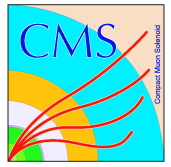

MuonHIP Alignment Results

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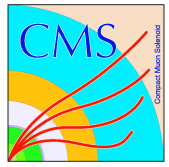
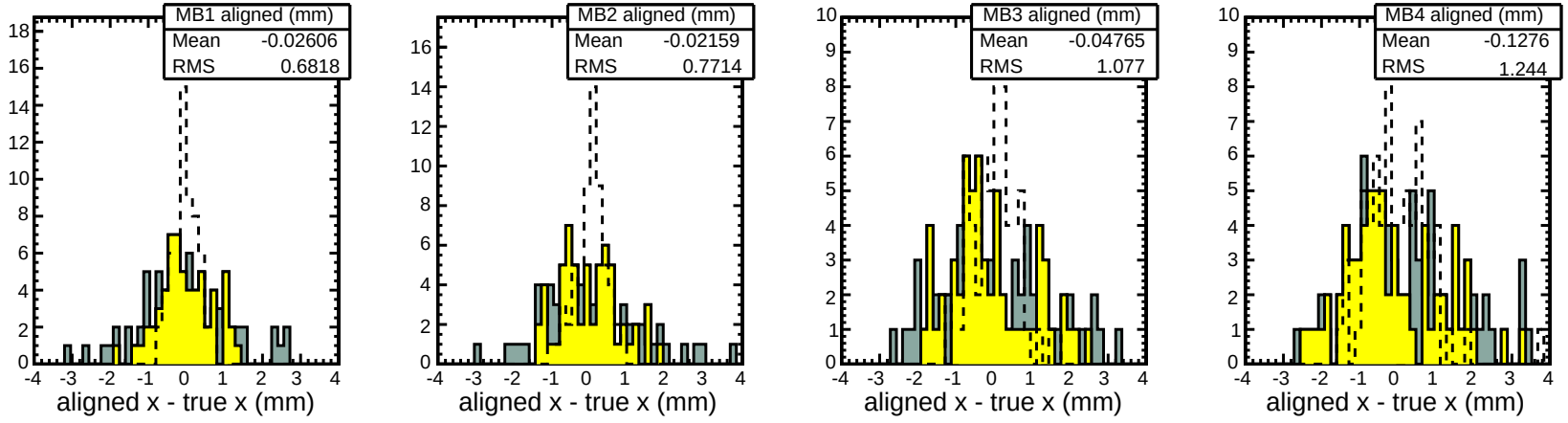
Summary

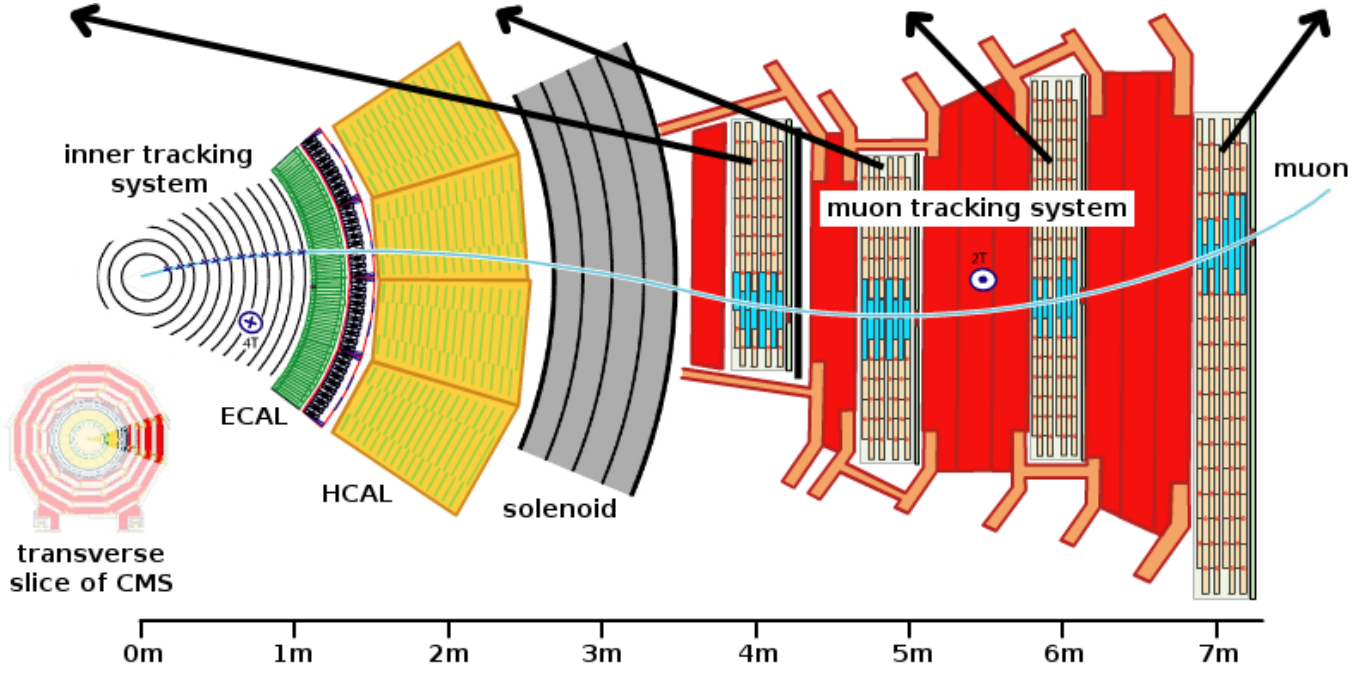


- Goal for S156: "few hundred microns" in first muon stations (ultimate goal is 200 μm with 100 pb^{-1})
- First time we saw low-p muon samples (MuonPT5, MuonPT11)
- Learned that alignment quality optimized by low p_T cut (10 GeV)
- Achieved: 500–800 μm in first muon stations in S156 (10 pb^{-1}), scale by $\sqrt{10} \rightarrow$ 250 μm at 100 pb^{-1}
- Strong dependence on tracker alignment
- Pointing resolution depends on $L_{\text{muon}}/L_{\text{tracker}}$ (negligible), curvature resolution depends on $(L_{\text{muon}}/L_{\text{tracker}})^2$ (important)
- Tracker momentum resolution should scale with statistics, since it is optimized by alignments to $Z \rightarrow \mu\mu$ mass constraints

Barrel aligned positions ($r\phi$)

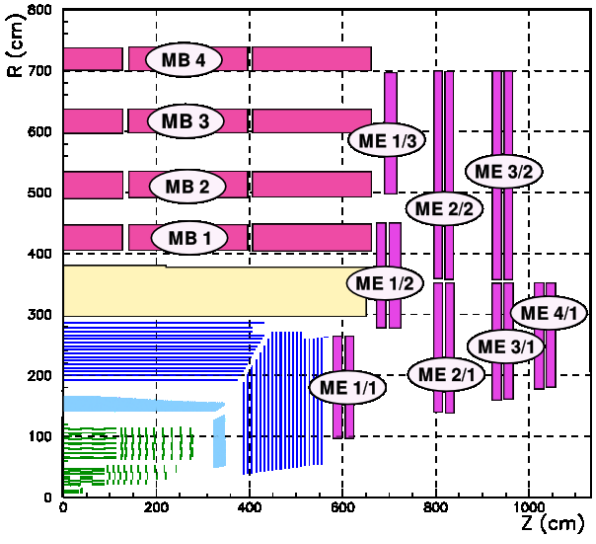
Grey: misaligned (1.5 mm), yellow: aligned (680 μm), dashed: if tracker were ideal (300 μm)

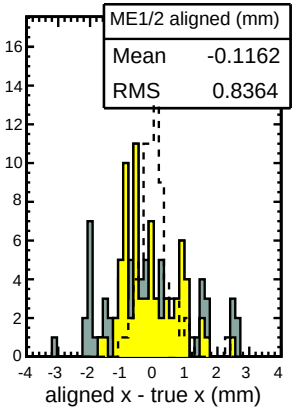


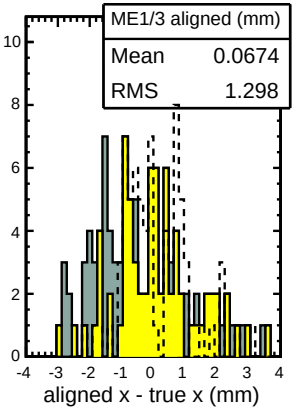


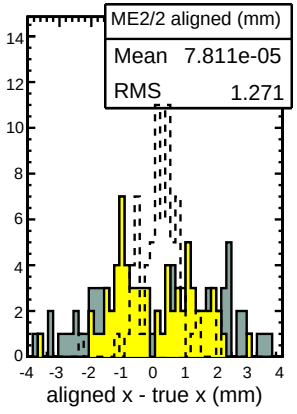
Endcap aligned positions ($r\phi$)

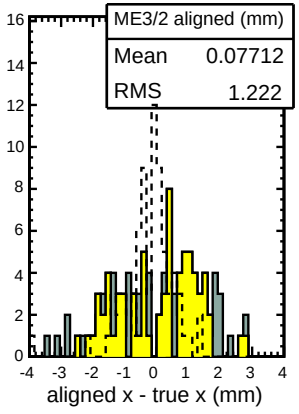
Best results in inner ring (bottom row), where $L_{\text{muon}} \sim L_{\text{tracker}}$

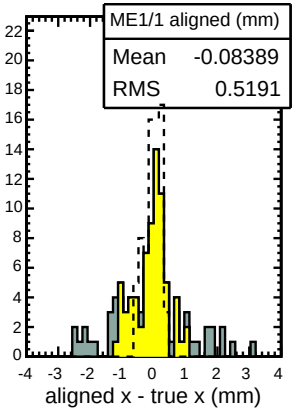


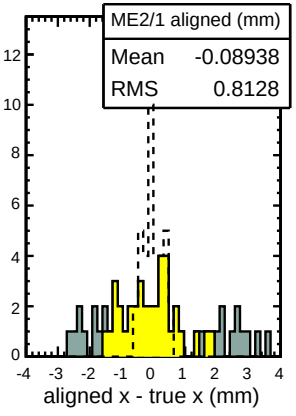


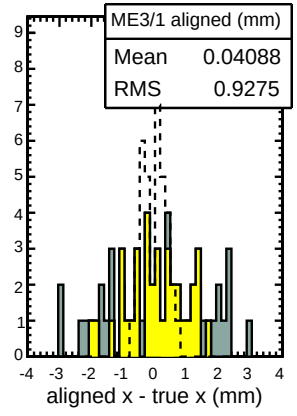


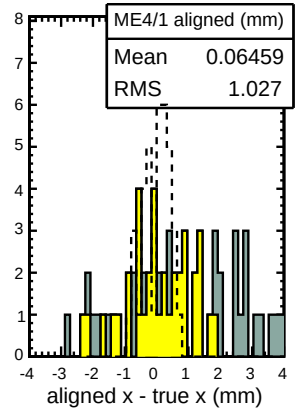












Conclusions

- Successful exercise from several points of view
  - Resolution equal to or better than initial misalignment in all stations and all parameters
  - Would scale appropriately to 100 pb^{-1} goals
  - Clarified exactly how muon alignment depends on tracker
  - Learned how to use low-p muons (previously, an open question)
  - Alignment machinery has matured quite a bit, added cuts against rare bad tracks discovered in the exercise
  - Included studies of how to use data to assess alignment quality (not shown here)
- Aligned constants used in S156 re-reconstruction
- Working on twiki page!