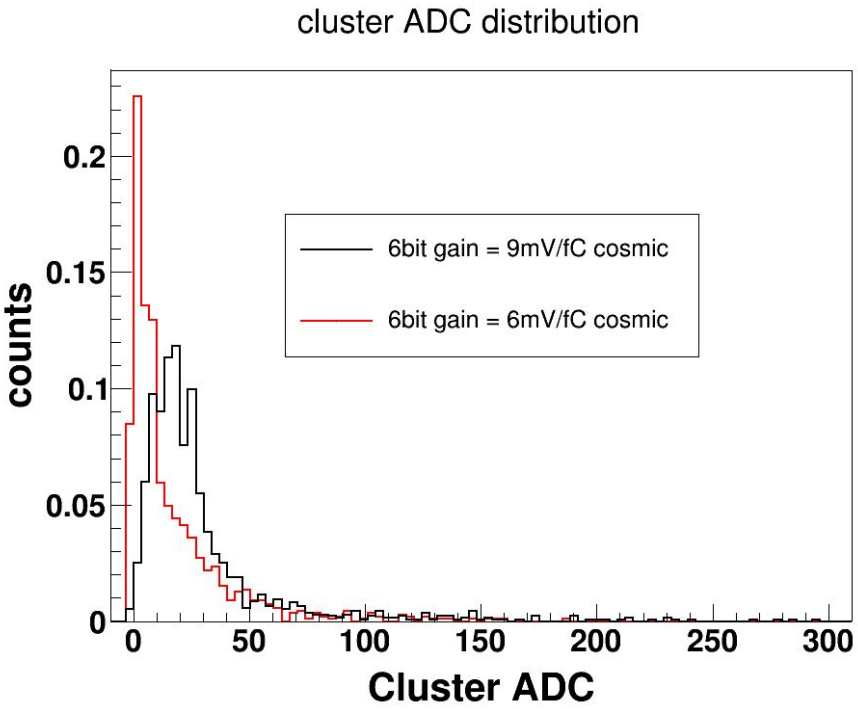
VMM SNR

Cosmic Signal ADC distribution – Sanity Check

- Lager gain setting can increase signal amplitude significantly
- GEM HV = 3900 V

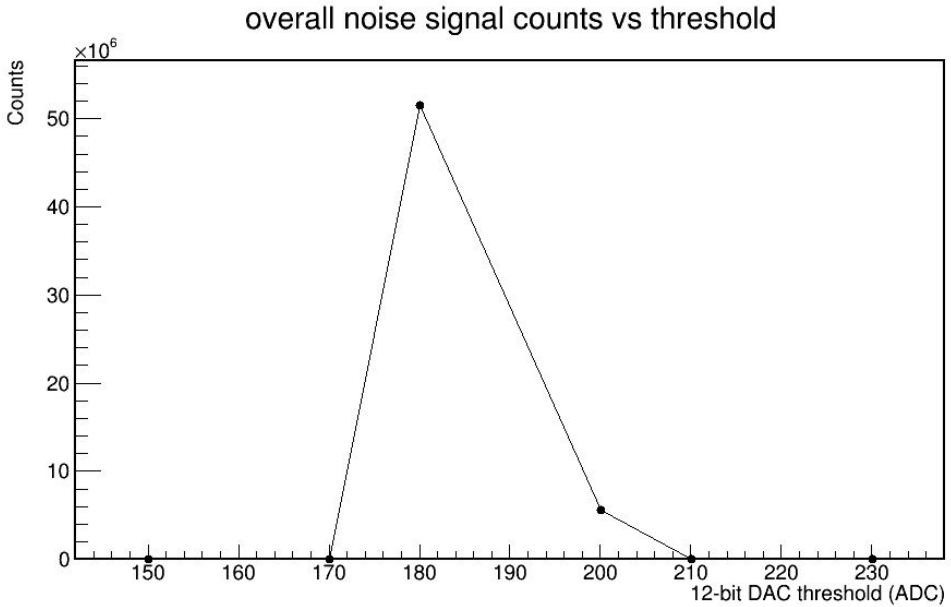


Determine Noise Amplitude

- VMM has peak finding implemented, when a signal pass through the threshold, the channel will be triggered
- Under normal operation, we set a proper threshold to cut away noise signals
- To study noise signal, we lower that threshold, and check the noise signal amplitude
- When threshold is too low, VMM will be in constant triggered mode, leading to no effective trigger

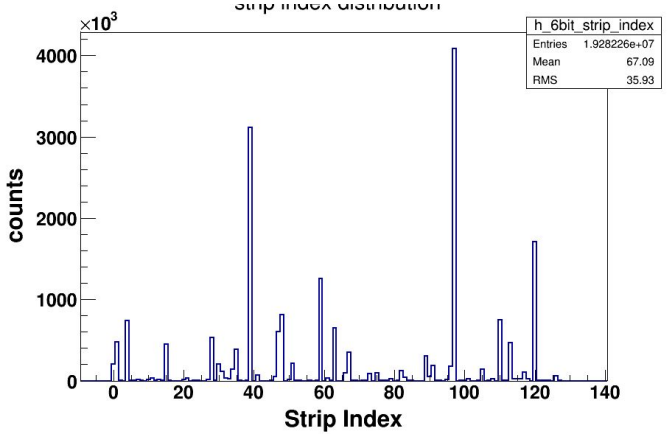
Determine Noise Amplitude

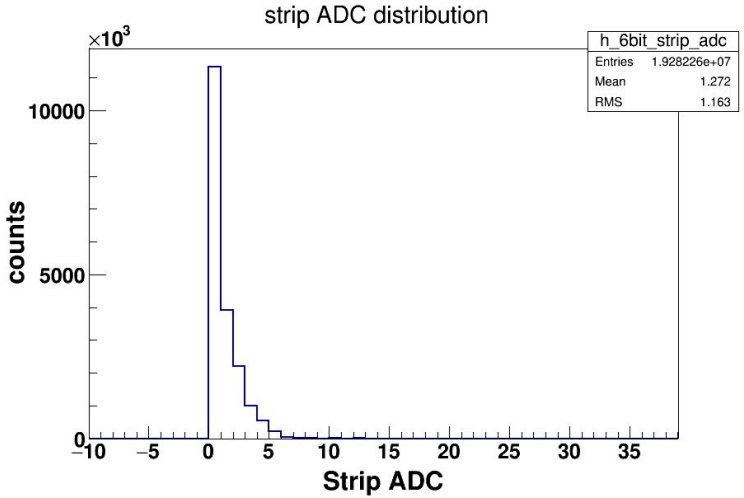
- 100000 triggers
- 6-bit mode, gain = 9 mV/fC

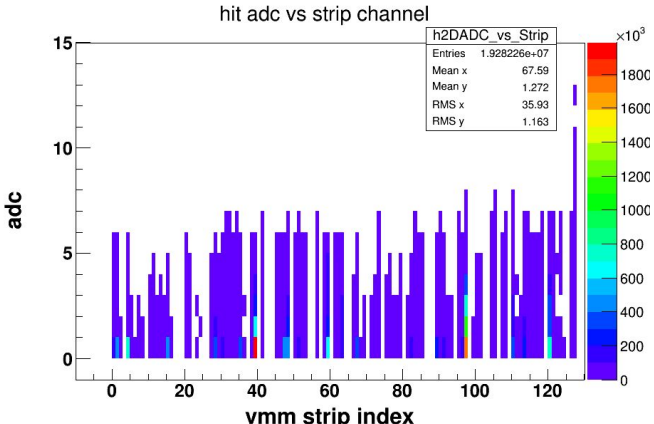


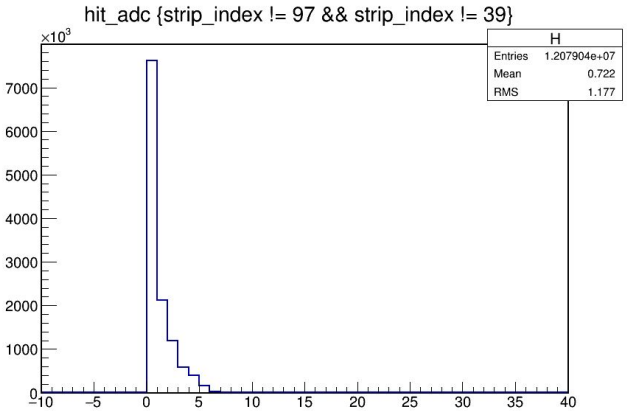
- **Global threshold DAC = 180, gain 9 mV/fC**

Noise Signal Amplitude



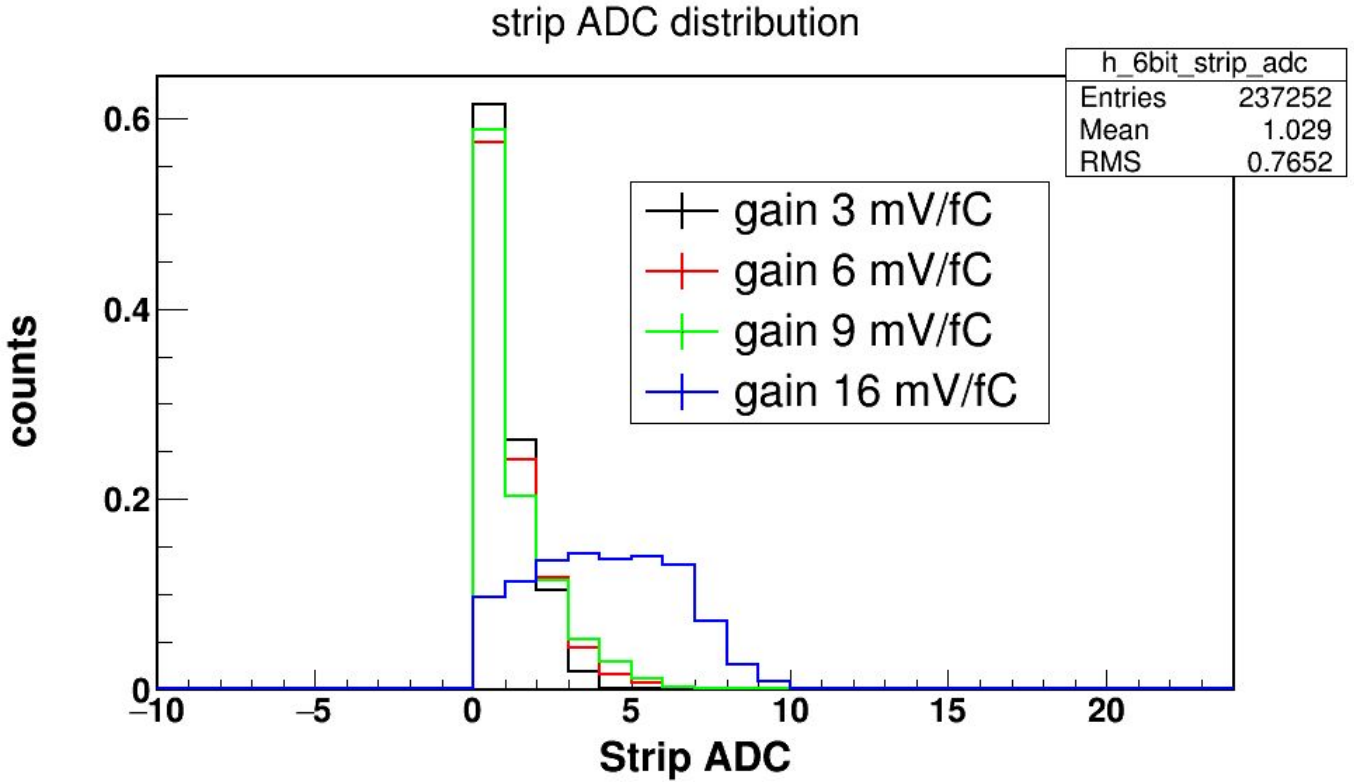






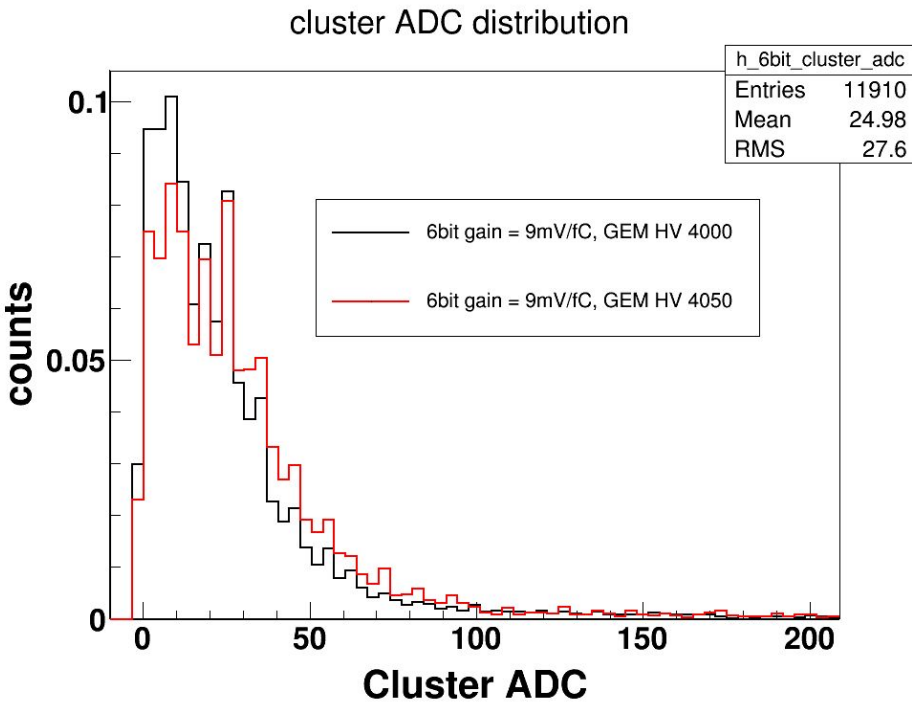
Noise amplitude with VMM Gain setting

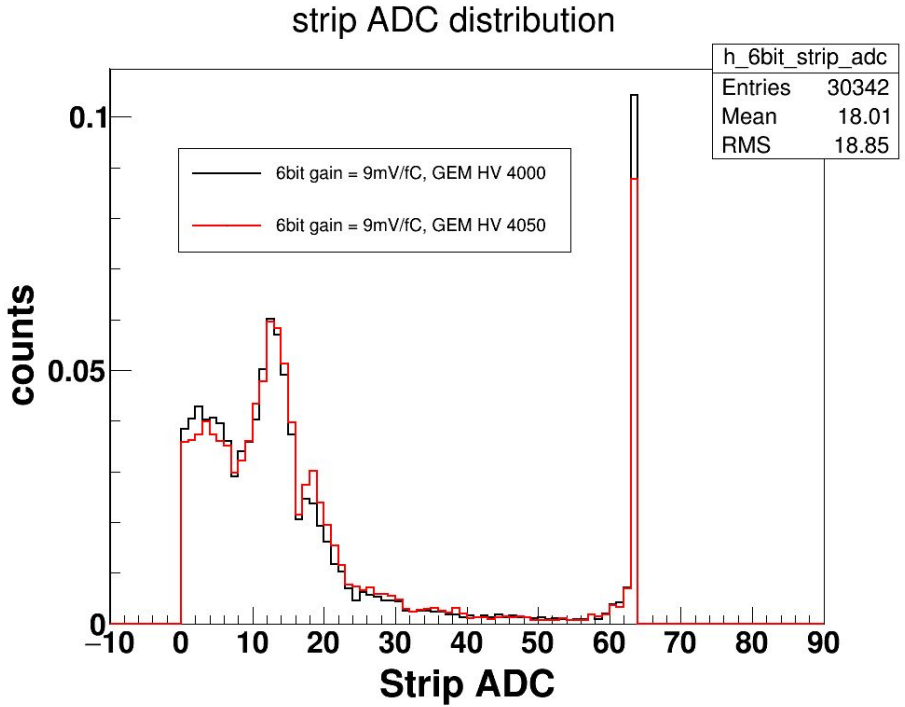
- Noise signal amplitude is independent of gain setting



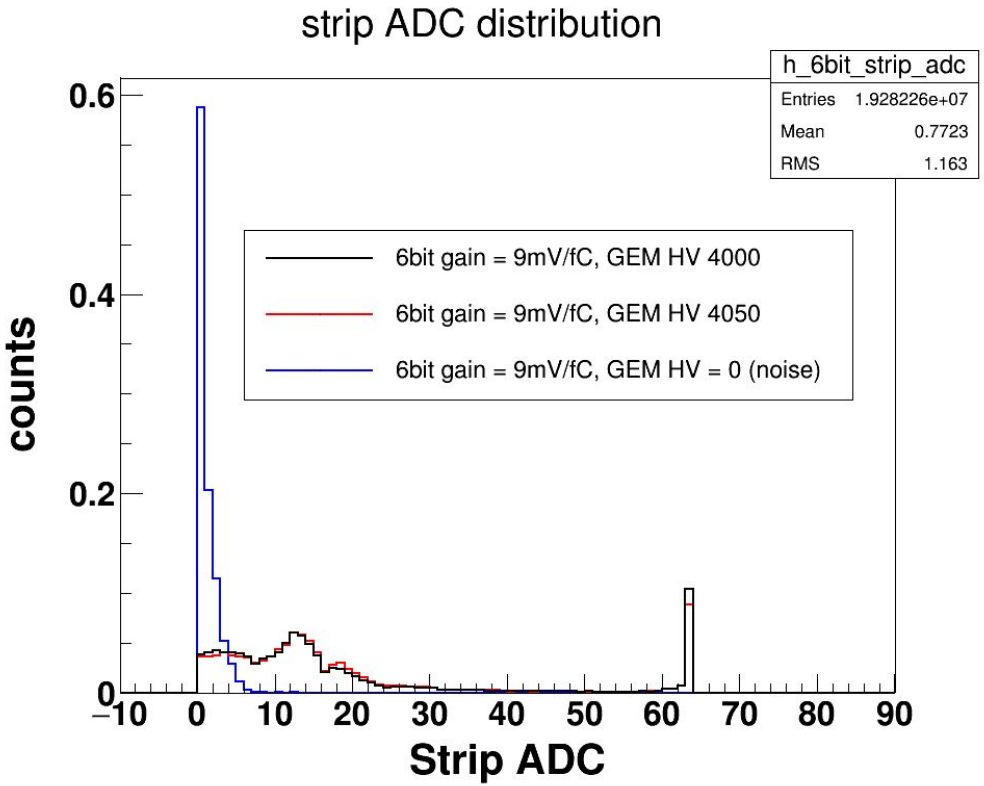
Noise vs signal with different GEM HV

- GEM gain already reached plateau at HV = 4000 V



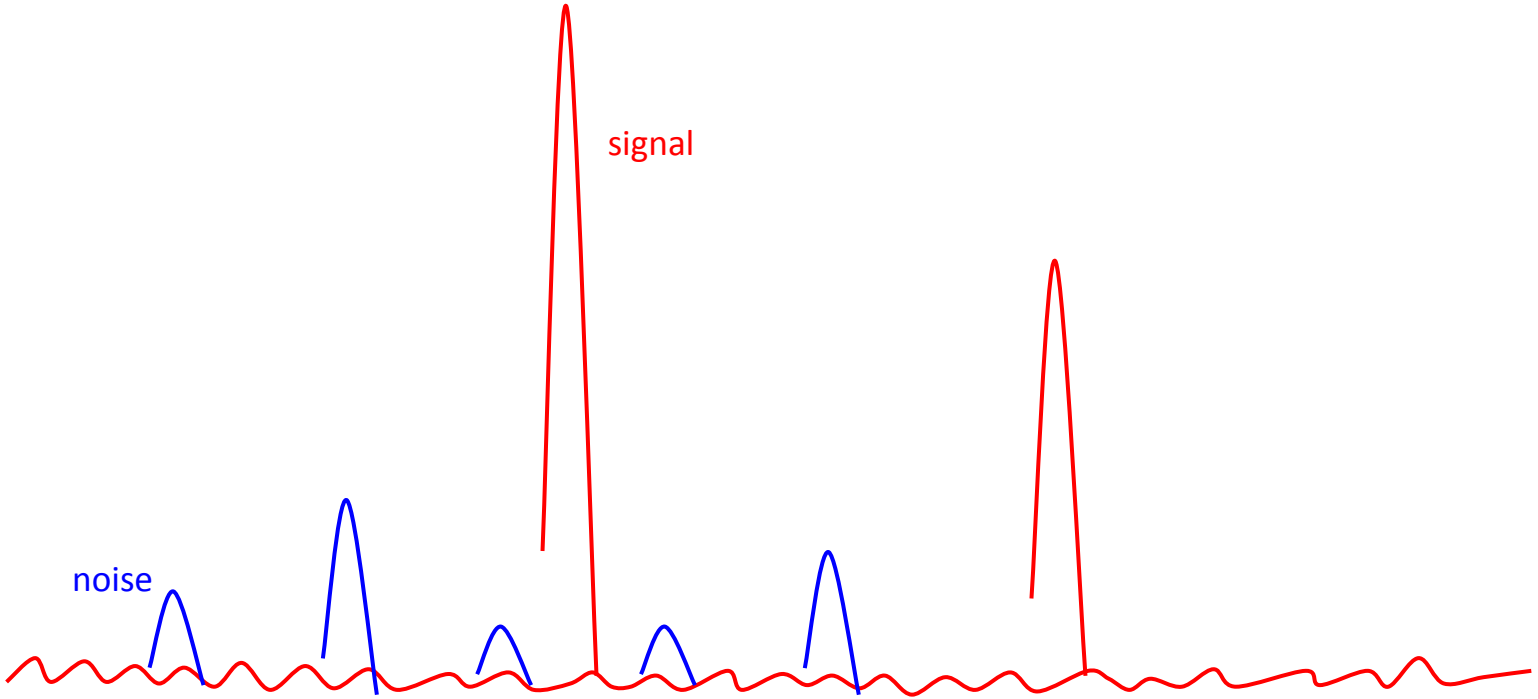


Noise vs signal with different GEM HV



All signal is already threshold subtracted by the VMM chip

- ADC output from VMM already have threshold subtracted



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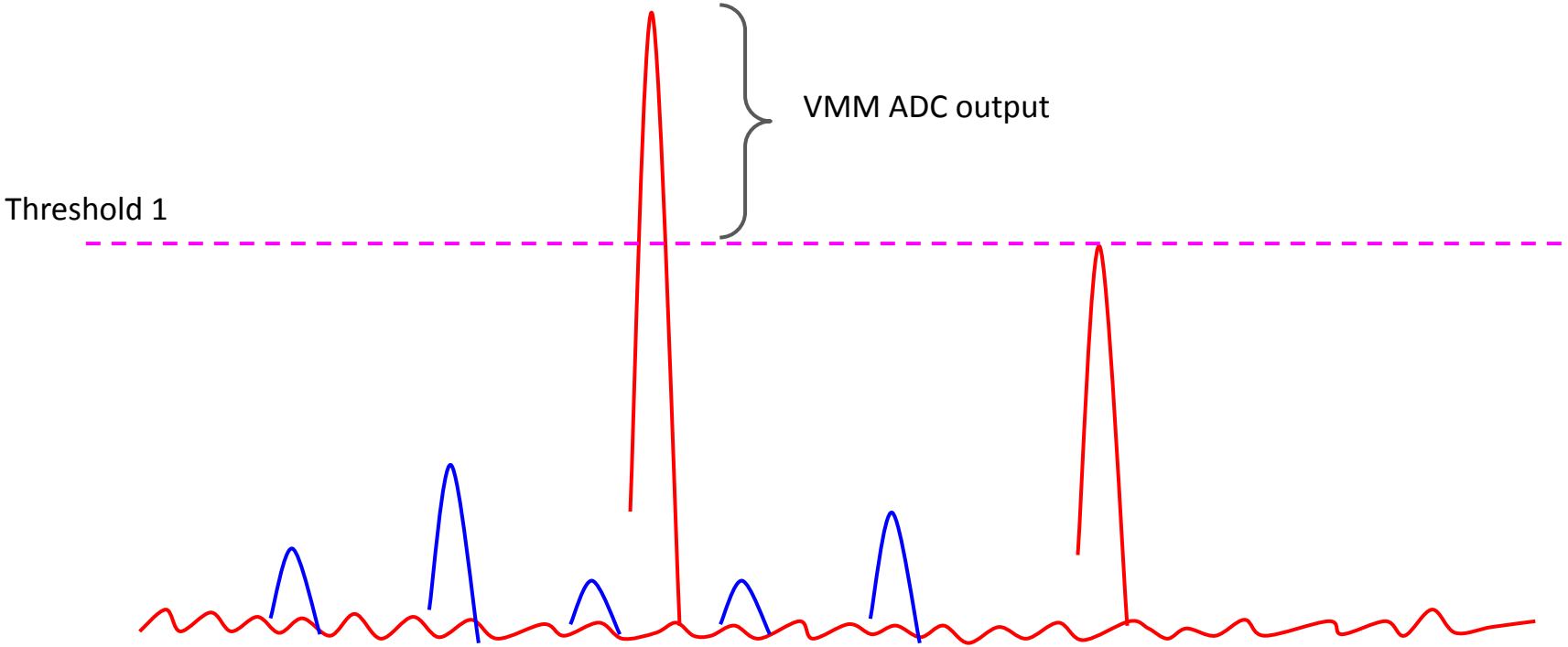

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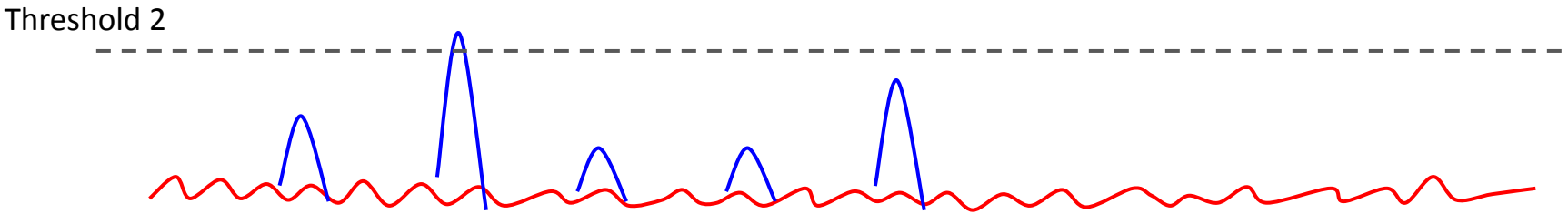

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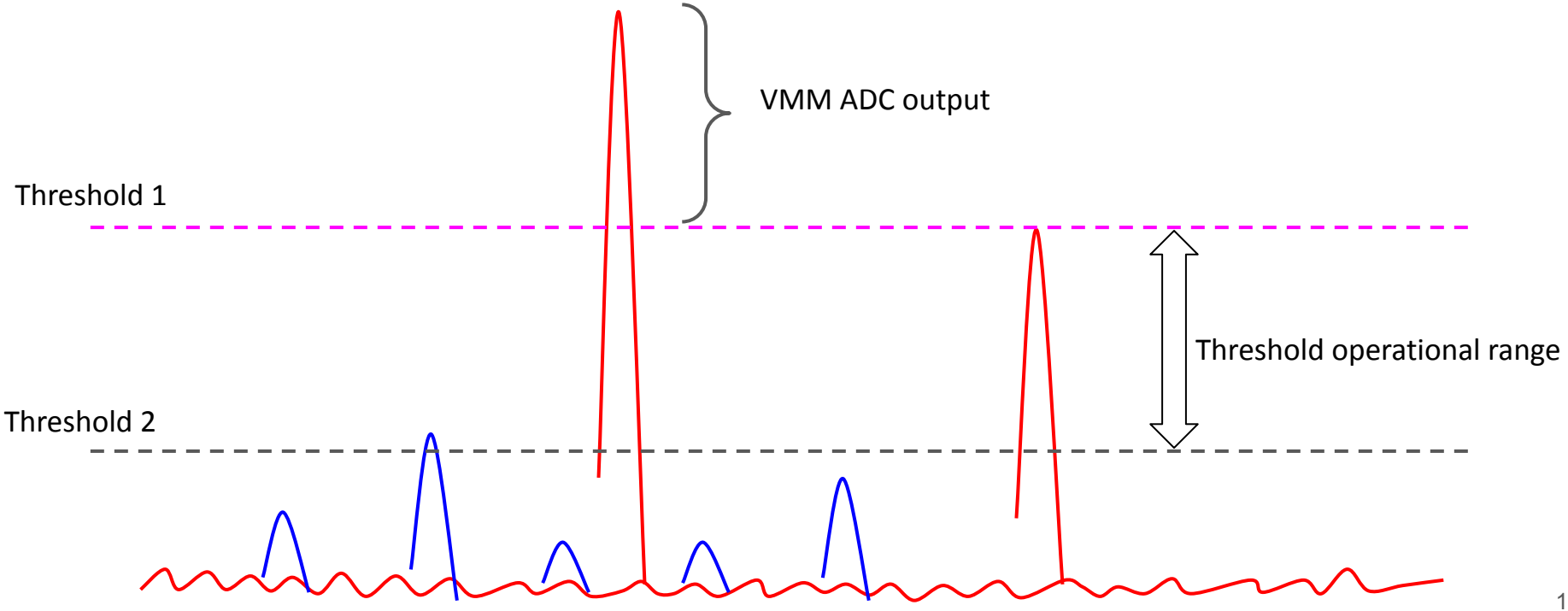

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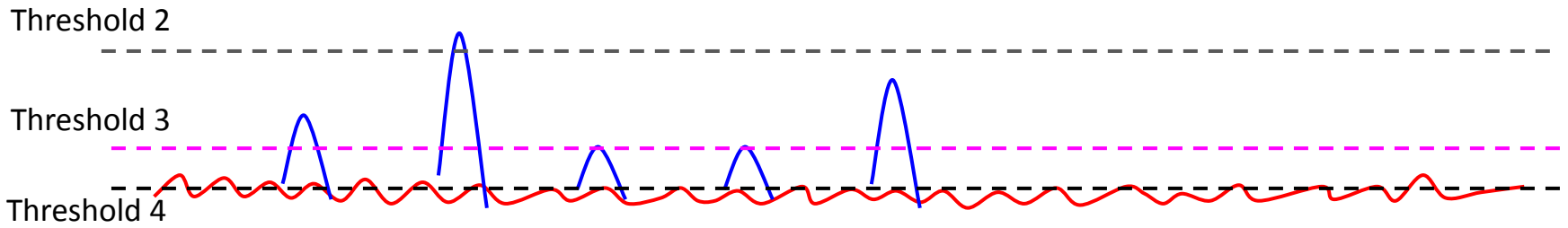

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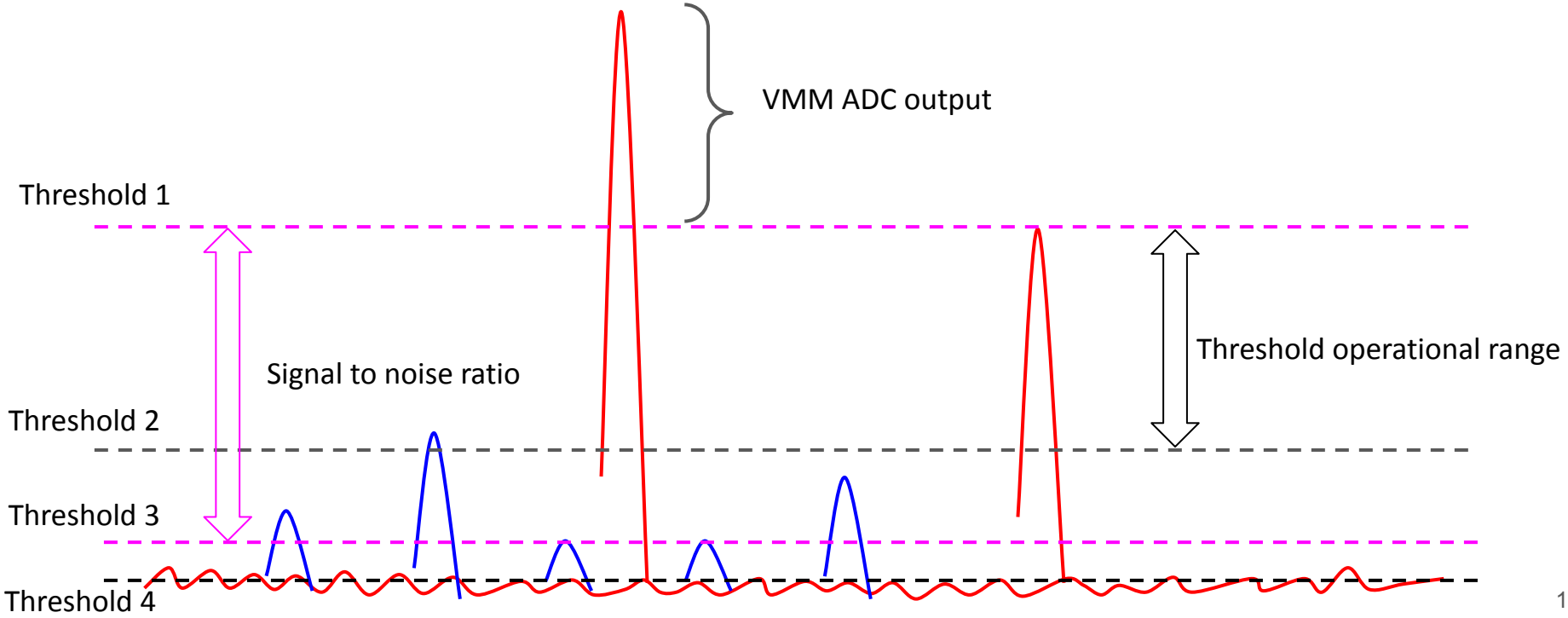
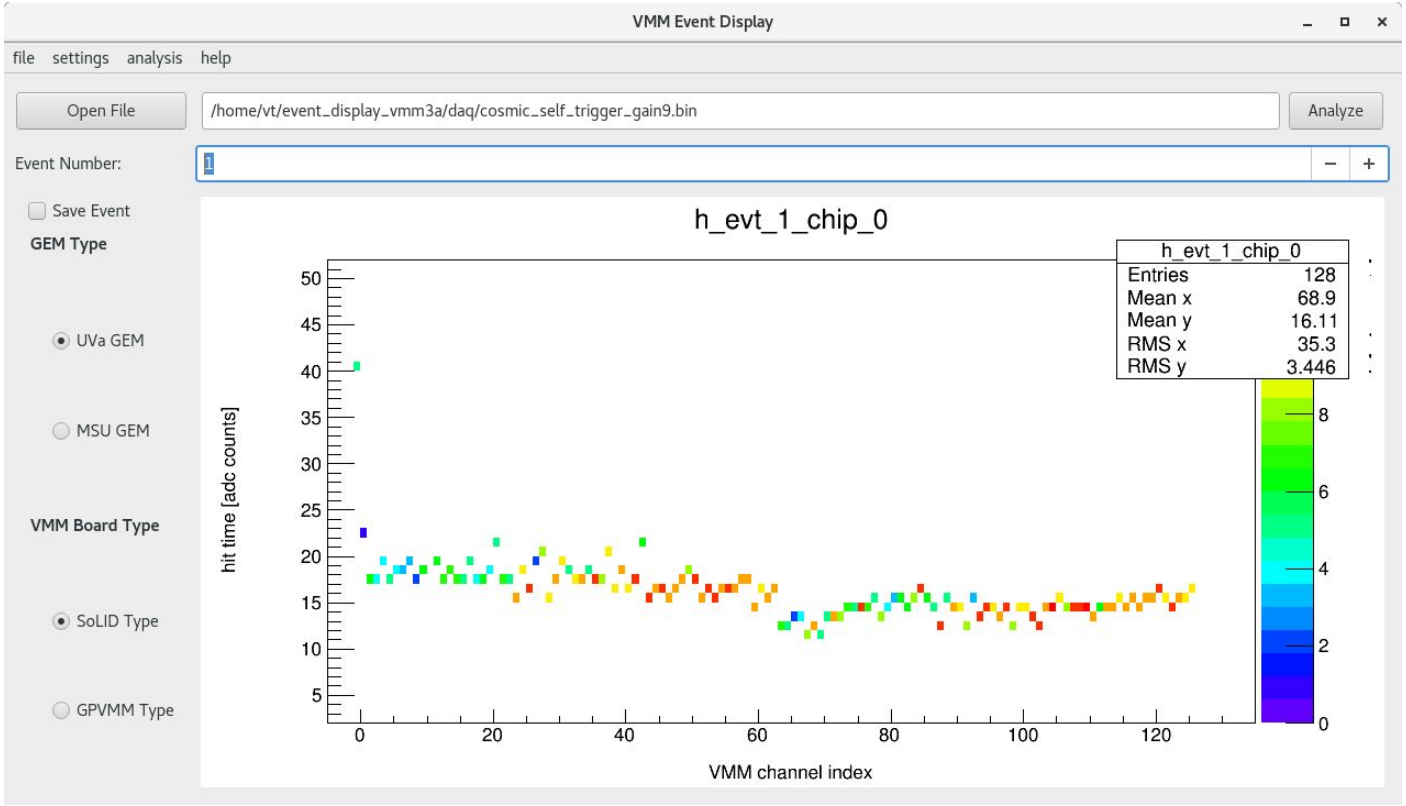


Effective way to estimate the distance between signal and noise

- Using DAC level to estimate signal amplitude
- We don’t see any signal with threshold at DAC = 250, so start from DAC = 250, within a fixed amount of running time:
  - Put GEM HV = 0, decrease the DAC level until we reach the maximum hit count, this DAC (DAC_low) indicate noise signal amplitude
  - Put GEM on HV, increase the threshold until we start to see the hit count drops, this DAC (DAC_high) indicate MIP signal value
  - Then the distance between MIP signal and noise is: DAC_high - DAC_low
  - VMM equipped a 12-bit DAC
  - At present, this difference is estimated to be > 80 DAC counts
  - This distance is independent of which VMM mode we use (6-bit, 8-bit, 10bit, L0, continuous…)

Another issue



We got the GPVMM board working, we can compare with GPVMM board with SoLID board

Outline

- How we determine noise signal amplitude
- Threshold vs counts plot
- Noise amplitude with different gain - noise independent of gain setting
- Noise amplitude with different threshold
- Noise level vs GEM cosmic signal ADC distribution (with different GEM HV)
- Self-triggering mode issue

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