FEMB Noise Scan & DQM update

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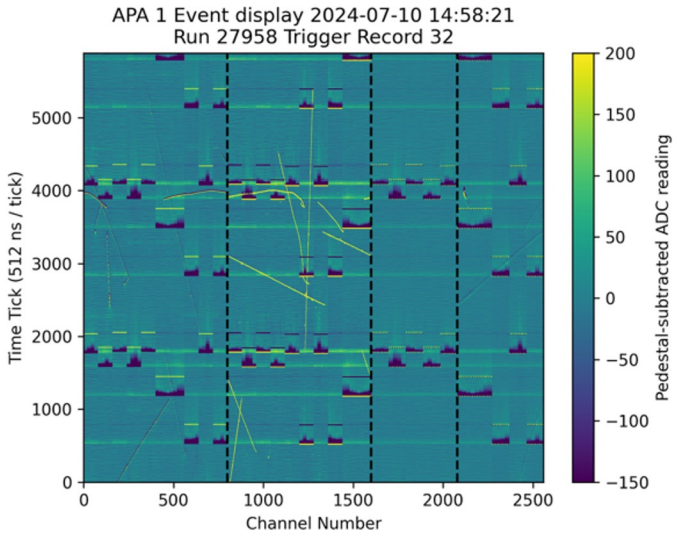
07/25

FEMB “Noise” - power rail drop

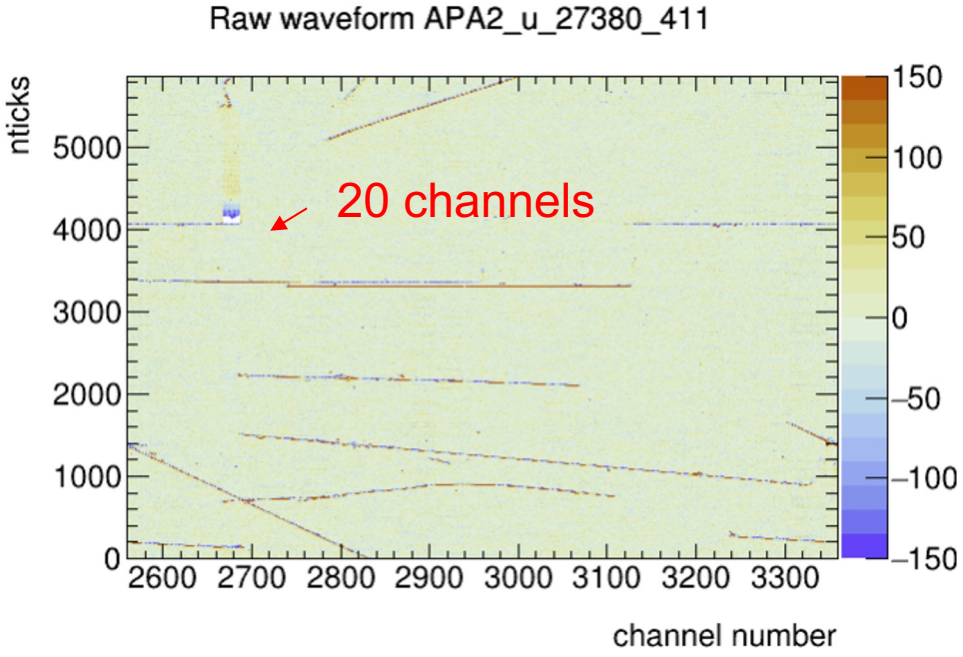
- Observed baseline distortion (undershoot & overshoot) in some U/V/W channels simultaneously
  - Confirmed in pulser data
- The probability of such problem seems better with lower preamplifier gain: 7.8mV/fC
- Shanshan’s explanation:
  - “... multiple FE channels with pulse draw sudden large current that exceed the capability of bypass capacitors for FE power rail, thus voltage of FE power rail frops slightly first and recovers.”
  - “Changing the gain doesn’t reduce input charge, instead it lowers the instant power consumption, and therefore, lowers current draw from bypass capacitors.”

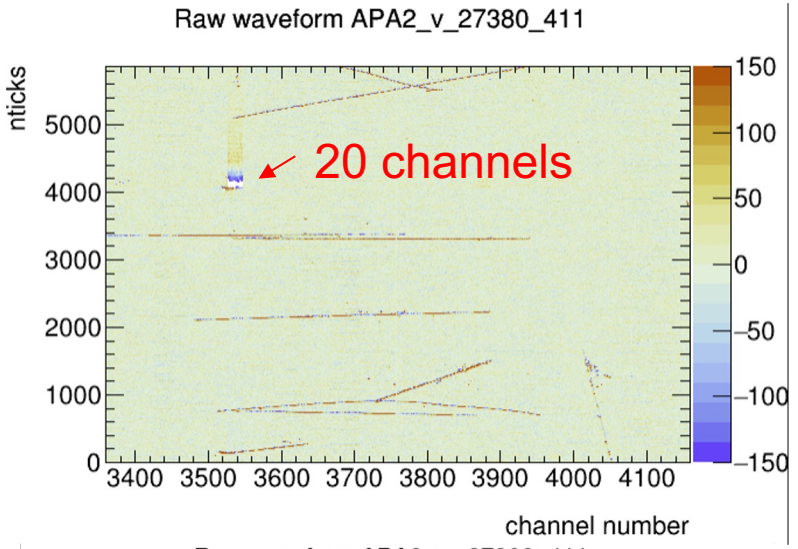
Roger Huang

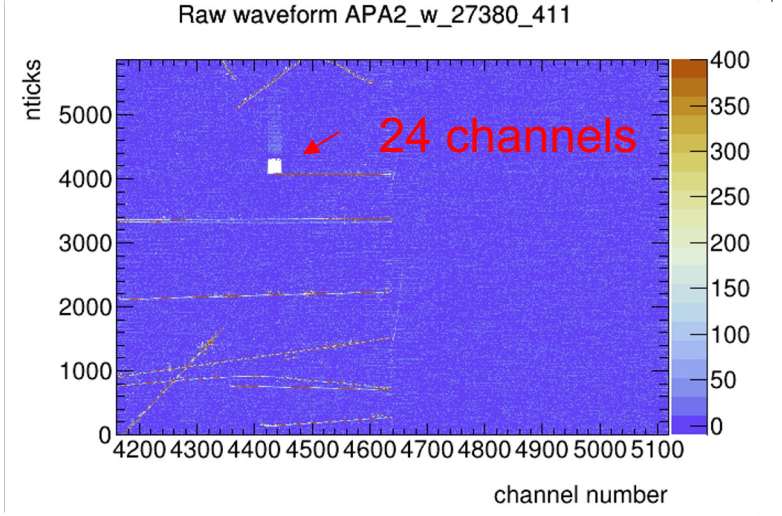


Pulser data

Waveform with the noise

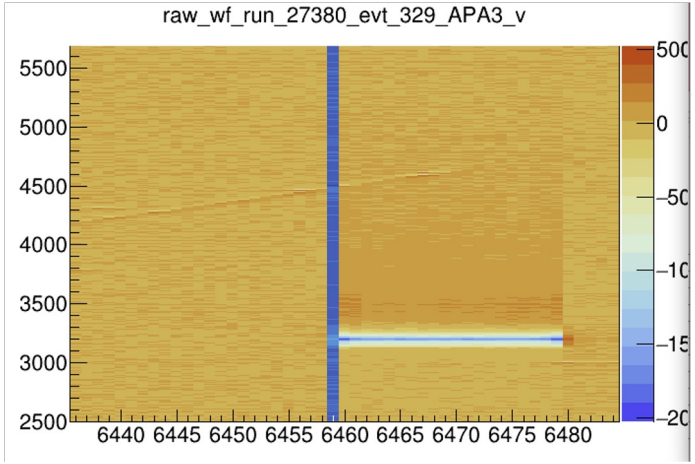


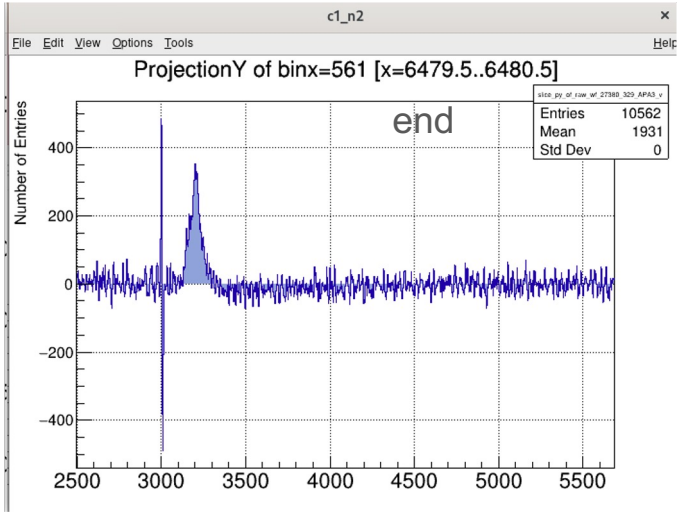


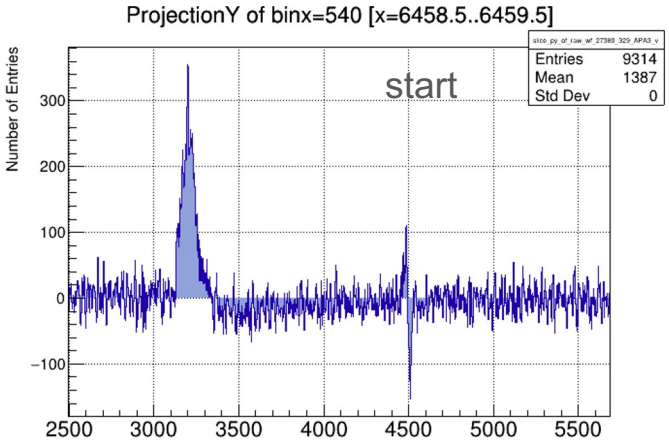


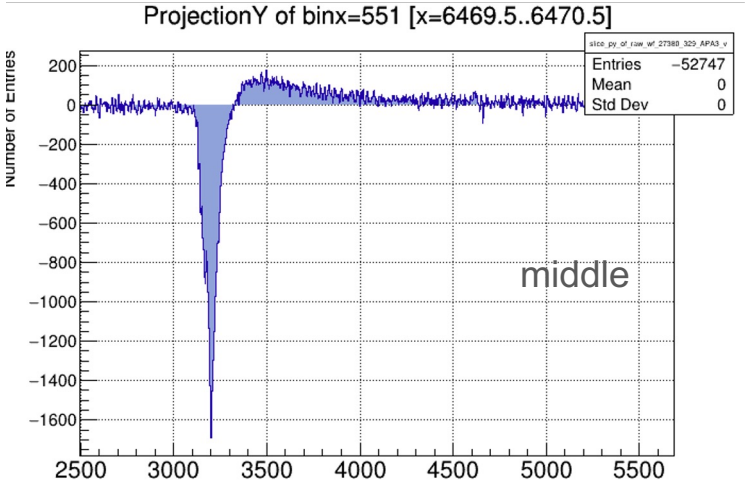
- 20 + 20 + 24 = 64 channels in the same FEMB
  - 128 channels per FEMB
  - Two power rails per FEMB

Waveform


raw_wf_run_27380_evt_329_APA3_v
5500
5000
4500
4000
3500
3000
2500
6440 6445 6450 6455 6460 6465 6470 6475 6480
500
0
−50
−10
−15
−20

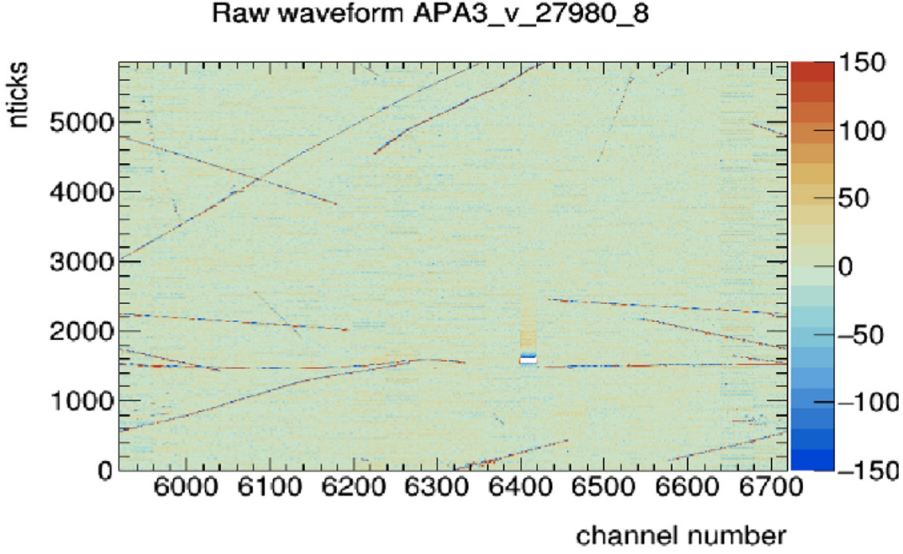

c1_n2
File Edit View Options Tools Help
ProjectionY of binx=561 [x=6479.5..6480.5]
Entries 10562
Mean 1931
Std Dev 0
end
Number of Entries
400
200
0
−200
−400
2500 3000 3500 4000 4500 5000 5500

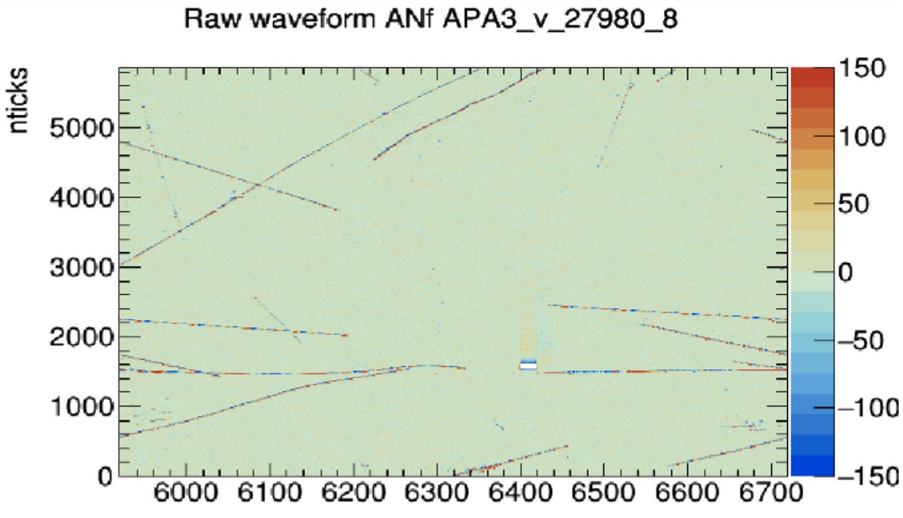

ProjectionY of binx=540 [x=6458.5..6459.5]
Entries 9314
Mean 1387
Std Dev 0
start
Number of Entries
300
200
100
0
−100
2500 3000 3500 4000 4500 5000 5500


ProjectionY of binx=551 [x=6469.5..6470.5]
Entries −52747
Mean 0
Std Dev 0
middle
Number of Entries
200
0
−200
−400
−600
−800
−1000
−1200
−1400
−1600
2500 3000 3500 4000 4500 5000 5500

Current Noise filter

- Can’t remove it
  - Head will be regarded as signal, and protected.
  - Tails will be regarded as part of the coherent noise.
  - Because coherent noise is evaluated in a group of 40 channels, this noise is in 20 channels, it will affect the other adjacent channels.



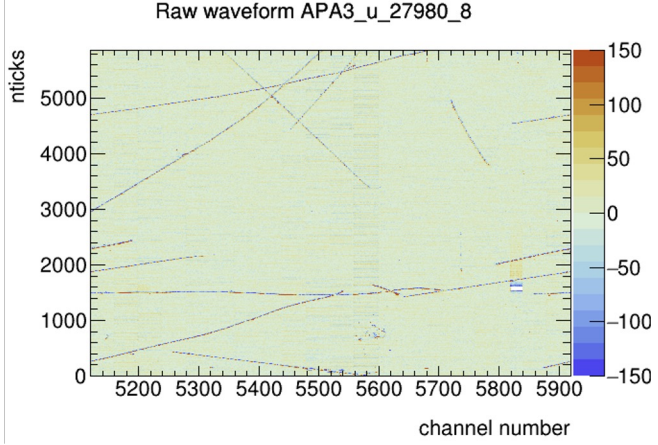


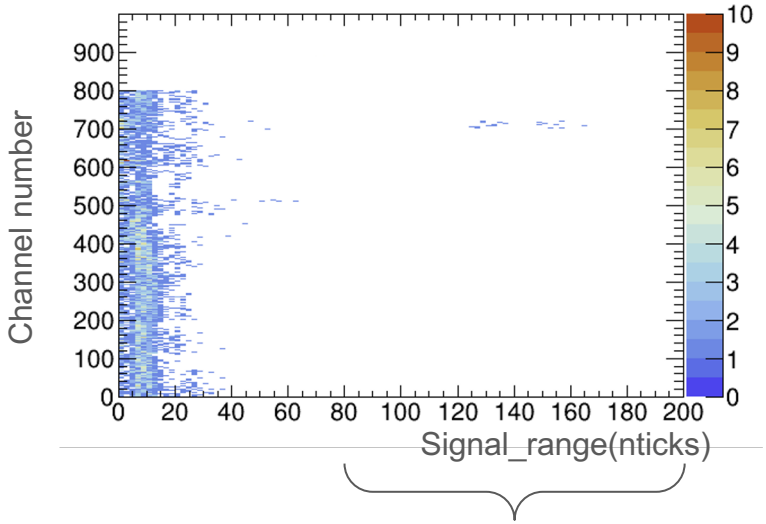
Scan datafiles to find more

- Features:
  - Width is wider.(in u and v)
  - Appears in 20 consecutive channels at same time
  - Can be seen in all 3 planes.
  - Negative pulse

- An easy and quick way to do scan
  - Find all signal ROIs in a plane:
    - (if ADC-baseline < -3.5 rms)
  - Add a cut on the number of signals with wide width.

- Addtional requirement:
  - Apply this cut on U and V plane
  - U and V should found this simultaneously





Cut: Integral(80,200)>15

Scan result:

- Run:27380
- Date: 06/22/2024
- Gain: 14mV/fC

- Scanl event: 565
- Noise event: 37
  - APA1:3
  - APA2:10
  - APA3:13
  - APA4:11

- Run:28052
- Date: 07/18/2024
- Gain: 7.8mV/fC

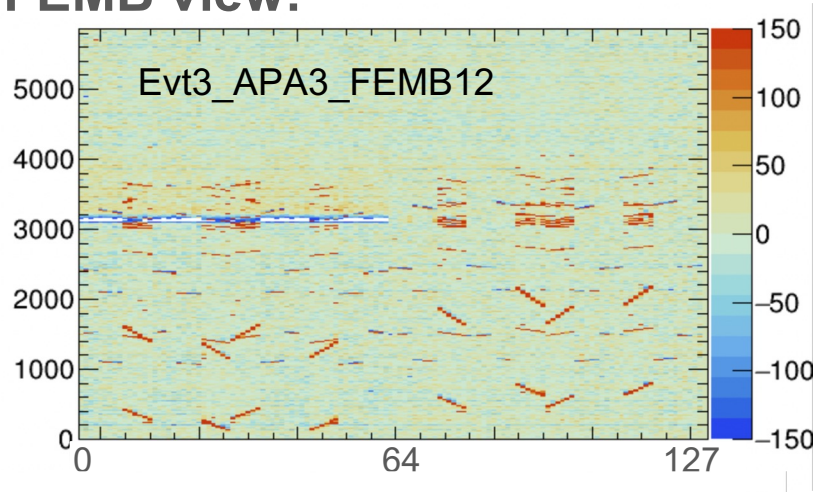
- Scan event: 413
- Noise event: 7
  - APA1:0
  - APA2:4
  - APA3:2
  - APA4:1

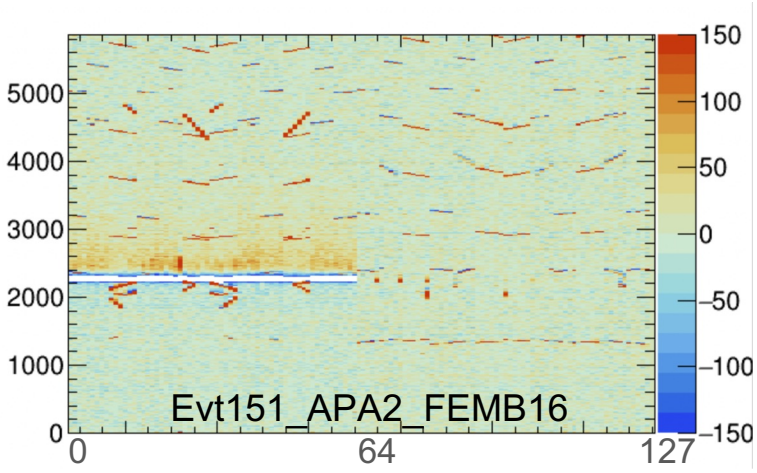
Not all related to beam activities

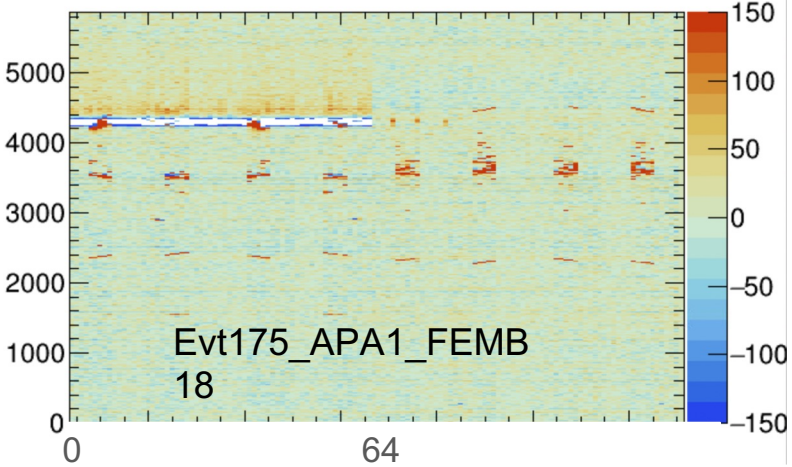
- Consistent with Roger and Shanshan’s explanation

Lower gain relieves the problem

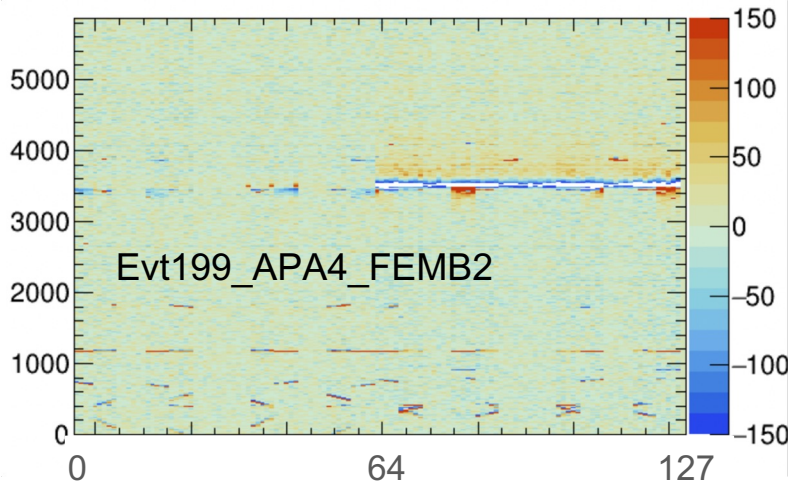
In FEMB view:





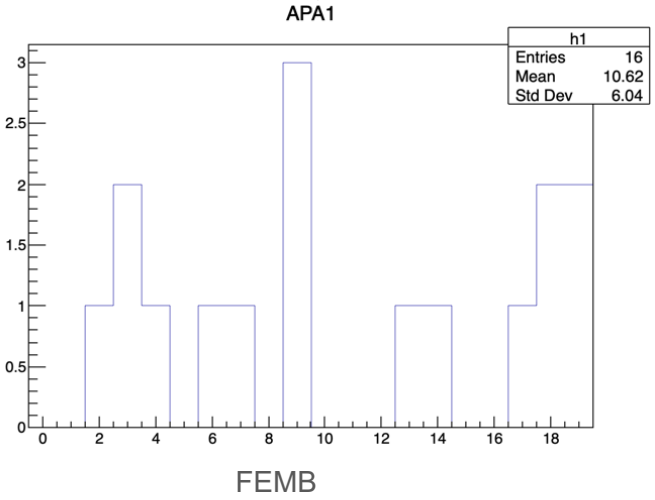


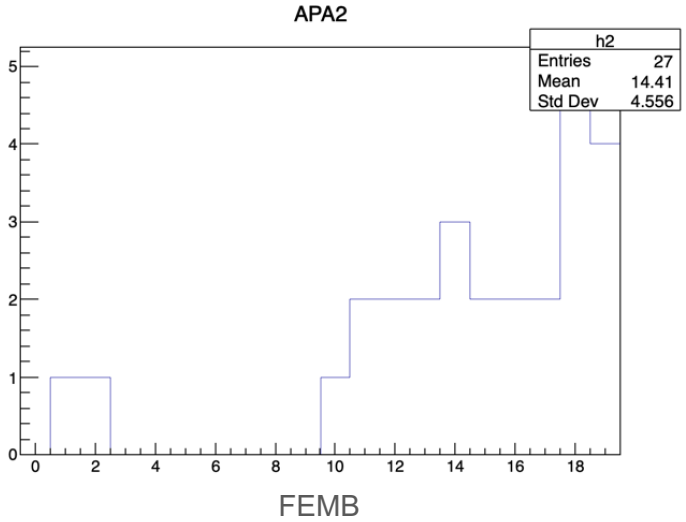
cold electronic channels

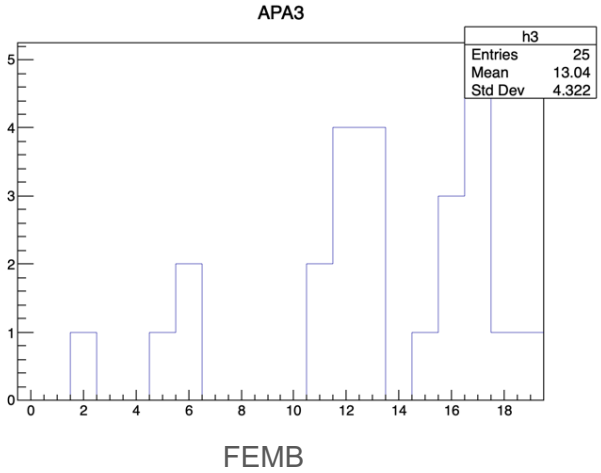


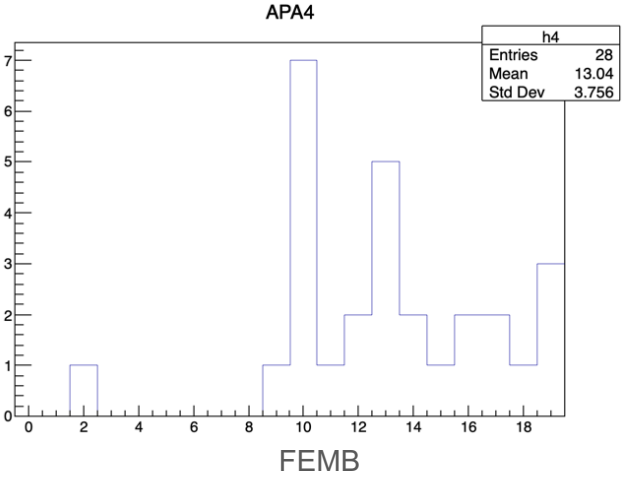
cold electronic channels

Statistics in APA, FEMB









Next for FEMB noise:

- Find it explicitly. For now only for the quick scan.
  - Normal signals are bipolar(positive) for induction(collection) plane, this noise is negative.
- Quantify it: amplitude, shaping;
  - Are they same among channels in same(different) group and same(different)events?
- Correct or blind the region;

Status and Next Plan for DQM:

- We have now:
  - Waveforms:
  - Baseline;
  - RMS;
  - Noise spectrum vs frequency;
  - Correlation channel to channel;

https://github.com/Ningclover/protodune_DQM_v_BNL

- More plots:(Xuyang)
  - Hit finding information
  - Information after deconvolution
  - dE/dx; electron lifetime…
  - Summary plots of different runs
  - …

- Improve the interface.(Gabriela)
  - Move to Django
  - interface Django app with s3 and elasticsearch services.

On your local terminal:

ssh -N -f -L localhost:8050:localhost:8050 <username>@dunegpvm11.fnal.gov

http://127.0.0.1:8050/