Analysis meeting for PS-SPS2023 beam test

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13/12/2023

Meeting idea

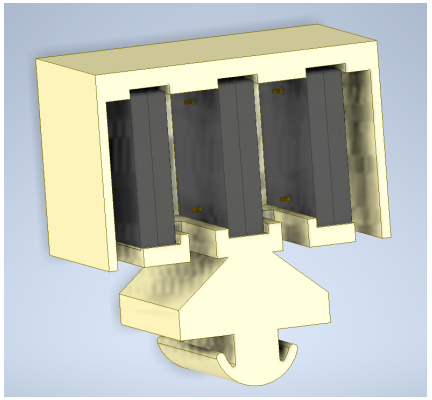
- Discuss and coordinate PS-SPS2023 beam tests analysis
- Discuss analysis of other beam tests (SPS2022)
- From electronics effects to MC simulations
- Cadence 2-3 weeks

Analysis group

- Elena: pedestal shift + gain change effects
- Gabriele: LPD calibration with PS muon runs
- Pietro: MC simulation + electron analysis
- Sergio: ions analysis?
- There’s work for everyone who wants to help!!!

PS-SPS2023 beam tests

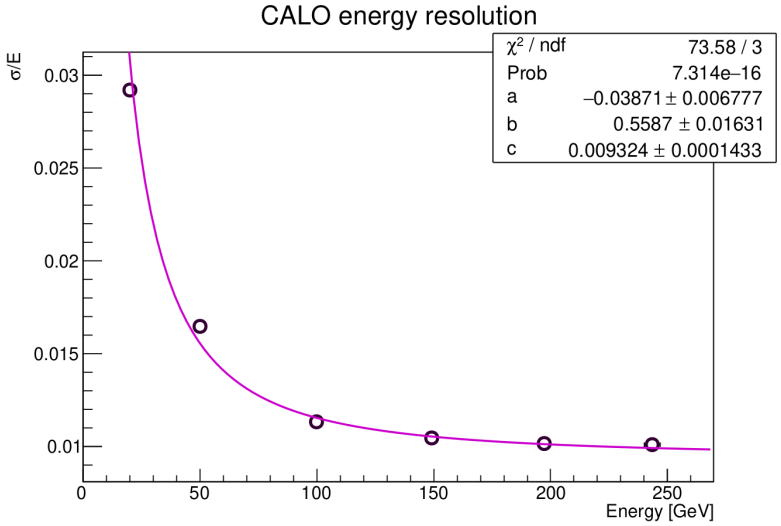
- Prototype of 7x7x21 crystals equipped with double photodiode read-out system
- At SPS charge tagger: 3 couples of blind PDs, measuring charge through nuclei MIP peaks

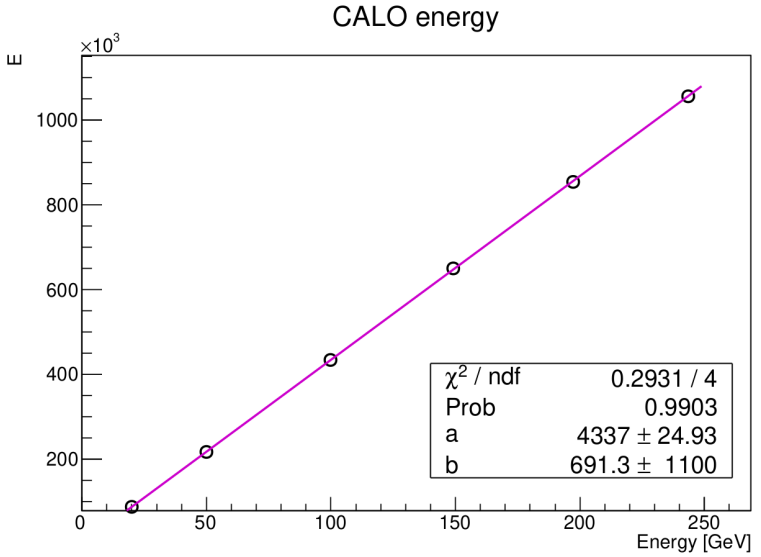


- PS:
  - Muons @ 5 GeV → calorimeter scan for calibration
  - Electrons @ 0.5, 0.7, 1, 2, 3, 4, 5 GeV → performance for low energy electromagnetic showers
  - Pions @ 10 GeV → performances for low energy hadronic showers
- SPS:
  - Electrons @ 20, 50, 100, 150, 200, 250 GeV→ performance for electromagnetic showers
  - Protons @ 300 GeV→ performances for hadronic showers and calibration
  - Ions @ 330 GeV → performances for hadronic showers + quenching effects study

PS-SPS2023 beam test
From Costanza Mannelli thesis

Energy resolution and linearity for electromagnetic showers
(No calibration and no track selections)

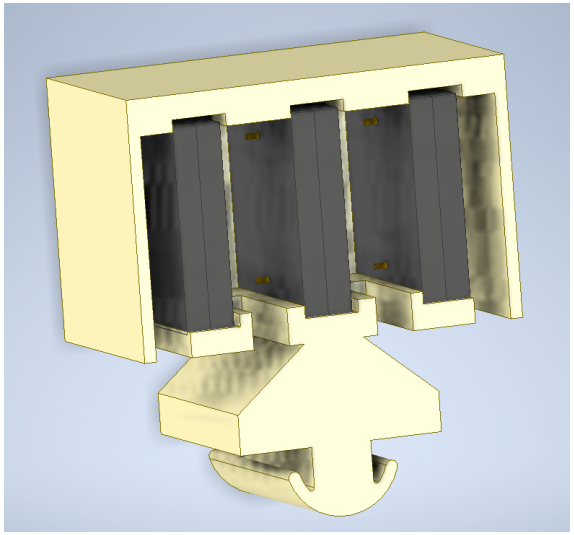


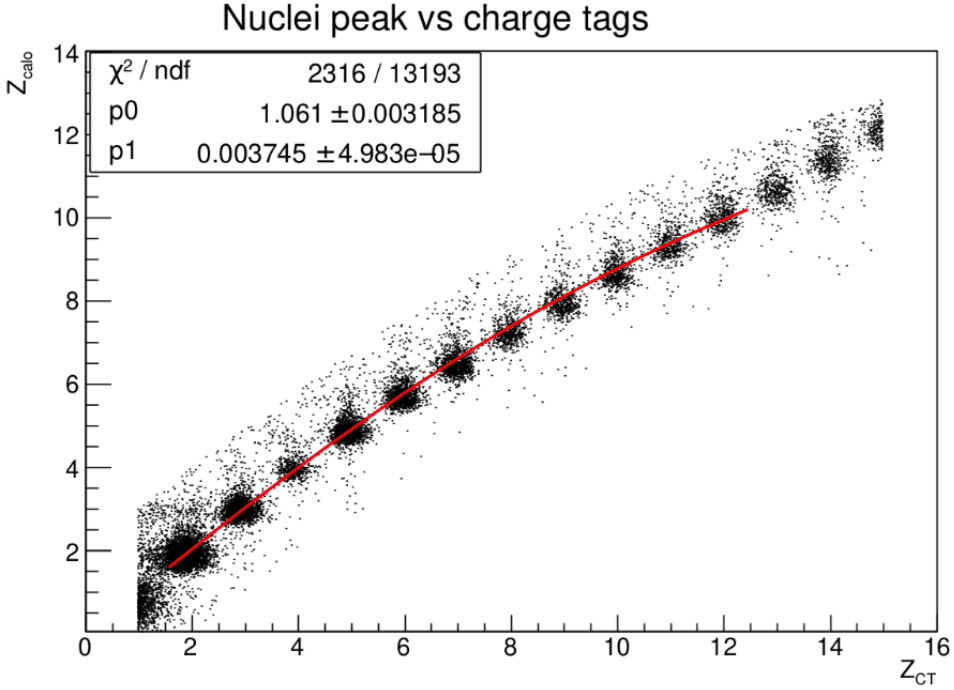


PS-SPS2023 beam test
From Costanza Giovacchini thesis

Charge tagger (from an idea of Oleksandr) just in front of the calorimeter:

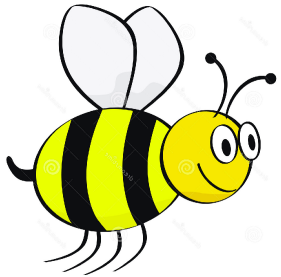
3 couples of blind PDs, measuring charge through nuclei MIP peaks





Start

- Acquired data seems decent and worthy of an accurate analysis
- Build an analysis group that can perform the analysis
- Pietro PhD thesis → electrons analysis and data-MC to validate electron flux analysis performed with simulations → Pietro main item of work for the following months
- Probably the last occasion to publish data of a HERD beam test (and of HERD in general...)



Useful links

- Distances between detectors:
  - PS: https://note.ihep.ac.cn/QK_9a3sQTt2s-XjGikgvow
  - SPS electrons: https://note.ihep.ac.cn/rargYTzlSfyQORv9jVzy9Q
  - SPS ions: beam survey on the HERD document server + https://note.ihep.ac.cn/47jsZ3TARQuAm1IG4Ujoow

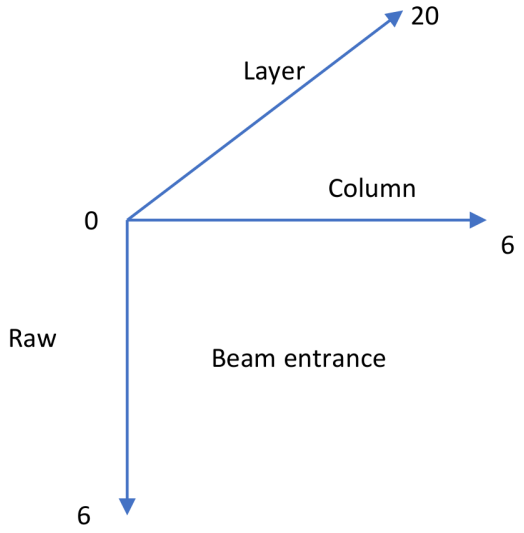
Useful information

- CaloCubeBTSoftware → branch PS-SPS2023 (repository gitLab)
- CALO PD data: /wizard/ceph/data/HERD/BeamTest/SPS2023/
  - /acquired_files → .dat format
  - /analysed_files → .root
- To pass from .dat to .root use CaloCubeBTSoftware/bin/analize_alone (ATTENTION: use the option “-T” to use the I2C trigger info)
- To estimate the charge measured with the charge tagger: CaloCubeBTSoftware/bin/draw_charge (use the option to analyze only a “small” number of pedestals ~25000)

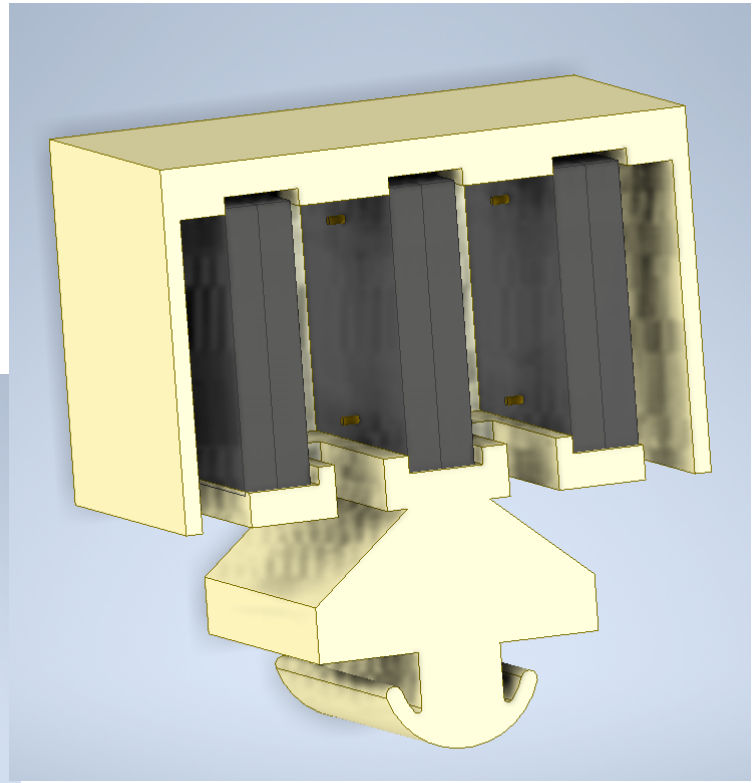
CALO reference system

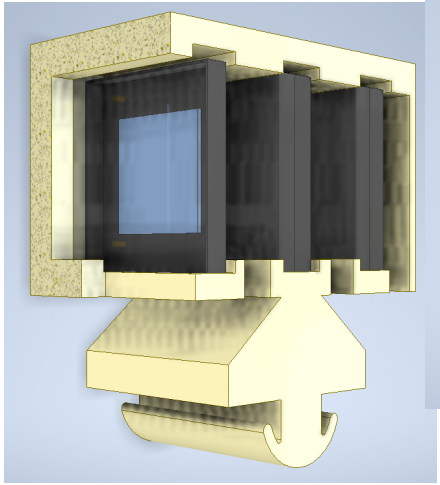
7 Rows, 7 Columns, 21 Layers

- LYSO-PD signals are indexed with “row”, “column”, “layer” according to the following description:
  - Layer 0 is the entrance layer of the beam, layer 20 is the last layer traversed by the particles
  - Row 0 is the top row (seen by the beam)
  - Column 0 is the left column (seen by the beam)
  - E.g. : central cube of first layer is [3][3][0], bottom left cube of the third layer is [0][6][2], …
  - In CaloCubeBTsoftware/MapFiles there is PS2023.csv with the map of chip-channel, row-column-layer
  - Blind PDs are associated to fake layers 21, 22



Charge Tagger





3 cuples of blind PDs with active area 9.2x9.2 mm2

“Aligned” with the central cube of the CALO

[chip][channel]: [82][21], [82][22], [82][23], [83][21], [83][22], [83][23]