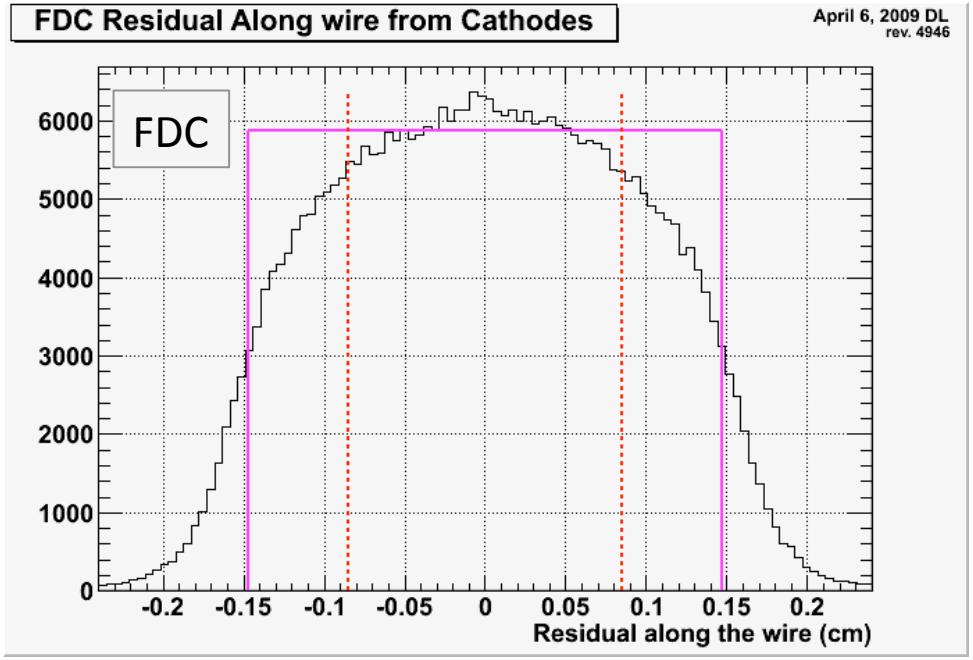
Tracking Efficiency Status Report

April 6, 2009

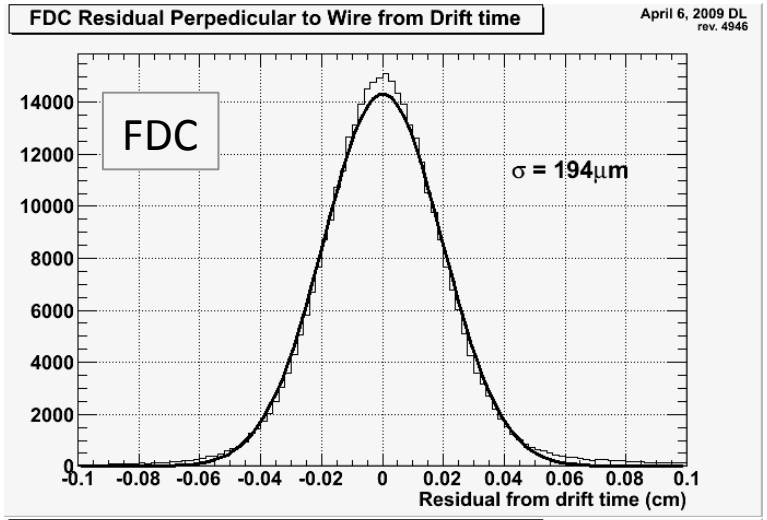
David Lawrence - JLab

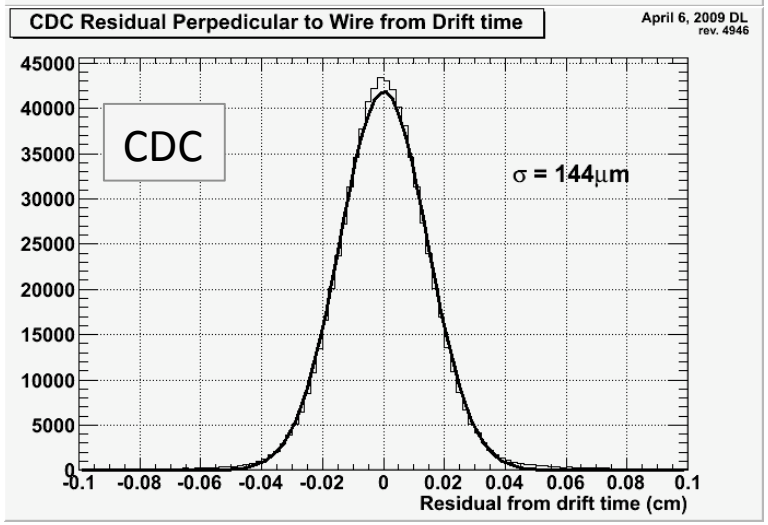
Residuals w/o MULS

Lorentz deflections were included in the simulation, but ALT1 fitter did not used corrected values. This leads to wide residuals along the wire so the ALT1 fitter was told to use a sigma of 850 microns for that component.



In the limit that the cathode residuals look like a box, the variance is the box width divided by sqrt(12)





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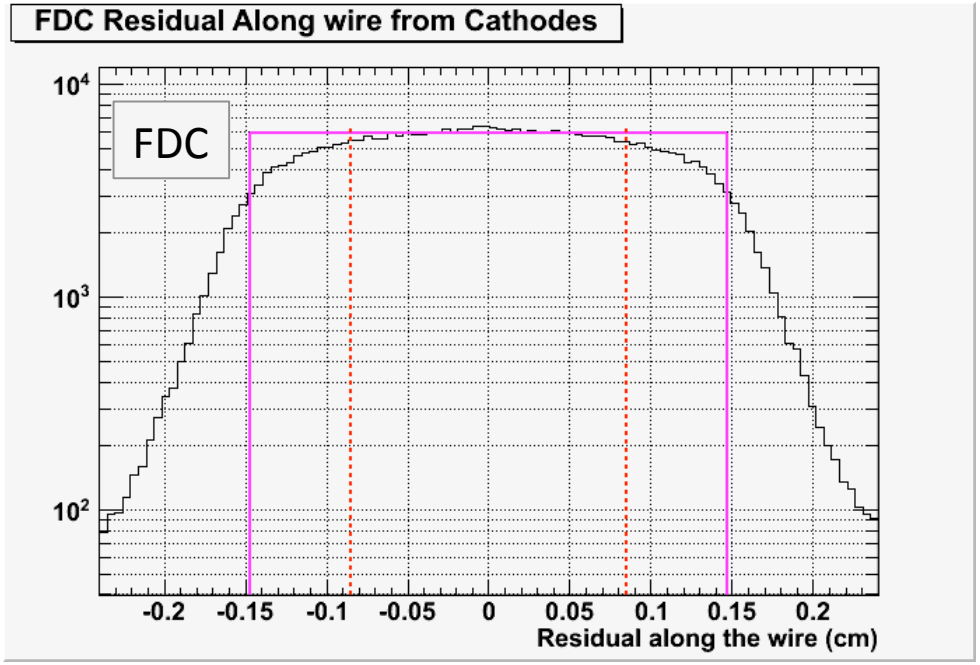
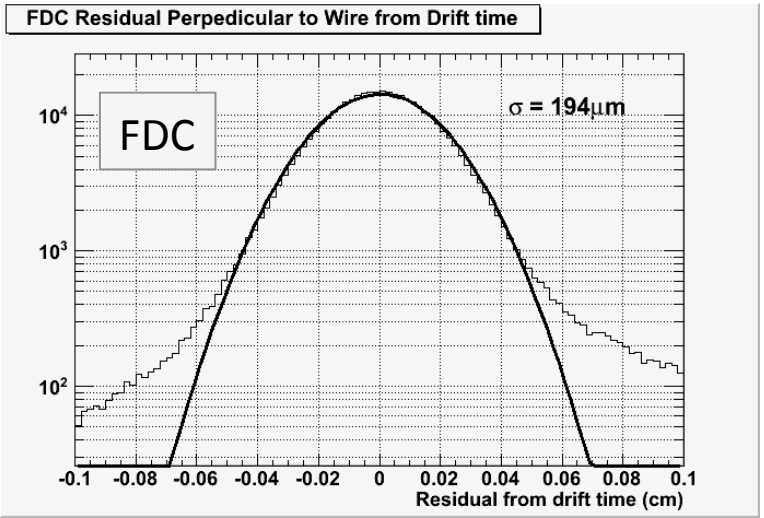
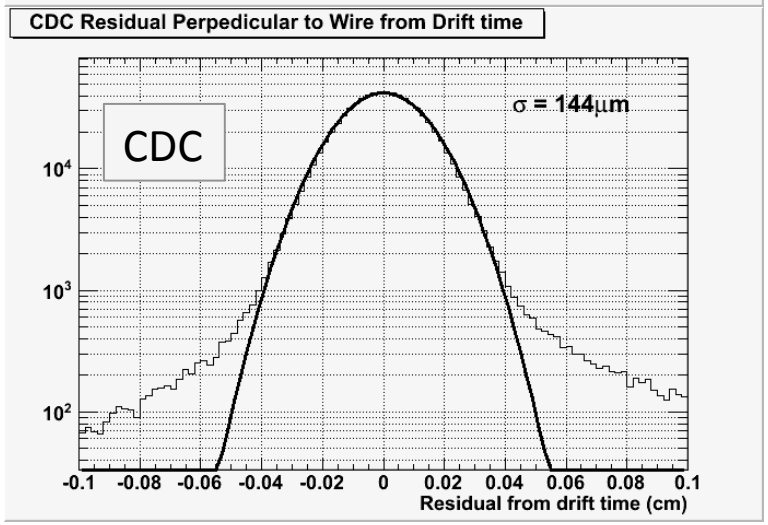
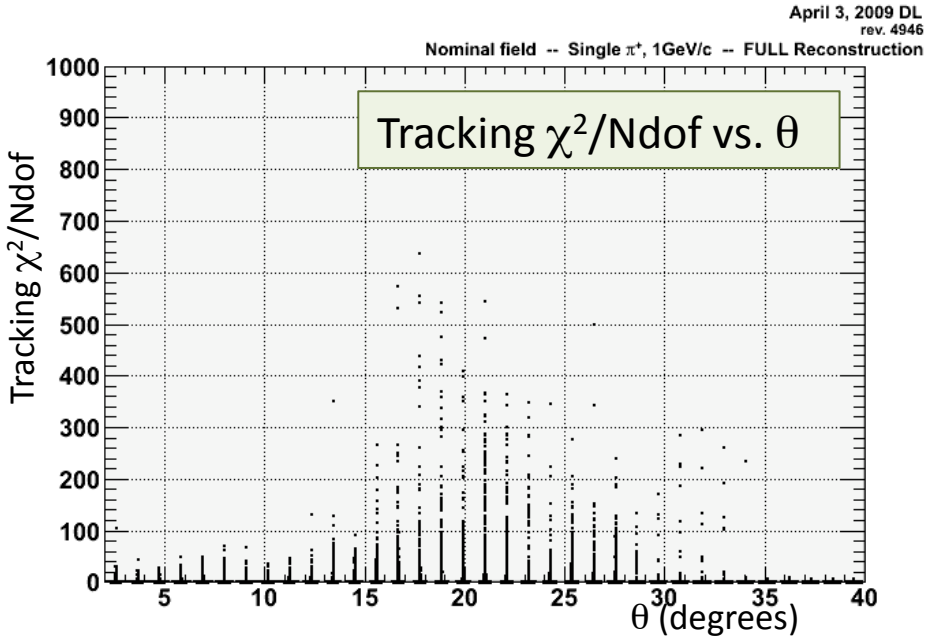


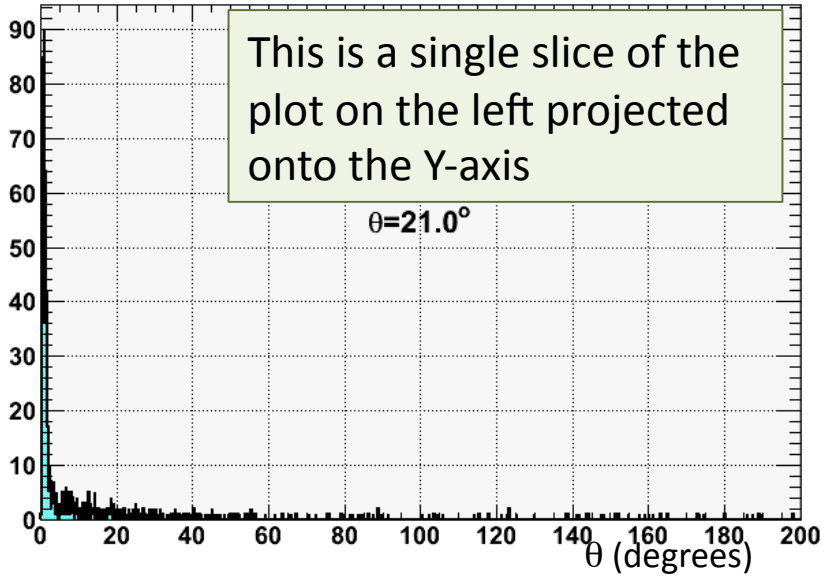
In the limit that the cathode residuals look like a box, the variance is the box width divided by sqrt(12)

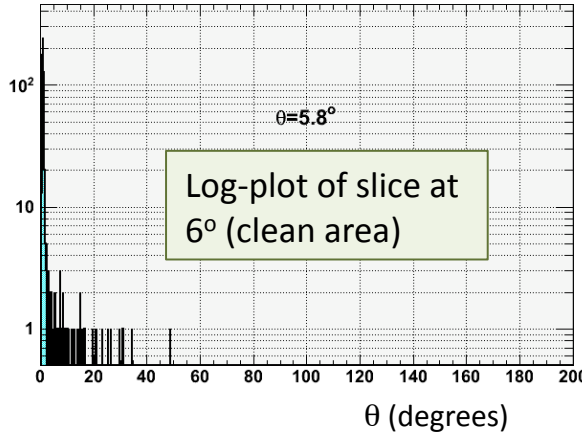


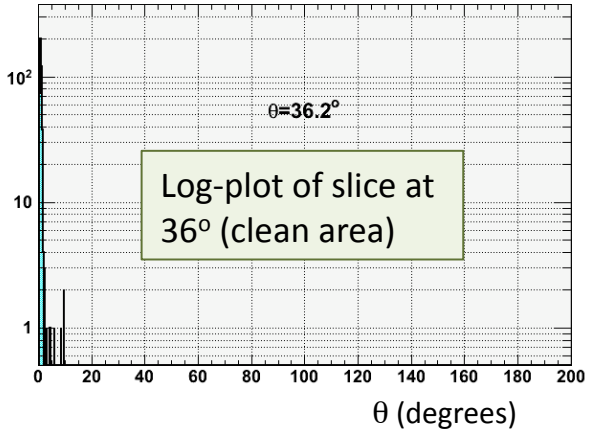


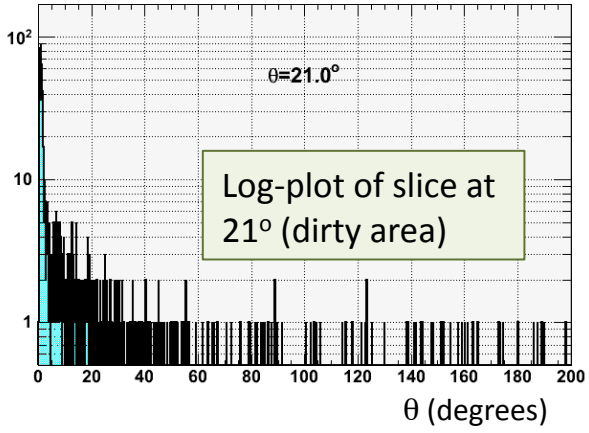
Tracking χ^2/Ndof



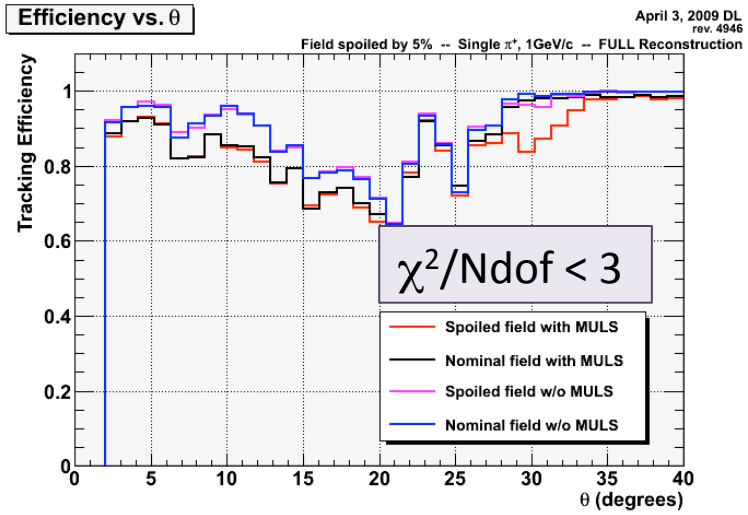


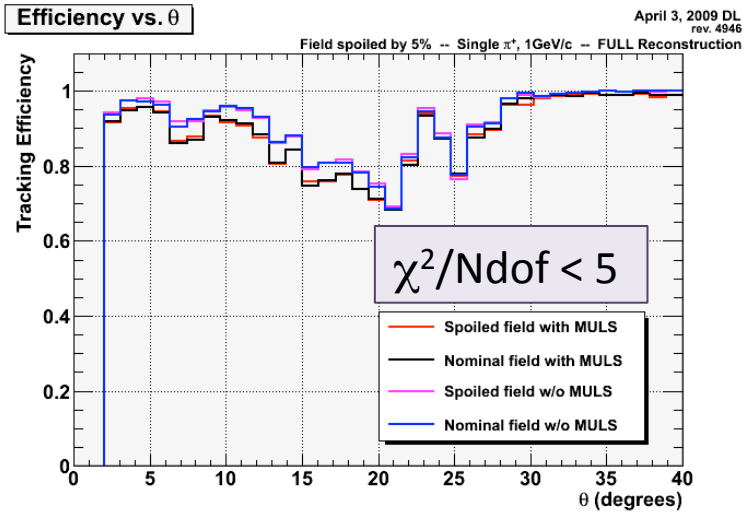


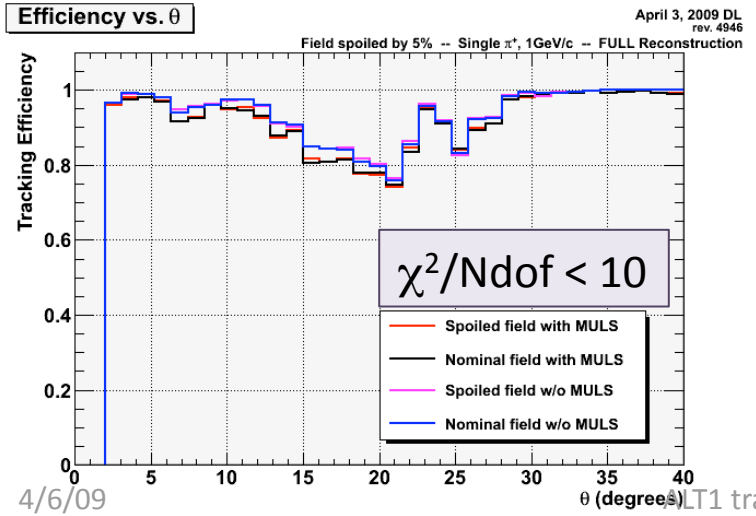


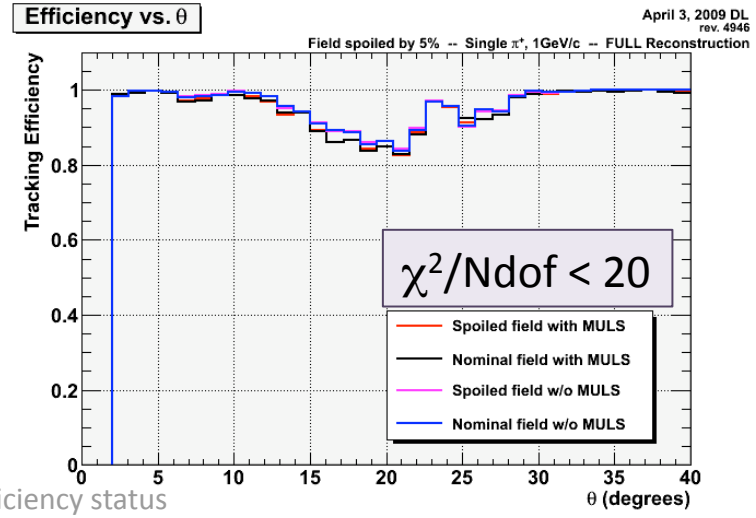


Full reconstruction efficiency for various χ^2/Ndof cuts



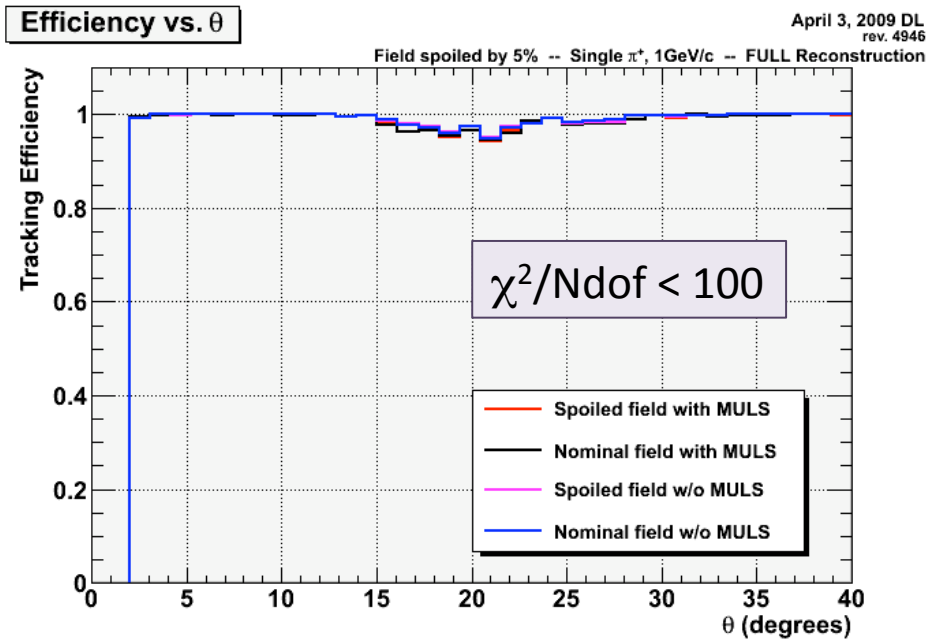


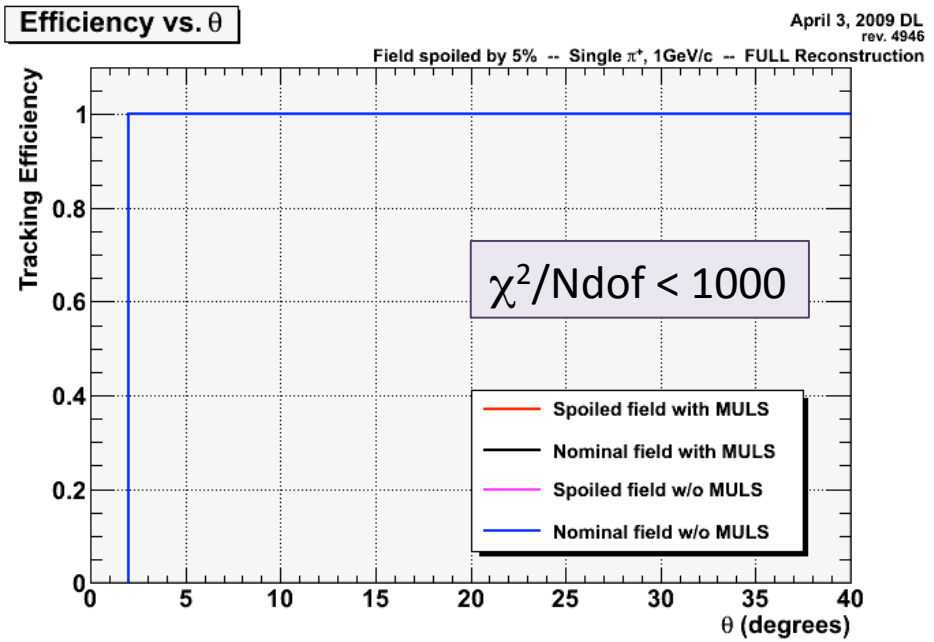




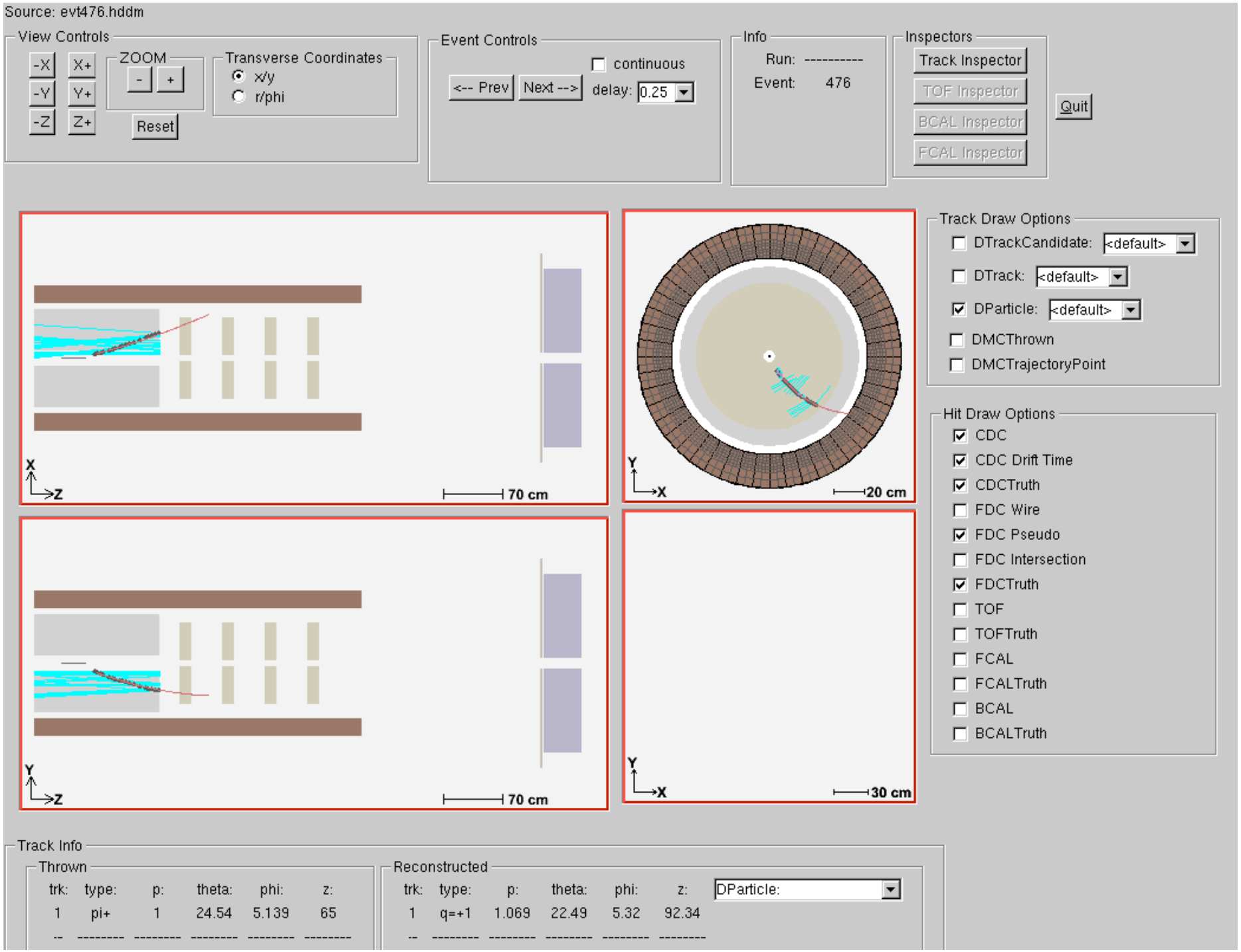
Tracking Efficiency for high χ^2/Ndof cut

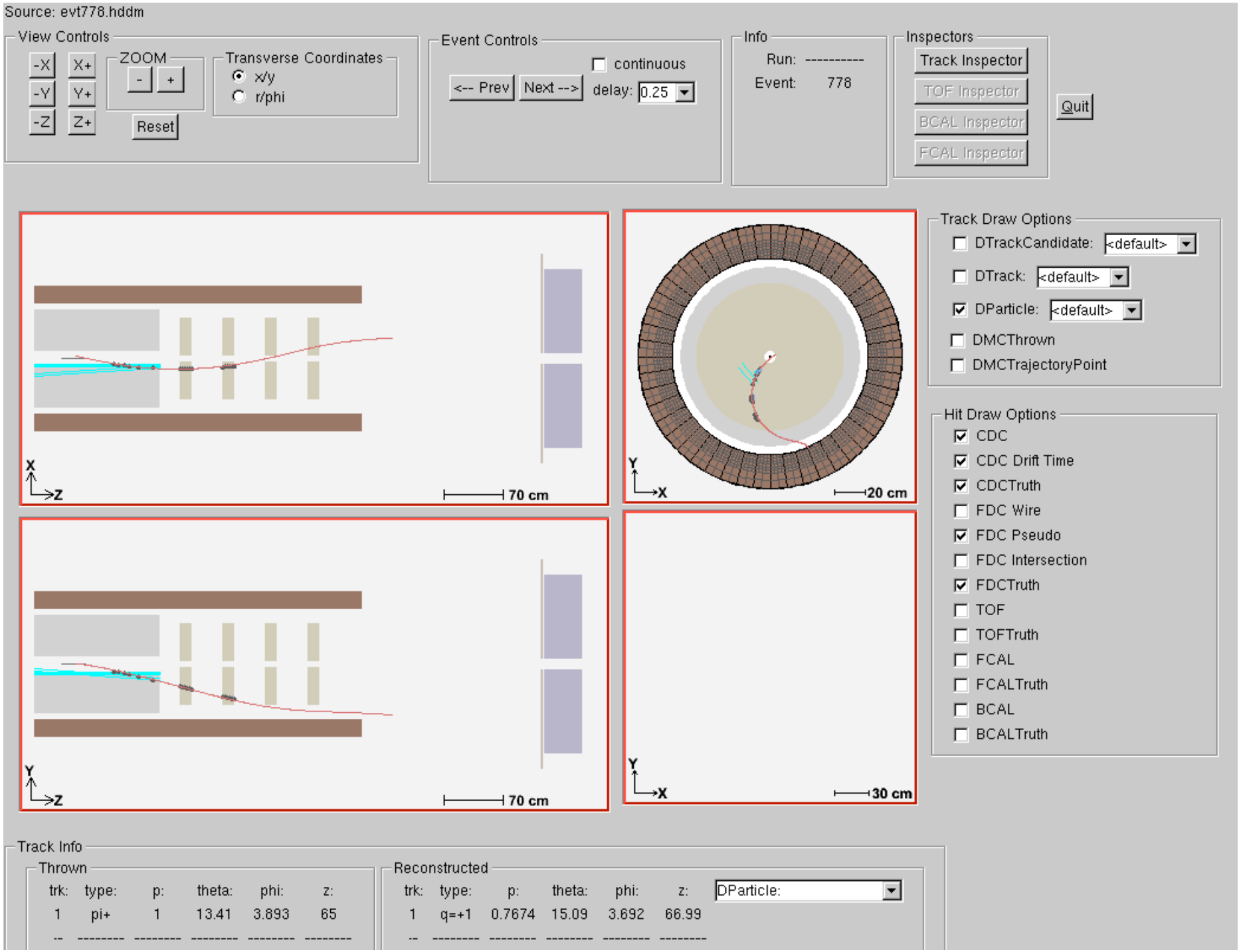
If we push the chi-sq cut high enough the efficiency goes to 1. This indicates that all tracks are being found and are surviving the time-based fitting process.





- The following are the first 6 events with a tracking χ^2/Ndof > 100
- All but the first have tracking χ^2/Ndof less than 160
- Events are all single π^+ tracks with:
  - no multiple scattering or energy loss
  - no background, secondaries or decays etc. …
  - position smearing added via Gaussian to drift-time
- Full reconstruction was done:
  - Track finding
  - Wire-based fit
  - Time-based fit
  - NO beamline/target constraint


Source: evt476.hddm
View Controls
-X
X+
-Y
Y+
-Z
Z+
ZOOM
-
+
Reset
Transverse Coordinates
x/y
r/phi
Event Controls
continuous
<-- Prev
Next -->
delay: 0.25
Info
Run: ----------
Event: 476
Inspectors
Track Inspector
TOF Inspector
BCAL Inspector
FCAL Inspector
Quit
X
Z
70 cm
Y
X
20 cm
Y
Z
70 cm
Y
X
30 cm
Track Draw Options
DTrackCandidate: <default>
DTrack: <default>
DParticle: <default>
DMCThrown
DMCTrajectoryPoint
Hit Draw Options
CDC
CDC Drift Time
CDCTruth
FDC Wire
FDC Pseudo
FDC Intersection
FDCTruth
TOF
TOFTruth
FCAL
FCALTruth
BCAL
BCALTruth
Track Info
Thrown
trk: type: p: theta: phi: z:
1 pi+ 1 24.54 5.139 65
Reconstructed
trk: type: p: theta: phi: z:
1 q=+1 1.069 22.49 5.32 92.34
DParticle: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View Controls
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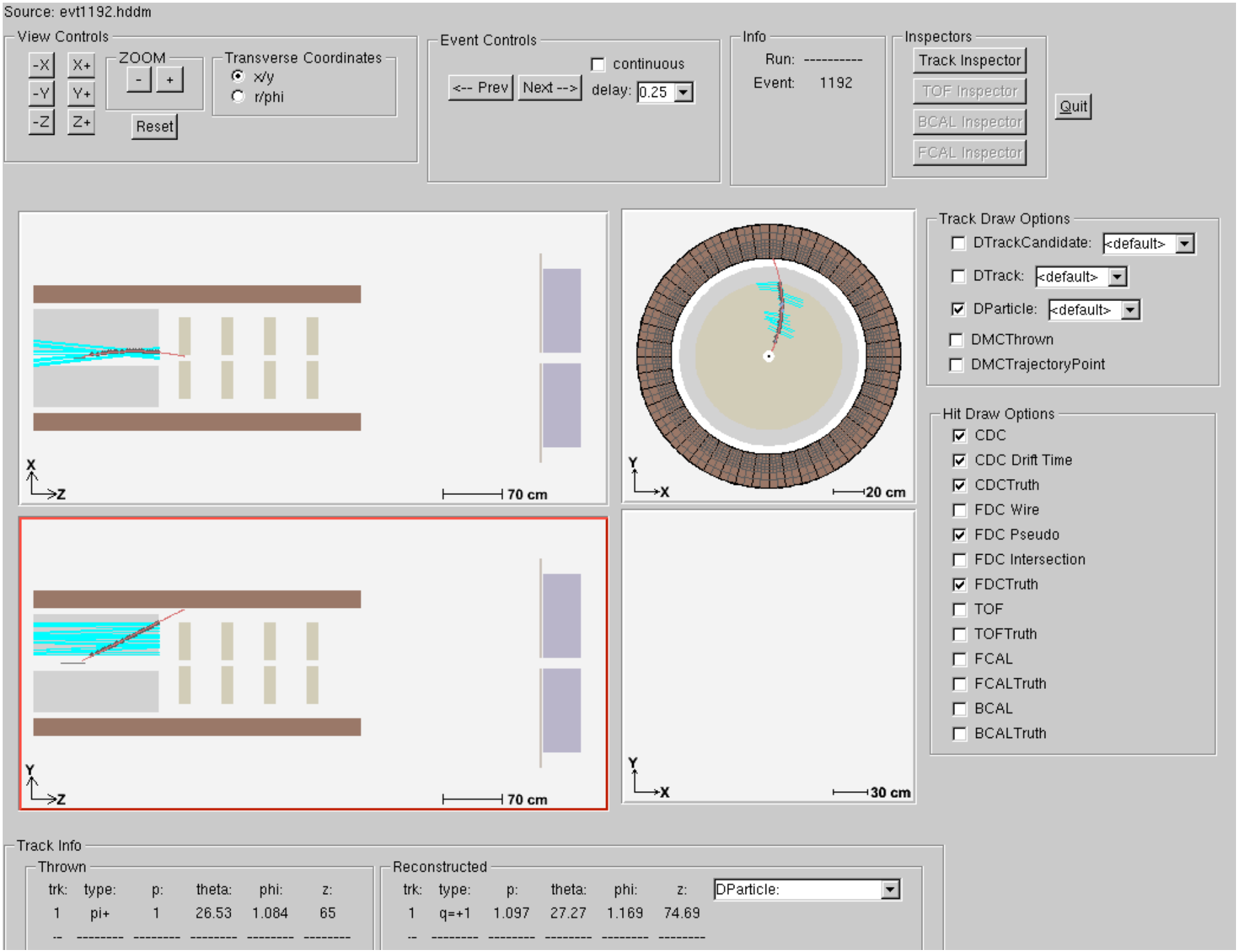
X+
-Y
Y+
-Z
Z+
ZOOM
-
+
Reset
Transverse Coordinates
x/y
r/phi
Event Controls
continuous
<-- Prev
Next -->
delay:
0.25
Info
Run: ----------
Event: 778
Inspectors
Track Inspector
TOF Inspector
BCAL Inspector
FCAL Inspector
Quit
X
Z
70 cm
Y
X
20 cm
Y
Z
70 cm
Y
X
30 cm
Track Draw Options
DTrackCandidate:
<default>
DTrack:
<default>
DParticle:
<default>
DMCThrown
DMCTrajectoryPoint
Hit Draw Options
CDC
CDC Drift Time
CDCTruth
FDC Wire
FDC Pseudo
FDC Intersection
FDCTruth
TOF
TOFTruth
FCAL
FCALTruth
BCAL
BCALTruth
Track Info
Thrown
trk: type: p: theta: phi: z:
1 pi+ 1 13.41 3.893 65
Reconstructed
trk: type: p: theta: phi: z:
1 q=+1 0.7674 15.09 3.692 66.99
DParticle: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View Controls
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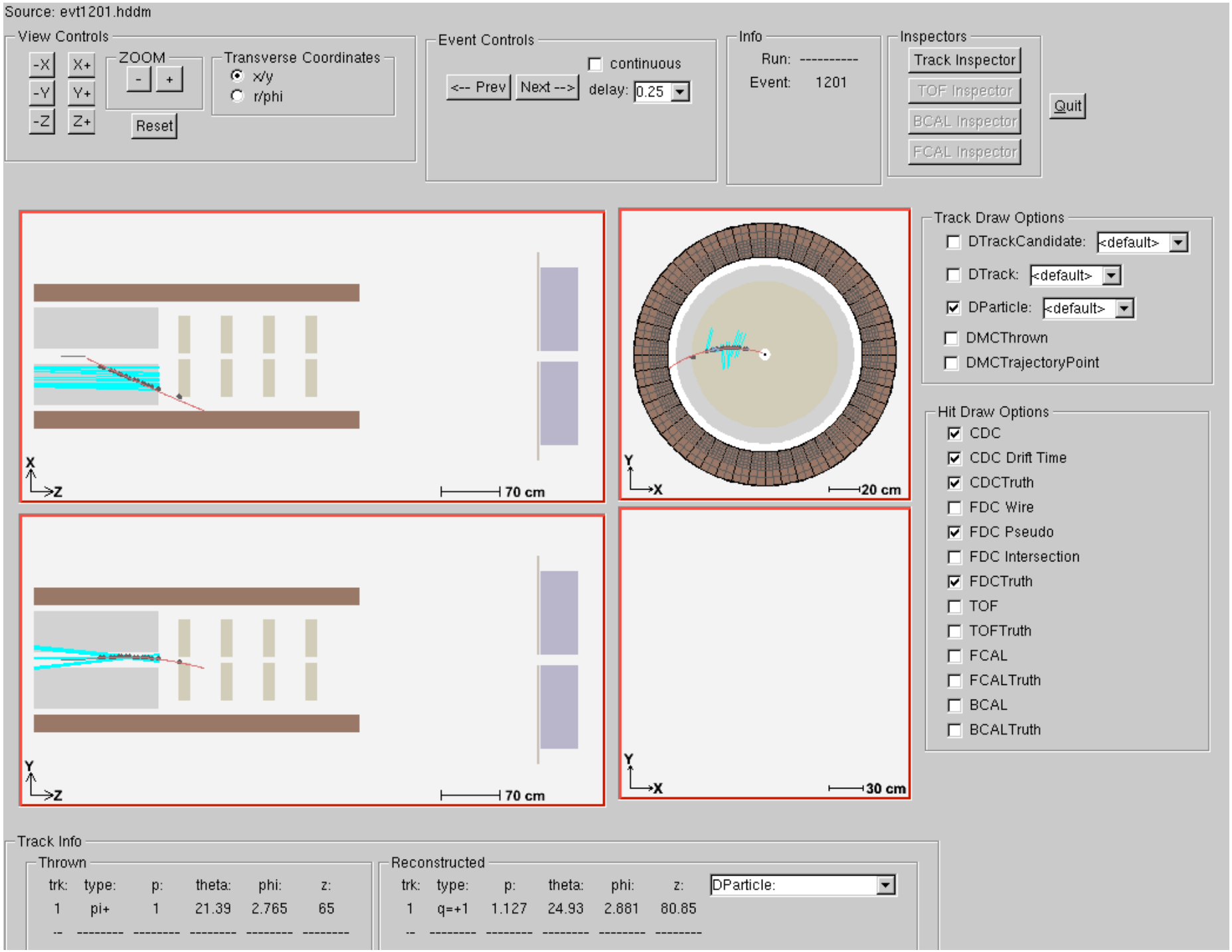
X+
-Y
Y+
-Z
Z+
ZOOM
-
+
Reset
Transverse Coordinates
x/y
r/phi
Event Controls
continuous
<-- Prev
Next -->
delay: 0.25
Info
Run: ----------
Event: 1192
Inspectors
Track Inspector
TOF Inspector
BCAL Inspector
FCAL Inspector
Quit
X
Z
70 cm
Y
X
20 cm
Y
Z
70 cm
Y
X
30 cm
Track Draw Options
DTrackCandidate: <default>
DTrack: <default>
DParticle: <default>
DMCThrown
DMCTrajectoryPoint
Hit Draw Options
CDC
CDC Drift Time
CDCTruth
FDC Wire
FDC Pseudo
FDC Intersection
FDCTruth
TOF
TOFTruth
FCAL
FCALTruth
BCAL
BCALTruth
Track Info
Thrown
trk: type: p: theta: phi: z:
1 pi+ 1 26.53 1.084 65
Reconstructed
trk: type: p: theta: phi: z:
1 q=+1 1.097 27.27 1.169 74.69
DParticle: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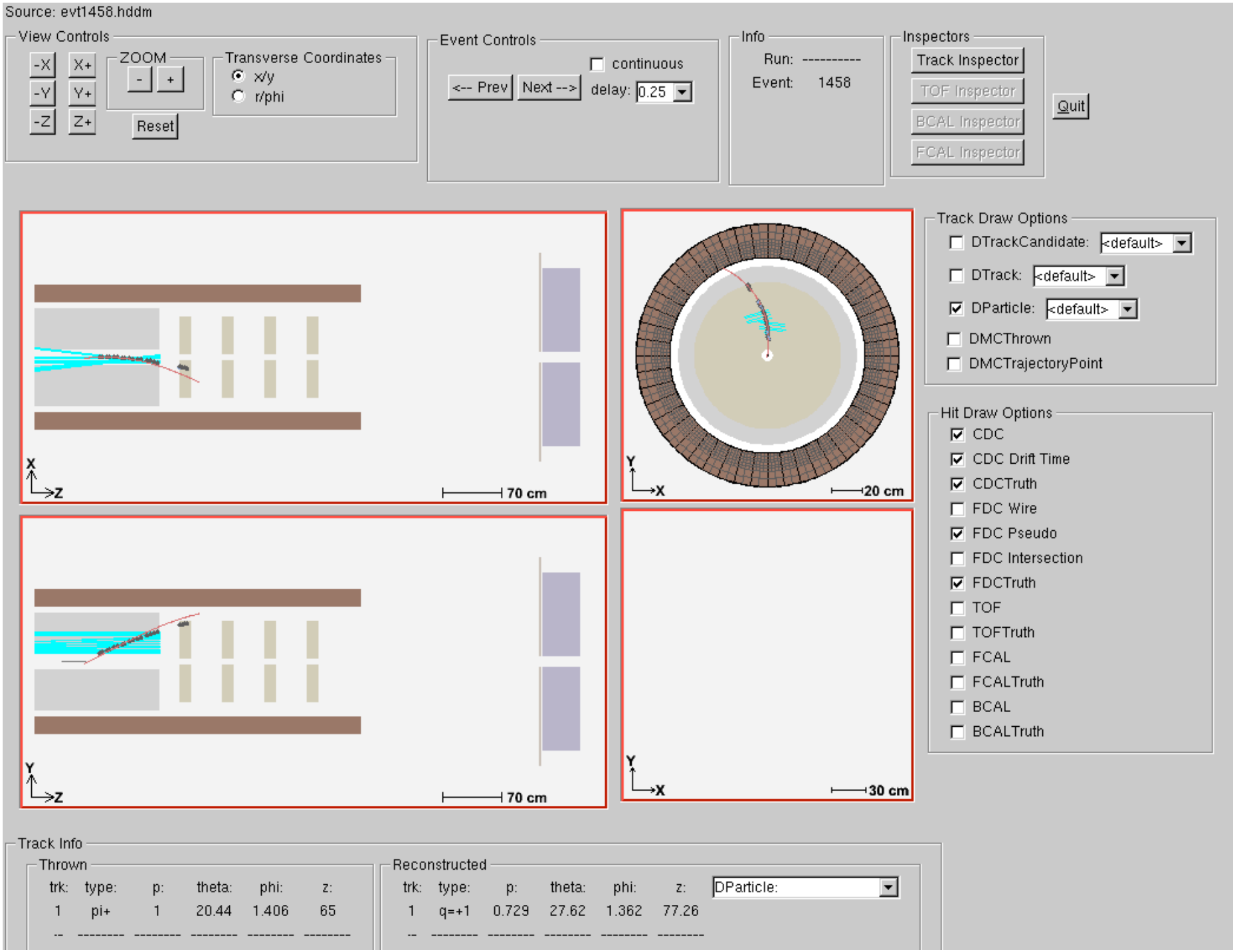
X+
-Y
Y+
-Z
Z+
ZOOM
-
+
Reset
Transverse Coordinates
x/y
r/phi
Event Controls
continuous
<-- Prev
Next -->
delay:
0.25
Info
Run: ----------
Event: 1201
Inspectors
Track Inspector
TOF Inspector
BCAL Inspector
FCAL Inspector
Quit
X
Z
70 cm
Y
X
20 cm
Y
Z
70 cm
Y
X
30 cm
Track Draw Options
DTrackCandidate:
<default>
DTrack:
<default>
DParticle:
<default>
DMCThrown
DMCTrajectoryPoint
Hit Draw Options
CDC
CDC Drift Time
CDCTruth
FDC Wire
FDC Pseudo
FDC Intersection
FDCTruth
TOF
TOFTruth
FCAL
FCALTruth
BCAL
BCALTruth
Track Info
Thrown
trk: type: p: theta: phi: z:
1 pi+ 1 21.39 2.765 65
-- -------- -------- -------- -------- --------
Reconstructed
trk: type: p: theta: phi: z:
DParticle:
1 q=+1 1.127 24.93 2.881 80.85
-- -------- -------- -------- -------- --------


Source: evt1458.hddm
View Controls
-X
X+
-Y
Y+
-Z
Z+
ZOOM
-
+
Reset
Transverse Coordinates
x/y
r/phi
Event Controls
continuous
<-- Prev
Next -->
delay:
0.25
Info
Run: ----------
Event: 1458
Inspectors
Track Inspector
TOF Inspector
BCAL Inspector
FCAL Inspector
Quit
X
Z
70 cm
Y
X
20 cm
Y
Z
70 cm
Y
X
30 cm
Track Draw Options
DTrackCandidate:
<default>
DTrack:
<default>
DParticle:
<default>
DMCThrown
DMCTrajectoryPoint
Hit Draw Options
CDC
CDC Drift Time
CDCTruth
FDC Wire
FDC Pseudo
FDC Intersection
FDCTruth
TOF
TOFTruth
FCAL
FCALTruth
BCAL
BCALTruth
Track Info
Thrown
trk: type: p: theta: phi: z:
1 pi+ 1 20.44 1.406 65
-- -------- -------- -------- -------- --------
Reconstructed
trk: type: p: theta: phi: z:
DParticle:
1 q=+1 0.729 27.62 1.362 77.26
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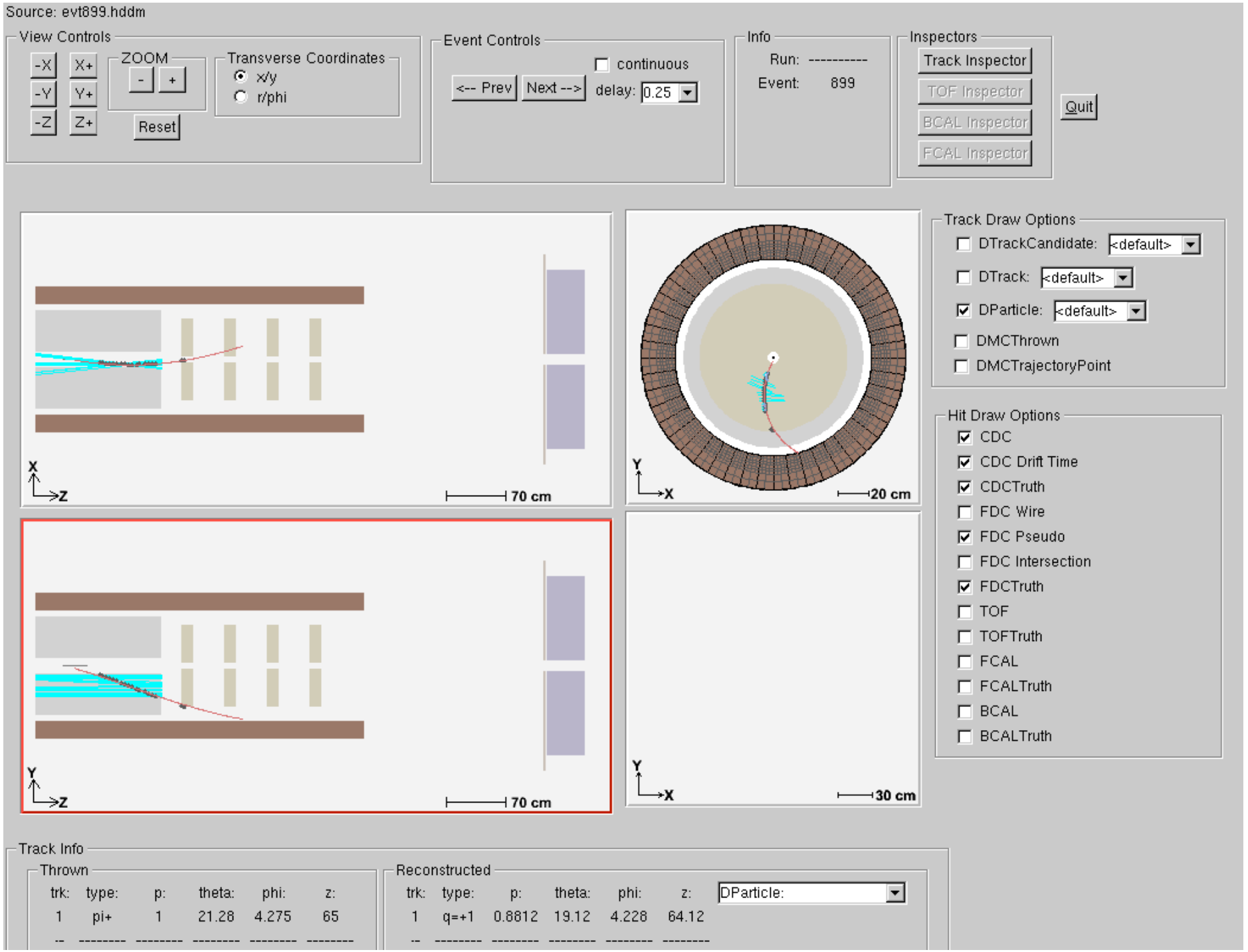
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-X
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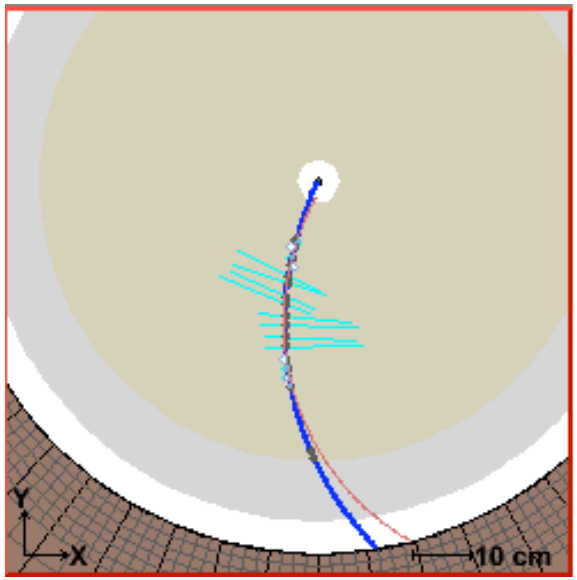
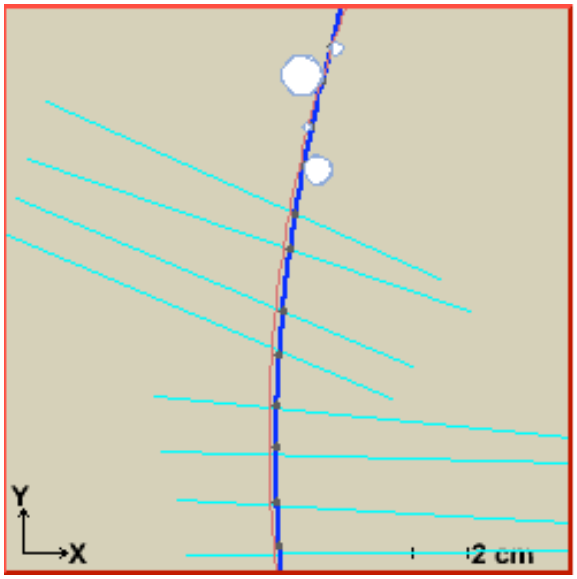
Y+
-Z
Z+
ZOOM
-
+
Reset
Transverse Coordinates
x/y
r/phi
Event Controls
continuous
<-- Prev
Next -->
delay: 0.25
Info
Run: ----------
Event: 899
Inspectors
Track Inspector
TOF Inspector
BCAL Inspector
FCAL Inspector
Quit
X
Z
70 cm
Y
X
20 cm
Y
Z
70 cm
Y
X
30 cm
Track Draw Options
DTrackCandidate: <default>
DTrack: <default>
DParticle: <default>
DMCThrown
DMCTrajectoryPoint
Hit Draw Options
CDC
CDC Drift Time
CDCTruth
FDC Wire
FDC Pseudo
FDC Intersection
FDCTruth
TOF
TOFTruth
FCAL
FCALTruth
BCAL
BCALTruth
Track Info
Thrown
trk: type: p: theta: phi: z:
1 pi+ 1 21.28 4.275 65
Reconstructed
trk: type: p: theta: phi: z:
1 q=+1 0.8812 19.12 4.228 64.12
DParticle:

A closer look at event 899



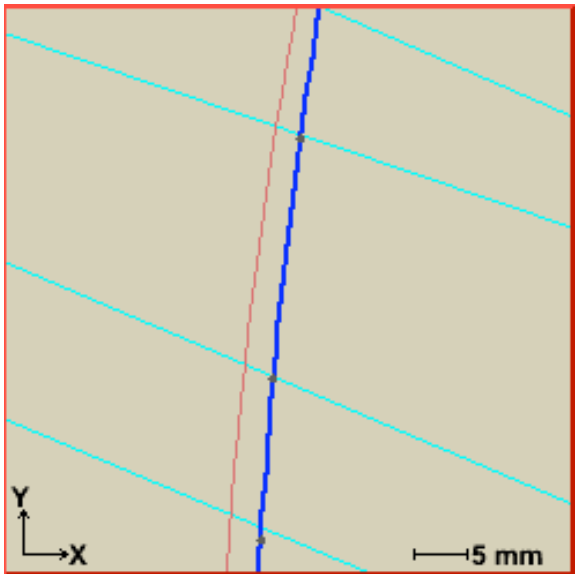
- Tracking χ^2/Ndof is 143
- No FDC wire hits



Zoom x5

- 16 CDC wires hit
  - 4 axial
  - 4+4=8 stereo
  - 4 axial

Fit track is ~2-3mm away from true trajectory



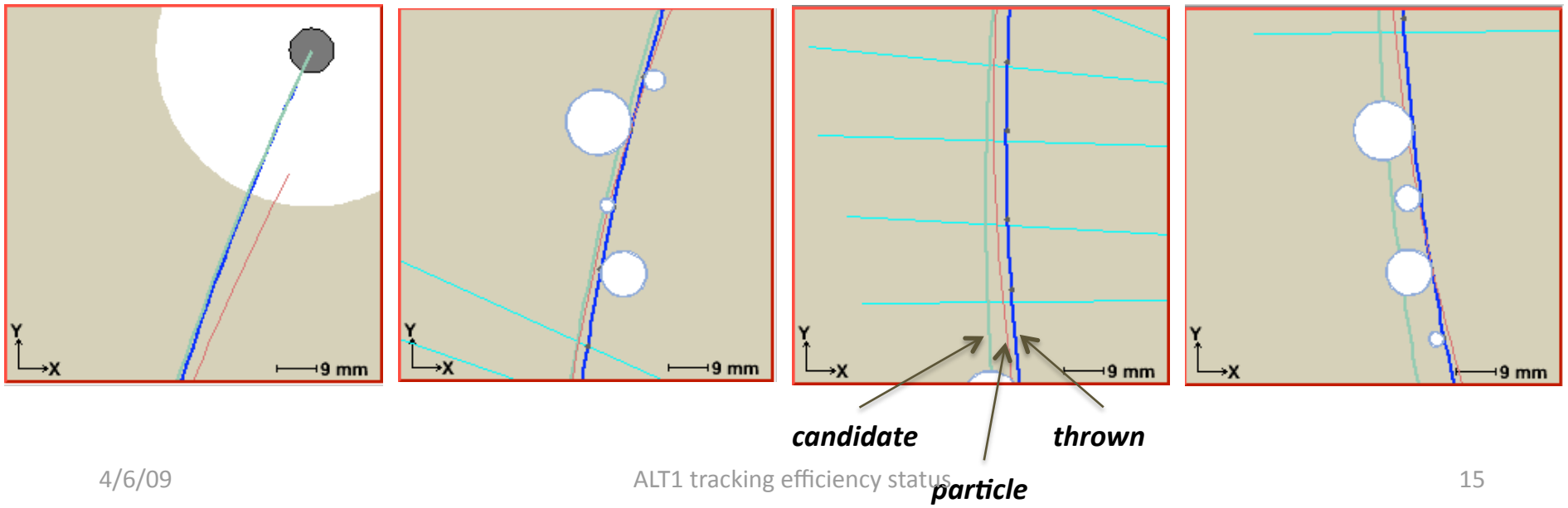
Zoom x20

Tracking Parameters at various stages for event 899

	Thrown	*Candidate*	*Wire-based*	*Time-based*	*Optimal*
p	*1*	*1.016*	*1.011*	*0.8812*	*1.015*
θ	*21.28*	*21.82*	*19.07*	*19.12*	*21.08*
ϕ	*4.275*	*4.266*	*4.625*	*4.228*	*4.279*
z	*65.0*	*65.2*	*64.14*	*64.12*	*64.93*

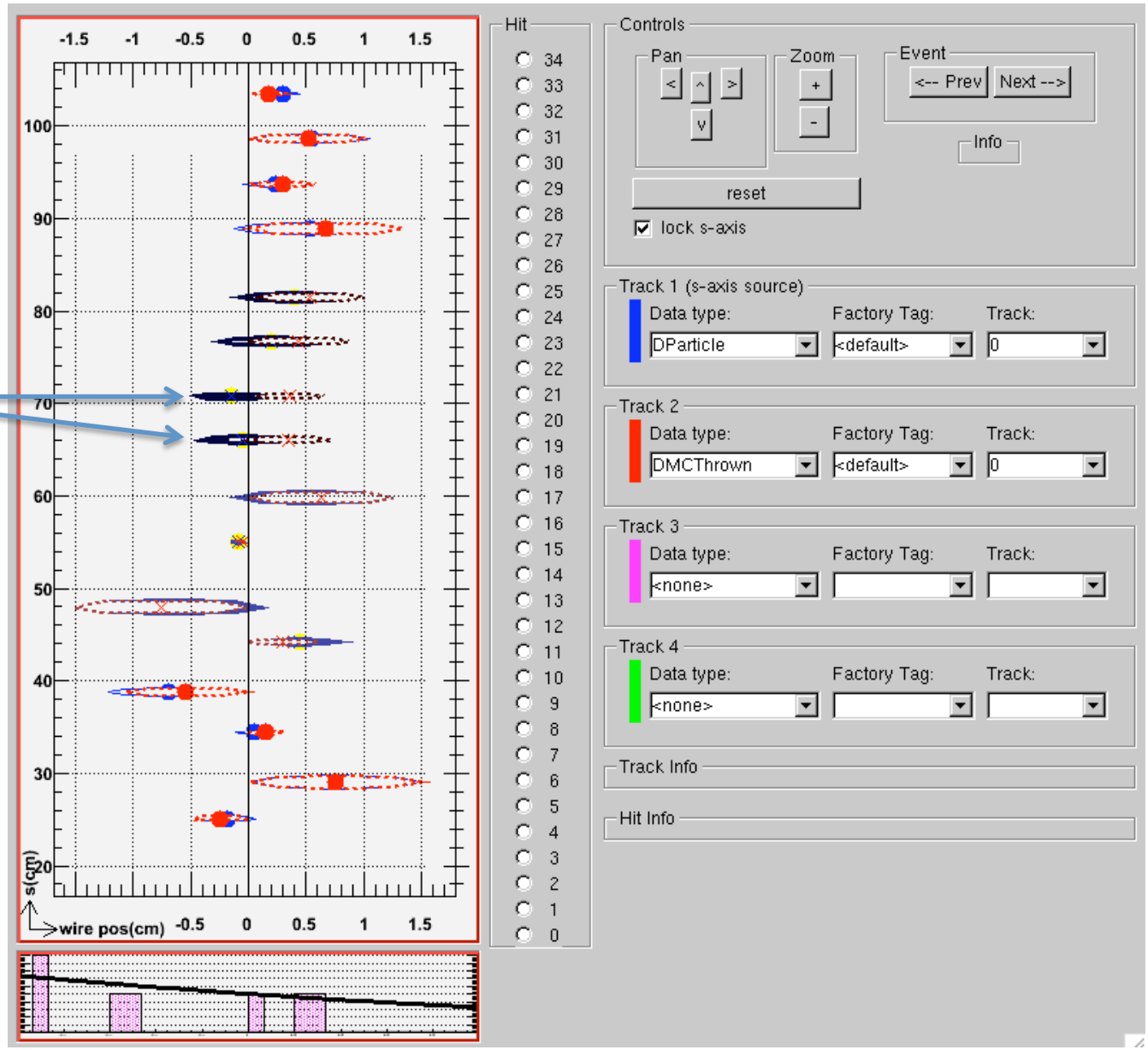
"Optimal" is when truth values are used for the wire-based tracks

Zoomed in views of X/Y plane with Thrown, Candidate (Helical fit) and Particle (Time-based fit)

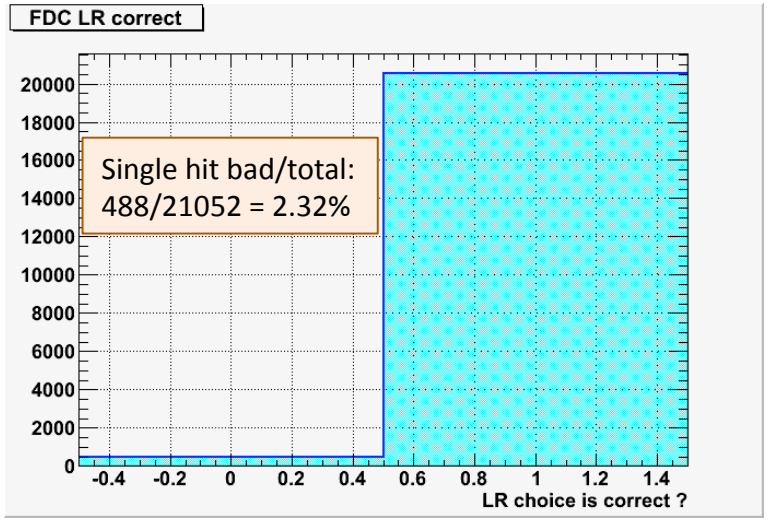


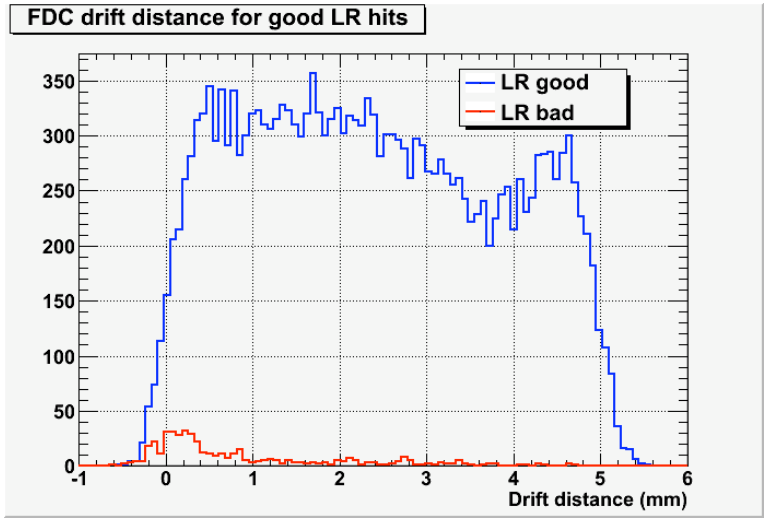
Track Inspector for event 899

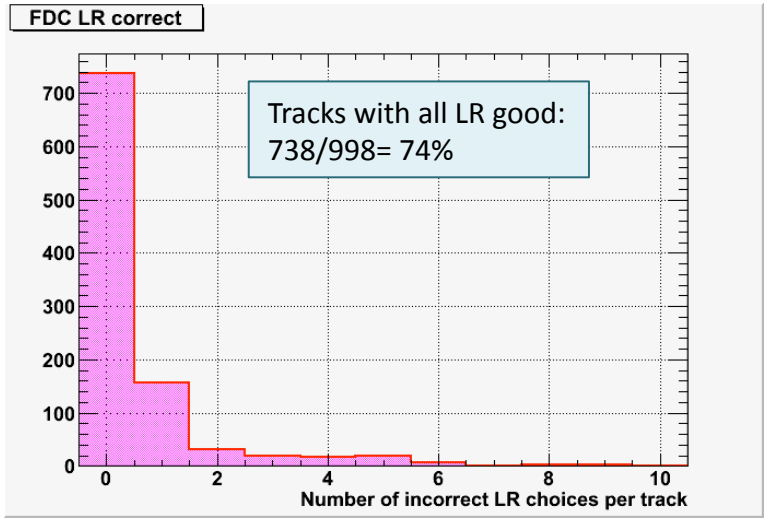
A couple of wires have incorrect LR assignments



Bad LR choices for 0.6 GeV/c π^+ at 10^o







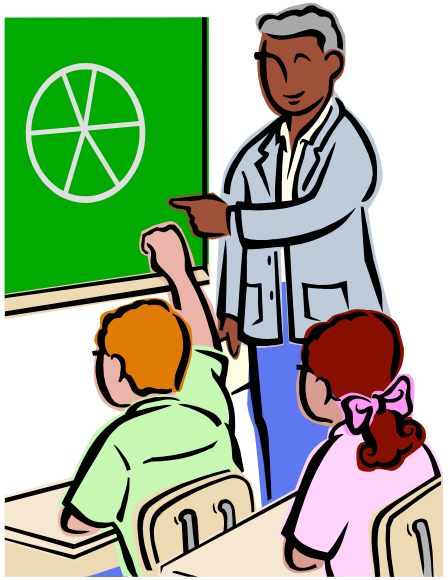
- If no correlations and 2.32% single hit correct LR probability, expect $(0.9768)^{21}$ = 61% of events to have all good LR

- For FDC, 200μm/2.5mm = 8% of hits will be within 1 σ of wire.

Summary

- It appears that most of the tracks are being found and fit successfully. However, the LR problem persists, pushing a significant fraction of events into the tails of the residual distribution even when multiple scattering is turned off
- Forcing a correct LR assignment using truth information is being worked on. It is not a trivial endeavor.

Backup Slides



Full reconstruction efficiency for various χ^2/Ndof cuts

Cut level scaled as function of θ using ratio of momentum resolution to resolution at 36°