Update on Test Beam Data Analysis for BGO Crystal Module

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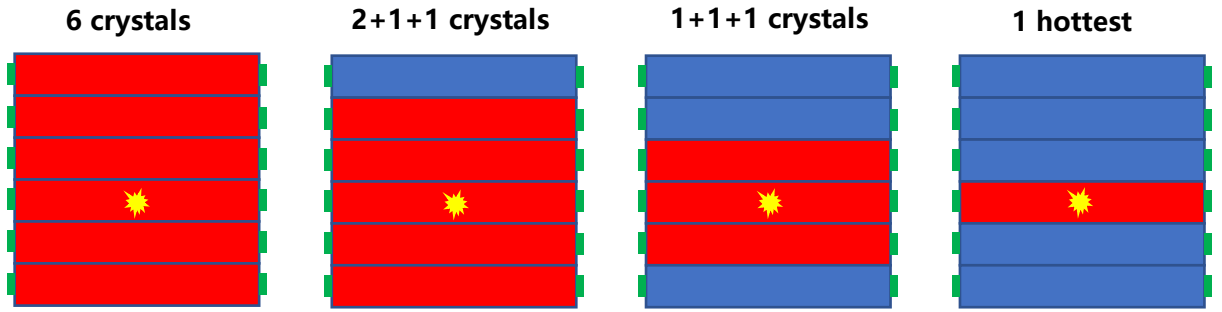
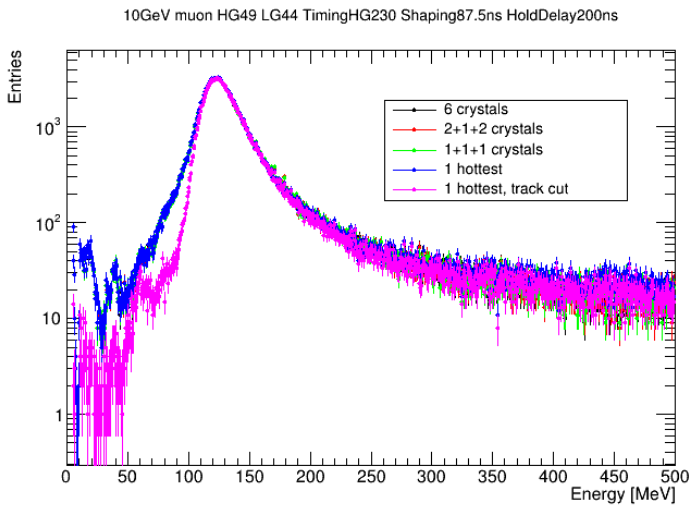
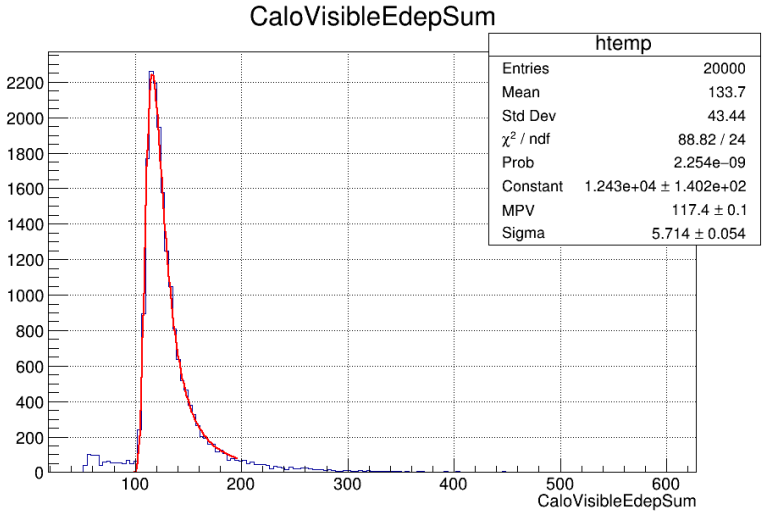
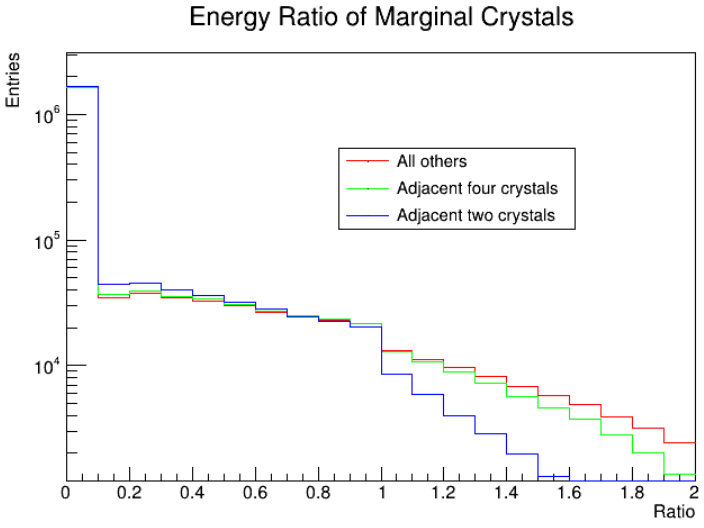
Muon Data – Crosstalk Check

- 10GeV muon data, 38 runs
- Electronics Setup: HG49 LG44, TimingHG230, Shaping87.5ns, HoldDelay200ns
- Count crystal energy from the hottest to edge
- Track cut: the hottest position in current two layers is within one crystal range of the previous two layers









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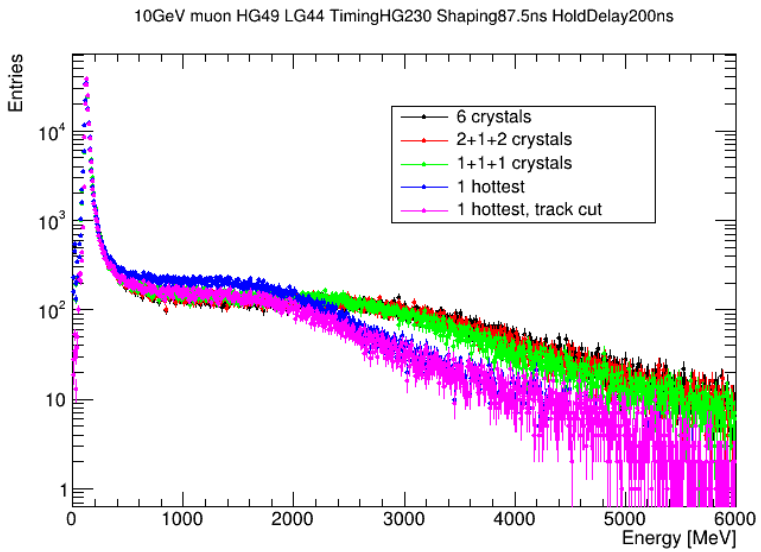
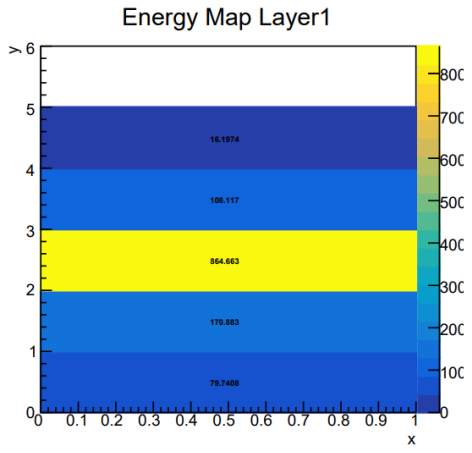
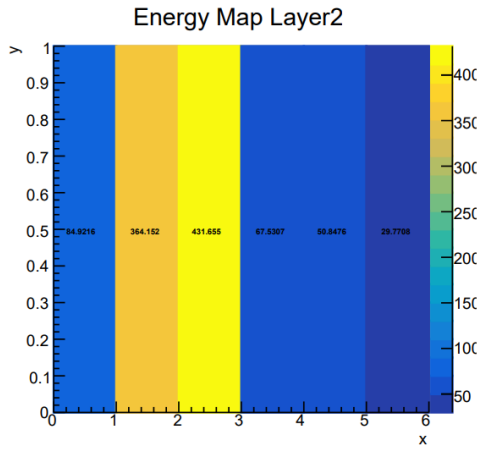
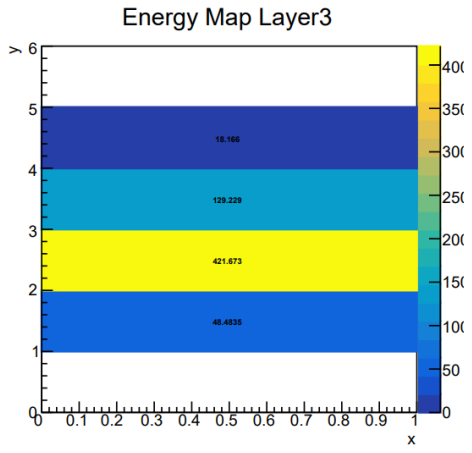
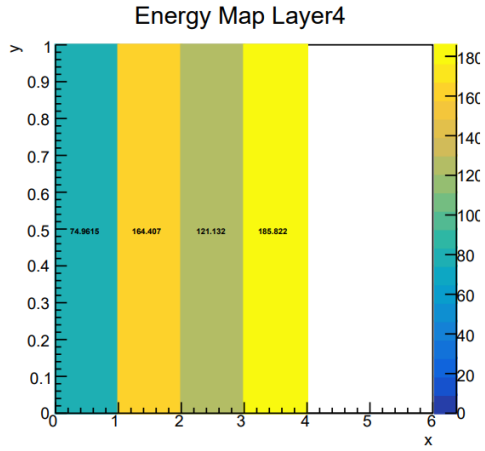
Muon Data – High Energy Component

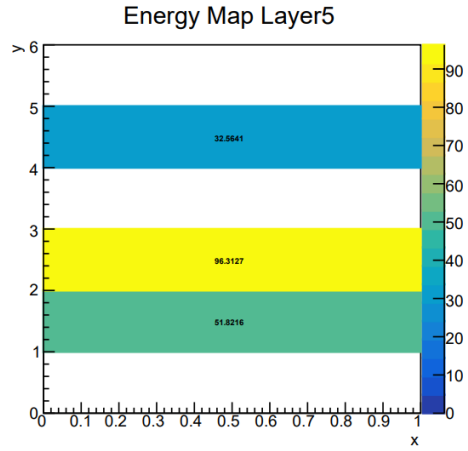


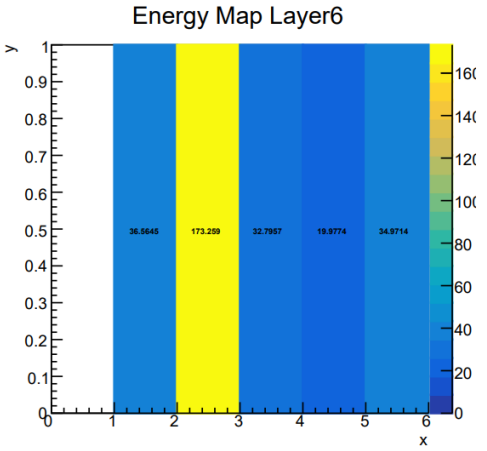






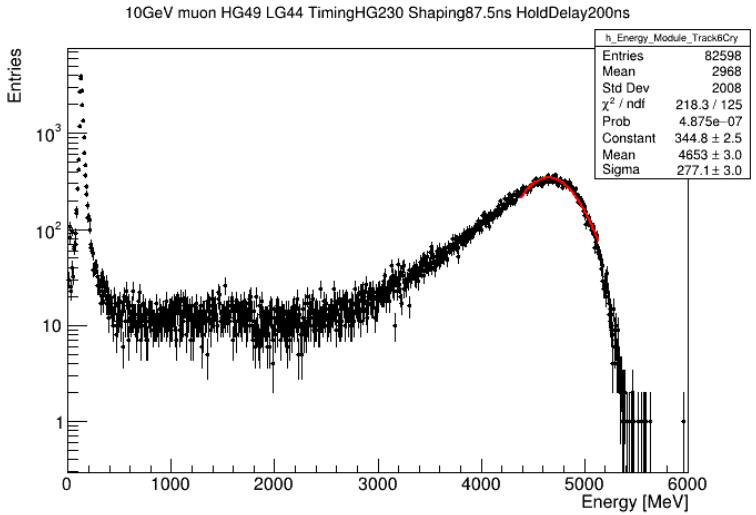


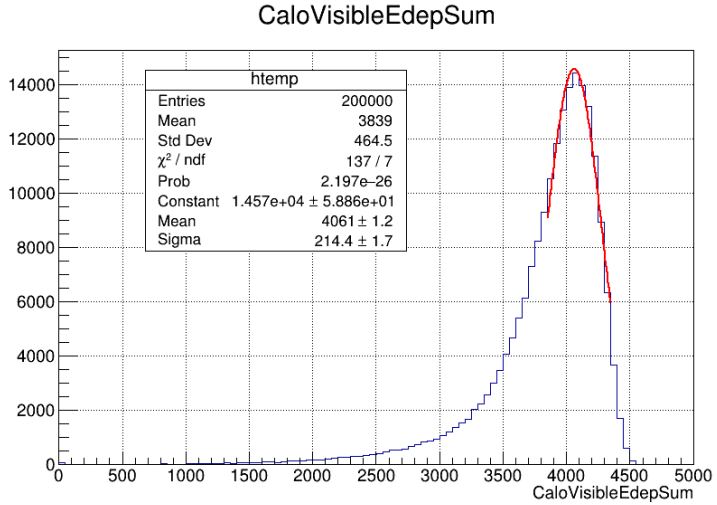


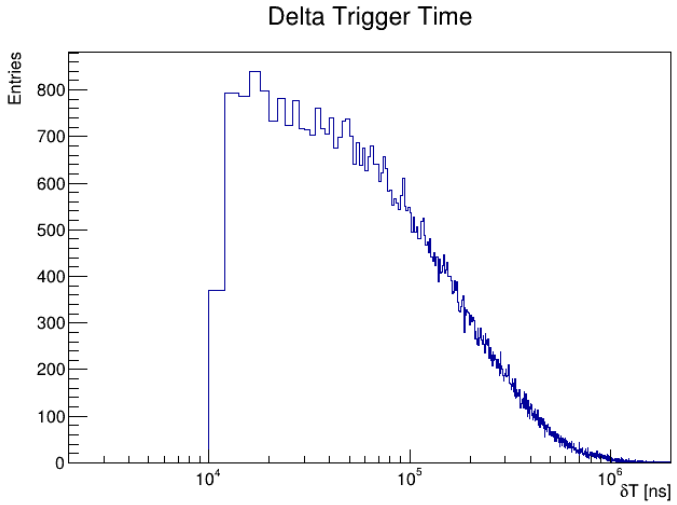


Electron Data

- 5GeV electron data, 10 runs
- Electronics Setup: HG49 LG44, TimingHG230, Shaping87.5ns, HoldDelay200ns
- Energy of data is bigger than simulation. Not sure if it is from pileup or divergence







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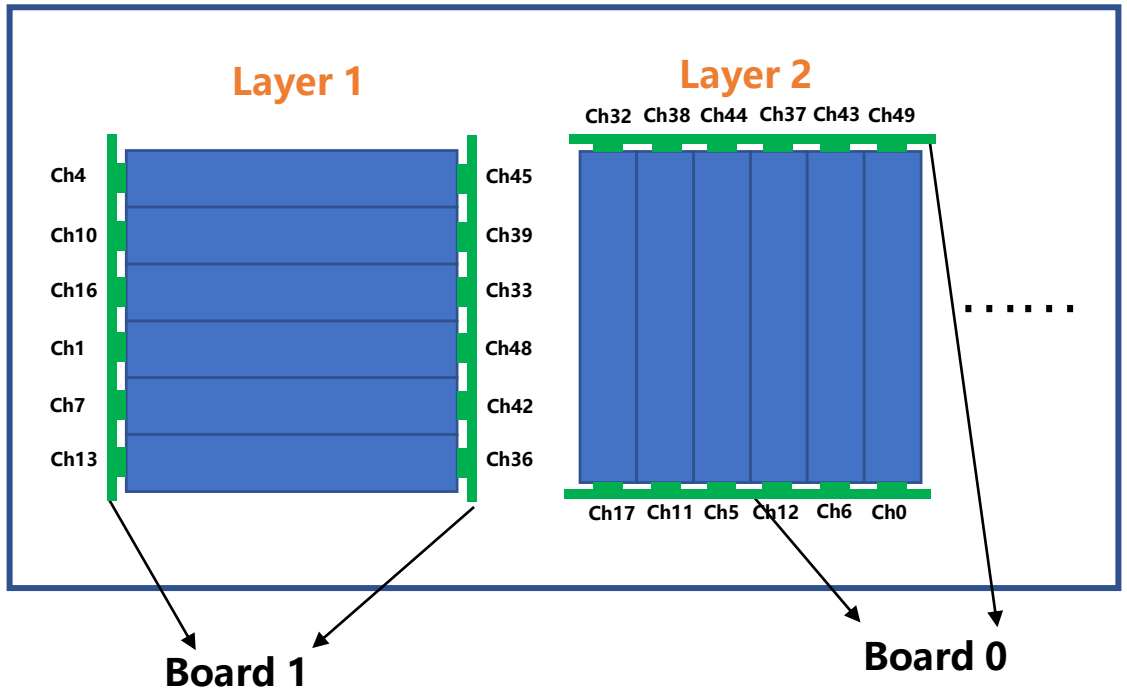
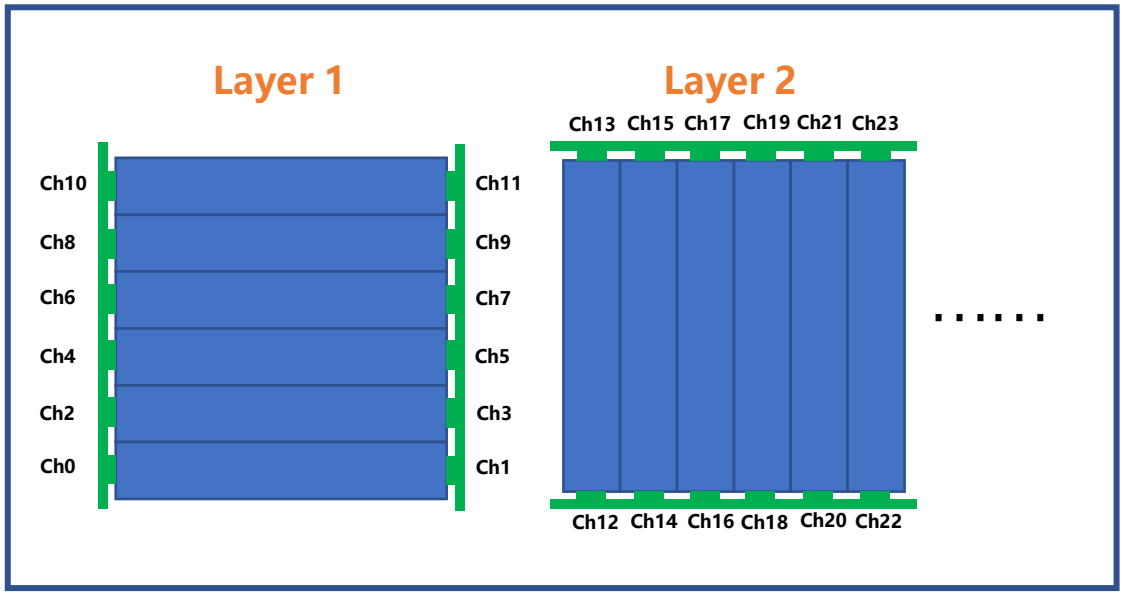
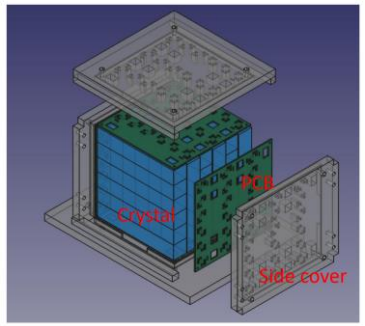
Backup

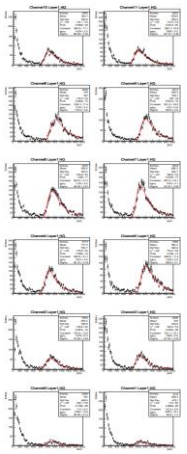
Channel Mapping

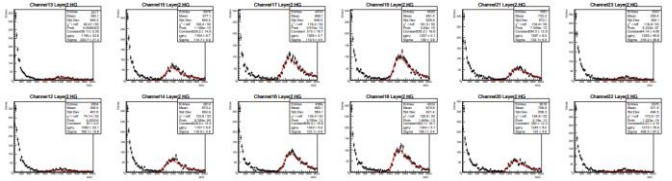
- Map channels for analysis. Channel num grows from left to right, bottom to top.





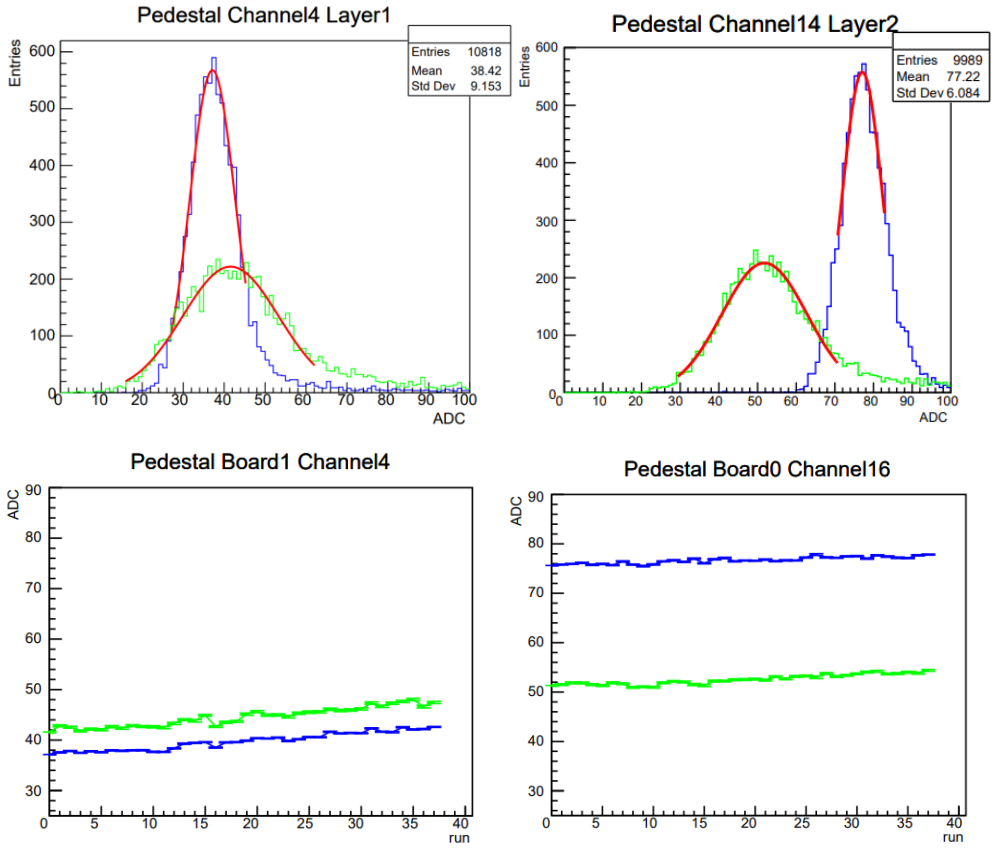




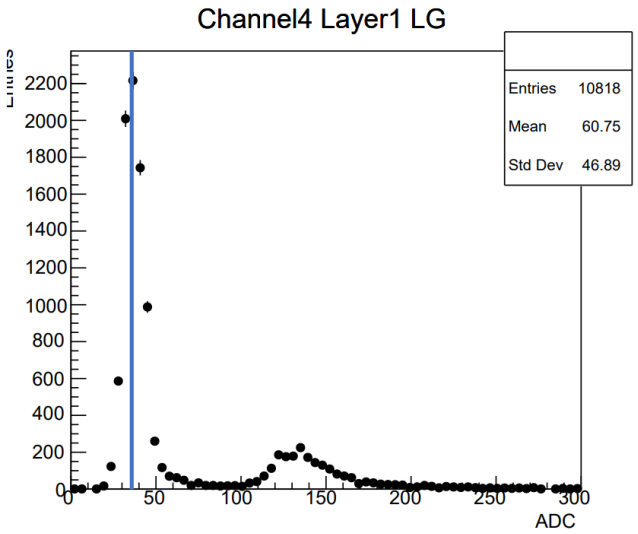


Pedestal Correction

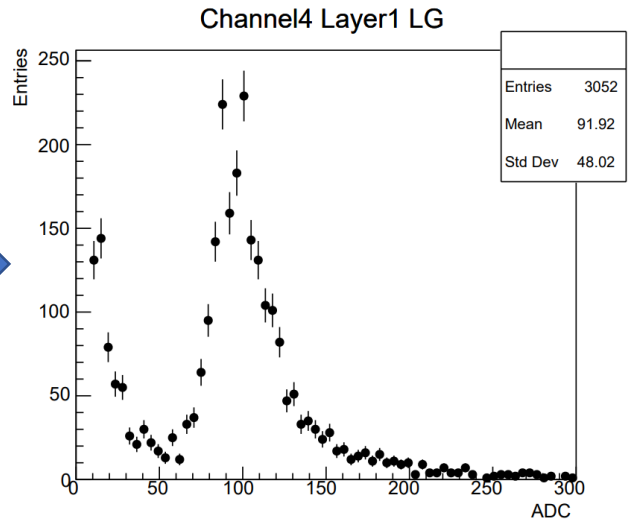
- Fit and shift the pedestal peak to zero channel by channel
- Pedestal fluctuate over time, and it also varies between boards and gain modes



Before correction



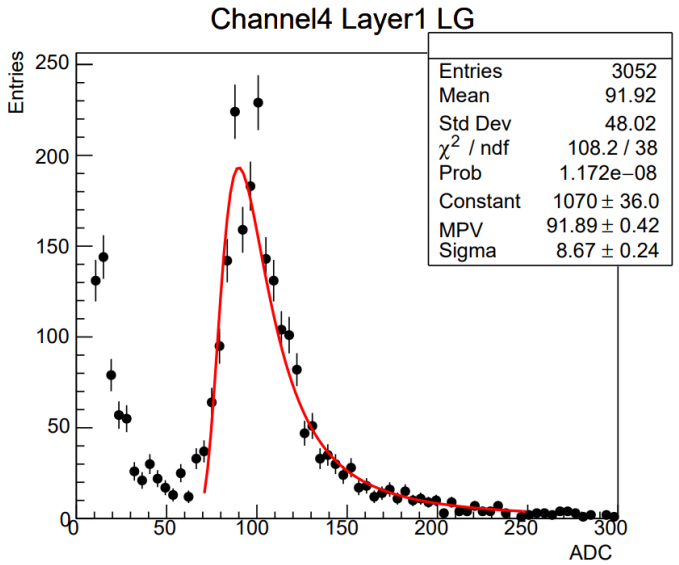
After correction

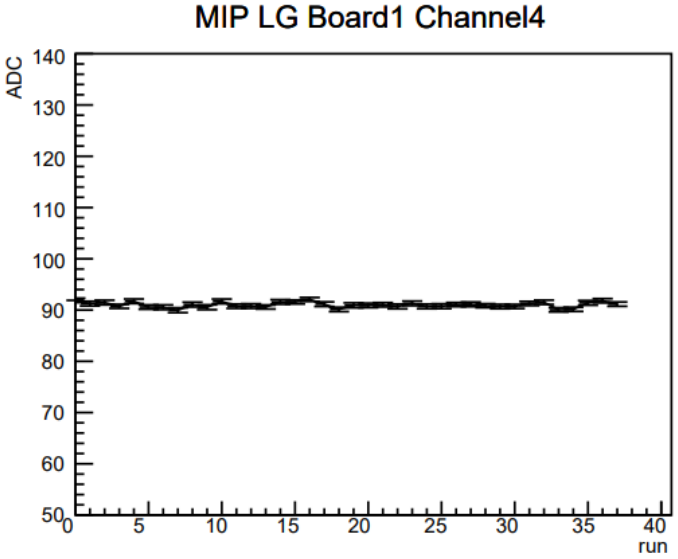


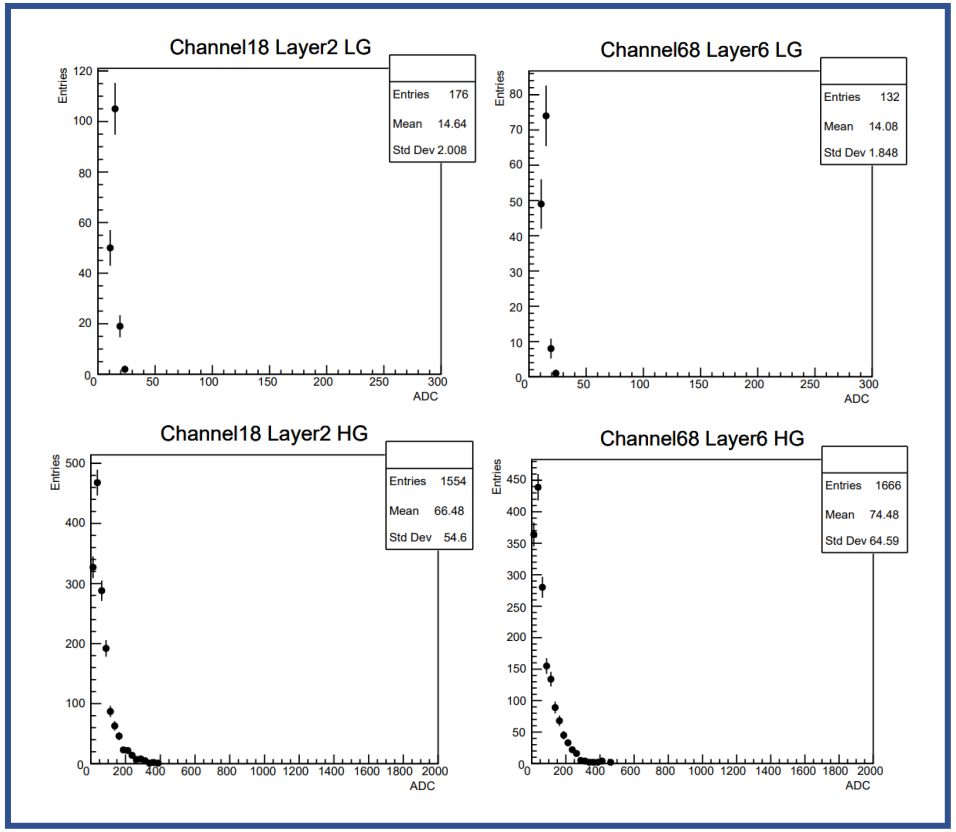
MIP Calibration

- After pedestal correction, MIP distribution becomes stable over time.
- There are two damaged channels with only pedestal. Use the signal of opposite channels in place of these channels.

2 damaged channels!



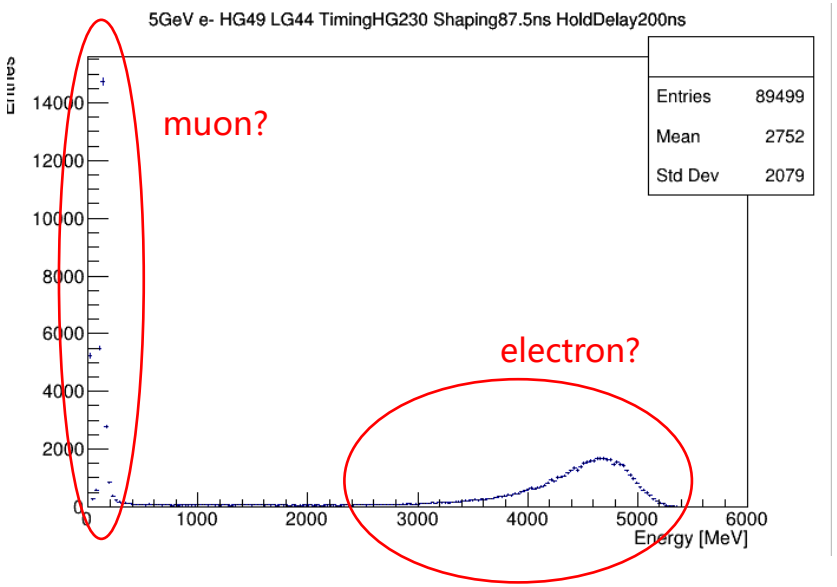


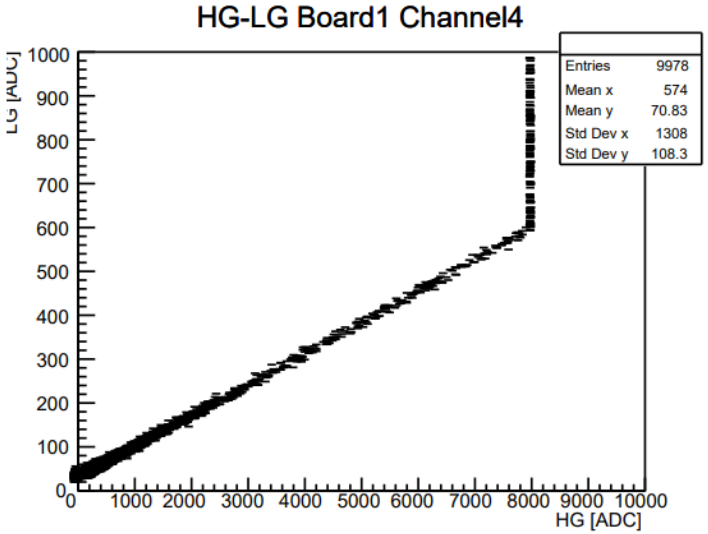


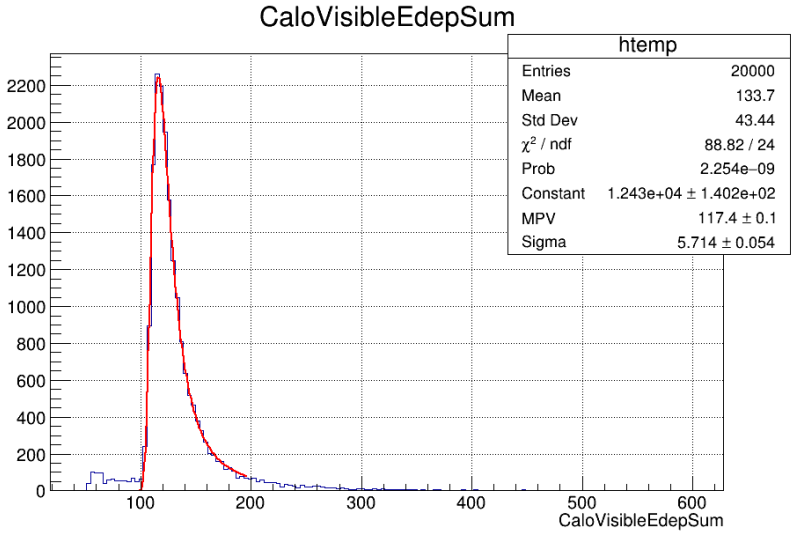
Energy of 5 GeV Electron Beam

- Merge all of data from ten runs（5GeV electron）
- Synchronous events selection: the two boards with different trigger time
- Pedestal correction channel by channel, run by run.
- MIP calibration: 10GeV muon data, $117.4/6/2 \approx 9.78\ MeV/ch$
- HG/LG threshold: 7800 ADC
- Cut: 0.5MIP

Simu from Baohua
10GeV muon → module

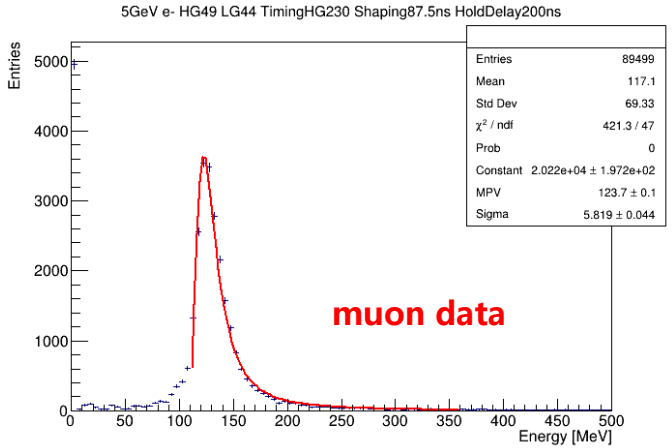


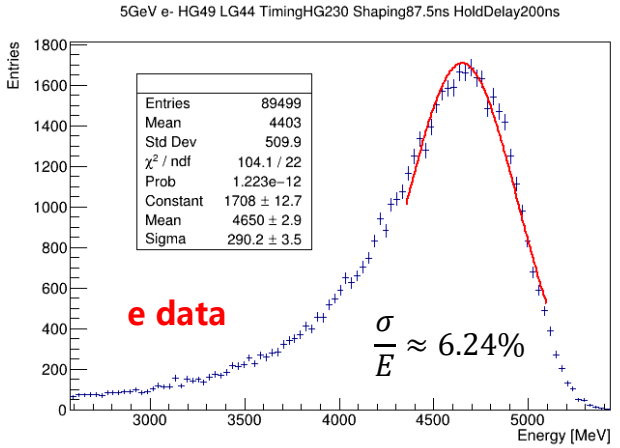


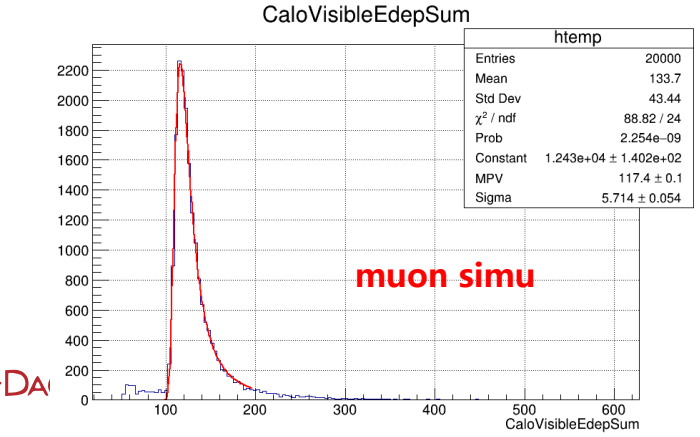


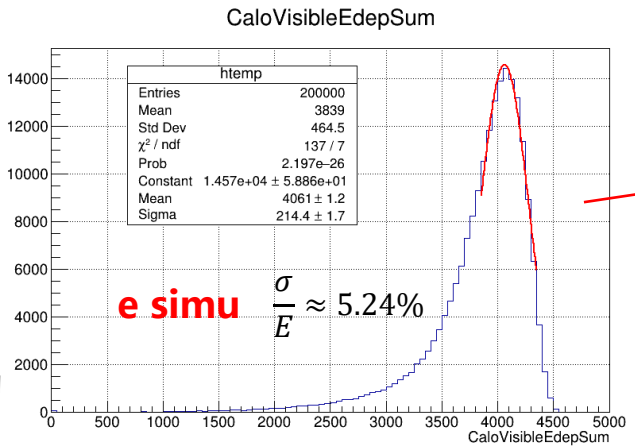
Electron Energy Estimation

- data>simu, both for muon and electron
- Energy and direction of data is not as ideal as simu?

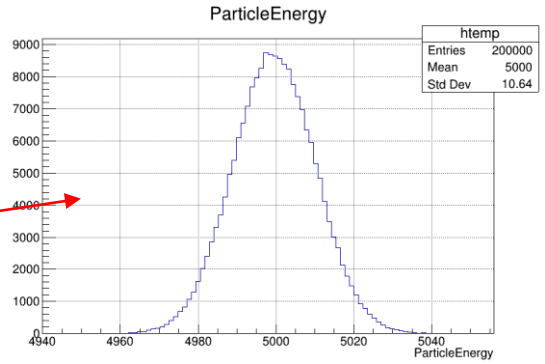








0.5% FWHM energy divergence



Temperature of Muon Data

Run1_list.txt

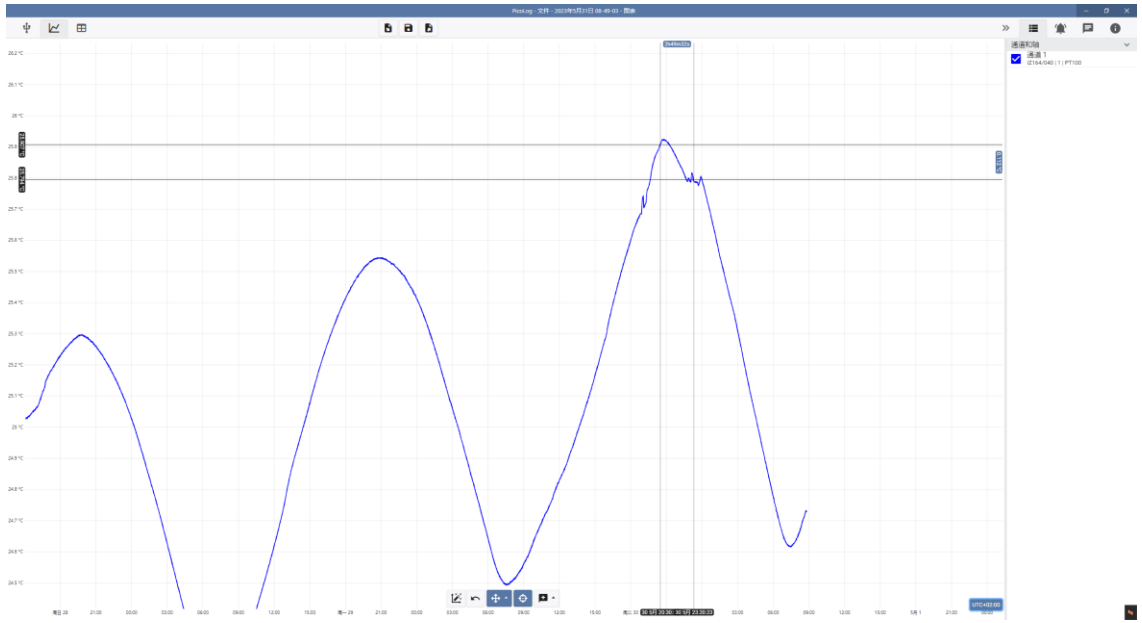
```
//************************************************
// File Format Version 3.1
// Janus Release 3.0.2
// Acquisition Mode: Spect_Timing
// Energy Histogram Channels: 8192
// ToA/ToT LSB: 0.5 ns
// Run start time: Tue May 30 20:28:24 2023 UTC
//************************************************
```

25.9℃

Run38_list.txt

```
//************************************************
// File Format Version 3.1
// Janus Release 3.0.2
// Acquisition Mode: Spect_Timing
// Energy Histogram Channels: 8192
// ToA/ToT LSB: 0.5 ns
// Run start time: Tue May 30 23:18:56 2023 UTC
//************************************************
```

25.8℃



Temperature of Electron Data

Run1_list.txt

```
//**************************************************
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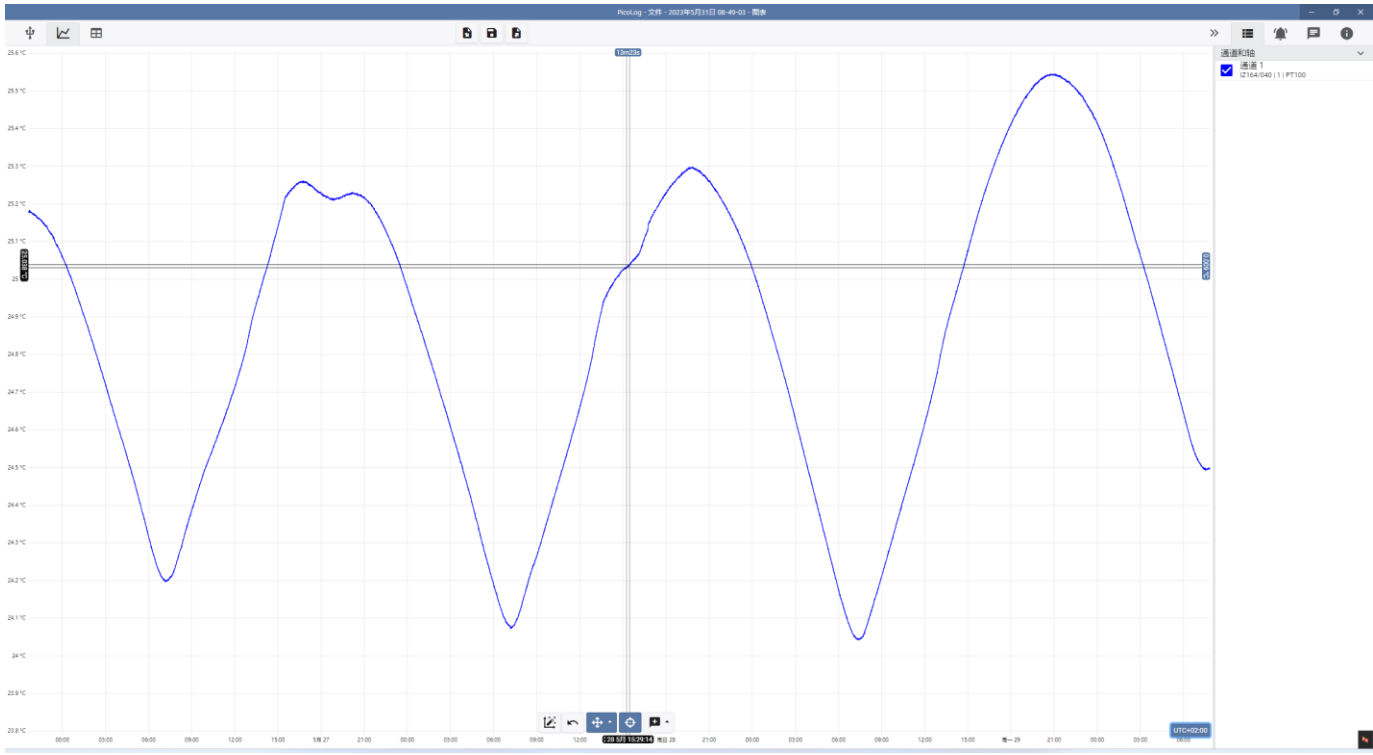
// Janus Release 3.0.2
// Acquisition Mode: Spect_Timing
// Energy Histogram Channels: 8192
// ToA/ToT LSB: 0.5 ns
// Run start time: Sun May 28 15:14:28 2023 UTC
//**************************************************
```

~25℃



Run10_list.txt

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//**************************************************
// File Format Version 3.1
// Janus Release 3.0.2
// Acquisition Mode: Spect_Timing
// Energy Histogram Channels: 8192
// ToA/ToT LSB: 0.5 ns
// Run start time: Sun May 28 15:28:55 2023 UTC
//**************************************************
```