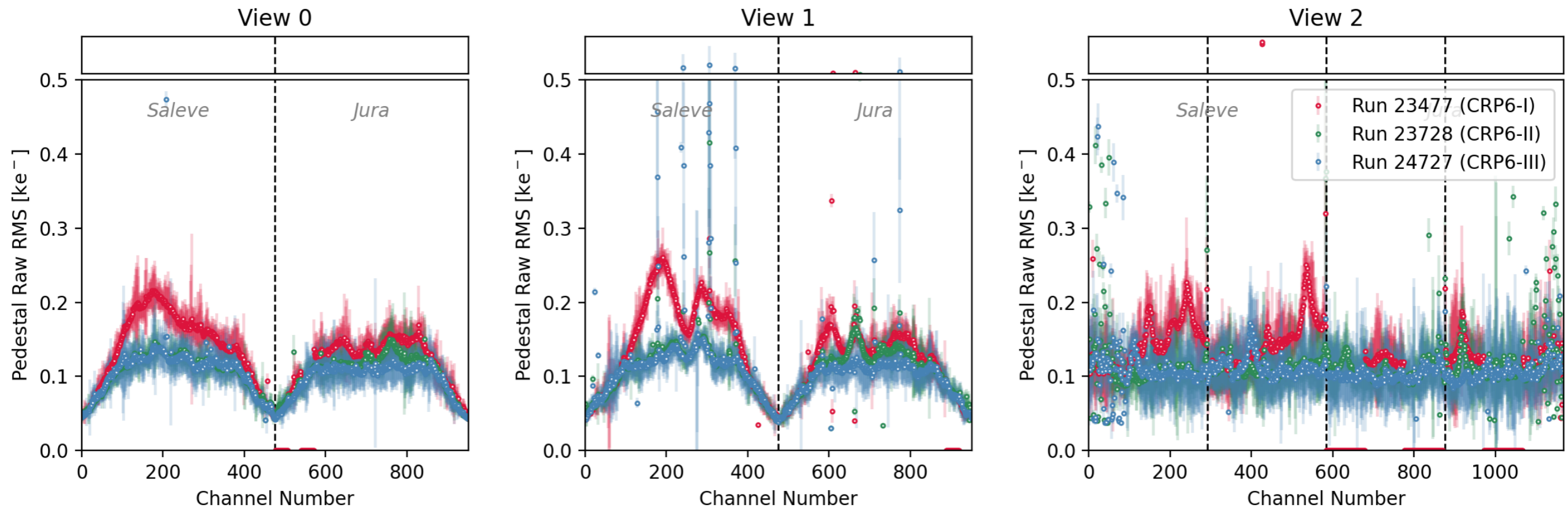


FIRST LOOK AT CRP6-III DATA

Laura Zambelli
LAPP, CNRS/IN2P3
April 24th 2024

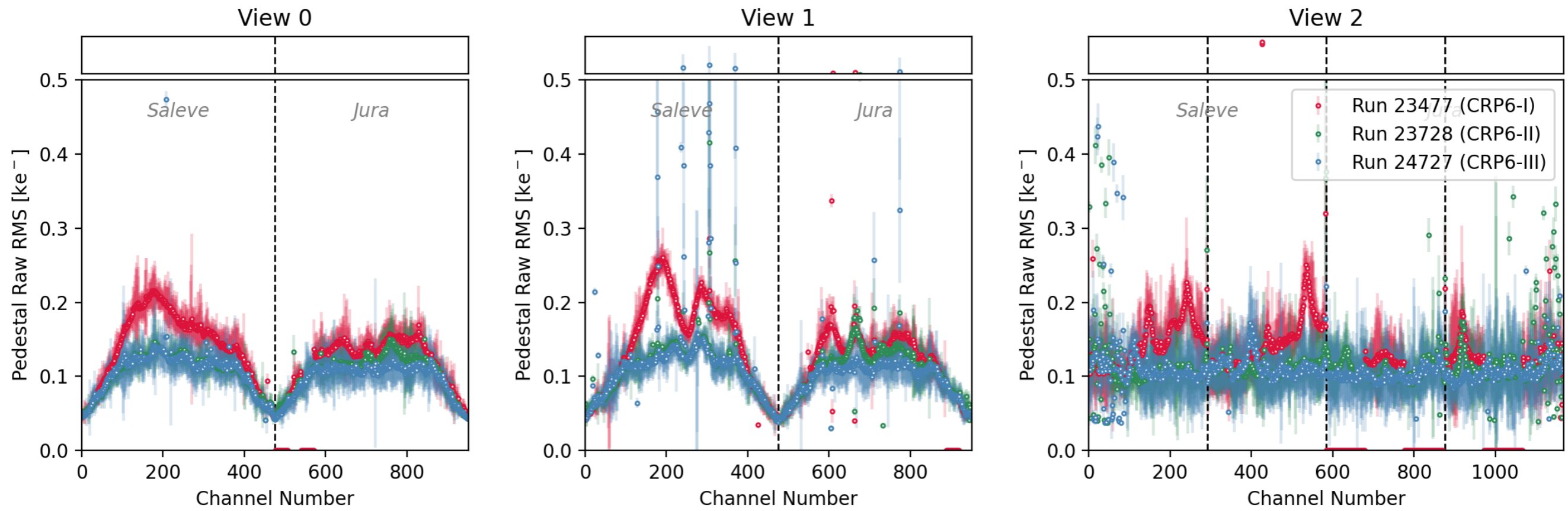
Raw Noise



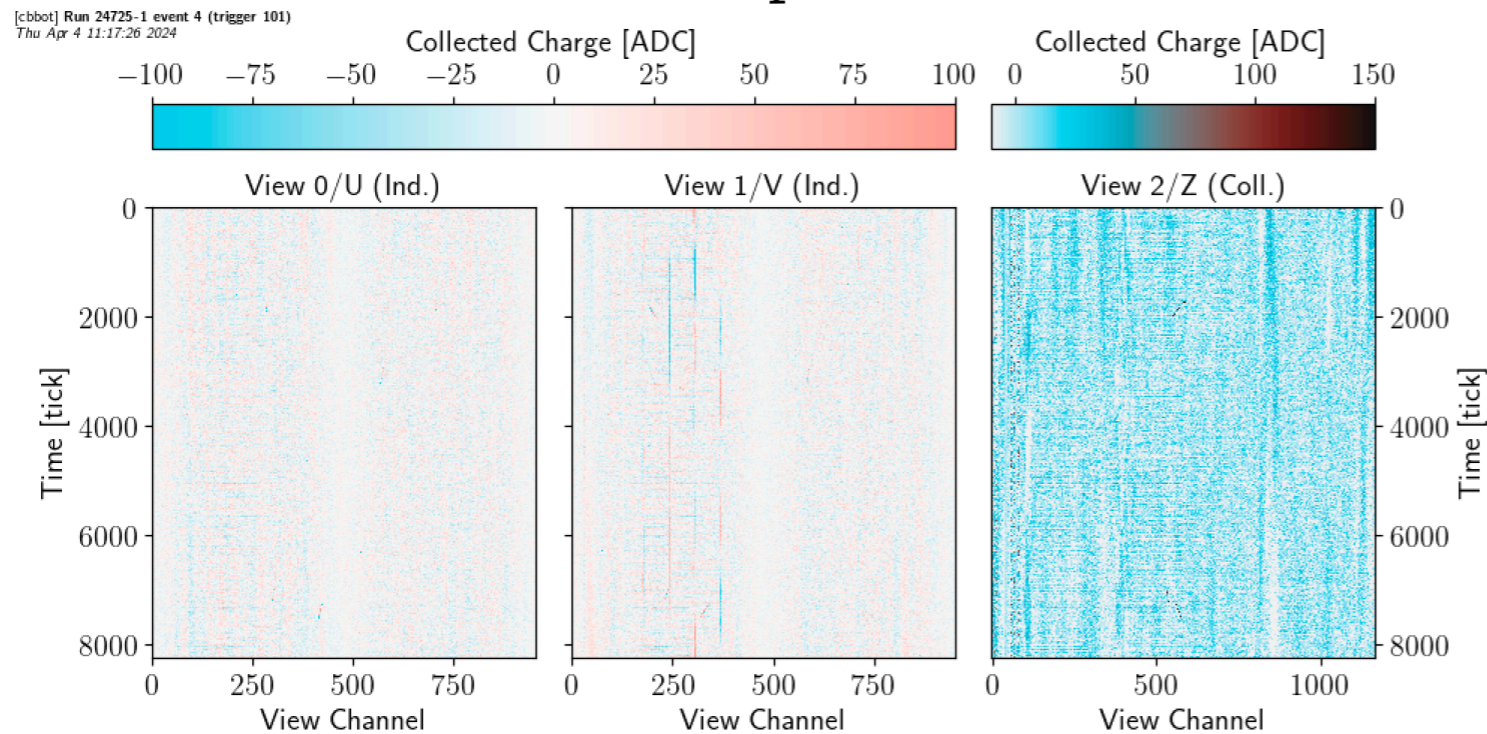
-> Very similar noise conditions as CRP6-II

Except regular spikes (every ~ 64 channels) of noise on Induction 2 / View 1 ; mostly on the Salève side. Was a bit present in CRP6-II, but now it is very much stronger

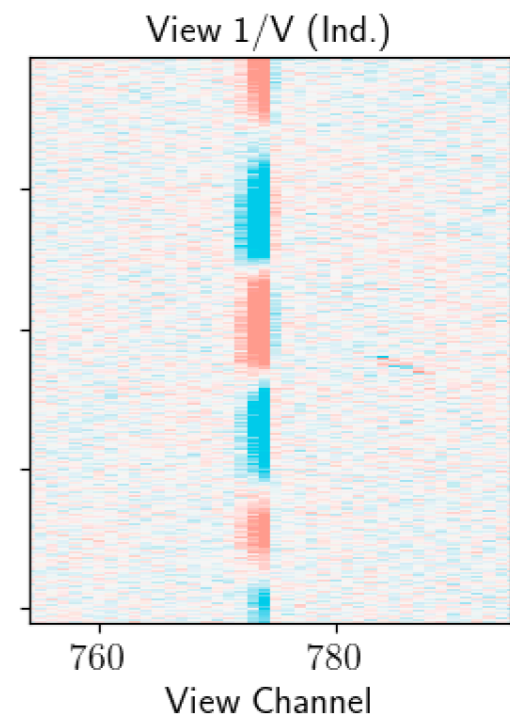
Raw Noise



Example:

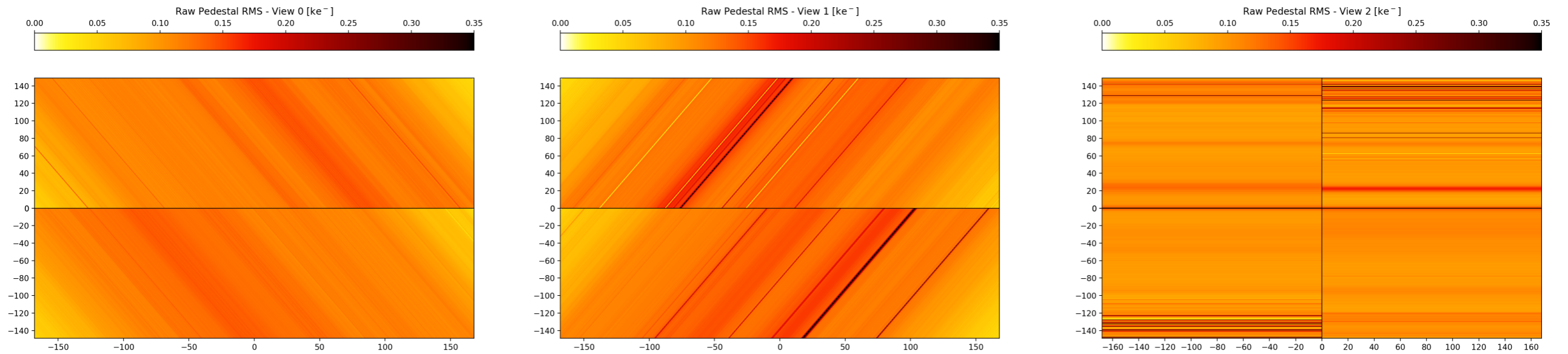


Zoom:

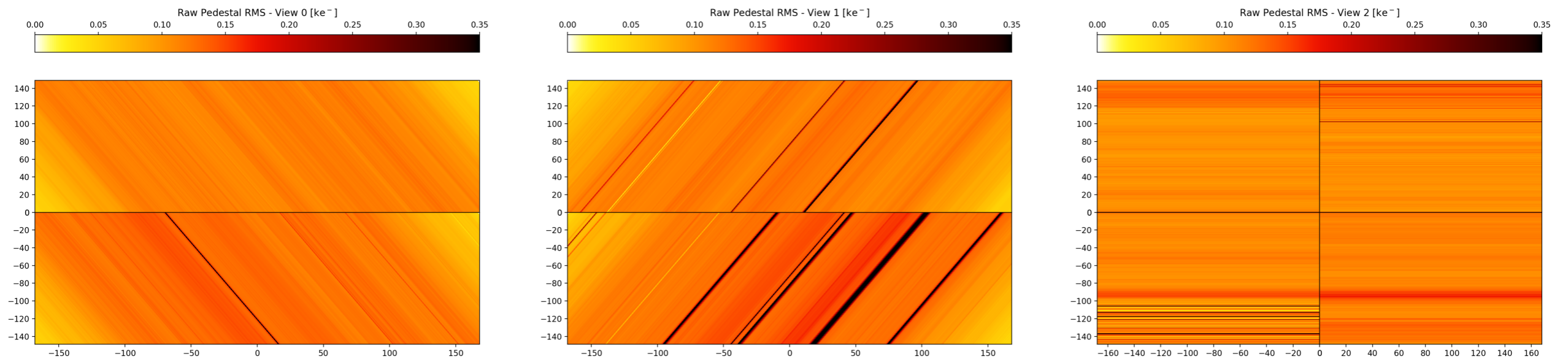


Raw Noise Visual Representation

CRP6 - II (run 23728)



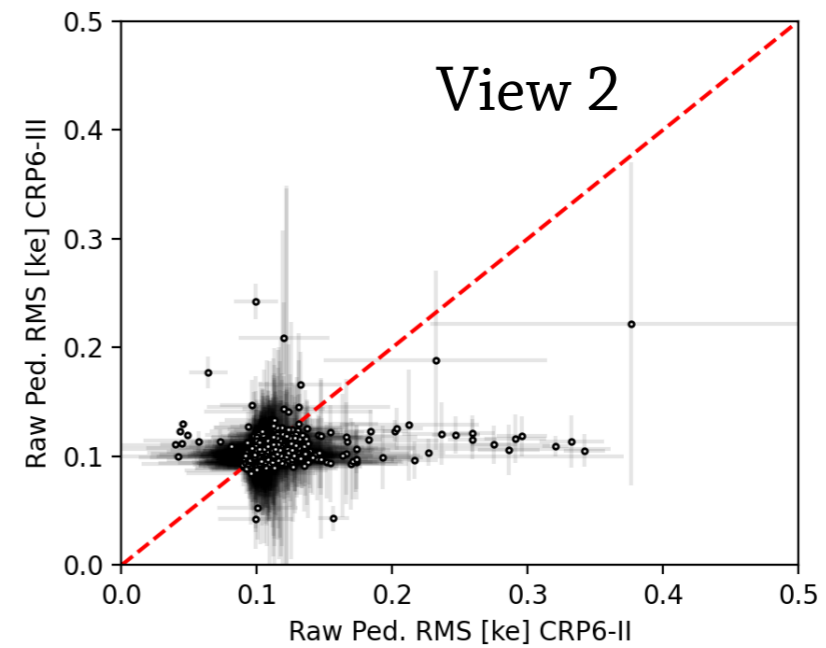
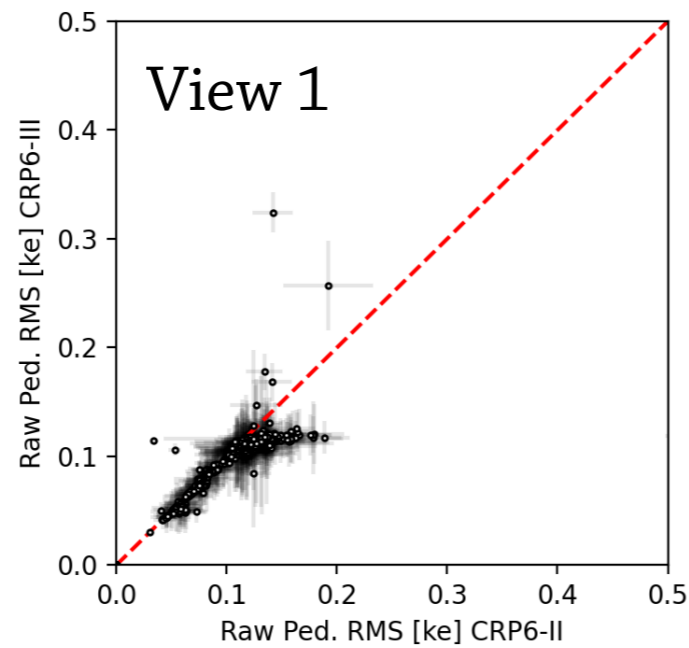
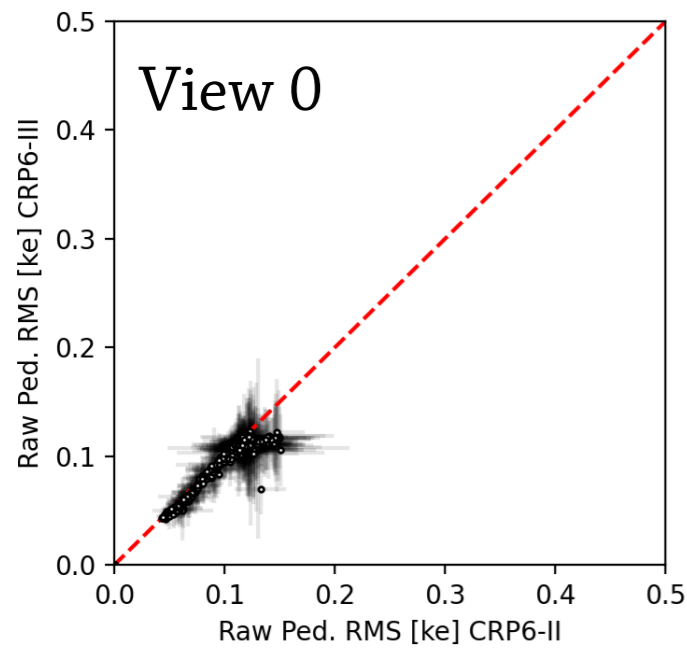
CRP6 - III (run 24727)



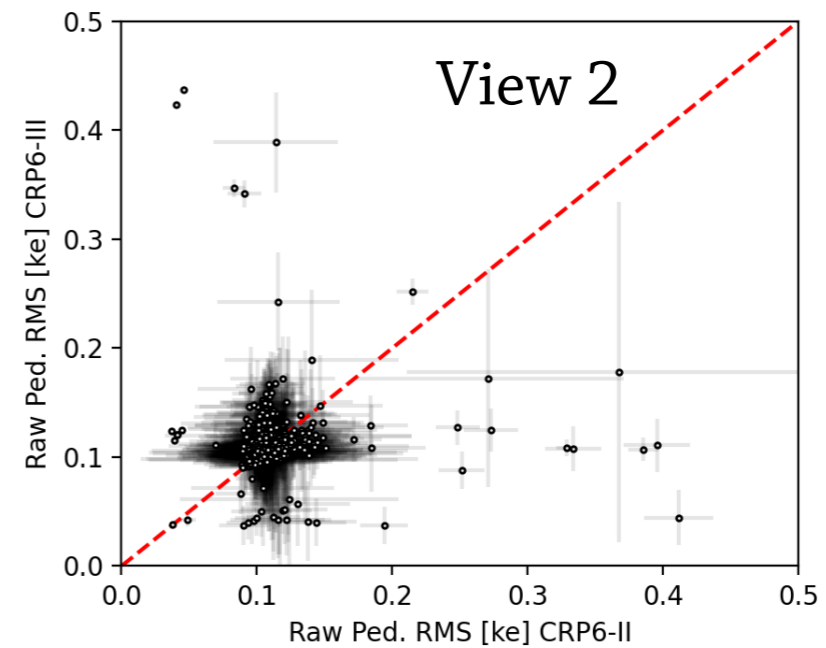
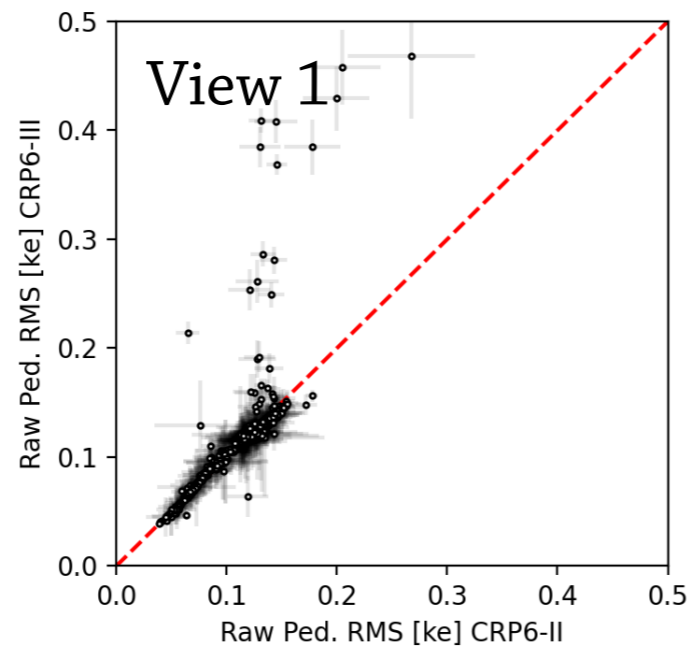
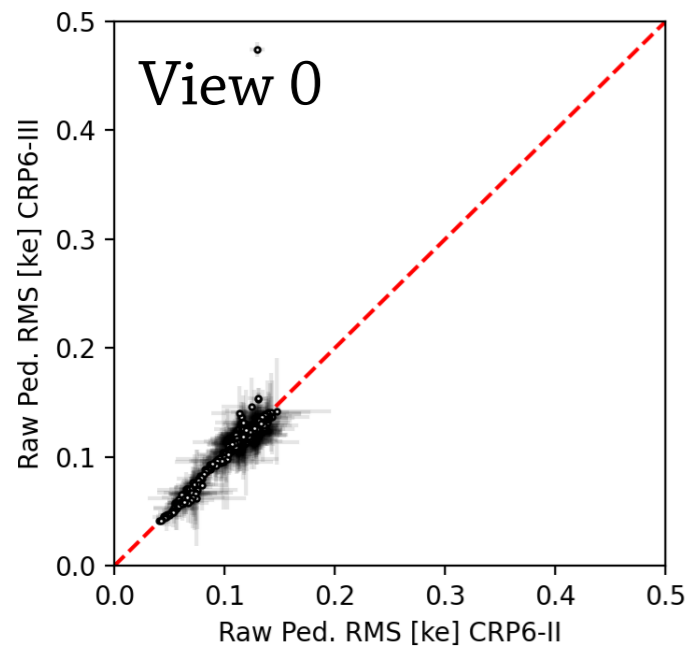
-> The band of noise on the collection view at around y=-90cm re-appeared

Raw Noise CRP6 comparison

Jura Side/CRU-A

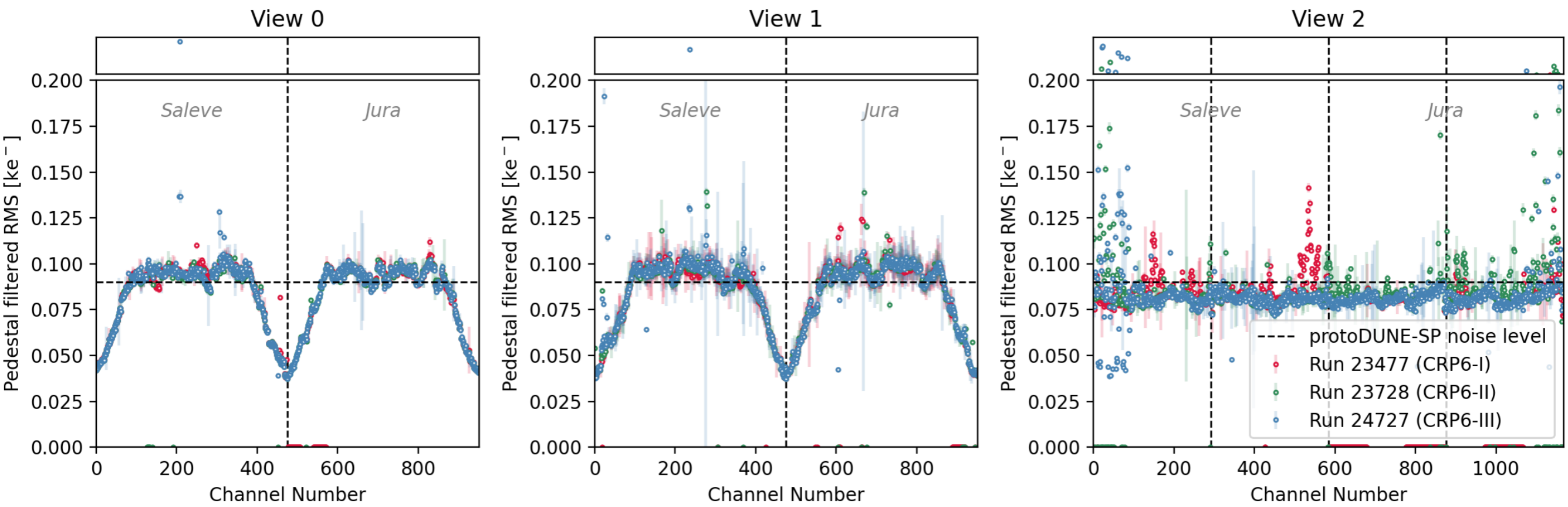


Saleve Side/CRU-B



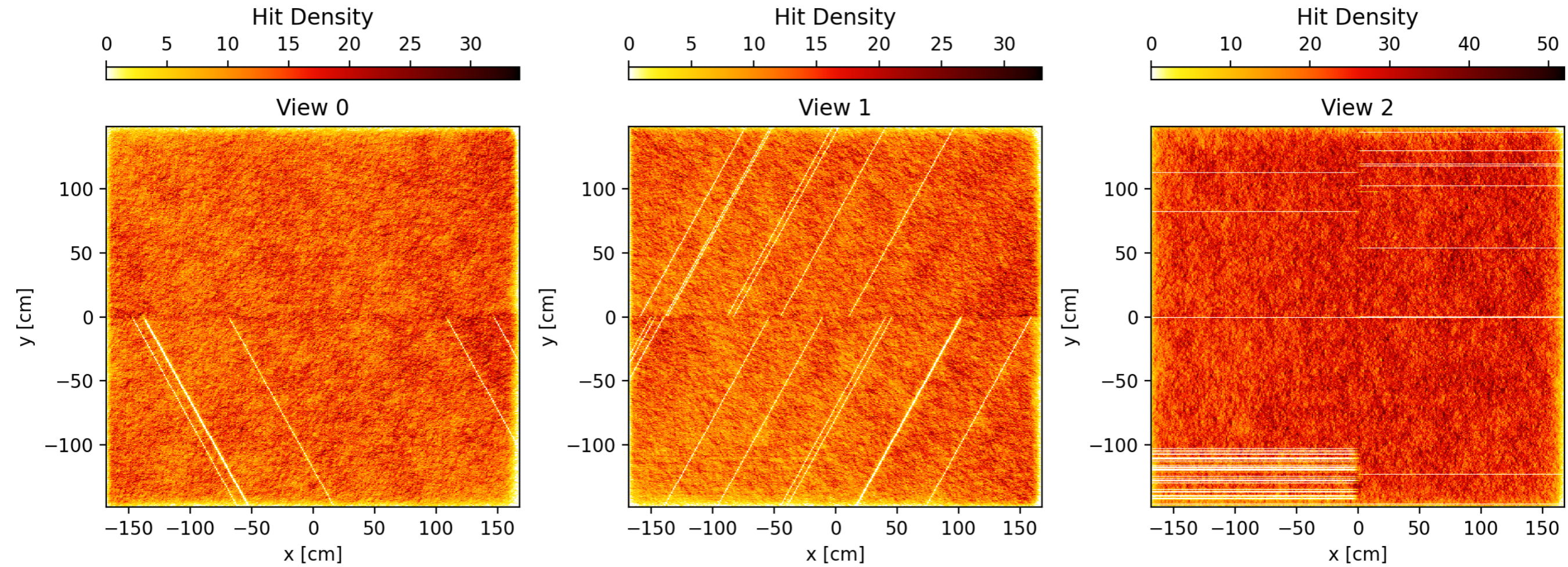
-> Overall the noisy / open channels

Filtered Noise



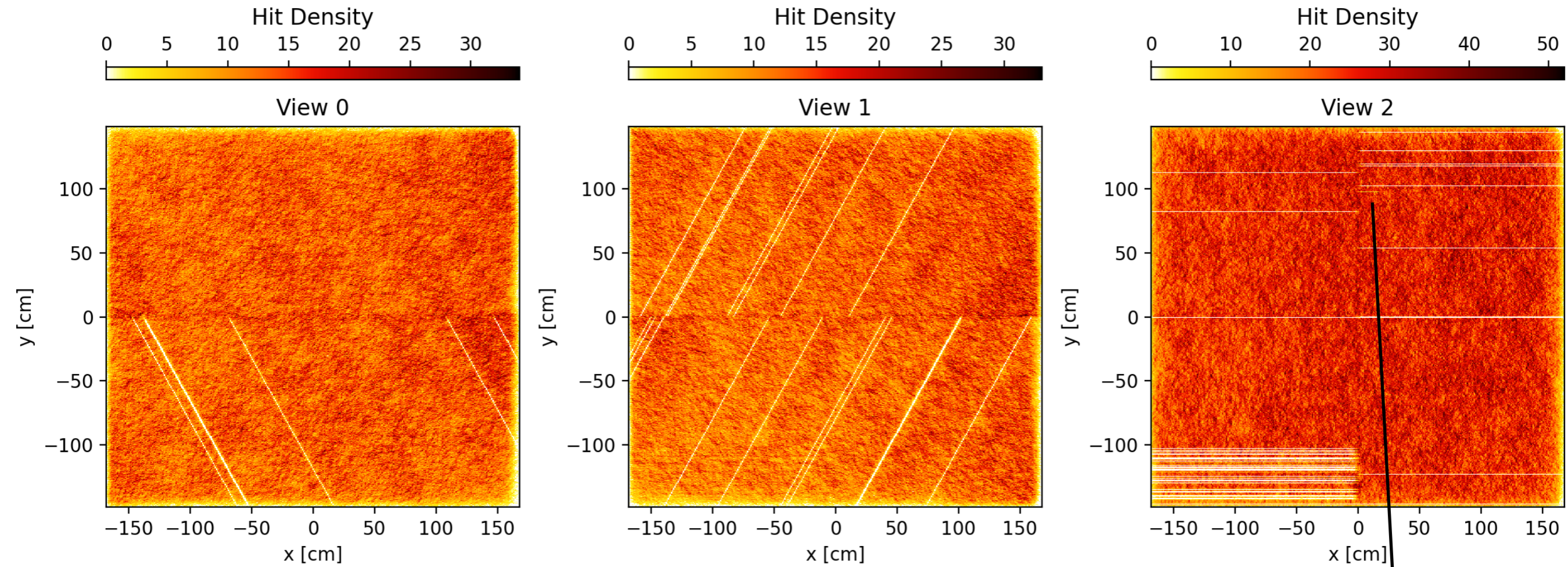
-> Filtered noise is at the same level as usual

Hit Density



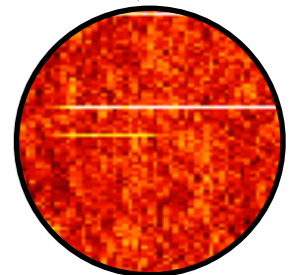
In my reconstruction, I switched OFF all the noisy/open channels for simplicity

Hit Density

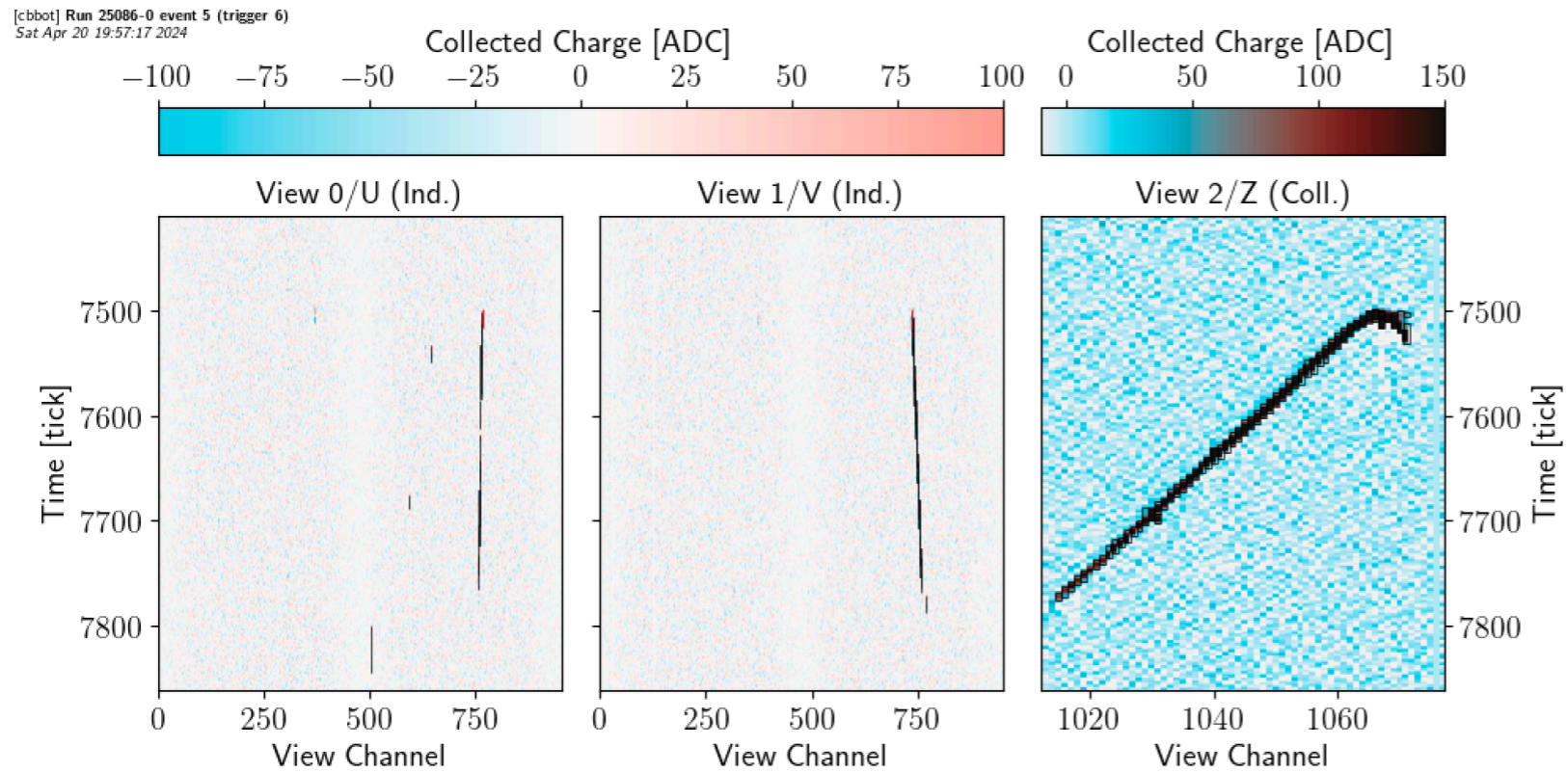


In my reconstruction, I switched OFF all the noisy/open channels for simplicity

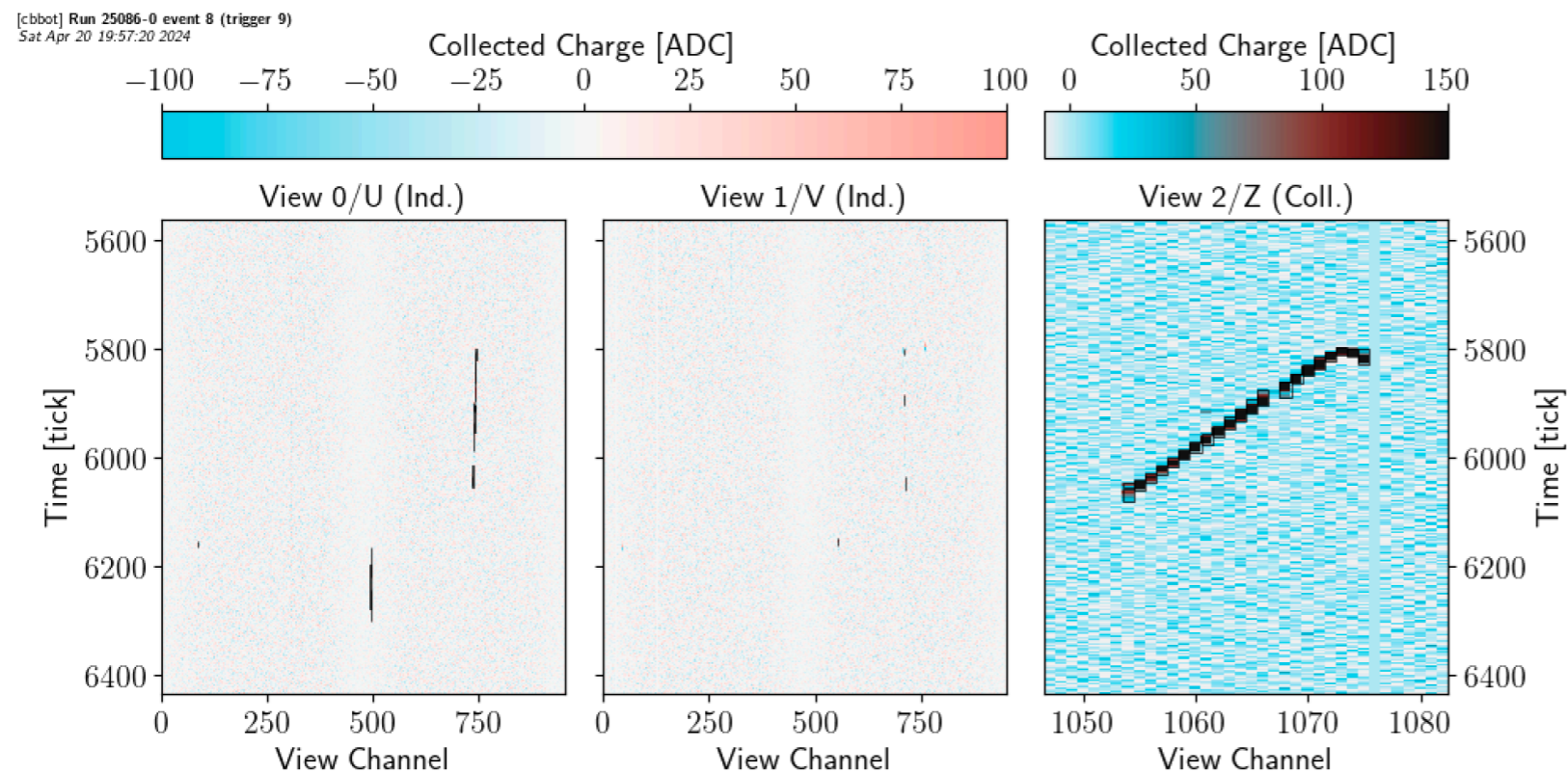
Seems that one channel on the collection view is partially broken
-> Channel 1067



Partially broken channel ?

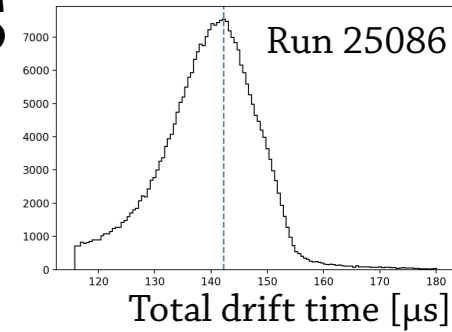


Channel 1067 is seeing signal



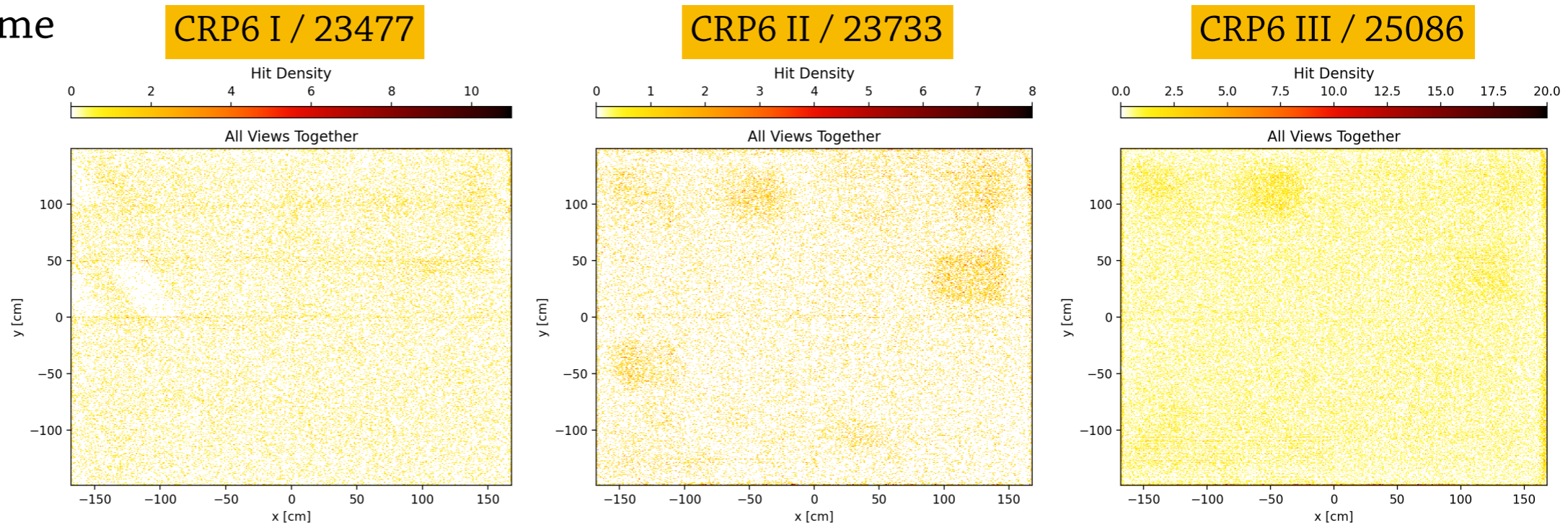
Channel 1067 is not seeing any signal

Cathode position & Drift field distortions

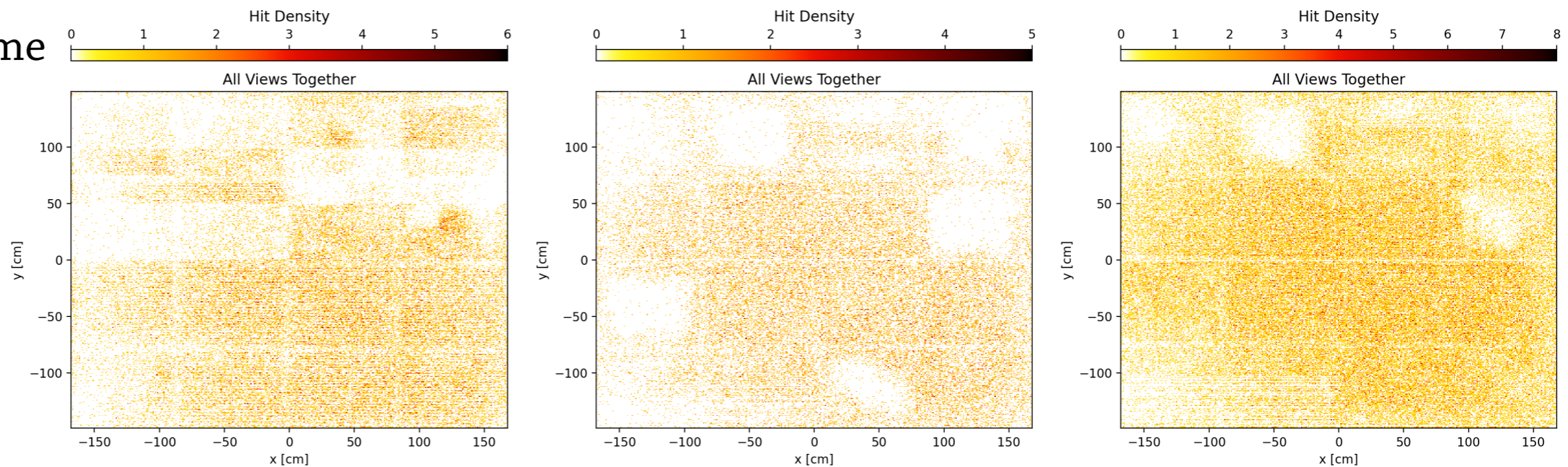


Looking at the end point of tracks based on their total drift time

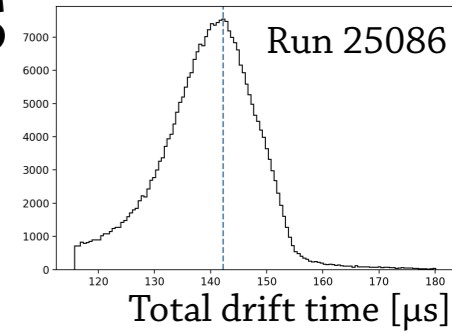
‘Short’ total drift time
($t_{\text{drift}} < 140 \mu\text{s}$)



‘Long’ total drift time
($t_{\text{drift}} > 140 \mu\text{s}$)

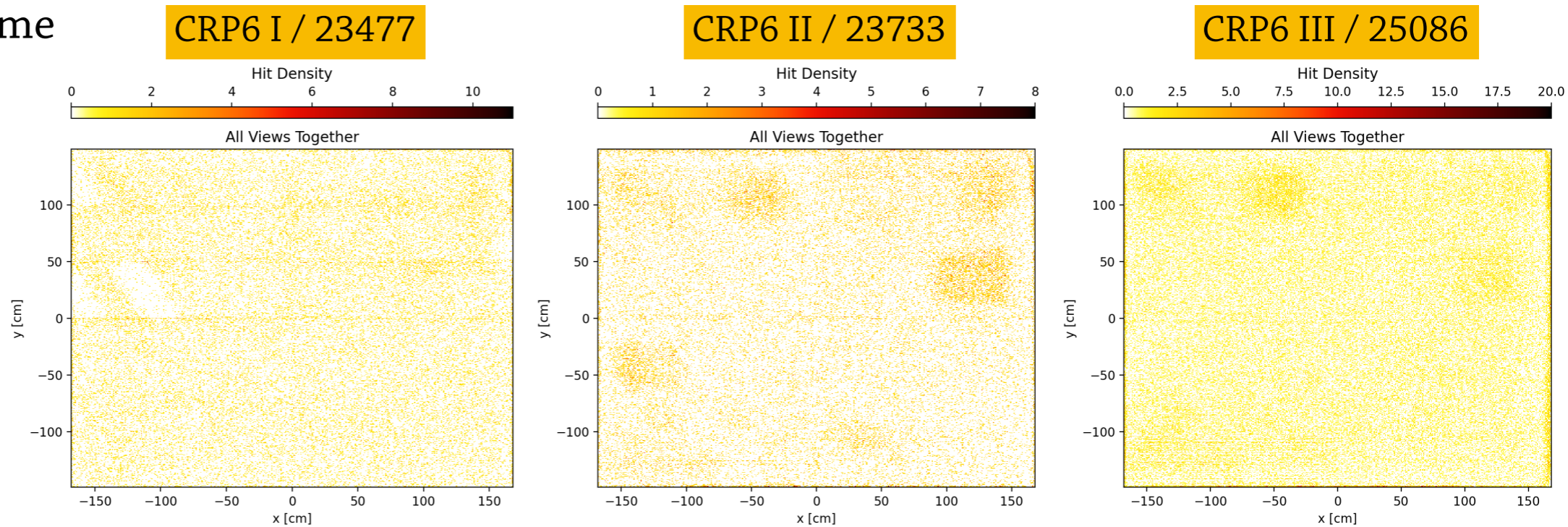


Cathode position & Drift field distortions

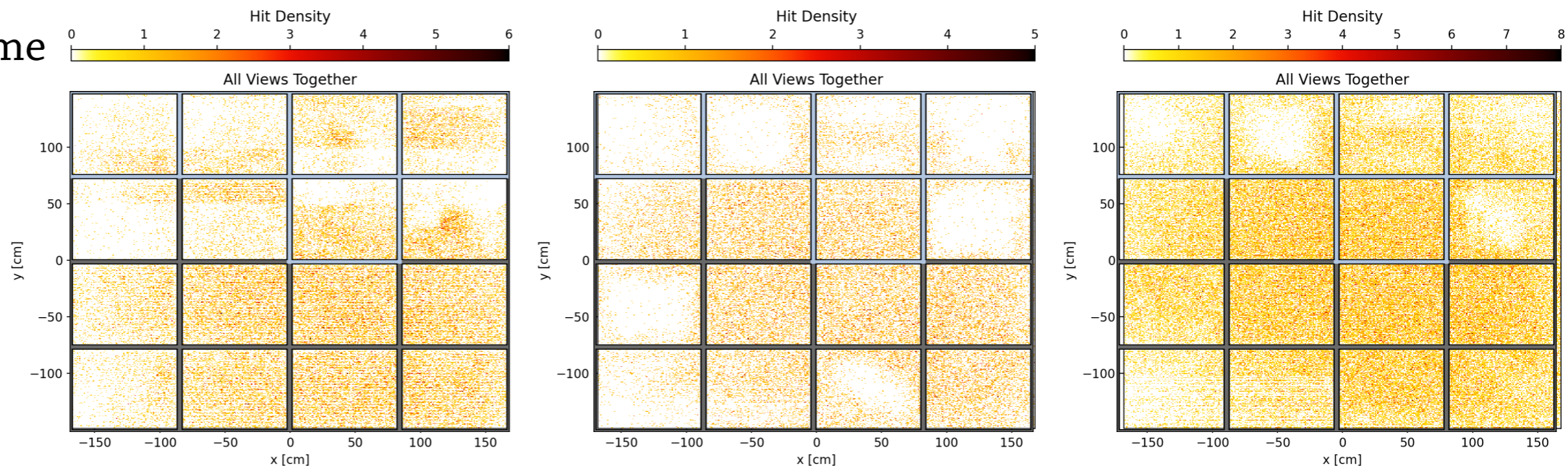


Looking at the end point of tracks based on their total drift time

‘Short’ total drift time
($t_{\text{drift}} < 140 \mu\text{s}$)



‘Long’ total drift time
($t_{\text{drift}} < 140 \mu\text{s}$)

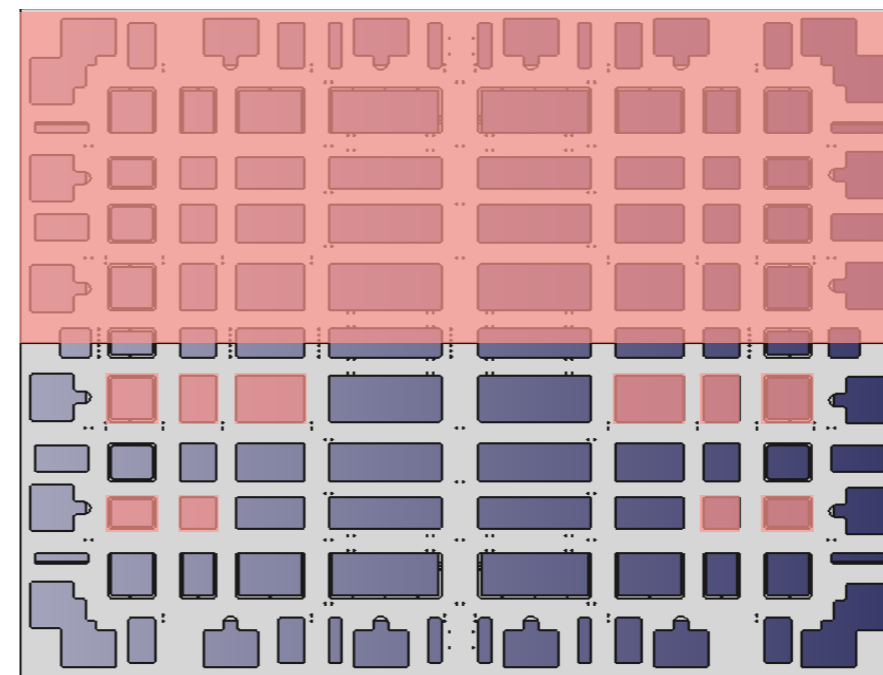
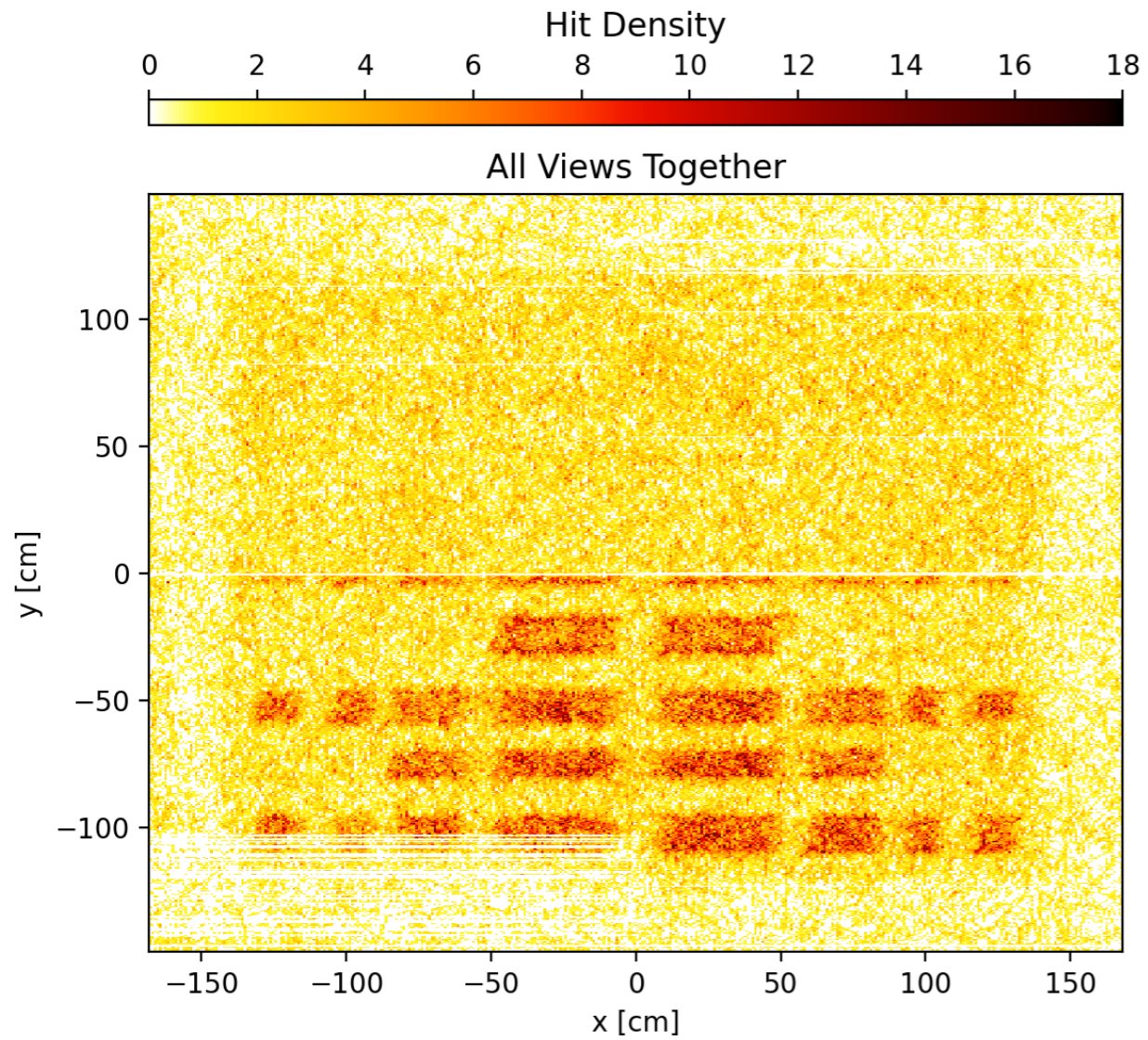


-> Seems like the cathode is slightly displaced to the left in this run

-> No more field distortions above C1 & C4 in this run - to be understood

Ghost tracks

CRP6 - III Run 25086

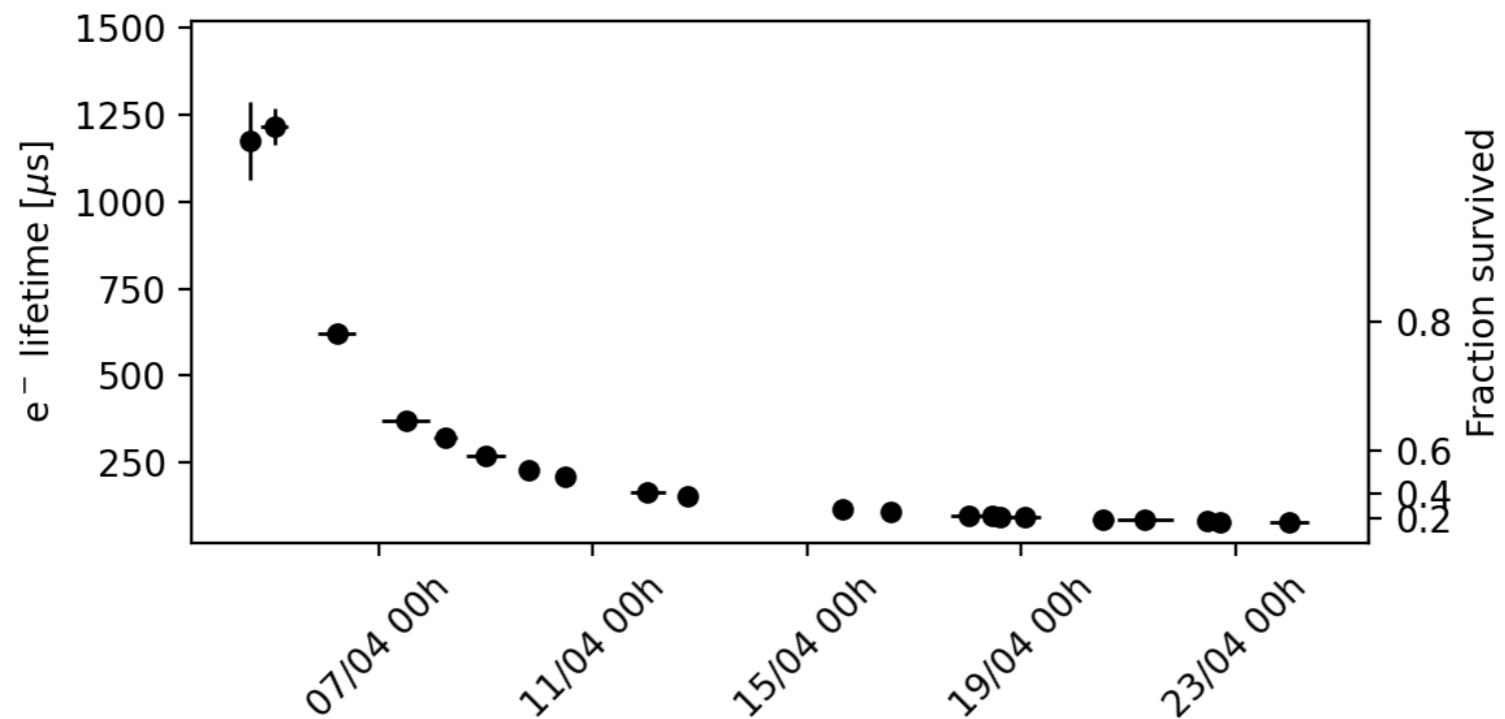
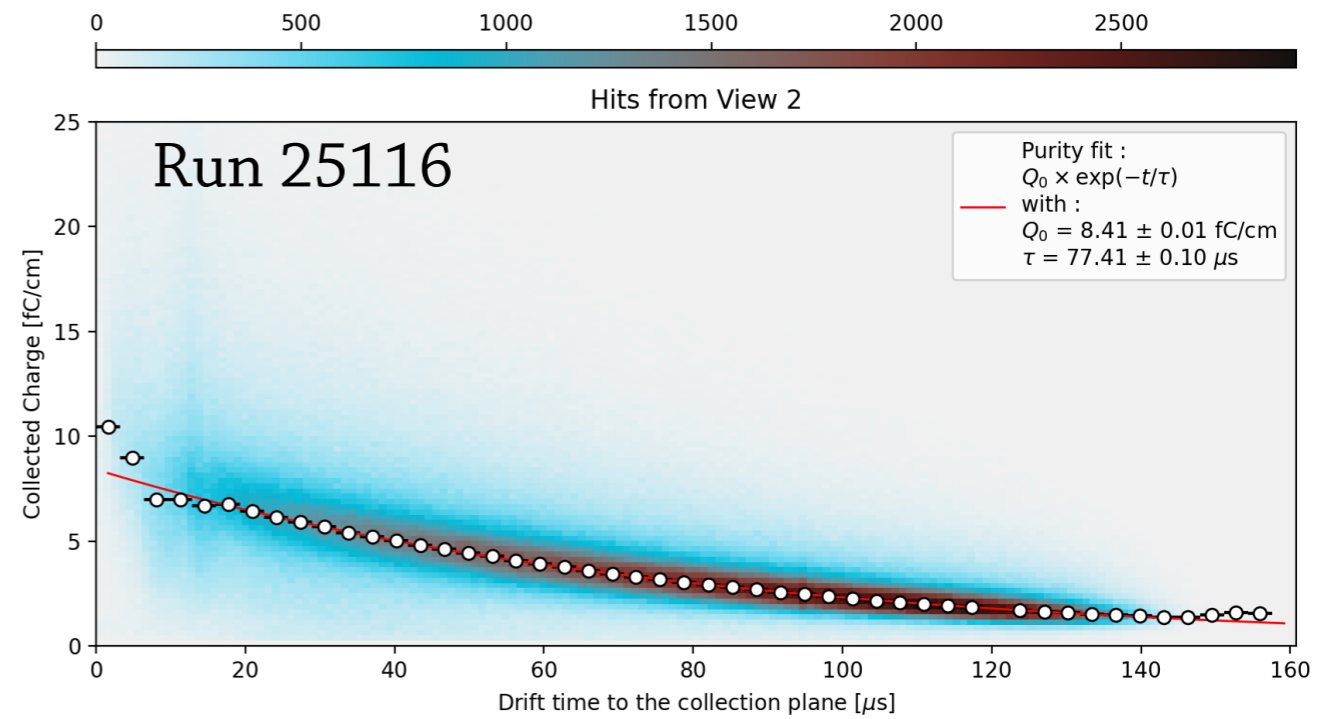
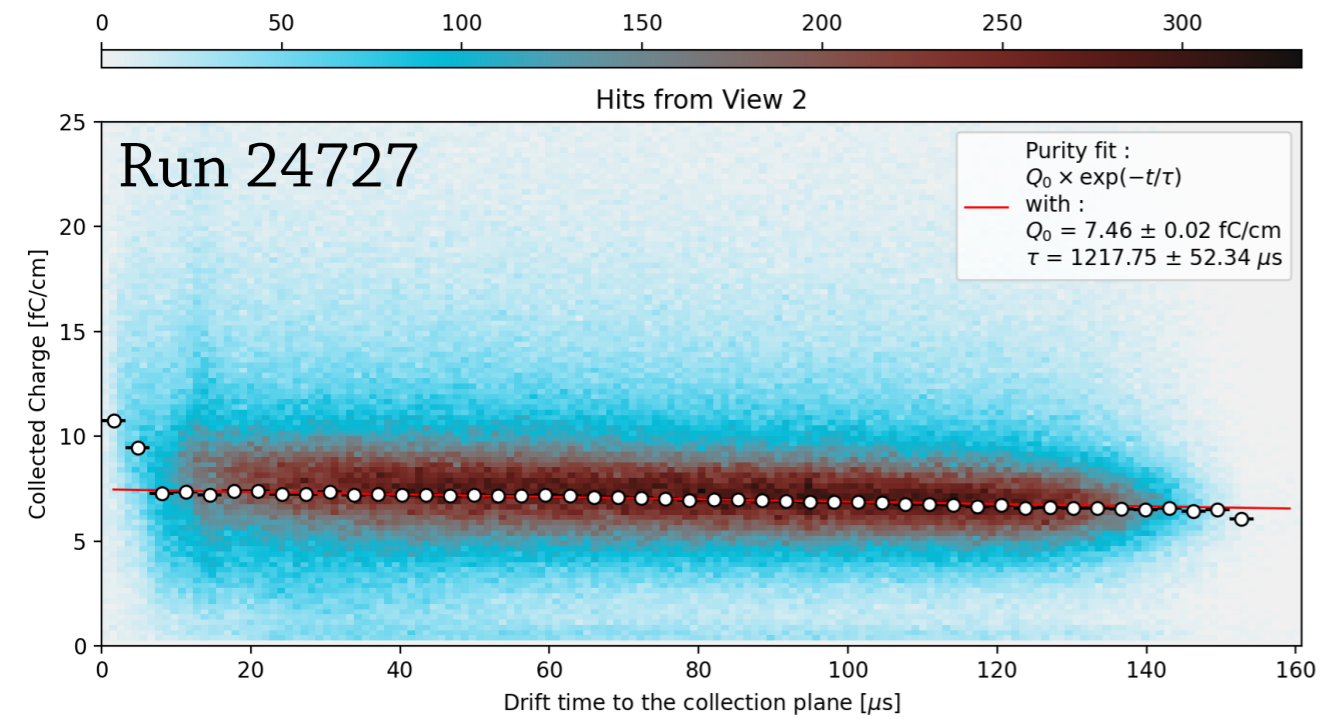


□ : Copper sheets installed in CRP6-II

-> Almost no more ghosts reconstructed on the Jura/A side with the new copper shield installed on the composite frame

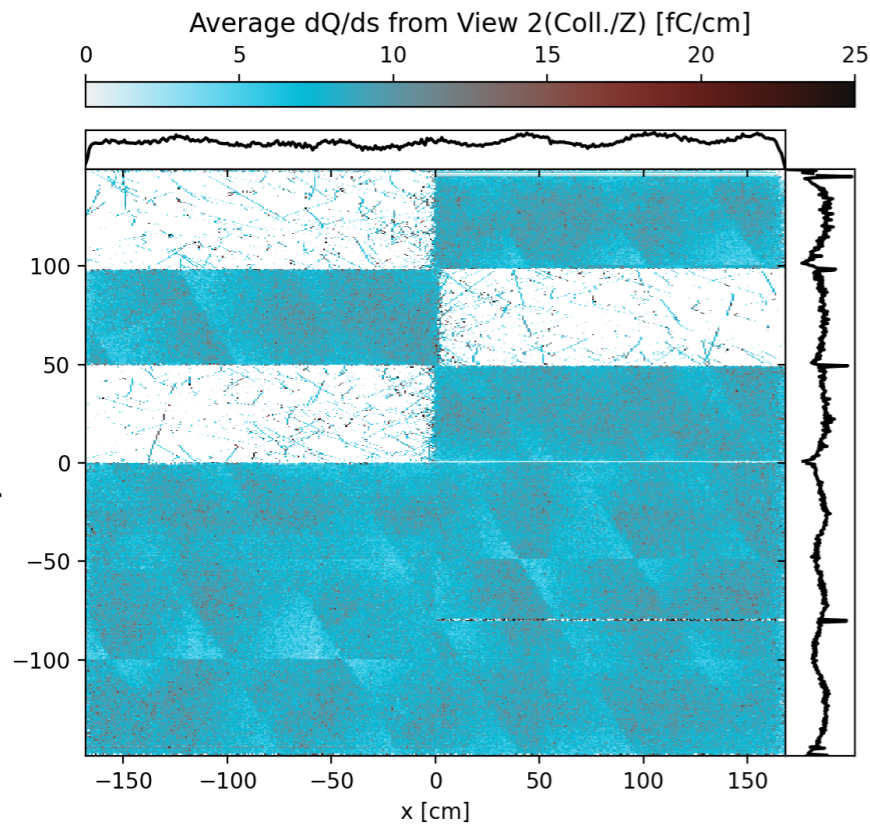
Purity Evolution

Purity decreased from $\tau_e \approx 1.2$ ms down to ~ 80 μ s

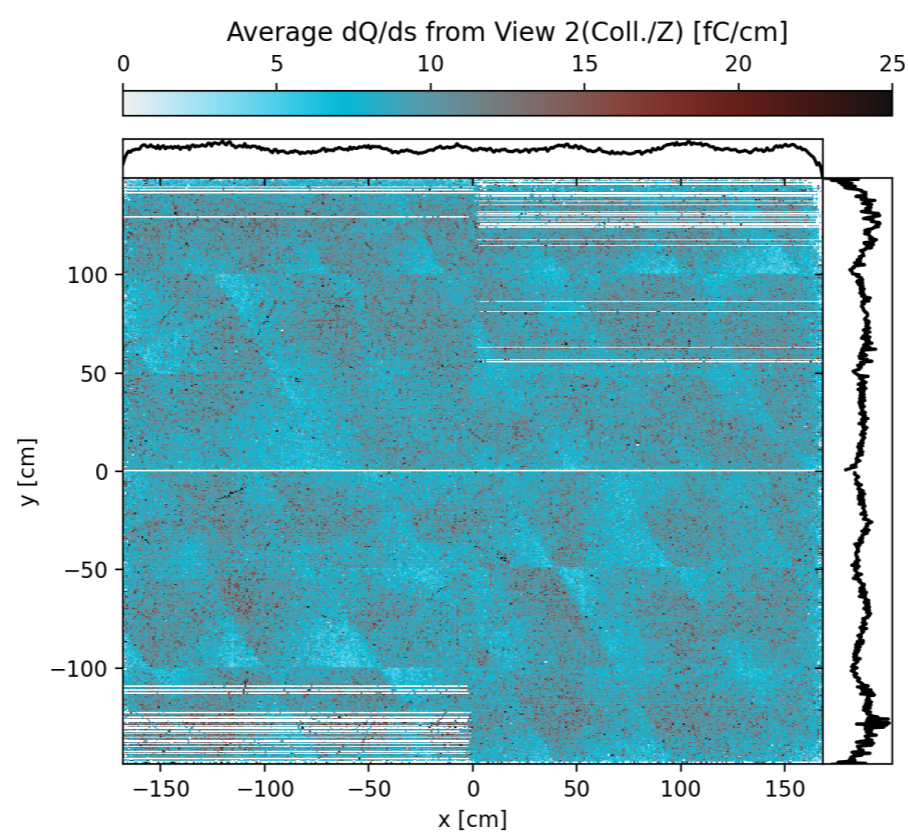


Transparency comparisons

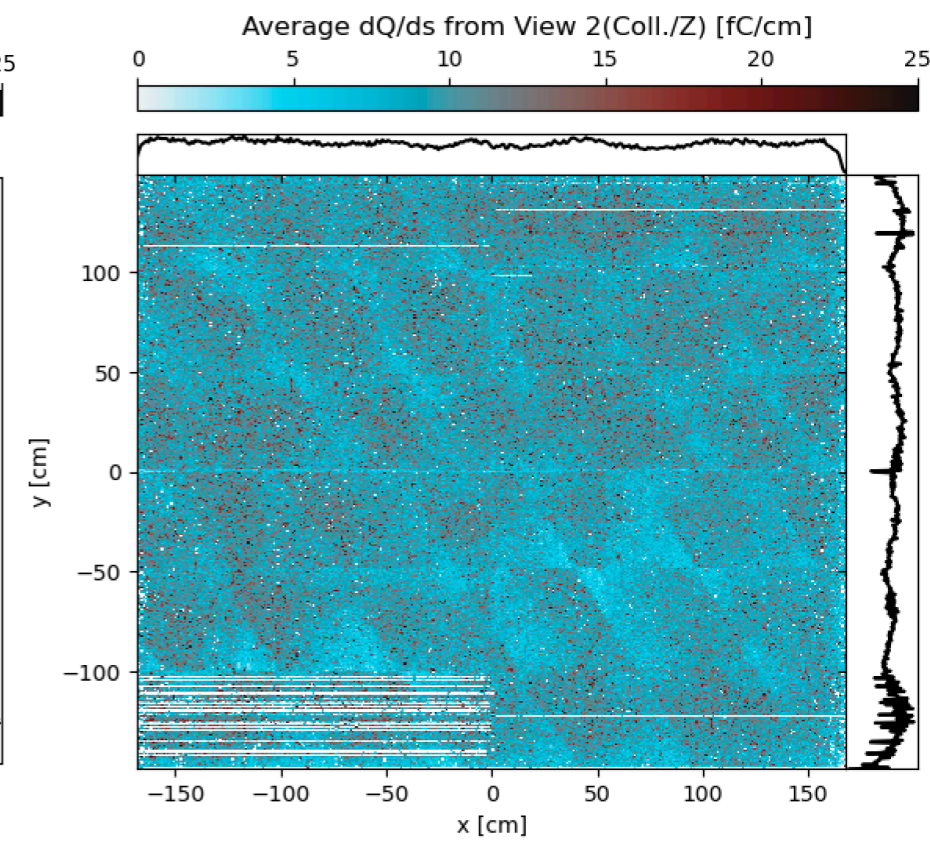
CRP6-I



CRP6-II



CRP6-III



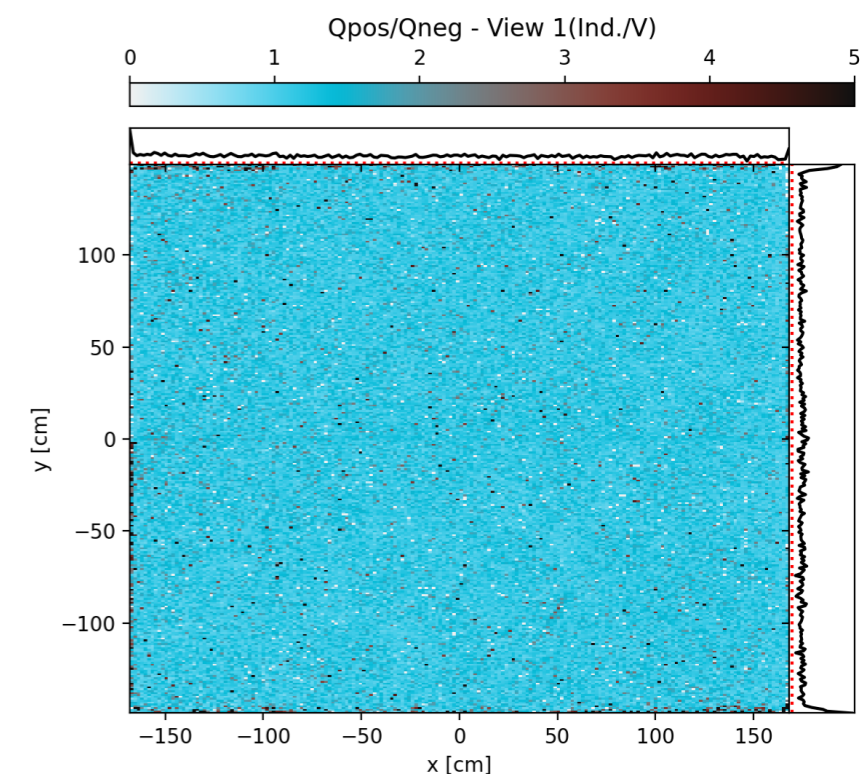
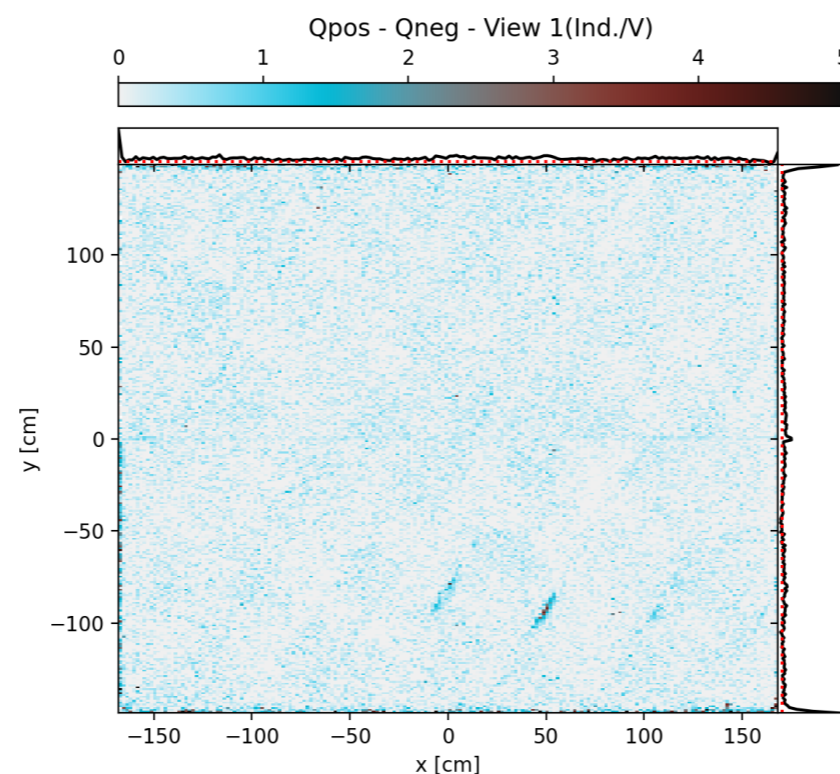
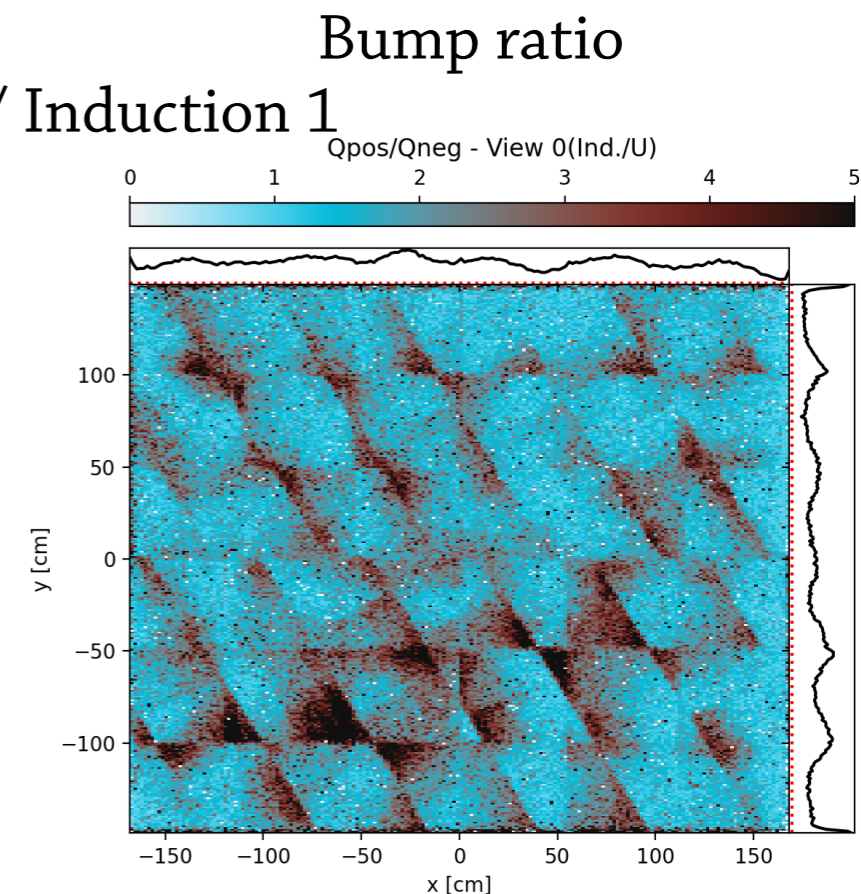
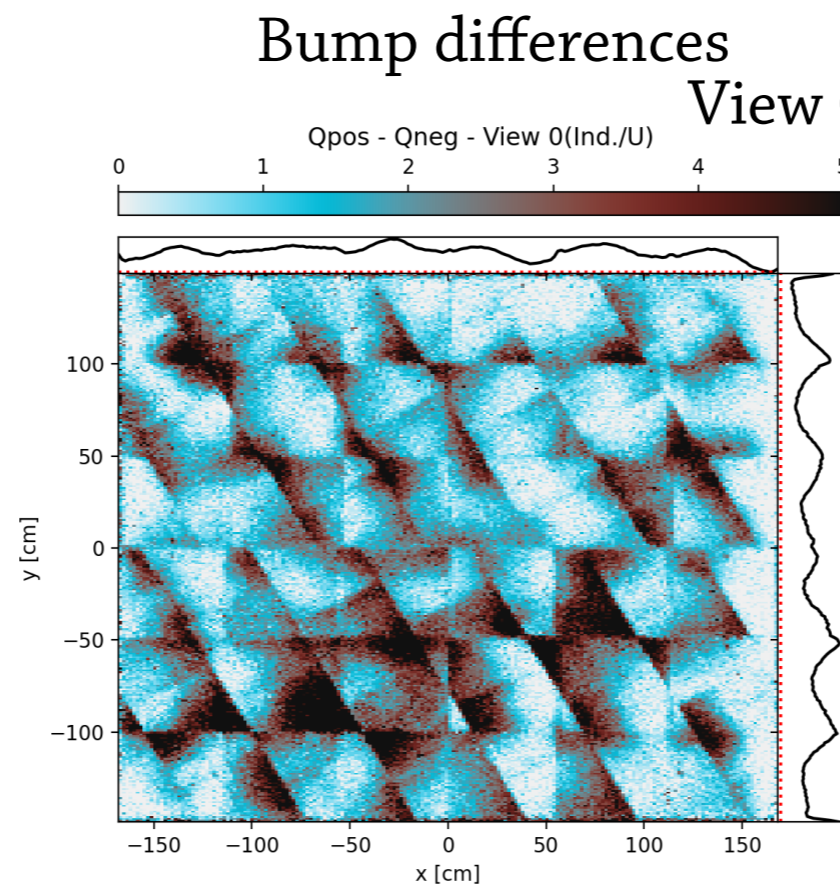
All runs in nominal HV conditions

-> Seems to be a small improvement on the Jura/A side in terms of transparency with CRP6-III

Using 'bipolarness' of induction hits can help to understand better the pattern structure

In view 0 / Induction 1, we can see the '50 cm' structure that Luis has found in his study with pictures

In View 1 / Induction 2, three small spots appeared on the Jura/B side, located along junctions of panels



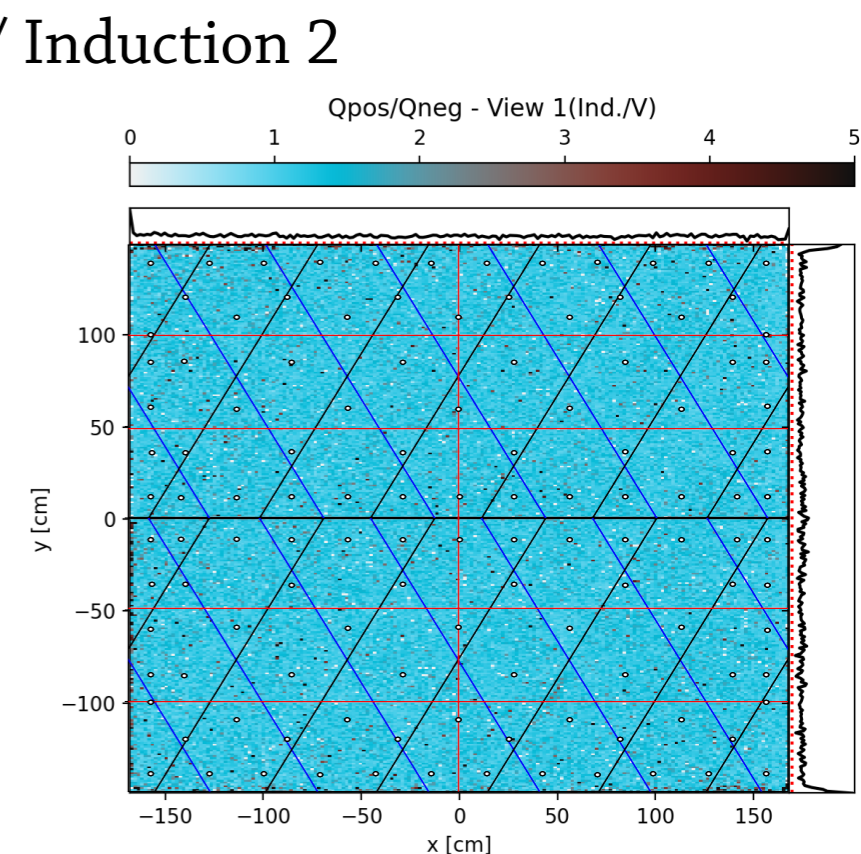
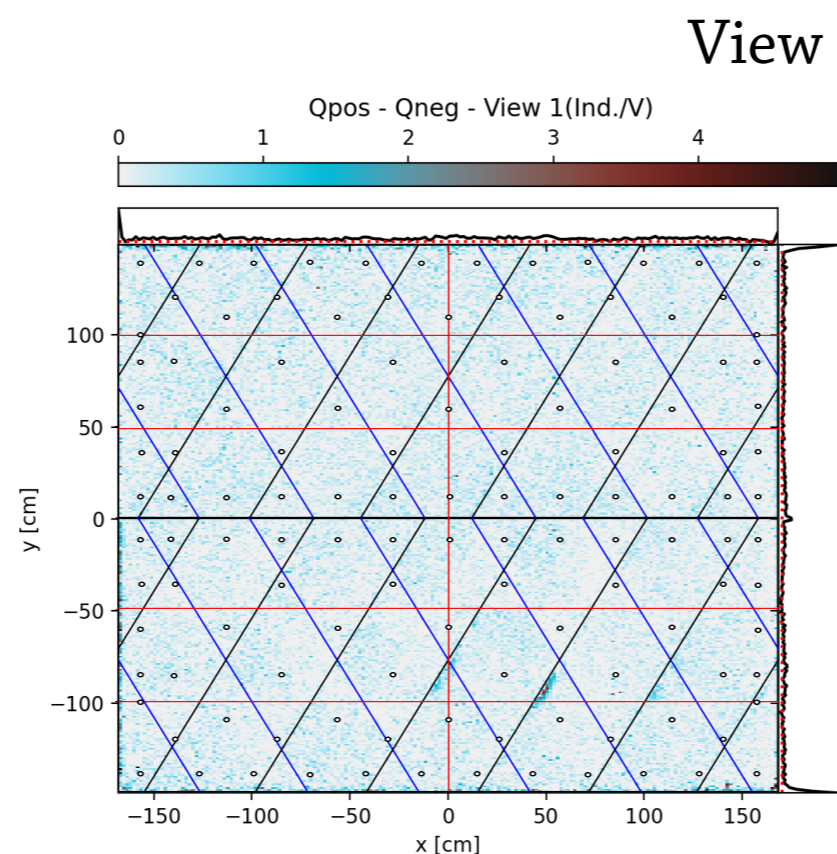
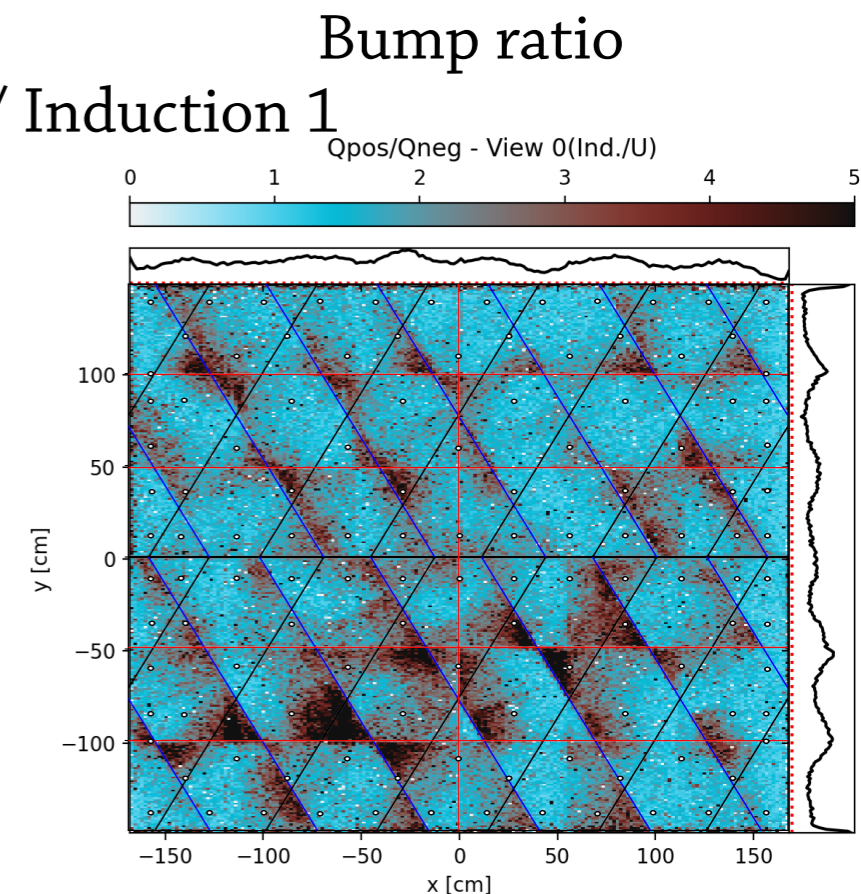
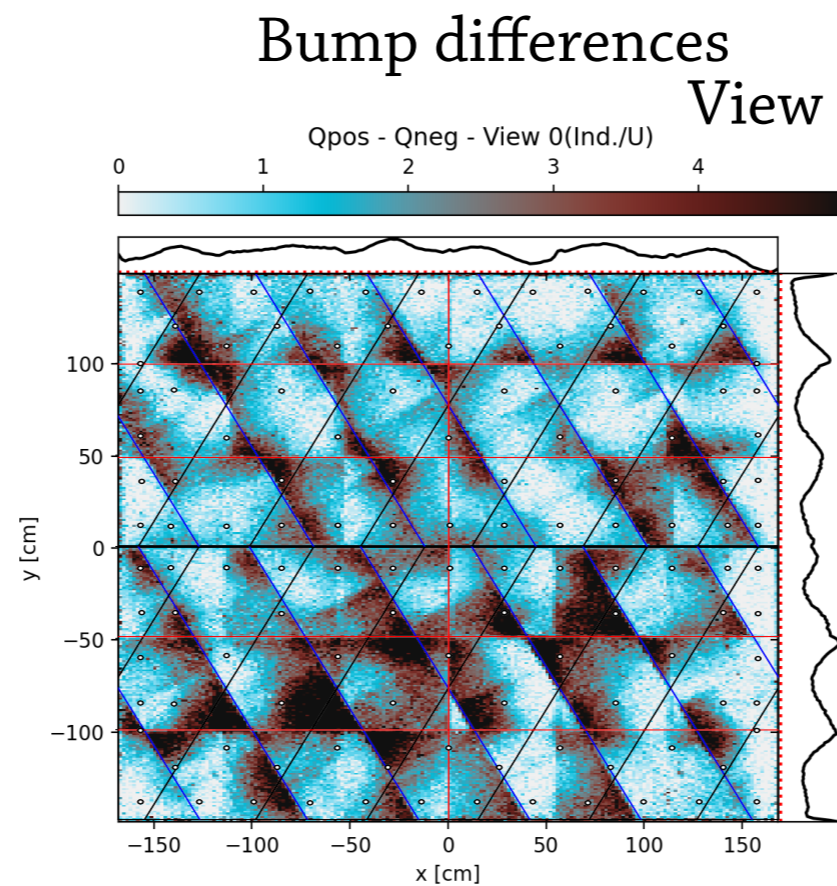
Pattern structure

CRP6 - III Run 24727

Using 'bipolarness' of induction hits can help to understand better the pattern structure

In view 0 / Induction 1, we can see the '50 cm' structure that Luis has found in his study with pictures

In View 1 / Induction 2, three small spots appeared on the Jura/B side, located along junctions of panels

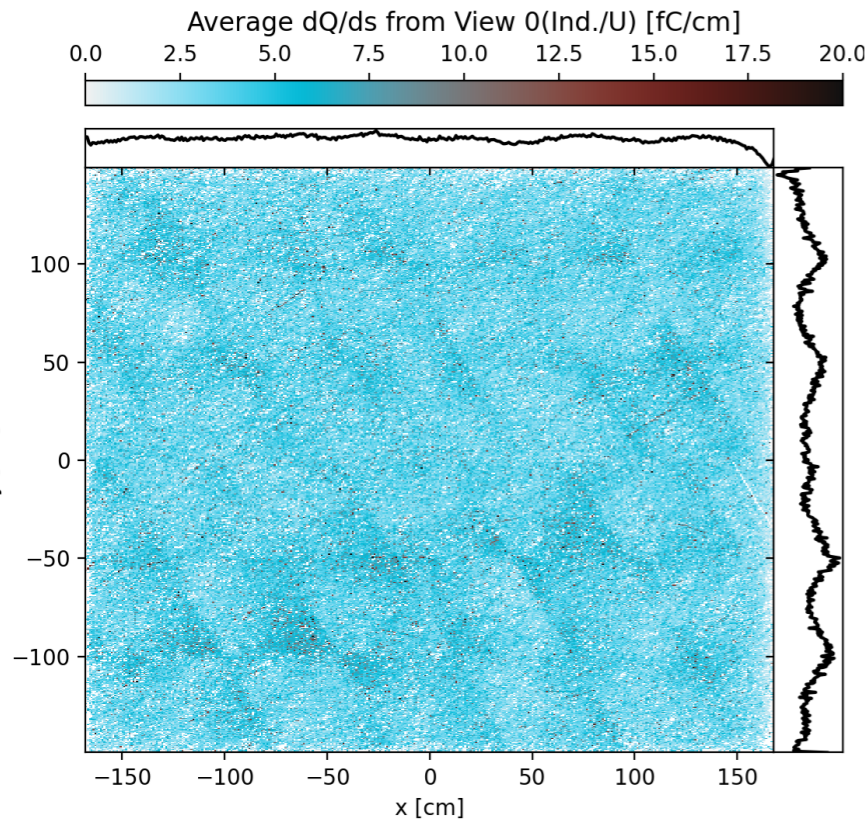


Transparency

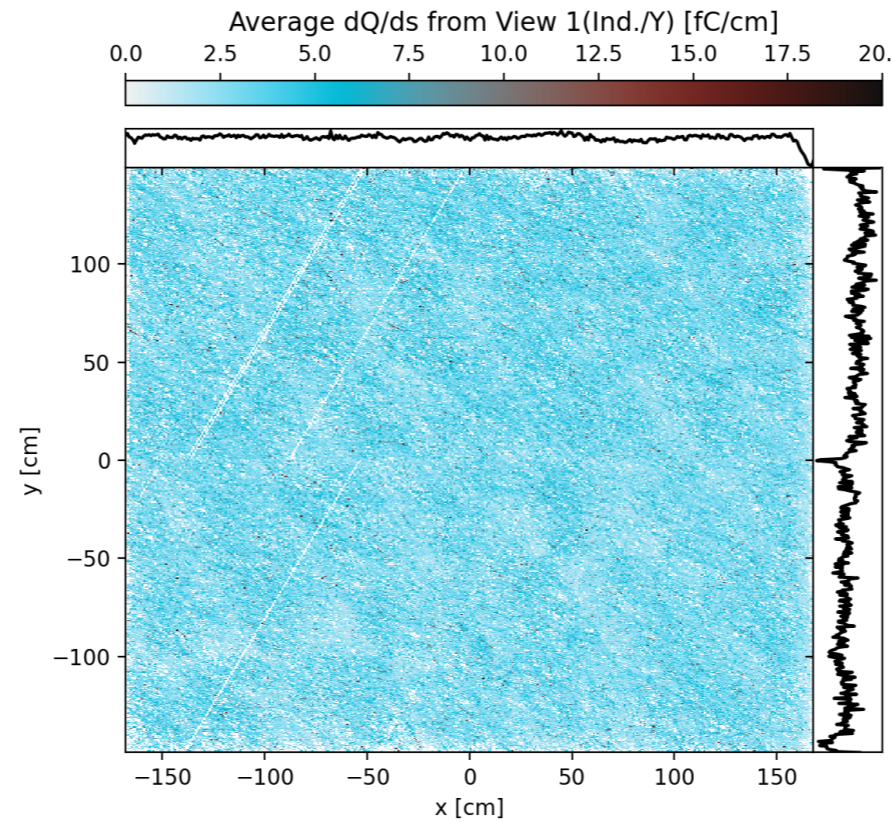
CRP6-III run 24727 ; HV biases : -1.5 / -0.5 / 1.0 kV [Nominal]

NB : $Q_{\text{ind}} = Q_{\text{pos}}$

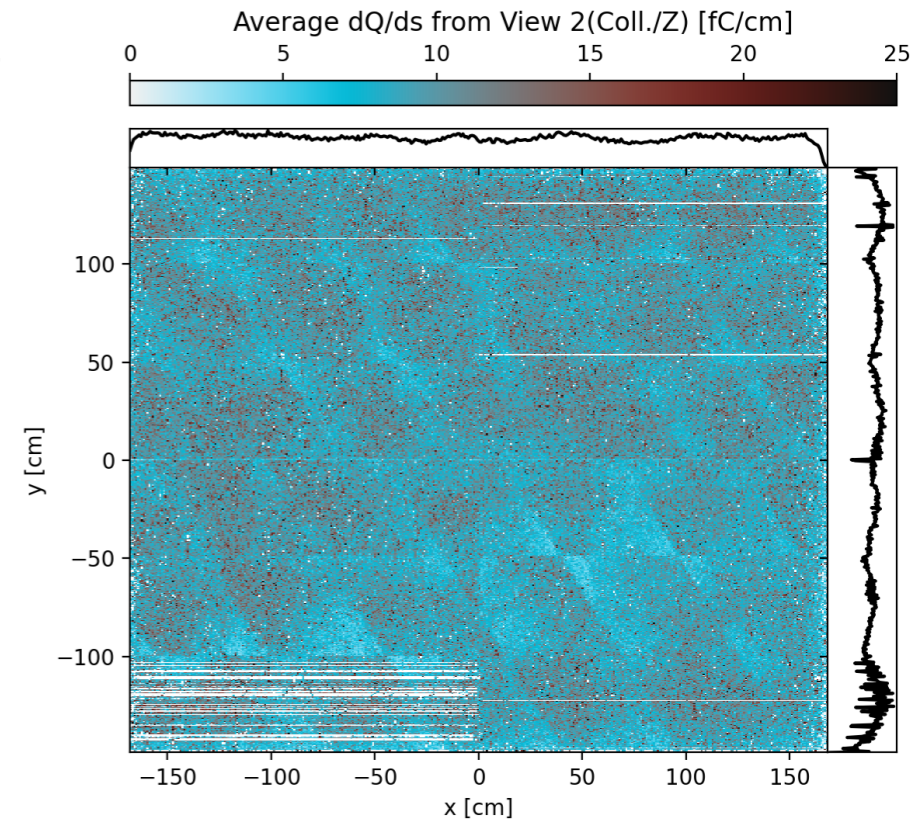
View 0



View 1



View 2



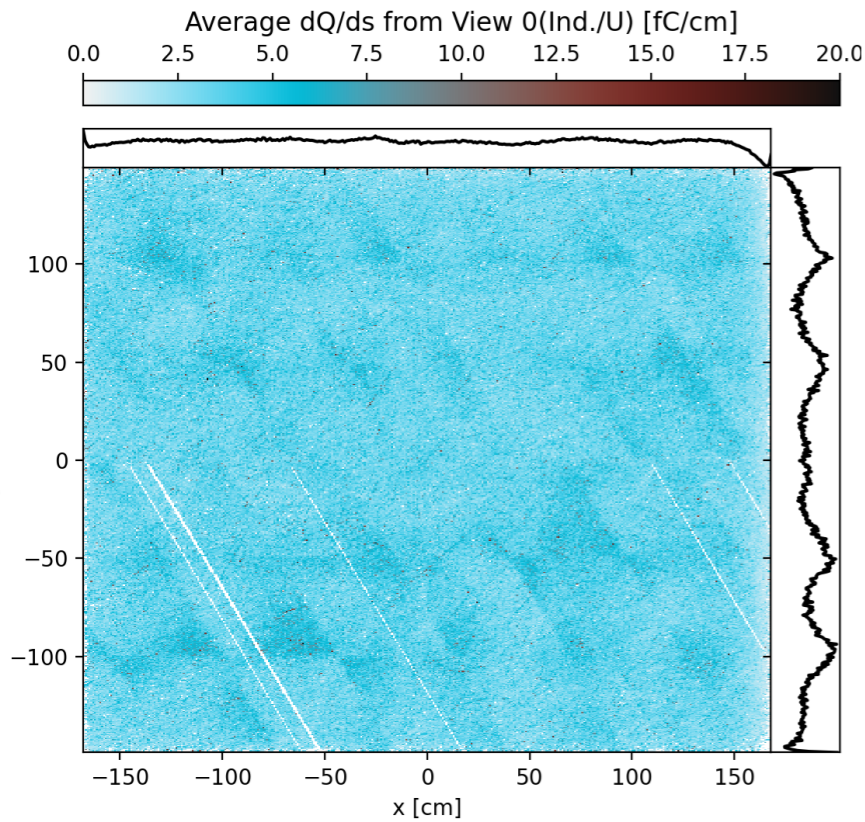
-> Very similar results as in the previous runs

Transparency

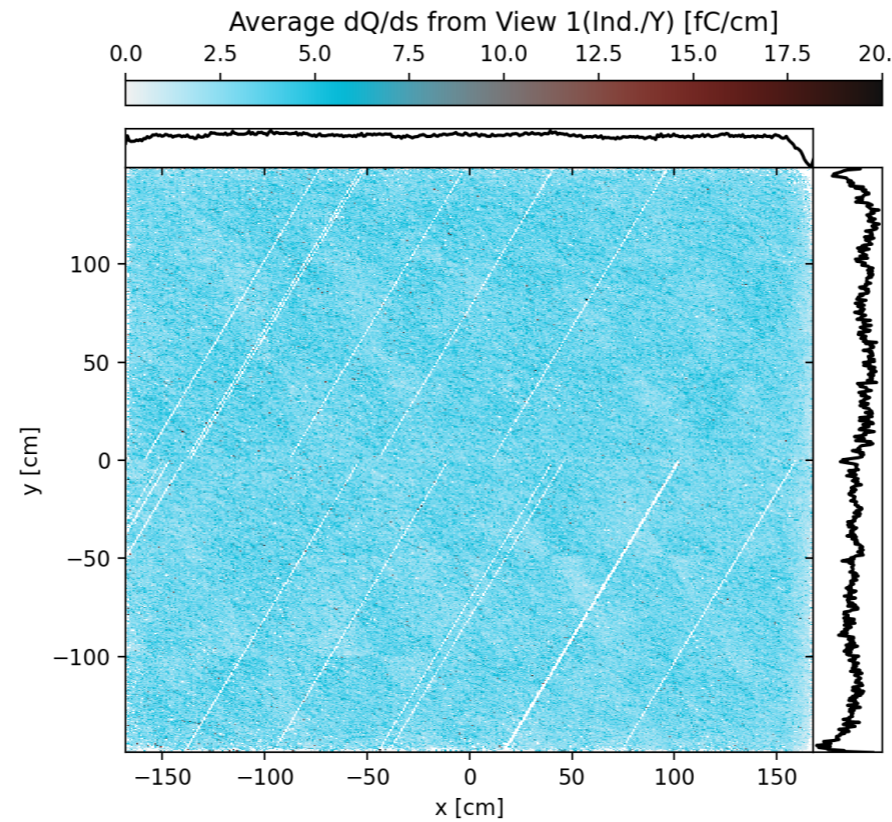
CRP6-III run 24731 ; HV biases : -1.6 / -0.6 / 1.0 kV

NB : $Q_{\text{ind}} = Q_{\text{pos}}$

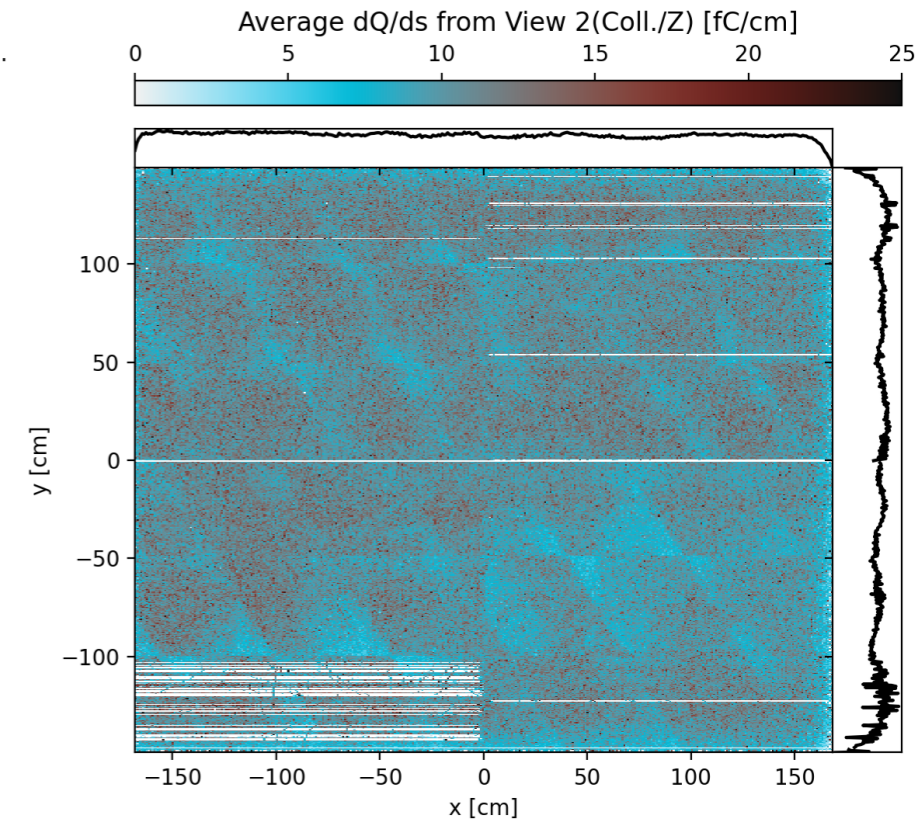
View 0



View 1



View 2



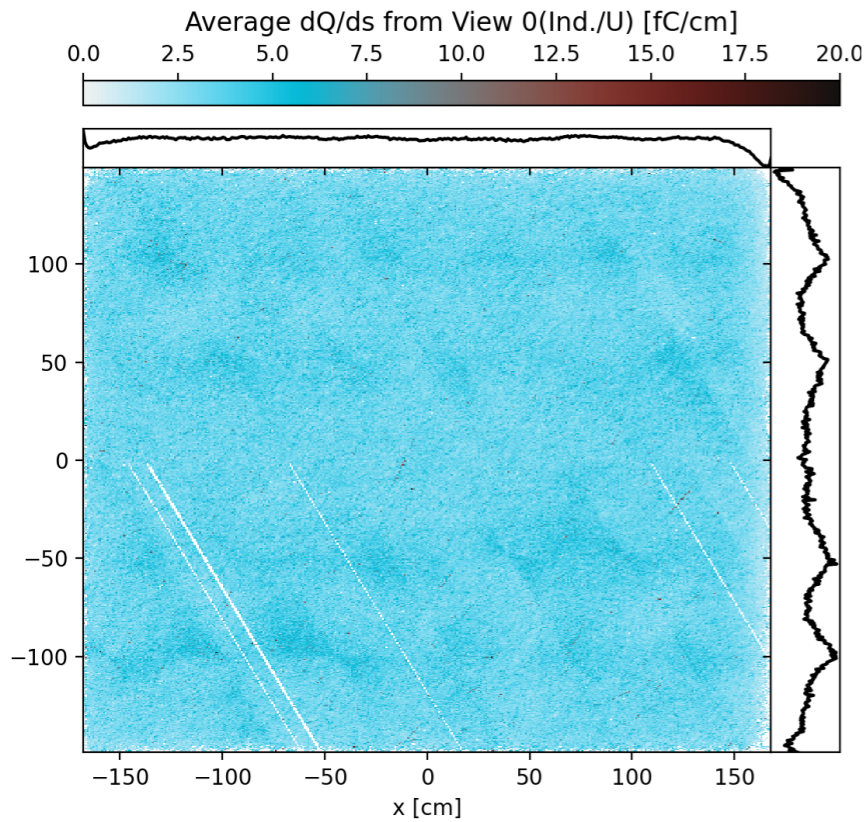
-> At $\Delta V_{\text{gap}} = 600$ V, little to no changes in the pattern wrt nominal

Transparency

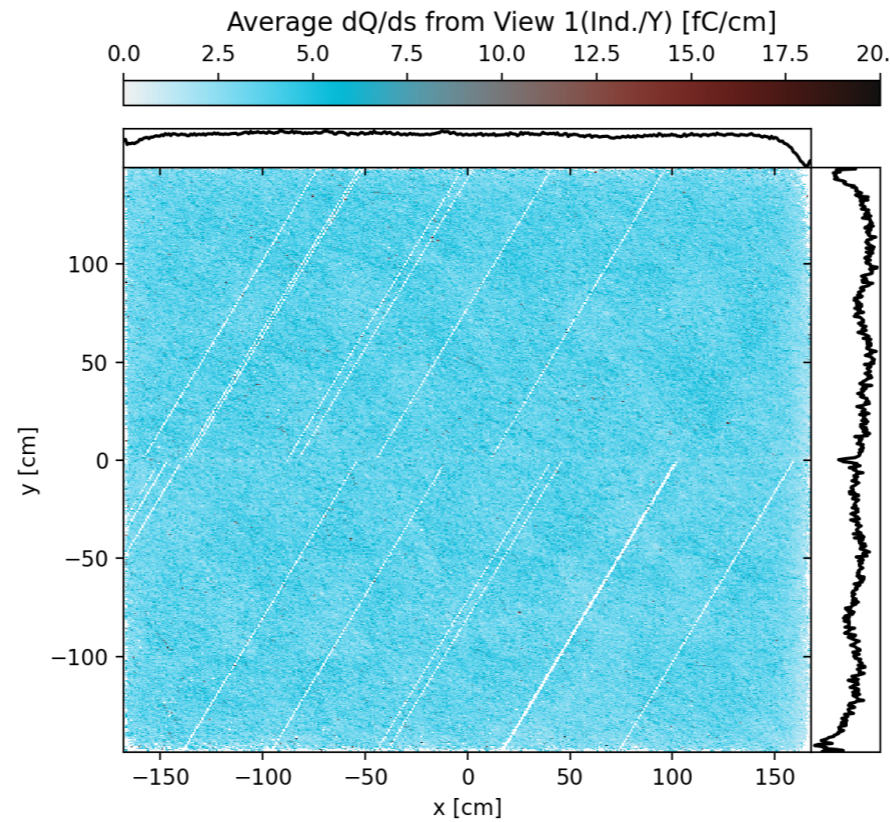
CRP6-III run 25066 ; HV biases : -1.7 / -0.7 / 1.0 kV [Nominal]

NB : $Q_{\text{ind}} = Q_{\text{pos}}$

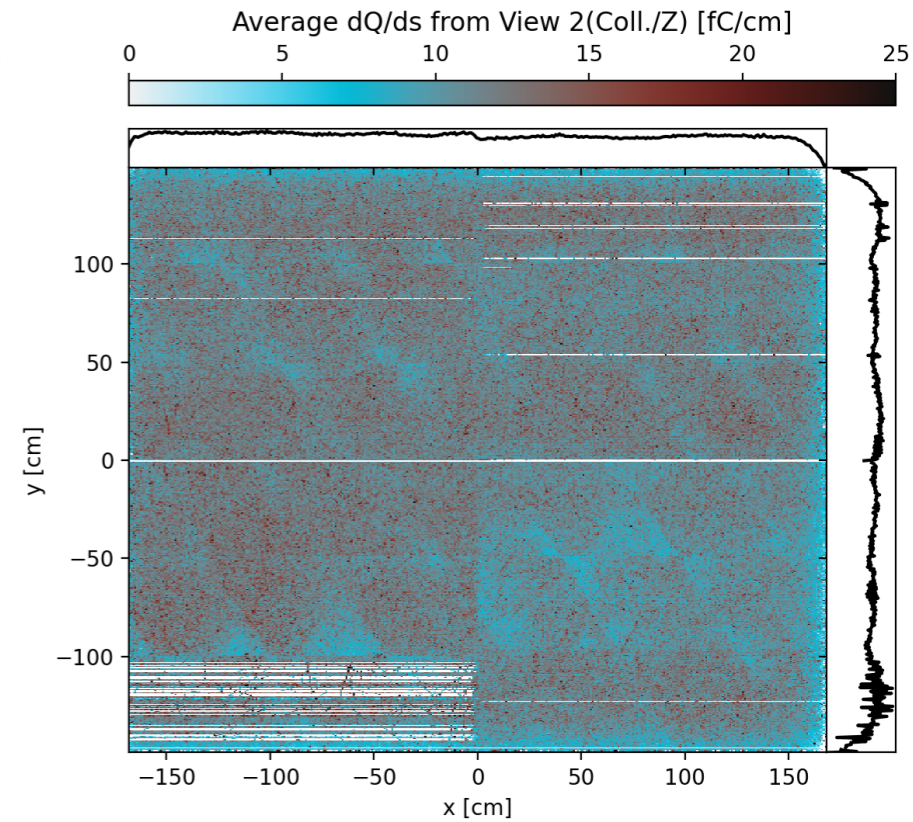
View 0



View 1



View 2



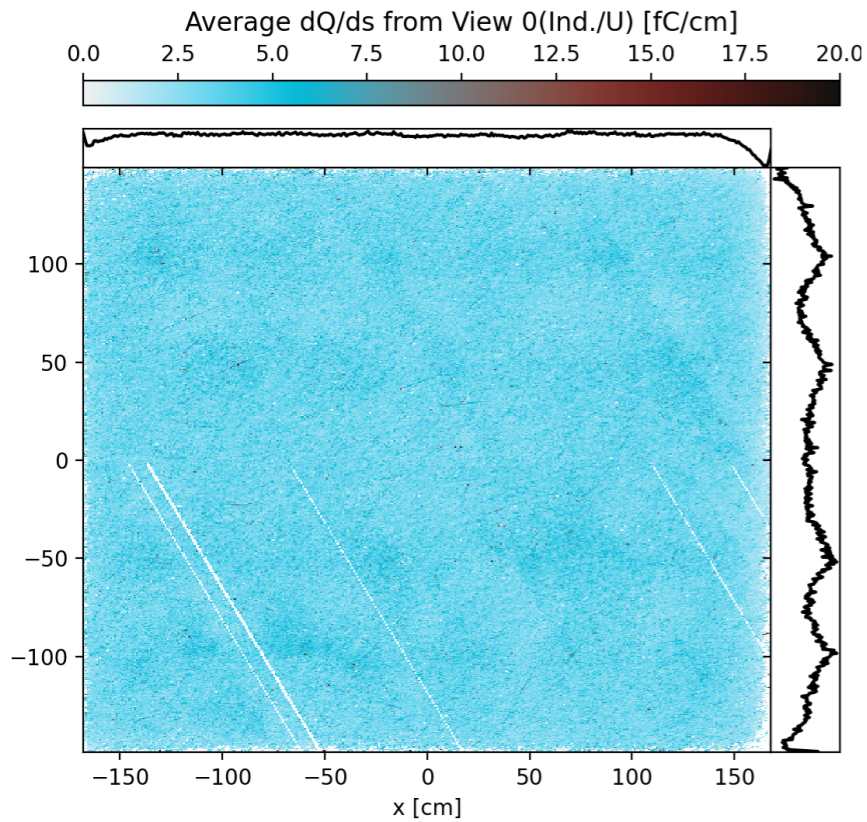
-> At $\Delta V_{\text{gap}} = 700$ V, the pattern starts to vanish

Transparency

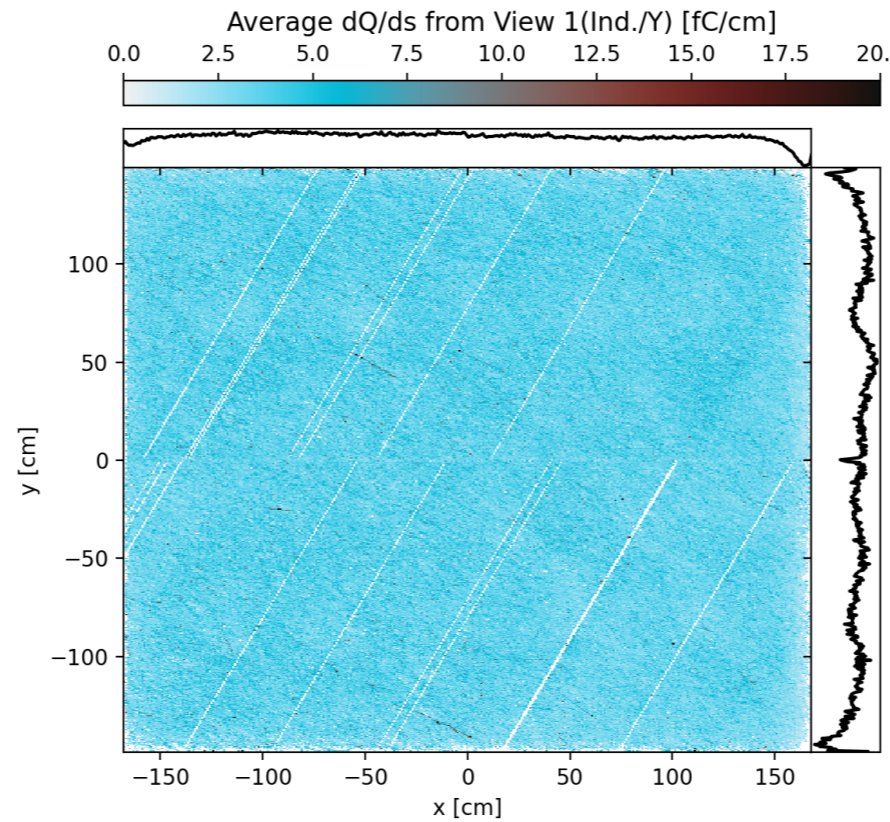
CRP6-III run 25078 ; HV biases : -1.8 / -0.8 / 1.0 kV [Nominal]

NB : $Q_{\text{ind}} = Q_{\text{pos}}$

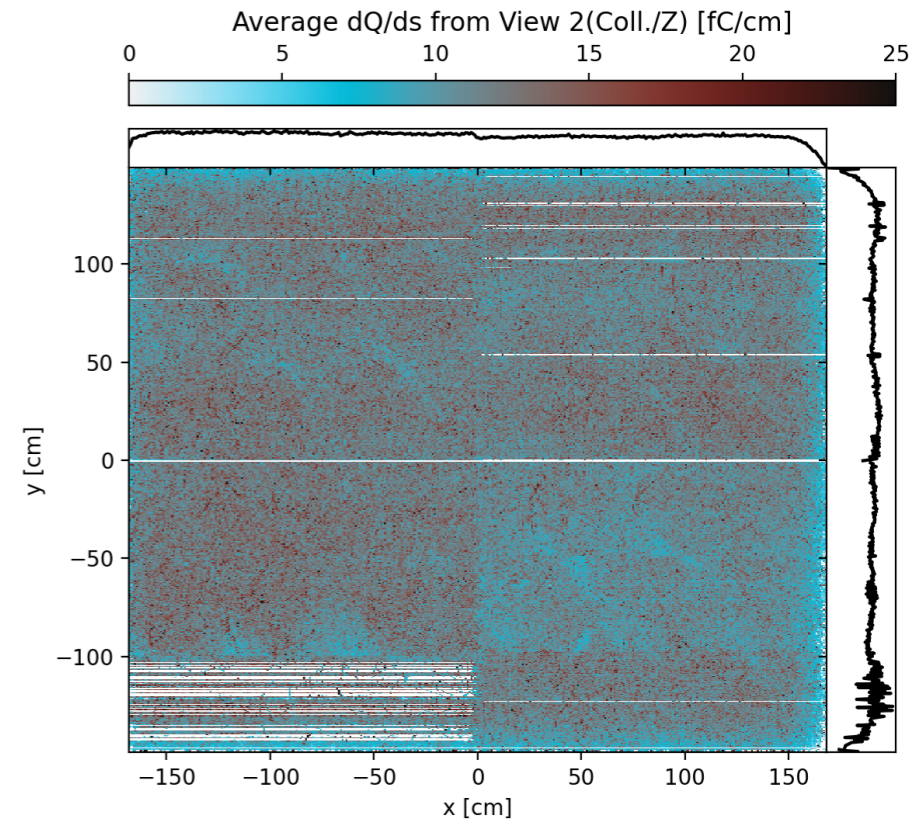
View 0



View 1



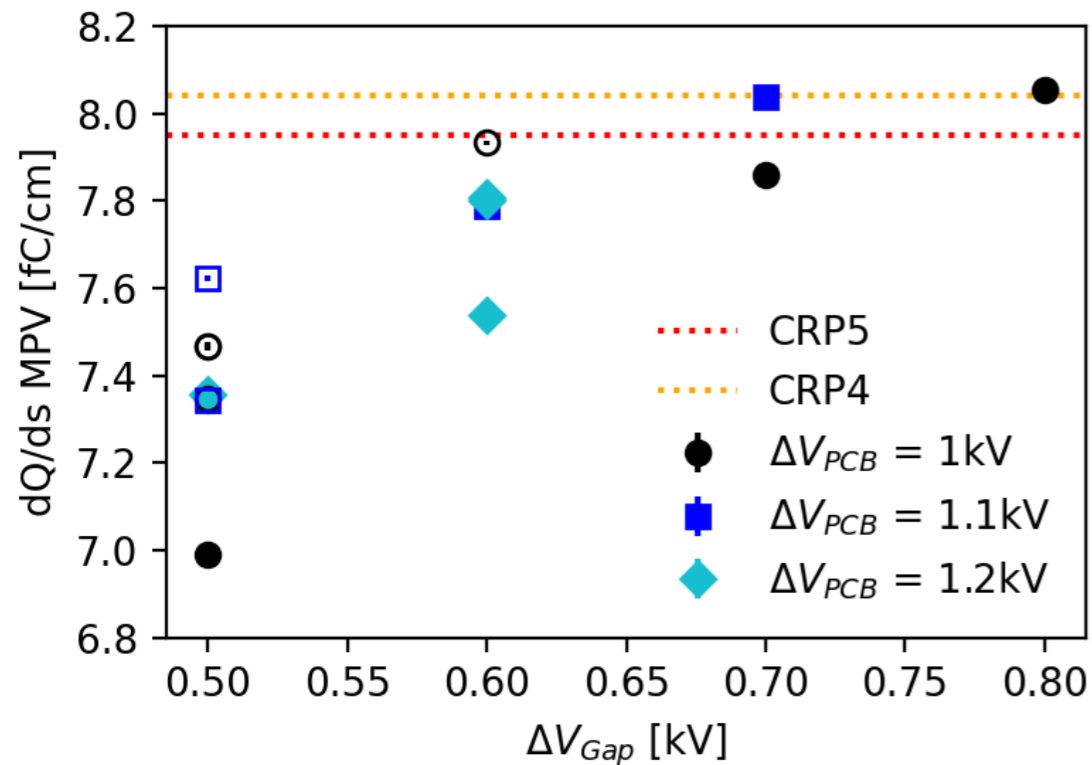
View 2



-> With very high ΔV_{gap} , most of the pattern vanishes

Transparency evolution

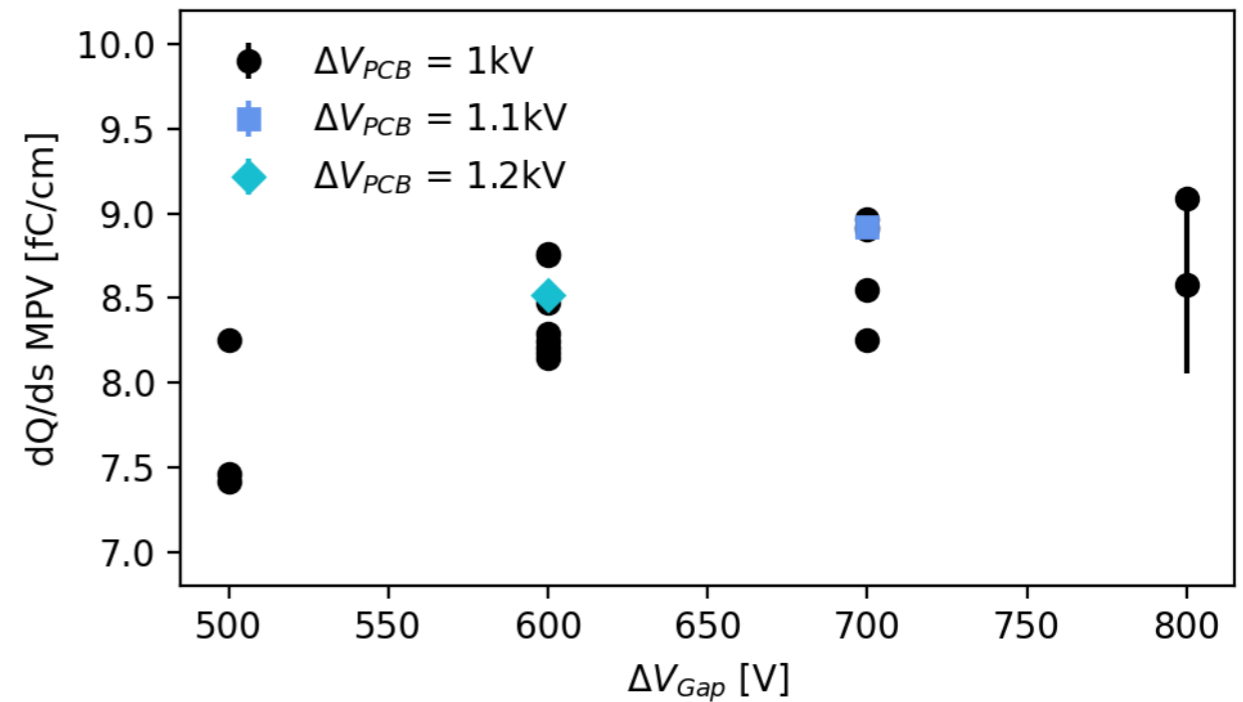
CRP6 -II



Please:

- don't mind the open markers
- note the change of scale

CRP6 -III

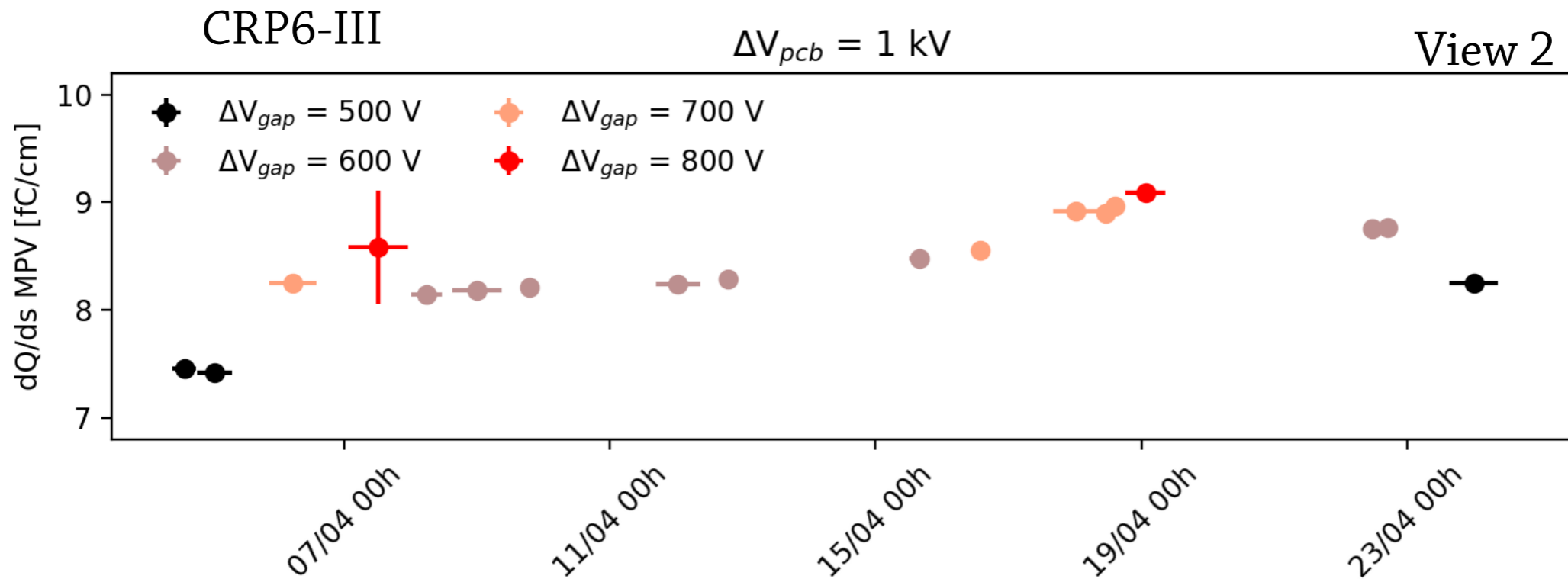


This time we focused our studies on $\Delta V_{pcb} = 1\text{ kV}$ and monitored the evolution with time at different ΔV_{gap} .

At $\Delta V_{gap} > 500\text{ V}$, it seems that we collect more charge than in CRP4&5:

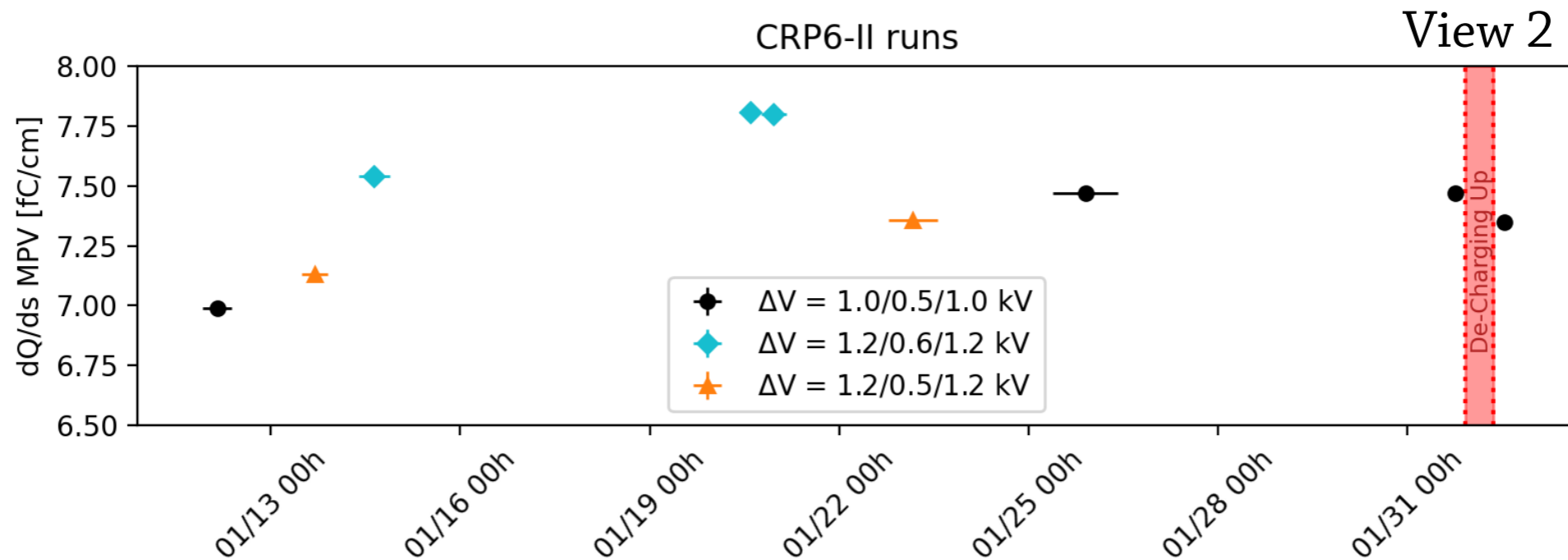
- > Nominal biases does not give full transparency ?
- > Electronic gain may have changed in CRP6-III (will do the calibration later)

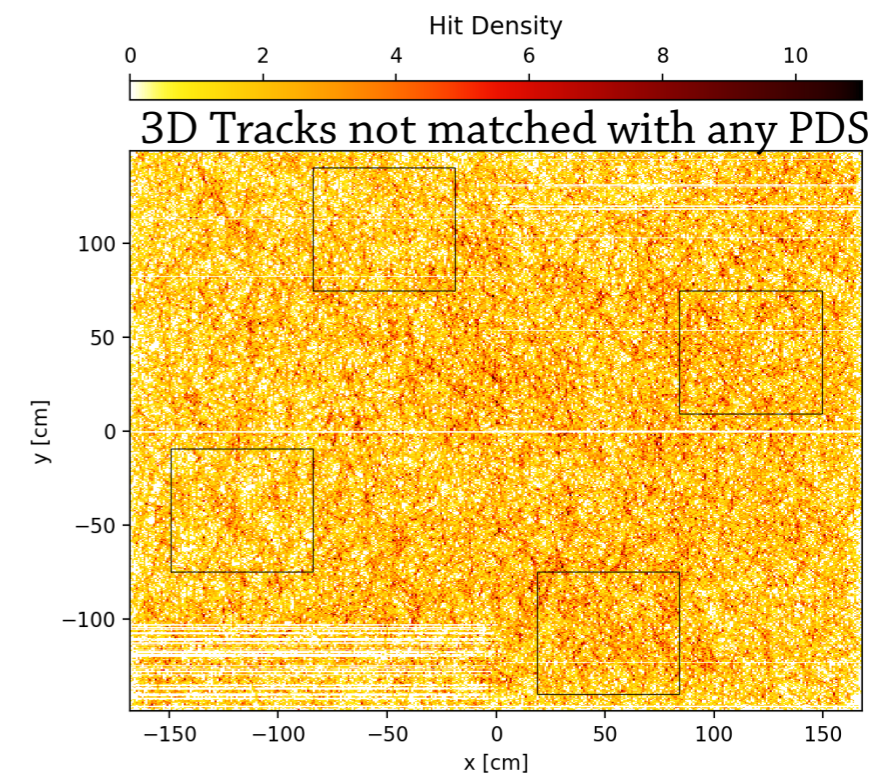
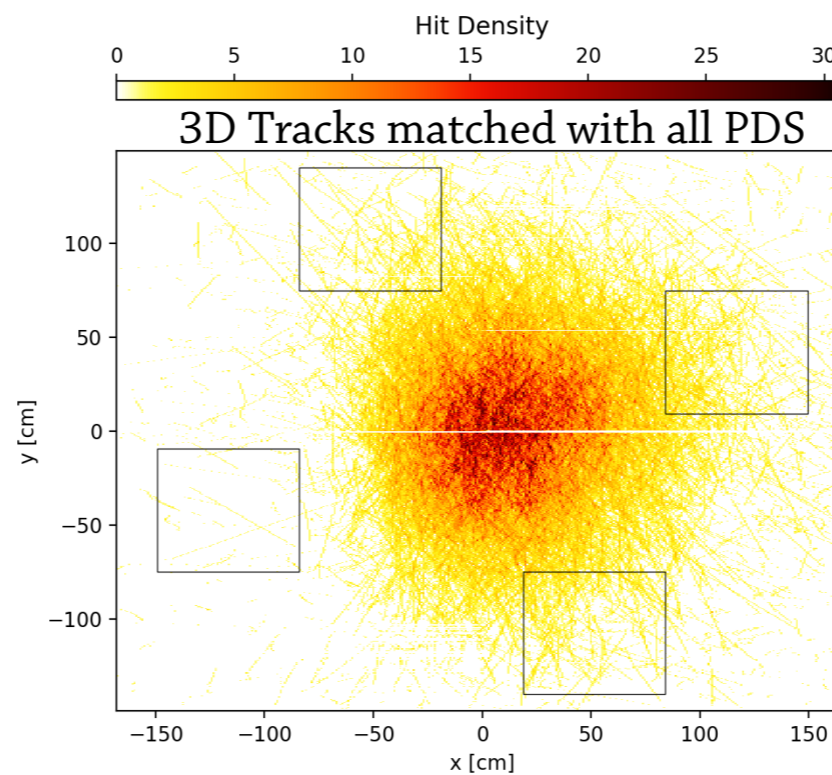
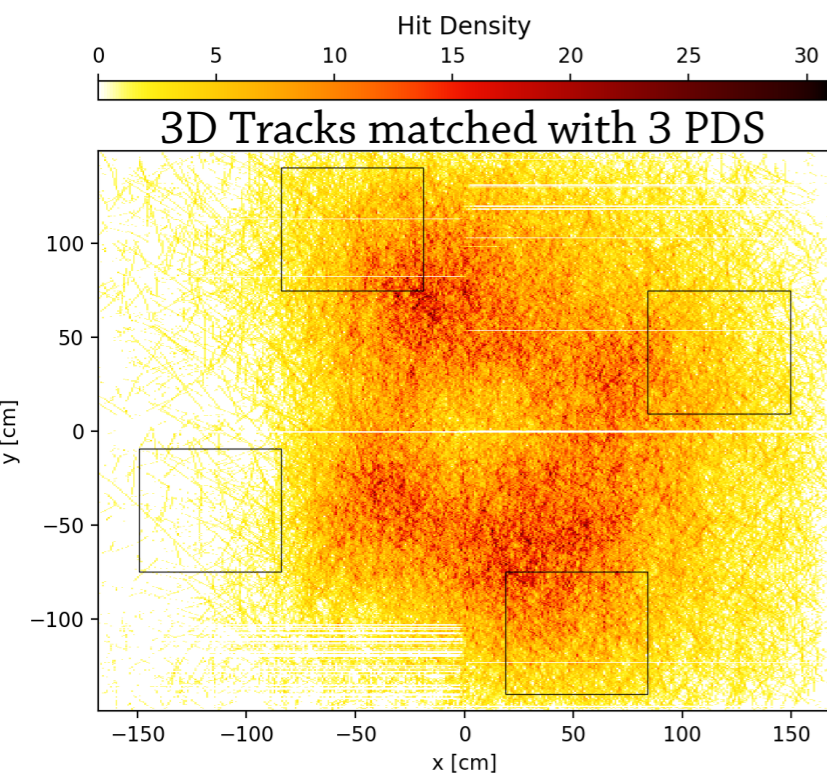
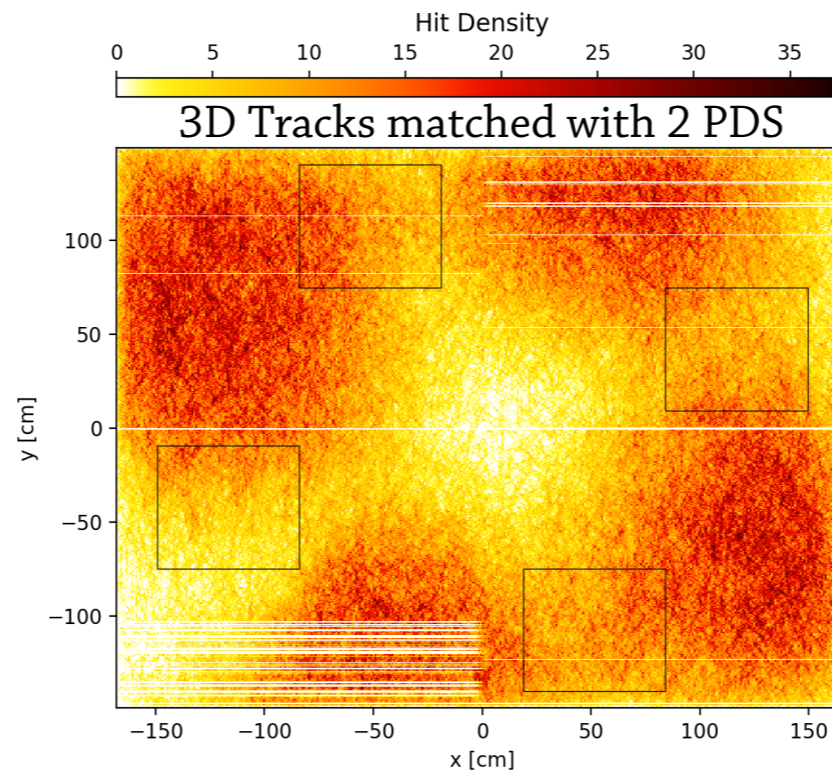
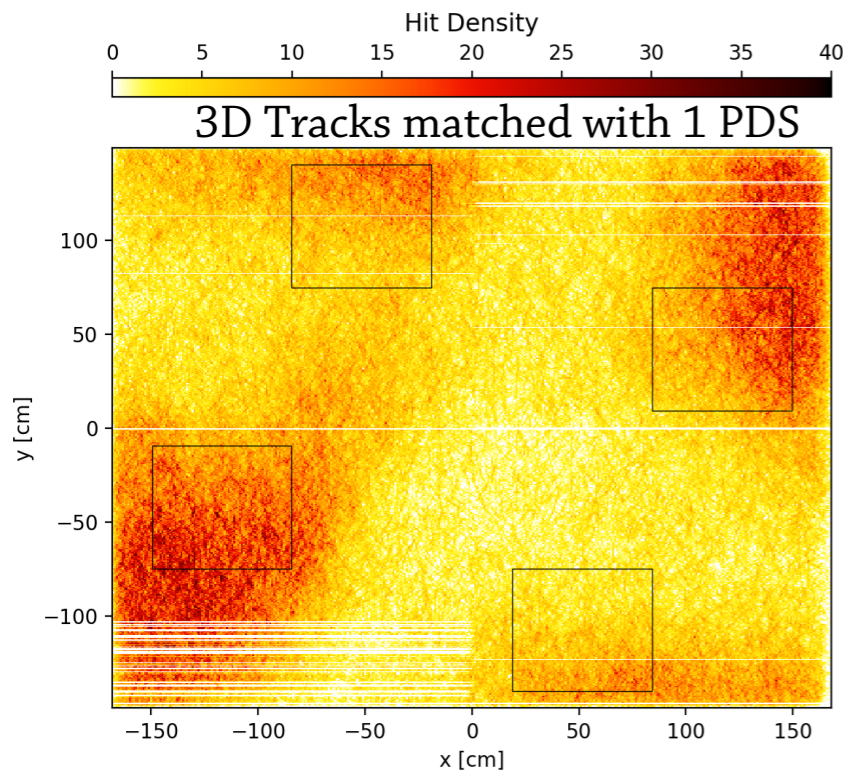
Transparency evolution with time



NB: a few runs are missing (reco ongoing)

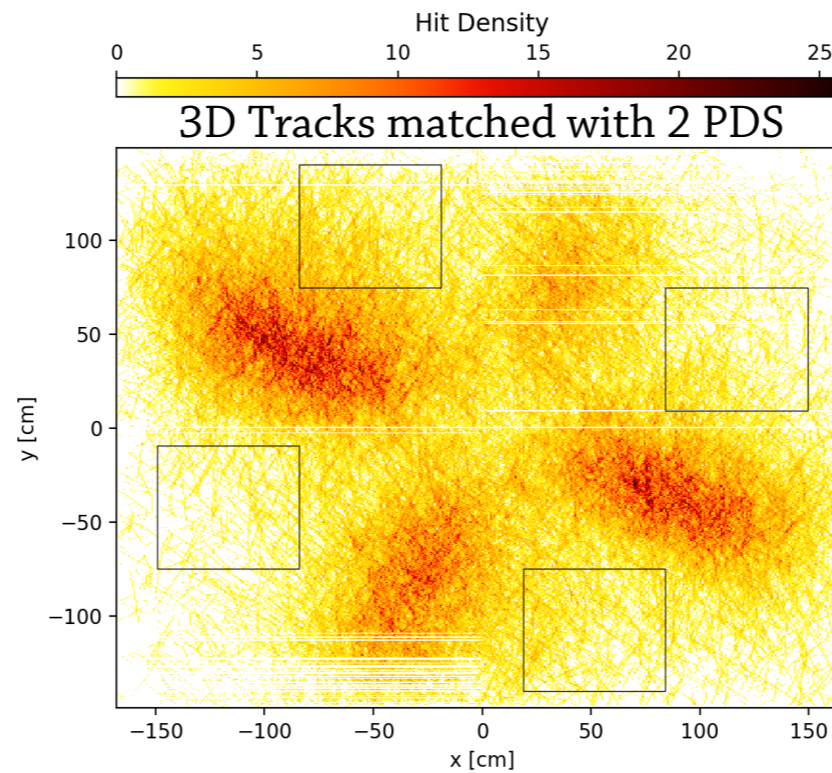
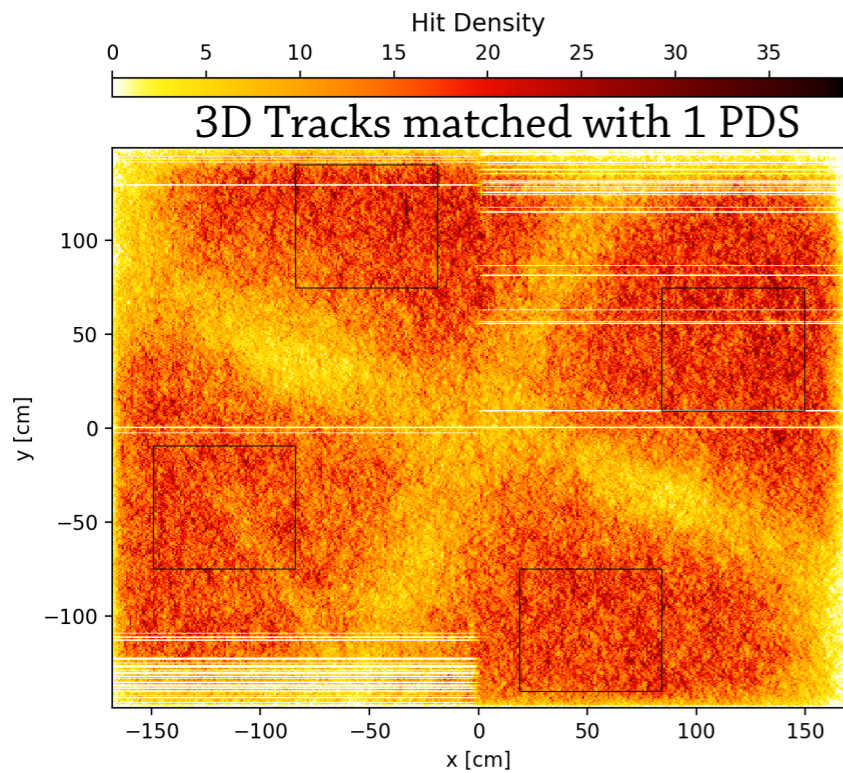
We observe a similar trend as in CRP6-II - could be some charging-up ?



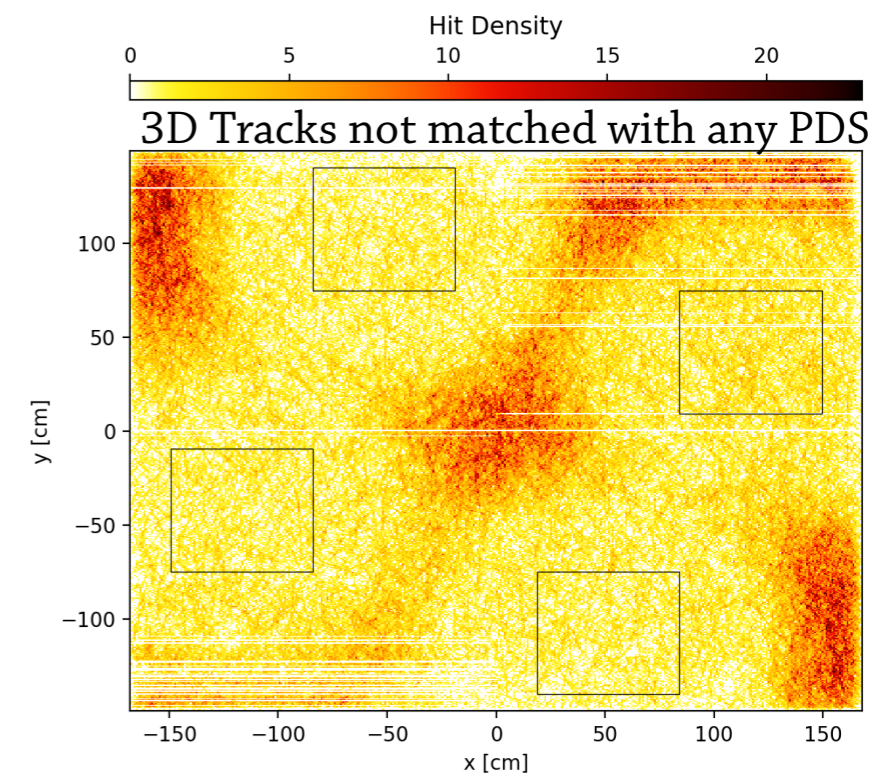
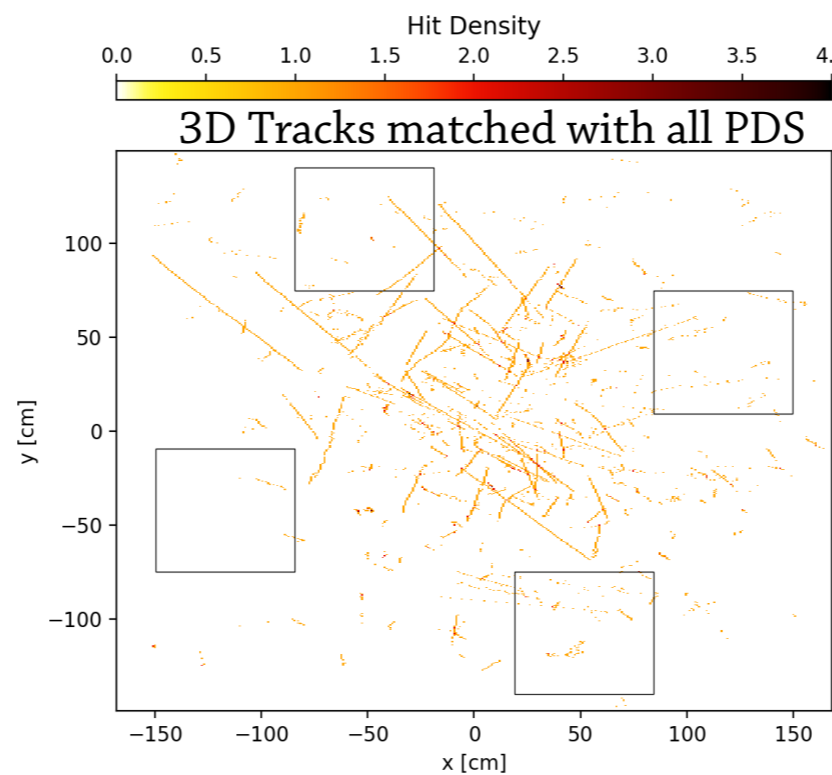
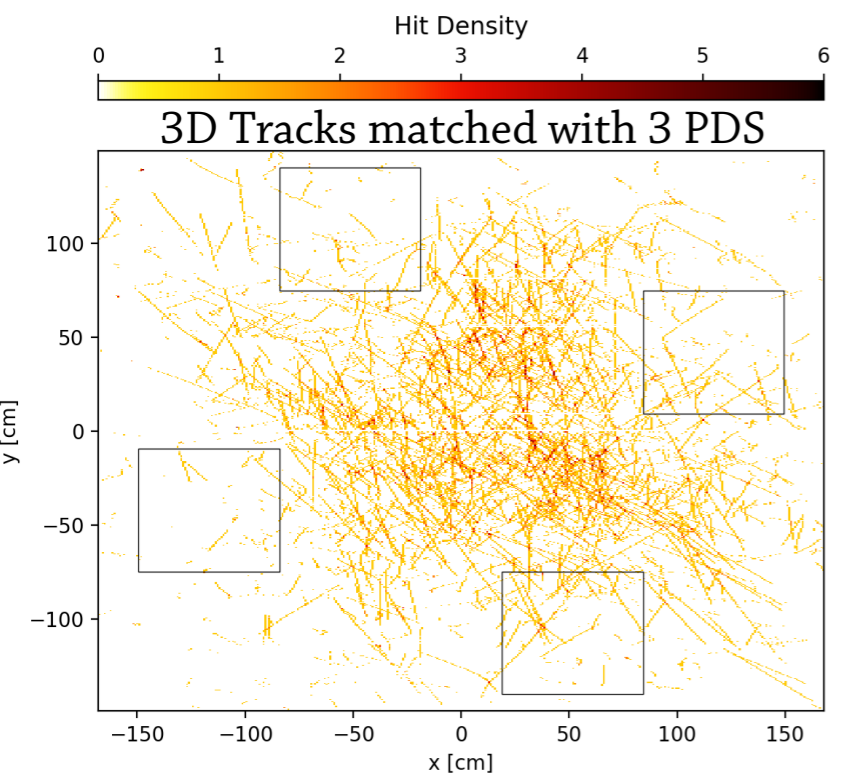


Preliminary results for track & light matching
-> Overall the PDS seems to see more light than in CRP6-II runs
-> Ongoing analysis for blip-light matching

NB : Only using cathode x-ARAPUCAs

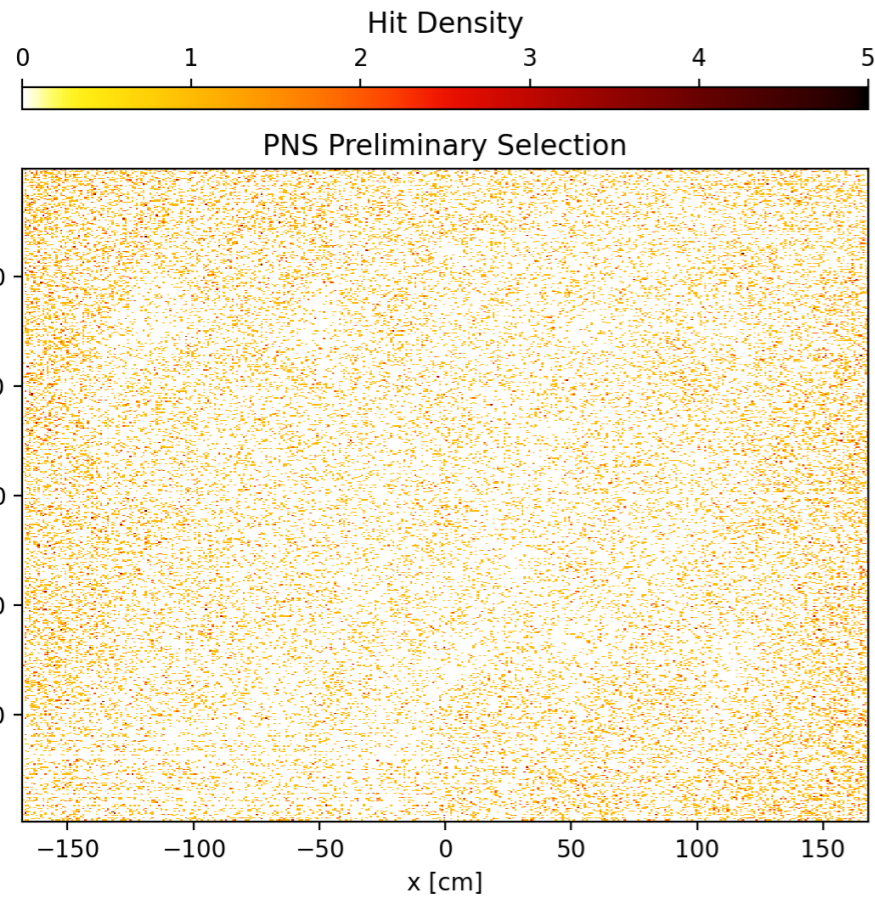


For comparison, same plots during CRP6-II operations
-> Most tracks was seen by only 1 PDS module

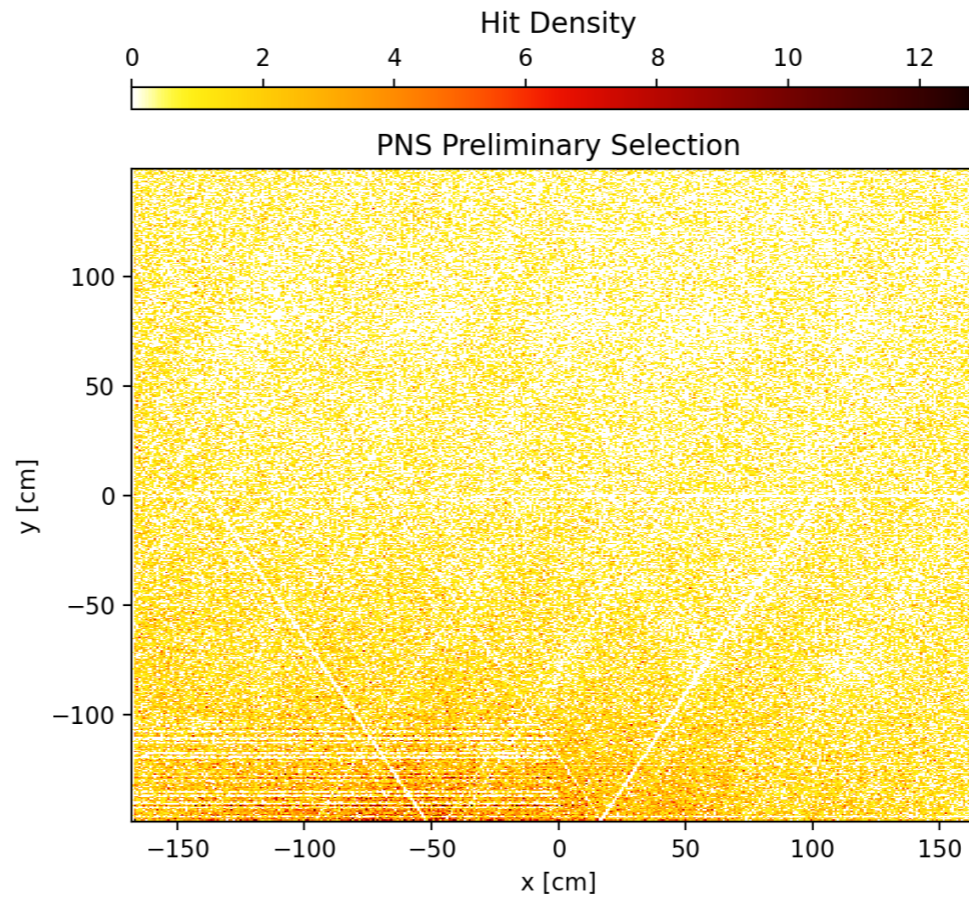


PNS runs

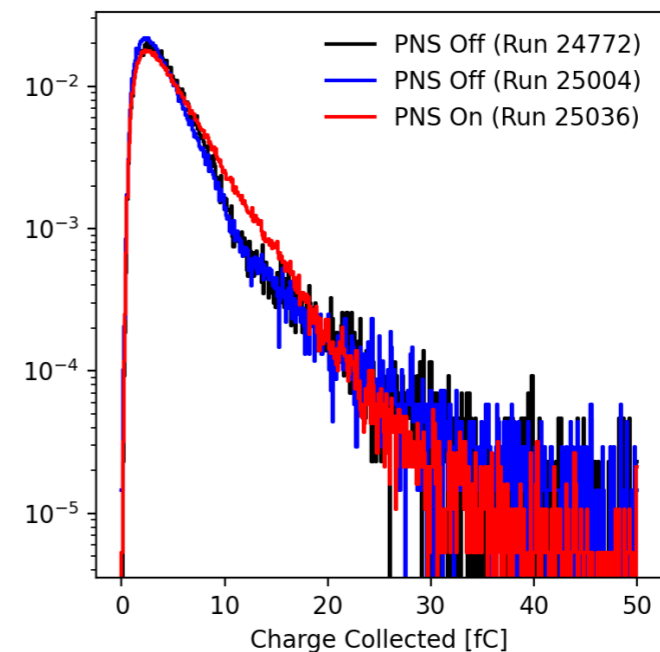
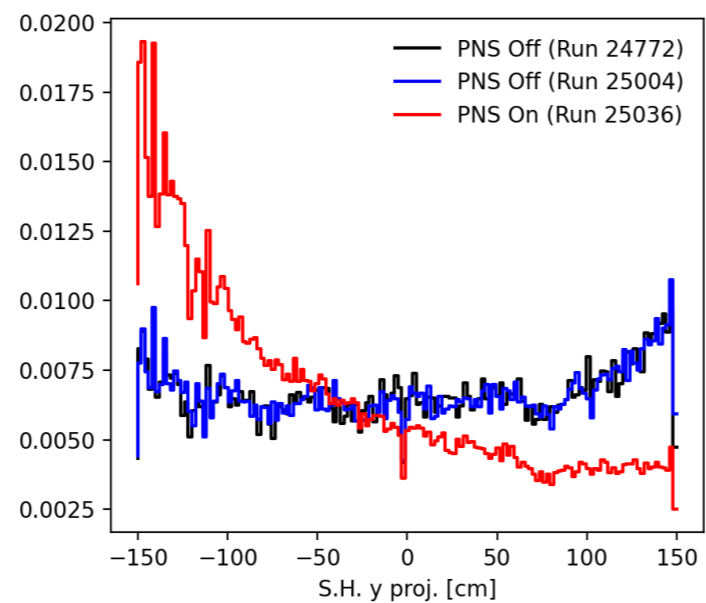
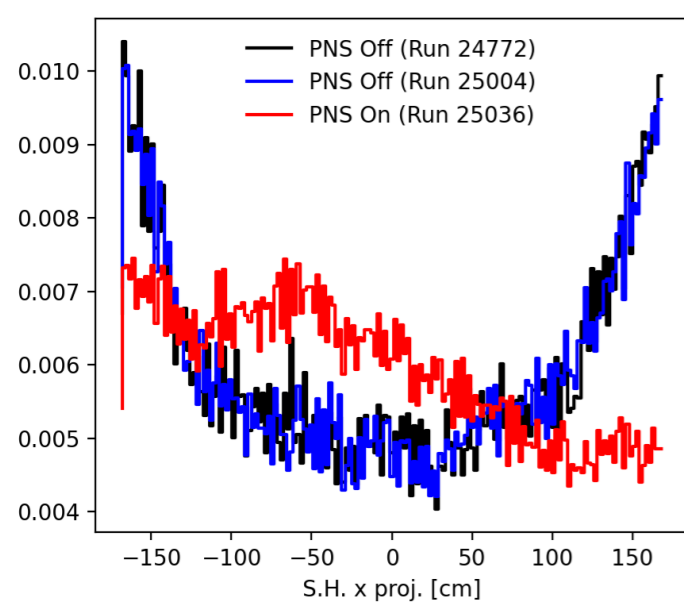
Run 24727 (PNS OFF)



Run 25036 (PNS ON)



Very preliminary
selection of PNS-like
(blips) events
-> Clear excess of blips
in the lower left side
of the CRP where the
PNS was installed



Conclusions

Preliminary analyses of CRP6:

- Noise improvements on Jura/A corner
- Still issues on Salève/B corner
- > Not necessary the same problematic channels as in CRP6-II run

About the pattern :

- Still visible (not a surprise)
- Less dramatic on the new anodes of Jura/A side with an improved assembly method
- Can 'cancel' most of the pattern structure with higher ΔV in the gap region
- Still observe a increase of the amount of charge collected with time
 - > Could be a charging-up effect

Lots of new data with charge, light and PNS to analyse !

Physics runs with TPC

run	N files	shield	Induction 1	Collection
24725	32	-1.5	-0.5	1
24727	473	-1.5	-0.5	1
24729	631	-1.7	-0.7	1
24730	809	-1.8	-0.8	1
24731	409	-1.6	-0.6	1
24735	675	-1.6	-0.6	1
24772	153	-1.6	-0.6	1
24776	457	-1.6	-0.6	1
24793	83	-1.6	-0.6	1
24836	51	-1.6	-0.6	1
24944	80	-1.6	-0.6	1
24986	596	-1.6	-0.6	1
25000	148	-1.6	-0.6	1
25004	372	-1.6	-0.6	1
25036	214	-1.6	-0.6	1
25066	696	-1.7	-0.7	1
25068	163	-1.7	-0.7	1
25071	115	-1.7	-0.7	1
25078	610	-1.8	-0.8	1
25083	590	-1.8	-0.7	1.1
25084	396	-1.8	-0.7	1.1
25086	1085	-1.8	-0.6	1.2
25088	148	-1.6	-0.6	1
25093	263	-1.6	-0.6	1
25116	673	-1.5	-0.5	1