FLUSH REPORT

INTT tracking in pp with SIM

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INTT tracking in pp with SIM

Development of tracking algorithm in pp collision with simulation

Goal in this workshop: Evaluation of my tracking algorithm with the truth information and sPHENIX tracking group

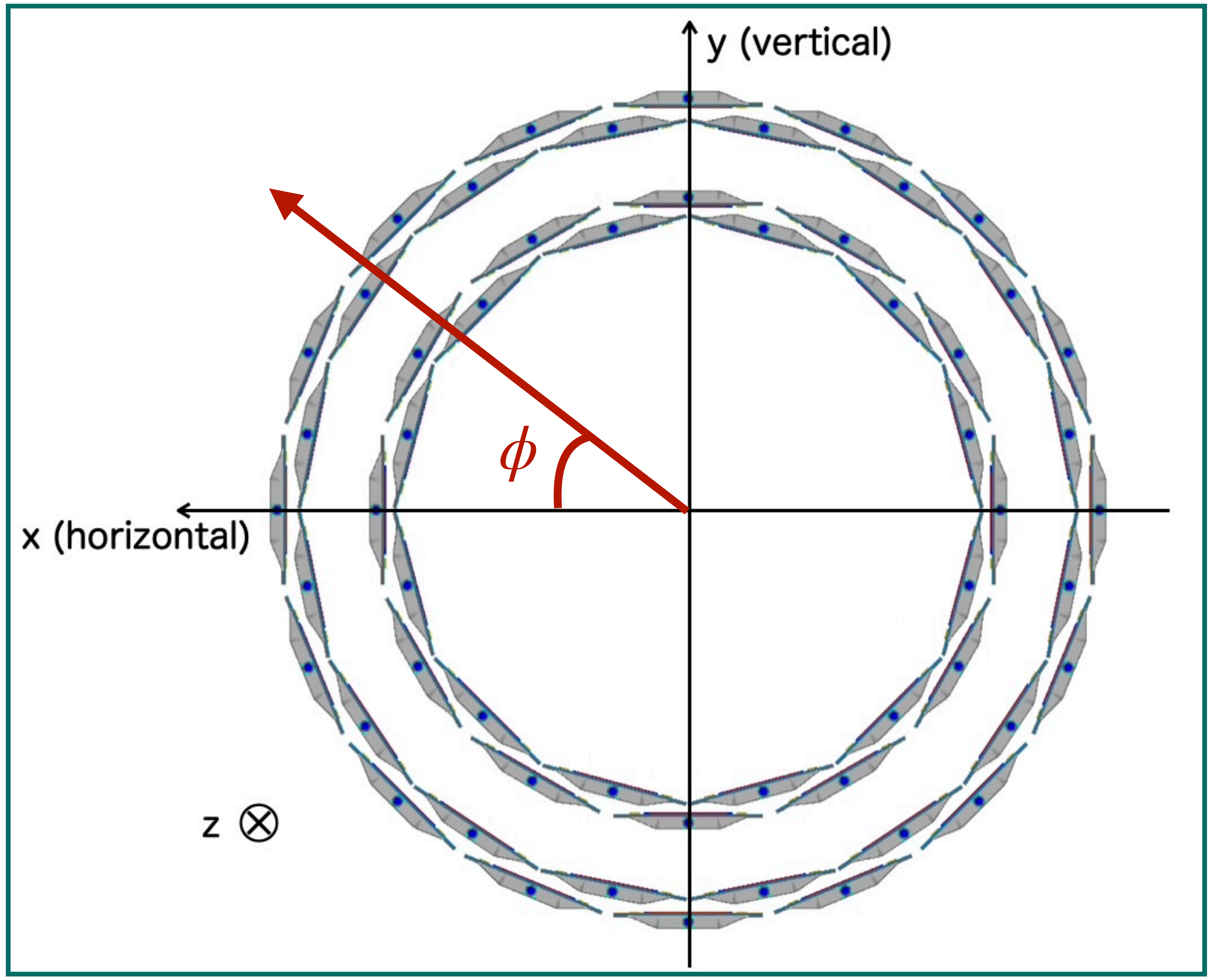
My To-Do List

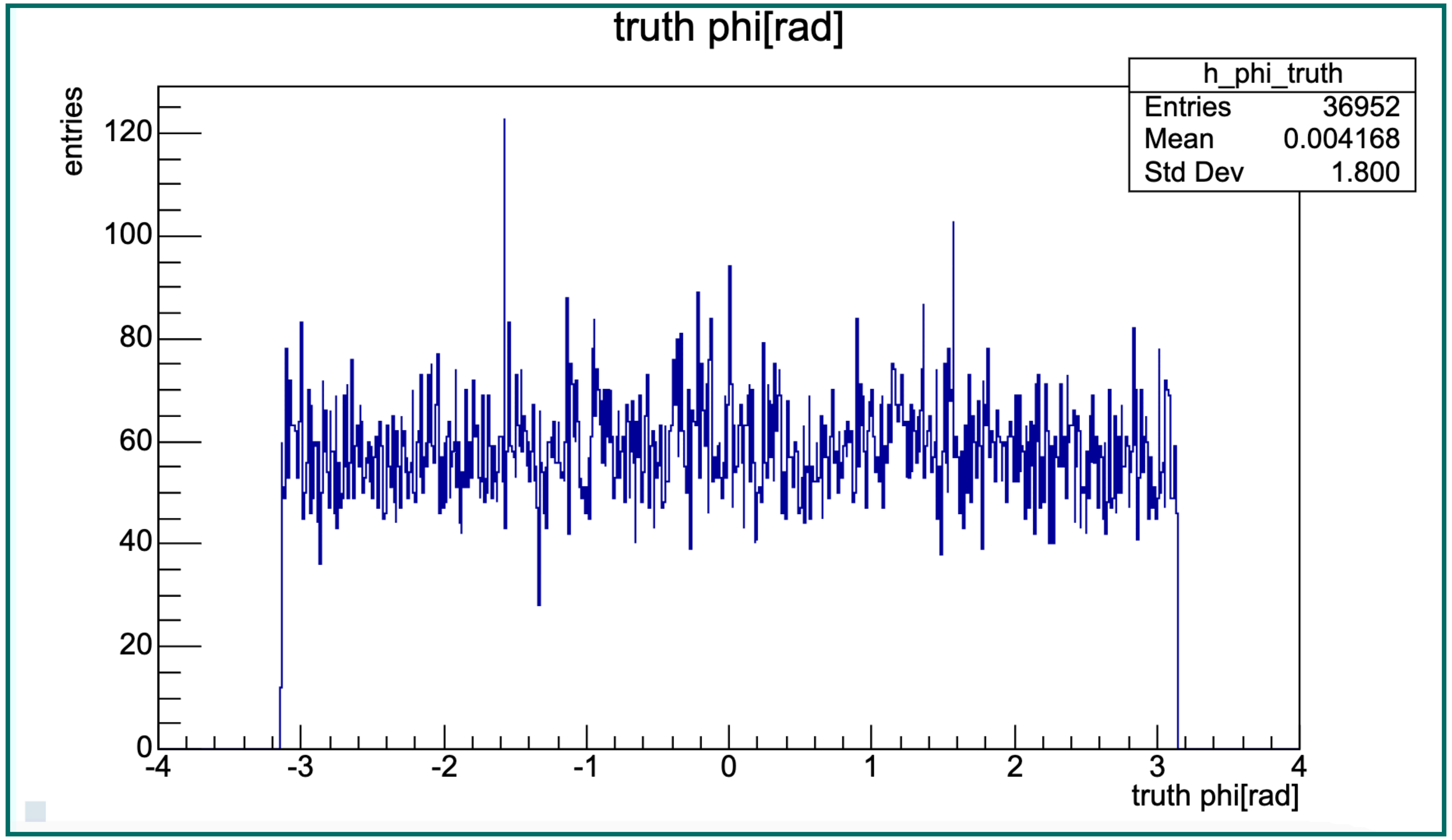
- Evaluation of my tracking algorithm with the truth track
  - Calculation of the angles (ϕ and θ) of my track
  - Checking the angles of the truth track
  - Comparison of the angles between my track and the truth track

- Evaluation of my tracking algorithm with the track which is made by sPHENIX tracking group
  - Understanding the tracking system of sPHENIX tracking group
  - Taking the tracking data of sPHENIX tracking group
  - Comparison between my track and the track which is made by sPHENIX tracking group

The angles of the truth track

- The truth angles is taken from PYTHIA.
- ϕ is the angle in the x-y plane.



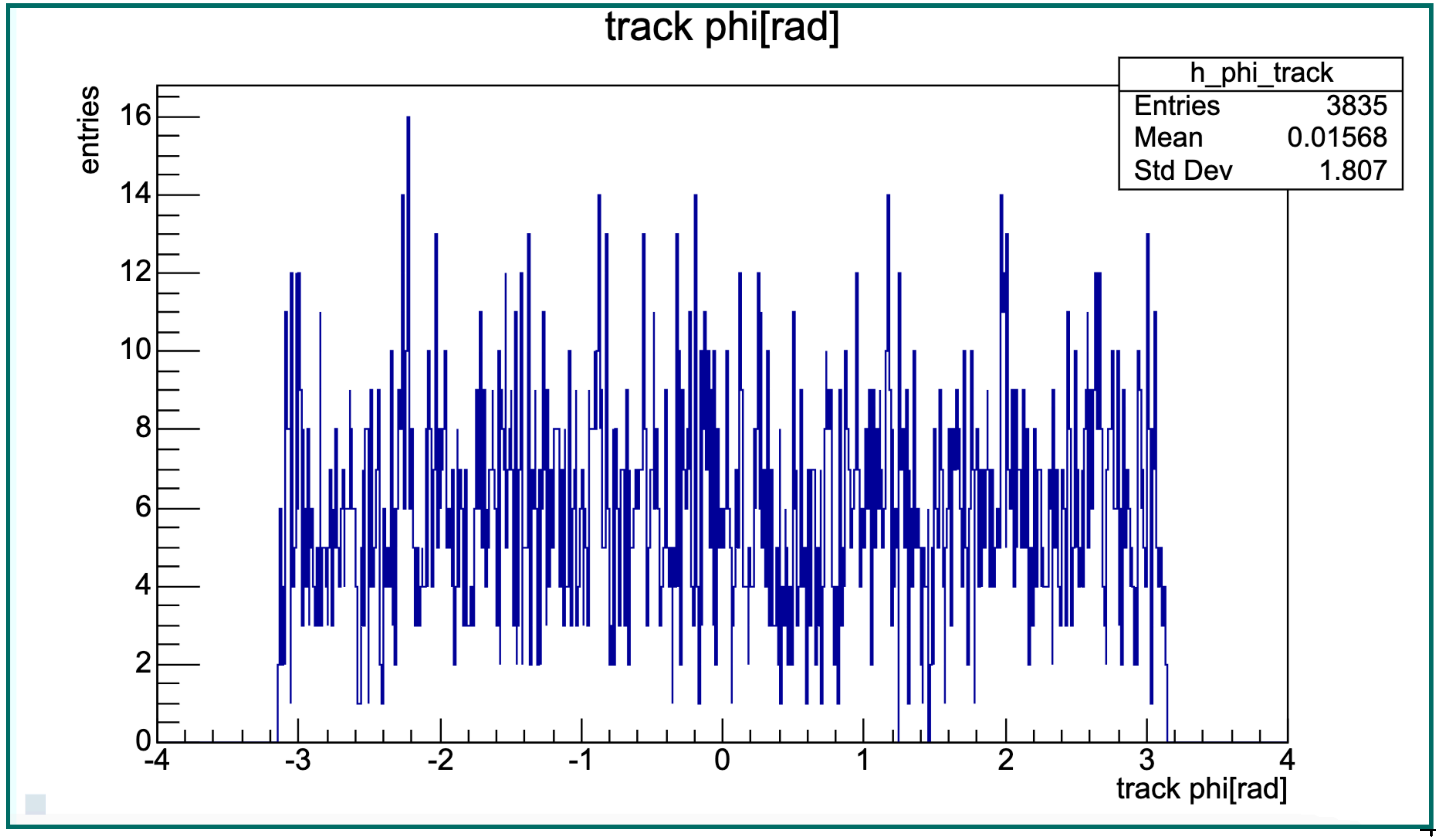


Calculation of the angles of my track

- The tracks is defined as $y = ax + b$ in x-y plane and r-z plane each.
- The angles (ϕ and θ) is calculated as below.

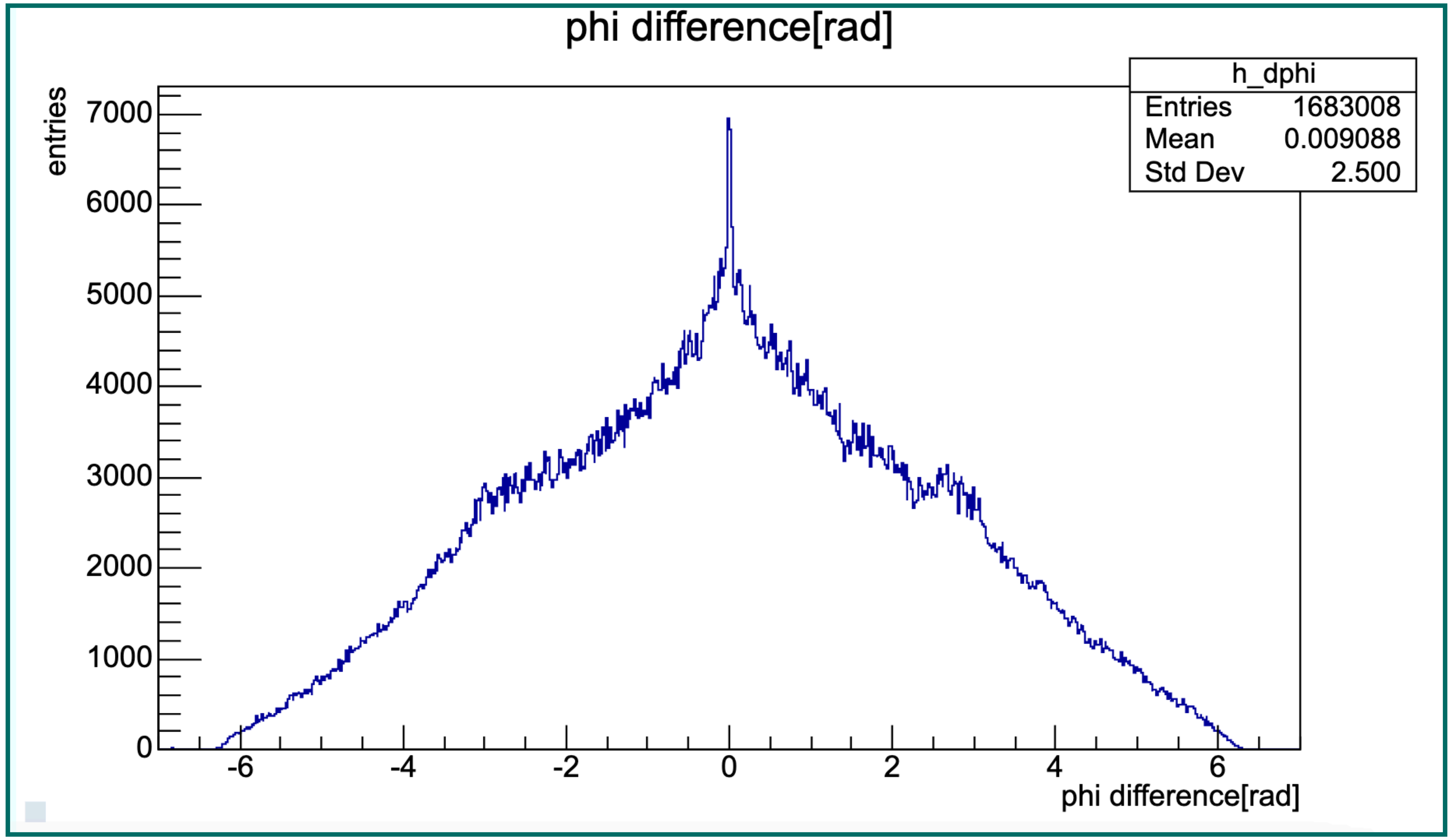
$$\phi = \mathrm{Arctan}(\mathrm{a_{xy}})$$

$$\theta = \mathrm{Arctan}(\mathrm{a_{rz}})$$



The angular difference

- The angular difference between one angle of my track and all of the truth tracks in one event is calculated.
- The bottom plot shows the difference of 100 events.



- The correct combination of the my track and the truth track is around 0 probably.

<u>Next step</u>

- After setting the window around 0 in x-axis, I'd like to calculate the ratio of the correct combination in the window.

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My To-Do List

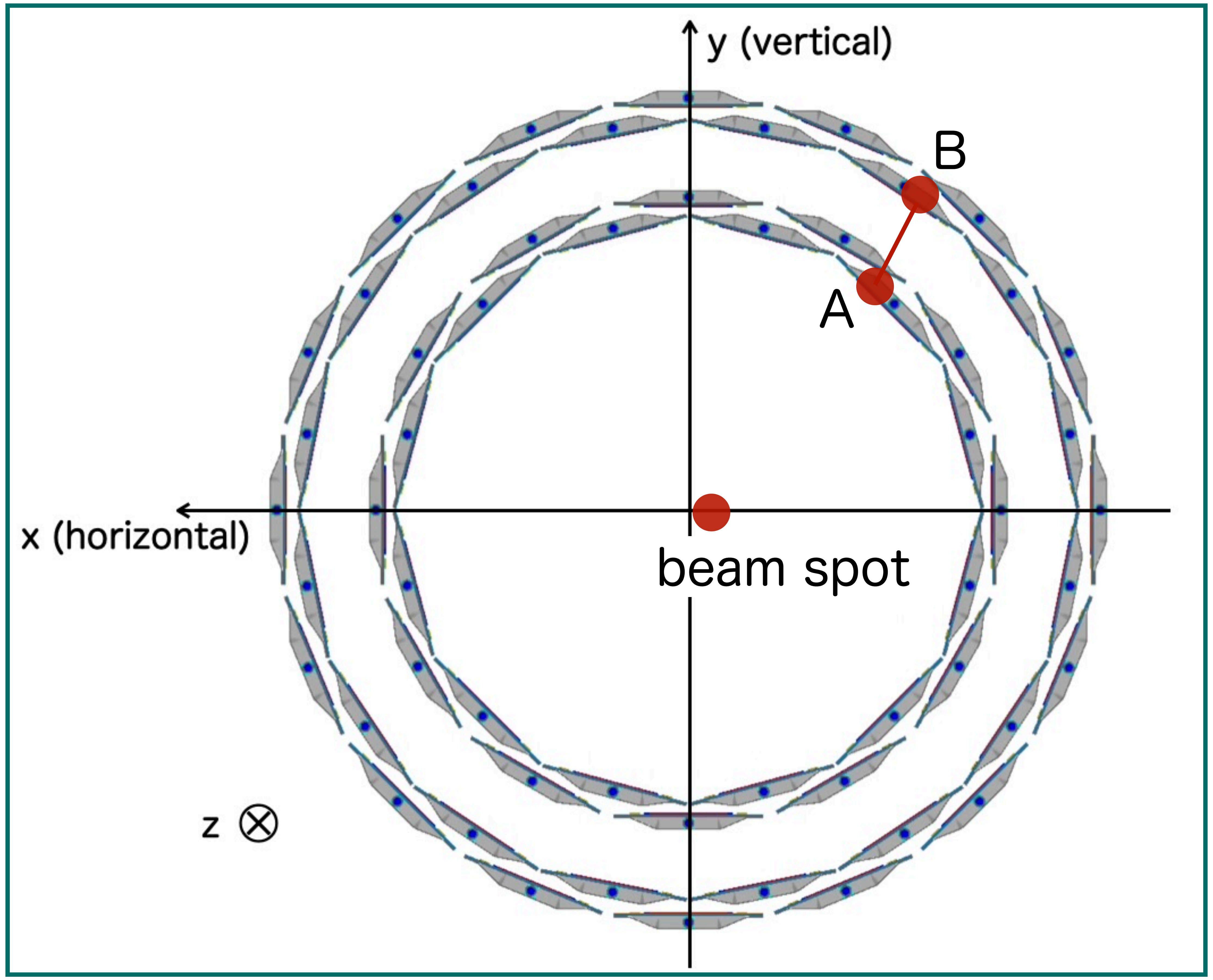
- Evaluation of my tracking algorithm with the truth track
  - Calculation of the angles (ϕ and θ) of my track (ongoing)
  - Checking the angles of the truth track
  - Comparison of the angles between my track and the truth track (ongoing)

- Evaluation of my tracking algorithm with the track which is made by sPHENIX tracking group
  - Understanding the tracking system of sPHENIX tracking group
  - Taking the tracking data of sPHENIX tracking group
  - Comparison between my track and the track which is made by sPHENIX tracking group

BACK UP

TRACKING METHOD

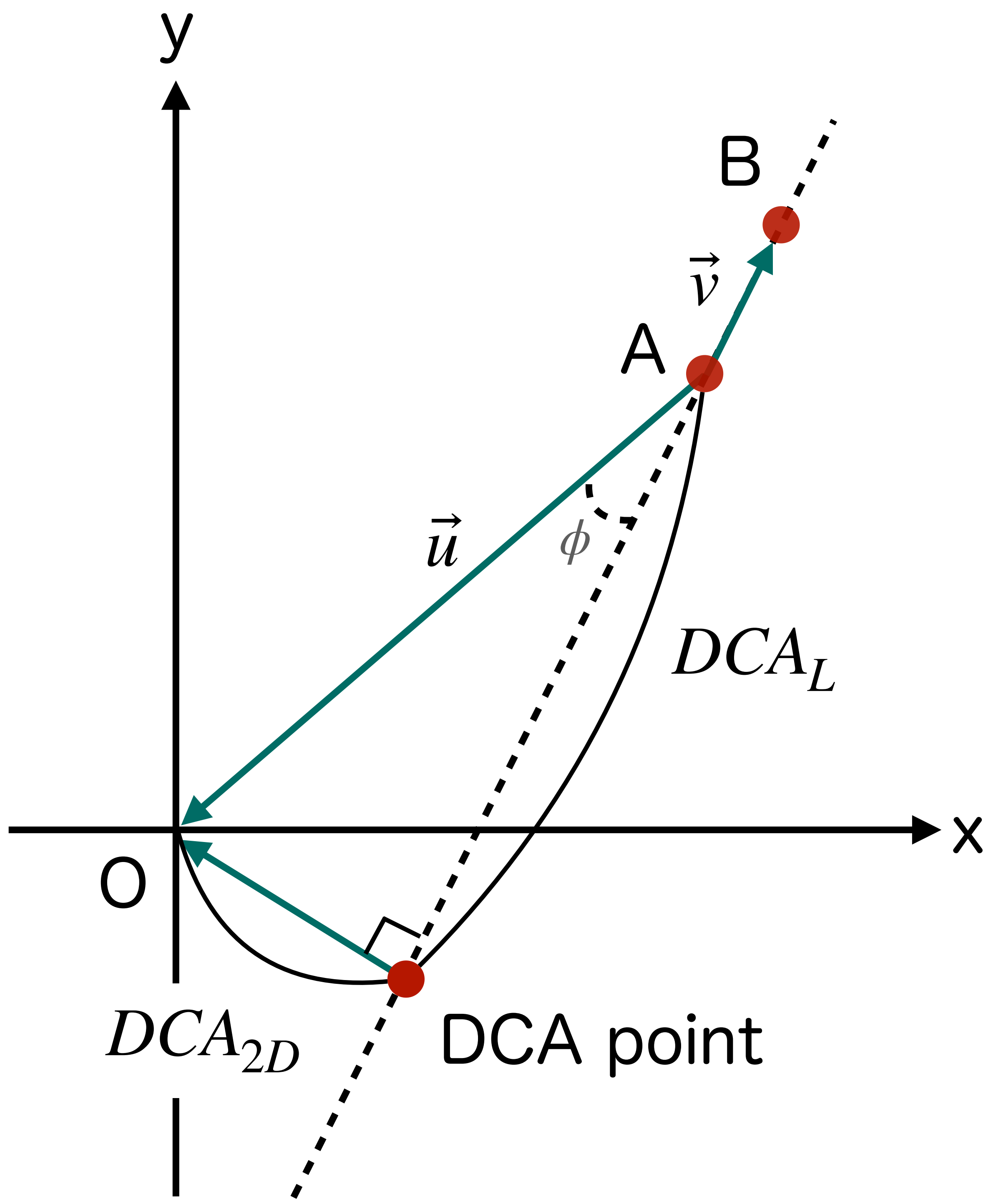
<Simulation>
PYTHIA + GEANT4 (100 events)
p + p collision, $\sqrt{s} = 200\mathrm{GeV}$, no magnetic field.



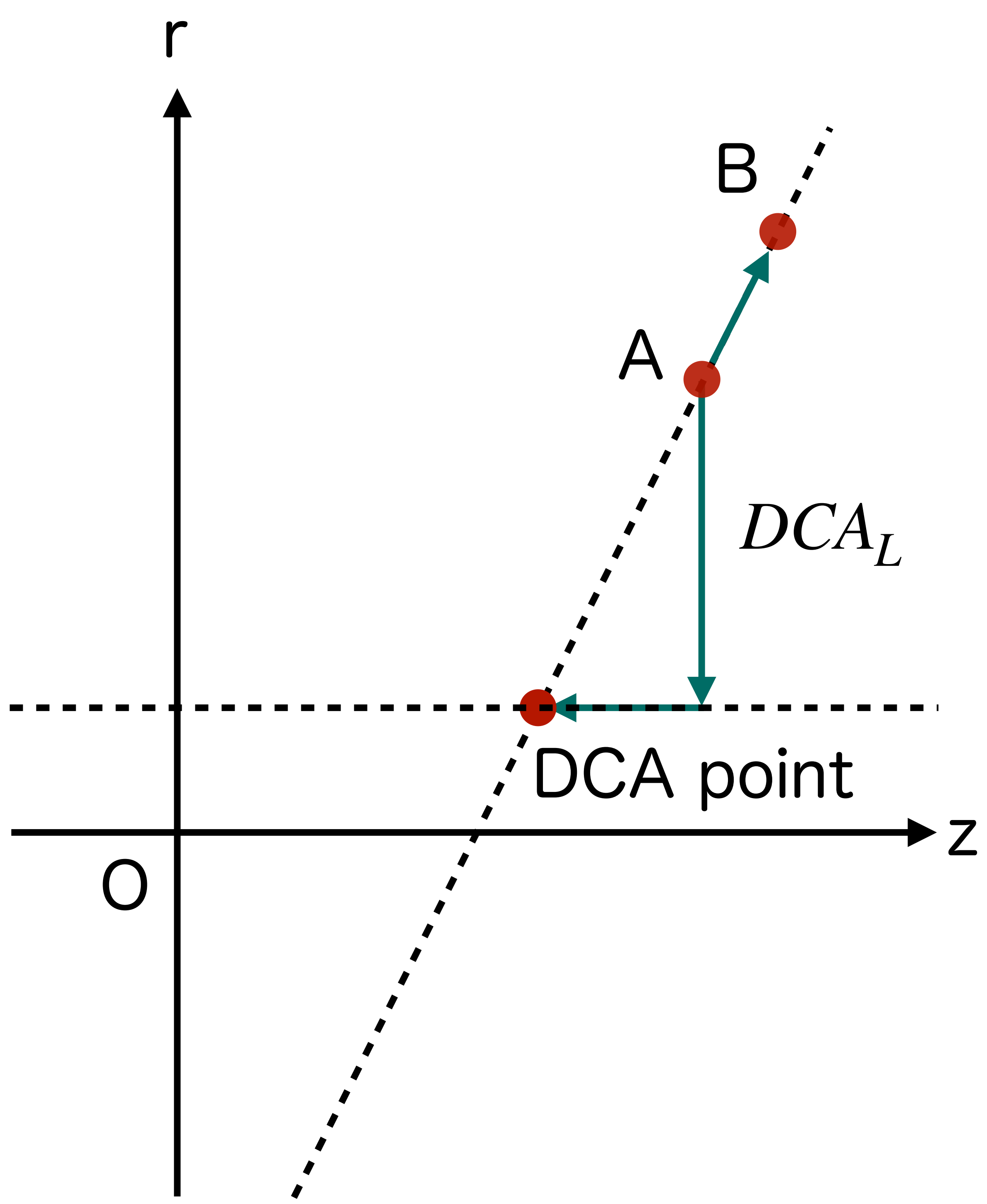
1. Selection a cluster A on the inner barrel and a cluster B on the outer barrel.
2. Connection them with a line (tracklet).
3. Determination the beam spot using tracklets.
4. Connection the three points (A, B, beam spot) by the least-squares method (track).

HOW TO GET THE BEAM SPOT4

x-y plane



r-z plane



Unit vector between A and B : $\vec{v}$

Unit vector between A and O : $\vec{u}$

- To find the beam spot, the distance of closest approach (DCA) between each tracklet and origin was calculated.

- Calculating DCA_{2D} and DCA_L.

$$\mathrm{DCA_{2D}} = \vec{\mathrm{v}} \times \vec{\mathrm{u}} = \vec{\mathrm{u}} \cdot \sin\phi$$

$$\mathrm{DCA_{L}} = \vec{\mathrm{v}} \cdot \vec{\mathrm{u}} = \vec{\mathrm{u}} \cdot \cos\phi$$

- Using DCA_L, the DCA position of the tracklet can be calculated.

$$DCA_X = DCA_L \times \vec{u}_x + A_x$$

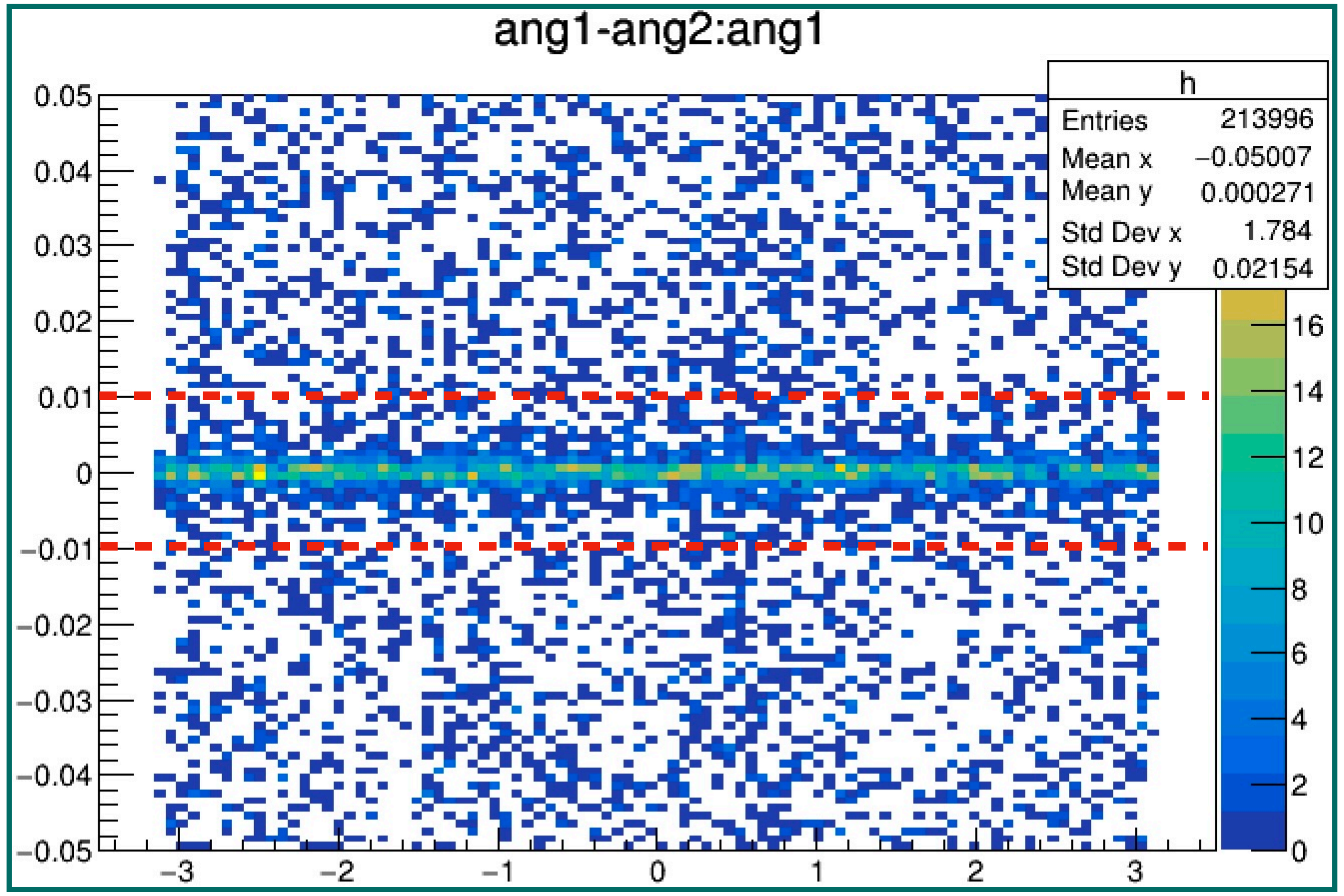
$$DCA_Y = DCA_L \times \vec{u}_y + A_y$$

$$DCA_Z = DCA_L \times \vec{u}_z + A_z$$

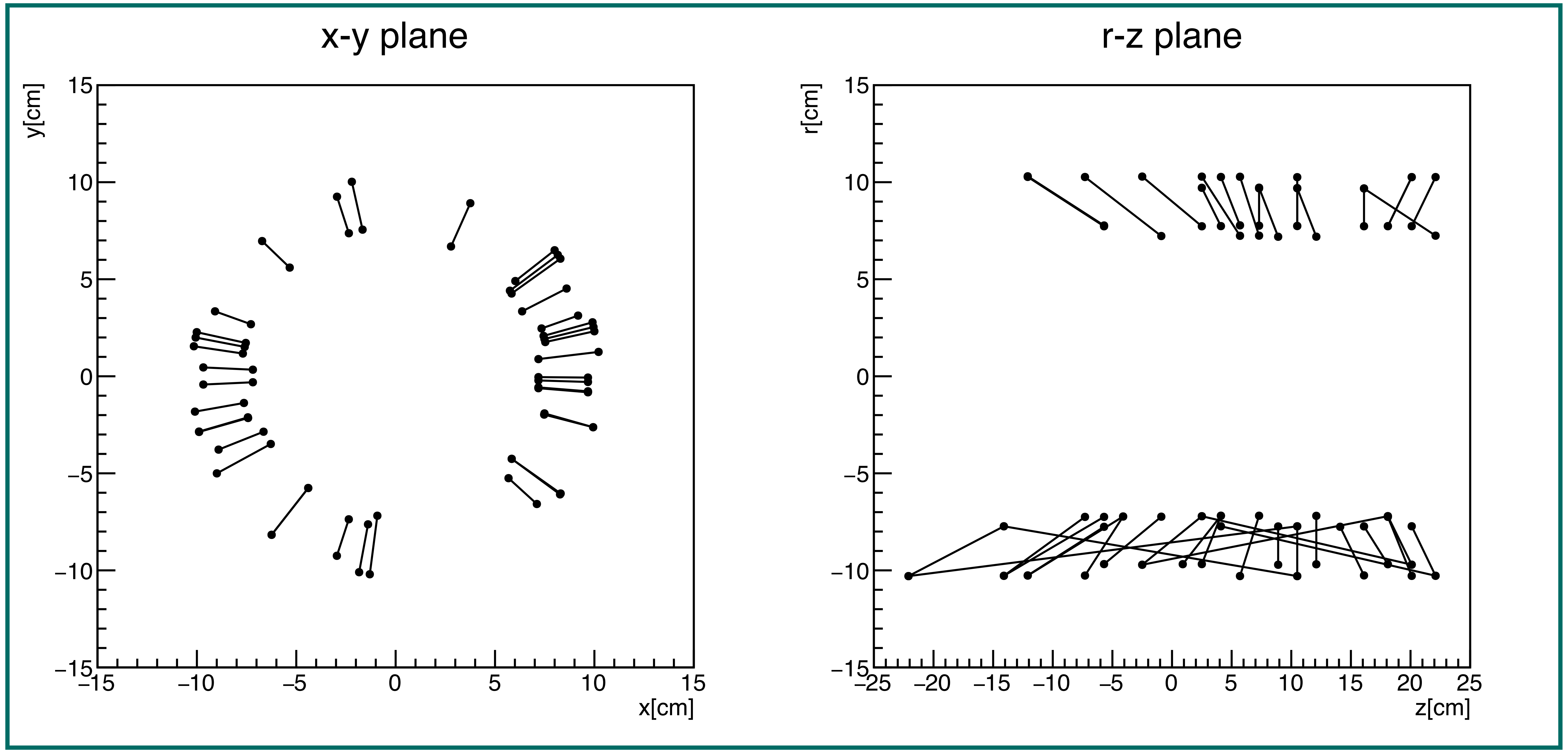
- The beam spot is the average of the DCA.

TRACKLET

- Tracklets are defined as those with angular difference in the X-Y plane between A and B $\Delta\phi < 0.01$[rad].

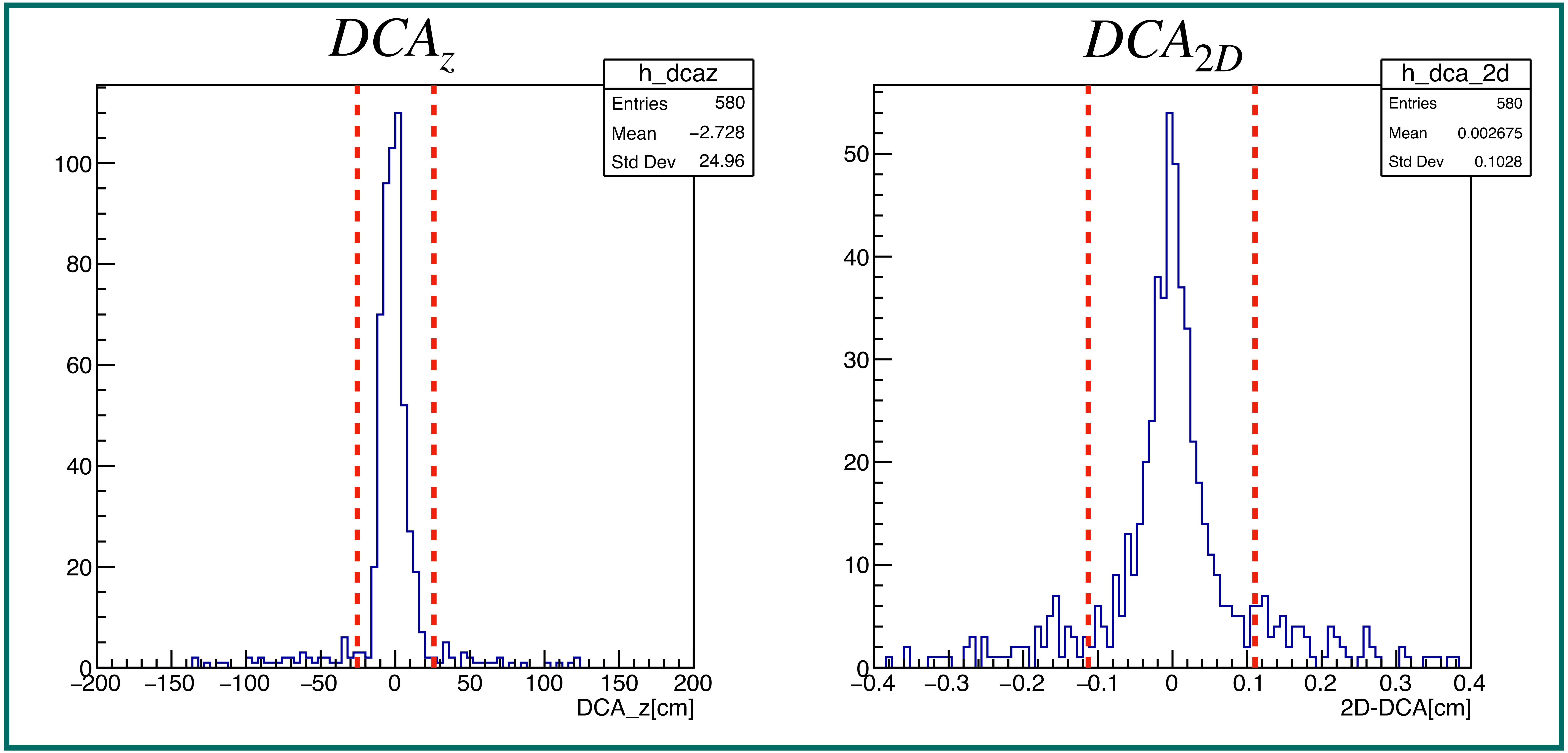


Some tracklets share a cluster.
Some DCA_zs seem to be extremely far from the beam spot.



DCA cut

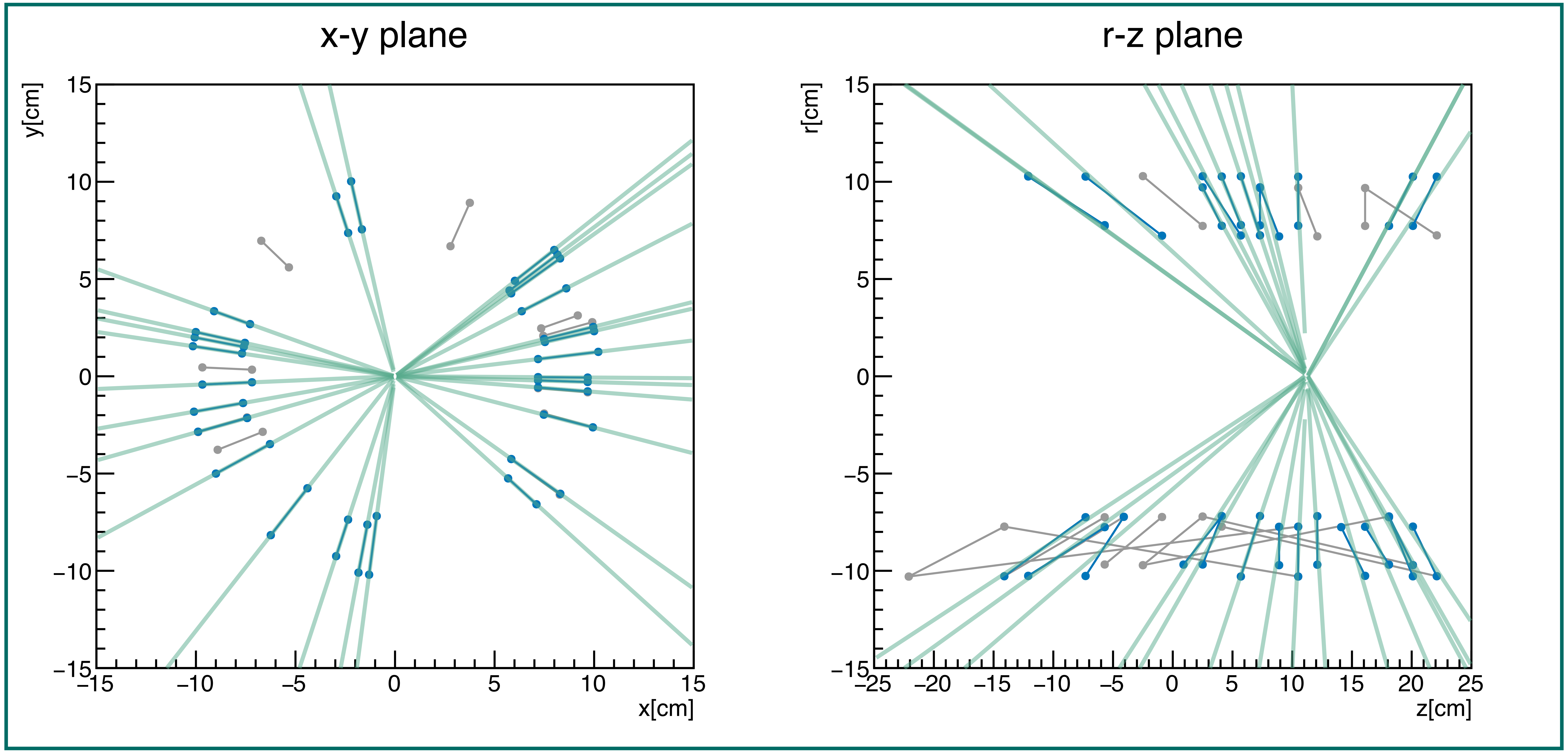
In this case, only tracklets within 1 sigma from the DCA_{2D} and DCA_z mean are used.

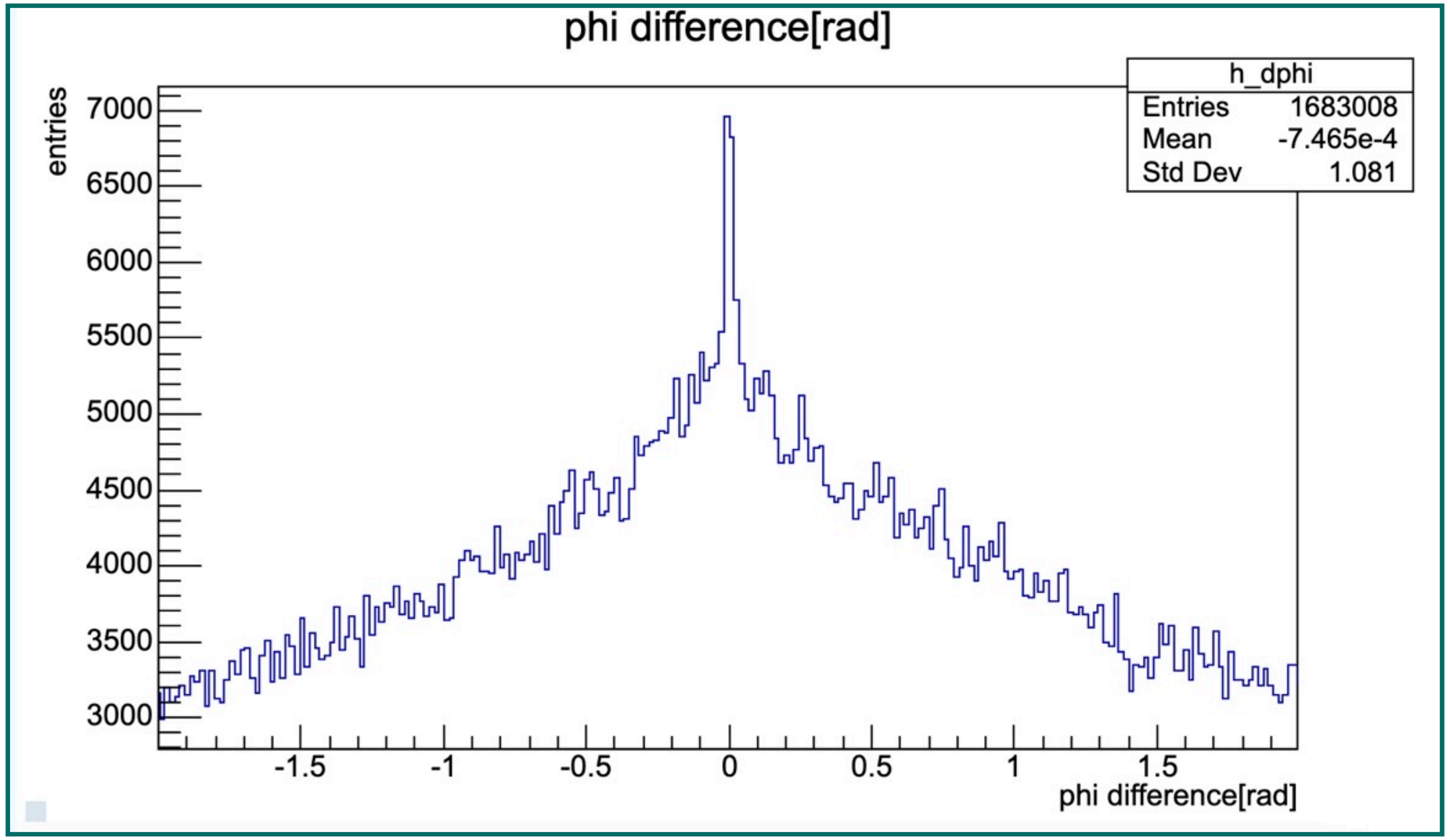


RESULT OF TRACKING

Blue : clusters and tracklets Green : reconstructed tracks

Glay : excluded clusters and tracklets




phi difference[rad]
h_dphi
Entries 1683008
Mean -7.465e-4
Std Dev 1.081
entries
7000
6500
6000
5500
5000
4500
4000
3500
3000
-1.5
-1
-0.5
0
0.5
1
1.5
phi difference[rad]

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1e72 - Google 検索 | INTT Analysis Workshop in NCU (6-17... | https://indico.bnl.gov/event/20852/co... | MT - ファイル - Nextcloud | https://www.star.bnl.gov/public/comp/...

An example of how to add one particular particle specie is given in "How to simulate D mesons" page. Here one can find some additional information on how to choose new particle ID. In fact one should remember for proper transmission of hep id from event generators, that only the hep Id is meaningfull.

The existing list is below:

In rough order of multiplicity: gamma,pi+,pi-,pi0,etc.

Particle Data Group IDs

22 GAMMA	**211** PION +	**-211** PION -	**111** PION 0	**130** KAON 0 LONG
321 KAON +	**-321** KAON -	**310** KAON 0 SHORT	**221** ETA	
2212 PROTON	**2112** NEUTRON	**-2212** ANTIPROTON	**-2112** ANTINEUTRON	**-11** ELECTRON
11 POSITRON	**-12** NU_E	**12** ANTI NU_E	**-13** MUON +	**13** MUON -
3122 LAMBDA	**3222** SIGMA +	**3212** SIGMA 0	**3112** SIGMA -	**3322** XI 0
3312 XI -	**3334** OMEGA -			
-3122 ANTILAMBDA	**-3222** ANTISIGMA -	**-3212** ANTISIGMA 0	**-3112** ANTISIGMA +	**-3322** ANTIXI 0
-3312 ANTIXI +	**-3334** ANTIOMEGA +			
-15 TAU+	**15** TAU-	**441** D+	**-441** D-	**421** D0
-421 ANTID0	**431** DS+	**-431** DS-		
24 W+	**-24** W-	**23** Z0	**-14** NU_M	**14** ANTINU_M
-16 NU_T	**16** ANTINU_T	**71** GEANT	**72** GEANT	**75** GEANT
700201 DEUTERON	**700301** TRITON	**700202** ALPHA	**700302** HE3	

It's been agreed some tome ago to use 700000+A*100+Z for atoms, but apart from this there is no conventions.

It is recommended to use something which is consistent with PYTHIA manual. For example it has pdg codes 80-100 reserved for "non-standard" particles or whatever you find logical.

Once a pdg code is selected, one have to put it in local copy of gstar_part.g with a geant code and decay table.