TAGH Update

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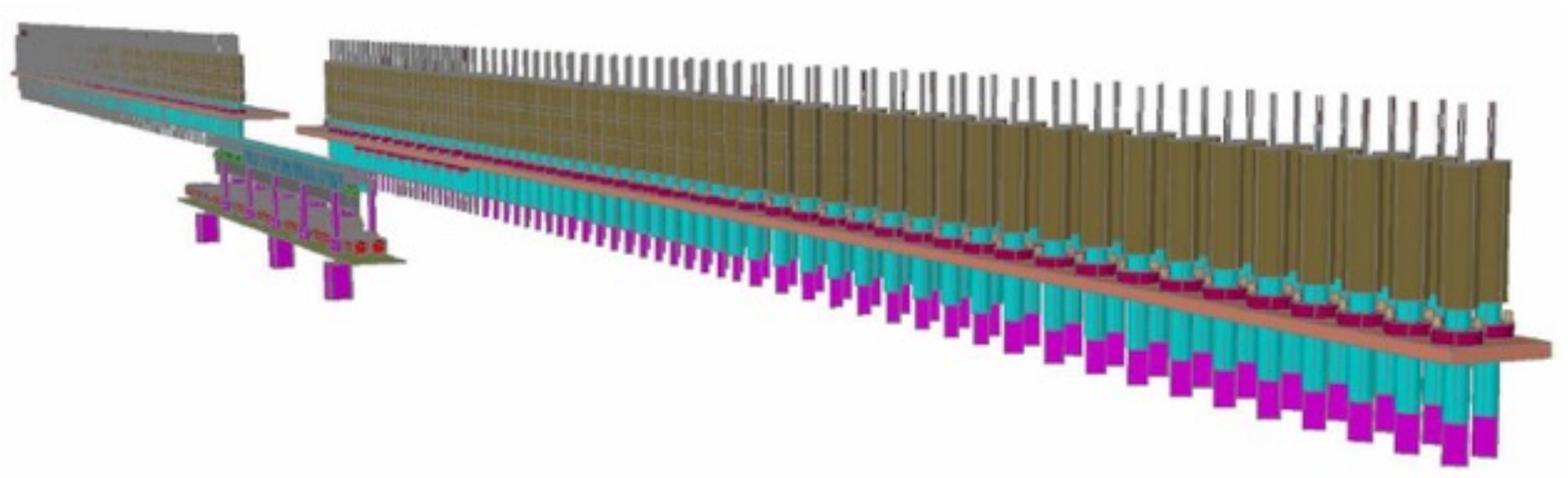
CUA
GlueX Collaboration Meeting
May 12, 2015



Outline

- High-rate commissioning with Spring data
- Timing calibrations
- Preliminary tagging efficiencies

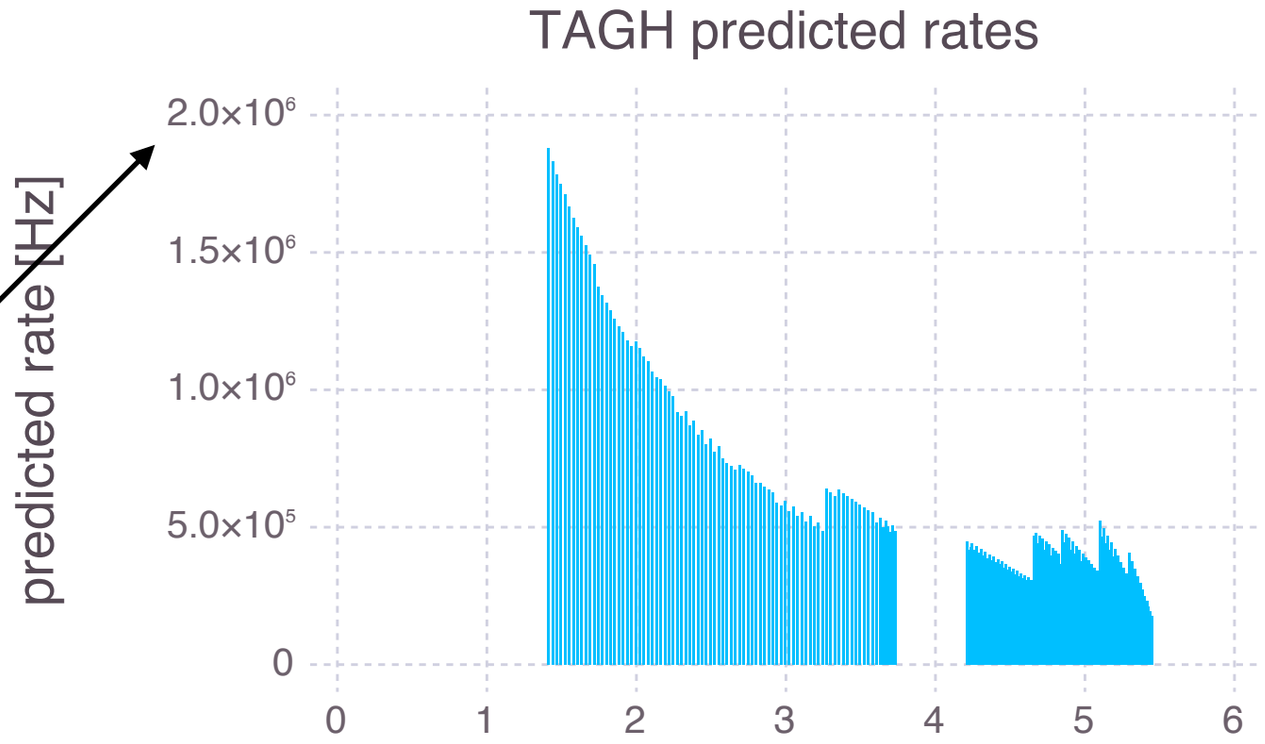
High-rate commissioning

- Many Fall runs taken with 2e-5 RL radiator, 50 nA
- First real taste of high rates with diamonds this Spring
- 50 micron : 3.3e-4 RL, and I from 10-100 nA
- Roughly, expect photon multiplicities of 10 to 50 times larger than typical Fall runs

$$\text{Rate} \approx \frac{\text{I}}{\text{e}} \times \text{th} \left(\frac{4}{3} \log \left(\frac{\text{x}_2}{\text{x}_1} \right) - \frac{4}{3} (\text{x}_2 - \text{x}_1) + \frac{(\text{x}_2^2 - \text{x}_1^2)}{2} \right)$$

x = k / E0

- predicted rates for
  I = 100 nA,
  th = 3.3e-4 RL

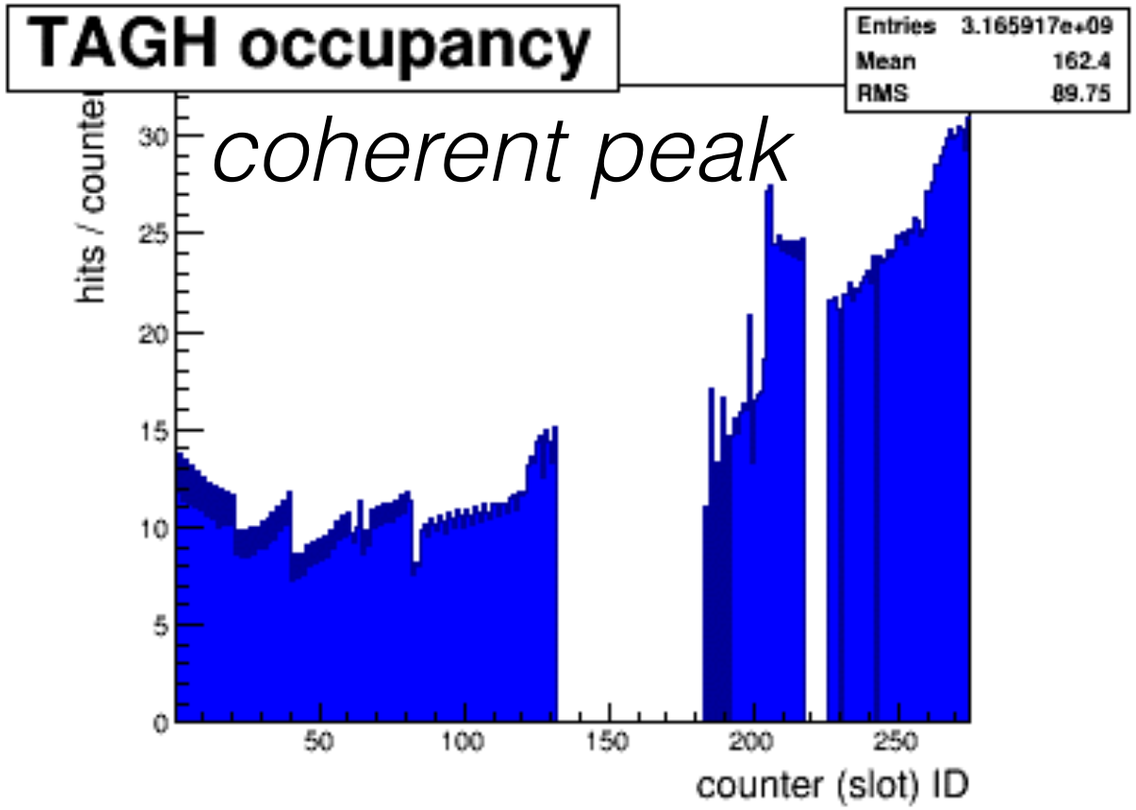


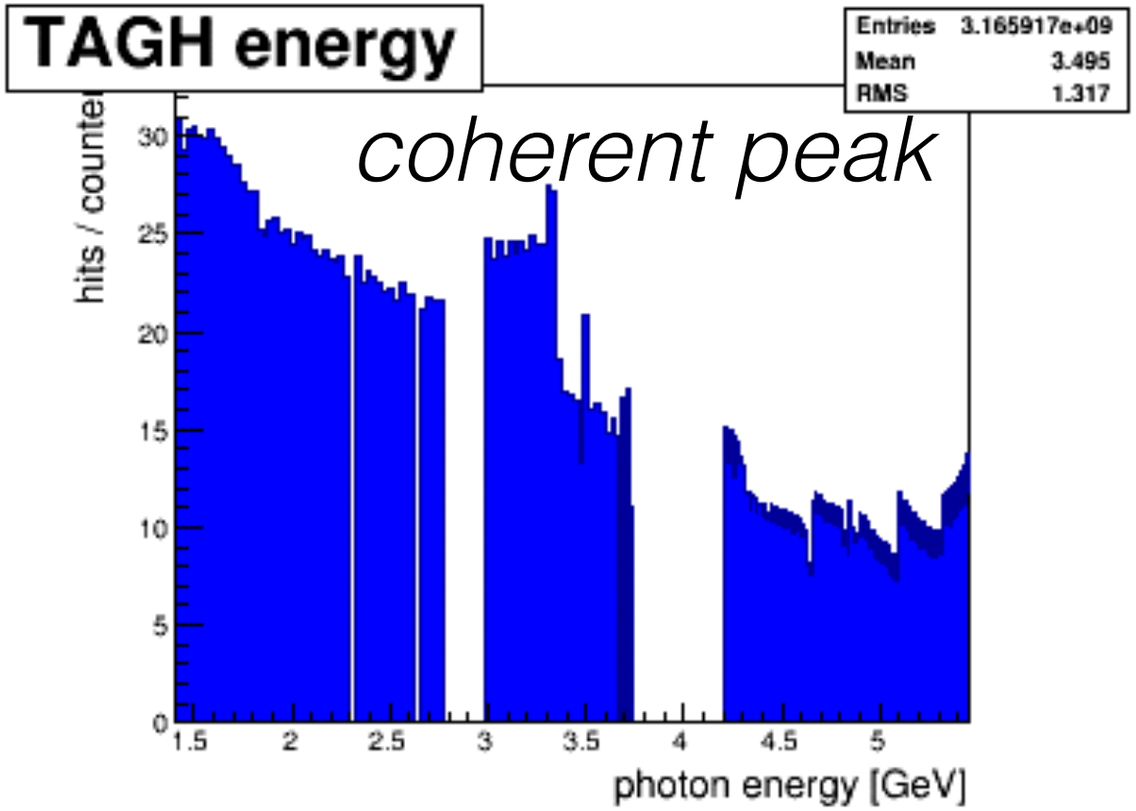
TAGH rate estimates

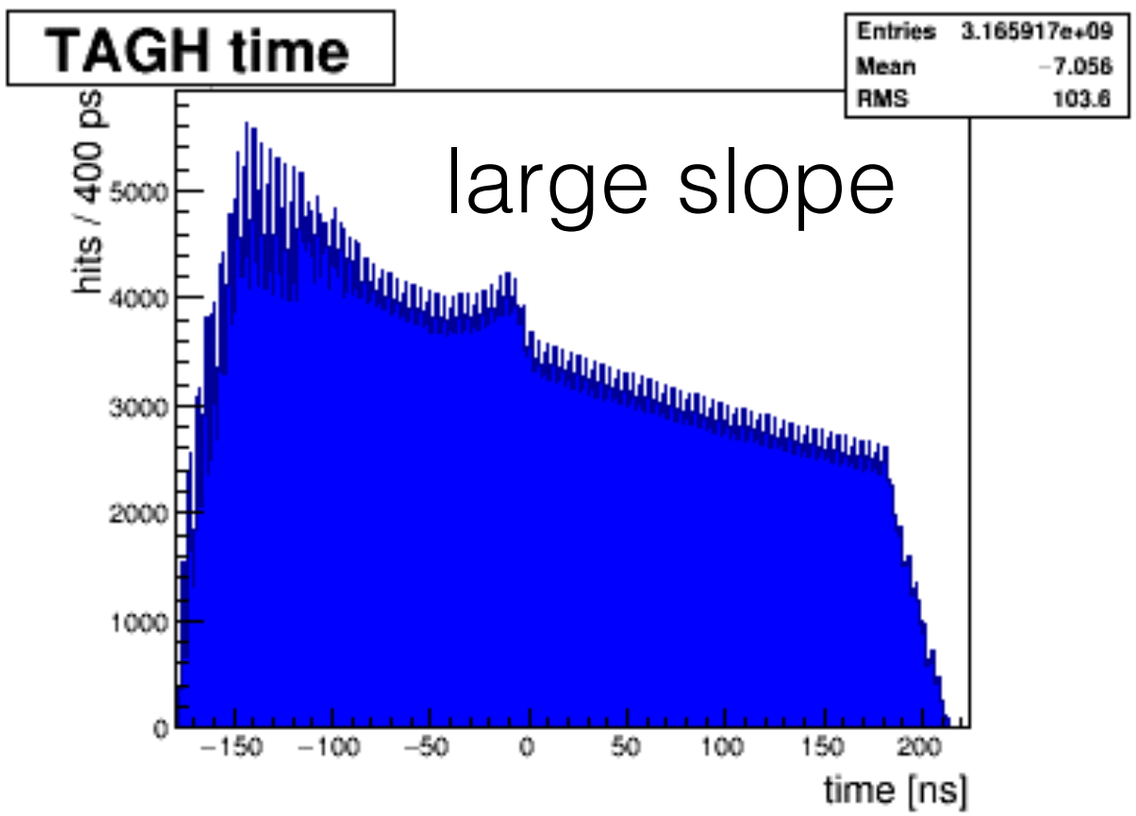
radiator (RL)	current (nA)	rate (MHz)	multiplicity
2E-05	50	3.8 (1.4)	1.5 (0.6)
3.3E-04	100	126 (48)	50 (19)
1E-04	1100	419 (159)	168 (64)

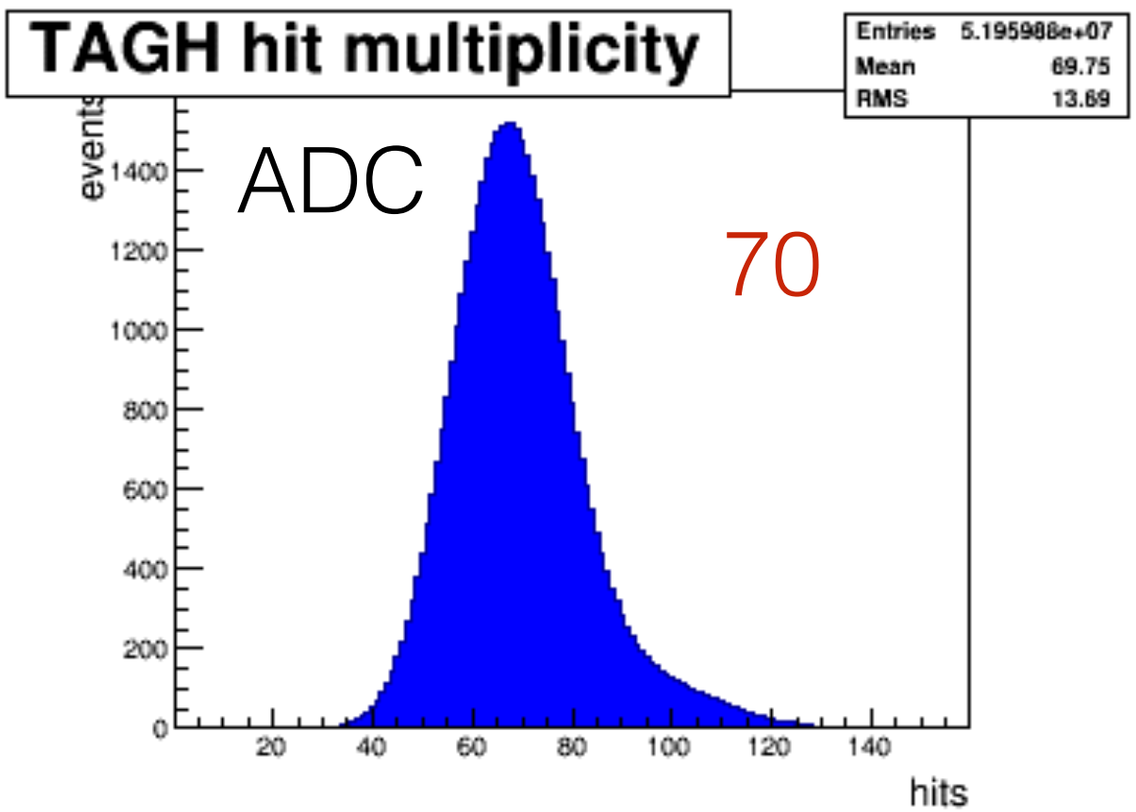
400 ns

Run 2931 FCAL/BCAL (m7) 70 nA on diamond



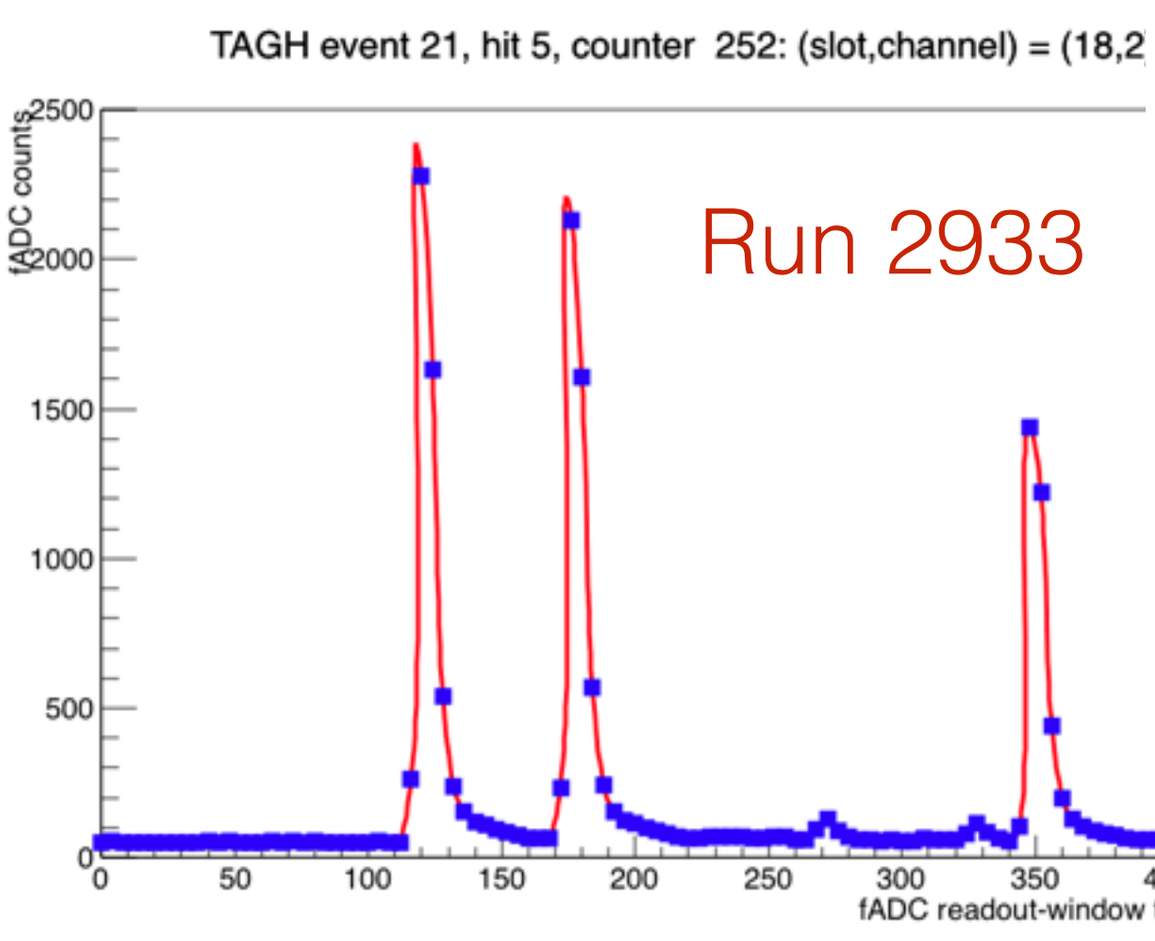


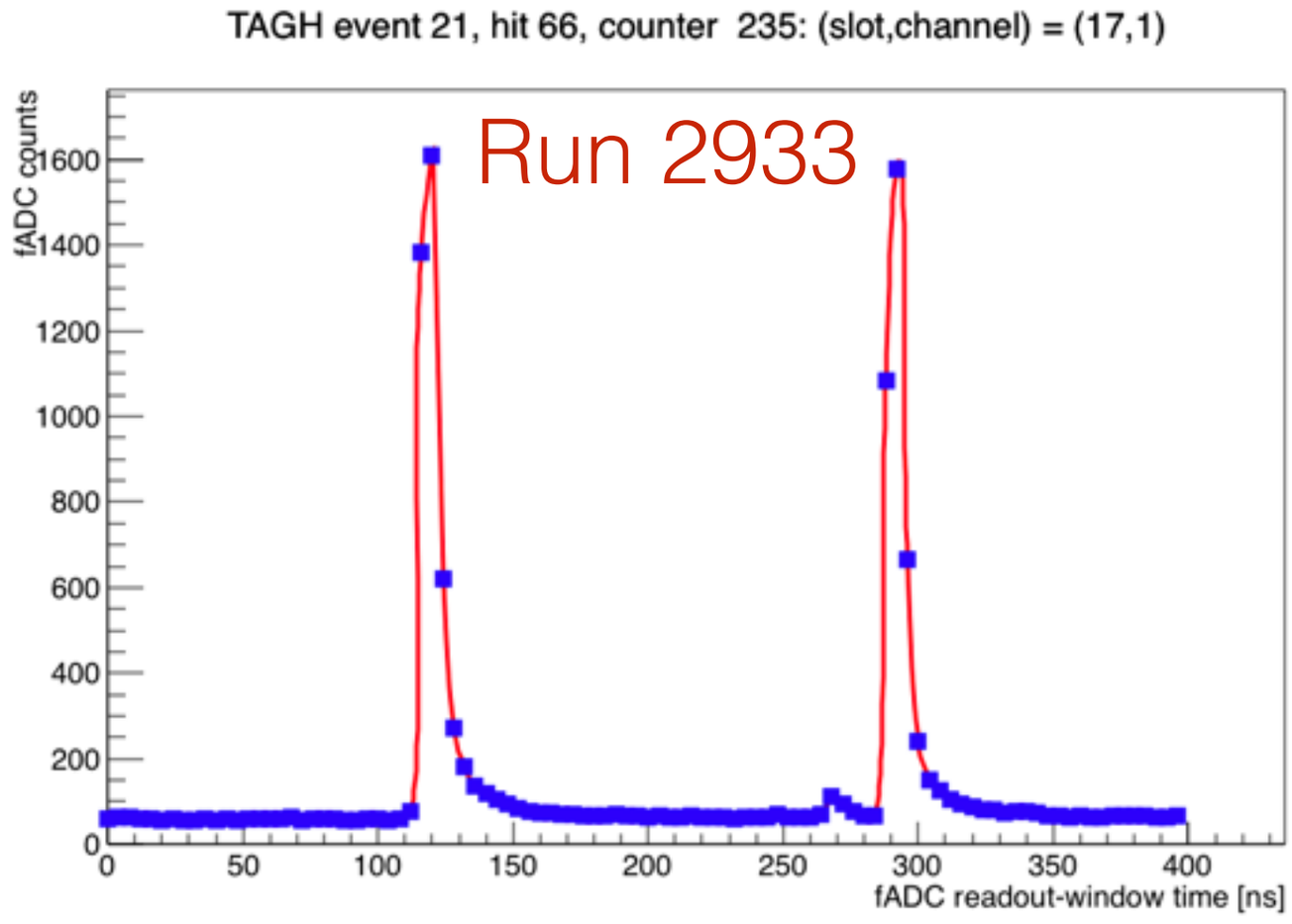




- Default peak finding mode set to Npeak = 1 for most runs (as 2931)

- Explains slope in fADC timing (earlier peak)

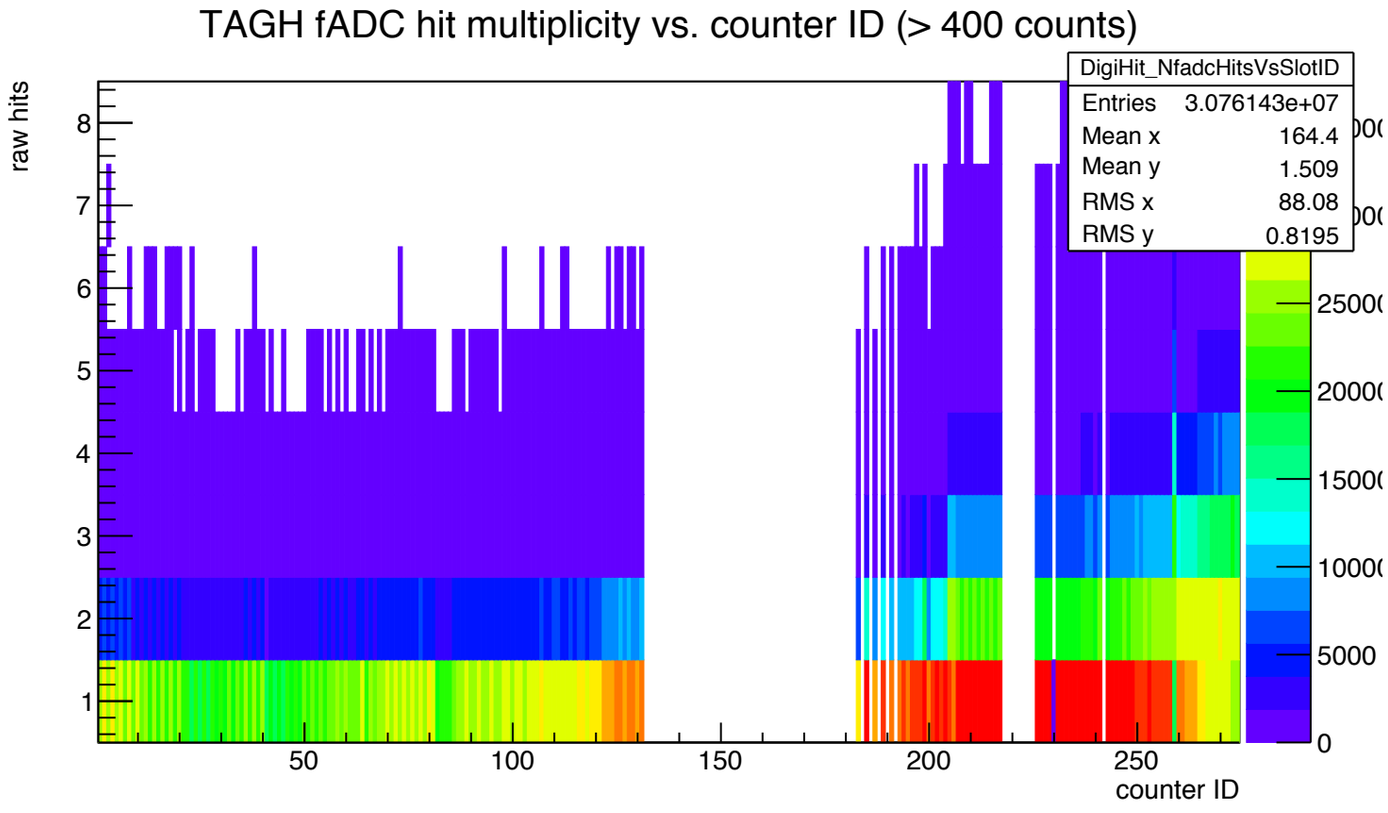


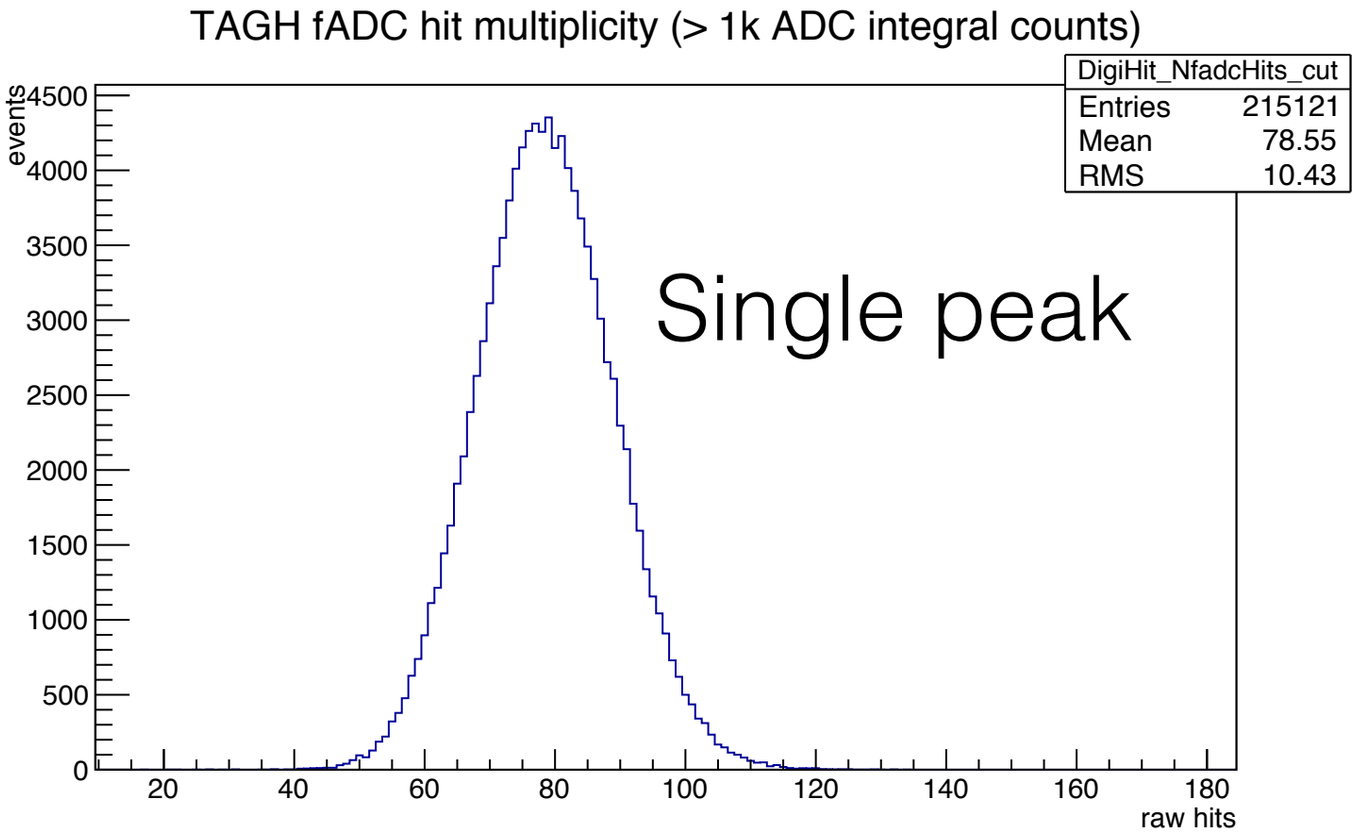


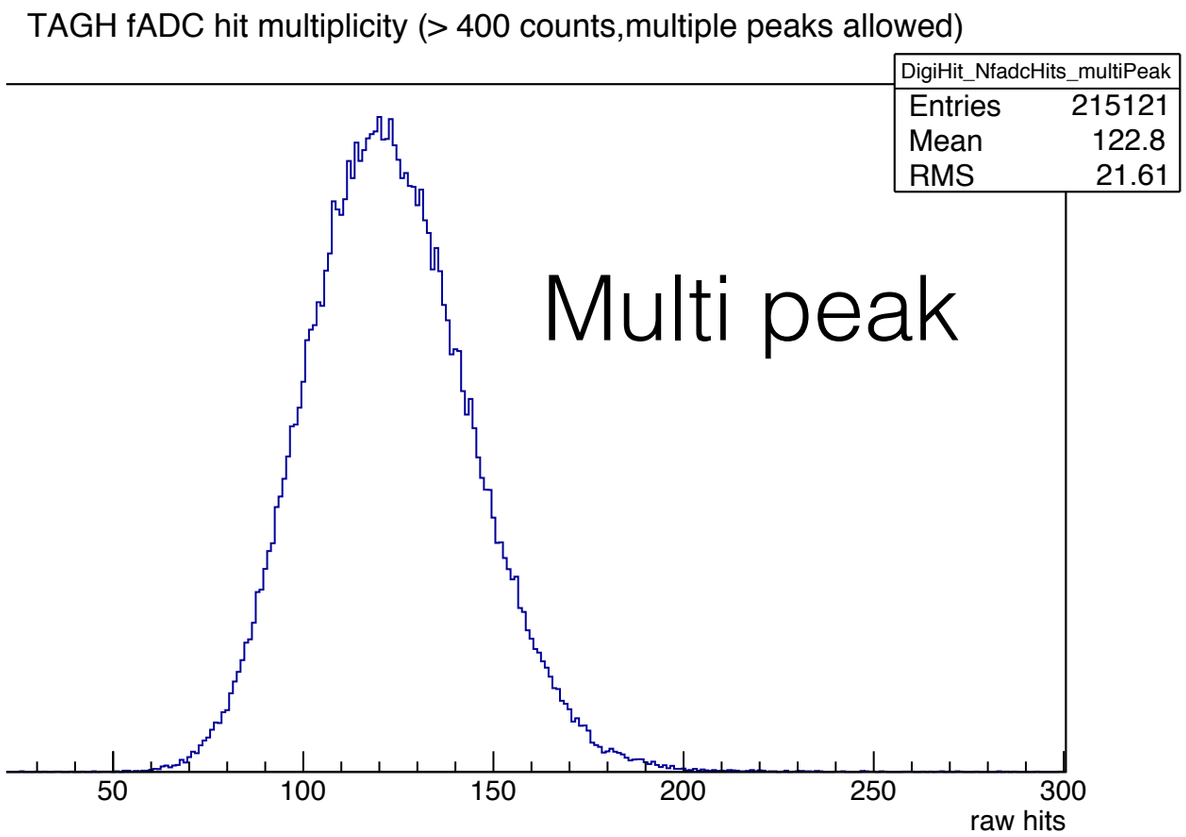
- Some later runs were taken with Npeak = 3

- Need to check that the firmware works correctly

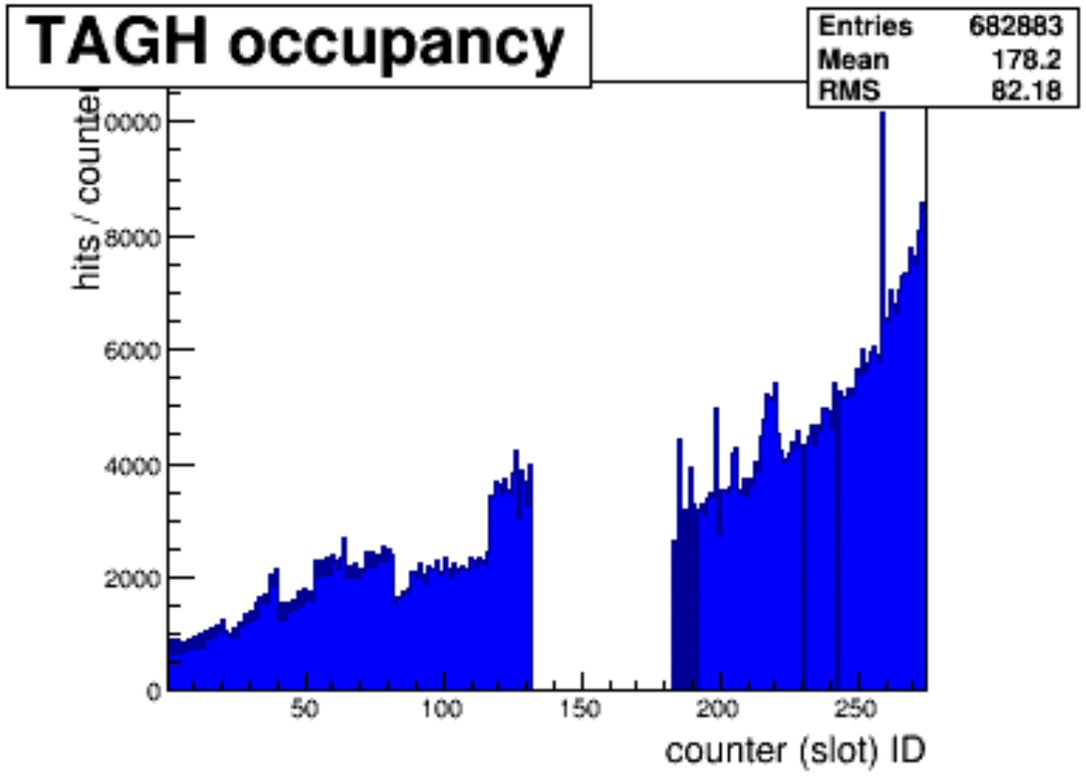
- Run 2933 (m8)
- count multiple peaks in software

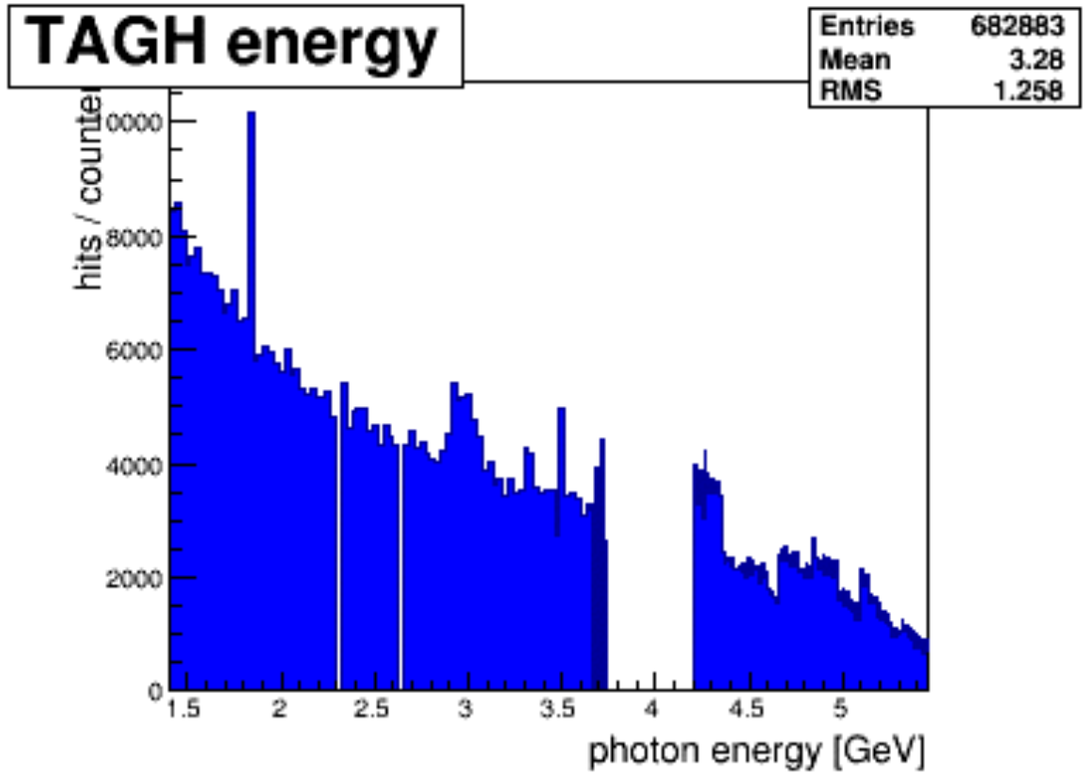


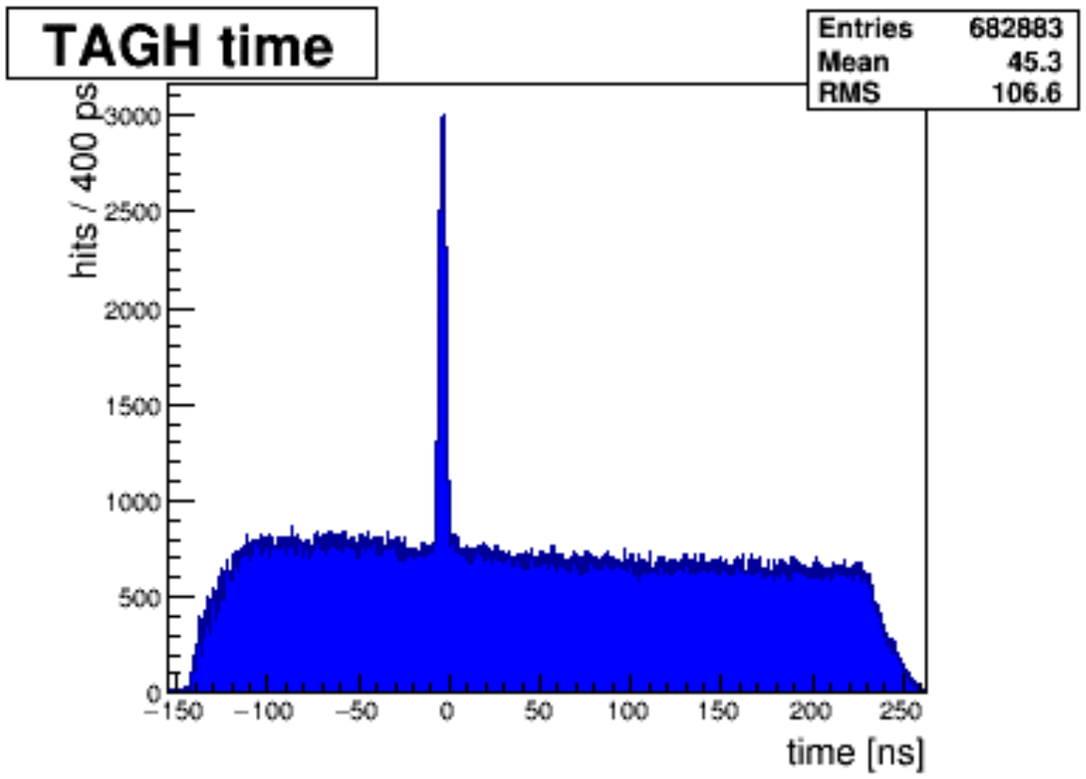


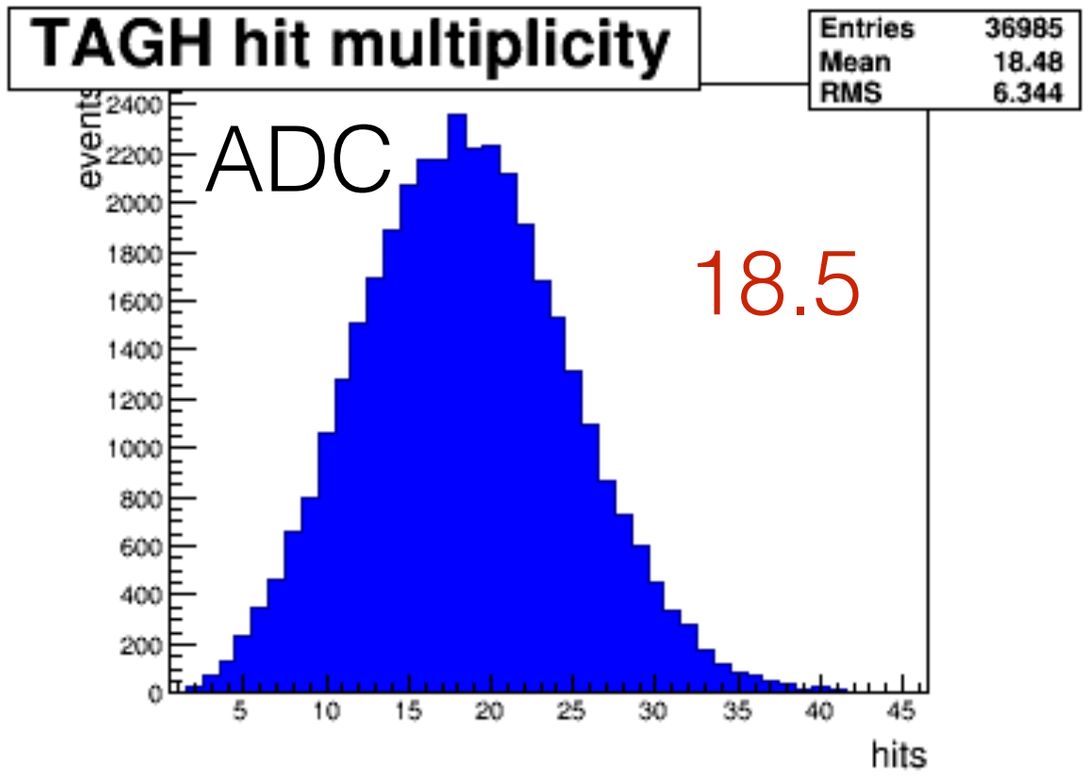


Run 3000 Pair Spectrometer 10 nA on diamond

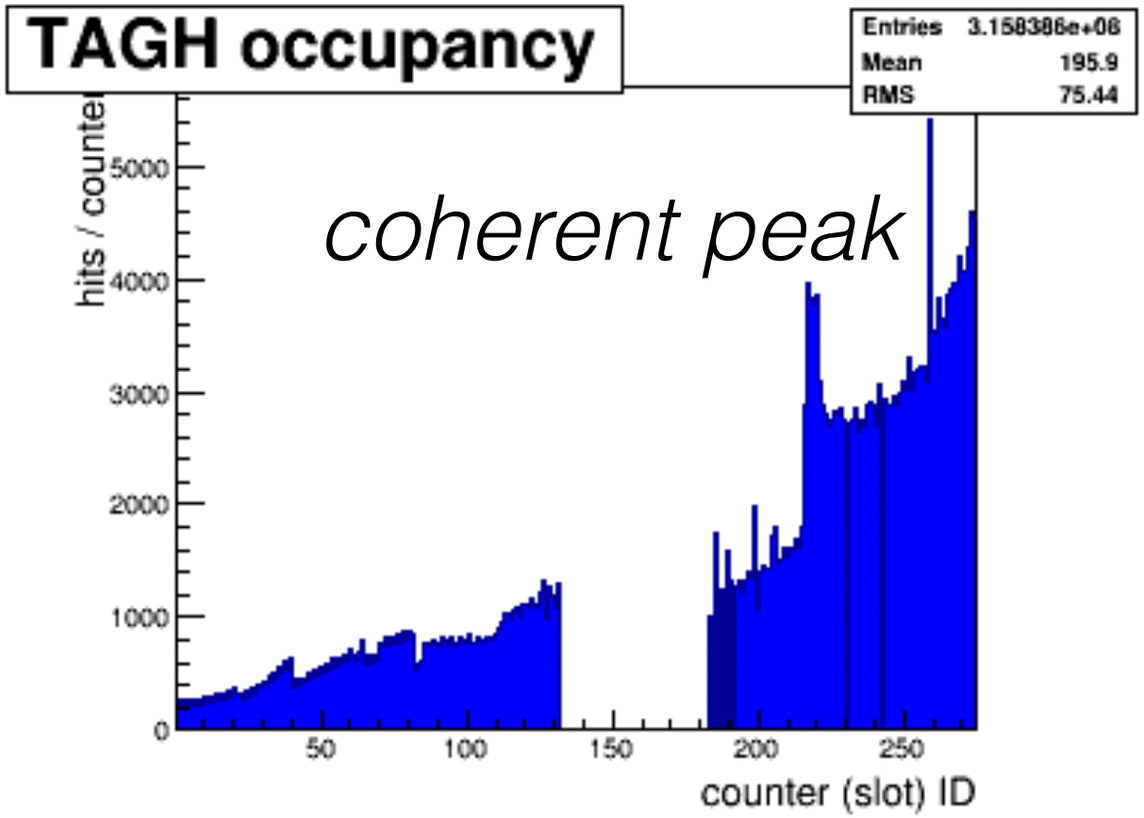


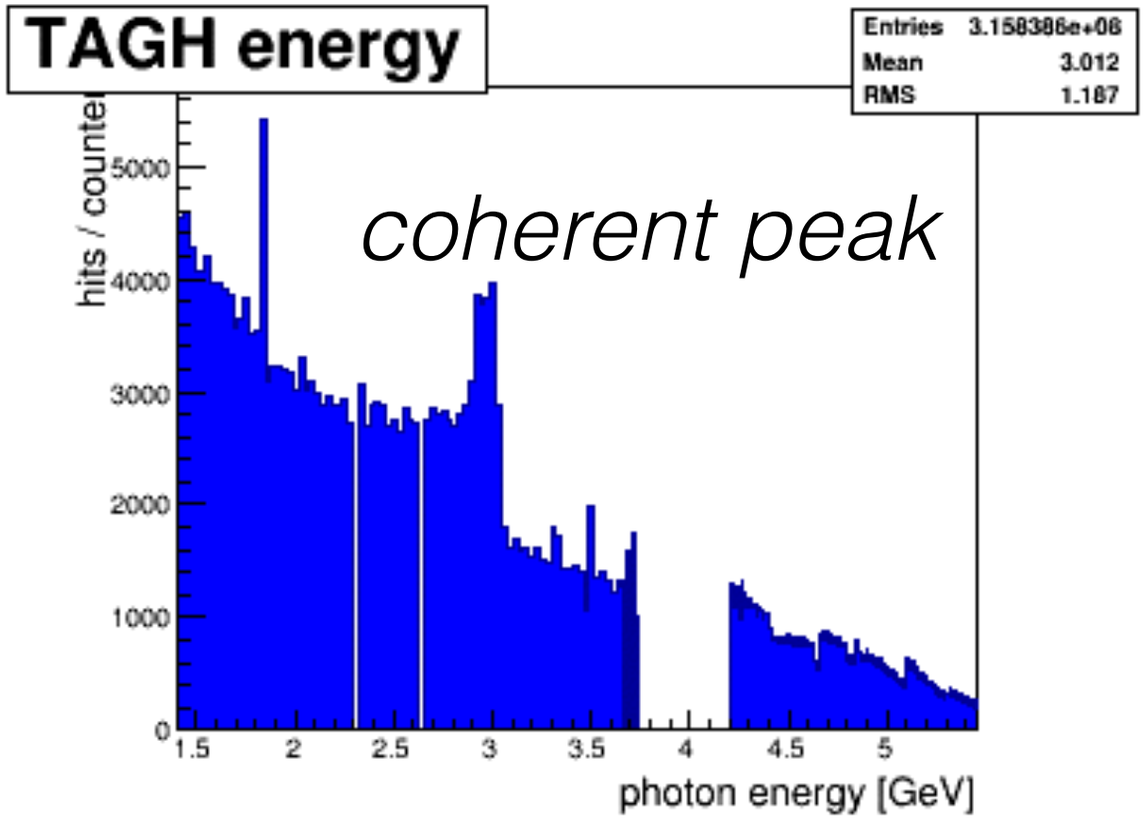


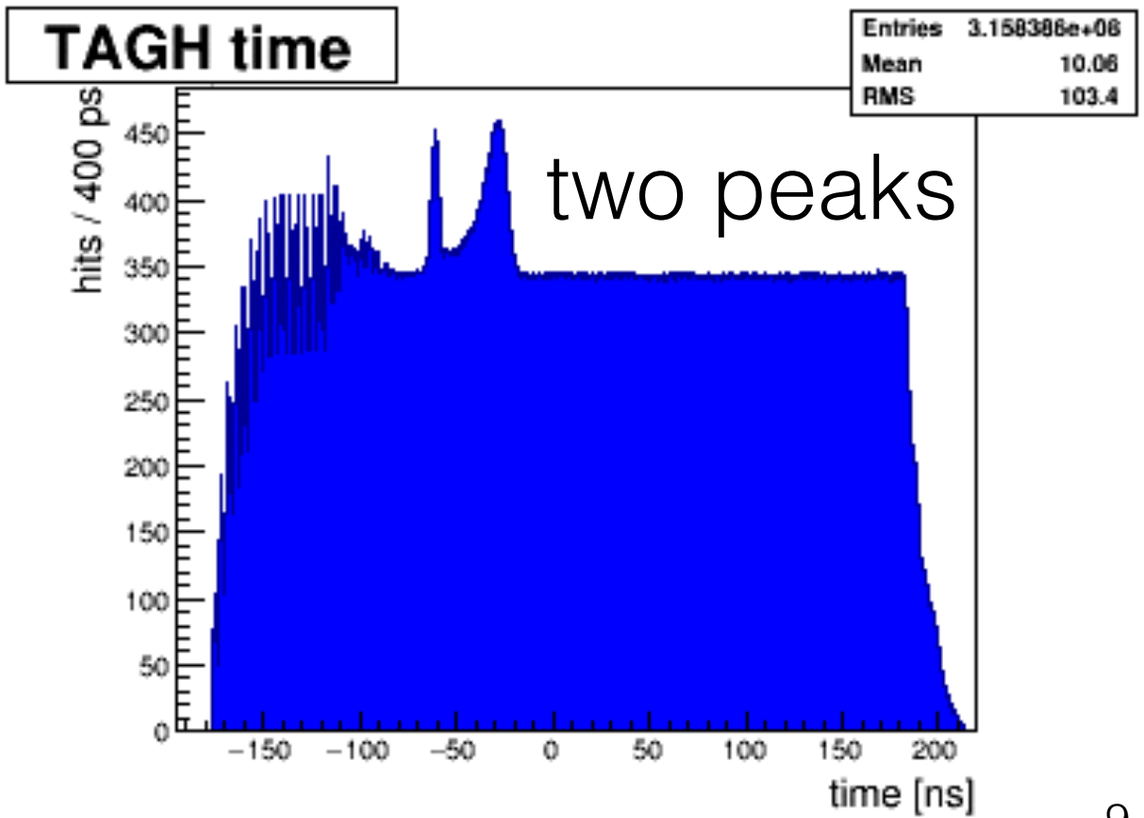


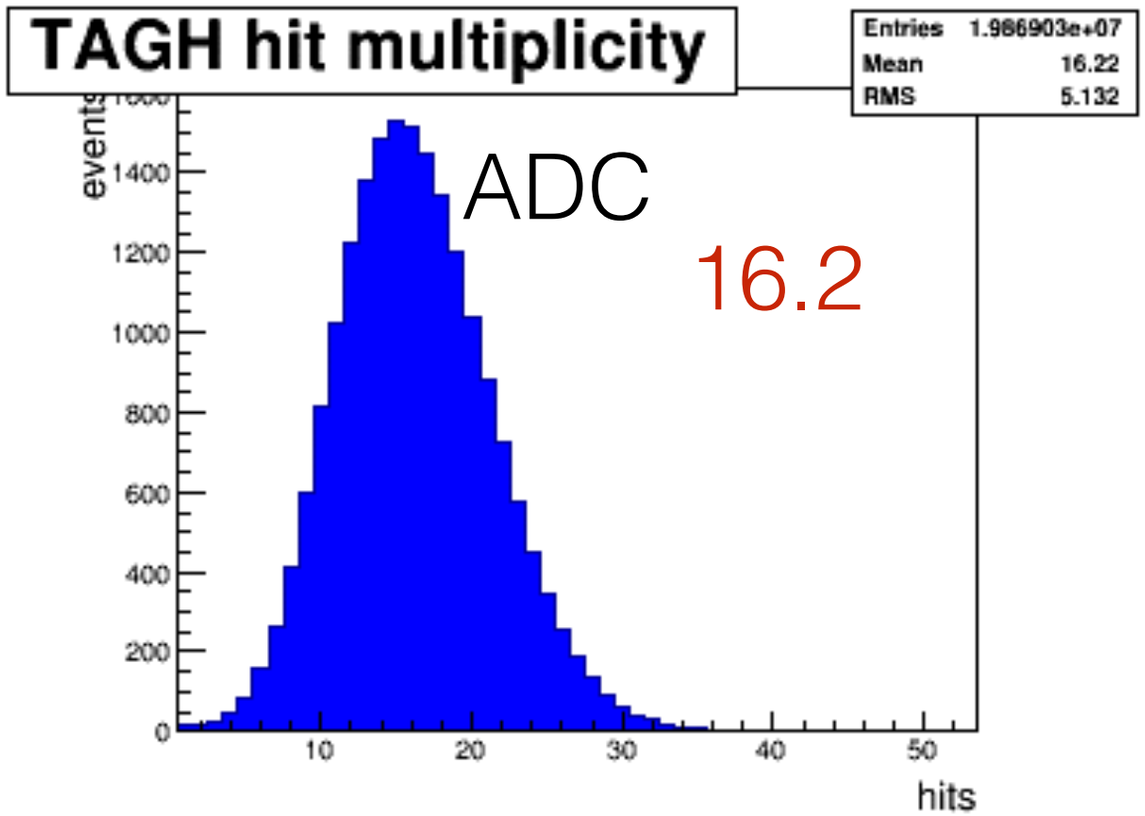


Run 3185 FCAL/BCAL/PS 12 nA on diamond



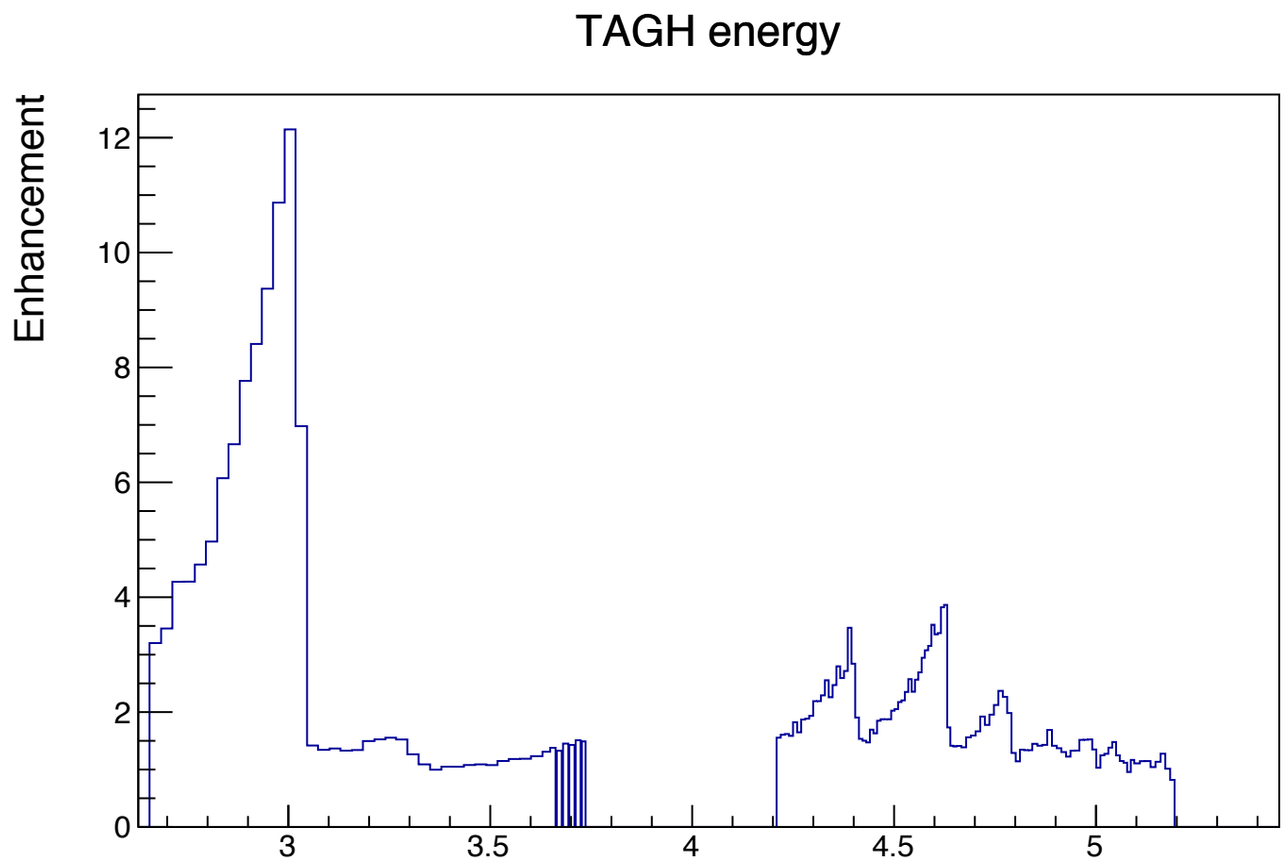


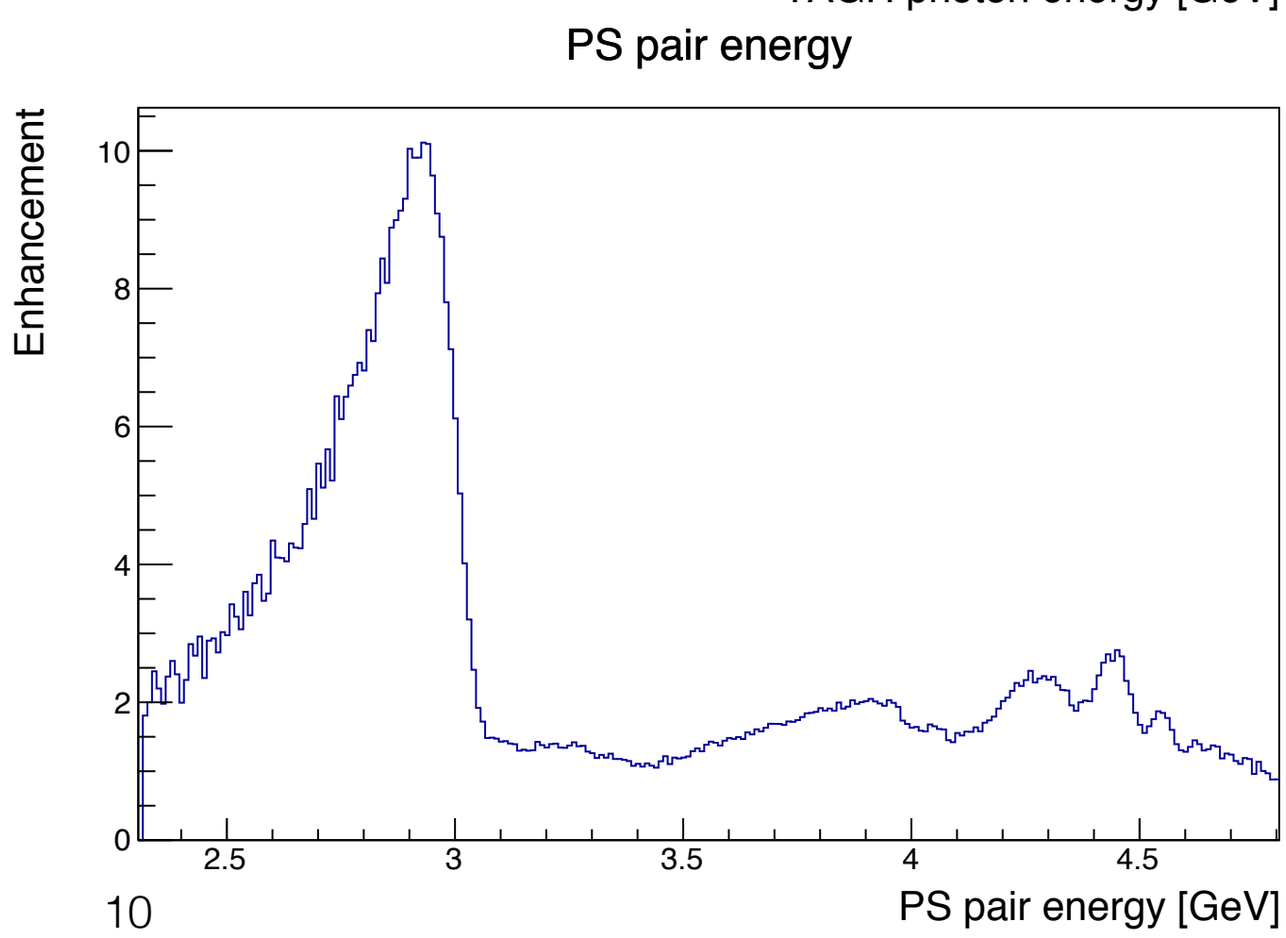




Run 3185/3179

- Select PS events by requiring PS and PSC pairs
- Subtract accidentals from prompts and divide diamond run by amorphous
- See backups for intermediate plots



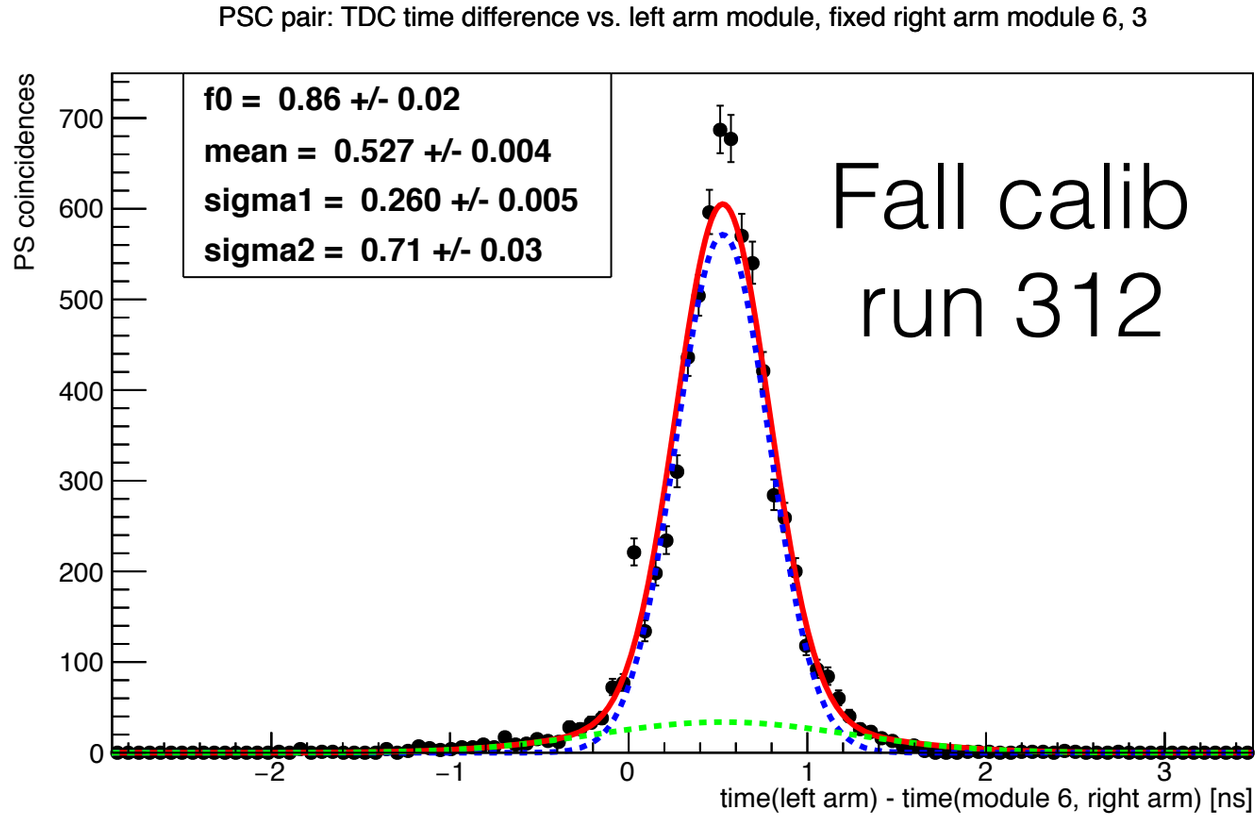


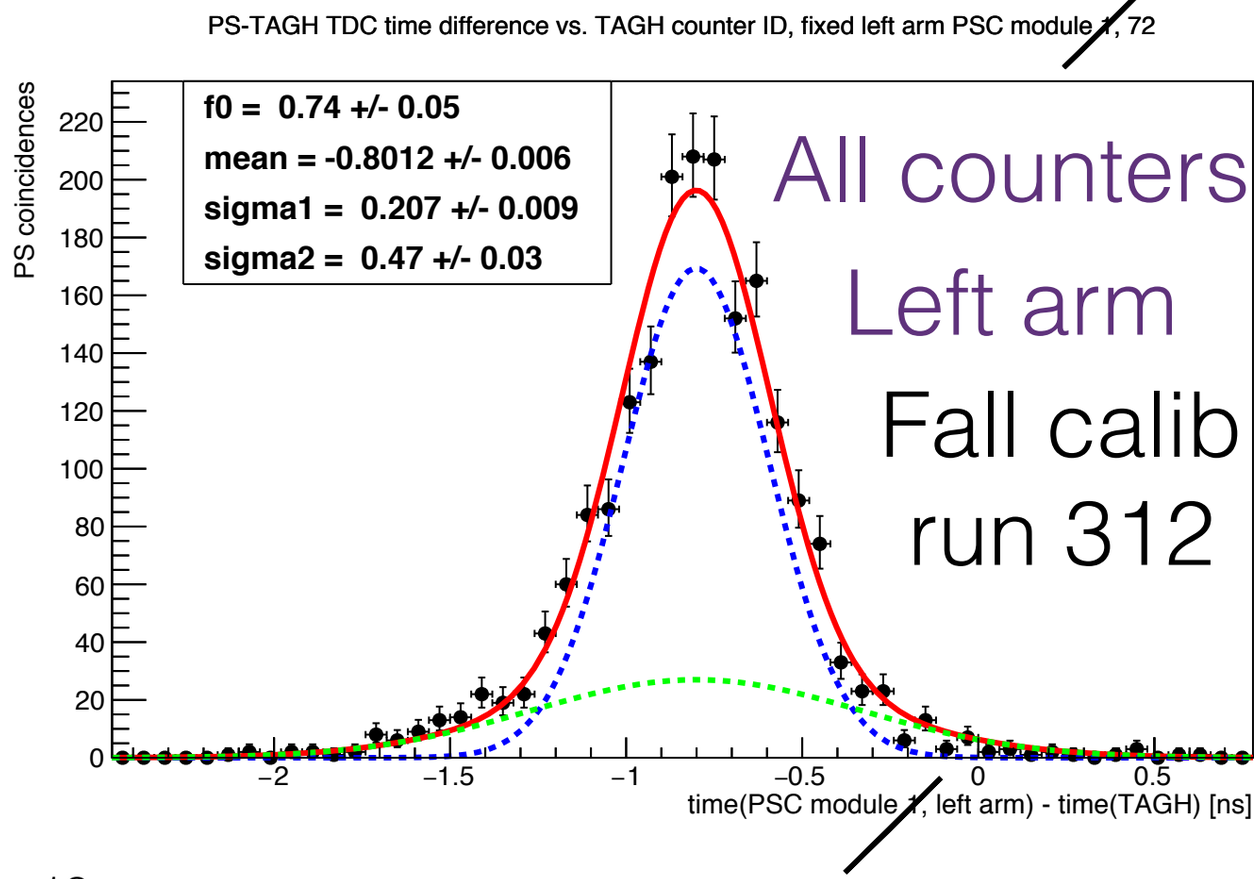
Timing calibrations

- PS-trigger data are preferred (clean sample)
- Strategy: first calibrate PS, then tagger-PS
- Use TDC times from coarse PS counters (8/arm)
- Select counter with most counts in left arm
- Determine offset with each counter in right arm
- Use the same procedure to find the left-arm offsets

Status

- v1 PSC base and counter-counter offsets are in
- need to correct an overall offset between left and right arms which remains
- at the moment one can use the sum of counters in a single arm to calibrate the taggers





Tagging efficiency

- What fraction of photons interacting in the target are tagged by the tagger detectors?

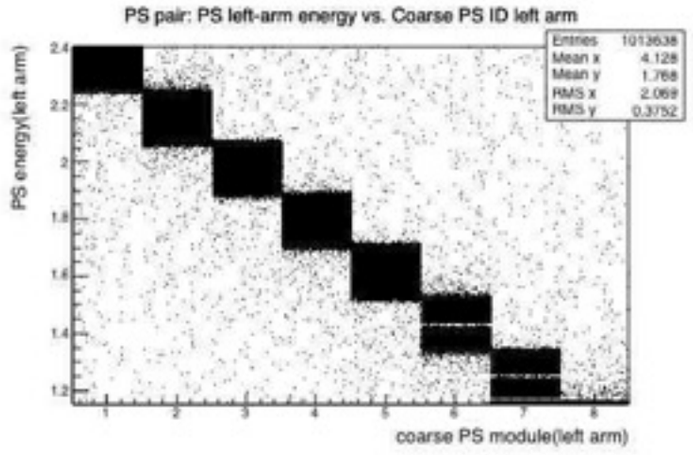
- PS-trigger runs can be used to estimate this value

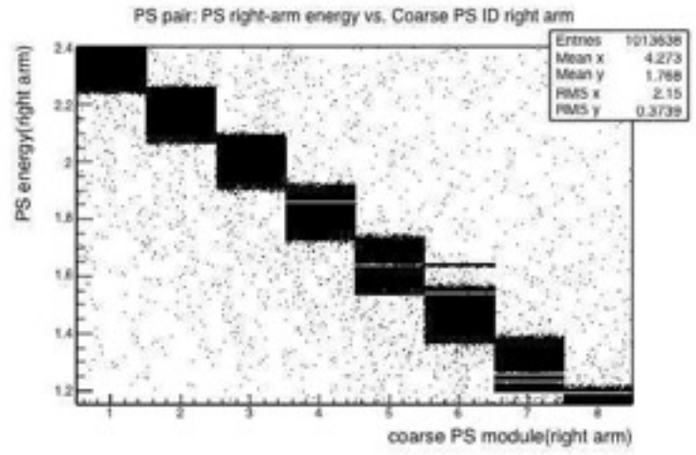
- Select PS/PSC pairs and determine the fraction of these that are in coincidence with a tagger hit for each PS pair energy bin

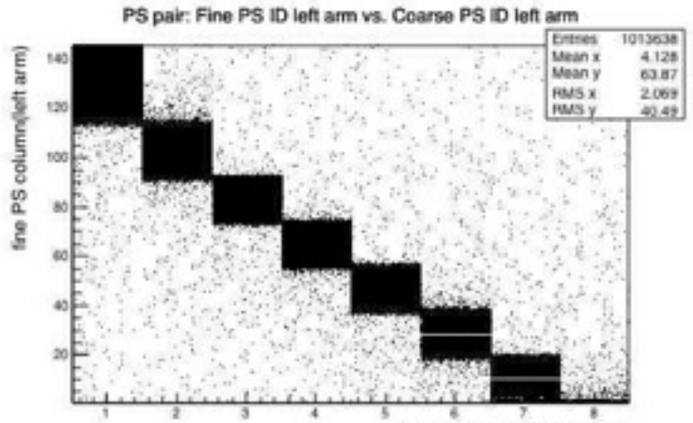
- Will show run 3185 (~ 20M triggers)

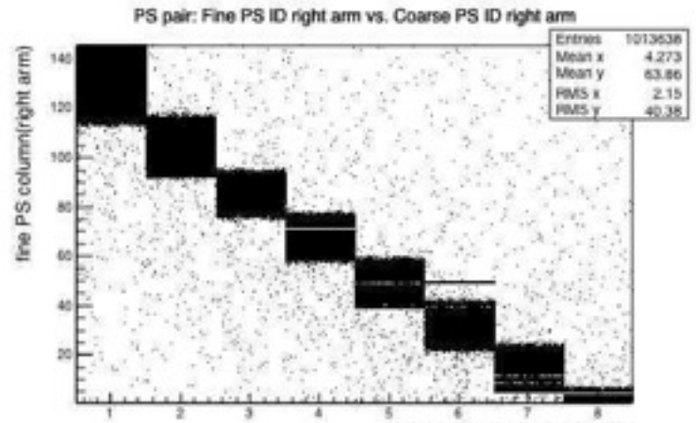
Candidate selection

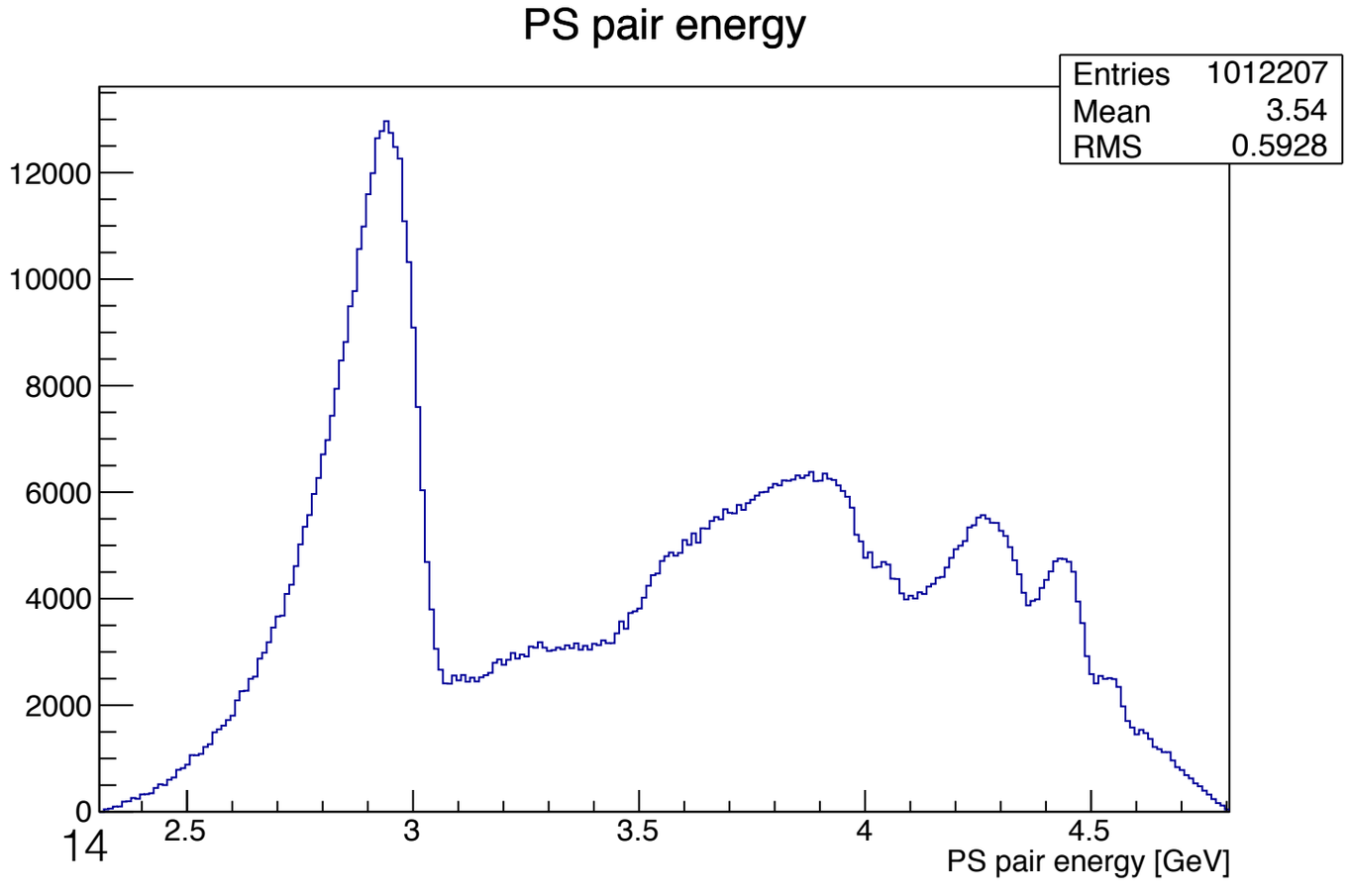
- PS and PSC left-right pairs within 10 ns
- If more than 1 hit pair, select closest in time
- Tagger energy within 15% of PS pair energy
- Select prompt peak in PSC/ tagger time difference and subtract accidentals (using side-band)





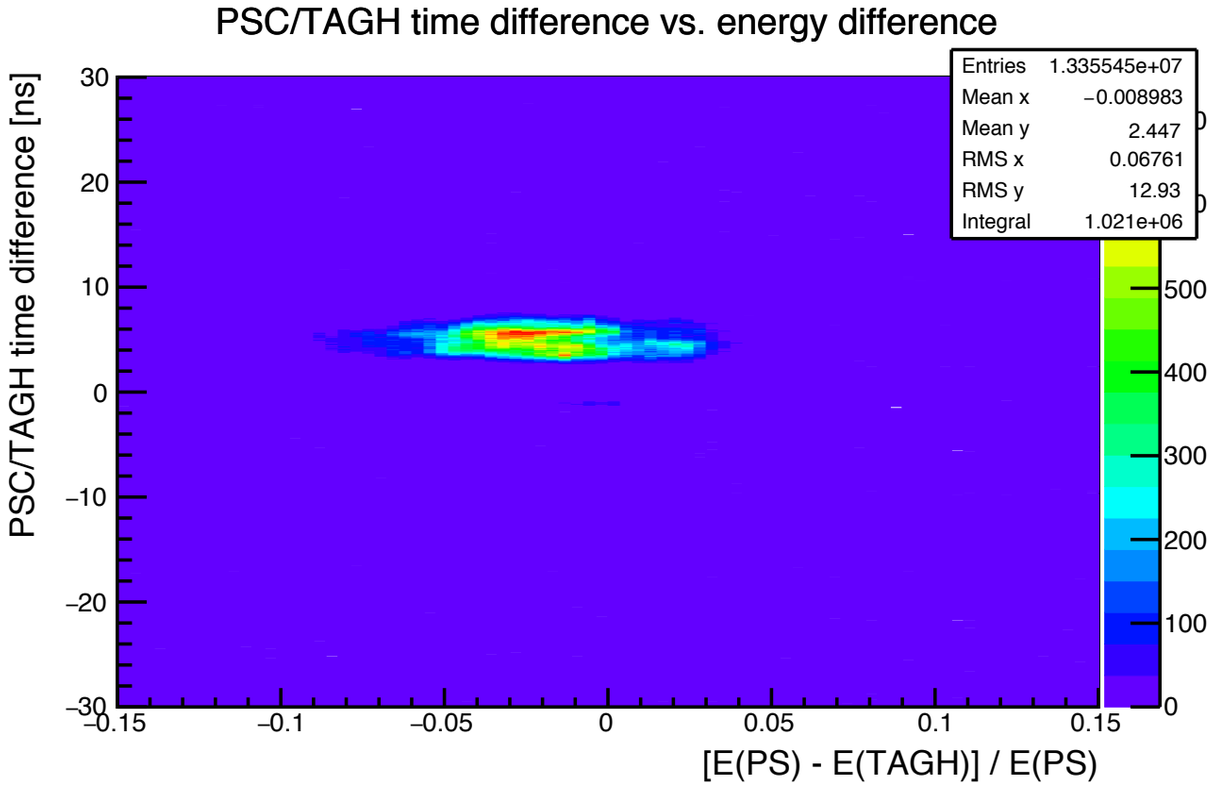


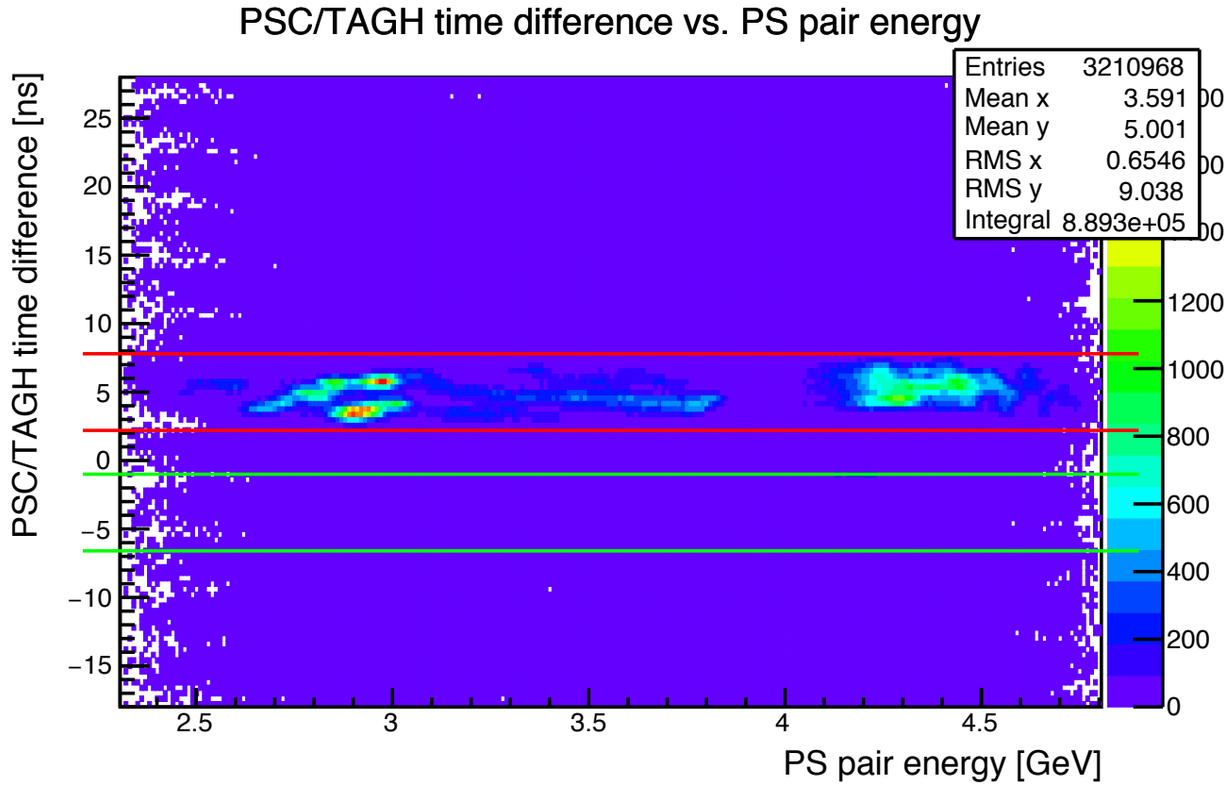


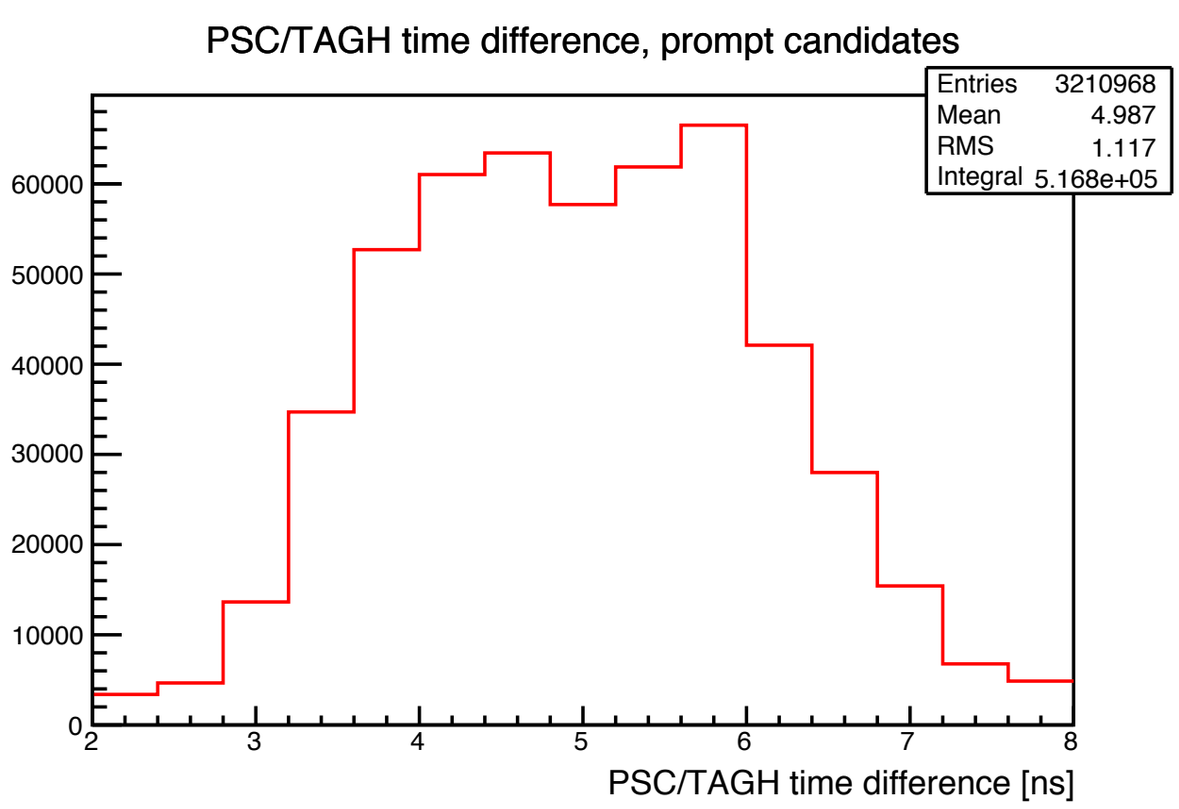


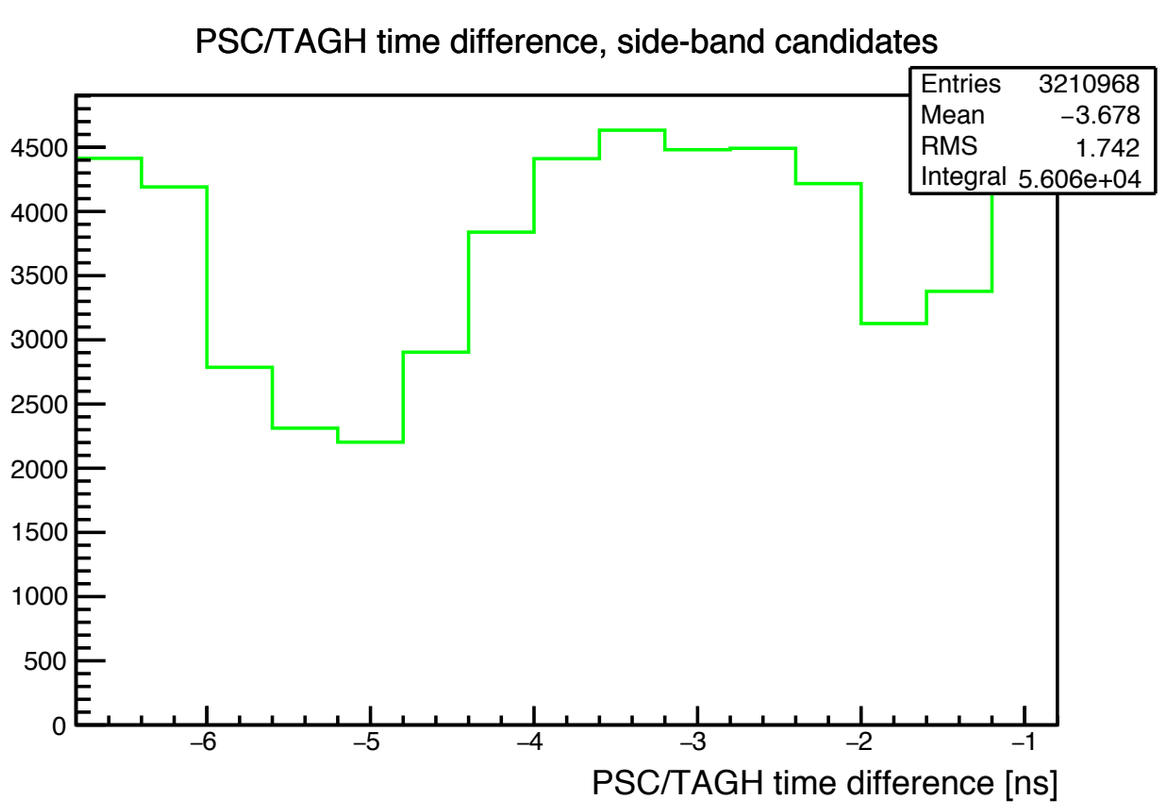
Run 3185

Hodoscope



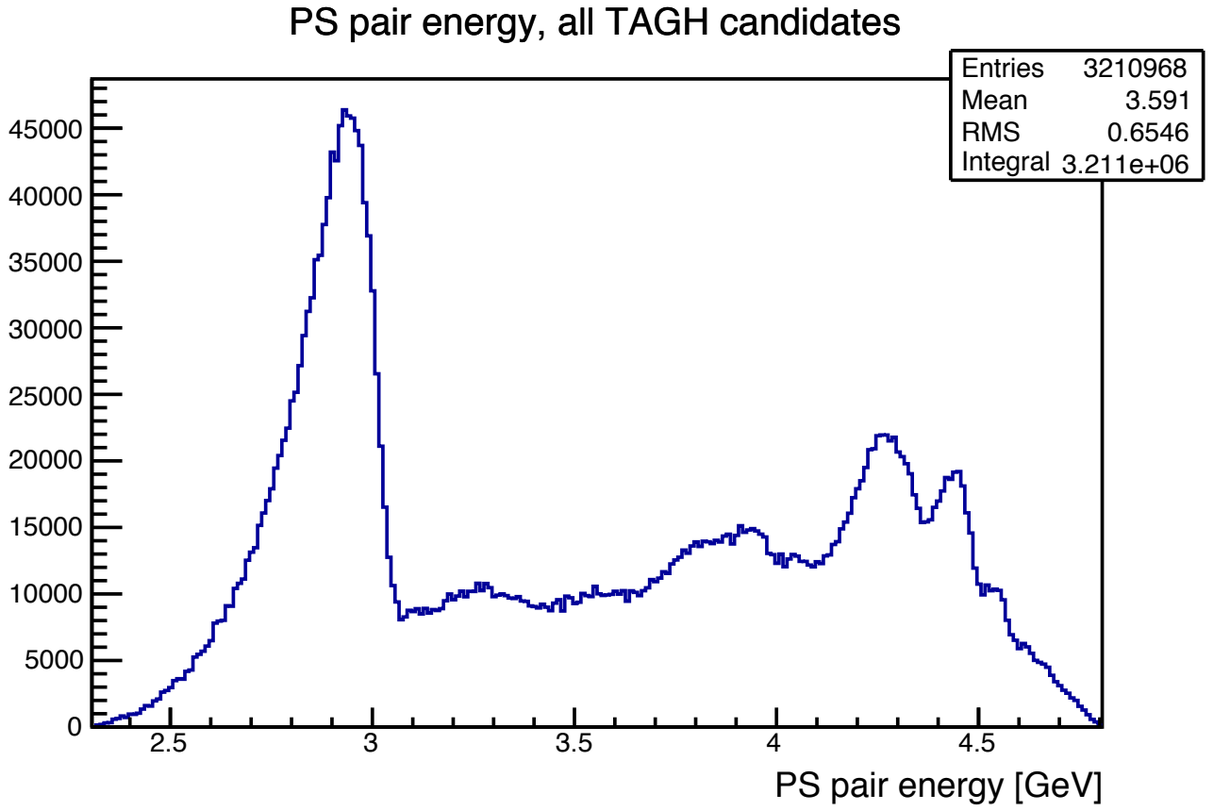


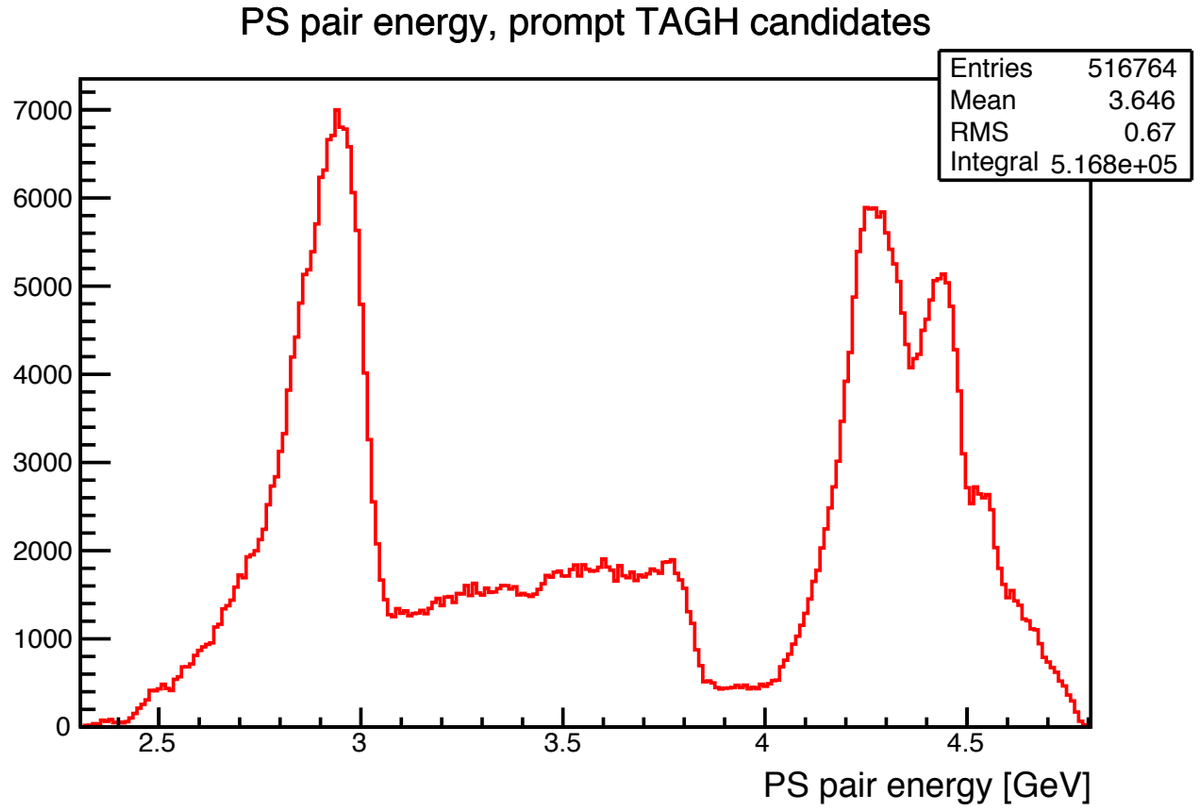


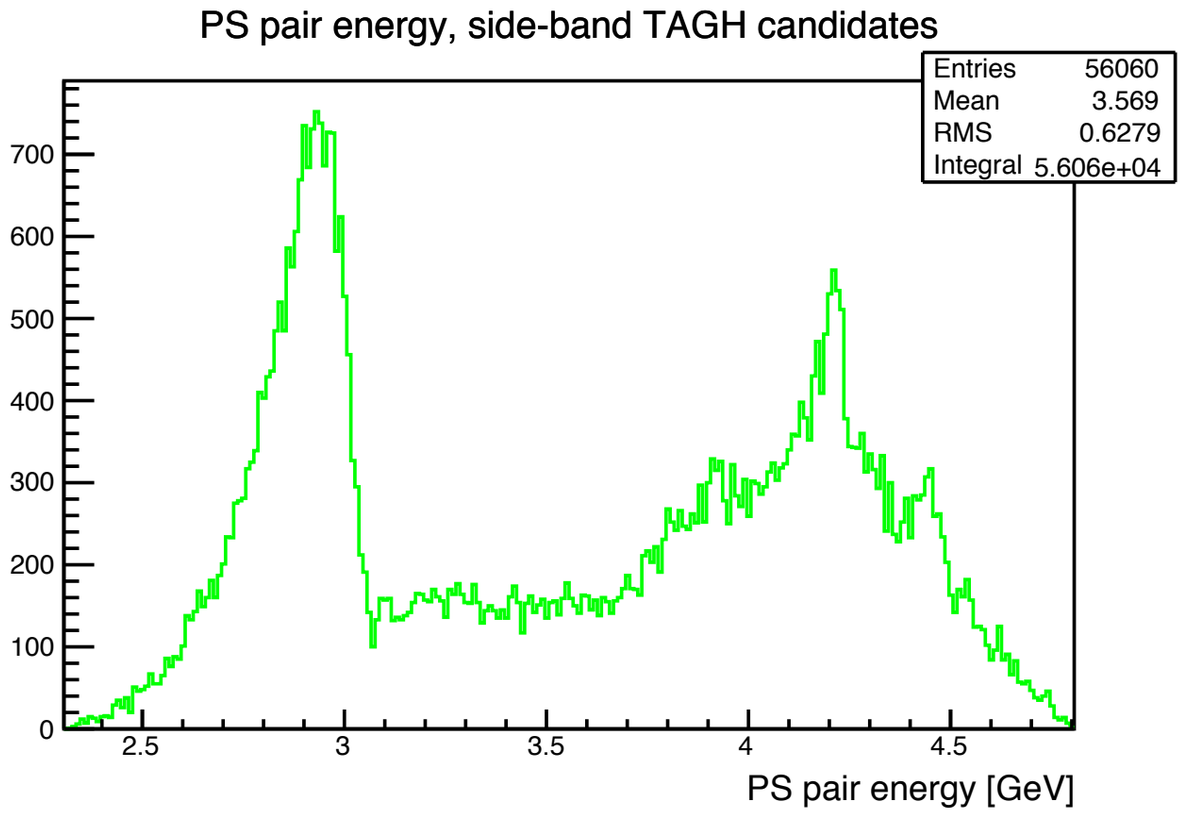


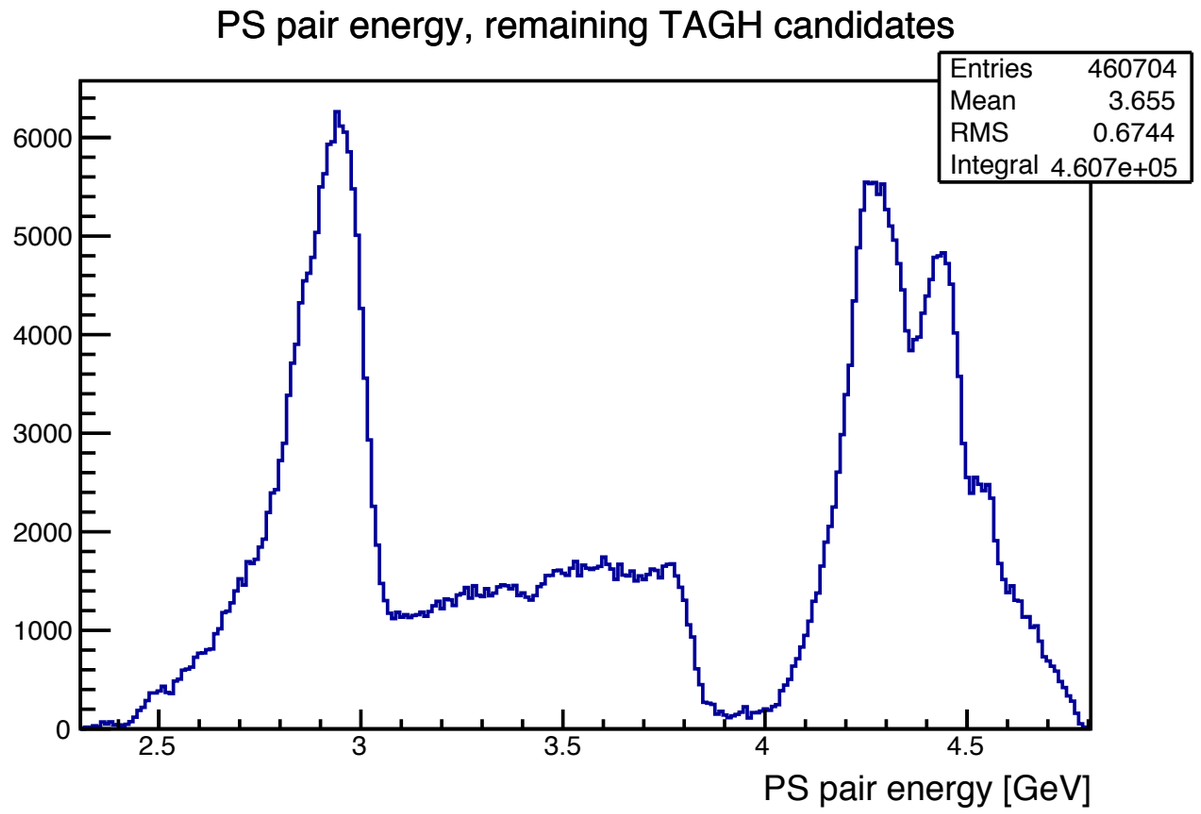
Run 3185

Hodoscope



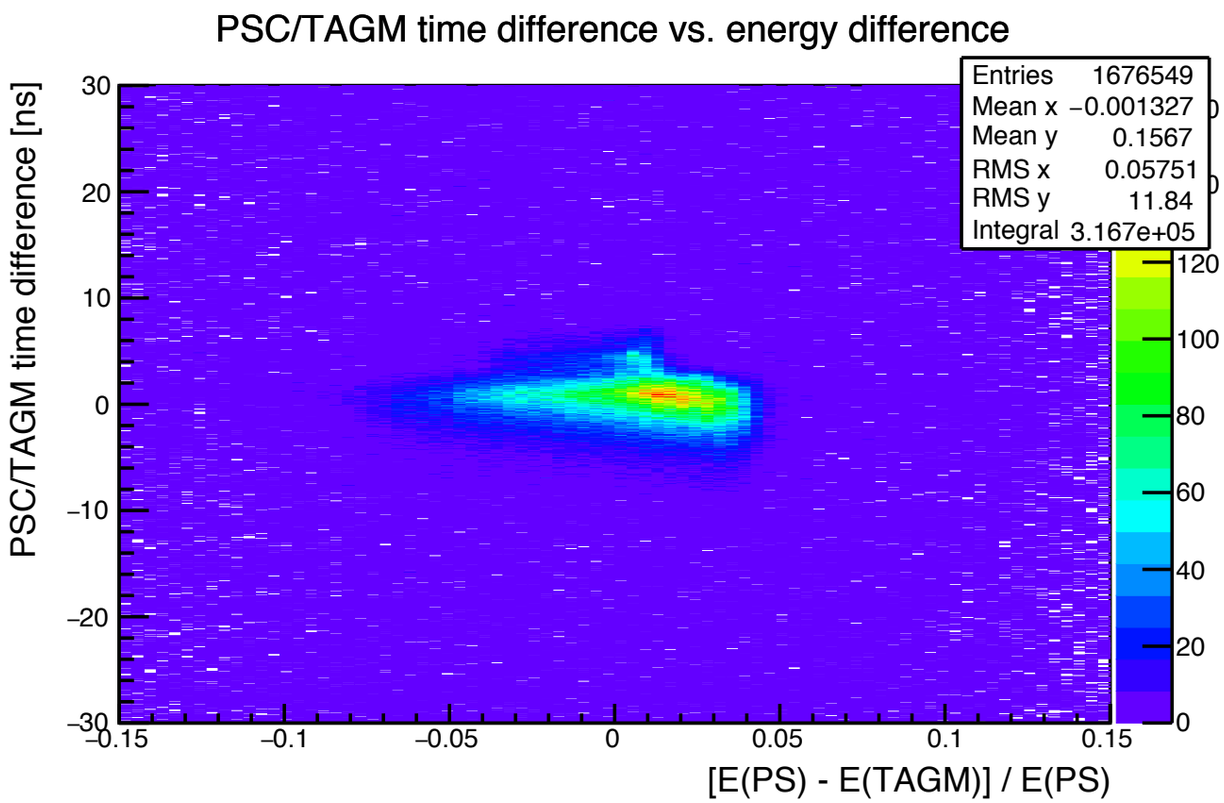


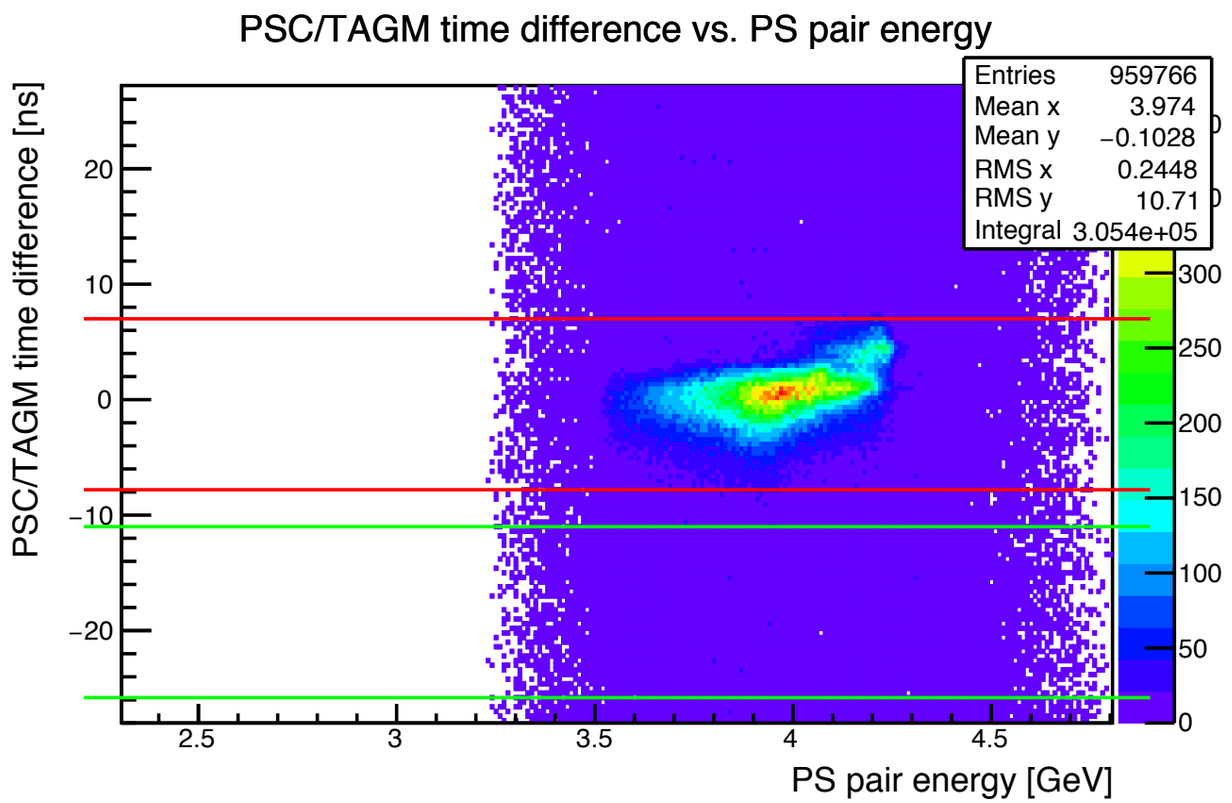


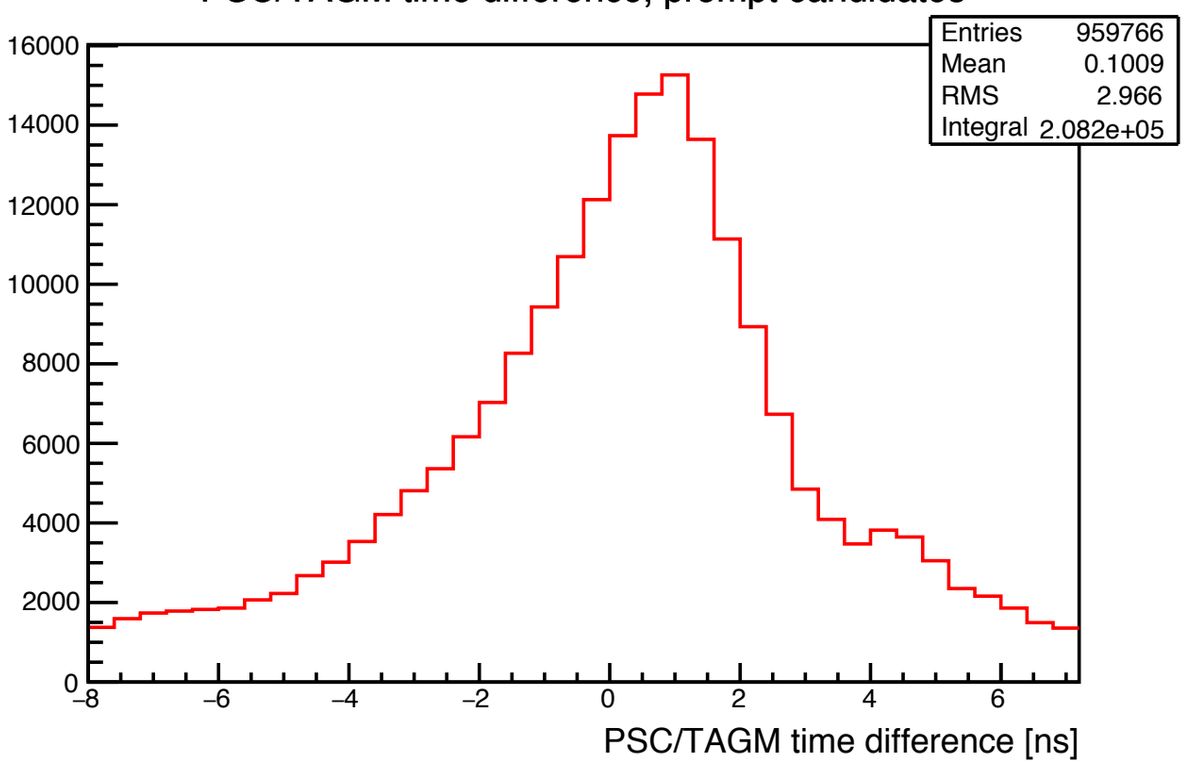


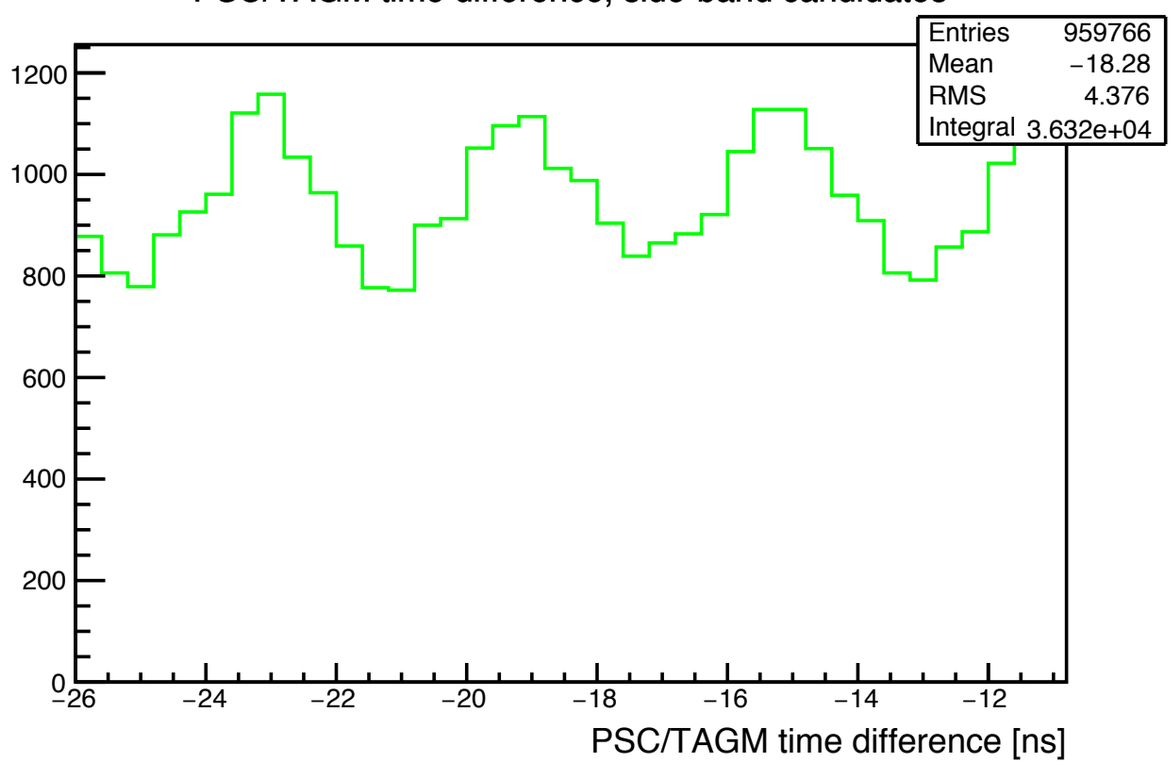
Run 3185

Microscope

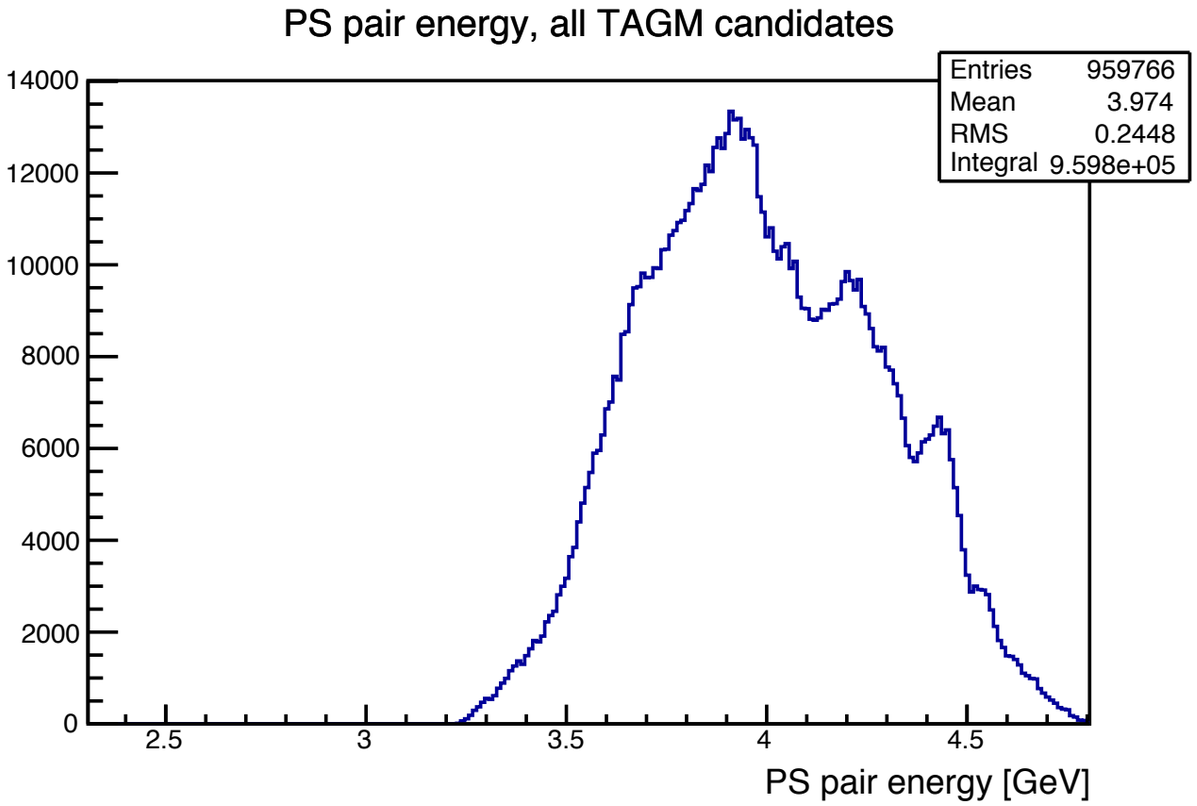


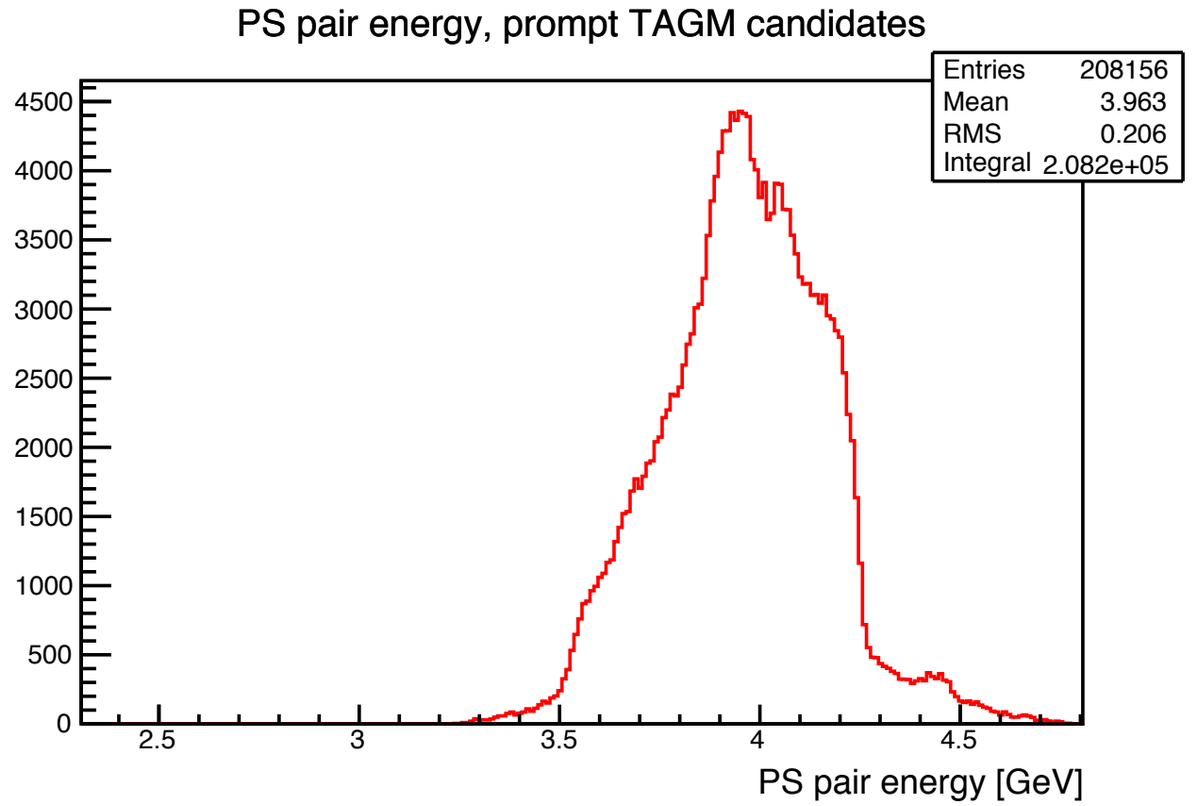


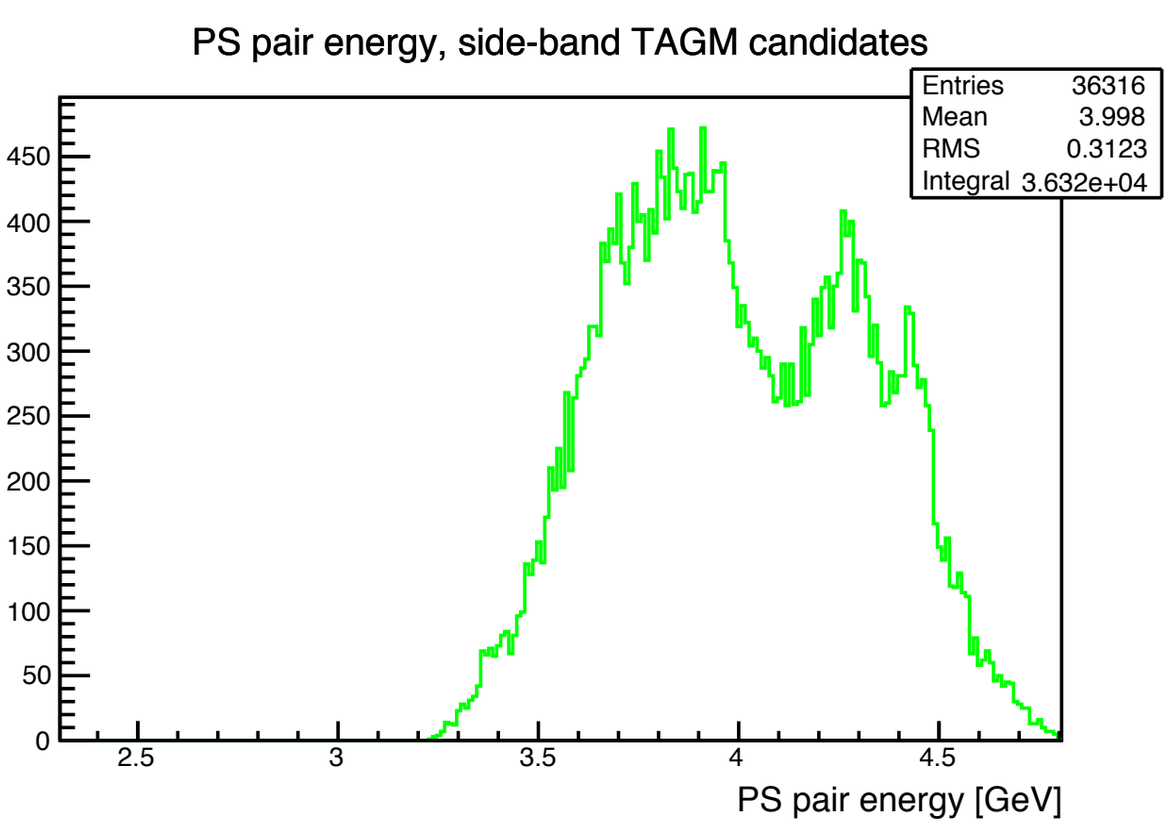


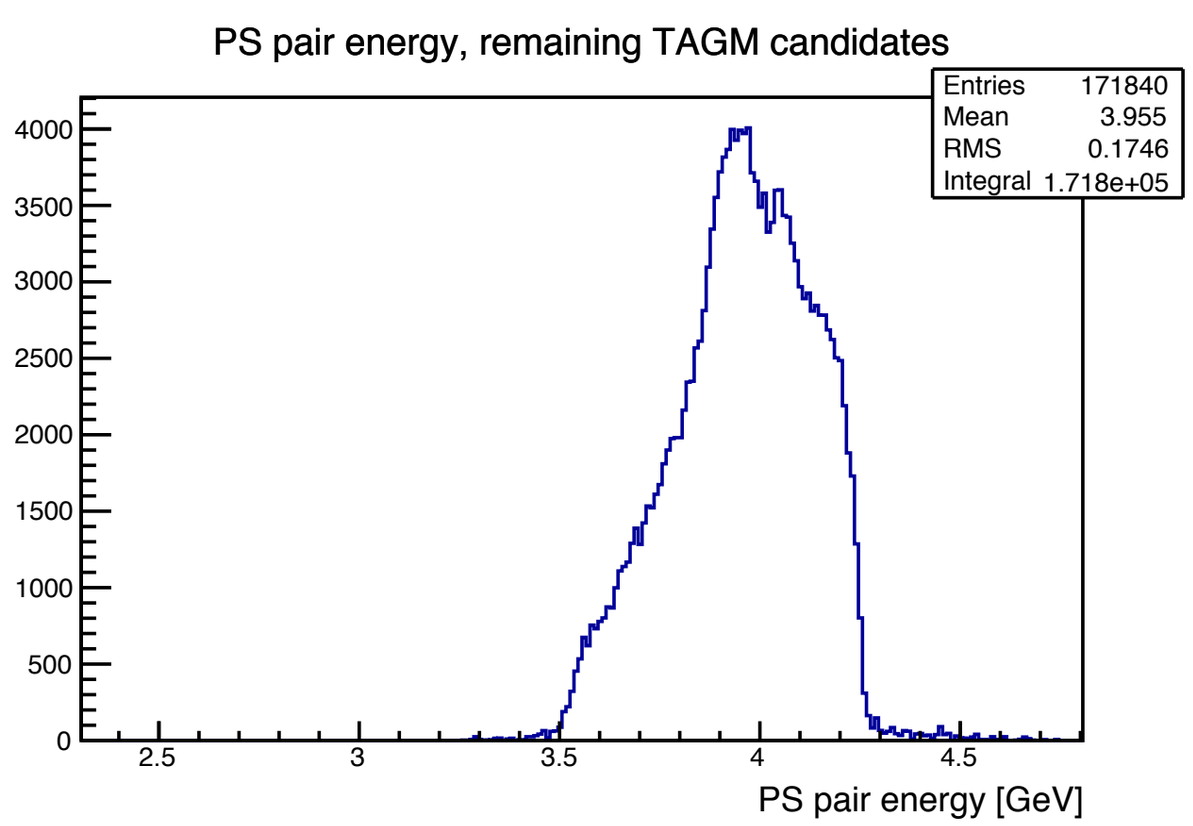


Run 3185 Microscope

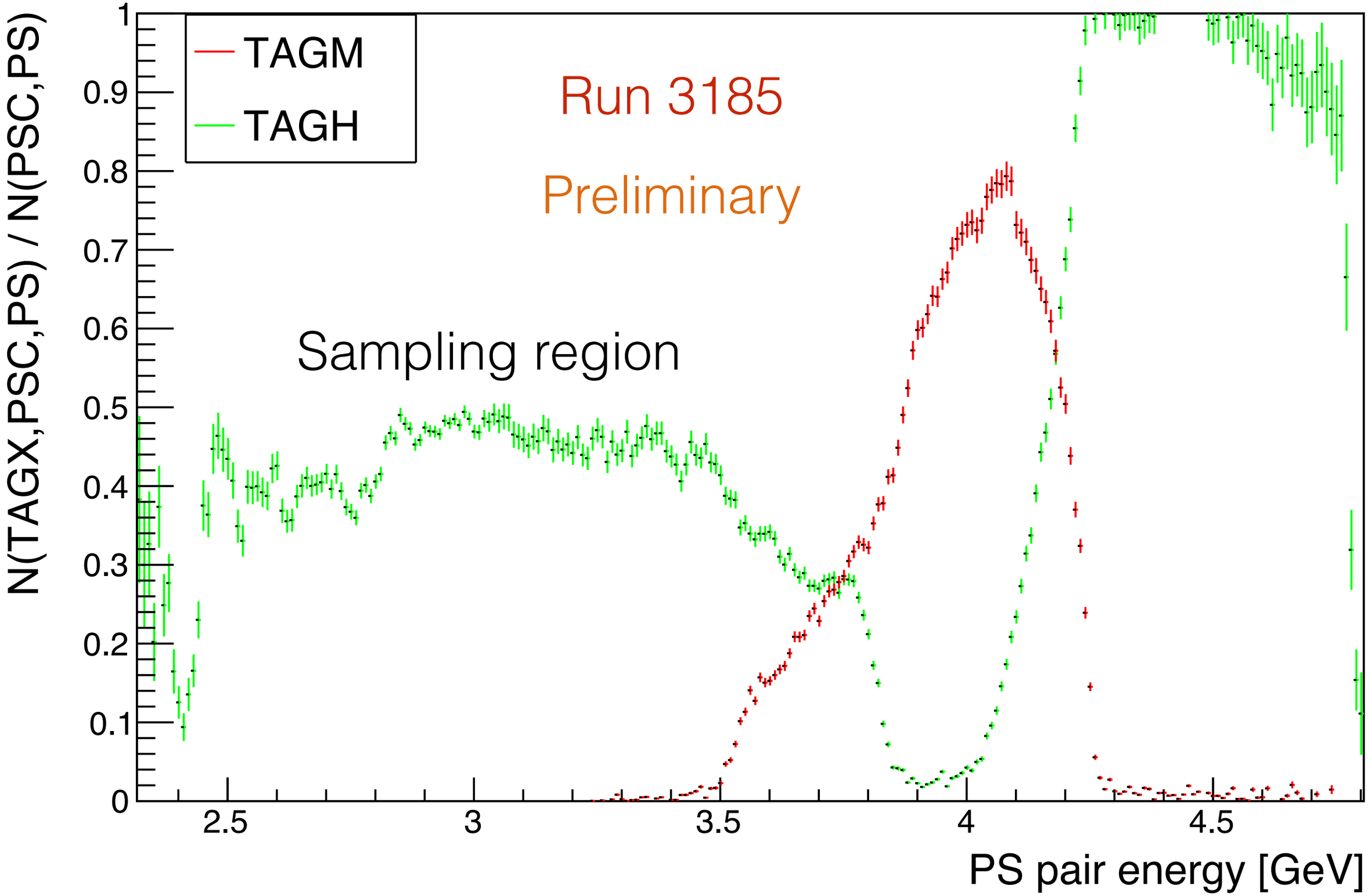








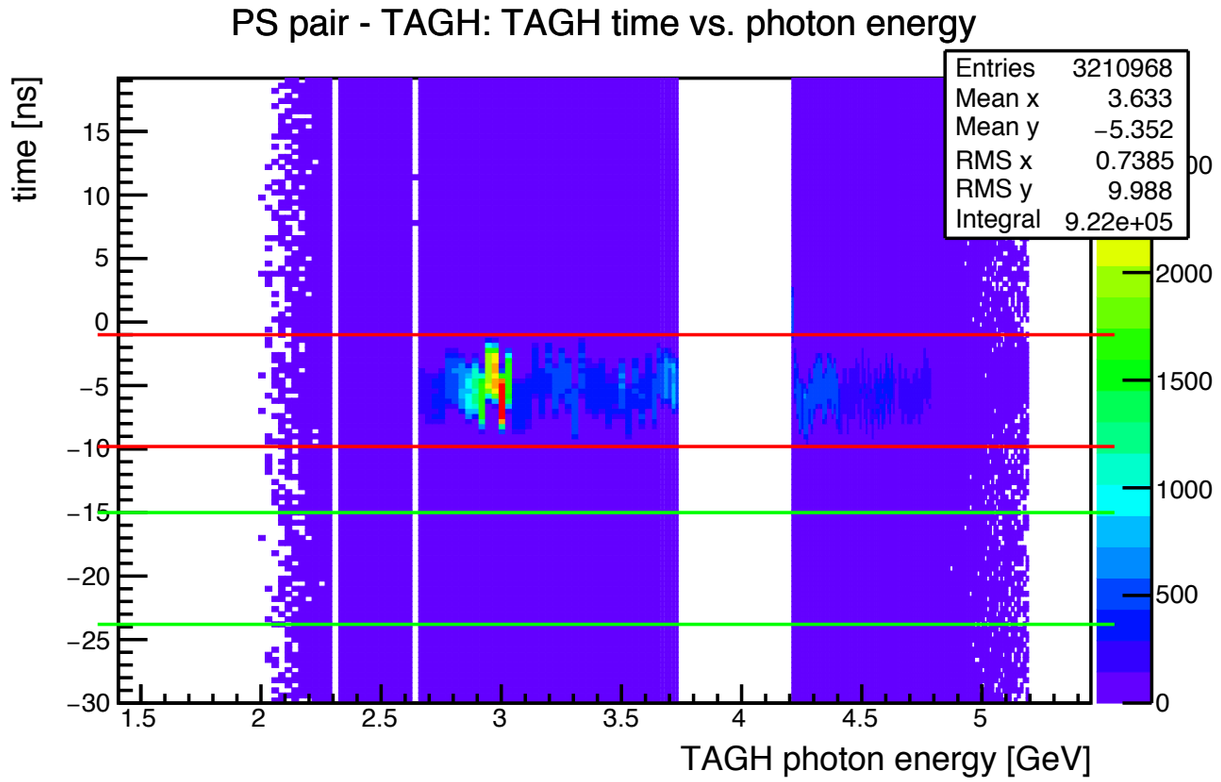
Tagging Efficiency

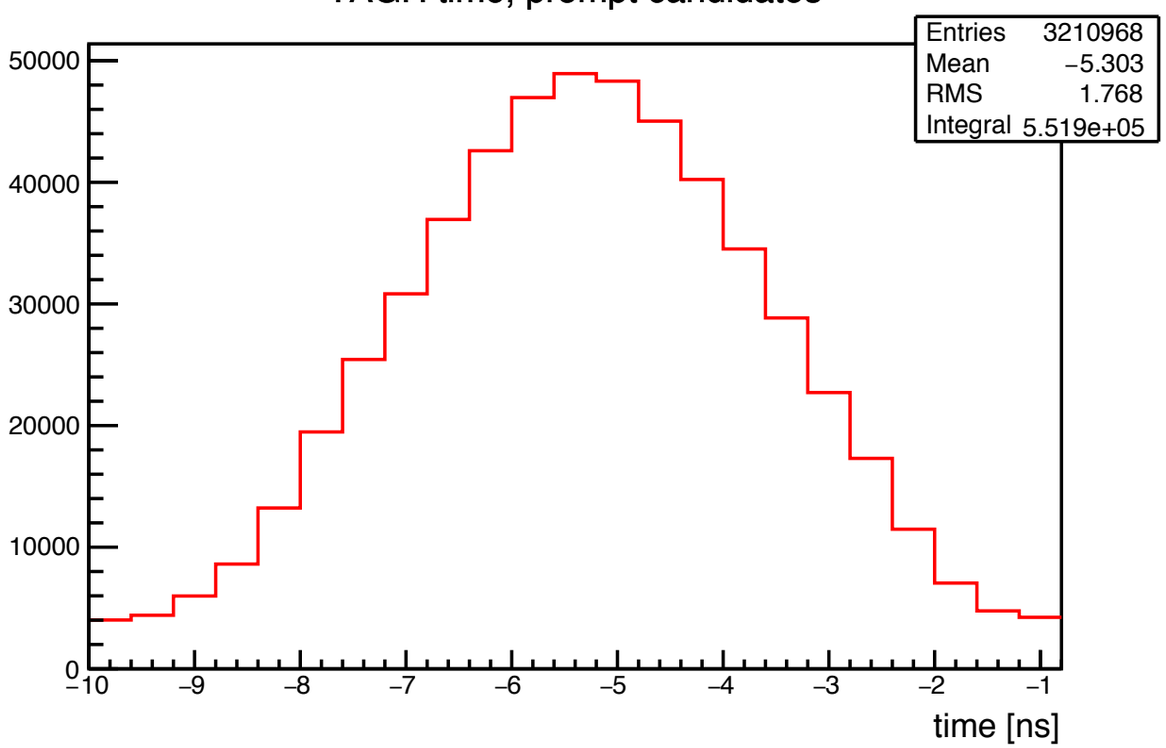


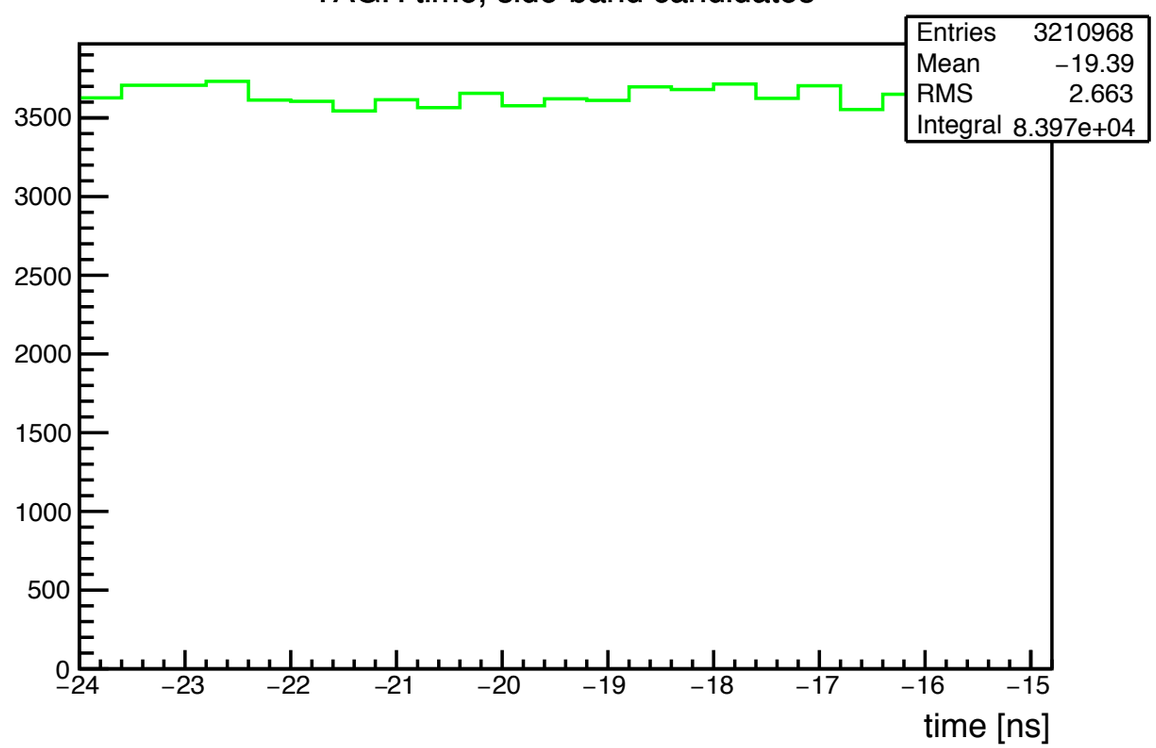
Summary/Outlook

- Overall good performance from TAGH this Spring
- Progress on PS/tagger timing calibrations, the new PS data will be very useful to advance these
- High-rate runs will be studied in more detail
- Preliminary tagging efficiencies appear to be at least in rough agreement with expectations

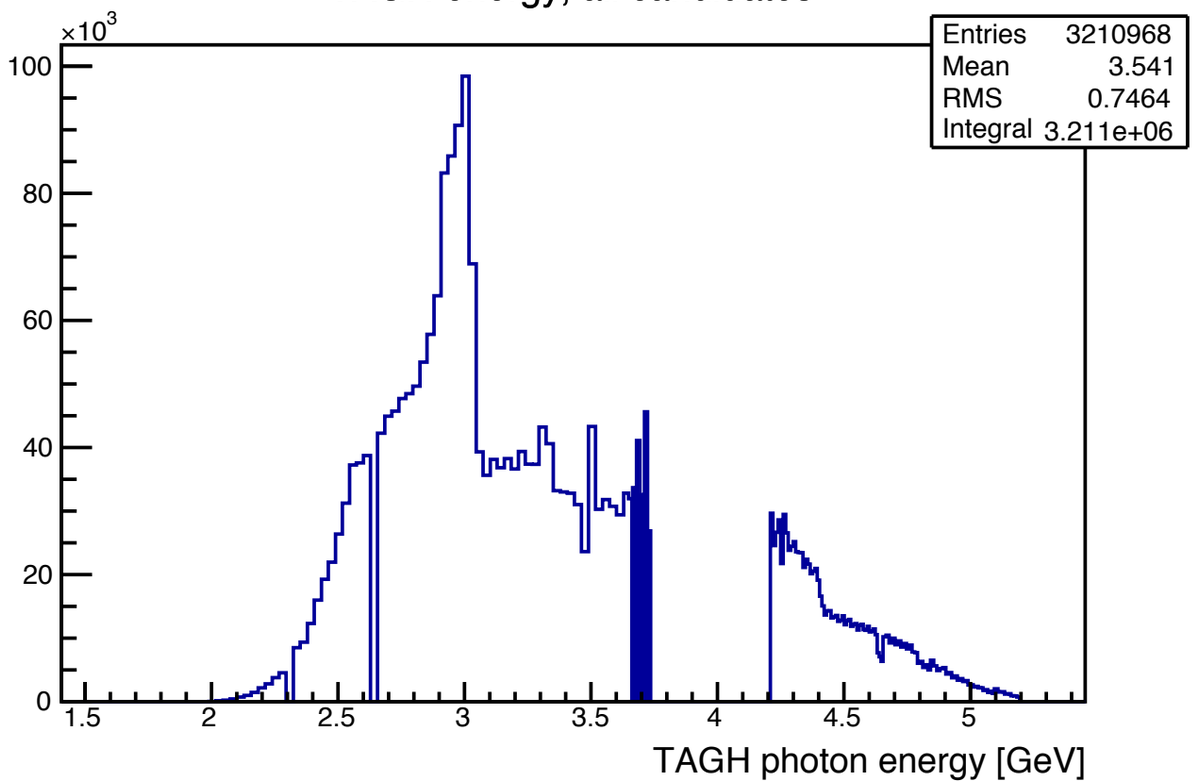
- Run 3185, diamond
- Select prompt and side-band candidates

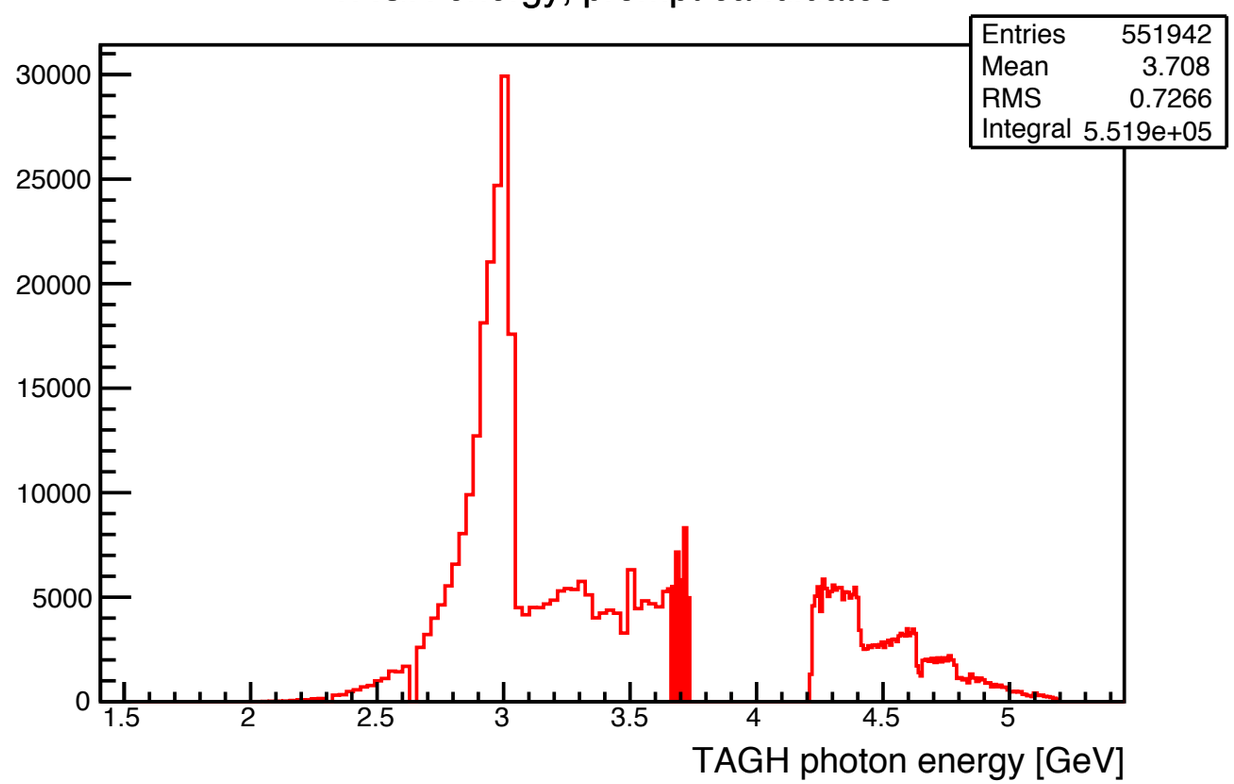


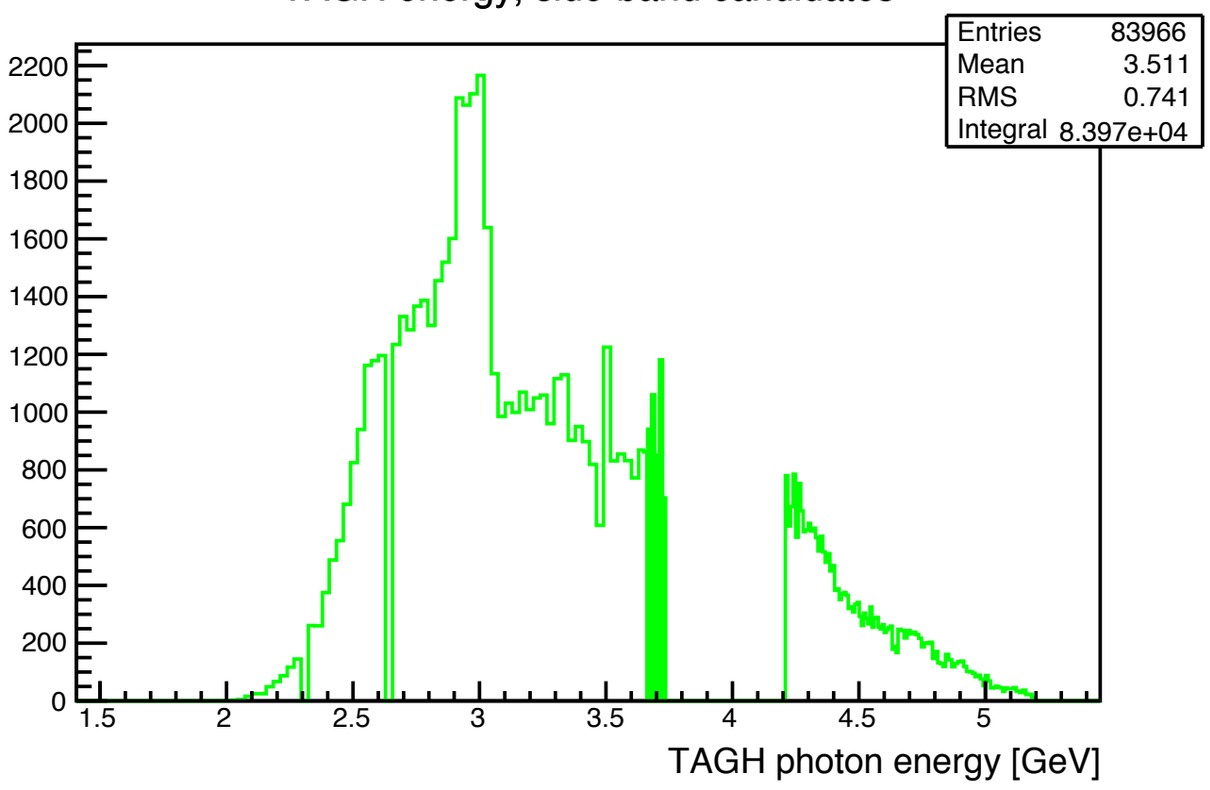


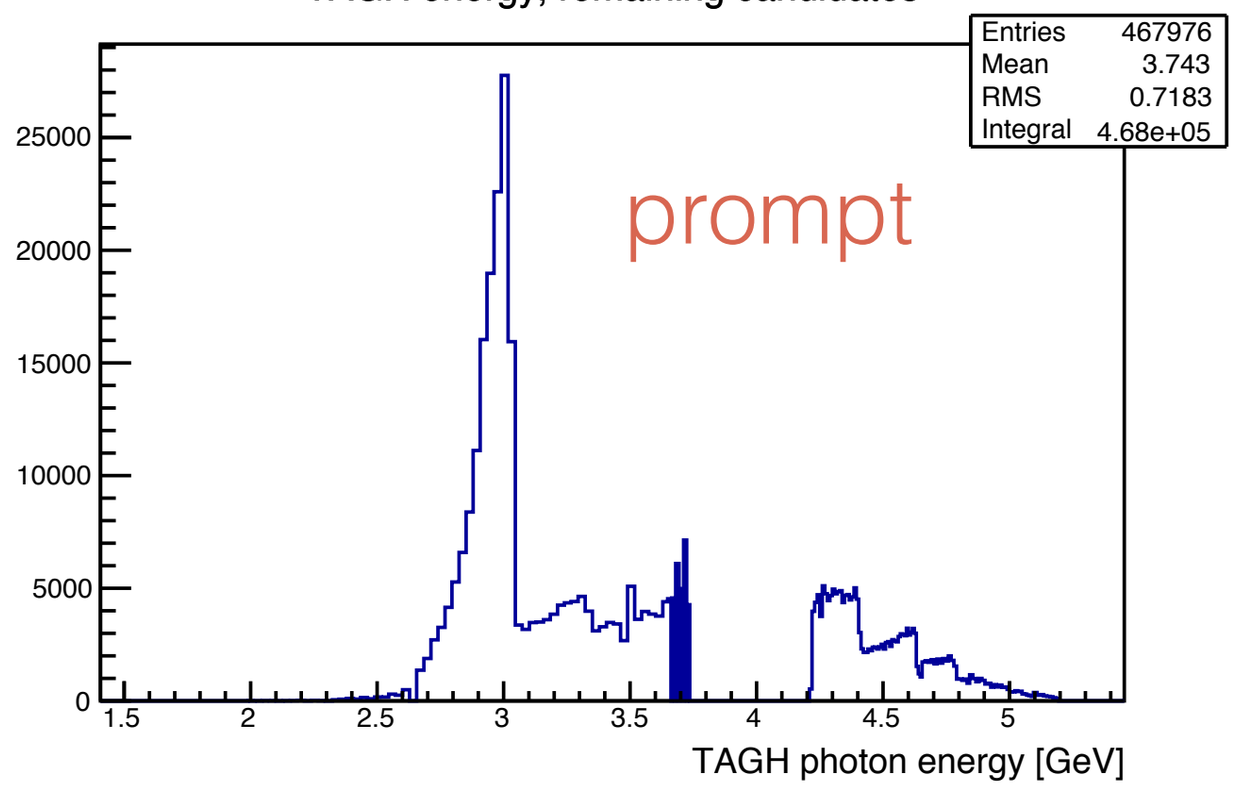


Run 3185

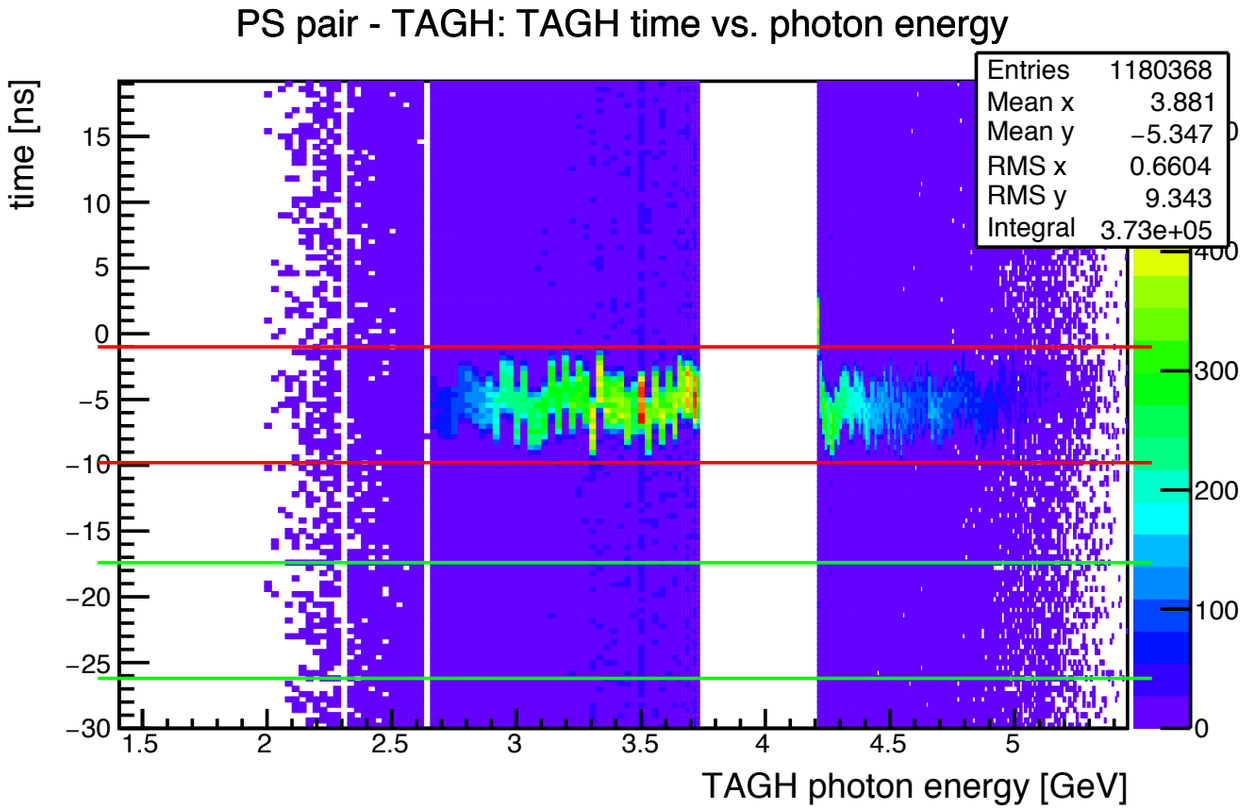

TAGH energy, all candidates
×10^3
Entries 3210968
Mean 3.541
RMS 0.7464
Integral 3.211e+06
TAGH photon energy [GeV]

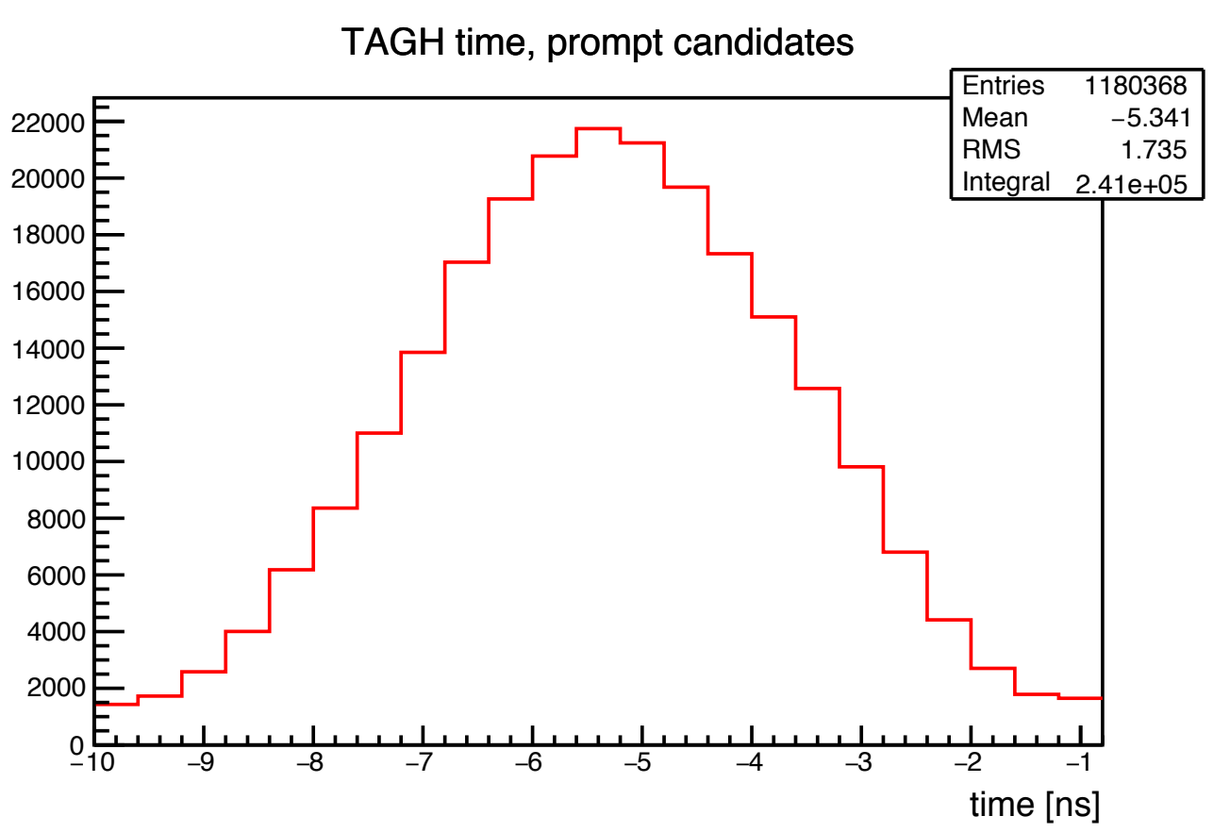

TAGH energy, prompt candidates
Entries 551942
Mean 3.708
RMS 0.7266
Integral 5.519e+05
TAGH photon energy [GeV]

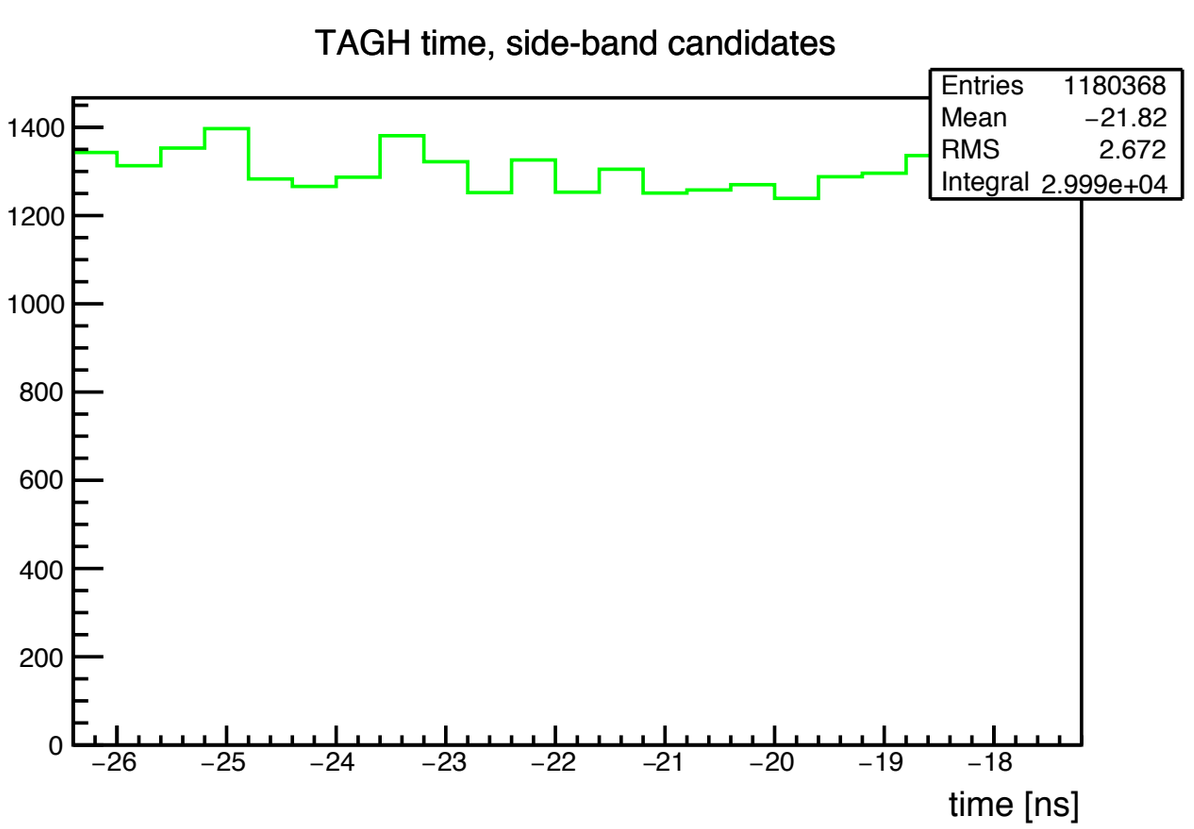

TAGH energy, side-band candidates
Entries 83966
Mean 3.511
RMS 0.741
Integral 8.397e+04
TAGH photon energy [GeV]


TAGH energy, remaining candidates
Entries 467976
Mean 3.743
RMS 0.7183
Integral 4.68e+05
prompt
TAGH photon energy [GeV]

- Run 3179, amorphous
- Select prompt and side-band candidates

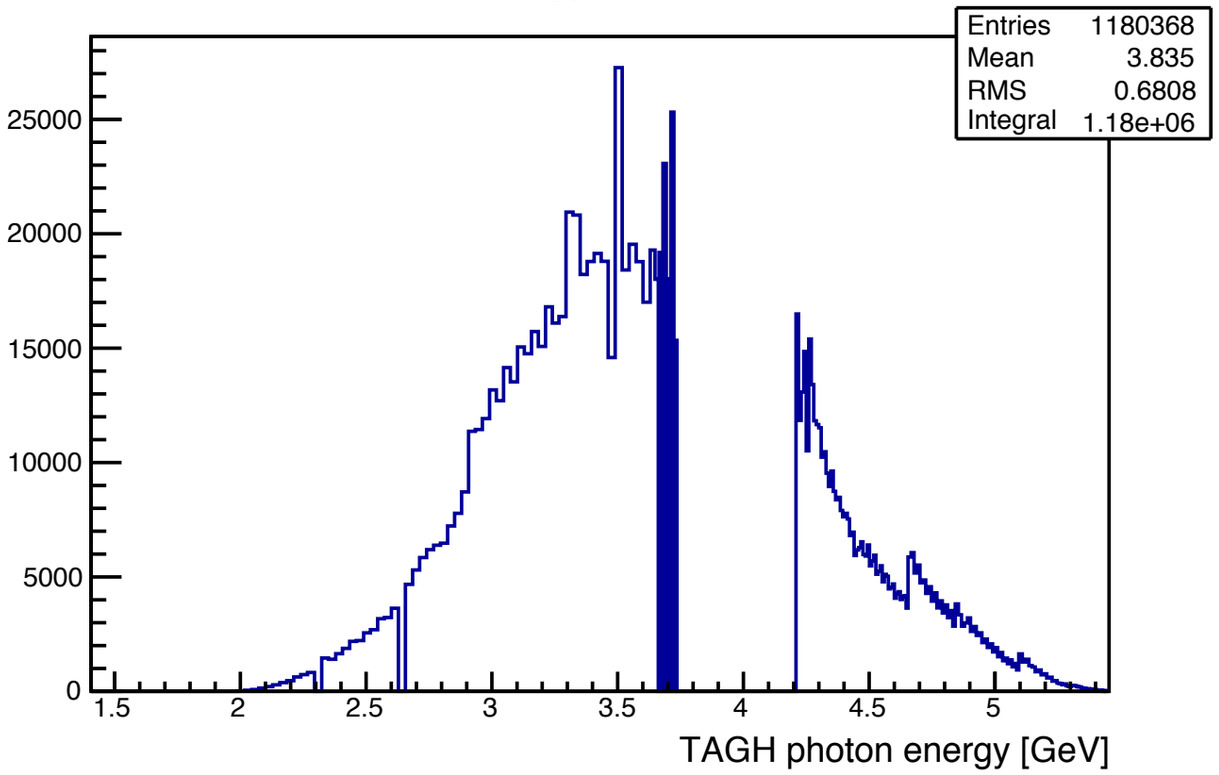




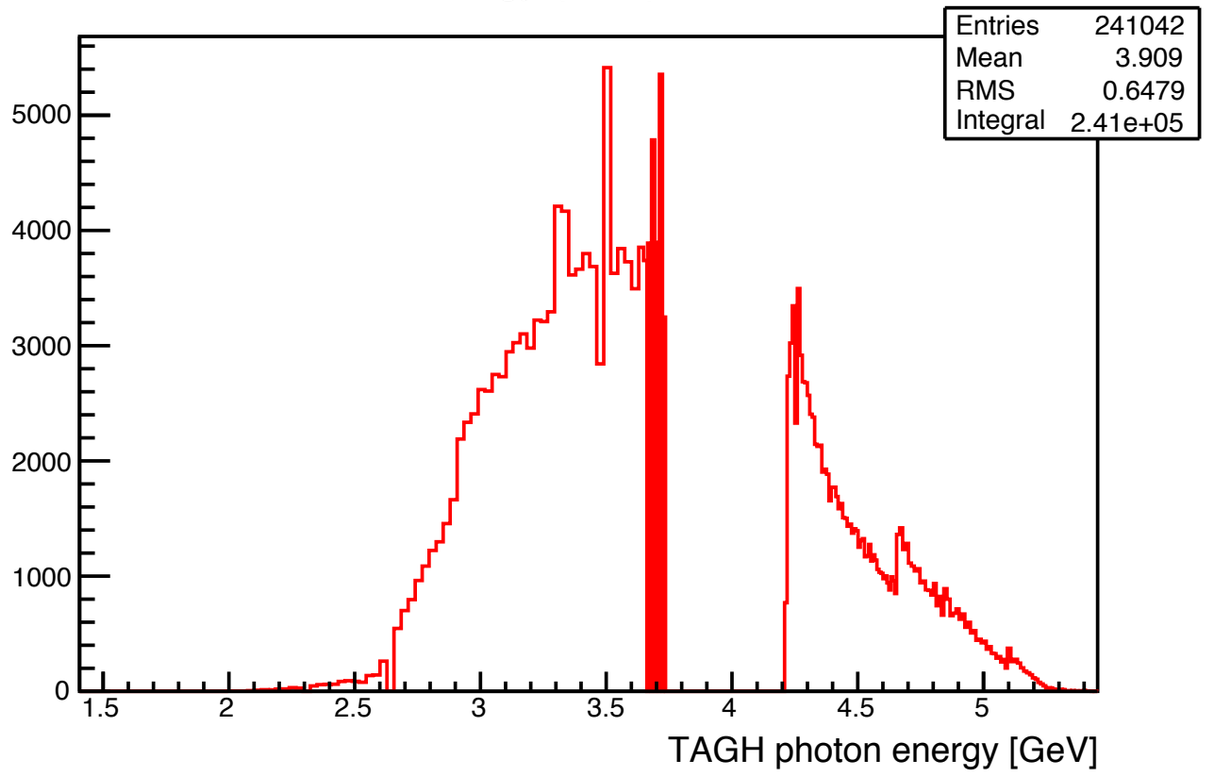


Run 3179

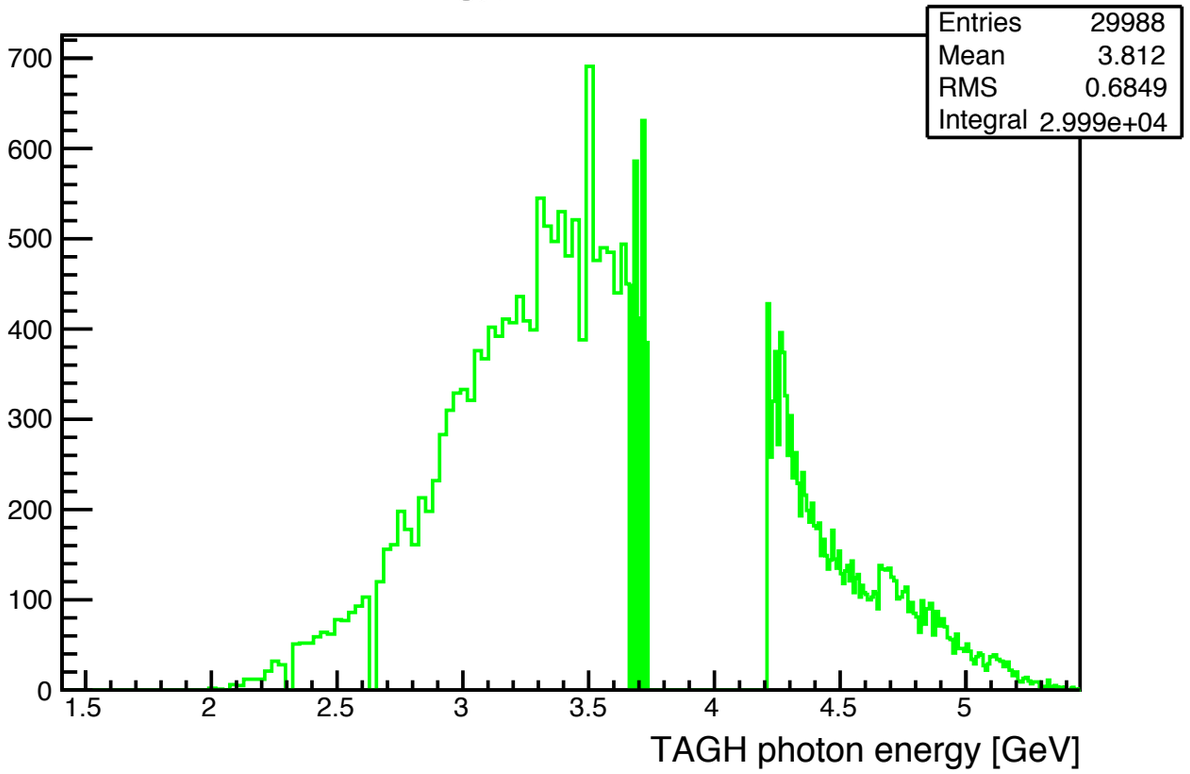
TAGH energy, all candidates



TAGH energy, prompt candidates



TAGH energy, side-band candidates



TAGH energy, remaining candidates