Some first results (Cluster charge)

- During the previous test beam we had a MPV for the charge of 2.6 fC = 15ke$^-$.
- This is far below the expected 4 fc = 25 ke$^-$
- I repeated the measurement using the new march data for it has significantly better noise performance and with varying cluster settings.

- The reason why I only found clusters with size 3 and below is because of a cut I had introduced in an early stage and forgot to remove it. Currently reanalyzing it again.

- All measurements below are with a cut on strips of S/N > 3 for them to be considered as cluster input.

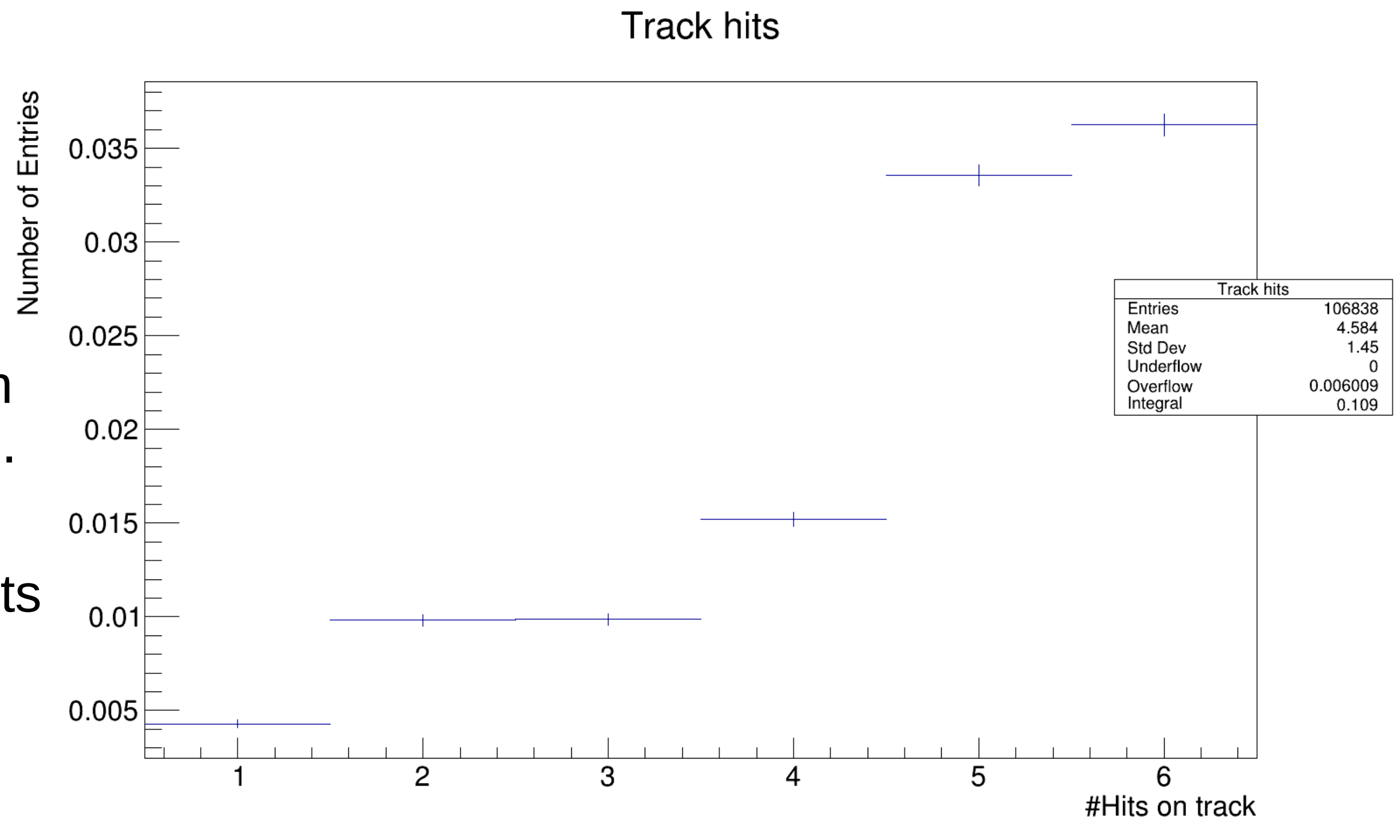
Correlated vs on Track

- Simply because it is much faster as it does not require GBL I decided to first check the charge distribution of all cluster hits that are correlated (see mail from yesterday).

- I saw some weird features in the charge distribution which I could not explain, I therefore repeated the same measurement with only taking the charge of hits that are on a Track generated by the Mimosa Telescope.

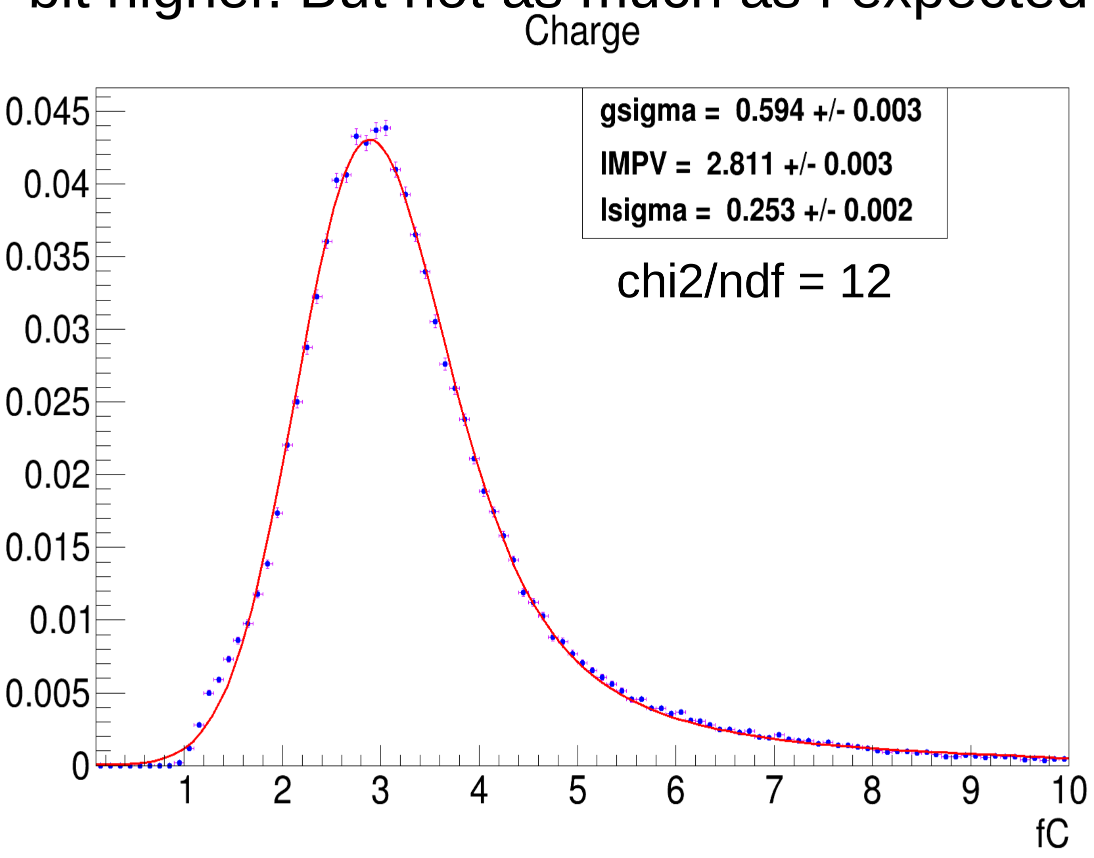
- Only 11% of all 106k Mimosa events have hits that are on a mimosa track. This is because mimosa records significantly more events than Lycoris. In the same time duration Lycoris recorded about 21k events.

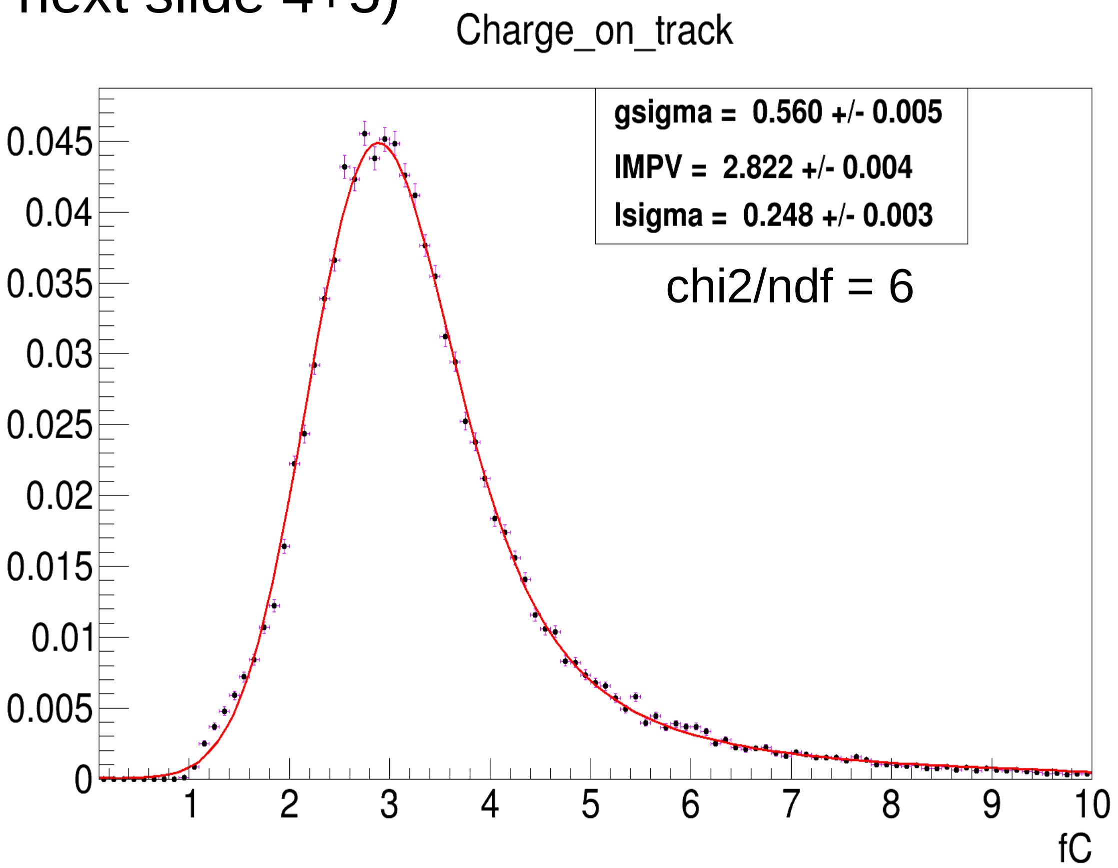
  → 50% of all Lycoris events have matching hits on track



Correlated vs on Track

- Overall the impact of requiring hits to be on track has a significant impact on the chi2/ndf for the landau x gauss convolution fit but overall does not remove the features I saw in the single and triple hit clusters (see slides 5+6).
- In the march data the MPV for the charge is 2.8 fC and therefore slightly higher and with the charge loss to the backside as a result of double hit influence the true charge again a bit higher. But not as much as I expected (see next slide 4+5)





Sidenote: Charge loss to the backside

- Double hit clusters will have reduced charge compared to single hit clusters as a result of those hits stemming from a floating strip hit.
- The floating strip is capacitively coupled to both neighboring strips and the backplane.
- The ratio of how much charge is registered in the neighboring strips versus the backplane depends on the interstrip capacitance C_{ss} and the capacitance to the backplane C_b

$$\frac{Q_\mathrm{s}}{Q_\mathrm{b}} = \frac{1}{2} \cdot \frac{1}{1 + 2(C_\mathrm{b}/C_\mathrm{ss}) + \frac{1}{2}(C_\mathrm{b}/C_\mathrm{ss})^2} \approx \frac{1}{2} \cdot \frac{1}{1 + 2(C_\mathrm{b}/C_\mathrm{ss})}$$

- In our case the ratio is supposed to be 40% based on a discussion with Tim Nelson.
- With two neighboring strips this means 80% of the total deposited charge will be registered in the two adjacent strips while 20% will be lost.
- This would mean that our ratio $C_b/C_{ss} = 1/8$
- The measurements by Hamamatsu are very confusing. I either do not understand what is what or there is something that still needs to be done before I can actually use them.

Charge for different cluster sizes

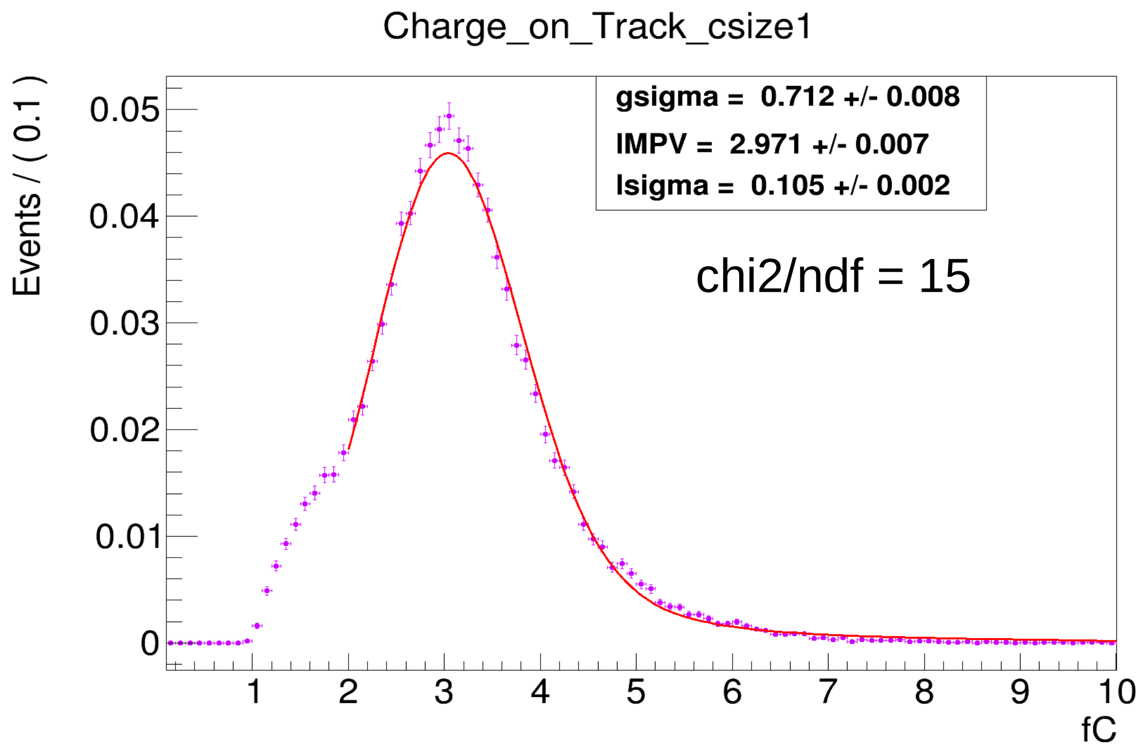
- Overall 1 hit clusters have a very large tail in low charge which is still present when requiring hits on tracks.

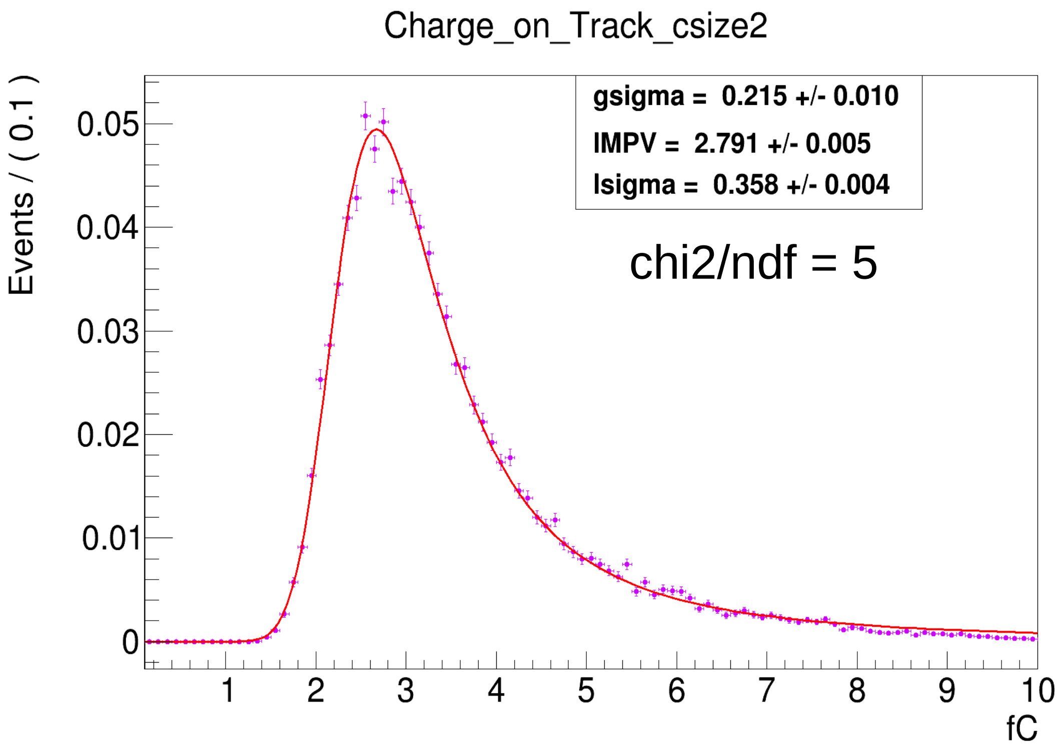
  → Noisy strip in beam often coinciding with actual track?
- The MPV of 1 hit clusters is ~2.97 fC

- 2 hit clusters have an extremely good looking charge shape without any visible artifacts.
- The MPV of 2 hit clusters is 2.79 fC

- Two hit clusters register 0.18 fC less charge than single hit which is equivalent to 6% less charge.

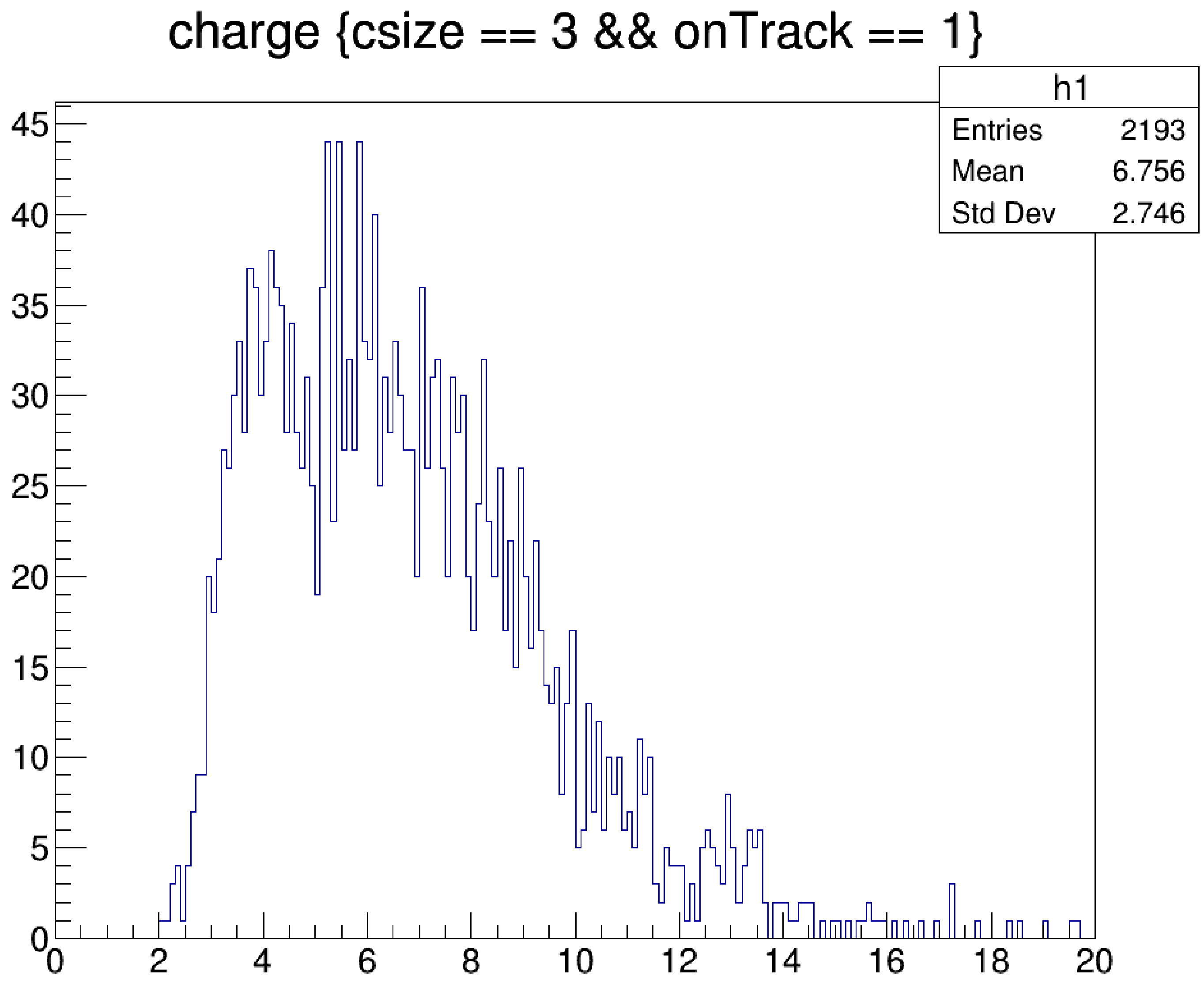
  → Why is it so close? Are the design parameters not fulfilled?
- Why do even single hit clusters register only 3 fC as opposed to 4 fC?
- Based on integration times it should not be a result of trigger delay (but I have that data so I can check).



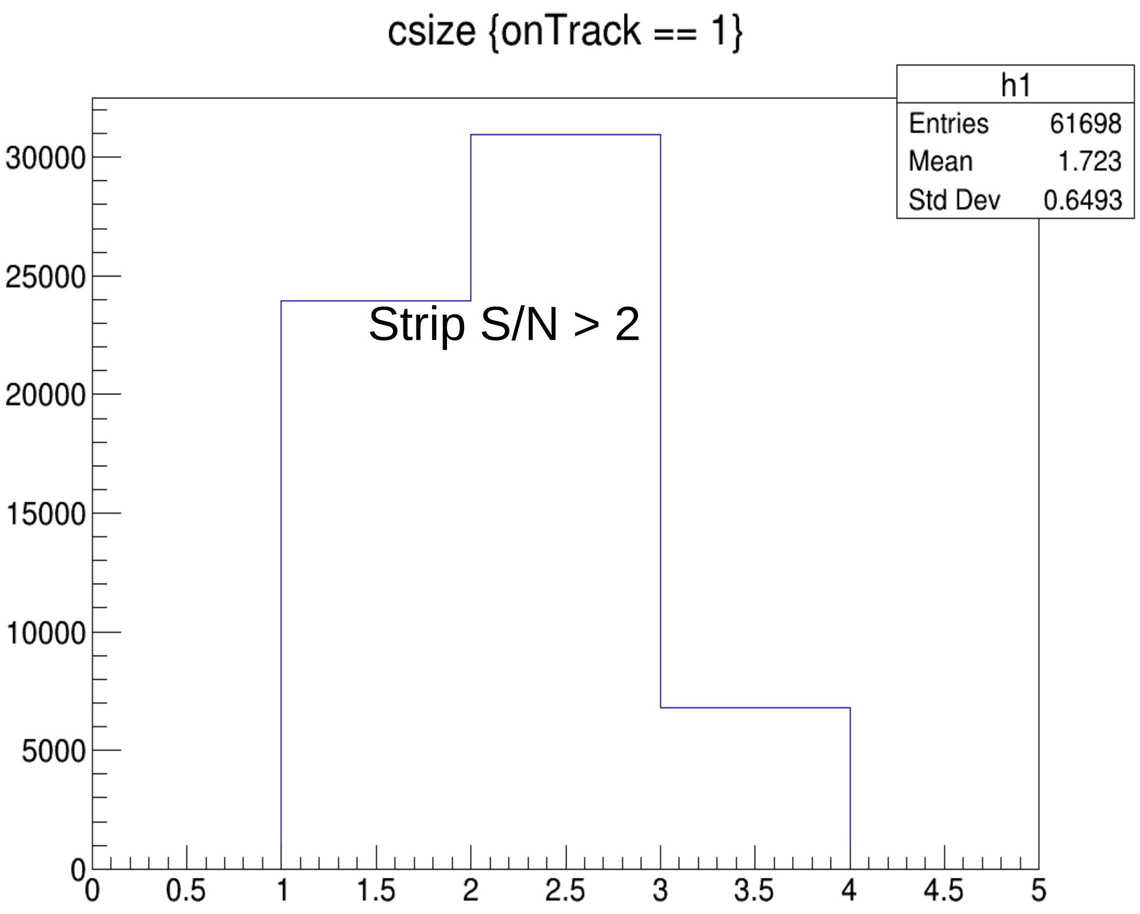


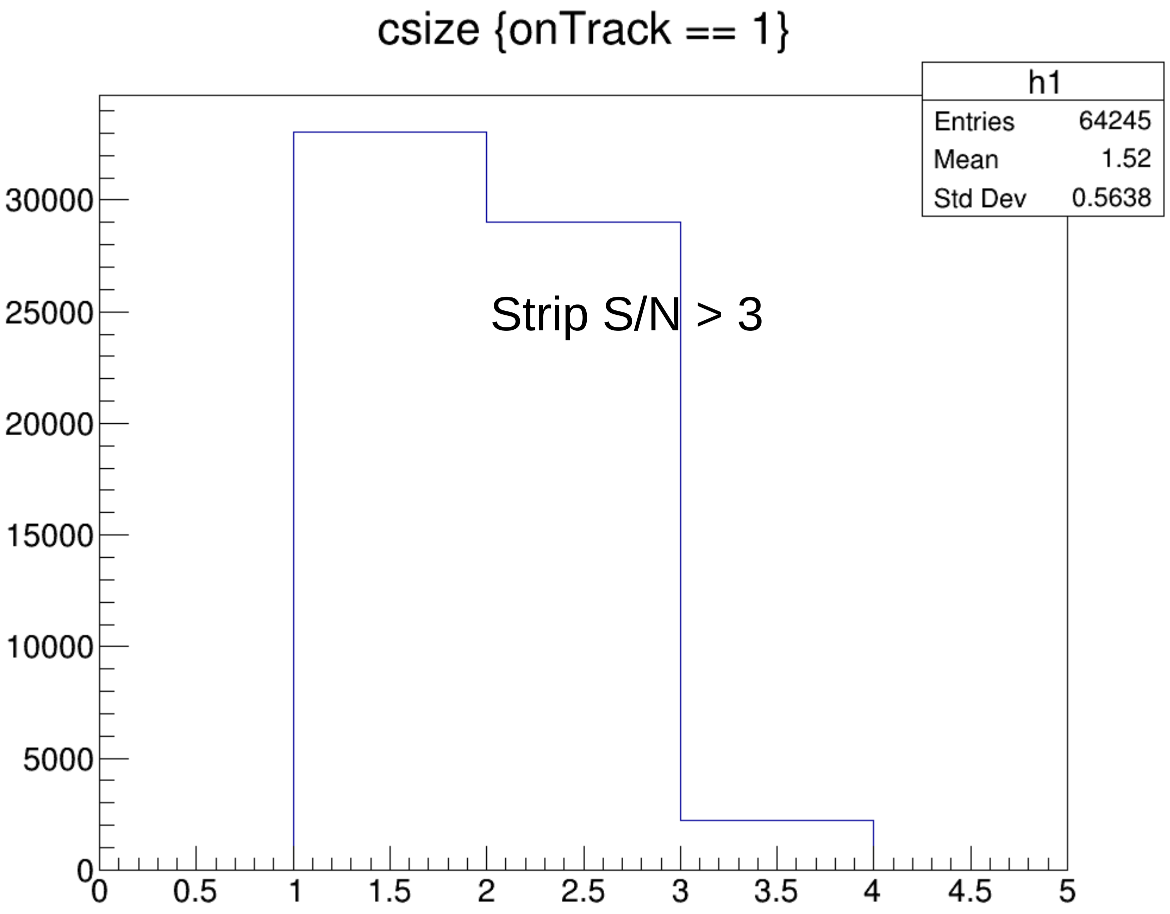
Charge for different cluster sizes

- Three hit clusters have a massive portion of high charge hits.
- This might very well be because to register 3 hit clusters we need to have registered charge at distances of 100 um from each other with requirements that even the furthest apart strips have registered > 0.6 fC of charge.
- This would introduce a natural bias to higher charge deposits such as delta electrons etc.

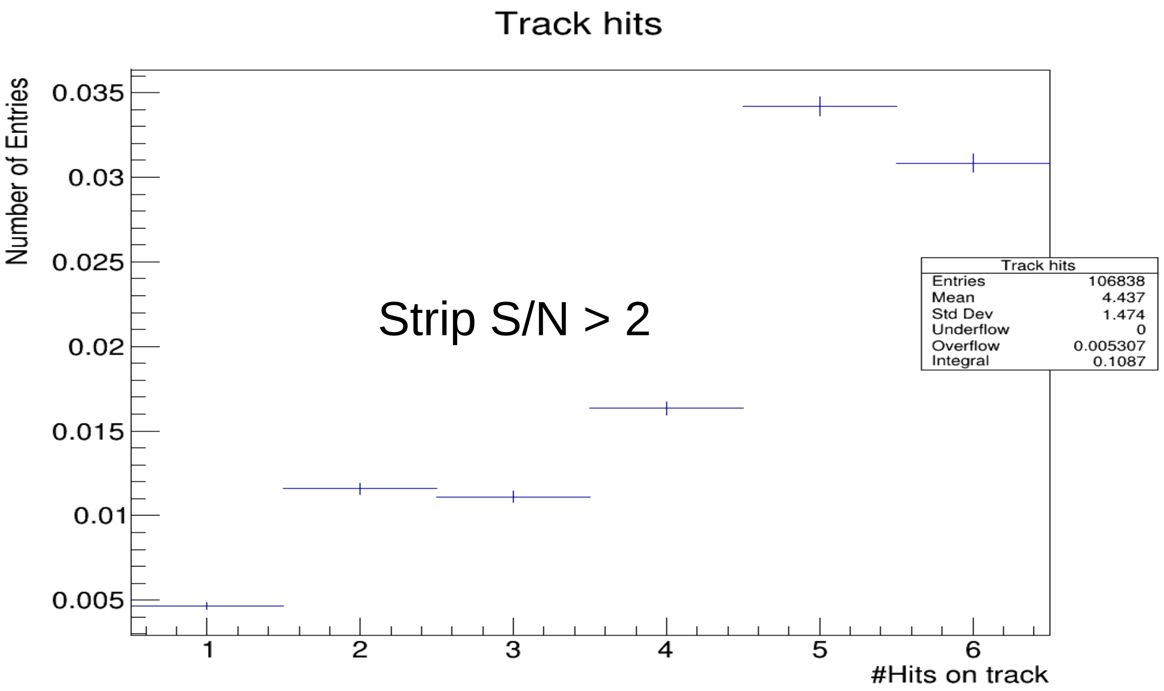


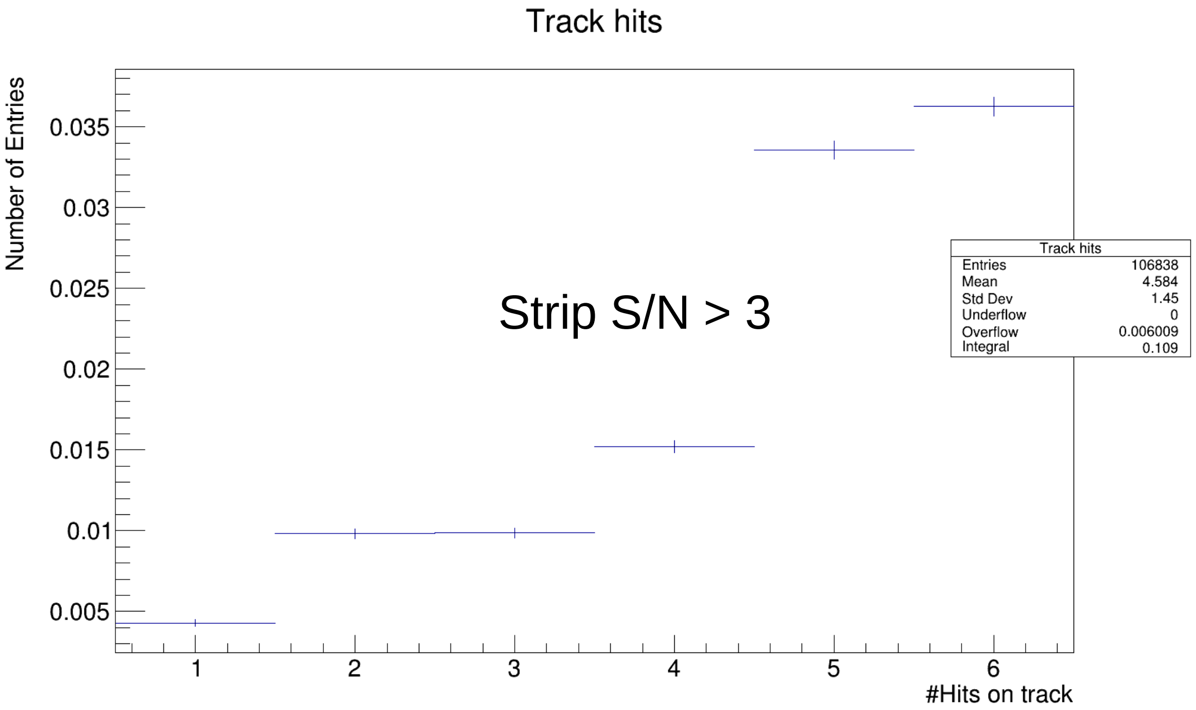
S/N Input cut impact



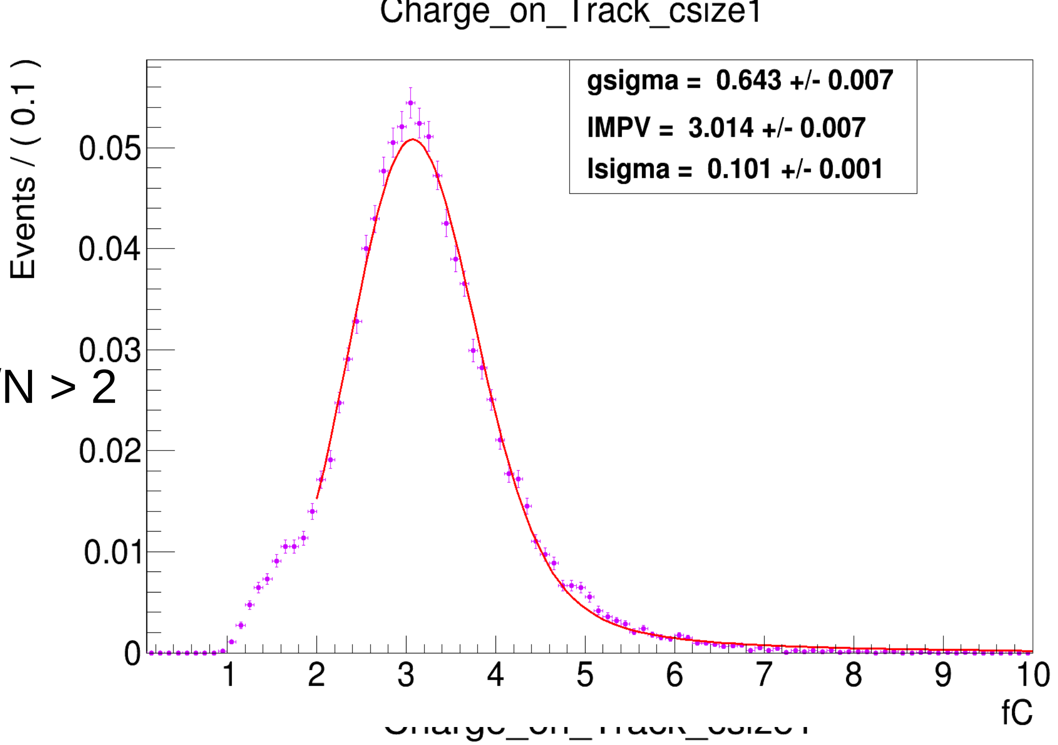


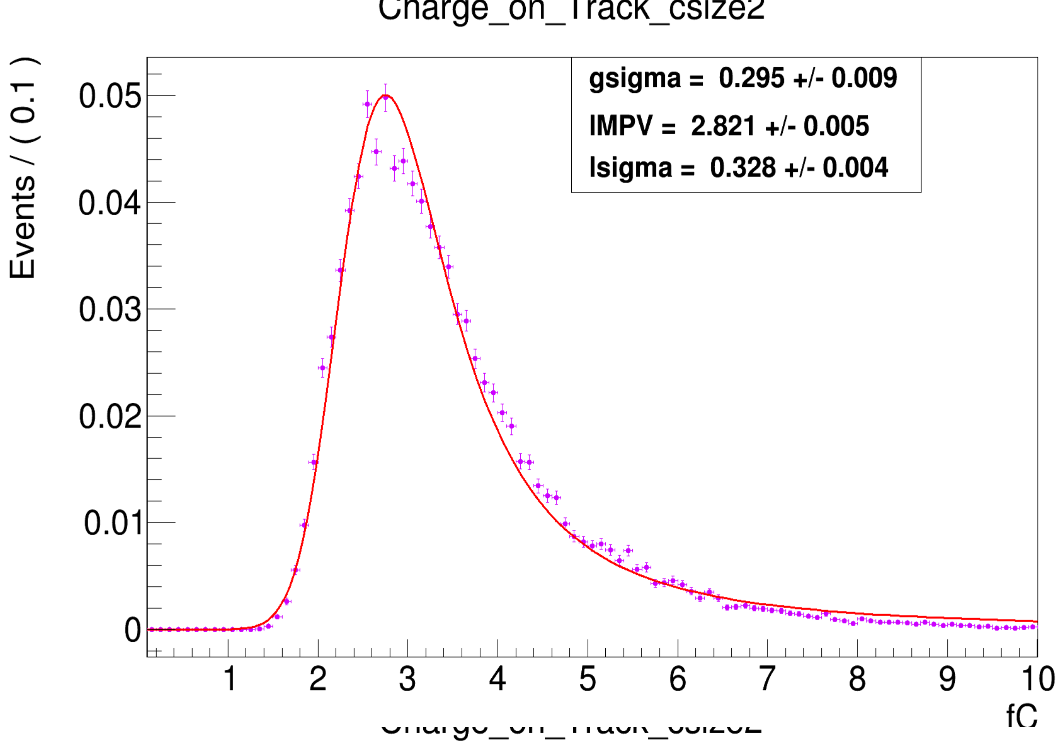
S/N Input cut impact



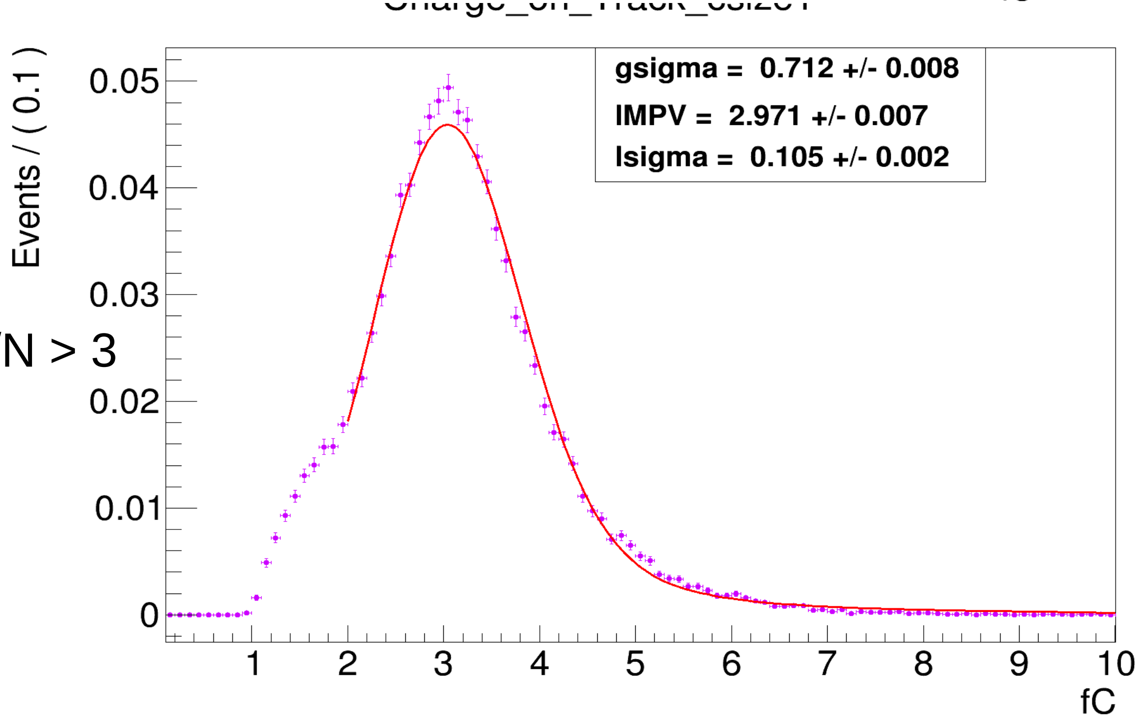


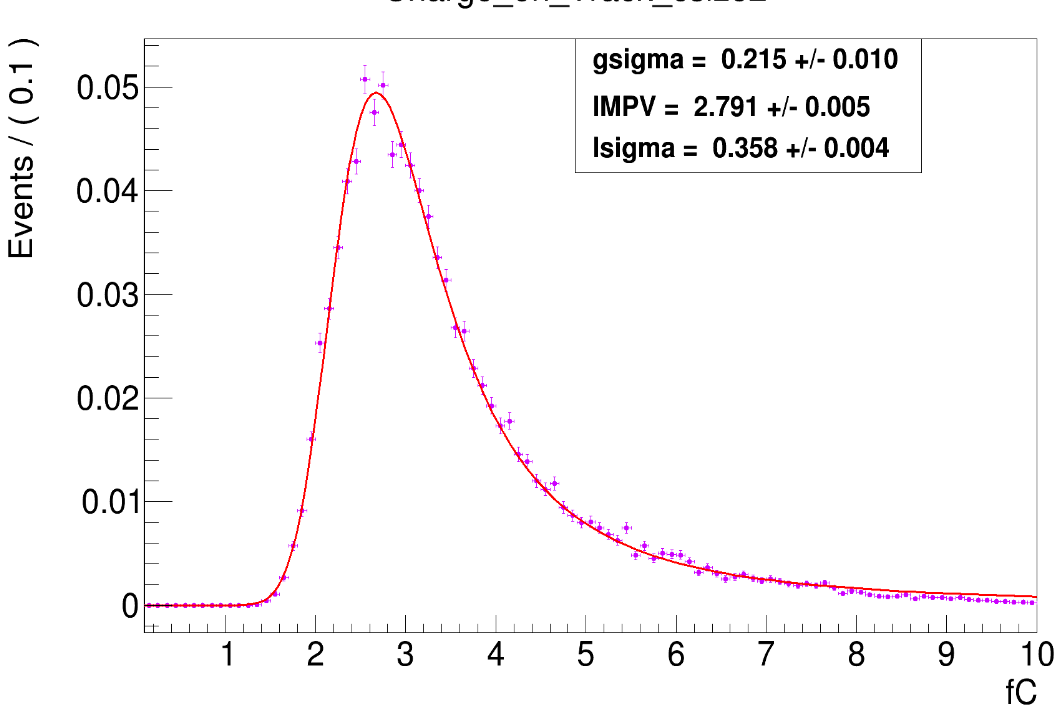
Strip S/N > 2



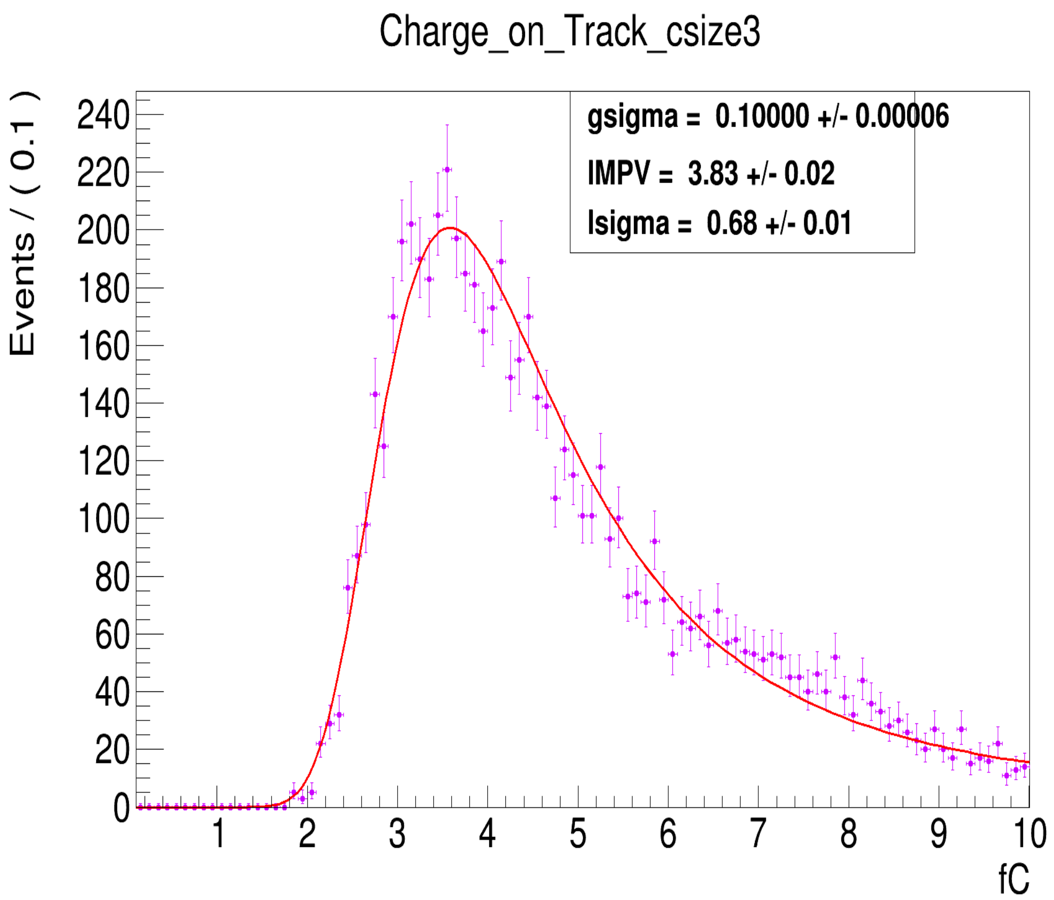


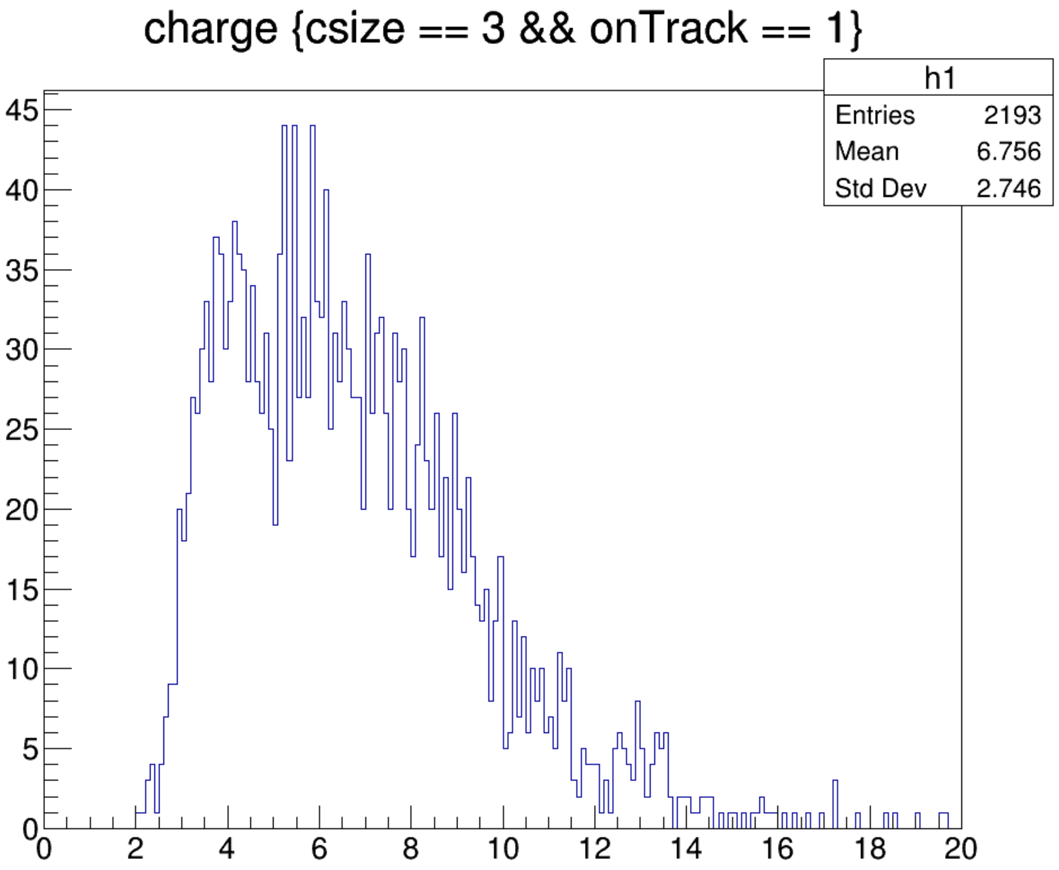
Strip S/N > 3





Charge for different cluster sizes





Sidenote: Time dependent noise?

Answer: NO