

PID @ PAB

How I Learned To Stop Worrying and Love Acronyms

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Goals

- Use Pulse Shape Discrimination to do Particle Identification (PID)
- Alphas and cosmics can be distinguished from pulse shape (look at peak amplitude vs tot charge)
- More on this here: <http://arxiv.org/abs/1306.4605>

What are we looking at?

- Remove events where we saturate
- Look at events with 1 trigger in window
- Peak: max per waveform (baseline subtracted)
- Area: sum (ADCs-baseline) for # of bins wanted

What parameters did we explore?

- All 3 different splitters: 10, 20, 30 nF
- HG and LG
- Time-window for integration:
 - 23 bins = 360 nano sec
 - 210 bins = 3.28 micro sec

No HG here: same results except a lot of events get saturated...but can make the plots!

Separating alphas from cosmics

- My “cut” is very crude: find a straight line that seems to separate the two groups of points well.
- Units used: Max Amp in PE
Area in PE x # time ticks (time tick = 15.625 ns)
- In following slides, BLUE = COSMIC
RED = ALPHA

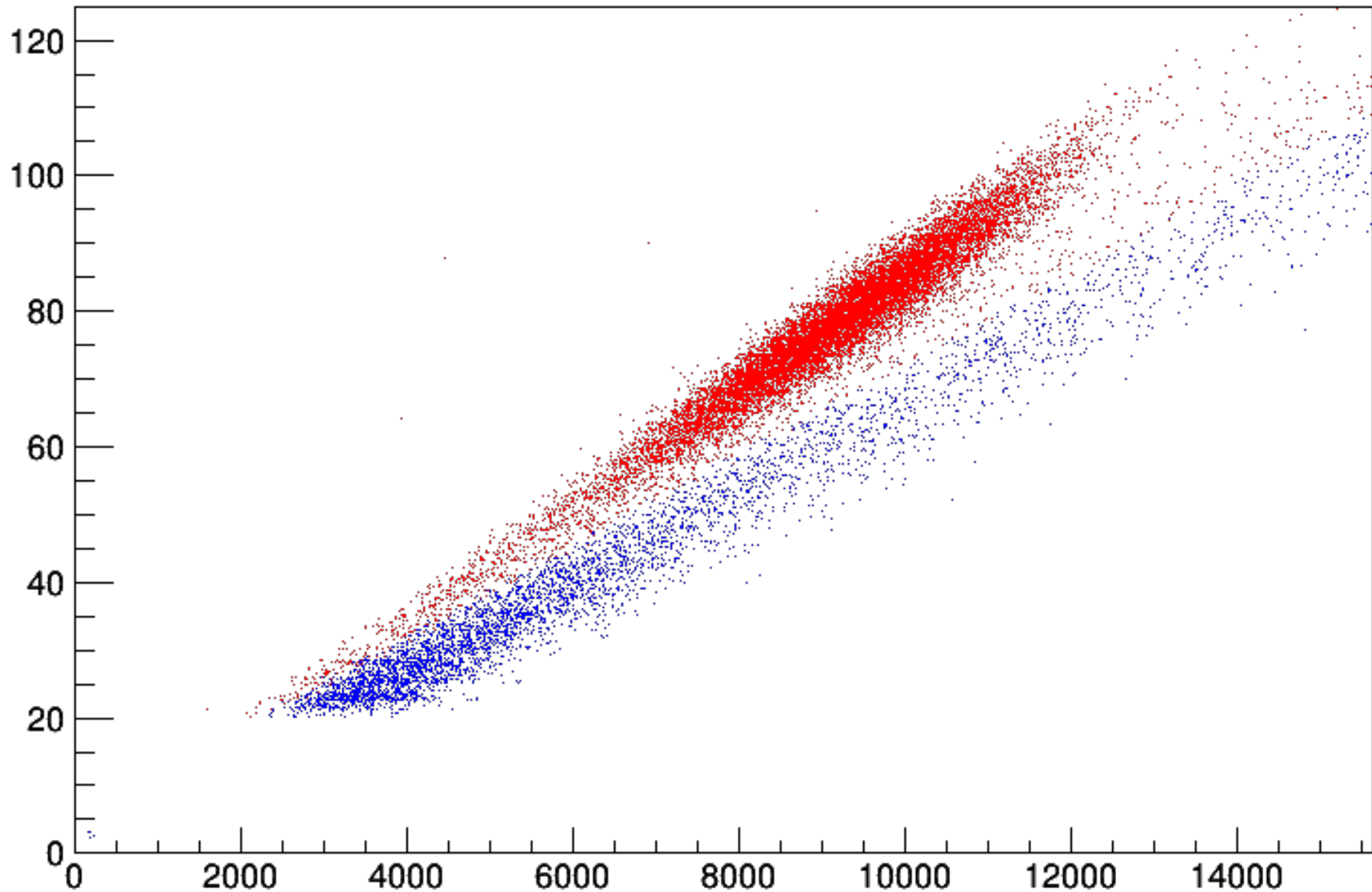
Other Details

- Same HV: 1120 V
- 20 ADC/pe in HG and 2 ADC/pe in LG
- Baseline: average over first 3 bins in event. Often includes first bin from pulse so concerned that it might affect results. This is explored in a later slide
- Cuts: used straight line: very crude

30nF – LG – 23 bins = 360 ns

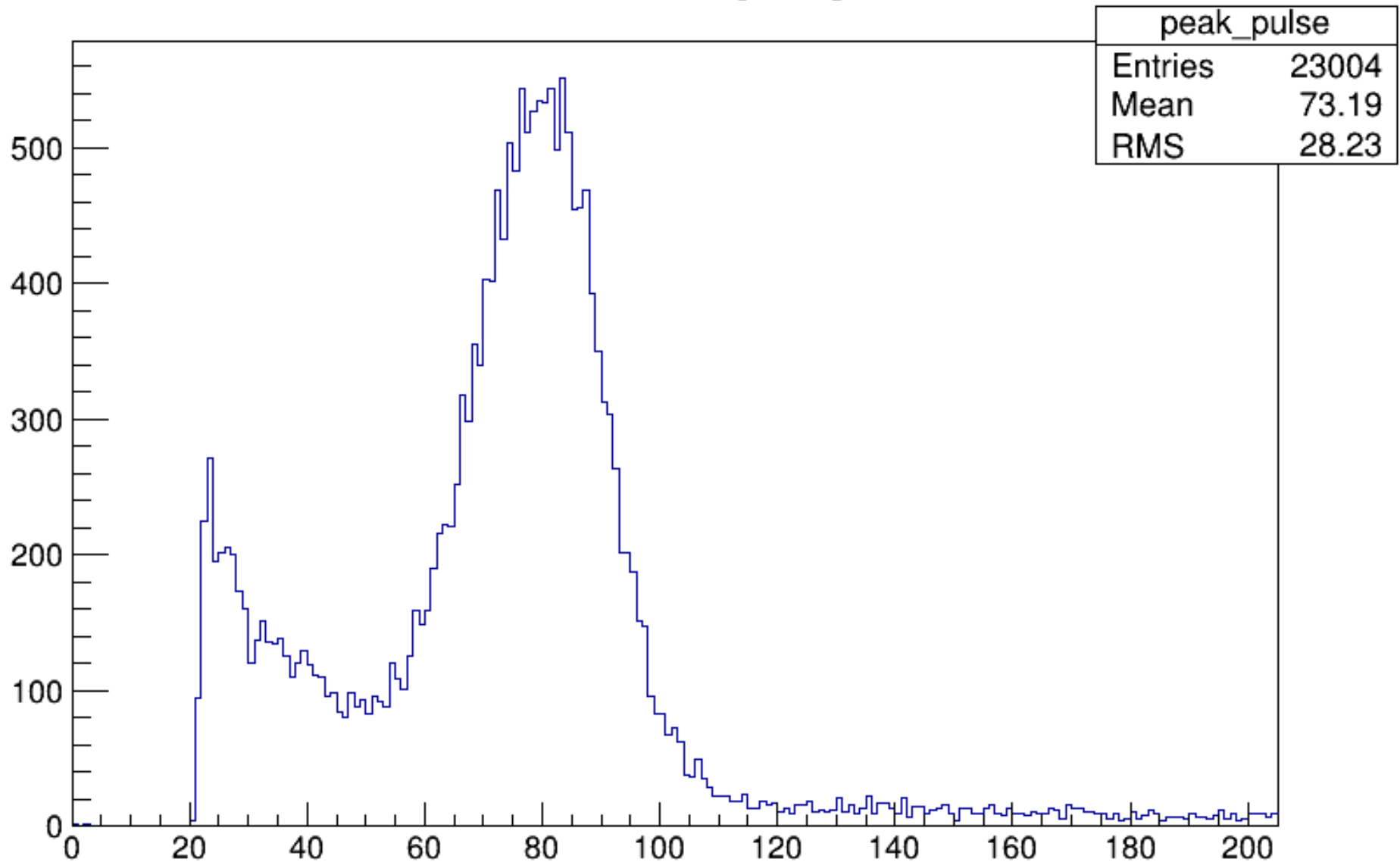
Area under Amp-alpha candidates

Area	1000
Area	1000
Area	1000
Area	1000



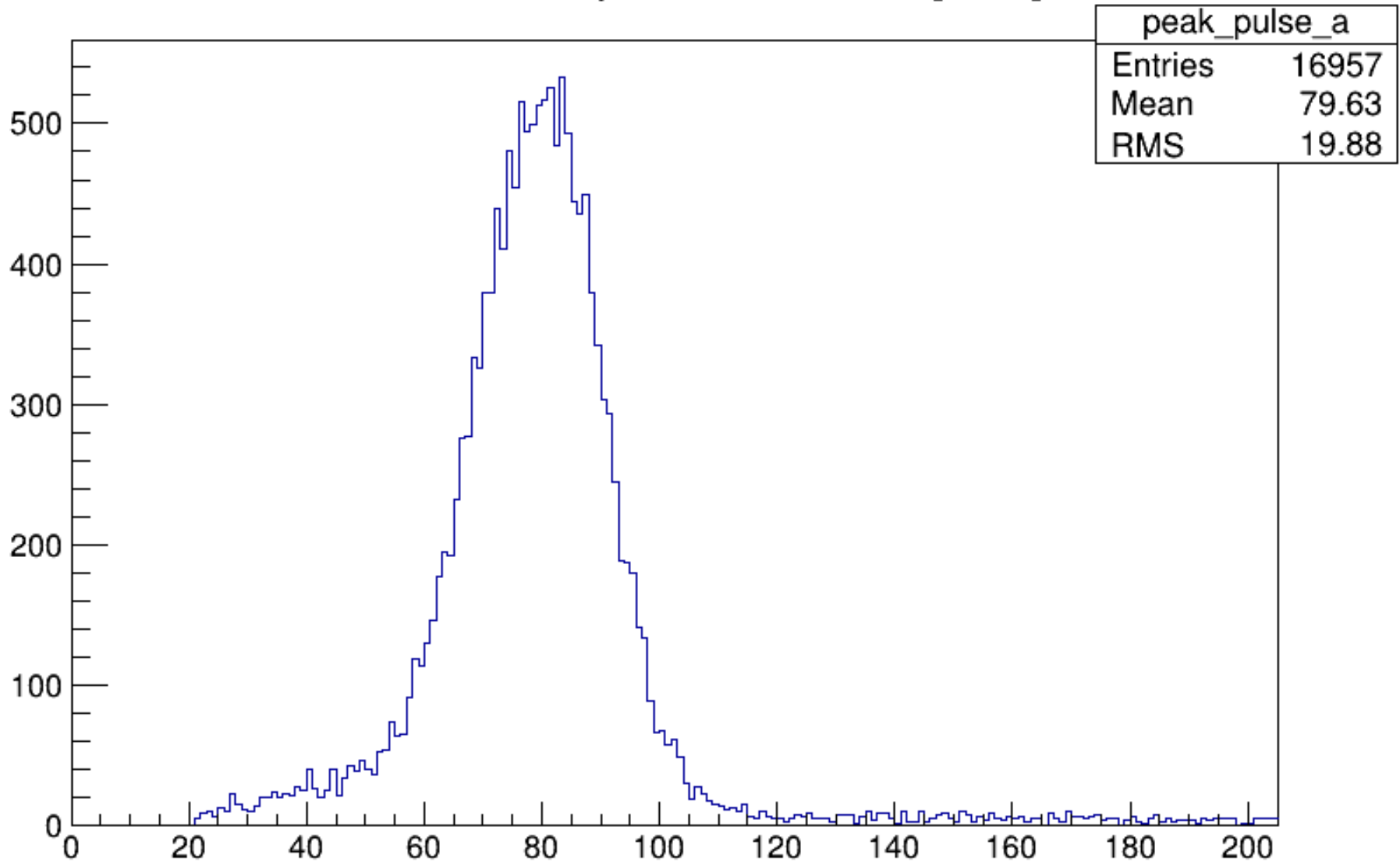
30 nF – LG – 23 bins = 360 ns

Pulse Peak [PEs]



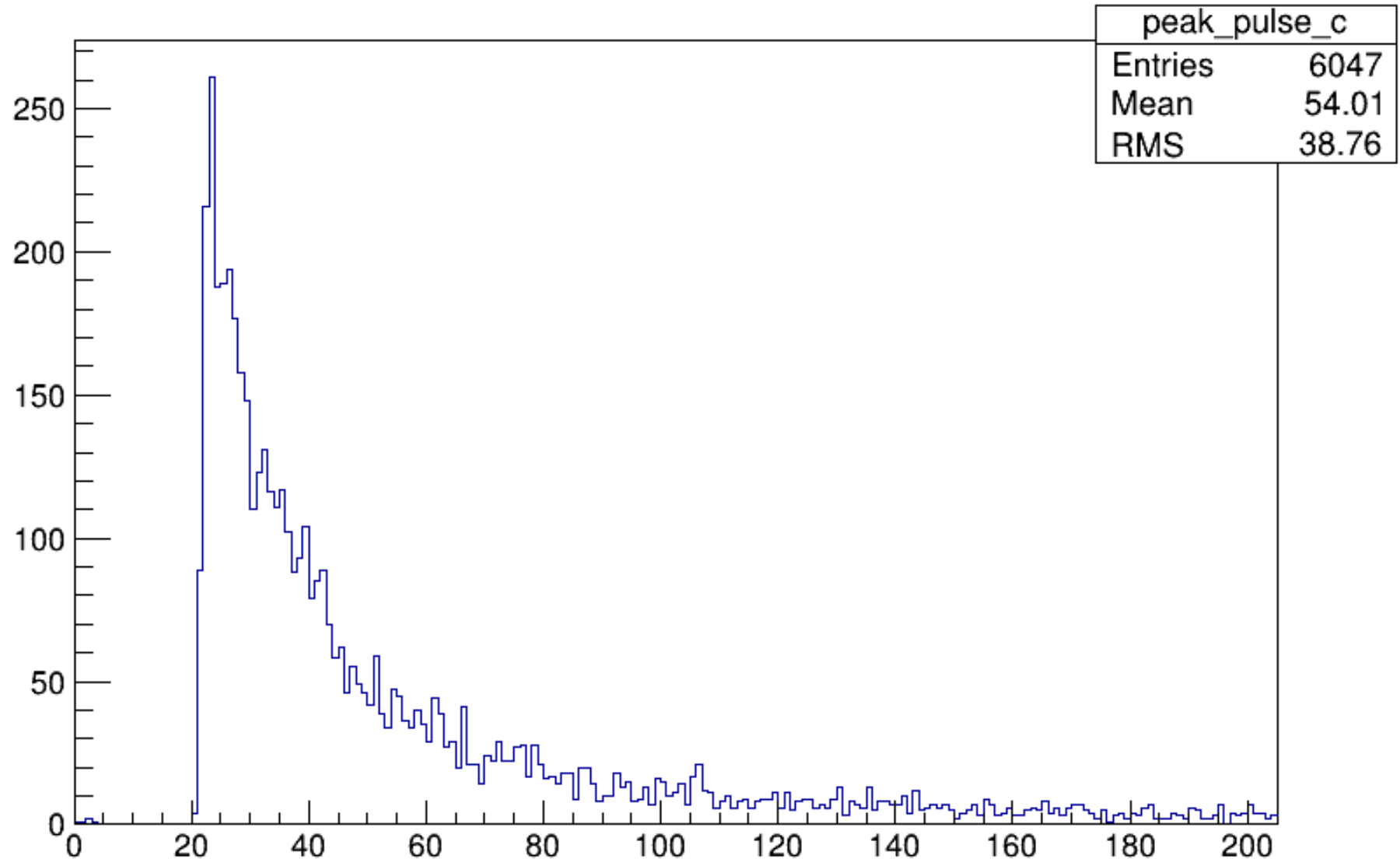
30 nF – LG – 23 bins = 360 ns

Pulse Peak - alpha candidates [PEs]



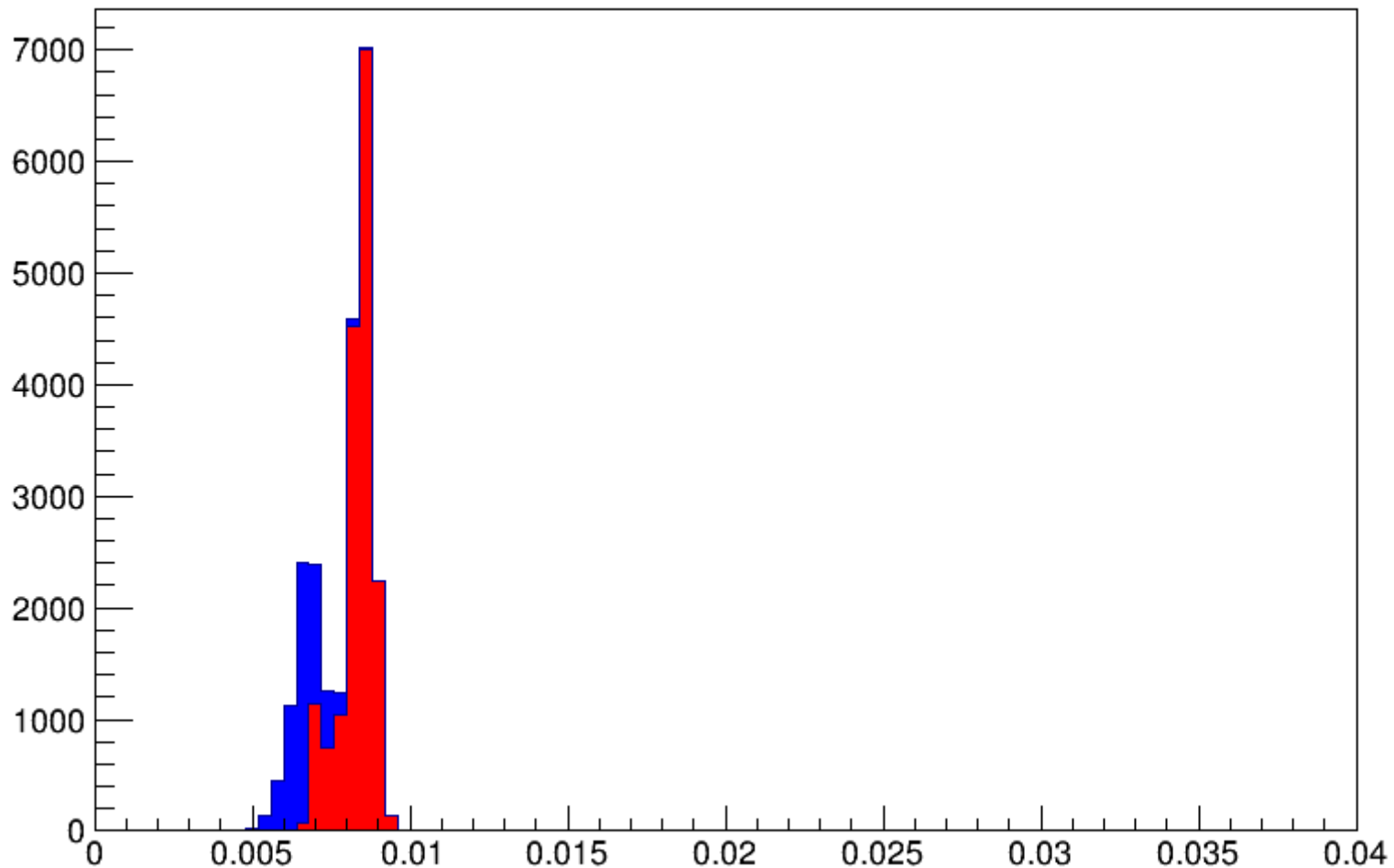
30 nF – LG – 23 bins = 360 ns

Pulse Peak cosmic candidates [PEs]



30 nF – LG – 23 bins = 360 ns

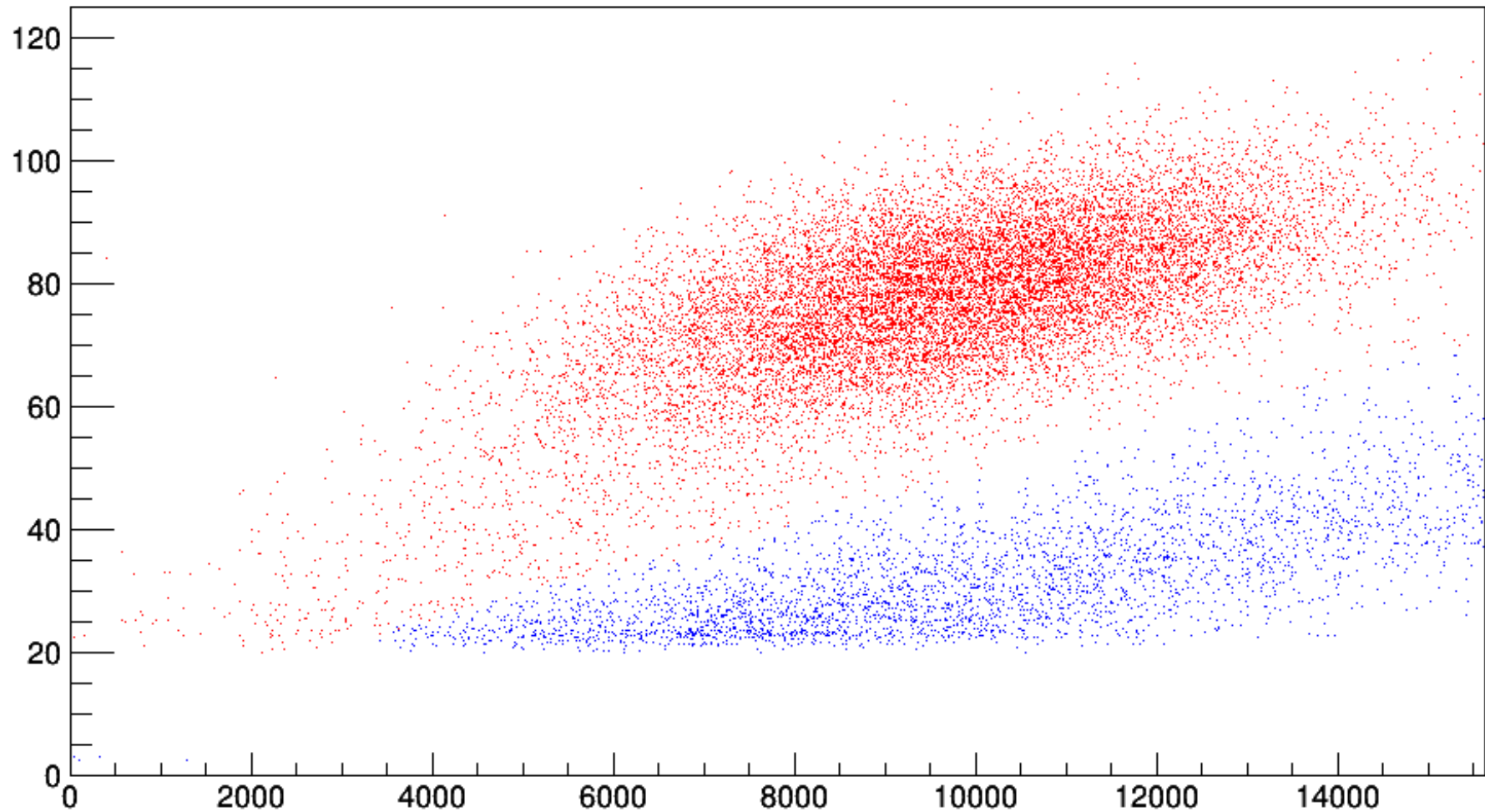
Amp to Area Ratio [1/PEs] UNITLESS!



30nF – LG – 210 bins = 3.28 us

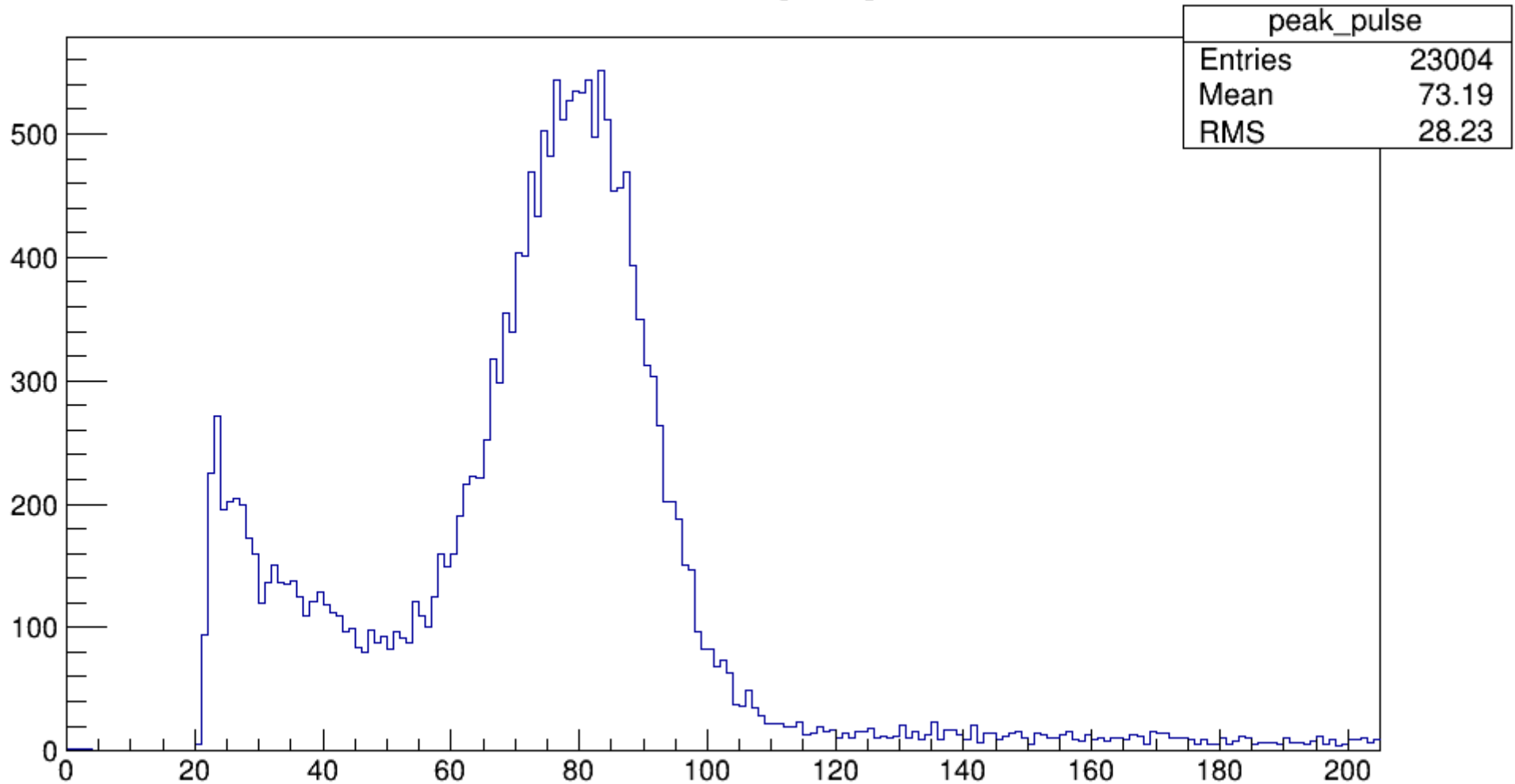
Area and Amp esopha candidates

Area	10000
Amp	100
Bin	210
Time	3.28 us



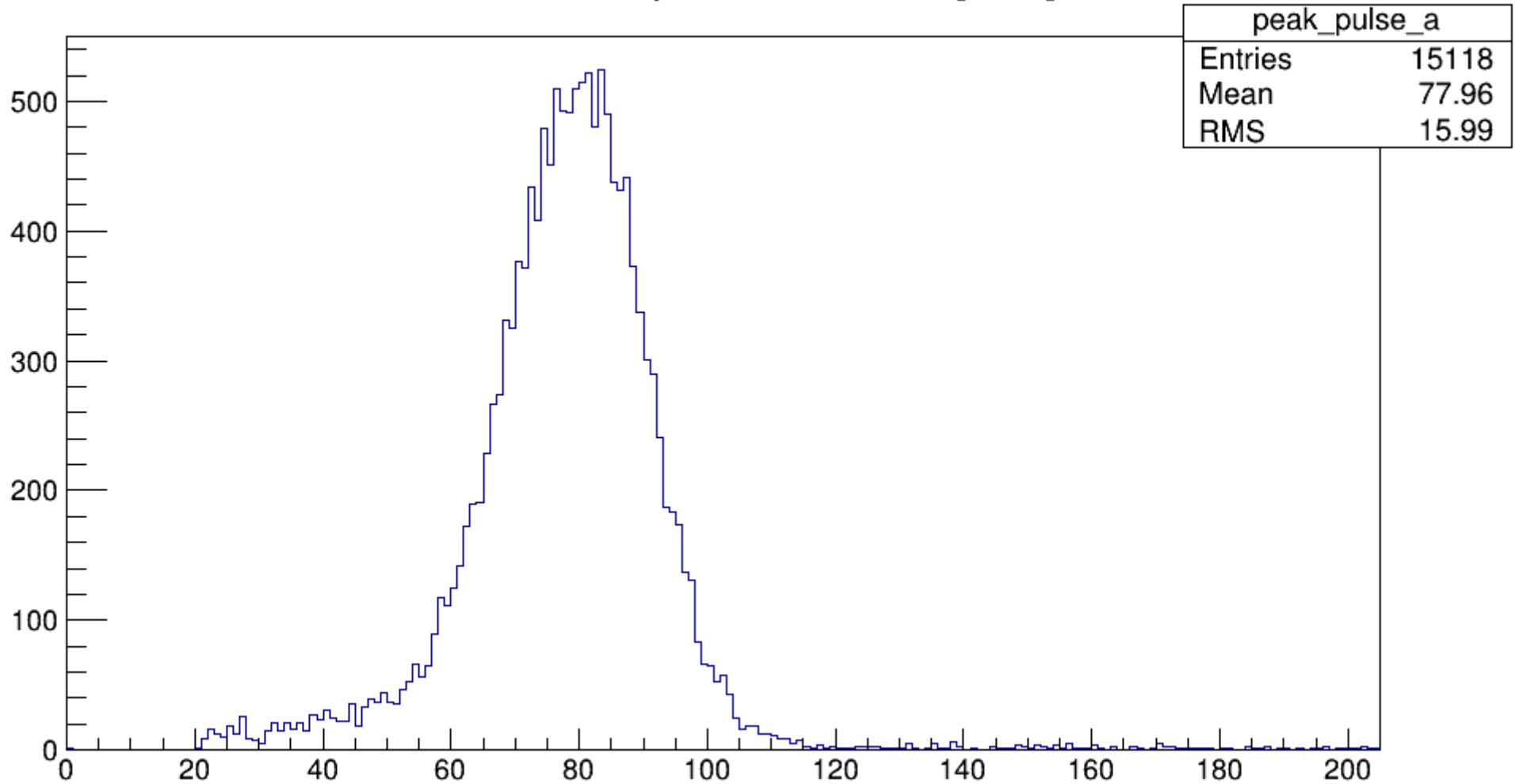
30 nF – LG – 23 bins = 3.28 us

Pulse Peak [PEs]



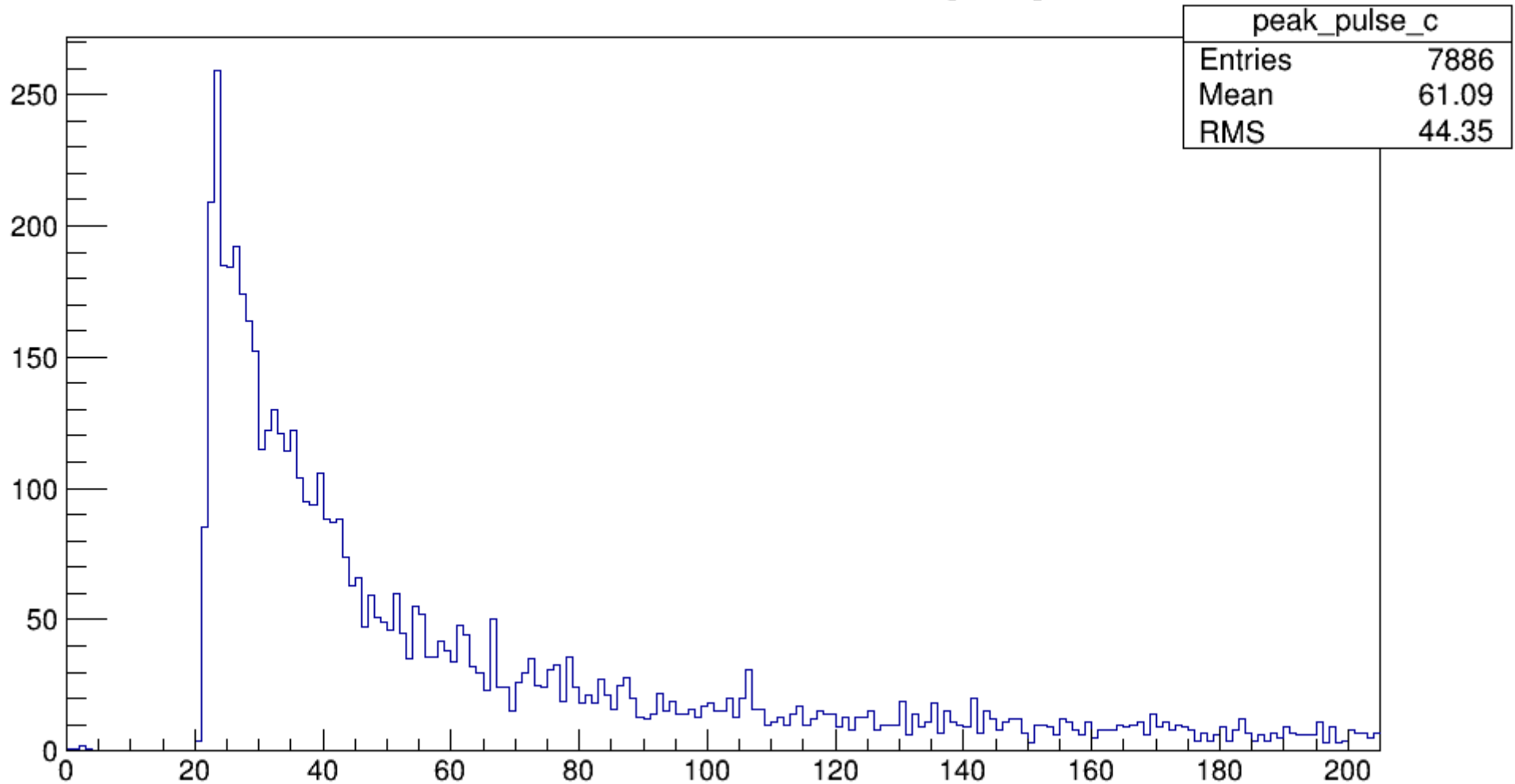
30 nF – LG – 23 bins = 3.28 us

Pulse Peak - alpha candidates [PEs]



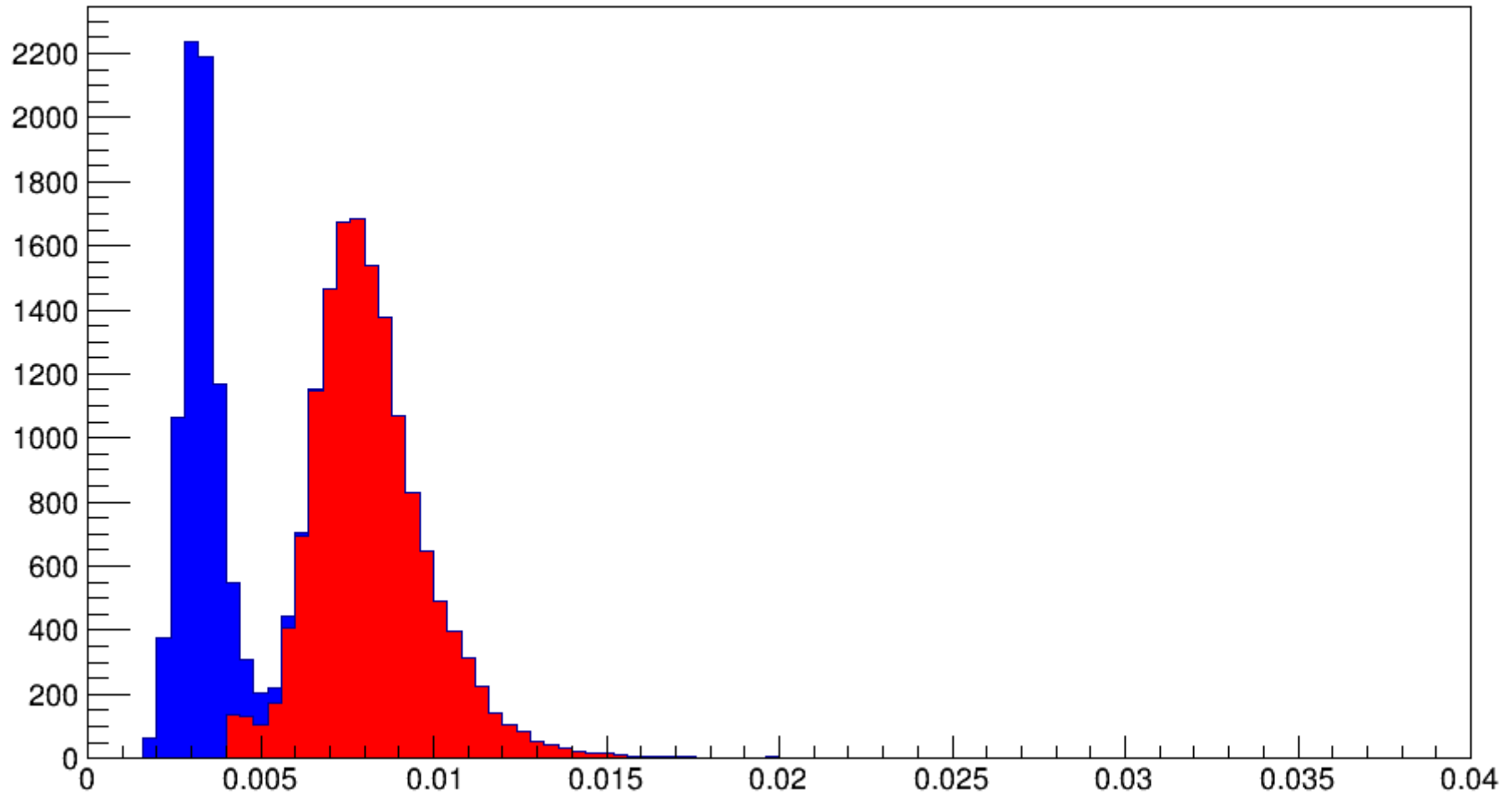
30 nF – LG – 23 bins = 3.28 us

Pulse Peak cosmic candidates [PEs]



30 nF – LG – 23 bins = 3.28 us

Amp to Area Ratio [1/PEs] UNITLESS!

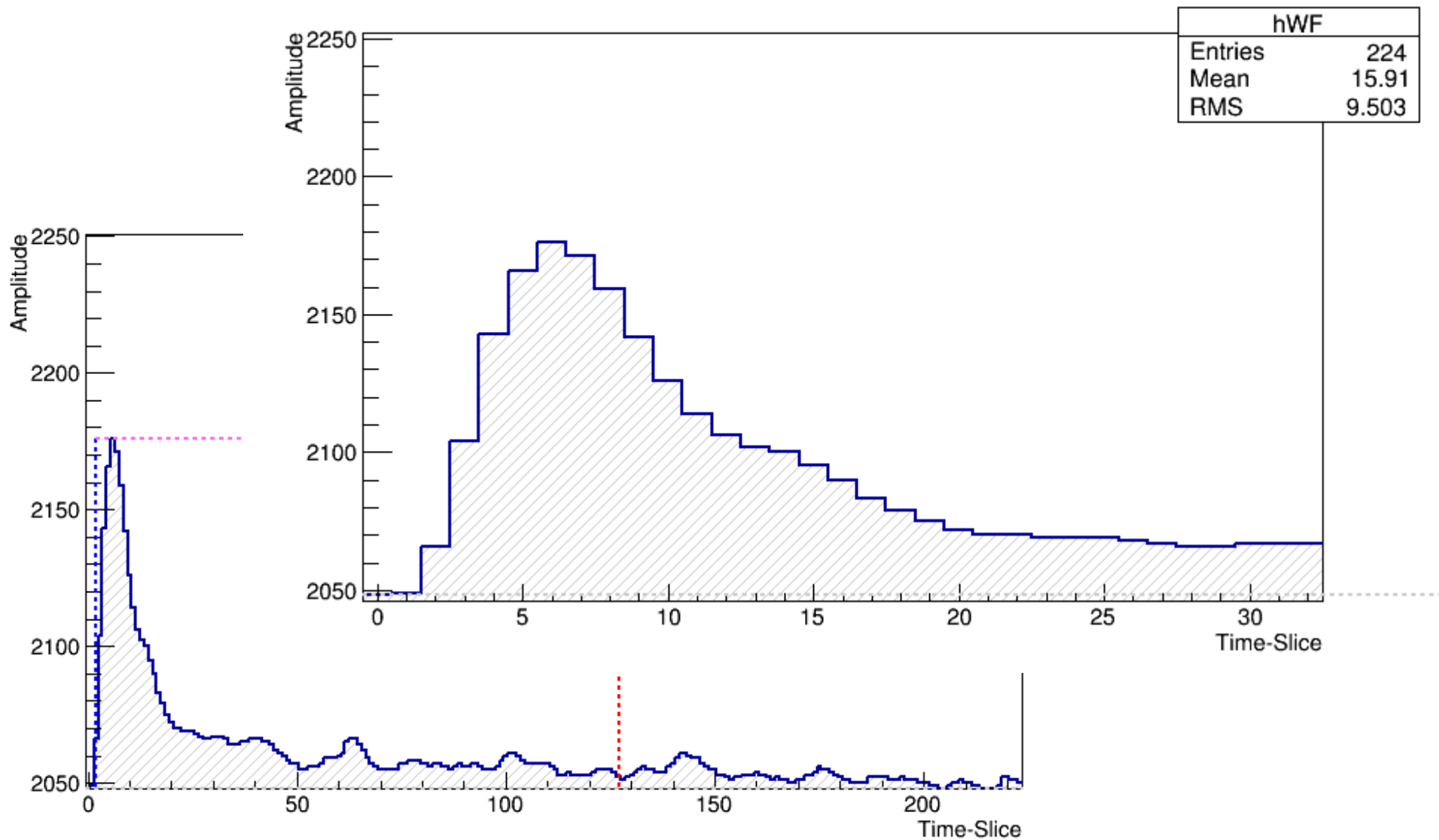


Looking at Pulses

- First 2 “alphas”, then 2 “cosmics”
- NOTE: whether I integrate with 20 bins or 200, the same events get placed in the same category (cosmic/alpha).
(this generally true...did not check thoroughly)
- Following pulses taken from LG 30nF run
- Ignore box around pulse...not used in analysis

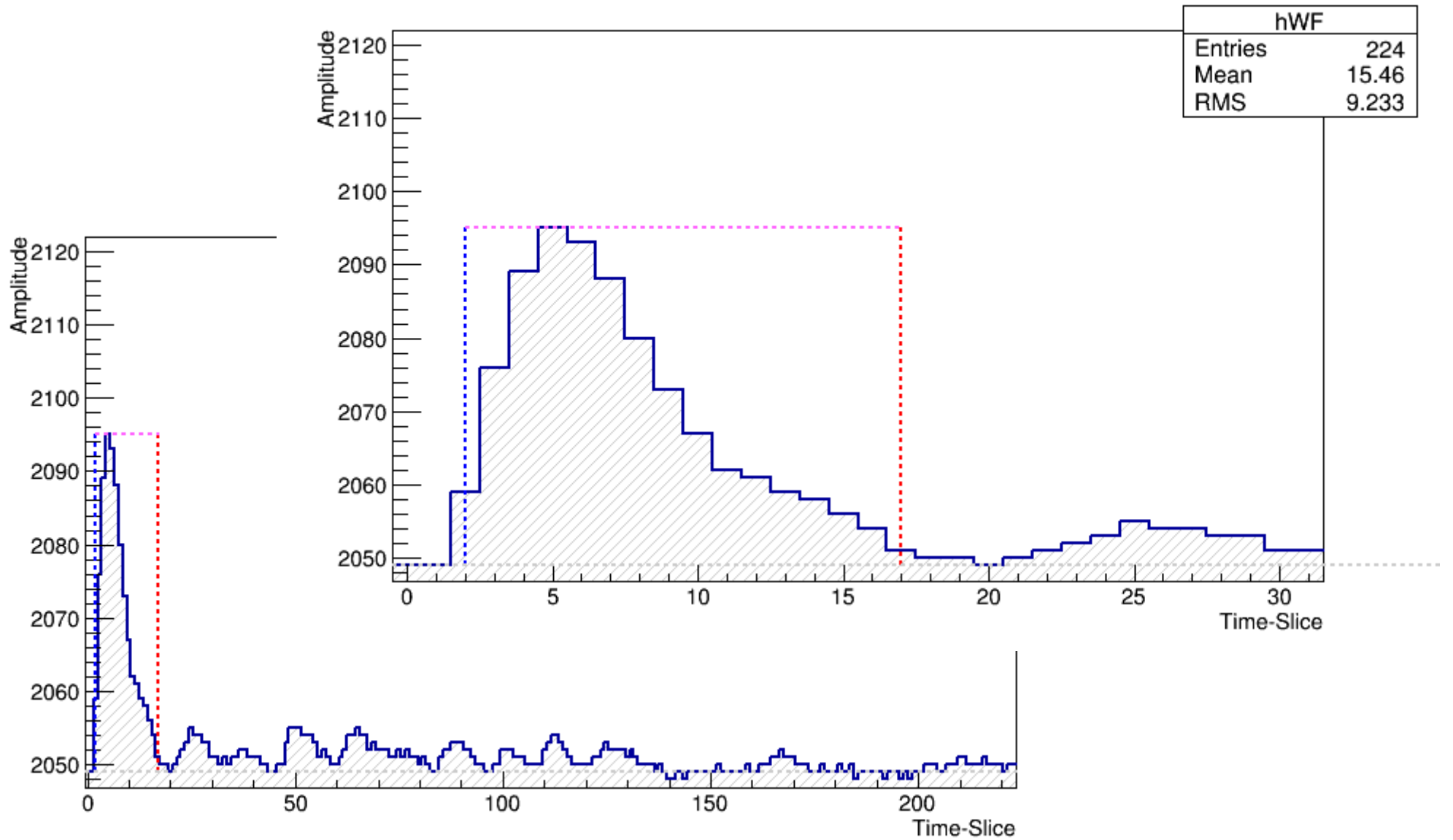
“alpha”

Channel 2 Reconstructed Pulse



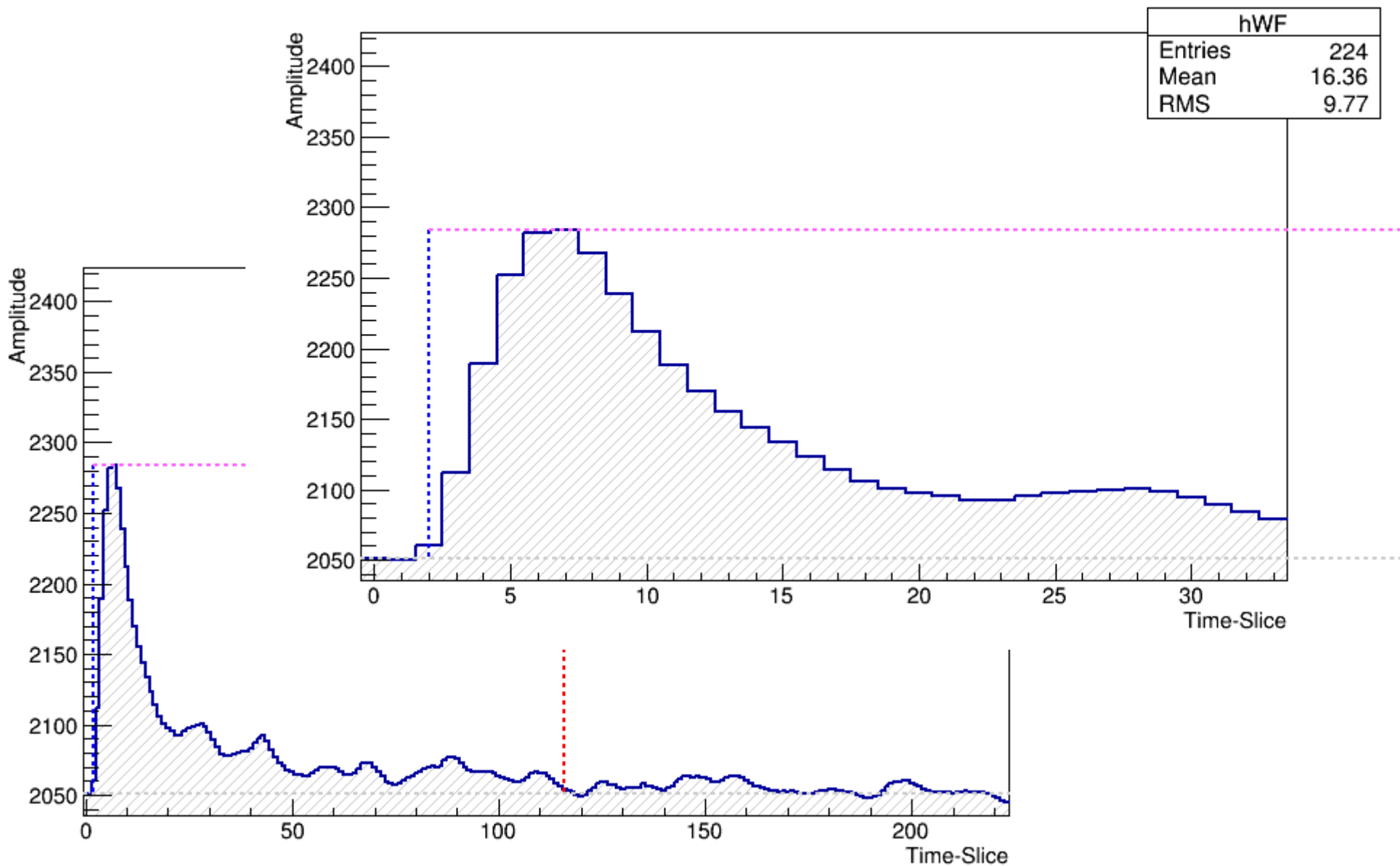
“alpha”

Channel 2 Reconstructed Pulse



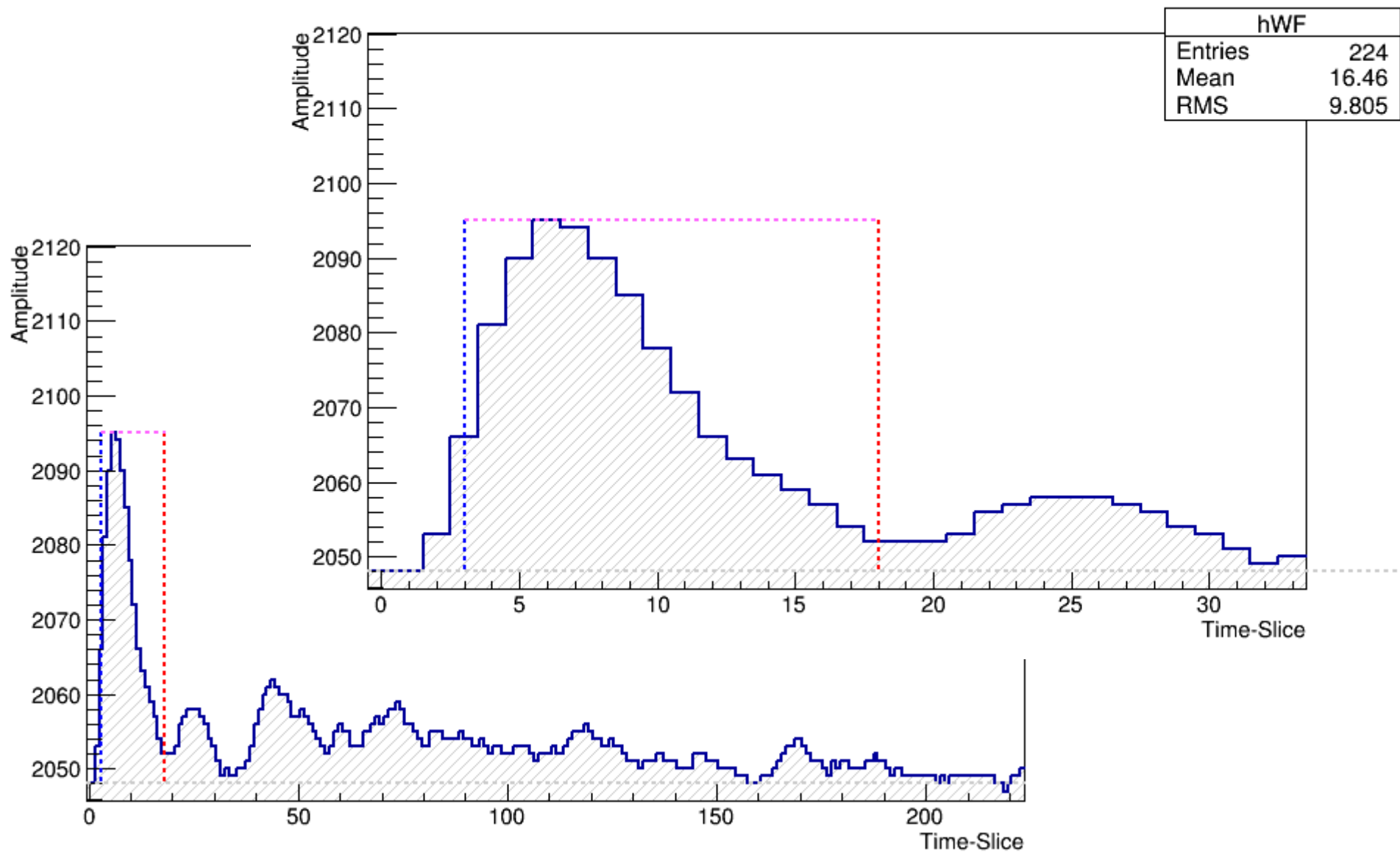
“cosmic”

Channel 2 Reconstructed Pulse



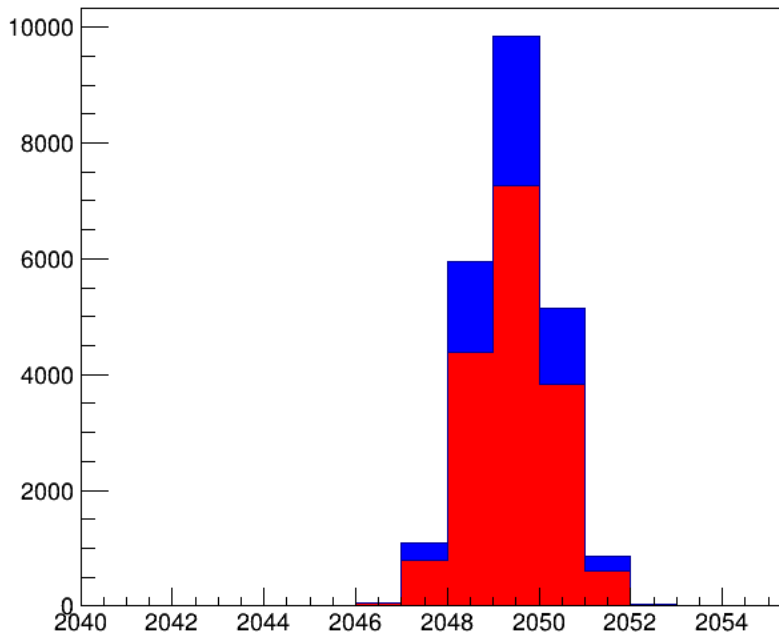
“cosmic”

Channel 2 Reconstructed Pulse

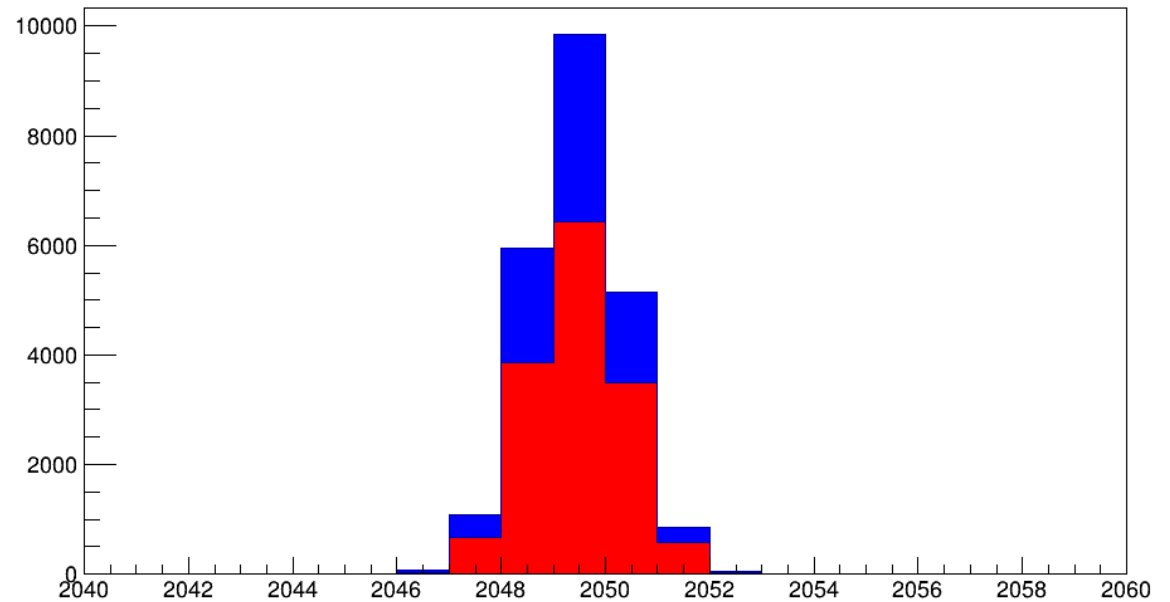


Check if there is a Bias in baseline calculation

Baseline Value [ADCs]



Baseline Value [ADCs]



LEFT: 360 ns. RIGHT: 3.28 us.

BLUE: COSMIC. RED: ALPHA

Both Gaussian with very small spread (between 2048-2052 ADC counts)

→ No Bias between cosmic and alpha

Conclusions

- For quantitative study (to compare 10,20,30 nF) we need to calculate some sort of efficiency/purity
- Can do this with cosmic trigger. Not yet there...
- For slides that show LG for 10,20,30 nF capacitors go to:
http://www.nevis.columbia.edu/~dcaratelli/particle_ID.pdf