Weak-Mode Studies 2012 Update

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DESY

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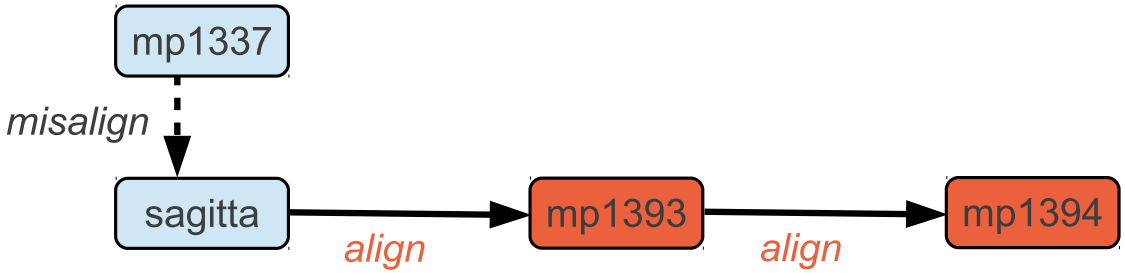
Motivation & Introduction

- Minimisation of residuals can be insensitive to certain global distortions ('weak modes')
- Study sensitivity of 2012 alignment to some systematic distortions ('misalignment scenarios') defined in TRK-11-002
  - Start from an output geometry of the 2012 alignment effort
  - Distort geometry according to misalignment scenario
  - Run alignment fit and check whether misalignment is still present or whether it can be mitigated

Here: follow-up to presentation in last CMS tracker-alignment meeting

Sagitta Misalignment



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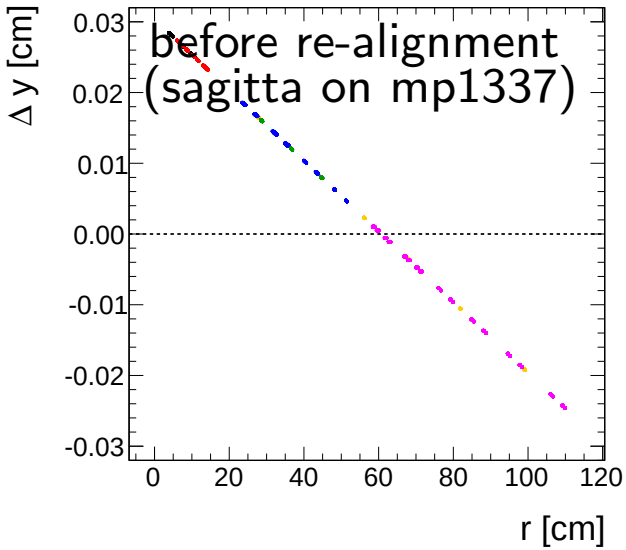
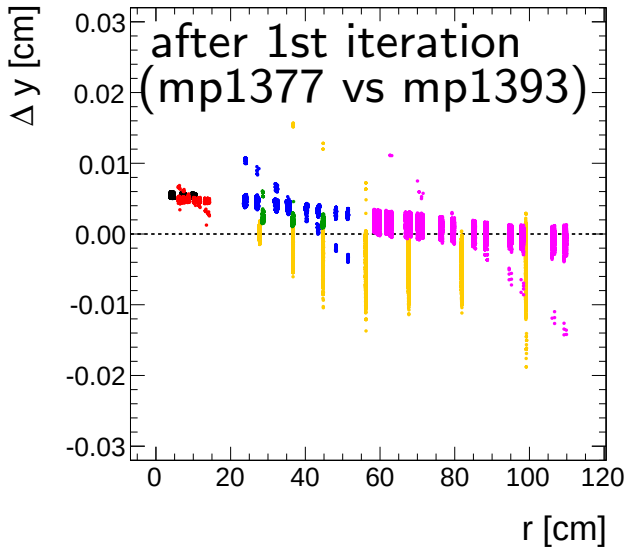
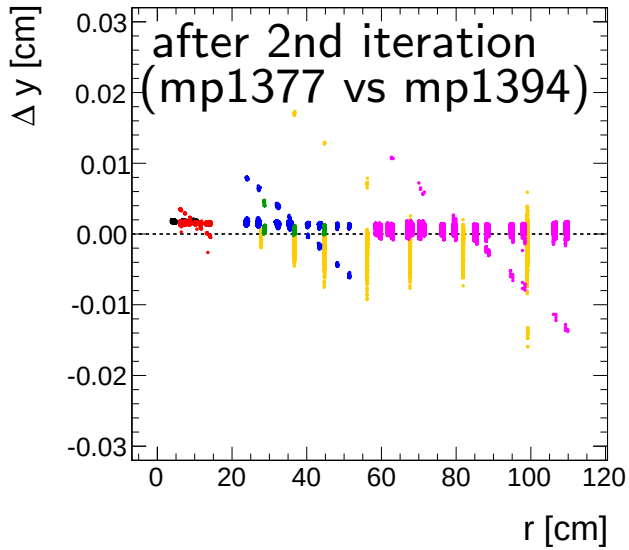
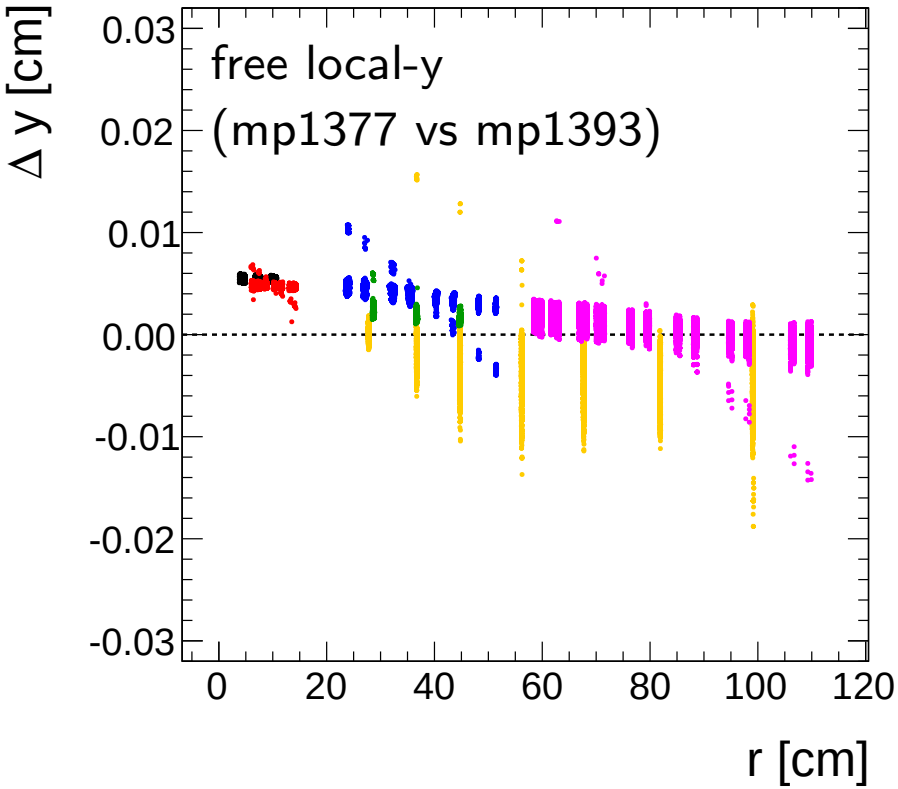


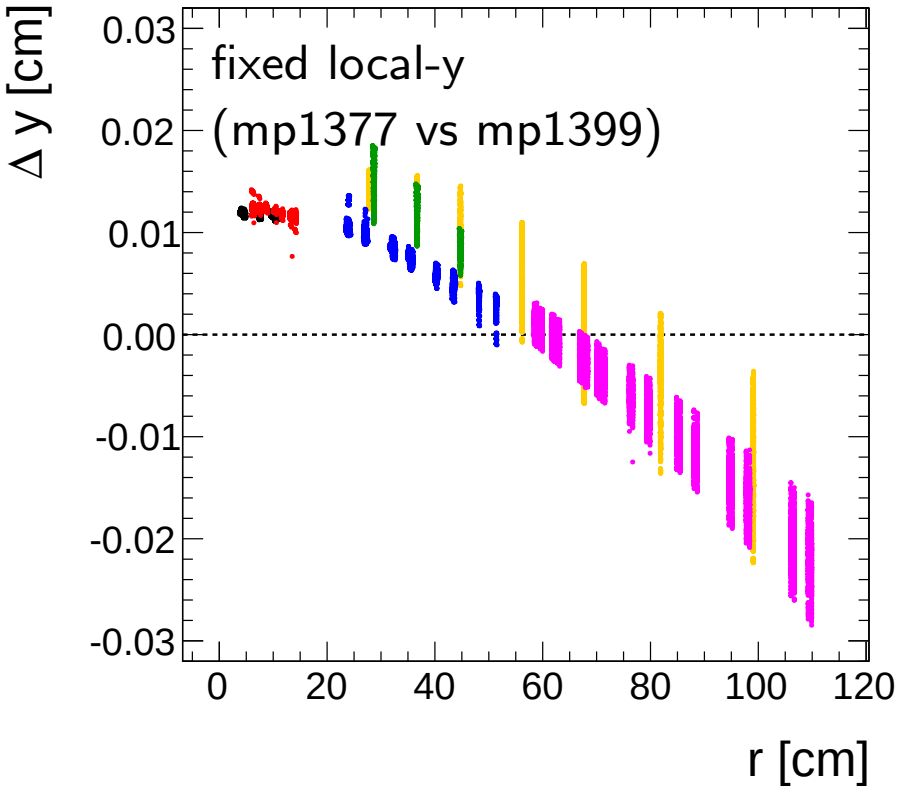




- Good recovery after second iteration in most modules
  - Better than for 2011 study, possibly due to free local-y in TID/TEC
- Some modules not moved by alignment
  - Dead or not traversed by enough tracks
  - Blind to certain movements

Fixed Local-Y Parameters in TID and TEC

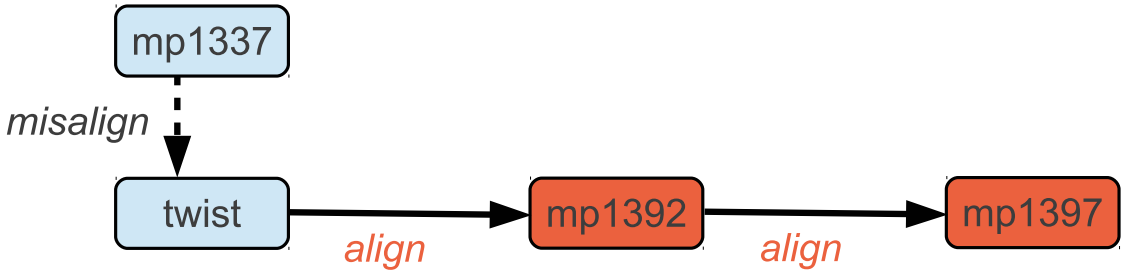




- Fixed local-y in TID and TEC: similar performance as in 2011 study

Aligning the local-y parameters in TID and TEC improves robustness against sagitta misalignment

Twist Misalignment: Summary



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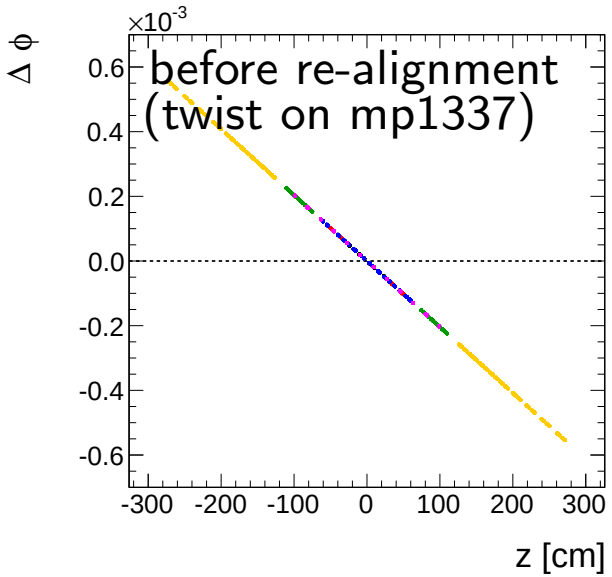
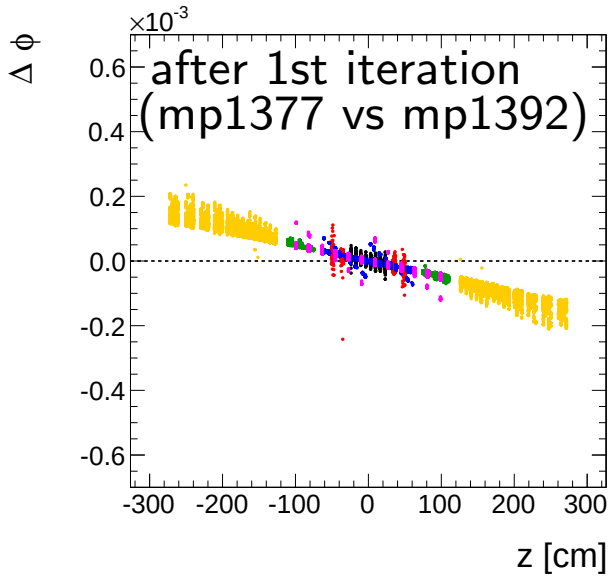
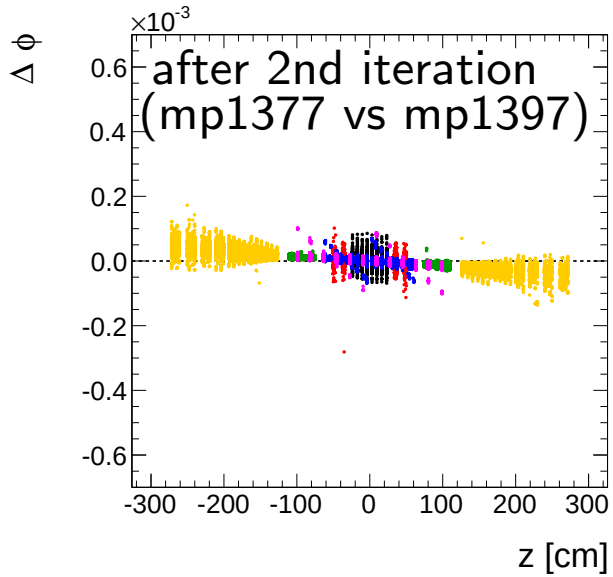
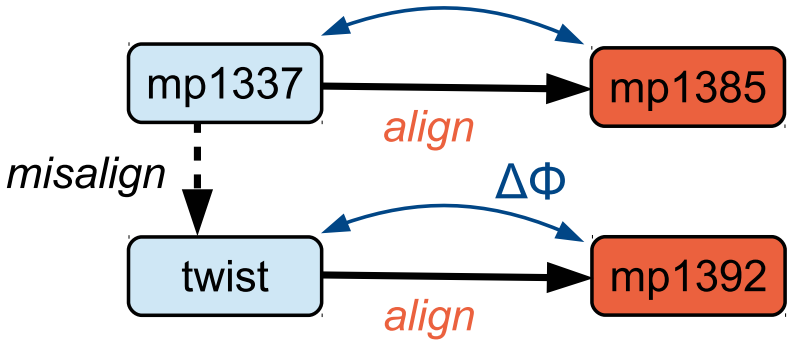






- Good recovery after second iteration in most modules
  - Similar performance as in 2011 study
- Increased spread of pixel modules after second iteration
  - Possibly due to non-convergence of mp1337 in the first place

Control Path: Iteration of Non-Misaligned Geometry



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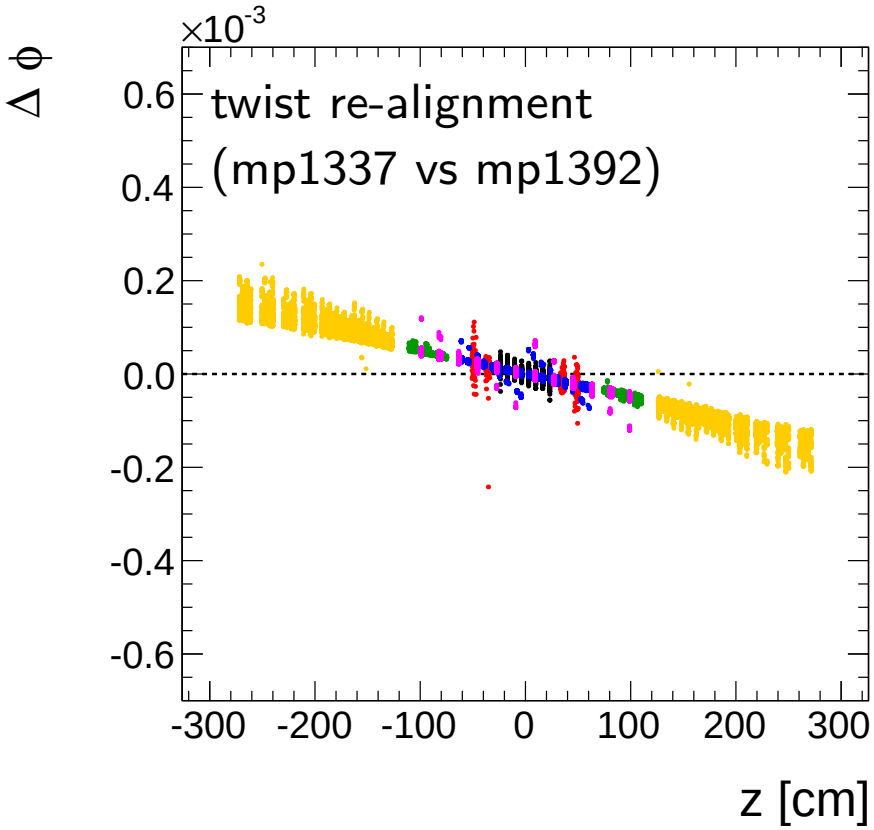
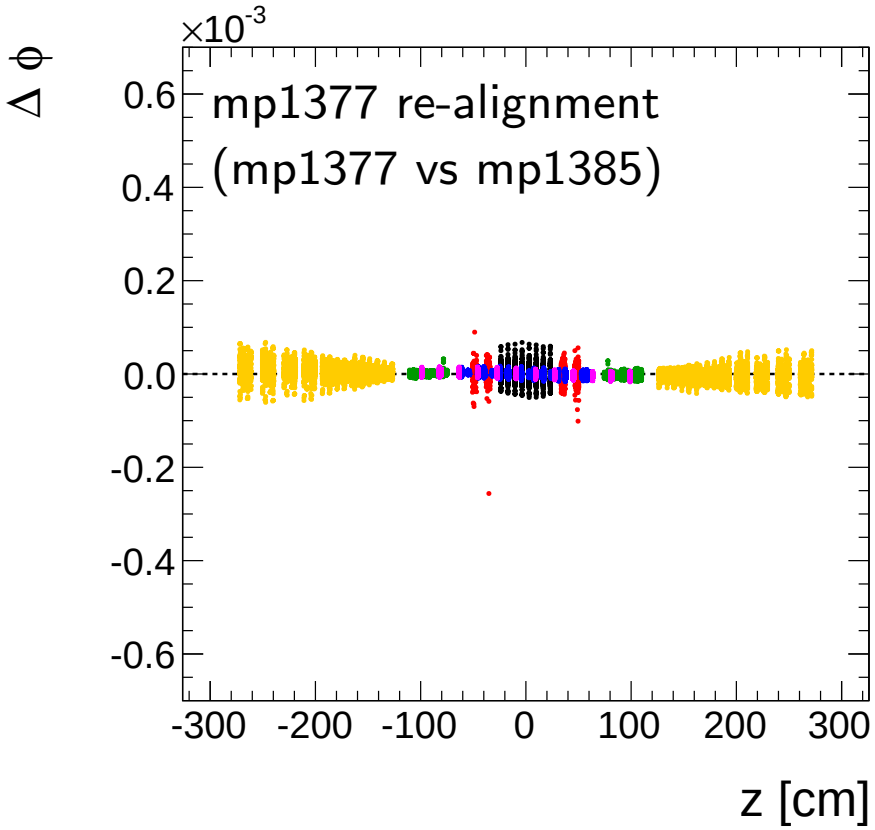
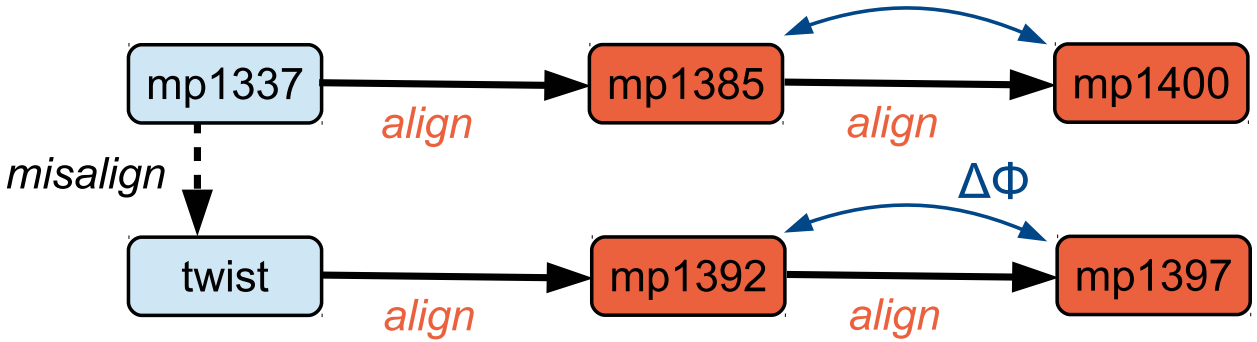




Control Path: 2nd Iteration of Non-Misaligned Geometry



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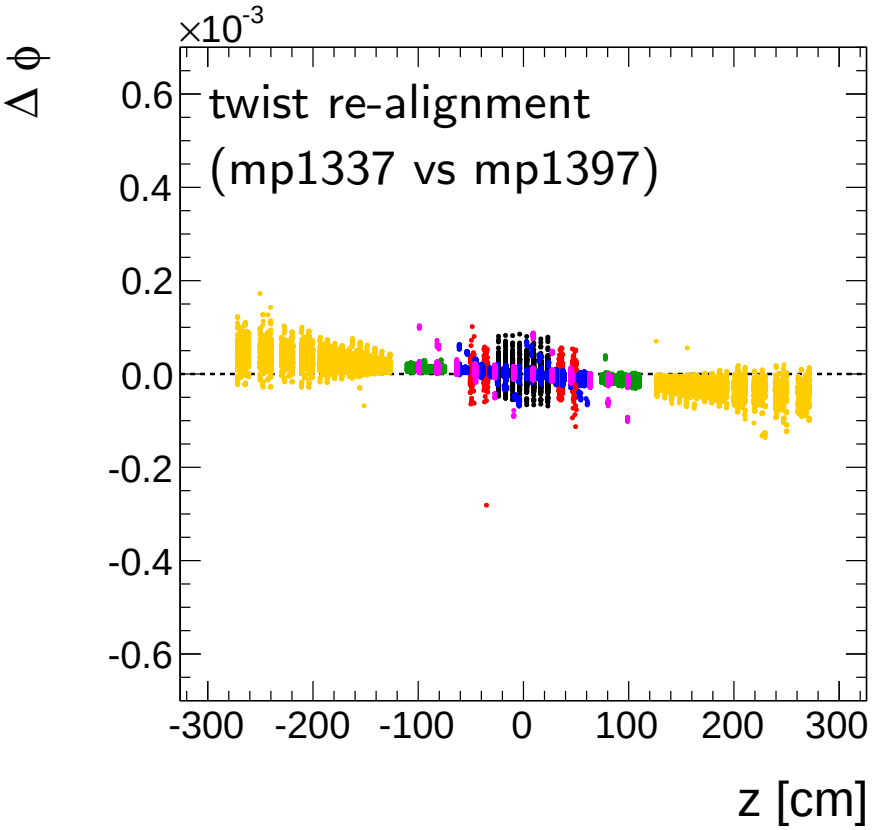
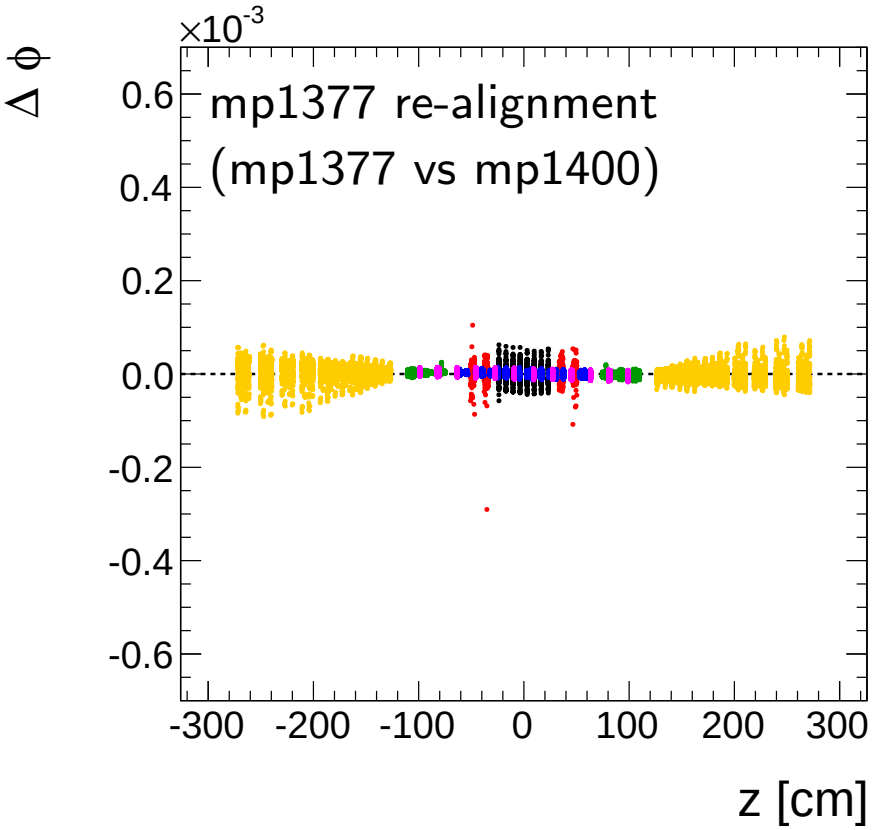
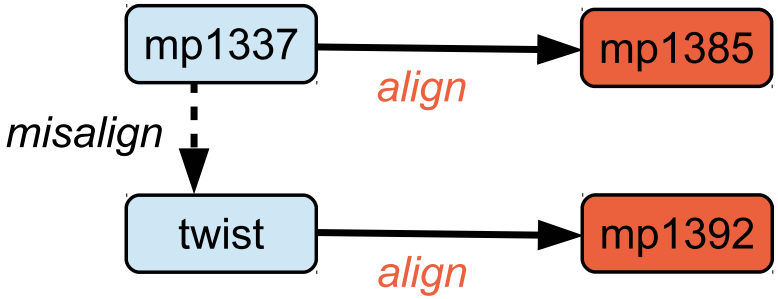




Twist: Comparison to Iterated Starting Geometry



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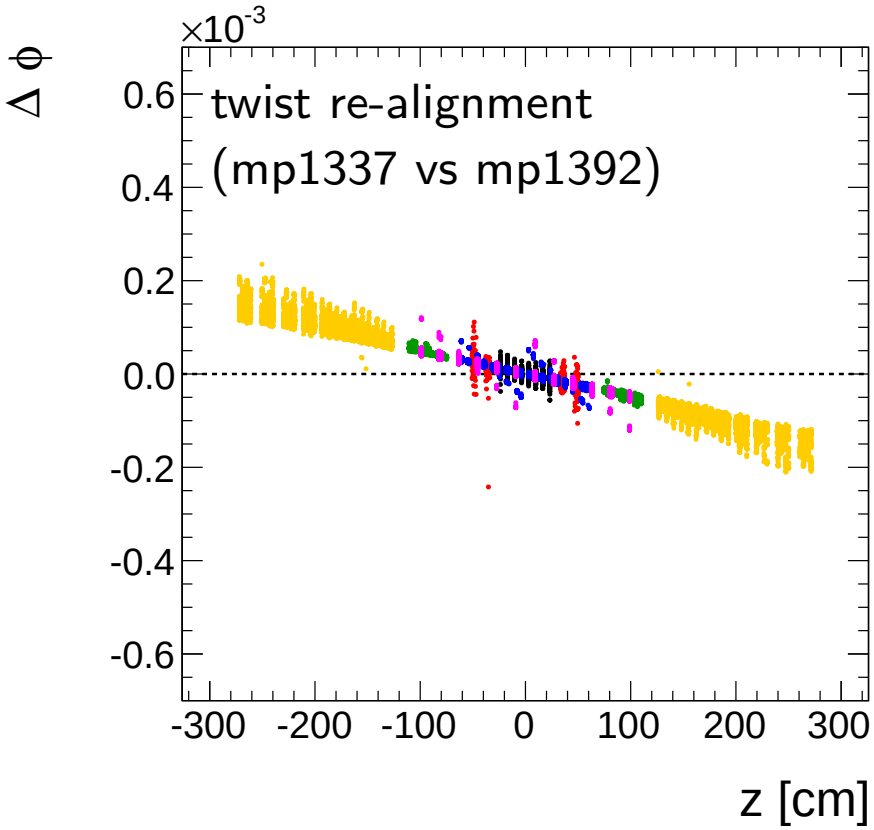

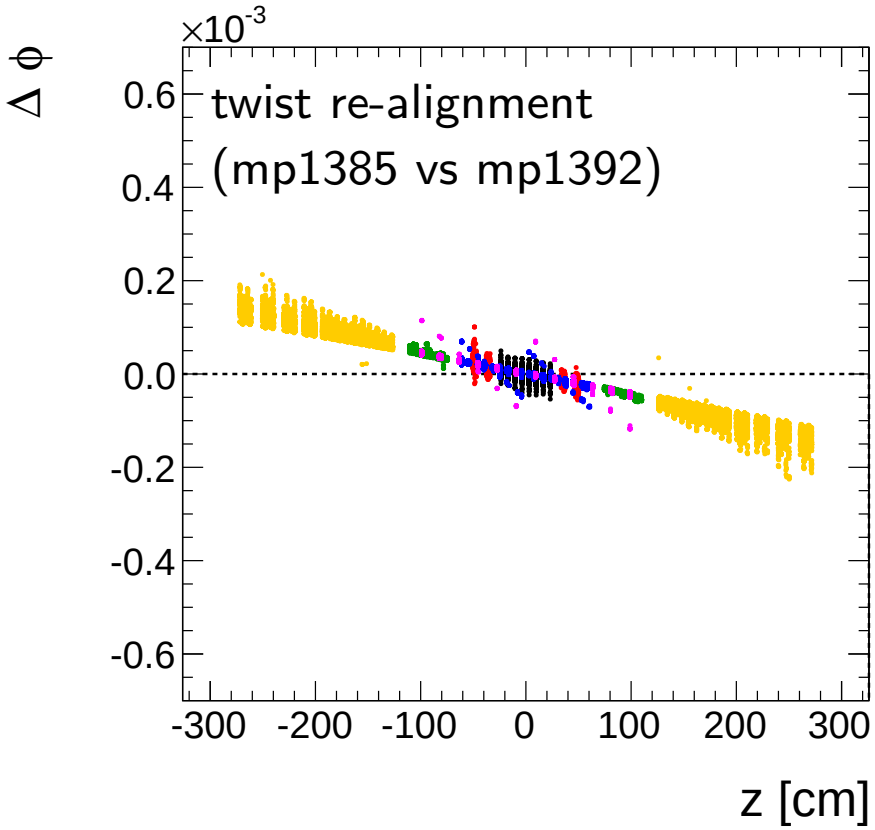

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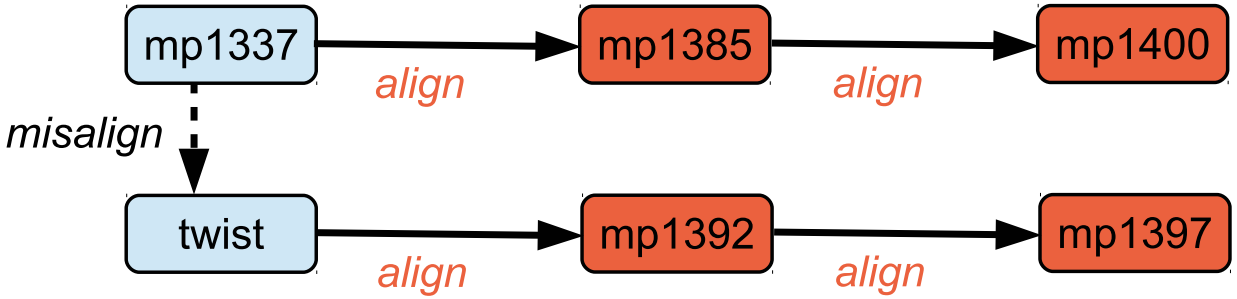

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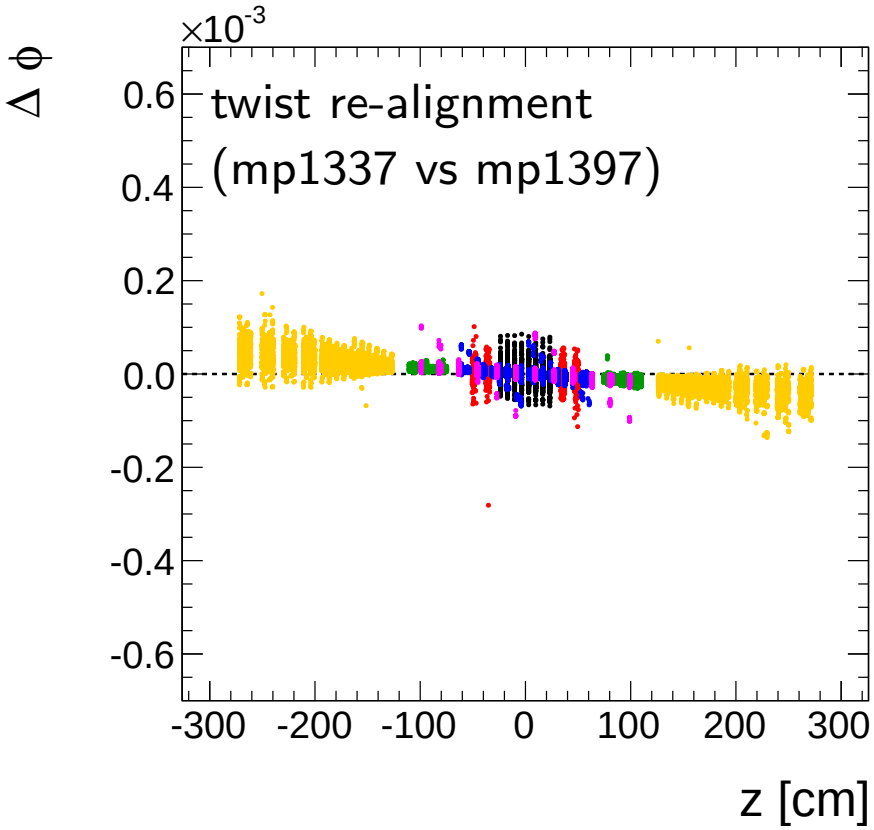
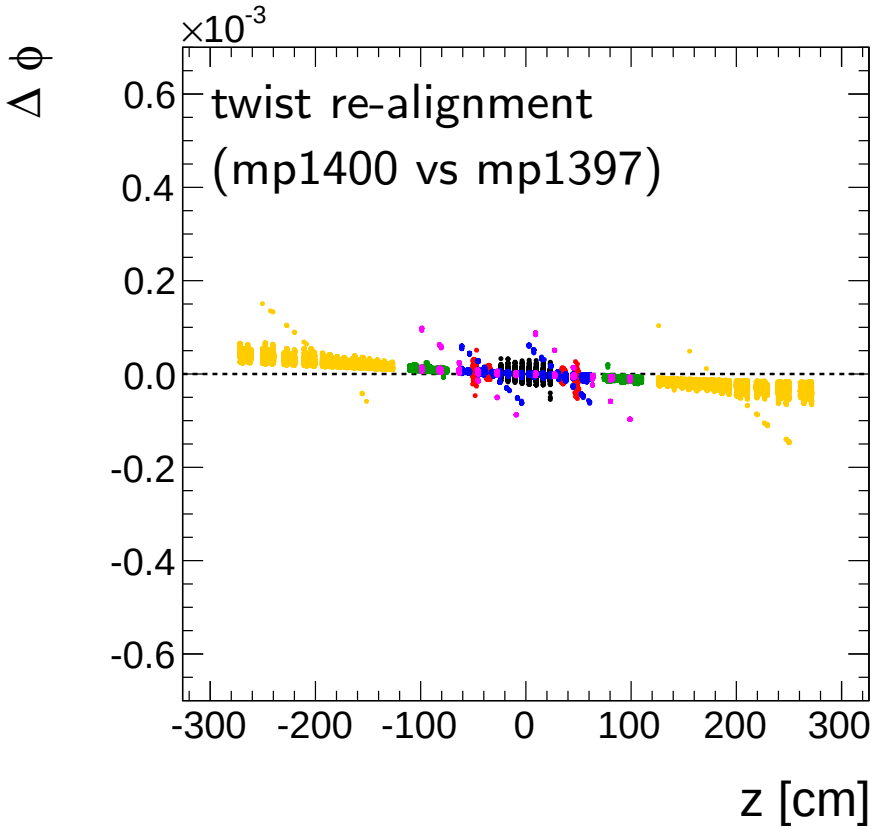
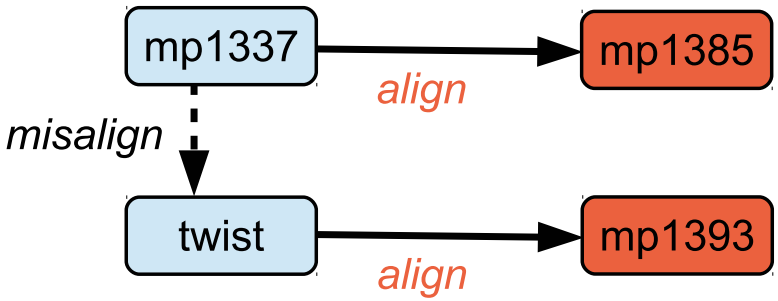




Sagitta: Comparison to Iterated Starting Geometry



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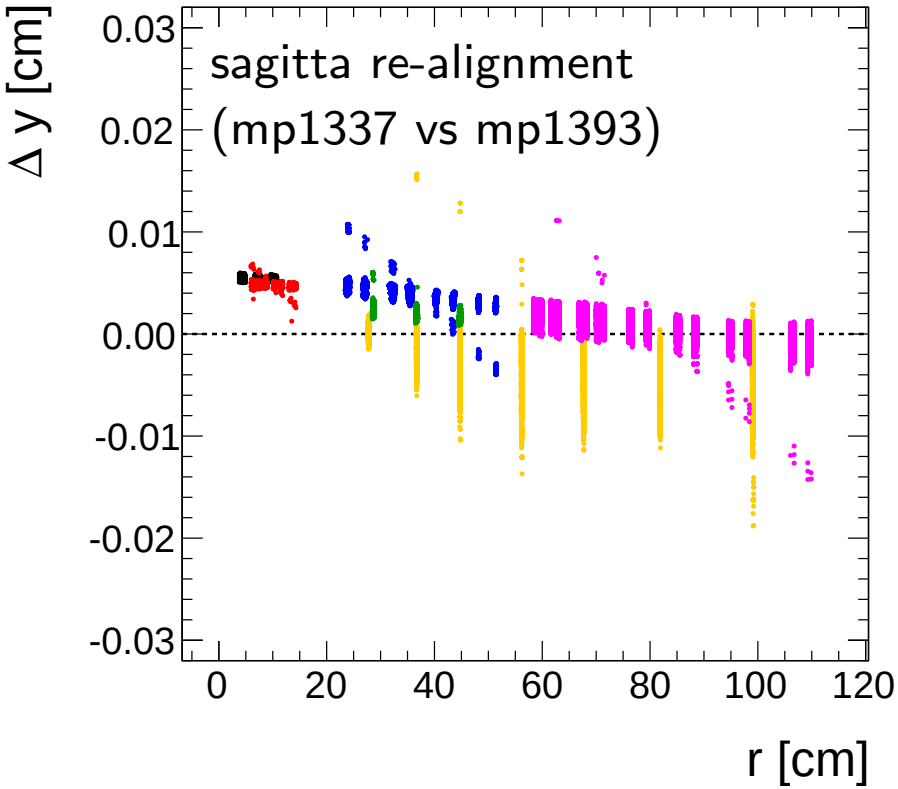

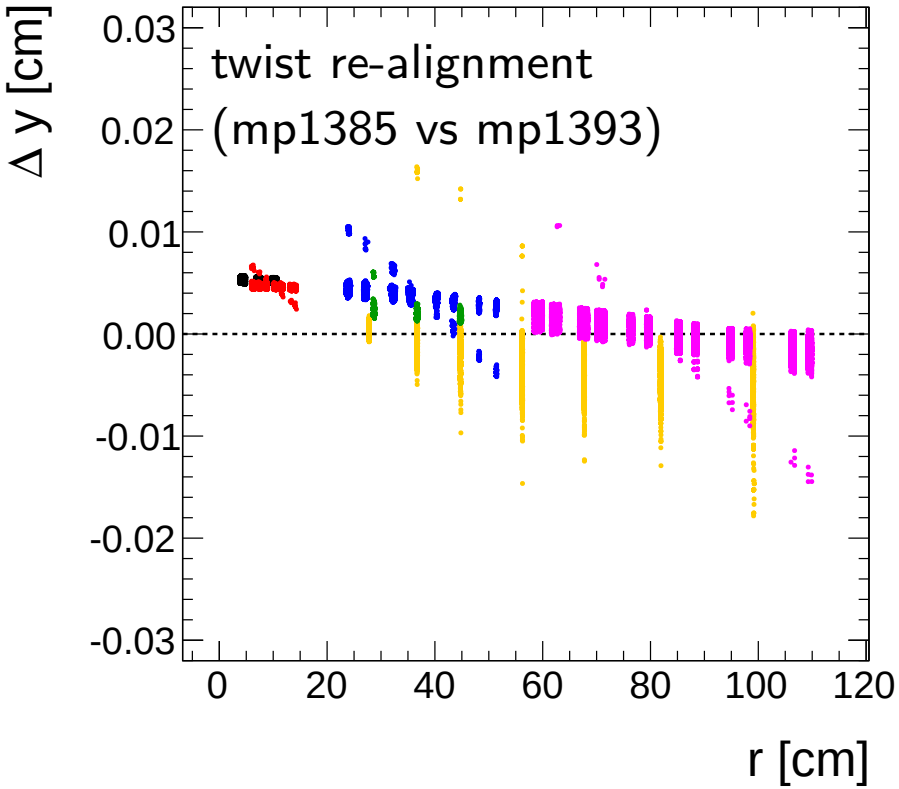

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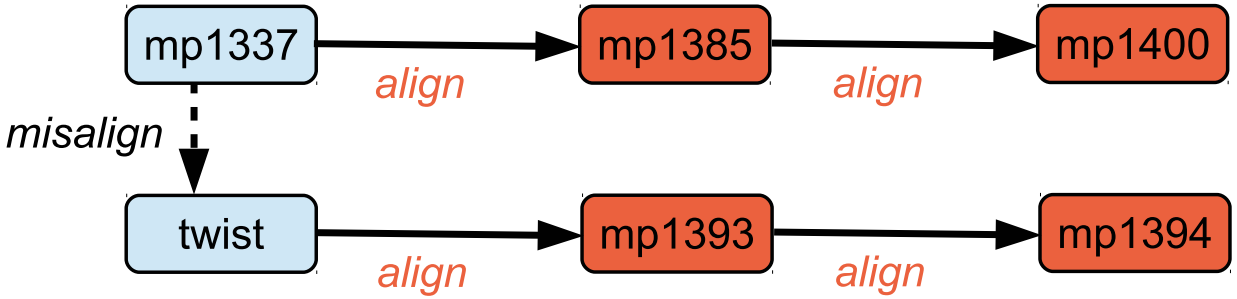

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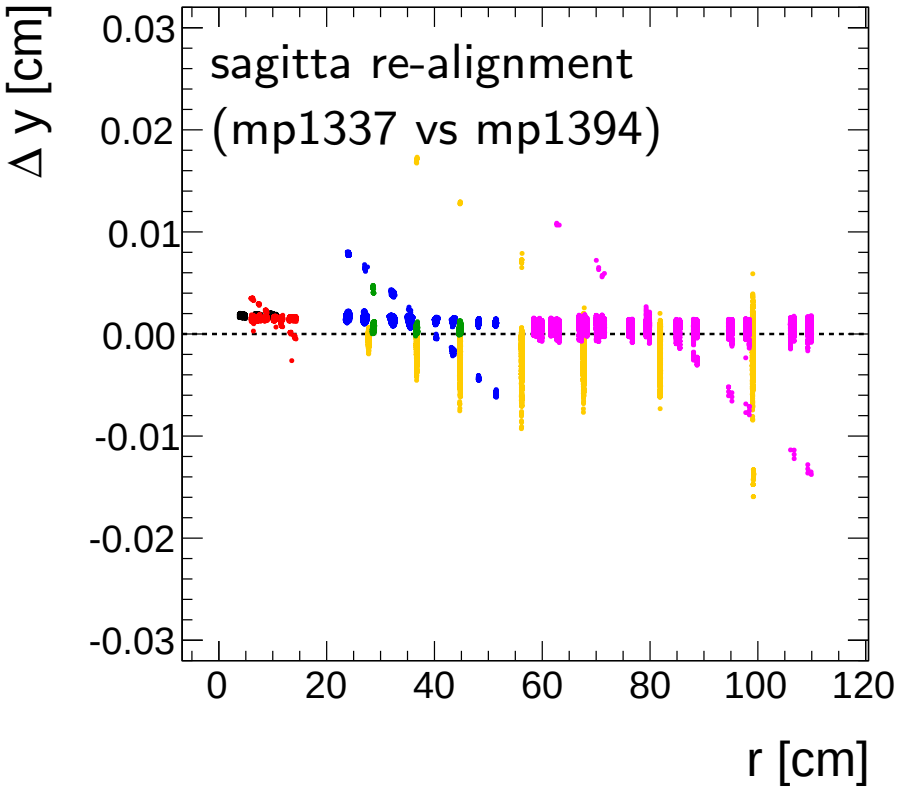

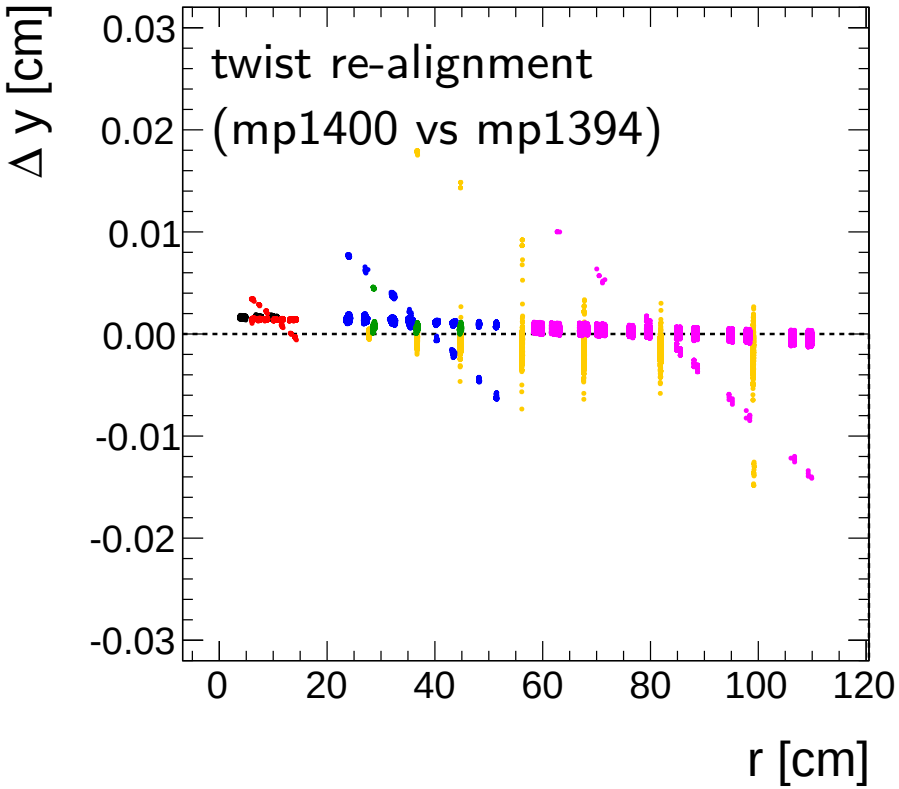

Summary & Conclusions

- Presented follow-up to first weak-mode studies with 2012 data
- Better sensitivity to sagitta misalignment compared to 2011 study
  - To large parts due to free local-y parameter of TID and TEC modules in 2012
- Increasing spread of pixel-module $\Delta\phi$ when re-aligning the twist misaligned geometry
  - Due to non-convergence of starting geometry mp1337
  - For future studies, better iterate mp1337 a few times

Additional Material

Setup & Starting Alignment

- `MPproduction/CMSSW_5_3_7_patch1_nbartosi`
  - Includes some private additions related to the LA calibration
- Global tag `FT_R_53_V21::ALL`
- Start from 2012 alignment `mp1337`
  - Not the one used for the 2012 rereco
  - But 'full' alignment produced by Nazar Bartosik
    - ★ Data from all 2012
    - ★ Including pixel LA calibration
    - ★ Local y of TID and TEC free (in difference to study with 2011 data)