SR Fitter Performance with Stopping Muons

The purpose of this exercise is to quantify track fitter failures in a stopping muon sample:

- run the track finder and select a set of stopping muons
- run the track fitter (SR and SA) and determine how many stopping muons fail

I will show results for the SR fitter. The comparison with the SA fitter is work in progress.

Data Selection

- Data: 48 runs (13532$<$Run$<$13748, March 2003), $\approx$ 6 livedays.
- Run the SR track finder, TrackSR (use frozen release R1.0), and select stopping muons:
  - SM1 only. Good demux status. One track.
  - Distance from vertex to detector edge $<$ 50cm or trk.vtx.plane$\leq$10 or trk.vtx.plane$\geq$238
  - z projected distance from track end to detector edge (trace) $>$ 50 cm (steep tracks)
  - End of track containment cuts: at least 50 cm from detector edge and within planes 10 and 238 (trk.end.plane$>$10 and trk.end.plane$<$238)

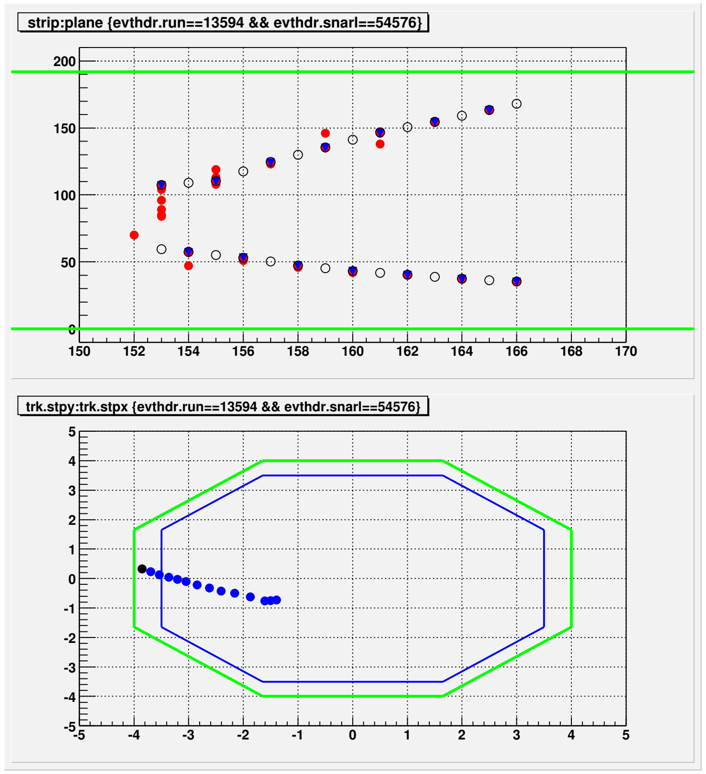
- Run the SR track fitter, FitTrackSR (use frozen release R1.0), with the 1745 events that were stopping according to TrackSR:
  - Require good fit (number of planes in u and v views match; good fit χ^2): 1745$\rightarrow$ 1628
  - Require vertex to be outside fiducial volume: 1628$\rightarrow$1585
  - Apply track end containment cuts: 1585$\rightarrow$1564

Fail fit quality cut (117 events)

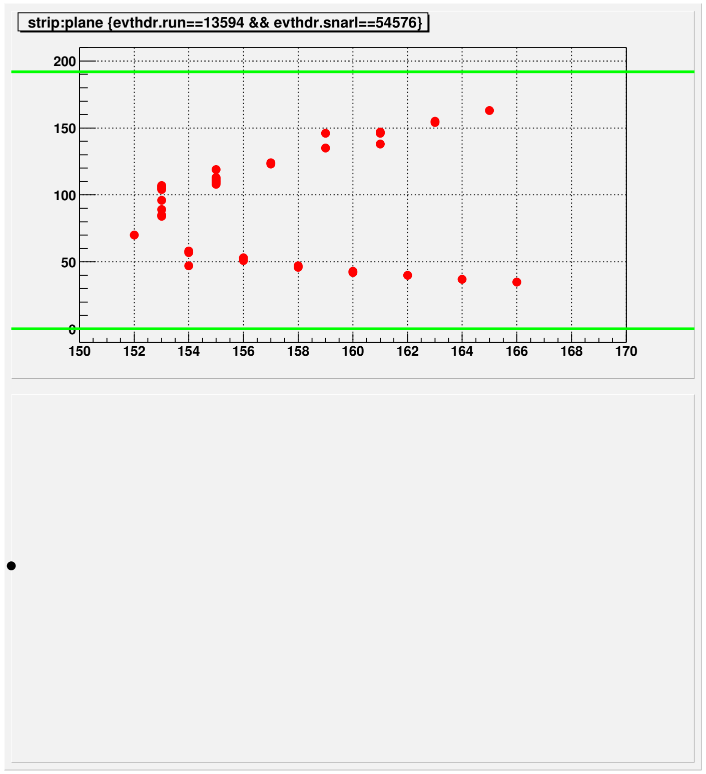
Scan 25 events. In most cases short, shower-like events. However some events ($\sim$ 5) have longer tracks ($>$ 15 planes).

Run 13594, Snarl 54576

TrackSR



FitTrackSR

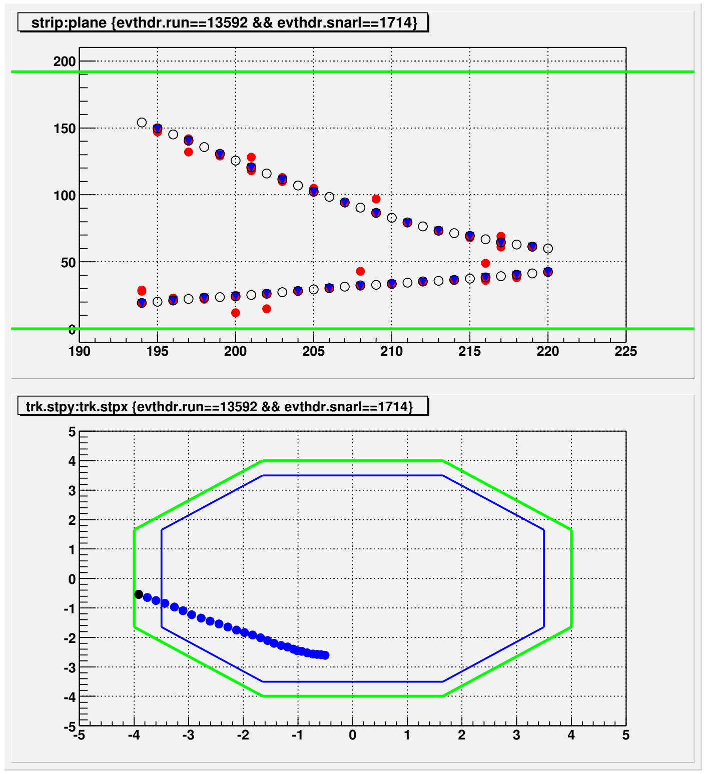


Fail fit quality cut (cont)

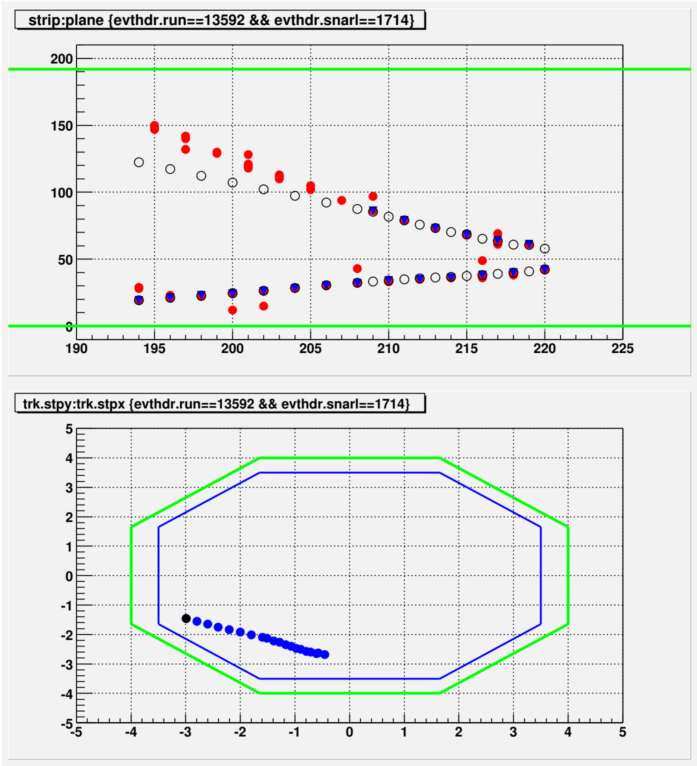
FitTrackSR failure (2 events)

Run 13592, Snarl 1714

TrackSR



FitTrackSR

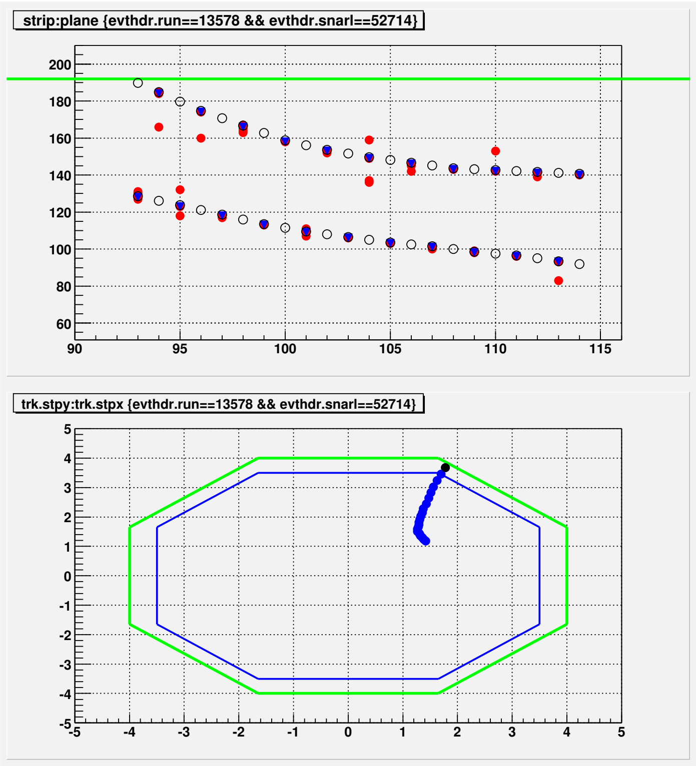


Fail non fiducial vertex cut (43 events)

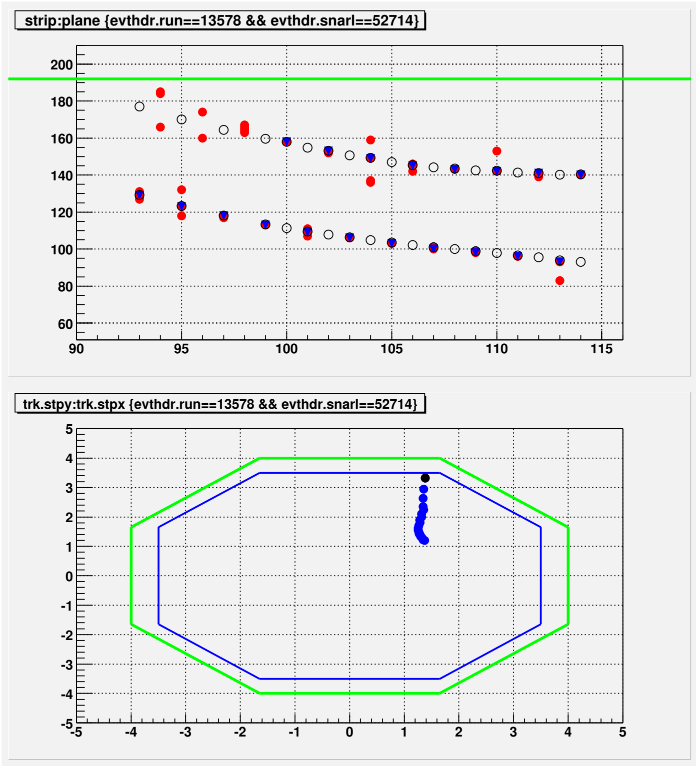
Scan 25 events. In most cases (22) FitTrackSR failed to include hits at the beginning of the track.

Run 13578, Snarl 52714

TrackSR



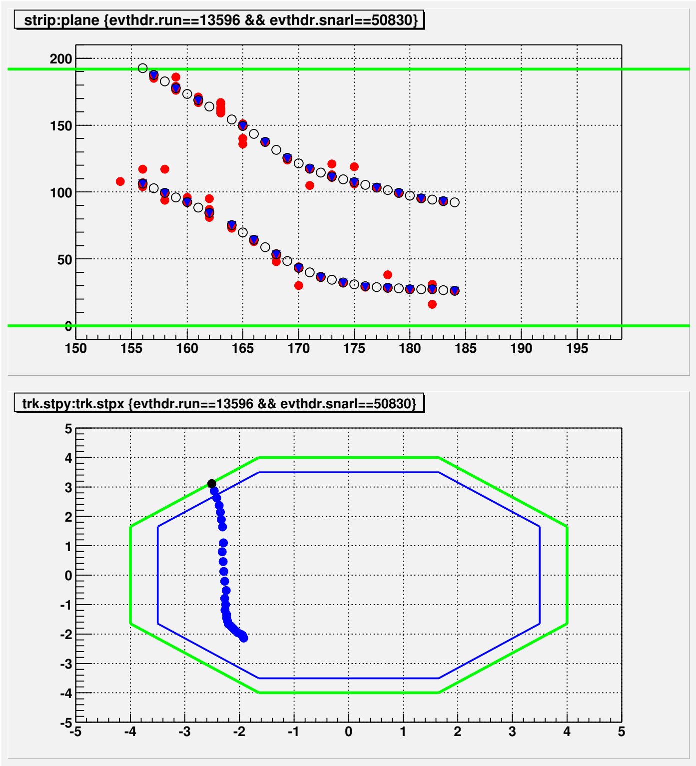
FitTrackSR



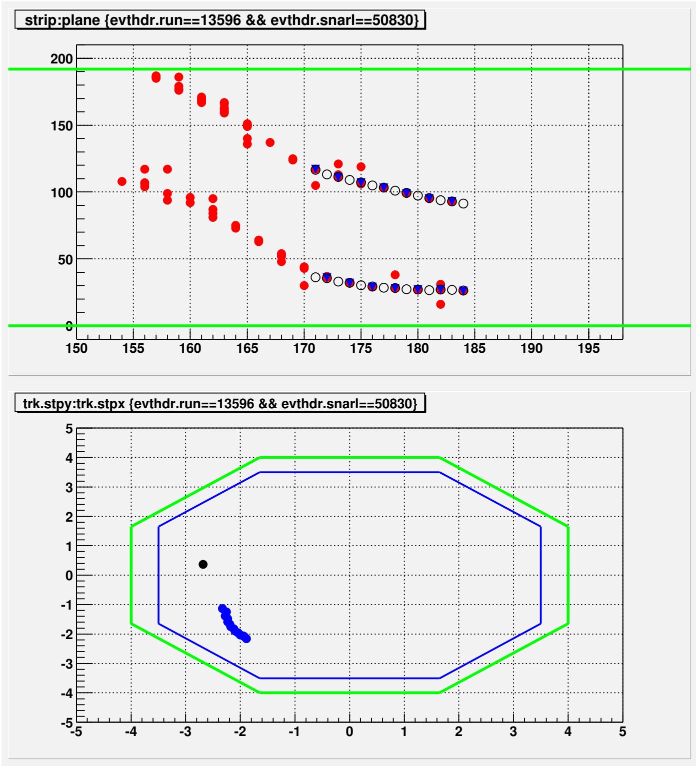
Fail non fiducial vertex cut (cont)

Run 13596, Snarl 50830

TrackSR



FitTrackSR

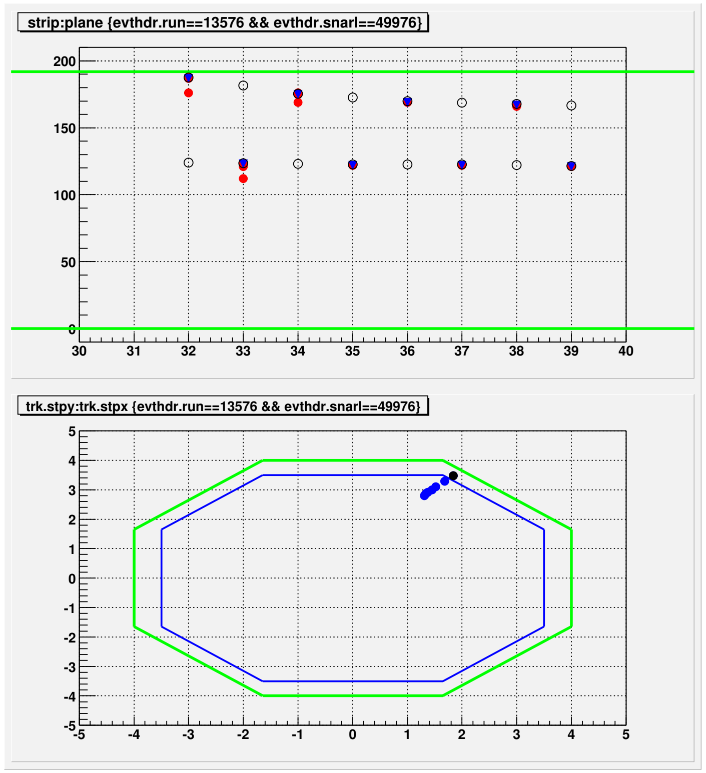


Fail non fiducial vertex cut (cont)

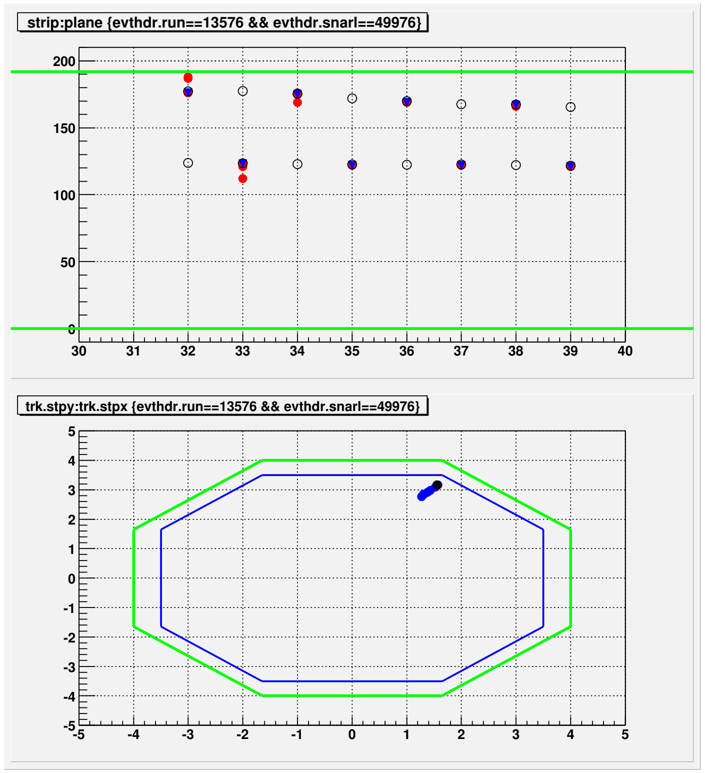
In 3 cases, FitTrackSr and TrackSR place vertex in different strips.

Run 13576, Snarl 49976

TrackSR



FitTrackSR

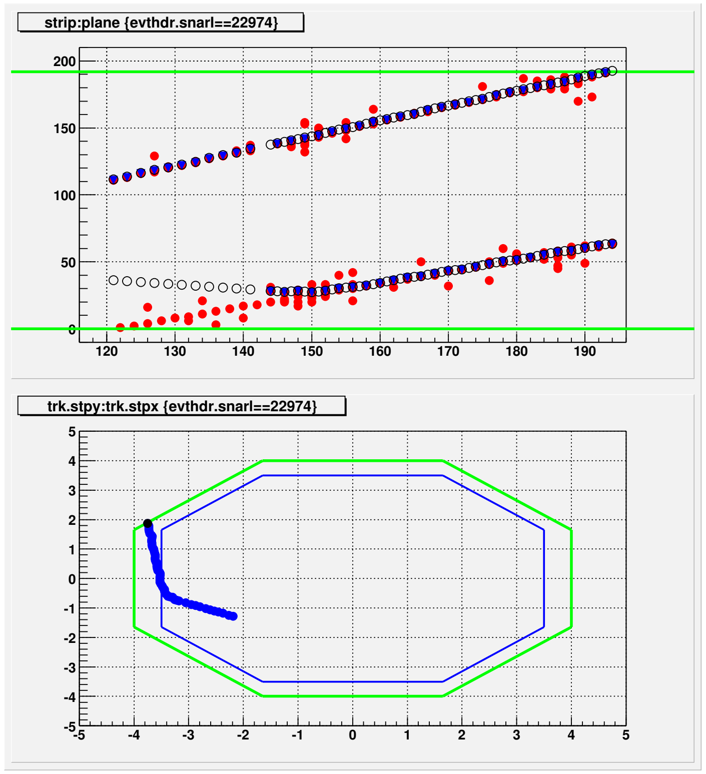


Fail track end containment cut (21 events)

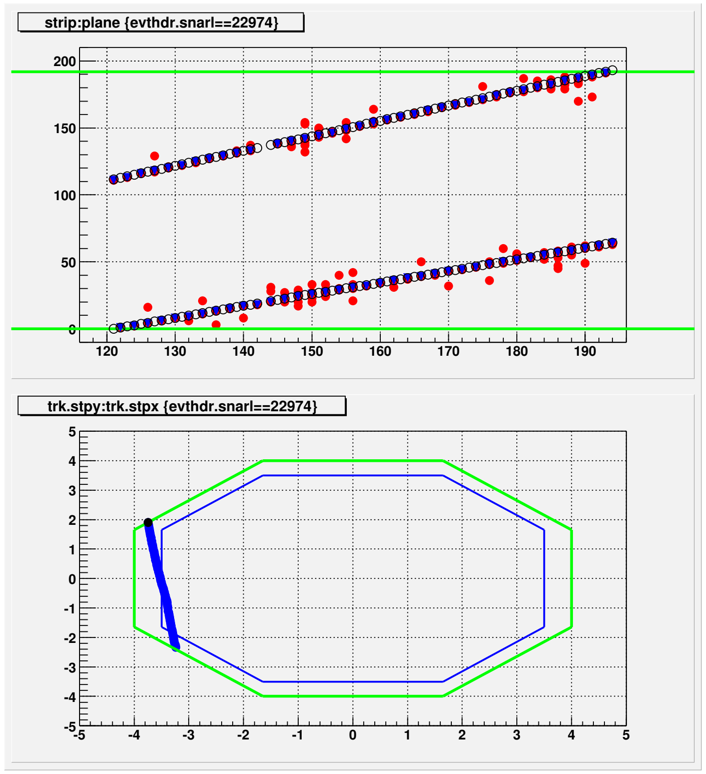
Most cases (15 events) are TrackSR failures.

Run 13700, Snarl 22974

TrackSR



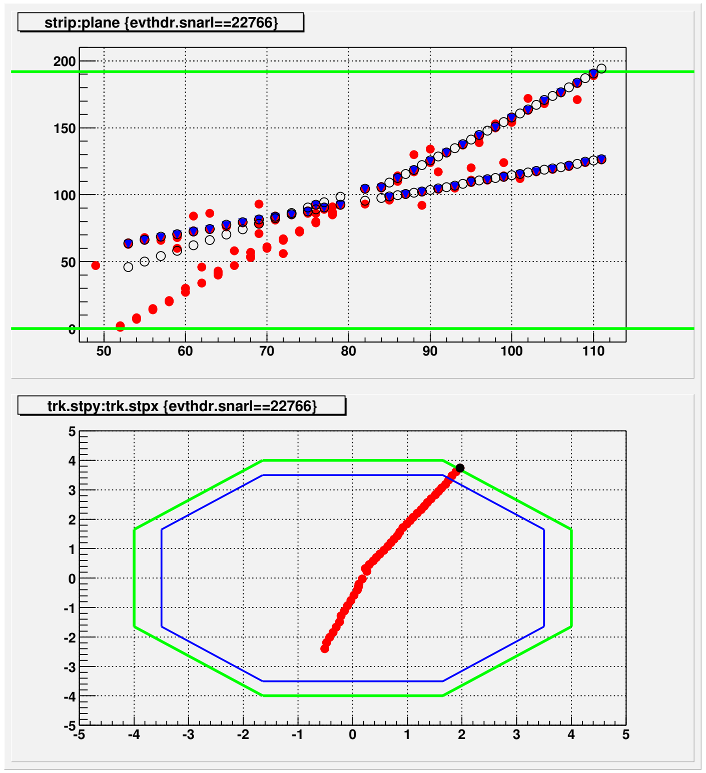
FitTrackSR



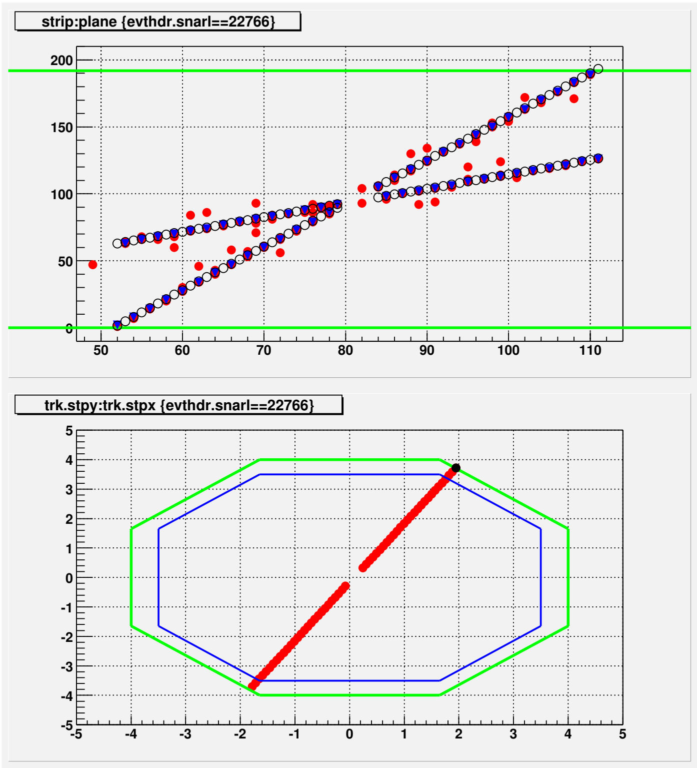
Fail track end containment cut (cont)

Run 13578, Snarl 22766

TrackSR



FitTrackSR

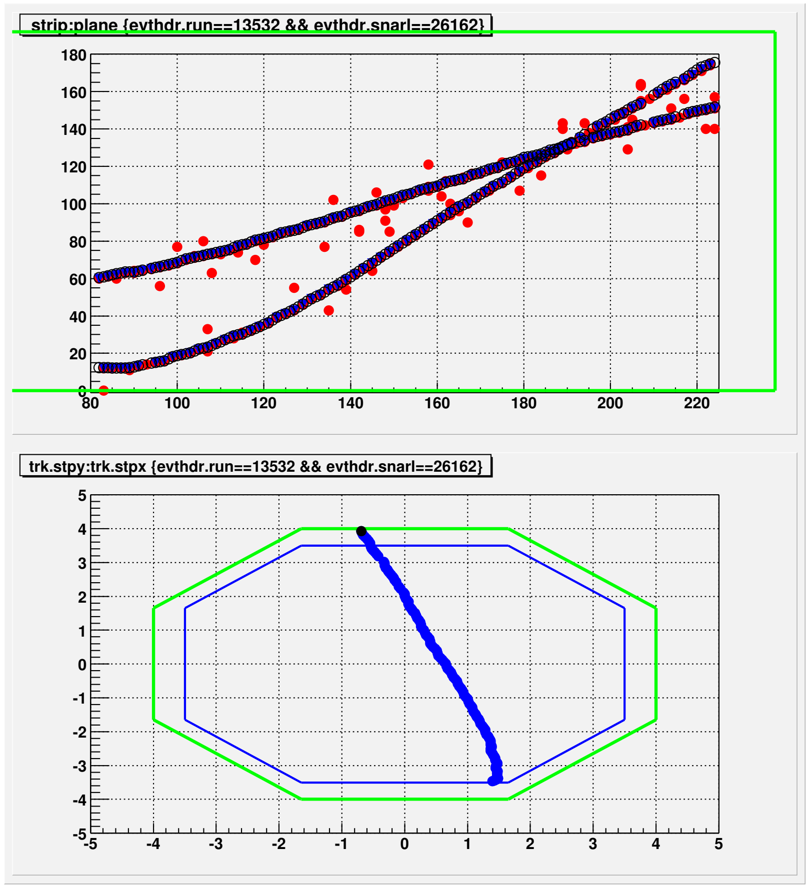


Fail track end containment cut (cont)

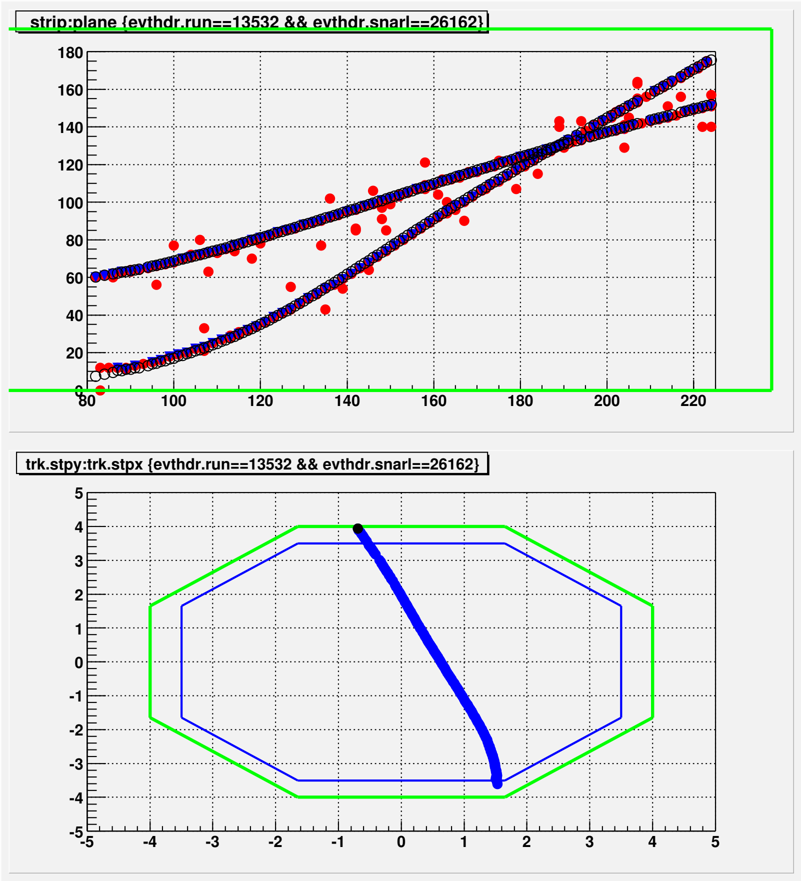
FitTrackSR failure (1 event)

Run 13532, Snarl 26162

TrackSR



FitTrackSR

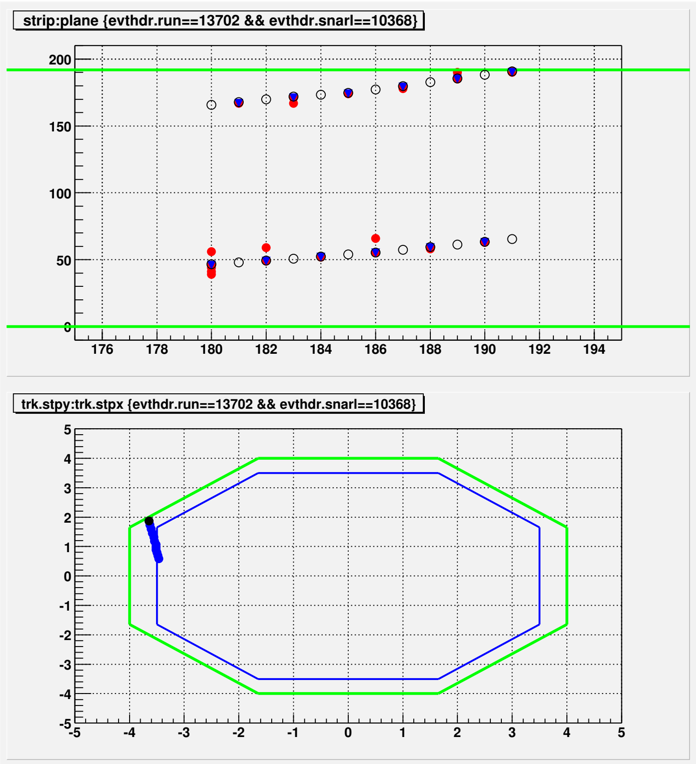


Fail track end containment cut (cont)

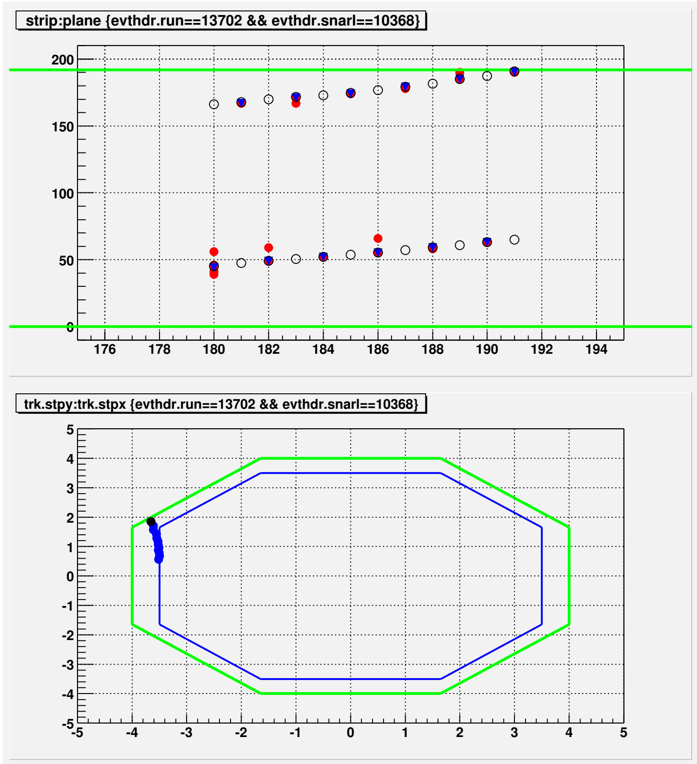
In the remaining events, the end of the track is very close to edge of fiducial volume.

Run 13702, Snarl 10368

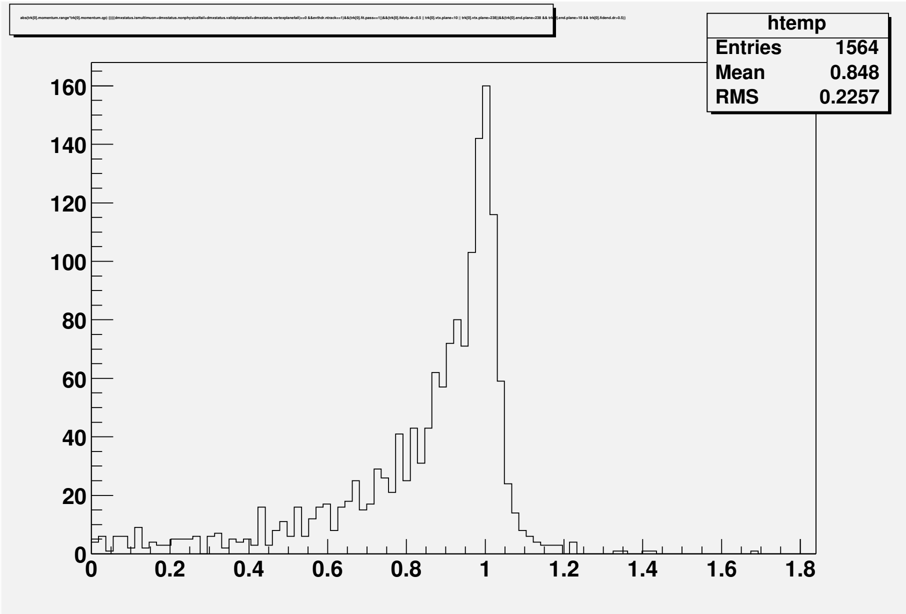
TrackSR



FitTrackSR



$p_{\mathrm{range}}/p_{\mathrm{curvature}}$ for Stopping Muons

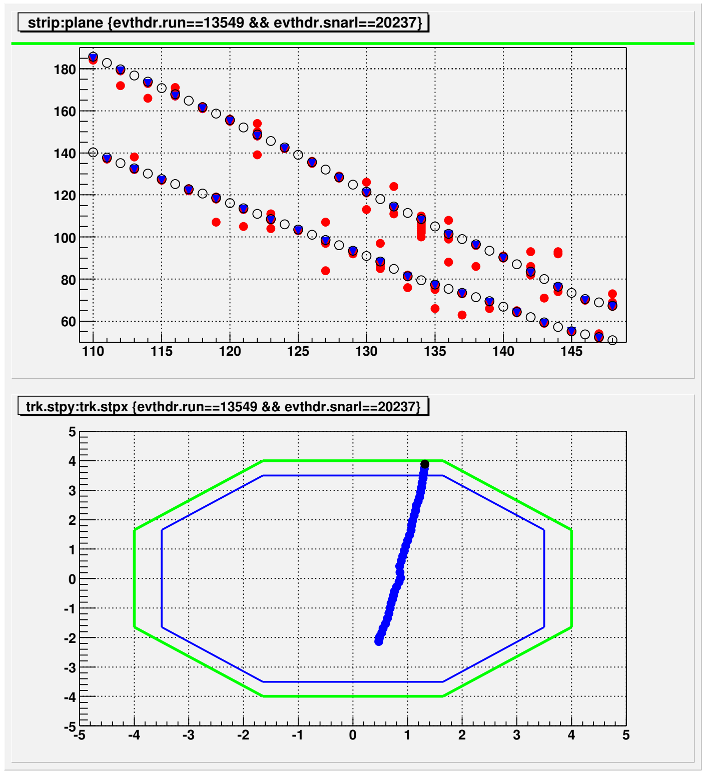


138 events have $p_{\mathrm{range}}/p_{\mathrm{curvature}}$ <0.5 (examples follow). Scan 35 events. All events stop inside fiducial volume. $\sim$ 25 events do not appear to have anything unusual. In $\sim$ 10 cases the fitter missed some hits.

Good

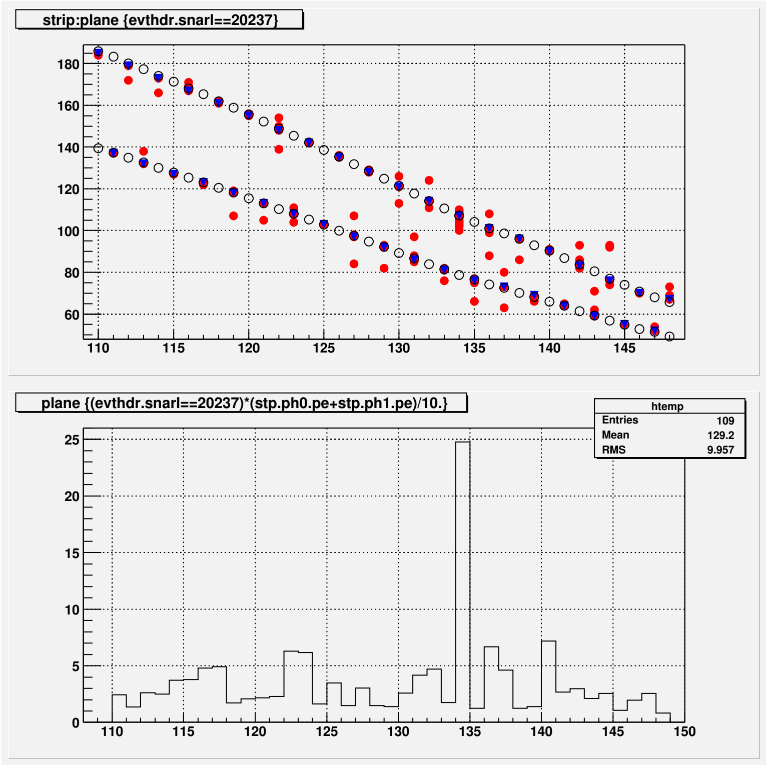
Run 13549, Snarl 20237

TrackSR



p_{range}=4.214 GeV

FitTrackSR

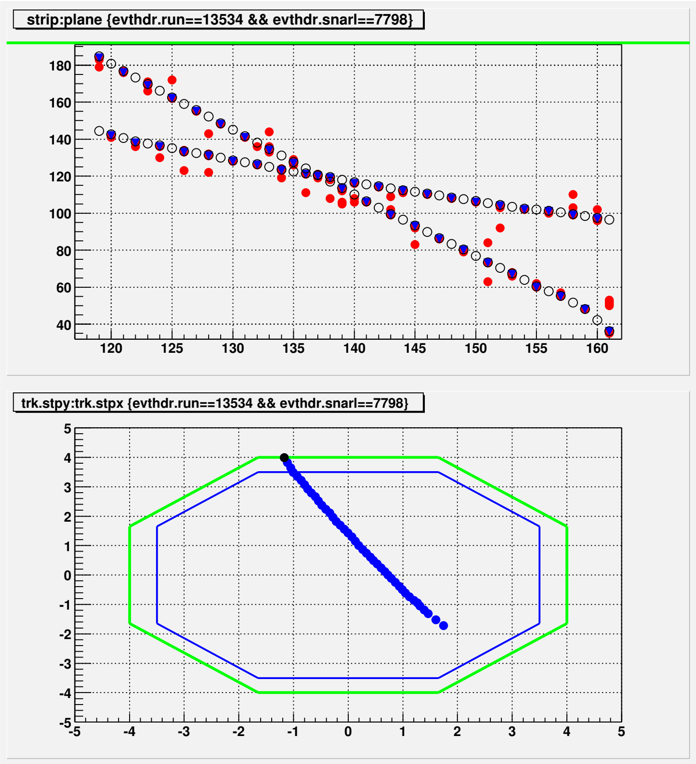


p_{curv}=18.07 GeV

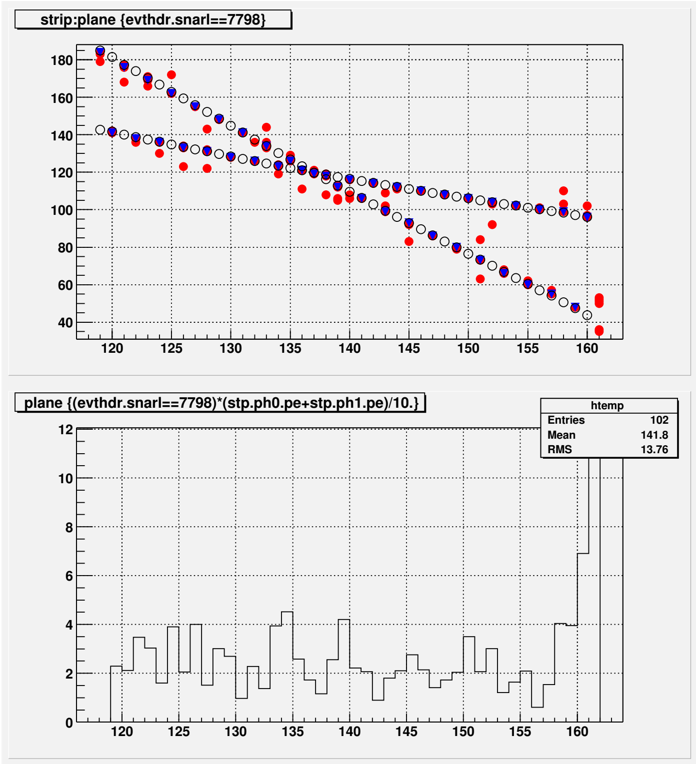
Missing hits

Run 13534, Snarl 7798

TrackSR



FitTrackSR



p_{range}=4.397 GeV

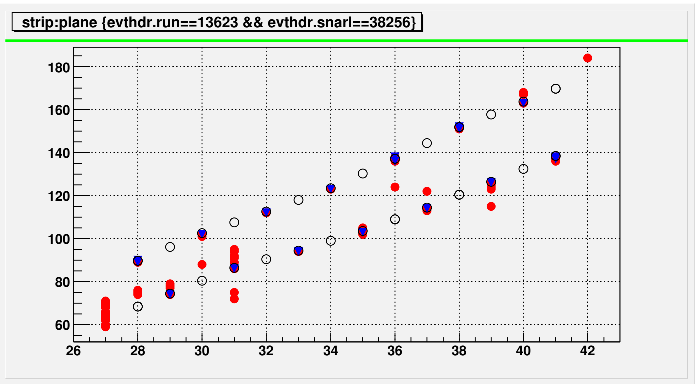
p_{curv}=11.55 GeV

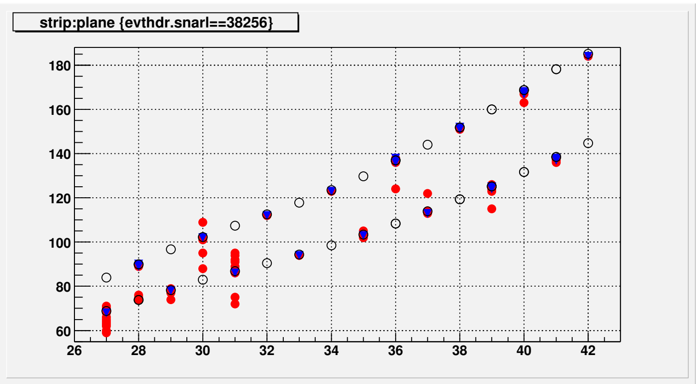
Missing hits (cont)

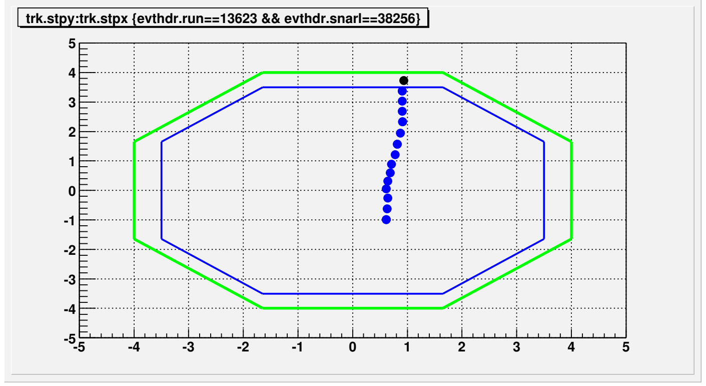
Run 13623, Snarl 38256

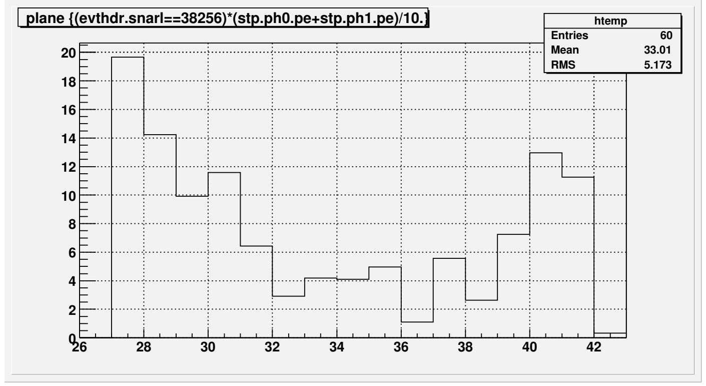
TrackSR

FitTrackSR









p_{range}=3.841 GeV

p_{curv}=8.208 GeV

Summary

- Approximately 4% of the stopping muons are rejected because of SR fitter failures (this estimate does not include showers). In most cases (3%) the fitter fails to track to the vertex and as a result the event looks fully contained.
- I have repeated this exercise with a sample of $\sim$ 5900 non-stopping muons. No obvious FitTrackSR failures are observed in this case.
- I ran Sergei's fitter (FitTrackSA) on a smaller sample of stopping muons. The set of events that are problematic with FitTrackSR are fitted well with FitTrackSA, however the overall rate of fitter failures for stopping muons is higher. I plan to run again over a larger sample with the updated FitTrackSA.