

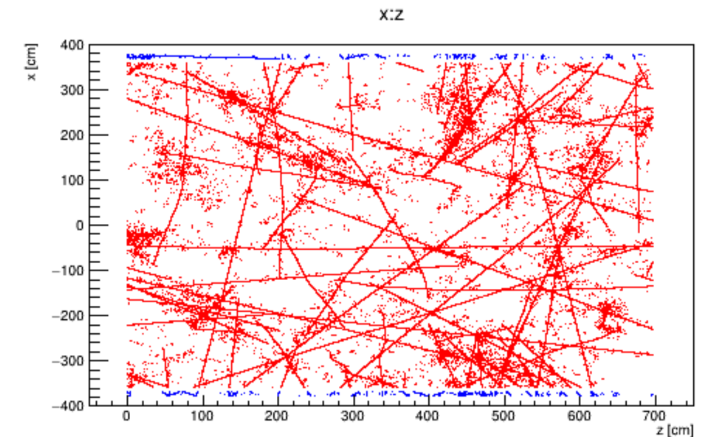
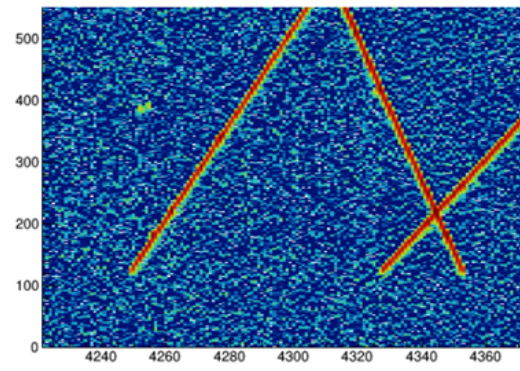
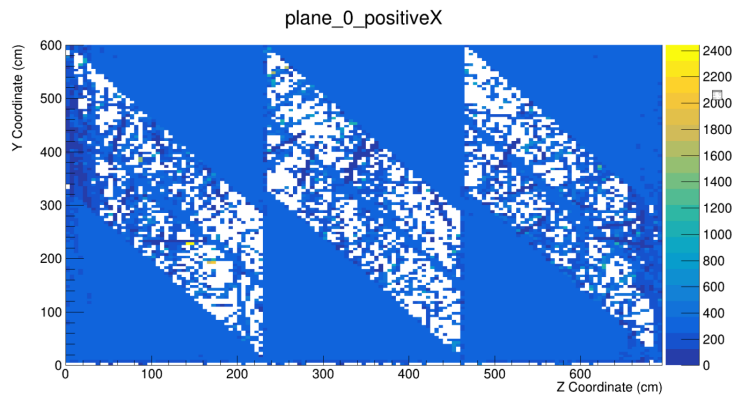
Status of the Simulation

Wenqiang Gu, David Rivera

For the simulation task force

Simulation sample

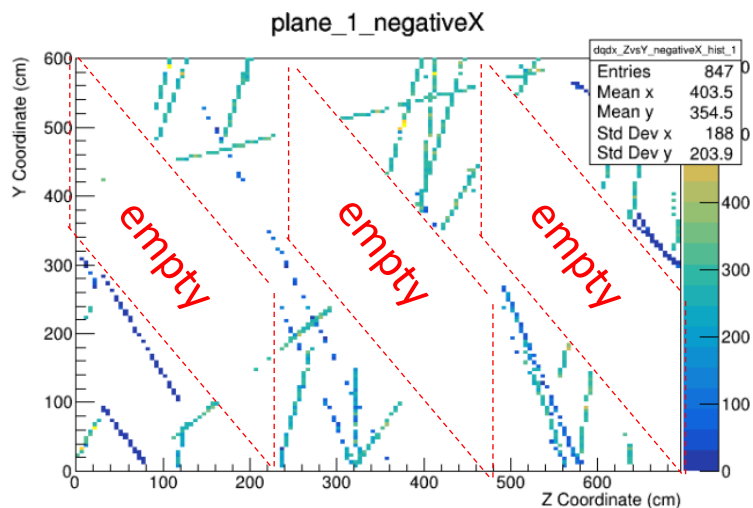
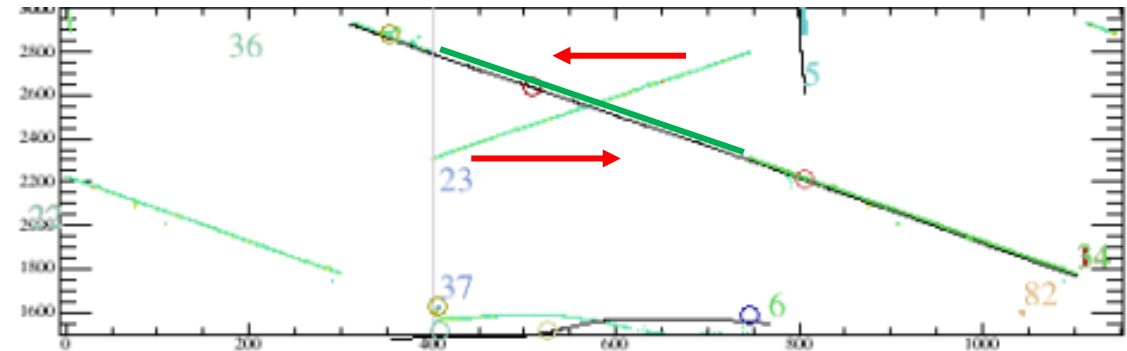
- Most recent 1GeV beam + cosmic sample
 - ▶ (w/o SCE) /dune/data2/users/wgu/files/beam_cosmic_p1GeV_woSCE.list
 - ▶ (w/ SCE) /dune/data2/users/wgu/files/beam_cosmic_p1GeV_SCE.list
- Several bugs found and solved in TPC simulation
- Larg4, CRT simulation updated



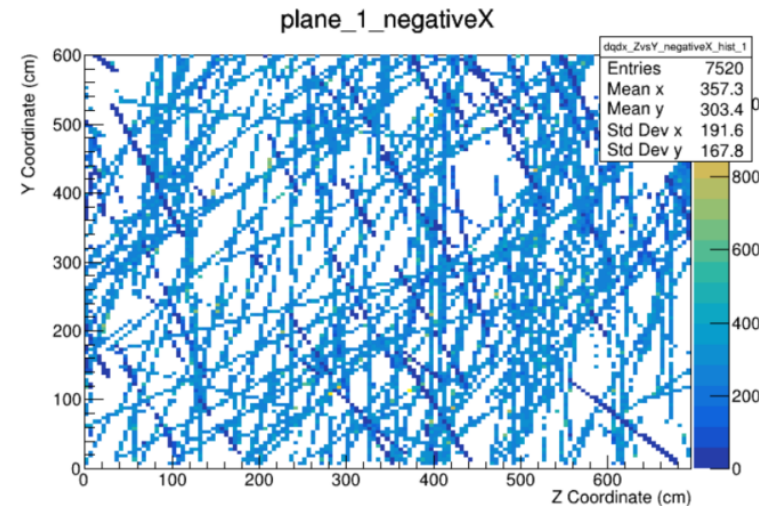
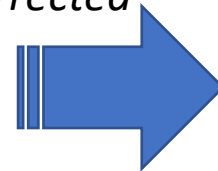
TPC simulation: wire mapping

- Missing or broken tracks in some planes
- Because of a mistake in the wire-channel mapping
- Solved!

Flipped wire-channel mapping in this region

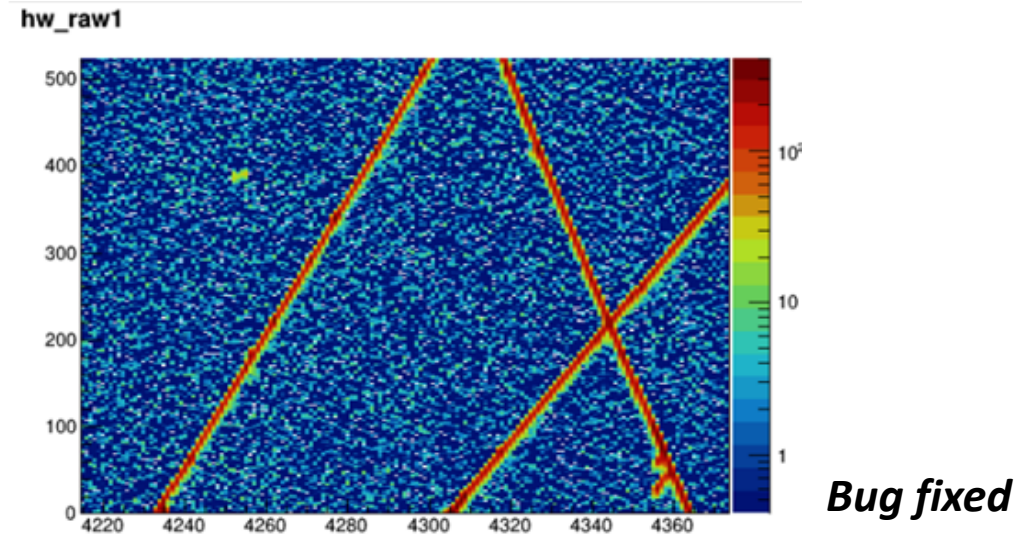
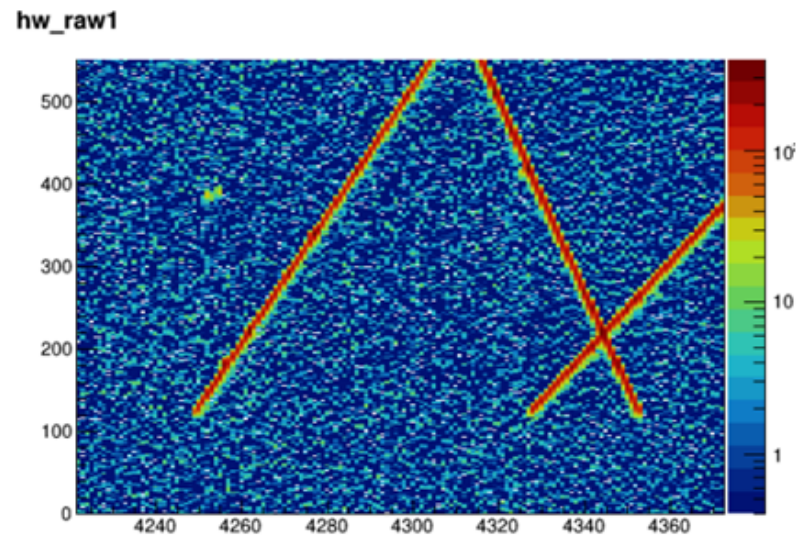


Channel mapping corrected



Reported by Ajib

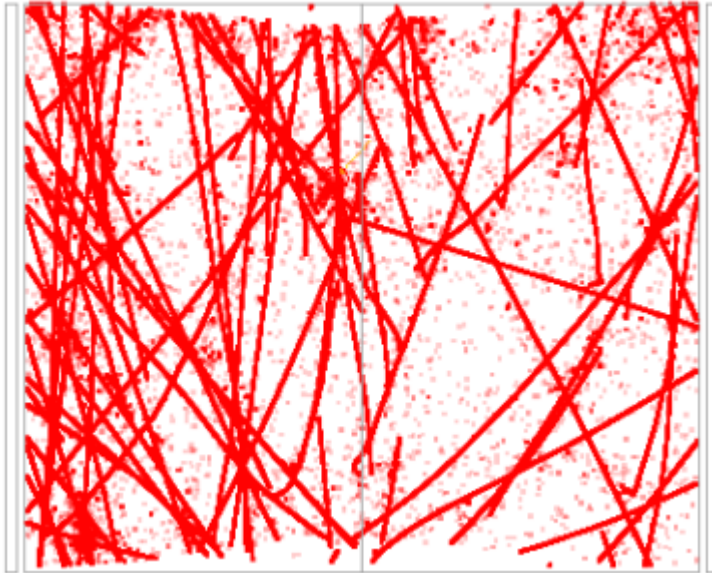
TPC simulation: cosmic tracks starts at tick 125



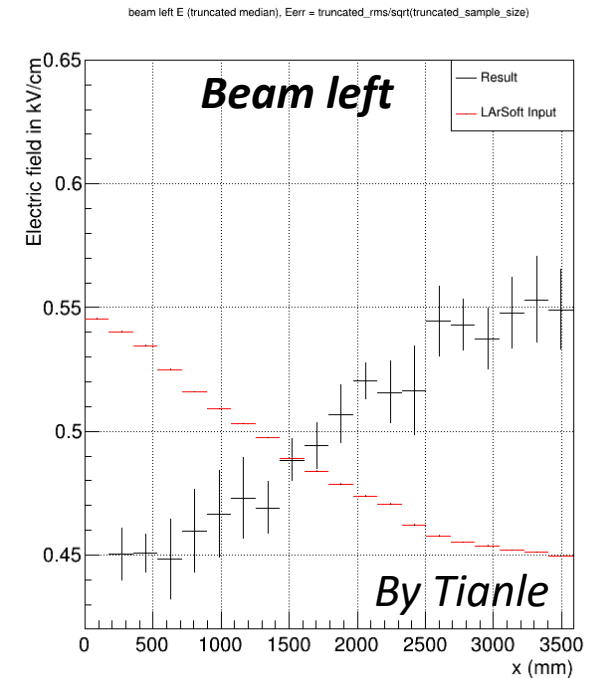
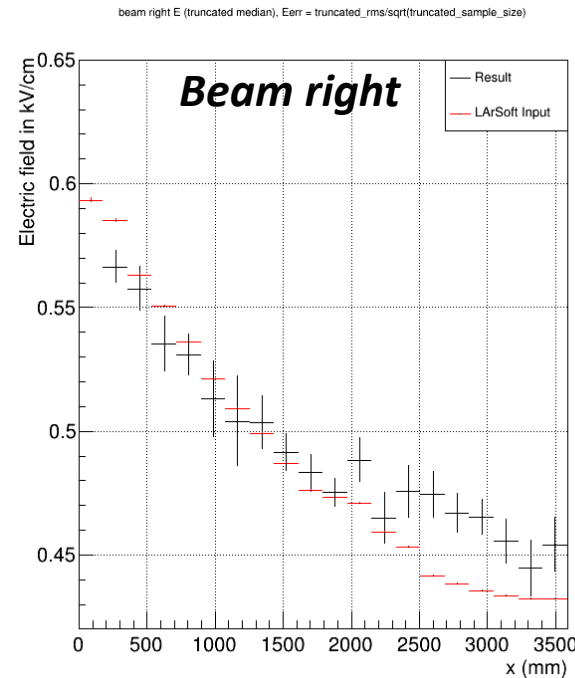
- Many cosmic tracks initiate from time tick 125 instead of 0
- Energy depositions between the response plane (10cm) and the anode plane were not simulated properly
- $10\text{cm}/1.6\text{mm/s} / 0.5 \sim 125$ ticks
- Solved!

SCE simulation

Y vs X: with SCE



<https://www.phy.bnl.gov/wire-cell/bee/set/98db20da-49a3-478b-8c60-0b5d06be7946/event/0/>



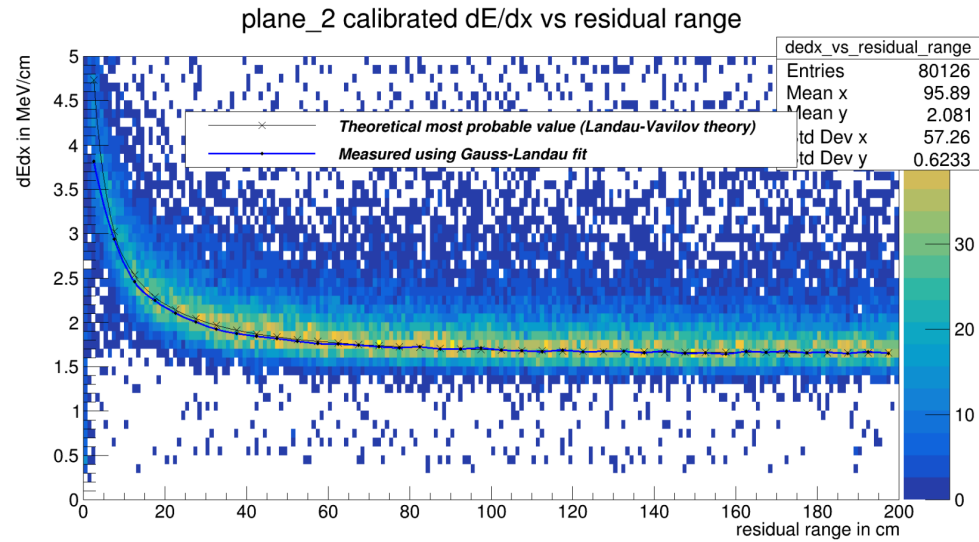
- SCE simulation overall looks reasonable
- However, there seems to be a sign flipping issue in beam left
 - ▶ Still investigating

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- New sample cosmics + beam with the sign flip correction to confirm this as the source of the beam left disagreement
 - ▶ 12.5k events (w/ SCE ON)
 - ▶ /dune/data2/users/wgu/files/beam_cosmic_p1GeV_SCE_bLflip.list
 - ▶ See #pdsp-sim-tasks channel for updates

Update in larg4

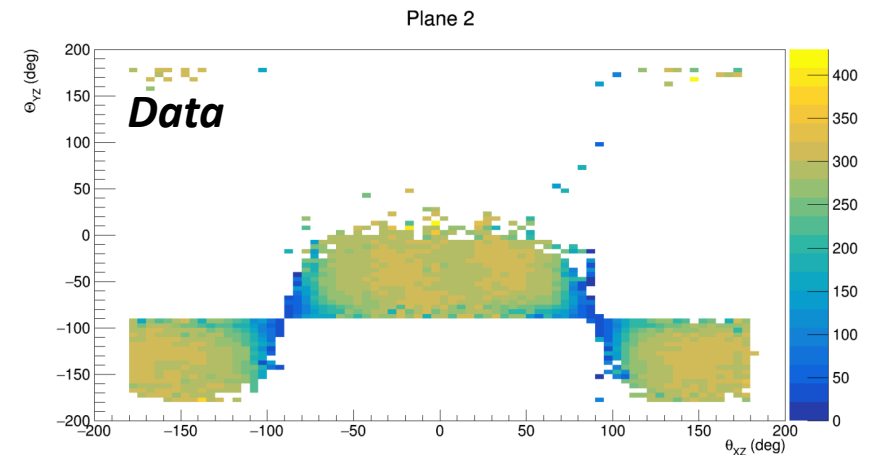
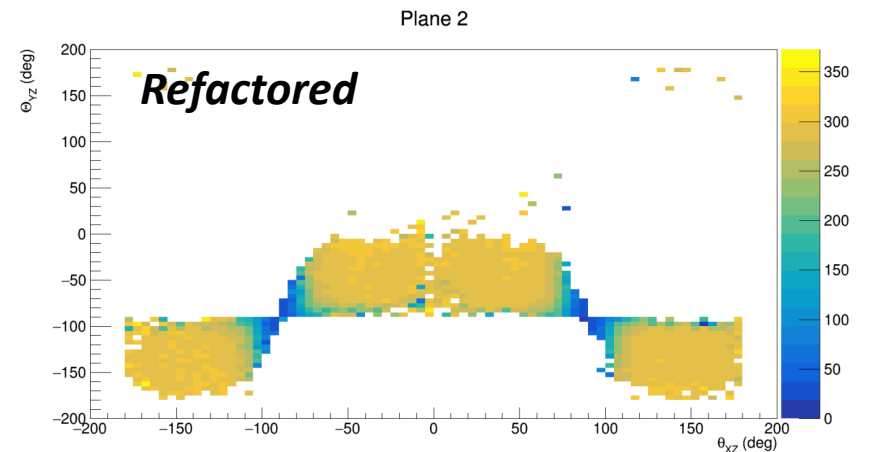
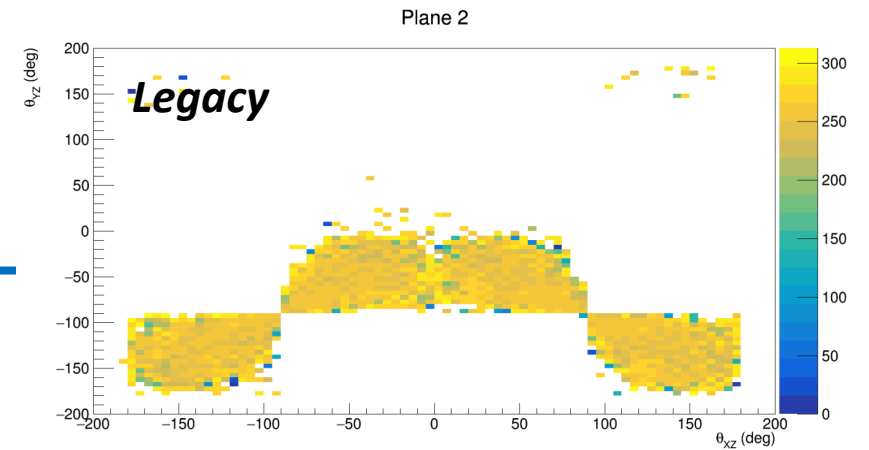
- Fixed Truth-MCParticle associations with multiple generators
- Backtracking working
- Can simulate :
 - ▶ Cosmics
 - ▶ Beam + Beam Background
 - ▶ Ar39, Ar42, Kr85, and Rn222
- No Neutron Tracking Cut
- KeepEMShowerDaughters
- StoreTrajectories

Calorimetry information

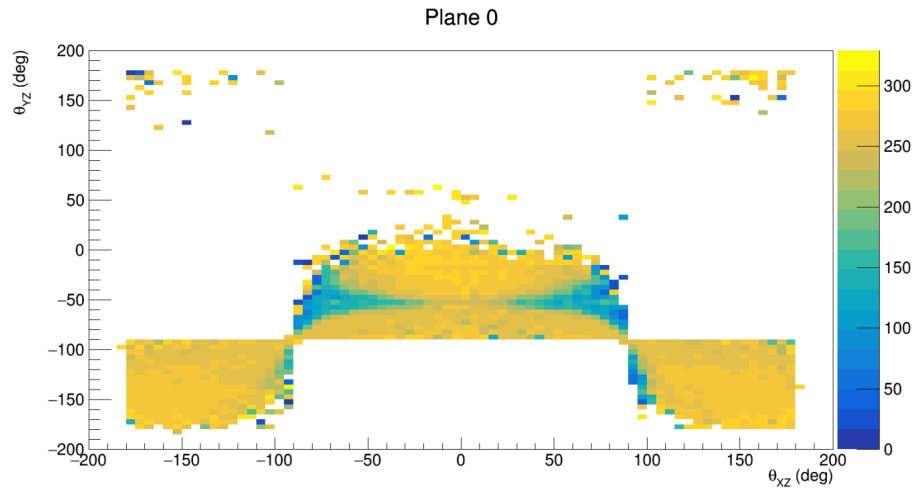


New simulation for cosmics (analyzed by Ajib)

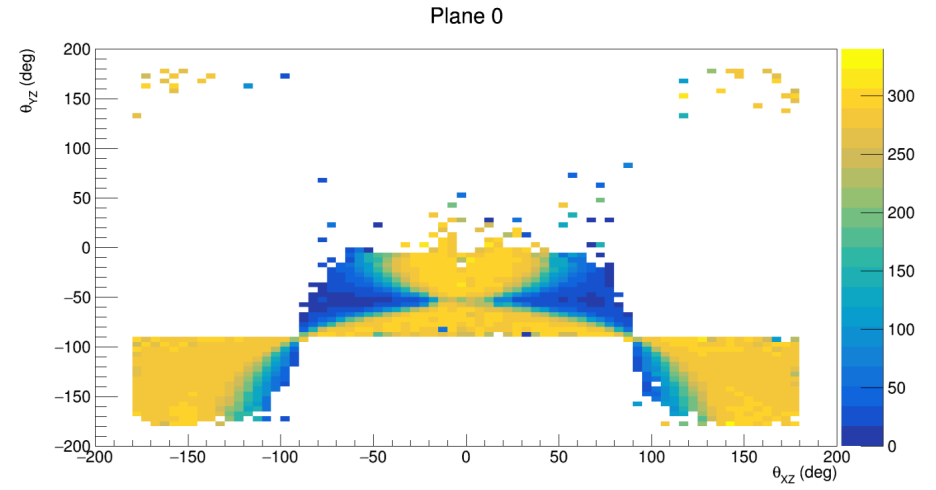
- SCE OFF
- dE/dx looks fine (some disagreement at low RR)
- Collection plane shown right
- The θ_{yz} and θ_{xz} dependence agrees better with the data



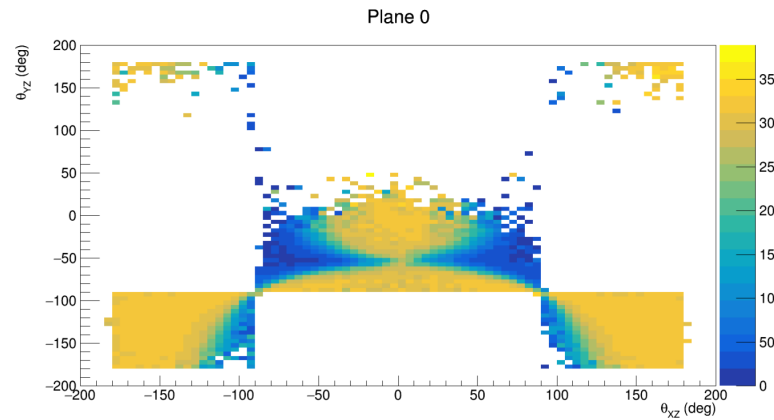
Induction plane (SCE OFF comparison)



Legacy



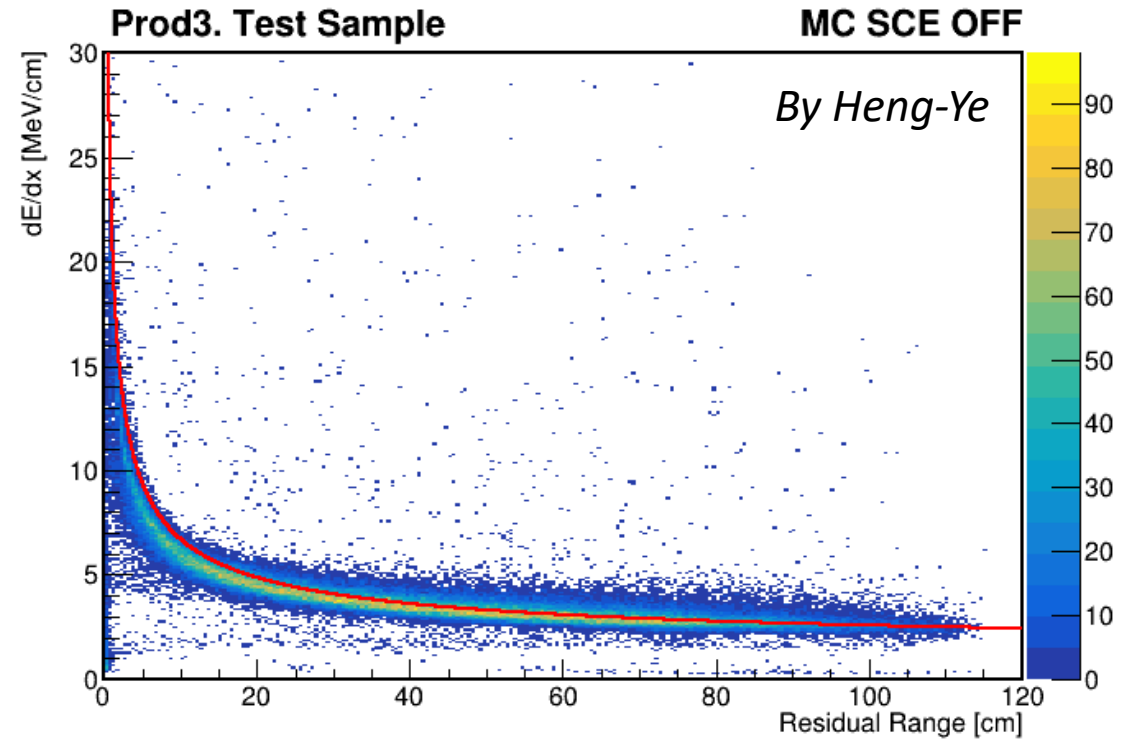
Refactored



Data (run 5387)

(from Ajib)

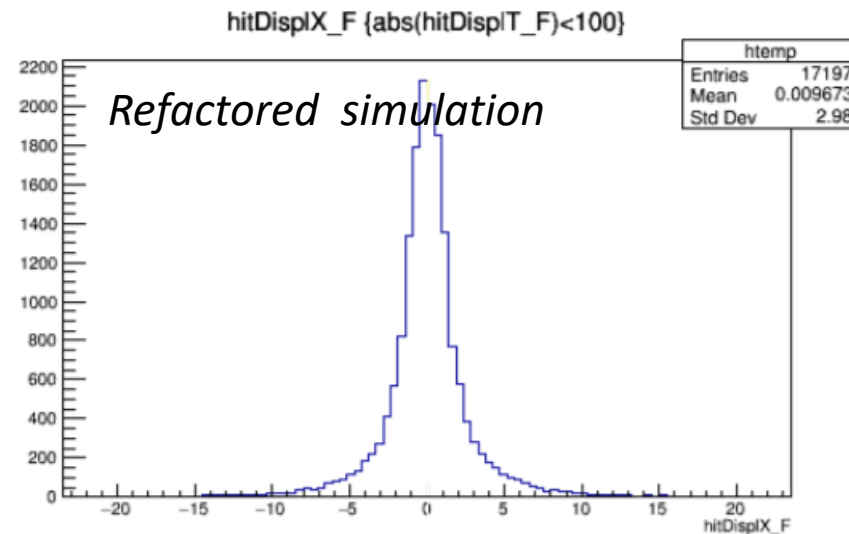
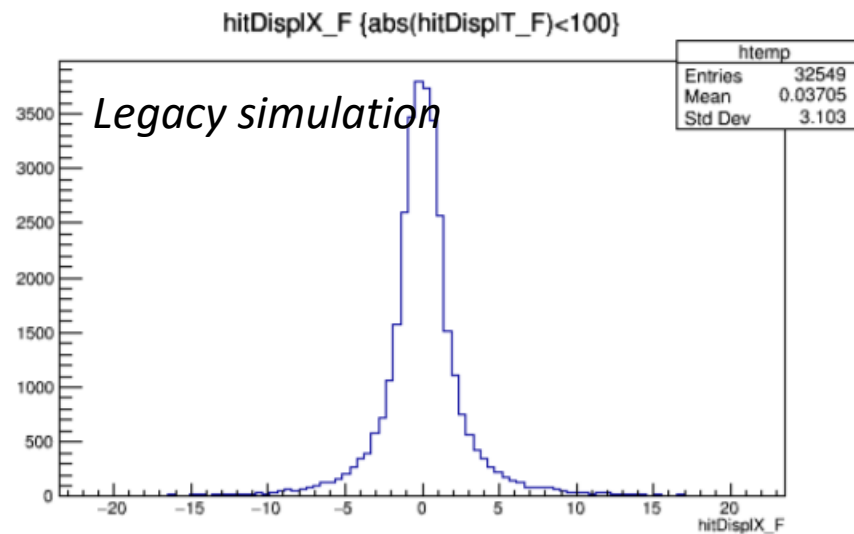
Calorimetry for proton



- However, proton is off at low RR
 - ▶ Still investigating

Update in CRT simulation (by Richie)

- Moved from AuxDetSimChannel to AuxDetHit
- Mapped GDML module to AuxDet module
- Some deficiency of reco and matched tracks
 - ▶ (Still investigating) 1.82 vs. 2.32 reconstructed hits



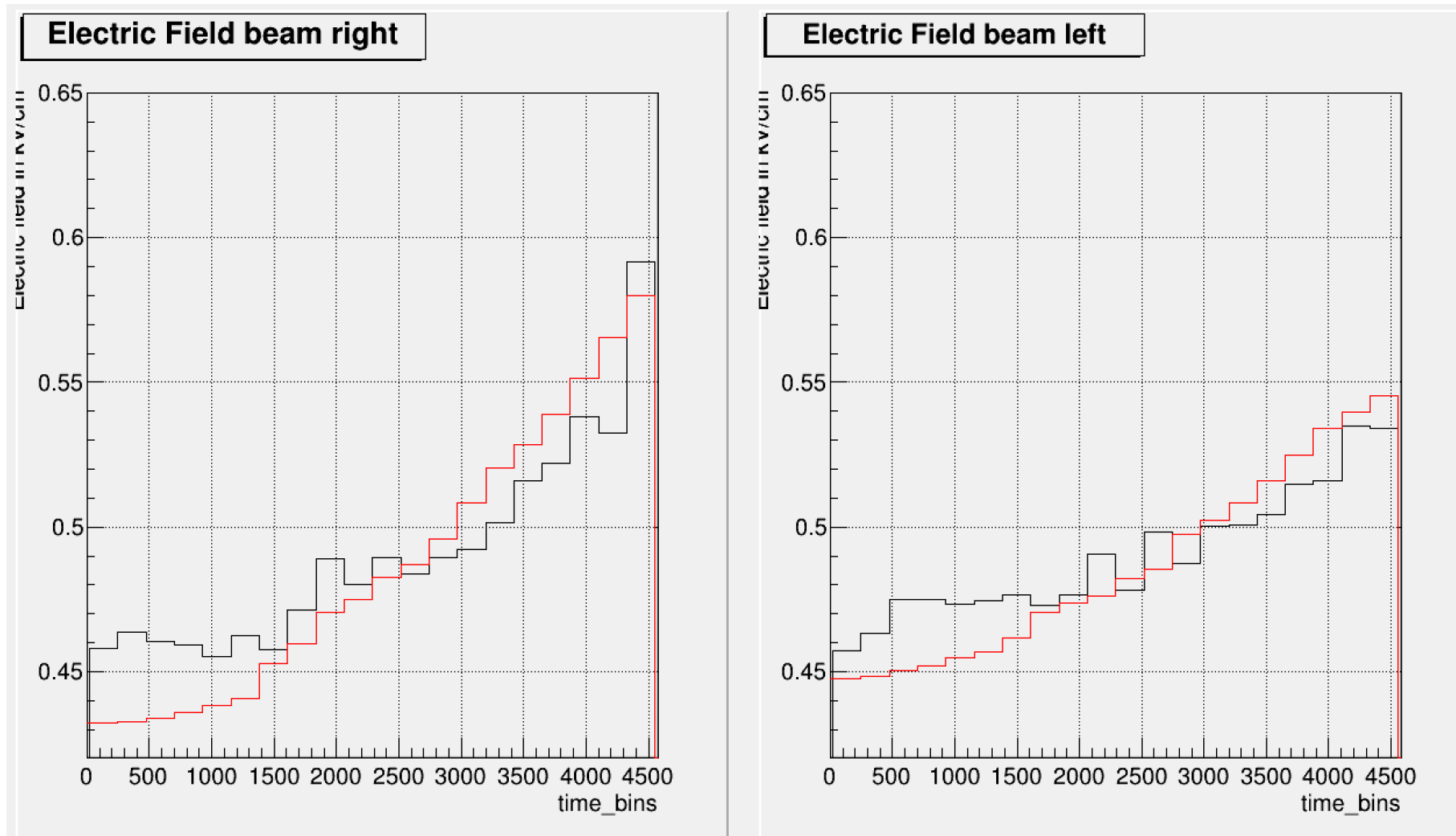
Resolution of matched hits for X modules

Readiness for the production

- Need to understand
 - ▶ SCE and the impact on cosmic dE/dx
 - ▶ Deficit in proton dE/dx
 - ▶ Deficiency in CRT reco and matched tracks

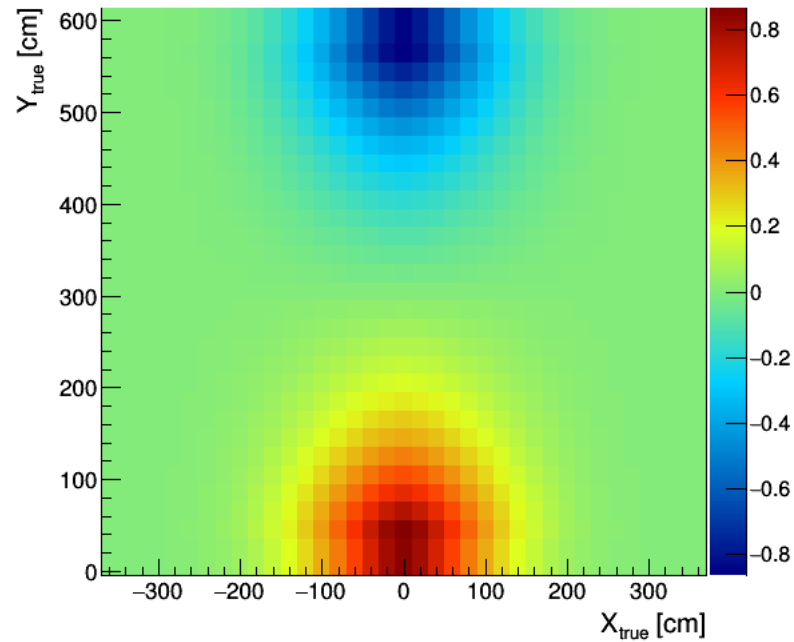
Backup

Expected



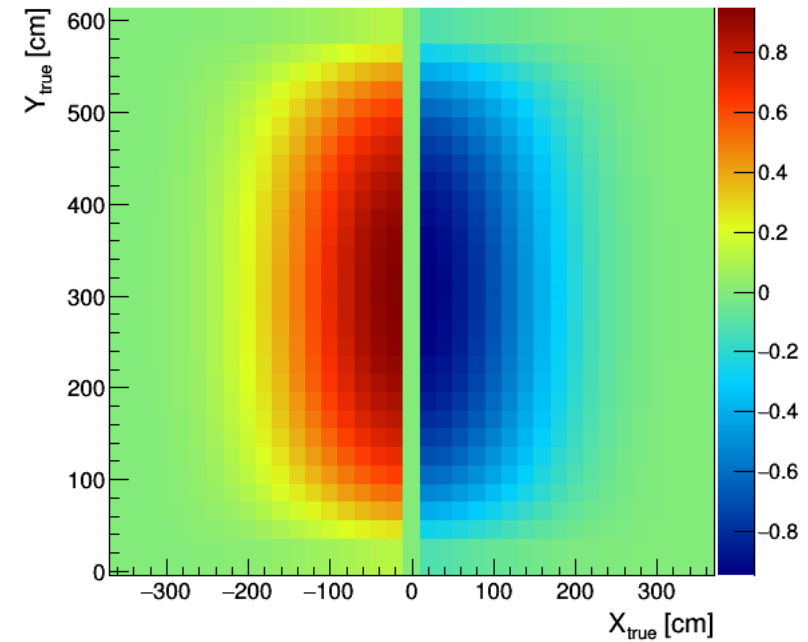
SCE in simulation (from M. Mooney)

Forward ΔY [cm]: $Z_{\text{true}} = -0$ cm



cosmic_XY_DY

Forward ΔX [cm]: $Z_{\text{true}} = -0$ cm



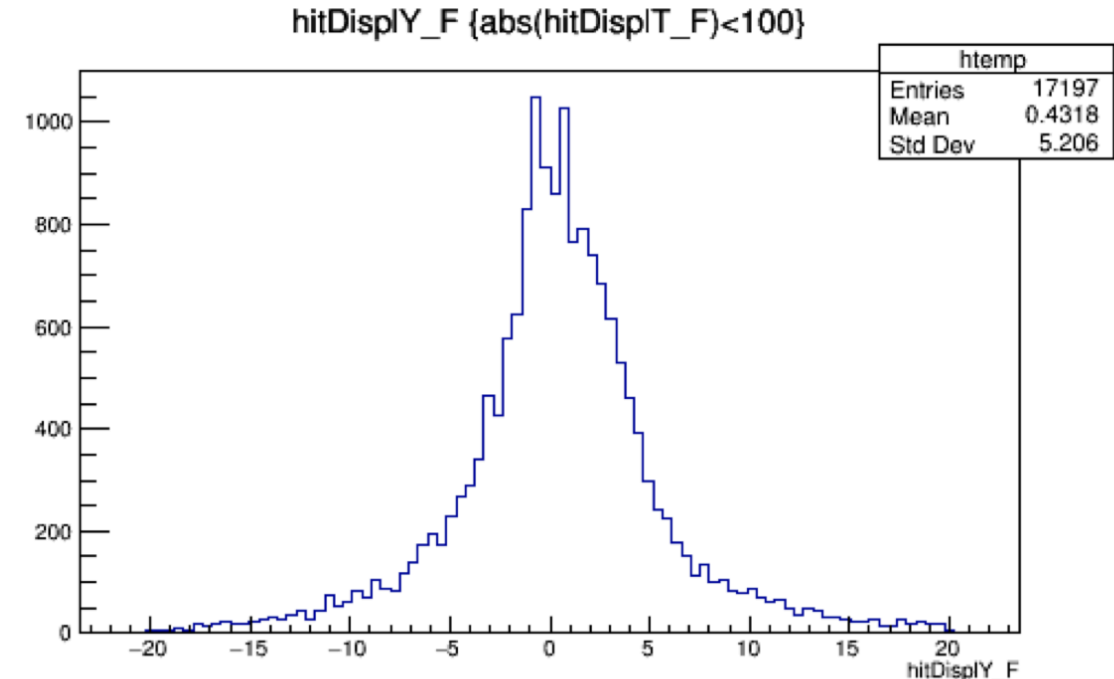
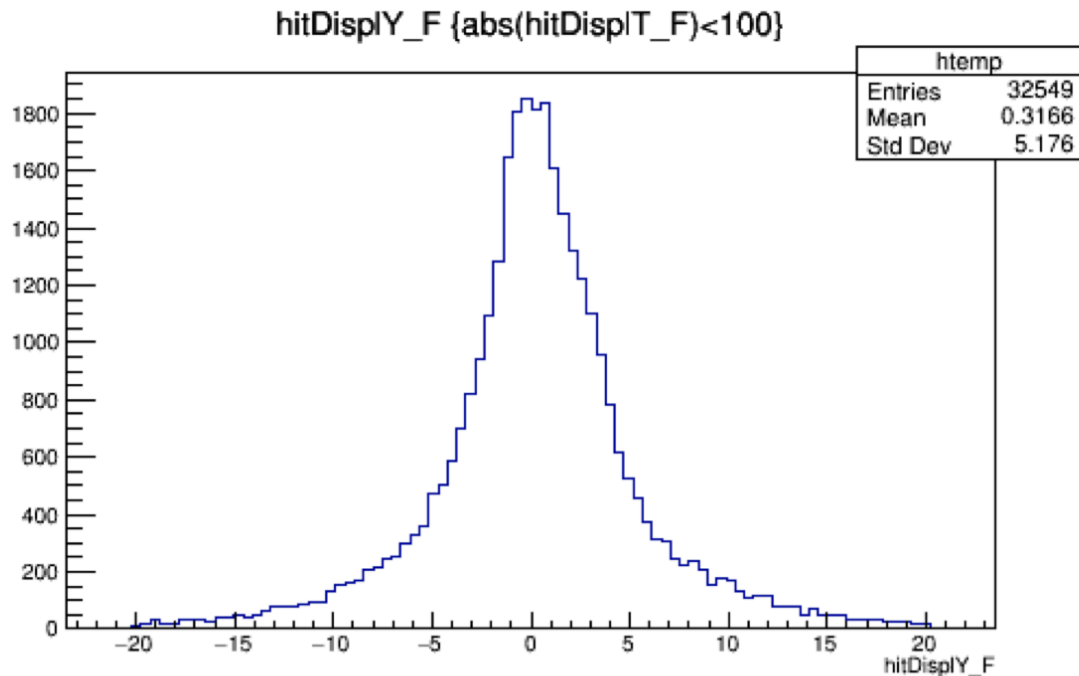
cosmic_XY_DX

CRT Reco Tests

(From Richie)

Rate

- 2.32 hits per event in legacy
- 1.82 hits per event in refactored



Resolution of matched hits in centimeters for Y modules between legacy (left) and refactored (right)