

Signal strength for higher fields and neutron generator

ProtoDUNE-SP Operations

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BNL

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Introduction

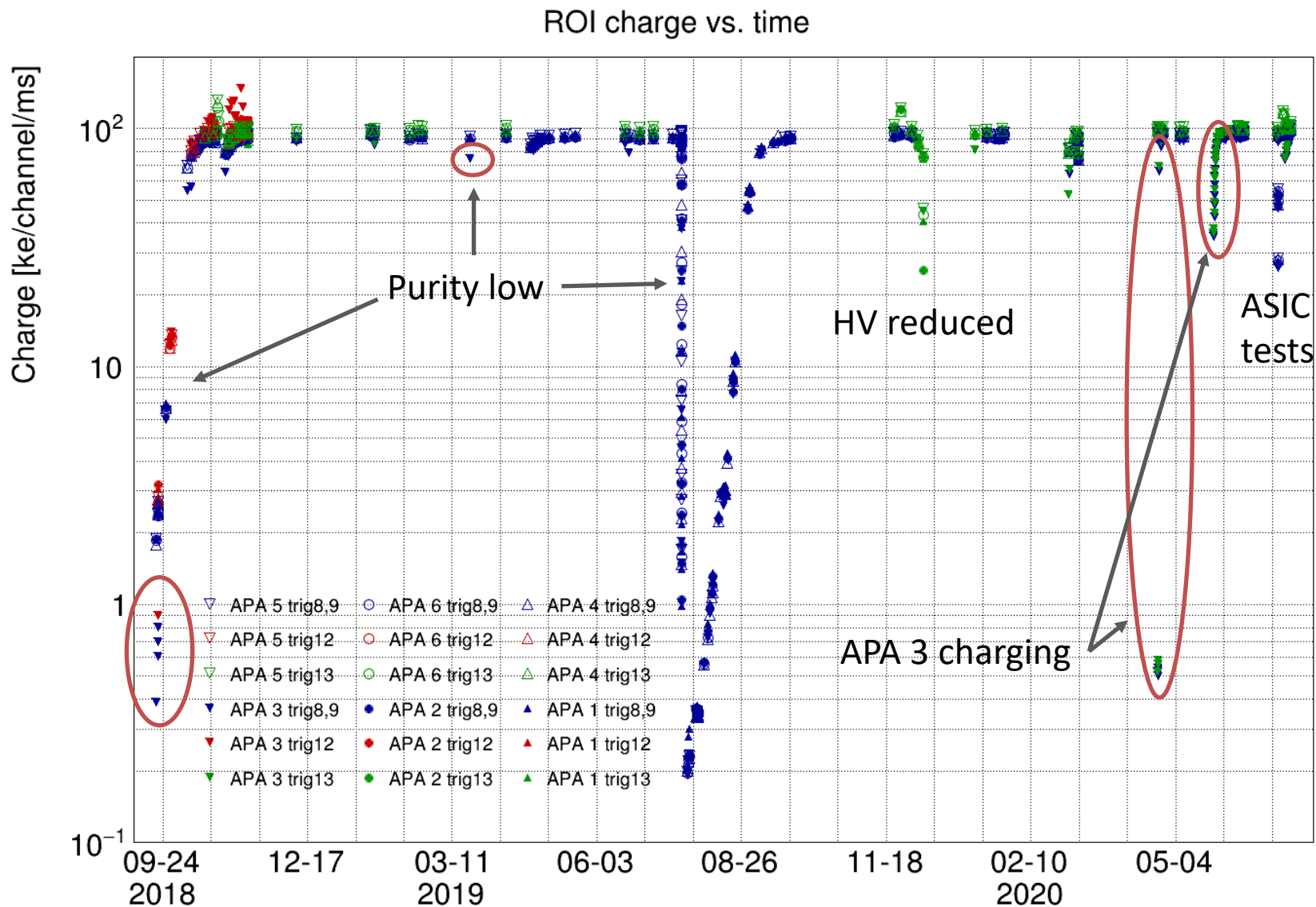
I have extended signal strength monitoring to recent data

- Increase in E-field: 600 and 650 kV/cm
- Data taken with neutron generator near APA 5

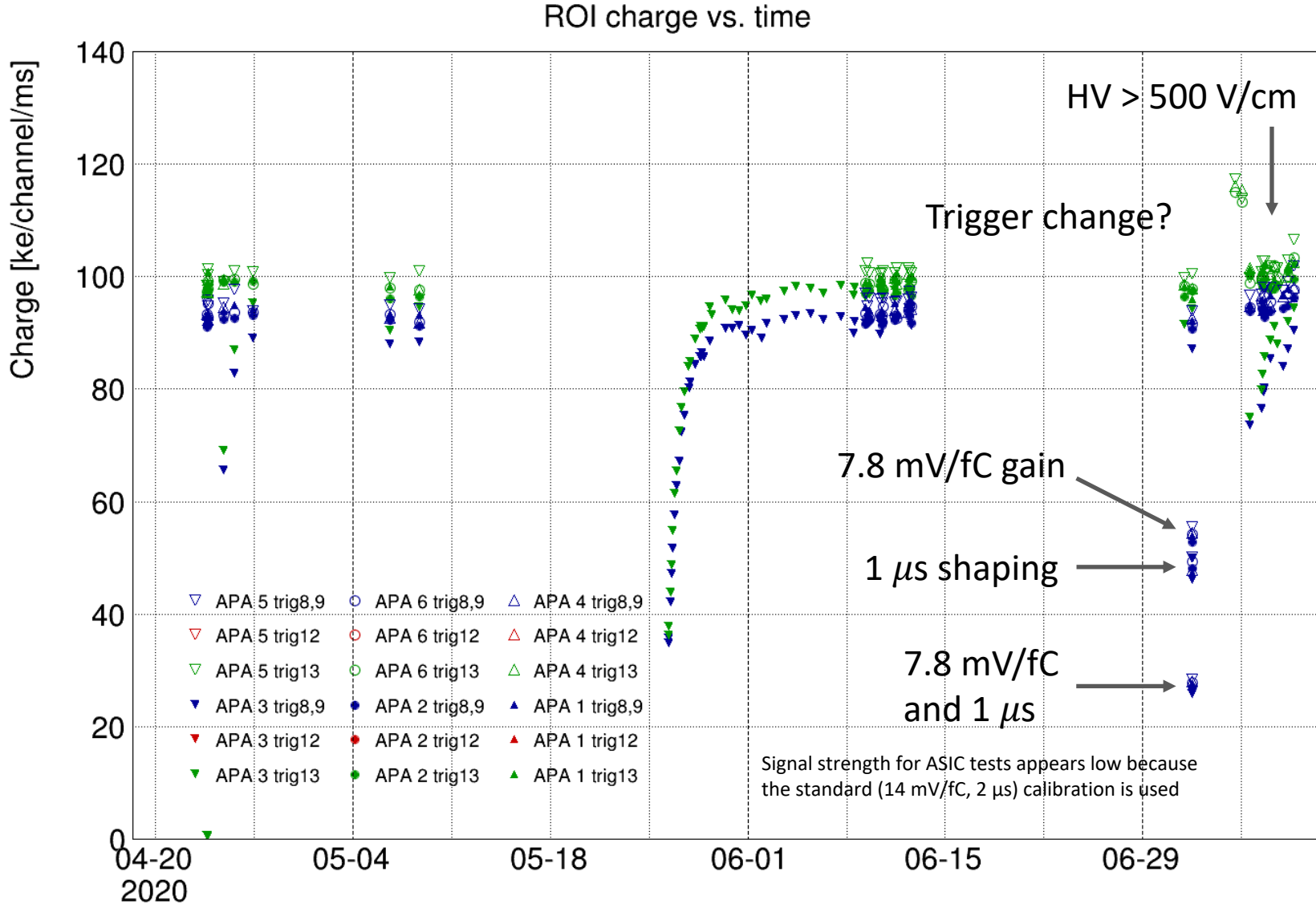
The following and other SS plots on the monitoring page

- <https://internal.dunescience.org/people/dladams/protodune/monitoring>
- These are updated as data is processed

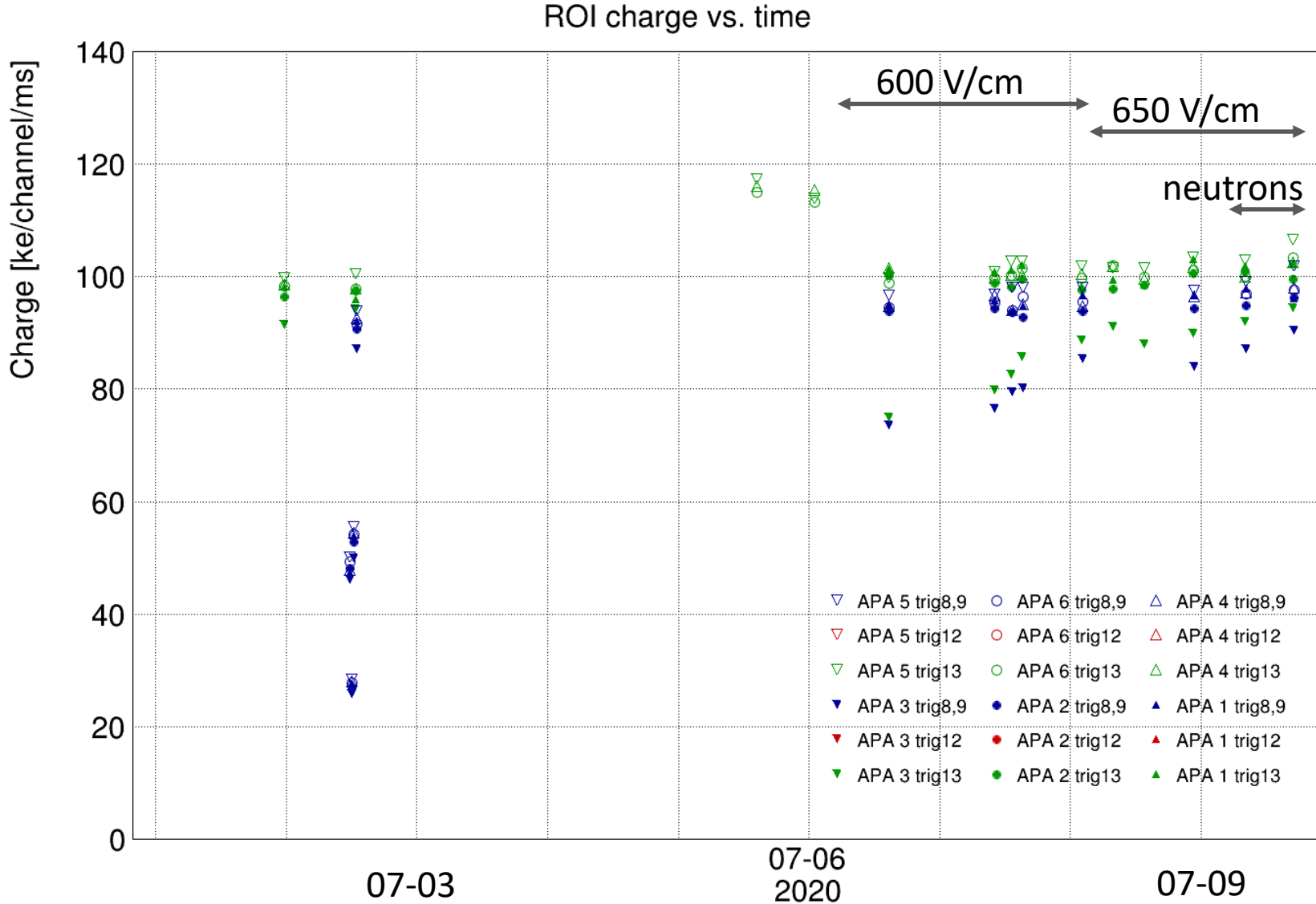
Signal strength for full run



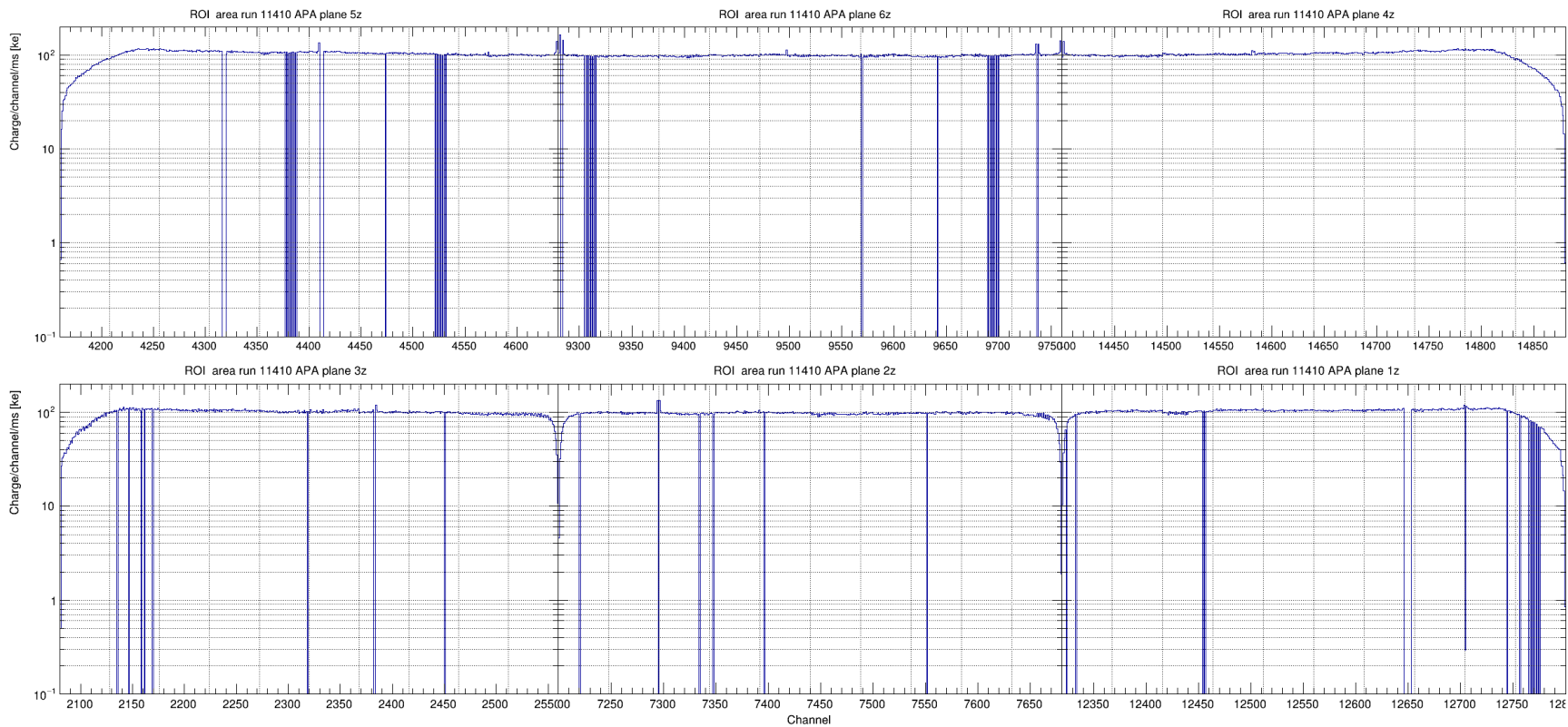
Recent signal strength



Very recent signal strength

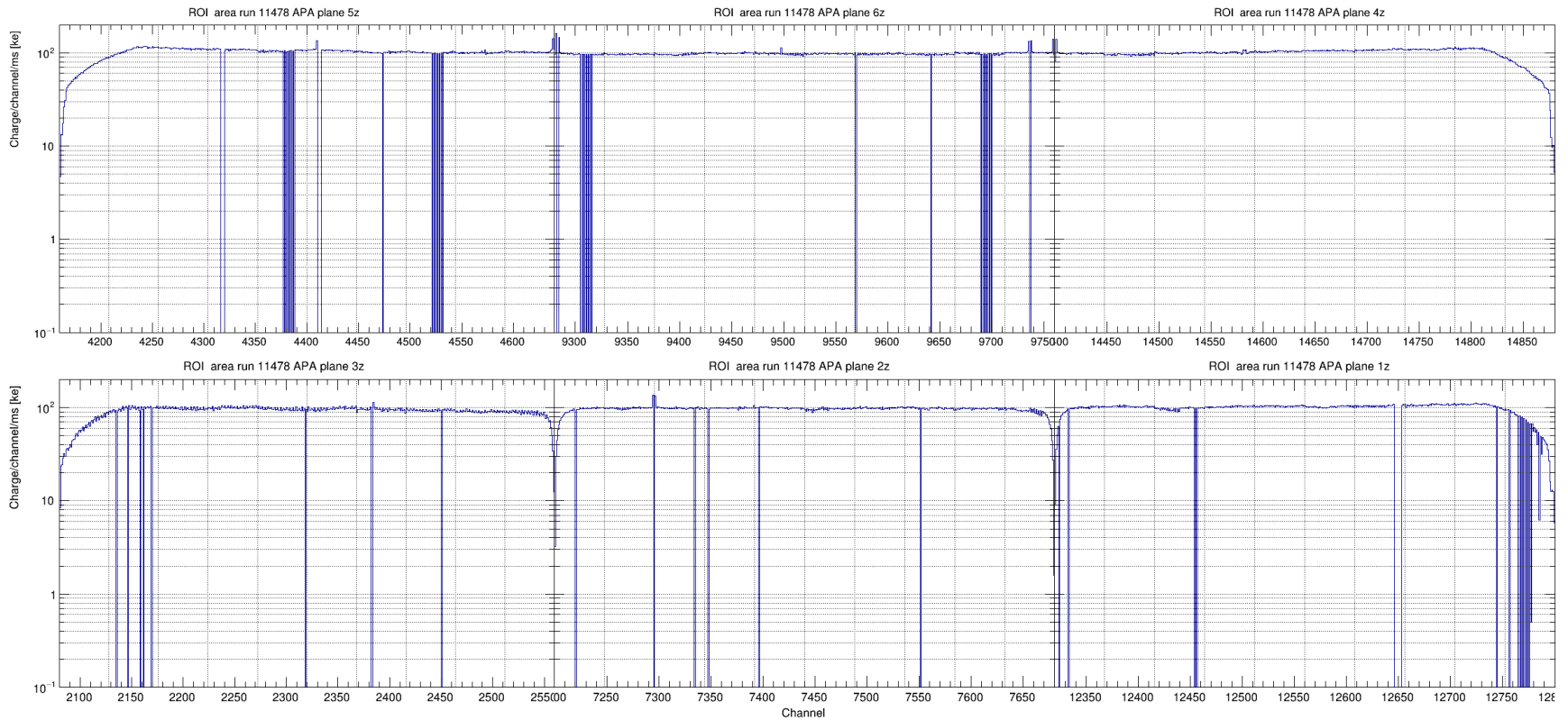


Run 11410, June 12, 500 V/cm



run011410 evts000000-003000 (2020-06-12 12:37 UTC) trig13

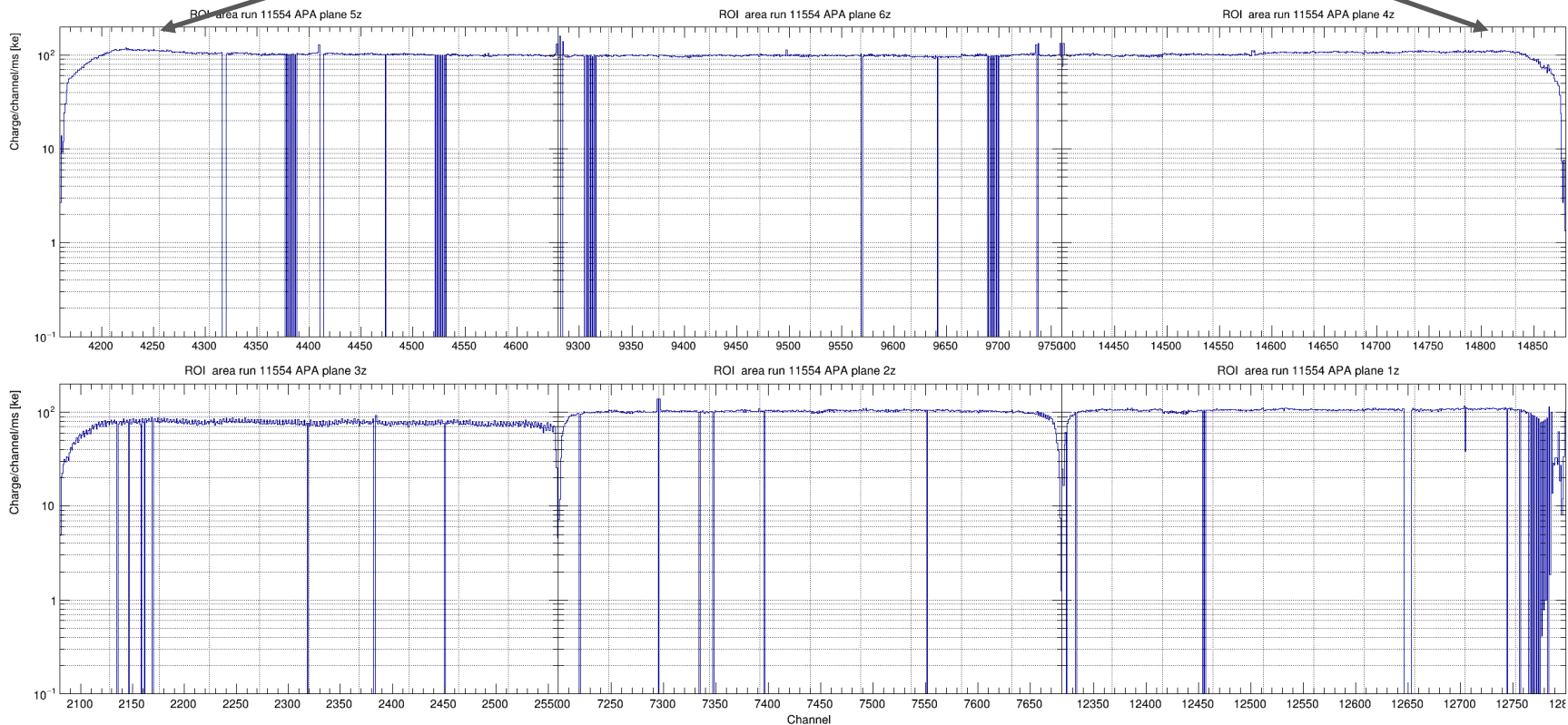
Run 11478, July 1, 500 V/cm



run011478 evts000000-003000 (2020-07-01 21:40 UTC) trig13

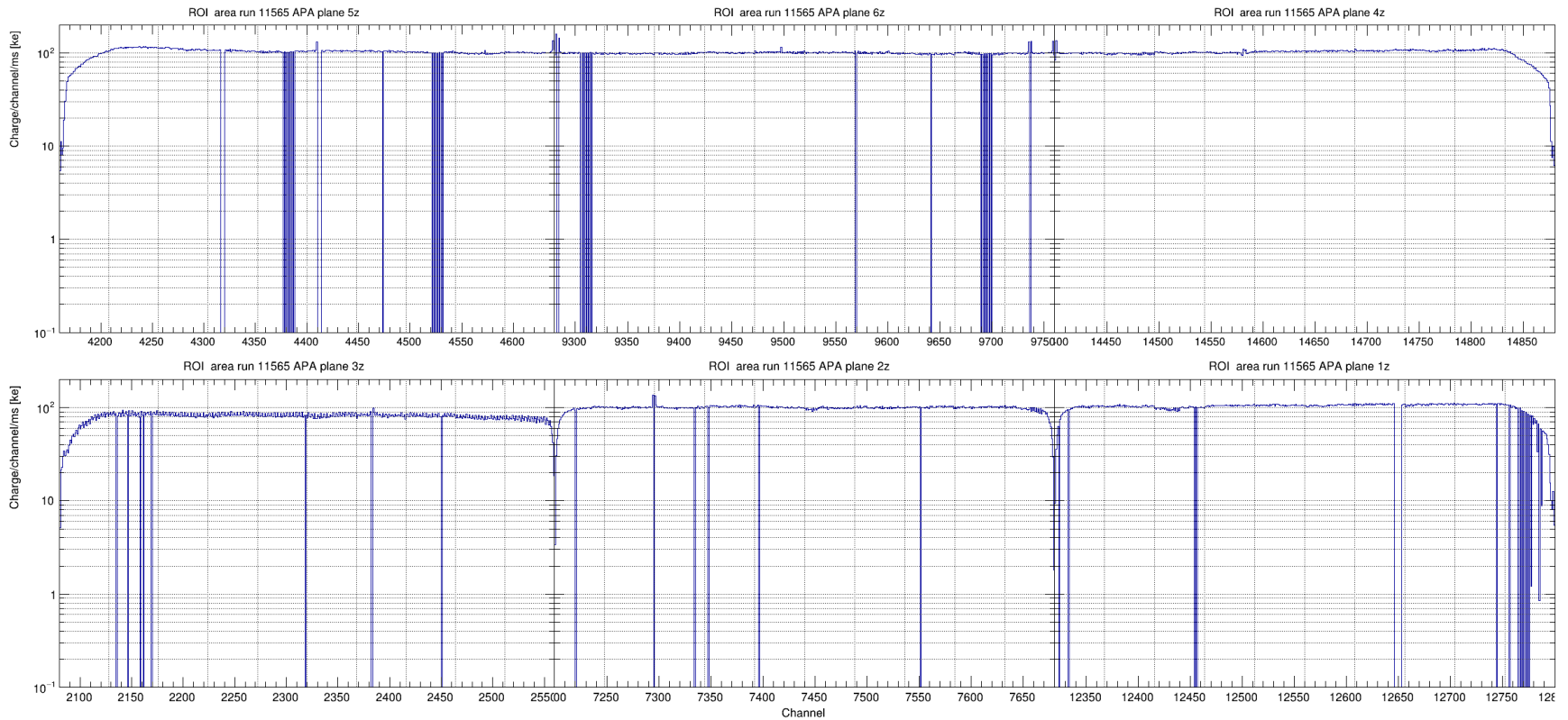
Run 11554, July 6, 600 V/cm

Expected decrease in space charge



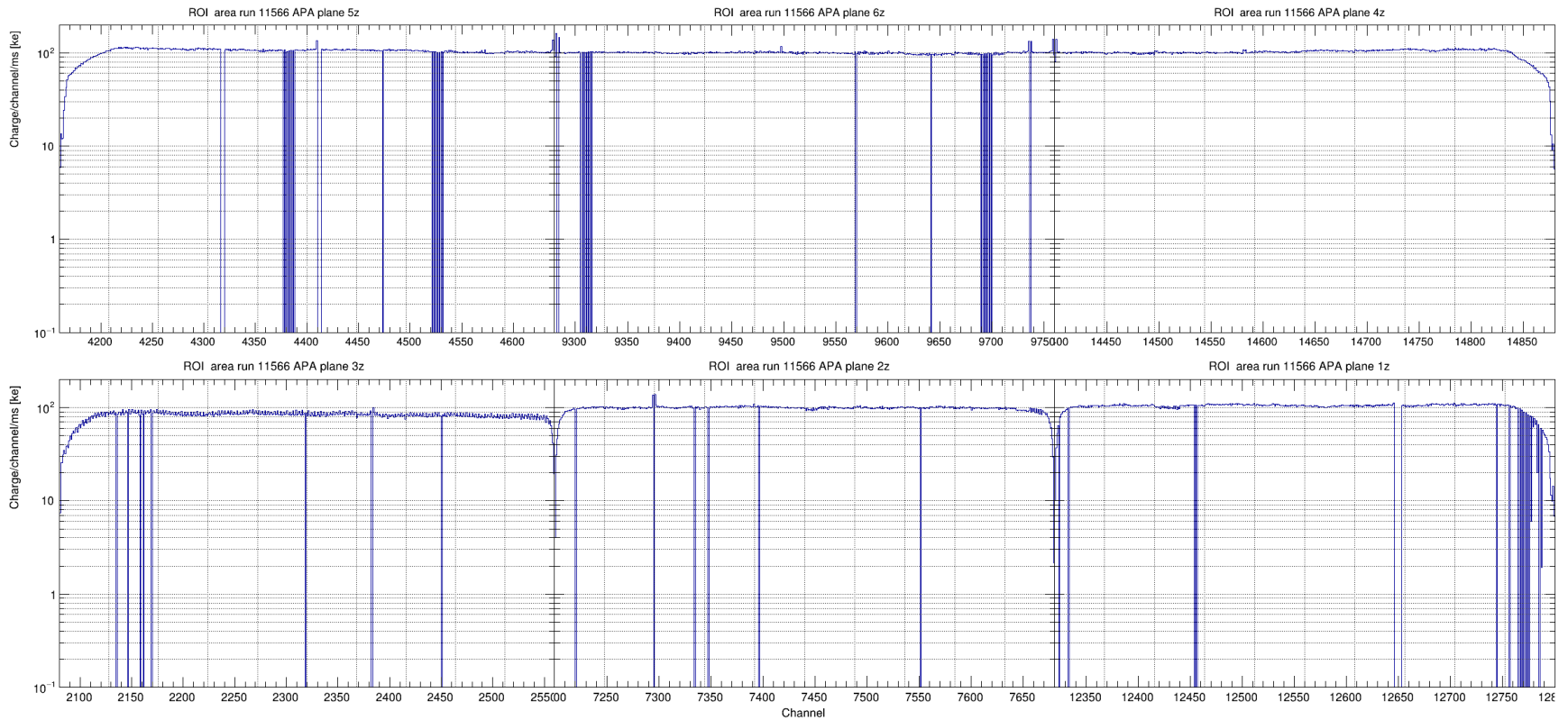
run011554 evts000000-003000 (2020-07-06 12:39 UTC) trig13

Run 11565, July 6, 600 V/cm



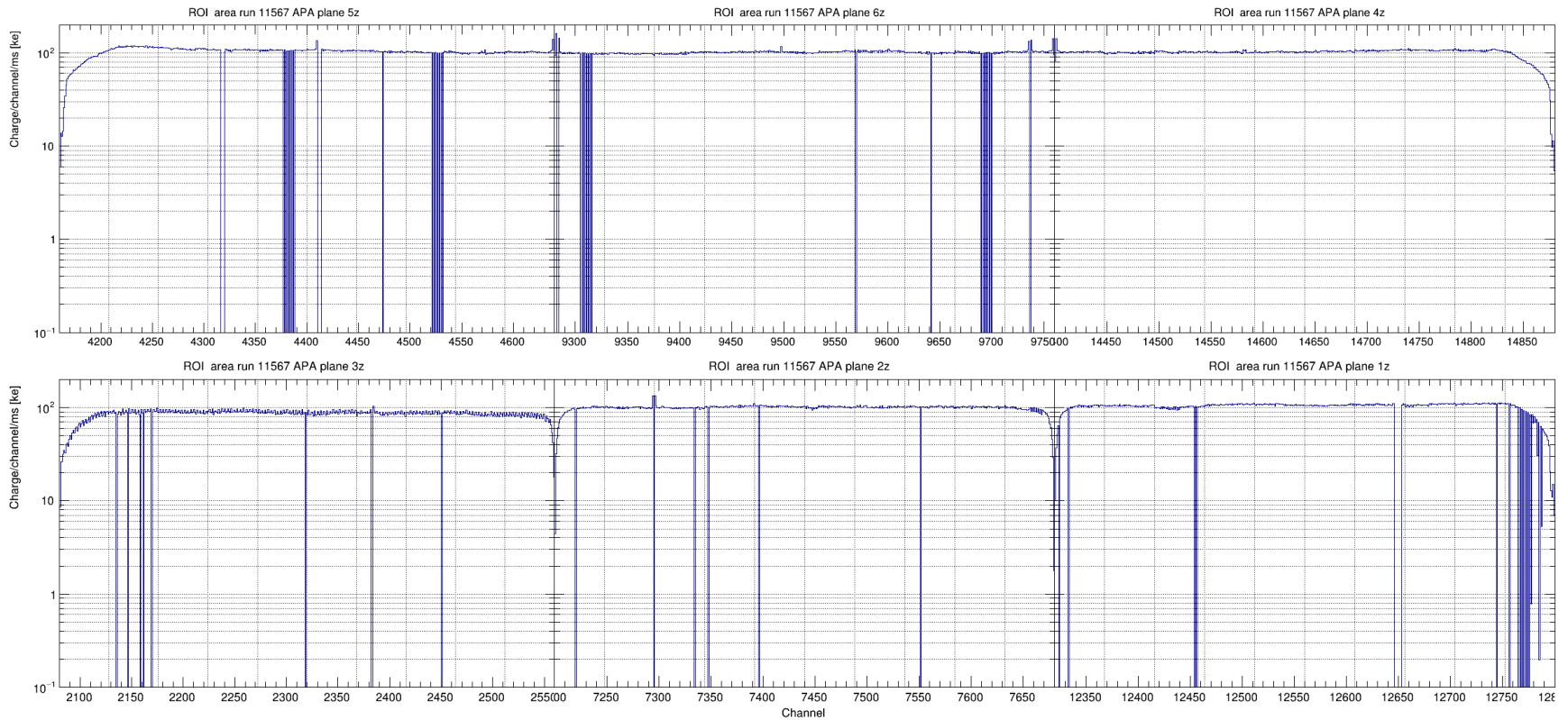
run011565 evts000000-003000 (2020-07-07 08:05 UTC) trig13

Run 11566, July 7, 600 V/cm



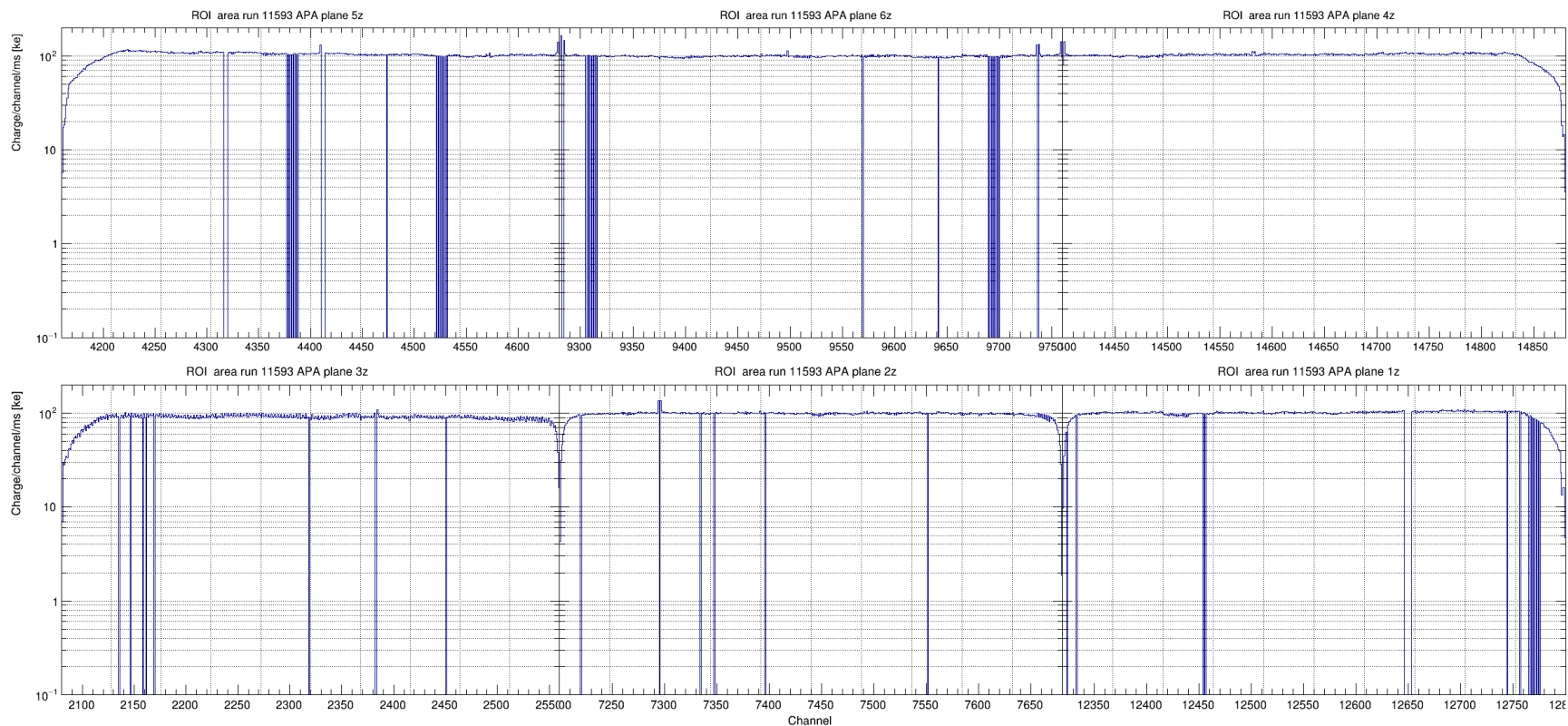
run011566 evts000000-003000 (2020-07-07 11:12 UTC) trig13

Run 11567, July 7, 600 V/cm



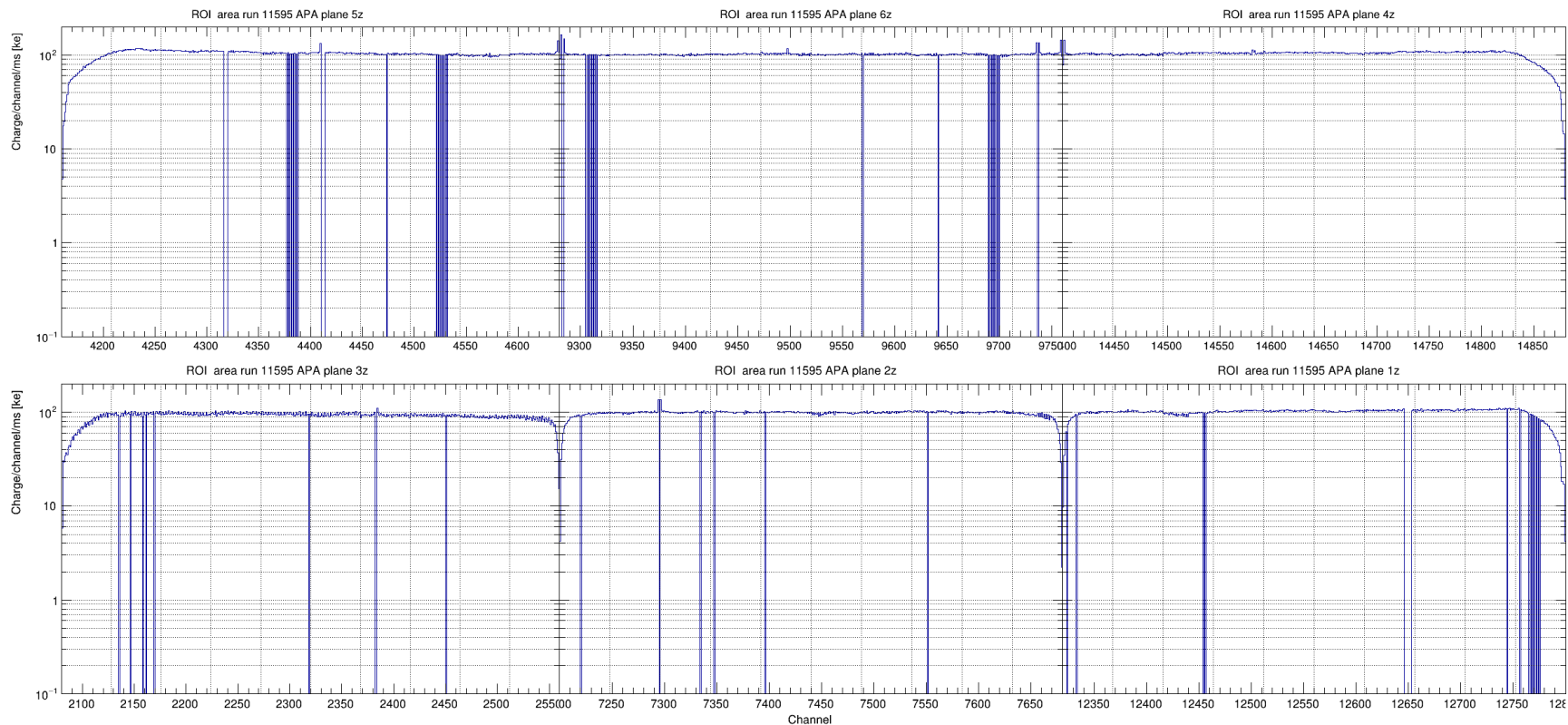
run011567 evts000000-003000 (2020-07-07 13:11 UTC) trig13

Run 11593, July 8, 600 V/cm



run011593 evts000000-003000 (2020-07-08 00:10 UTC) trig13

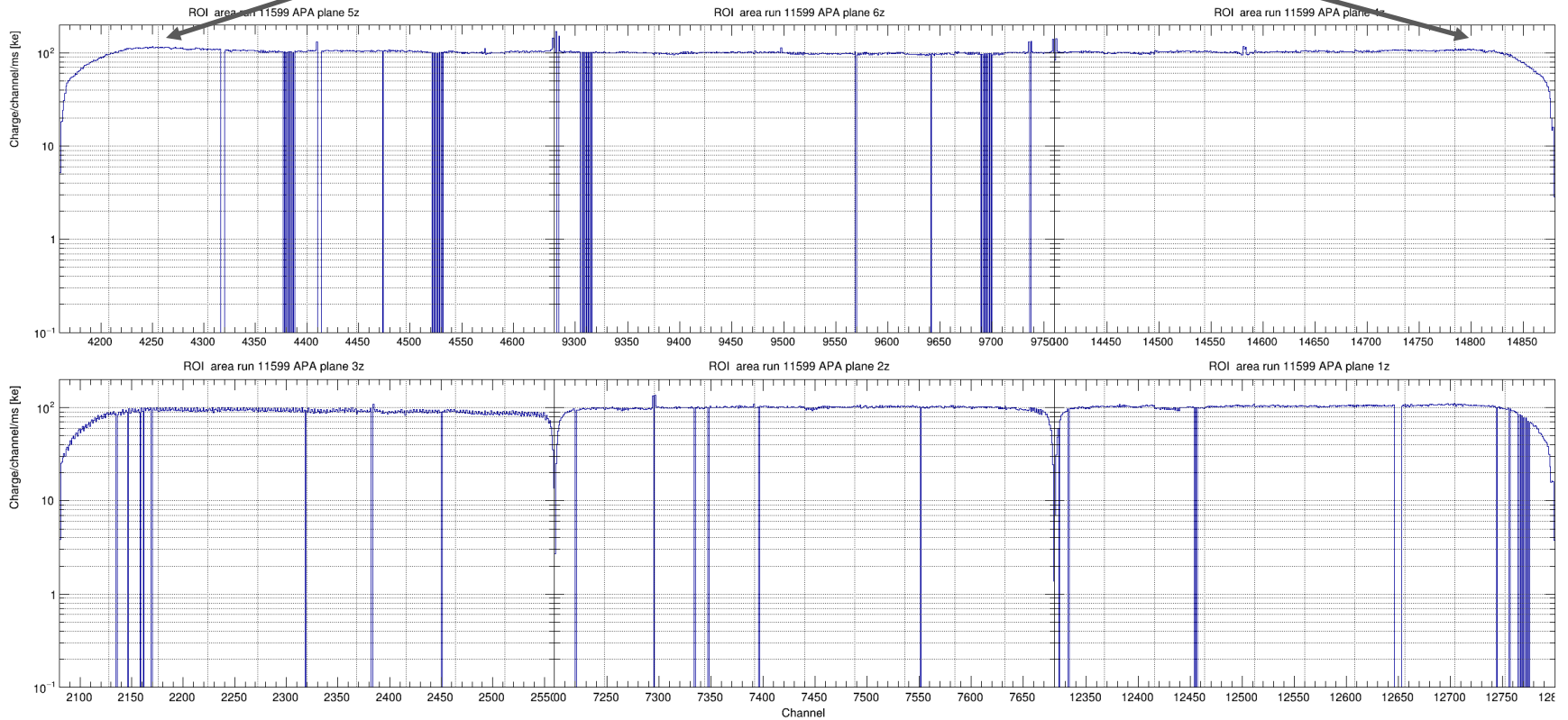
Run 11595, July 8, 600 V/cm



run011595 evts000000-003000 (2020-07-08 05:48 UTC) trig13

Run 11599, July 8, 650 V/cm

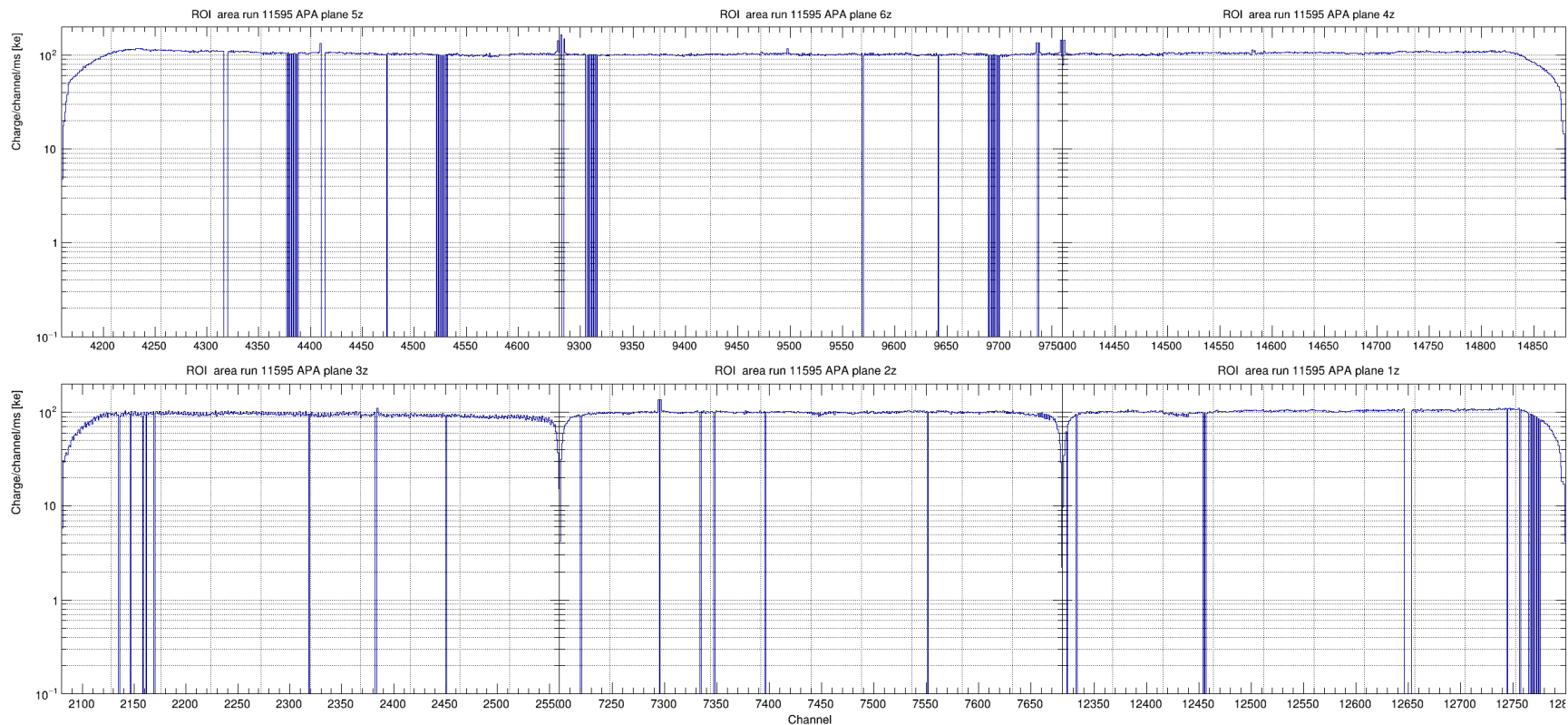
Space charge increases?



run011599 evts000000-003000 (2020-07-08 11:37 UTC) trig13

HV increase was 2 hours before this run.
Brief decrease in HV before that.

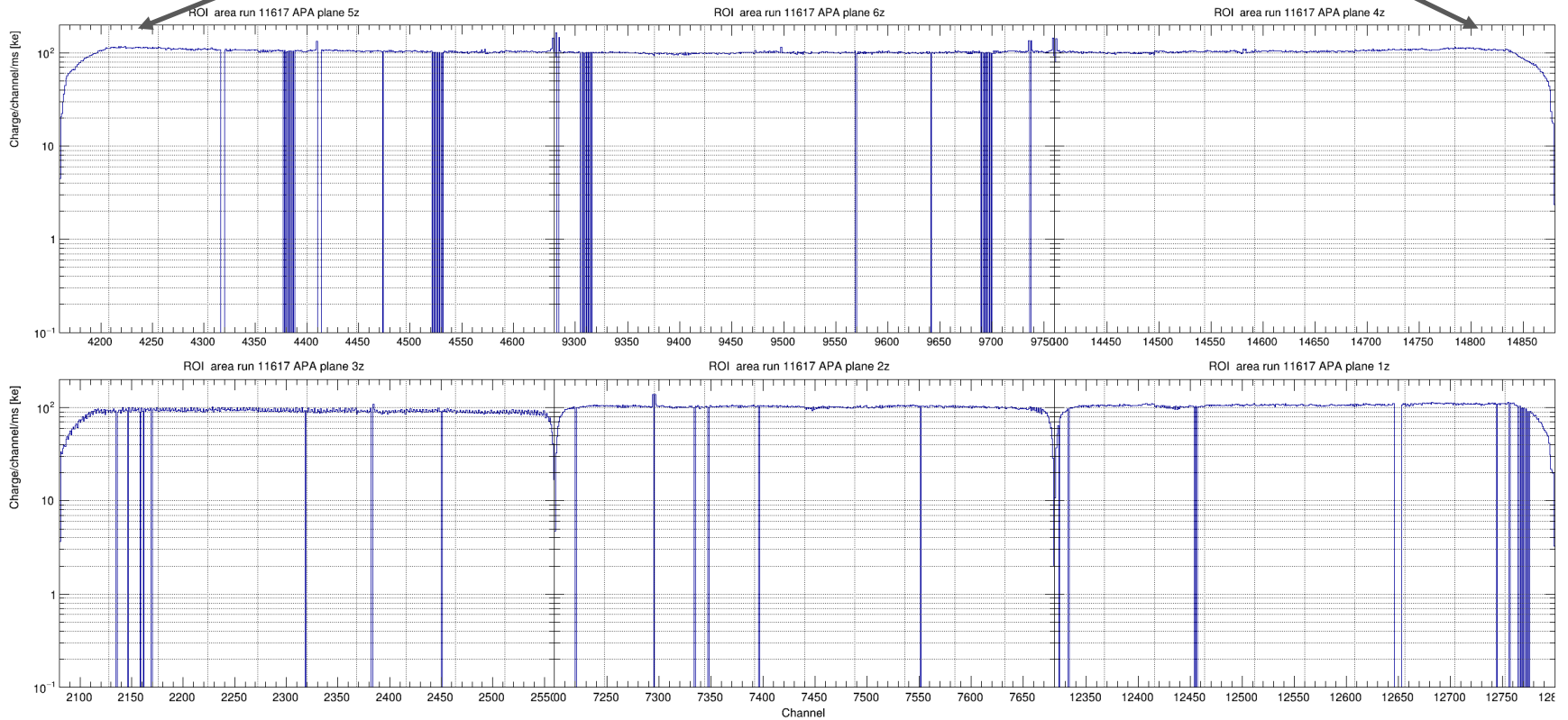
Run 11595, July 8, 600 V/cm (again)



run011595 evts000000-003000 (2020-07-08 05:48 UTC) trig13

Run 11617, July 8, 650 V/cm

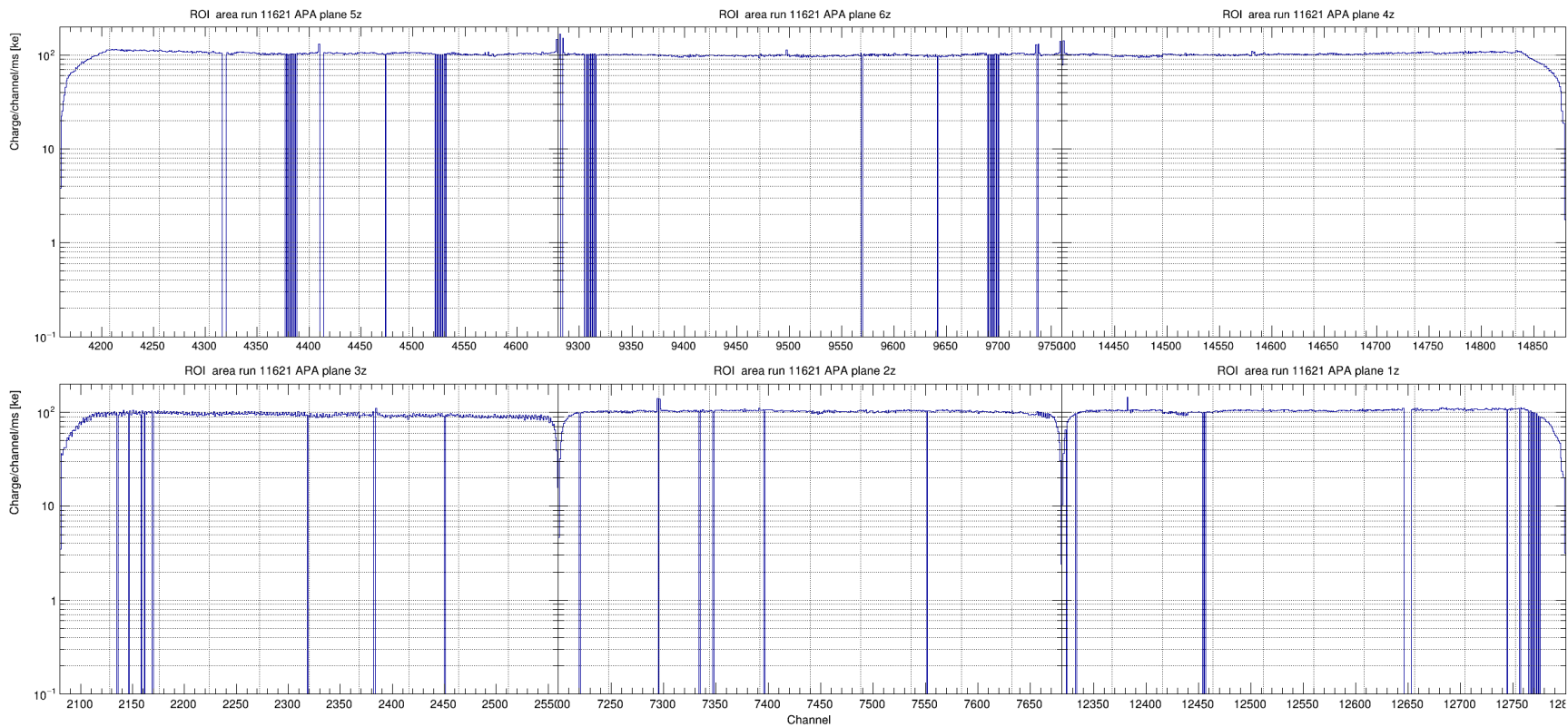
Now see the expected increase in space charge



run011617 evts000000-003000 (2020-07-08 20:38 UTC) trig13

Run 11621, 650 V/cm, neutrons

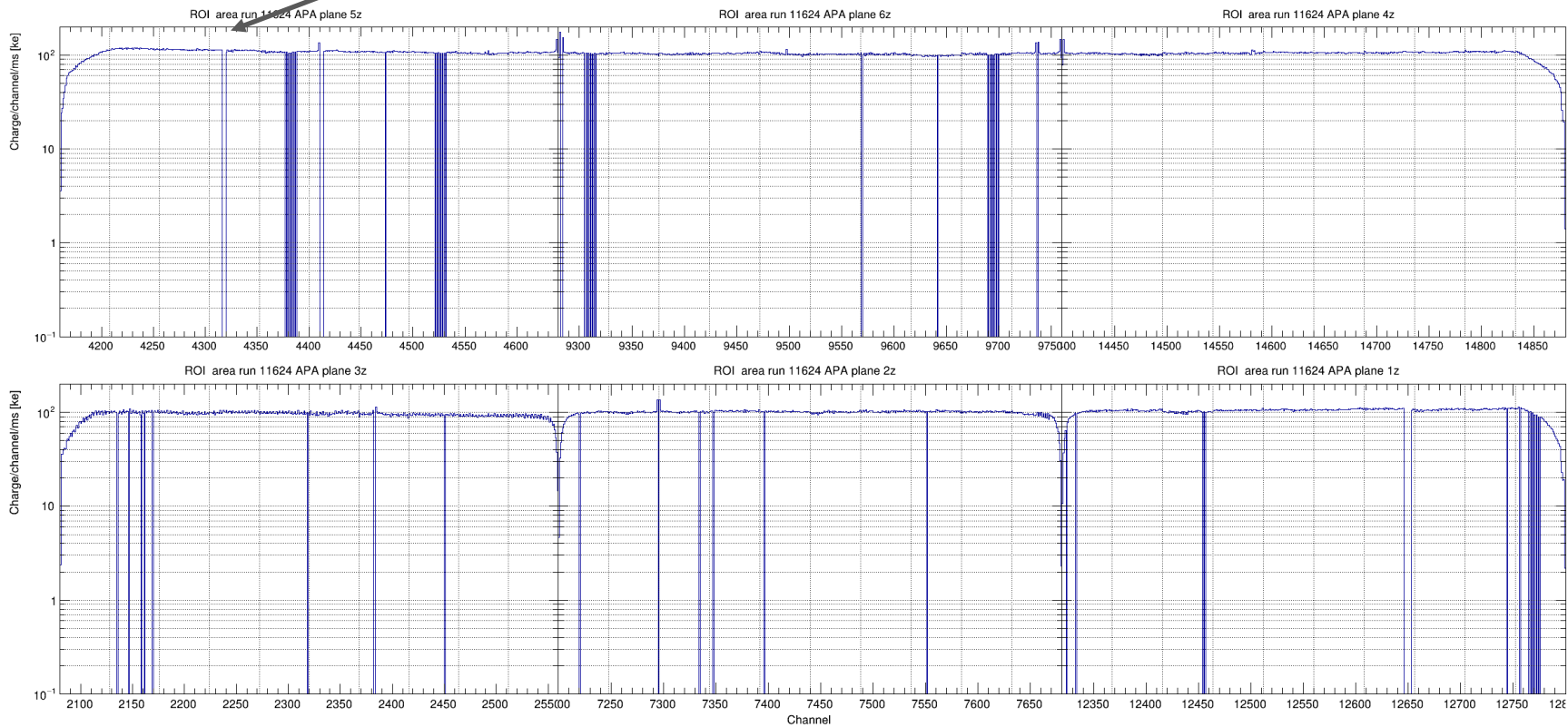
No increase from neutrons?



run011621 evts000000-003000 (2020-07-09 06:08 UTC) trig13

Run 11624, 650 V/cm, neutrons

Increase from neutrons?



run011624 evts000000-003000 (2020-07-09 14:56 UTC) trig13

E-field comments

HV = 600, 650 V/cm

- Displays look good
 - Except first 600 V/cm run (11544) was noisy
 - Many plots at
 - <https://internal.dunescience.org/people/dladams/protodune/data/dqmw>
- As expected, space charge decreases as field increases
- Increase of about 2% in the signal strength with each field increase

Neutron generator comments

Neutron generator

- No effect obvious for run 11621
 - But I looked at the start and generator may not have started running ~~or not soon enough for the 2 hour Ar41 lifetime~~ (ignore: 6 MeV gammas are prompt)
- Run 11624 shows an increase of ~ 2 ke/ms/channel in APA 5
 - $\times (480 \text{ channels}) = 1000$ ke/ms in APA 5
 - With 6.1 MeV $\rightarrow 90$ ke for each Ar41 decay, this corresponds to about 10 neutrons/ms (10 kHz)
 - 10X the prediction from Jingbo: $0.1\% \times (1 \text{ Mhz}) = 1$ kHz
- I will look at other runs and later in run 11621

Extras

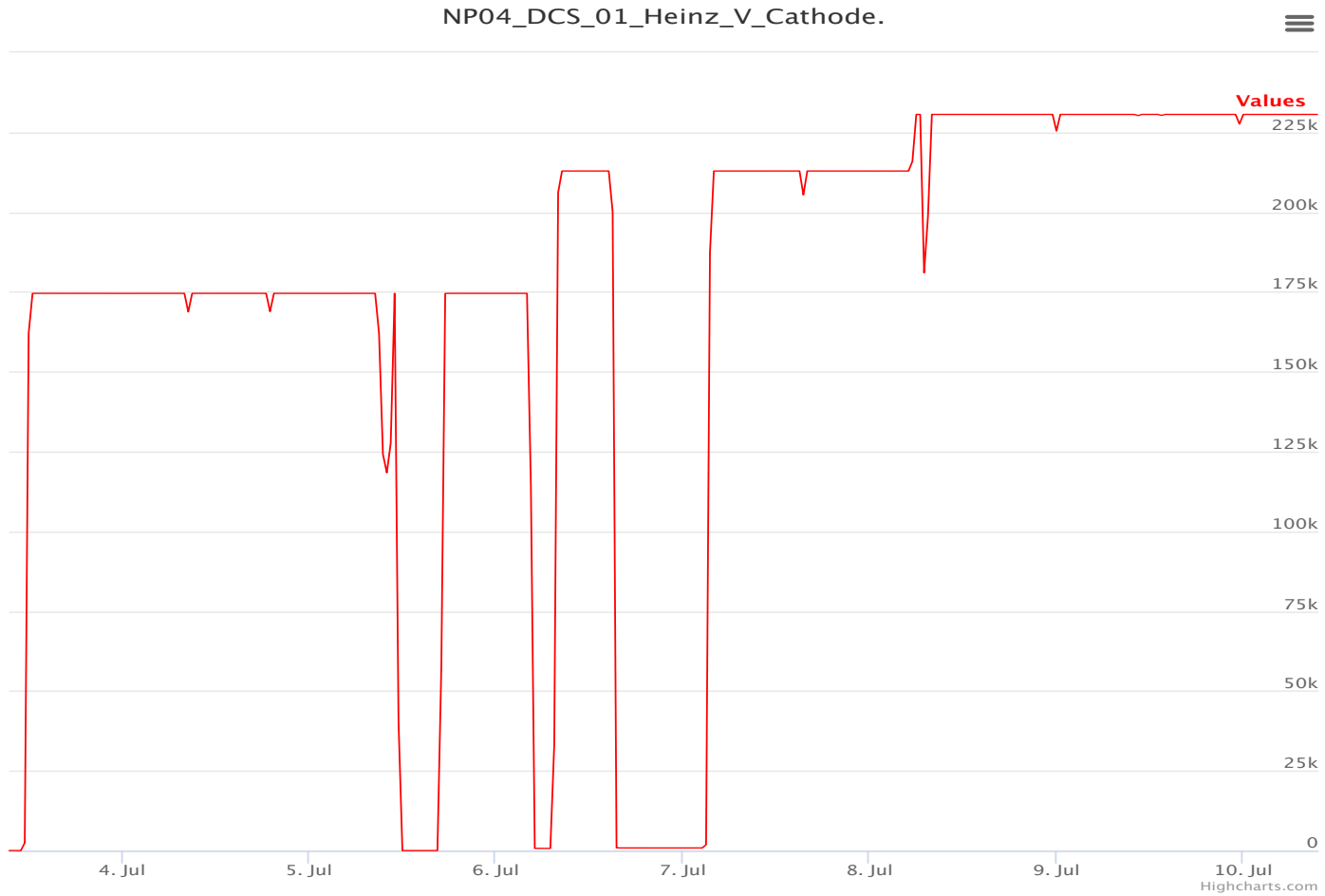
HV for recent data

Pulser gains from Dec 2018 and July 2020

HV history

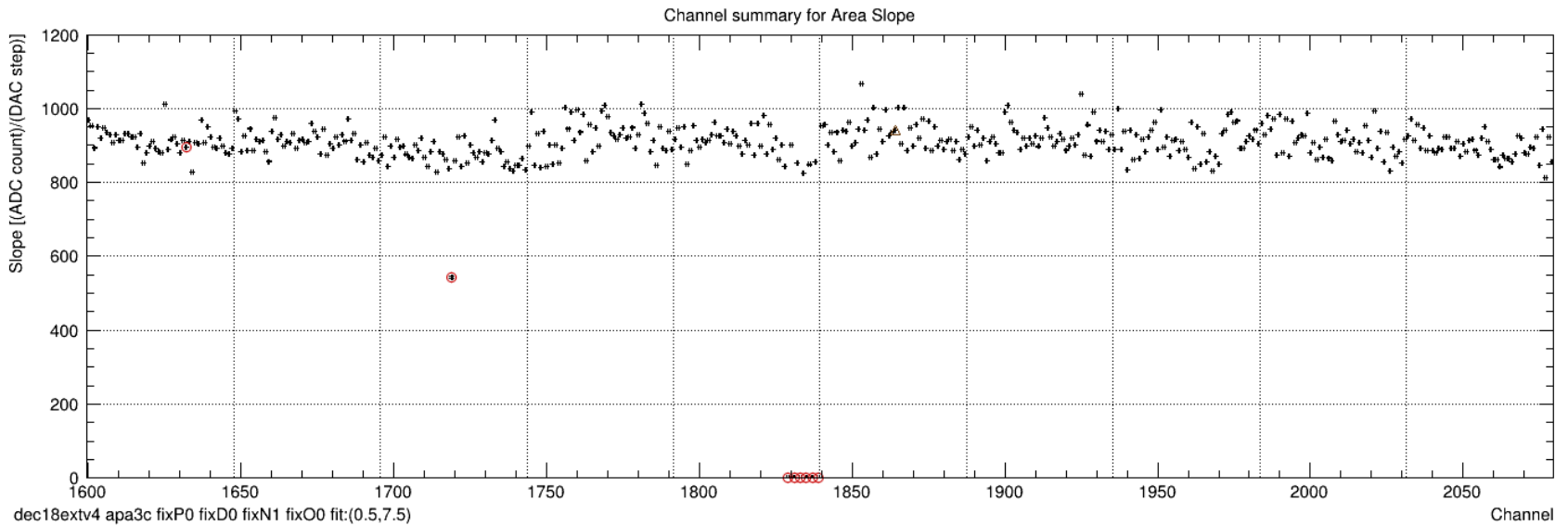
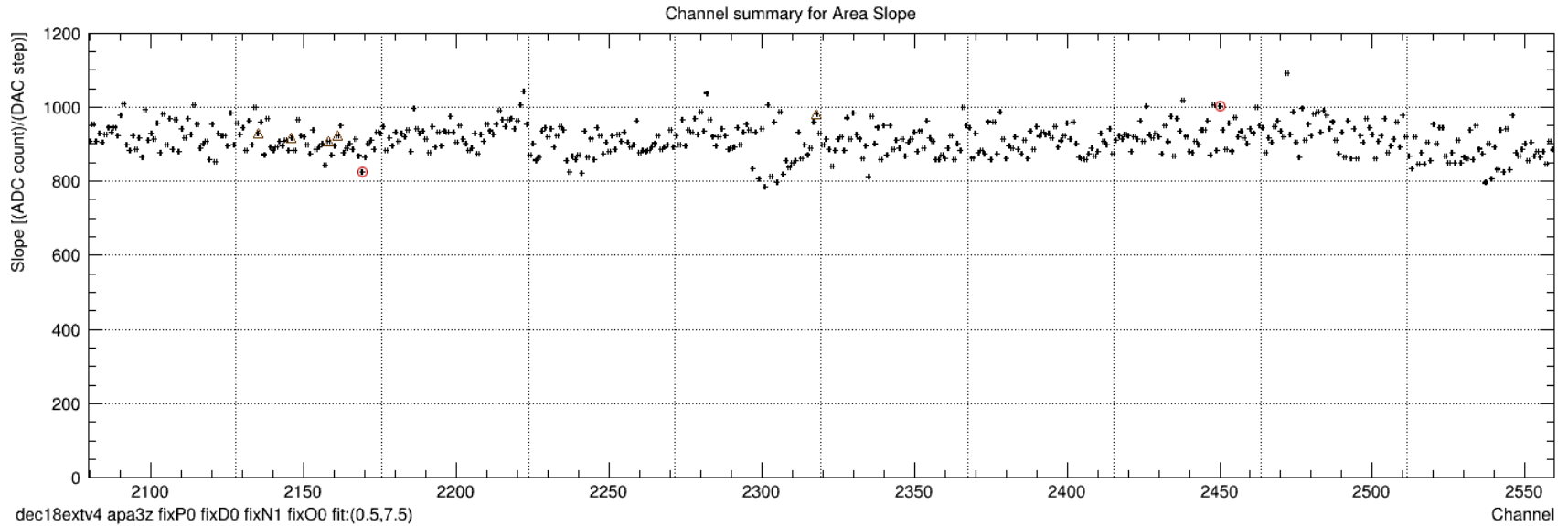
NP04 Slow Control Web Interface

<https://np04-slow-control.web.cern.ch/np04-slow-control/app/#!/hist...>



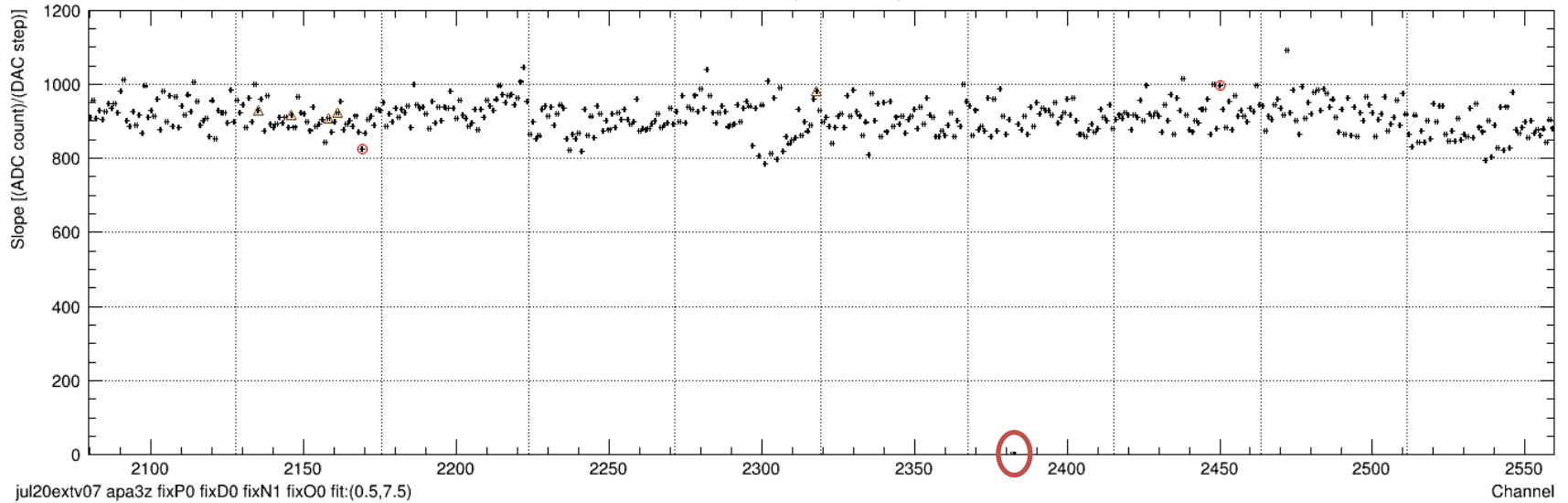
EDT (?)

APA 3 collection, Dec 2018, tight ROI

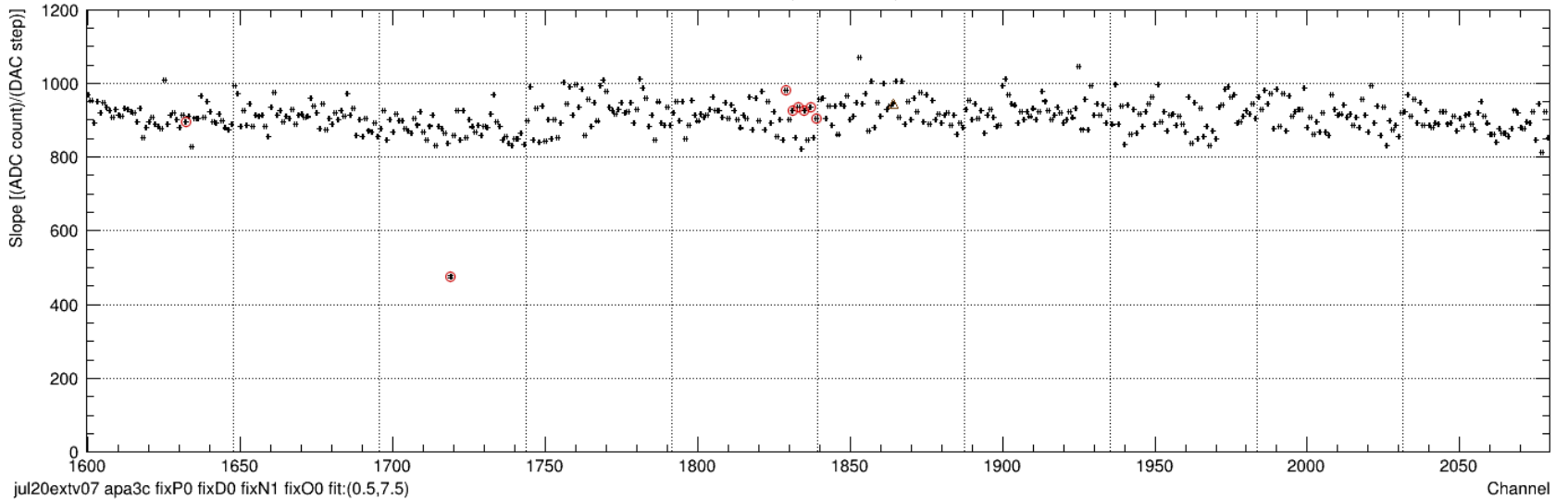


APA 3 collection, July 2020, tight ROI

Channel summary for Area Slope



Channel summary for Area Slope



Raw ADC for TPC plane 1z (APA 5: US-DaS)

