

Assessment of the pandora reconstruction in a two-view far detector

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Lyon 1

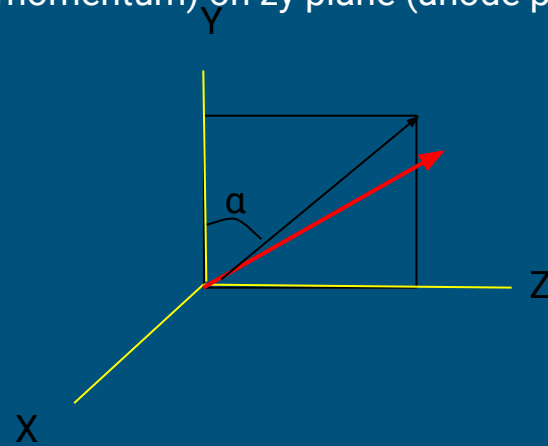
Intro

- The objective of this study is to understand why even in simple scenarios track reconstruction fails in a two view geometry
 - Surely more than one reason behind failures
 - Started by investigating cases where tracks are parallel to wire direction
 - Also investigating: angle between muons, angle with respect to drift direction

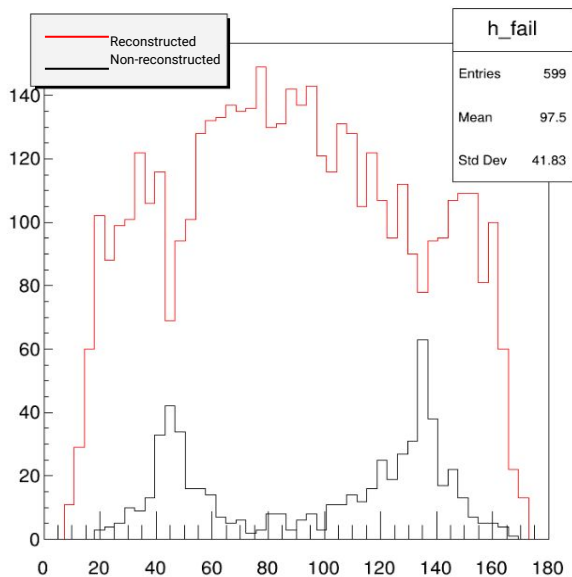
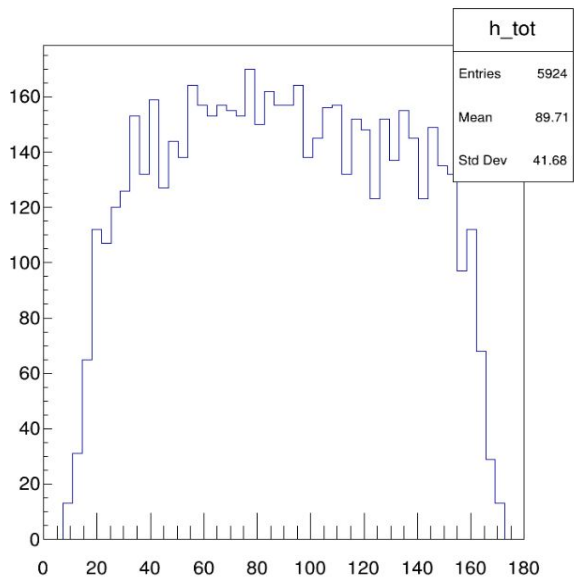
- Simulation used:
 - di muon events
 - dunefd 1x2x6 geometry
 - induction wires being 45 degrees from Z and orthogonal form each other
 - Reconstruction done ignoring collection plane (two views) + calorimetry

Method: angular distribution on anode plane

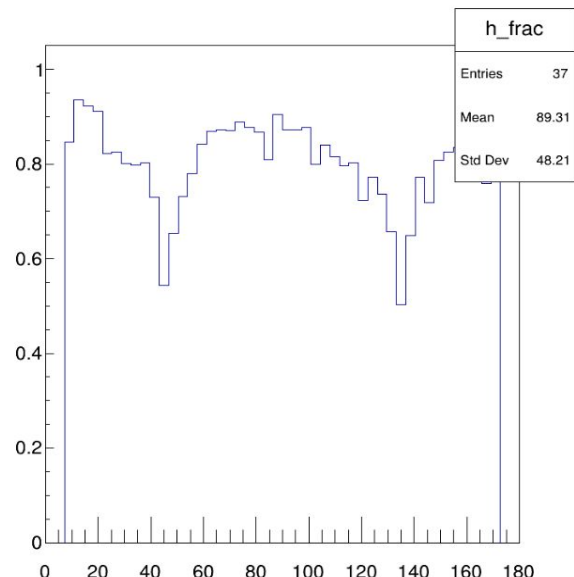
- Project the truth muon start direction (calculated with momentum) on zy plane (anode plane) then calculate angle between the trajectory and y-axis.
 - We expect wires to be at 45 and 135 degrees
- Our definition of a successful Reconstruction:
 - Muon has an associated pfparticle
 - Pfparticle is associated to this muon in all views
- Plot angular distributions for :
 - All muons
 - Muons that failed reconstruction.
 - Efficiency = muons that passed reconstruction / all muons



Angles between projection and y axis

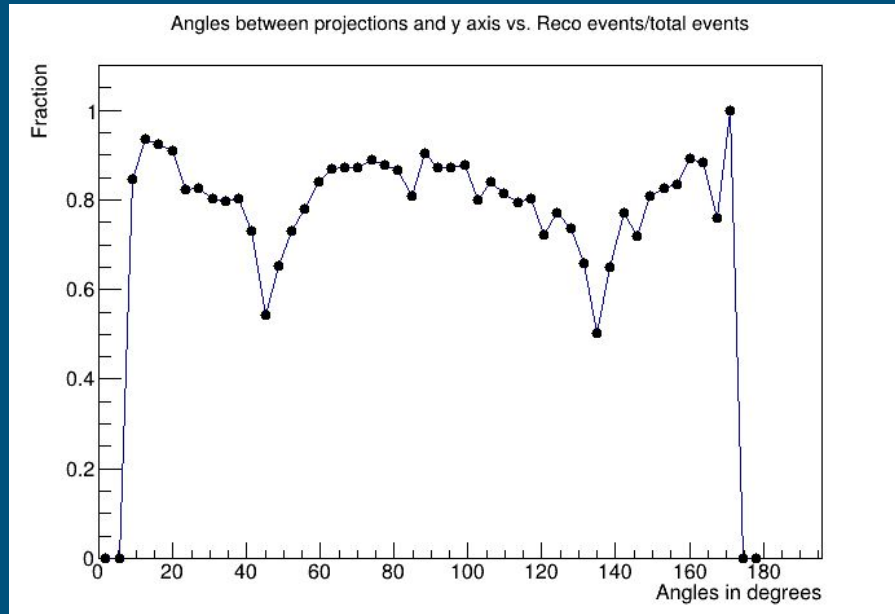


h_{reco}/h_{tot}



Current findings

- Significant population of particles with failed reco around 45 and 135 degrees
- In this geometry wire direction is ± 45 degrees, which could suggest difficulties in the reconstruction of parallel tracks



Event 9

Number of tracks: 1

Angle between muon trajectories : 38.8897

Angle between muon trajectories projected on zy plane:
25.2251

for truth particles :

Angles between projections on zy plane and y axis :

168.738

143.513

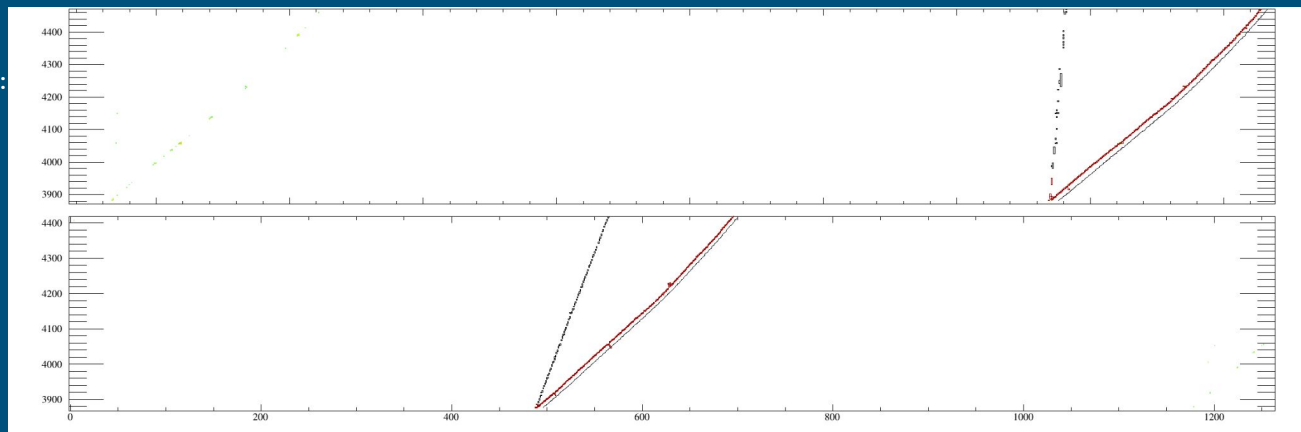
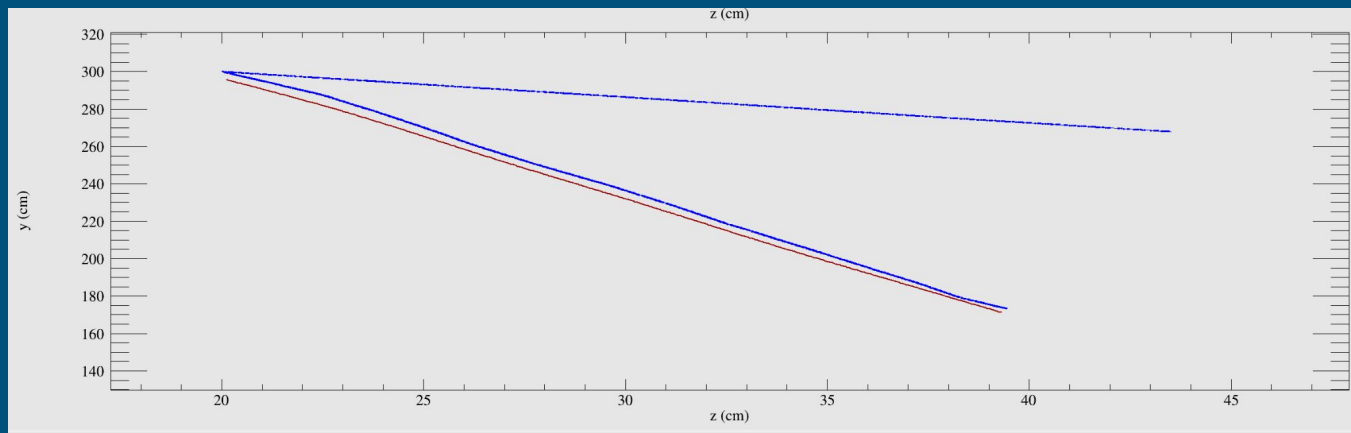
for tracks :

169.796 Associated distance : 134.49

Angles between muons and x axis :

71.8697

38.4561



Event 20

Number of tracks: 1

Angle between muon trajectories : 43.1256

Angle between muon trajectories projected on zy plane:
25.1724

for truth particles :

Angles between projections on zy plane and y axis :

30.4067

55.5791

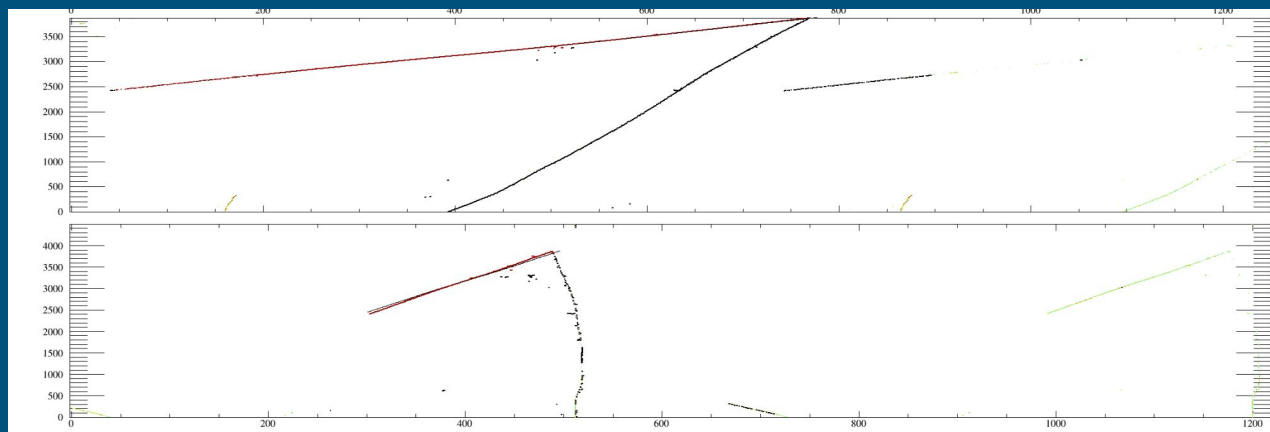
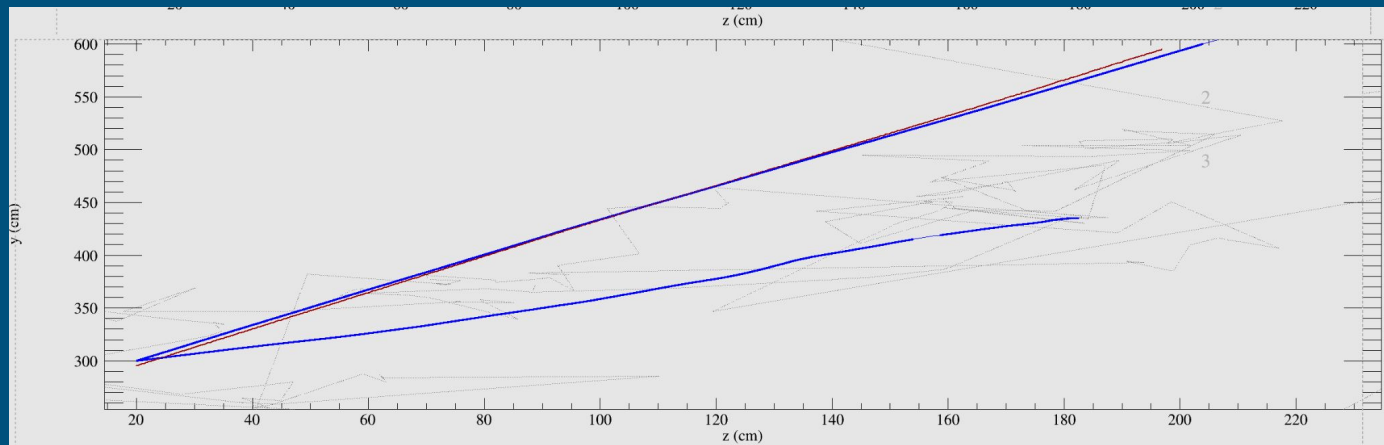
for tracks :

30.0054 Associated distance : 366.336

Angles between muons and x axis :

109.615

148.688



Event 21



Number of tracks: 1

Angle between muon trajectories : 41.1619

Angle between muon trajectories projected on zy plane: 35.5917

for truth particles :

Angles between projections on zy plane and y axis :

134.972

99.3803

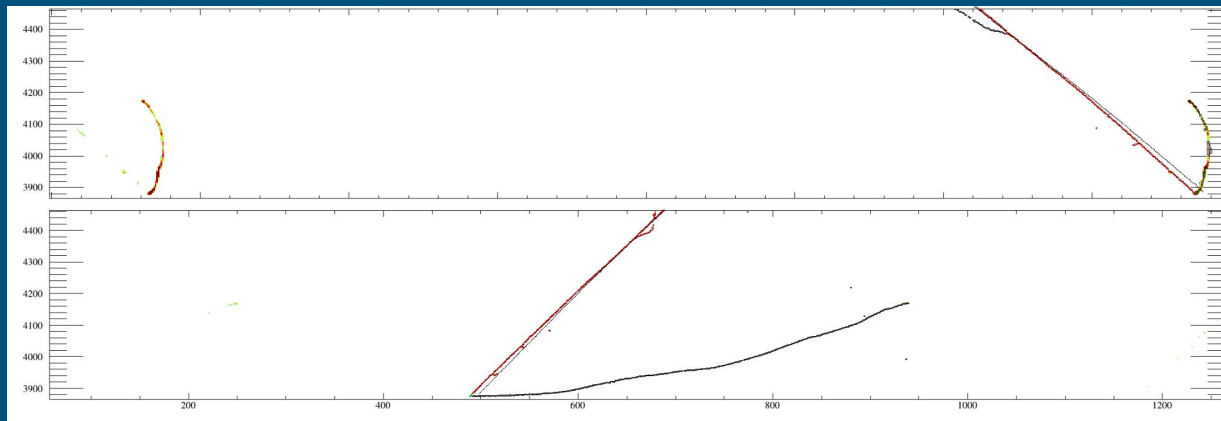
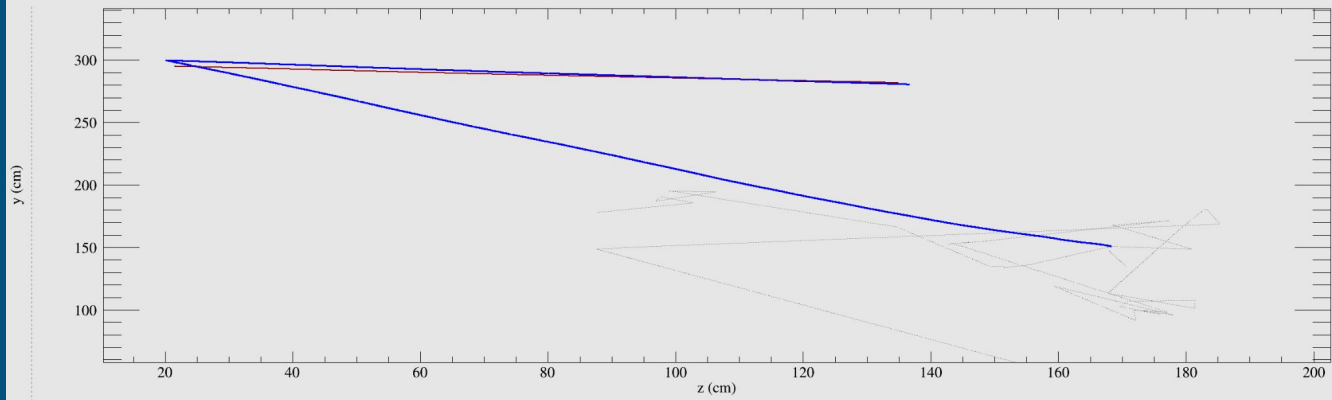
for tracks :

96.8474 Associated distance : 123.421

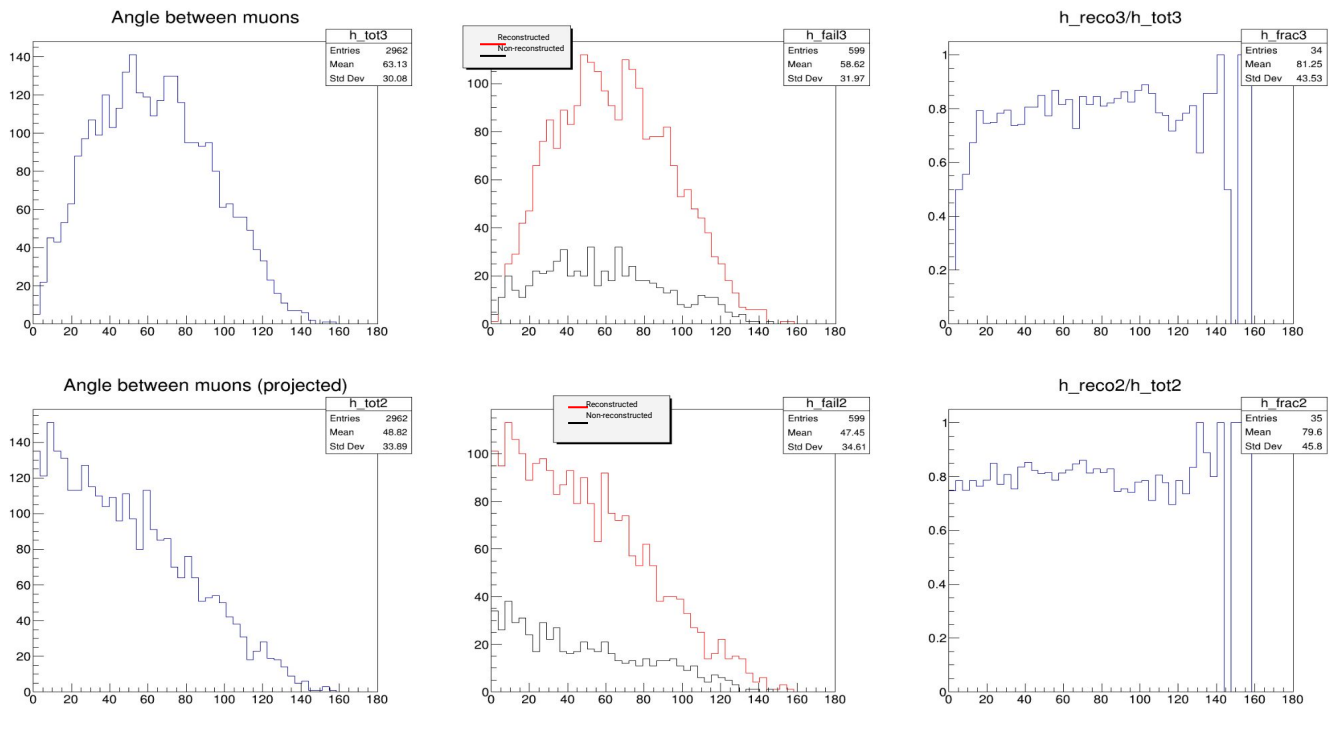
Angles between muons and x axis :

88.7074

66.1828



Angle between muons



- First row angle between muons
 - Low efficiency on small angles comes from a bug, will redo plots with bug fix
- Second row angle between muons projected on zy plane
 - No drop in efficiency in small angles?

Conclusions

- Current failure modes identified:
 - Truth trajectories parallel to wires
- As expected tracks parallel to wires have lower reconstruction efficiency in a two view geometry
 - 40% of total failed events

To do

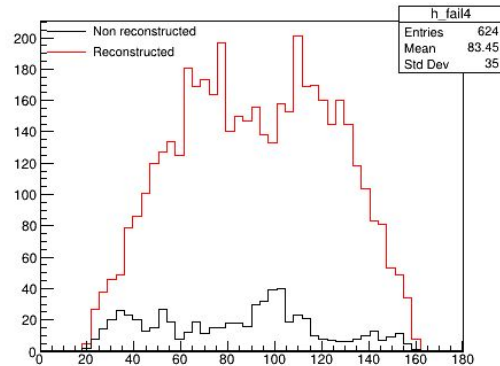
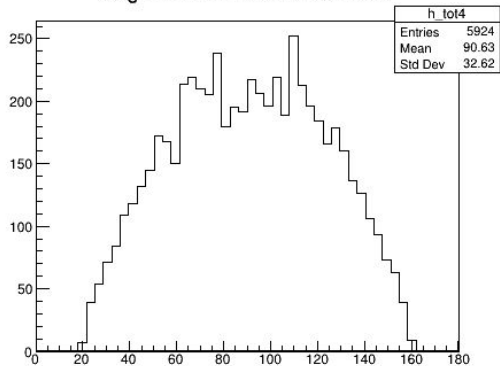
- Confirm findings with event displays
- Redo plots
 - with more statistics (and)
 - for 3 view geometry and 2 view without calorimetry matching
- Look at events with pandora event display
 - Search for other failure modes
 - Understand which step of reconstruction fails
 - charge profile plots

Backup slides

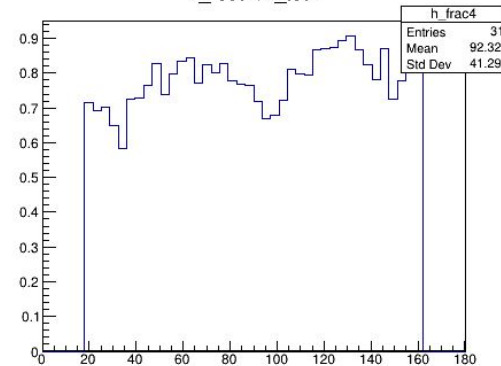
Unresolved issues

- Projected angles of truth particles not do not always correspond to what we see in the event displays (tracks not always parallel even if 45/135 degrees)
 - Possible problem in code
- Each run has a very small amount of events (4-12) that were completely ignored by the reconstruction

Angle between muons and x axis



h_reco4/h_tot4



Angle
between
particule and
drift
direction (x
axis)

- Maybe simulation generates muons between 20 and 160 degrees?

Event displays

Event 4 (retomar event) disp

Number of tracks: 2

Angle between muon trajectories : 50.6446

Angle between muon trajectories projected on zy plane:
28.3854

for truth particles :

Angles between projections on zy plane and y axis :

140.756

112.37

for tracks :

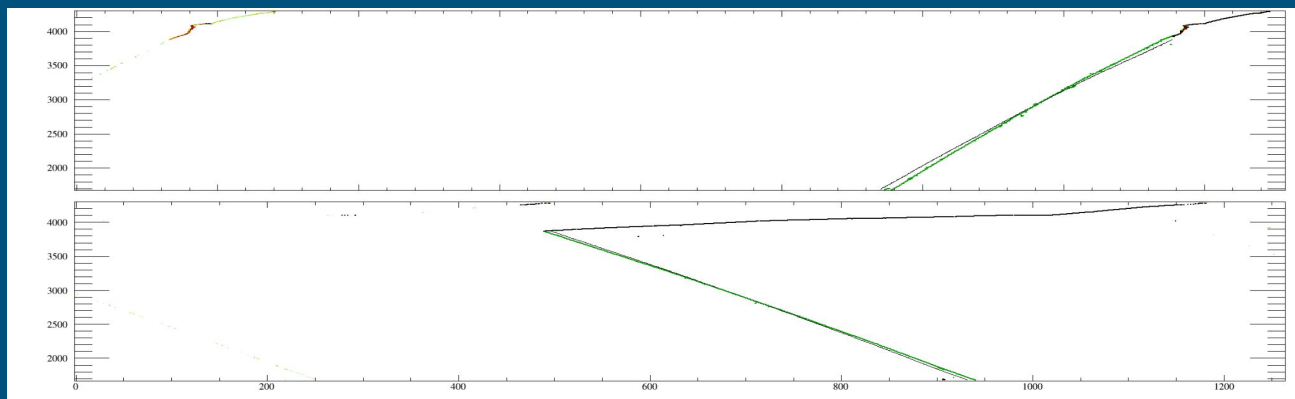
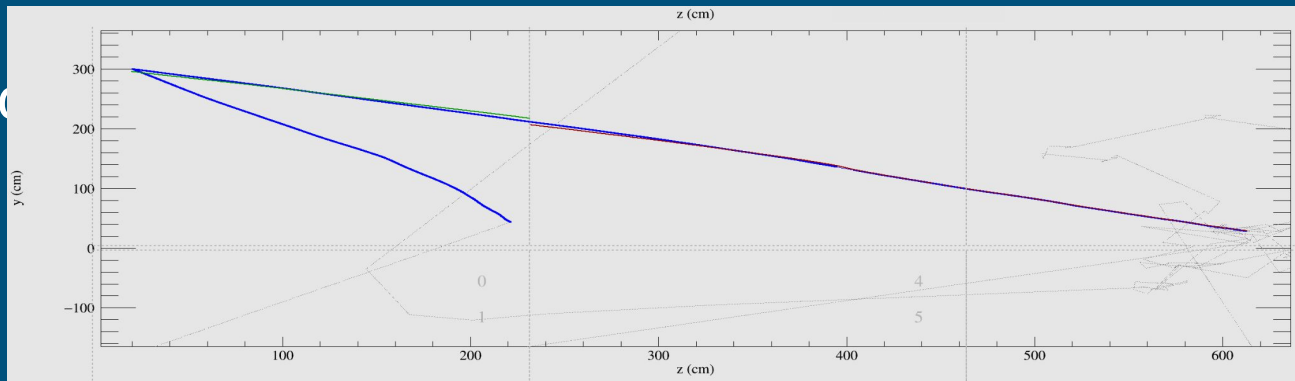
109.79 Associated distance : 523.167

110.633 Associated distance : 286.28

Angles between muons and x axis :

82.6016

125.628



Event 7

Number of tracks: 1

Angle between muon trajectories : 14.153

Angle between muon trajectories projected on zy plane: 9.63575

for truth particles :

Angles between projections on zy plane and y axis :

125.485

115.849

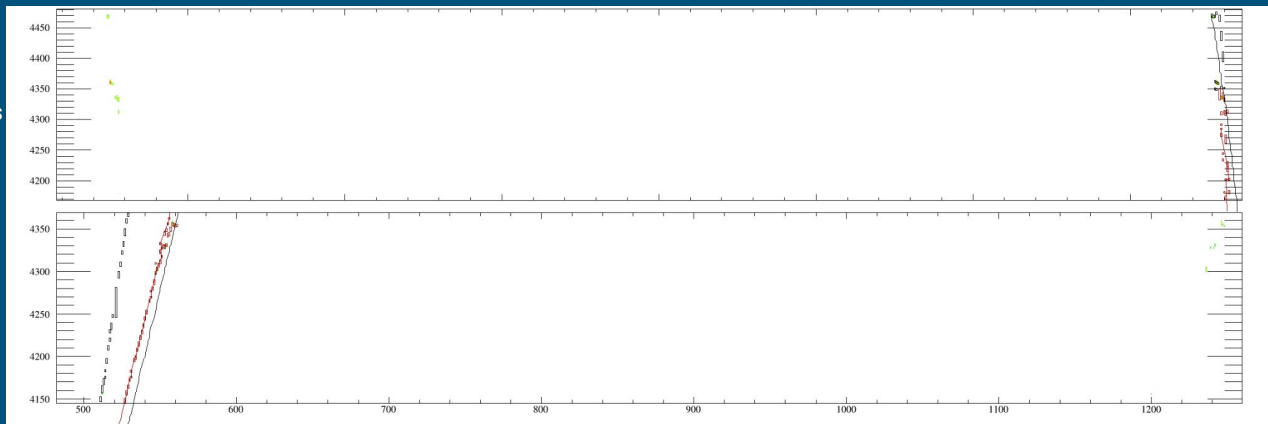
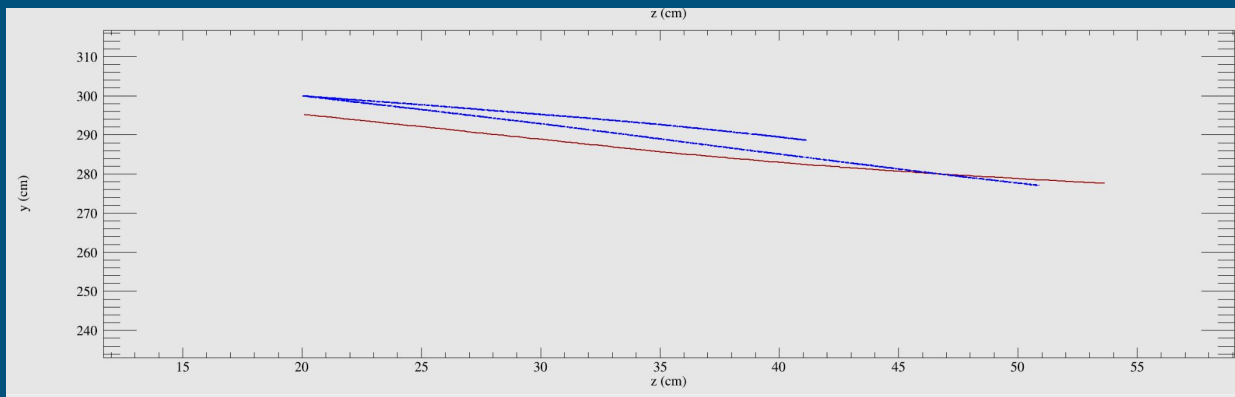
for tracks :

122.387 Associated distance : 60.426

Angles between muons and x axis :

39.9821

26.8217



Event 16

Number of tracks: 2

Angle between muon trajectories : 25.2728

Angle between muon trajectories projected on zy plane:
33.2392

for truth particles :

Angles between projections on zy plane and y axis :

84.3037

51.0645

for tracks :

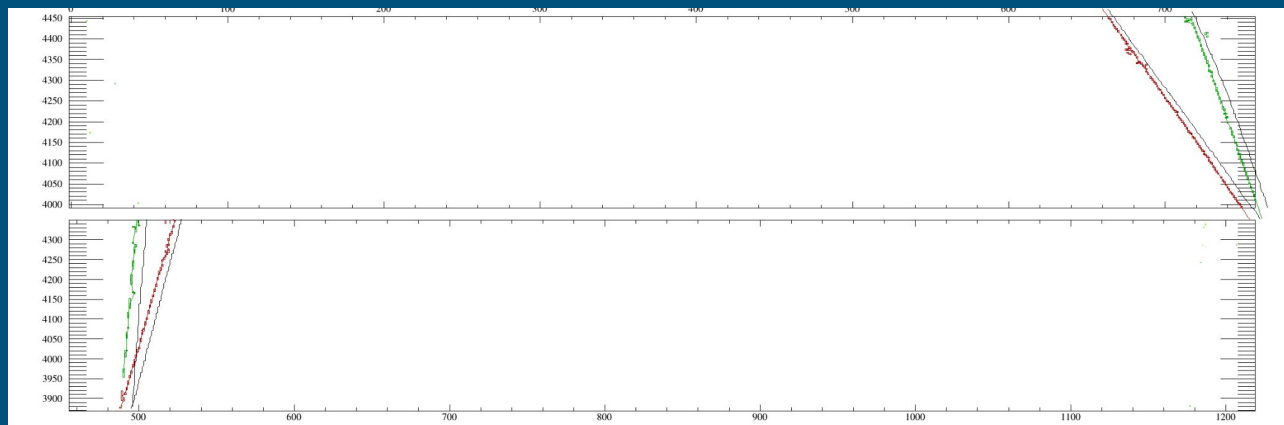
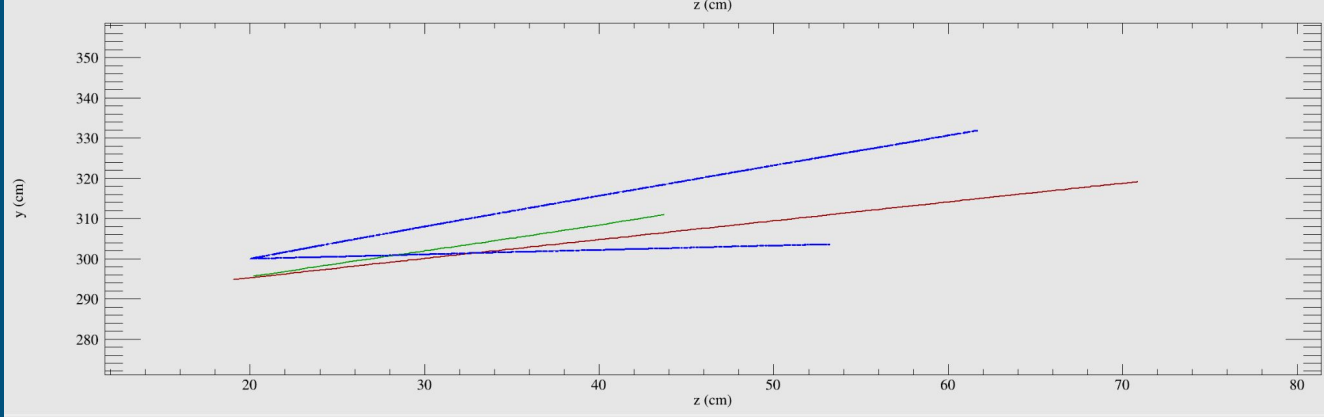
63.7401 Associated distance : 74.3591

57.238 Associated distance : 54.6844

Angles between muons and x axis :

33.7856

47.5241



Event 24

Number of tracks: 2

Angle between muon trajectories : 53.2189

Angle between muon trajectories projected on zy plane:
53.7088

for truth particles :

Angles between projections on zy plane and y axis :

135.642

81.9333

for tracks :

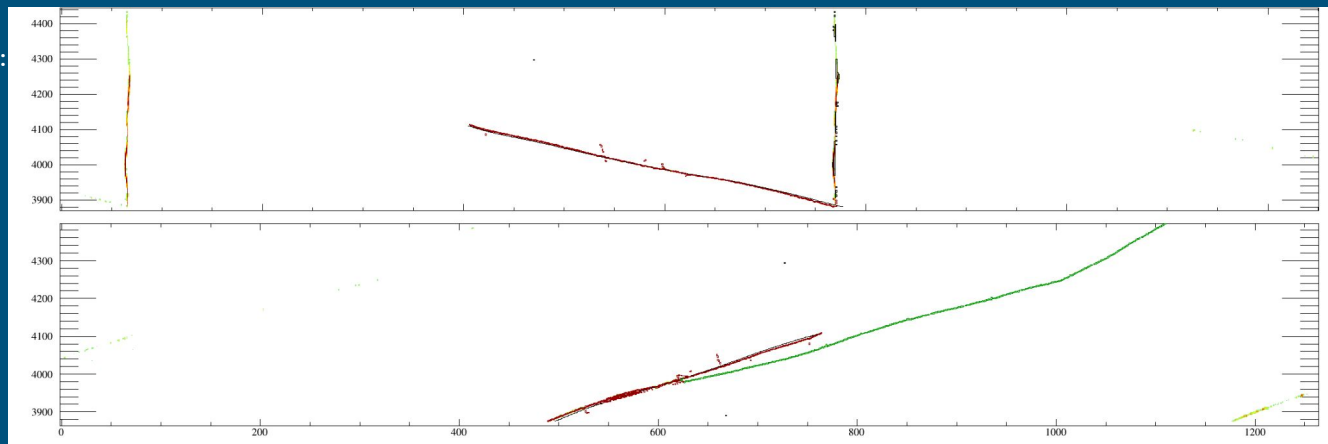
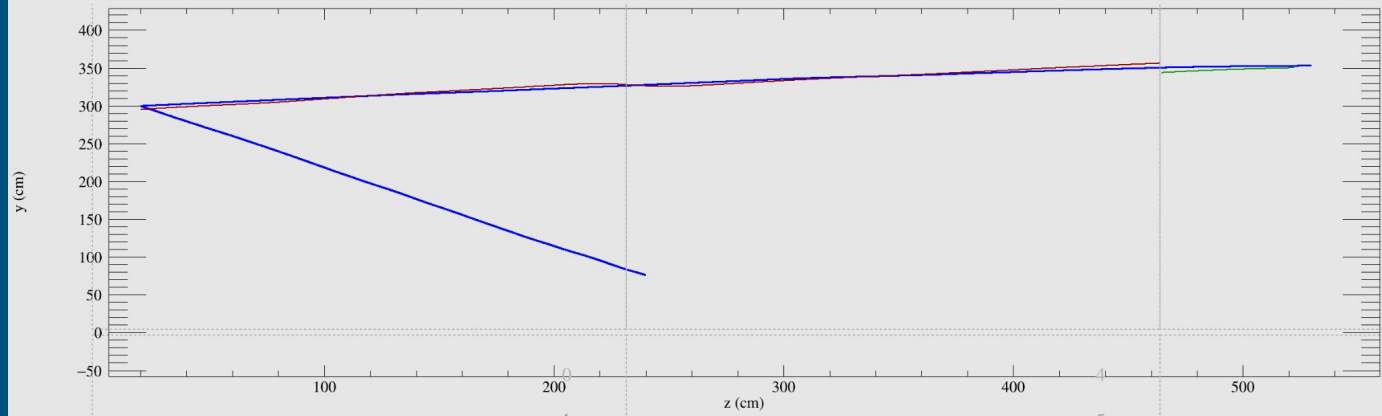
79.2498 Associated distance : 451.086

81.317 Associated distance : 58.2493

Angles between muons and x axis :

79.9963

83.5267



Event 32 (interessante mirage xz)

Number of tracks: 1

Angle between muon trajectories : 76.1495

Angle between muon trajectories projected on zy plane:
73.7187

for truth particles :

Angles between projections on zy plane and y axis :

30.3267

104.045

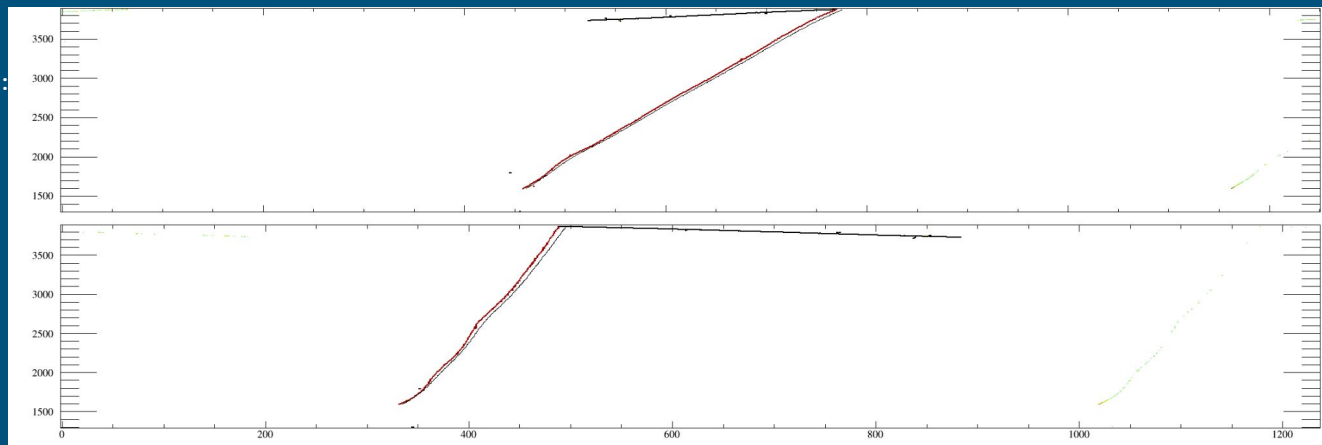
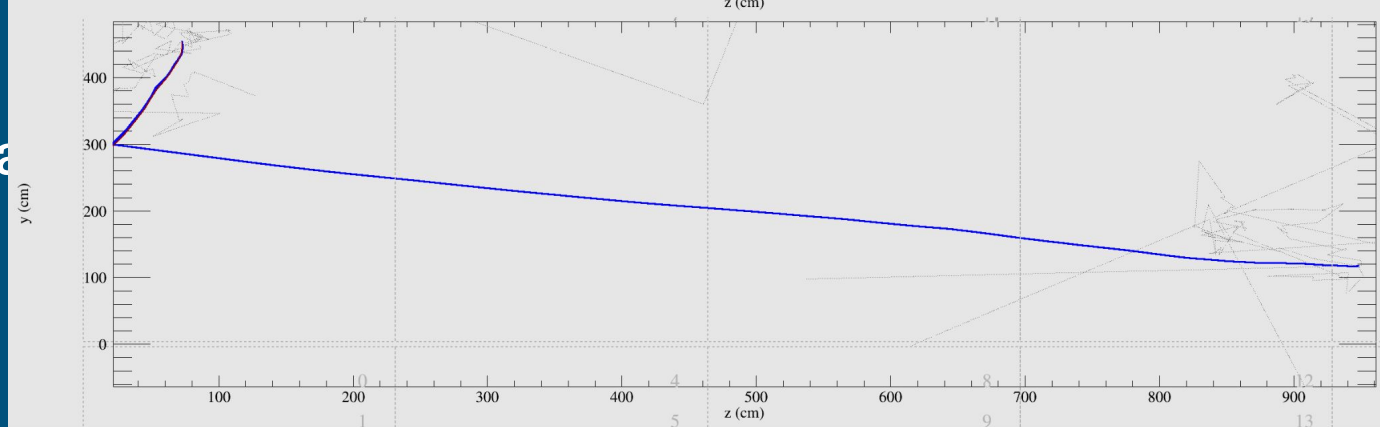
for tracks :

27.7281 Associated distance : 246.262

Angles between muons and x axis :

131.295

92.5148



Event 42

Mismatch views