Mainz Test Beam analysis "peer review"

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Test beam anomalies investigated

Linearity:

- Low- and high-energy runs seem to have different calibration factors, and show a discontinuity in the charge-energy linearity

Resolution:

- discrepancies between the stochastic term in σ(E)/E vs E and the expected photostatistics
- overall resolution higher than expected

Check on the pedestals

Present analysis searches the maximum of the waveform in a predefined time range after the trigger, for each channel;

this value is used as input for the energy reconstruction:

- the pedestal is subtracted to the peak (=an average over 20 samples on pre-defined time window) on an event-by-event basis
- resulting amplitude value for the on-beam (=central) crystal is equalized to the others, using the factors extracted by dedicated calibration runs;
- this value is then summed to the others (ped-subtracted and equalized as well), when these are above a threshold;
- the resulting cluster energy enters the reconstructed energy spectrum for the corresponding trigger energy.

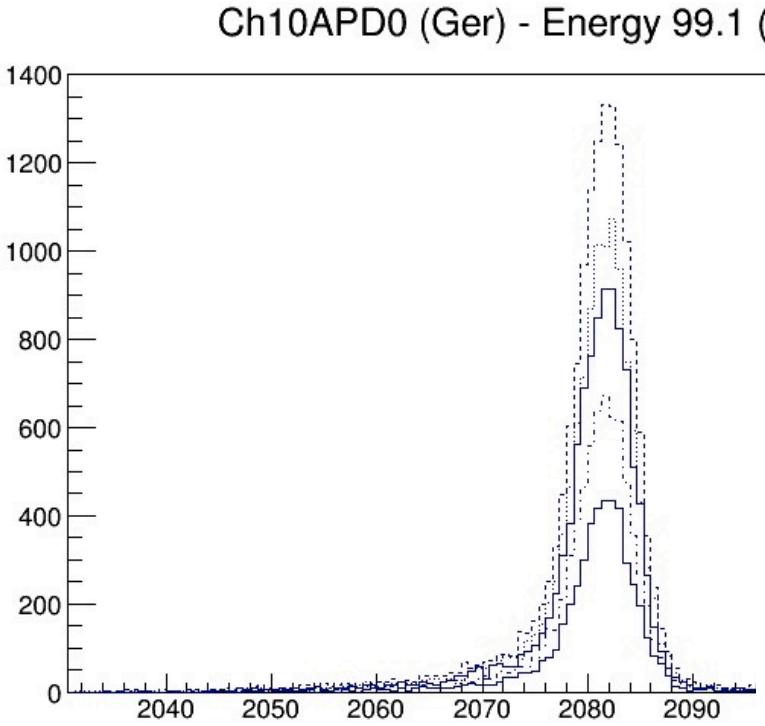
Check on the pedestals II

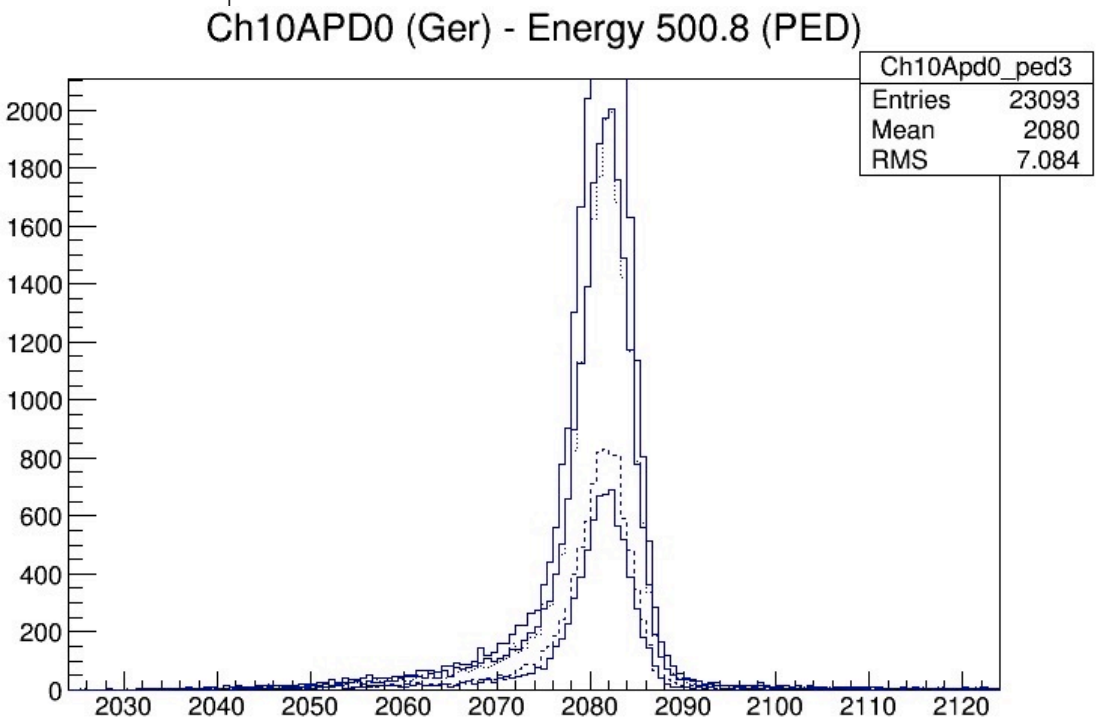
- A correlated shift of the signal baseline, depending on the trigger energy, could cause a systematic error on the evaluation of the reconstructed energies. This would be masked by the event-by-event subtraction of the pedestal.

- In order to check if this correlated shift is present, pedestal distributions have been plotted for each trigger energy, using the same evaluation as for the event-by-event subtraction (i.e. the fixed time window after the trigger)

Check on the pedestals III

- The pedestal distributions did not show systematic deviations with respect to the trigger energy





Homogeneous value of 2082 counts, error on the 2nd decimal (fit not shown)

Single crystal vs cluster

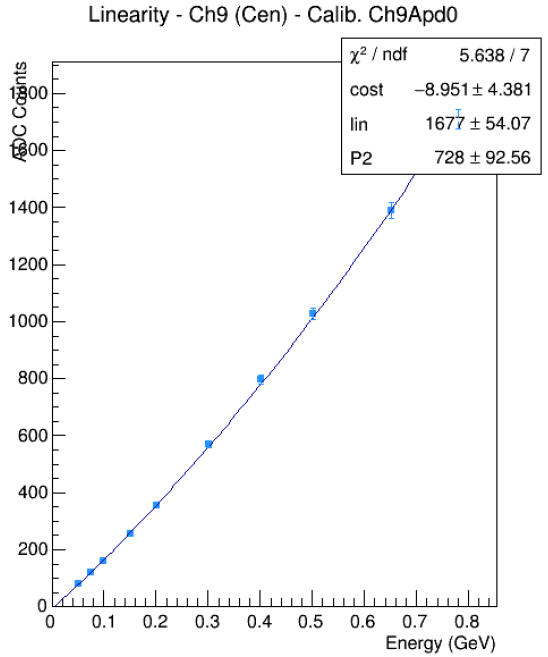
- The cluster size has an increasing number of crystals for increasing energy (expected)
- The energy share between the central cluster and the surrounding ones is instead larger for smaller energies, and this arose some doubts concerning possible low-energy photon background
- Started analyzing the energy resolution using only the central crystal: larger leakage contribution expected but other contribution could give useful hints

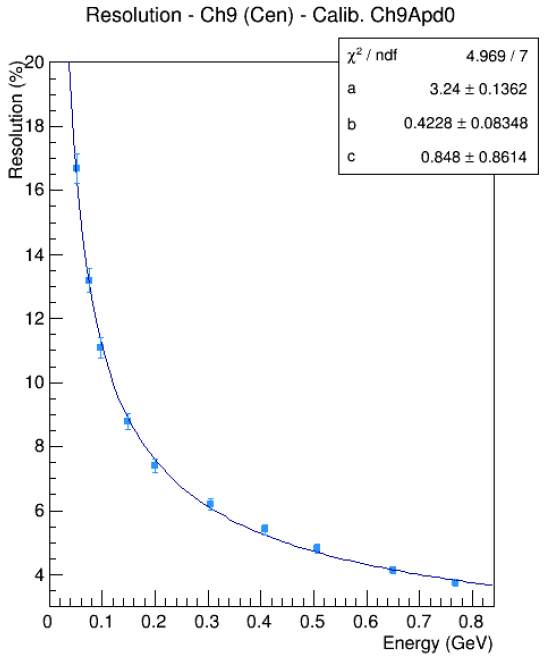
Compensating the electronics non-linearity

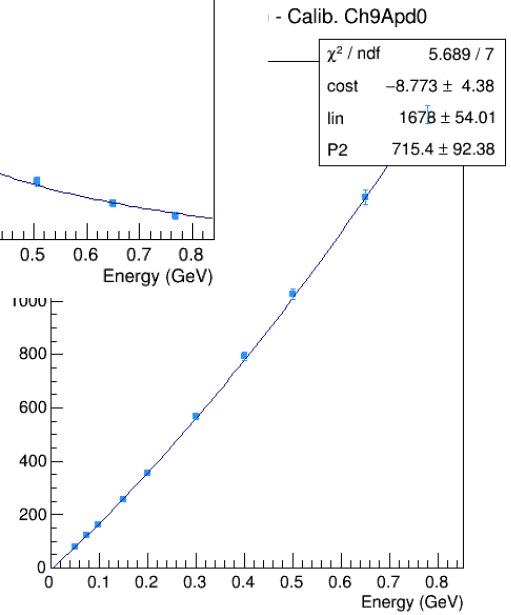
- Lab measurements by Rossi-Tagnani, igniting test signals in the preamps used for the test beam, shown that the FEE is indeed non –linear
- Given this result, a correction to the amplitude-energy plot to account for it seems reasonable (it remains to explain why it happens)
- By using a 2^{nd} degree polynomial function, it is possible to well reproduce the data points and extract a parametrization for the energy calibration of the calorimeter in our experimental conditions.

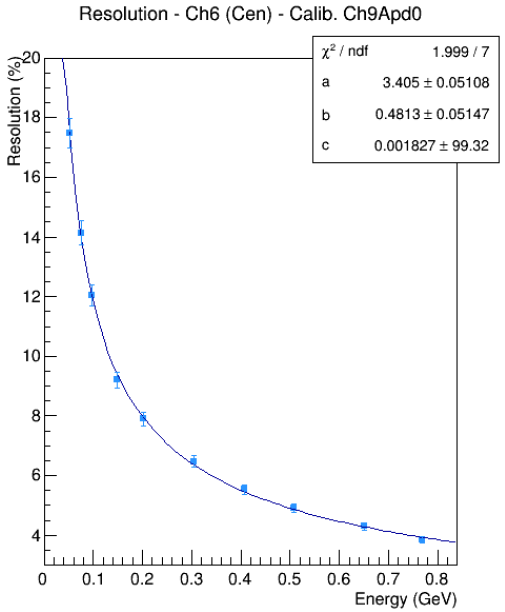
Pol2 fit and resolution

- By using the value extrapolated from the fit, for each energy, I have performed the resolution fit on Ch6 and 9 (reference ch9 for equalization)









Conclusions

- Resolution not so different from the one already obtained
- Calorimeter energy calibration now relies on a good fit on a polynomial curve, without “manual” shifts
- Non-linearity due to FEE, specific reason unknown but accountable for the effect seen at the test beam
- Still working on the correct evaluation of errors on the energy extrapolation, this could improve the fit result