

INTT tracking

Hinako Tsujibata (Nara Women's University)

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Development of a tracking algorithm using INTT

- Tracking method with B-off and B-on data.
- Event display of tracking.
- Reconstructed pT and pz of MC and data.

Used data

【MC】 (p+p/200GeV)

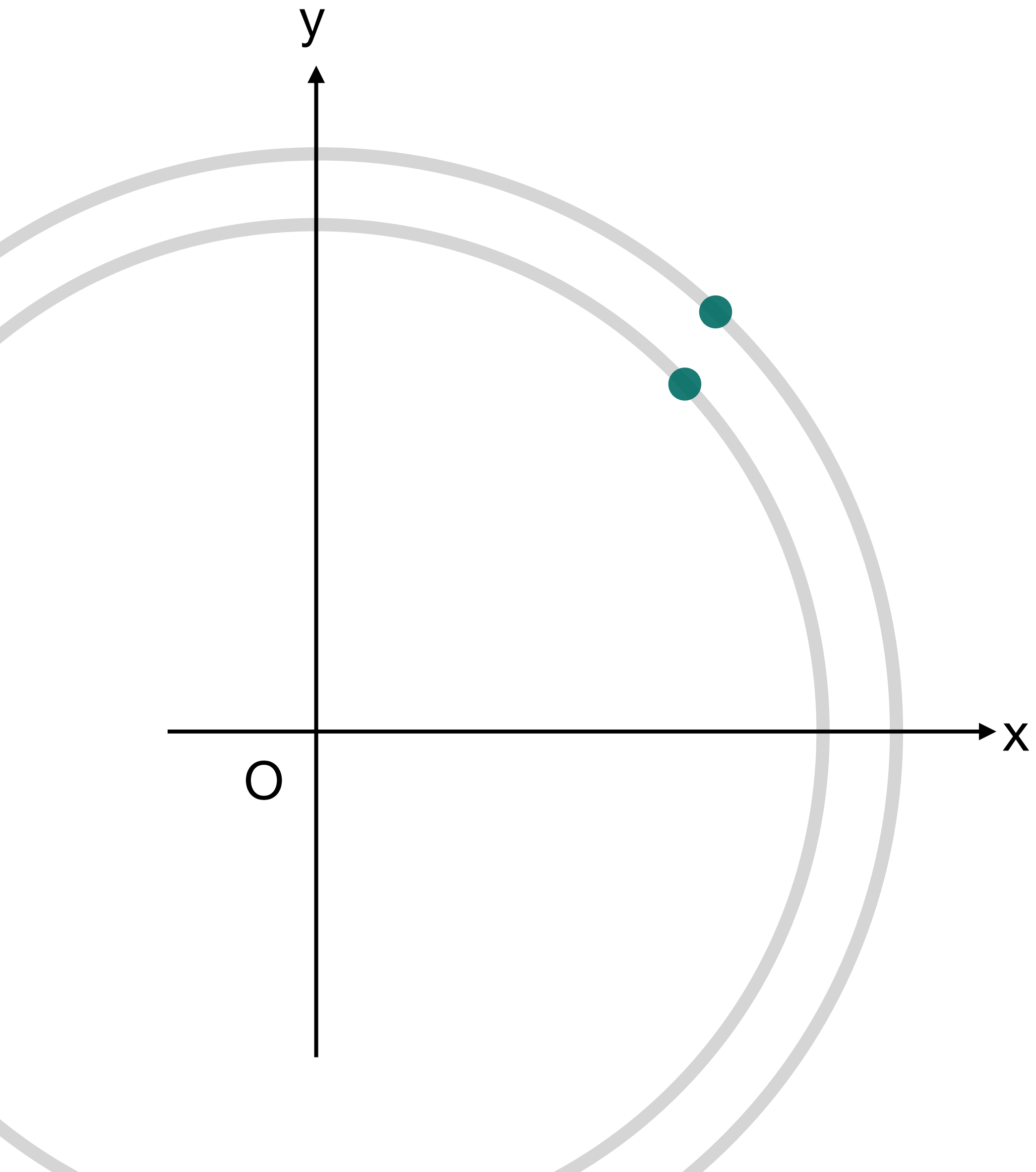
- PYTHIA8 + GEANT4
- B-on / B-off
- vertex : Gaussian distribution
 - mean : $(x, y, z) = (0, 0, 0)$
 - width : $(x, y, z) = (10^{-4}, 10^{-4}, 10^{-4})$

【run 40741】

- 2024/04/28
- 10K events
- DAC0 = 30
- B-off

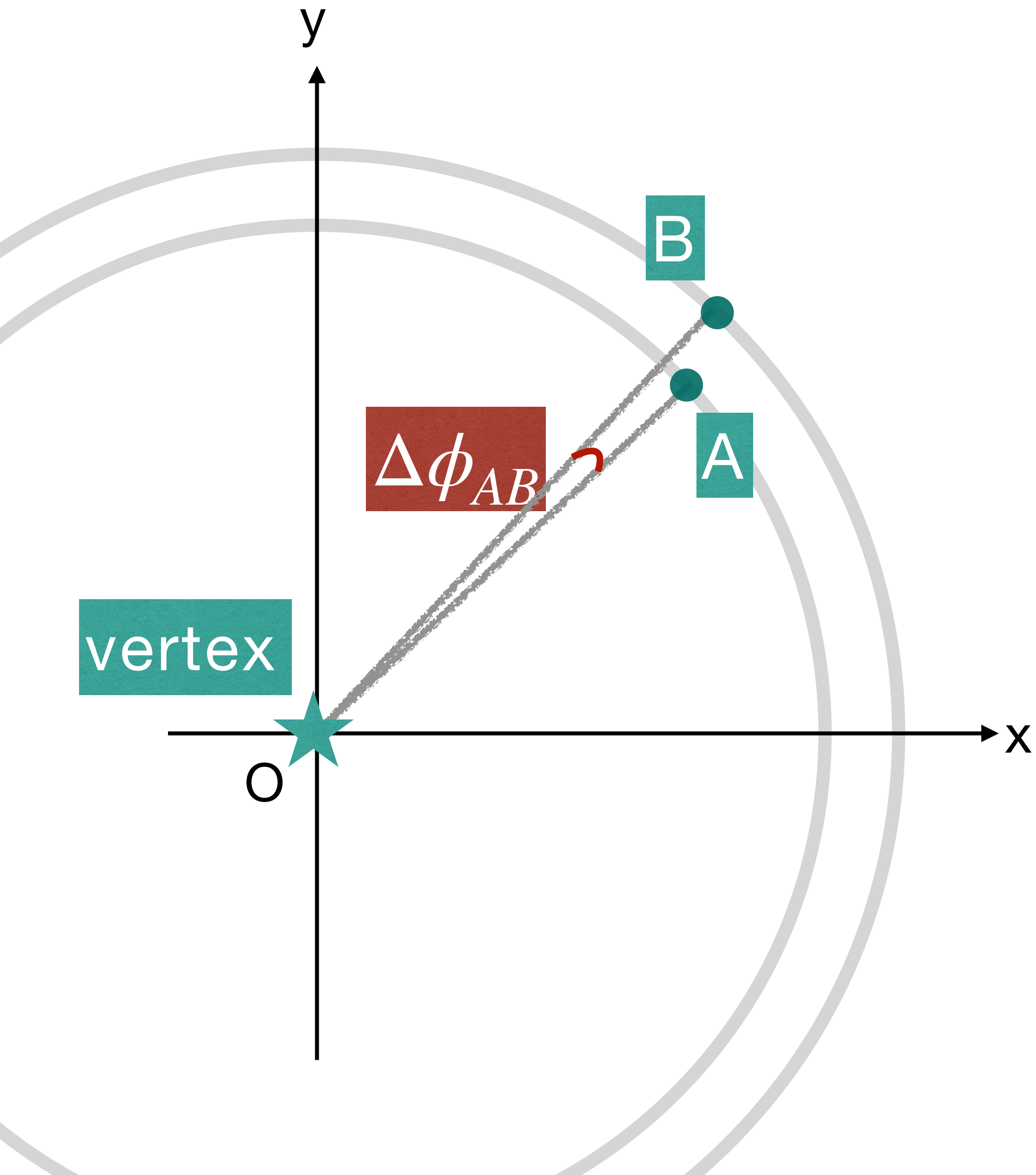
【run 41981】

- 2024/05/10
- 10K events
- B-on (B = 1.4T)



1. Reconstruct a “tracklet”.

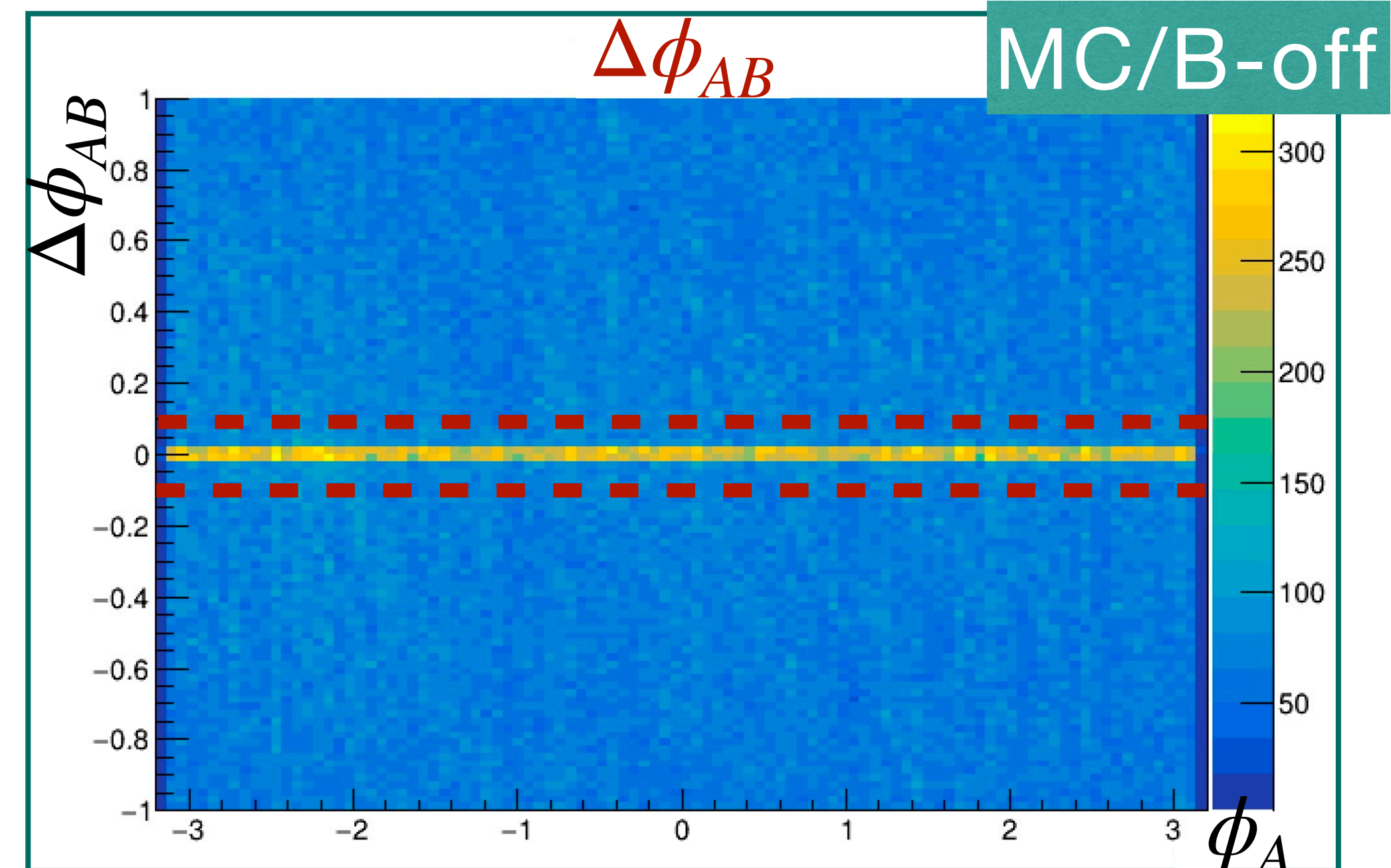
2. Optimize the tracks.



1. Reconstruct a “tracklet”.

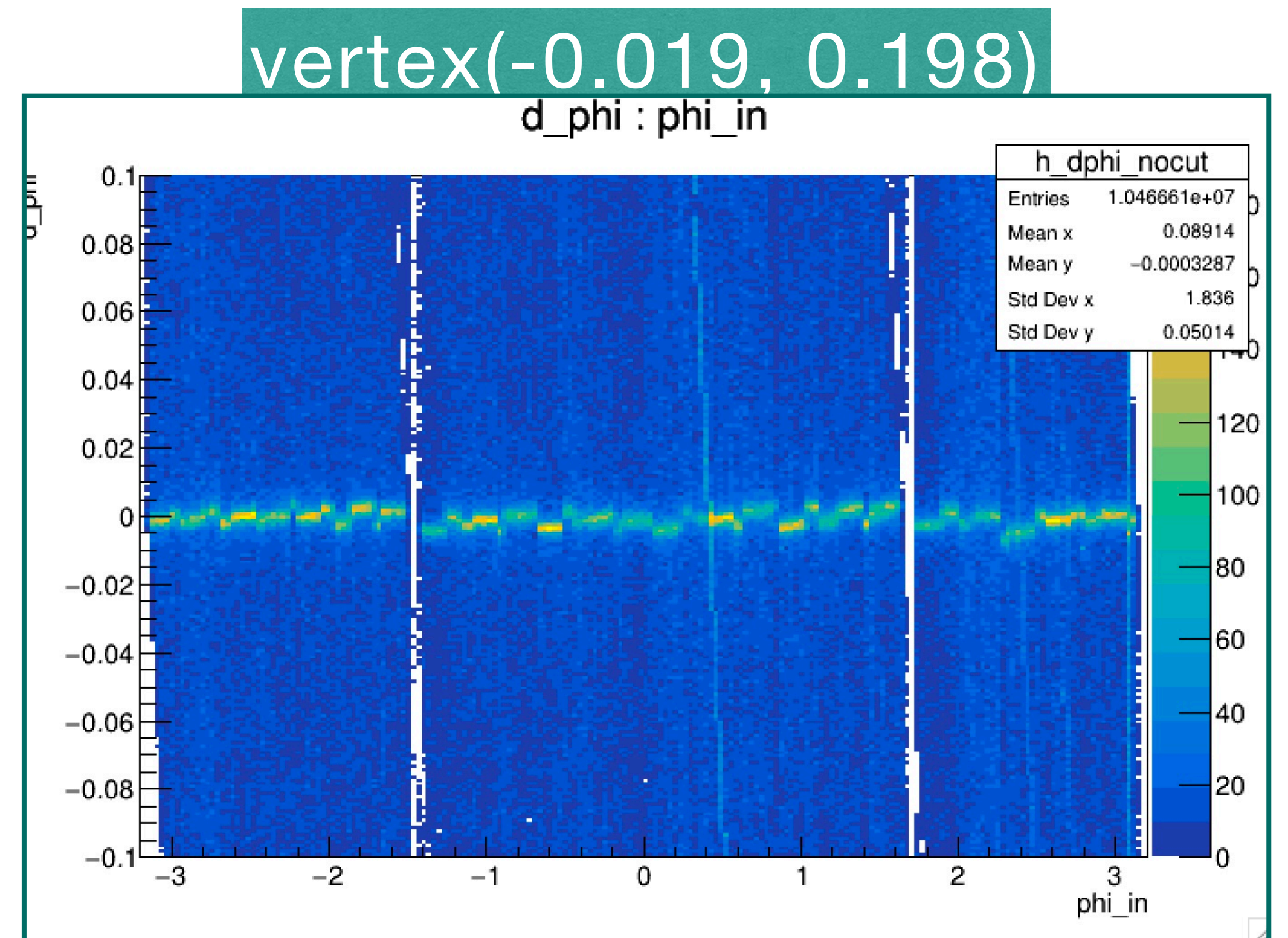
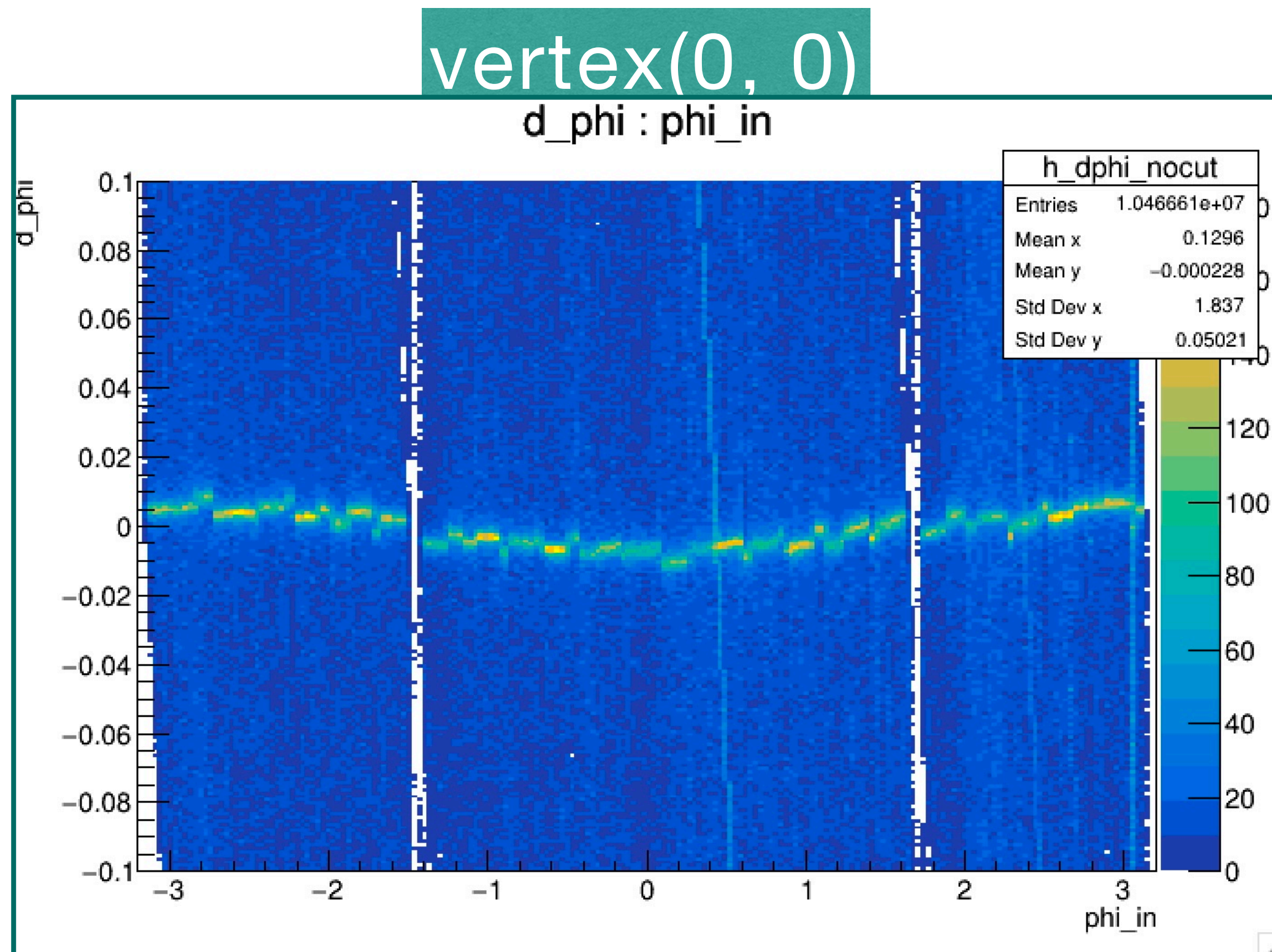
- Make a pair of inner cluster **A** and outer cluster **B**.

Requirement : the angular difference between clusters from vertex is $|\Delta\phi_{AB}| < 0.1$.

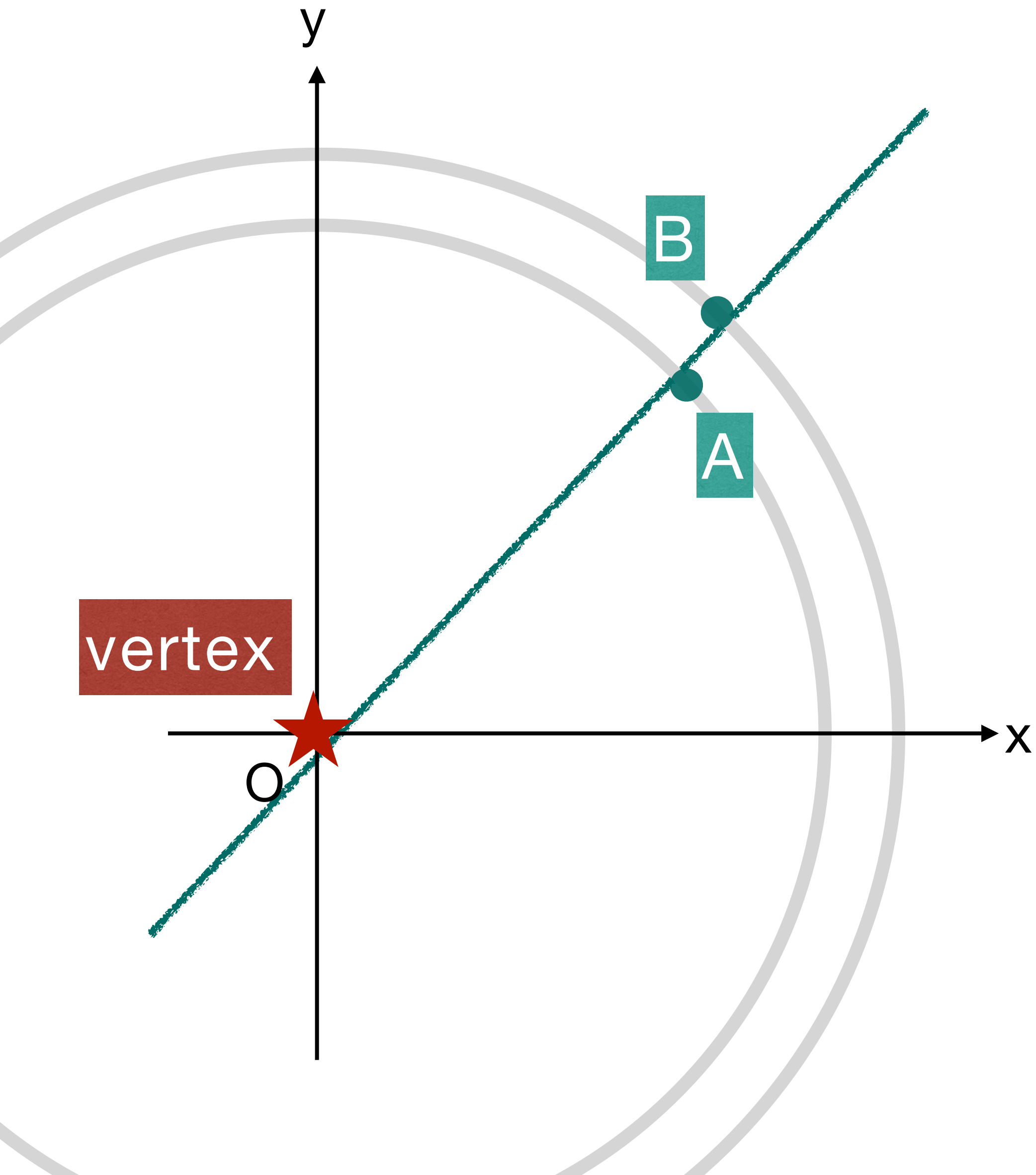


Used vertex value (run 40741/B-off)

- The vertex used in this analysis is $(x, y) = (-0.019, 0.198)$.
- The plot below shows angular difference btw inner cluster and outer cluster in x-y plane.



- The vertex(-0.019, 0.198) should be used.
- The range of d_phi cut($|\Delta\phi_{AB}| < 0.1$) works for data as well.



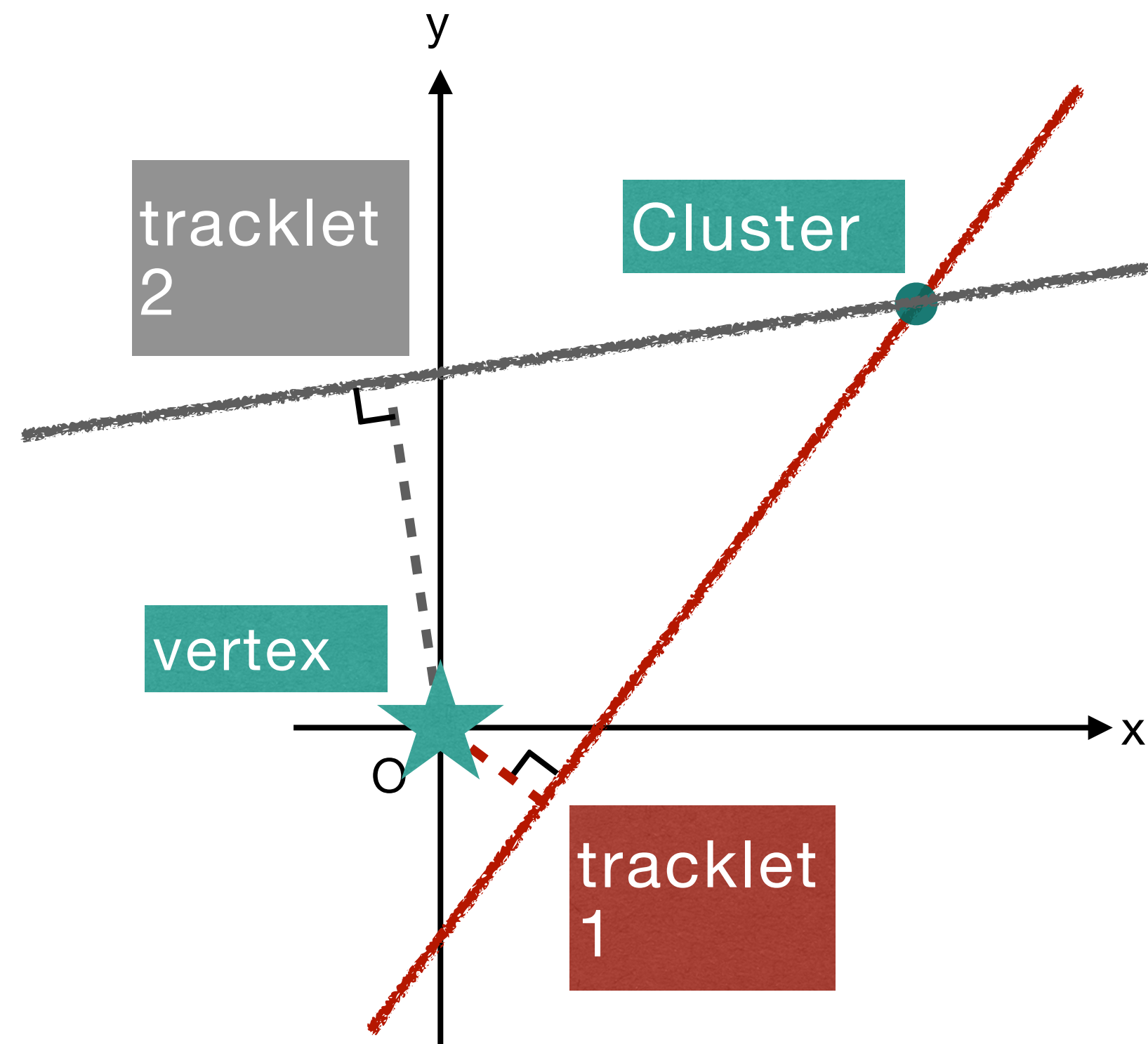
2. Optimize the tracks.

- Fit the tracklet and reconstructed vertex with a linear function using the least-square method.

Exclude the background

When multiple tracklets share one cluster

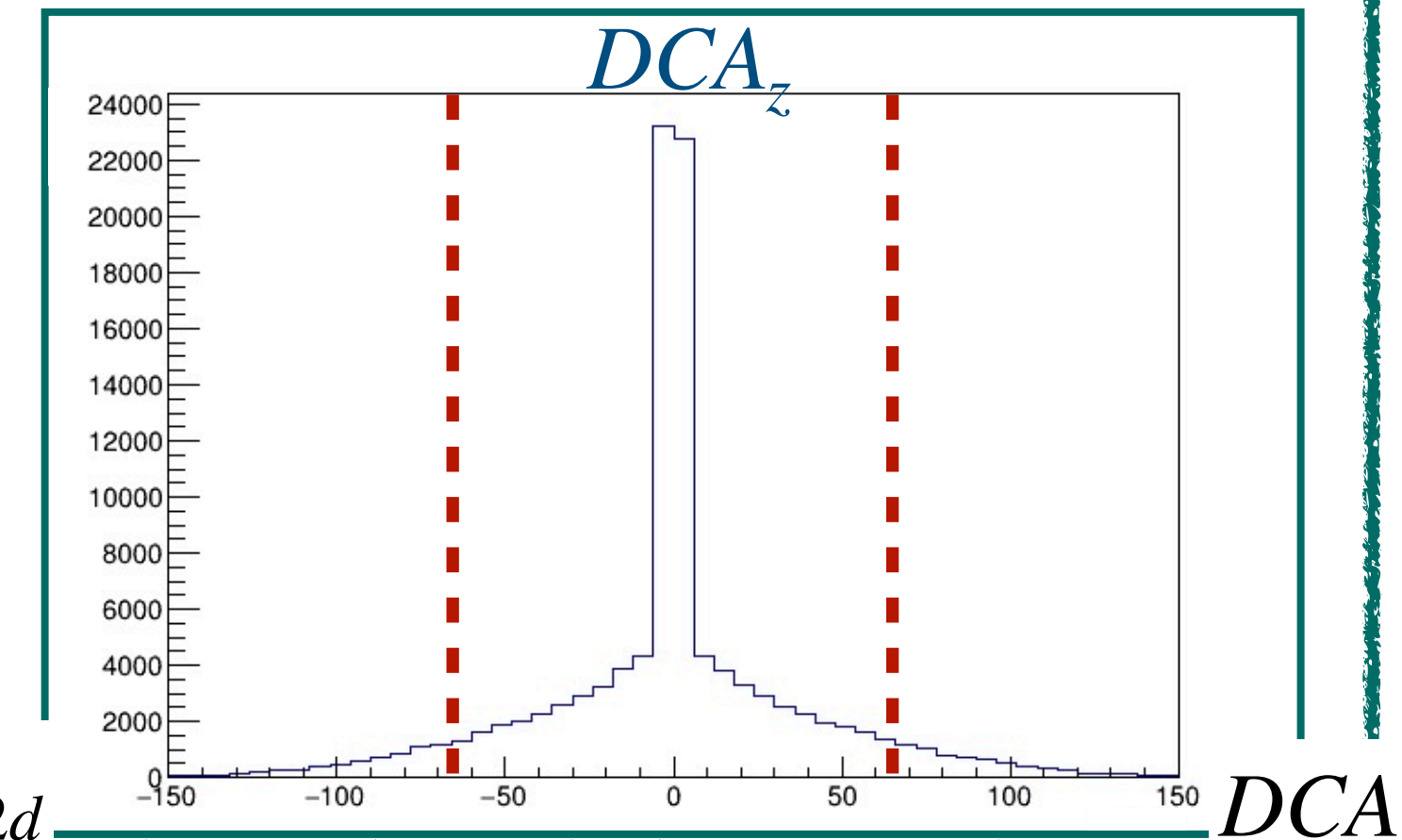
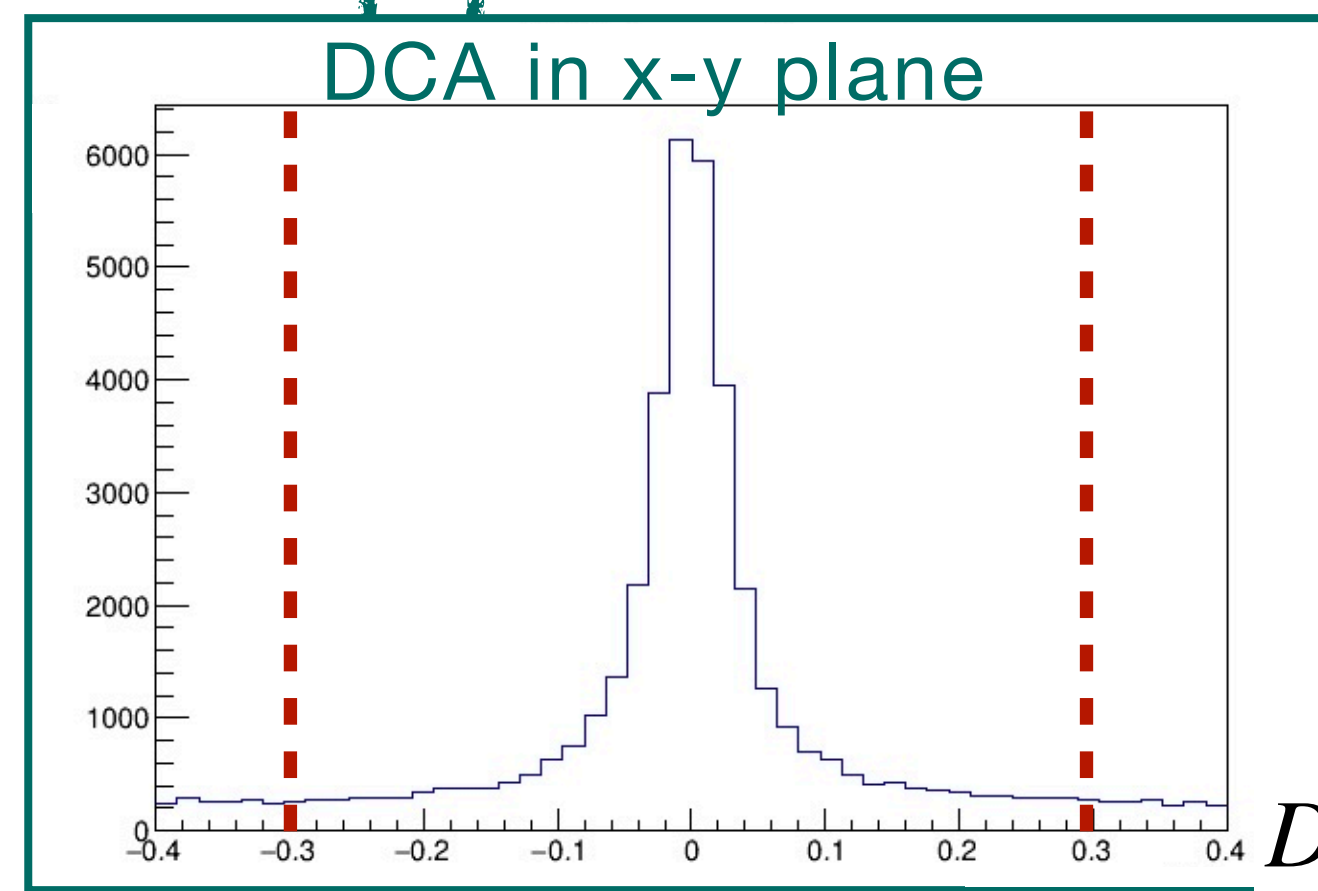
- Select the tracklet which is the closest to the vertex in x-y plane.



When tracklet is far from the vertex

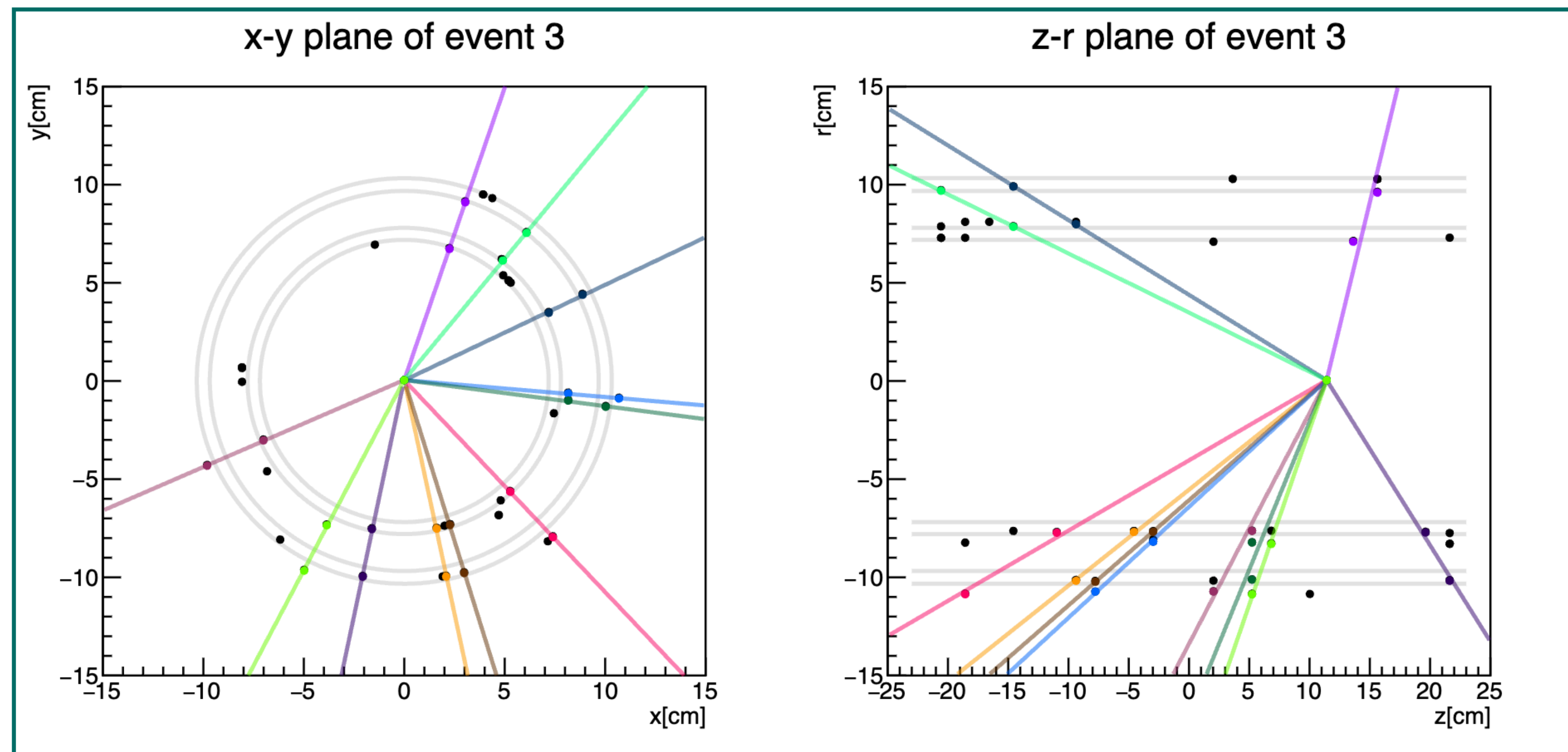
- Exclude tracklet whose DCA in x-y plane, DCA_z is far from the vertex.

<window>
 $-3\sigma \sim 3\sigma$

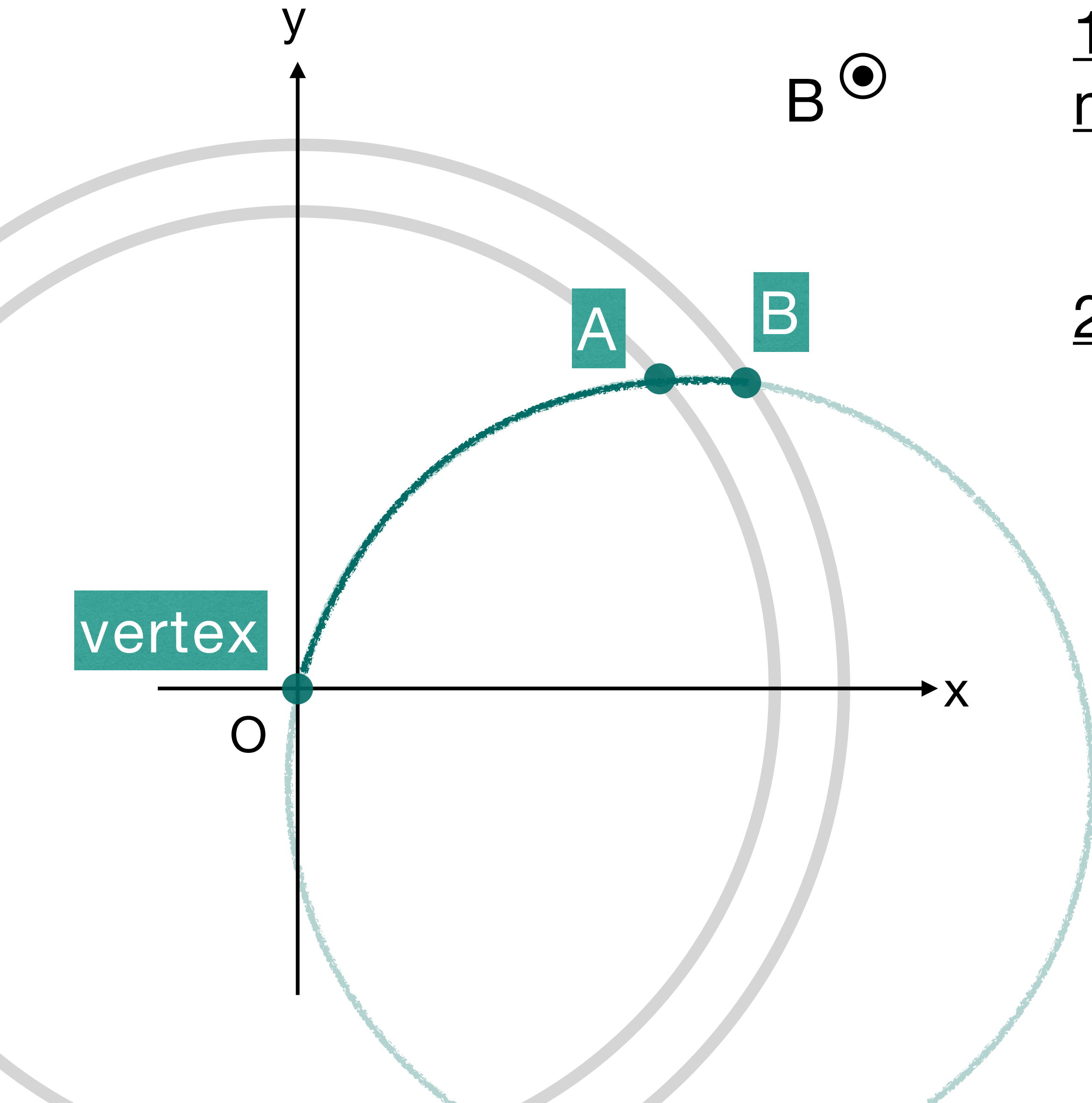


Reconstructed tracks (run40741/B-off)

- The tracks were reconstructed successfully using data(run40741/B-off).
- This result is reported in the Shift Change Meeting(April 29) 😊.



How to reconstruct a track (B-on)

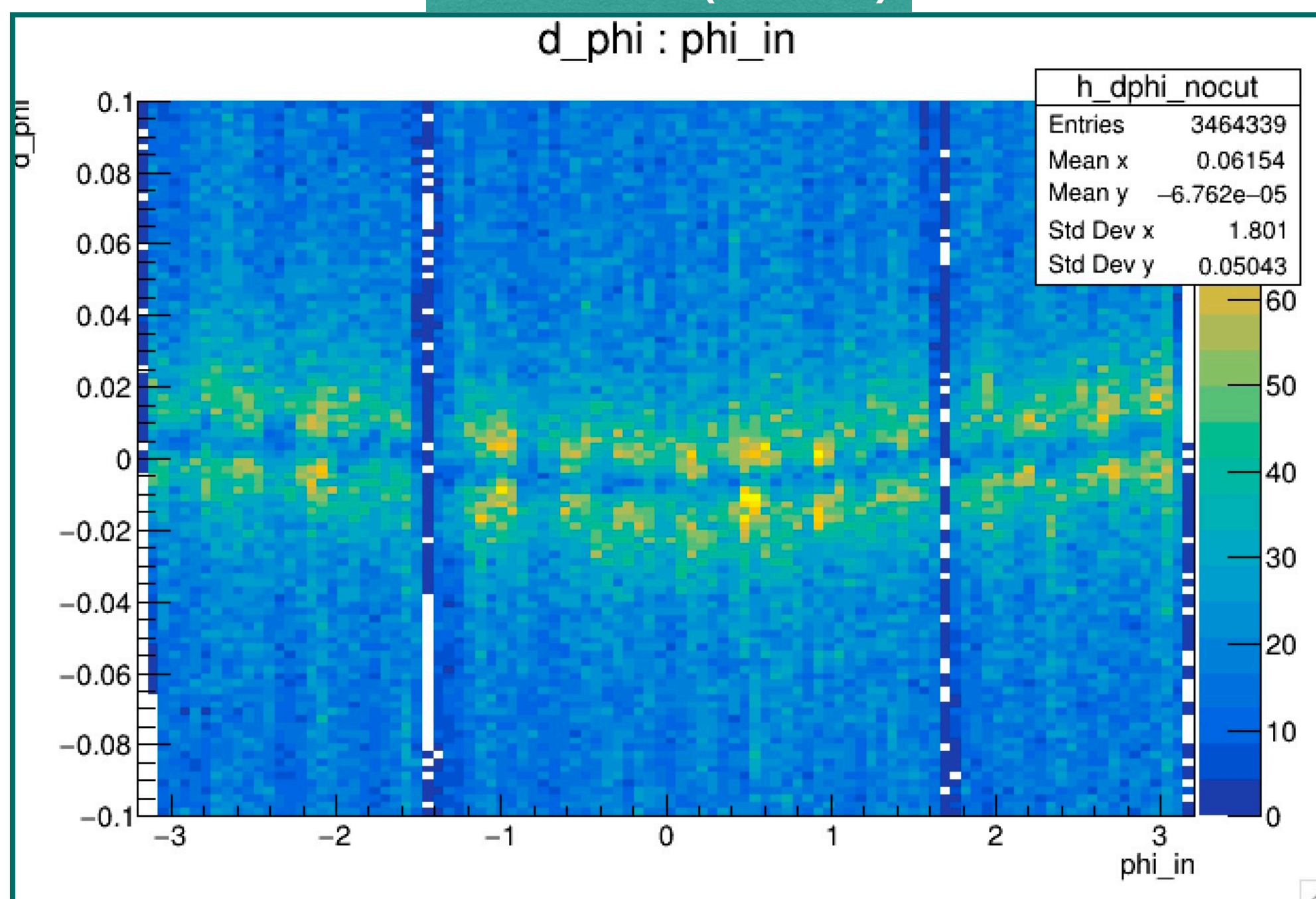


1. Reconstruct a “tracklet” in the same method as B-off data.
The vertex is the same as B-off is used.
2. Optimize the tracks.
Connect the tracklet and reconstructed vertex with a circle.

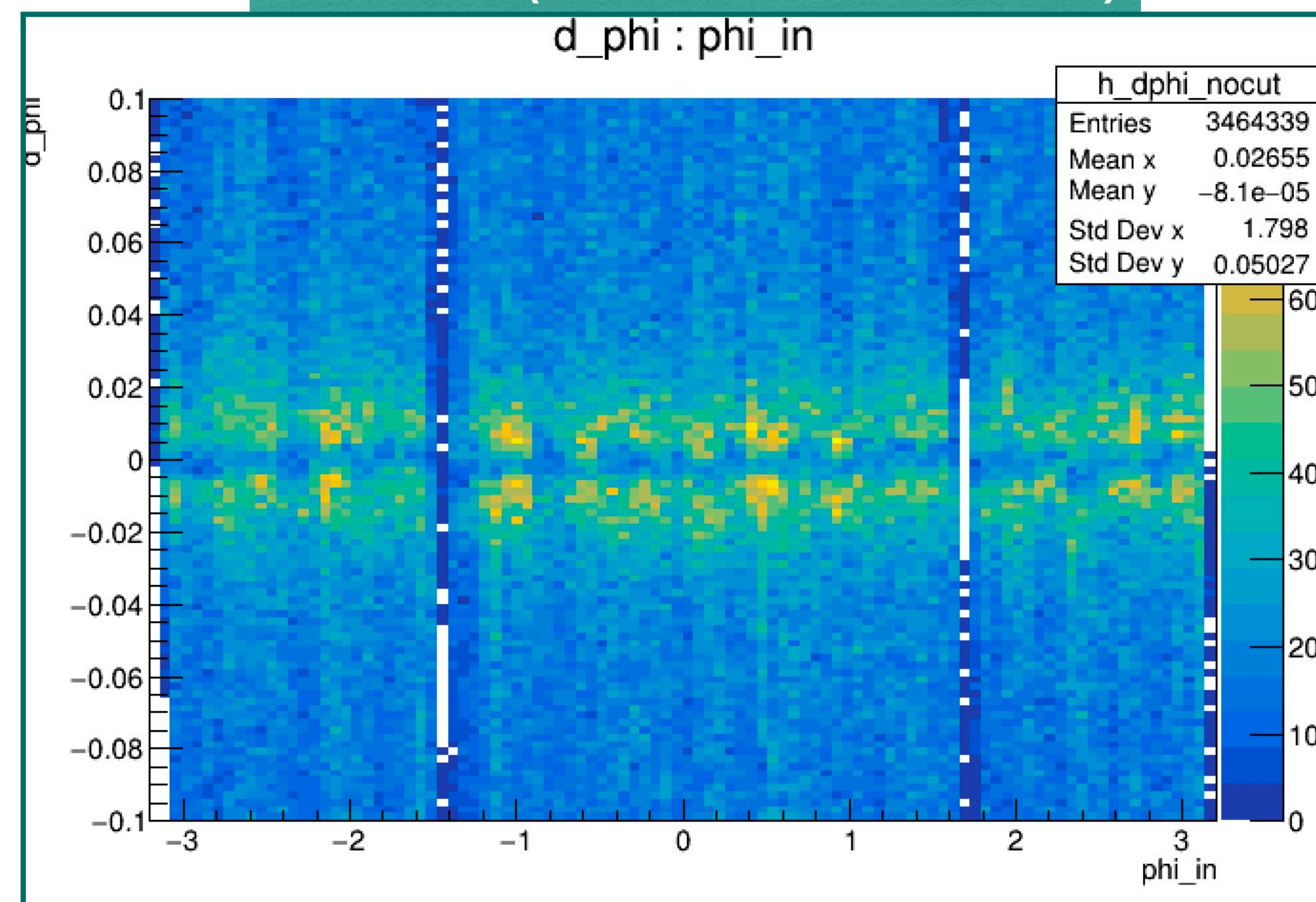
Used vertex value (run 41981/B-on)

- The vertex used in this analysis is $(x, y) = (-0.019, 0.198)$.
- The plot below shows angular difference btw inner cluster and outer cluster in x-y plane.

vertex(0, 0)



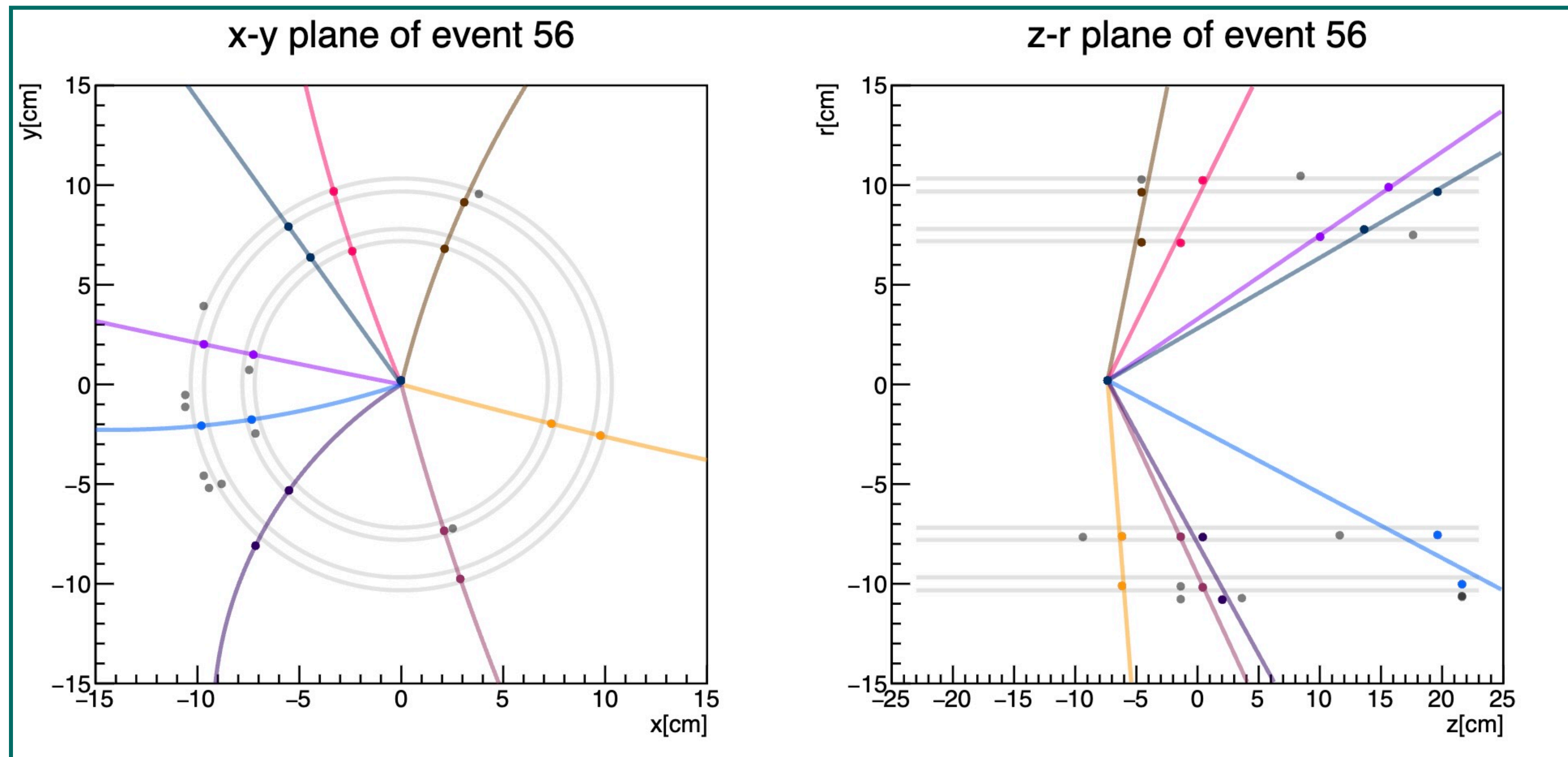
vertex(-0.019, 0.198)

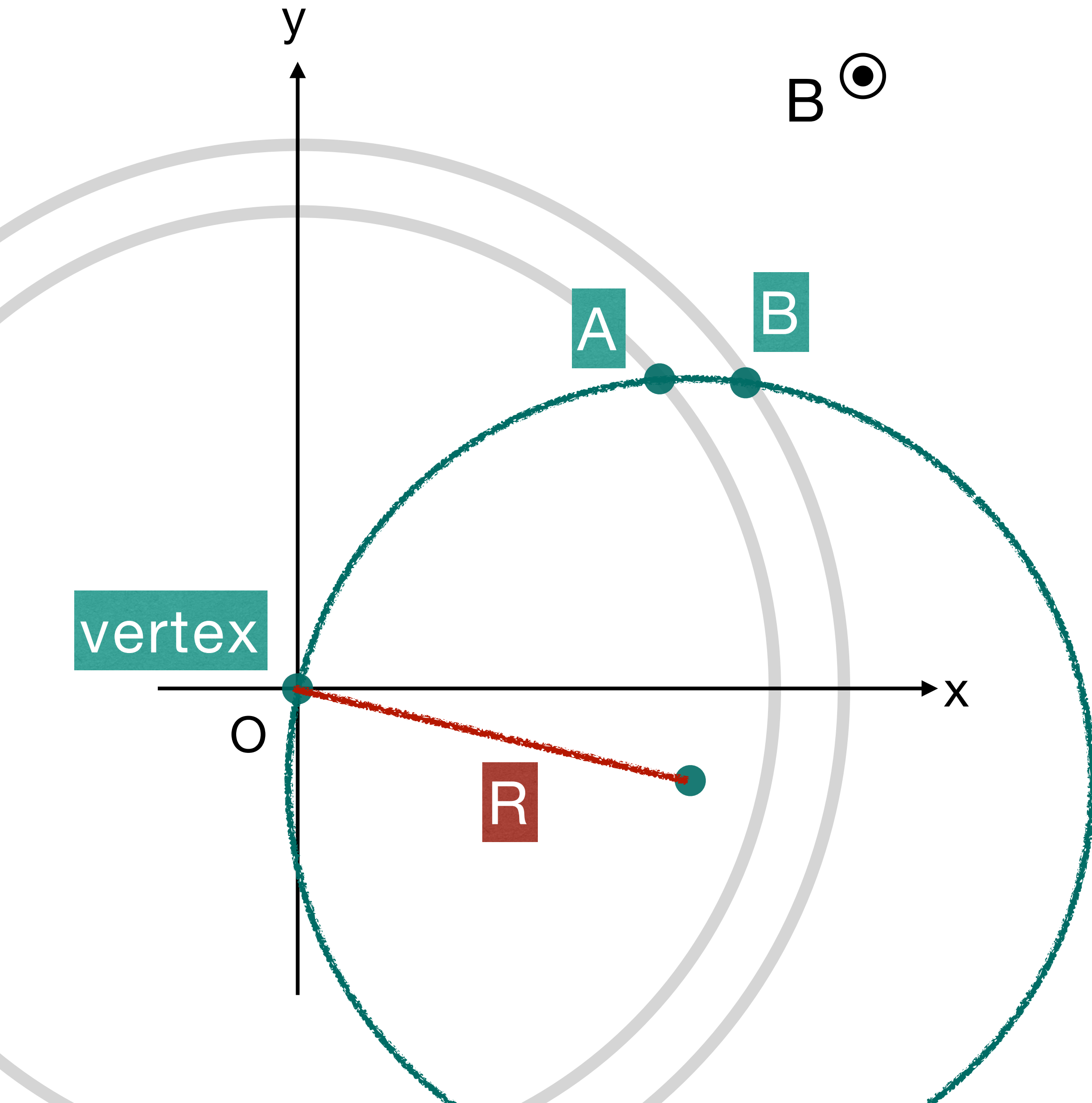


- The vertex(-0.019, 0.198) should be used with B-on data as well.
- The range of d_phi cut works for B-off data.

Reconstructed tracks(run41981/B-on)

- The tracks were reconstructed successfully using data(run40741/B-on).
- This result is reported in the Shift Change Meeting(May 13)😊.





1. Reconstruct a track curvature with B-on data.
2. Calculate the Radius of curvature (R).
3. Calculate p_T from the equation for circular motion.

$$m \frac{v_T^2}{R} = ev_T B$$

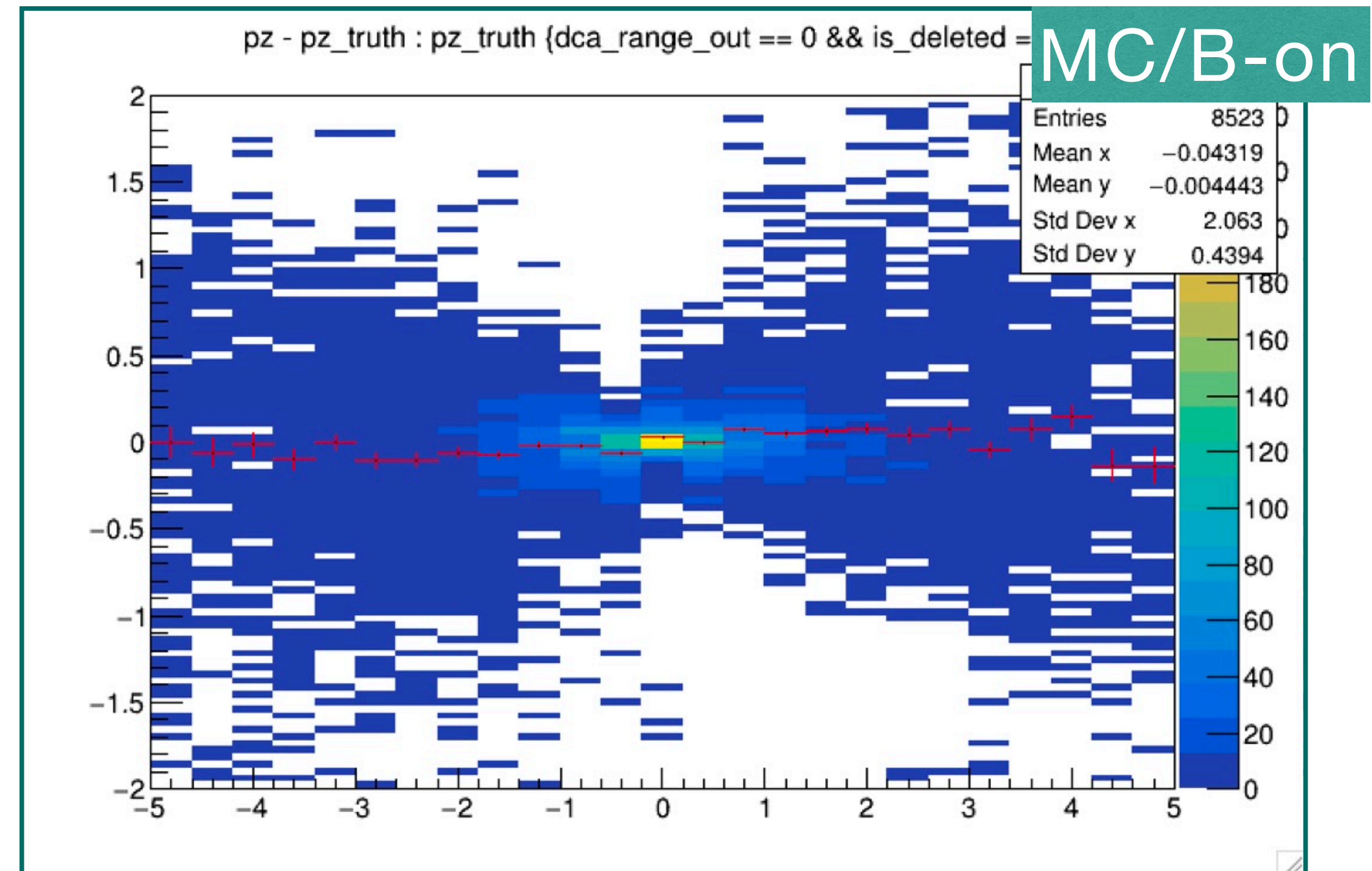
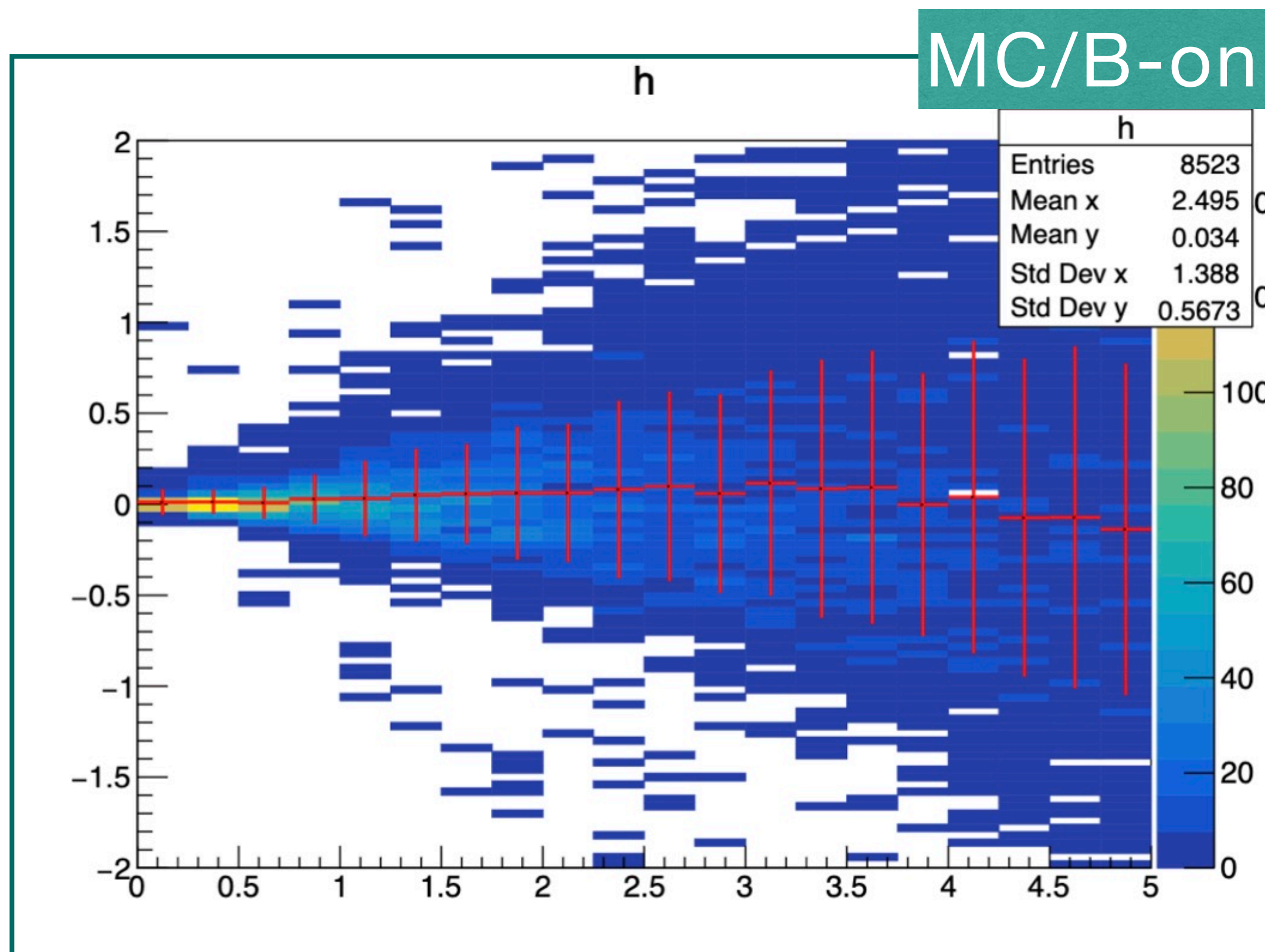
$$p_T = 0.3BR \quad [\text{GeV}/c]$$

- $B = 1.4\text{T}$ is used in this analysis.

Reconstructed pT, pz (MC/B-on)

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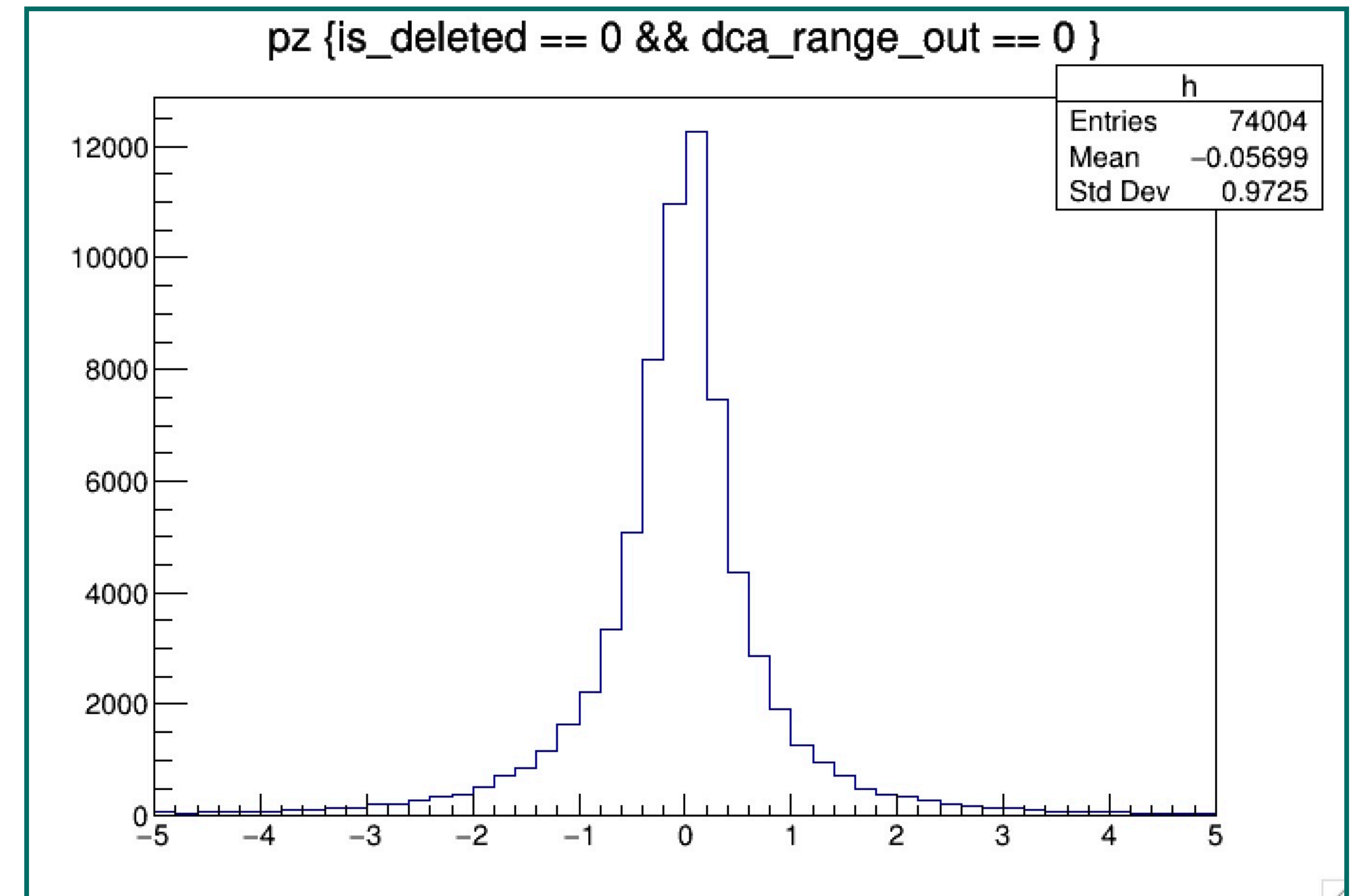
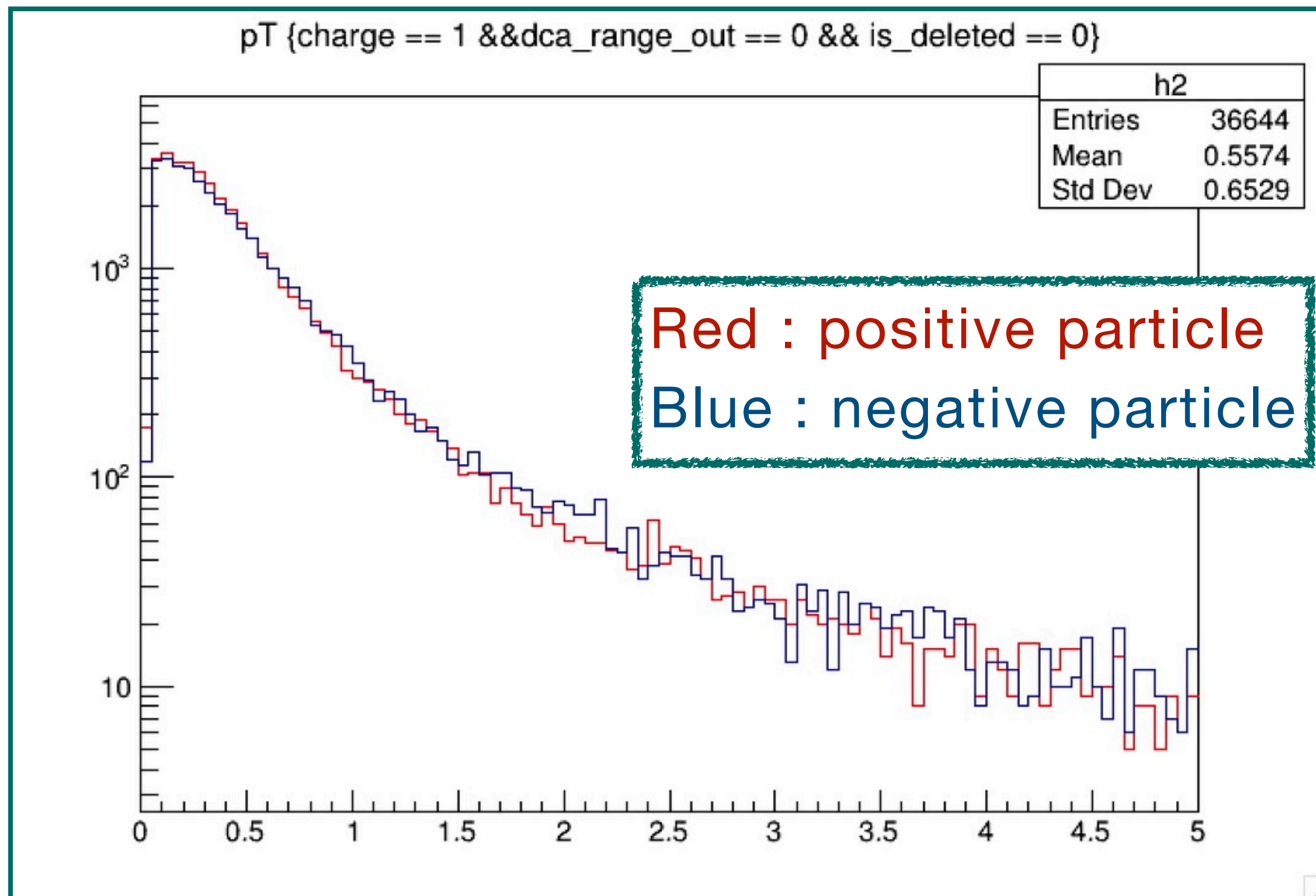
- Left(Right) plot : pT(pz) difference btw reconstructed pT(pz) and simulated pT(pz) as a function of simulated pT(pz).
- **Red line** represents the mean value and StdDev of pT(pz) difference.



- pT resolution is 20% and pz resolution is 2% in 5GeV.

Reconstructed pT with run 41981 (B-on)

- pT and pz are reconstructed with B-on data (run41981).
 - The left plot shows pT and the right plot shows pz.



- pT and pz are reconstructed successfully with data.
- The # of positive particles is as same as the # of negative particles as the level of few%.

Summary : Development of a tracking algorithm using INTT

- Tracks are reconstructed with B-off and B-on data successfully.
- Obtained pT and pz with MC and data.
 - (MC)pT resolution is 20% and pz resolution is 2% in 5GeV.
 - The result with data should be compared with MC.
 - The # of positive particles is as same as the # of negative particles as the level of few%.

Next step

- Associate INTT tracks with EMCAL tracks

BACK UP