Update on Direct Laser Reconstruction

TPC Distortions Meeting

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Progress Update

- From Last Time

Rel-Angles

- Study hot spots, make new svtx track with hot spot info, turn on distortions

Optimum Pointing Angle

- Maximum # of GEMs crossed (preferably at center) + maximum # of layers traversed
- Repeat w/ distortions

Clustering

- Fix Clustering

Progress Update

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- Maximum # of GEMs crossed (preferably at center) + maximum # of layers traversed
- Repeat w/ distortions

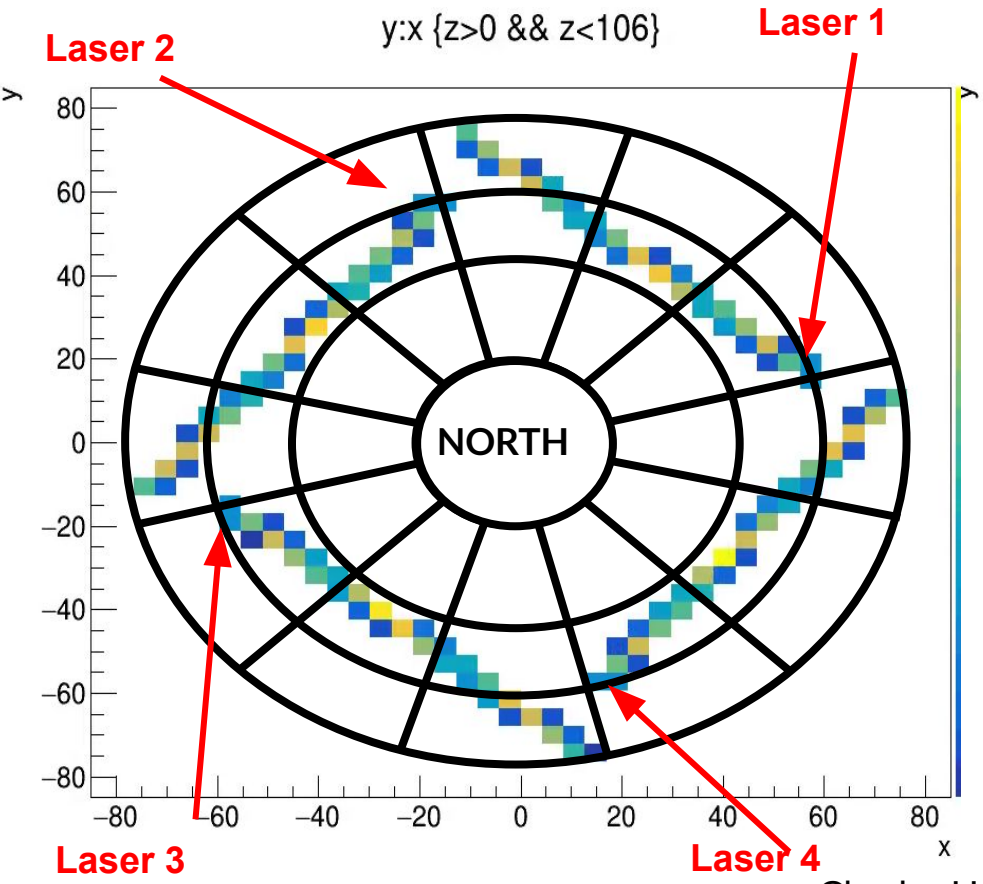
Clustering

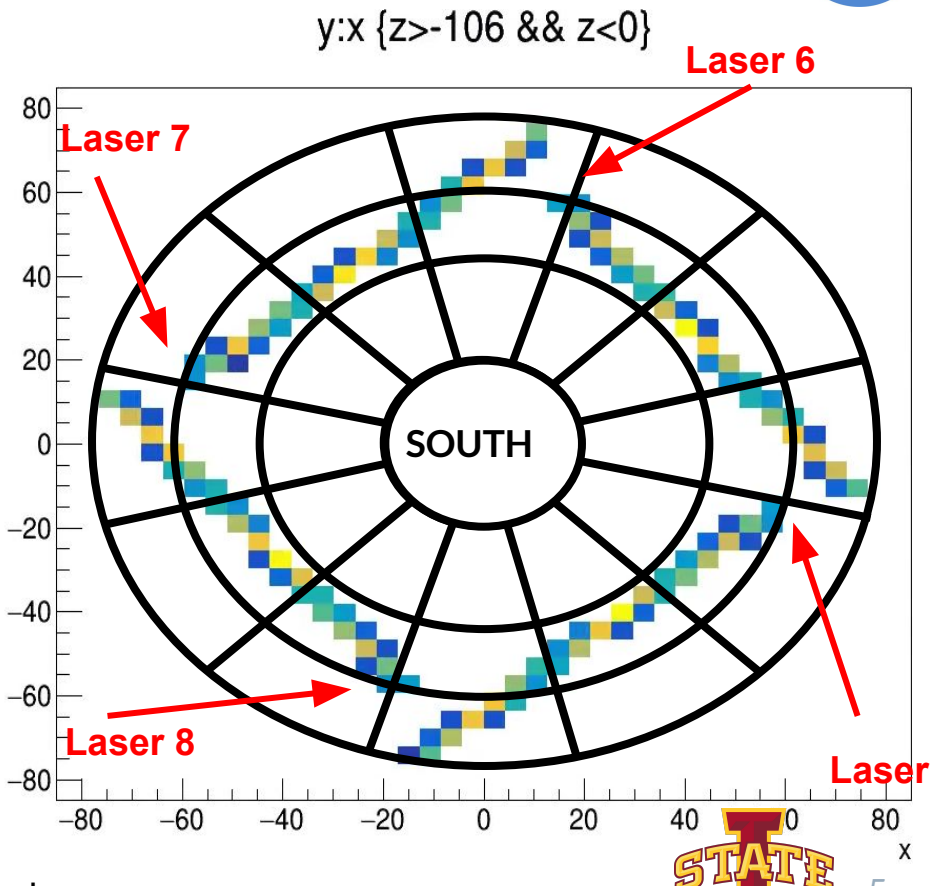
- Fix Clustering

RELATIVE ANGLES
(FINDING DIRECTION OF TRACK)

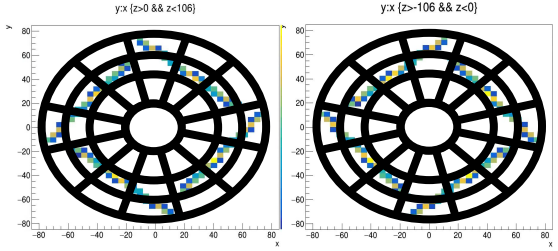
Progress Update

directLaser->SetArbitraryThetaPhi(**70*deg_to_rad, 125*deg_to_rad**);





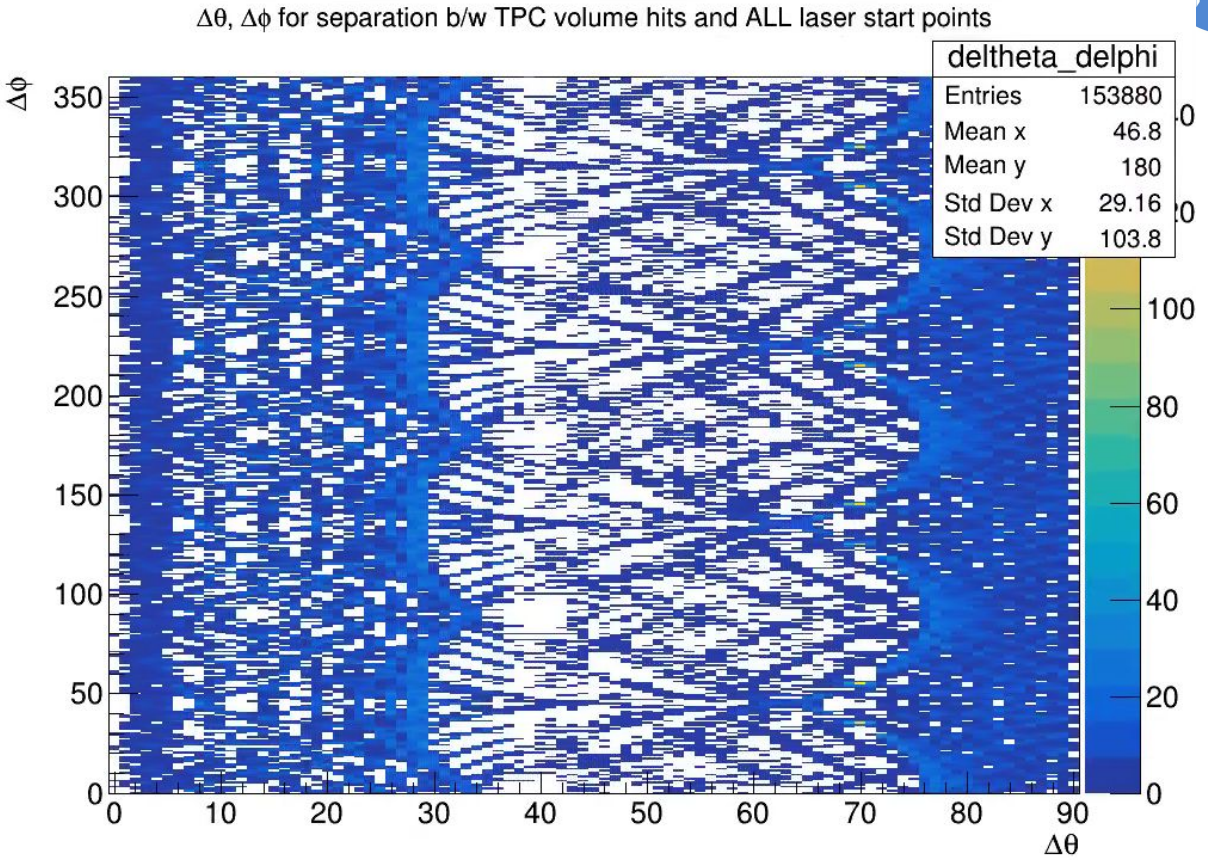
Progress Update



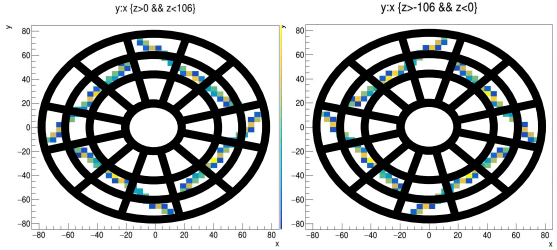
directLaser->SetArbitraryThetaPhi(
70*deg_to_rad,125*deg_to_rad);

NOISE = OFF

DISTORTION = OFF



Progress Update

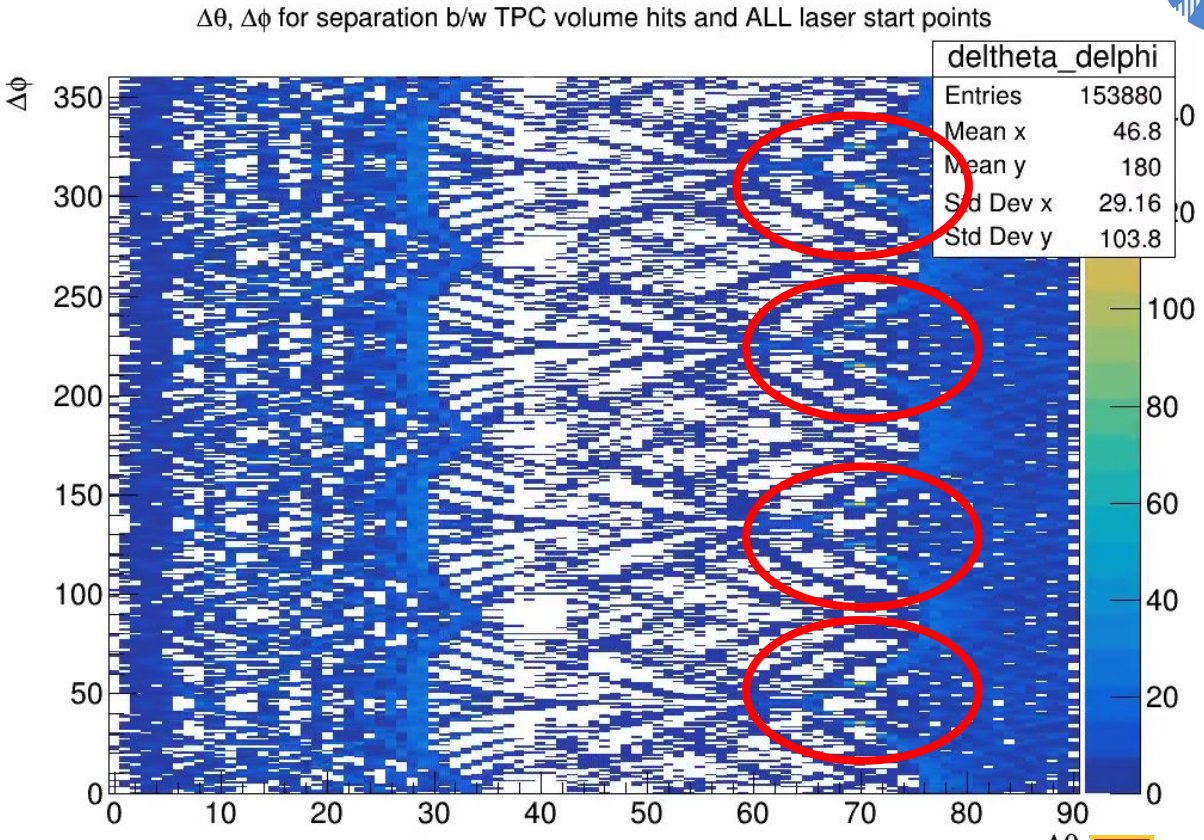


directLaser->SetArbitraryThetaPhi(
70*deg_to_rad,125*deg_to_rad);

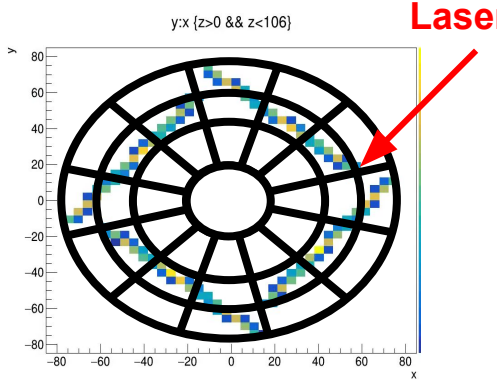
NOISE = OFF

DISTORTION = OFF

WHERE ARE HOT SPOTS ?
HARD TO SEE …



Progress Update



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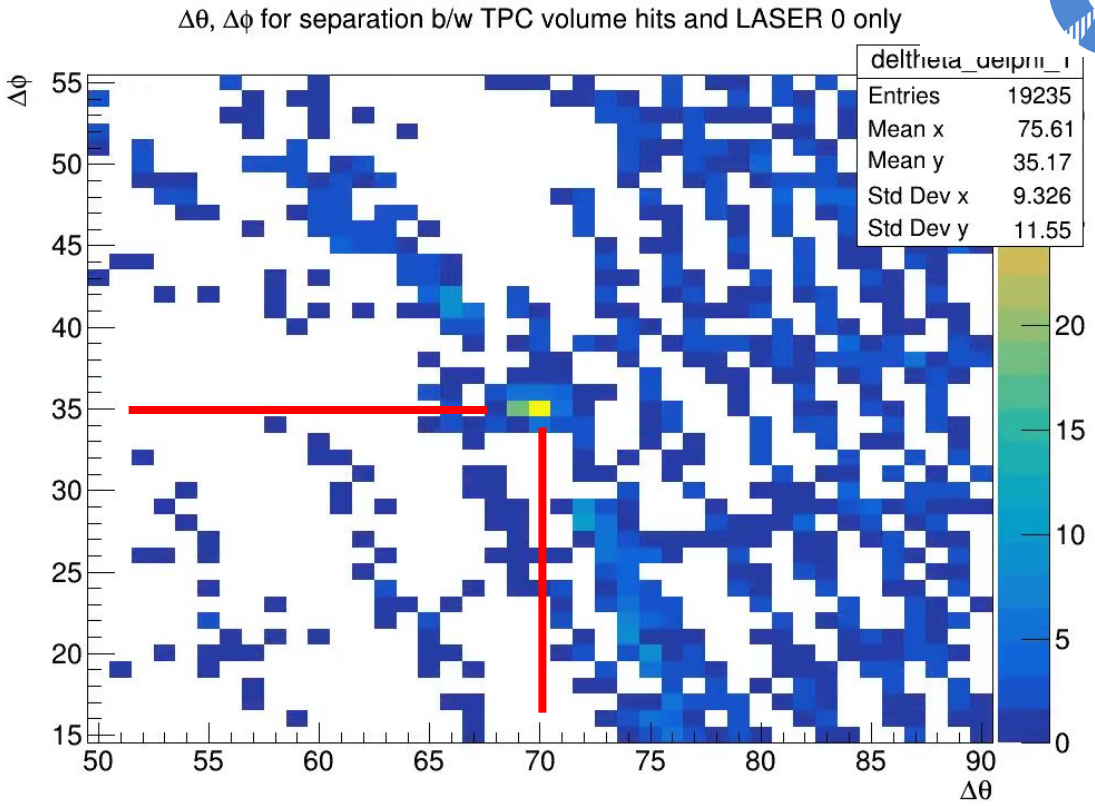
70*deg_to_rad,125*deg_to_rad);

NOISE = OFF

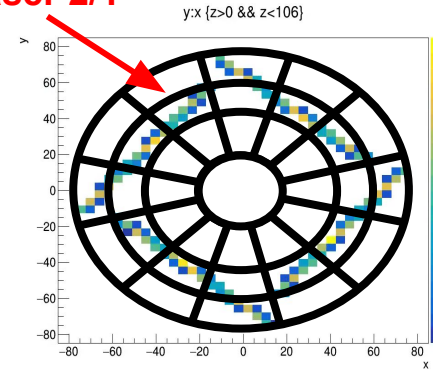
DISTORTION = OFF

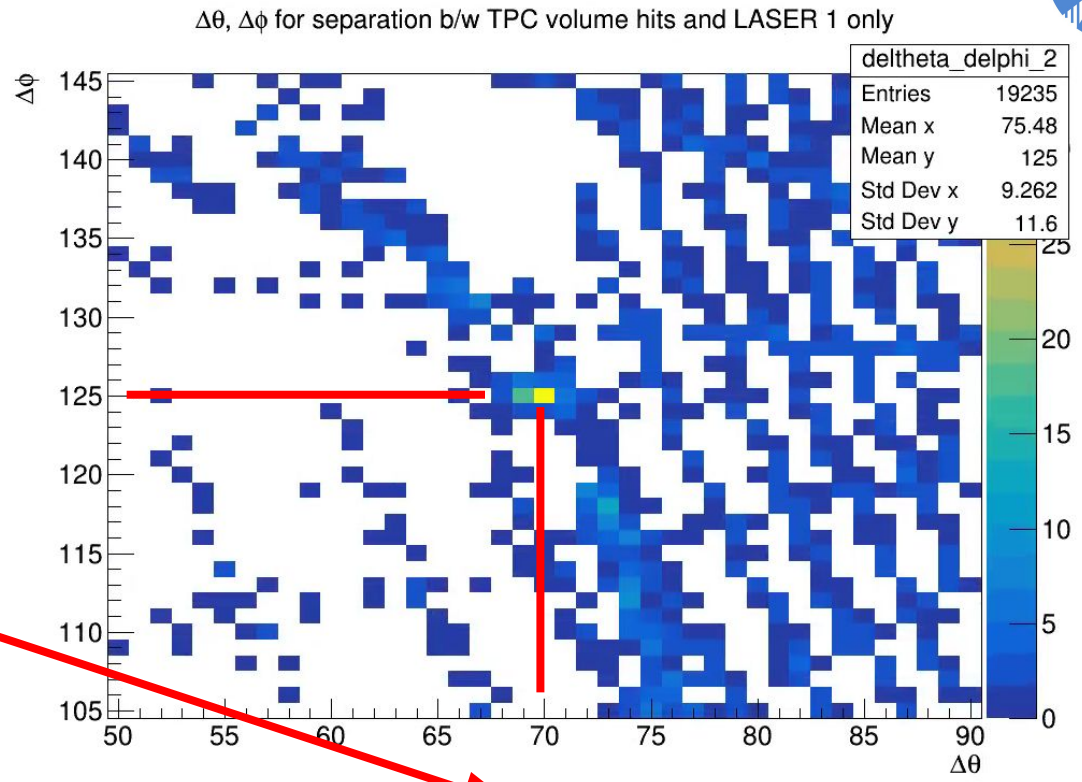



```
Laser # 1 deltheta max: 70, delphi max: 35
```

Progress Update

Laser 2/1





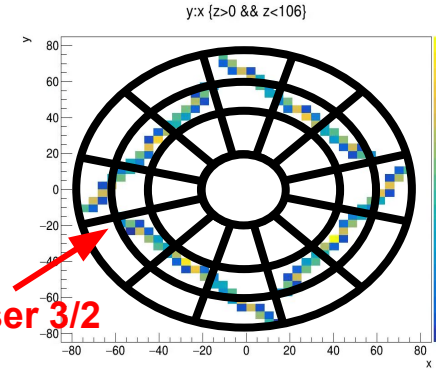
directLaser->SetArbitraryThetaPhi(
70*deg_to_rad,125*deg_to_rad);

NOISE = OFF

DISTORTION = OFF

```
Laser # 2 deltheta max: 70, delphi max: 125
```

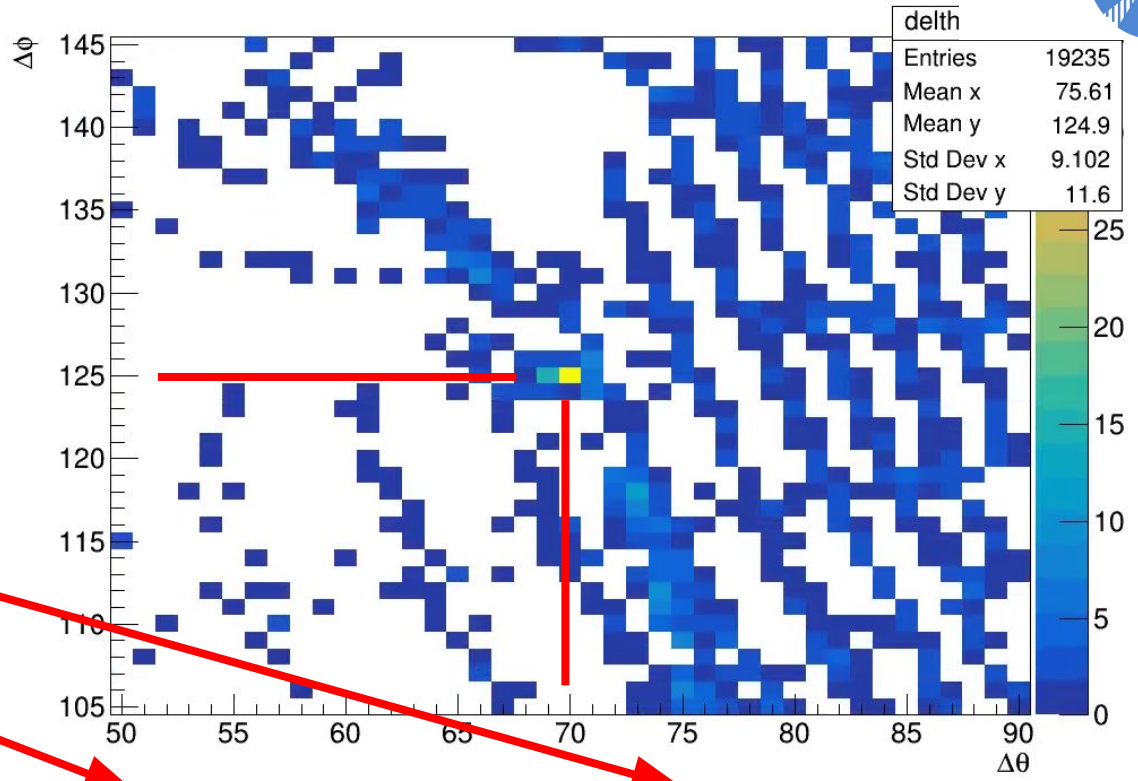
Progress Update



directLaser->SetArbitraryThetaPhi(
70*deg_to_rad,125*deg_to_rad);

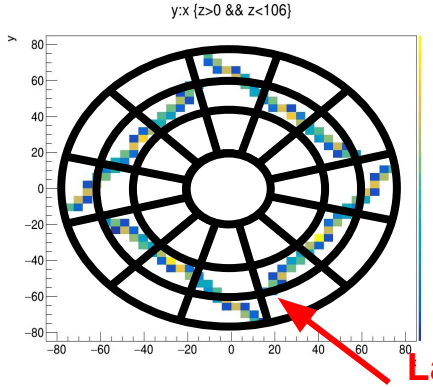
NOISE = OFF

DISTORTION = OFF




```
Laser # 3 deltheta max: 70, delphi max: 125
```

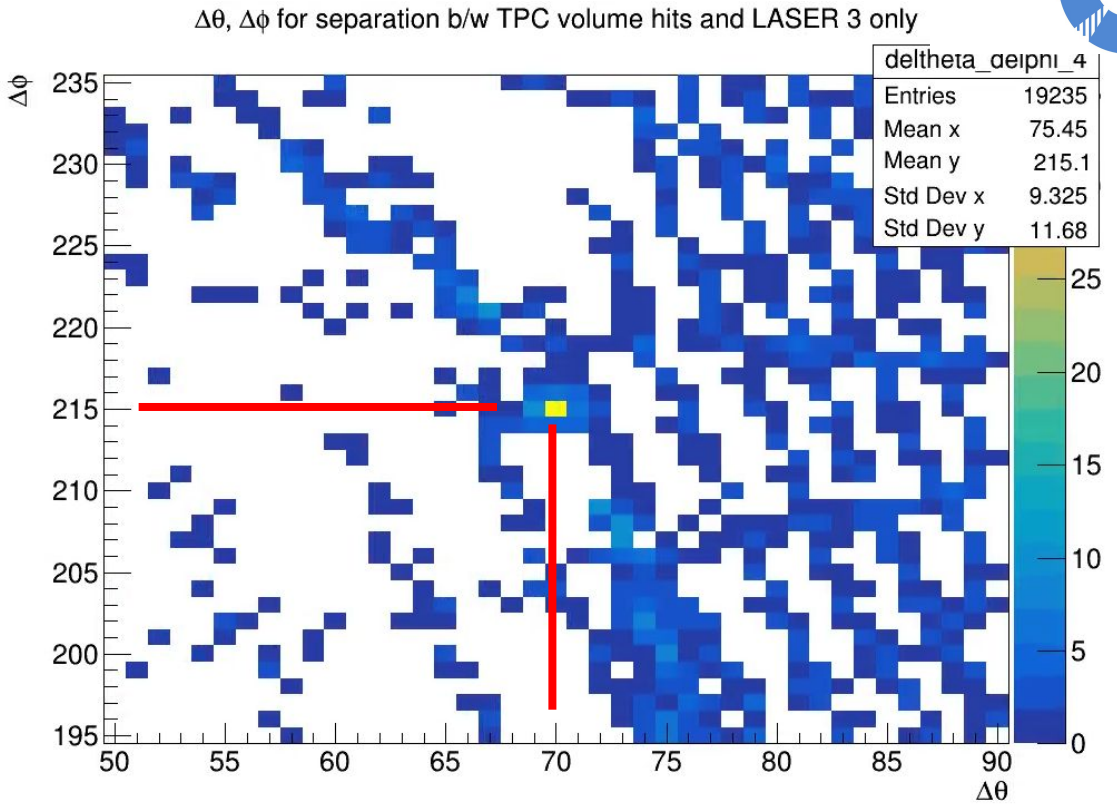
Progress Update



directLaser->SetArbitraryThetaPhi(
70*deg_to_rad,125*deg_to_rad);

NOISE = OFF

DISTORTION = OFF




```
Laser # 4 deltheta max: 70, delphi max: 215
```

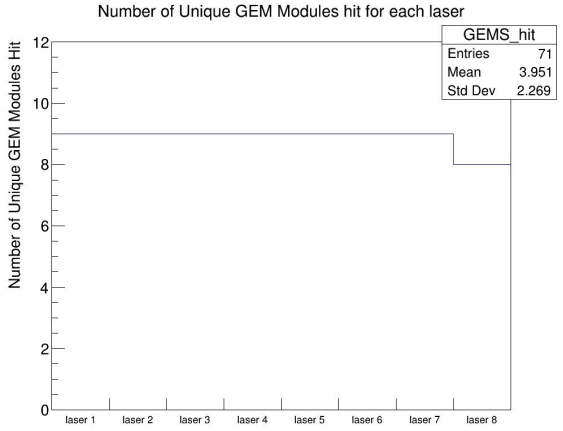
OPTIMUM ANGLE
(HOW TO HIT A LOT IN Z AND R-φ)

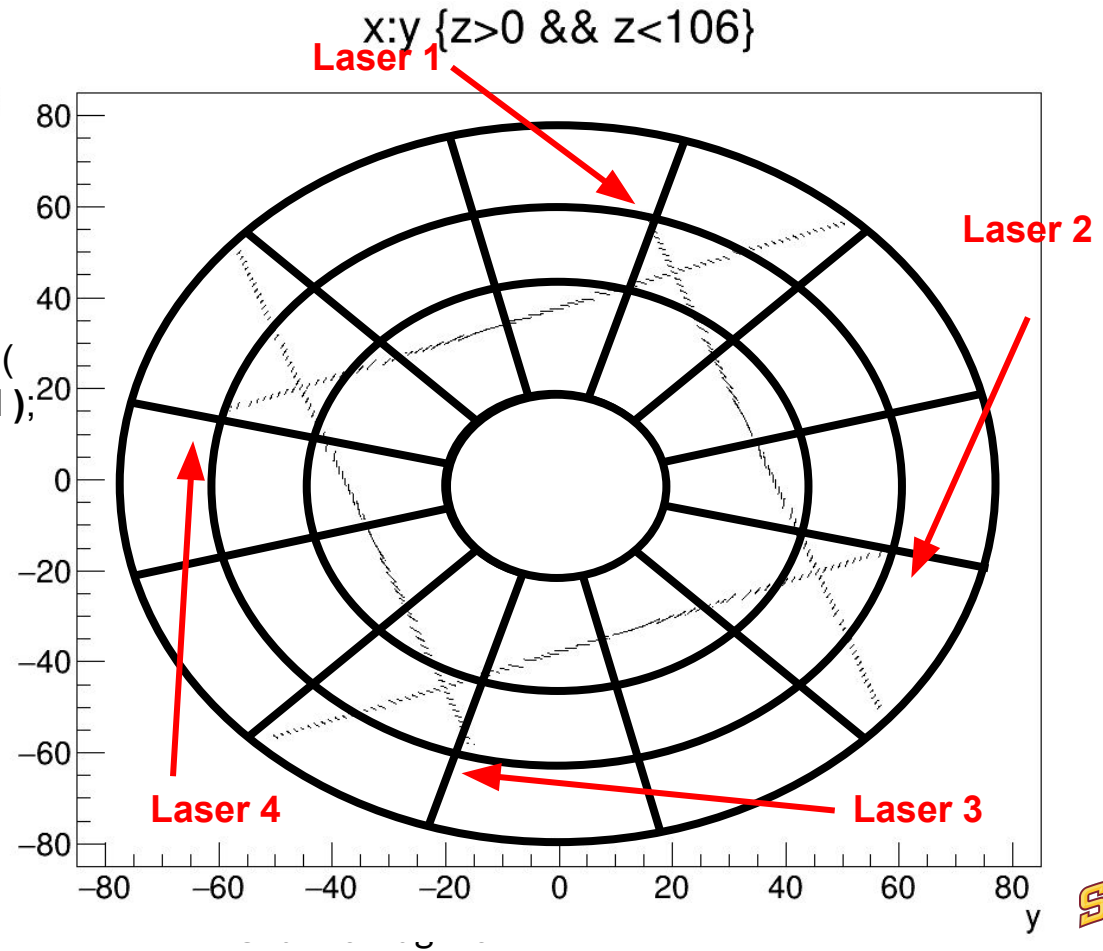
Progress Update

North Side (Distortions ON)

/cvmfs/sphenix.sdcc.bnl.gov/gcc-12.1.0/release/release_new/new.7/share/calibrations/distortion_maps/static_only.distortion_map.hist.root

directLaser->SetArbitraryThetaPhi(**50*deg_to_rad , 145*deg_to_rad);**



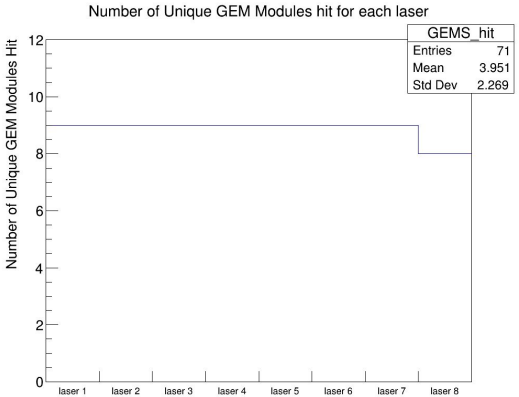


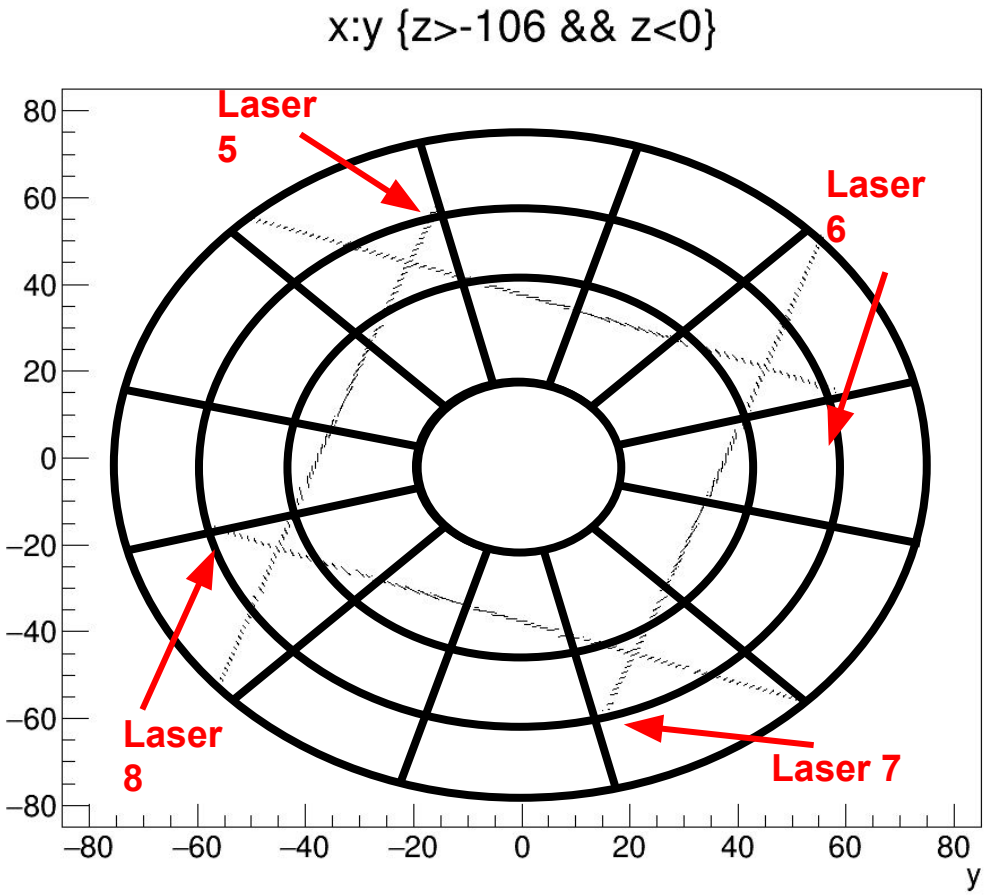
Progress Update

South Side (Distortions ON)

/cvmfs/sphenix.sdcc.bnl.gov/gcc-12.1.0/release/release_new/new.7/share/calibrations/distortion_maps/static_only.distortion_map.hist.root

directLaser->SetArbitraryThetaPhi(**50*deg_to_rad , 145*deg_to_rad**);





Progress Update

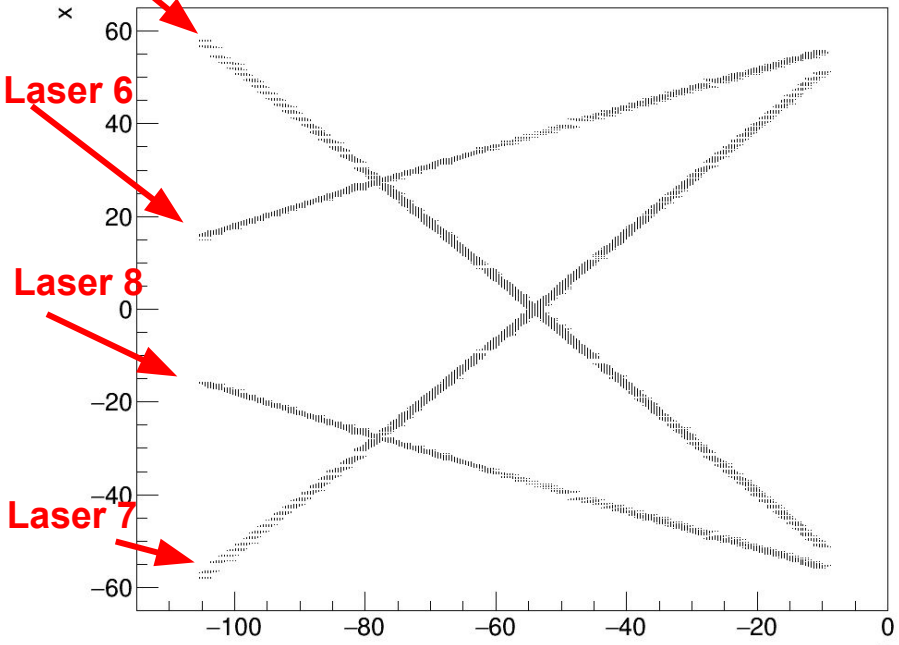
directLaser->SetArbitraryThetaPhi(
50*deg_to_rad , 145*deg_to_rad);

Central Membrane

Laser 5

South Side (Distortions ON)

x:z {z>-106 && z<0}



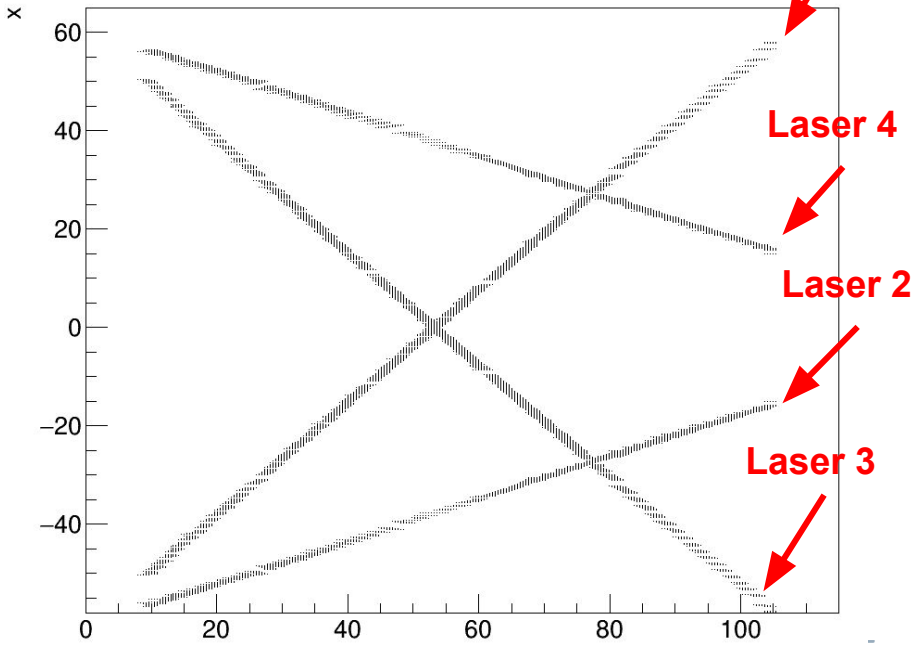
Laser 6

Laser 8

Laser 7

North Side (Distortions ON)

x:z {z>0 && z<106}



Laser 1

Laser 4

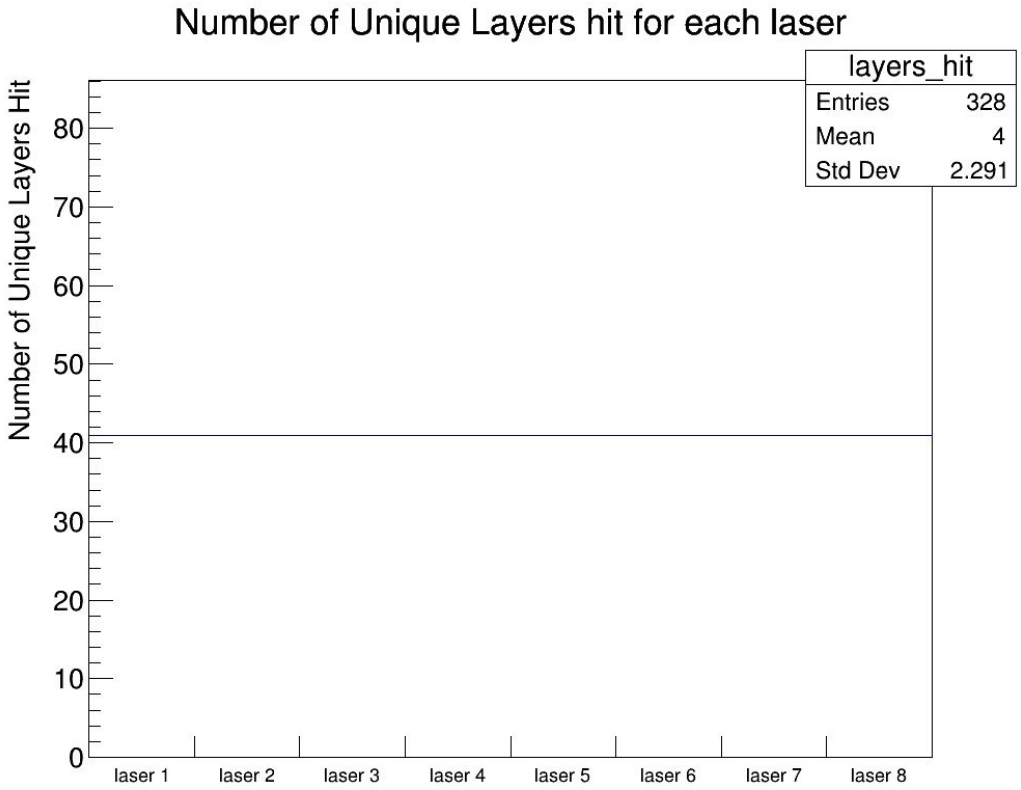
Laser 2

Laser 3

Progress Update

directLaser->SetArbitraryThetaPhi(
50*deg_to_rad , 145*deg_to_rad);

(Distortions ON)



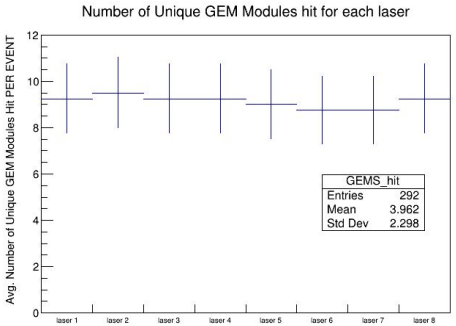
Progress Update

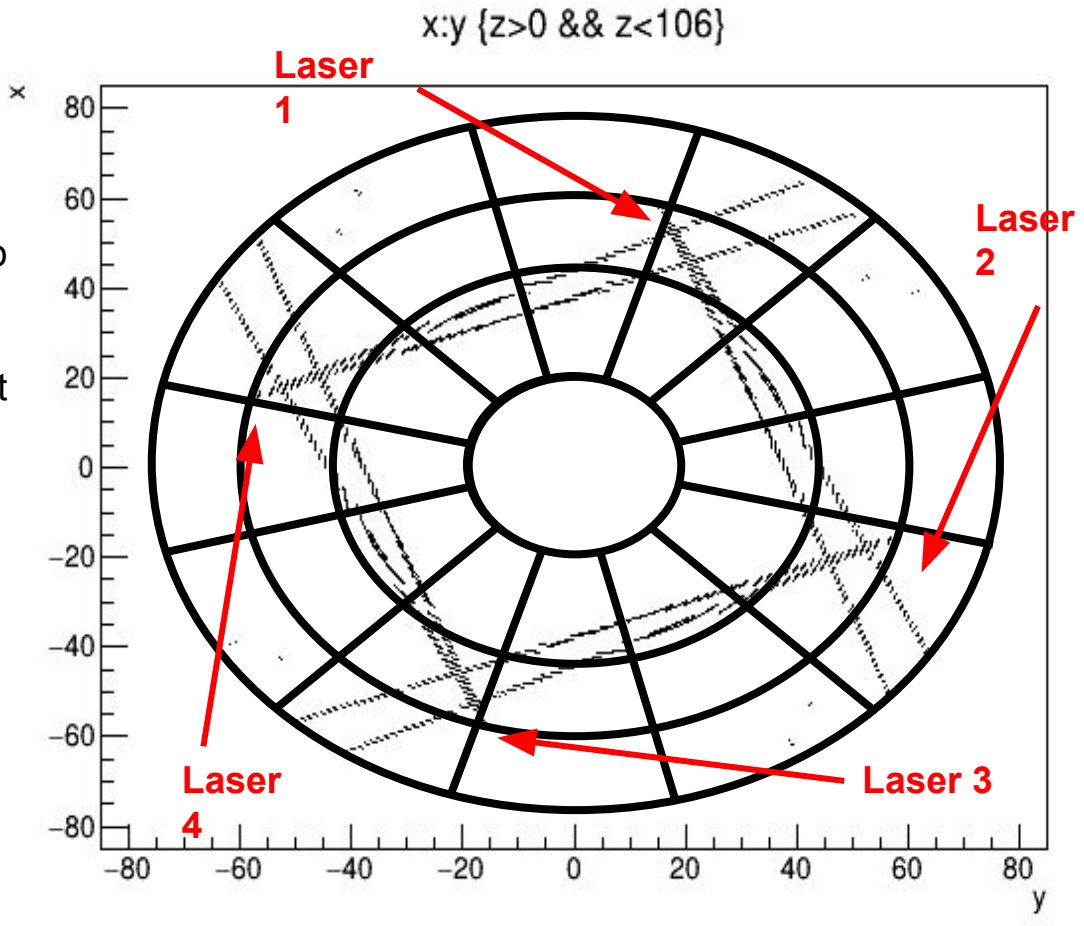
North Side (Distortions ON)

/cvmfs/sphenix.sdcc.bnl.gov/gcc-12.1.0/release/release_new/new.7/share/calibrations/distortion_maps/static_only.distortion_map.hist.root

directLaser->SetPhiStepping(**2, 140*deg_to_rad, 150*deg_to_rad**);

directLaser->SetThetaStepping(**2, 45*deg_to_rad, 55*deg_to_rad**);

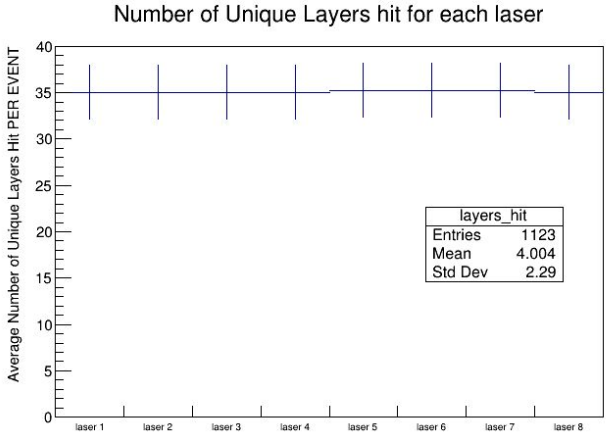




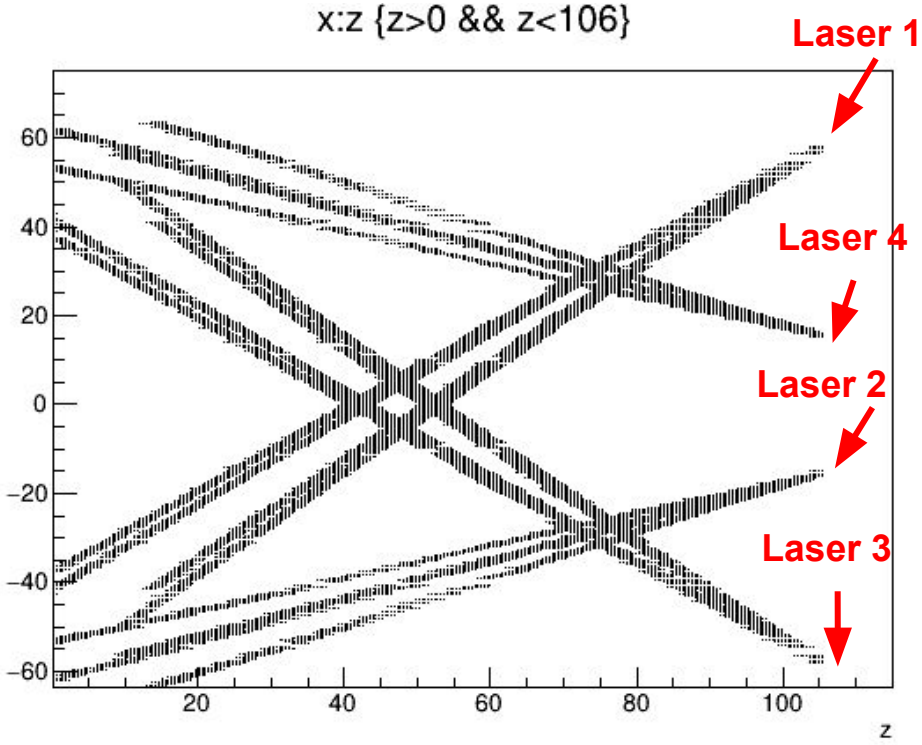
Progress Update

directLaser->SetPhiStepping(2, 140*deg_to_rad, 150*deg_to_rad);
directLaser->SetThetaStepping(2, 45*deg_to_rad, 55*deg_to_rad);

Central Membrane



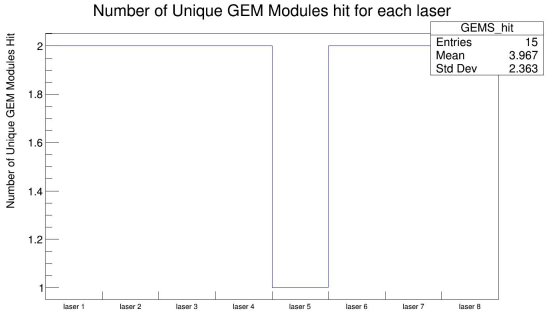
North Side (Distortions ON)



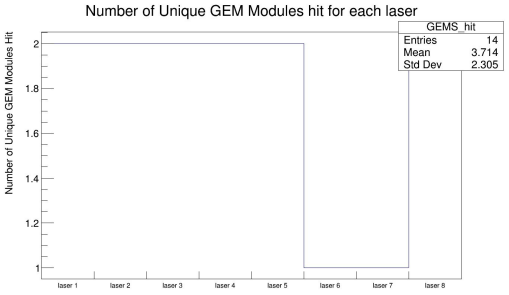
Progress Update

- **From Luis (Work in Progress)**

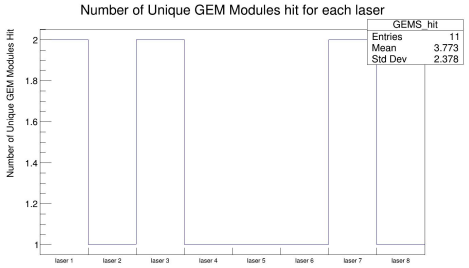
θ=50,Φ=0



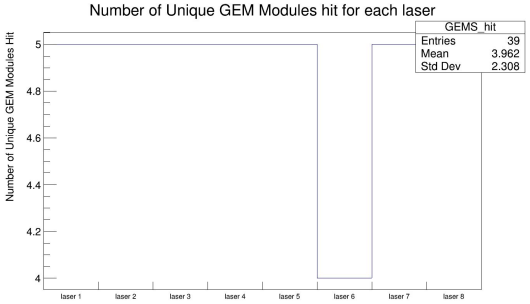
θ=50,Φ=45



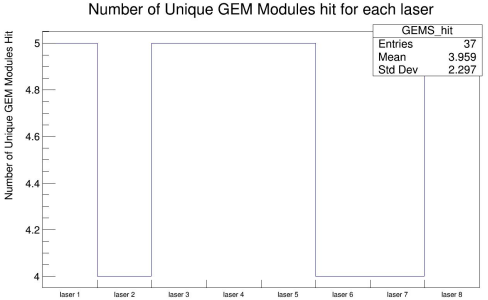
θ=50,Φ=90



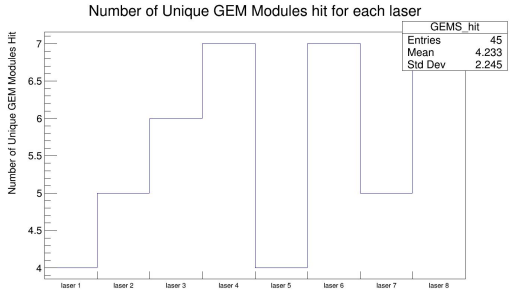
θ=50,Φ=135



θ=50,Φ=145



θ=50,Φ=180



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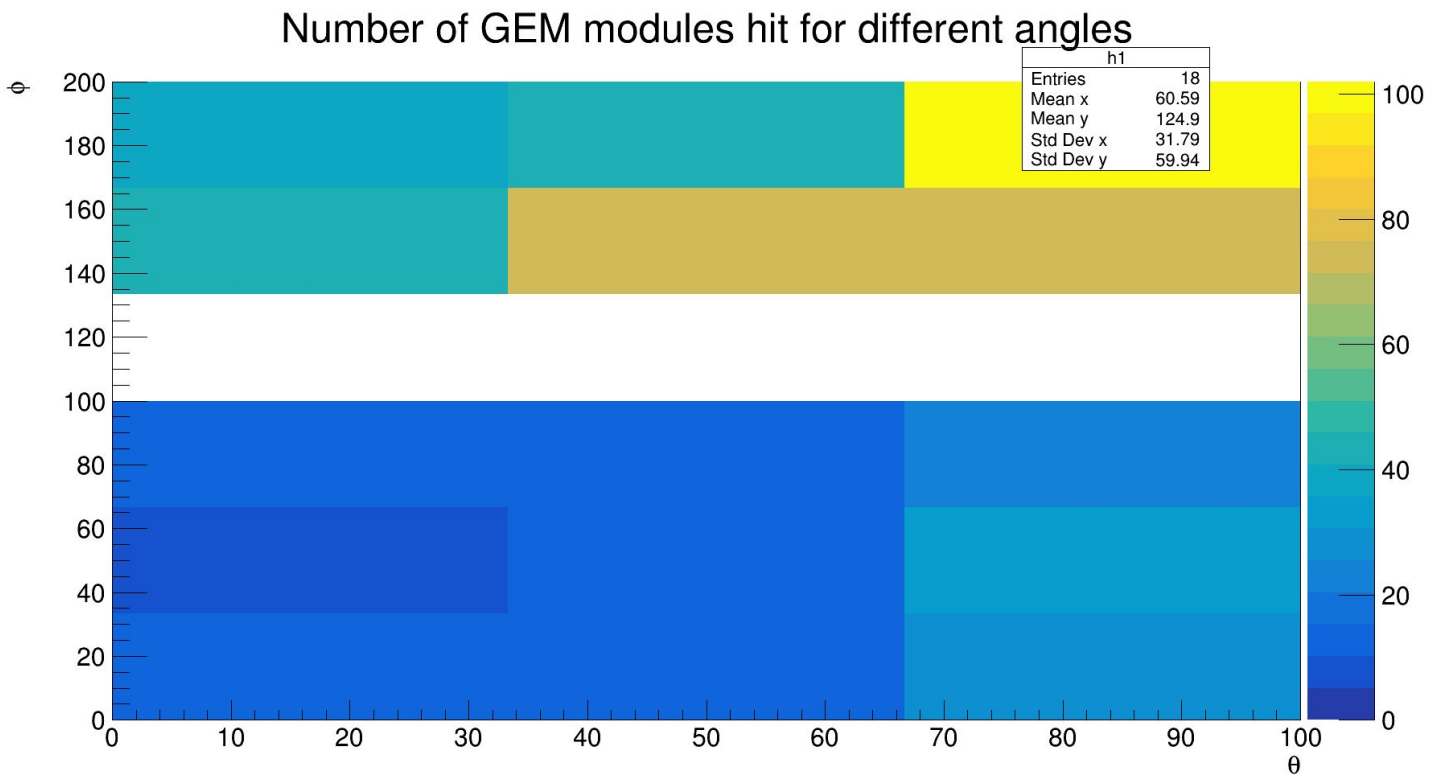
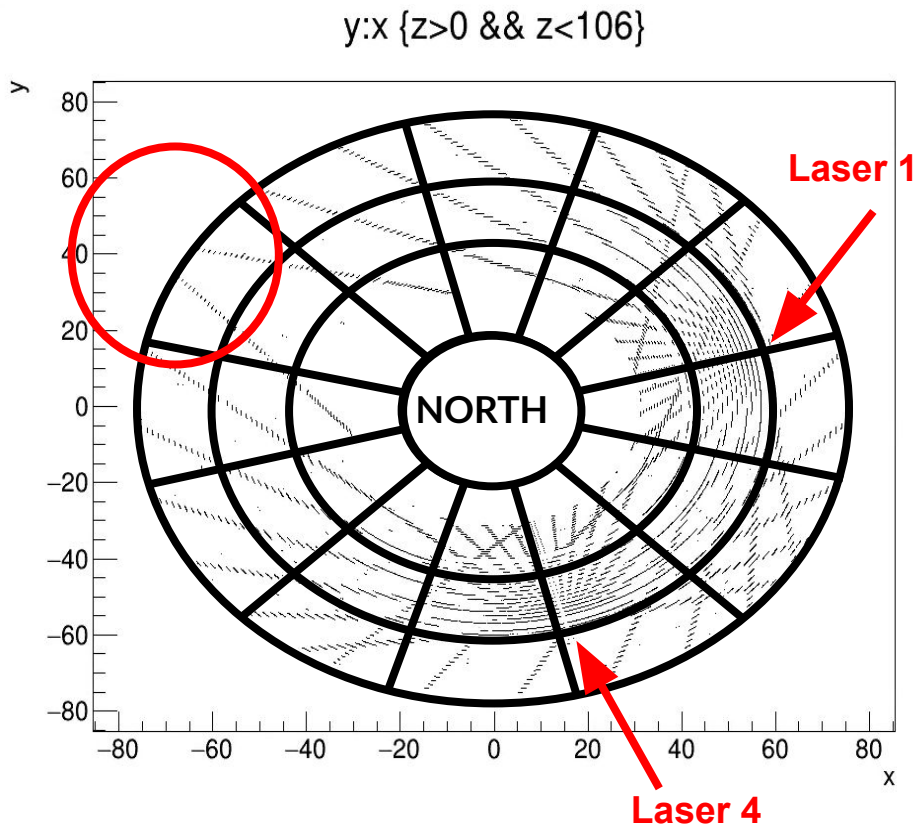
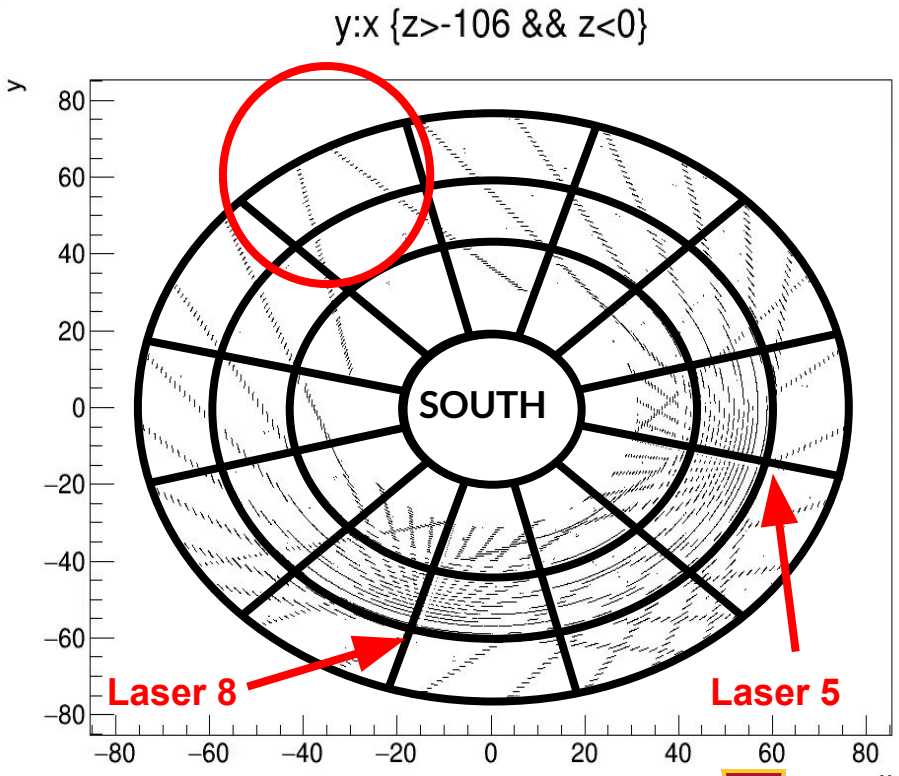


Progress Update

Ross: “**I'm proposing we do 3 and 6 o'clock on the north and south faces**, so that we have two lasers crossing the TPOT region. This produces some shared blind spot in the opposite corner of the tpc, where the coverage will be poor. “





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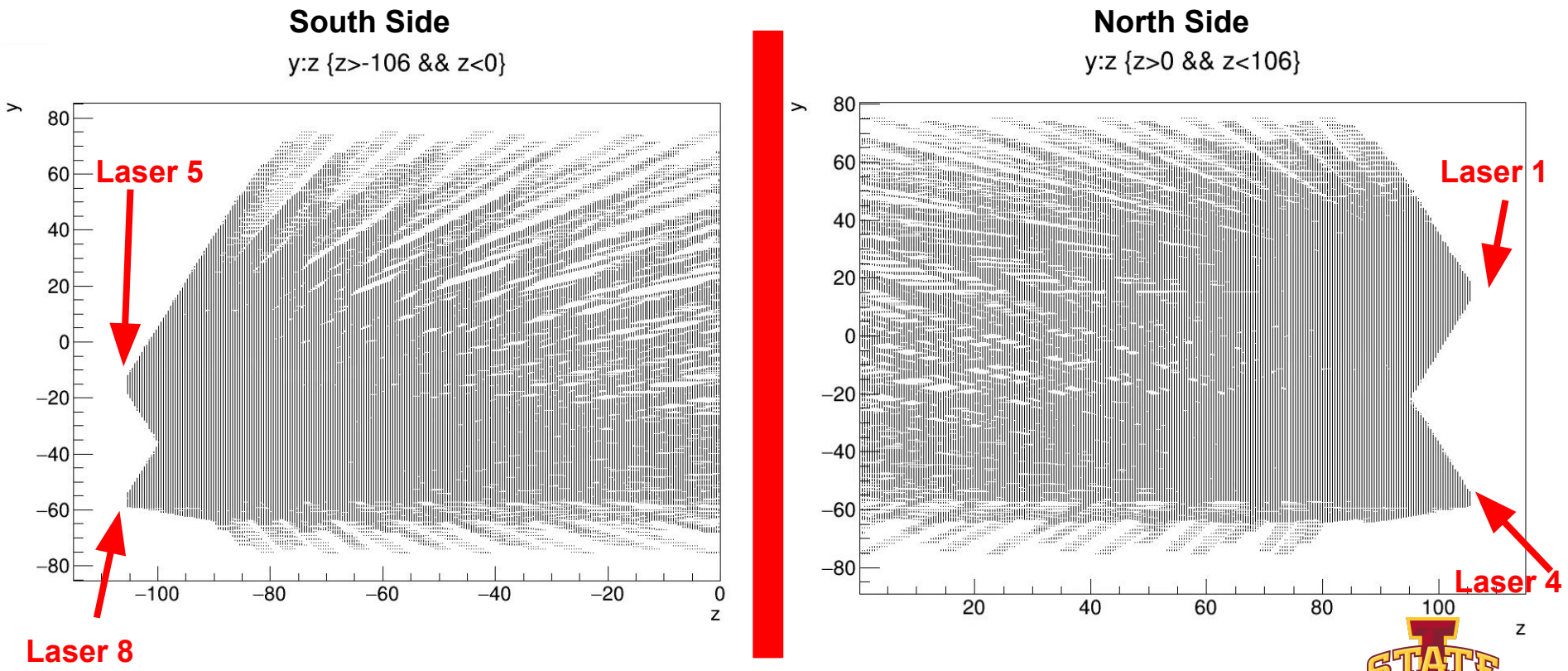


CLUSTERING PROBLEMS (WHY DOESN'T IT WORK?)

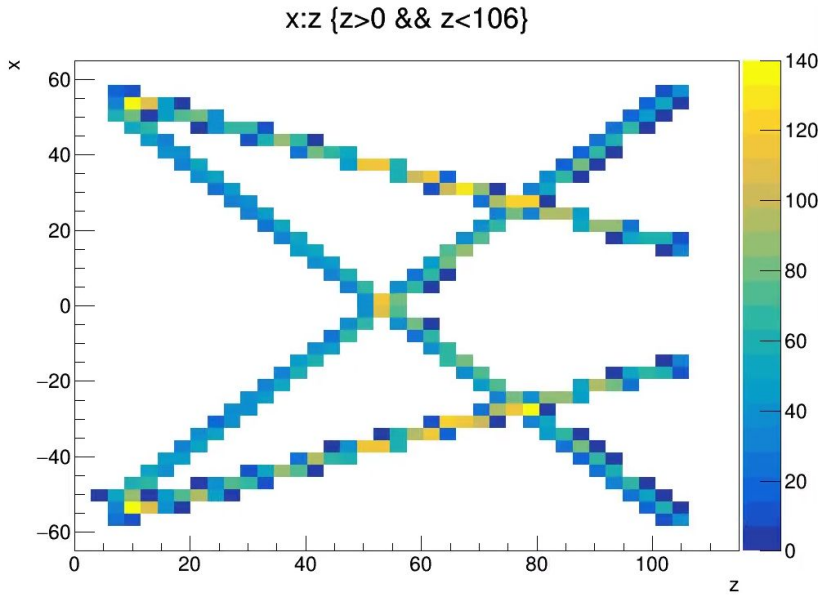
Progress Update

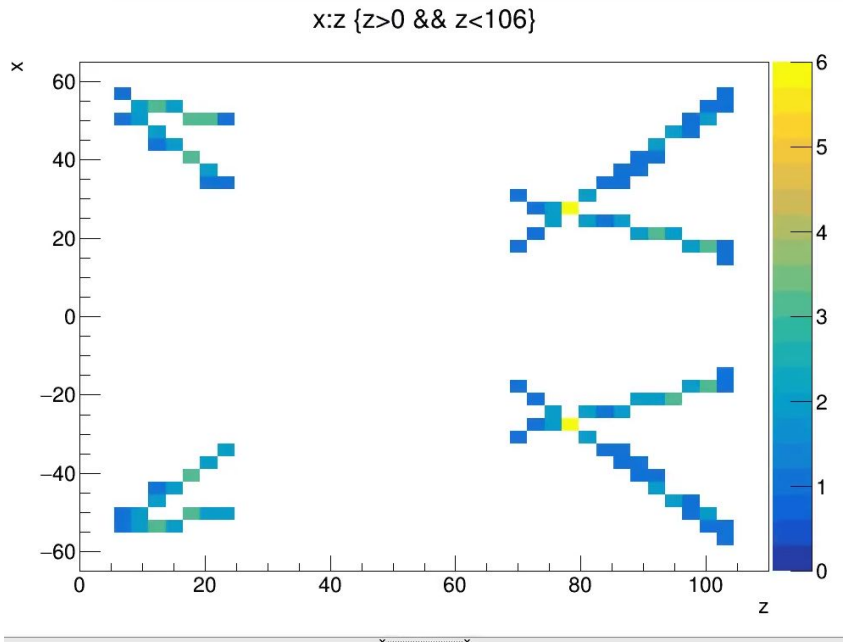
directLaser->SetArbitraryThetaPhi(
50*deg_to_rad,145*deg_to_rad);

NOISE = OFF

DISTORTION = OFF

ASSOC. HITS → **CLUSTERS**






```
exeeded  max zrange:  zrange 11.872 max zrange 10
```

Progress Update

How the laser association works:

1) Process the track

2) Read in the hit map

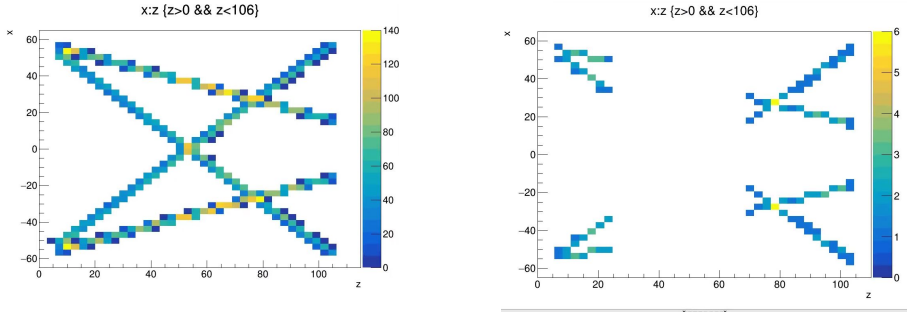
3) Loop over all the hits, loop over all the tracks
   a) Calculate DCA of hit to track
   b) If DCA < DCA_MAX keep hits

4) Bin the kept hits from 3b) by layer

5) Loop through hits from 4, make sure track passes completely through layers

6) Compare z_value of the track projection to all kept hits from 4)
   a) If z_trk - z_asssoc_hit < 10, cluster hits together

ASSOC. HITS → CLUSTERS




```
exeeded  max zrange:  zrange 11.872 max zrange 10
```

Progress Update

Conclusions/Takeaways

Relative Angles

- Not sure what do about finding maximum from histogram. In **Δφ**, one will always have 90 degree harmonics (even for individual origin points)

Optimum Laser Angles

- Worried about chicken and egg problem - hard to come up with optimum if not sure what laser setup will be (but laser crew might want ME to tell them what is a good setup)
- Luis building capability to determine optimum in fine-grained binning (many configurations)

Clustering

- Why is it going wrong? Not sure, tried relaxing z_range cut and didn't work

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