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# TRACK EXTRAPOLATION TO ECAL (AGAIN!)

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# TRACK EXTRAPOLATION TO ECAL

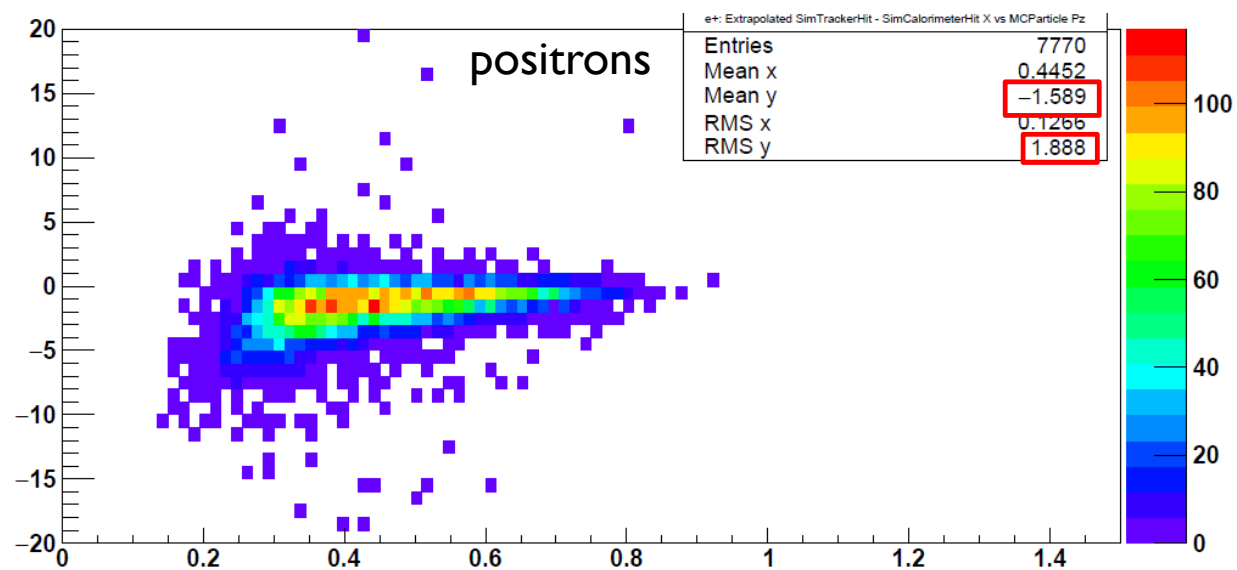
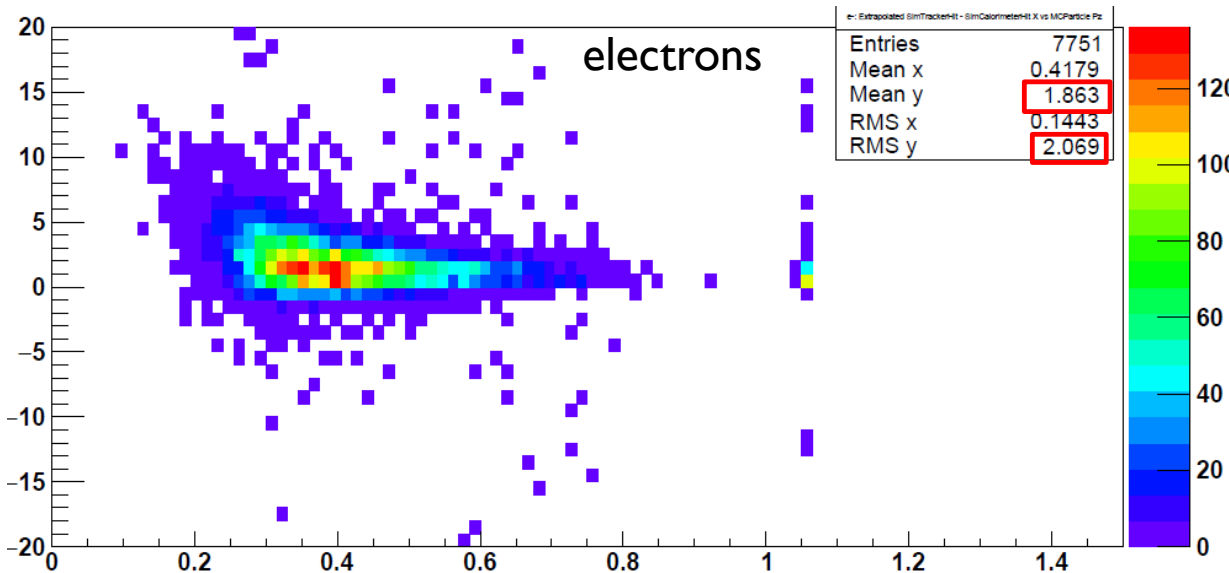
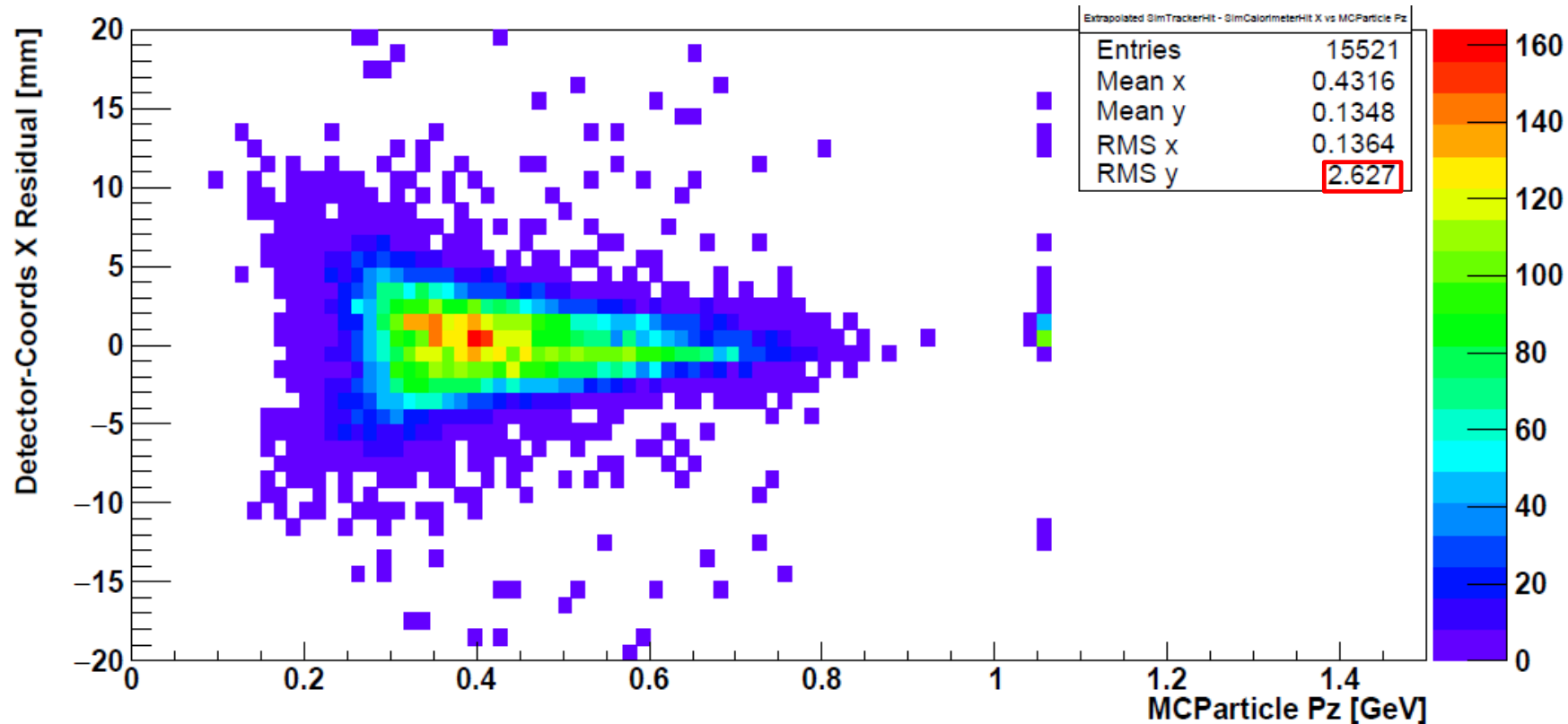
- TrackDataDriver uses `TrackUtils.extrapolateTrackUsingFieldMap` to create new `TrackState@ECal` for every GBL Track
  - Old hps-java versions: extrapolate from `TrackState@IP`
  - New versions: extrapolate from `TrackState@LastHit`
- Perhaps we still have a problem (Tim): extrapolation only uses y-component 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 backplash 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

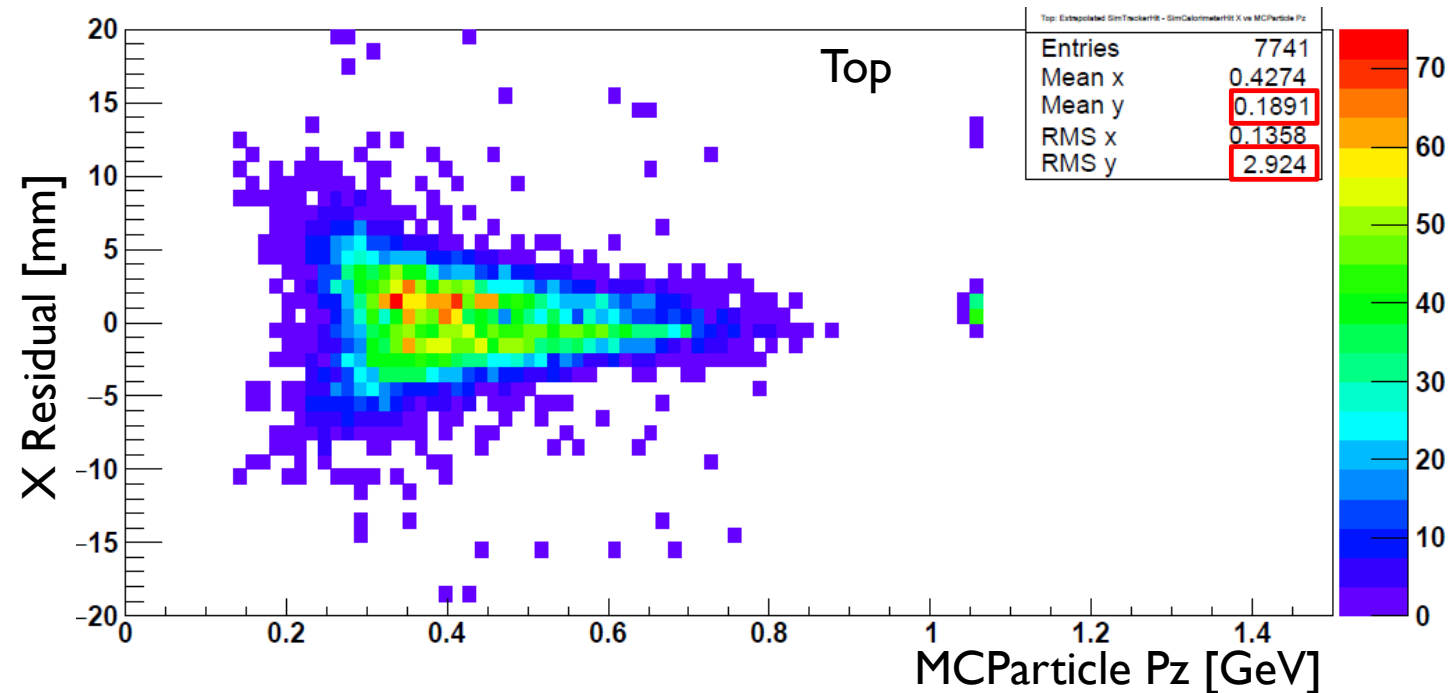
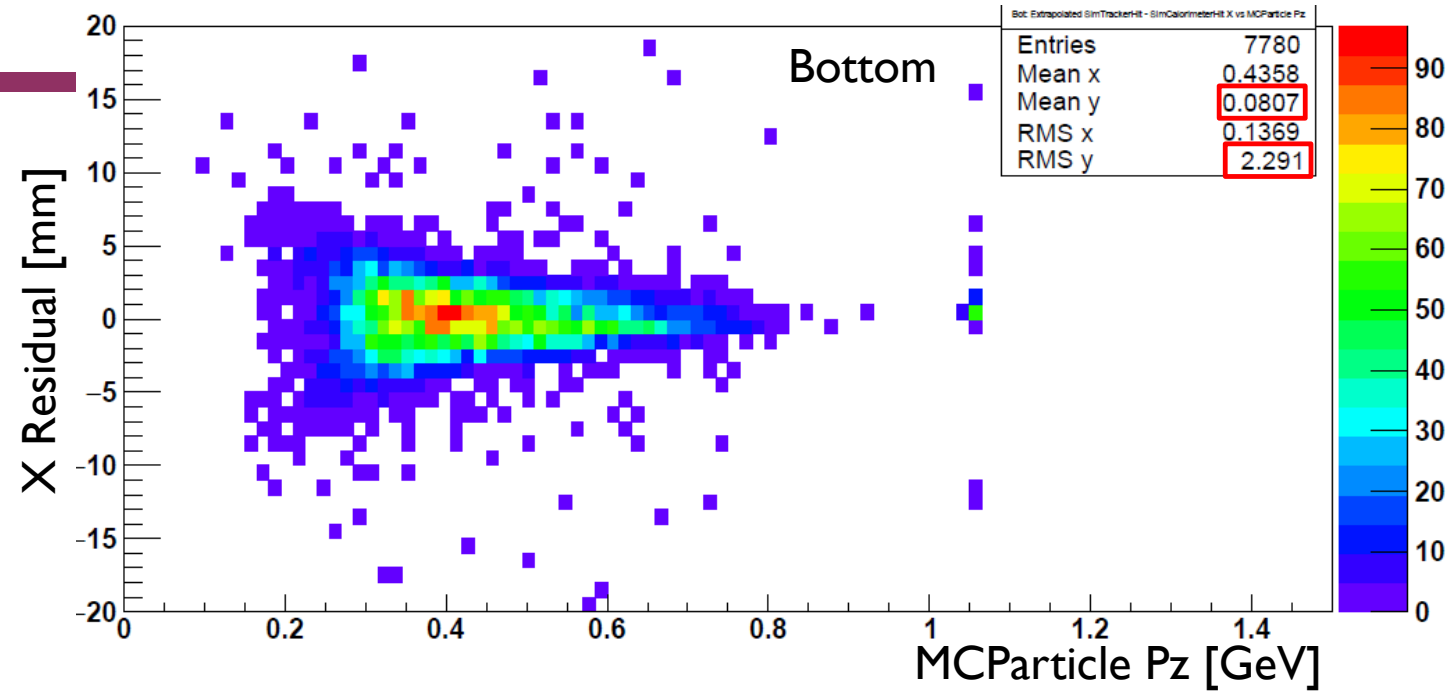
# X RESIDUALS

- 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

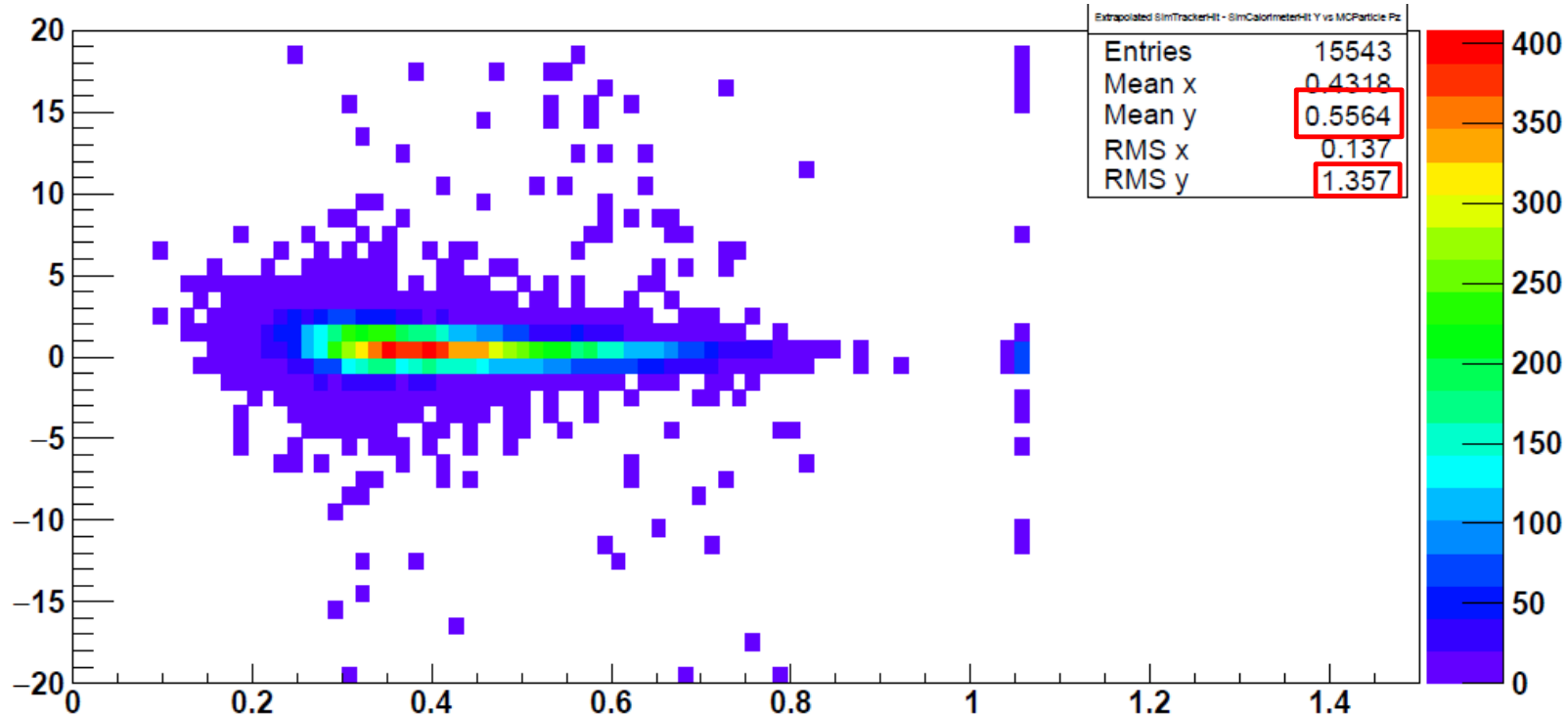
Mean  $\approx 0.5$ , not 0

e+ : mean 0.623 +/- 0.013

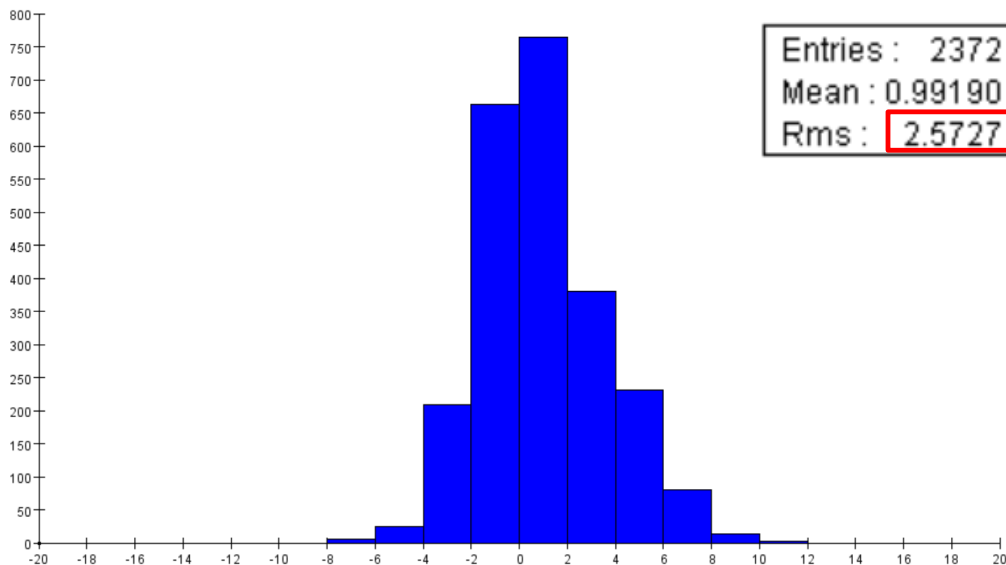
RMS 1.18

e- : mean 0.490 +/- 0.017

RMS 1.52



Ecal cluster y - track y @ Ecal - top - matched



- 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)

