Report on the
ALICE FoCal-E CERN-SPS beam test
and activities

Dec 20
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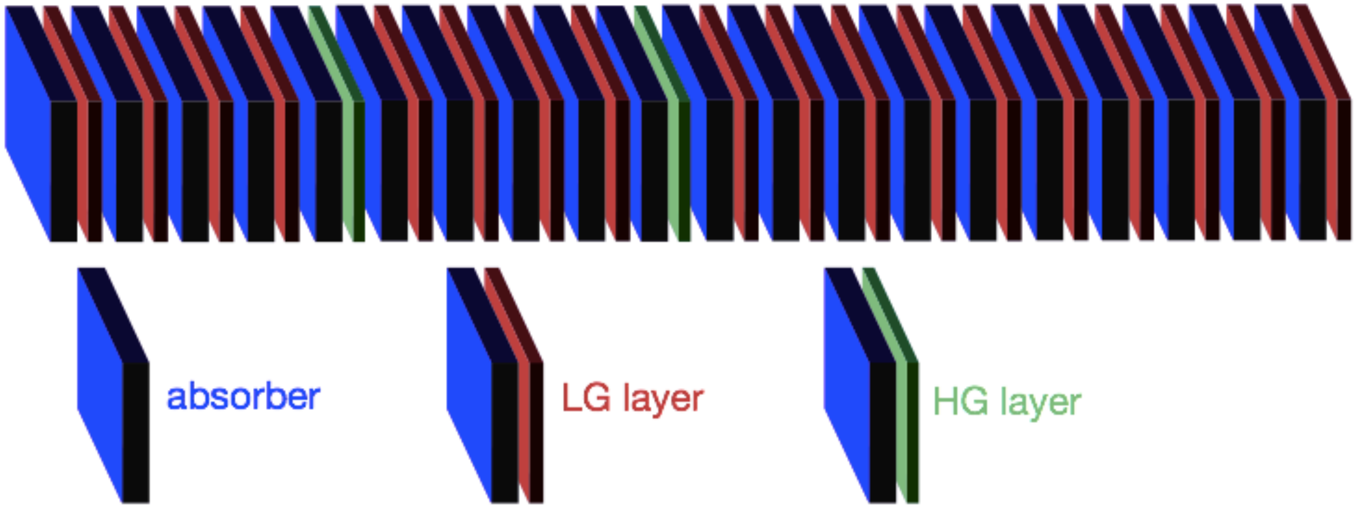
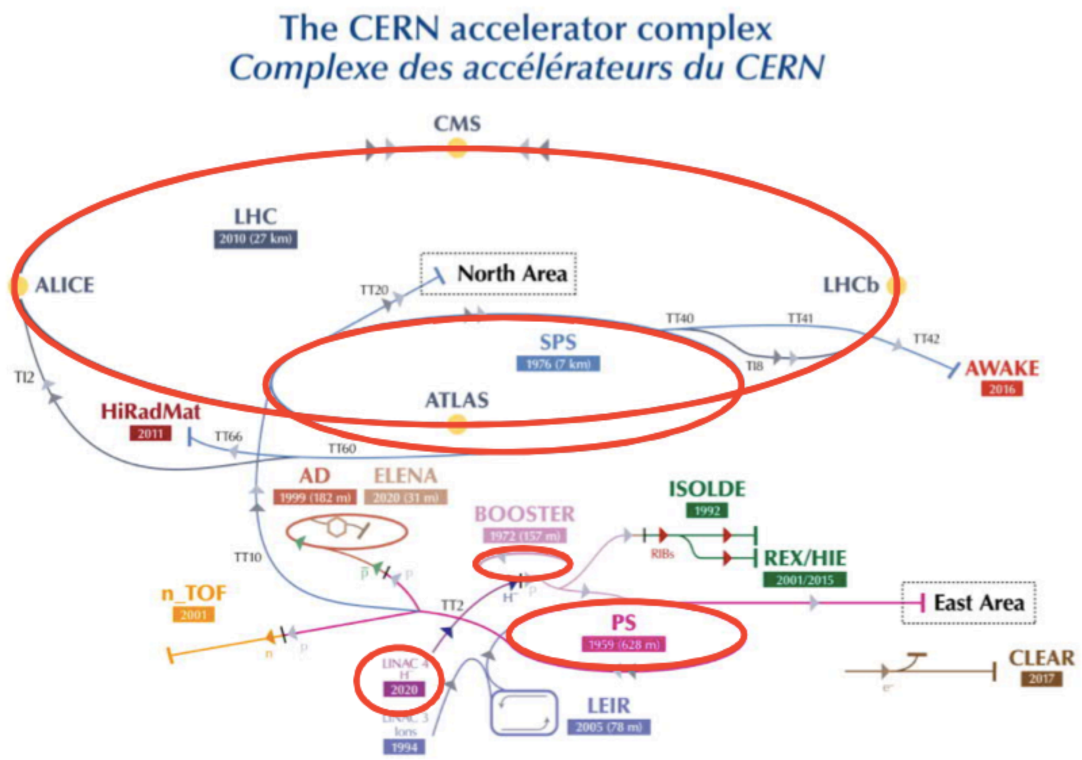
ALICE FoCal-E detector



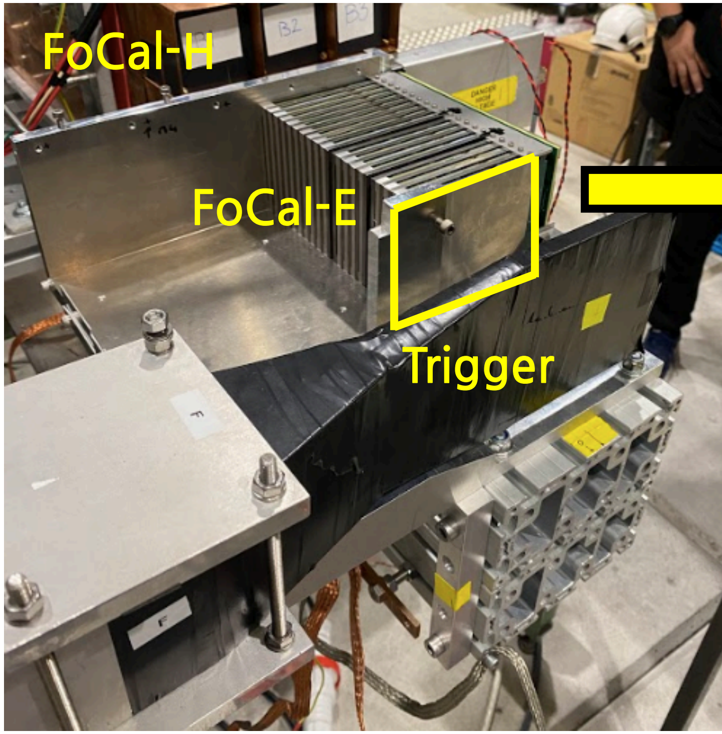
- FoCal-E detector is a Si + W sampling calorimeter.
- It is composed of the low (FoCal-E pad, 1 cm x 1 cm cell) and high (FoCal-E pixel, 30 μm x 30 μm cell) granularity layers.
- A FoCal-E prototype was tested using the high-energy electron (20~300 GeV) at the CERN-SPS H2 beam line.

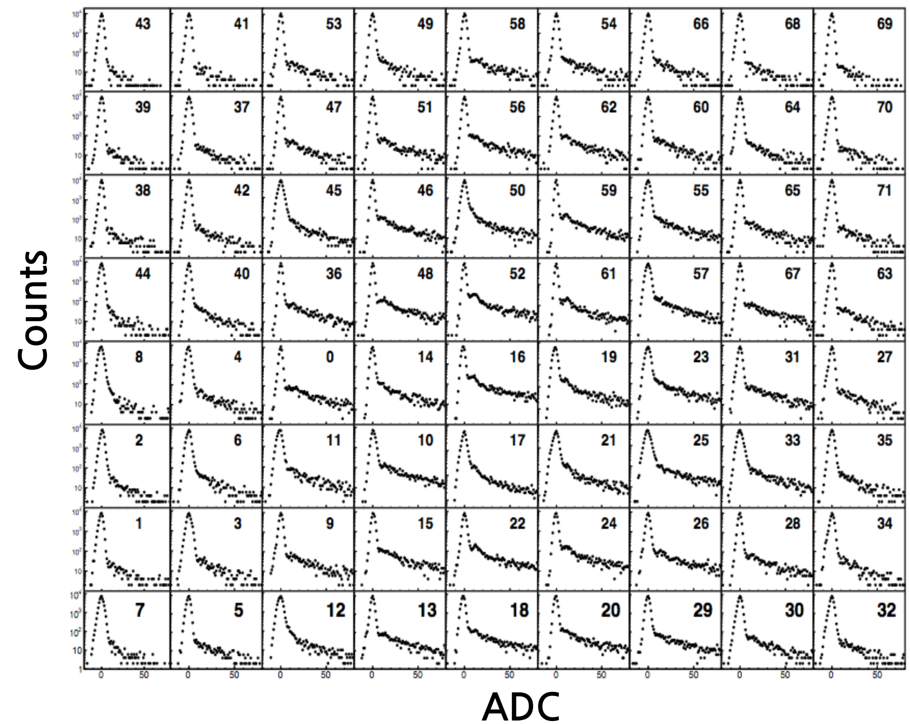
CERN accelerator complex



- Proton is delivered to the LHC via Linac → Booster → PS → SPS → LHC.
- ALICE FoCal had the beam test on November at the H2 beam line which were located at the north experimental area of the SPS.
- Secondary electron or hadron beams are produced from the primary proton at the H2 beam line.

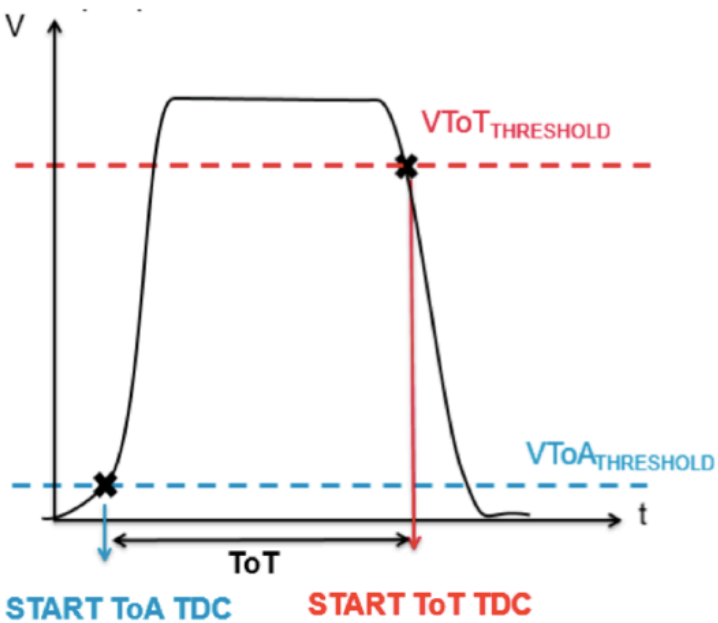
Experimental setup

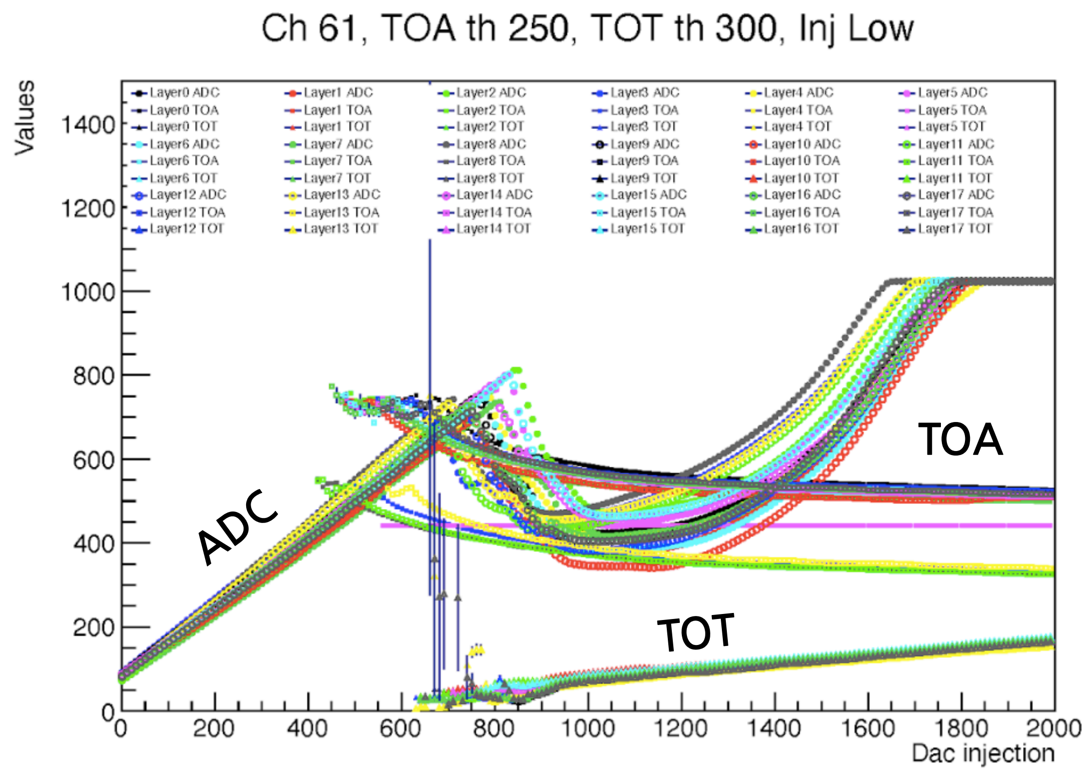




- FoCal-E and FoCal-H were installed with a trigger detector.
- A layer of the FoCal-E prototype consists of 72 channels of 1 cm x 1 cm pad.
- We took data from November 3 to 10 (first half with the hadron and the other half with the electron).

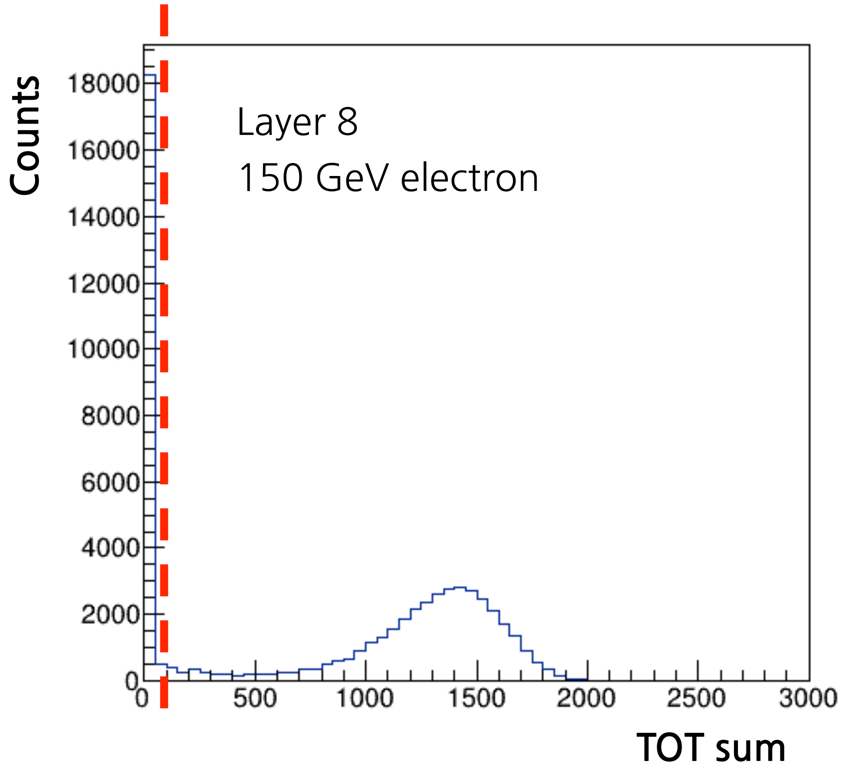
FoCal-E pad readout





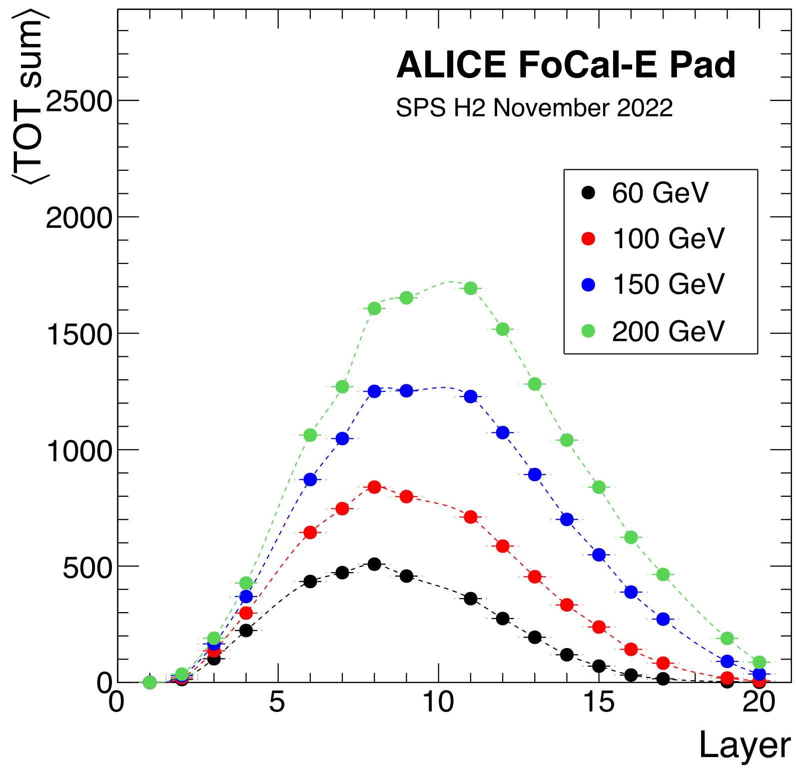
- FoCal-E pad uses the HGCROC chip for readout.
- HGCROC provides the ADC for smaller signal up to 100 MIPs ~ 150 fC.
- HGCROC also provides the TOT for larger signal up to 10 pC.

Basic cut condition



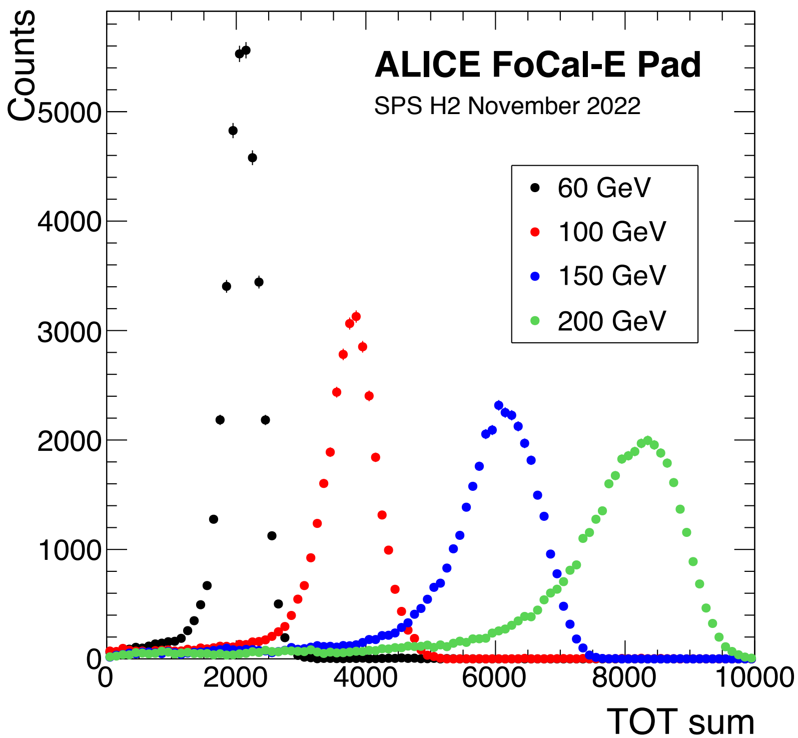
- Measured events are composed of the electron and the background.
- The TOT sum should be non-zero in the electron event.
- The basic cut condition applied was the TOT sum at layer 8 was larger than zero.

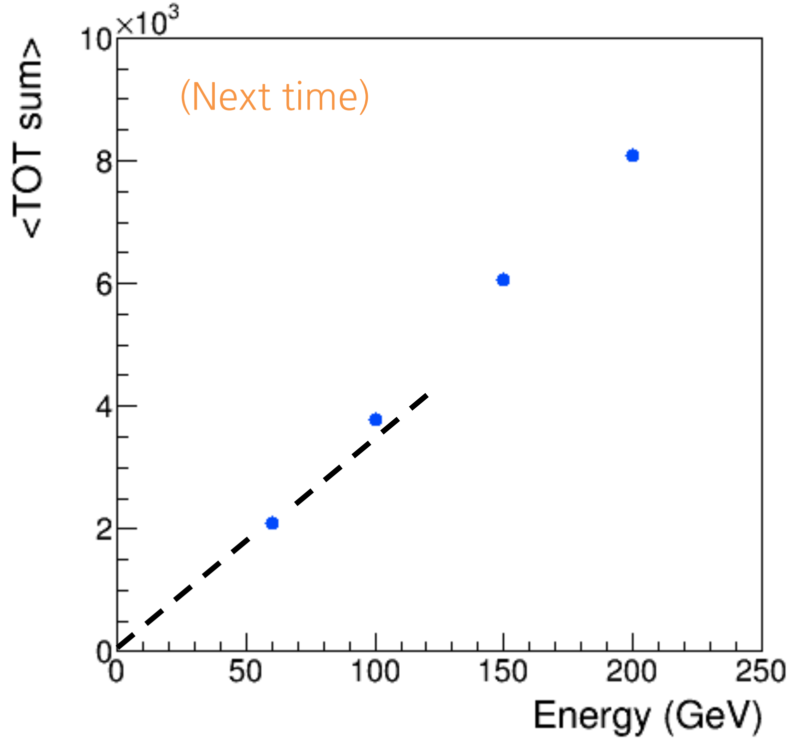
Preliminary plots



- We can see the longitudinal shower profile well.
- Layer 5 and 10 are the pixel layers.
- There is TOT gain problem at layer 18. So we excluded the data points accordingly.

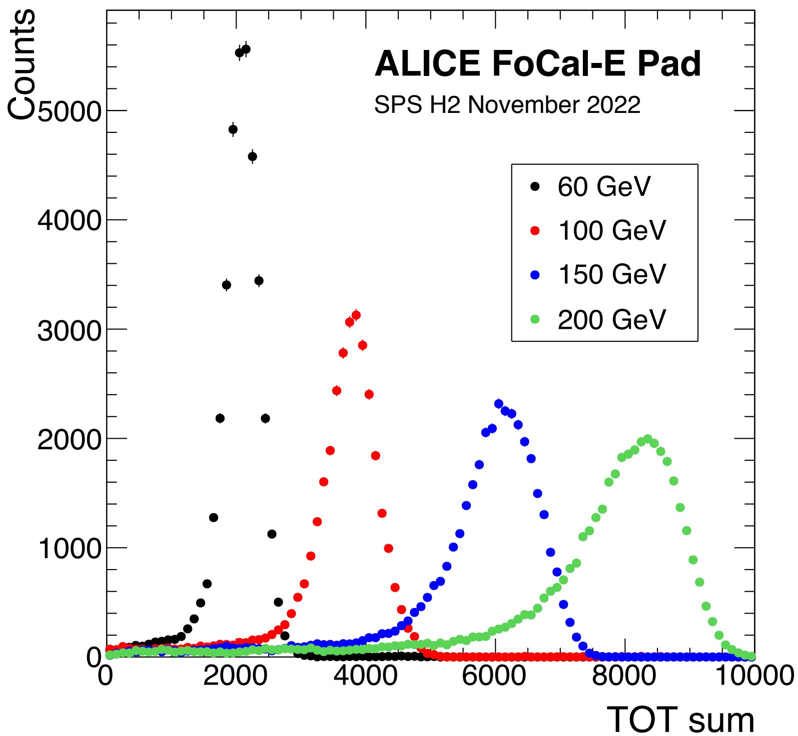
Preliminary plots

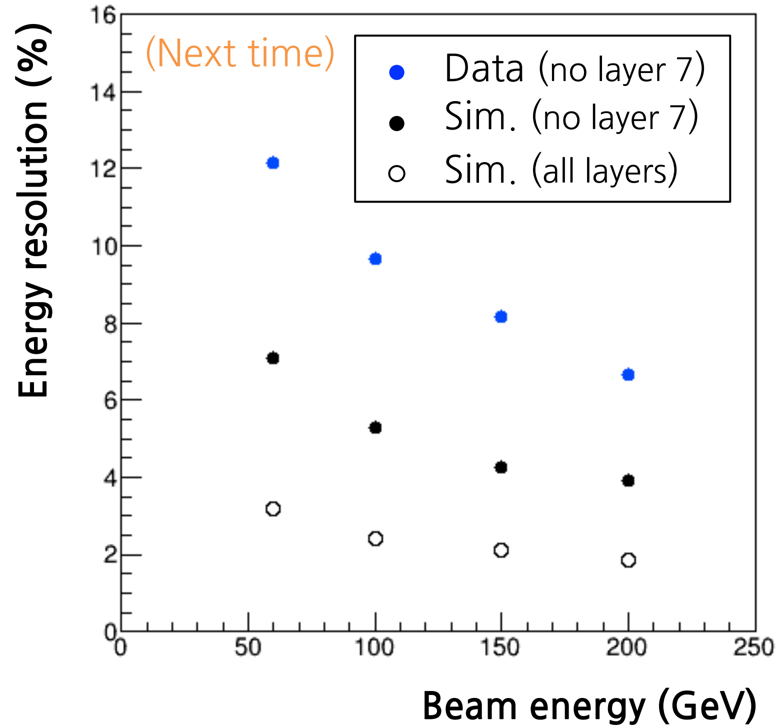




- Linearity can also be indirectly shown by summing up the TOTs of all layers.
- Since half of the TOT channels was not working at layer 7, layer 7 was not included when the TOT was summed up.
- Since we have more non-zero TOT values in the higher energy run, the 〈TOT sum〉 Vs. energy is not perfectly linear.
  - ADC should be combined for better linearity.

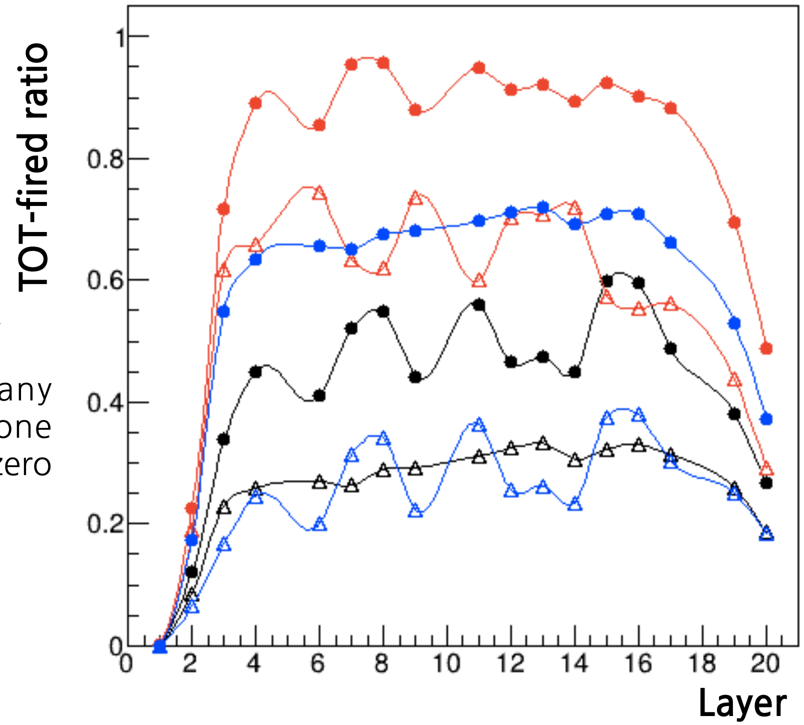
Preliminary plots





- Since we have many factors to improve the energy resolution, this plot will also be updated later for the preliminary one.
- After two preliminary plots were issued, we have started the detailed run QA for the full-scale analysis.

TOT-fired ratio (150 GeV)



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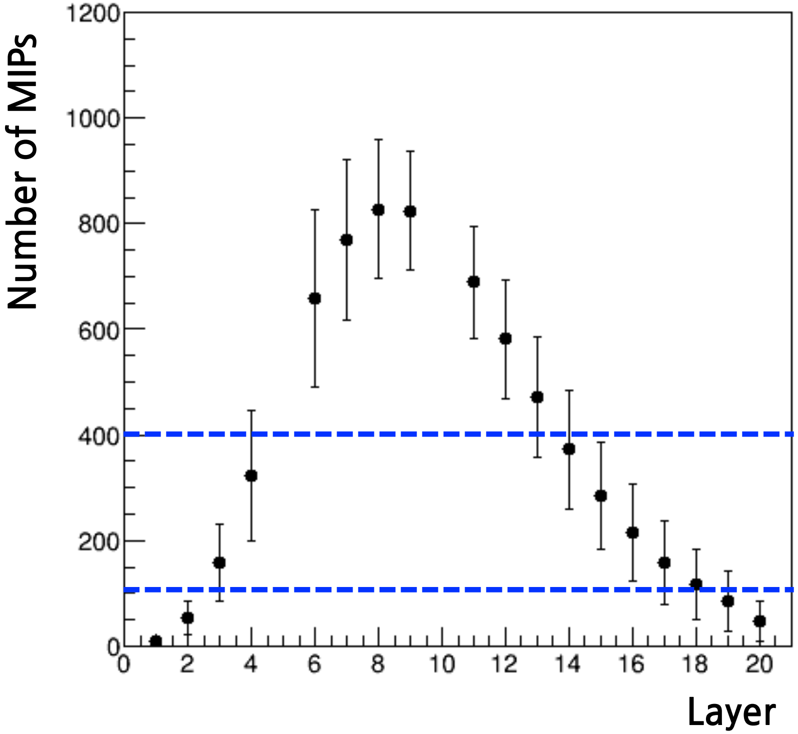
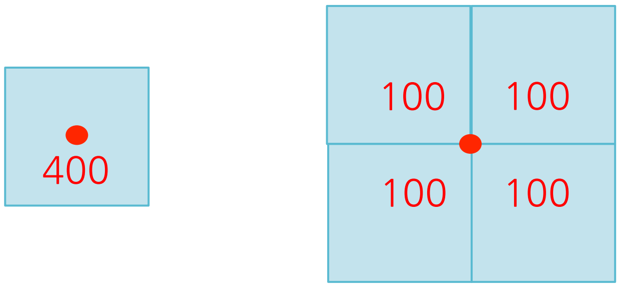
Fraction how many events at least one channel has non-zero TOT value

- All runs have the zigzag pattern. Even the most health run, 08__22_57_07 has at least one zigzag pattern.
- This should not be ideal but seems to be a current characteristic when the TOT is fired.
- Assuming this phenomenon is unavoidable, the best solution is selecting the good events to study the detector performance correctly.

Number of MIPs over the layers (150 GeV)



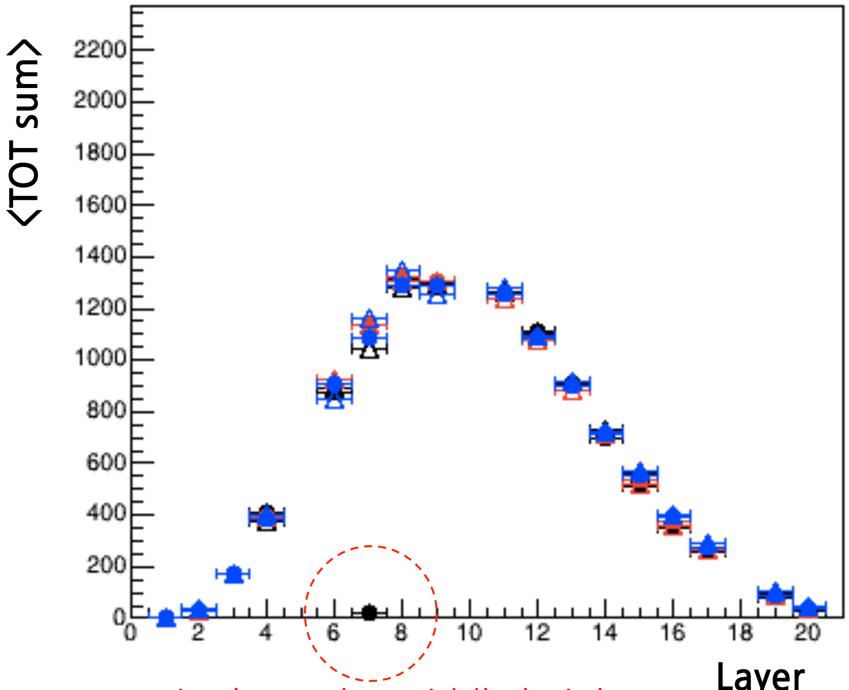


Even though the electron hit the edge of a channel, we can observe the non-zero TOT.

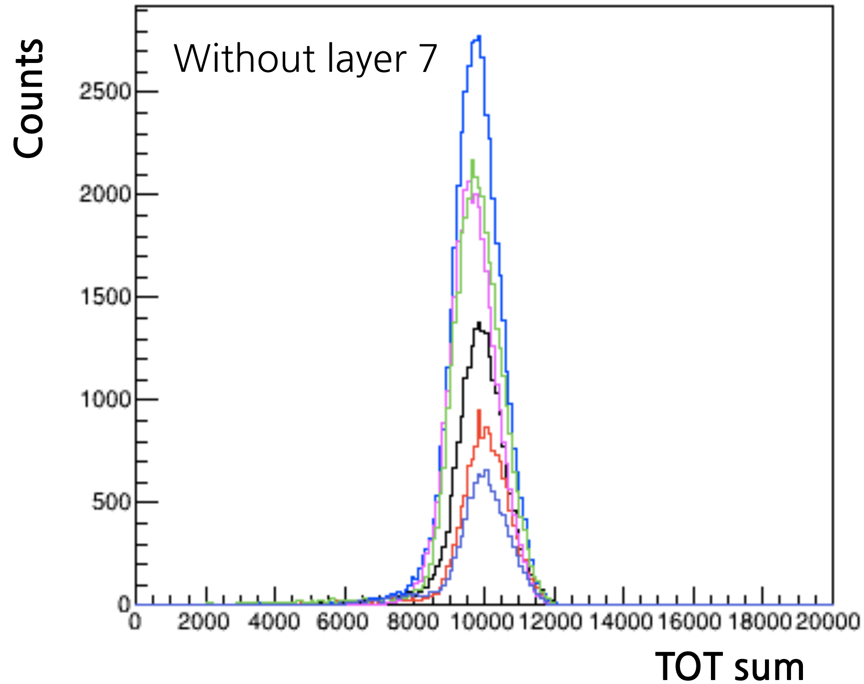
TOT starts to have non-zero value.

- In the simulation, 150 GeV e+ hit the center of the FoCal module.
- Among the 72 channels, a channel which showed the maximum number of MIPs was selected.
- We should observe the non-zero TOT at least in the layer 6, 8, 9, 11, and 12 if the EM shower is developed in the detector. (Layer 7 has a problem for TOT.)

Detector performances with the new cut condition



Beam spot is above the middle height.



- After the new cut condition is applied, detector performances of all runs got comparable.
- This cut condition will be considered when we estimate the detector performance later again.

Plan

- With the run QA, our understanding about the run quality and analysis strategy will be better.
- How to combine the ADC with the TOT will be studied by a student by analyzing the DAC scan data.
- Detector performance will be studied more precisely after the run QA and DAC scan data analysis are done in January.