Forward calorimeter upgrade activities in Japan

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"Internaltional Workshop on Forward Physics and Forward Calorimeter Upgrade in ALICE"
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Center for Computational Sciences, Univ. of Tsukuba, Japan

Active institutes in FoCal

- *University of Tsukuba*
- *Tsukuba University of Technology*
- *Hiroshima University*
- *Nara Women's University*
- *RIKEN Nishina Center*

筑波大学
University of Tsukuba

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

広島大学

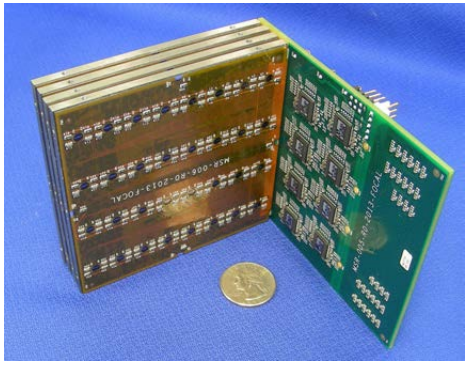
National University Corporation
Nara Women's University

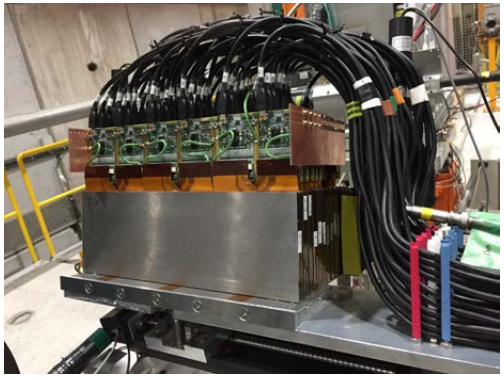
RIKEN

RIKEN
NISHINA
CENTER

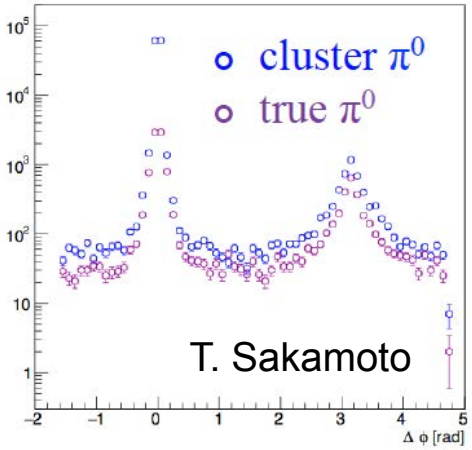
Main activity in FoCal Japan

- Joined in 2013
- FoCal-E pad detector R&D
  - ORNL prototype evaluation
  - new prototype, mini-FoCal
- FoCal simulation
  - Pb-Pb π^0 reconstruction
  - MAPS noise effect
  - π^0-π^0 correlations
  - jet reconstruction w/ HCAL

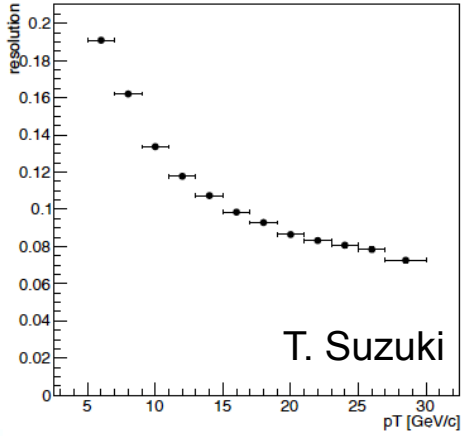




π^0-π^0 correlations

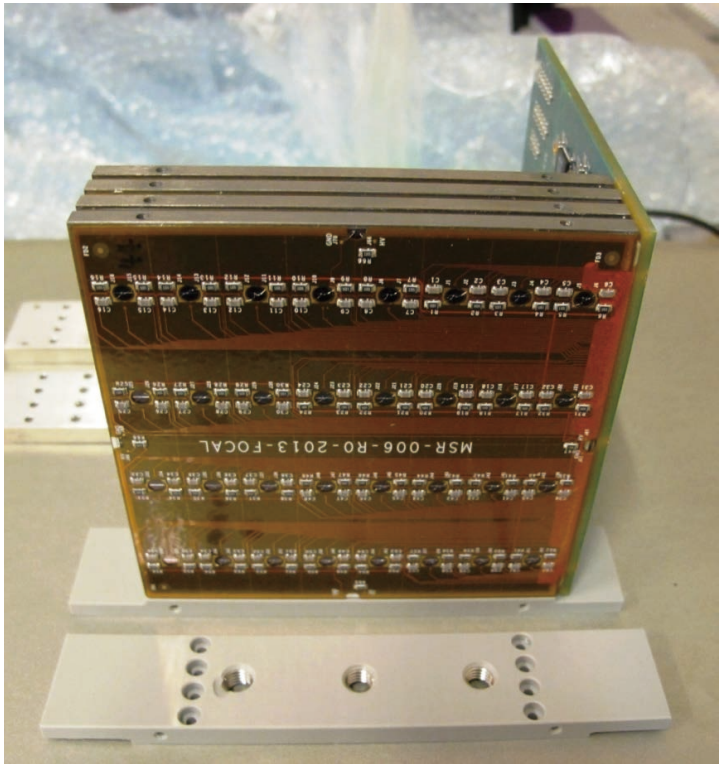


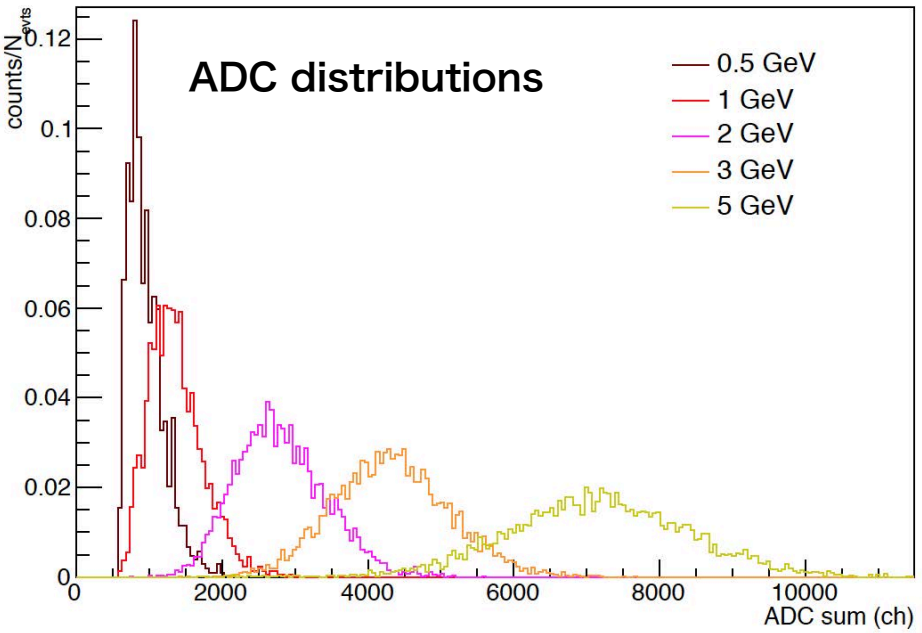
Jet p_T resolution



FoCal simulation
PYTHIA 13 TeV

PAD prototype (2014 - 2017)



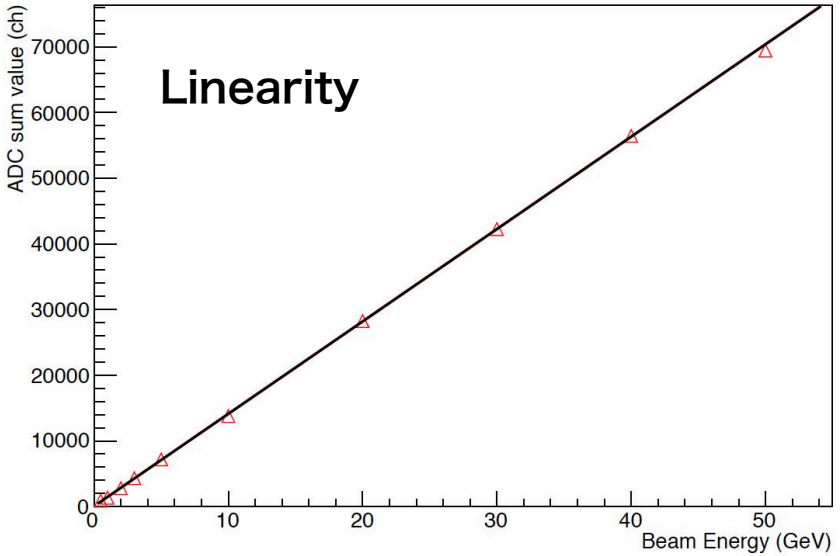


↑ **ORNL/Japan PAD prototypes**

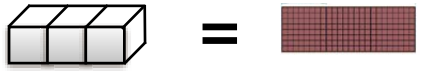
JP contributions:

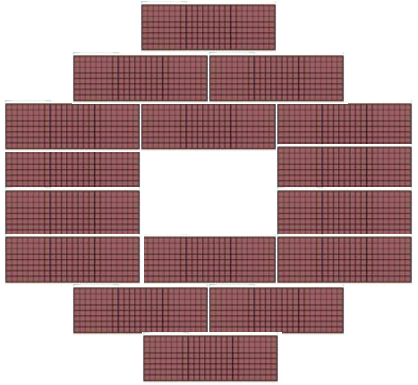
APV+SRS readout & test at PS/SPS

- Prototype working as expected.
- NIM paper under preparation.

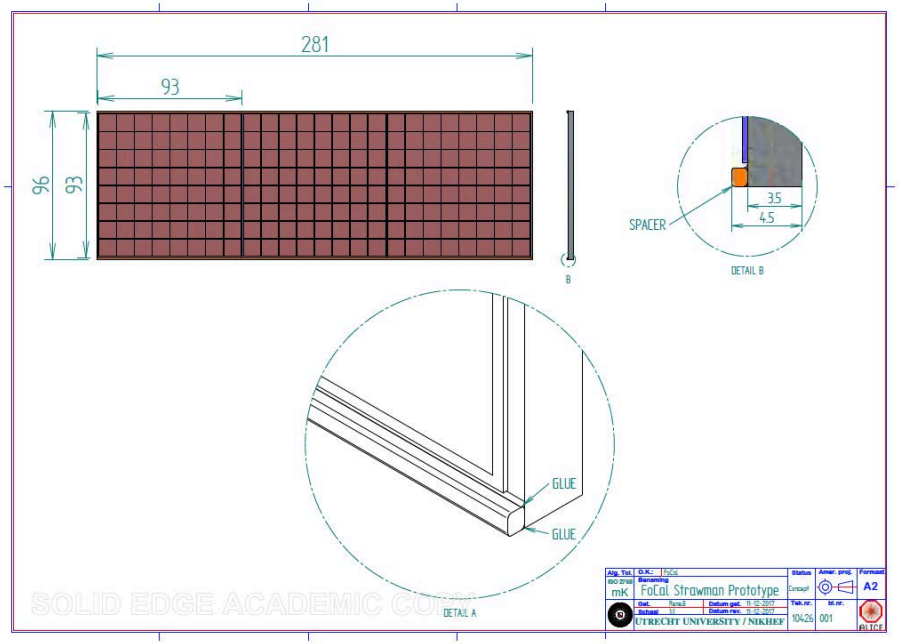


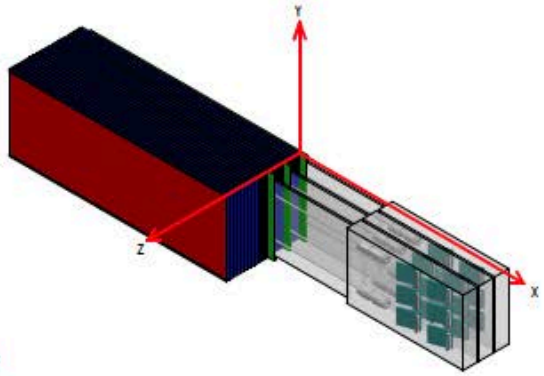
mini-FoCal design (2017-)

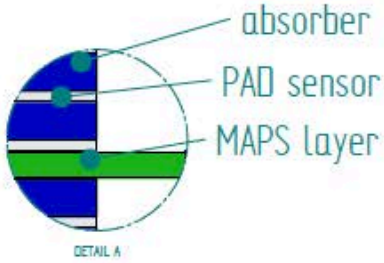




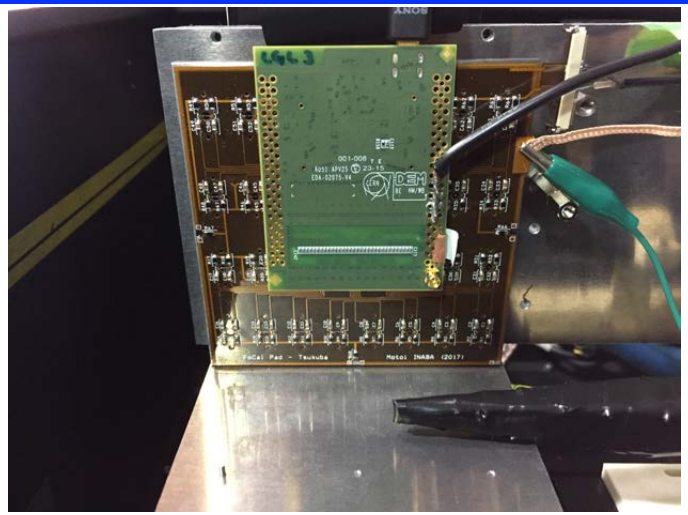
- Three towers structure.
  - 20 layers of silicon PAD / tower (20 X_0)
  - 3 layers of MAPS / tower
  - Total No. of PD: 64 x 20 x 3 = 3,840
- Combine PAD and MAPS for three towers as one
- Close to the final design of FoCal EM
- No MAPS at this time.
- Optimized to measure 50 - 200 GeV photons.

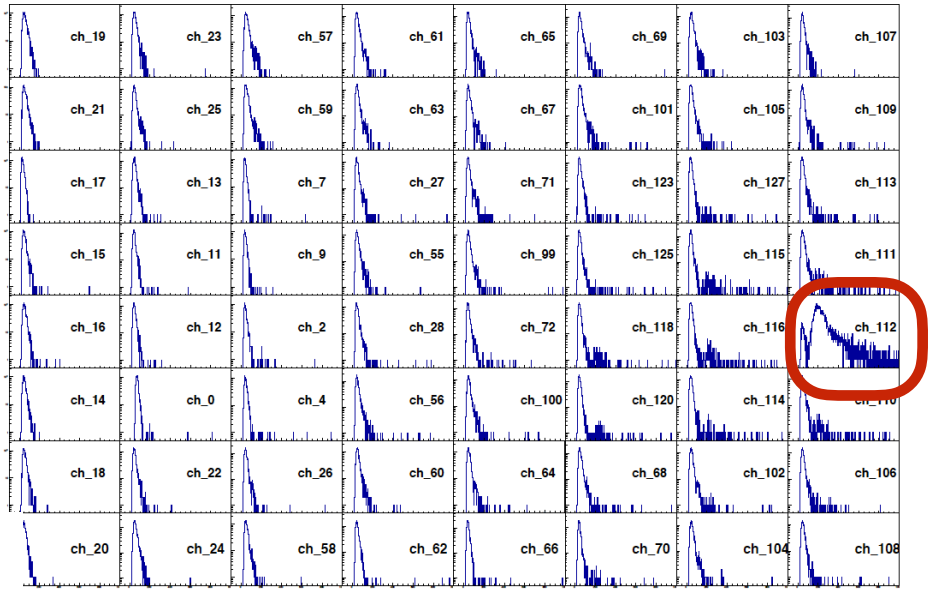


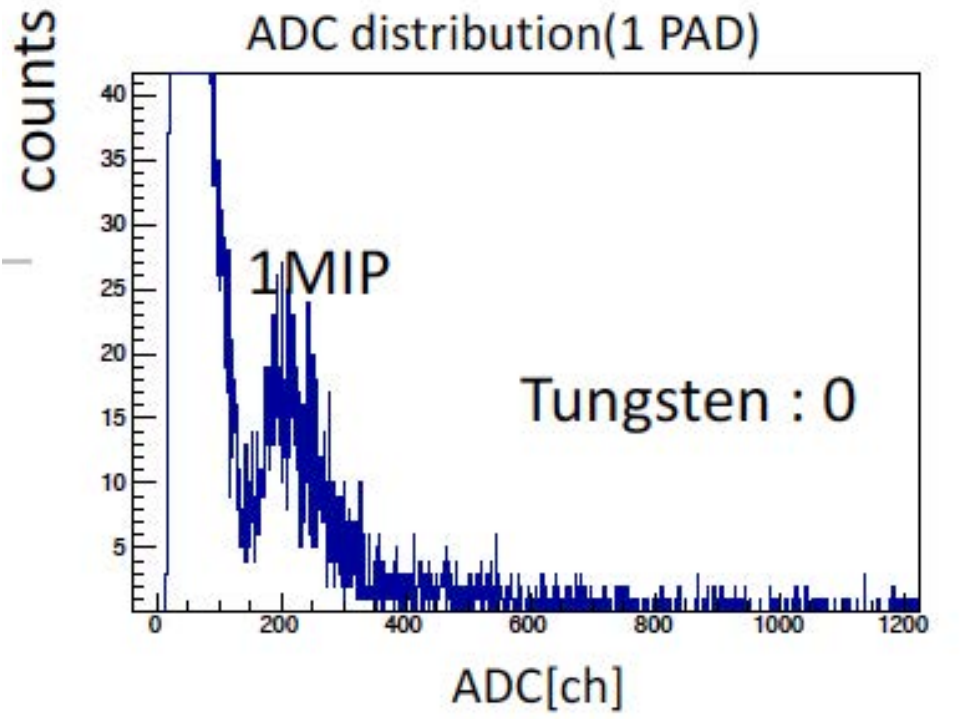




ELPH test beam (Dec. 2017, 800 MeV e+)



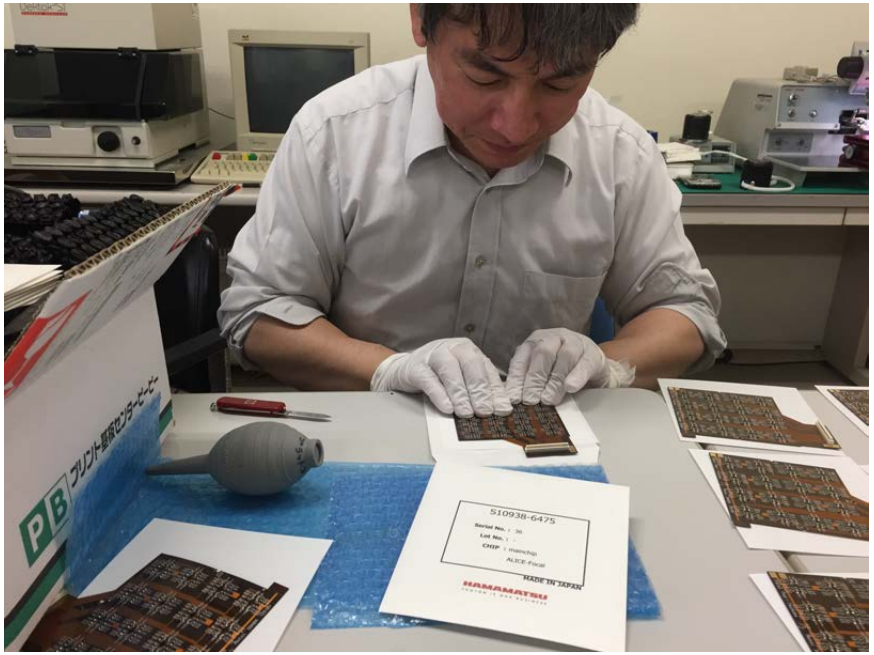


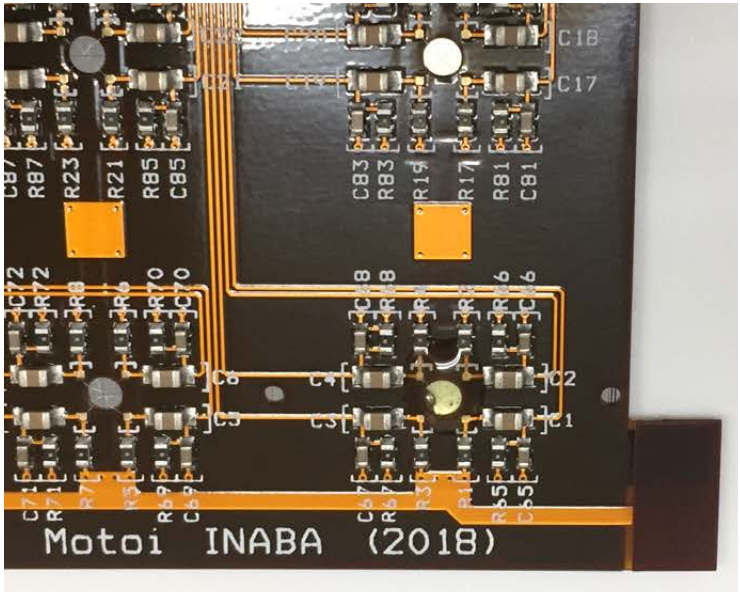


K. Tadokoro

8x8 Si PAD, ELPH test beam (800 MeV/c, e+), Dec. 2017

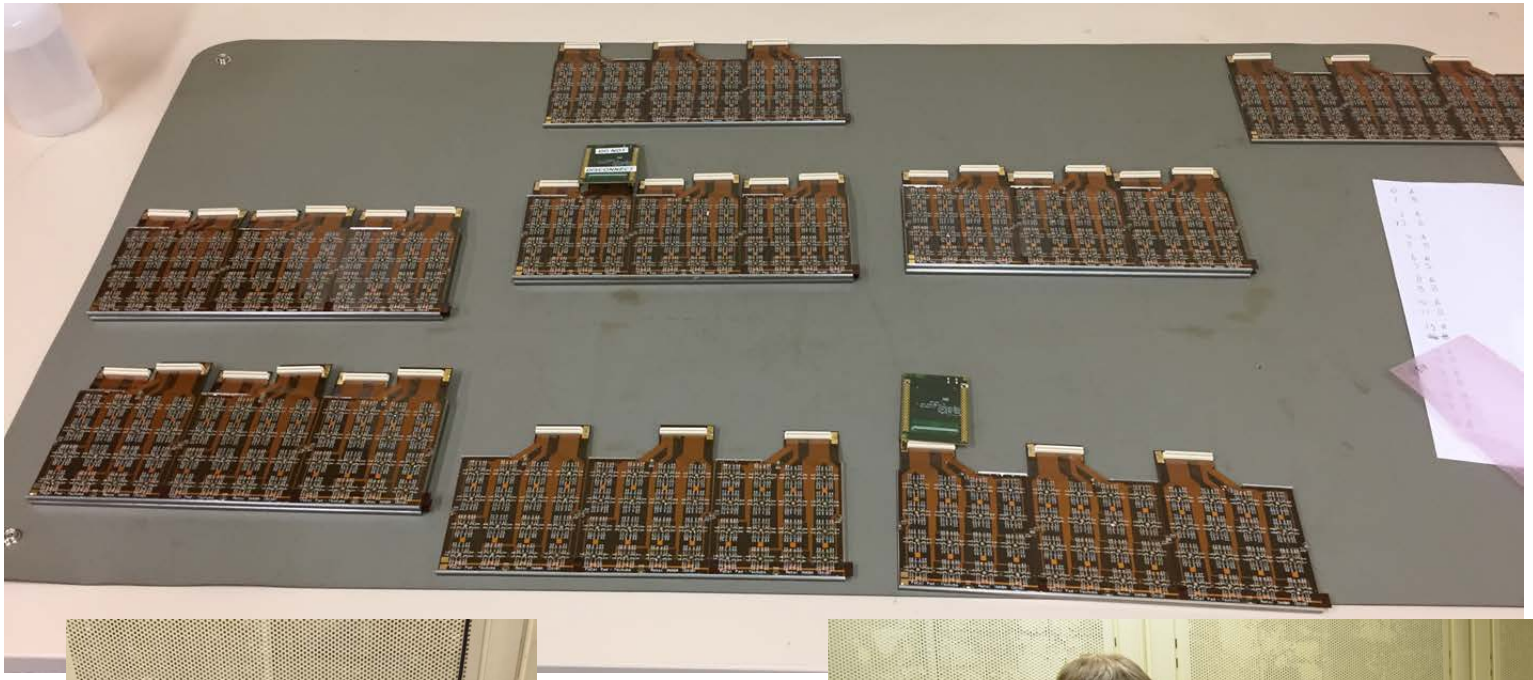
PAD detector assembly in Tsukuba (July, 2018)

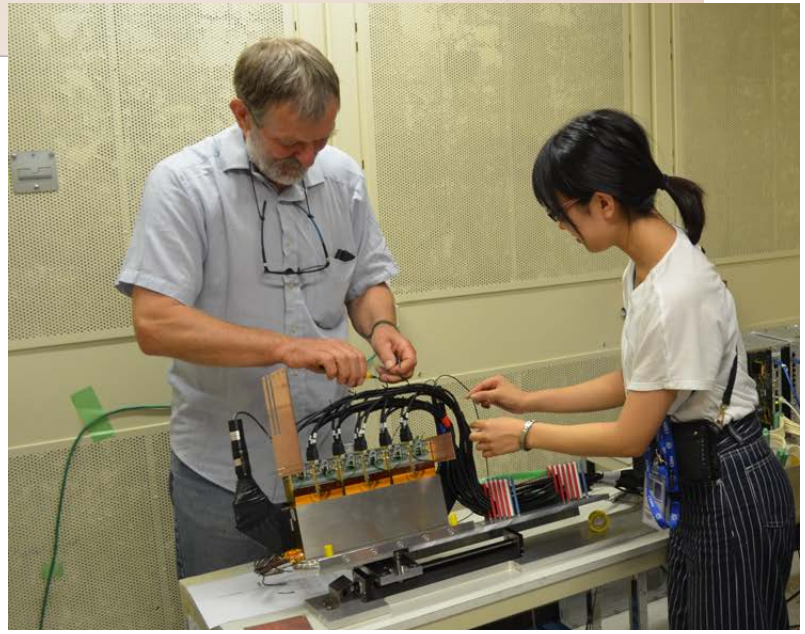




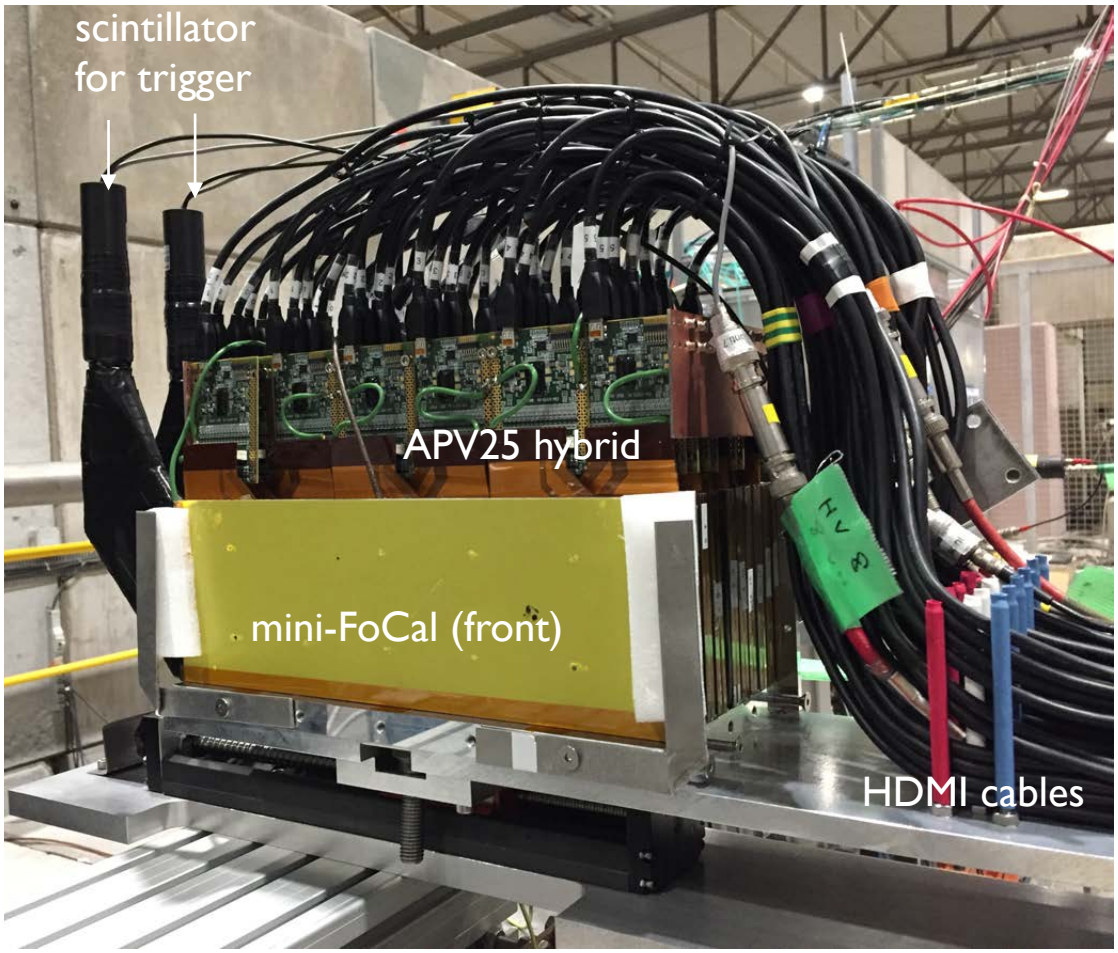
PAD detector assembly @ CERN

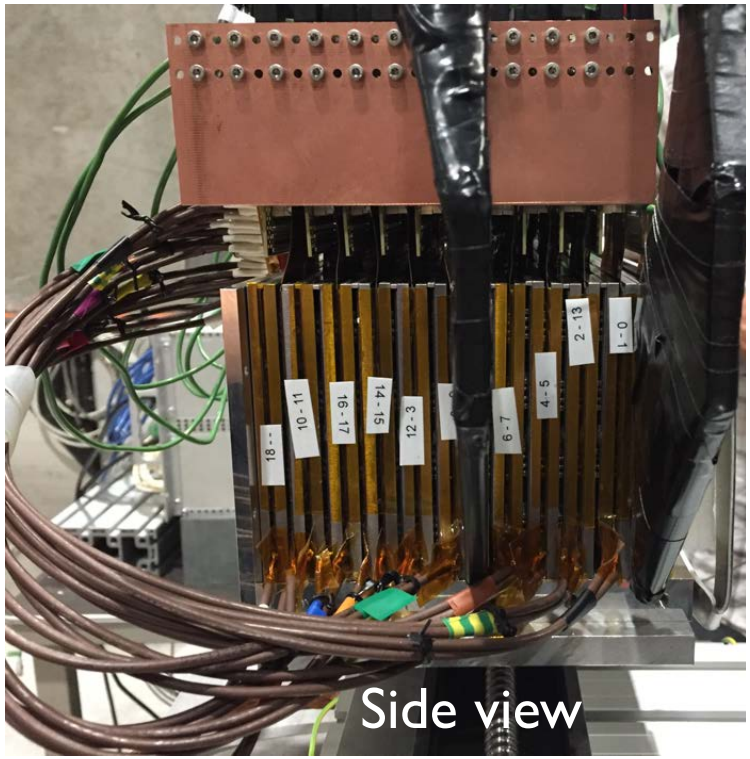
Detector arrived, started assembly, installed





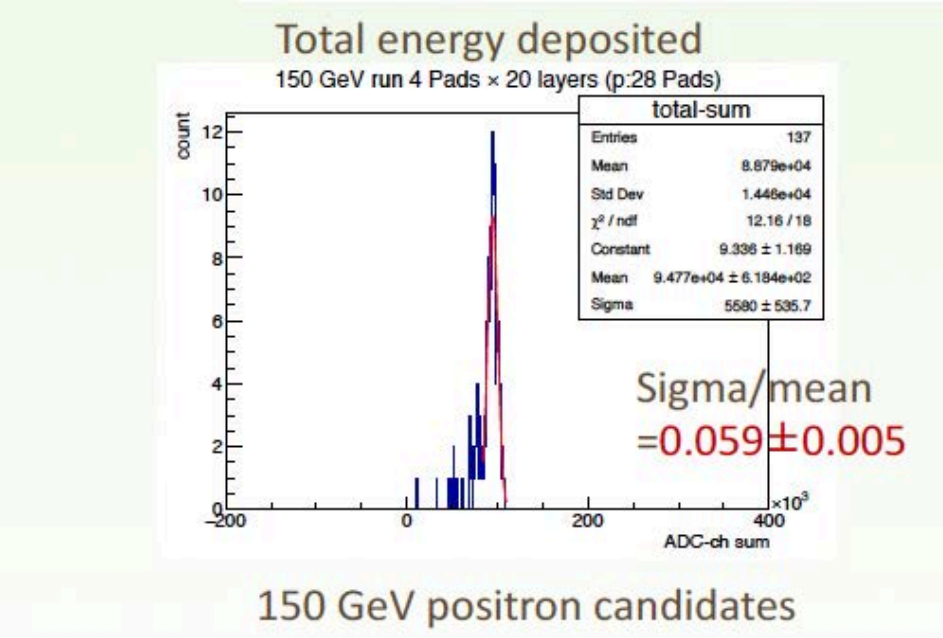
mini-FoCal





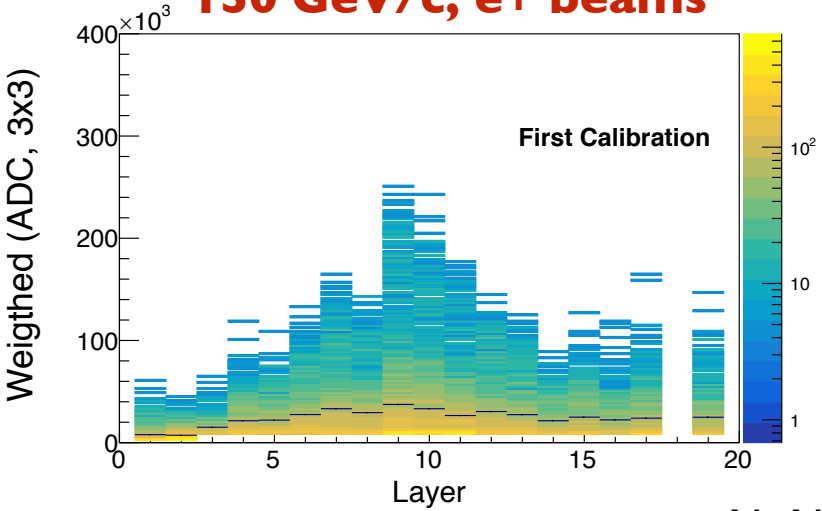
19 layers of Si-W layers

mini-FoCal @ PS, SPS test beam (2018)

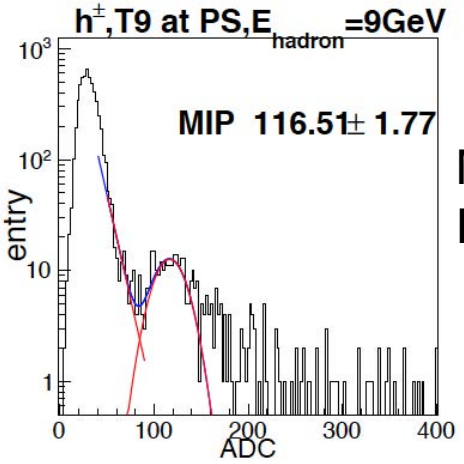


← 5.9 % Energy resolution (preliminary)

S. Takasu



N. Novitzky

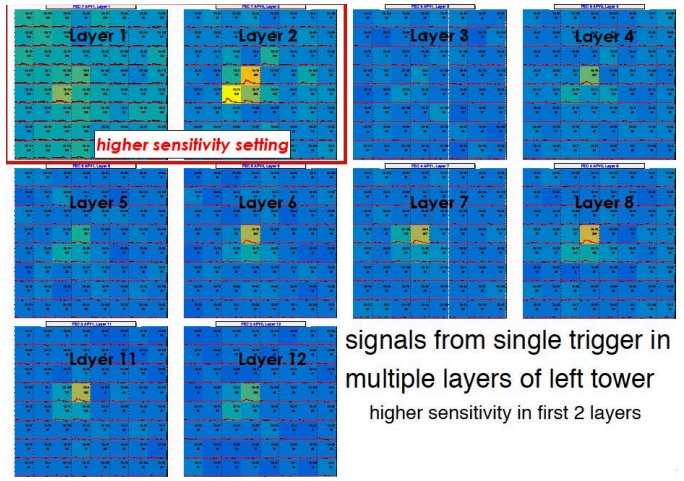


MIP signal @ PS hadron beams

Y. Minato

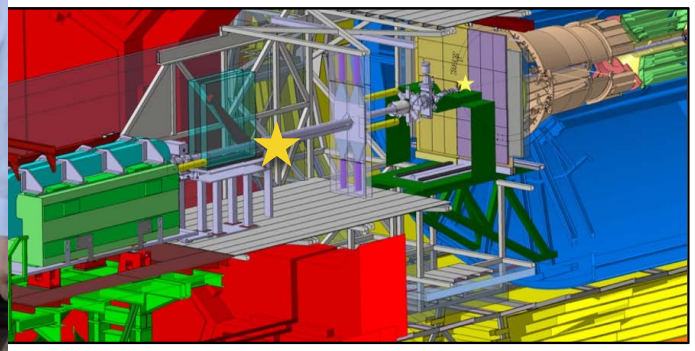
FoCal in ALICE during pp 13 TeV (2018)

- A prototype of FoCal has been installed in ALICE (7.6 m from IP)
- Three tower structure, EM-part (PAD only), tested at PS and SPS in 2018.
- Took data successfully and data analysis is ongoing.



signals from single trigger in multiple layers of left tower

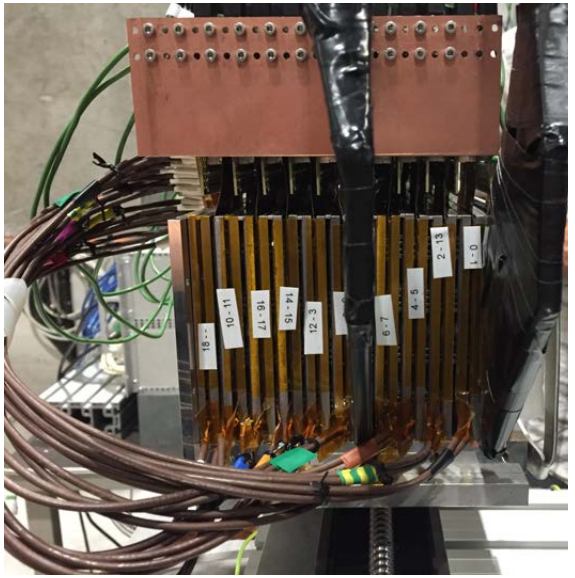
higher sensitivity in first 2 layers

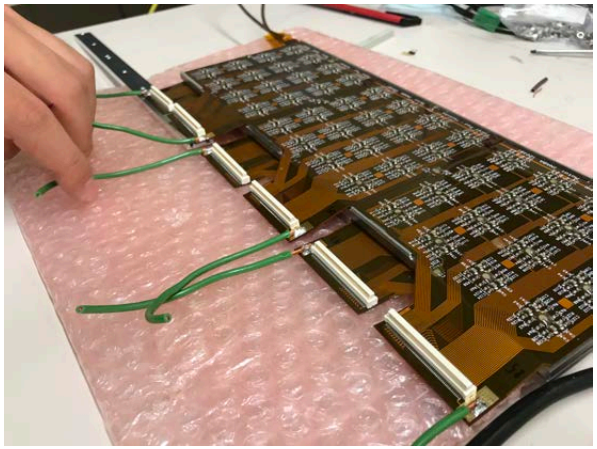


A. van den Brink

Plan for 2019

- **Towards LoI and TDR**
  (1) Frontend readout electronics
  (2) Evaluation of analog signal by the long cable transmission
- **Tools**
  - mini-FoCal detector
  - high power IR laser (+ ps IR laser)
  - wire bonding, IV-CV measurement.
  - SRS readout system (SRS system (FEC v6, ADC), CSA+ multi-channel analyzer)





Thank you for your attentions !