SCE in ProtoDUNE Data

Hannah Rogers - October 17, 2018

ProtoDUNE Simulation / Reconstruction Meeting

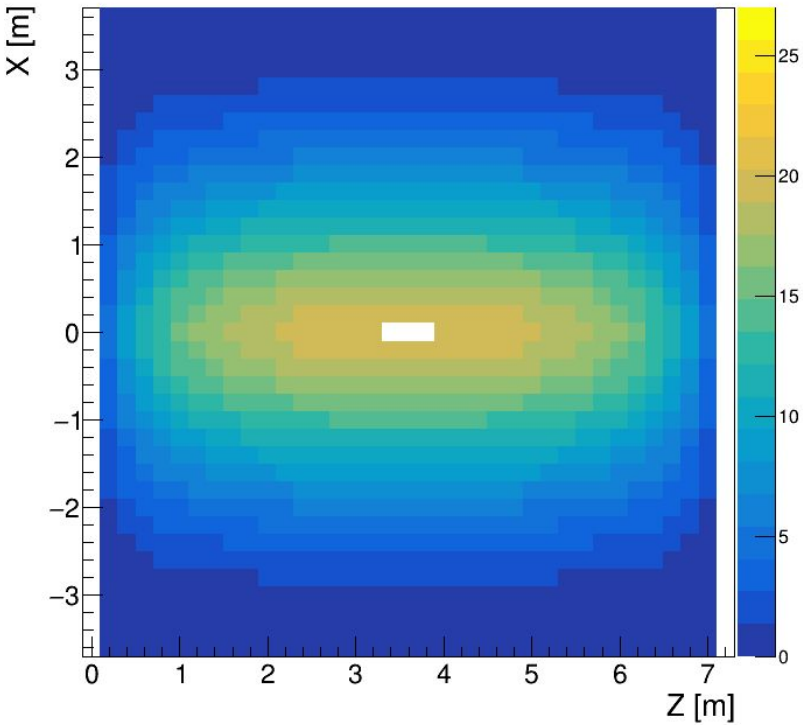
ProtoDUNE Data Run 5141

- /dune/data/users/lwhite86/np04_raw_run005141_0016_dl2_reco.root
- 108 events
- 11074 tracks total
- 354 cathode-crossing tracks
  - 3.20% of all tracks
  - 3.25 tracks per event
- No flash information -> No anode-piercing tracks

Spatial Offsets at the Top - Simulation Expectations

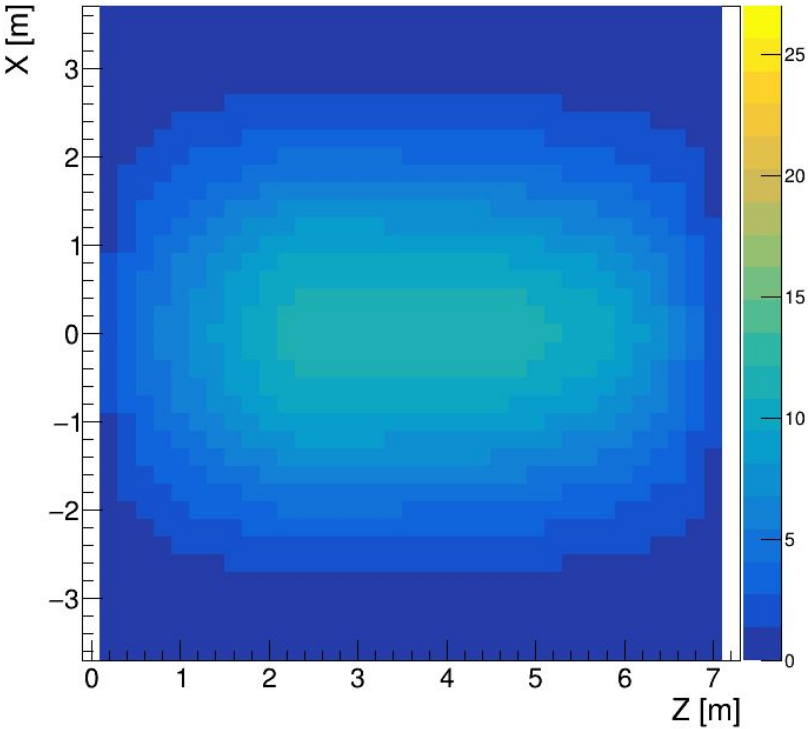
Without fluid flow:

Y_{true} - Y_{reco} [cm]: Y = 5.80 m

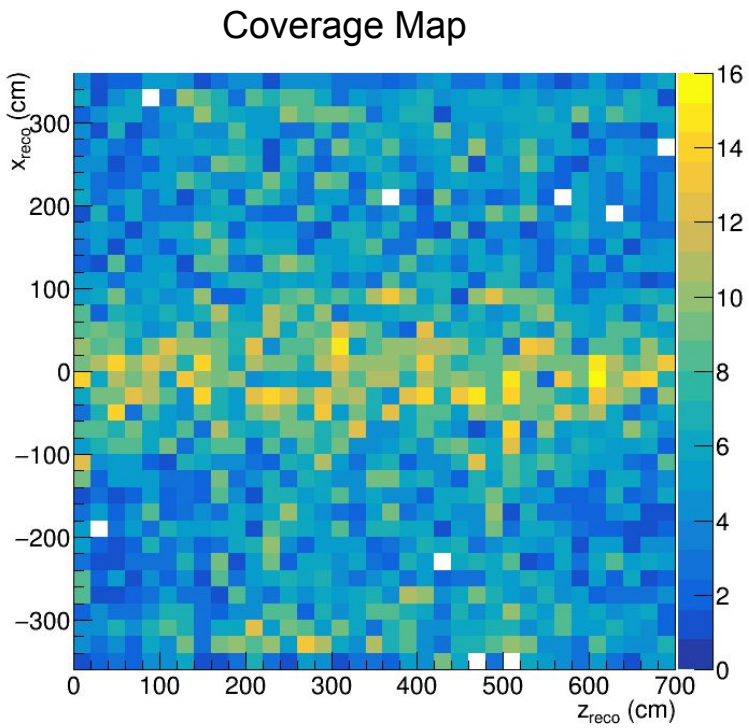


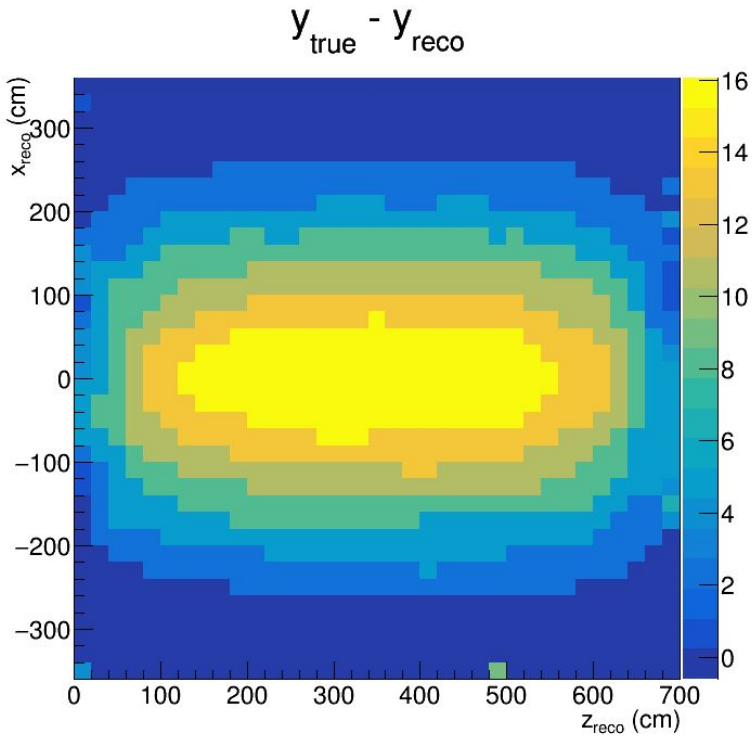
With fluid flow:

Y_{true} - Y_{reco} [cm]: Y = 5.80 m



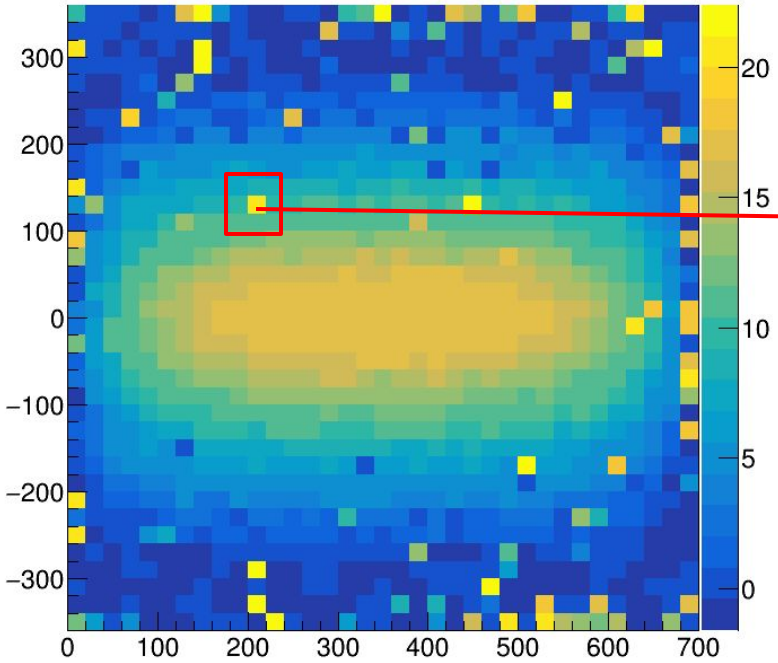
Spatial Offsets at the Top - Reconstructed from MC

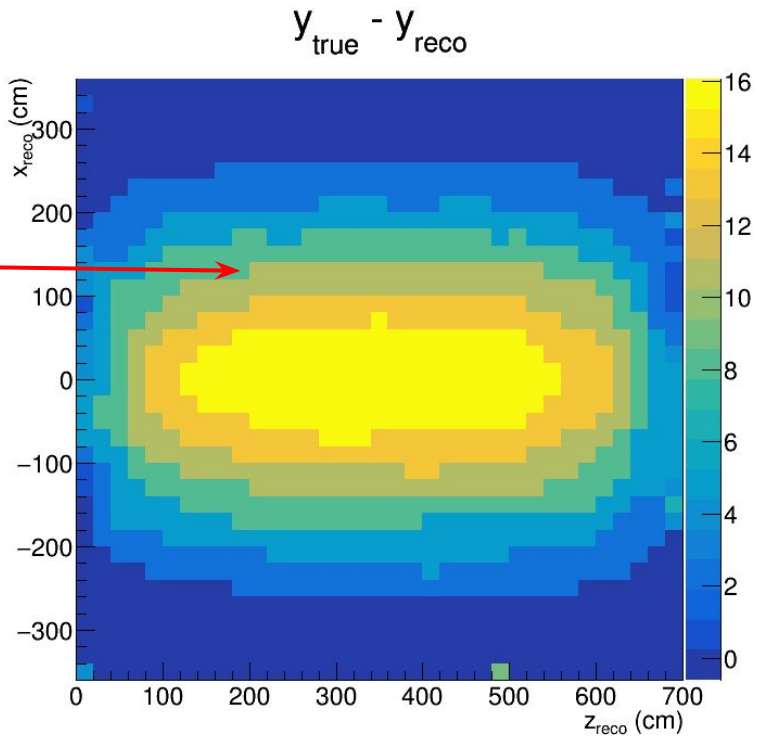




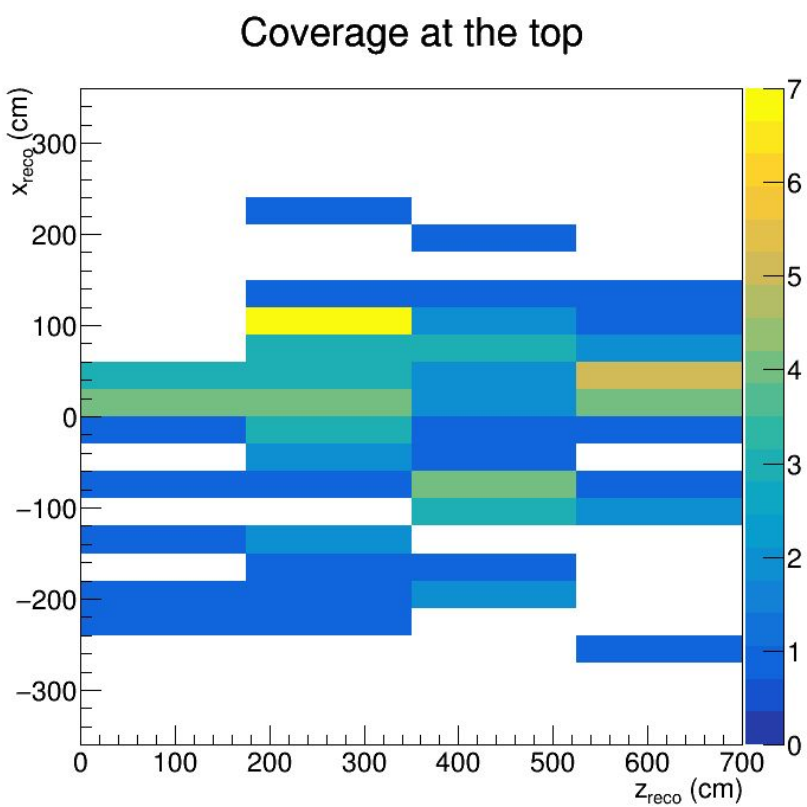
Effect of Median Filter

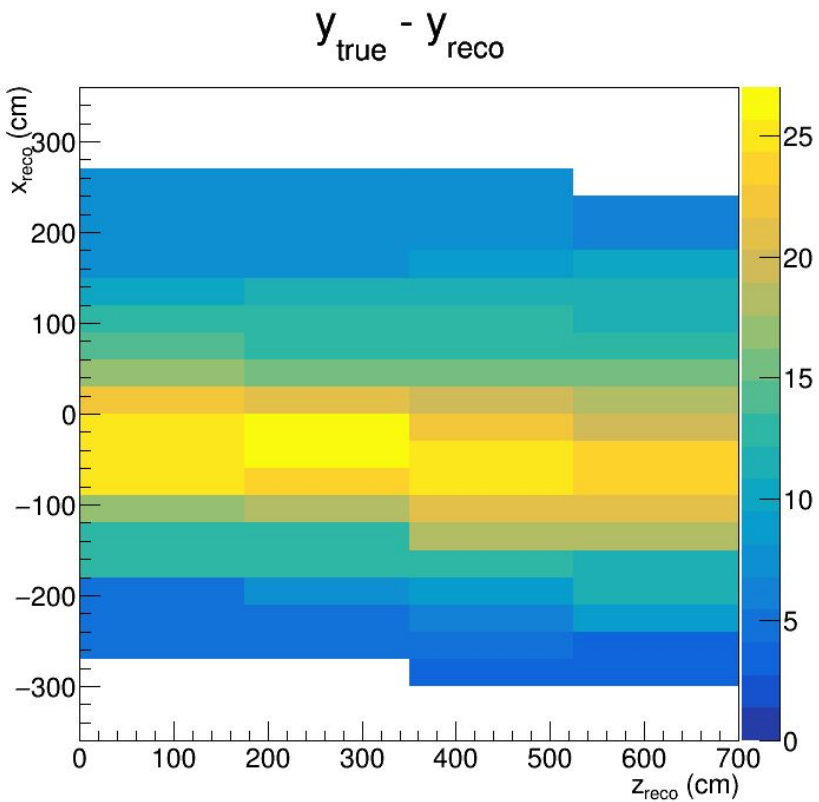
- For each bin: Take median value of bin and eight surrounding bins
  - Original bin value determined by mode of offsets of all tracks in that voxel





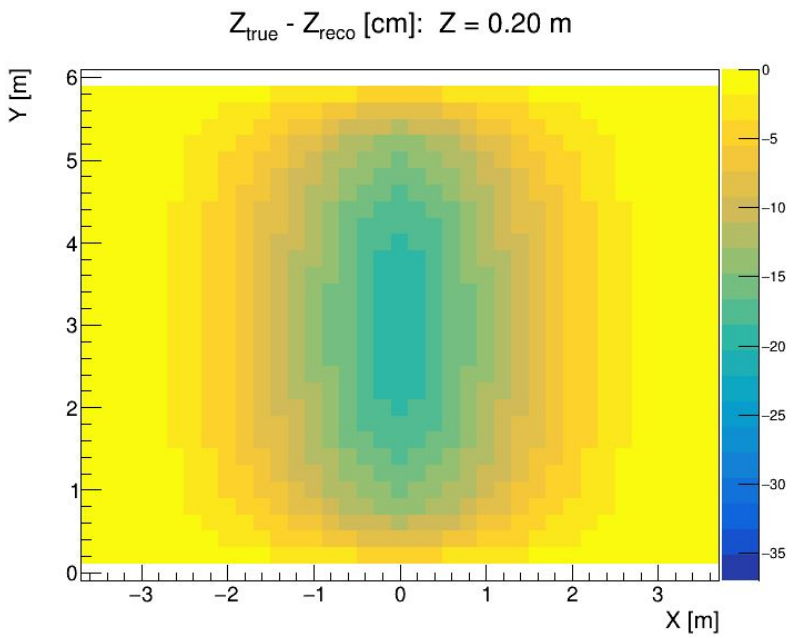
Spatial Offsets at the Top - Results from Data



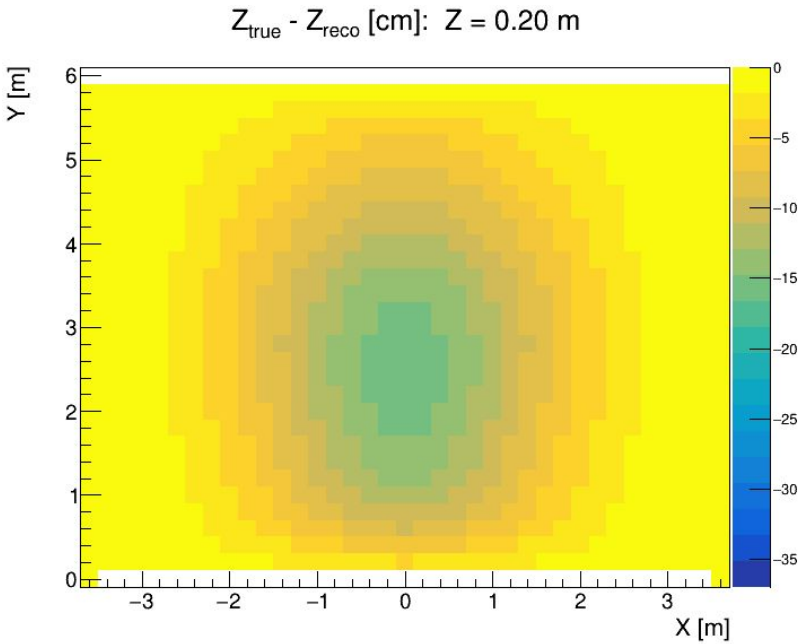


Spatial Offsets at the Front - Simulation Expectations

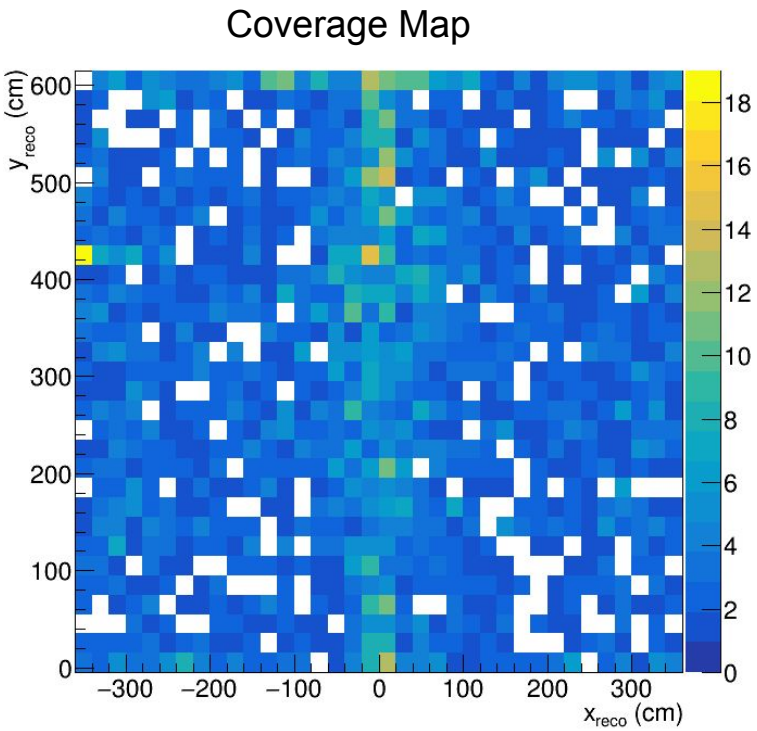
Without fluid flow:

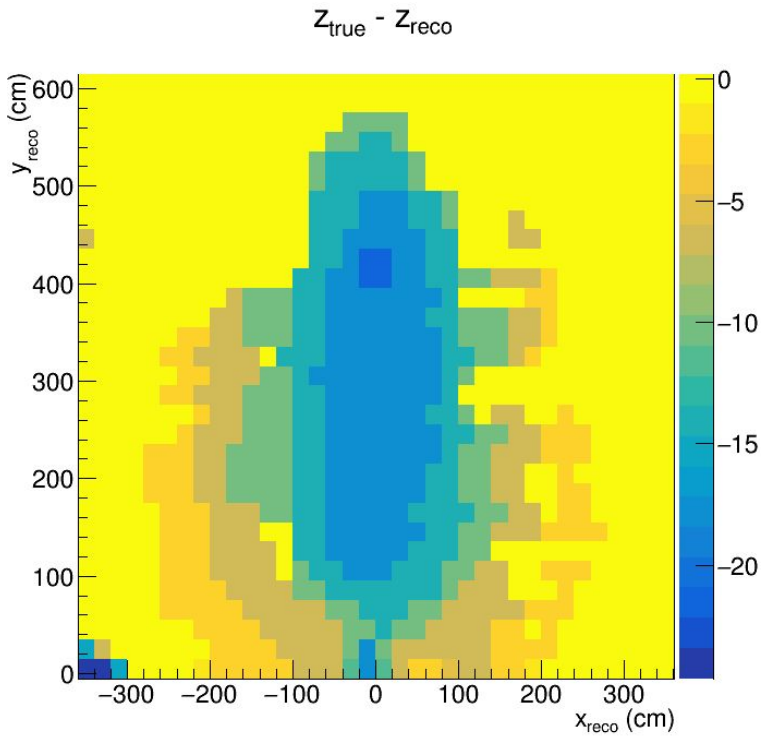


With fluid flow:

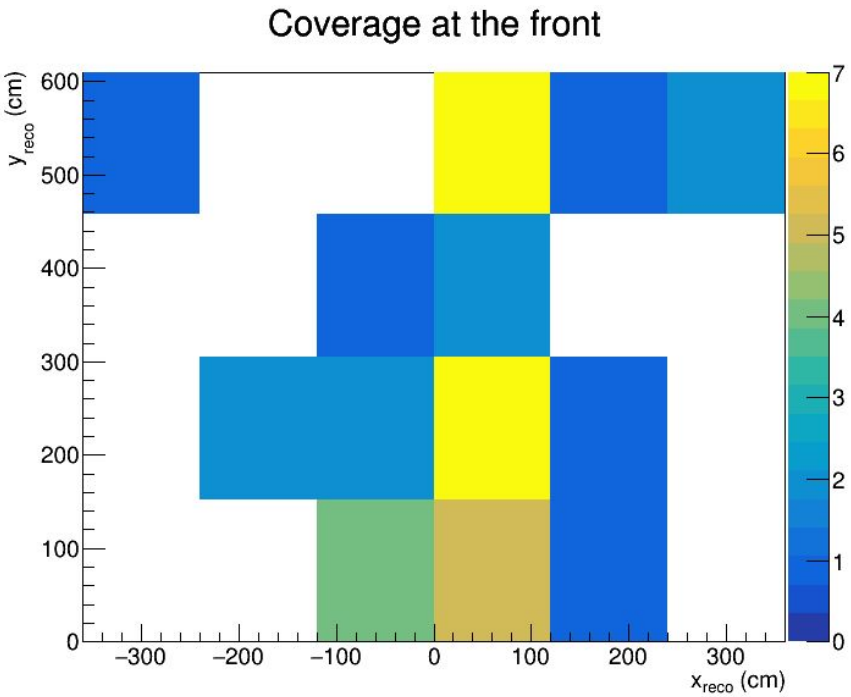


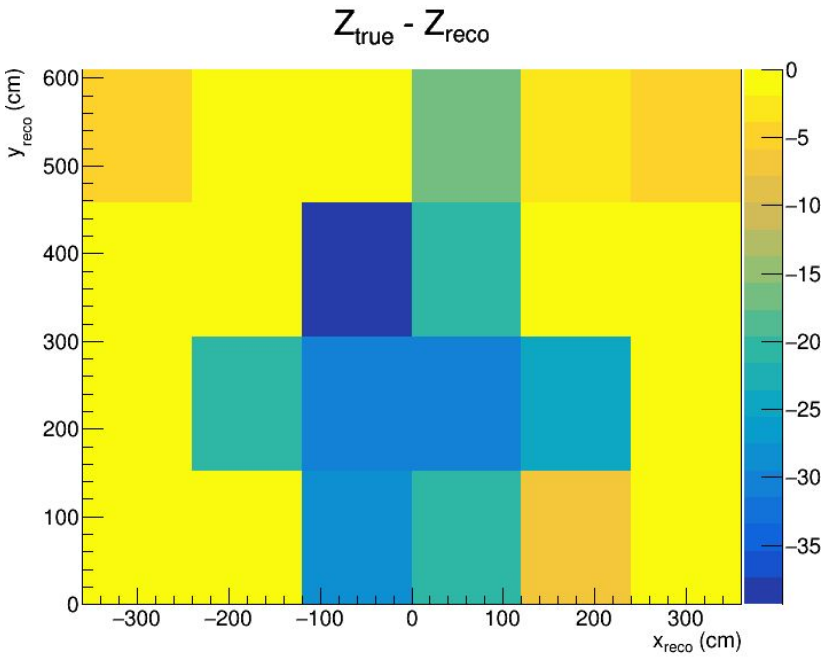
Spatial Offsets at the Front - Reconstructed from MC





Spatial Offsets at the Front - Results from Data





No median filter due to low statistics

Time Dependent SCE

- Offset of beam location is increasing with time since ProtoDUNE started taking data (estimated by eye from evd)
  - Cannot be fully explained by increase in beam energy
  - Electron lifetime tracks spatial offsets
  - Possible connection with flux of 80 GeV pions from target
- From Flavio Cavanna / David Adams:

  Run 4875 [180 kV, 1 GeV, lifetime ~2.2 ms PurMon - to be checked] - offset 19 cm
  Run 5152 [180 kV 7 GeV, lifetime ~2.8 ms PurMon] - offset 31 cm
  Run 5225 [180 kV 1 GeV, lifetime ~3.0 ms PurMon] - offset 33 cm

- Next step: Time dependent study of SCE spatial offsets
  - Specifically study correlations with beam activity and Argon purity /electron lifetime