Primary Vertex Finding

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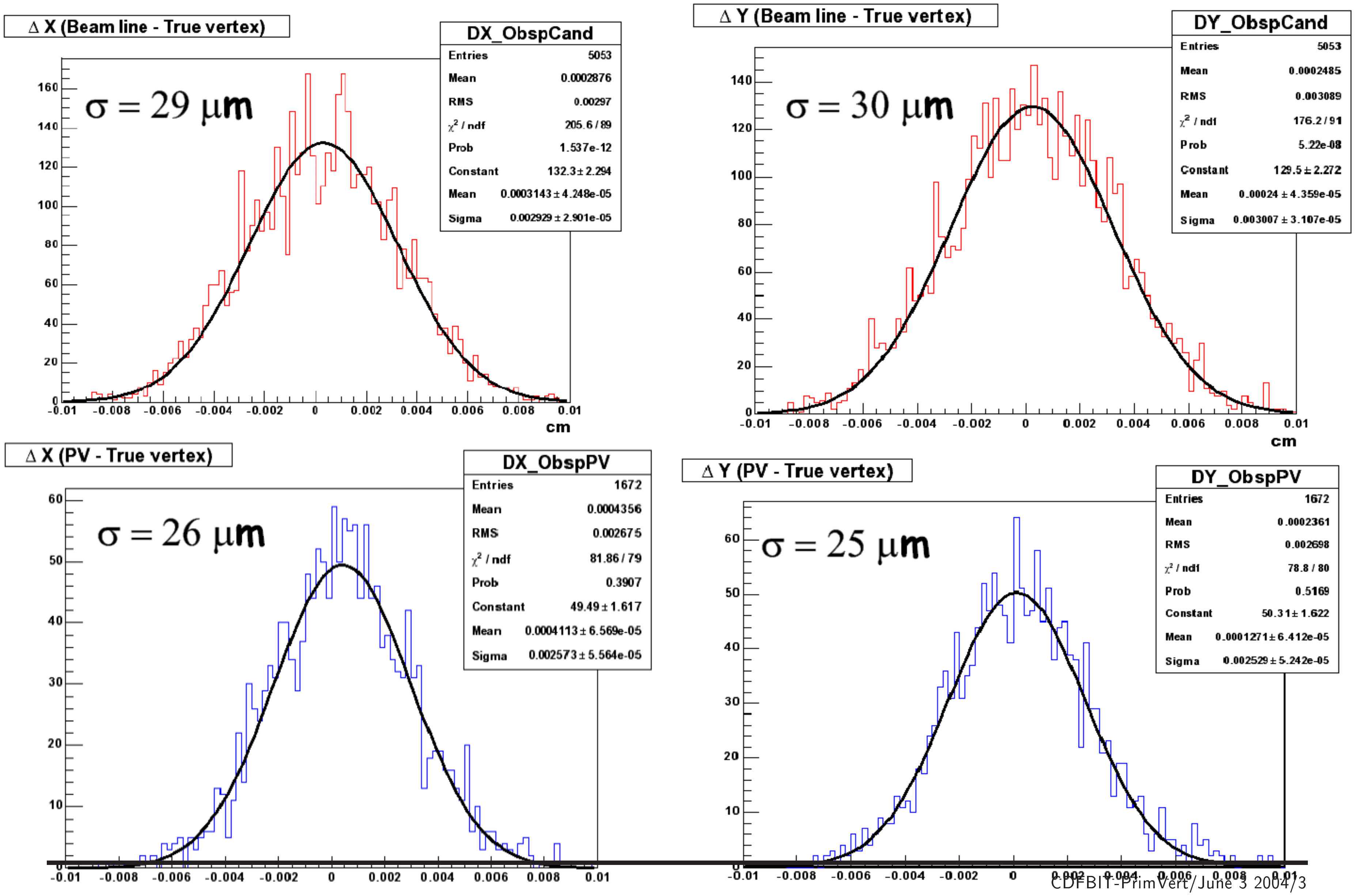
- Monte Carlo Studies
- A first look at J/ψ Data
- Plans for the Future

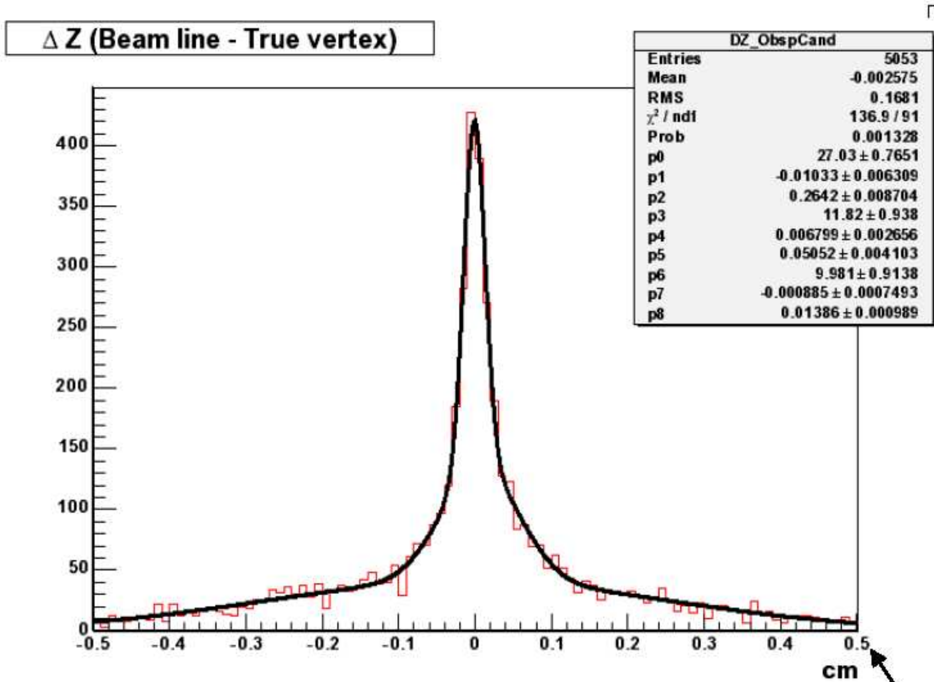
Monte Carlo Update

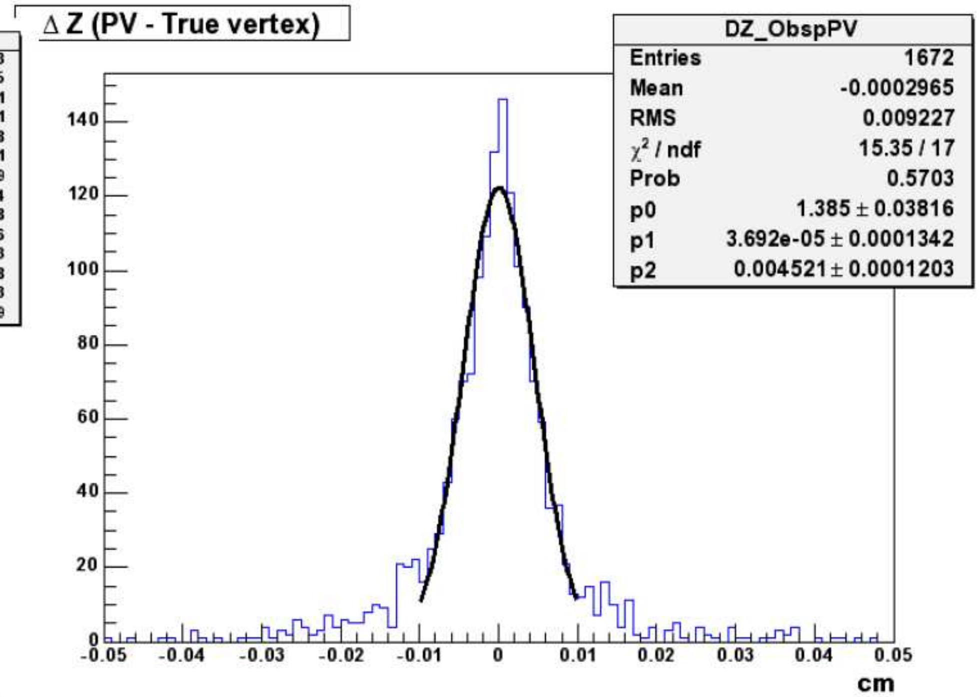
- Description of sample and method (see talk from April 9th)
  - Pythia $b\overline{b}$ with one $B^{\pm} \to D^0\pi^{\pm}$
  - 5.3.1 Monte Carlo and Reconstruction
  - Beam spot set to 30μ
  - Compare OBSP to event-by-event vertex from PrimVertex
- Results look promising
  - Modest improvement in σ_x and σ_y
  - Major improvement in σ_z
- Additional plots of $p_t(B)$ and $c\tau$ dependence of performance

Resolutions in the transverse plan Zseed=zcand



Resolutions in the z direction Zseed=zcand

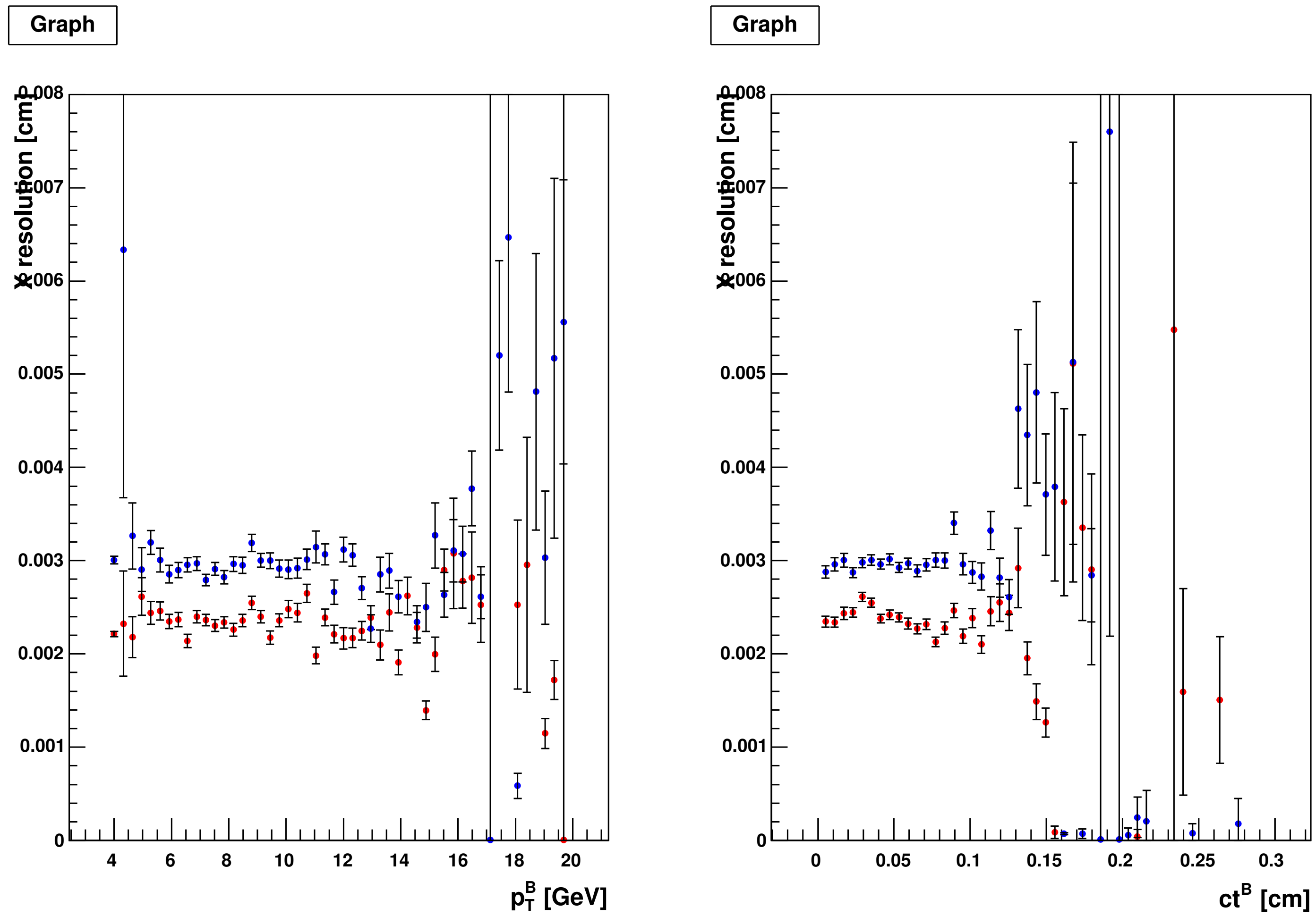


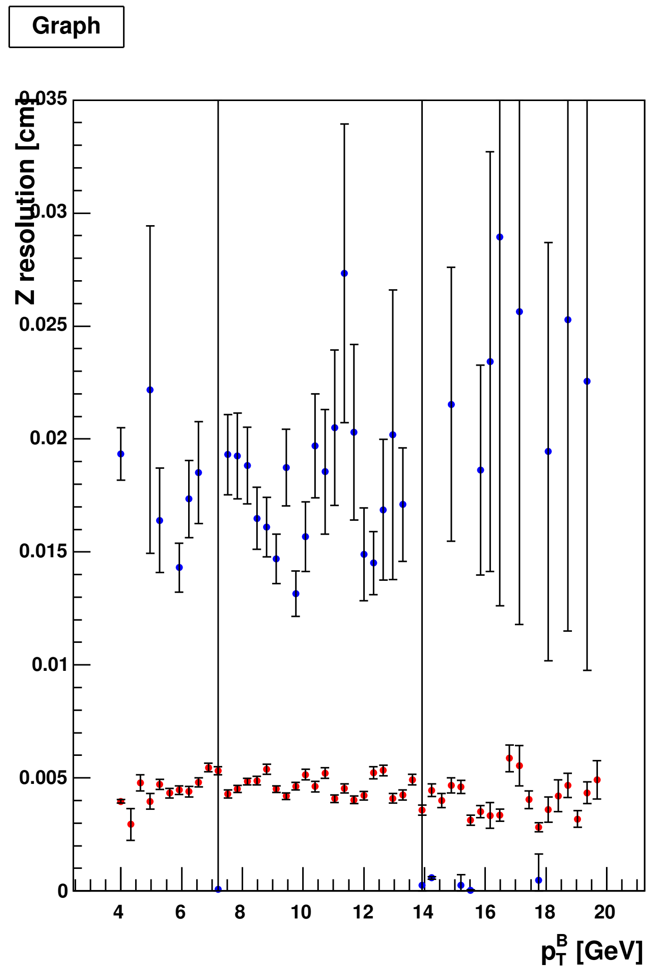


3 Gaussians:
55% σ = 2.6 mm
24% σ = 505 μm
21% σ = 139 μm

Different scale

$\sigma = 45\ \mu$m


Graph
X resolution [cm]
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
4
6
8
10
12
14
16
18
20
p_T^B [GeV]
Graph
X resolution [cm]
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
0.05
0.1
0.15
0.2
0.25
0.3
ct^B [cm]


Graph
Z resolution [cm]
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
4
6
8
10
12
14
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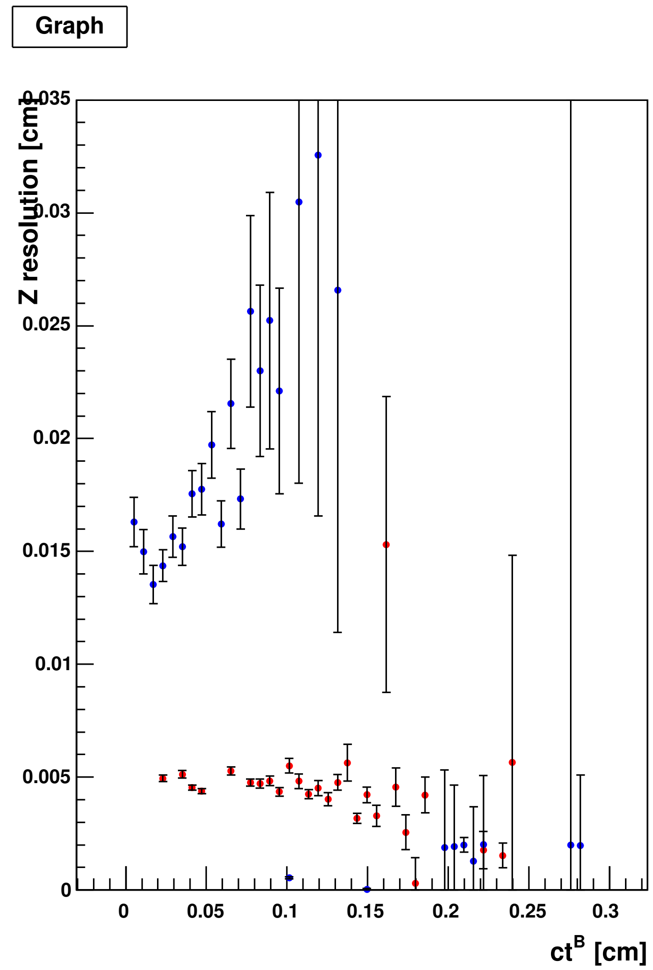
p_T^B [GeV]

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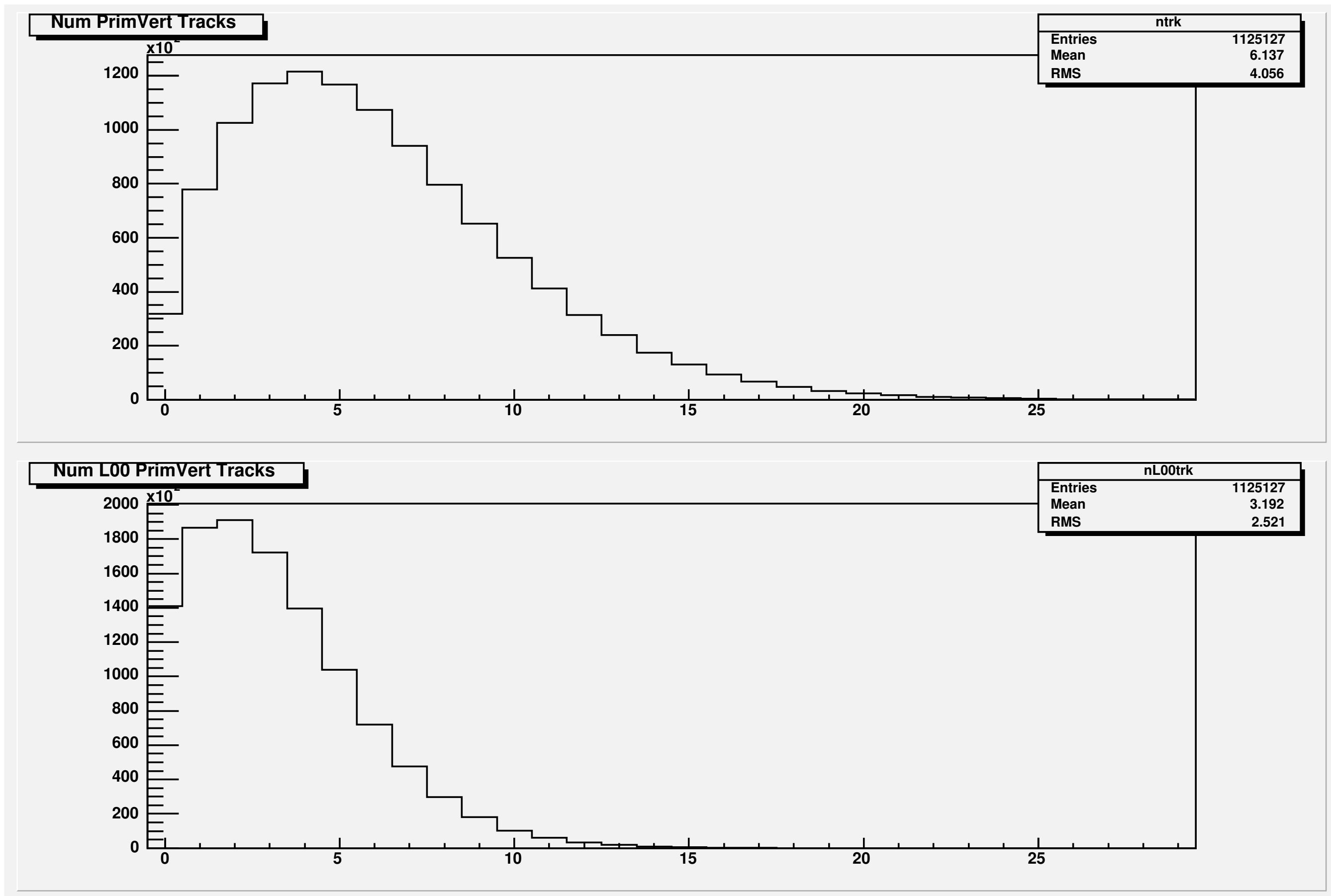
0.1
0.15
0.2
0.25
0.3
ct^B [cm]

First Look at J/ψ Data

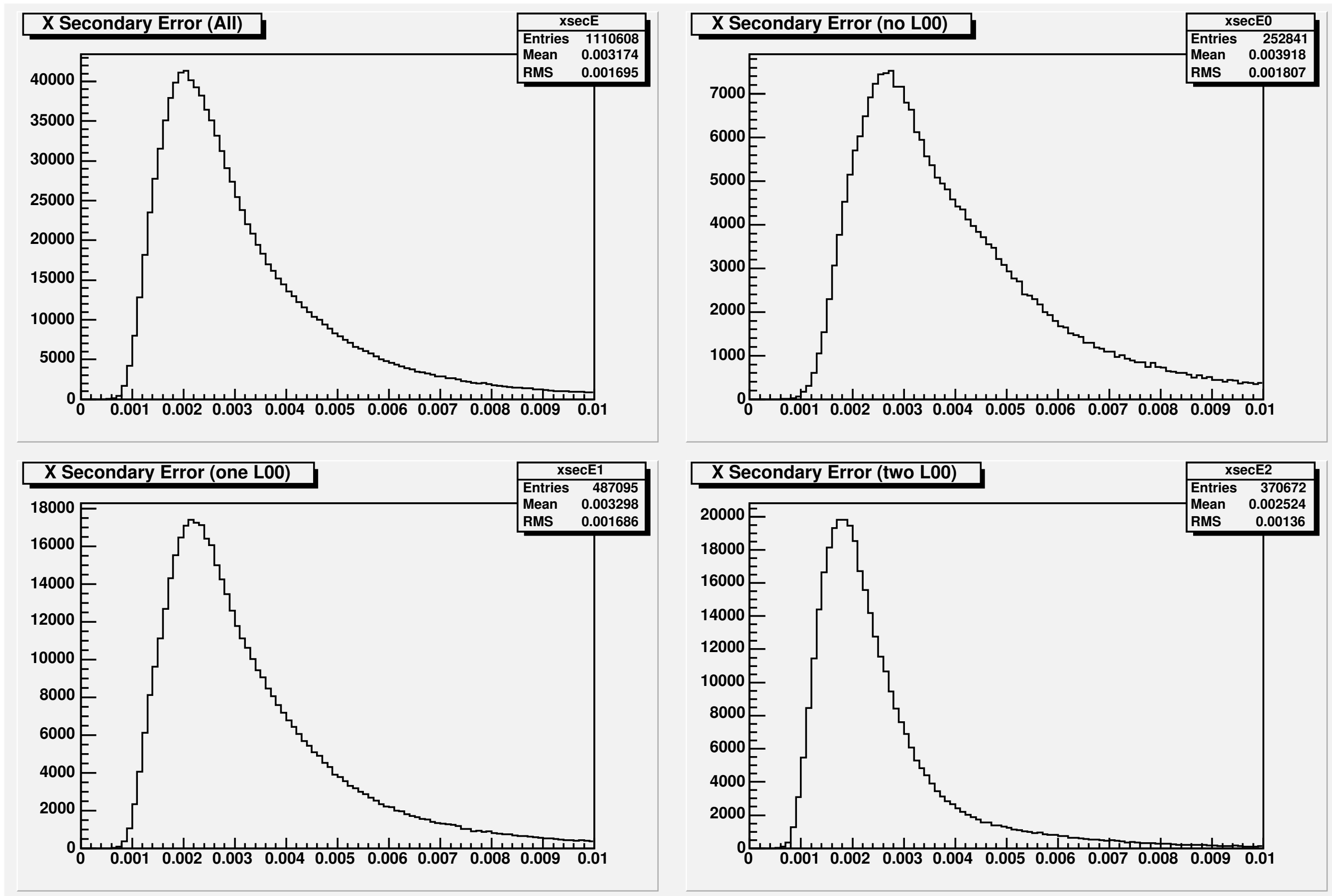
- Use 5.1 Production: xpmm0c
- Refit with TrackSelectorModule
  - KAL refitter
  - BPAK blessed phantom layer and covariance rescaling
  - Pass 13 alignment
  - Data processed both with and without L00
- Use VertexAlg/PrimeVtxFinder
  - Require $z_0 < 1$ cm from J/ψ vertex (extrapolated to beamline)
  - Exclude J/ψ legs from list of tracks
- Study primary and secondary vertex resolution returned from fits
- Use pull distributions to test whether the returned resolutions are correct
- Today, will show results for fit WITH L00

Number of Tracks Used in Vertex Determination



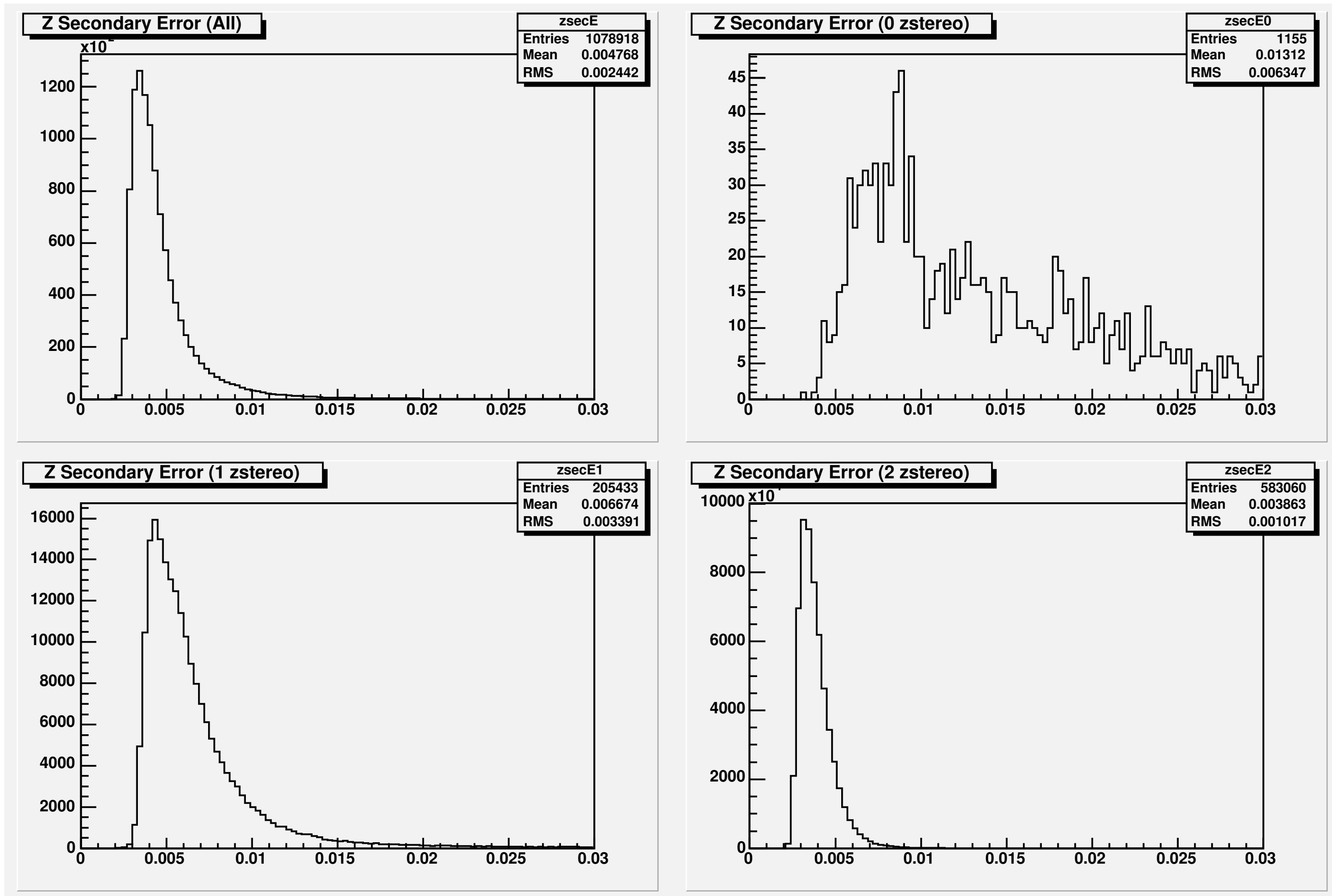
- Mean number of tracks: 6.1
- Mean number of L00 tracks: 3.2

X Secondary Vertex Error vs Number ψ Tracks with L00 Hits



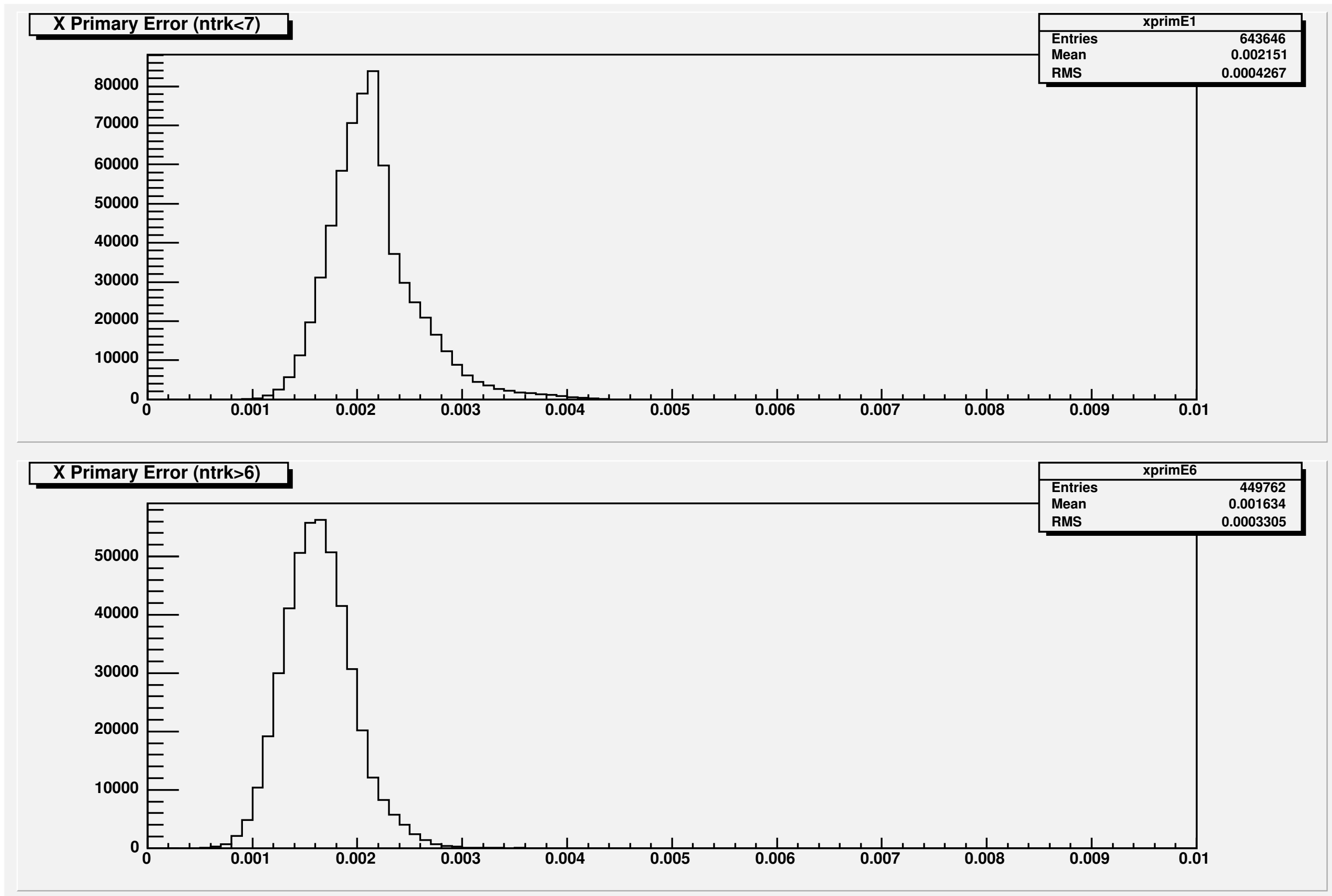
- Mean resolution 39 μm: No L00 Hits
- Mean resolution 25 μm: Two L00 Hits

Z Secondary Vertex Error vs Number ψ Tracks with ≥ 3 Z Hits



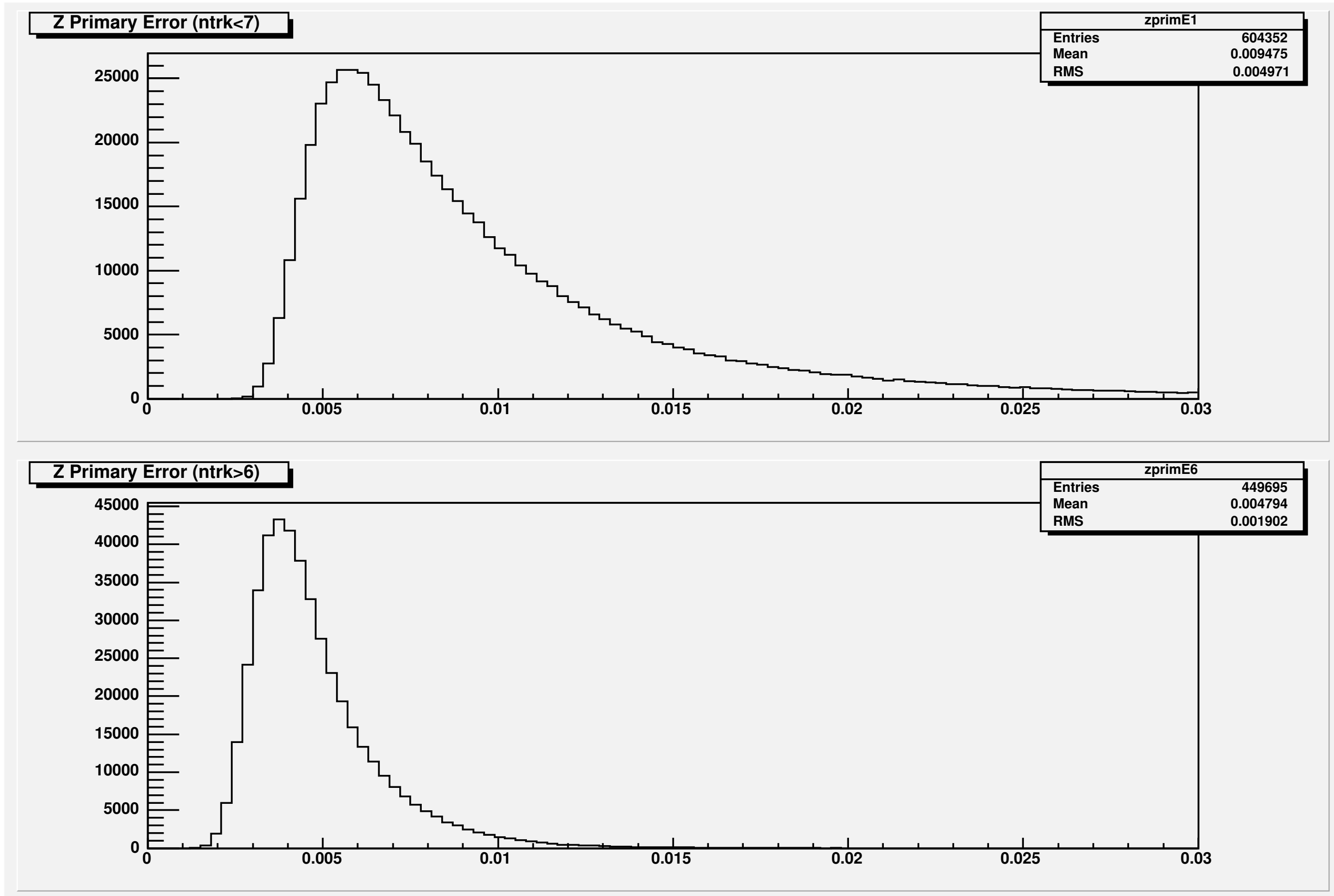
- Mean resolution 130 μm: No ≥ 3 stereo hit tracks
- Mean resolution 39 μm: Two ≥ 3 stereo hit tracks

X Primary Vertex Error: > 6 and ≤ 6 Tracks Used in Vertex



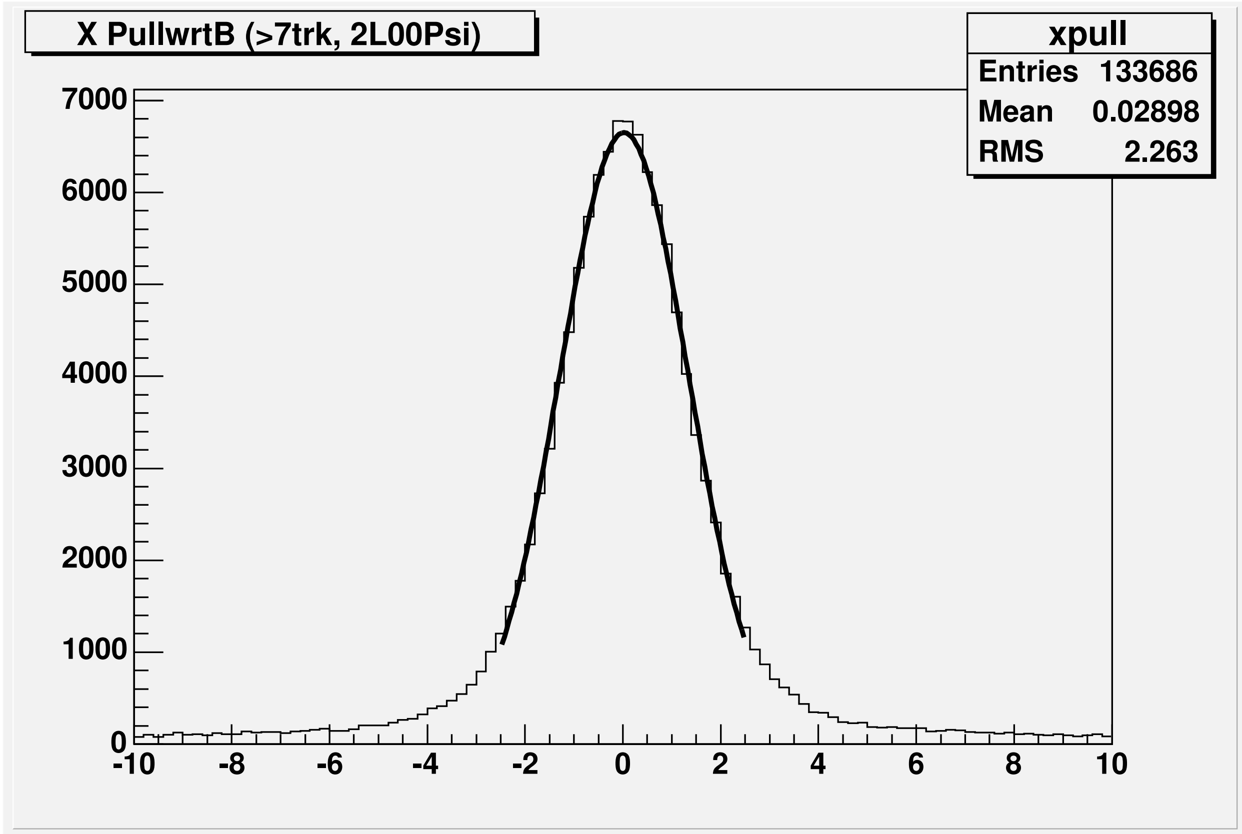
- Mean resolution 22 μm: ≤ 6 Tracks
- Mean resolution 16 μm: > 6 Tracks
- Note: average beamline used as a constraint in PrimeVtx fit

Z Primary Vertex Error: > 6 and ≤ 6 Tracks Used in Vertex



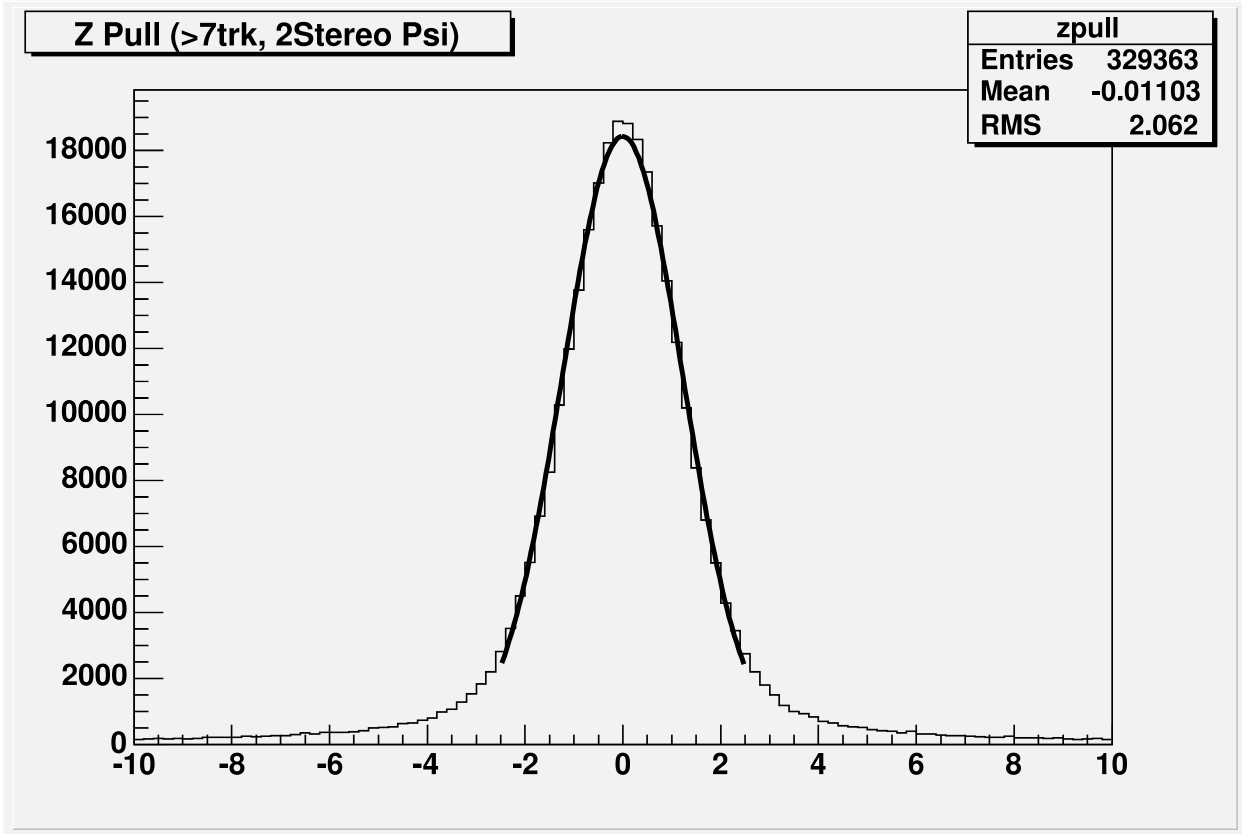
- Mean resolution 95 μm: ≤ 6 Tracks
- Mean resolution 48 μm: > 6 Tracks

But Are the Reported Errors Correct?



- Best resolution case:
  - Both J/ψ legs have L00 hits, > 7 tracks for determining primary vertex
- $\sigma = 1.3$

How About Z Pulls?



- Best resolution case
  - Both J/ψ legs have L00 hits, > 7 tracks for determining primary vertex
- $\sigma = 1.2$

Progress Status

- Added CharmMods module to perform event-by-event, candidate by candidate primary vertex finding
- Fixed two "bugs" in PrimVtx:
  - P_t : 400MeV$\rightarrow$ 500MeV
  - Tracks were required to have ≥ 2 SAS $+ \geq 2\,90^\circ$ hits
  - (results shown in this talk **before** the fix)
- Sample ntuplizer being tested
- Characterize pulls both with and without L00 as function of number of tracks in vertex
- Check calculation of vertex uncertainty by separately running PrimVtx on 2 TrackViews, each with half of primary tracks
- Study how resolution changes as cuts on tracks used in vertex finding are varied
- Repeat exercise for events with fully reconstructed B decays
- Look at L00 Monte Carlo

Conclusions

- PrimVtxFinder works well on low multiplicity J/ψ events
- Improvement of transverse beam size for those events with reasonable number of tracks for vertex finding
- Significant improvement in determination of z vertex position
- Pulls when L00 included in fit have width ~ 1.3 for both transverse and longitudinal components
- Will move to B sample soon
- Studies on TOF improvements being pushed through