
sTGC cluster finder

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Outline

- How to find the sTGC cluster
- Simple start with low multiplicity events
- Results
- Summary and outlook

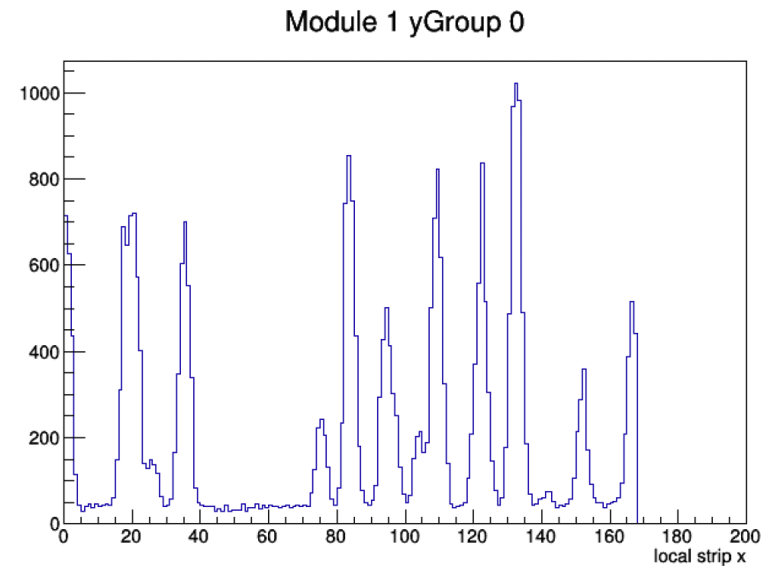
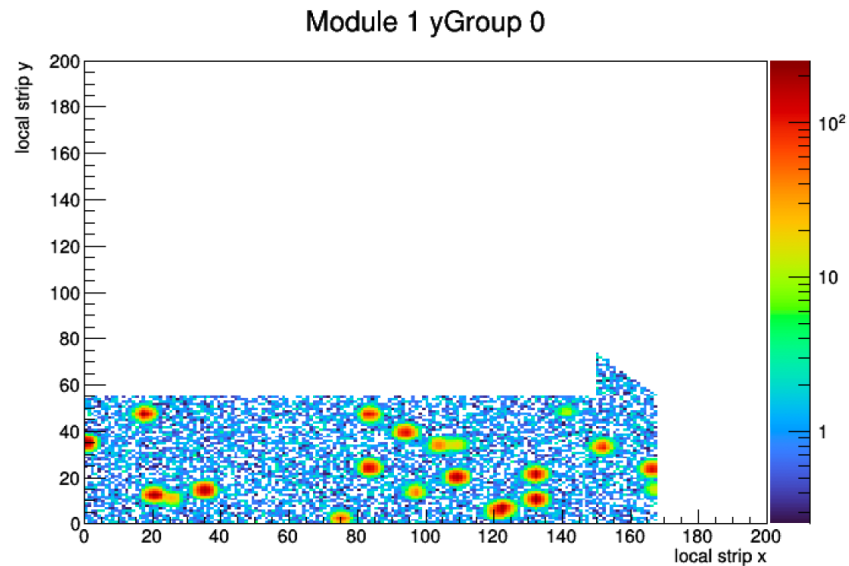
How to find the sTGC cluster

- 1) Algorithm to find 1D clusters
- 2) Get the 1D hit position information
- 3) Combine 1D cluster from X and Y back into 2D

How to find the 1D cluster

- 1) Projection ADC distribution to 1D

1D Strip measurements



Strips that run along y give x — position information

How to find 1D cluster

Total hits = 20

How to find the 1D cluster

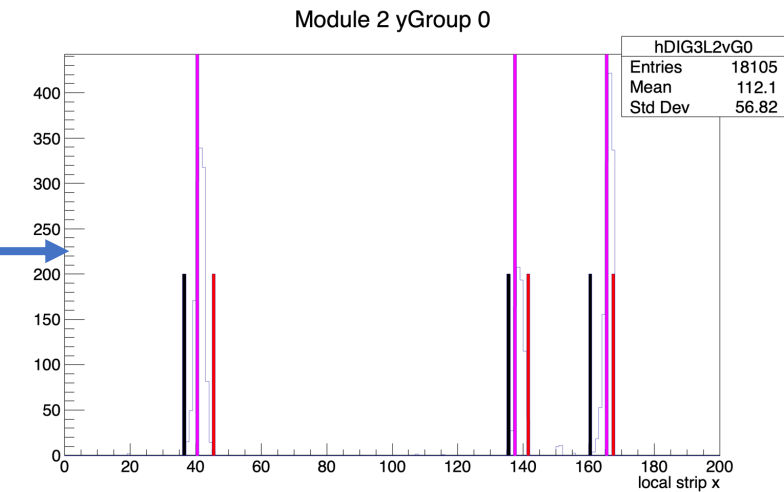
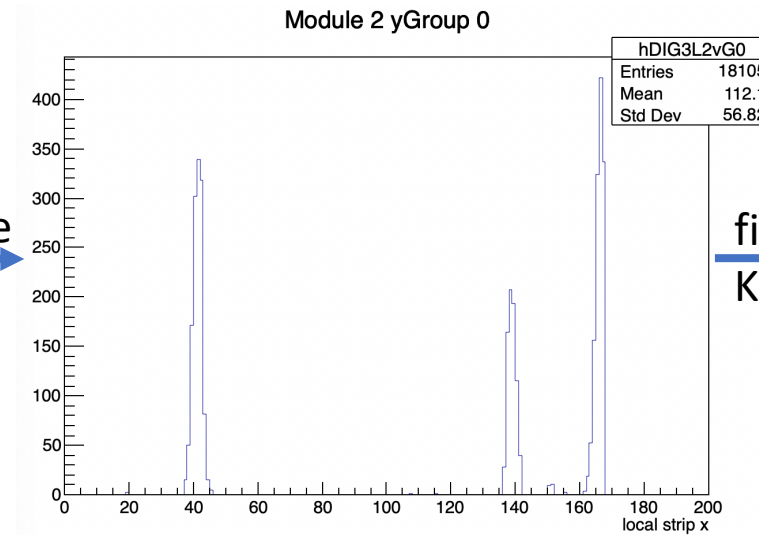
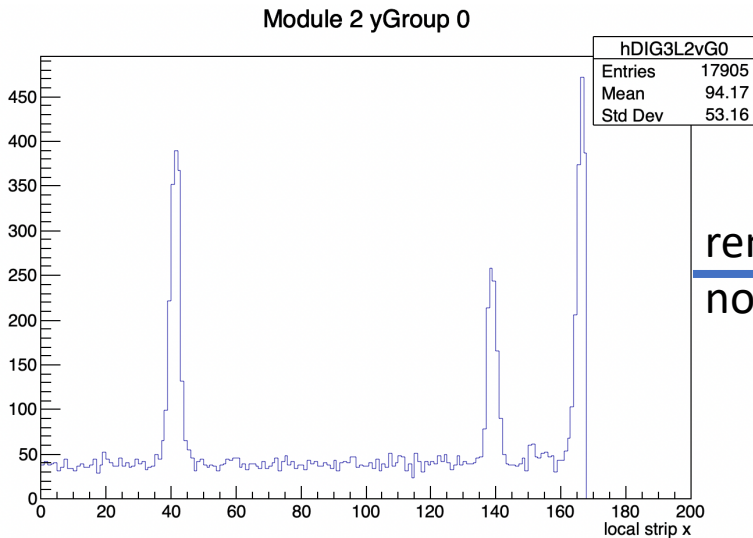
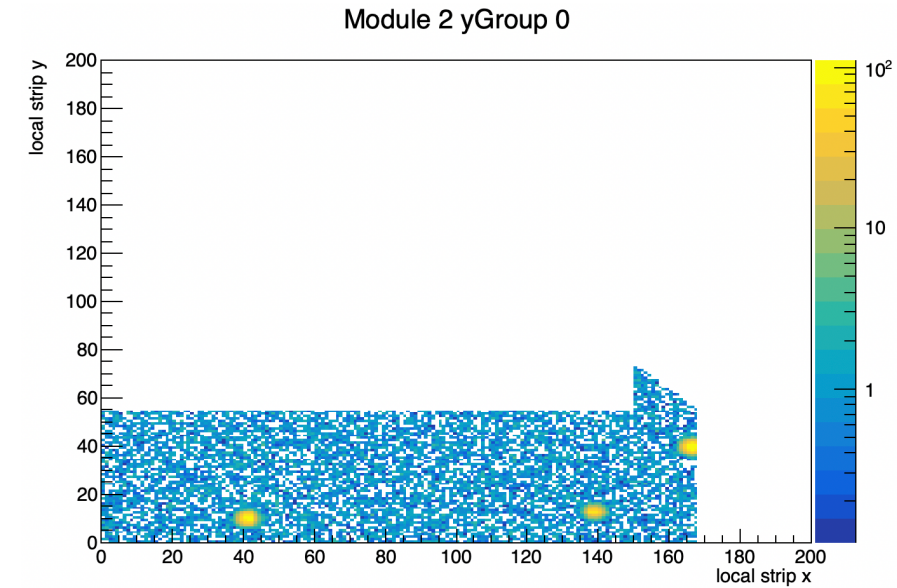
- 1) Projection ADC distribution to 1D
- 2) Remove noise
- 3) Get the 1th order Derivative of 1D ADC distribution
- 4) find the key point :

start point of signal region (derivative = 0 -> derivative > 0)

end point of signal region (derivative < 0 -> derivative = 0)

maximum point(s) in signal region (derivative > 0 -> derivative < 0)

minimum point(s) in signal region (derivative < 0 -> derivative > 0)



1D cluster finder (high multiplicity)

Total hits = 200, more overlap events

4) find the key point :

start point of signal region (derivative = 0 -> derivative > 0)

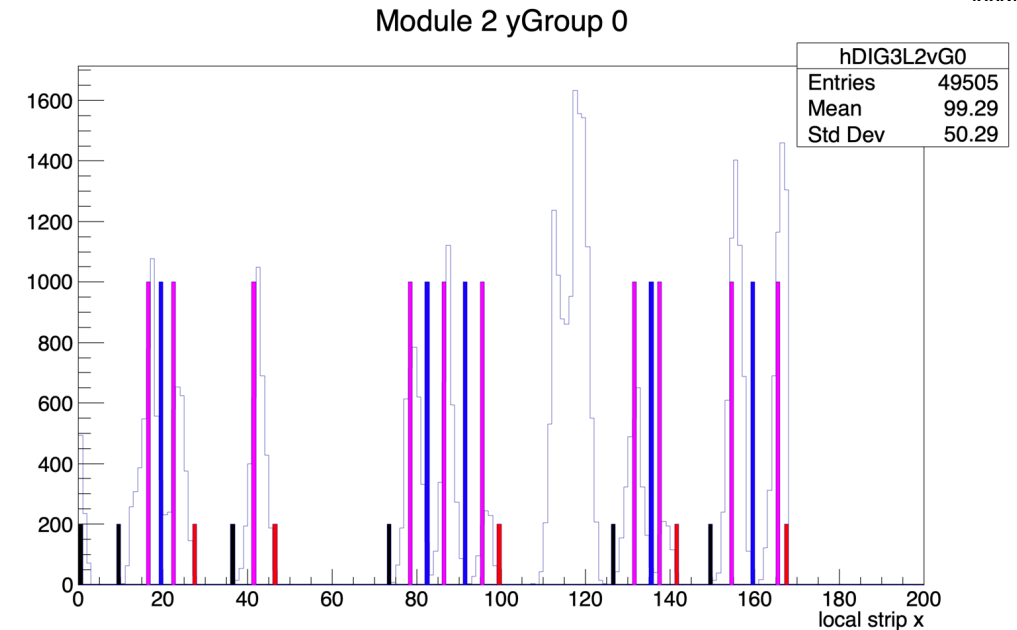
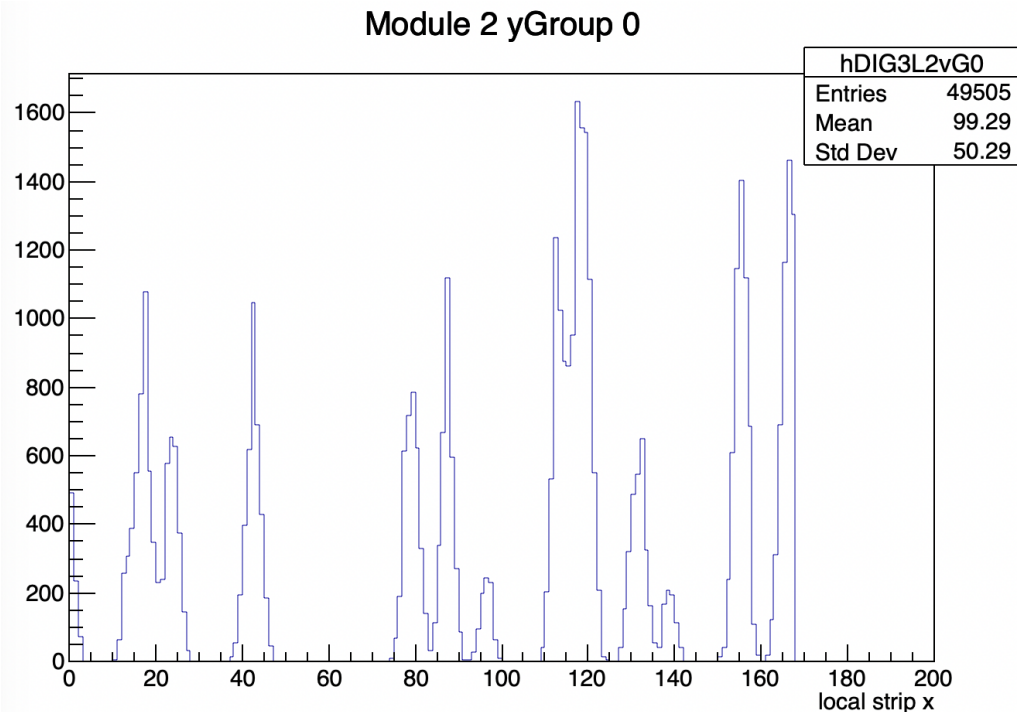
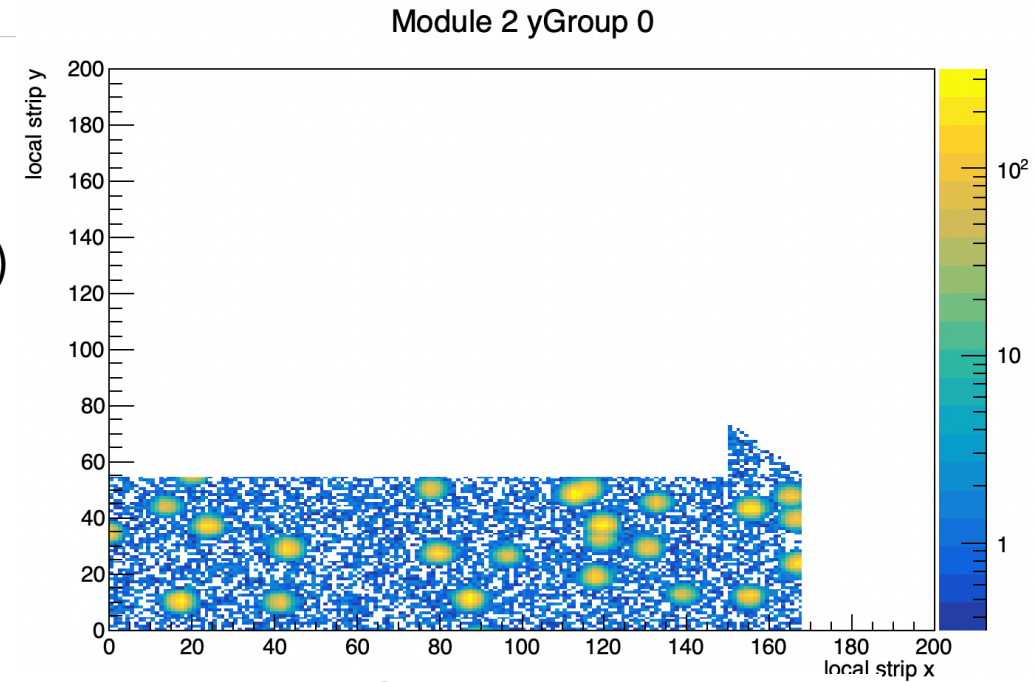
end point of signal region (derivative < 0 -> derivative = 0)

maximum point(s) in signal region (derivative > 0 -> derivative < 0)

minimum point(s) in signal region (derivative < 0 -> derivative > 0)

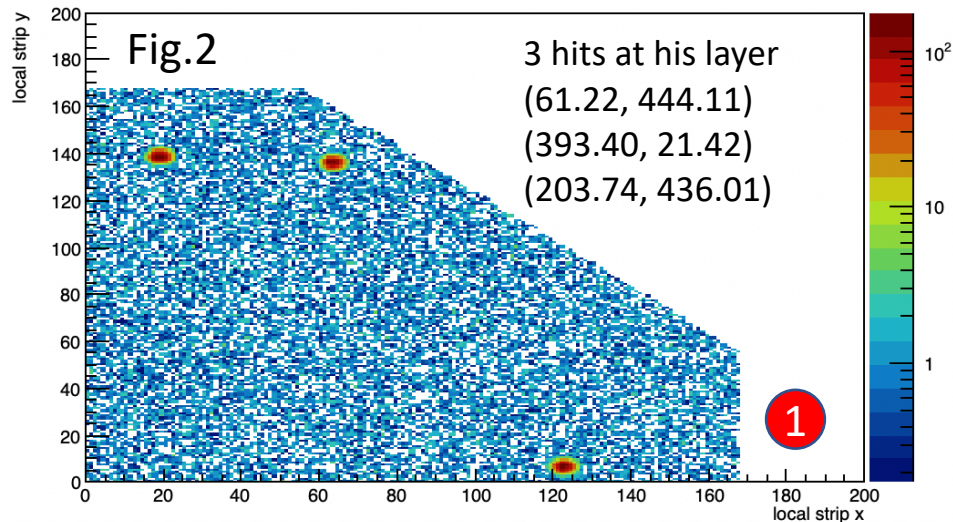
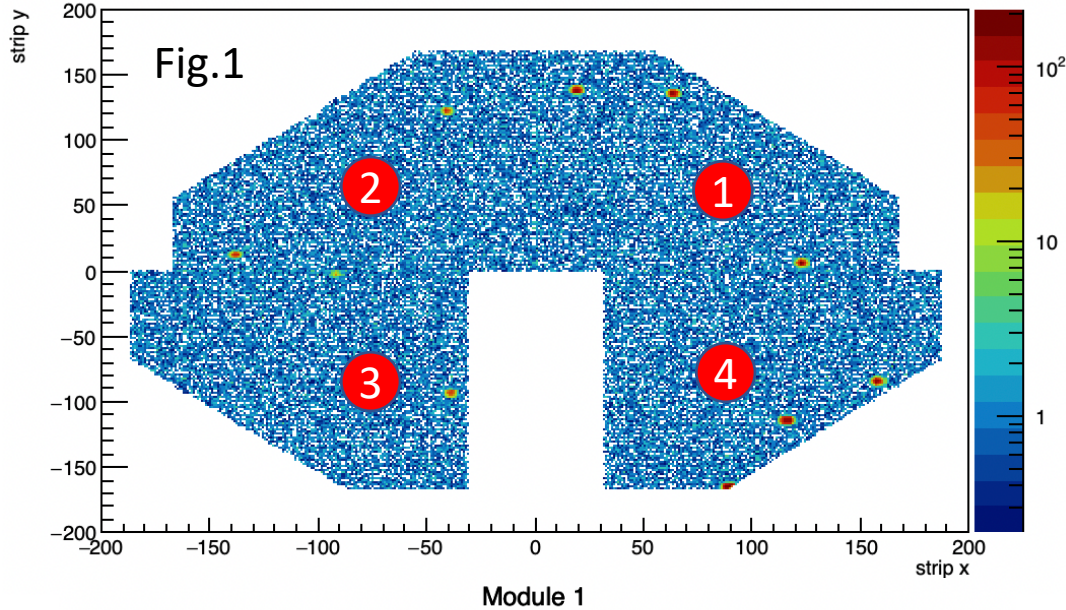
With high multiplicity, the minimum points become more important to split hits with similar x(y) position.

(Maximum point + hits width ?)

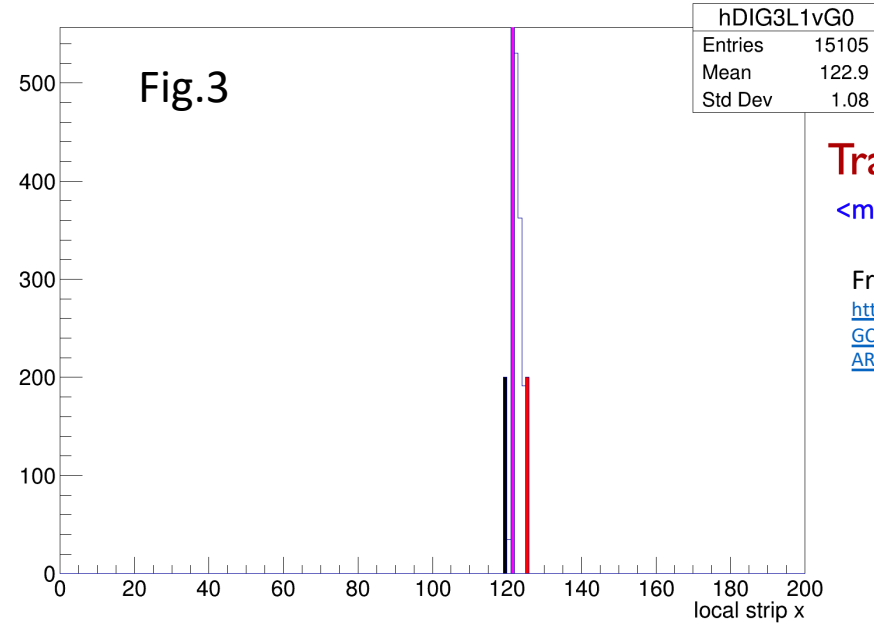


Cluster finder performance with low multiplicity events

- 1) Algorithm to find 1D clusters
 - 2) Get the 1D hit position information
- Total hits = 10



Module 1 yGroup 0



Tracking performance – PP

$$\langle \text{mult}_{\text{GEN}}^{\text{forward}} \rangle \approx 5$$

From Zhenyu Chen's study

https://drupal.star.bnl.gov/STAR/system/files/STARsTGC_20190520.pdf?destination=system%2Ffiles%2FSTARsTGC_20190520.pdf

$$x = \frac{\sum X_i * Q_i}{\sum Q_i} \text{ where } X_i \text{ is the position of } i^{\text{th}} \text{ strip, } Q_i \text{ is the sum}$$

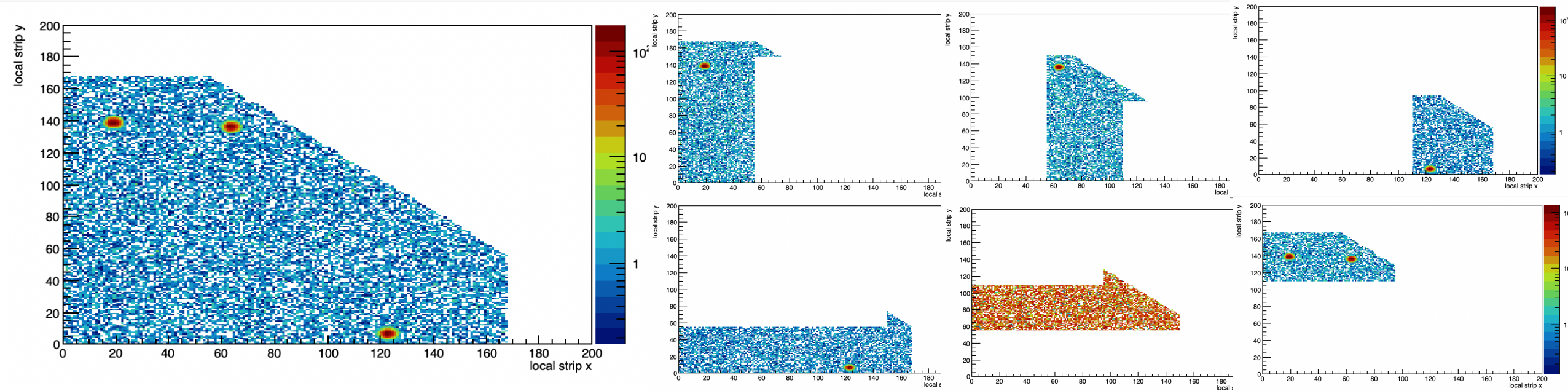
ADC of i^{th} strip

(393.40, 21.42)

Module = 1 group = 0 direction = v
393.648

Module = 1 group = 2 direction = h
21.7347

Combine the 1D hits to 2D hits



3 modules in both horizontal and Vertical direction. Combining the x and y information with different module. This part still need to be finalized.

Low multiplicity event

- ghost hits ~ 0 , will be studied at high multiplicity events
- how to combine hits at group edge will be studied at high multiplicity events

Summary and next to do

Summary

- Test the 1D cluster finder performance at low multiplicity

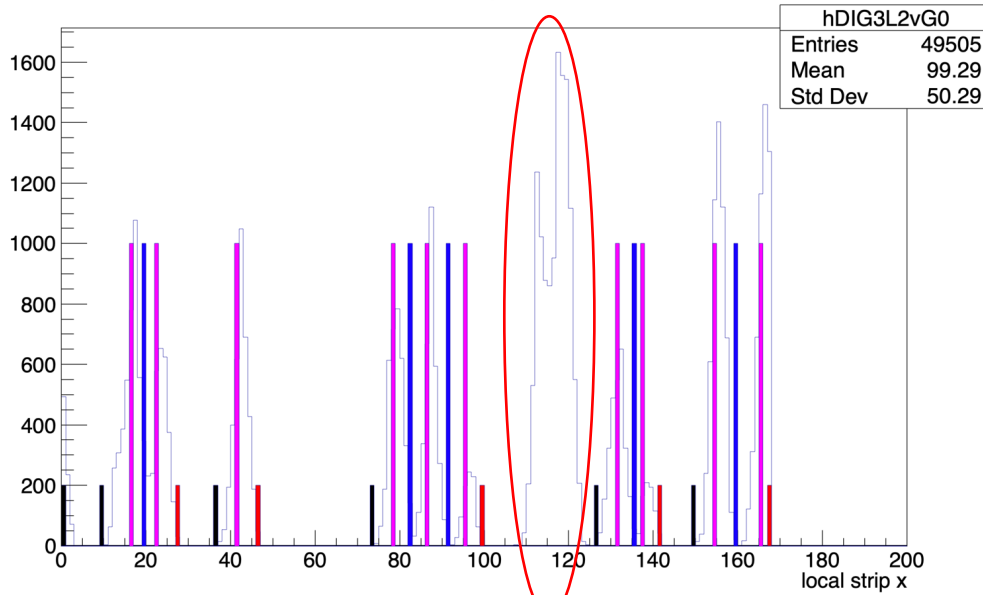
Next to do

- Finalize the combine 1D hits to 2D hits part
- Test the performance at high multiplicity event
- Add Time information and diagonal strip in cluster finder

Reason of skip

Total hits = 200, more overlap events

Module 2 yGroup 0



start point of signal region (derivative = 0 -> derivative > 0)

These points have an additional condition:

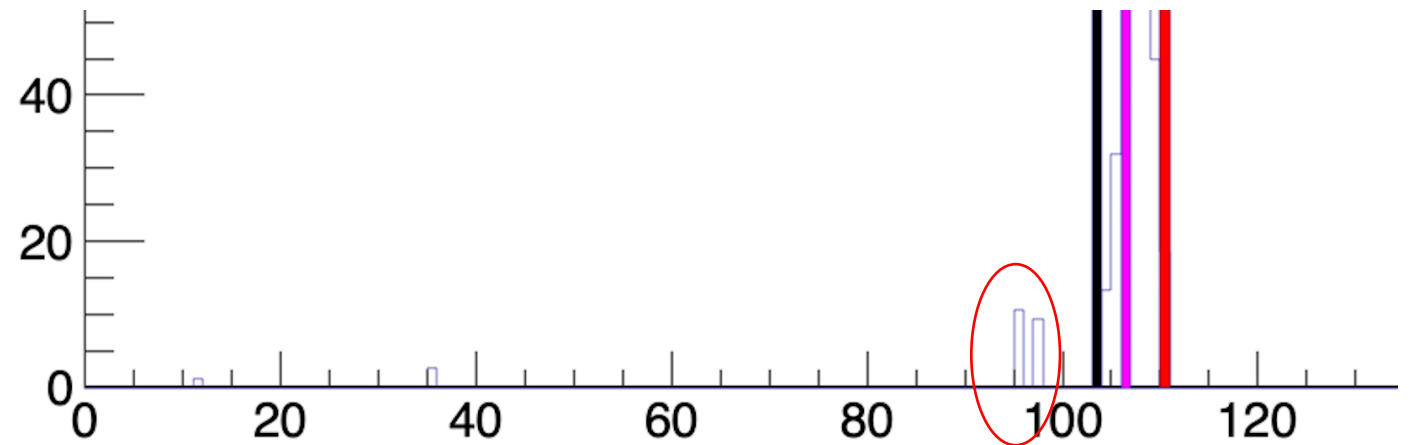
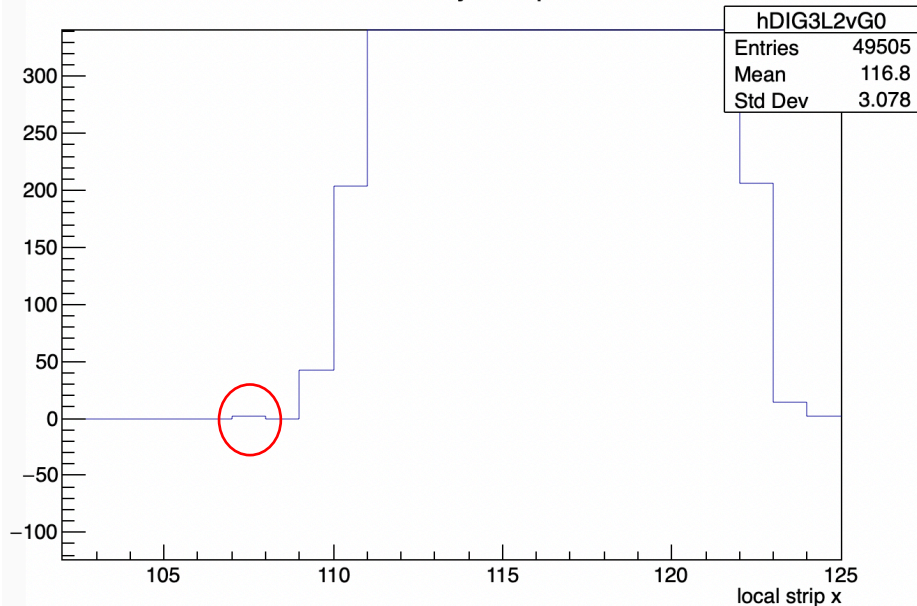
For example : if bin 10 is a candidate of start point.

(bin10 derivative = 0 && bin11 derivative > 0)

And bin content of bin 11, 12, 13 must larger than 0, then bin10 become a start point. (Condition2)

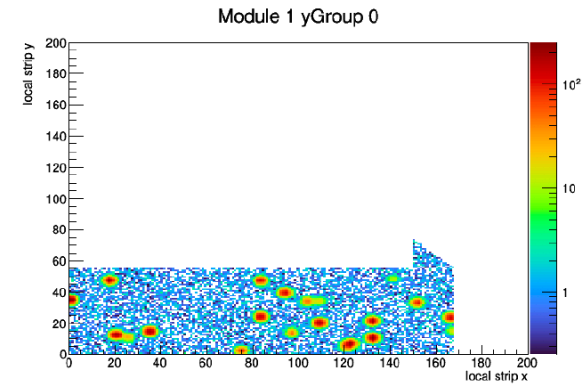
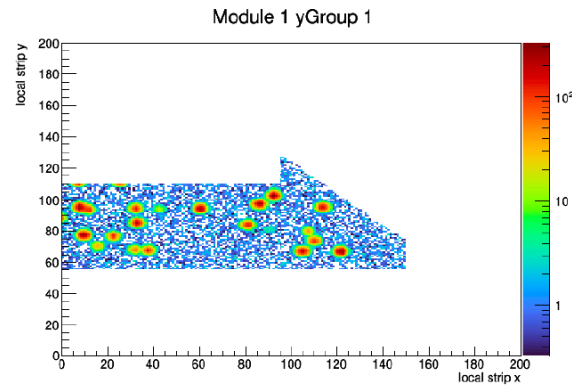
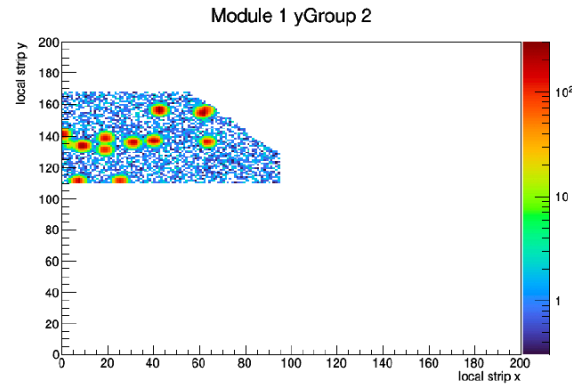
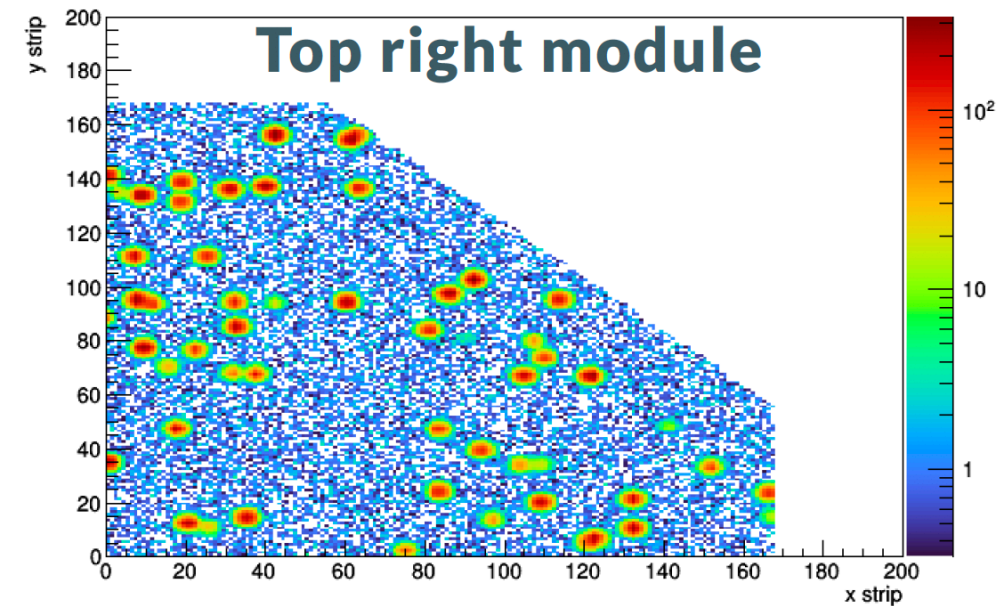
The purpose of condition2 is to move the noise in right bottom plot

Module 2 yGroup 0



XY Strip Groups

XY Strip groups



Vertical strips: project onto the x -axis to get signal on strip @ x position.