



# Muon HIP Alignment Constants Sign-Off

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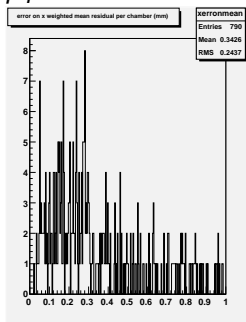
- ▶ Claim before going into the exercise:  $10 \text{ pb}^{-1}$  is just beginning to be enough data for a good track-based alignment
- ▶ Result: it's true, but with large QCD  $\mu$  statistics, the procedure works better than expected
- ▶ Detector studies: observed dependence of residual width (per chamber) on  $p_T$
- ▶ But figure of merit ( $\text{stdev}/\sqrt{N}$ ) is optimized for minimum  $p_T$  cut (high statistics is better than clean tracks)
- ▶ Great bug-finding exercise (I have a to-do list after the exercise)



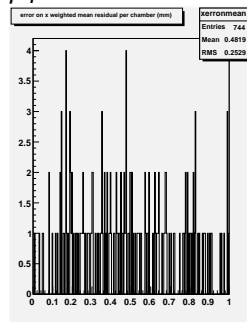
- ▶  $p_T$  cuts from 10 GeV to 35 GeV (10 GeV is best)
- ▶ Barrel  $xyz\phi_x\phi_y\phi_z$  endcap  $xy..\phi_y\phi_z$  and barrel  $xy...\phi_z$  endcap  $xy...\phi_z$  (best)
- ▶ Wheels and rings only and Chamber-by-chamber (best)
- ▶  $\chi^2$  and DOF cuts on extrapolated tracker tracks (new)
- ▶ Event sample: MuonPT5

Figure of merit:  $\text{stdev}/\sqrt{N}$  per chamber (data-only)

$p_T > 10$  GeV

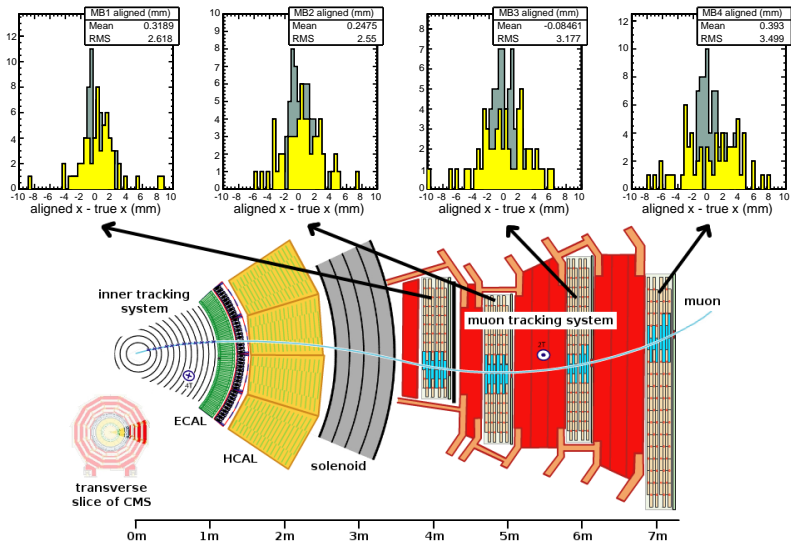


$p_T > 35$  GeV



# Barrel aligned positions

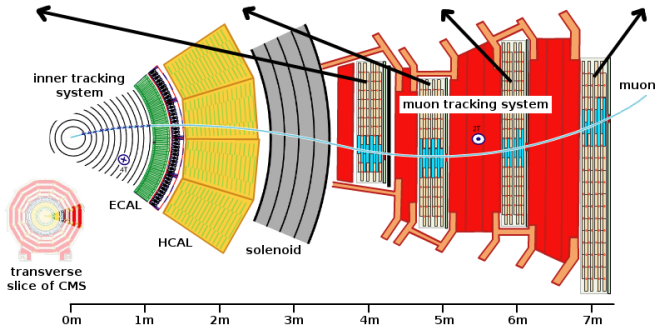
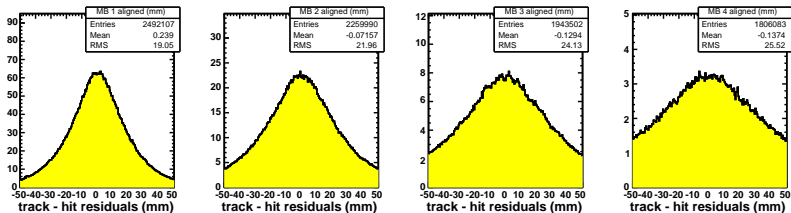
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# Barrel track residuals

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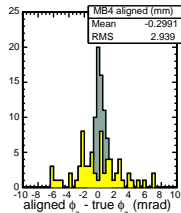
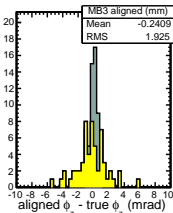
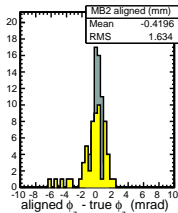
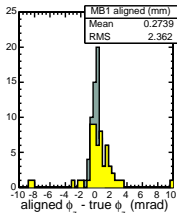
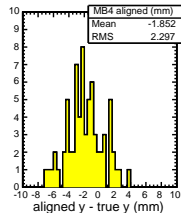
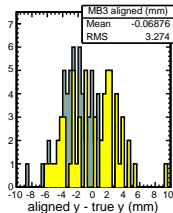
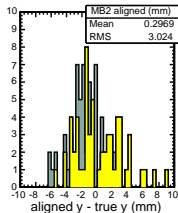
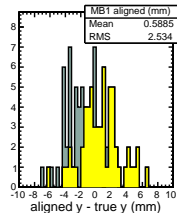
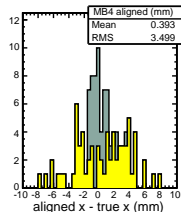
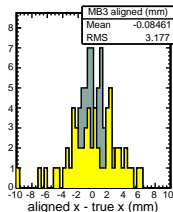
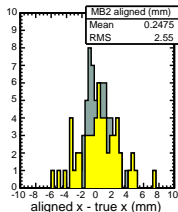
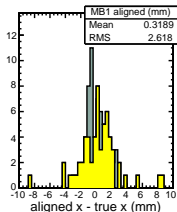
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# Barrel positions: $x$ , $y$ , $\phi_z$

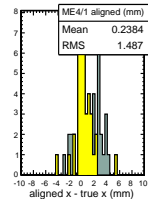
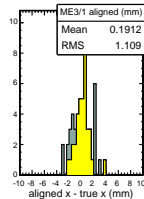
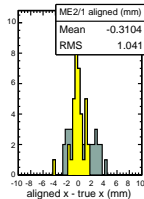
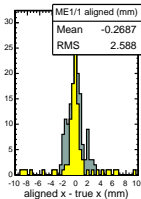
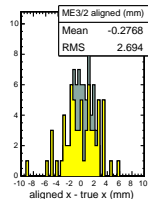
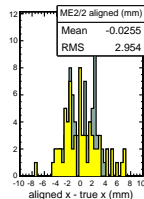
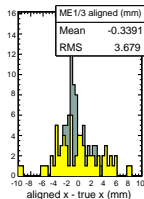
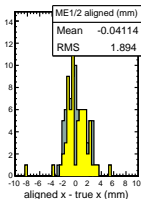
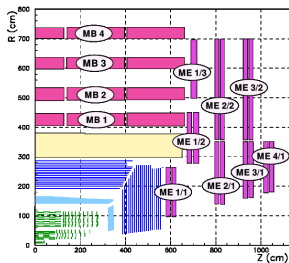
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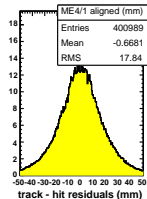
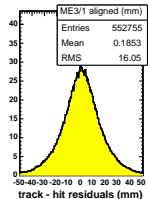
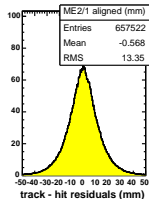
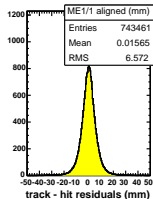
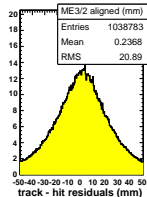
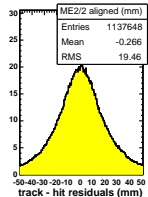
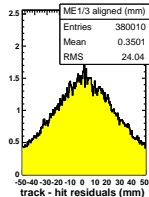
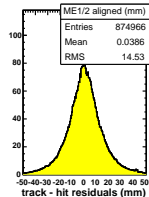
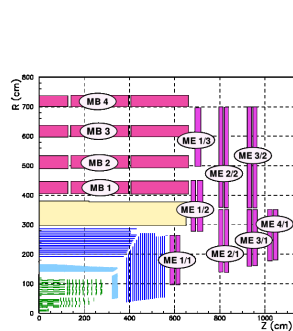
# Endcap aligned positions

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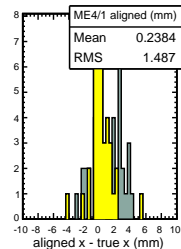
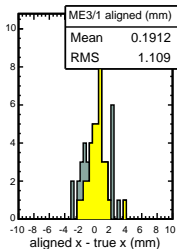
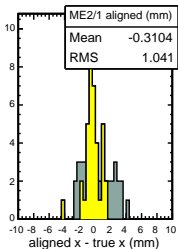
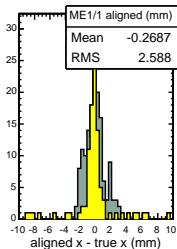
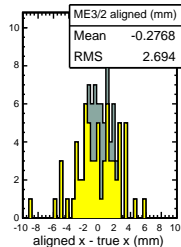
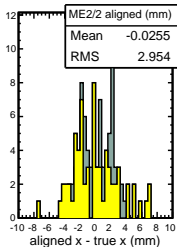
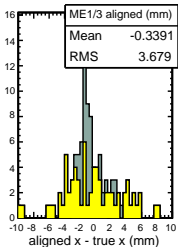
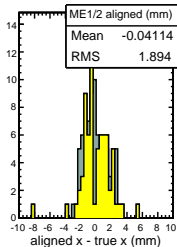


# Endcap track residuals

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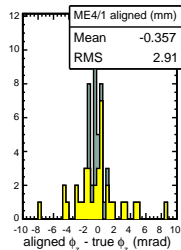
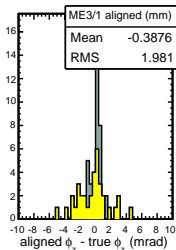
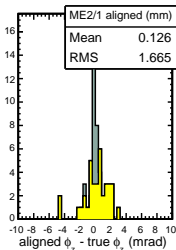
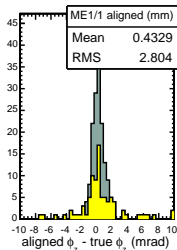
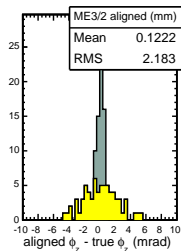
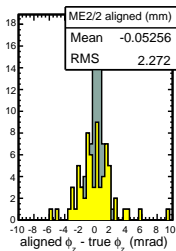
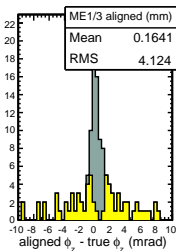
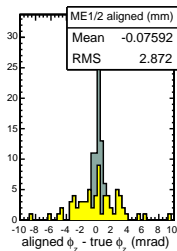




# Endcap positions: $\phi_z$

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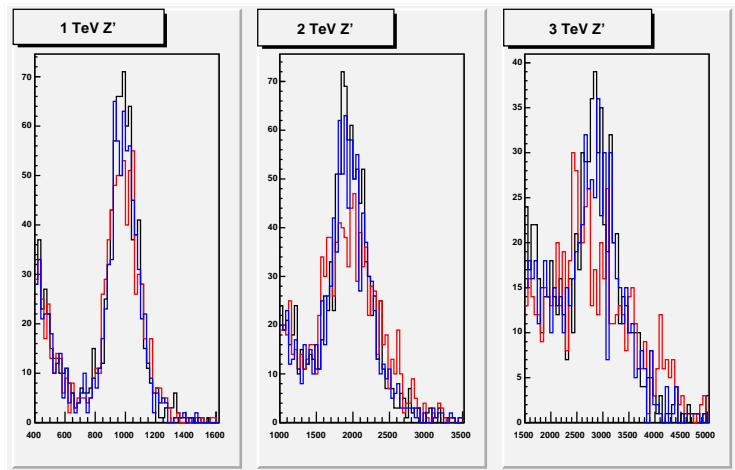
- ▶ We have a tool for selecting aligned chambers by hand: I would have selected MB1, ME1/1, ME1/2, ME2/1, ME2/2, ME3/1
- ▶ Discovered a bug in handling of angles, so we didn't use it

## Software to-do list

- ▶ Fix geometry-merging tool
- ▶ Implement selection: take only chambers with  $\text{stdev}/\sqrt{N} < 1 \text{ mm}$
- ▶ Make tracker  $\chi^2$  and DOF cuts formal (selection module)
- ▶ APE of hits is  $\sqrt{2}$  larger than what is applied in configuration file!
- ▶ Update monitoring plots in CVS



- ▶ initial constants
- ▶ HIP tracks-only alignment
- ▶ MillePede-survey in barrel, HIP in endcap



# Should we use it?

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Use MillePede-survey for the barrel, tracks-only for the endcap

- ▶ endcap alignment (especially inner ring) is better than barrel because of statistics
- ▶ if we only had  $1 \text{ pb}^{-1}$  of real data, we would rely heavily on survey information (Muon0invPbScenario = Muon1invPbScenario)

On the other hand...

- ▶ it means we worsen the resolution relative to  $0 \text{ pb}^{-1}$  scenario
- ▶ the MillePede-survey result is effectively a scenario like the  $0 \text{ pb}^{-1}$  scenario, but with updated constants

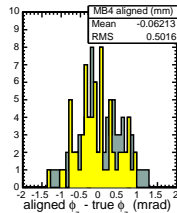
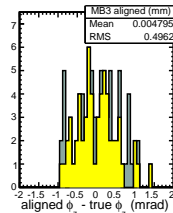
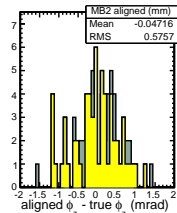
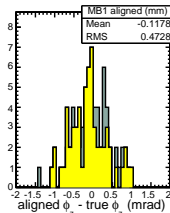
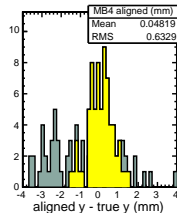
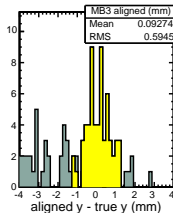
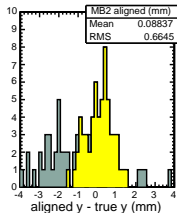
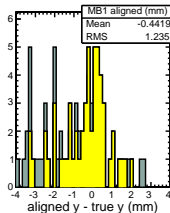
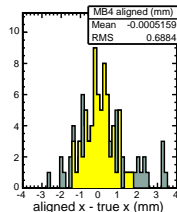
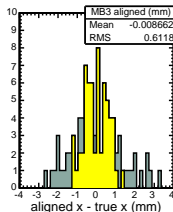
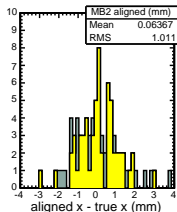
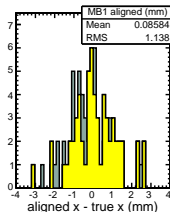
## Conclusions

Nevertheless, a very useful exercise, and we'll be using these event samples for more detector studies!

# MillePede-survey: $x$ , $y$ , $\phi_z$

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# MillePede-survey residuals

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