

# New Detector Qualification: 2021 HPS\_Run2021Pass1\_v3

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Recon/Analysis Meeting  
May 16, 2023

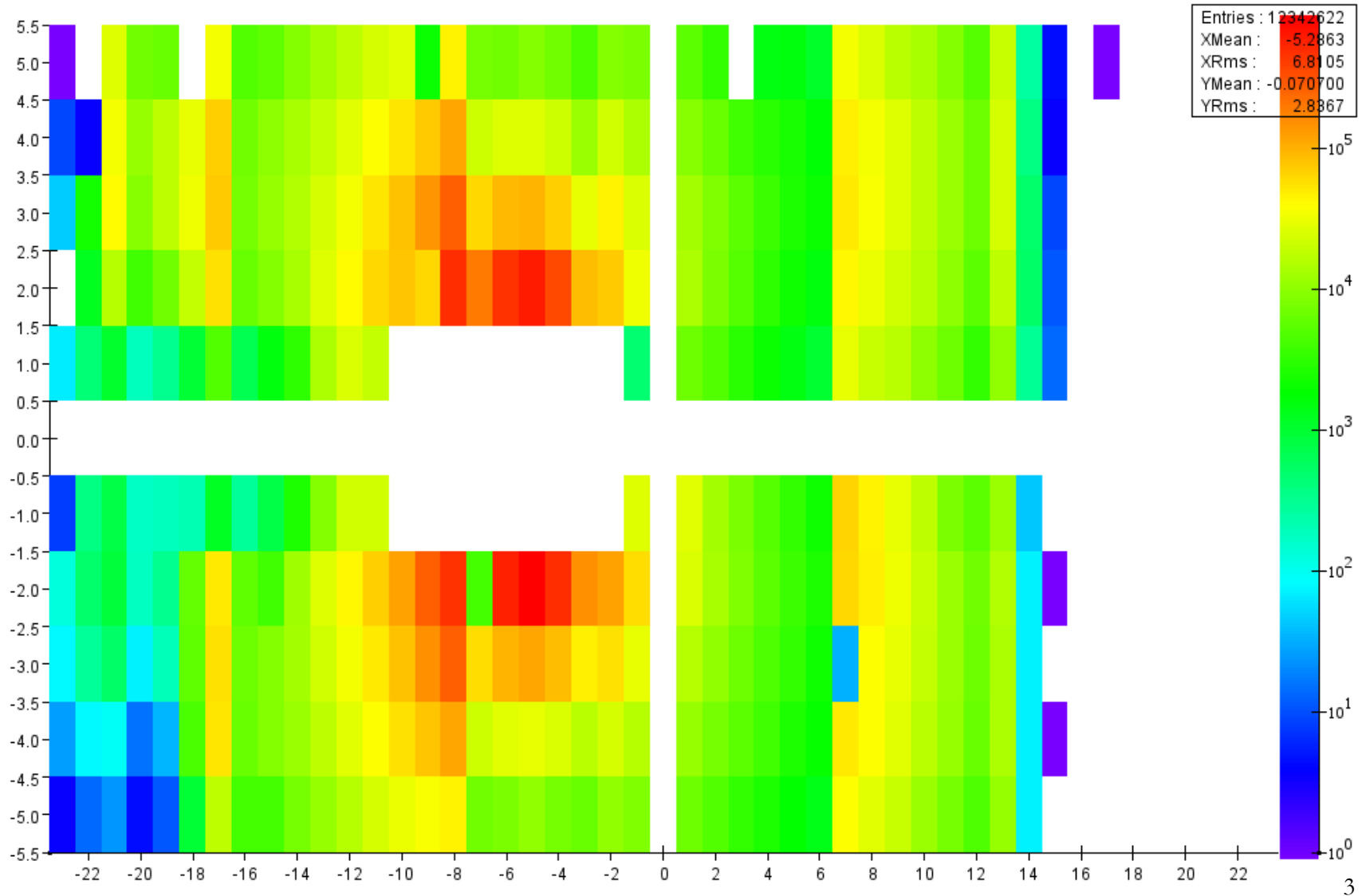
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# Characterizing A New Detector

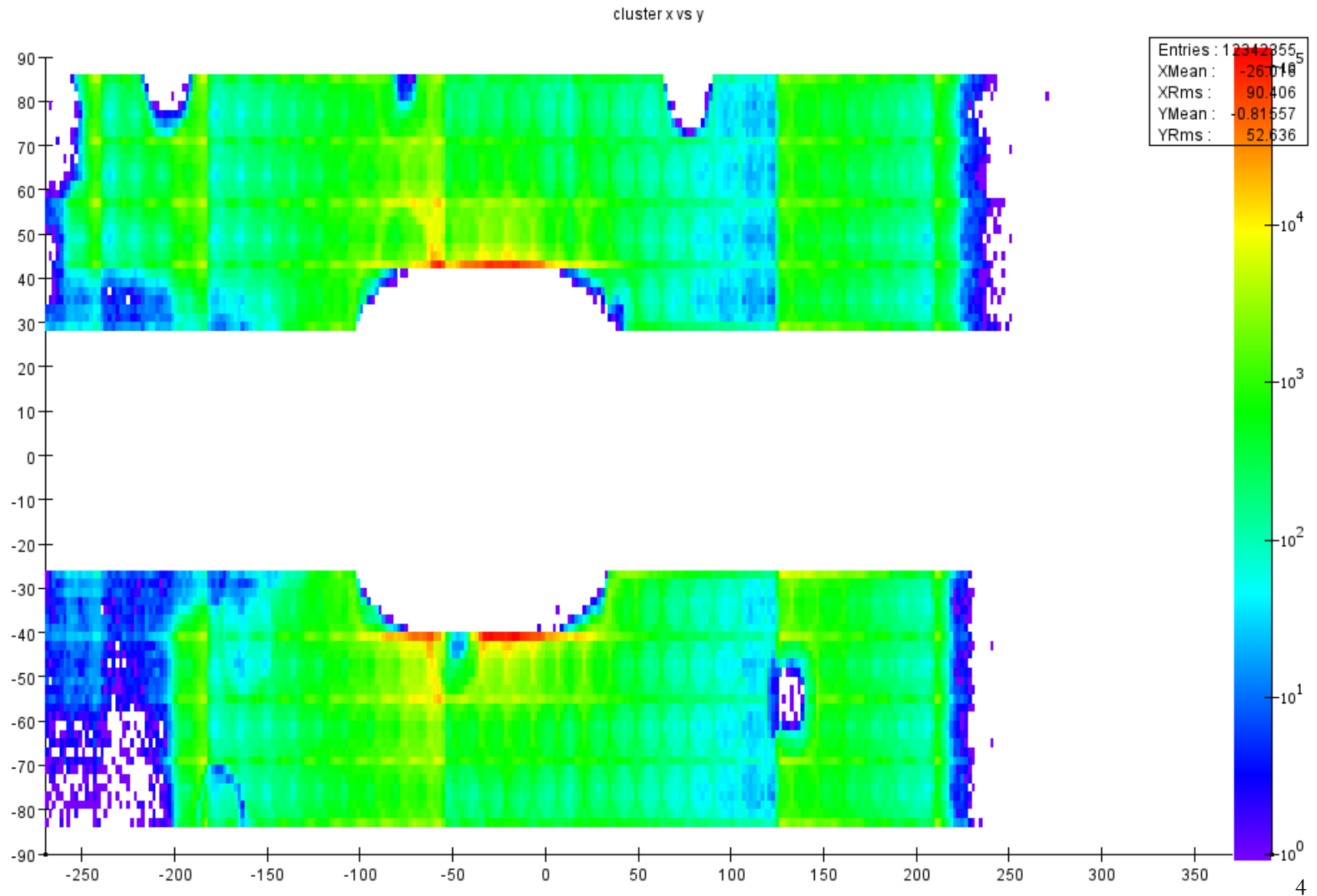
- Characterize the detector performance for a new iteration of the 2021 detector
  - HPS\_Run2021Pass1\_v3
- Use FEE trigger skims from runs
  - 014615
  - 014621
  - 014685
  - 014688

# Cluster IX vs IY

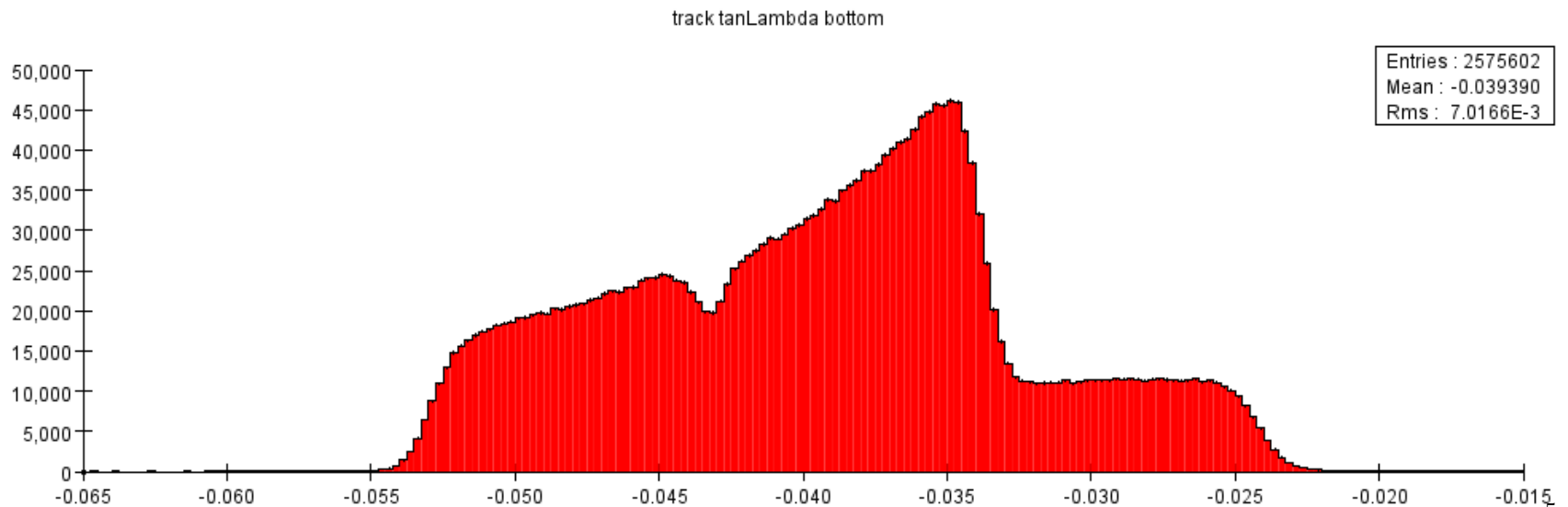
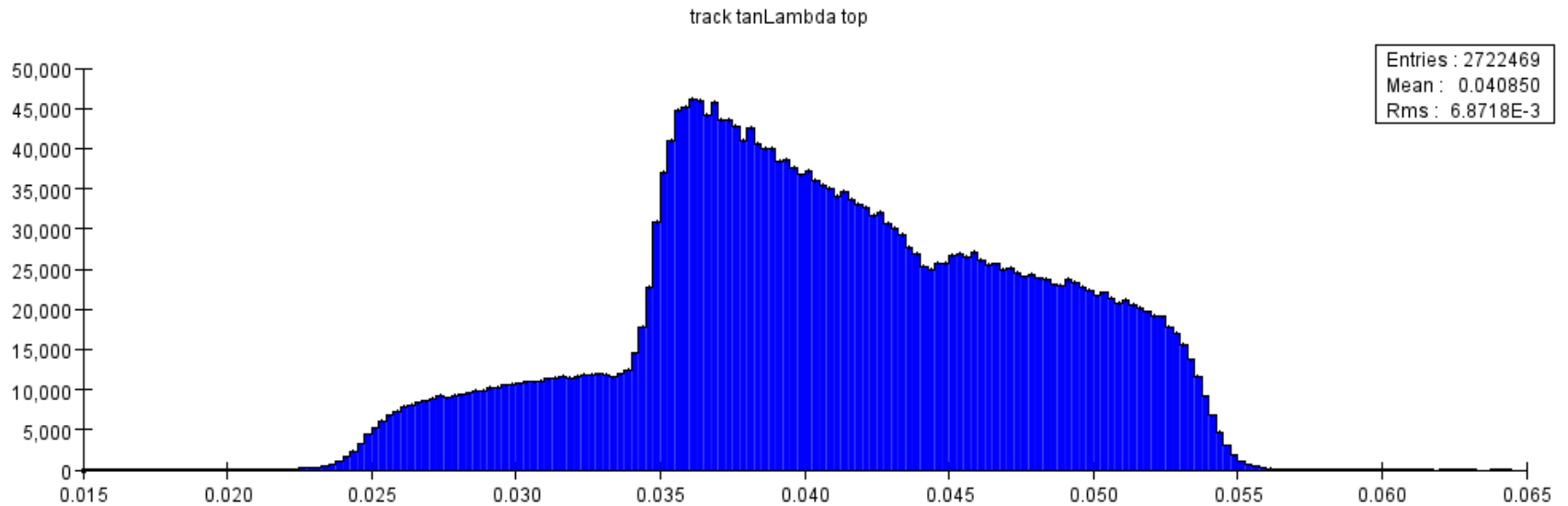
cluster ix vs iy



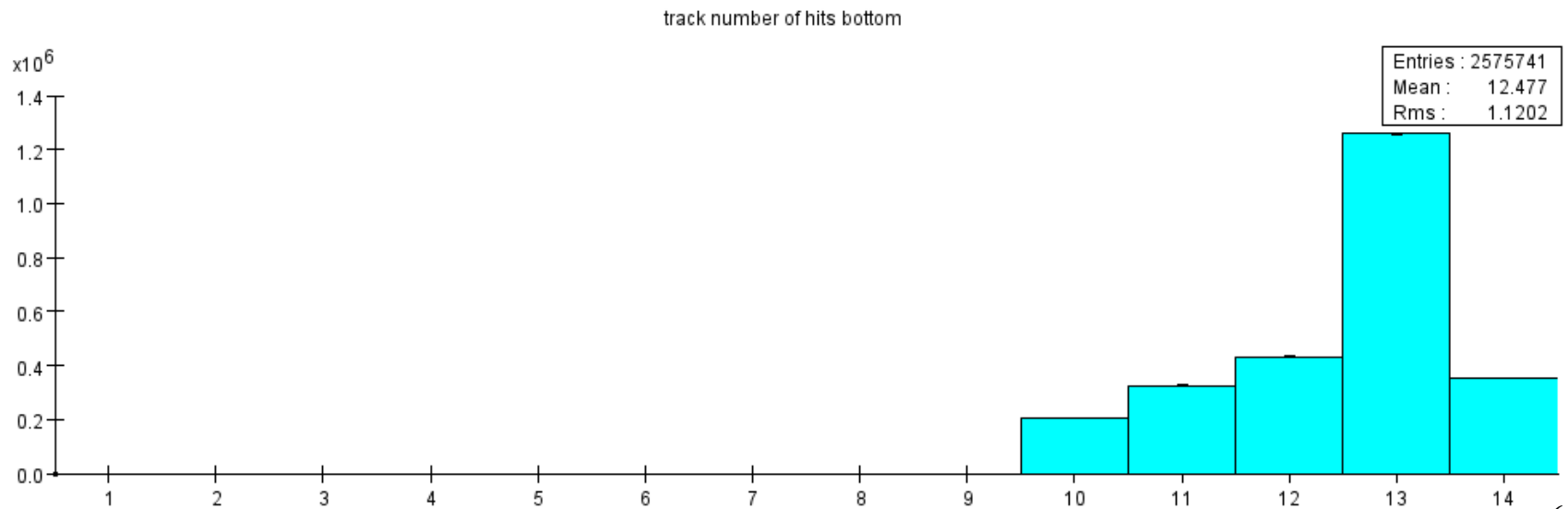
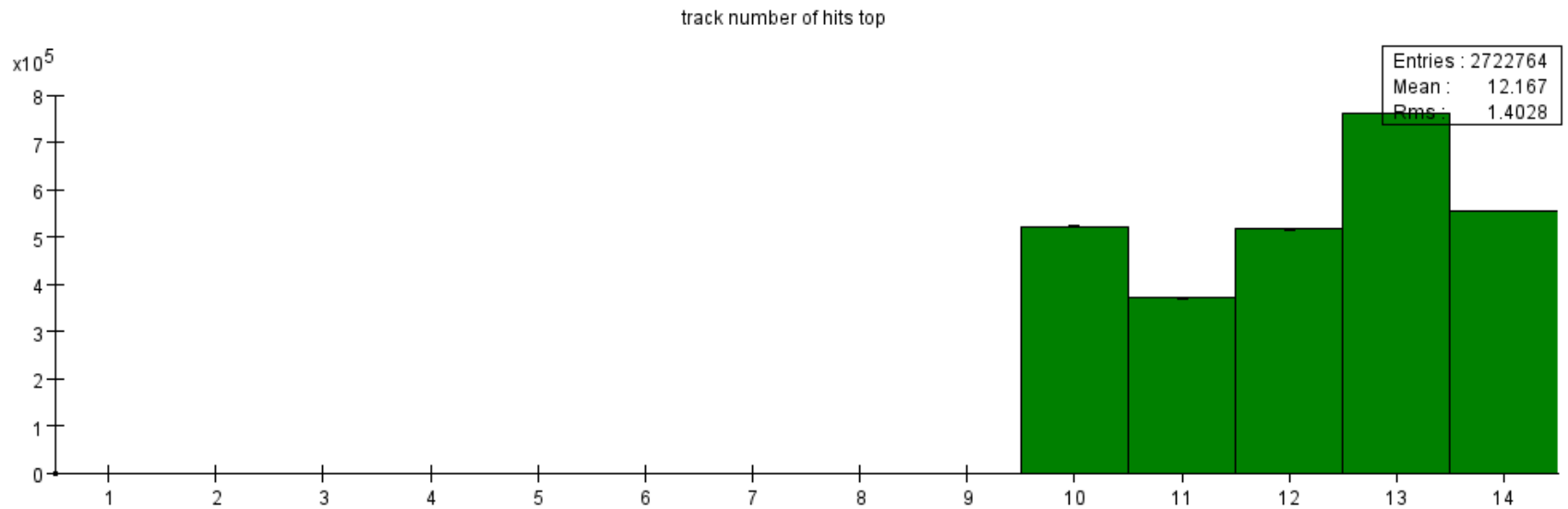
# Cluster X vs Y



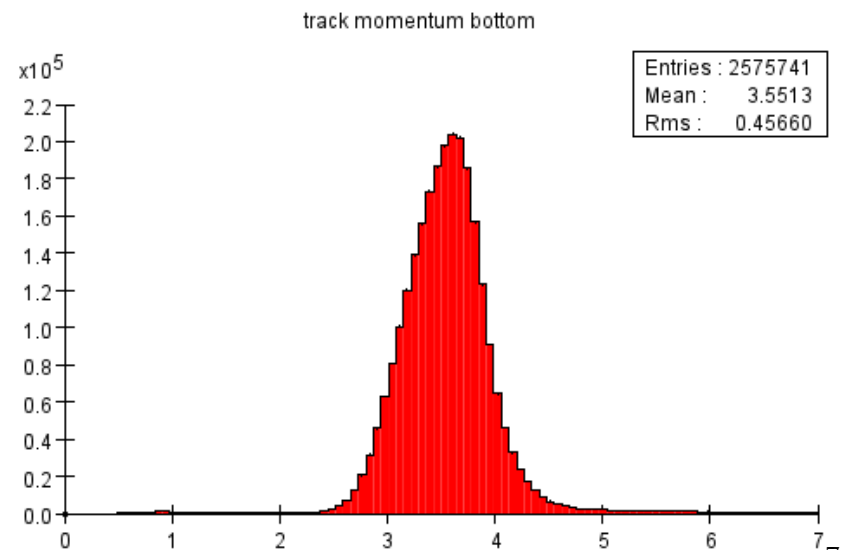
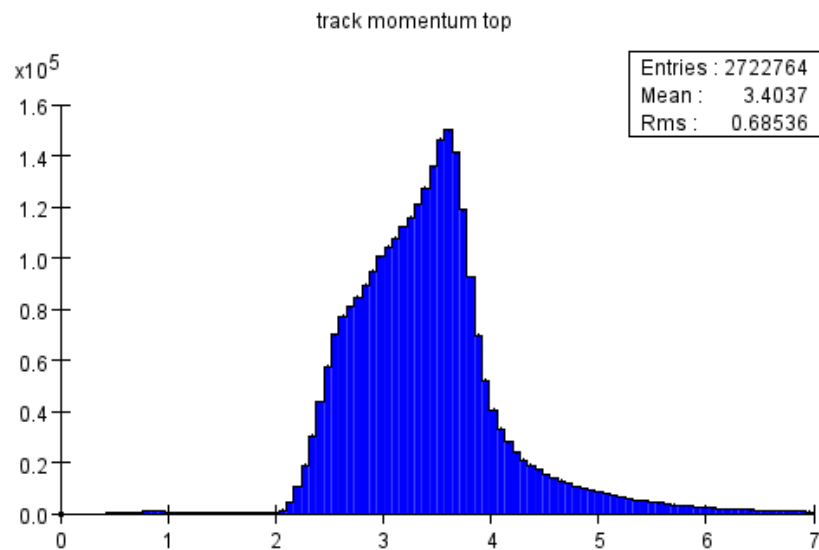
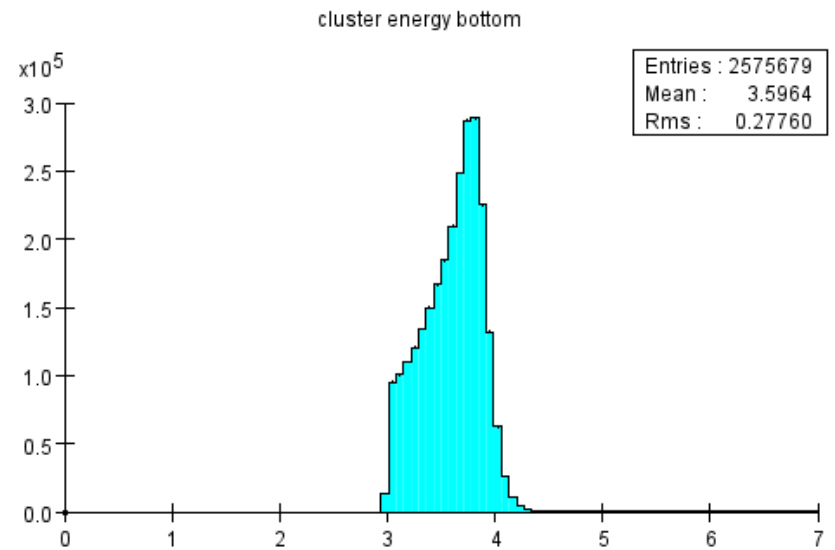
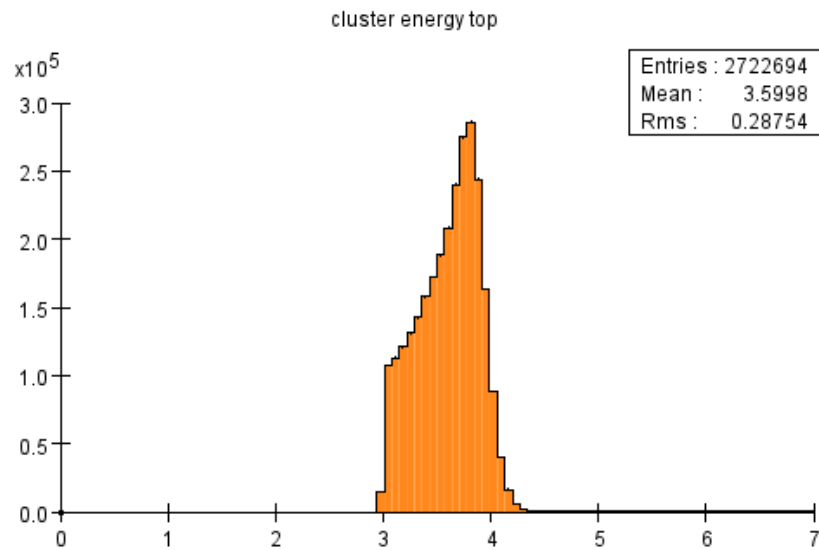
# Track tanLambda



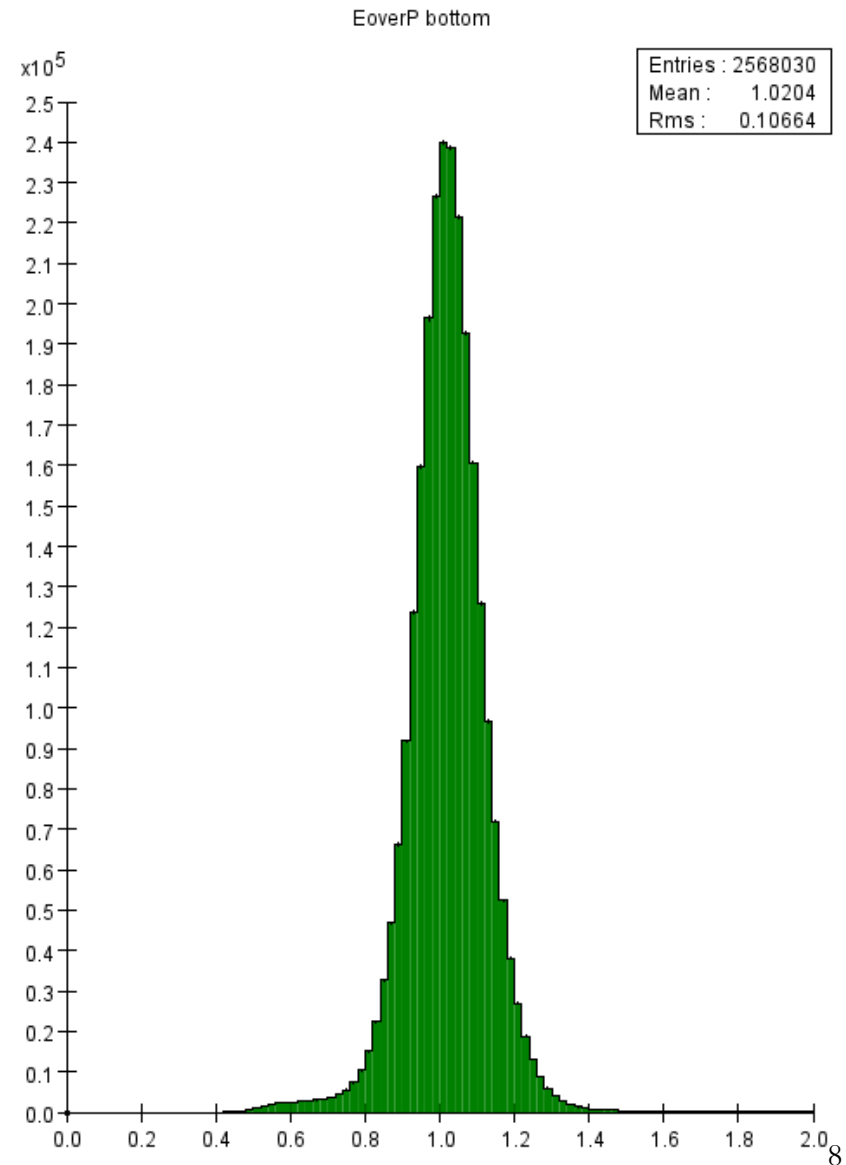
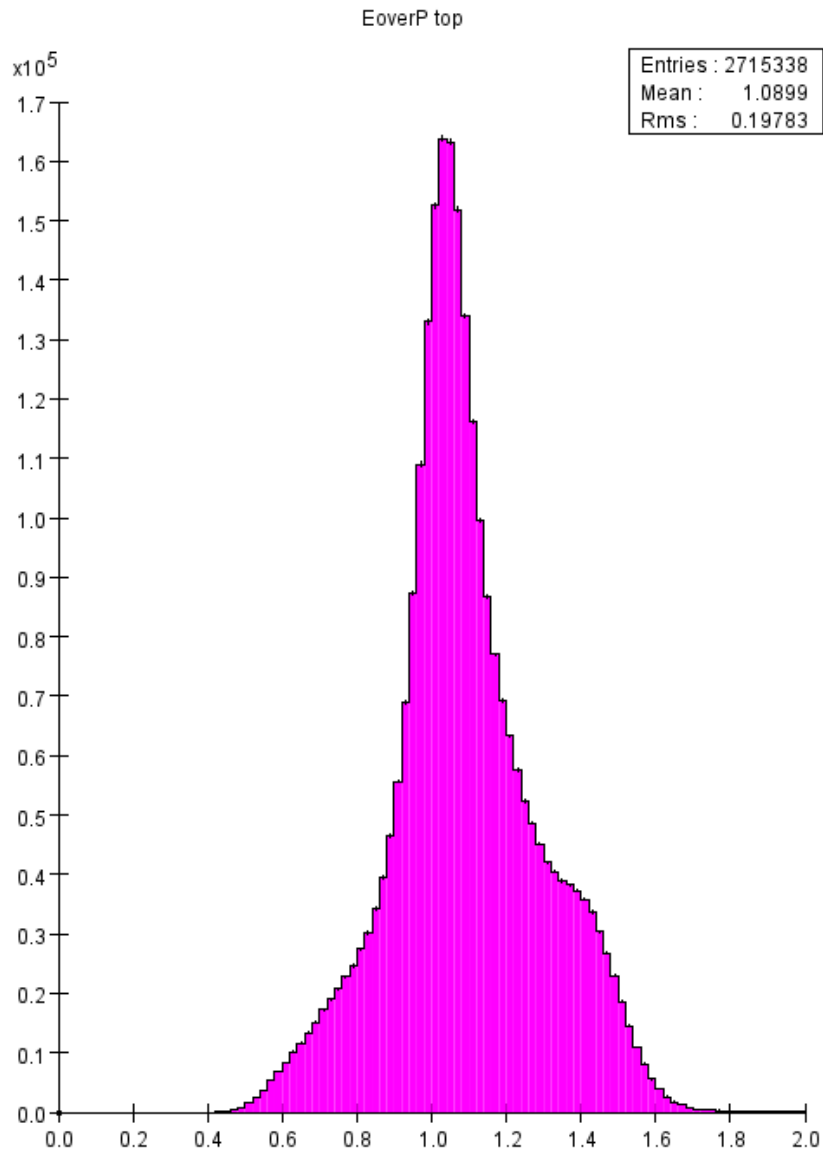
# Track Nhits



# FEE Fiducial Cluster E, Track p



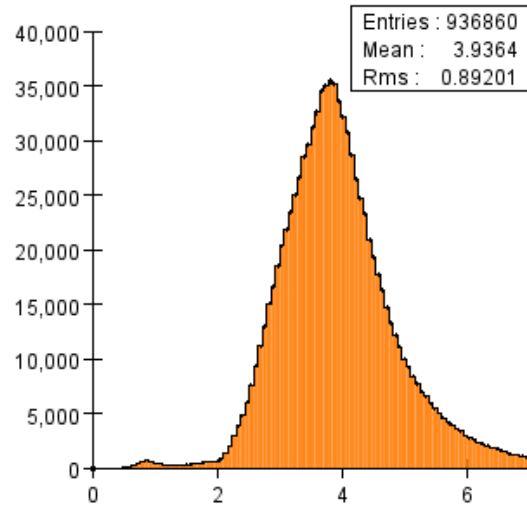
# Fiducial Track E/p



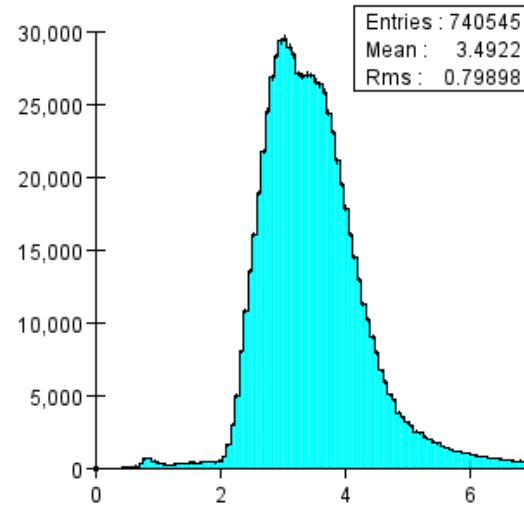


# Track Momentum Nhits Top

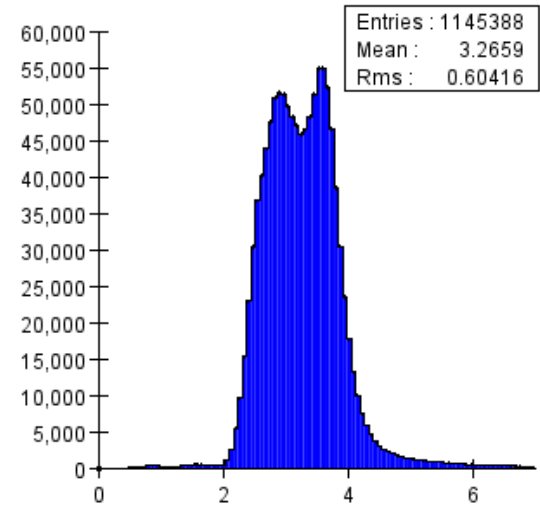
track momentum top 10 hits



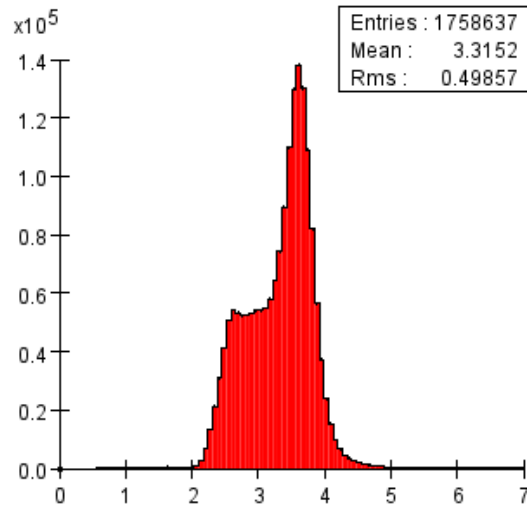
track momentum top 11 hits



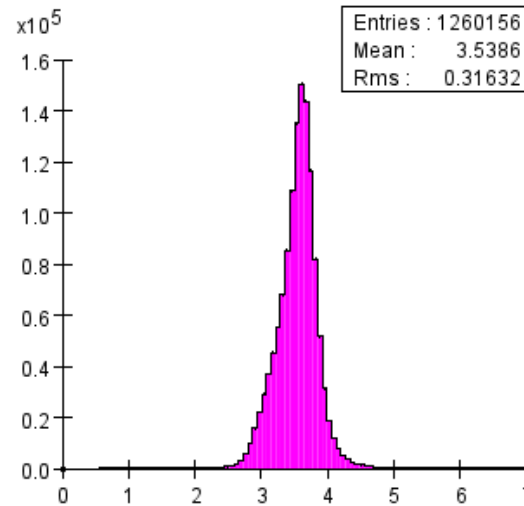
track momentum top 12 hits



track momentum top 13 hits

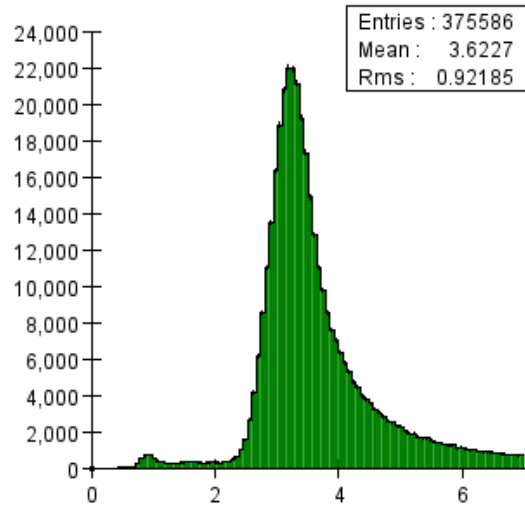


track momentum top 14 hits

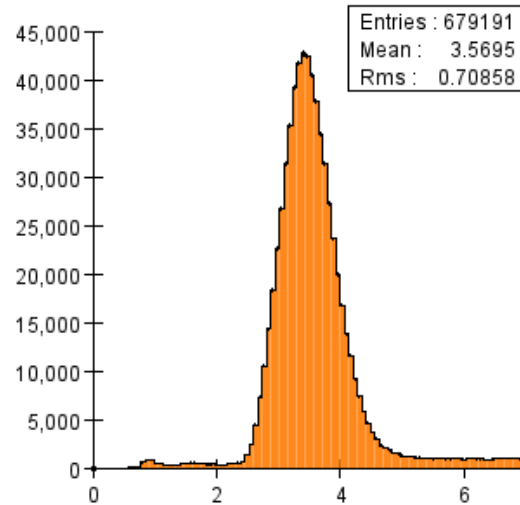


# Track Momentum Nhits Bottom

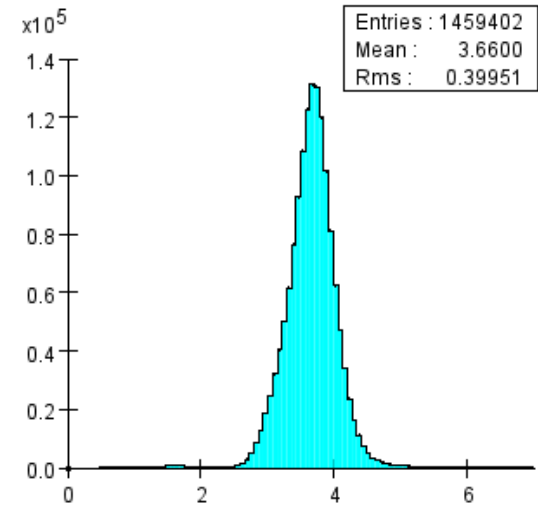
track momentum bottom 10 hits



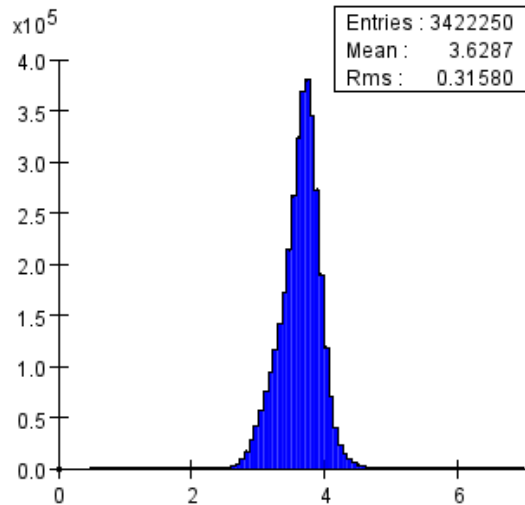
track momentum bottom 11 hits



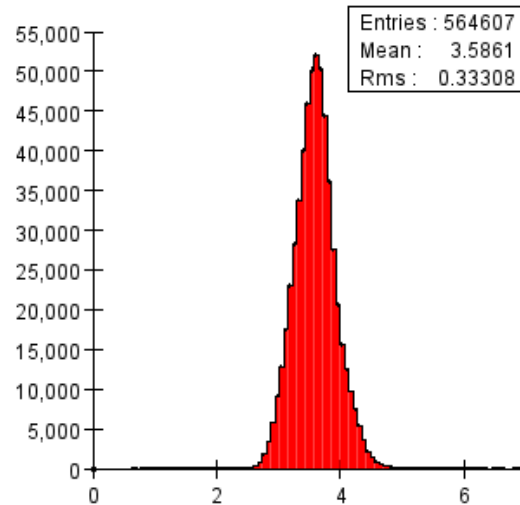
track momentum bottom 12 hits



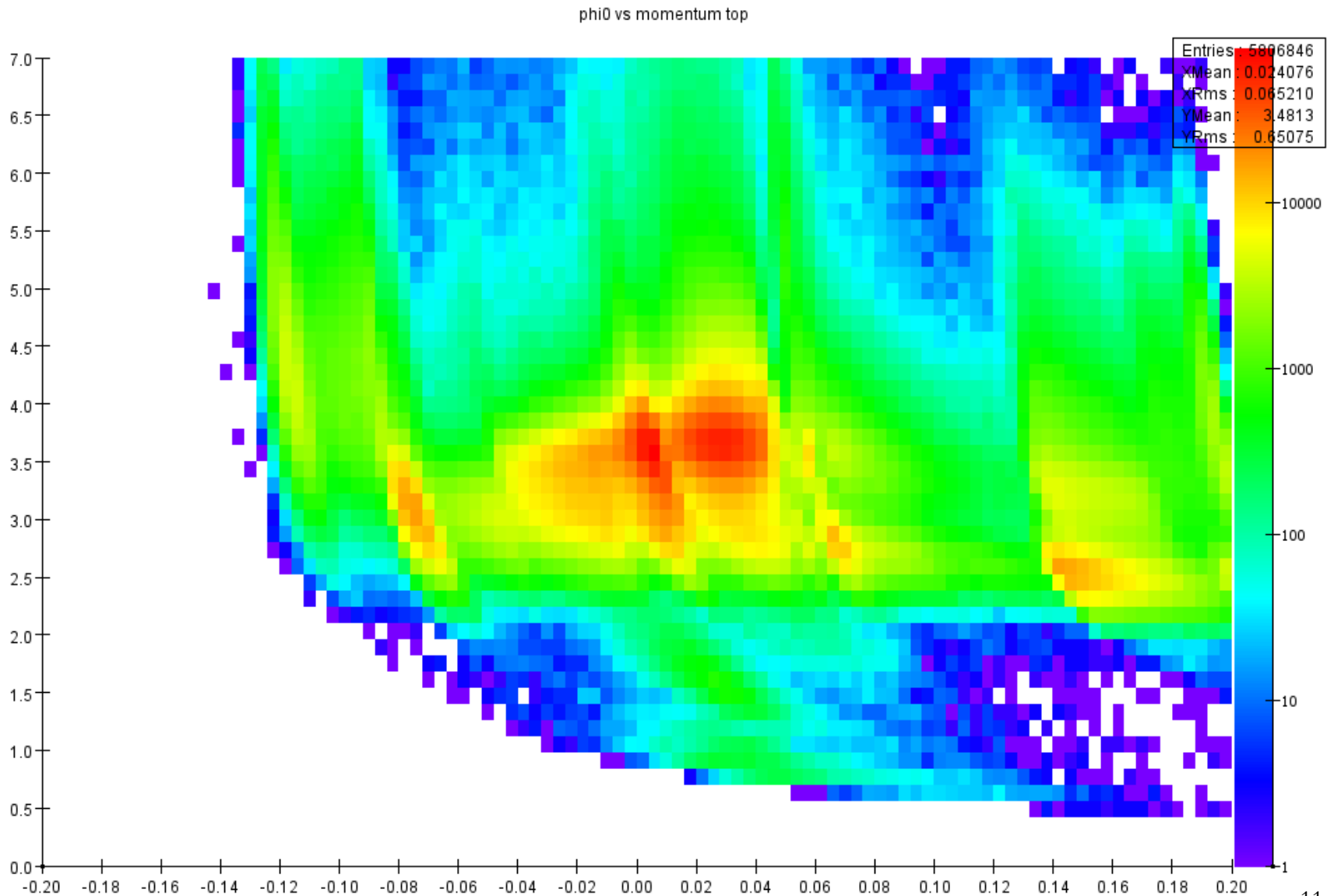
track momentum bottom 13 hits



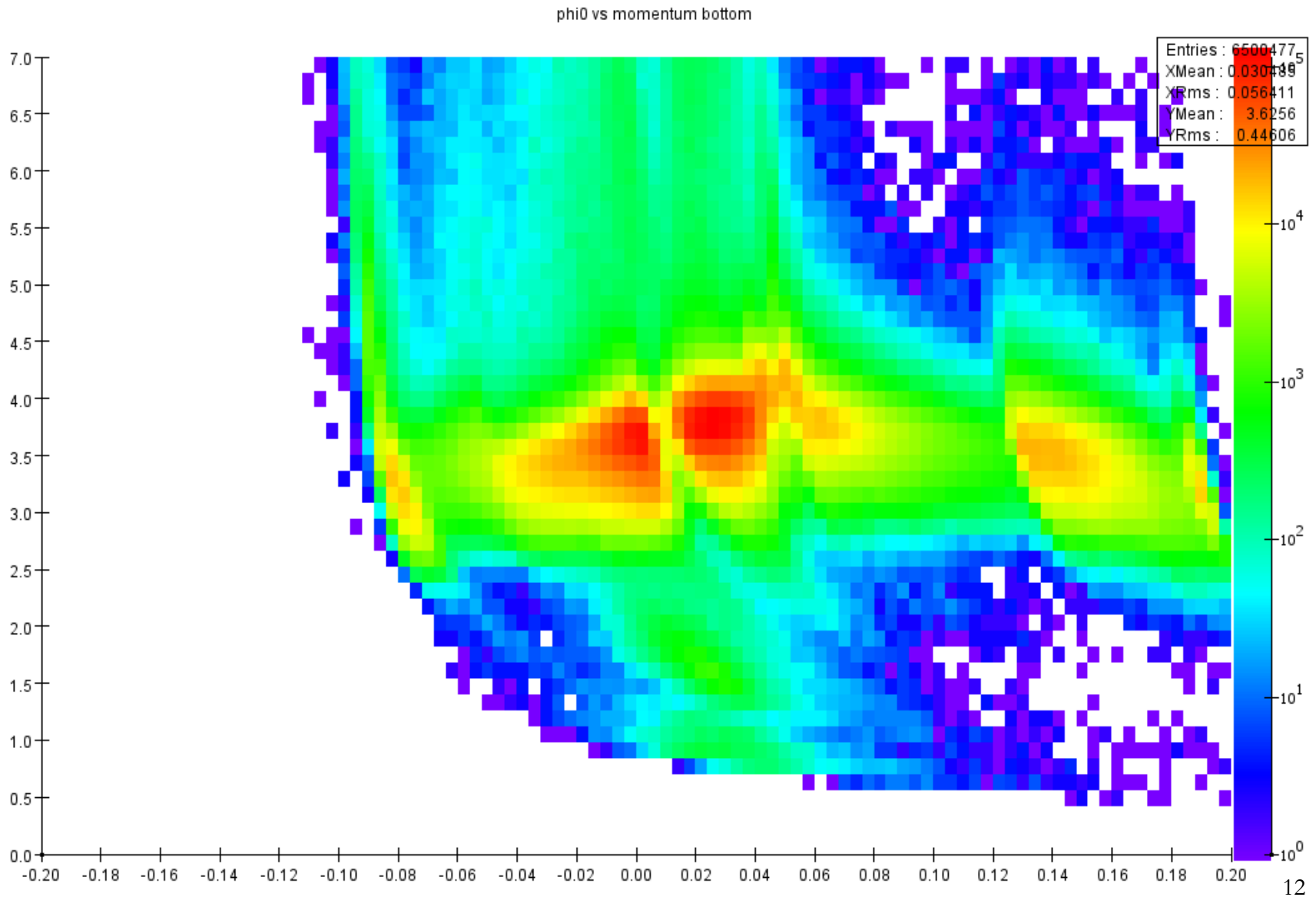
track momentum bottom 14 hits



# Track $\phi_0$ vs momentum top

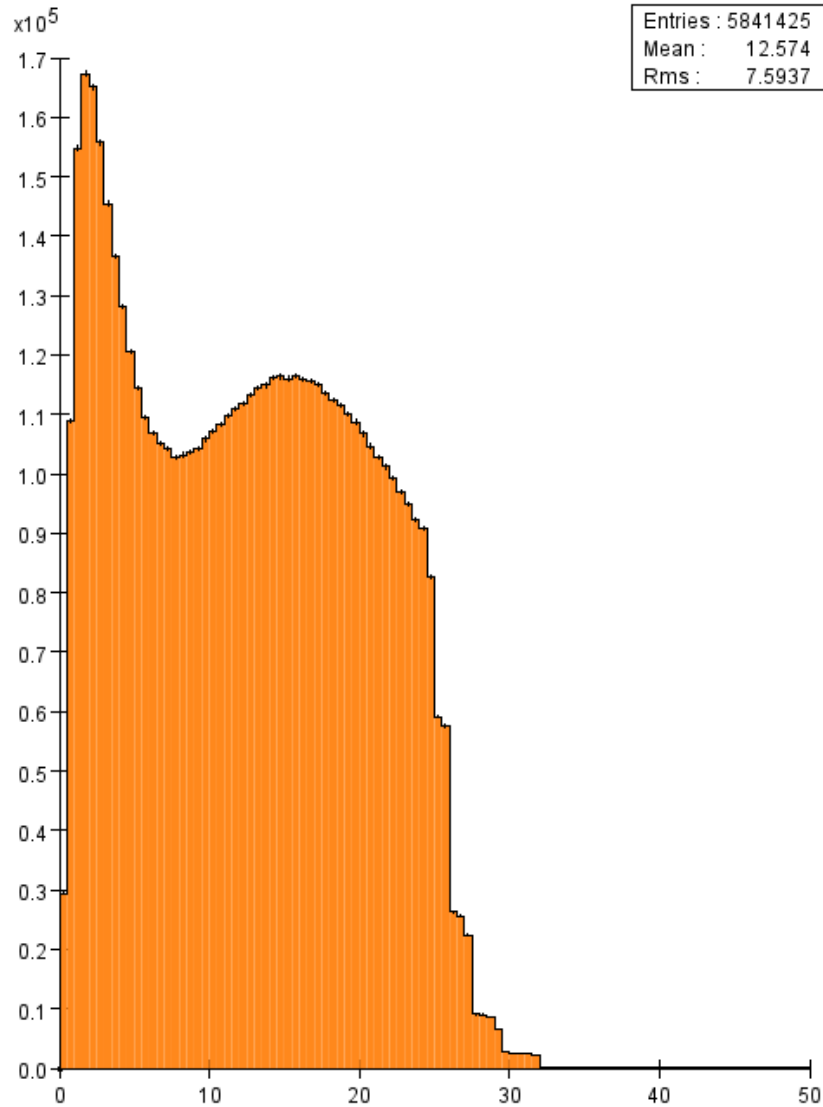


# Track $\phi_0$ vs momentum bottom

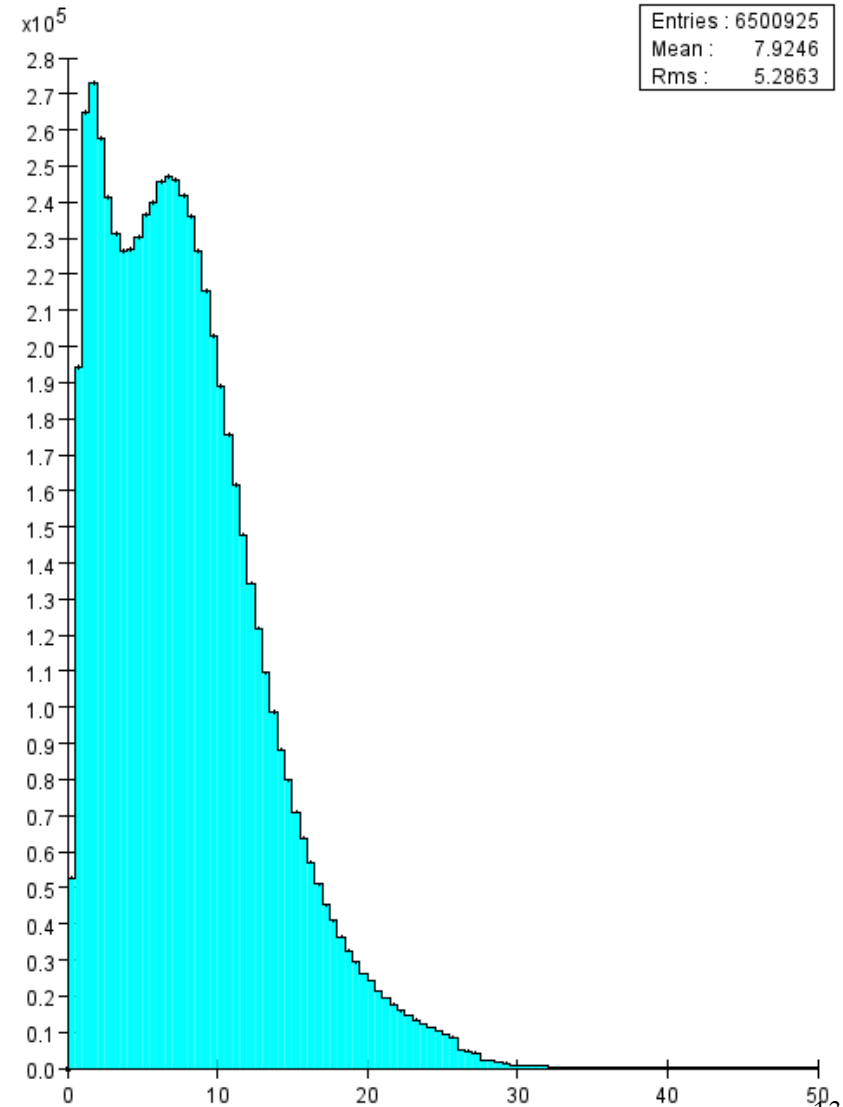


# Track Chi-Squared

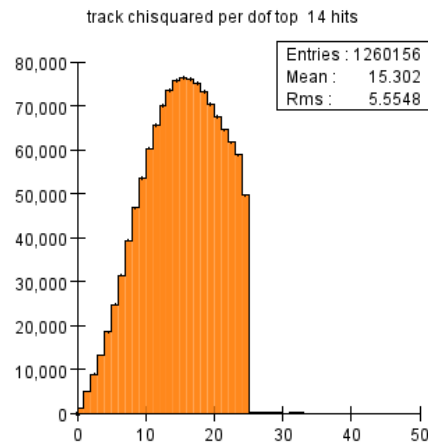
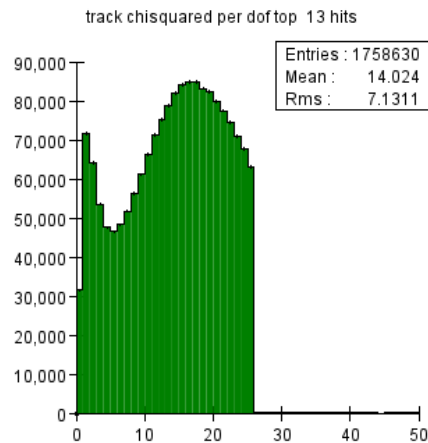
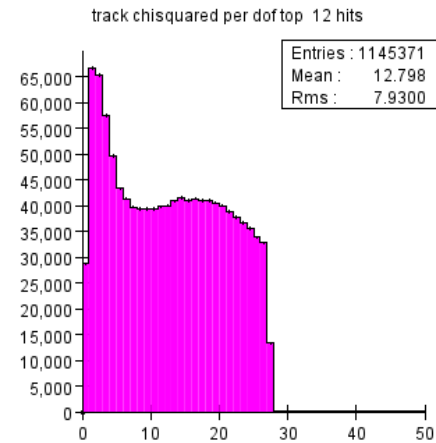
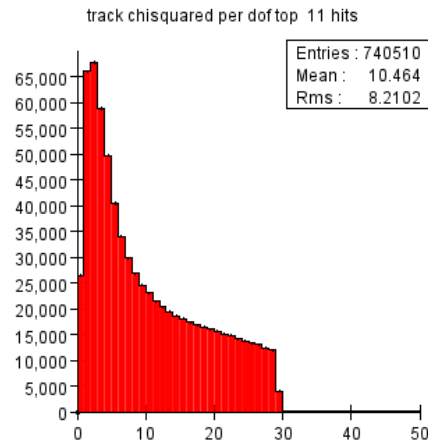
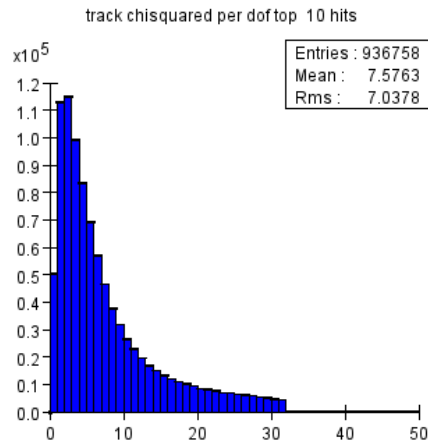
track chisquared per dof top



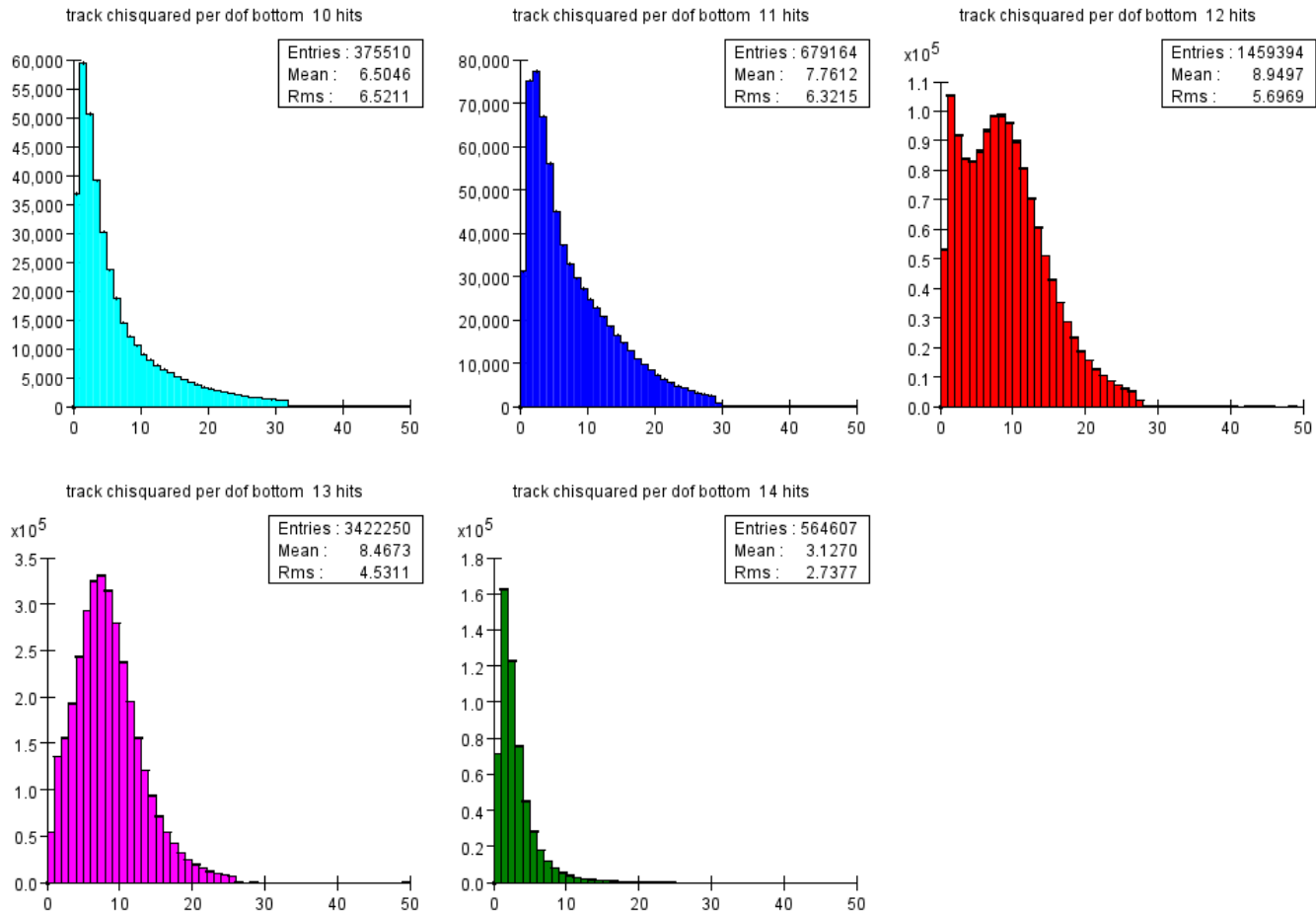
track chisquared per dof bottom



# Track Chi-Squared by Nhits Top

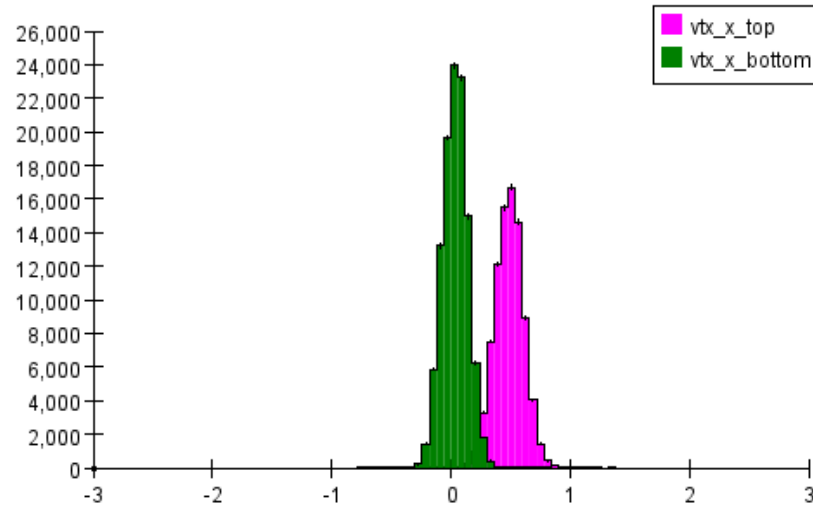


# Track Chi-Squared by Nhits Bottom

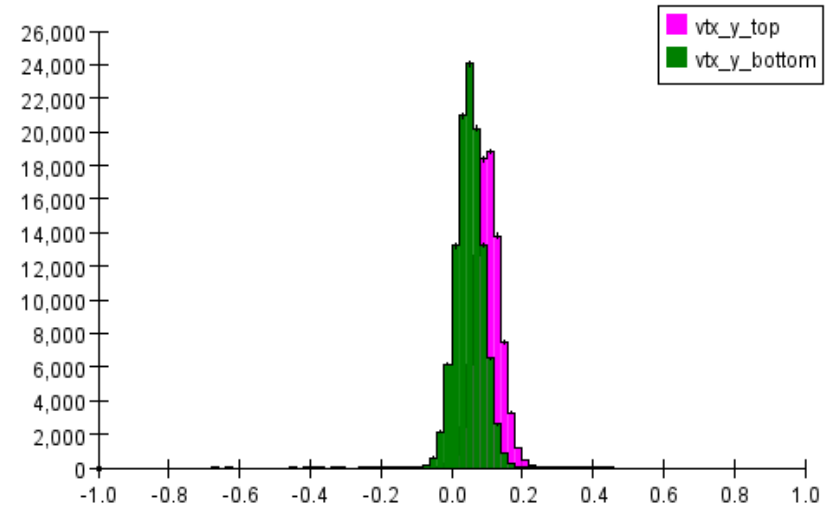


# IP Position (multi-event vertex)

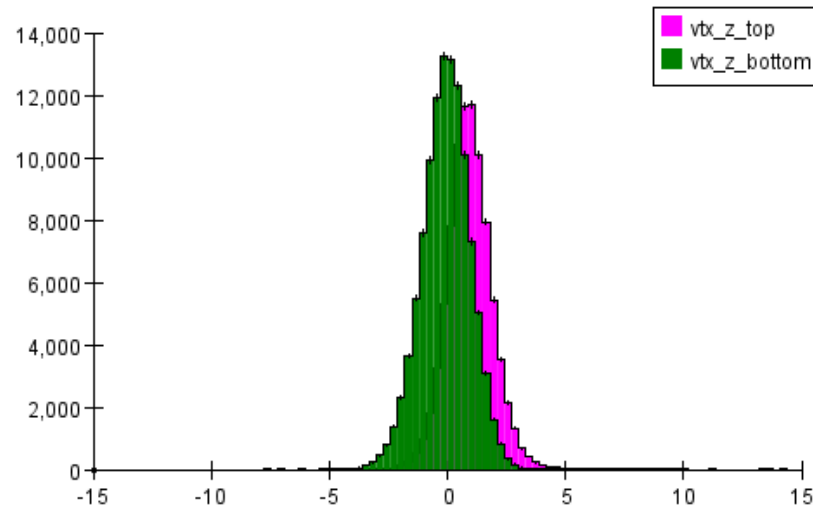
feeTriggerSkims\_HPS\_Run2021Pass1\_v3\_analysis.aida - 2021 3.74Gev - HPS\_R...



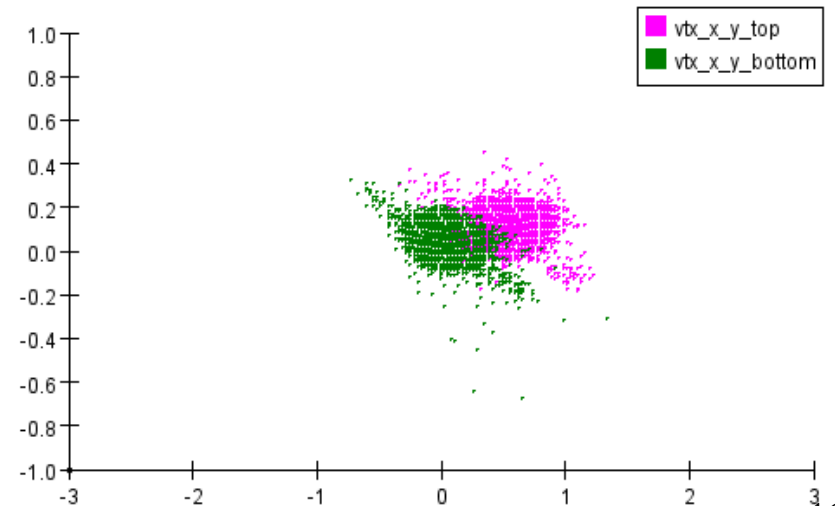
feeTriggerSkims\_HPS\_Run2021Pass1\_v3\_analysis.aida - 2021 3.74Gev - HPS\_R...



feeTriggerSkims\_HPS\_Run2021Pass1\_v3\_analysis.aida - 2021 3.74Gev - HPS\_R...

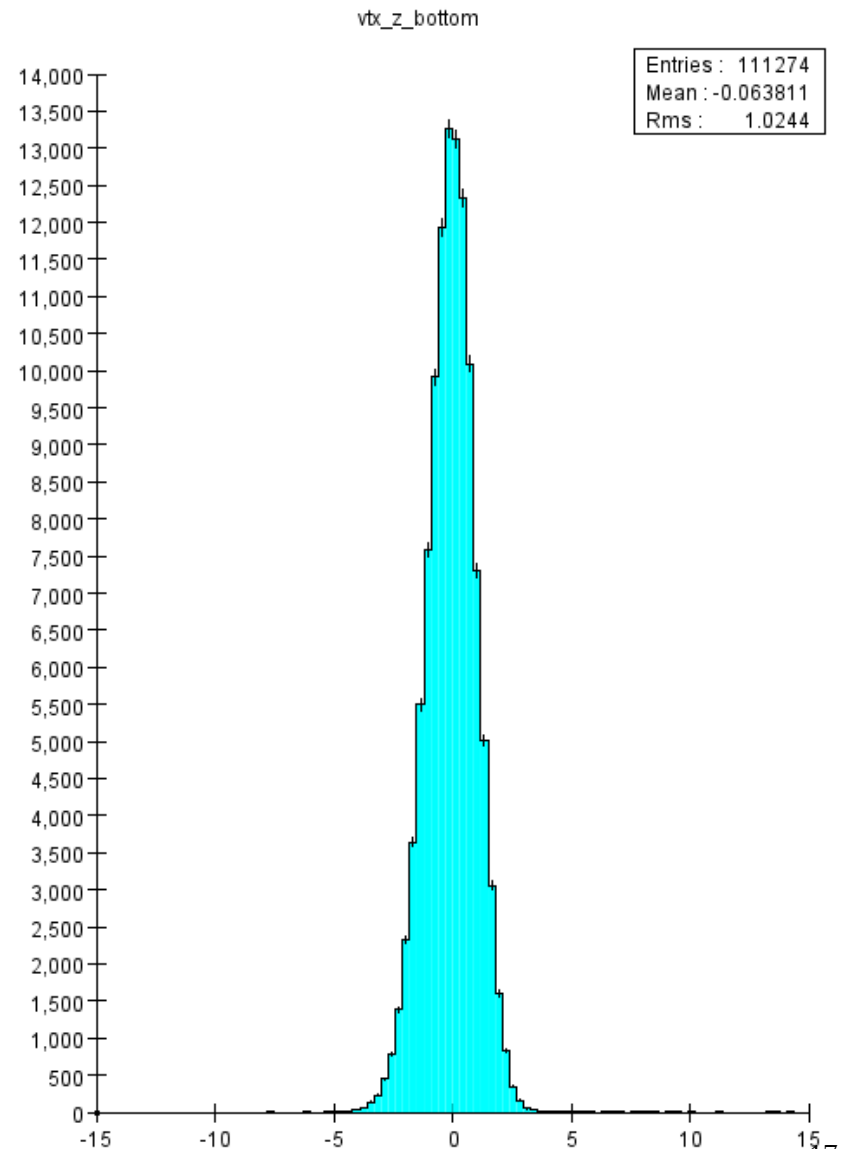
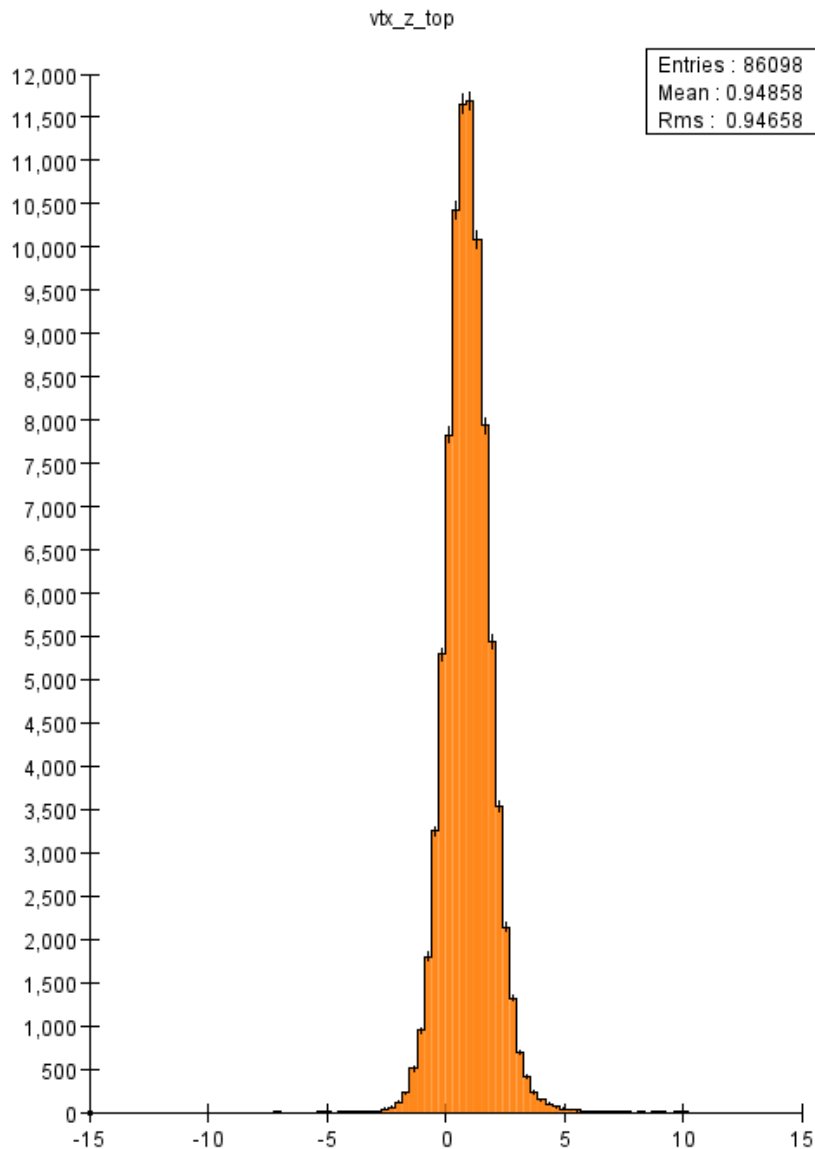


feeTriggerSkims\_HPS\_Run2021Pass1\_v3\_analysis.aida - 2021 3.74Gev - HPS\_R...

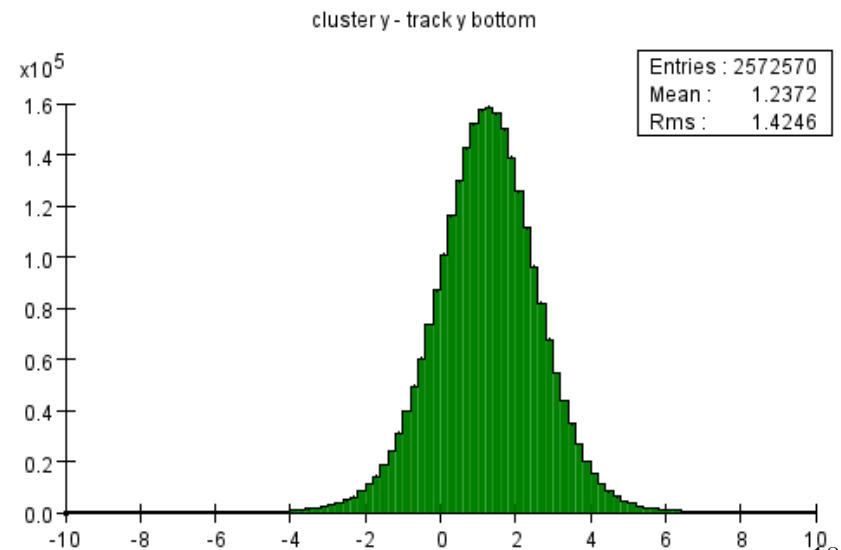
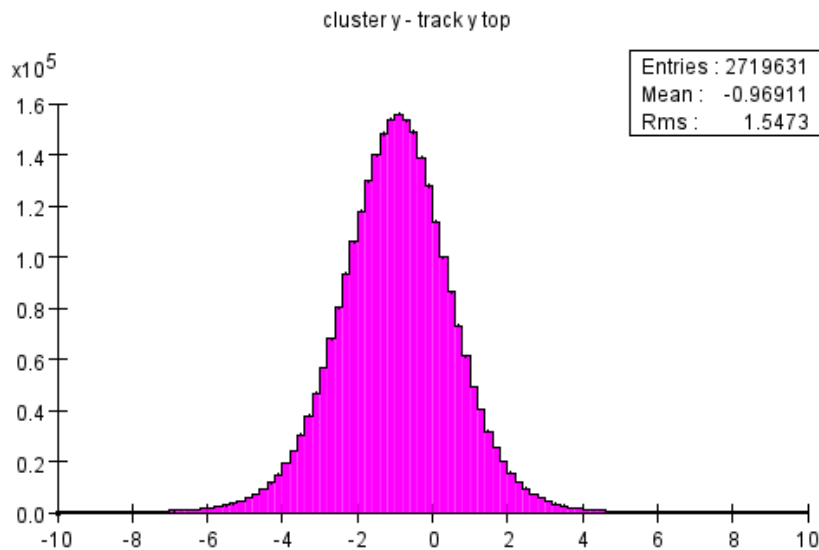
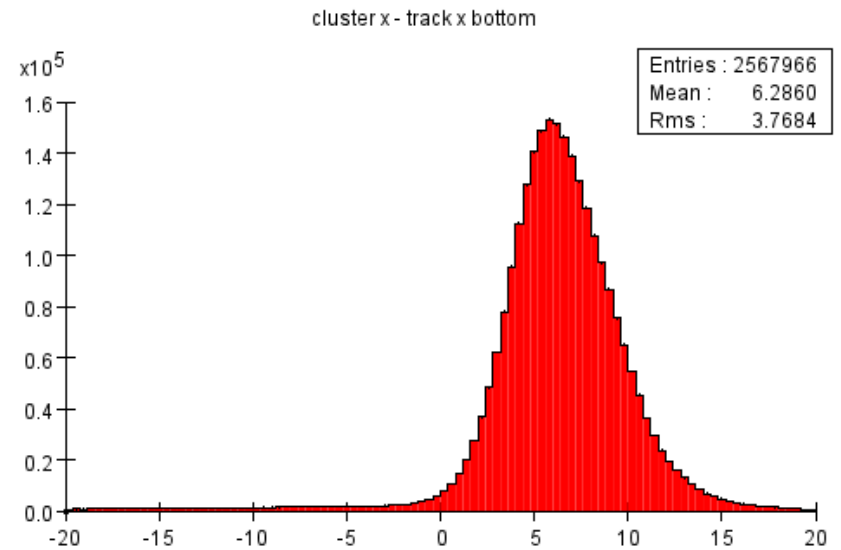
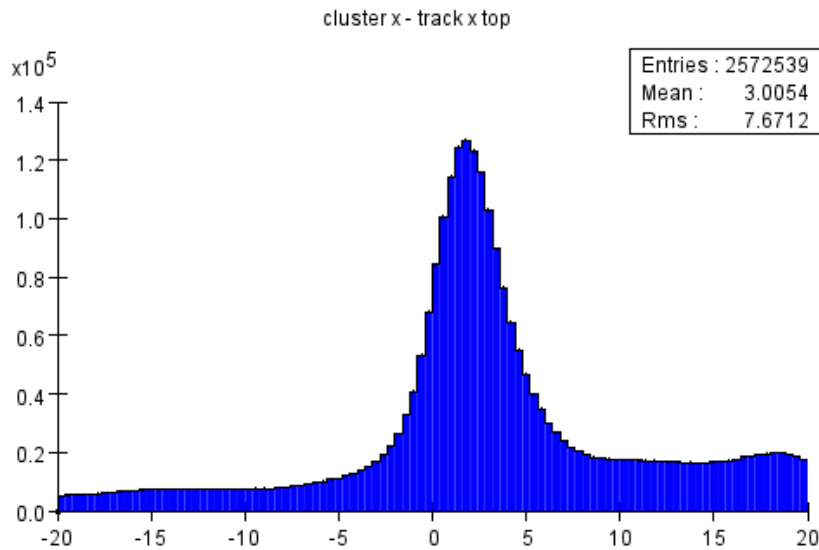




# IP Z Position (multi-event vertex)

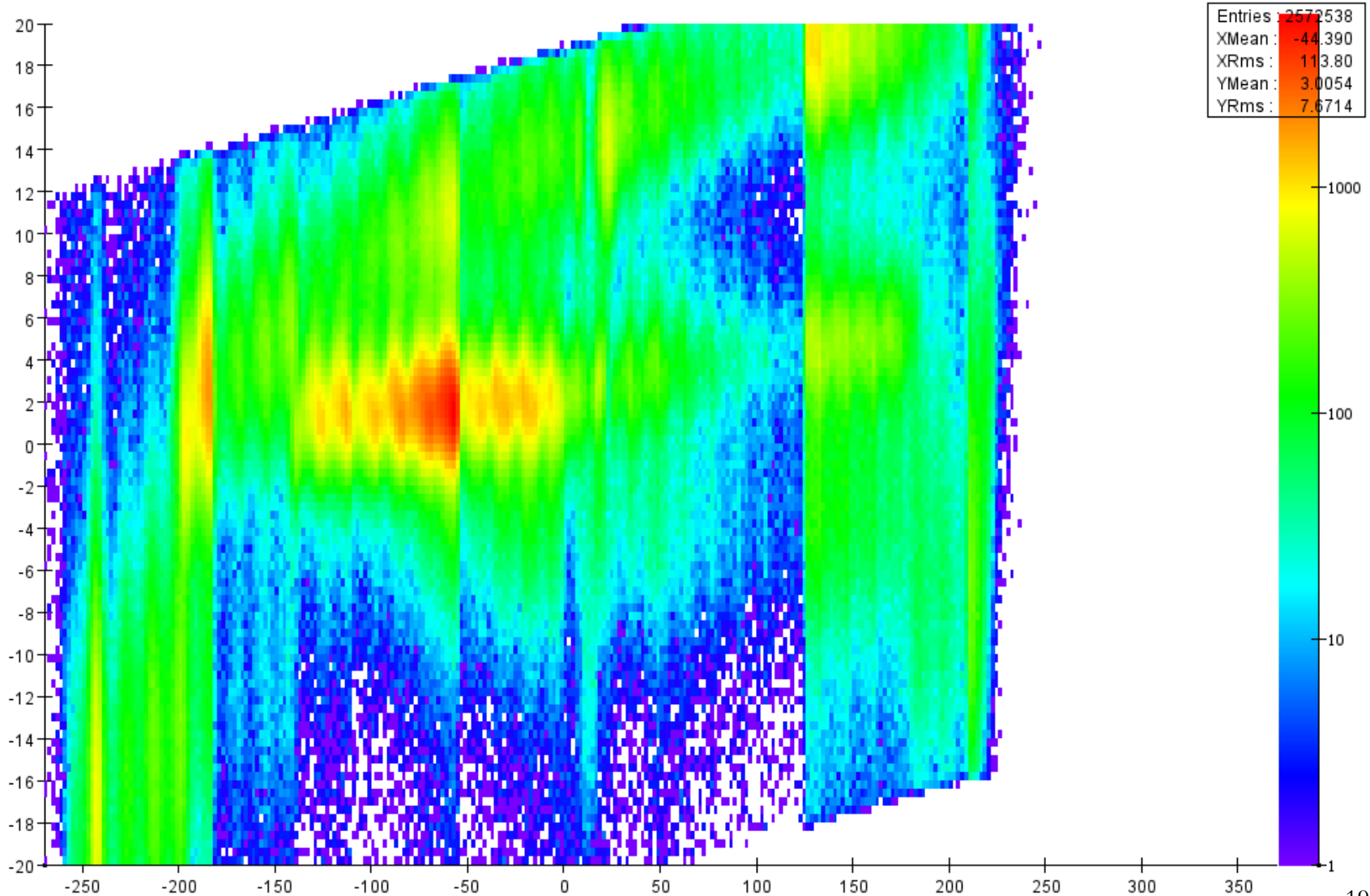


# Check other end of track (fiducial)



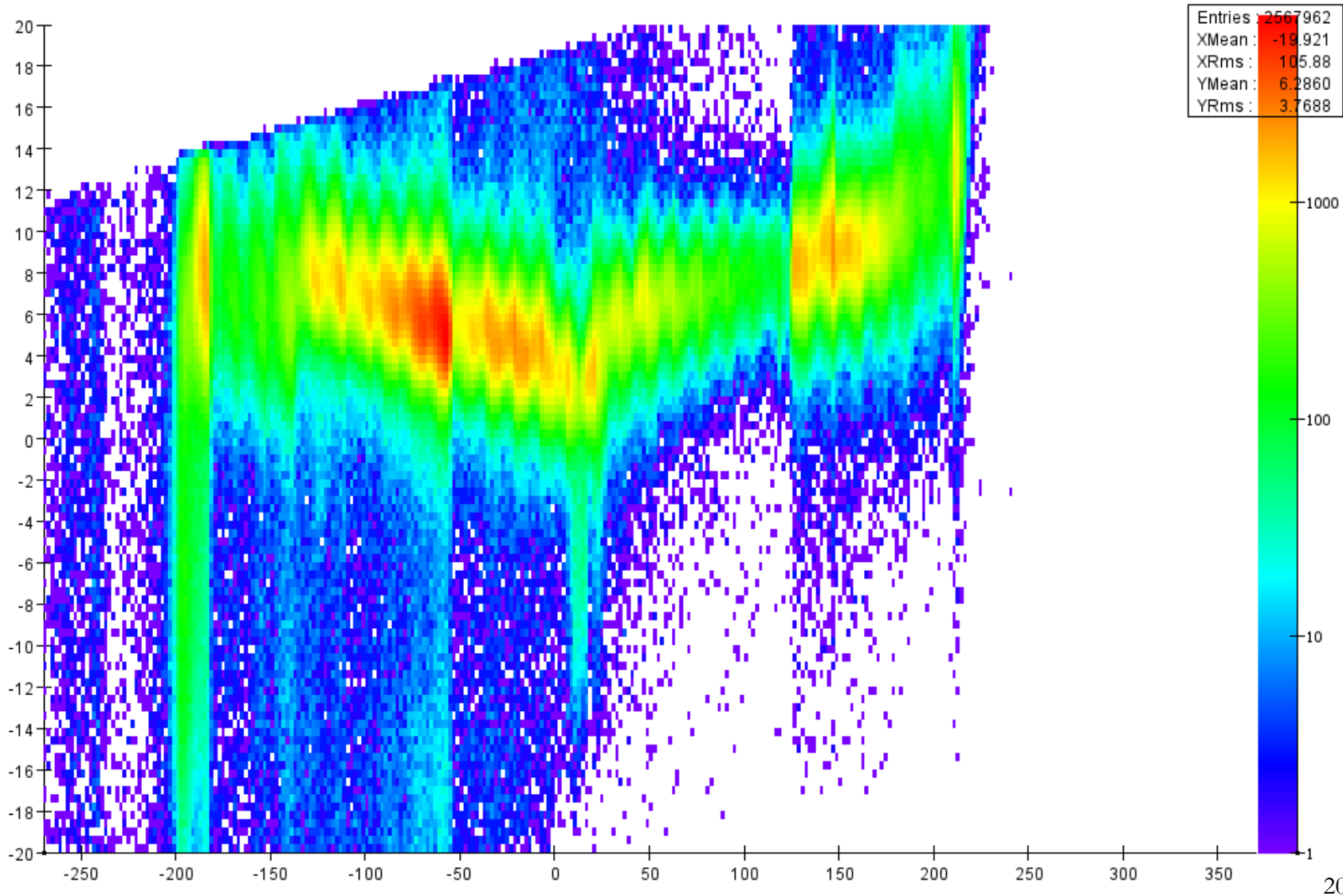
# Track X – Cluster X vs X top (fiducial)

cluster x - track x vs cluster x top



# Track X – Cluster X vs X bottom (fid)

cluster x - track x vs cluster x bottom



# Summary

- A number of issues remain with the calibration of the 2021 detector HPS\_Run2021Pass1\_v3
- Momentum bifurcation remains in top
- Track chi-squared shows evidence for severe internal tension, primarily in top
- Global alignment of top and bottom shows evidence for yaw and pitch in positions of multivertex IPs
- Large deviations seen in track-cluster match
  - >2cm in the top
  - structure in bottom shows strong slot/hole difference

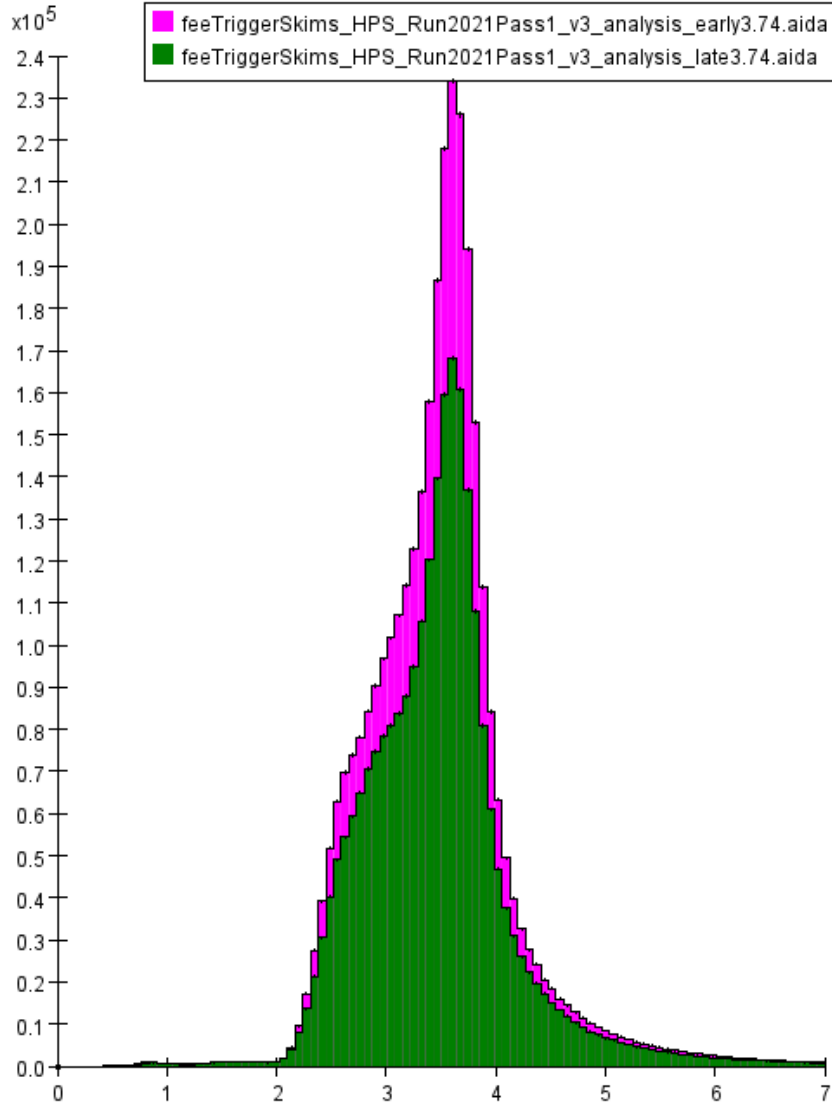
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# Addendum

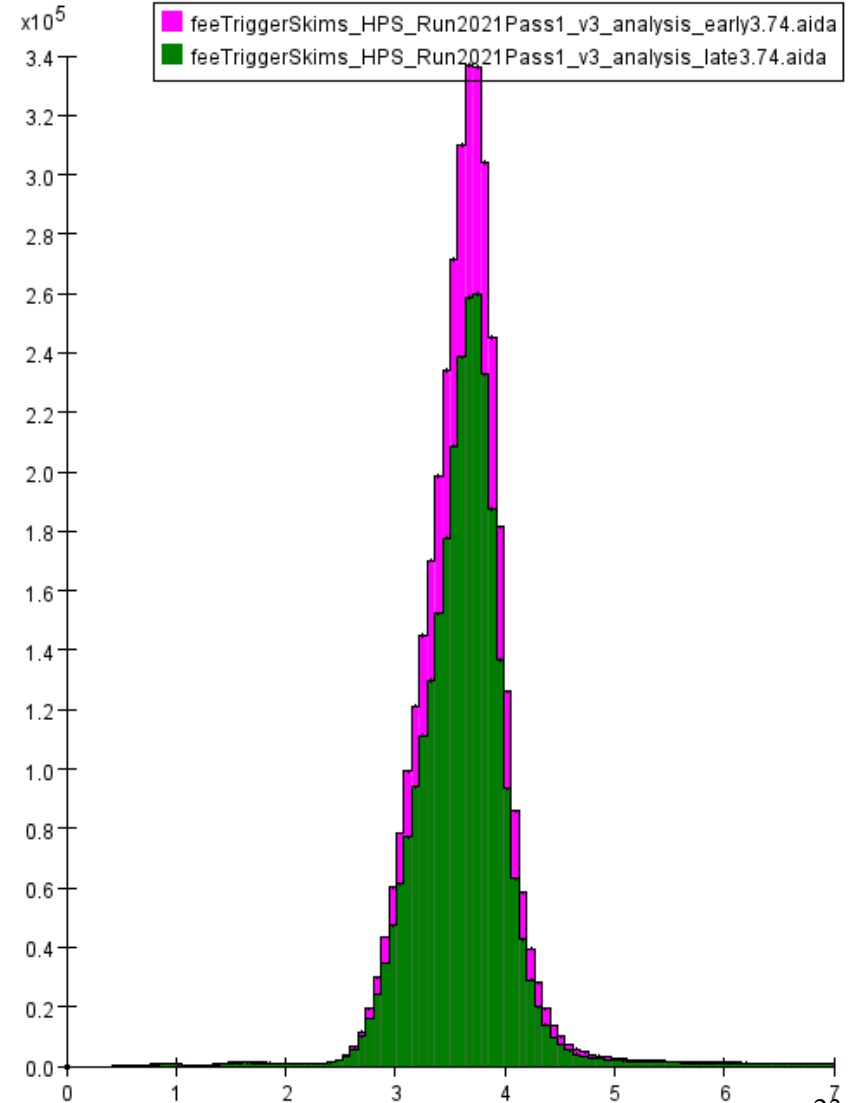
- One additional goal of this study was to compare the 3.74GeV detector performance before and after the 1.92GeV run.
- Split the previous plots into before (14615, 14621) and after (14685, 14688) periods
- Compare a few plots which might be sensitive
- No evidence for any significant differences in before and after alignment.

# Track Momentum Early vs Late

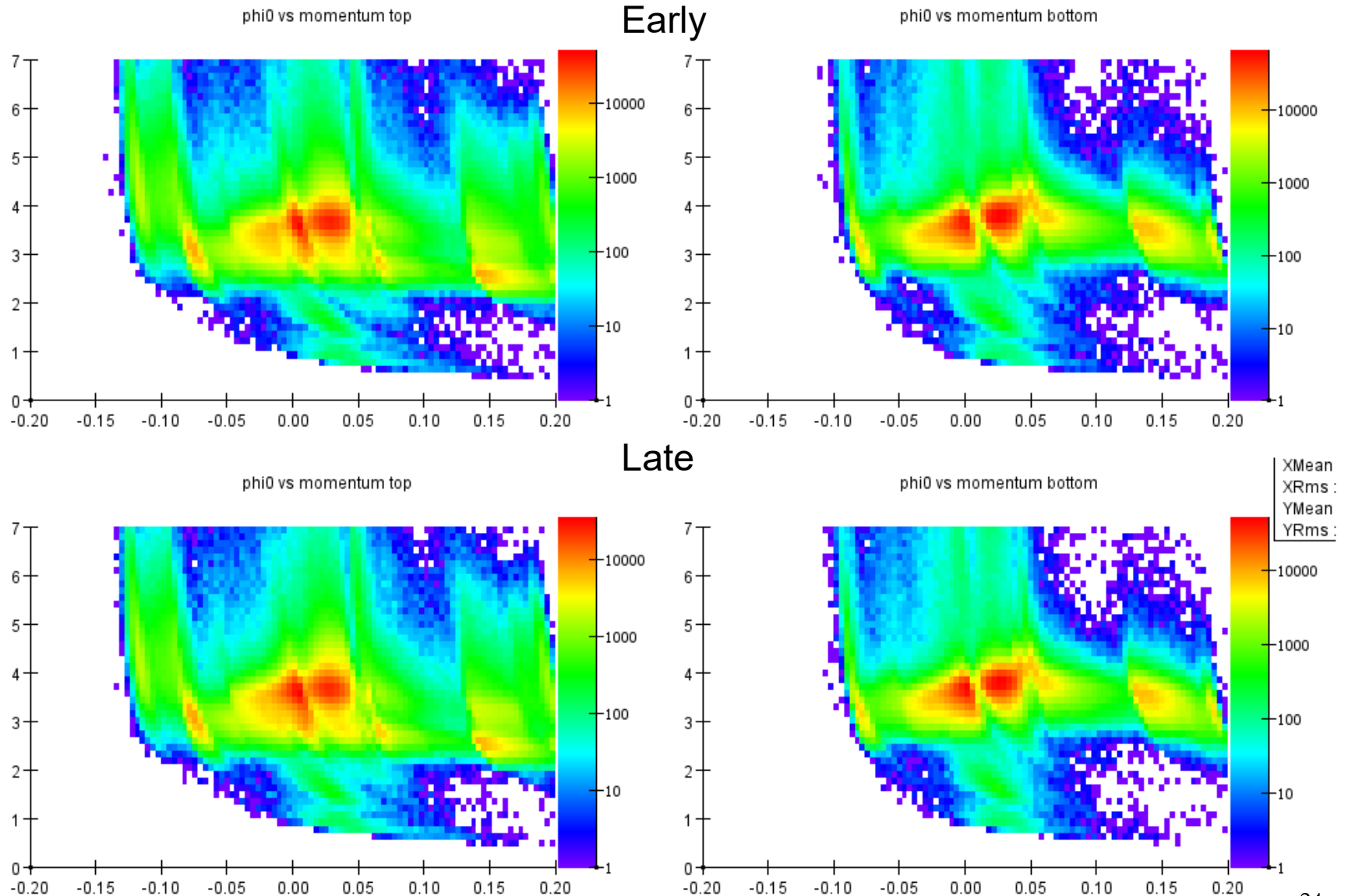
2021 3.74Gev - HPS\_Run2021Pass1\_v3 - track momentum top



2021 3.74Gev - HPS\_Run2021Pass1\_v3 - track momentum bottom

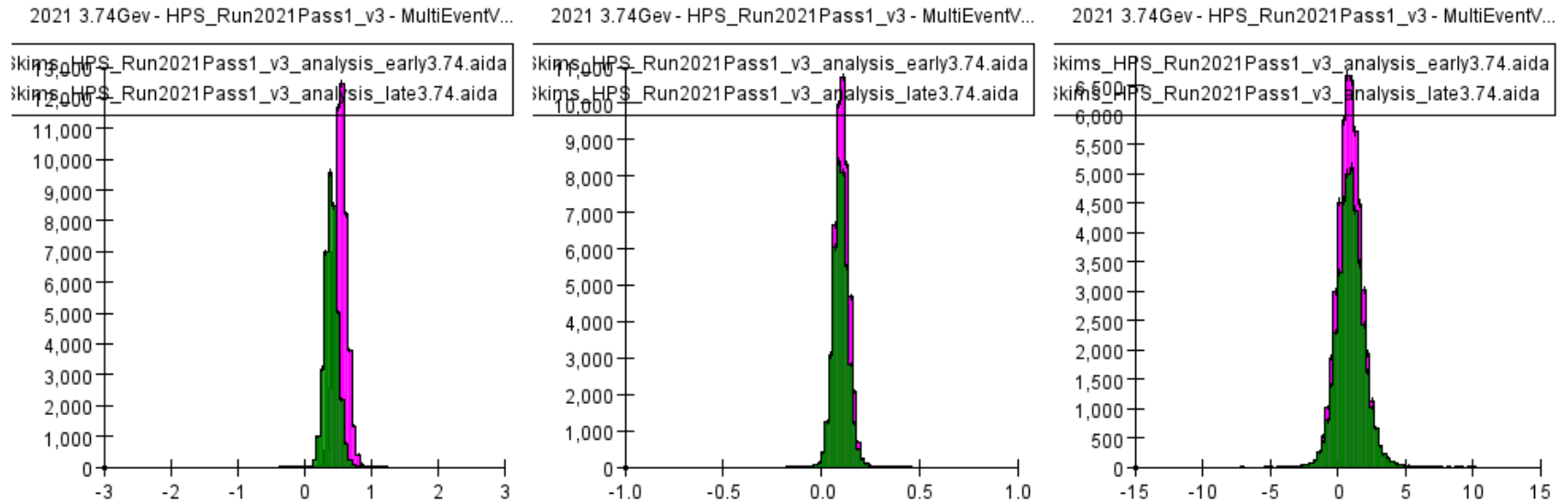


# Track $\phi_0$ vs $p$





# MultiVertex IP Early vs Late



Differences in (x,y) can be due to different beam conditions. Target Z the same.

