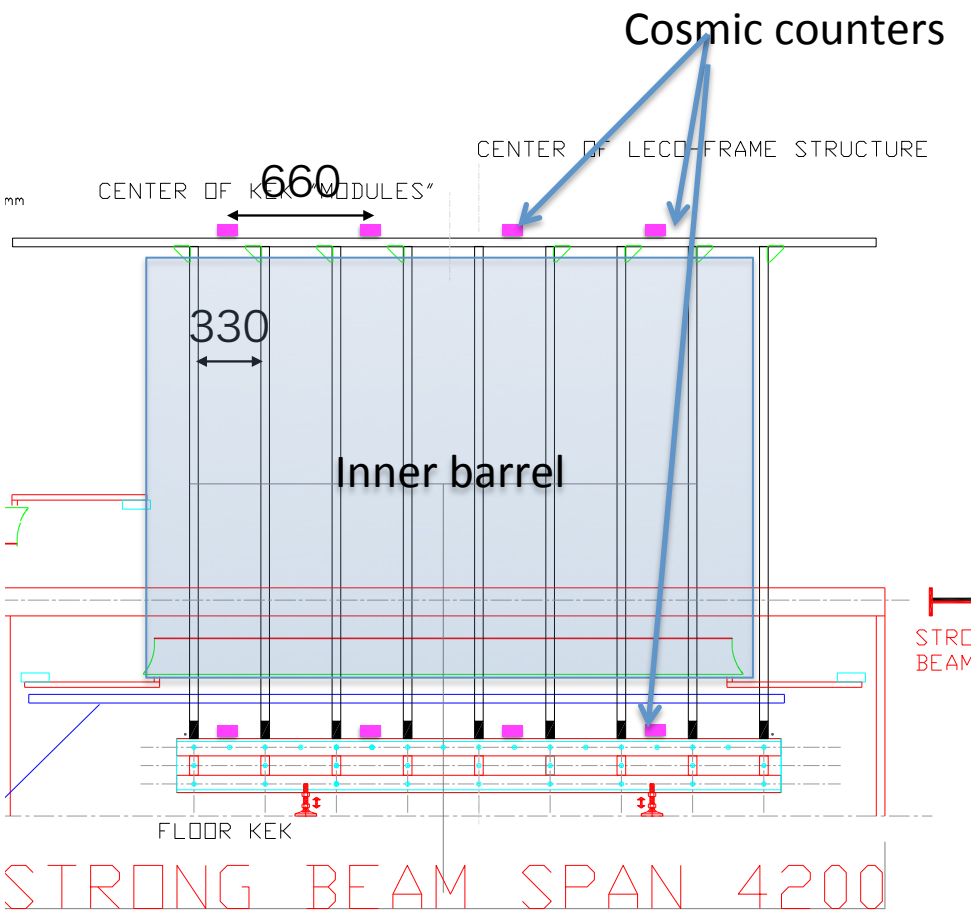
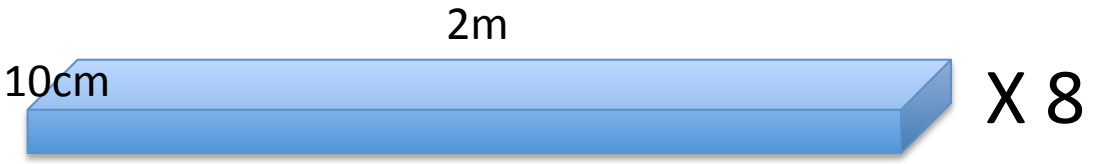
inner barrel cosmic ray data analysis

Data taking

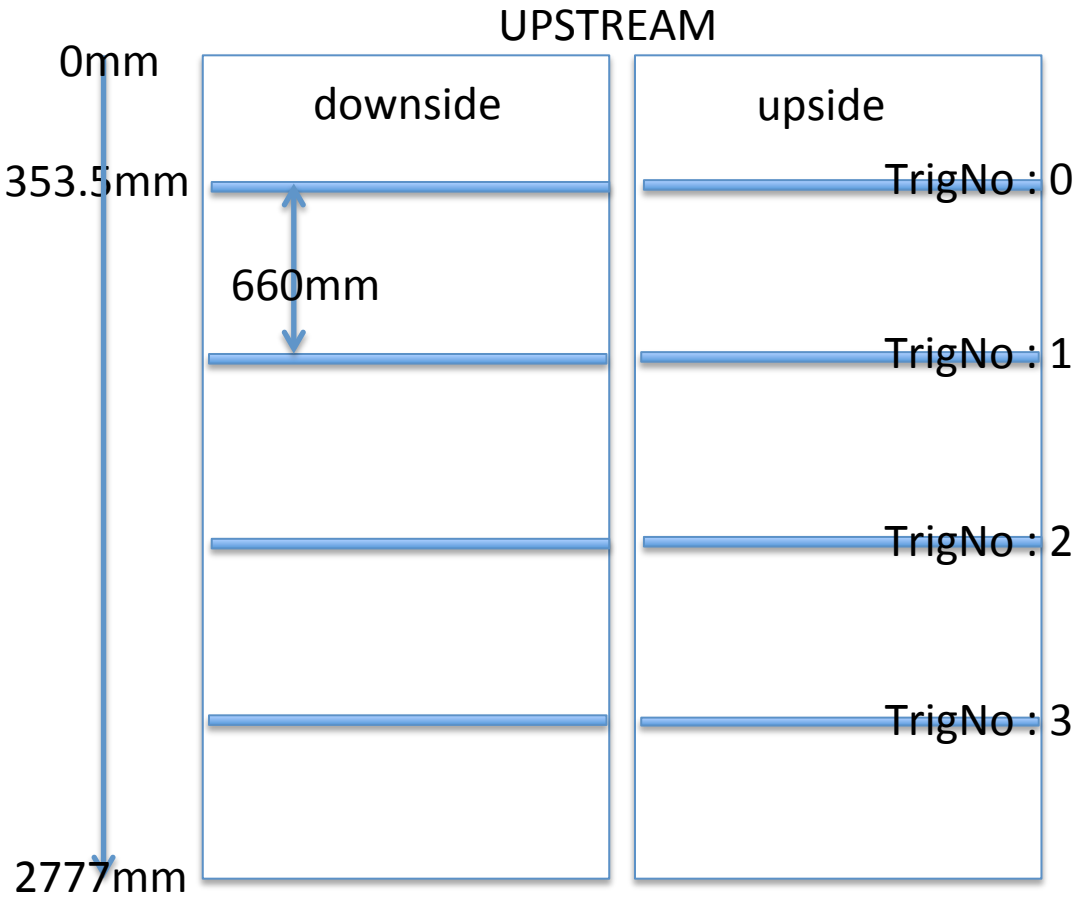
- FADC data acquisition system. (125MHz)
- Cosmic counter trigger system. (pink boxes)
  - 1 upstream && 1 downstream coincidence signal



Cosmic counter

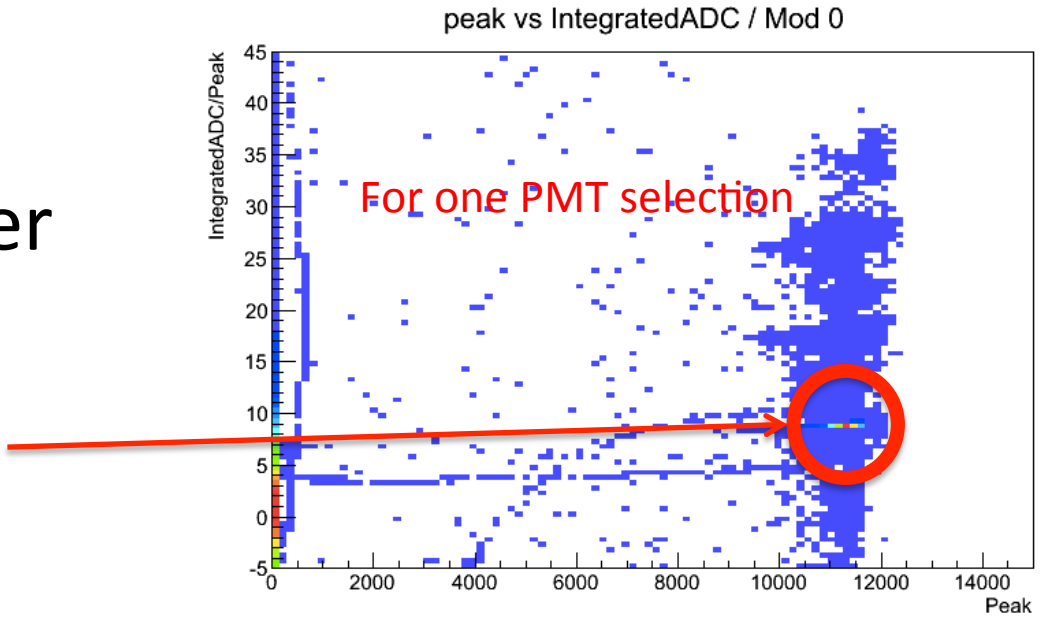


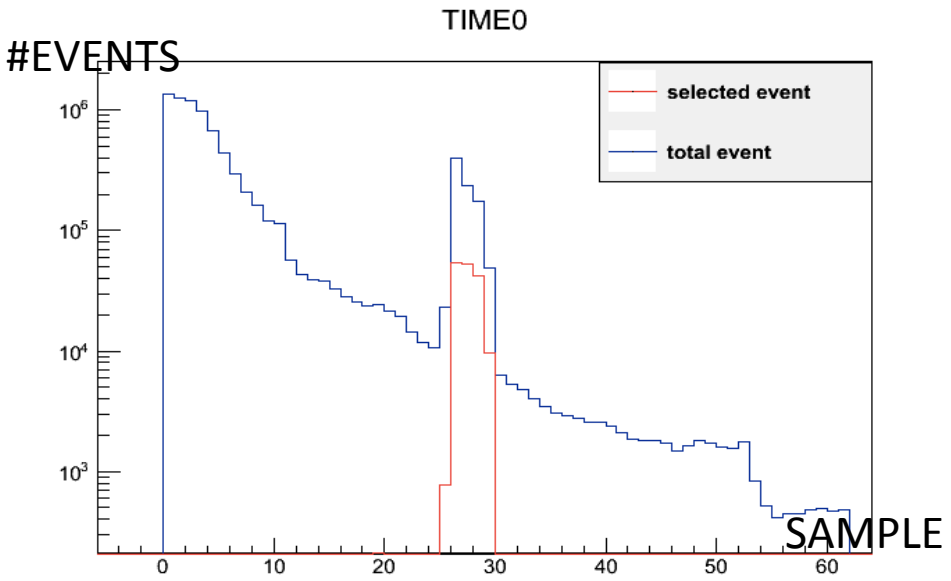
- 16 PMTs
- Both end read out for each scintillator
- 125.0mm/ns light propagation



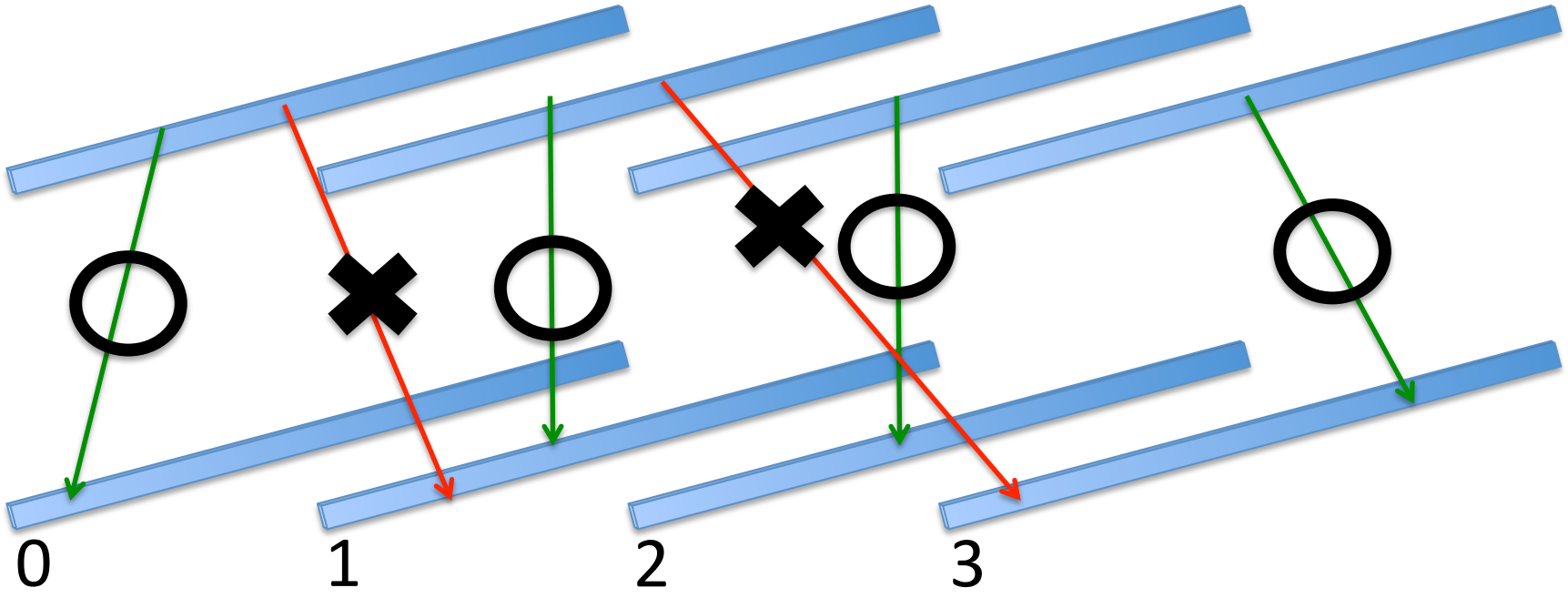
Cosmic counter data

- Take logic signal after discrimination
- Selection condition
  - Peak
    - Logic signal
  - Integrated ADC / peak
    - Stability of pulse shape
  - Coincidence with the other side PMT





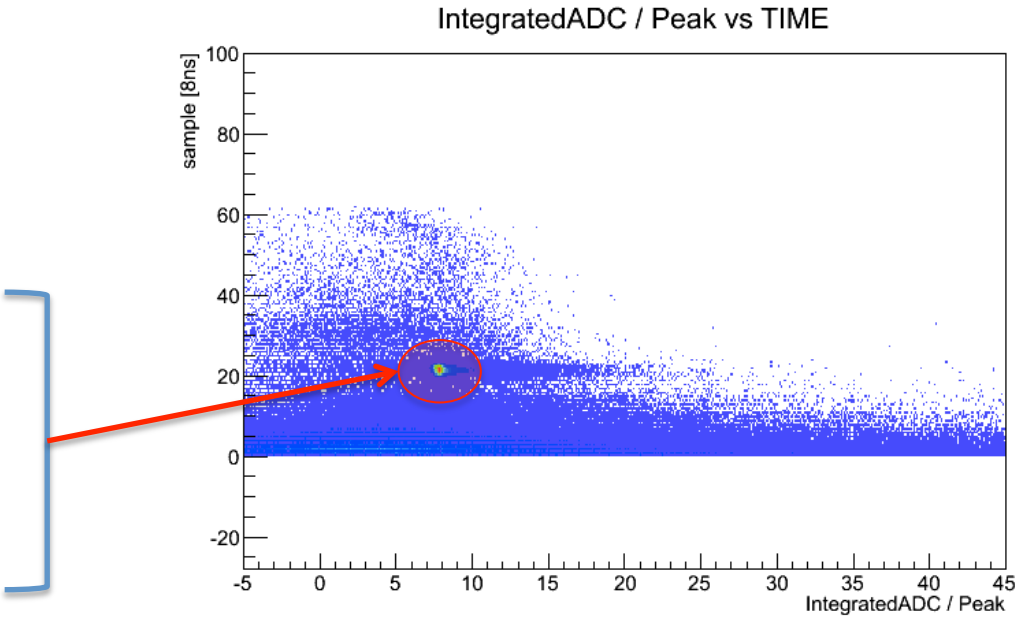
data selection

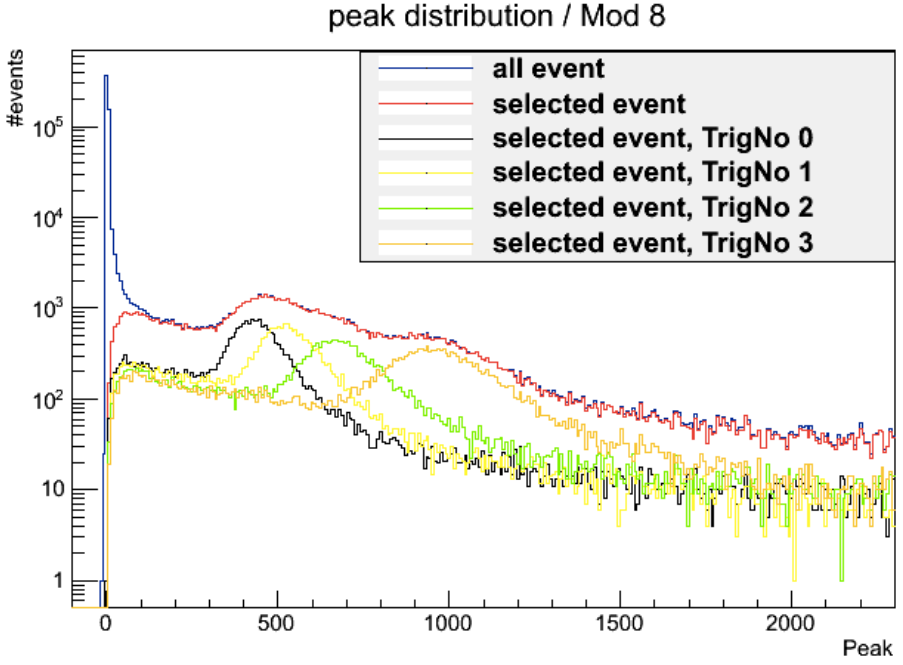


- Event selection mechanism
  - Upstream cosmic counter && downstream cosmic counter which have same beam direction position coincidence signal

IB event Selection

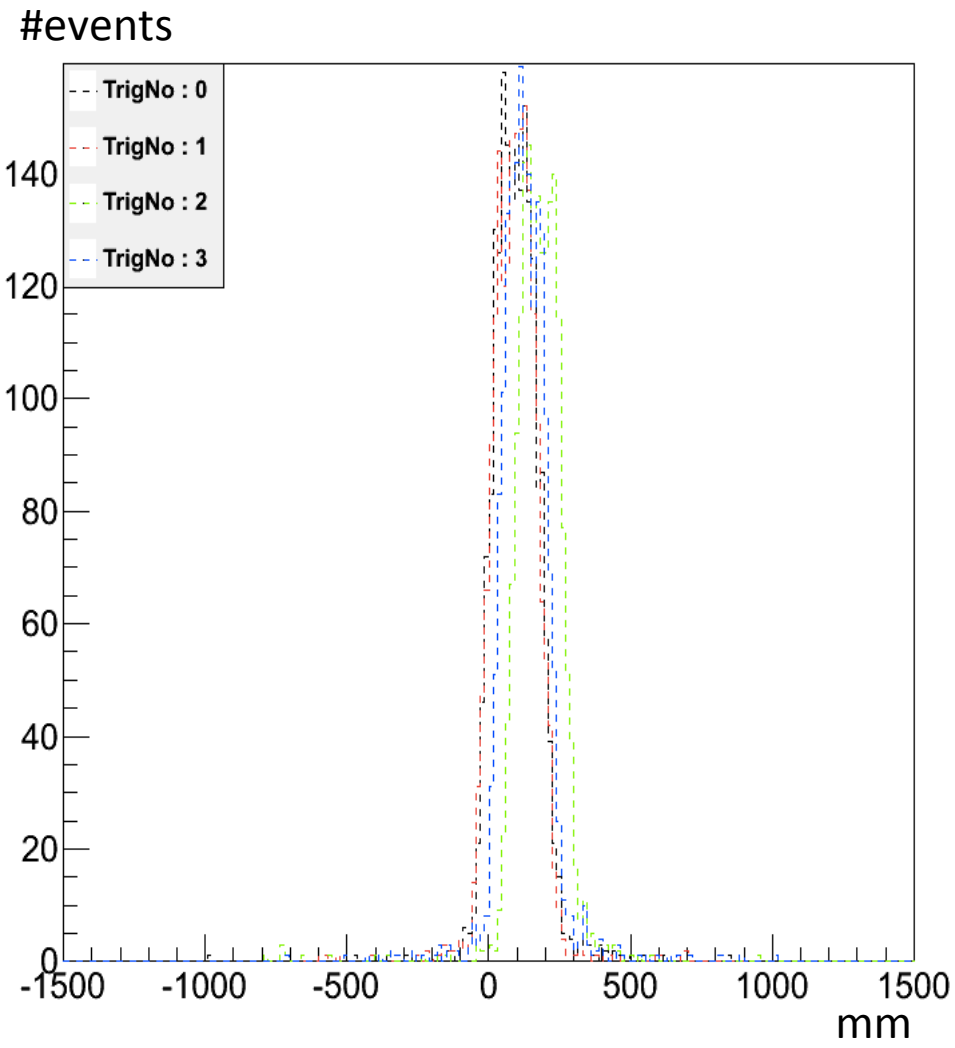
- Selection condition
  - Time
    - Delay timing
  - Integrated ADC / peak
    - Stability of pulse shape
- Peak distribution
  - After selecting, reduced zero events.
  - Landau distribution
  - Each distribution along position of 4 cosmic counters



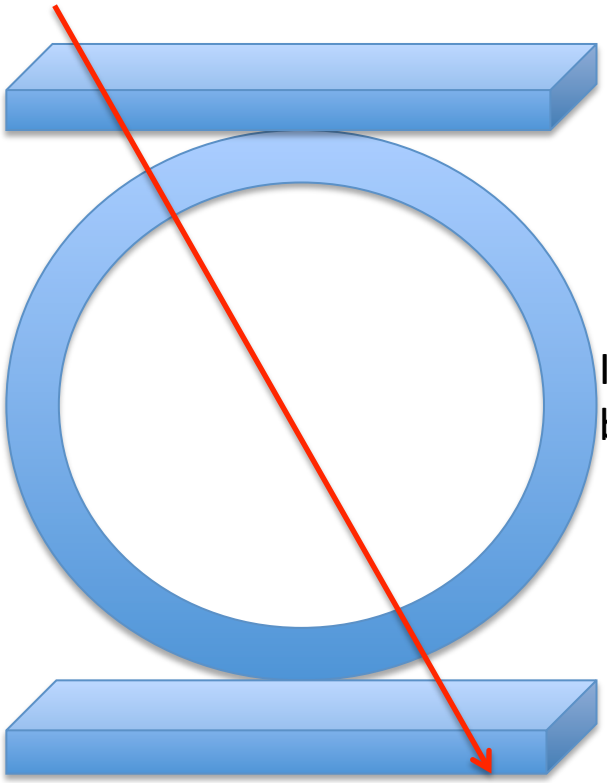


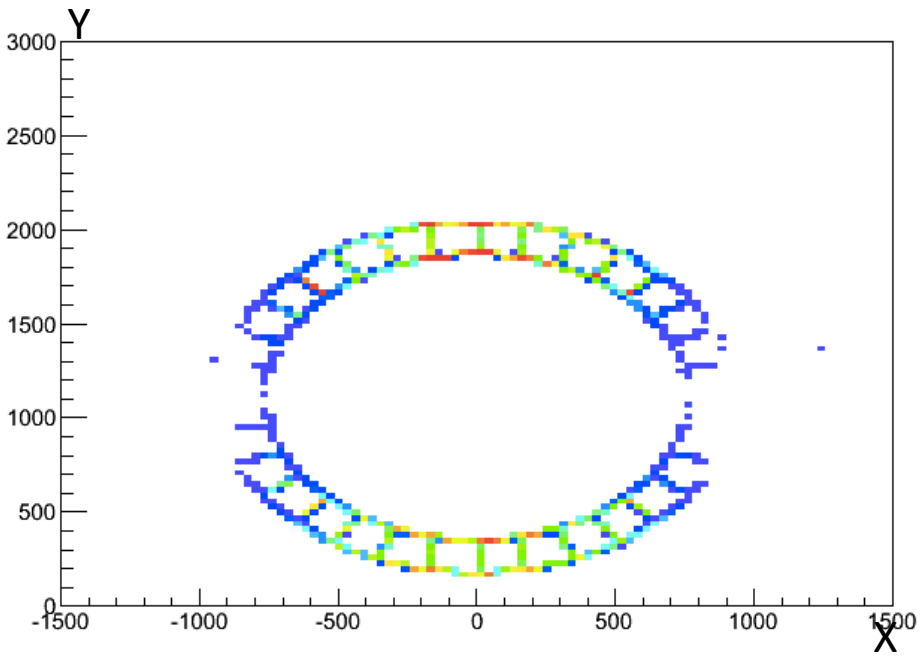
hit positions @ cosmic counter

- Hit position distribution
  - Downside cosmic counter
- Require 2 inner barrel hit condition
  - ModID8 && ModID24



Cosmic ray tracking

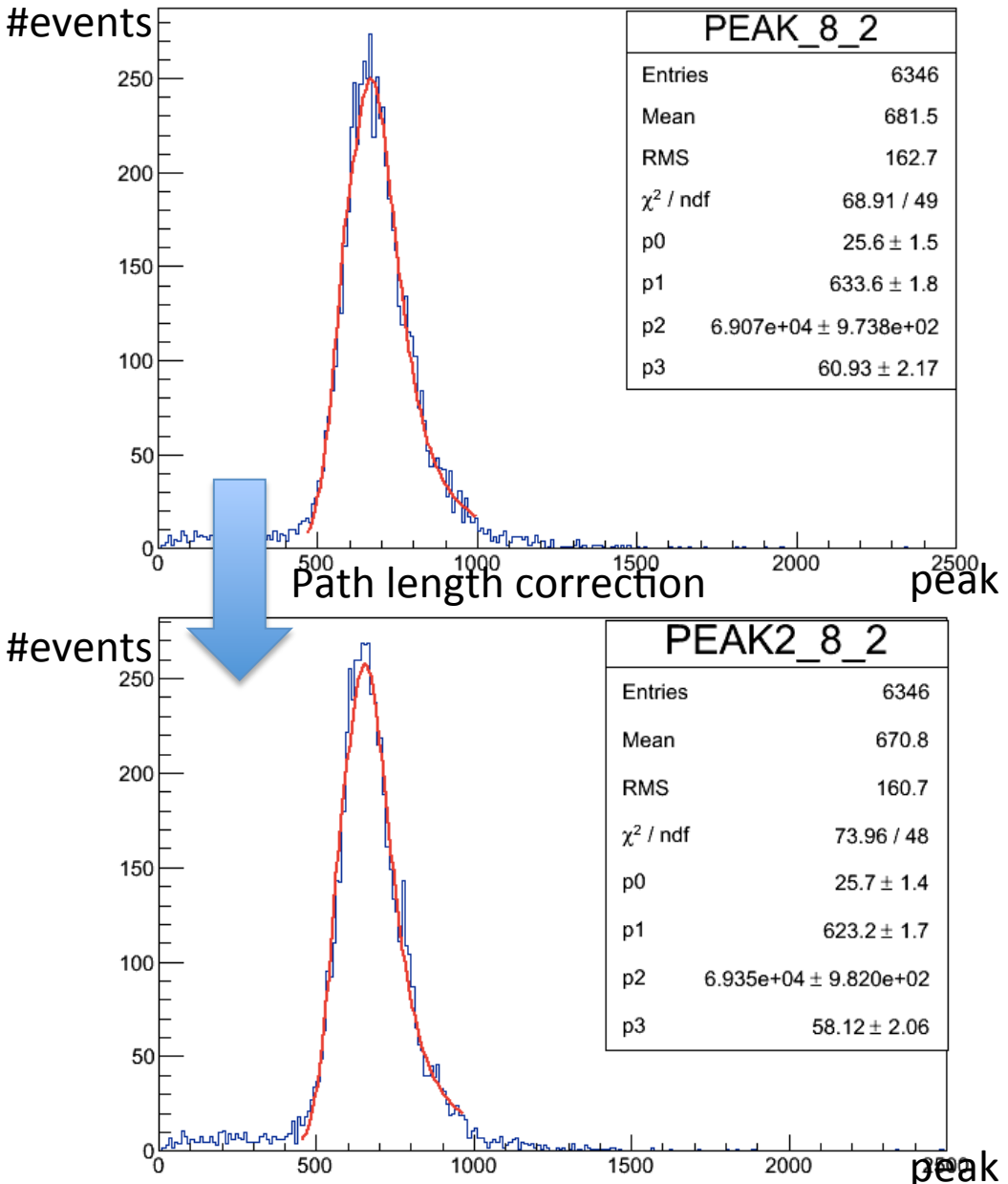




- Cosmic ray track from two cosmic counters
- Only 2hit event in inner barrel.
- Reconstructed cosmic ray position on boundary of inner barrel

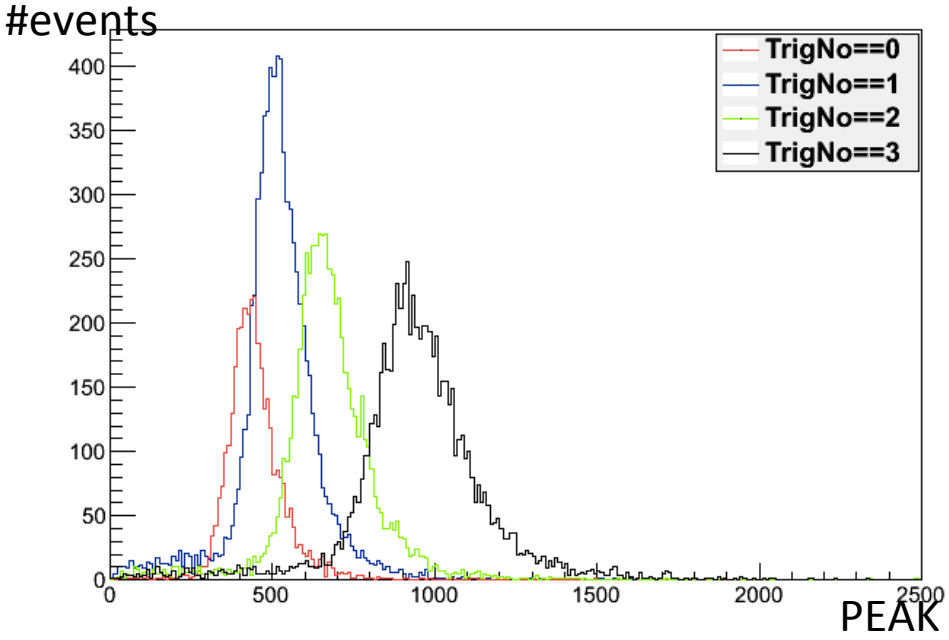
ADC spectra

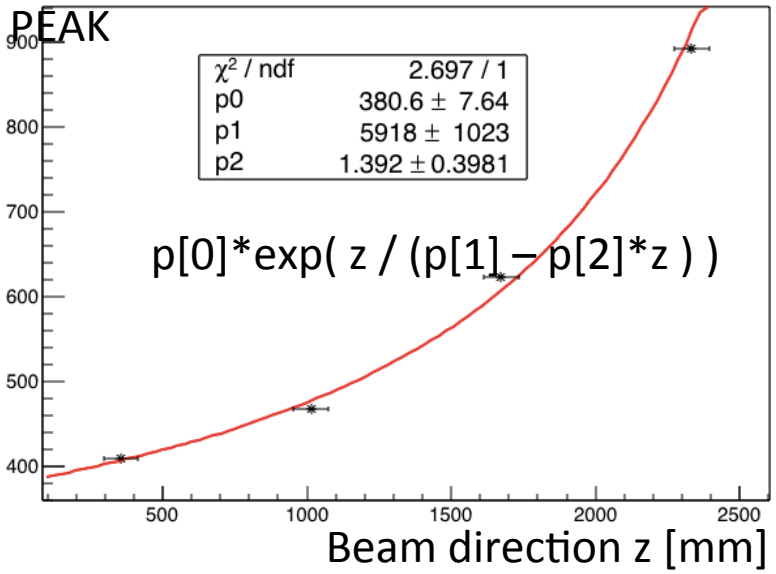
- Fit Function
  - Landau-gaussian convolution distribution.
- Path length normalization
  - ADC normalization with regard to path length of cosmic ray



Attenuation

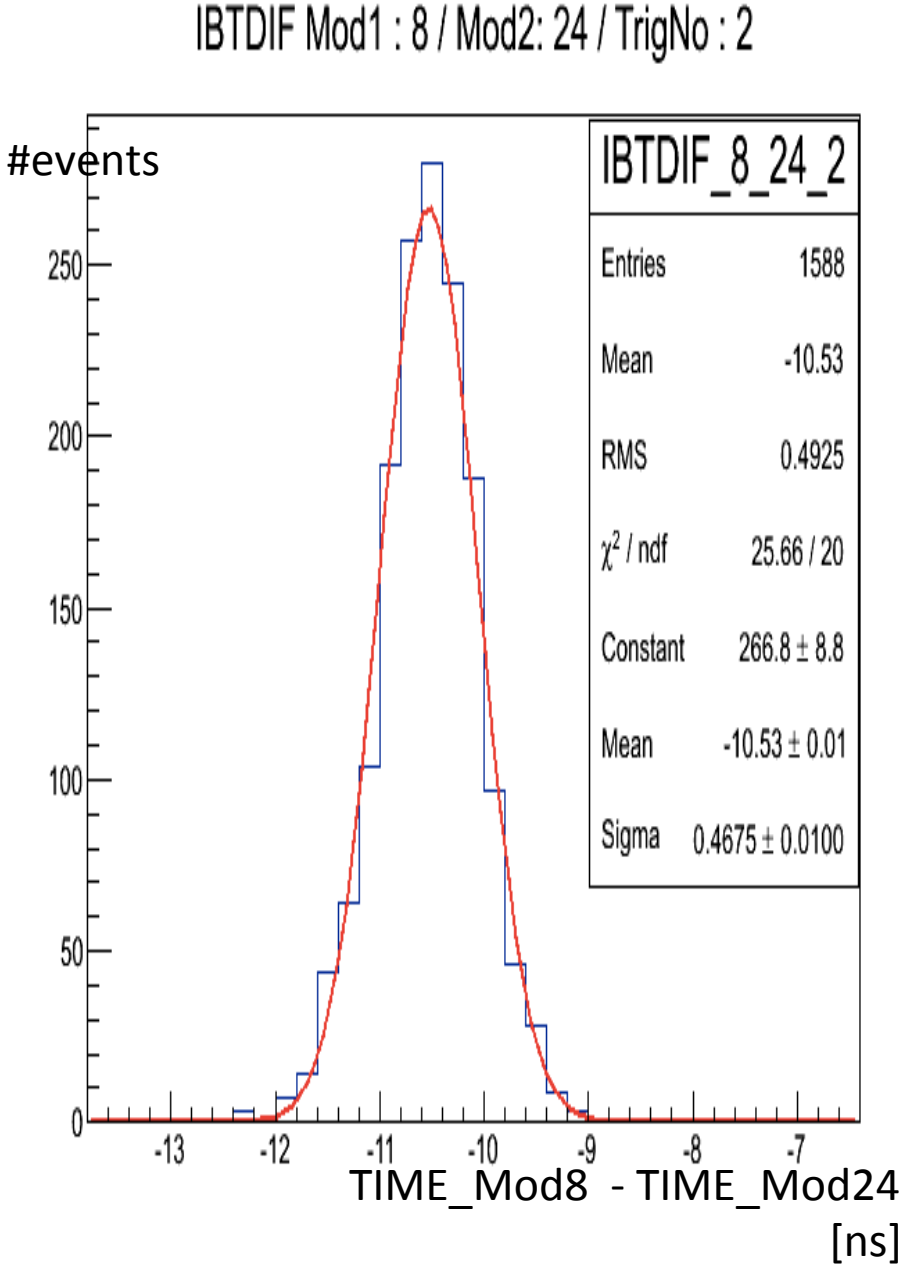
- Fit function
  - Effective exponential function (empirical)
- Only 4 data point
  - For each cosmic counter



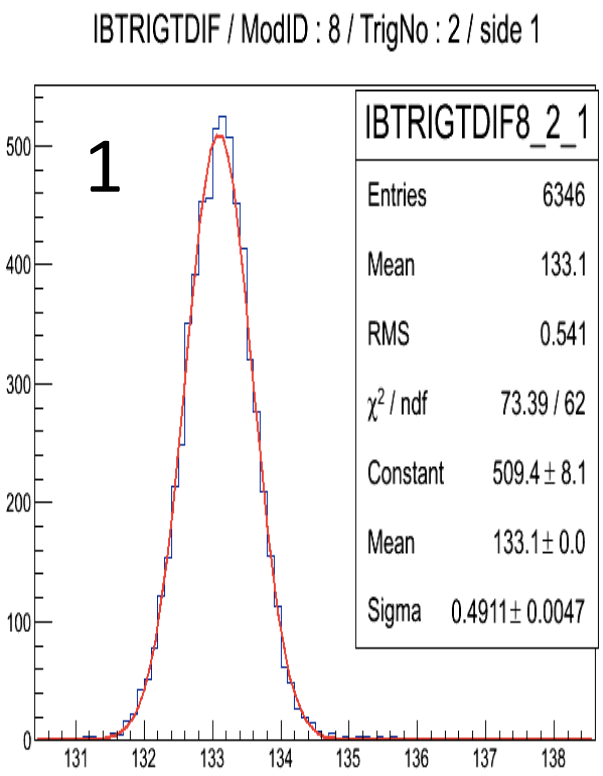


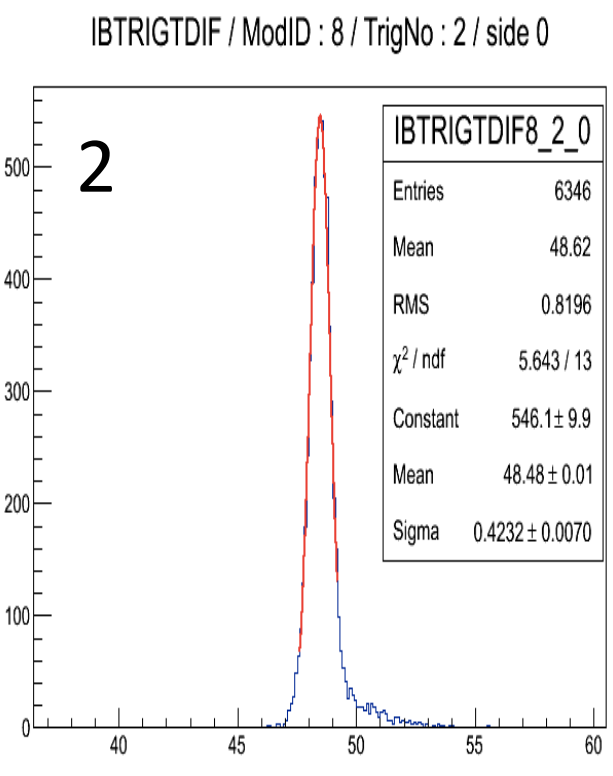
Timing resolution

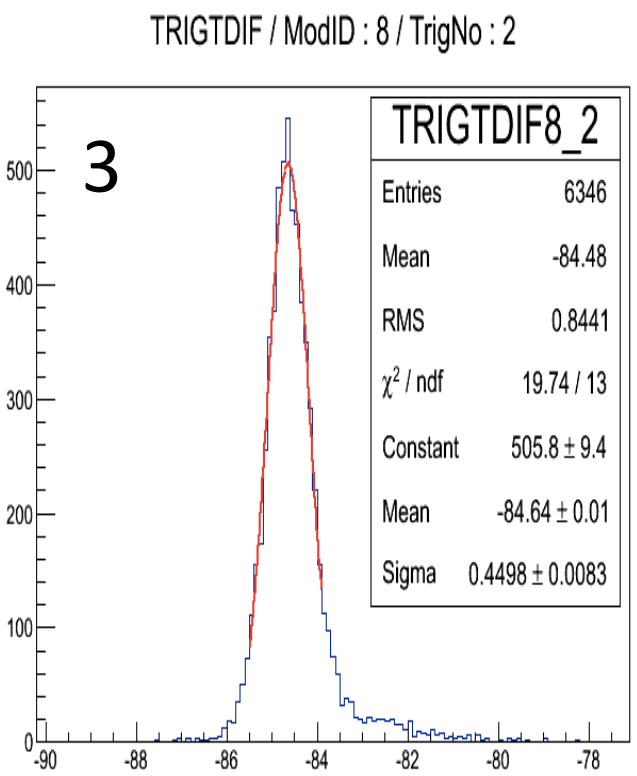
- Approximate
  - Timing resolution is almost same for all inner barrel module
- 2sigma^2 = 0.4675^2
  - Timing resolution : 0.3306 [ns]



Timing resolution 2







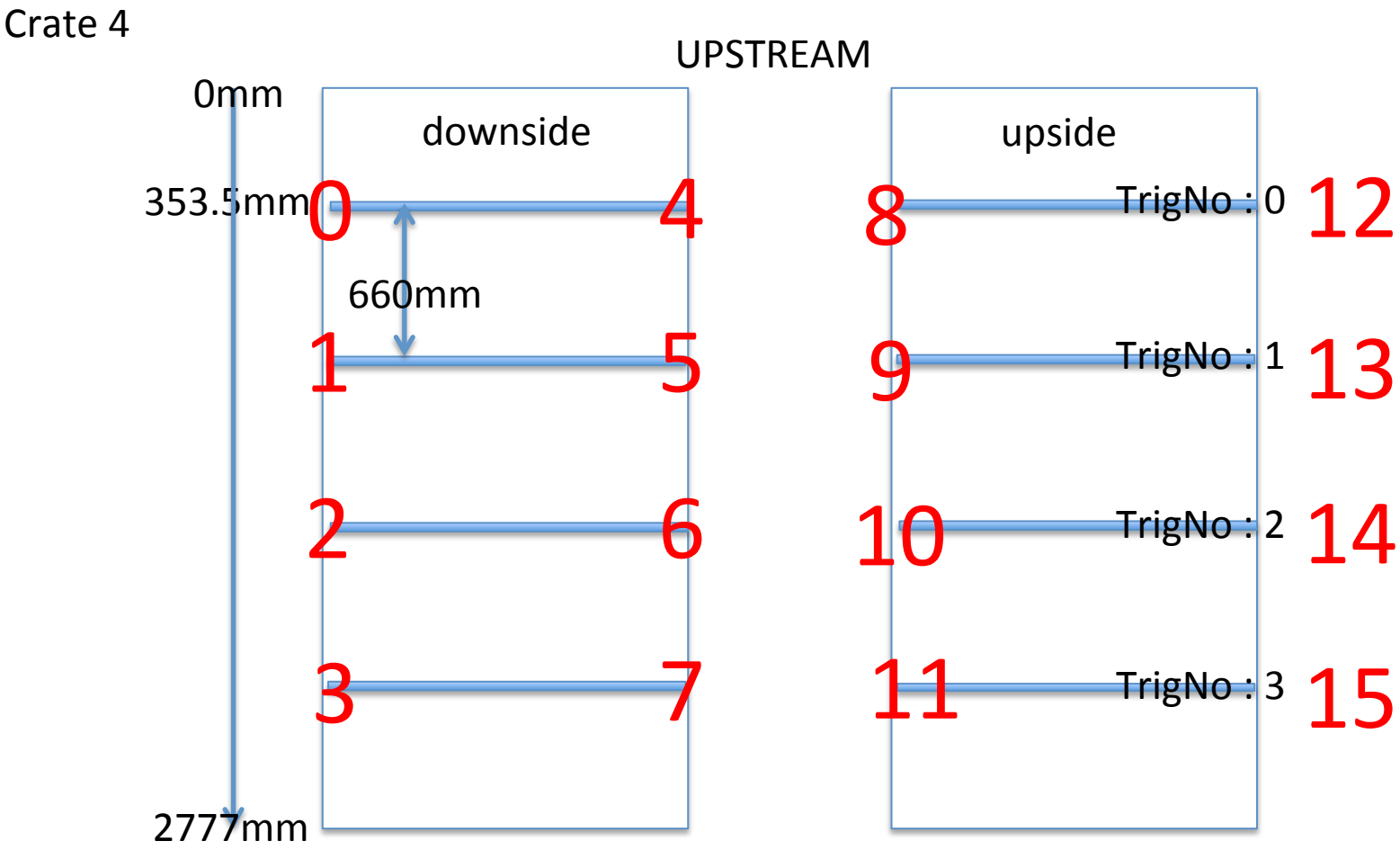
- 1) Upside cosmic counter – inner barrel
- 2) Inner barrel – Downside cosmic counter
- 3) Upside cosmic counter – Downside cosmic counter
  - Inner barrel timing resolution : 0.3301 [ns]

result

- Check MIP for possible module
  - PMT broken modules : 4, 9, 12, 15
  - Need to arrange HV for gain matching
- Check attenuation effect
- Get timing resolution @ MIP
  - 0.33ns

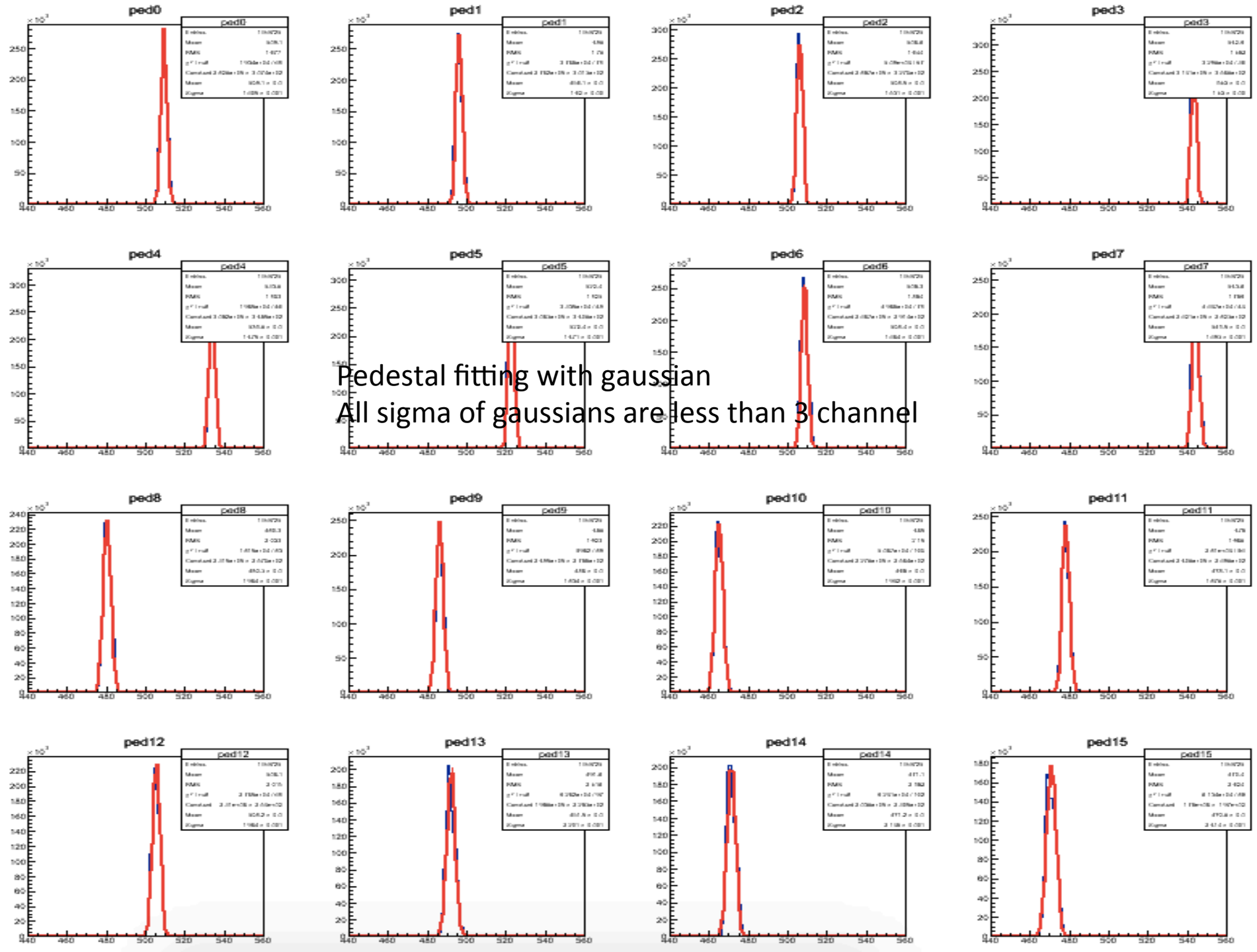
backup

Trigger PMT assignment



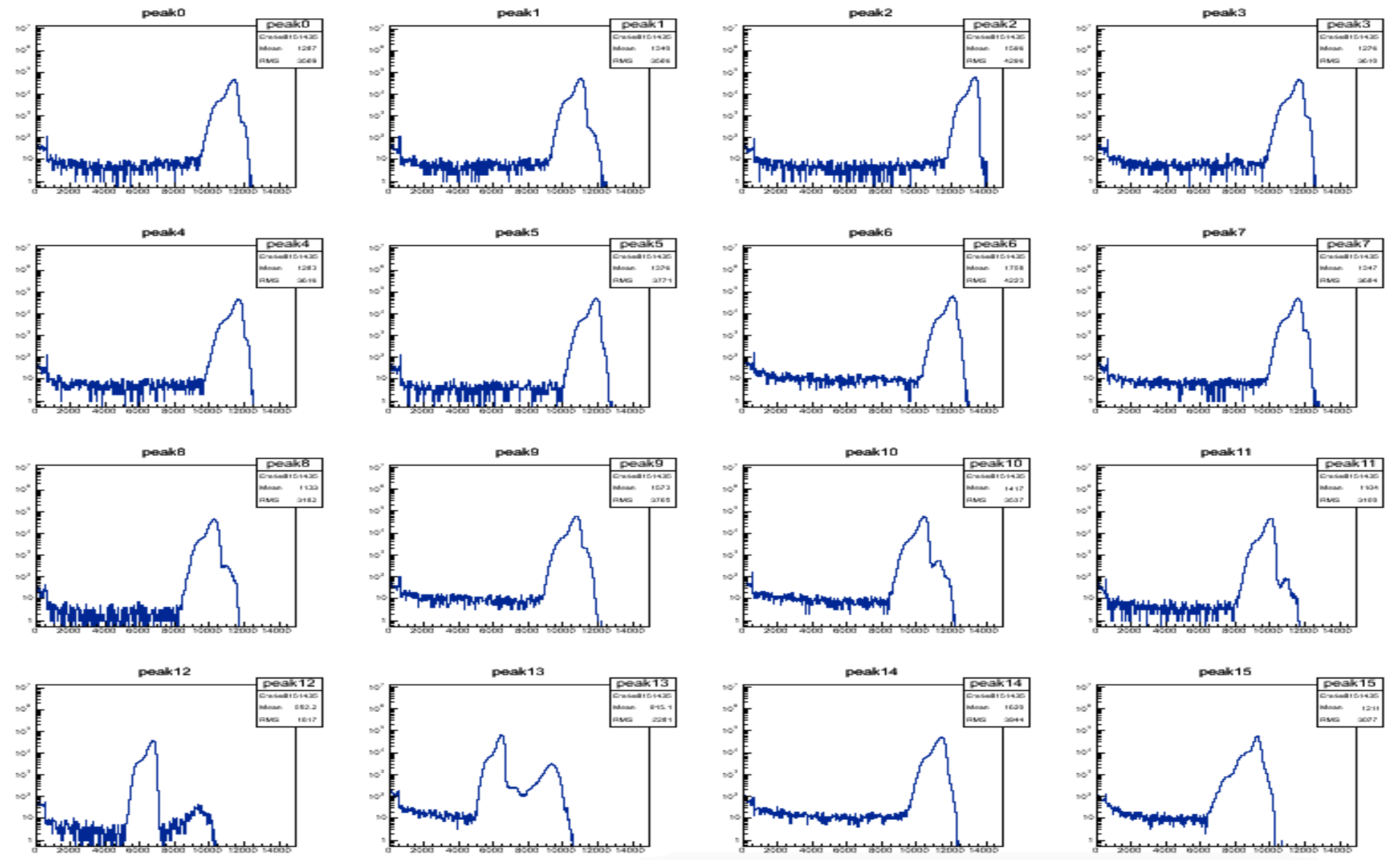
Inner barrel PMT assignment

- 0~31 : Downstream PMT
- 32~63 : Upstream PMT
- 36, 41, 44, 47 PMTs are broken
- Crate0~3

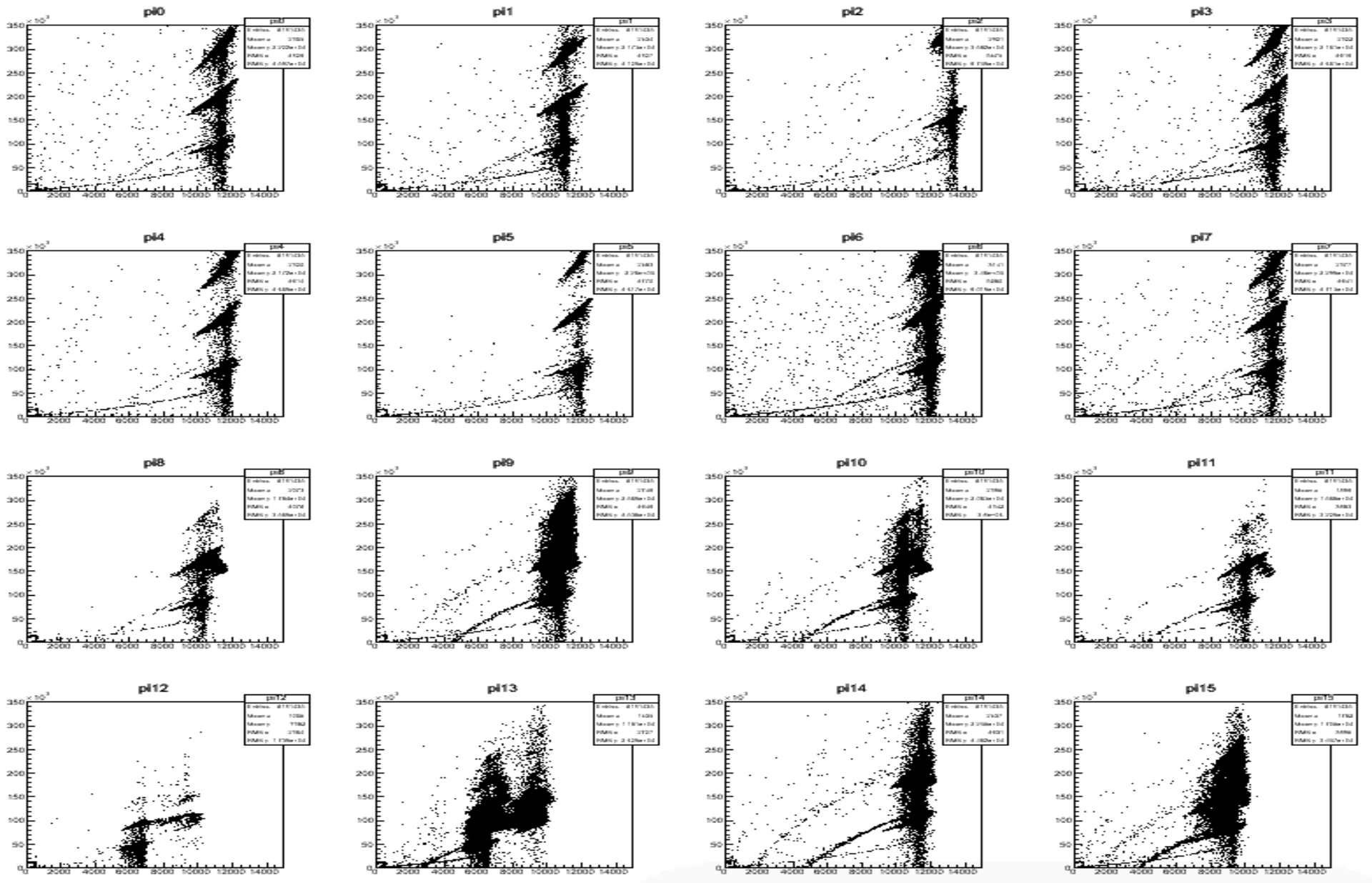


Pedestal fitting with gaussian

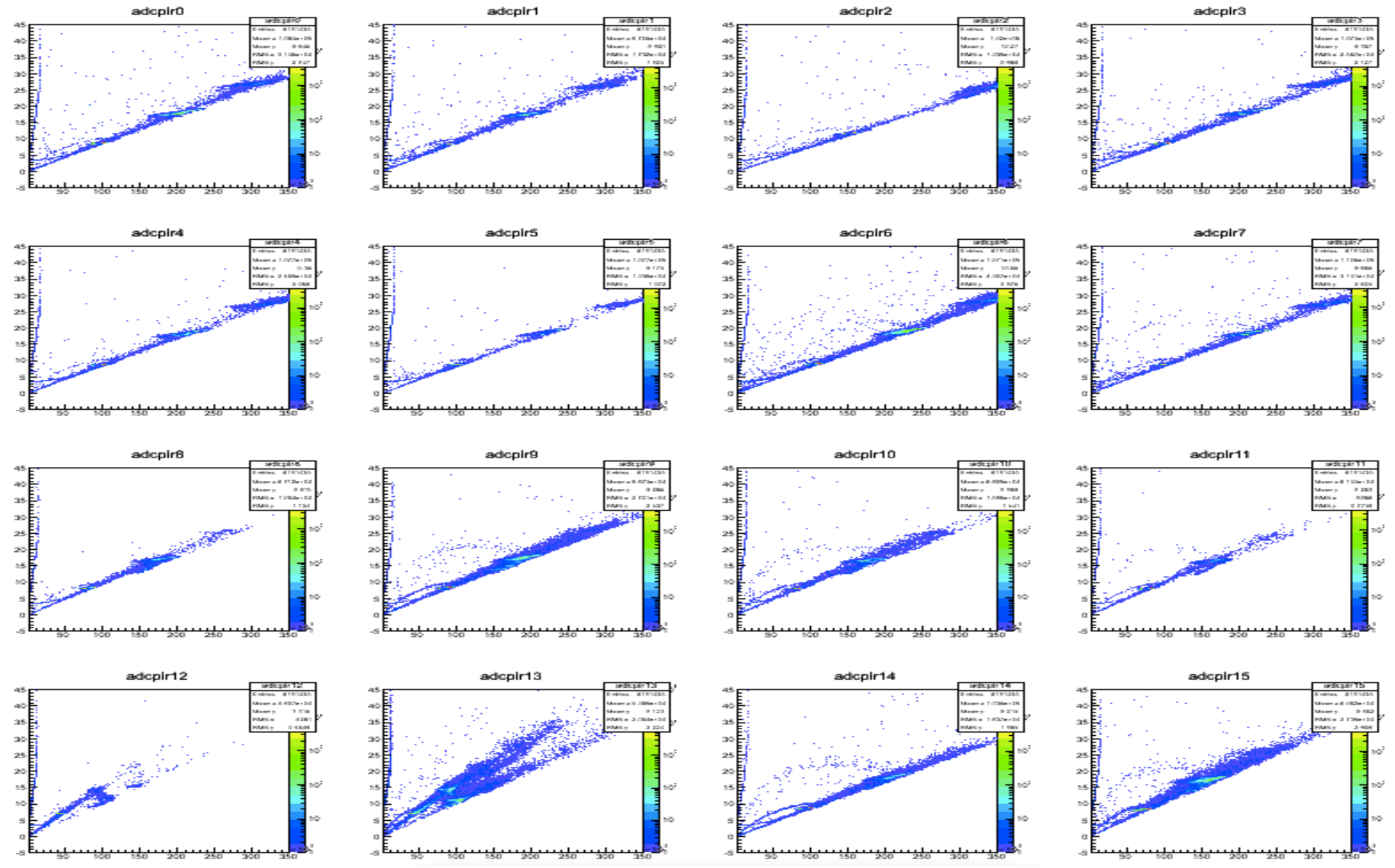
All sigma of gaussians are less than 3 channel



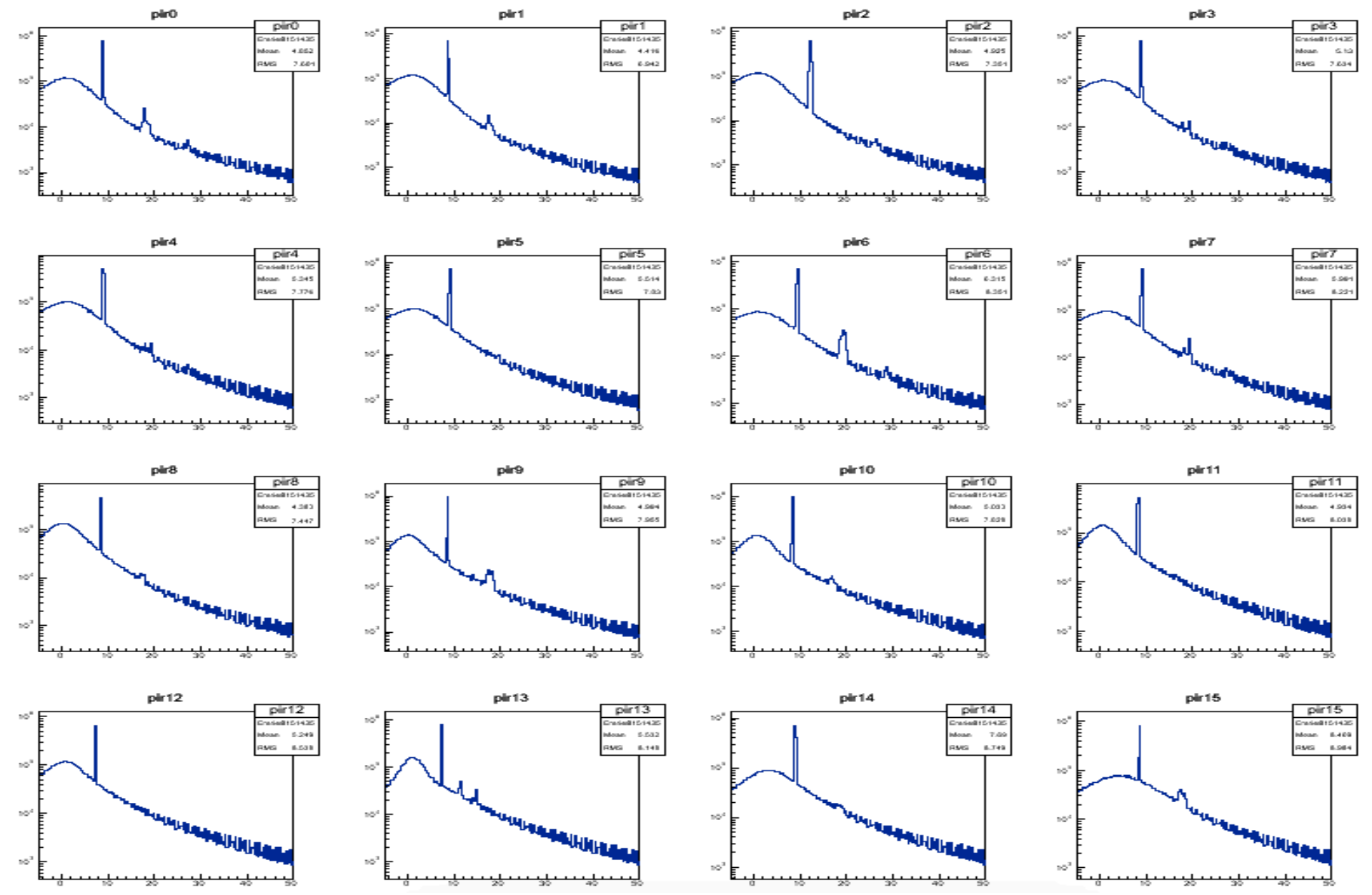
- Peak distribution (x-axis : peak, y-axis : # events)
- Ch12, ch13 have wired distribution,
  - Just select peak which has smaller value.



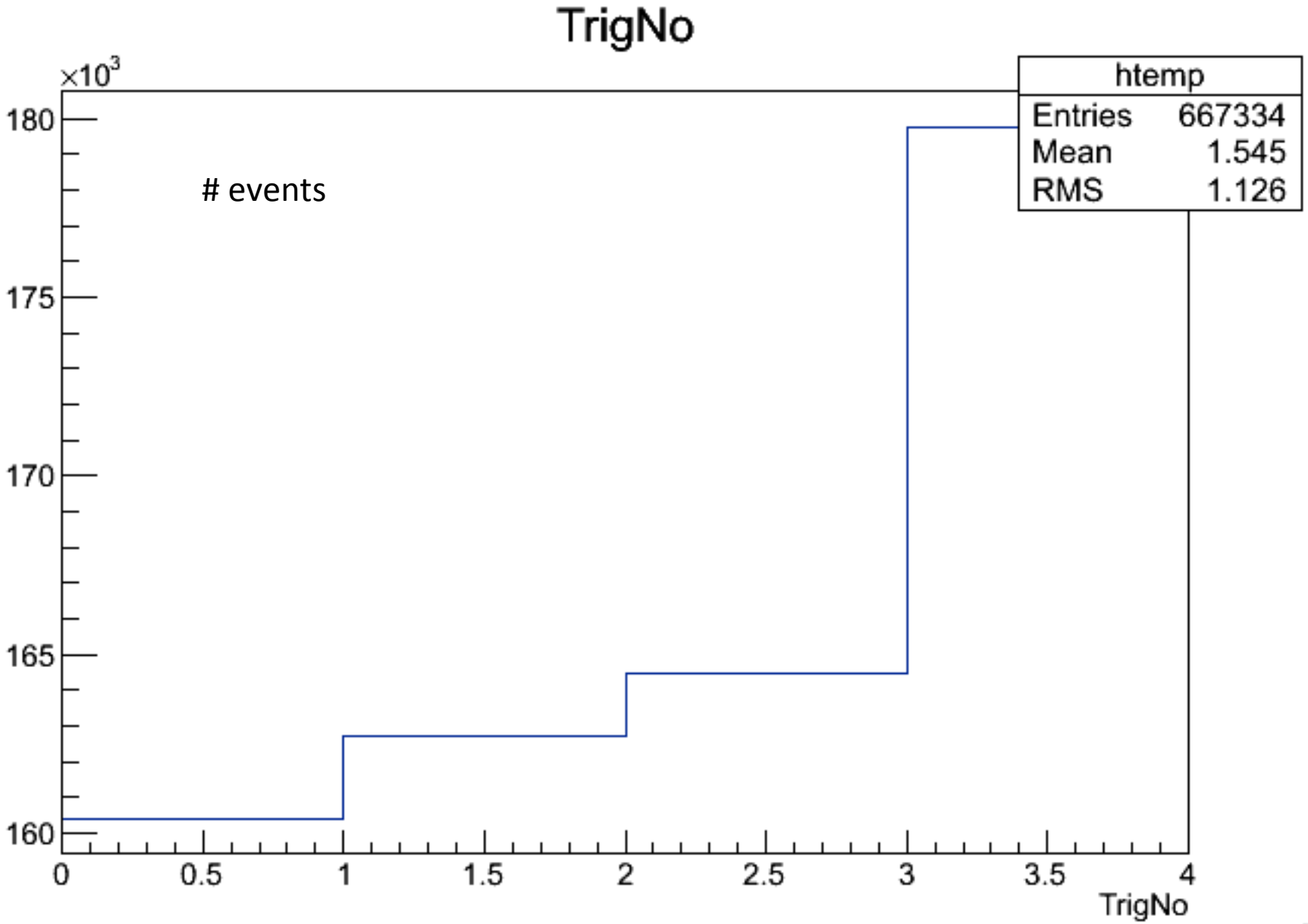
- Peak vs IntADC(x-axis : peak, y-axis : IntADC)
- Same peak with different ADC -> # of signal?
- Same ADC with different peak -> ??



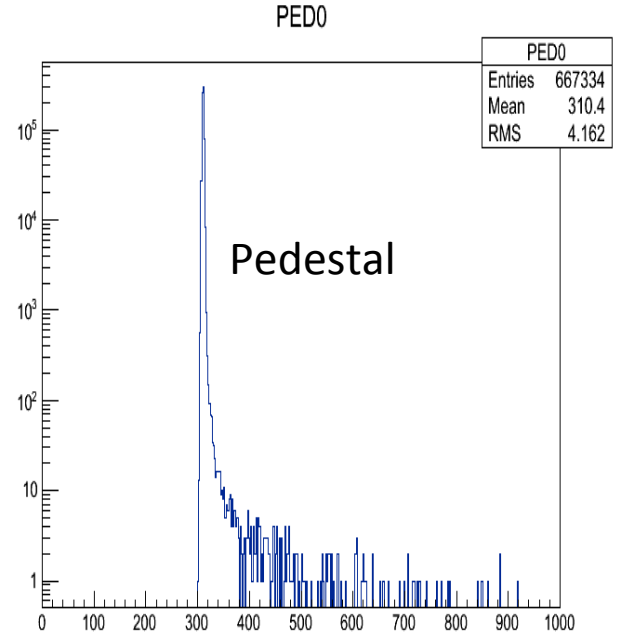
- X-axis : adc, y-axis : adc/peak

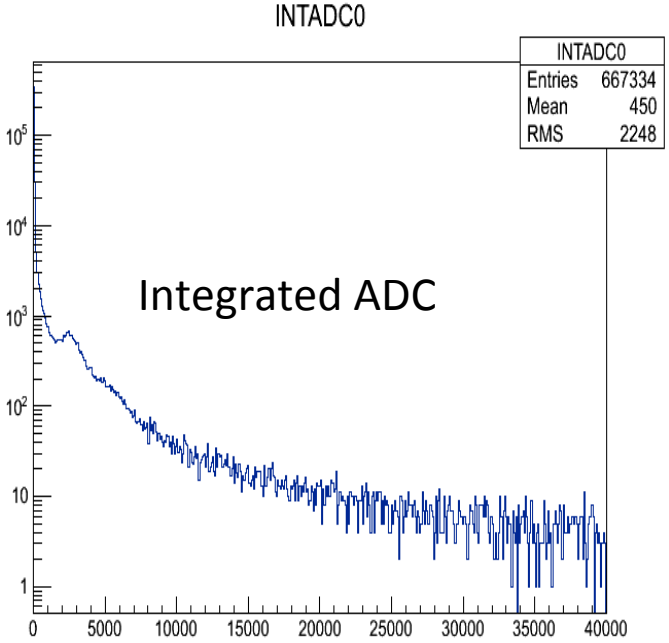


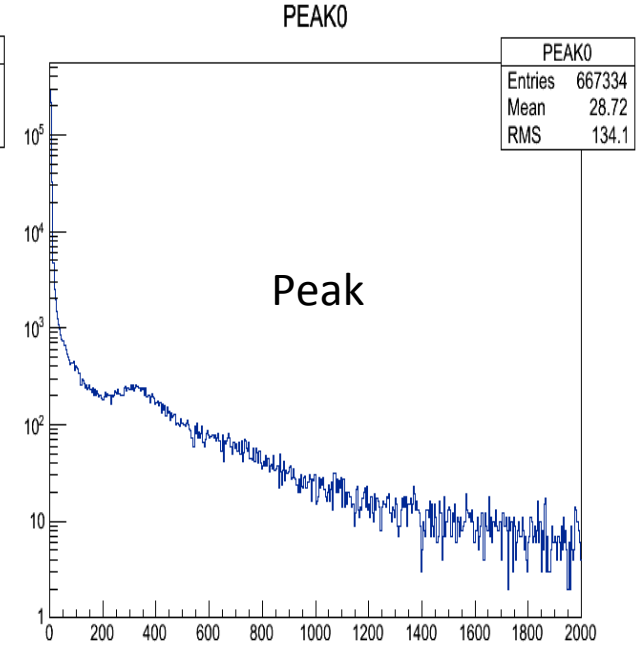
- IntADC / peak distribution (x-axis : peak, y-axis : #events)
- For ch13, there is unusual peak(same ADC with diff. peak)
- Select intADC/peak

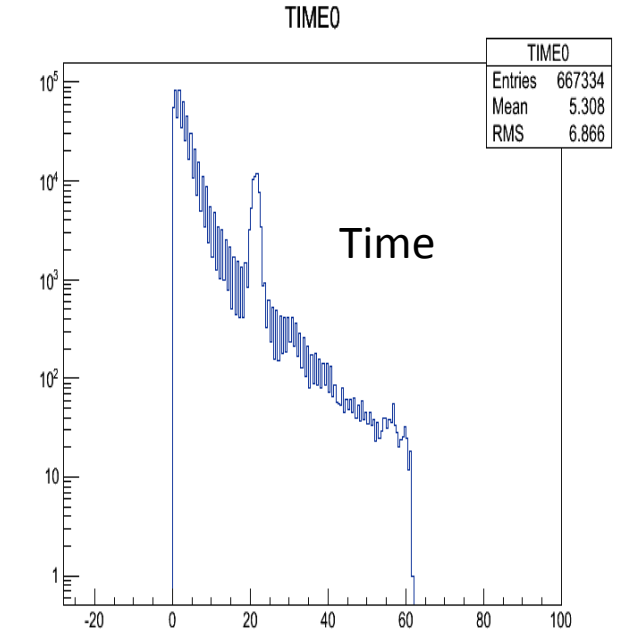

TrigNo
htemp
Entries 667334
Mean 1.545
RMS 1.126
events
×10^3
180
175
170
165
160
0
0.5
1
1.5
2
2.5
3
3.5
4
TrigNo

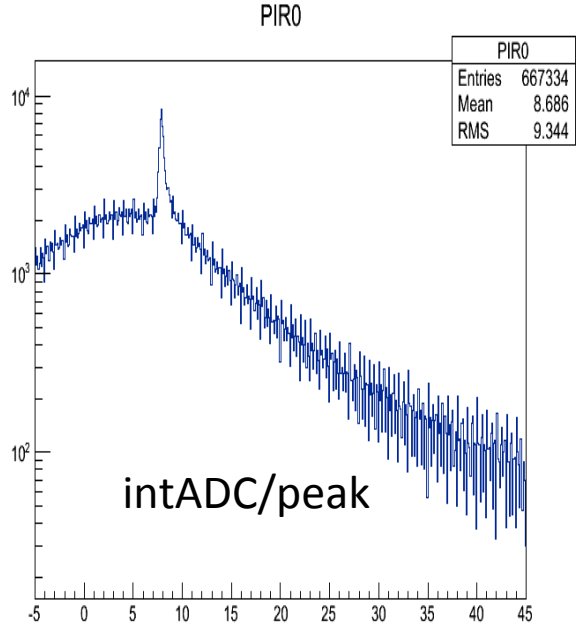
IB event selection (ch0)







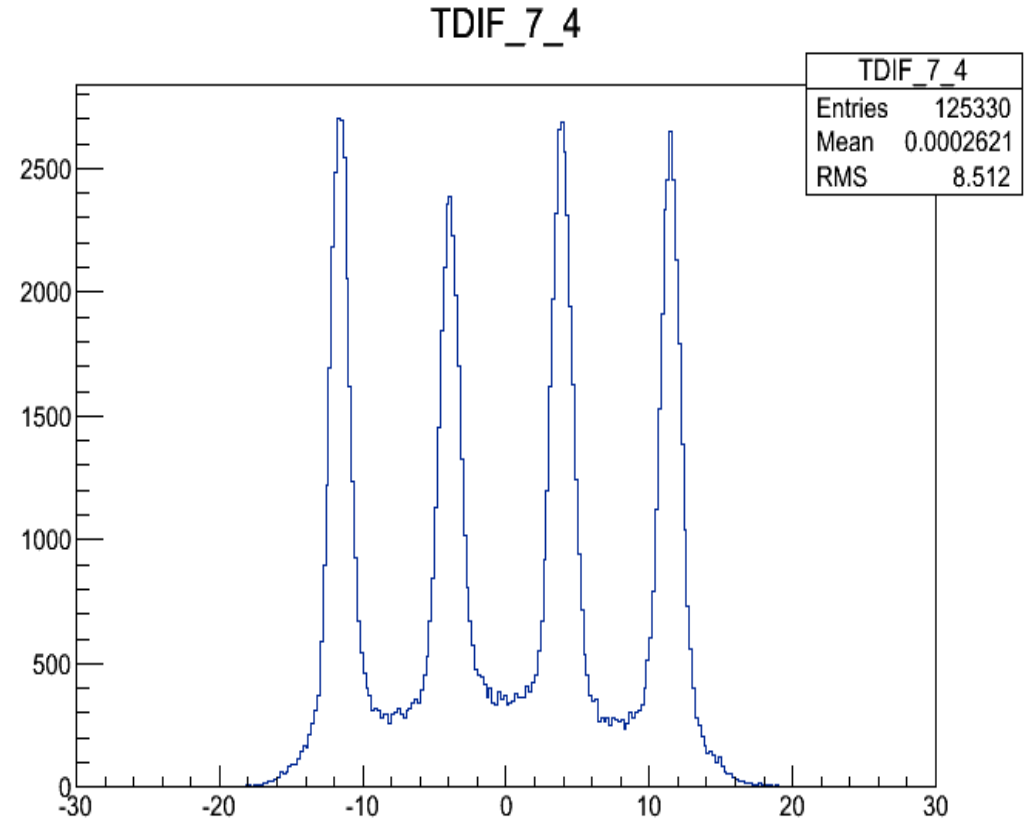




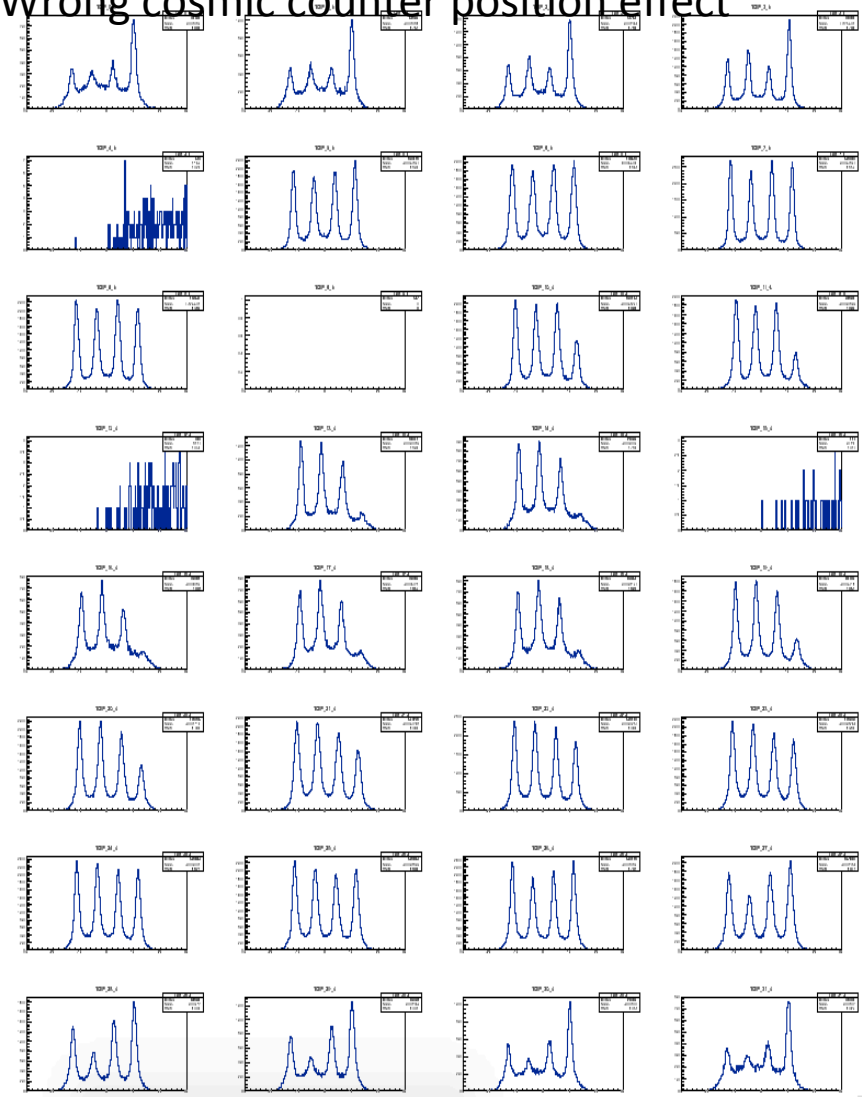
Pedestal : stable
IntegratedADC. Peak : there is MIP peak
Time, intADC/peak : variables to select real cosmic ray event

TDIF distribution (after correction)

Inner barrel data

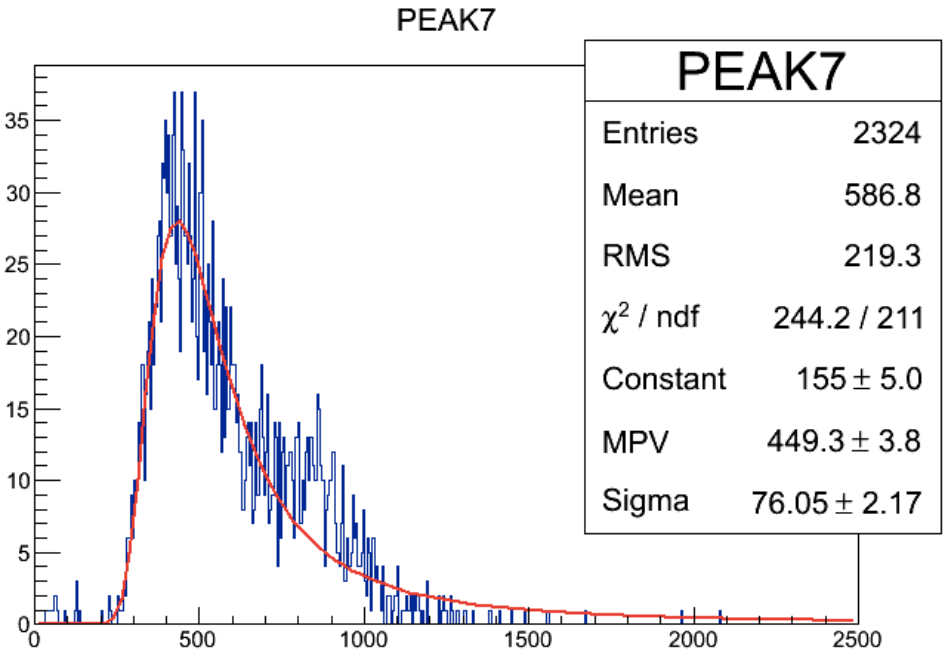


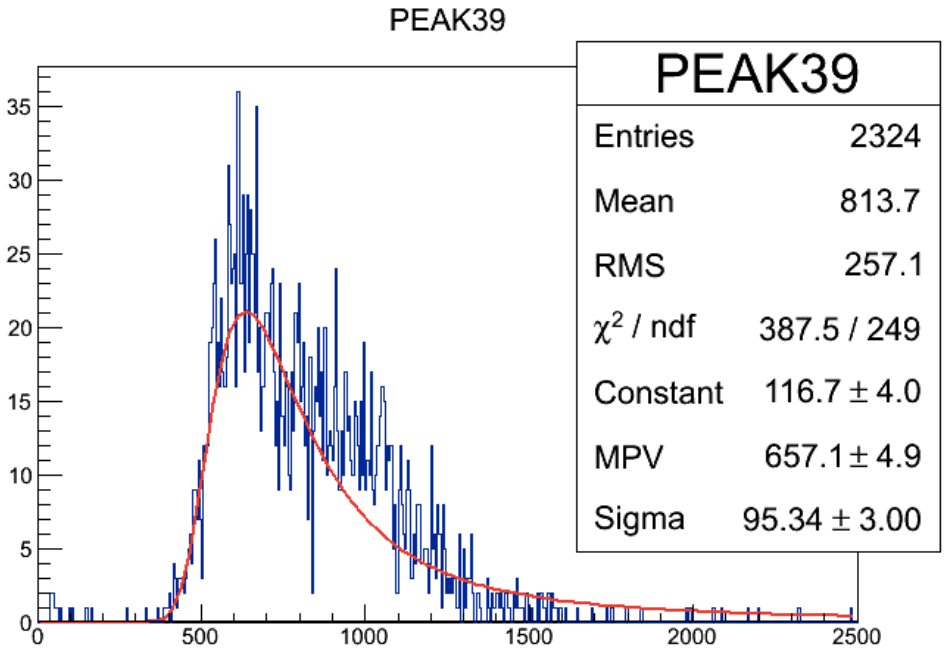
Wrong cosmic counter position effect



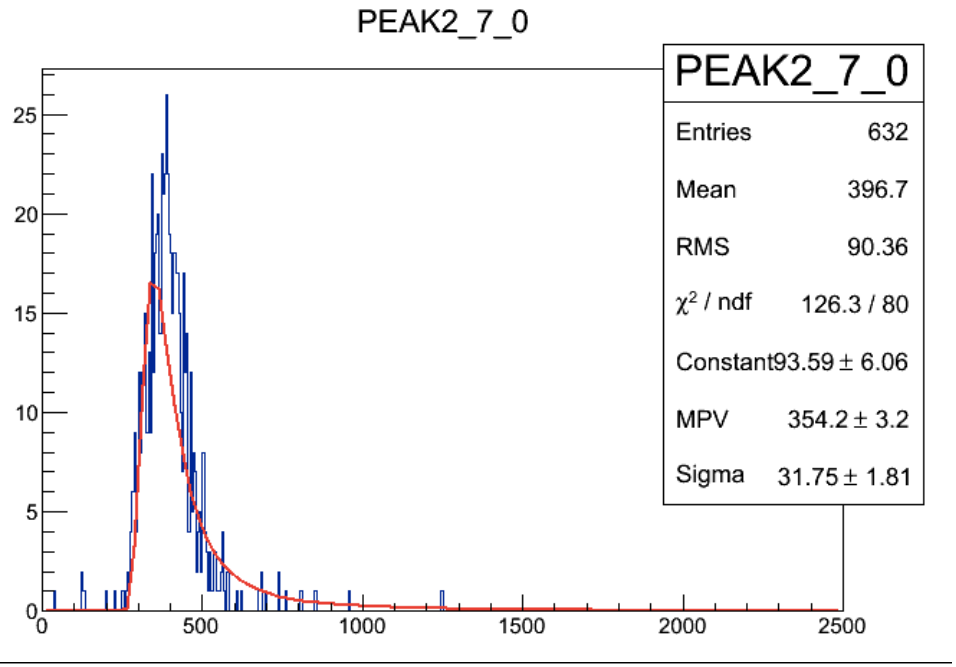
PMT 36, 41, 44, 47 are broken

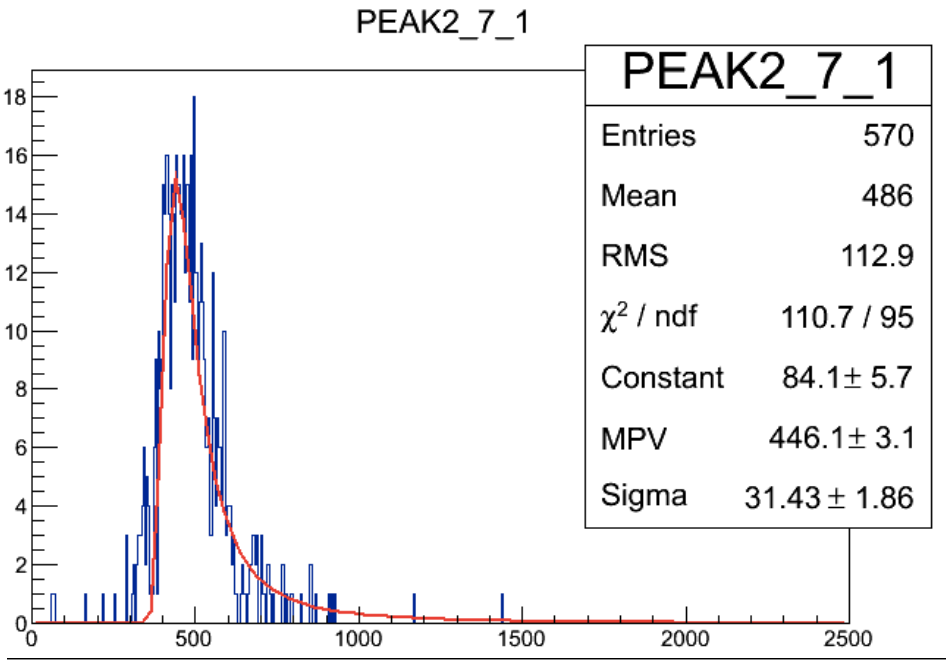
ADC spectrum

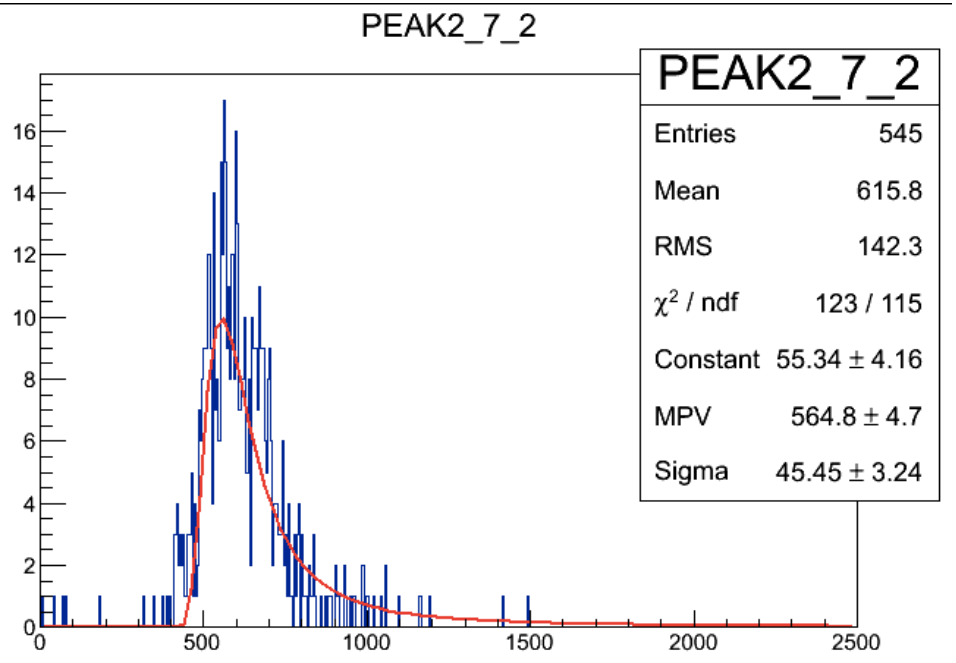


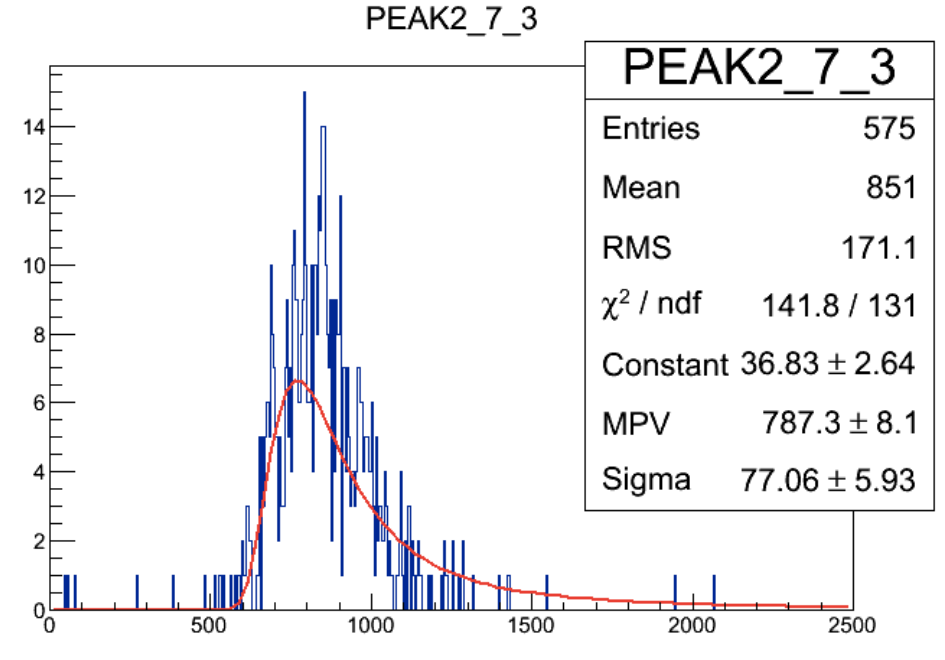


For each trigger position (attenuation)

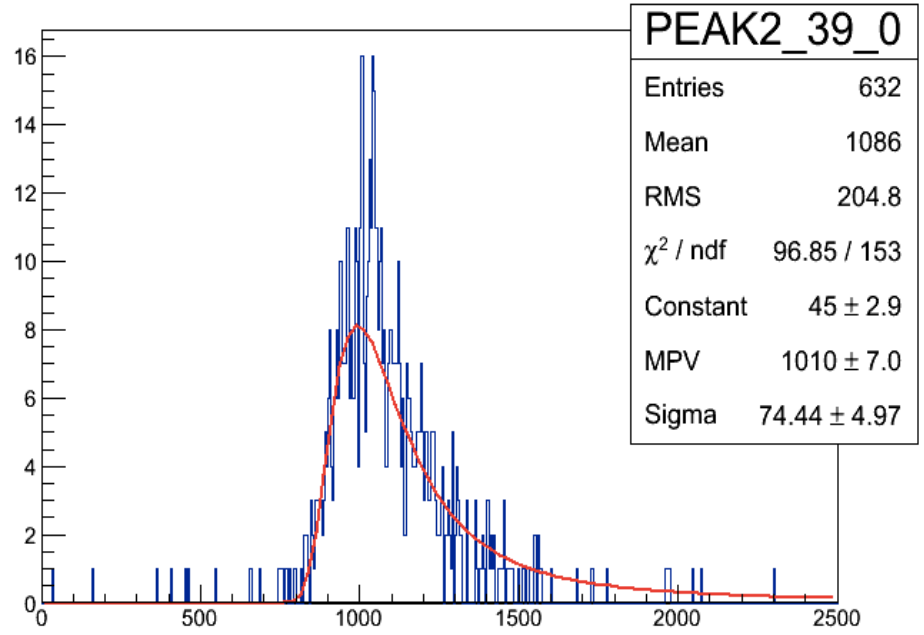




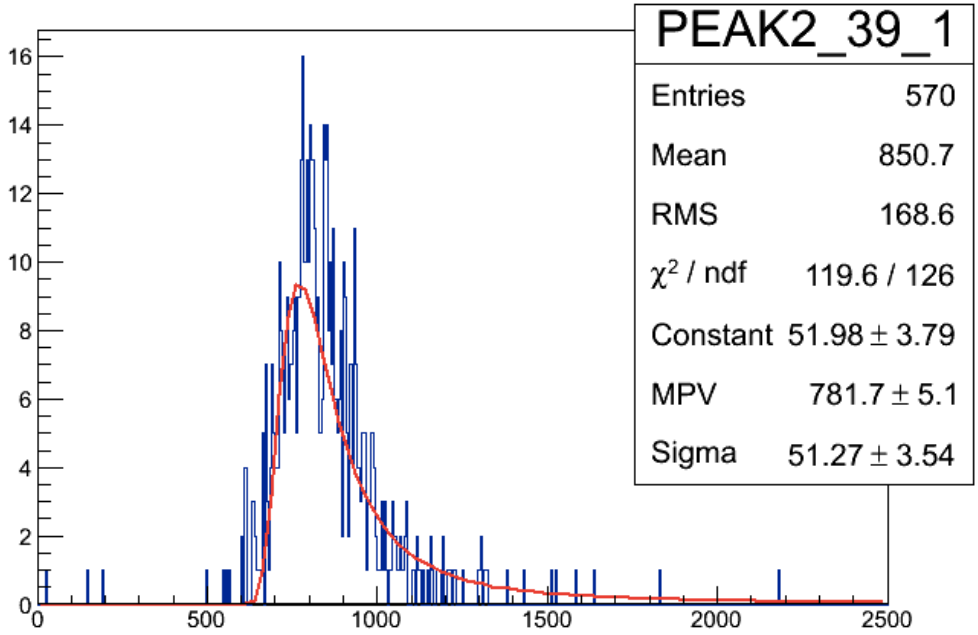




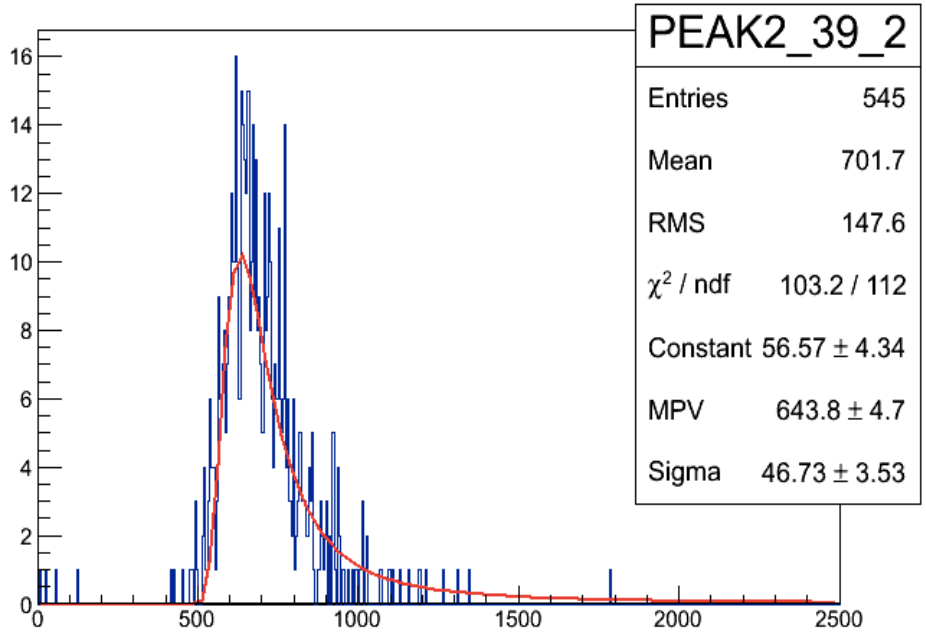
PEAK2_39_0



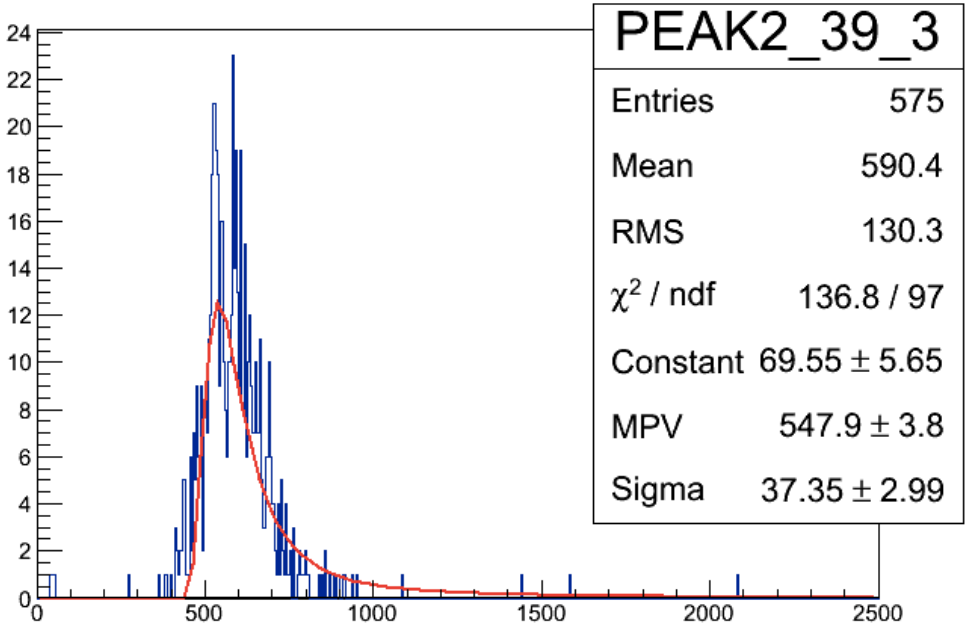
PEAK2_39_1



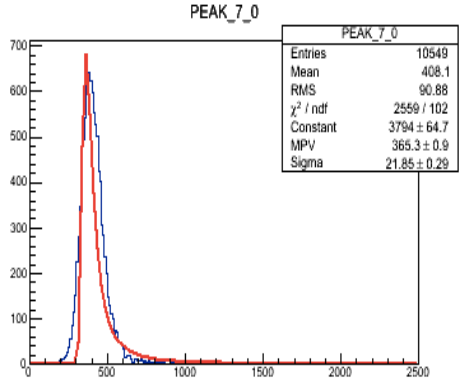
PEAK2_39_2

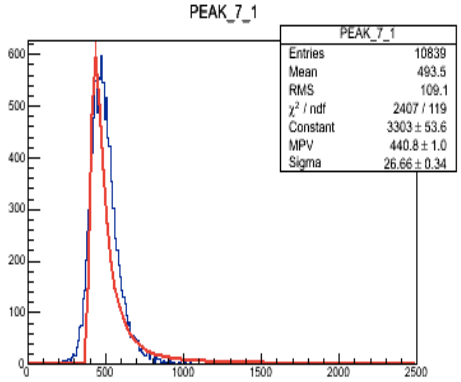


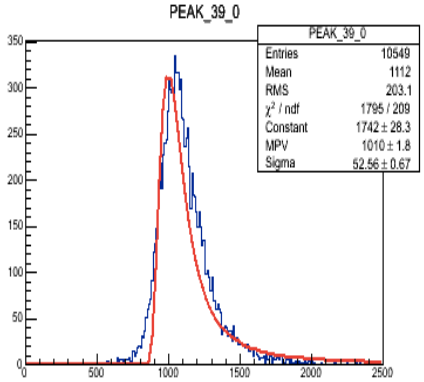
PEAK2_39_3

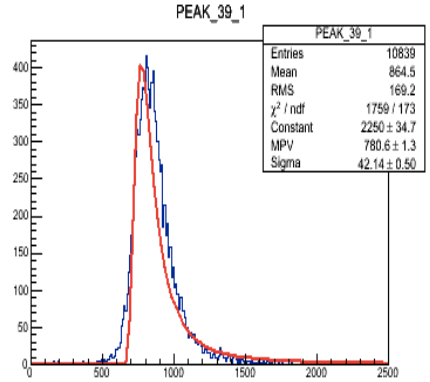


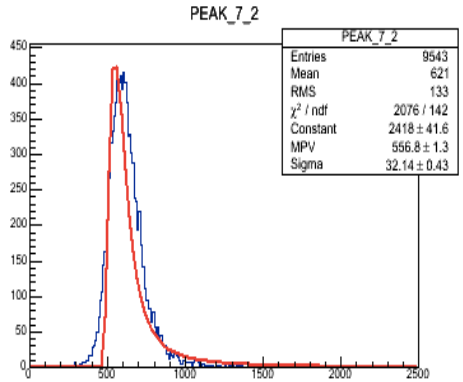
Attenuation check, curve

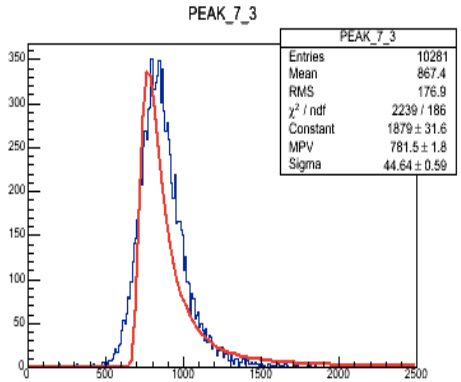


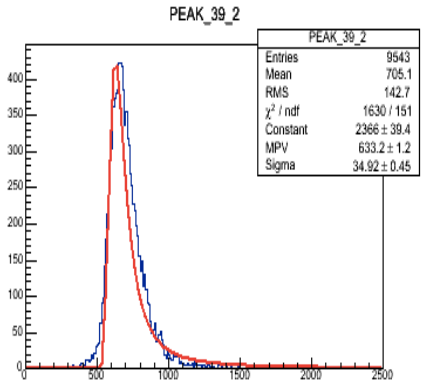


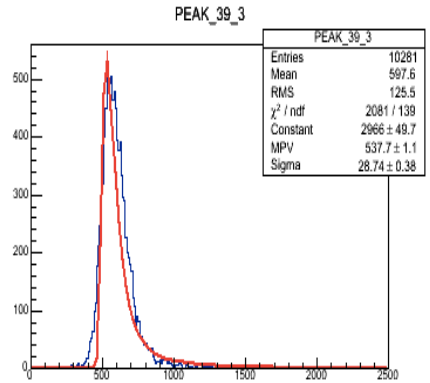


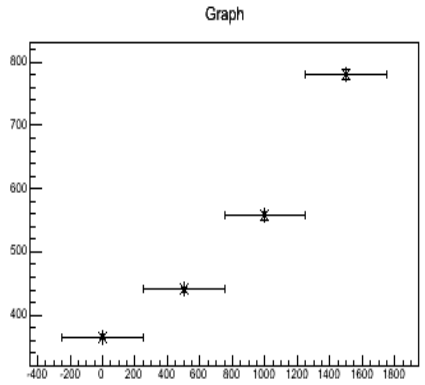


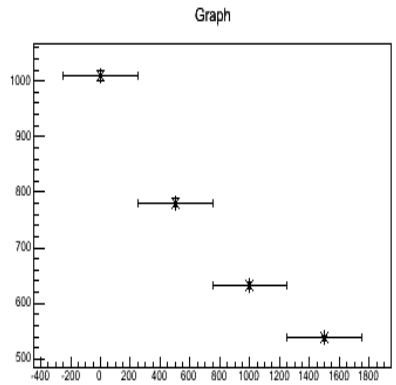






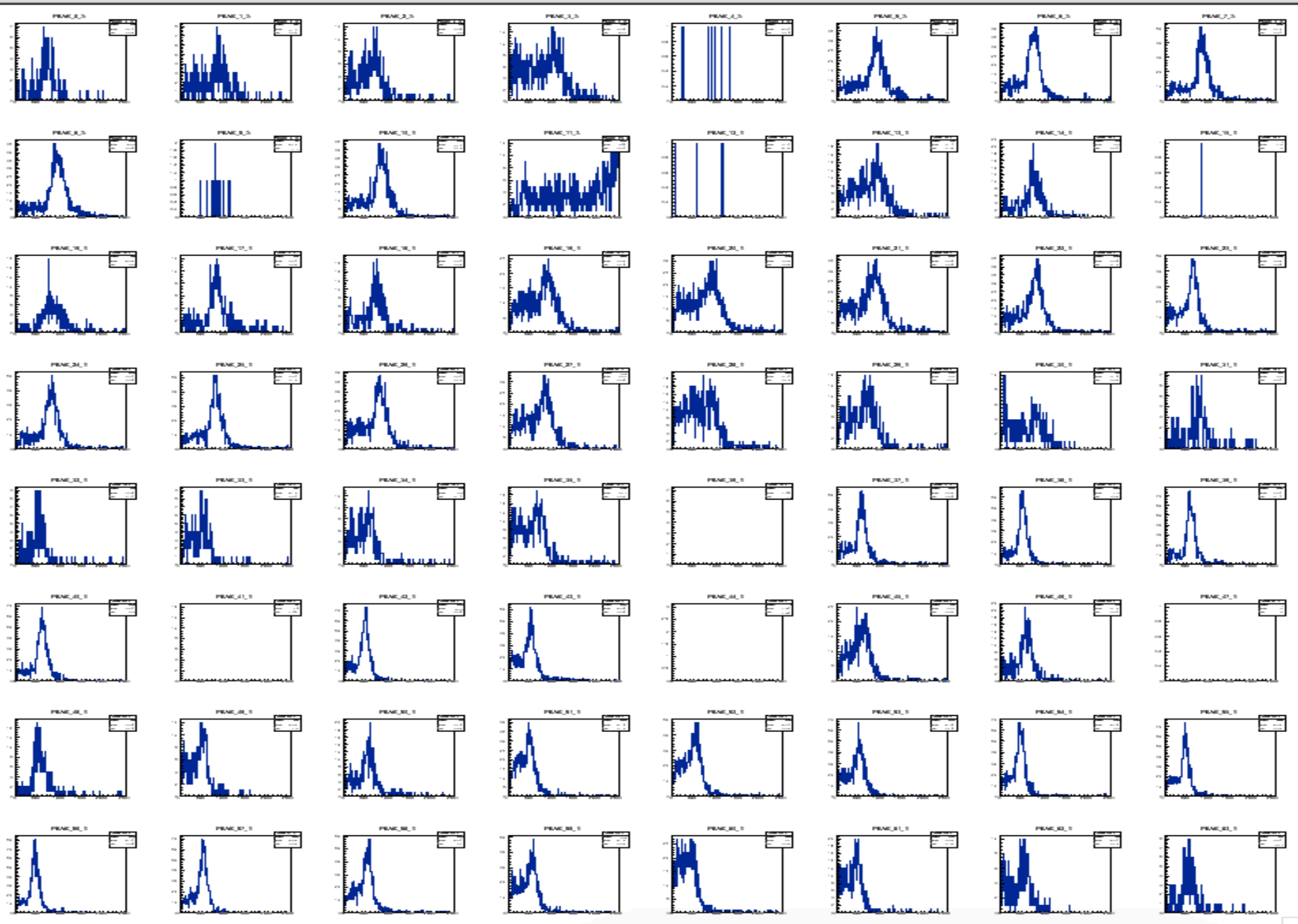






c3

File Edit View Options Tools Help



c2

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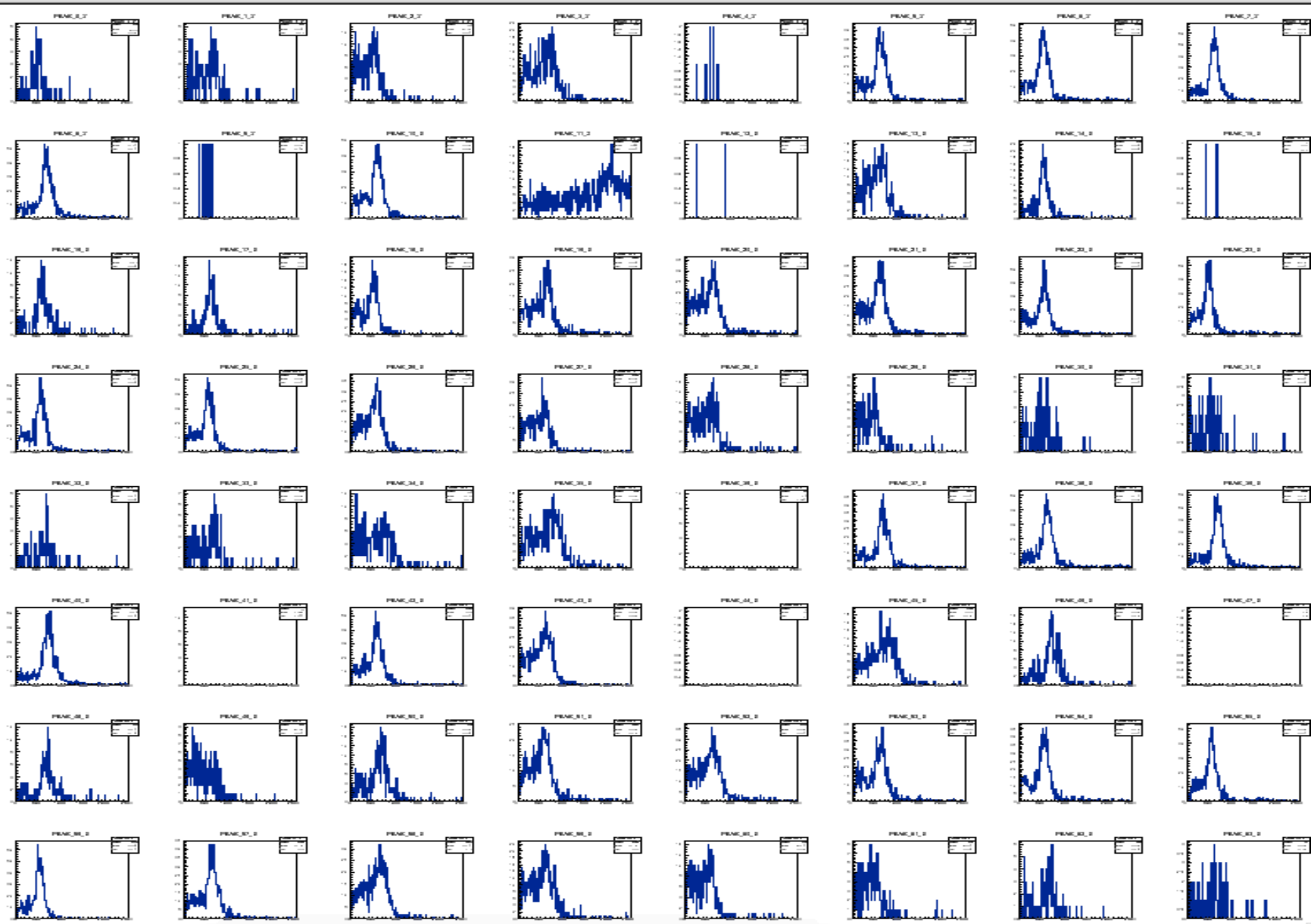

c1

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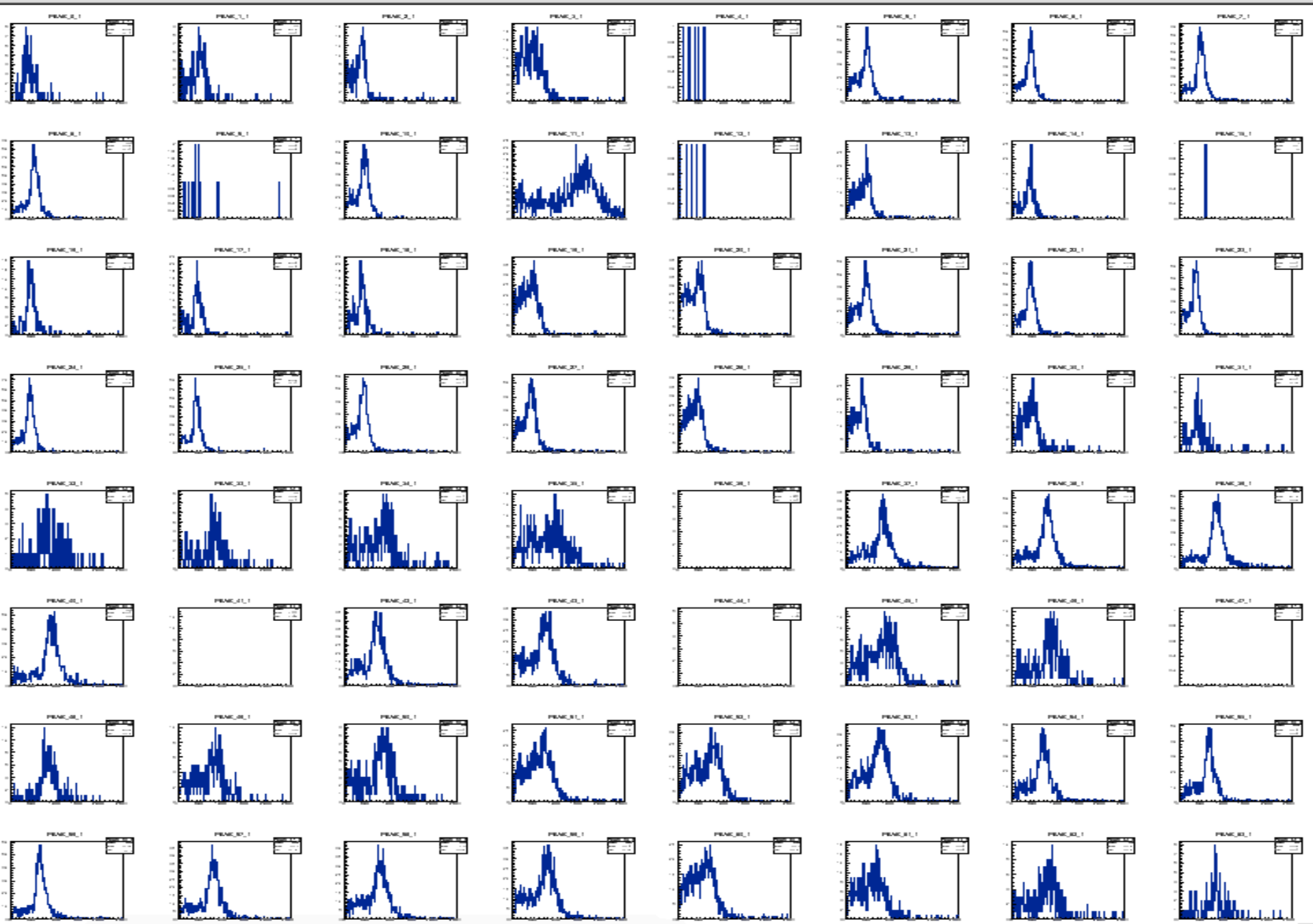
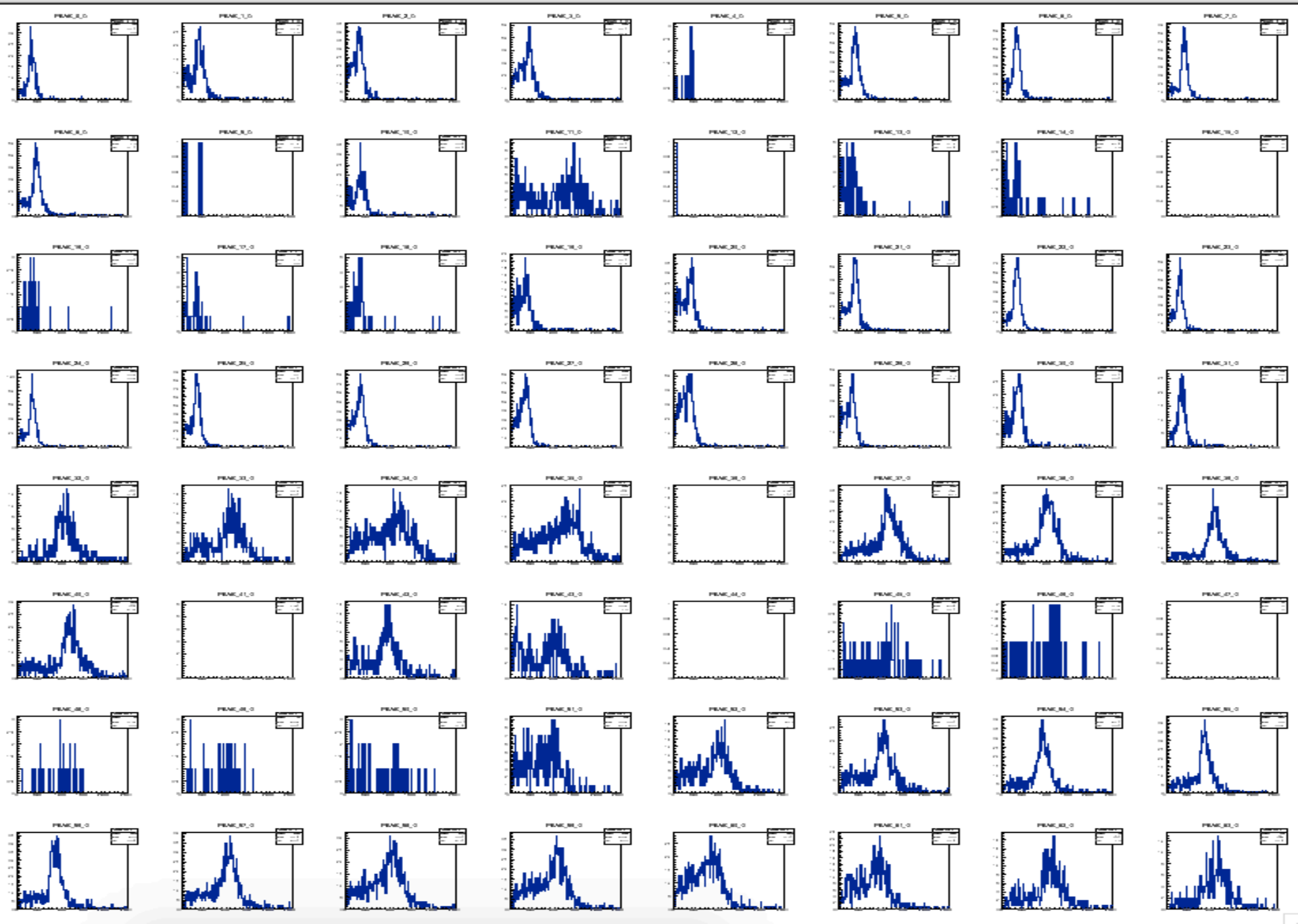


c0

File Edit View Options Tools Help



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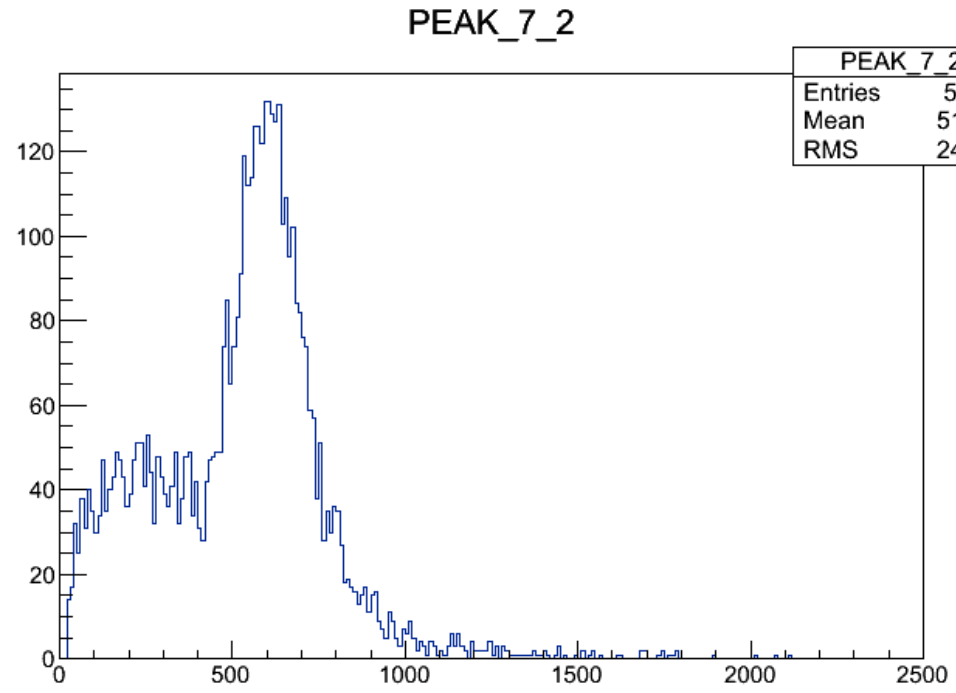

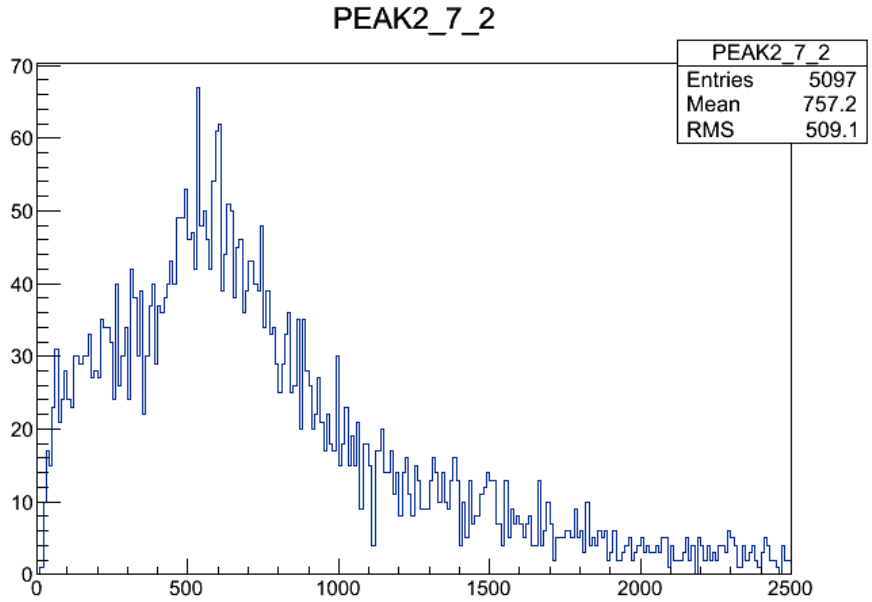

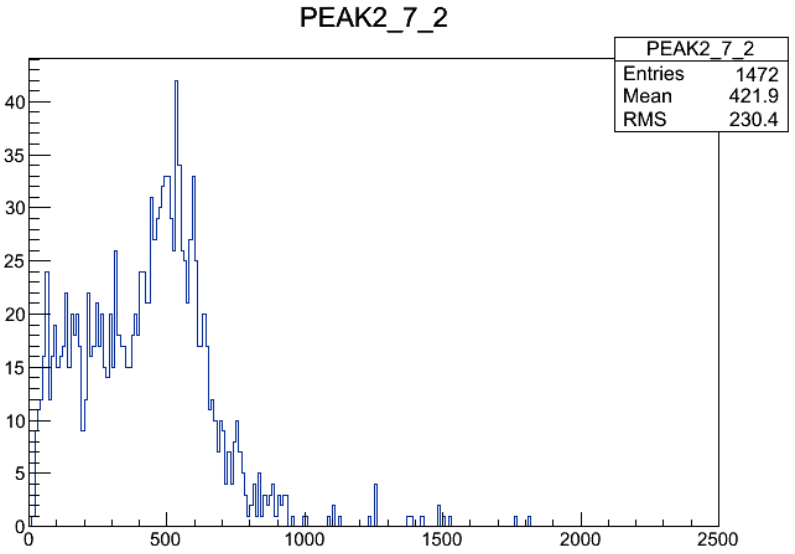

nHIt==2 is best