Michel Electron Analysis

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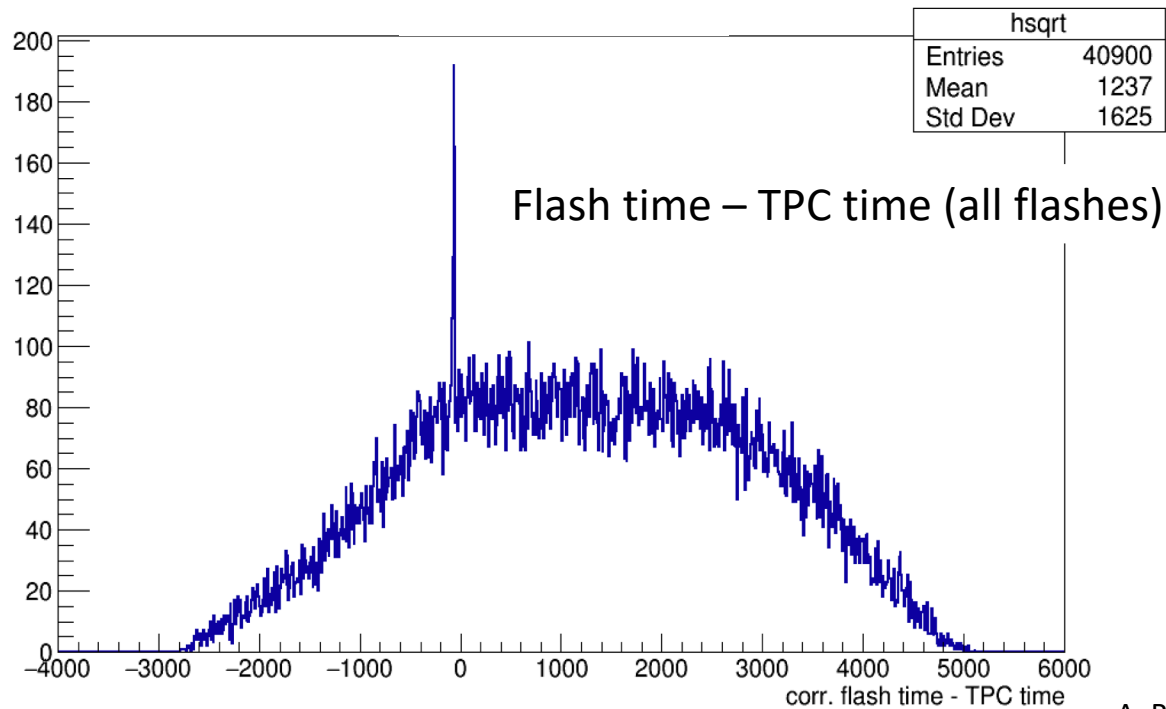
03/28/2019

TPC and PDS(flash) time matching
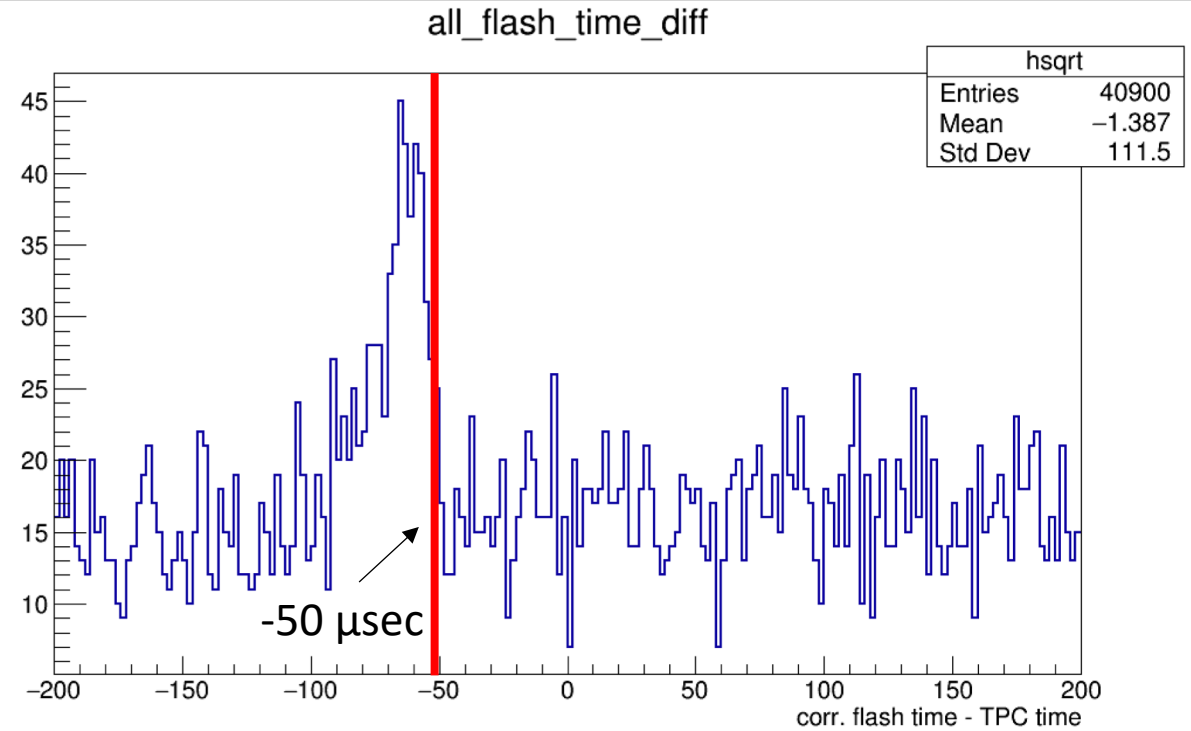
Last time when I presented I was asked to
1. make a plot of "flash – TPC time" for all flashes
2. Calculate and apply the offset
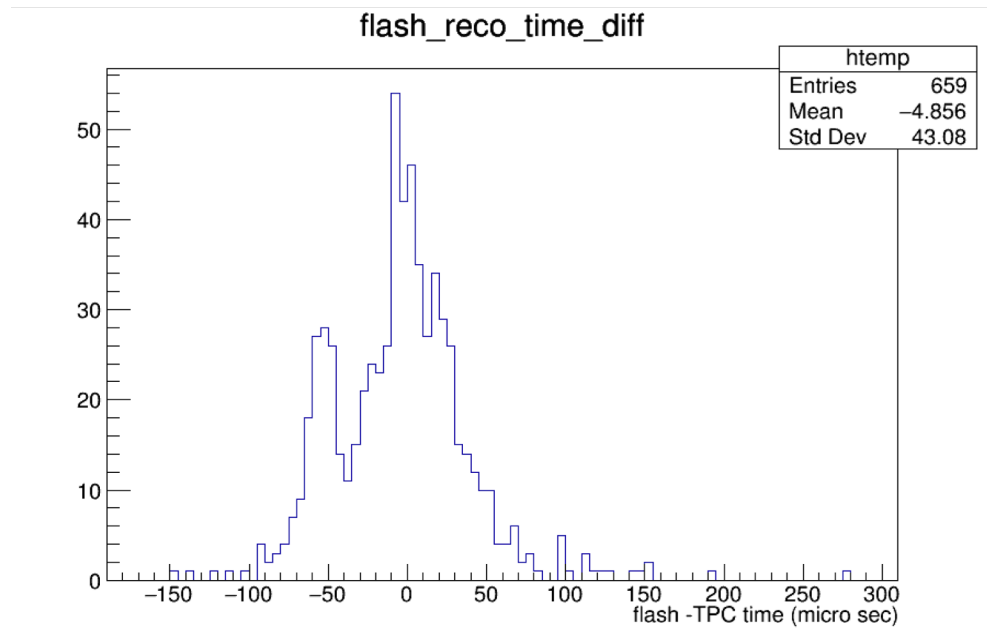3. Apply > 20 PE cut on flashes

Using cosmic data

Flash time – TPC time (all flashes)

hsqrt	
Entries	40900
Mean	1237
Std Dev	1625

all_flash_time_diff

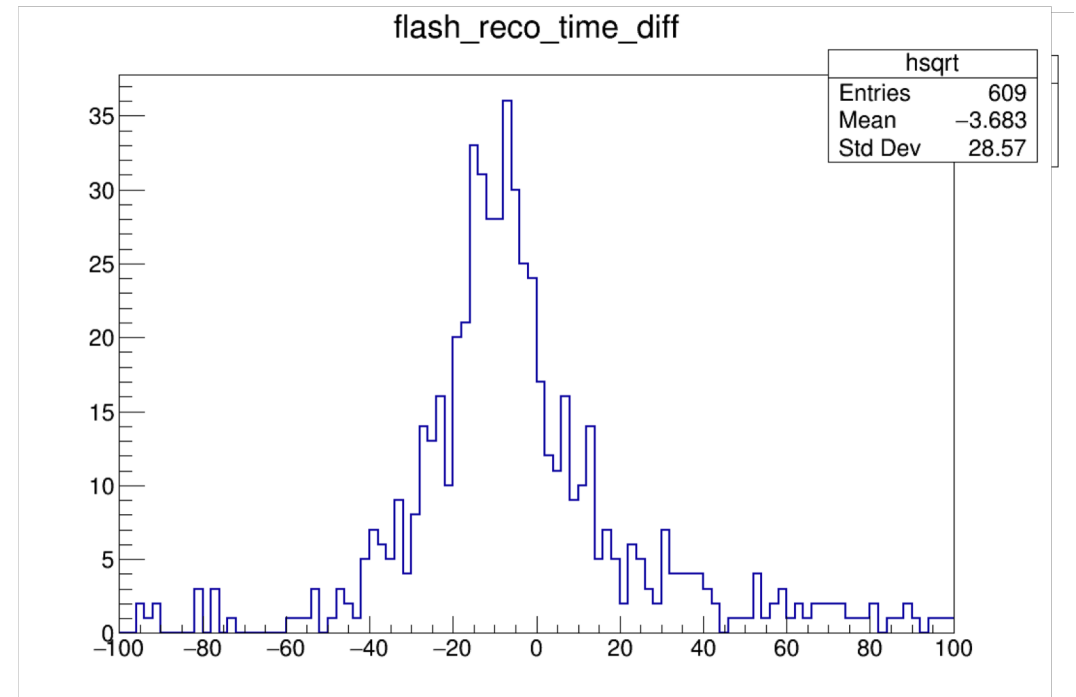| hsqrt	
Entries	40900
Mean	−1.387
Std Dev	111.5

-50 μsec

Corrected Flash time – TPC time

- Before correcting for offset and >20 PE cut (shown previously)

- After

Using cosmic data

Michel analysis MC truth study
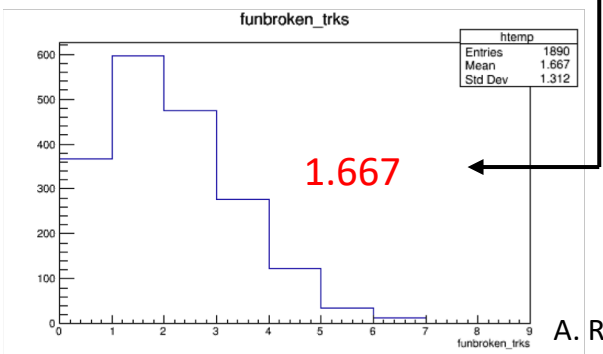
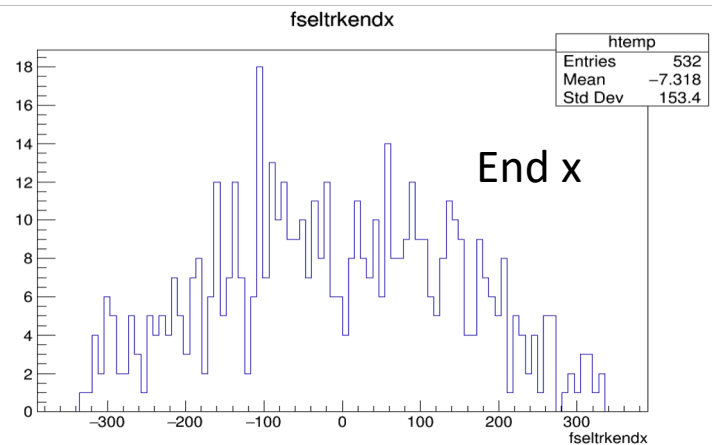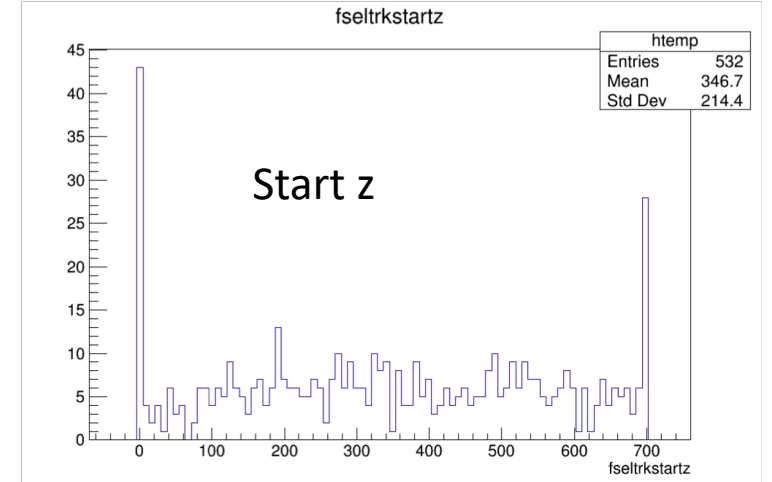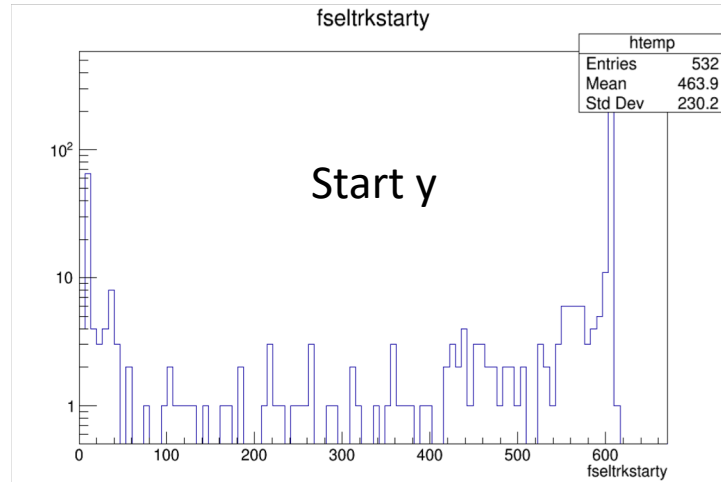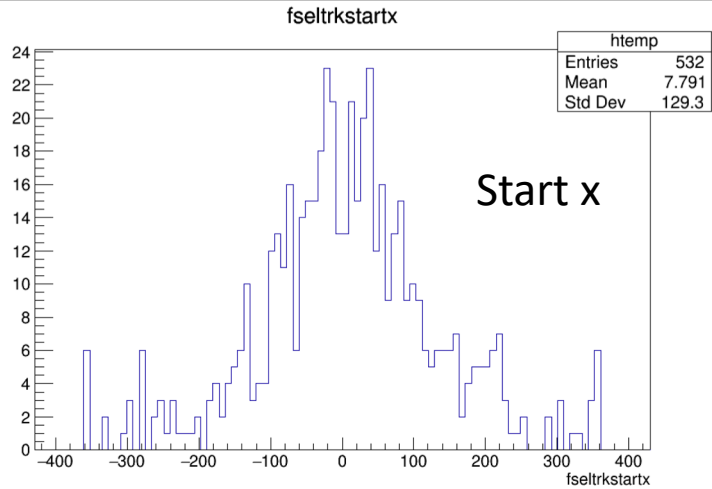- The purpose is to determine the sample purity and selection efficiency

- Used "jhugon_mcc11_pd_sp_reco_3ms_1.0GeV"

- Total number of events: 1890

- Each event consists of
  - One MC truth single particle instance
  - One cosmic instance in the spill

- First perform track selection based on reco information and use the backtracker to obtain the MC true results.

Track selection cuts

PFP tracks → T0 tagged → stopping tracks → Unbroken tracks → >100cm tracks → >40 CP hits tracks → Tracks decaying to candidate michels

fPFP_trks

htemp
Entries	1890
Mean	109.3
Std Dev	22.04

Tracks/event: 109.3

fstopping_trks

htemp
Entries	1890
Mean	2.581
Std Dev	1.678

2.581

flongcm_trks

htemp
Entries	1890
Mean	1.613
Std Dev	1.289

1.613

fsel_mu

htemp
Entries	1890
Mean	0.2815
Std Dev	0.5216

0.282

fT0_trks

htemp
Entries	1890
Mean	7.034
Std Dev	2.796

7.034

funbroken_trks

htemp
Entries	1890
Mean	1.667
Std Dev	1.312

1.667

flonghits_trks

htemp
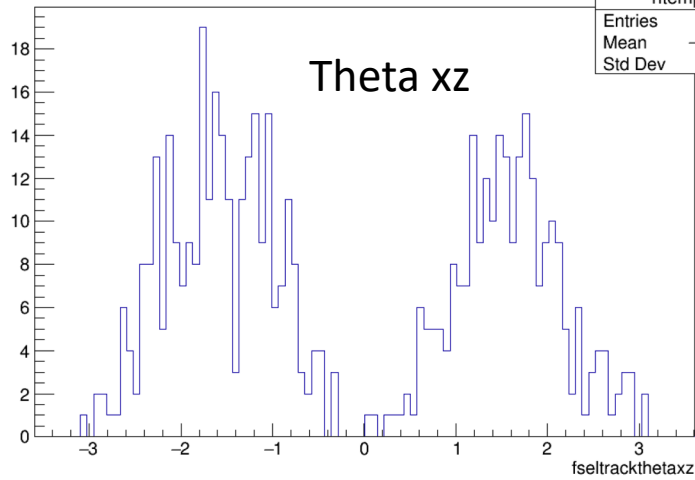| Entries | 1890 |
| Mean | 1.604 |
| Std Dev | 1.283 |

1.604

A. Rafique, ANL
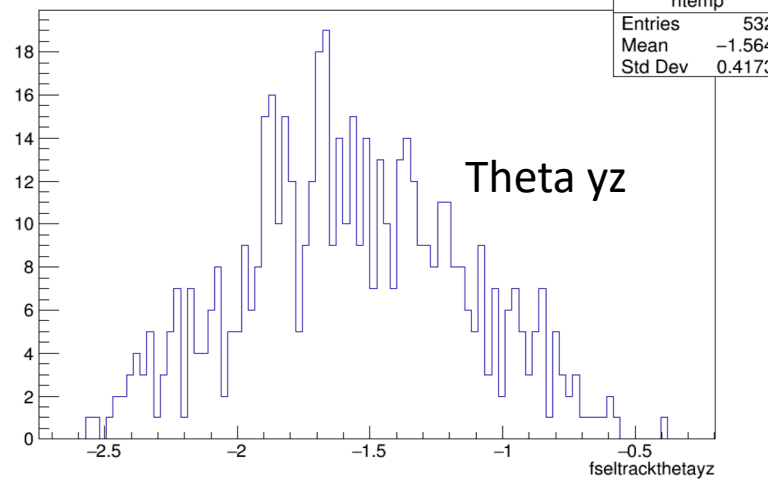
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Candidate muon reco kinematics

Each selected track must have an endpoint outside the TPC. We therefore see a huge accumulation of tracks at the end points
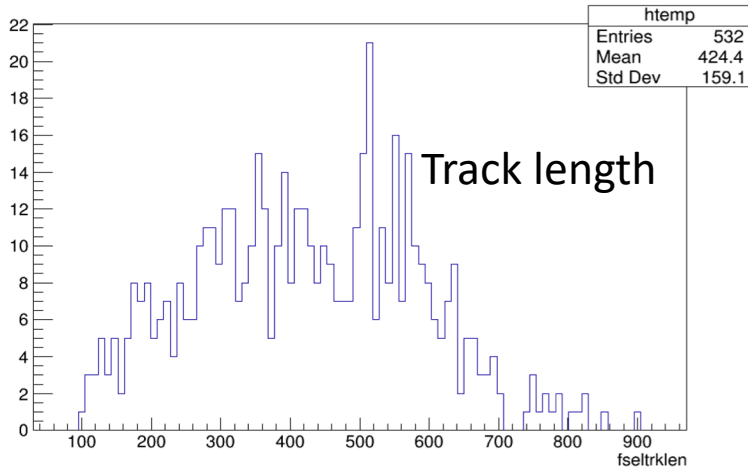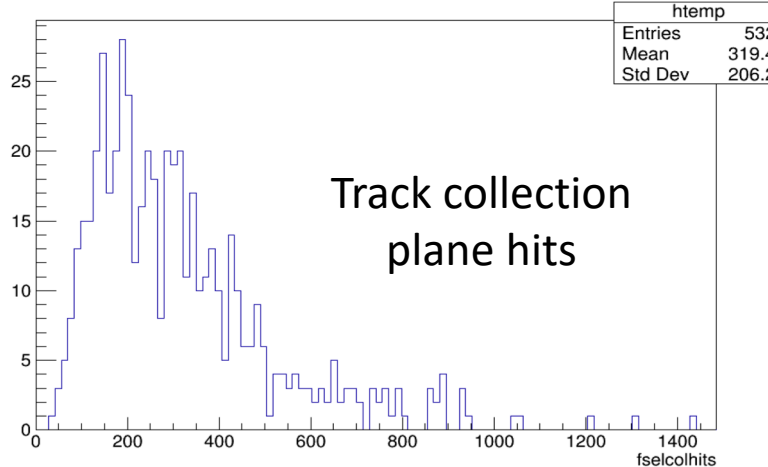
Candidate muon reco kinematics (cont.)

MC truth Study

- Total events: 1890 events
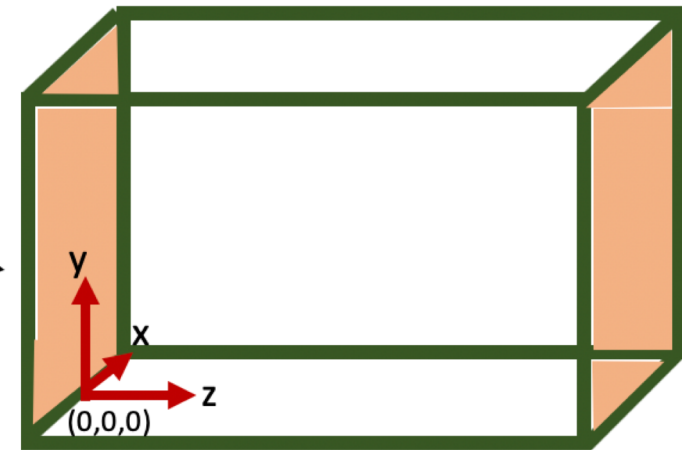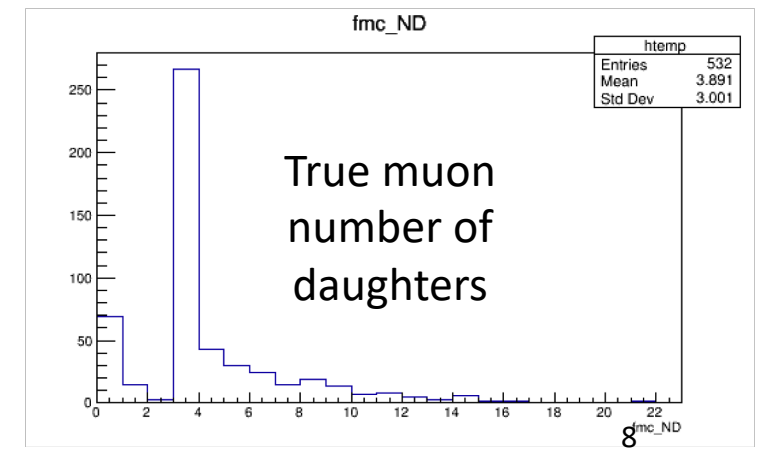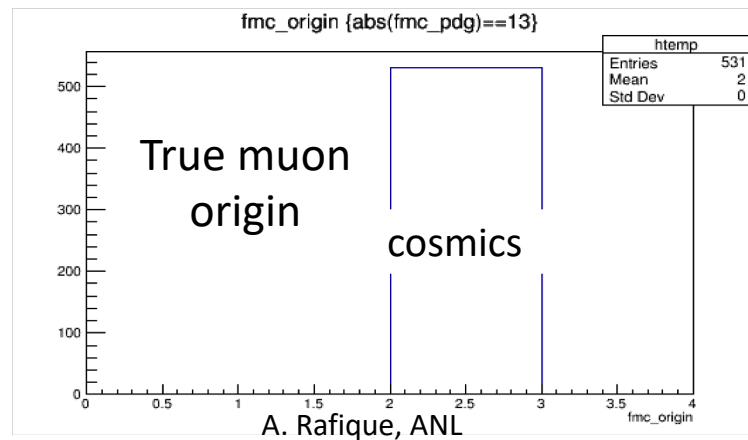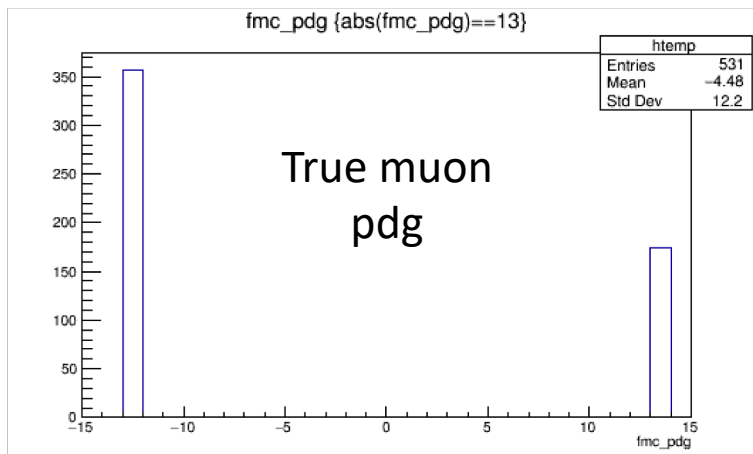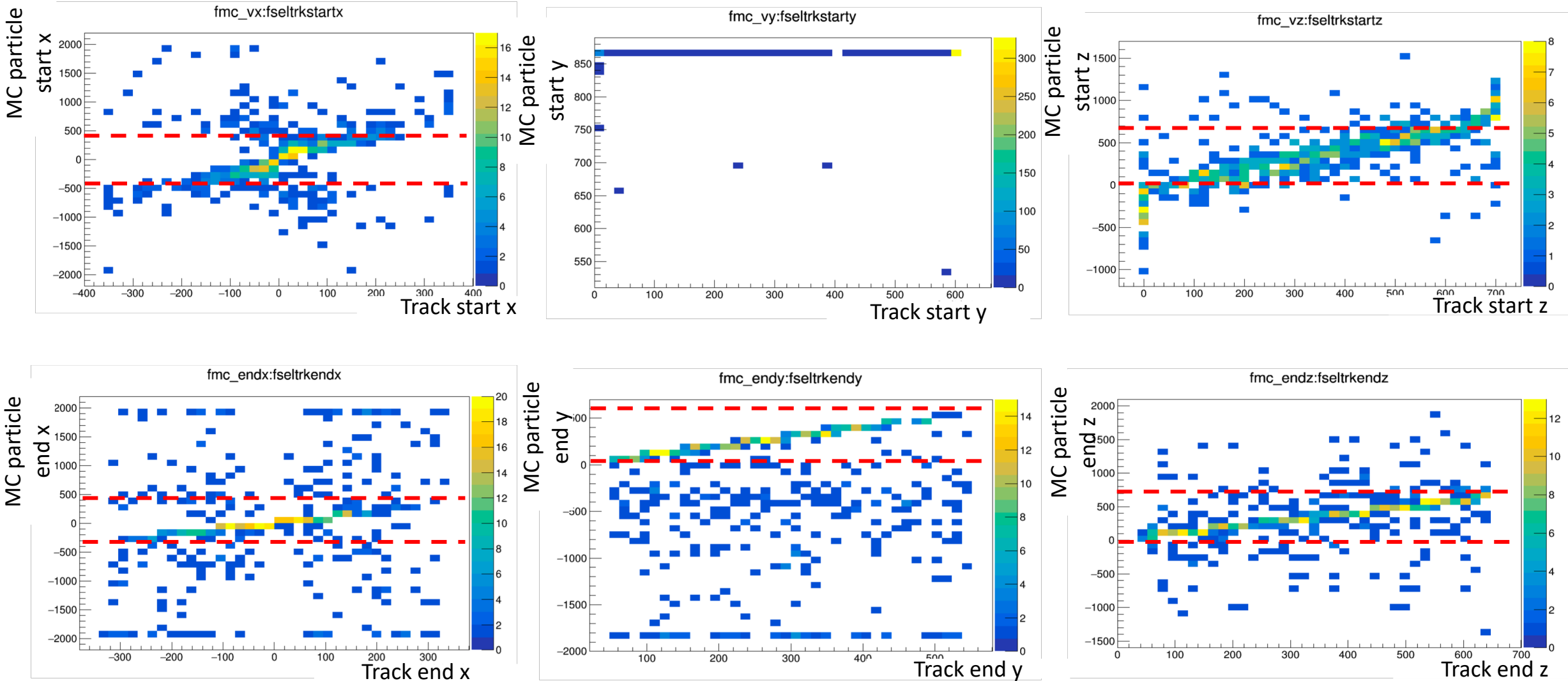
- Selected decaying candidate muons: 532

- Selection rate: 28%

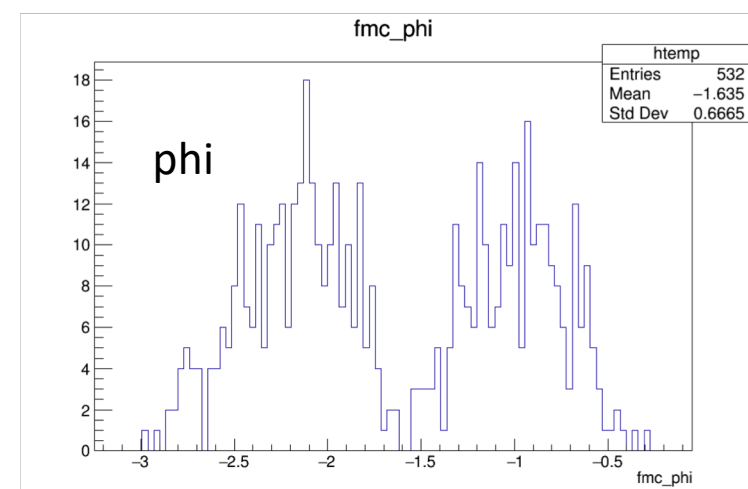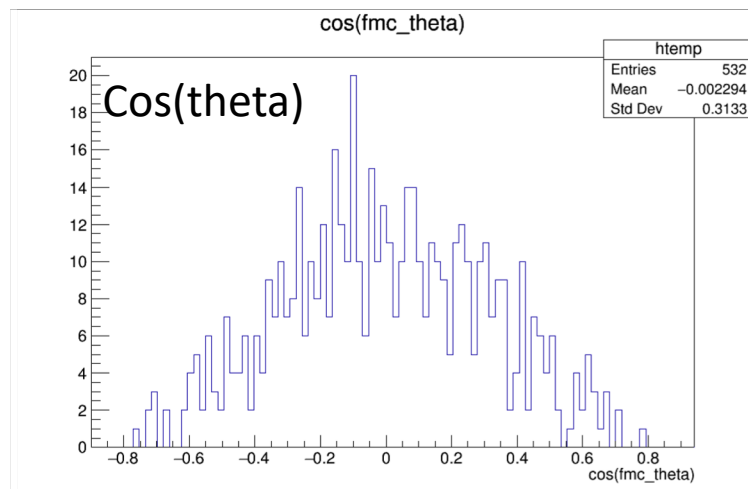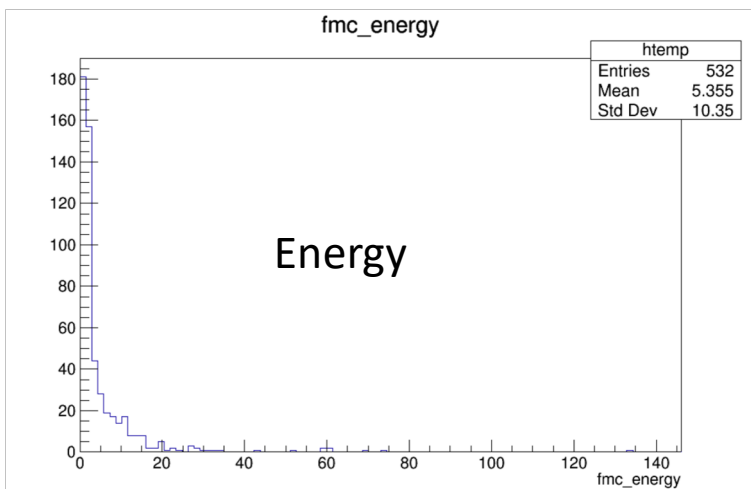- Using reco-truth matching:
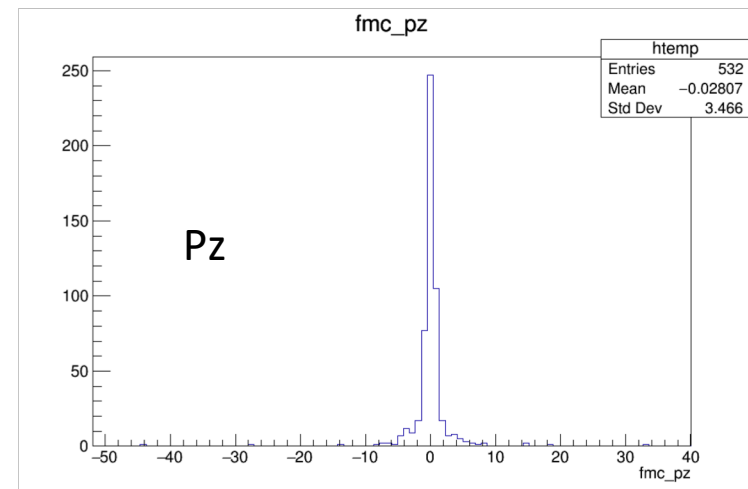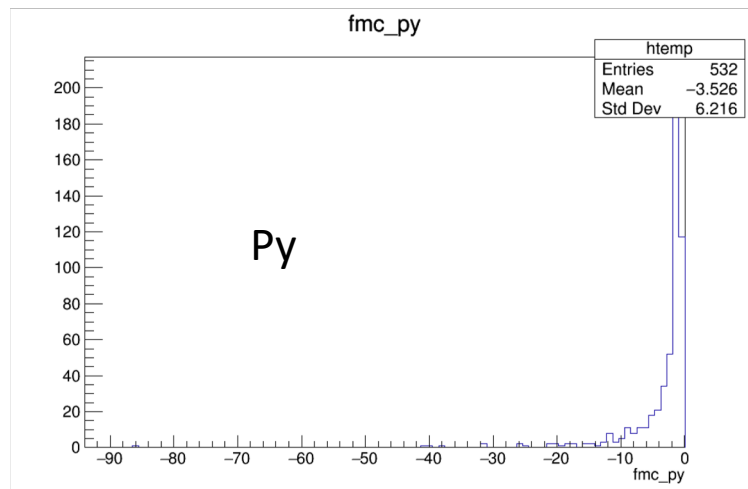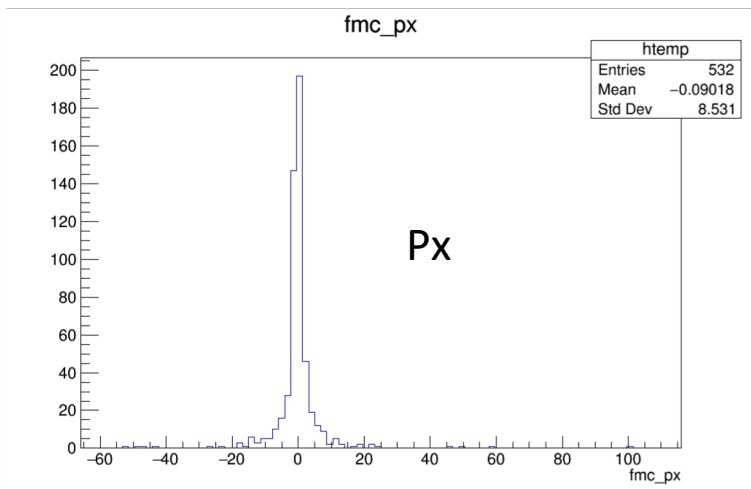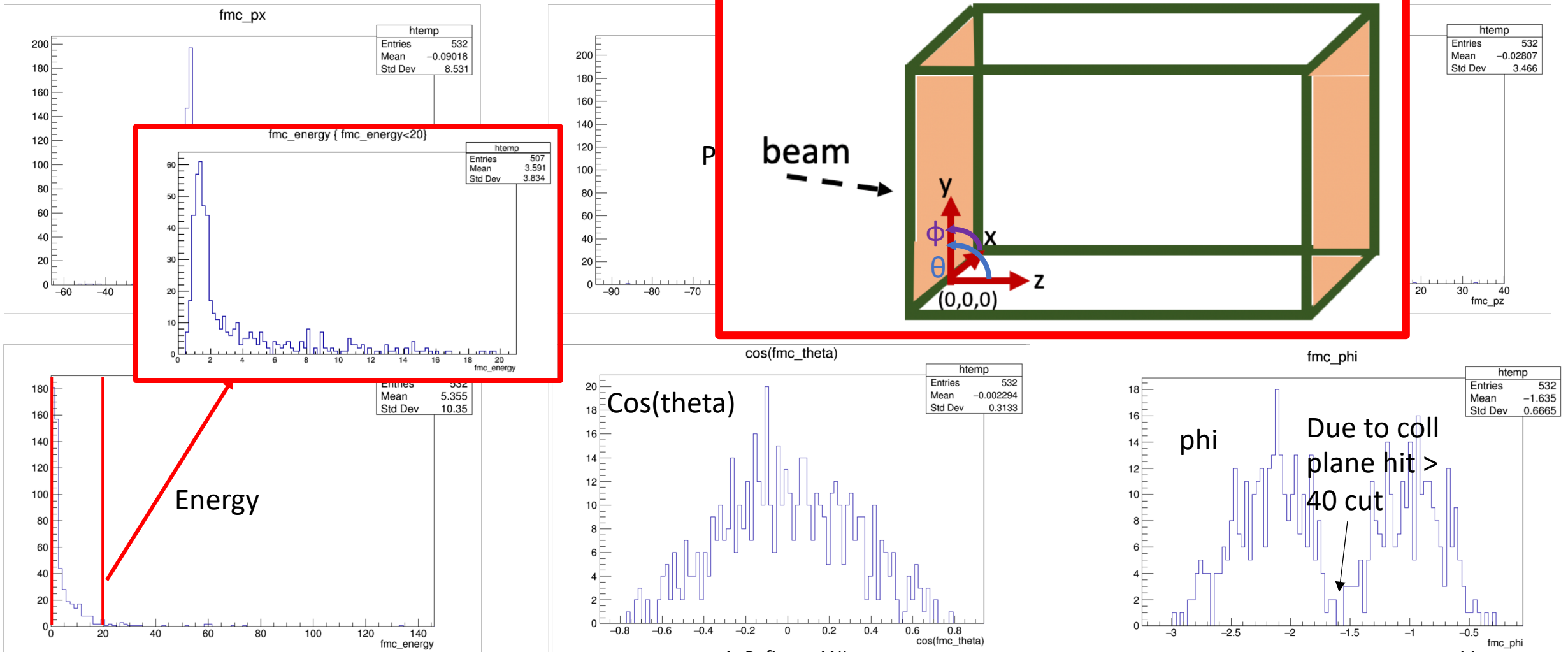 - True muons: 99.8% from cosmics

Reco vs true kinematics

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Fiducial volume boundaries

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MC truth muon kinematics

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MC truth muon kinematics
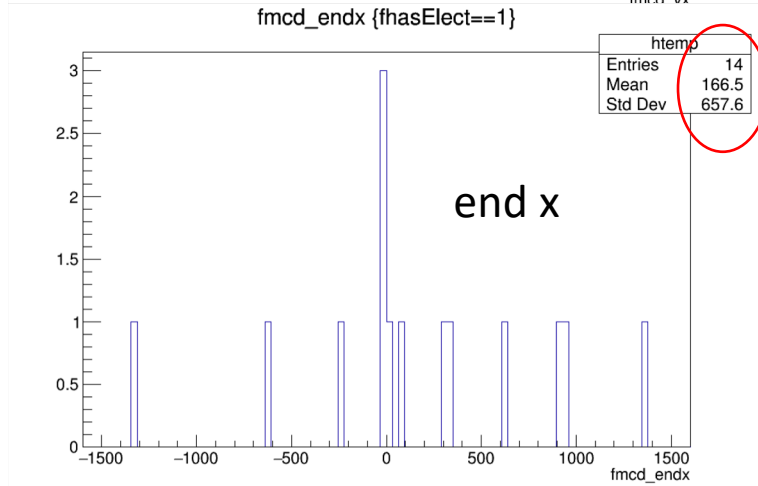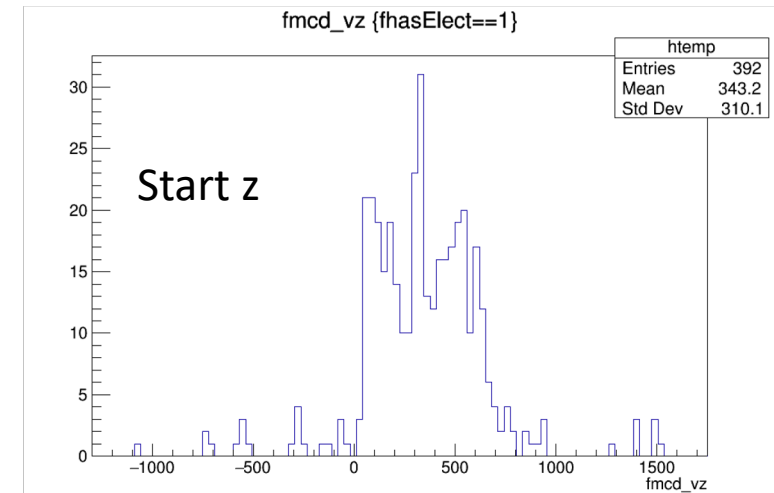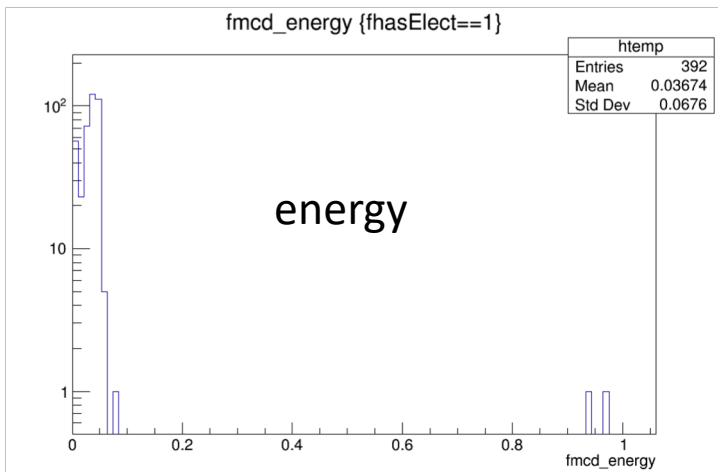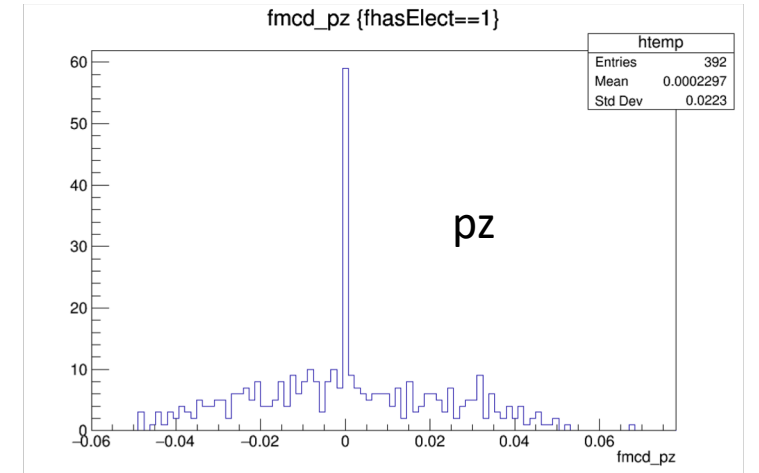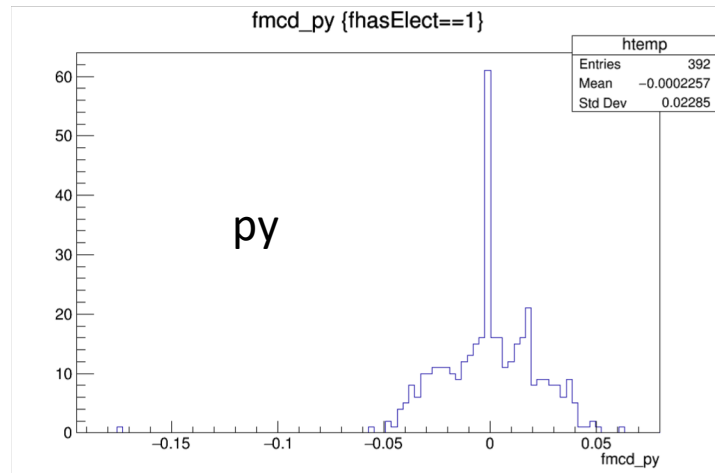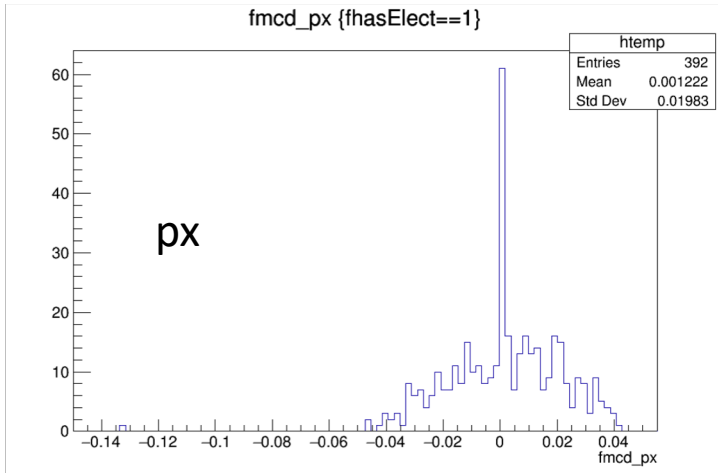

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MC truth study

- Total selected reco tracks = 532

- Total true matched muons = 531

- Selected true muons that decay into true electrons: 392

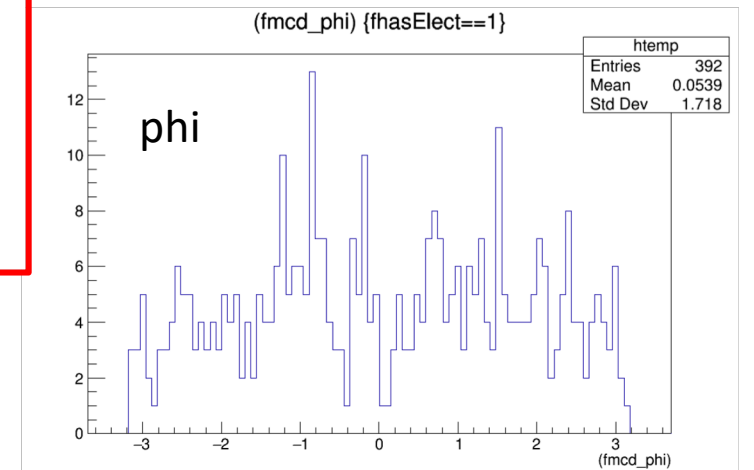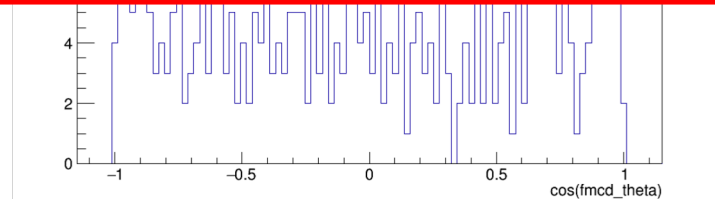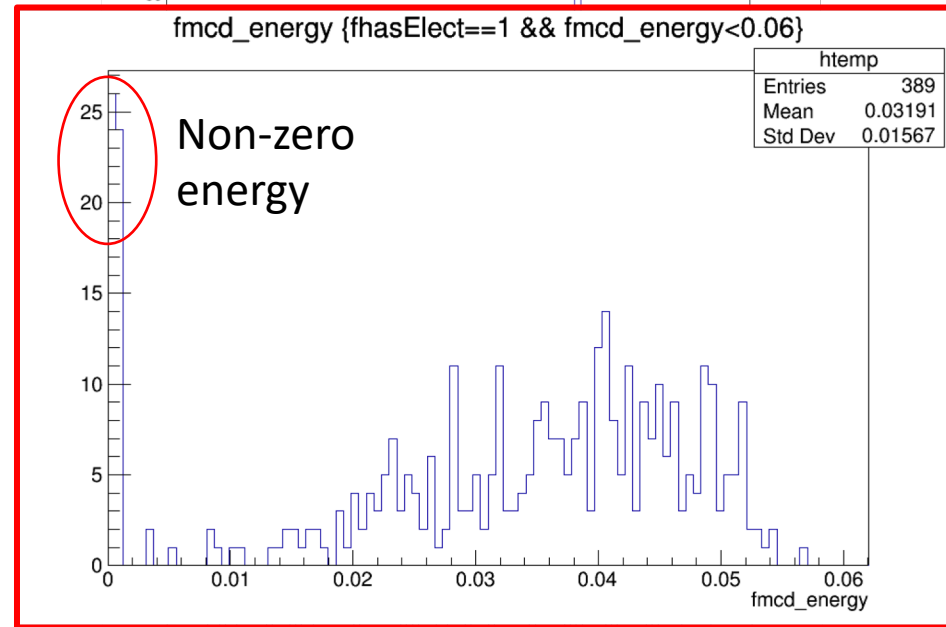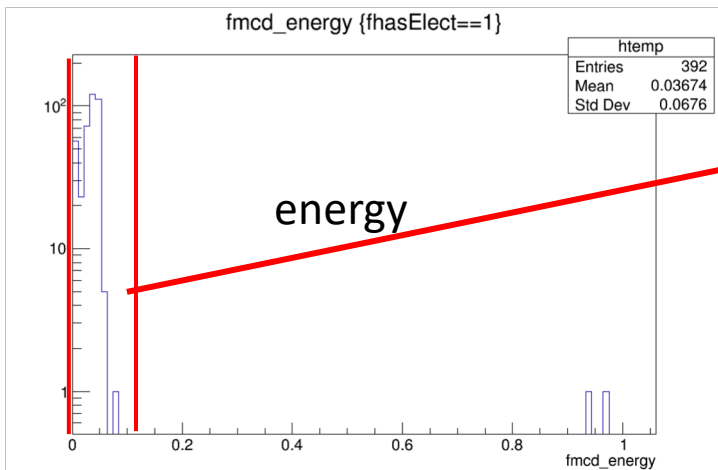- Sample purity = 392/532 = 74%

True michel electron kinematics
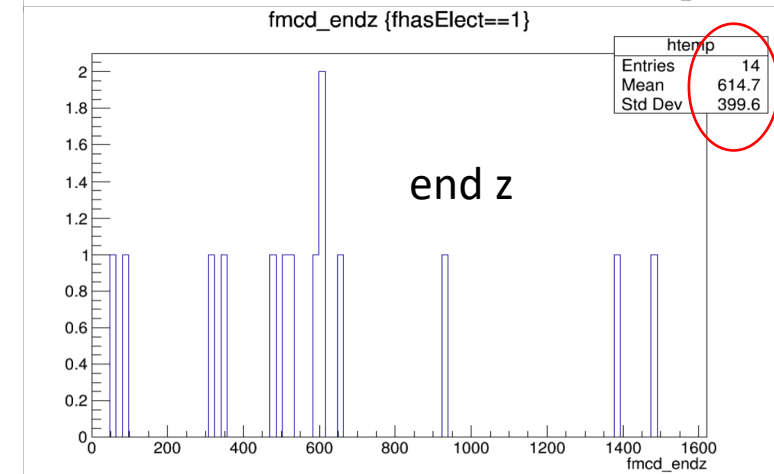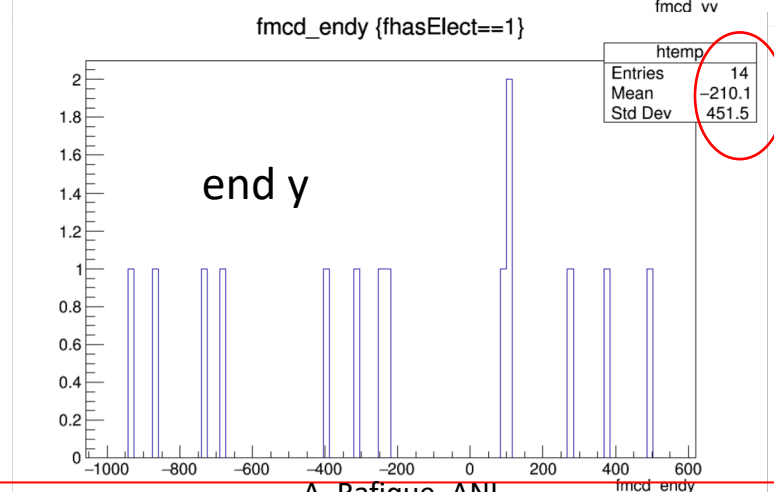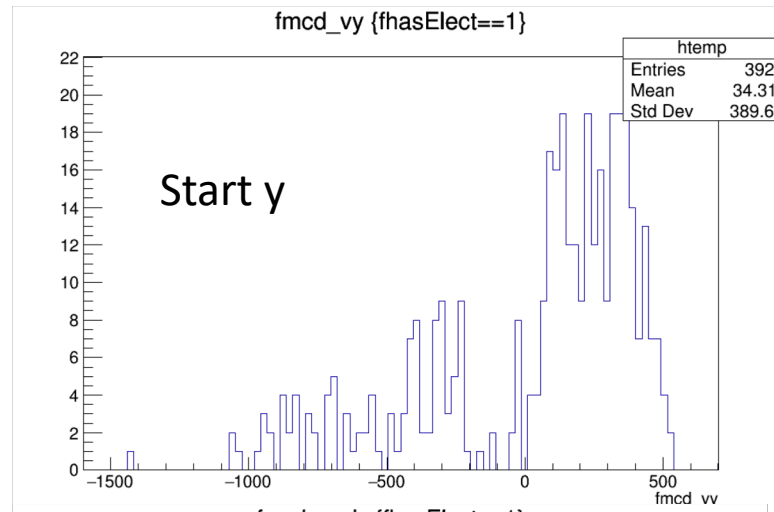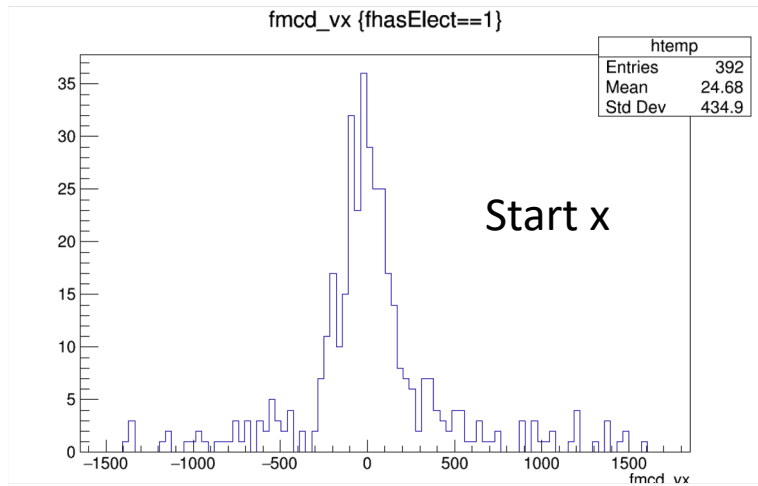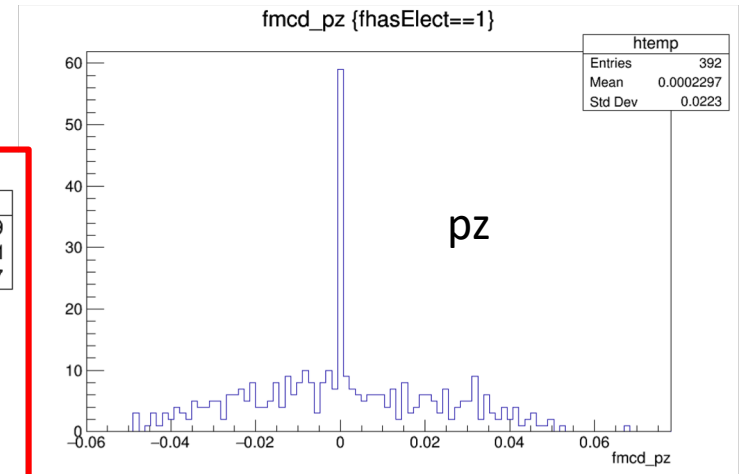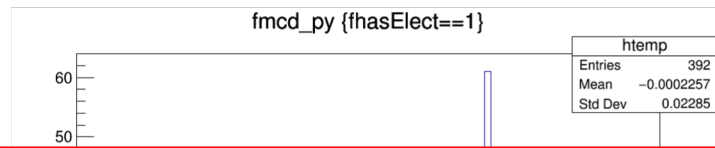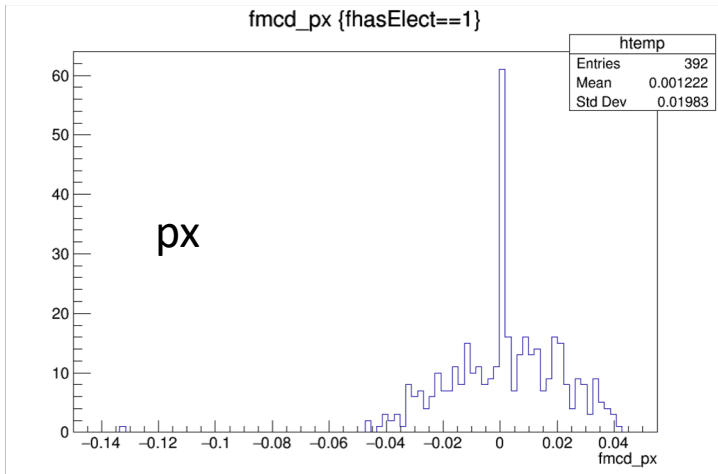
Most daughter electrons don't have any true end points associated with them

True electron kinematics
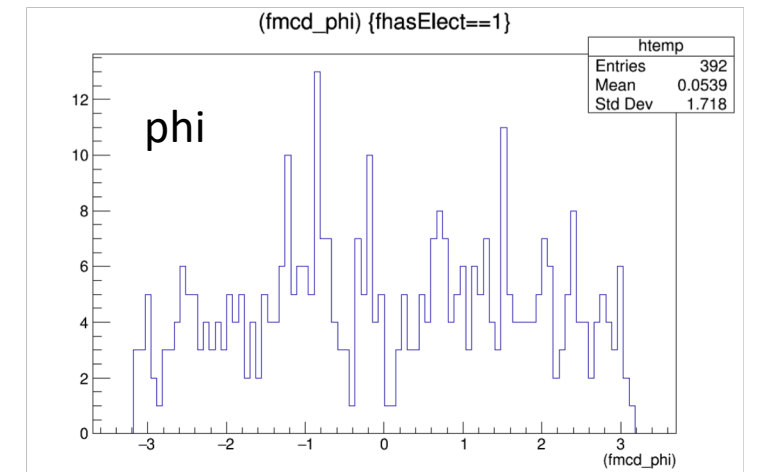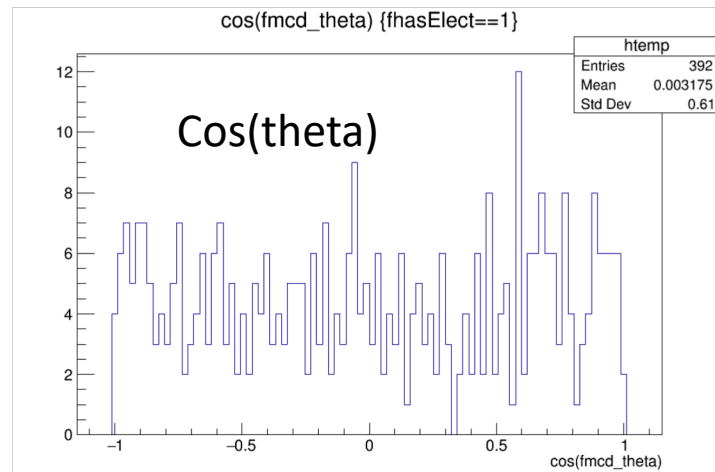
True electron kinematics

Summary and next steps

- MC true results look promising

- Selection works on MC

- We have a purity of about 74%

- Optimize the cut values

- Run the selection on data

- Use dQdx, dEdx information for the electronic shower energy reconstruction

- Use timing information from PD and TPC to verify the detection of michels.