INTT cosmics analysis update
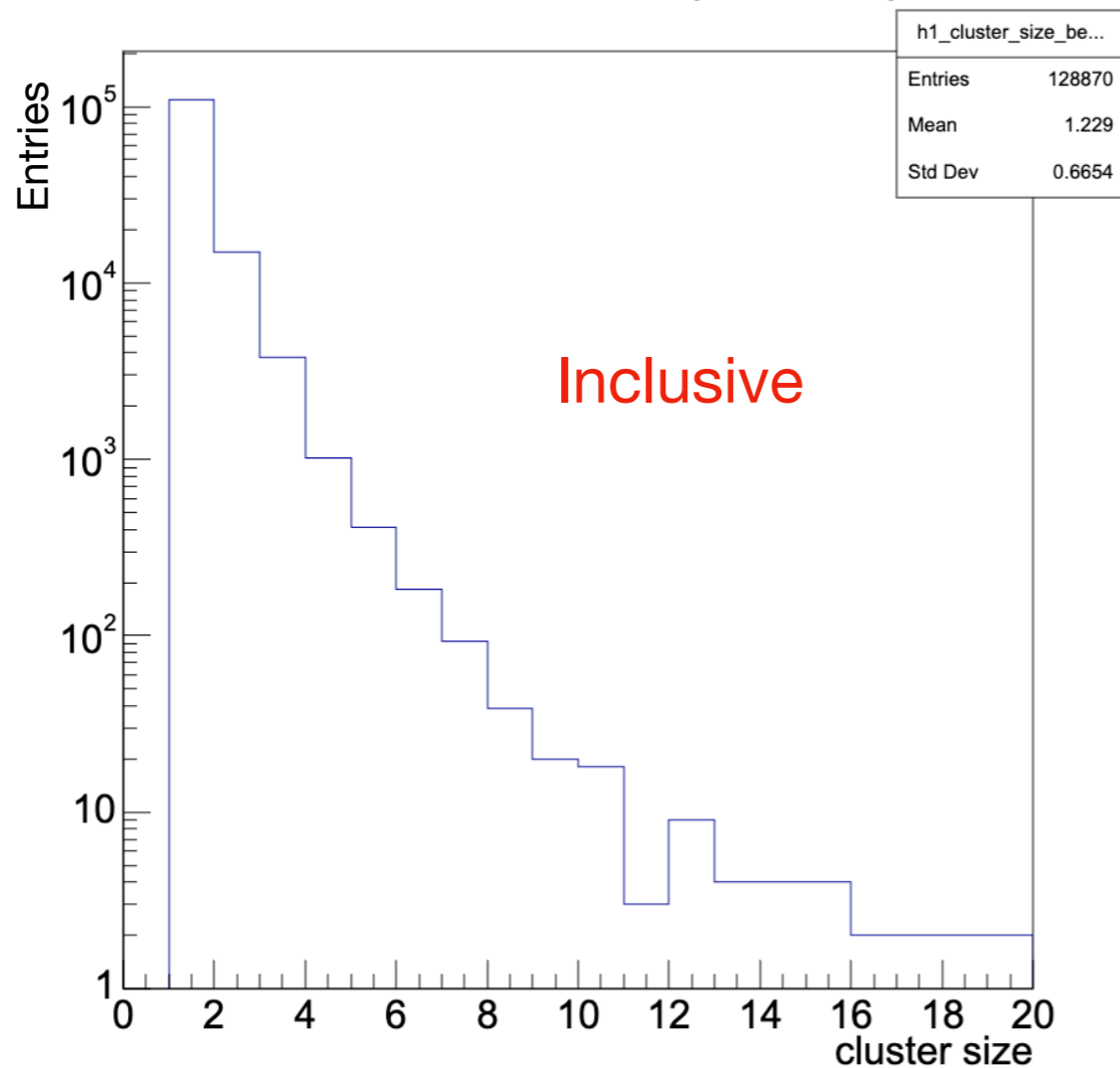## Wei-Che Tang, NCU

Cosmic analysis status

- Analyzed a single run. The information of the run is shown below:

  - Run number: 39524

  - Data taking duration: ~1hr

  - Total events processed: ~240K

  - Trigger used: HCal vertical narrow trigger

- Pre-selection for cosmic analysis:

  - Hot channel mask: (This applies before doing the clustering)

    - 13 hot channels are masked

  - Clusters cut:

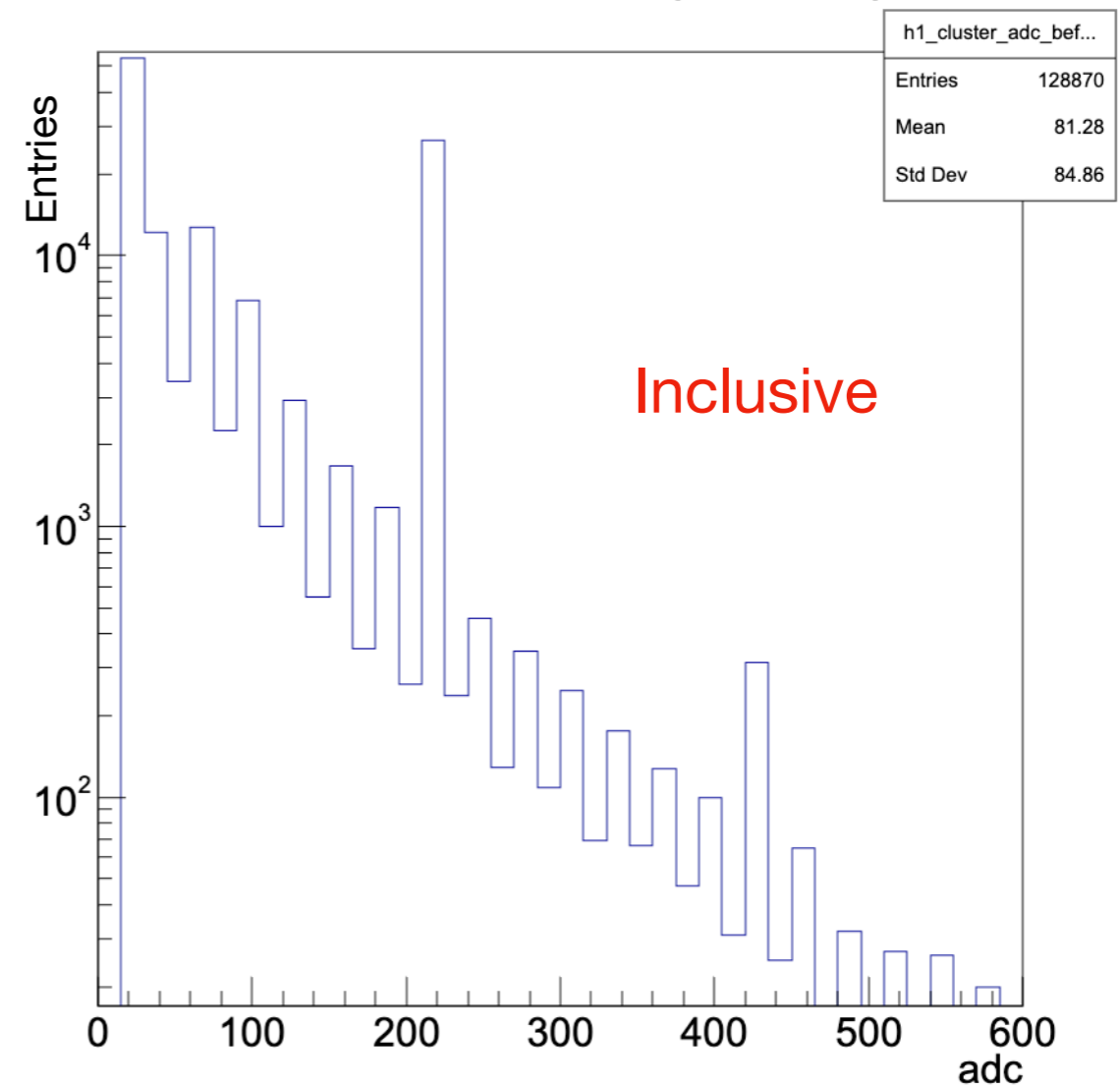   - Good cluster requirement: cluster adc > 15 & cluster size < 9 (adc0 is set to 15)

Run data check

- Pre-selection comparison:
  - Left: Cluster size distribution
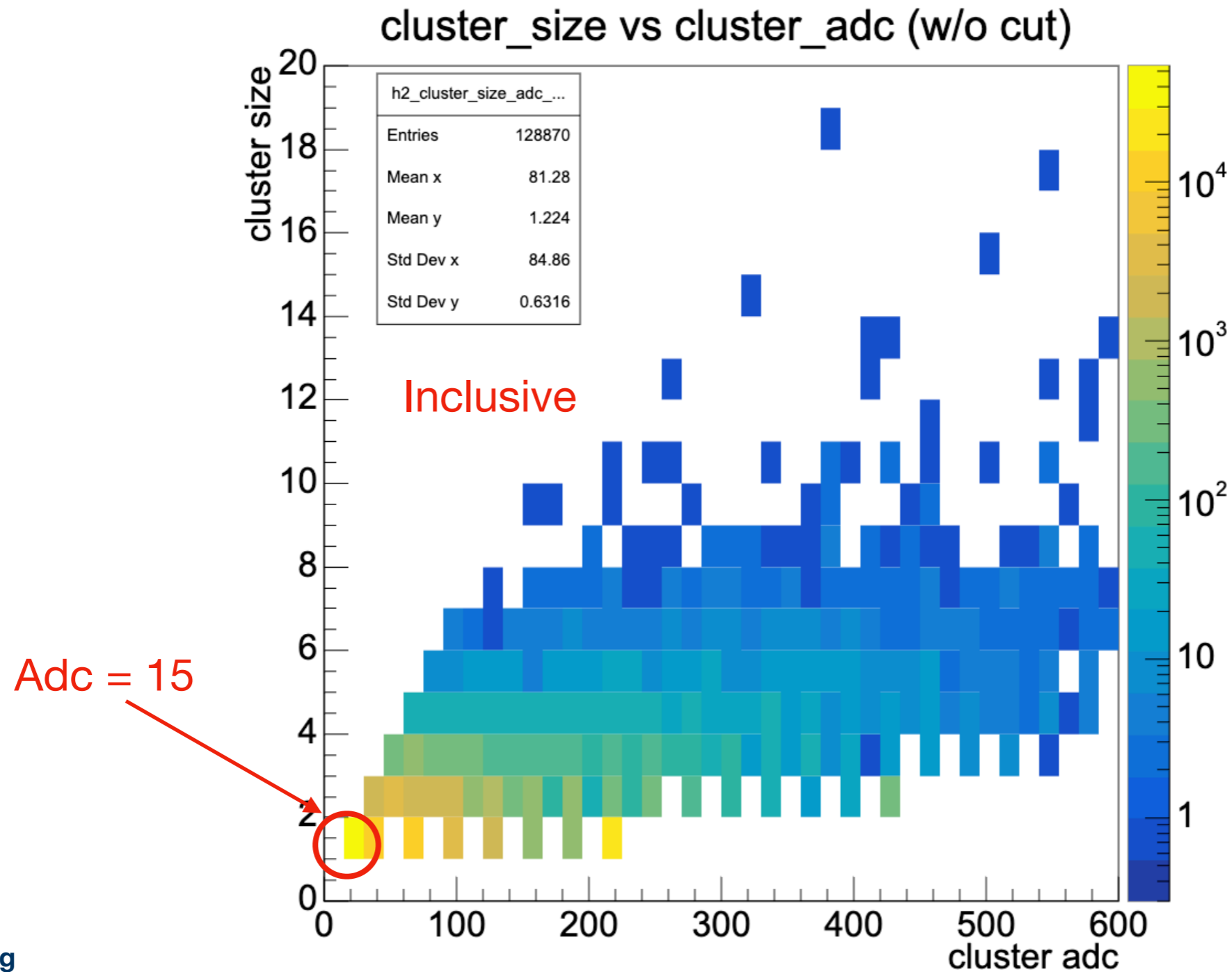 - Right: Cluster adc distribution

cluster size dist. (w/o cut)

| h1_cluster_size_be...	
Entries	128870
Mean	1.229
Std Dev	0.6654

Inclusive

cluster Adc dist. (w/o cut)

h1_cluster_adc_bef...	
Entries	128870
Mean	81.28
Std Dev	84.86

Inclusive

Run data check

- Pre-selection comparison:

  - Cluster adc v.s. cluster size

cluster_size vs cluster_adc (w/o cut)

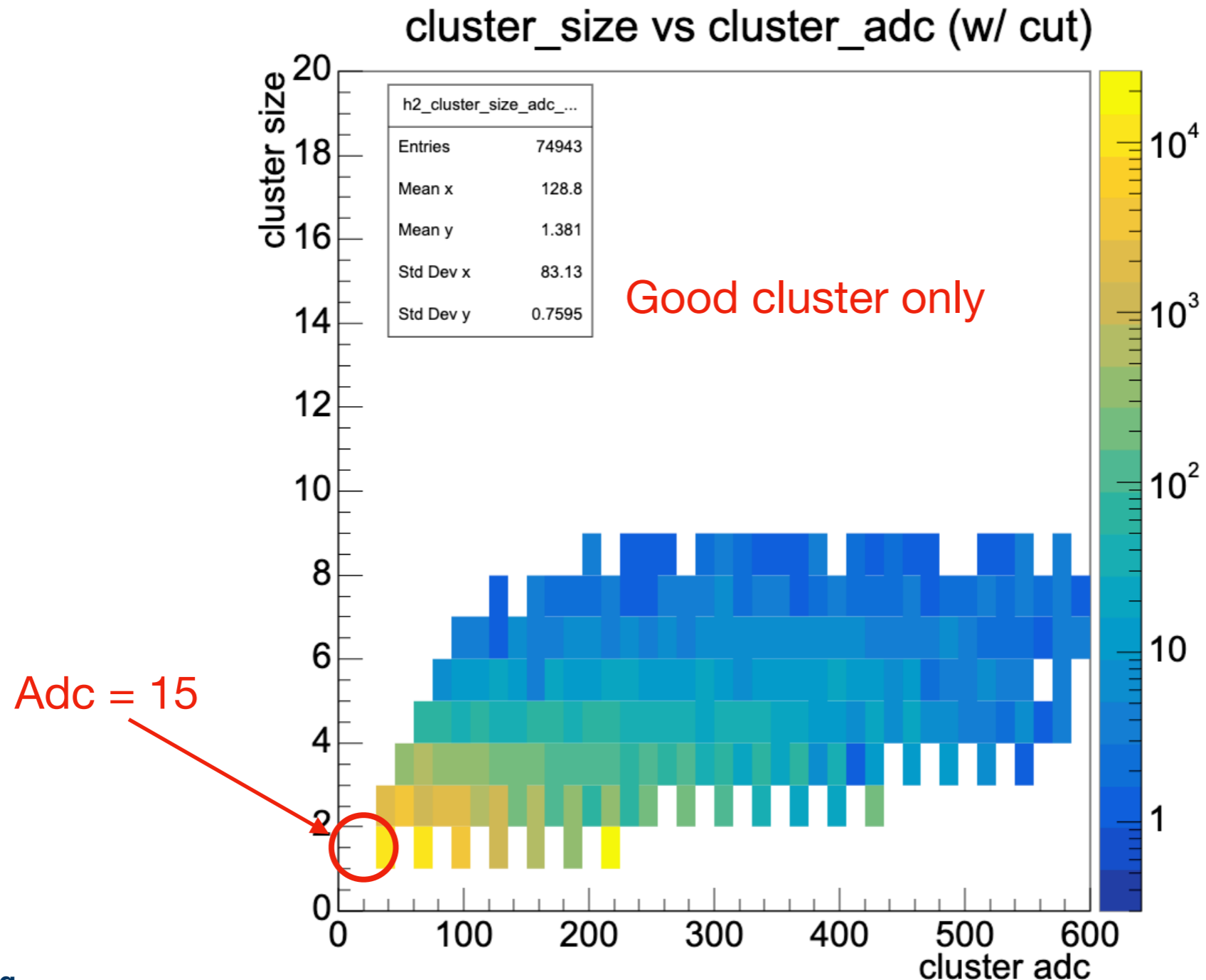| h2_cluster_size_adc_...	
Entries	128870
Mean x	81.28
Mean y	1.224
Std Dev x	84.86
Std Dev y	0.6316

Inclusive

Adc = 15

Run data check

- Pre-selection comparison:
  - Left: Cluster size distribution
  - Right: Cluster adc distribution
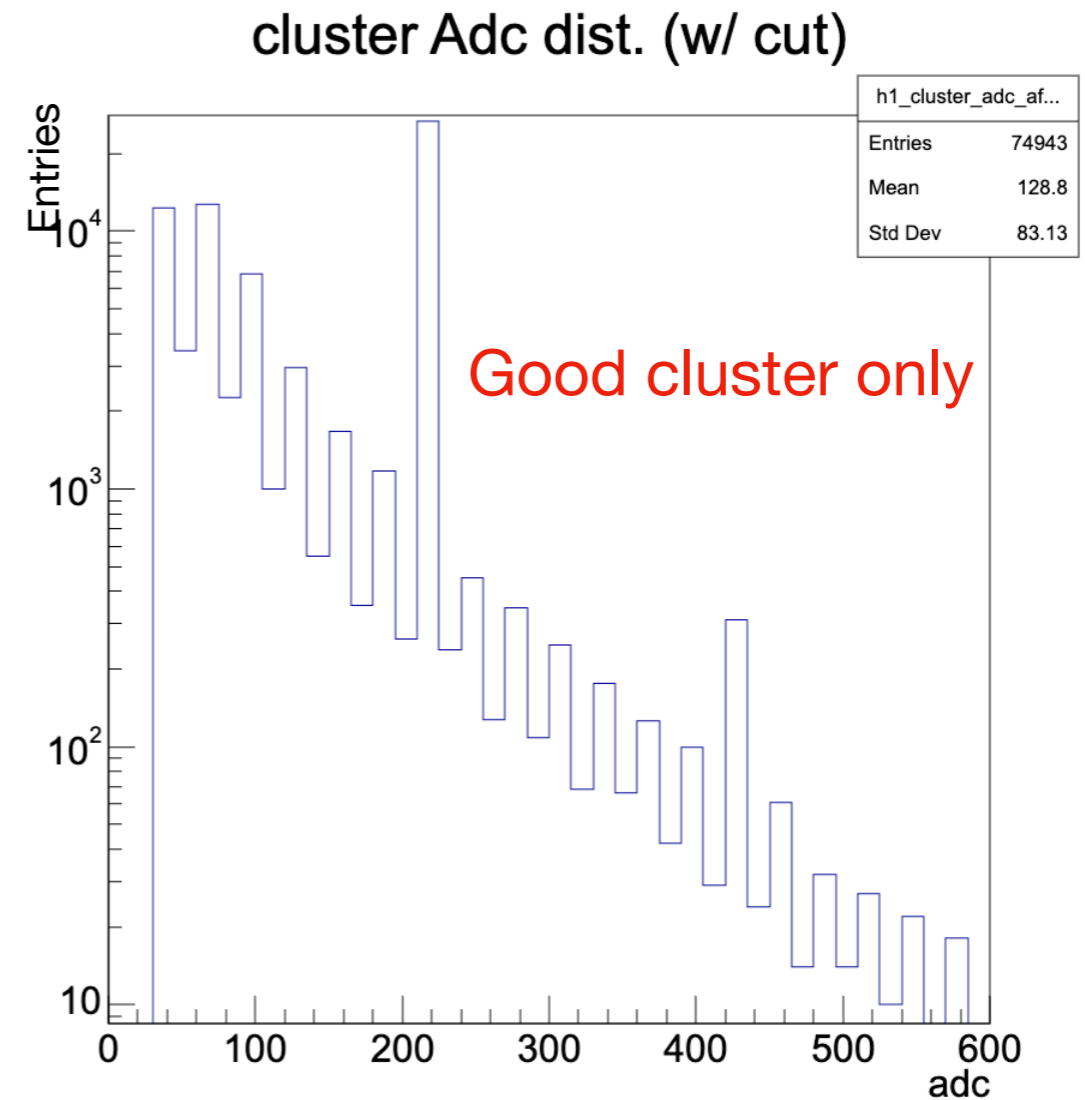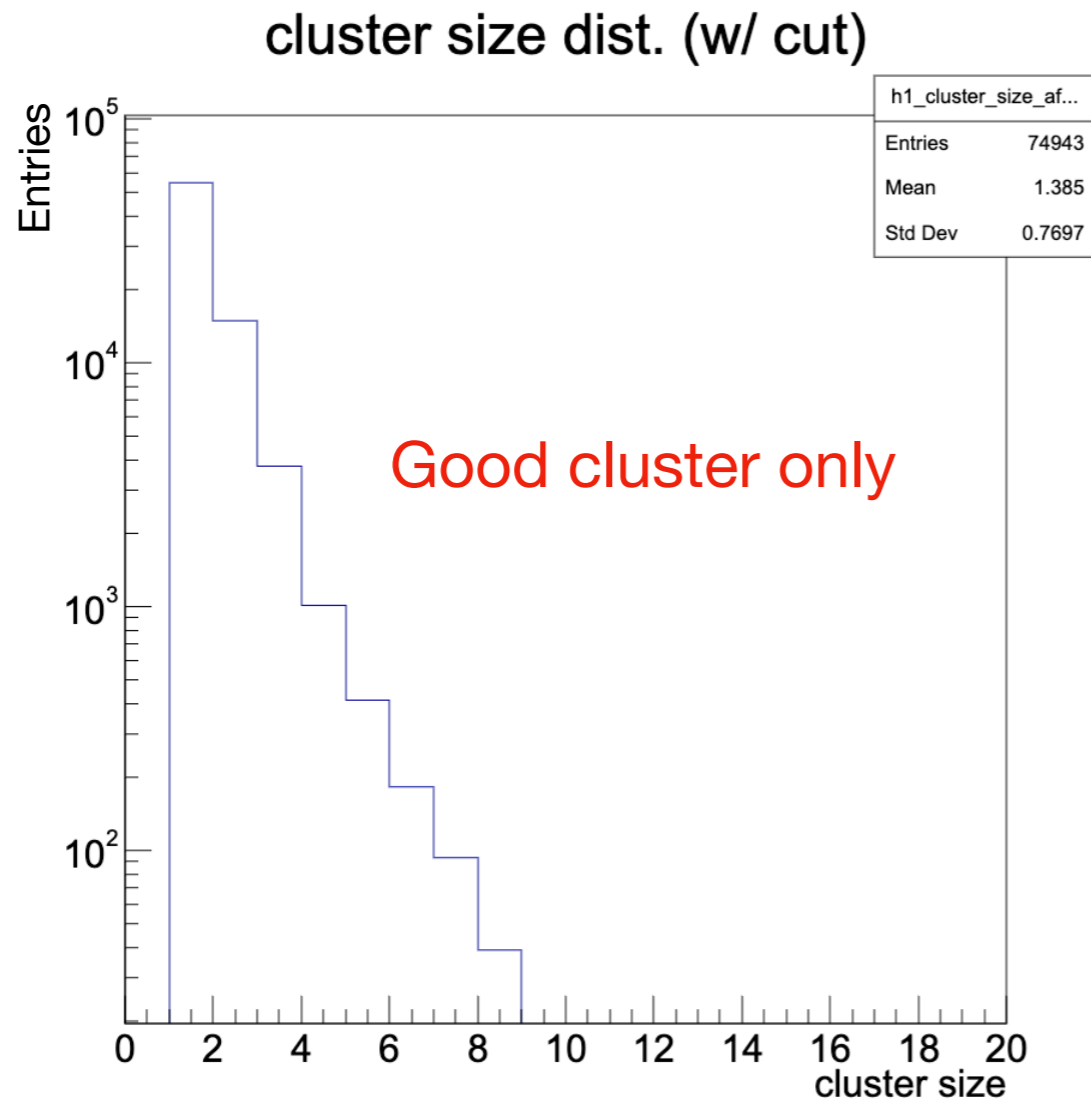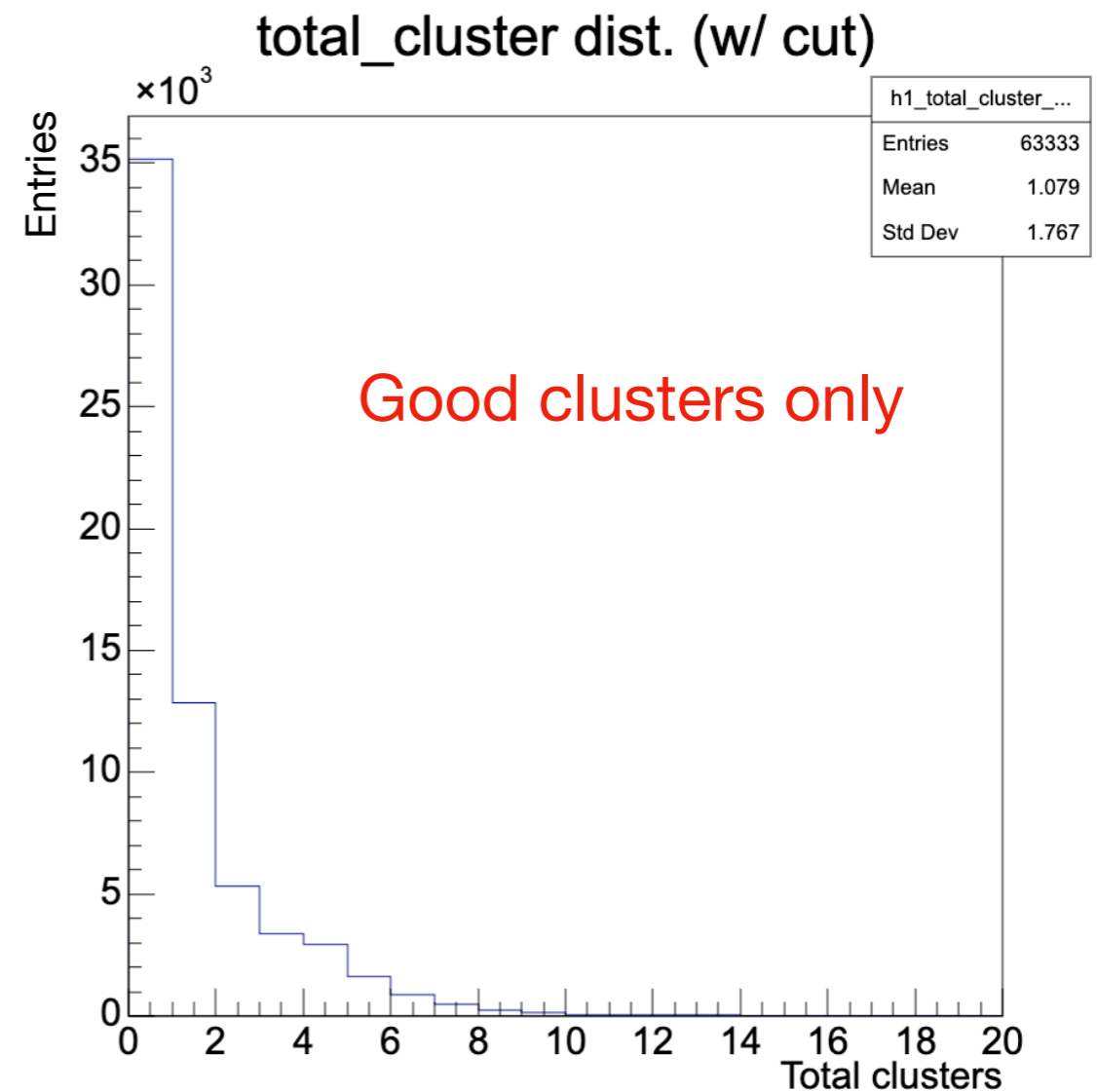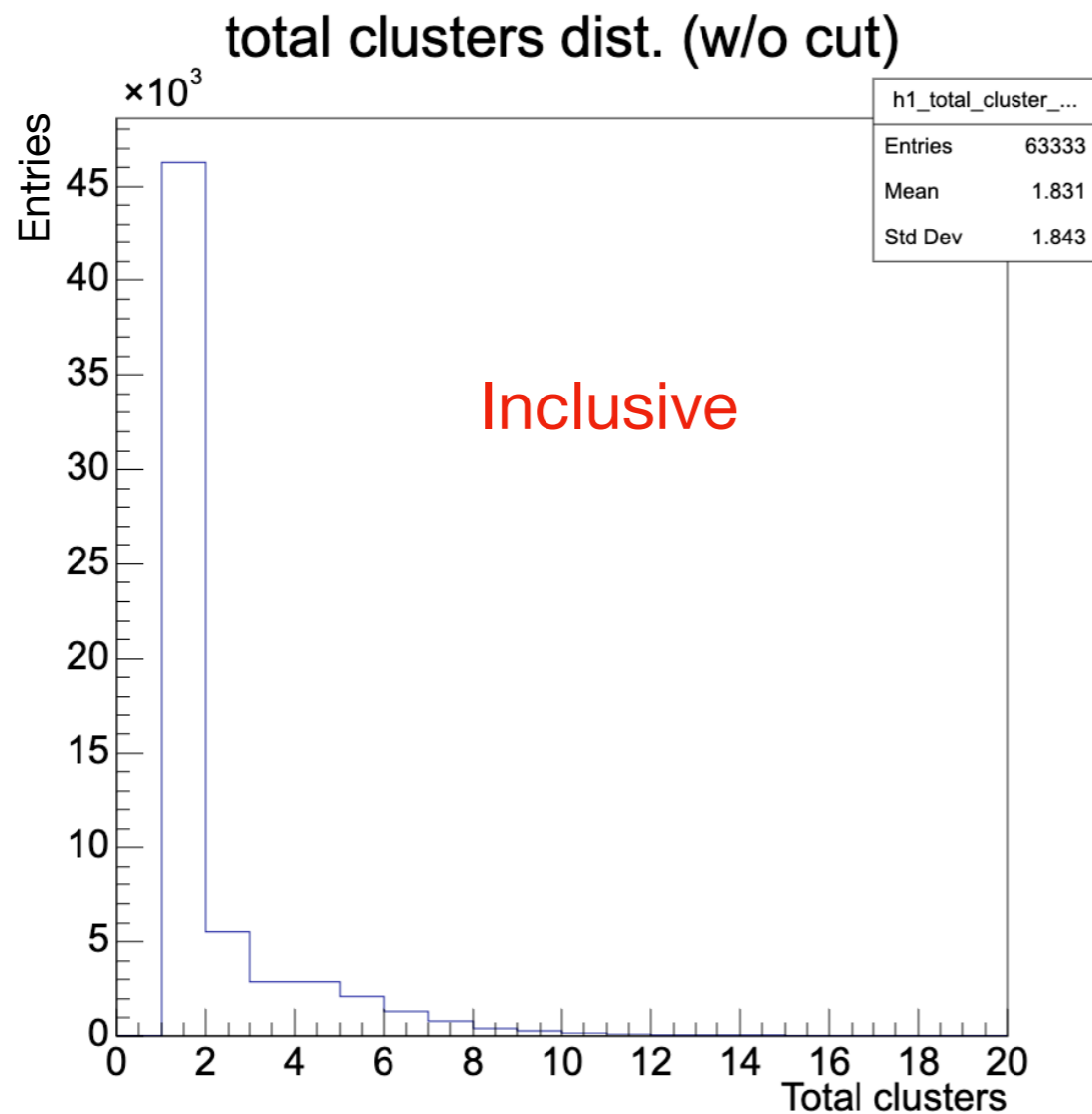
Run data check

- Pre-selection comparison:

 - One can find some bin disappear due to the cluster cut

cluster_size vs cluster_adc (w/ cut)

Good cluster only

Adc = 15

Run data check

- Pre-selection comparison:
  - The total clusters in one event.
  - The empty events are removed before the cut.

total clusters dist. (w/o cut) — Inclusive

total_cluster dist. (w/ cut) — Good clusters only

Cosmic tracks selection

- **Only focus on the event whose total good clusters equals to 4.**

- Track angle determined by reduced χ^2 method.

- Use the reduced residual to evaluate the fitting quality (to minimize the angle dependence).
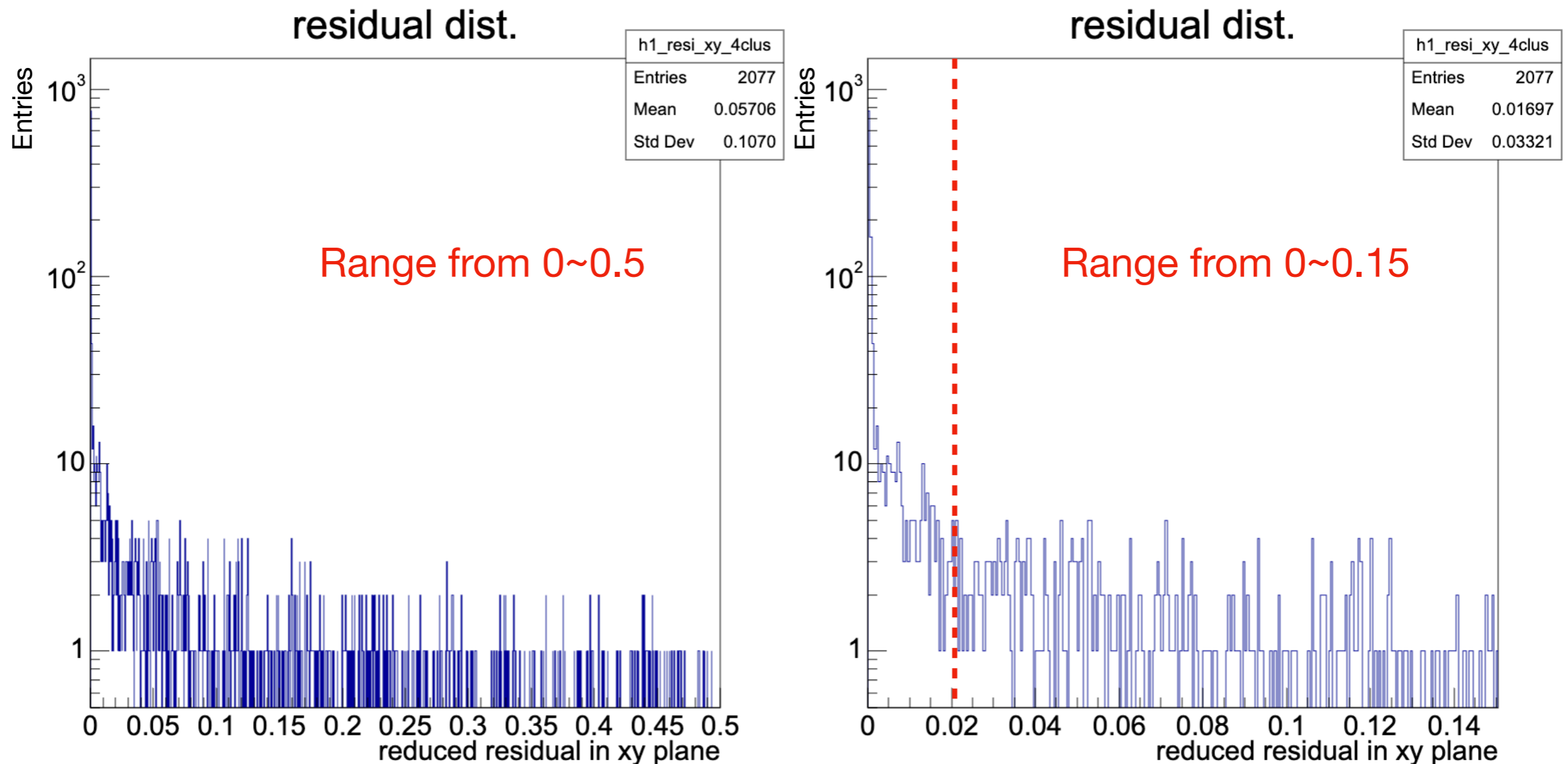
- The event display is shown in xy, zy, zx and zr planes. (The units are in cm)

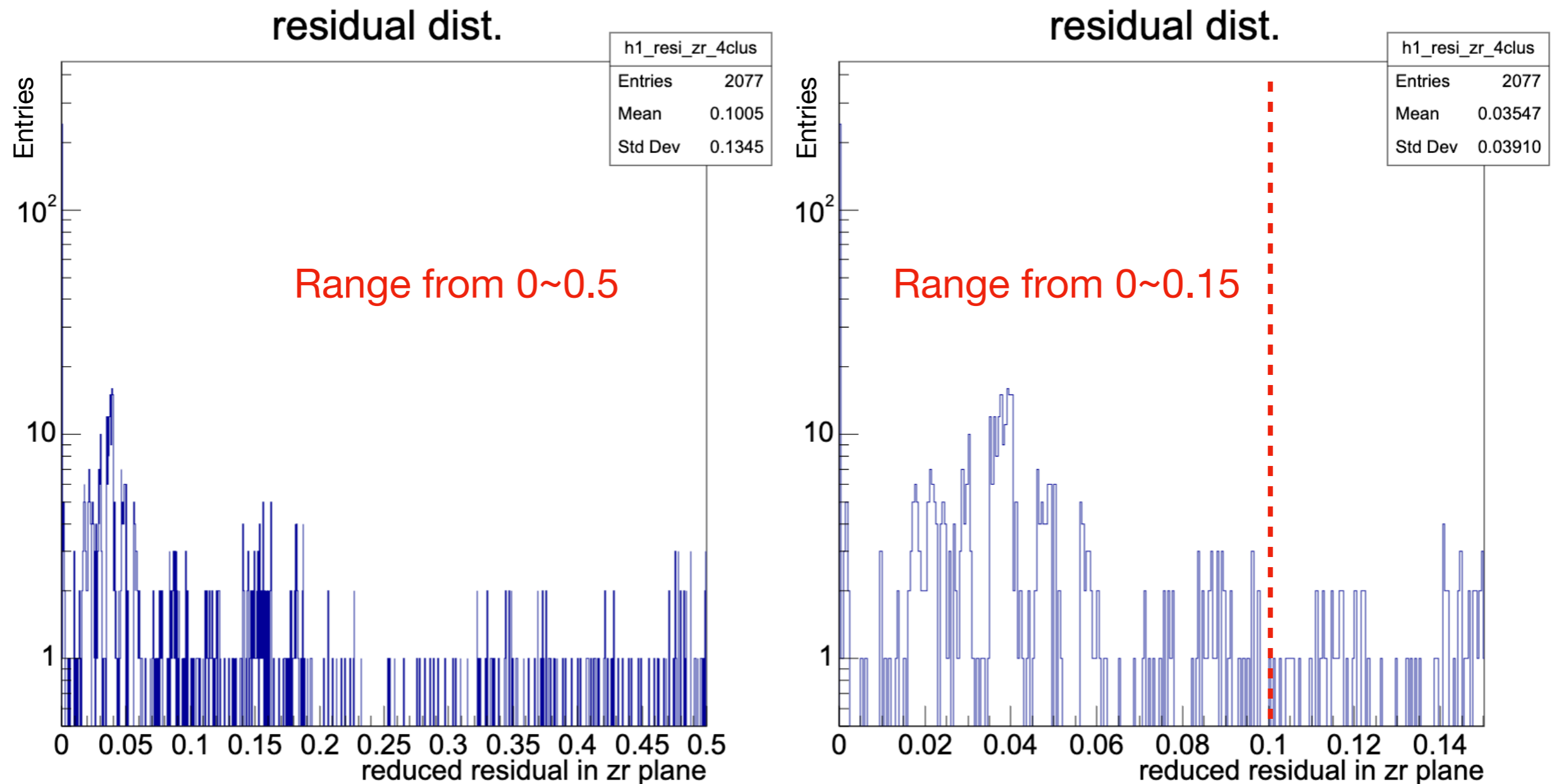- Mainly focus on the xy and zr planes in the analysis.
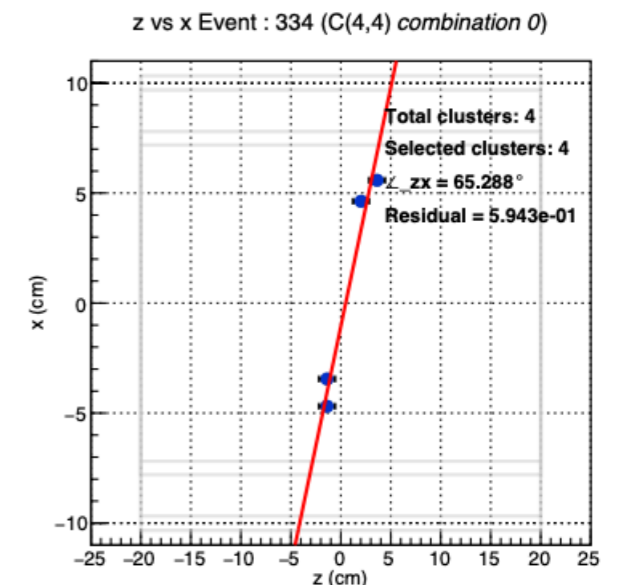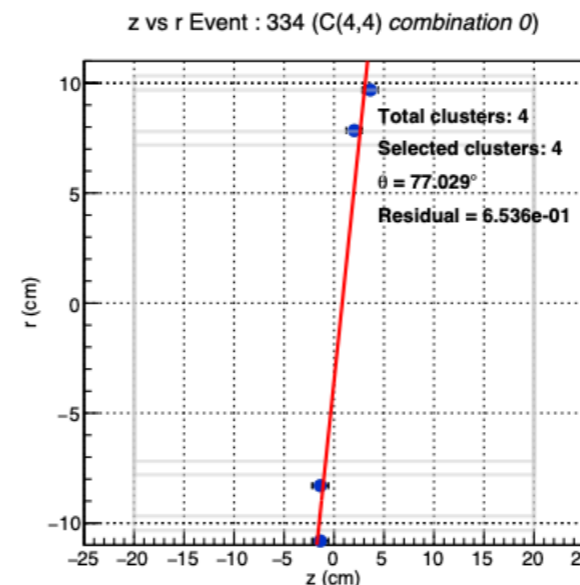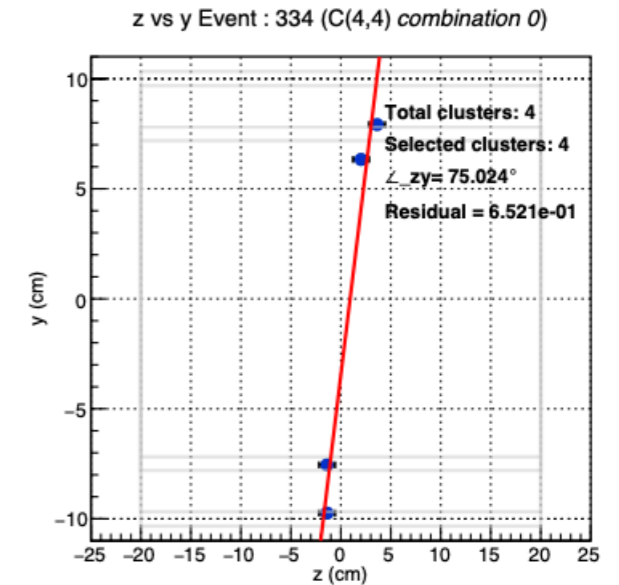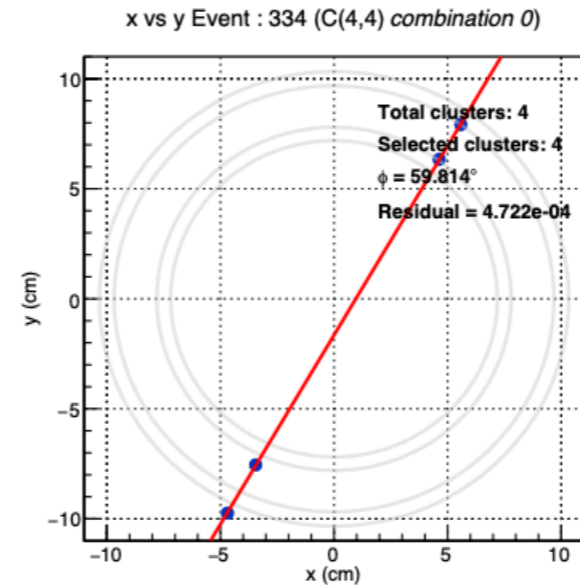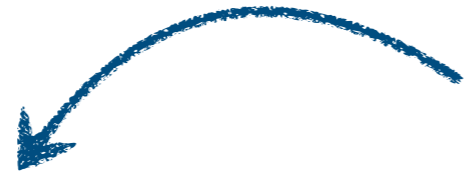
Fitting quality check

- The reduced residual distribution in **xy plane.**

- Selected the tracks whose reduced residual is smaller than 0.02 as a good track.
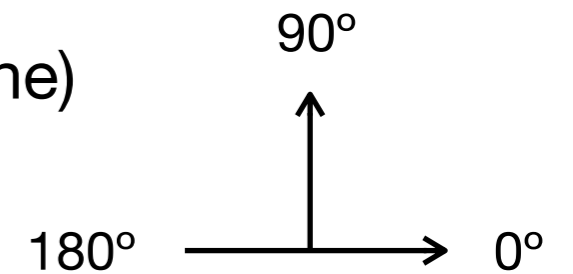
Fitting quality check

- The reduced residual distribution in **zr plane**.

- Selected the tracks whose reduced residual is smaller than 0.1 as a good track.
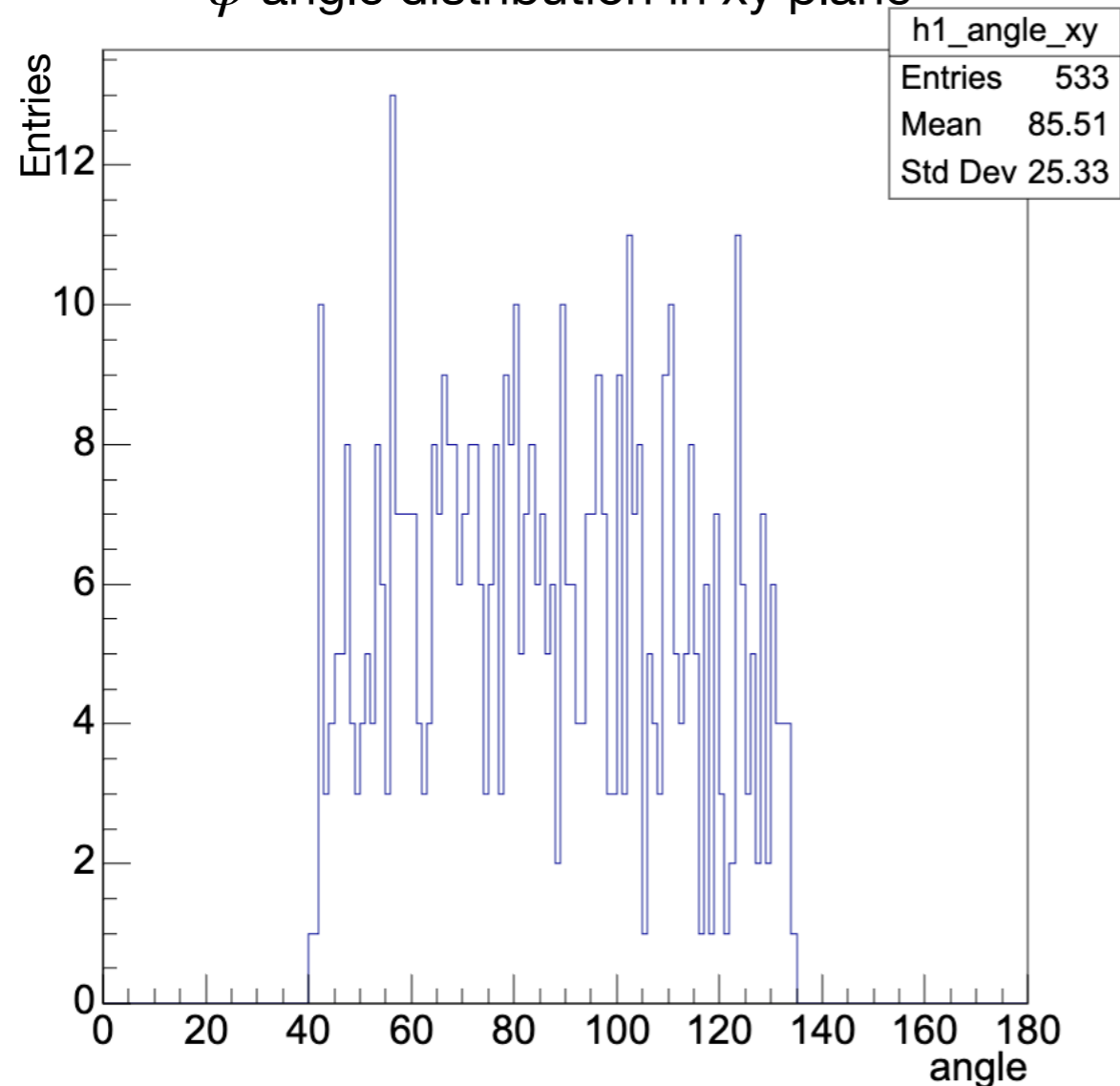
Angle distribution

- The distribution of the ϕ angle (xy plane) and θ angle (zr plane)
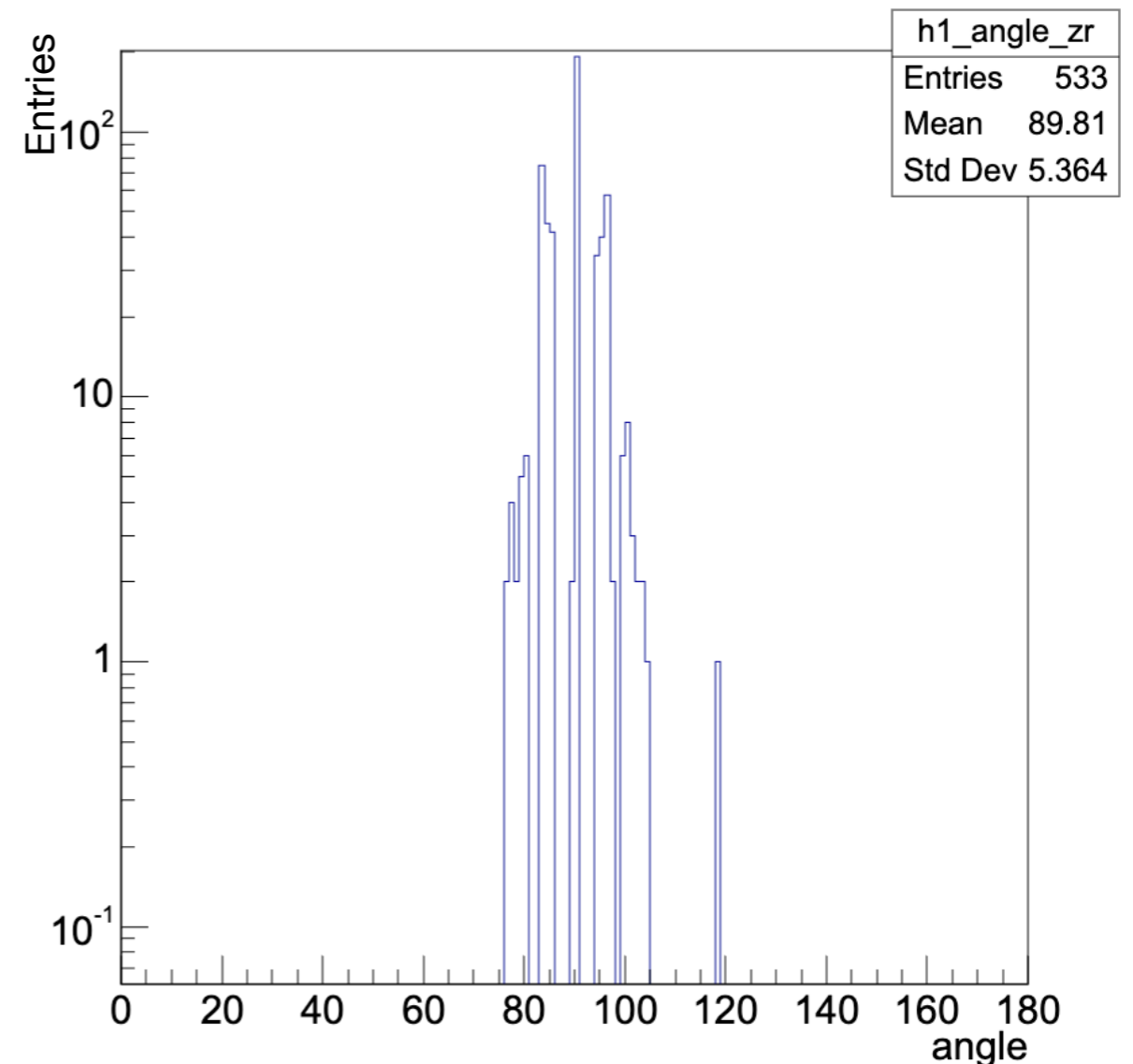
- Residual cut applied.

ϕ angle distribution in xy plane
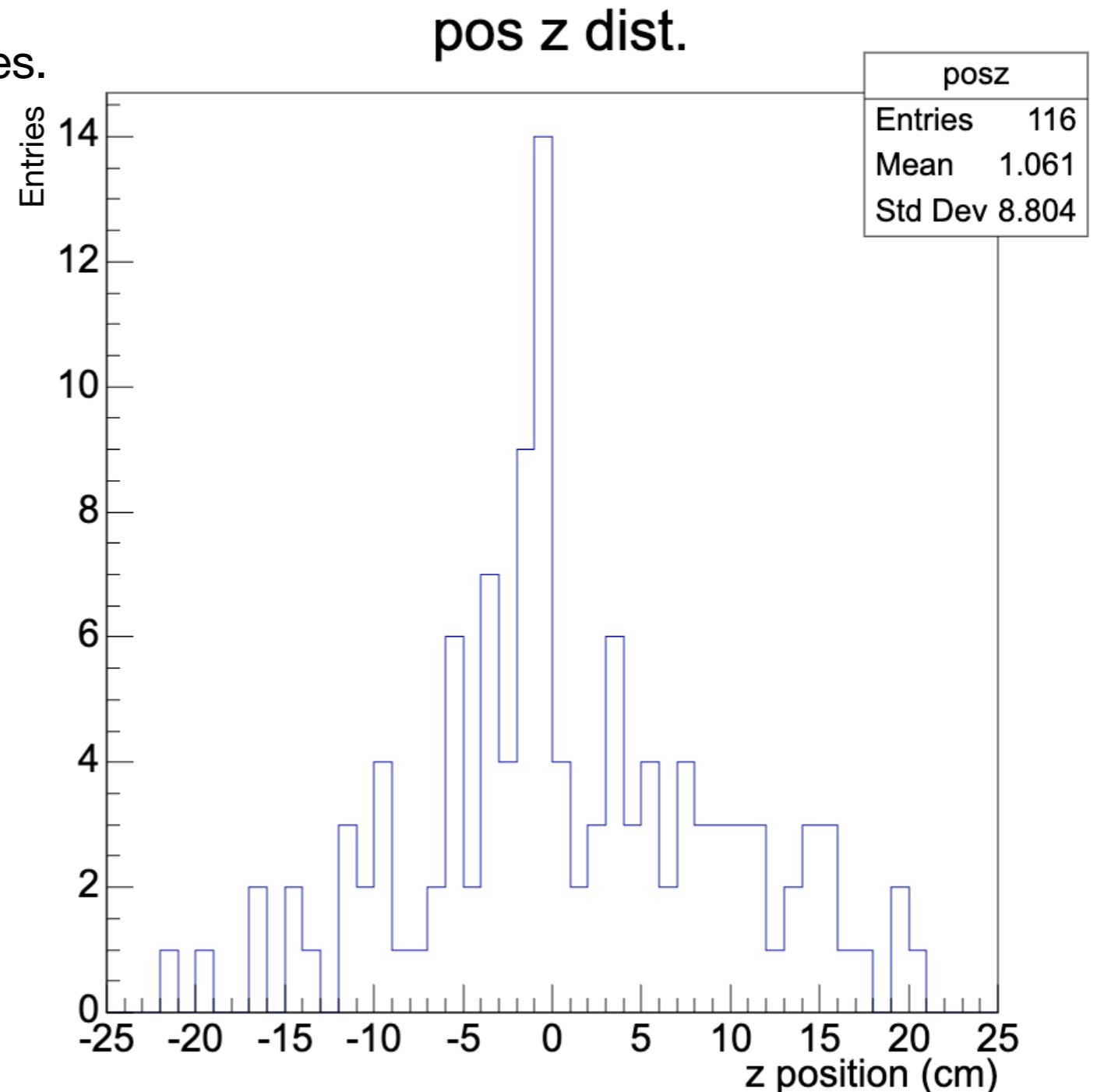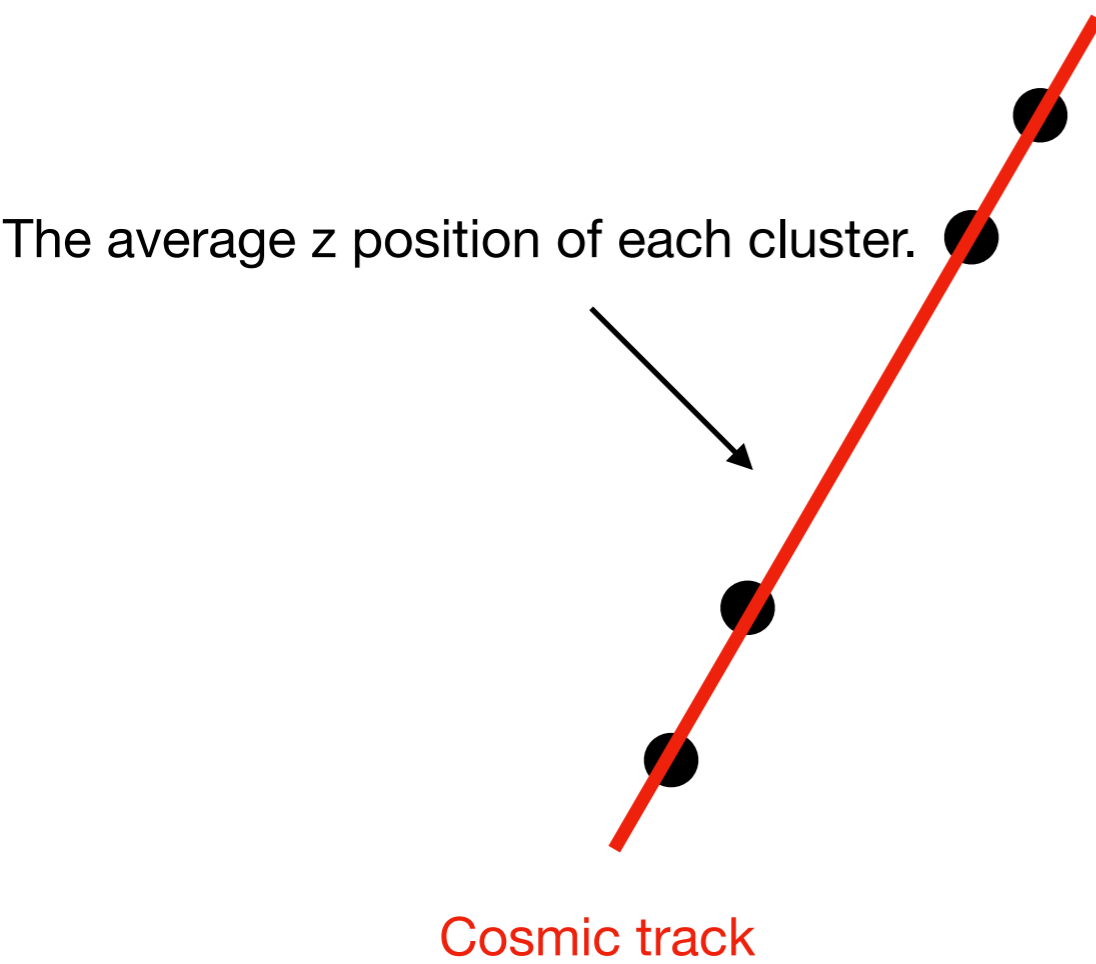
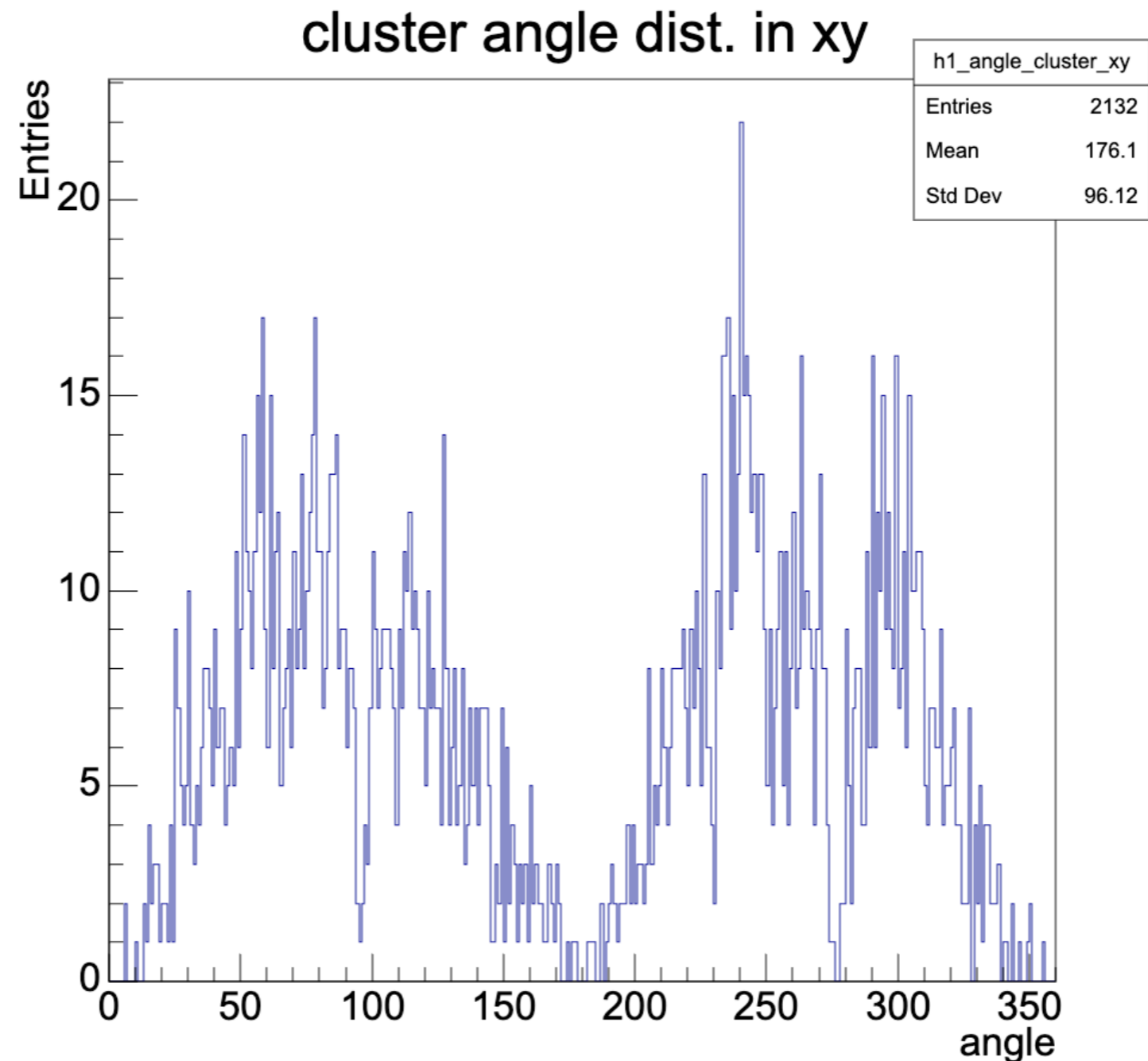θ angle distribution in zr plane

Z position distribution

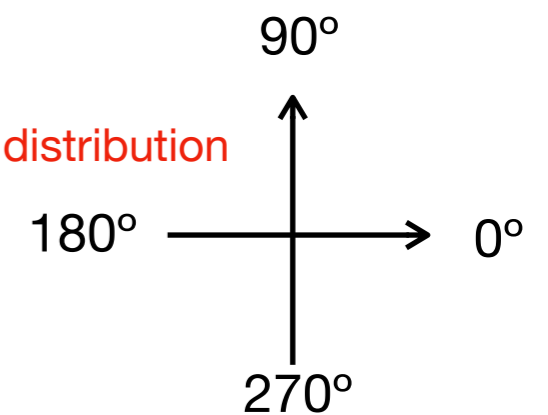- The position distribution along z axis.

- Residual cut applied.

- Restrict the angle from 88~90 degrees.

The average z position of each cluster.

Cosmic track

Cluster angle distribution

- The cluster ϕ angle distribution in xy plane.

- The distribution is symmetry roughly speech.


cluster angle dist. in xy

Summary

- Run 39524 is analyzed.

- Try to look into the distribution of cluster size, cluster adc and total clusters.

  - Compare the distribution before and after the cluster cut

  - Those distributions seem to be normal.

- Try to look into the angle distribution and also z position distribution.

  - The ϕ angle distribution in xy plane is mostly concentrated 40 ~ 140 degrees.

  - The θ angle distribution in zr plane is mostly concentrated around 90 degrees.

  - The z position distribution has a Gaussian like distribution rather than a flat distribution.

Back up

Cosmic tracks event displays

Total clusters = 4, selected clusters = 4
Residual xy = 0.0046, residual zr = 0.0497

Total clusters = 7, selected clusters = 5
Residual xy = 0.0017, residual zr = 0.2849
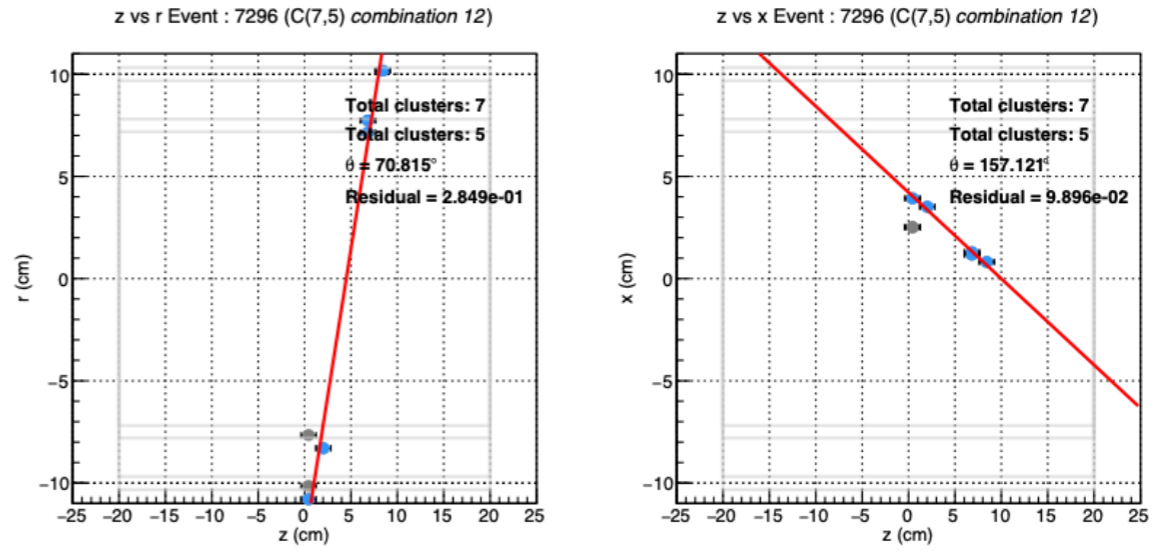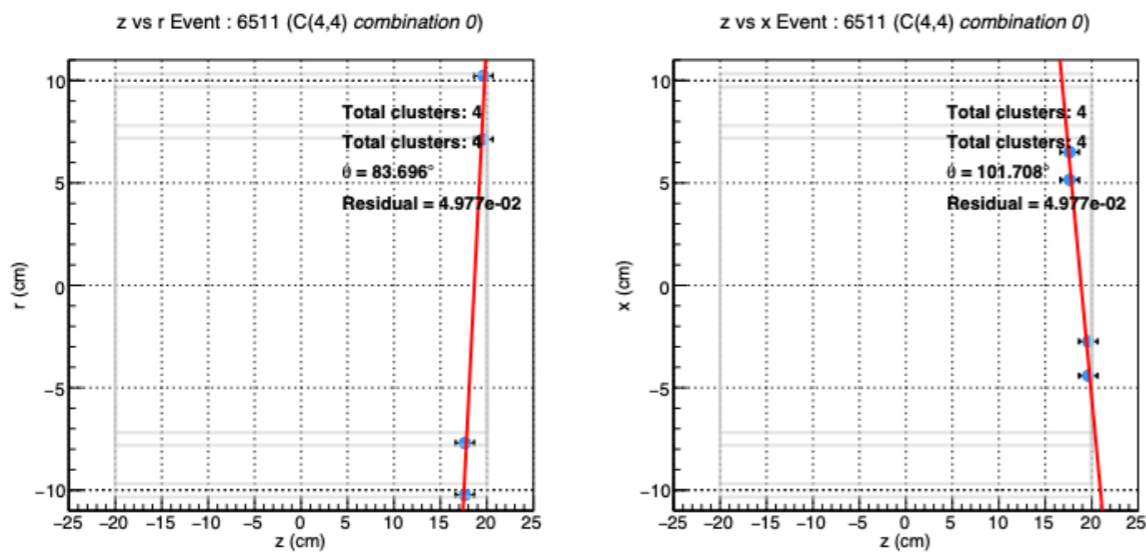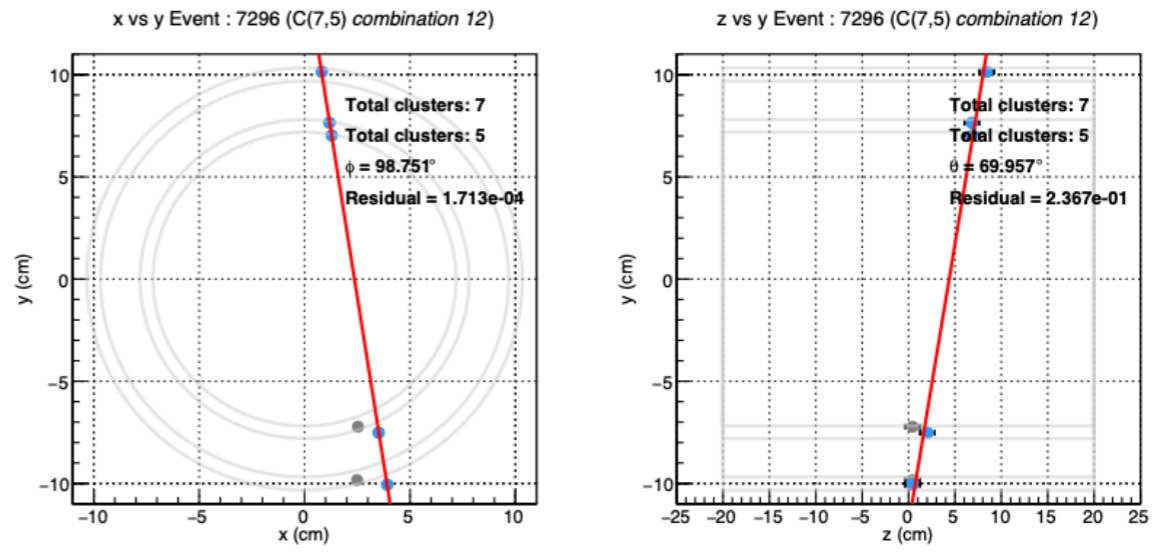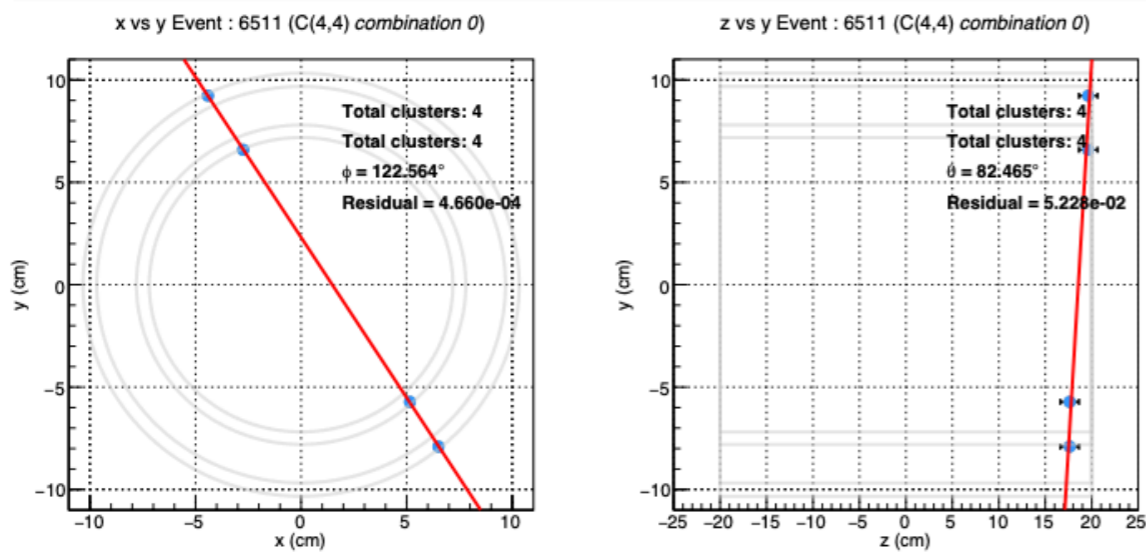
Residual distribution check

- The cosmic tracks are fitted with a straight line, $y = c + mx$

- Residual distribution of the tracks. (instead of χ^2/ndf distribution)

- Because the cosmic tracks mostly come from vertically, calculating the residual by perpendicular way is a better method.

χ^2/ndf Residual

Vertical offsets   Perpendicular offsets
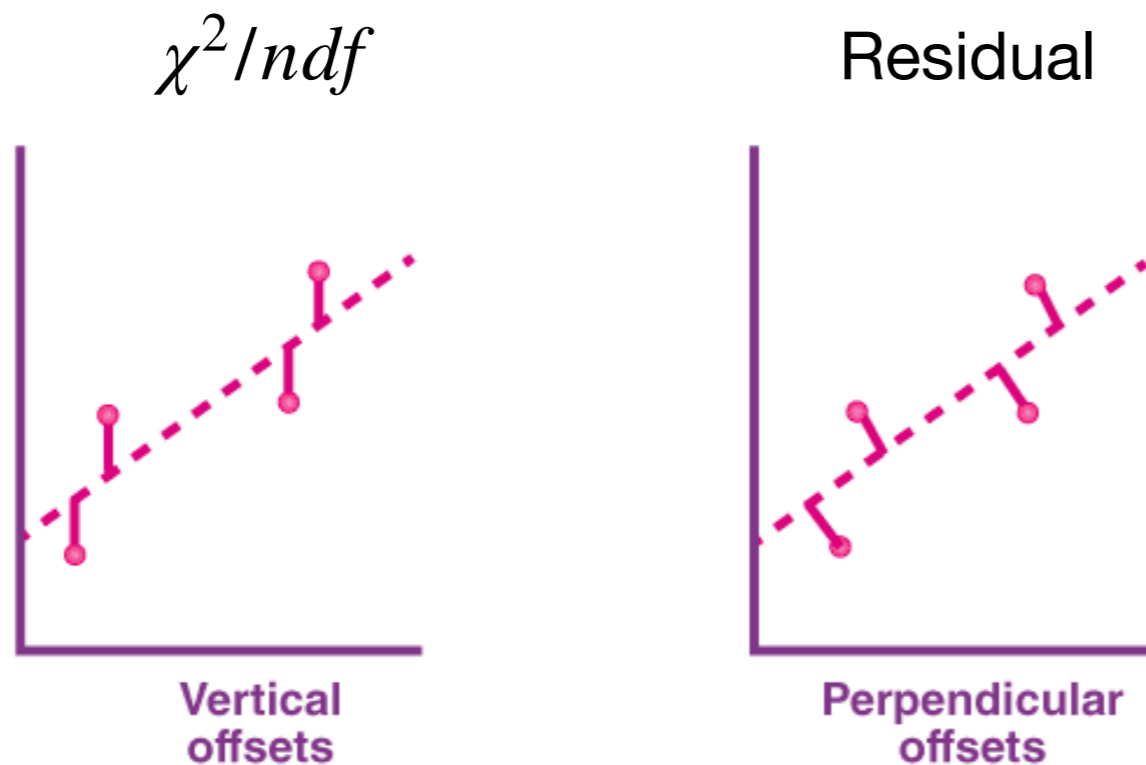
Cosmic tracks reconstruction

- To process a cosmic run for tracking analysis

  1. Run the hot channel classification

  2. Run the combiner to get the Trkr_Hitset DST (Hot channel excluded)

  3. Run the clustering to get the Trkr_Cluster DST

  4. Run the cosmic tracking macro to reconstruct the cosmic ray