

MCC3.0 Single Muon Tracking

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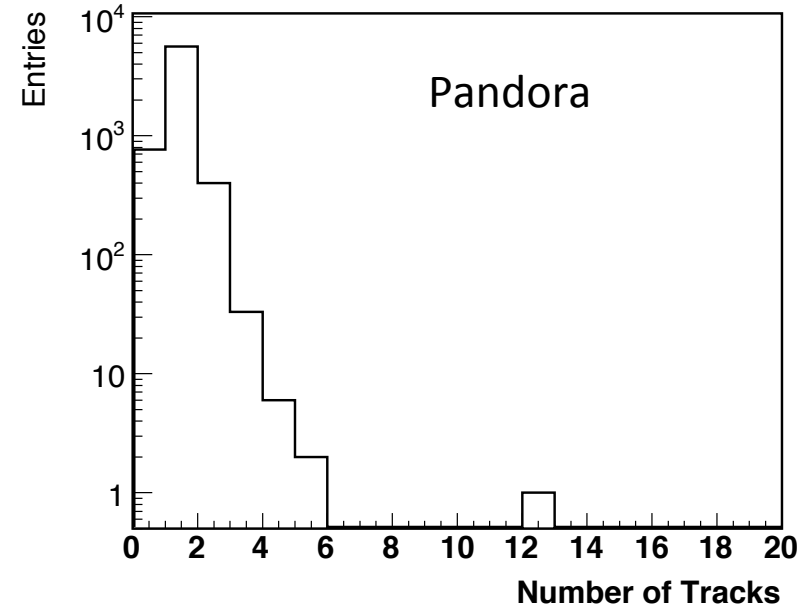
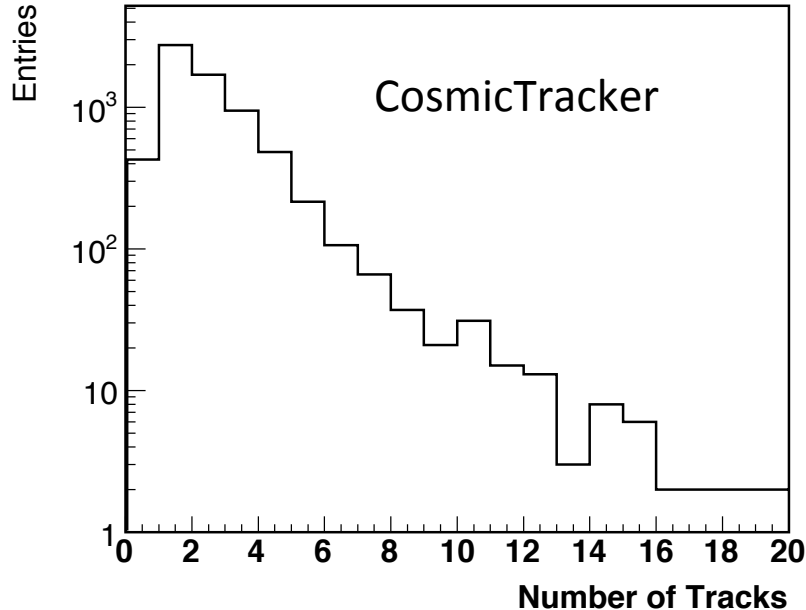
Introduction

- Want to study and improve tracking performance in the 35t detector
- Some suggestions from others (these are not my words!):
 - Need updated validation plots: efficiencies, residuals, etc.
 - Space point formation can likely be improved
 - Stitching needs significant work
- Today: Show new validation plots – guidance for improvements
- These results use mergeana ntuples from the 35t MCC 3.0
 - LArSoft v04_12_00 e7:prof
 - 35t4apa geometry v3
 - 10k single antimuons, no cosmics
 - muons have random start positions (except $y=141.55$) and momenta
- Will compare cosmic tracker and pandora, both without any cheating

Number of Tracks

One particle, one track?

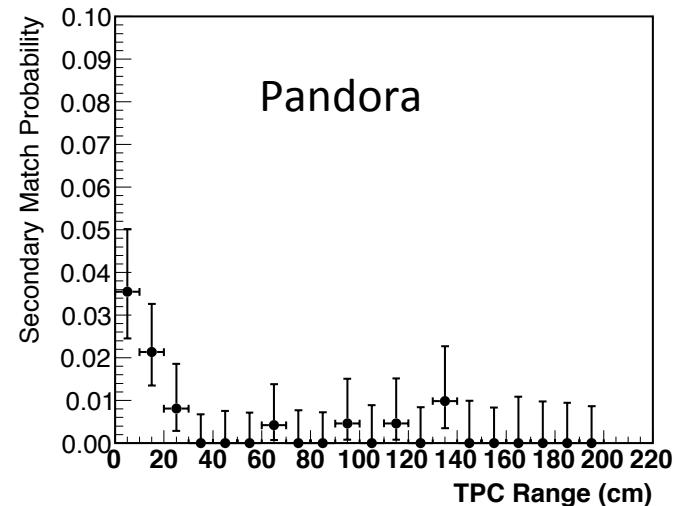
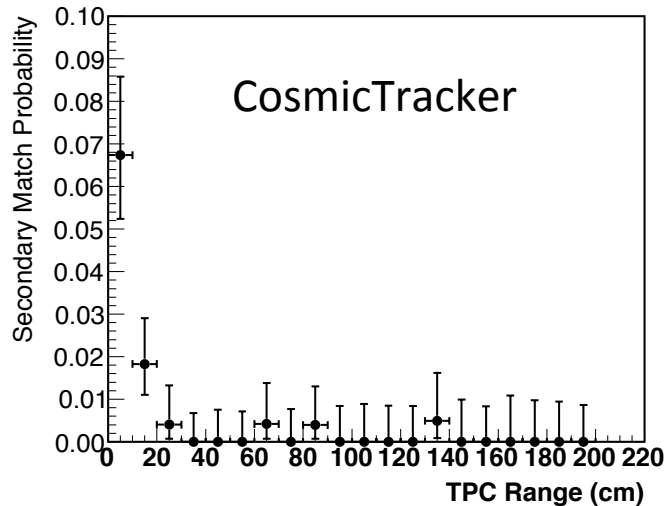
- 40% of the time, yes (82% in pandora)
- 0 tracks 6.3% of the time (11% in pandora)



Remainder of talk focuses on 1-track events

Do Tracks Belong to Primary Muon?

Check how often the track is truth-matched to a secondary particle



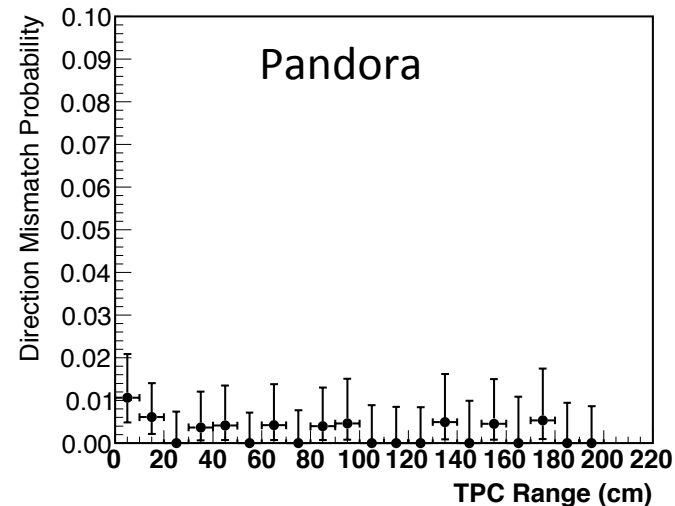
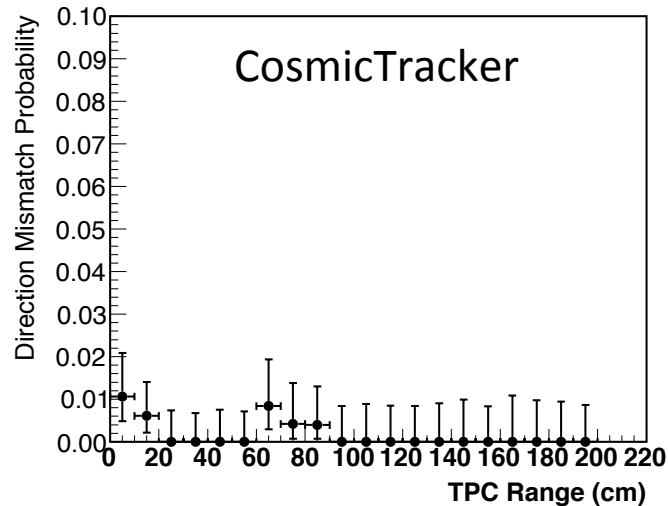
Secondary matches are rare for both trackers

Most likely to occur when the range of the primary muon in the TPC active volume is less than 20 cm

Do Tracks Point in the Right Direction?

Calculate the distances between the track and true muon endpoints – check that these are minimized for the assign track direction

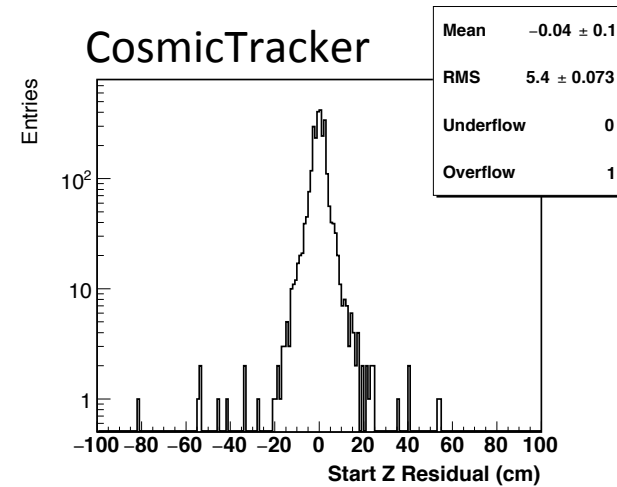
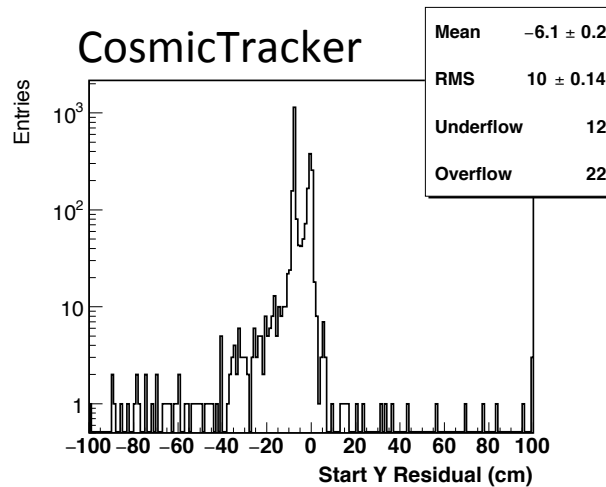
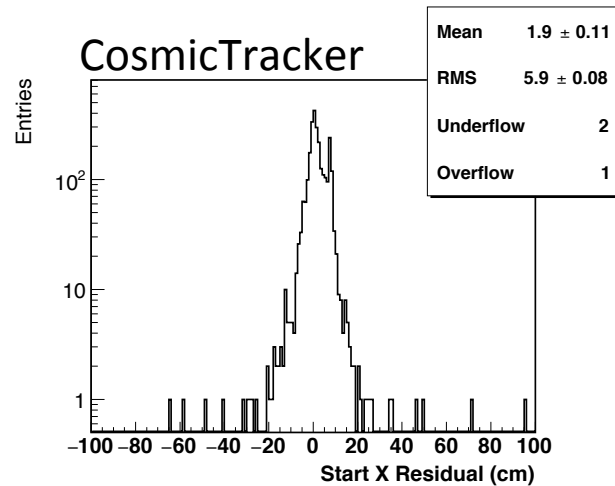
Do not include tracks matched to secondaries



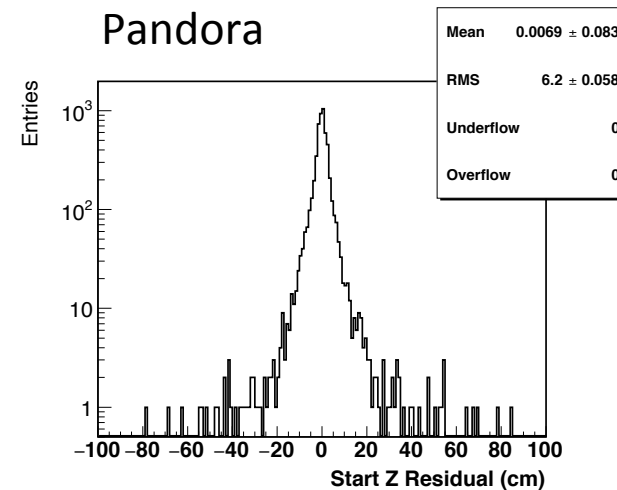
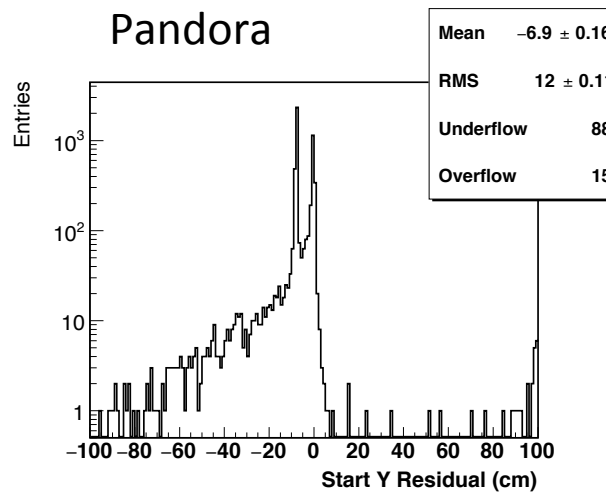
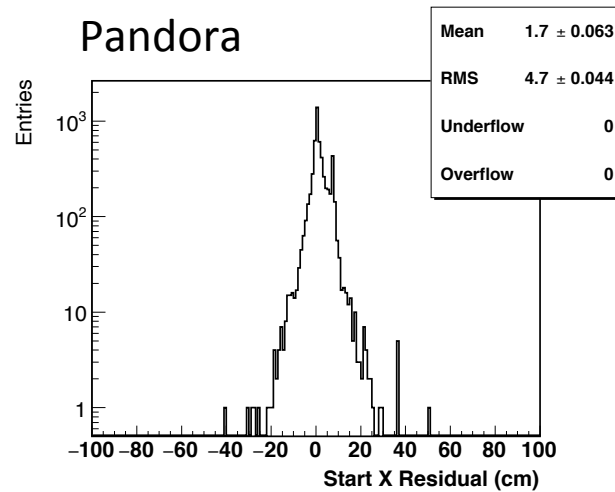
Direction mis-reconstruction is extremely rare

Secondary matches and direction mis-reconstructions are not included in the following slides

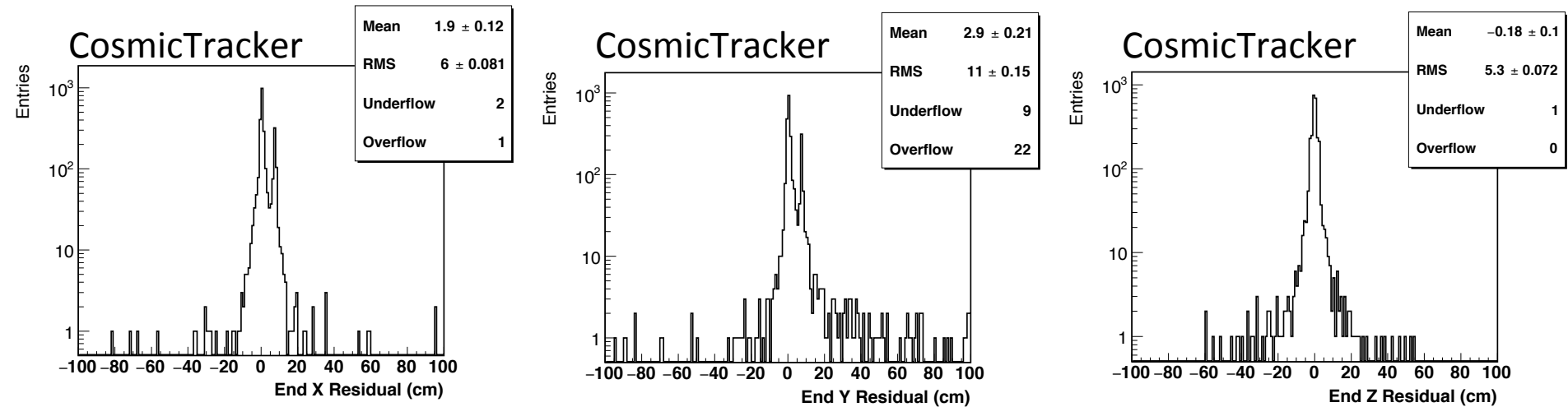
1 Track Events: Start Residuals



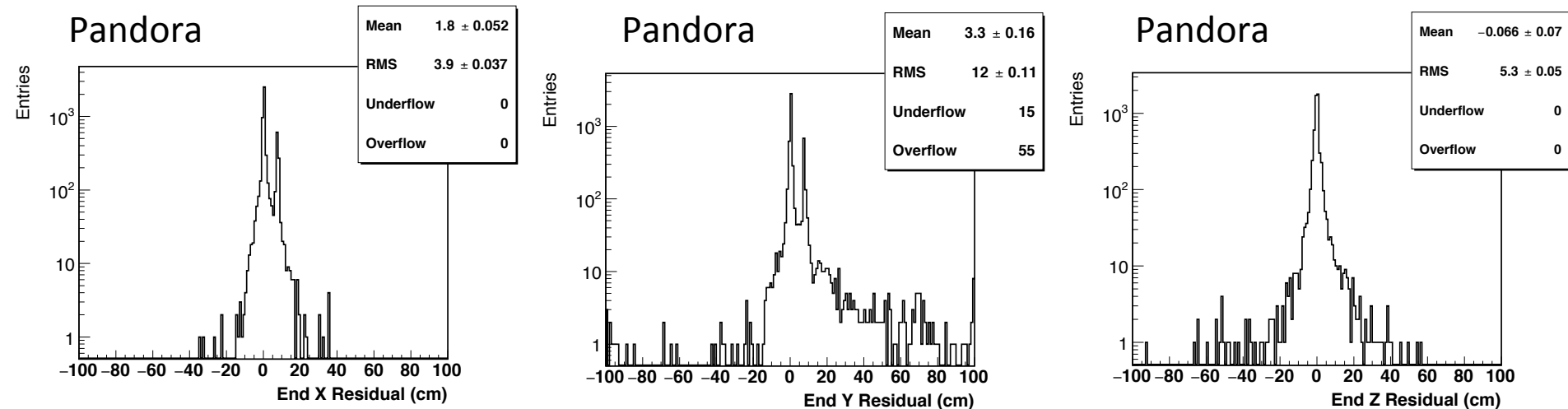
Residuals: Reco - True



1 Track Events: End Residuals



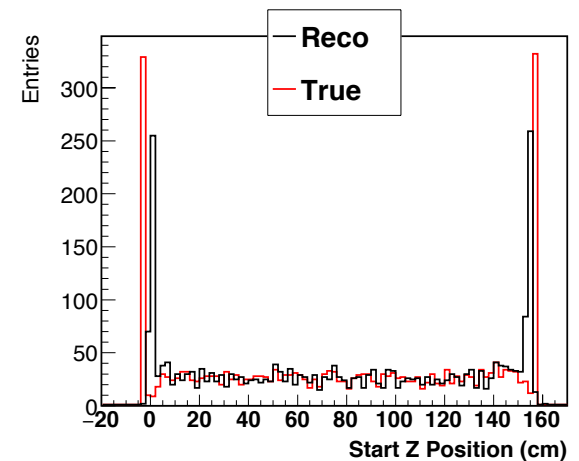
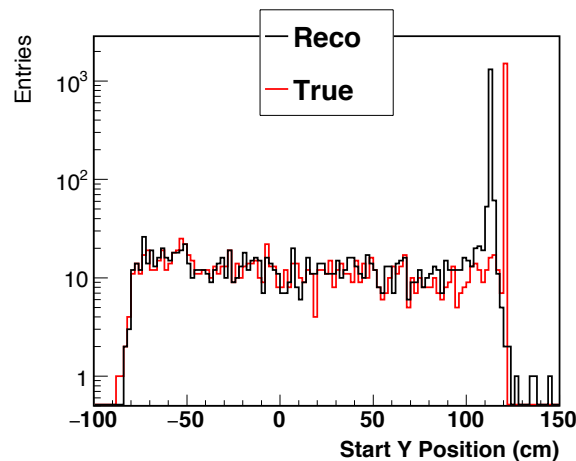
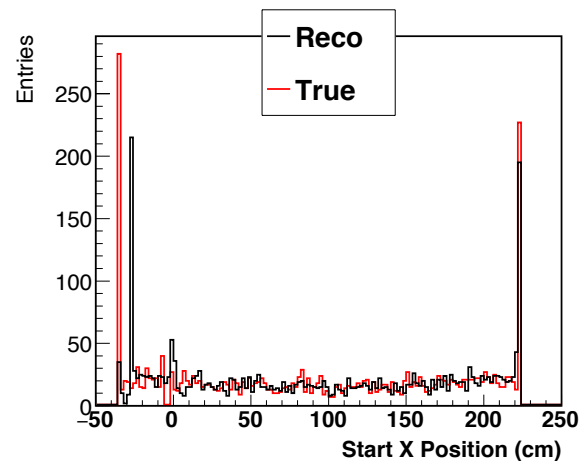
Residuals: Reco - True



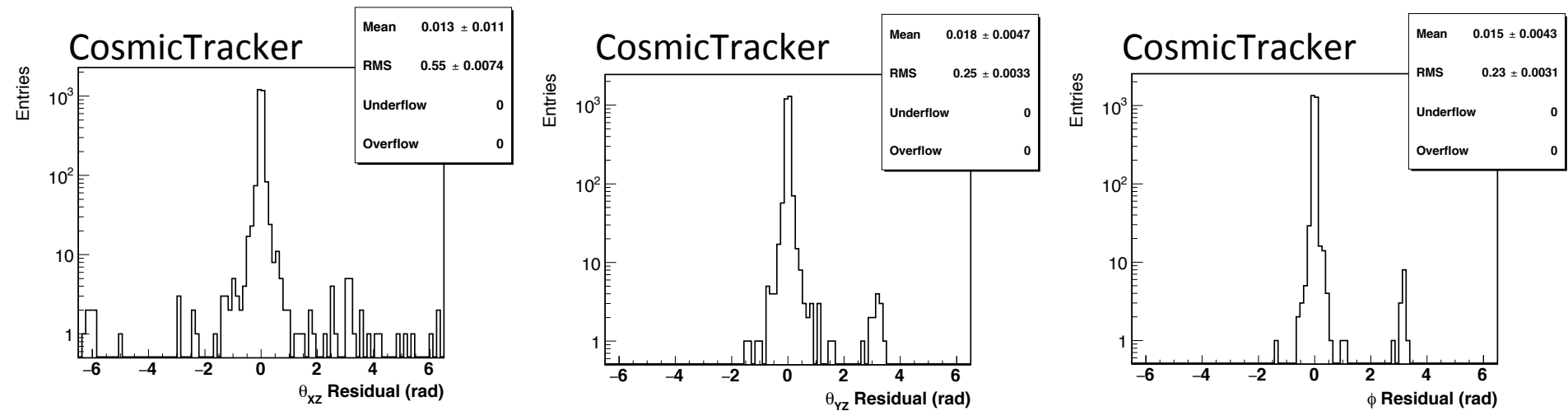
What is up with the bimodal structure?

The true start position is the point at which the geometry says the muon enters the TPC active volume

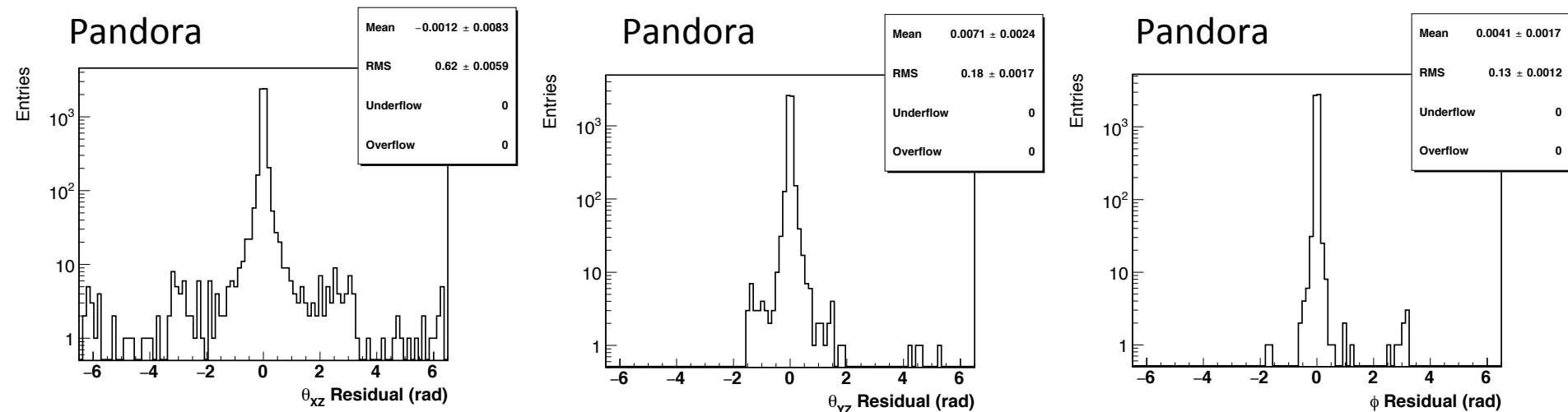
Apparently the reconstruction is unable to start/end tracks at the edge of the active volume



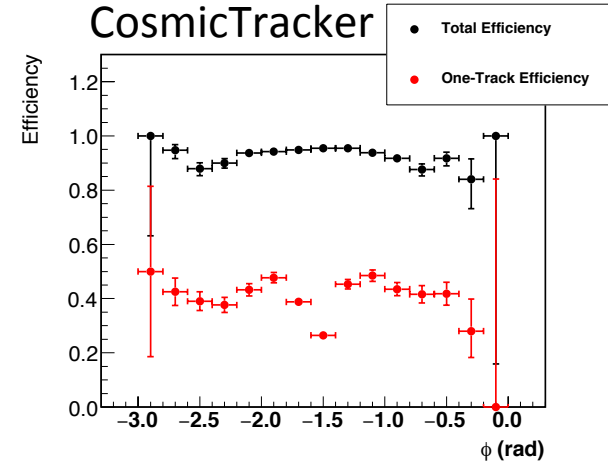
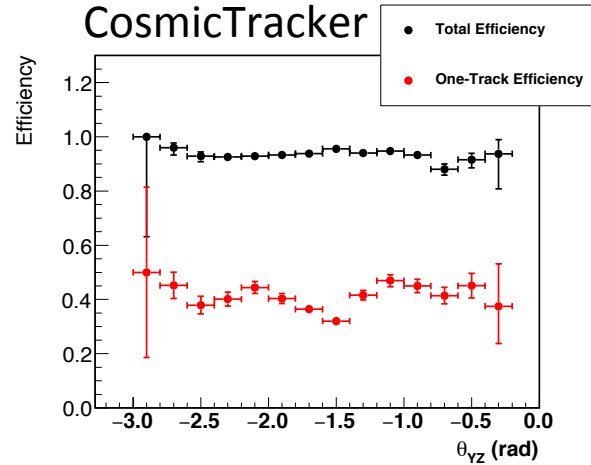
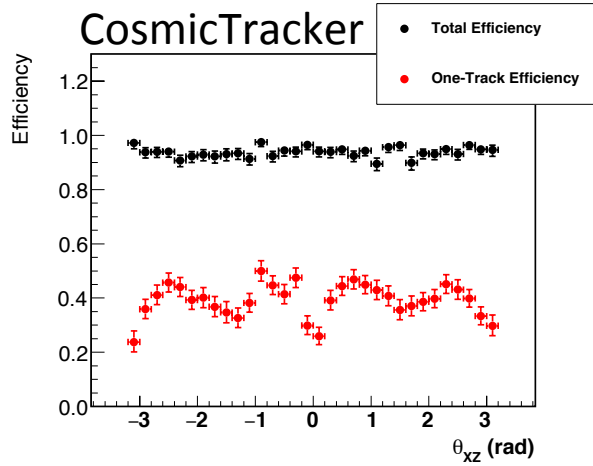
1 Track Events: Angle Residuals



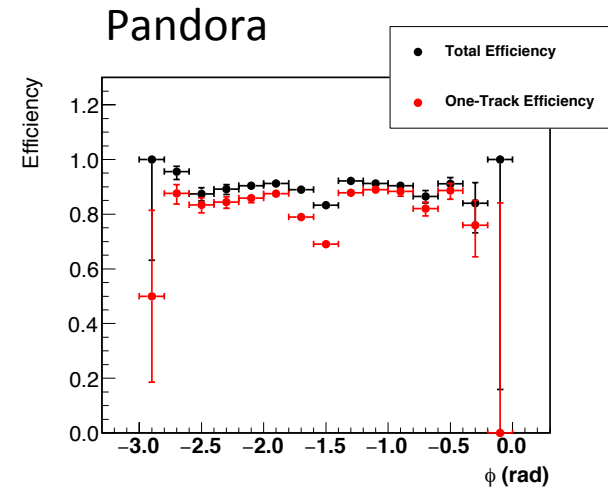
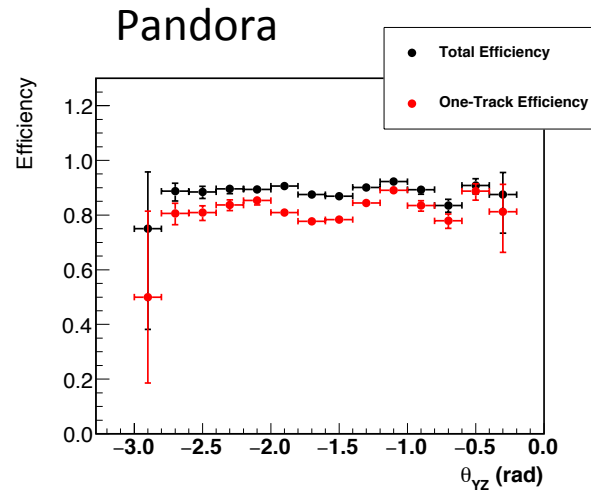
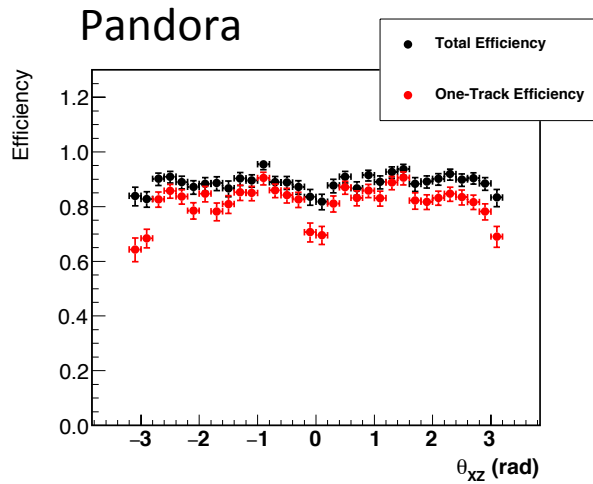
Residuals: Reco - True



Tracking Efficiencies



Residuals: Reco - True



Next Steps

- Determine why track multiplicity is so high with CosmicTracker
 - Is track stitching partially to blame?
- Zero-track rate shows some mild angular dependence. Is there a more important factor?
 - Perhaps edge effect
 - Why does Pandora do worse?
- Understand bimodal structure of endpoint residuals
 - Is the code that determines the beginning of the active volume correct?
- Adapt Tracy Usher's 3D cluster reconstruction to 35t. How does it fare?
- I'm very new to this effort. Other suggestions?