

Aaron Mutchler

University of Colorado Boulder

► Impact of  
Diffusion  
Constants in  
GarSoft  
Reconstruction



# GarSoft

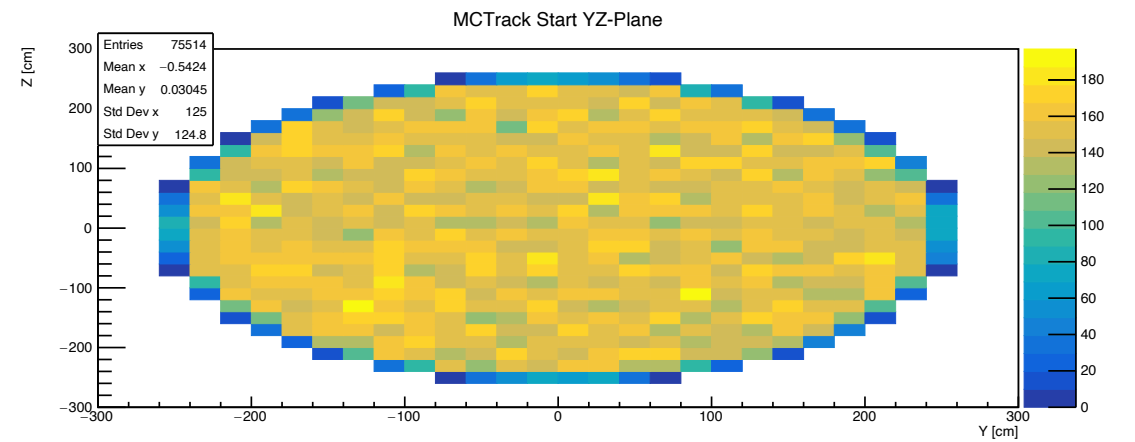
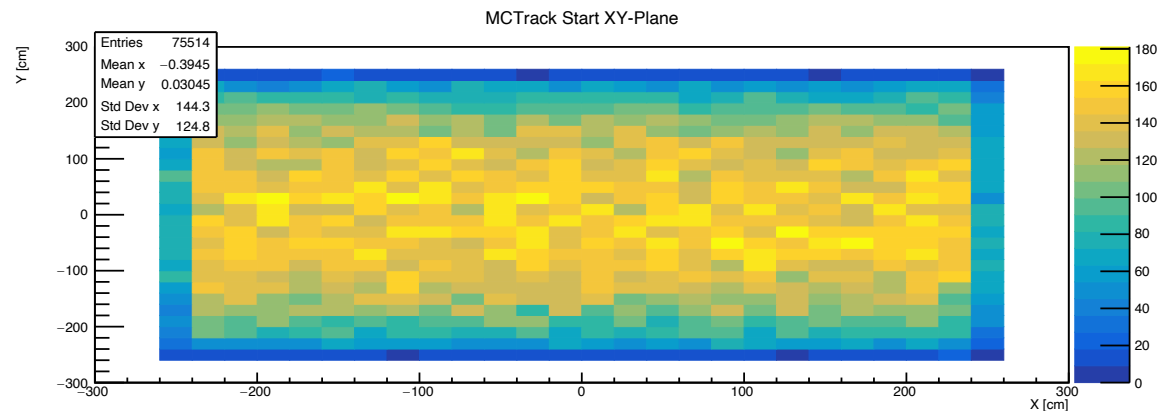
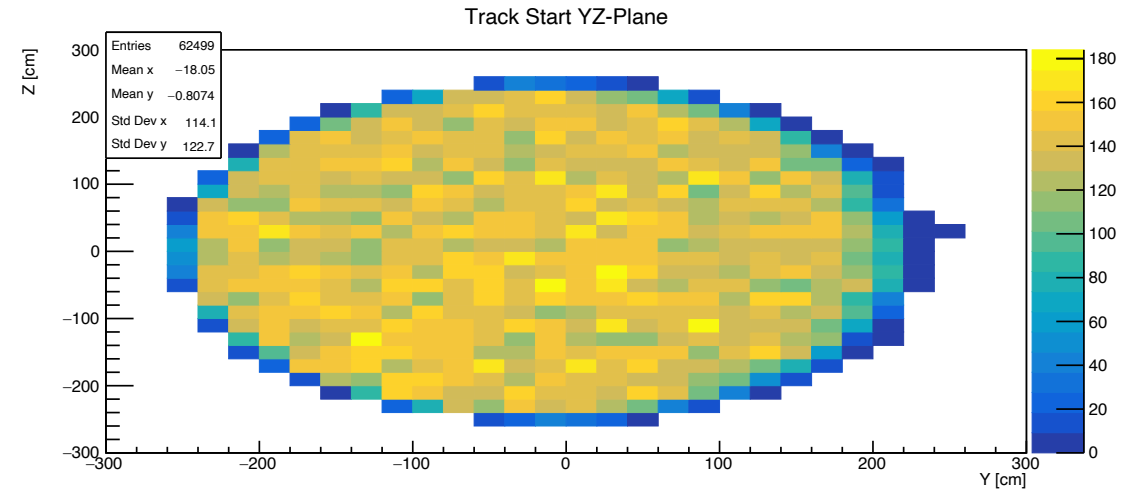
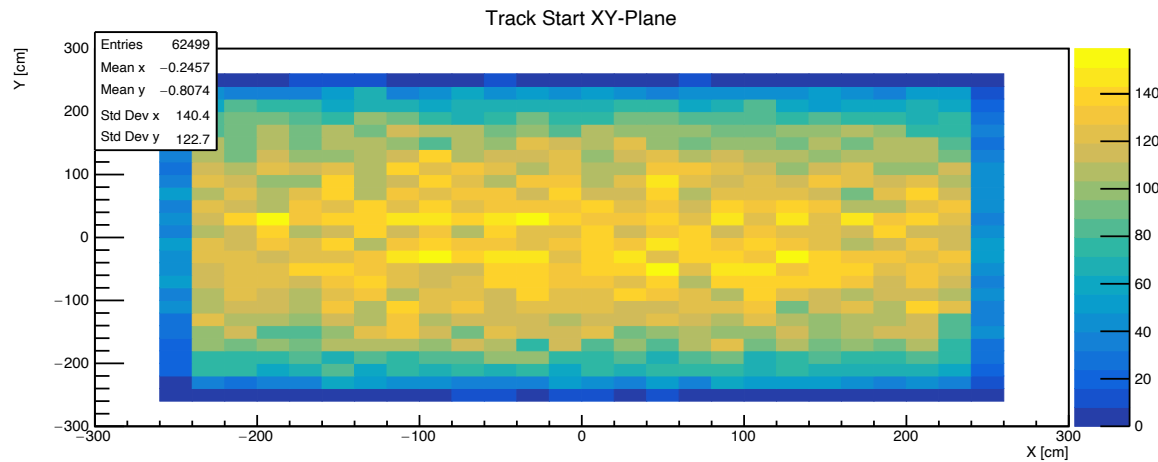
- Lately I have been studying track reconstruction with GarSoft.
- The focus of my studies has been the impact of increased diffusion on track reconstruction efficiency.
- Aside from the nominal case I looked at 2, 4, 10, and 20 times the diffusion constants (both longitudinal and transverse).
- I also plotted the simulated track starting positions in the YZ and XY planes next to the reconstructed track starting positions.

# The Nominal Case

- Simulate 100,000 muon events spread uniformly throughout the detector (for 10- and 20-times diffusion, 50,000 events).
- Momentum range from 0.1 to 5 GeV/c (uniformly distributed)
- Longitudinal diffusion:  $201.25 \frac{\mu m}{\sqrt{cm}}$
- Transverse diffusion:  $160.285 \frac{\mu m}{\sqrt{cm}}$

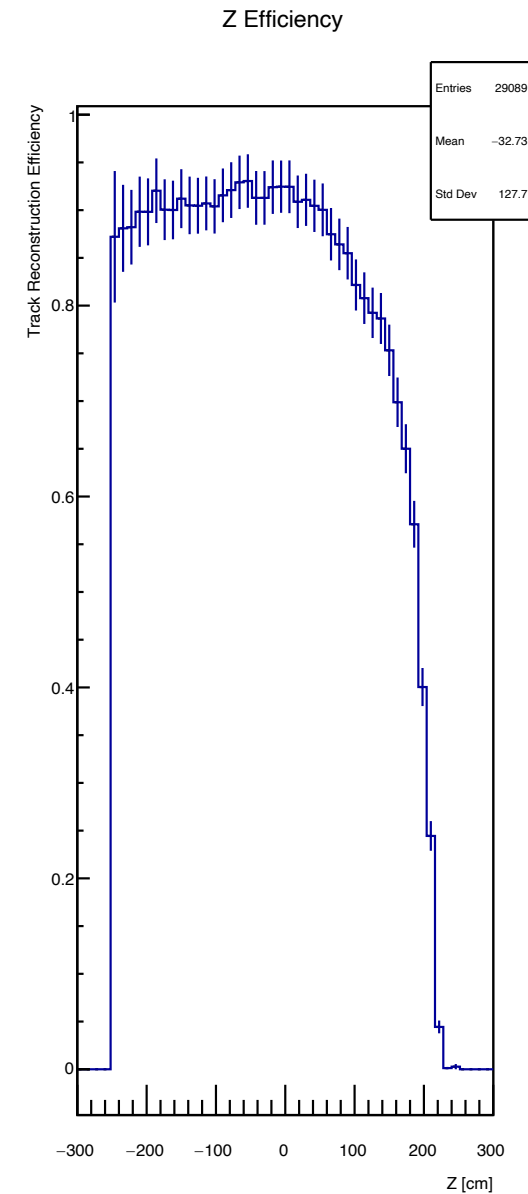
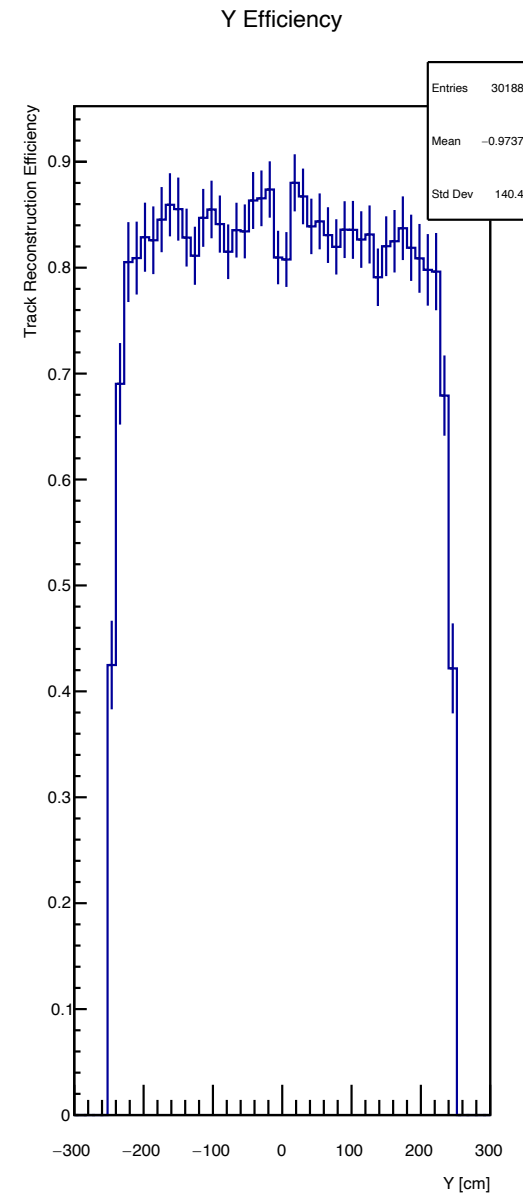
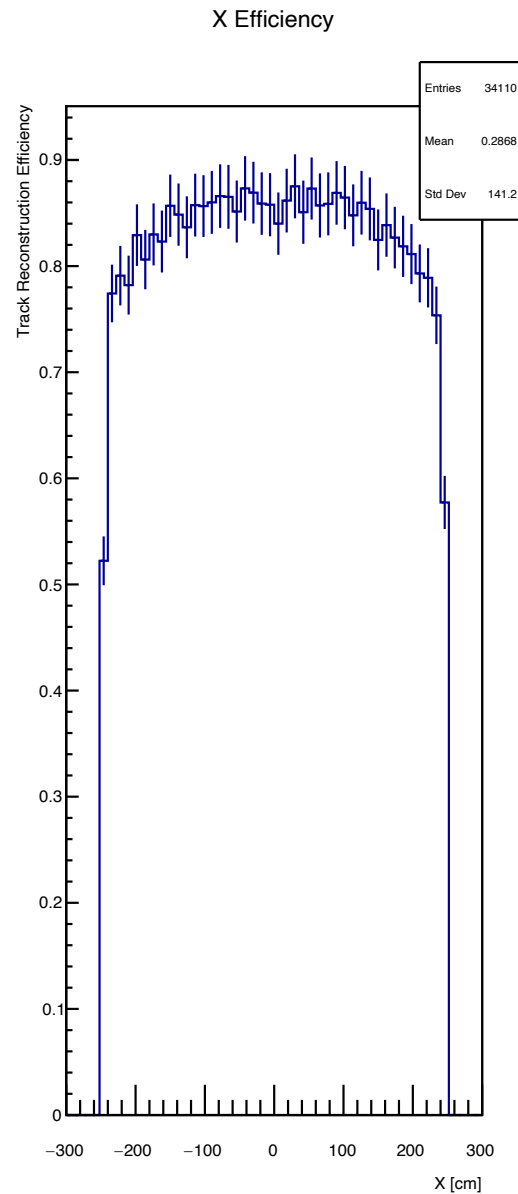
# Nominal

- Monte Carlo simulated start positions on bottom
- Reconstructed track position on top



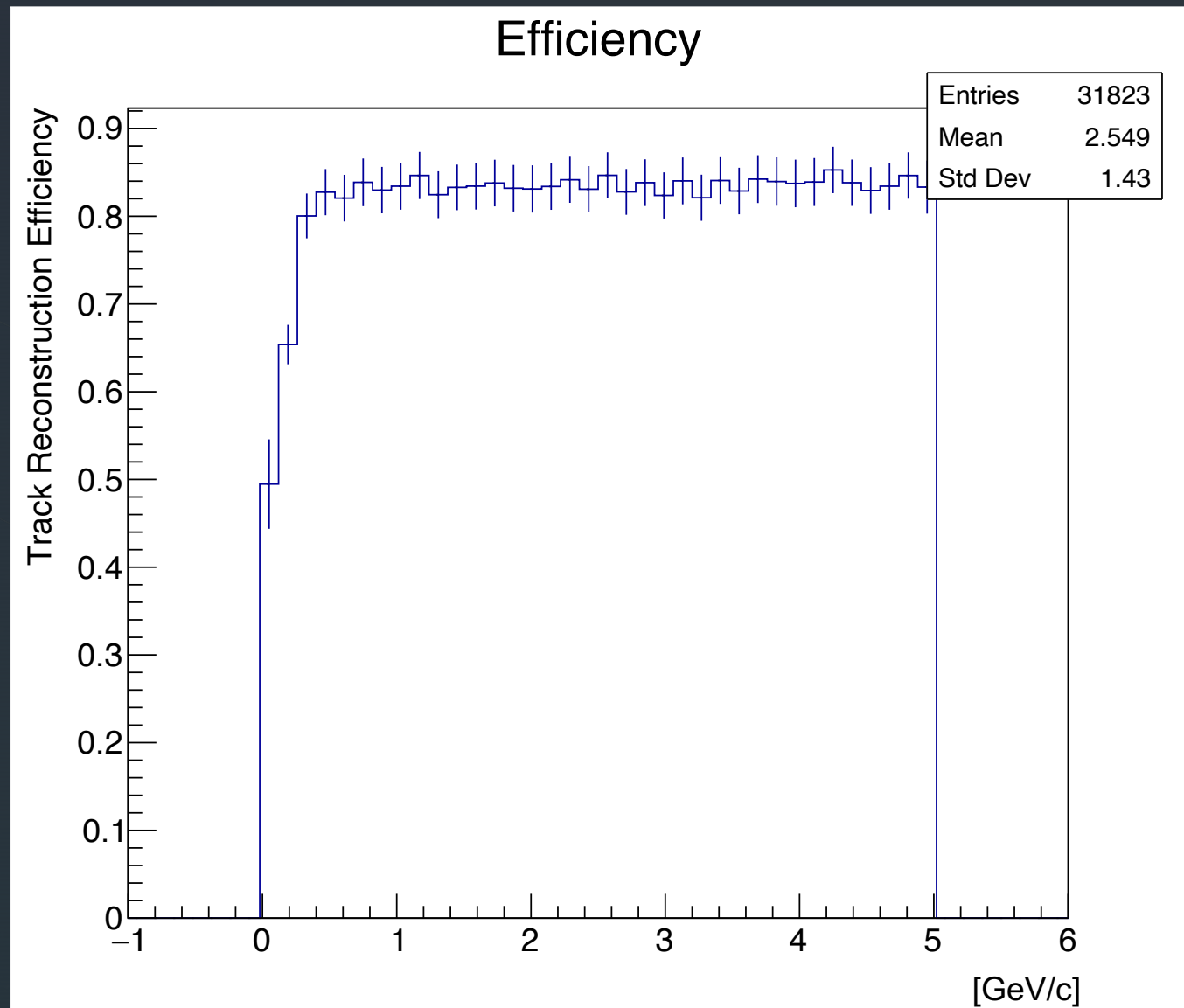
# Nominal

- Of the reconstructed tracks, I only select those within 5 cm.
- Of those, pick the closest to simulated track: this is a matched track and select the associated MC track.
- Divide the simulated tracks by the matched tracks.



## Nominal Momentum Efficiency

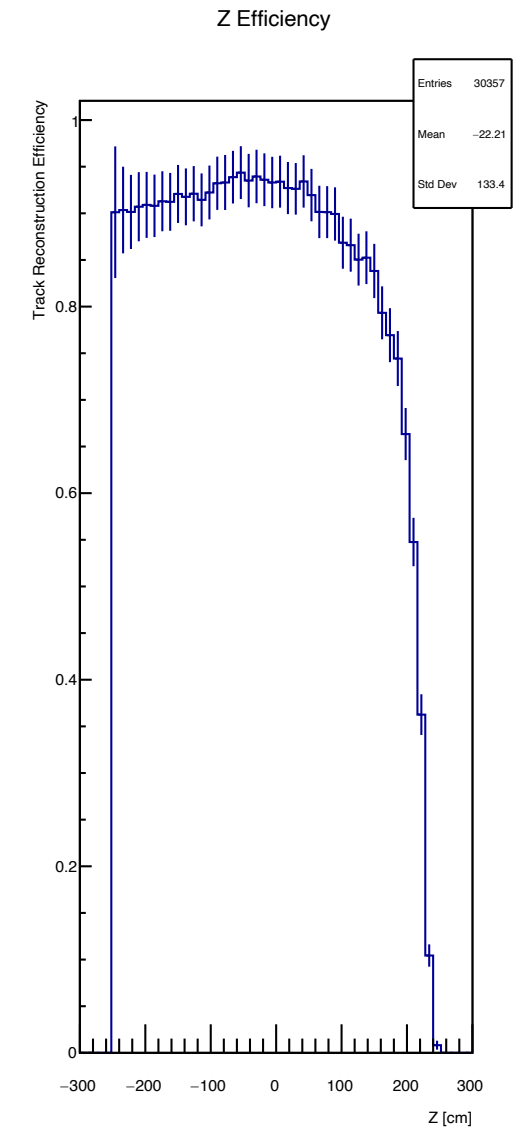
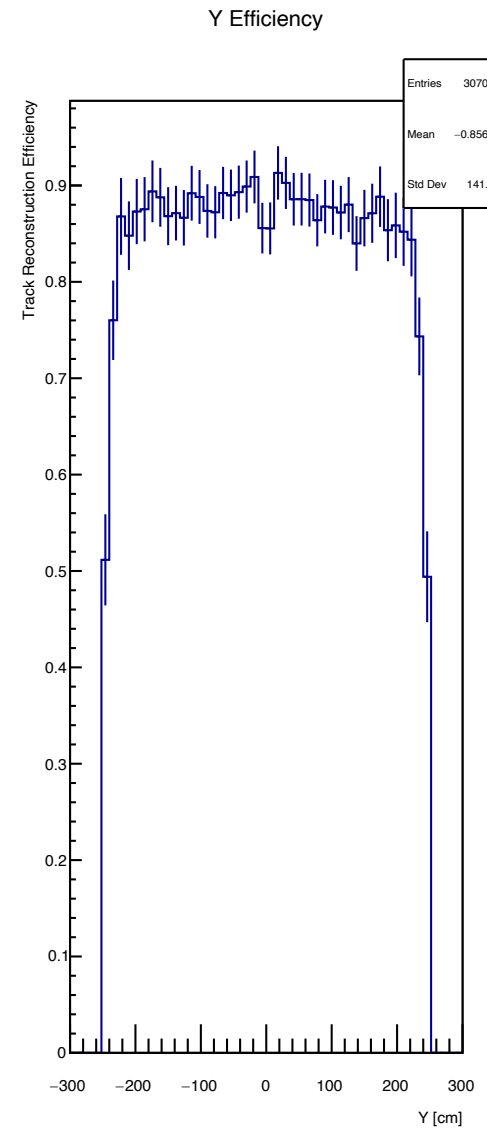
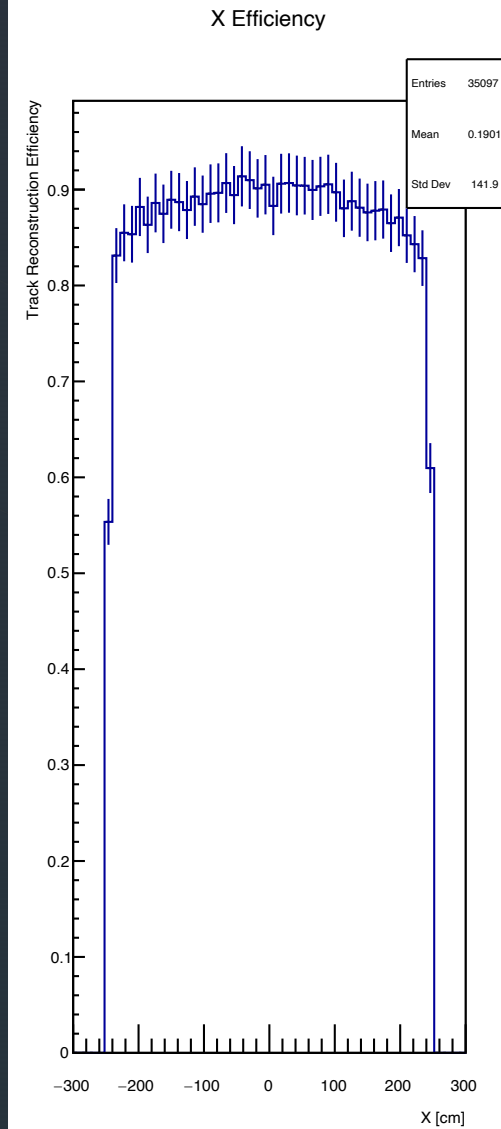
- Lower momentum, worse efficiency.





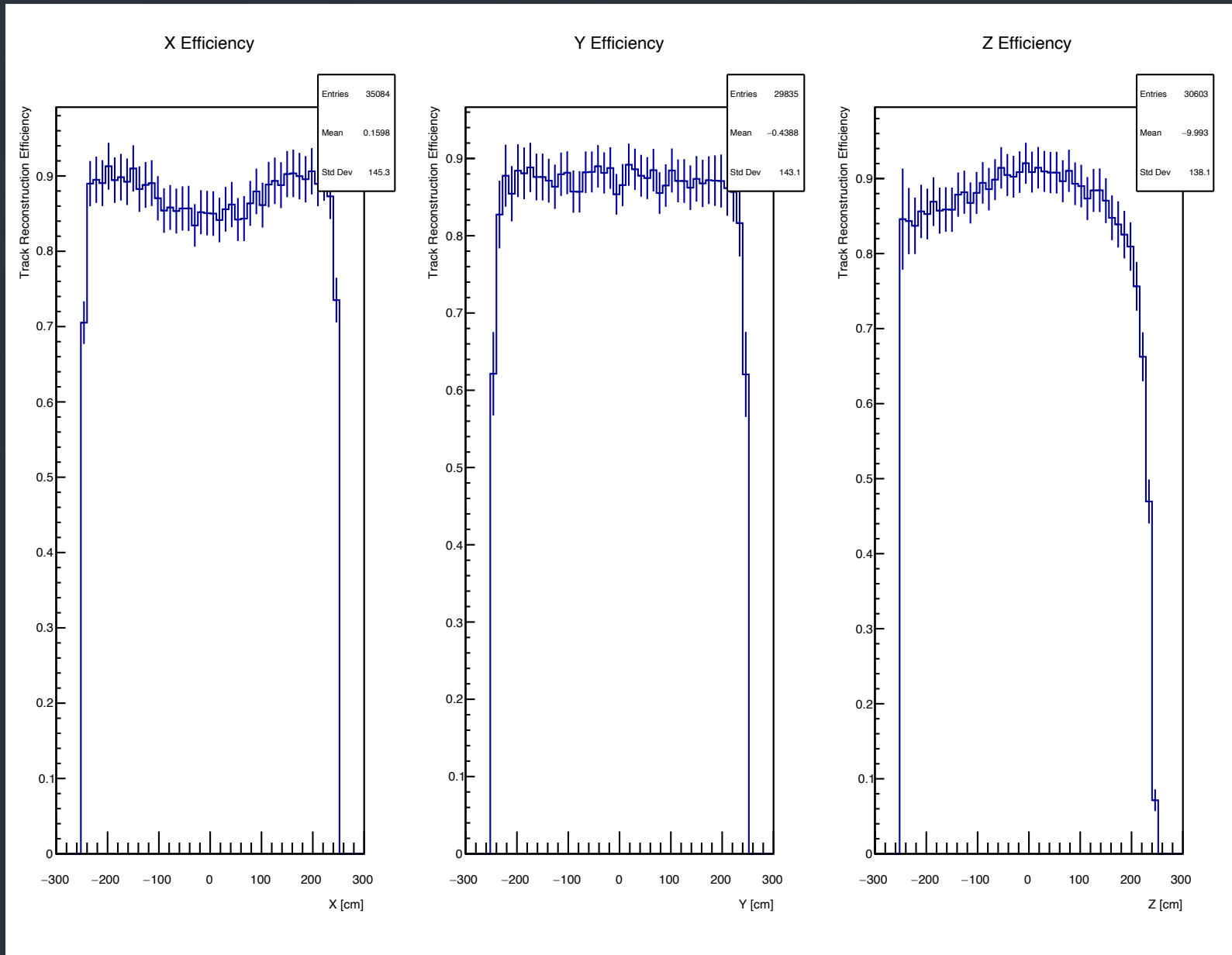
# Twice Diffusion constants

- Not a significant change



# 4x Diffusion Constants

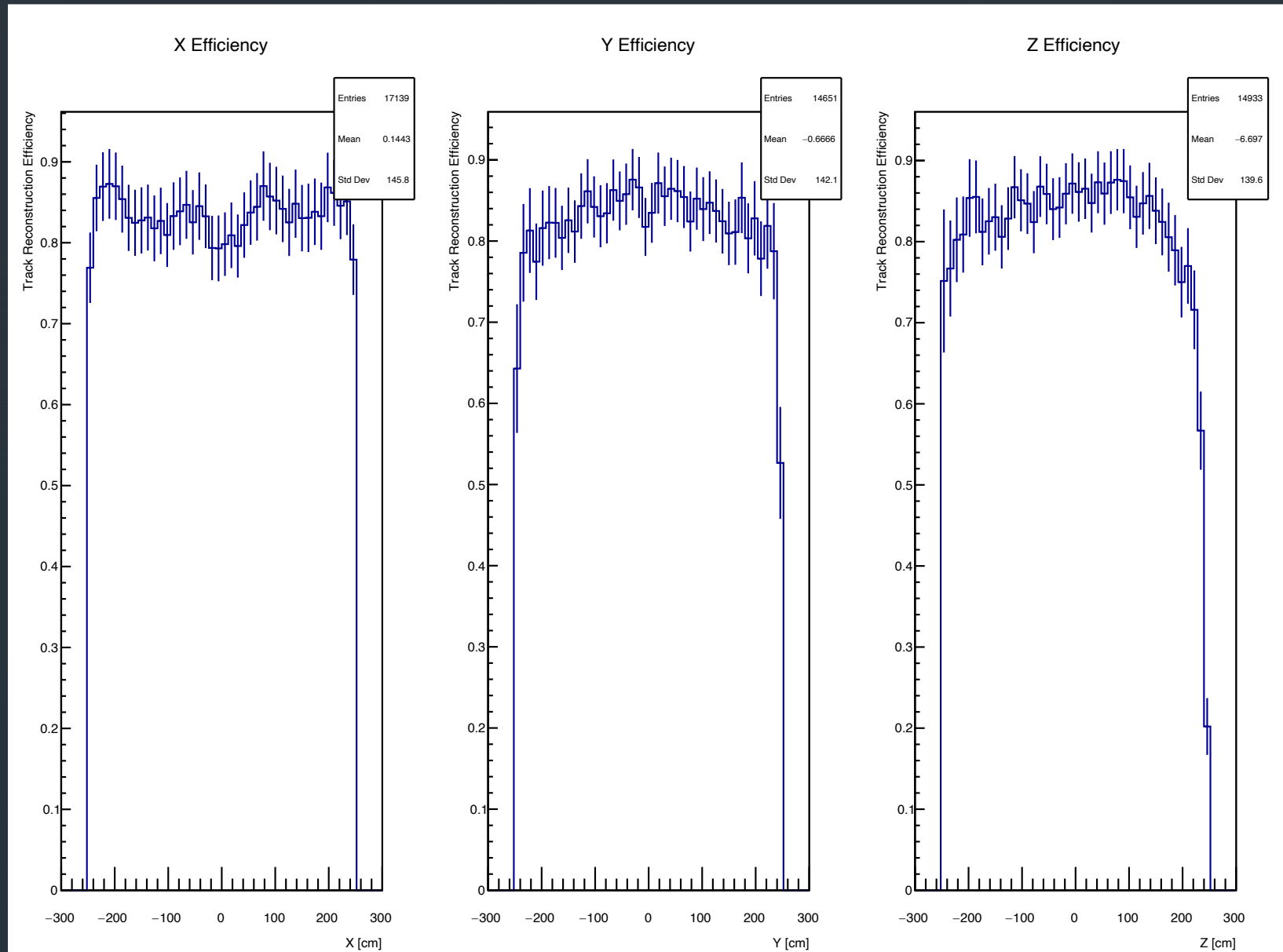
- Impact starts to become clearer.
- About 5% loss in x





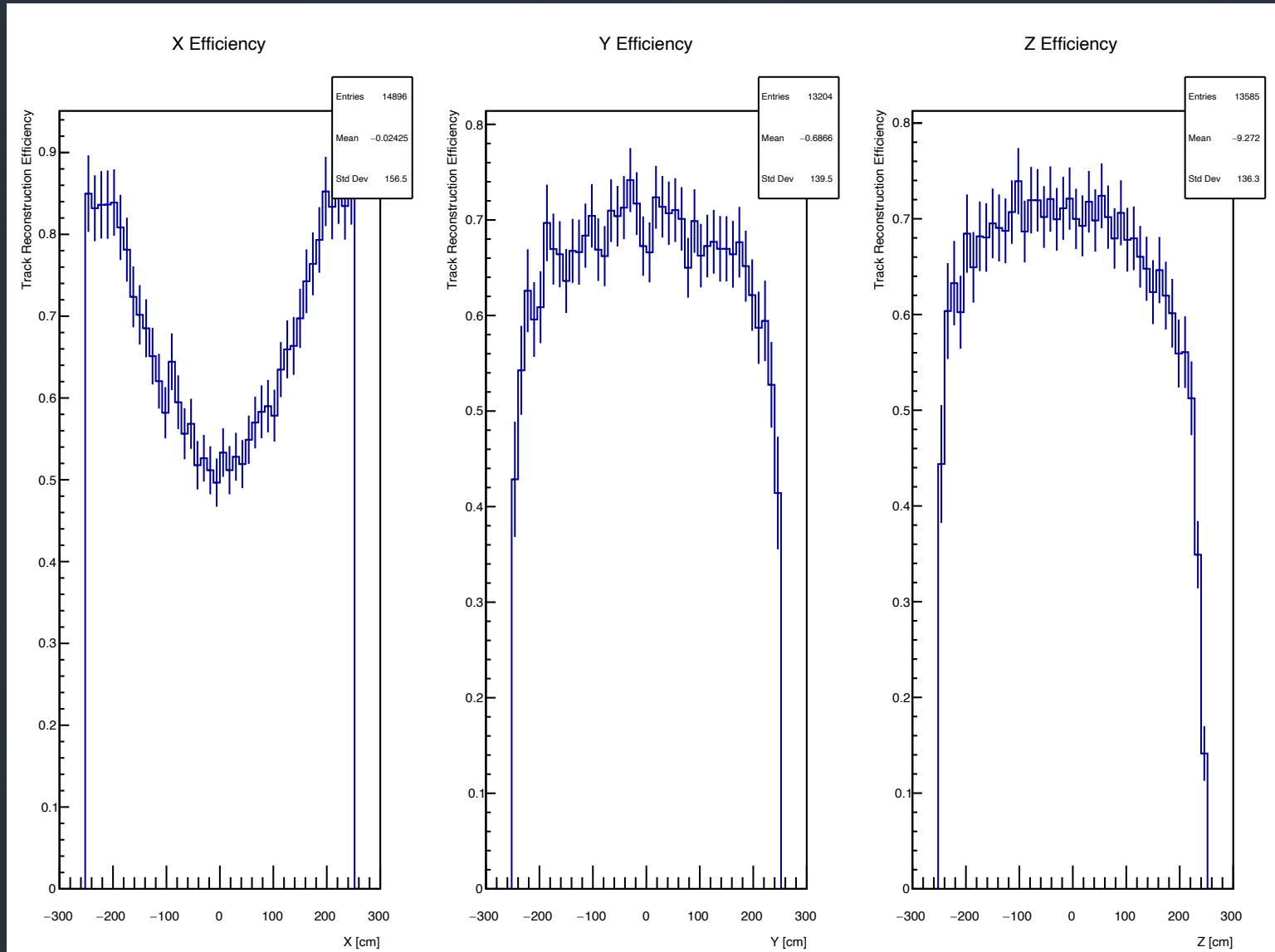
# 10x

- Effect becoming much clearer.
- Dropping about 10% at worst.



# 20x

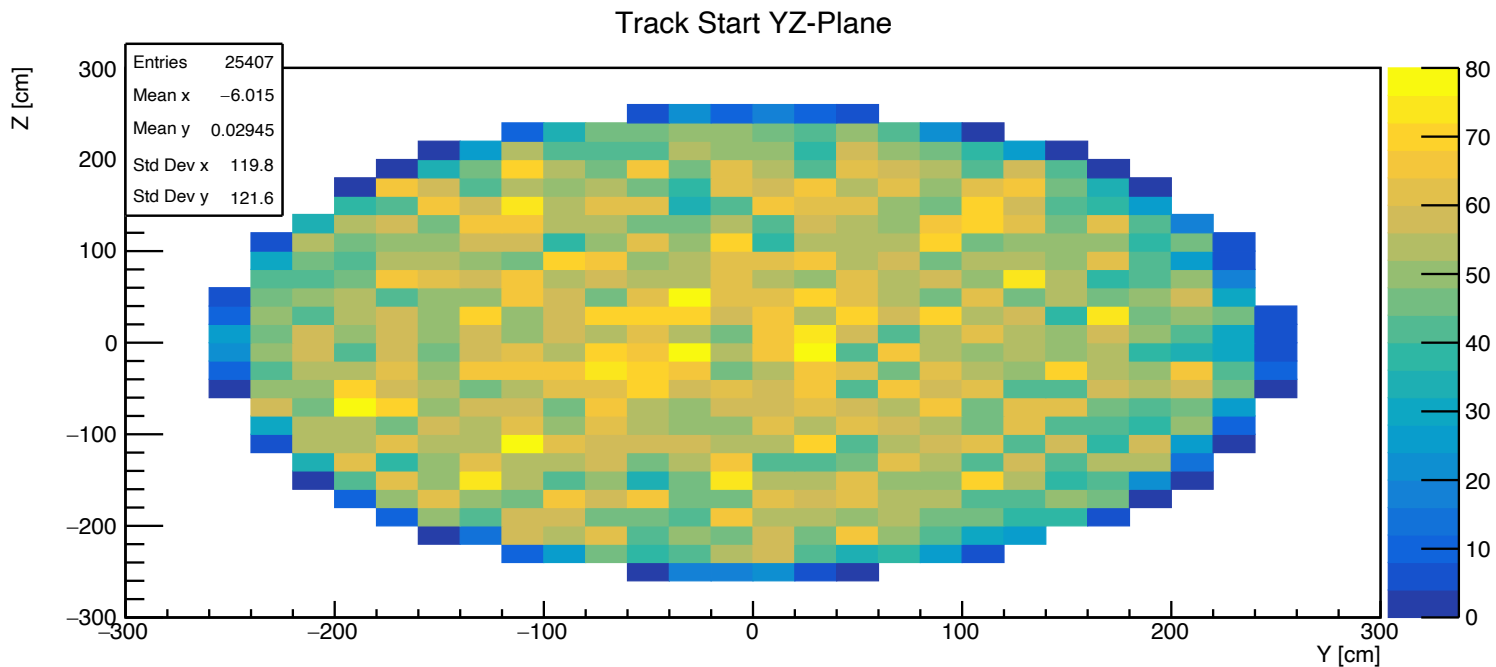
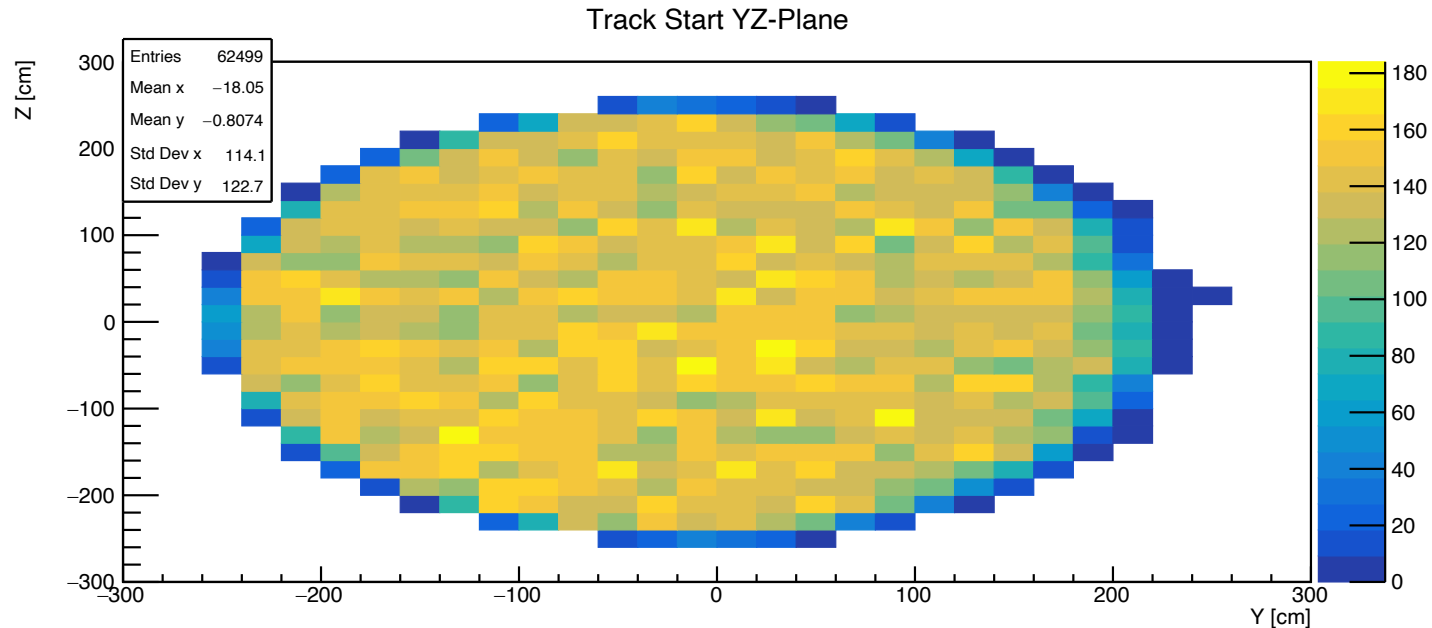
- Dramatic change and loss in efficiency



# Nominal

▶ To help show the loss in reconstruction ability between nominal (right) and 20 times the diffusion constants (below).

## 20x





# Summary

- About 90% efficient in reconstruction ability for nominal diffusion.
  - Drops to about 50% with 20 times the nominal diffusion.
  - Can safely reconstruct with a factor of 2 or 4 but performance degrades above this.
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