Resolving twist: summary and more diagnostic ideas

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The situation

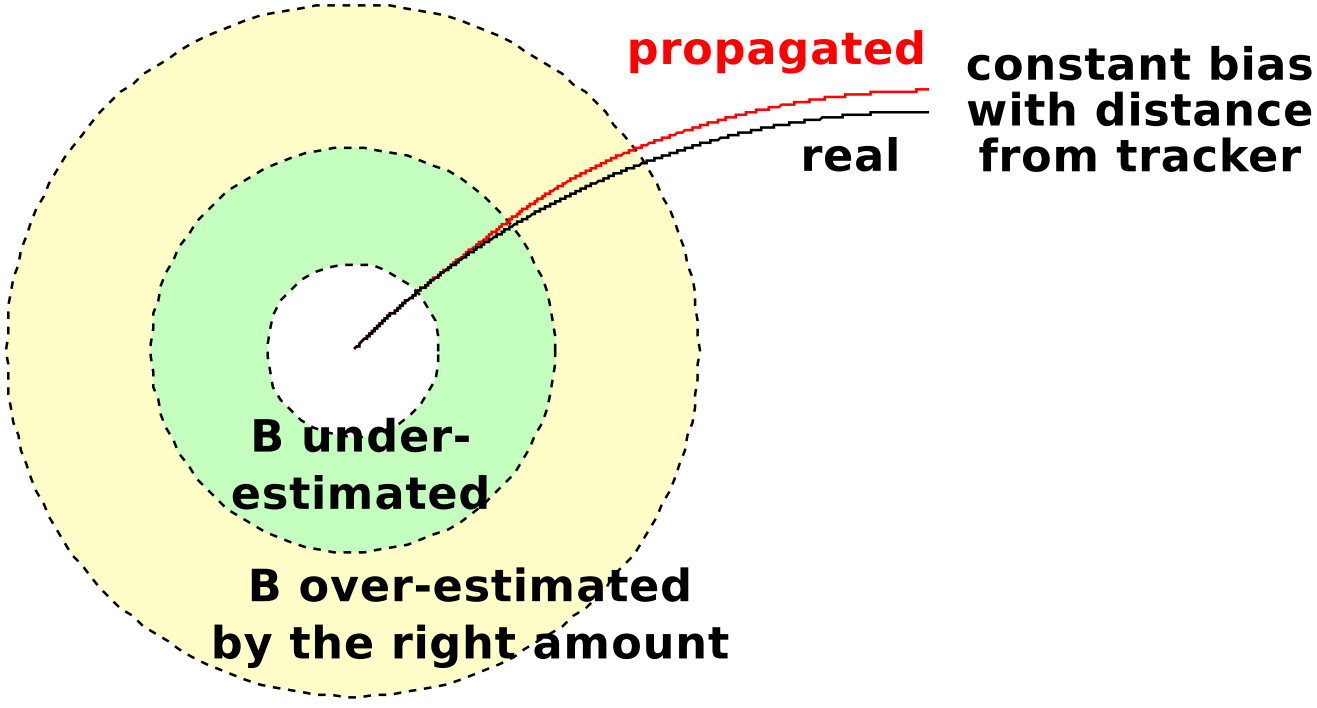
- The discrepancy between the barrel hardware geometry and tracks remains unresolved
- This means that our "probability distribution" for the correct geometry is bimodal: a peak around the track-based result and a peak around the hardware result
- This is not a usable probability distribution for physics analyses
- Using the wrong geometry yields a 40% smearing of a 1.1 TeV/c^2 Z' peak: so the "probability distribution" is too wide as well as having an unusable shape
- If this is not resolved, then high-p_T muon analyses will have to be based on tracker-tracks only: worse statistical uncertainty, better-understood systematics
  - that is, all muon alignment work will be ignored
- The deadline for having a firm conclusion about which twist properly represents the real muon system is Nov 5

Attempts to resolve it

- Comparison with inclinometers: independent measurements say that ends of MABs are not rotated around the beamline
- Link doesn't see a rotation of the two sides, either, but the ME− side measurement has only one laser
- HW-barrel 0 T alignment agrees with photogrammetry within wheels, but the PG positions of the wheels have mm-scale uncertainties
- Track/HW discrepancy does not grow with distance from the beamline (confirmed at residuals level)
- Endcap $\rightarrow$ transfer lines $\rightarrow$ barrel provides closure tests, but may not be ready in time
- New idea: try alignment in "two-bin mode" to cancel B-field
- New idea: look for mismatch with vertical StandAlone cosmics

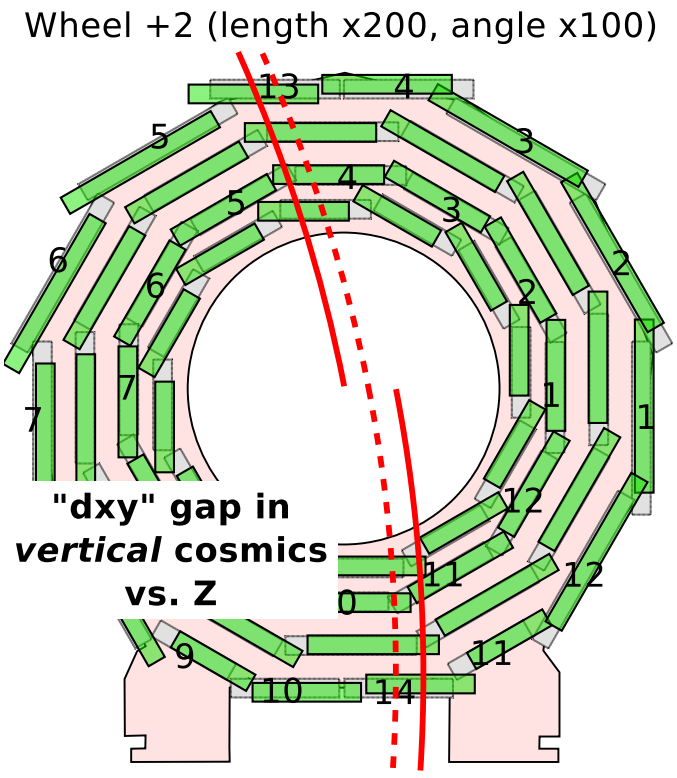
Magnetic field

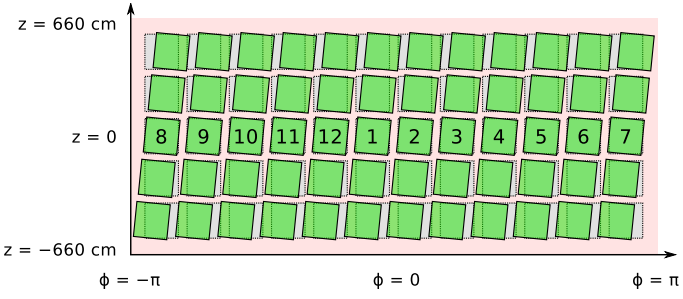
- Might be B_r error instead of the usual B_z? No, I tried some simulations: B_r also makes deviations that grow with distance from the tracker, even with B_r effect partly cancelling B_z
- (Un)lucky cancellation? Conceivable...



- "Two-bin mode": compute alignment 1 with μ^+, alignment 2 with μ^-, align to average and plot differences: cancels sensitivity to $\vec{B}$

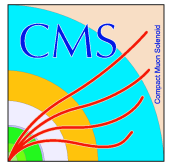
Mismatch in vertical cosmics





- At one extreme end of the barrel, twist moves top chambers to the left and bottom to the right (they do *not* rotate around the beamline: that's not *our* twist)
- This would break vertical StandAlone cosmics: d_{xy} gap that is proportional to z
- Independent of tracker-to-muon alignment
- The verticalness of the tracks is crucial: must be non-tracker-pointing cosmic rays (StandAloneMuons)

The end of this talk



- This week, I tried the vertical-track test in MC collisions with a twisted geometry— and learned why non-tracker-pointing is essential (it's a 3-D effect)
  - collisions won't work: need straight-down cosmic rays
  - skimming a sample now
- Magnetic field can be easily cancelled by the "two-bin mode" of the alignment algorithm (demonstrated in Feb 2009 when the B-field errors were large)
  - for B-field components in any direction (axial, radial, or azimuthal), the effect on trajectory depends on the charge of the muon: $\vec{B}$ must yield differences between μ^+ and μ^-
  - work on this has started...
- I will be unavailable for next Friday's meeting: results by HyperNews
- Any other ideas that can lead to a firm conclusion about this degree of freedom are encouraged...