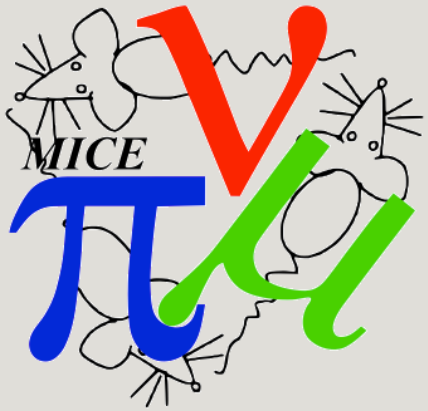
FC1 Magnetic Mapping

V. Blackmore

CM39

25th June, 2014



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List of measurements

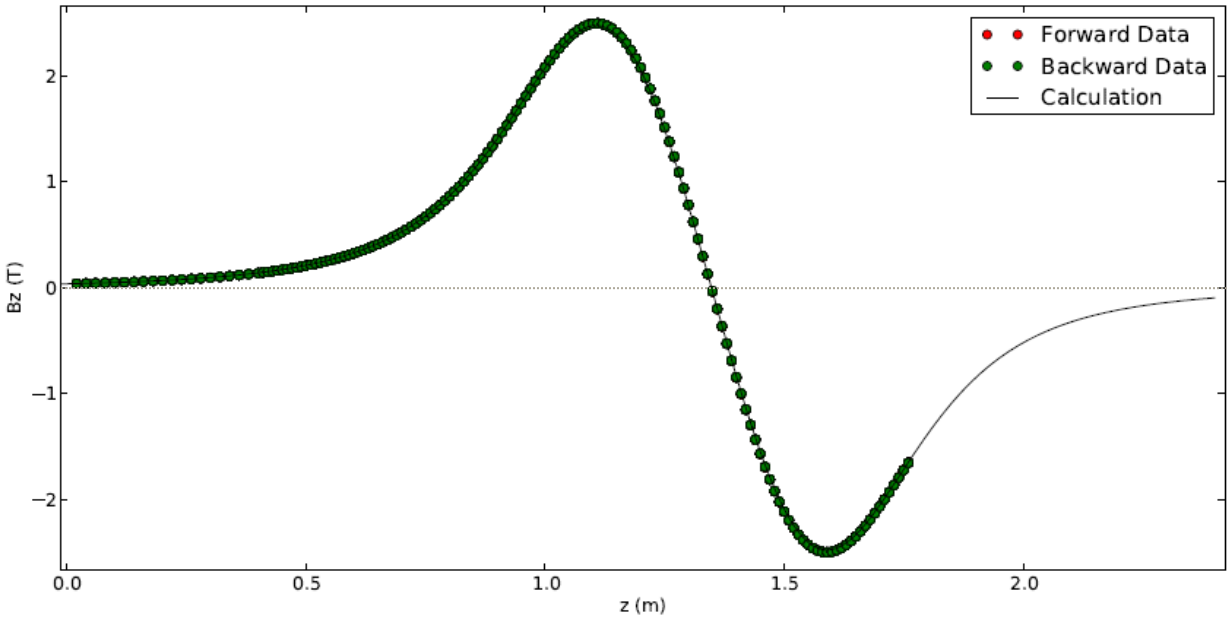
- FC1 field map measurements
- Measured at several currents in flip and solenoid mode:
  - Flip mode: 0A, 50A, 100A, 150A, 180A
  - Solenoid mode: 0A, 3A, 50A, 75A, 100A, 114A, 120A

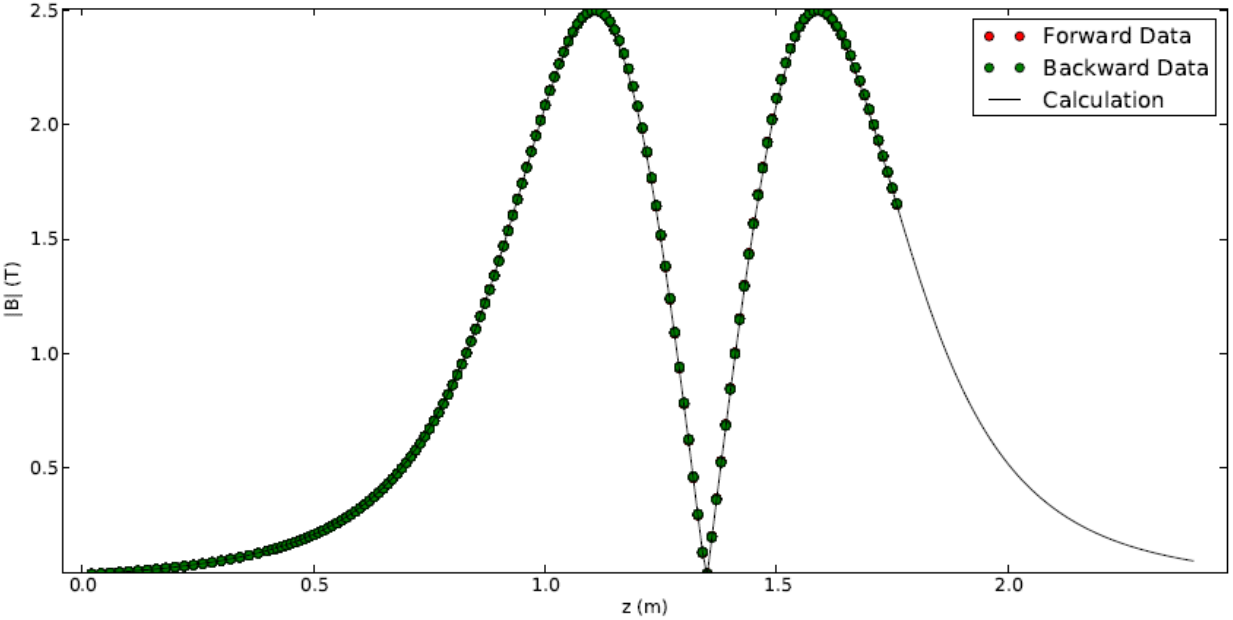
- Now for some extremely preliminary plots!
  - Comparison to calculation
  - Z positioning of mapper
  - Forward/backward measurements
  - Thoughts on how to logically continue…

See “Status of AFC Module” on Friday for more information

Comparison to calculation

- Flip mode
- 150A
- Mapper takes data in both directions of travel – requires some correction (see later)
- Top: B_z from mapper
- Bottom: $|B|$ from mapper – avoids the question of Hall probe alignment w.r.t. the field
- Negligible difference between B_z and $|B|$





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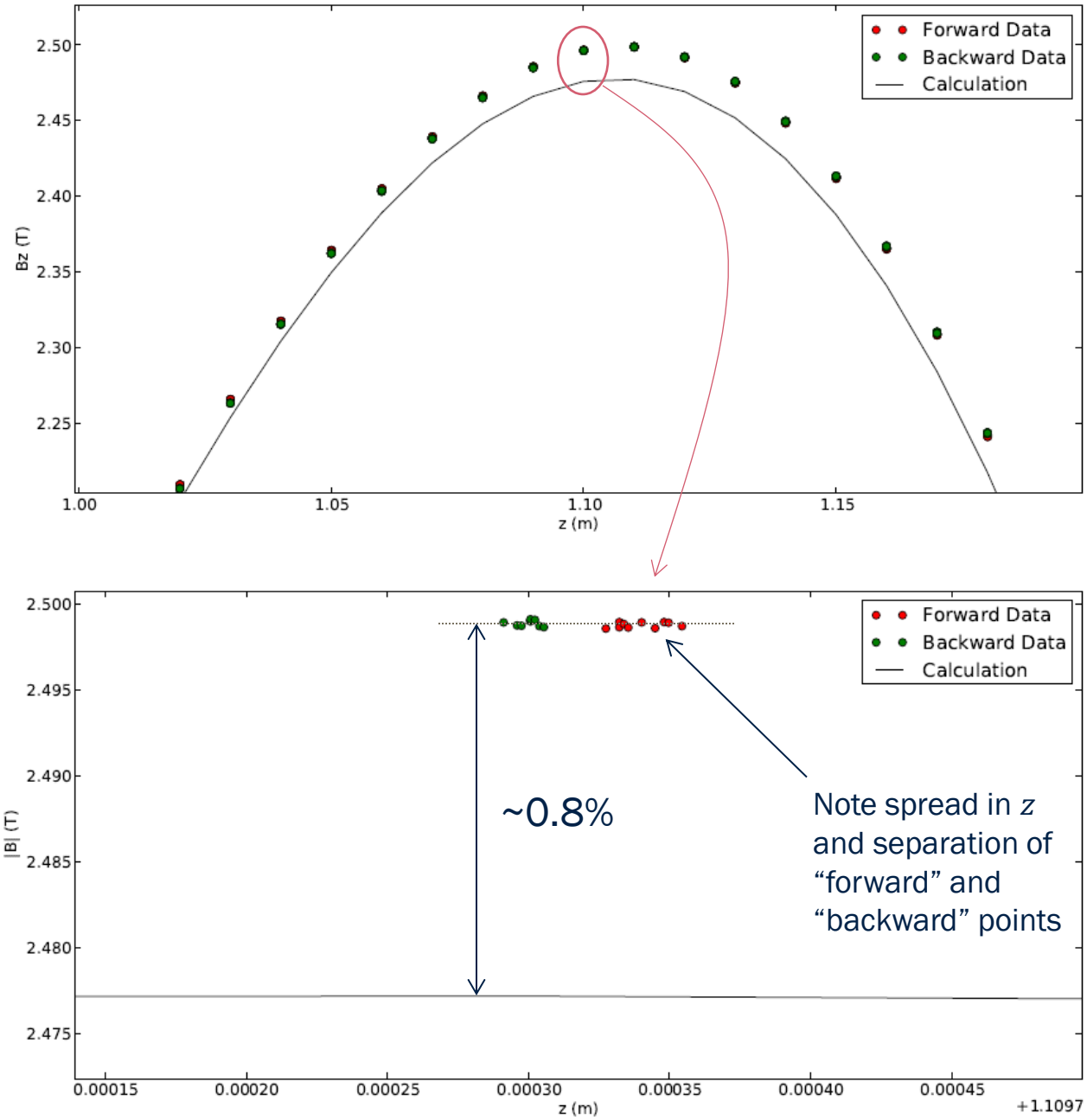

Comparison to calculation

- Solenoid mode
- 100A
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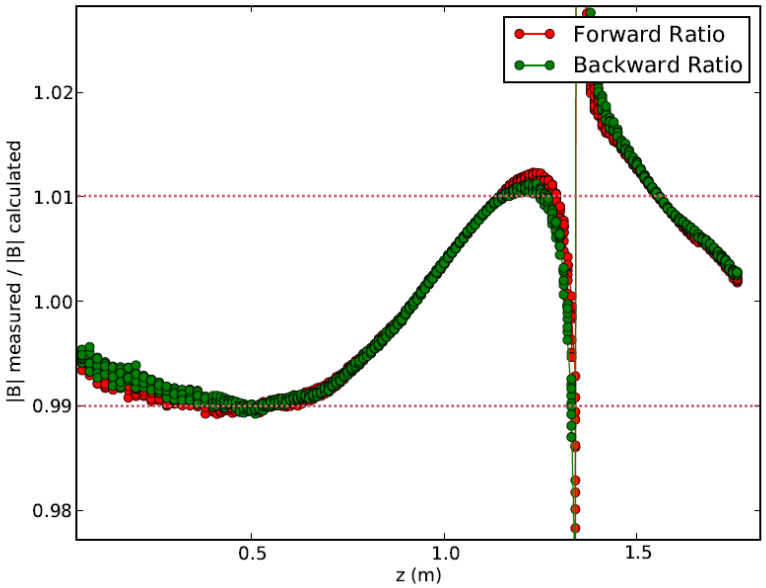
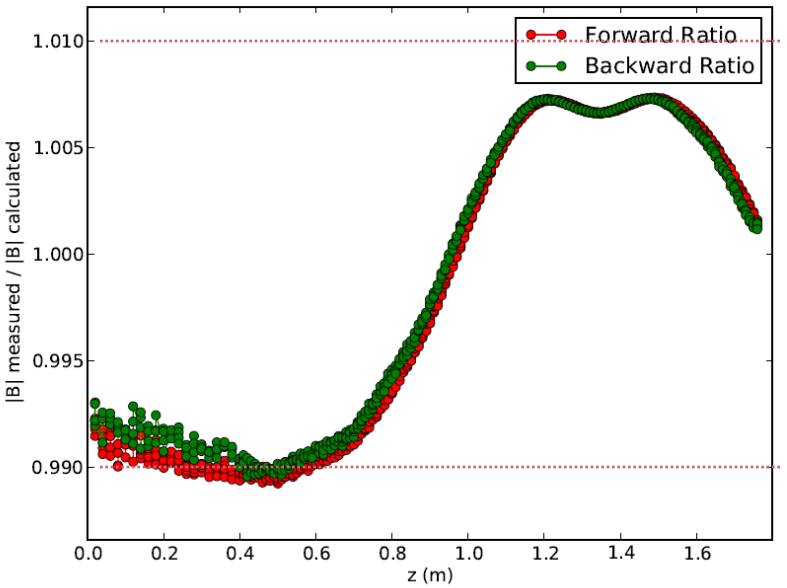


Ratio of measured to calculated field in Flip Mode at 150A

Ratio of measured to calculated field in Solenoid Mode at 100A



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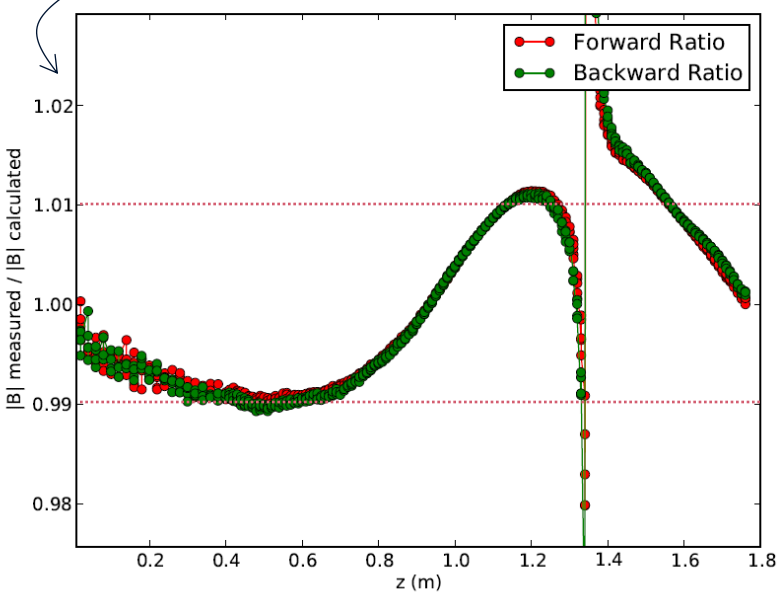
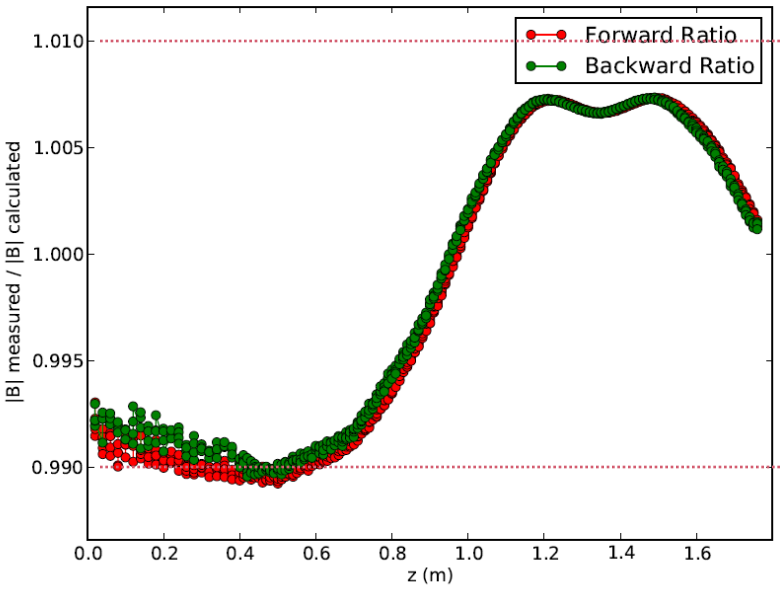
y-axis not *quite* identical, unfortunately!



Ratio of measured to calculated field in Flip Mode at <u>100A</u>

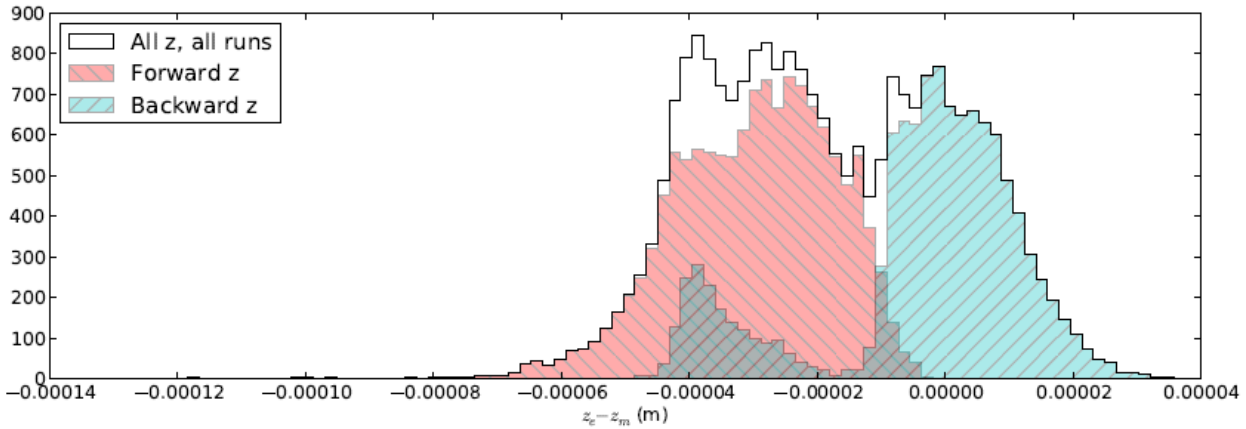
Ratio of measured to calculated field in Solenoid Mode at <u>100A</u>

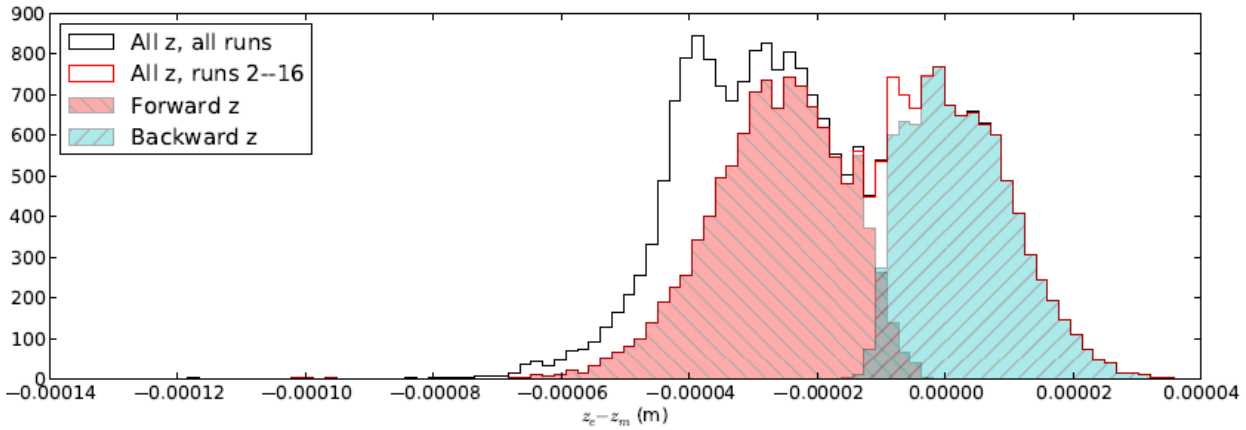


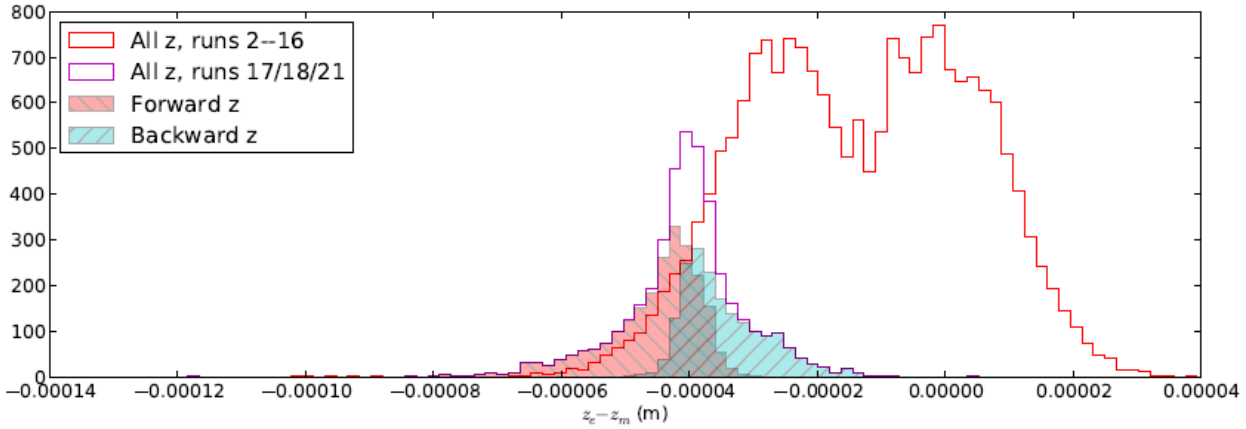
z-Positioning Accuracy

- Mapper has a given grid of points it measures over
- Mapper reports the z-position data is taken at

- Question:
  How reliable is the mappers longitudinal positioning?







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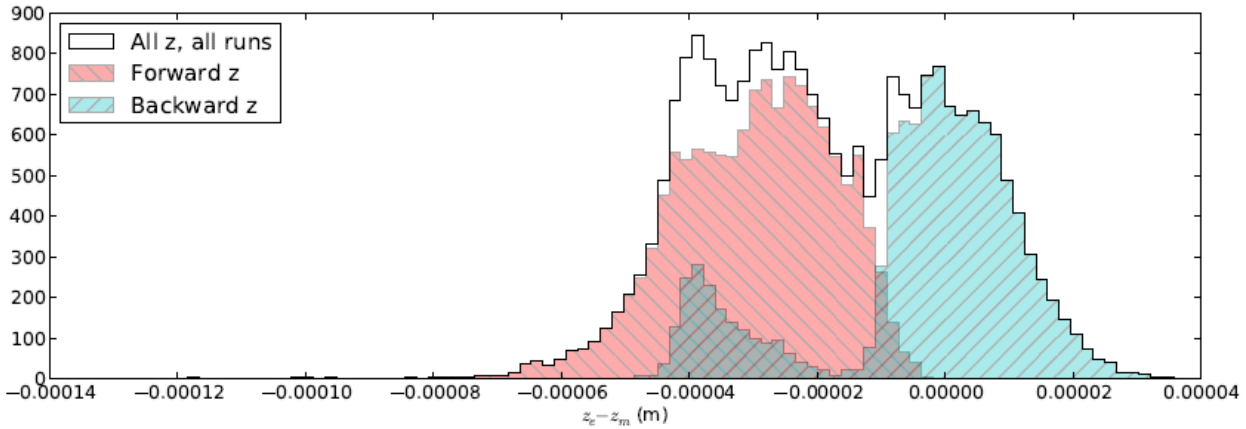
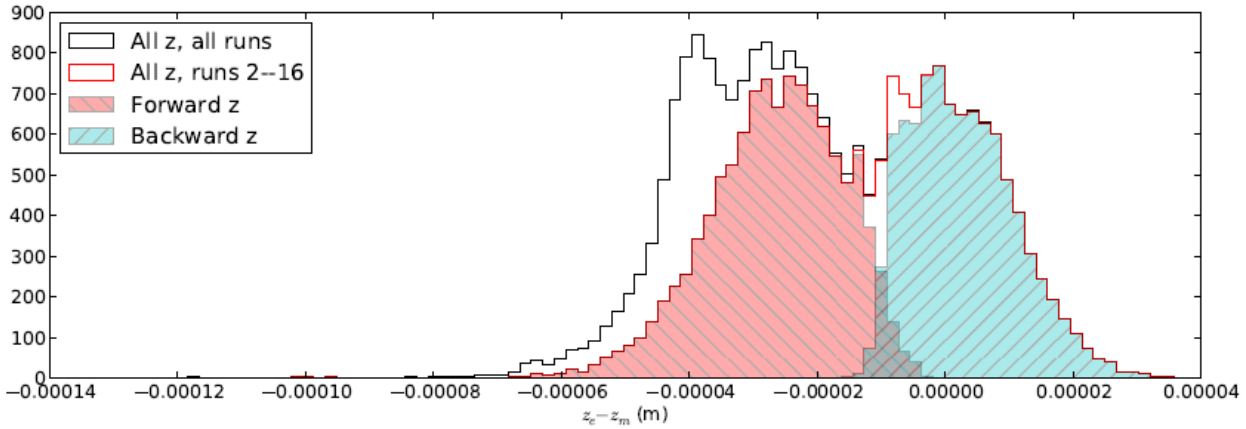
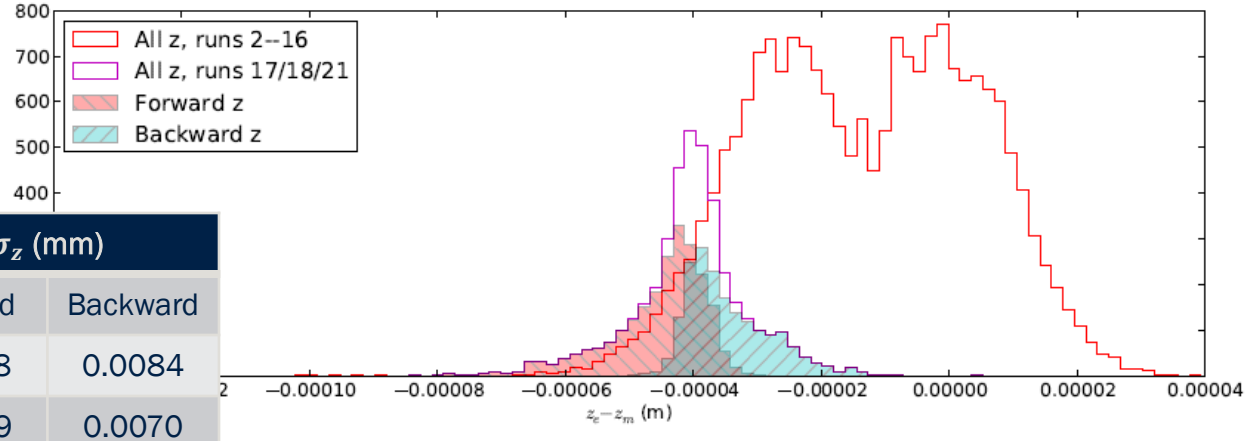


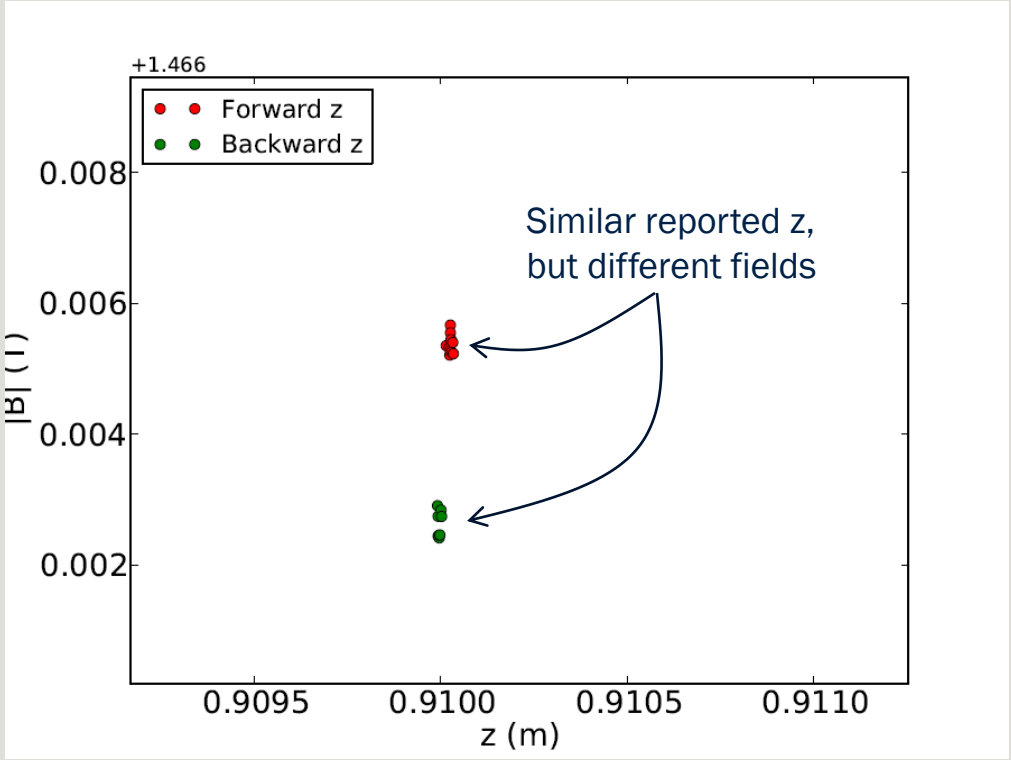




Runs	Mean z (mm)		σ_z (mm)	
	Forward	Backward	Forward	Backward
2–16	-0.0267	0.0029	0.0108	0.0084
17–21	-0.0463	-0.0342	0.0099	0.0070

"Forward-Backward" correction

- 0.7mm correction applied to data files during SS mapping, accounts for belt tension
- Correction was not removed for FC mapping, different belt, different tension
- Therefore "backwards" measurements are reported at "the wrong z"



1. Take "forward" measurements as "the truth"
2. Find the field gradient and intercept between adjacent "forward" points
3. Given that gradient and intercept, locate the "true" z of "backward" points

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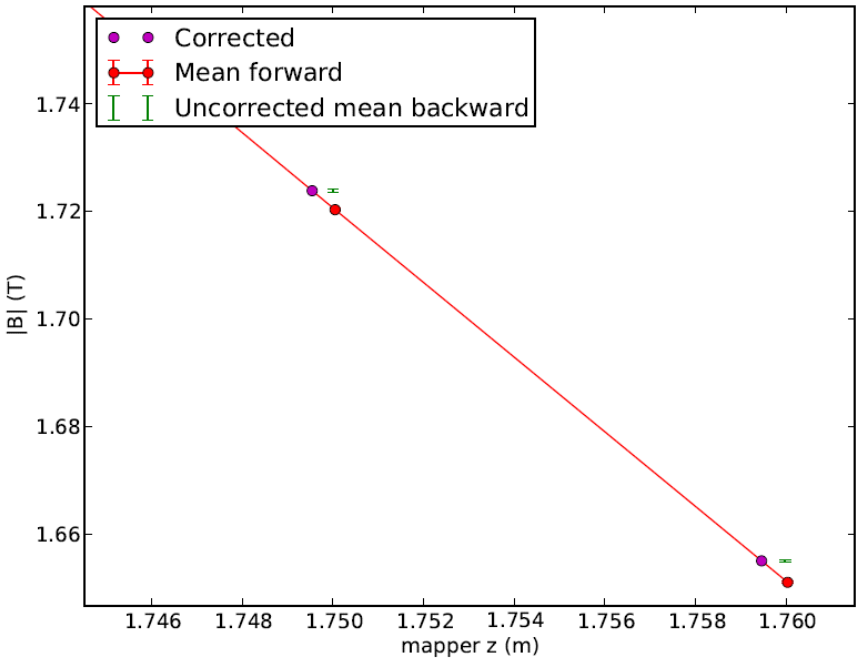

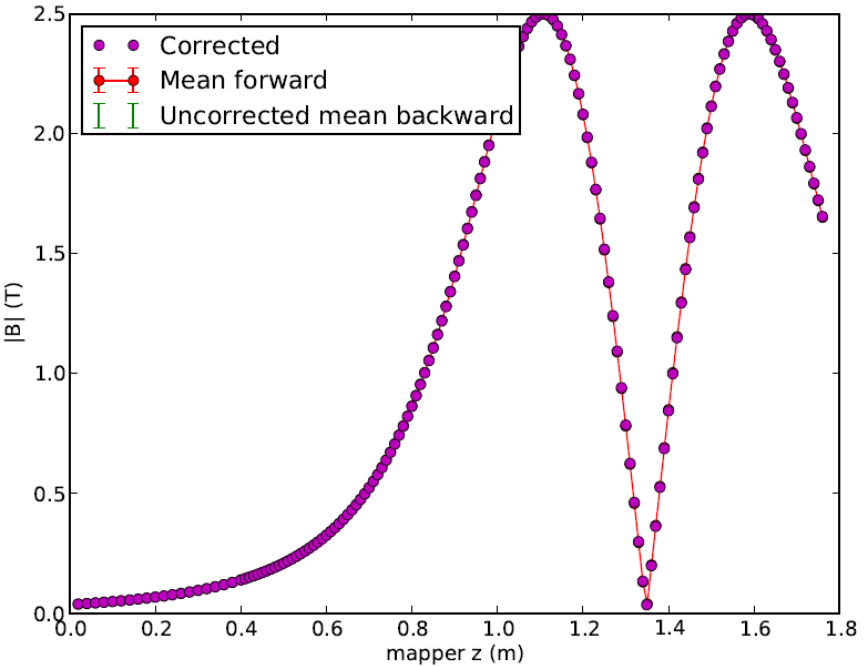

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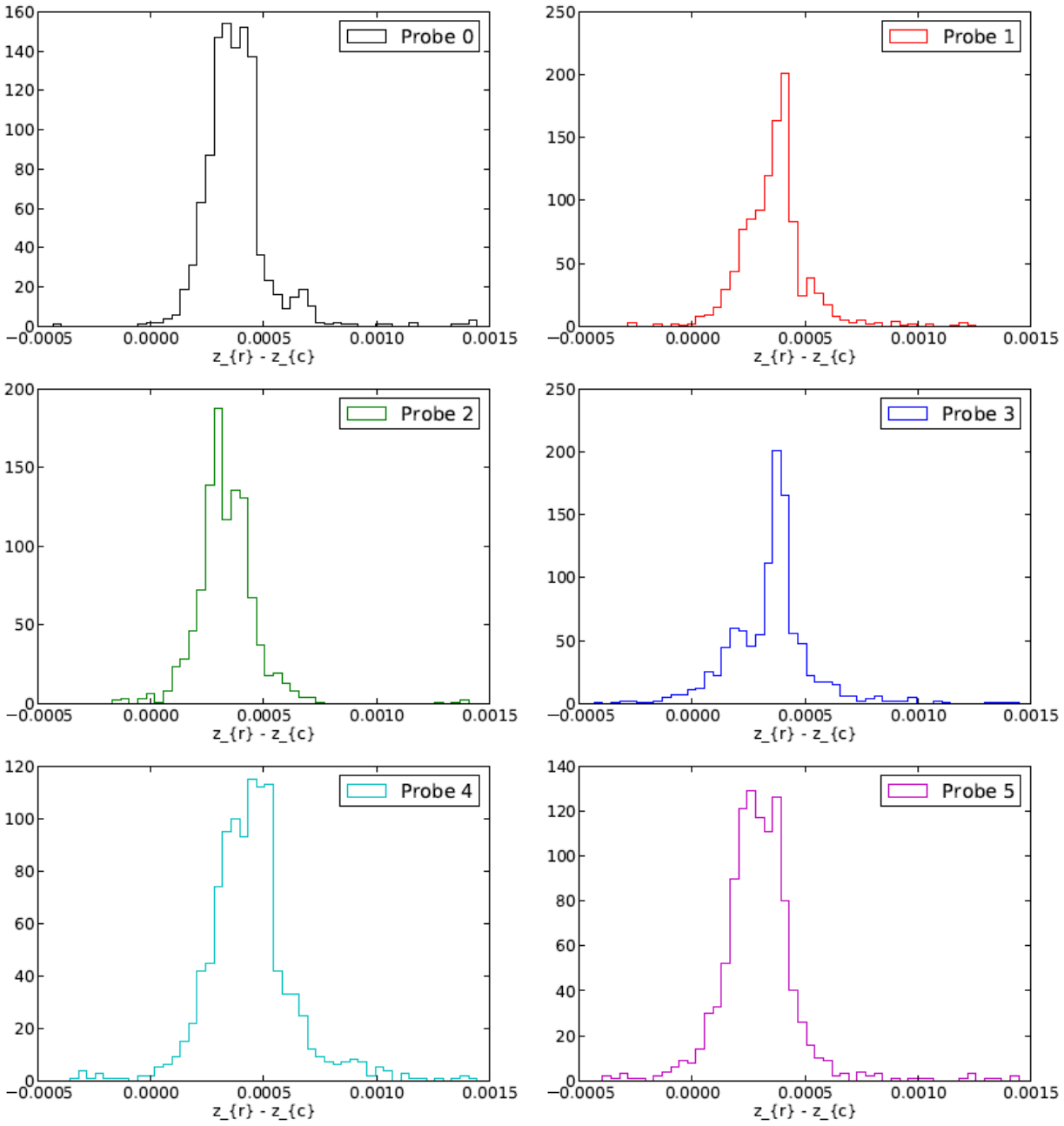

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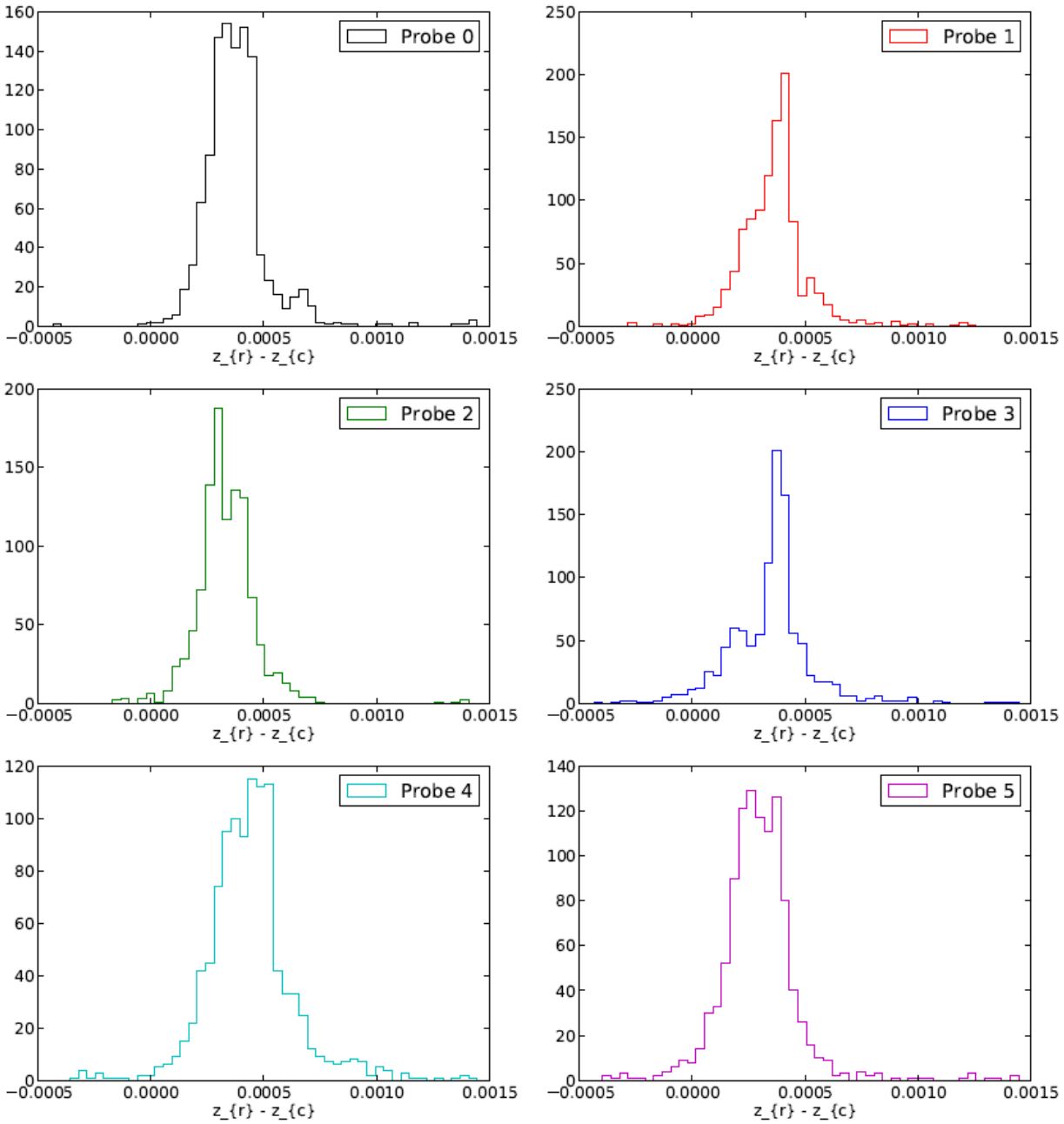
- Over many runs…

Probe	Mean dz (mm)	σ_{dz} (mm)
0	0.3758	0.1467
1	0.3468	0.2235
2	0.3180	0.2484
3	0.6241	3.5956
4	0.4604	0.4251
5	0.4019	2.7874



Summary

- **Just starting** to look at the data
  - All very early
  - FC1 still appears to have a higher field than expected
  - Can't attribute this to current stability or being off-axis
- Rough plan:
  - Quantify σ_B on data points
  - Examine 'forward-backward' correction more closely
  - Look at cylindrical symmetry
  - Check linearity and residual fields
  - Find measurements in terms of FC1 fiducials
  - Bigger picture: Find magnetic axis (required by Dec), find best-fit field model (by Dec)