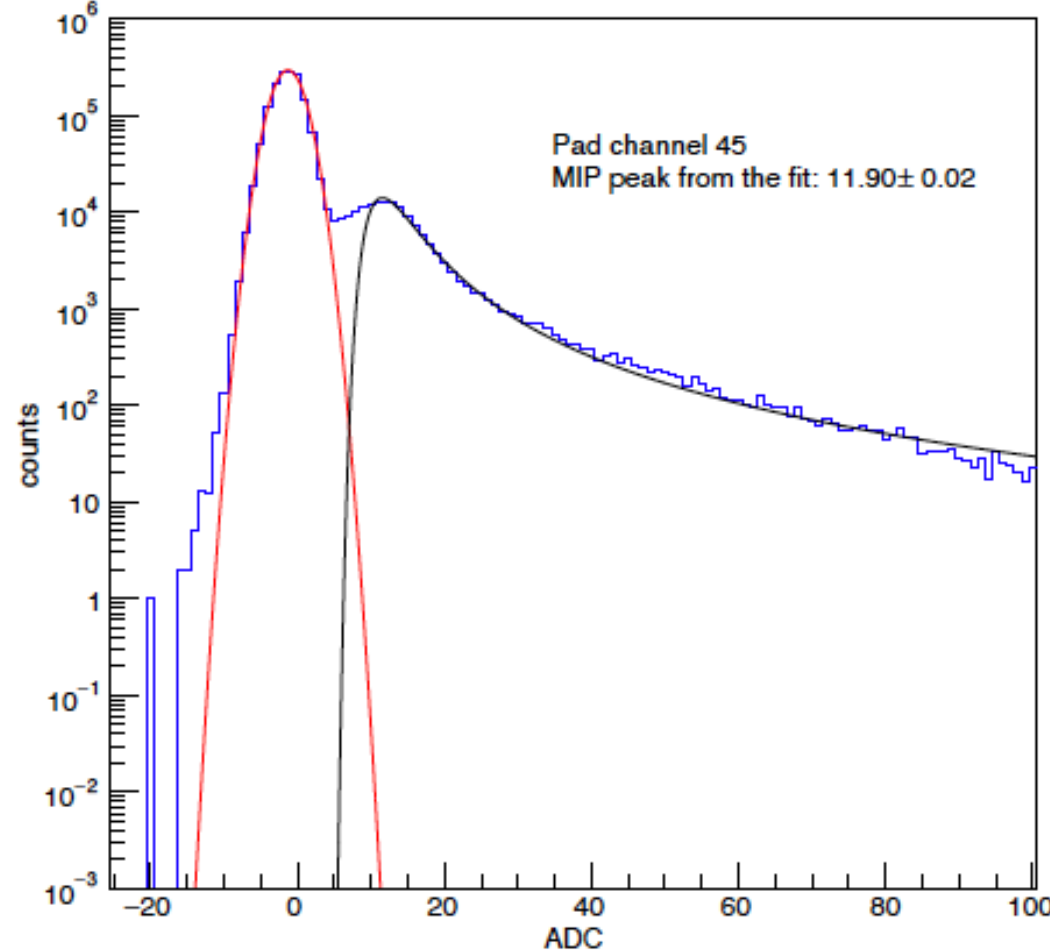
- 8x9 cells + calibration cells (w/Al), produced 30, and delivered.
- Various type of test cells were also produced (next slides).
- More rad. hard than n-type.
- Compatible with HGCROC.

SPS test beam FoCal-E setup (2021.Sep-Oct)

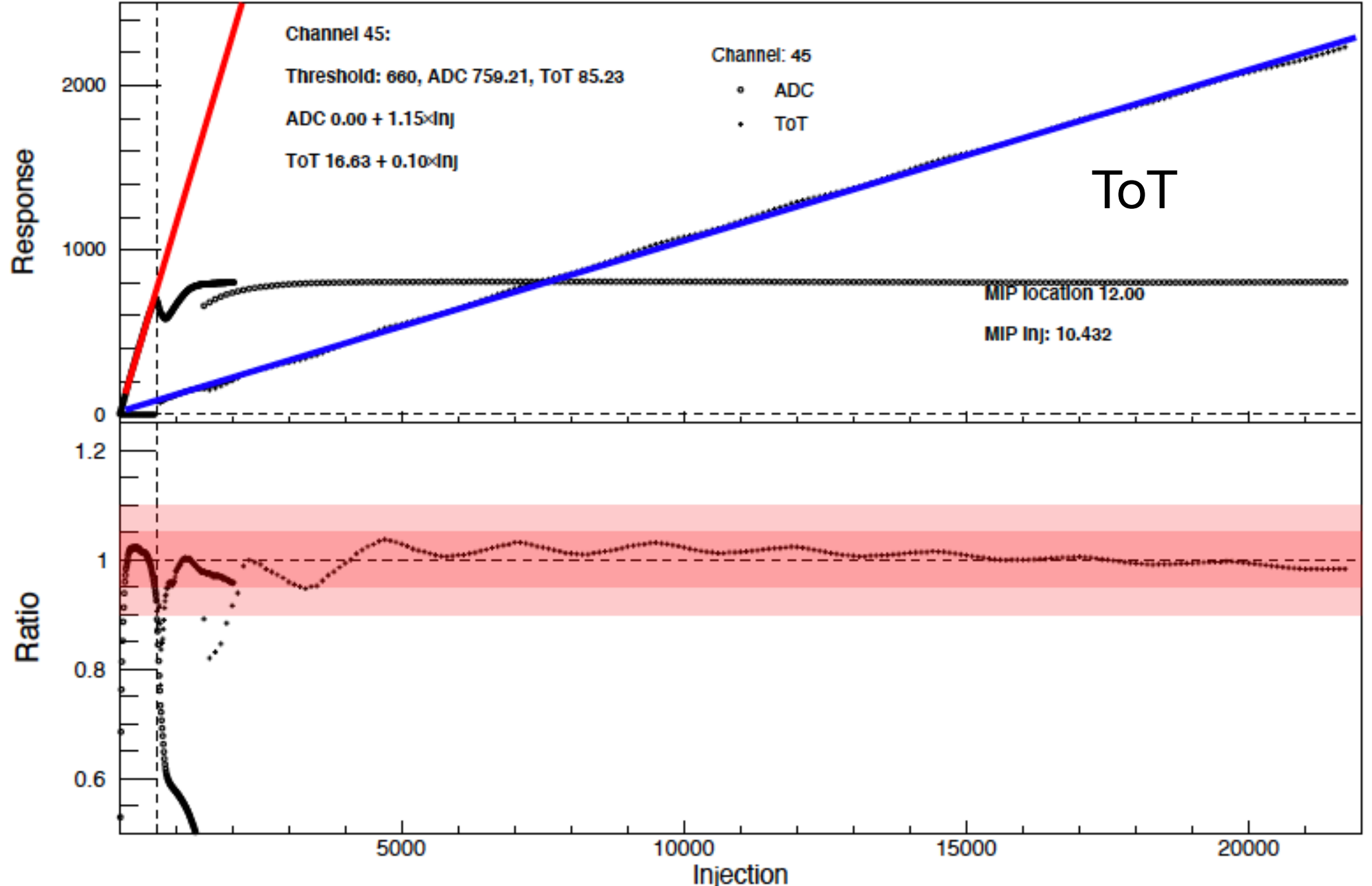


FoCal-E PAD results @ SPS test beam in 2021

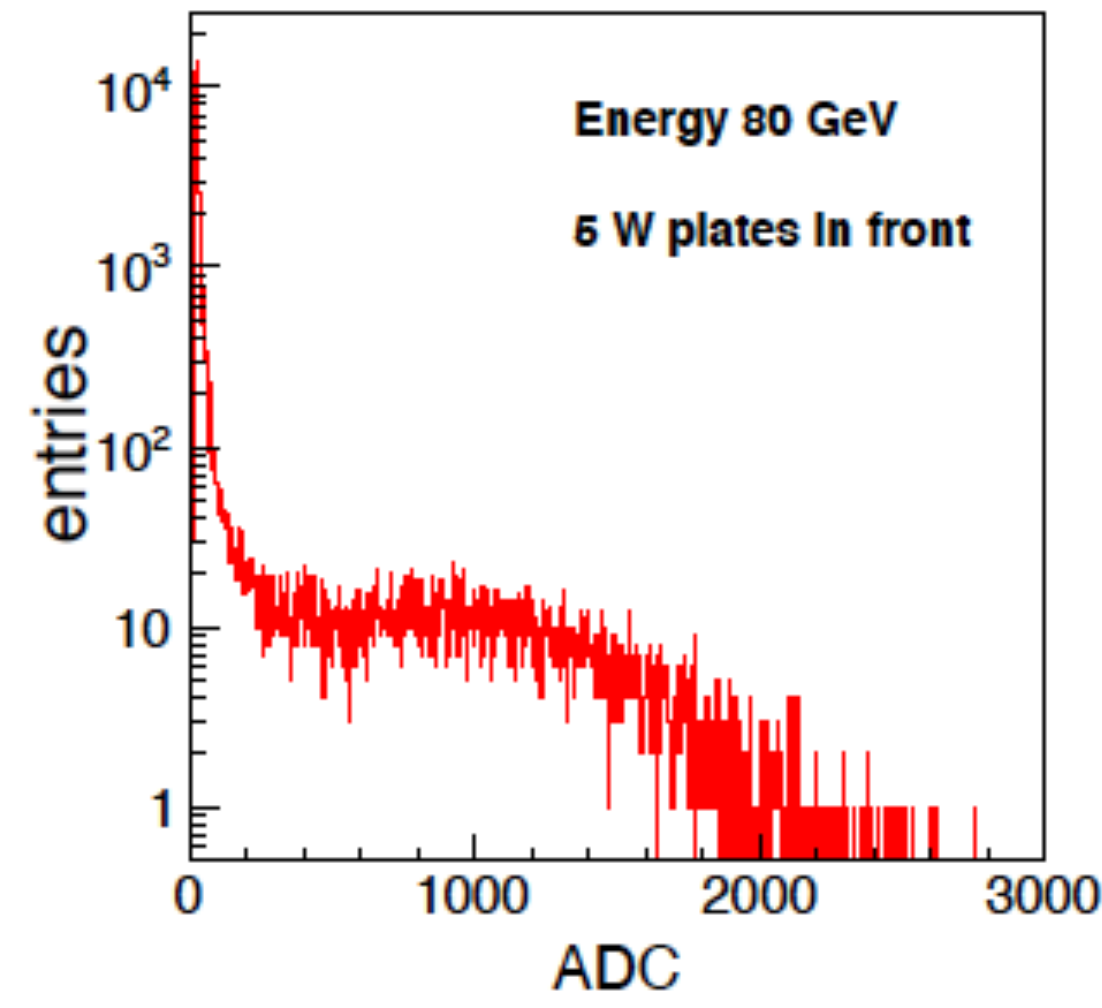
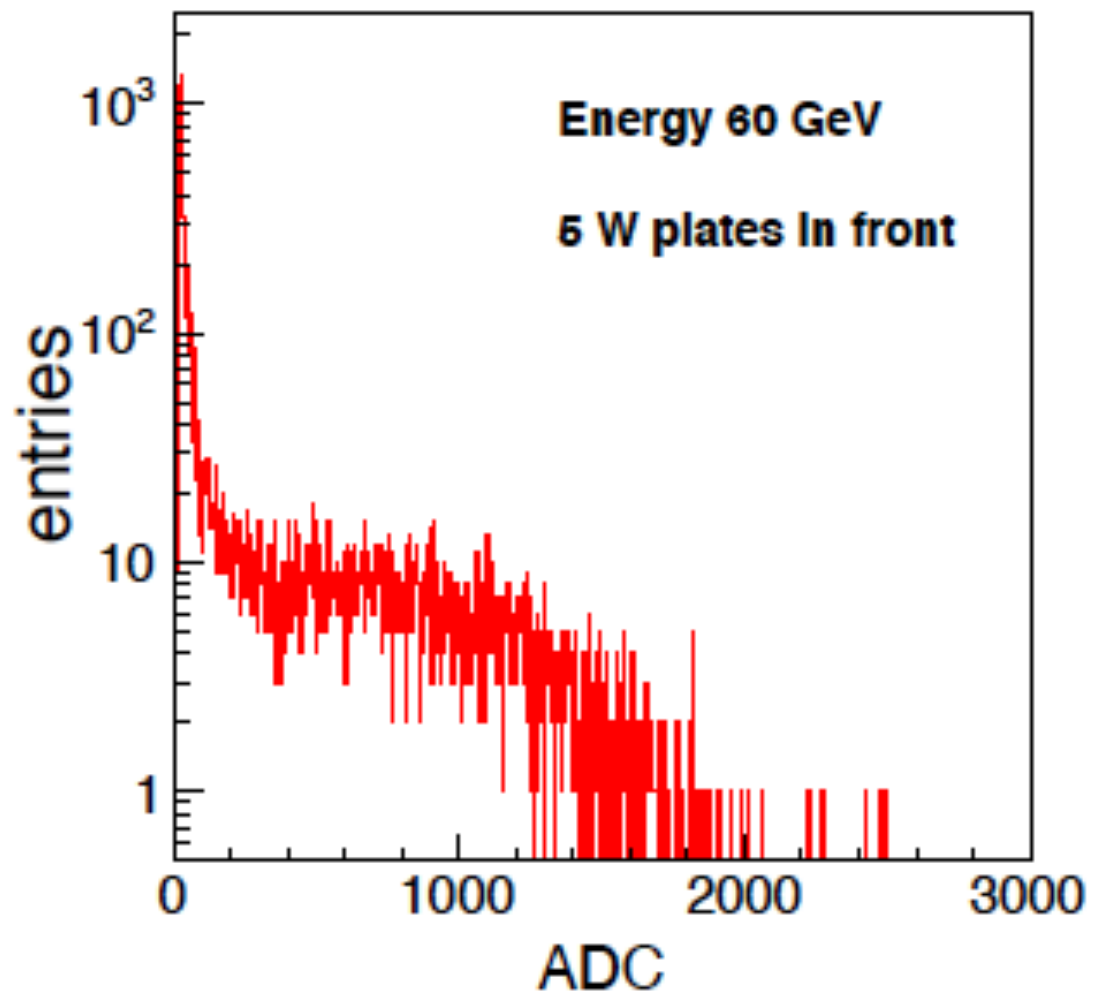
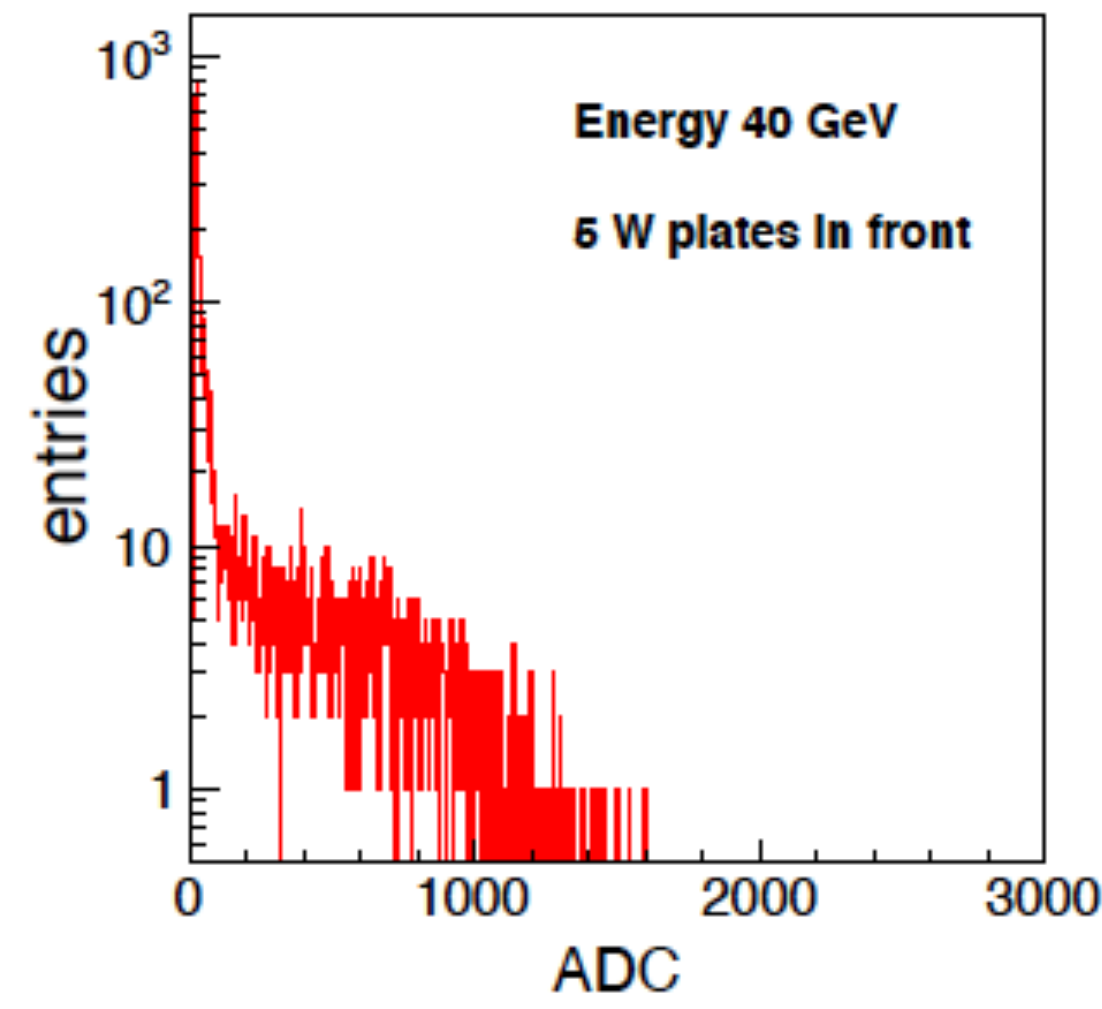
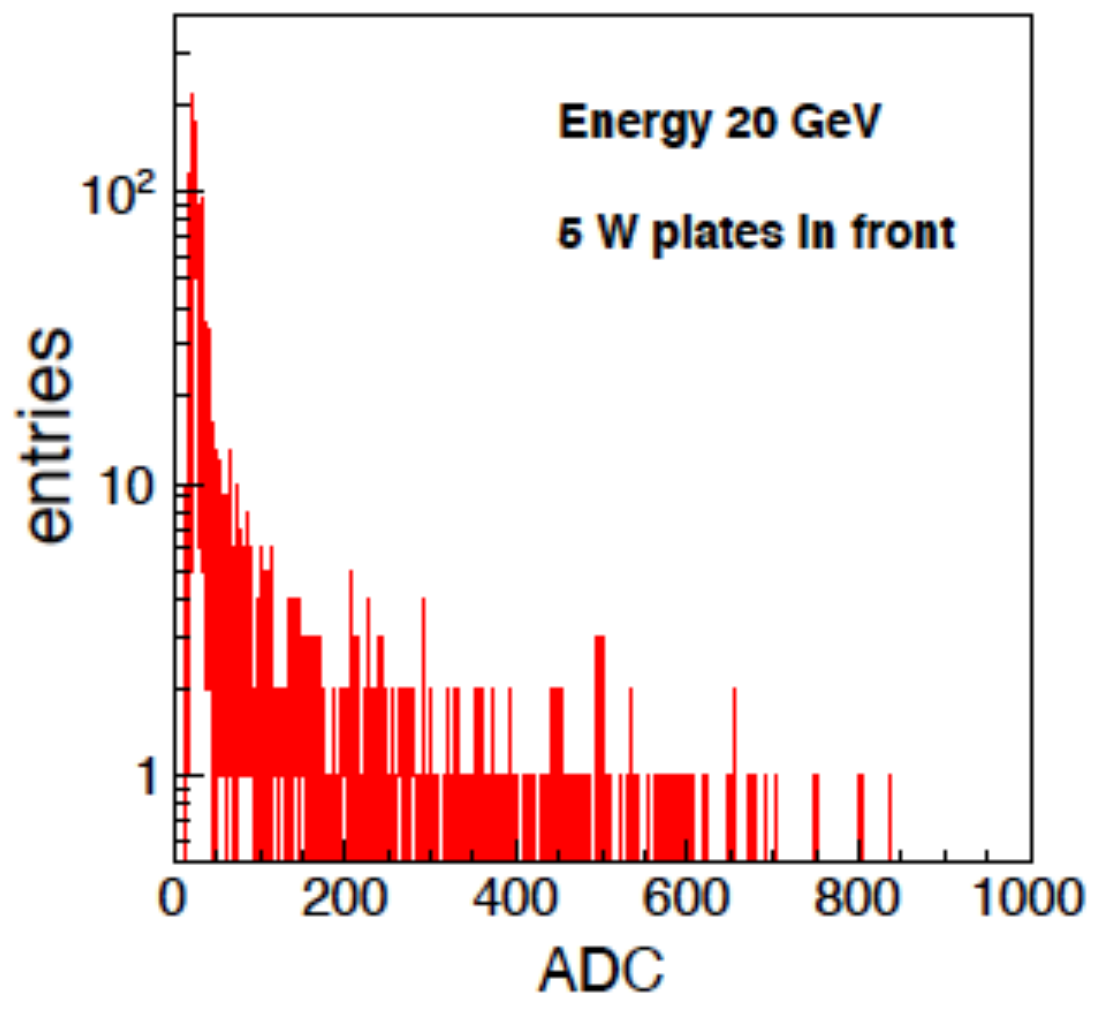
MIP data



ADC



Shower data (20, 40, 60 and 80 GeV)

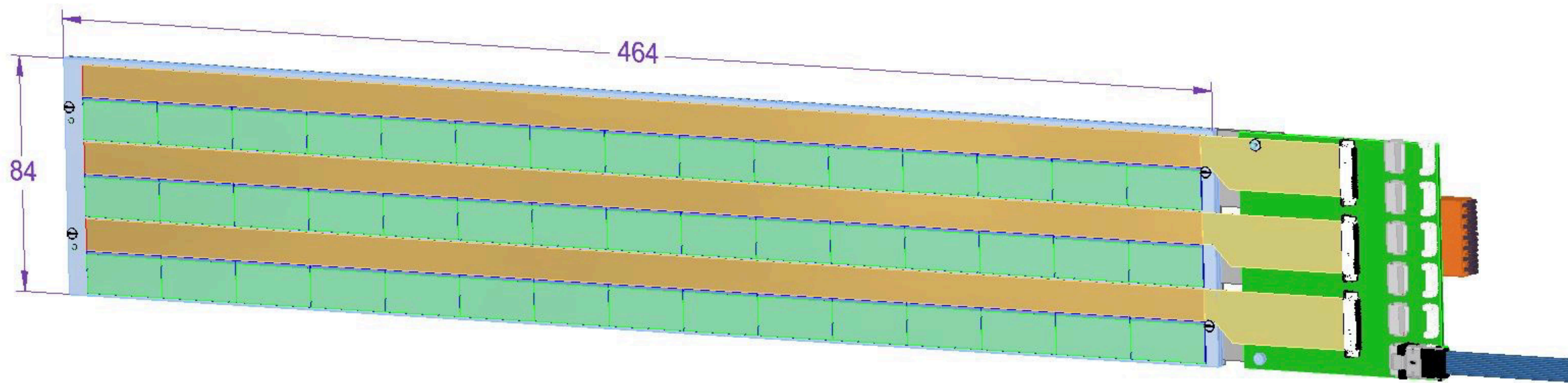


(Norbert/ Haidi)

FoCal-E PIXEL



9 ALPIDE chips on a flex cable:
30 x 1.5 cm²
(developed for pCT application)

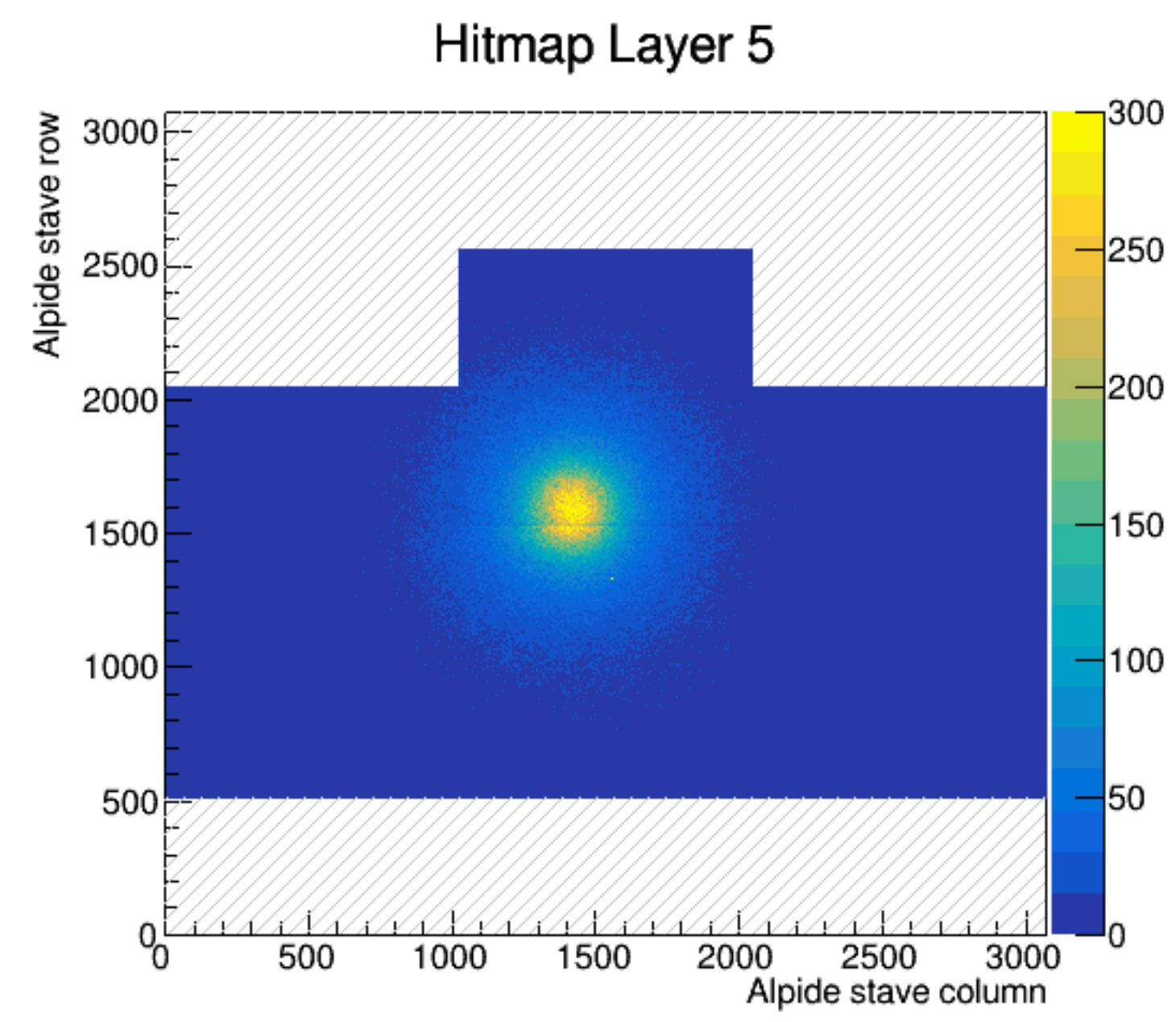
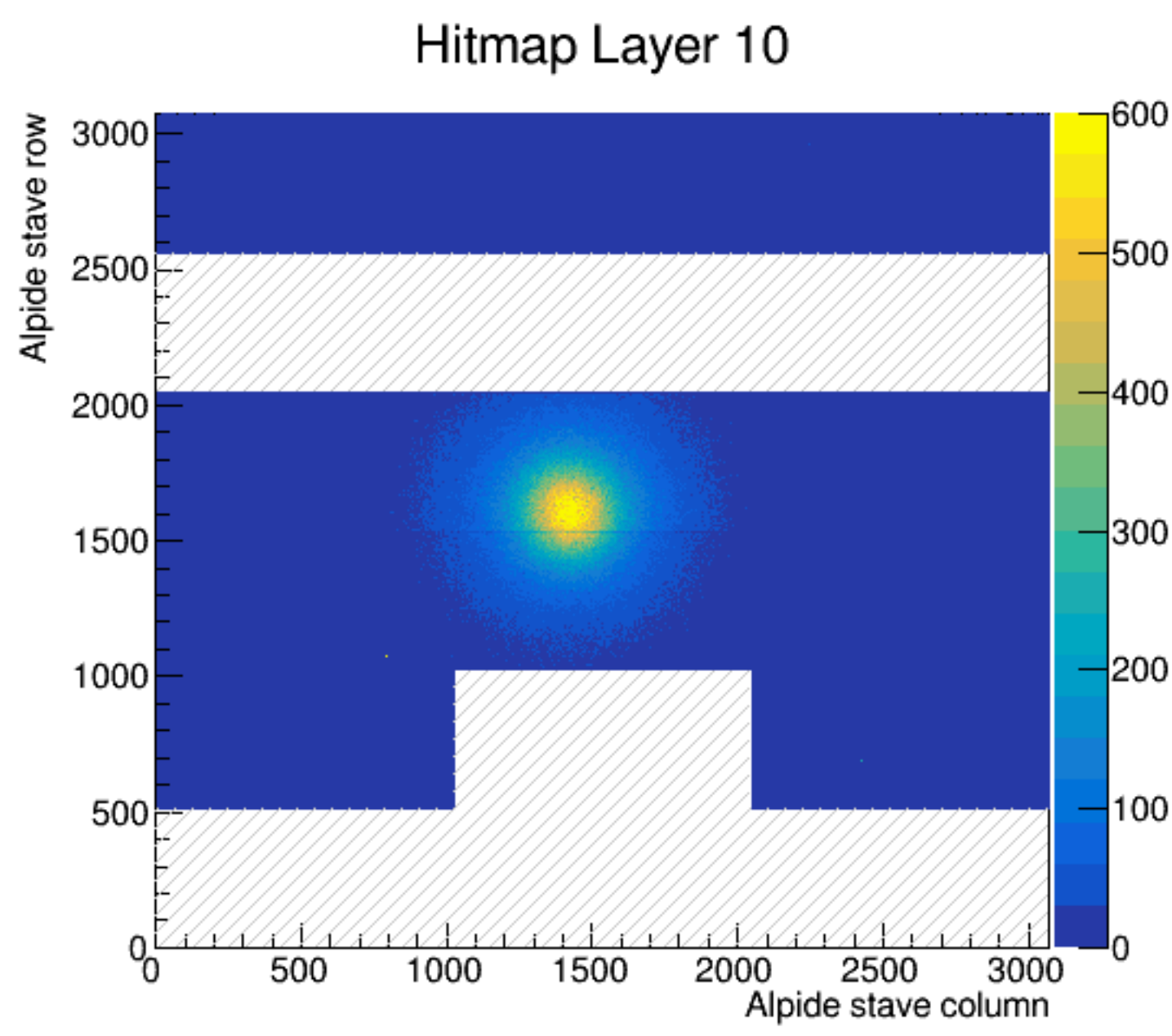


Full module: 2 x 3 “strings”

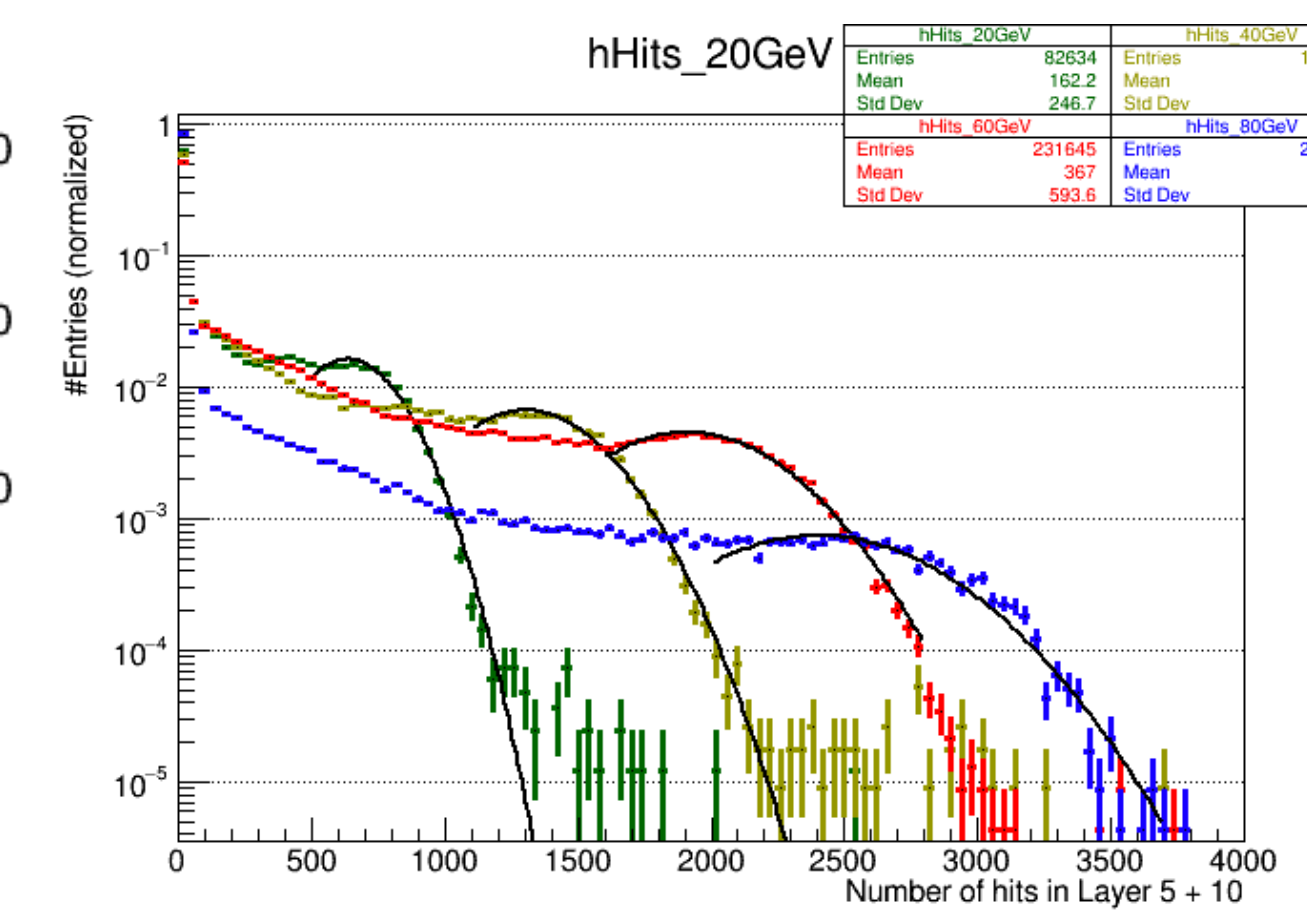
→ FoCal design: 15-chip flex cables

Pixel: SPS preliminary results

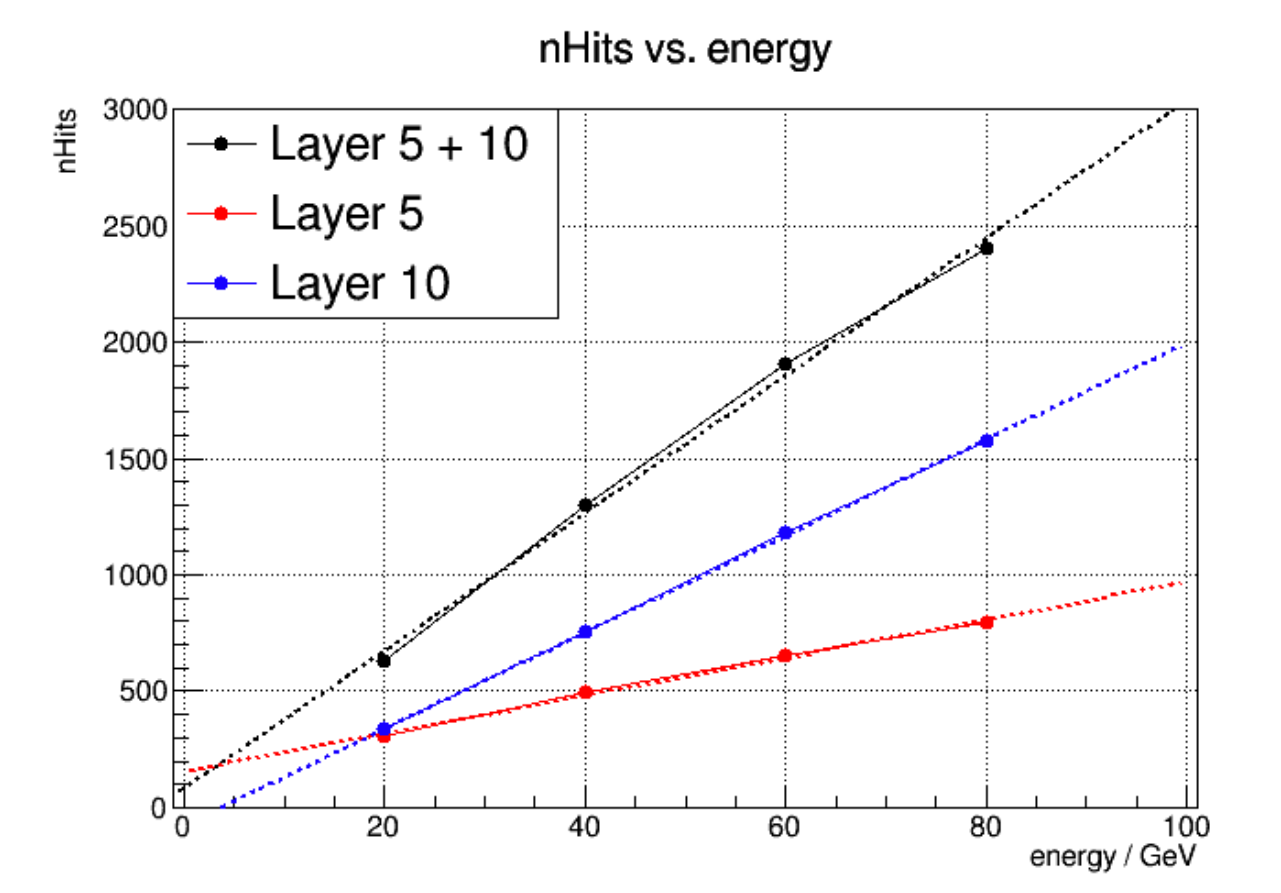
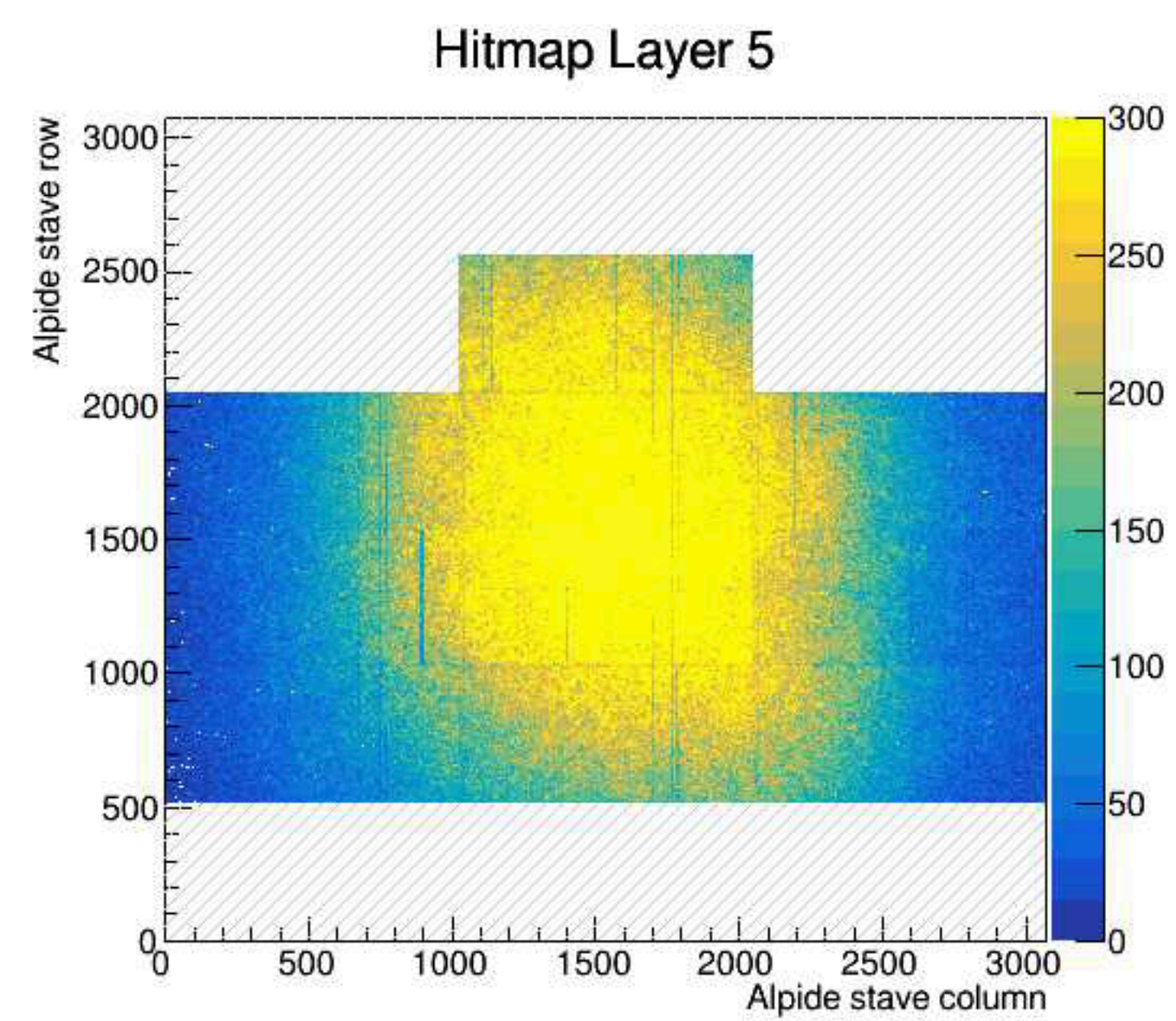
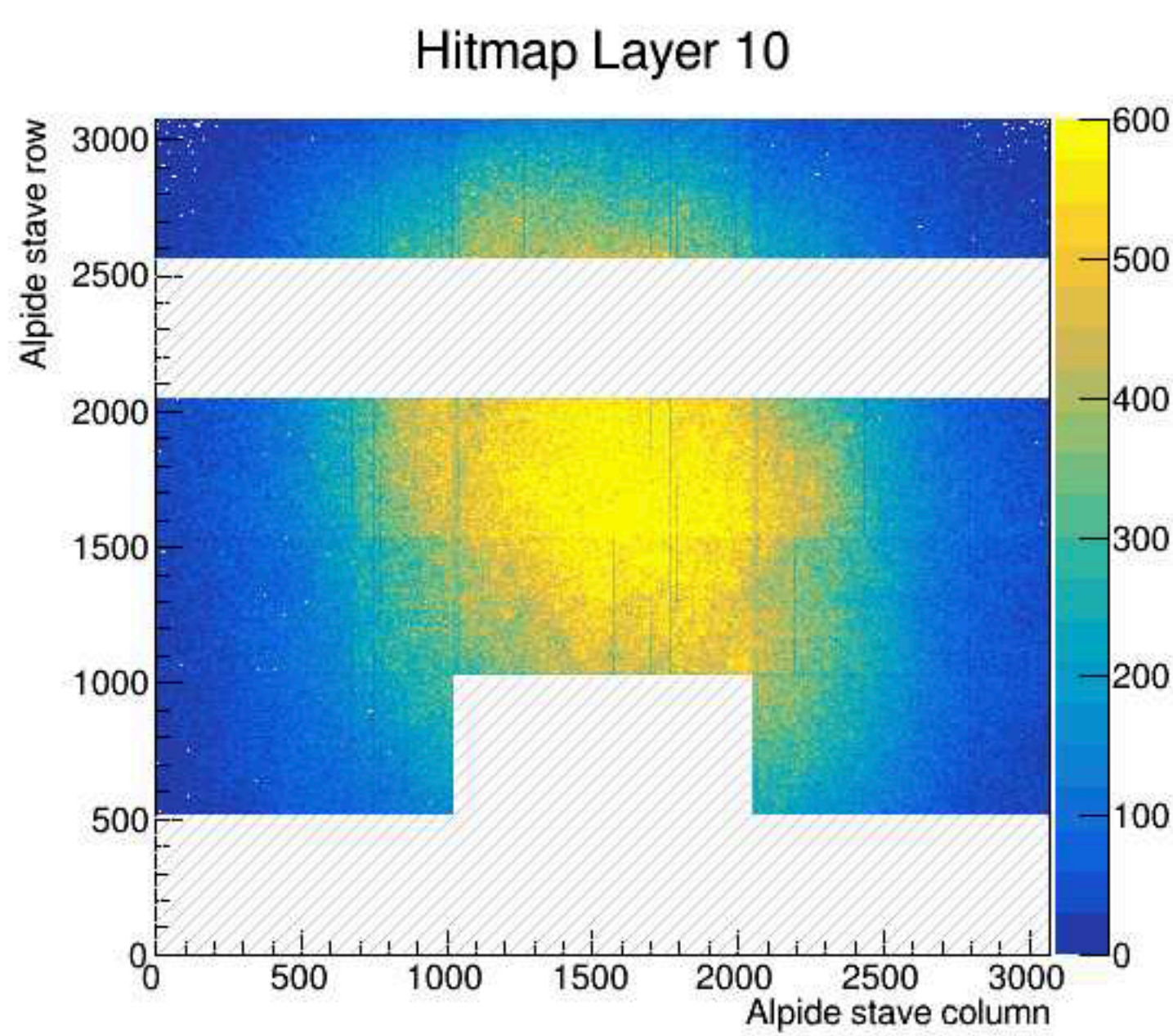
Hadron beam
120 GeV



20, 40, 60, 80 GeV (h+e)



Hadron+e
60 GeV



Current status of FoCal-E pad (1)

Electronics (HGCROC, aggregator board):

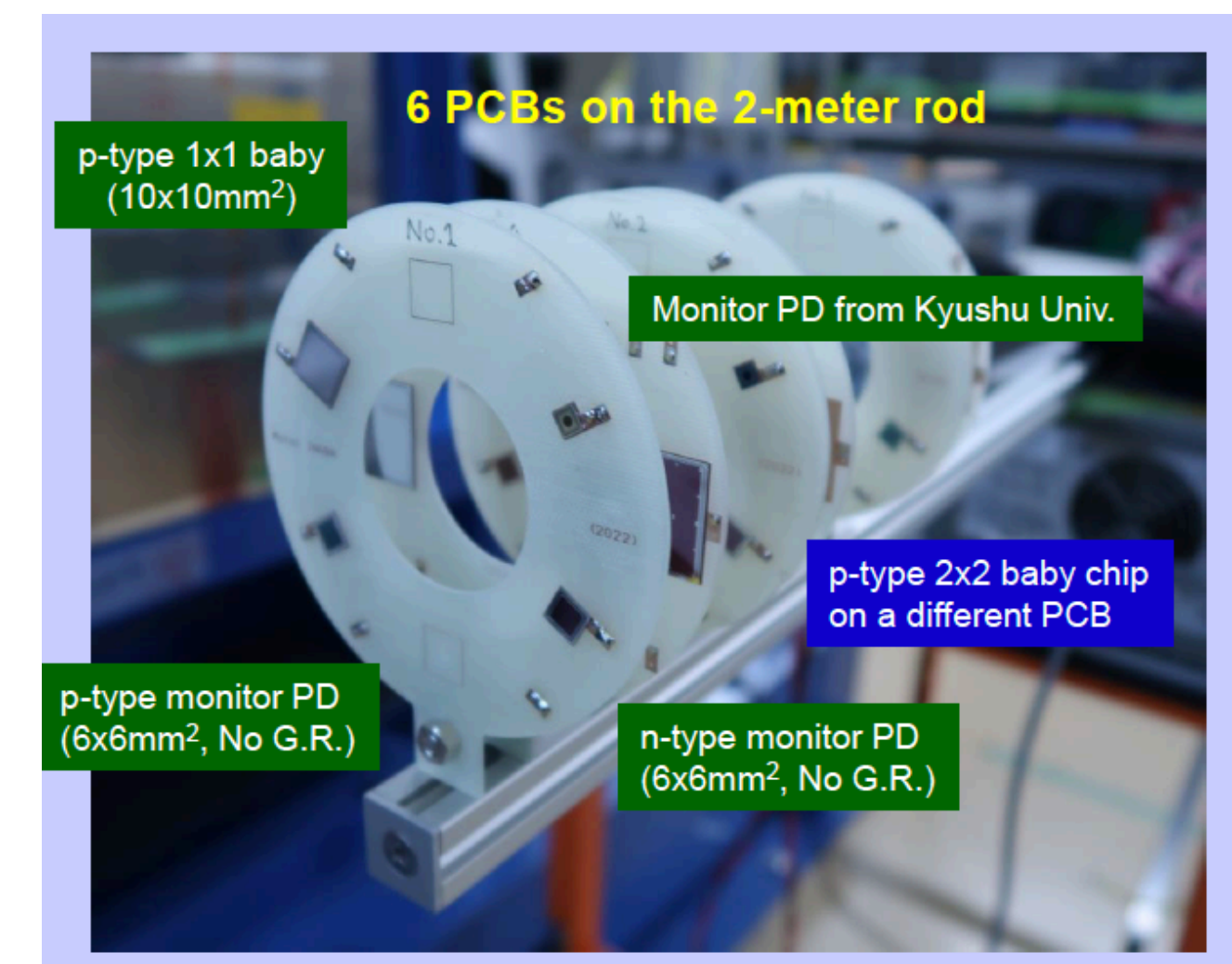
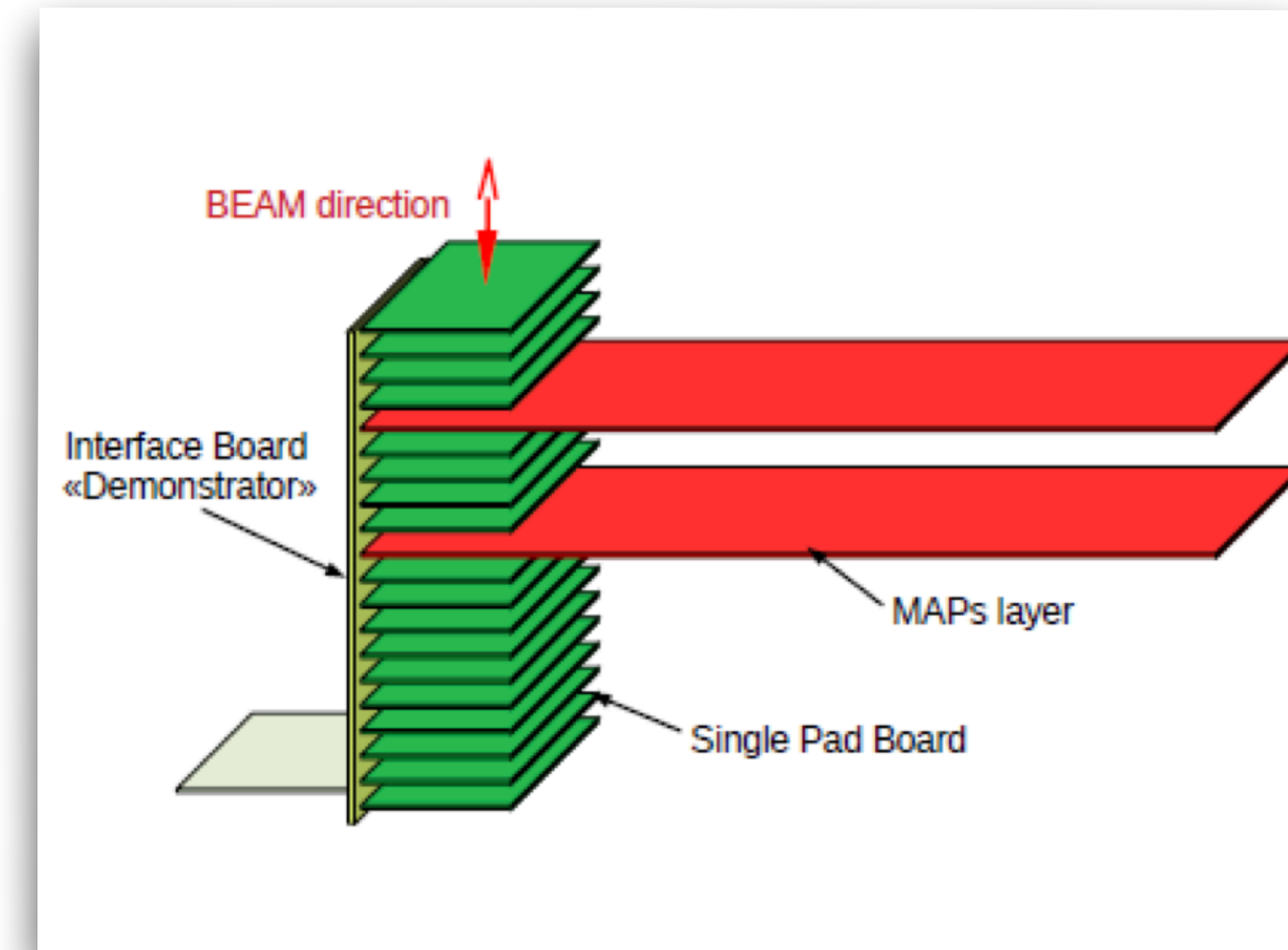
- Grounding issues we had before have been resolved.
- 4 boards using HGCROC v2 chips have been assembled, and checking the functionality at Grenoble.
- Confirmed one board is working well, and other boards testing is ongoing.
- Aggregator board and interface board are assembled, and the check is ongoing at Grenoble.

Probe station:

- Motoi Inaba is working on it.
- All necessary parts and equipments have been ordered.
- To be ready by the end of March, 2022.

Neutron irradiation test at RANS (RIKEN):

- Checked the noise level at RANS, and we will revisit it in Feb.1.
- First measurement is scheduled on March 3-4.
- At Nara Women Univ., temperature dep. before and after irradiation test.



Current status of FoCal-E pad (2)

Trigger:

- New members from Nagasaki & Saga (K. Oyama, T. Fusayasu) joined in FoCal-E CRU (Common Readout Unit).
- We will soon have a dedicated meeting on trigger simulation for designing of FoCal-E trigger electronics, together with Grenoble and Pixel groups.

KEK test beam line:

- <5 GeV/c electrons, few kHz, new beam line at KEK.
- Beam line construction is ongoing, and the first beam is expected in spring in 2022.
- FoCal group showed our interests to use this beam line extensively (short term and longer term).

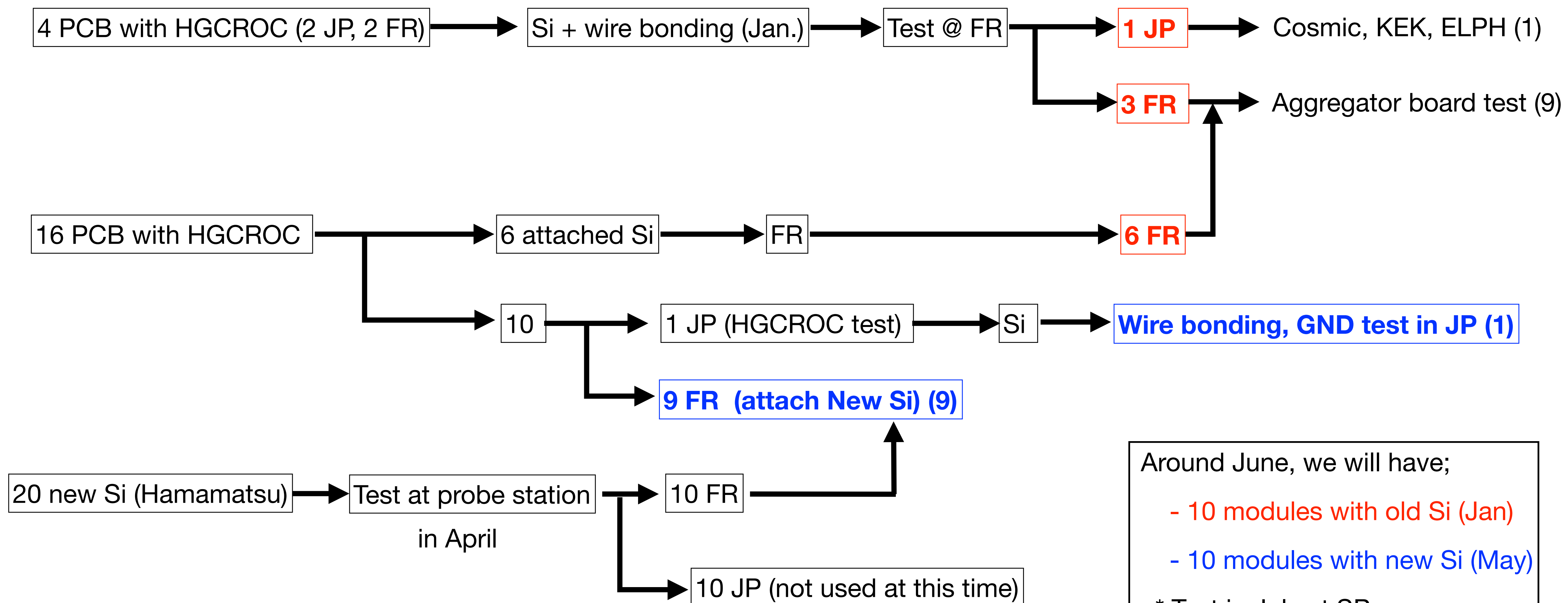
PS/SPS test beam preparation:

- Full single towers (18 pad, 2 pixel) will be tested at SPS in September in 2022 for TDR.



KEK PF-AR beam line, Jan. 13, 2022

HGCROC, PCB, wire bonding and test scheme



Around June, we will have;

- 10 modules with old Si (Jan)
- 10 modules with new Si (May)

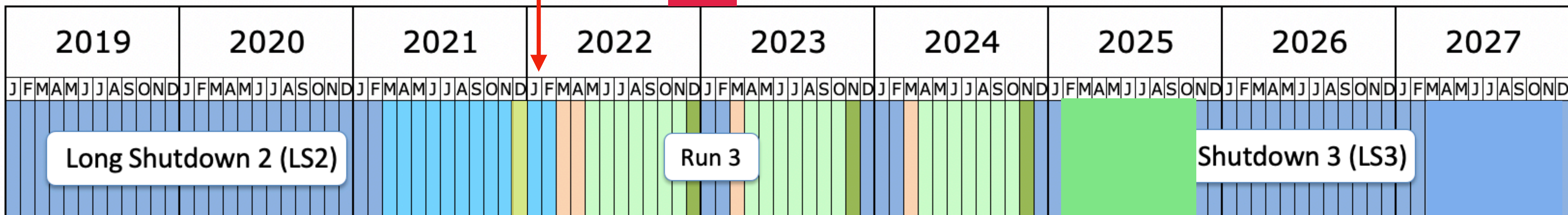
* Test in July at SP

* Test in Sep. (18 modules)

Plan

Now

TDR



FoCal



KEK

PS/SPS

RHIC
commisioning

RHICf-II

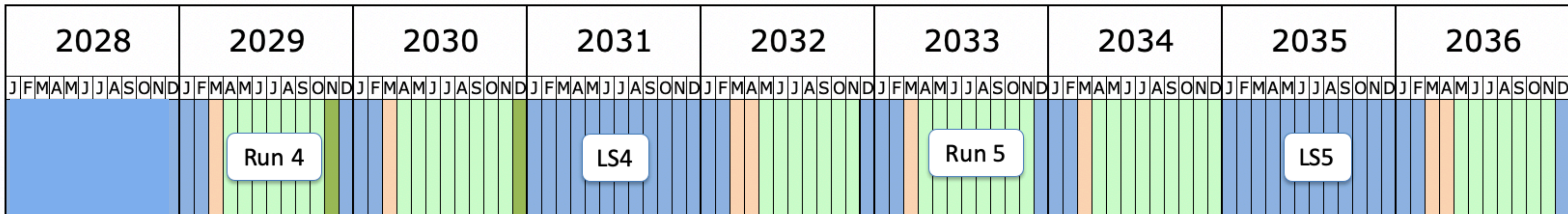
ALICE test

Installation

Another module
construction for
RHICf-II

Construction of
mini-FoCal for
ALICE test

Construction



Installation

Phyiscs

Physics : ALICE3 & FoCal+ (?)

Backup

FoCal SPS test beam in 2022

- SPS and PS test beams
- May-June for PS, Sep-Oct for SPS, in 2022

FoCal-E

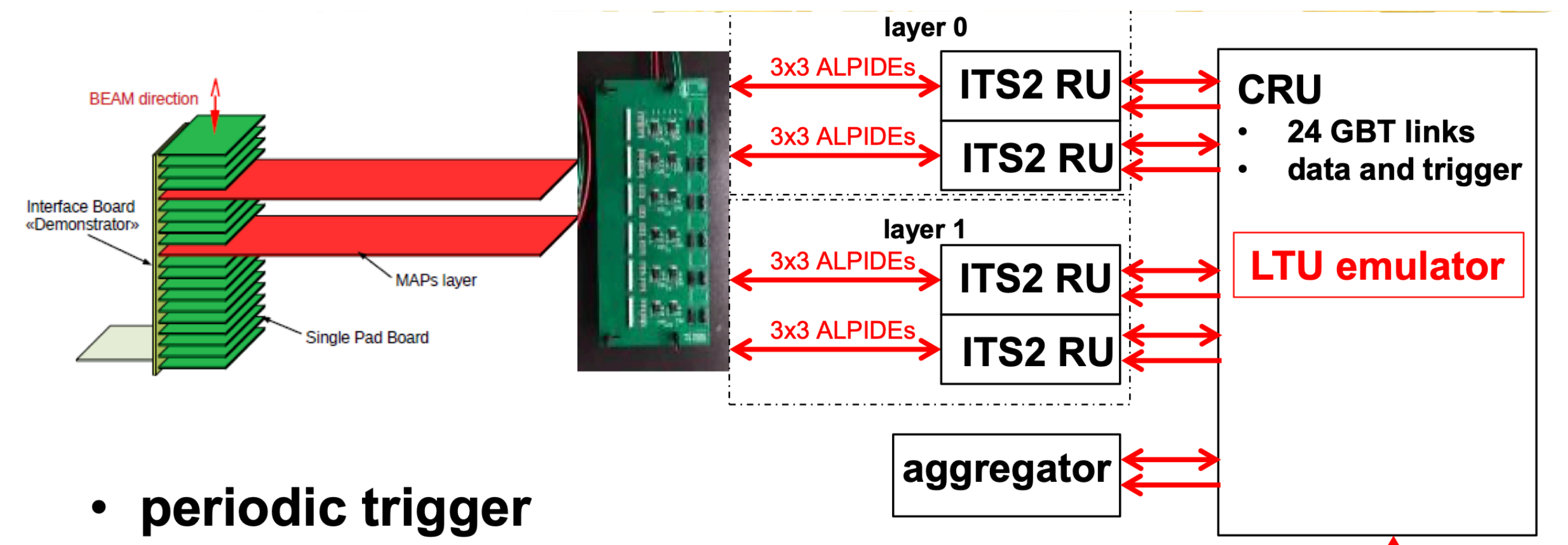
- 18 single pad (2022), and 2 pixel layers
- Use final readout: HGCRROC for PAD

FoCal-H

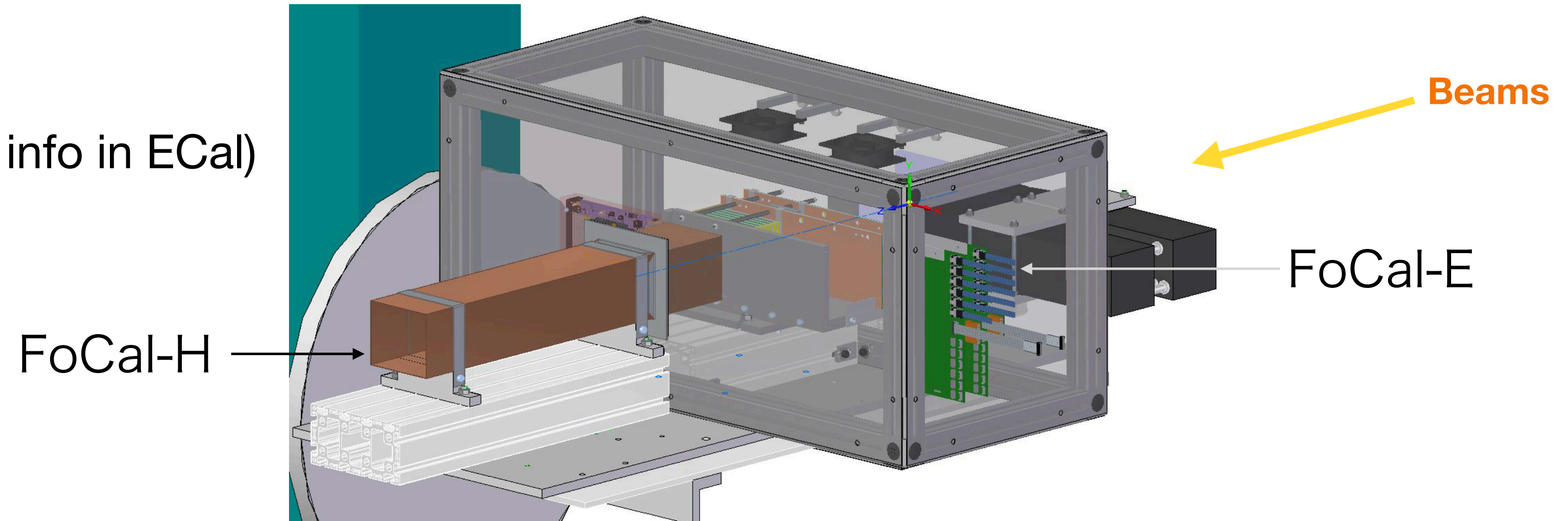
- 10 x10cm² area
- 60-80cm depth (TBD)

Common DAQ

(e.g. hadron rejection using HCal info in ECal)



- **periodic trigger**
 - LTU emulator inside CRU sends BCID
 - RU generates ALPIDE strobes
- **physics trigger**



FoCal-E integration

