

FD Reconstruction Efficiencies Studies II

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Technical Details

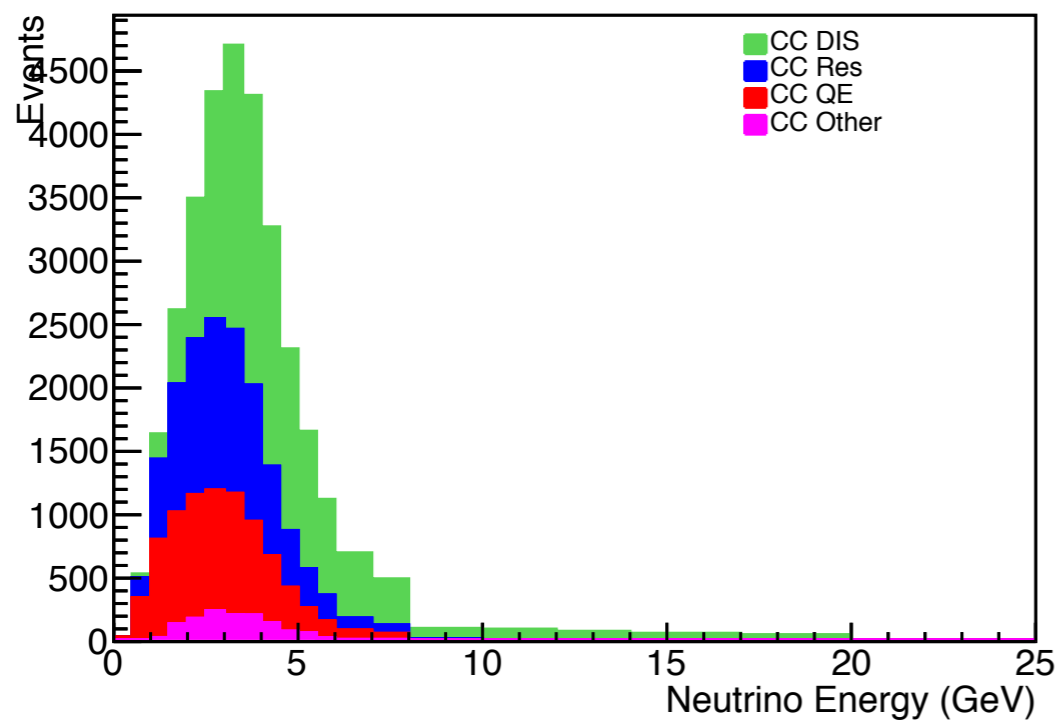
Sample used MC 4.0

- ❖ Location /pnfs/lbne/persistent/dunepro/v04_20_00/
- ❖ LArSoft v 04_20_00 e7:prof
- ❖ FD geo workspace 4APA
- ❖ Muon neutrinos unoscillated sample

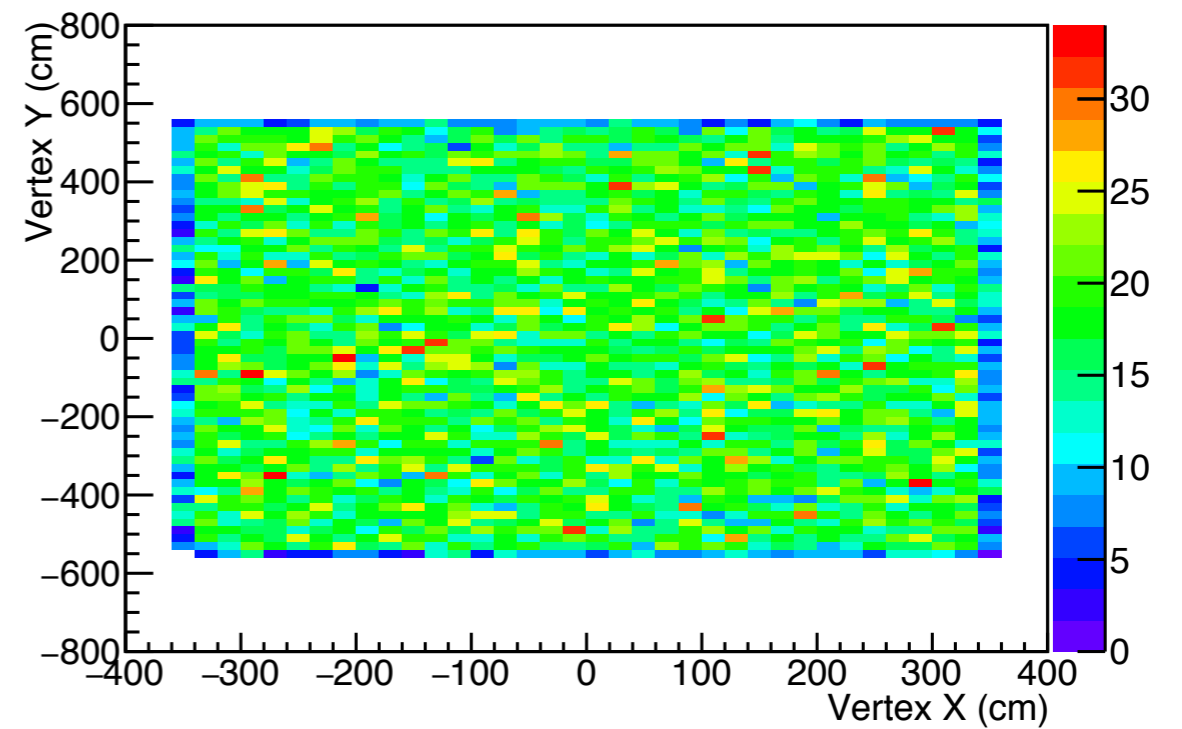
Selection

- ❖ Muon neutrino events
- ❖ Charged current events (~69k events)
- ❖ Tracking efficiency for primary lepton (muon)
- ❖ Tracking efficiency for leading pion π^\pm
- ❖ Tracking efficiency for leading pion p
- ❖ Two tracks algorithms “pmtrack”
- ❖ Plot as function of true momentum(energy/angle)

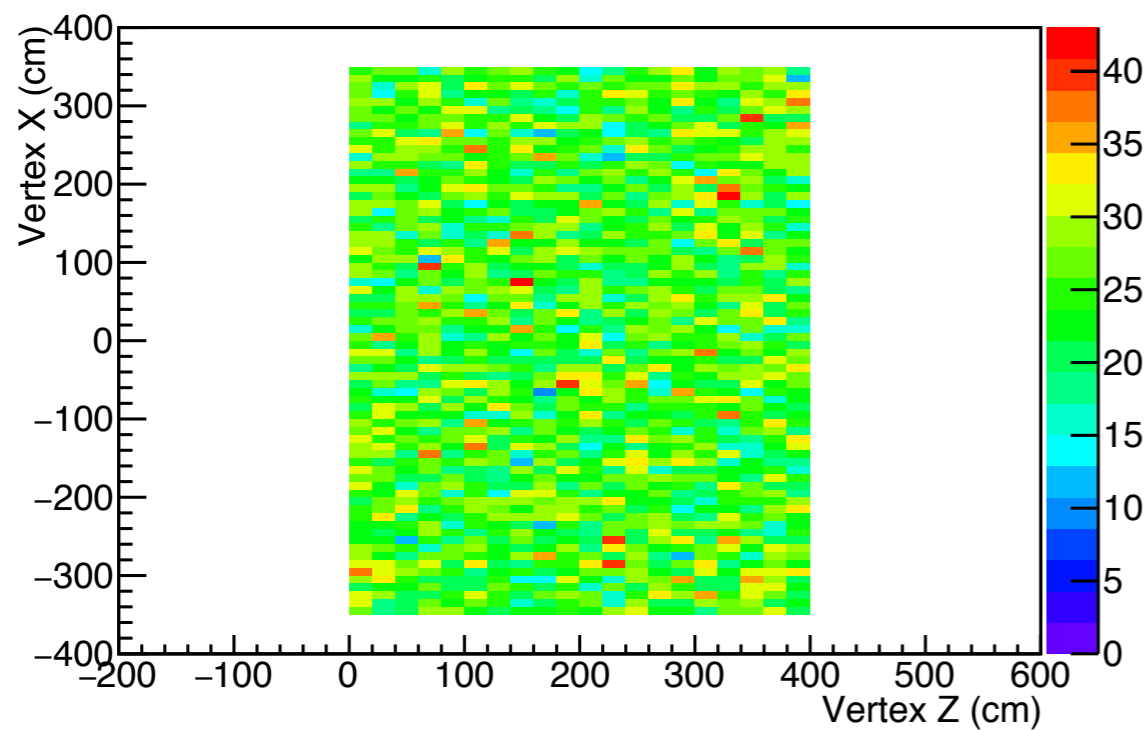
CC V_μ Events



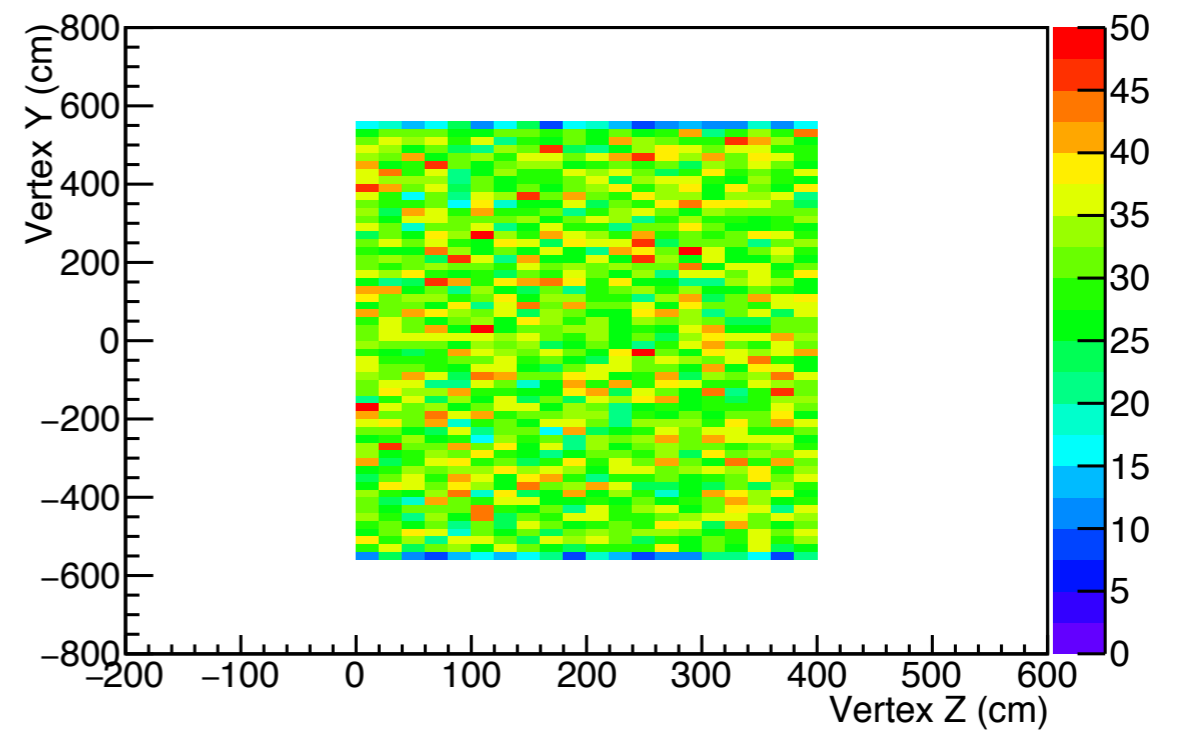
Vertex X vs Y



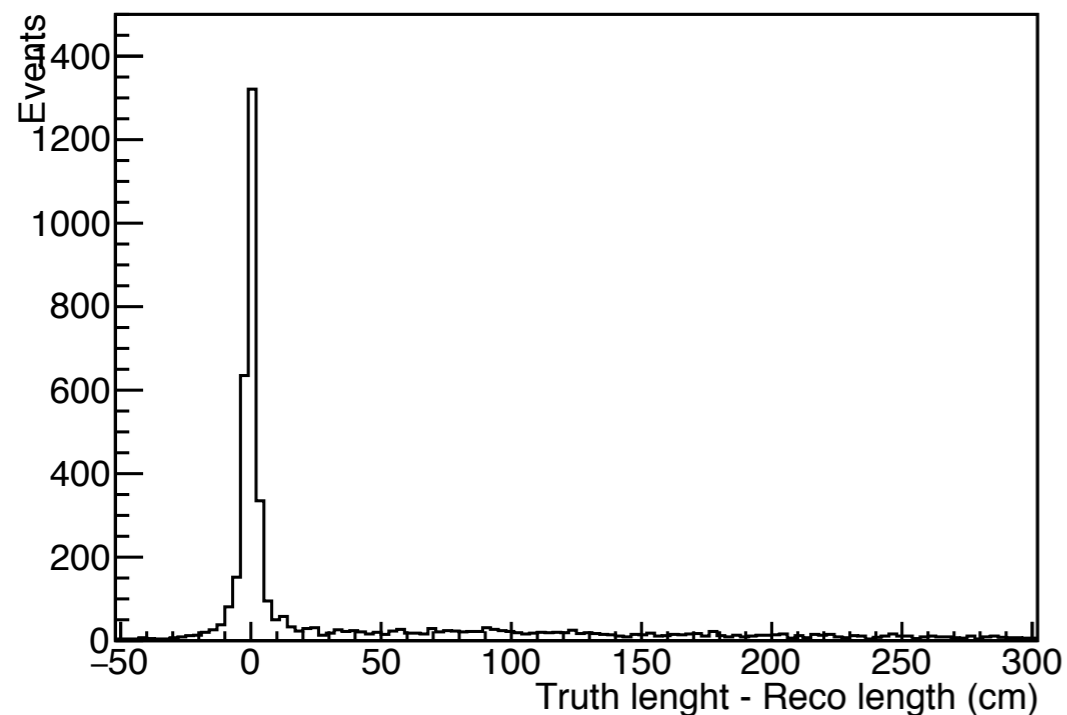
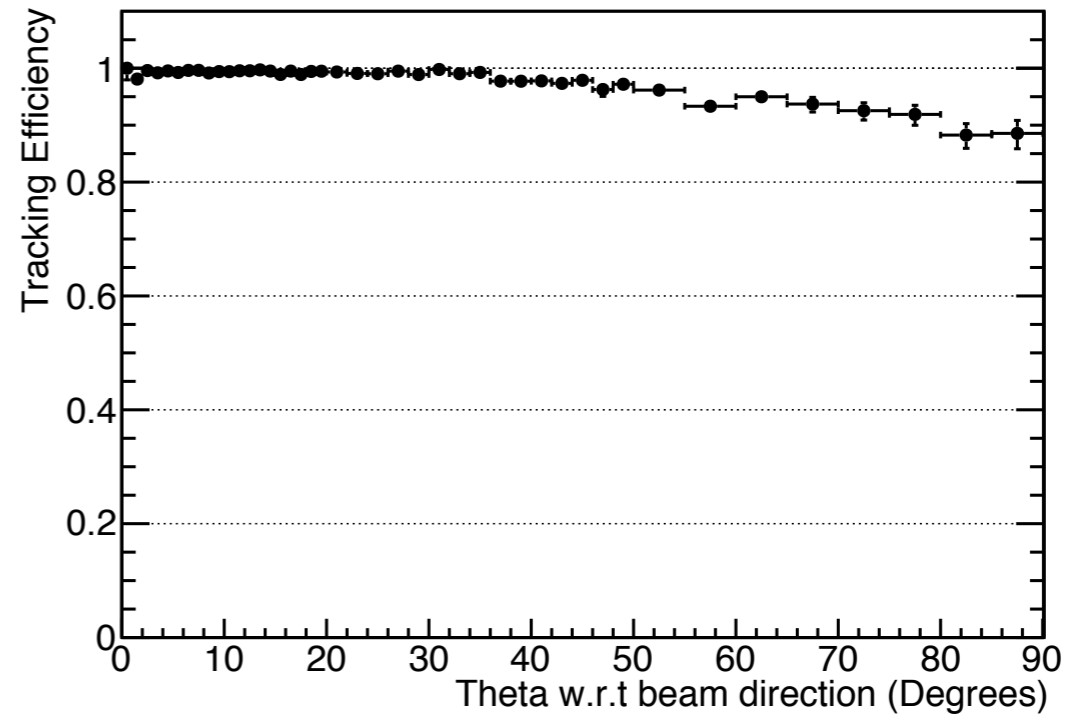
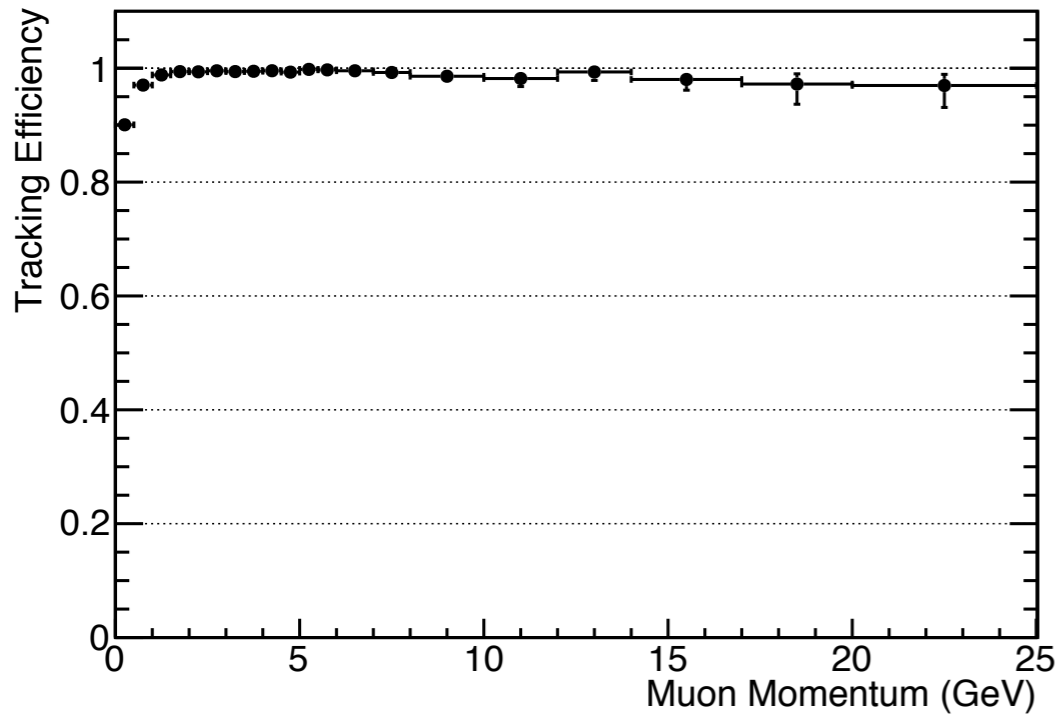
Vertex X vs Z



Vertex Y vs Z

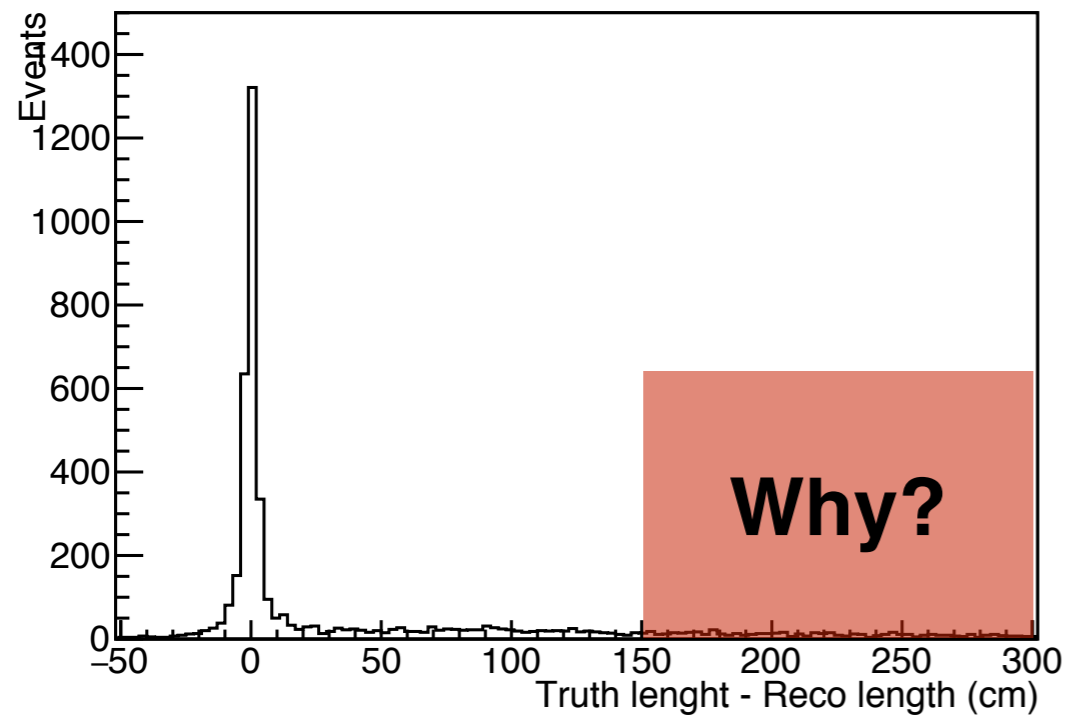


Muon Tracking Efficiency (CC $\nu\mu$ Events)



For muon events that stop inside FV
calculate residual between TG4
trajectory and track length

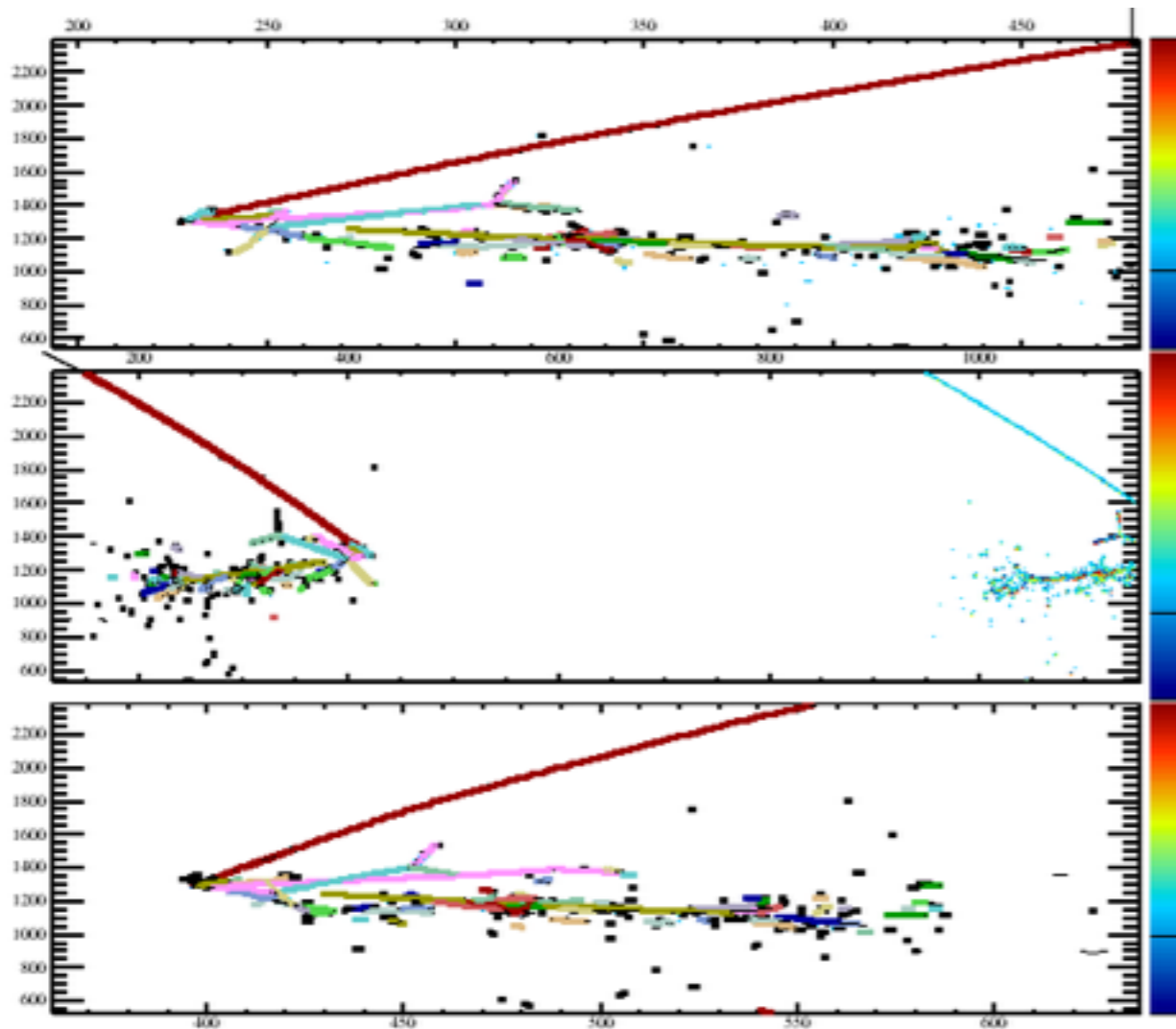
Muon Tracking Efficiency (CC $\nu\mu$ Events)



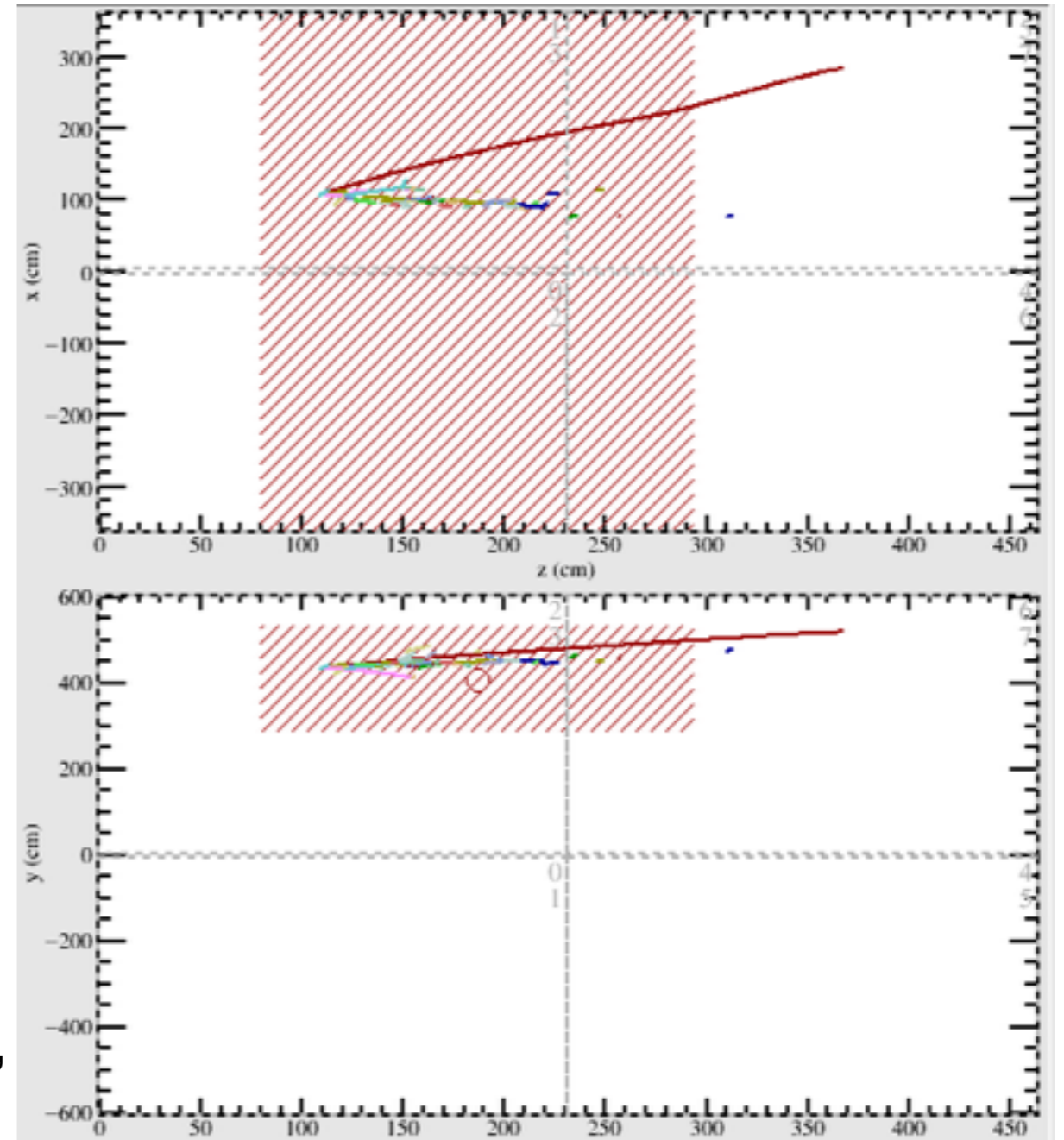
Why muon tracks are missing that much?
Let's see some event displays

Muon Tracking Efficiency (CC $V\mu$ Events)

run 20000001/466/46598 (0.8 GeV μ)
 $\mu+\pi+\pi^0$

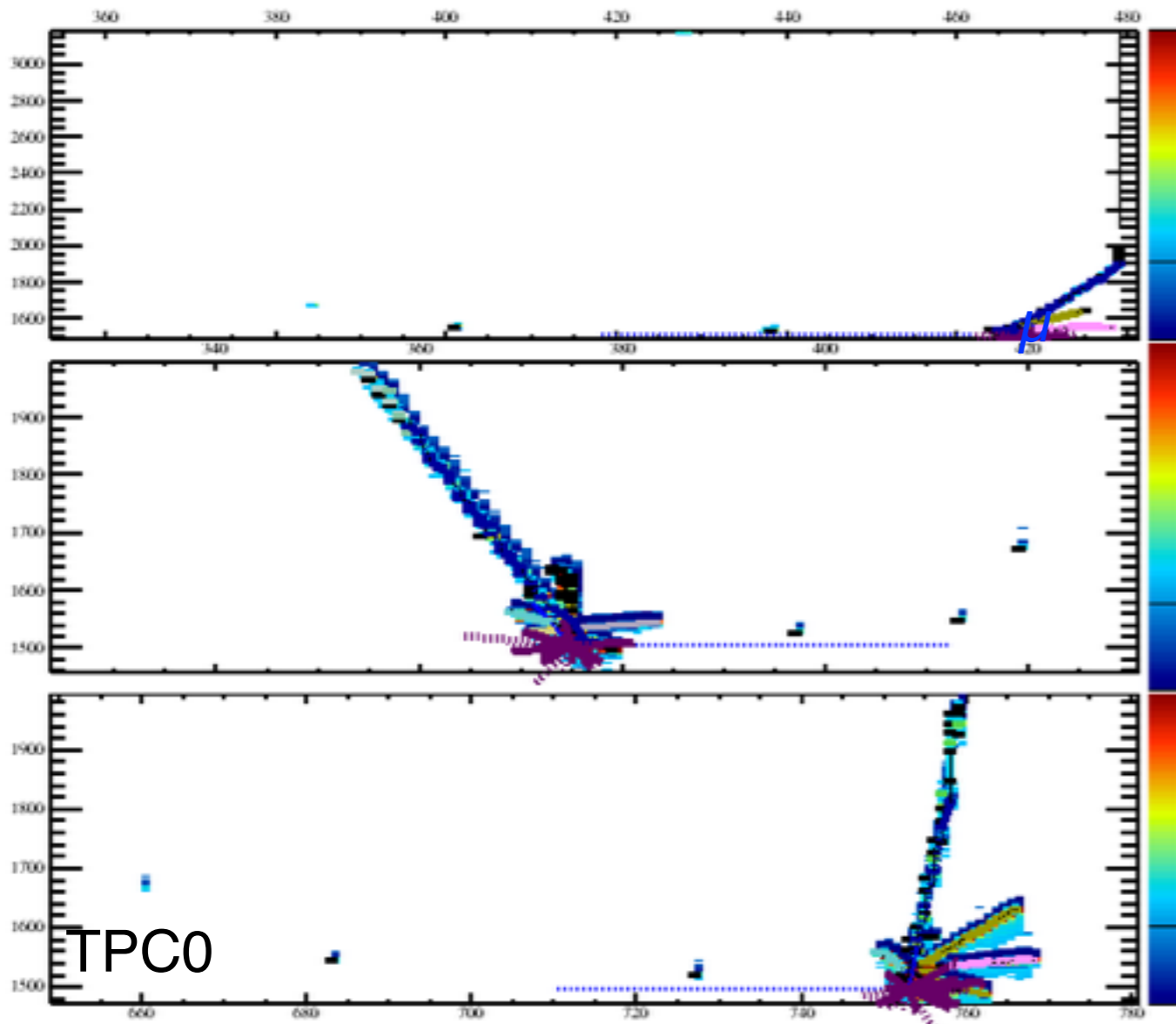


Because of π^0 there is a mess at the vertex, therefore muon track misses first hits

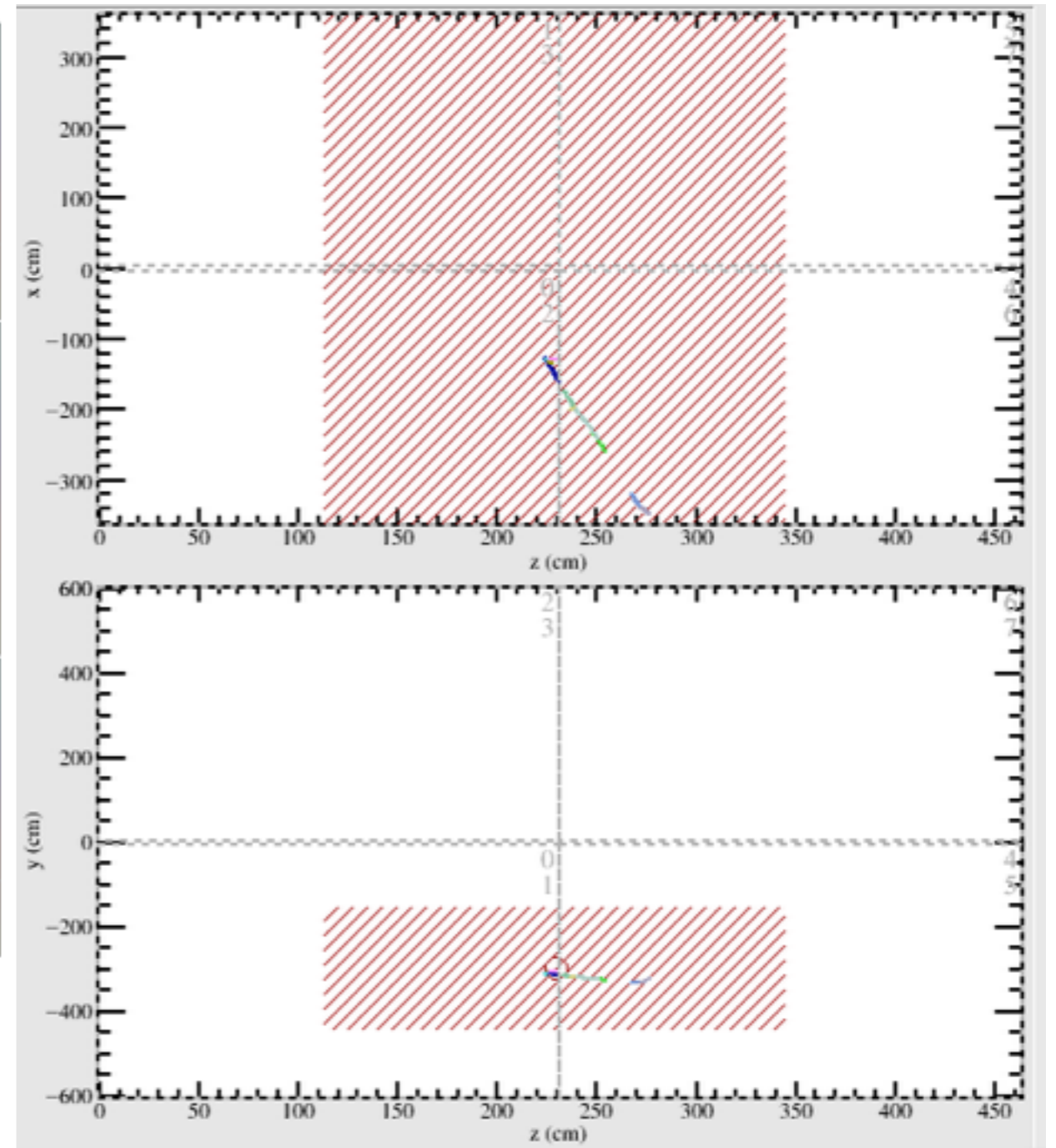


Muon Tracking Efficiency (CC $\nu\mu$ Events)

run 20000001/734/73334 (0.6 GeV μ)

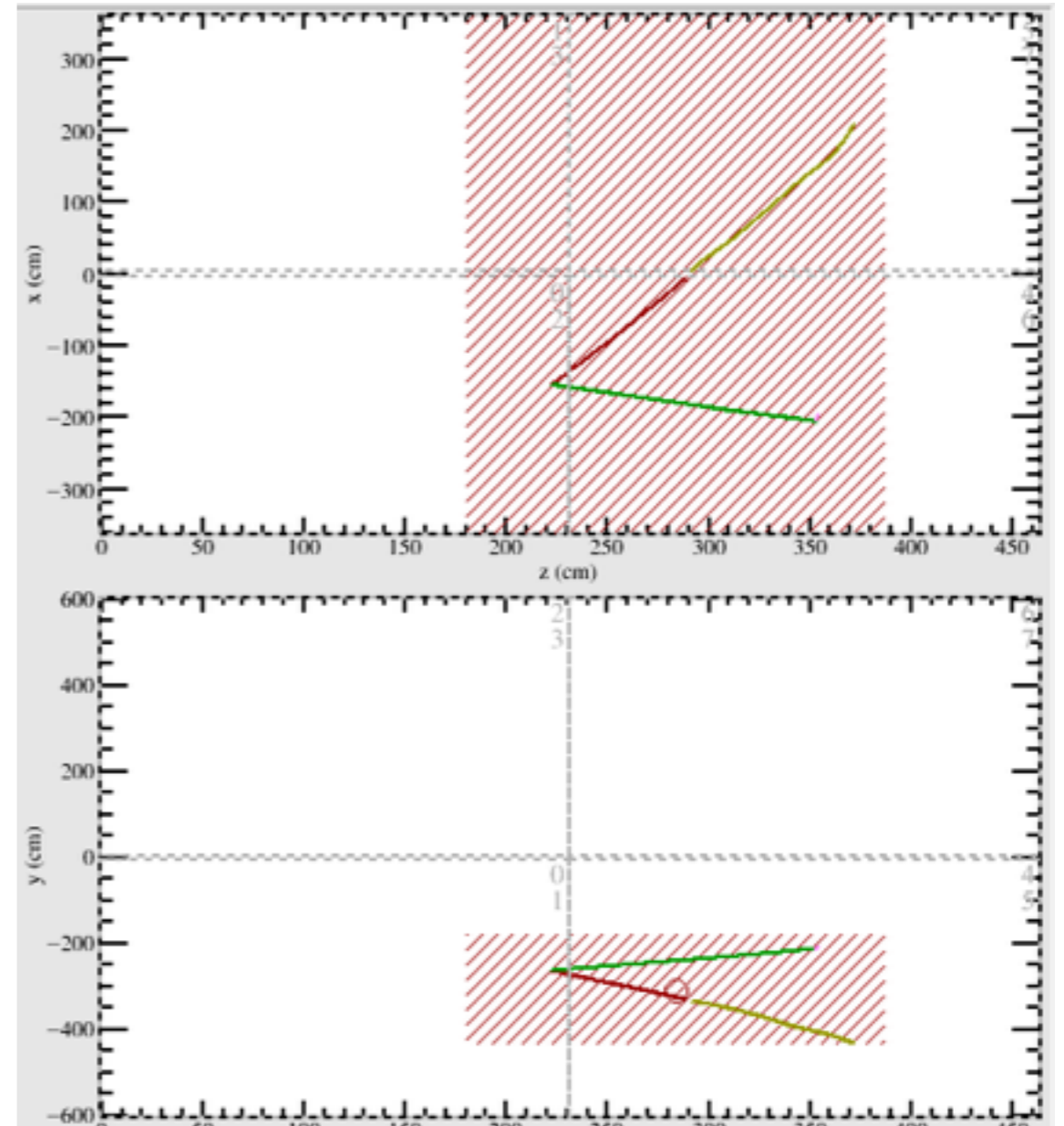
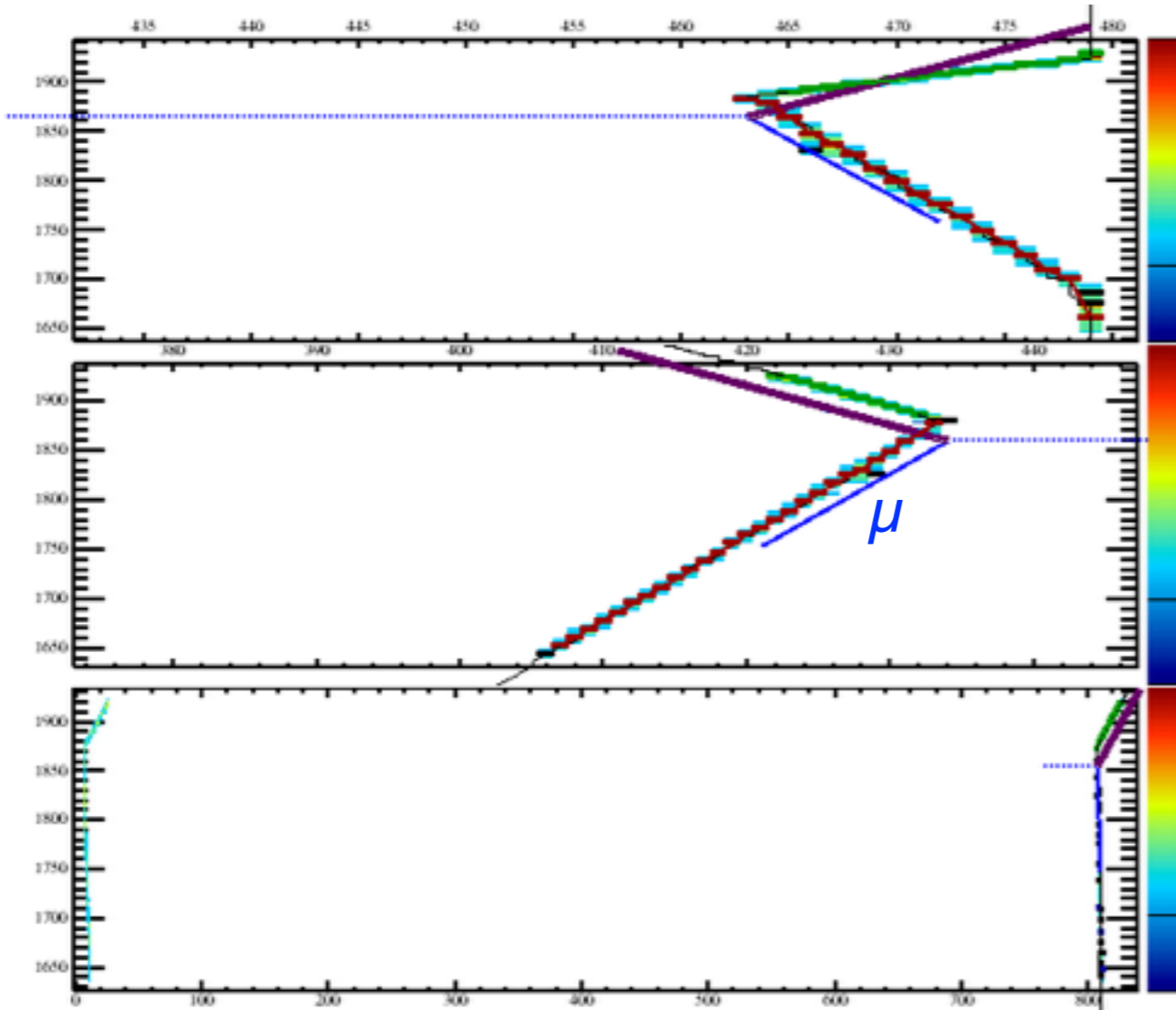


Muon traversing multi TPCs



Muon Tracking Efficiency (CC $\nu\mu$ Events)

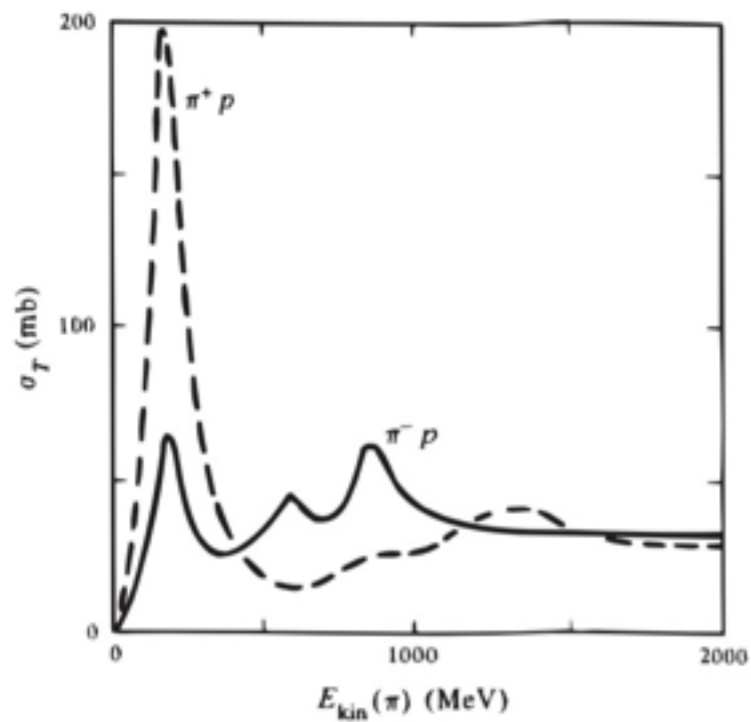
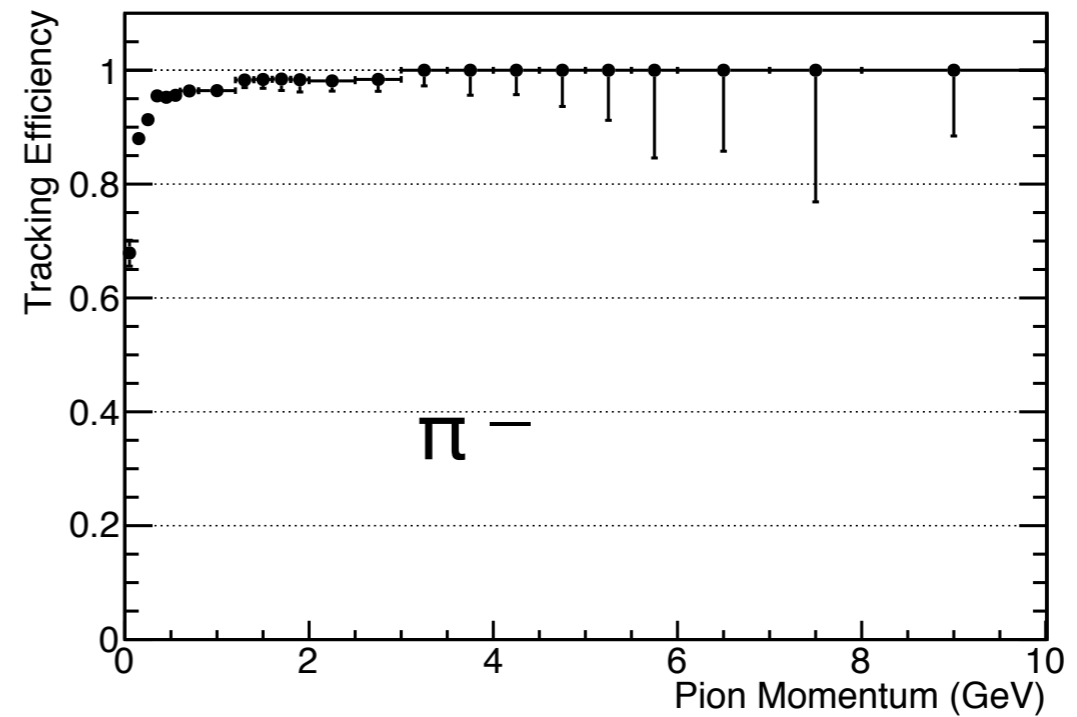
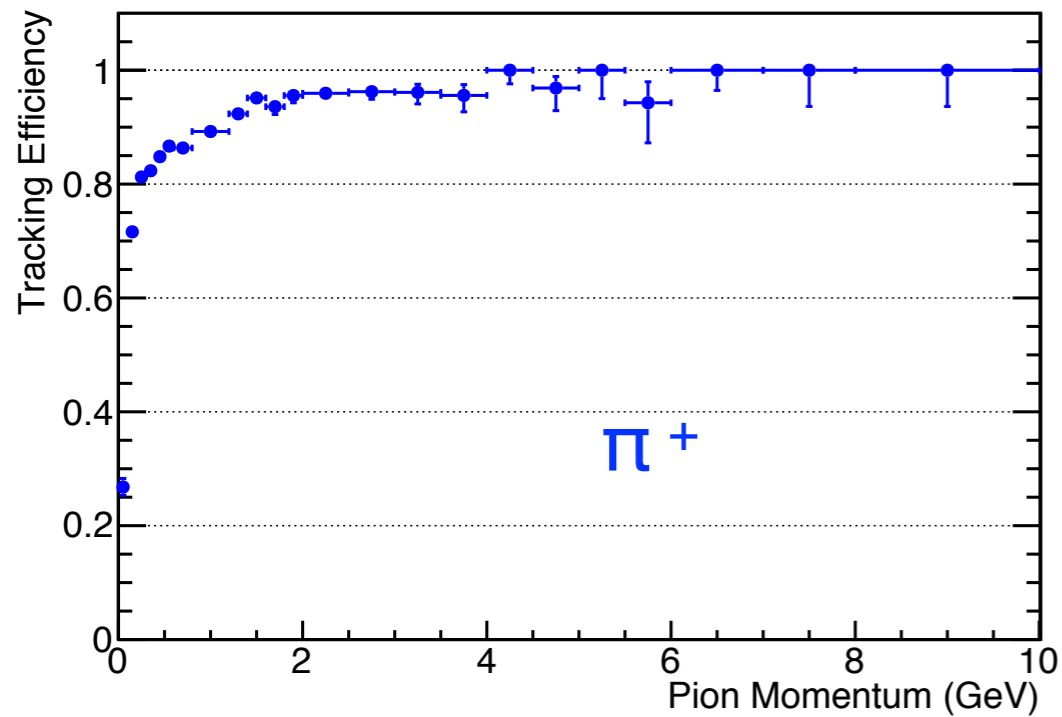
run 20000001/734/73336 (1.1 GeV μ)



TPC0

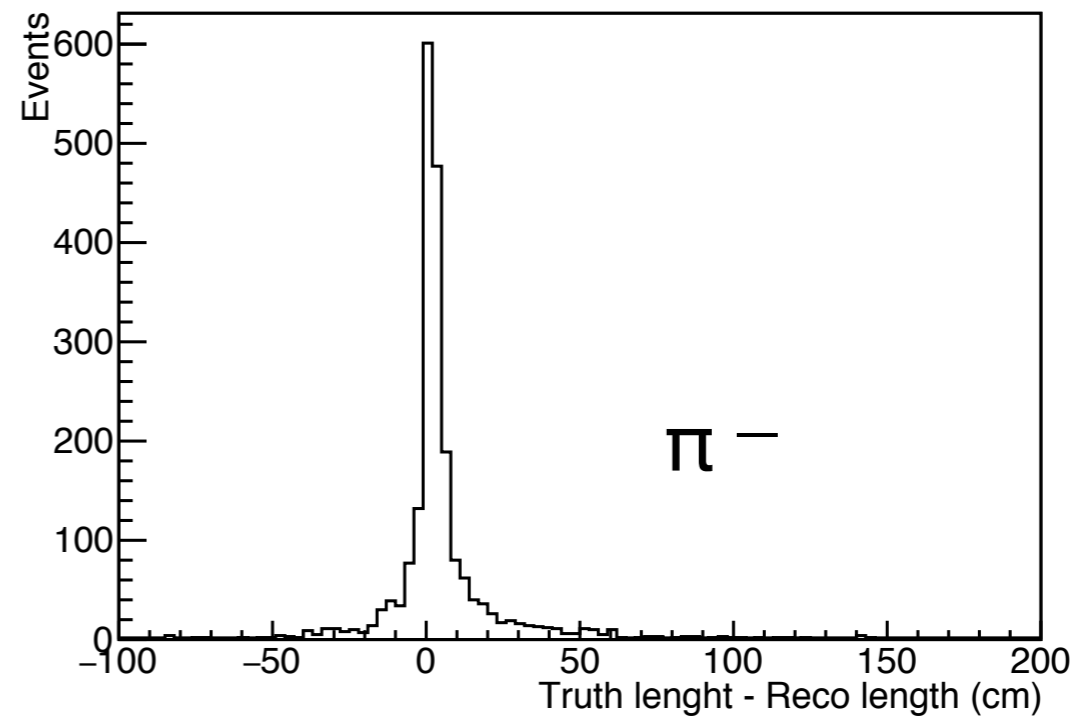
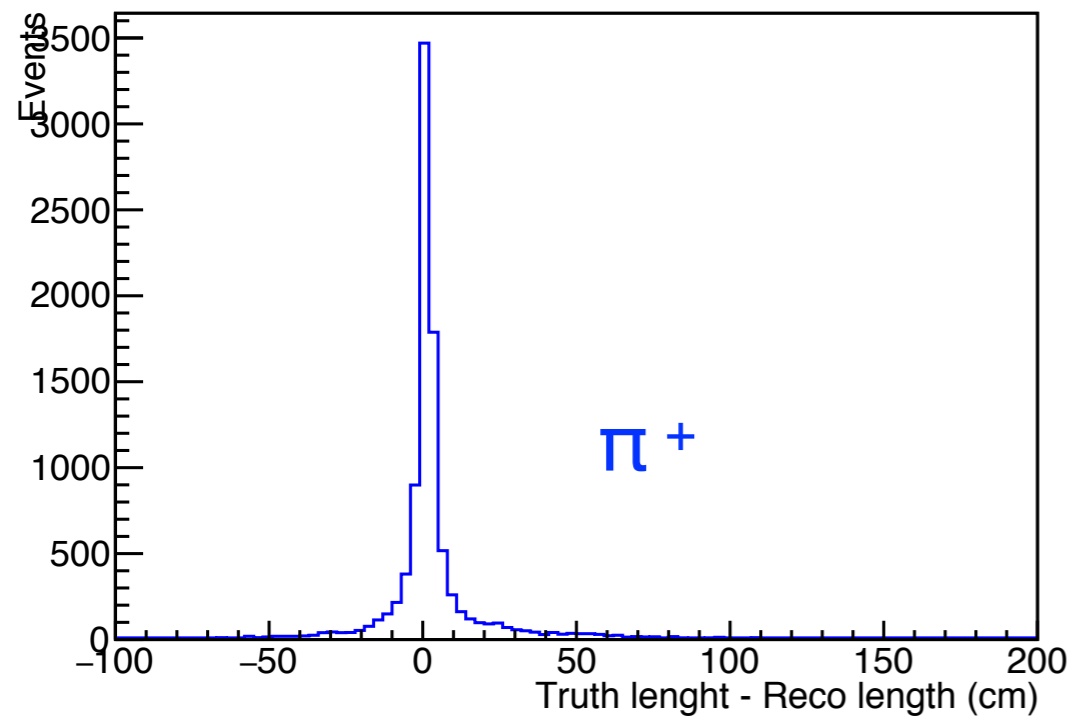
Muon traversing multi TPCs, muon track becomes two tracks

Pion (π^\pm) Tracking Efficiency (CC $\nu\mu$ Events)



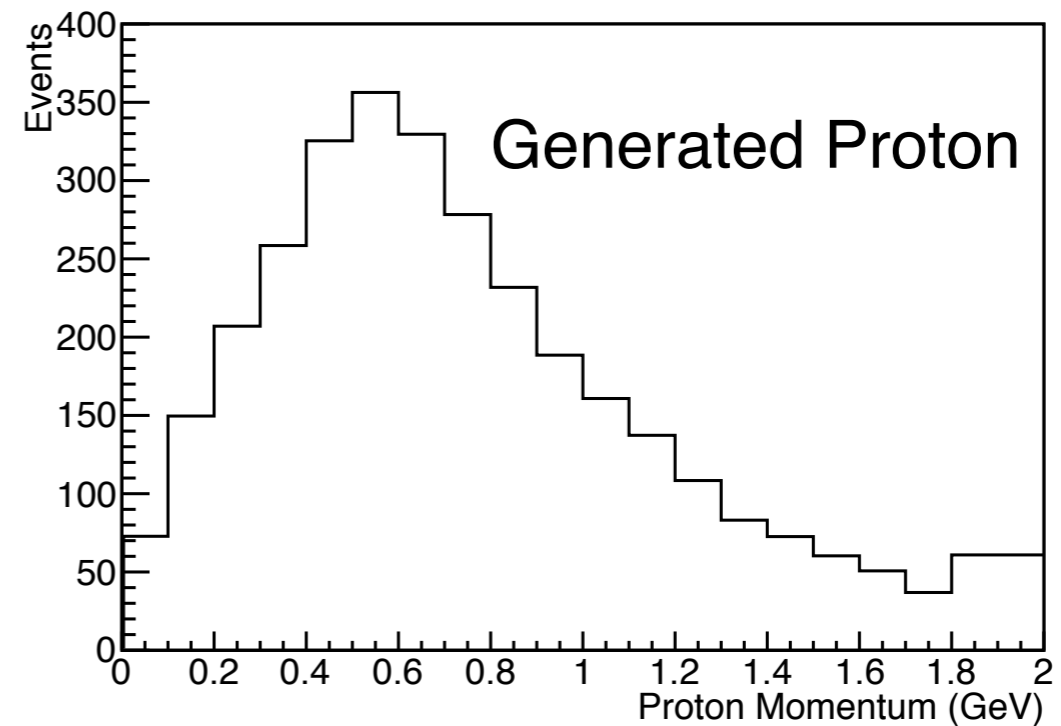
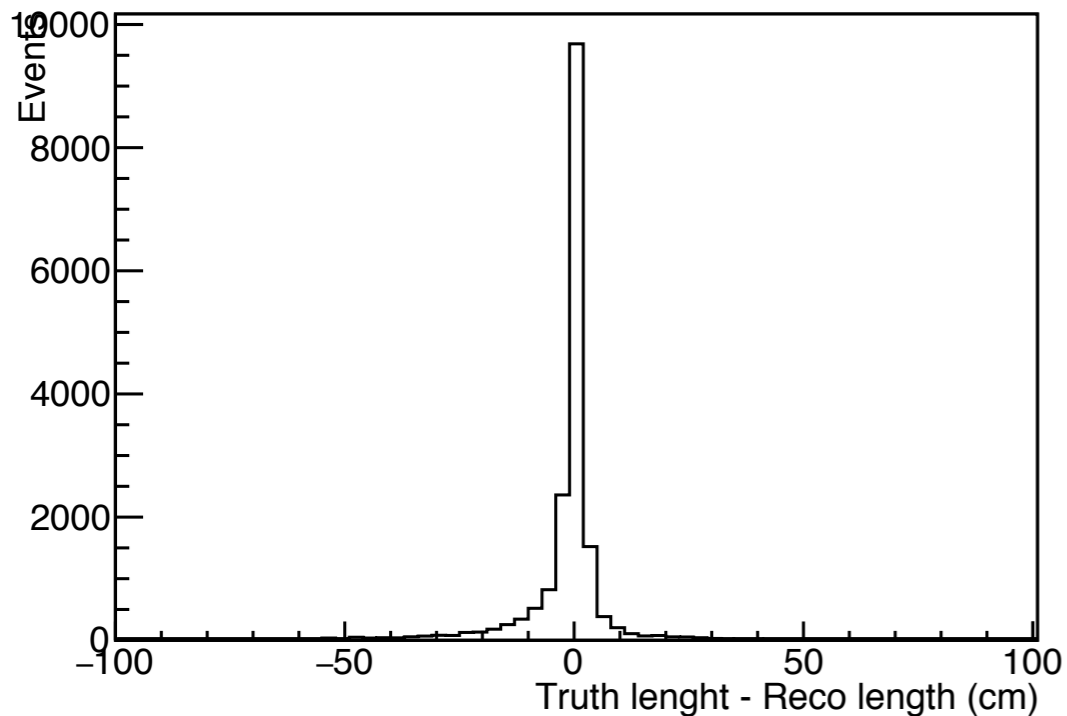
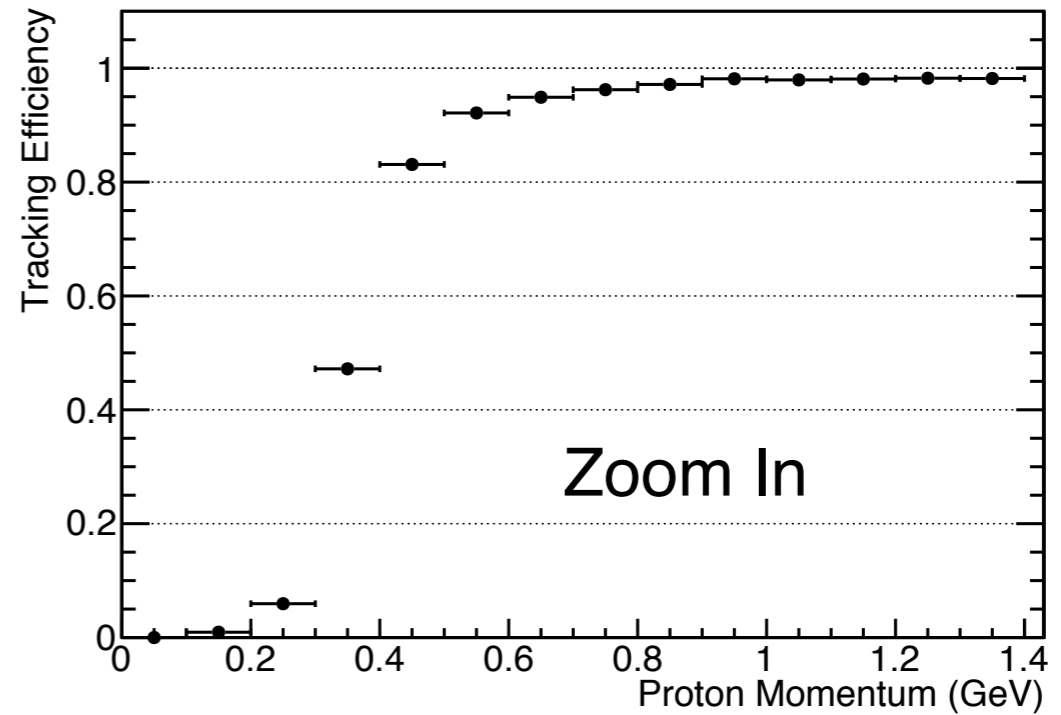
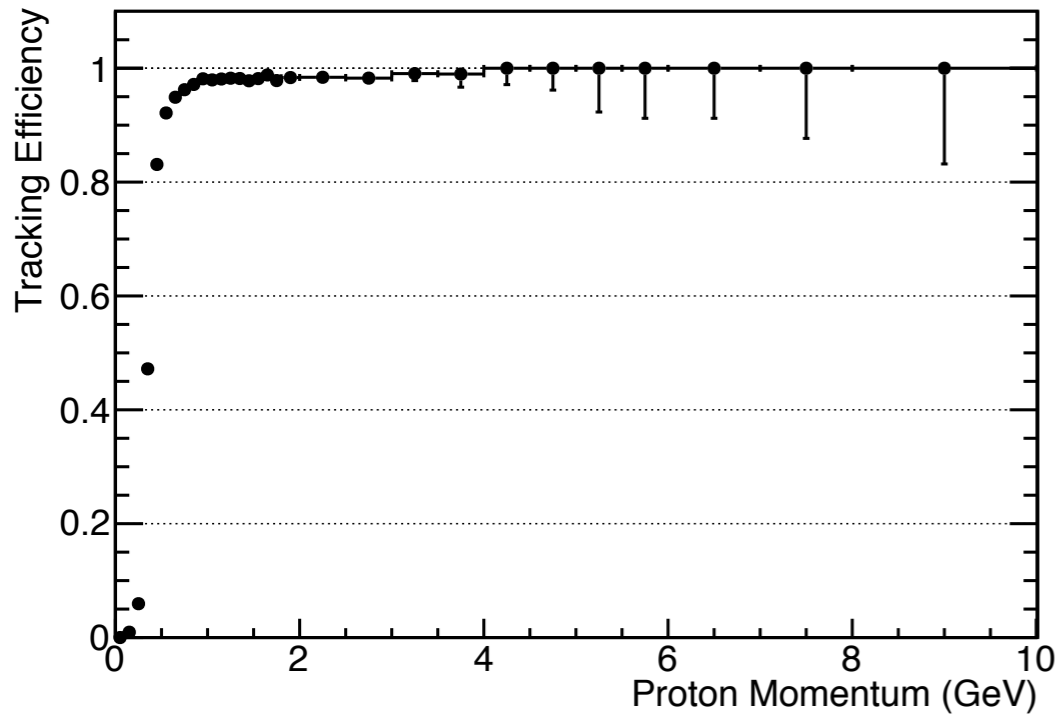
For multi-pion events plot as a function of the leading pion

Pion (π^\pm) Tracking Efficiency (CC $\nu\mu$ Events)



For pion events that stop inside FV
calculate residual between TG4
trajectory and track length

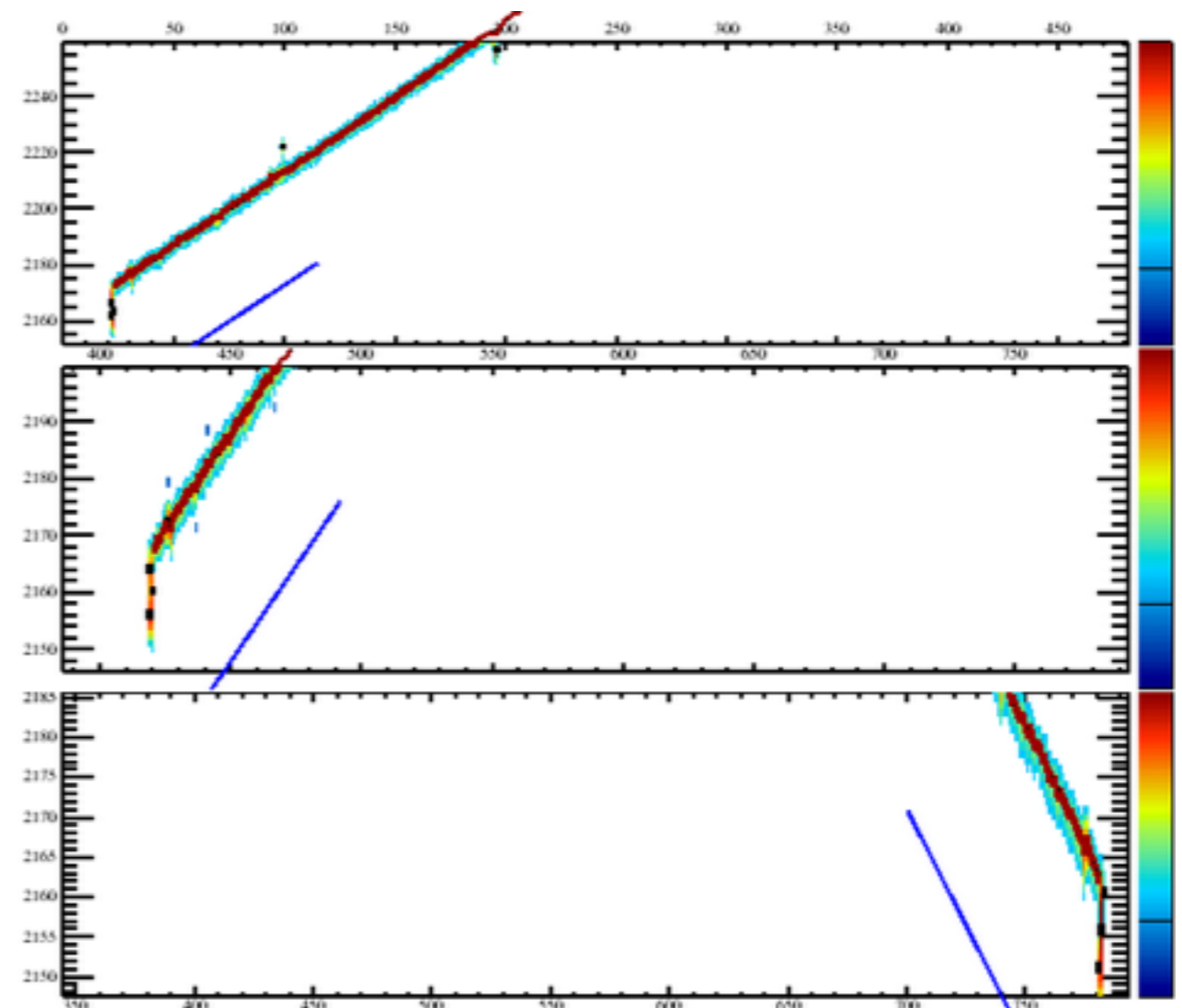
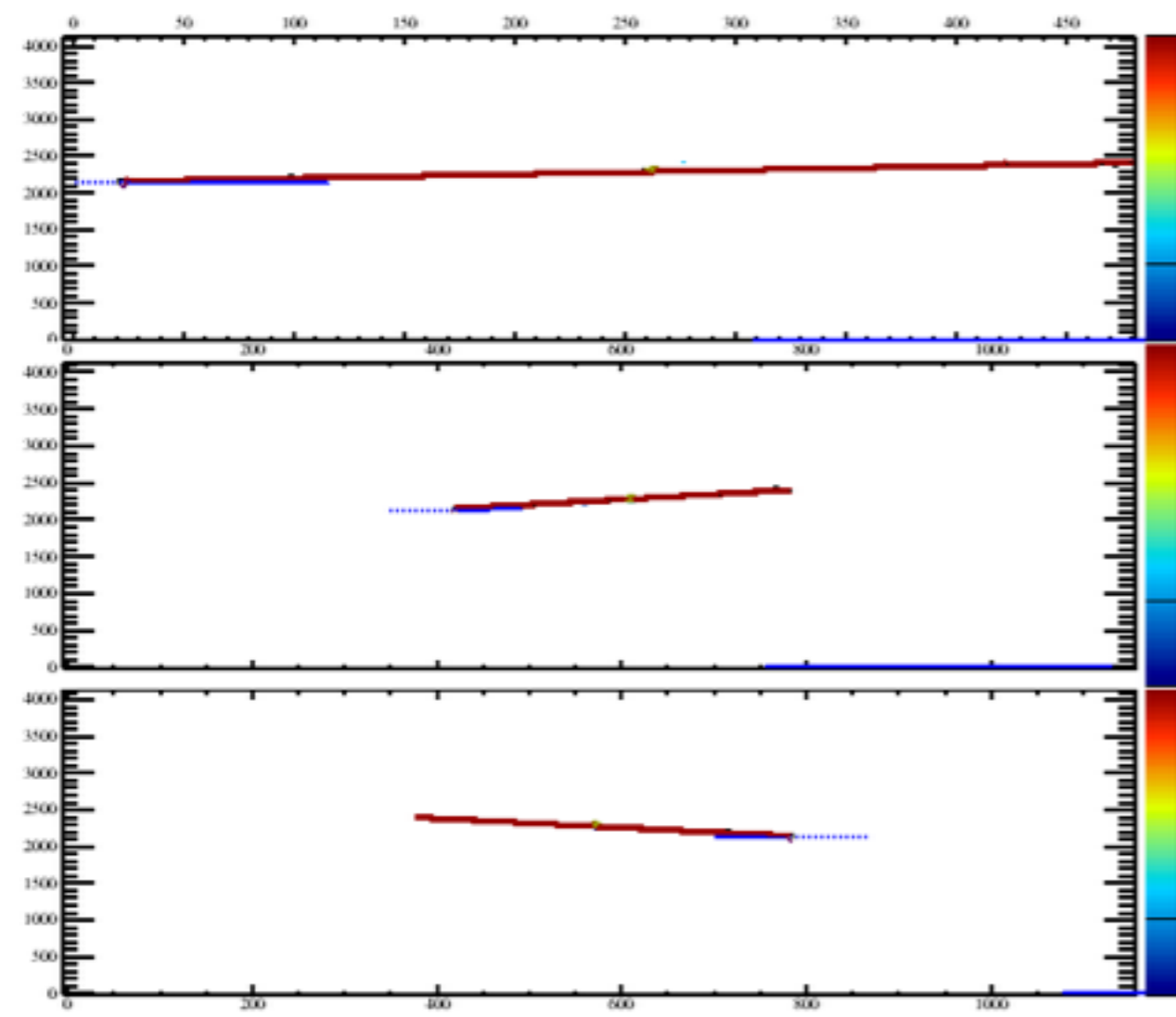
Proton Tracking Efficiency (CC $\nu\mu$ Events)



Proton Tracking Efficiency (CC ν_μ Events)

run 20000001/466/46515 (0.3 GeV p)

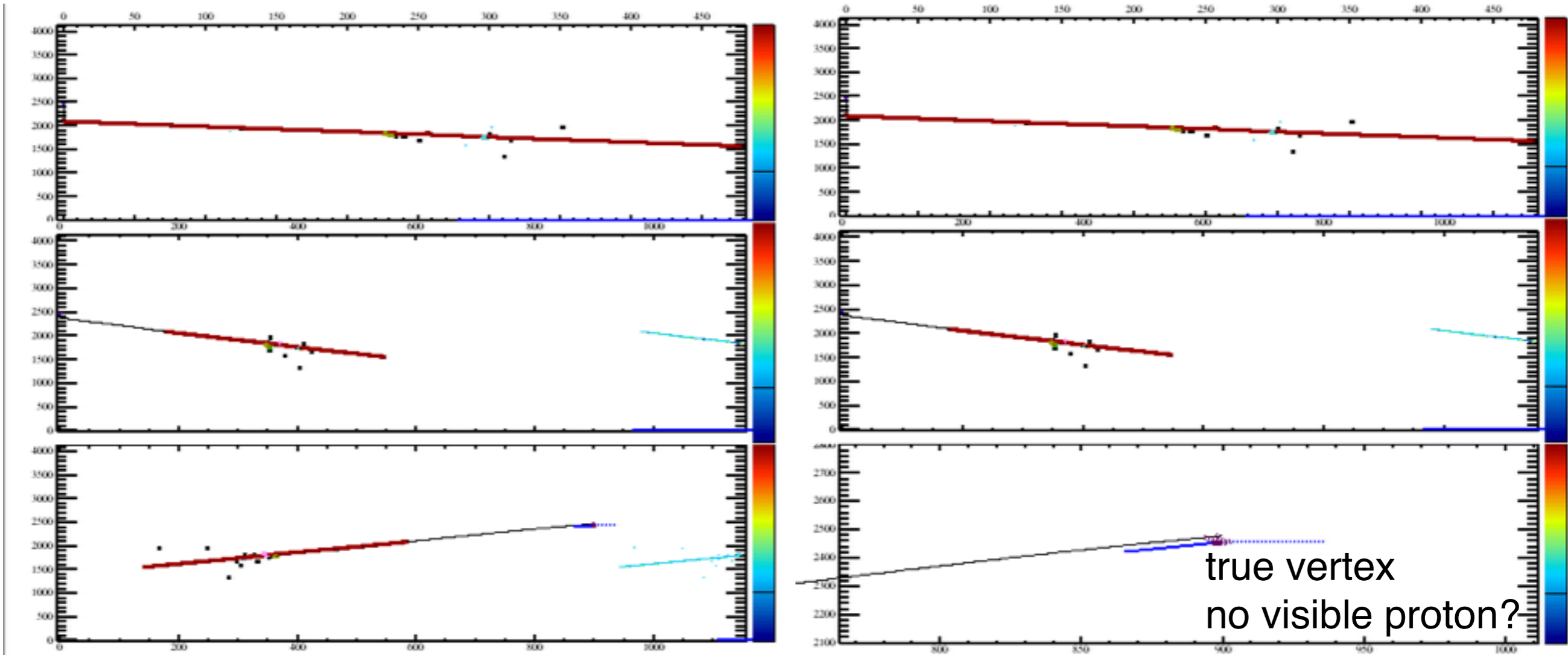
Zoom In



Proton Tracking Efficiency (CC $\nu\mu$ Events)

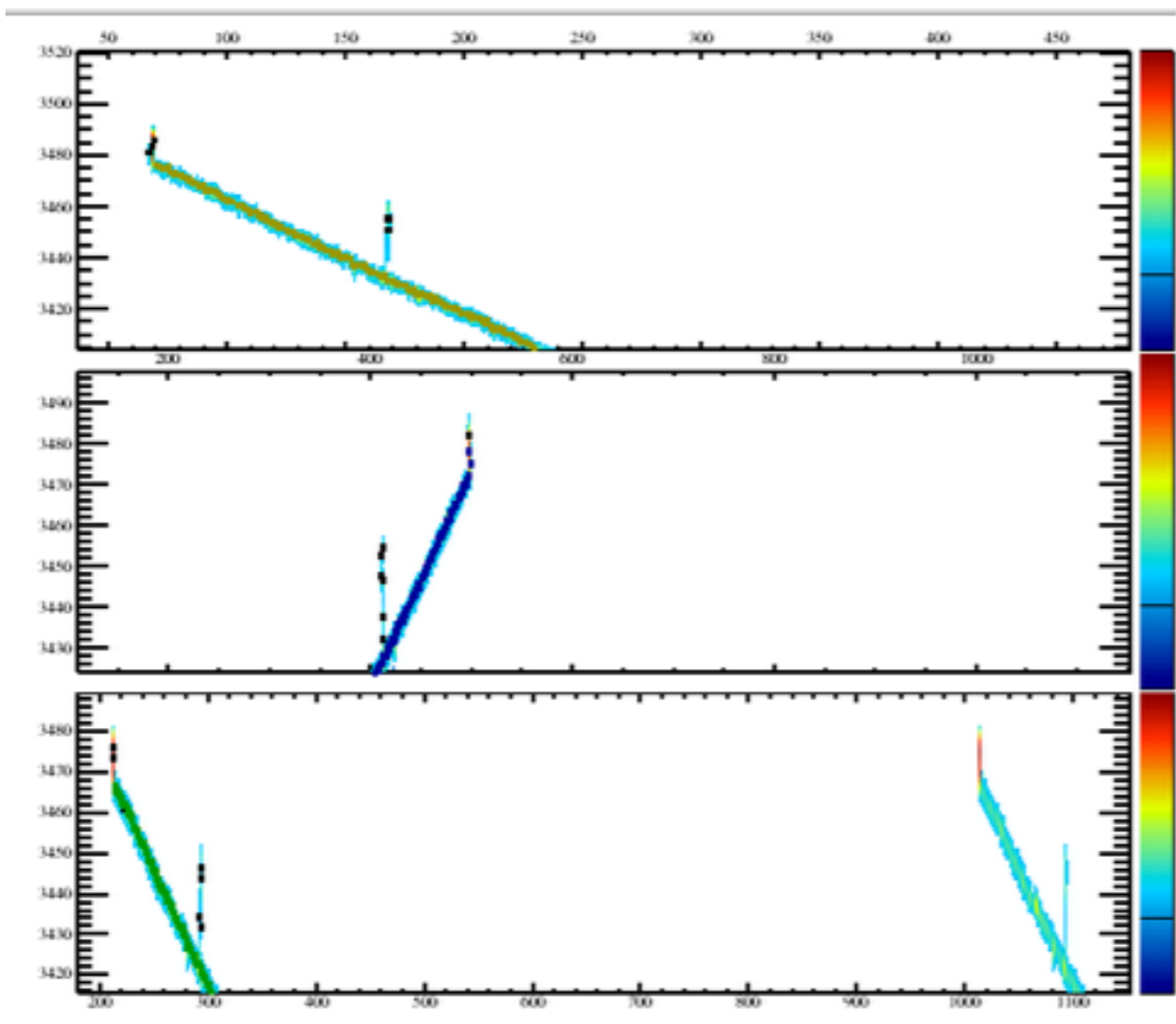
run 20000001/579/57803 (0.2 GeV p)

Zoom In



Proton Tracking Efficiency (CC $\nu\mu$ Events)

run 20000001/579/57837 (0.3 GeV p)

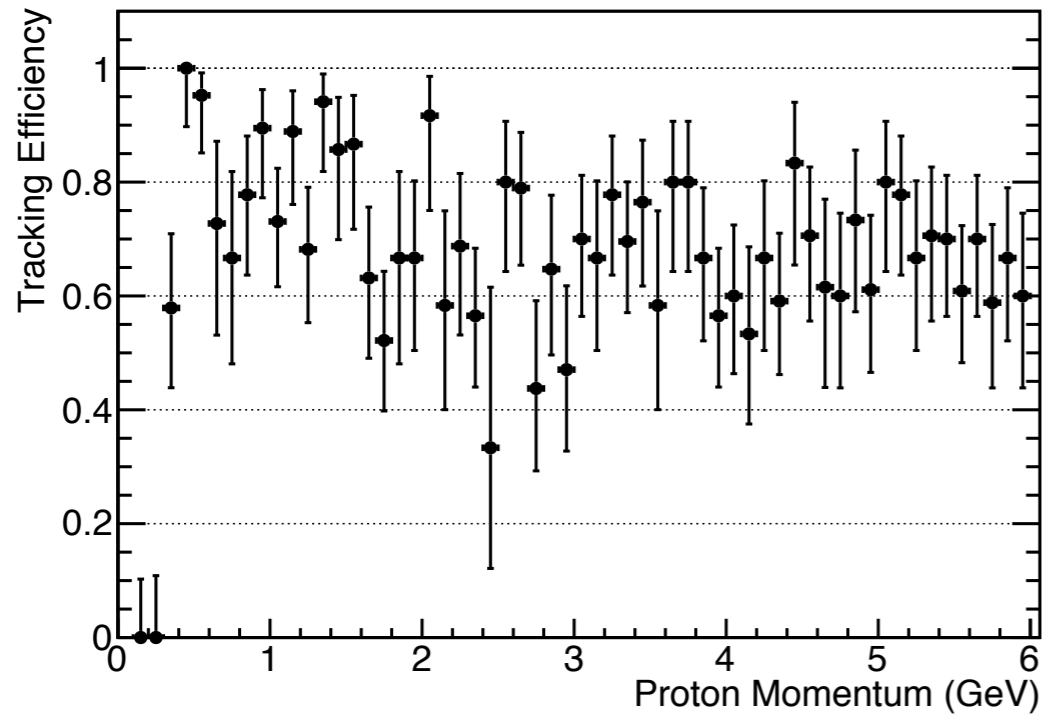


Im using PMtrack (Projection Matching tracker)

It seems that PMtrack cannot handle short track

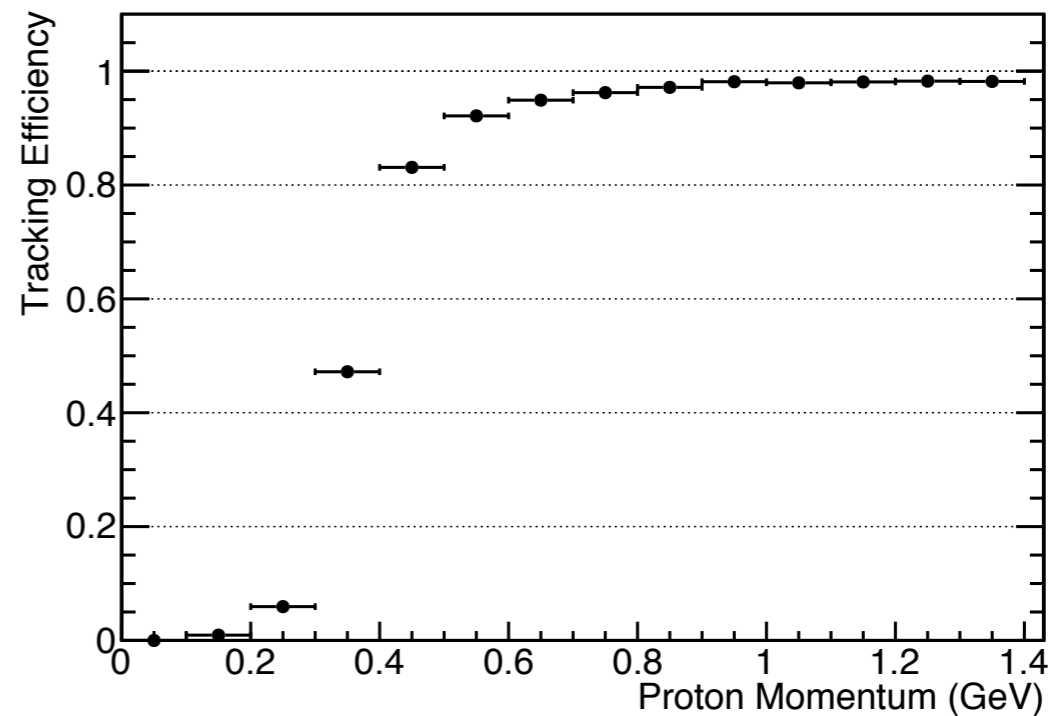
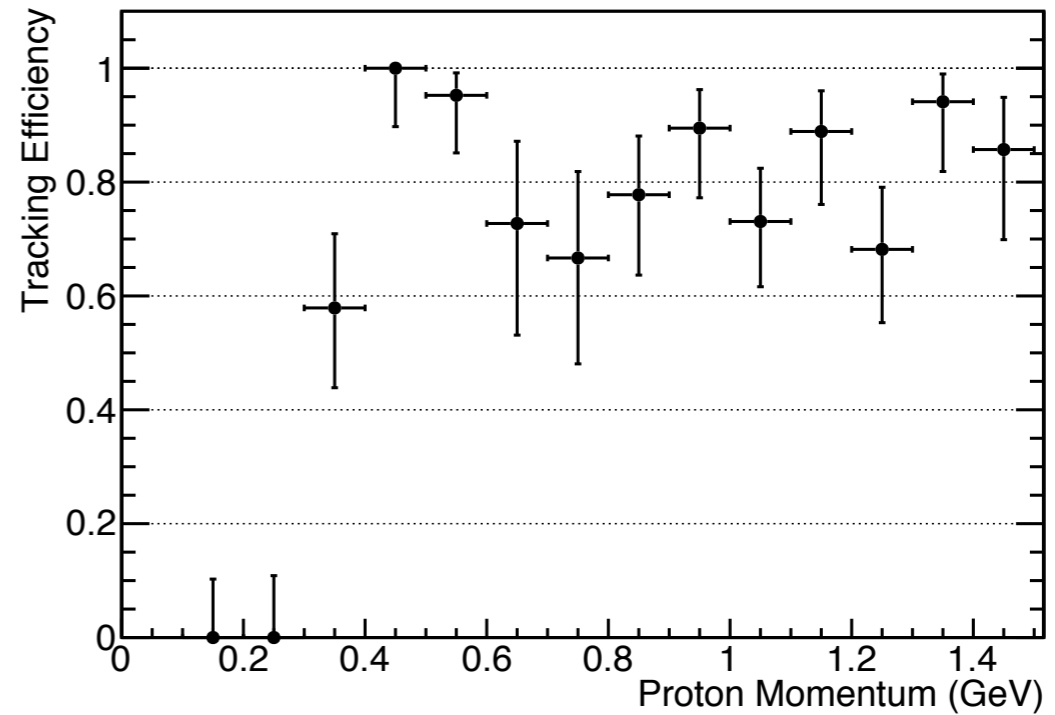
Or it need to be tuned for short track
Protons are heavy ionizing particles
therefore they don't travel through the
Argon as muon or pions

Proton PC (0.1-6 GeV)



1K PC Protons
Same conclusion
It seems that PM tracking has a
300 MeV threshold for protons

Zoom In



The End
