OAK RIDGE National Laboratory

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LFHCAL @PS 2025 Premature Summary

Friederike Bock, Oskar Hartbrich
(for the LFHCAL crew)

U.S. DEPARTMENT of ENERGY

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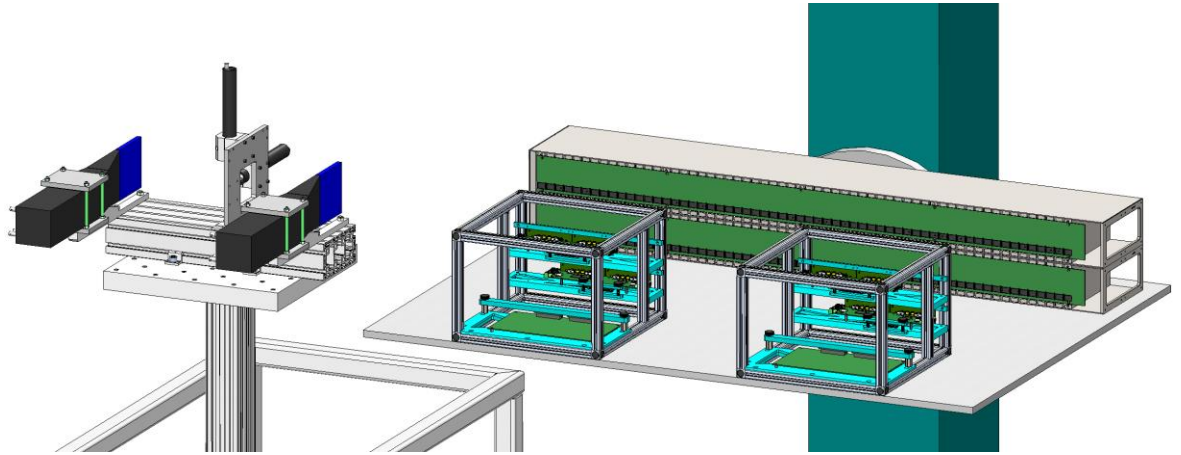
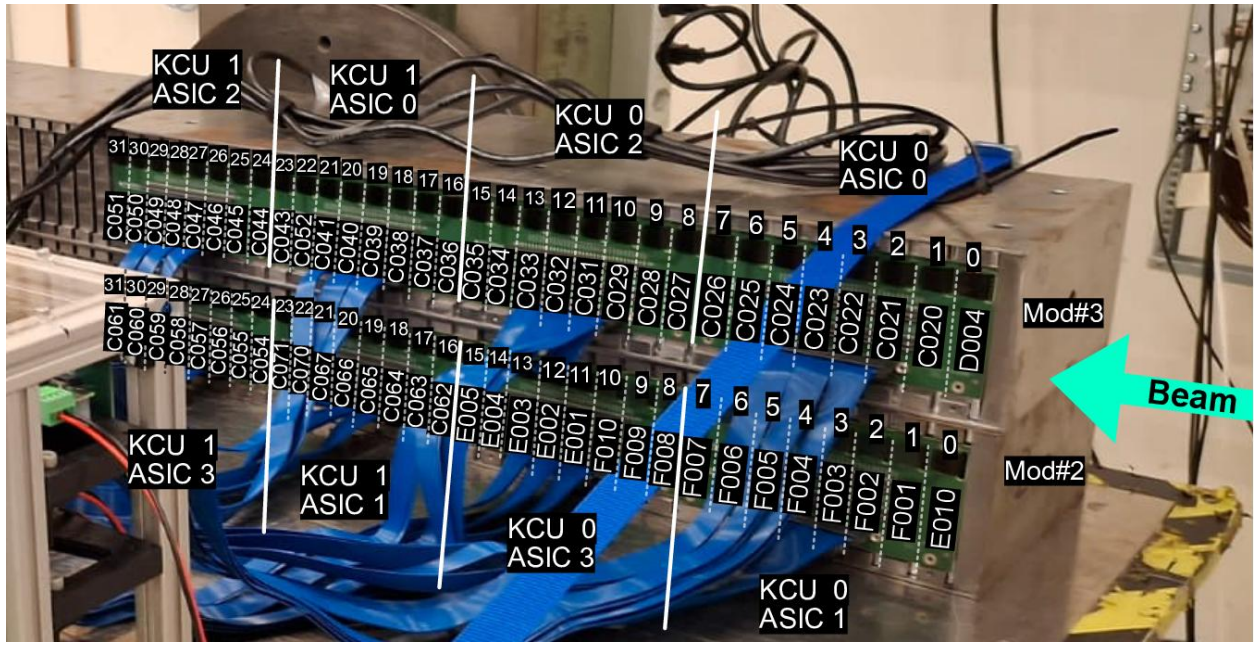
LFHCAL at CERN PS 2025



- One week of CERN PS beam: November 19-26th 2025
- Two “8M” LFHCAL modules (final specs)
    - 20cm * 20cm * 130 cm total
- Readout with updated H2GCROC prototype system
    - Based on Debrecen H2GCROC boards + KCU105 readout
- 50% instrumented, single tile readout
    - Summing board not available on time
- Main goals:
    - Electron resolution
    - Longitudinal hadron shower profile
    - Muon calibration stability

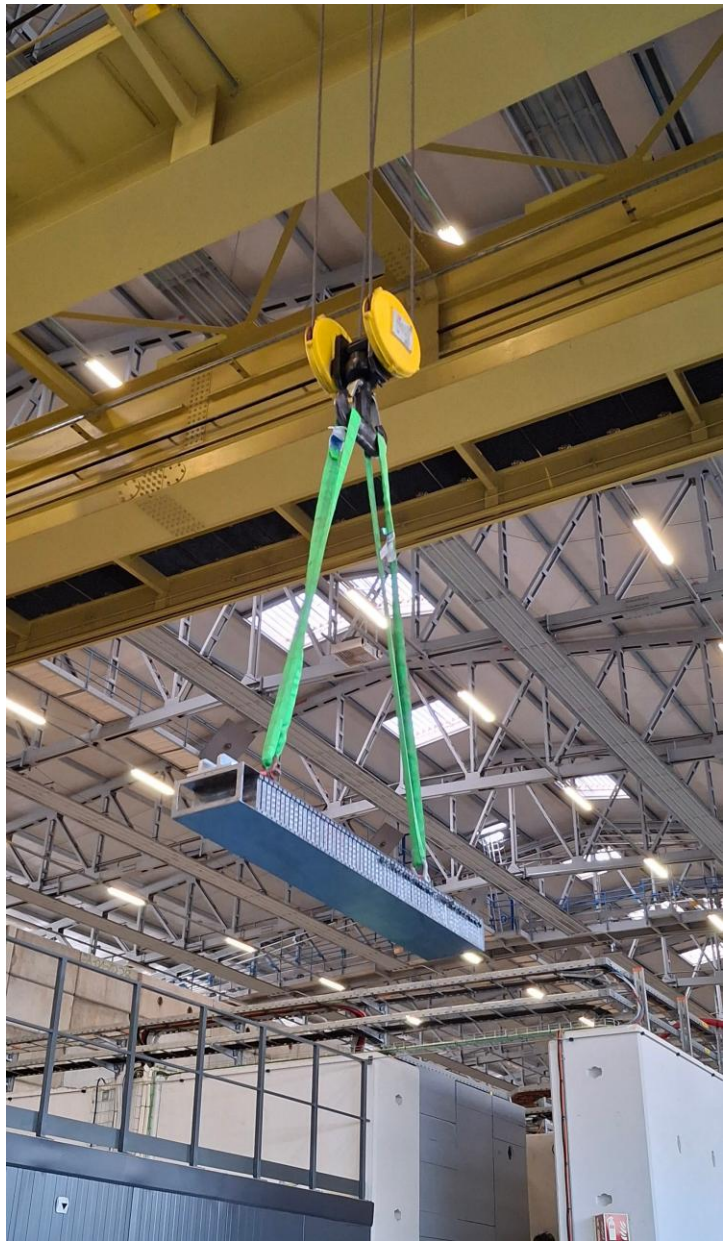
Differences to 2024 Campaign

- Improved hardware, firmware setup
  - 4x HGCROC per KCU, only 2 KCUs
  - 10gbit ethernet + new packet format
  - Required some modification of existing software, all tested and verified working now
  - Hardware + Software Setup Tutorial
- Much simplified event decoding
- Much improved event synchronization



- New temperature readout system
  - Based on Raspberry Pi + 18b20 1wire sensors
  - Thanks to hint from Martin Purschke

Impressions



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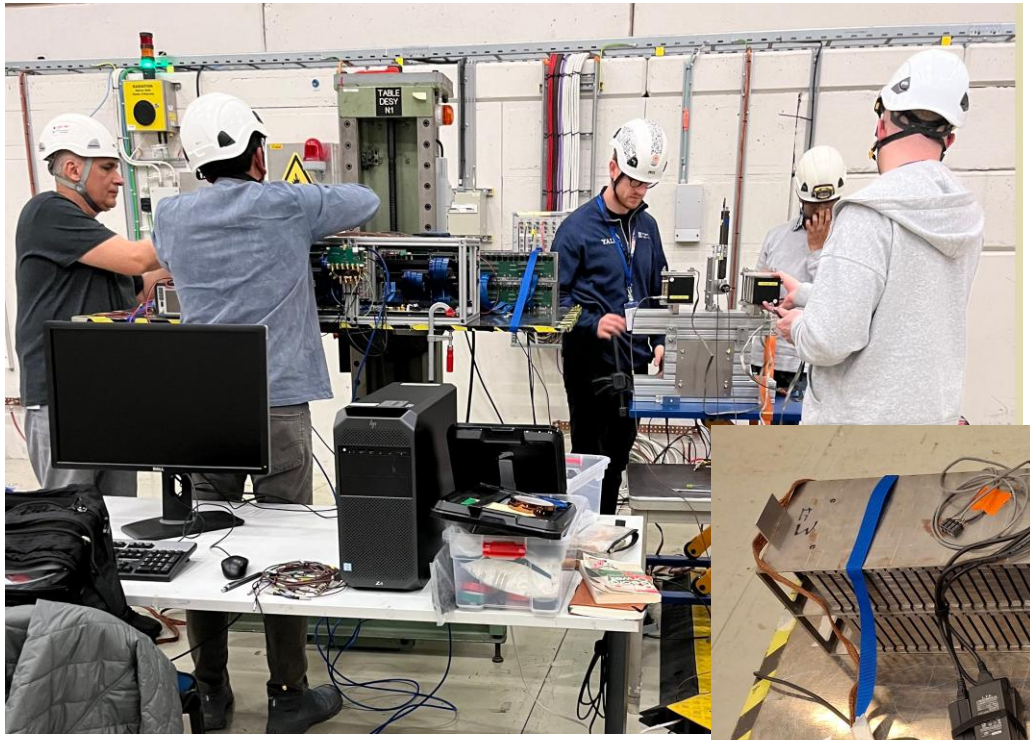

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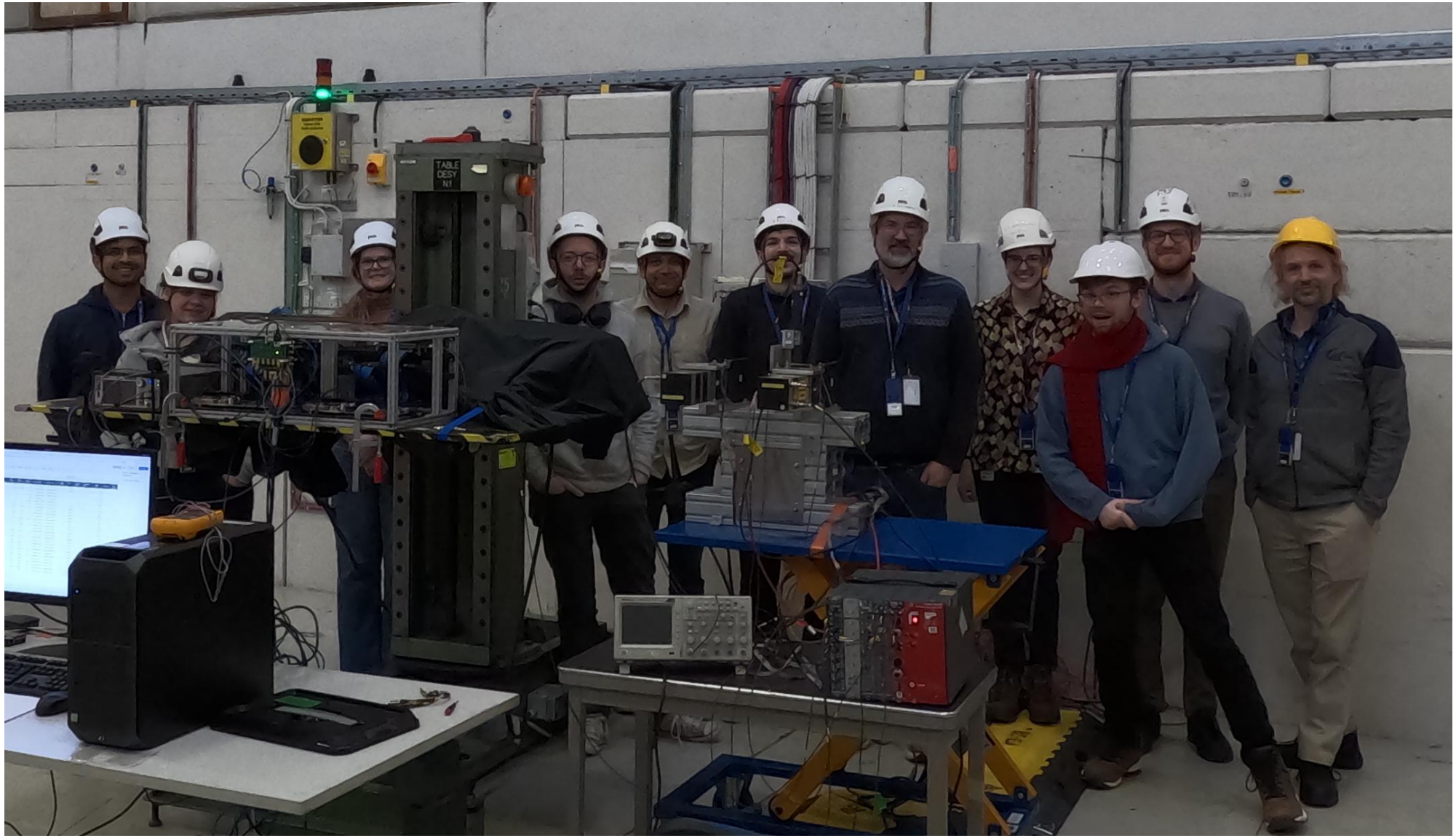
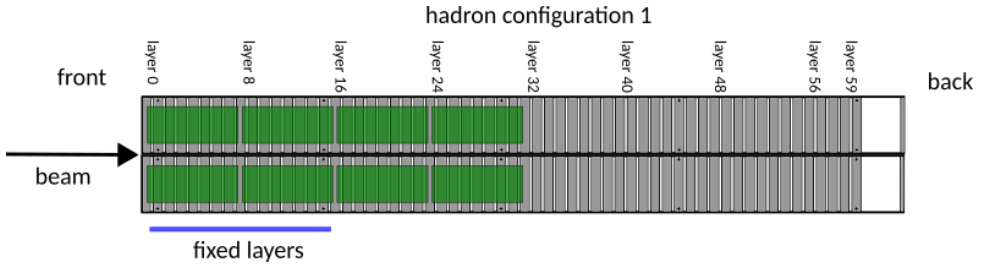
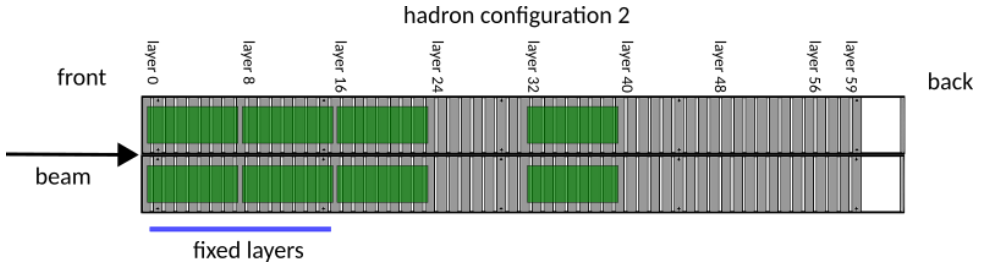


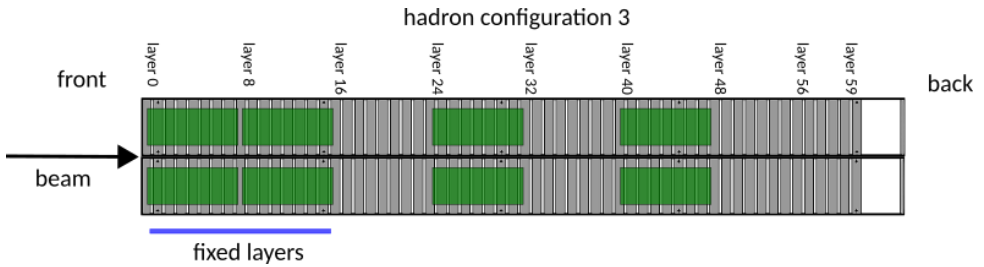
Recorded Data Overview

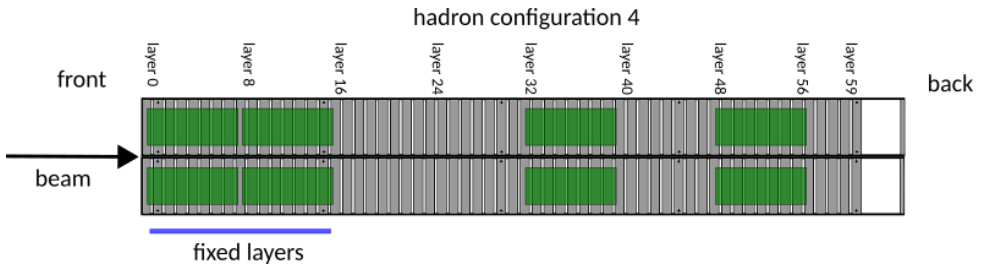
- Full electron (+-), hadron (+-), energy scan + muons in “configuration 1”
  - For 3 different SiPM bias voltages (S/N studies, comparison to 2024 data)
- Hadron (+-) energy scan, muons in “configuration 2-4”
  - For longitudinal profile
  - All at baseline SiPM bias
- Various rate test runs, diagnostics, etc.

- About 28M events total
  - ~800Gb









Many Thanks to:

- The local shift crew:
    - McKenna Sleeth (Vanderbilt)
      Andi Mankolli (Vanderbilt)
    - Emily Pottebaum (Yale)
      Ryan Hamilton (Yale)
      Isaac Mooney (Yale)
      Prakhar Garg (Yale)
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      Adam Gibson (Valparaiso)
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      Gabor Nagy (Debrecen)
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- Vincent Andrieux (Mainz): pre-arrival shipping handling
- Offline software/hardware support:
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- H2GCROC board lenders
    - UC Riverside (Miguel Arratia et al)
    - Argonne (Henry Klest et al)
    - Georgia State (Megan Connors et al)
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    - Ton: trigger scintillators, mechanics and cables
    - Nicola, Tommaso, Ian: hosting us in FOCAL lab and hardware support
- The CERN PS operations team
    - For up to 6 spills per supercycle to make up for beam downtimes

Summary & Outlook

- Very successful LFHCAL beam campaign completed
- Full library of electron and hadron data on tape

- Plenty of analysis to be done…

- Next beam time (hopefully) soon:
    - 4x 8M module, close to final electro-mechanics

Bonus: New long PCB has arrived