

ND Spectrometer Track Finding Improvements

The current track finding procedure for the ND spectrometer closely follows the standard tracking algorithm. Namely...

Given a 2D track seed (in this case, an upstream track).

- 1: extrapolate the track end to the next active plane, using a quadratic fit to the last three hits on the track.
- 2: Find the hit closest to the extrapolated track
- 3: If the hit is within a minimum distance from the extrapolated track determined from a model of tracking errors and measurement uncertainties, add the hit to the track.

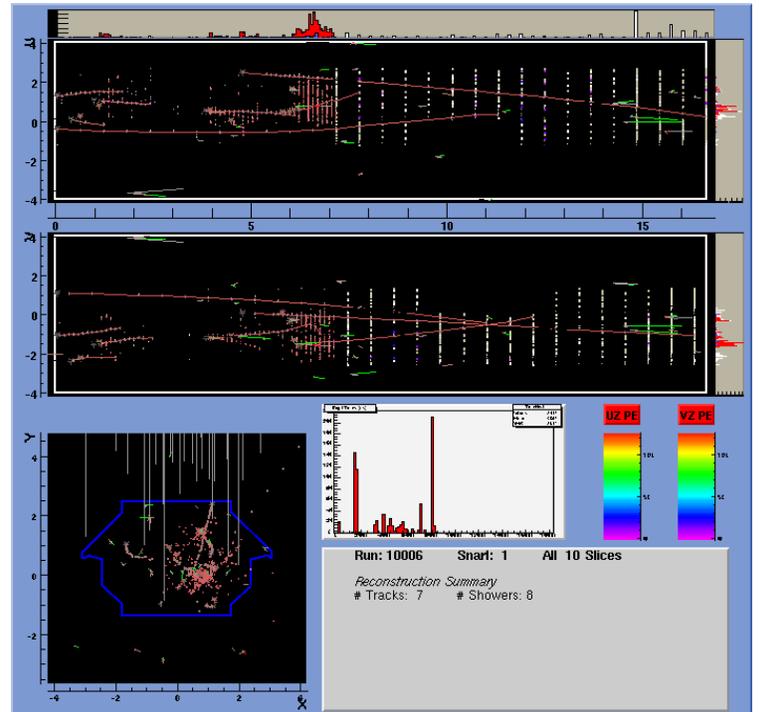
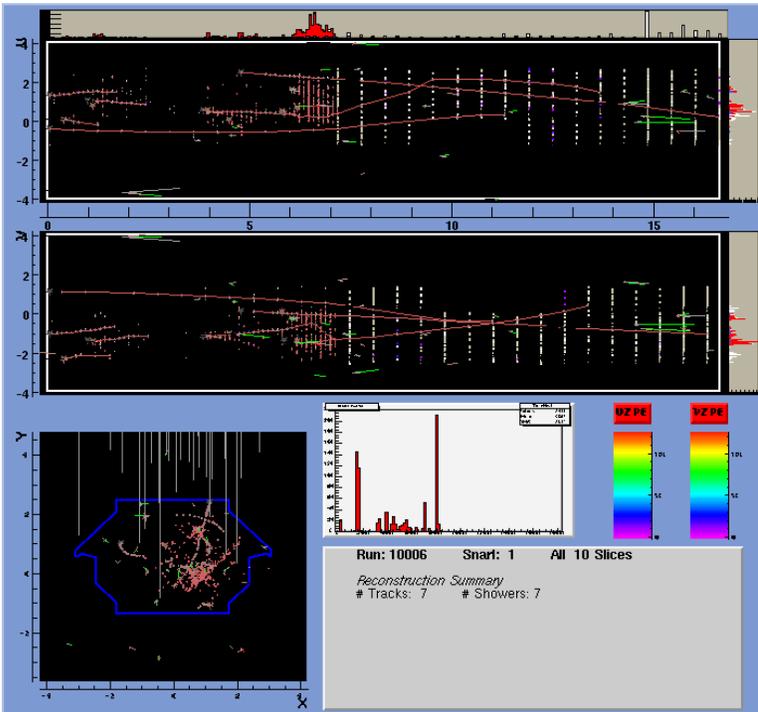
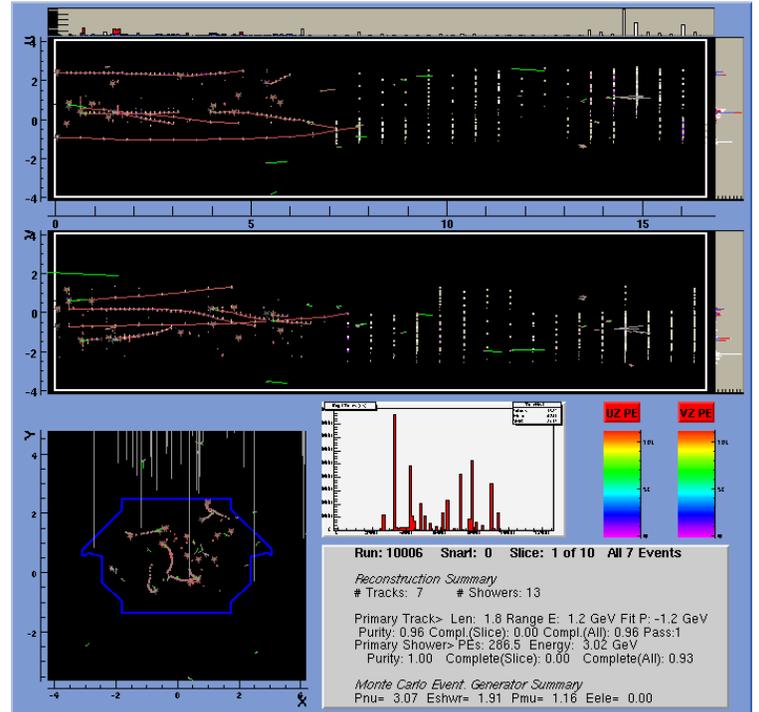
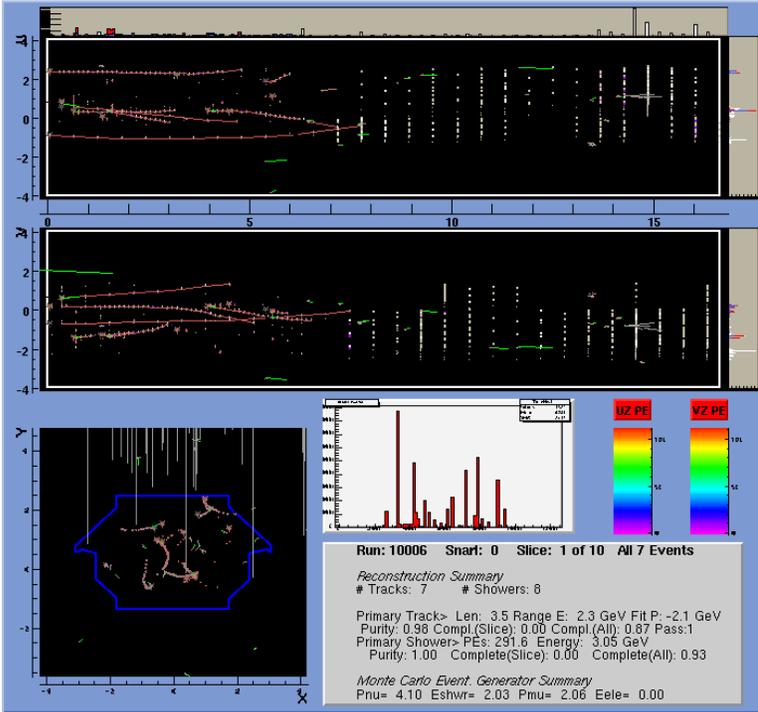
In the spectrometer, the granularity of the tracking medium is on the same scale as track deflection between sampling points -> this makes ND spectrometer tracking tricky and on the hairy edge.

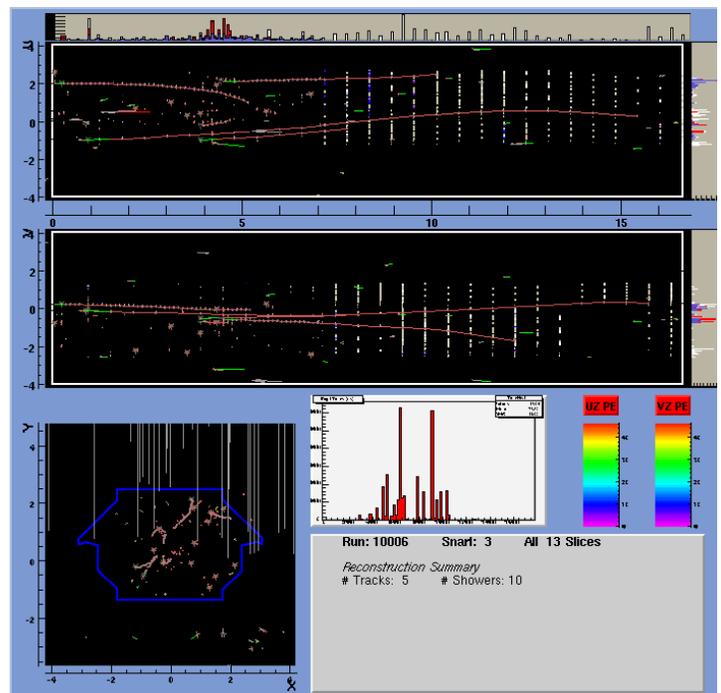
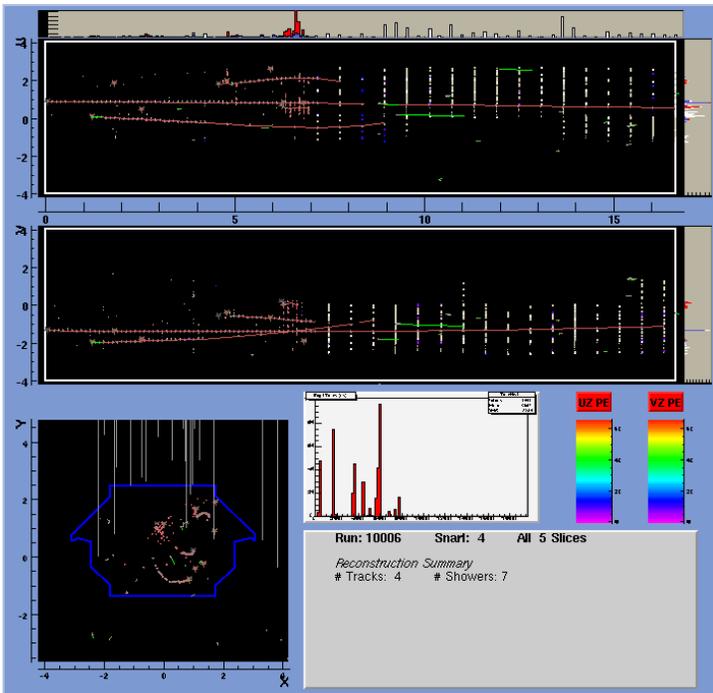
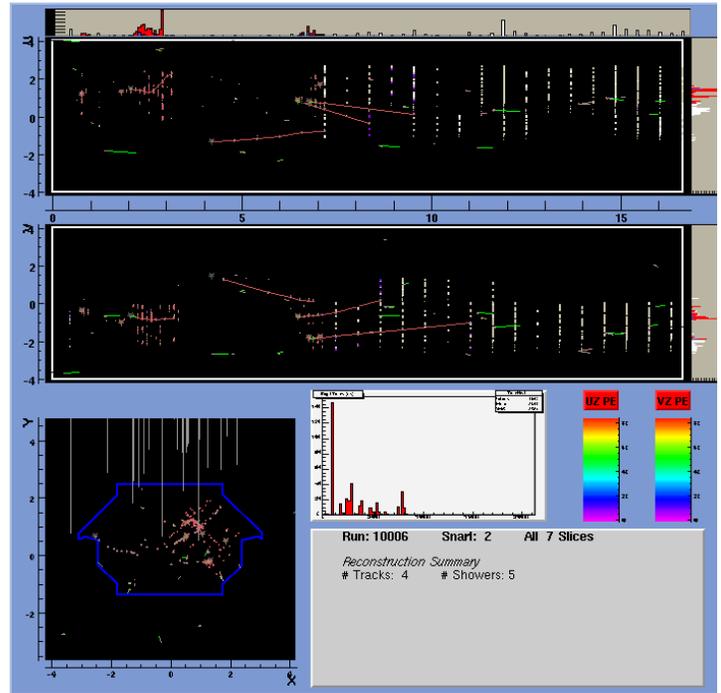
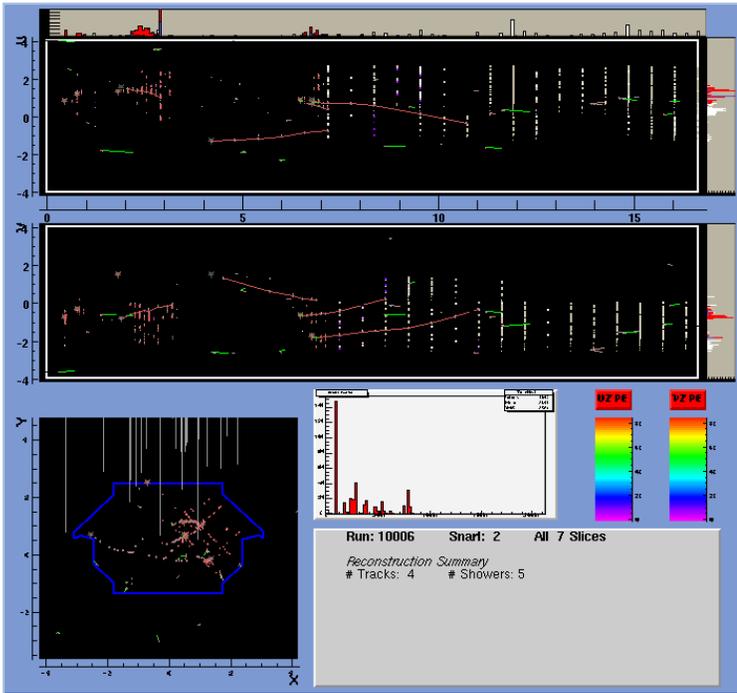
The better one can extrapolate the track, the less likely it becomes that one misses a hit, or merges hits from multiple tracks. In this respect, using the Kalman filter as a track finder represents something like the optimal approach to track finding, as it employs the best possible model for track swimming.

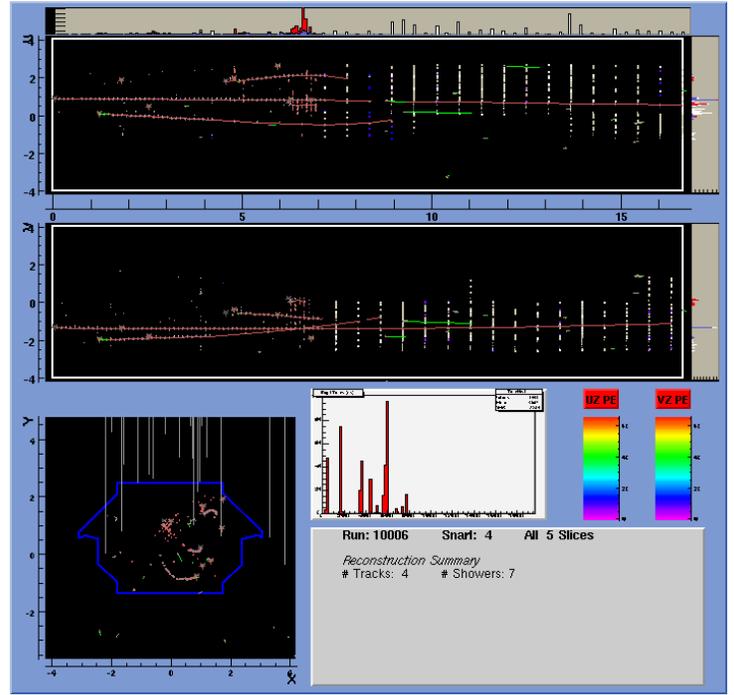
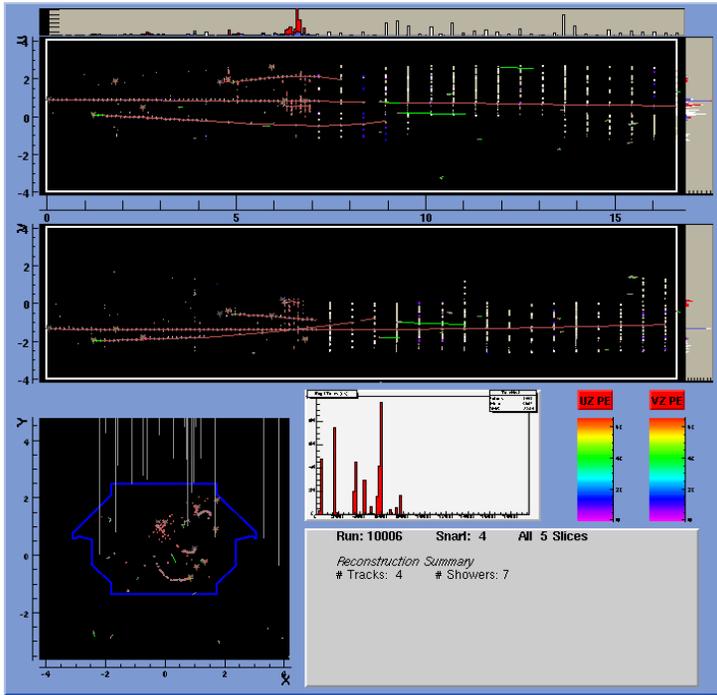
I've spent a little time over the last week developing methods within AlgFitTrackCam to provide spectrometer tracking that replaces the algorithm in AlgTrackSRLList. I have a working version in place that already performs at least as well as AlgTrackSRLList. I expect that with tuning this could be pretty close to optimal.

R18-2

New





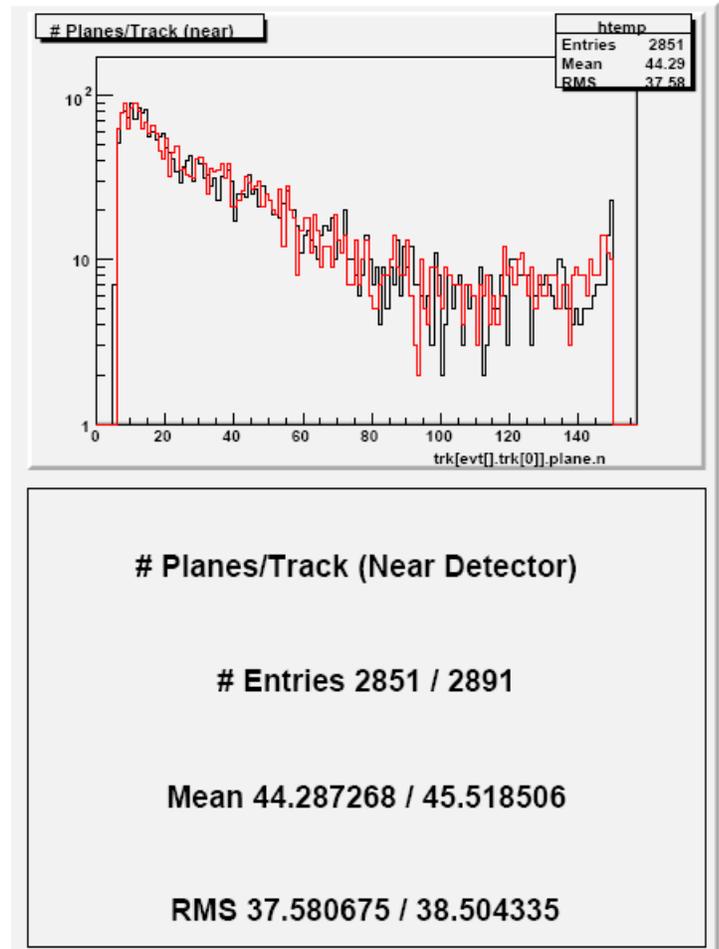


Planes Per Track

Red: R18-2

Black: Kalman Finder

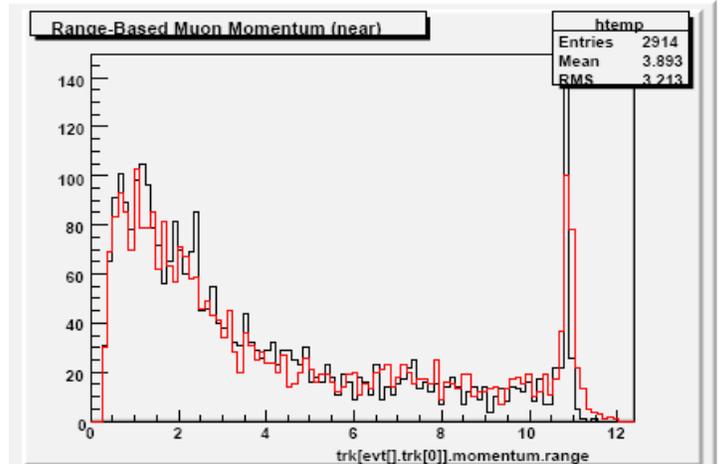
No glaring issues



Range-based Momentum

Note sharper peak at detector end.

This is most probably a good sign.



Range-based momentum (Near Detector)

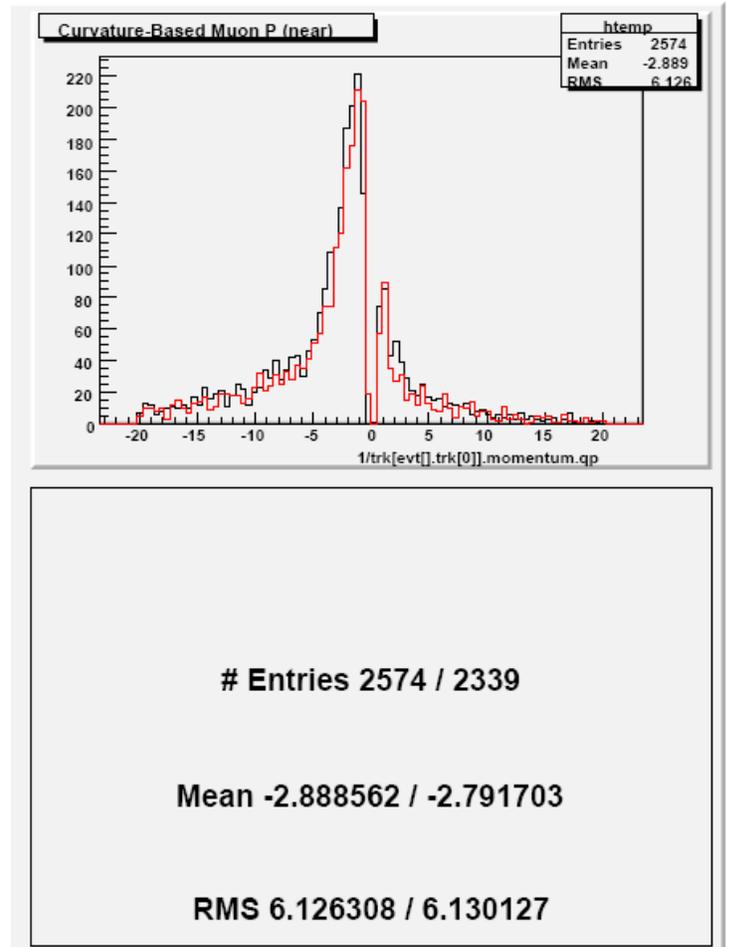
Entries 2914 / 2889

Mean 3.893461 / 4.279617

RMS 3.213003 / 3.462872

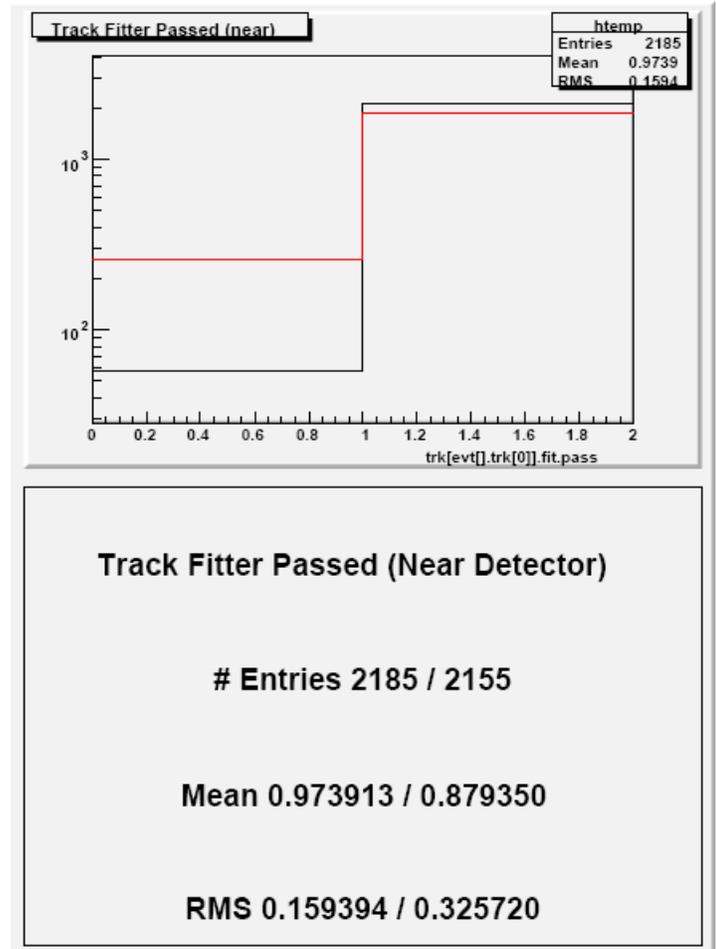
Curvature-based Momentum

Large number of events due to use of CandFitTrackCam (lower fit.fail rate).



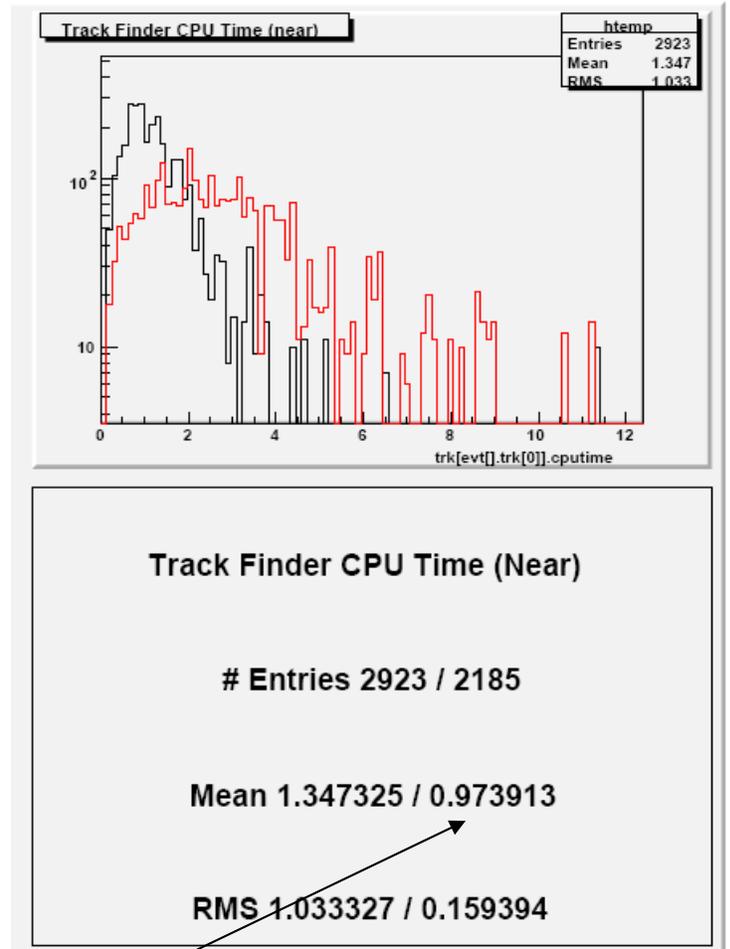
Trk.Fit.Pass

Improvement here is due to use of CandFitTrackCam, which has a different definition of failure. I'm not sure what if any impact the new spectrometer track finder is having at this point.



Track Finder CPU Time

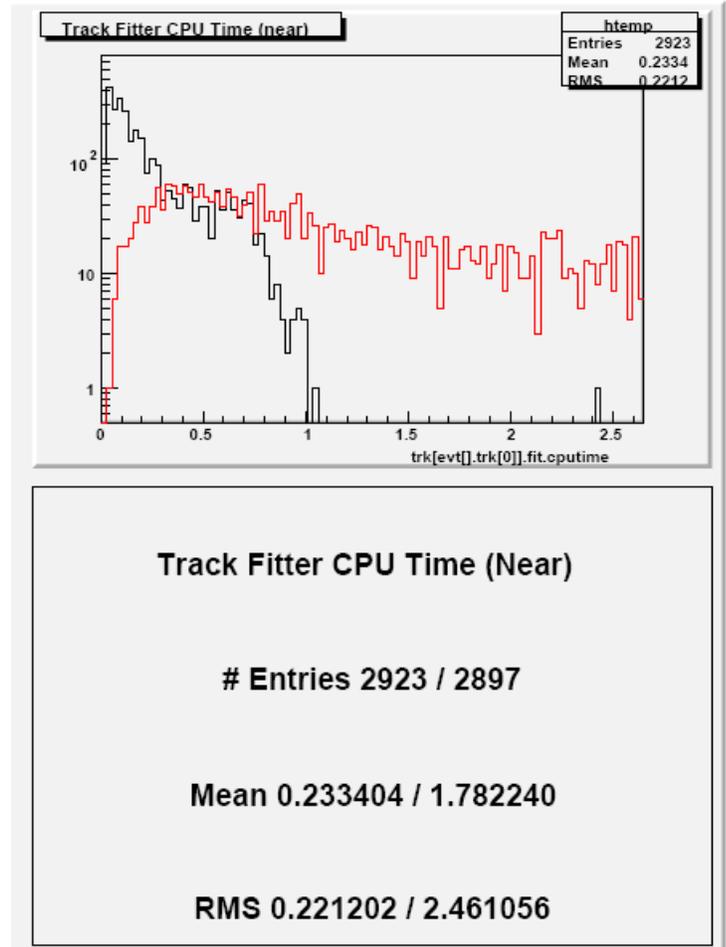
ND track finding time drops by about 1 sec per snarl.



Wrong! (error in script)

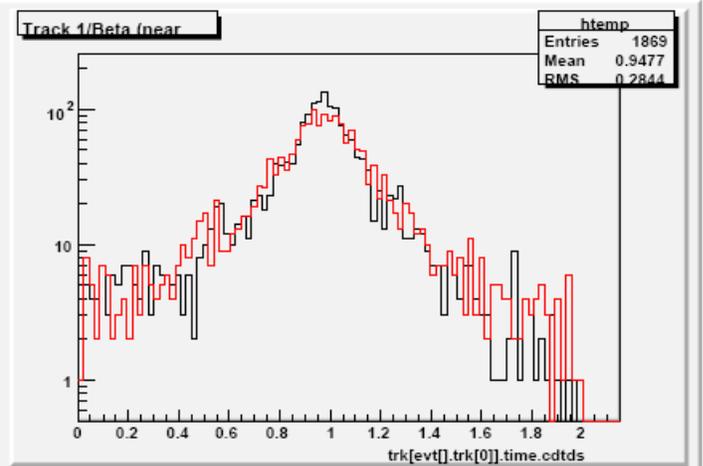
Track Fit CPU Time

CandFitTrackCam time is roughly a $\frac{1}{4}$ second per snarl for the near detector. I'm not sure how much this increased as a result of the new track finding code, but increase is clearly smaller than decrease in the finder.



1/beta distribution

The 1/beta distribution has tightened up. Why?

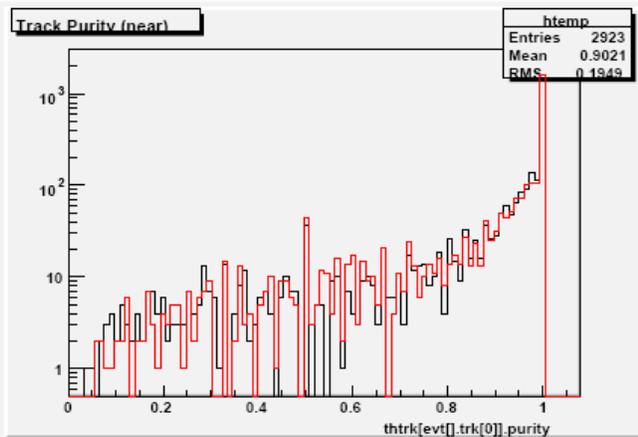


1/beta (Near Detector)

Entries 1869 / 1845

Mean 0.947748 / 0.961557

RMS 0.284438 / 0.306159

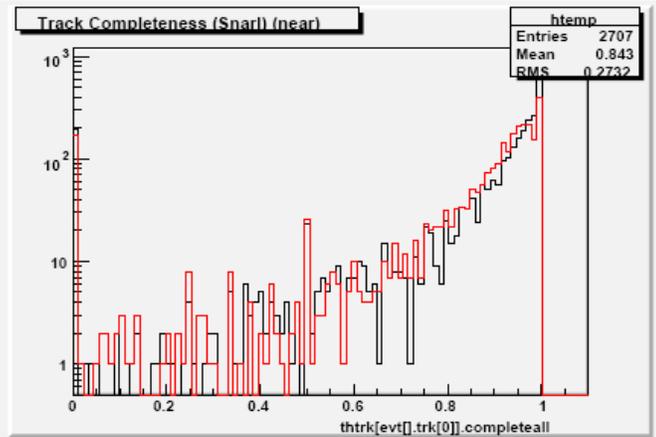


Track Purity (Near Detector)

Entries 2923 / 2897

Mean 0.902142 / 0.901487

RMS 0.194873 / 0.188888

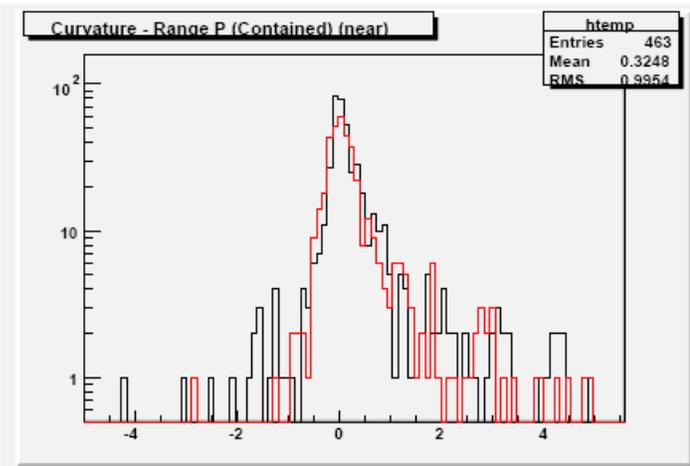


Track Completeness (Near Detector)

Entries 2707 / 2667

Mean 0.842965 / 0.836389

RMS 0.273166 / 0.260717

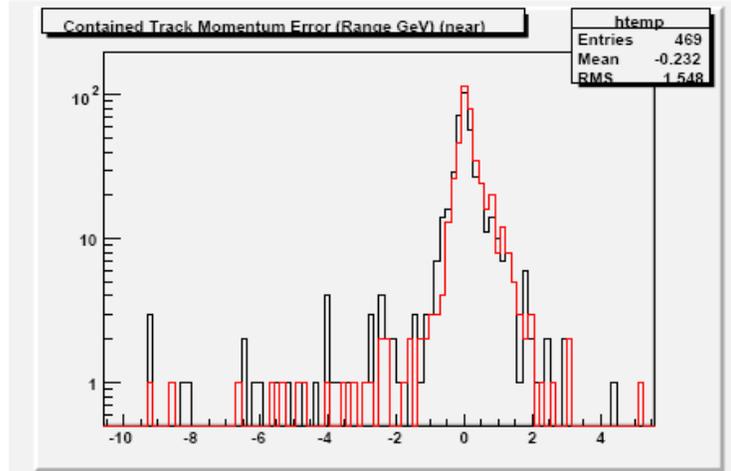


Curvature - Range P (Near Detector)

Entries 463 / 404

Mean 0.324804 / 0.329307

RMS 0.995400 / 0.878914

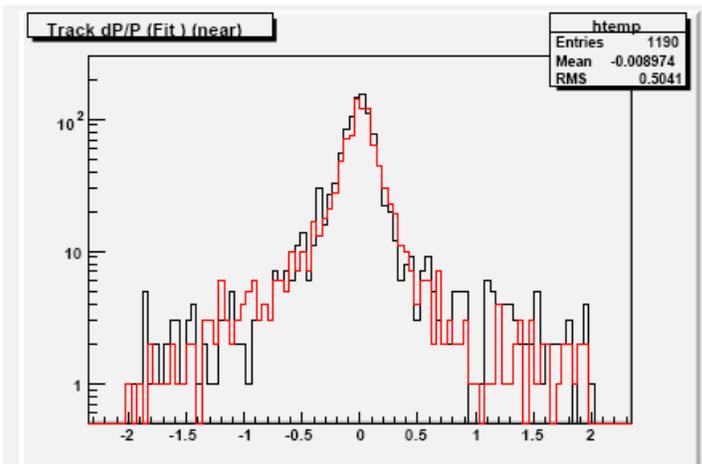


Track Momentum Error (GeV) (Near Detector)

Entries 469 / 452

Mean -0.231963 / 0.066092

RMS 1.547787 / 1.163171



Track dP/P (fit) (Near Detector)

Entries 1190 / 1067

Mean -0.008974 / -0.026252

RMS 0.504079 / 0.460657