Track and Vertex Reconstruction Update

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MIPP Collaboration Meeting

April 8, 2006

TPC Track Reconstruction

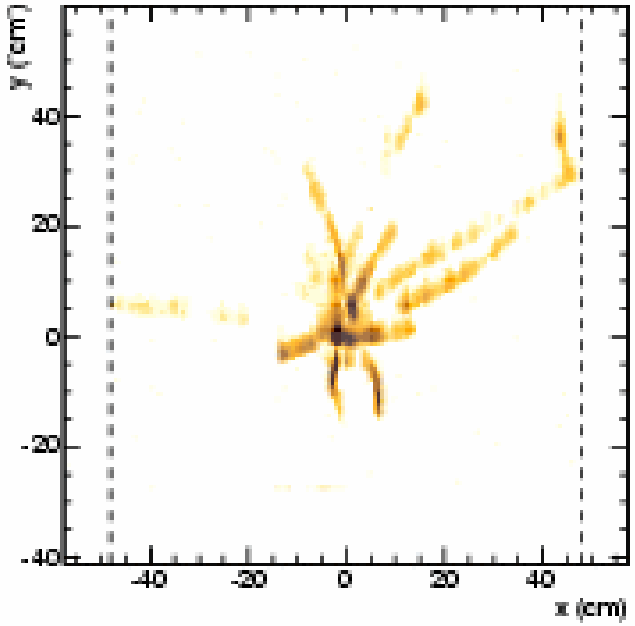
- TPCRecoJP has existed for > 1.5 years
- Simple clustering and hit forming algorithm
- Distortion effects are corrected
- Track finding and fitting taken from E910 (assumes homogeneous B-field)
- Track finding efficiency > 95% (unsubstantiated! ;-)
- Since we assume track path is a helix, fits are very quick (relatively).

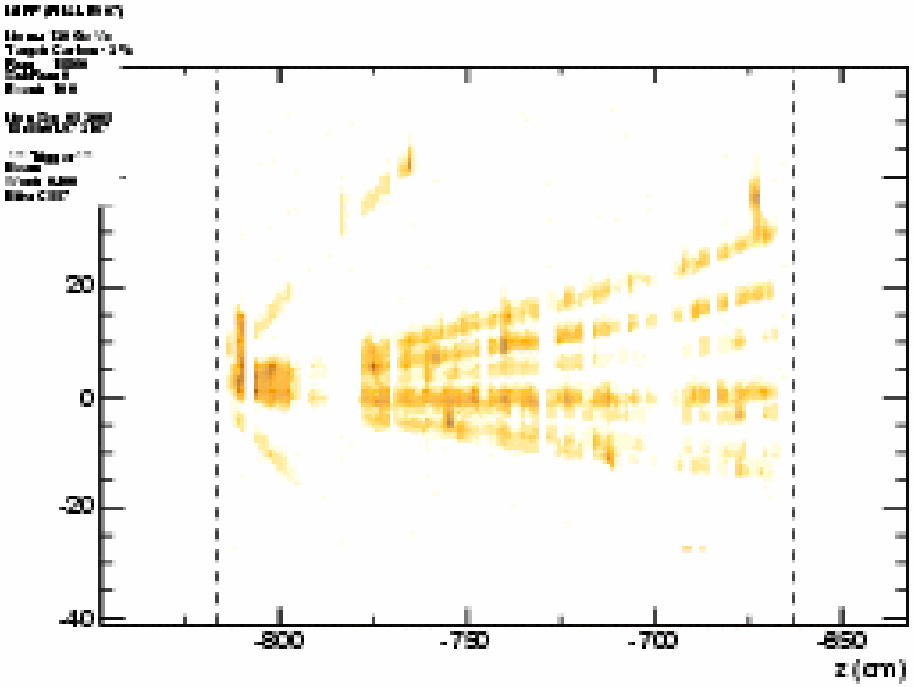
MIPP (FNAL E907)

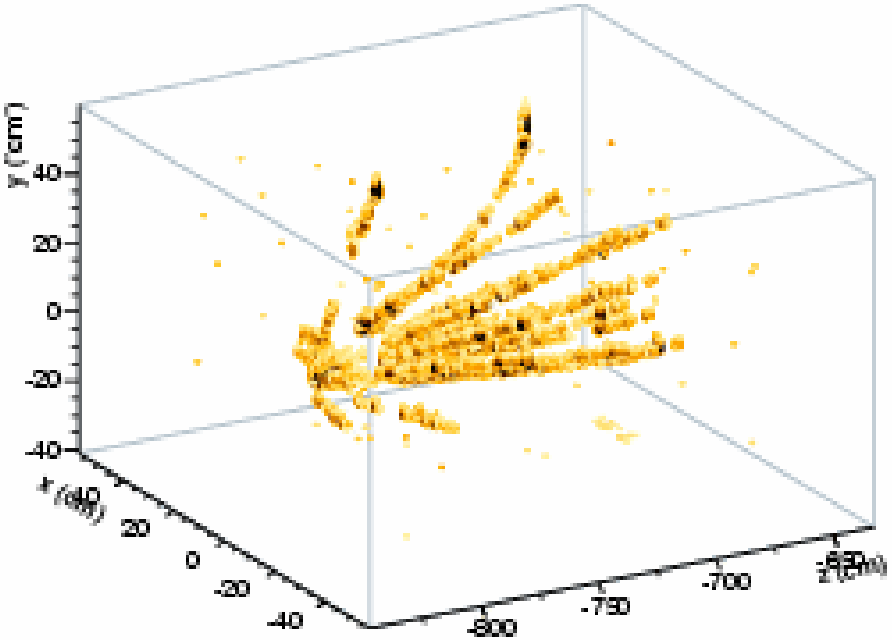
Mom.: 120 GeV/c
Target: Carbon - 2%
Run: 15880
SubRun: 0
Event: 100

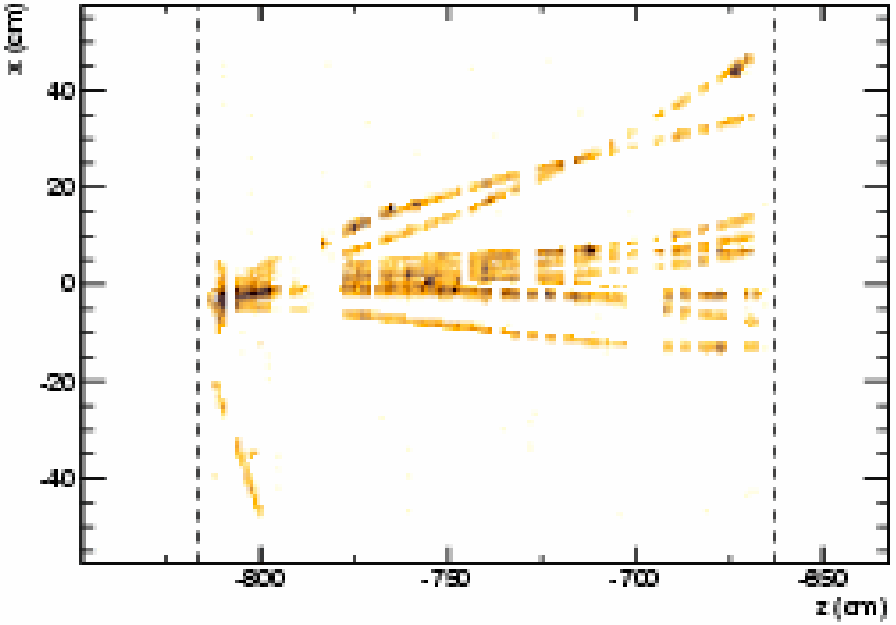
Mon Sep 05 2005
18:55:01.972167

*** Trigger ***
Beam
Word: 0400
Bits: C557









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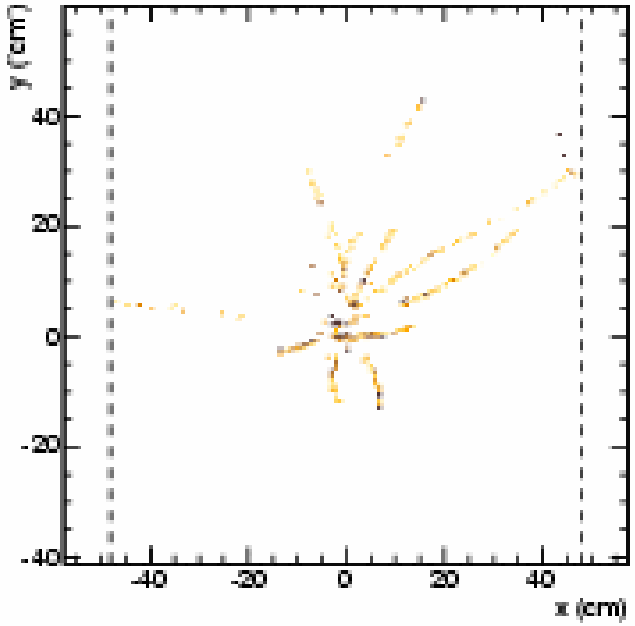

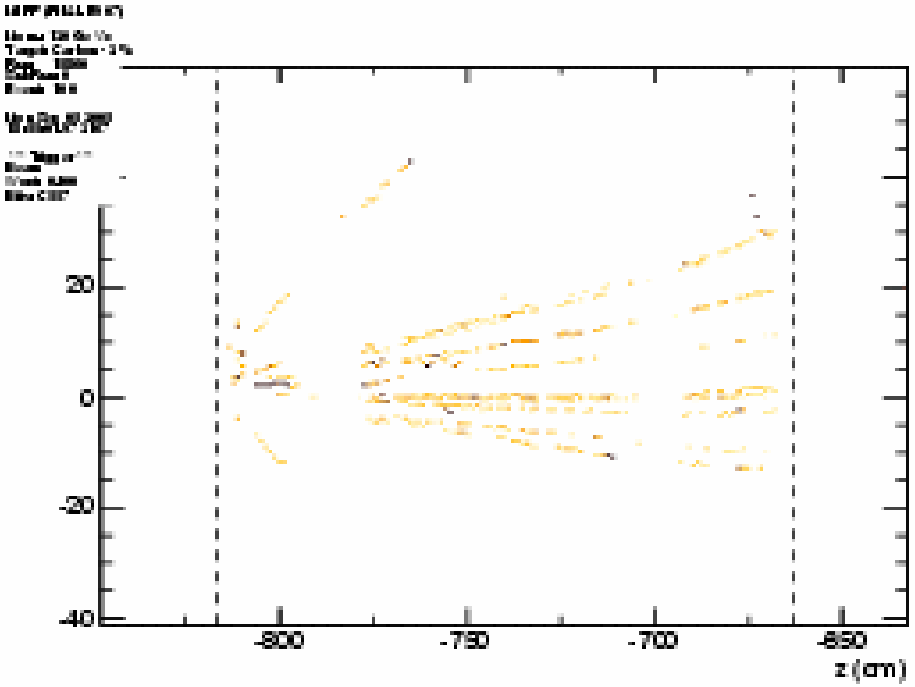

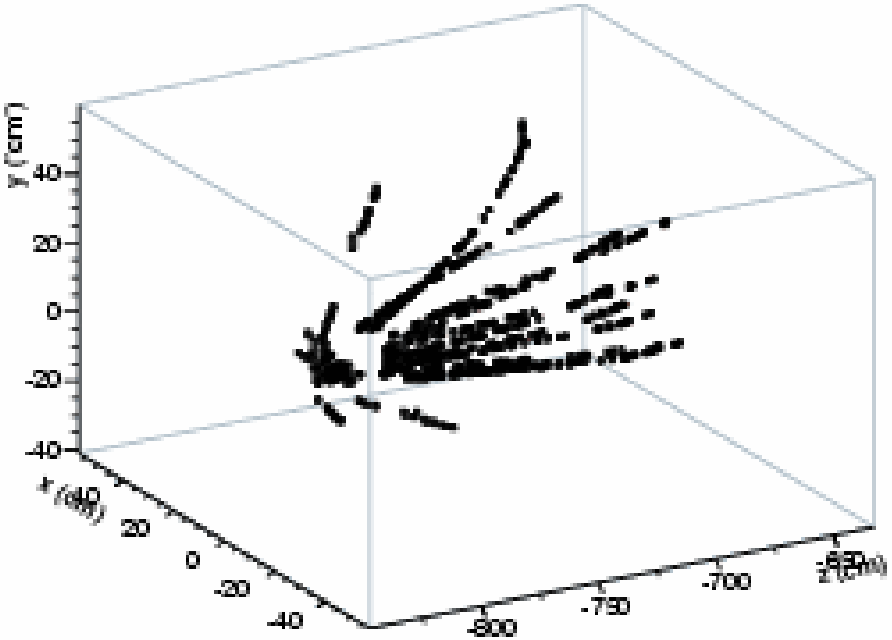

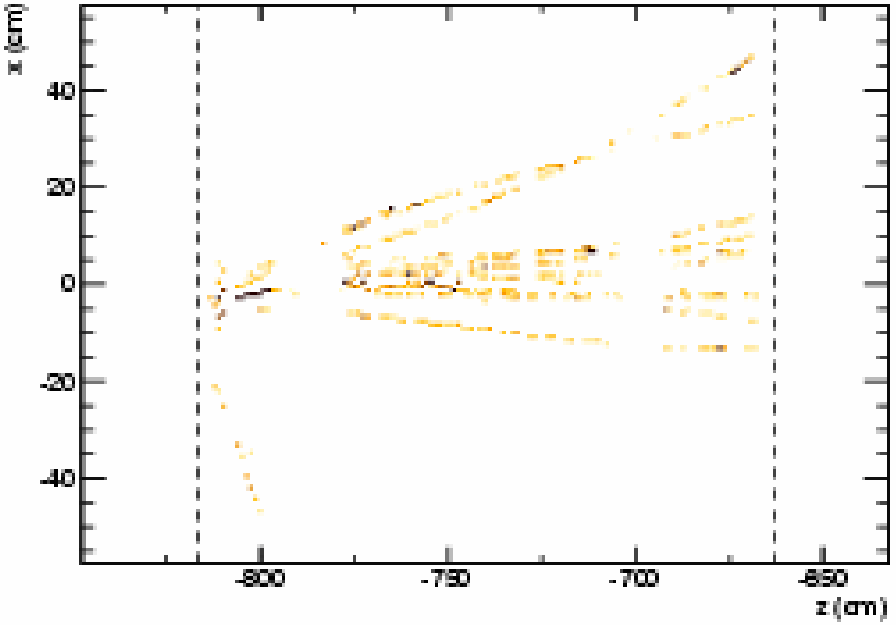

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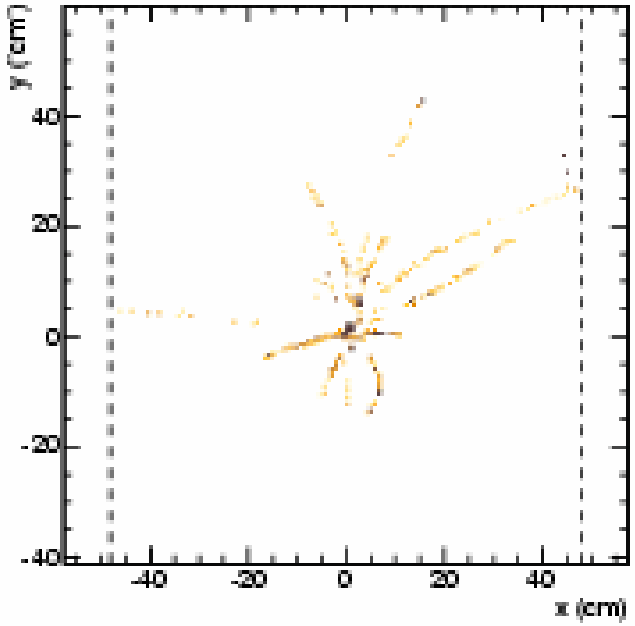

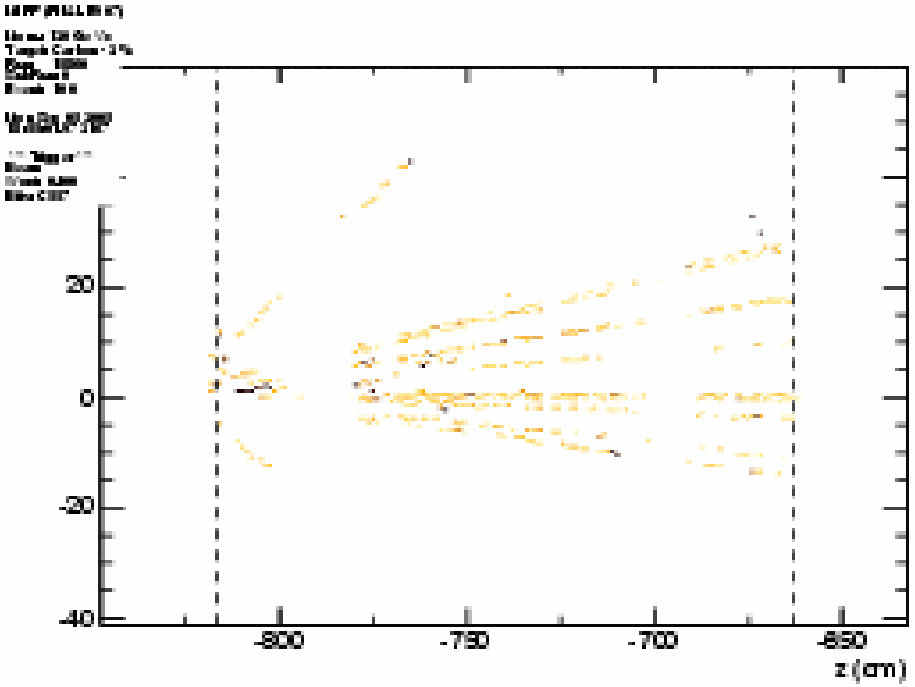

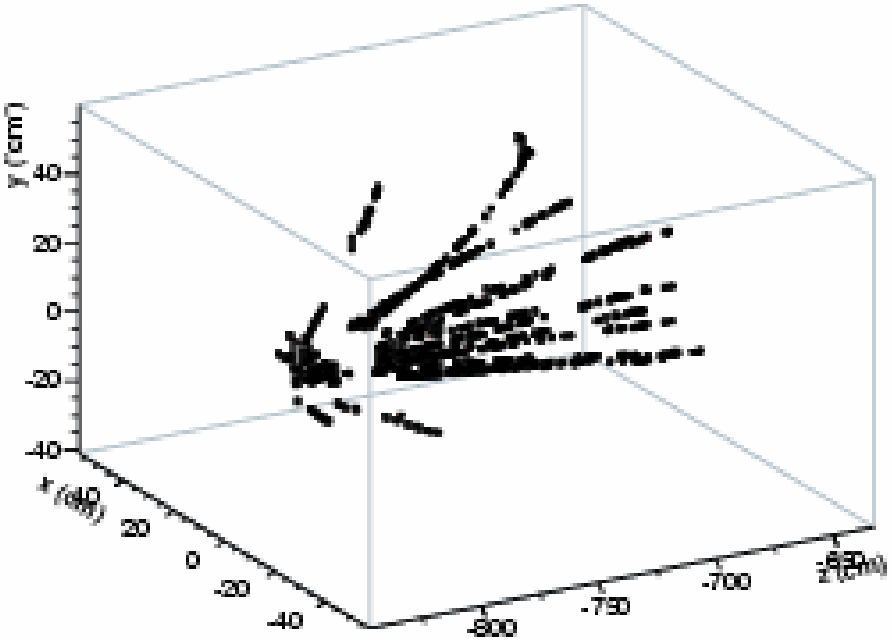

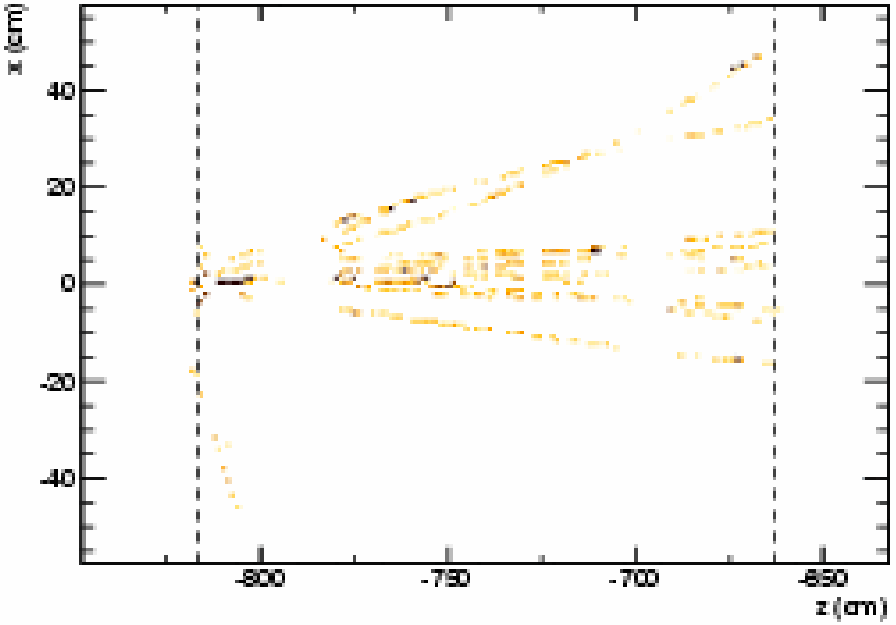

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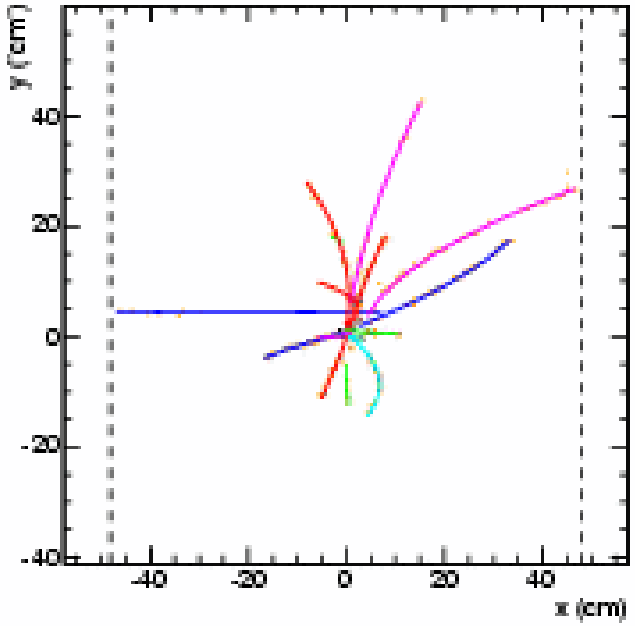
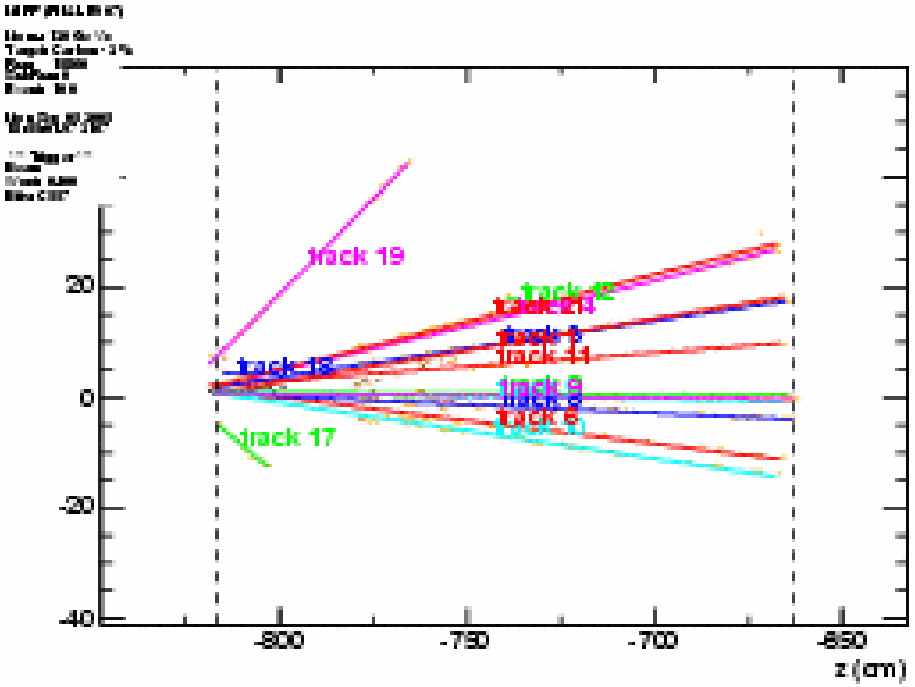
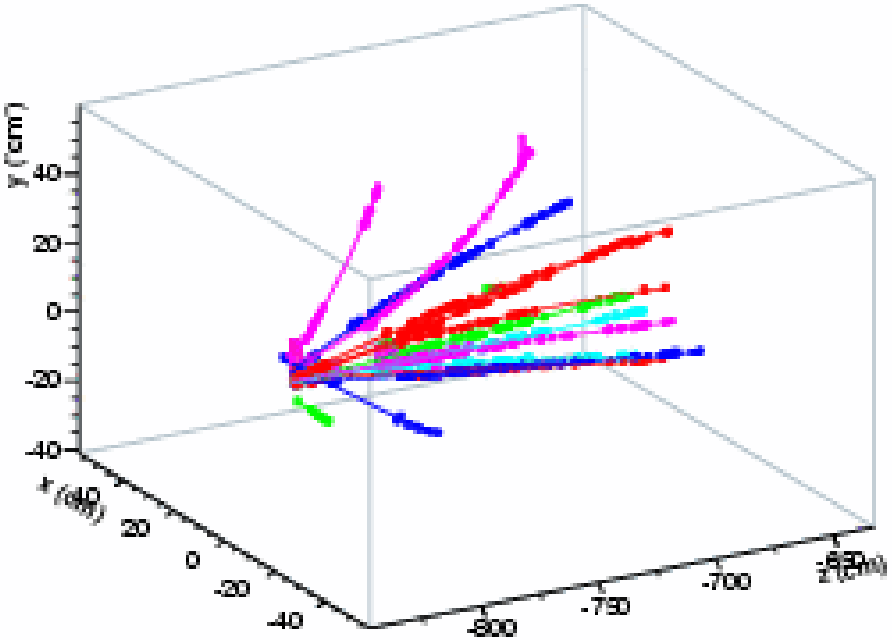
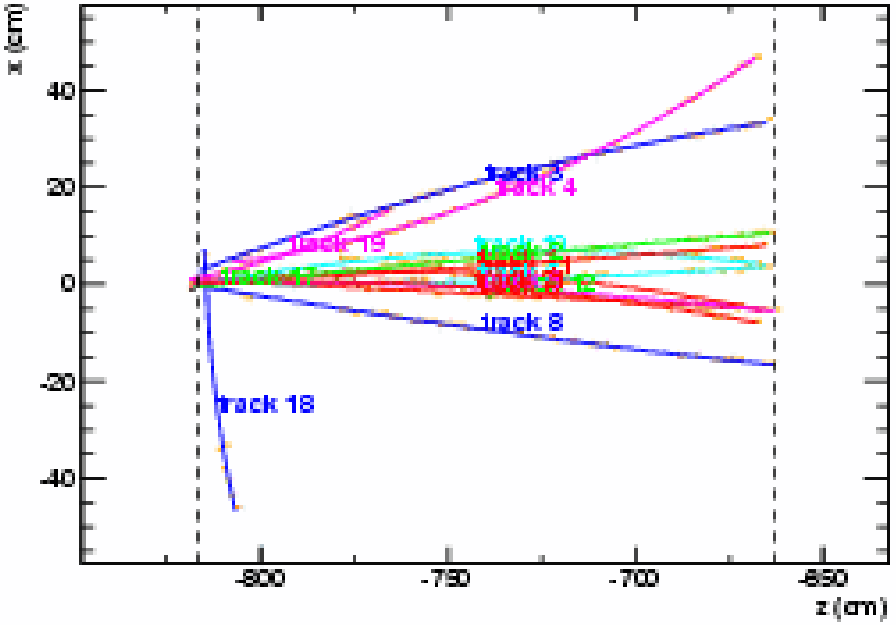








TPC Vertex Reconstruction

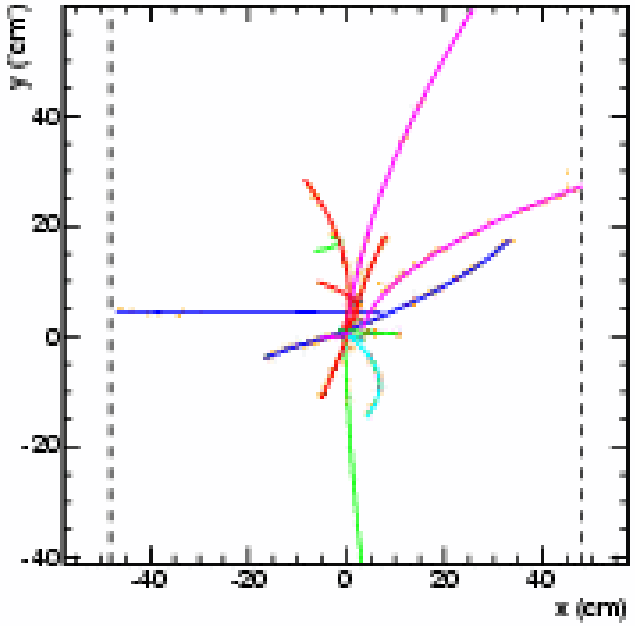
- Algorithm is pretty straightforward:
  - collect pairs of intersecting tracks; create vertex for each pair, calculating position by determining DOCA (in 3D).
  - merge 2-track vertices, if it makes sense to do so.
  - reject any tracks that contribute too much to the <DOCA>, recalculate vertex position.
- Assumes no field beyond TPC.
- Tracks are not refit with the vertex as an additional measurement.

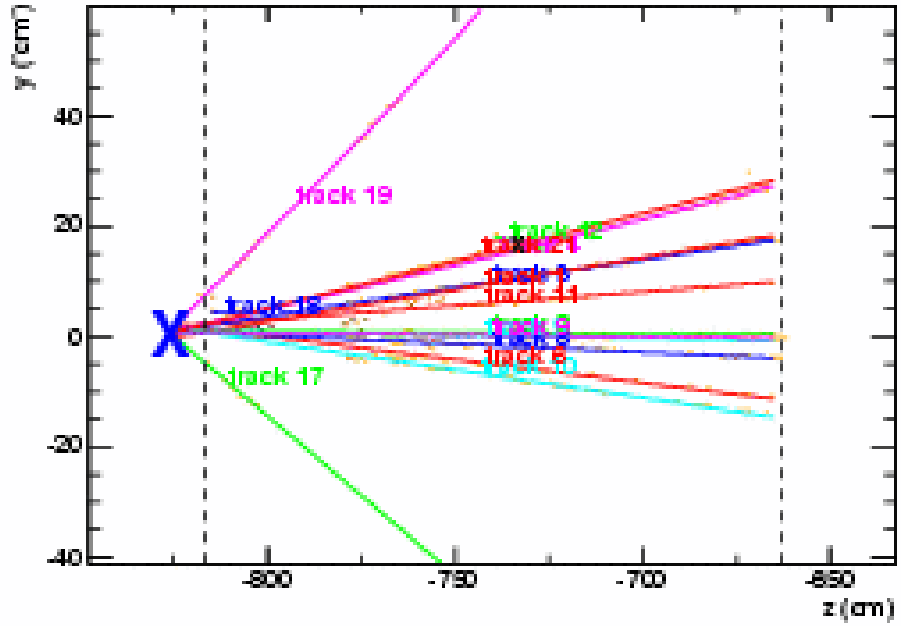
MIPP (FNAL E907)

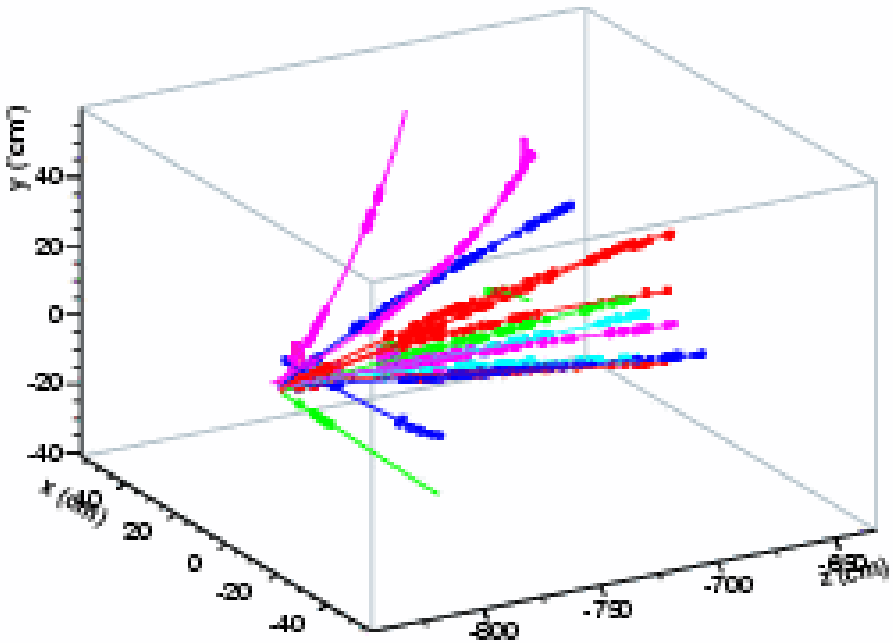
Mom.: 0 GeV/c
Target:
Run: 15880
SubRun: 0
Event: 100

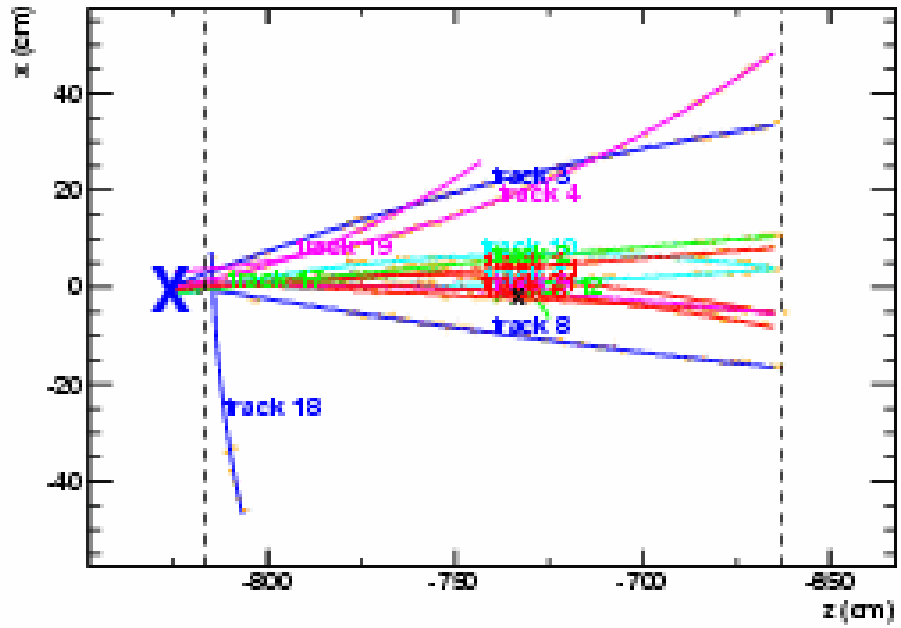
Mon Sep 05 2005
18:55:01.972167

*** Trigger ***
Beam
Word: 0400
Bits: C557



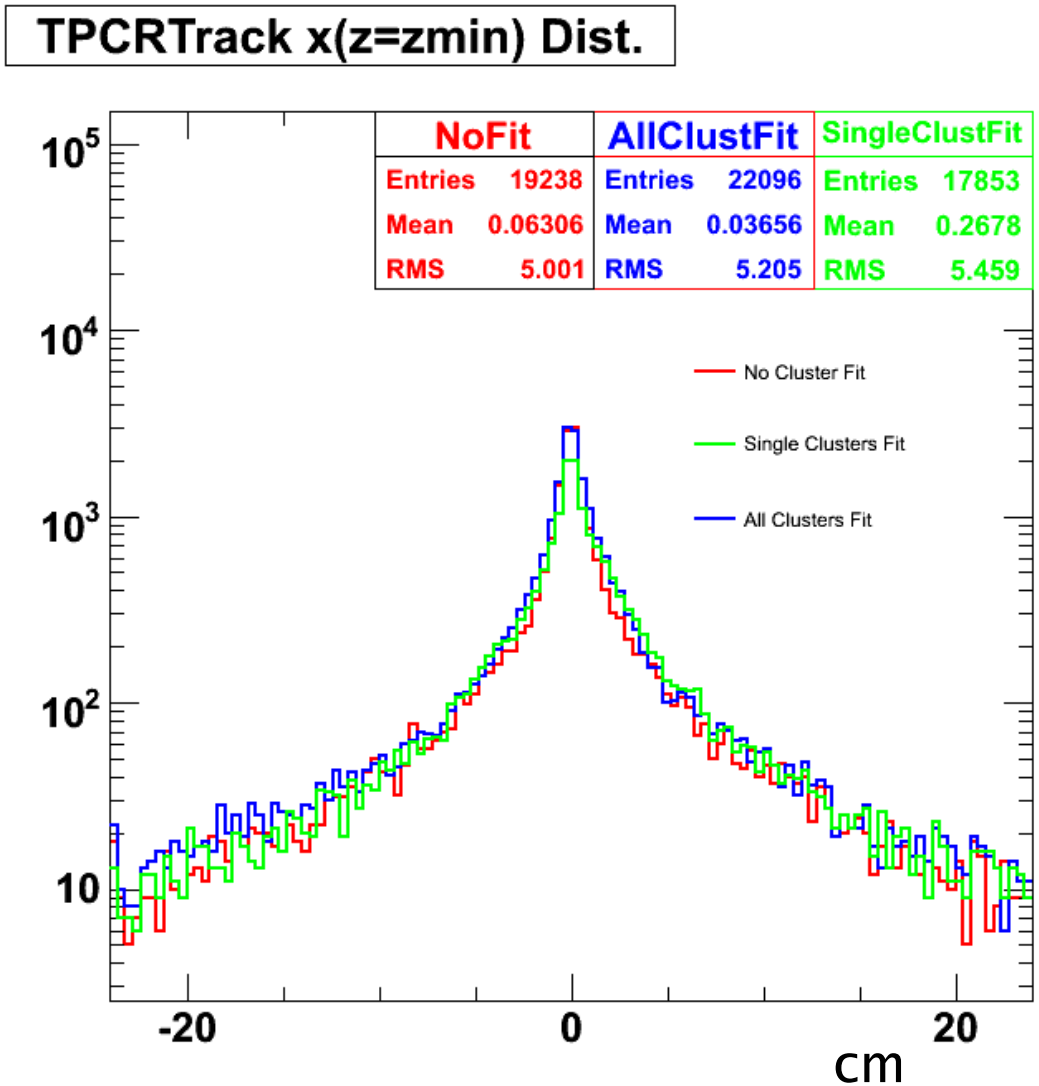


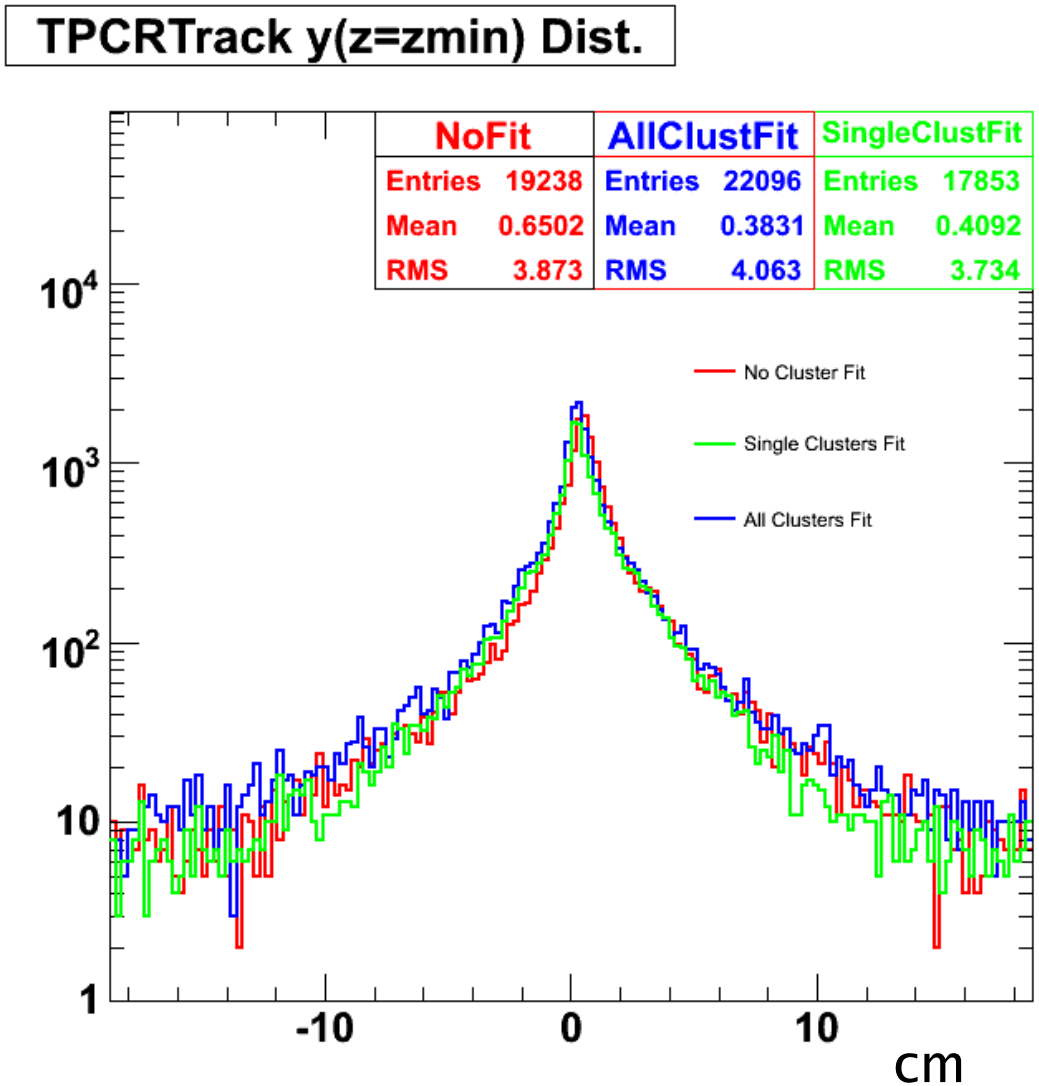




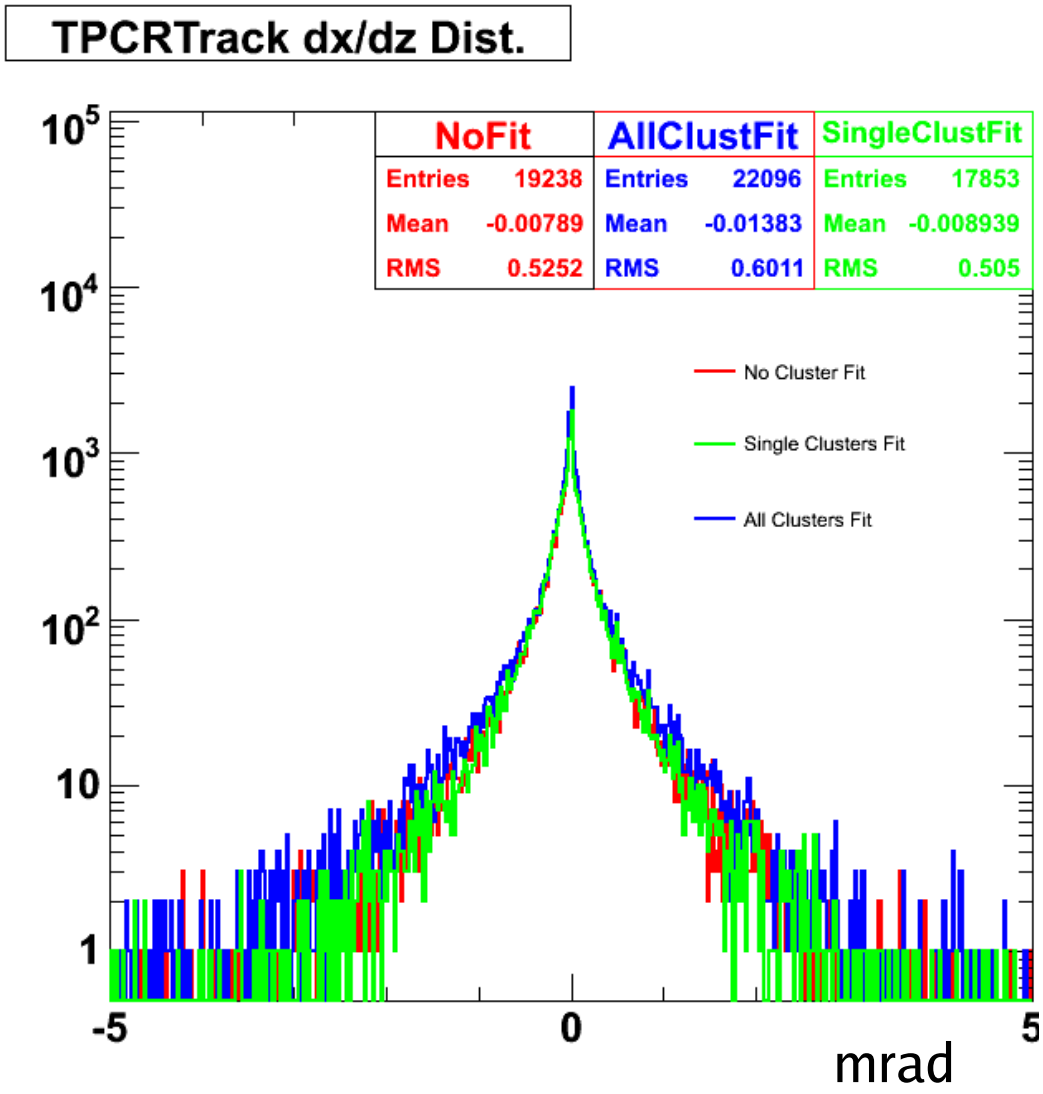
Effect of TPC Cluster Fits on Track Reconstruction

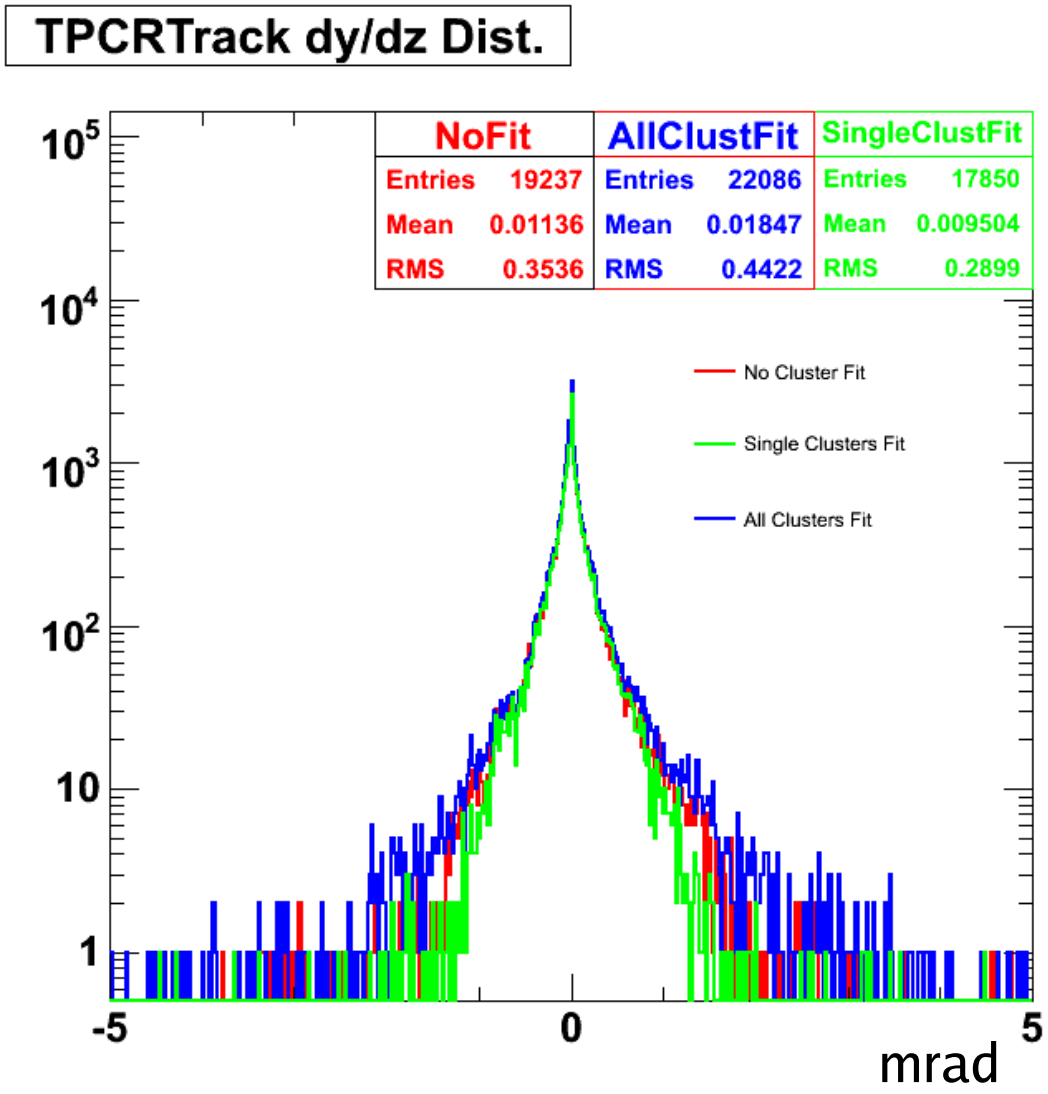
- There seems to be a bug... anamipp dumps core after a few thousand events when cluster fits are turned on.
- Running through the first 3k events of run 15860, we find the following:



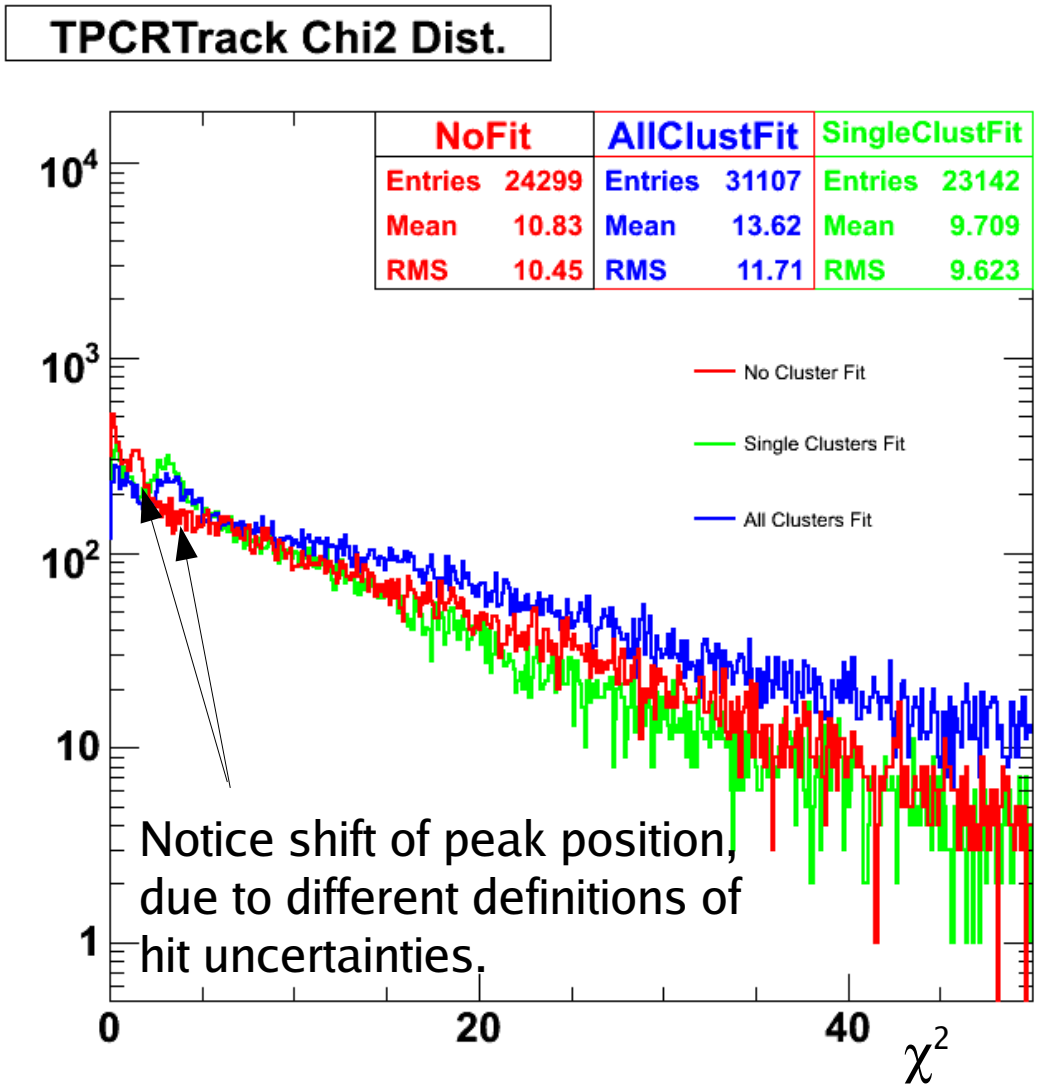


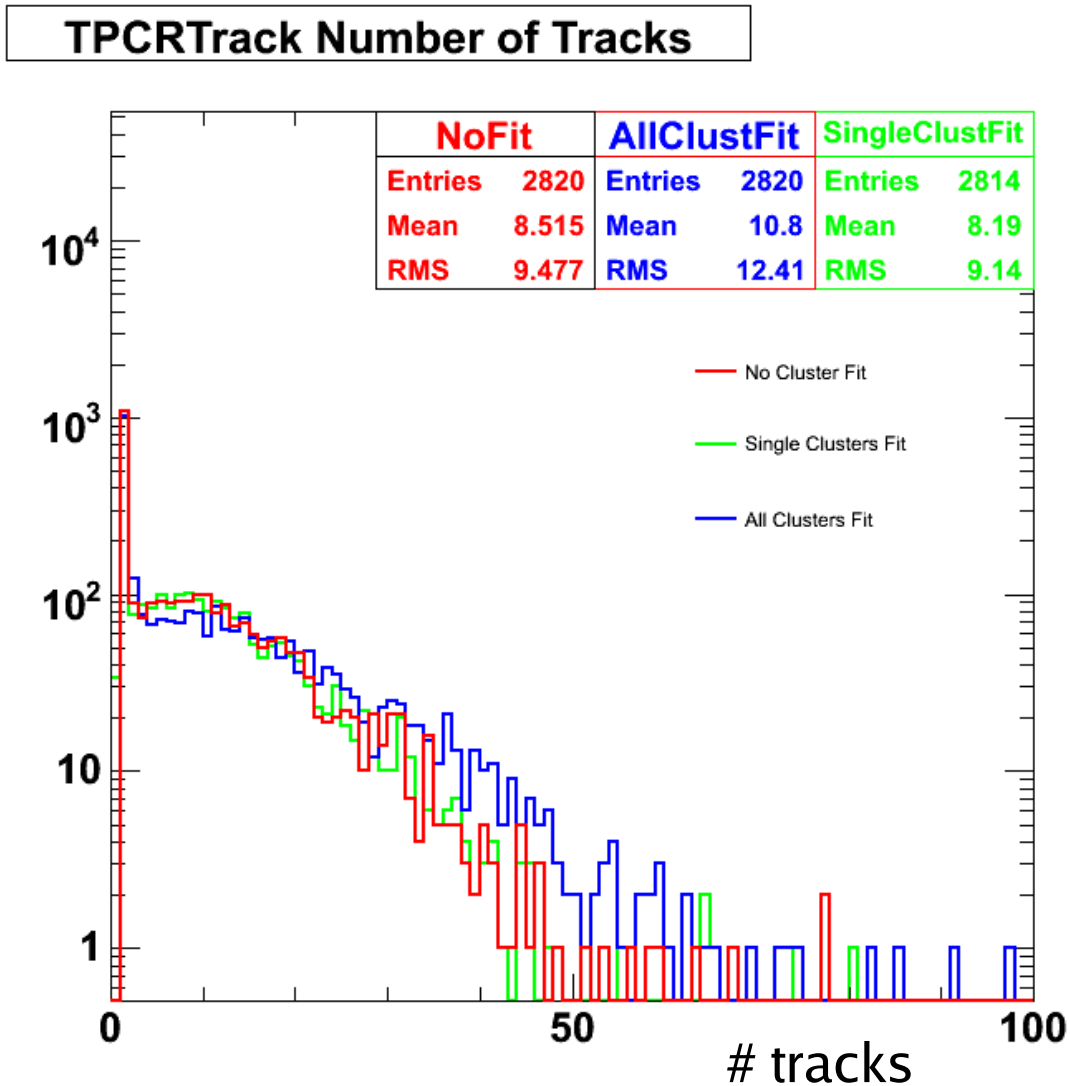
Track x, y position at the face of the TPC.



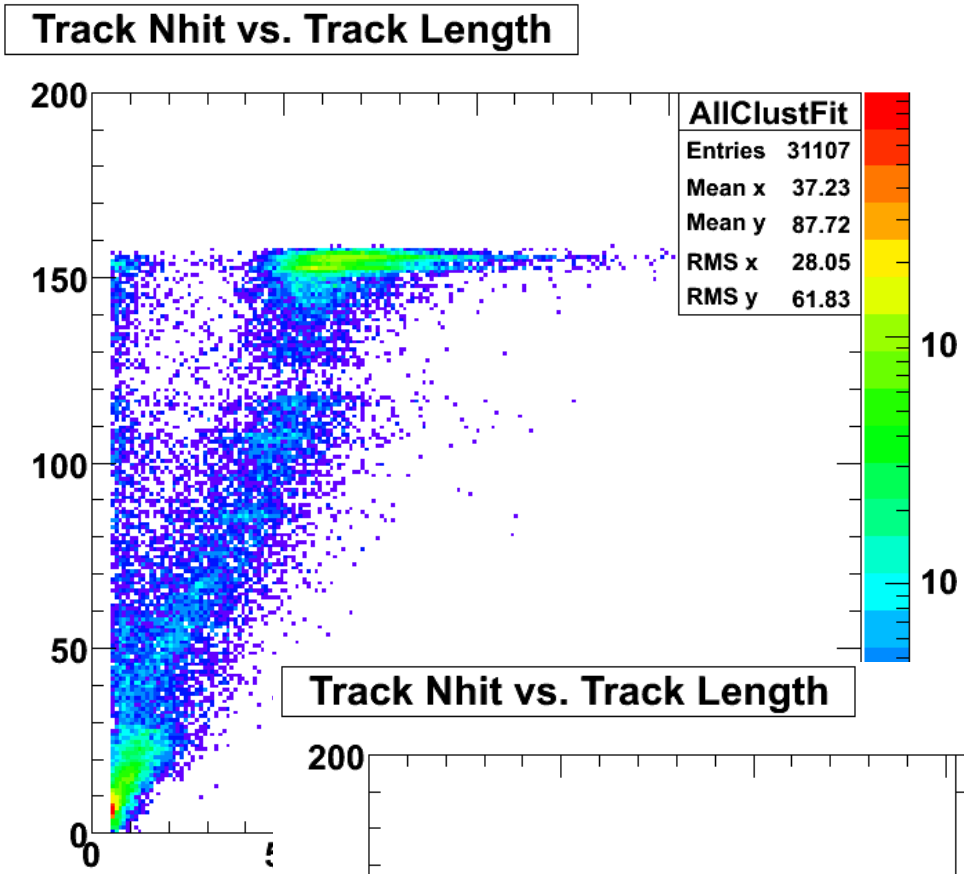


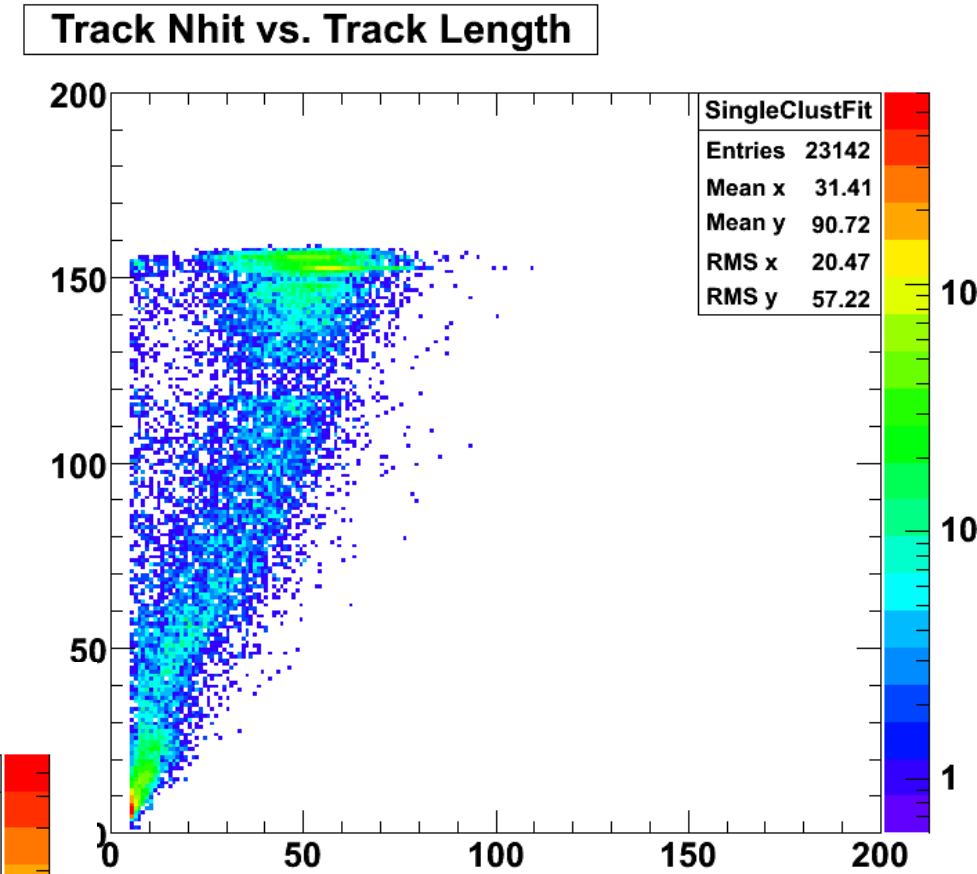
Track slopes at the face of the TPC.

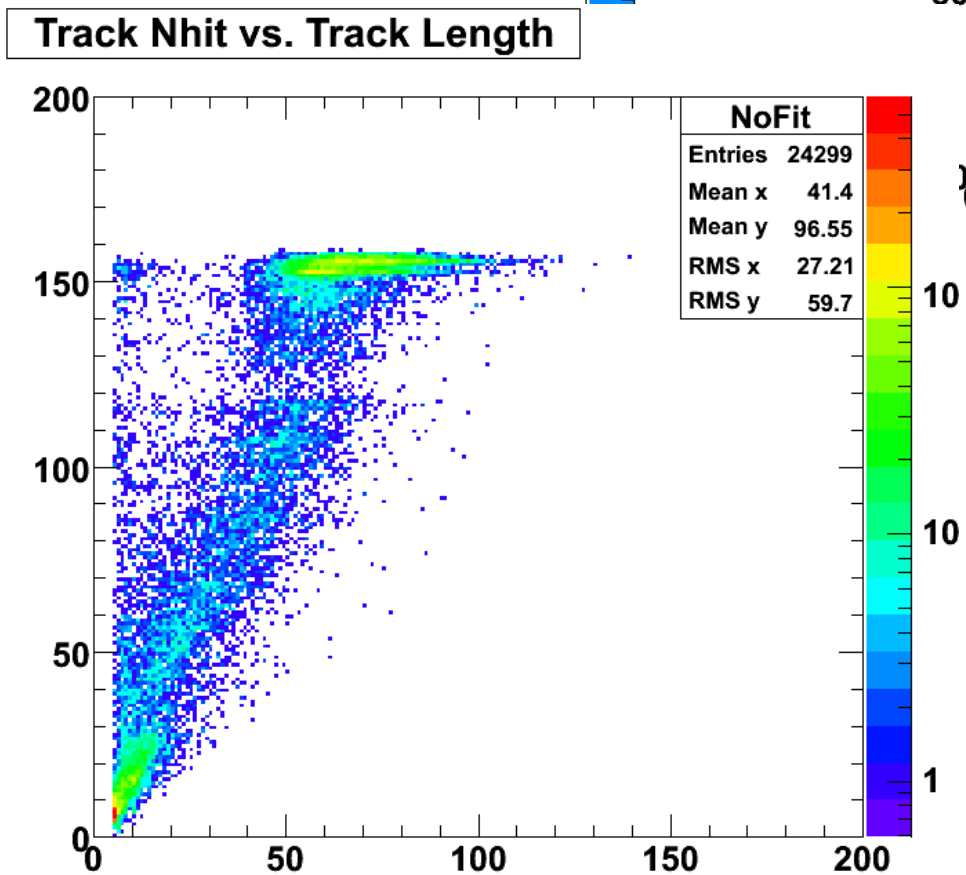




Track χ^2 and multiplicities.


Track Nhit vs. Track Length
AllClustFit
Entries 31107
Mean x 37.23
Mean y 87.72
RMS x 28.05
RMS y 61.83
200
150
100
50
0
10
10


Track Nhit vs. Track Length
SingleClustFit
Entries 23142
Mean x 31.41
Mean y 90.72
RMS x 20.47
RMS y 57.22
200
150
100
50
0
50
100
150
200
10
10
1


Track Nhit vs. Track Length
NoFit
Entries 24299
Mean x 41.4
Mean y 96.55
RMS x 27.21
RMS y 59.7
200
150
100
50
0
50
100
150
200
10
10
1

In Conclusion...

- TPC tracking: 1 : 1.15 : 1.76 (no cluster fit: single cluster fit: mult. cluster fit)
- By eye, track finding using single clusters only seems to be fine.
- Multiple cluster finding may need some more work.
- (Obviously) cannot use cluster fits until the cause of the anamipp crashes is resolved.

What's (Relatively) New: Kalman Fits

- At the last MIPP software workshop, it was decided to use the Kalman Filter for reconstructing tracks and vertices.
- Suggested we use the RecPack toolkit (used by Nomad, HARP, MICE, etc.). The MICE version of this package was provided and made to compile with the MIPP software.
- We had relatively rapid start up with this package, and can currently re-fit TPCRecoJP tracks, as well as find vertex near the target.

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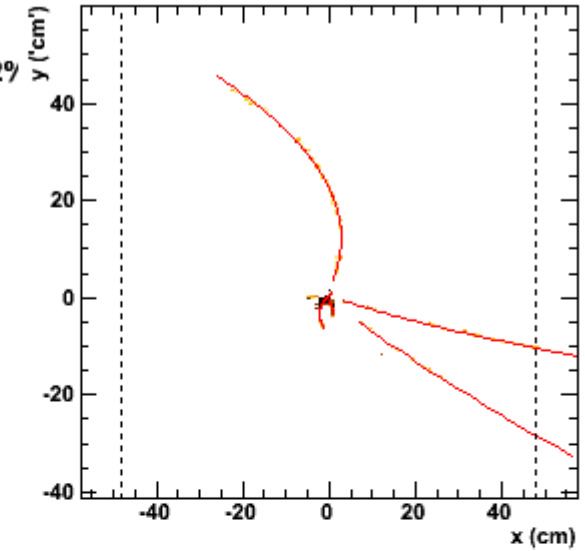

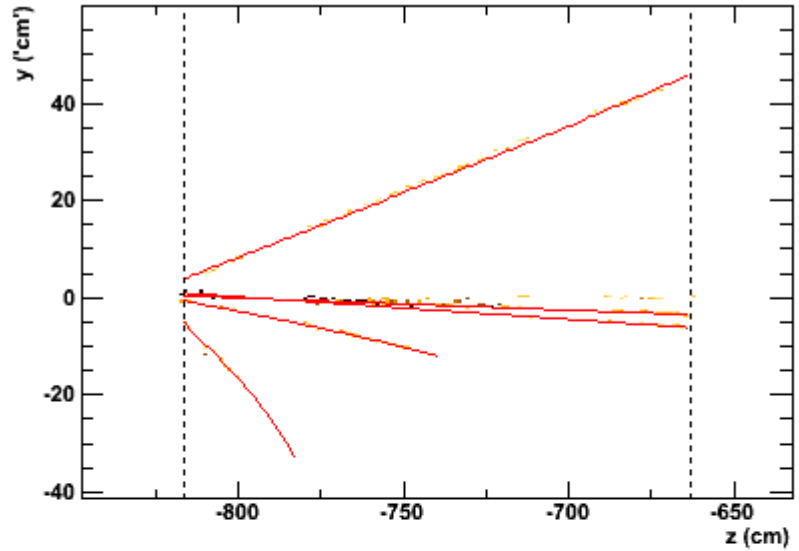

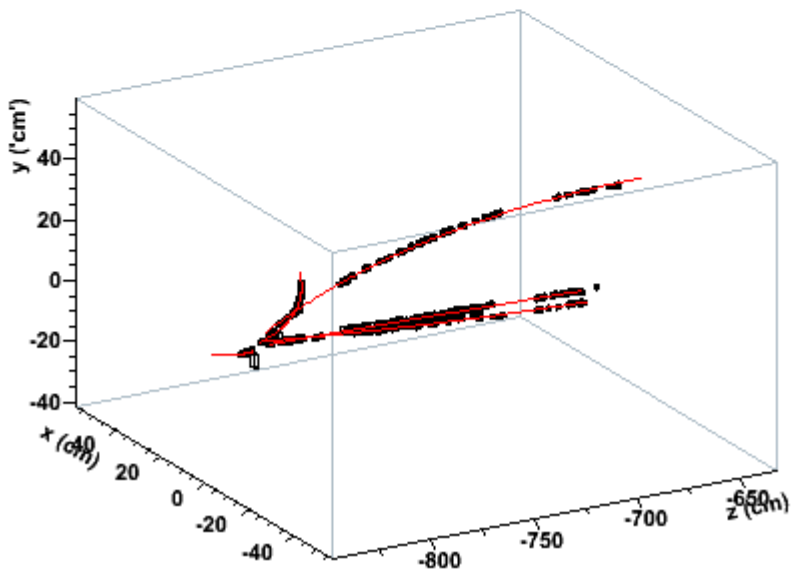

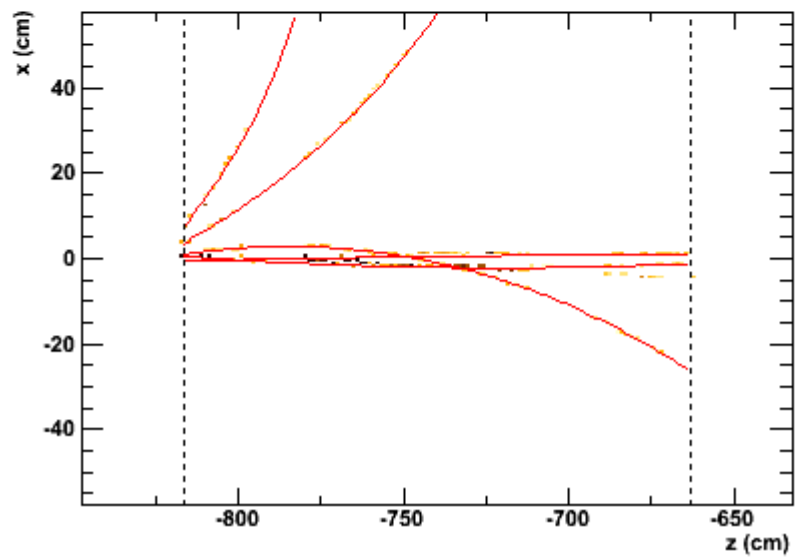

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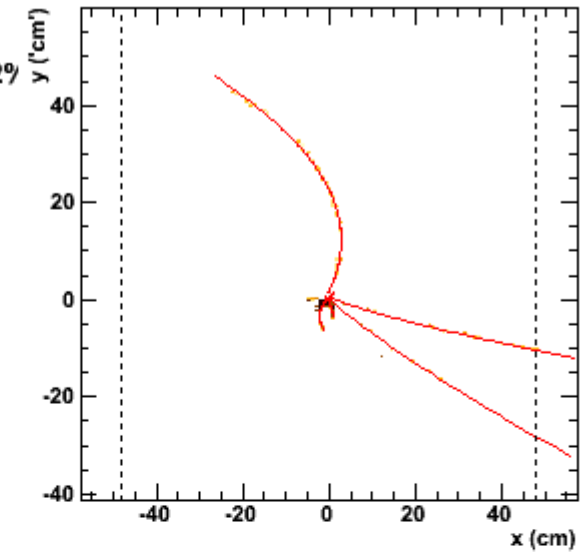

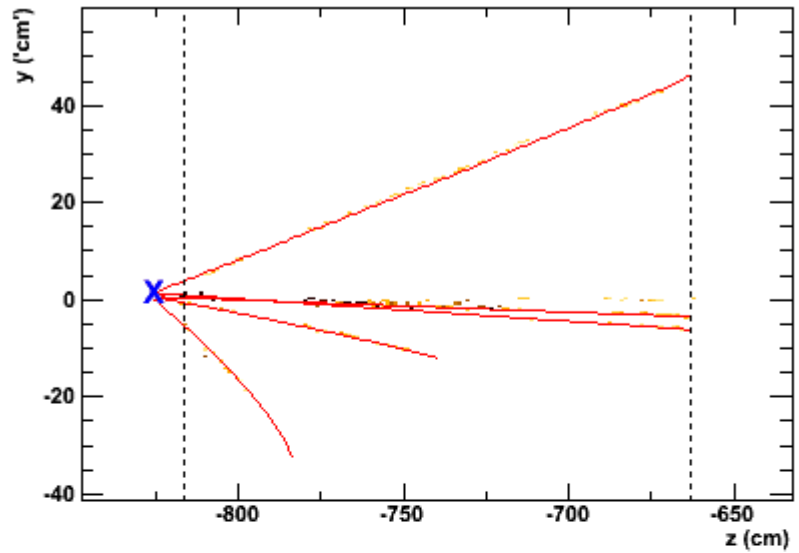

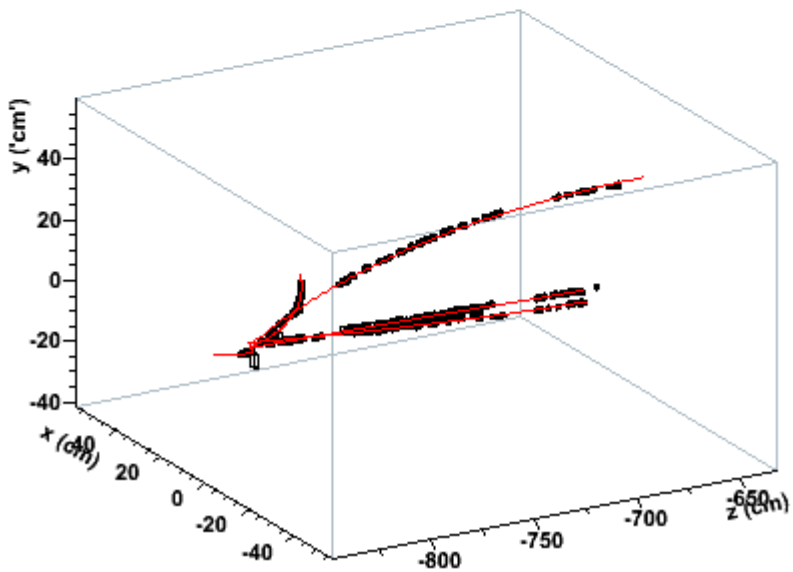

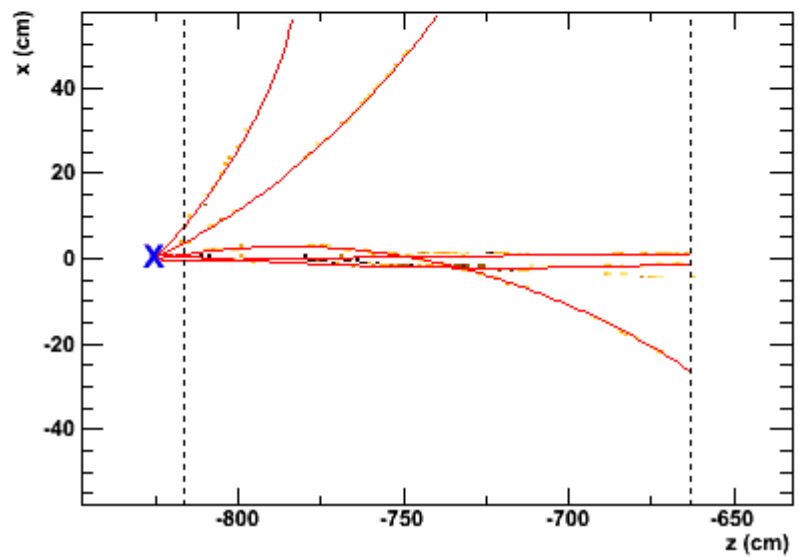

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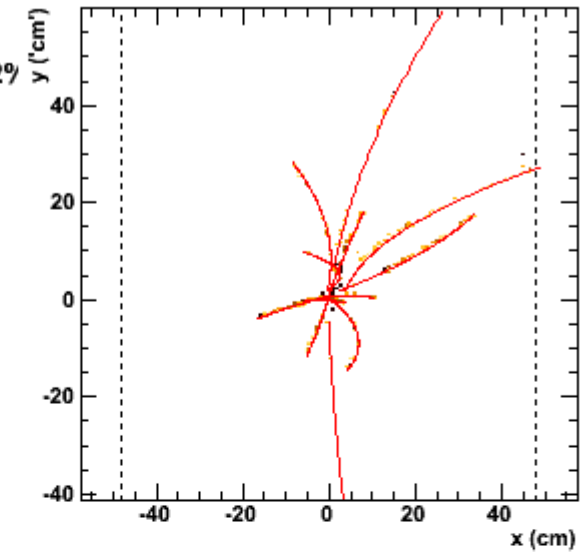

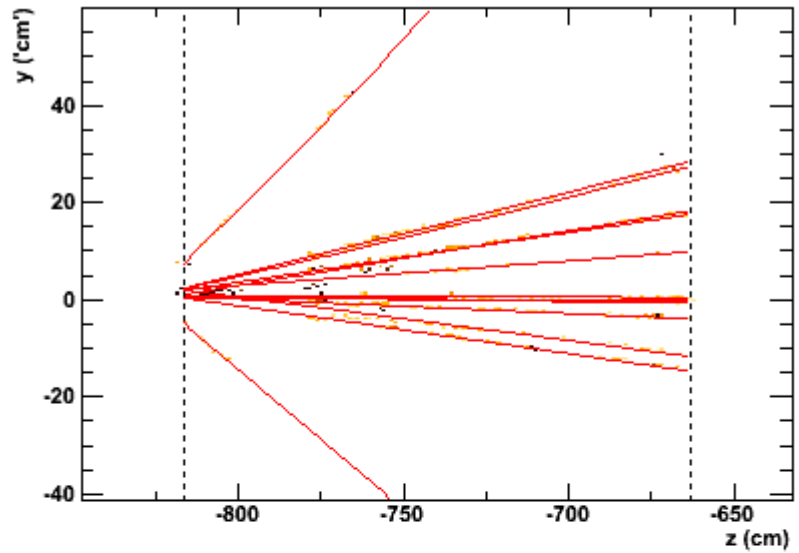

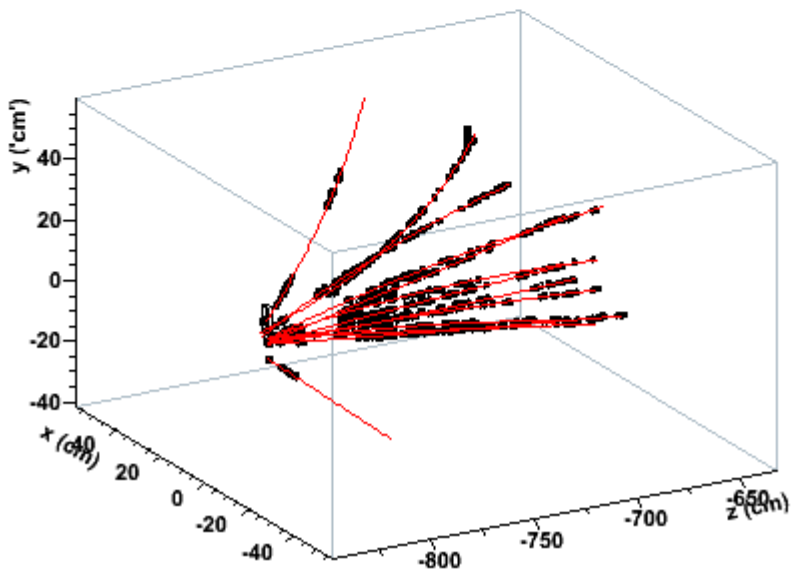

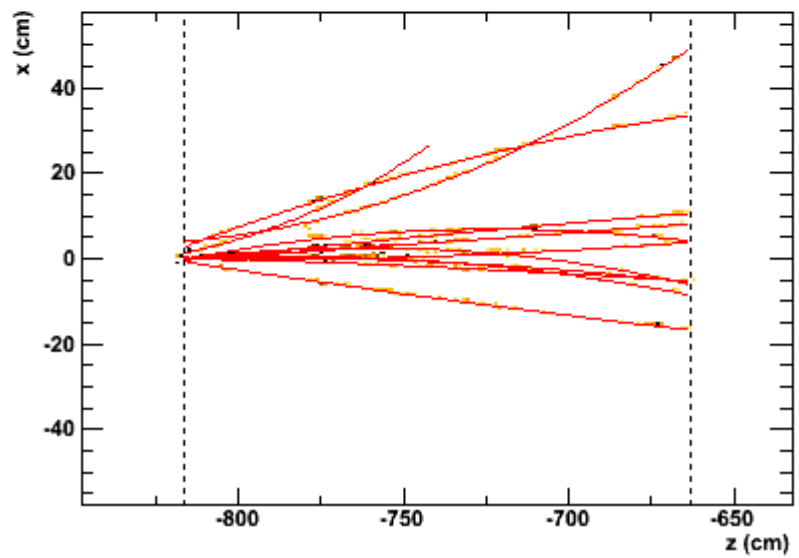

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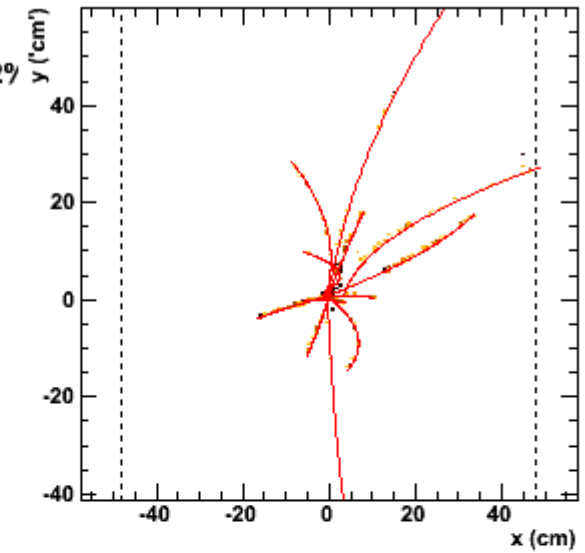
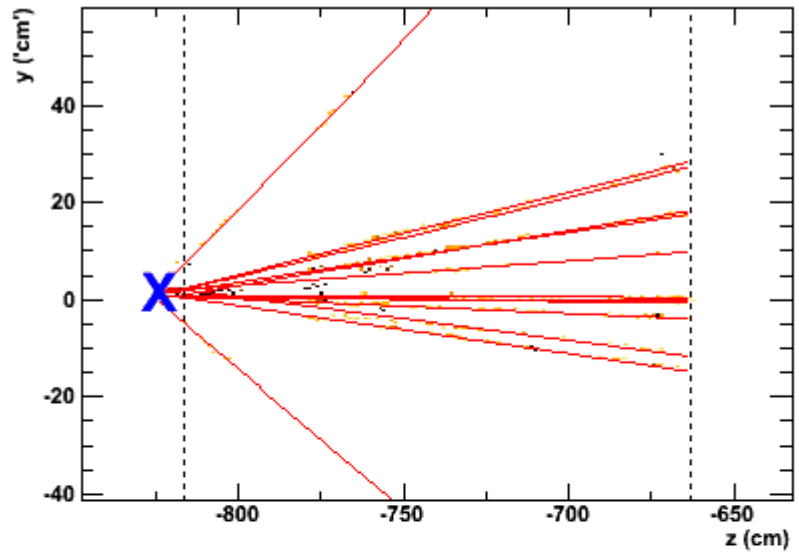
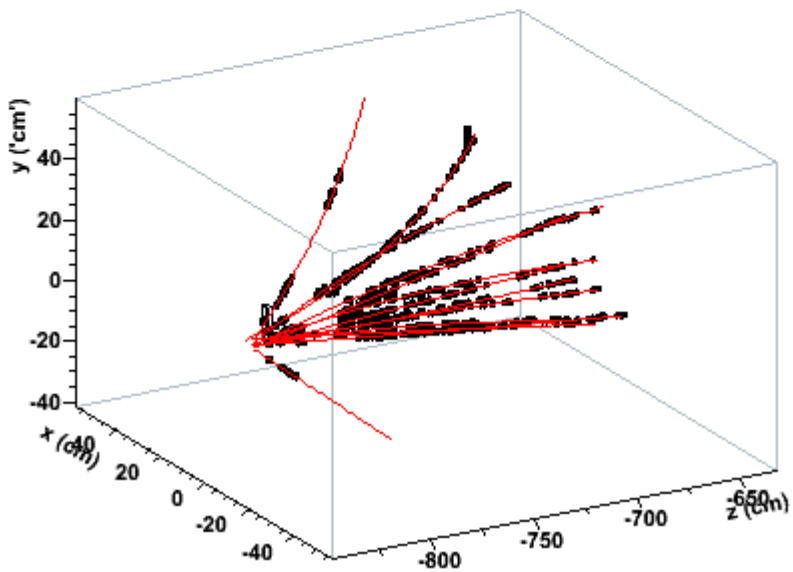
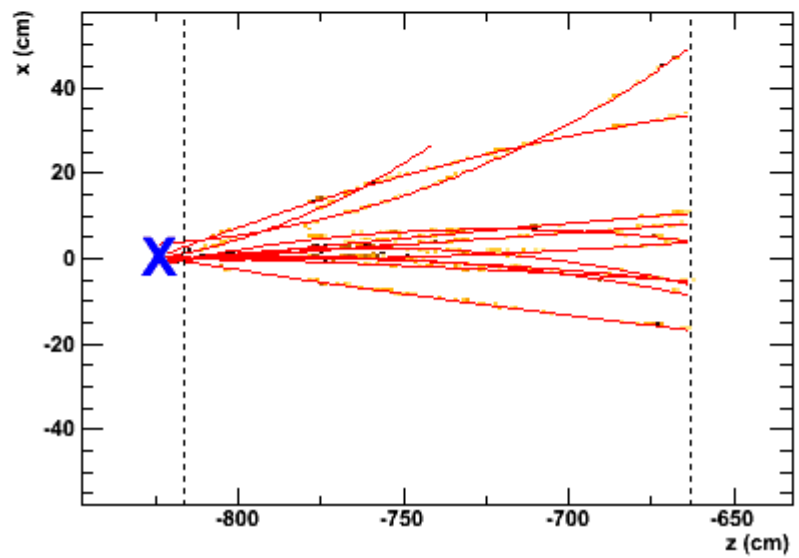
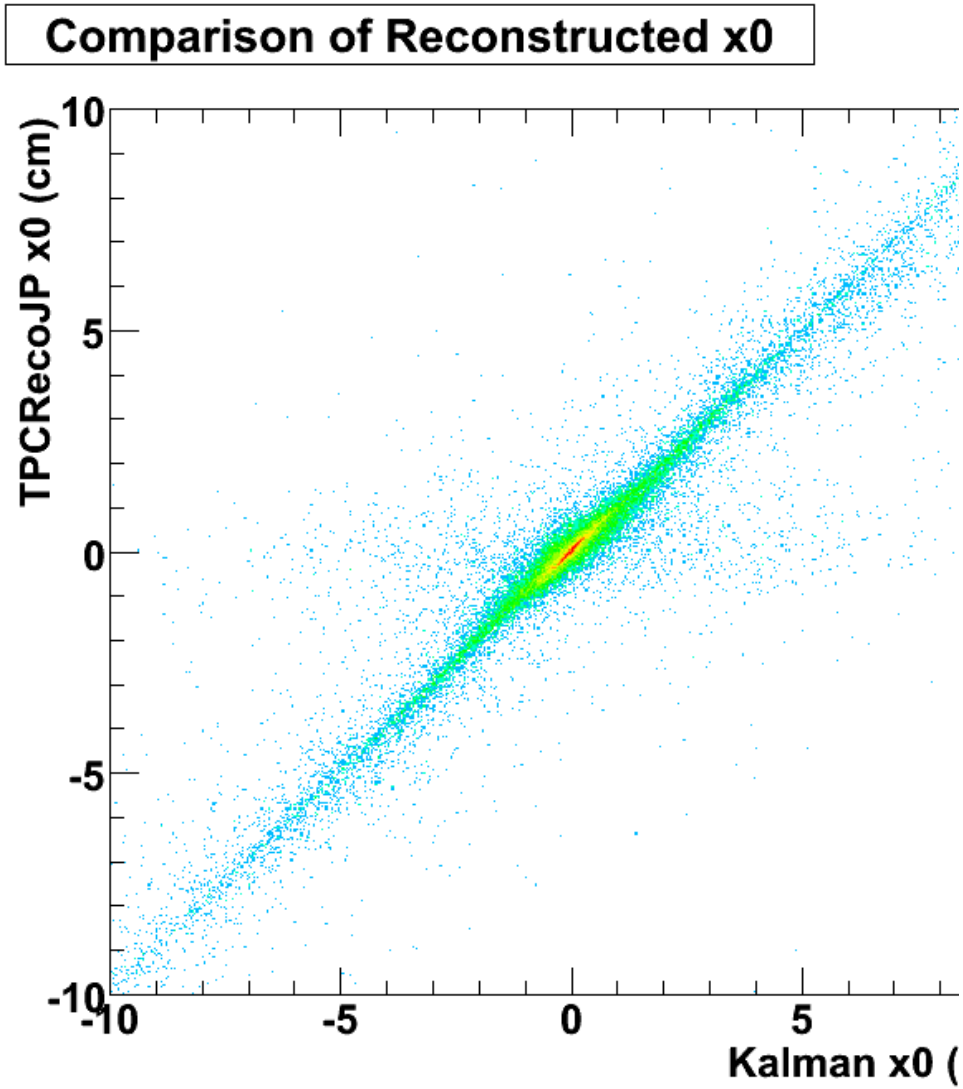
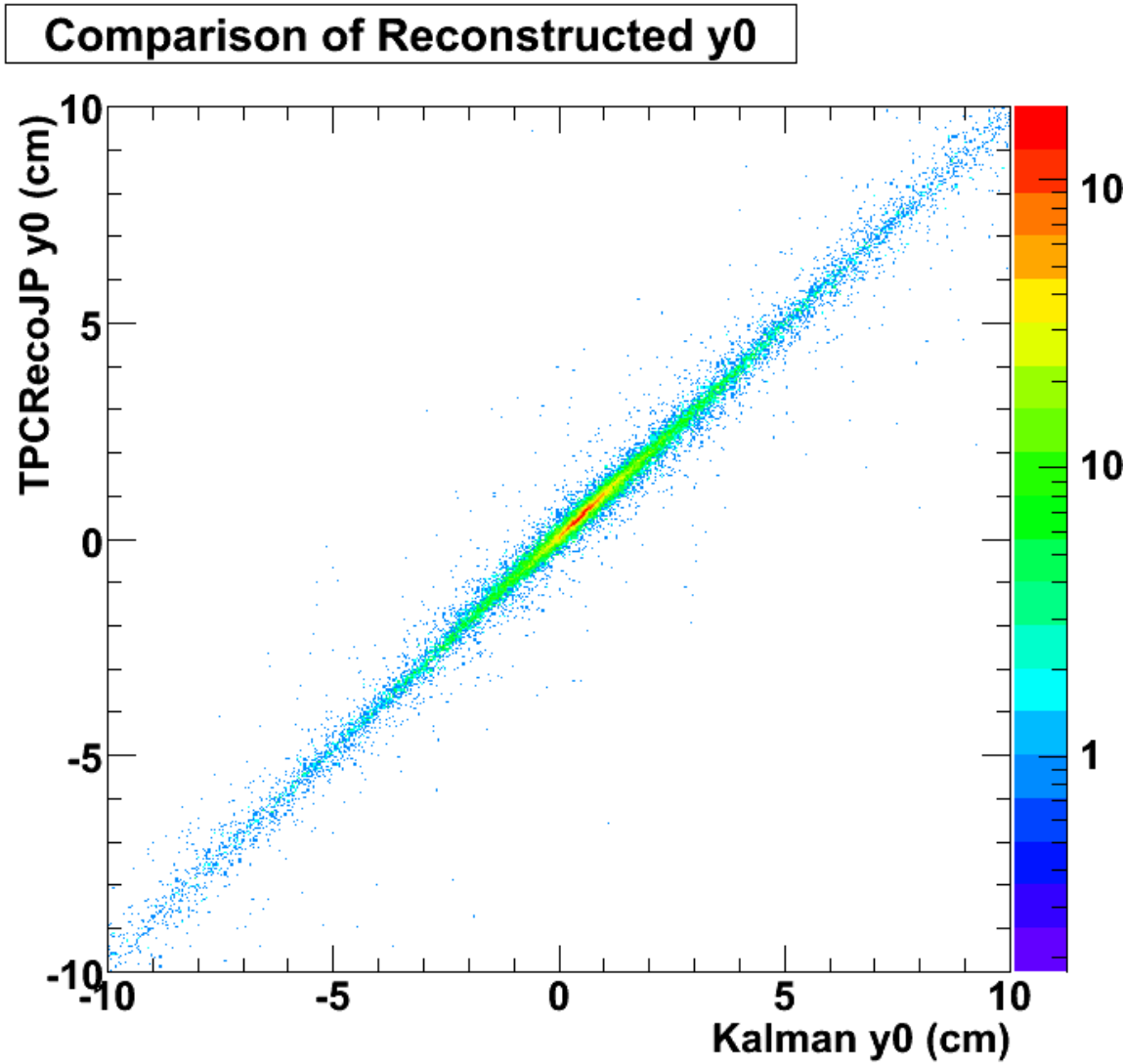




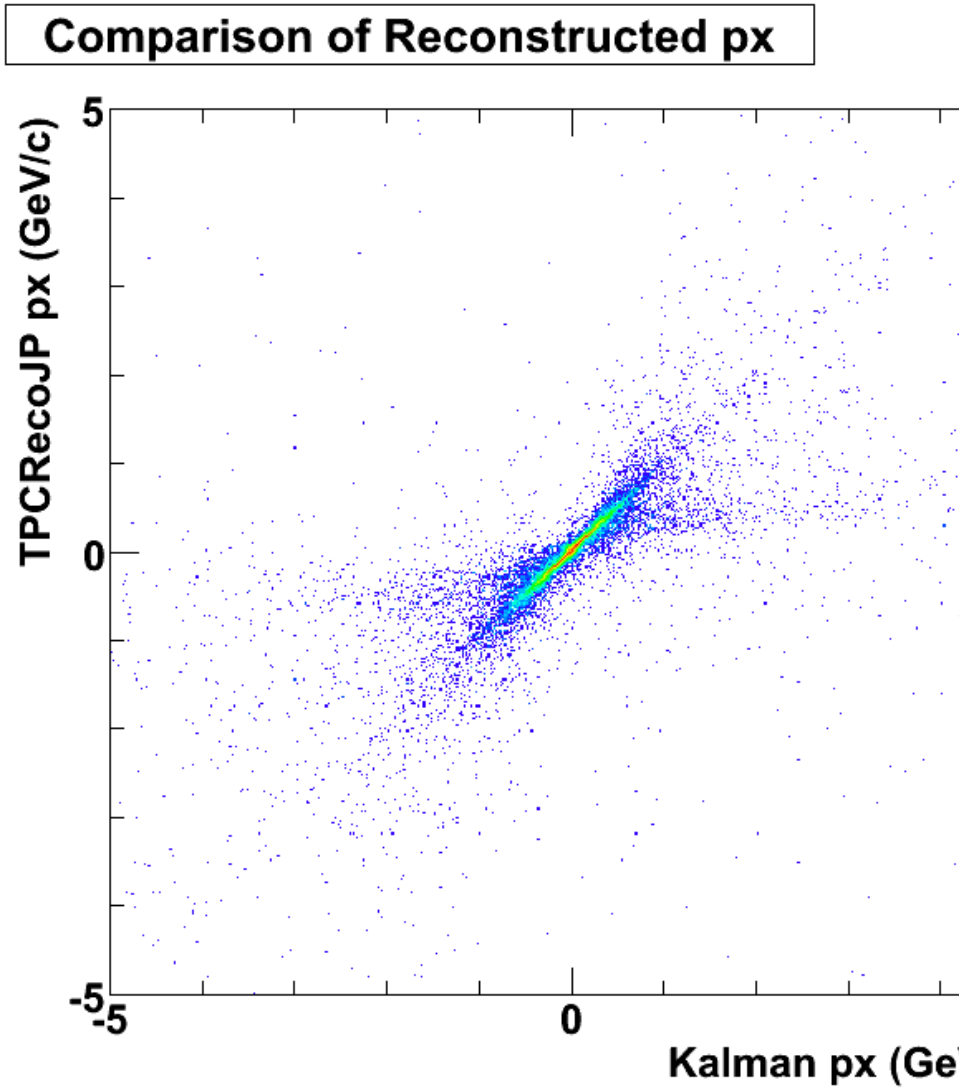


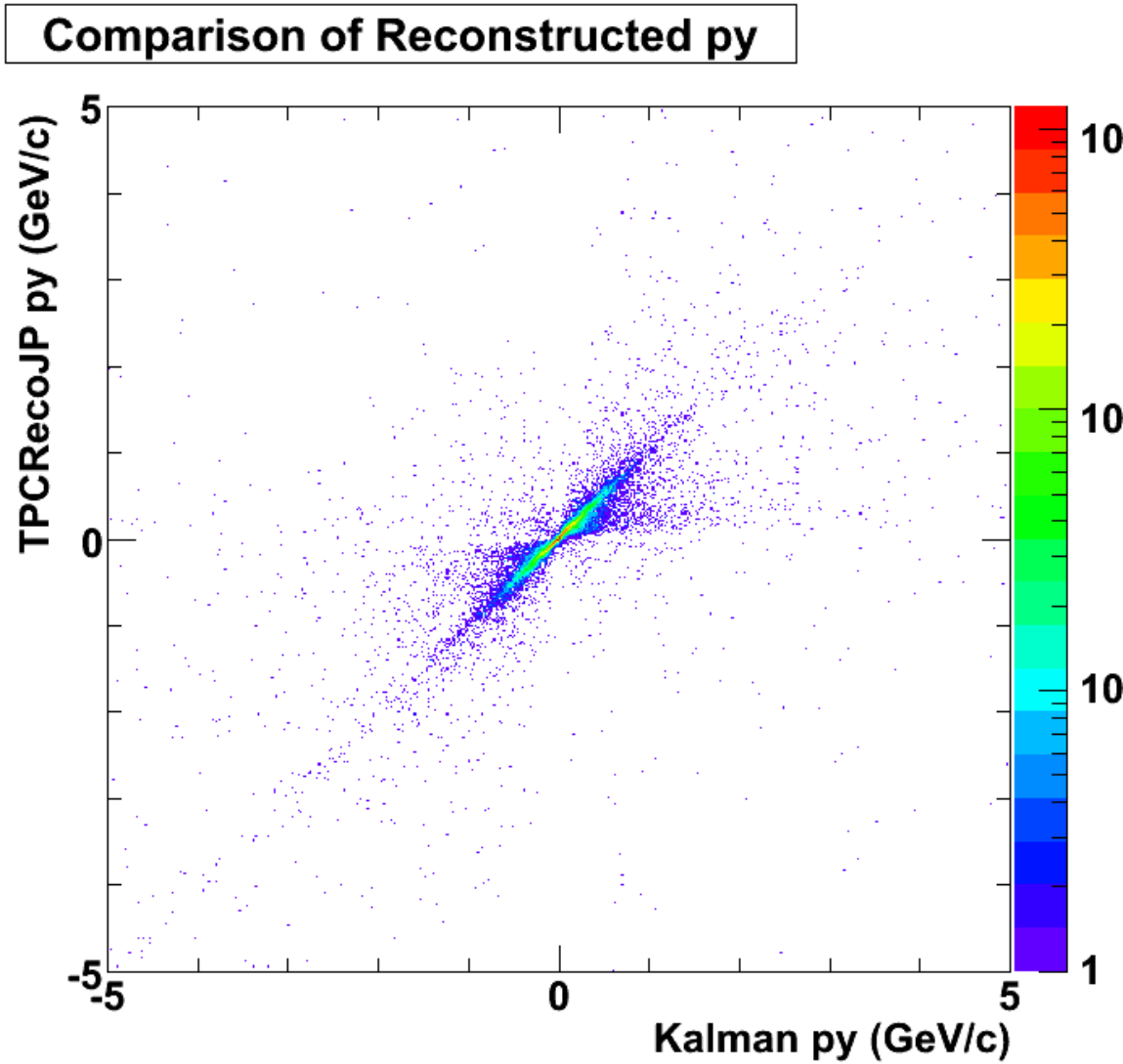




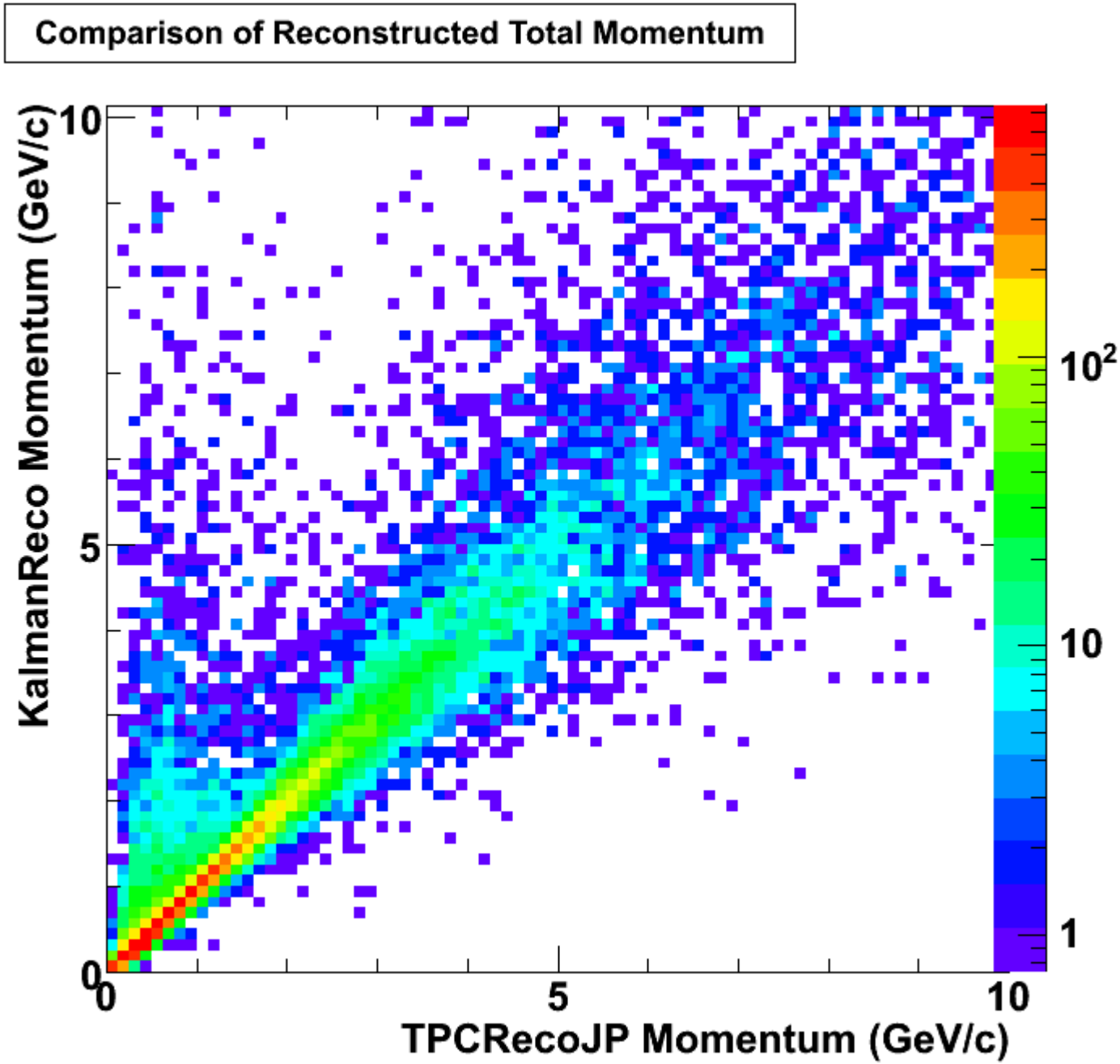


TPCReco (x,y) at zmin vs. Kalman (x,y) at zmin





TPCReco (px,py) at zmin vs. Kalman (px,py) at zmin



TPCReco |p| vs. Kalman |p|

What Works:

- TPC track re-fits
- Vertex fits (only near the target for now...)

What's Missing:

- Vertex-constrained fit
- Ability to swim through field map
- Incorporation of wire hits

Time estimate:
~8 weeks?
Sooner if I get
some help...

Conclusion

- Tracking is in ~good shape... vertexing is ~automatic with Kalman code.
- Vertex-constrained track fits is a work-in-progress... just a matter of time.
- Waiting for support from RecPack experts to resolve current issues; once that's done, I believe rapid progress can be made on the Kalman (global) fits.