Updates in CSC Alignment

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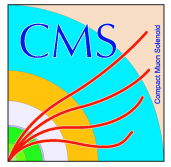
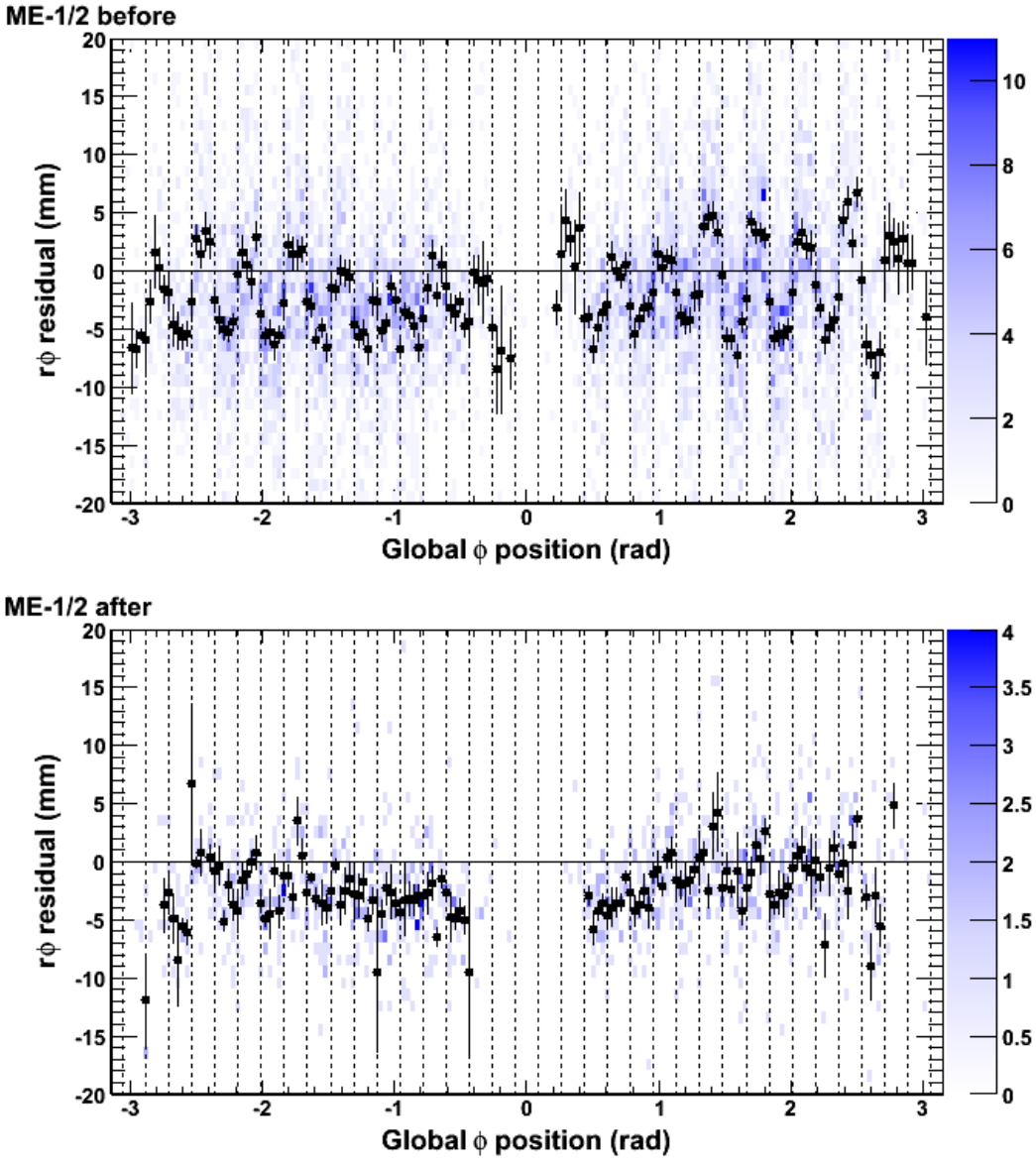
Outline



- Alternation feature: finally found what toggles it, but not what causes it
- CRAFT-2009 endcap alignment (with tracks!)
- October exercises: (1) spreading the expertise
  (2) preparing for beam-halo

Alternation feature

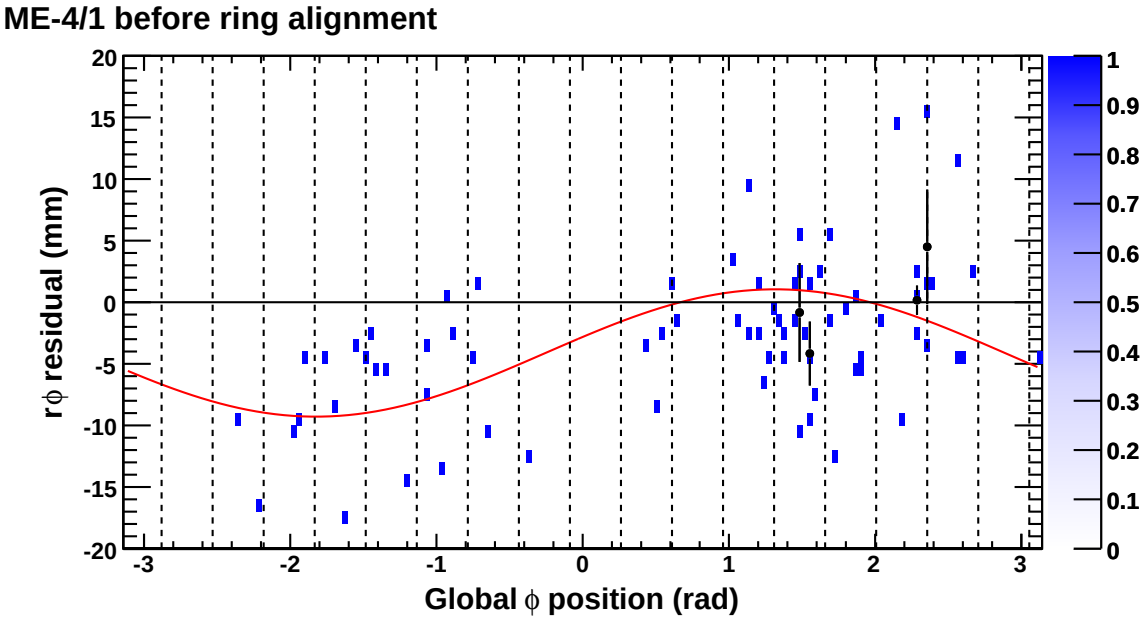


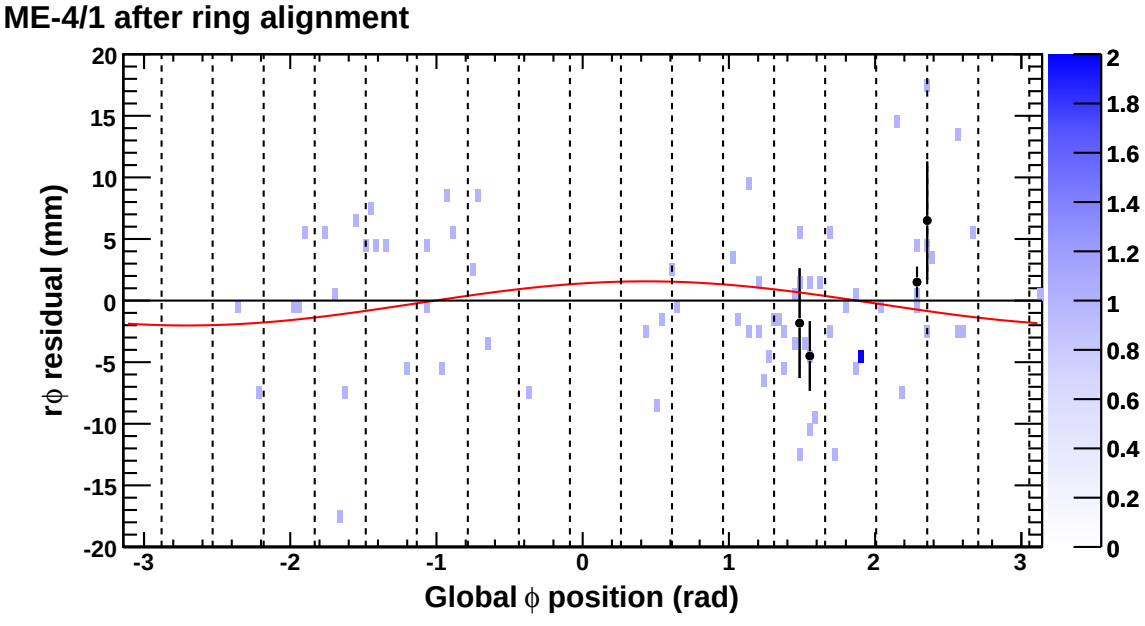
- Non-physical alternation of residuals from one chamber to the next stood in the way of alignment
- $p_T > 40$ GeV cut $\rightarrow$ $p_T > 100$ GeV suppresses the effect
- Not observed in RecHits (overlaps)
- Unclear what the effect is (not $\vec{B}(\vec{x})$)
- But it is now possible to perform alignment

CRAFT-2009 alignment

- Two-step procedure:
  1. Z and local ϕ_x from link and endcap hardware alignment
  2. global X, Y, ϕ_Z of rings from tracks (combined into fits vs. ϕ)
- Tracks are very sensitive to (2) and 2009 data is sufficiently uniform in ϕ for robust alignment
- Not enough tracks to individually align chambers
  - tested machinery and it works, but so few chambers can be aligned that it doesn't make much difference
- Status:
  - SQLite from (1) should be delivered today, tested signs ($\pm$)
  - also waiting for tracker alignment update to start (2)
- Preliminary results follow (16 pages), final results will be similar

Ring fits: ME−4/1





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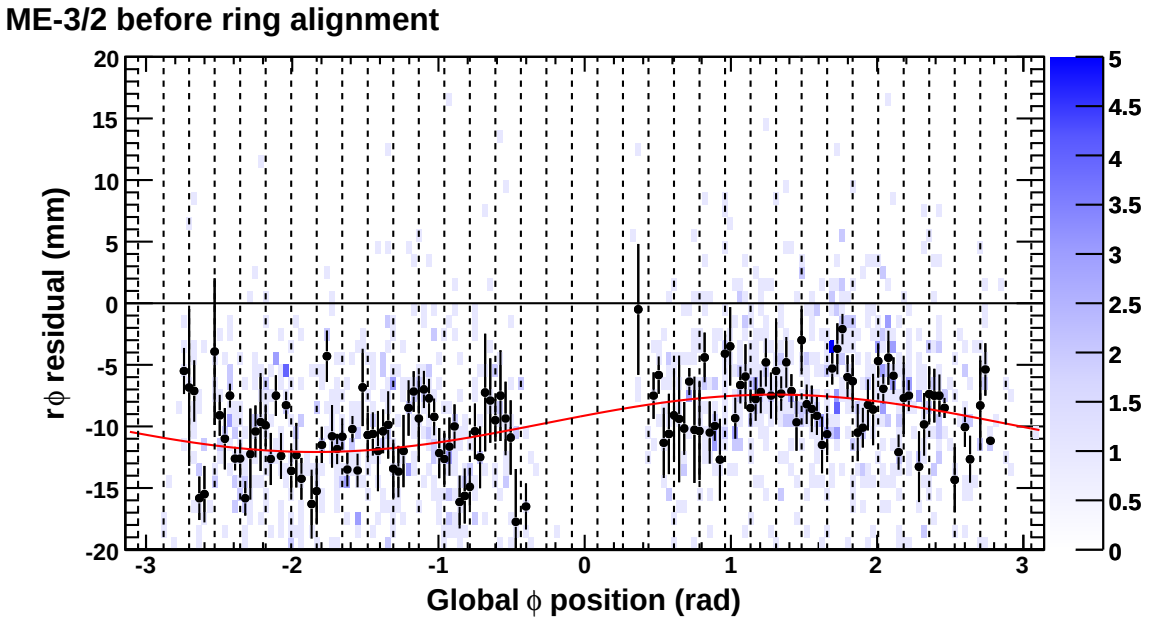
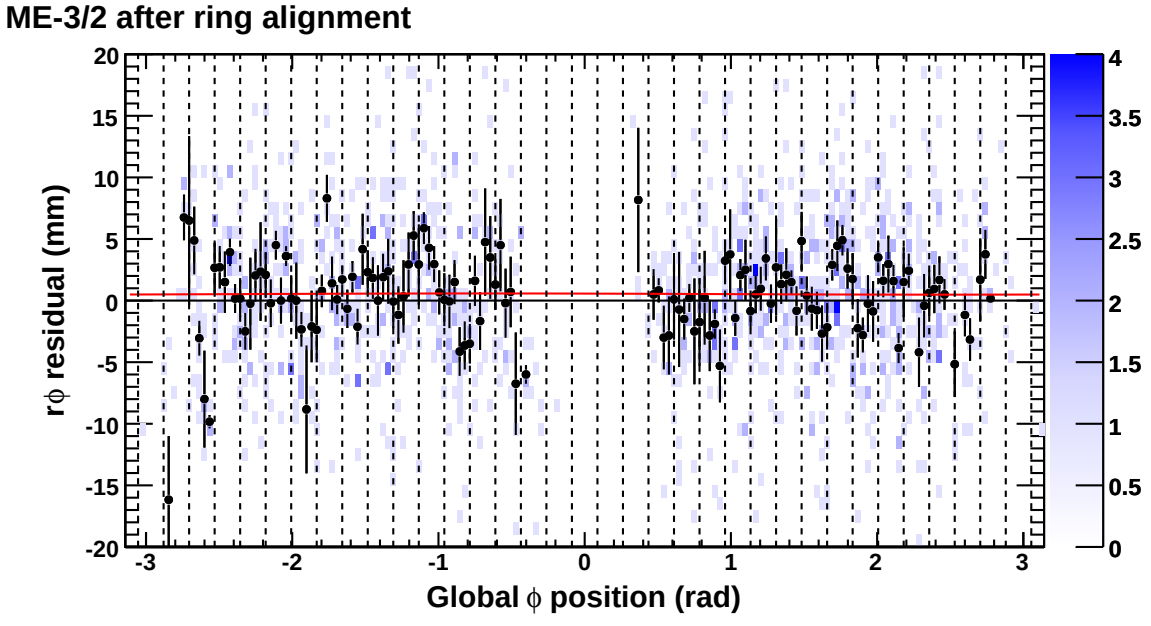
Ring fits: ME−3/2





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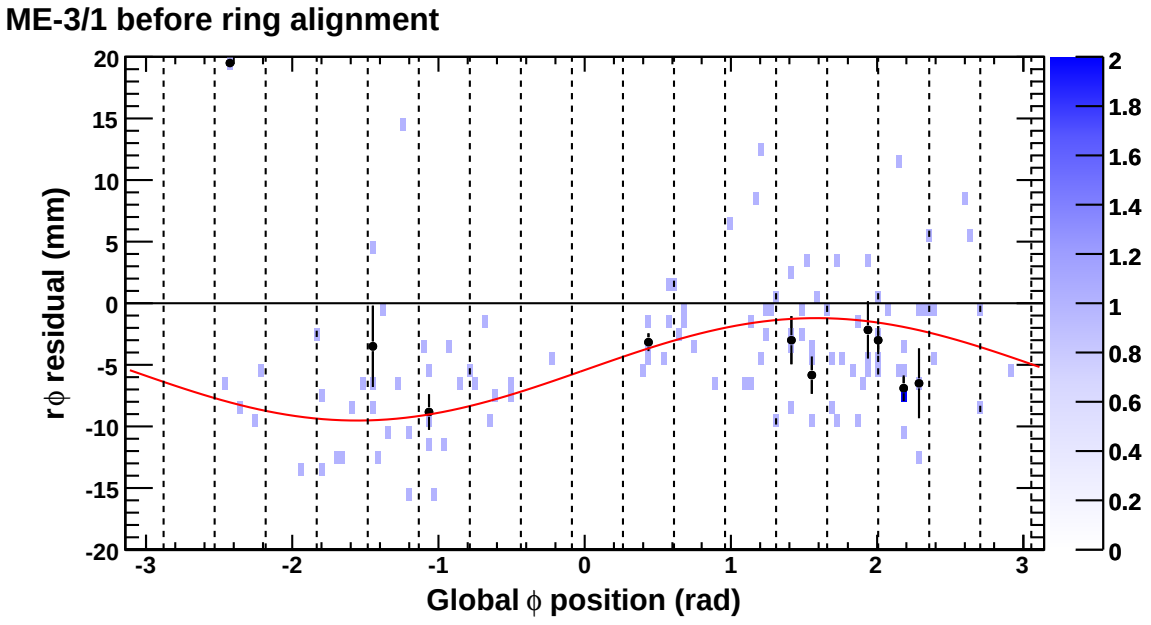

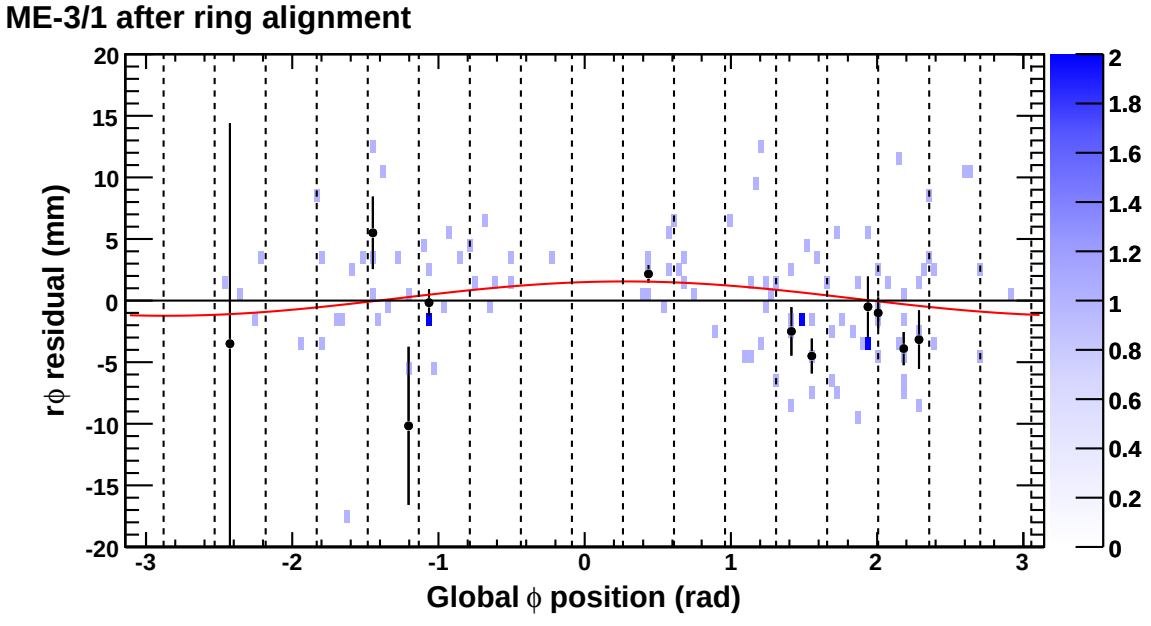

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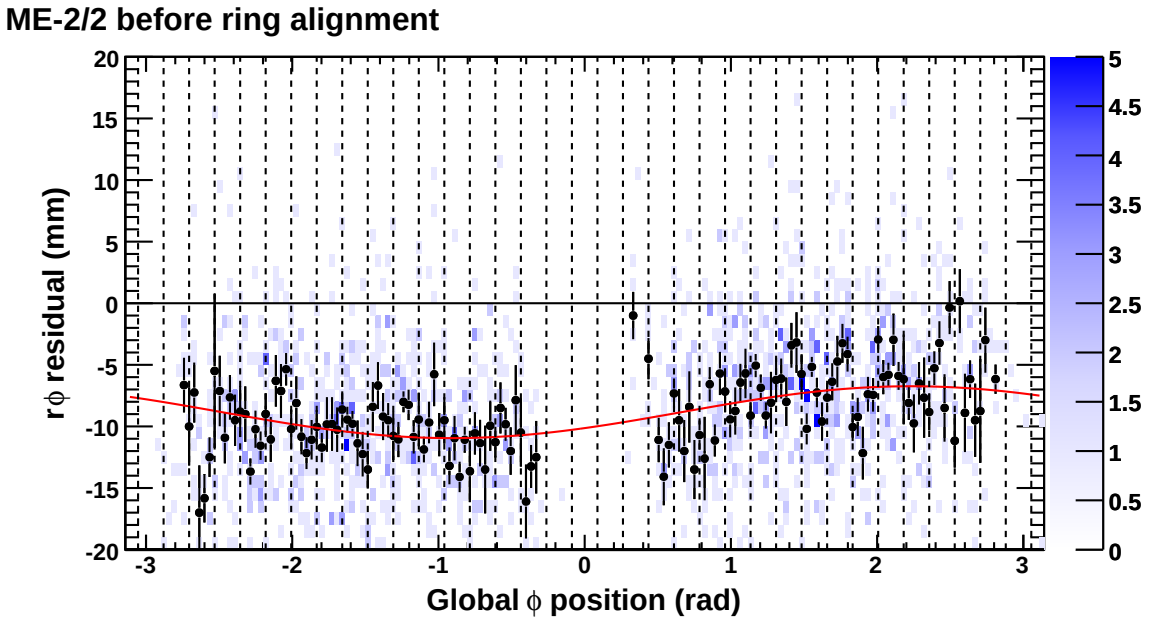
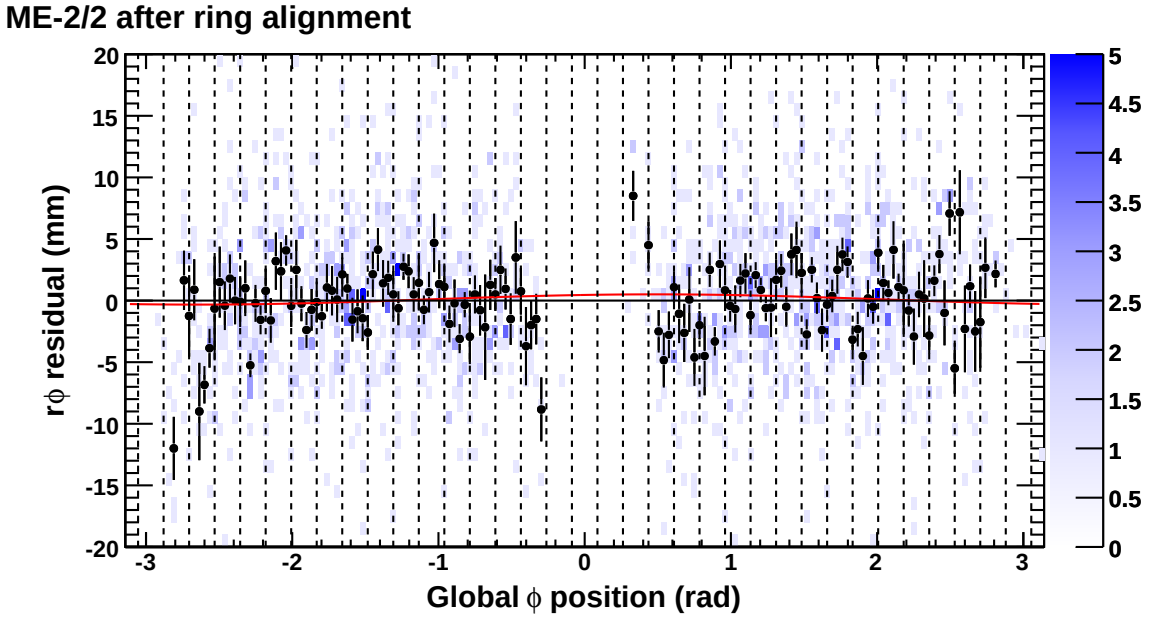
Ring fits: ME−2/2





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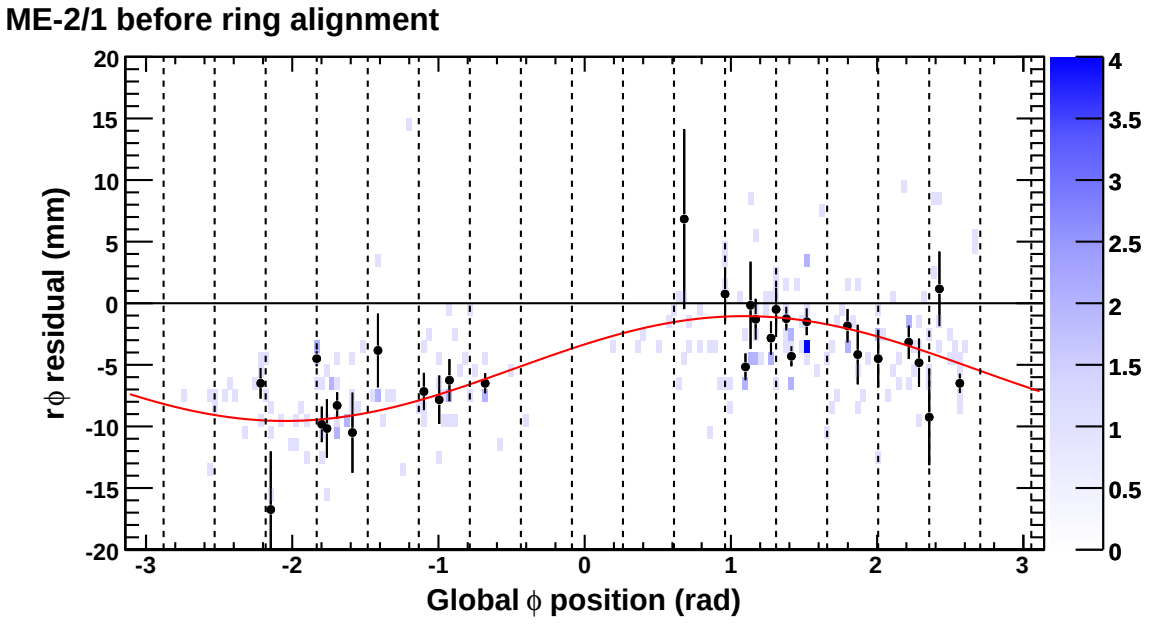

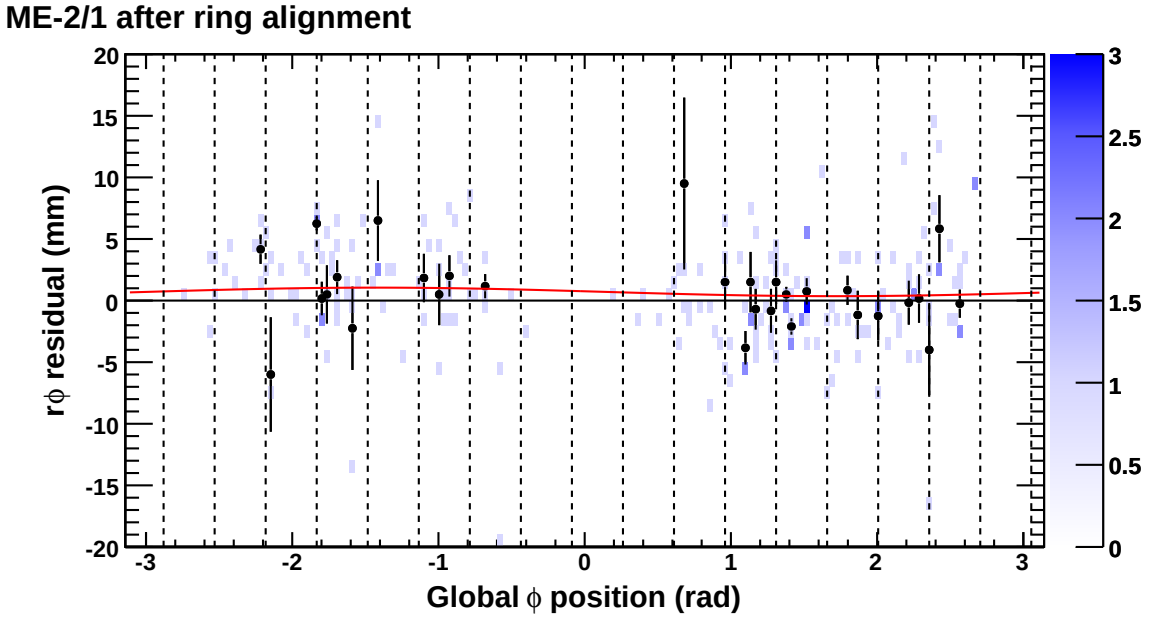

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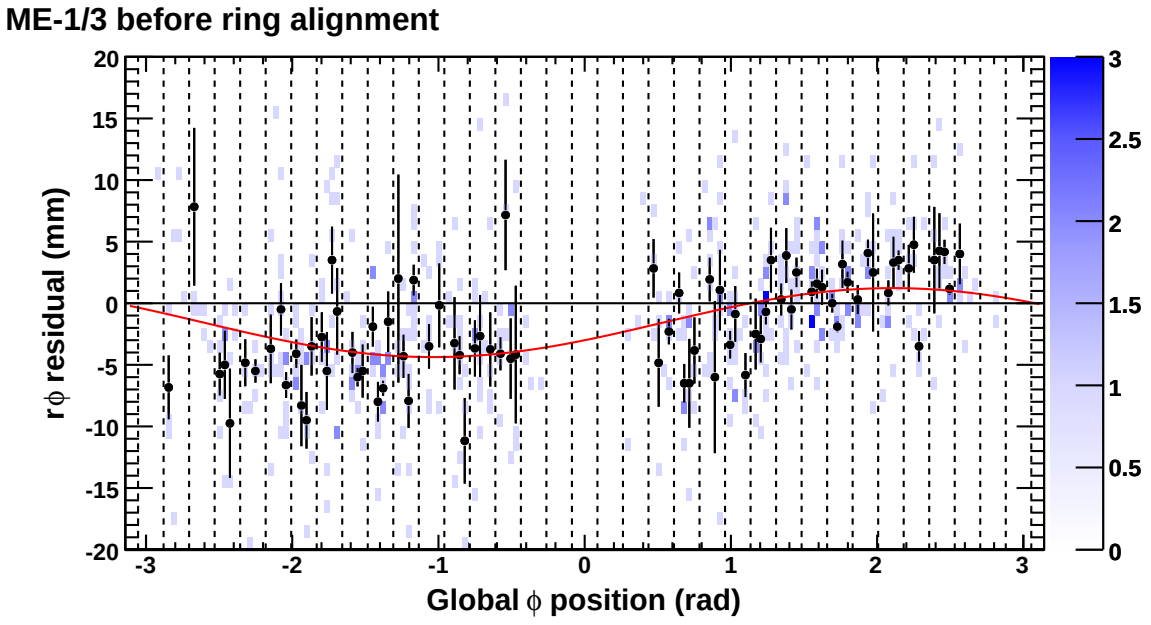
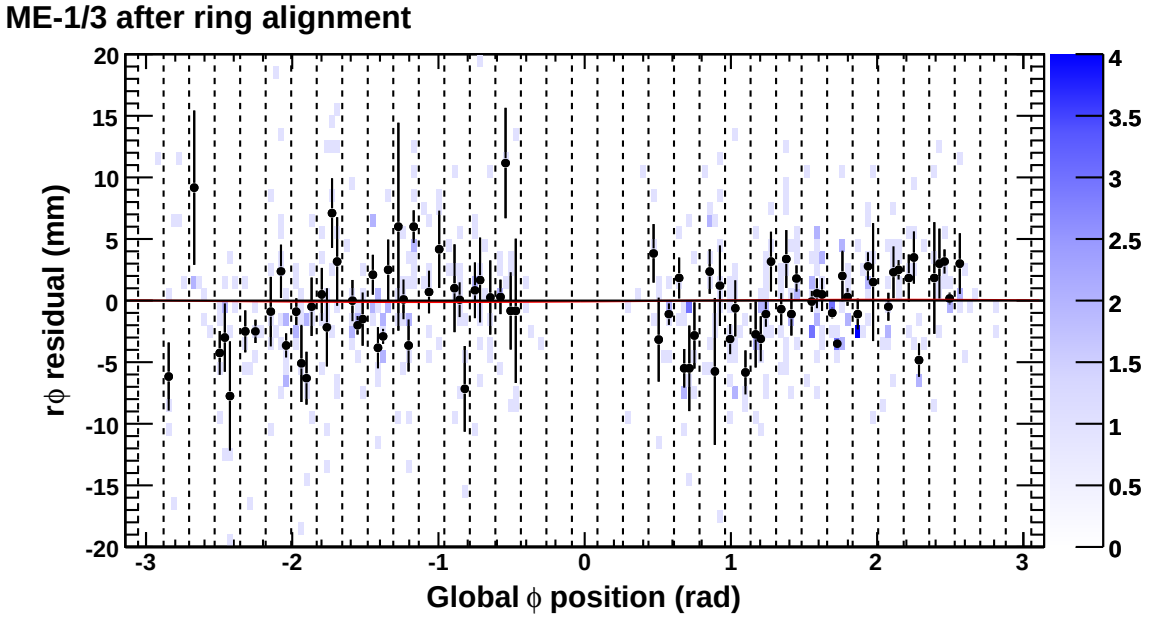
Ring fits: ME−1/3





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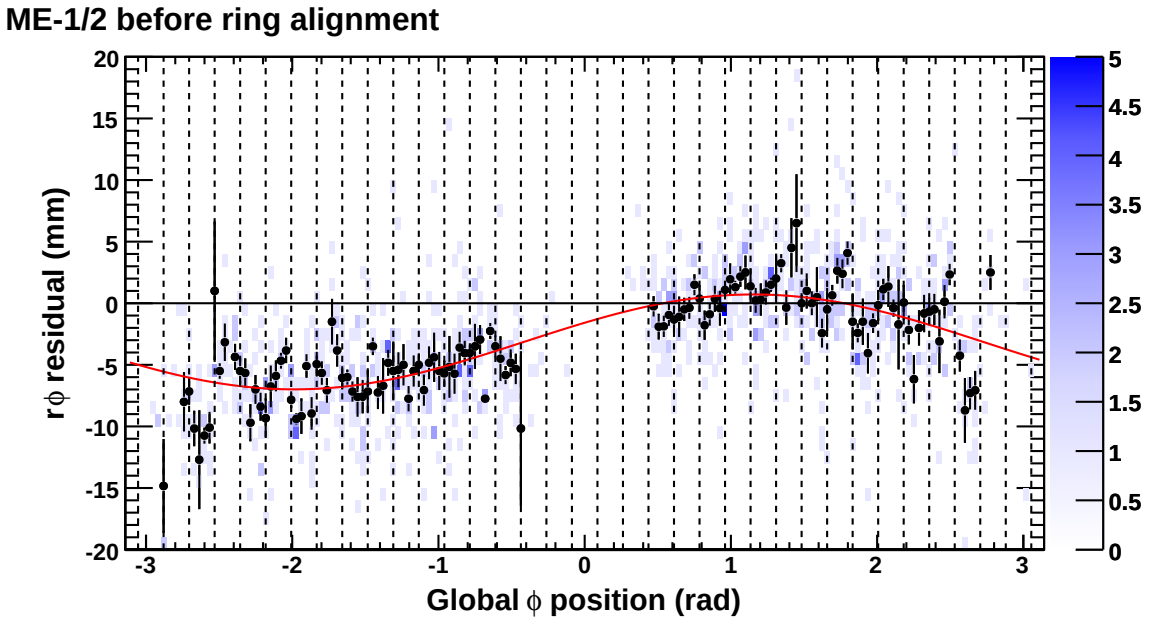
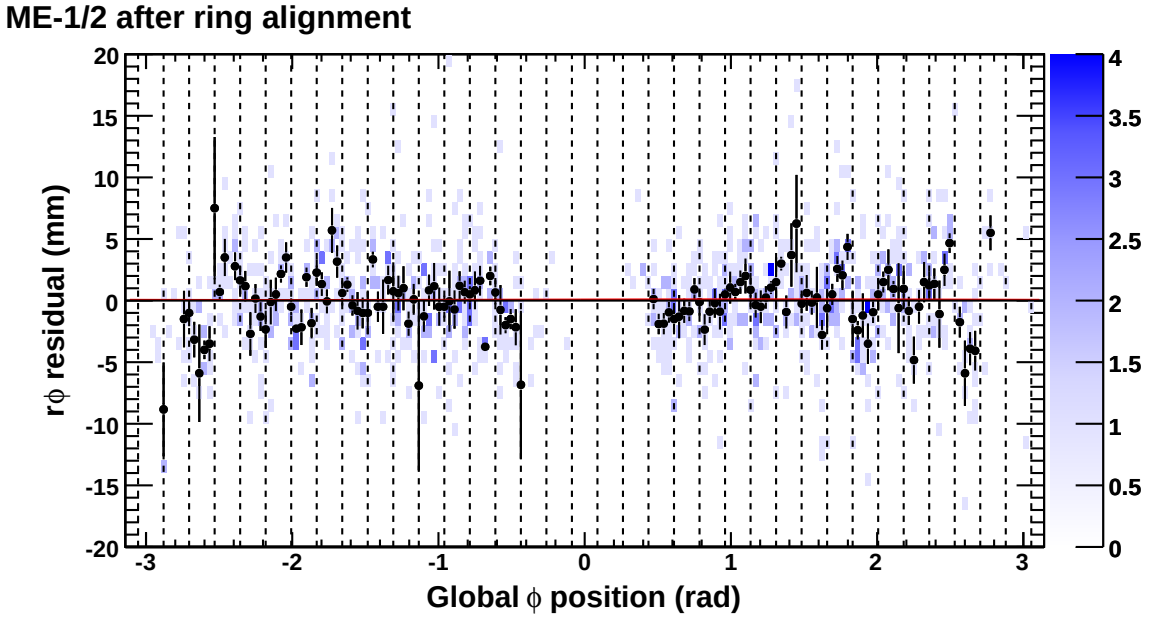
Ring fits: ME−1/2





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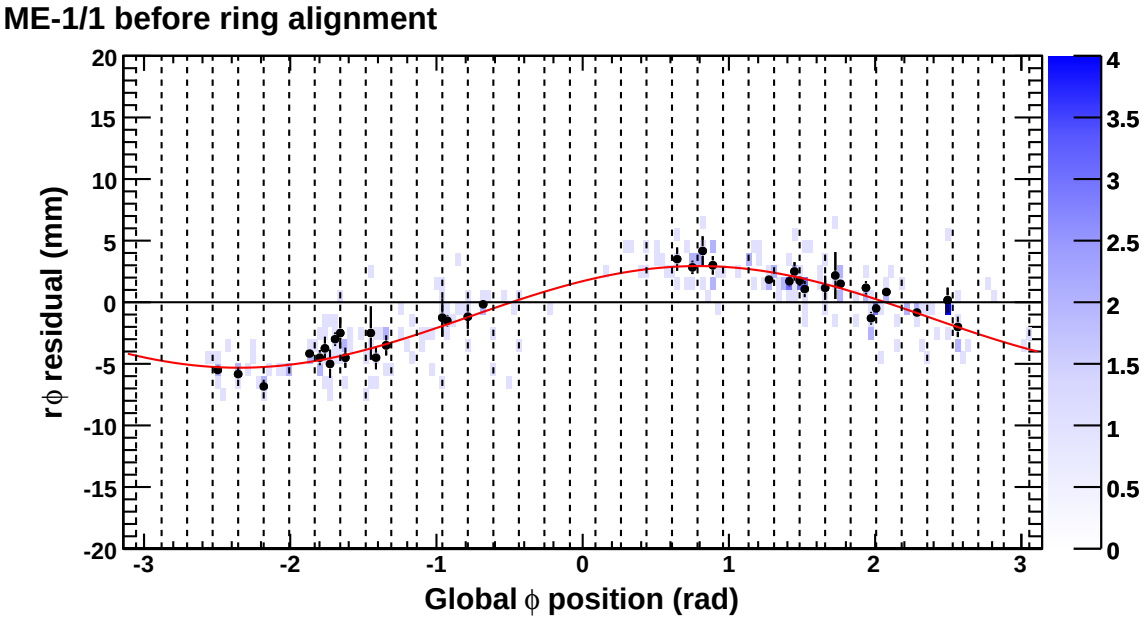

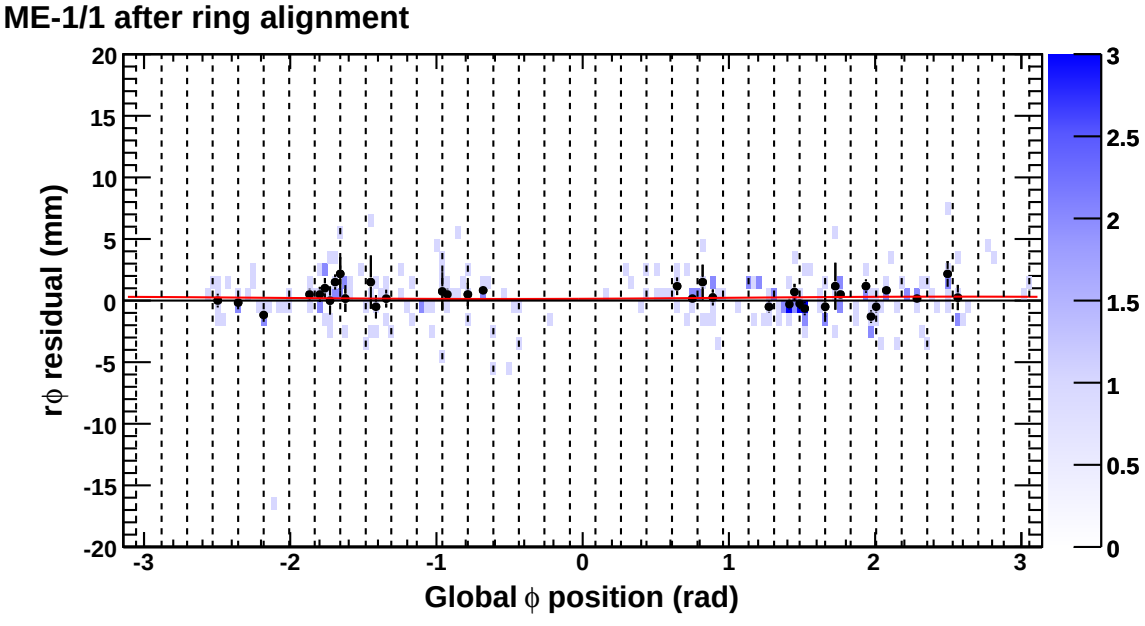

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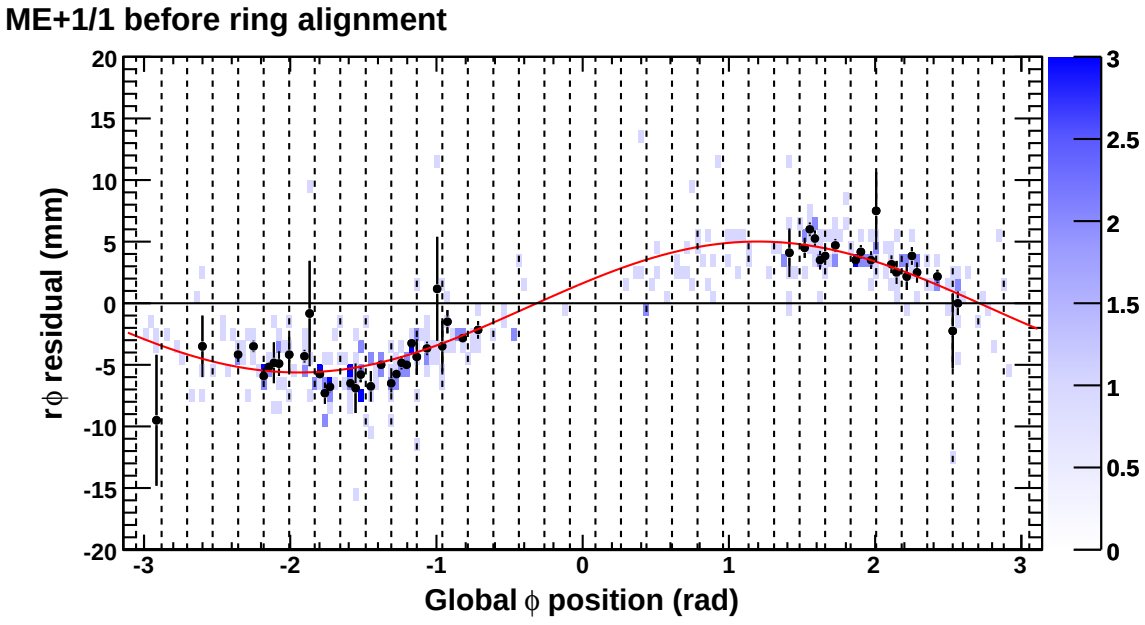
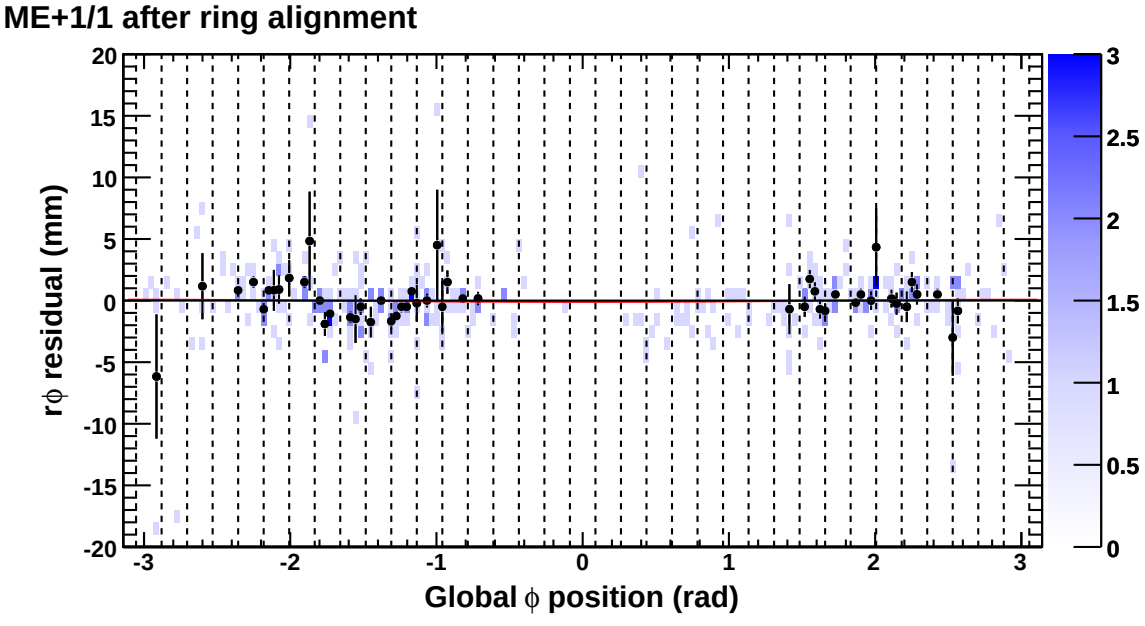
Ring fits: ME+1/1





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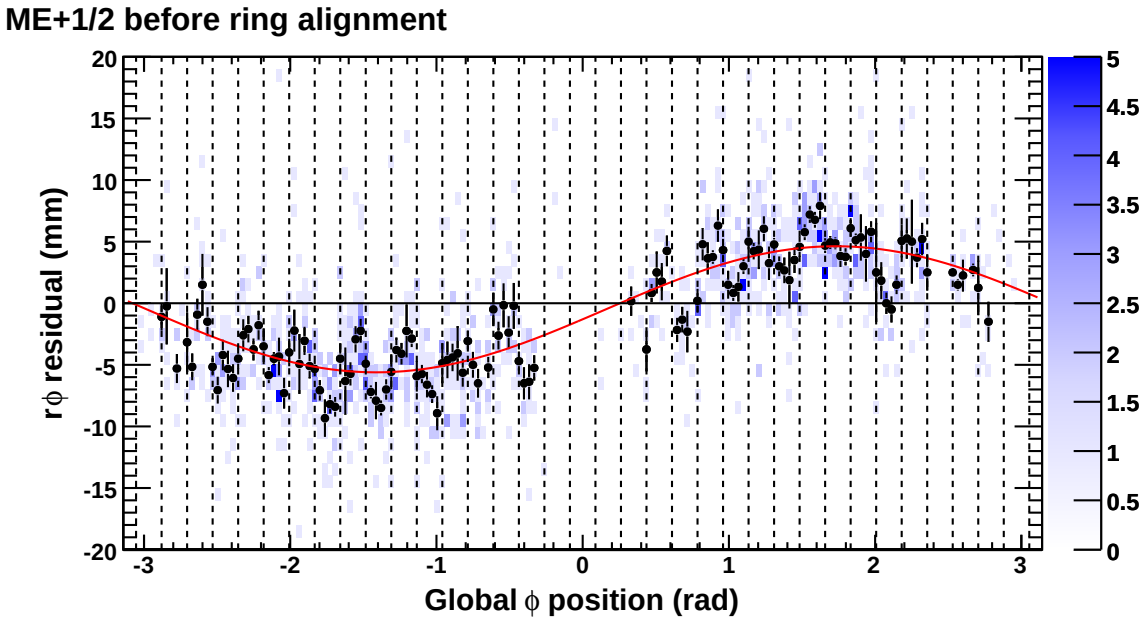
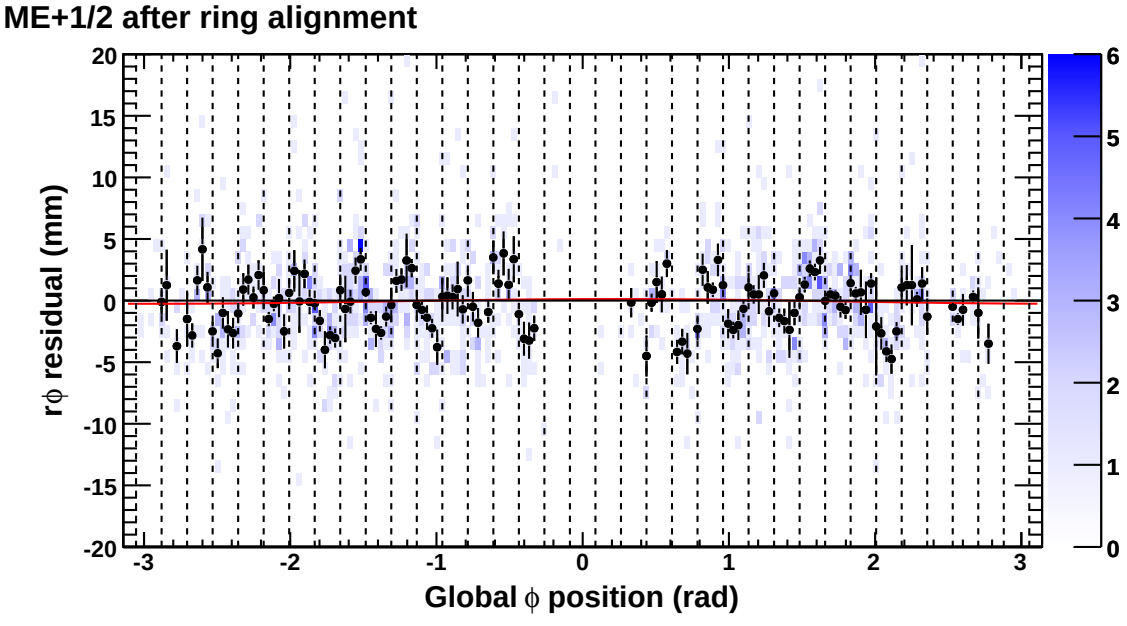
Ring fits: ME+1/2





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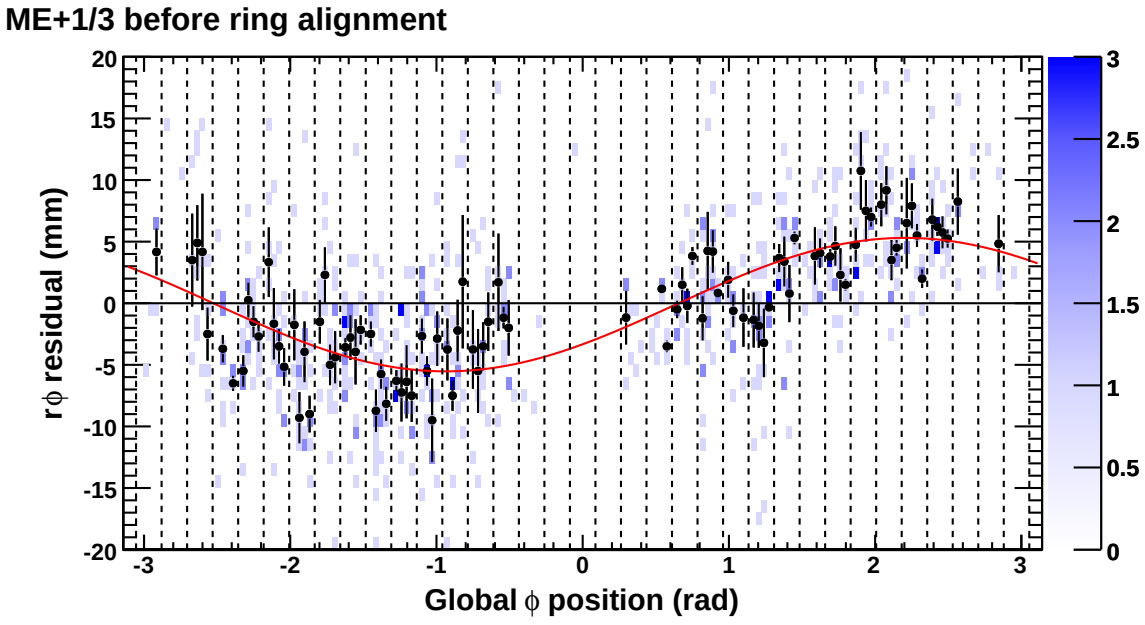
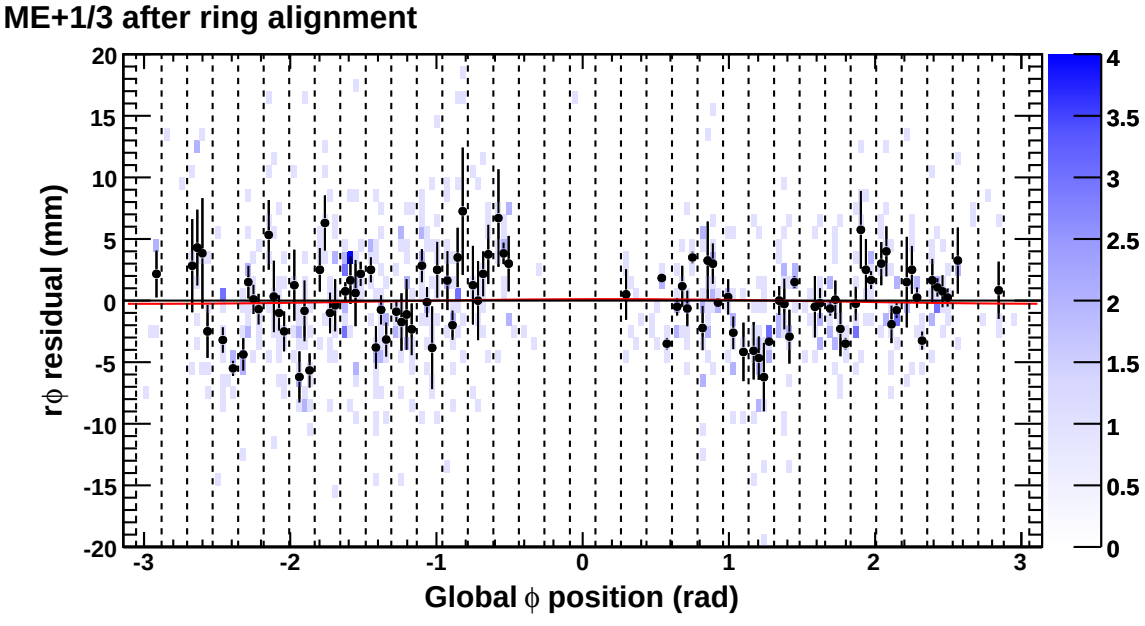
Ring fits: ME+1/3





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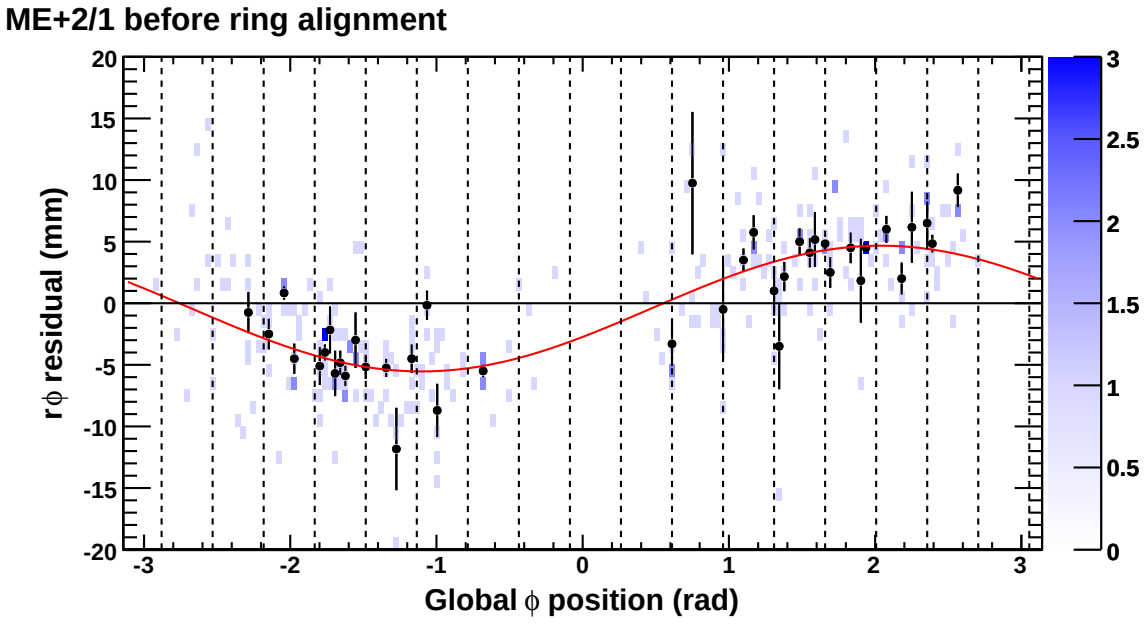
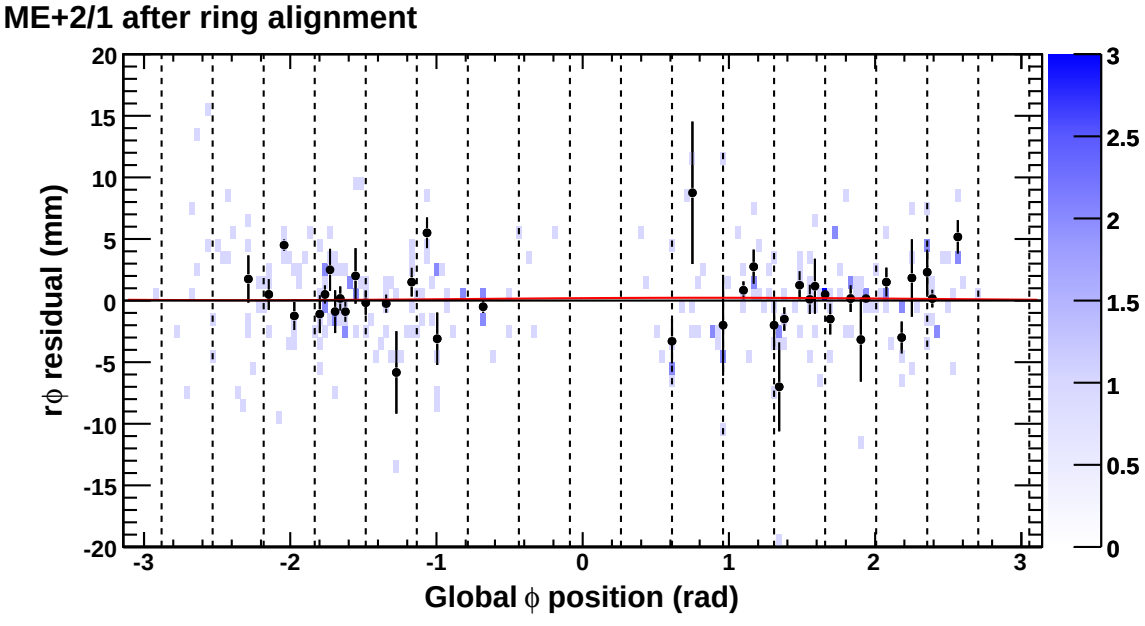
Ring fits: ME+2/1





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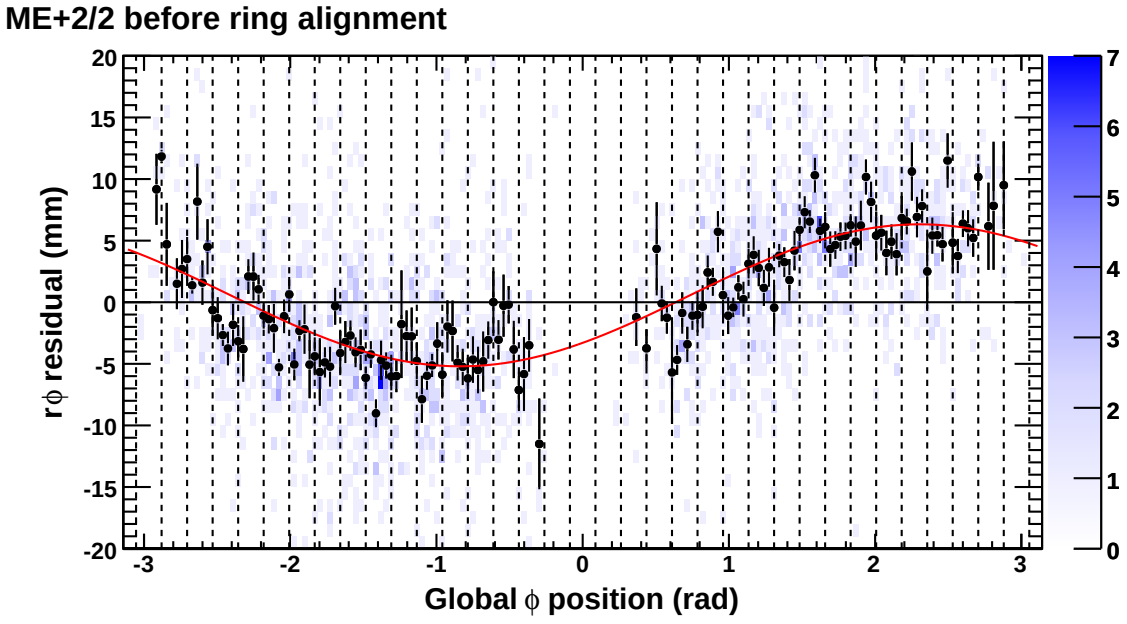
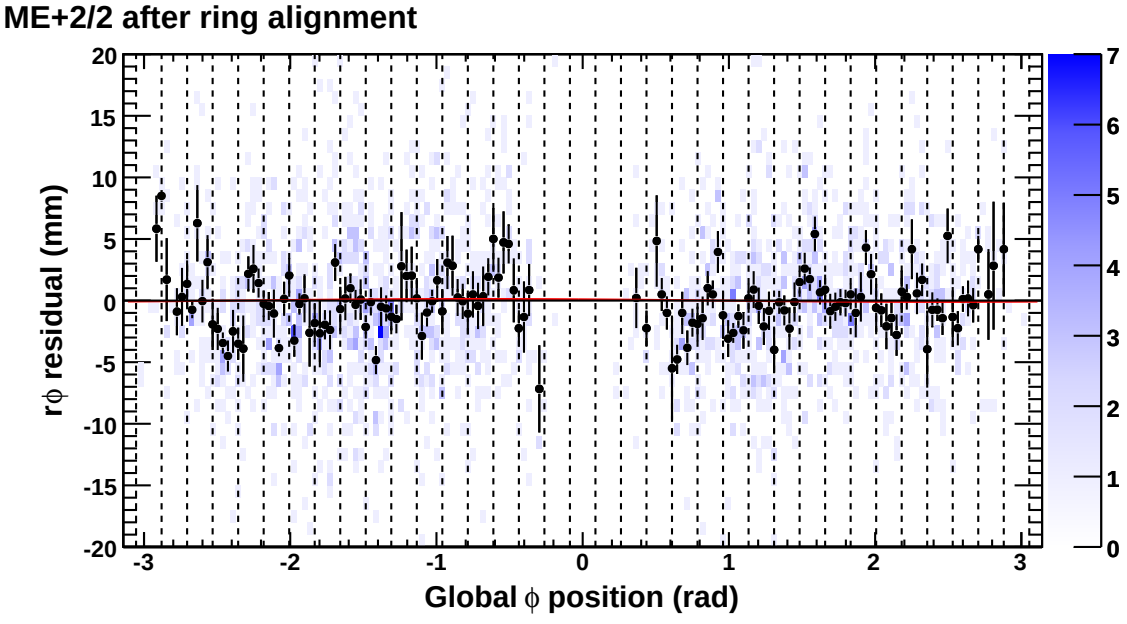
Ring fits: ME+2/2





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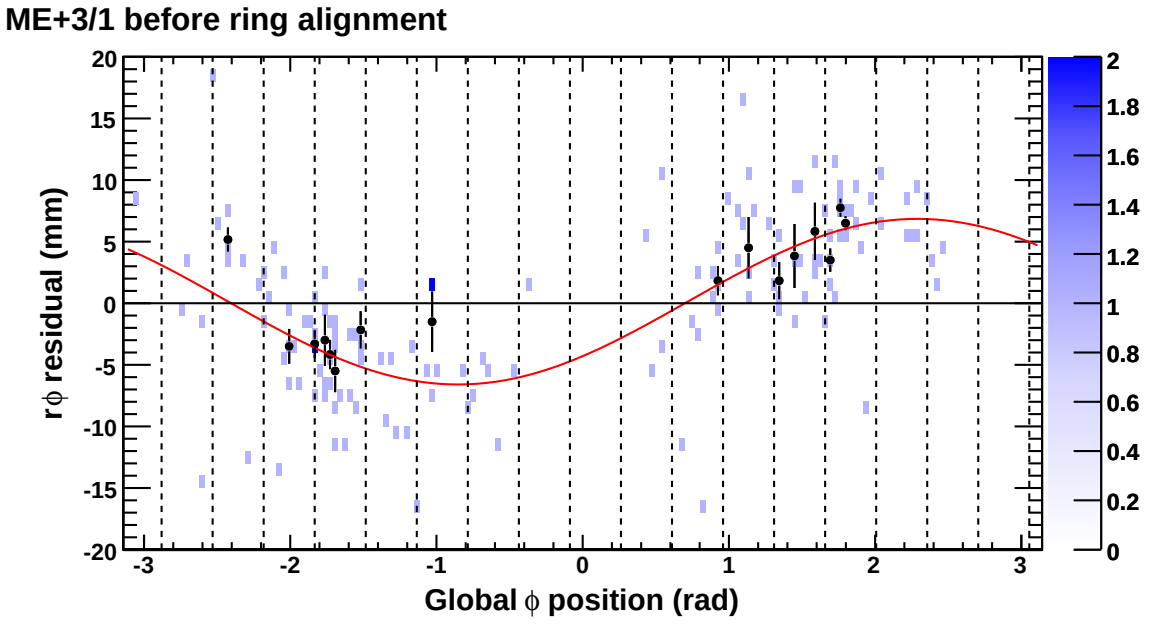

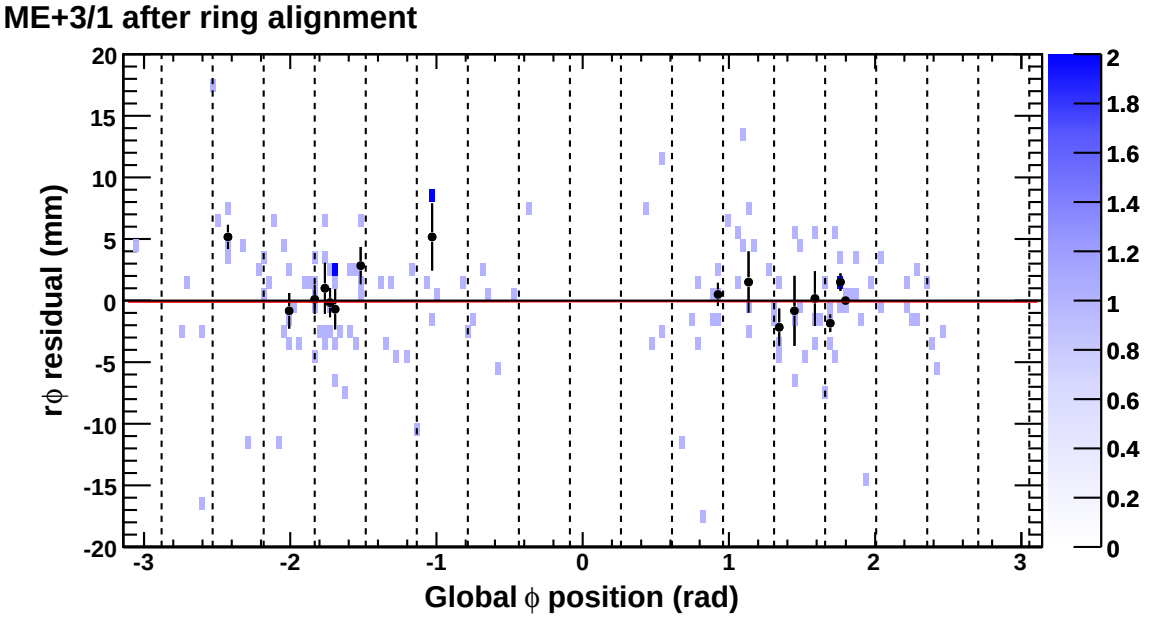

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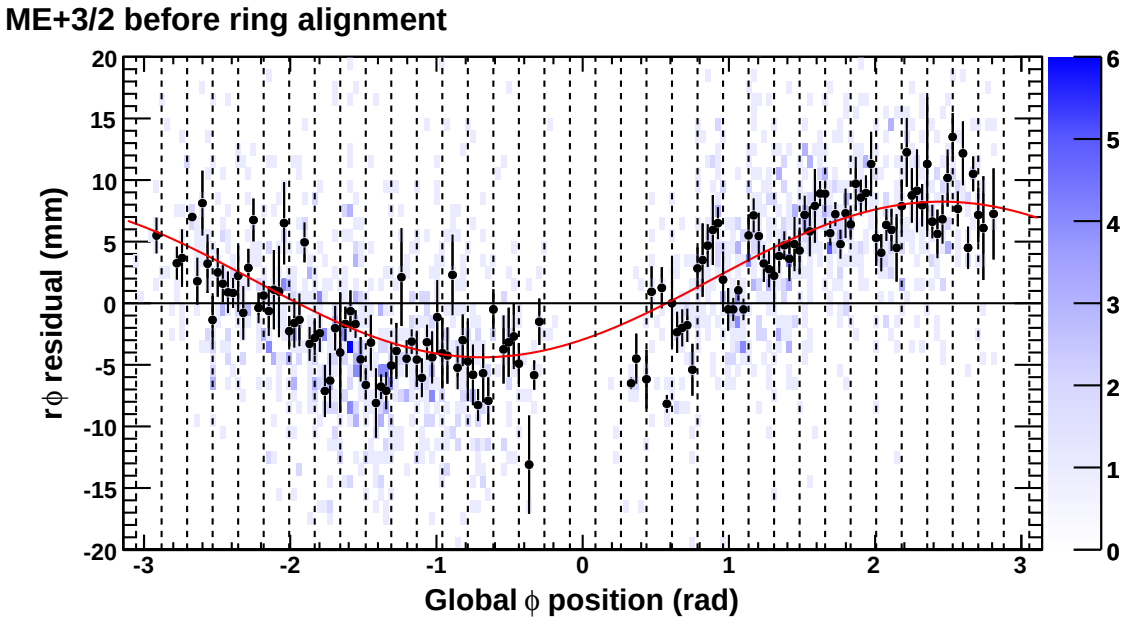

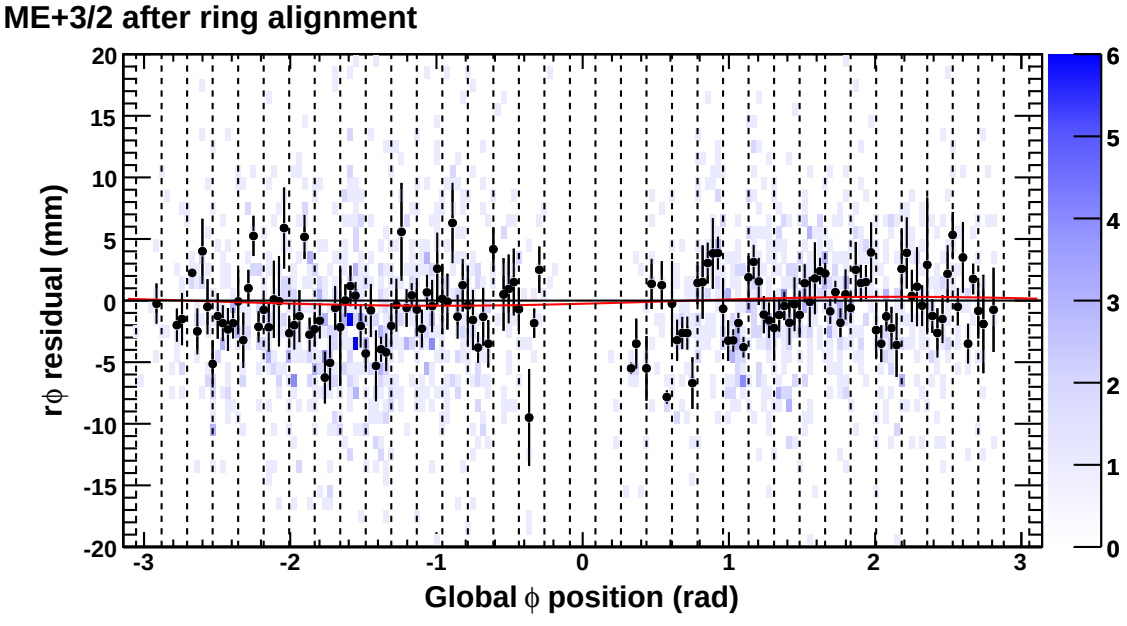

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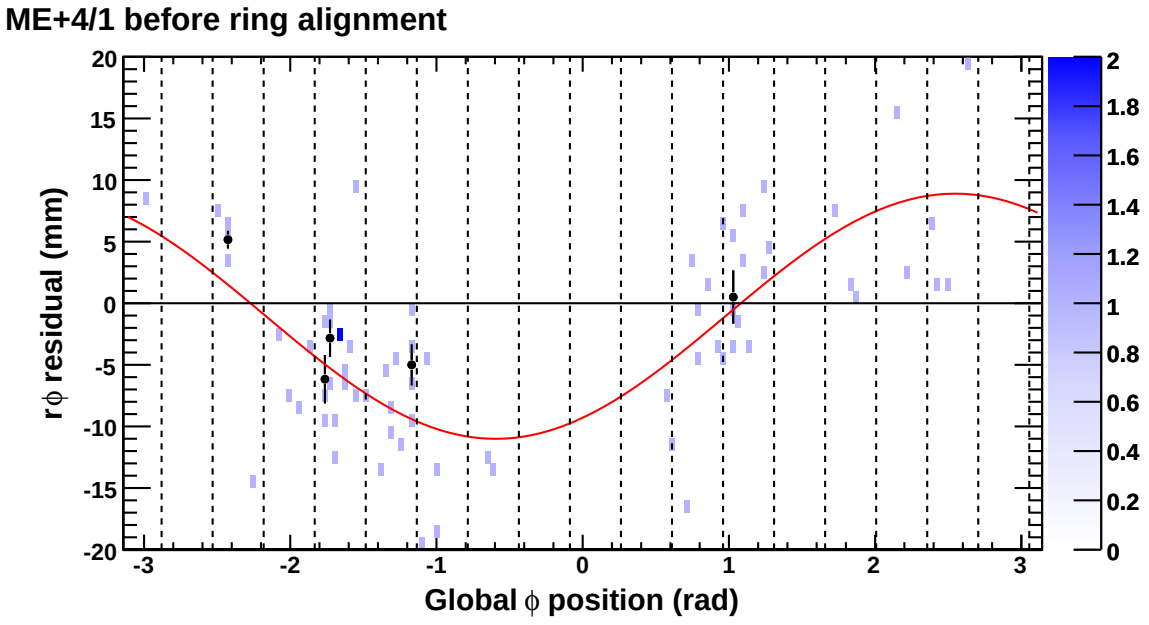

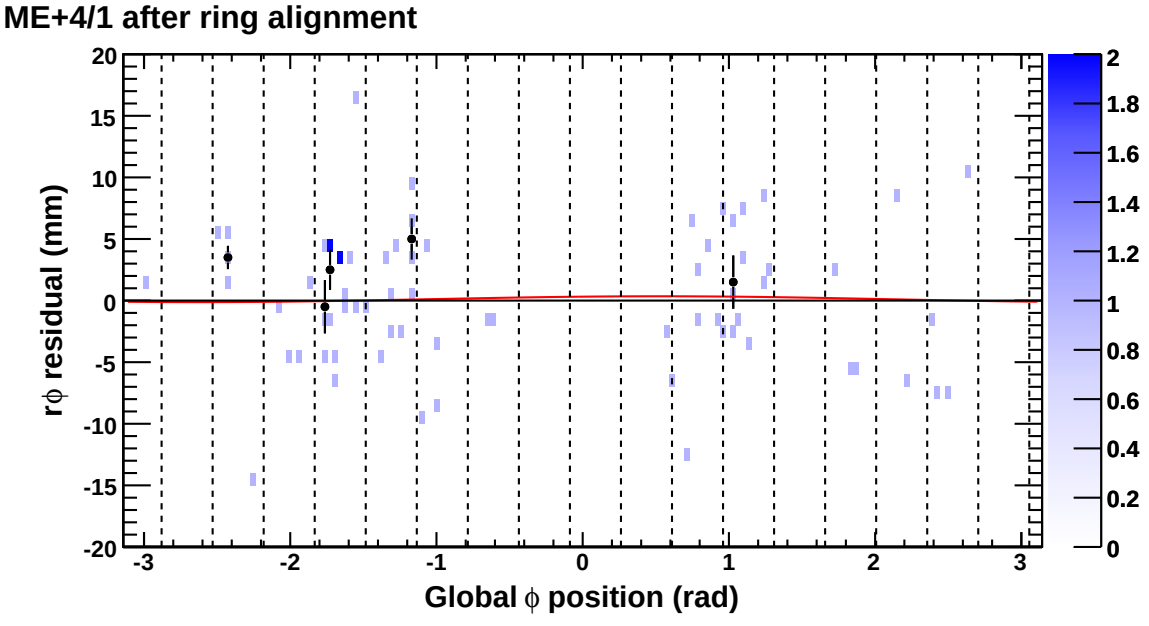

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Table of ring corrections

- Grouped items are physically connected to the same disk; values are correlated but not exactly equal within fitting errors
- Large χ^2/ndf expected from incomplete chamber alignment

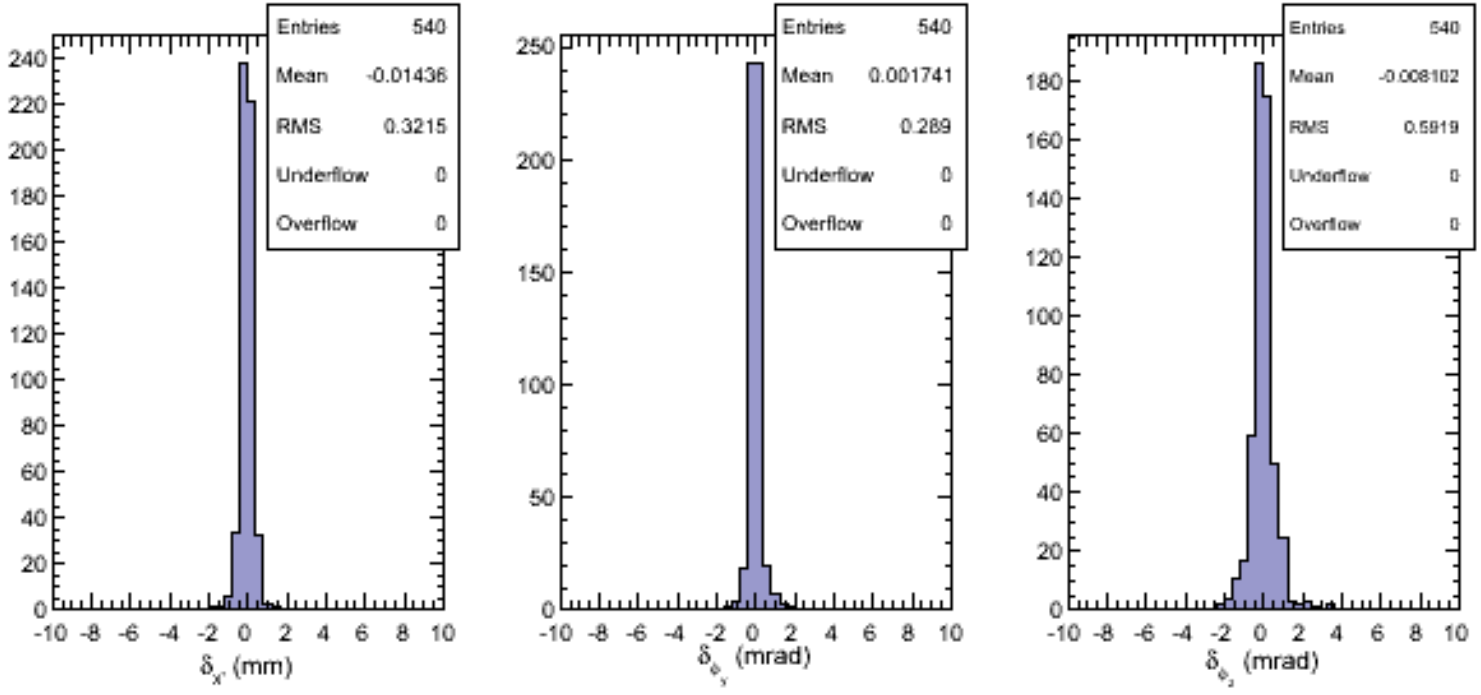
ring	δ_x (mm)	δ_y (mm)	δ_{ϕ_z} (mrad)	χ^2/ndf
ME−4/1	5.00 ± 0.14	−1.30 ± 0.22	1.57 ± 0.05	79.8998
ME−3/2	2.25 ± 0.04	−0.62 ± 0.06	1.85 ± 0.01	60.1288
ME−3/1	4.16 ± 0.12	0.06 ± 0.18	2.12 ± 0.04	63.914
ME−2/2	1.66 ± 0.04	1.29 ± 0.05	1.68 ± 0.01	52.9565
ME−2/1	3.77 ± 0.09	−1.96 ± 0.13	2.18 ± 0.03	37.8555
ME−1/3	2.41 ± 0.06	1.43 ± 0.09	0.26 ± 0.01	45.2275
ME−1/2	3.52 ± 0.05	−1.56 ± 0.07	0.85 ± 0.01	23.7824
ME−1/1	2.93 ± 0.09	−2.90 ± 0.13	0.66 ± 0.04	5.31818
ME+1/1	4.95 ± 0.08	−1.93 ± 0.11	0.17 ± 0.04	11.9906
ME+1/2	5.05 ± 0.05	0.81 ± 0.07	0.13 ± 0.01	22.0969
ME+1/3	4.36 ± 0.06	3.22 ± 0.08	0.02 ± 0.01	38.1421
ME+2/1	4.56 ± 0.08	2.30 ± 0.12	0.18 ± 0.03	28.5622
ME+2/2	4.28 ± 0.04	3.86 ± 0.05	−0.11 ± 0.01	47.6725
ME+3/1	5.06 ± 0.10	4.42 ± 0.17	−0.05 ± 0.03	25.2588
ME+3/2	4.01 ± 0.04	4.88 ± 0.06	−0.37 ± 0.01	60.8494
ME+4/1	5.58 ± 0.15	8.24 ± 0.24	0.40 ± 0.05	31.3307

October Exercise (1)

- Simulated alignment exercise with 3_2_X collisions/cosmics MC
- Done in 2_2_X: `https://hypernews.cern.ch/HyperNews/CMS/get/muon-alignment/342.html`
- Workflow performed by a new grad student, Aysen Tatarinov, from documentation and with help from Vadim Khotilovich and me

  `https://twiki.cern.ch/twiki//bin/view/CMS/SWGuideMuonAlignReferenceTarget`
- Prelim. CSC resolution: 320 μm δ_x, 290 μrad δ_{ϕ_y}, 590 μrad δ_{ϕ_y}

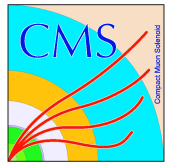
Note: I had encountered problems with ME1/3 in 2_2_X which appear to have been fixed!



October Exercise (2)

- CSC Overlaps alignment was very successful in 2008 (2_1_X)
- Software has not been updated since, might need small corrections to work in the new environment
- Second October exercise: test CSC Overlaps in 3_2_X
  - requested and recieved 3_2_X beam-halo sample
  - checked samples: everything is ready and in the right format
  - still need to work through exercise
- Boundary condition: *real* beam-halo expected in $\sim$2 weeks, algorithm must be fully vetted in Monte Carlo before then

Summary



- Alternation feature strangely depends on p_T
  - what could cause that?
- CRAFT-09 alignment includes new corrections for large transverse disk displacement
- Alignment machinery is being documented, has successfully been run by a new user
- 2009 beam-halo is imminent: need to make sure tools are ready