New signal strength

ProtoDUNE sim/reco

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January 15, 2020

Updated 9:50 EST

Introduction

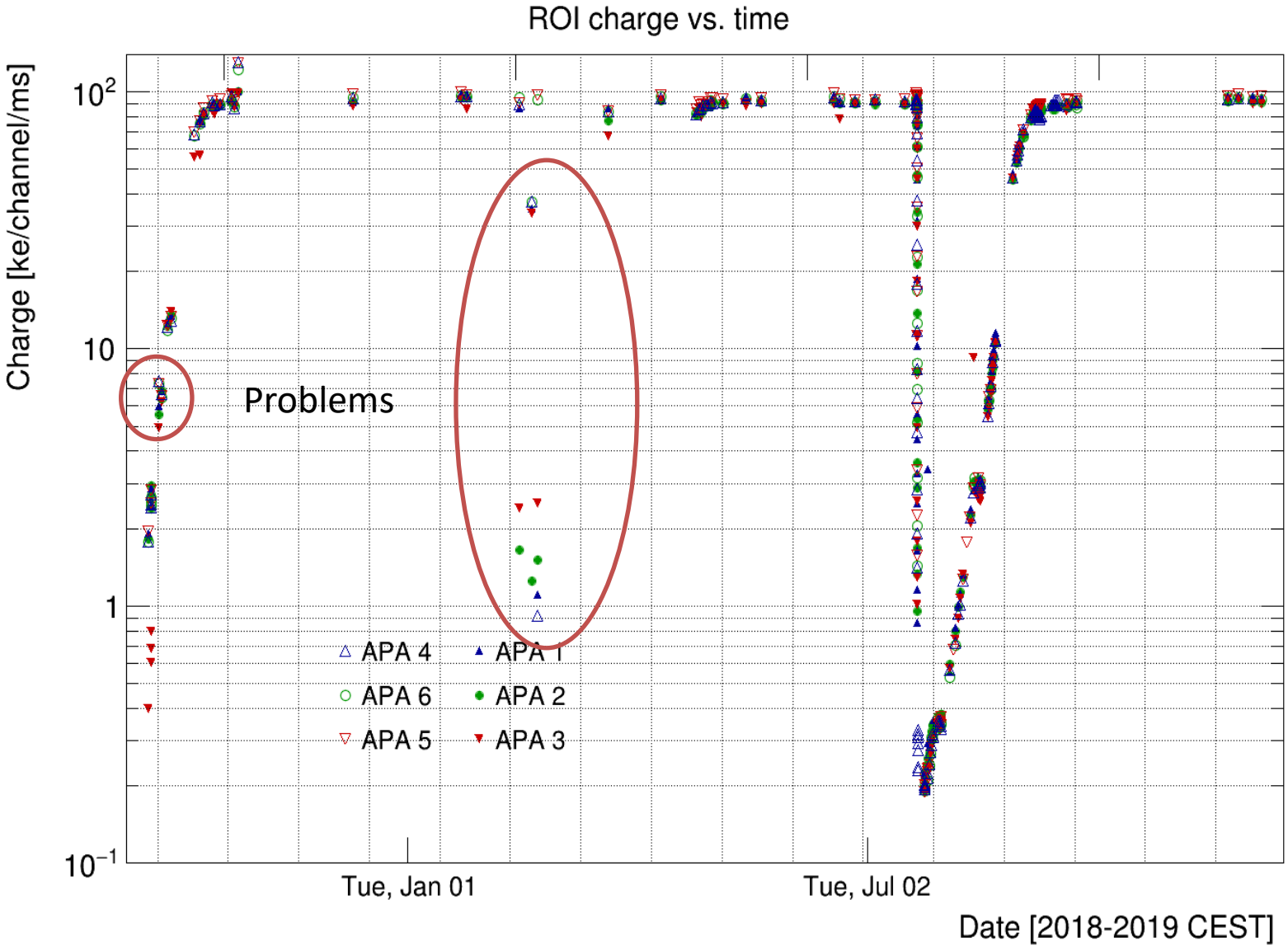
I have been showing plots of signal strength

- Collected current (electrons/ms) for each collection channel
  - Integrated over each APA in summary plot
  - See following slide
  - Latest: https://internal.dunescience.org/people/dladams/protodune/monitoring/roiChargeLogVsAllTime.png
- Some problems there
  - Noise filter with wrong window size (3.0 → 7.5 ms) failed intermittently
  - RCE data unpacking failed intermittently
  - Calculation of time (denominator in current) was based on event count ignoring failures from the above and other problems
- Signal strength depends on trigger
  - Beam and telescope triggered events should and do have more charge
  - Calculation ignores trigger but choice of triggers varies run to to run

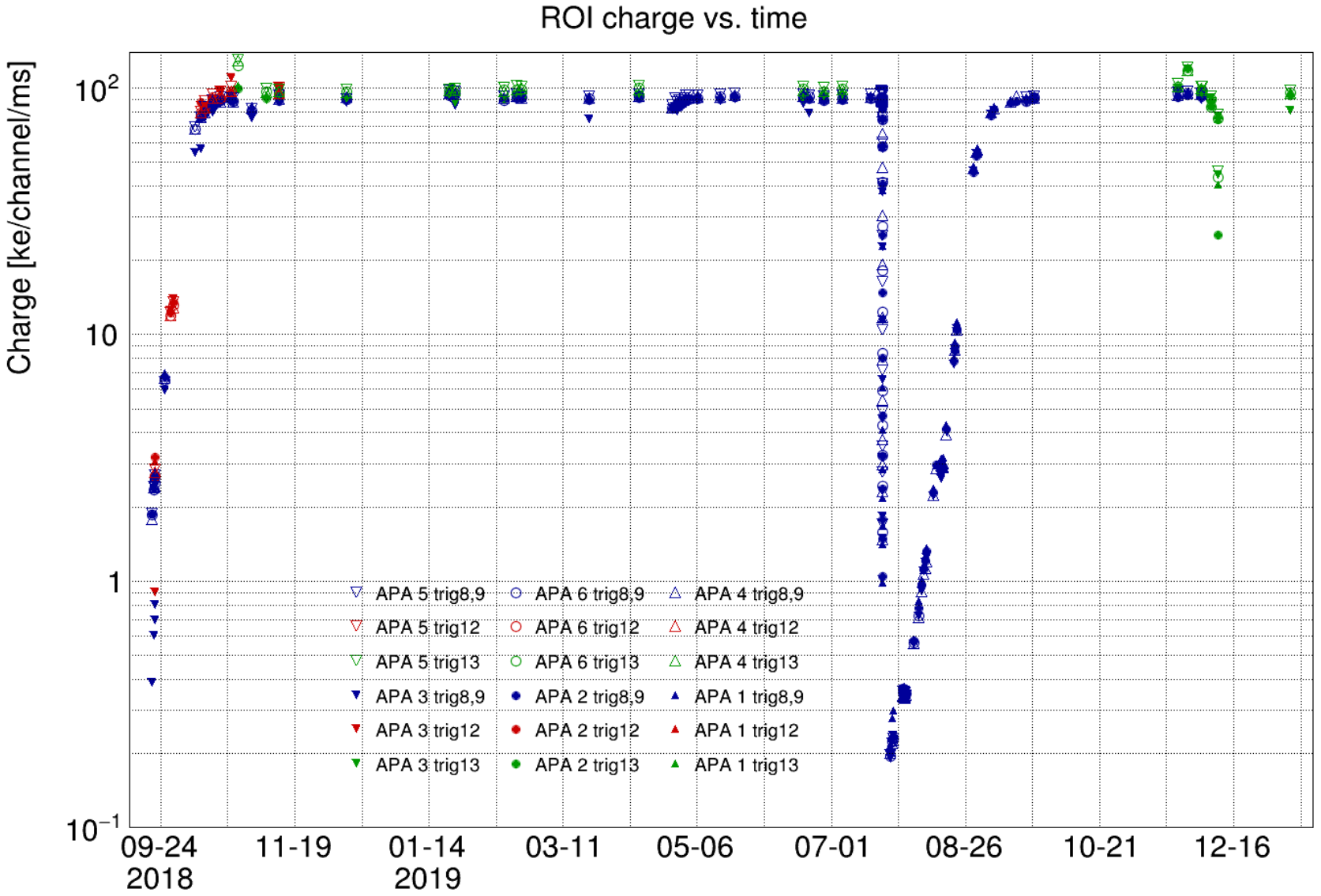
New result

- Fix all the above problems (details follow)
- Reprocess with single trigger flag for each job (each point on plot)
- See 2nd following slide

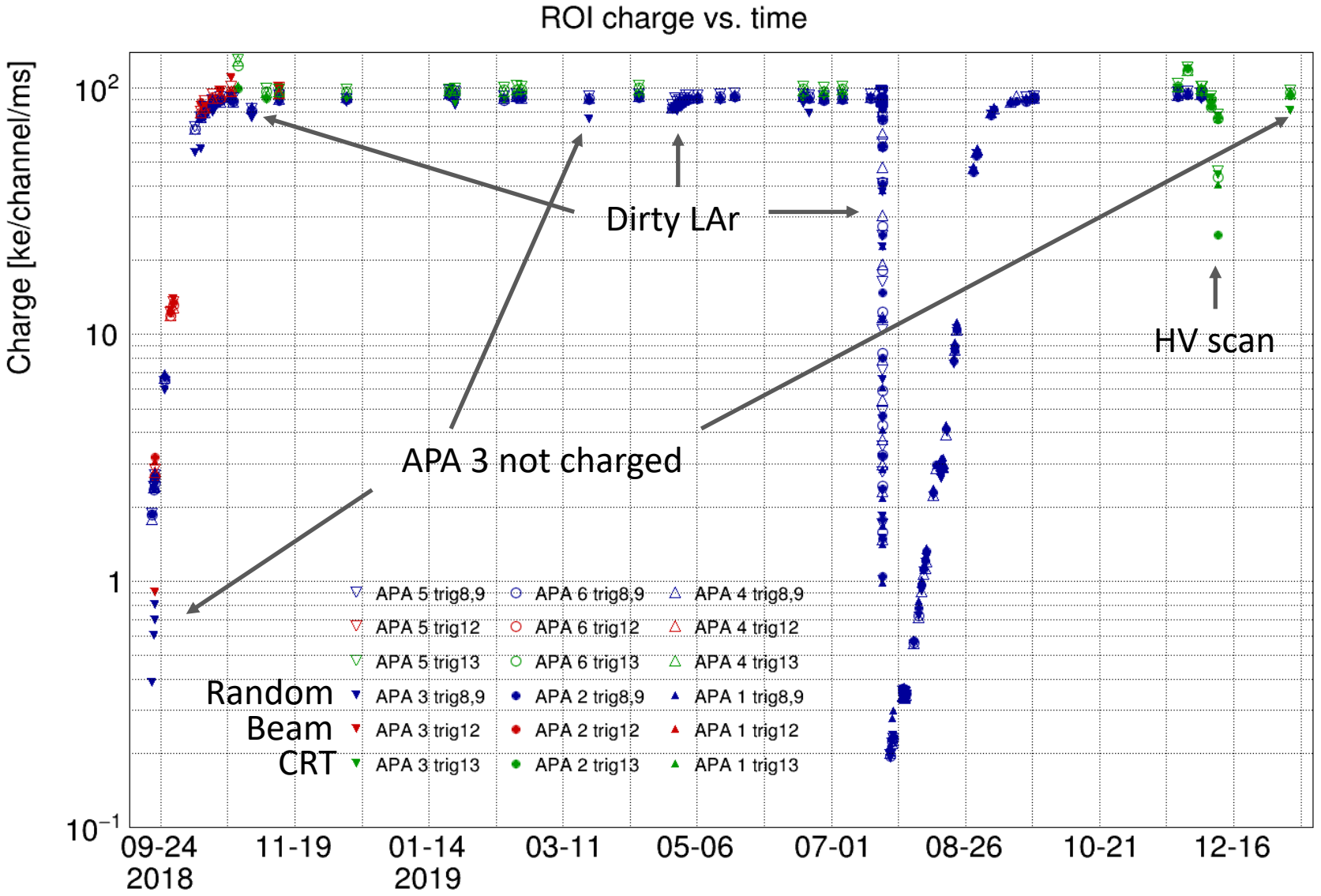
Old result


ROI charge vs. time
Charge [ke/channel/ms]
10^2
10
1
10^{-1}
Problems
APA 4
APA 1
APA 6
APA 2
APA 5
APA 3
Tue, Jan 01
Tue, Jul 02
Date [2018-2019 CEST]

New result


ROI charge vs. time
Charge [ke/channel/ms]
10^2
10
1
10^{-1}
09-24
2018
11-19
01-14
2019
03-11
05-06
07-01
08-26
10-21
12-16
APA 5 trig8,9
APA 6 trig8,9
APA 4 trig8,9
APA 5 trig12
APA 6 trig12
APA 4 trig12
APA 5 trig13
APA 6 trig13
APA 4 trig13
APA 3 trig8,9
APA 2 trig8,9
APA 1 trig8,9
APA 3 trig12
APA 2 trig12
APA 1 trig12
APA 3 trig13
APA 2 trig13
APA 1 trig13

New result annotated



Noise filter

Issue in noise filter

- Uses fixed-length LArFFT service
- Can mirror data with shorter than expected length
  - But this only works if data is at least half the assumed length
  - Below that there is access beyond array bounds and algorithm will anyway need to be more sophisticated
- Problem for signal strength processing
  - I was sometimes processing 7.5 ms data with LArFFT for 3.0 ms window
  - Also, corrupt data is sometimes shorter than it should be

My fixes

- Add abort with error message to noise removal tool if data has size outside ½ to 2 times the LArFFT size
- Use correct nominal window size in my jobs
- Modify dataprep service to discard data that is not close to the expected size (within 0.5%)

RCE decoding

I was seeing crashes in RCE decoding

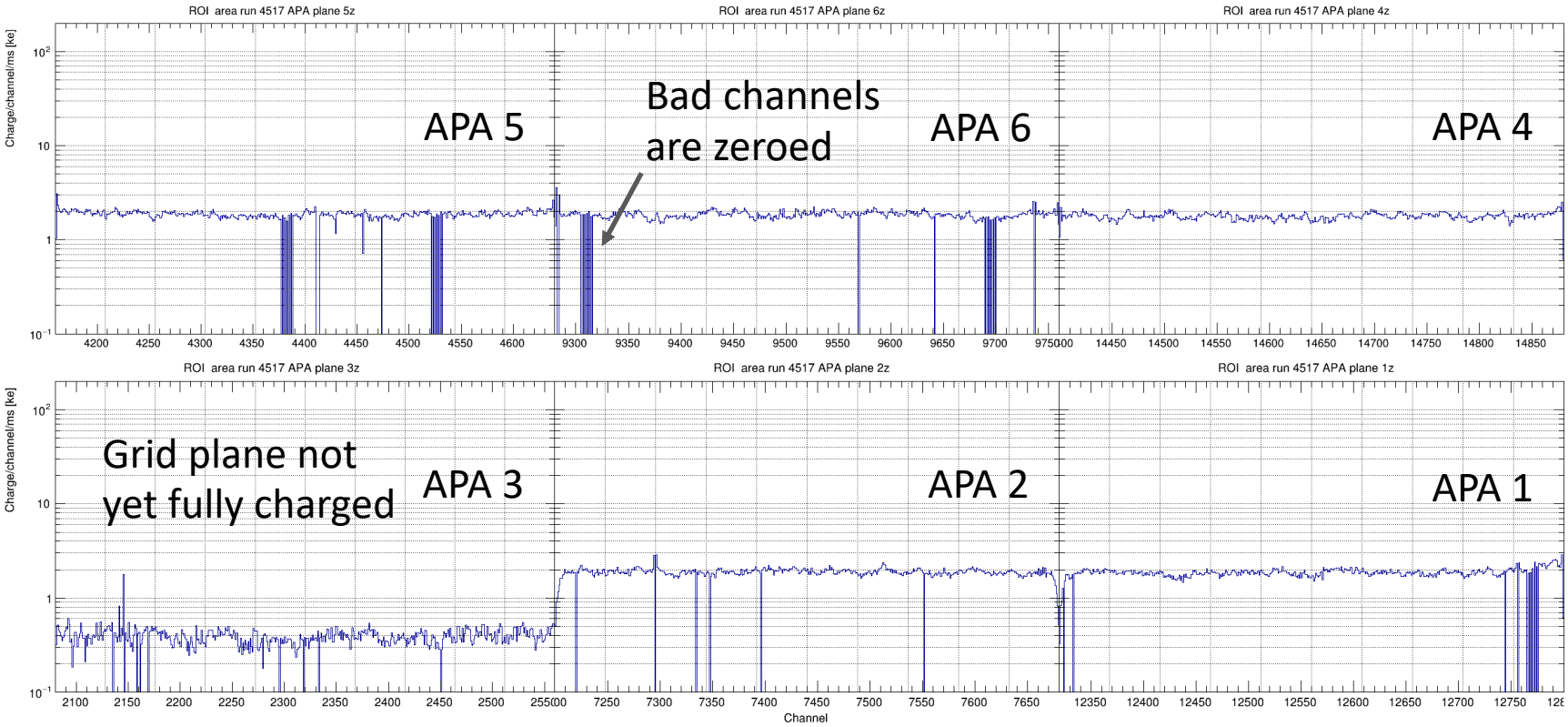
- Valgrind showed invalid memory access
- I patched a couple problems
- Tom created a copy of code in DUNE controlled package
  - Previously depended on external and no longer supported code
- My mods are in the copy and will be used for future releases

More plots

Preceding and other plots may be found at

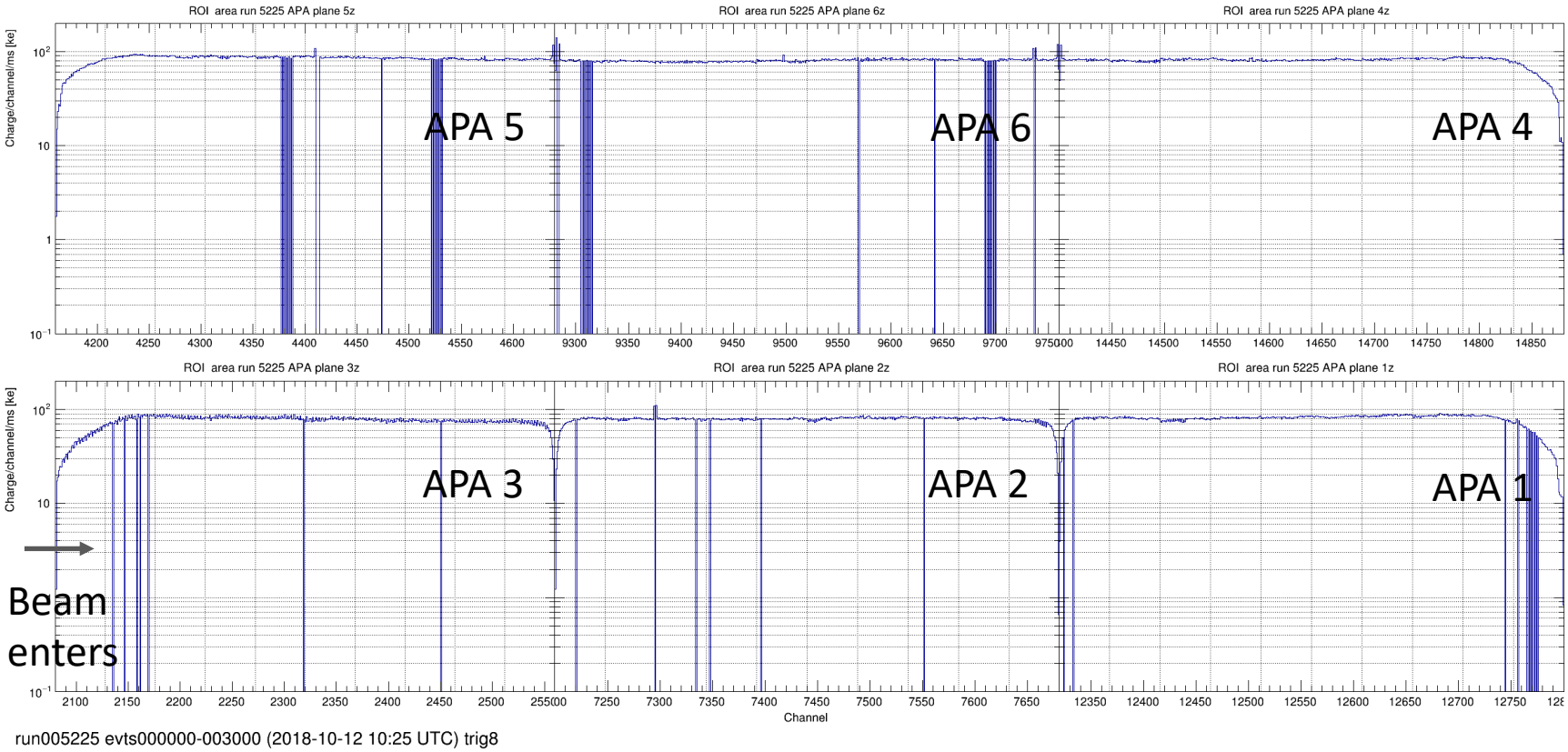
- https://internal.dunescience.org/people/dladams/protodune/monitoring
- Also includes plots of charge for each channel
  - A few of these follow

Early run



run004517 evts000000-003000 (2018-09-20 09:18 UTC) trig9

Beam run with random trigger



Same run with beam trigger