Mainz Test Beam analysis "peer review"

S. Fiore

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 maximum value 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.

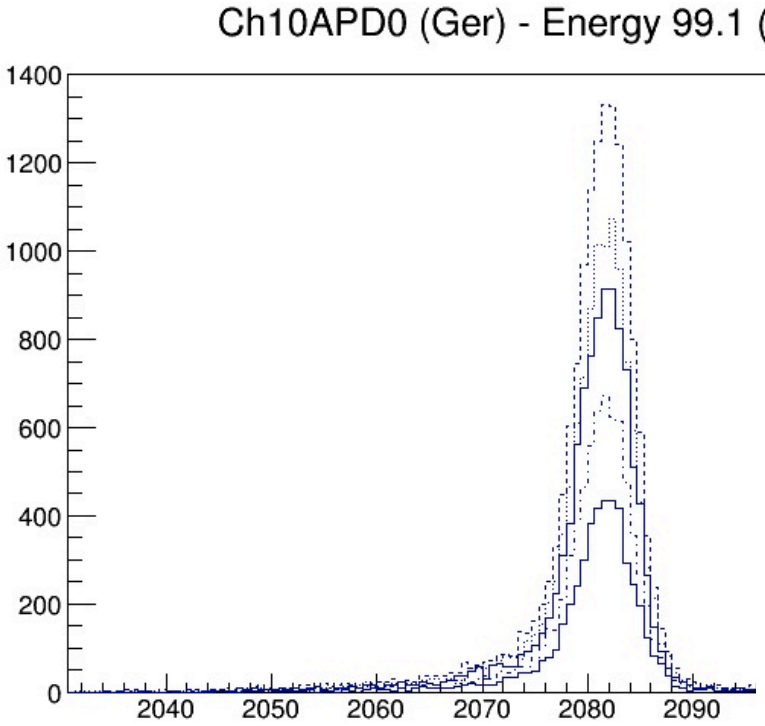
Check on the pedestals II

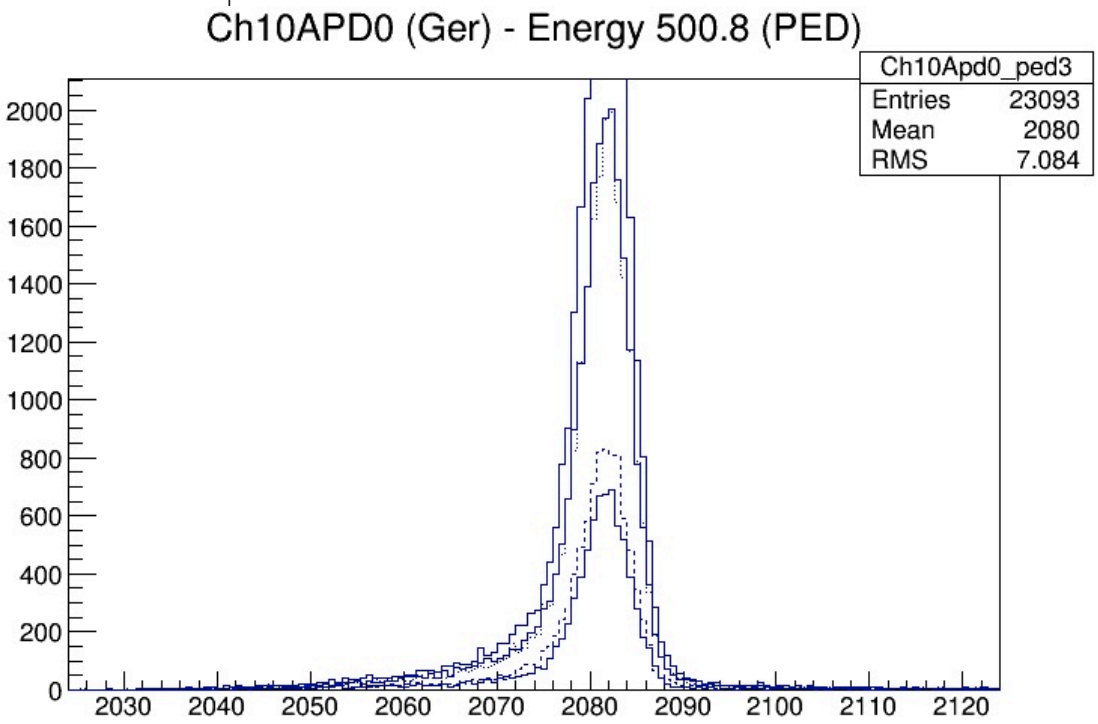
- A correlated shift of the signal baseline, depending on the trigger energy, could cause a systematic error on the evaluation of the reconstructed energies. This would be masked by the event-by-event subtraction of the pedestal.

- 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

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

Energy definitions in the resolution plot

Performing the single crystal analysis, I found that, in the definition of σ(E)/E vs E , different values of E are used:

- on the x axis, the "true" photon energy is used
- for σ(E)/E, the reconstructed value of E is instead used

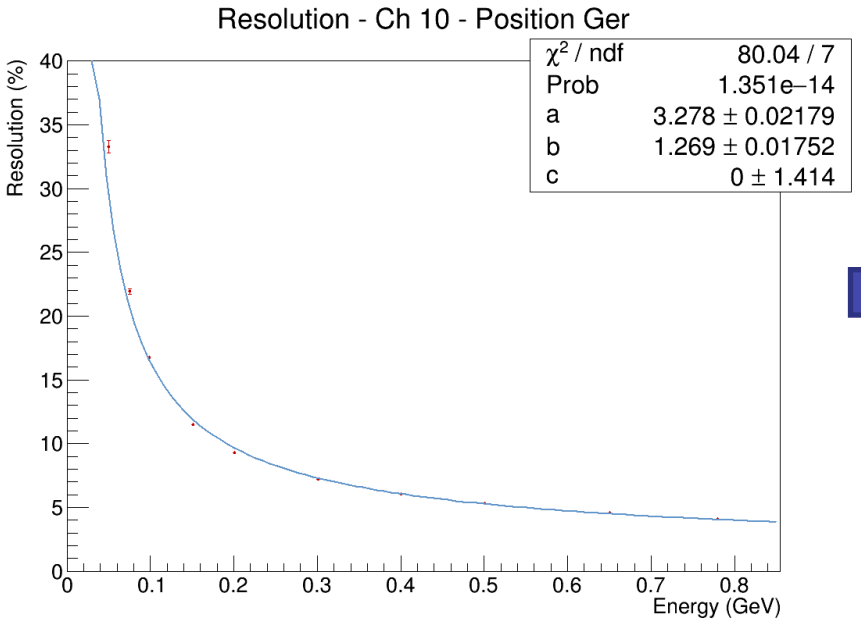
Made some tests with coherent variables:

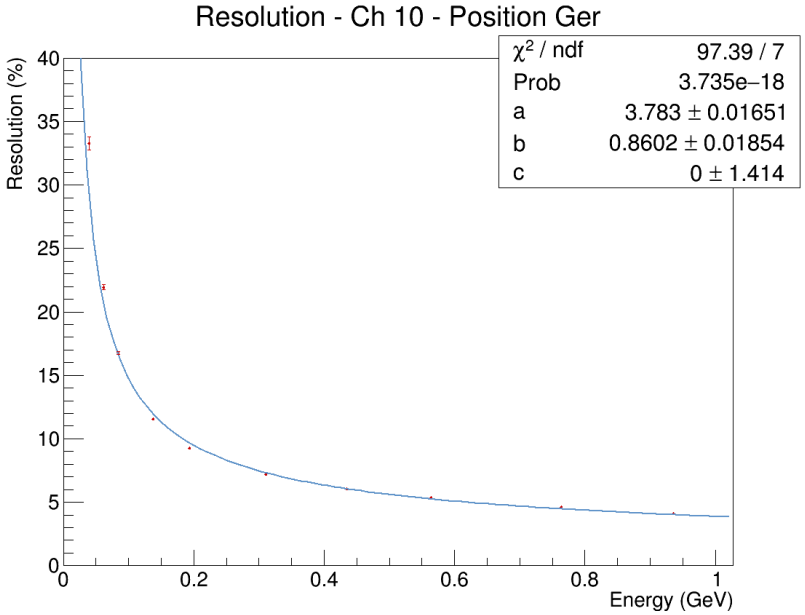
- using reconstructed E also for the reference x value
- using the "true" E in the σ(E)/E
- fit values and fit macro same as Alessandro

Reconstructed energy as reference energy

Original definition $\sigma(E)/E_{reco}$ vs E_{true}

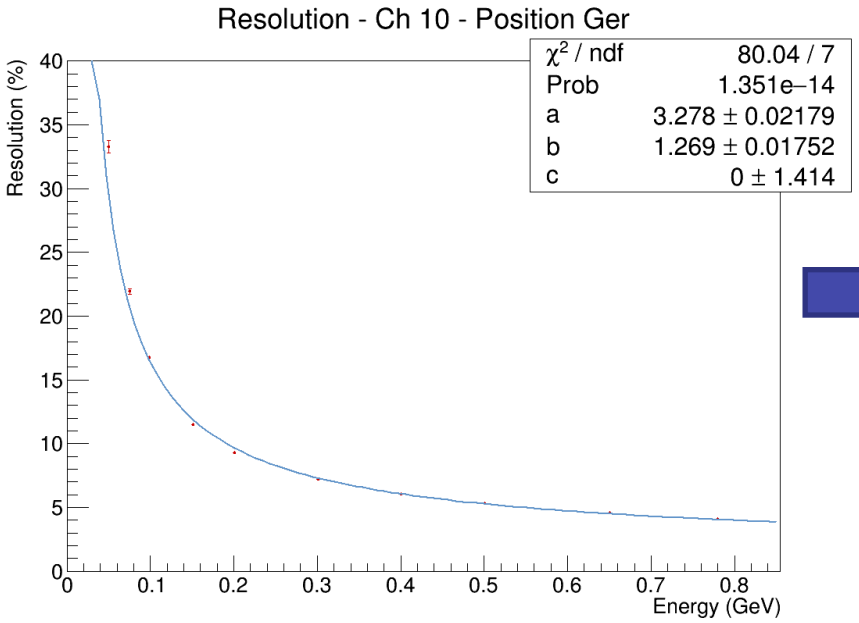
$\sigma(E)/E_{reco}$ vs E_{reco}



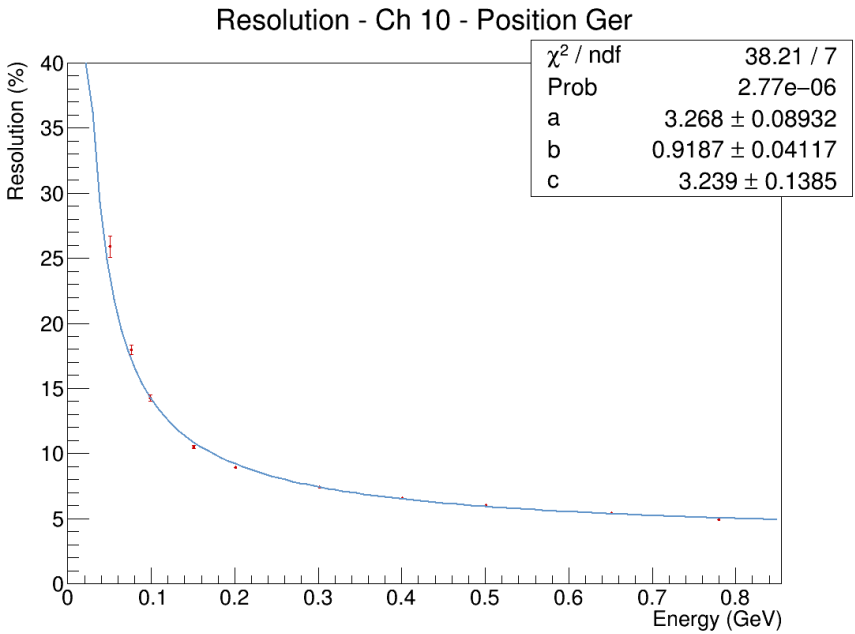


True energy as relative energy

Original definition $\sigma(E)/E_{reco}$ vs E_{true}



$\sigma(E)/E_{true}$ vs E_{true}



Fit values to be checked, also checking other crystals

Next

- review the resolution to get updated fit values to be compared with the different evaualtions
- try to use as “resolution” the width of $E_{reco} - E_{true}$ distribution. This would disentangle from possible loopholes between calibration and energy definitions in the resolution plot
- complete the single crystal analysis