

ALICE FoCal beam test activities at PS and SPS in 2022

Max Rauch for the ALICE FoCal Collaboration

PS/SPS Users End of Year Wrap-up / Feedback Session

2nd December 2022

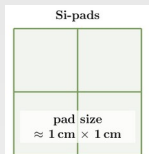


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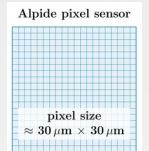
UNIVERSITY OF BERGEN



ALICE FoCal Beam Tests 2022



- Silicon sensor with pad size of ~1 cm x 1 cm
- 8 x 9 pads per sensor
- Each sensor read out with one HGCROC
- Charge measurement per pad with ADC, ToT, and ToA
- High dynamic range: MIP ↔ 10 pC
- Longitudinal shower profile information from each layer



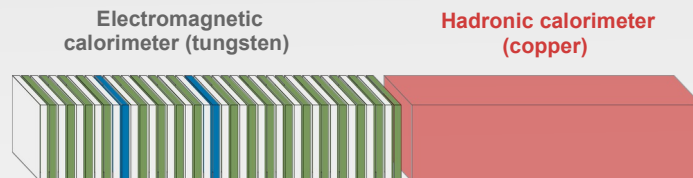
- ALPIDE pixel sensor (ALICE ITS vertex detector pixel sensor)
- Pixel size of ~30 μm x 30 μm
- 1024 x 512 pixels per chip
- Time constant of analog front-end ca. 5 μs
- Two-shower separation at the mm-scale

Cu tubes + scintillators



- Copper tubes parallel to beam pipe (diameter 2.5 mm)
- Filled with scintillating fibers (diameter 1.1 mm)
- Fibers coupled to silicon photomultipliers
- Prototype 2 with 200 x 200 x 1100 mm³ active area

Beam direction



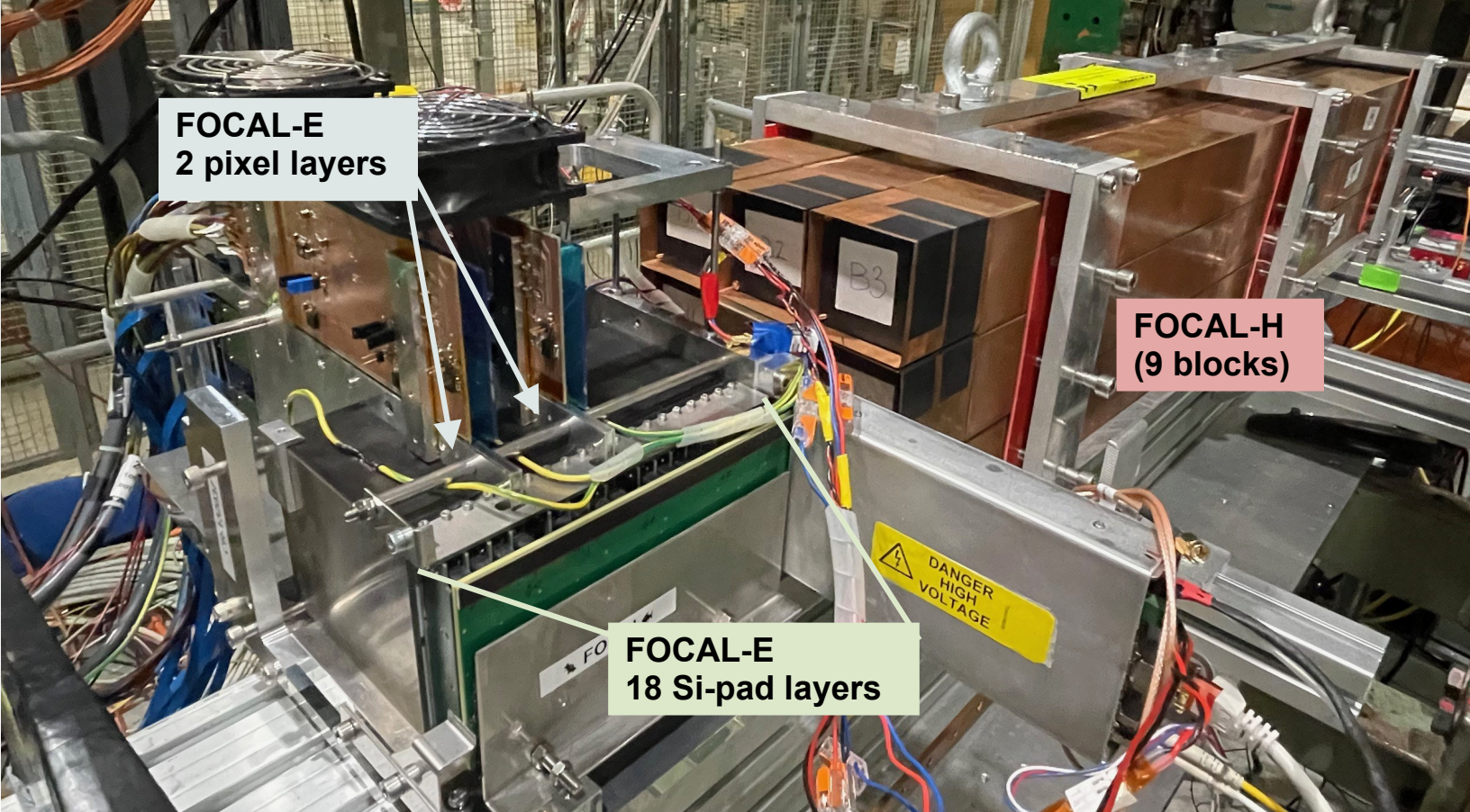
Measurement results will be included in ALICE FoCal TDR (scheduled for 2023)

	Beam line / Momentum	FoCal-E Pad	FoCal-E Pixel	FoCal-H
Jun 2022	PS T9 1 – 9 GeV	18 silicon pad sensor + 18 HGCROCs		Full length (110cm) prototype ~ 20cm x 20cm active area
Sep 2022	SPS H6 20 – 120 GeV	Common readout with ALICE CRU/FLP/o2 readout in GBT mode Common trigger with FoCal-H		Common trigger with FoCal-E
Sep 2022	PS T10 5 – 9 GeV	Tests of HGCROC settings		Test of VMM readout
Nov 2022	SPS H2 20 – 350 GeV	Implementation in ALICE o2 online QC	ALICE ITS Outer Barrel HIC layers Implementation in ALICE o2 online QC	

ALICE FoCal Setup at H2



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FOCAL-E
2 pixel layers

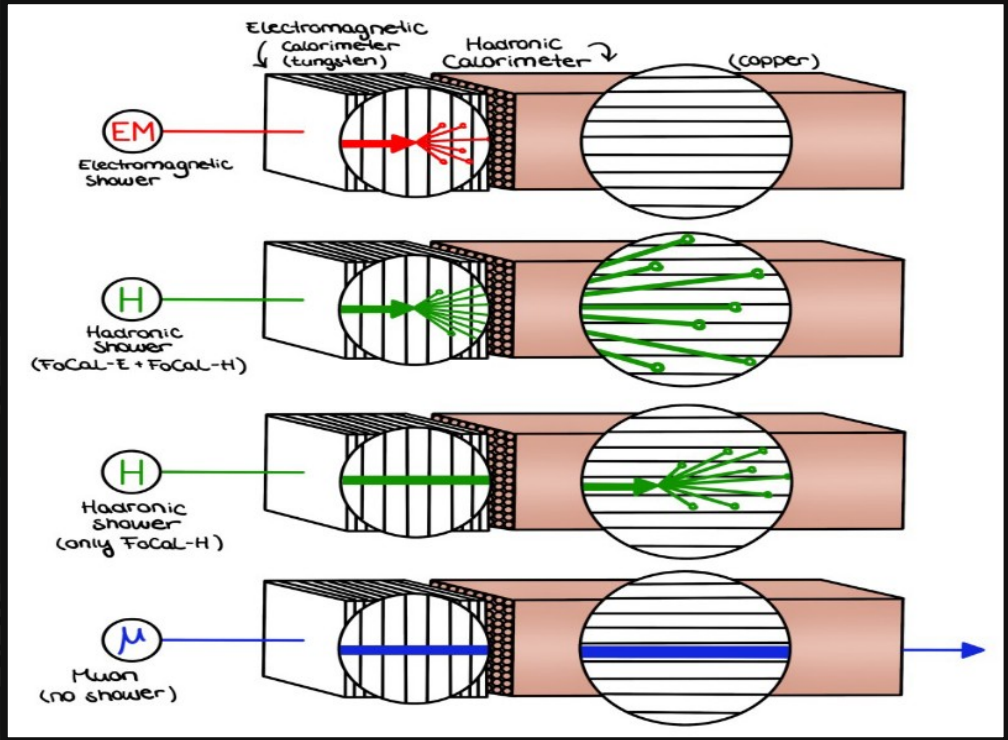
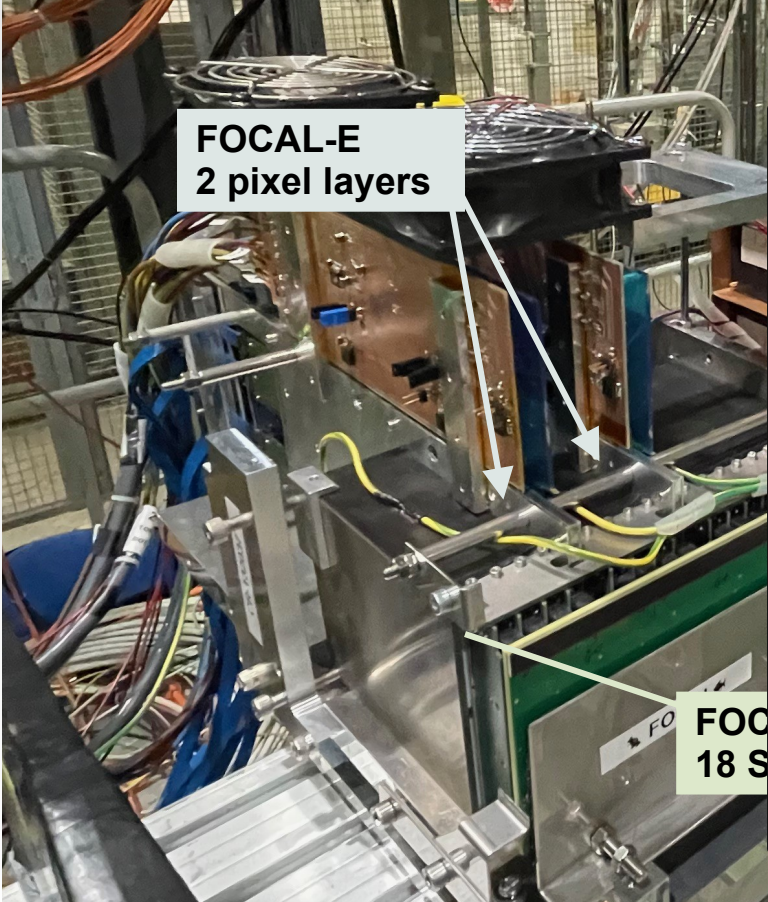
FOCAL-H
(9 blocks)

FOCAL-E
18 Si-pad layers

ALICE FoCal Setup at H2



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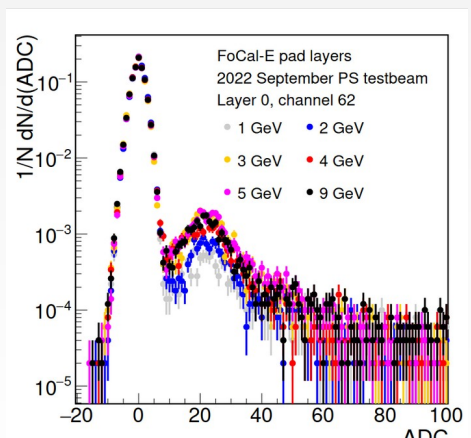
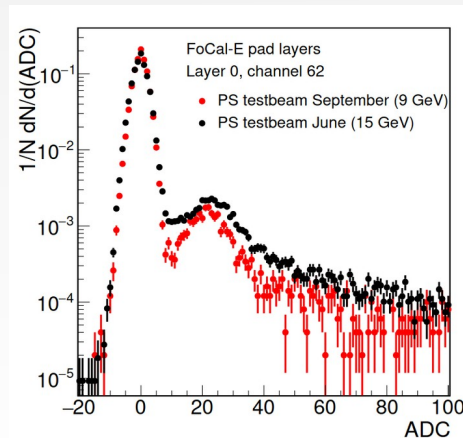
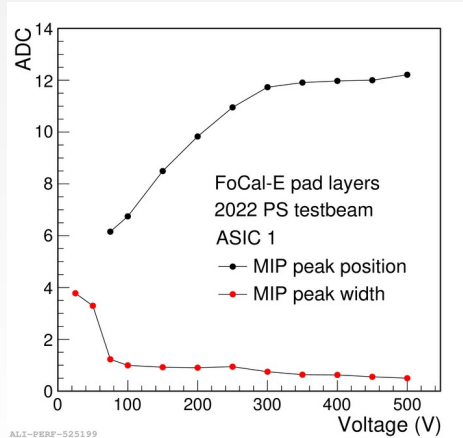
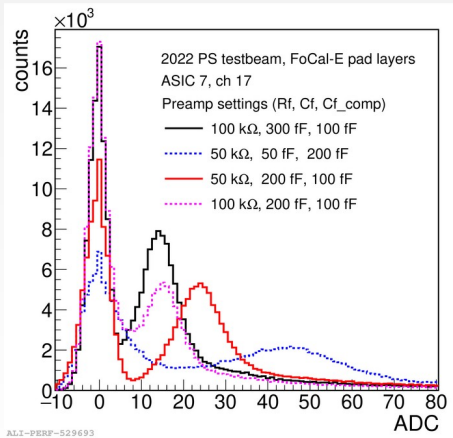
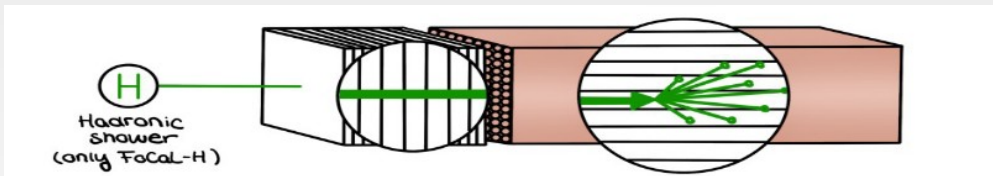
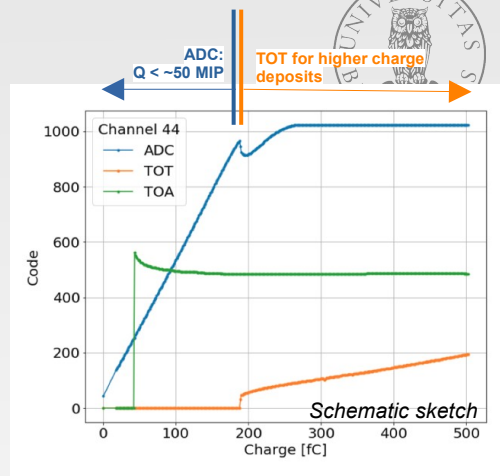


FoCal-E Pads w/ Hadrons at PS

- HGCROC uses ADC and TOT information for charge measurement
- MIP peak response measured for various parameters like pre-amplifier settings, sensor bias voltage, particle energy
- Analysis of electrons between 1 and 5 GeV ongoing



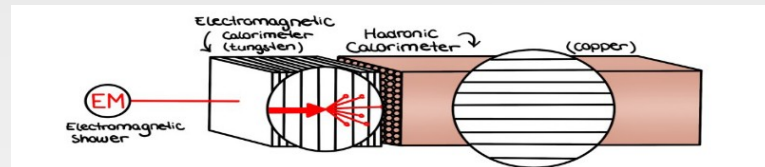
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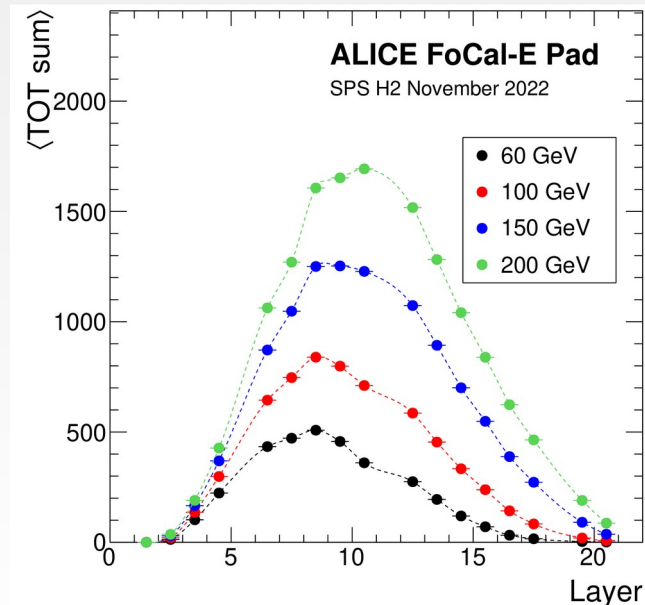
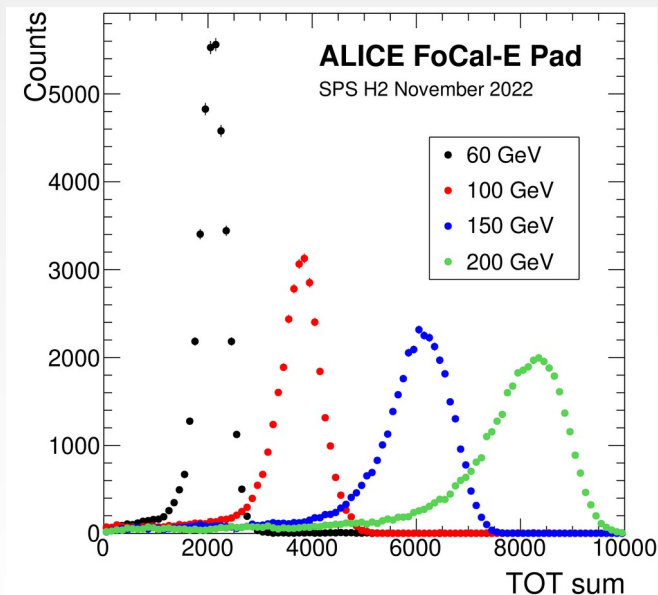
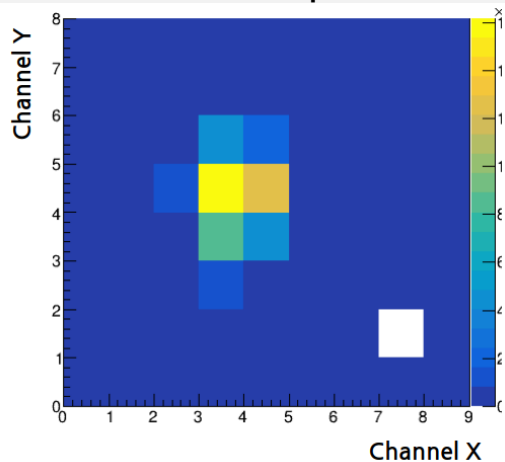
FoCal-E Pads w/ Electrons at SPS H2



- Measured TOT response for electron showers → proportional to particle energy
- Very clear **longitudinal shower profile** resolution possible
- Behavior for > 200 GeV electron showers under investigation



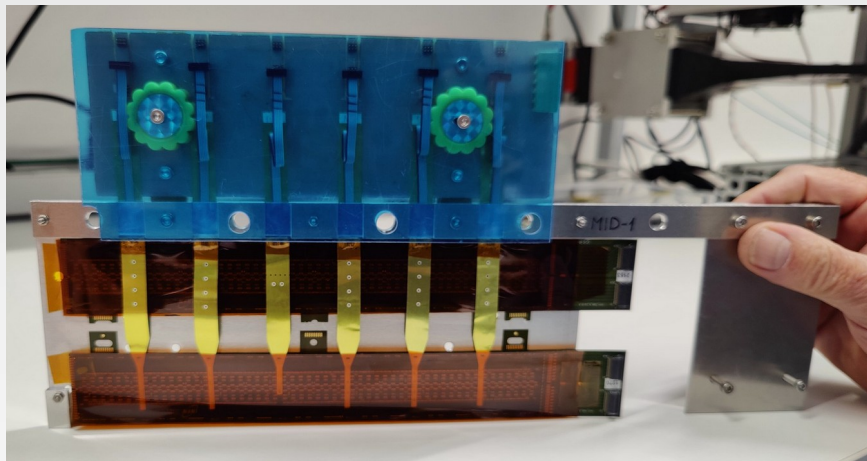
Beam spot electron beam measured with TOT in 9cm x 8cm plane



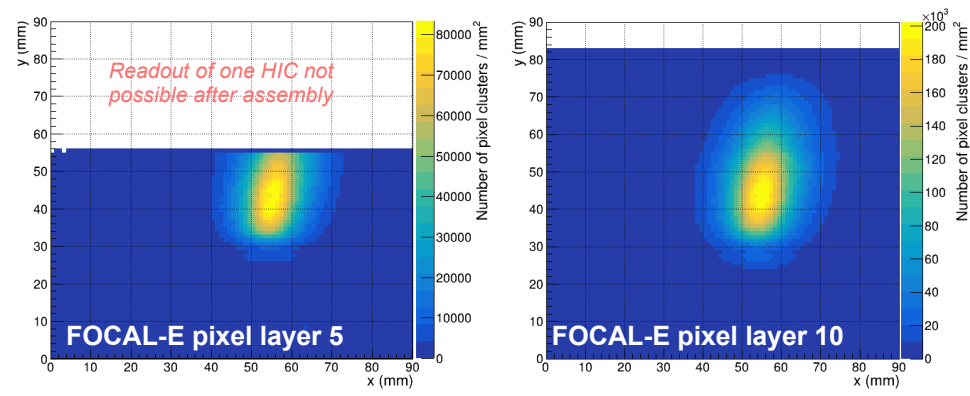
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Pixel Layers (based on ITS OB HIC)



Hit profile of 300 GeV electron beam at H2

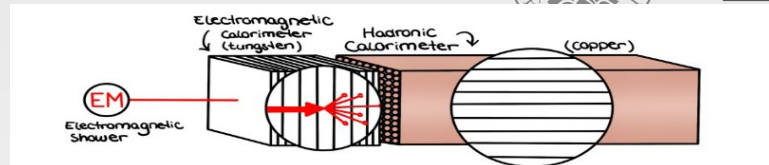


- Prototyping of automated tap-bonded prototype pixel layers from LTU in Kharkiv, UA was delayed in 2022
- Alternative solution developed based on ALICE ITS Outer Barrel HIC modules
 - Assembly activities started in ~August 2022
 - Setup ready for November 2022 beam test
- Full acceptance in Pixel Layer 10, reduced acceptance in Pixel Layer 5

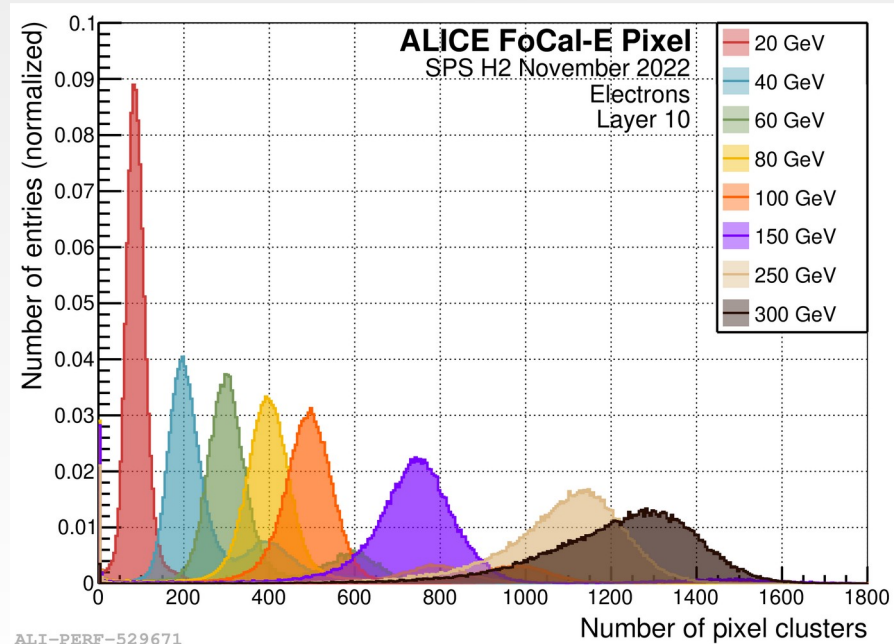
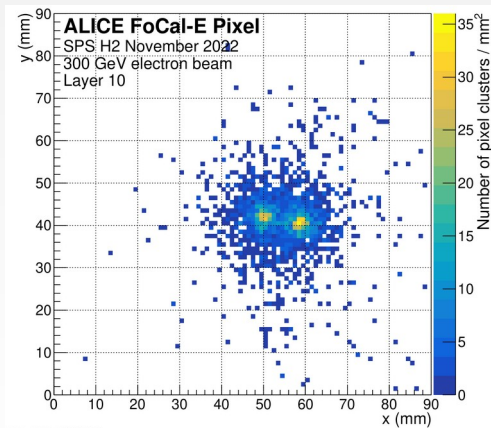
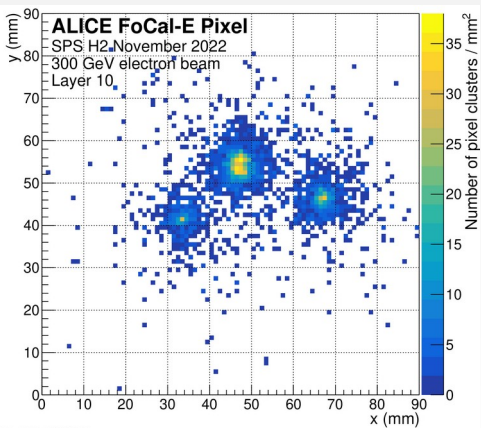
FoCal-E Pads w/ Electrons at SPS H2



- Very good beam purity observed
 - Quantitative analyses to be made
- Number of pixel clusters (i.e. pixel hits grouped to clusters) is approx. proportional to particle energy
- Observed multiple electron shower events
- Interesting studies regarding two-shower resolution can be made
 - → two-gamma shower separation from π^0 decays



E



ALI-PERF-5295625

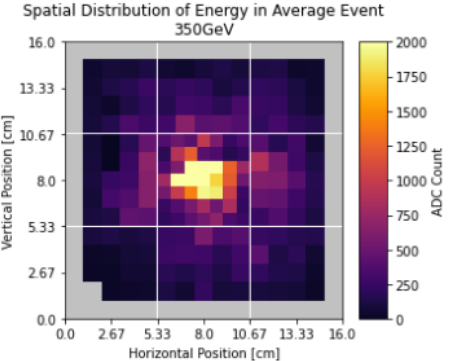
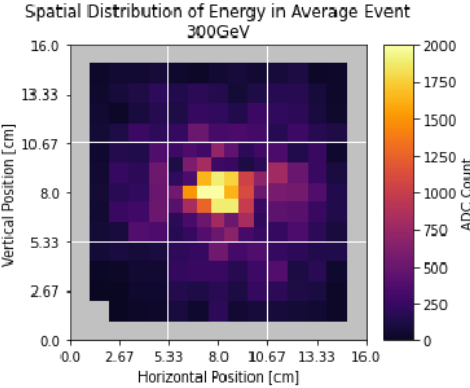
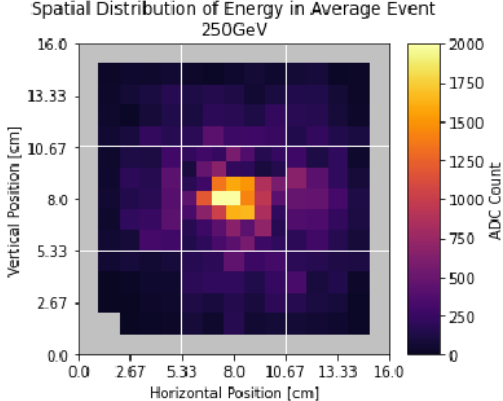
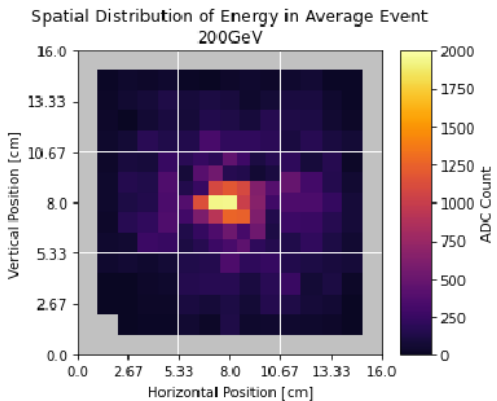
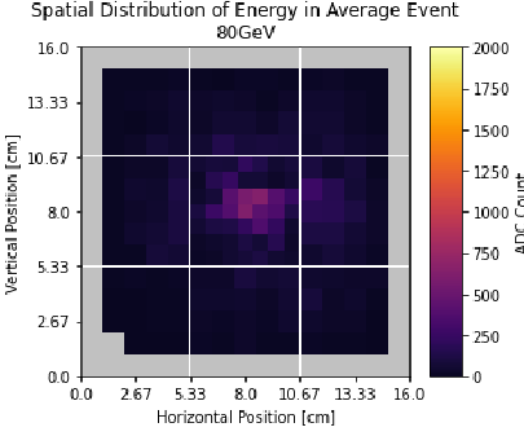
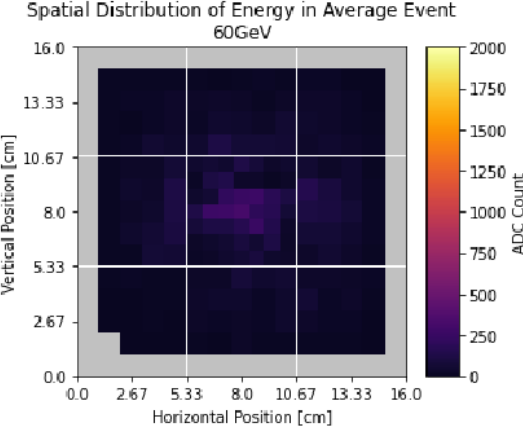
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FoCal-H in Hadron Beams at H2

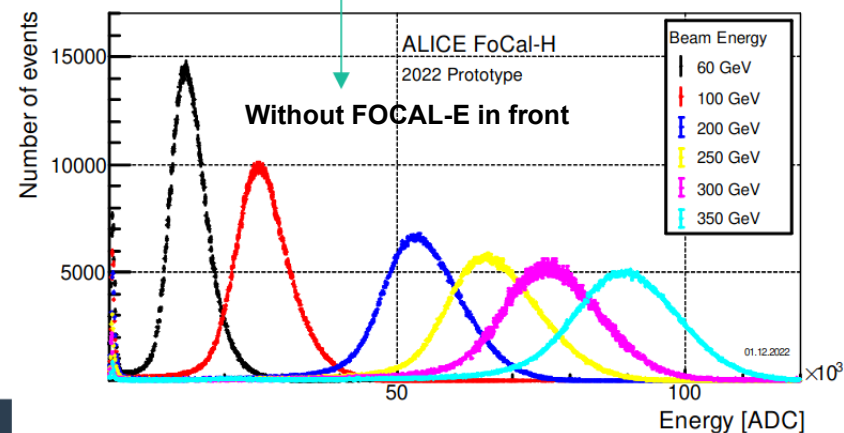
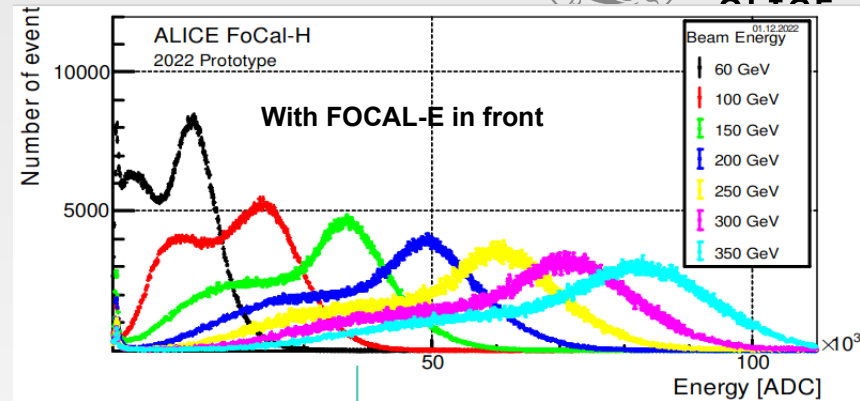
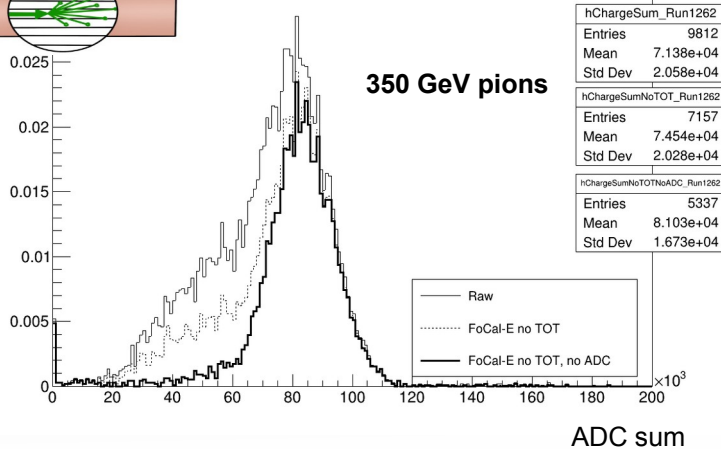
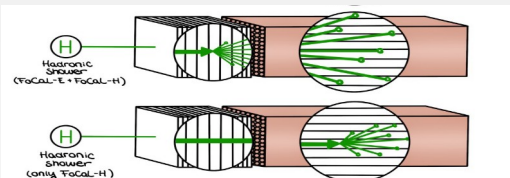


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FoCal-H in Hadron Beams at H2

- Charge count in FoCal-H proportional to beam energy
- Spectrum with FoCal-E in front highly affected by pre-showers
- Corrections possible in data due to common data taking
 - **Full energy response of FoCal to be studied**



Many thanks to the full PS/SPS team!



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ALICE FoCal testbeam crew after the SPS H2 beam test in November 2022