Muon HIP Baseline Results

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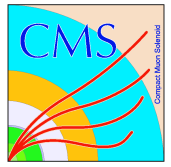
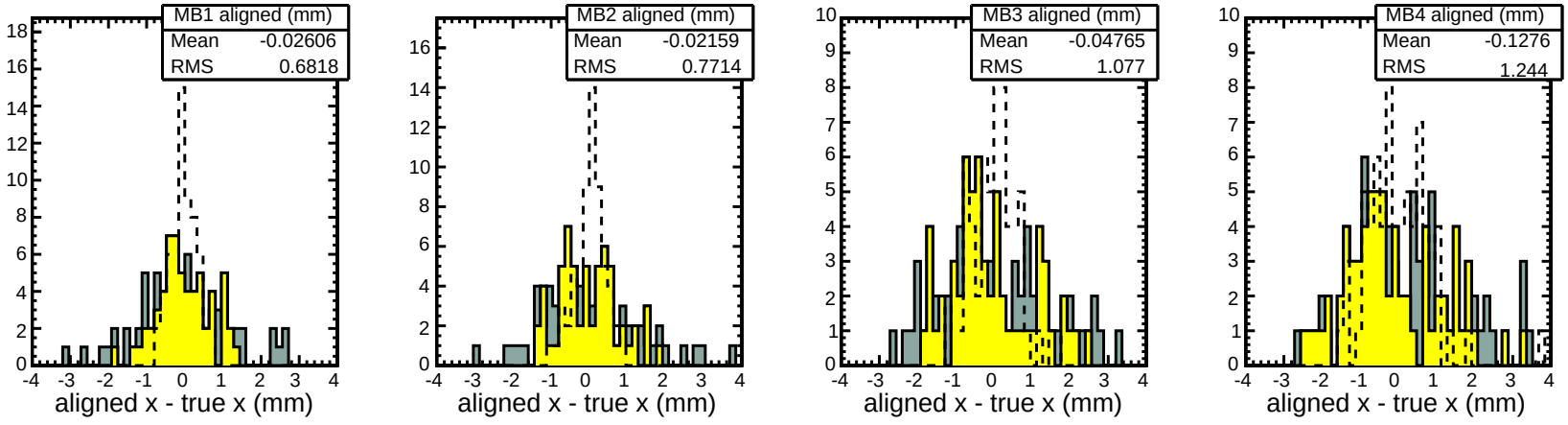
Basic story



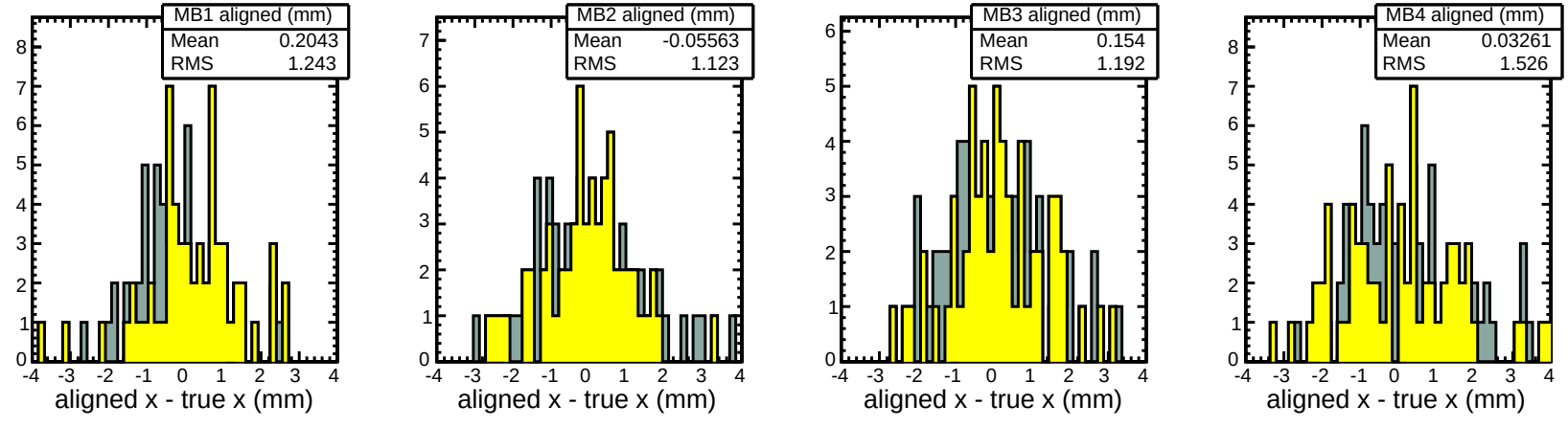
- Quality of MuonHIP alignment depends strongly on tracker alignment
- S156 tracker alignment is good enough for a "satisfactory" muon alignment
  - barrel $r\phi$ resolution strongly correlated with tracker alignment's p_T results
- Considered alternative schemes to include muon hits in track refit and iterate
  - narrowed residuals distributions as expected
  - but the means are still imperfectly placed
  - converged slowly to the same result as one-step procedure
- Results: all stations aligned in local x, and ϕ_z, some in y
  - all stations either improved or stayed the same; kept all corrections

Barrel comparison x (global $r\phi$)

Muon HIP barrel actual station 1: 680 μm



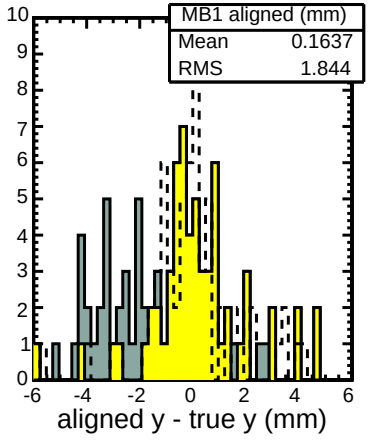
MillePede barrel station 1: 1240 μm

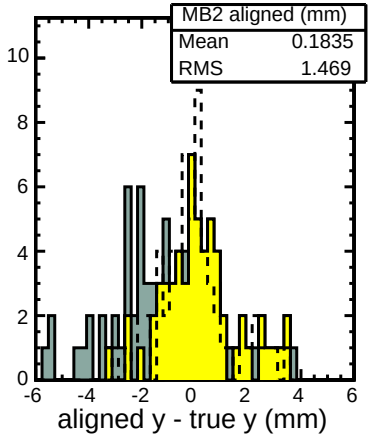


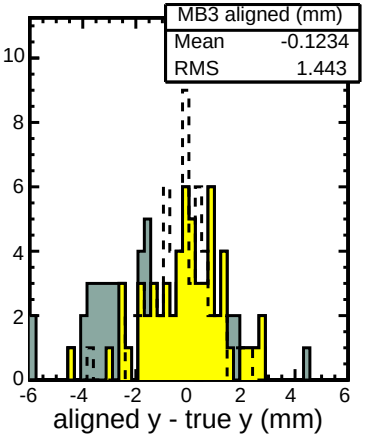
Filled grey is initial misalignment, filled yellow is actual new constants, dashed line if tracker were perfect

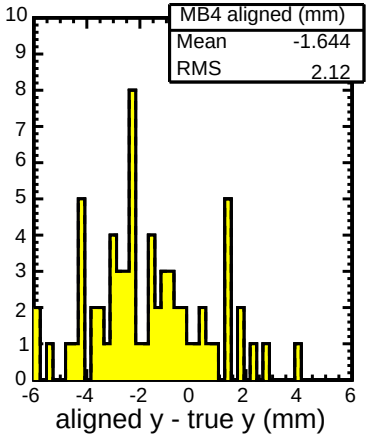
Barrel comparison y (global z)

Muon HIP barrel actual station 1: 1840 μm

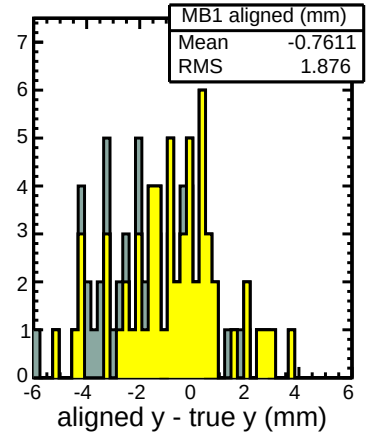


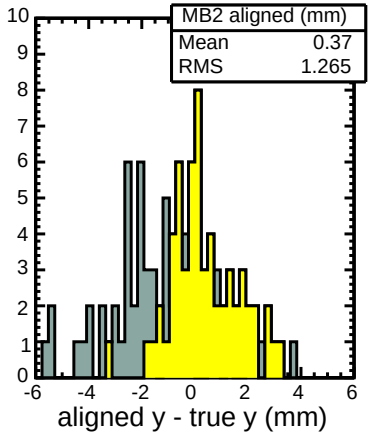


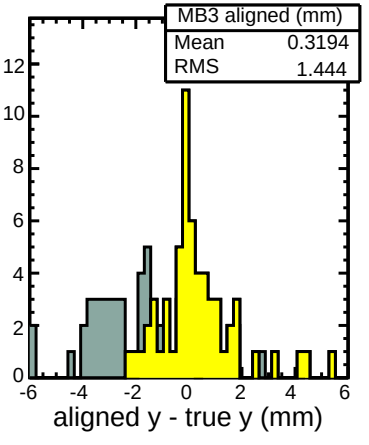


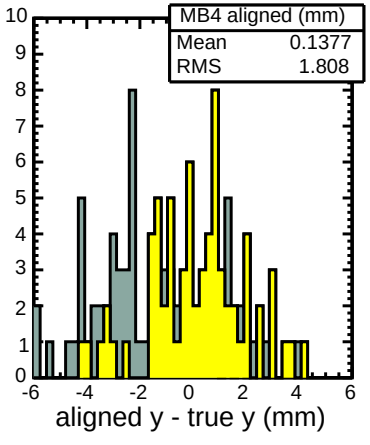


MillePede barrel station 1: 1870 μm









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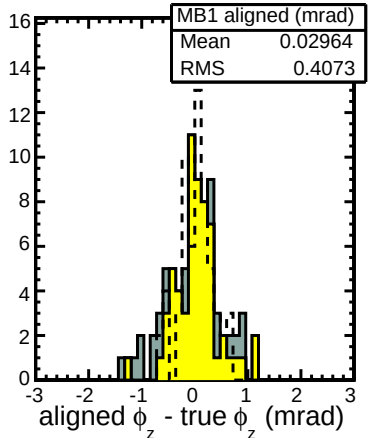
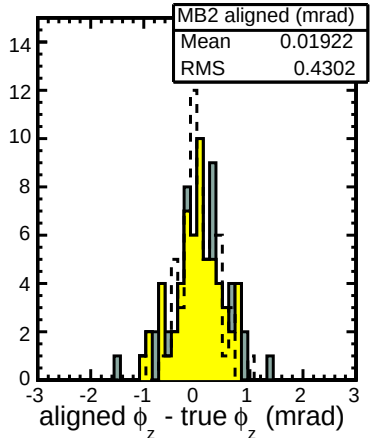
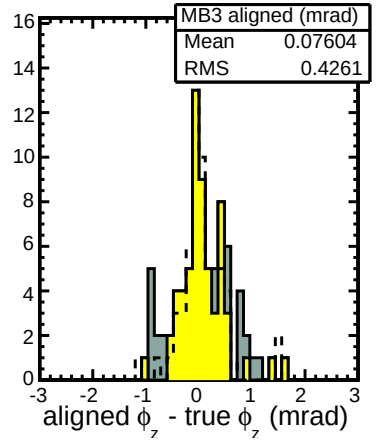
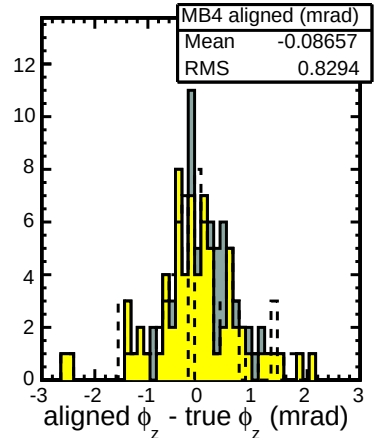
Barrel comparison ϕ_z

Muon HIP barrel actual station 1: 0.4 mrad

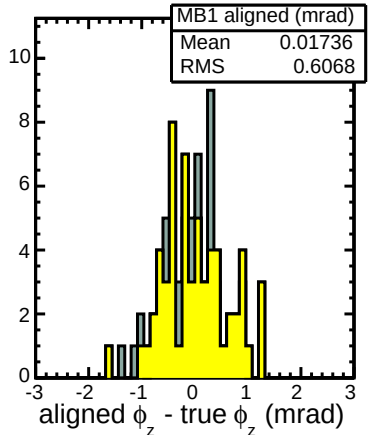


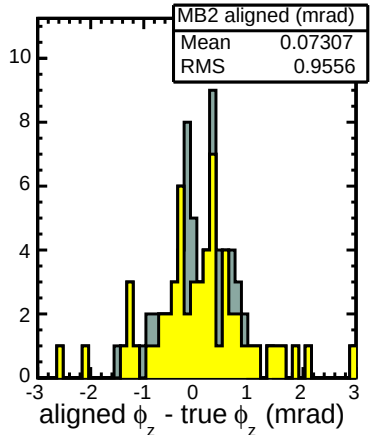


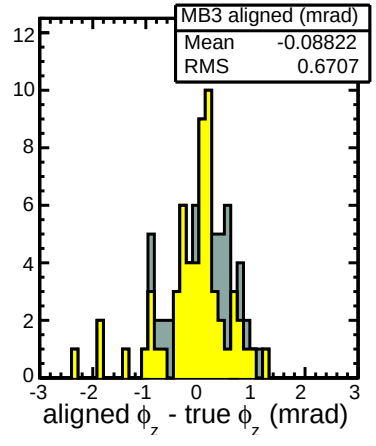


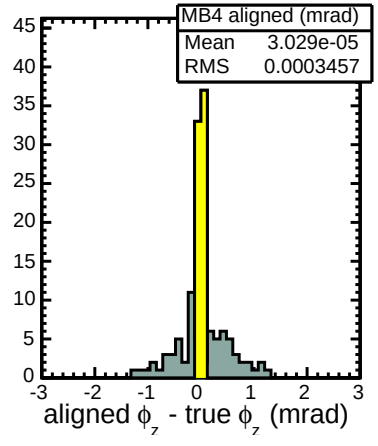


MillePede barrel station 1: 0.6 mrad









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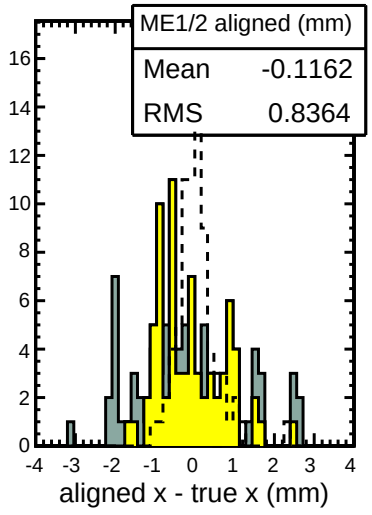
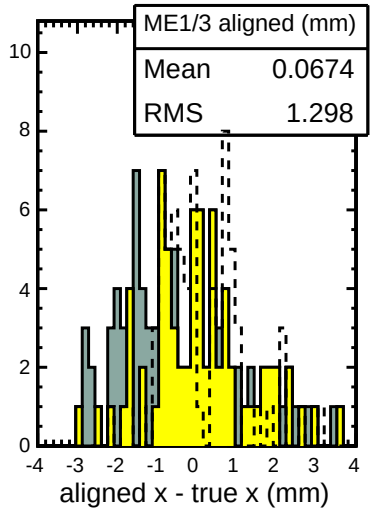
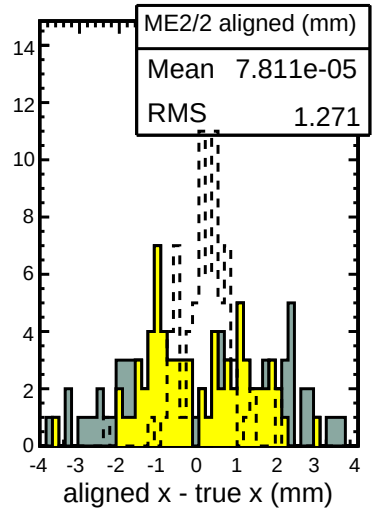
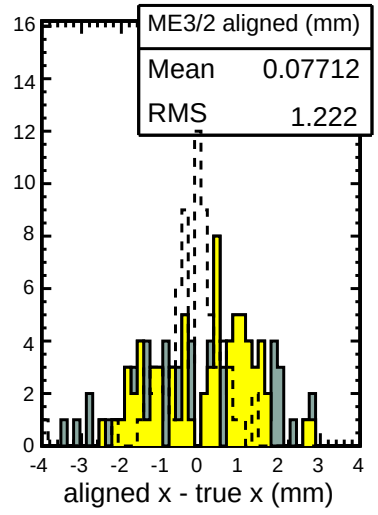
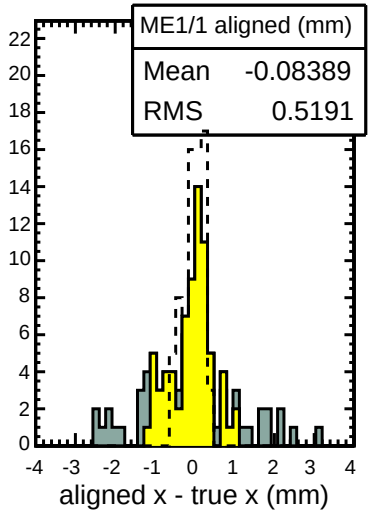
Endcap constants x (global $r\phi$)

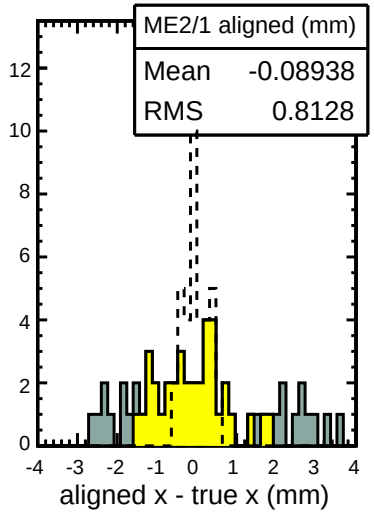


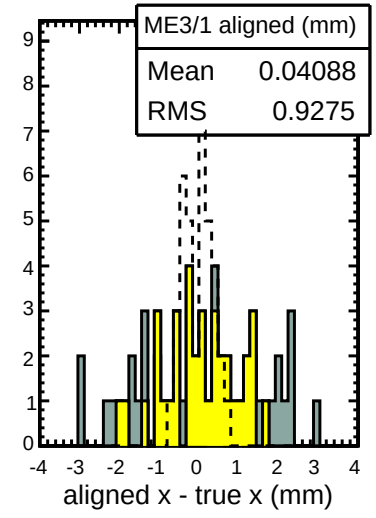


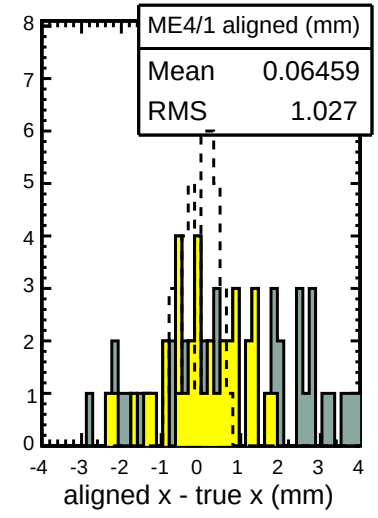






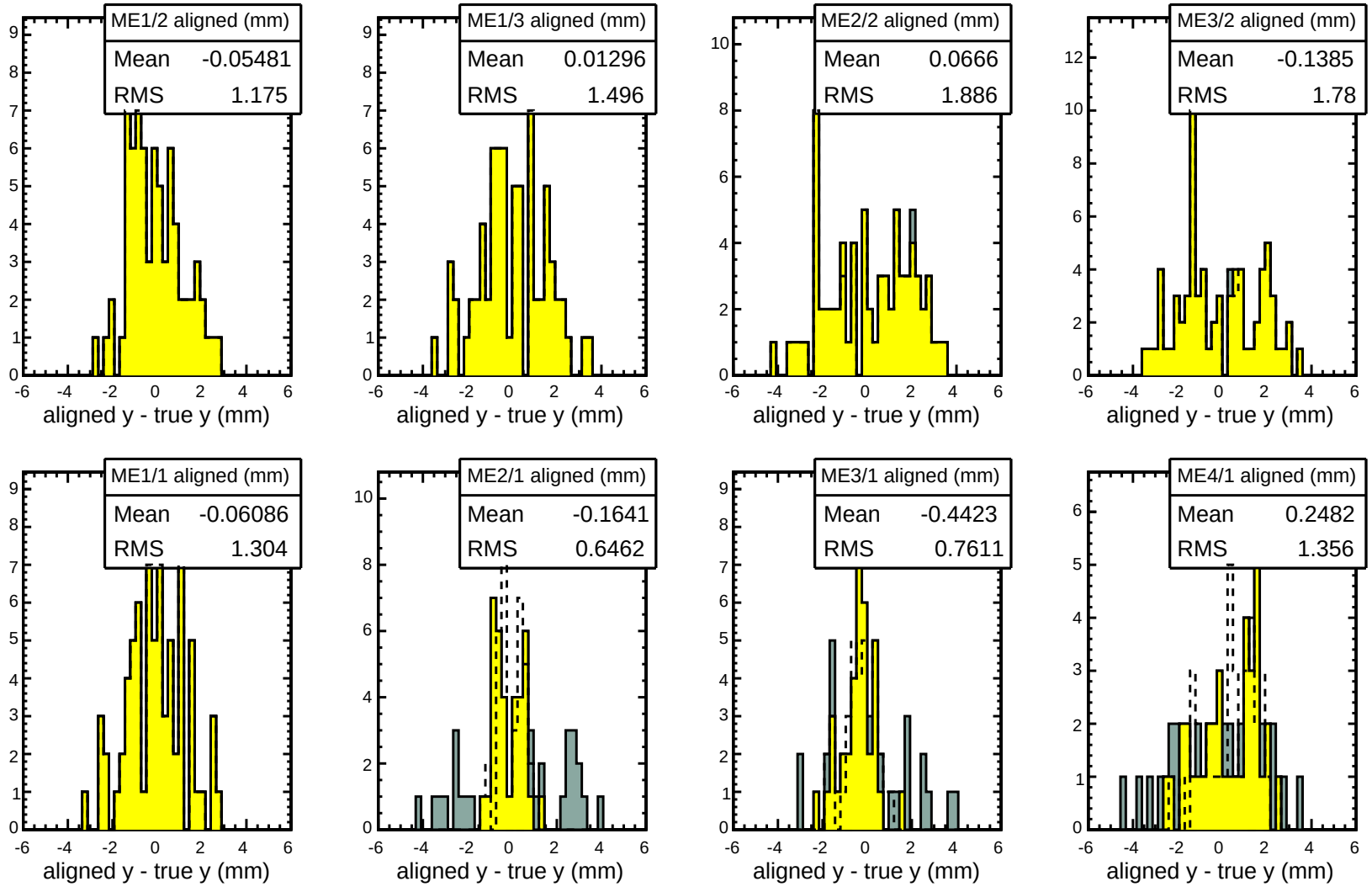




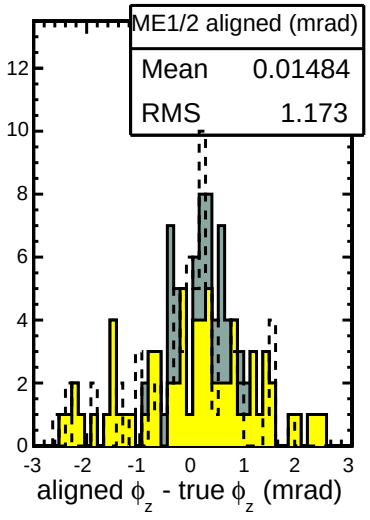


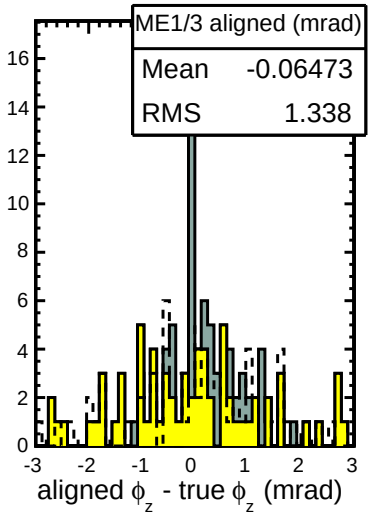
Endcap constants y (global R)

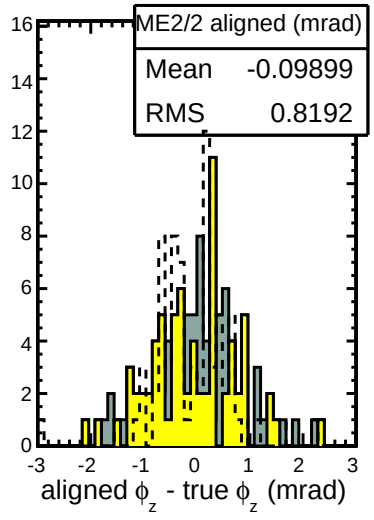
Best measurement where p_T is small (inner ring); ME1/1 has an asymmetric y residual distribution (under study)

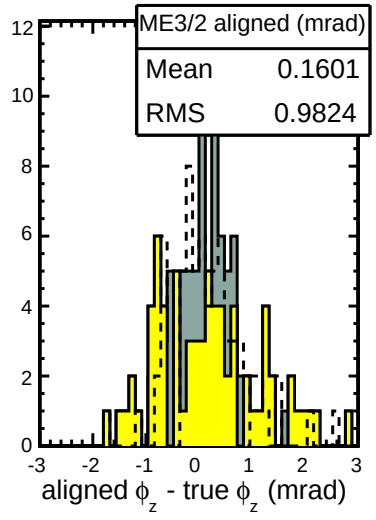


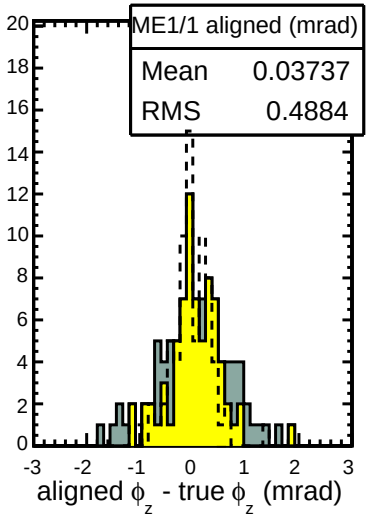
Endcap constants ϕ_z

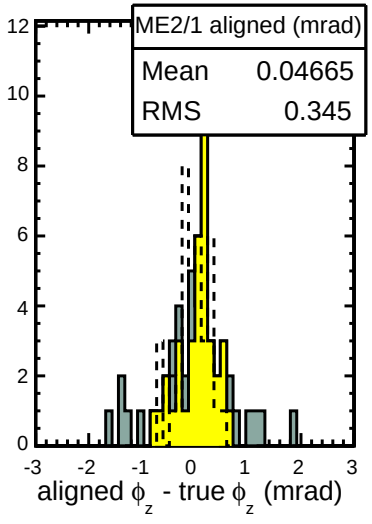


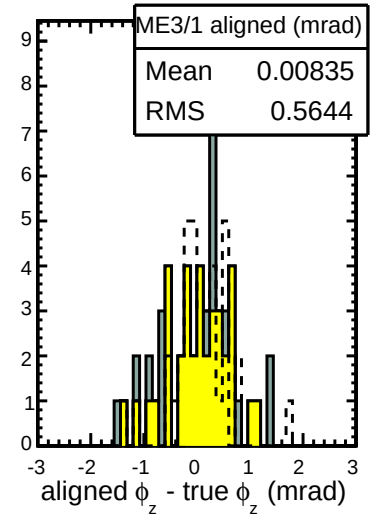


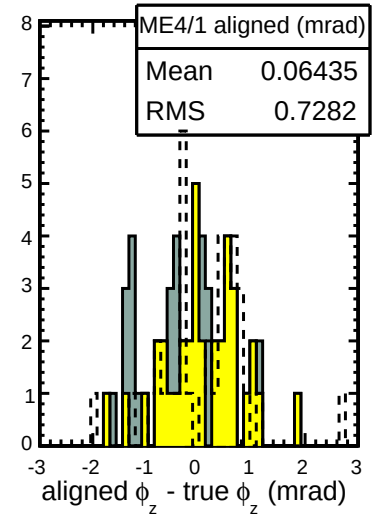








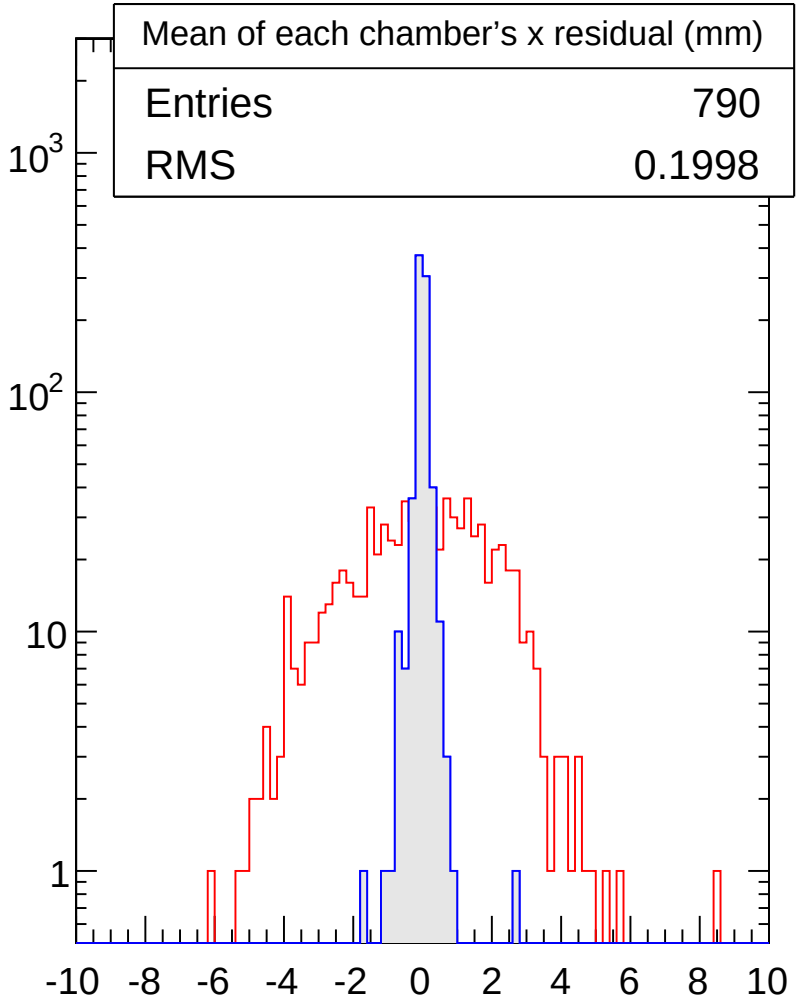




Sanity check

Mean of residuals distributions, before (red) and after (blue) alignment

Note: this is what I minimized



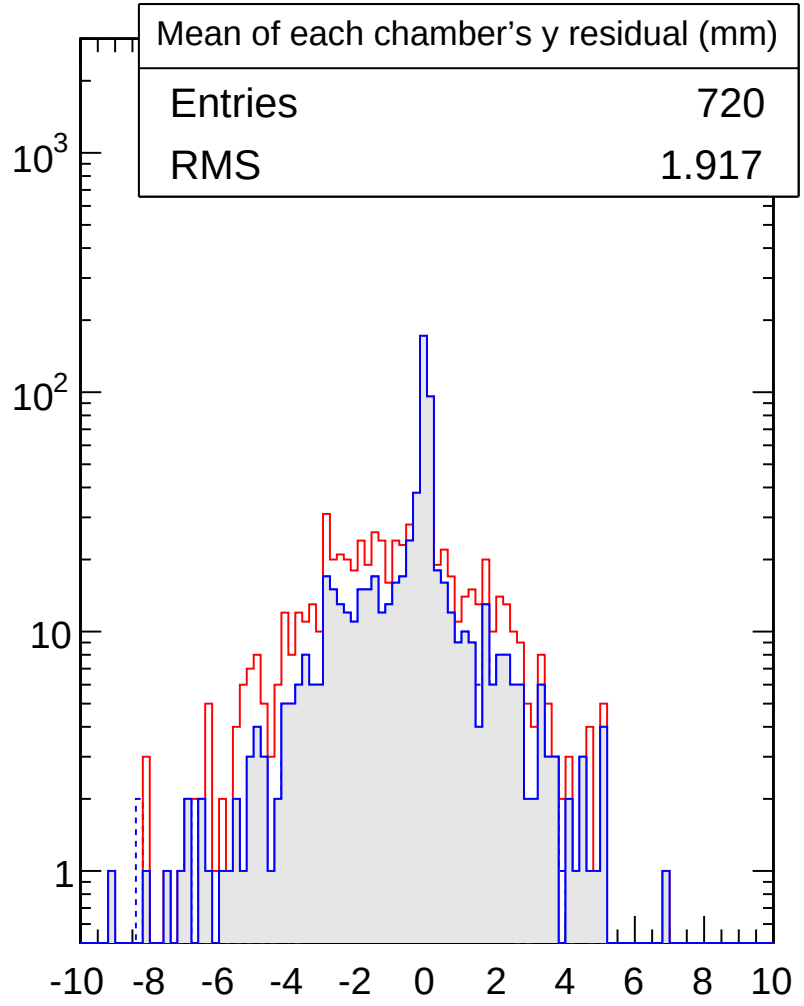
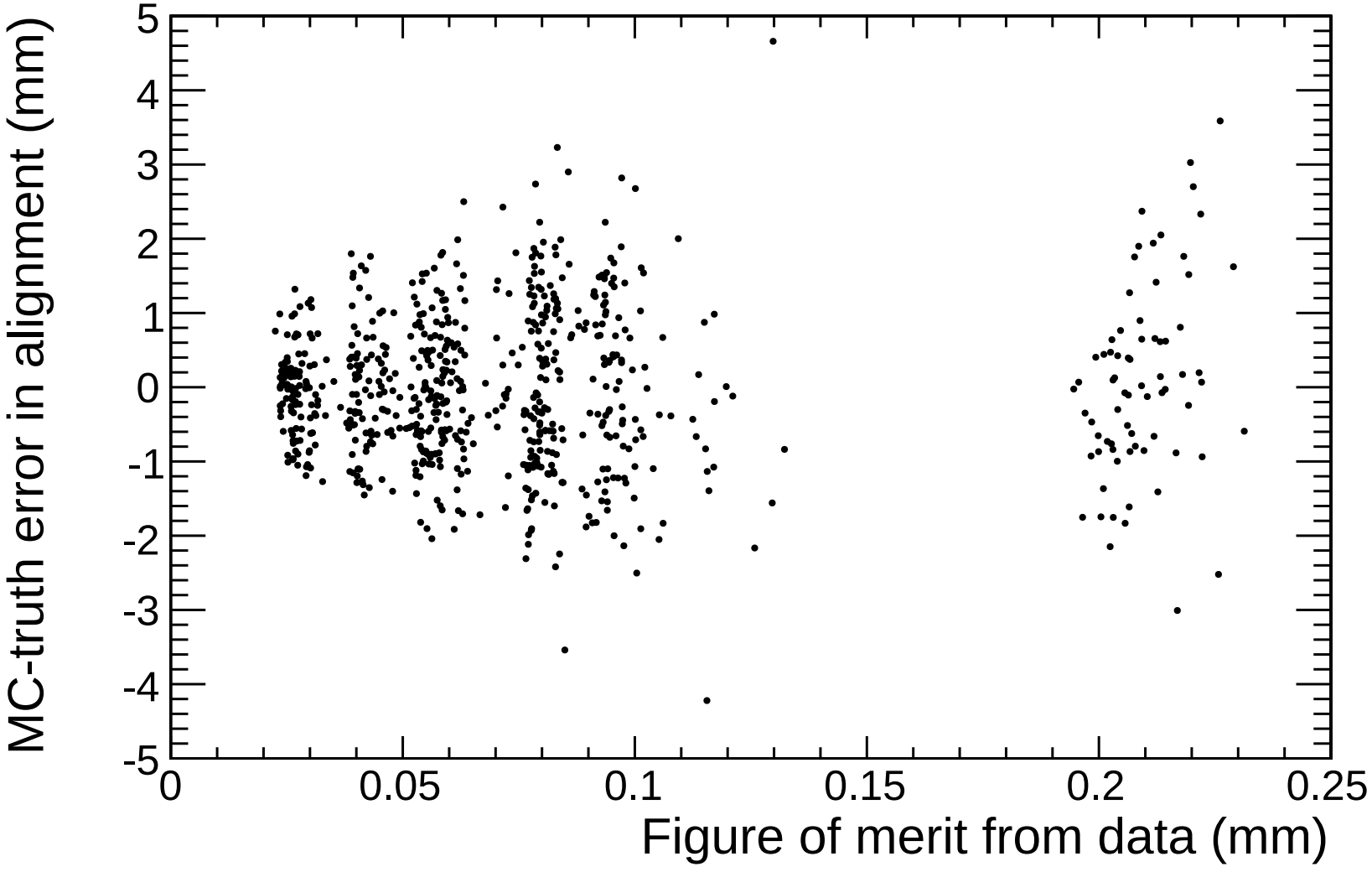


Figure of merit correlation

Figure of merit (stdev/$\sqrt{N}$) correlated with sigma of alignment error



Conclusions

I recommend use of HIP constants for barrel and endcap

To be taken offline:

- Perhaps tracker alignment can benefit from a weak constraint to muon hits
- 1 cm APEs would tighten p_T resolution without sensitivity to muon misalignment
- improvement in tracker p_T resolution would help muon alignment