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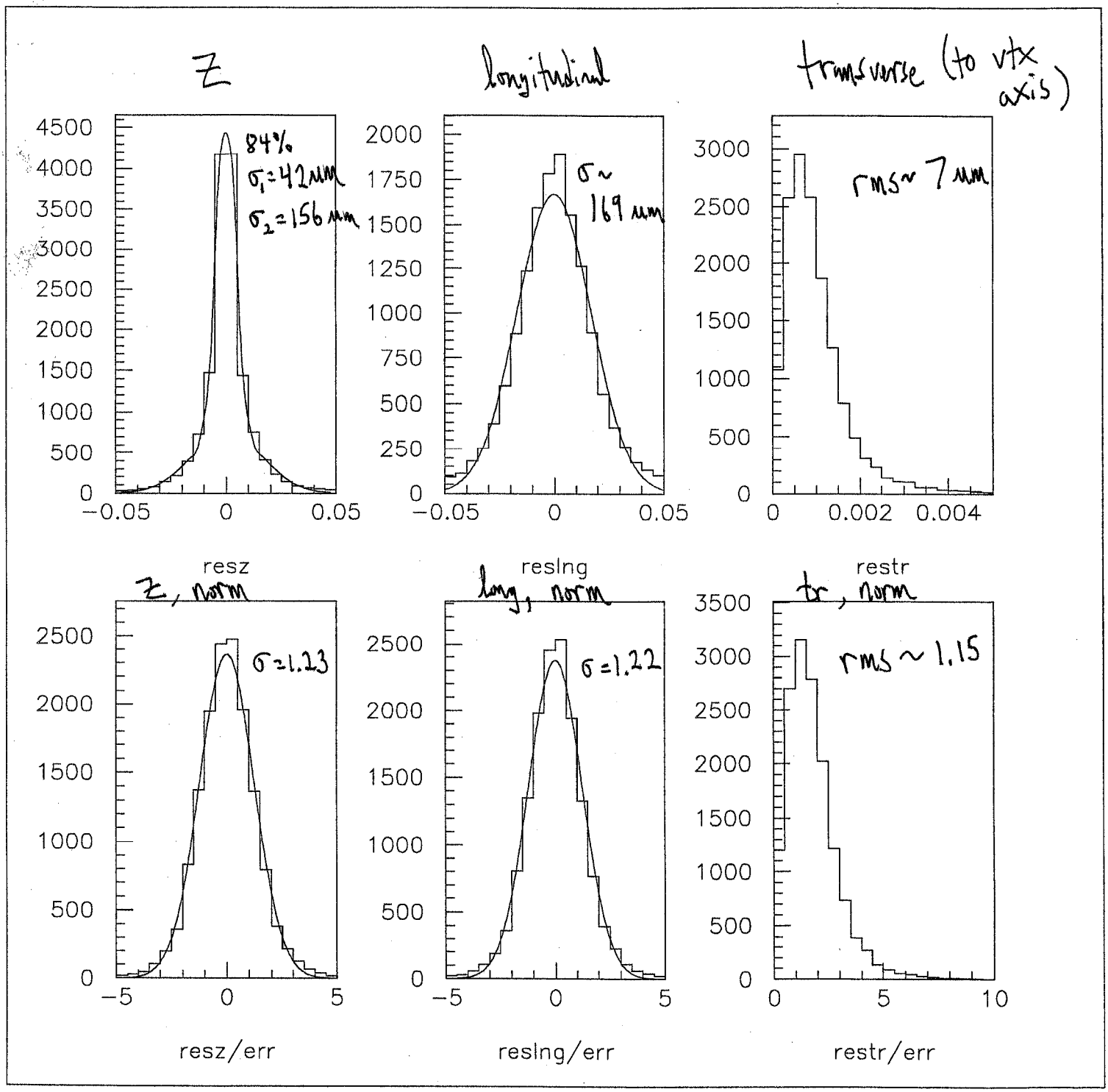
May 22, 2001

Vertexing Resolution

1. Review of Tau study
2. Impact Parameter Study
   - ↳ Misalignment shift constants
3. Diagnostics

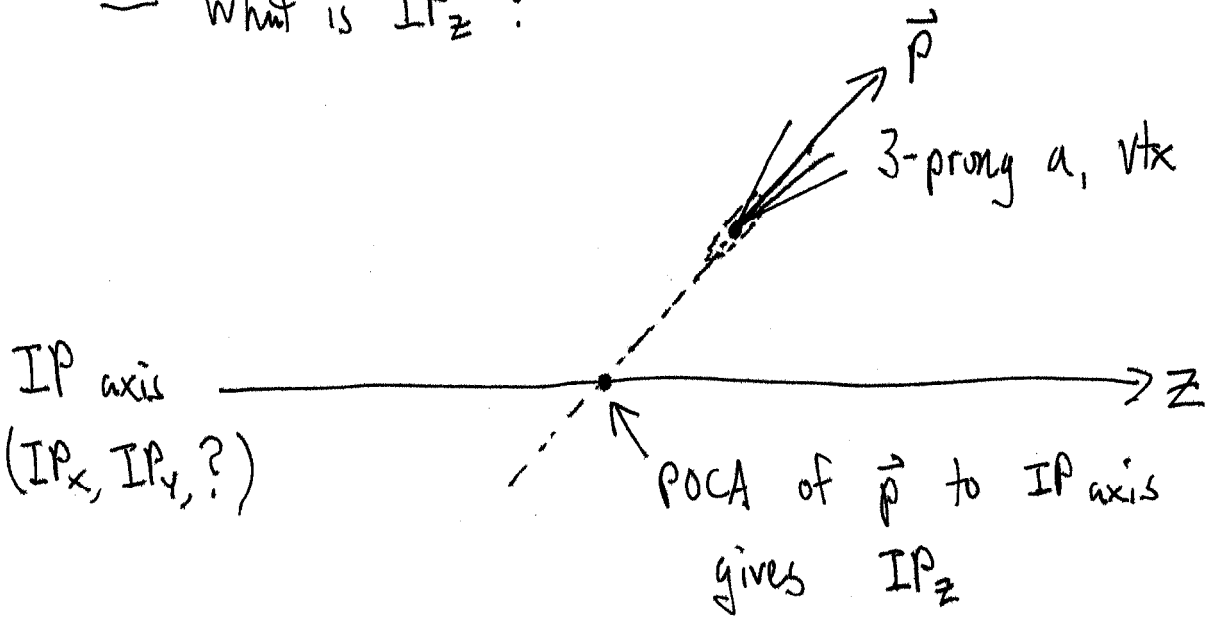
MC true vertexing resolution, 3 prong Υ's



Measure Tau Decay Length Distribution

— The negative tail gives the longitudinal vtx resolution.

— What is IP_z?

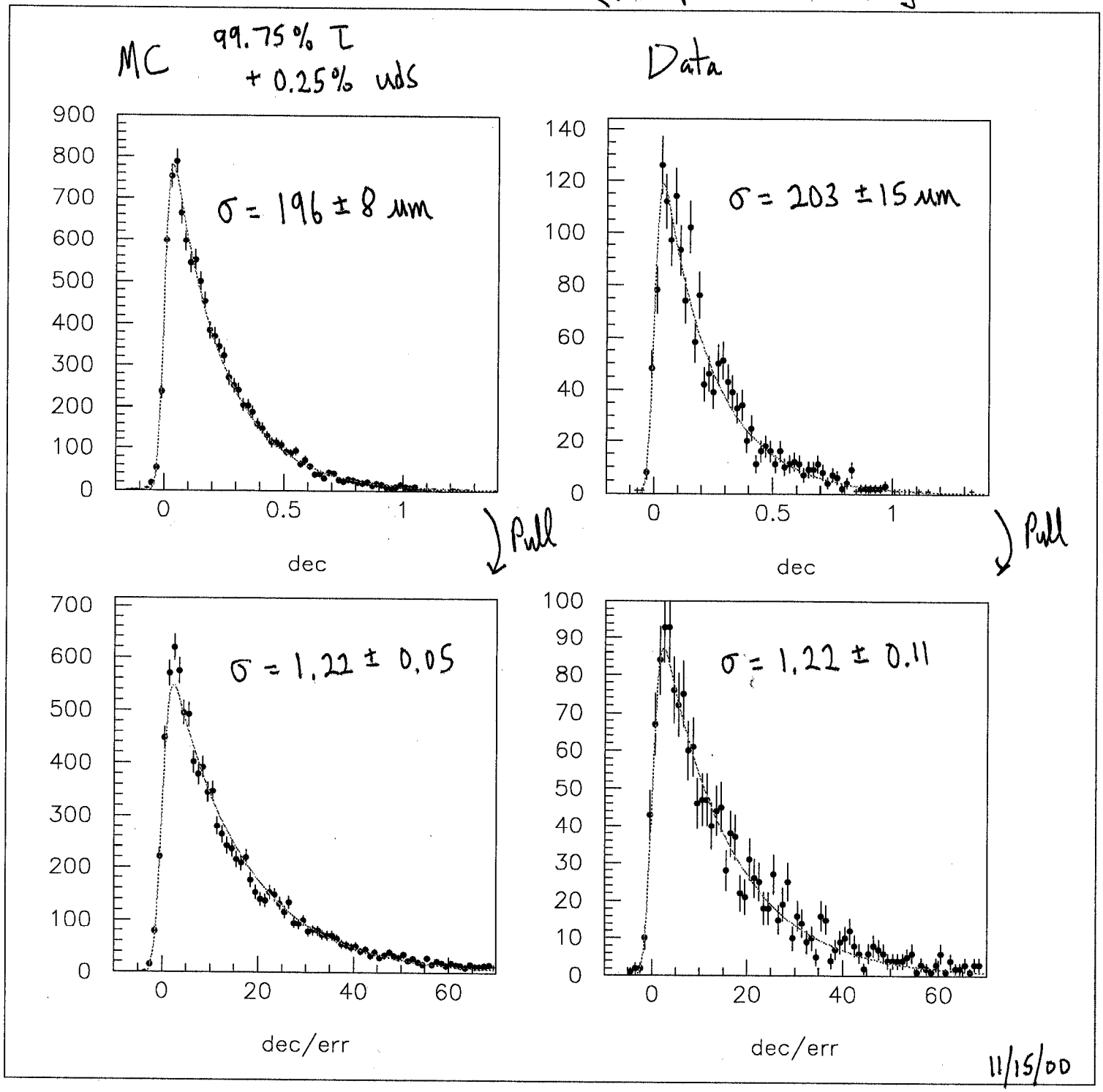


→ Decay Length = $\left| \overrightarrow{Vtx} - \overrightarrow{IP} \right|$

signed using thrust axis.

Measured Decay Length for 3-prong τ vtxs in 1-3 tagged τ sample

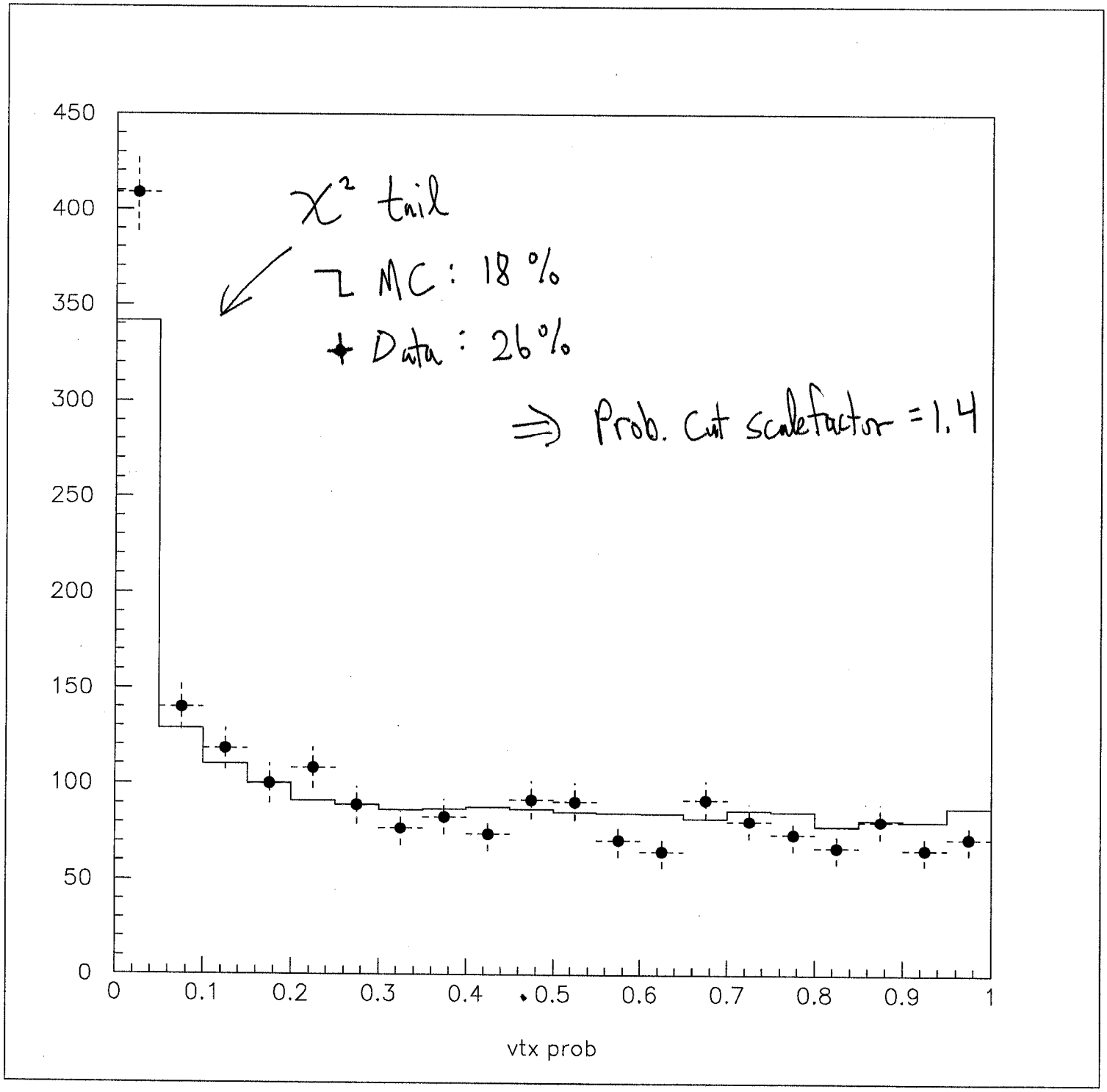
(vtx prob > 5% to get core resolution)



Fits to 

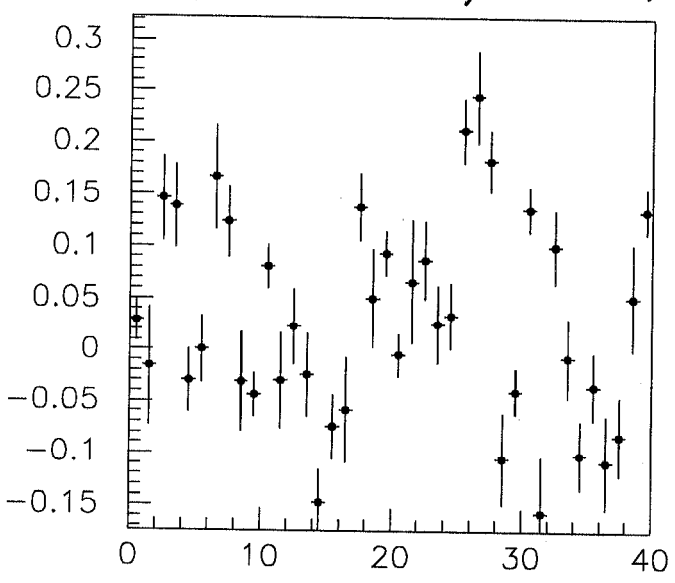
→ Core resolution and error estimates are OK.

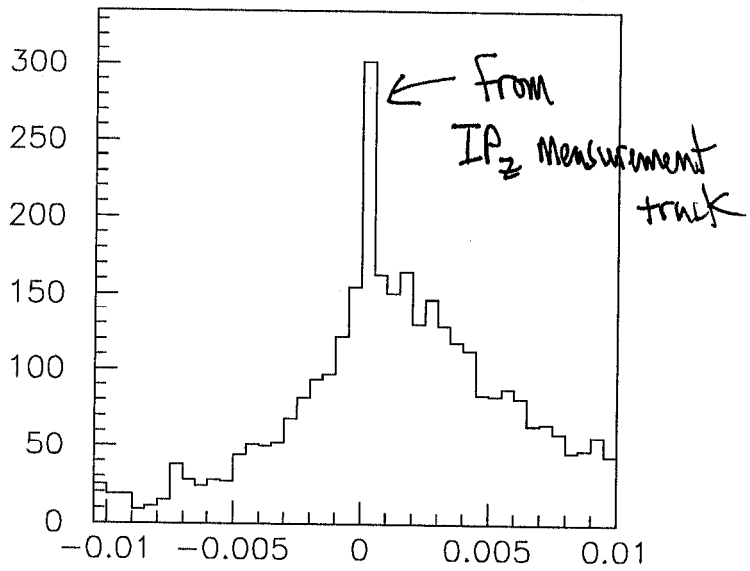
3-prong τ vtx confidence level (1-3 tagged τ sample)

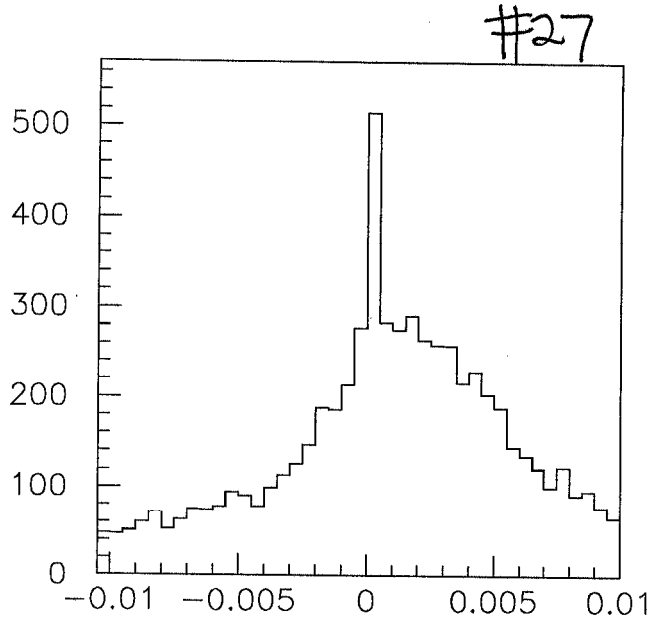


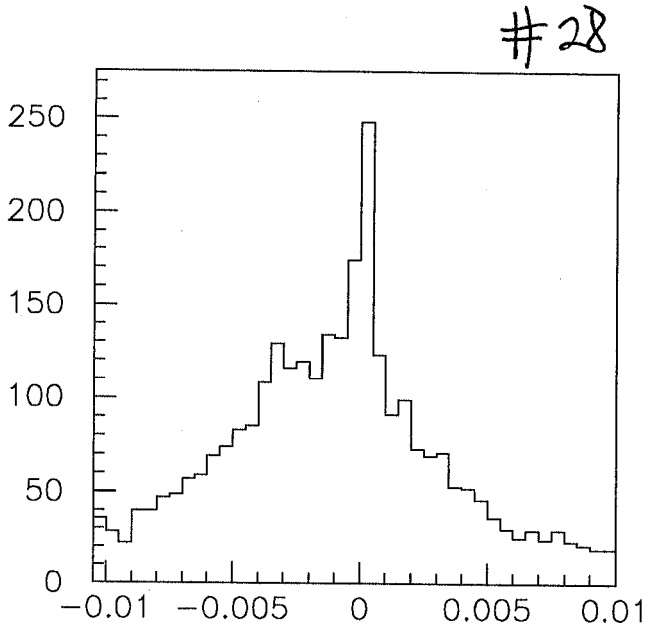
$P_T > 0.7$ GeV 4/30/01

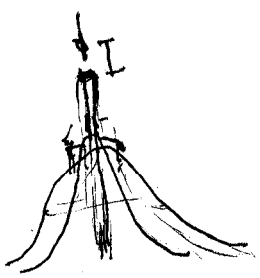
$|\cos\theta| > 0.65$

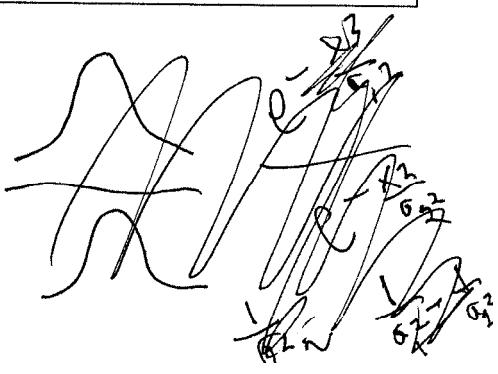












VXD3 Misalignment

- Both r-phi, z mean impact parameter dists show scatter ← not modelled in MC!
- Cumulative track error distributions smaller in MC than data
- Correct approach: introduce constraints in detector alignment
- Practical approach: shift track positions, misalign the MC to match the data mean shifts
  - Shifts dependent on cos(theta), phi
    - Problems with CCD overlap regions…
- Diagnostics:
  - Cumulative error distributions ← core resolution
  - 3-prong Tau vertex probabilities ← tail resolution

Misalignment Procedure

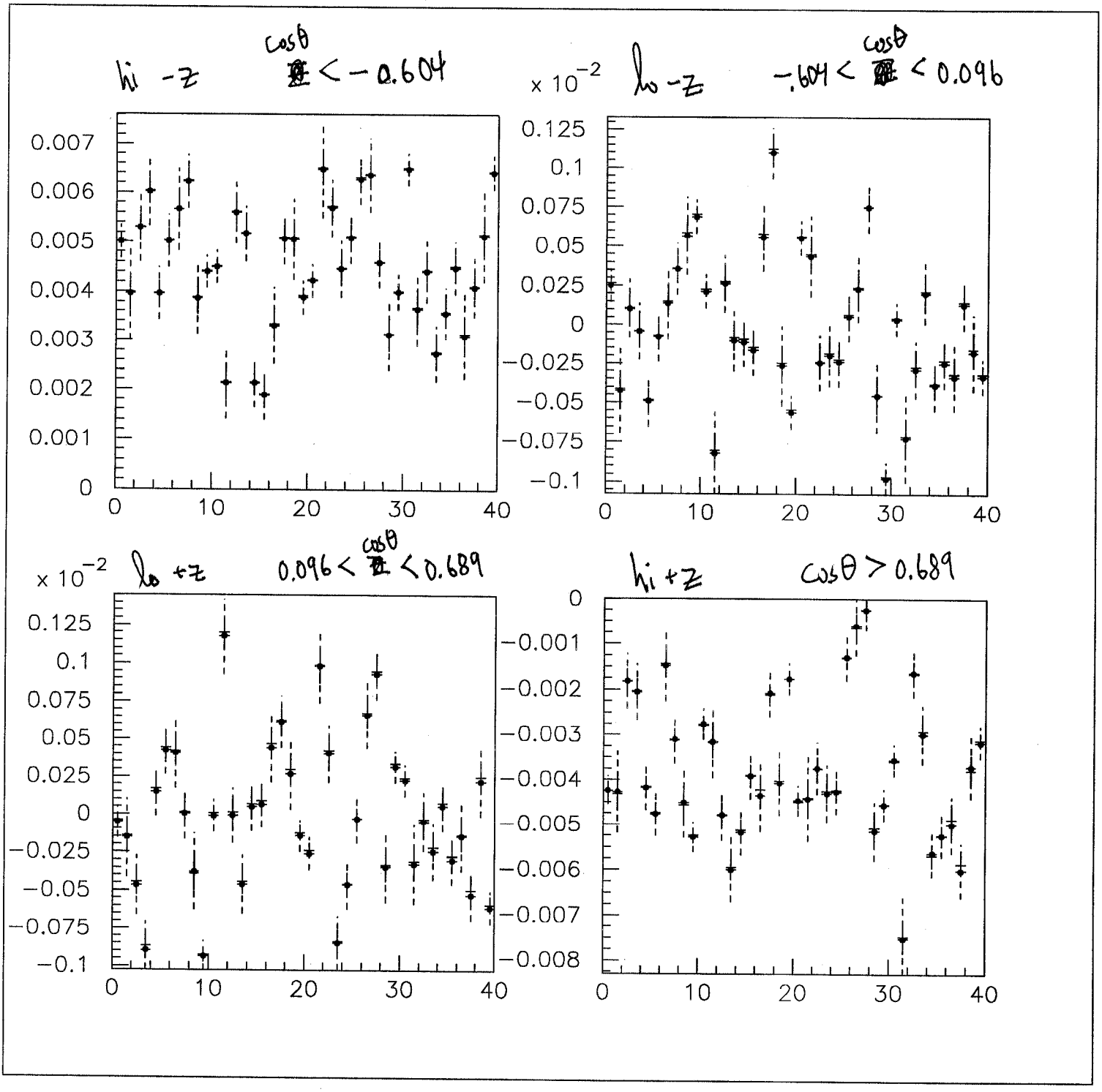
- Divide VXD3 into cos(theta),phi regions (triplets)

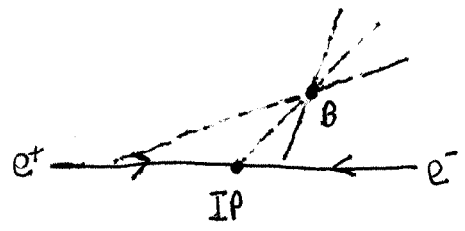
- Swim the tracks to the new calculated IP position
- In each region, compare data,MC impact parm dists to get vectors of shift constants. (Reject I.P. z meas. track)
- Apply the shifts and recalculate the IP position (Shifted regions will pull the IP making the mean impact parm shift smaller than the true shift.)
- Iterate until convergence

Finally, check that the cumulative shift is centered since the true IP position shift is not measured, only relative shifts.

<doca z> vs triplet

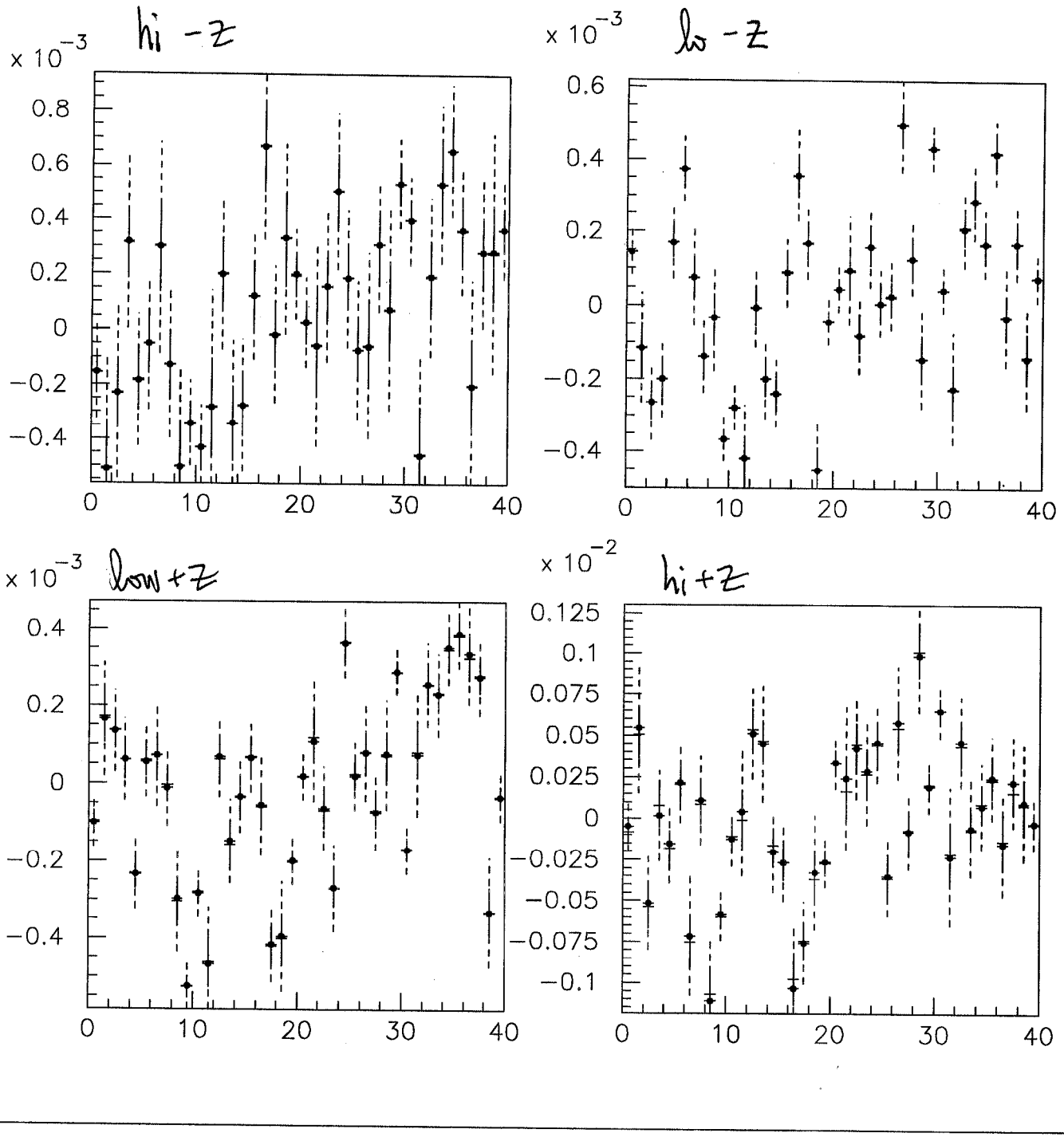
full shift





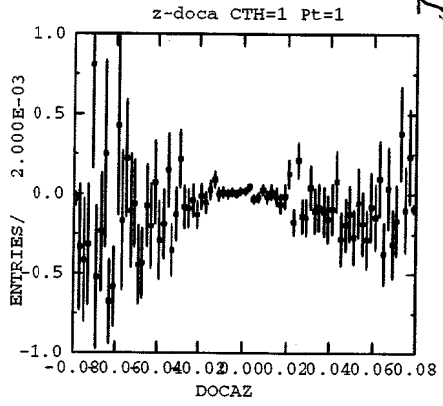
⟨Impact r-φ⟩ vs triplet

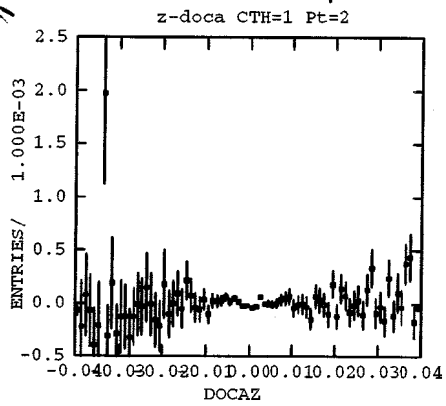
full shift

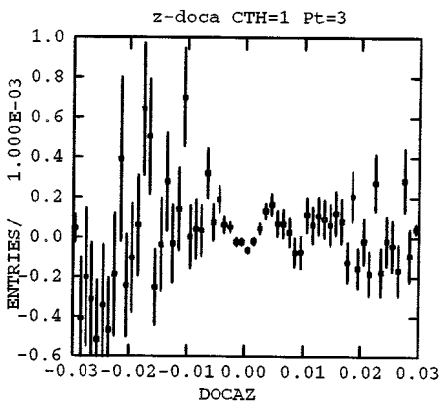


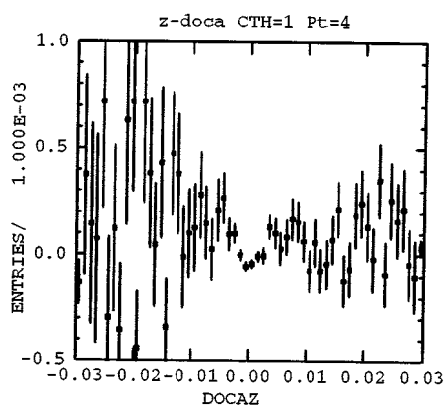
Data / MC - 1

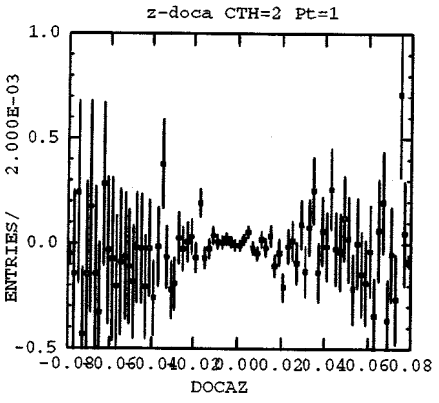
No Sh

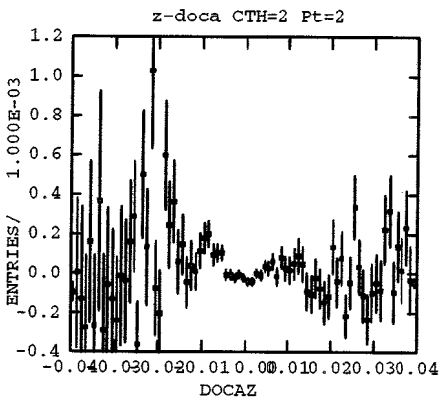


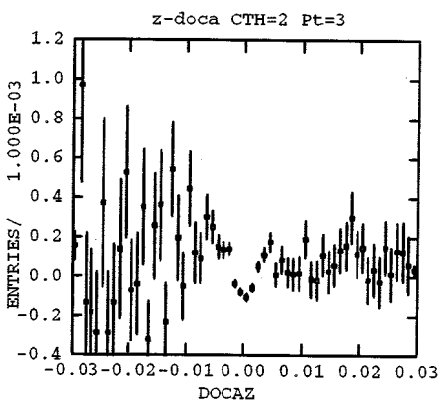


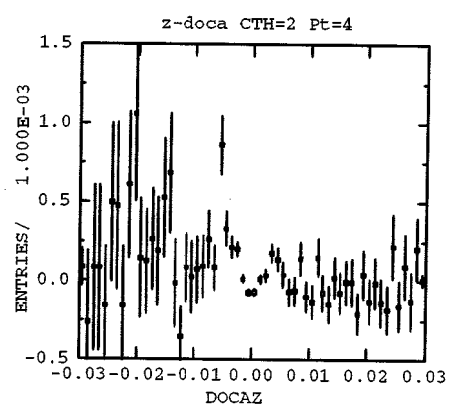


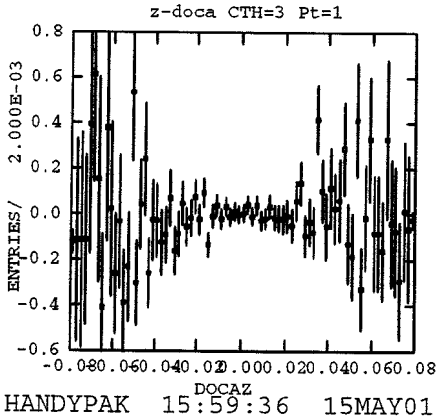


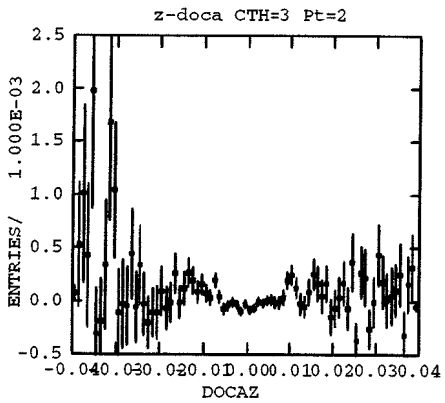


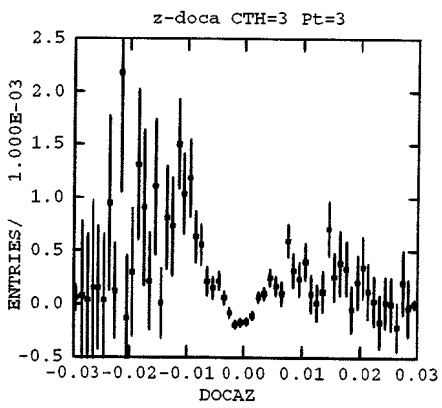


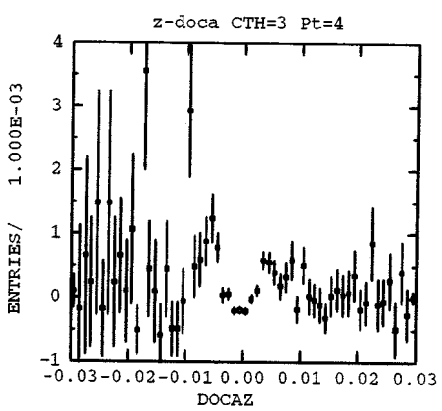












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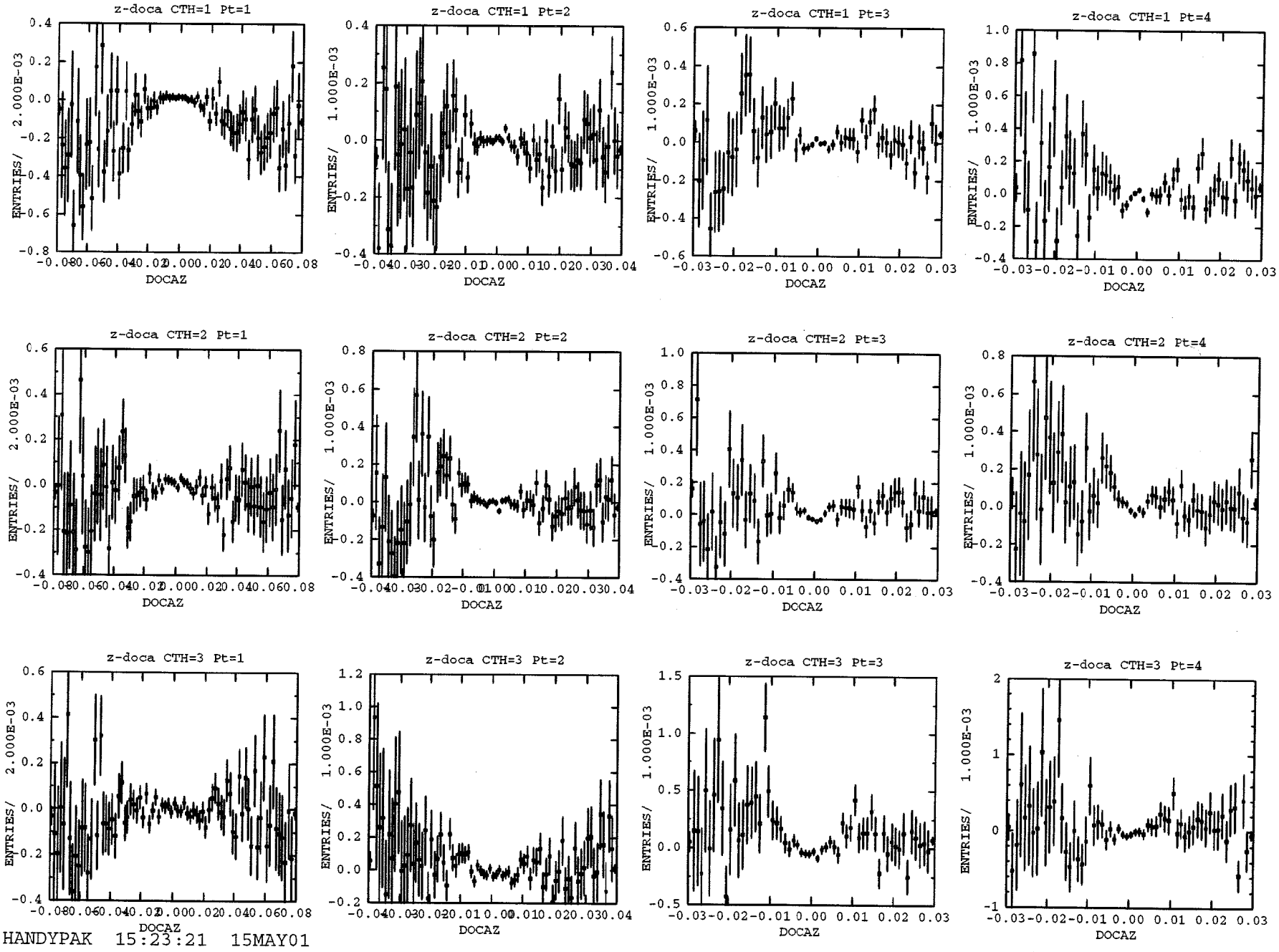
full shift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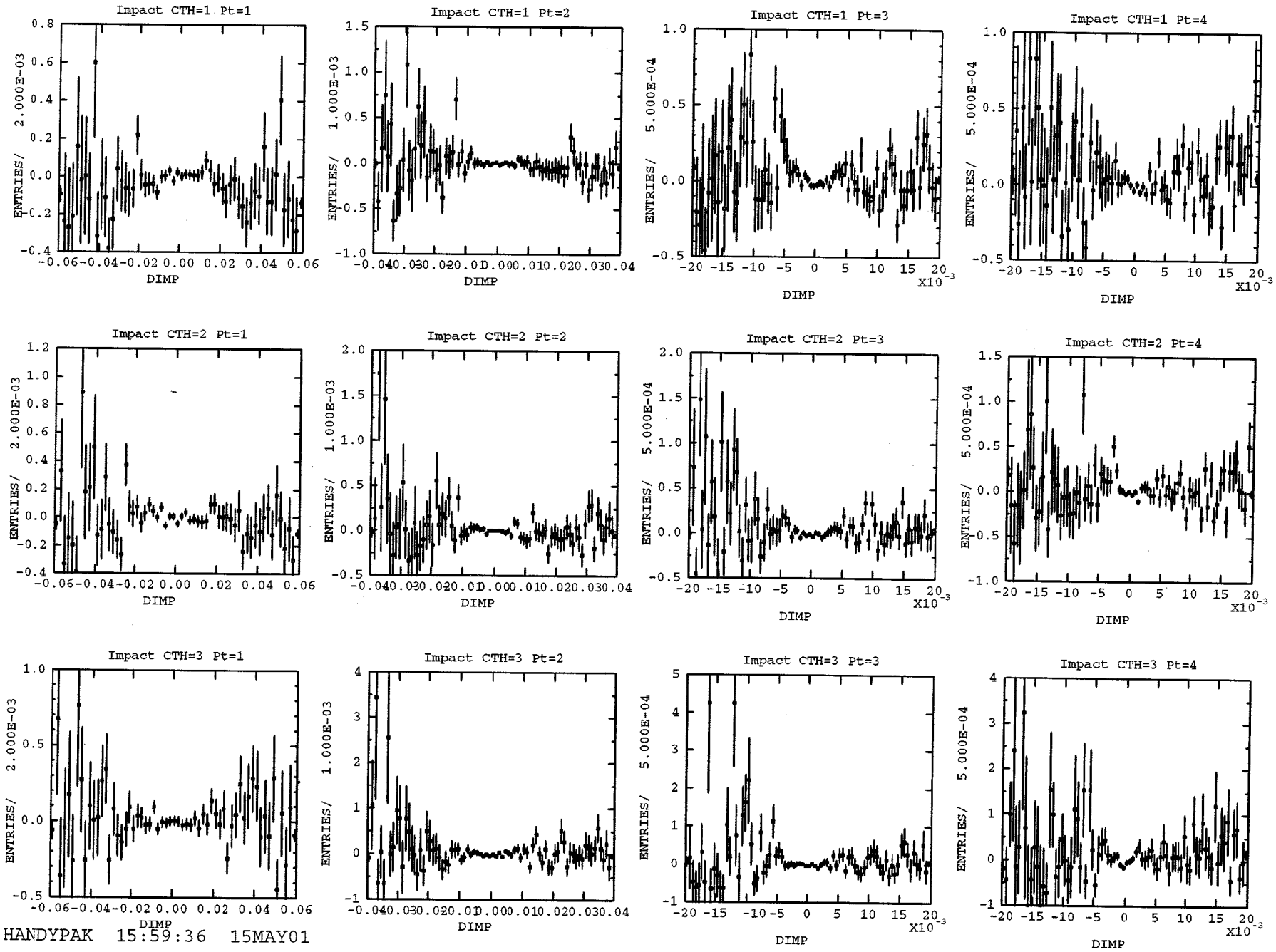
z-doca CTH=1 Pt=2
z-doca CTH=1 Pt=3
z-doca CTH=1 Pt=4
z-doca CTH=2 Pt=1
z-doca CTH=2 Pt=2
z-doca CTH=2 Pt=3
z-doca CTH=2 Pt=4
z-doca CTH=3 Pt=1
z-doca CTH=3 Pt=2
z-doca CTH=3 Pt=3
z-doca CTH=3 Pt=4
ENTRIES/
DOCAZ
HANDYPAK 15:23:21 15MAY01

no shift


Impact CTH=1 Pt=1
Impact CTH=1 Pt=2
Impact CTH=1 Pt=3
Impact CTH=1 Pt=4
Impact CTH=2 Pt=1
Impact CTH=2 Pt=2
Impact CTH=2 Pt=3
Impact CTH=2 Pt=4
Impact CTH=3 Pt=1
Impact CTH=3 Pt=2
Impact CTH=3 Pt=3
Impact CTH=3 Pt=4
ENTRIES/ 2.000E-03
ENTRIES/ 1.000E-03
ENTRIES/ 5.000E-04
DIMP
X10-3
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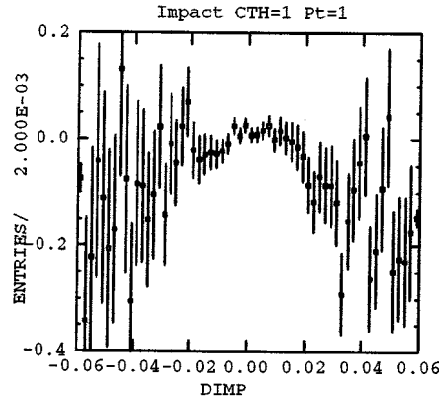
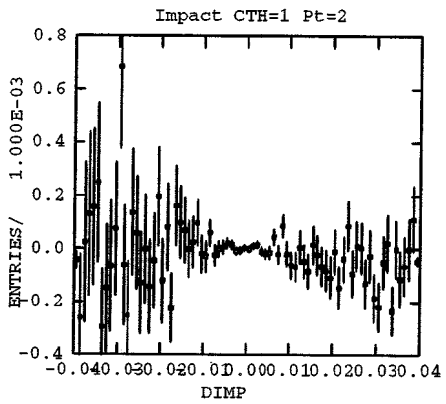
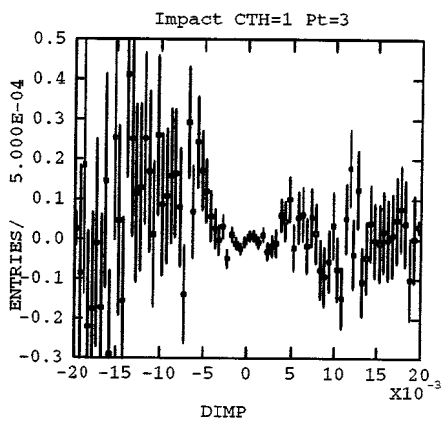
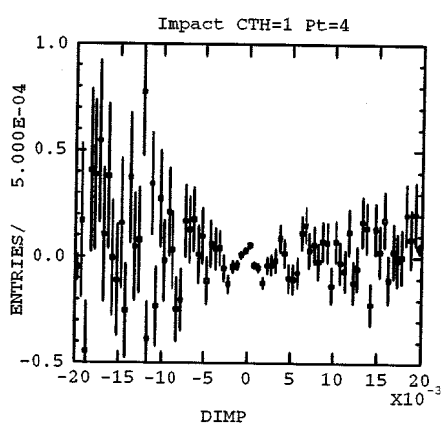
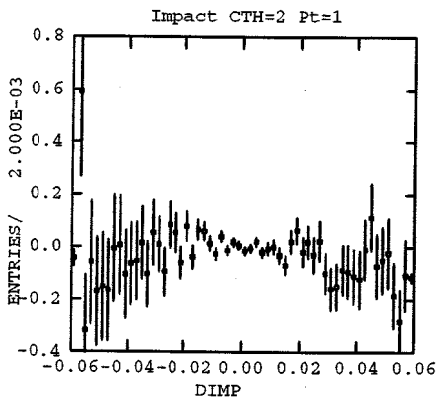
Full Shift

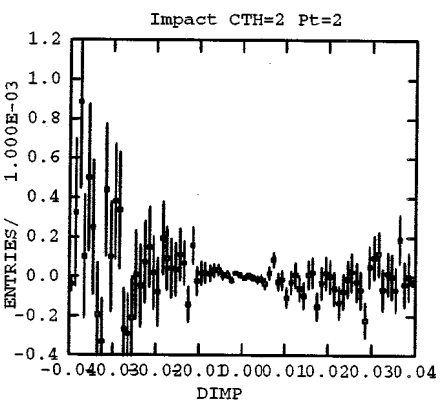


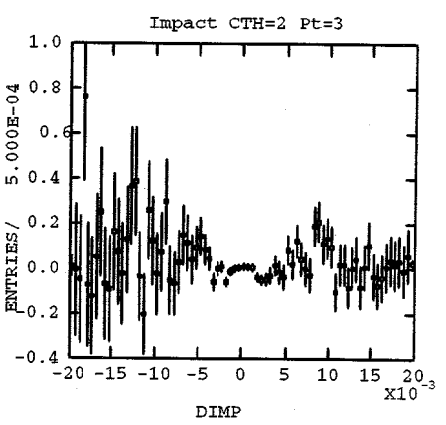


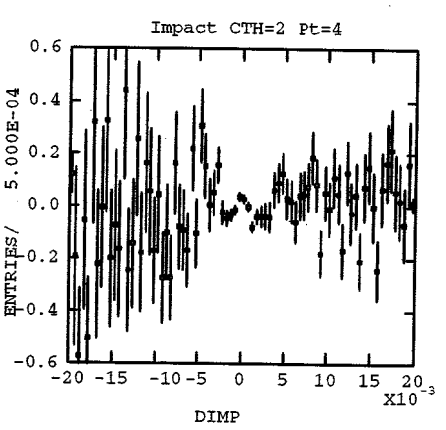


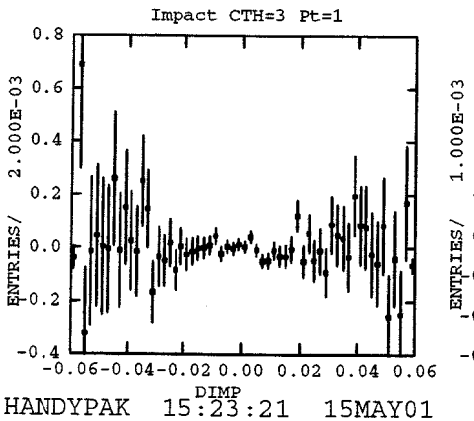


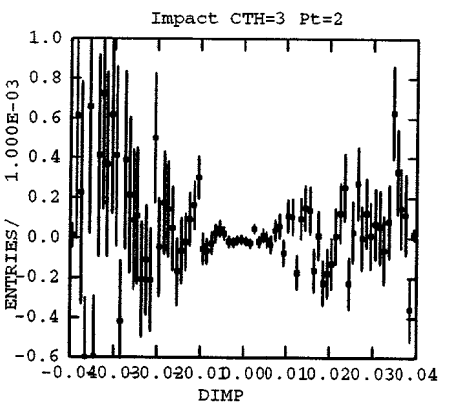


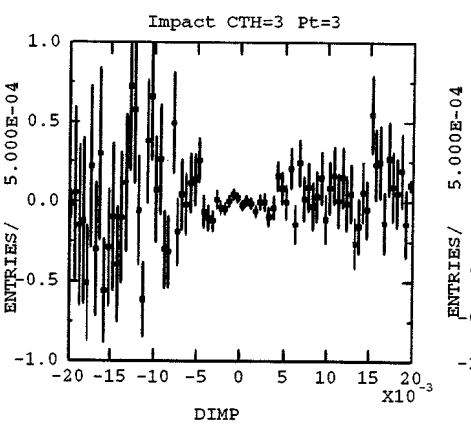


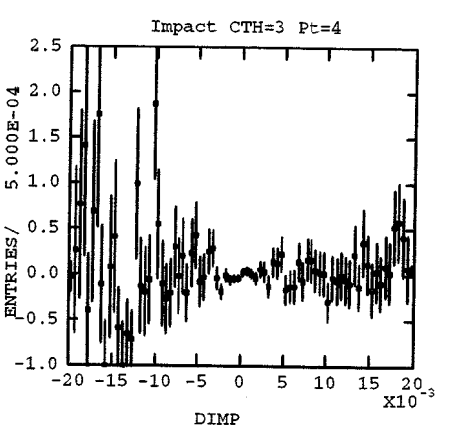












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Shift Distributions, all tracks

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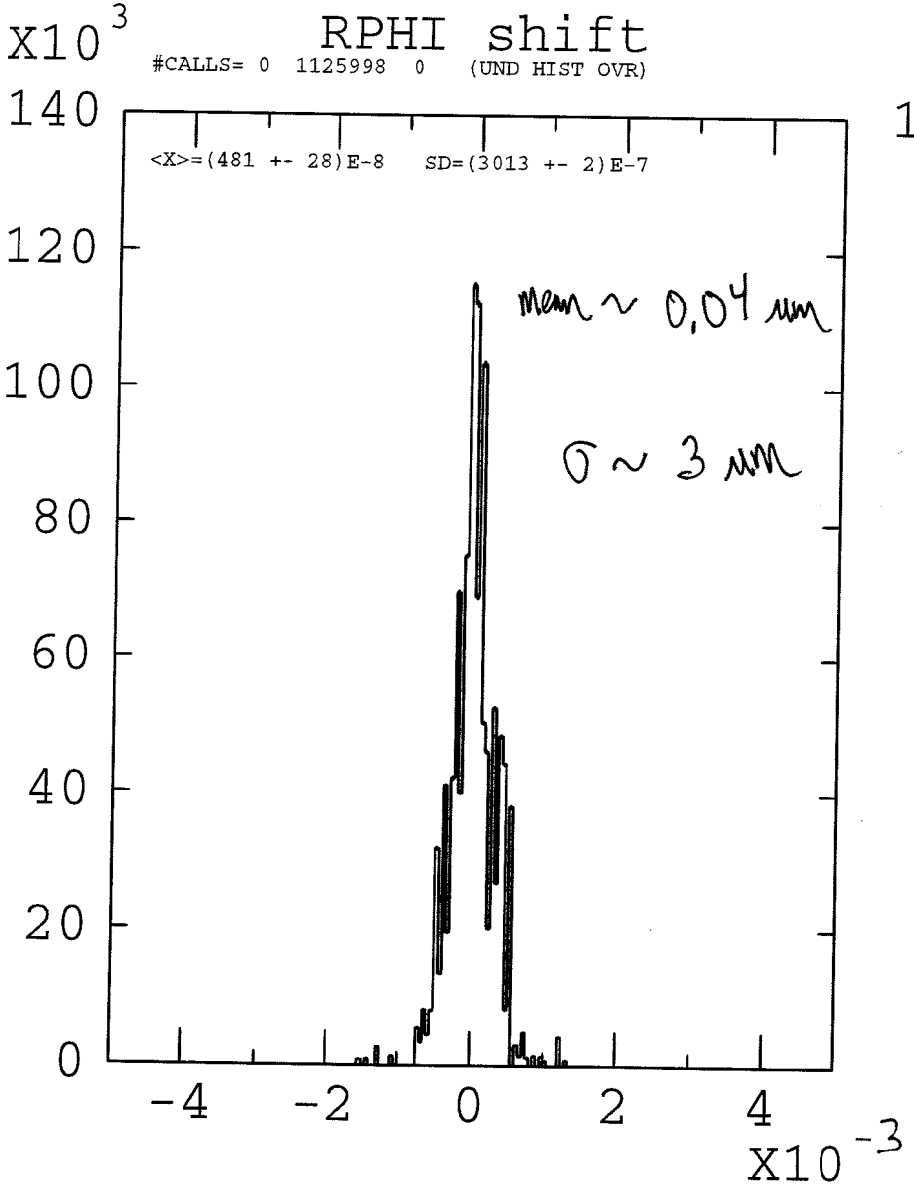

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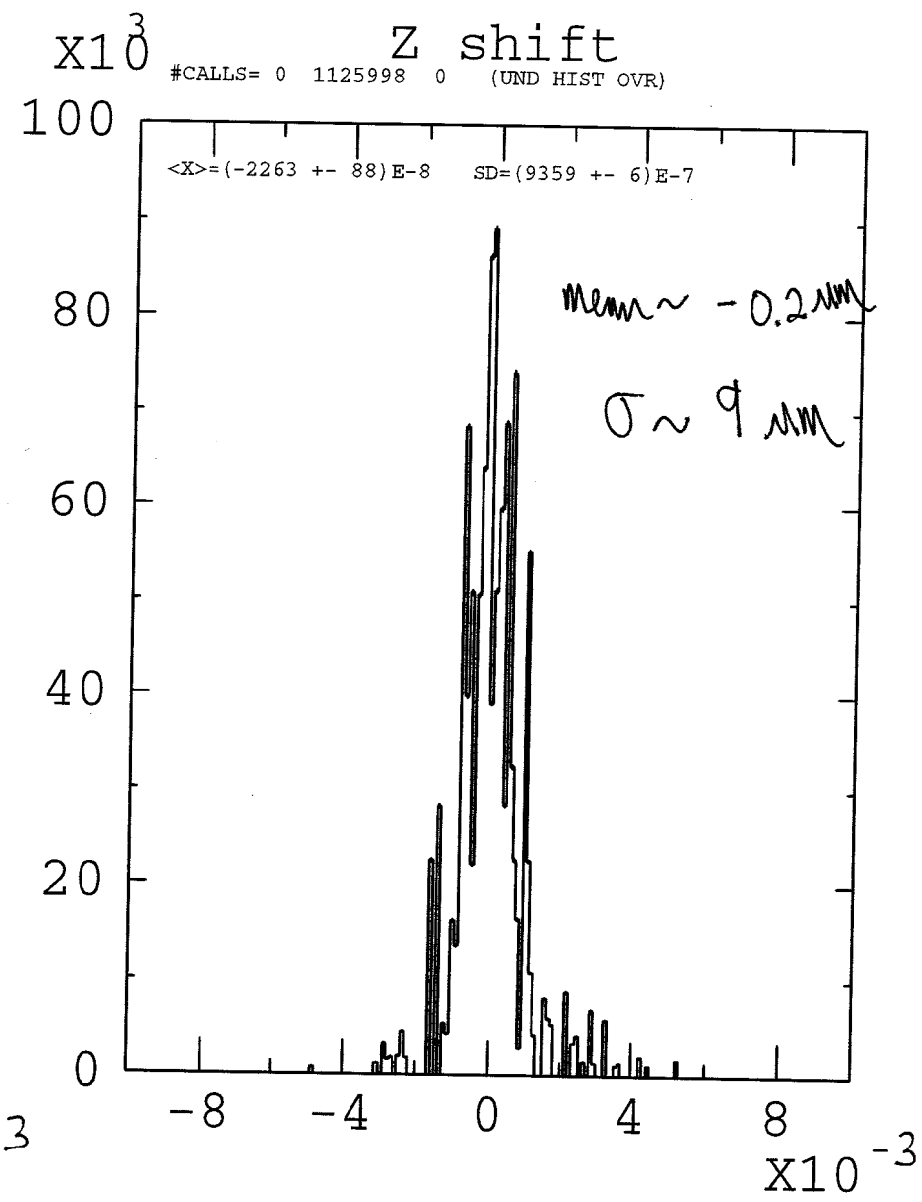

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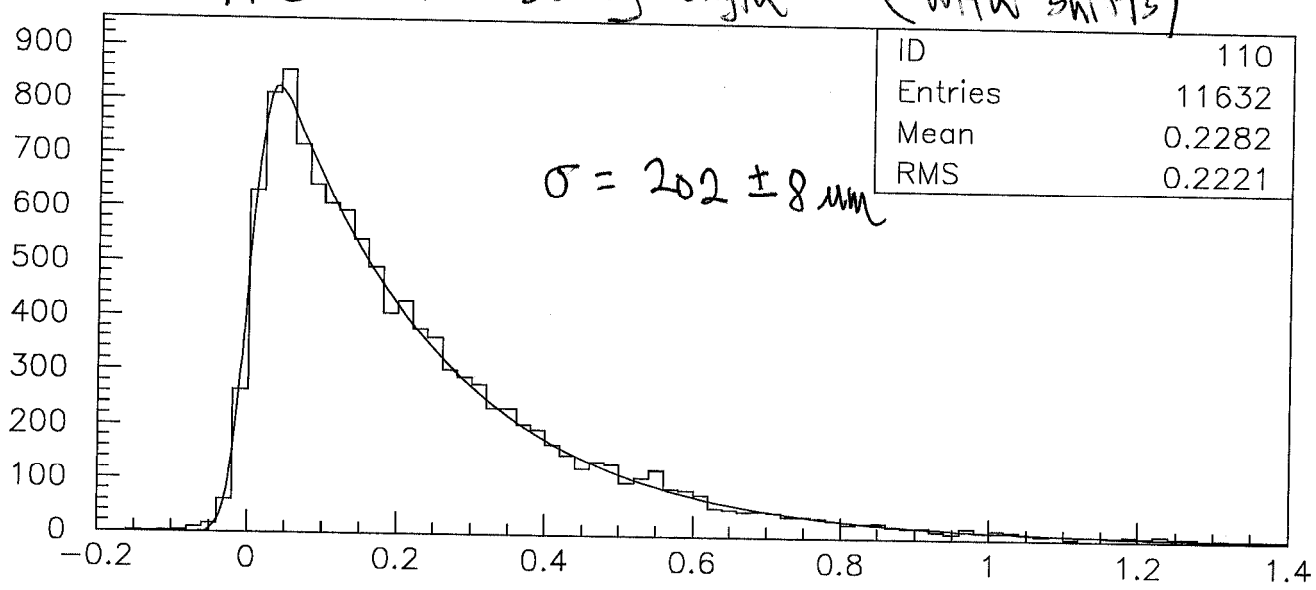
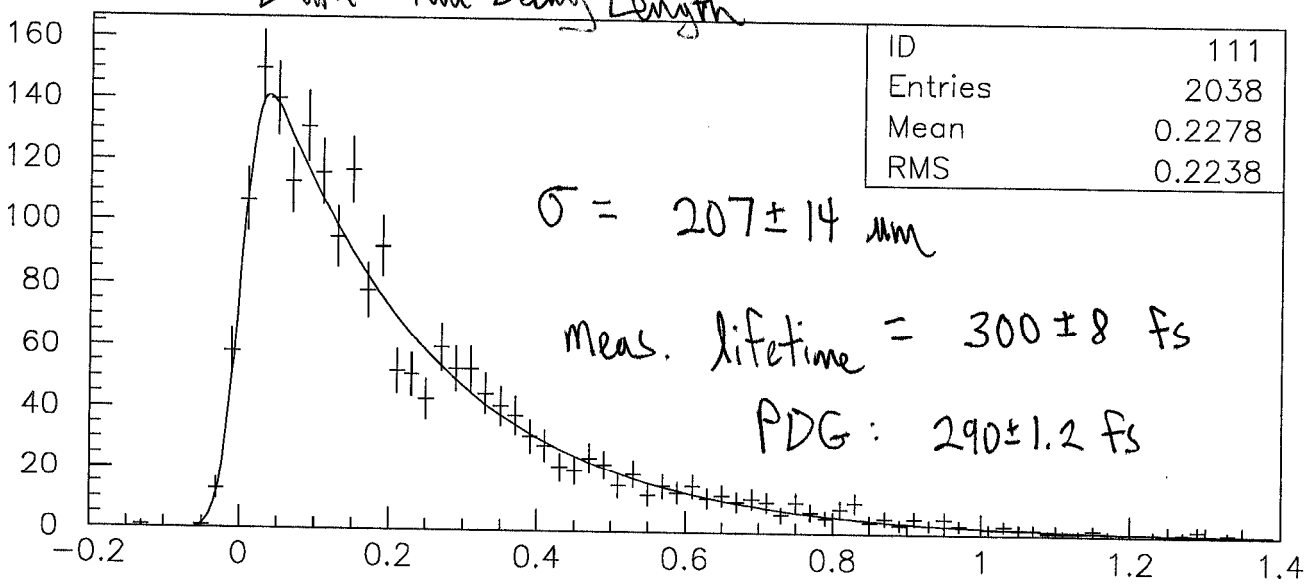
MC Tau Decay Length (with shifts)

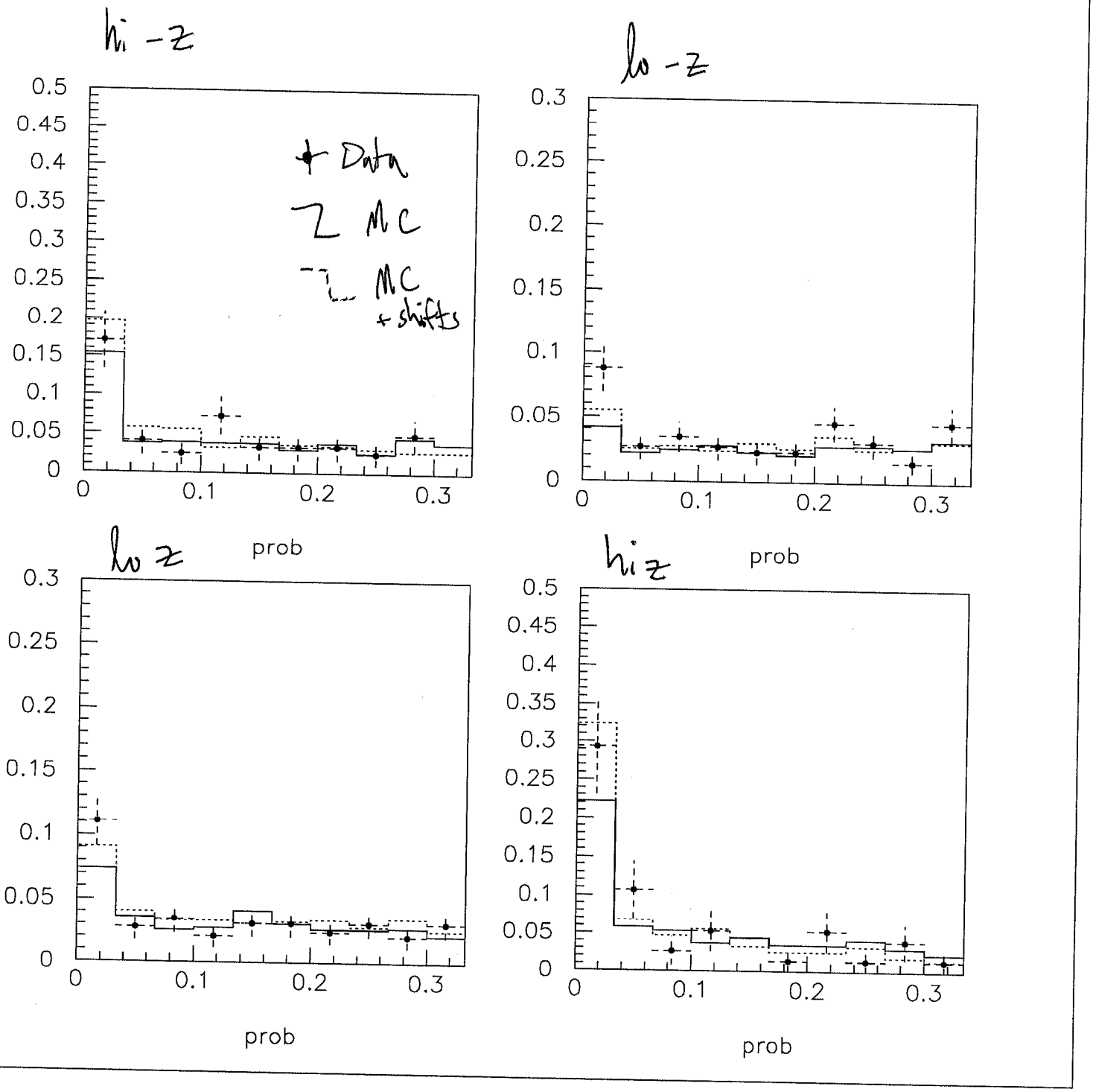


Data Tau Decay Length

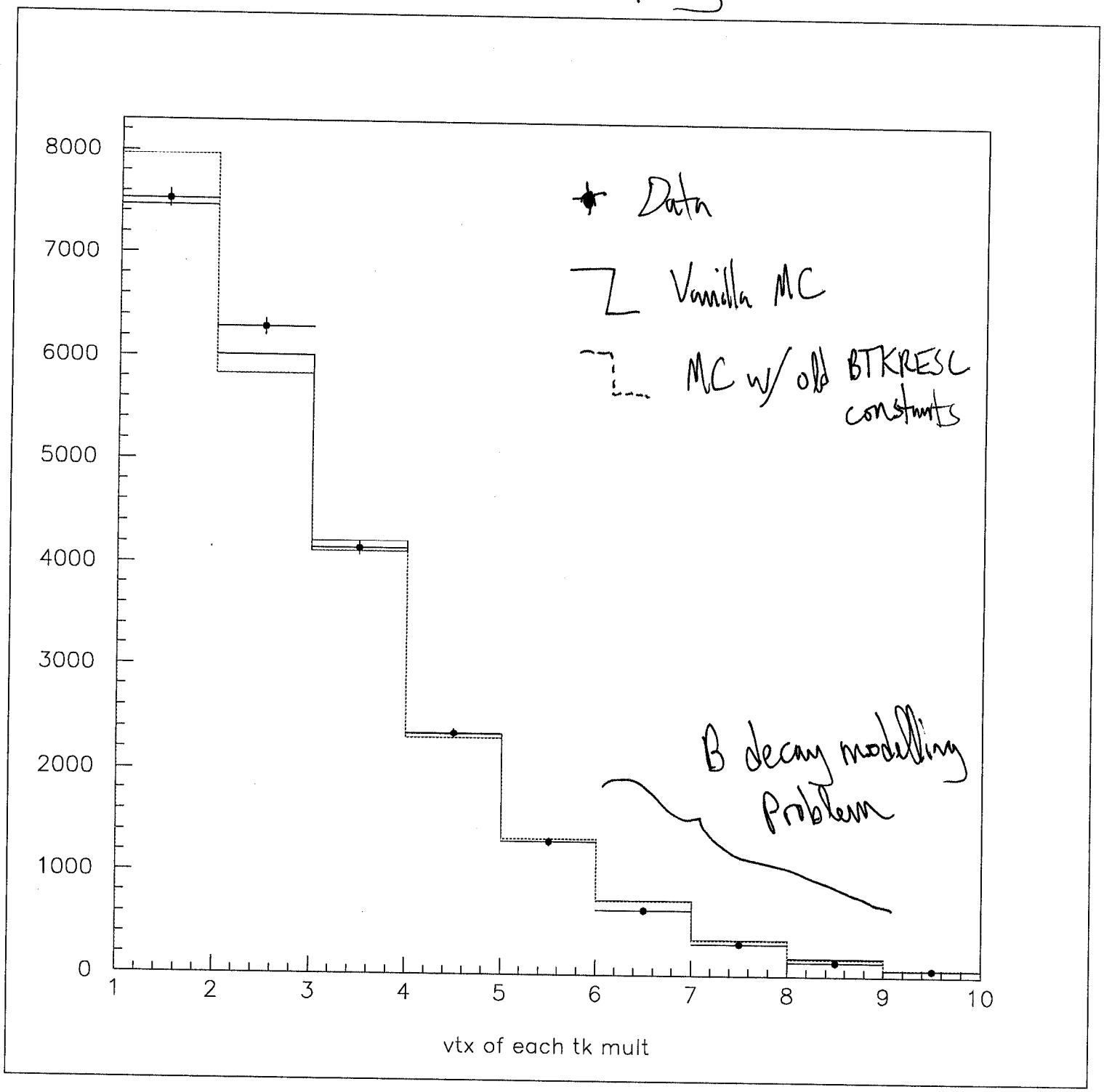


3- Prong τ Prob

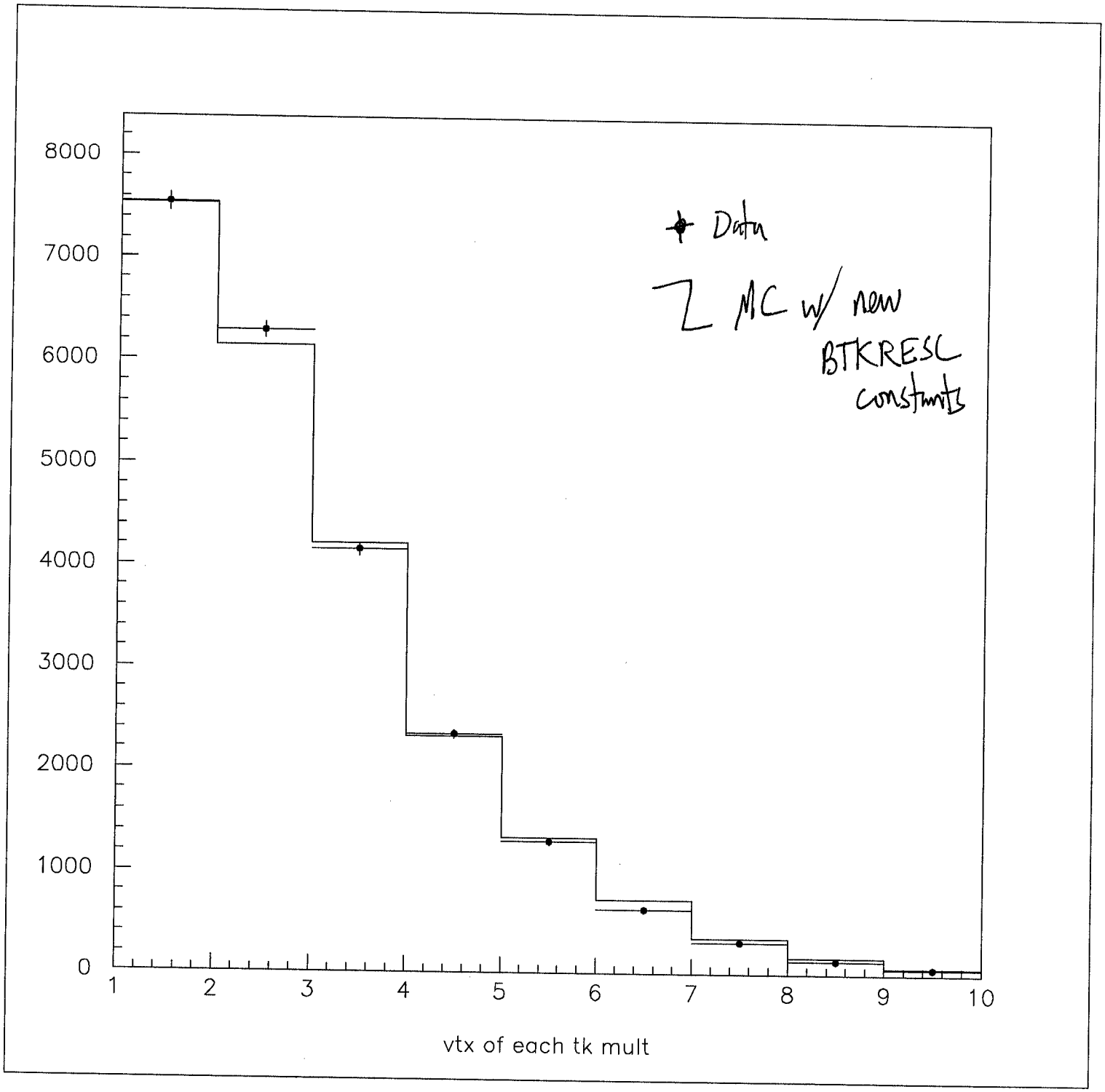
$P_T > 5$ GeV



Found Vtx Track Multiplicity



Found Vtx Track Multiplicity



MC Error Modelling

- Data: local triplet resolution ~ 4 microns = convolution of cluster errors and local misalignments
  - Mu-pair miss distance indicates additional quasi-global misalignments ~ 4 microns extra effective smearing
- MC:
  - Rough cluster error modelling
  - Convolve with extra CCD ladder smearing to match Mu-pair measurements, (low statistics)
    - Impact Parms: evidence for some undersmearing
  - No shift correction before ladder smearing

  → Some regions may be oversmeared after shifting.
  - detector material modelled.

Summary

- New VXD3 geometry-based shift constants,
  - d(rphi) ~ 3 microns, d(z) ~ 9 microns
  - Some large shifts d(rphi) ~ 10 microns, d(z)~ 40 microns
- Match to impact parameter mean distributions much improves the cumulative Data/MC error distribution
  → no additional smearing needed, maybe even oversmeared
- 3-prong Tau vtx prob: tails are now better modelled.
- Additional doublet regions shifts under investigation
- Low momentum track errors too big. Too much scattering.

- New version of BTKRESC soon (this week) in DEVHEAVY.