Tracking Status

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D0 Collaboration Meeting
April 26, 2002

Outline

- Overview.
- Current tracking MC performance.
- Tracking results from data.
- P11 status.
- Tasks.

Tracking Programs/Algorithms

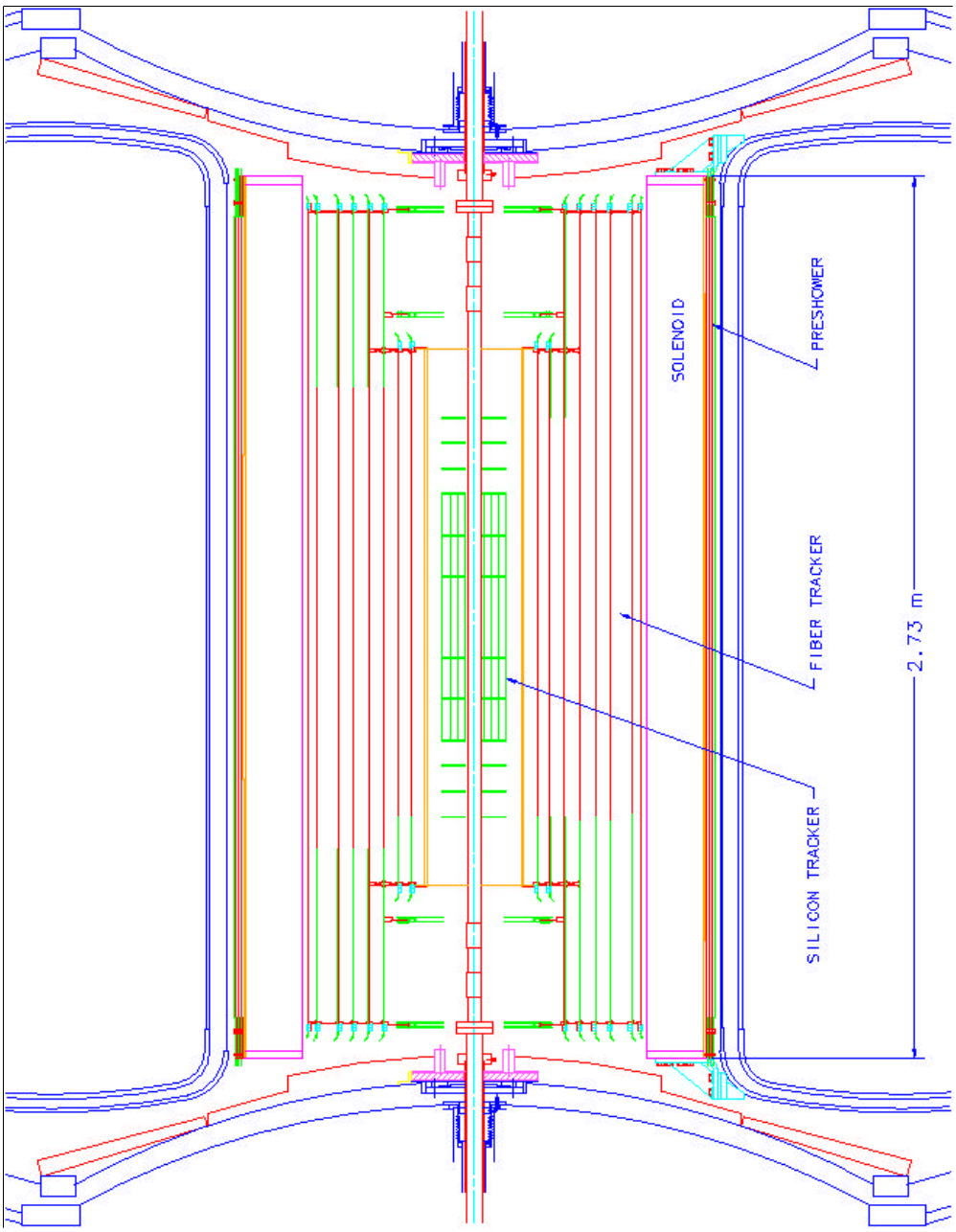
- GTR/TRF (D. Adams).
  - Road following.
- HTF (A. Khanov).
  - Histogramming.
- Elastic_reco (A. Haas).
  - Histogramming.
- (G. Borissov).
  - Road following.
- L3 (D. Whiteson, R. Beuselinck).

Types of Tracks.

- CFT axial.
  - (Up to) eight CFT axial doublets.
- CFT stereo.
  - Eight axial + eight stereo CFT doublets.
- SMT barrels.
  - Four or more SMT barrel hits.
- SMT barrels + disks.
- Global tracks.
  - CFT + SMT.

GTR Tracking Regions/Steps

- CFT central axial/stereo.
  - Track crosses eight CFT barrels..
- SMT standalone (central).
  - Four SMT barrels.
- CFT overlap.
  - Inner 6-7 CFT barrels (misses outer barrel).
- SMT overlap.
  - Four SMT barrels in overlap fiducial region.
- SMT forward & gap.
  - Standalone SMT tracking with disks (required) + barrels.
- SMT extension.
  - Extend CFT tracks to SMT.
- CFT extension.
  - Extend tracks found in SMT to CFT.
- H disk extension.
  - Extend forward SMT tracks to H disks.


SOLENOID
PRESHOWER
FIBER TRACKER
SILICON TRACKER
2.73 m

Chunk Types

Chunk	Algorithm	MC	Data	Track type
113	gtr	X	X	CFT axial
111	gtr	X	X	CFT stereo
121	gtr	X		CFT overlap (<8 barrels)
101	gtr	X	X	Full CFT (stereo)
201	gtr	X	X	Global (CFT→SMT)
230	gtr		X	SMT central (barrels)
203	gtr	X		SMT overlap (b*+d)
311	gtr	X		Gap (SMT b*+d*)
301	gtr	X		SMT forward (b+d*)
321	gtr	X		SMT → H disks
211	gtr	X		Global (SMT→CFT)
333	gtr		X	Global (SMT→CFT)
401	gtr	X		201+211+321
401	gtr		X	113+101+201+230+333
930	htf			CFT
901	htf			SMT (barrels+disks)
911	htf			Global
920	htf			SMT barrels.
10xxx	elastic_reco			

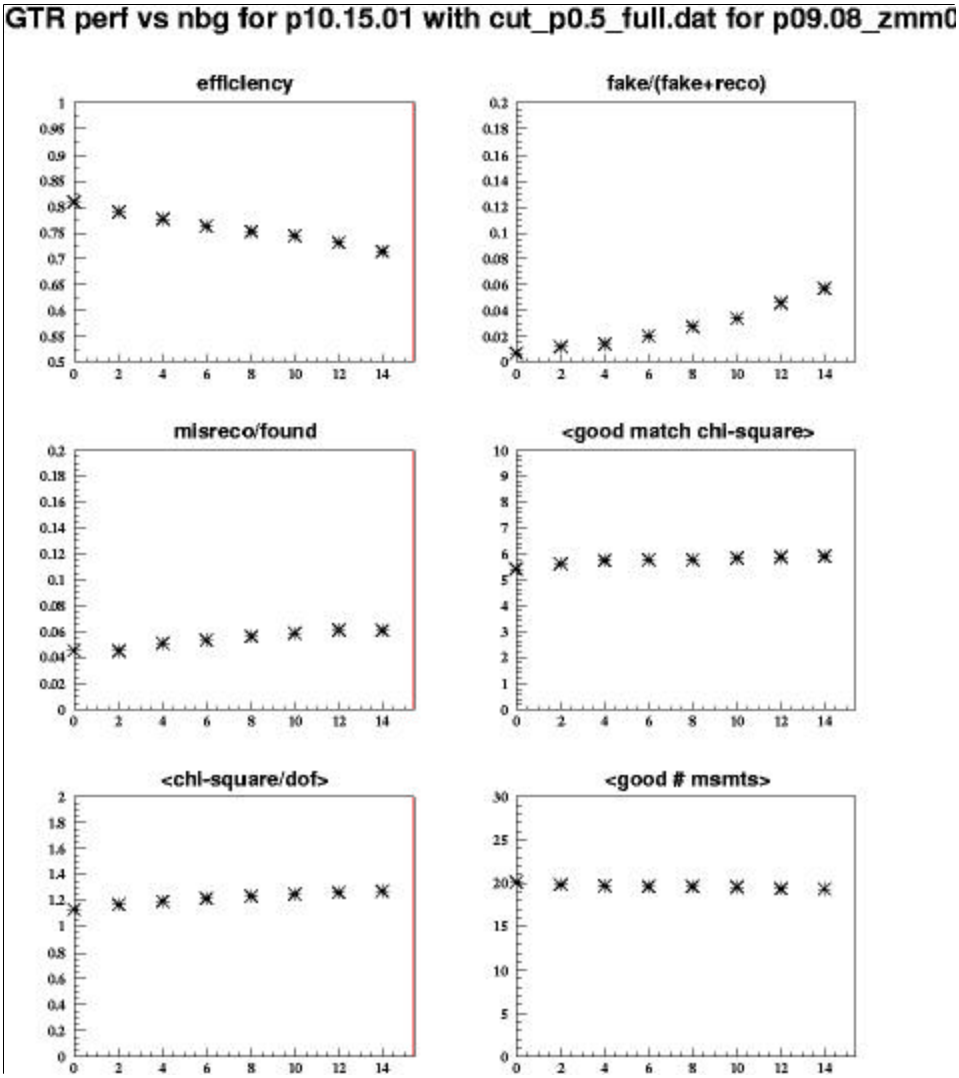
* Required

GTR Software Status

- P10
  - Tracking using uniform field Bz=-2T.
- P11
  - Non-uinform field fitting.
  - Field polarity from database or mc info.
  - Offset beam position.
  - Interacting propagator to muon system.
  - Smoothing refitter (optimal fits at all surfaces).
  - CFT cluster angle corrections.
  - Allow misses in CFT.
  - Global cuts (e.g. min pT) set via rcp.
  - Gtr_analyze root-tuple.
  - Additional paths:
    - SMT overlap tracking.
    - H disk extension.

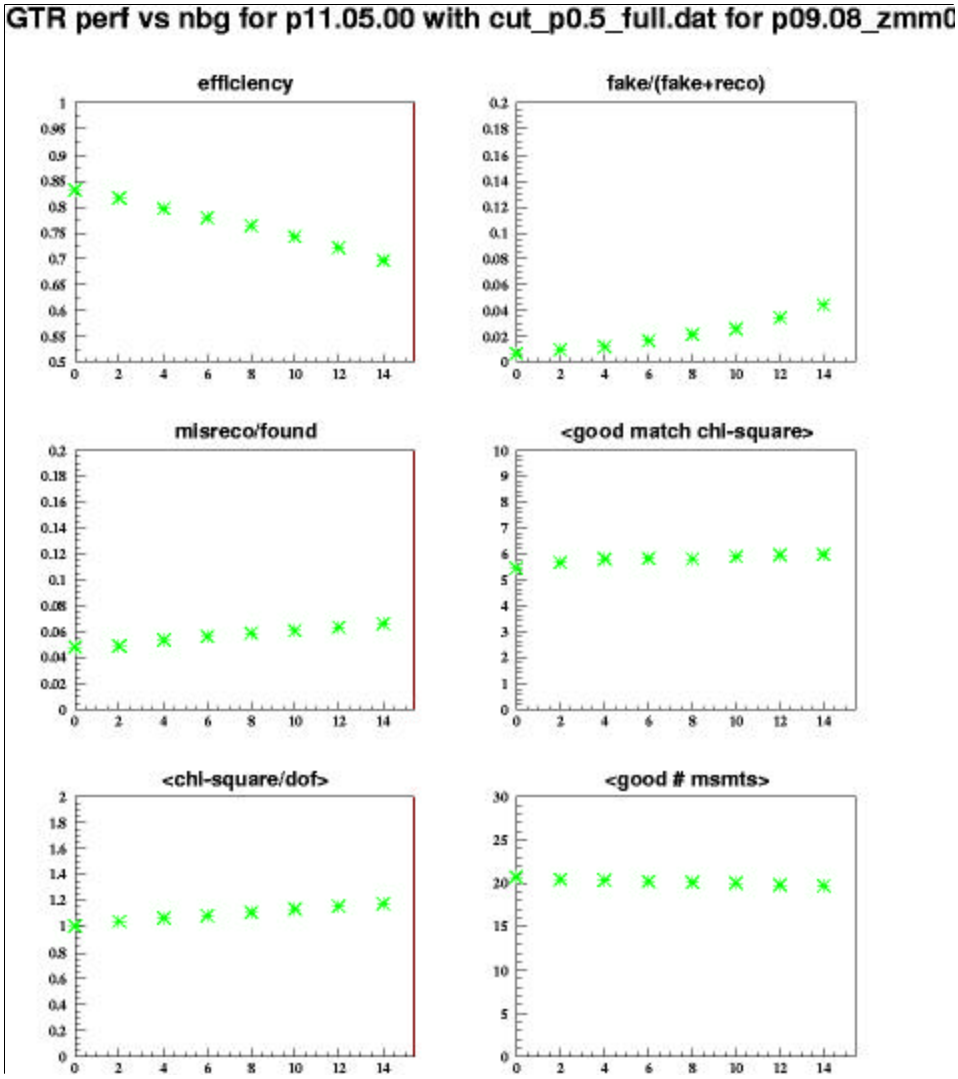
Tracking Performance vs. Background Events, Low pT

$Z \rightarrow \mu\mu$ events $p_T > 0.5$ GeV p10.15.01



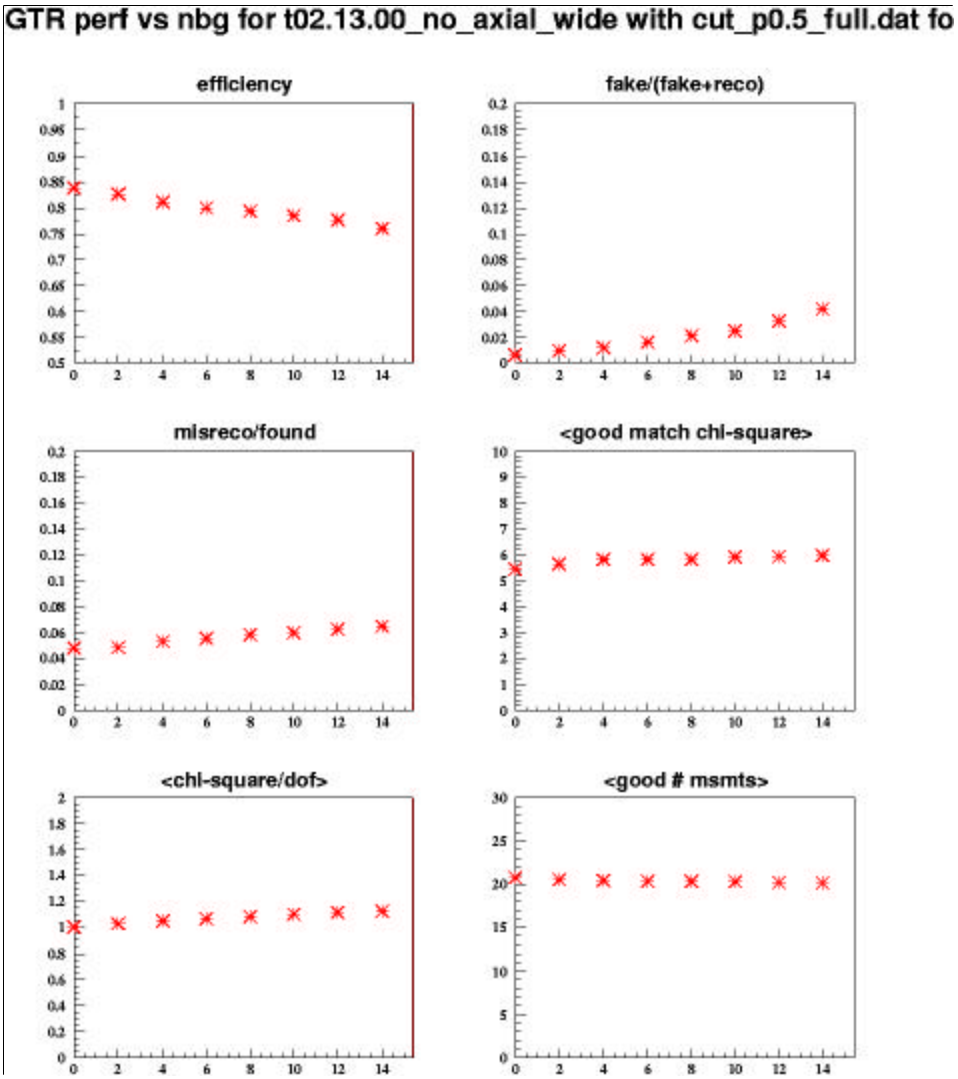
Tracking Performance vs. Background Events, Low pT

$Z \rightarrow \mu\mu$ events $p_T > 0.5$ GeV p11.05.00



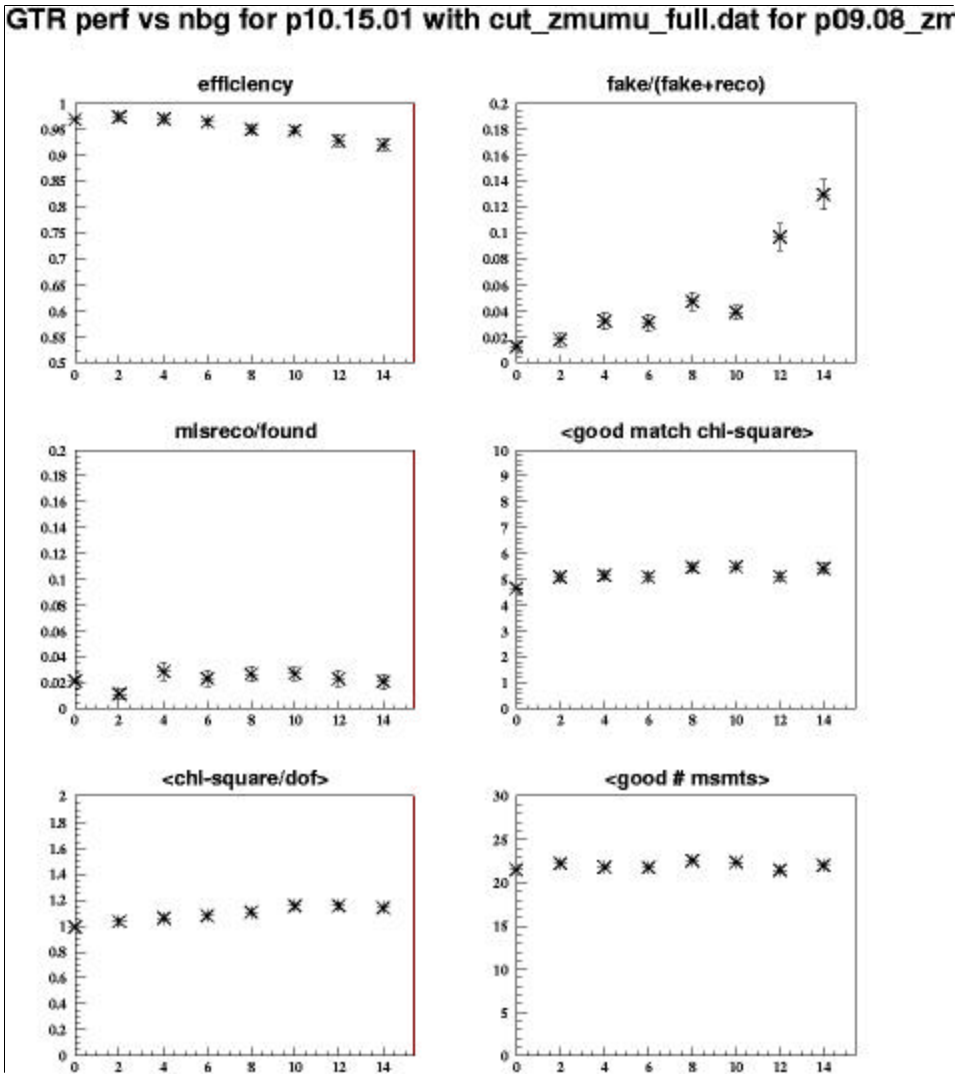
Tracking Performance vs. Background Events, Low pT

$Z \rightarrow \mu\mu$ events $p_T > 0.5$ GeV p11.05.00+



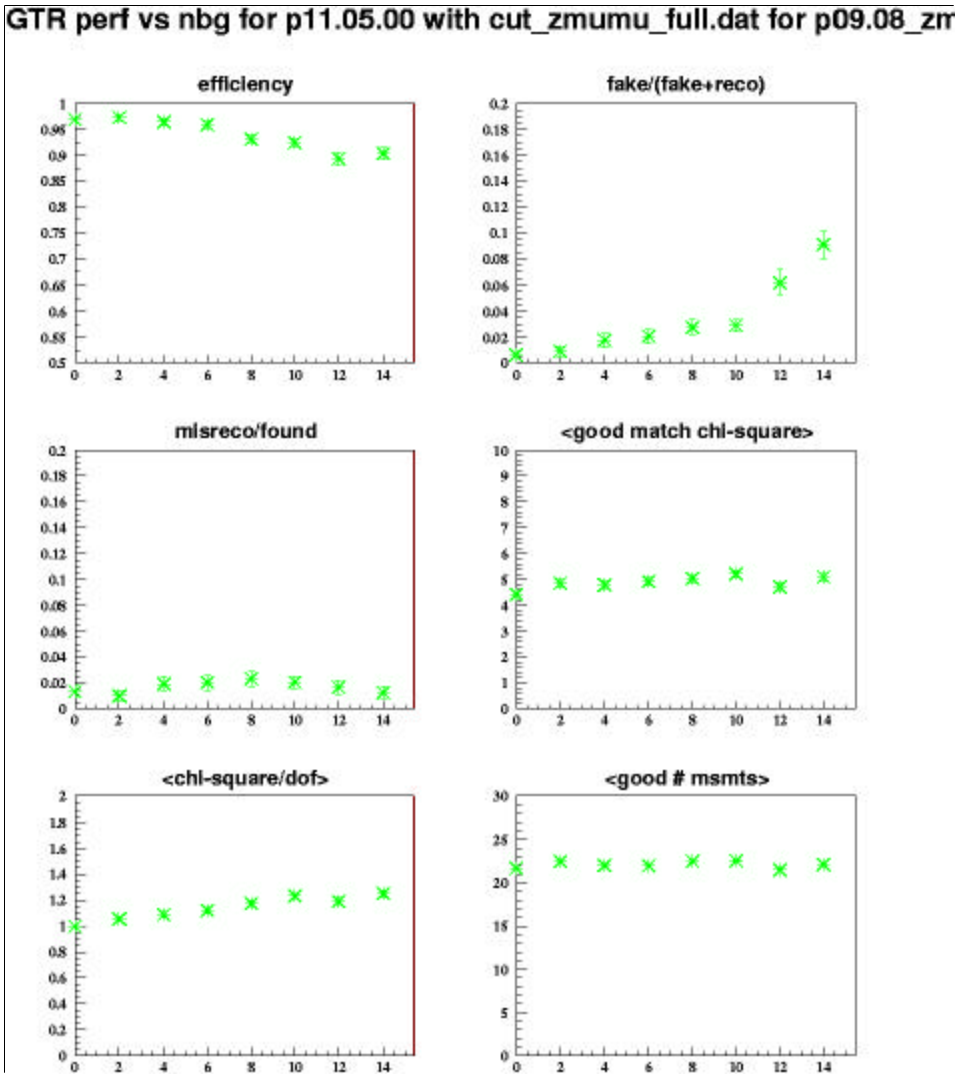
Tracking Performance vs. Background Events, High pT

$Z \rightarrow \mu\mu$ events μ from Z p10.15.01



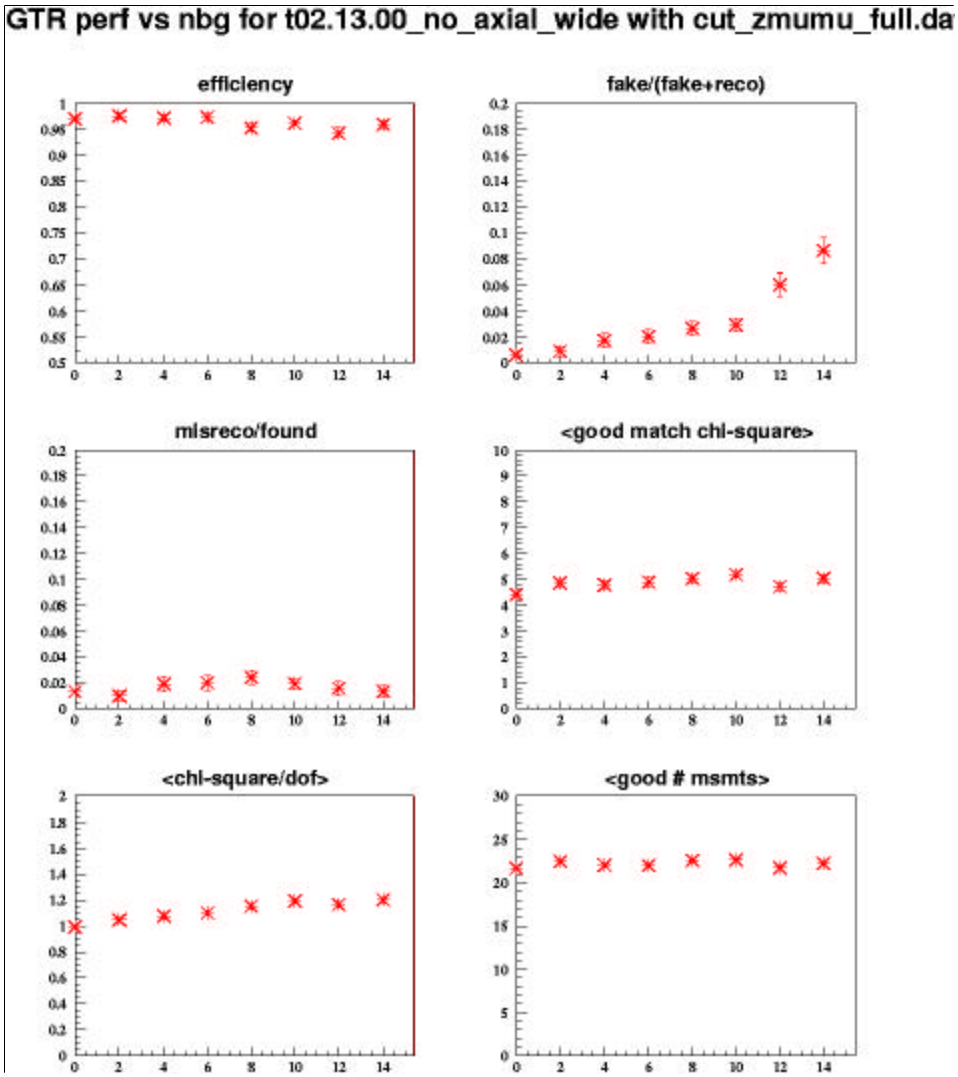
Tracking Performance vs. Background Events, High pT

$Z \rightarrow \mu\mu$ events μ from Z p11.05.00

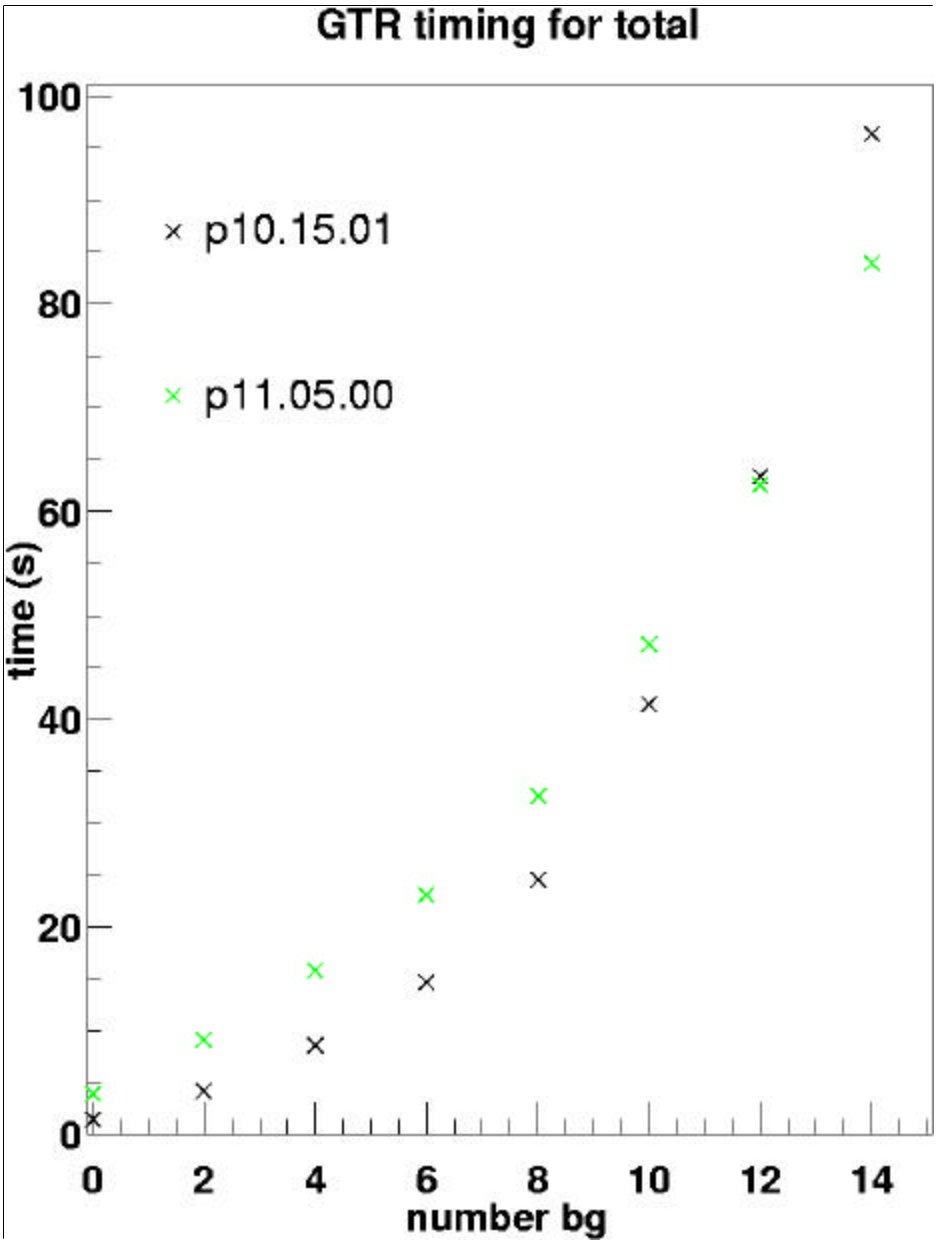


Tracking Performance vs. Background Events, High pT

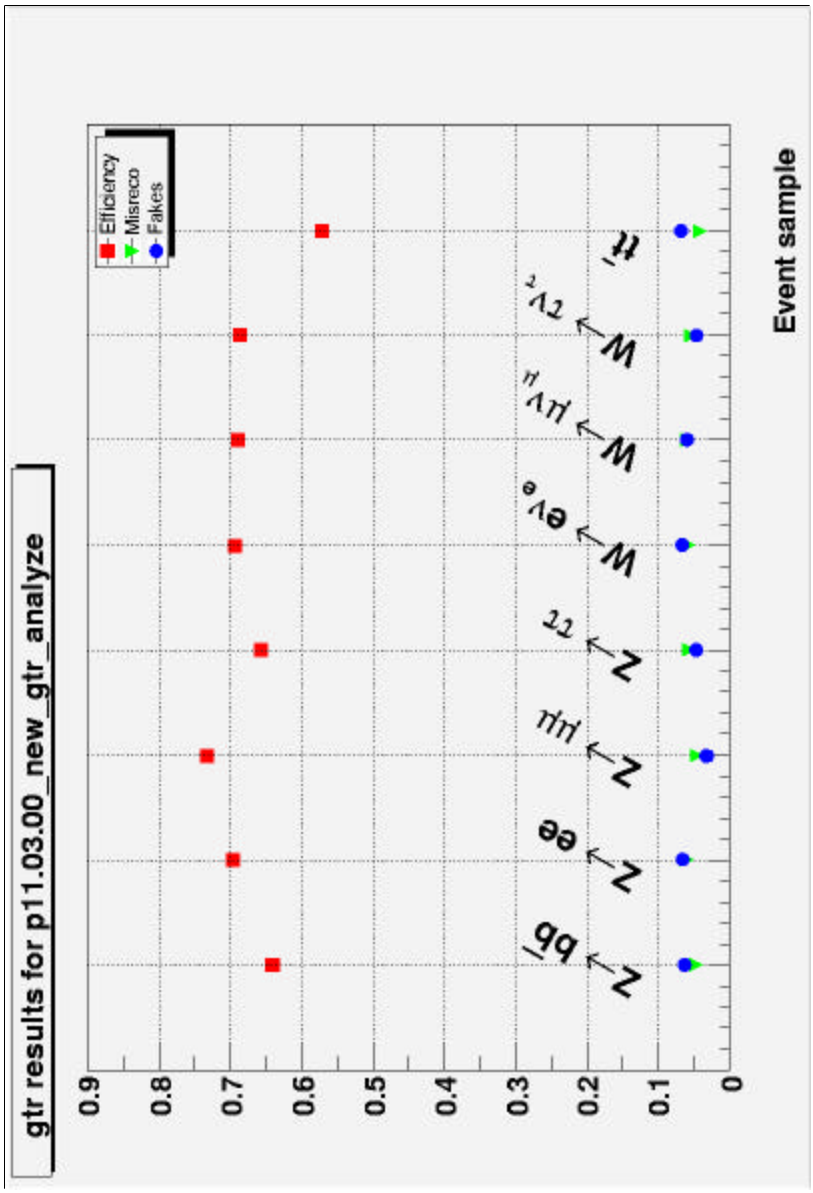
$Z \rightarrow \mu\mu$ events μ from Z p11.05.00+



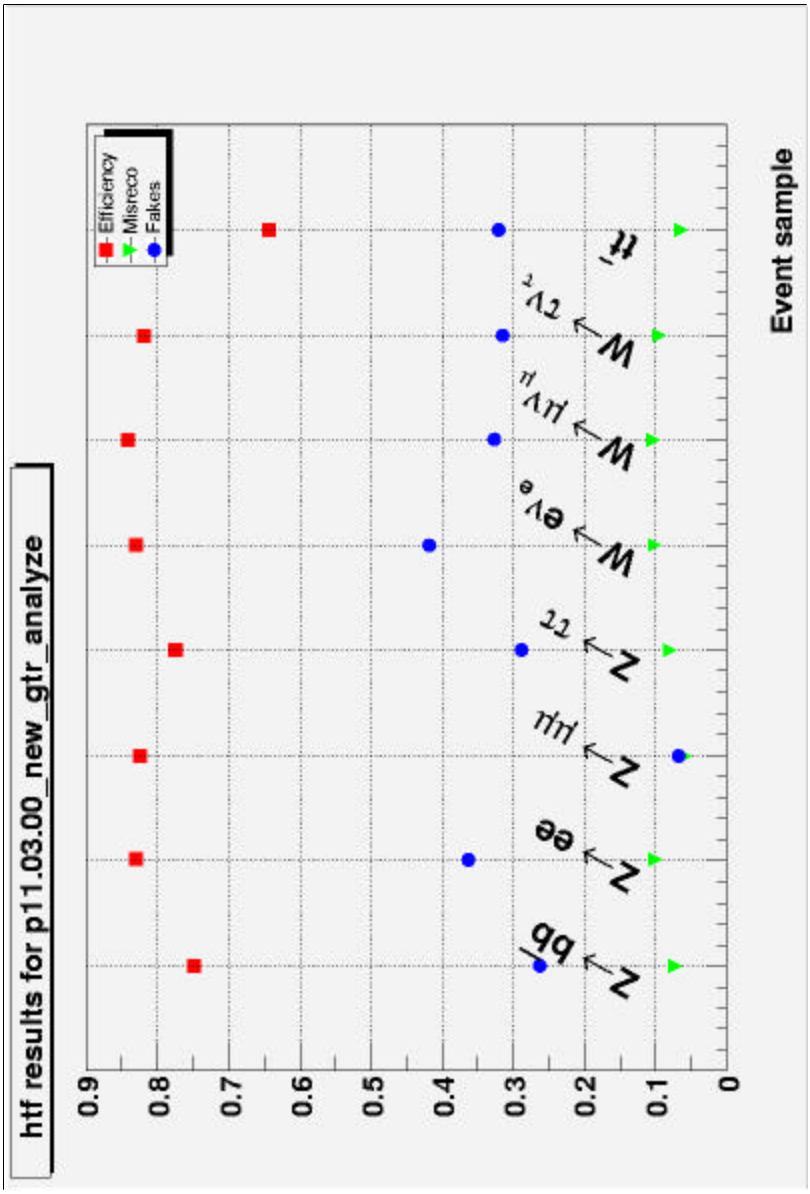
CPU Time


GTR timing for total
p10.15.01
p11.05.00
time (s)
number bg
0
20
40
60
80
100
0
2
4
6
8
10
12
14

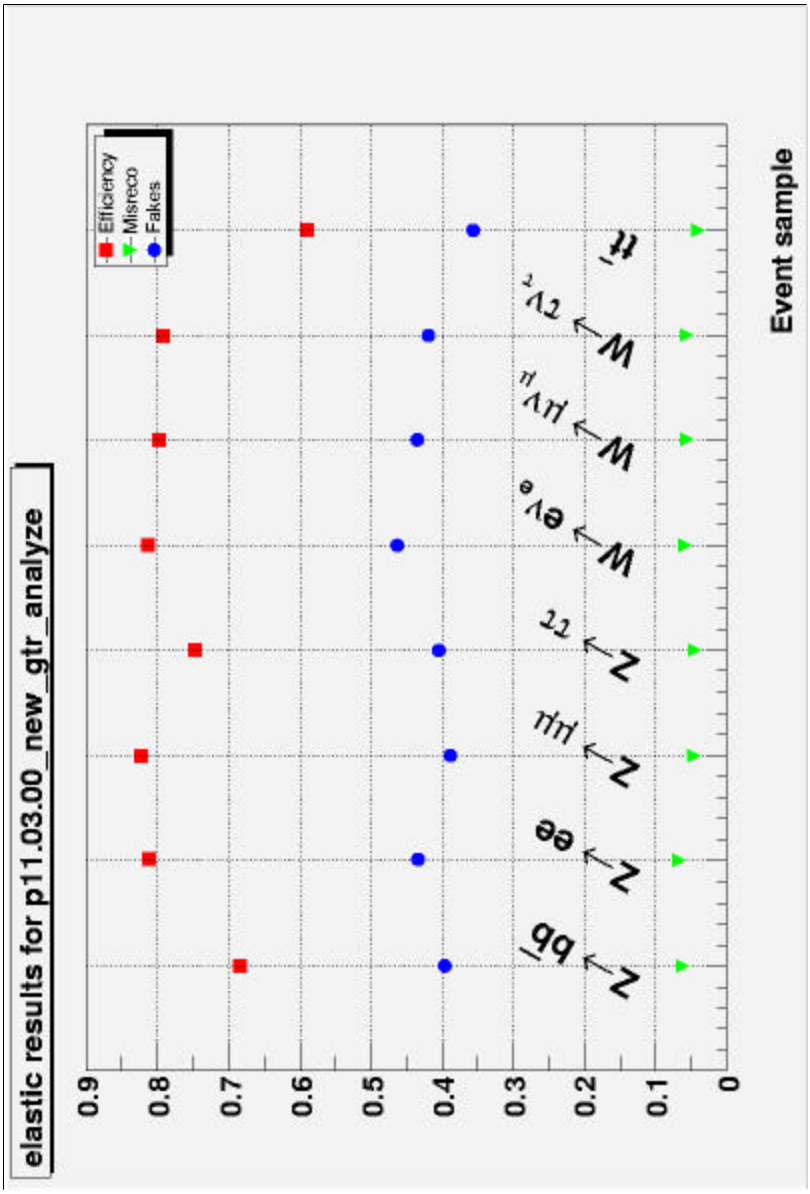
GTR Performance



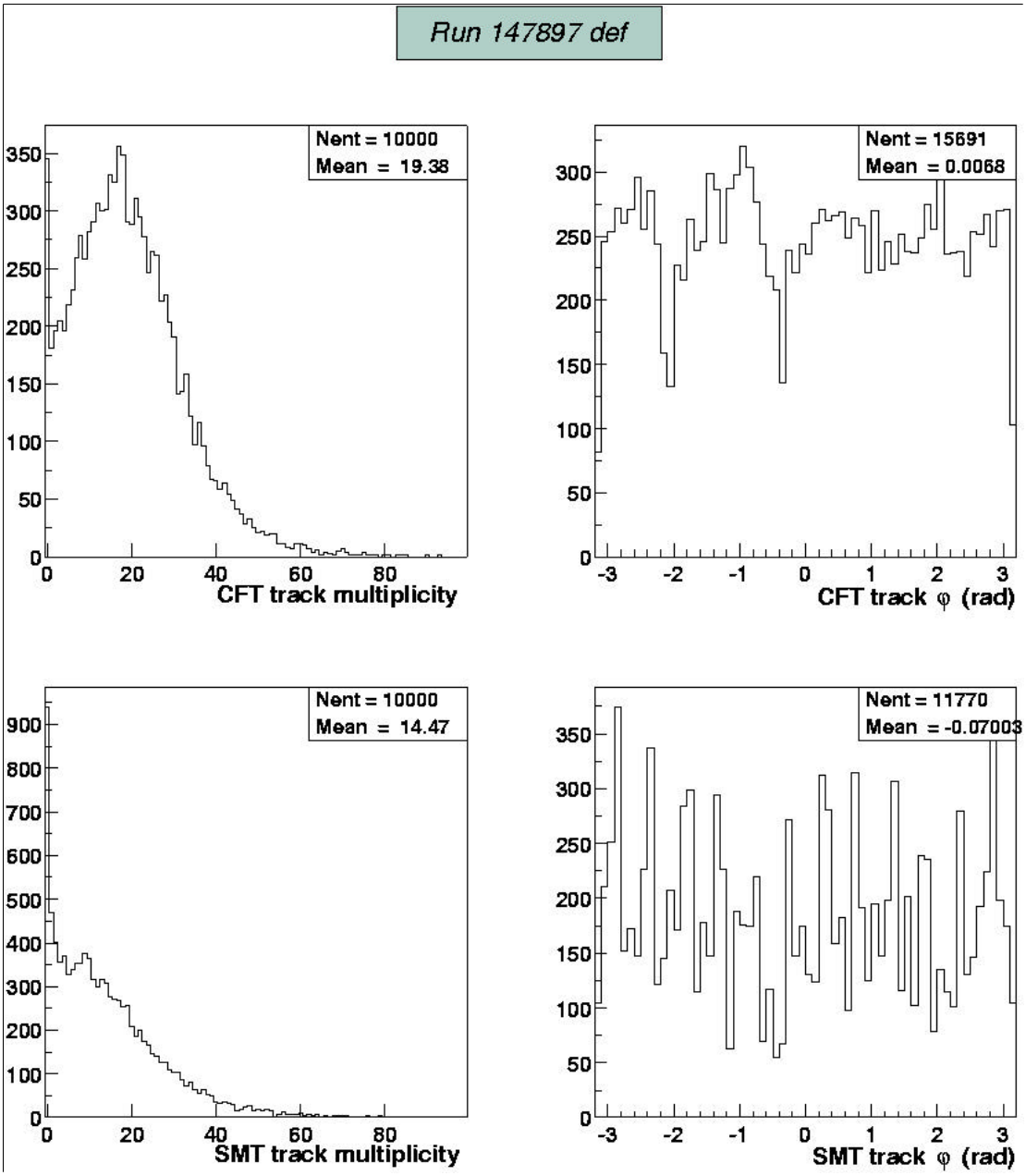
HTF Performance



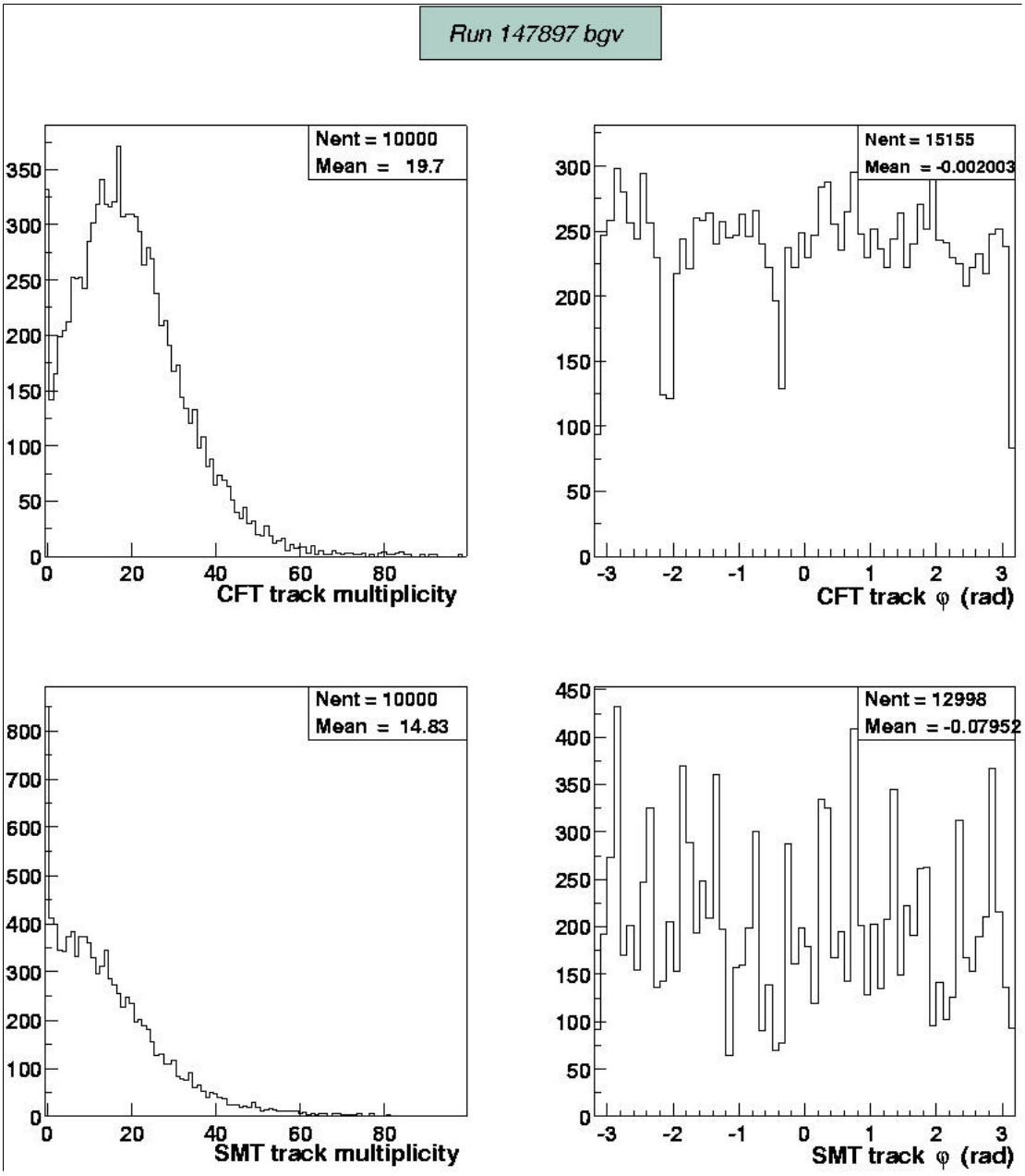
Elastic_reco Performance



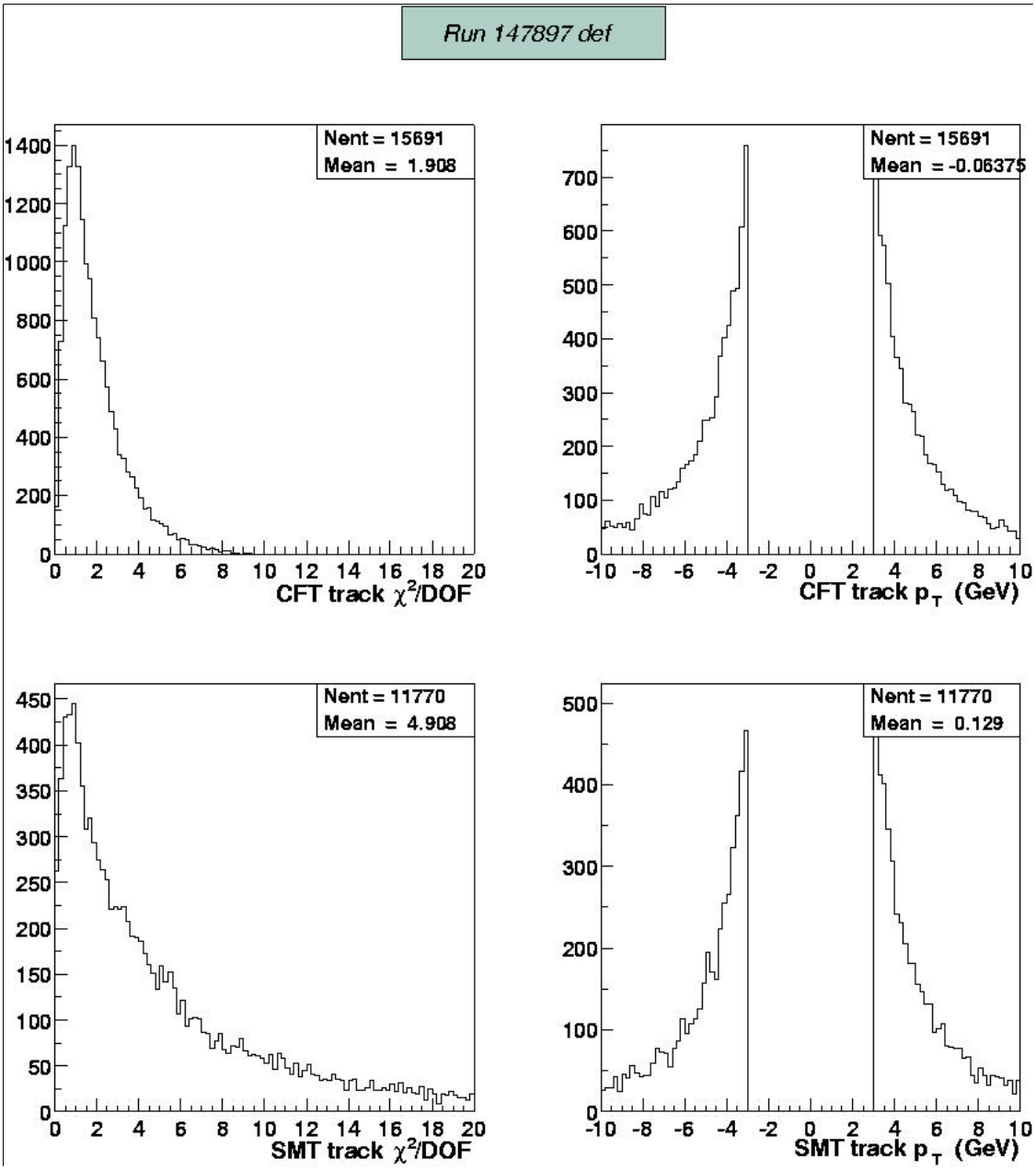
CFT Axial & SMT (p10 geom.)



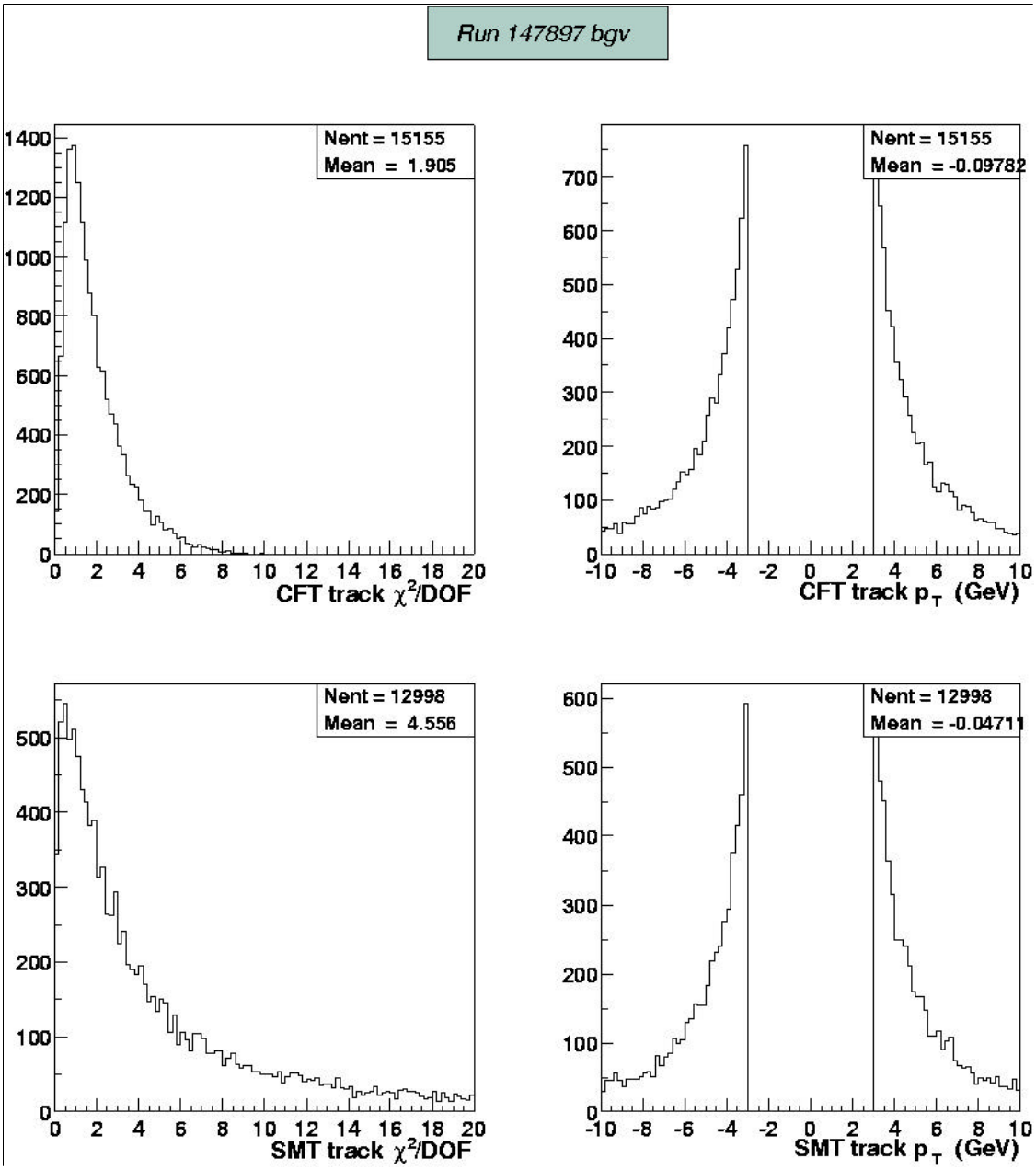
CFT Axial & SMT (aligned)



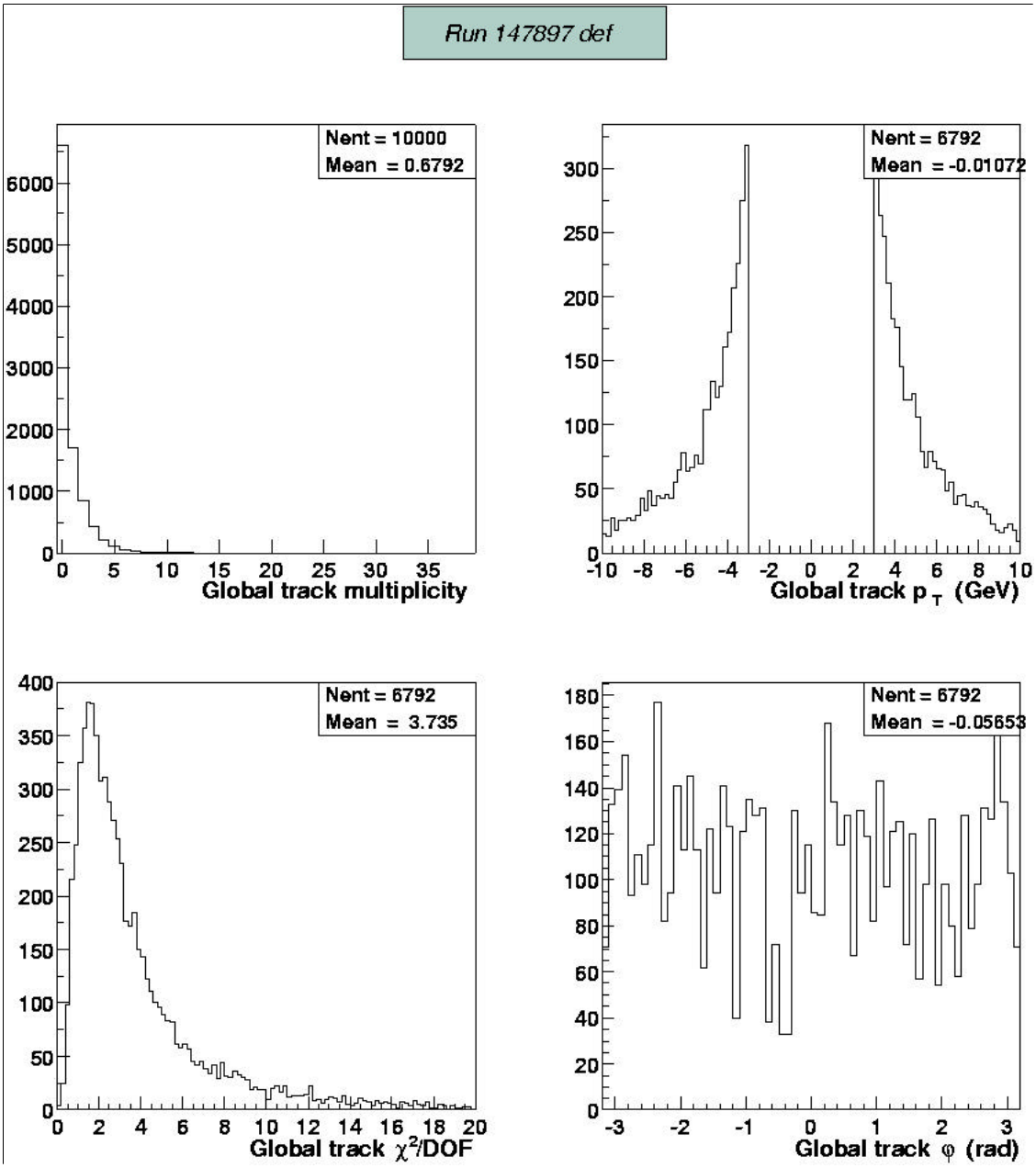
CFT Axial & SMT (p10 geom.)



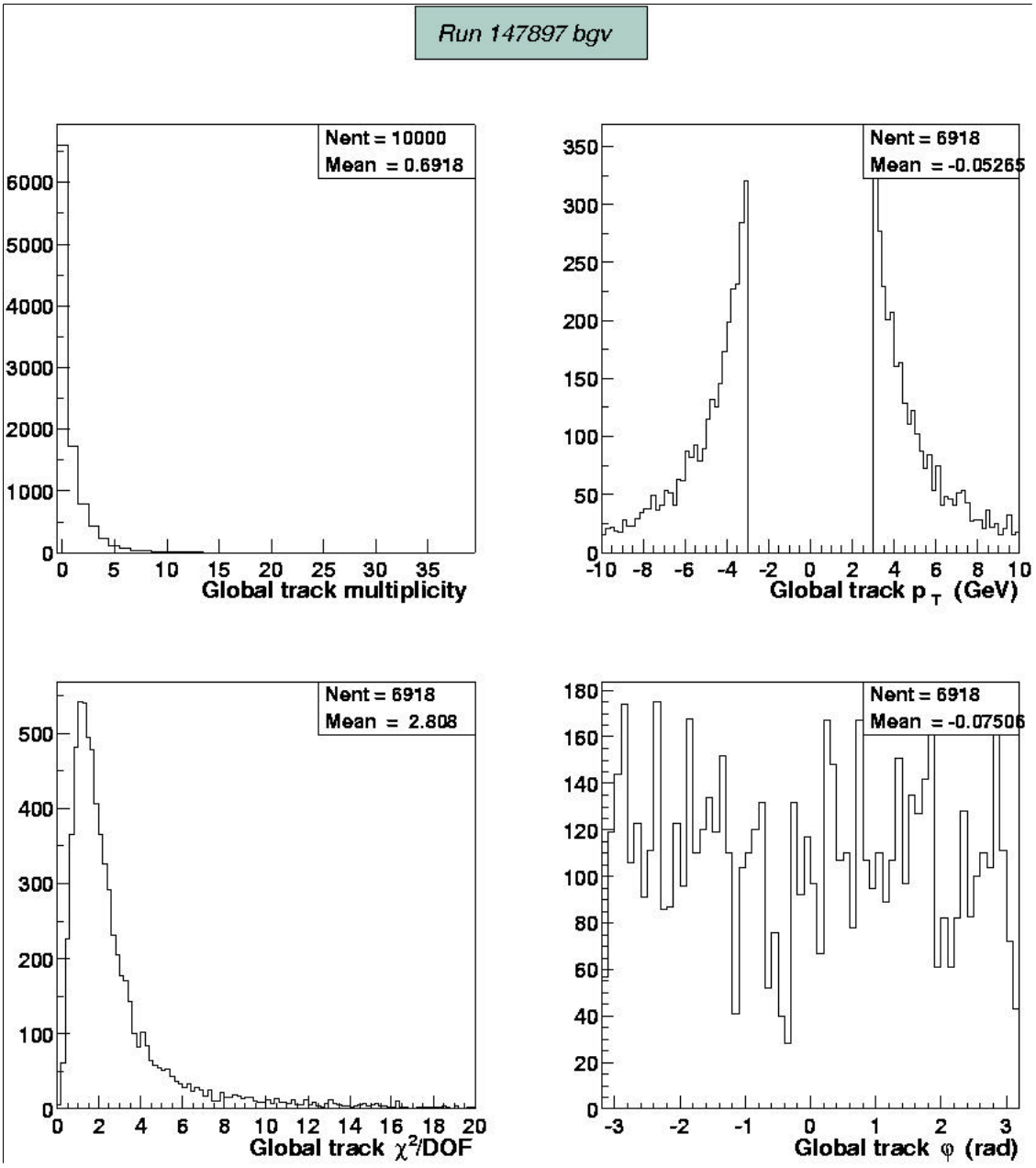
CFT Axial & SMT (aligned)



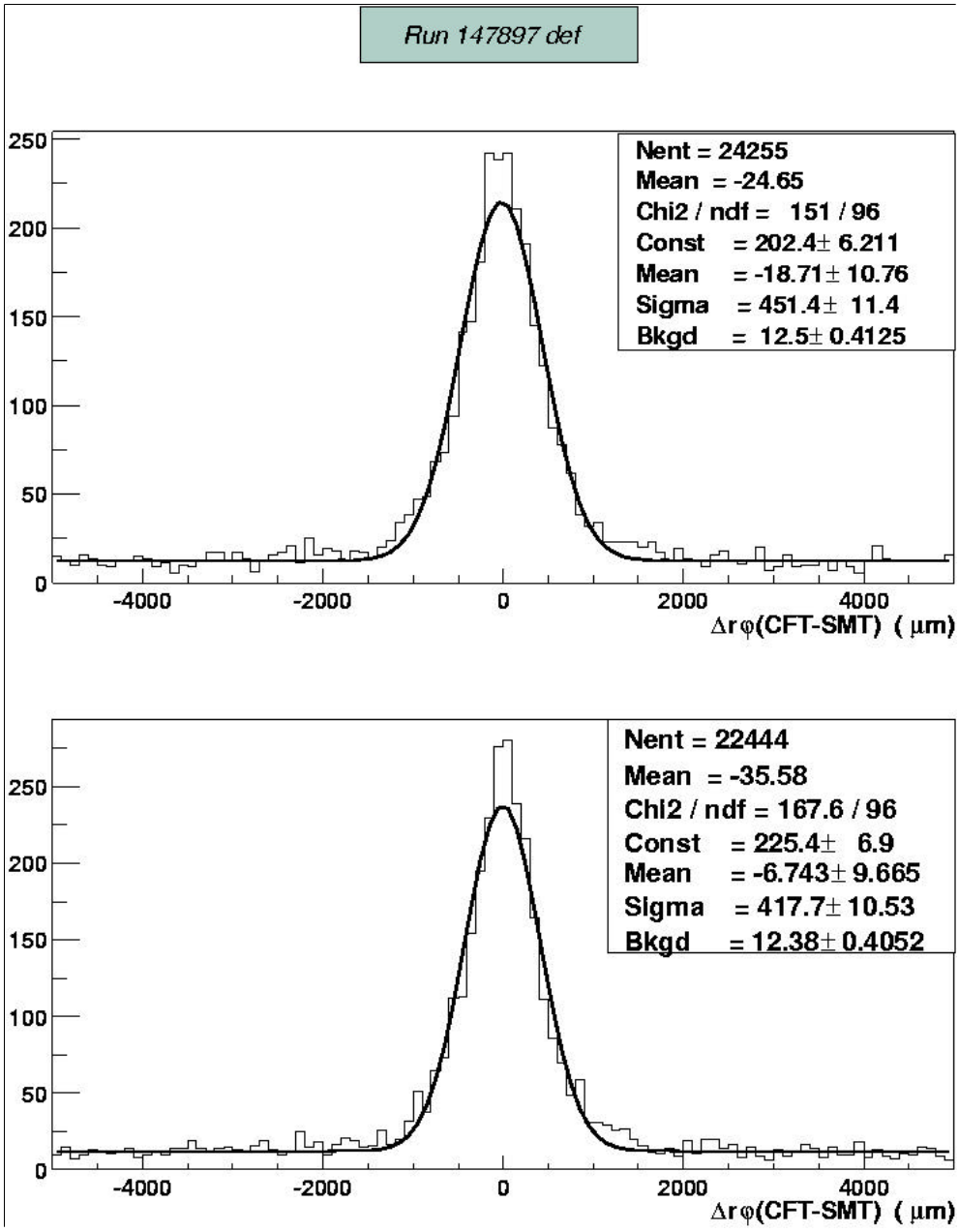
Global Tracks (p10 geom.)



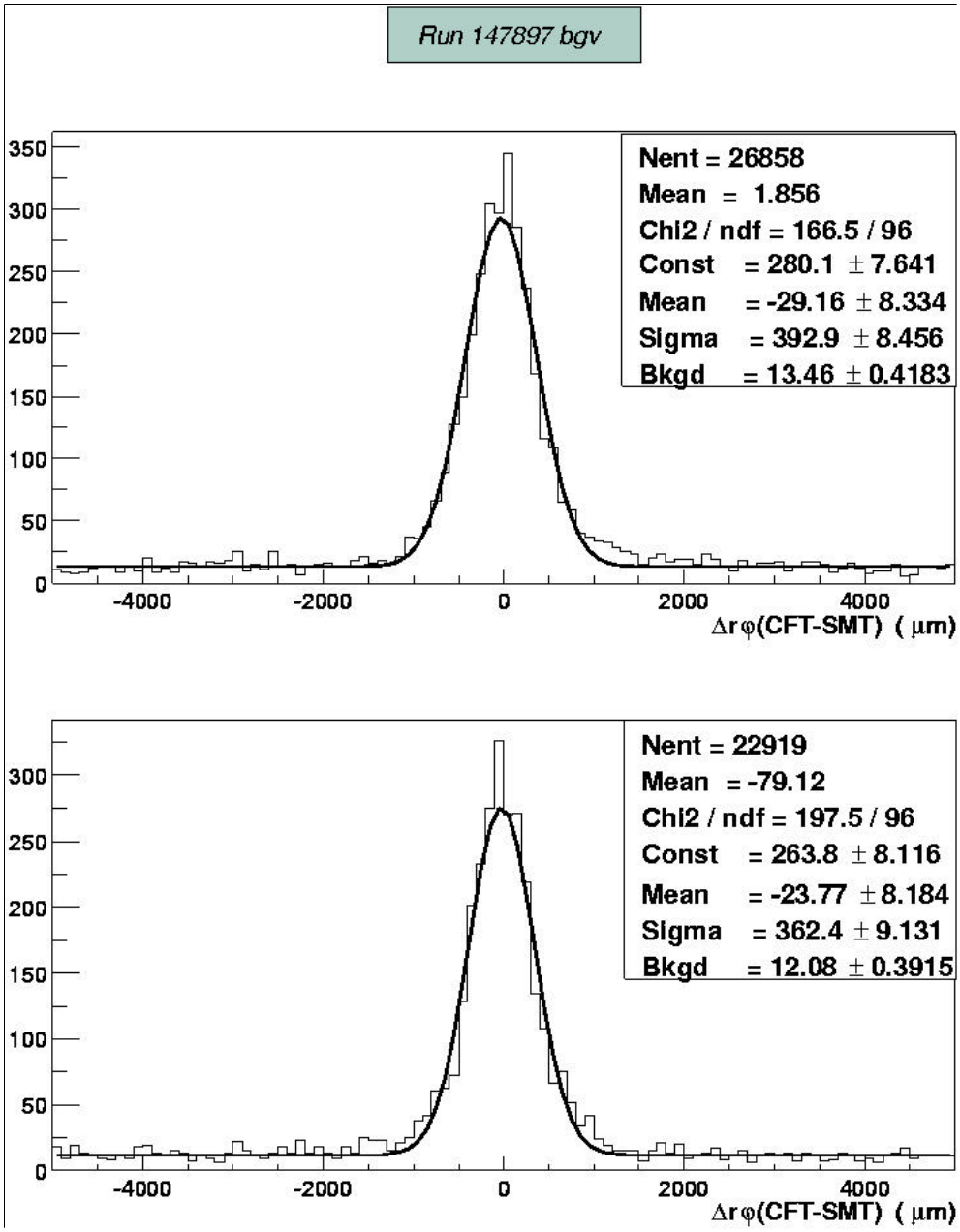
Global Tracks (aligned)



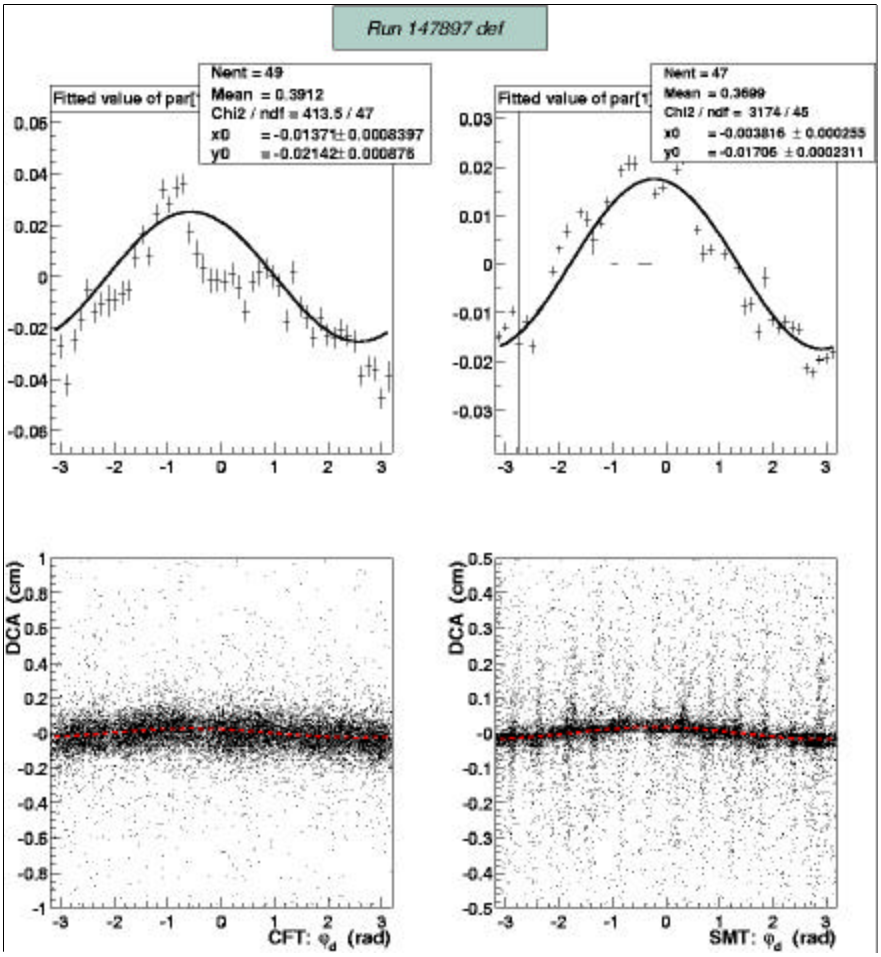
CFT-SMT Matching (p10 geom.)



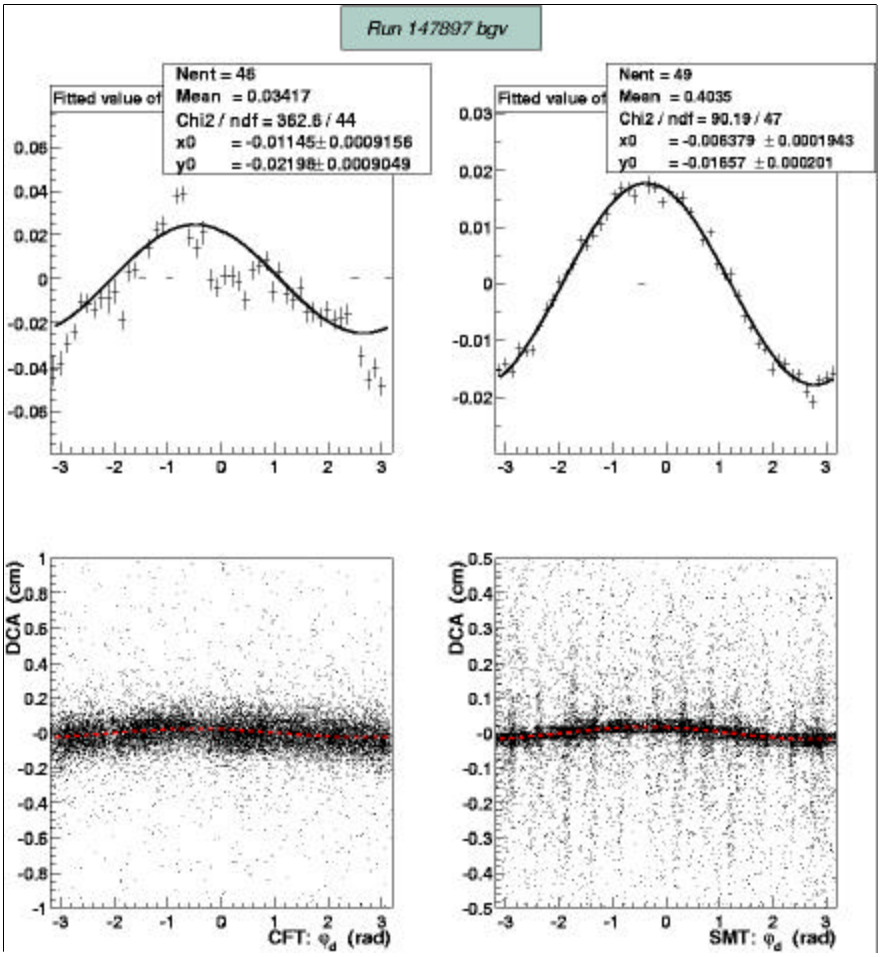
CFT-SMT Matching (aligned)



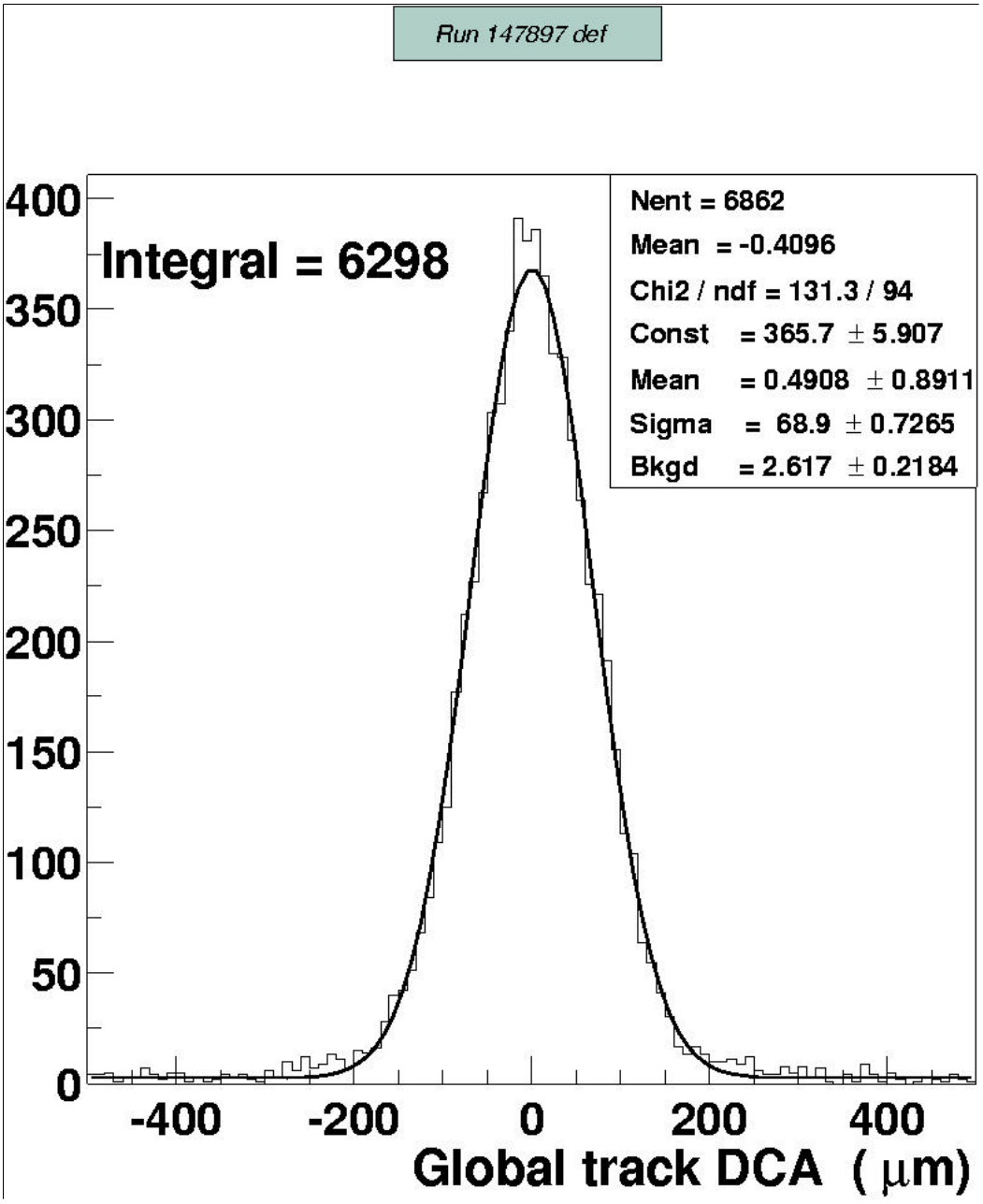
CFT Axial & SMT (p10 geom.)



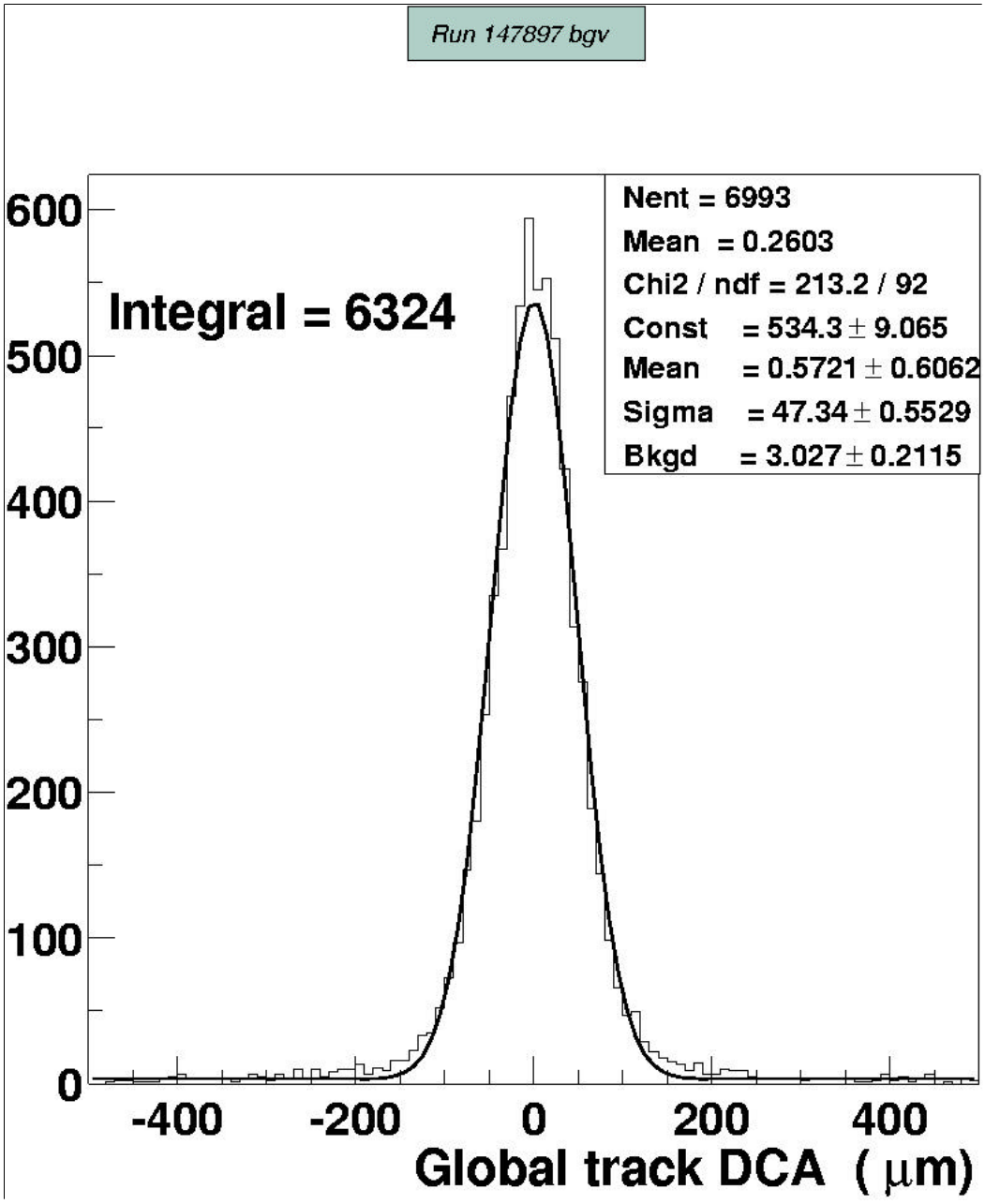
CFT Axial & SMT (aligned)



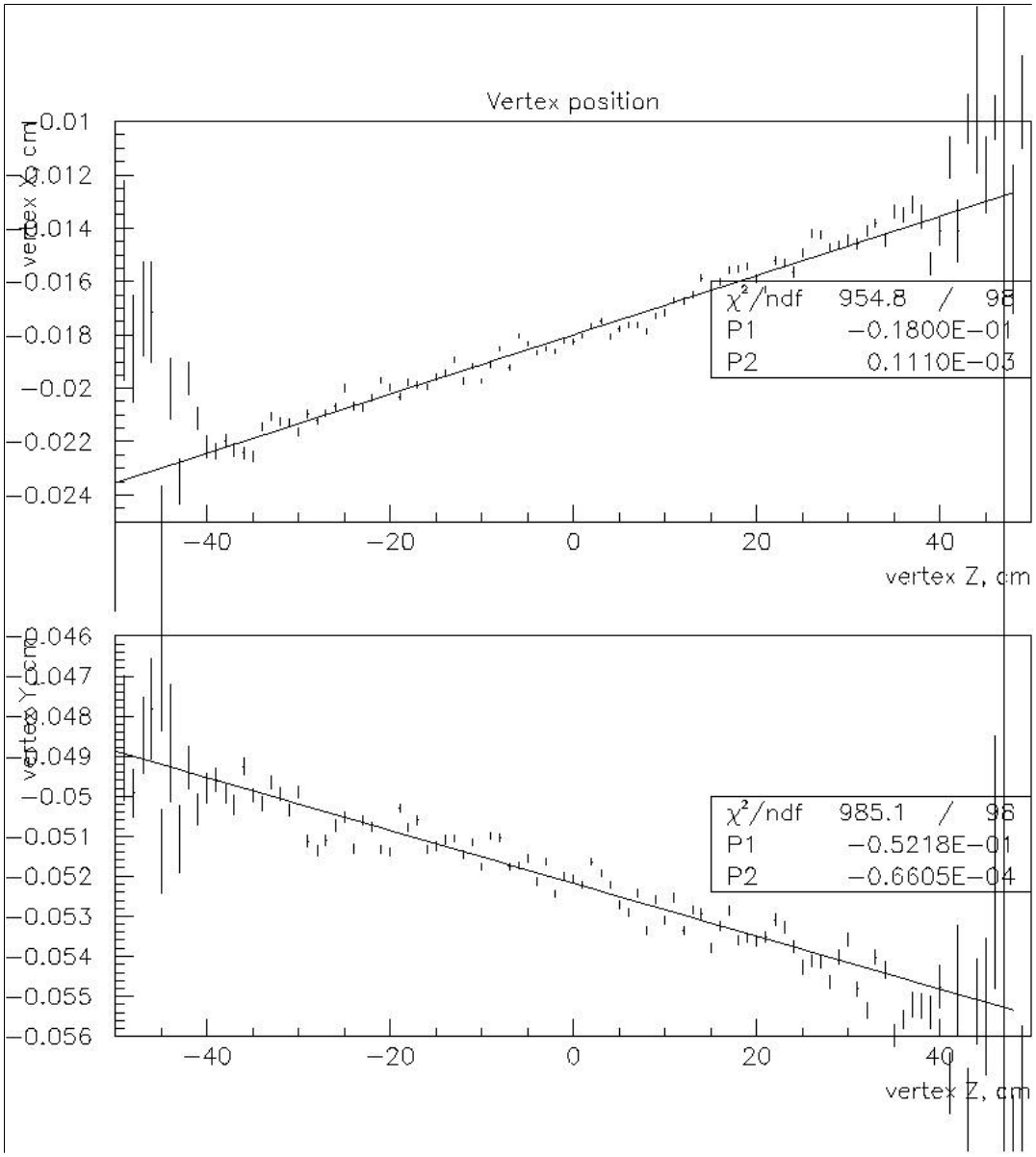
Global Track DCA (p10 geom.)



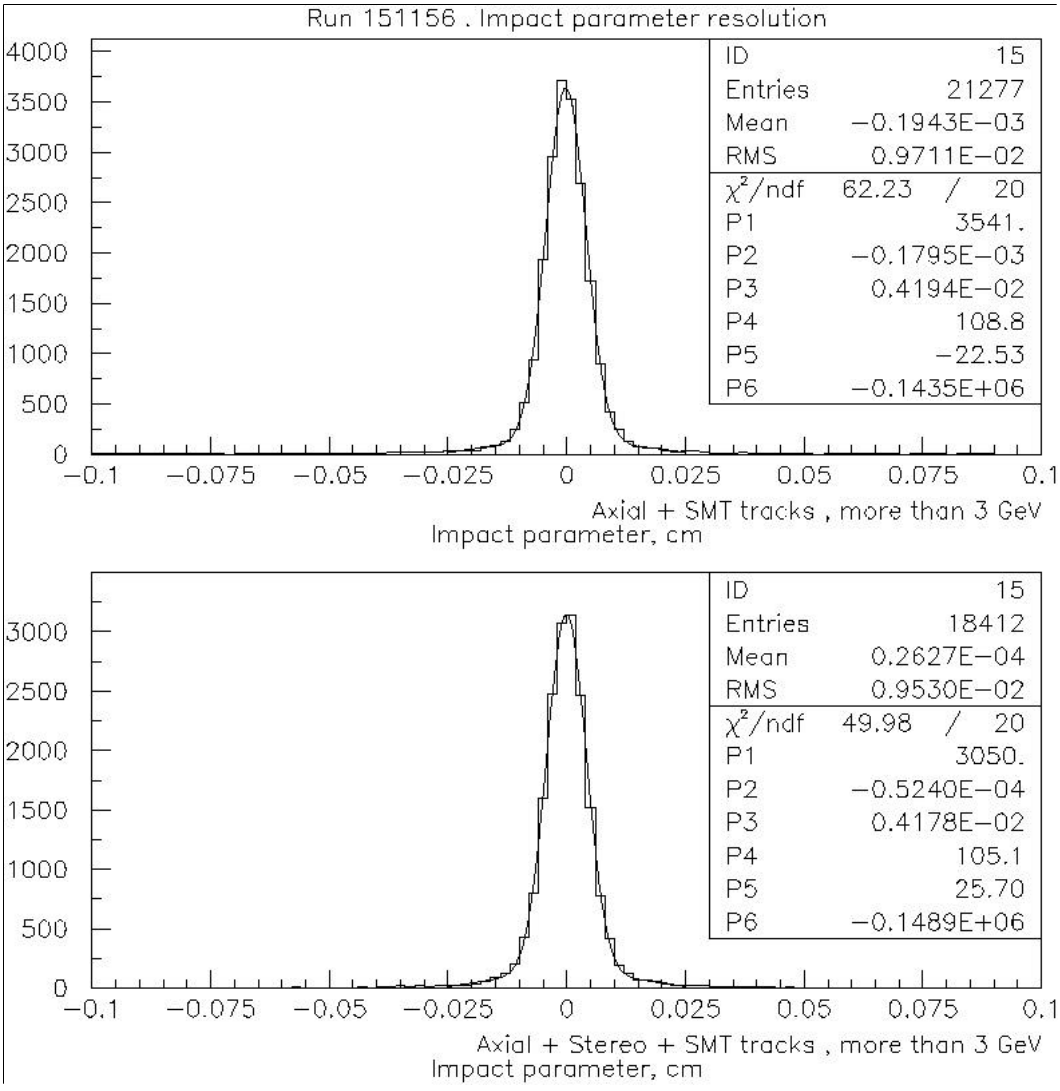
Global Track DCA (aligned)



Beam Slope

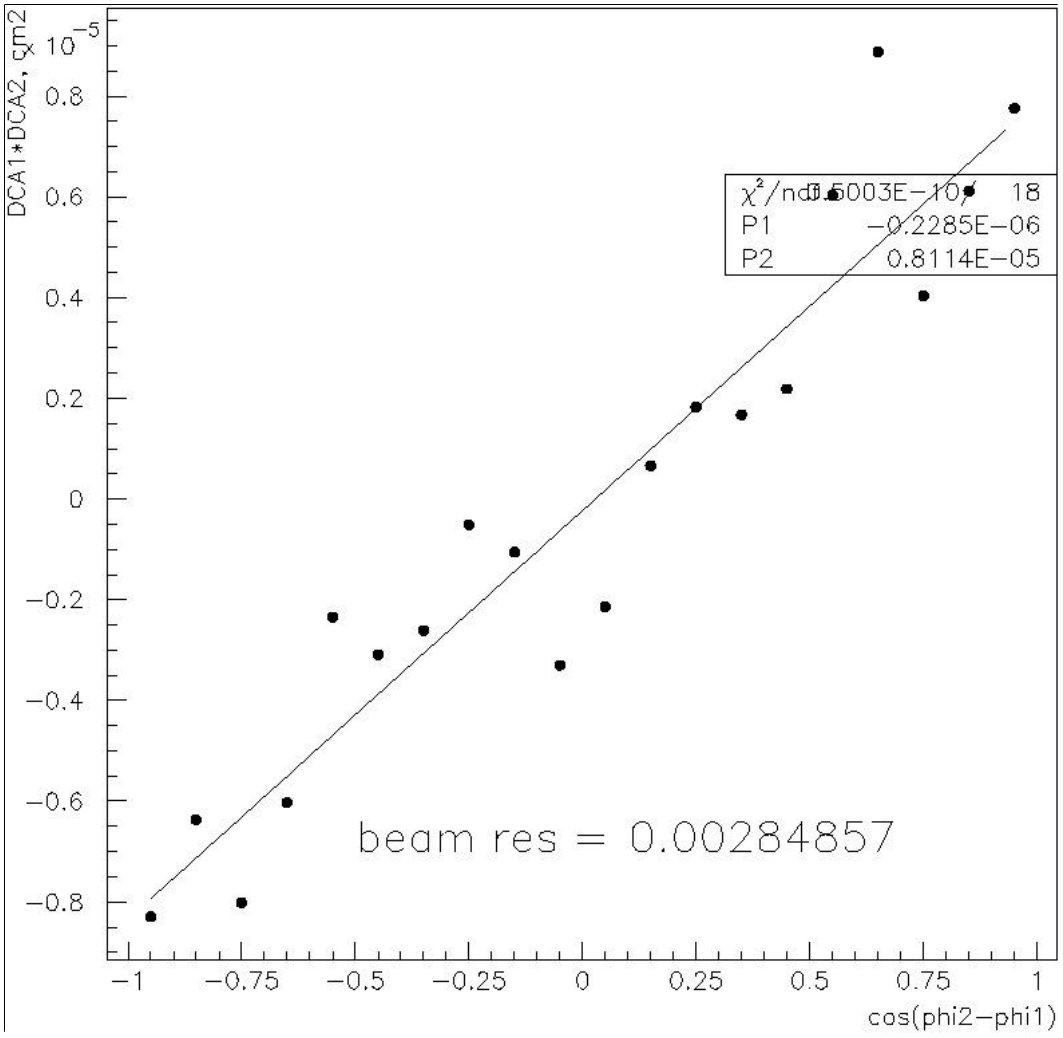

Vertex position
vertex X, cm
−0.01
−0.012
−0.014
−0.016
−0.018
−0.02
−0.022
−0.024
χ²/ndf 954.8 / 98
P1 −0.1800E−01
P2 0.1110E−03
−40
−20
0
20
40
vertex Z, cm
vertex Y, cm
−0.046
−0.047
−0.048
−0.049
−0.05
−0.051
−0.052
−0.053
−0.054
−0.055
−0.056
χ²/ndf 985.1 / 98
P1 −0.5218E−01
P2 −0.6605E−04
−40
−20
0
20
40
vertex Z, cm

Slope Corrected DCA

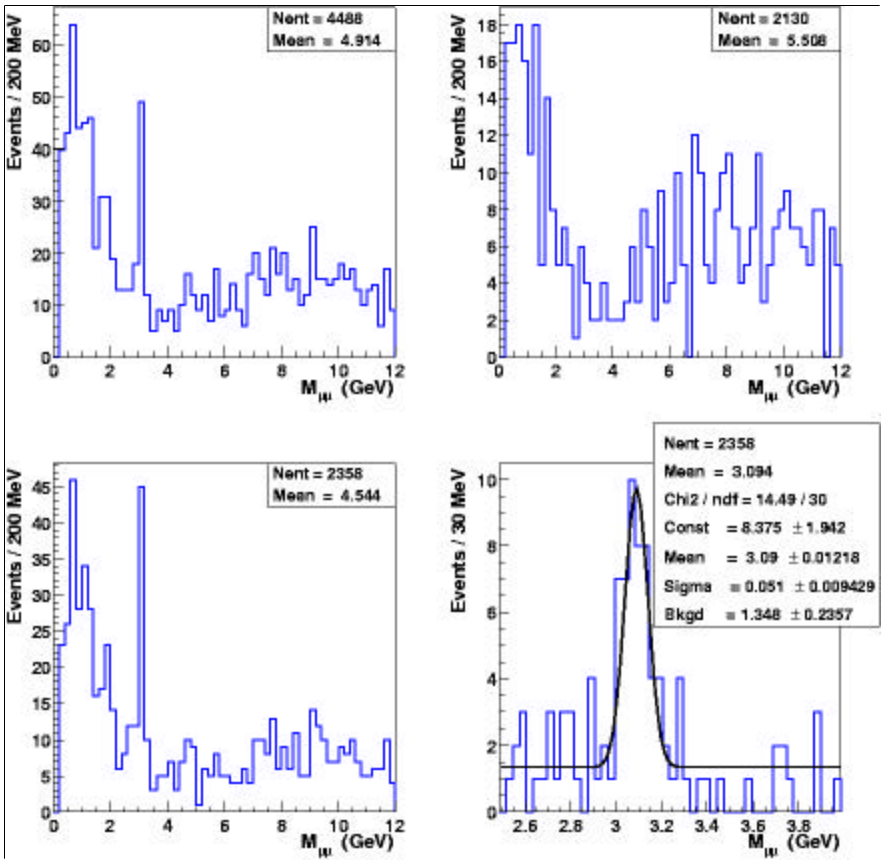


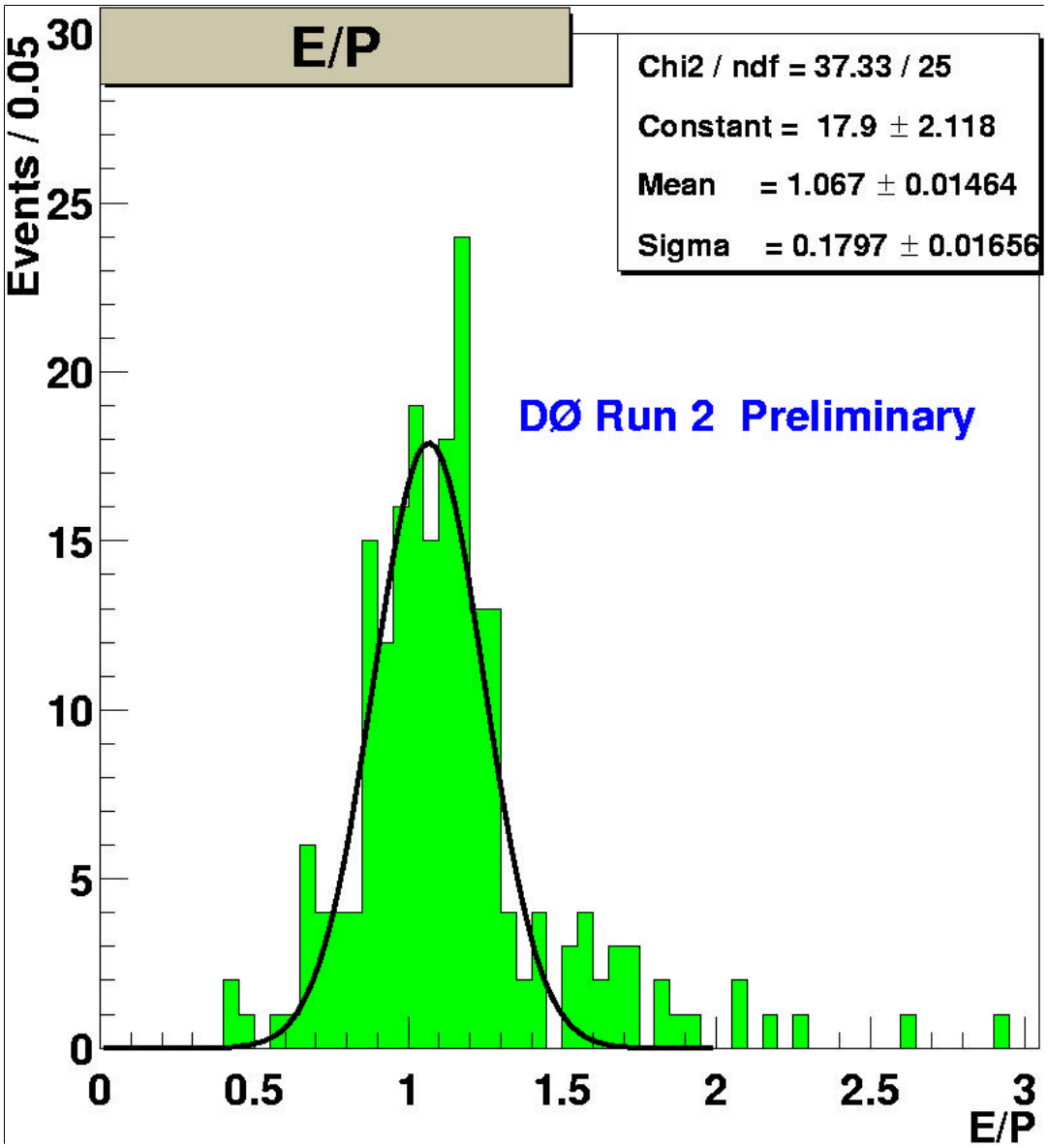
True Beam Width

$\langle r_1 r_2 \rangle = \langle r_b^2 \rangle \cos(\phi_1 - \phi_2)$

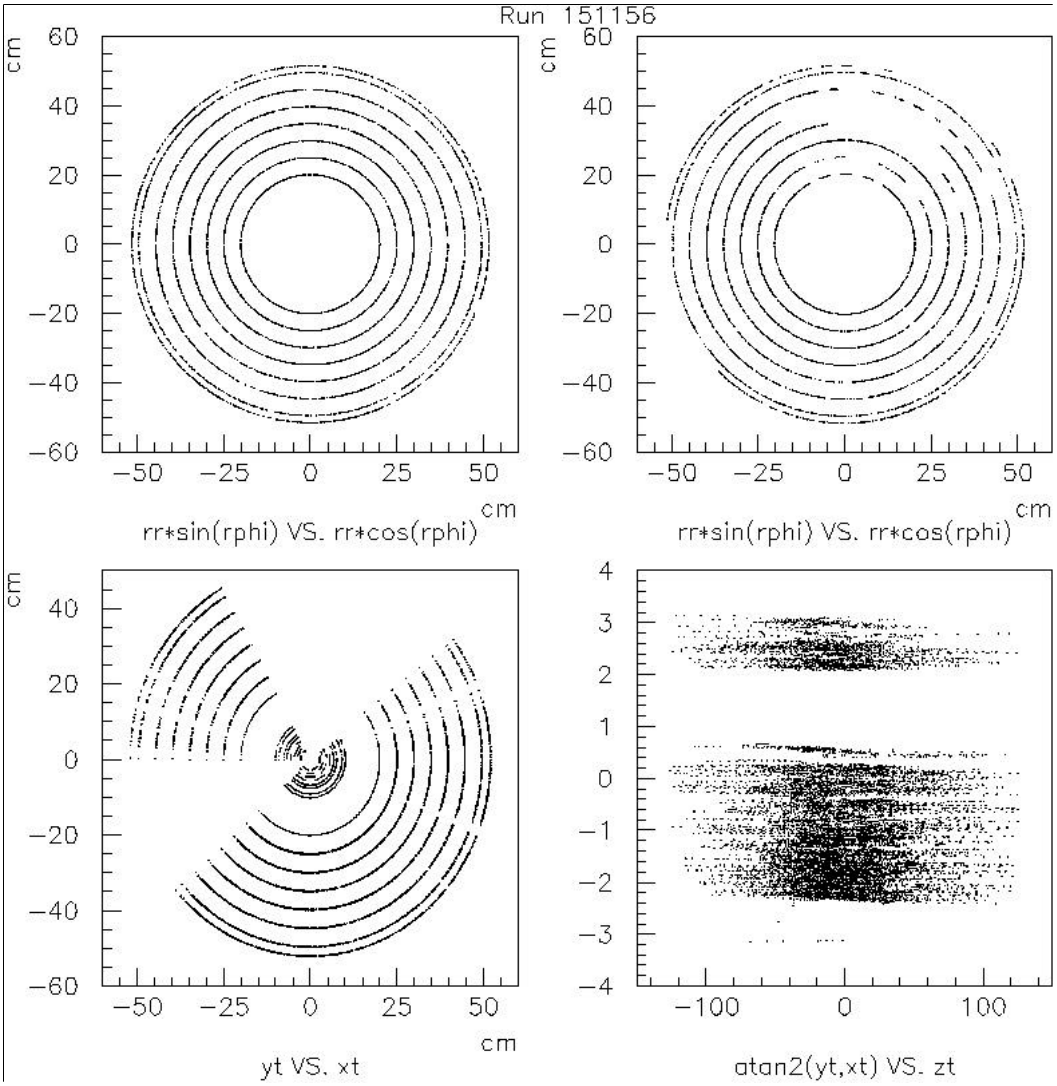


J/ψ→μμ Invarient Mass

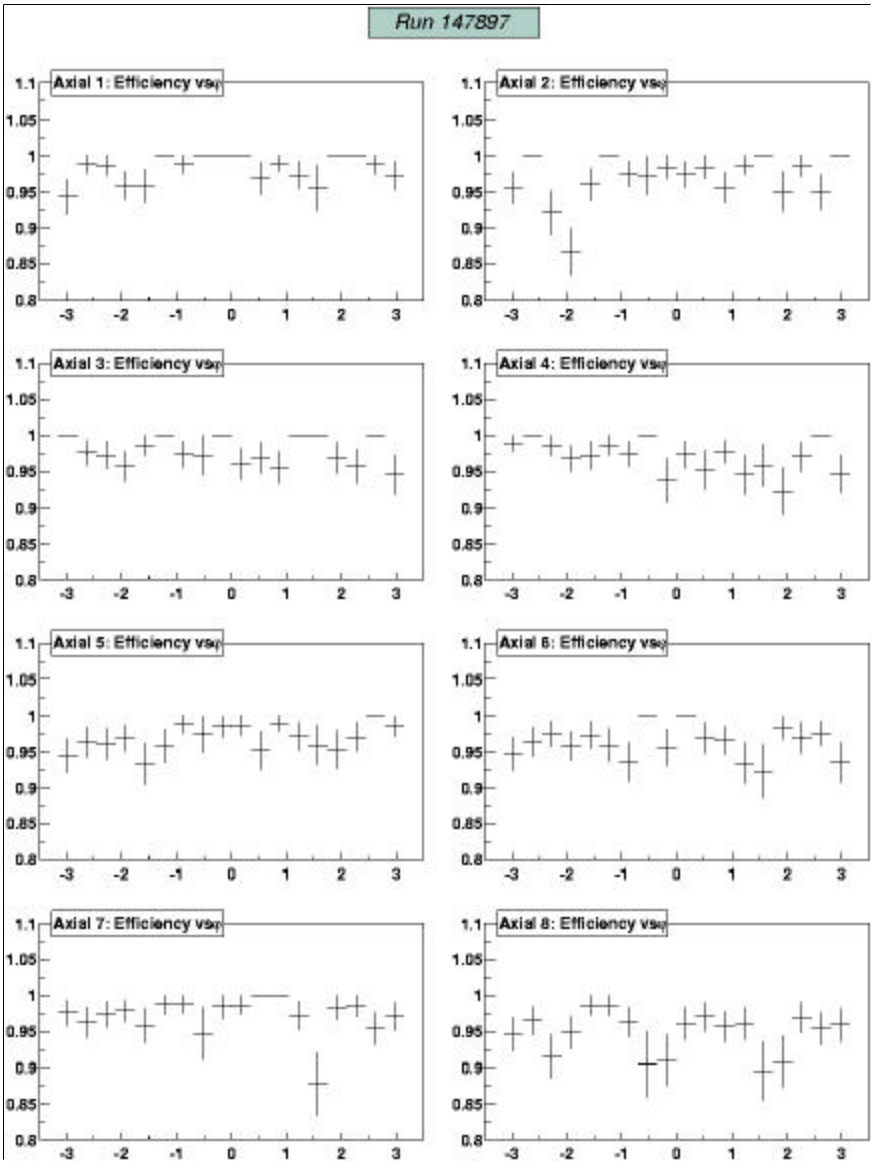



E/P
Chi2 / ndf = 37.33 / 25
Constant = 17.9 ± 2.118
Mean = 1.067 ± 0.01464
Sigma = 0.1797 ± 0.01656
DØ Run 2 Preliminary
Events / 0.05
E/P
0
5
10
15
20
25
30
0
0.5
1
1.5
2
2.5
3

CFT Stereo


Run 151156
cm
rr*sin(rphi) VS. rr*cos(rphi)
cm
rr*sin(rphi) VS. rr*cos(rphi)
cm
yt VS. xt
atan2(yt,xt) VS. zt

CFT Efficiency from Data



Selected Ladder SMT Efficiencies

cut on vtx : **| vtx | < 30 mm**

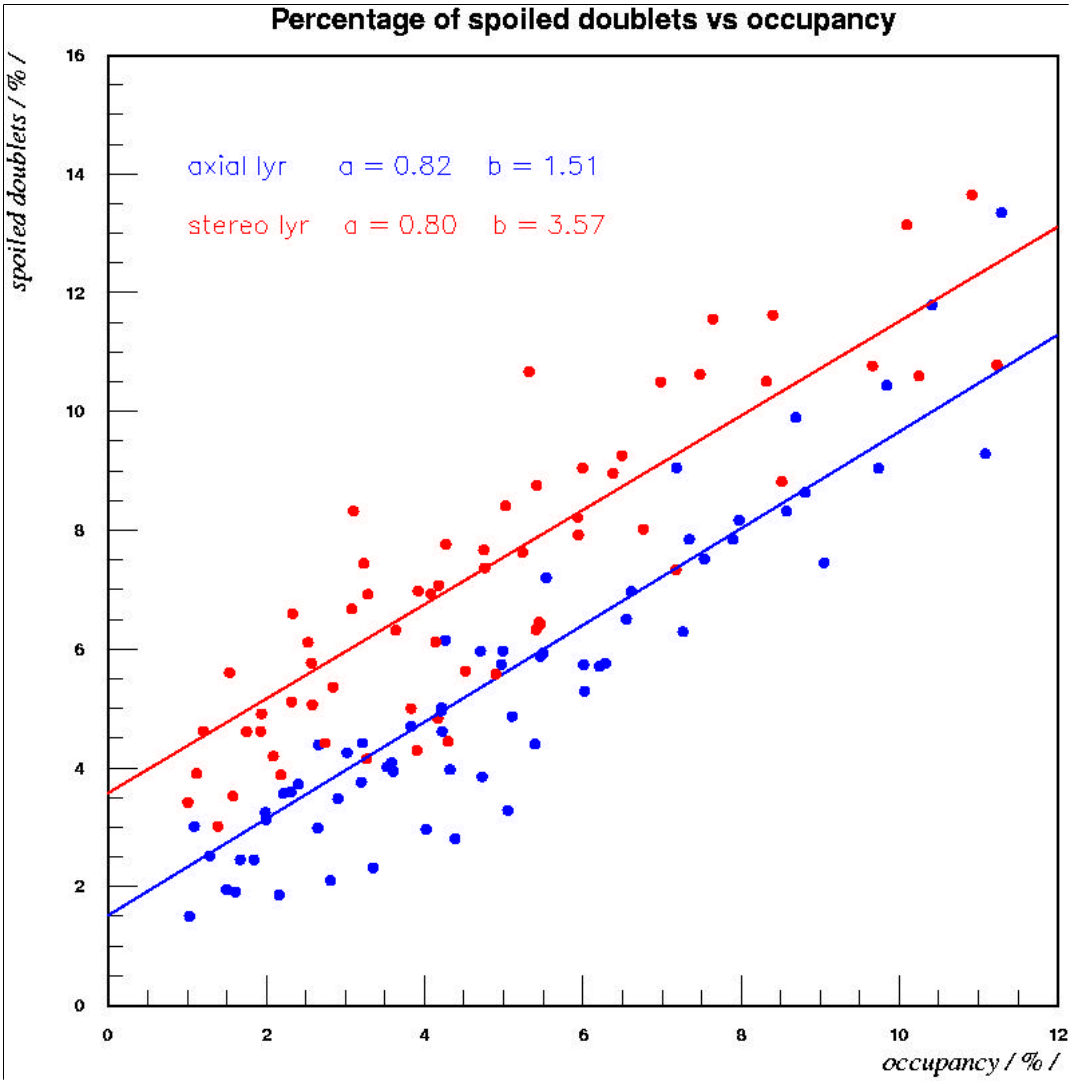
eff = (97.6 ± 2) %

(4x 6-chip devices, lay=1, lad=1)
p-sides only ! All devices have the same efficiency within errors. Errors are overestimated and have to be studied more carefully as they give limits on efficiency estimation.

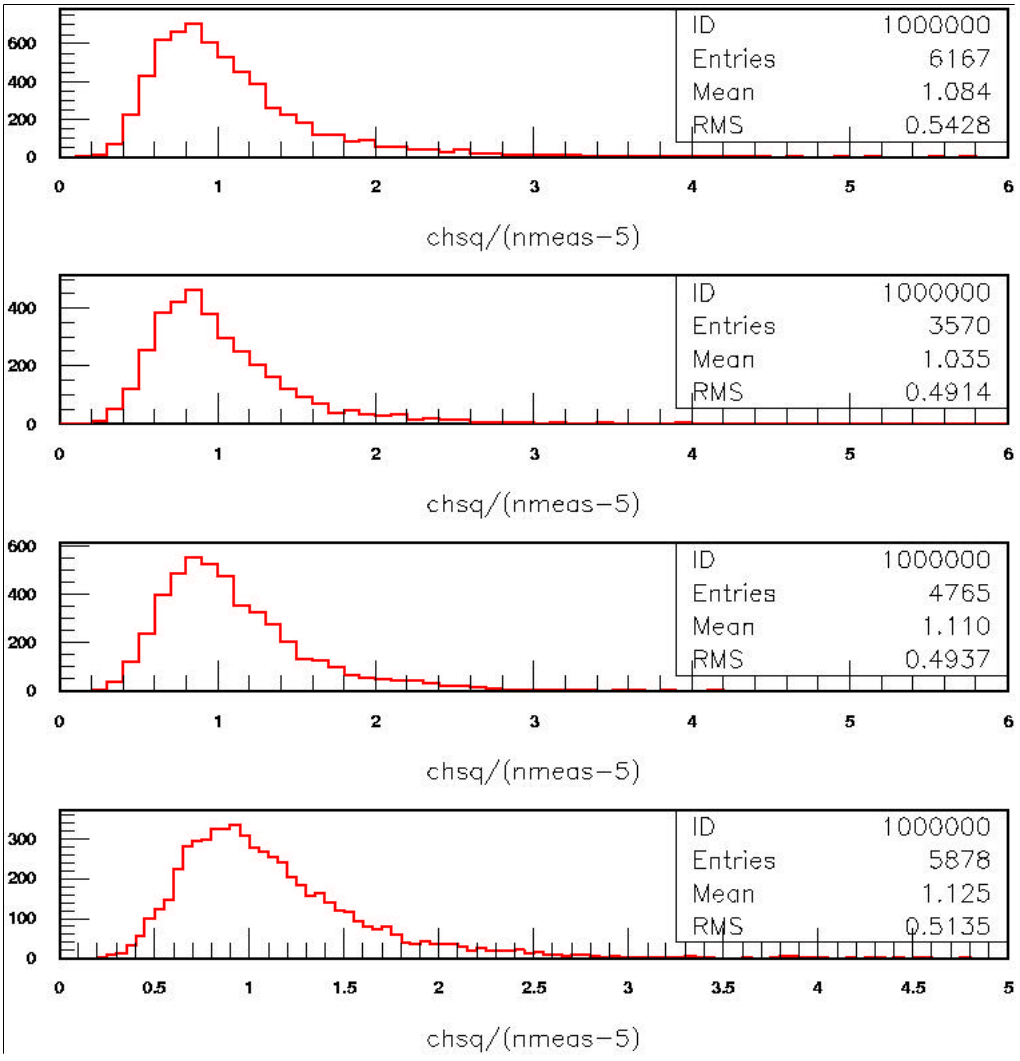
Issues & High Priority Tasks

- Alignment.
  - Align SMT wrt CFT.
- SMT clusters.
  - Lorentz corrections.
  - Cluster errors.
- Calibration
  - Read detector calibration constants from database.
- Understand CFT stereo.
- Merge data & mc paths.
- Fully implement misses in CFT.
- Implement & tune wide doublets for CFT.
- Ongoing monitoring of tracking performance, over time & between algorithms.

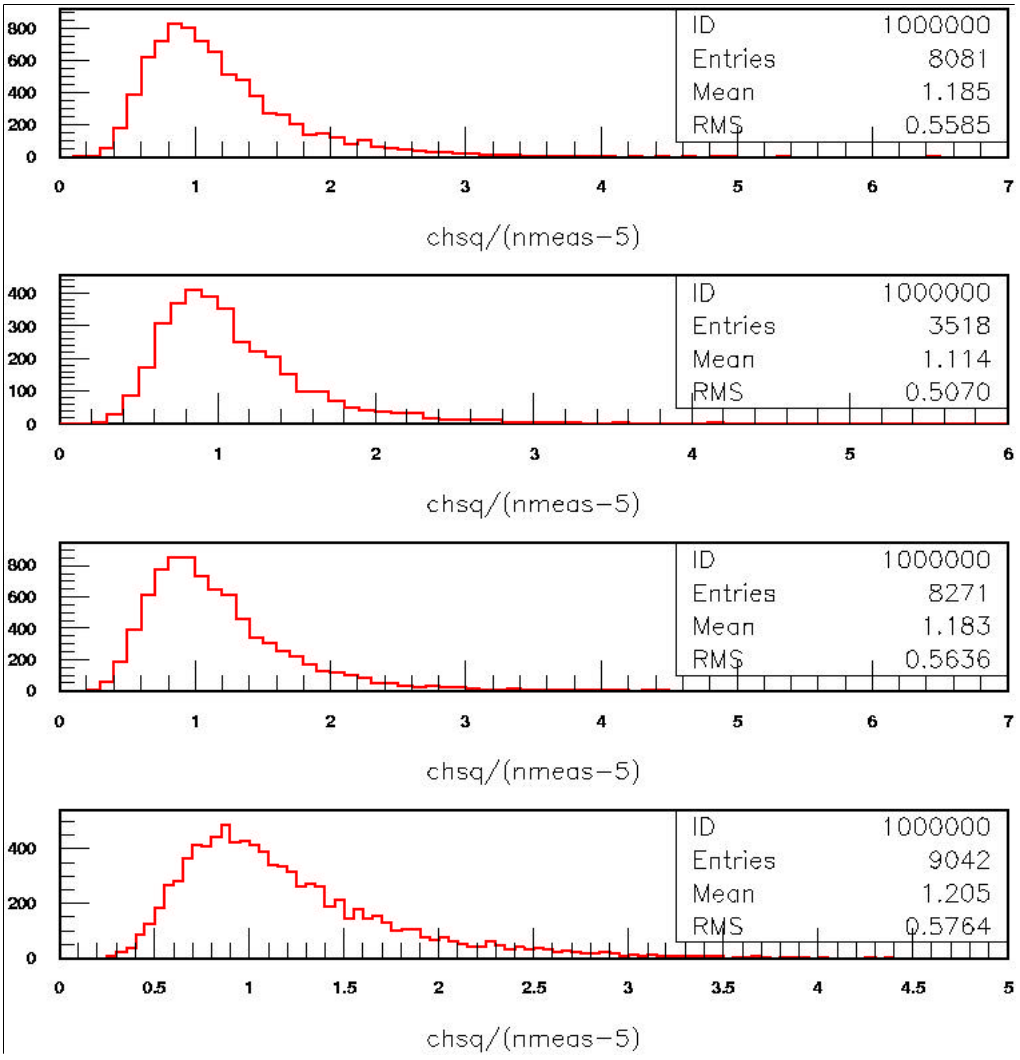
Spoiled CFT Doublets vs. Occupancy



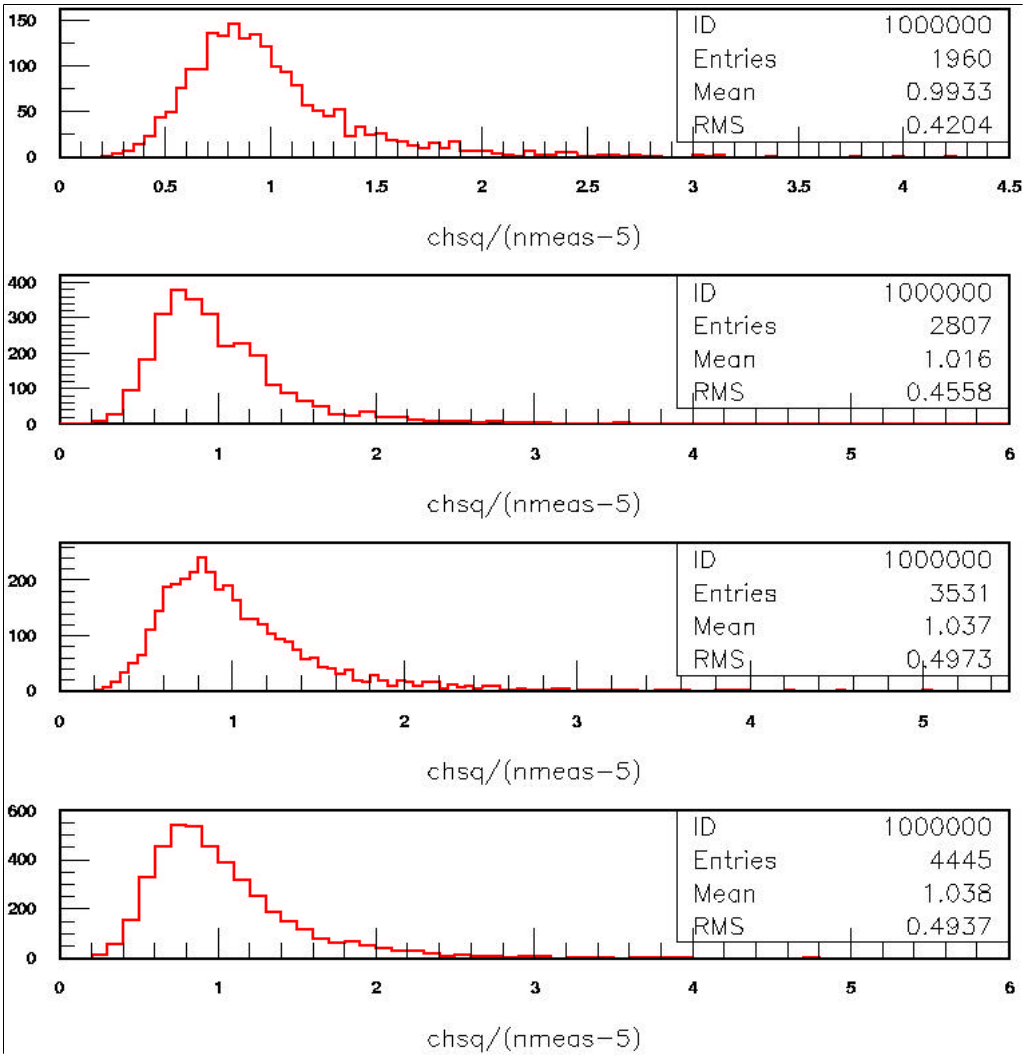
Chisquare Using Narrow Doublets



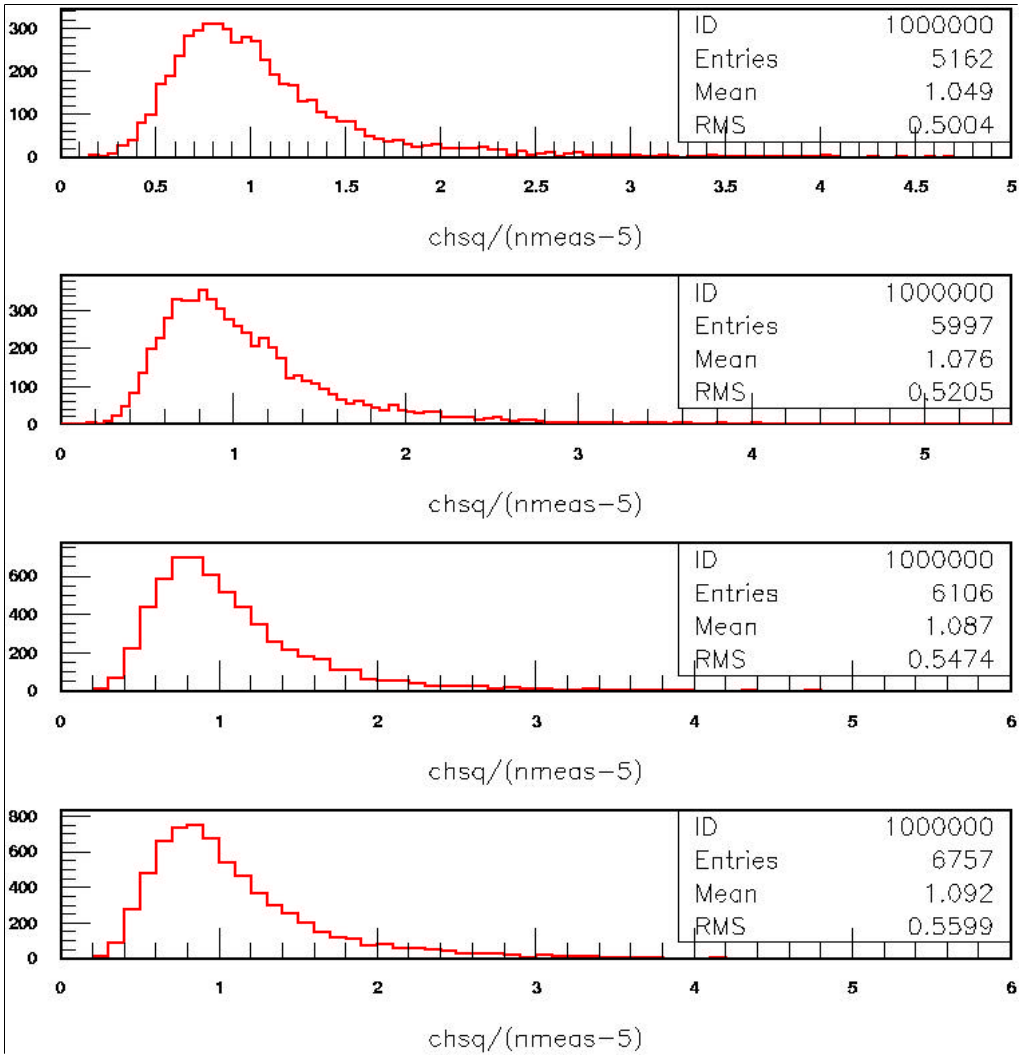
Chisquare Using Narrow Doublets



Chisquare Using Wide Doublets



Chisquare Using Wide Doublets



Conclusions

- Much progress commissioning D0 tracking detectors.
  - CFT stereo fully instrumented.
  - Need for special “data tracking” is less.
- Initial SMT alignment.

  $\sigma_{DCA} = 42\ \mu m$ ($p_T > 3$ GeV).
- Numerous software improvements from p10 to p11.