

**New production
- data analysis -
2020-06-04**

Run list

RUN	gain	threshold	
10	standard	standard	RUN 10-16 thresh 17 kHz RUN 17 thresh 8 kHz HV 835 V
11	standard	standard	
12	standard	standard	
13	standard	standard	
14	standard	standard	
15	standard	standard	
16	standard	standard	
17	standard	standard	
18	high	standard	RUN 18-21 thresh 10 kHz HV 845 V
19	high	standard	
20	high	standard	
21	high	standard	
23	high	high	RUN 23-24 thresh 5 kHz HV 845 V
24	high	high	
25	high	high	
26	high	high	
31	high	flat	RUN 31-34 thresh L1 = 12 fC thresh L2 = 6 fC HV 835 V
32	high	flat	
33	high	flat	
34	high	flat	

Run list

RUN	gain	threshold
10	standard	standard
11	standard	standard
12	standard	standard
13	standard	standard
14	standard	standard
15	standard	standard
16	standard	standard
17	standard	standard
18	high	standard
19	high	standard
20	high	standard
21	high	standard
23	high	high
24	high	high
25	high	high
26	high	high
31	high	flat
32	high	flat
33	high	flat
34	high	flat

Reconstructed all sets with the same procedure

- Usual reconstruction with CgemBoss
- Still my standalone track fit and cluster selection

Event selection with cuts application

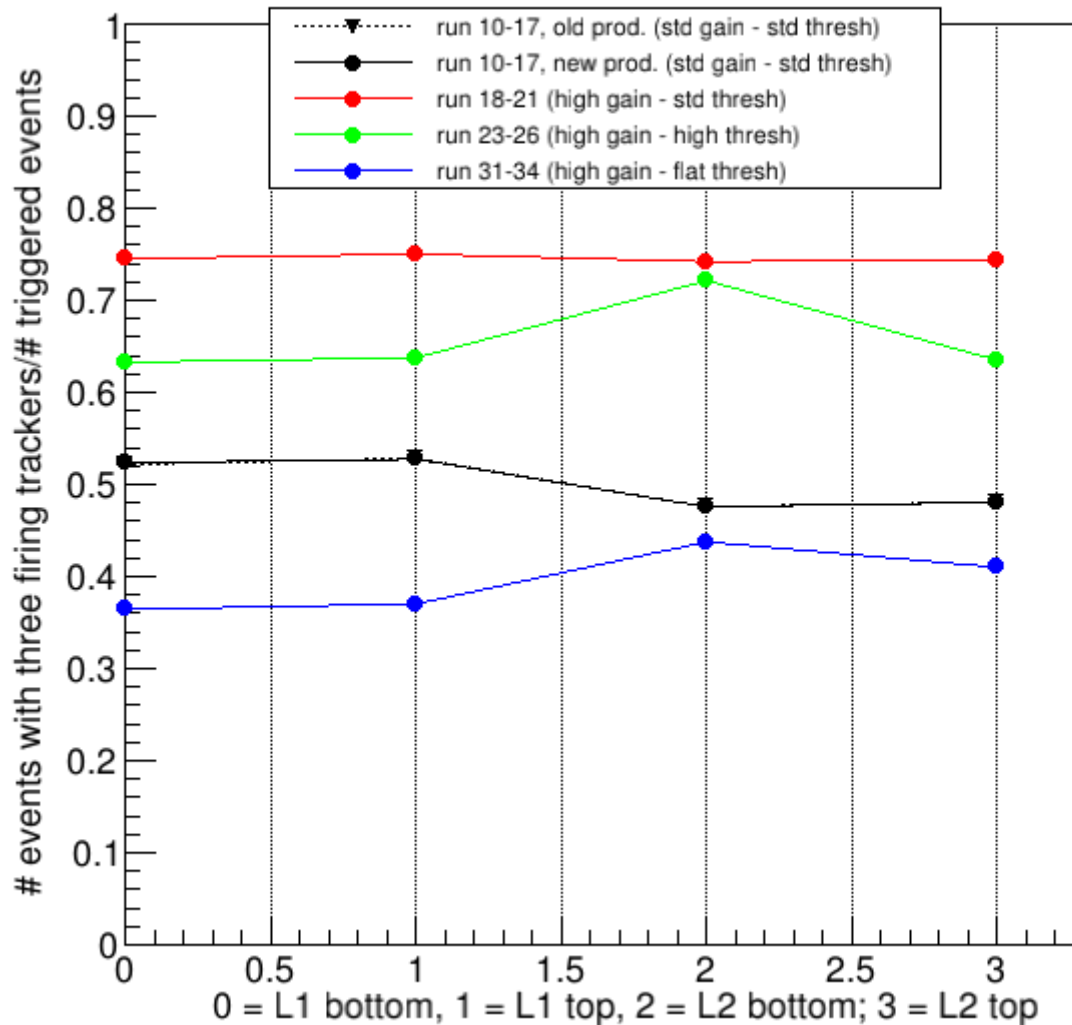
- Cuts on:
 - Energy:

L1, x view, $Q_{\text{CLUSTER}} > 20 \text{ fC}$
 L2, x view, $Q_{\text{CLUSTER}} > 15 \text{ fC}$

L1, v view, $Q_{\text{CLUSTER}} > 10 \text{ fC}$
 L2, v view, $Q_{\text{CLUSTER}} > 10 \text{ fC}$

- No cut on cluster size
- L1 2D-clusters shall not share the same v cluster component
 - If two trackers share the same v 1D-cluster → skip event
 - If the test plane shares the same v 1D-cluster with the tracker → take the next closest cluster
- Selection of good fitted tracks via chi2 cut:
 - $\chi_{xy} < 0.01 + \chi_{rz} < 1$

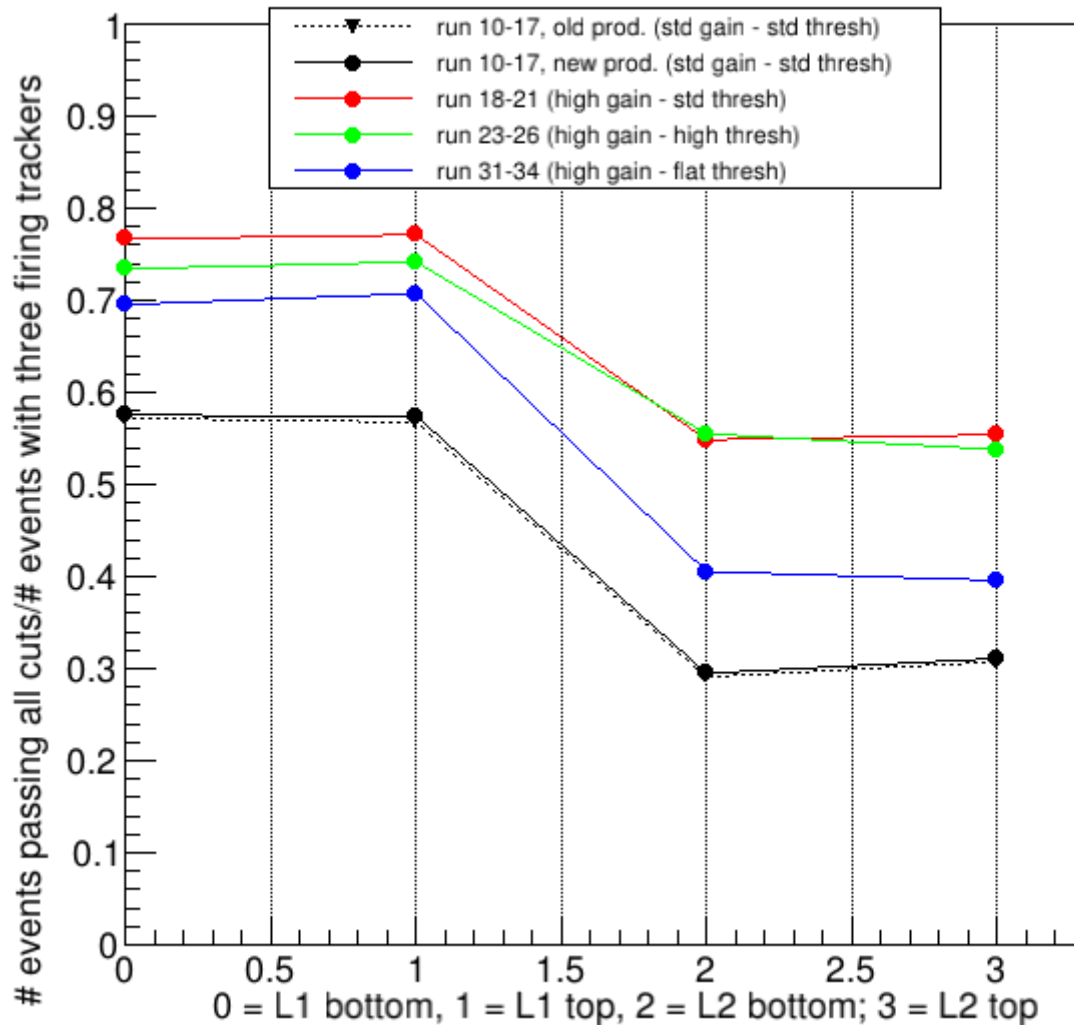
First selection: three firing layers



- # triggered events = events in run set
- New production for runs 10-17 does not change the situation (coincides with old production)
- The best situation is with high gain and standard thresholds
- Flat thresholds lower the amount of events with all three trackers firing

- 4 points = 4 cases:
 - L1 bottom
 - L1 top
 - L2 bottom
 - L2 top

Number of valid events, after cuts



- 4 points = 4 cases:
 - L1 bottom
 - L1 top
 - L2 bottom
 - L2 top

Cut list:

- Energy:

L1, x view, $Q_{\text{CLUSTER}} > 20$ fC
L2, x view, $Q_{\text{CLUSTER}} > 15$ fC

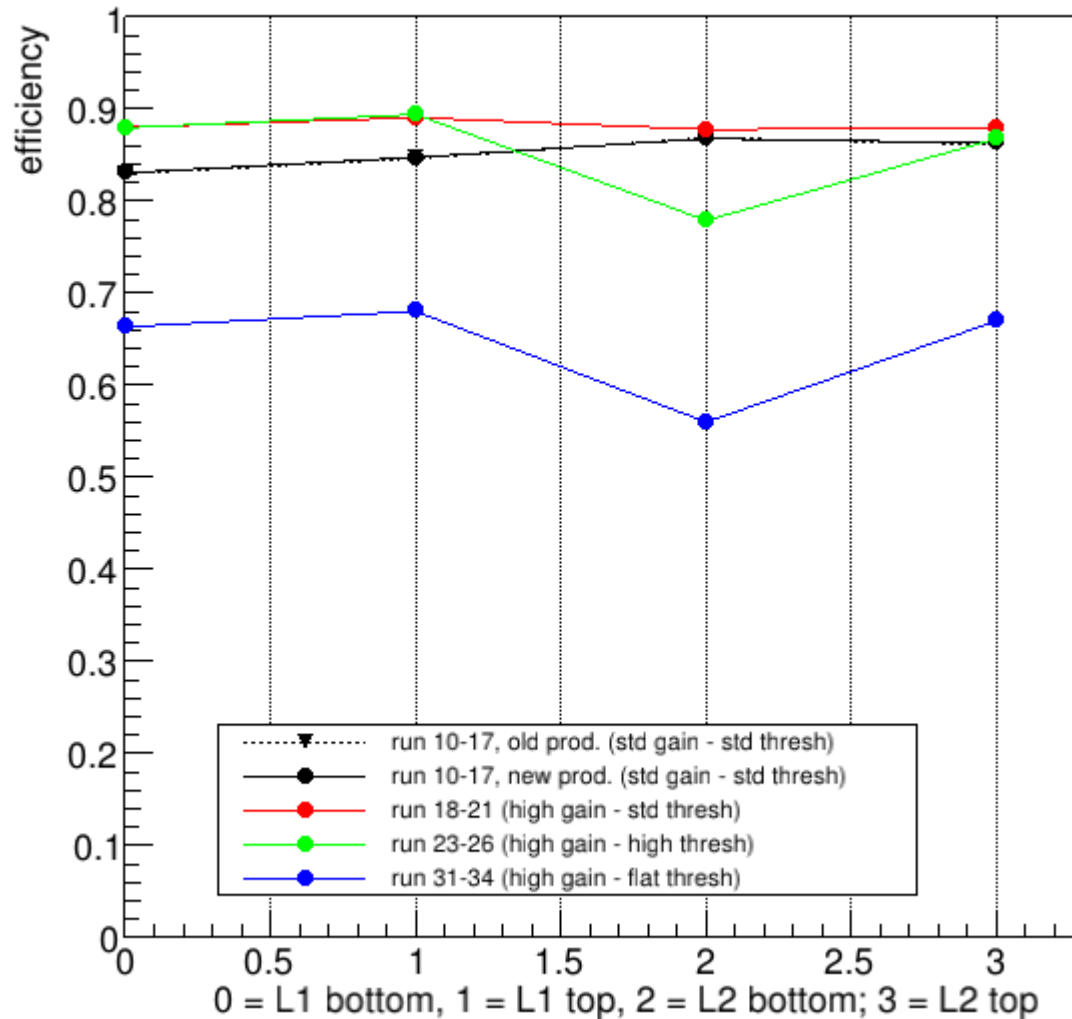
L1, v view, $Q_{\text{CLUSTER}} > 10$ fC
L2, v view, $Q_{\text{CLUSTER}} > 10$ fC

- no cut on cluster size
- L1 2D-clusters shall not share the same v cluster component

Why L1 has more events than L2?

- When testing L1, the trackers are the two L2 sheets + the other L1 → no skipping if double counting of L1 z 1D-cluster → not cut events
- When testing L2, the trackers are the two L1 sheets + the other L2 → if there is double counting of L1 z 1D-cluster the event is cut

Efficiency



Additional selection

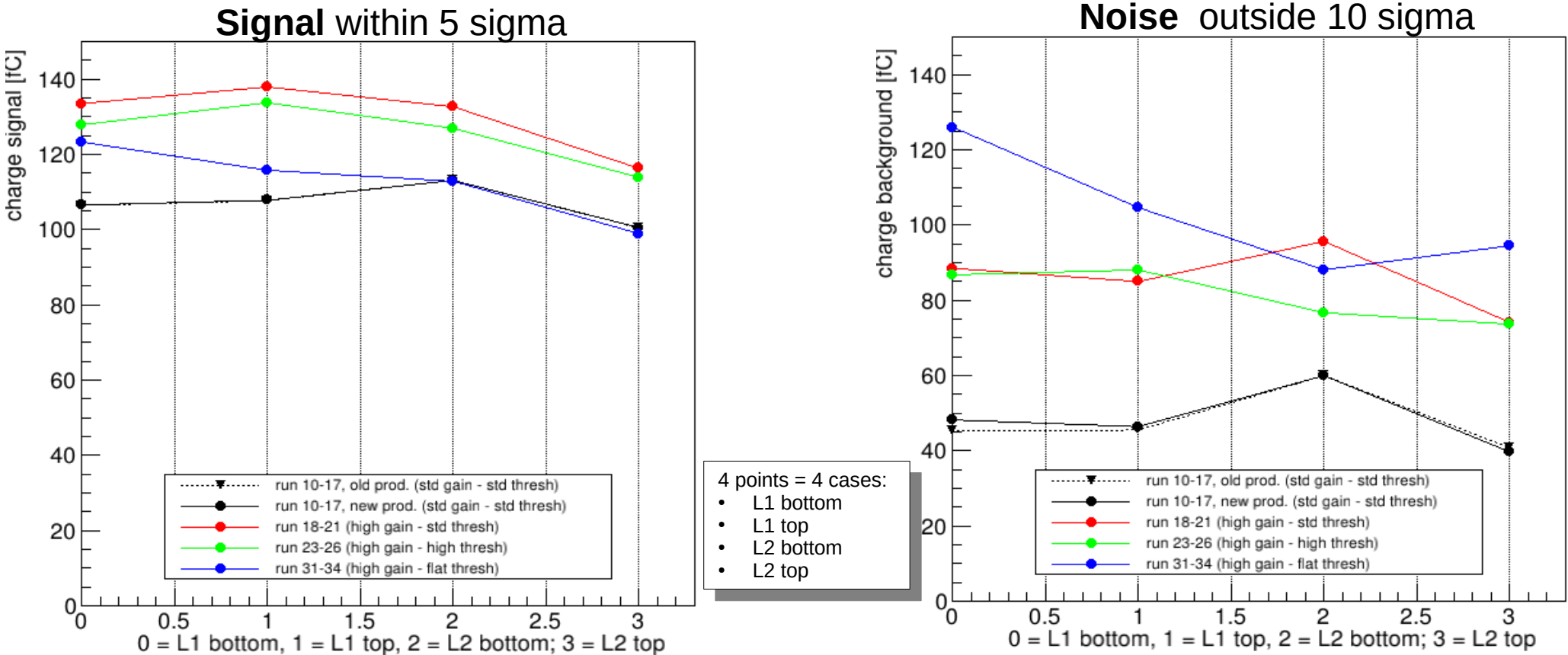
- $\chi_{xy} < 0.01 + \chi_{rz} < 1$
- **Efficiency**

$$\text{Eff} = \frac{n(\text{req} > 2 + \chi^2_{xy} + \chi^2_{rz} + \text{in_phi} + \text{in_z})}{n(\chi^2_{xy} + \chi^2_{rz})}$$

- Higher gain \rightarrow better efficiency (black vs red)
- The threshold does not affect it (green vs red)
- The drop in L2 bottom for the green and blue lines is due to the loss of FEB 34 (high power consumption \rightarrow switched off and debugging)

- 4 points = 4 cases:
 - L1 bottom
 - L1 top
 - L2 bottom
 - L2 top

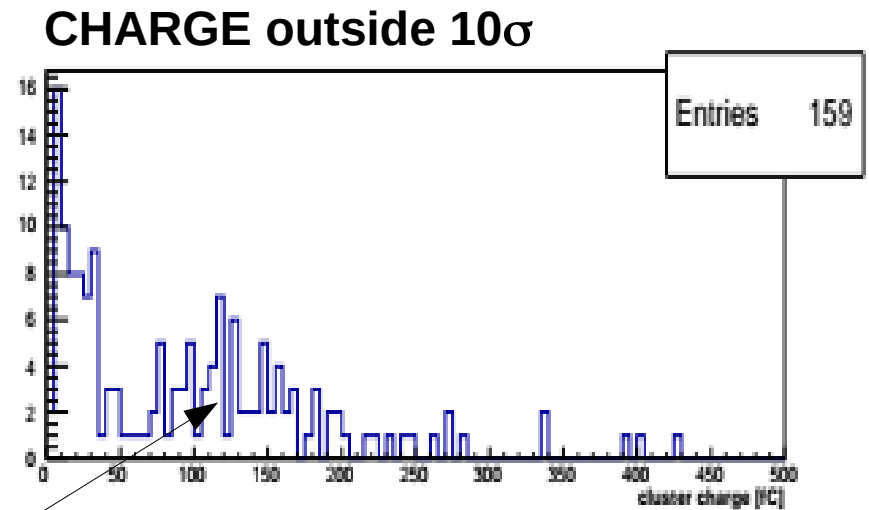
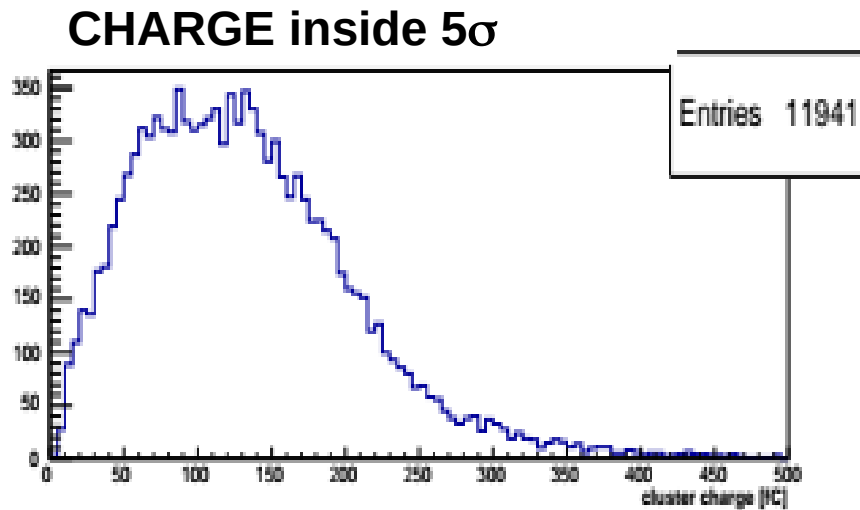
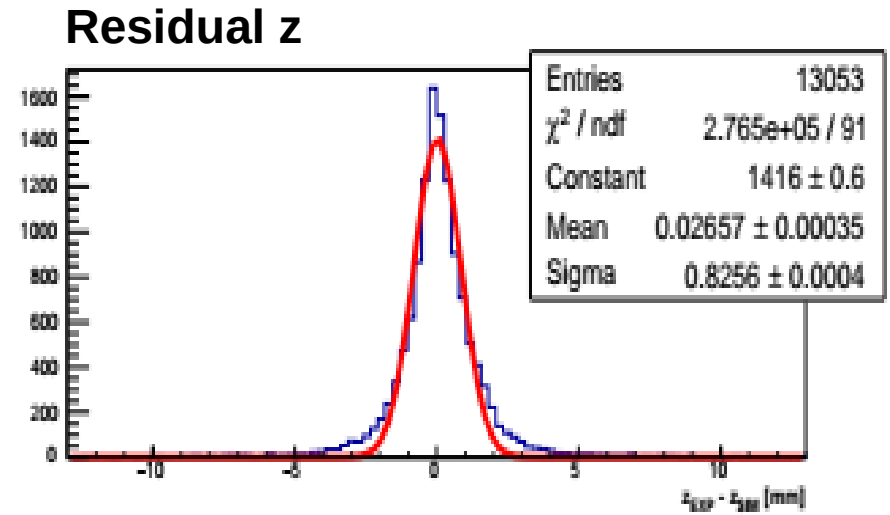
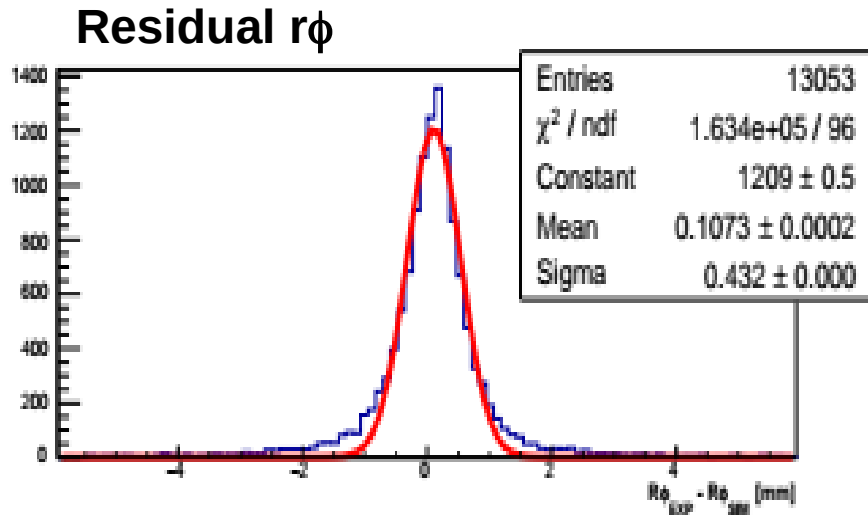
Charge



- The charge is the mean of the histo of the total charge of the 2D-cluster ($Q_x + Q_y$)
- There is a loss of validity of this parameter as variable to distinguish between signal and noise as the gain increases → we should study new cuts for the selection of signal probably (especially for flat threshold)

Example – L2 bottom

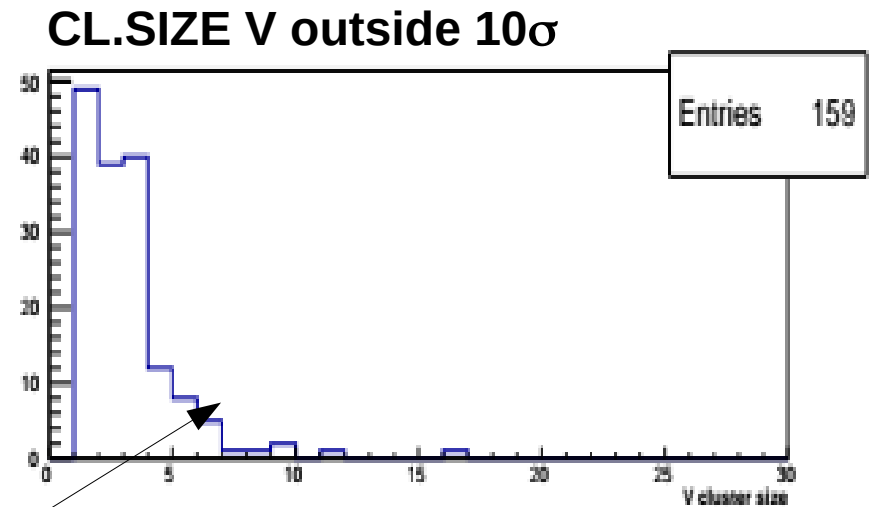
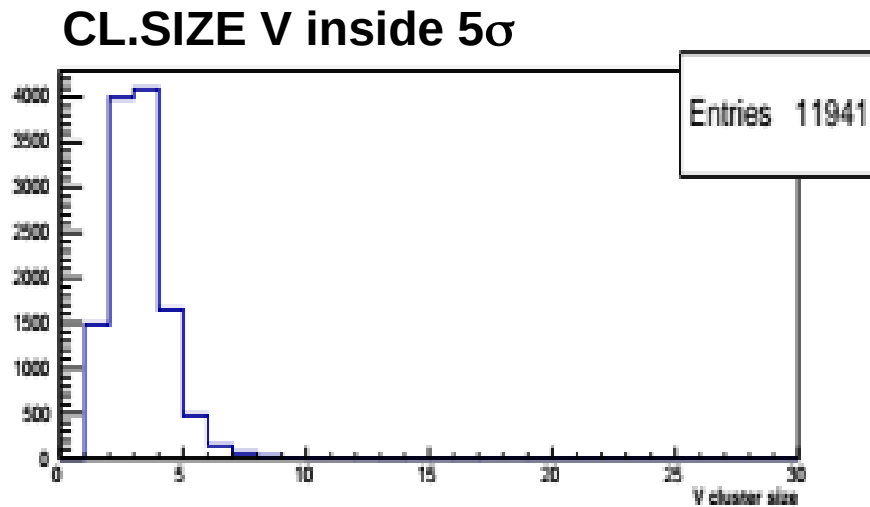
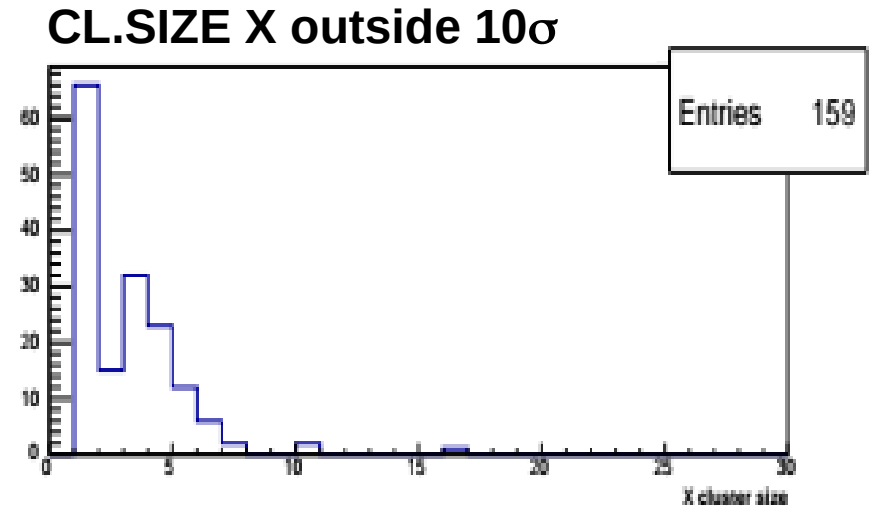
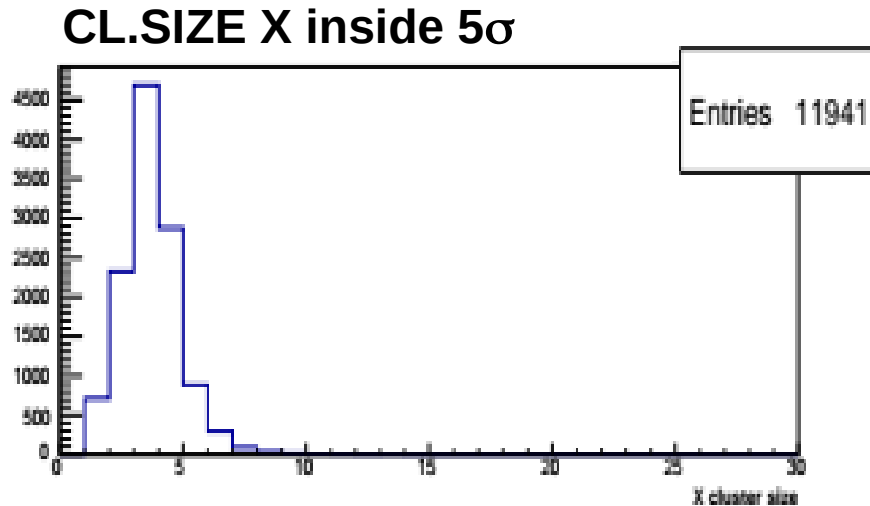
Run set 18-21, high gain, std threshold



The are many entries at high charge in noise histogram, outside 10 sigmas

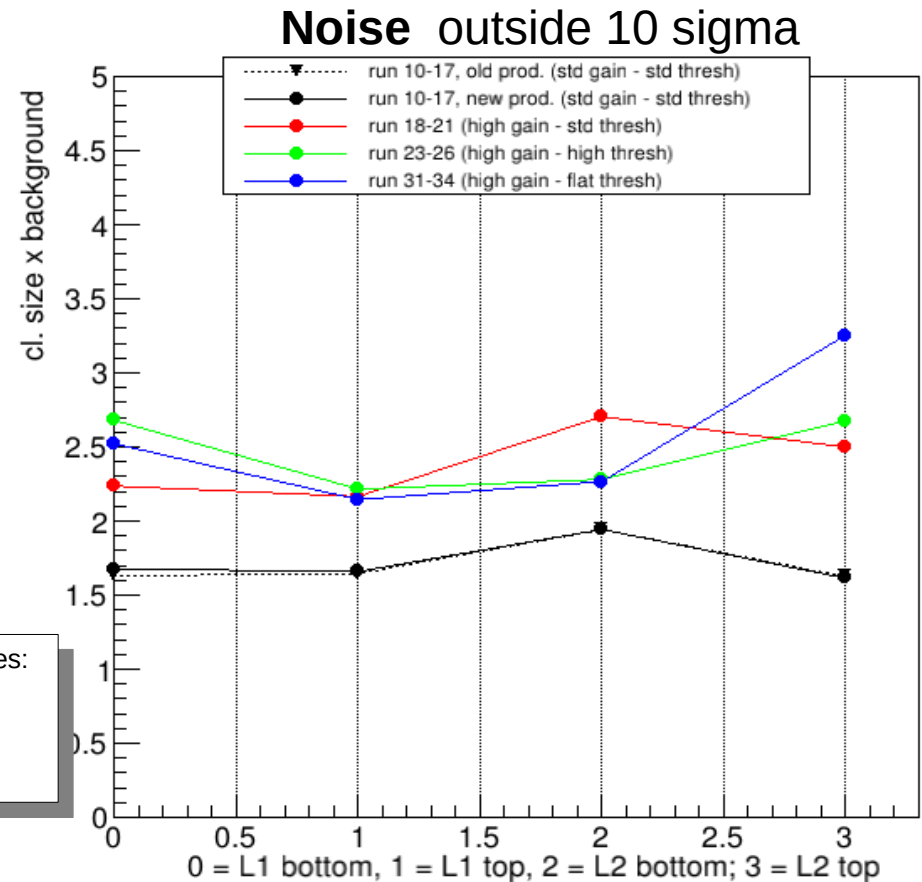
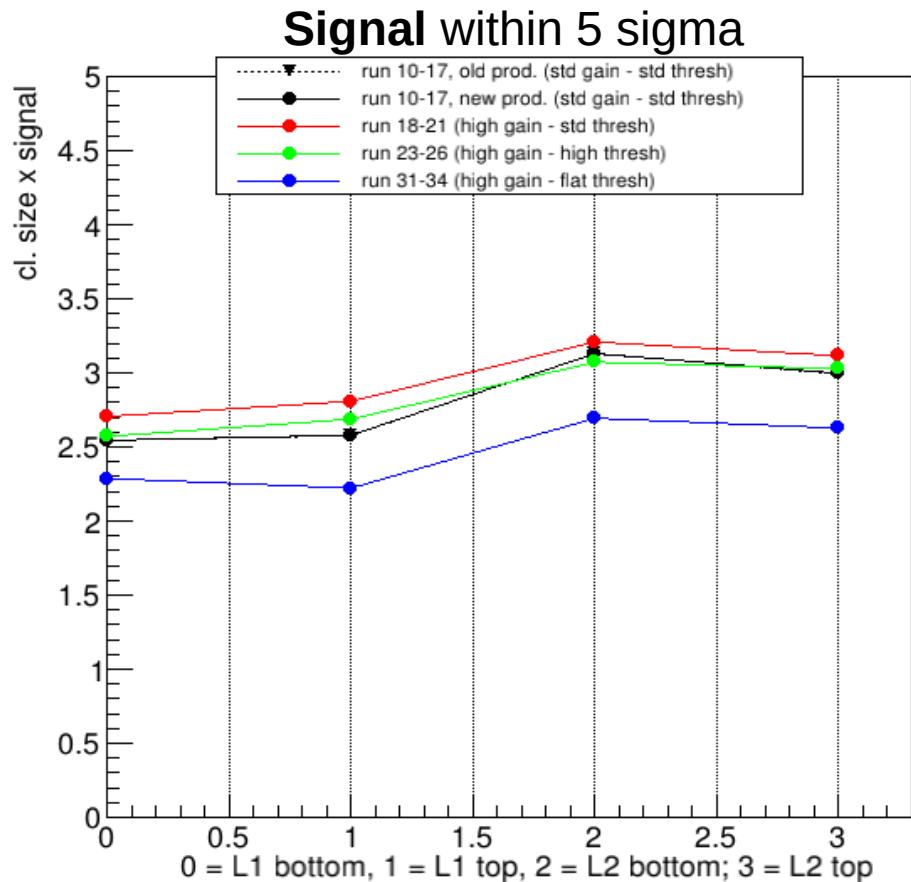
Example – L2 bottom

Run set 18-21, high gain, std threshold



The are many entries at high cl.size in noise histogram, outside 10 sigmas

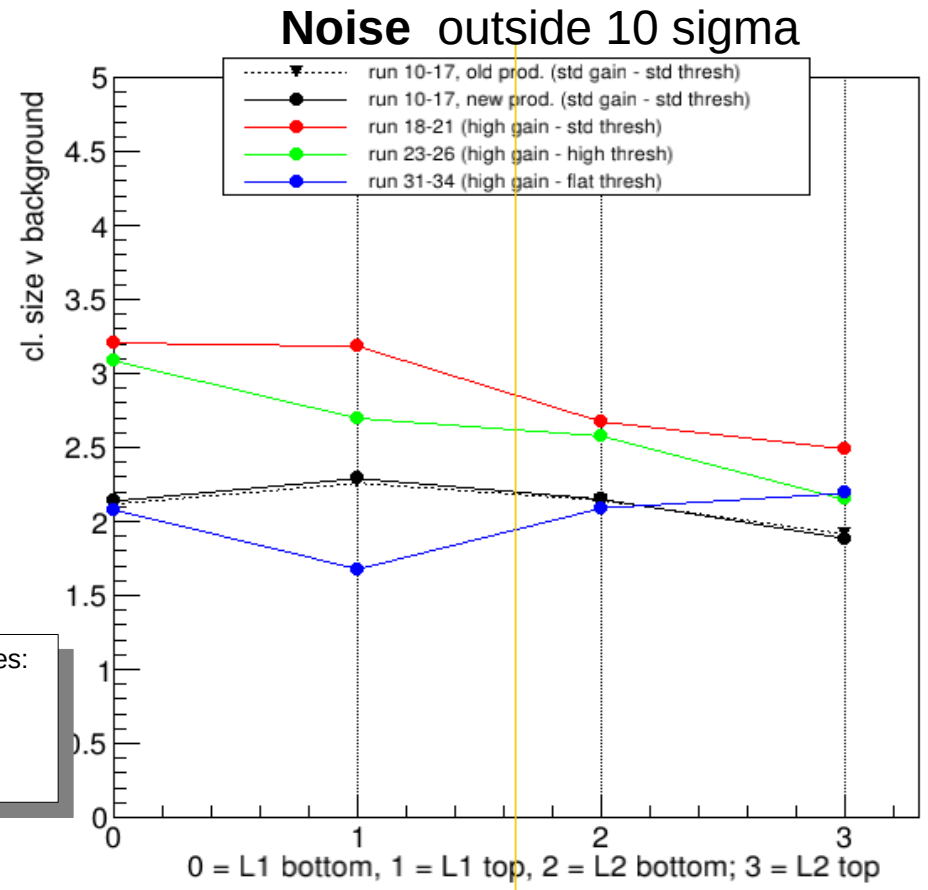
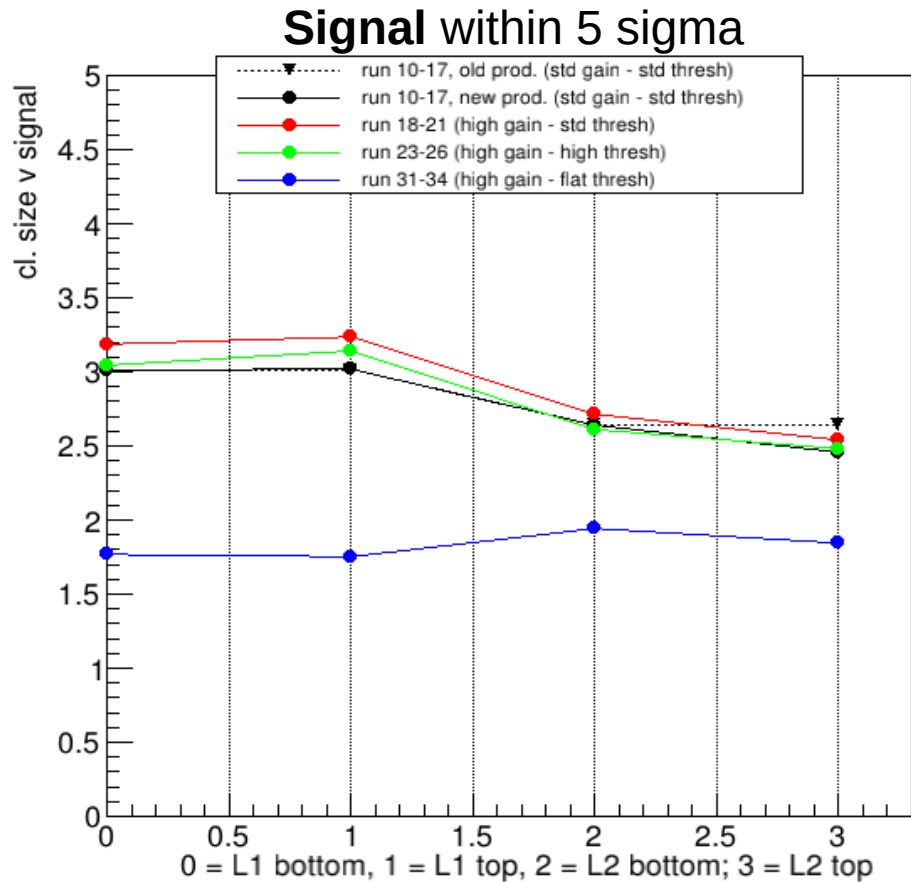
1D cluster size, x view



4 points = 4 cases:
 • L1 bottom
 • L1 top
 • L2 bottom
 • L2 top

- Same comments as for the charge
- Either there is signal in the noise window (reconstruction failure?) or the HV messes the noise up, but should not!
- Maybe with the higher gain also the secondaries are more evident?

1D cluster size, v view



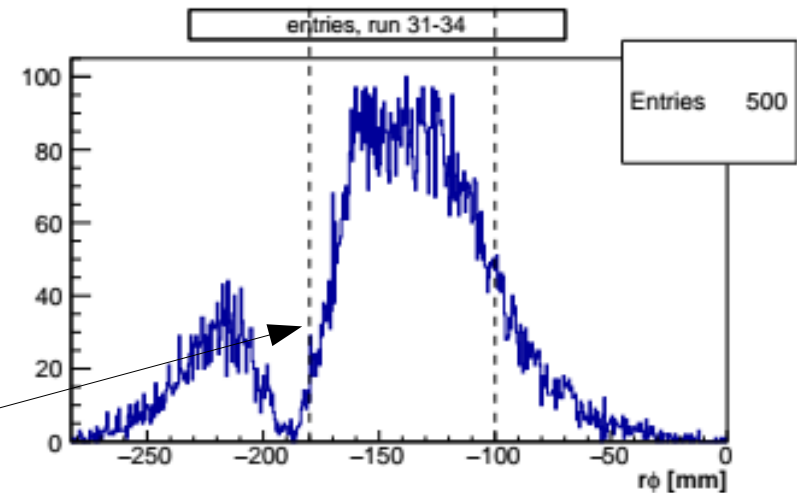
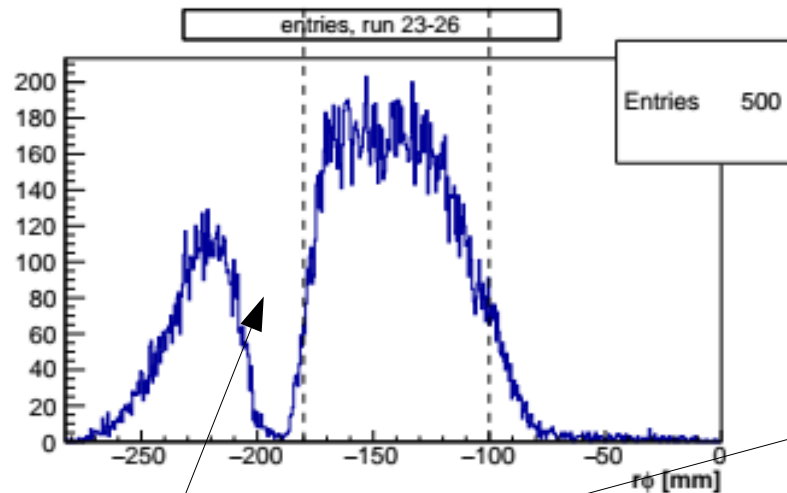
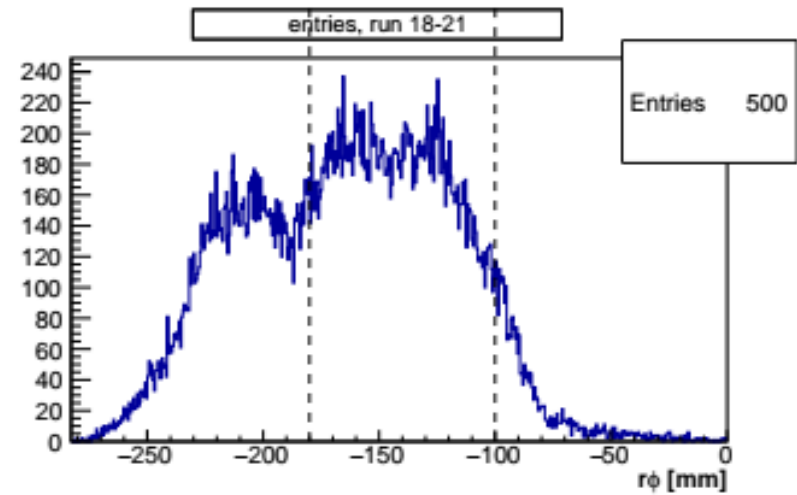
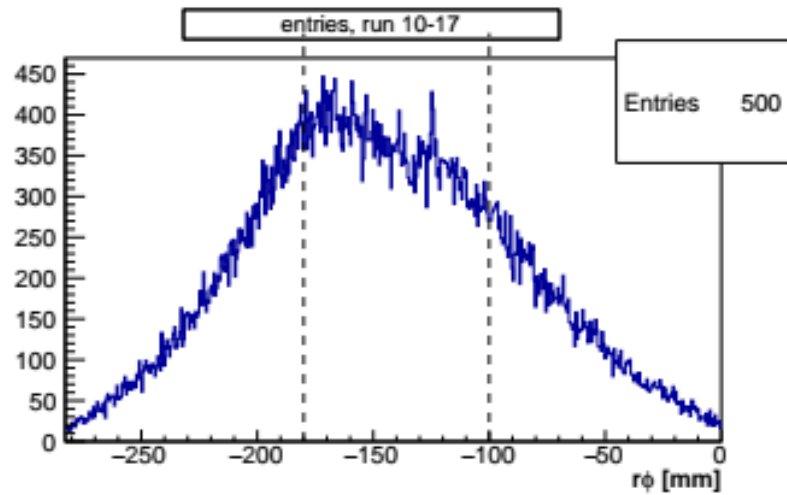
4 points = 4 cases:

- L1 bottom
- L1 top
- L2 bottom
- L2 top

- Same comments as for the charge

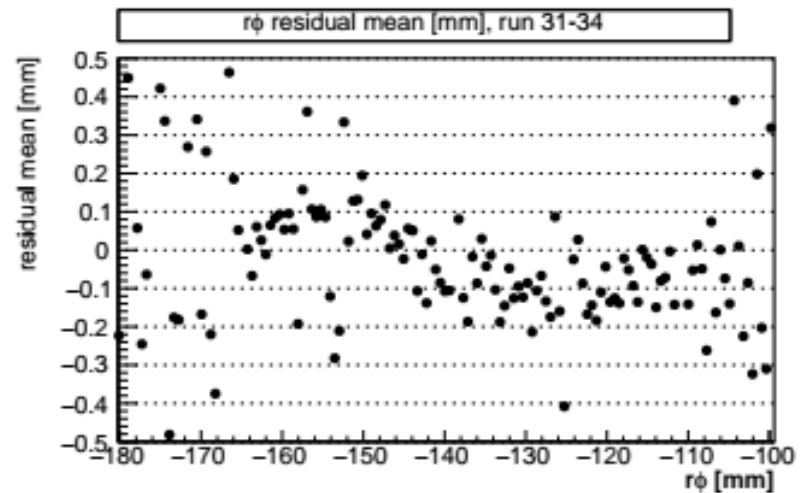
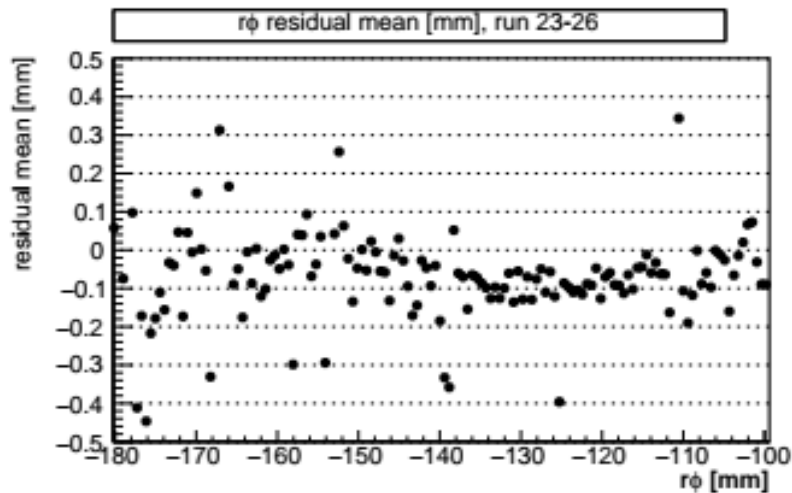
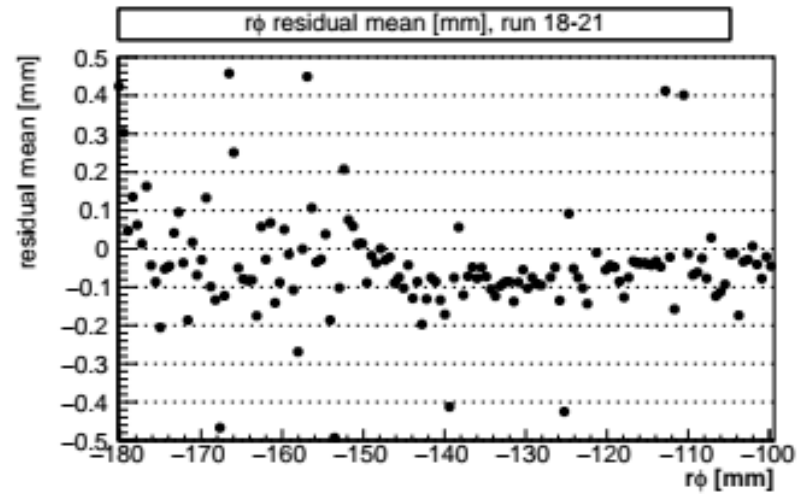
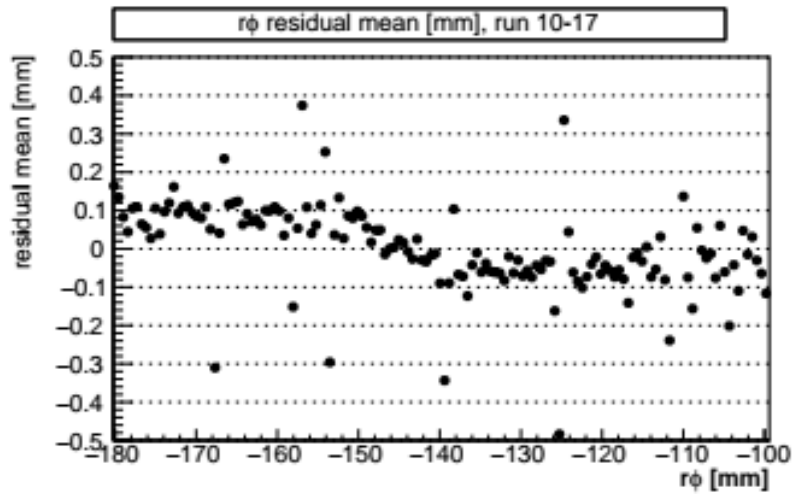
studies vs $r\phi$ position

#entries vs $r\phi$ position



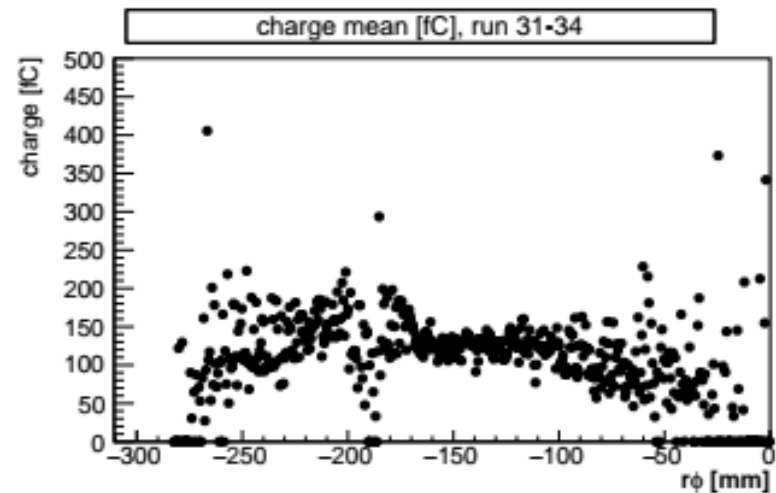
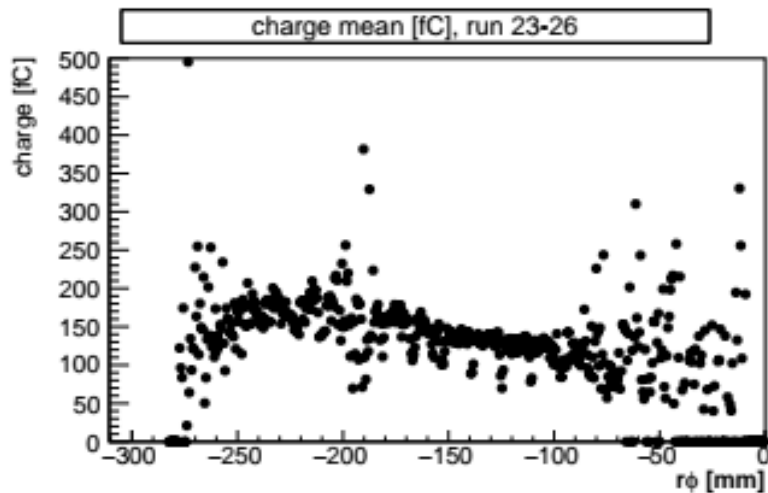
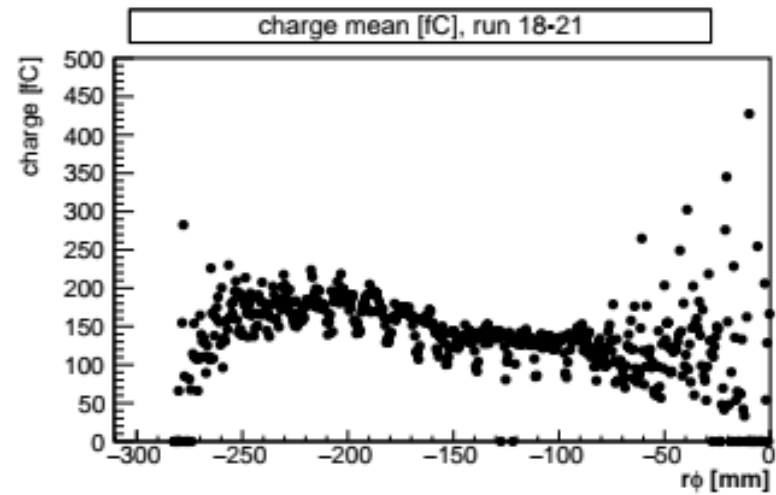
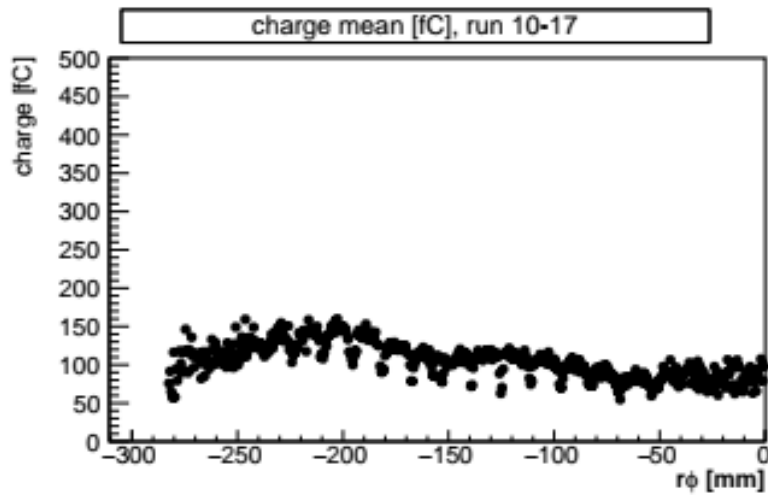
- Entries vs position along the circumference: this is **LAYER 1, BOTTOM**
- The holes are due to the FEB 34 off
- Need to have enough statistics → let's limit the plots to the area between the dashed lines

ZOOM: residual vs $r\phi$ position



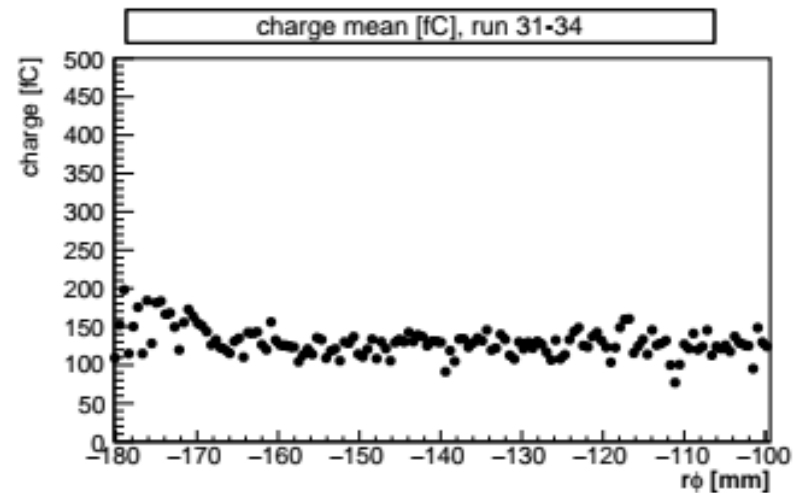
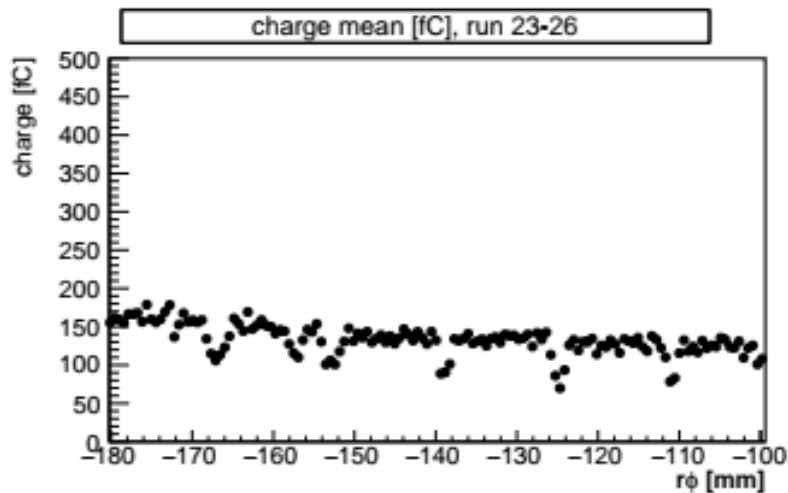
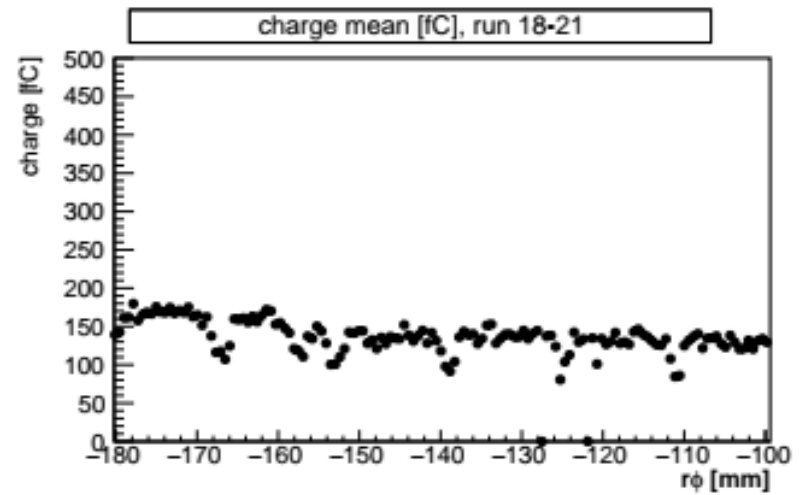
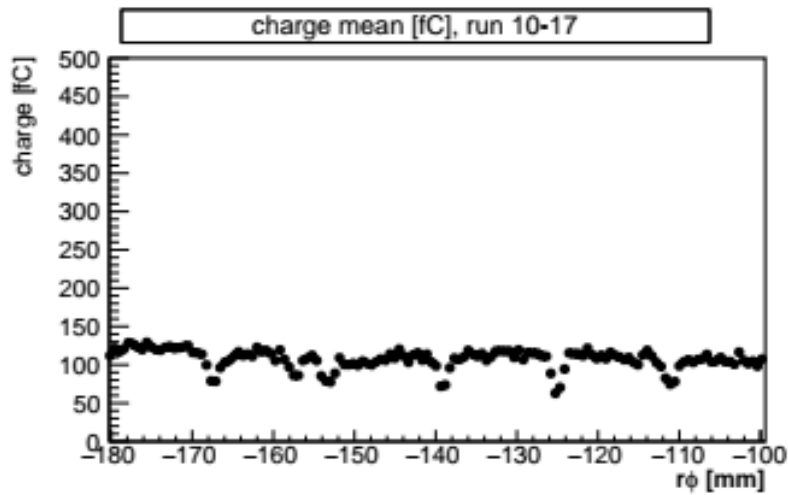
- LAYER 1, BOTTOM
- The statistics is low, but no evident difference
- Note! The “S-like” shape: alignment?

charge vs $r\phi$ position



- LAYER 1, BOTTOM
- The charge is higher for higher gain, as expected → let's ZOOM

ZOOM: charge vs $r\phi$ position



- LAYER 1, BOTTOM
- The charge is higher for higher gain, as expected
- ...but what about the trend?

Conclusions and TODO list

- For the analysis, include cluster selection and fit from cgemboss instead of the standalone I tried with the last tag of CgemLineFit but I get this error:

```
NTupleSvc          ERROR Cannot book N-tuple /NTUPLES/LineFit/cosmic (Invalid parent directory)
CgemLineFit        ERROR Cannot book N-tuple:0
EventLoopMgr       ERROR Unable to initialize Algorithm: CgemLineFit
ServiceManager     ERROR Unable to initialize Service: EventLoopMgr
ApplicationMgr      INFO Application Manager Terminated successfully
```

posted on the HN: Aiqiang has the solution, needs to upload (thanks!)

- Double hit in same strip to be investigated
- For the microsectors:
 - investigate different electric settings
 - specific reconstruction