# 2021 Data Reconstruction & Calibration for Analysis: Workshop Snapshot

Norman Graf (SLAC)

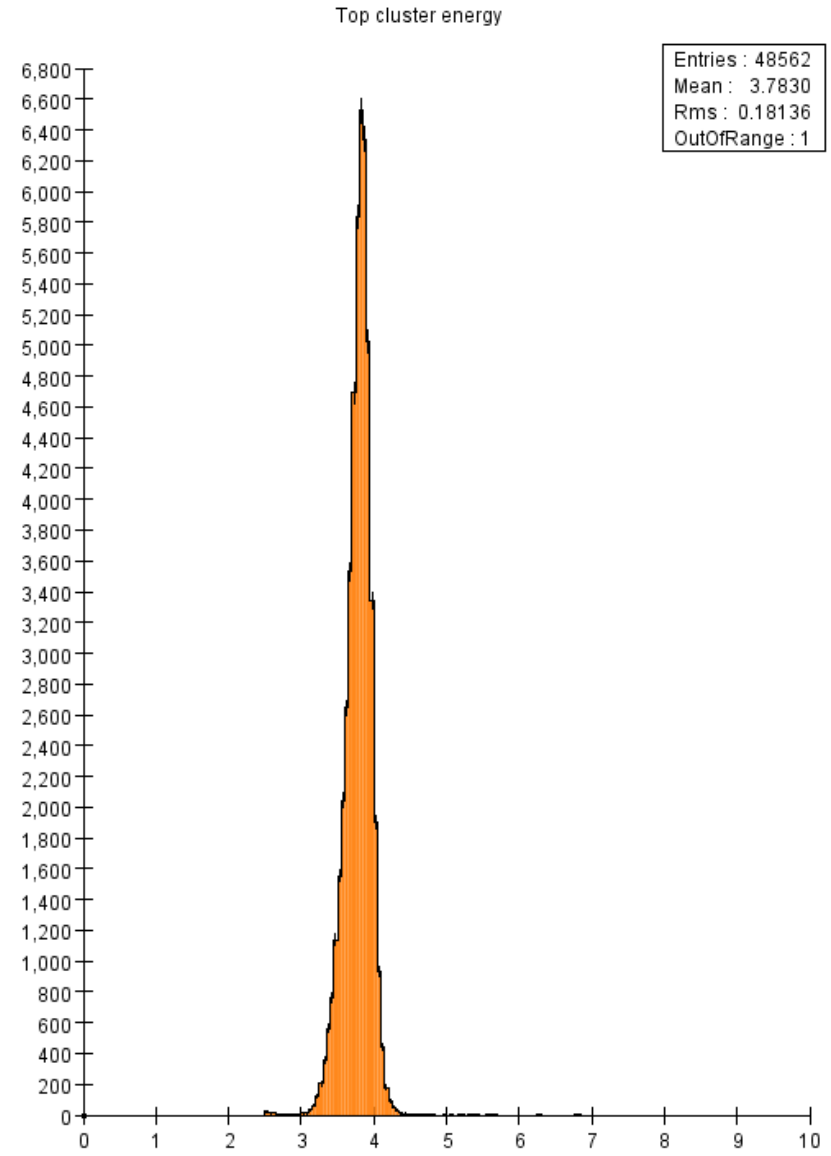
HPS Weekly Meeting

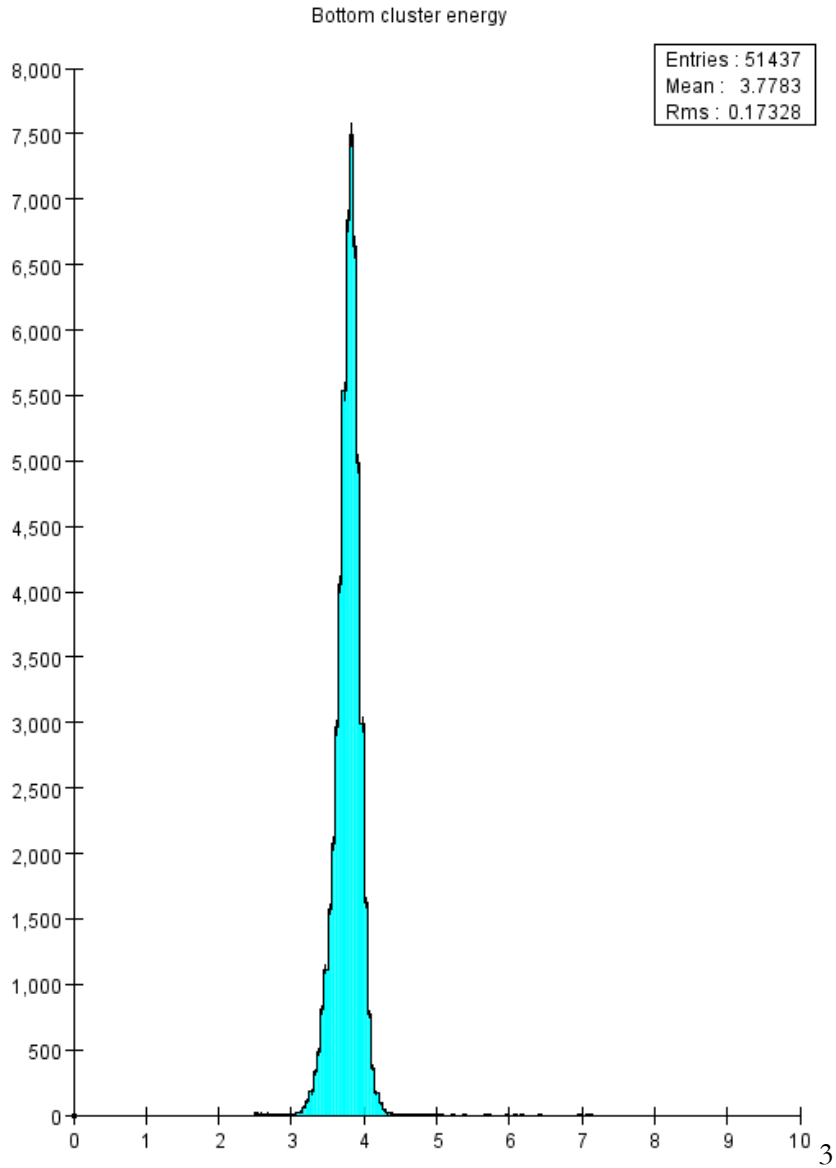
March 23, 2022

# Data Processing & Analysis

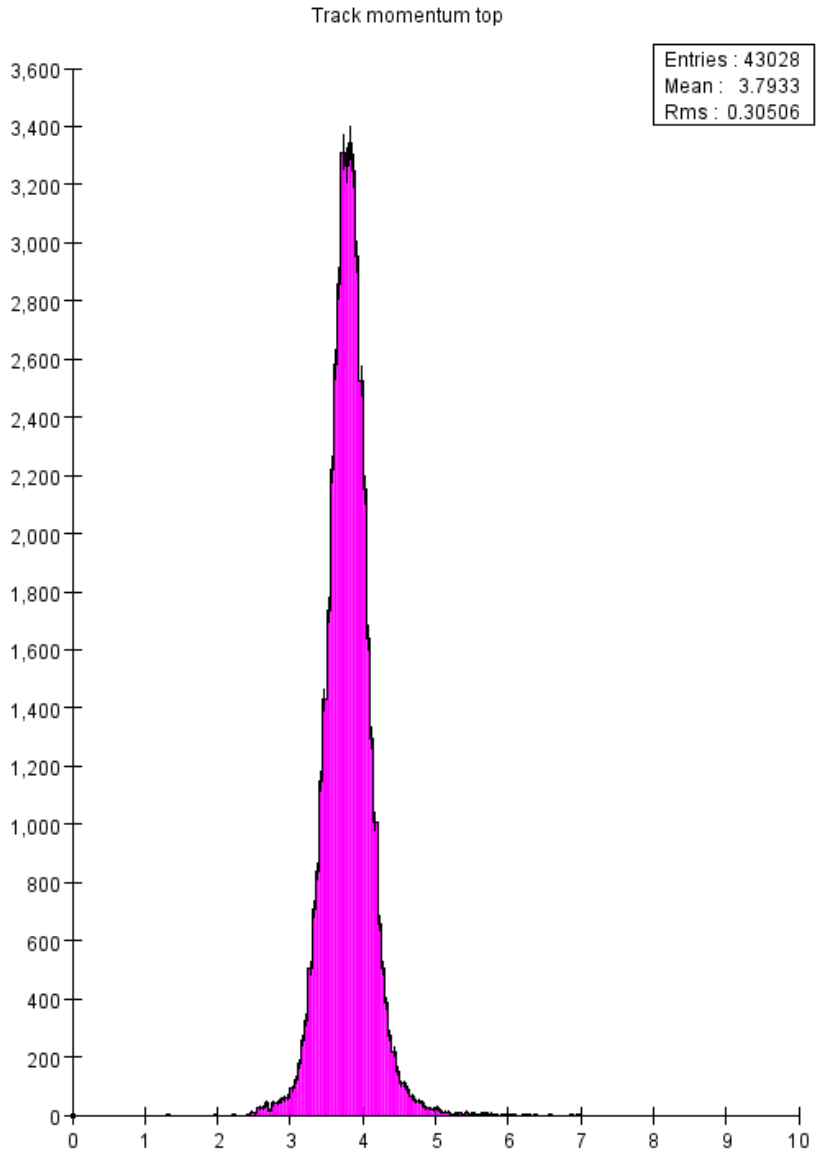
- Using the latest Ecal corrections as derived by Andrea (see his talk earlier today).
- Using HPS_Run2021Pass2FEE
- Using the usual mix of FEE, WAB & three-prong Tridents to study energy and momentum calibration
- Look at Møllers to study mass scale

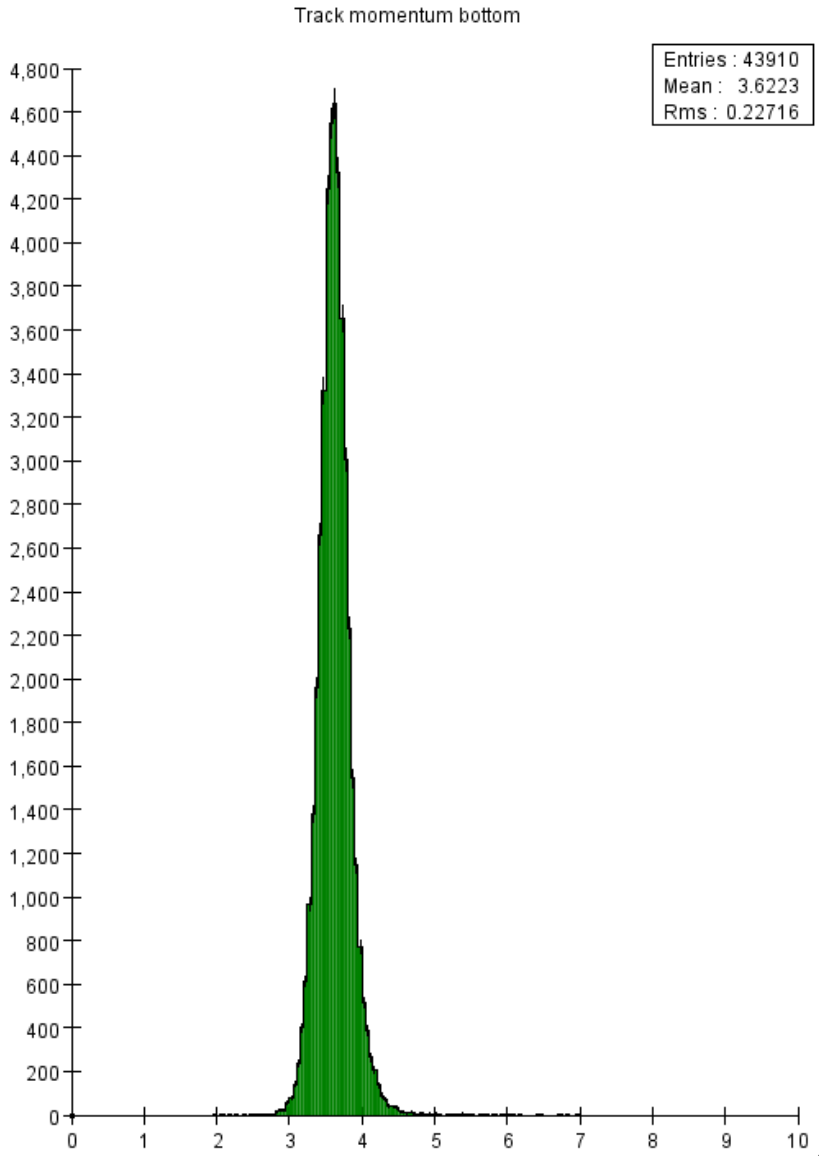
# FEE Ecal Cluster Energy 14168



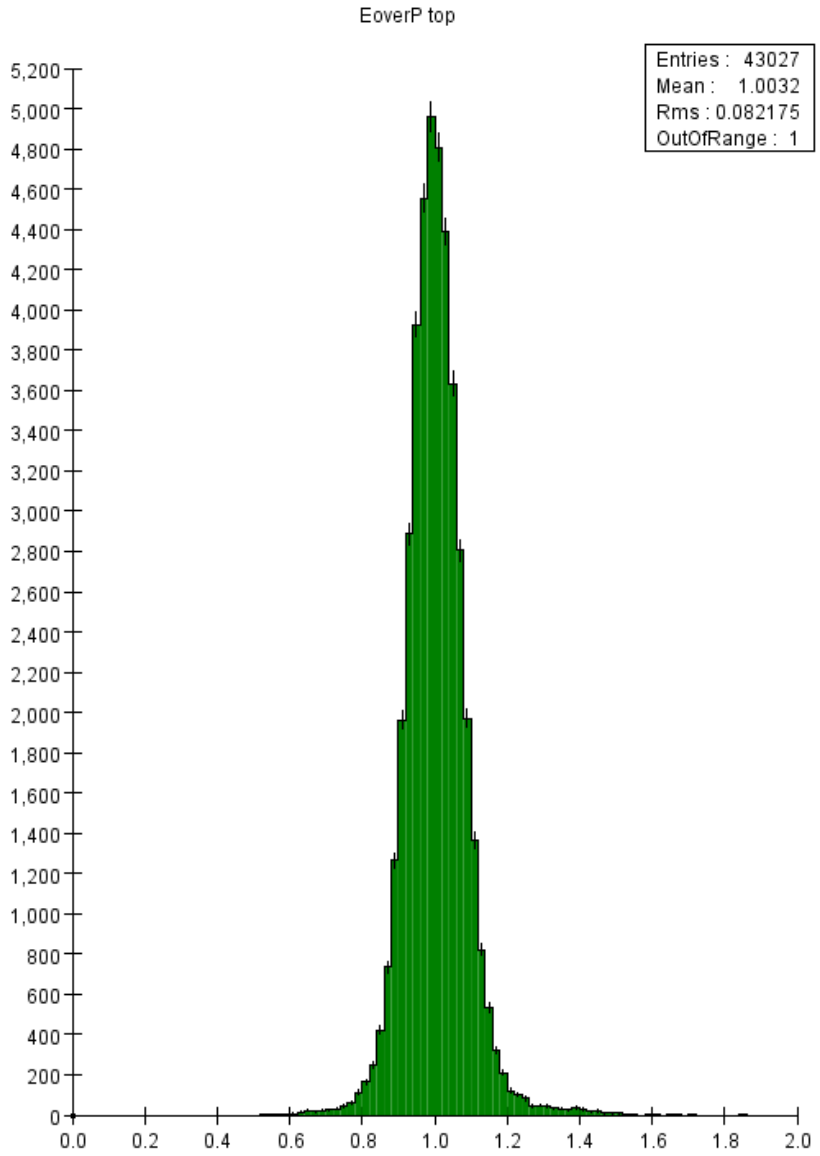



# FEE Track Momentum 14168



# FEE E/p 14168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1,800
1,600
1,400
1,200
1,000
800
600
400
200
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0.0
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0.8
1.0
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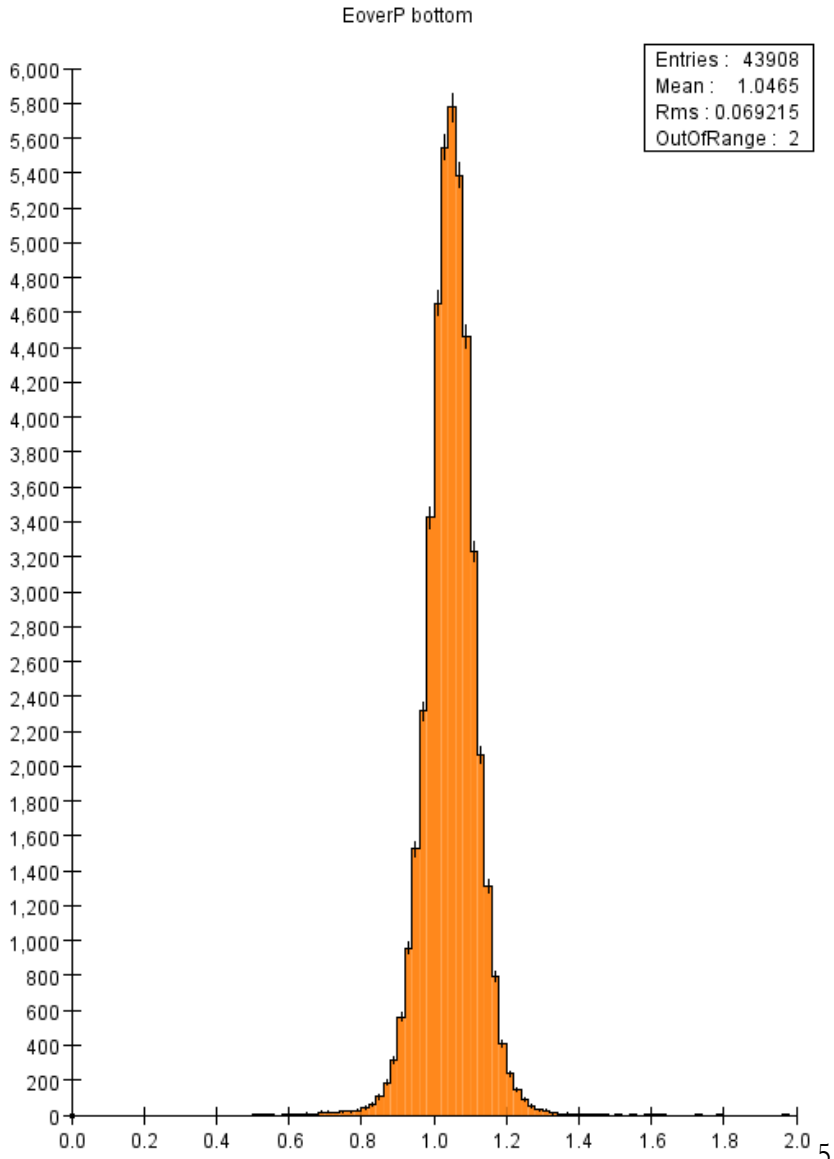
1.6
1.8
2.0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200
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1.2
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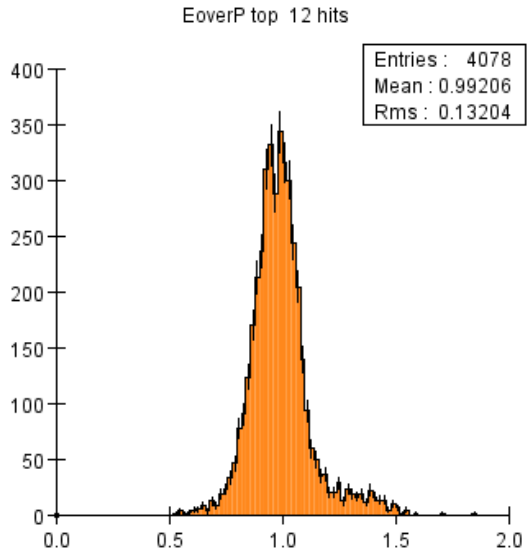
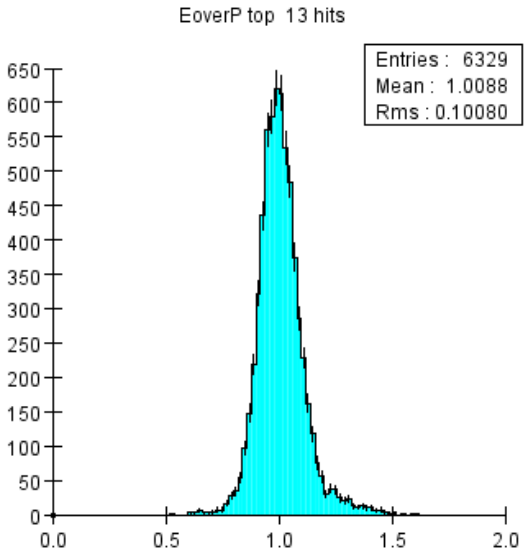
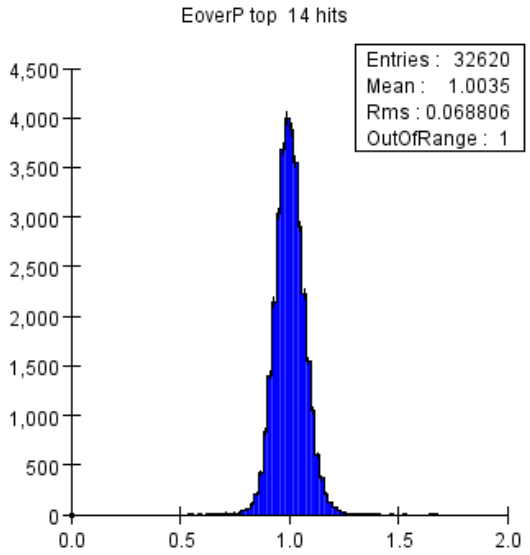
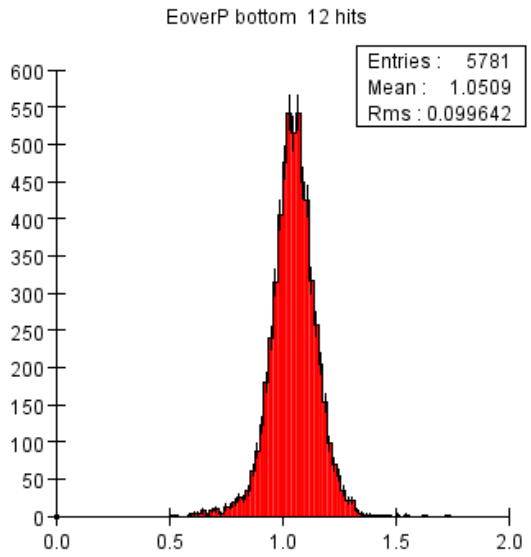
1.6
1.8
2.0

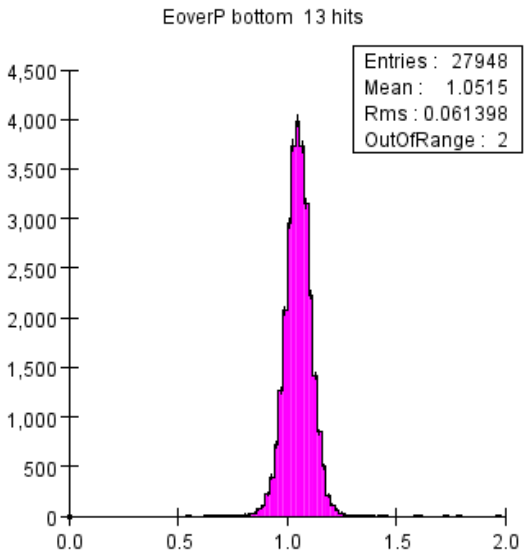
# FEE Track p vs nHits 14168

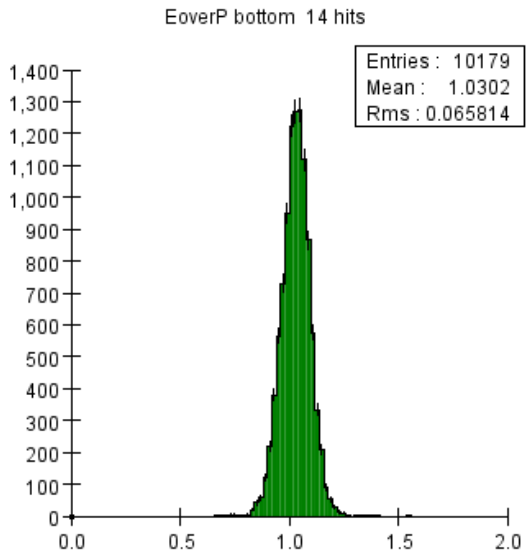


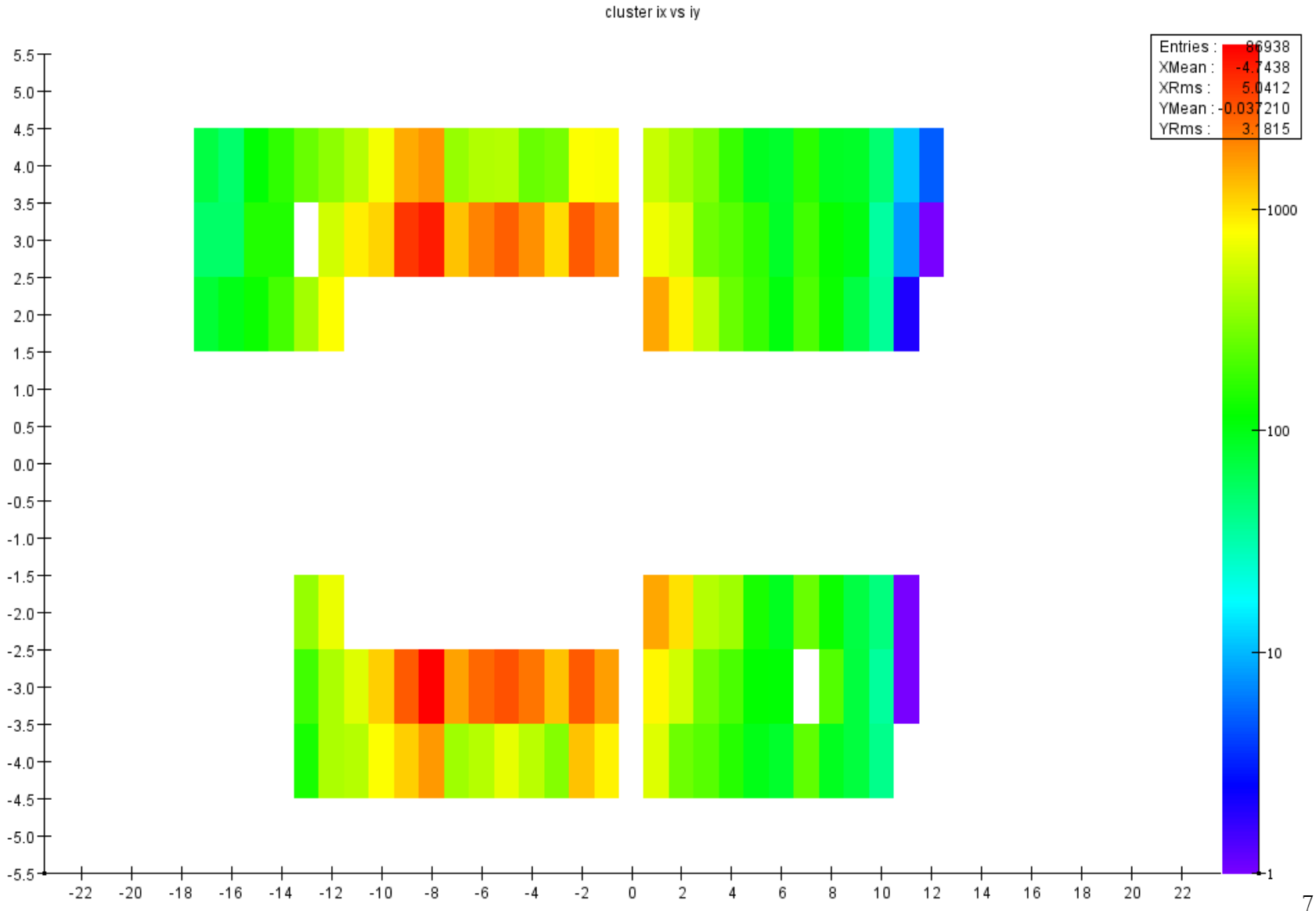



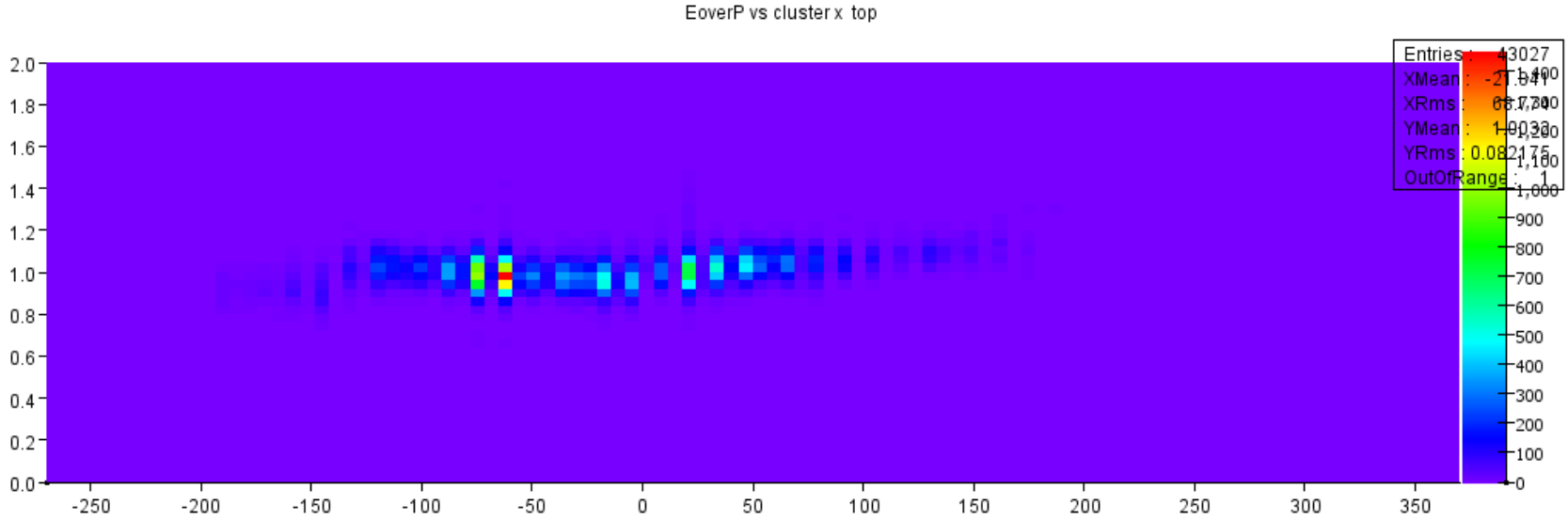



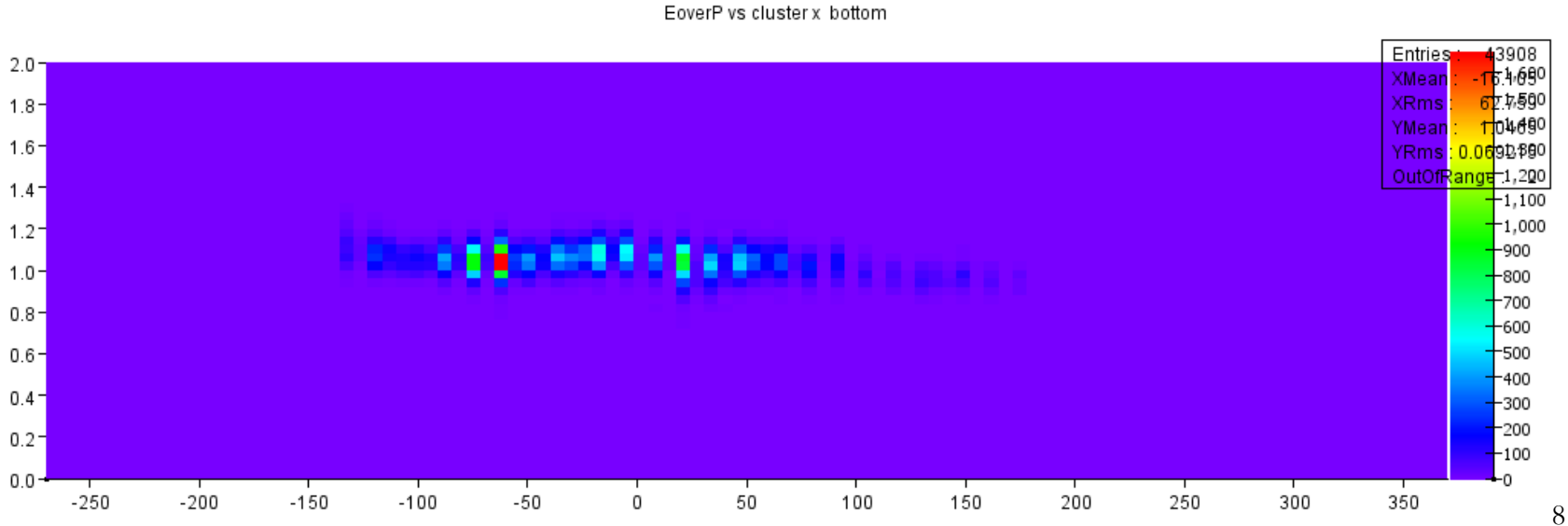



# FEE Cluster ix vs iy 14168

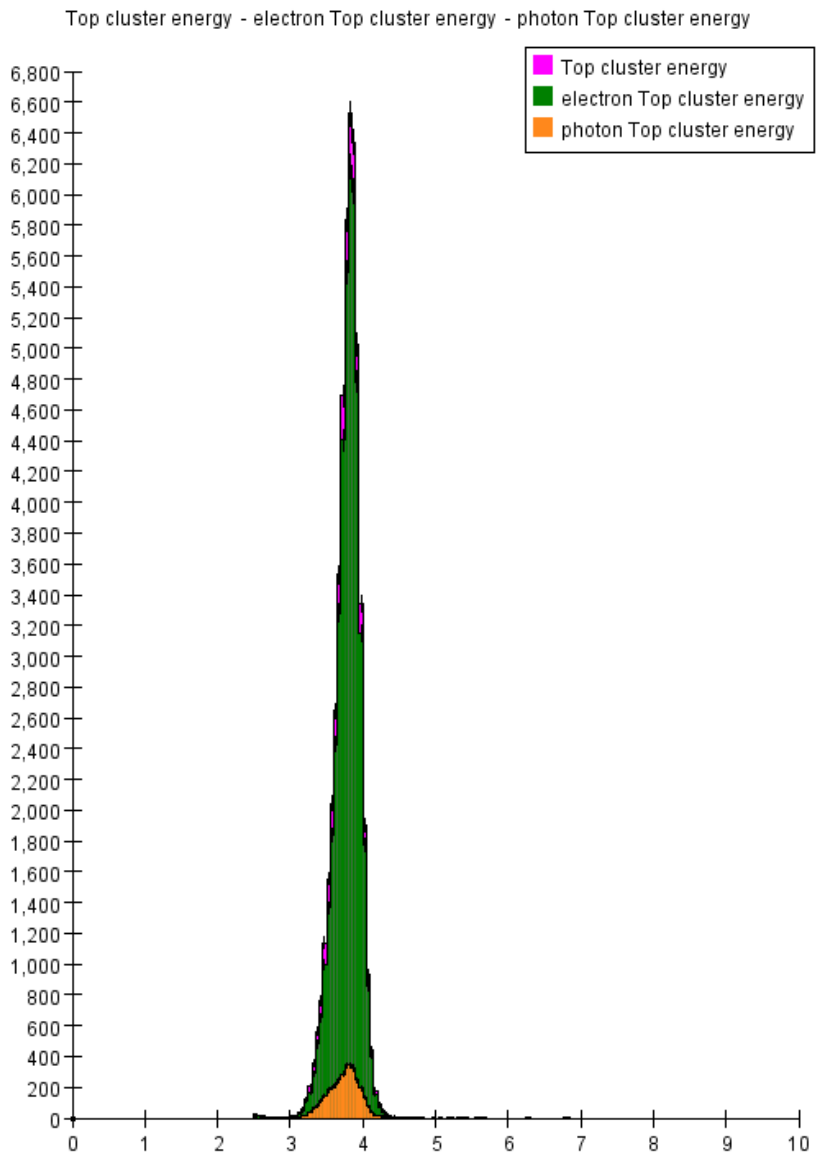


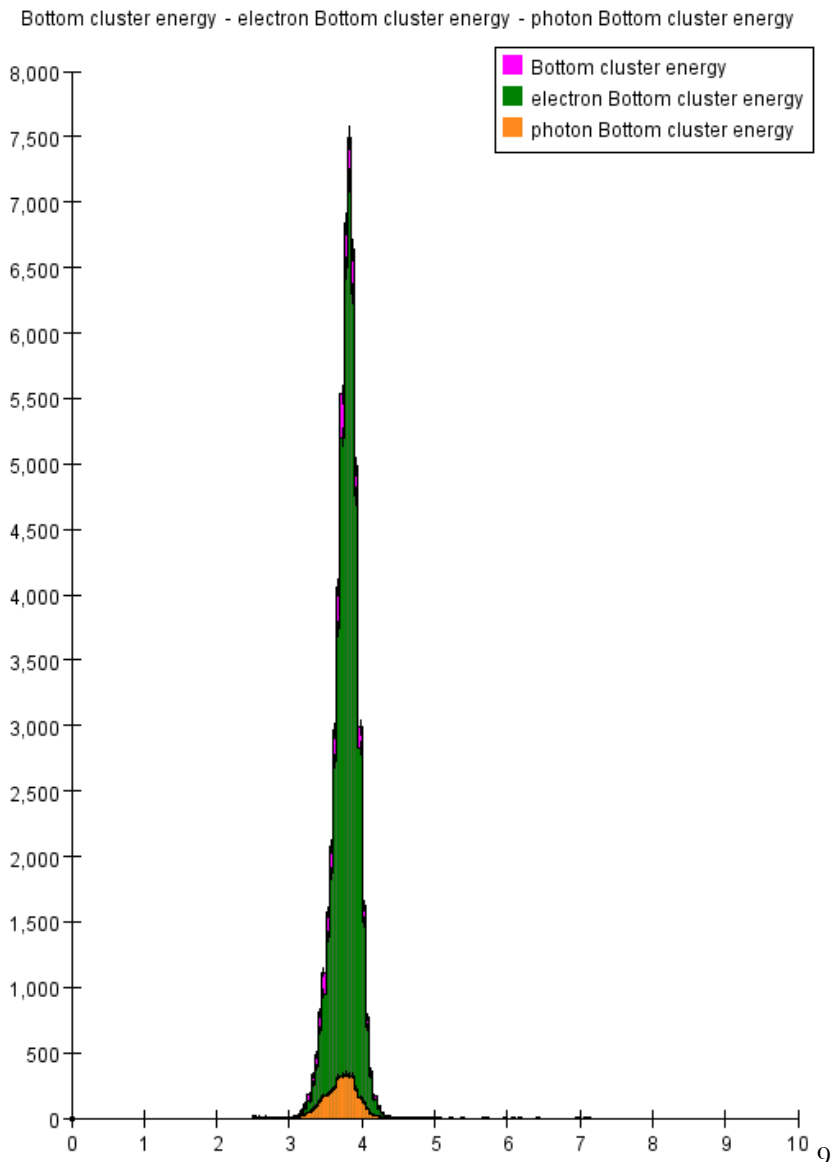
# FEE E/p vs Cluster x 14168



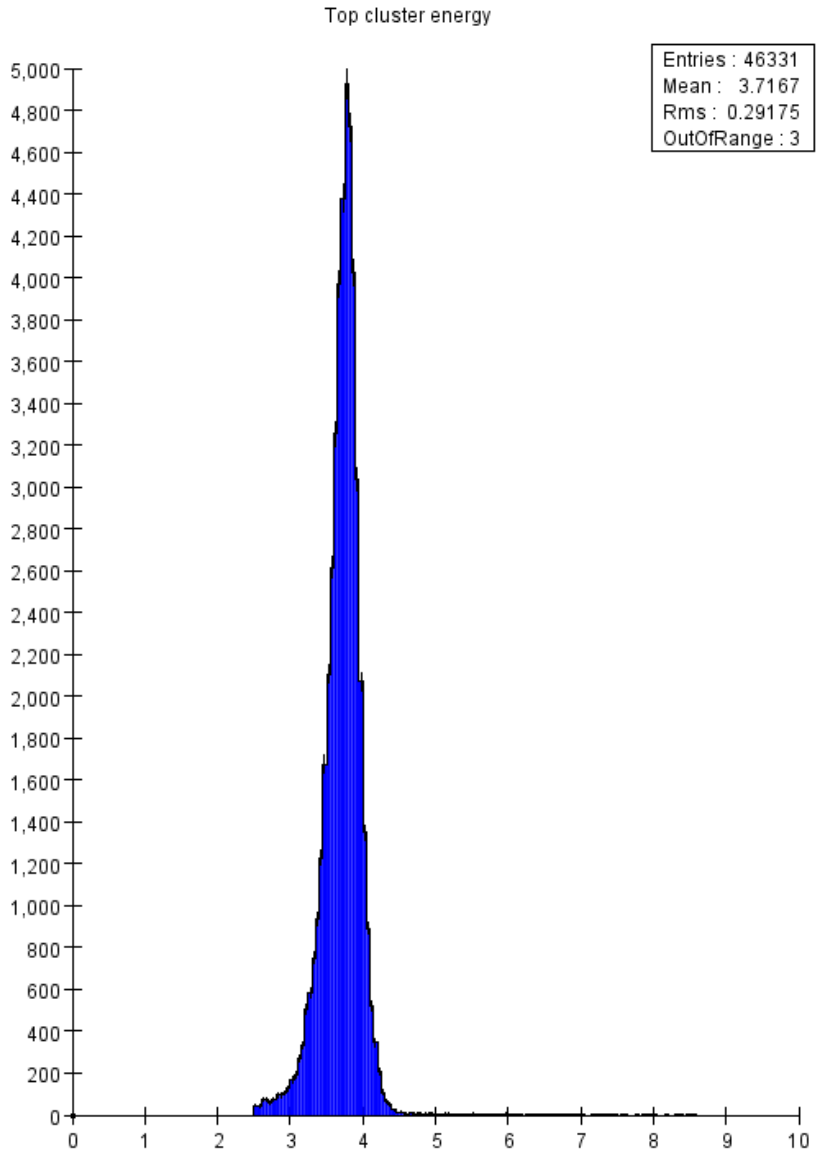



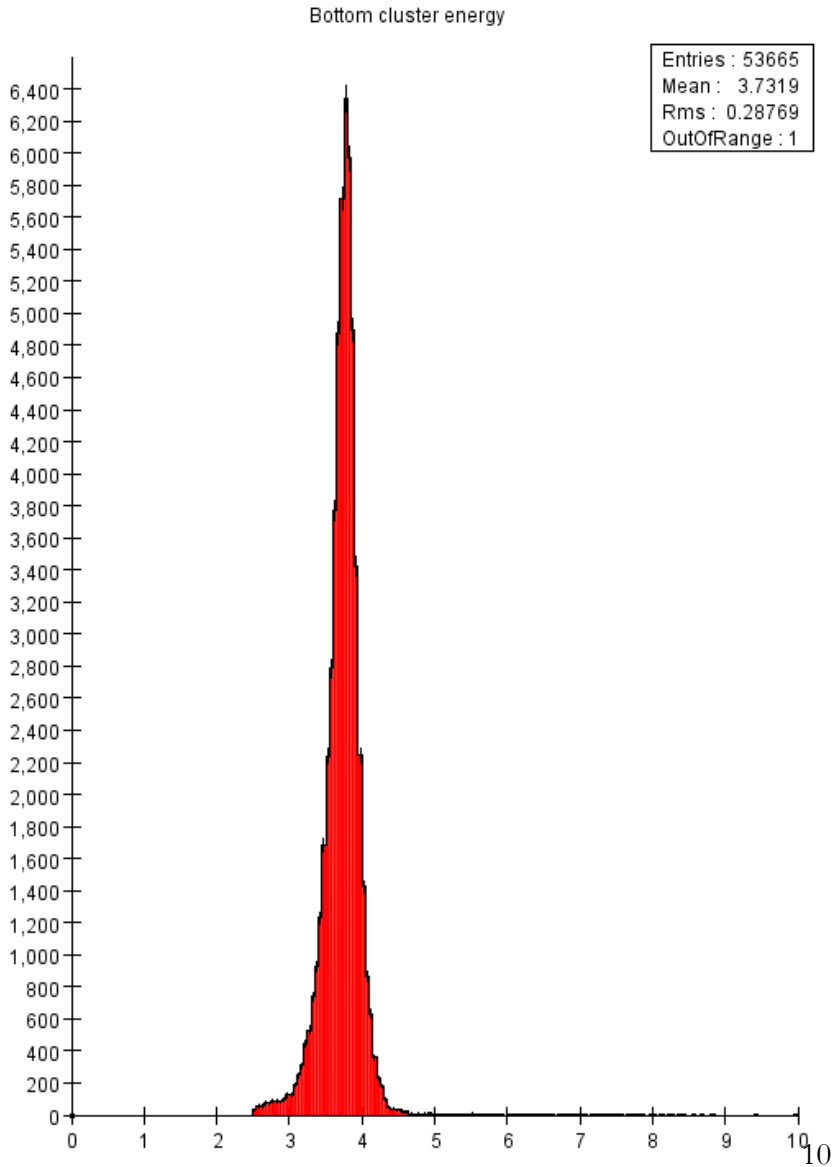
# FEE Track Finding Efficiency 14168



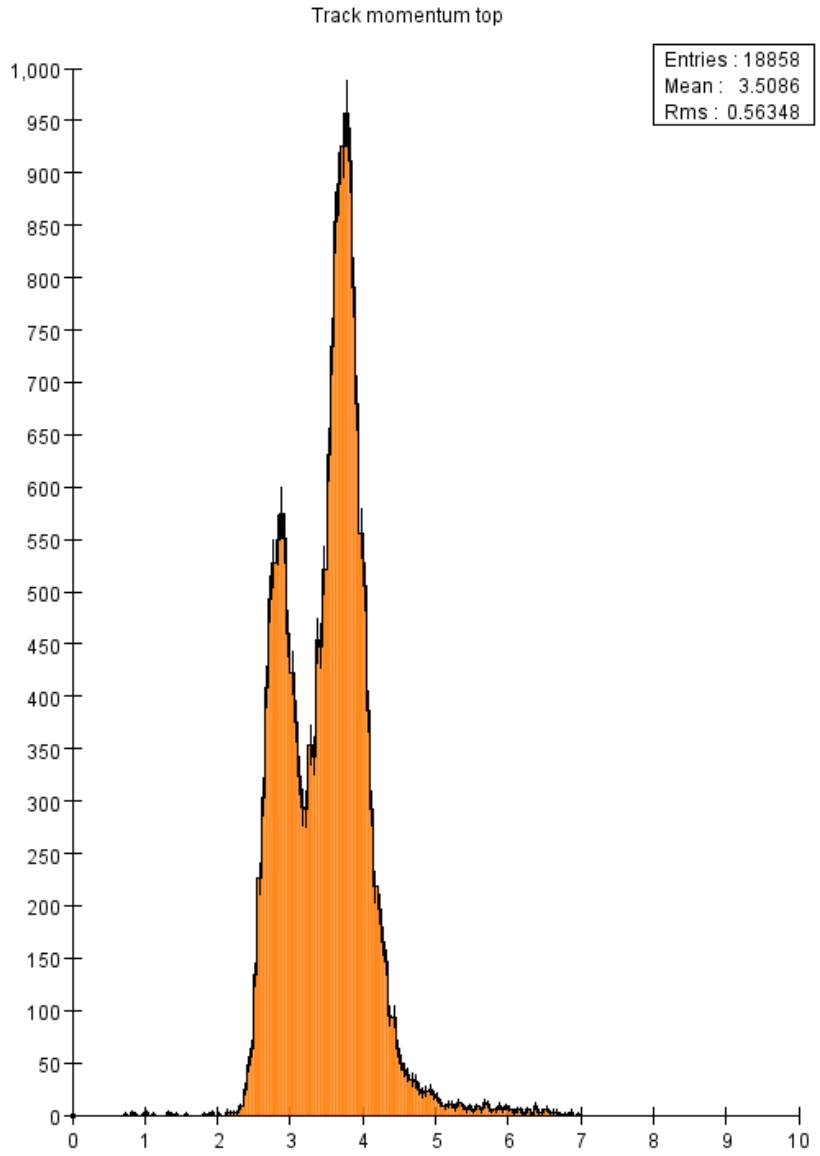



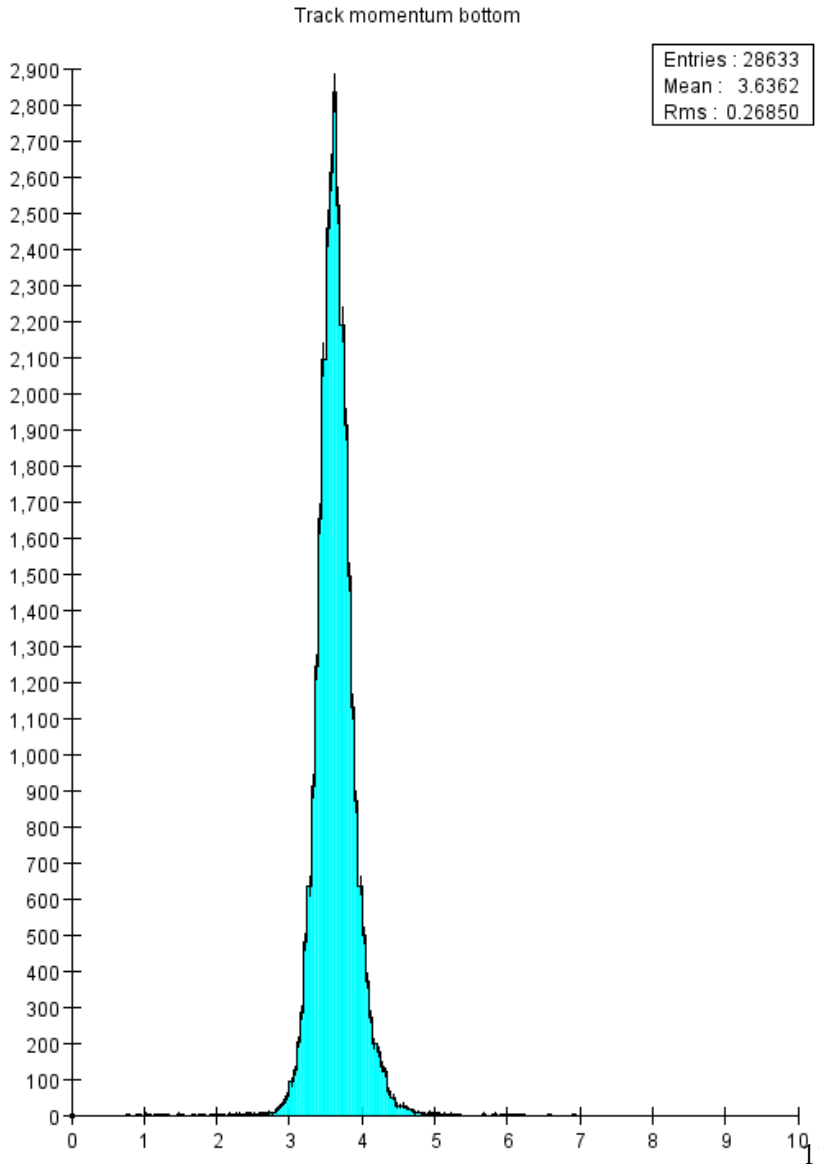
# FEE Ecal Cluster Energy 14771



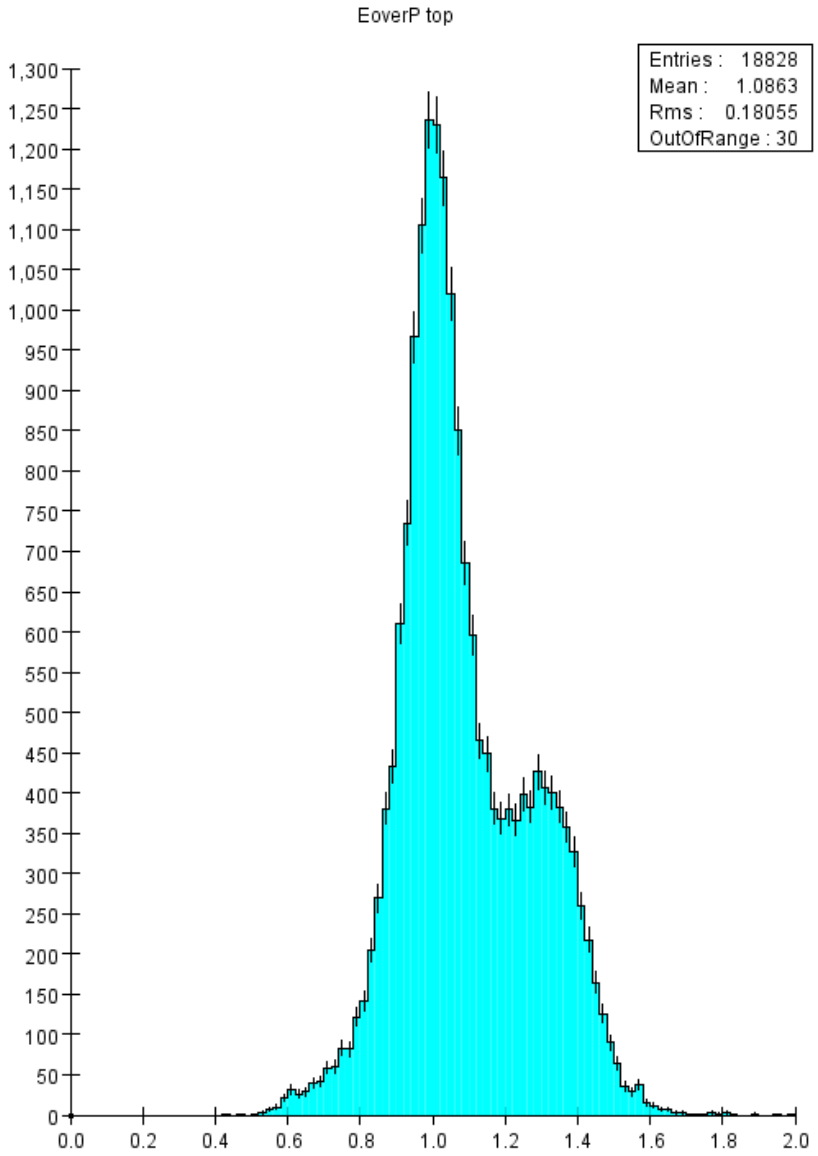



# FEE Track Momentum 14771



# FEE E/p 14771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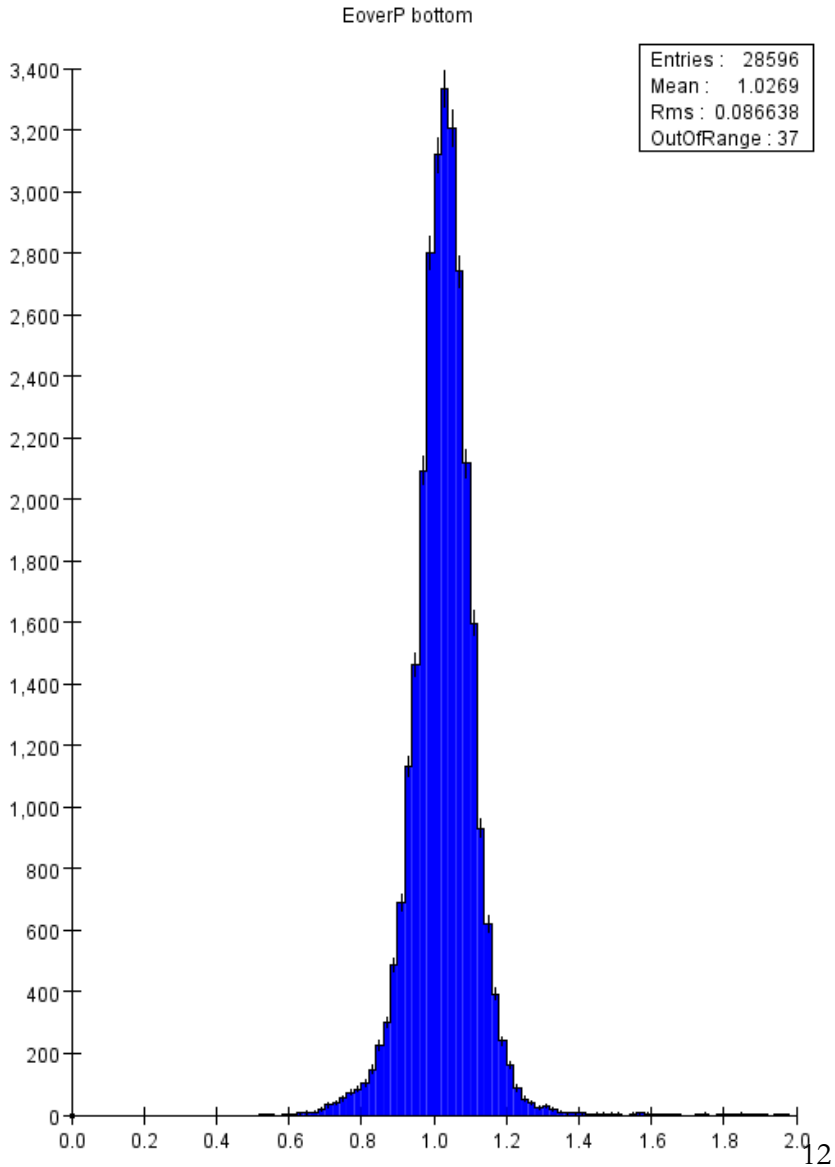
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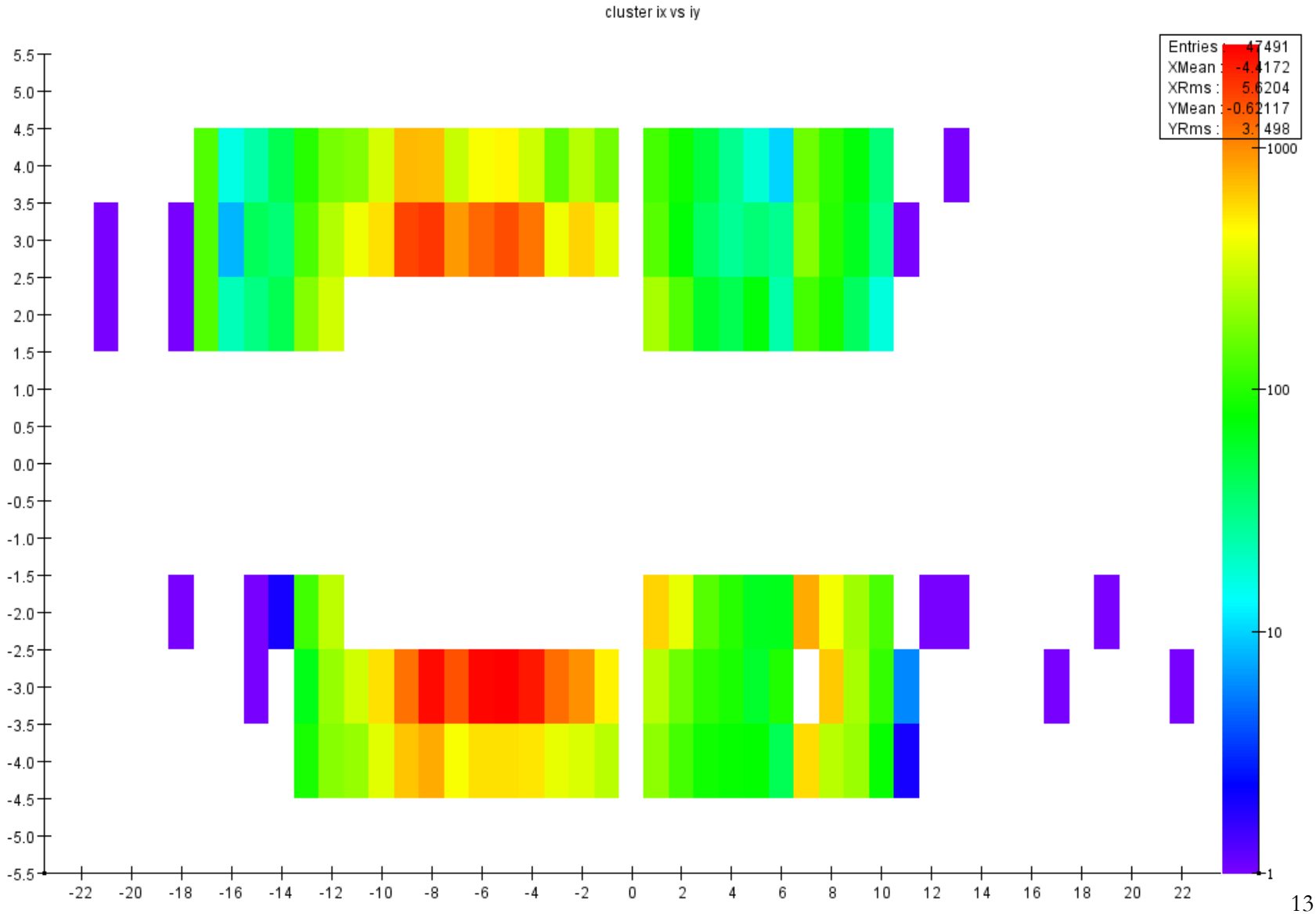
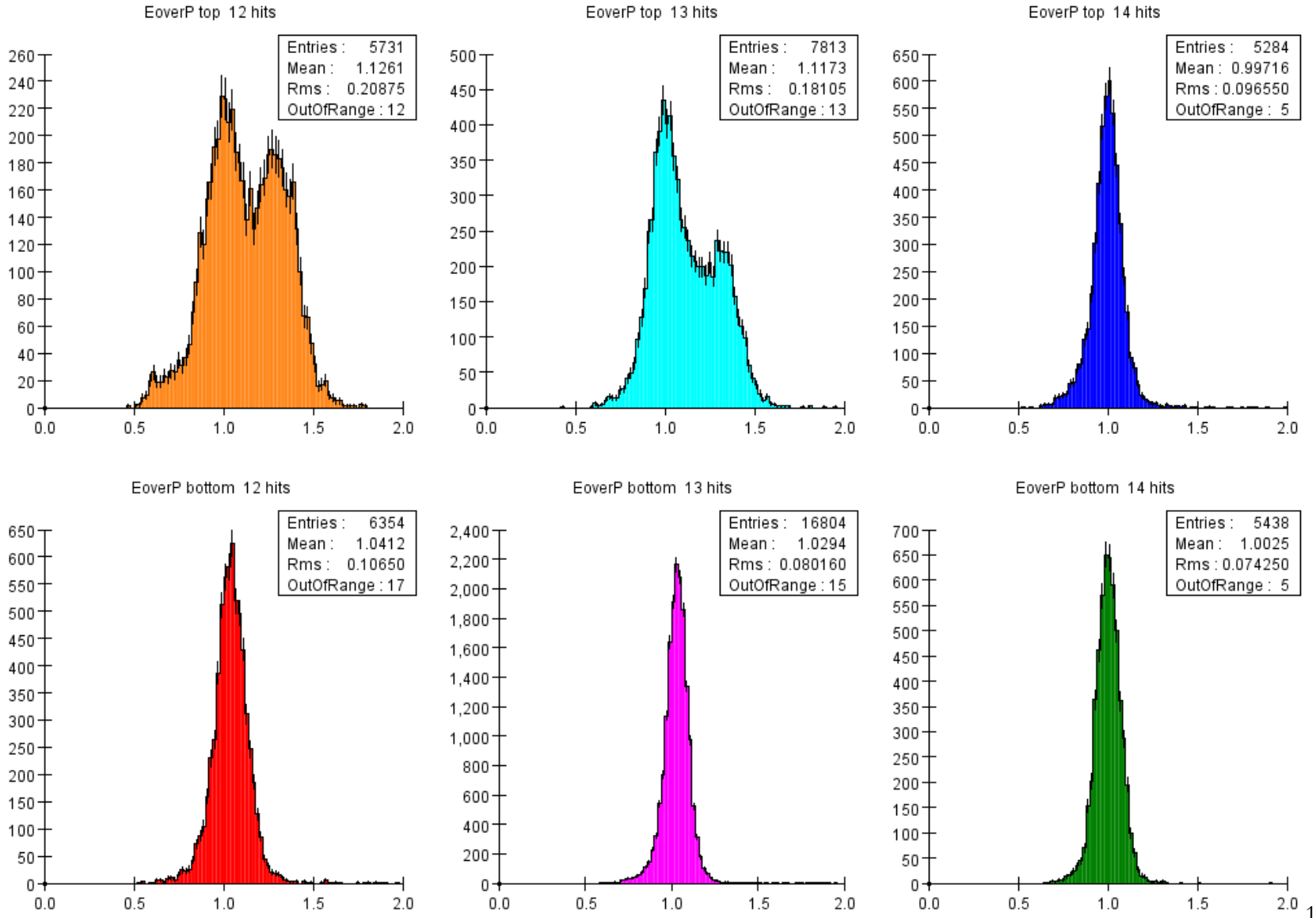
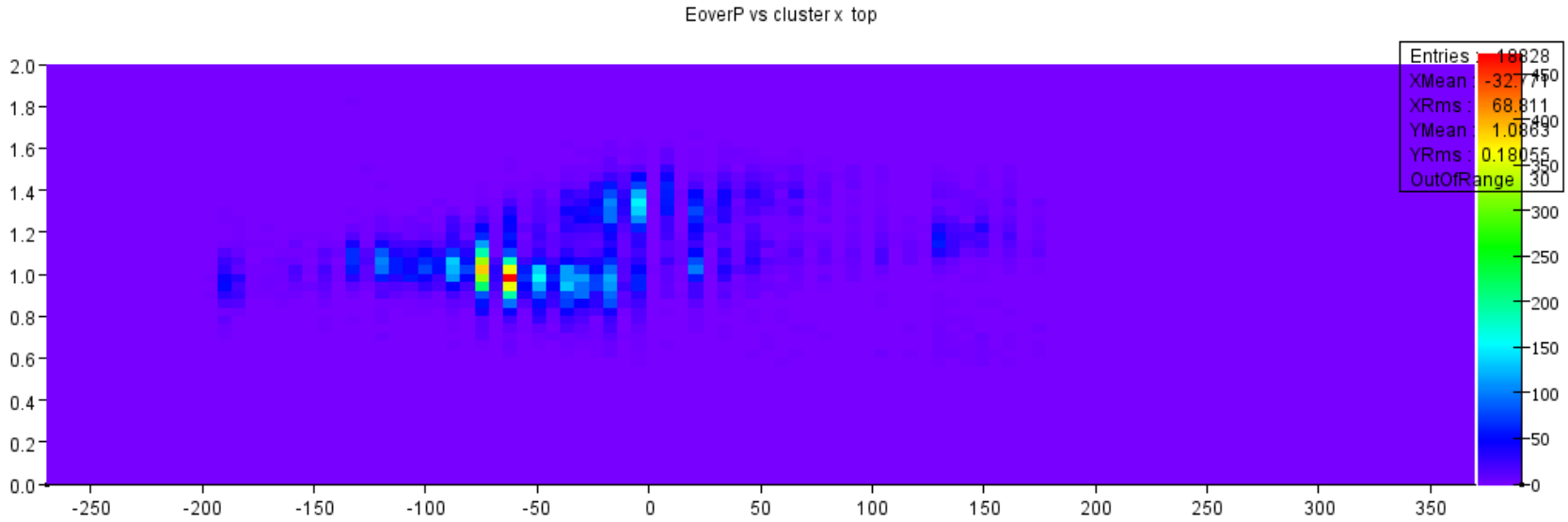
# FEE Cluster ix vs iy 14771

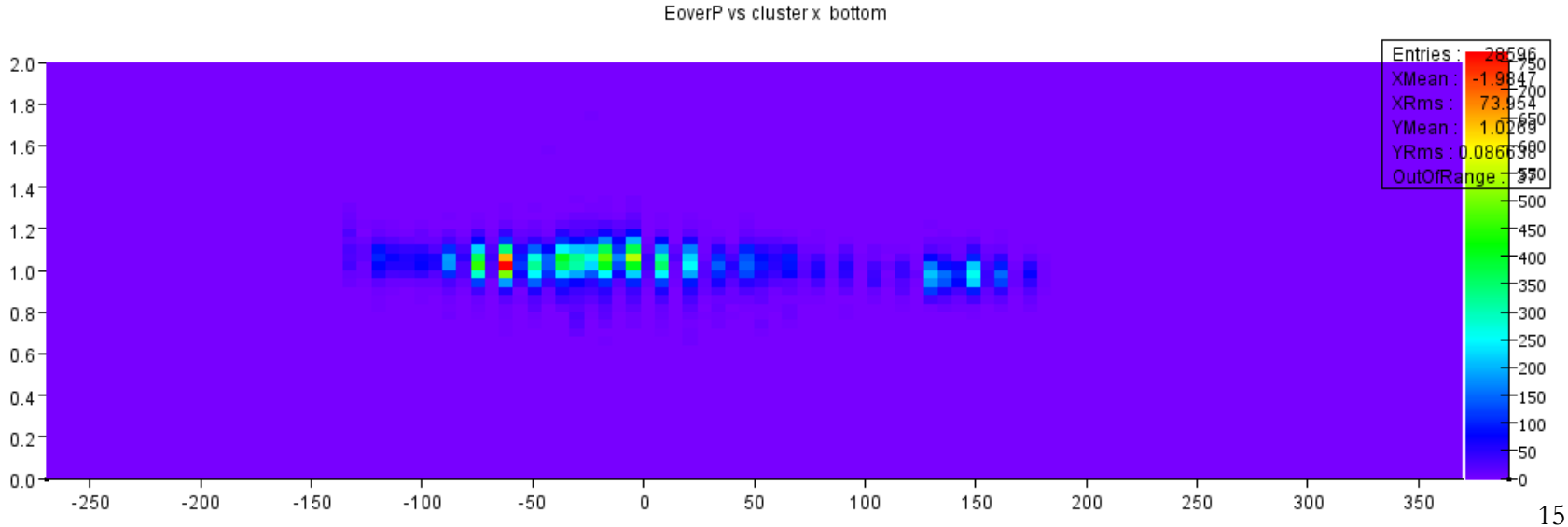


# FEE Track p vs nHits 14771

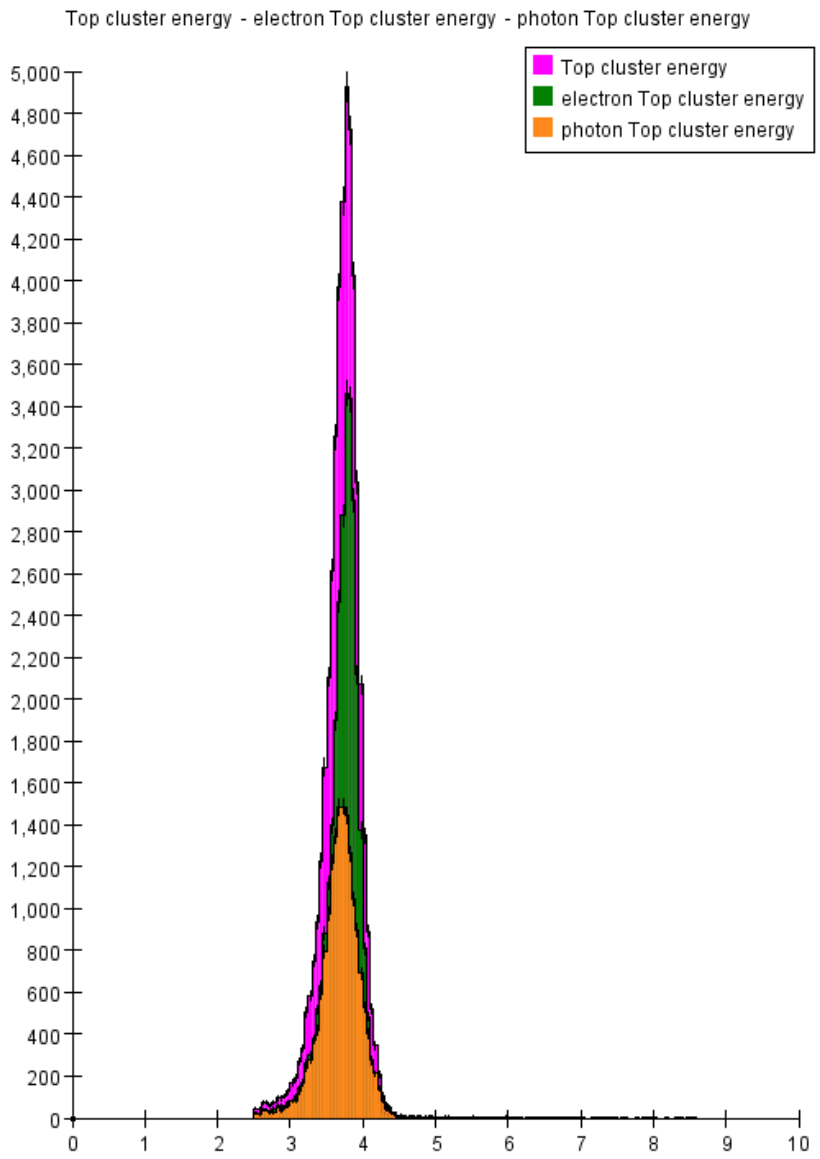


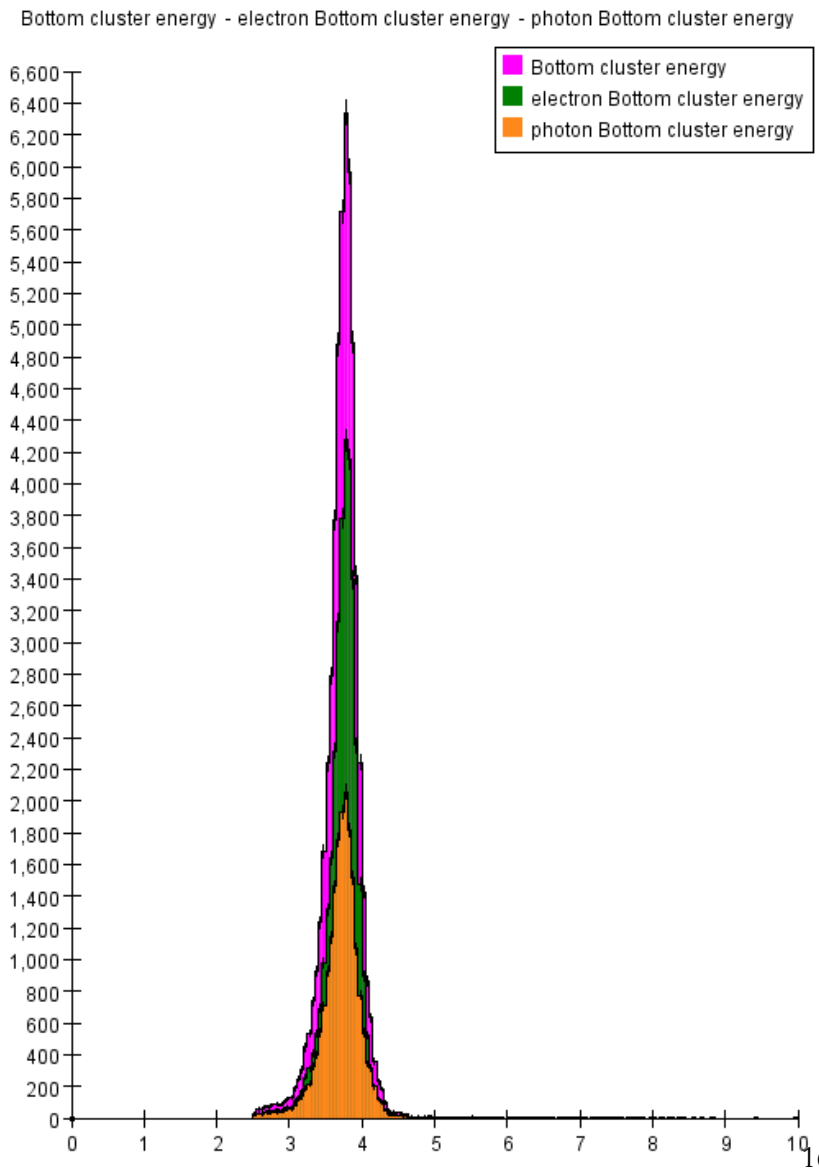
# FEE E/p vs Cluster x 14771



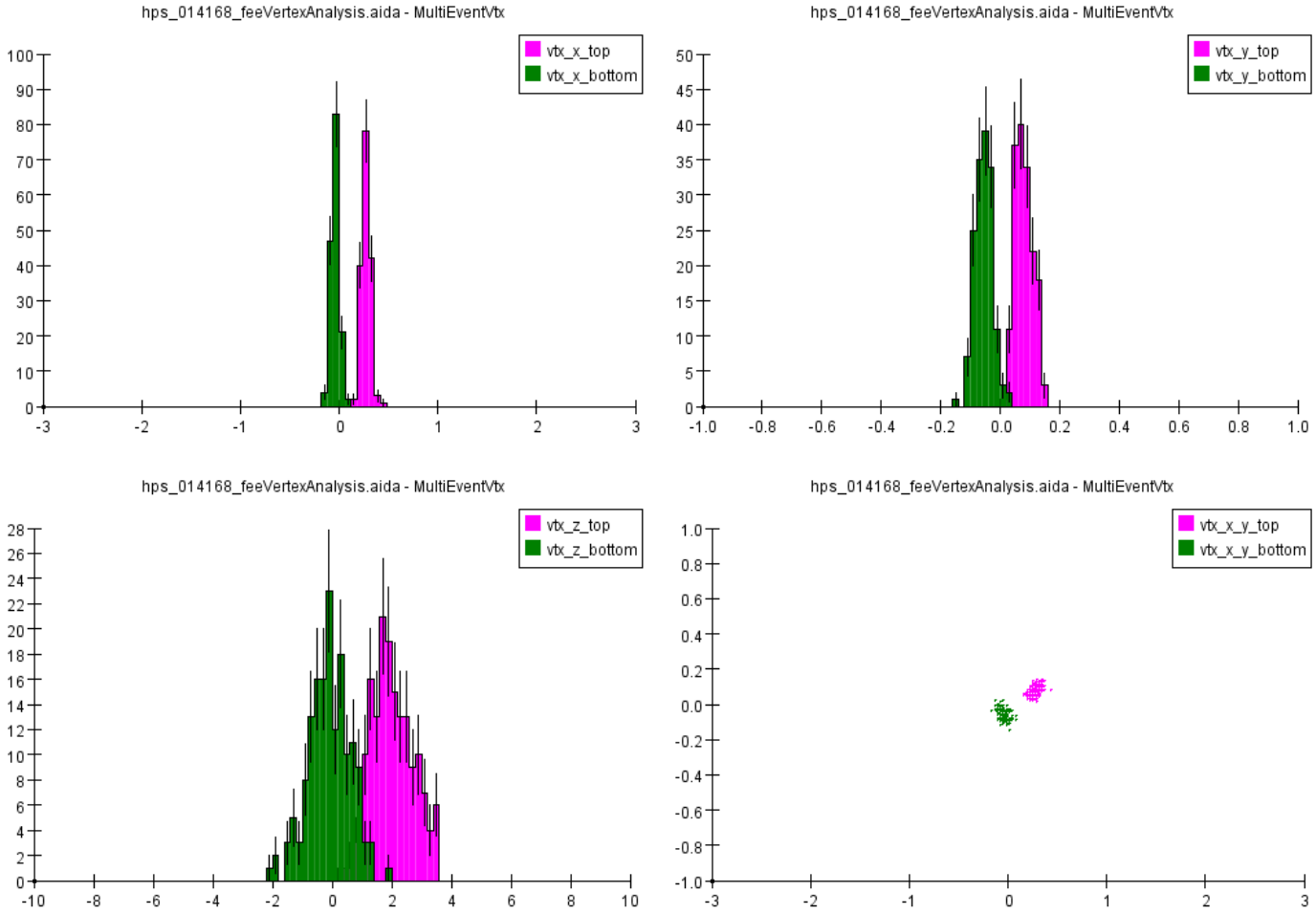



# FEE Track Finding Efficiency 14771

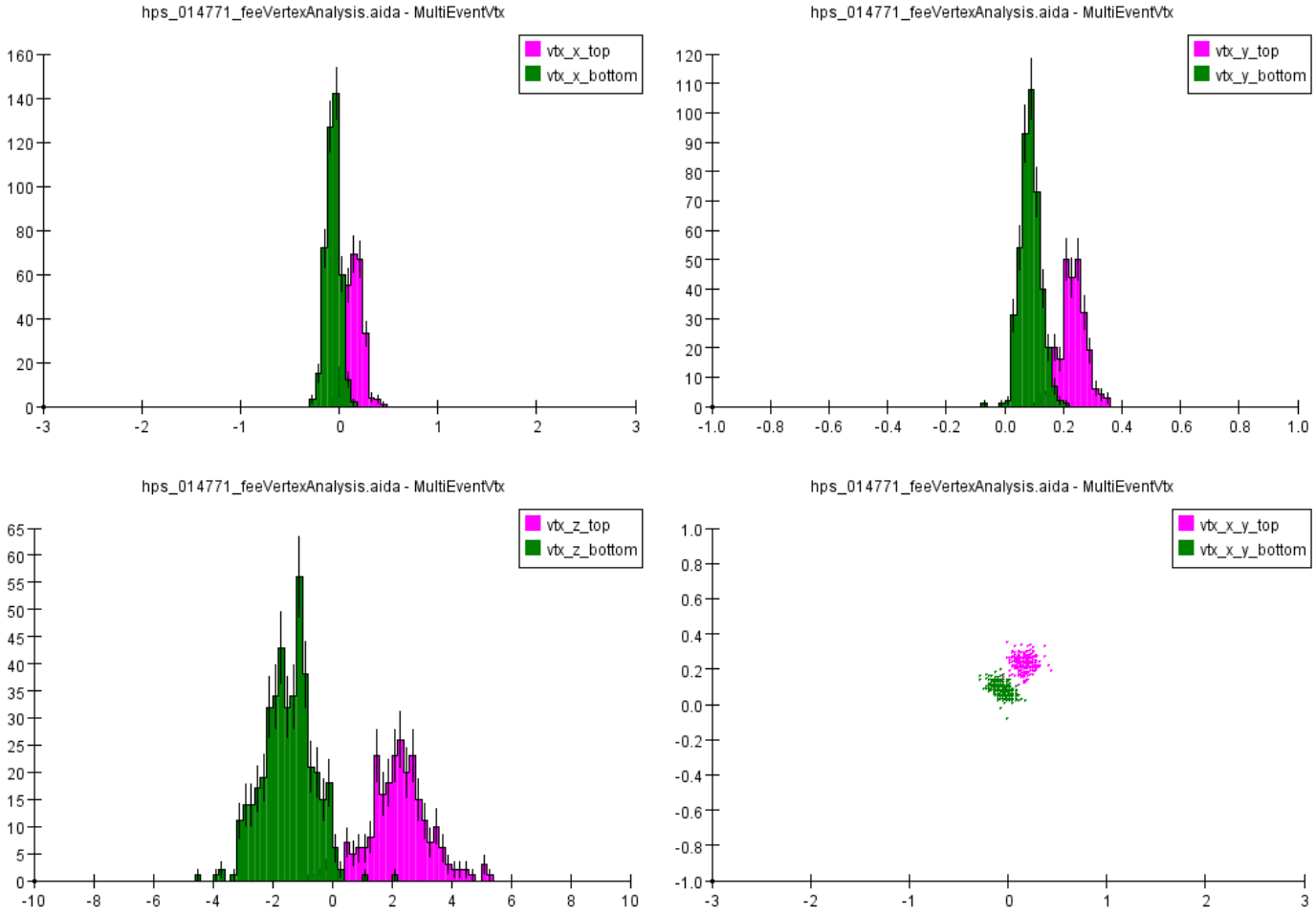


# FEE Vertex Positions 14168



# FEE Vertex Positions 14771



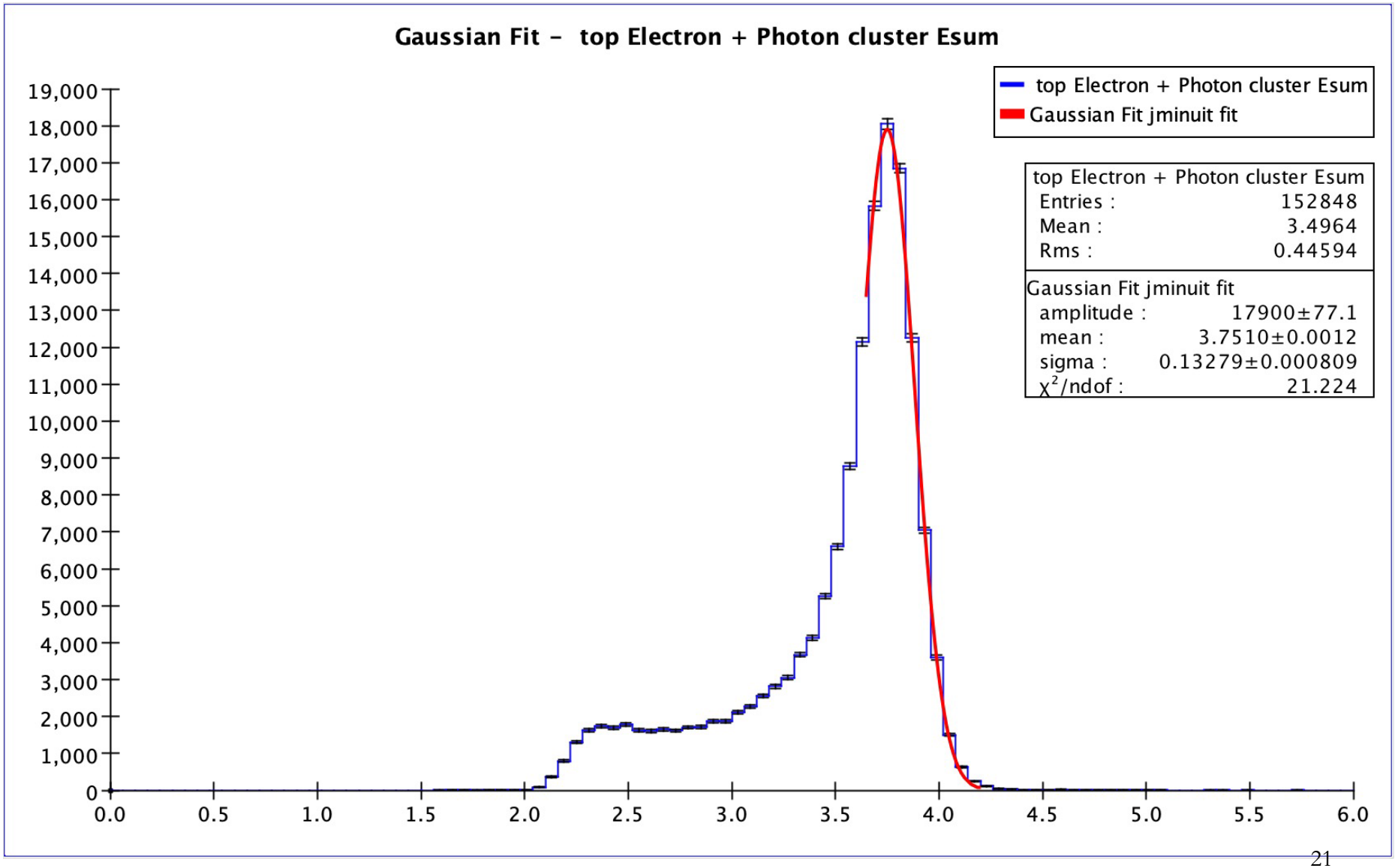
# FEE Tracking vs time

- Early run 14168 appears to be well behaved.
- Later run 14771 has issues with track-finding efficiency, momentum reconstruction and global position

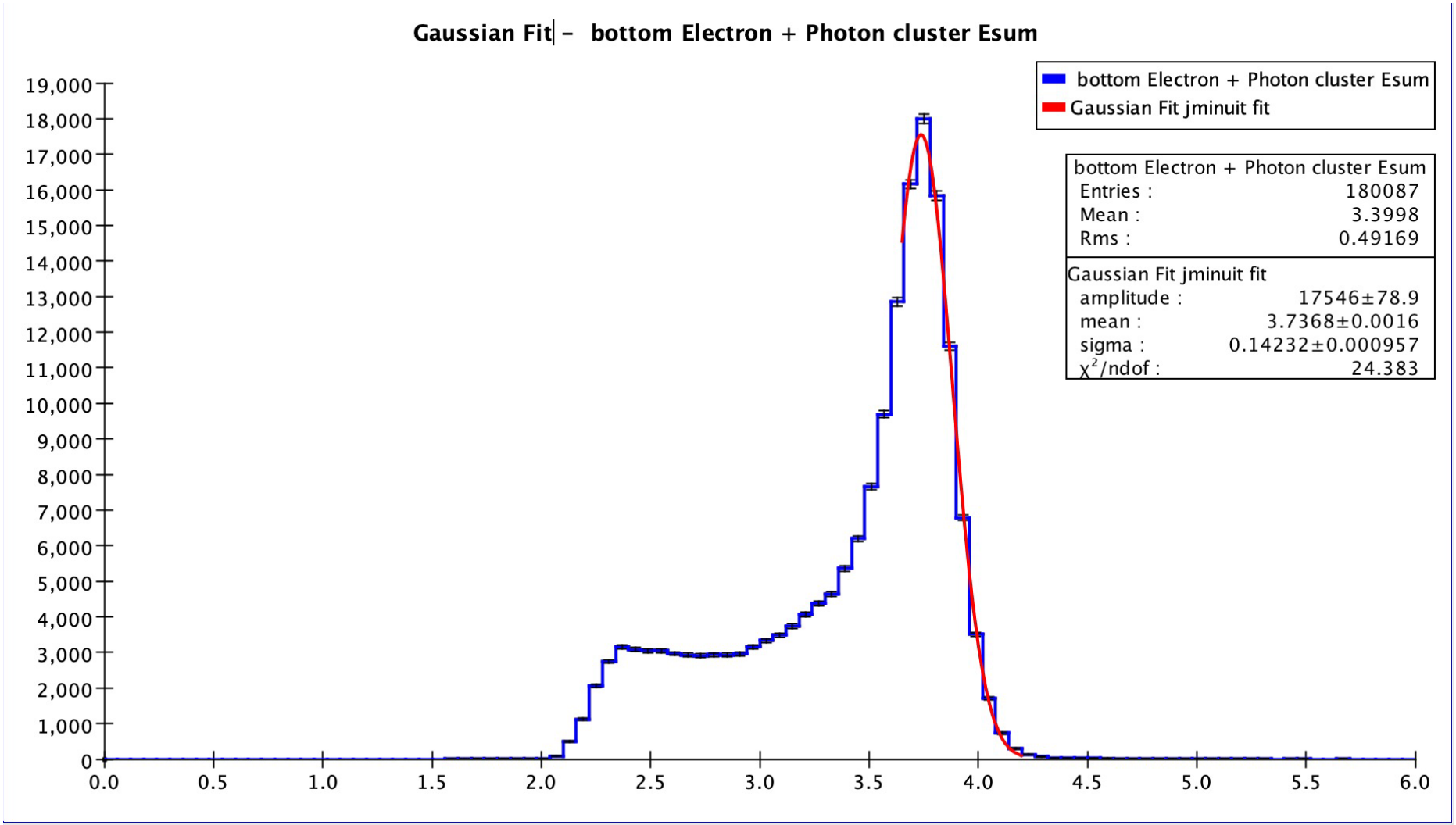
# WAB Data Selection and Recon

- Reran the reconstruction over a selected set of WAB candidates from the 2021 run.
  - Two-cluster events which reconstruct as electron +photon with esum>3GeV
- Using the latest snapshot of iss887 which has Andreas' gains (from FEEs) and "sampling fractions" (from MC and data WABs)

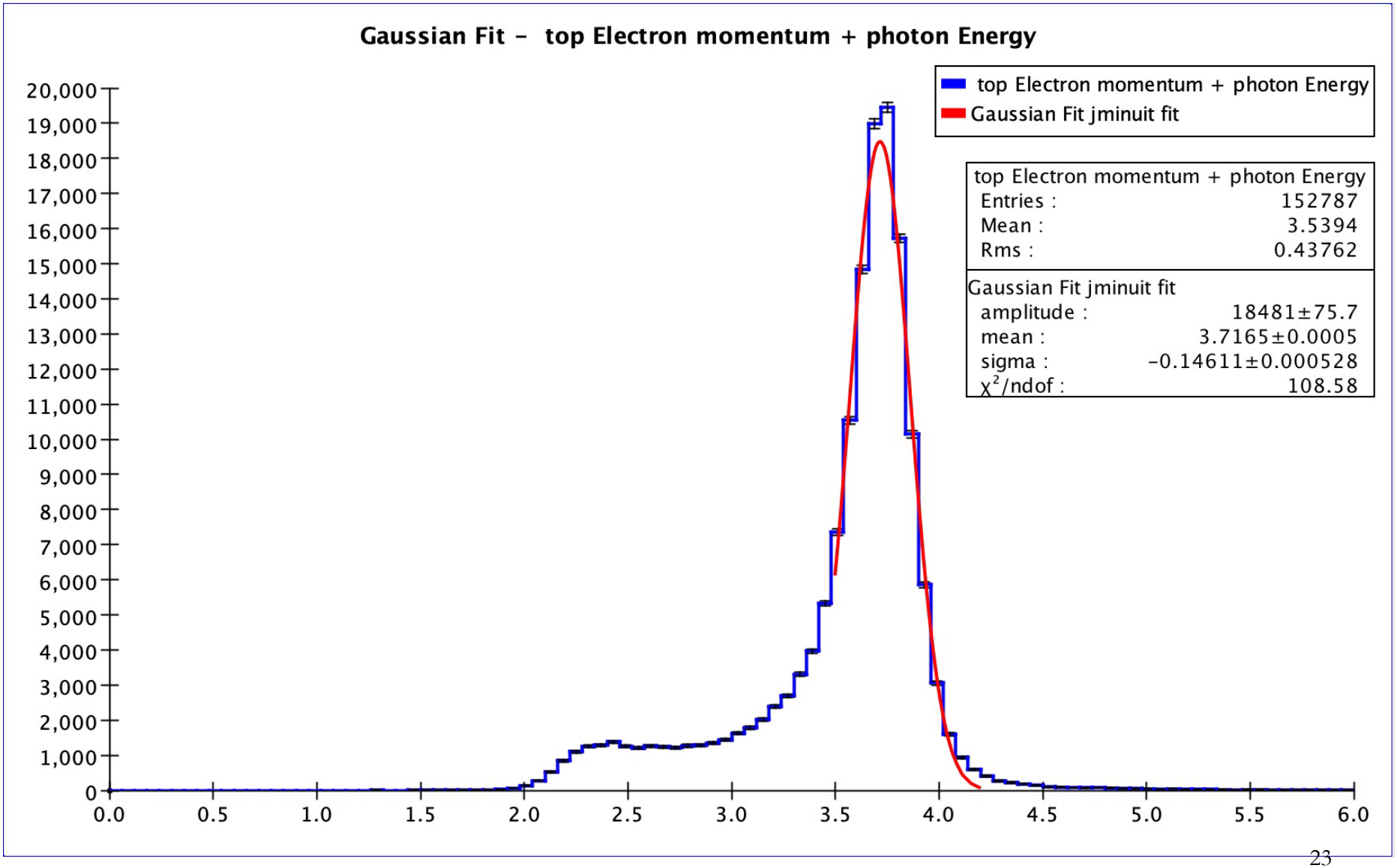
# Electron Energy + Photon Energy



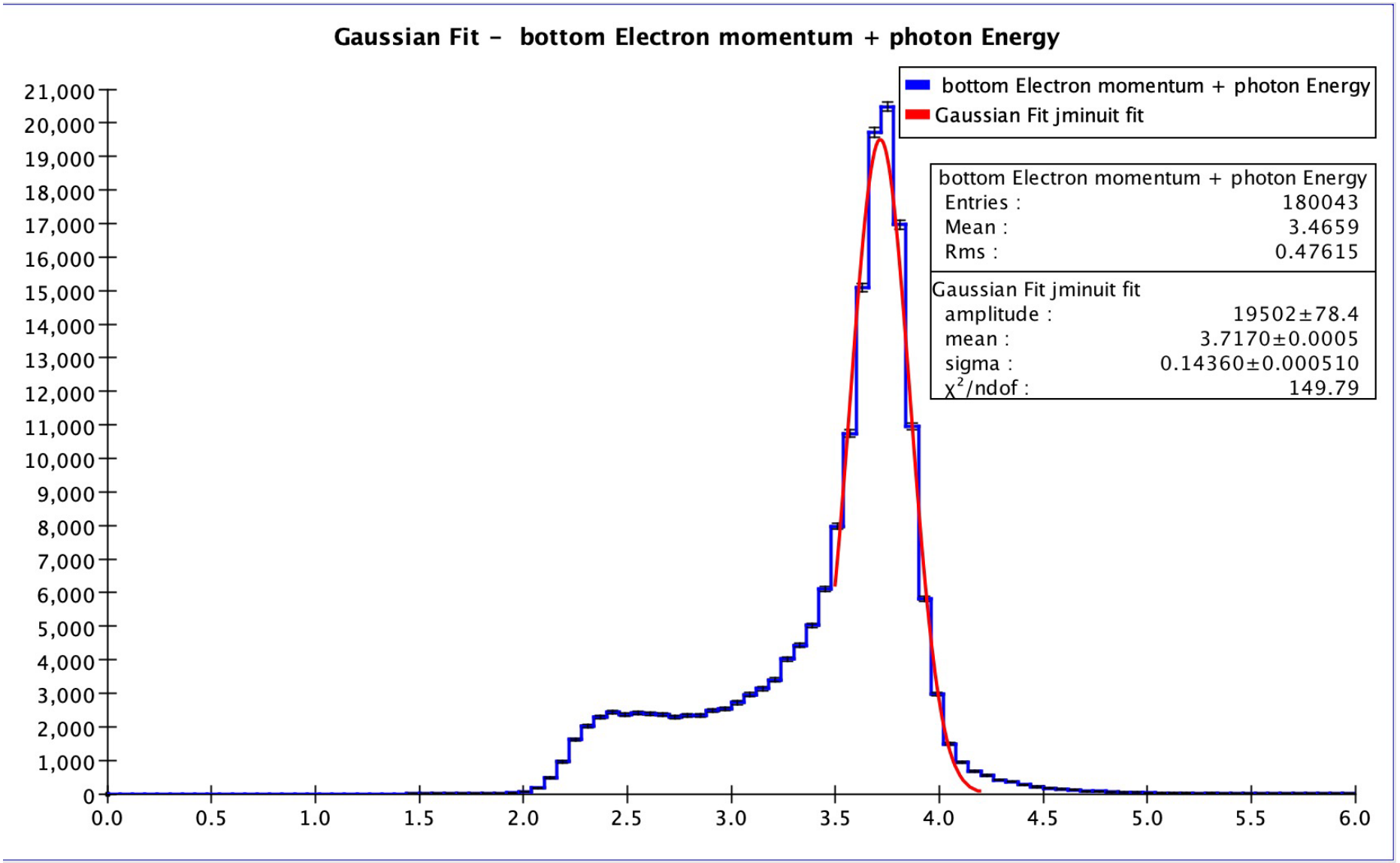
# Electron Energy + Photon Energy



# Electron Momentum + Photon Energy



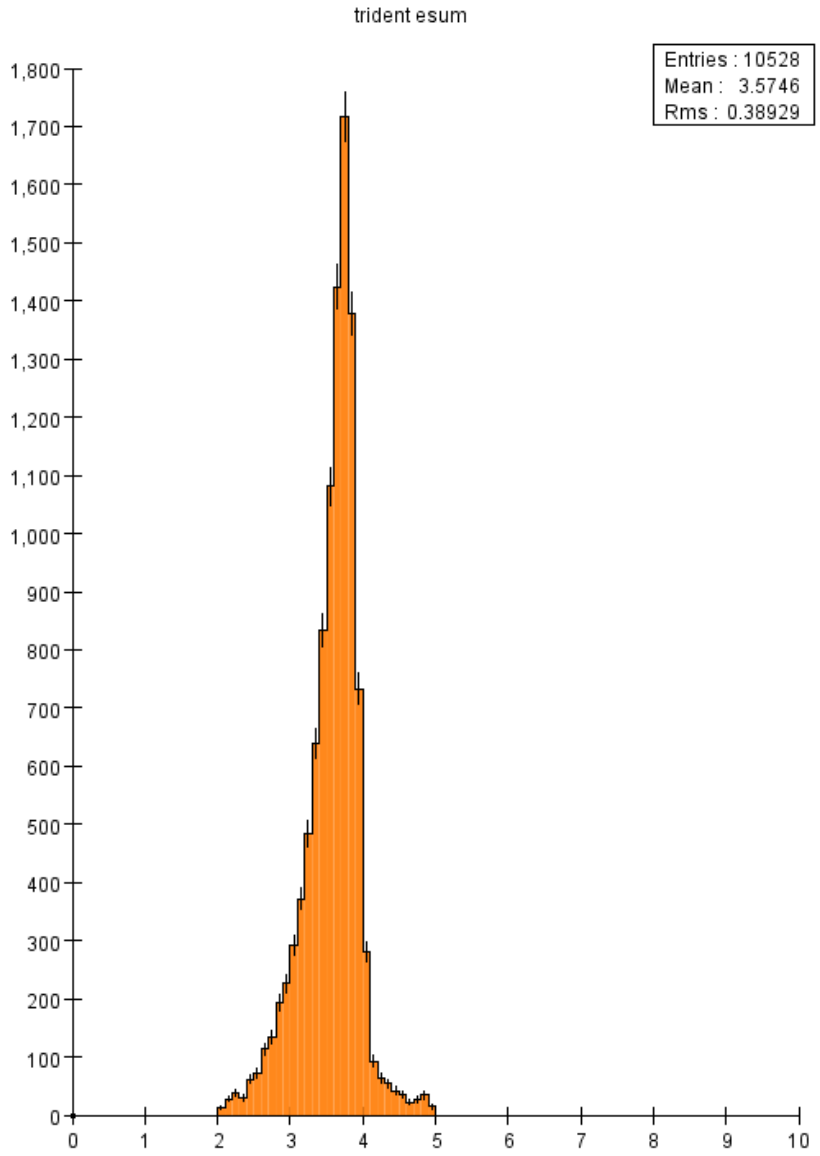
# Electron Momentum + Photon Energy

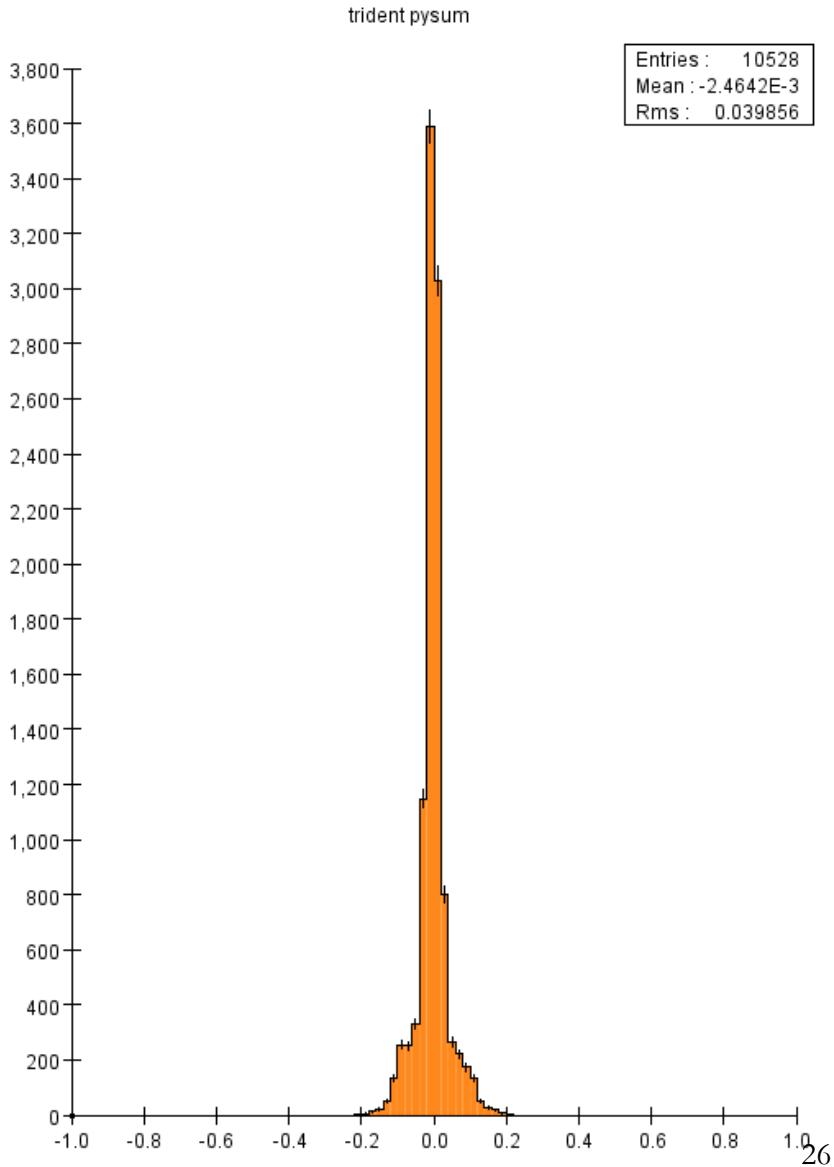


# WABs

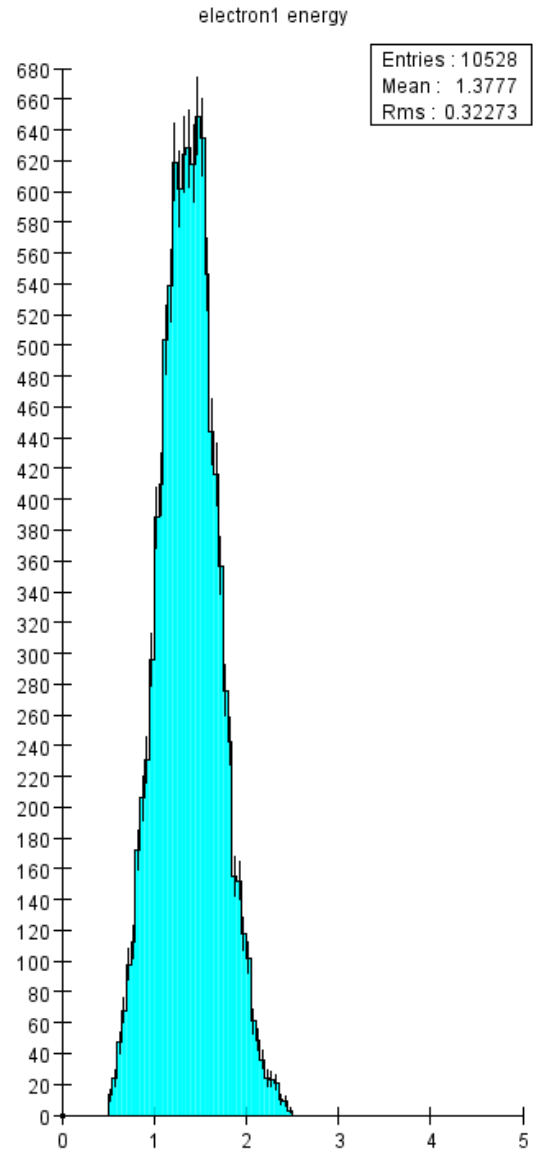
- Ecal corrections are working well
- Track momentum appears to reconstruct a few percent low.

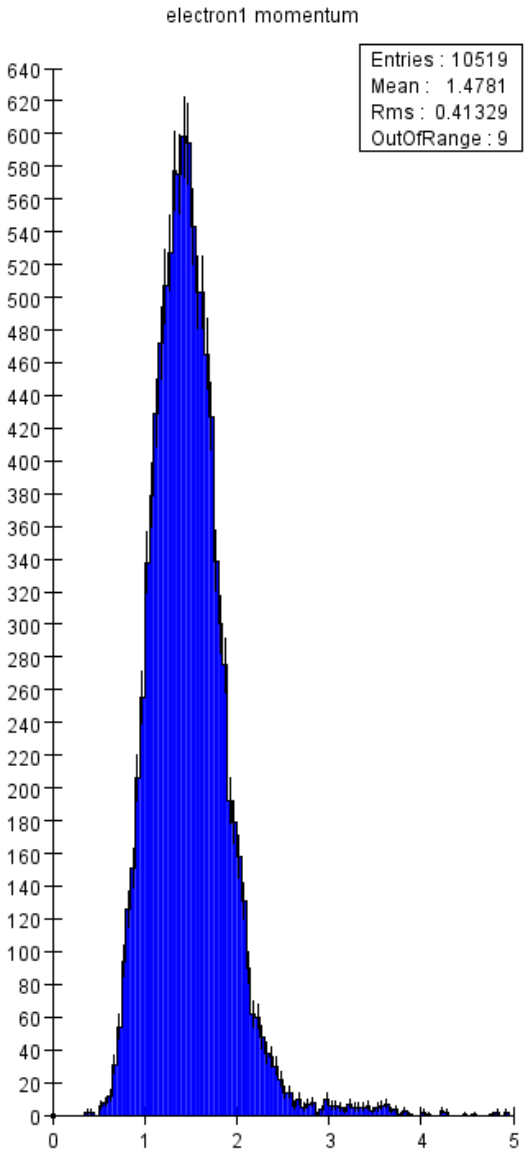
# Three-prong Tridents

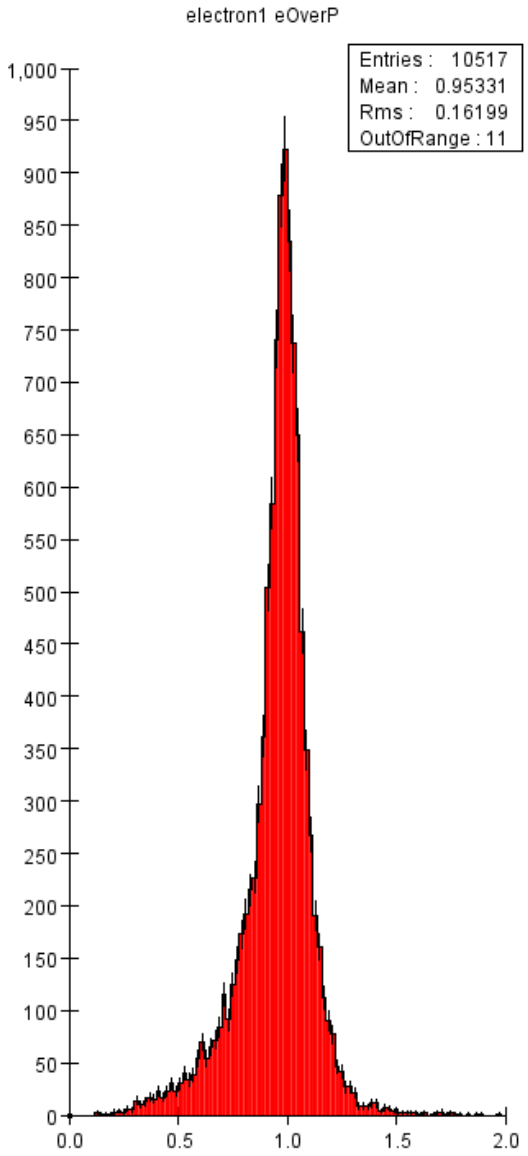


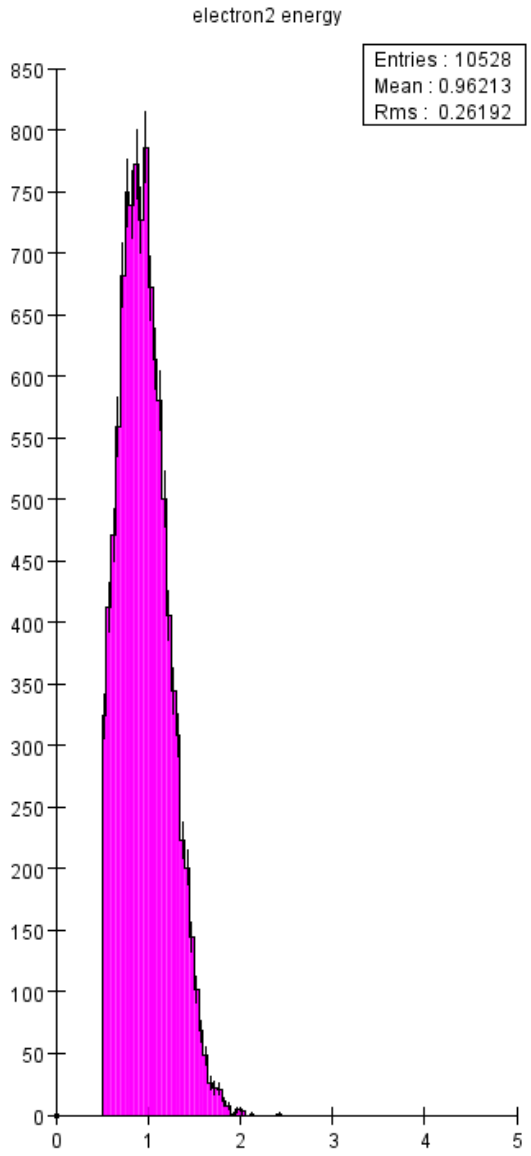
# Three-prong Tridents: Electron1

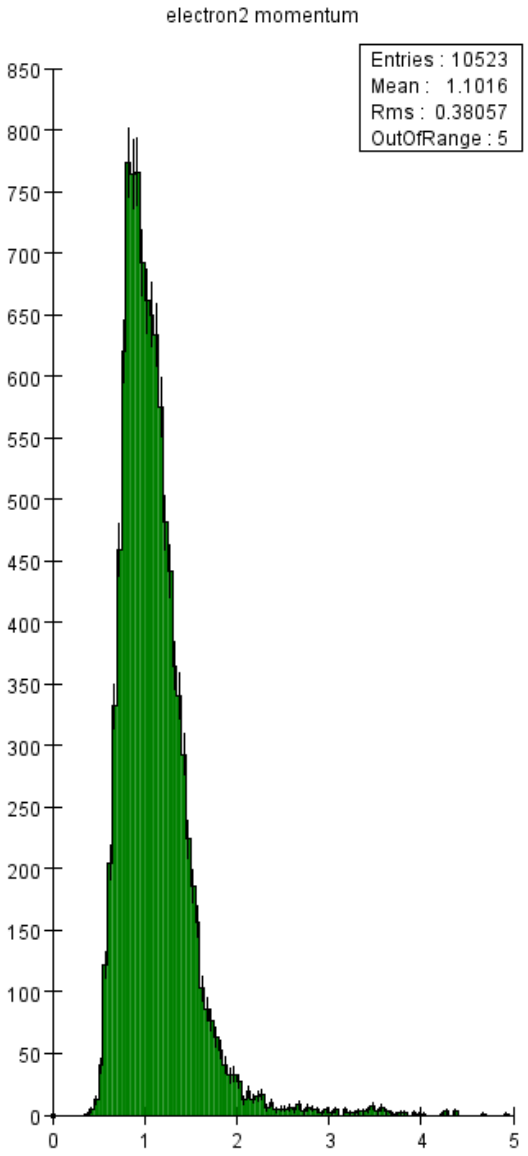


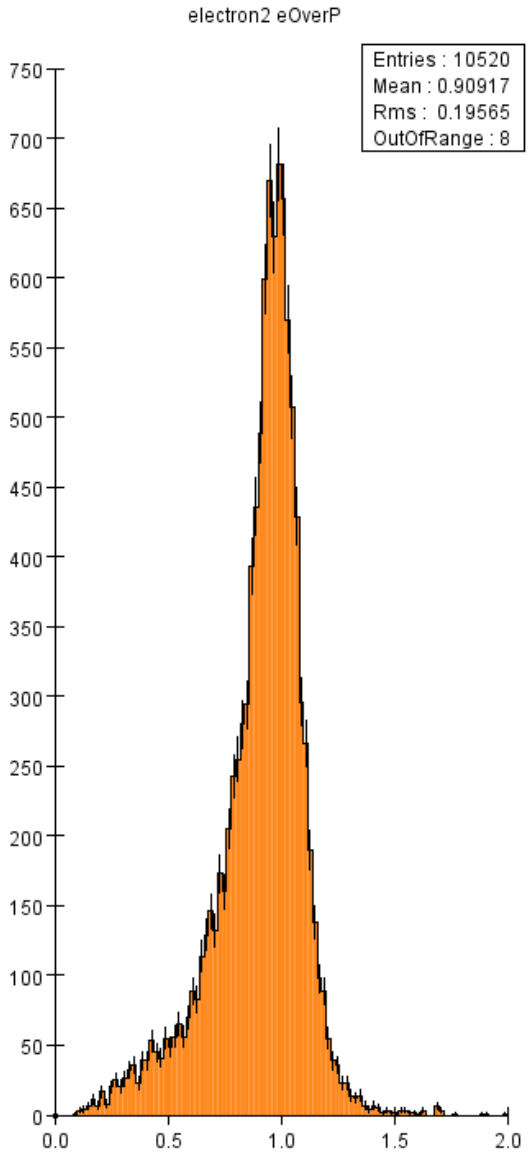



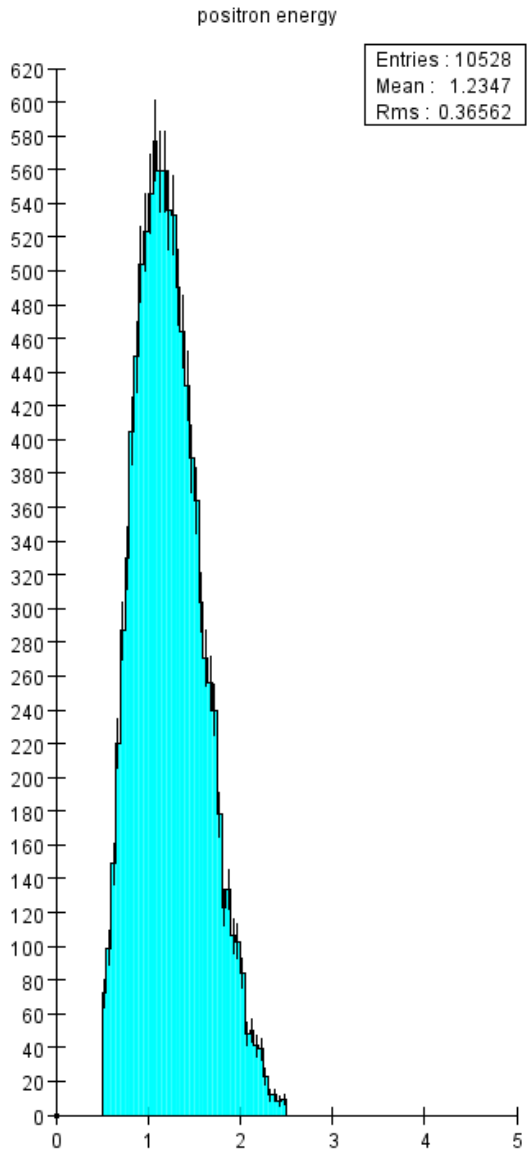
# Three-prong Tridents: Electron2

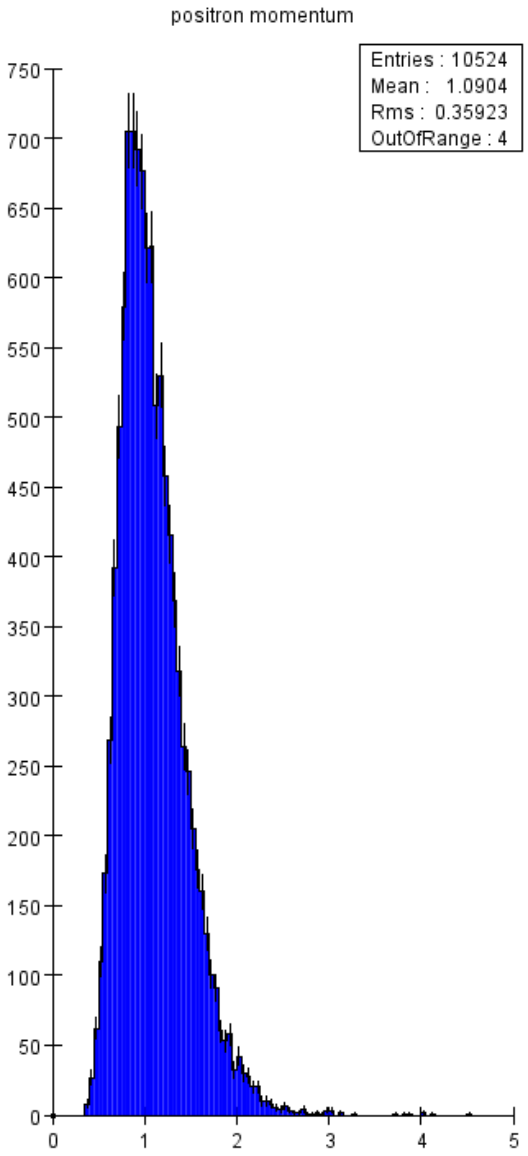


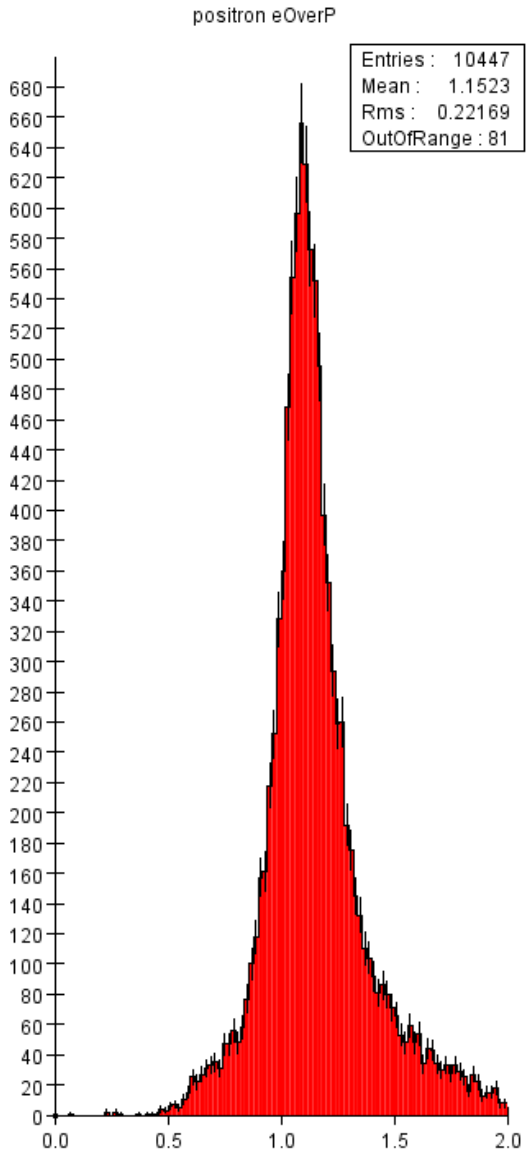



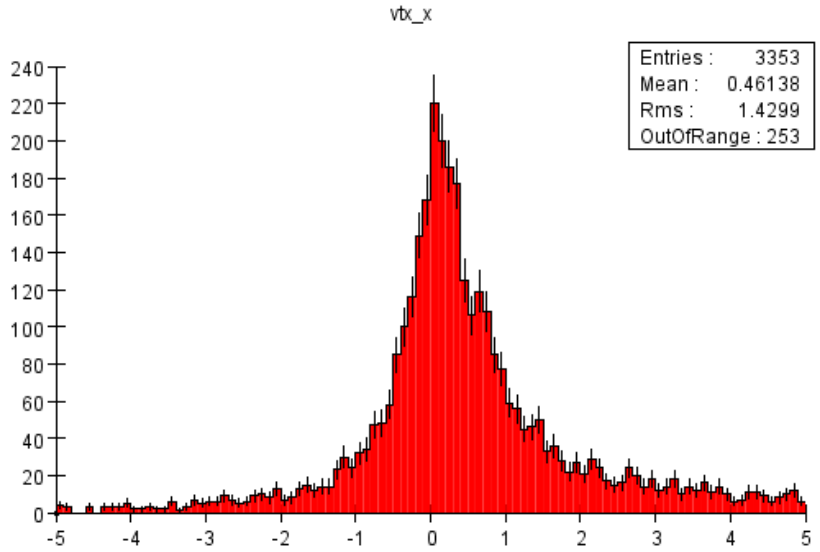
# Three-prong Tridents: Positron

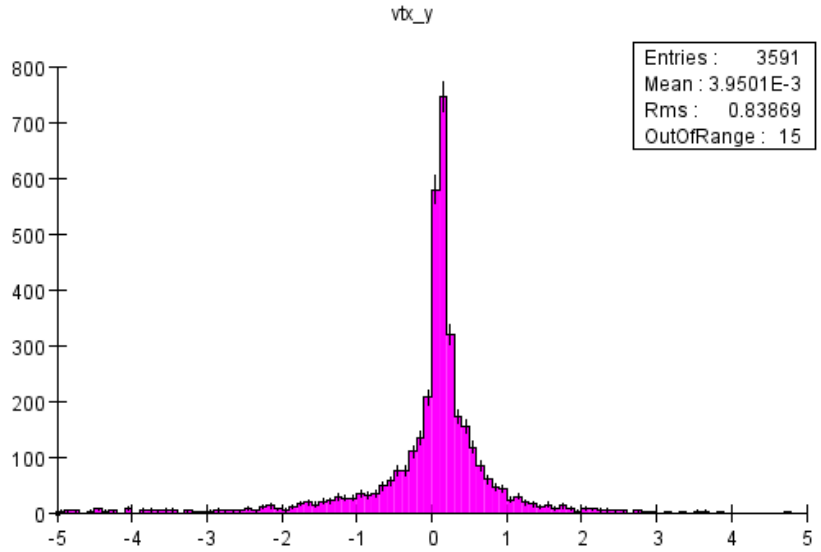


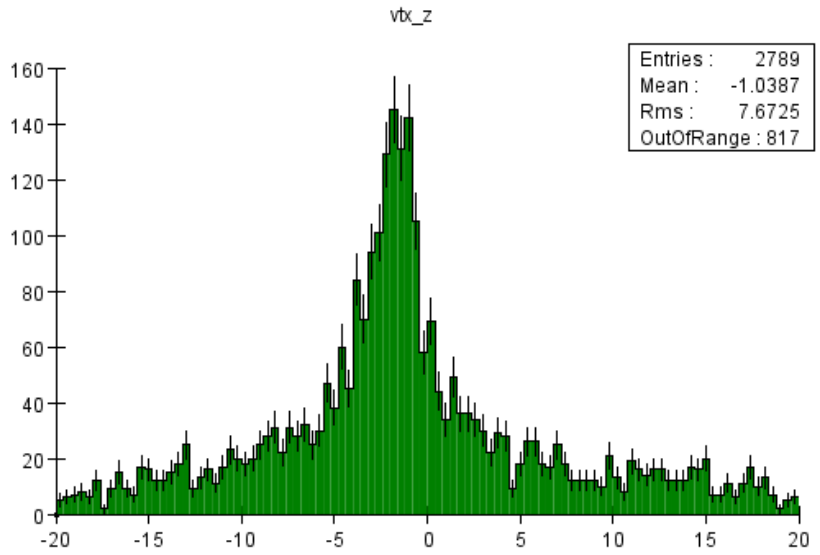



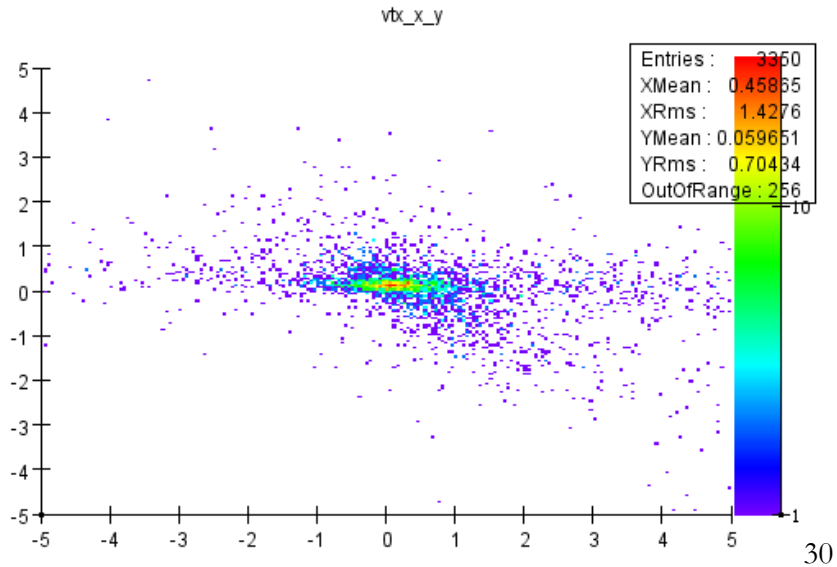



# Trident Vertex Position



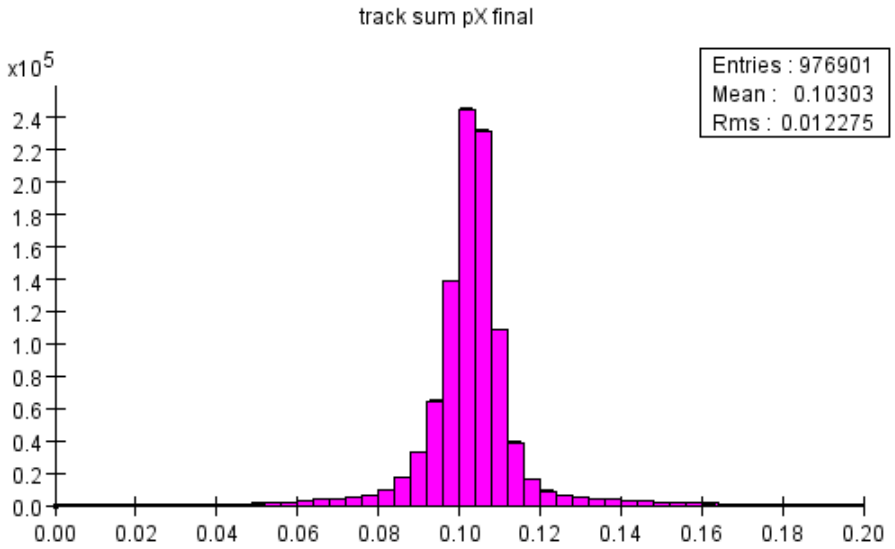



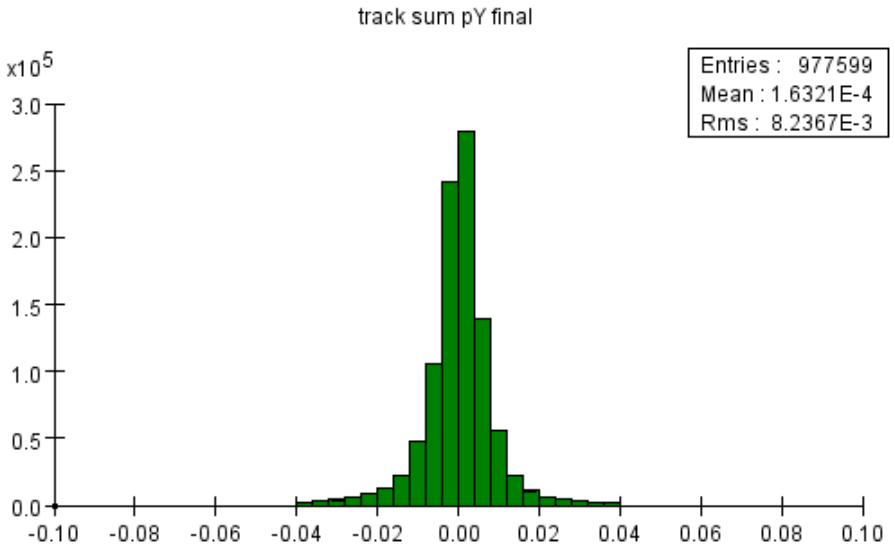



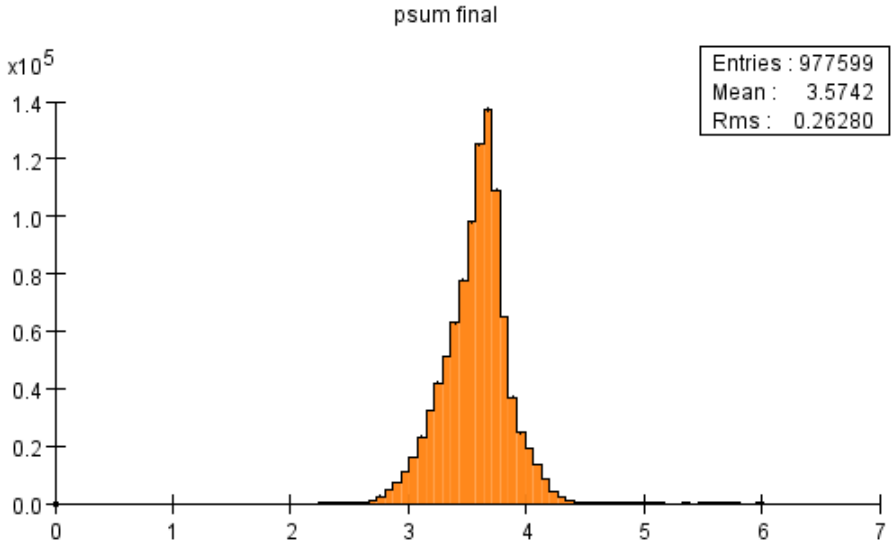
# Tridents

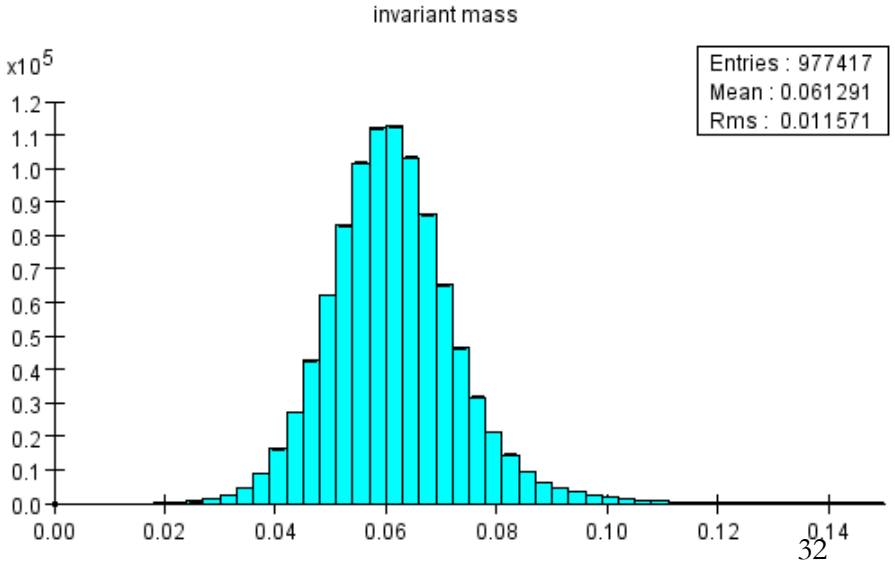
- Electron track calibration appears to be OK
- Positron track momentum is low
- Difficult to say much about vertex position knowing that the FEE “vertices” show such a large top/bottom discrepancy
  - Perhaps look at positron-same-side-electron vertexing

# Møllers Signal Selection

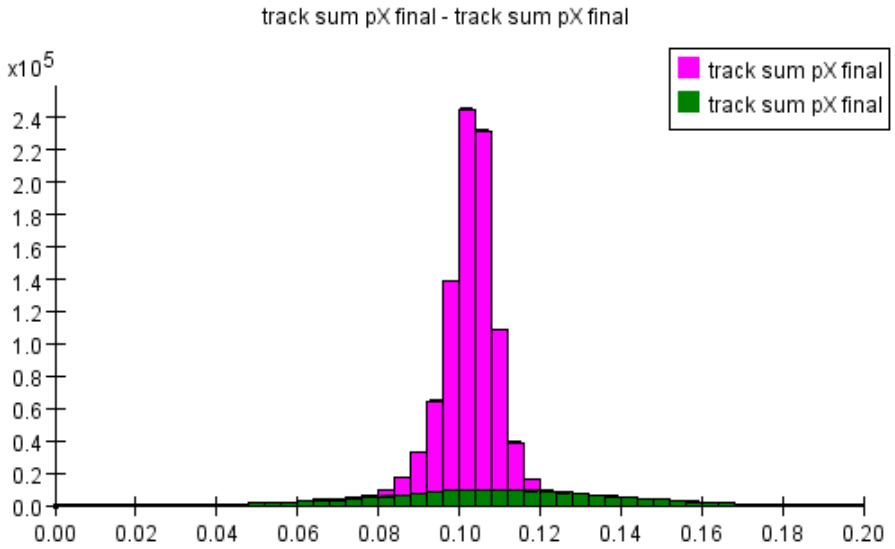


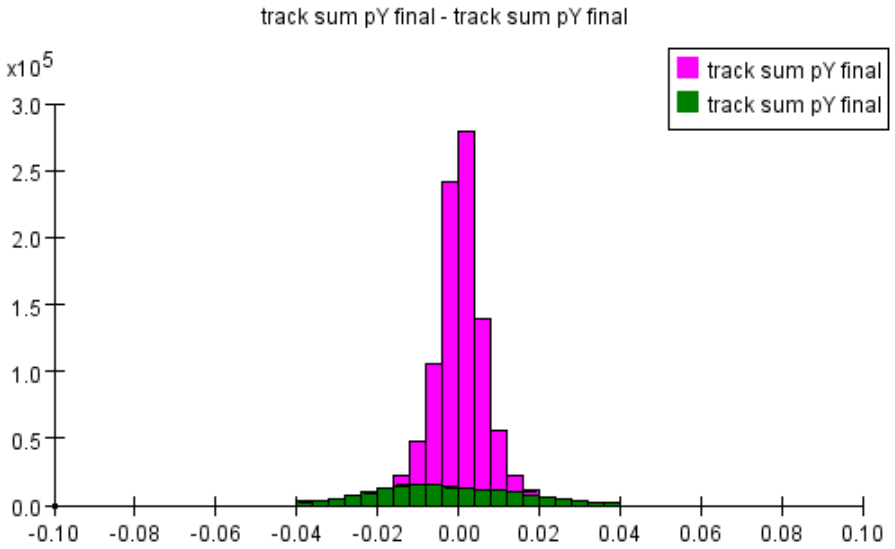



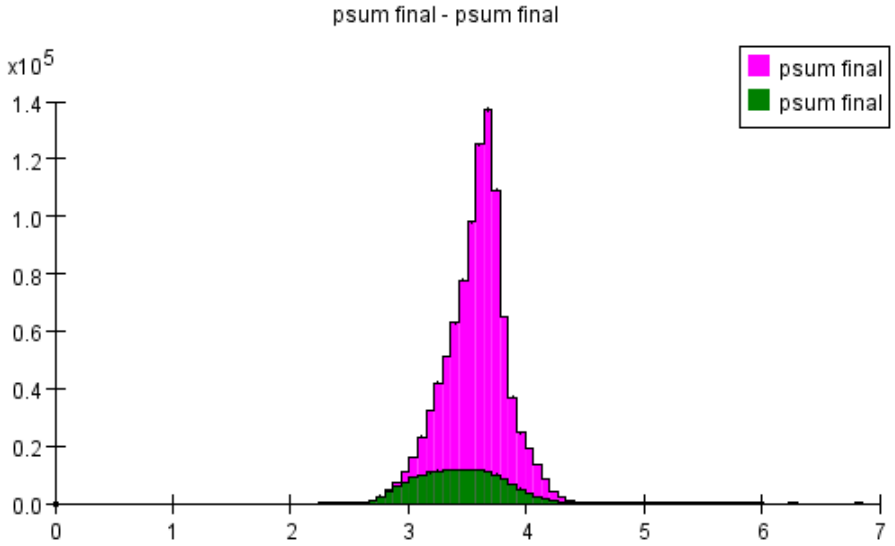



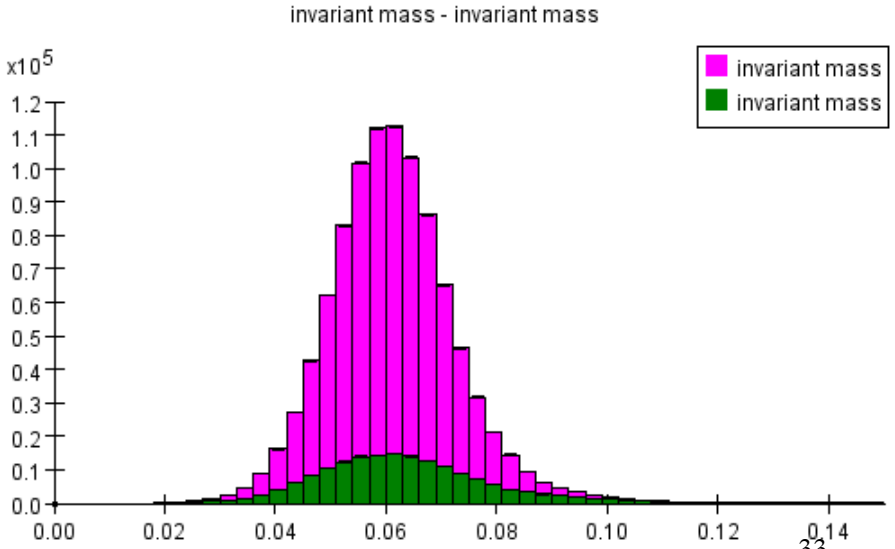



# Møllers Out-of-time Backgrounds

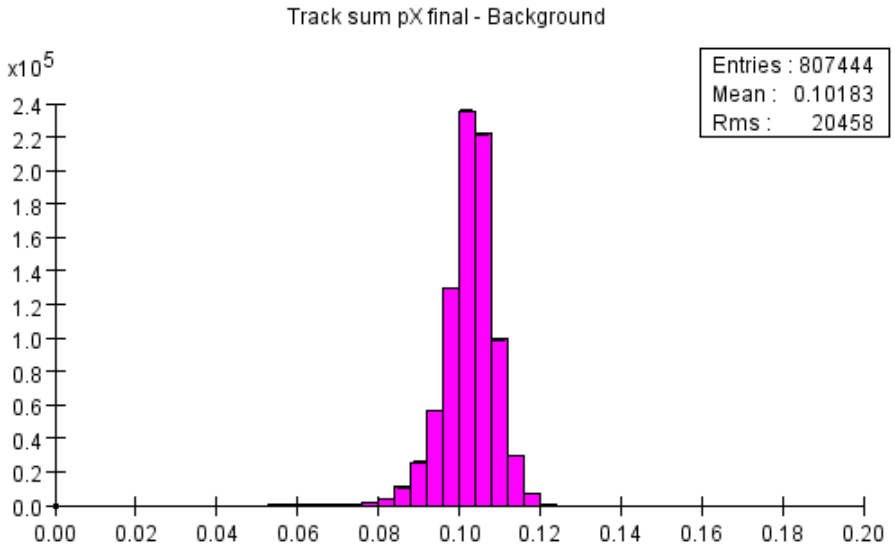


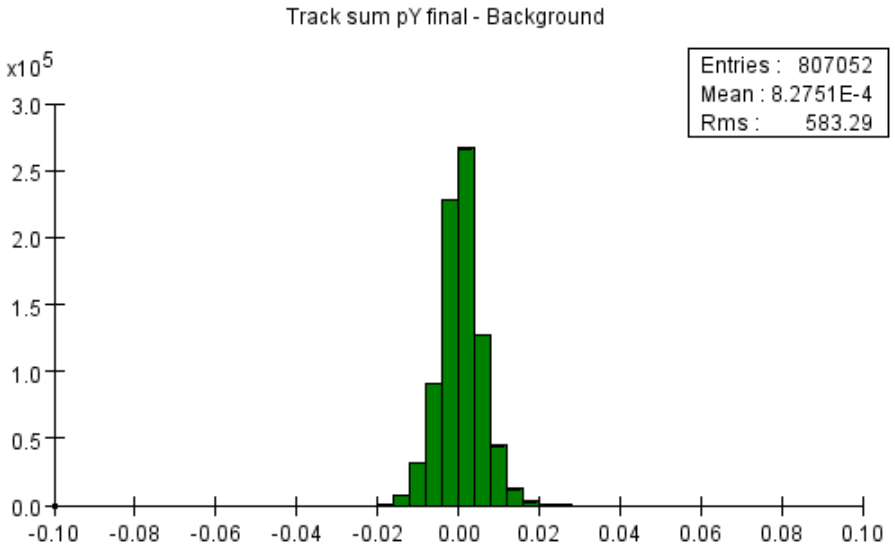



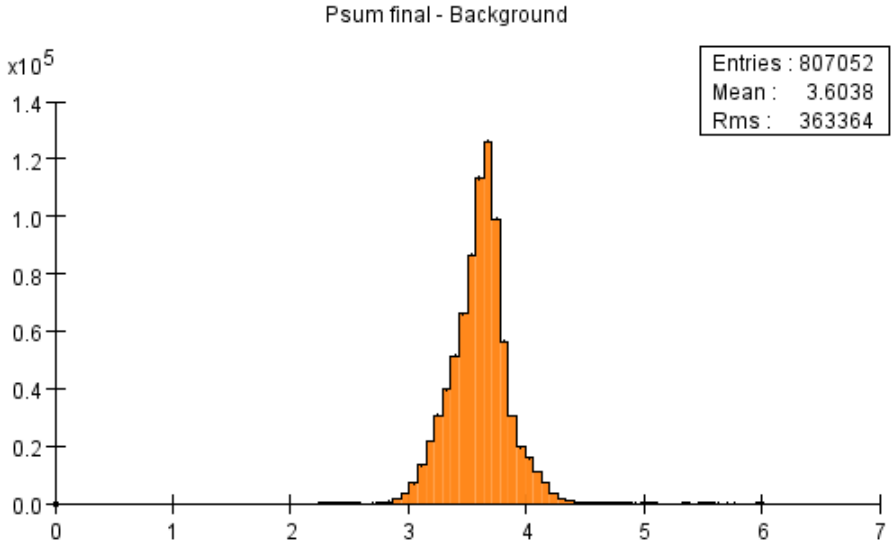



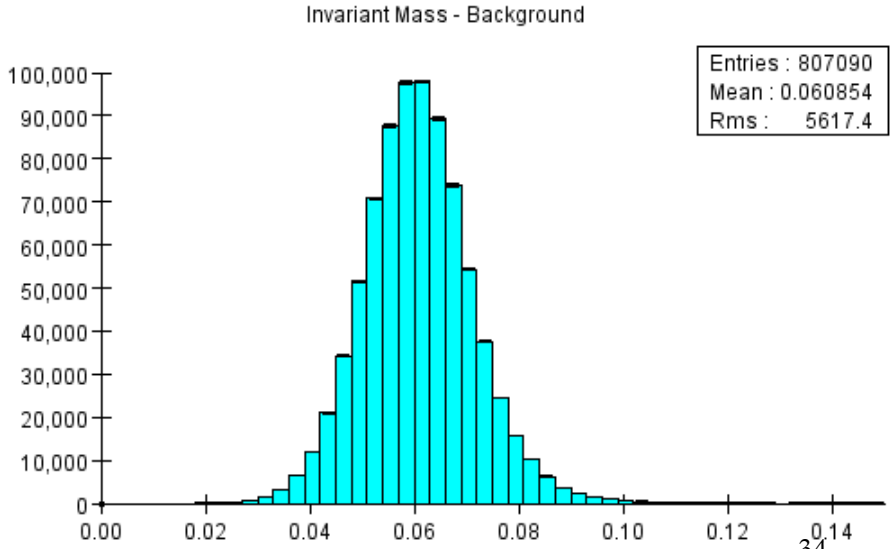



# Møllers Background Subtracted

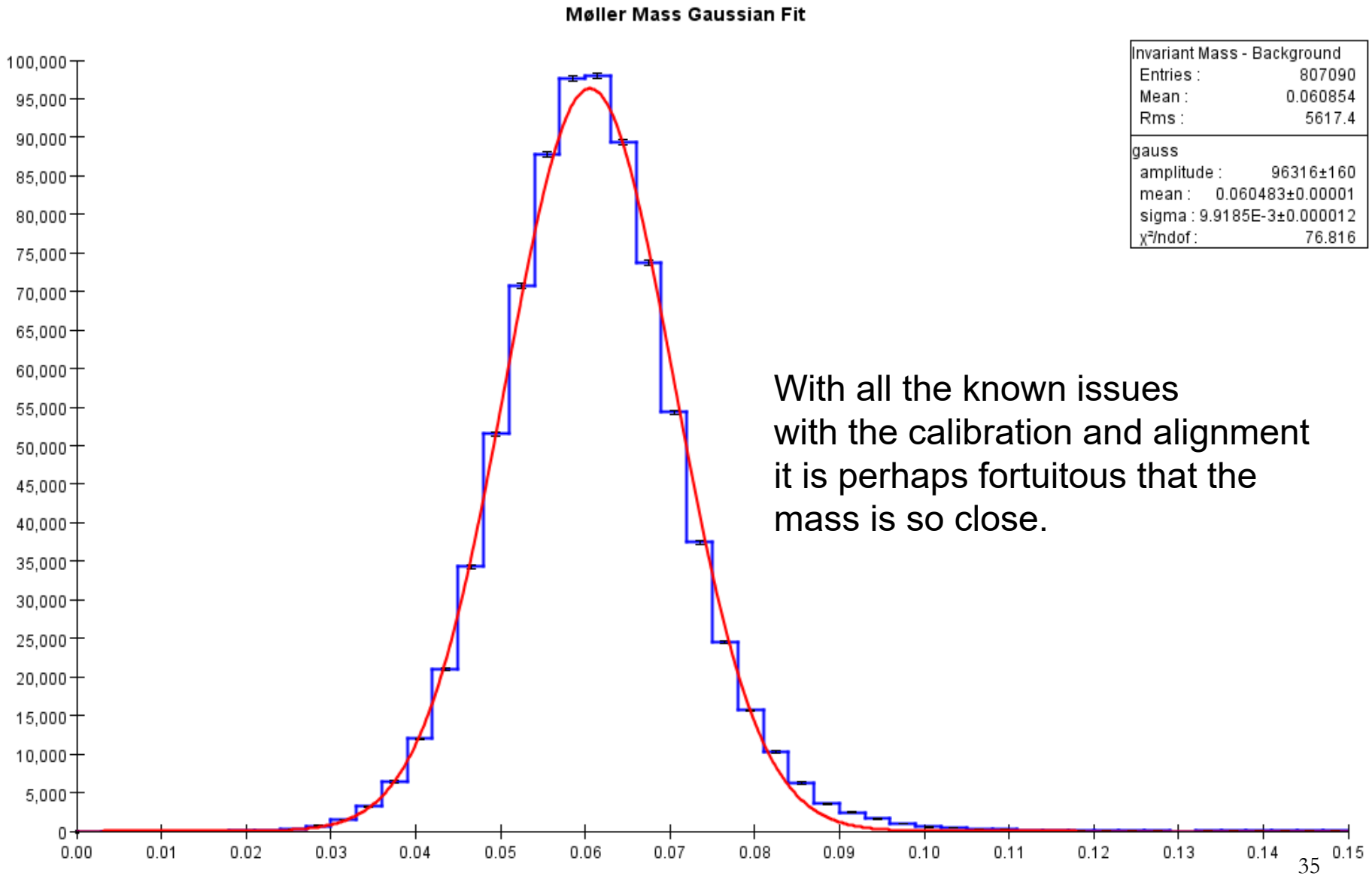


# Møller Candidate Mass




With all the known issues with the calibration and alignment it is perhaps fortuitous that the mass is so close.

# Next steps

- Need to systematically study the SVT alignment as a function of time to understand track-finding efficiency as well as momentum scale and resolution.
- The data taken using the SVT positioning wires (runs 14753 and 14754) should be used when imposing a beamspot constraint as target location is not as well known as the wires
- Use energy of well-calibrated Ecal clusters associated with tracks to impose a momentum constraint on the tracker alignment
- Use WAB and three-prong tridents to check both energy and momentum calibration scale and resolution
- Use track-by-track p-$\theta$ constraint from Møller events to obtain global alignment.