TRACK EXTRAPOLATION TO ECAL (AGAIN!)

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TRACK EXTRAPOLATION TO ECAL

- TrackDataDriver uses TrackUtils.extrapolateTrackUsingFieldMap to create new TrackState@ECal for every GBL Track
  - Old hps-java versions: extrapolate from TrackState@IP
  - New versions: extrapolate from TrackState@LastHit
- Perhaps we still have a problem (Tim): extrapolation only uses y-component from BFieldMap
  - Could fringe effects (x and z field components) significantly affect low-momentum track extrapolation accuracy?
  - Track-cluster matching criterion is loose enough that it's unaffected… but, other potential analysis problems?
- Test using MC truth info, rather than reco track-cluster matching
  - Look at each MCParticle passing some basic selection requirements
  - Take position&momentum of its SimTrackerHit in last SVT layer, pass to extrapolateTrackUsingFieldMap to extrapolate to ECal
  - Compare extrapolation result to particle's SimTrackerHit in TrackerHitsECal collection (simulated hit on ECal scoring plane)

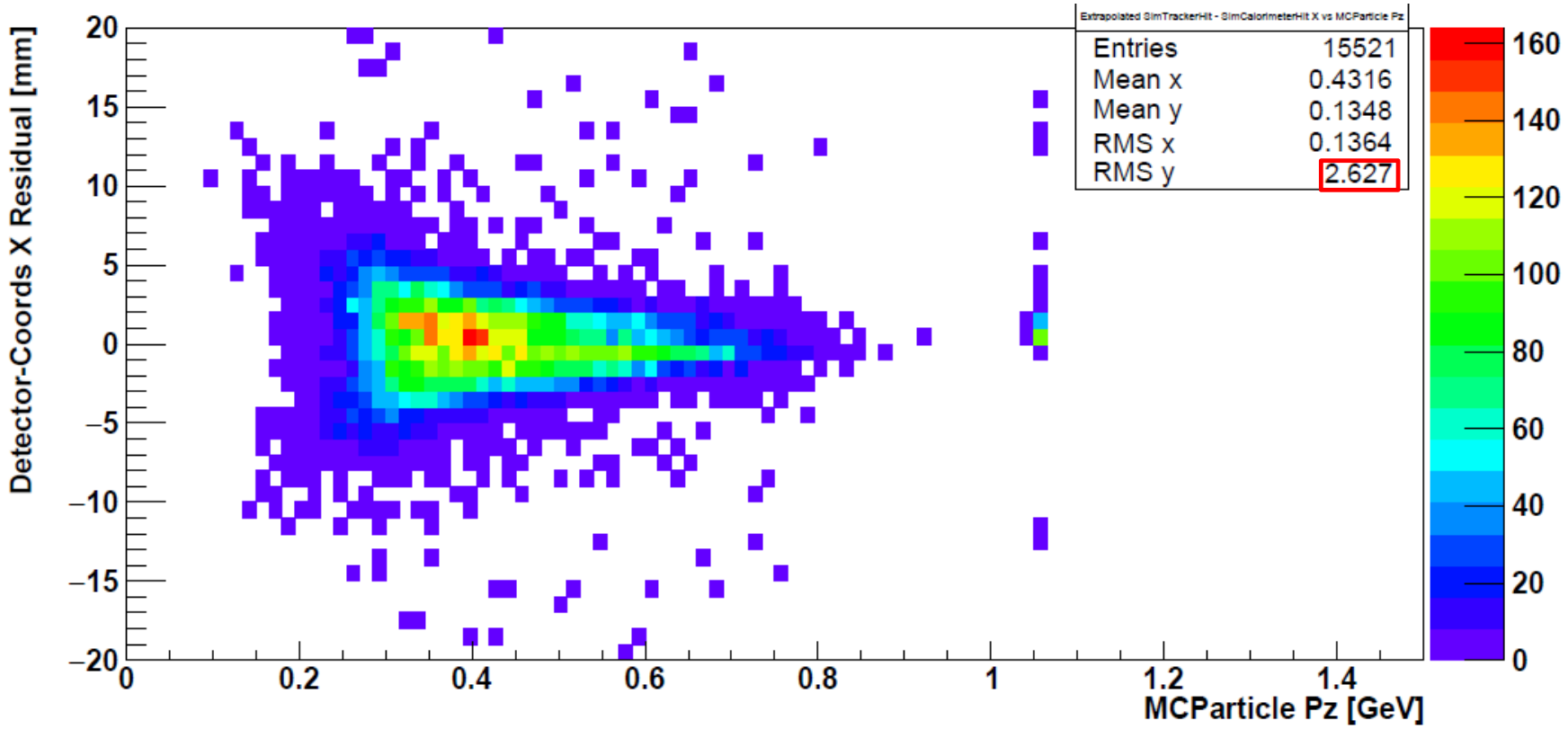
BASIC SELECTION

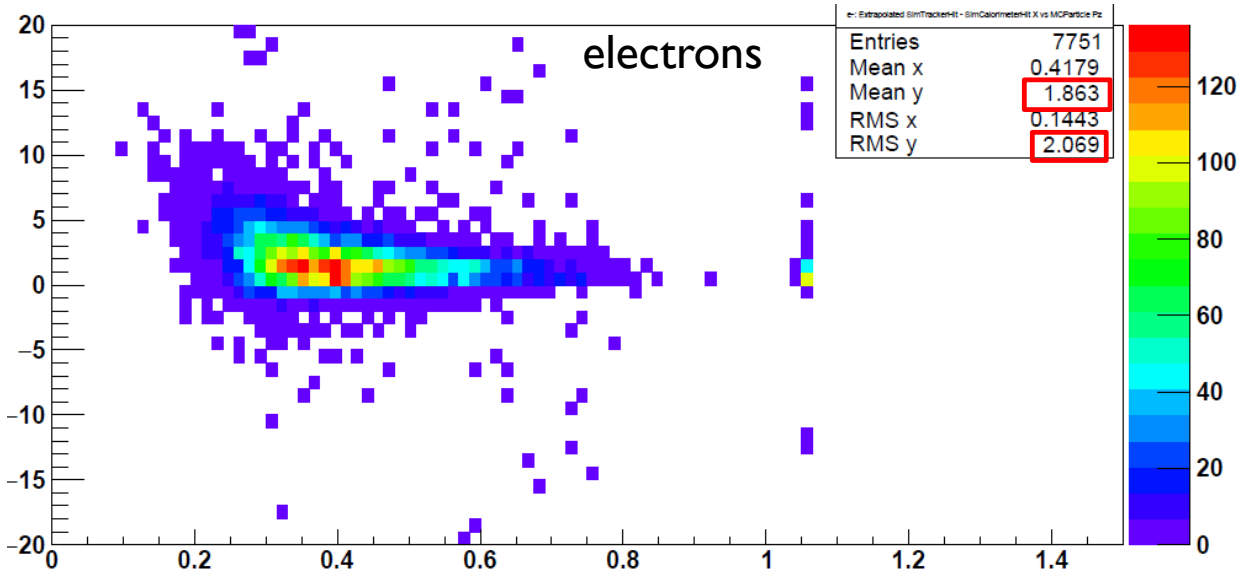
- MCParticle must have:
  - Non-zero charge
  - getGeneratorStatus() == MCParticle.***FINAL_STATE***
  - getSimulatorStatus().isDecayedInCalorimeter()
  - SimTrackerHit in SVT Layer 6

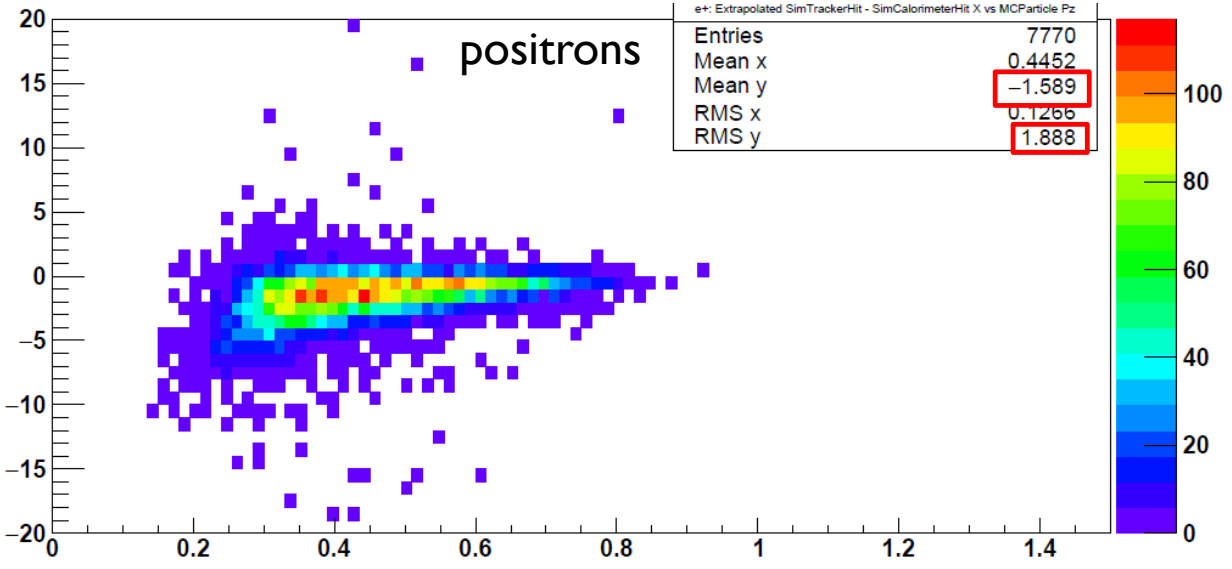
- Often have multiple TrackerHitECal entries assigned to same MCParticle
  - Usually backsplash from calo shower… so select TrackerHitECal entry with earliest time
  - If this entry is obviously far from extrapolated position at ECal … maybe particle brem'd a photon that reached ECal before it. So, loop through all TrackerHitECal entries looking for a better match to extrapolated position

X RESIDUALS

- Residual = extrapolated position – TrackerHitECal position
- Momentum dependence!
- Why non-zero mean?
- Should RMS be smaller?

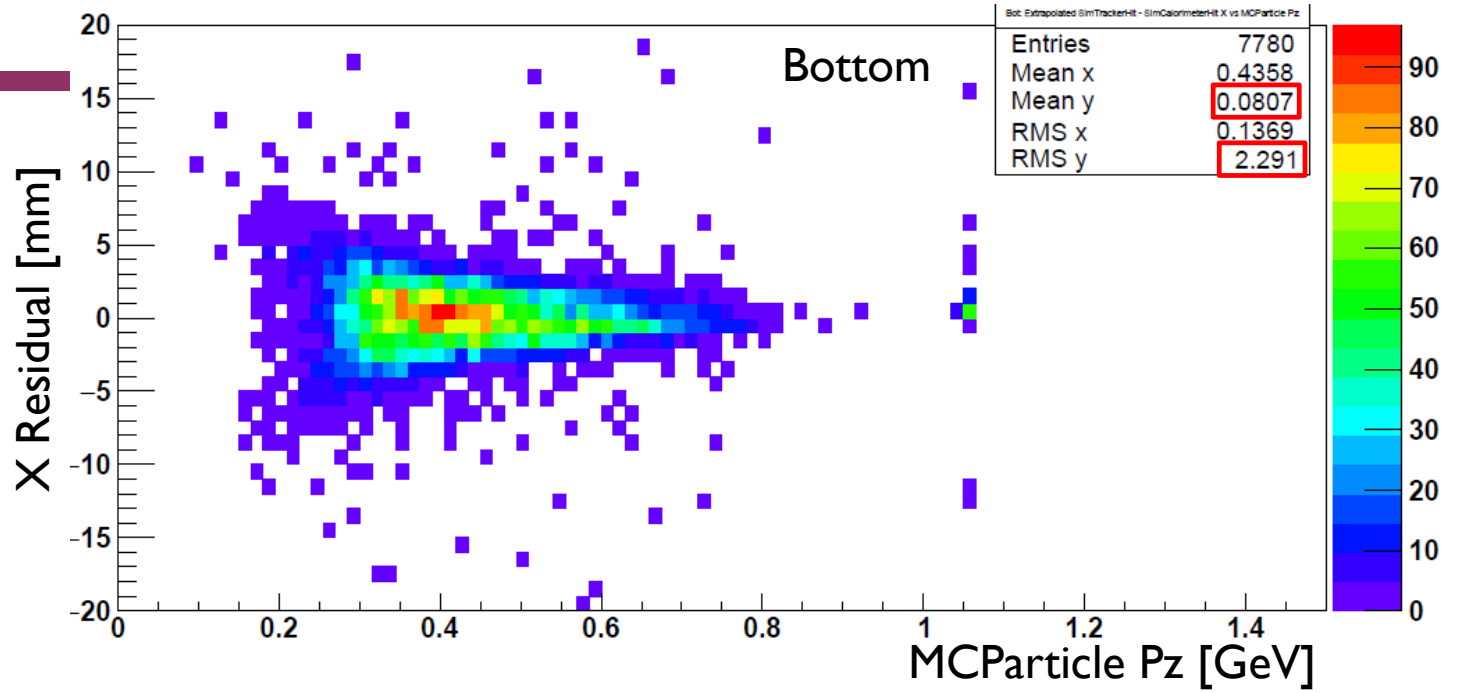


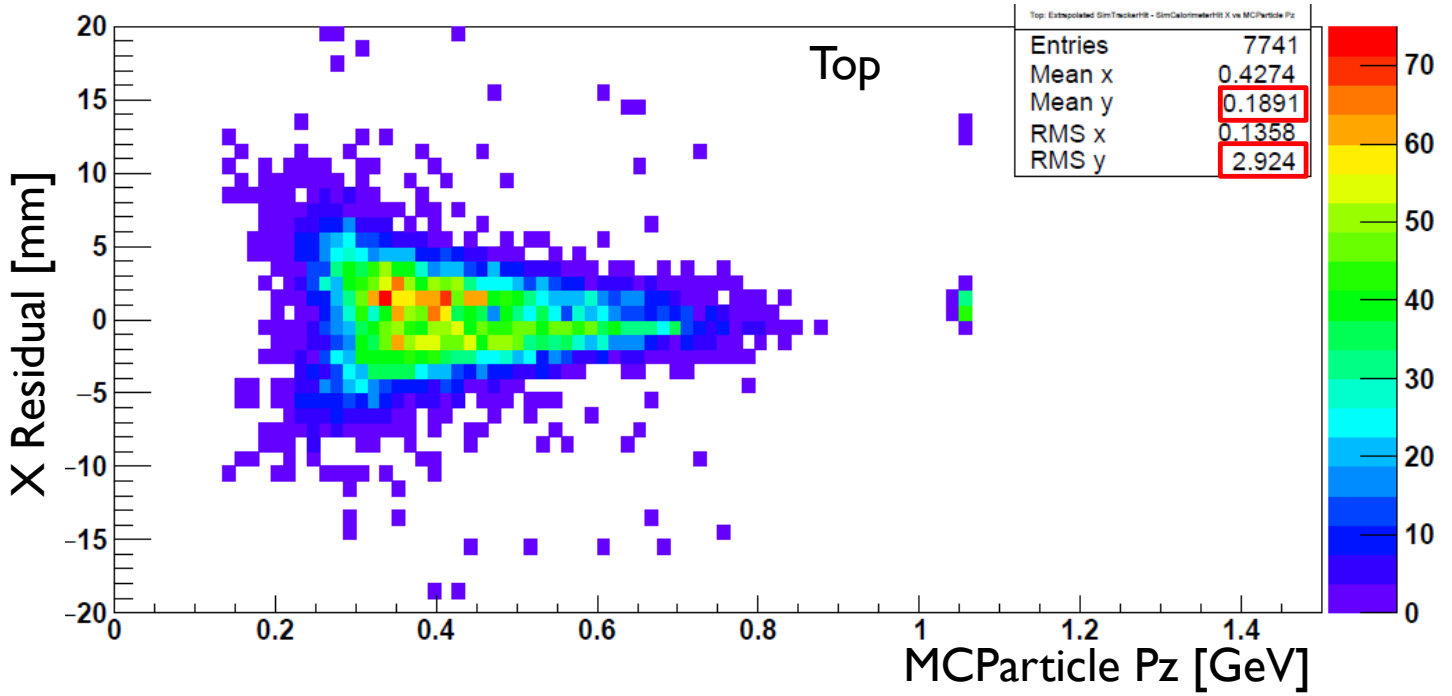




X RESIDUALS

- My favorite rabbit-hole: Why are the mean and RMS bigger for top than bottom?

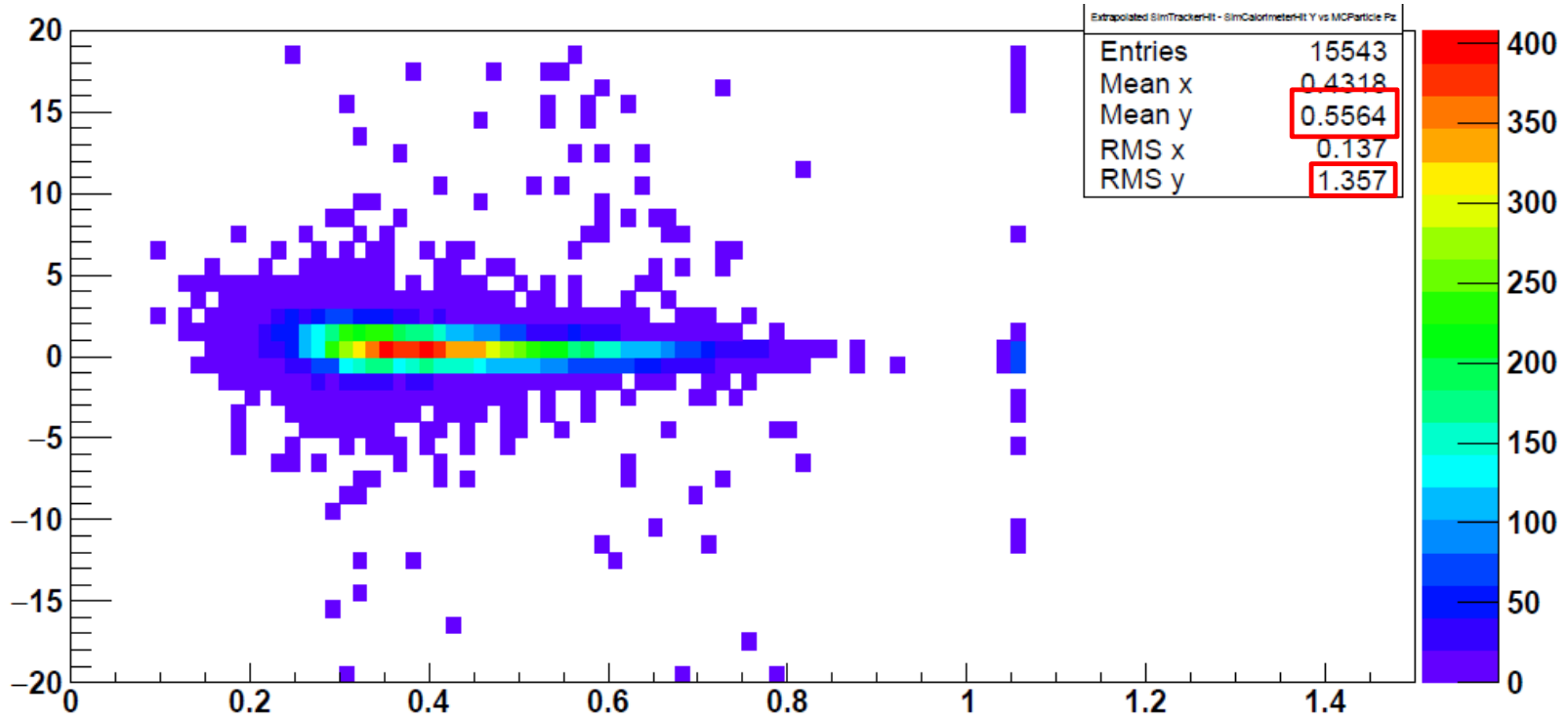


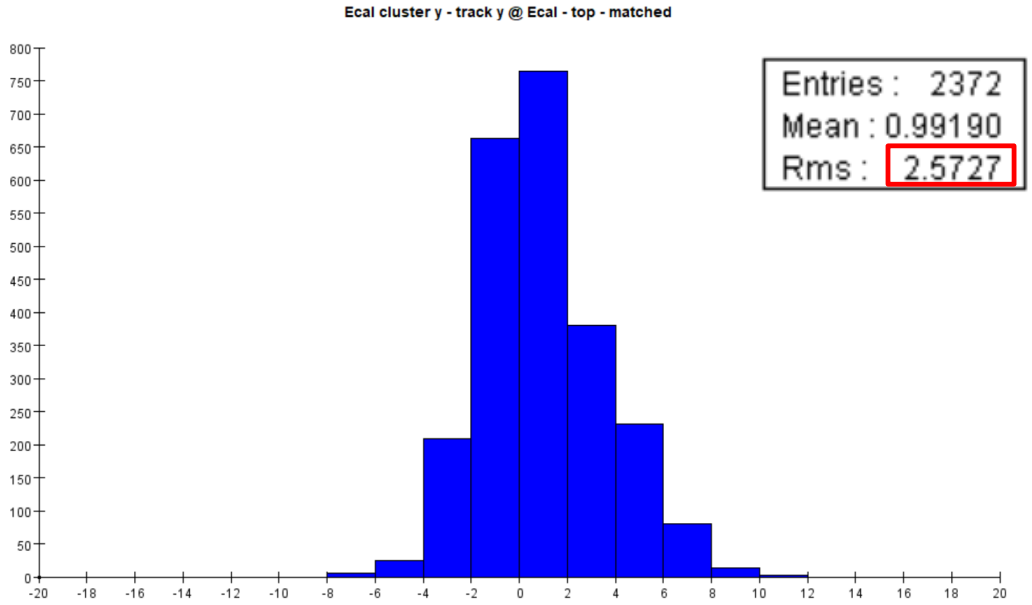


Y RESIDUALS

Mean ≈ 0.5 , not 0

e+ : mean 0.623 +/- 0.013
RMS 1.18
e- : mean 0.490 +/- 0.017
RMS 1.52

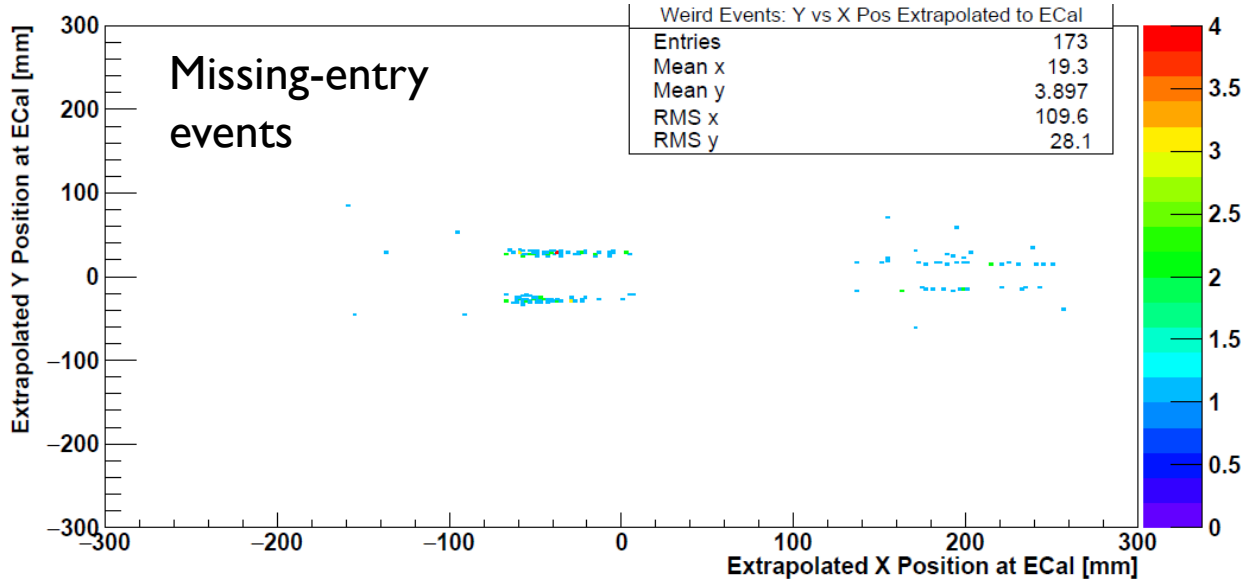


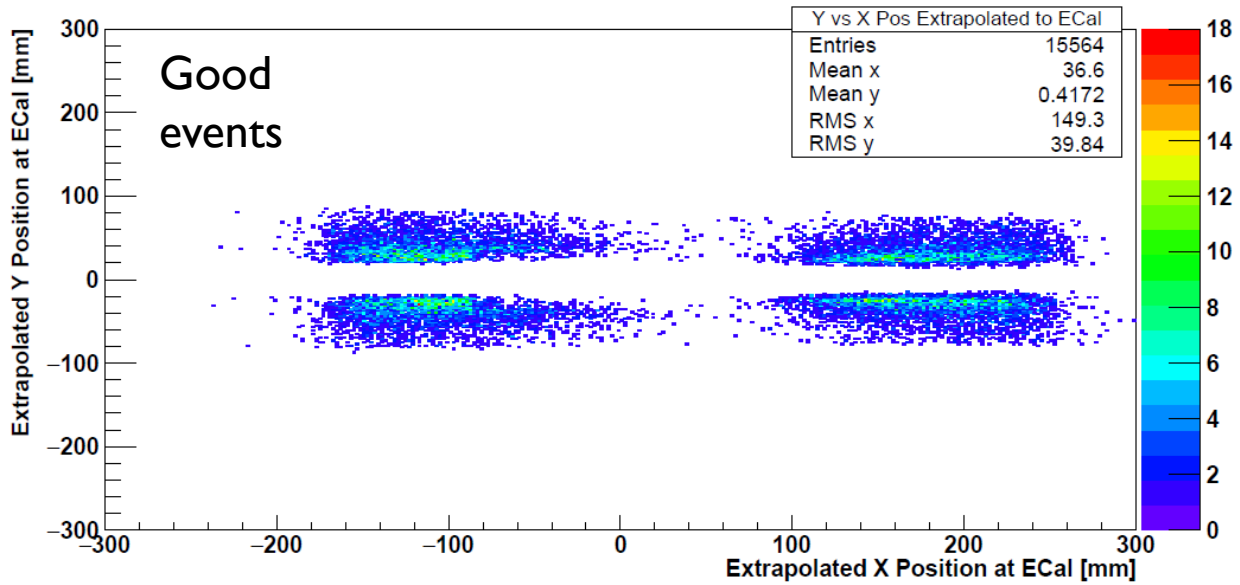


- RMS smaller for Y than for X
  - Although Y (not X) is where Tim expected Bfield effects to show up!
- RMS about half as large as for [reco track – cluster] residuals

FOOTNOTE: "MISSING" TRACKER HIT ECAL ENTRIES

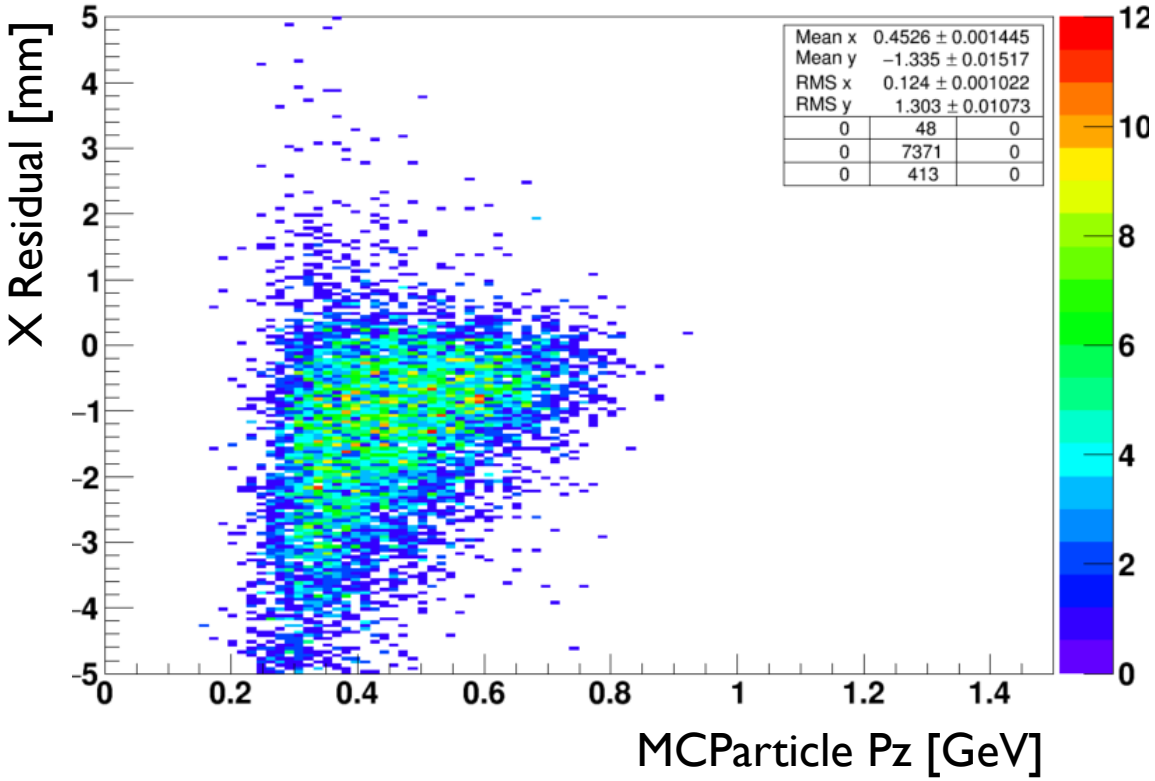
- For about 1% of MCParticles passing the basic selection, there is no TrackerHitECal entry reasonably close (within 30mm in X) to the extrapolated ECal position.
- Due to hole in ECal scoring plane swallowing them (possibly after scattering in vacuum chamber, brem / shower / hard-interaction, etc)

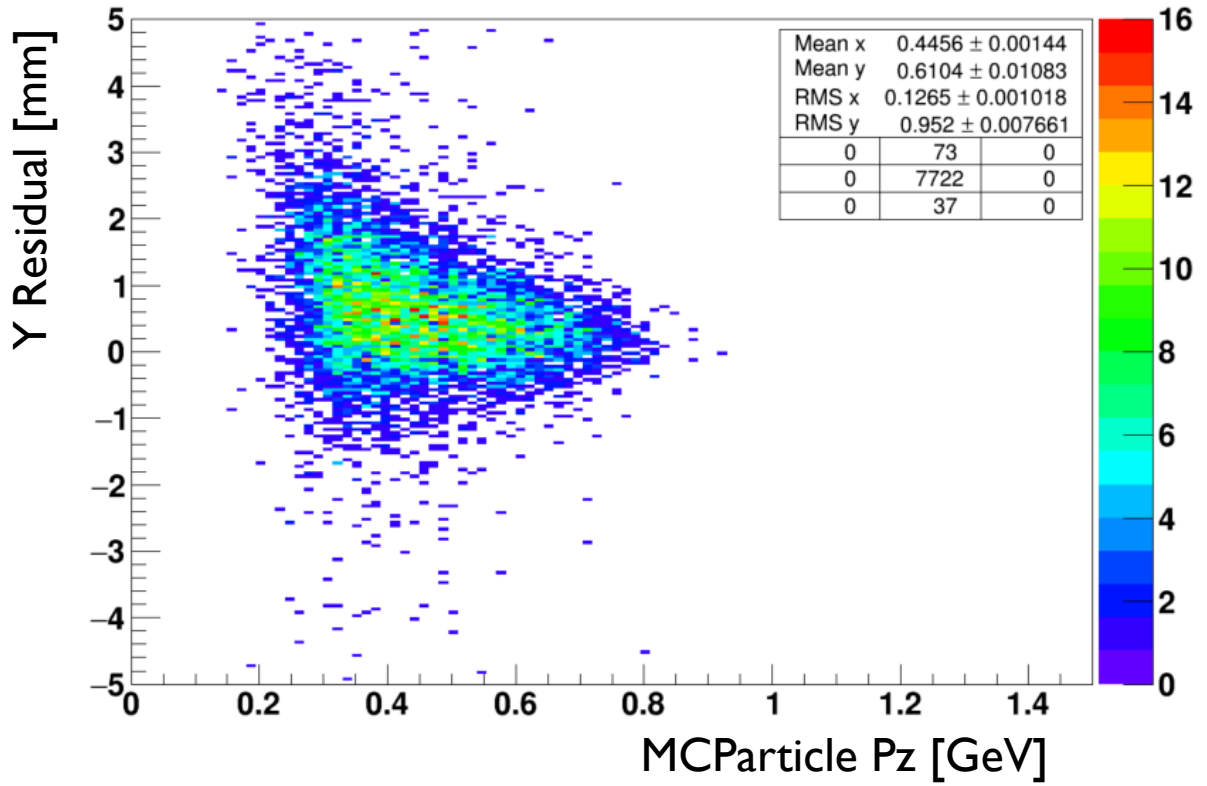




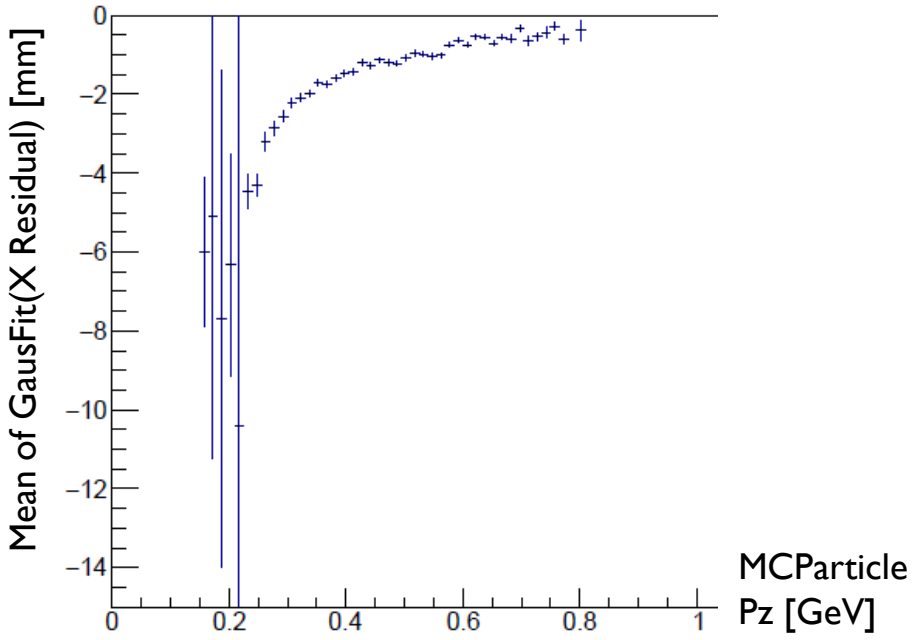
ADDITIONAL PLOTS

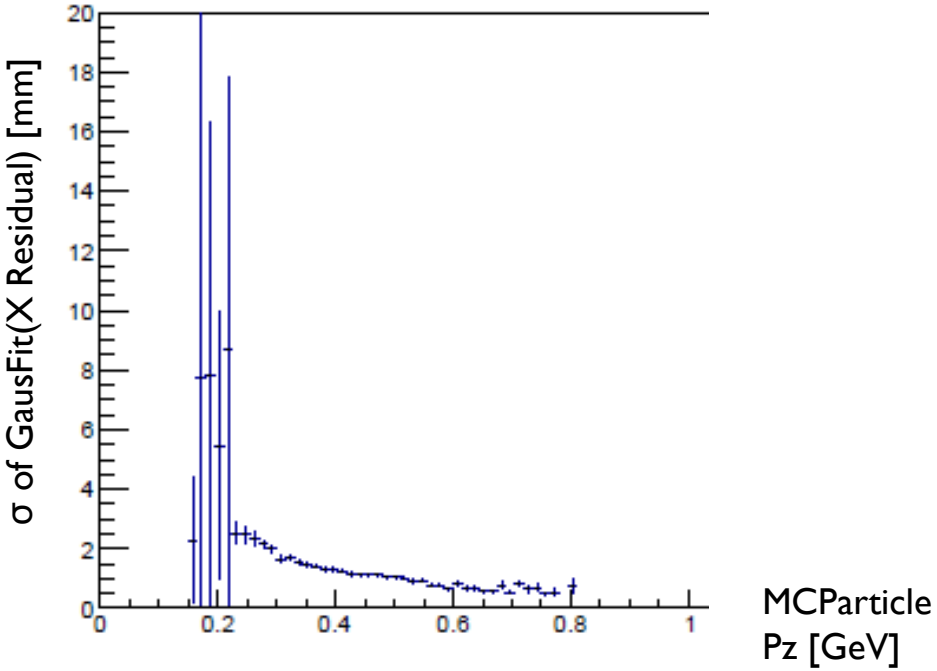
POSITRONS

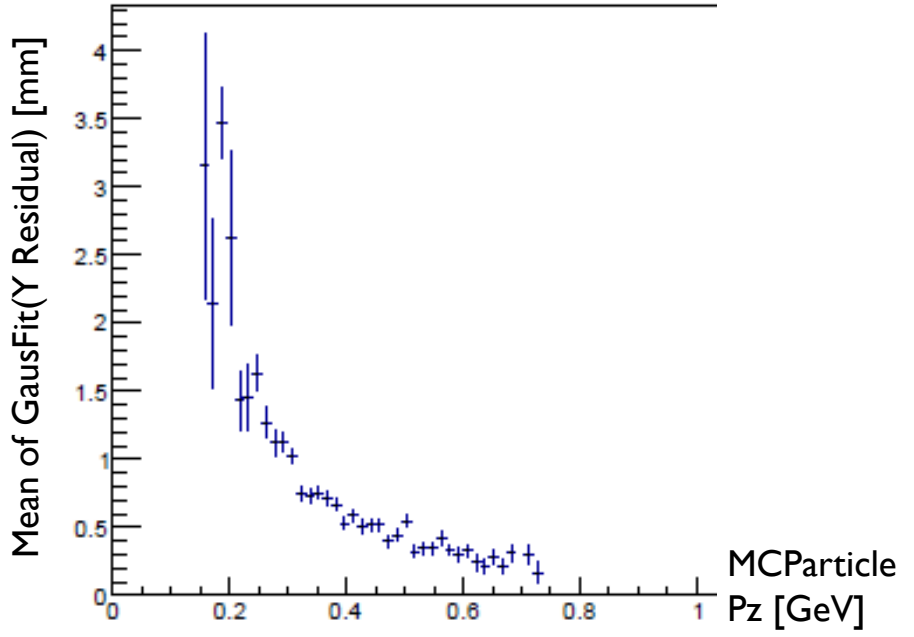

Mean x 0.4526 ± 0.001445
Mean y −1.335 ± 0.01517
RMS x 0.124 ± 0.001022
RMS y 1.303 ± 0.01073
0 48 0
0 7371 0
0 413 0
X Residual [mm]
MCParticle Pz [GeV]

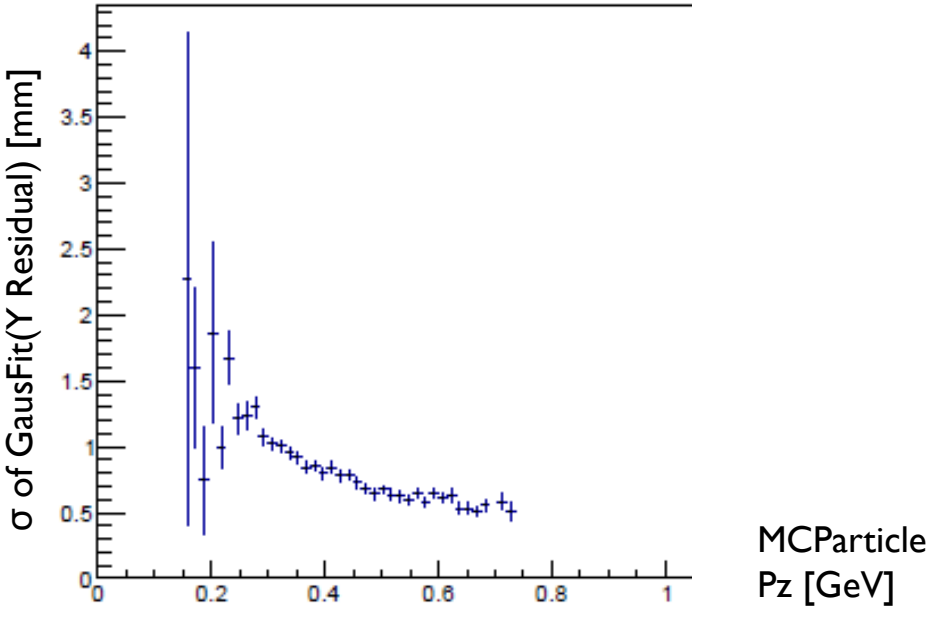

Mean x 0.4456 ± 0.00144
Mean y 0.6104 ± 0.01083
RMS x 0.1265 ± 0.001018
RMS y 0.952 ± 0.007661
0 73 0
0 7722 0
0 37 0
Y Residual [mm]
MCParticle Pz [GeV]

POSITRONS

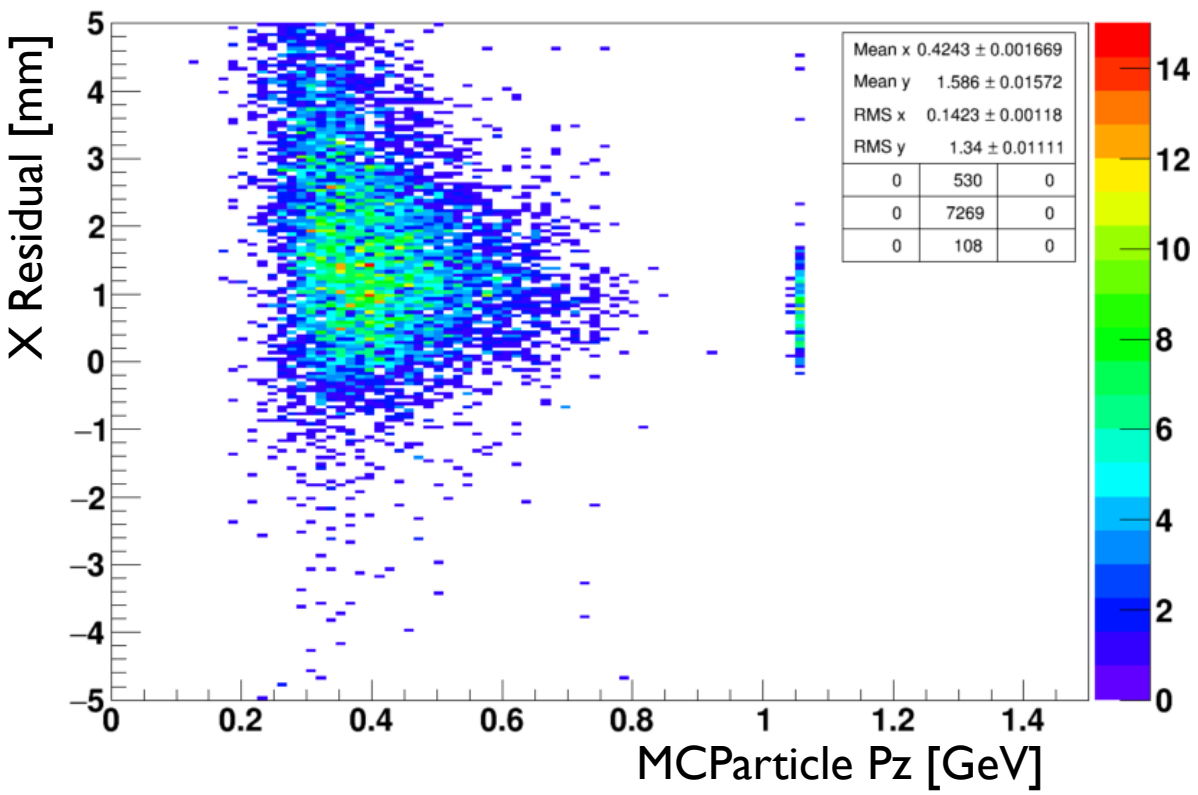

Mean of GausFit(X Residual) [mm]
0
−2
−4
−6
−8
−10
−12
−14
0
0.2
0.4
0.6
0.8
1
MCParticle
Pz [GeV]

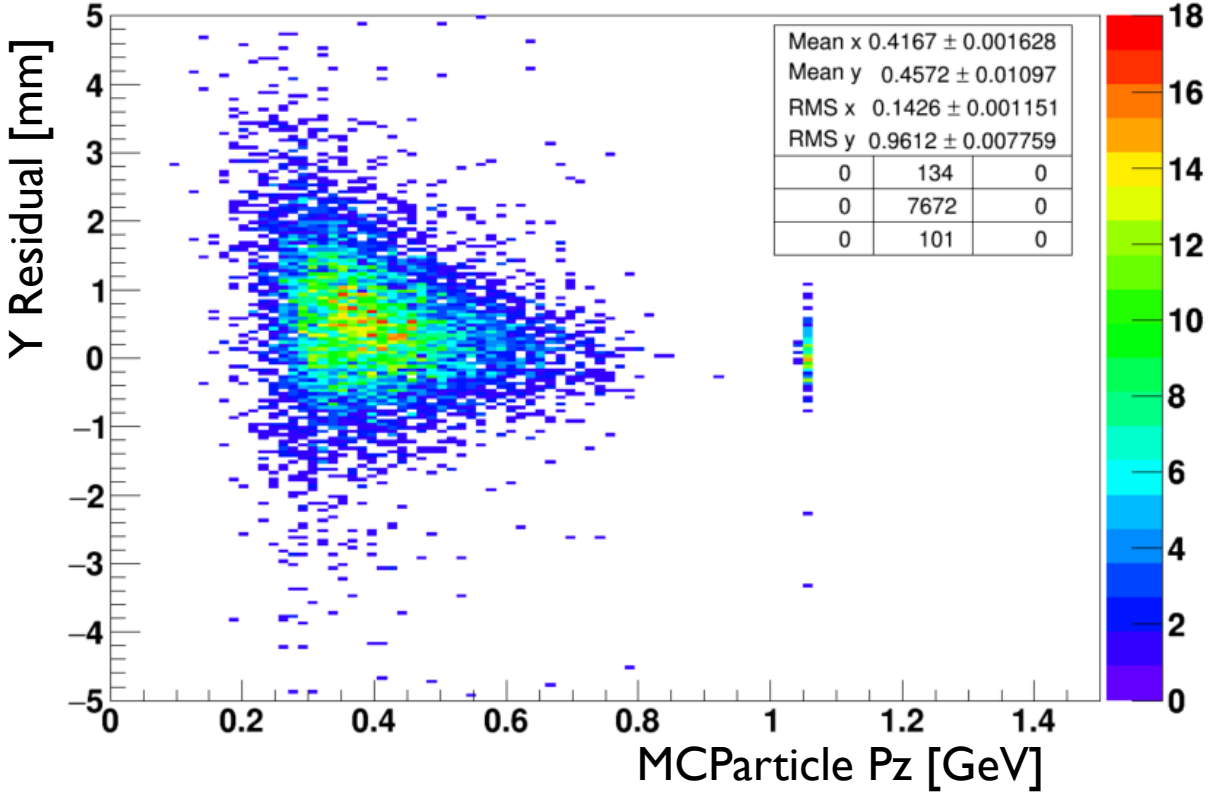

σ of GausFit(X Residual) [mm]
20
18
16
14
12
10
8
6
4
2
0
0
0.2
0.4
0.6
0.8
1
MCParticle
Pz [GeV]


Mean of GausFit(Y Residual) [mm]
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
MCParticle
Pz [GeV]

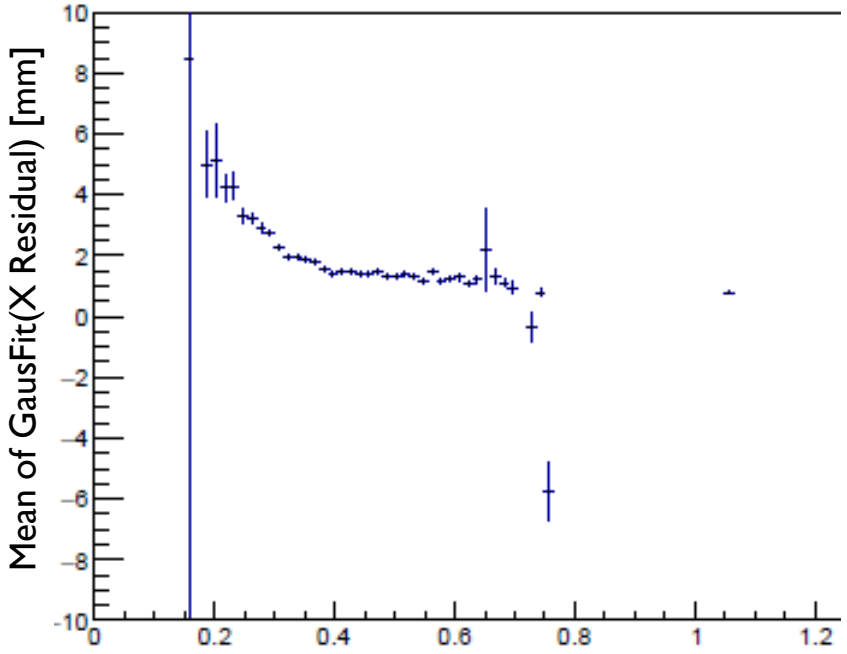

σ of GausFit(Y Residual) [mm]
4
3.5
3
2.5
2
1.5
1
0.5
0
0
0.2
0.4
0.6
0.8
1
MCParticle
Pz [GeV]

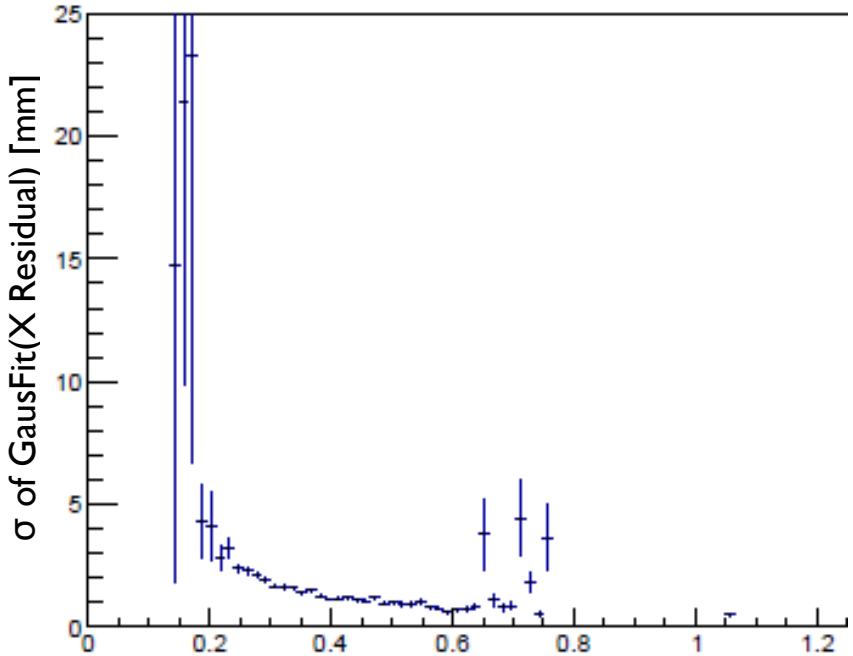
ELECTRONS

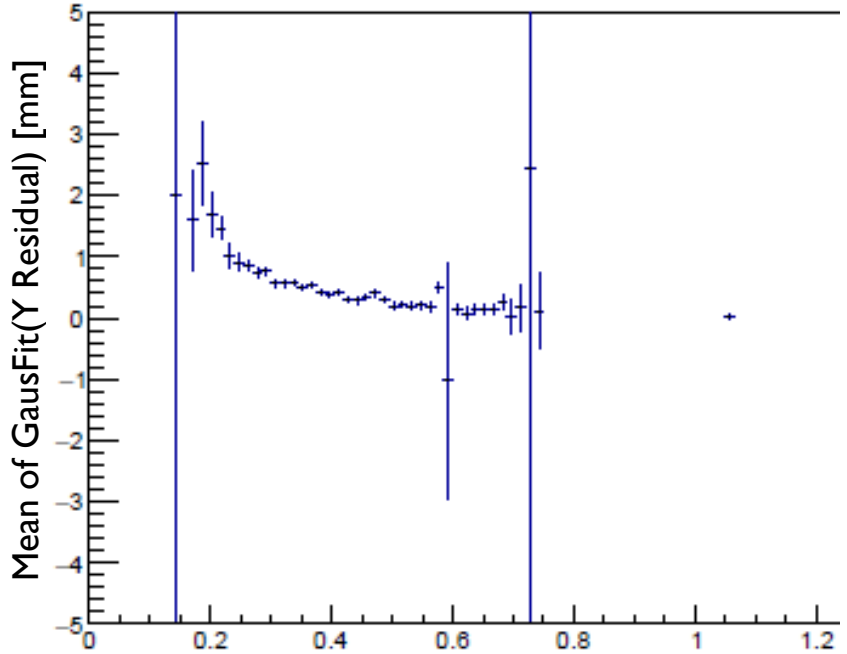

Mean x 0.4243 ± 0.001669
Mean y 1.586 ± 0.01572
RMS x 0.1423 ± 0.00118
RMS y 1.34 ± 0.01111
0 530 0
0 7269 0
0 108 0
X Residual [mm]
MCParticle Pz [GeV]

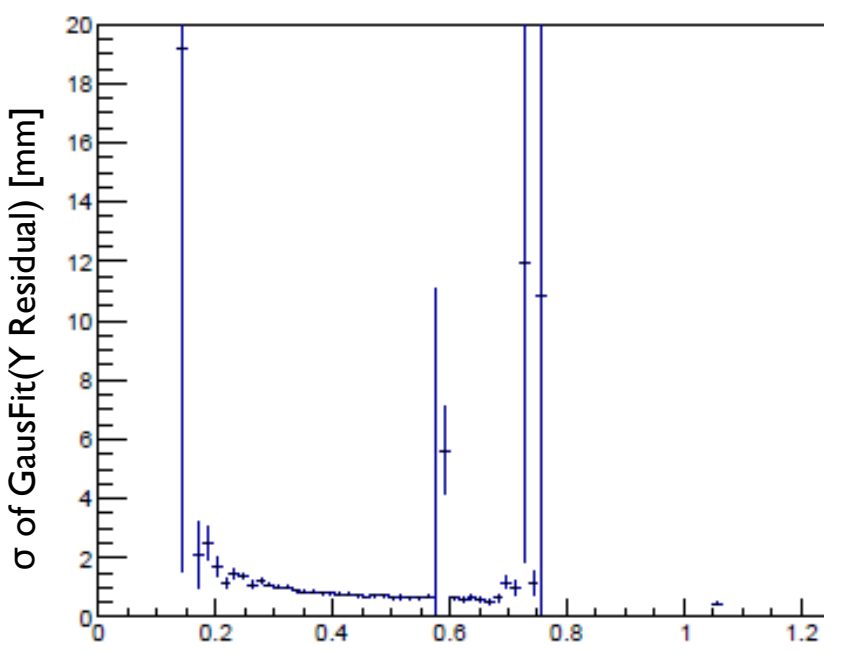

Mean x 0.4167 ± 0.001628
Mean y 0.4572 ± 0.01097
RMS x 0.1426 ± 0.001151
RMS y 0.9612 ± 0.007759
0 134 0
0 7672 0
0 101 0
Y Residual [mm]
MCParticle Pz [GeV]

ELECTRONS


Mean of GausFit(X Residual) [mm]
MCParticle Pz [GeV]


σ of GausFit(X Residual) [mm]
MCParticle Pz [GeV]


Mean of GausFit(Y Residual) [mm]
MCParticle Pz [GeV]


σ of GausFit(Y Residual) [mm]
MCParticle Pz [GeV]