

PDVD geometry and QL matching check

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PDVD; wire geometry check

Xin's observation

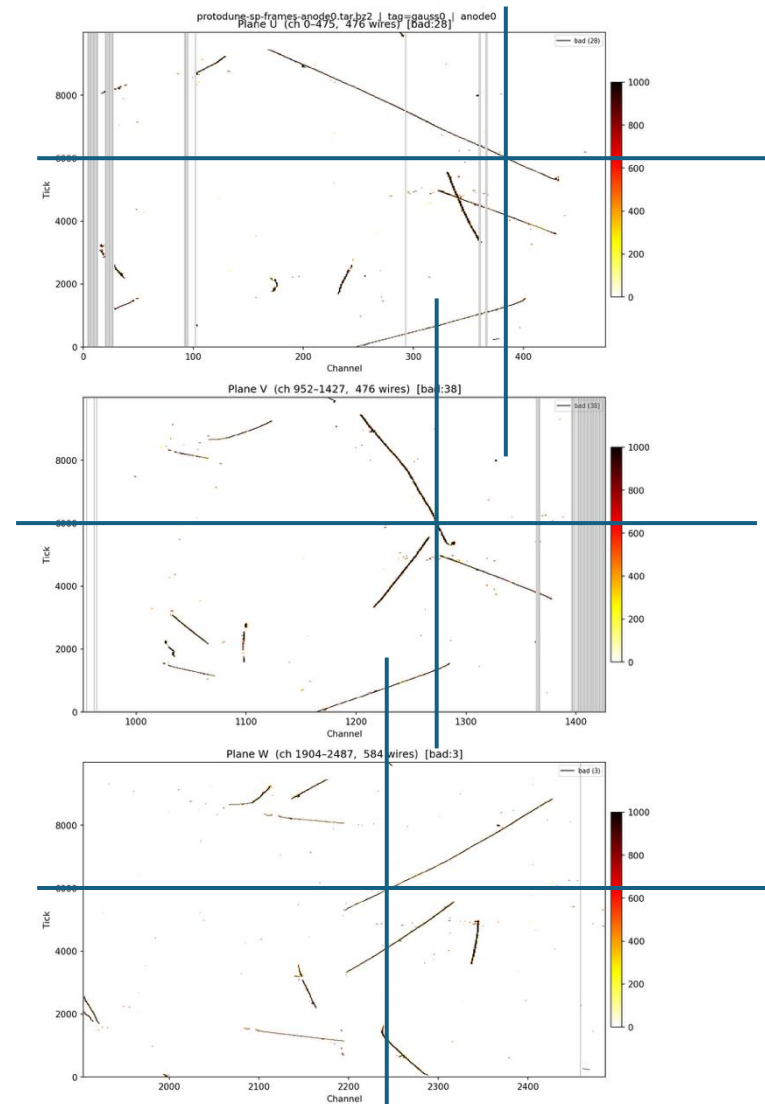
- The U/V wires should be shifted along the **z** direction:
 - **Anodes 0, 2, 5, 7:** ($z - 9.8$) mm
 - **Anodes 1, 3, 4, 6:** ($z + 13.2$) mm

Calibration using data

- Select the same time region across all three wire planes.
- Determine the **y-z** positions of the fired wires.
- The three fired wires are expected to intersect at the same point.

Cross-check

- I verified this by selecting one reference point in each anode.



PDVD; wire geometry check

CRP5

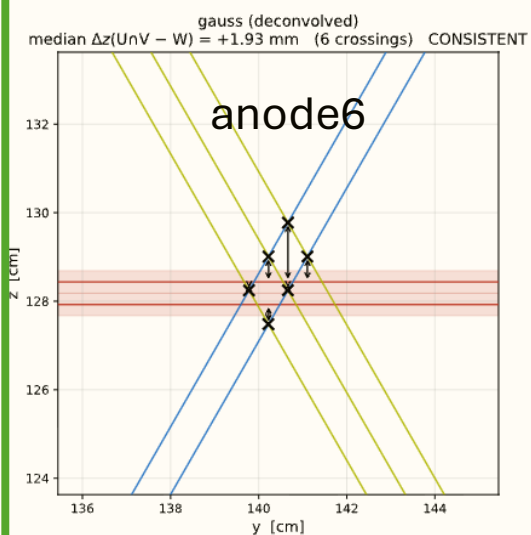
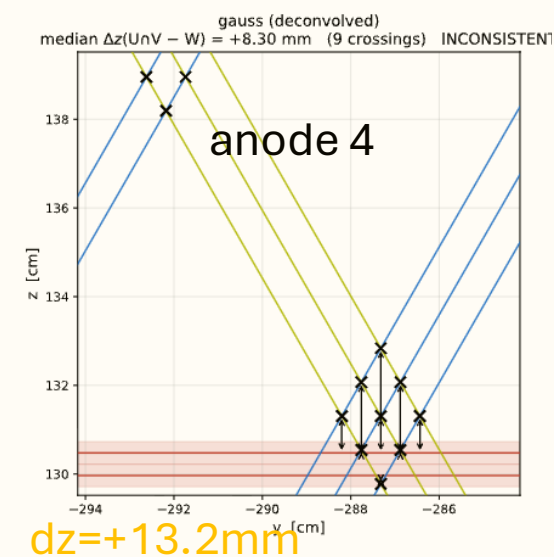
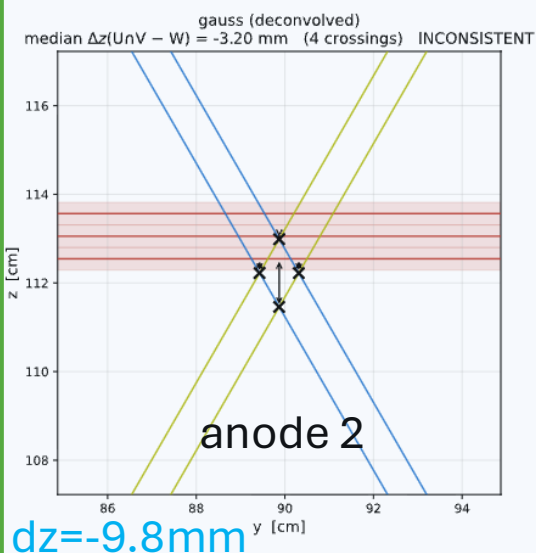
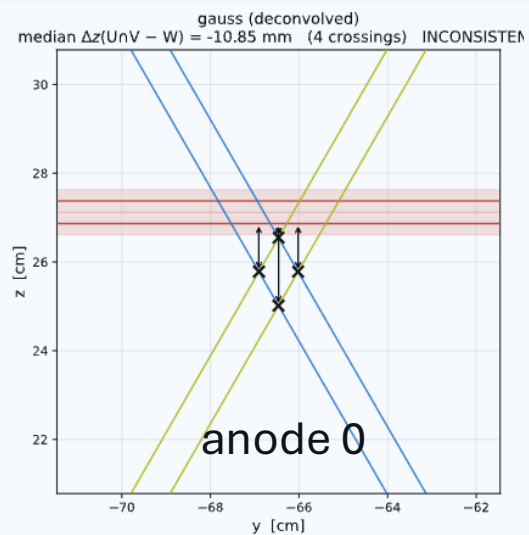
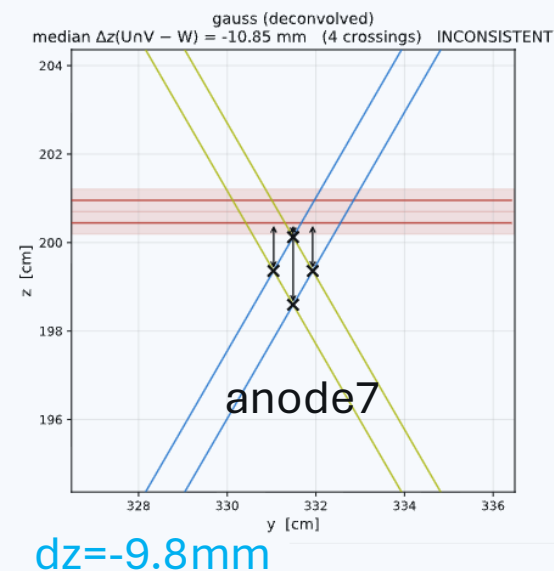
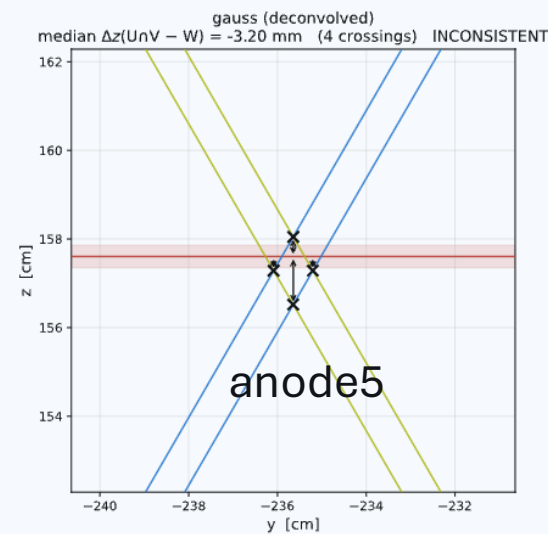
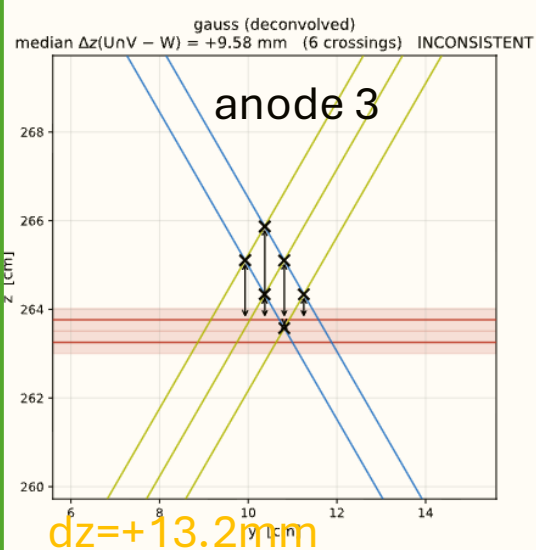
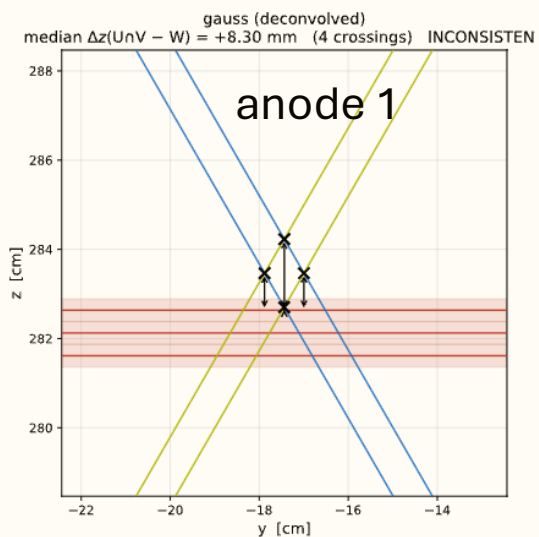
bottom

CRP4

CRP2

top

CRP3

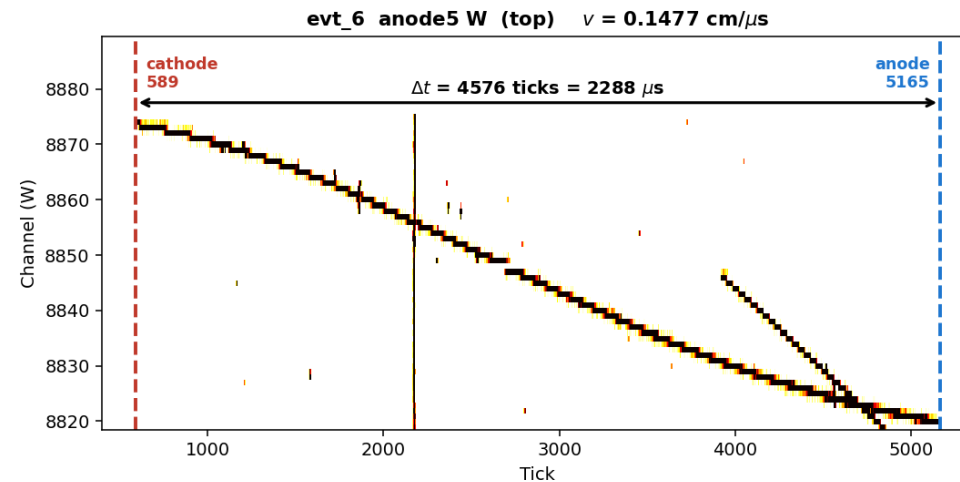
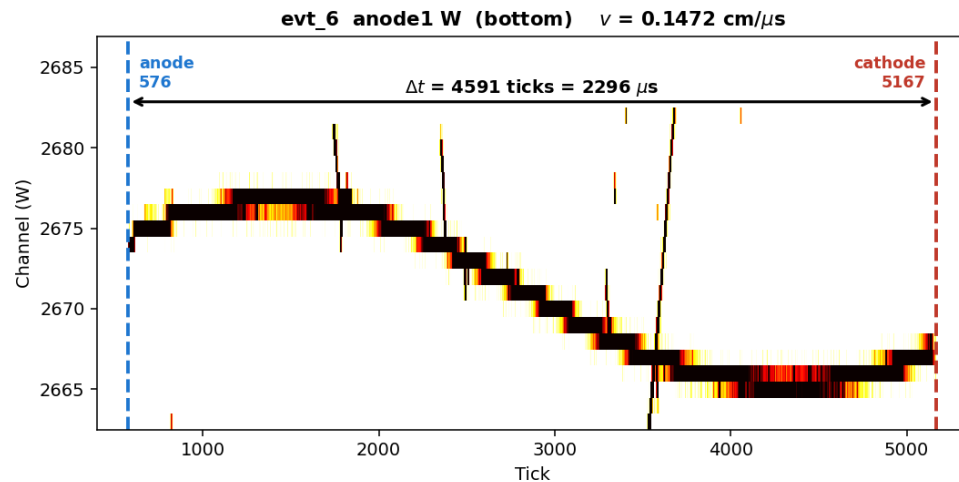


drift speed check:

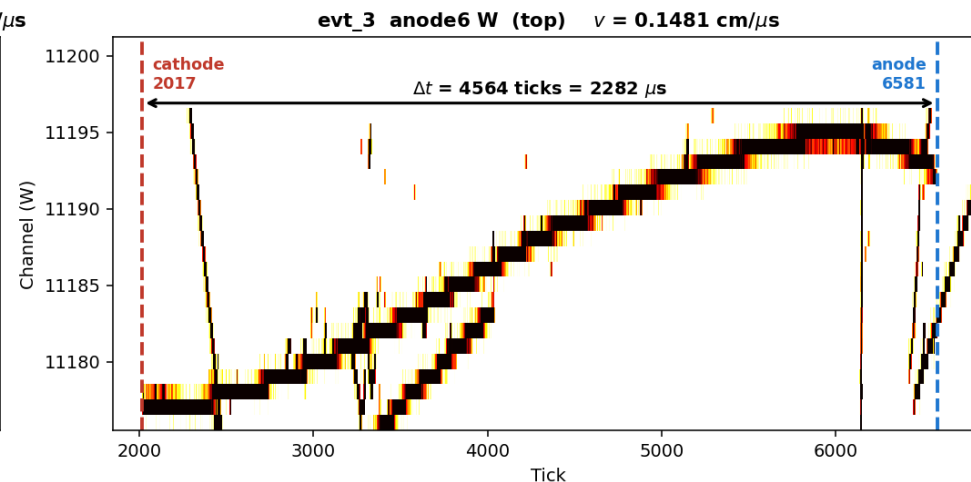
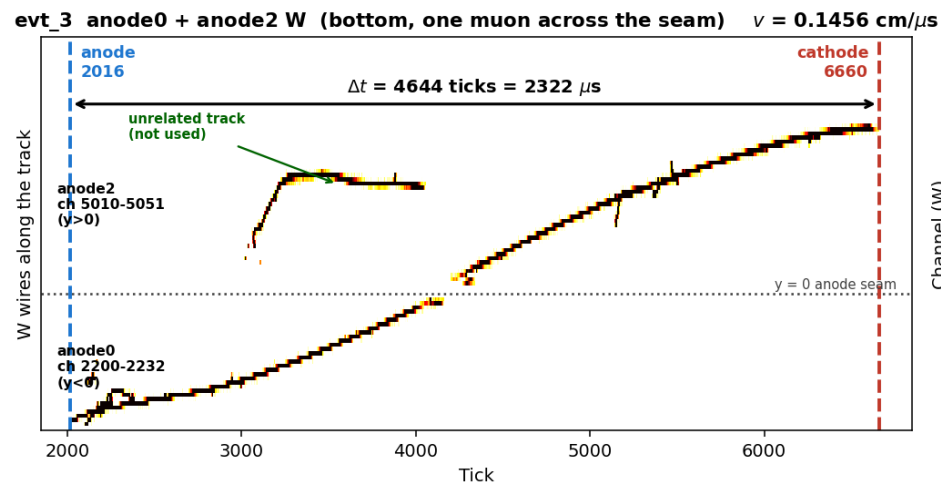
ProtoDUNE-VD drift velocity from anode-to-cathode tracks (run 039252, W plane, tick = $0.5\ \mu\text{s}$, $D = 338\ \text{cm}$)
evt_6 bottom 0.1472 / top 0.1477 evt_3 bottom 0.1456 / top 0.1481 $\text{cm}/\mu\text{s}$ mean 0.1472 ± 0.0011 (spread 1.7%)

drift distance: 338 cm

Xin selected track:

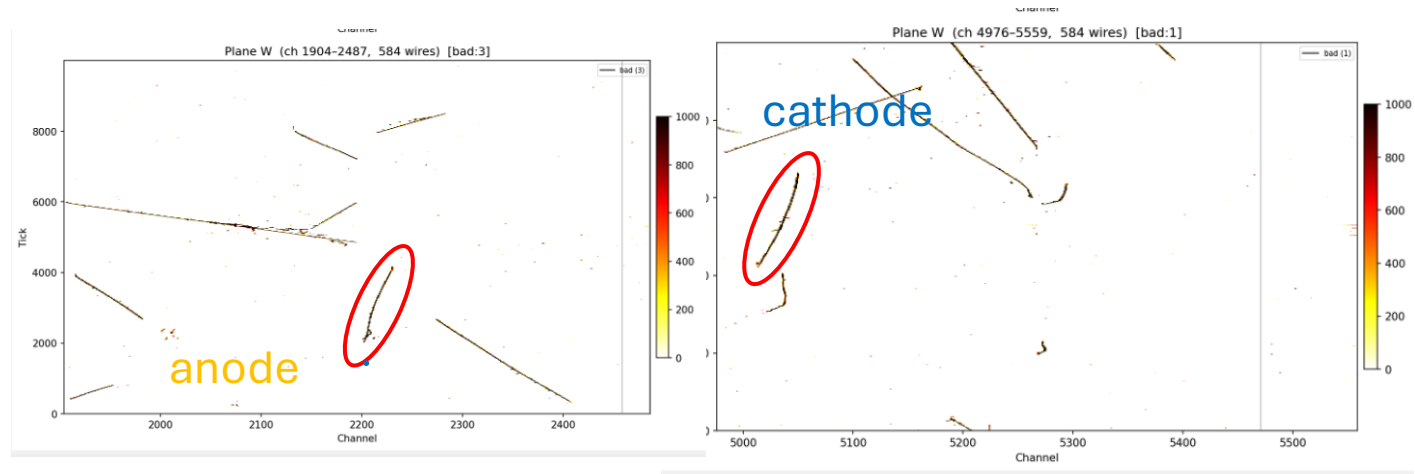
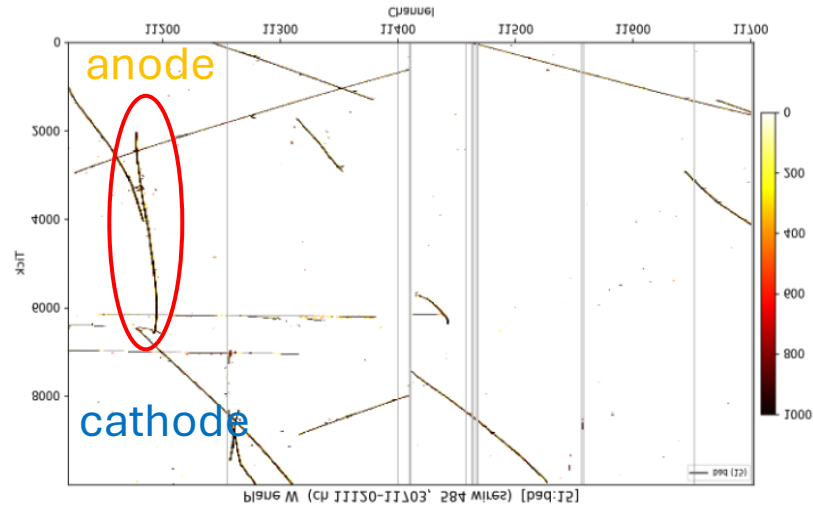


another new A-C-A
track:



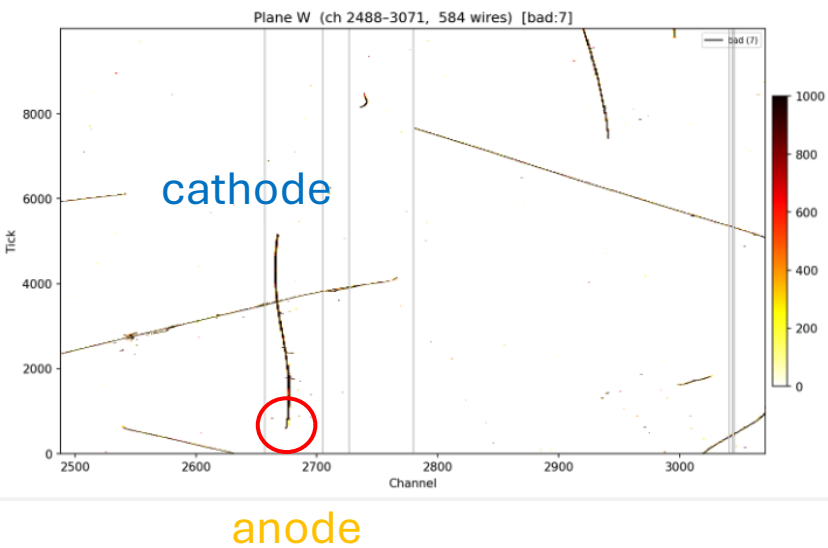
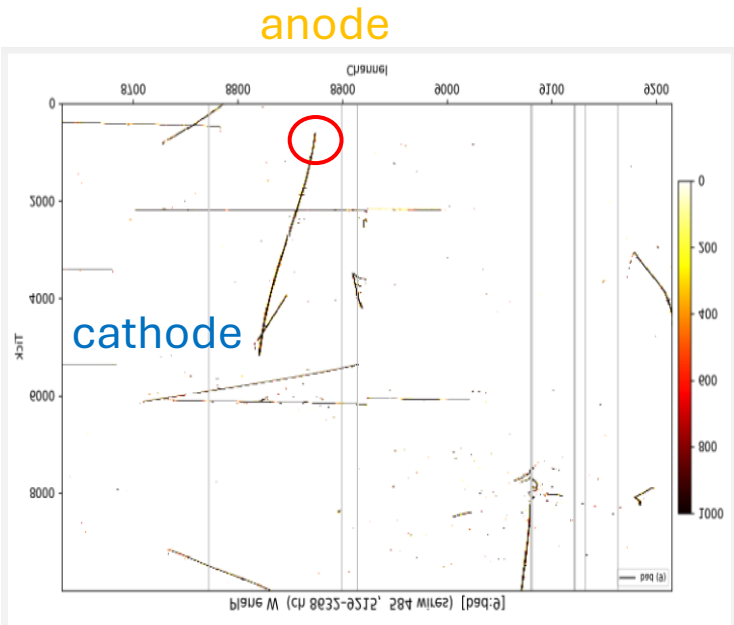
PDVD: More A-C-A tracks

Track 2



Track 0

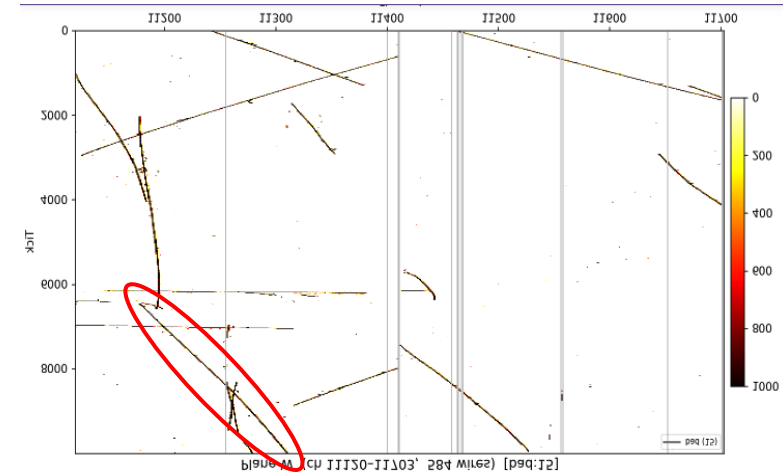
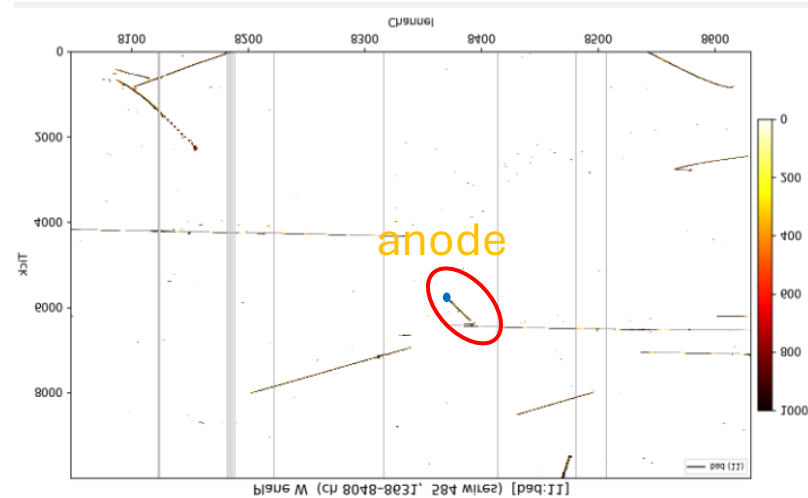
Xin selected:



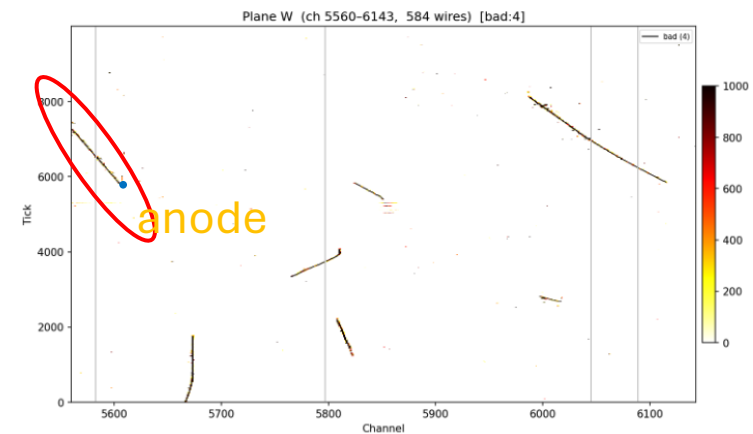
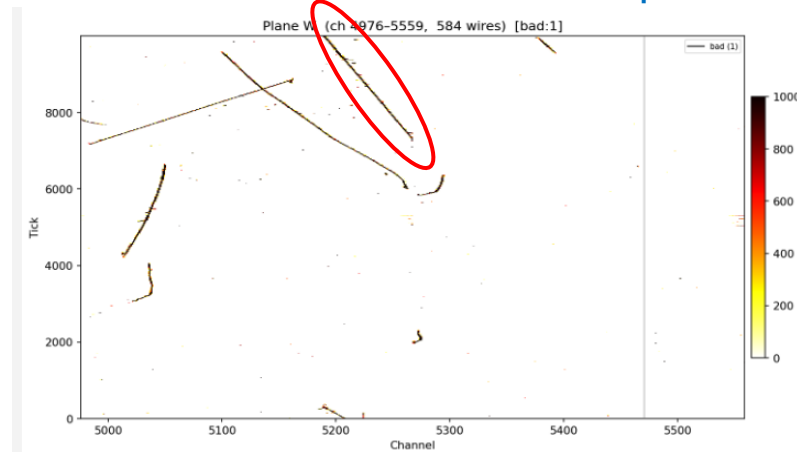
PDVD; anode-cathode-anode crossing track

/nfs/data/1/xning/wirecell-working/data/vd/run039324/evt_3/

Track 1

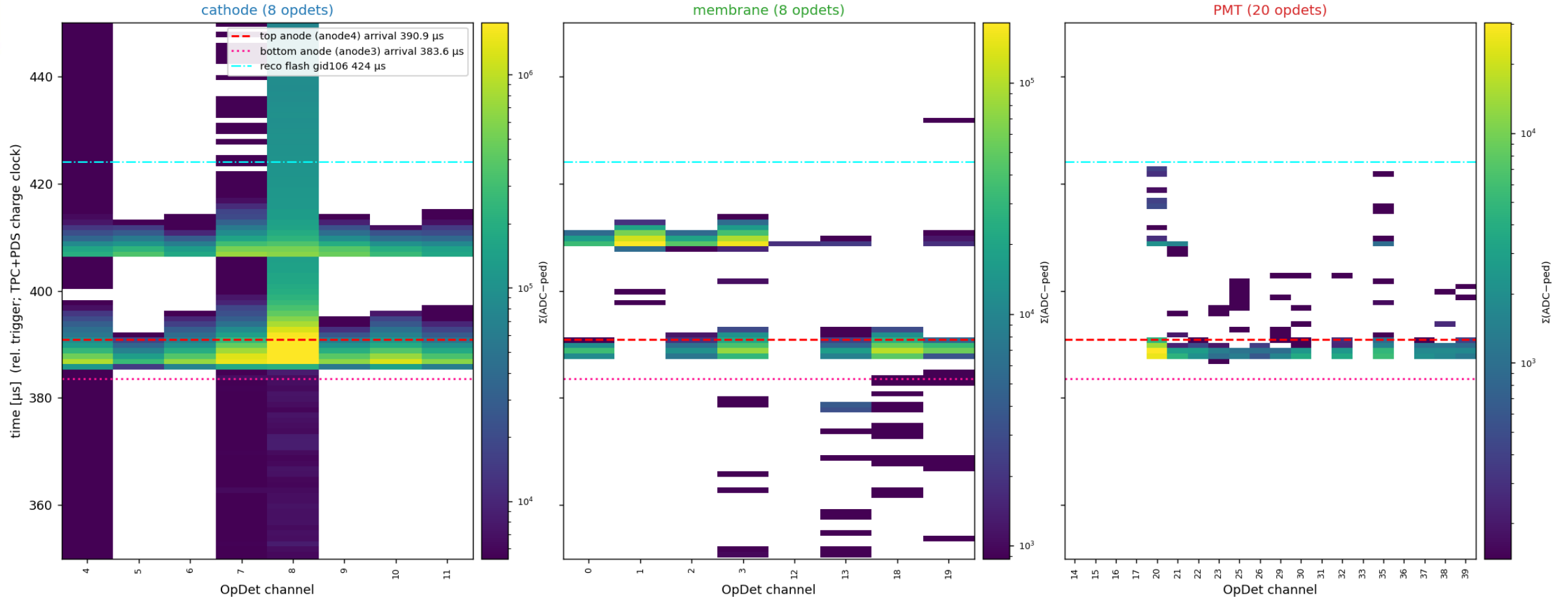


the final cathode point is outside the window.



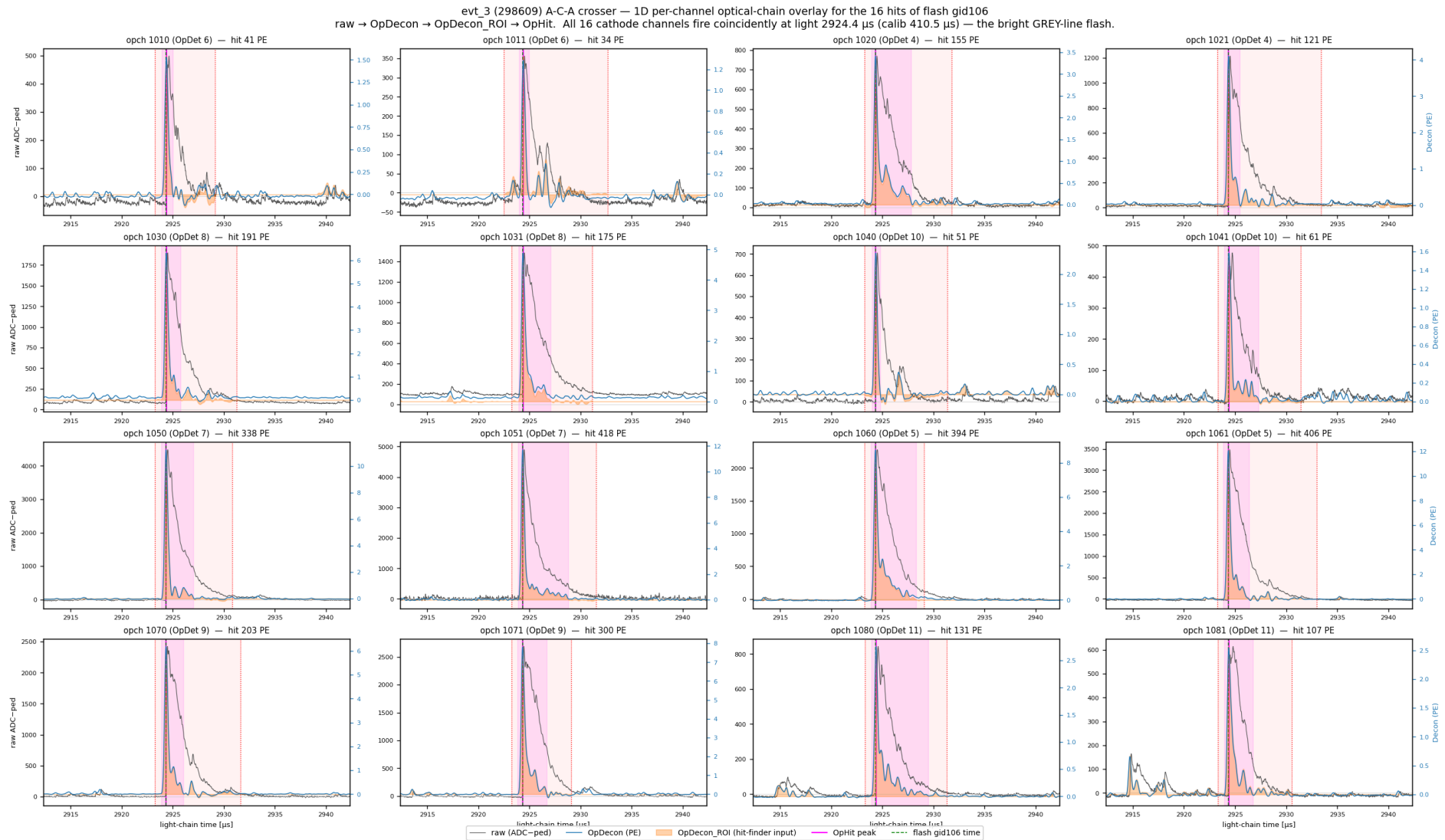
Last time: check anode time vs flash

evt_3 (event 298609) light 2D hist on the CHARGE CLOCK — zoom to the A-C-A crosser time
dashed = charge-track anode-arrival times (top 390.9 μs , bottom 383.6 μs); nearest reconstructed flash gid106 @ 424 μs



The blue flash time does not overlap with the raw flash because the hardcoded **13.5 μs** offset is included.

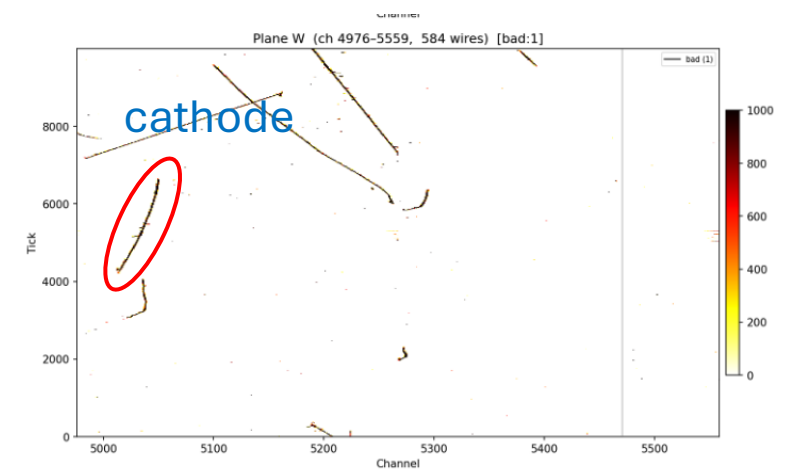
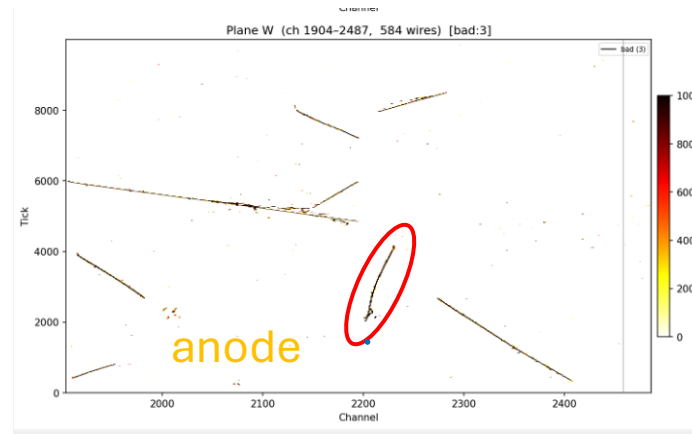
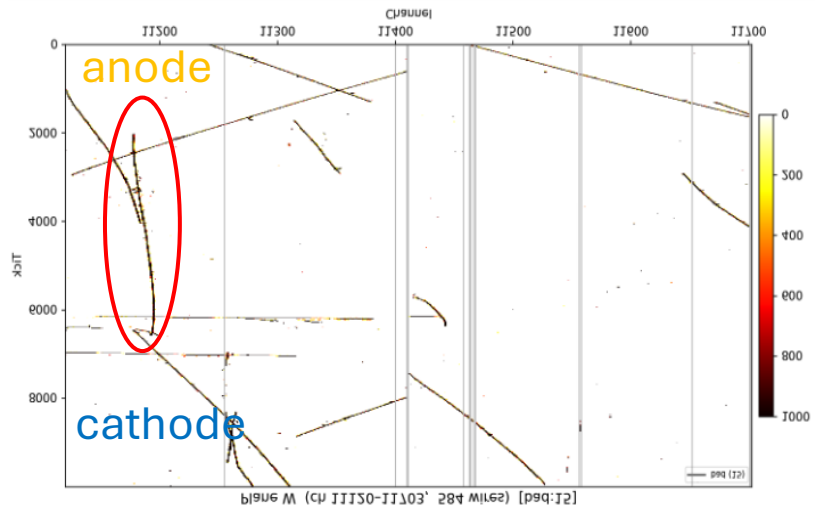
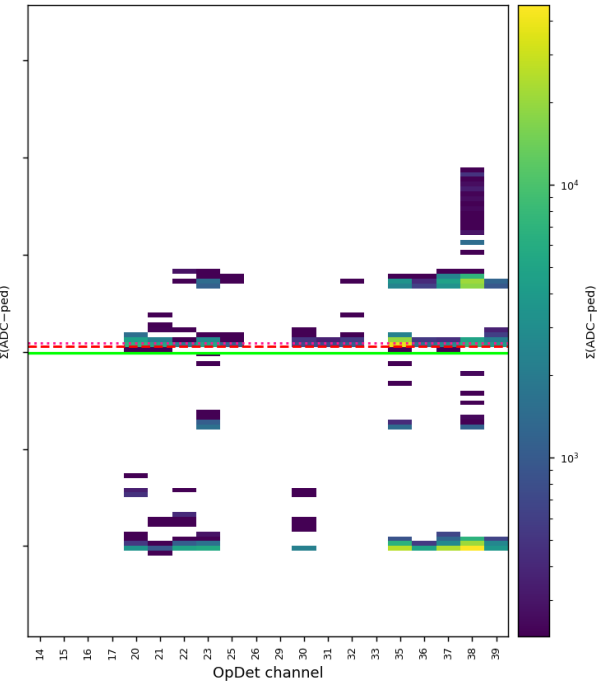
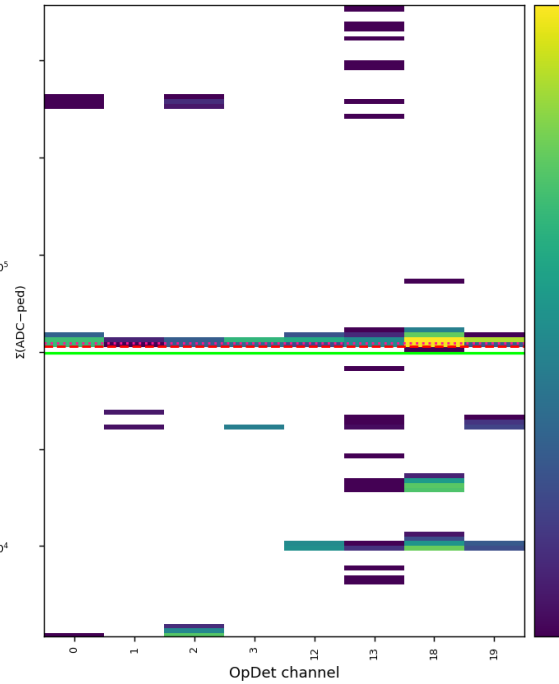
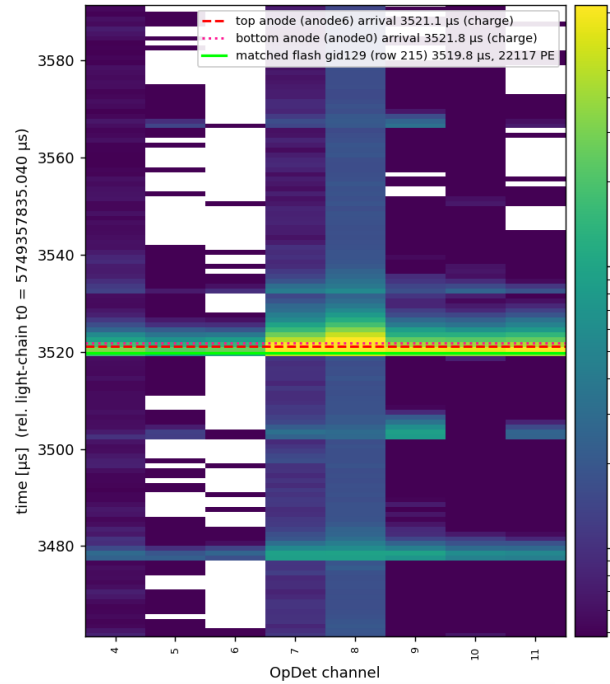
Flash reco check:



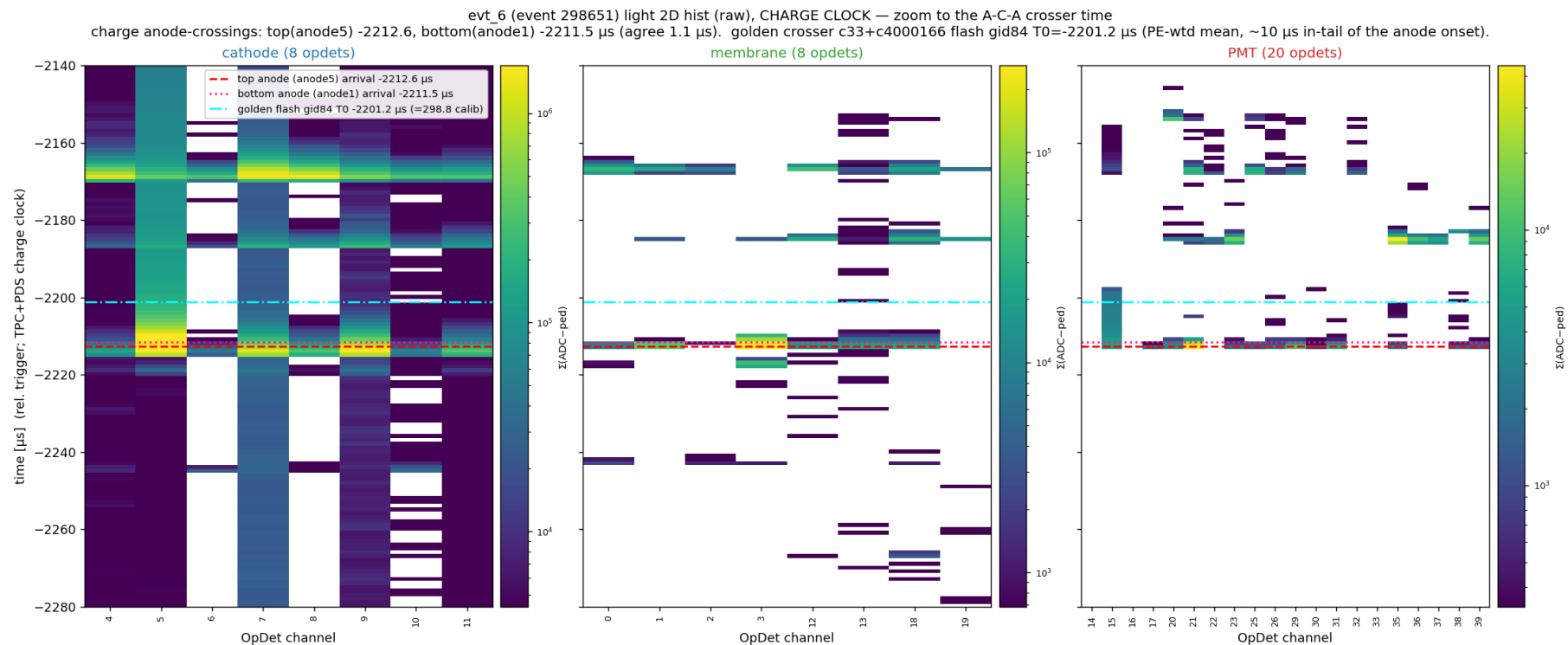
The reconstructed flash time is correct.

Checking Additional Anode Times vs. Flash Time

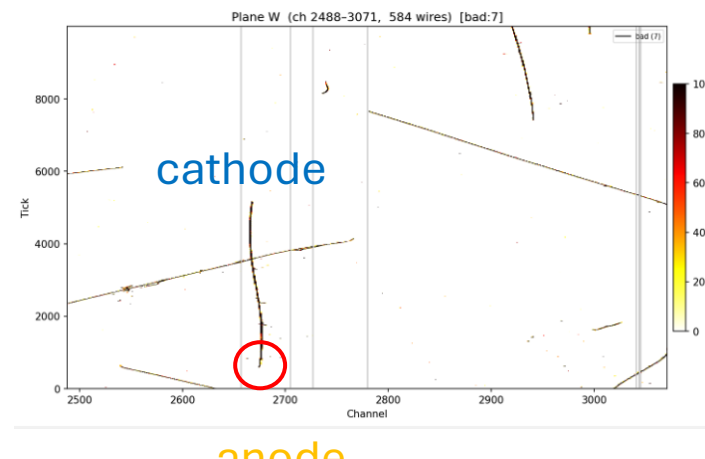
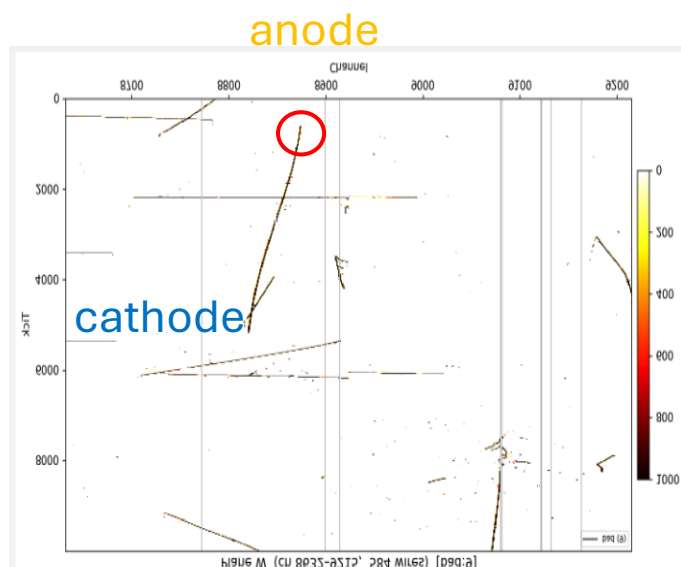
evt_3 (event 298609) raw light 2D hist on the LIGHT-CHAIN t0 AXIS — 2nd A-C-A crosser (anode0 x<0 / anode6 x>0)
charge anode t0 (charge-only): bottom 3521.8 / top 3521.1 μs | matched flash gid129 read straight from the opflash archive: 3519.8 μs (no offset, no +13.507 pull)
cathode (8 opdets) membrane (8 opdets) PMT (20 opdets)



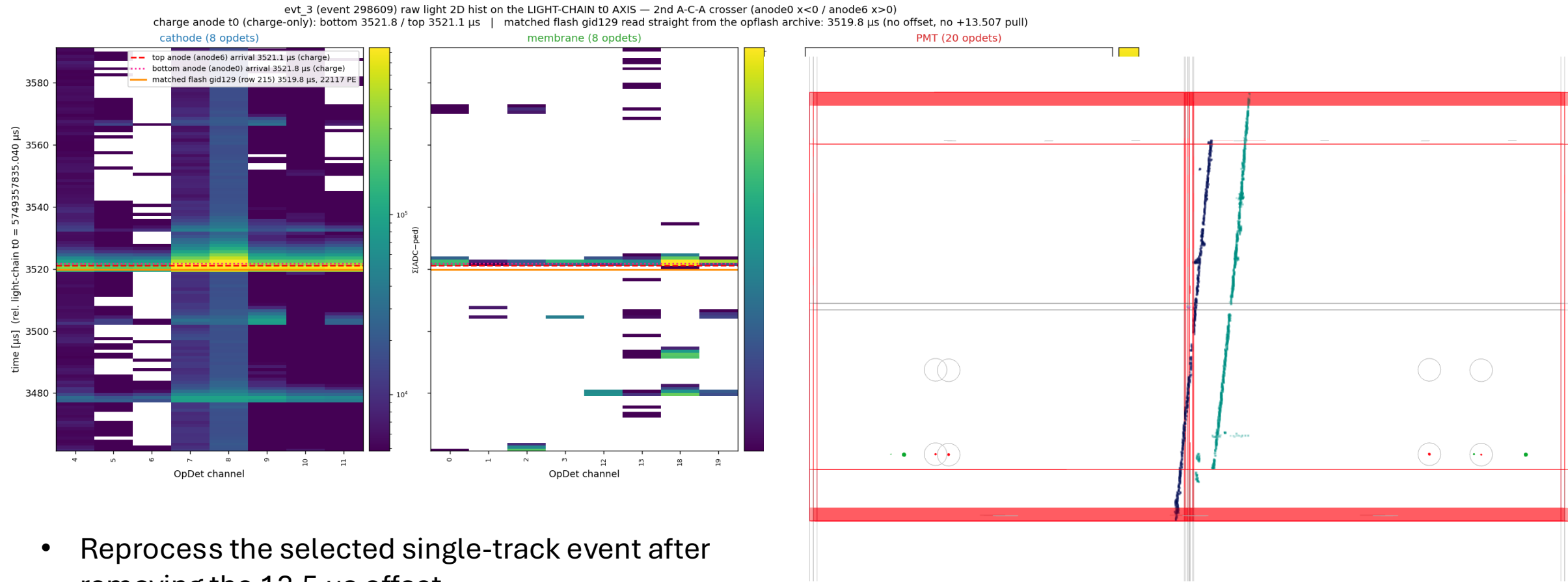
check more anode time vs flash



The charge anode crossing time is reliable.



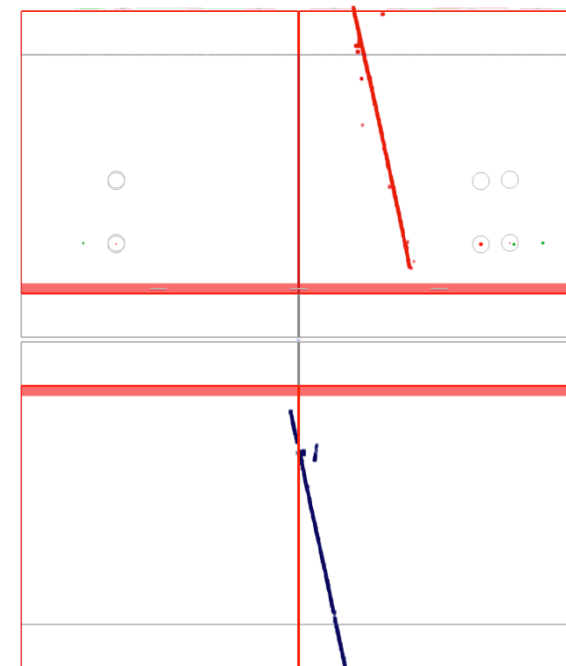
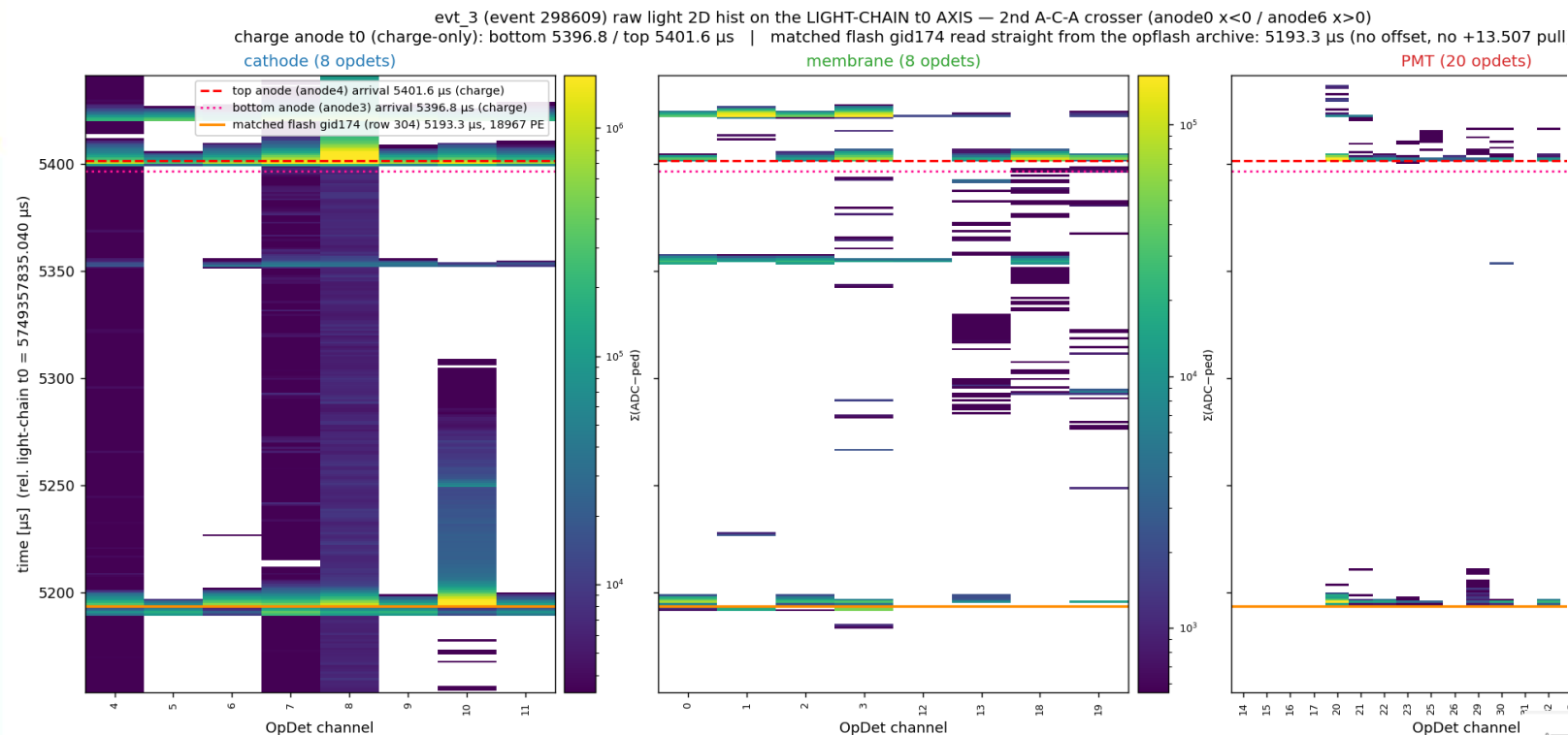
Remove the Time Offset: Track 1



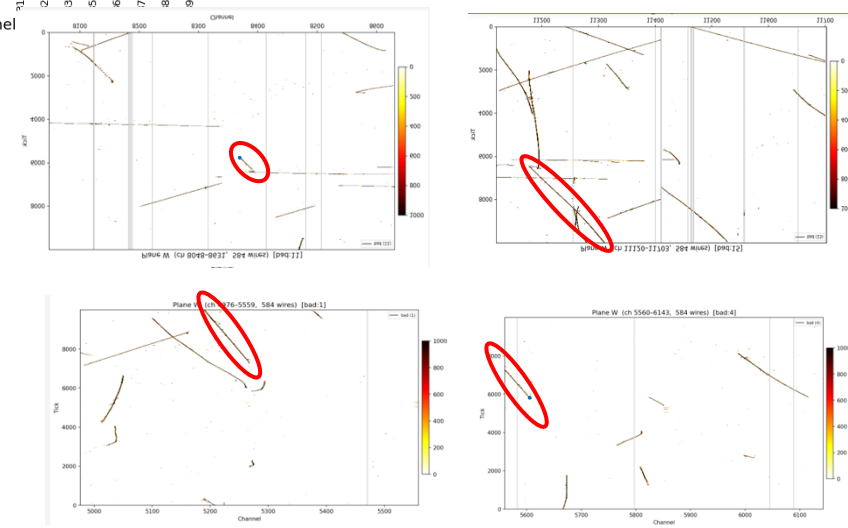
- Reprocess the selected single-track event after removing the 13.5 μs offset.
- For this track, the Q-L matching works well.

<https://www.phy.bnl.gov/twister/bee/set/3258e912-a905-4d69-94f5-688916b9ddff/event/0/>

Remove the Time Offset: Track 2

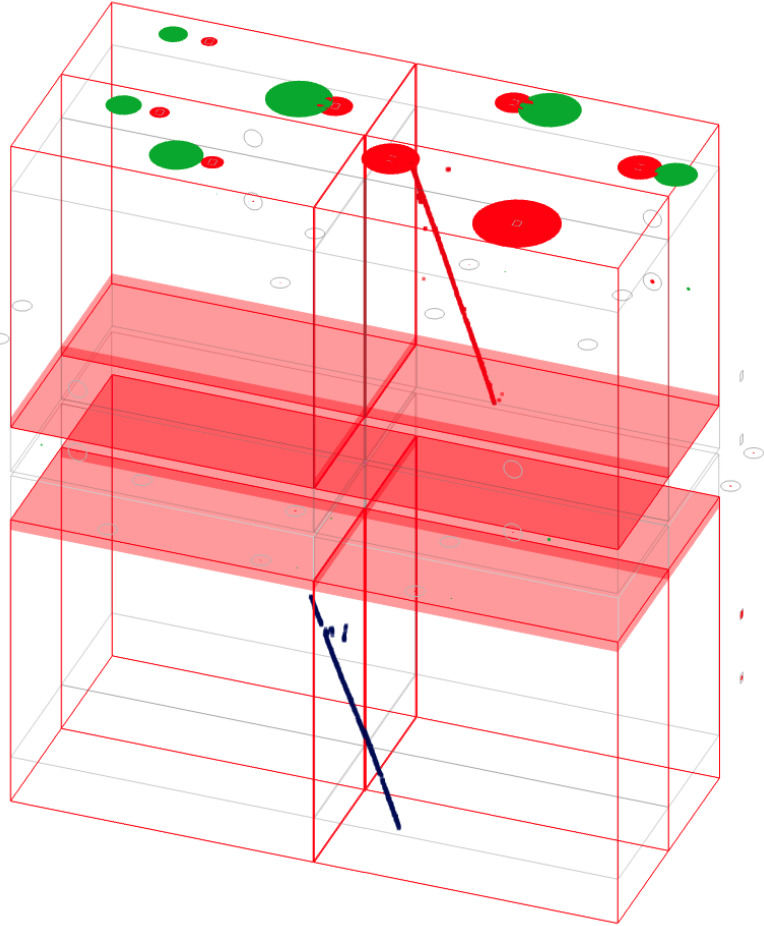


- This matching is incorrect.
- The matching prefers the track to touch the cathode
- but the track actually should touch anode.

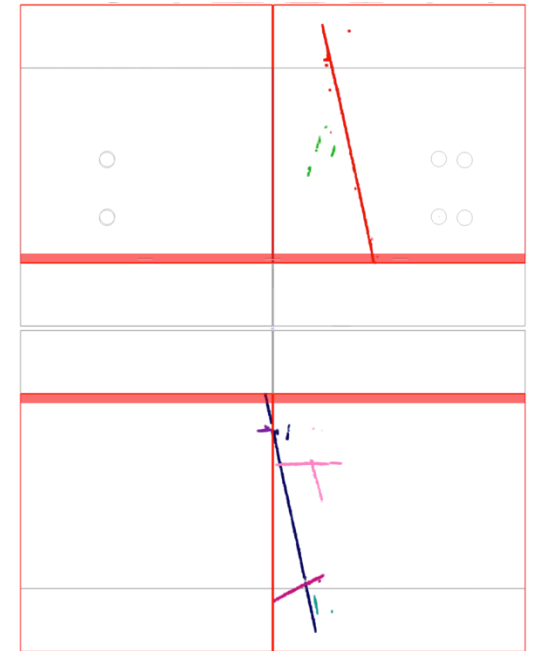
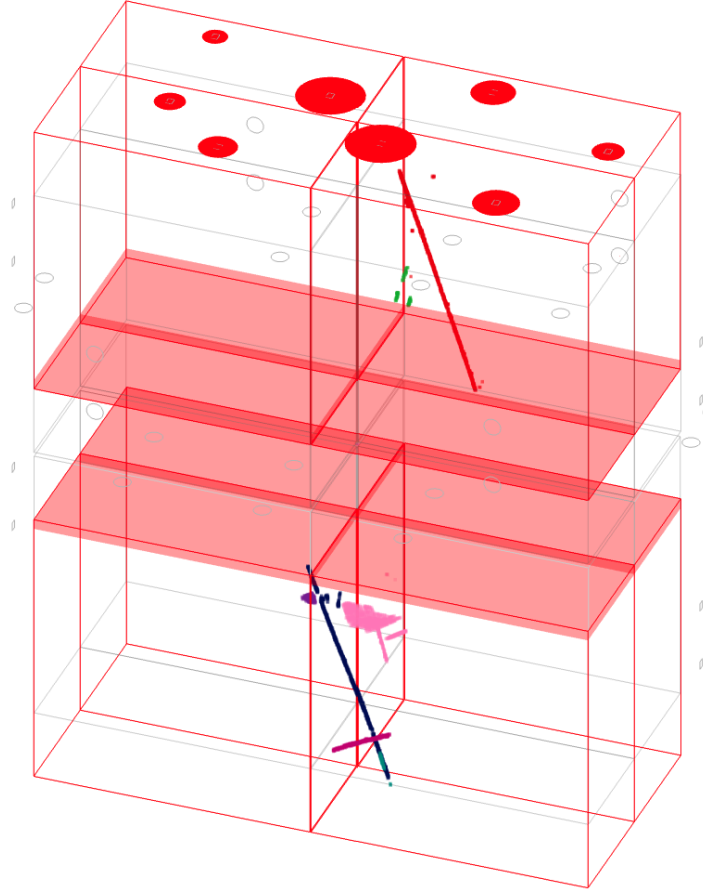


Remove the Time Offset: Track 2

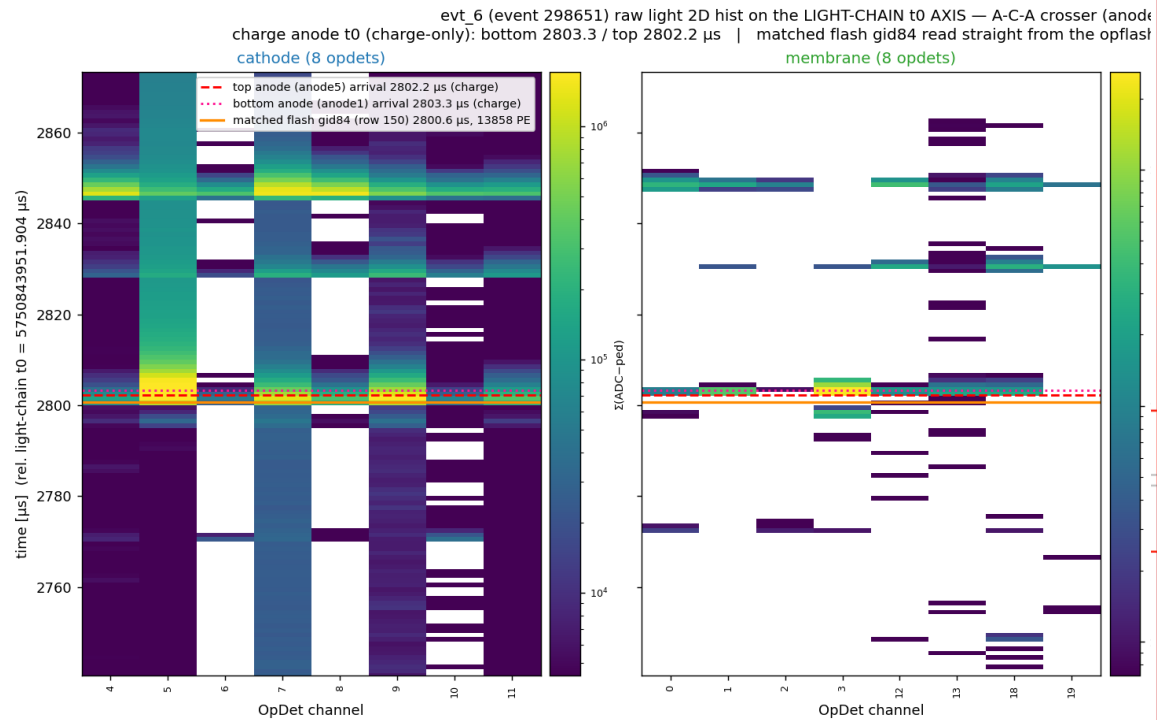
code matching one:



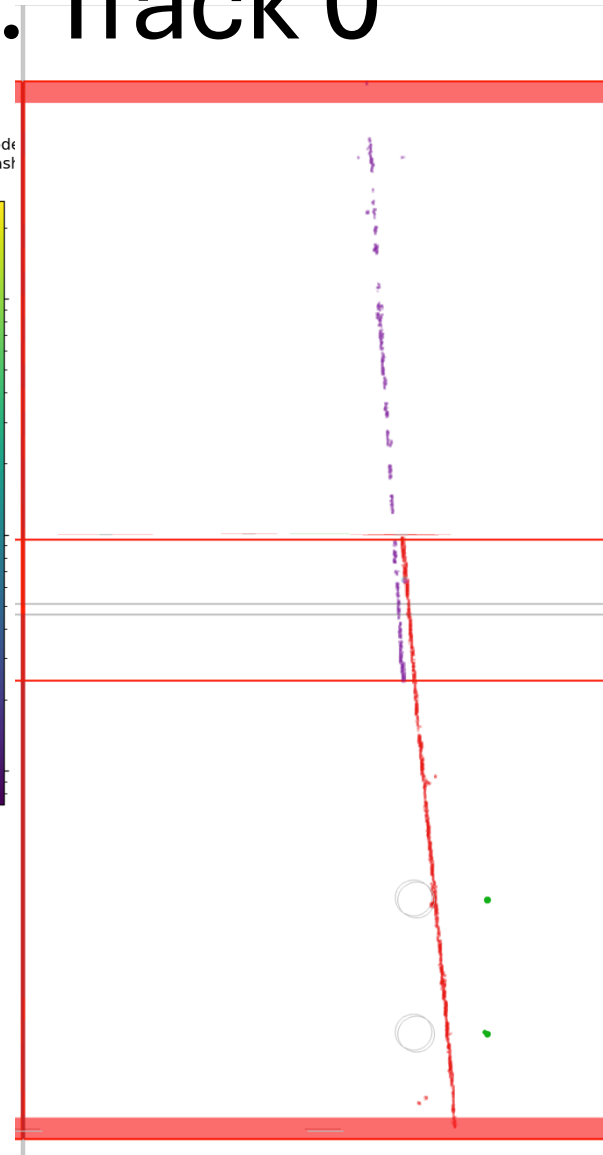
This should be the actual flash:



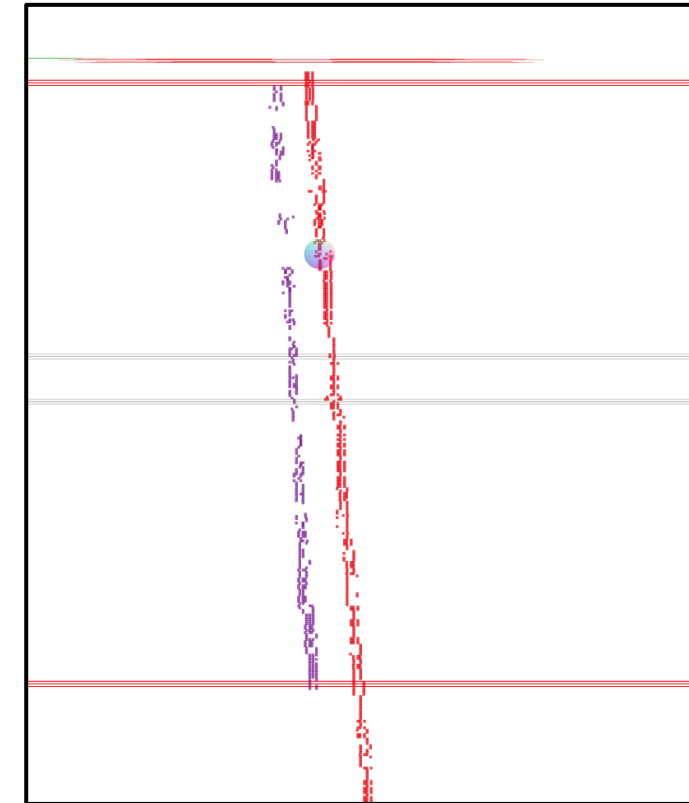
Remove the Time Offset: Track 0



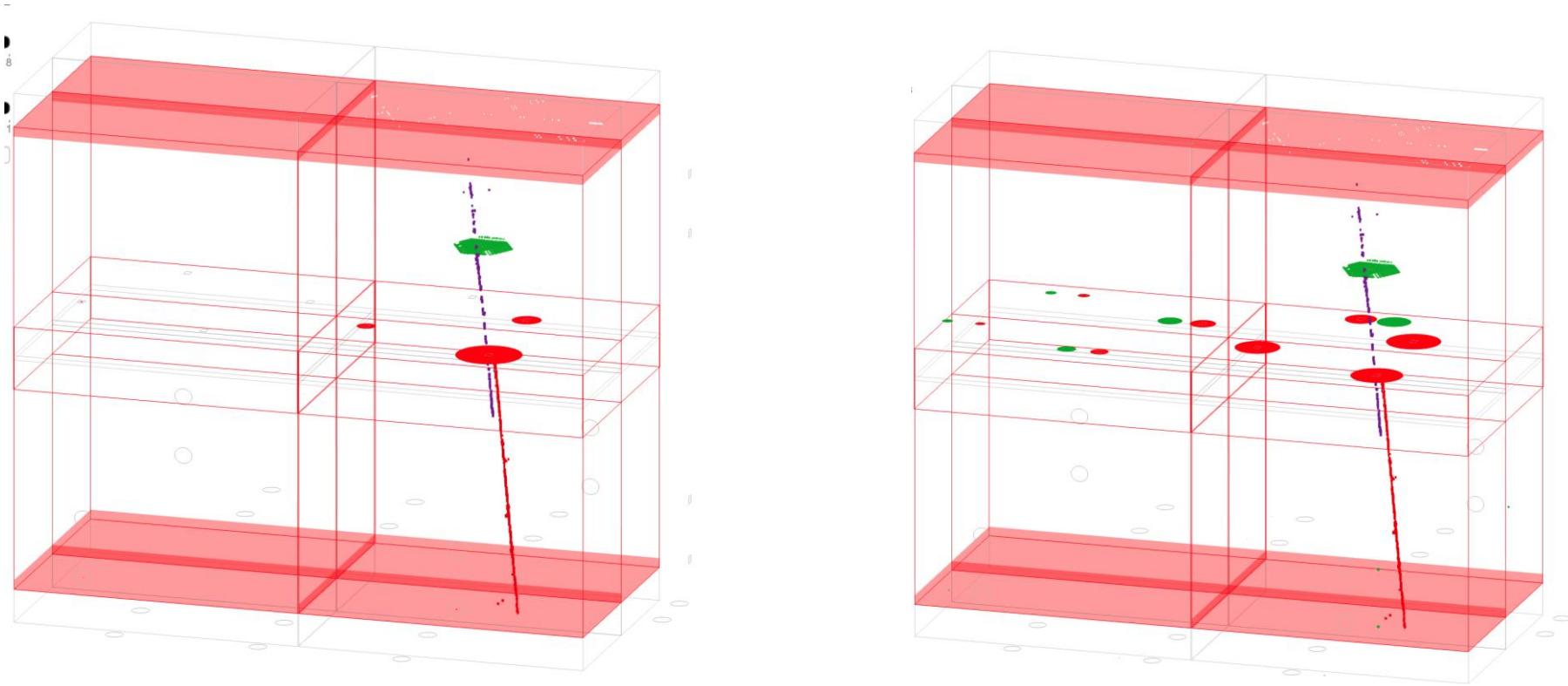
This is the track Xin used.



a little bit outside the cathode

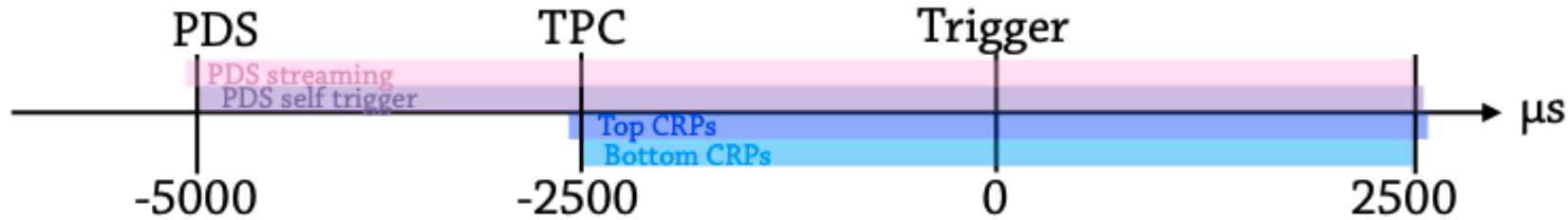


additional flash reco problem:



These two flashes differ by only **1.3 μs** , suggesting that they should be identified as the same flash.

Timestamps in PDVD



$$t_{\text{charge}} = \text{TPC} + \text{tick} \cdot 0.5\mu\text{s} - \text{trigger}$$

$$t_{\text{light}} = \text{PDS} + \text{tick} \cdot 0.016\mu\text{s} - \text{trigger}$$

Absolute timestamp (μs): vd/run039324/evt_3/

- TPC_top = 5749360348.848
- TPC_bottom = 5749360347.648
- trigger = 5749362848.784

- PDS = 5749357848.608
- The DAPHNE digitizer runs at 62.5 MHz → 1 sample = 16 ns = 0.016 μs