


Systematics Studies which become Debugging Sessions

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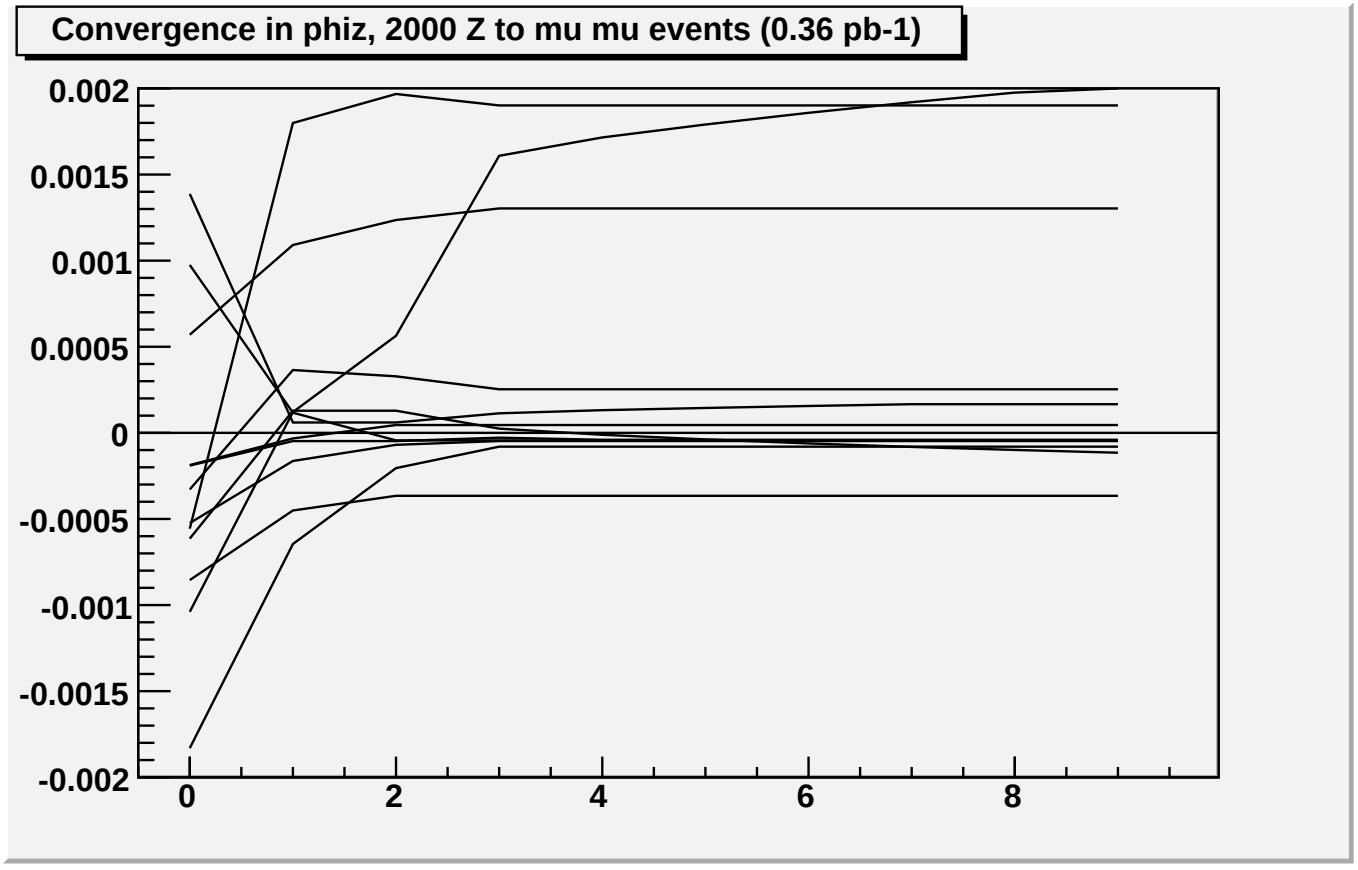
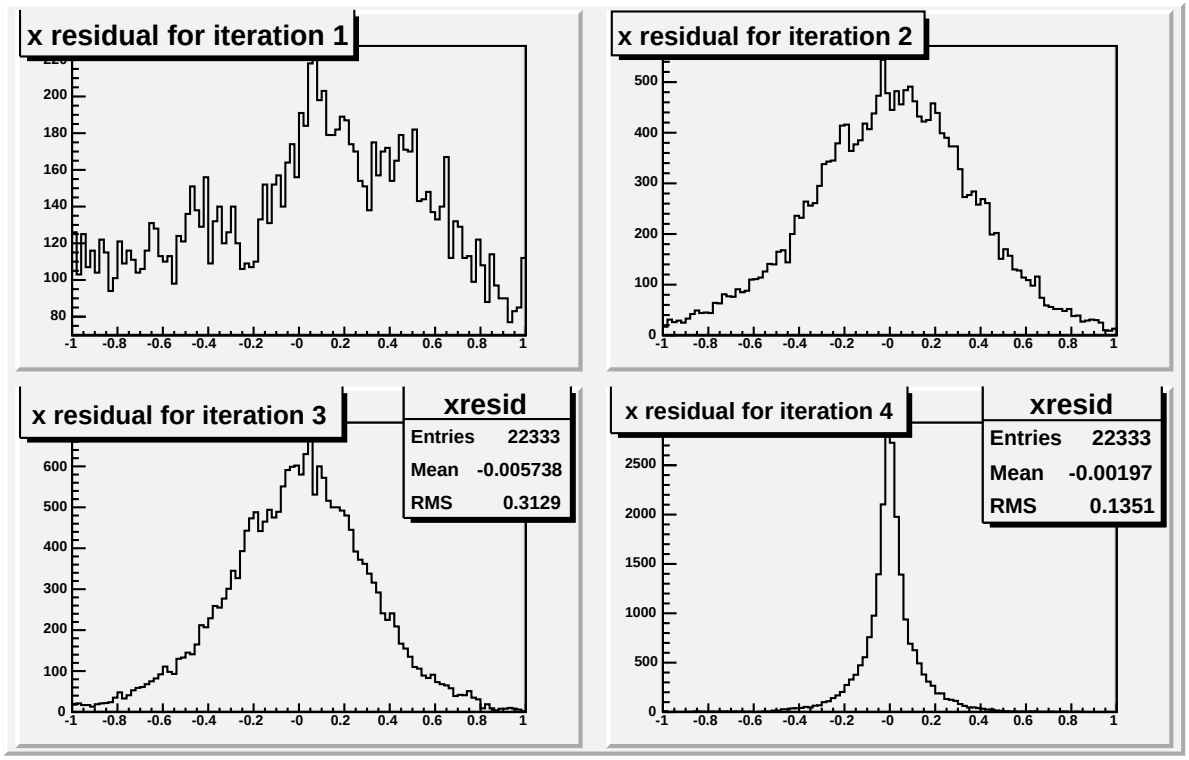
What I've been up to

- Using sample of 5000 $Z \rightarrow \mu\mu$ events in 1_5_2
  /castor/cern.ch/user/p/pivarski/AlCaRecoMu/1_5_2/zmumu.root
- (Not using 15× larger sample of single muons. . . yet)
  /castor/cern.ch/user/p/pivarski/AlCaRecoMu/1_5_2/singlemu/*
- Fully realistic misalignments:
  - CSC Layers $\Delta x = 191$ μm, $\Delta y = 335$ μm, $\Delta\phi_z = 40$ μrad
  - All Chambers $\Delta x = \Delta y = \Delta z = 3$ mm, $\Delta\phi_x = \Delta\phi_y = \Delta\phi_z = 1$ mrad
  - Disks/wheels $\Delta x = \Delta y = \Delta z = 1$ cm, $\Delta\phi_x = \Delta\phi_y = \Delta\phi_z = 1$ mrad
  - Tracker 10 pb^{-1} scenario
- Align muon system to tracker with globalMuons: x, y, ϕ_z
- Aligning disks and wheels with 2000 $Z \rightarrow \mu\mu$ (0.36 pb^{-1})
- WORK IN PROGRESS!!!

Nominal case (everything as specified on slide 2)



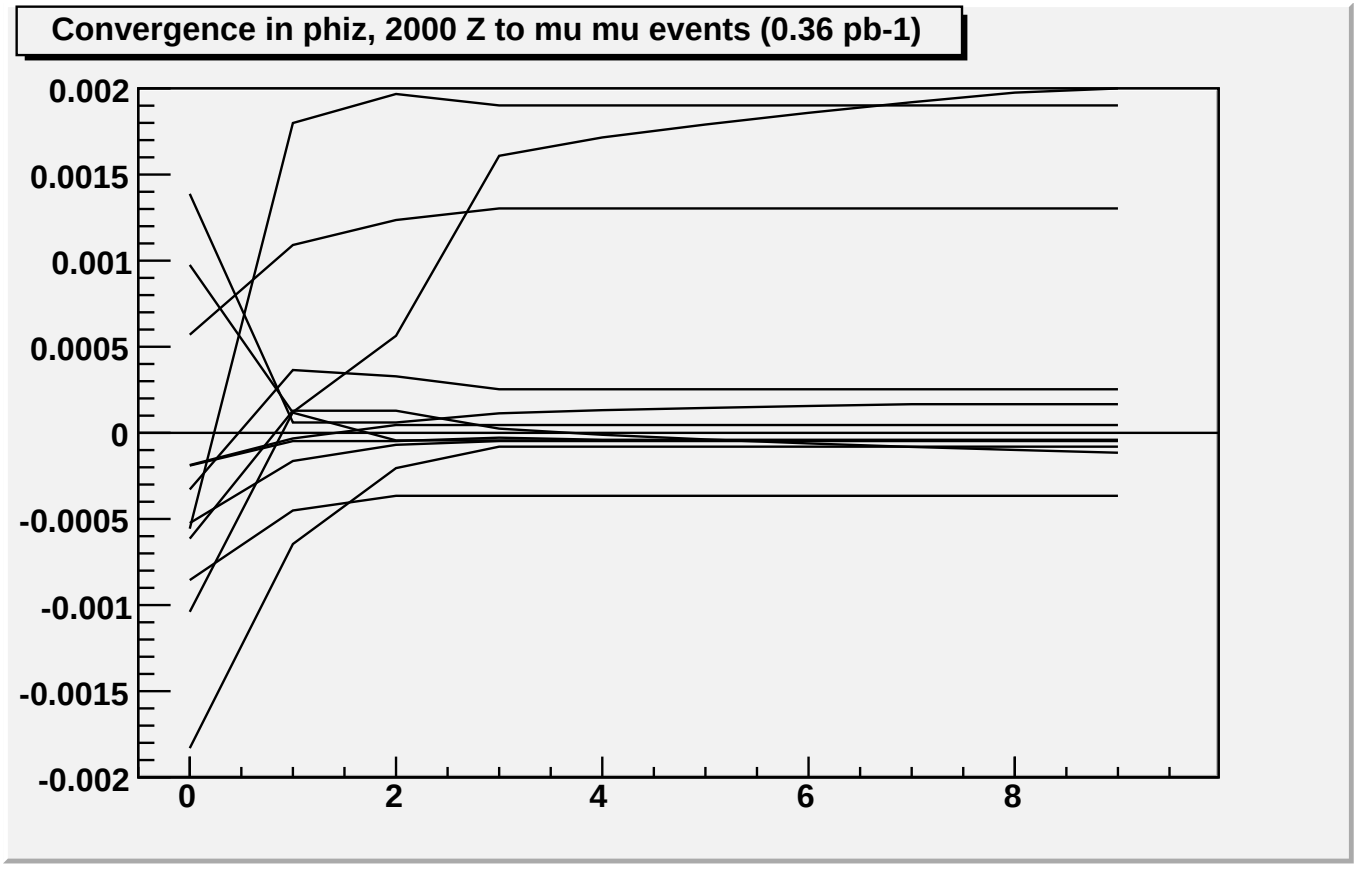
Effect of fitting weights on residuals



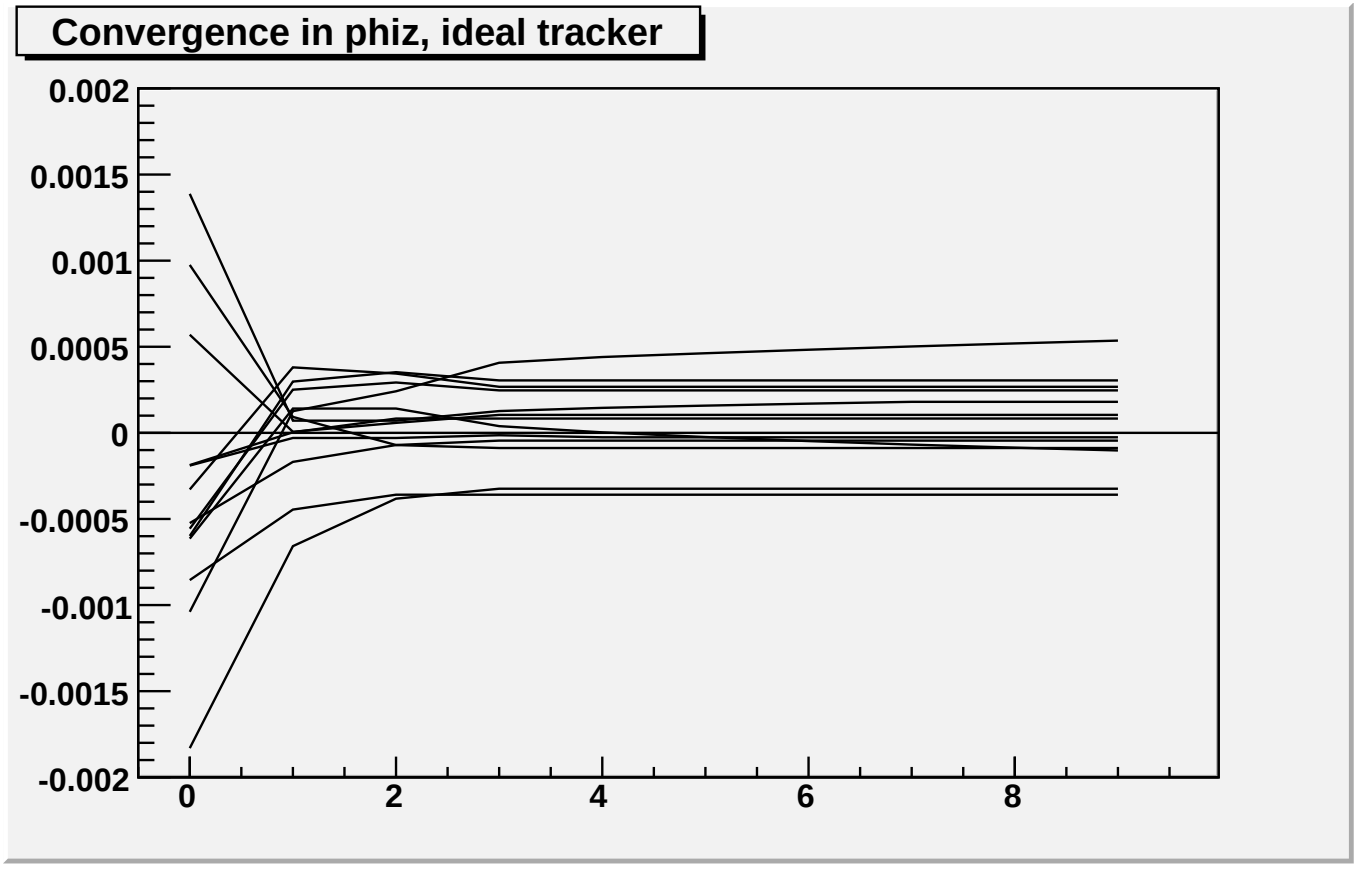
Alignment parameter errors (APEs) in muon system fall exponentially, drop below hit uncertainty between steps 3 and 4.

Error used in fit $= \sqrt{(\text{APE})^2 + (\text{hit uncertainty})^2}$

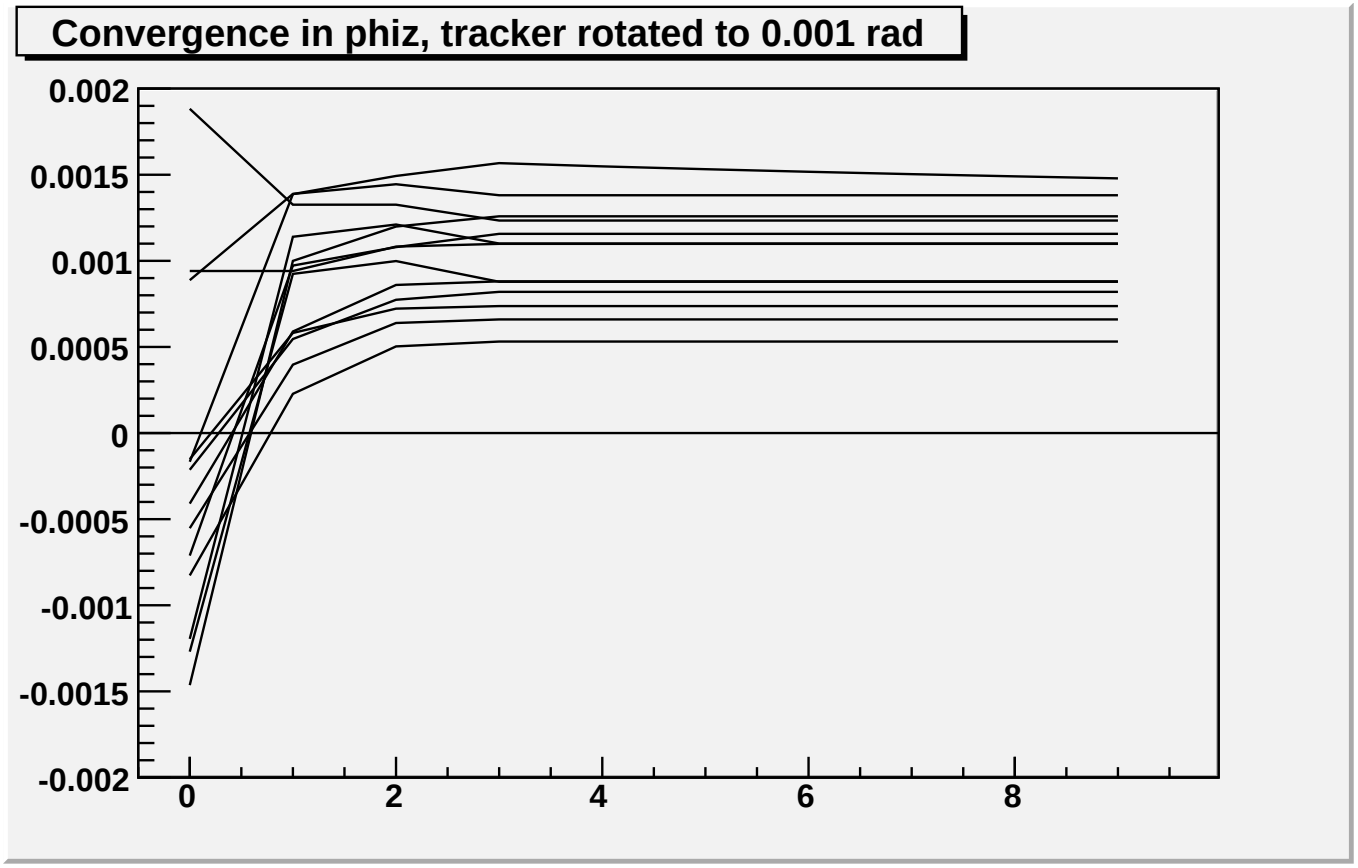
Nominal case again (just a reminder)



Ideal tracker

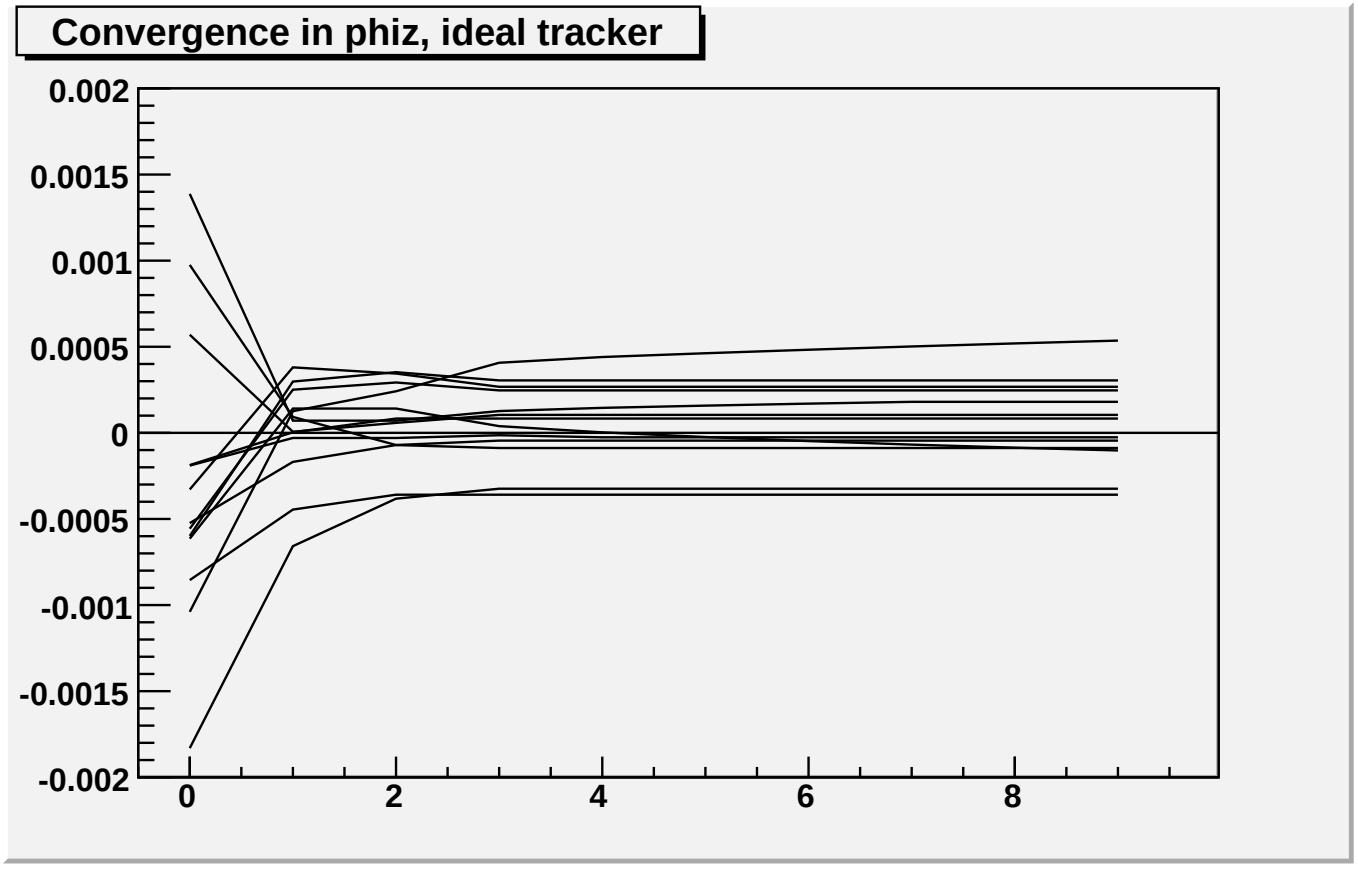


Roll the tracker (ideal + 1 mrad rotation)

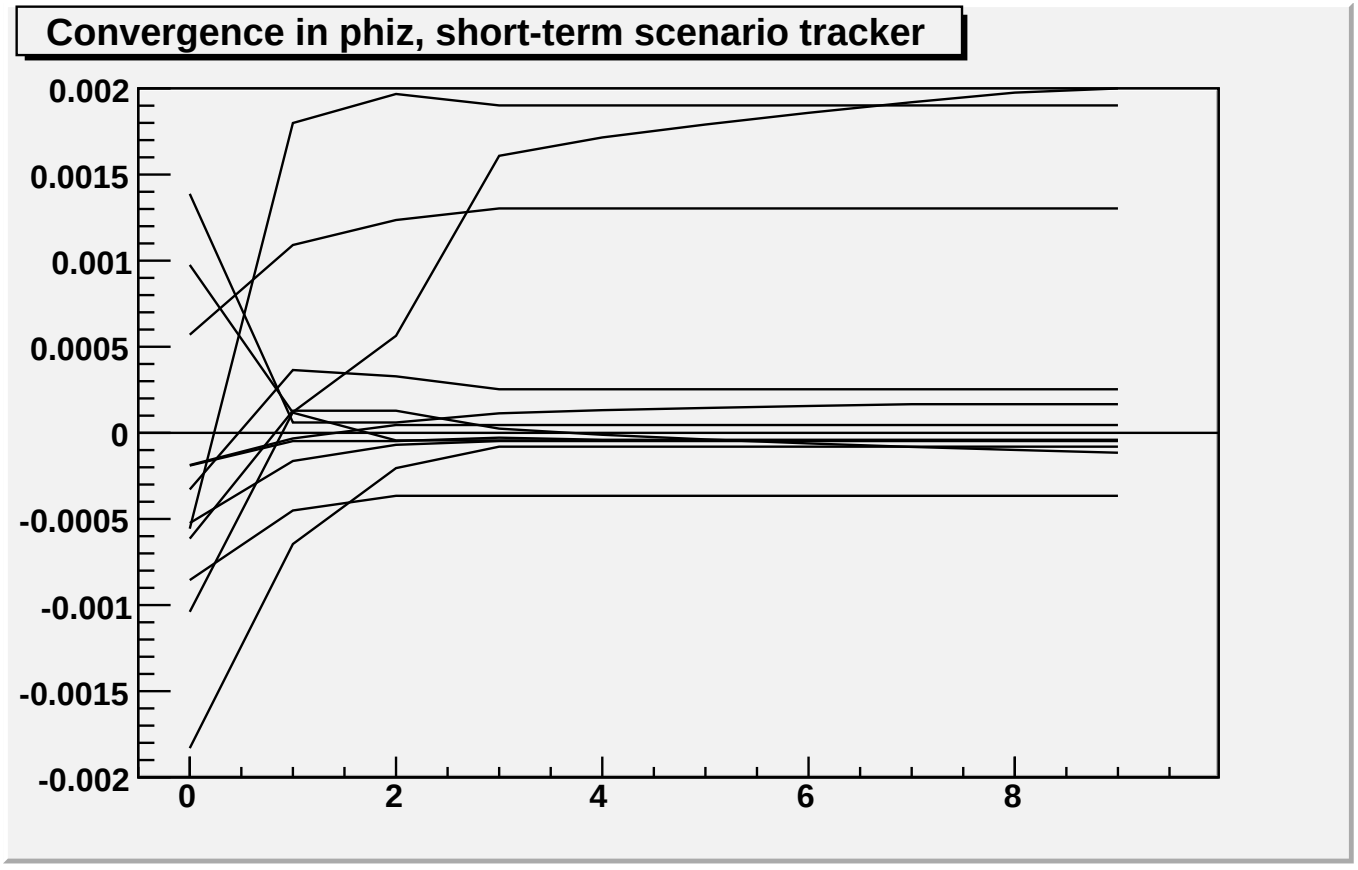


Lessons: (1) pixel barrel (PXB) center is not on the beamline
(2) *make sure to exclude RPC hits from track fitter!!!*

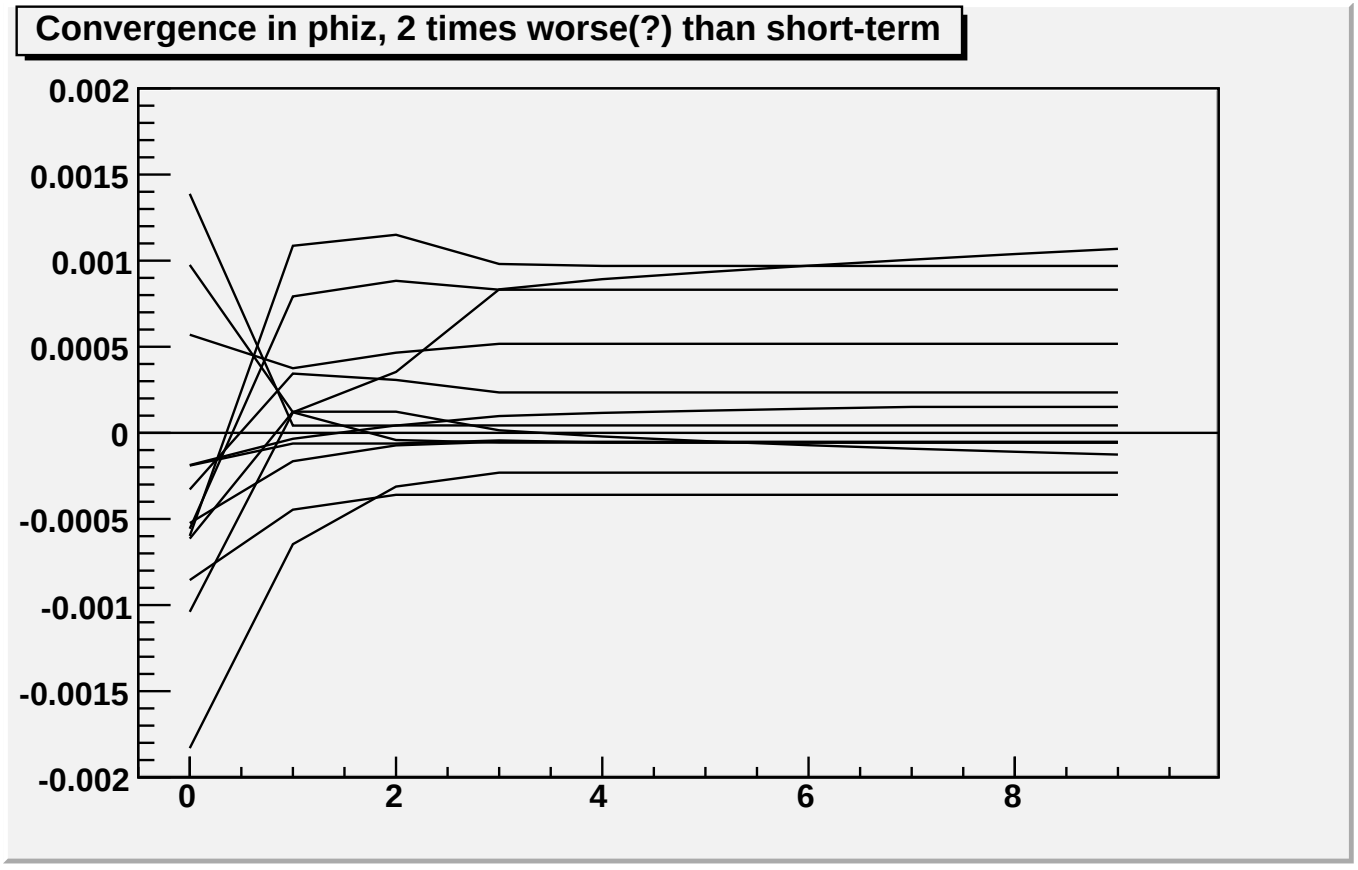
Ideal tracker again (just a reminder)



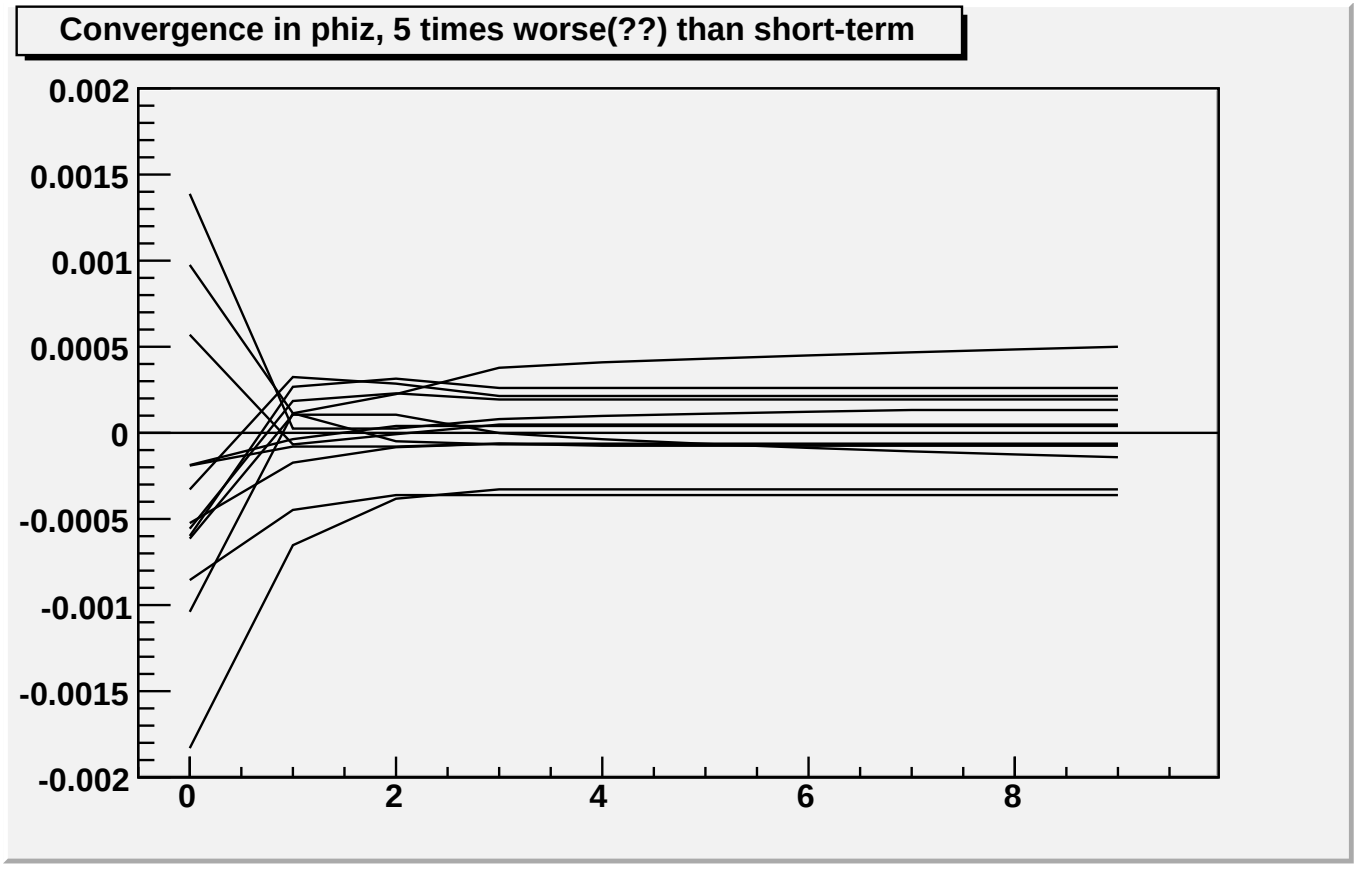
Nominal 10 pb^{-1} tracker scenario again (just a reminder)



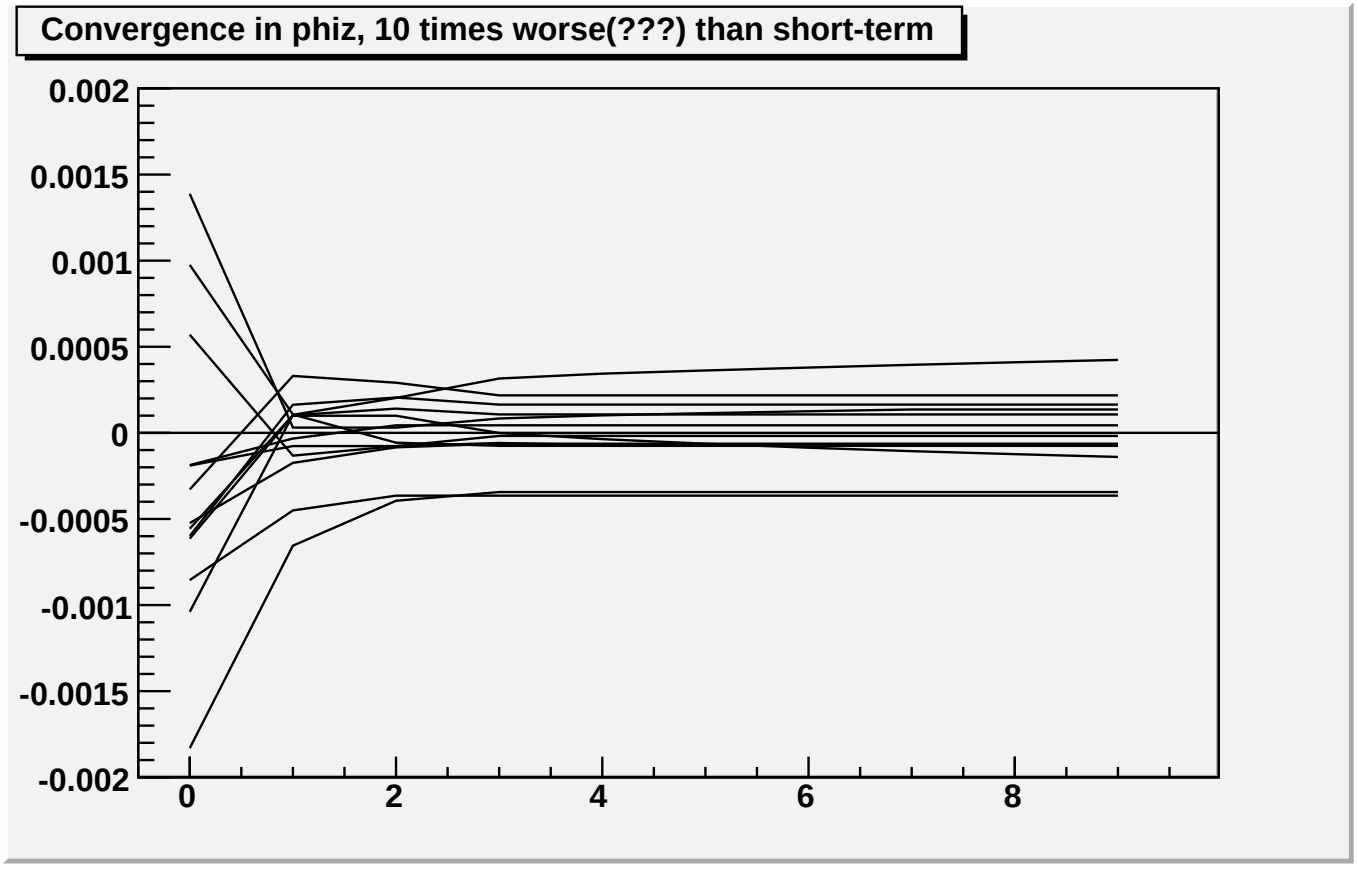
Twice the tracker misalignment (?)



Five times the tracker misalignment (??)

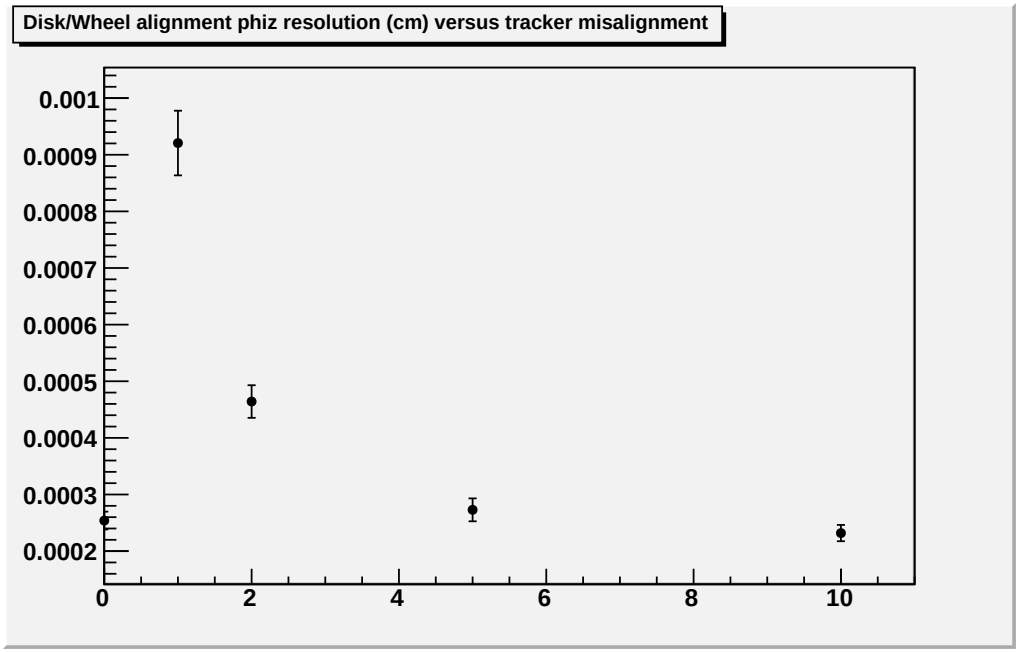


Ten times the tracker misalignment (?!??!??!???)



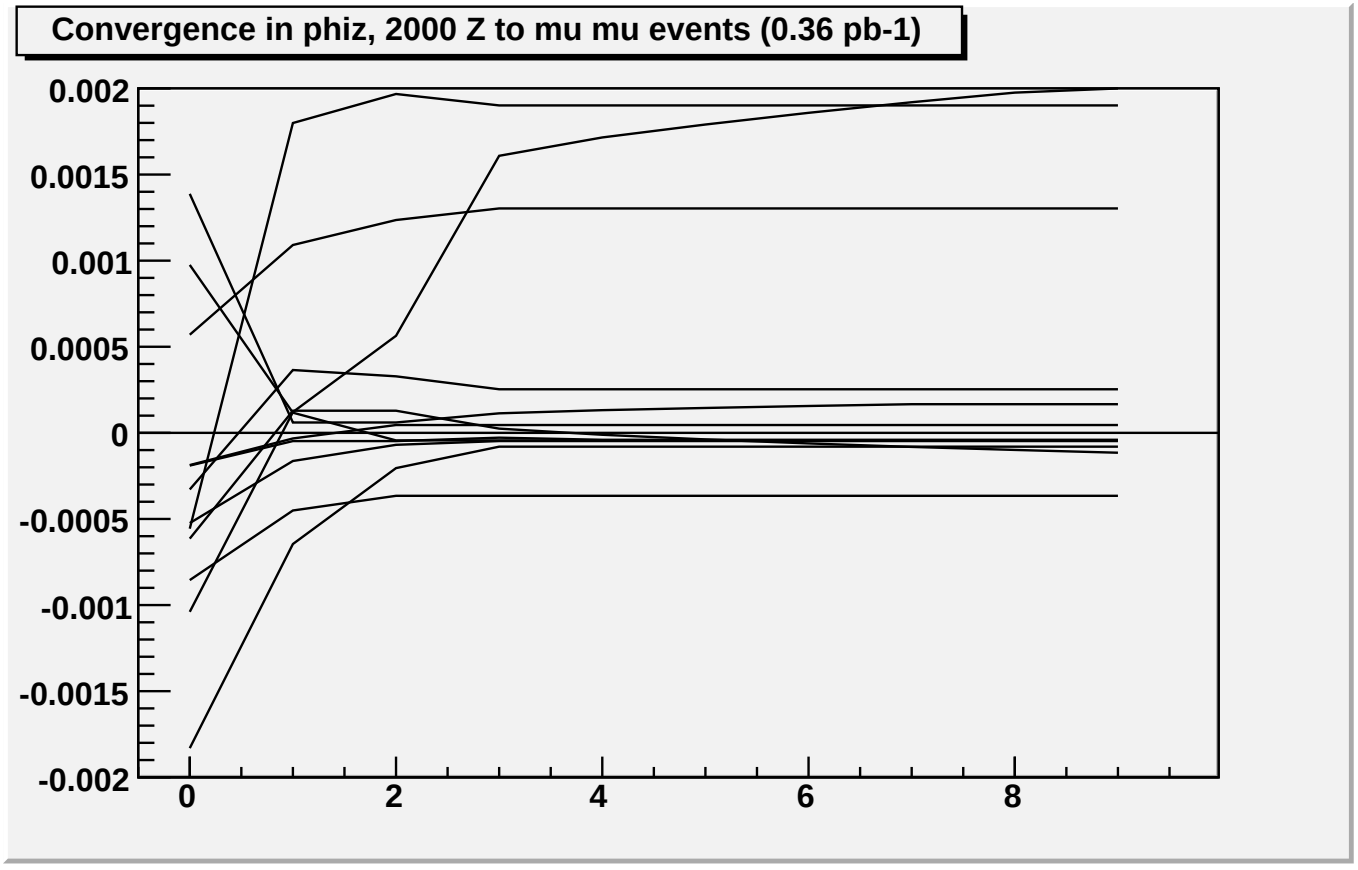
No, I don't understand this yet.

RMS of 13 disk/wheels times 10 trials, randomizing muon alignment with each trial (but not tracker alignment).

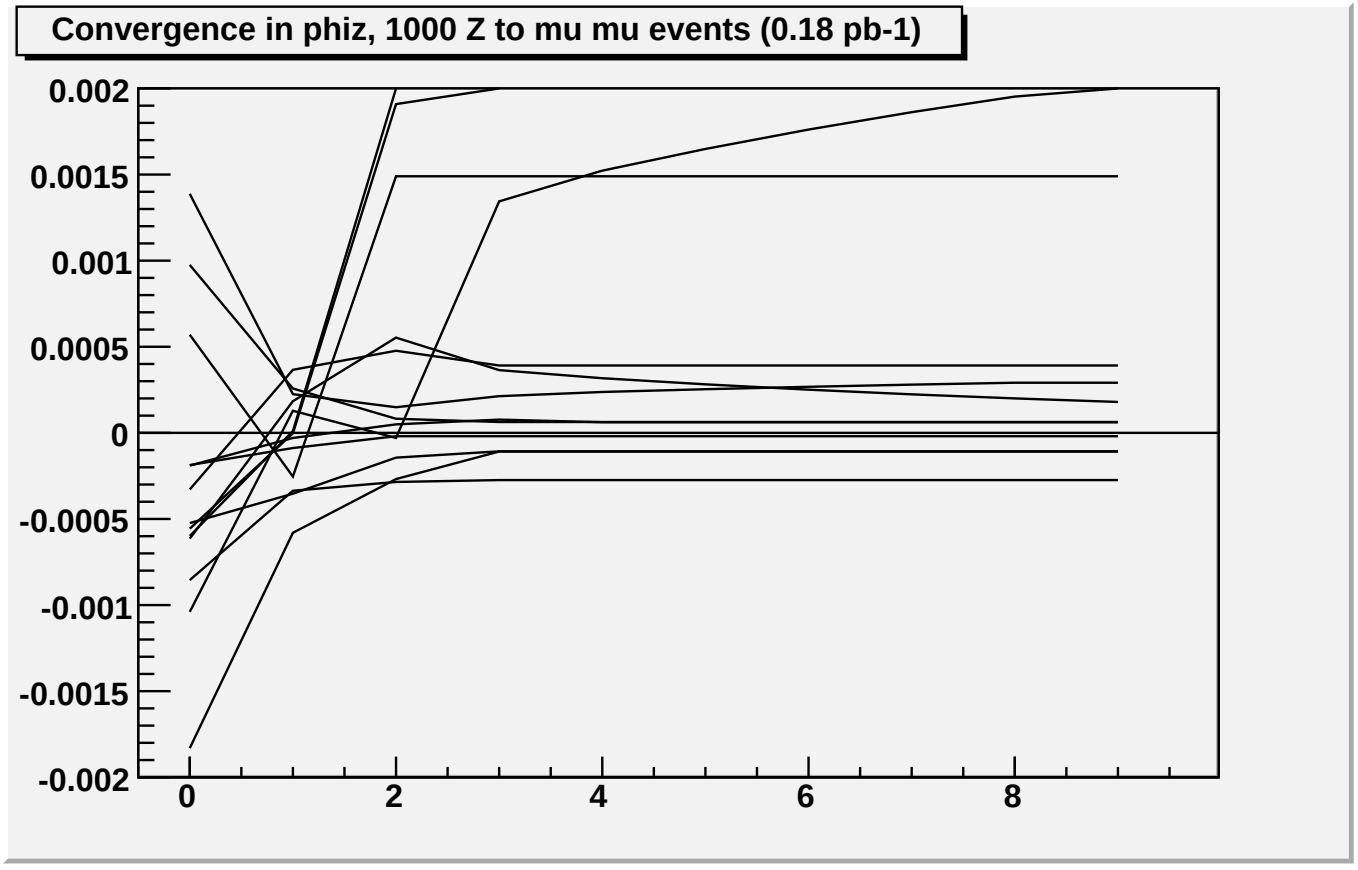


I need to find out how the misalignment scenarios affect tracker APEs. That might be the problem. (It doesn't look like the code is dividing by the scale factor, rather than multiplying.)

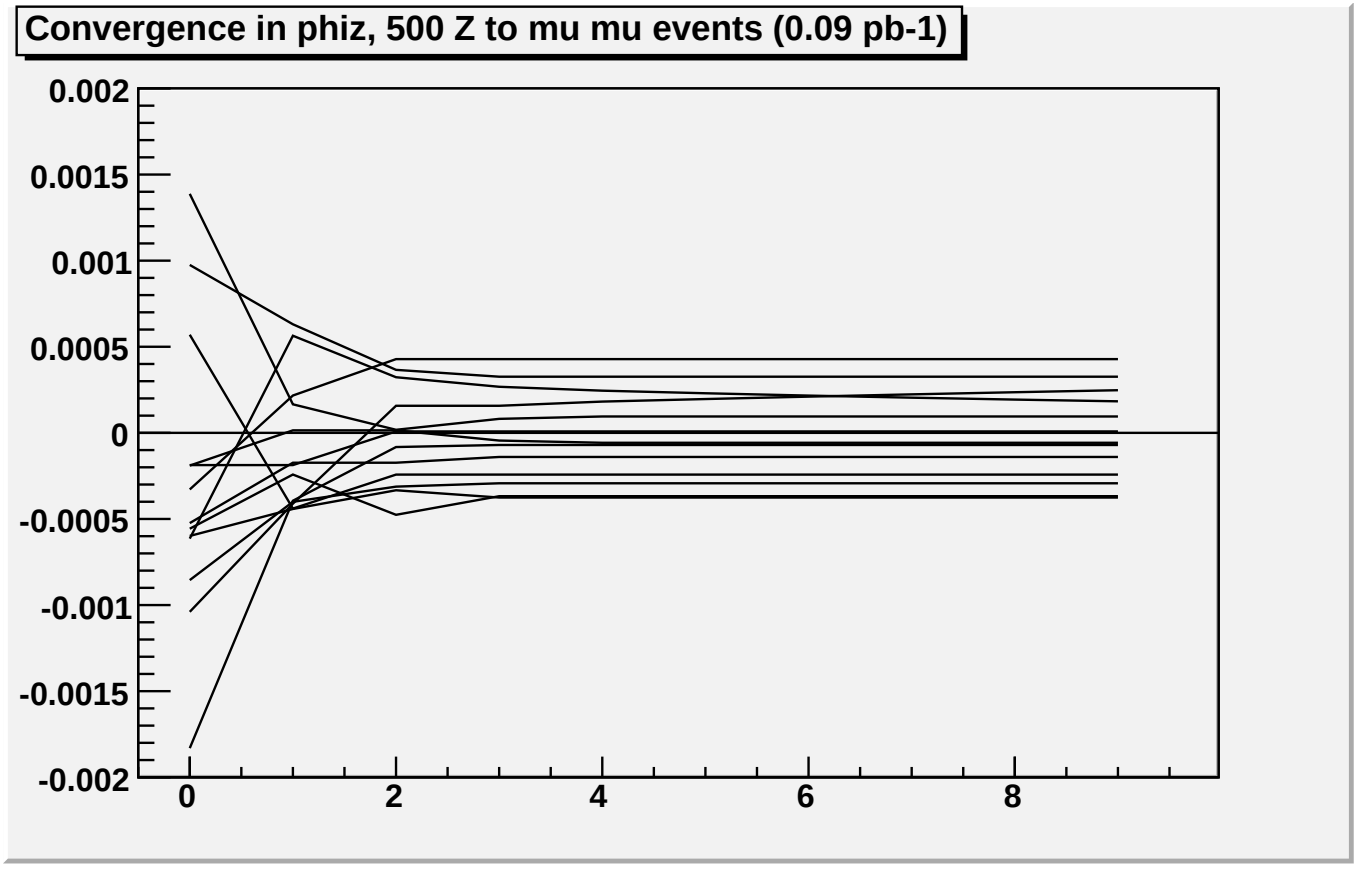
Nominal case again (just a reminder): statistics study



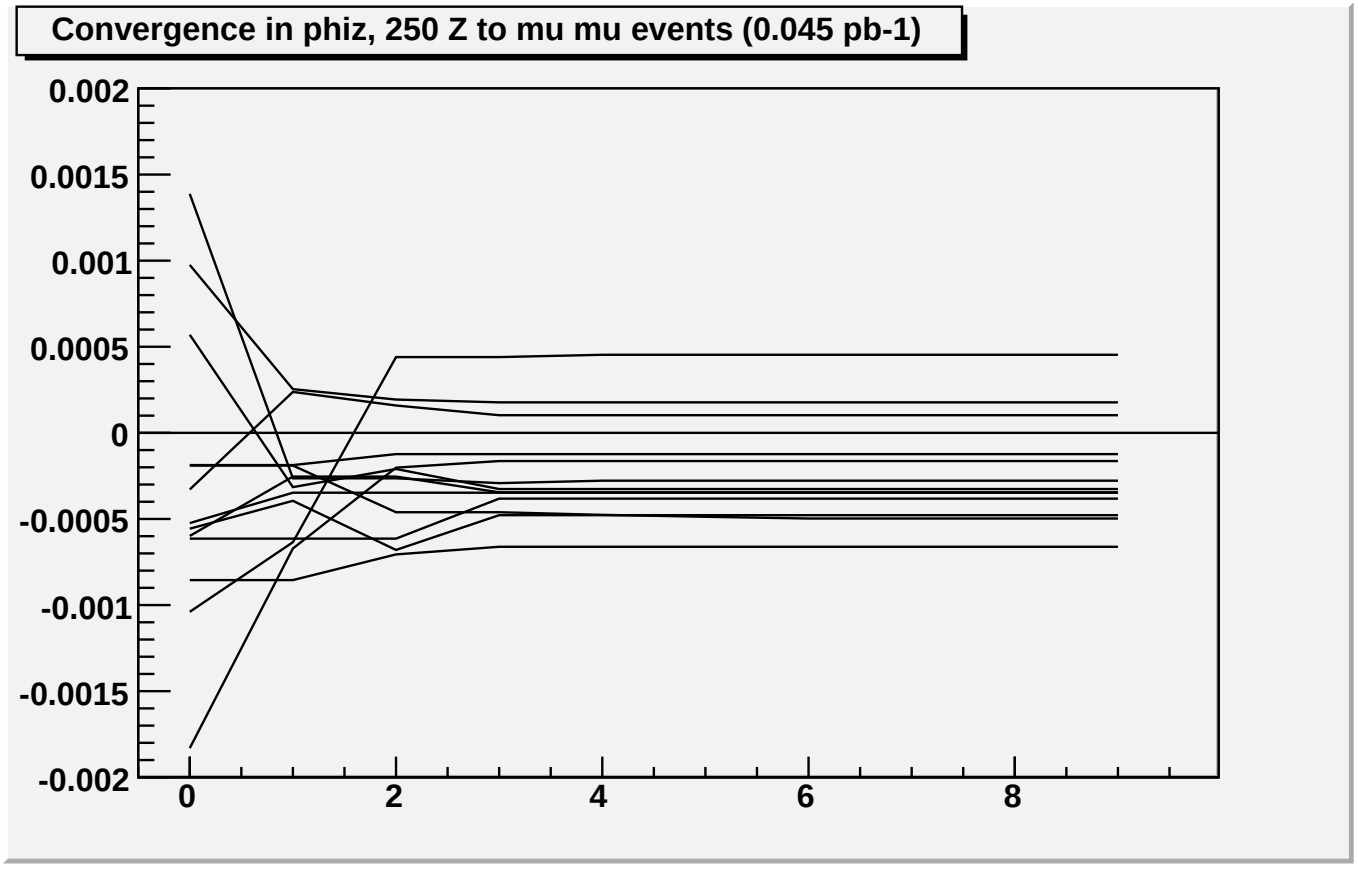
Half statistics



Quarter statistics



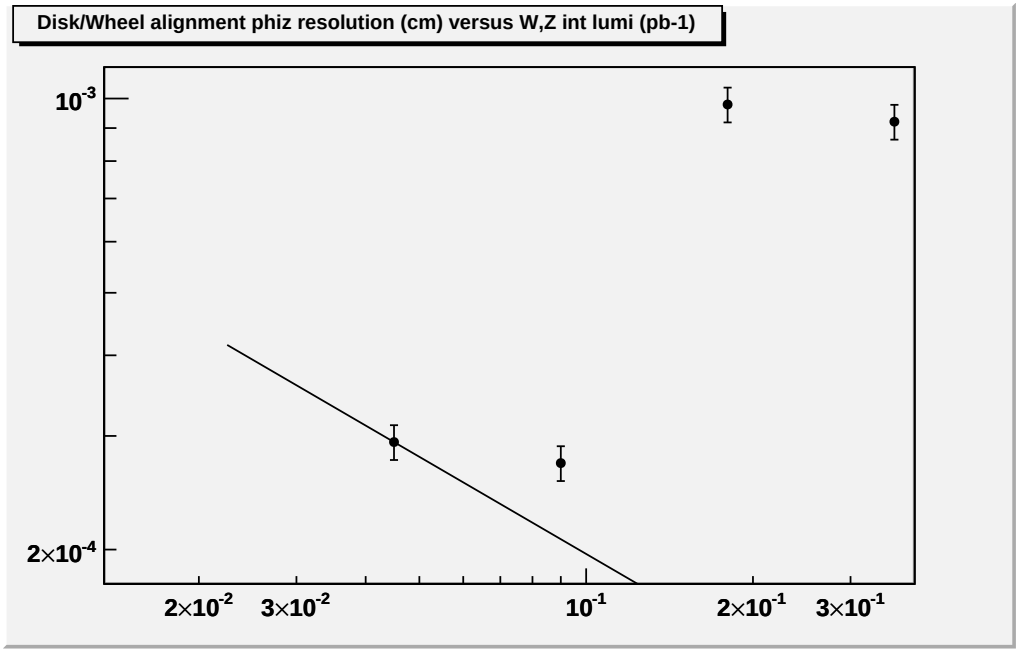
Eighth statistics



I wouldn't claim to understand this yet.

RMS of 13 disk/wheels times 10 trials, randomizing muon alignment with each trial (but not tracker alignment).

Events used in each simulation are independent.



Those outliers affect the large-statistics trials most.