# MUSE and the Proton Radius Puzzle

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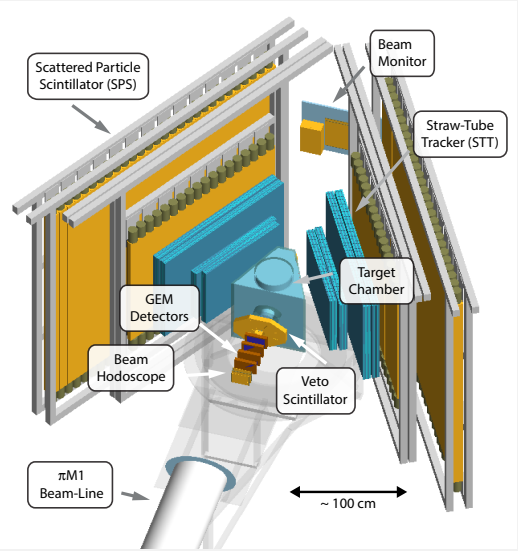
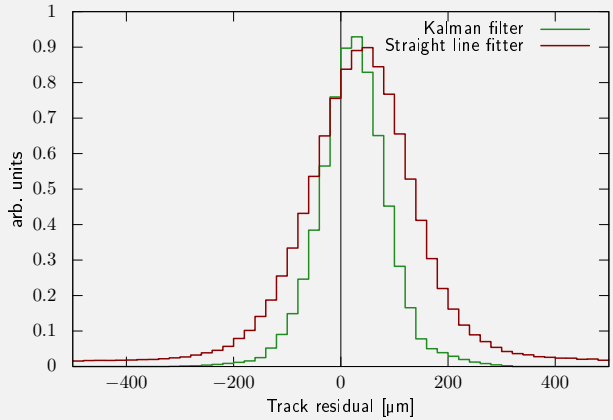
MUSE

# MUSE Setup




- Fixed $LH_2$ target experiment
- Secondary beam line
- Measure incoming beam event by event
- Beam contains $e$'s, $\mu$'s, and $\pi$'s
- Can select positive or negative charge polarities
- Active Veto to reject decay events
- Use RF signal for PID via TOF
- Veto $\pi$'s in the trigger

# Incoming Tracks in MUSE




- Kalman Filter for incoming Track
  - Implemented our own and using one from GenFit
  - Has noise filtering (Can be improved by including BH seed into Kalman Filter)
  - Resolution of 100$\mu$m
  - Straight line fitter developed by undergraduate student John Santucci.

# Scattered Tracks in MUSE

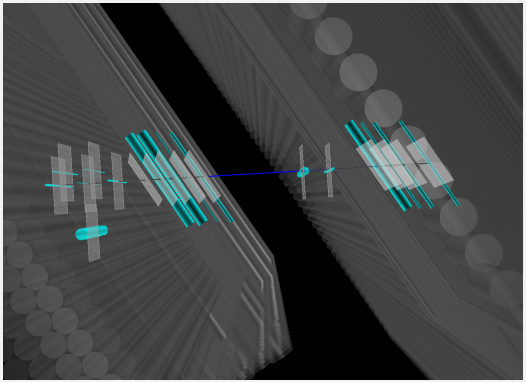
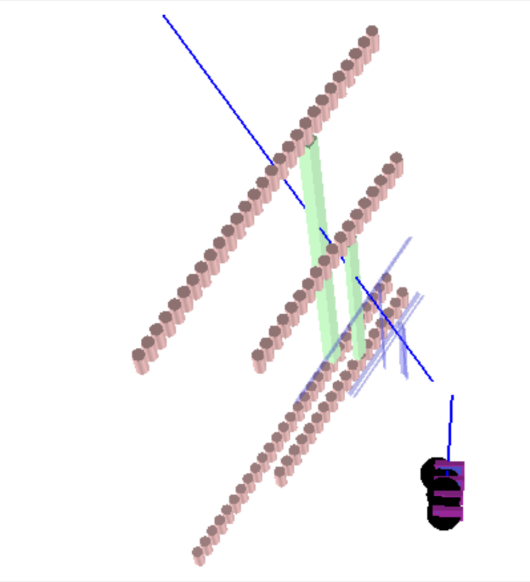
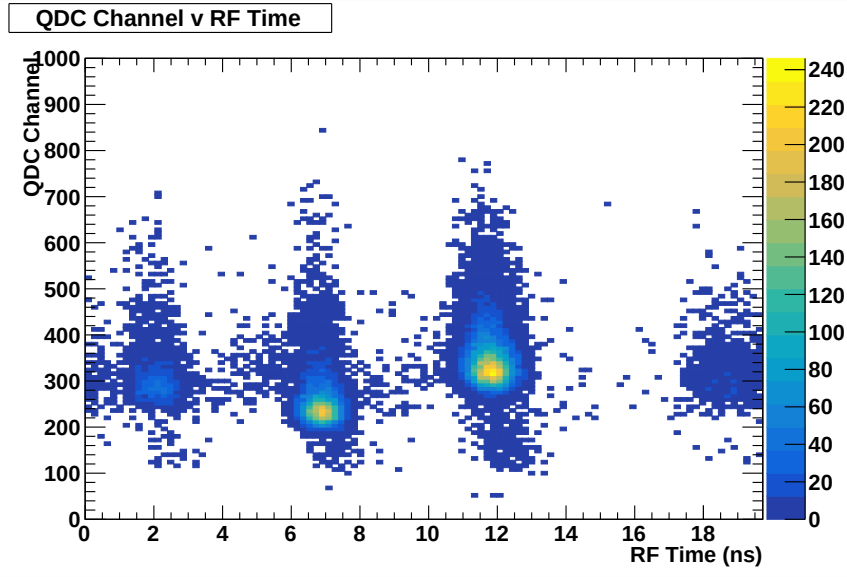


Figure: Left: Screenshot of a track in the STT, fitted with GenFit's deterministic annealing filter. Some hits (e.g., lower left) were rejected by the fitter.

# Tracking in MUSE



# Separating Particle Species - Looking for $\pi$'s

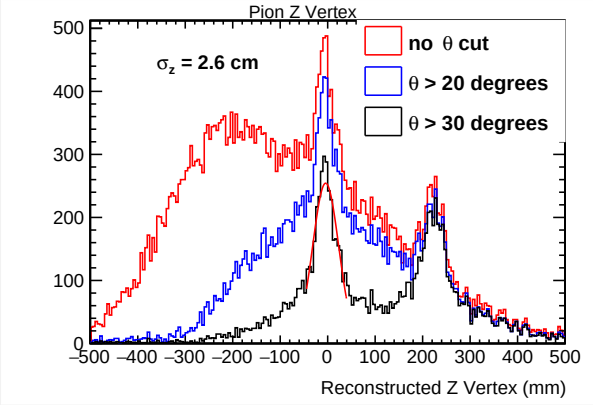


# Vertex Reconstruction

- Start with $\pi$ scattering from carbon target
- $+161$ MeV/$c$
- Pion decay cone $\sim 14^\circ$, experiment designed to cover 20-100$^\circ$
- No survey information included
- Reconstructing left side of STT

# Preliminary Carbon Scattering

- We know pion decays dominate $\theta < 20^\circ$
- Cut on MUSE acceptance $20^\circ < \theta < 100^\circ$
- Clearly see carbon target and exit posts
- Width of reconstructed carbon is $\sim 2.6$ cm
- Survey not yet implemented



# Thank you!

Questions?