

# Status of the Tracker MC

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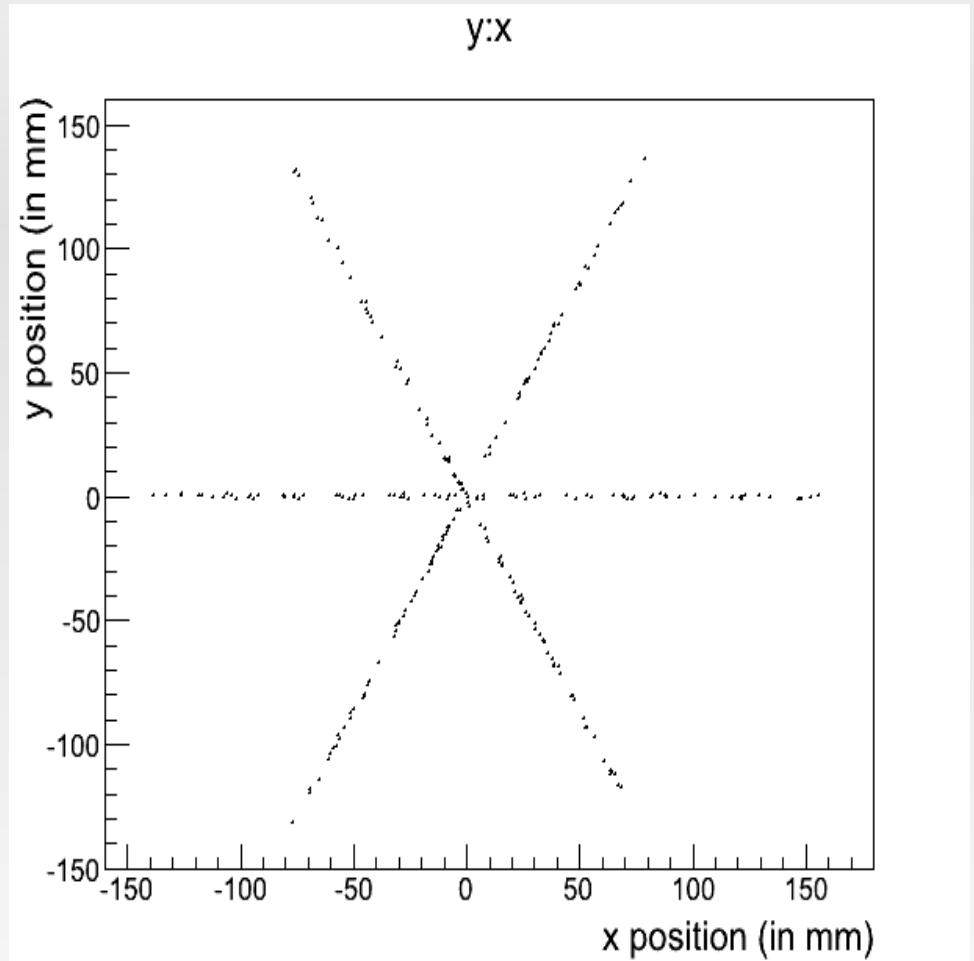
For MICE CM 33

# Outline

- Initial State of Tracker MC
  - Progress and Known Issues
- Single Station Test
- Looking Ahead
  - Straight Track Testing
  - Step IV
  - Upcoming Projects

# Initial State of Tracker MC

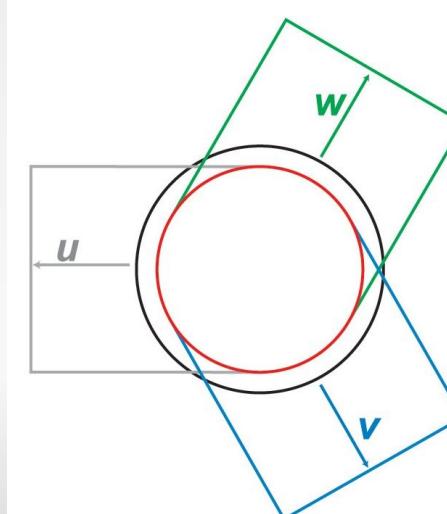
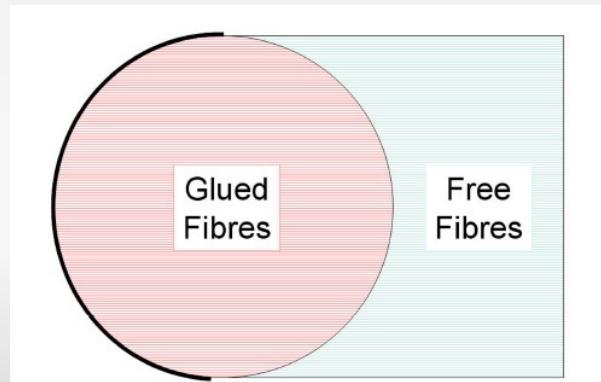
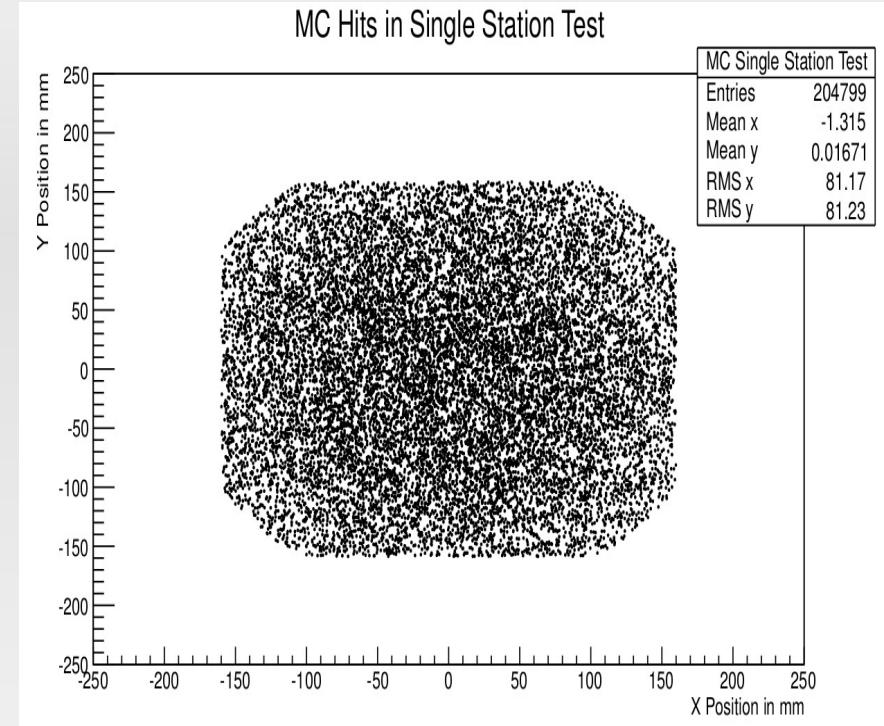
- Tracker not recording hits in vast majority of events
- After many tests, it was found fiber lengths were too small
  - G4Mice modeled tracker planes as... planes
  - MAUS models planes as fibers
  - Fiber lengths not updated in moving from G4Mice to MAUS
- 2 months of work to change the variable “tlen” from 1.0 mm to 150.0 mm



~250 recorded hits in all 3 planes  
in a run of ~15000 particles.  
1.7% of particles record a hit.

# Initial State of Tracker MC: Known Issues

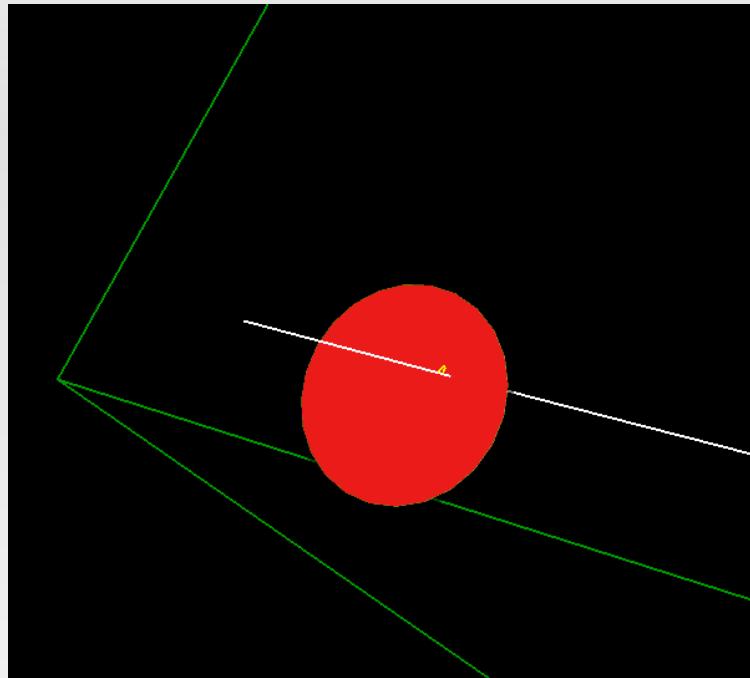
- Simulations run using old and incorrect geometries
  - Tracker planes are modeled incorrectly
  - legacy geometry files used, need to upgrade
- Beam poorly modeled
  - Small changes to default beam included in MAUS
  - Needs to match to experiment



Above: MC plane geometry  
Left: Actual plane geometry

# Single Station Test

- Beam generated:
  - 500 cm from station
  - 4 mm emittance
  - $226 \pm 25$  MeV
  - $\sim 3000$  muons over 75 spills
- Trigger Condition
  - At least one digit produced in any plane
- Match to data
  - Attempt made to match npe
  - Still need to collect dead channels

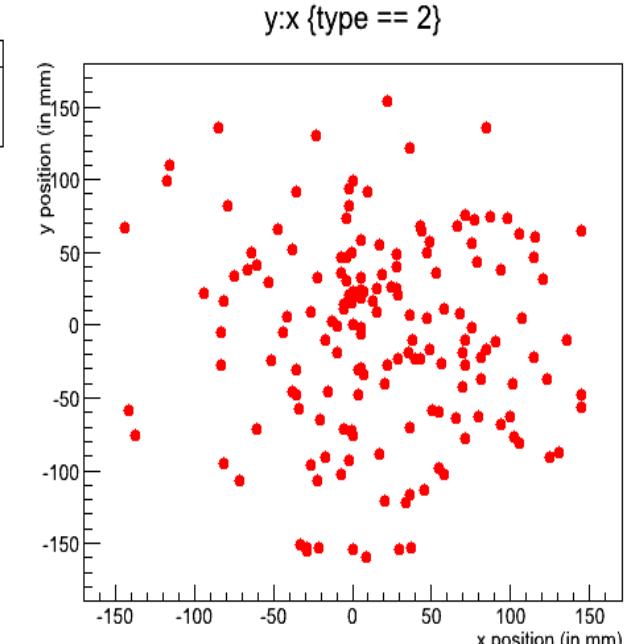
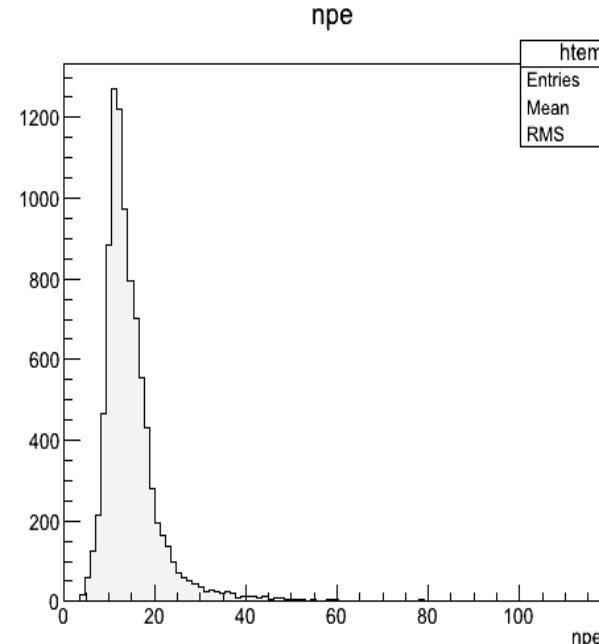
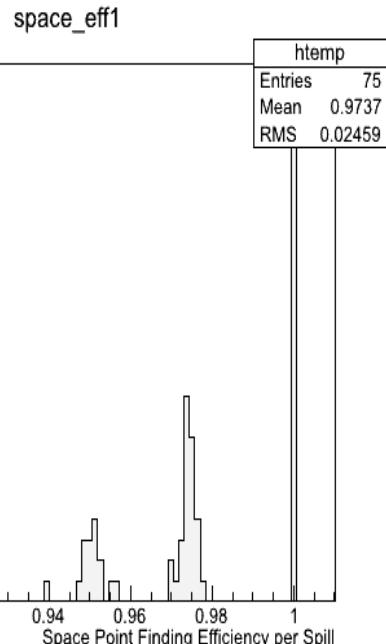
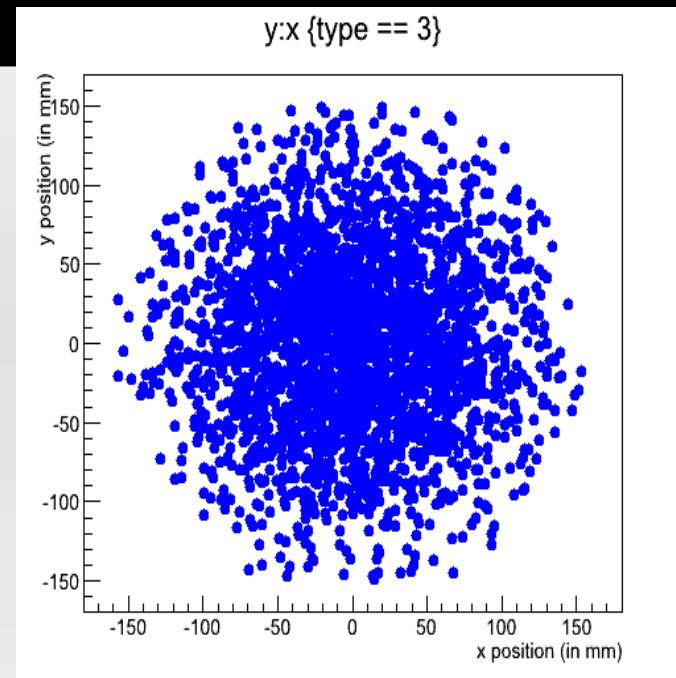


Muon (white line) traveling through single tracker station (red circle). Green lines show edge of simulation.

# Single Station: Uncorrected NPE

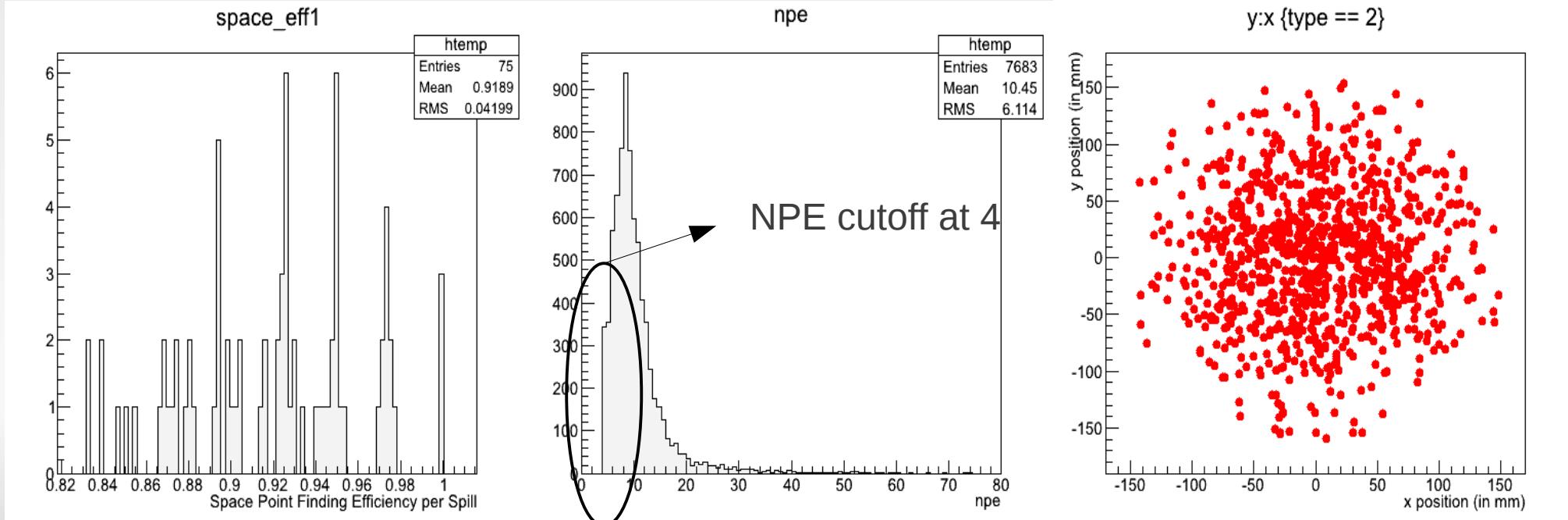
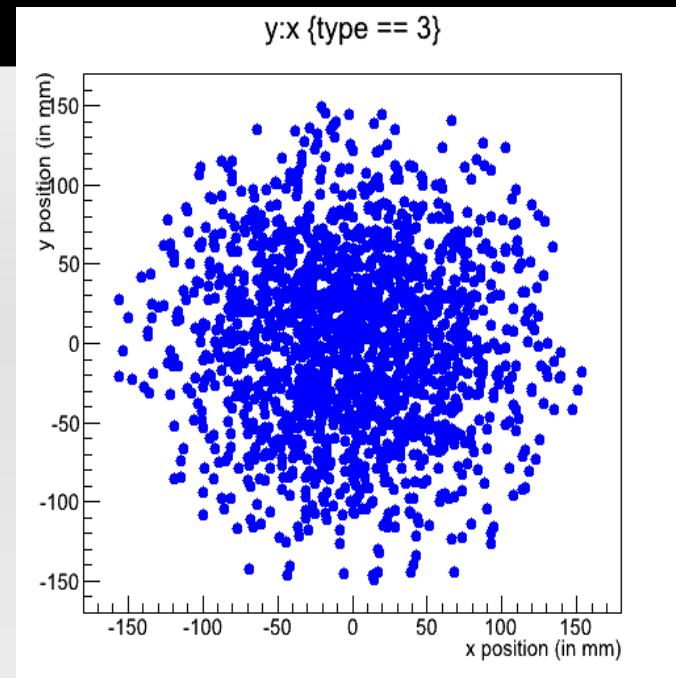
## Results:

- NPE average 15.1
- 4 NPE minimum cutoff
- Space point finding efficiency 97%



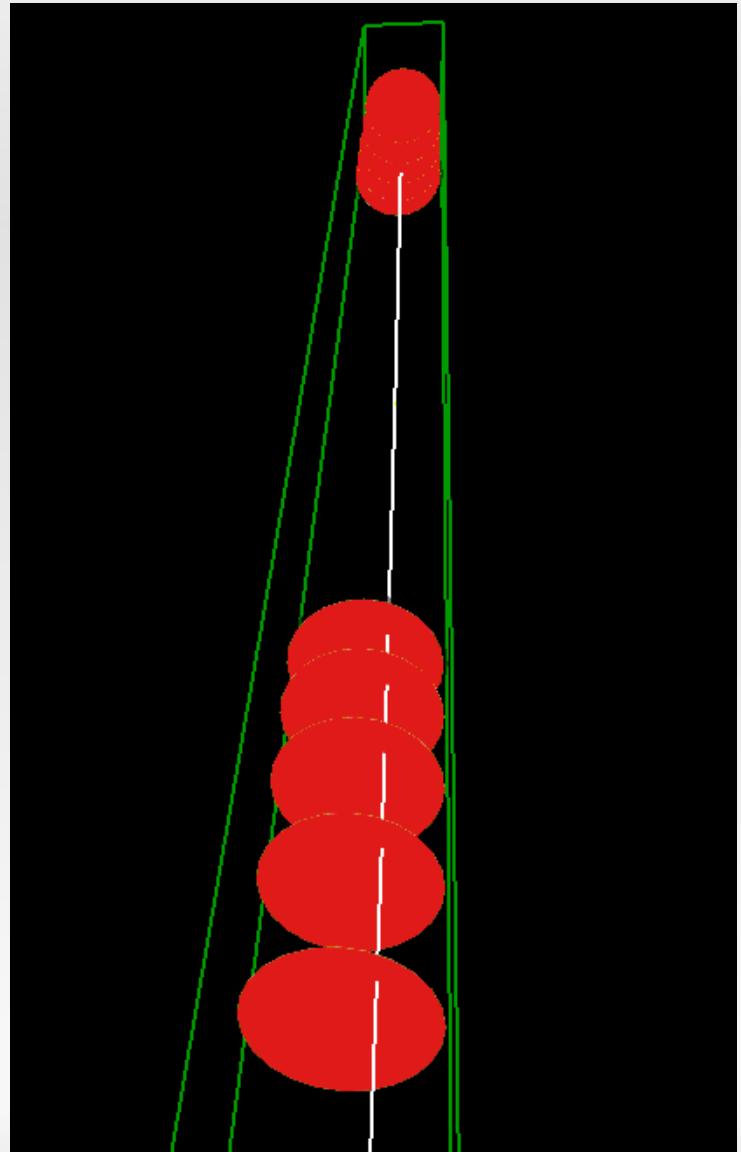
# Single Station Test Corrected NPE

- Results:
  - NPE average 10.4
  - 4 NPE minimum cutoff  
(This should be 2 NPE)
  - Space point finding efficiency drops to 92%



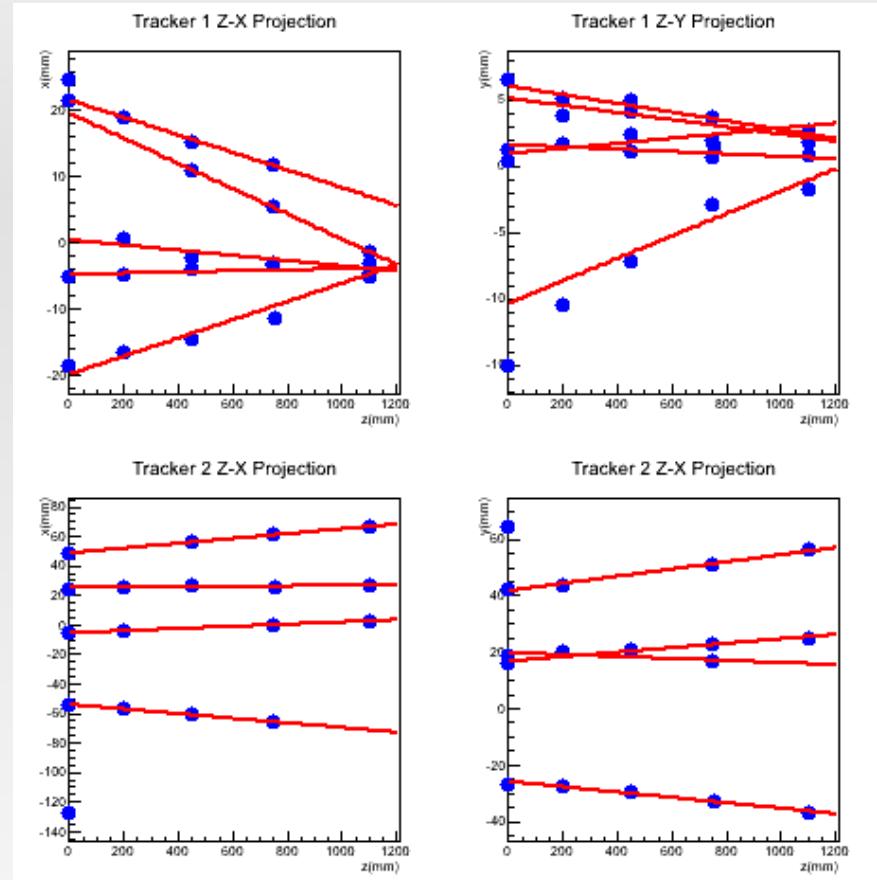
# Looking Ahead: Straight Track Testing

- Beam generated:
  - Just prior to tracker 1 station 5
  - Low emittance – 1mm
  - Nominal energy 226 MeV
- No trigger condition
- Adding geometry allows for modeling of cosmic runs.



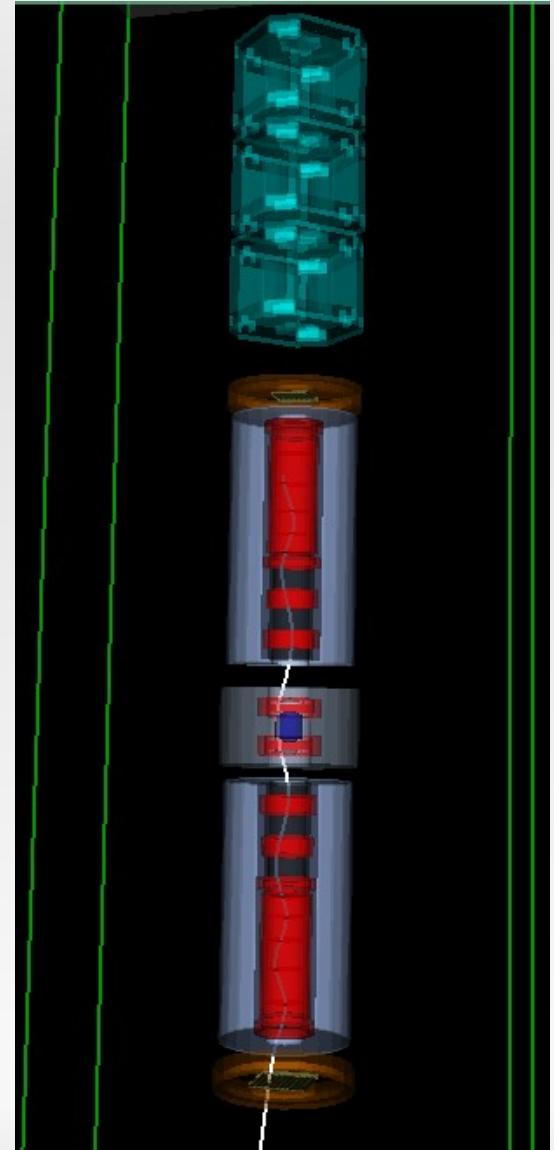
# Looking Ahead: Straight Track Testing

- Have MC reconstructed tracks, space points, and MC true space points. Still need MC true reconstructed tracks. The difference is:
  - MC reconstructed – takes the MC hits in the scintillating fibers and constructs space points and tracks
  - MC true reconstructed – takes virtual hits with true position and constructs space points and tracks
- We can compare these two to determine how well our software is working.



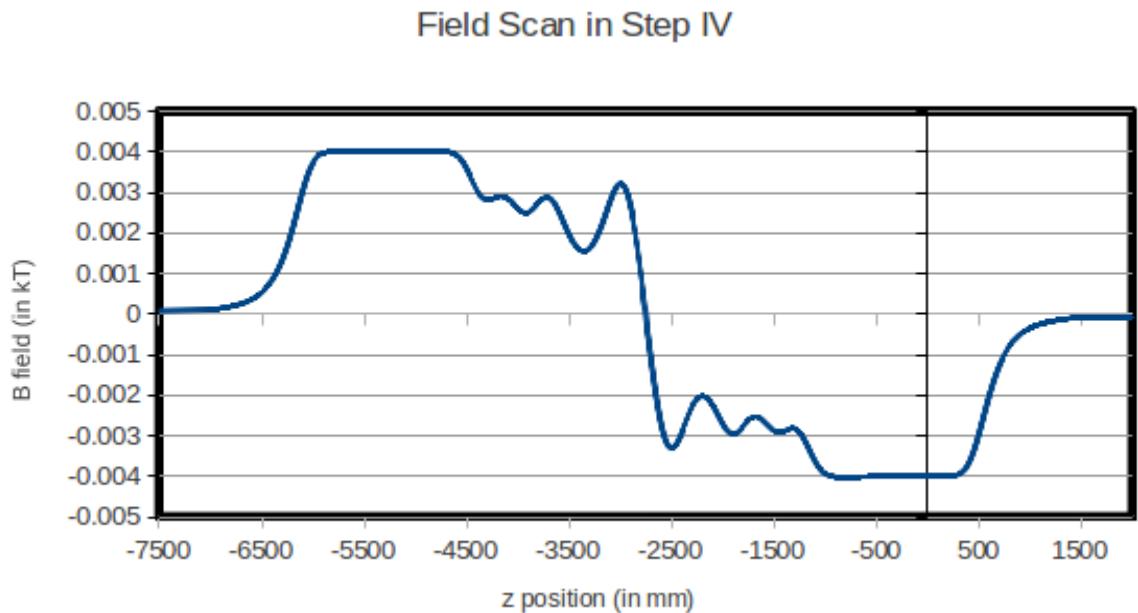
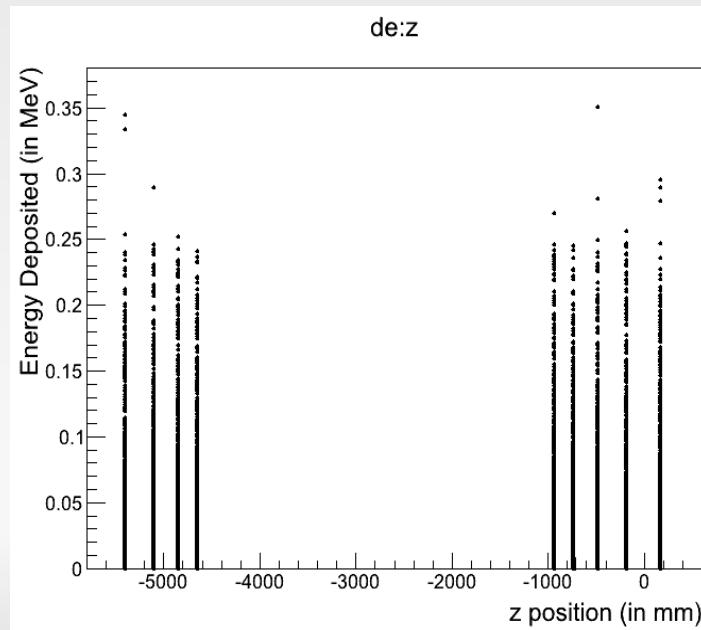
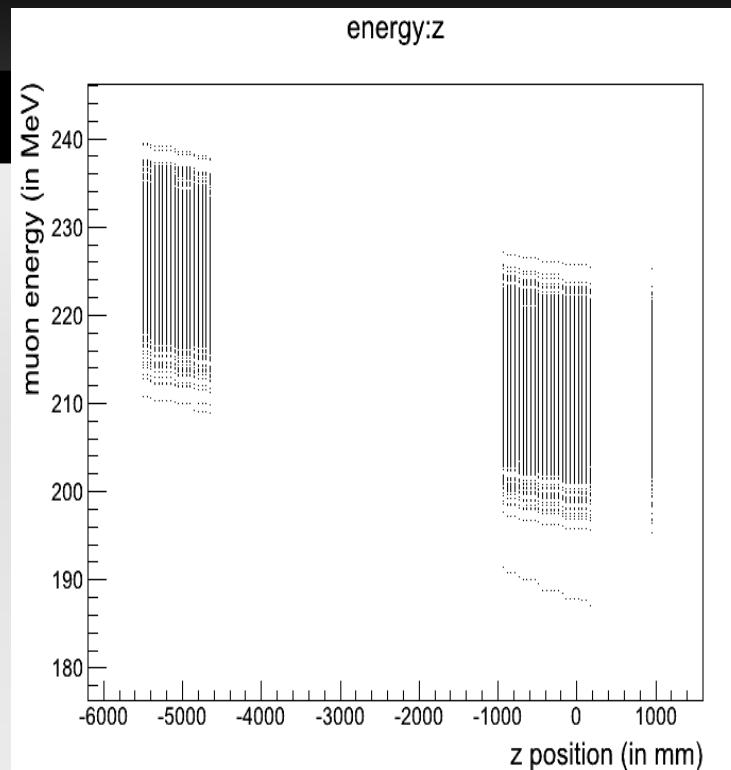
# Looking Ahead: Step IV

- Beam generated:
  - Within tracker  
(misses station 5 of tracker 1)
  - Nominal 226 MeV
  - 6 mm emittance
- Trigger Condition
  - Slab hit recorded in TOF 2



# Looking Ahead: Step IV

- Verified 4T solenoid magnetic field
- Particle energy
  - Function of z
  - Deposited in plane
- With modification tool for analyzing helical tracking



# Looking Ahead: Upcoming Projects

- New student from University of Chicago Savannah Thais working on MC, so there is a need to divide up the work
- Develop method of comparing reconstructed MC to MC truth
  - Track fitting (helical and linear)
  - Space points
- Compare MC reconstruction to data reconstruction for Single Station and Cosmic
- Integrate new geometries into simulation
  - Just discovered repository of geometries (Thanks to Matt, Pavel, and Peter)
- Better model for tracker planes

# Conclusion

- Preliminary tests completed tracker MC is working
- We can start looking into verification tracker software
- Still work to do before accurate view of Step IV can be made

Comments / Questions?