INTT cosmics analysis update

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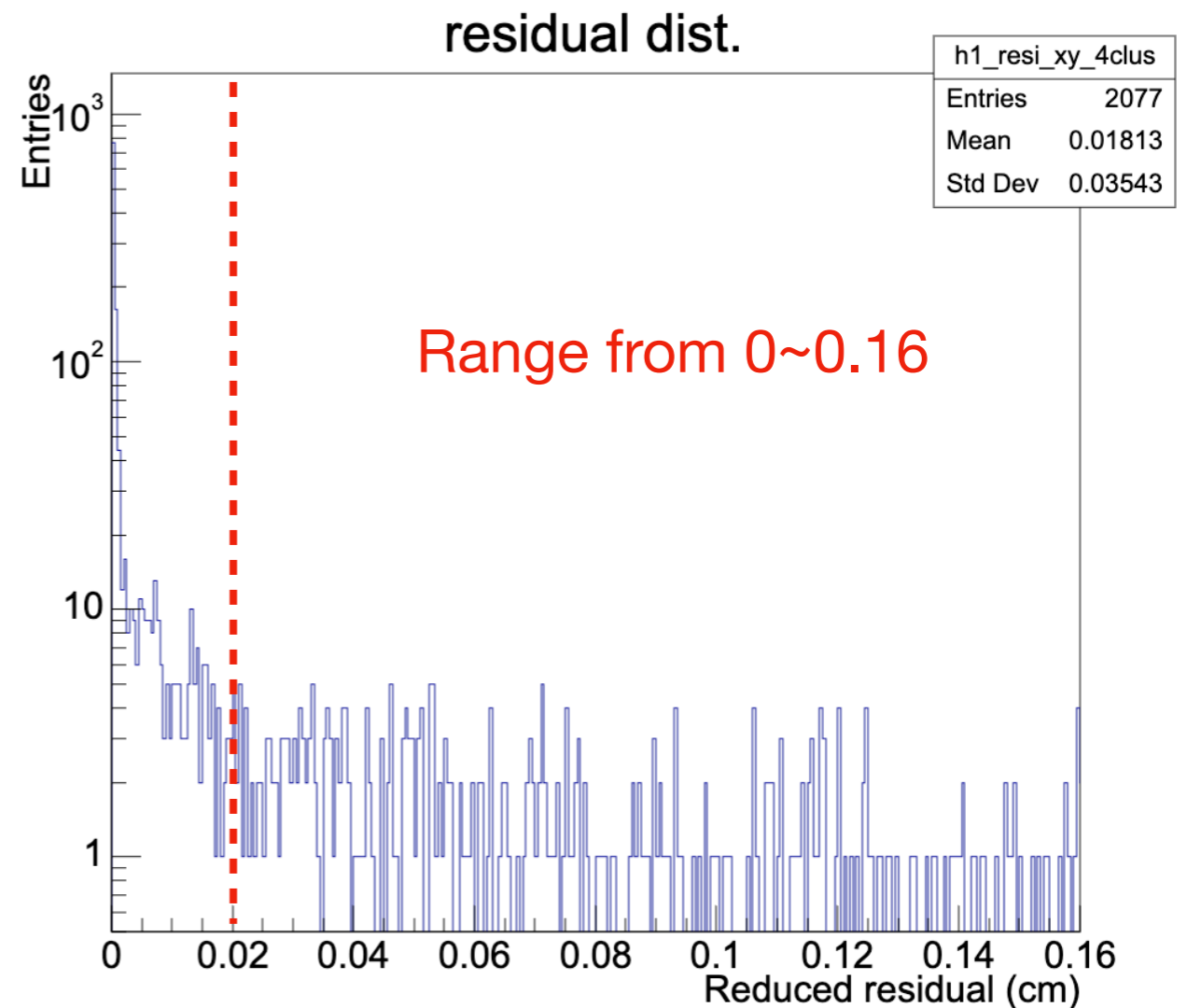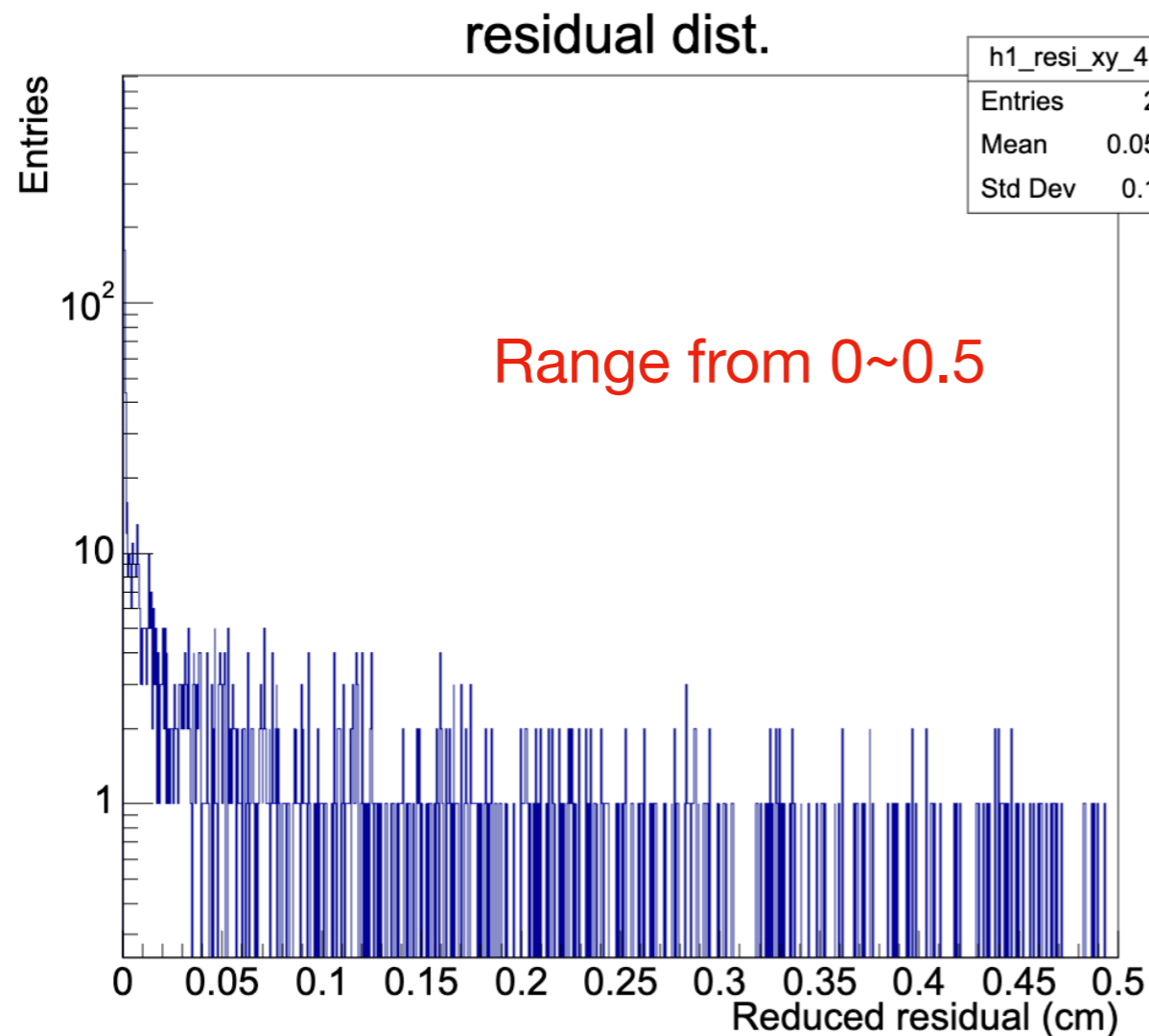**2024/10/23 group meeting**

Cosmic analysis status

- Analyzed multiple runs. The information of the run is shown below:

  - Run number: 39524~39530

- Problem from last week:

  - In zr residual distribution, there is a peak around 0.04 cm.

    -> might be a sign of misalignment (?)

Fitting quality check
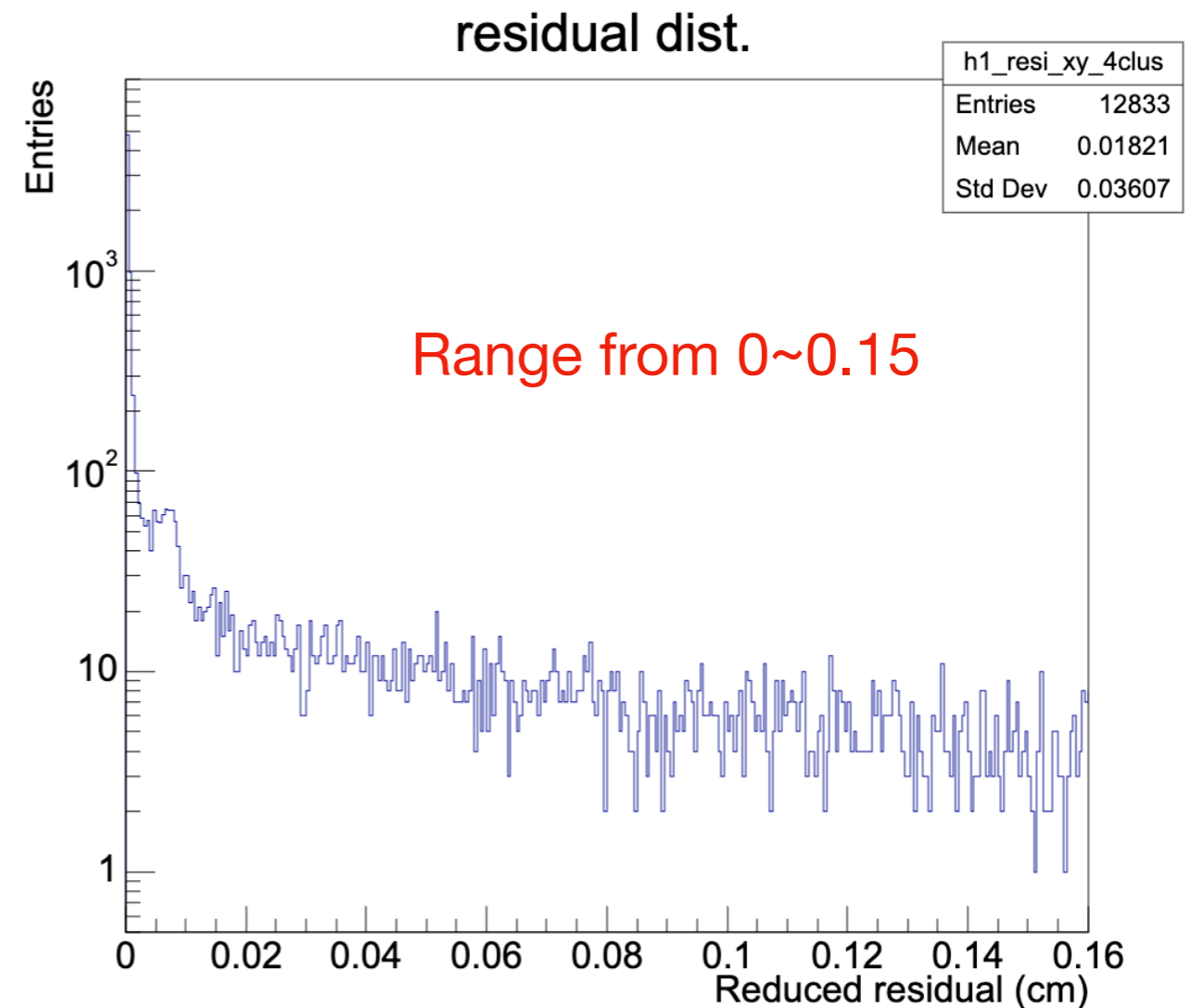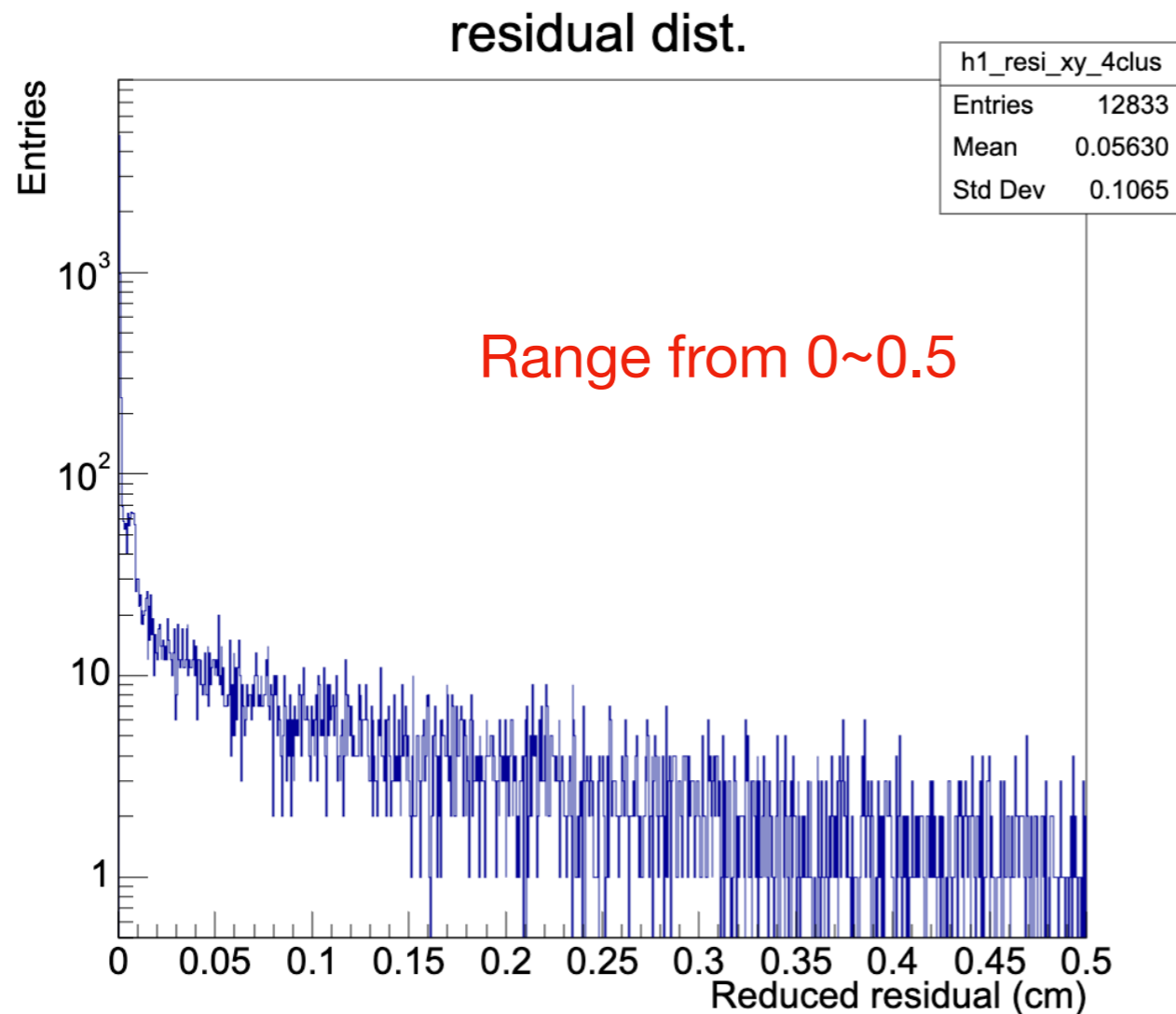
(Single run 39524)

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

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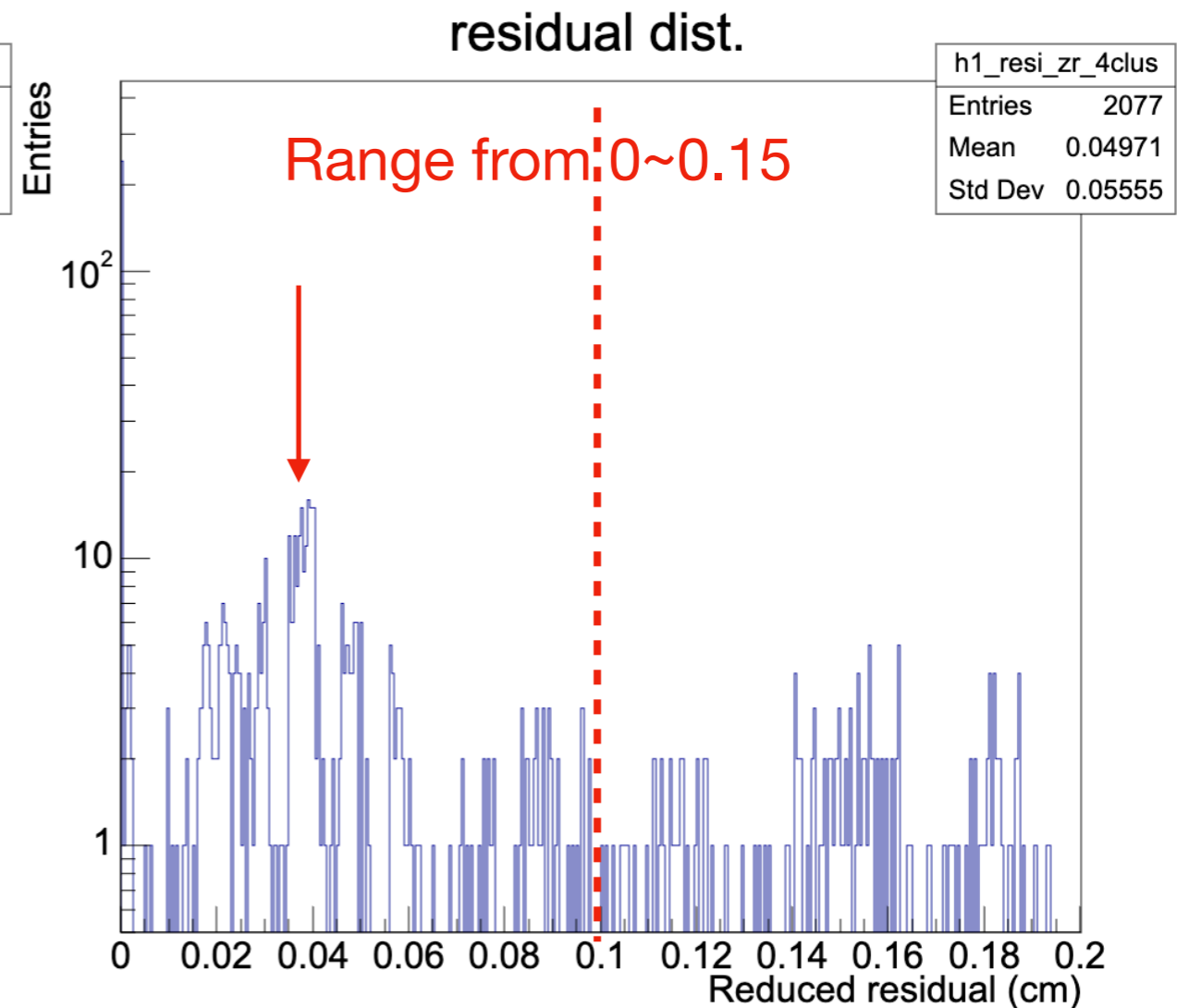
Fitting quality check

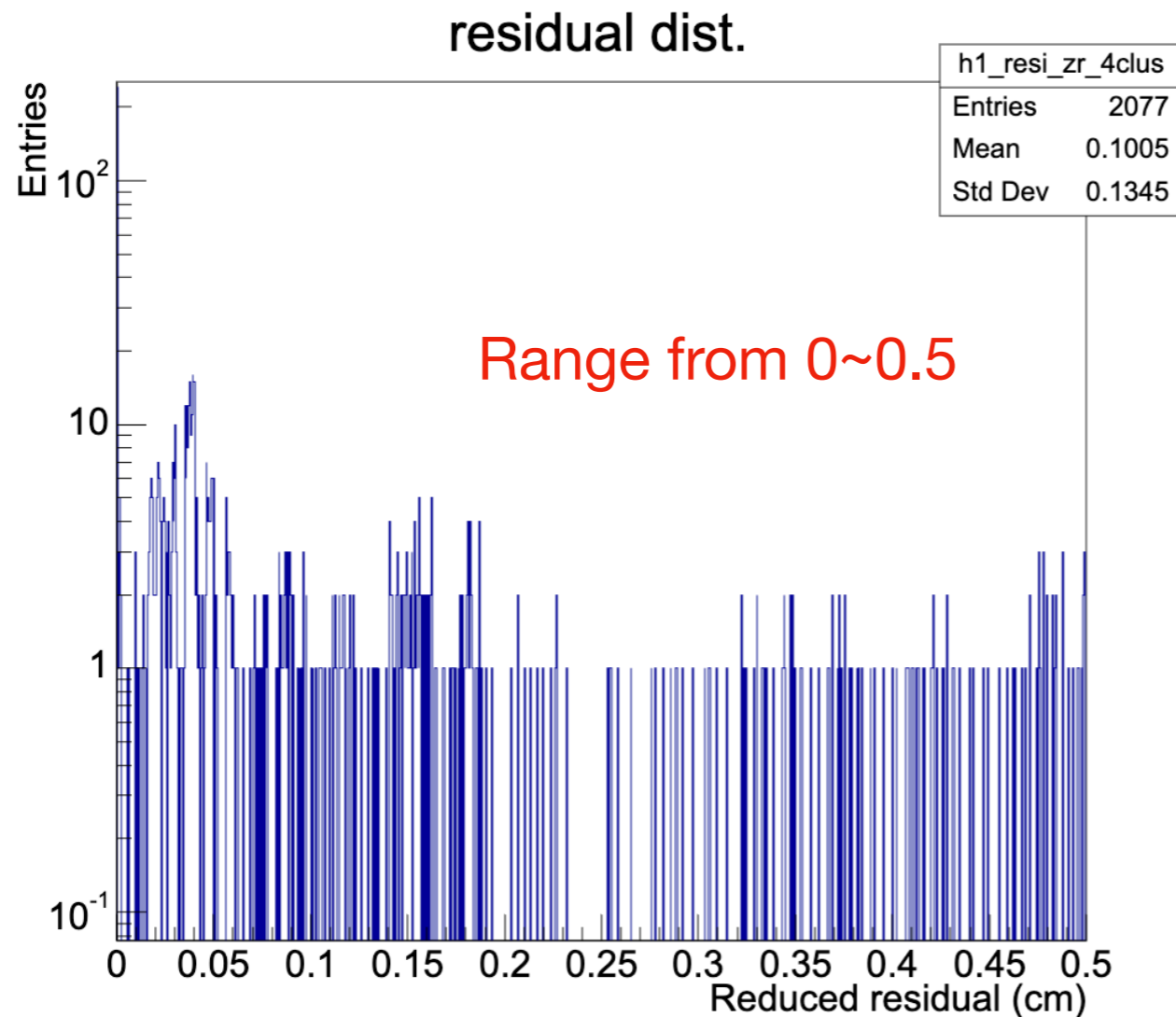- The reduced residual distribution in **xy plane** for combined run.
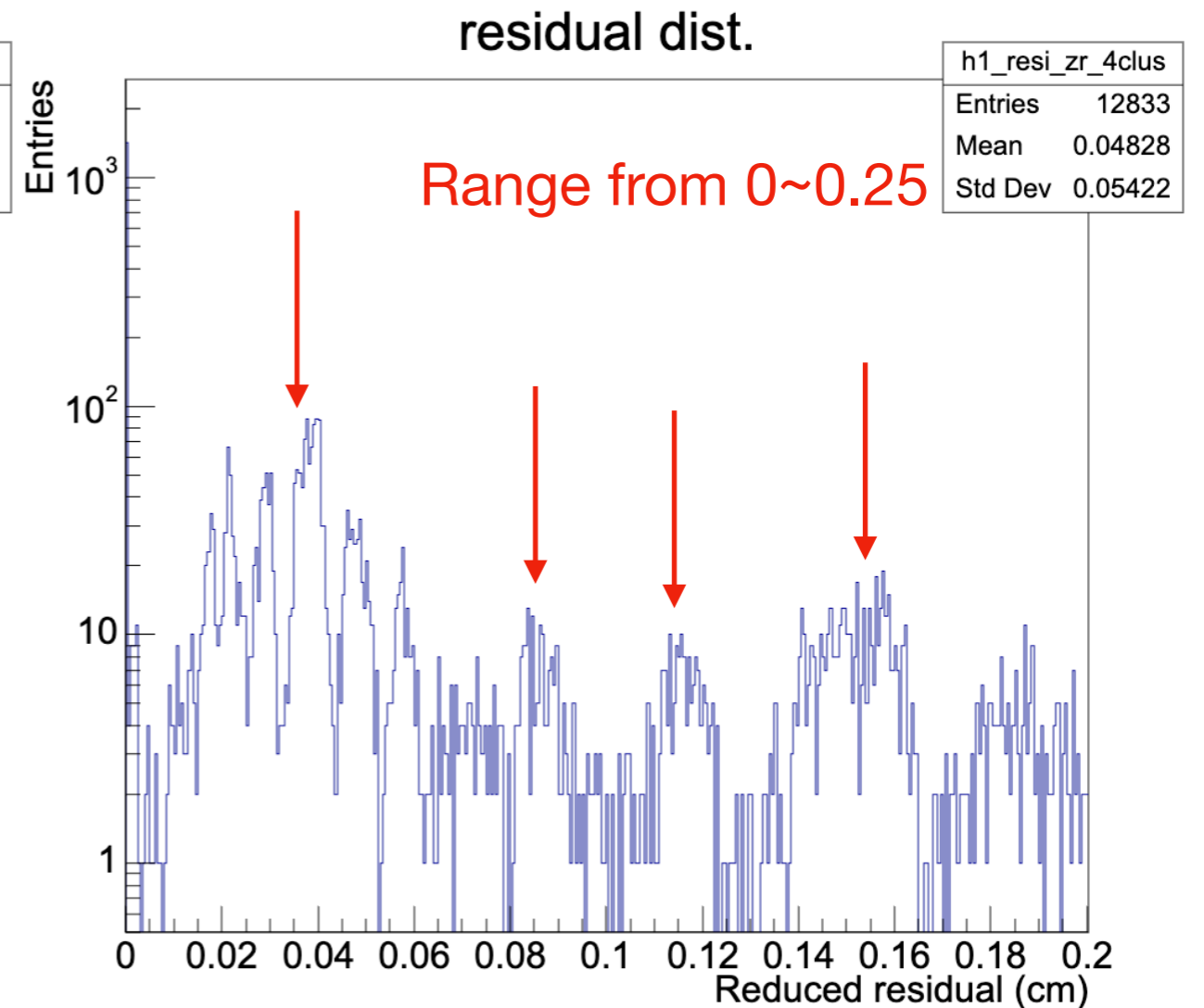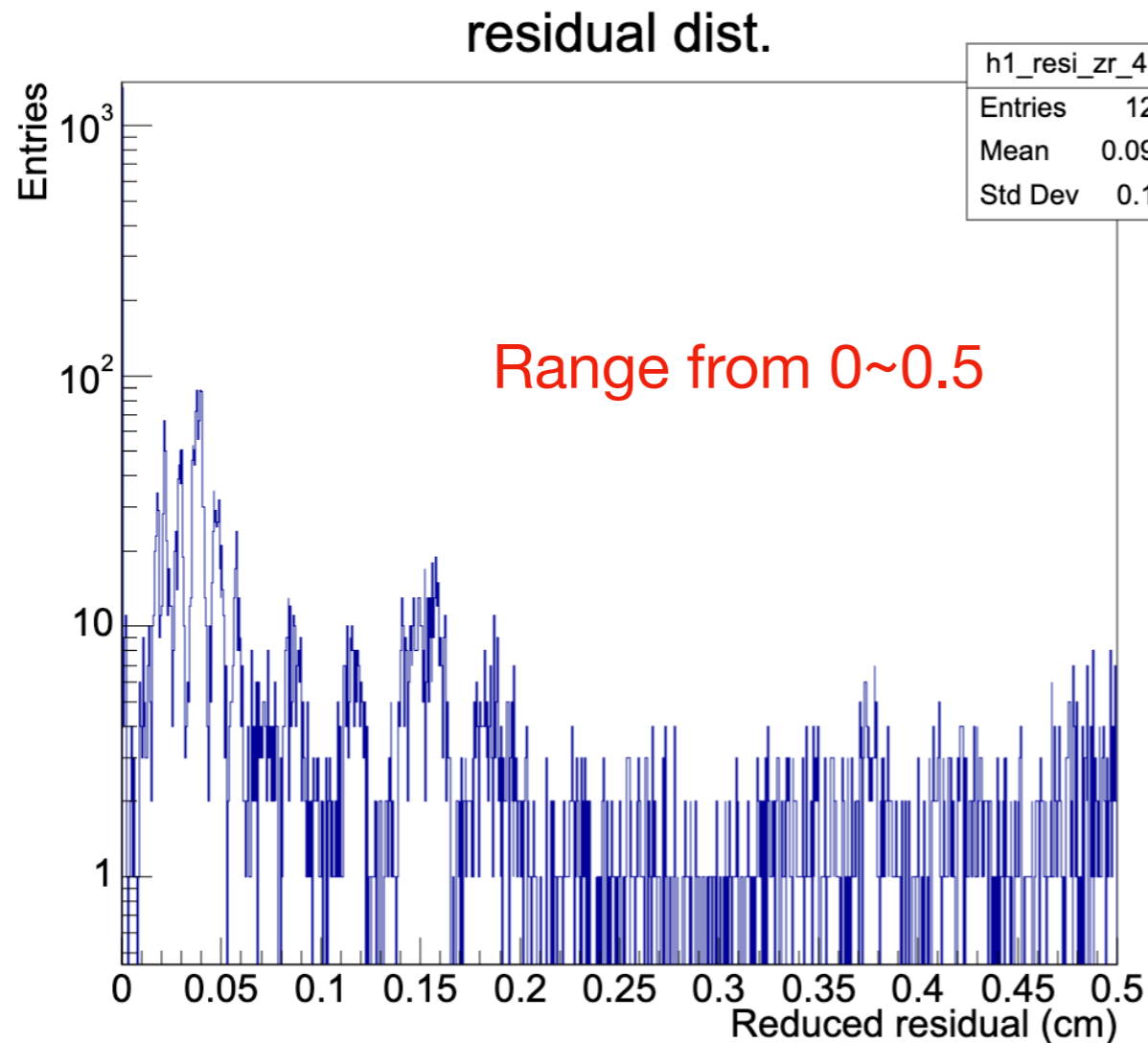
Fitting quality check

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

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

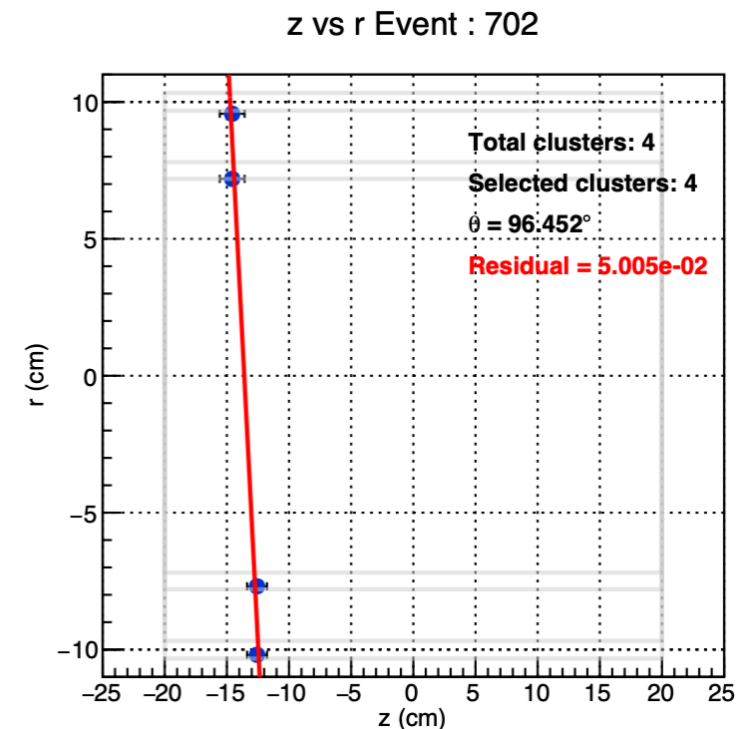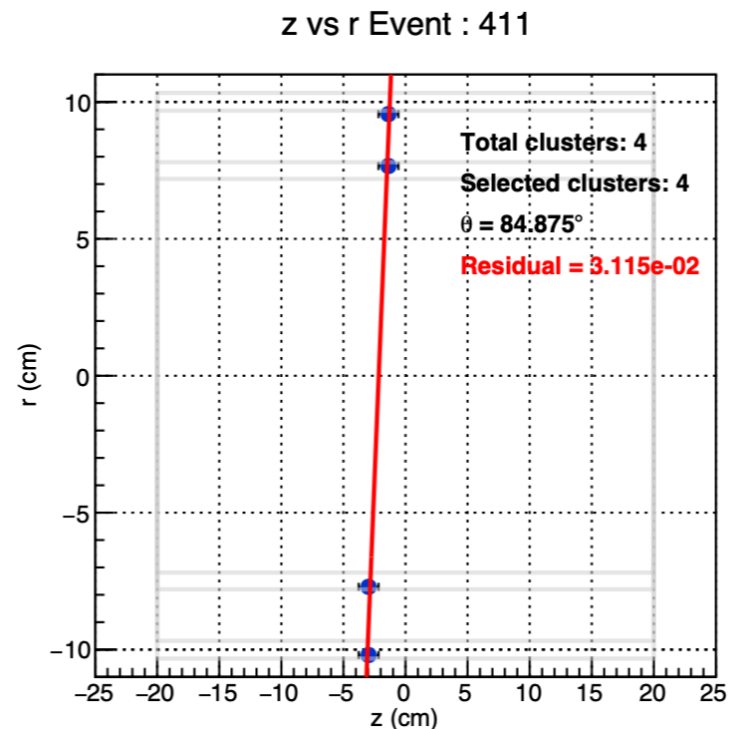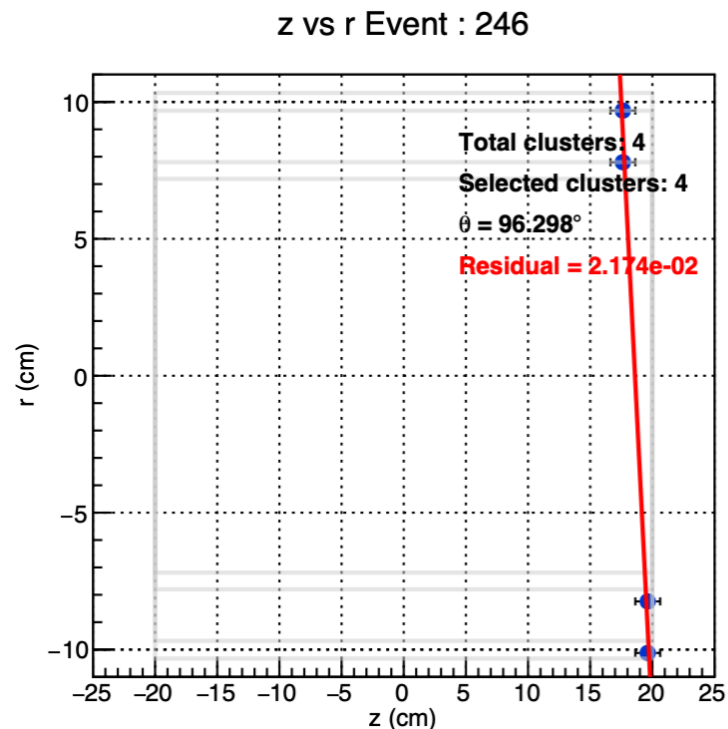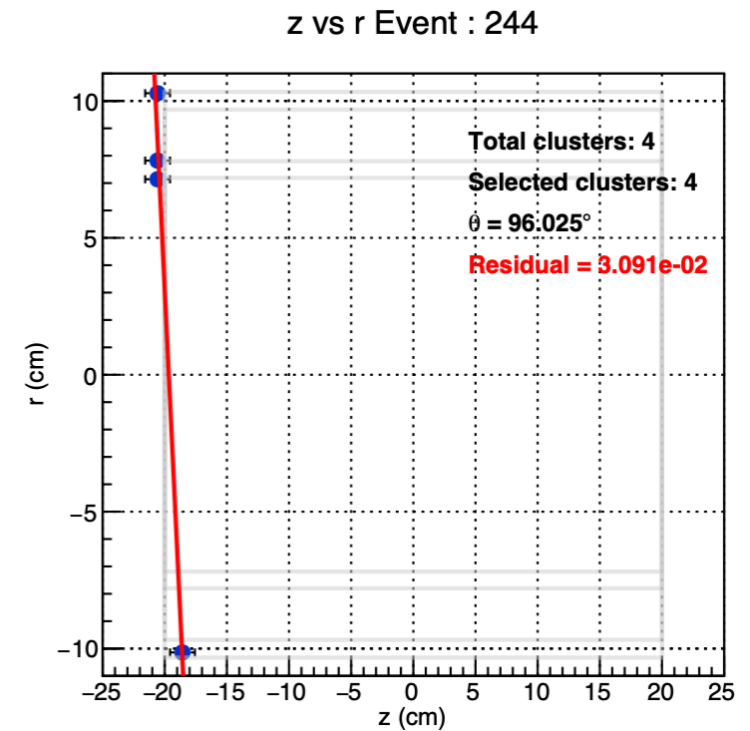- There is a peak around 0.04.

Fitting quality check

(Combined run)

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

- More peaks appear in zr residual distribution in combined run.

Event display check

- Take a look of event display where zr residual located at **0.02~0.06**.

z vs r Event : 212

Total clusters: 4
Selected clusters: 4
$\theta = 83.731°$
Residual = 3.931e-02

z vs r Event : 237

Total clusters: 4
Selected clusters: 4
$\theta = 95.014°$
Residual = 3.735e-02

z vs r Event : 244

Total clusters: 4
Selected clusters: 4
$\theta = 96.025°$
Residual = 3.091e-02

z vs r Event : 246

Total clusters: 4
Selected clusters: 4
$\theta = 96.298°$
Residual = 2.174e-02

z vs r Event : 411

Total clusters: 4
Selected clusters: 4
$\theta = 84.875°$
Residual = 3.115e-02

z vs r Event : 702

Total clusters: 4
Selected clusters: 4
$\theta = 96.452°$
Residual = 5.005e-02

Run data check

- The event displays show that there is a pattern among those event.

- There is a z axis shift between upper hand clusters and lower hand clusters.

- The angle of these event is fix around 96° and 84°.

z vs r Event : 702

Locate on same z axis

Total clusters: 4

Selected clusters: 4

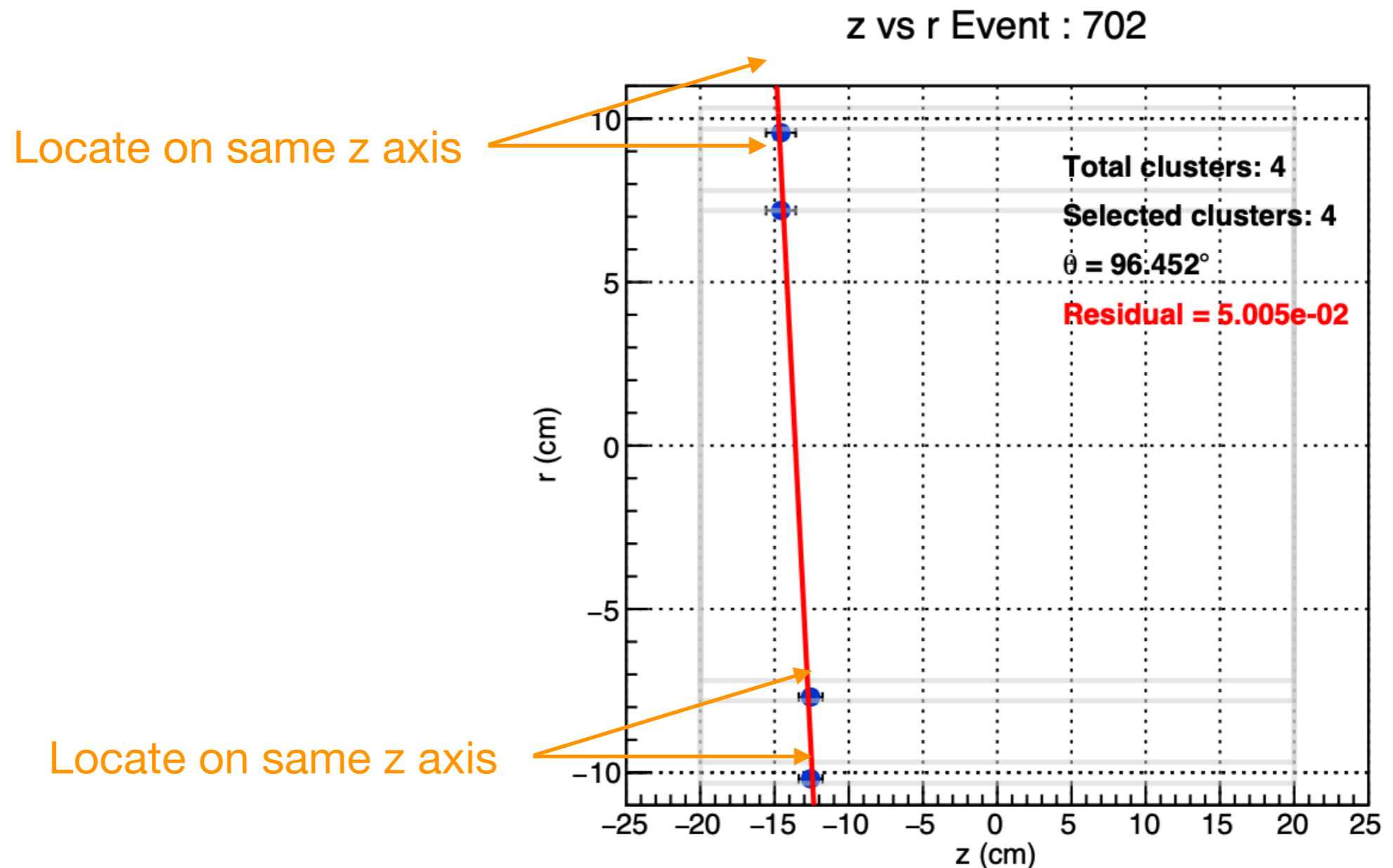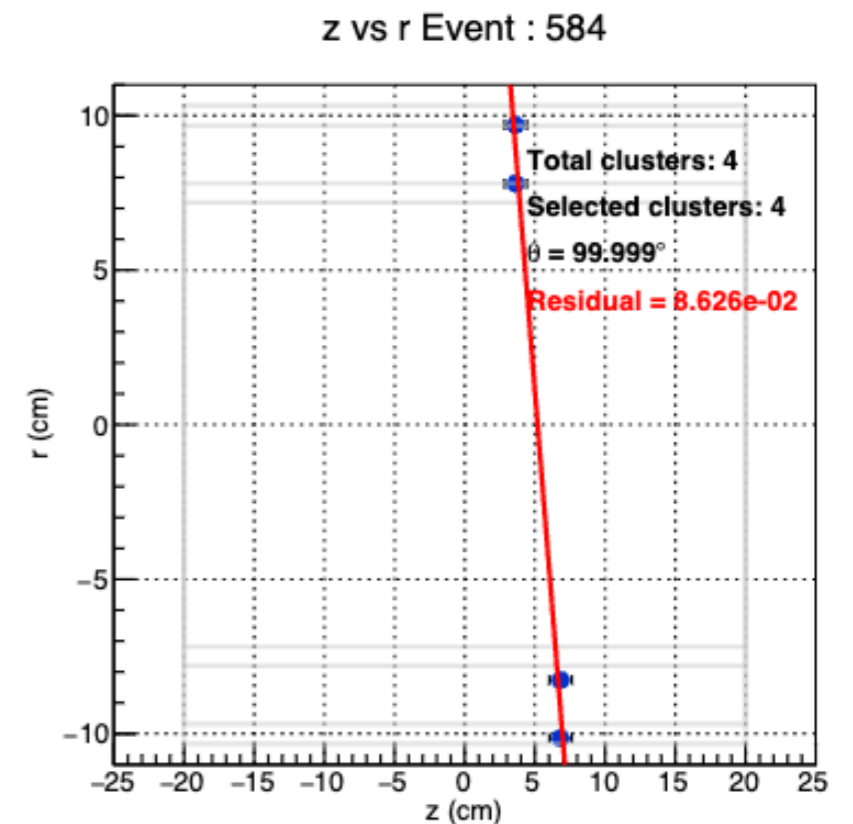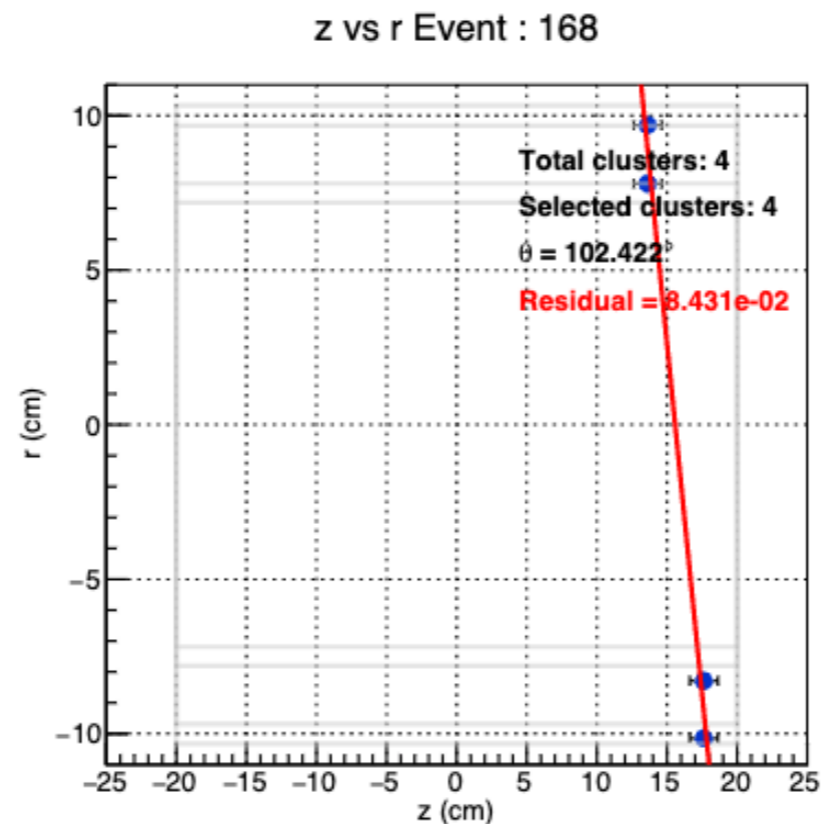$\theta = 96.452°$

Residual = 5.005e-02

Locate on same z axis

Event display check

- Another look of event display where zr residual located at 0.08~0.1.

- There is a z axis shift between upper hand clusters and lower hand clusters.

  -> The shift is bit larger comparing to the previous event display.
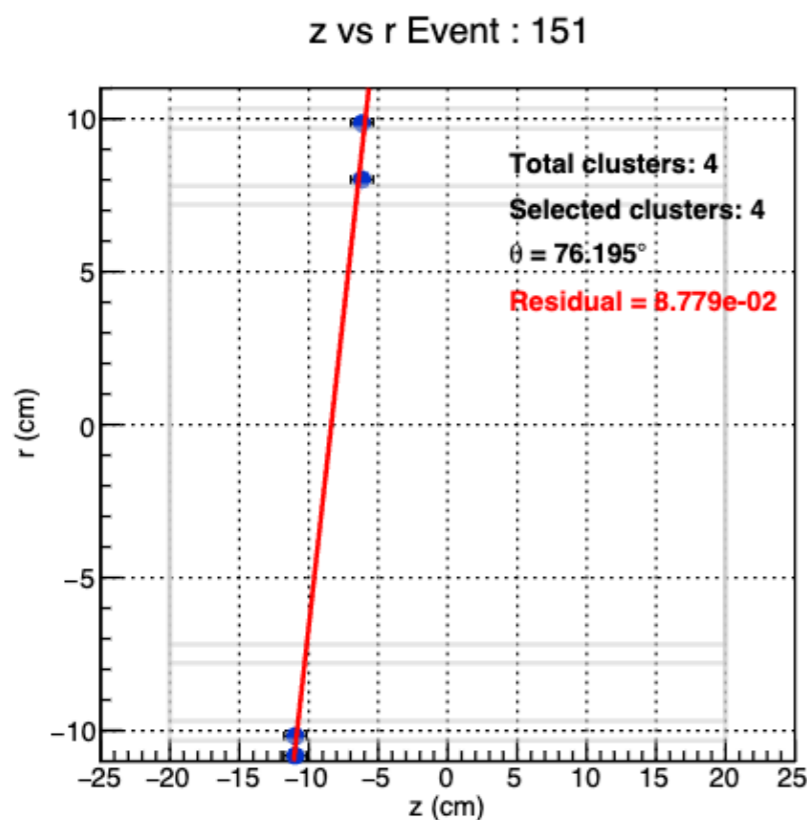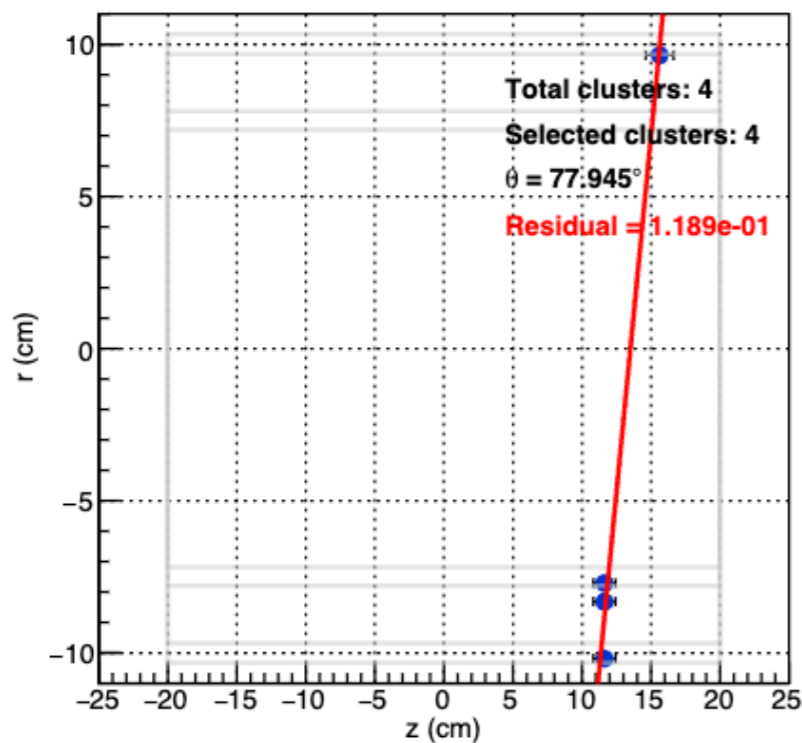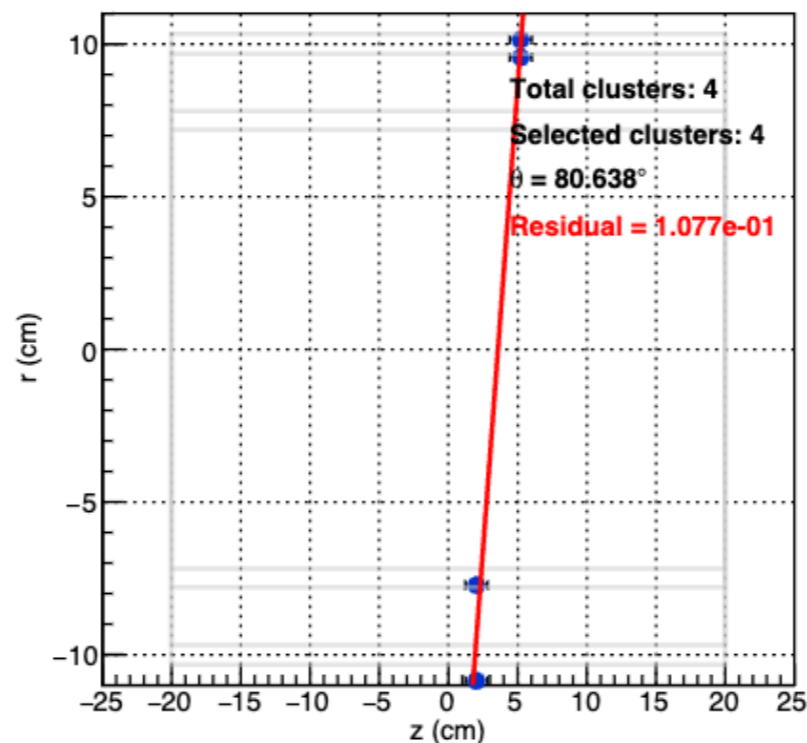
Event display check

- Another look of event display where zr residual located at 0.1~0.12.

- There is a z axis shift between upper hand clusters and lower hand clusters.

  -> Although there is larger residual in zr plane, all the clusters are still within the z acceptance.
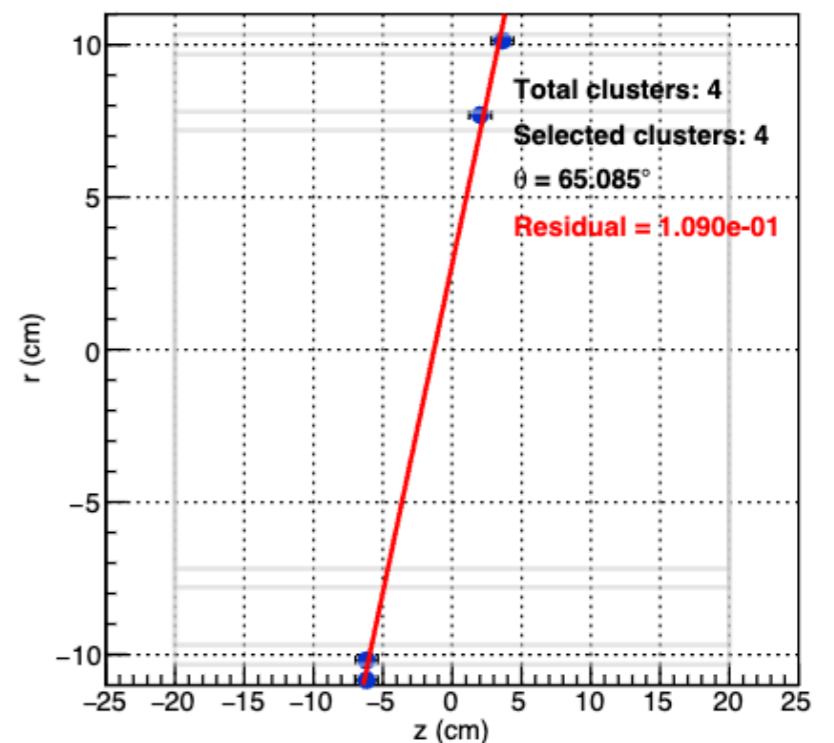
Conclusion

- Multiple runs are analyzed.

- Serval peaks found in zr residual distribution.

  - Take a look at the event display whose zr residual is located in those peaks.

  - No misalignment evidence is found, but a z position pattern of those events.

- We might have a too strict cut on zr residual.

  - No need to apply cut but check whether a fitting line is within the acceptance respect to the z axis.

Back up

Cosmic analysis status

- Analyzed multiple runs. The information of the run is shown below:
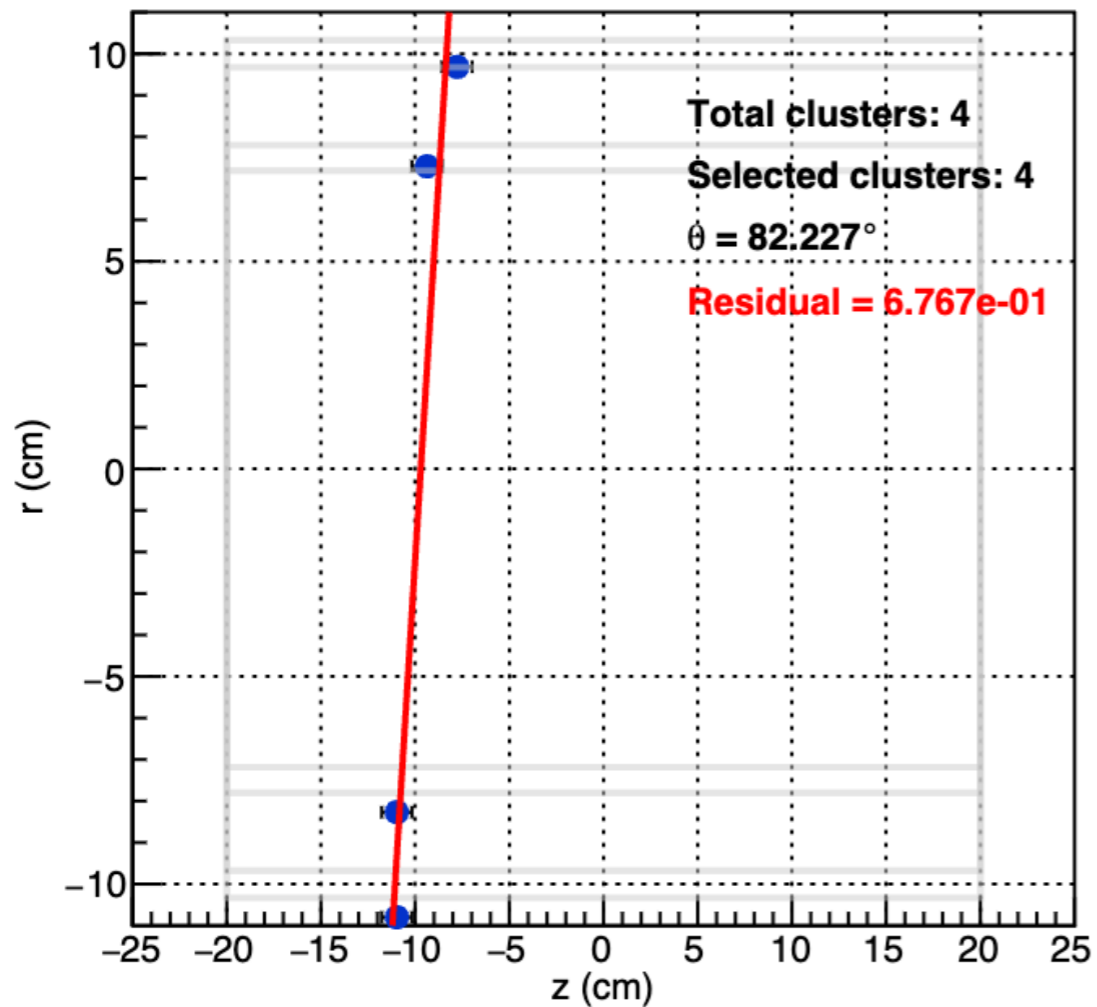
  - Run number: 39524~39530

- Pre-selection for cosmic analysis:

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

    - 13 hot channels are masked

  - Clusters cut:

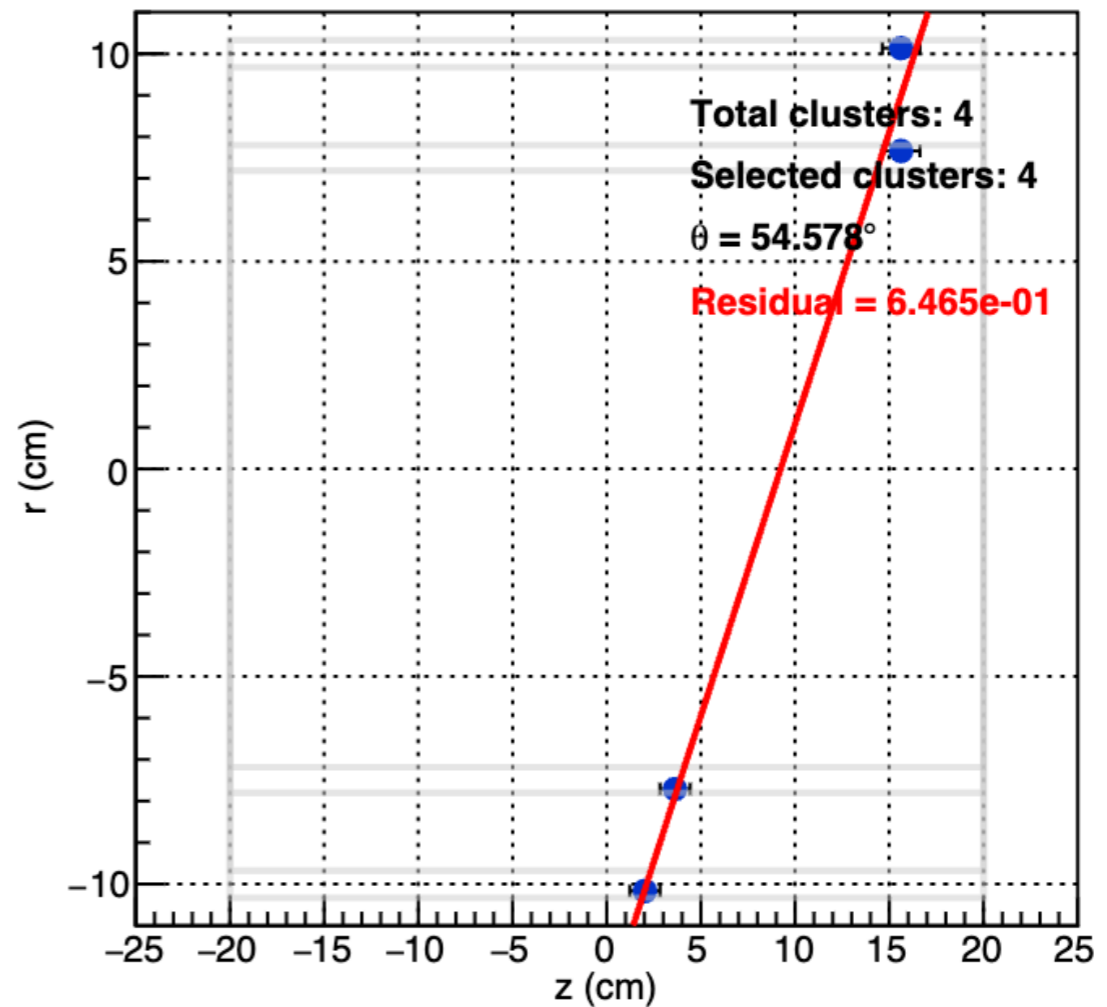   - Good cluster requirement: cluster adc > 15 & cluster size < 9 (adc0 is set to 15)

Event display check

- Another look of event display where zr residual located at 0.5~1.

z vs r Event : 20

Total clusters: 4
Selected clusters: 4
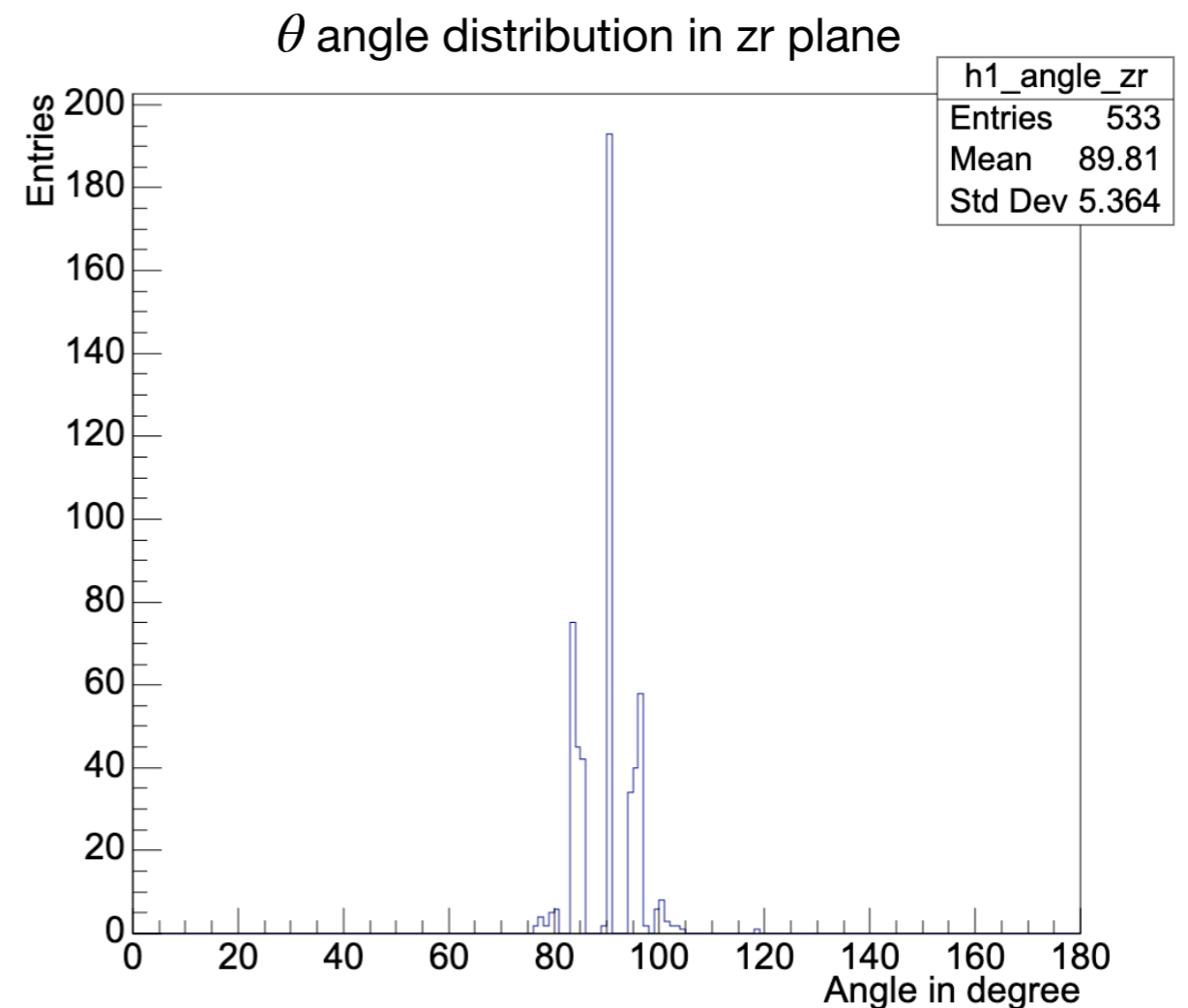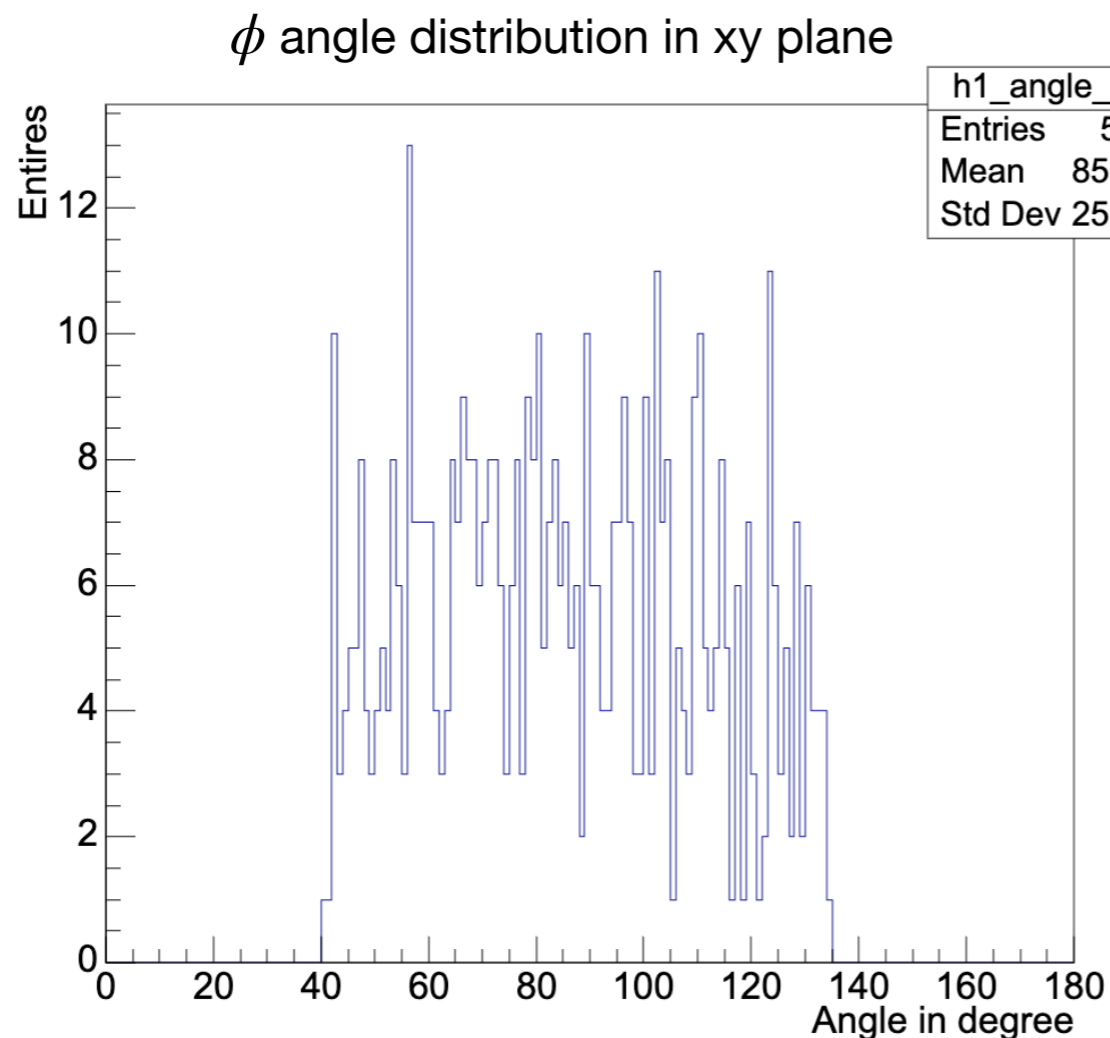θ = 82.227°
Residual = 6.767e-01

z vs r Event : 570

Total clusters: 4
Selected clusters: 4
θ = 54.578°
Residual = 6.465e-01

Angle distribution

- The distribution of the ϕ angle (xy plane) and θ angle (zr plane)

- Residual cut at xy residual < 0.02 and zr residual < 0.1.

- The zr residual cut might be too tight for cosmic rays.

90°

180° → 0°

Coordinate of angle distribution

ϕ angle distribution in xy plane

h1_angle_xy	
Entries	533
Mean	85.51
Std Dev	25.33

θ angle distribution in zr plane

h1_angle_zr	
Entries	533
Mean	89.81
Std Dev	5.364
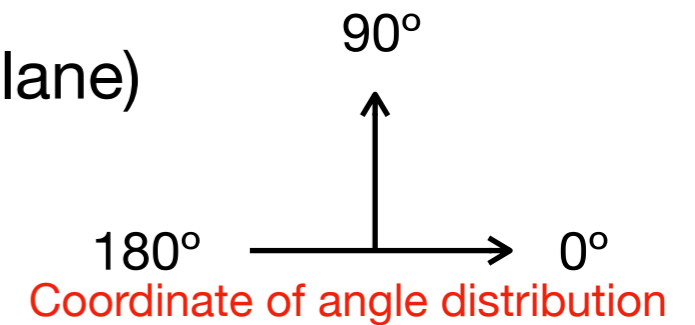
Residual distribution check

- 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
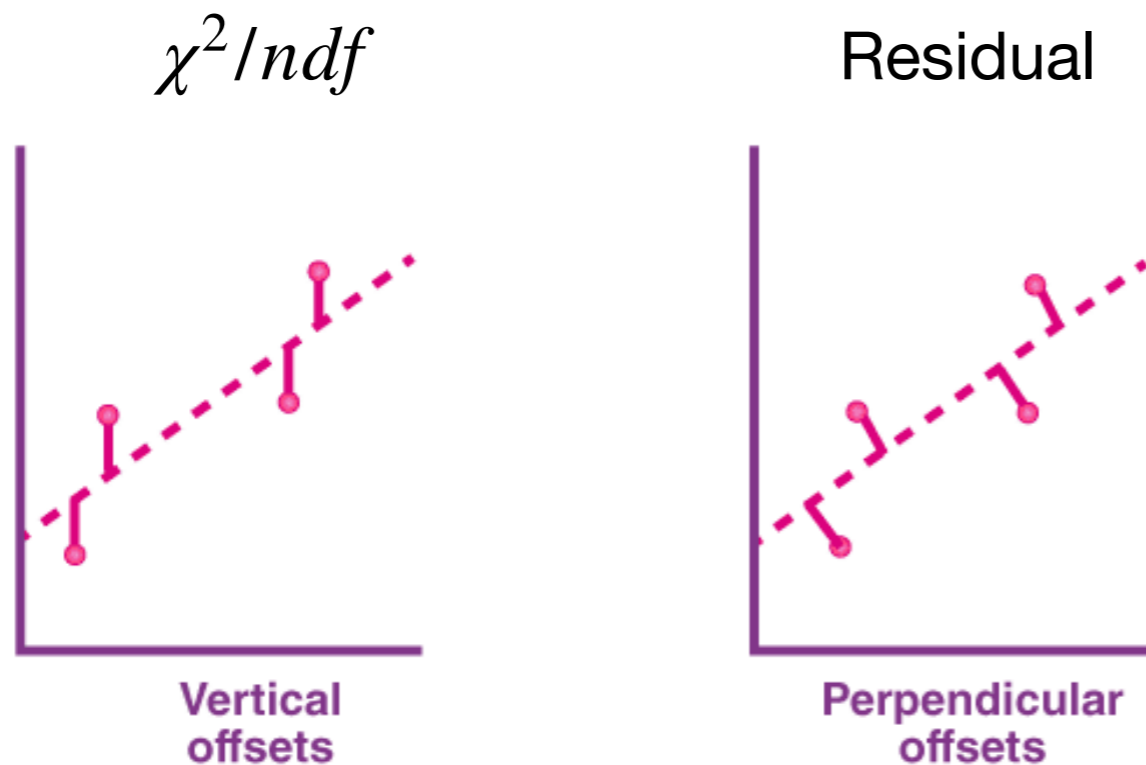
Cosmic tracks event displays

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