sPHENIX INTT - Geometry

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INTT meeting
December 13th 2023
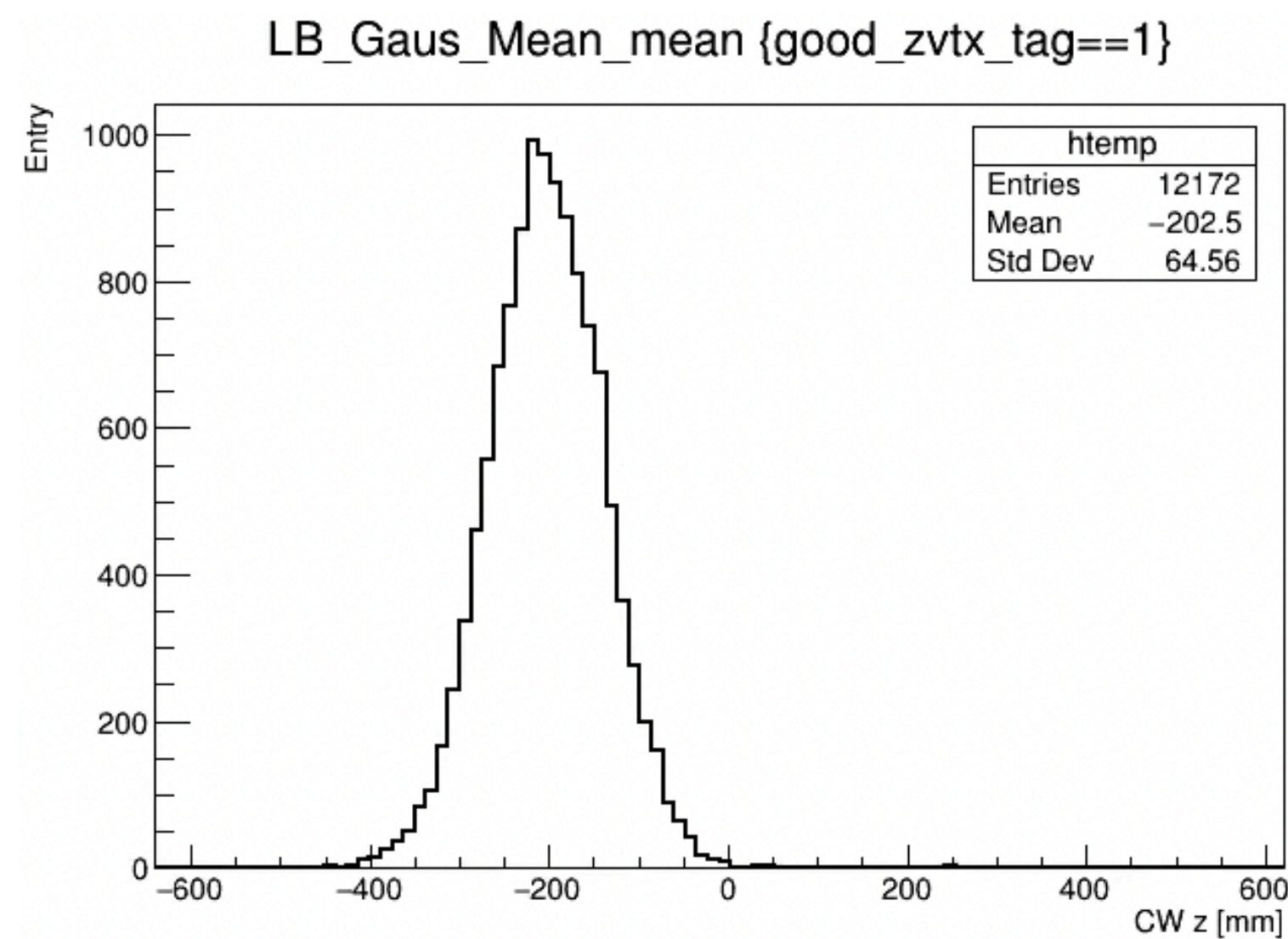
National Central University

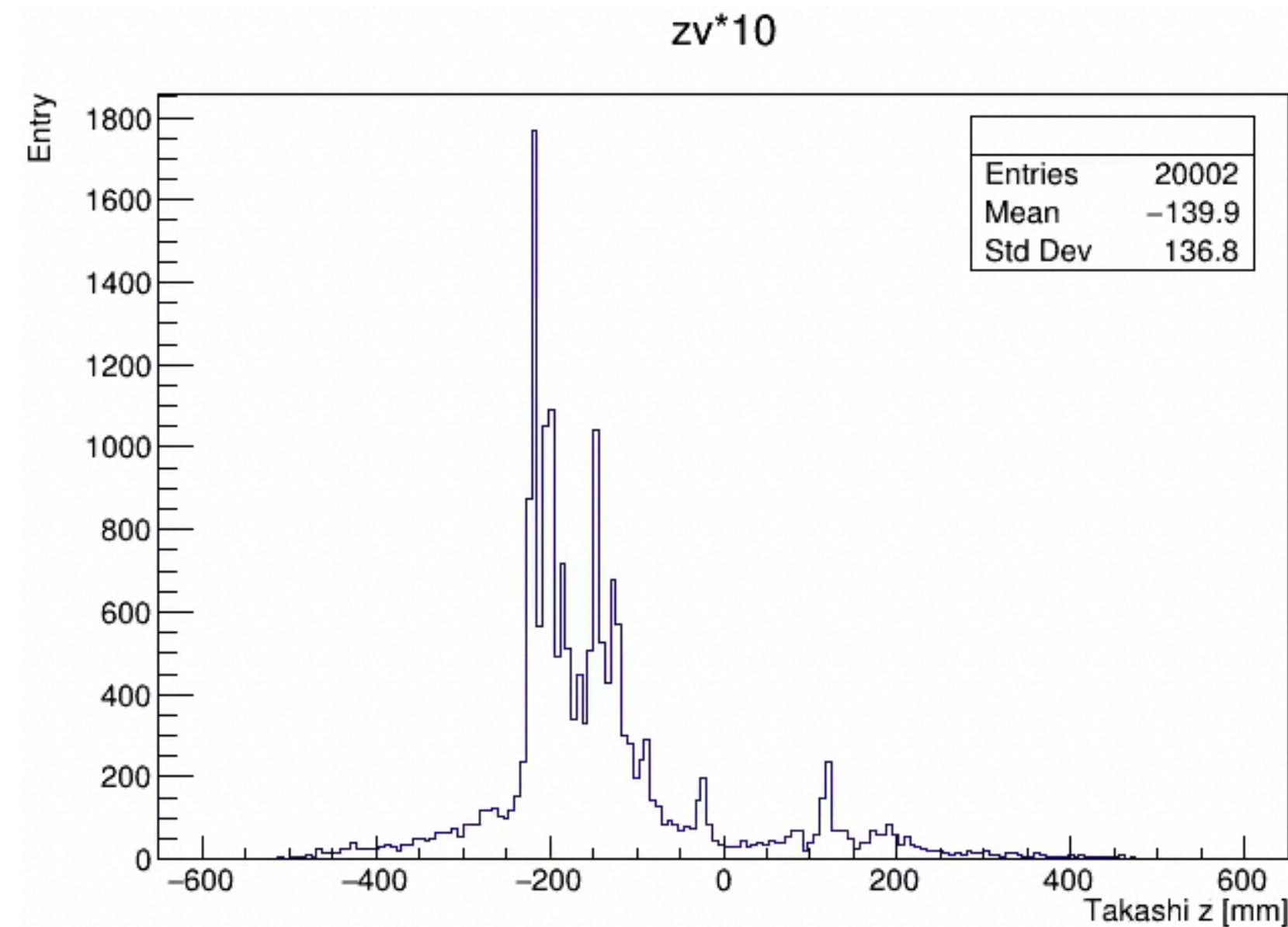# INTT zvtx - comparison b/w two algorithms

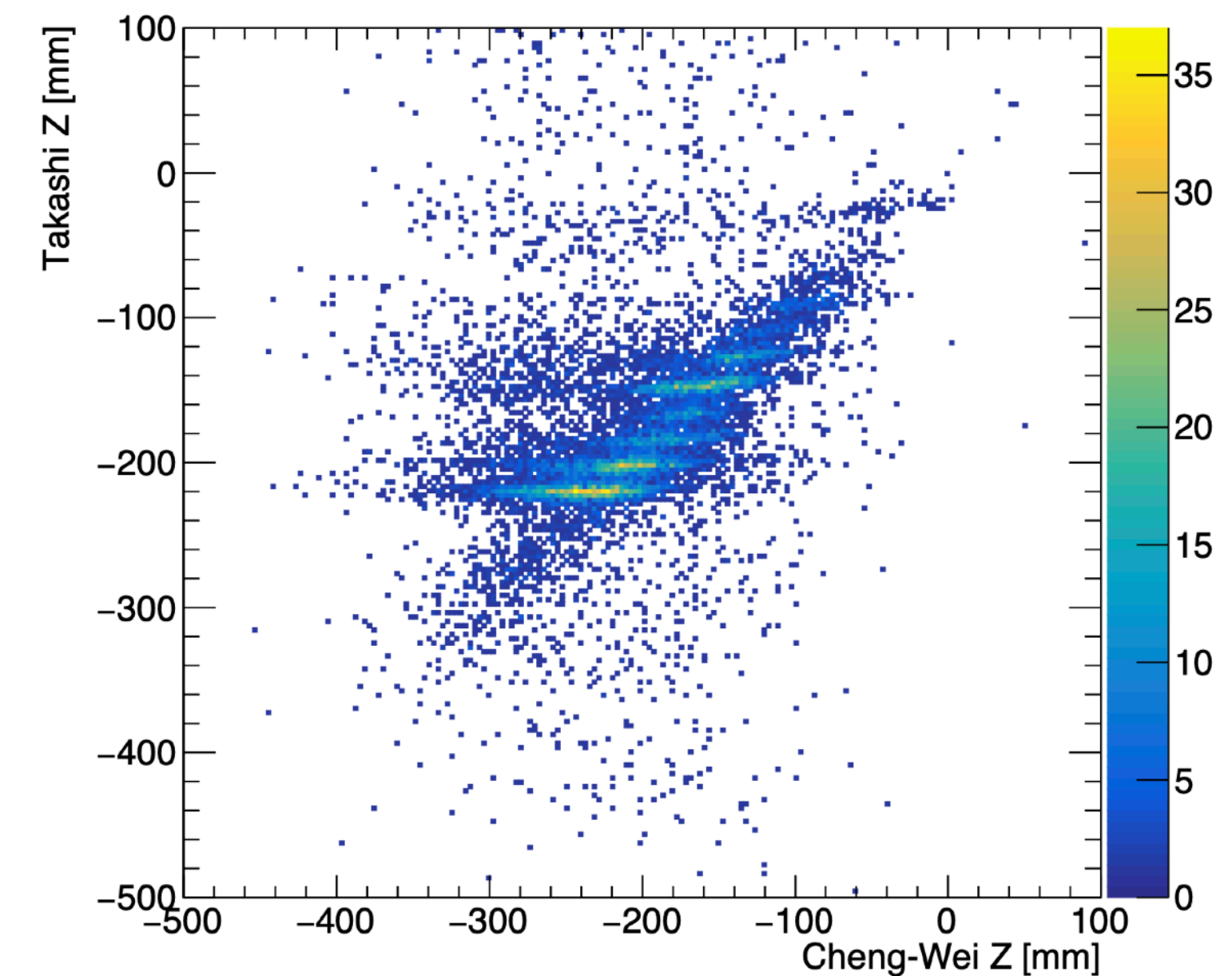Run 20869, first 20k events

| From Cheng-Wei	From Takashi	Correlation

- CW z : has quick event selection which removes the events without clear z vertex
- Z correlation by matching the event ID (not bco_full, but should be fine)
- Two algorithms more and less agree each other in spite of the multiple peaks

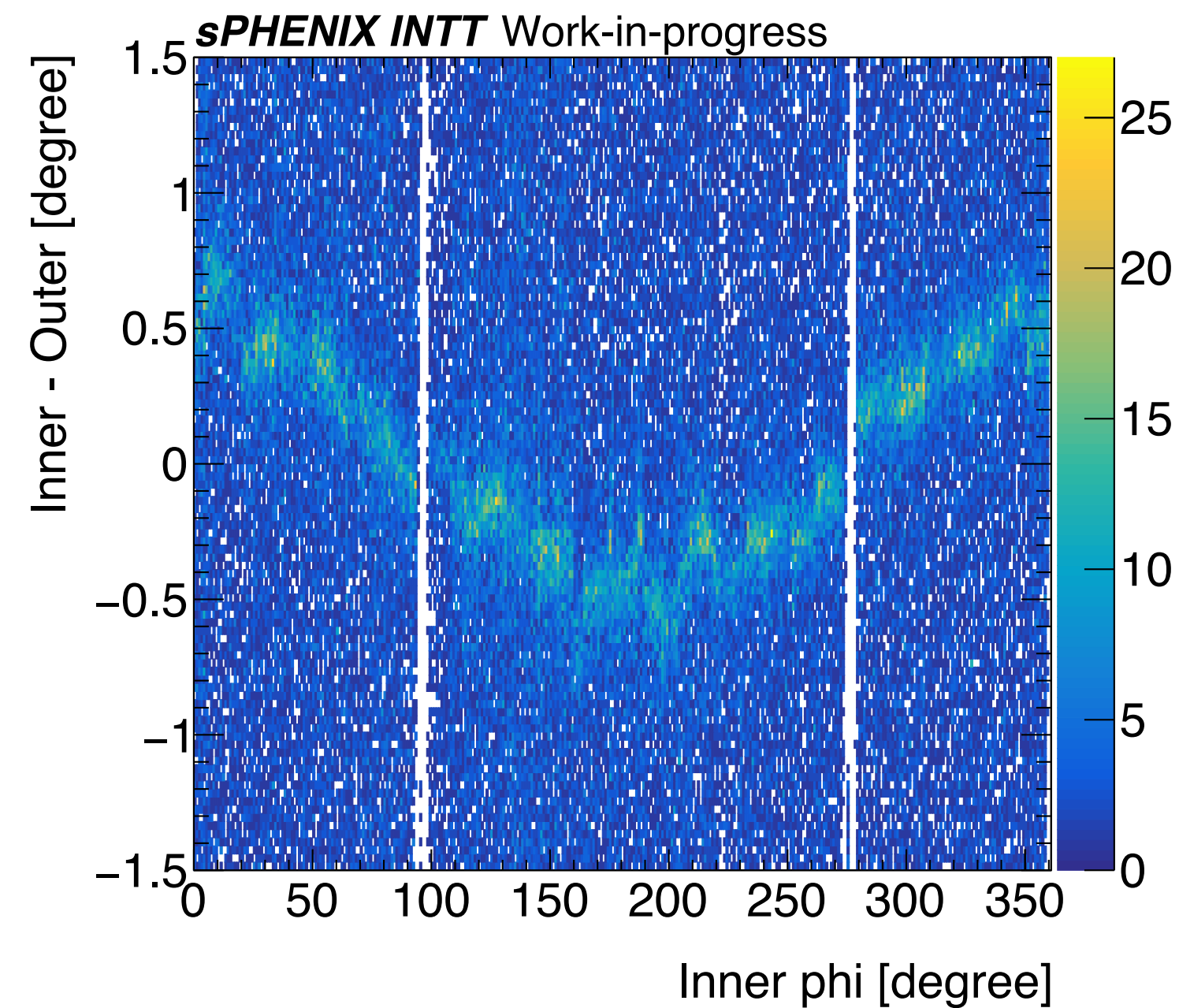The tree of Takashi z provided by Maya

INTT geometry study

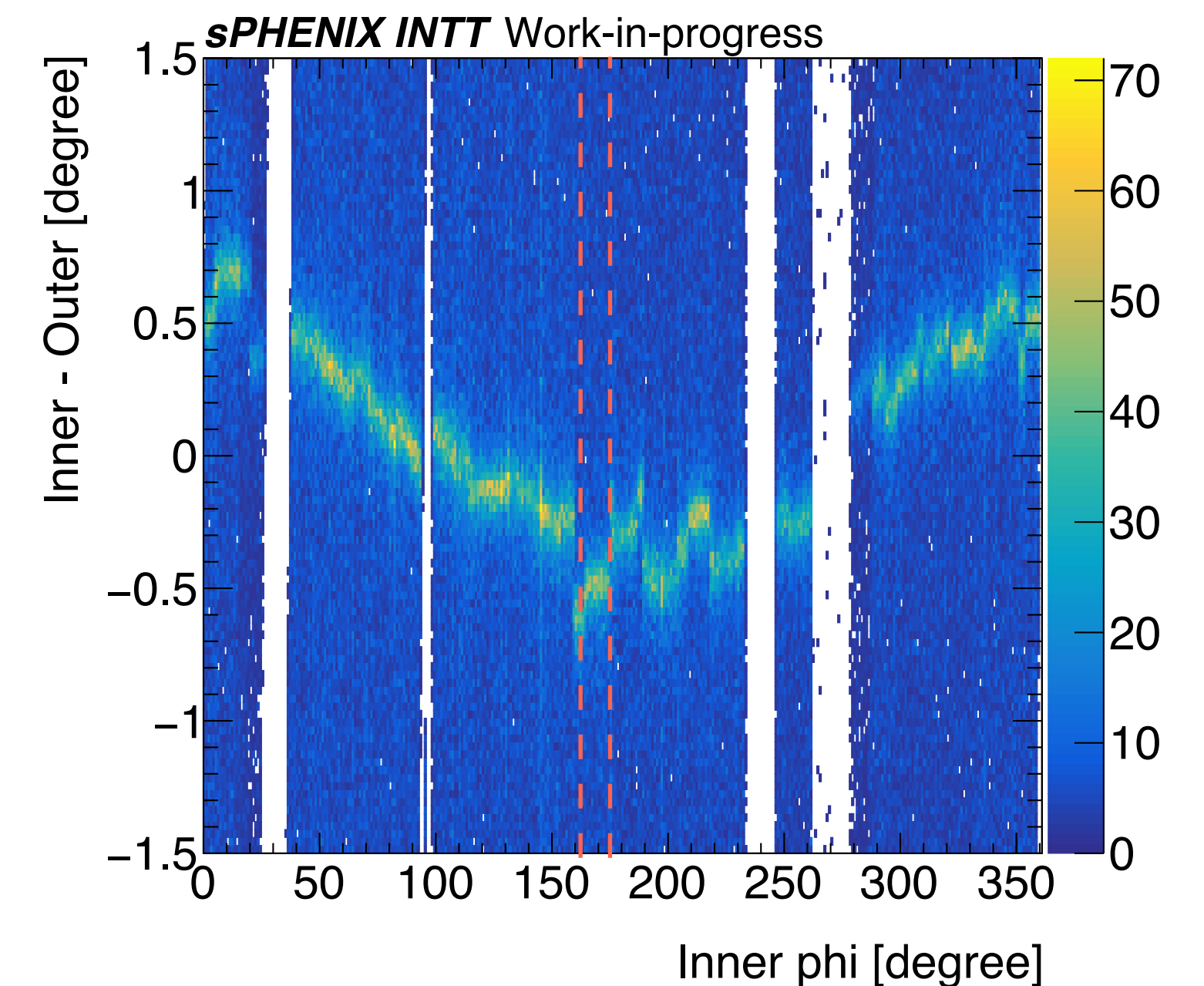Run 20869, Nhits < 1500, first 20k events, full survey geometry included

All combinations
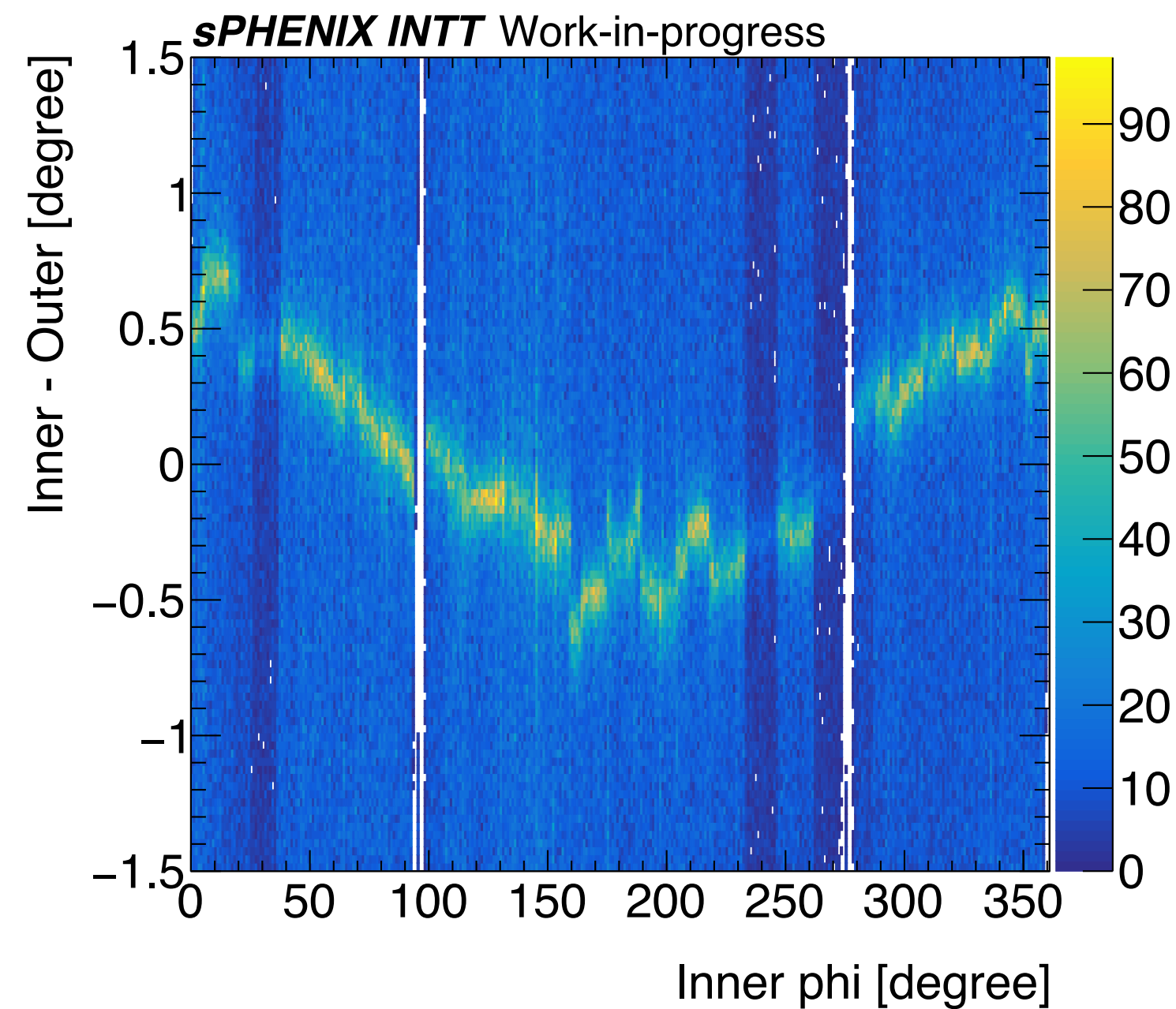
Tracklets formed by north-side clusters

Tracklets formed by south-side clusters

First focus on 160 ~ 175 degree

INTT geometry study
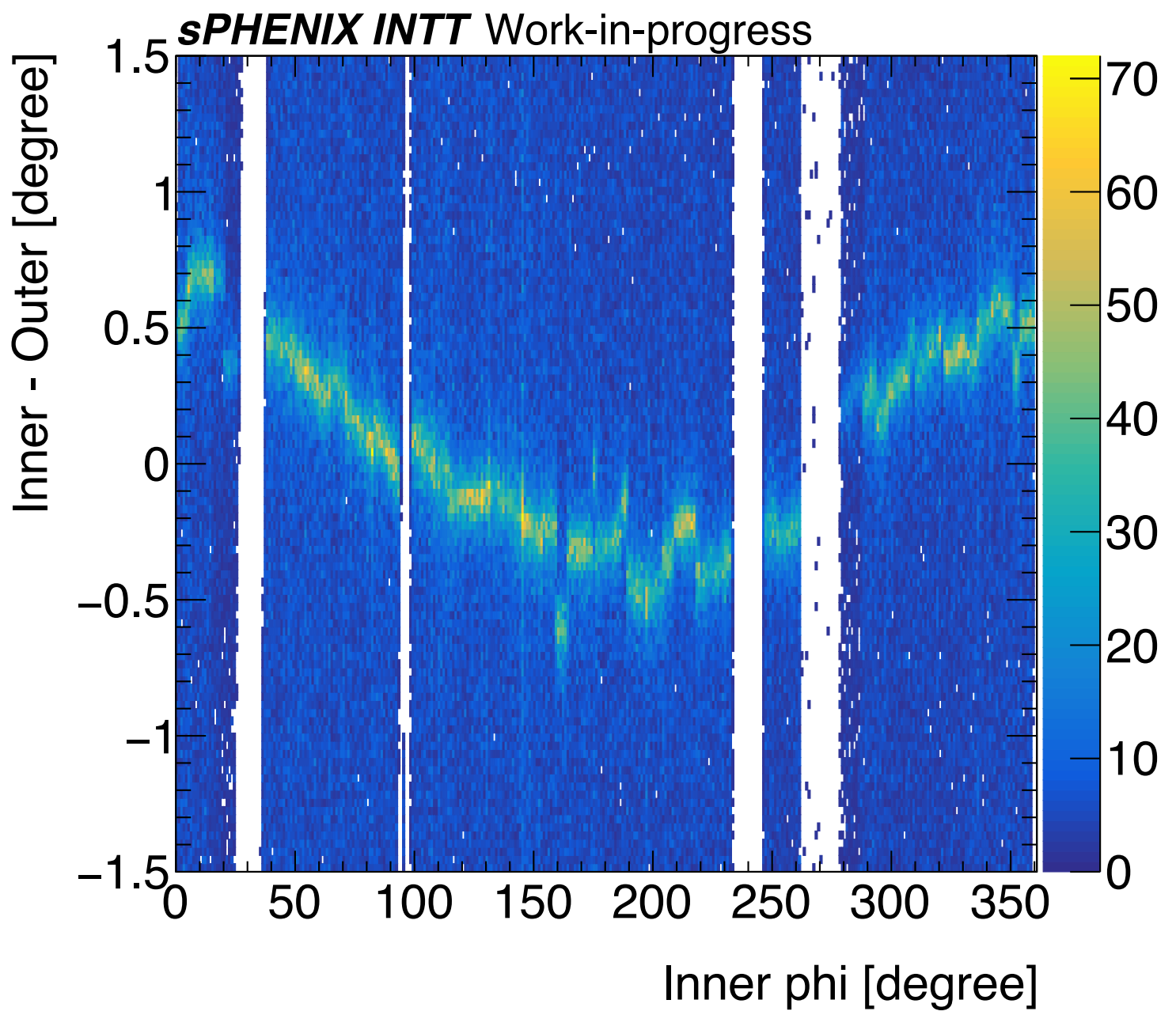
Notation: B_xL_{yzz}
  x: Barrel ID (0 for inner or 1 for outer)
  y: Layer ID (0 for inner or 1 for outer)
  zz: Ladder ID (from 0 to 15)
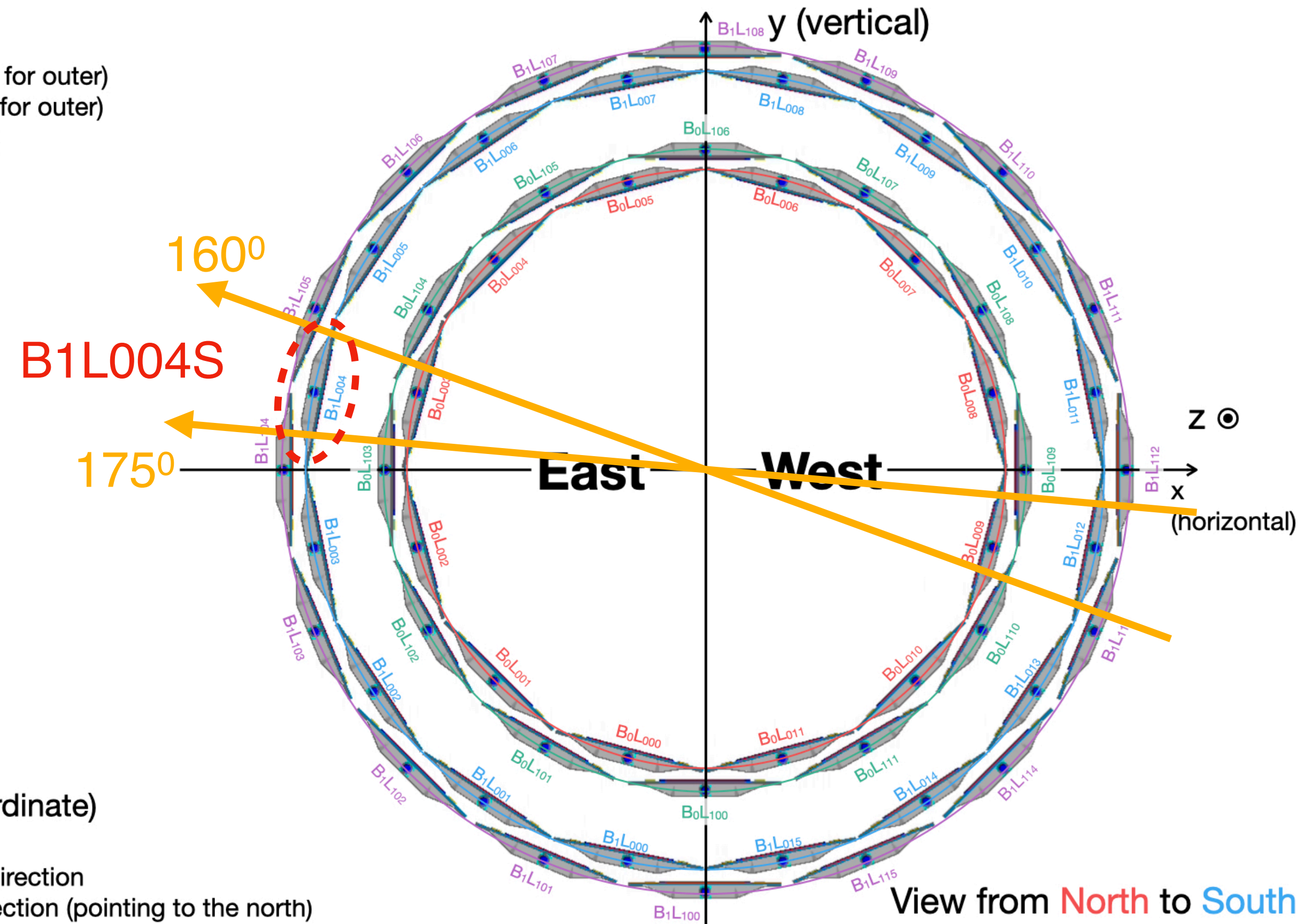
Axis (Right-haded coordinate)
  x-axis: $\vec{y} \times \vec{z}$
  y-axis: Vertically upward direction
  z-axis: The blue beam direction (pointing to the north)
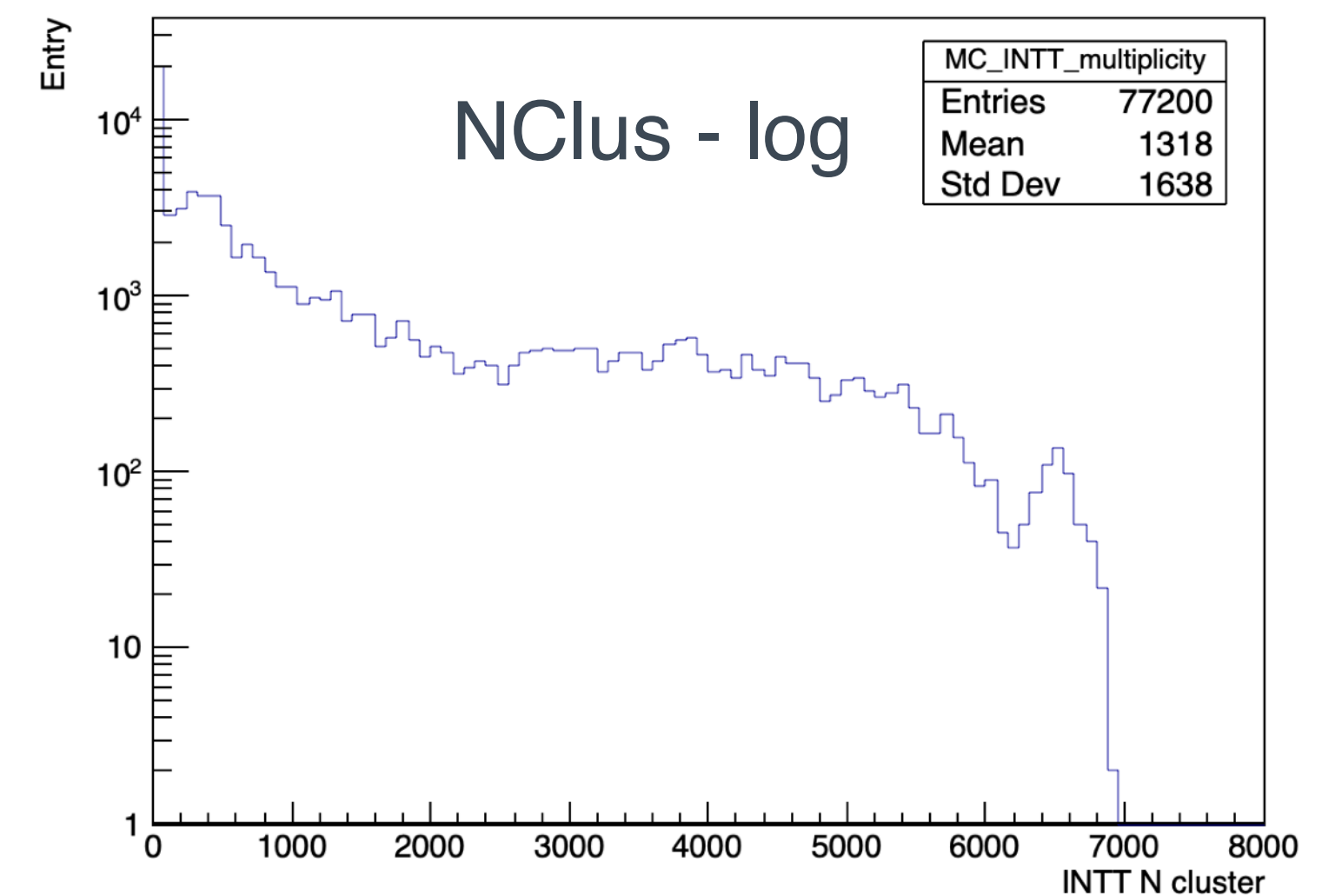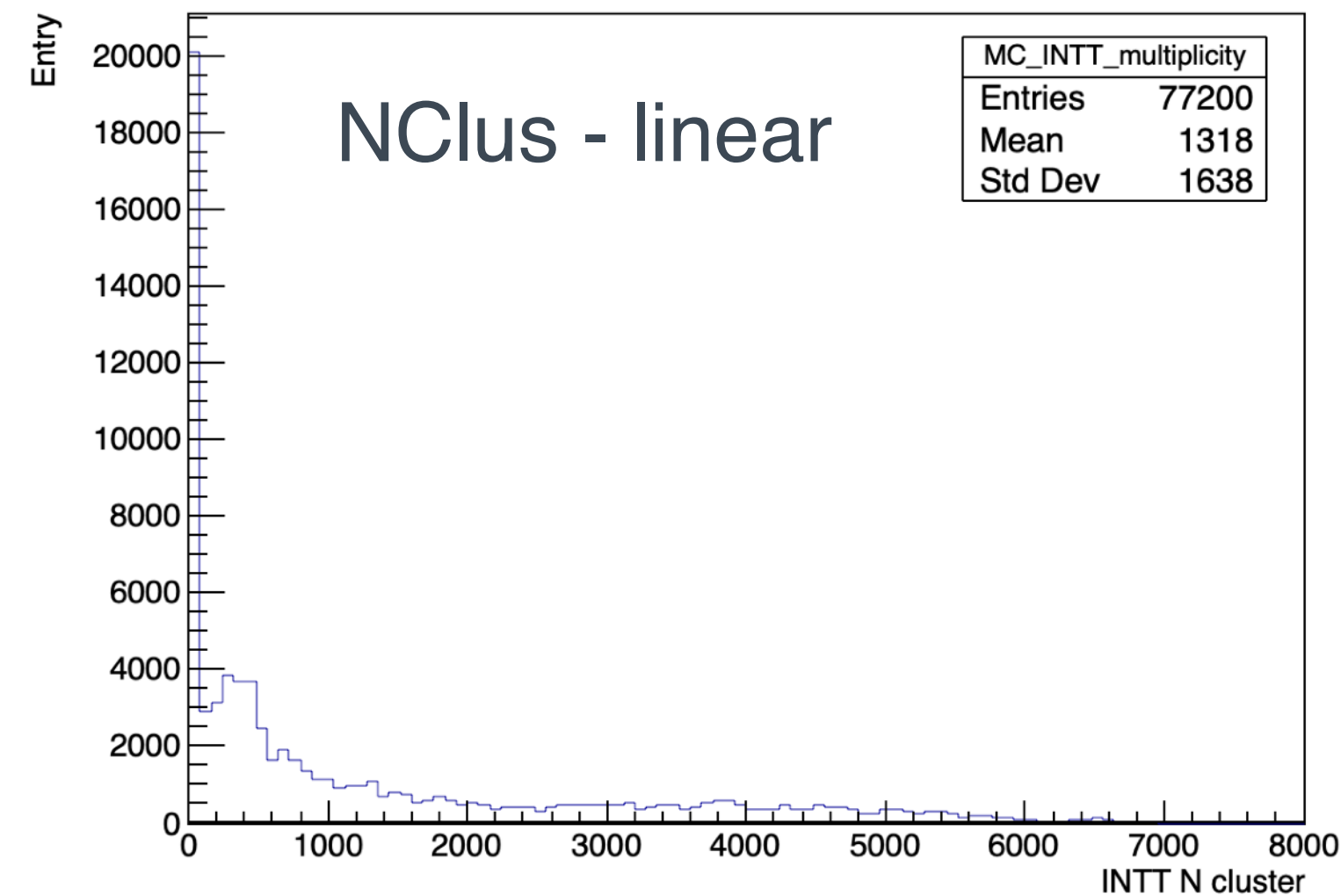
Tracklets formed by south-side clusters

sPHENIX INTT Work-in-progress
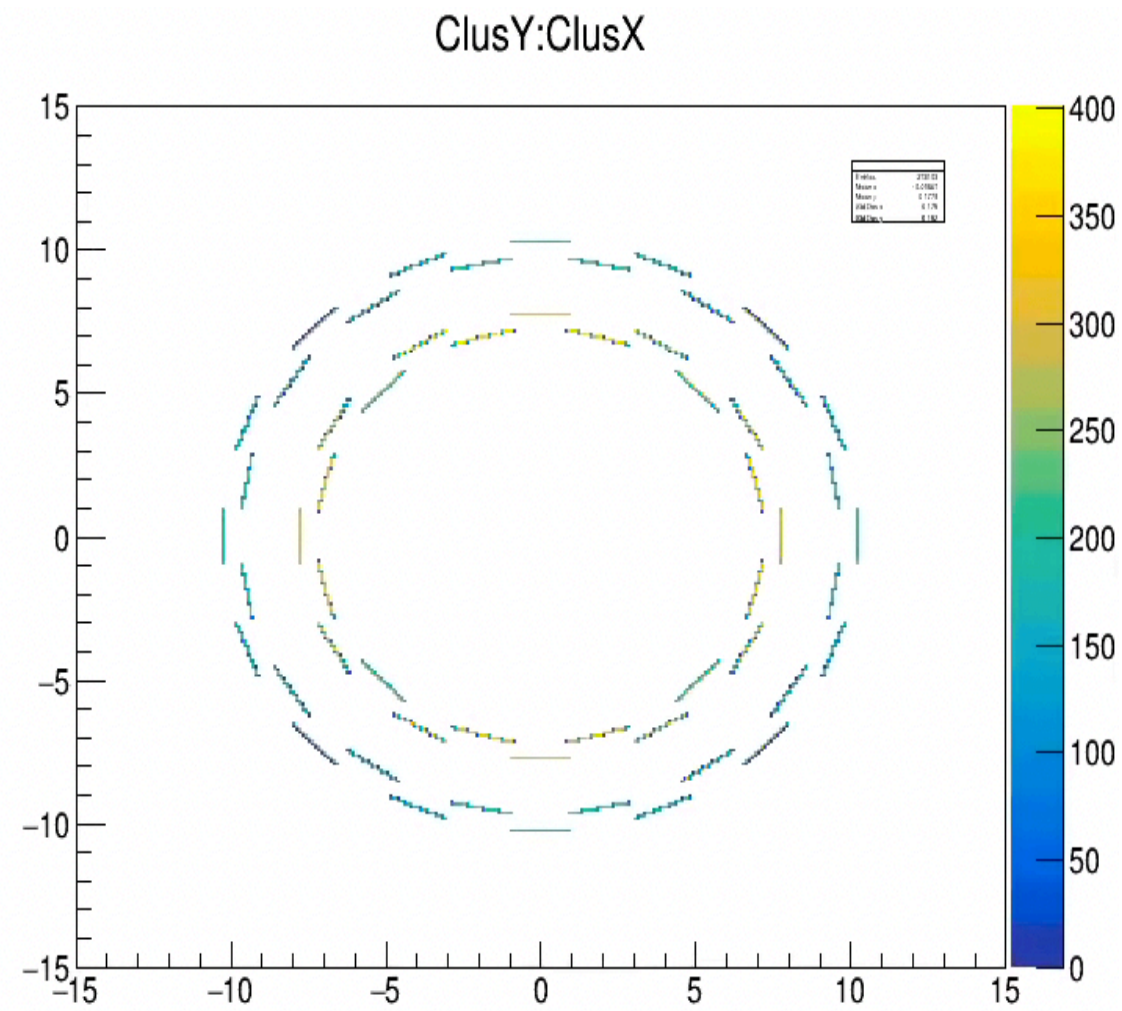
+0.25 mm in X and Y for B1L004S
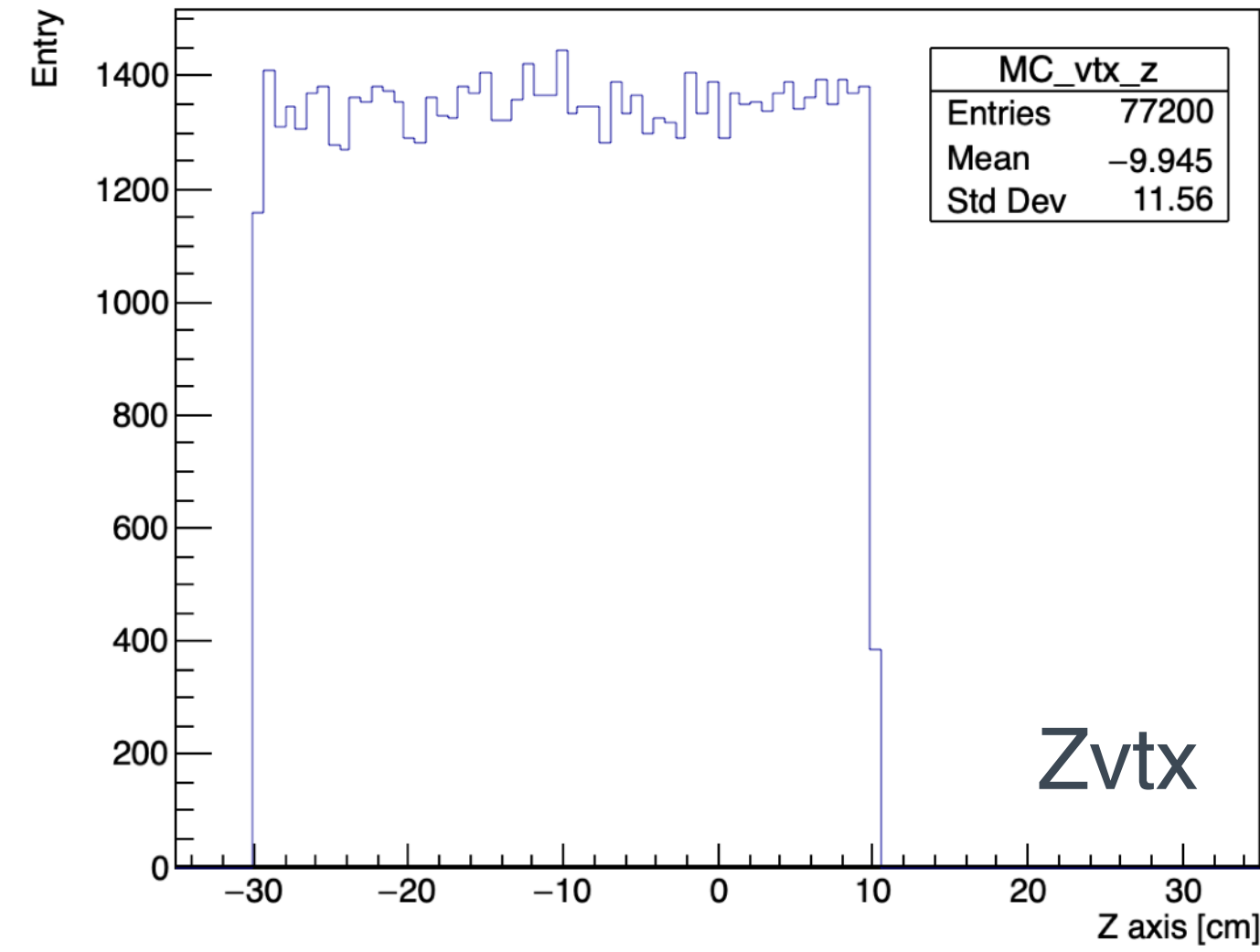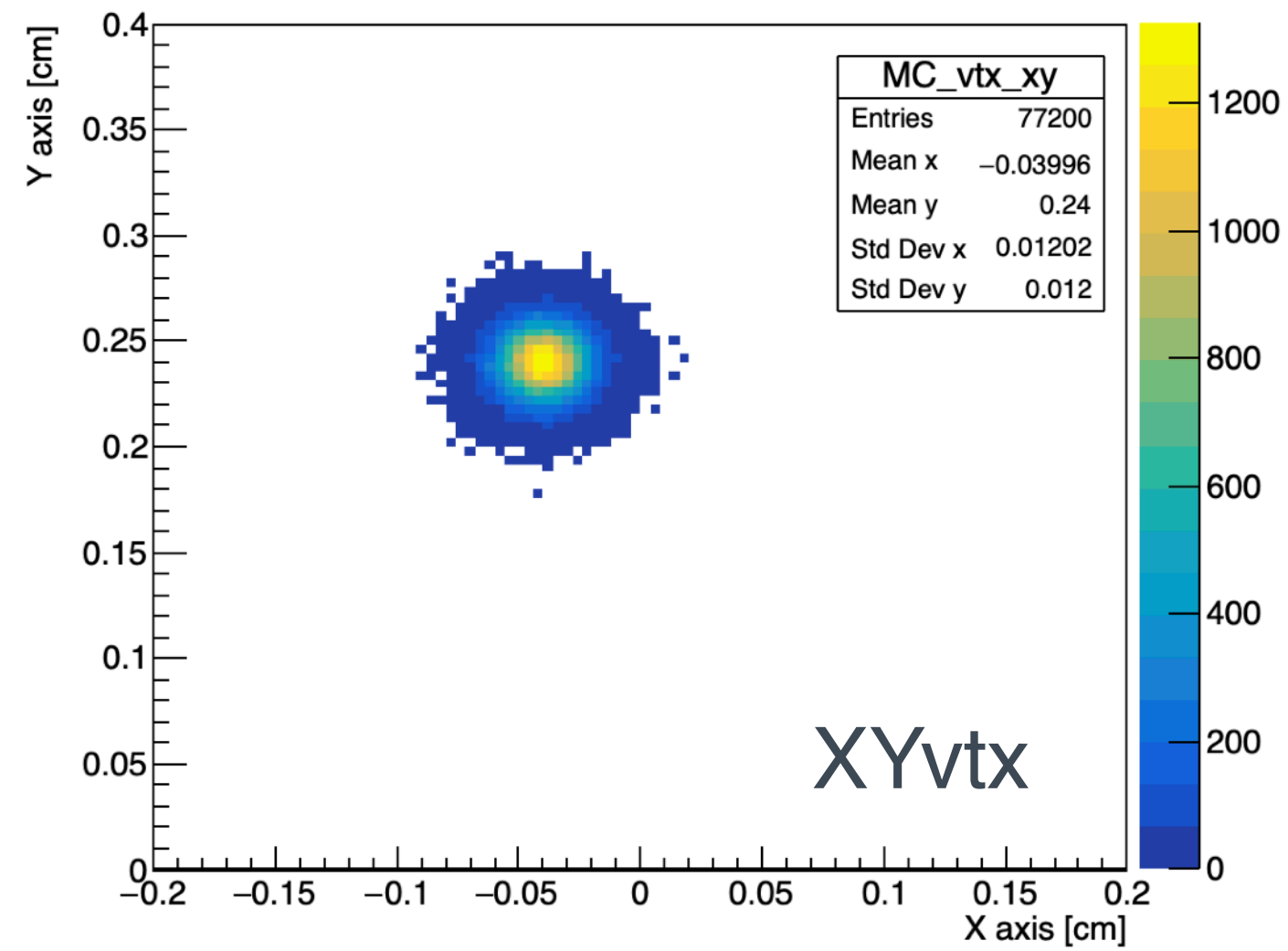
Such a group in the correlation plot is originated from single ladder

Directory : /sphenix/user/ChengWei/sPH_dNdeta/dNdEta_INTT_MC_388_000
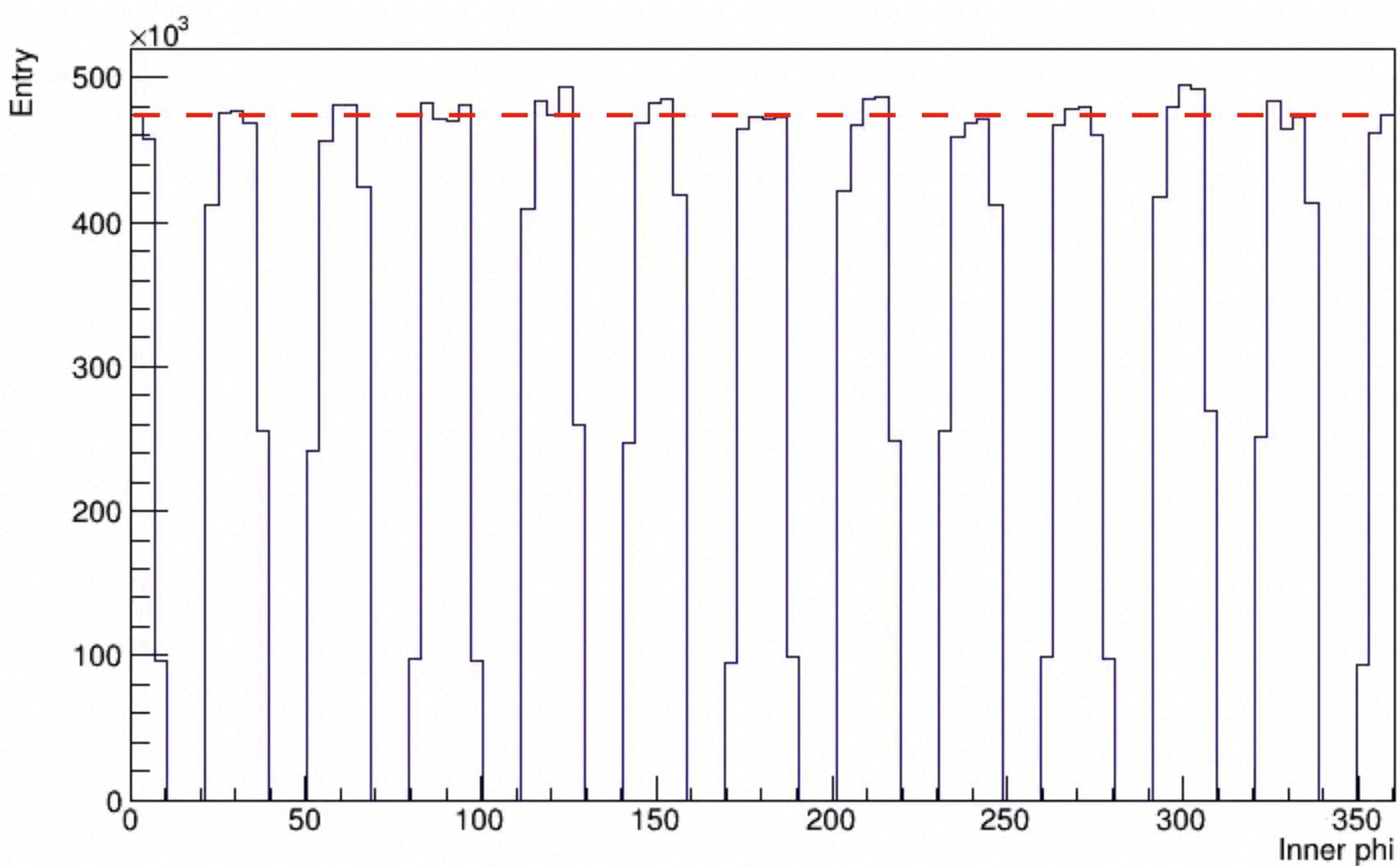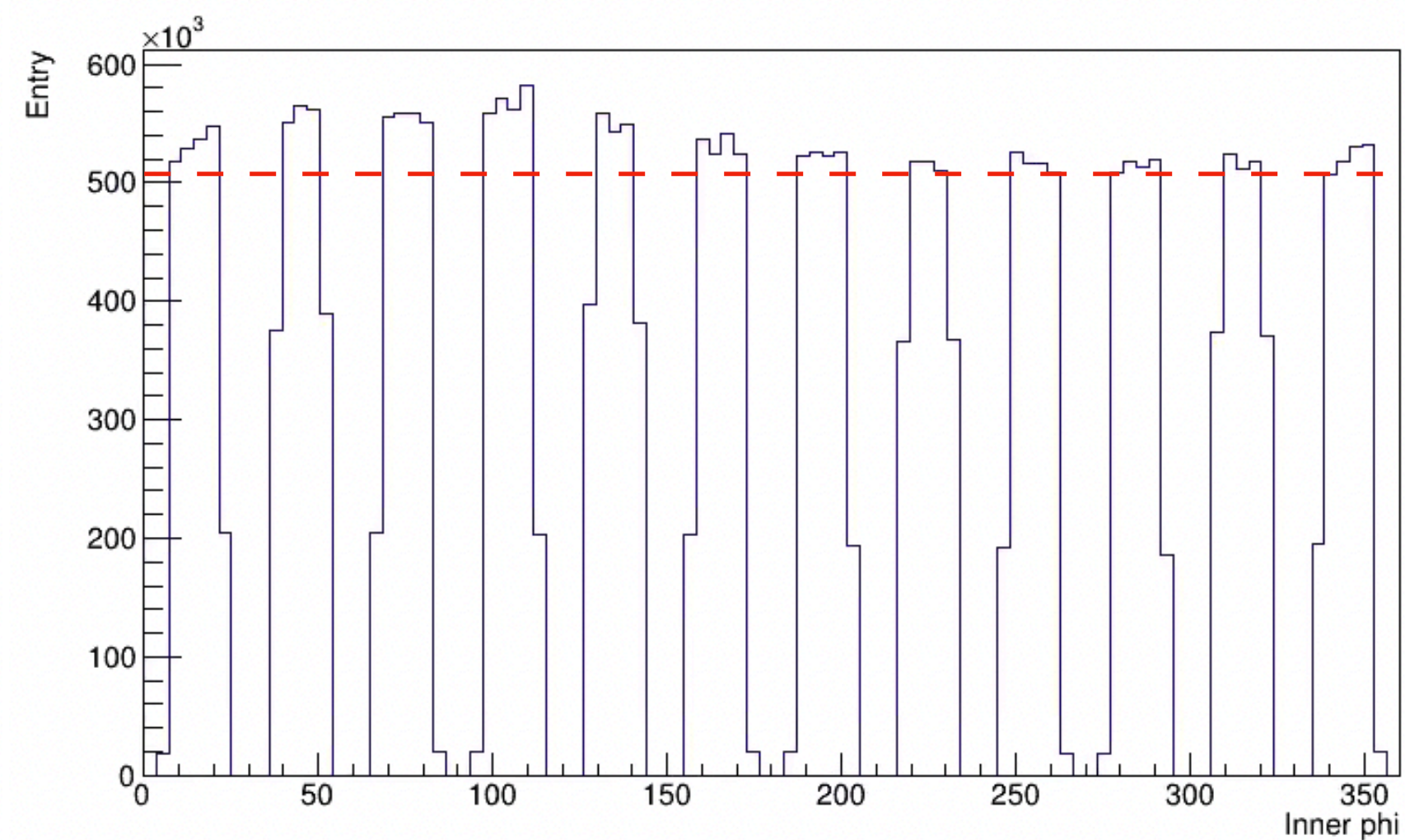
N event : 80k, required NTruthVtx = 1
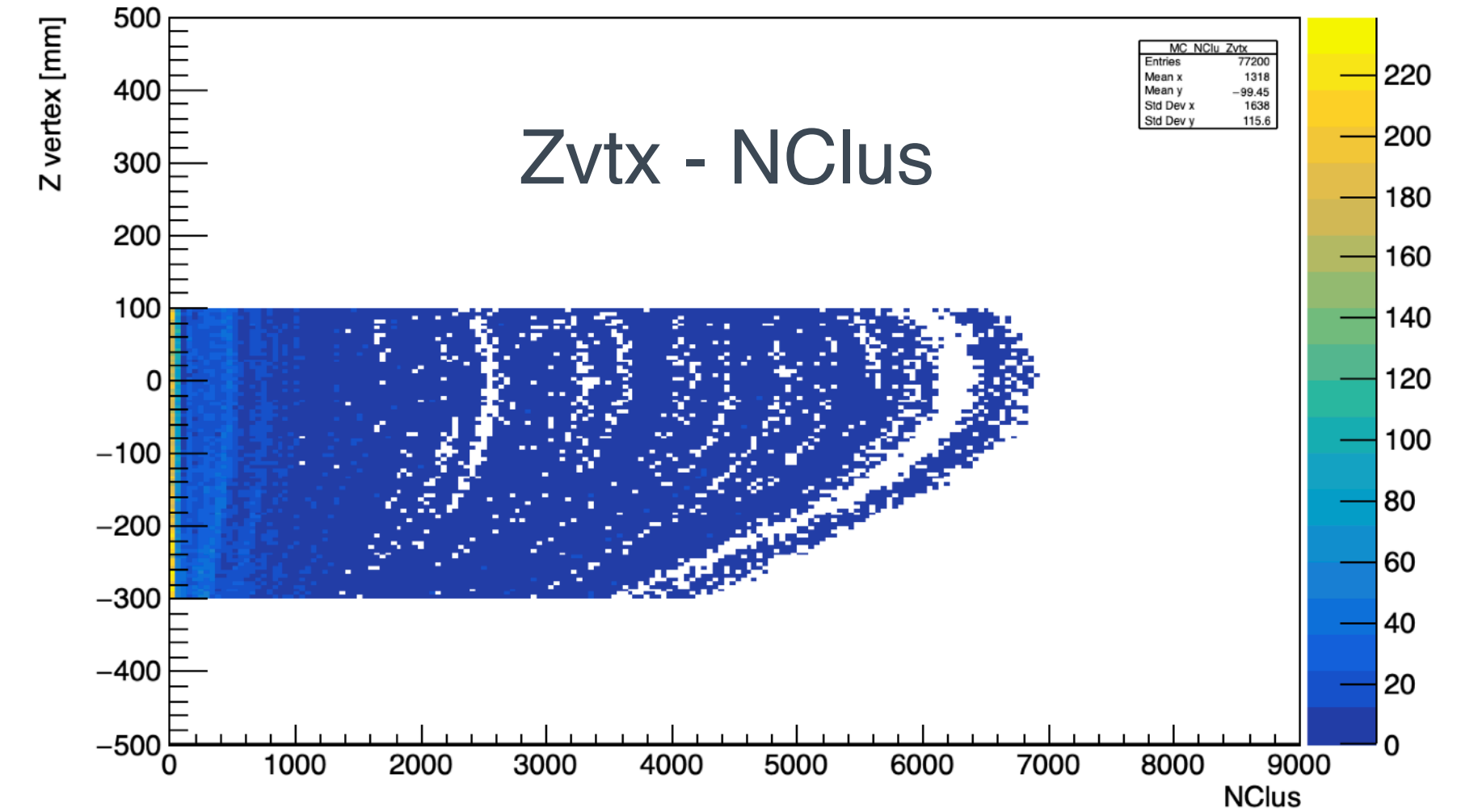
MC - cluster phi distribution

ana.382 (Geometry not yet updated)
The vertex XY was set to be (0, 0)
The innermost sub-layer of INTT

ana.388-000
Vertex XY (-0.4 mm, 2.4 mm)
The innermost sub-layer of INTT

Data run 20869
Plot from Misaki

Rad.
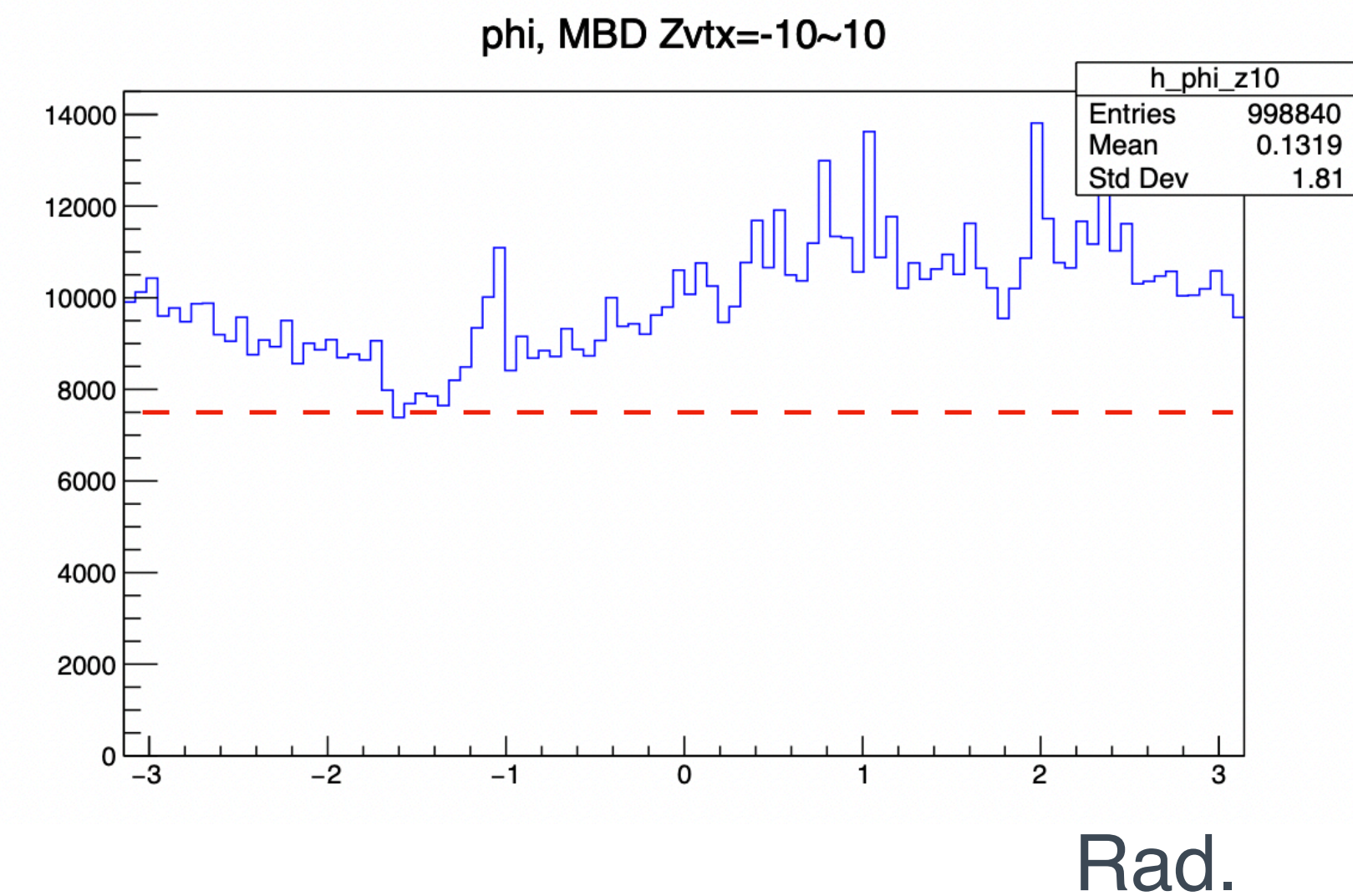
The structure of the distribution varies with different vertex positions

MC tracklet φ difference

With origin of coordinate (0, 0)

If change origin of coordinate
to (-0.4 mm, 2.4 mm)
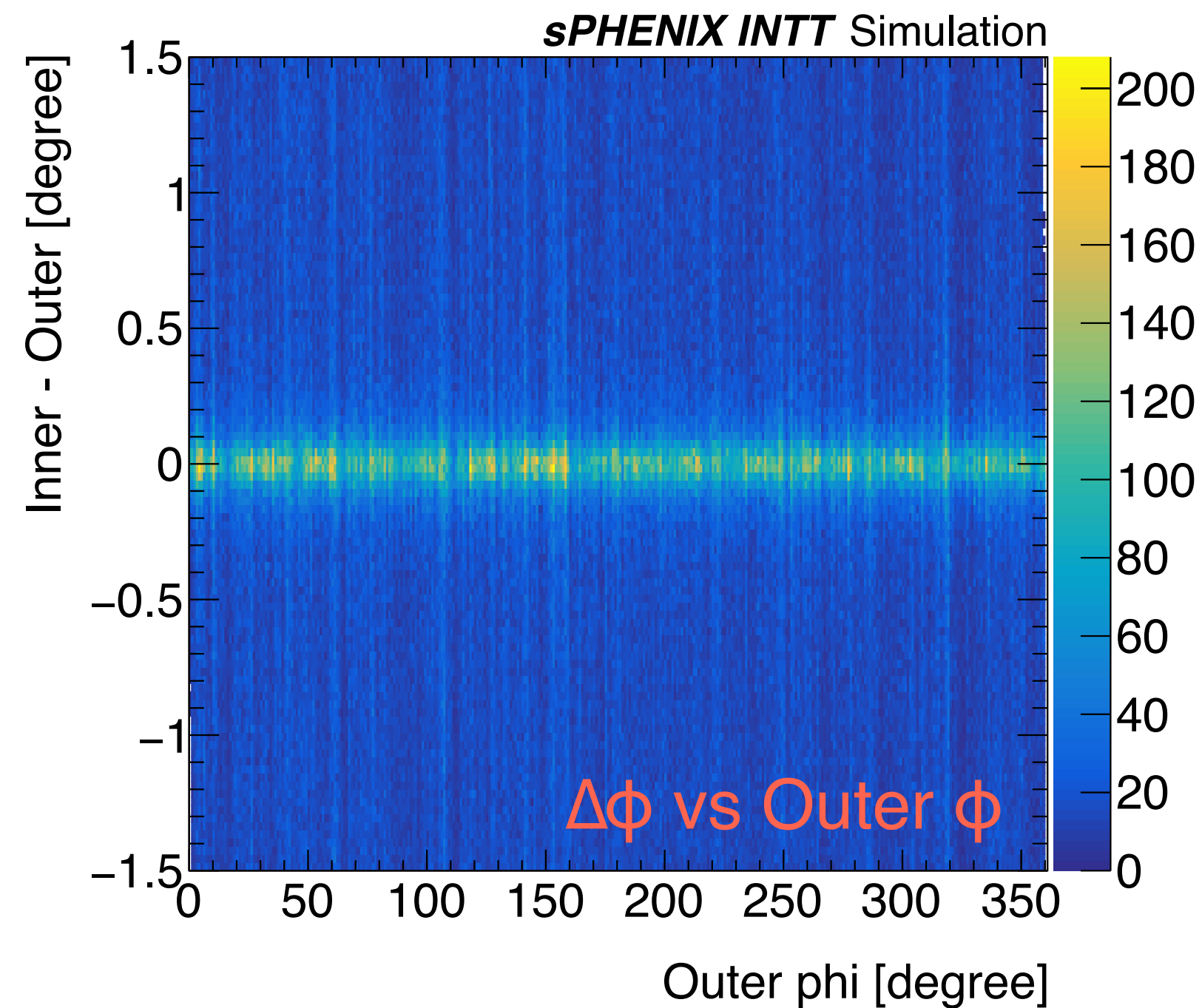
DCA correlation
Assume vertex (0, -2 mm)
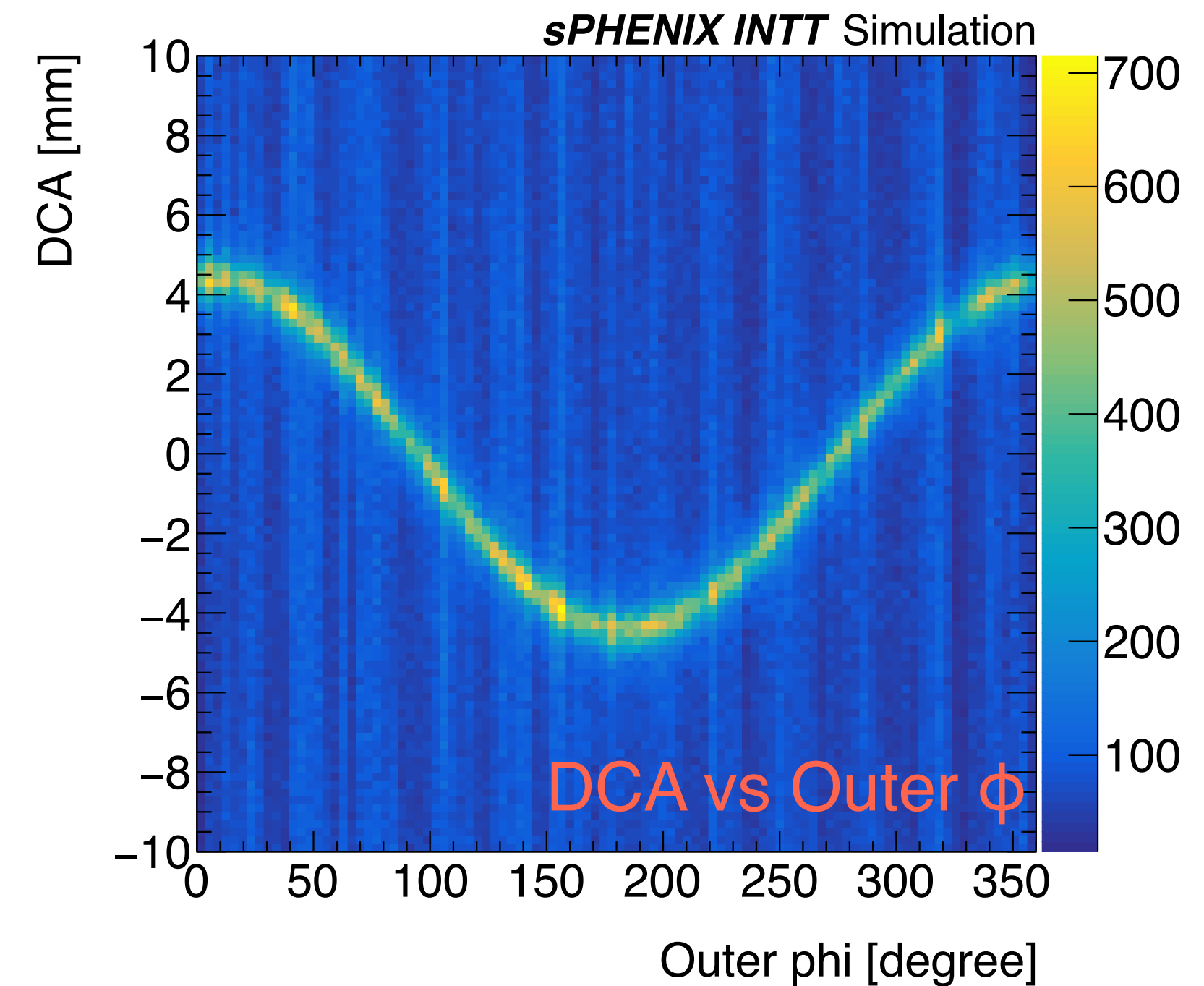
It isn't because of the wrong mapping of geometry
It seems to be simply because the nature of the INTT geometry (ladder by ladder dependent)

Notation: $B_x L_{yzz}$
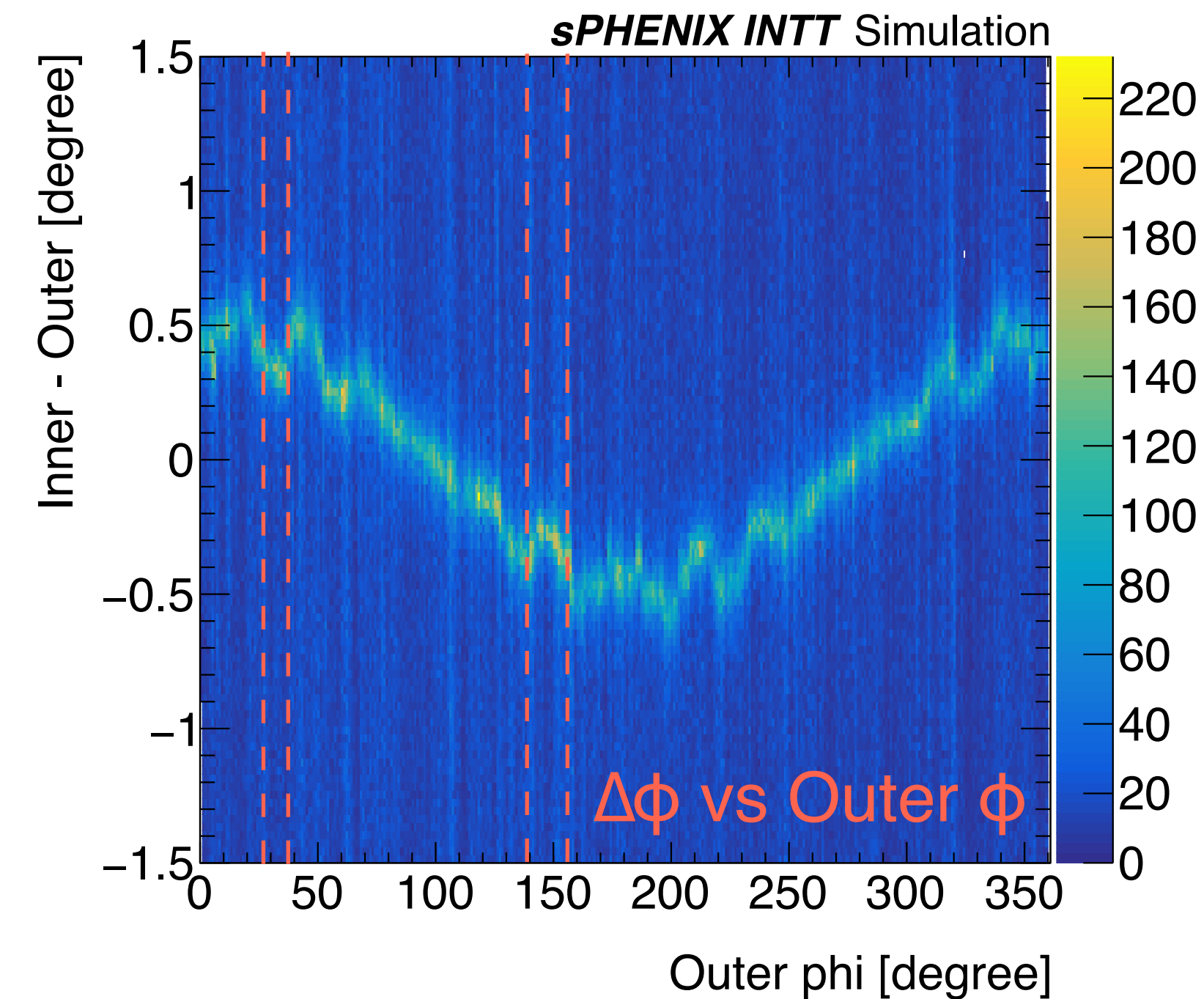   x: Barrel ID (0 for inner or 1 for outer)
   y: Layer ID (0 for inner or 1 for outer)
   zz: Ladder ID (from 0 to 15)
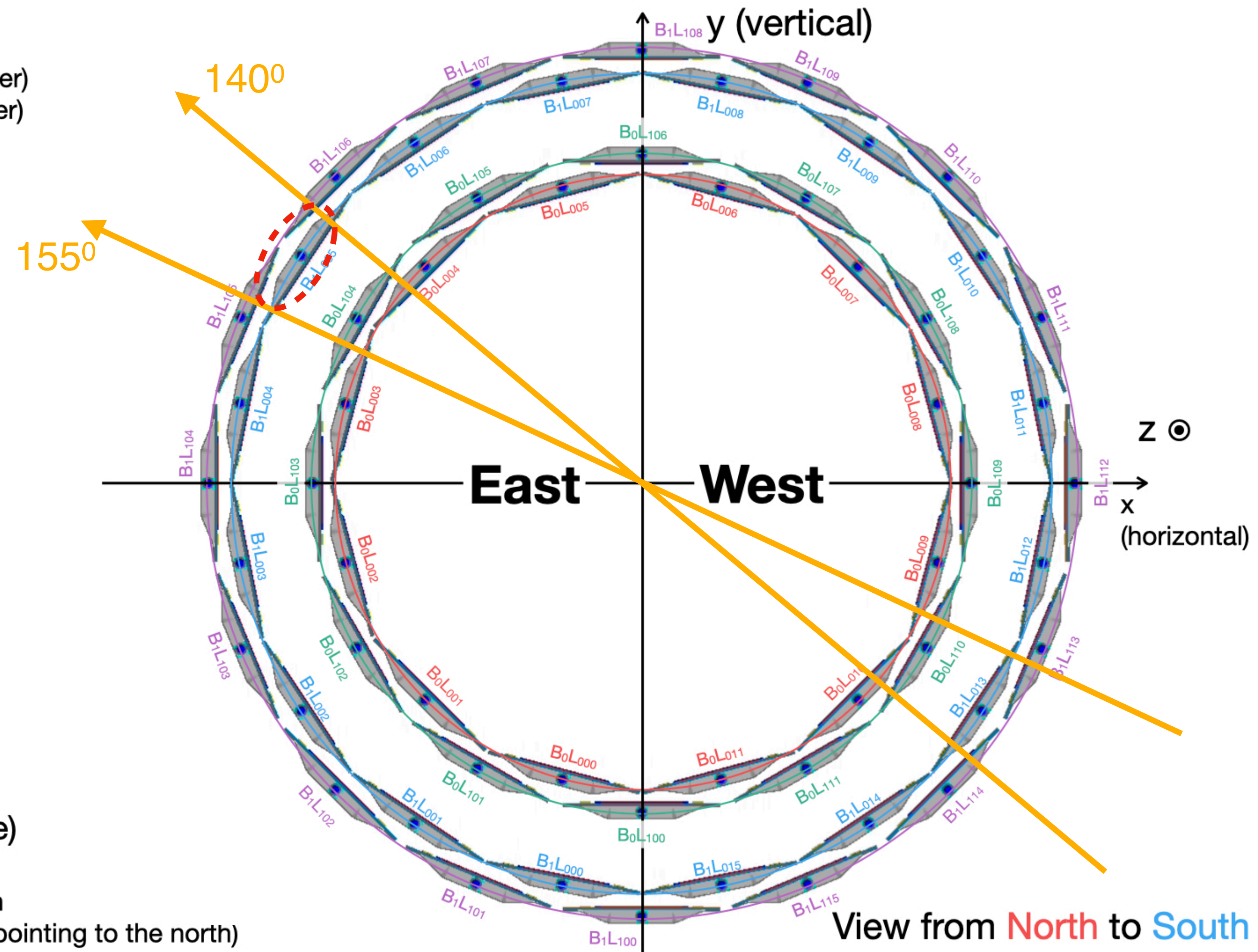
Axis (Right-haded coordinate)
   x-axis: $\vec{y} \times \vec{z}$
   y-axis: Vertically upward direction
   z-axis: The blue beam direction (pointing to the north)

MC tracklet φ difference
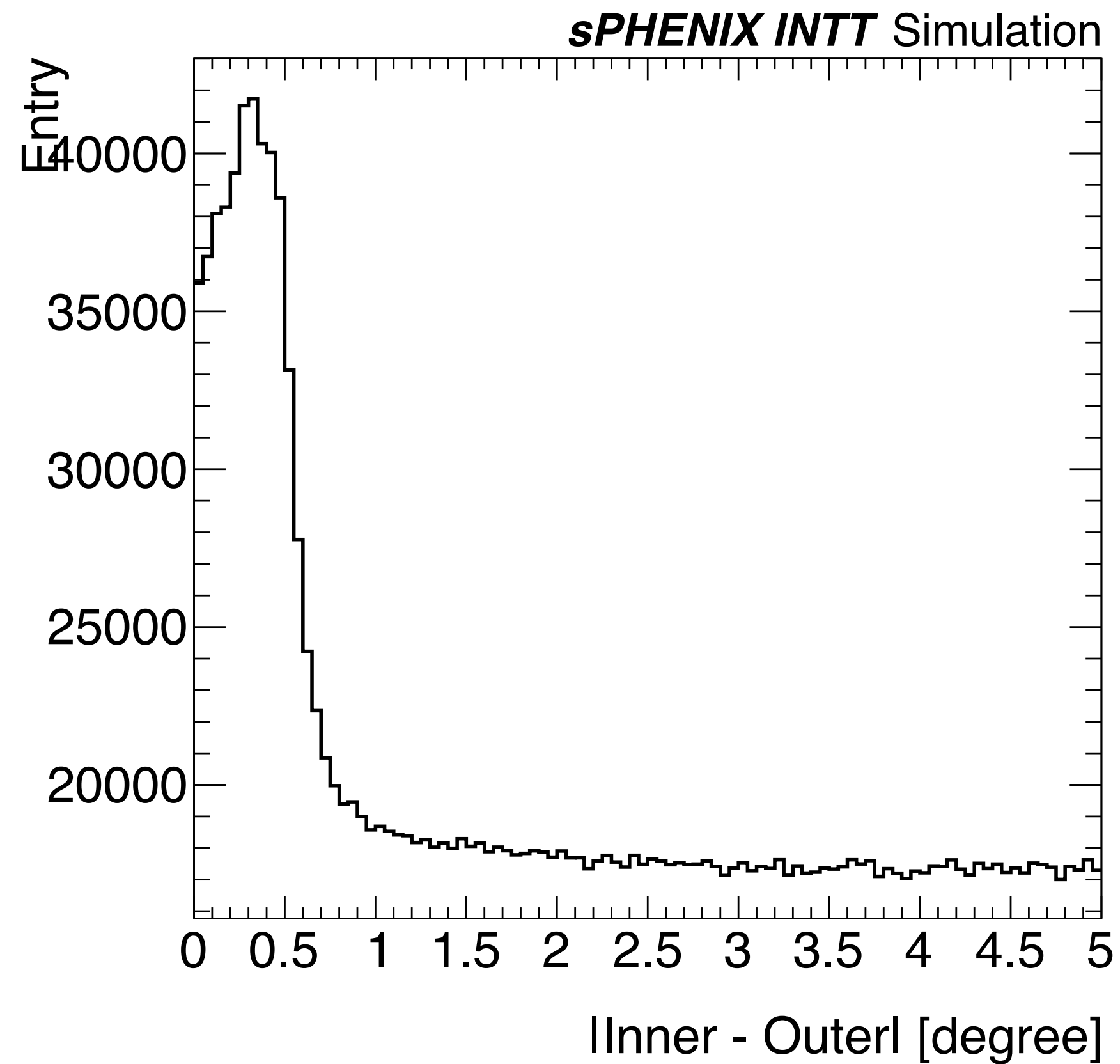
With origin of coordinate (0, 0)

If change origin of coordinate to (-0.4 mm, 2.4 mm)

sPHENIX INTT Simulation

Entry

|Inner - Outer| [degree]

sPHENIX INTT Simulation

Entry

Δφ dist.

|Inner - Outer| [degree]
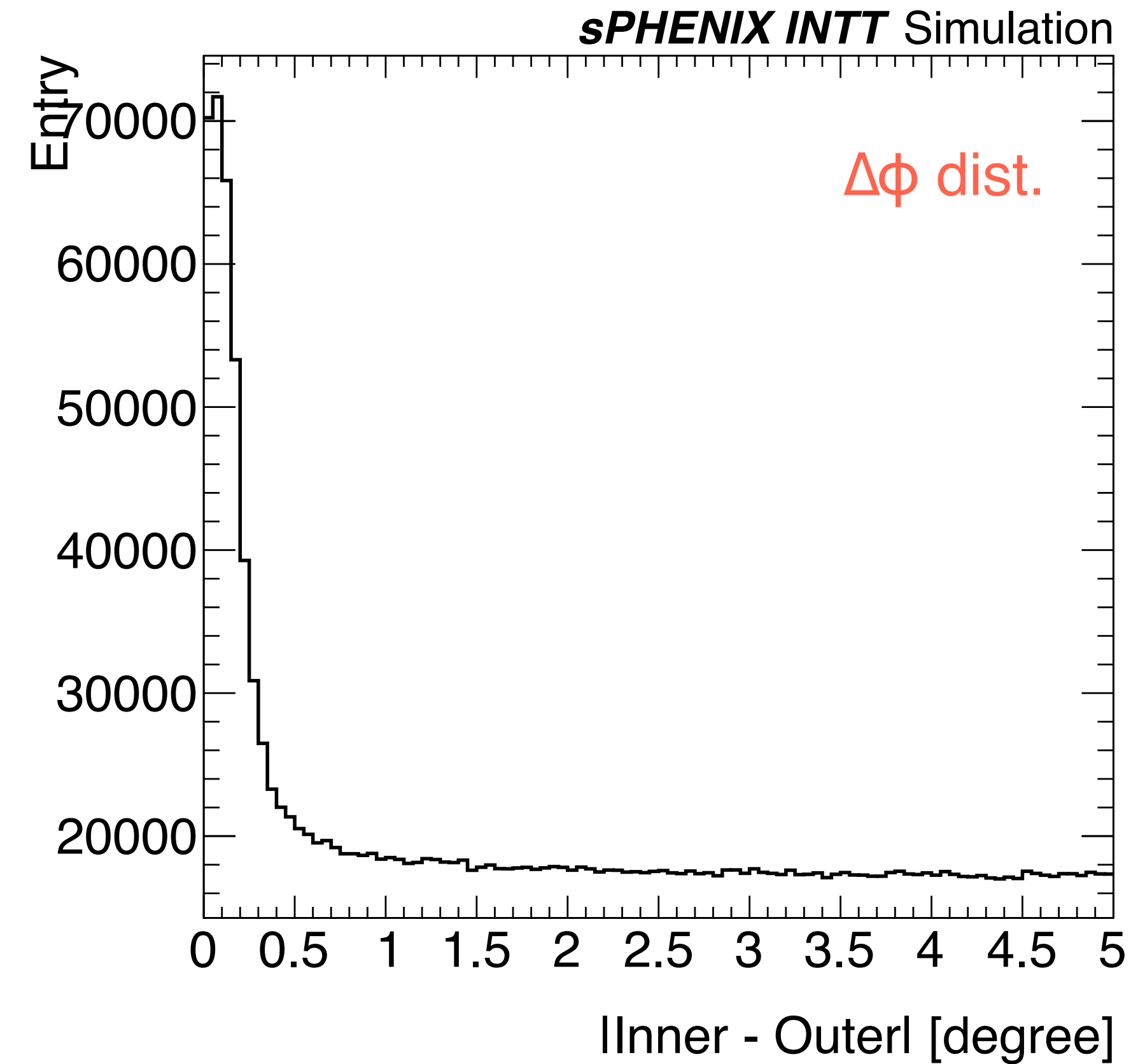
Δφ distribution can be narrowed by considering the VTXxy in cluster φ calculation

MC tracklet φ difference
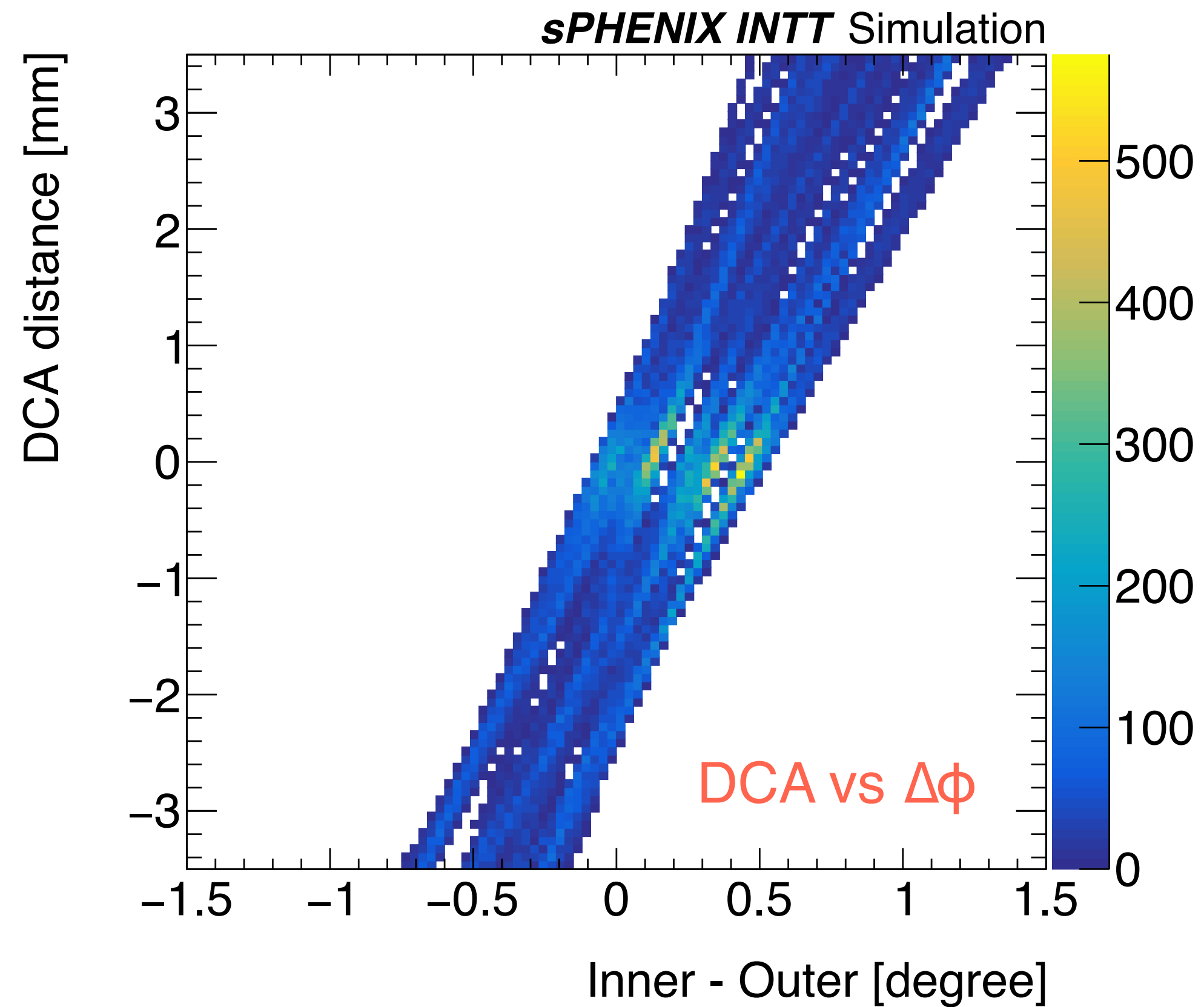
With origin of coordinate (0, 0)

If change origin of coordinate
to (-0.4 mm, 2.4 mm)

sPHENIX INTT Simulation

DCA vs Δφ

sPHENIX INTT Simulation

DCA vs Δφ

Δφ distribution can be narrowed by considering the VTXxy in cluster φ calculation

Cheng-Wei Shih (NCU, Taiwan)
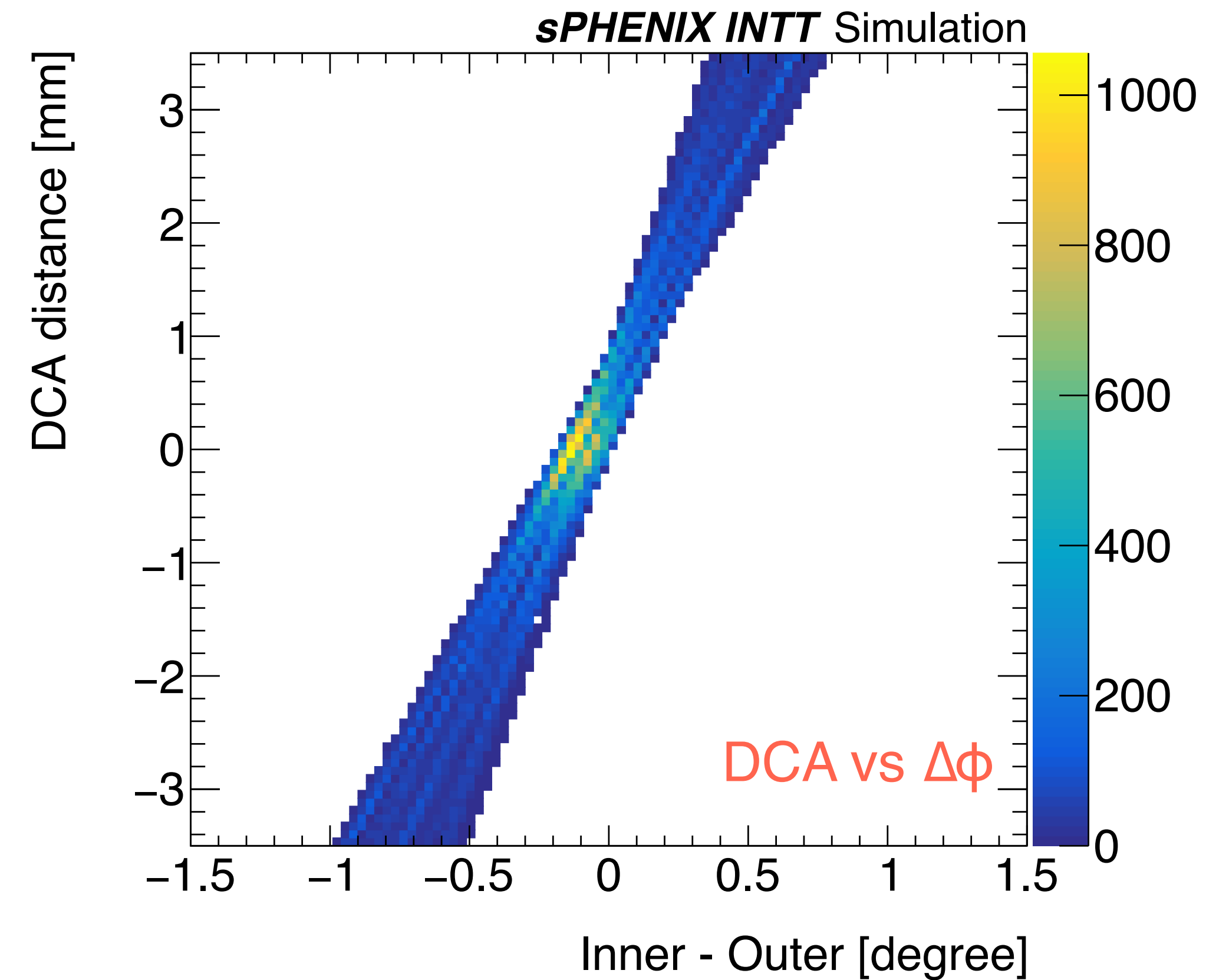
Previous plots, No vertex correction
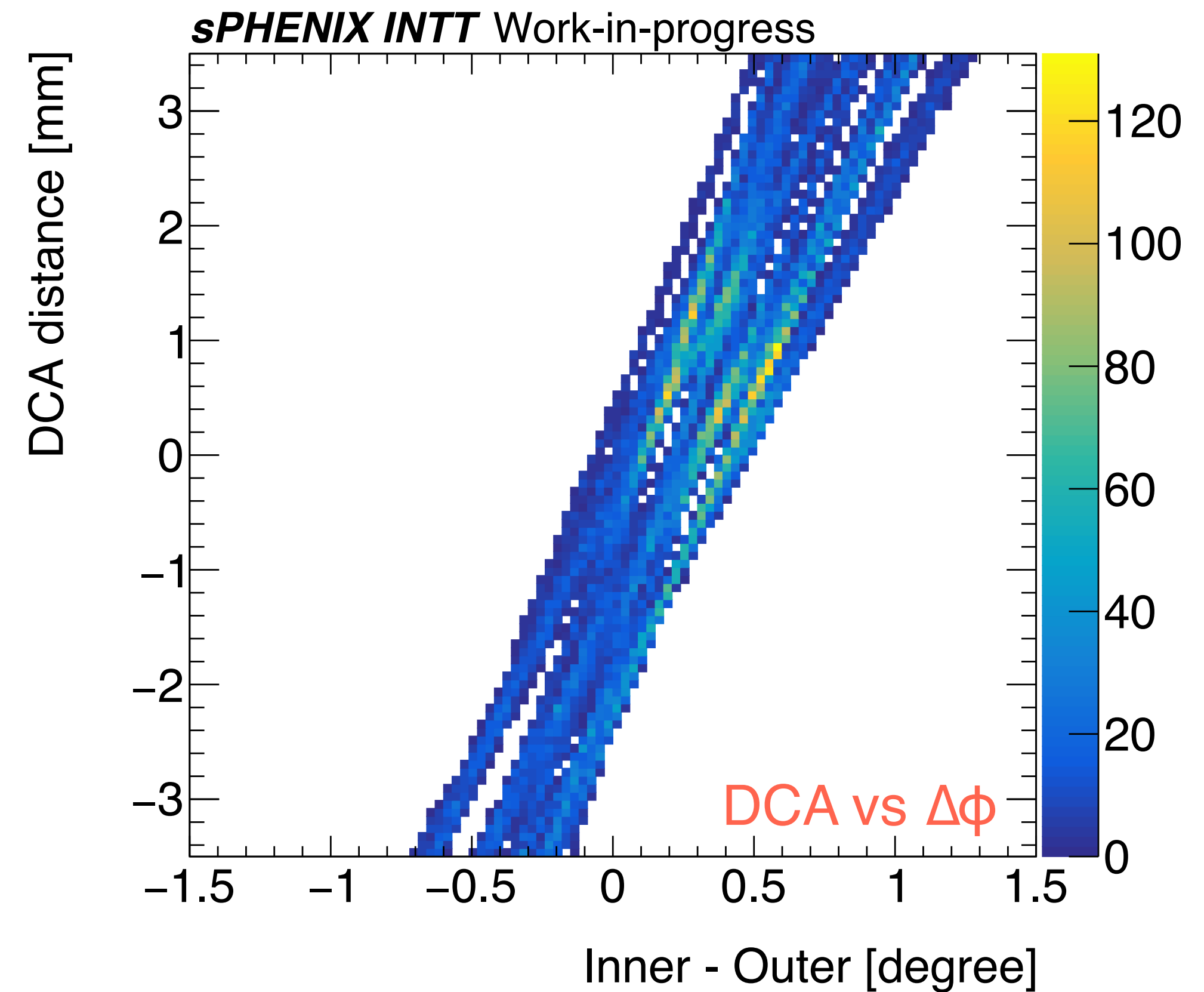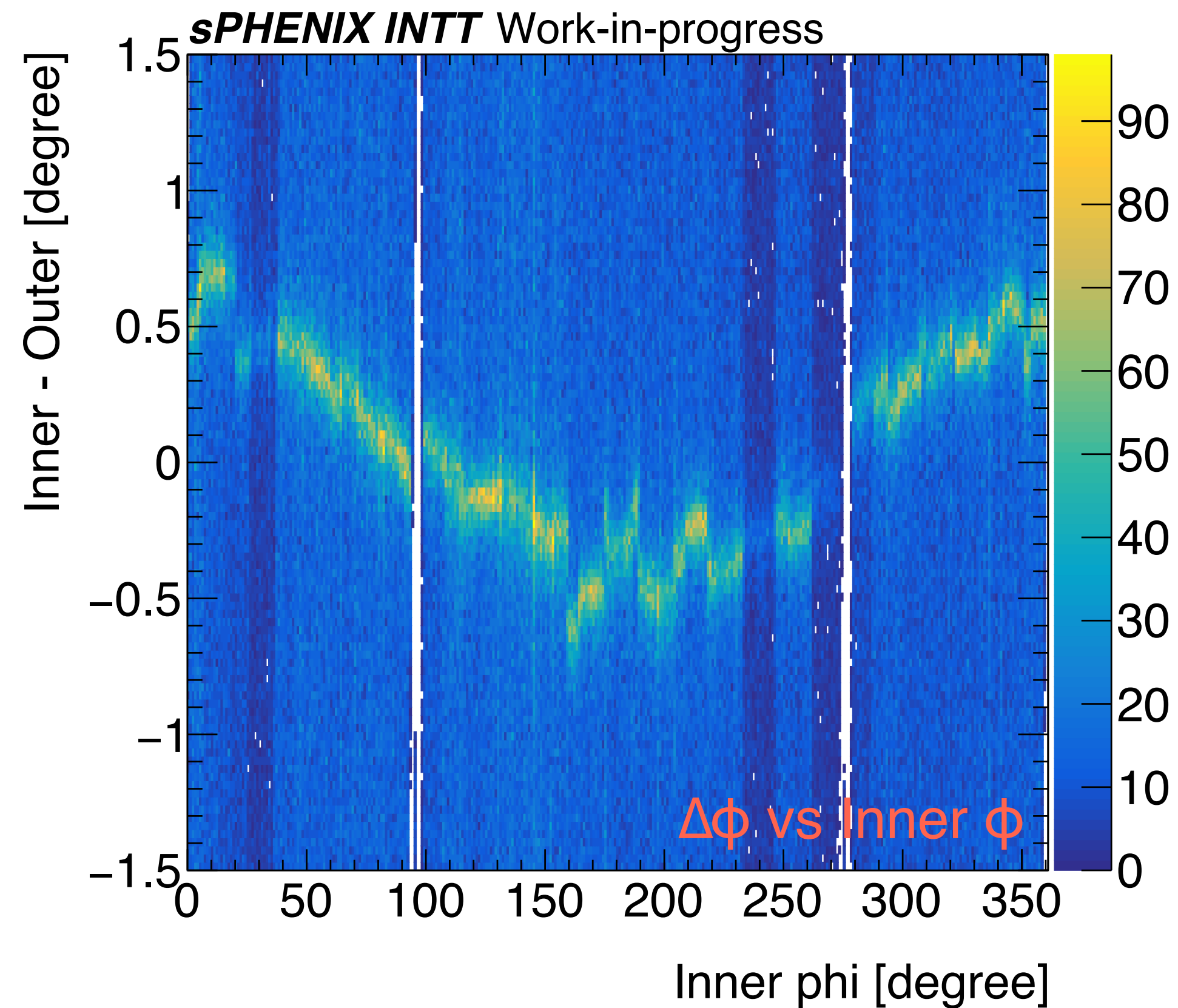
The behavior can be easily understood with the vertex correction, feasibly
Will implement this with data soon!

MC Zvtx update aaa.388-000
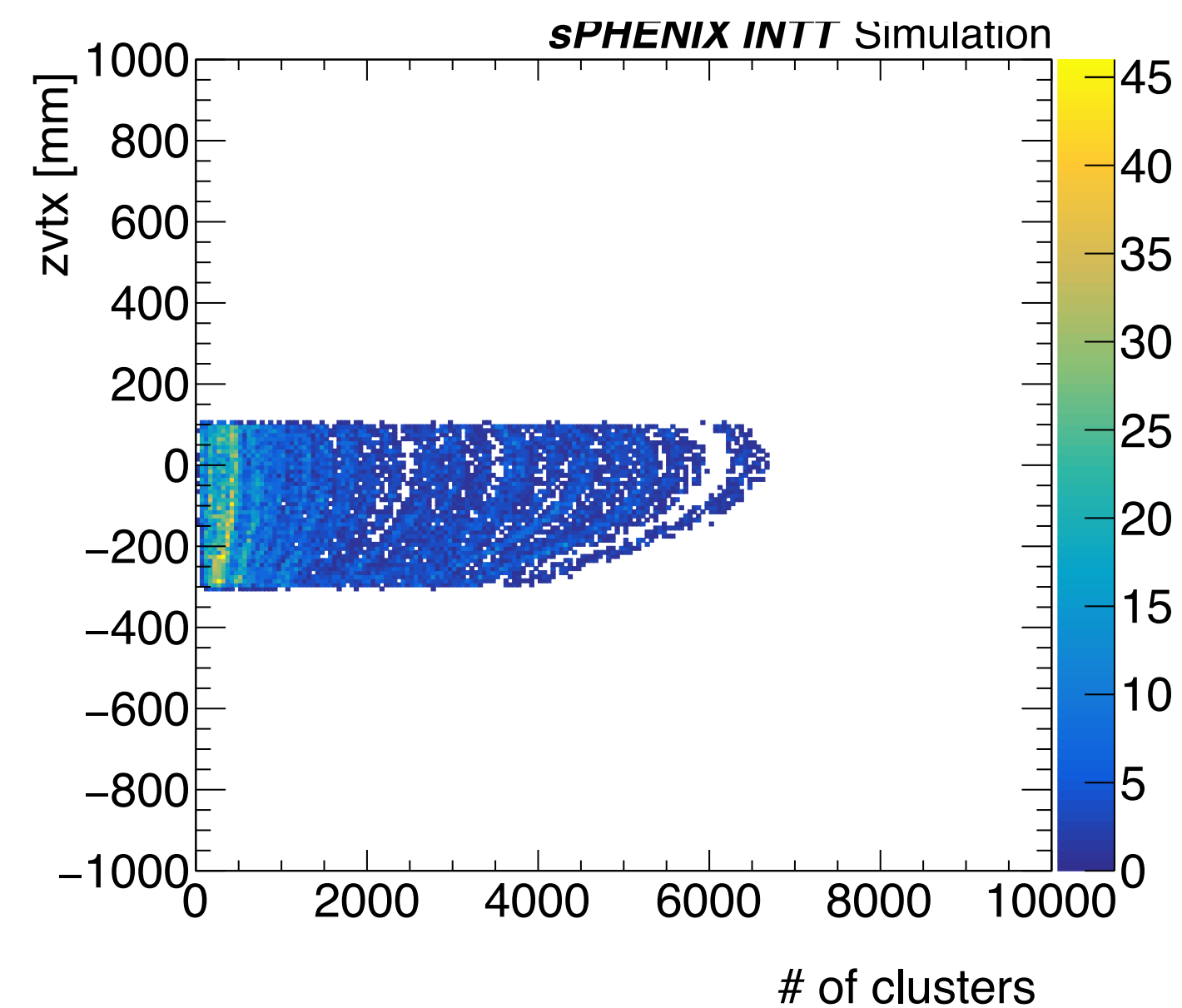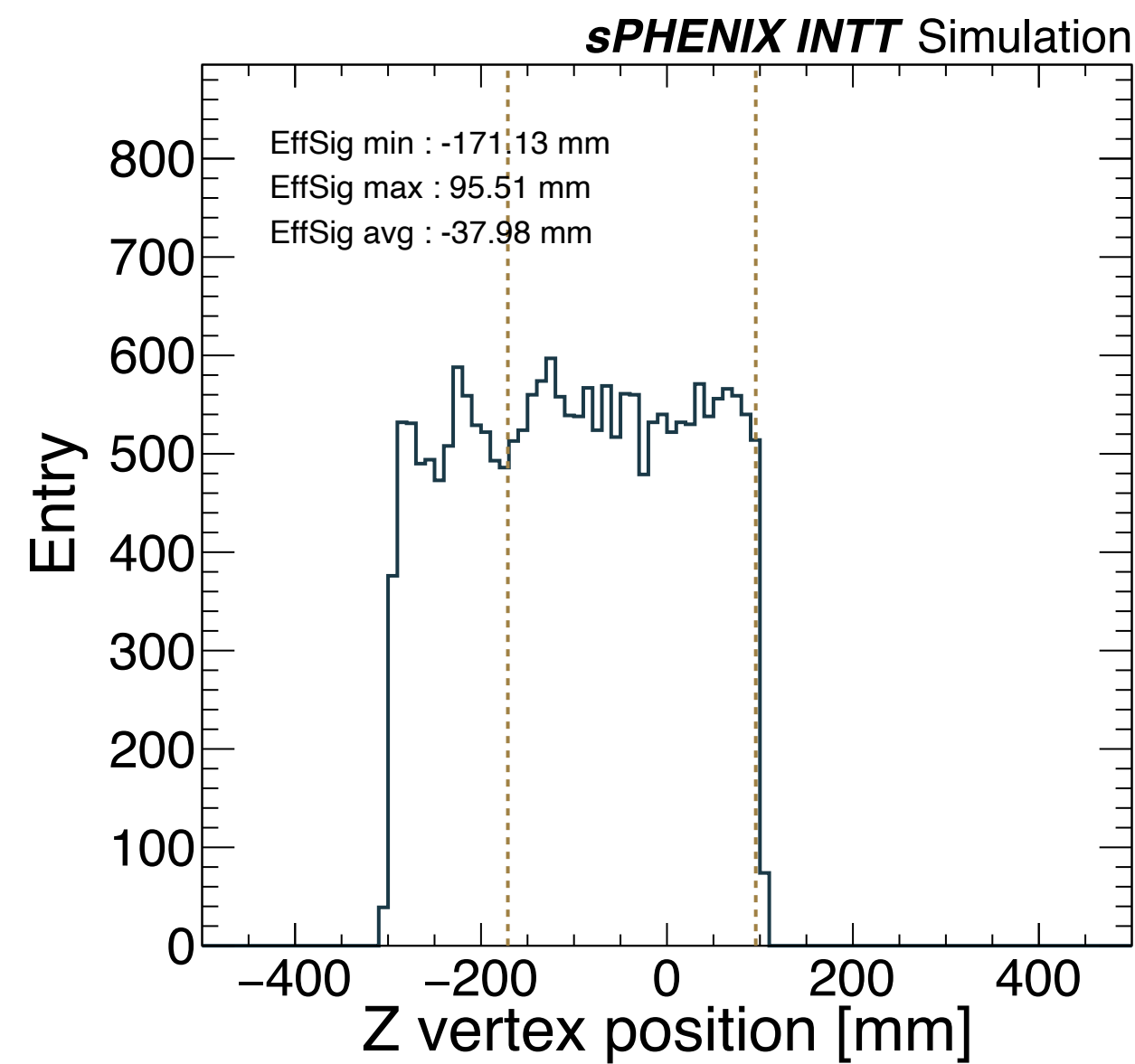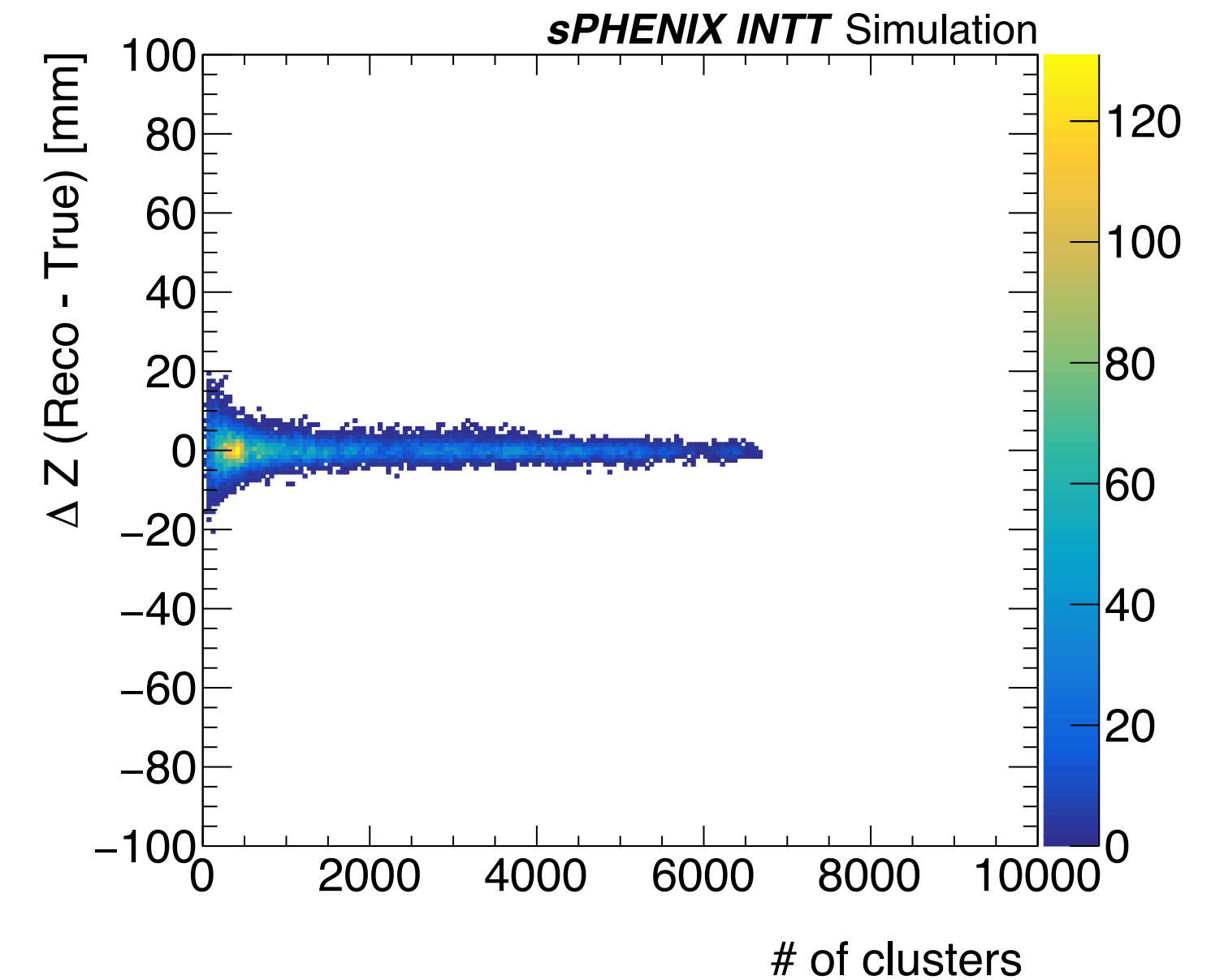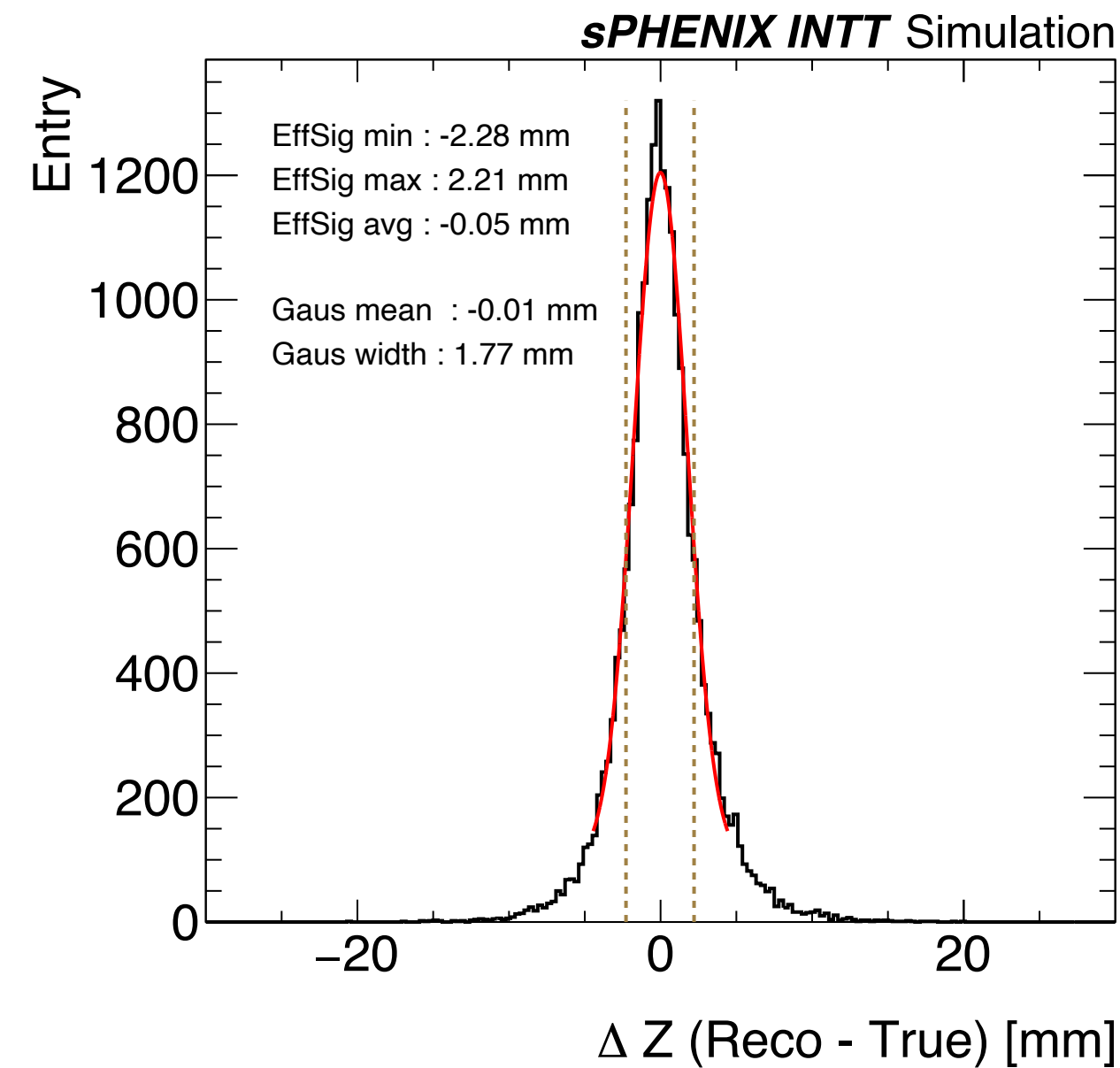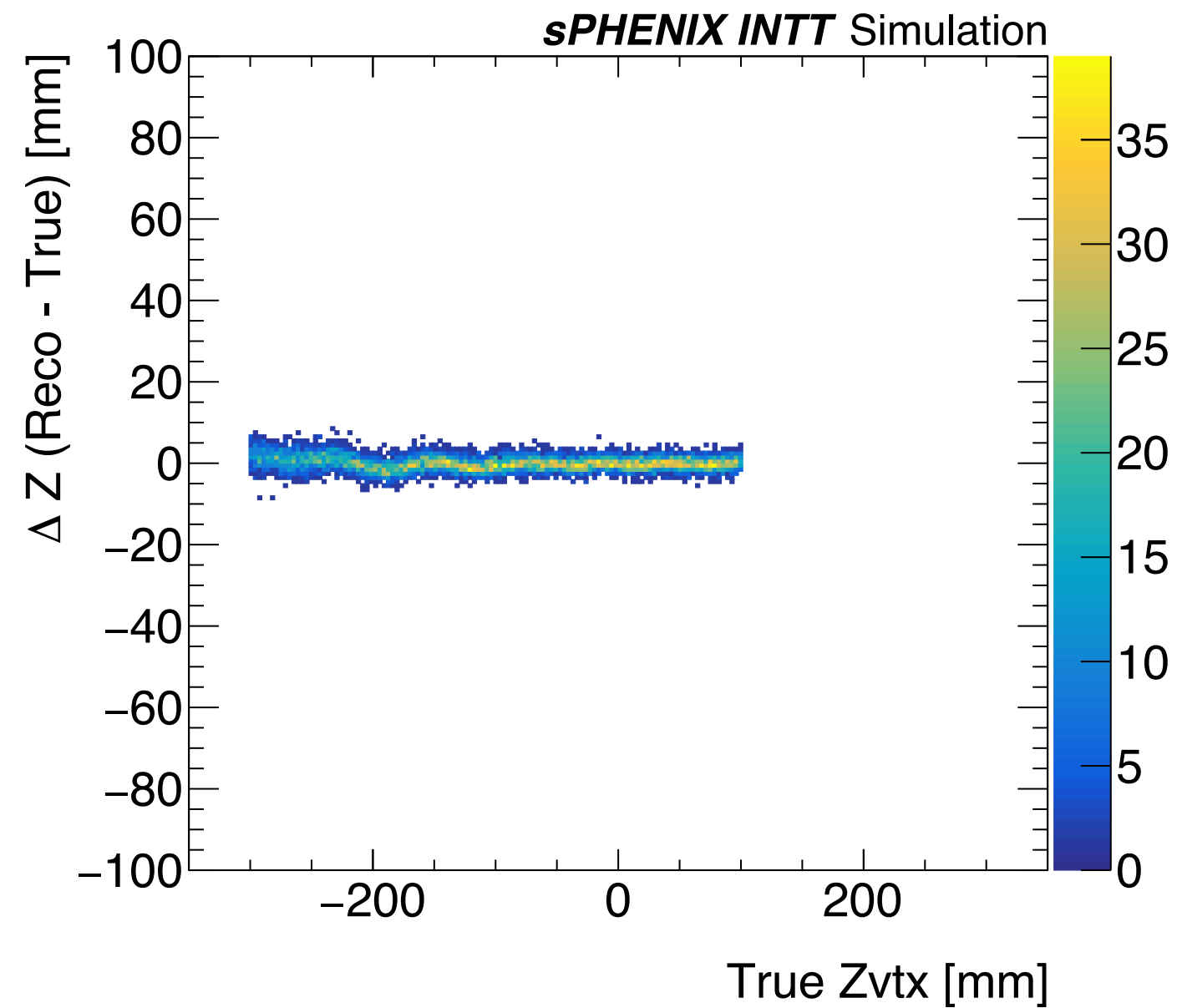
- "Have potential to use -10 ~ 0 cm region only (5% → 100k events in total)"
  - Comments : Be careful about the possibility that the vertex dependent centrality distribution
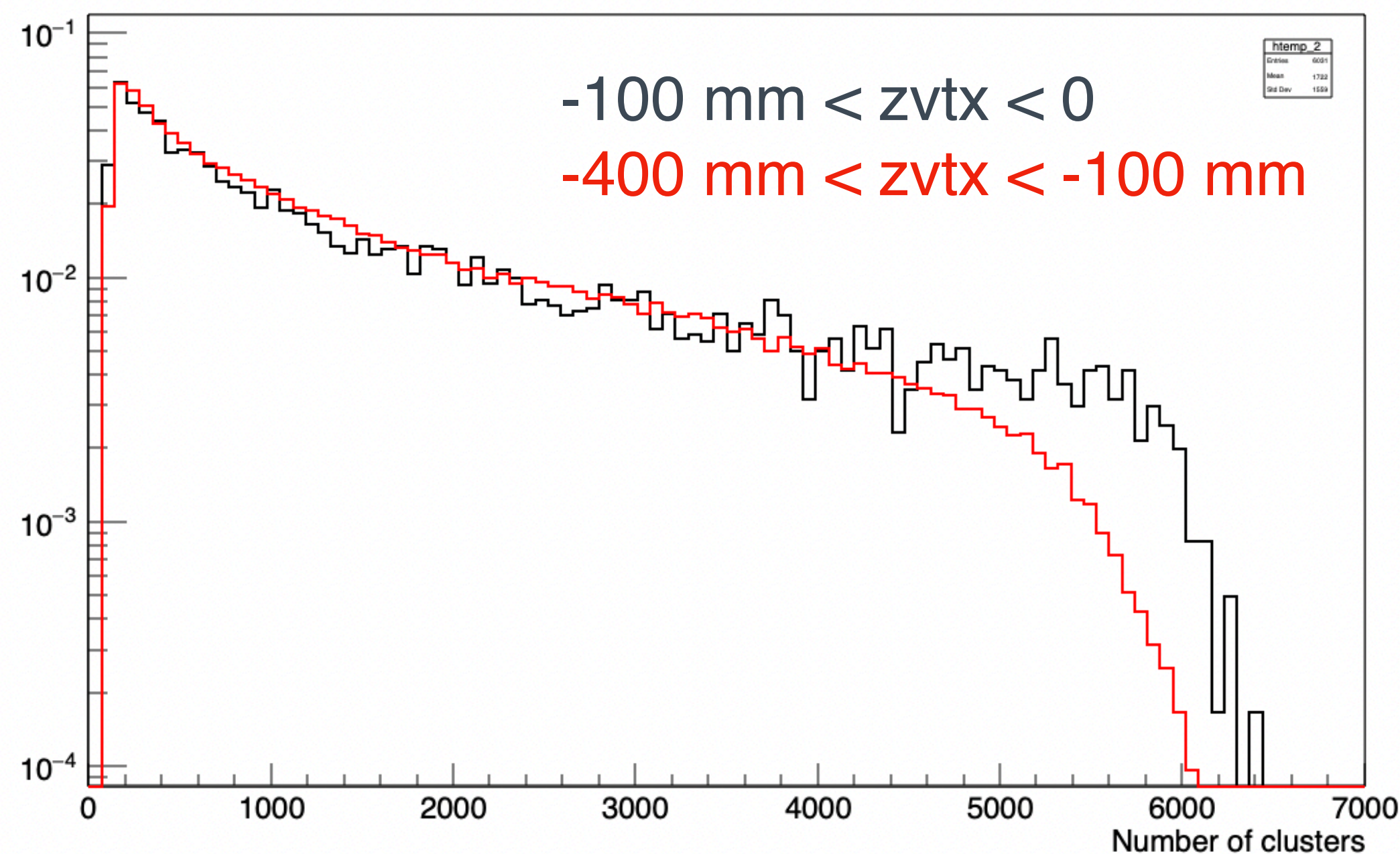
- Tried to quickly check it with INTT, has bias in high multiplicity region
  - Zvtx within ±10 cm has higher potential to have high multiplicity
  - The agreement between two distributions in low multiplicity region seems to contradict with Dennis' hypothesis
  - MBD can study this in much detail

Conclusions

- The comparison between two INTT Z-determination algorithms was performed. You can see a positive correlation in spite of the multiple peaks

- The discontinuous group seemed to be from single ladder

- Two new batches of MC were generated with the vertex position in practice, and corrected INTT geometry
  - Zero-adc issue is under investigation by Misaki

- The introduction of vertex-XY correction could narrow the $\Delta\phi$ distribution, and eased the understanding of DCA-$\Delta\phi$ behavior
  - It would be good to have a vertex XY before vertex Z reconstruction, which can improve the purity of tracklet selection as the vertex is known to be not at origin

- The zvtx resolution study over a wider z vertex region was performed
  - Basically independent to the position in acceptance. Overall ΔZ: 1.71 mm

- Vertex dependent centrality distribution has to be checked with MBD

Back up

Notation: $B_x L_{yzz}$
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Axis (Right-haded coordinate)
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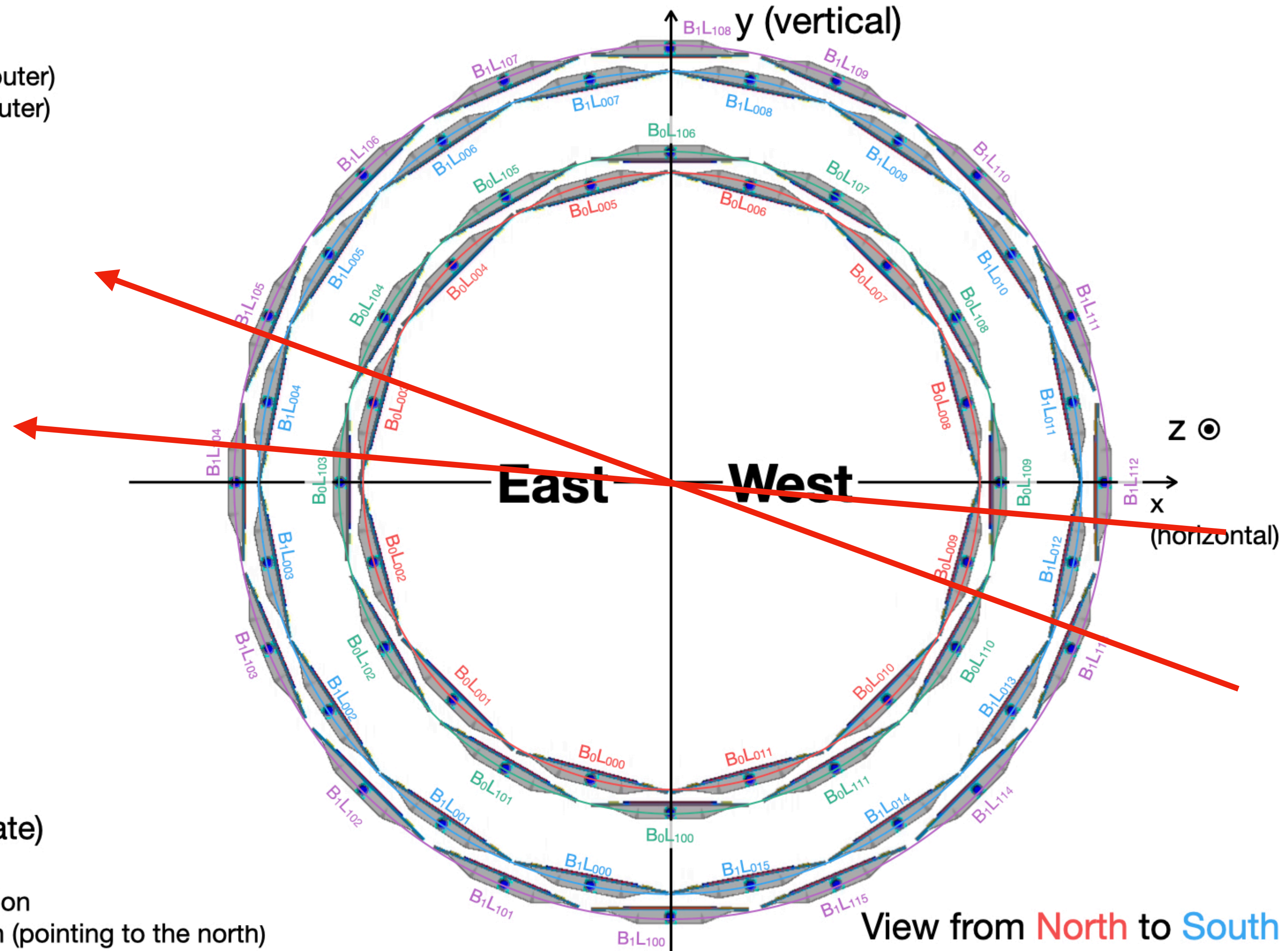 z-axis: The blue beam direction (pointing to the north)

View from North to South

Notation: B_xL_{yzz}
  x: Barrel ID (0 for inner or 1 for outer)
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View from: North to South

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- x: Barrel ID (0 for inner or 1 for outer)
- y: Layer ID (0 for inner or 1 for outer)
- zz: Ladder ID (from 0 to 15)

sPHENIX INTT Simulation

Axis (Right-haded coordinate)
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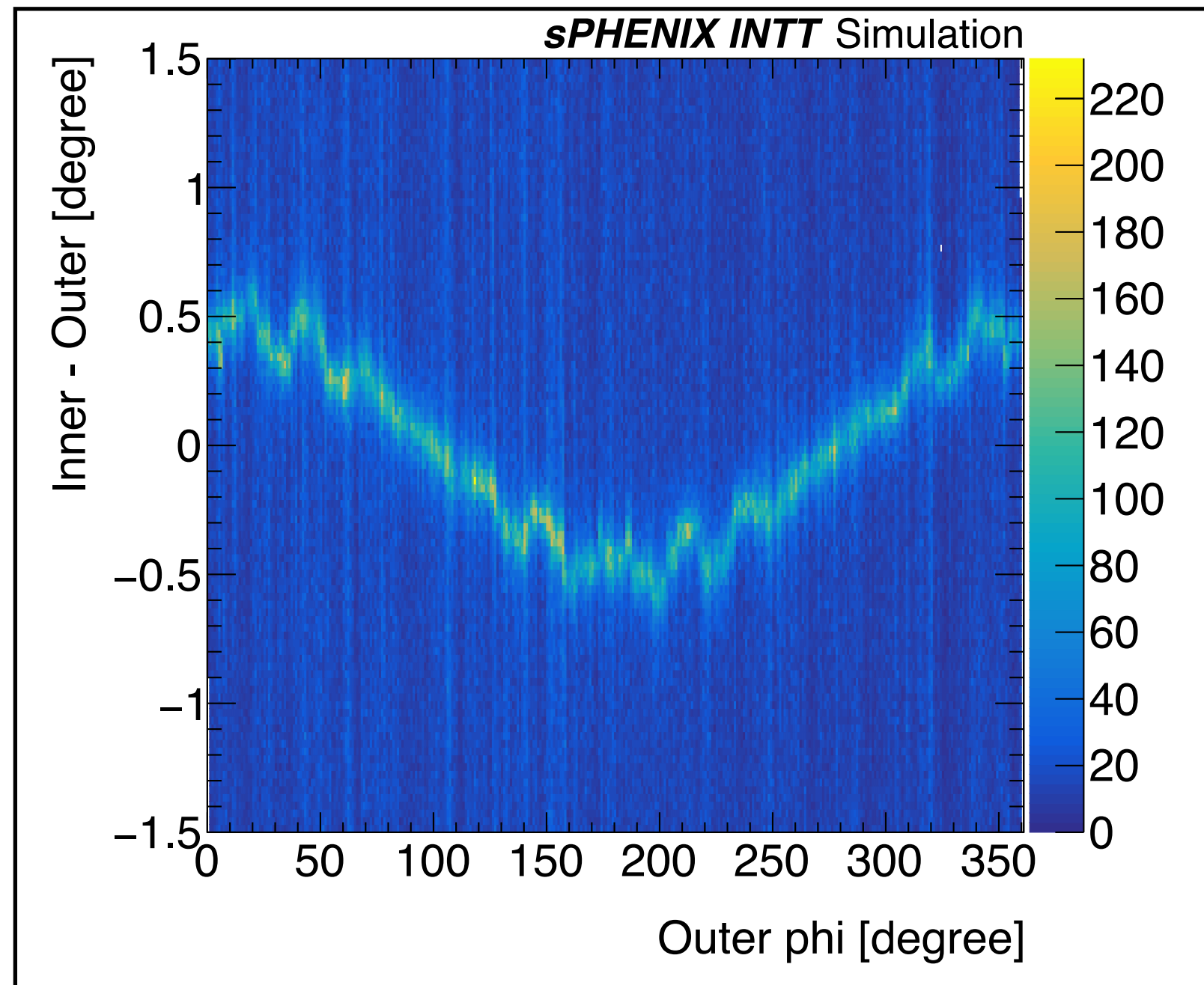

View from North to South

Cheng-Wei Shih (NCU, Taiwan)