SVT Hits

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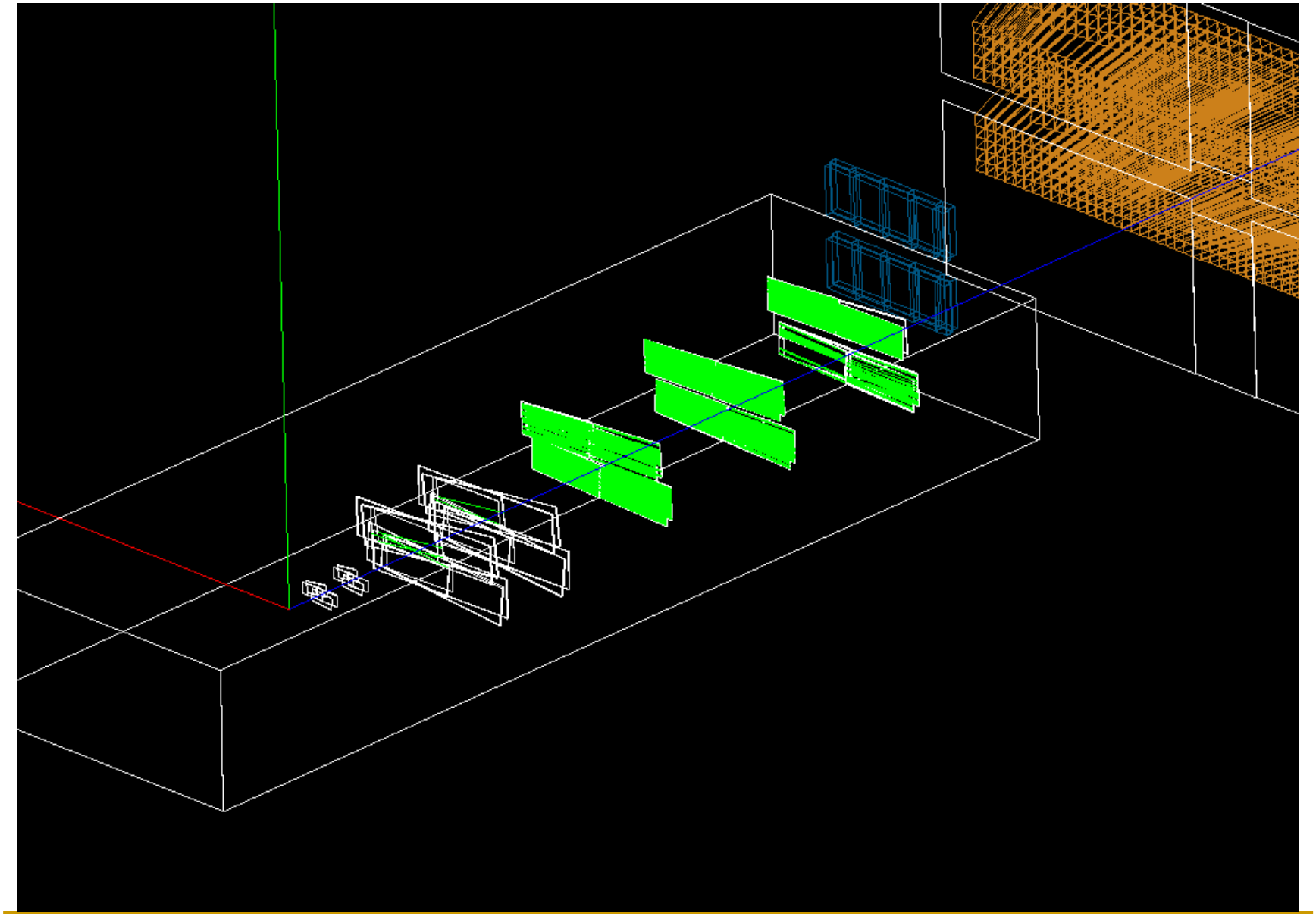
Software Meeting

January 6, 2021

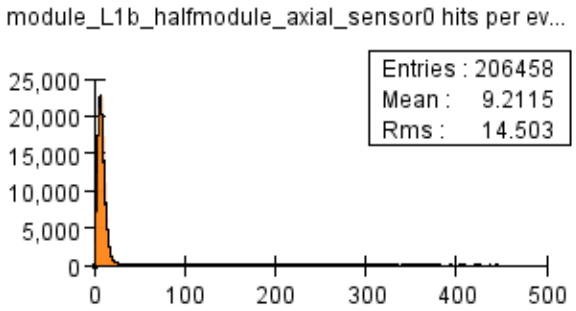
SVT “Monster” Event

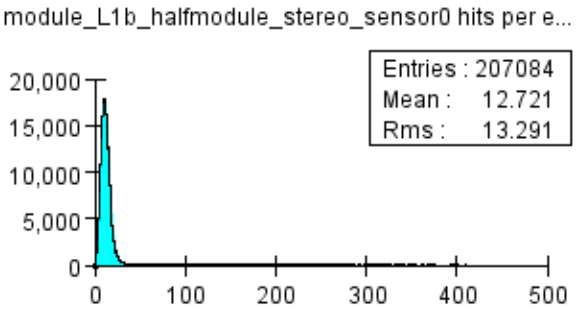


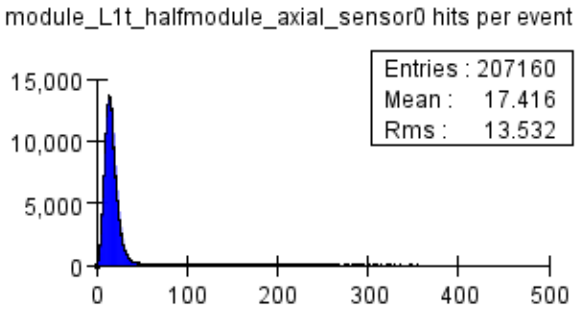
SVT Hits

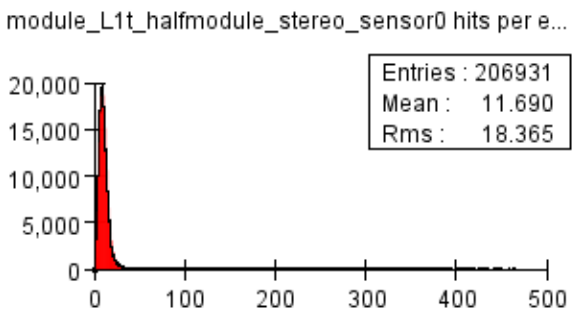
- A number of events and runs from 2019 have large numbers of SVT hits.
  - Some appear to be pathological whereas others appear to be simply increased occupancy.
- Fitting the APV25 waveforms for these hits consumes large amounts of CPU time.
- Handling such large numbers of hits also drastically slows the track-finding pattern recognition.
- Need a strategy / strategies to handle these runs/events.

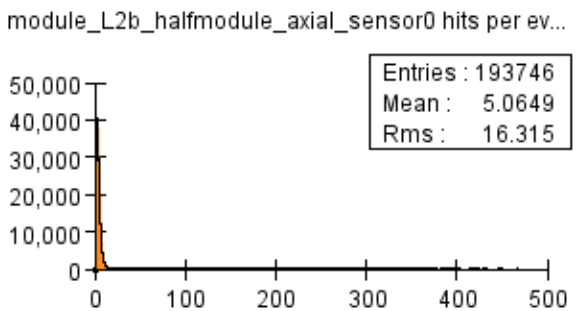
hps_010022 Hits per event by sensor

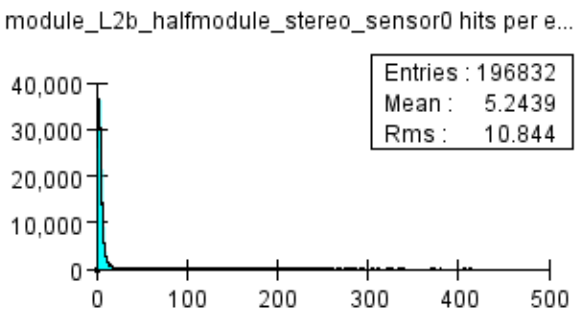


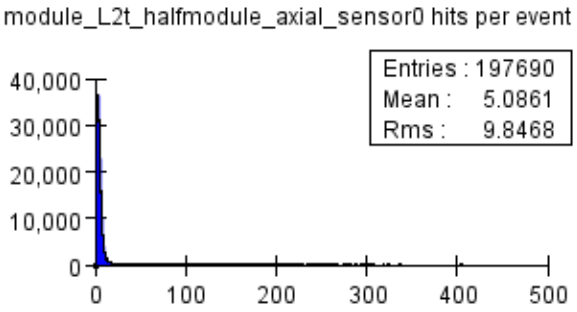


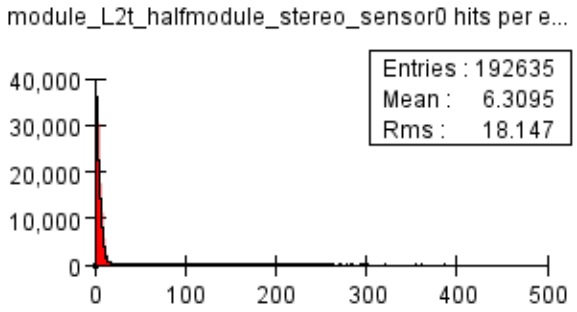


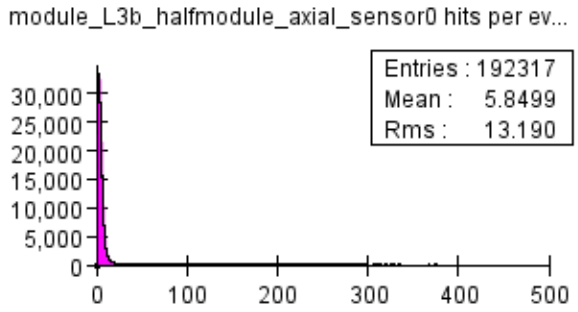




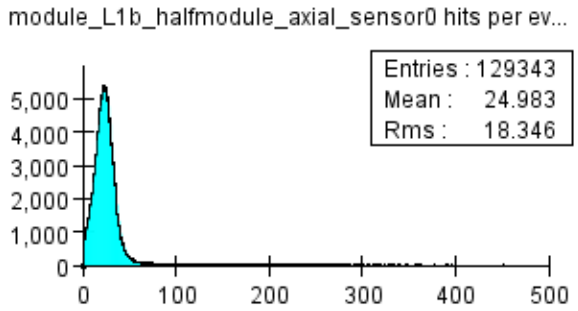


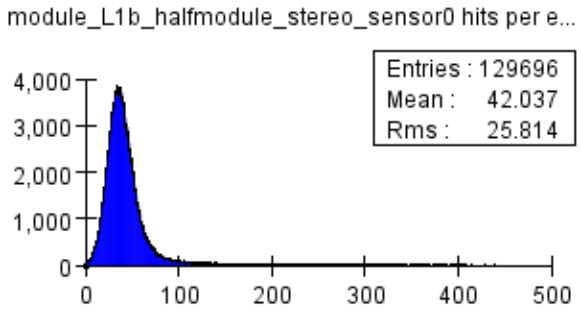


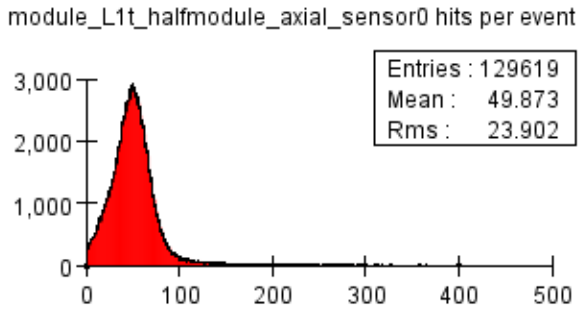


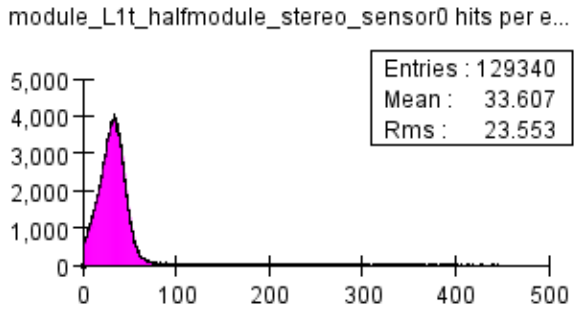


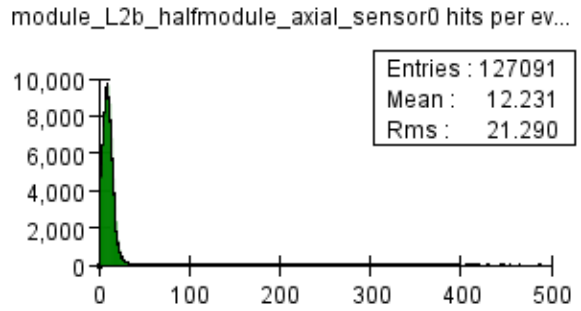
hps_010515 Hits per event by sensor

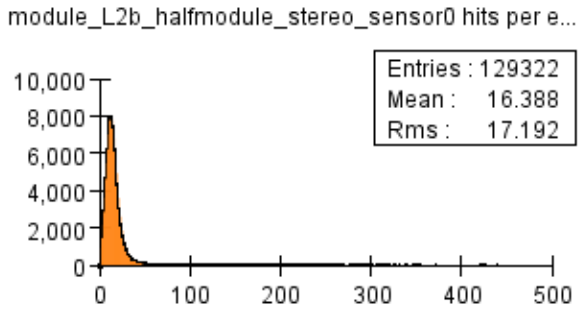


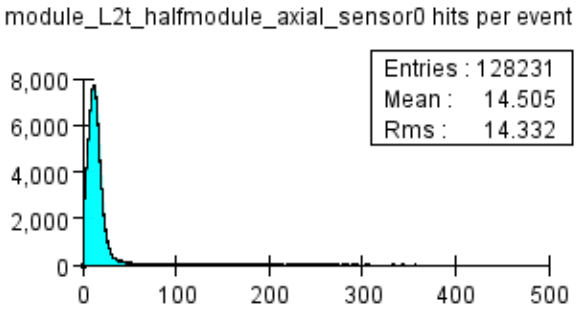


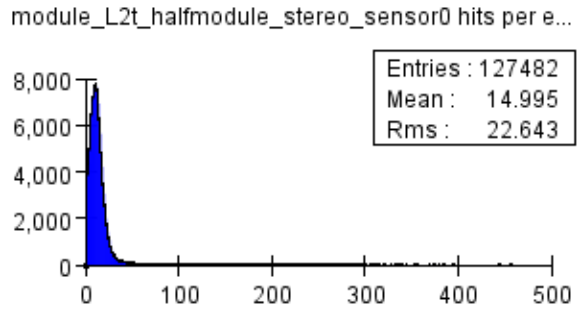


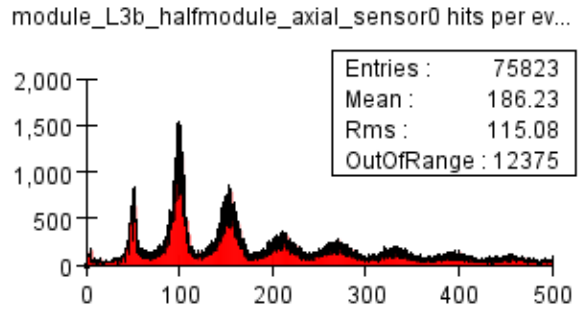




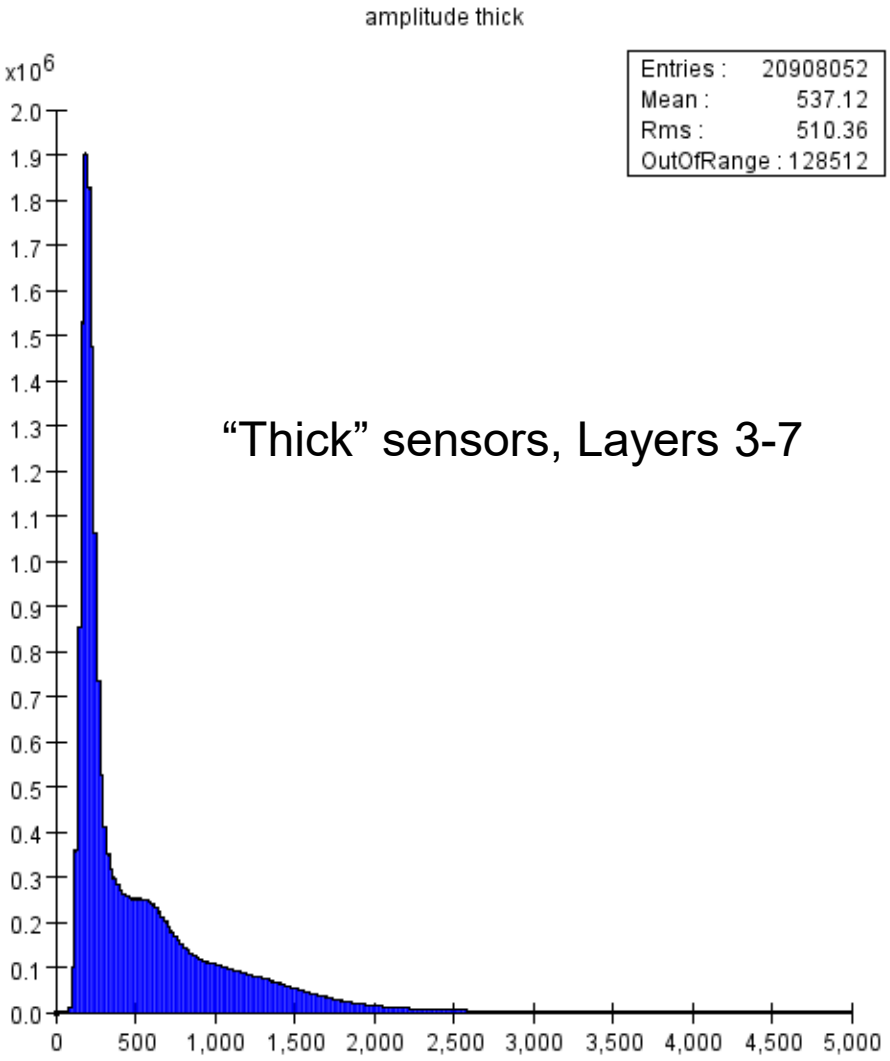




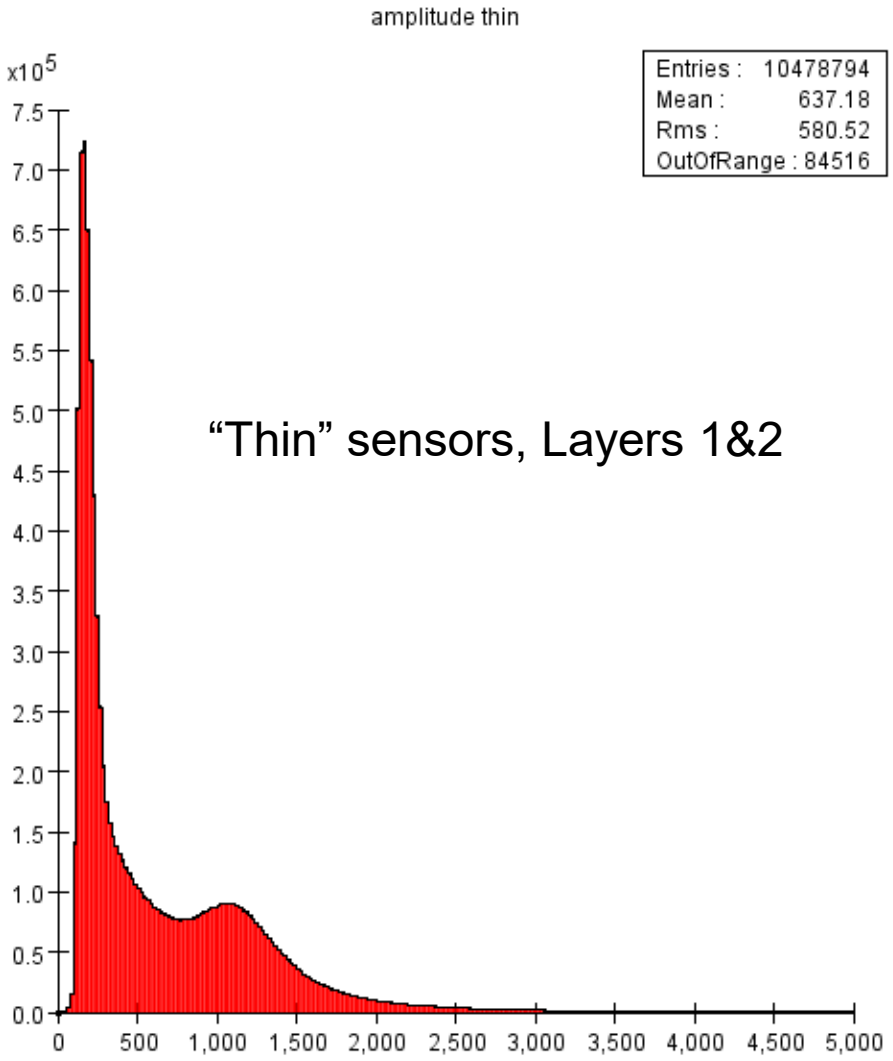




Raw Hit Amplitudes



"Thick" sensors, Layers 3-7



"Thin" sensors, Layers 1&2

APV25 Waveform Fitting

- Fitting the APV25 waveforms is CPU-intensive.
- Seek methods to skip fitting for obviously “bad” or inconsequential hits.
- Non-fit analysis

of the six samples

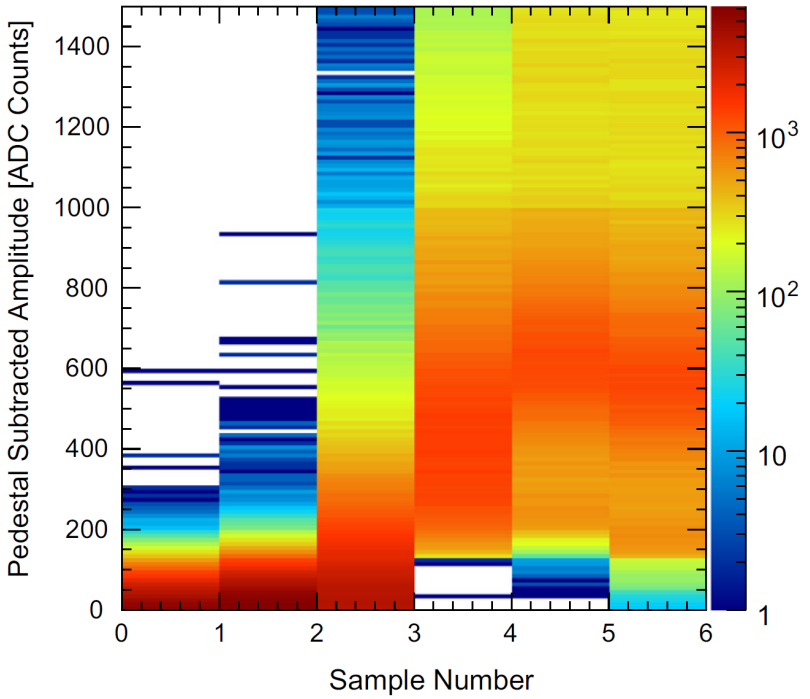
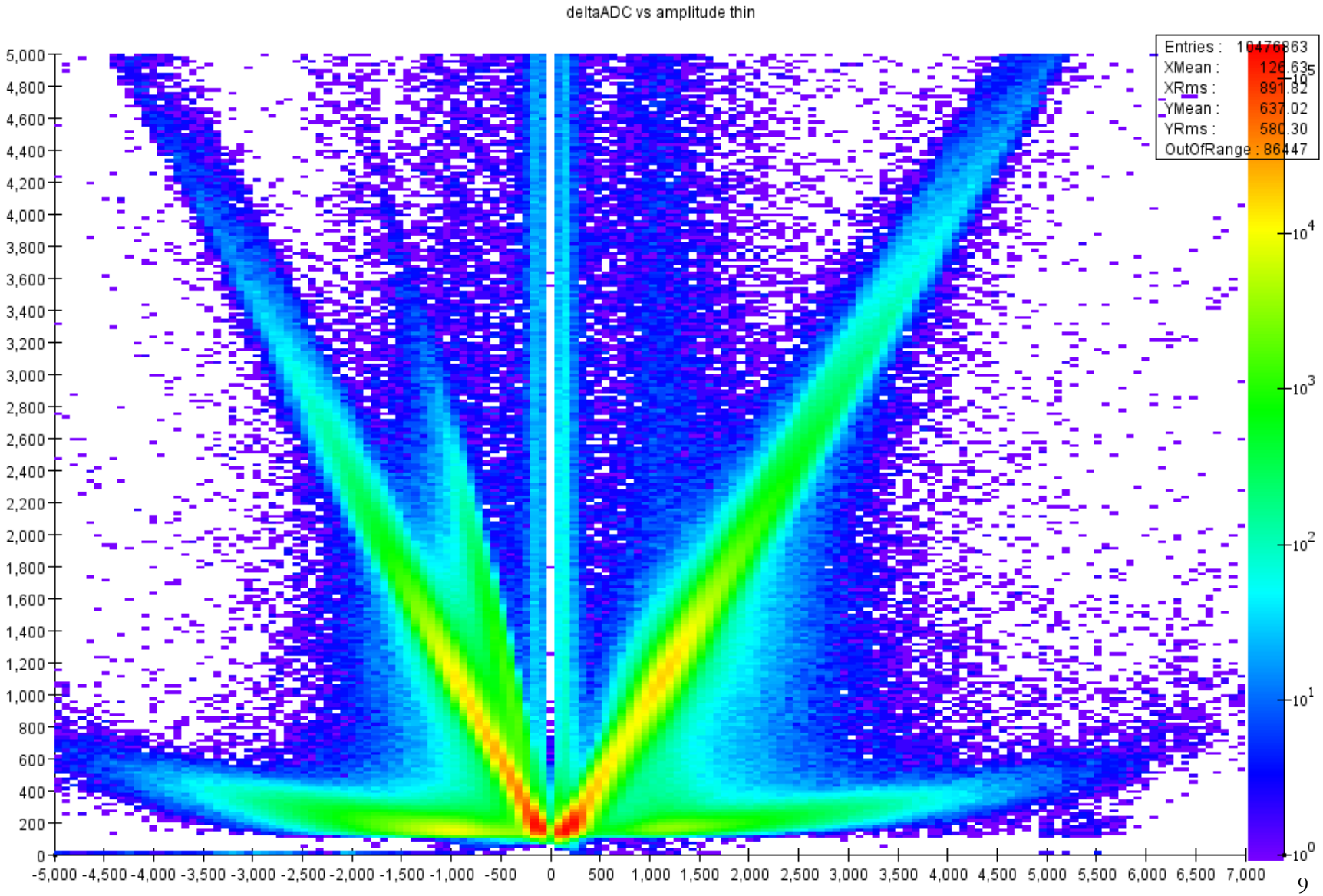


Fig. 11. Accumulation of six pedestal-subtracted samples from individual SVT channels associated with hits on tracks.

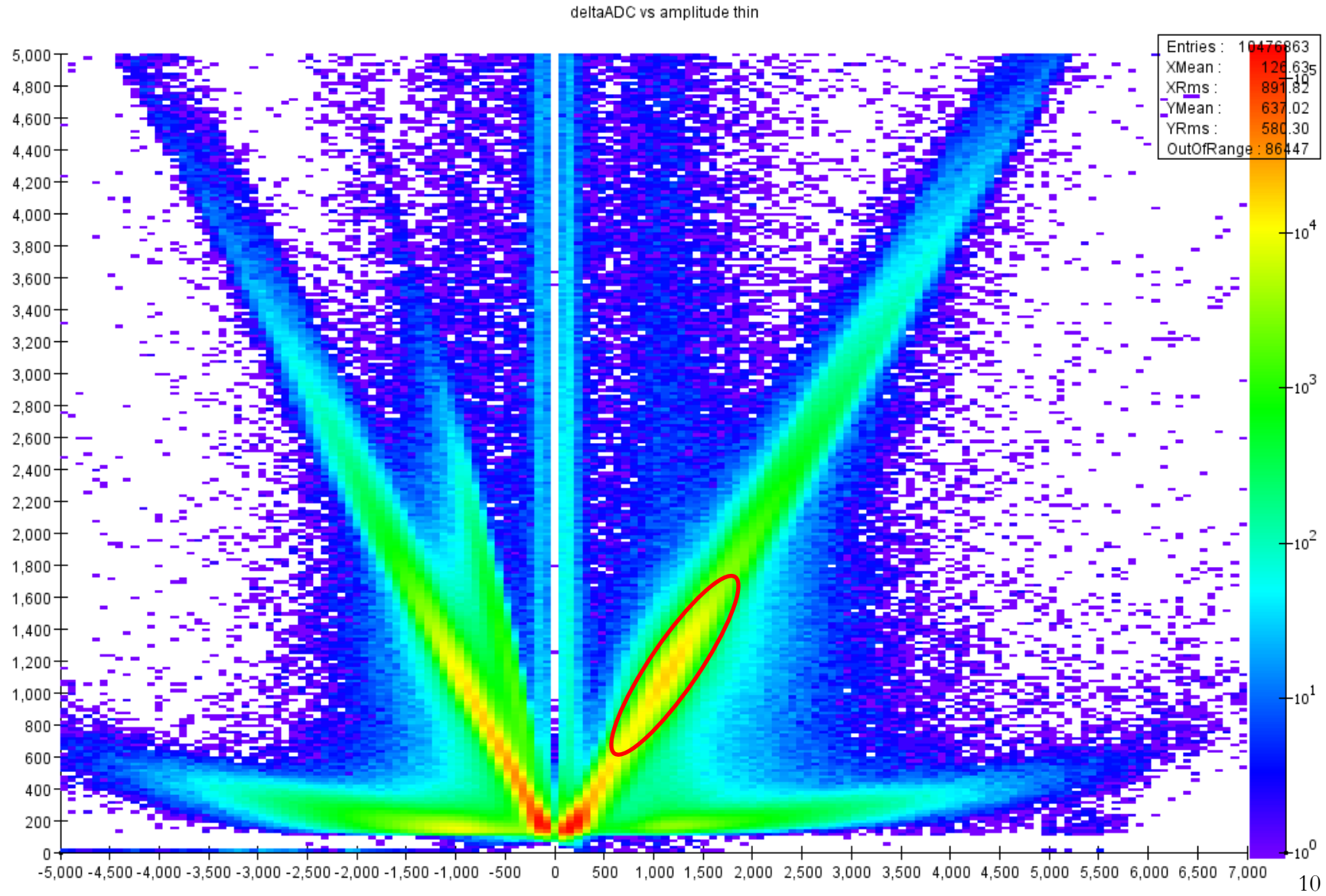
APV25 Waveform Analysis

- Attempt to selectively remove low-amplitude hits BEFORE fitting the APV25 waveforms.
- Hits with a small difference between maximum and minimum sample cannot have a large amplitude
  - deltaADC = max(6 samples) – min(6 samples)
- Signal pulse should increase with time
  - sign = i_min < i_max ? 1 : -1
- Use these two simple variables to analyze hits

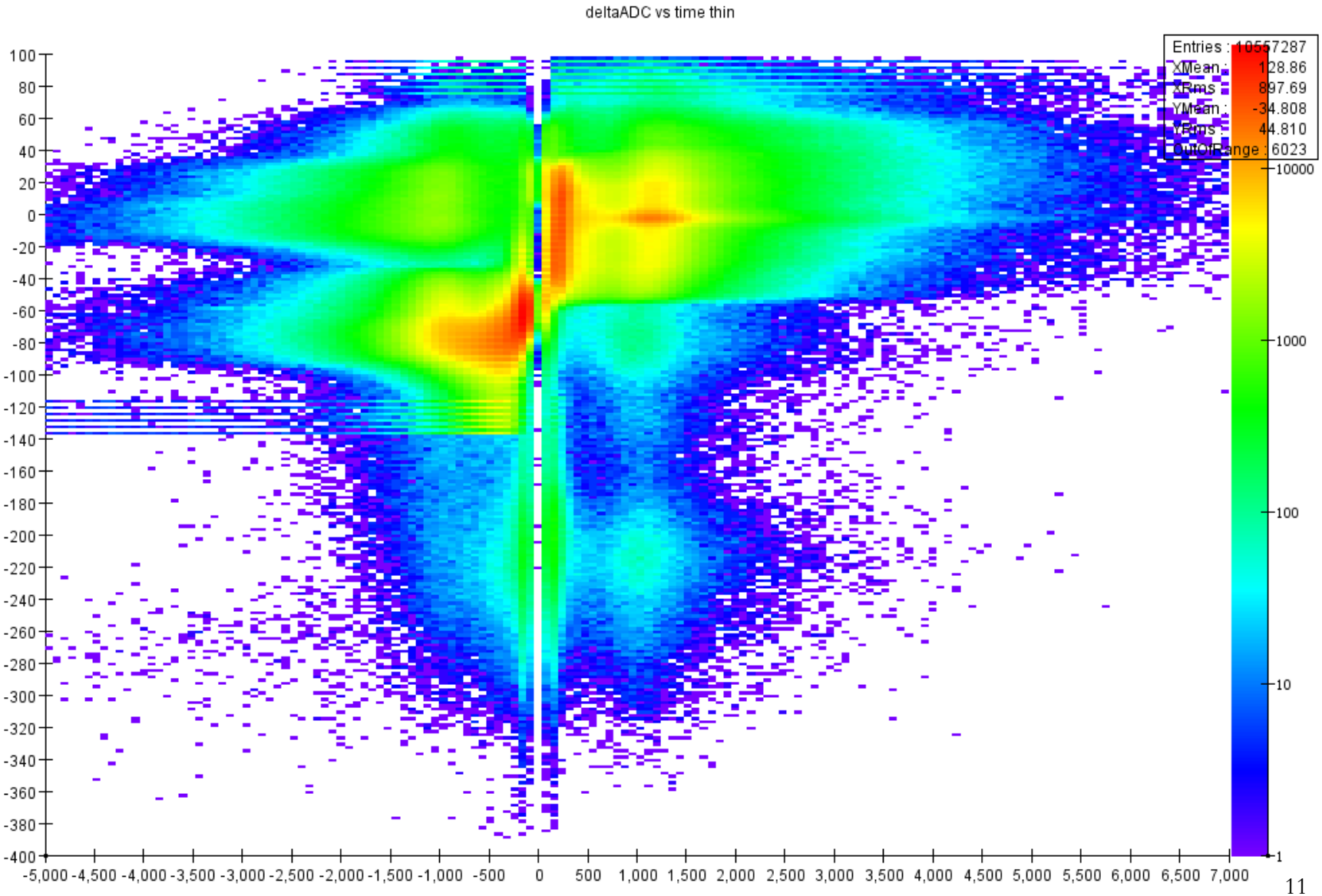
deltaADC vs Fit Amplitude Thin



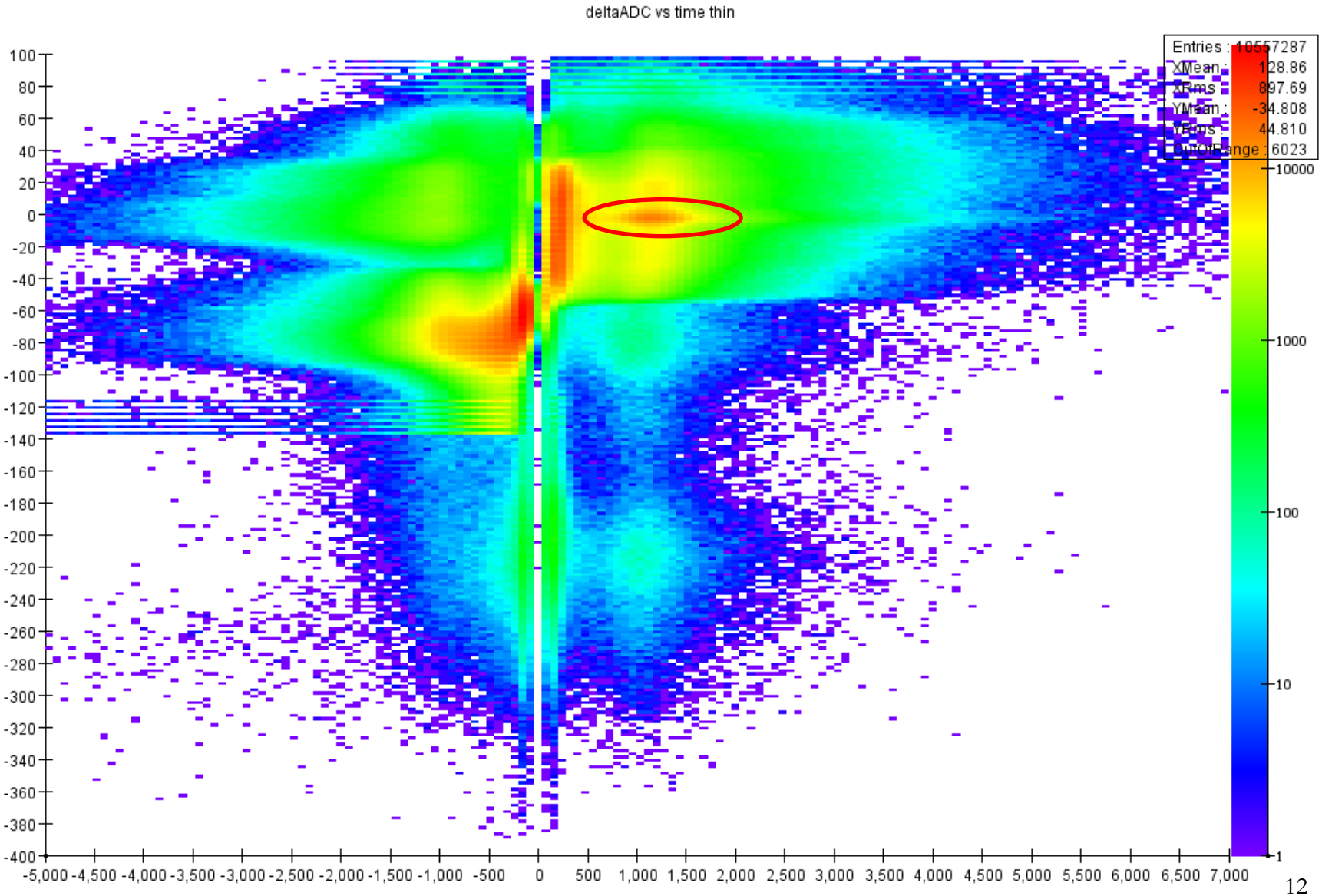
deltaADC vs Fit Amplitude Thin



deltaADC vs Fit t0 Thin



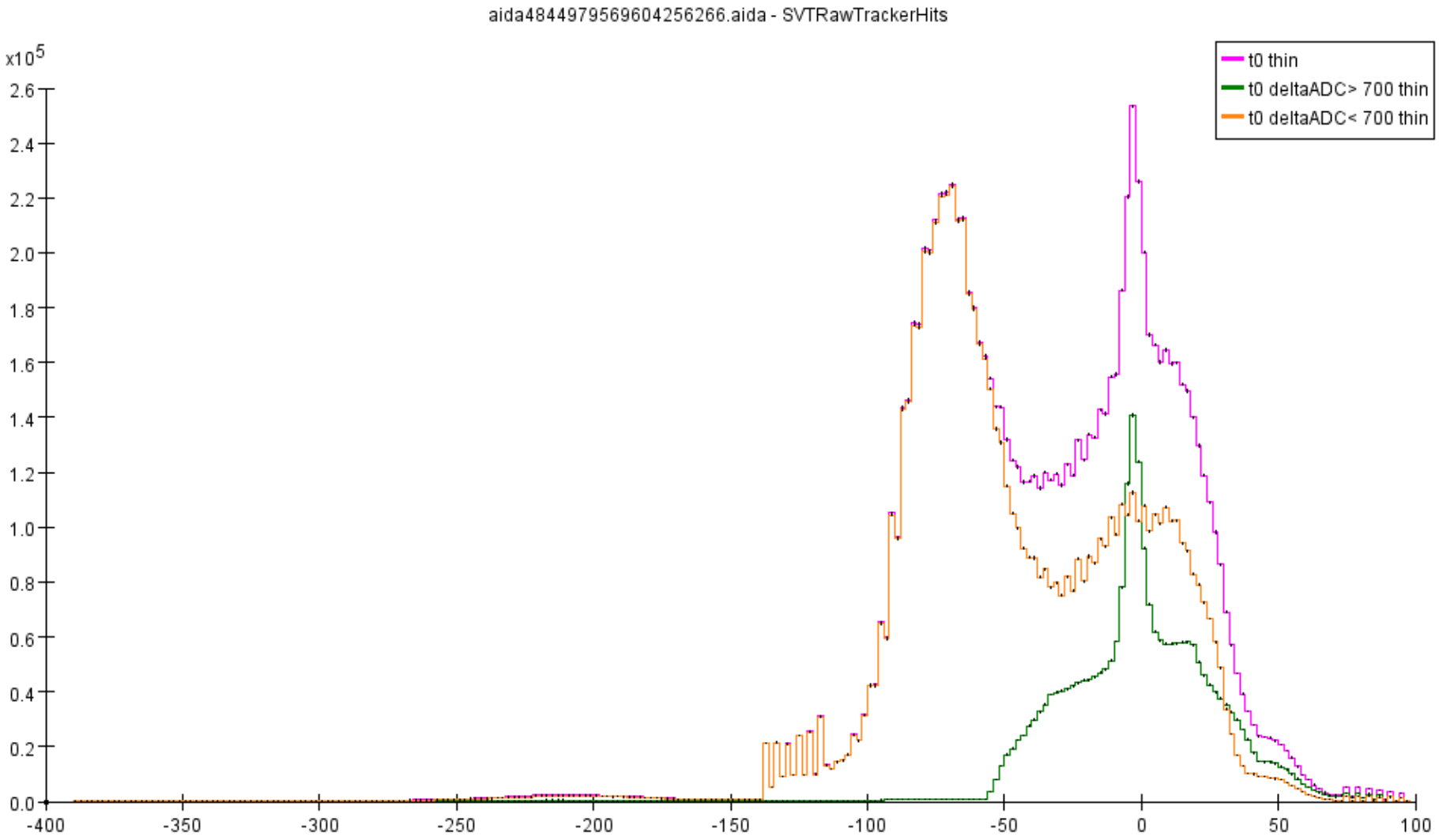
deltaADC vs Fit t0 Thin



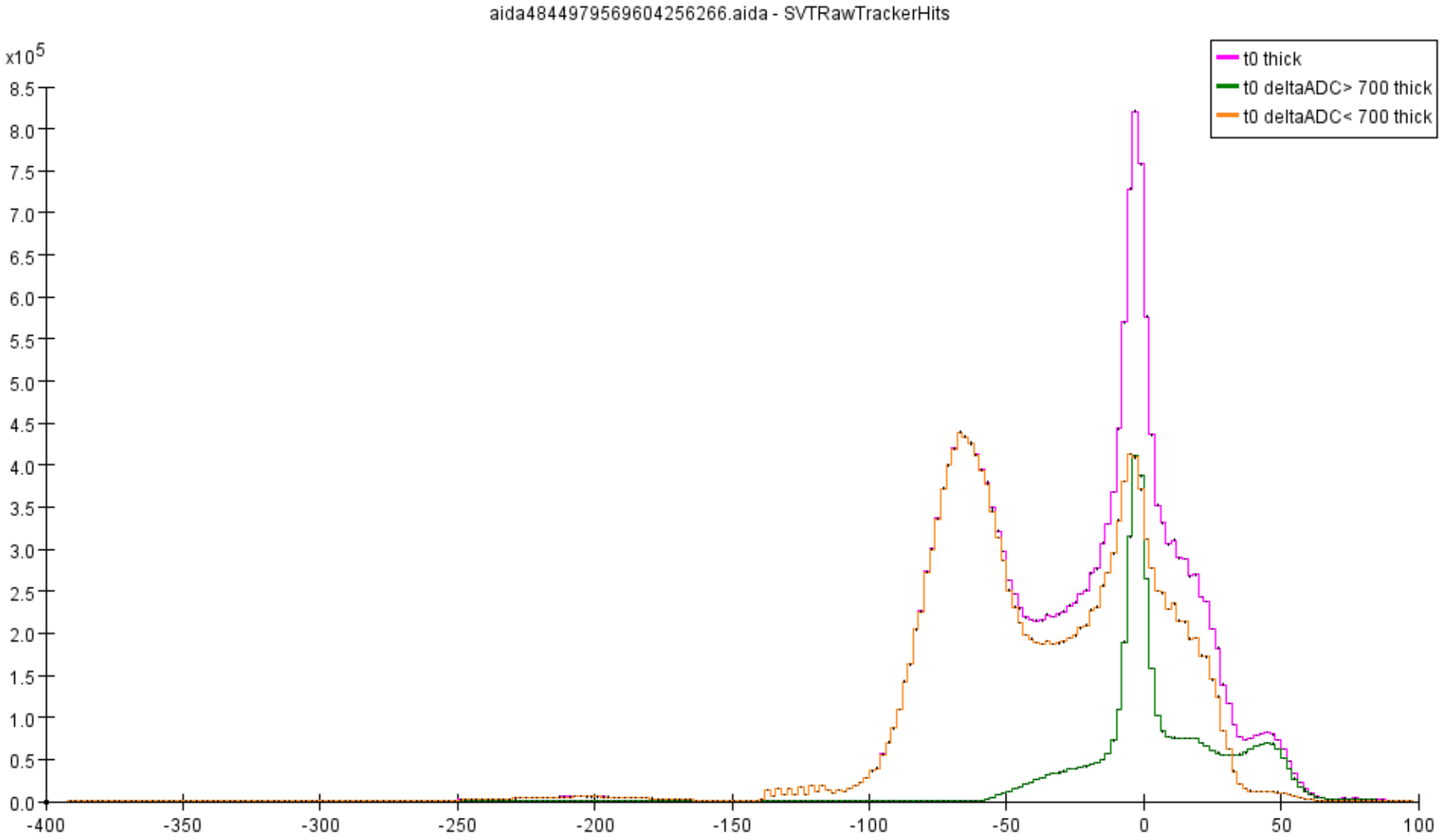
deltaADC

- A cut at deltaADC<700 appears to select good events in both amplitude and time while rejecting a large fraction of the background.

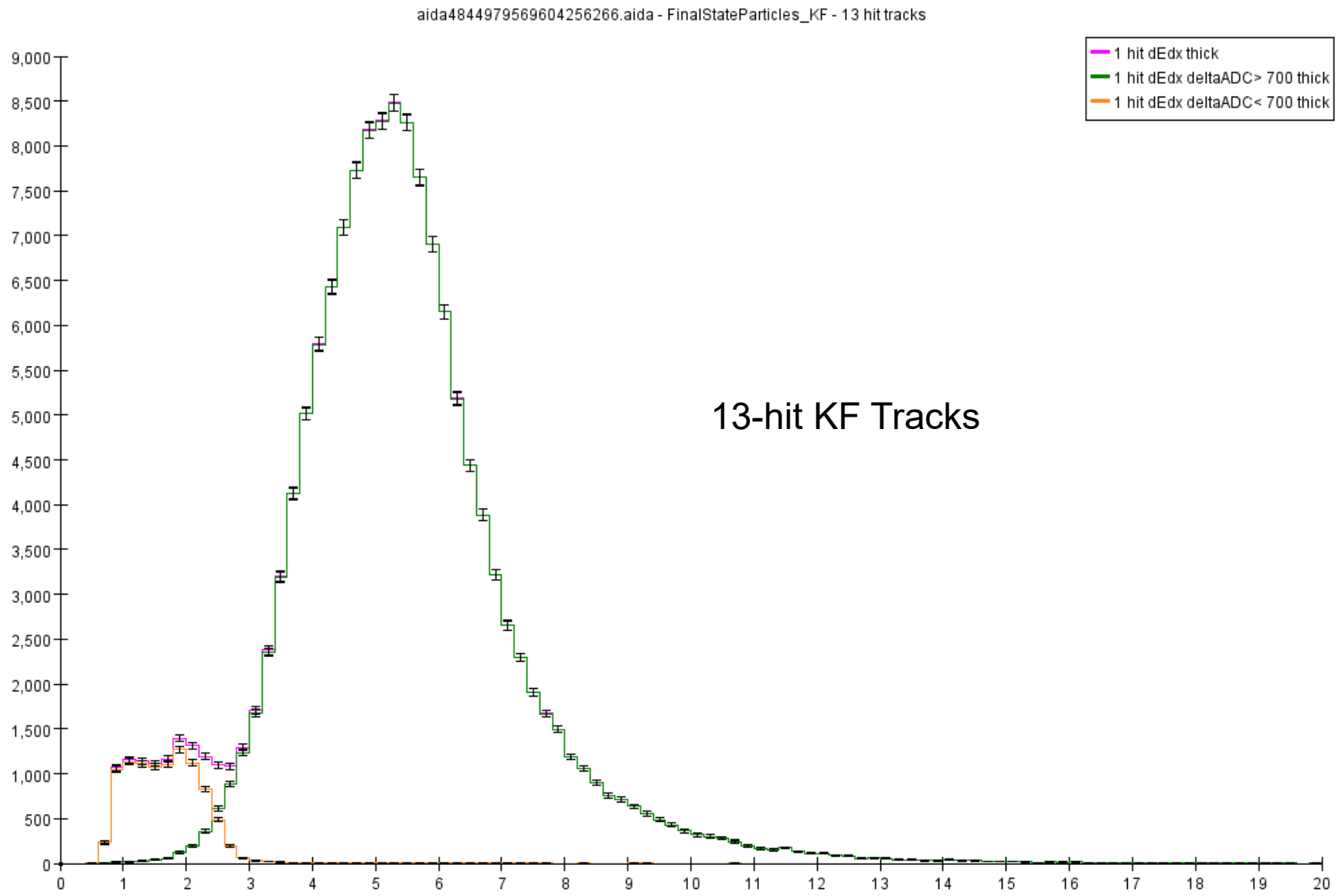
Fit t0 Thin Before/After deltaADC cut



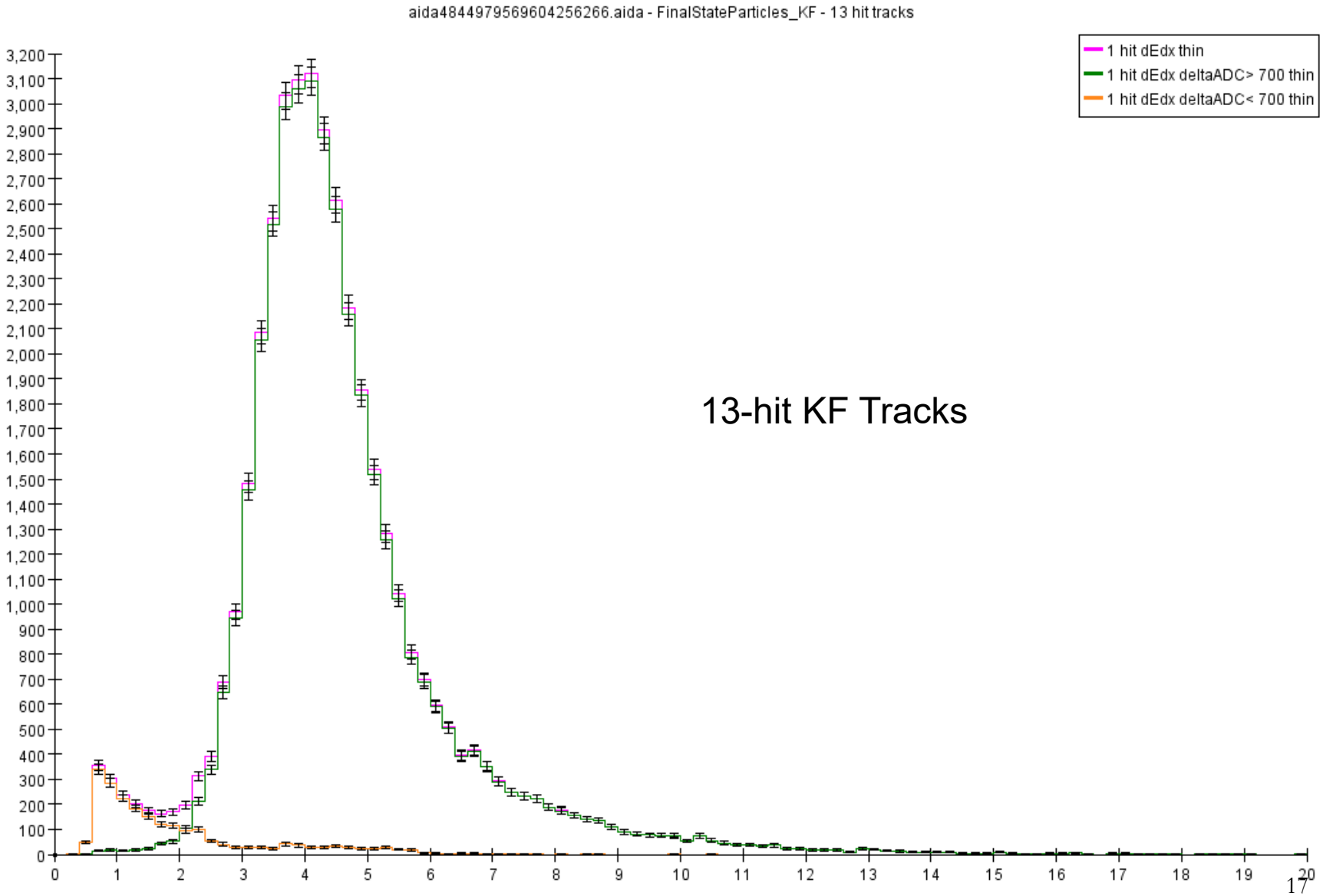
Fit t0 Thick Before/After deltaADC cut



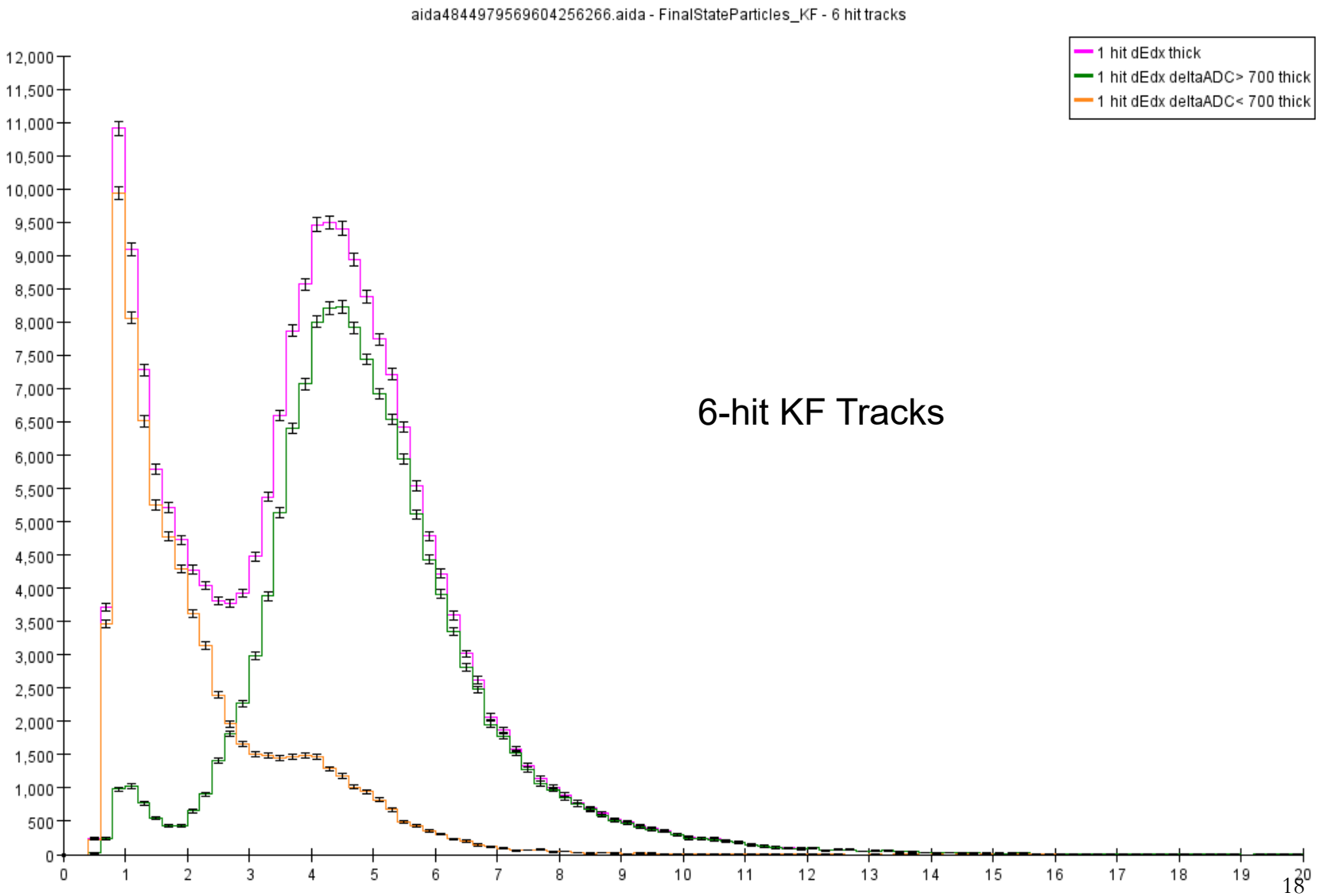
Amplitude Thick with deltaADC cut



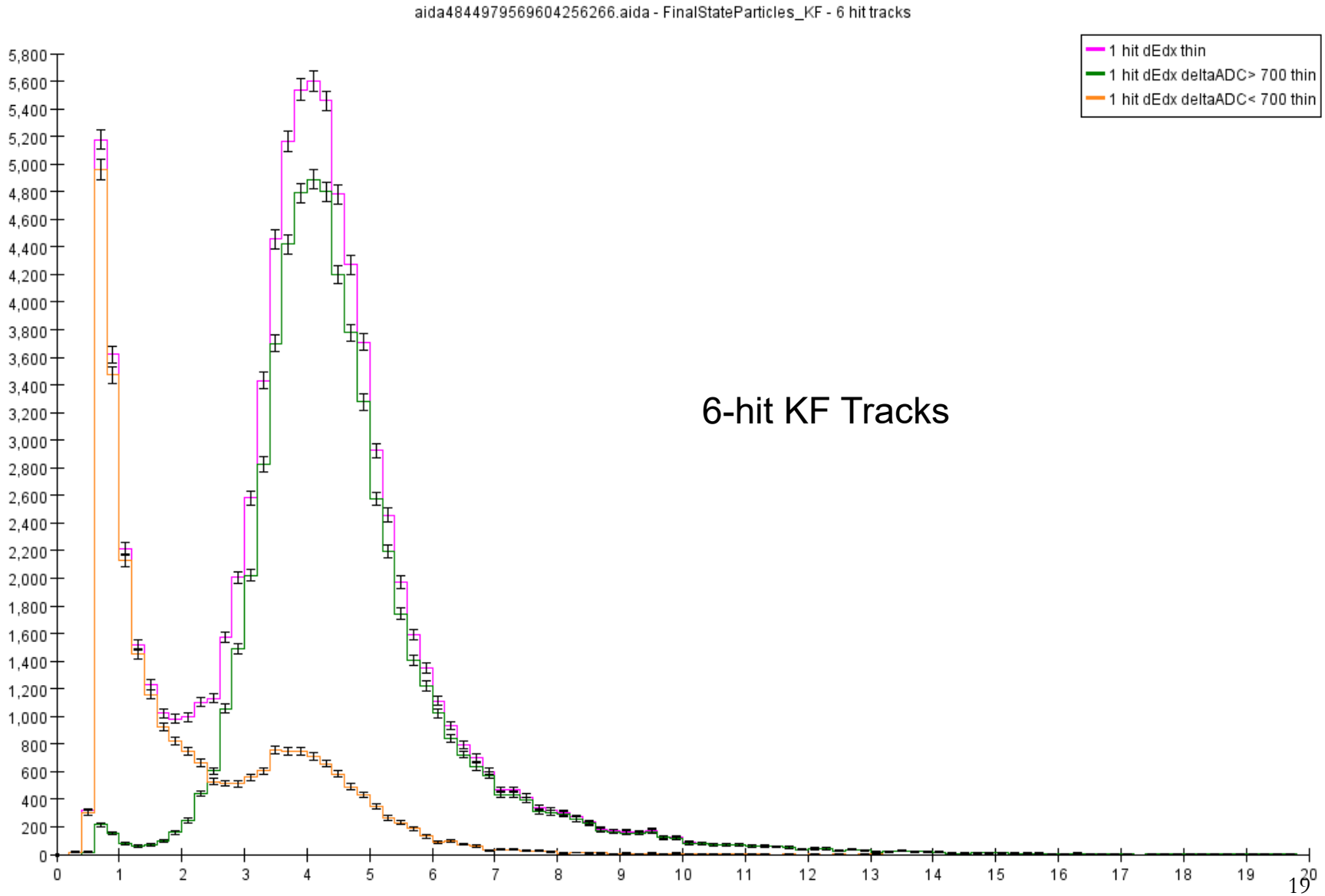
Amplitude Thin with deltaADC cut



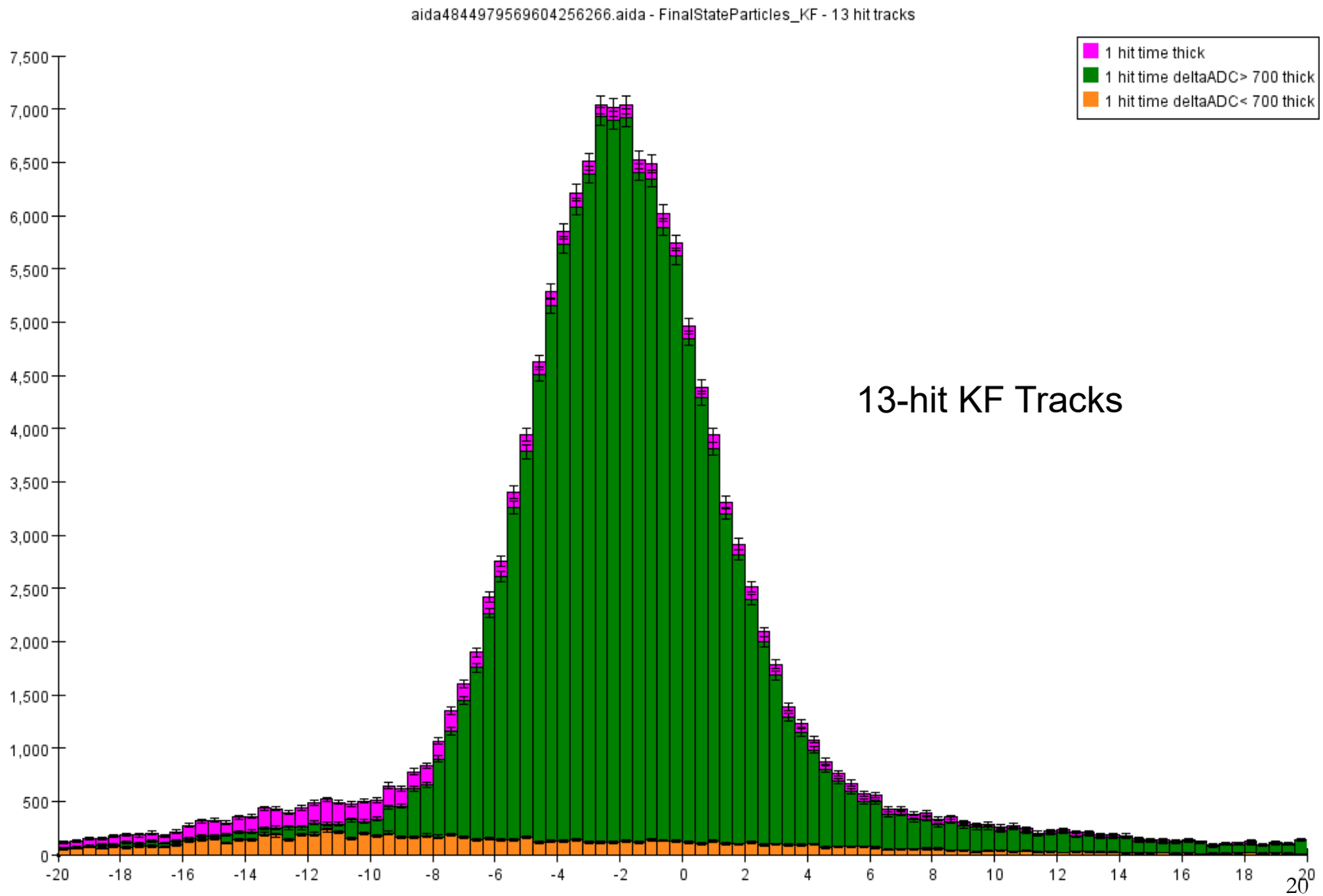
Amplitude Thick with deltaADC cut



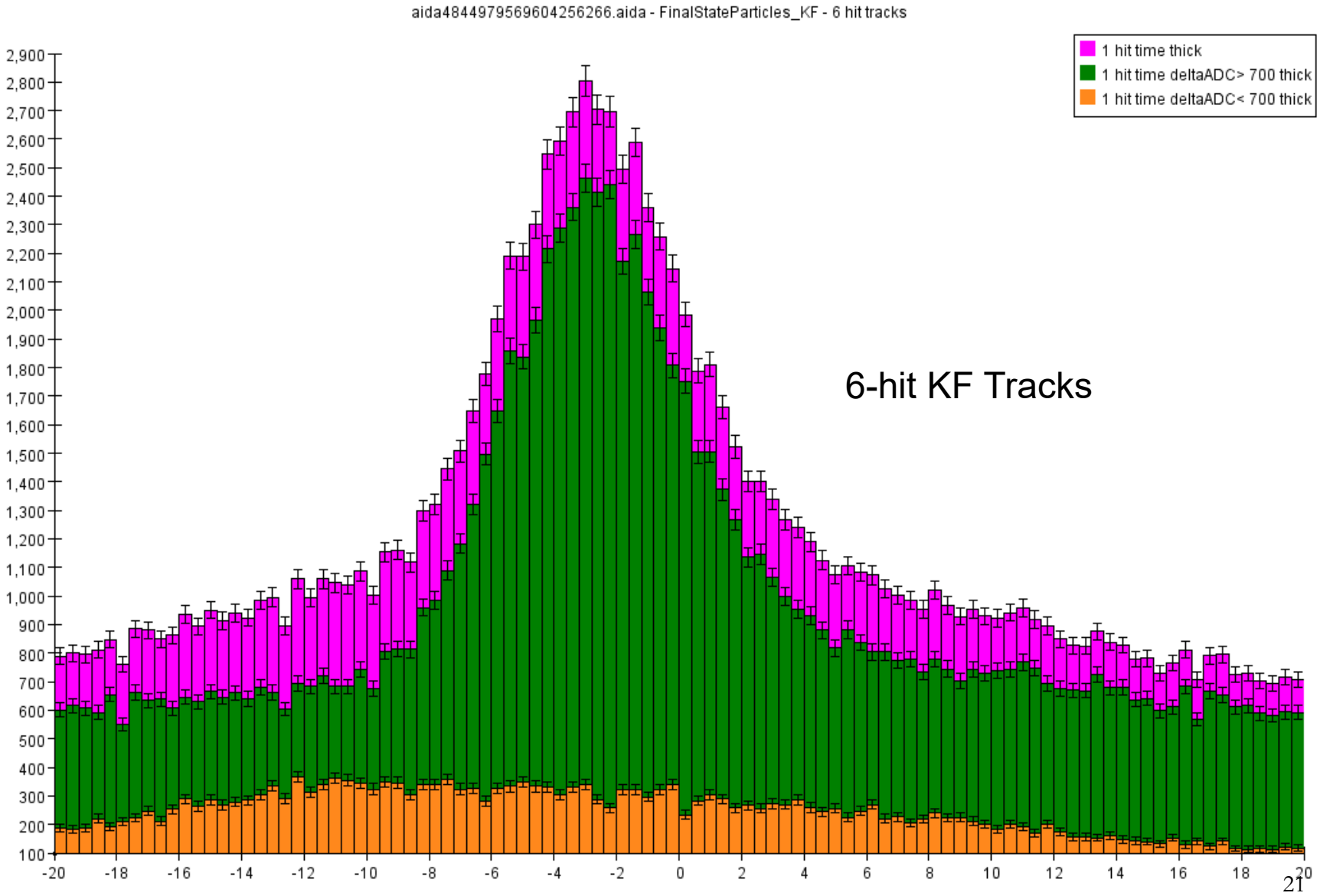
Amplitude Thin with deltaADC cut



t0 Thick with deltaADC cut



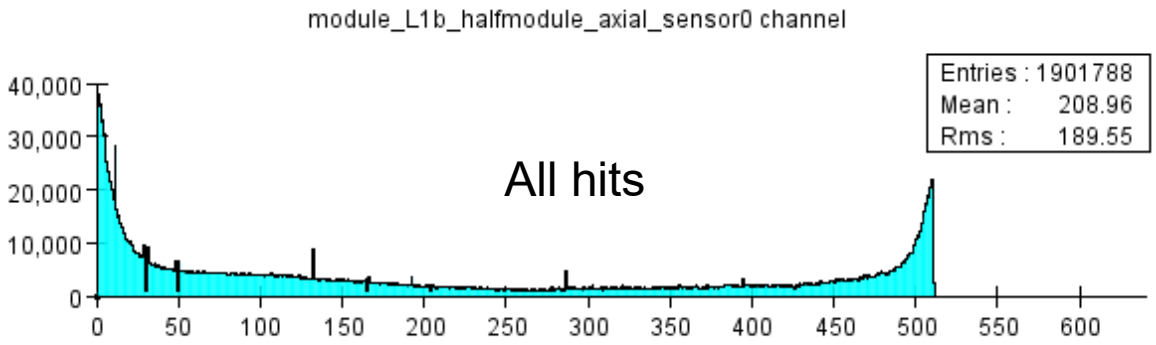
t0 Thick with deltaADC cut

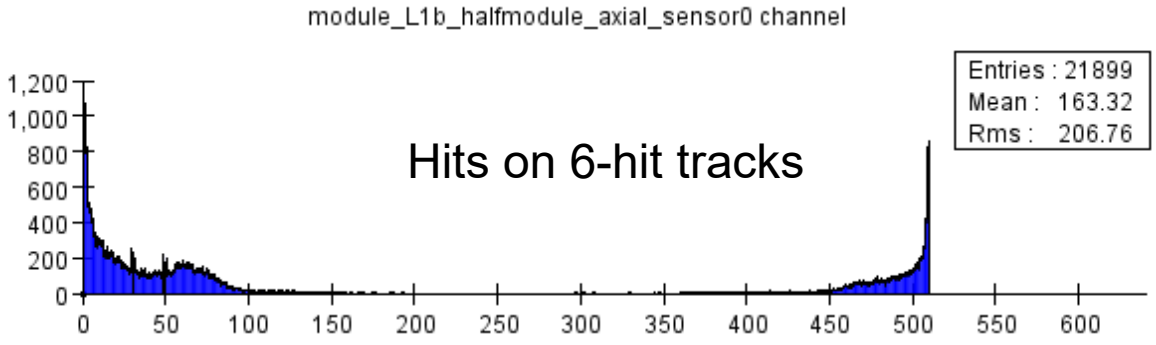


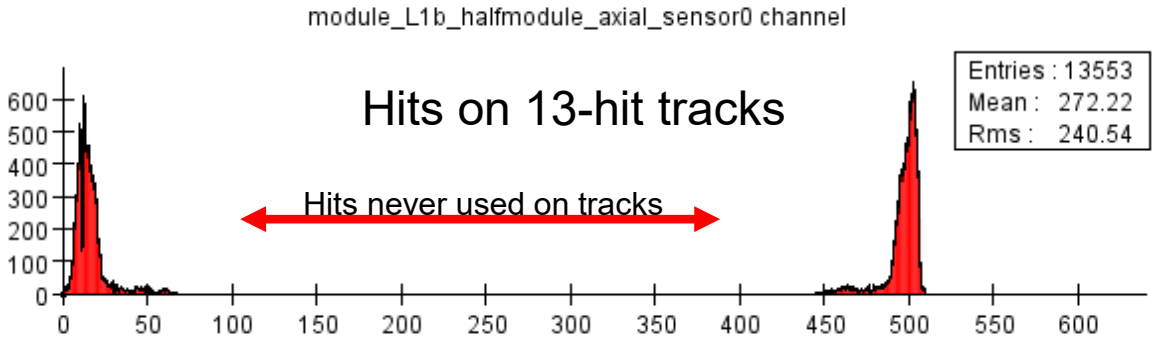
Phase Space considerations

- Large areas of our tracking sensors are never illuminated by tracks, especially in the early layers.
- Not fitting the waveforms for channels in these areas would speed up the reconstruction.

Layer 1 Bottom Hit Channel







Status

- A simple cut based on the six SVT APV25 ADC samples appears to be able to discriminate between “good” hits useful for tracking and “noise” hits.
- Plan to incorporate this into our hit-processing and only fit the wave-forms for hits which pass the deltaADC * sign cut.
- Large regions of the sensors cover “dead” zones for our physics events. Ignoring these channels should lead to a further speedup in our reconstruction. Need input from SVT & analysis group to define good/bad fiducial regions.