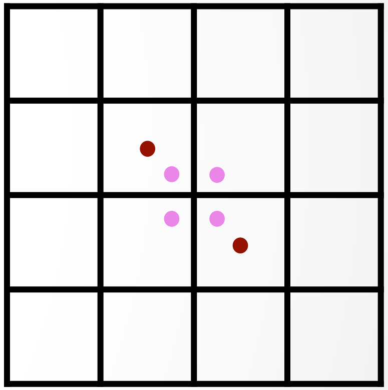
Pure CsI Test Beam Update

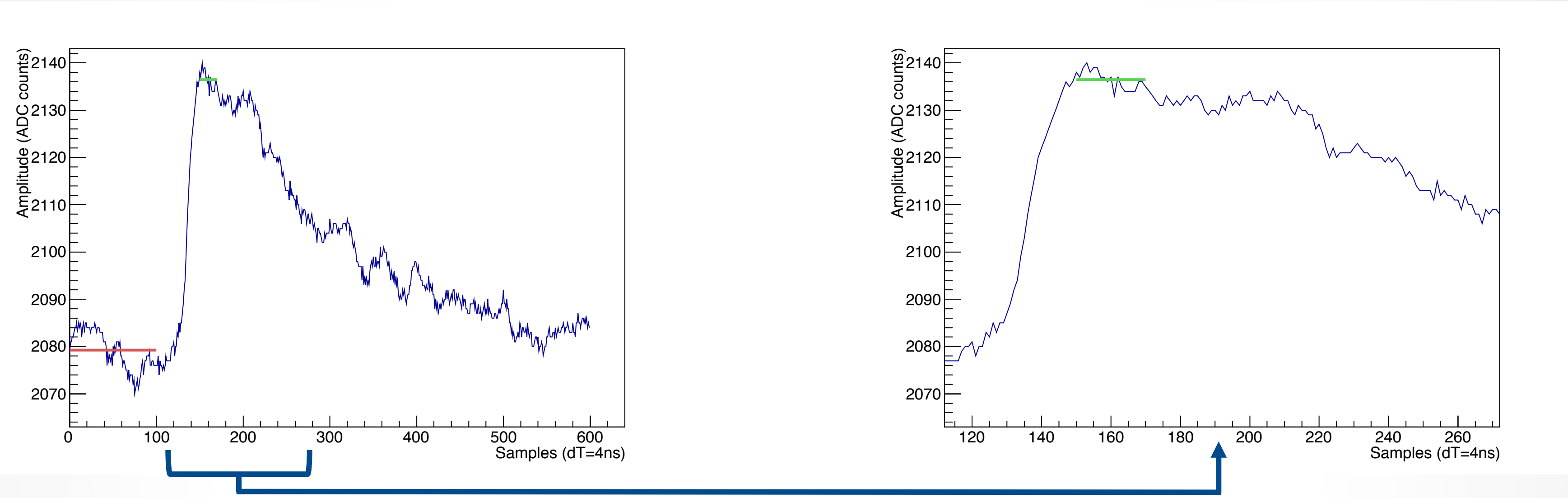
A. Rossi, C. Cecchi, E. Manoni

Data acquisition configurations

- We acquired 5 different energies for each run
  - Trigger : 5 different tagger in OR
  - The 5 tagger signals used in the trigger are acquired for offline separation of the energies
- Three different trigger configuration:
  - **Calibration: 289MeV – 350MeV – 422MeV – 480MeV – 550MeV**
    - **One run at the center of each crystal**
  - **Low Energy: 50MeV – 76MeV – 99MeV – 151MeV – 201MeV**
    - **1 run at the center of two internal crystals (red dots)**
    - **4 runs at each points which maximize the containment according to MC (pink dots)**
  - **High Energy: 301MeV – 400MeV – 501MeV – 651MeV – 780MeV**
    - **1 run at the center of two internal crystals (red dots)**
    - **4 runs at each points which maximize the containment according to MC (pink dots)**

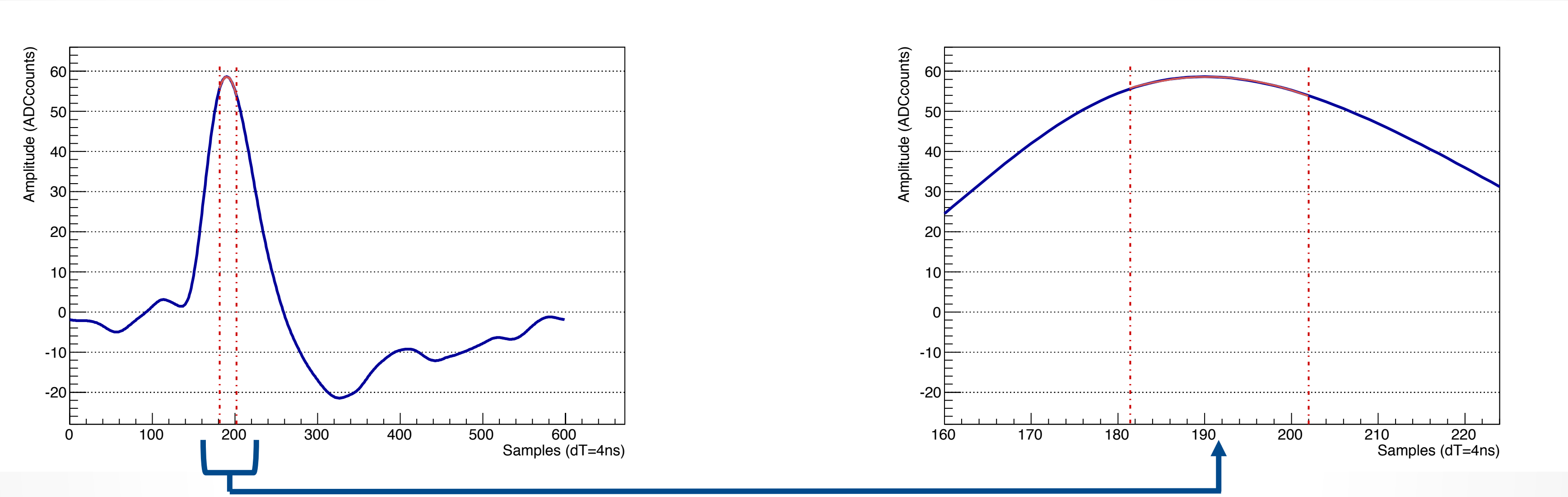


Amplitude Extraction



- Pedestal : first 100 samples mean
- Signal : Mean between fixed windows (20samples)
- Amplitude : Signal - Pedestal

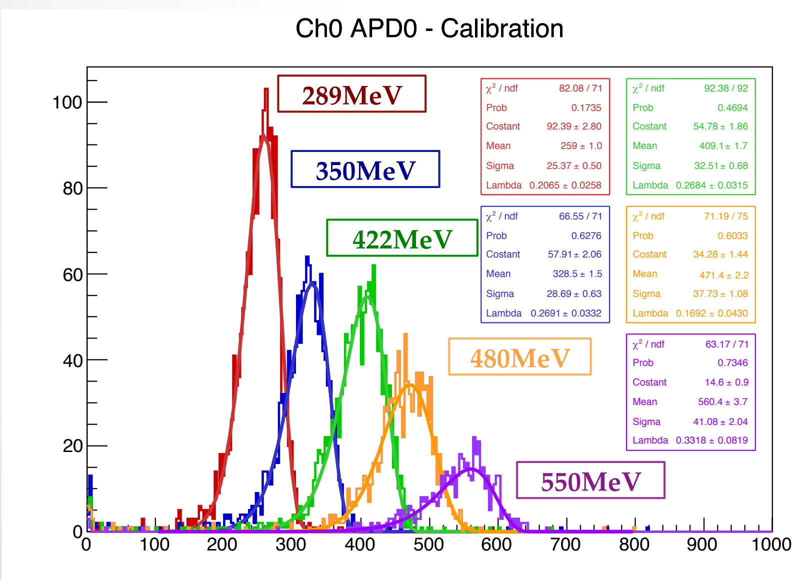
Amplitude Extraction (shaping)

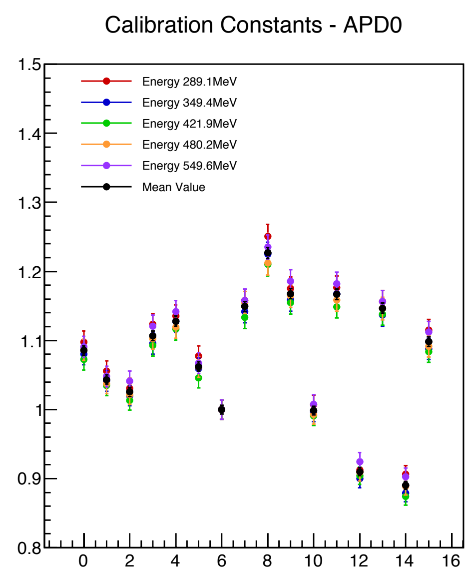


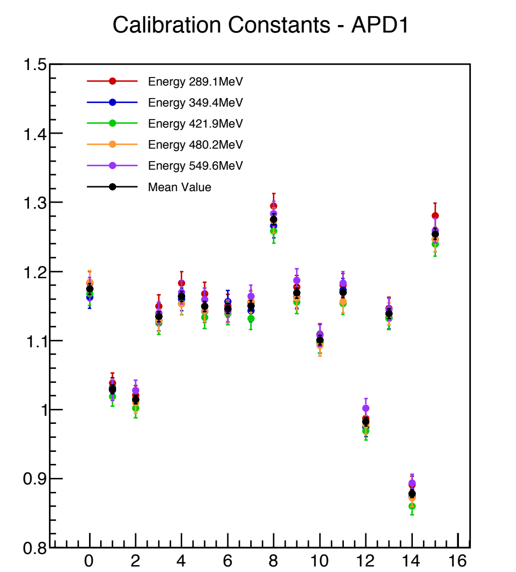
- Signal : Gaussian fit on fixed windows (20samples)
- No pedestal subtraction
  - With software shaping baseline always at zero

Calibration

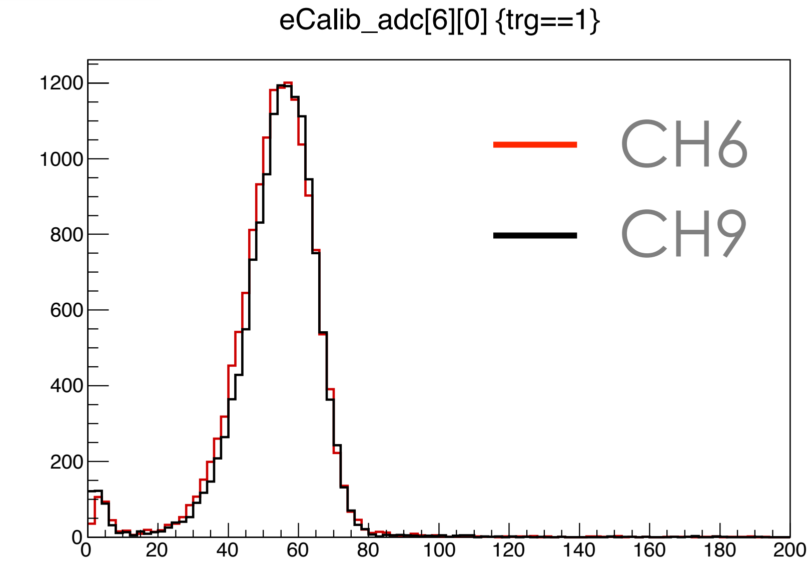
- Fit the deposited energy distribution for each APD for each energy with Novosibirsk function
    - Only the deposited energy on the crystal in which the beam is directed
- Using the Mean value to intercalibrate the 32Chs
- We have 5 different constants (one for each energy) for each channel
    - **Final constants as the mean value**

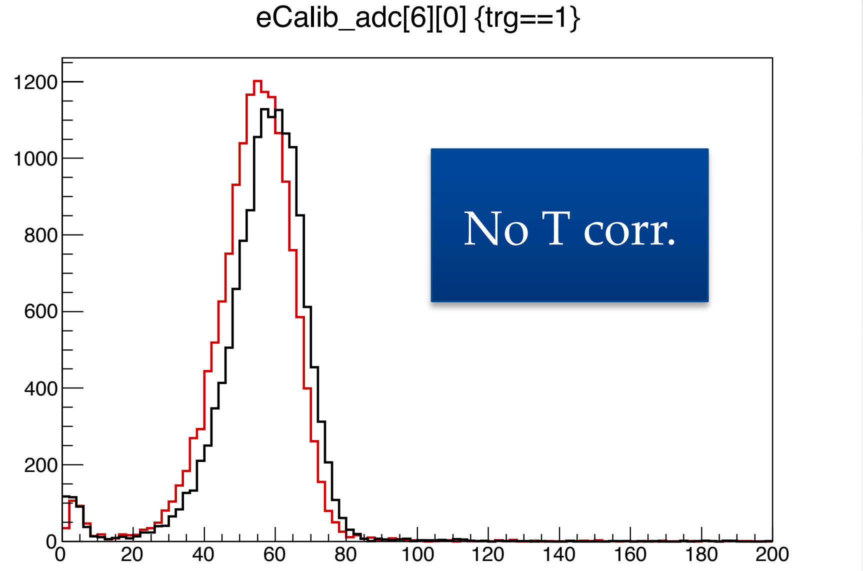


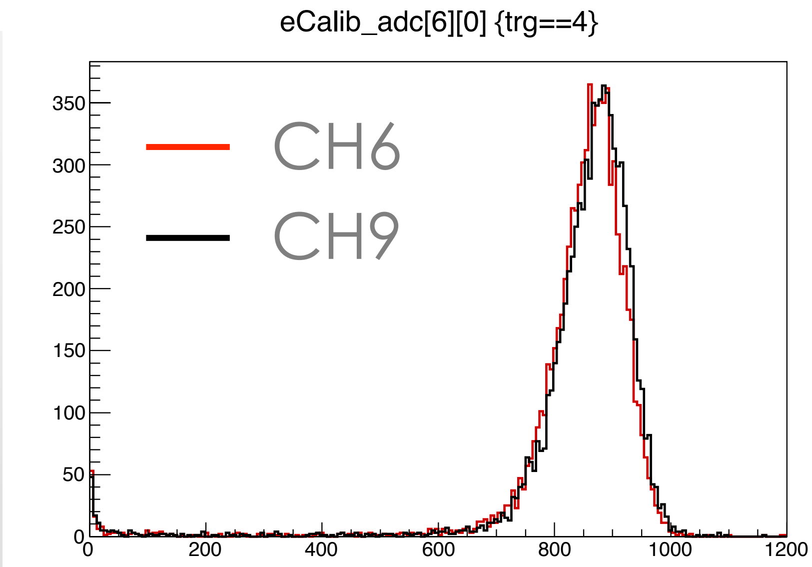




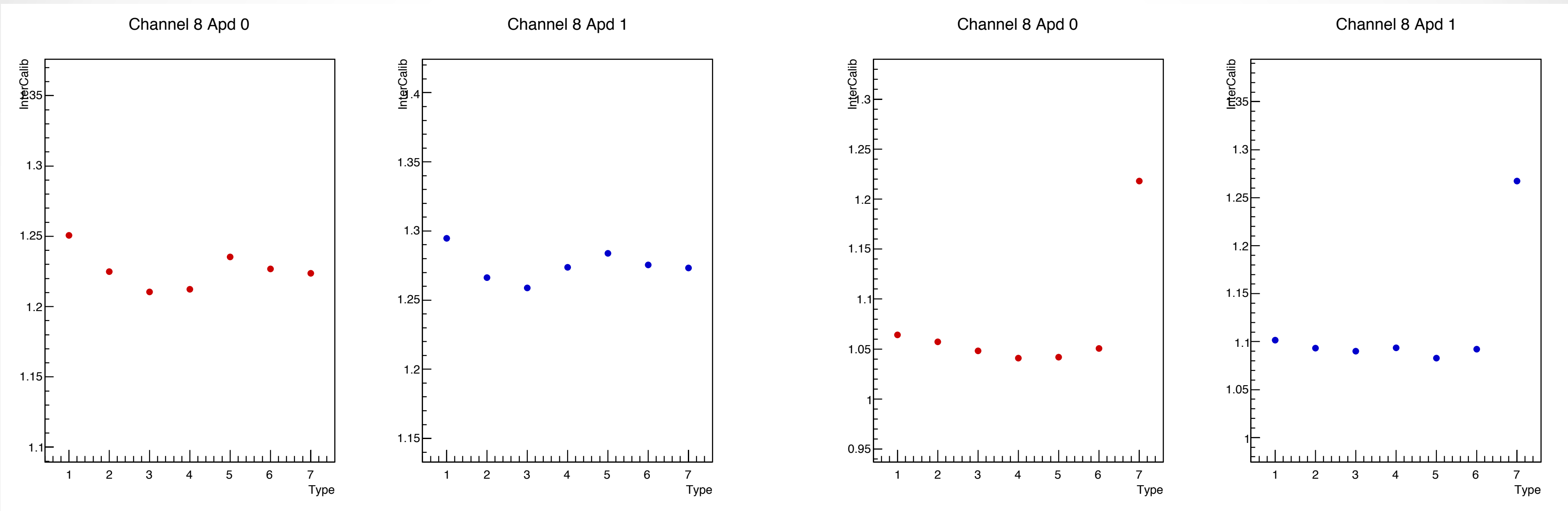
Check calibration





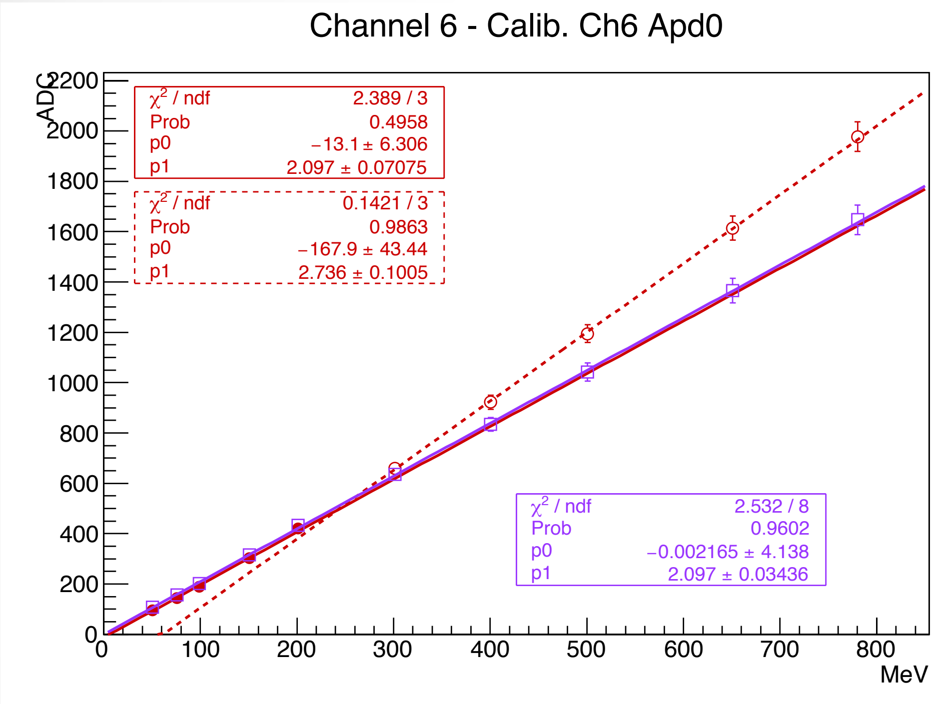


- Comparison at 75MeV and 780MeV between Ch6 and Ch9 (APD0)



- Intercalibration extracted by minimizing RMS of the sum of all channel
- Reasonable for Ch6 reference (with high errorrs) but completely wrong with Ch9 reference.

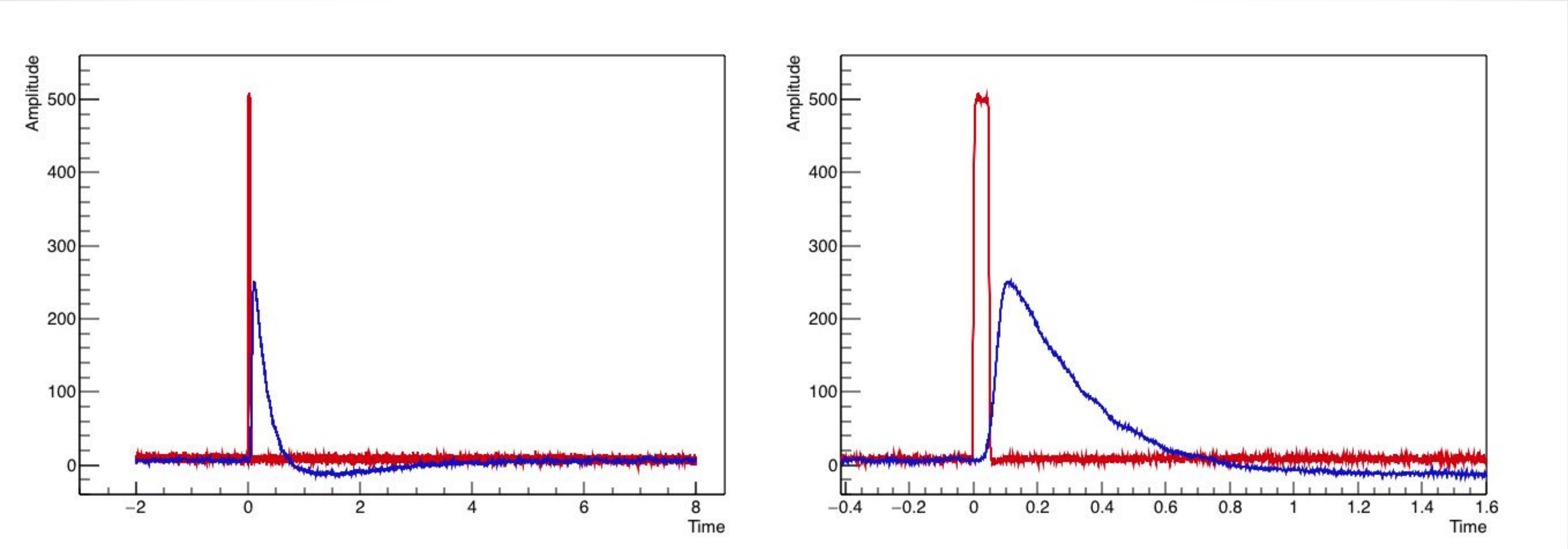
Linearity



- Non linearity observed
- Difference between the two different run (high/ low energy)
- Source still unknow

- Correction applied to linearize the response
  - Shift on high energy points → worsening the resolution (conservative approach)

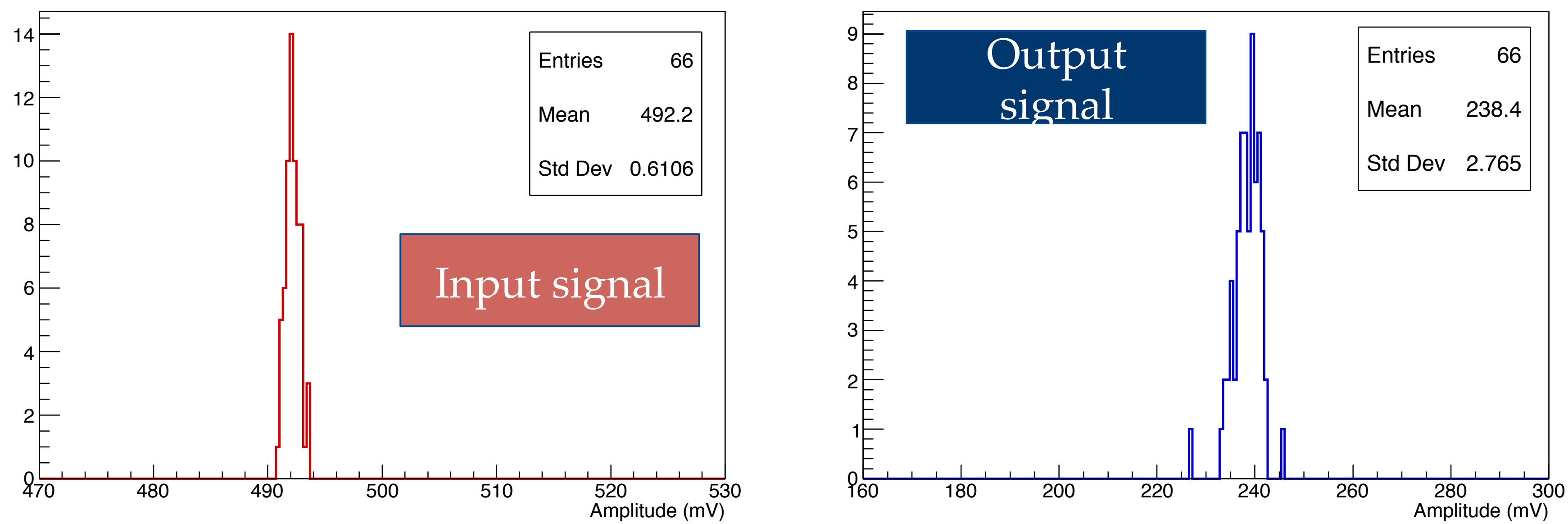
PreAmp Test setup



- Send charge as input to the preamp
  - Same range of beam test
- Analyze output amplitude

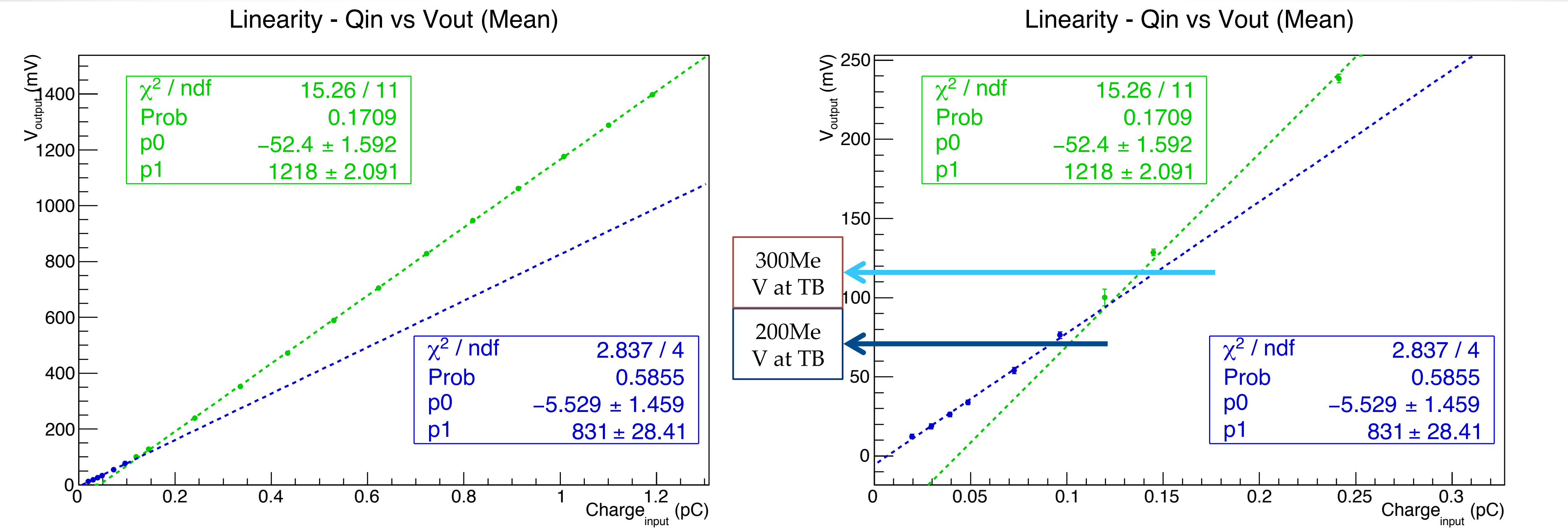
PreAmp Test: Amplitude extraction

- Input Signal level extracted as mean value at the plateau of the square waveform
- Output Signal amplitude extracted as Mean around peak (40ns)
  - Same approach as at beam test



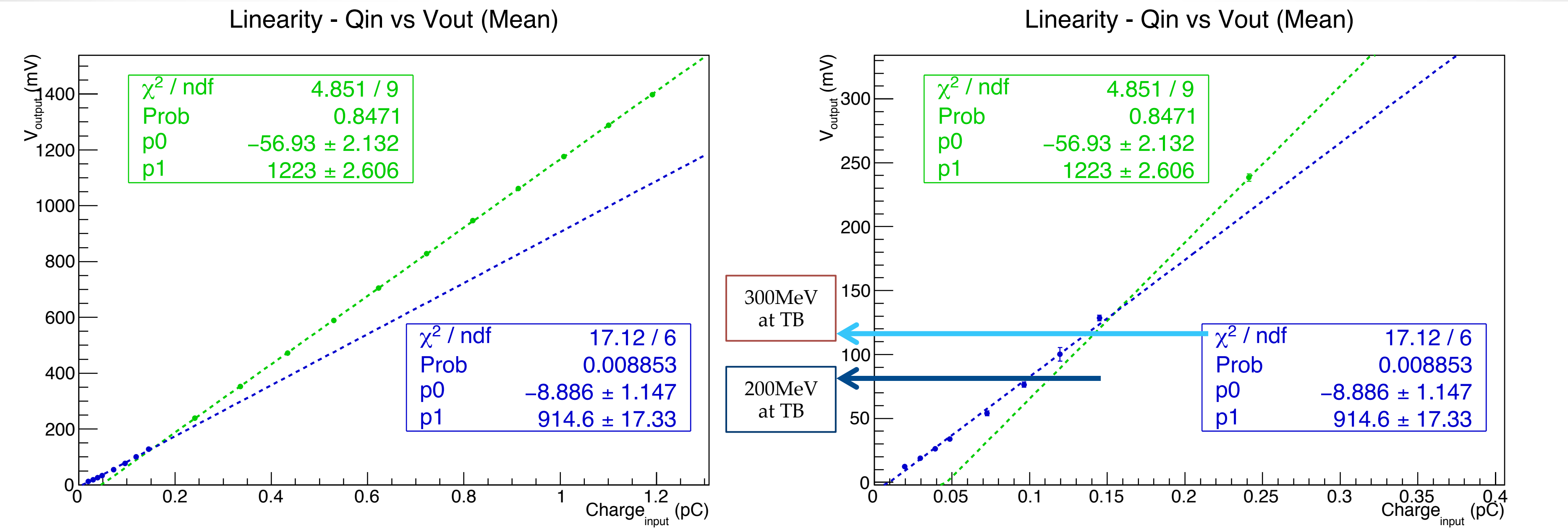
- Few data to perform fit
- Use mean and RMS as as central value and error

PreAmp Test: Linearity



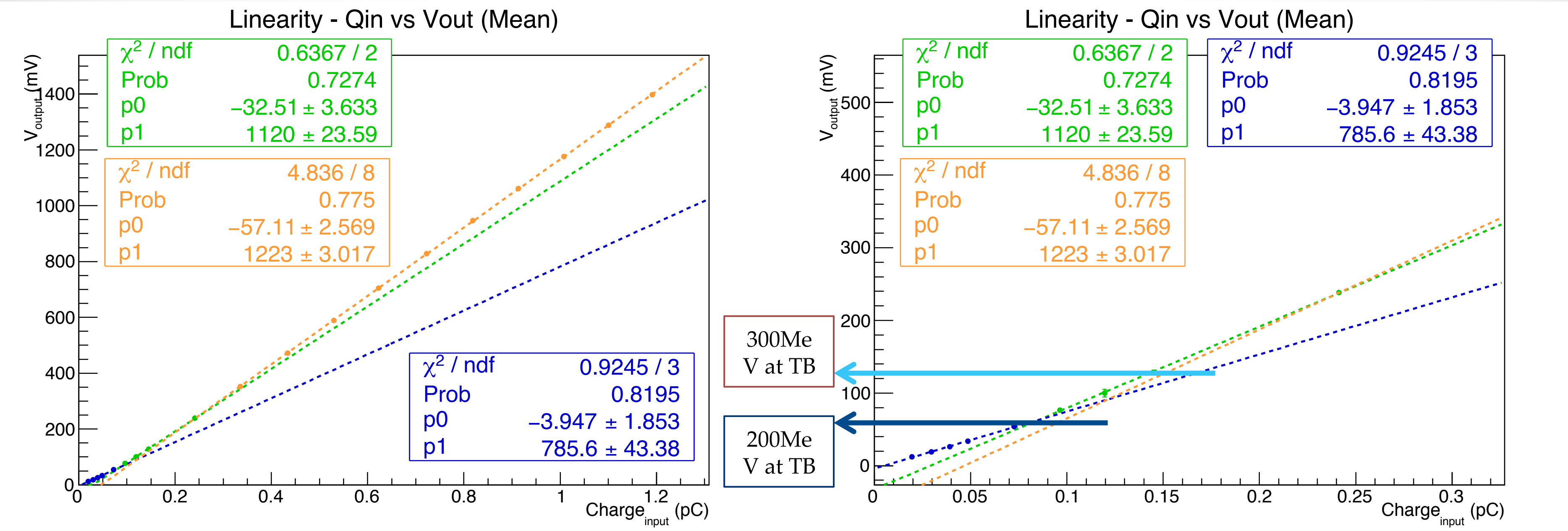
- Preamp seems to show the same non-linearity as observed on data

PreAmp Test: Linearity (2)



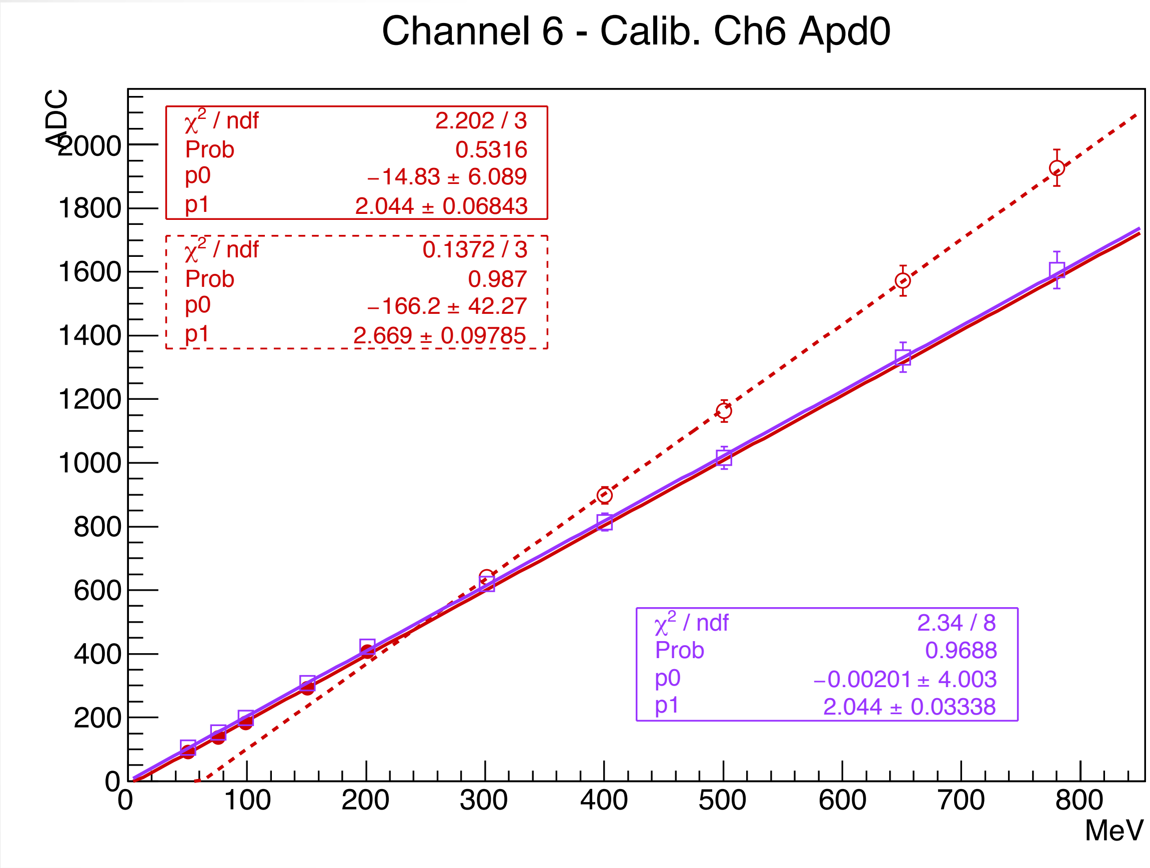
- Try to change the number of points used to fit the two Pol1

PreAmp Test: Linearity (3)



- Use 3 different regions to describe the preamp response

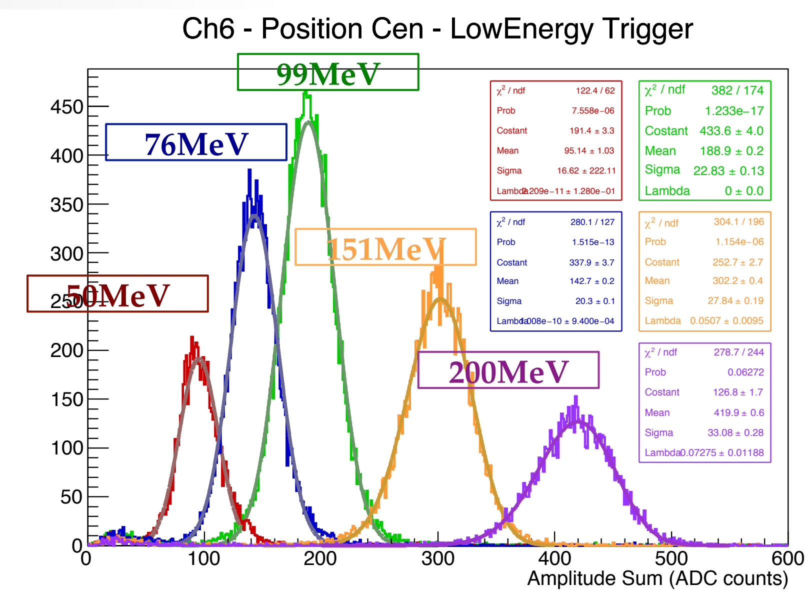
Linearity (SHP)

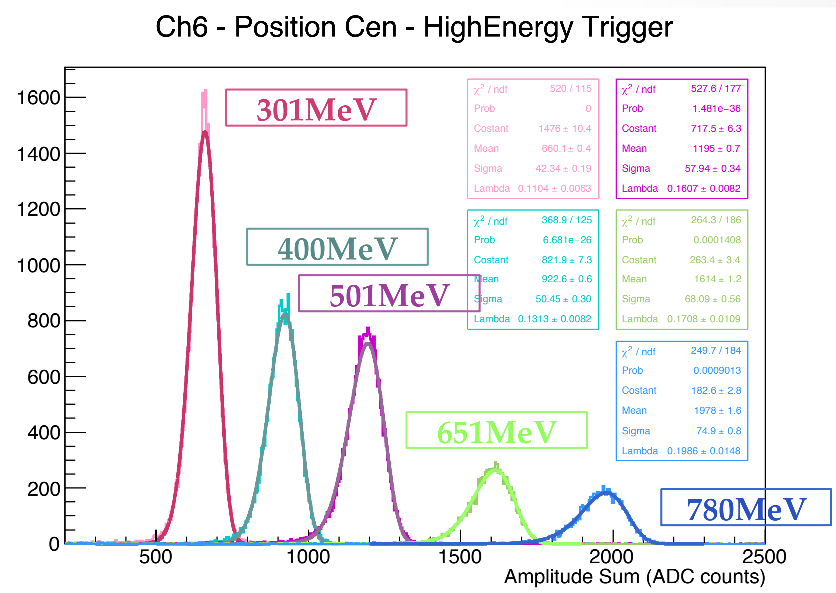


- Same strategy also for shaped data

Energy Distributions

- Sum all the channels with Signal greater than 0 together
  - Intercalibration parameters applied
- Stable temperature during all the test period
  - No T correction needed

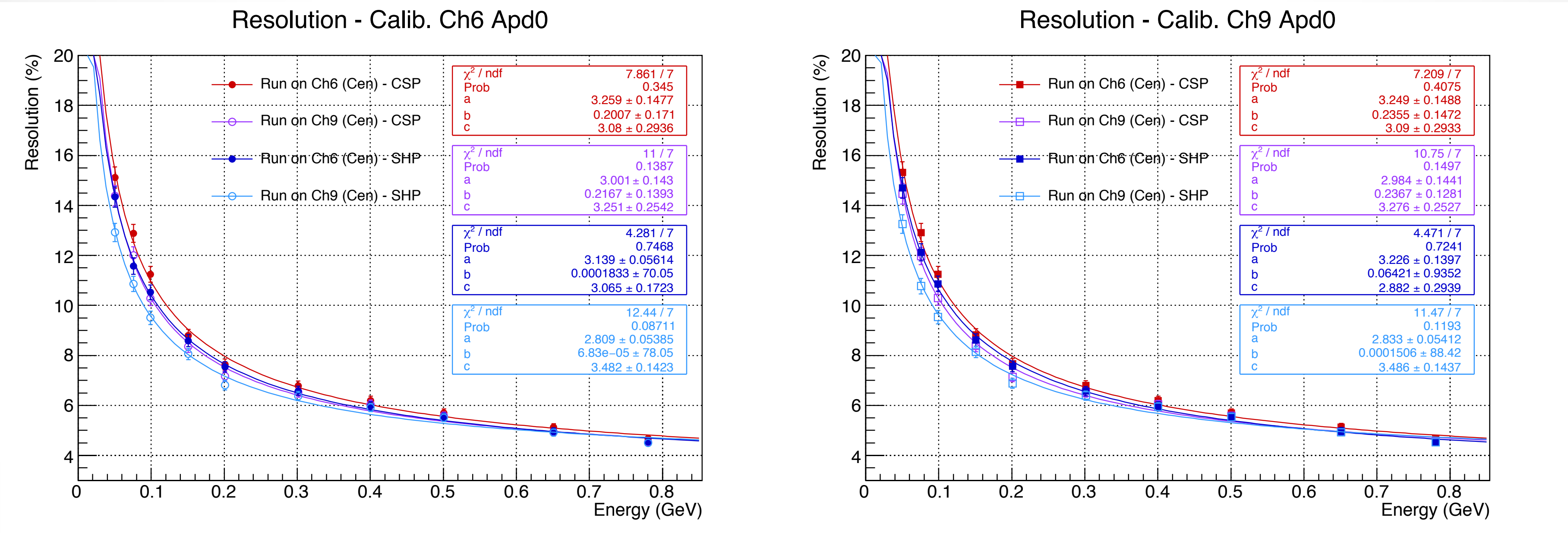




Resolution

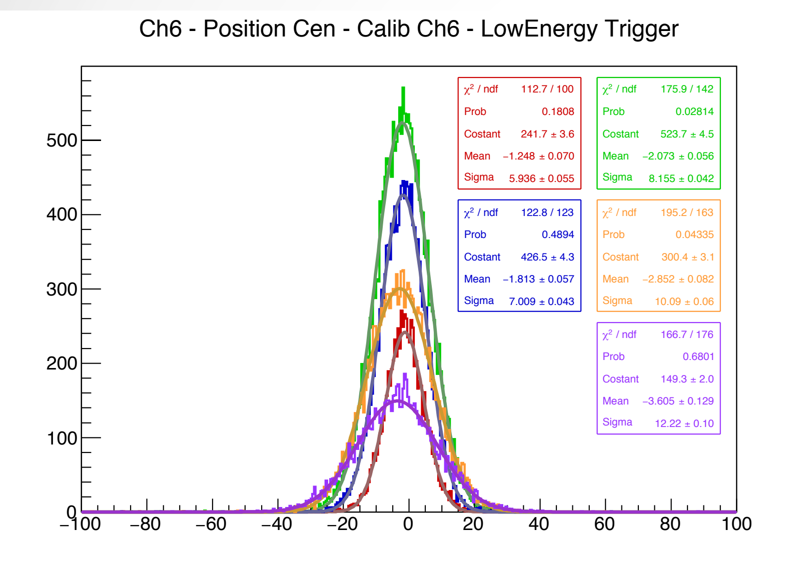
- Crystal Center

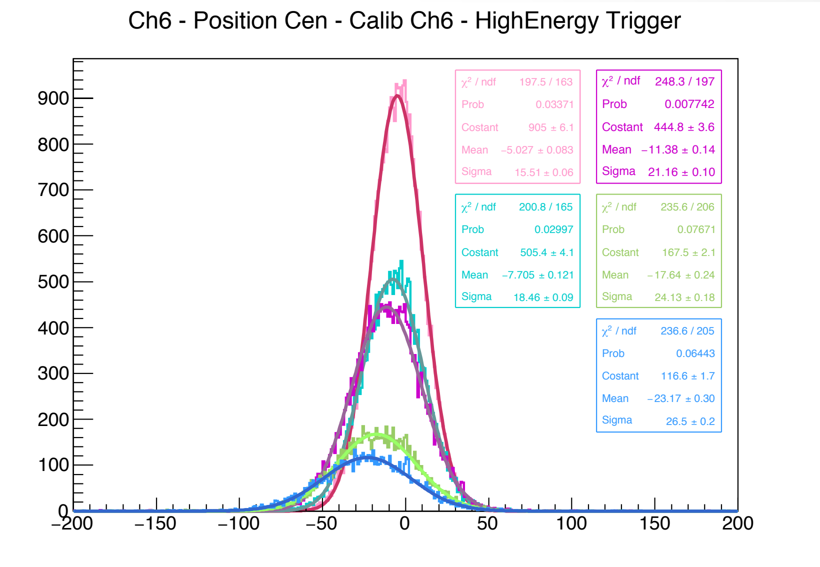
Fit function : $\sigma(E)/E = \frac{a}{\sqrt{E}} \oplus \frac{b}{E} \oplus c$

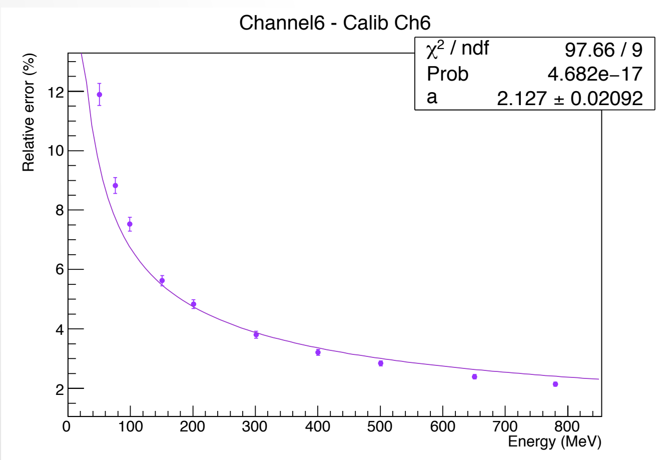


- Resolution after shaping not updated

Photostatistics

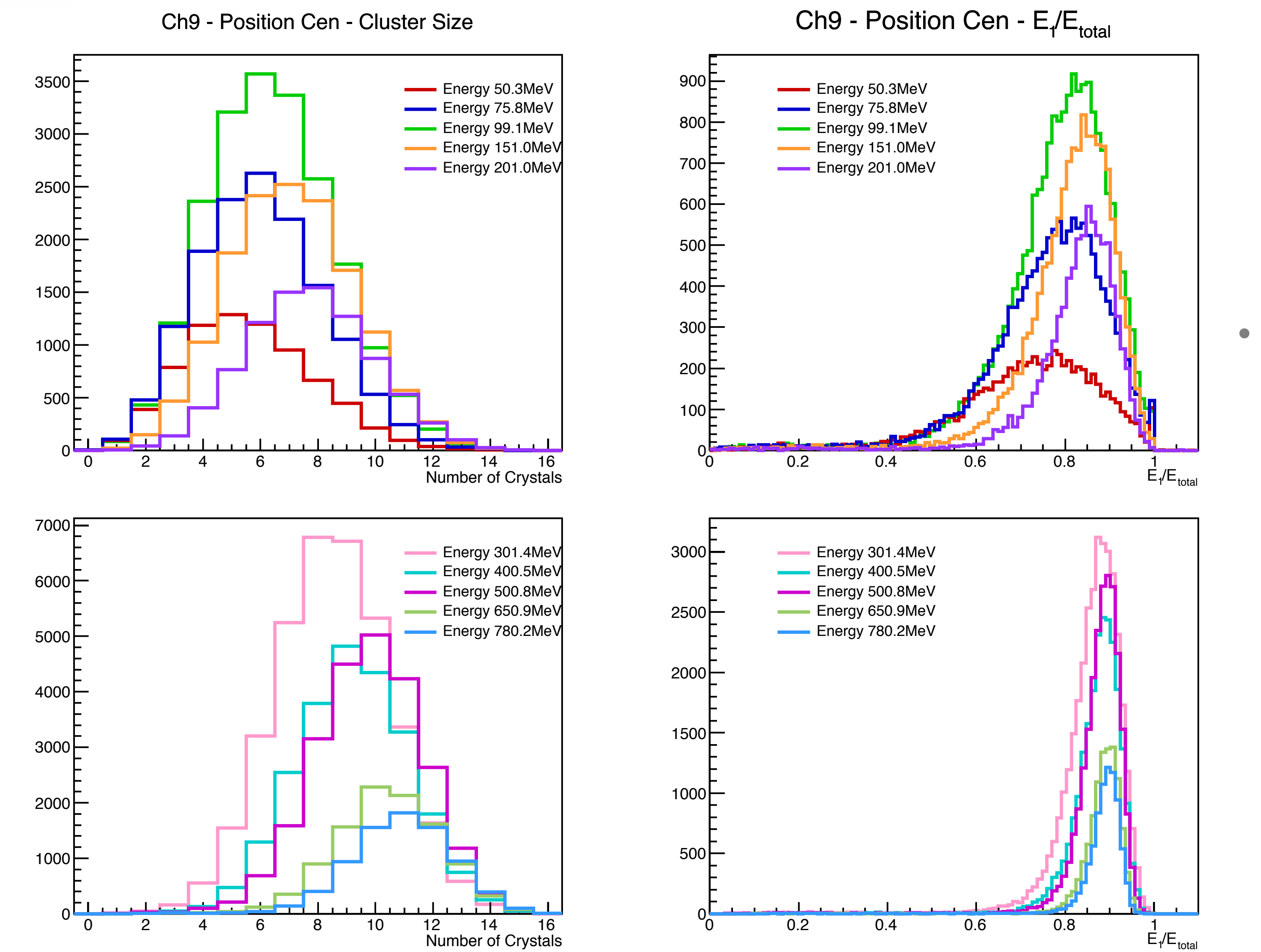






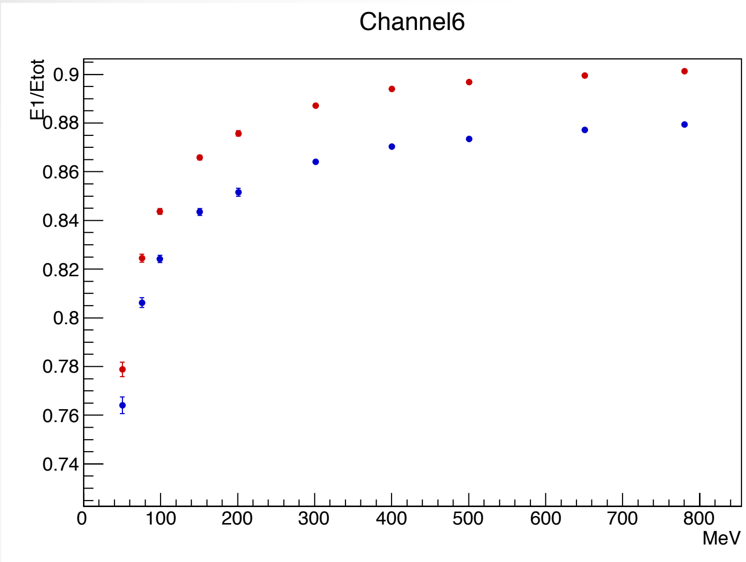
- a/sqrt(E) evaluated with total deposited energy in the matrix

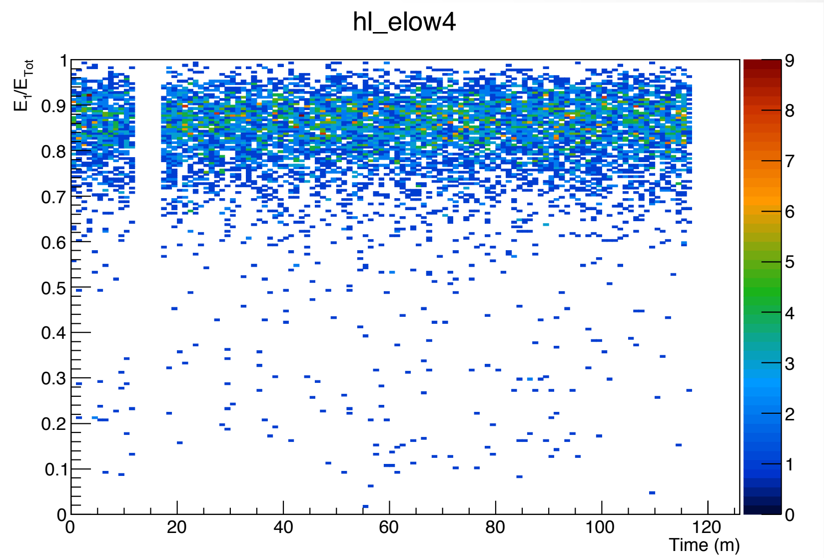
Cluster Size

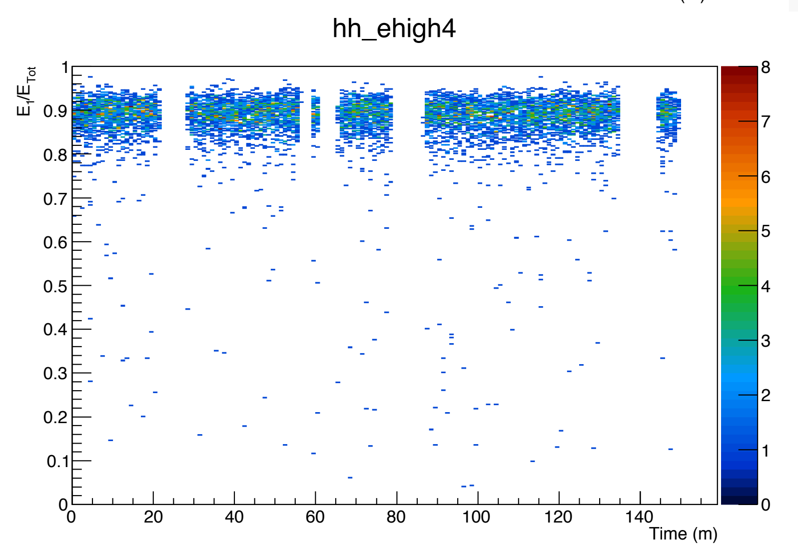


- E1/Etot ratio lower at lower energies
  - Is it as expected?
  - Higher contribution from low energy photons?

E1/ETot

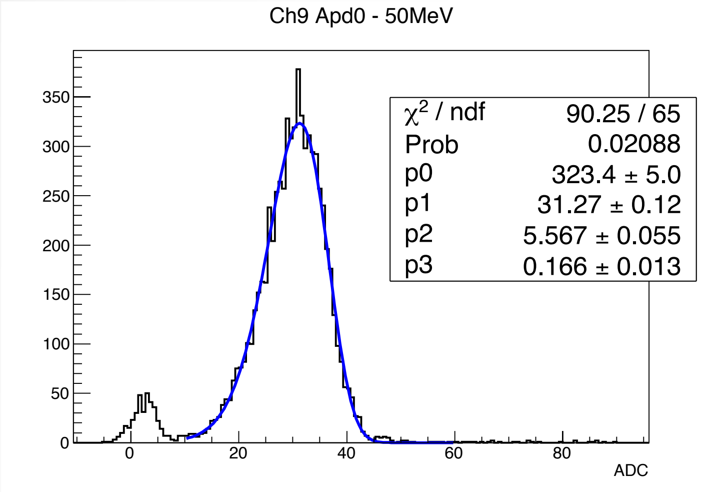


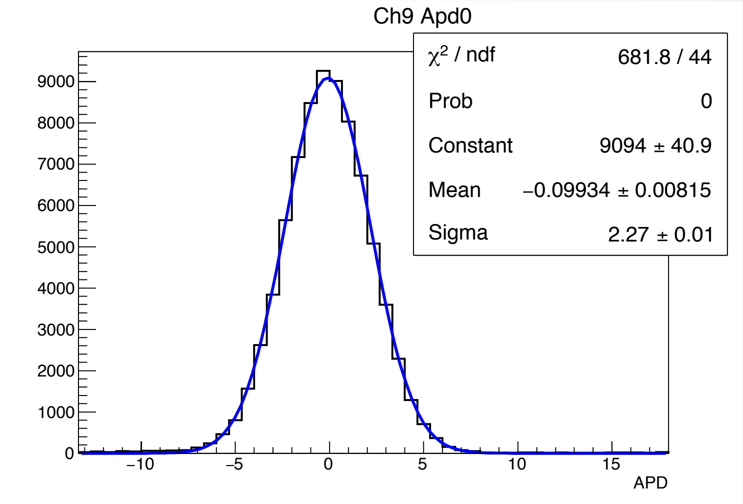




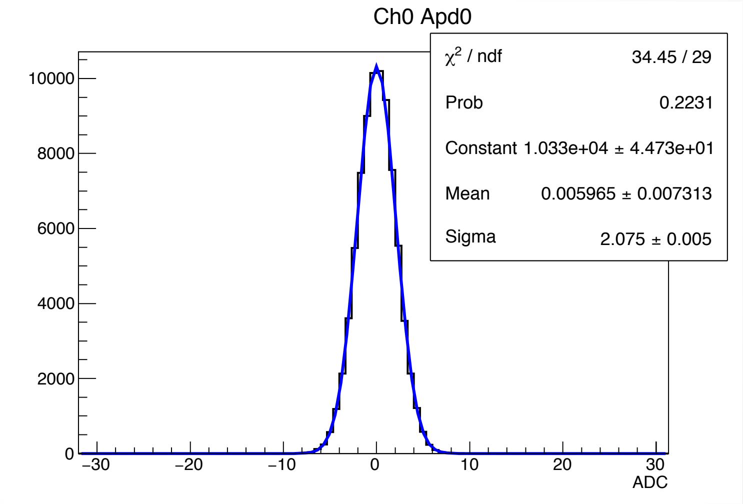
- E1/Etot stable with time
- The energy dependence is mainly due to the noise

Noise





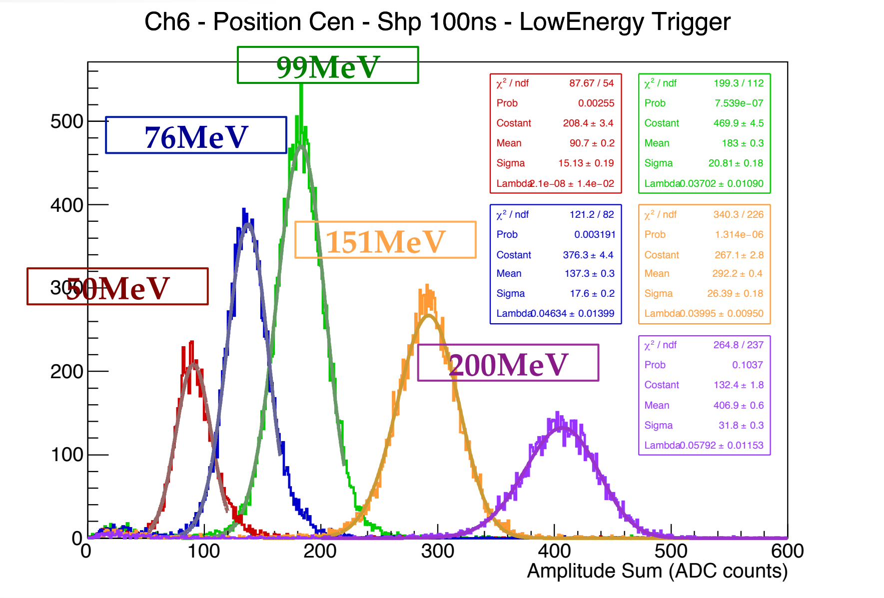
- If e1/etot ~ 80%
- ENE
  - 40MeV*2.1/31.3=**2.7MeV**
- **For 9xtal cluster**
  - **Noise 2.7*sqrt(18)~11MeV**

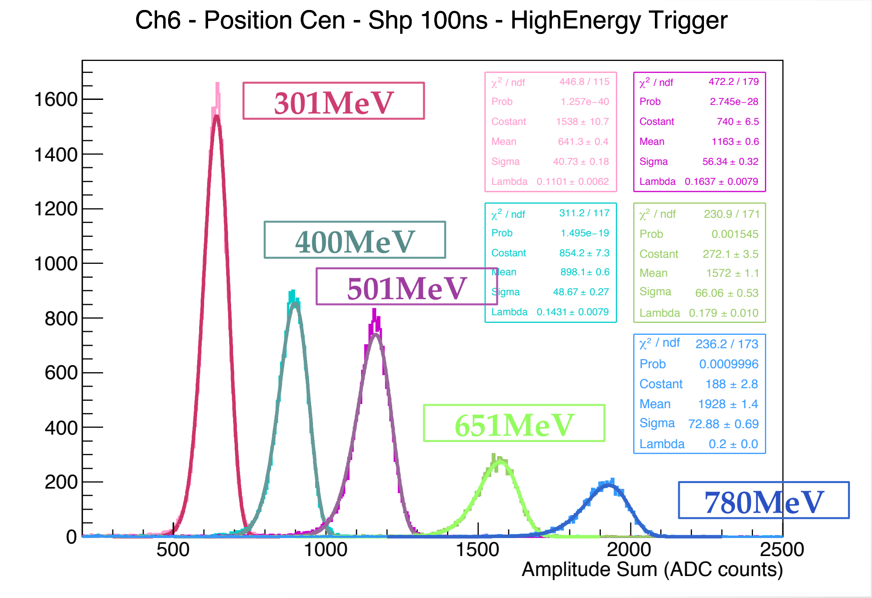


Backup

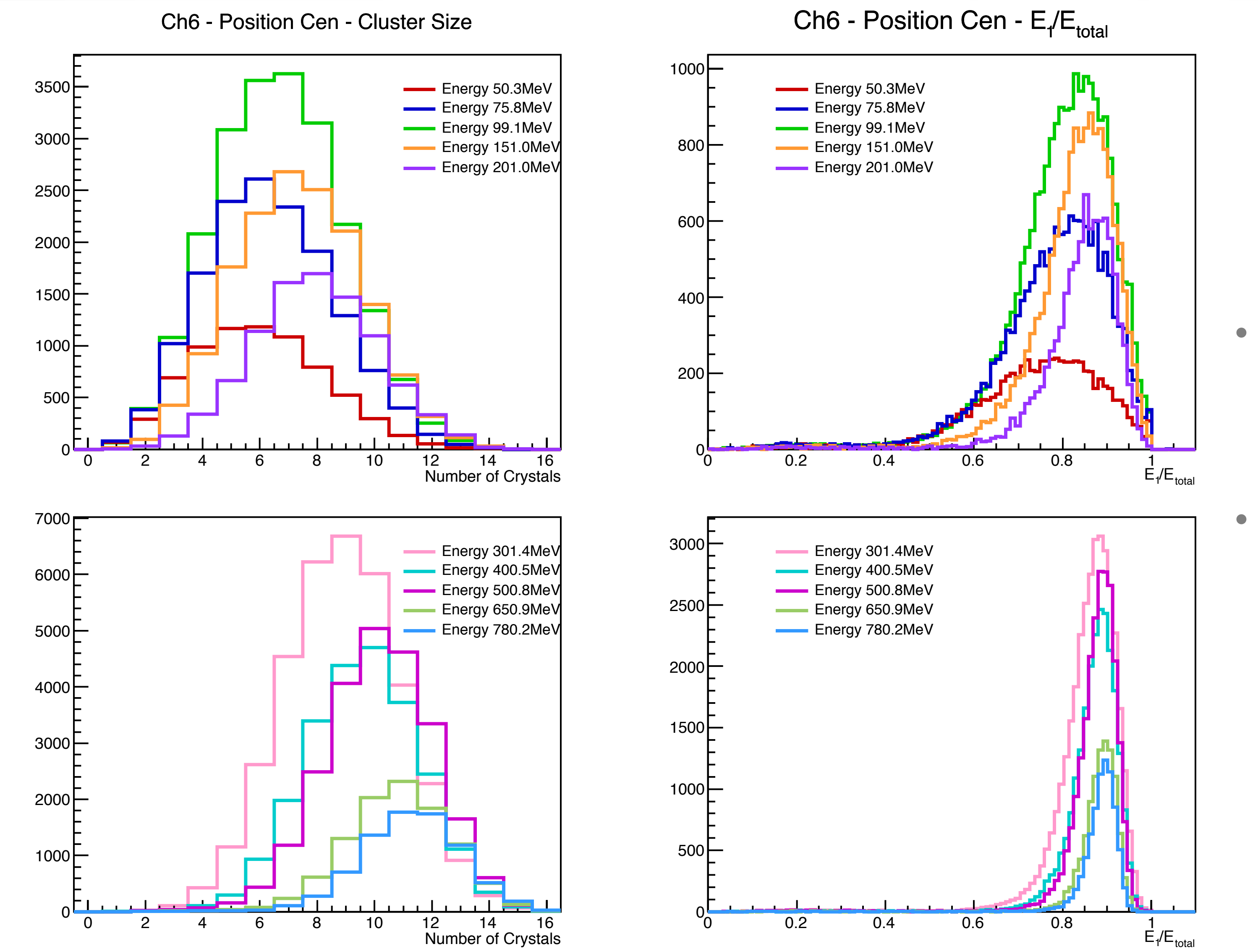
Shaped Signal Analysis

- Same analysis applied also to shaped (100ns) signals





Cluster Size (SHP)



- Cluster Size slightly bigger wrt CSP
  - ~0.3 crystals
- E1/Etot has same behavior as before shaping