

# TIGER clusters analysis

Some hints from clusters with TIGER readout

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BES3 Italia Meeting

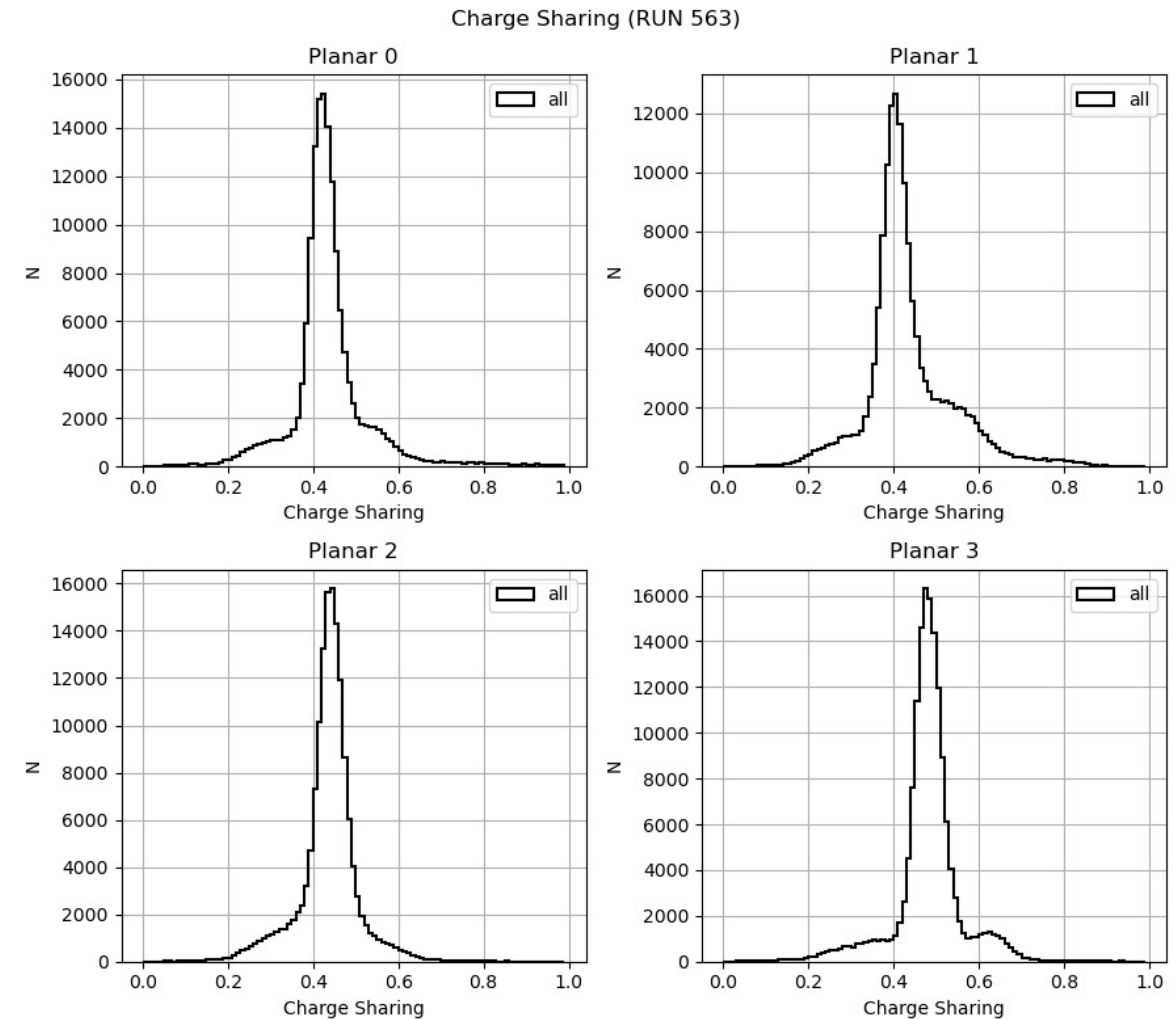
07.04.2022

# Motivations

$$cs = Q_x / (Q_x + Q_y)$$

- RUN 563: 825V, 0° (July 2021 test-beam)
- Starting from only efficient events, study effects causing bad **charge-sharing** (holes inside the cluster, cluster size = 1, etc.)
- Try to extend to inefficient events with similar cluster characteristics

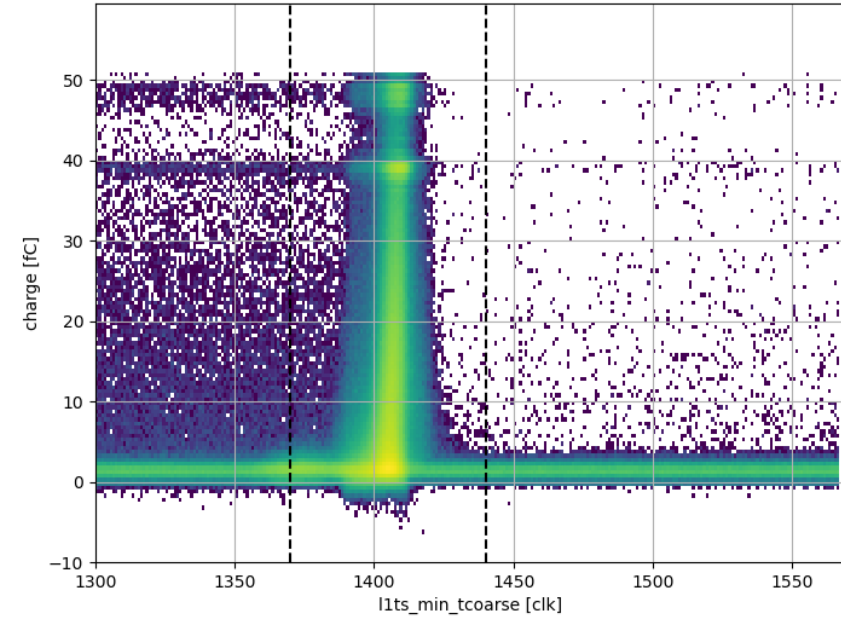
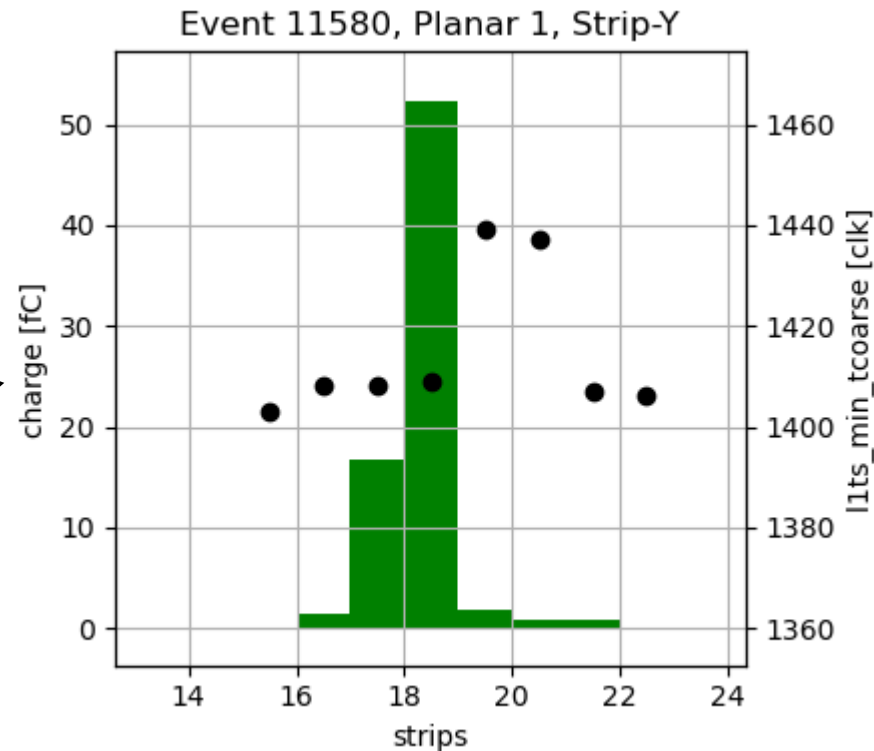
➤ Found possible reason for bad data-driven “time-walk” calibration curves



# Cluster display

Display charge and time of strips inside one cluster

Strip charge



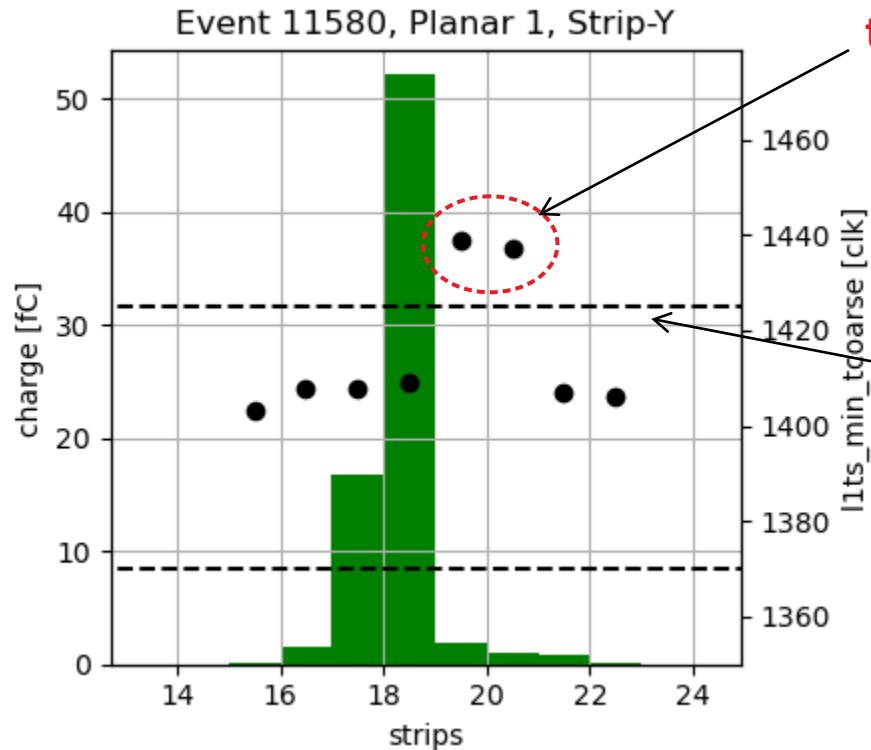
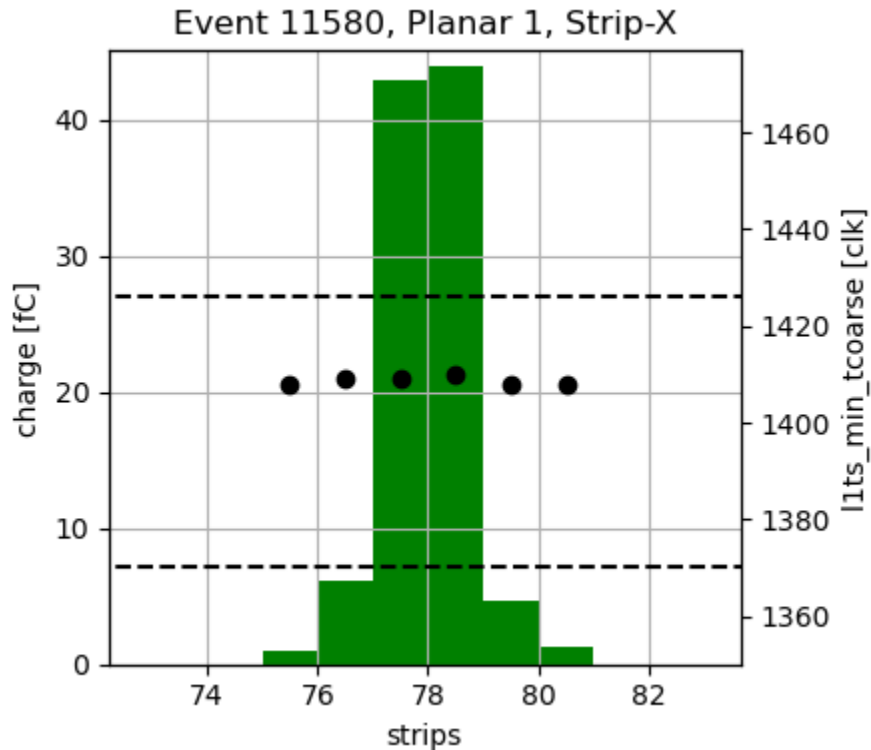
Strip time

- on-time hit (1370-1440)
- off-time hit (before signal: > 1440)
- off-time hit (after signal: < 1370)

# Off-time hit

on-time hit (1370-1440)  
off-time hit (before signal)  
off-time hit (after signal)  
missing strip

cs = 0.573841



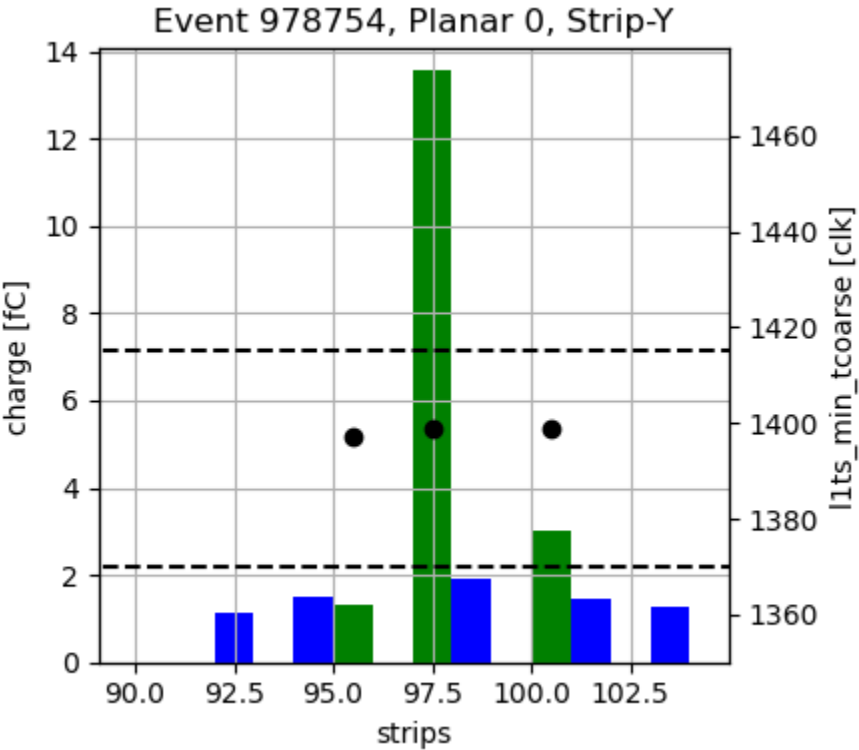
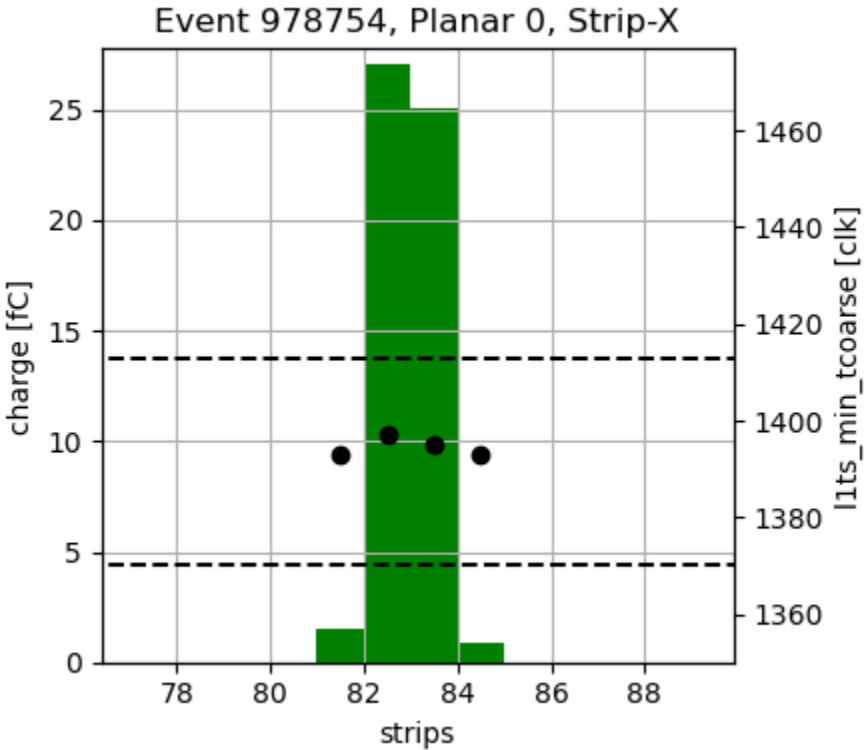
These 2 hits are still inside the signal time window but they arrive too early to be considered part of the real signal

l1ts\_min\_tcoarse of strips with high charge + 16 clk (cannot exceed signal time window [1440] and cannot be < 1420)

- This event is still efficient, but **time of strips 19-20 is taken as a good low-charge hit, while it's (likely) noise, and this affects "time-walk" data-driven calibration and also CC resolution**

# Missing hit

on-time hit (1370-1440)  
off-time hit (before signal)  
off-time hit (after signal)  
missing strip

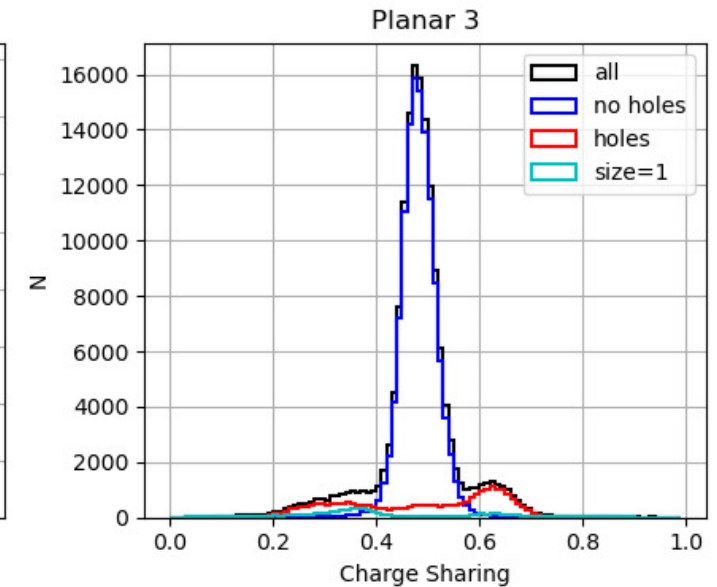
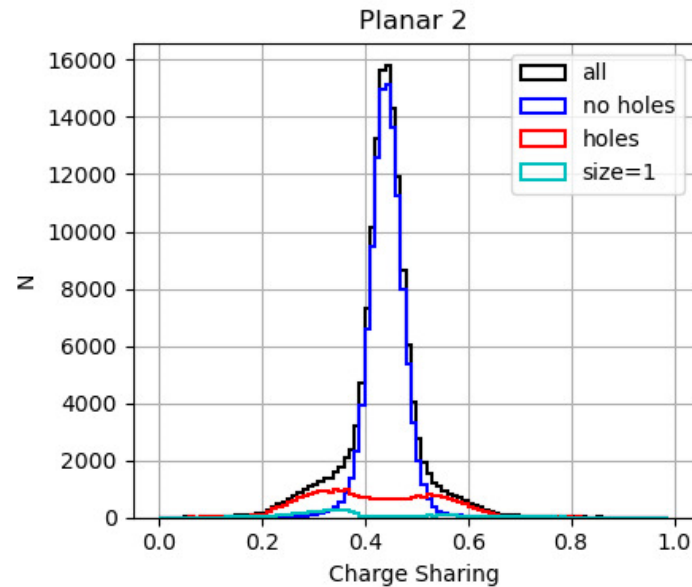
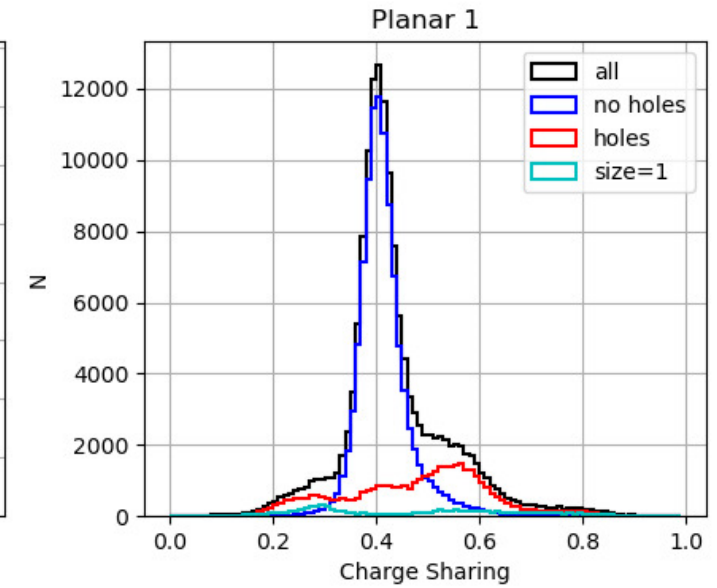
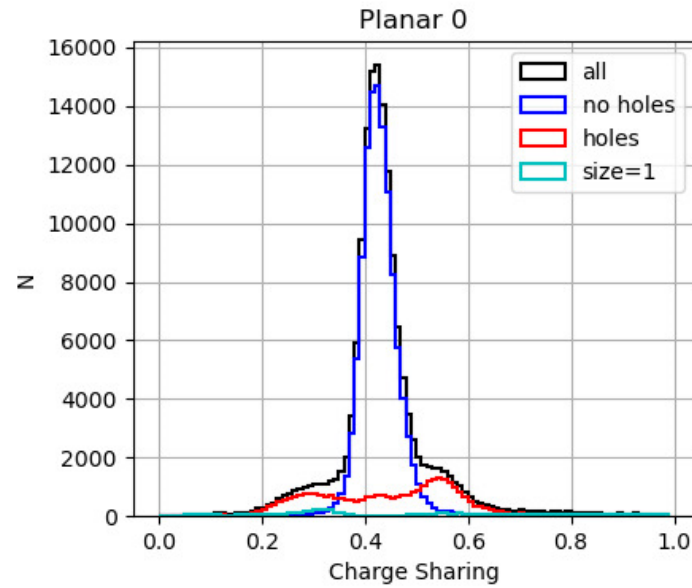


- Expected pos\_x = 6.38113 cm
- Cluster cc = 96.813156 strip OR 100 strip
- Reconstructed pos\_x = 6.29285514 cm OR 6.5 cm → efficiency not OK

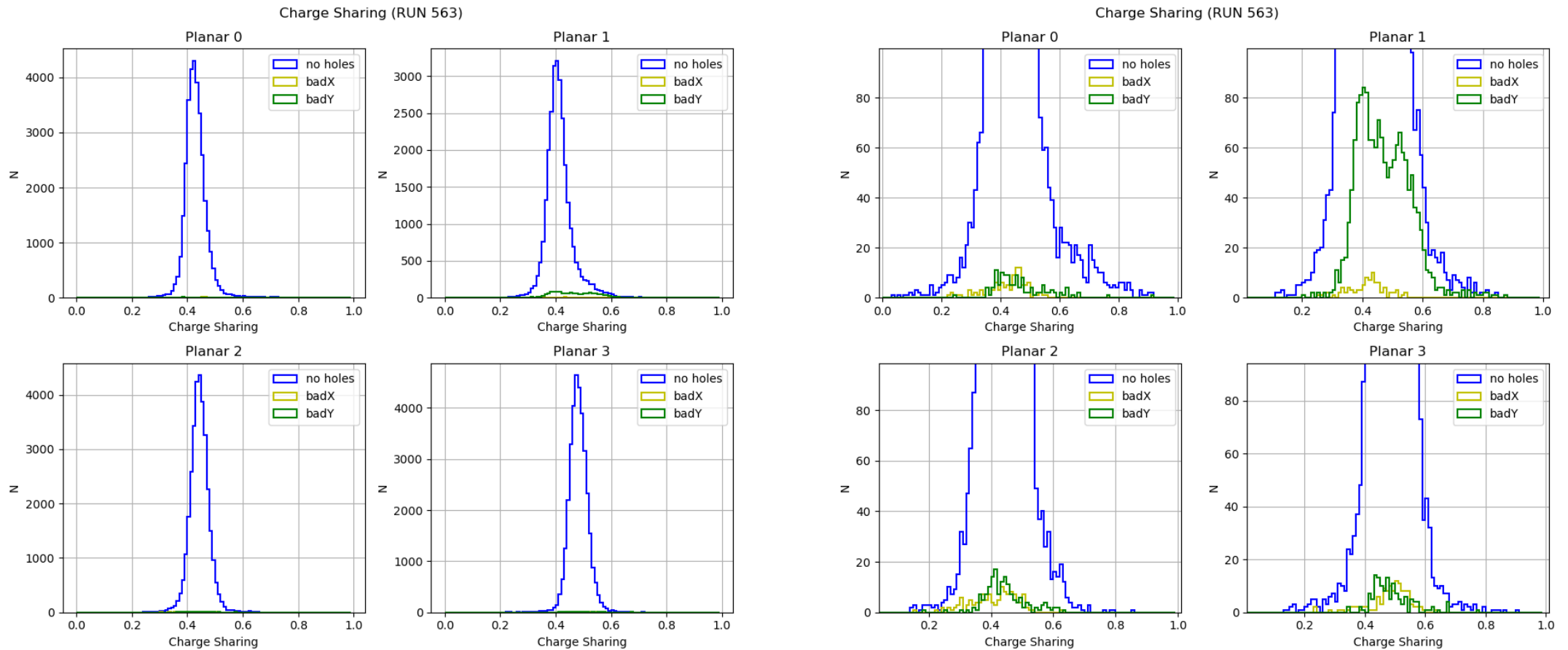
# Charge Sharing

- Tails in charge sharing distribution are mostly due to holes in the cluster
- Generally, holes are located more on the right of the peak due to larger cluster size of view Y

Charge Sharing (RUN 563)



# Charge Sharing (off-time hits)



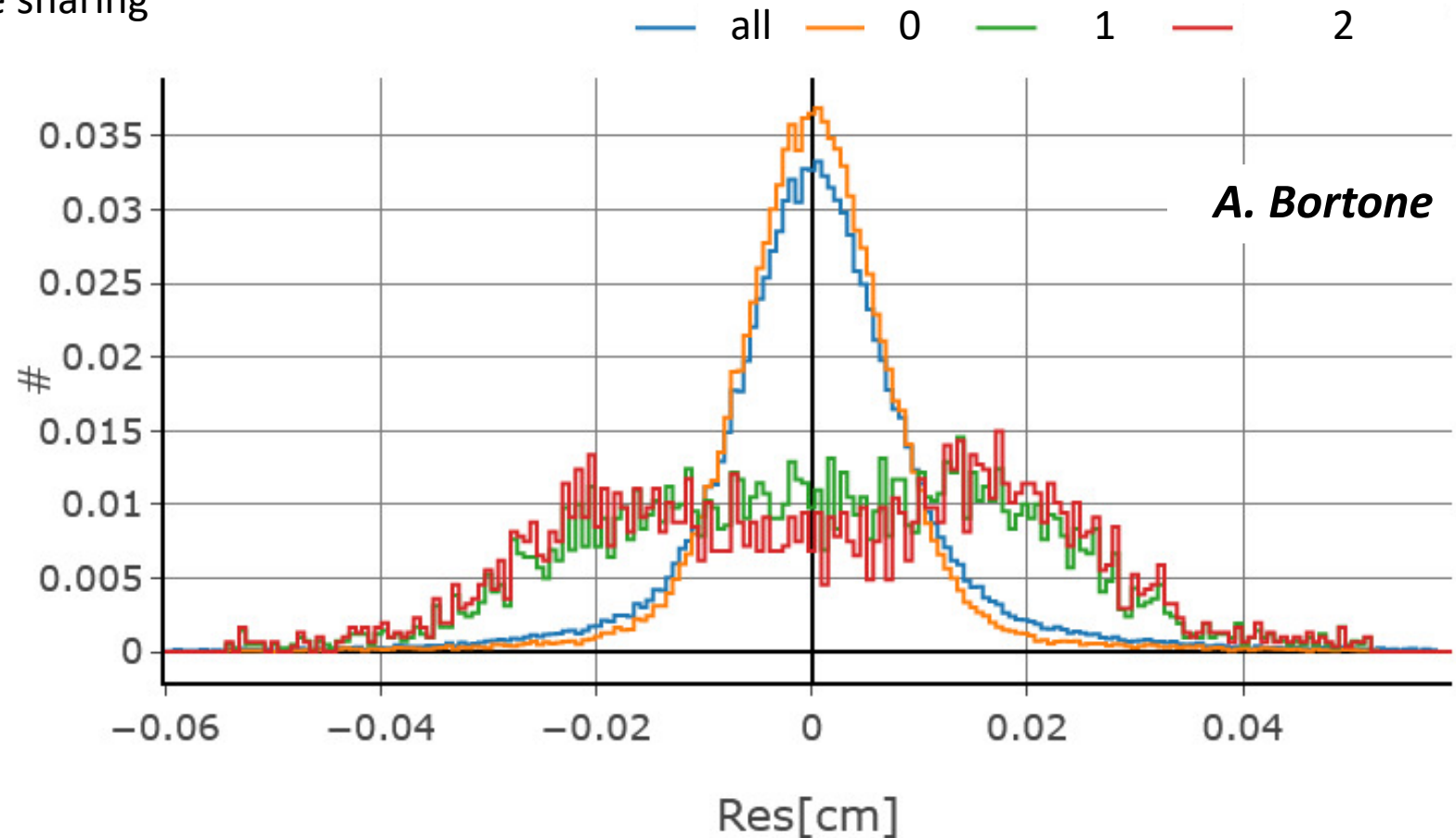
**Planar 1, View Y is more affected by off-time hits because its FEB had a higher noise rate → we know when this effect starts to be relevant**

# Residuals (planar 2, view X)

0: no holes, no off-time hits

1: hole or off-time hit

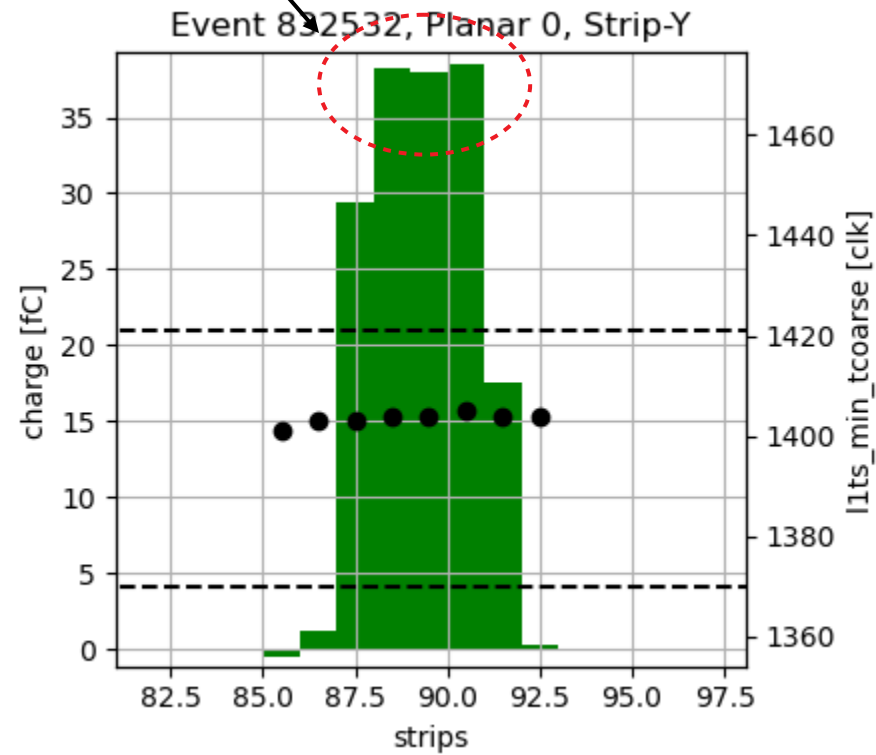
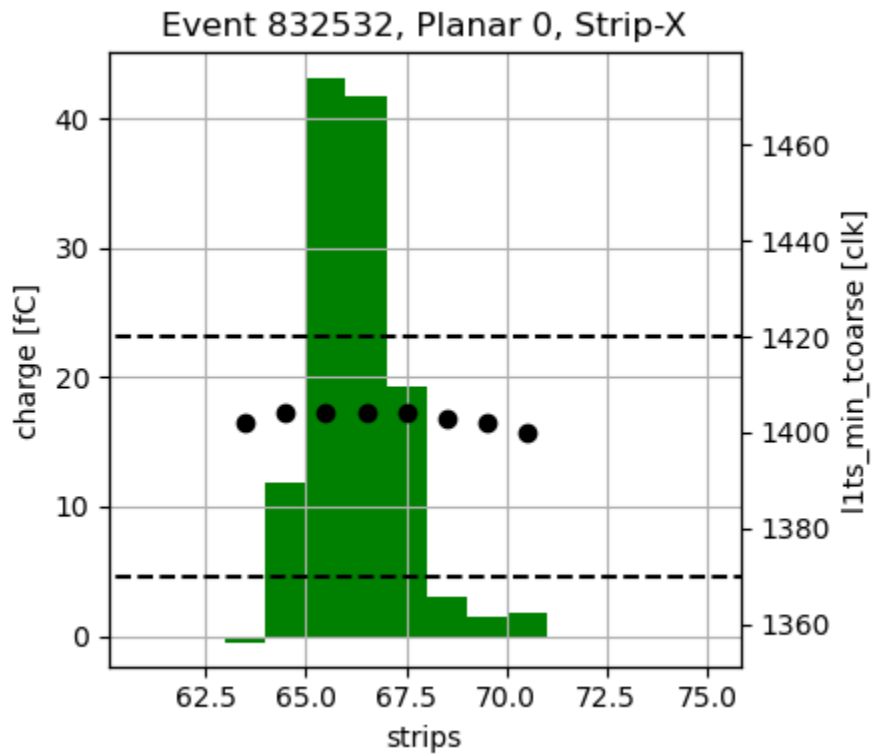
2: hole or off-time hit AND bad charge sharing





# Channel charge saturation

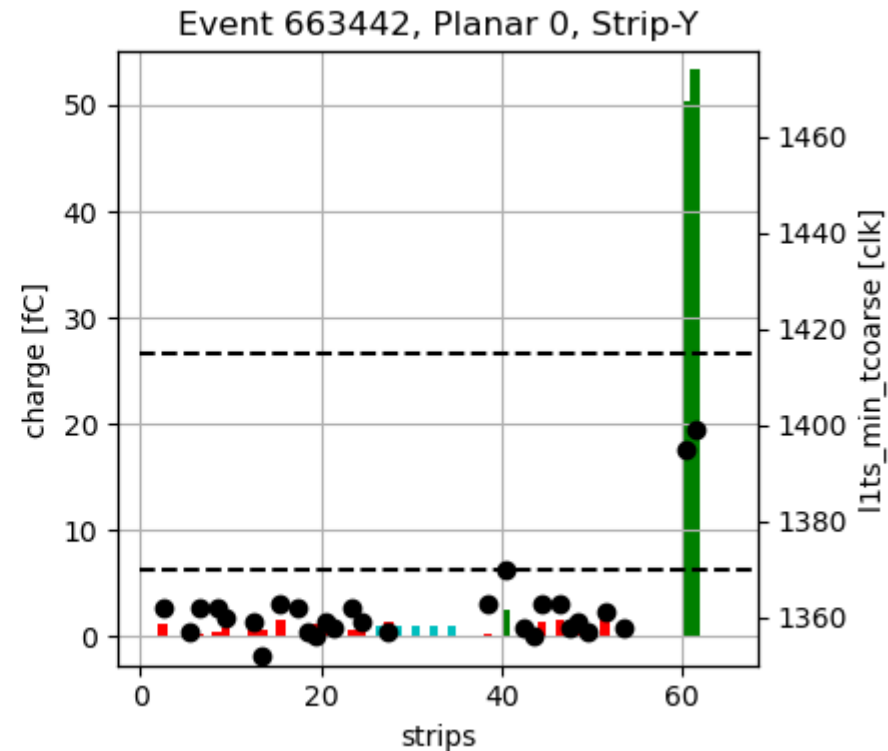
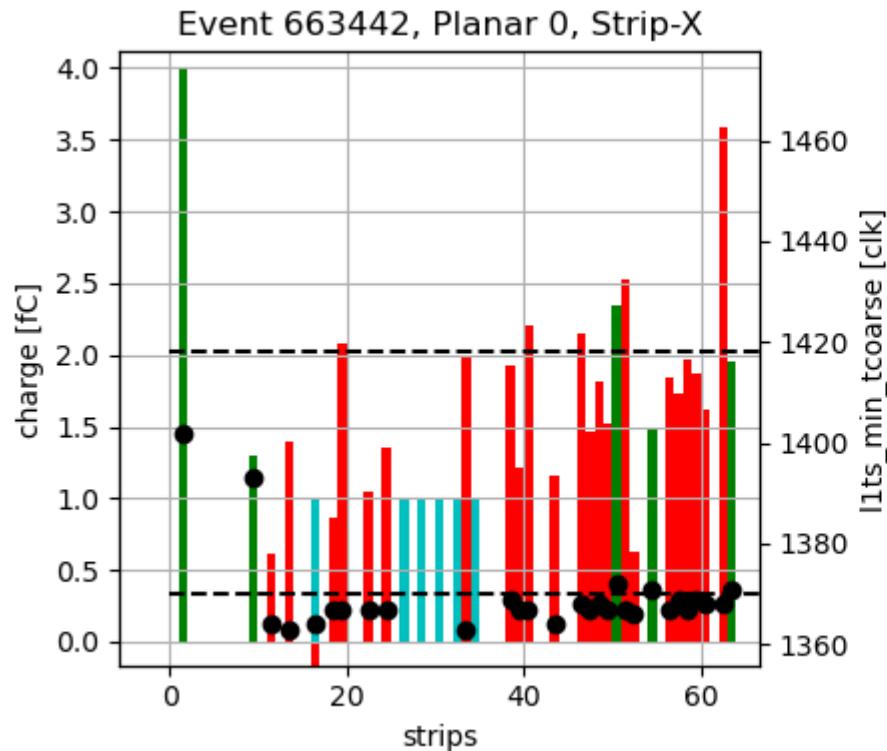
on-time hit (1370-1440)  
off-time hit (before signal)  
off-time hit (after signal)  
missing strip



- Expected  $pos_y = 5.86327$  cm
- Reconstructed  $pos_y = 5.77432$  cm  $\rightarrow$  efficiency not OK

# GEMROC buffer saturation

on-time hit (1370-1440)  
off-time hit (before signal)  
off-time hit (after signal)  
missing strip



Many hits at the same time (after signal time window) → they can overwrite previous data (corresponding to the signal time window) inside the GEMROC buffers → Alberto is working to increase the buffers size

# Summary

- Charge sharing can provide some useful information to spot issues on the clusters and maybe also correct some of them
- We may have found the noise level when the rate becomes too high and we start lose too many hits
  - Try threshold settings with hysteresis to reduce hits induced by noise
  - Some of these issues can be mitigated also from the GEMROC side and Alberto is working on some improvements on the firmware (increased buffers size and Trigger-Match algorithm waiting time)
- Check CGEM data for off-time hits in dataset used for “time-walk” calibration