1 GeV Pion Tracks - Run 5387

ProtoDUNE Sim/Reco Meeting - 01/16/2019

Owen Goodwin

DEEP UNDERGROUND NEUTRINO EXPERIMENT

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Introduction

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- Study of some basic variables of reconstructed 1 GeV pion candidate tracks.
- Using all of Run 5387 (defname `runset-5387-reco-unified-hv-180kV-beam-1GeV-v0`);
  - 1 GeV Beam Momentum
  - 180 kV drift field
  - Hadron Trigger
- Use Justin Hugon's beamline filter to select 1 GeV pion events. Details here https://indico.fnal.gov/event/19185/contribution/2/material/slides/0.pdf
- Then use protoana::ProtoDUNEPFParticleUtils to get reconstructed TPC beam particle

Introduction

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Initial # of Events (missed one file)	46629
Passed 1GeV Pion Beamline filter	21848
Passed inactive FEMB filter (beamside)	20991
Passed Unstable HV filter	20991
Reconstructed beam particle found in TPC	13311
Contains at least one Beamline Particle?	13122

Need to look into last step.

Beamline Information Checks

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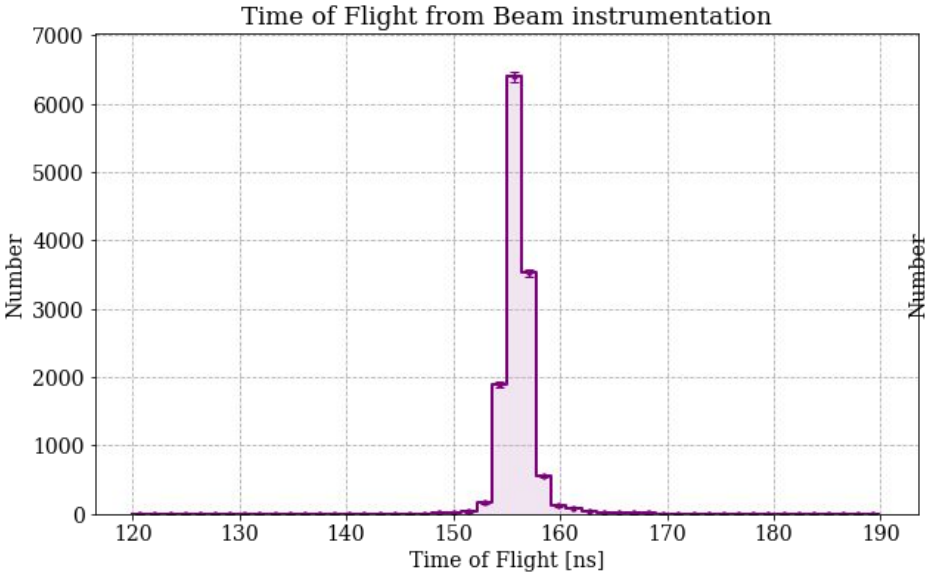

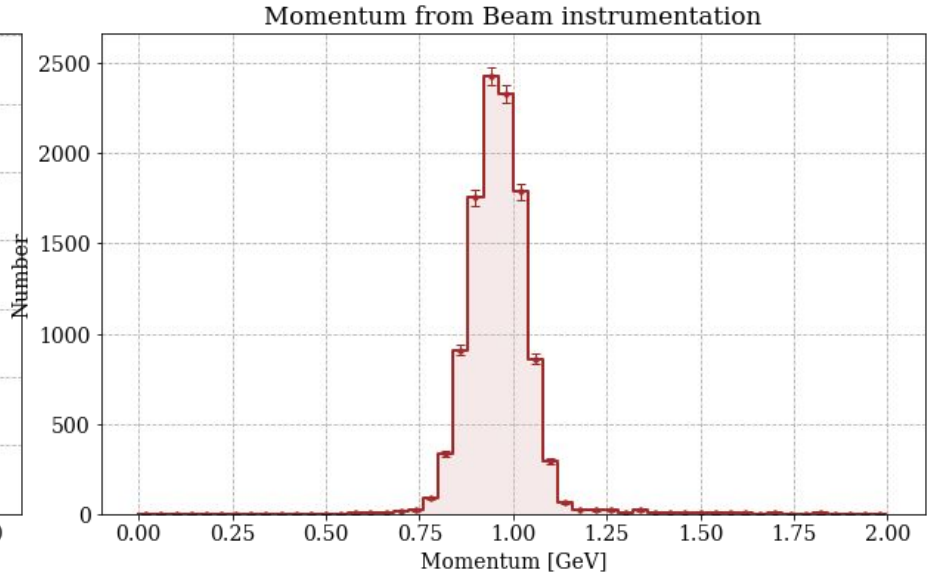

Beam Start Position

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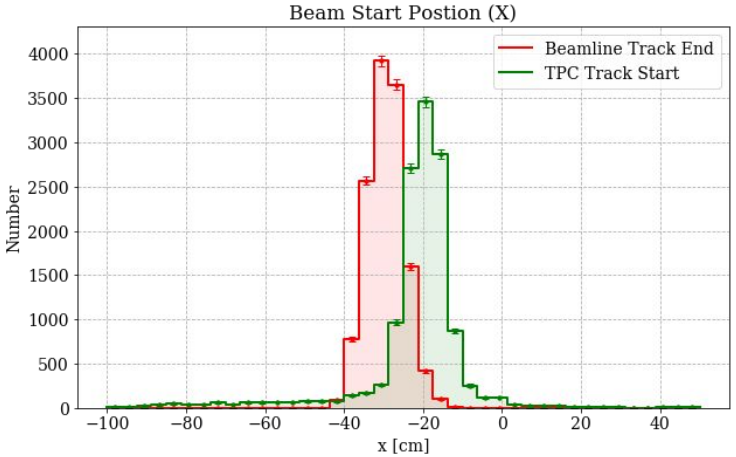

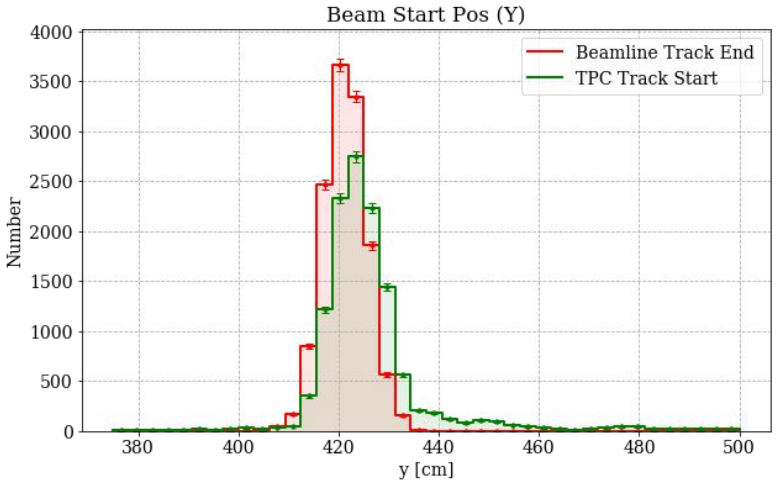

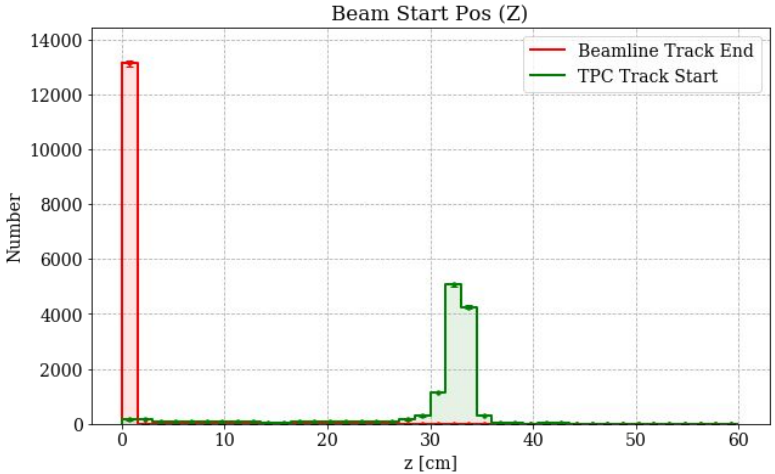

Flipped TPC tracks with Start Z > End Z

~32 cm offset in Z as seen in other studies

Beam Start Position

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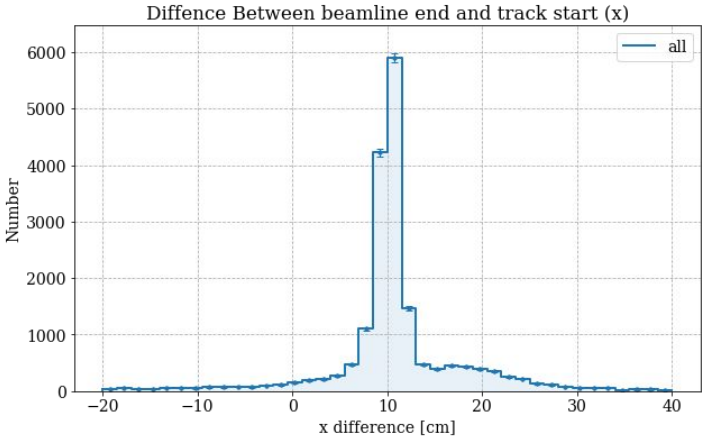

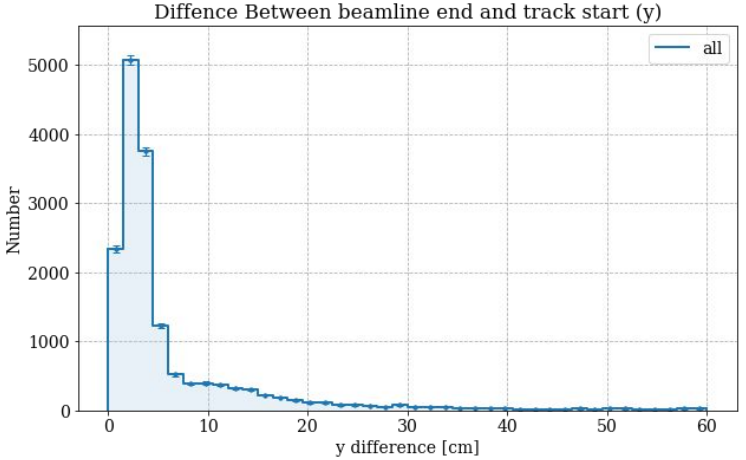

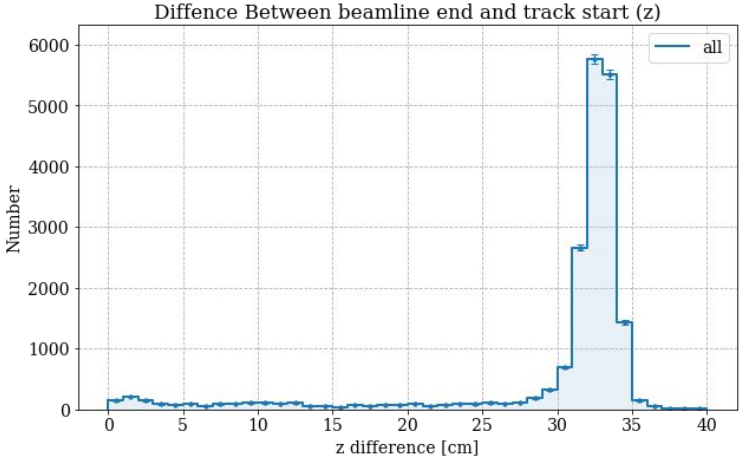

~32 cm offset in Z as seen in other studies

Directional Match

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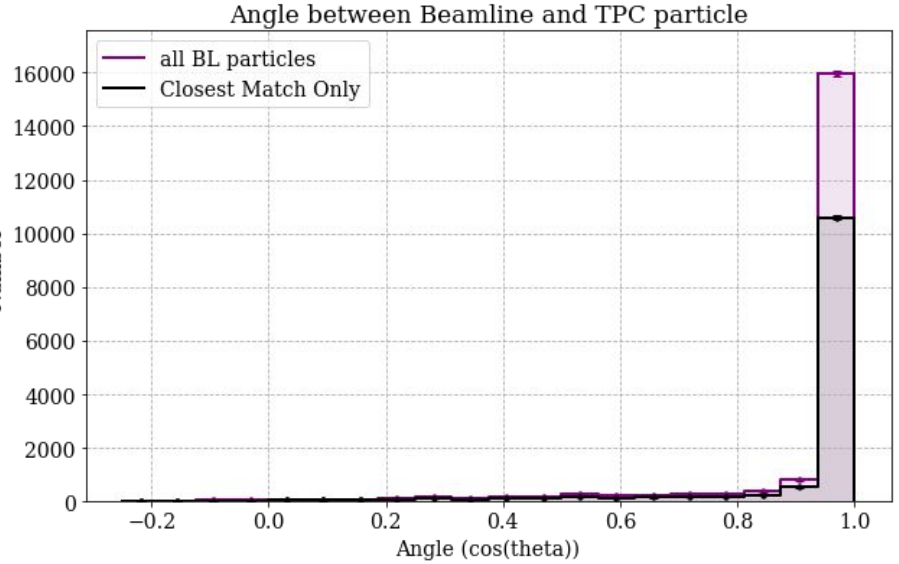

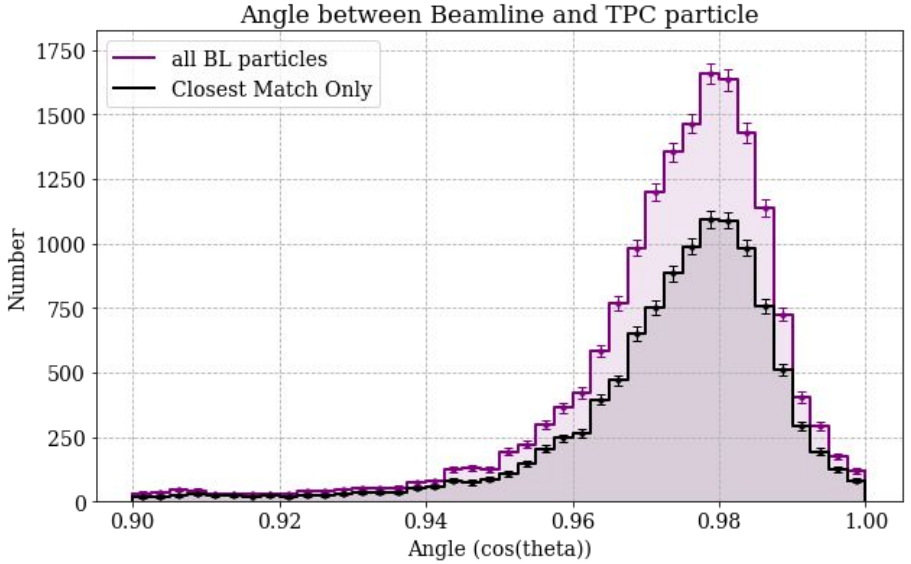

Angle between beamline particle and TPC particle.

Closest Match contains only the best matching beamline particle for each Evt

Track Length

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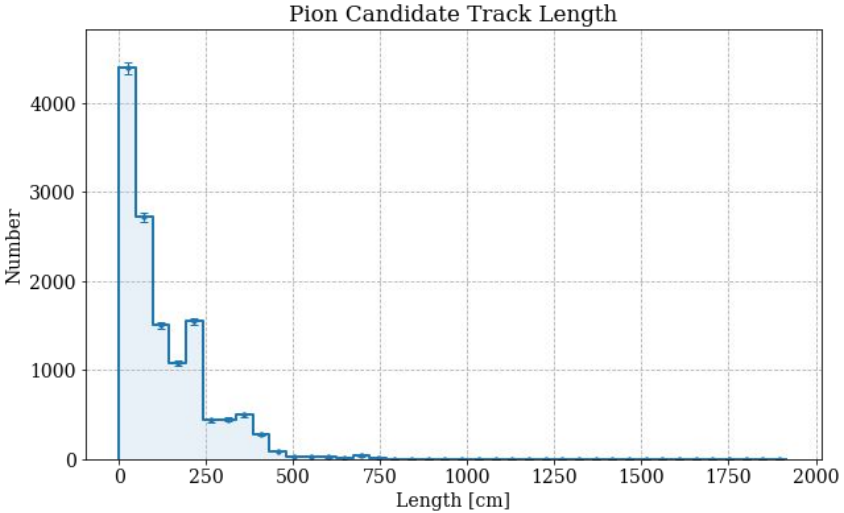
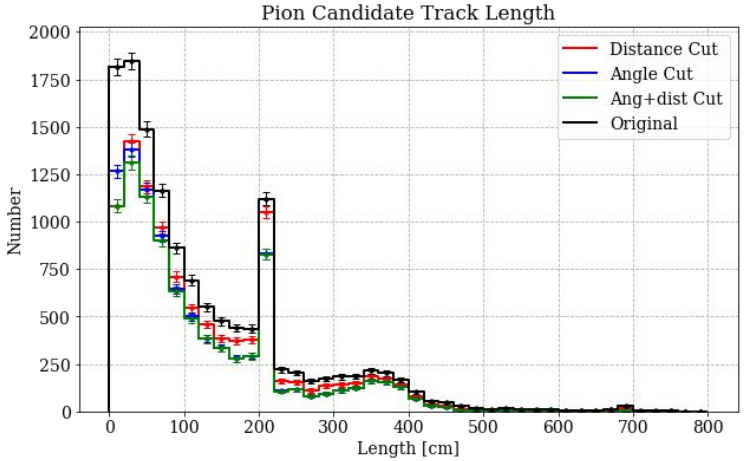
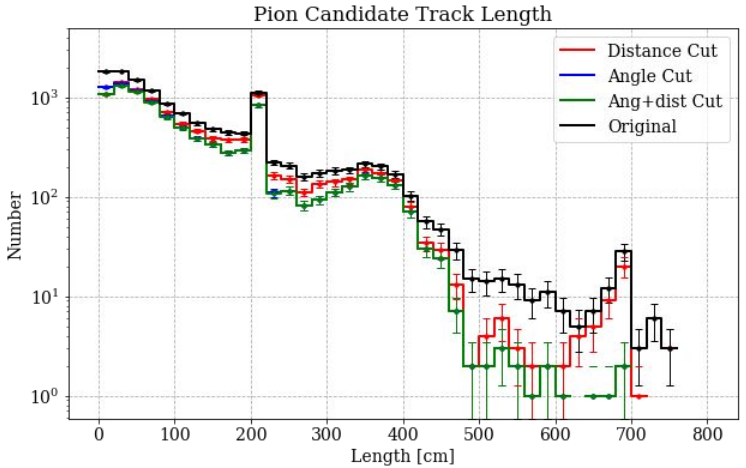


Distance Cuts: 6cm< x diff < 14cm and y diff < 10cm and 29cm<z diff <36 cm
Angle cut: Cos(theta)>0.9
Both Cuts remove extreme high length tail.





Track Length

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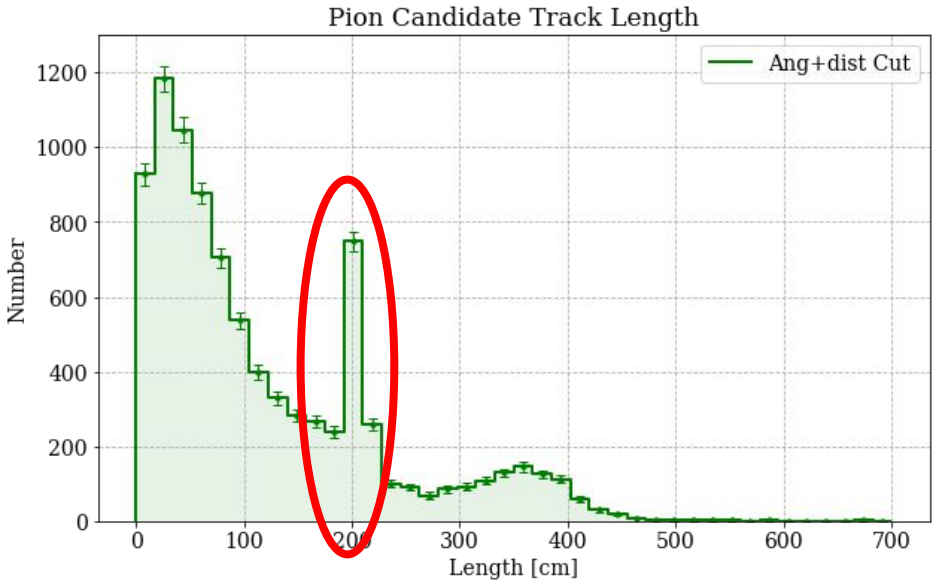

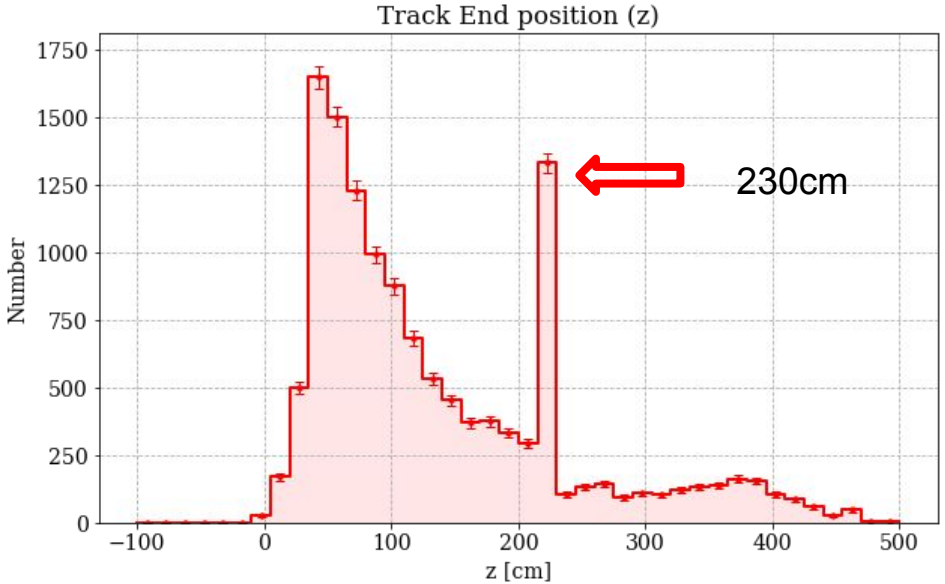

Spike at 200cm cause by broken tracks at end of first

APA (230cm in Z direction)

Event Display (Run 5387, Ev 60537)

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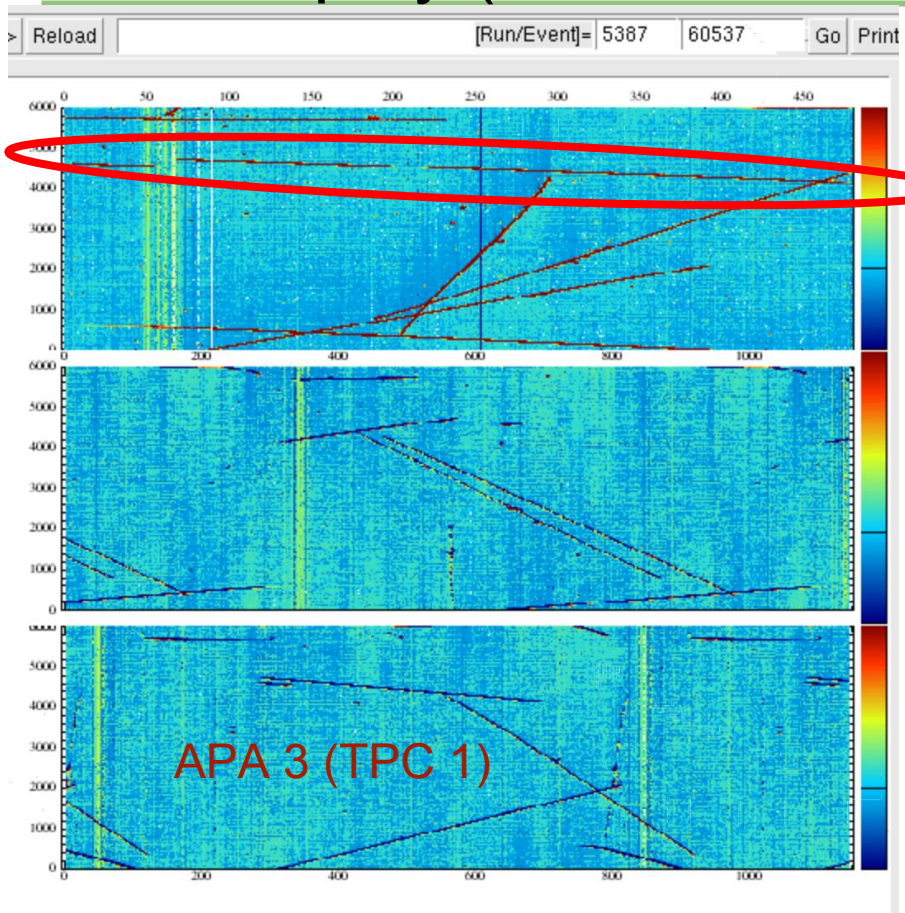

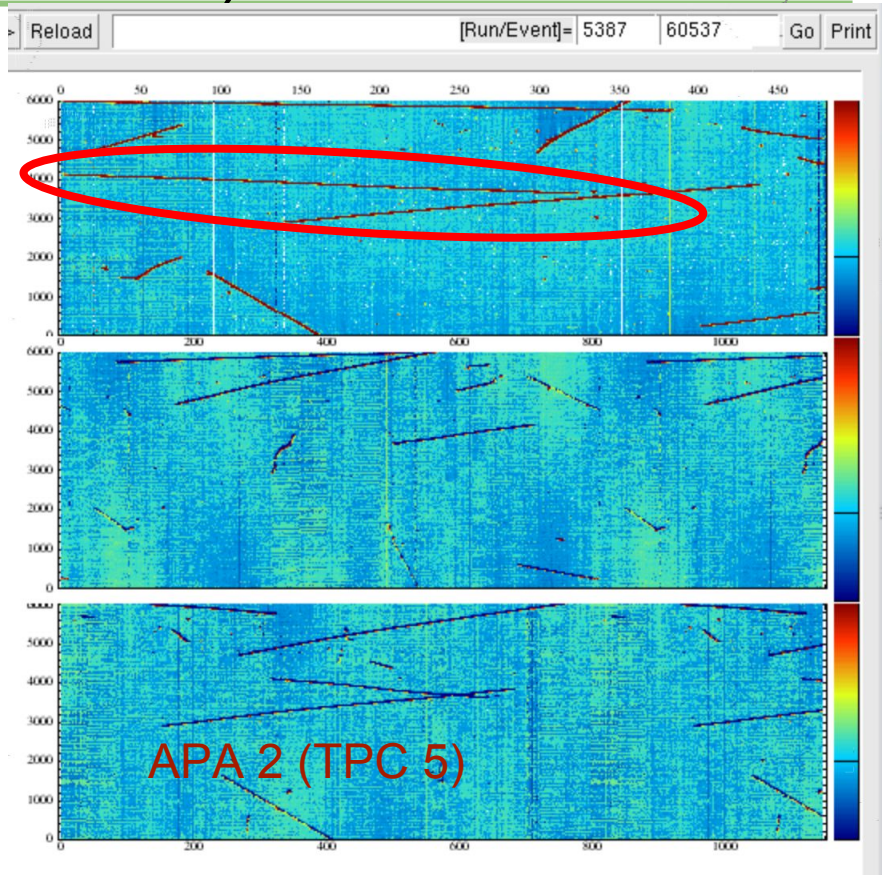

Event Display (Run 5387, Ev 60537)

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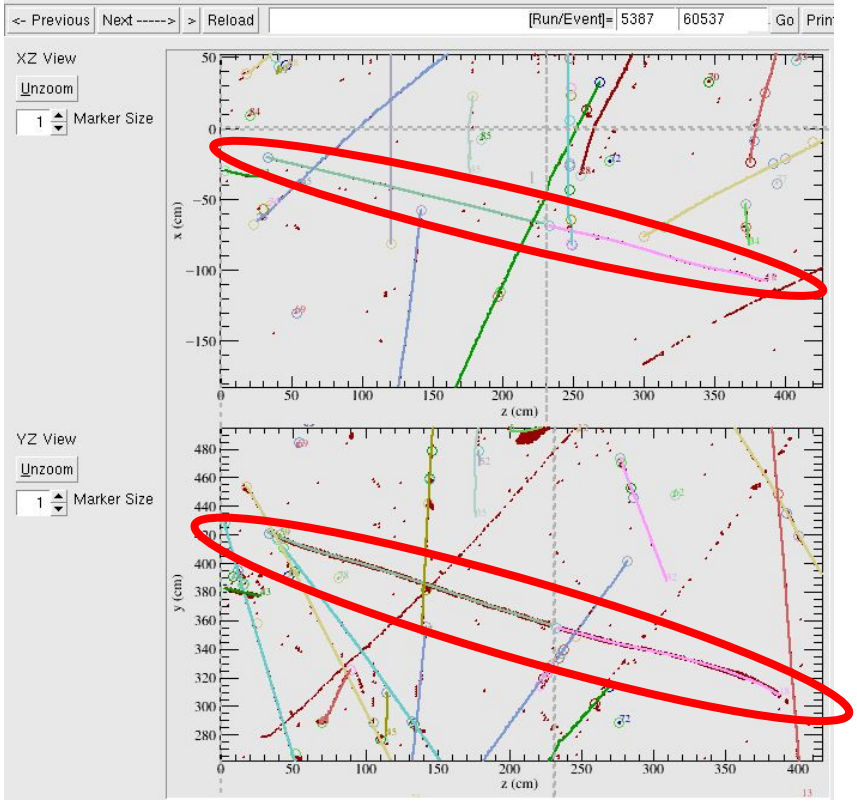

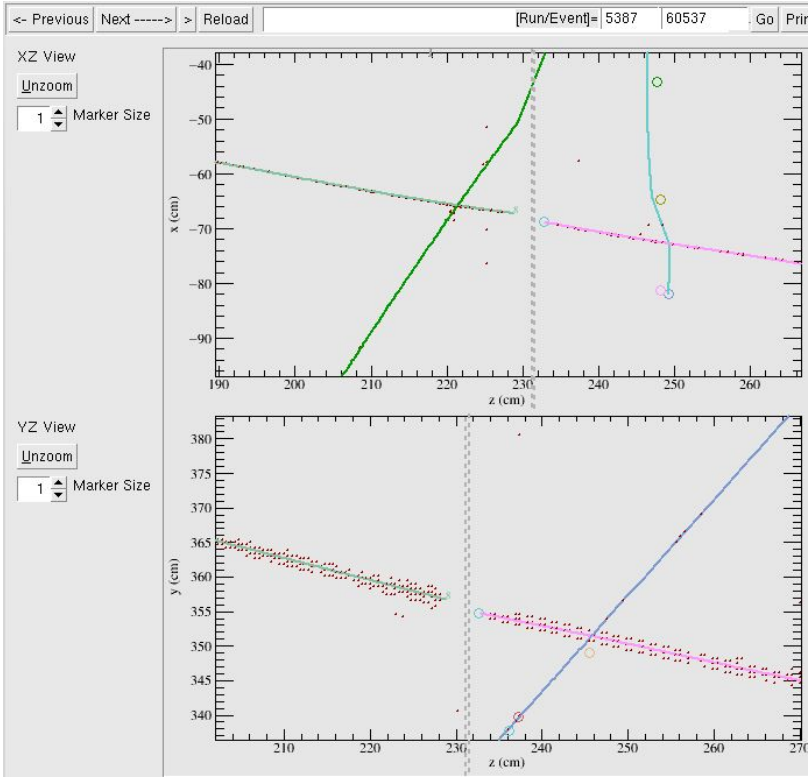

Track Split into two Reconstructed tracks

(Run 5387, Ev 49259)

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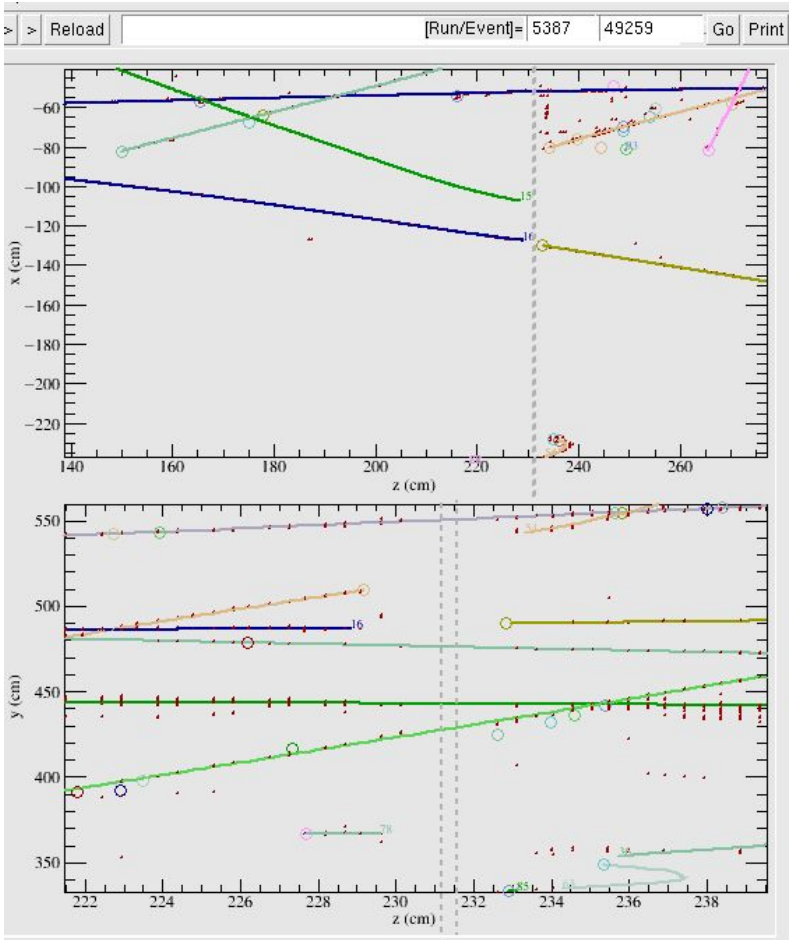

Track Length

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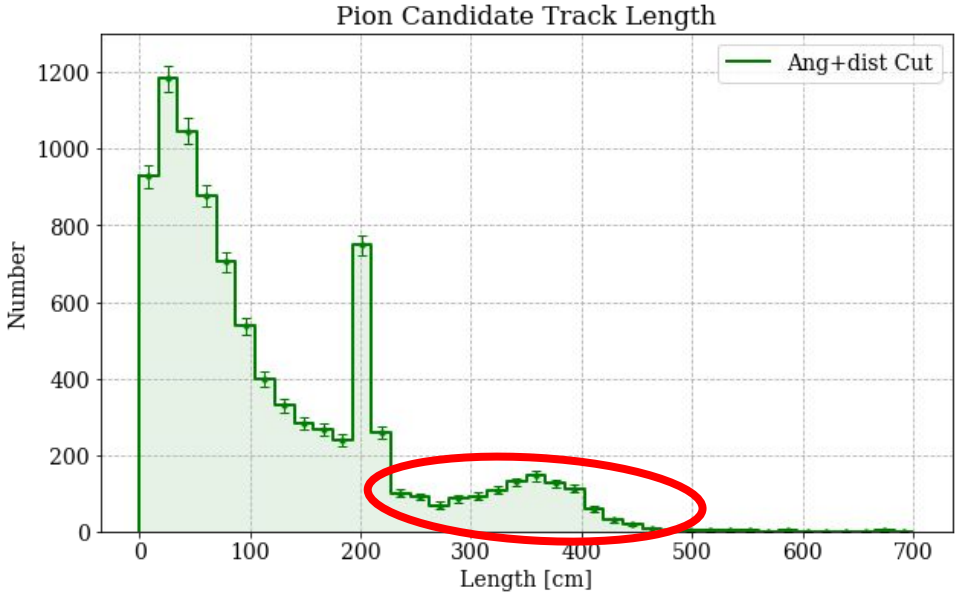

Peak much beyond Pion-LAr interaction length at 1 GeV (<1m)

Muon Contamination

1GeV mom Stopping Muon expected range using CSDA tables (http://pdg.lbl.gov/2012/AtomicNuclearProperties/MUON_ELOSS_TABLES/muonloss_289.pdf) is ~395cm

Track Length

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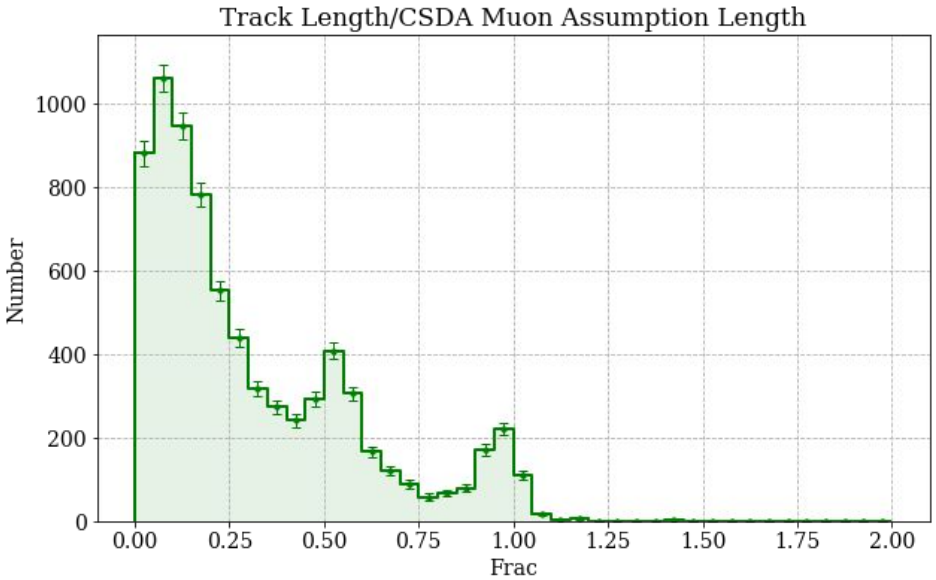

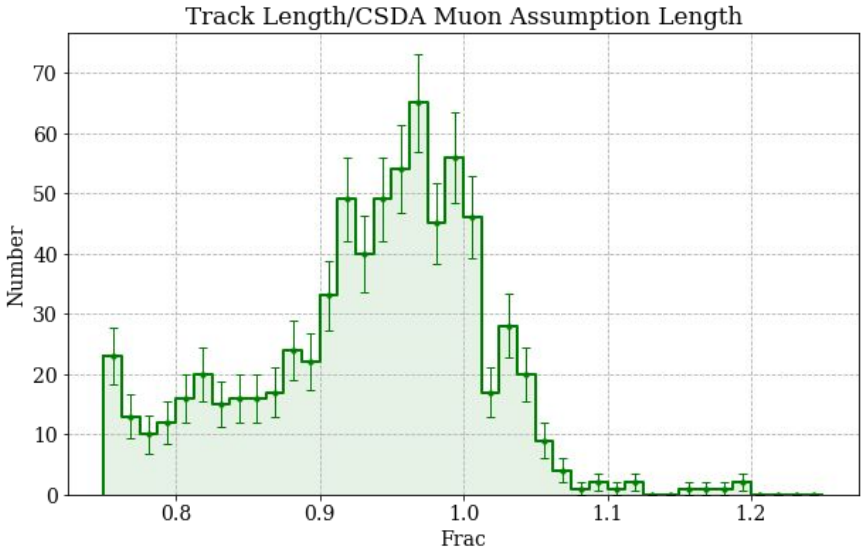

Calculate CSDA range of particle (muon assumption) using Beamline momentum.

Divide Track Length by this.

Stopping muon peak just below 1.

Run 5387, Ev 8588

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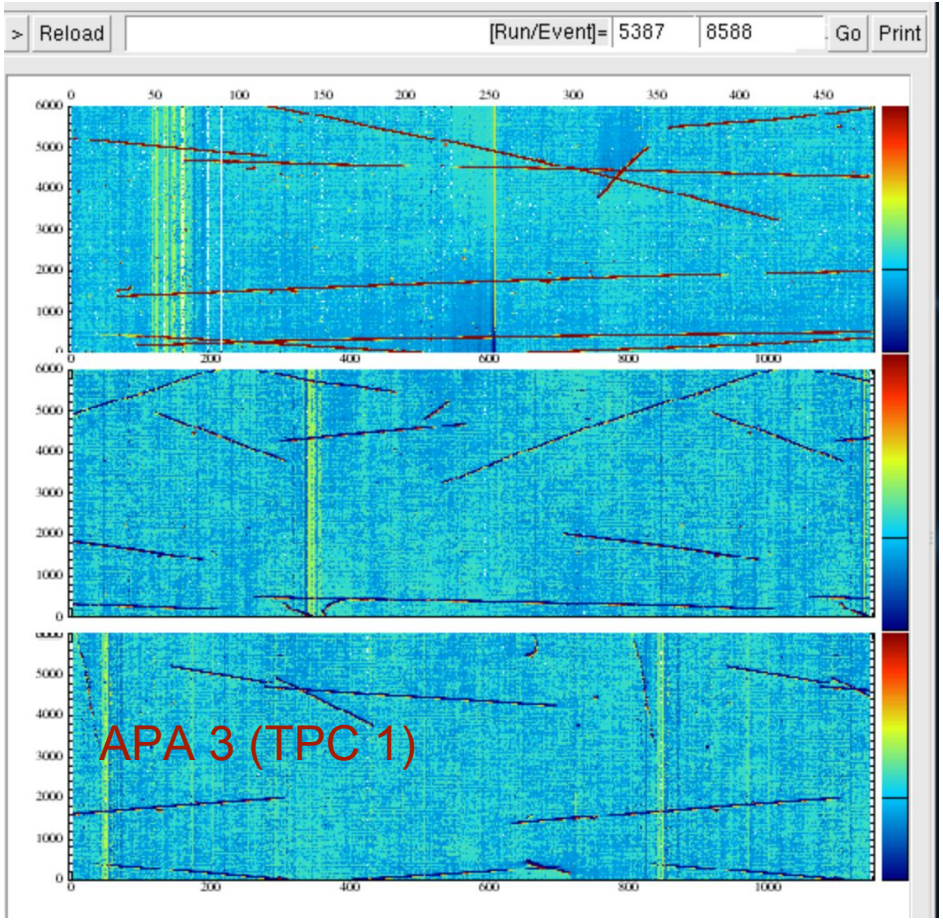

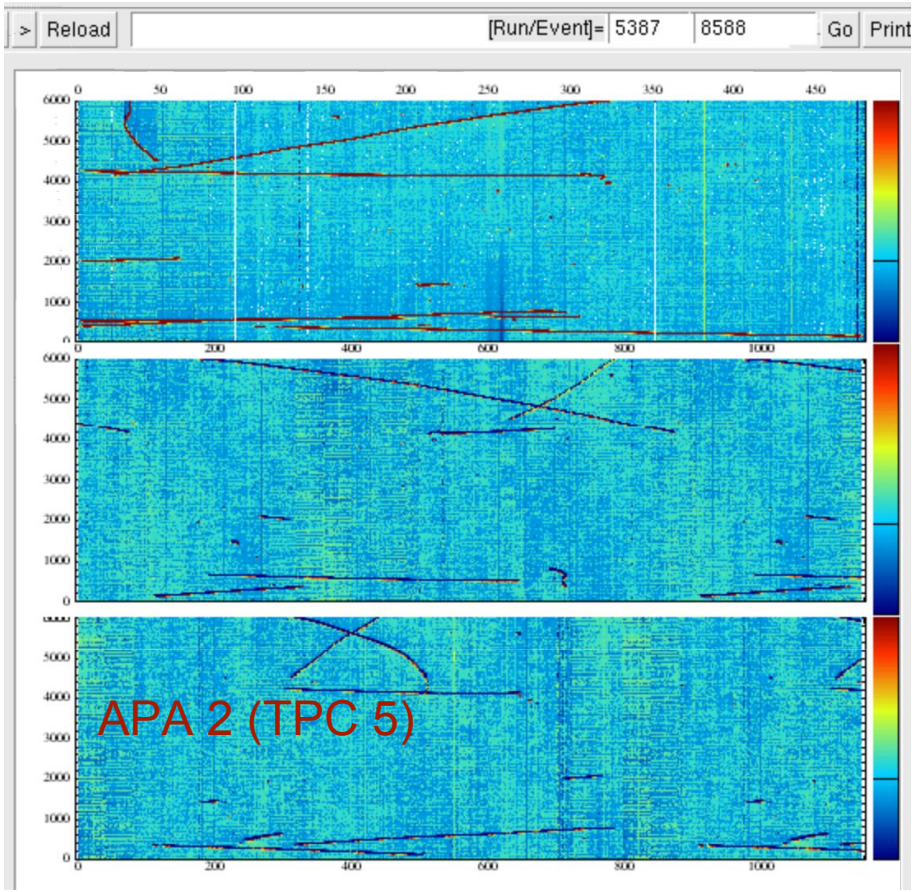

Run 5387, Ev 8588

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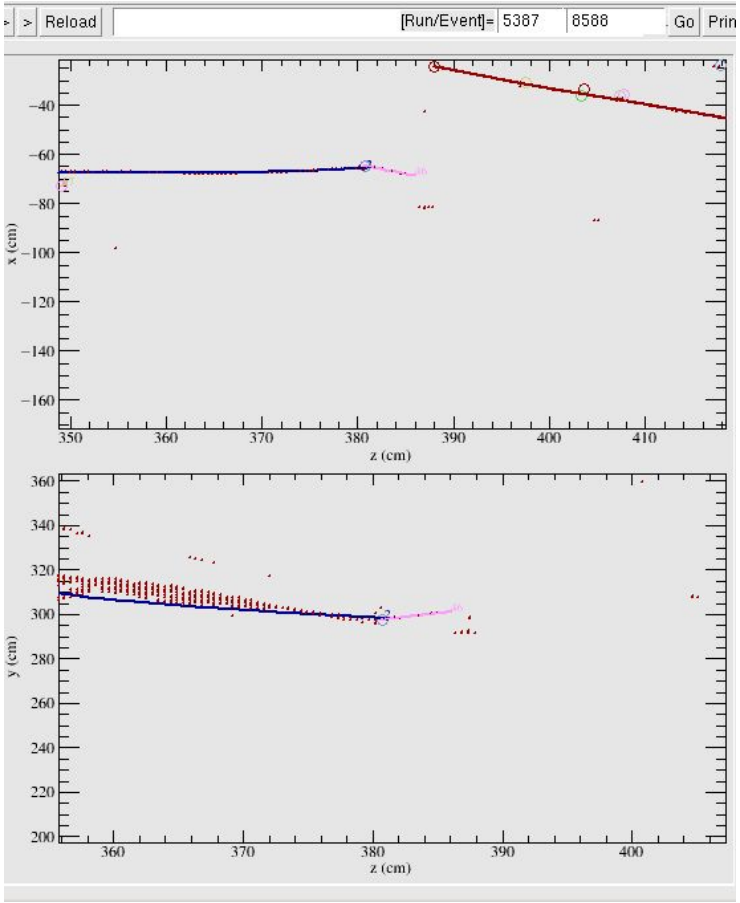

Stopping Muon with reconstructed Michel electron?

BACKUP

Summary + Possible Next Steps

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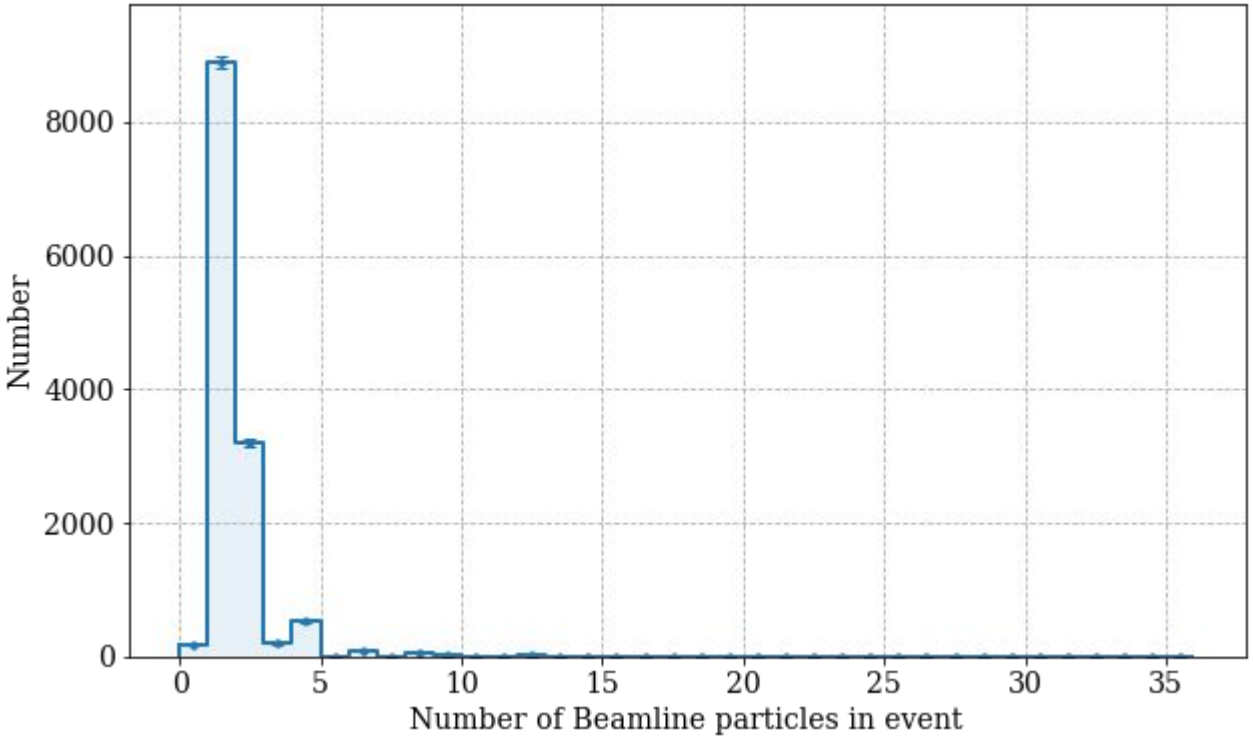
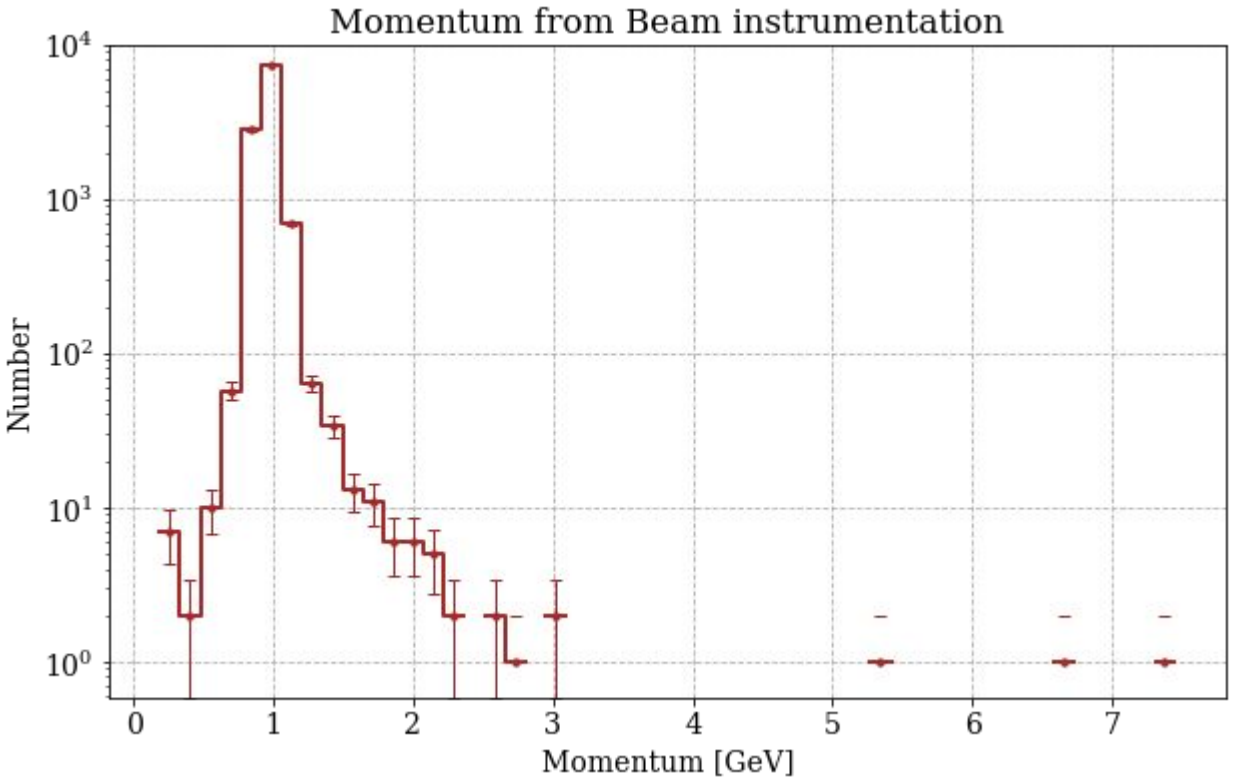
Study variables separated by track end processes

Matching broken tracks

Muons?


Number
8000
6000
4000
2000
0
0
5
10
15
20
25
30
35
Number of Beamline particles in event


Momentum from Beam instrumentation
Number
10^4
10^3
10^2
10^1
10^0
0
1
2
3
4
5
6
7
Momentum [GeV]

Track Reco Wrong way

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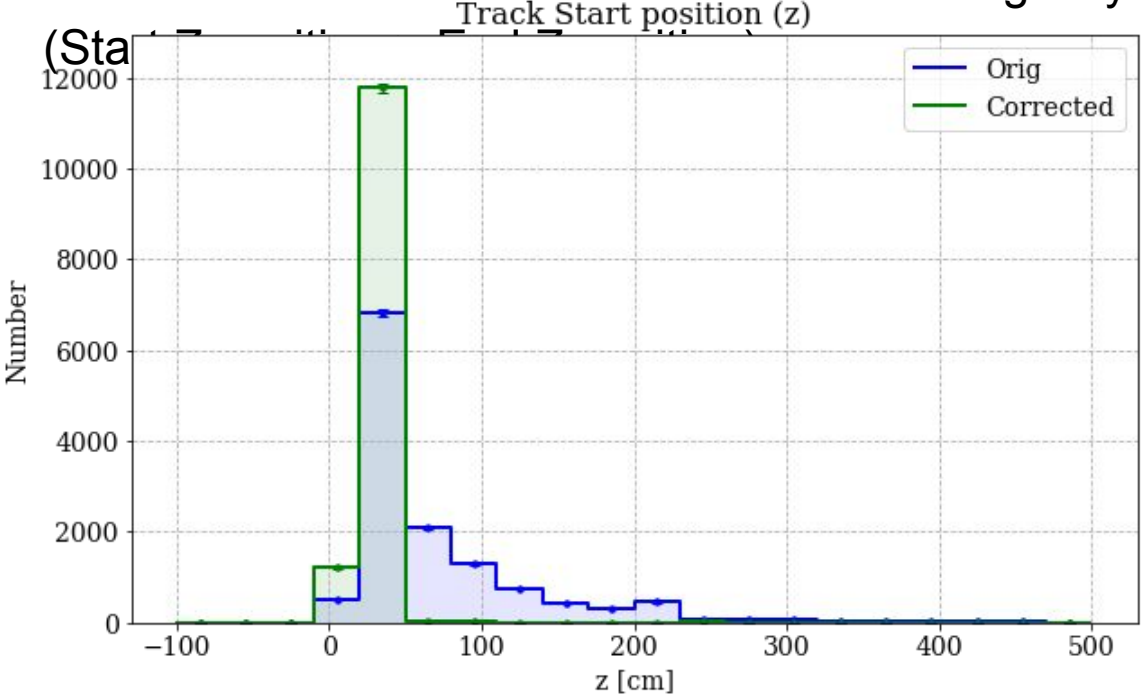
7594/13122 = 57.8%

of Pion Candidate tracks reconstructed “wrong way” round.

(Sta



I flip the tracks the wrong way round.

Plots shows z start position before and after flipping

Beamline Particle info

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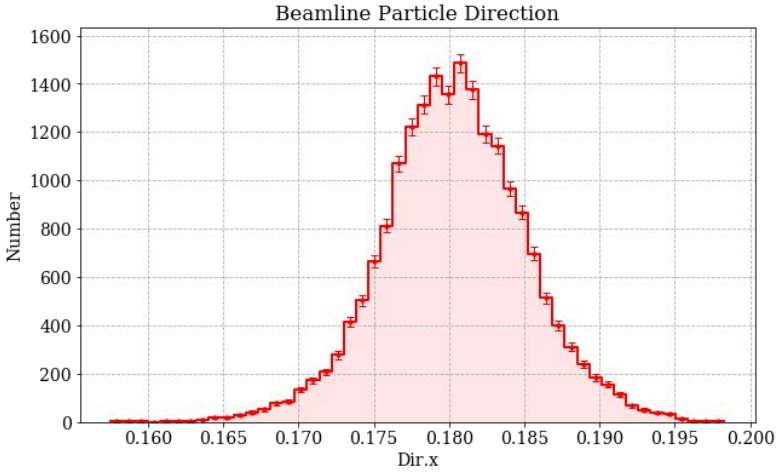

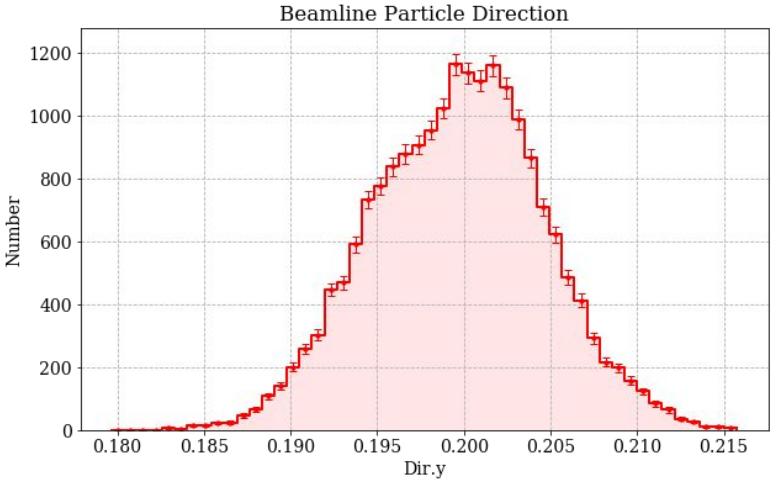

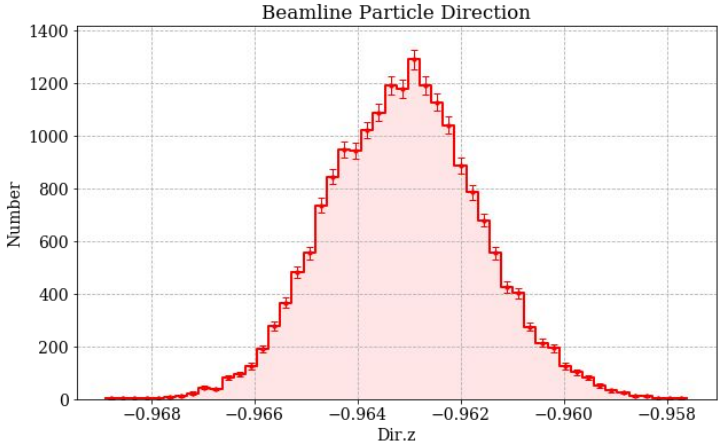

Beamline particles have opposite direction to expected? Going in negative Z direction

Beamline Particle info

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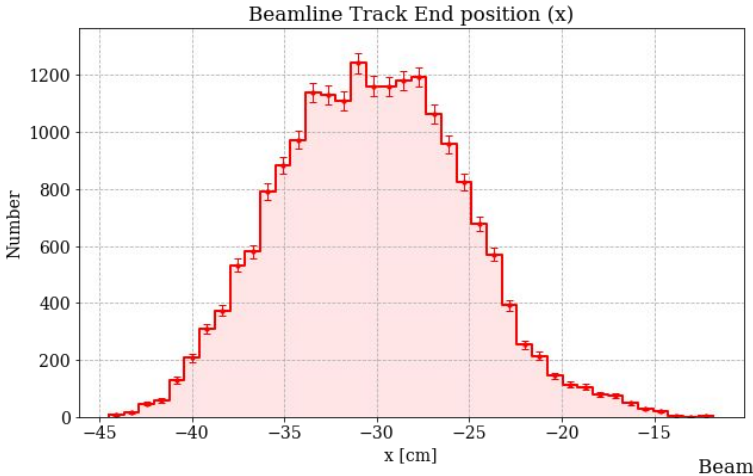

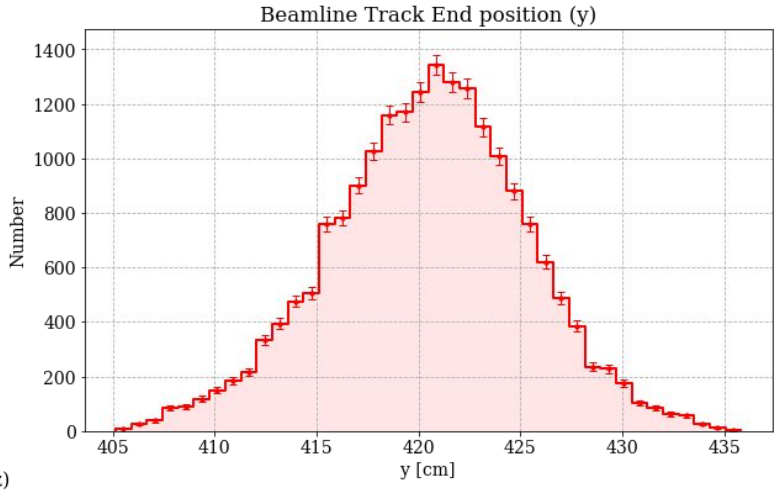

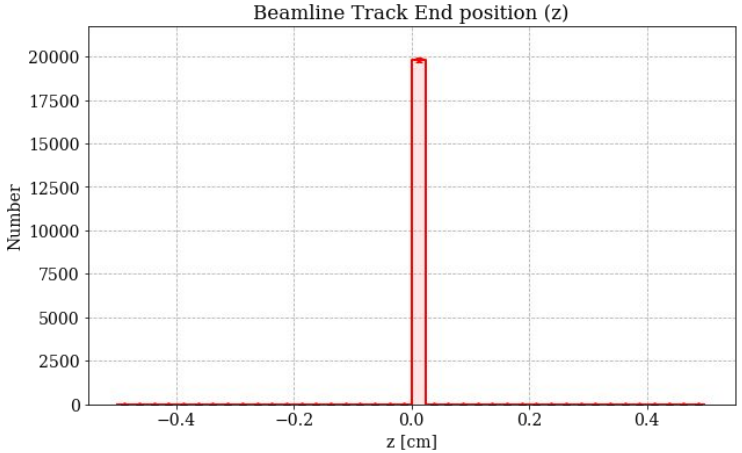

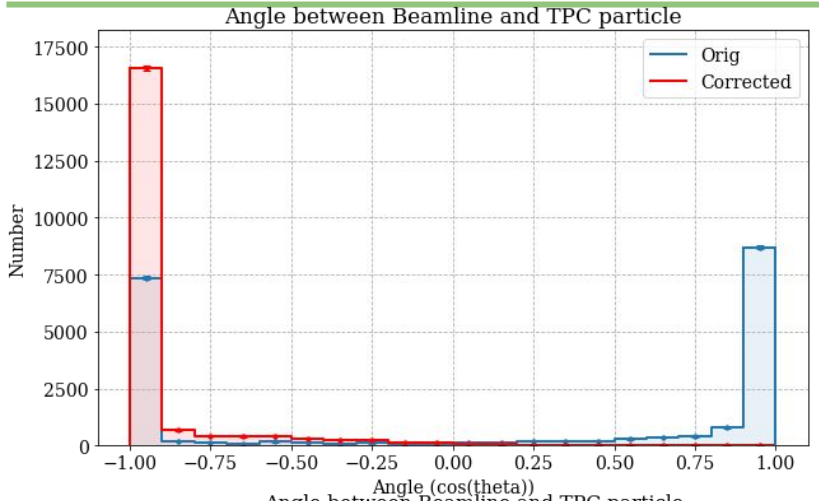

Orig is before I flip the backwards going TPC tracks
Corrected after.

Corrected and flipped is after I also flip direction of all beamline particles

Pion Cand StartPos

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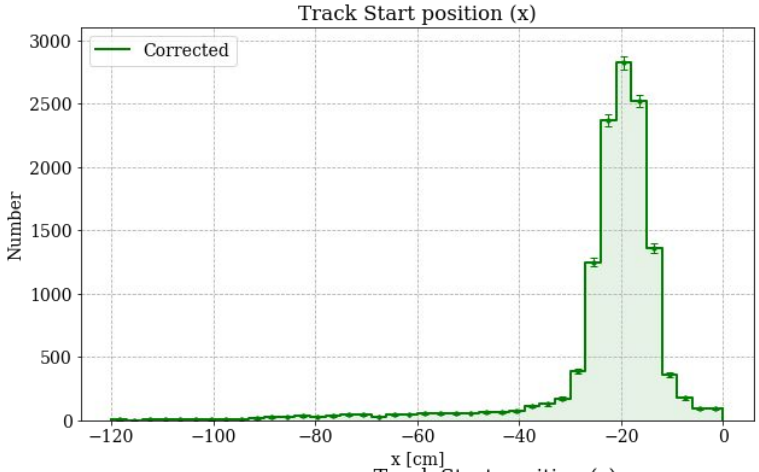

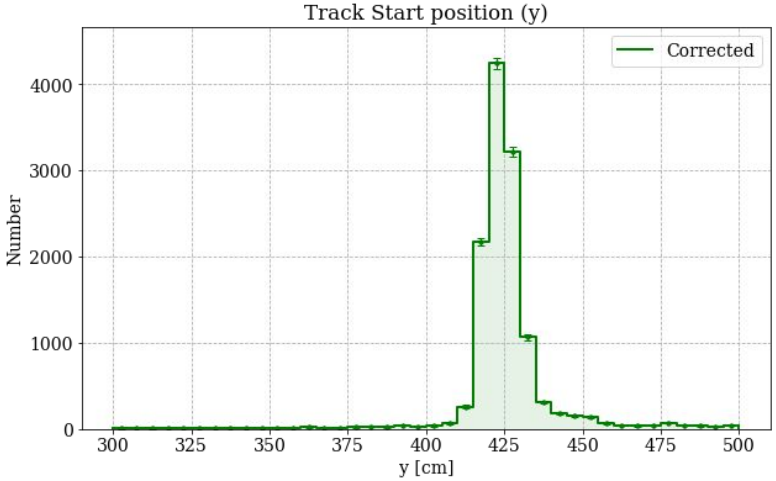

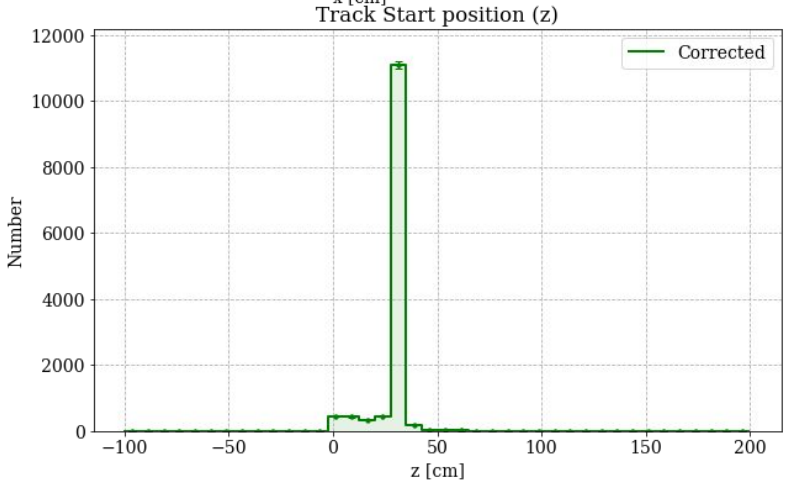

Pion Cand EndPos

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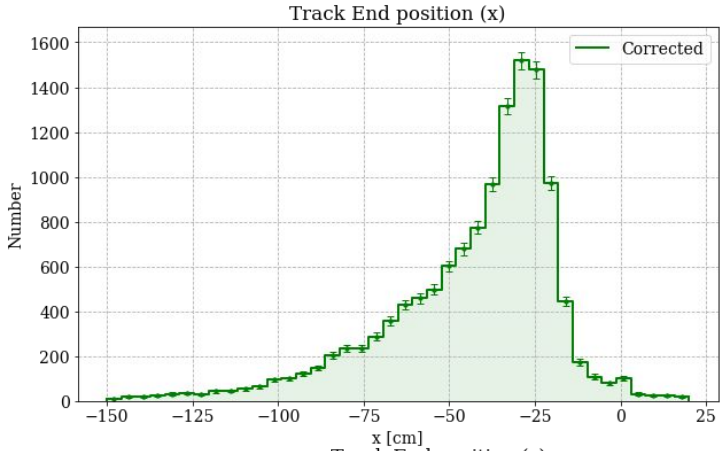

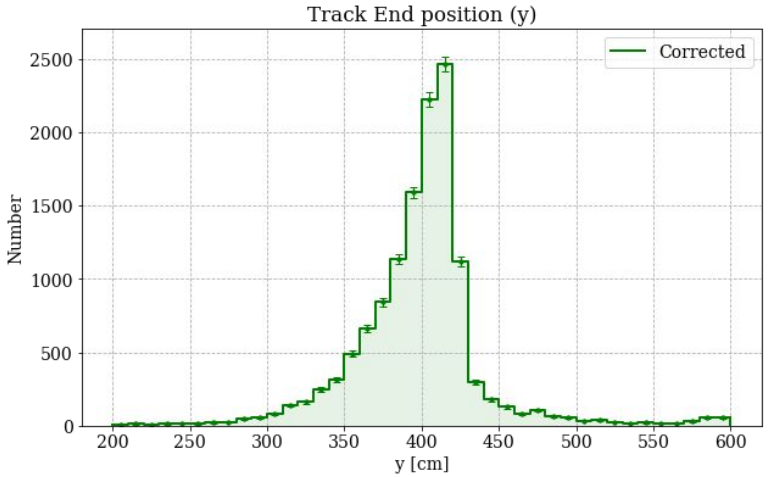

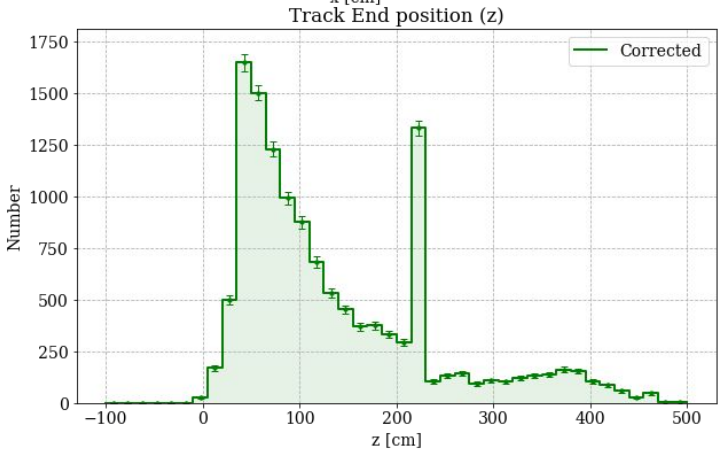

z=230cm edge of first APA