

FC2 FIELD MAPPING

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CM40

26th October, 2014

Measurements

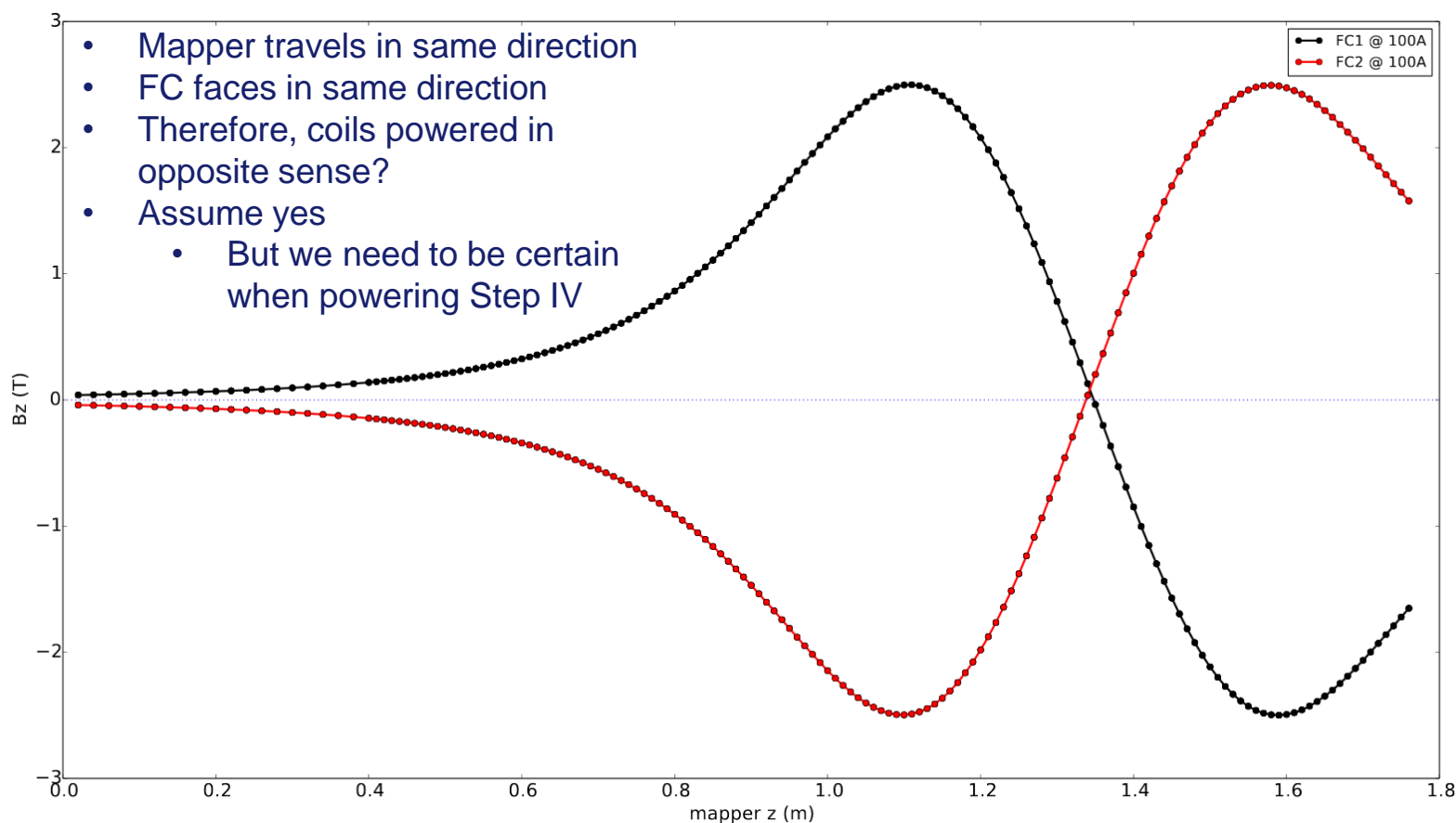
- FC2 field mapped at same points as FC1
- Flip mode: 0, 50, 100, 150, 180A
- Solenoid mode: 0, 50, 75, 100, 114, 120A
- Plus: 180→175→170→165→160→150A in flip mode
 - “Ramp down” issue prevented this with FC1
 - *Almost* did the same for FC2, but Steve Watson rescued it.
 - Useful? We’ll see...
- Everything here is even more preliminary than plots shown for FC1. Mapping **just** finished, thinking time has just begun!

Q1) Is FC2 different?

- Training behaviour suggests FC2 is a different beast...
 - Do the field maps illustrate why?

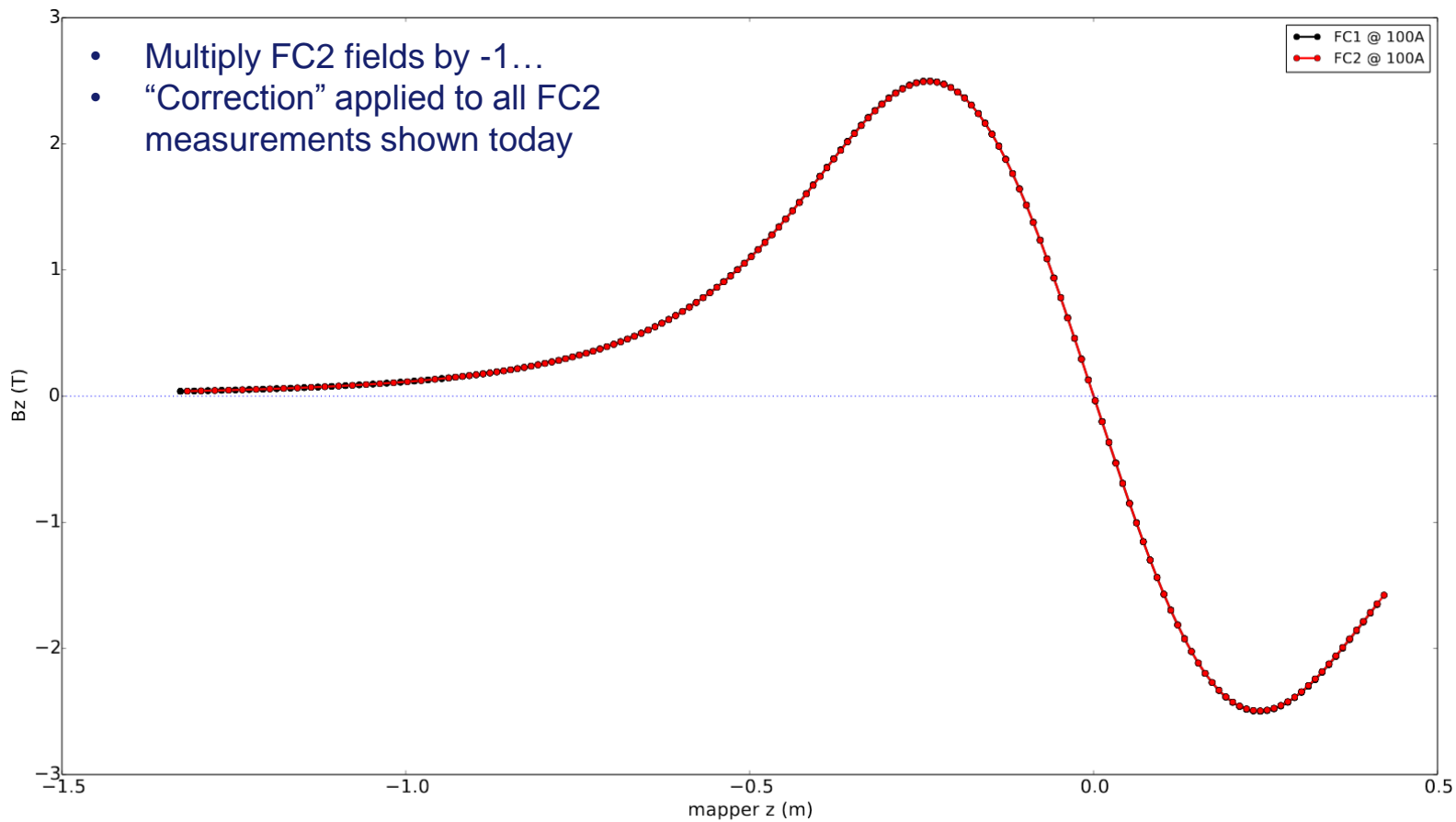
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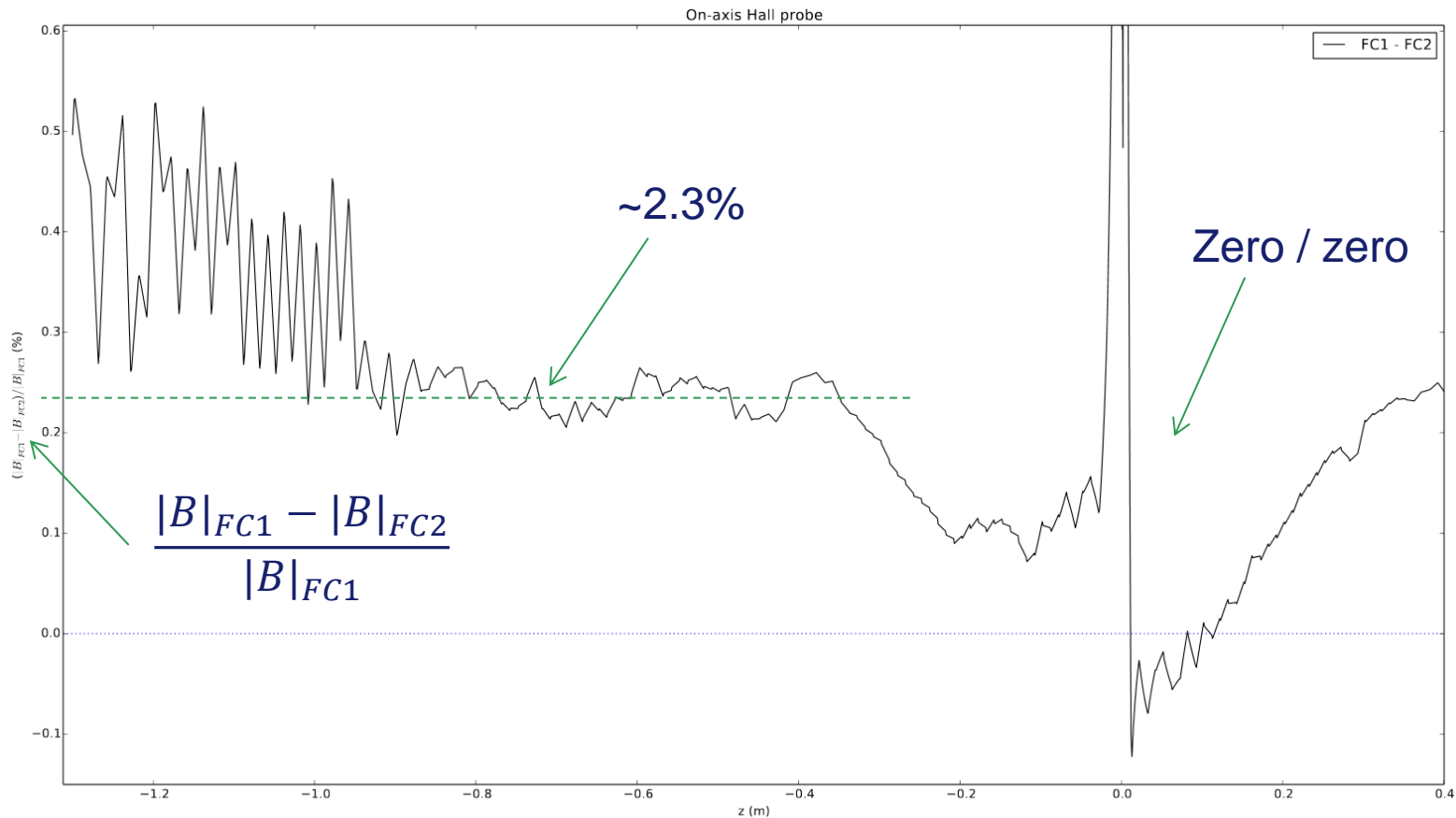
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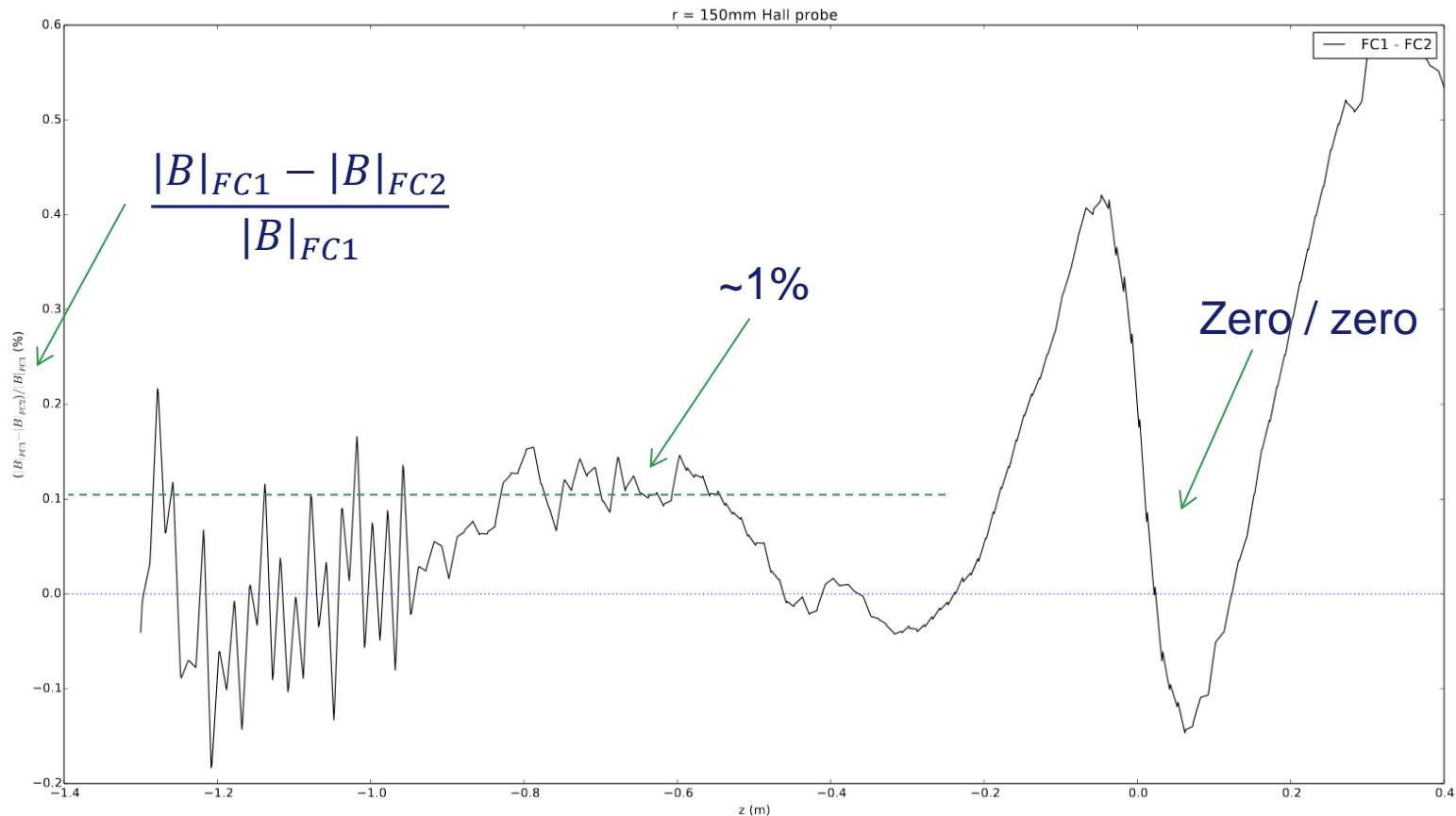
Q1) Is FC2 different?

- Directly comparing the difference between the on-axis probe $|B|$ measurements of FC1 and FC2...



Q1) Is FC2 different?

- Directly comparing the difference between the exterior probe $|B|$ measurements of FC1 and FC2...

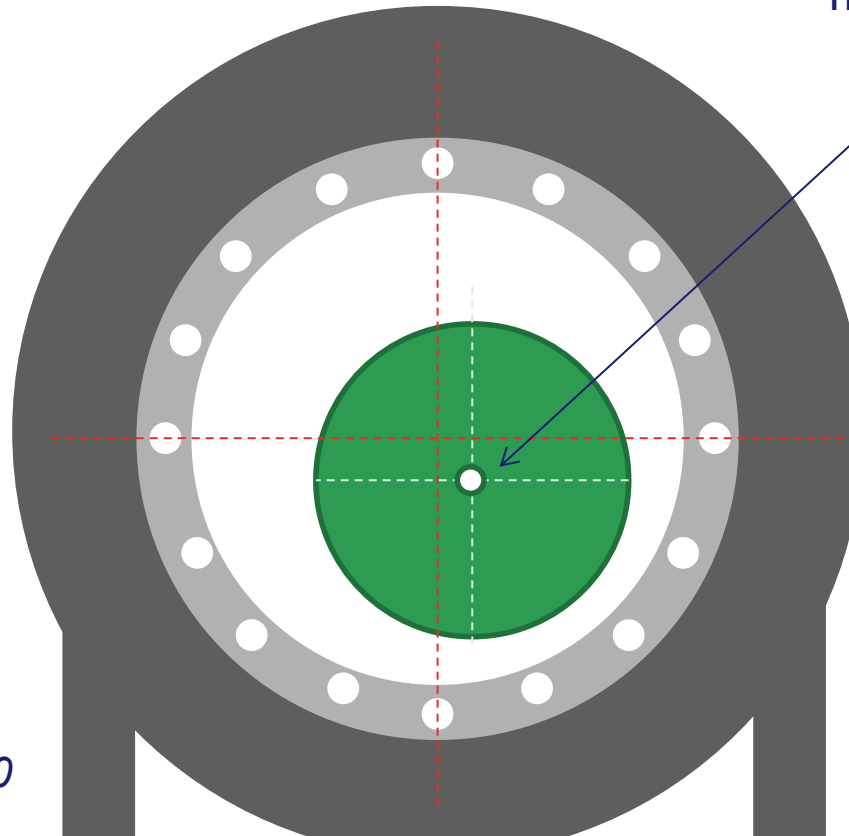


If measurements were at exactly the same positions, would we really see this?

Q1 isn't (strictly) a fair question

- Different magnets, mapper moved
- Look at survey...

Survey watches central Hall probe as mapper moves through FC



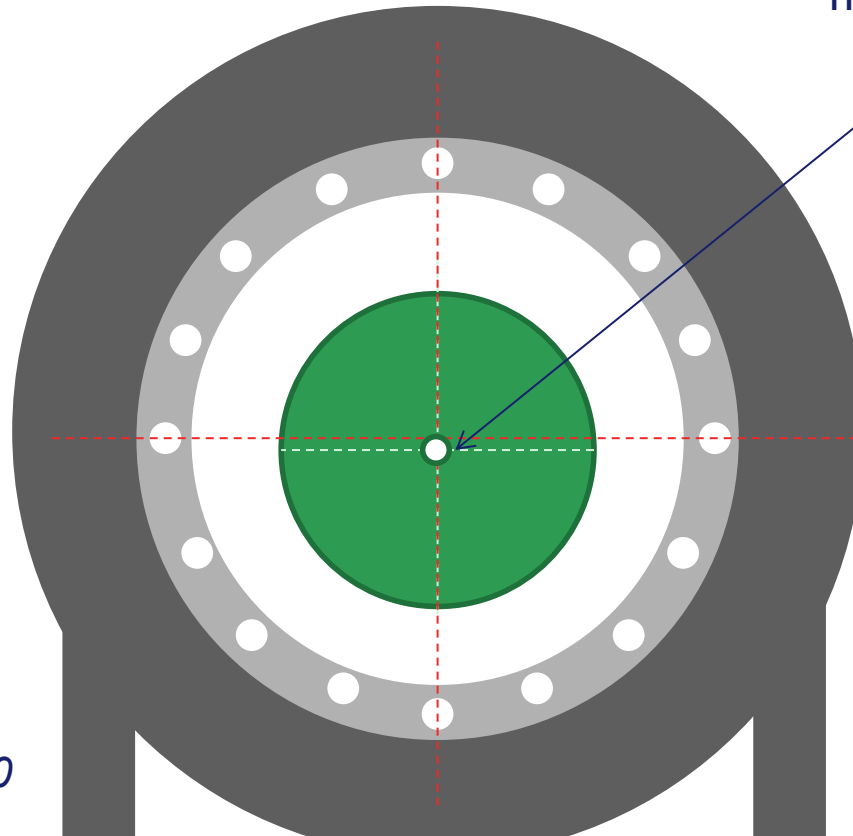
Exaggerated FC.

*Centricity of flanges
defines survey's $x=0, y=0$*

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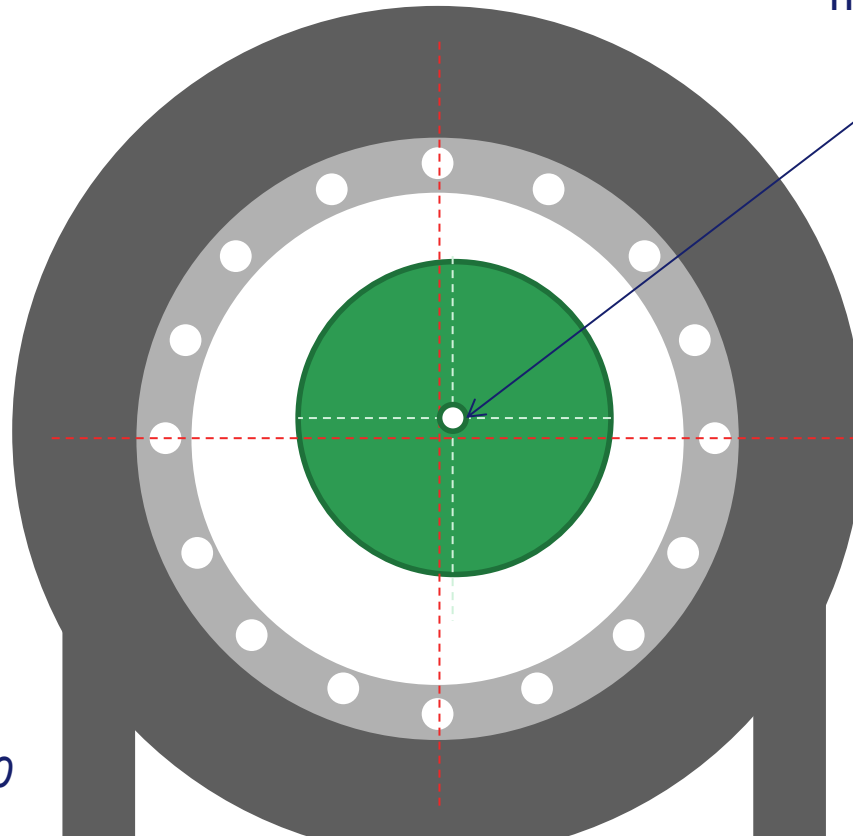
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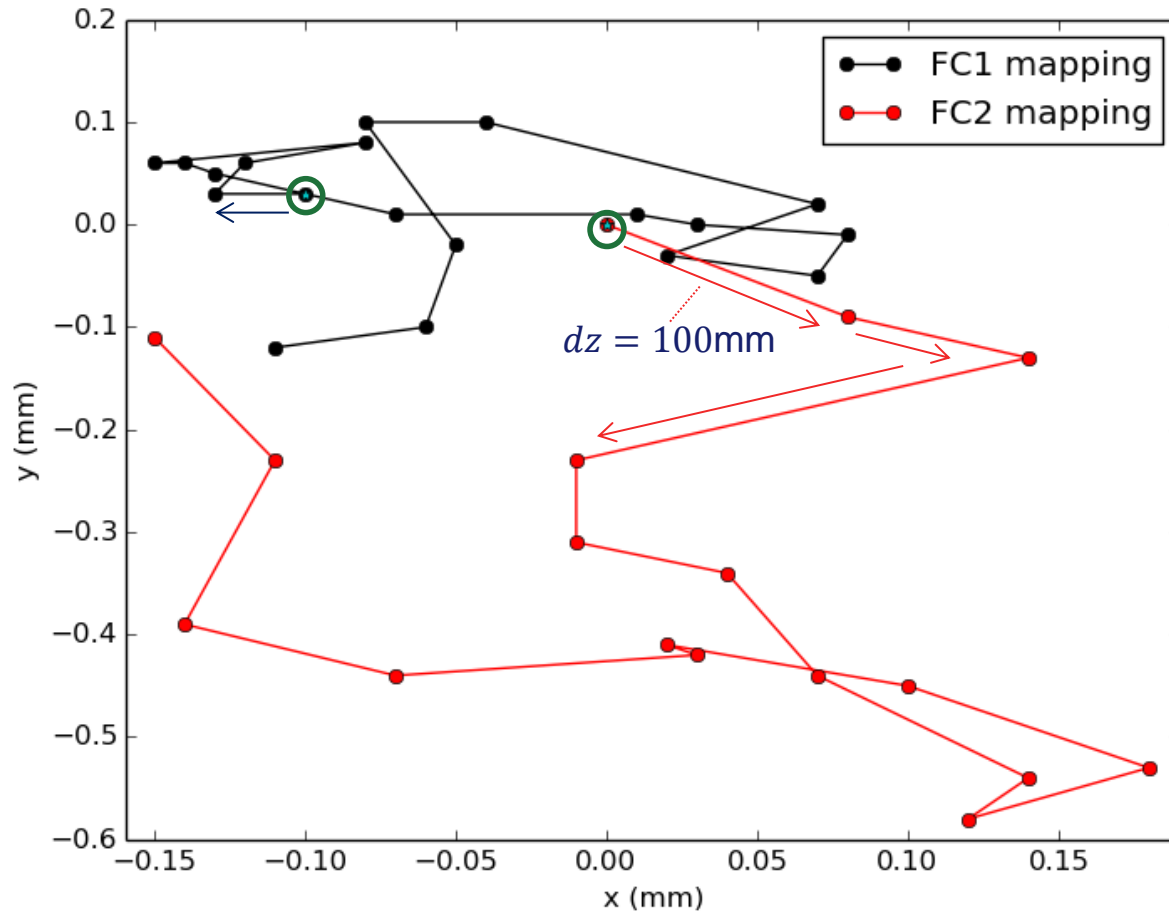
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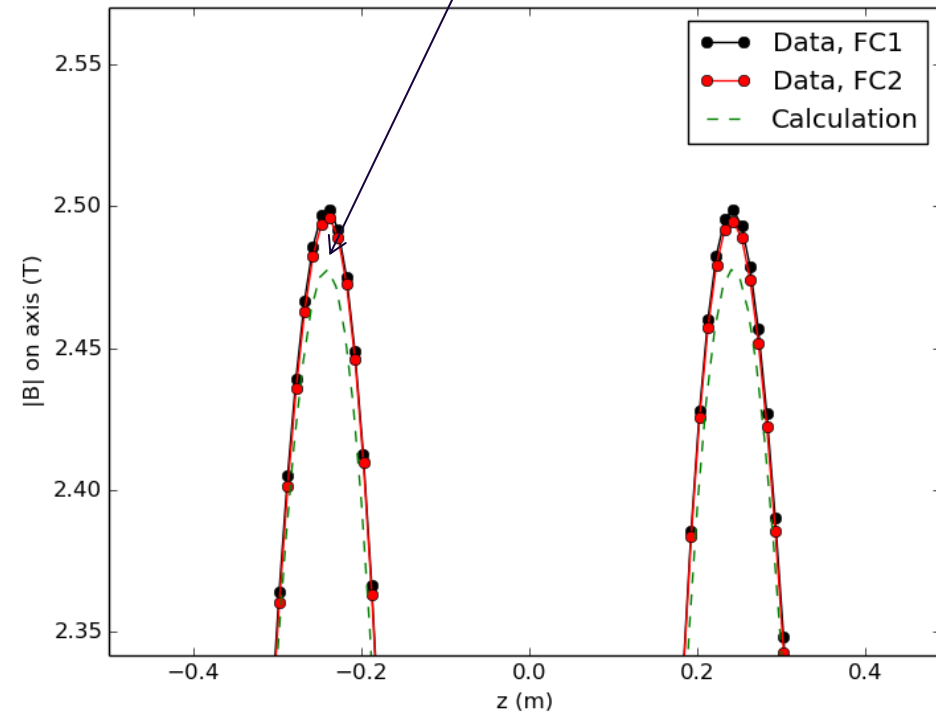
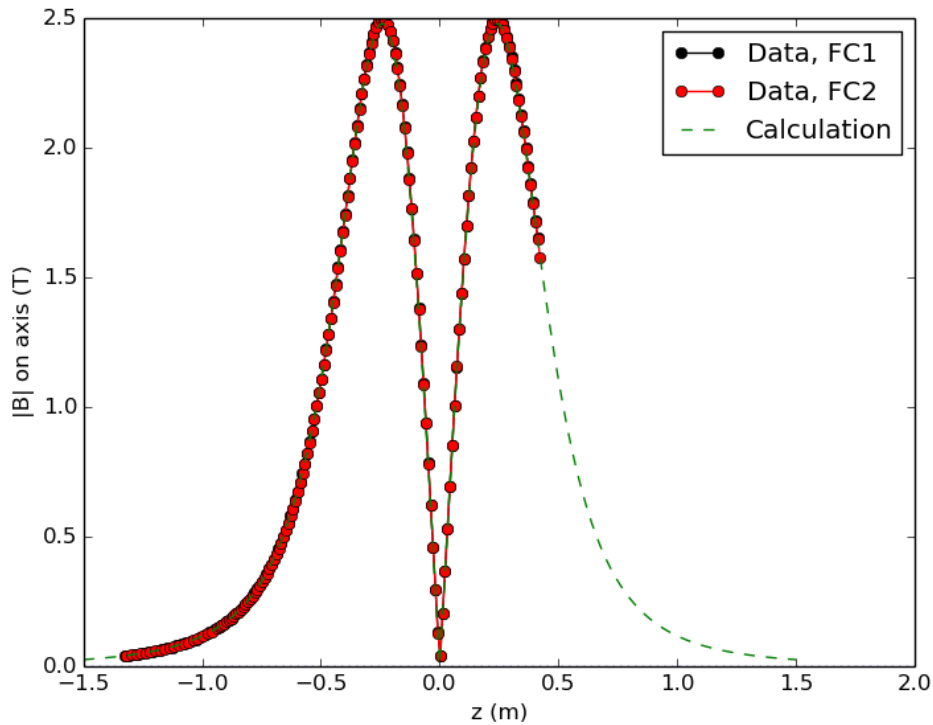
Q1 isn't (strictly) a fair question



- Mapper moves around different (x, y) areas of surveyed system.
 - Still within 1mm of each other, however...
- Ignore survey for now and compare measurements to calculation...

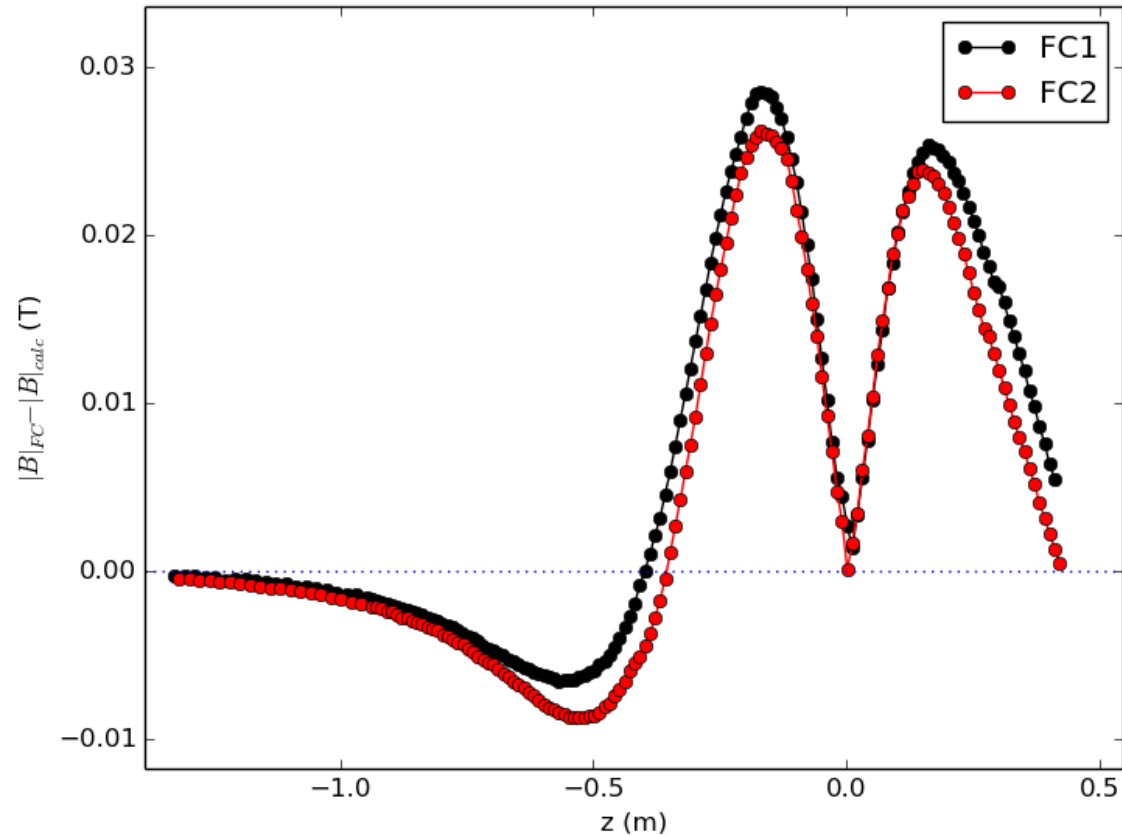
Compare FC1 & FC2 to Calculation

- 150A, flip mode field maps
- Plotting $|B|$ vs. z
- FC's always higher than calculation...
 - Off axis? Higher current density?



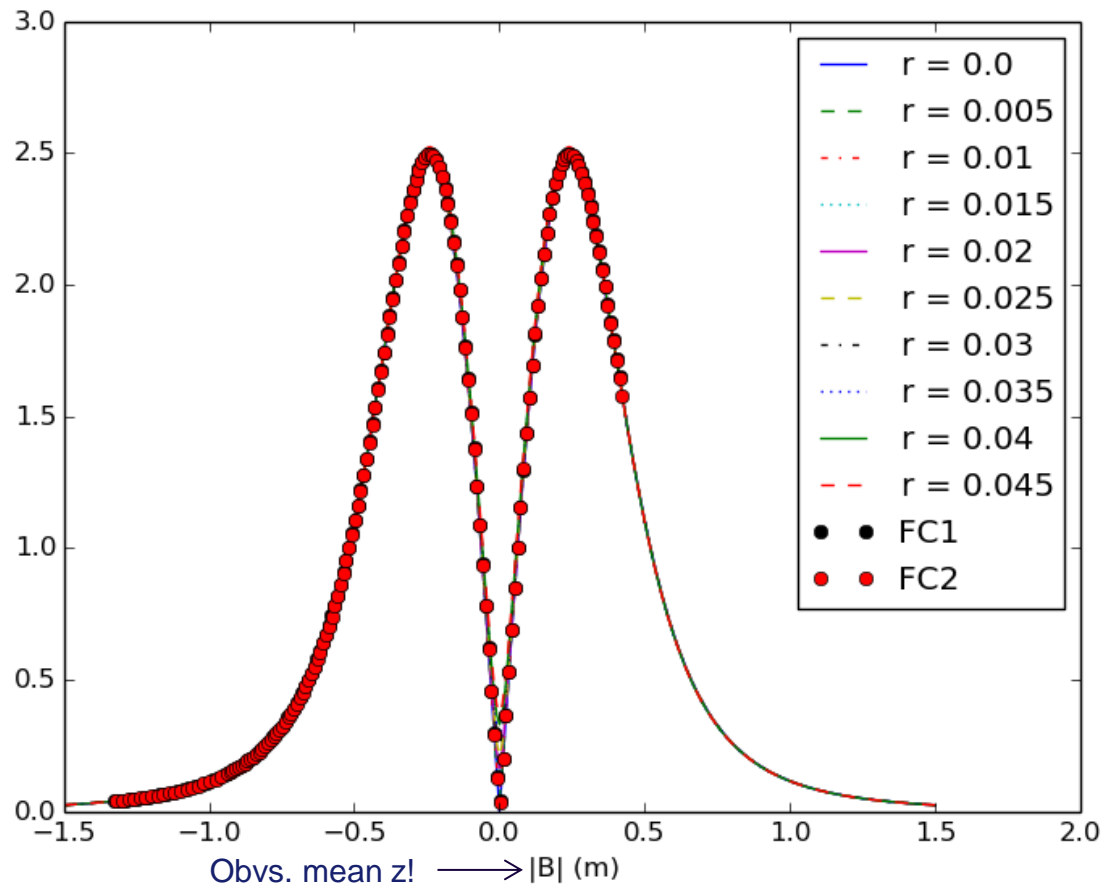
Compare FC1 & FC2 to Calculation

- Consider being off-axis first
 - Know that mapper isn't *always* central from survey (slide 11)
- But difference seems very large...
 - Larger than the ~1mm difference surveyed
- How far off-axis could we be?



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- Calculate field off-axis, compare to data.



Compare FC1 & FC2 to Calculation

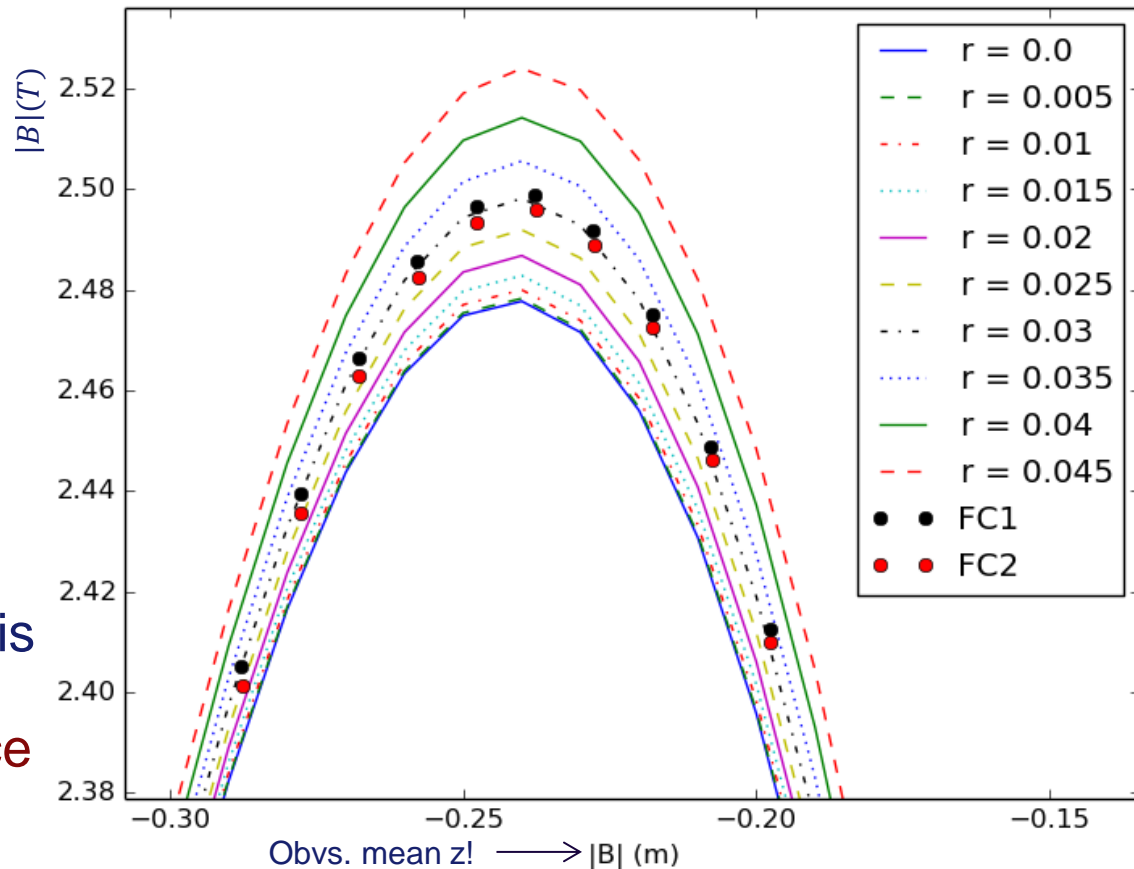
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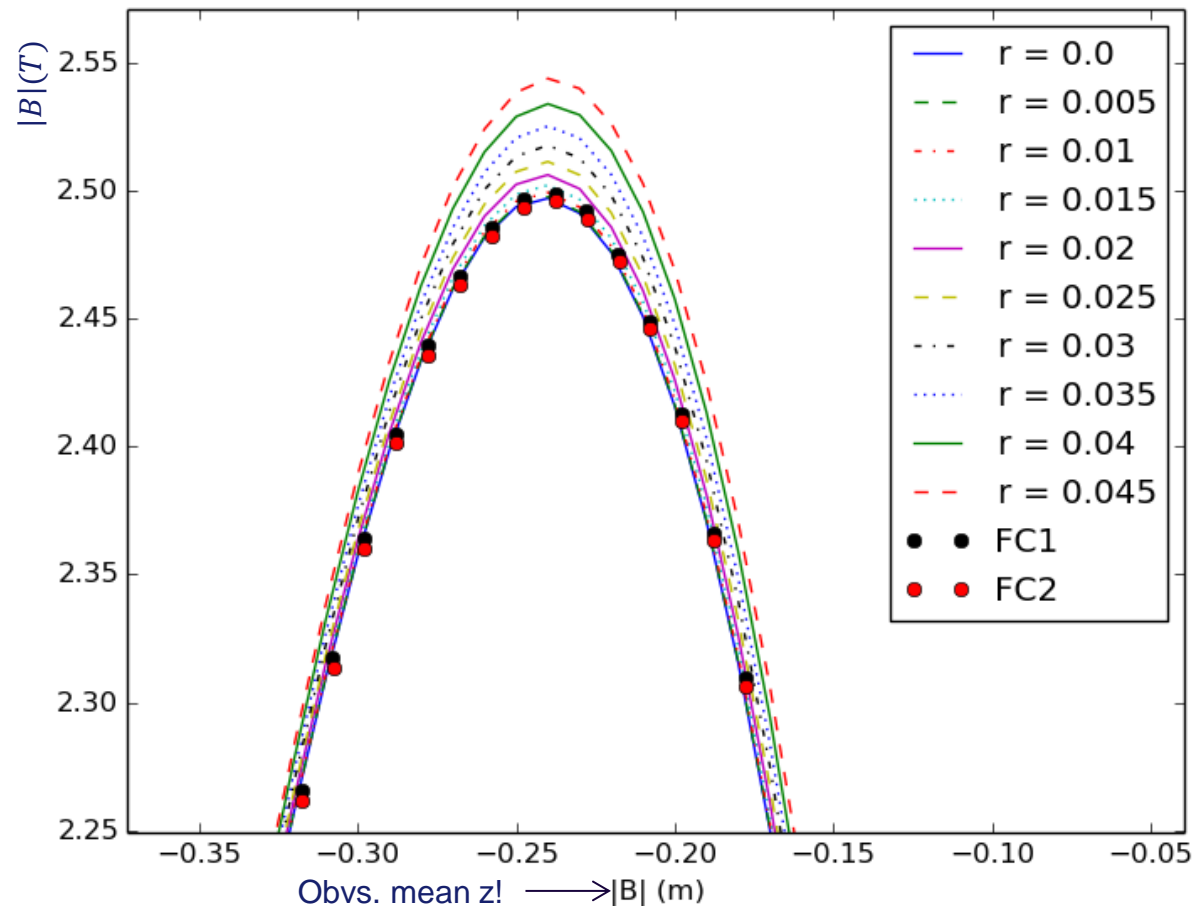
- Calculate field off-axis, compare to data.

- Closest is 30mm off-axis
 → this can't be the reason for the difference



Compare FC1 & FC2 to Calculation

- Consider shrinkage...
 - Calculation assumes the *warm* dimensions shown in drawings
 - But coils are at 4K
- If the coils shrink, the current *density* will increase → could describe this effect
- Quick check: Warm outer radius of coils is ~361mm.
 - Calculate now with 358mm
- More believable
 - Unsurprising
 - Fits to coil dimensions are useful to see how coils shrink
 - But catch-22 with finding axis?



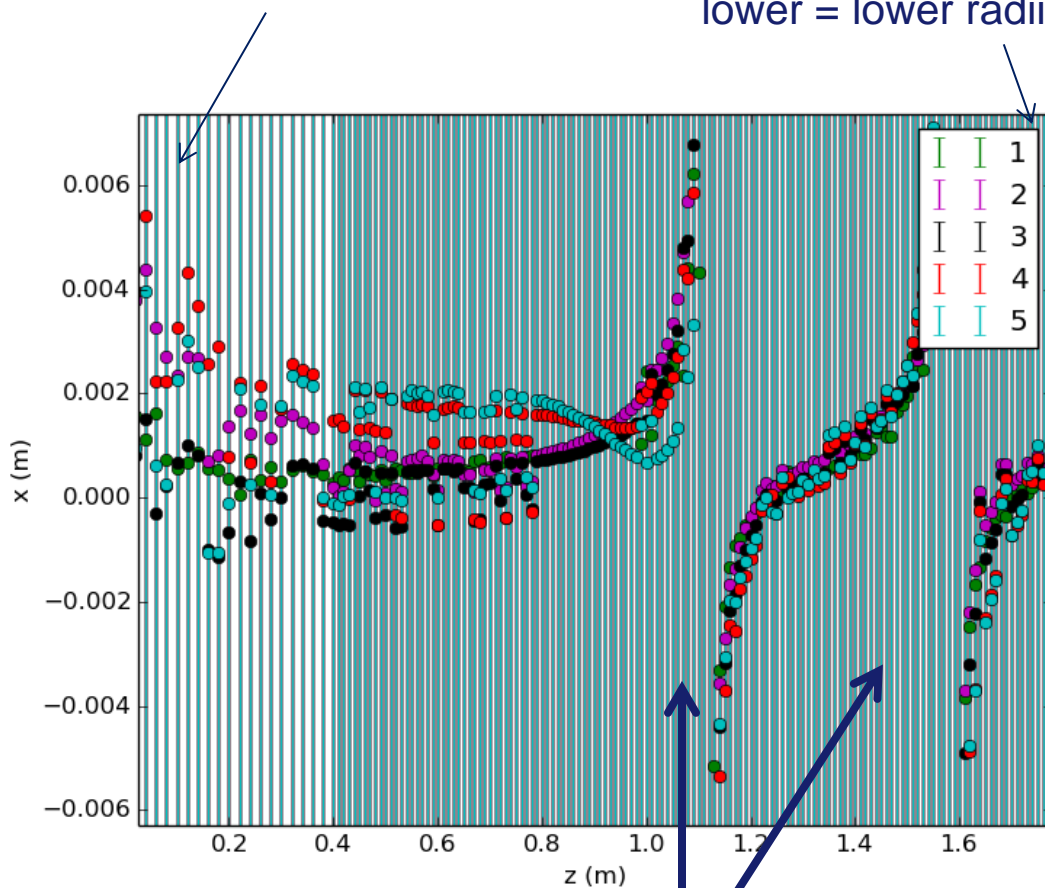
Finding the magnetic axis (x, FC2@150A)

• Uses:

- Alignment of cooling channel
- Better fits to coil dimensions for realistic MAUS field maps

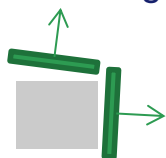
This isn't a "pretty pattern". They're the error bars from Minuit!

Hall probe ID, lower = lower radii



$$\text{Fit: } B_x \cong mx + c + \alpha B_y + \beta B_z$$

Allow for small amount of mixing of other components (Hall probes measure perpendicular field)



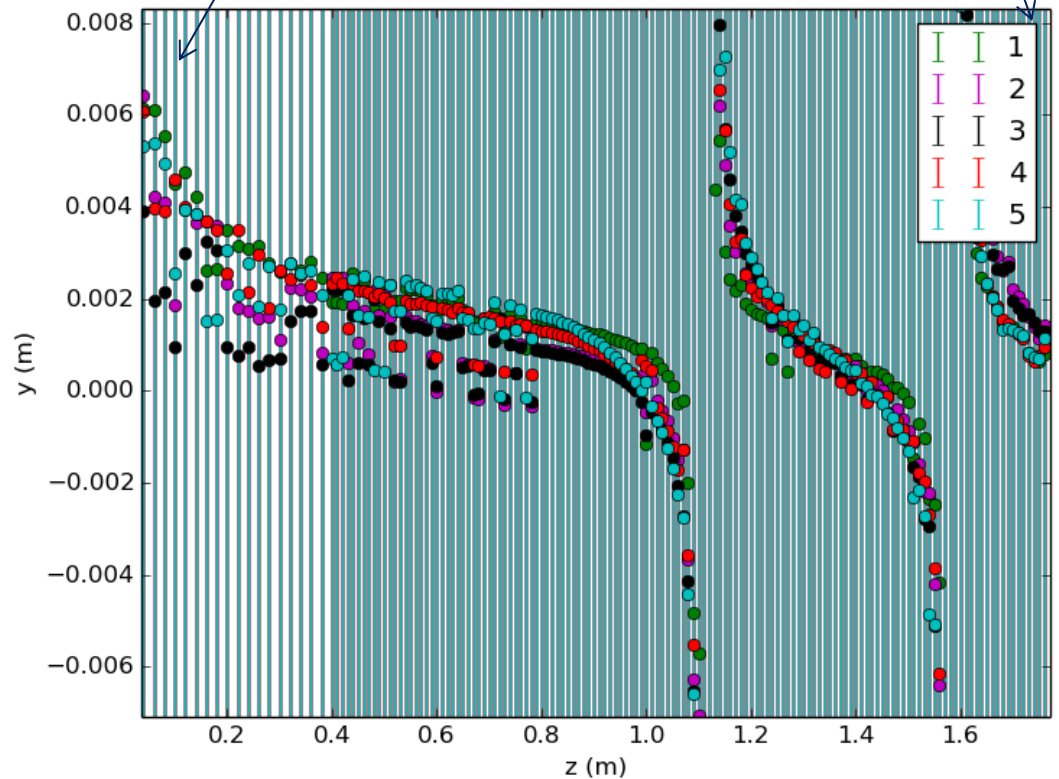
"peak field" region

Finding the magnetic axis (y, FC2@150A)

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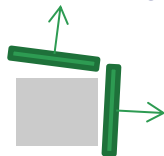
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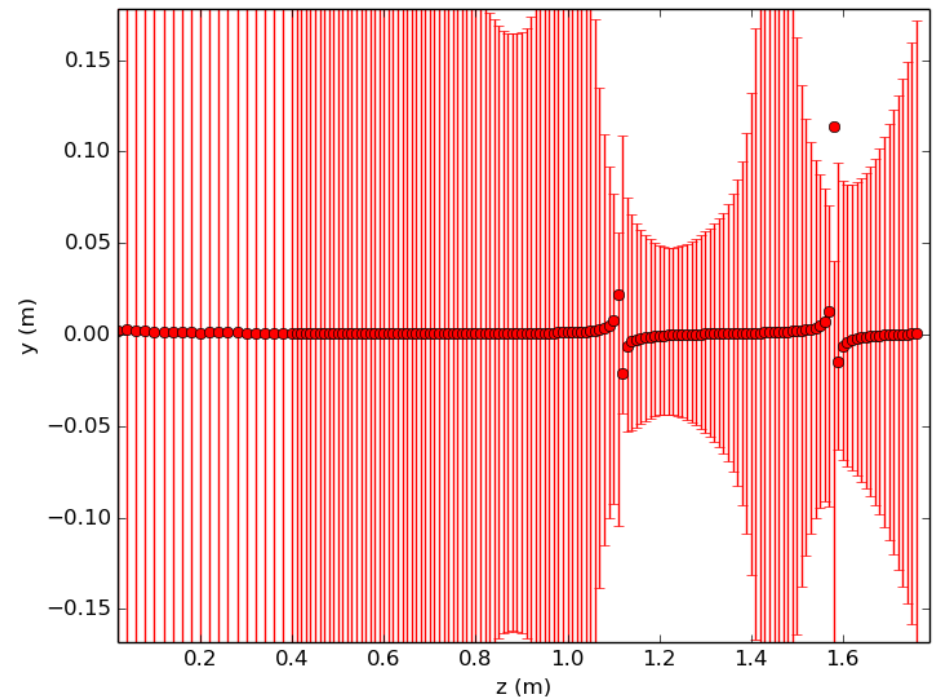
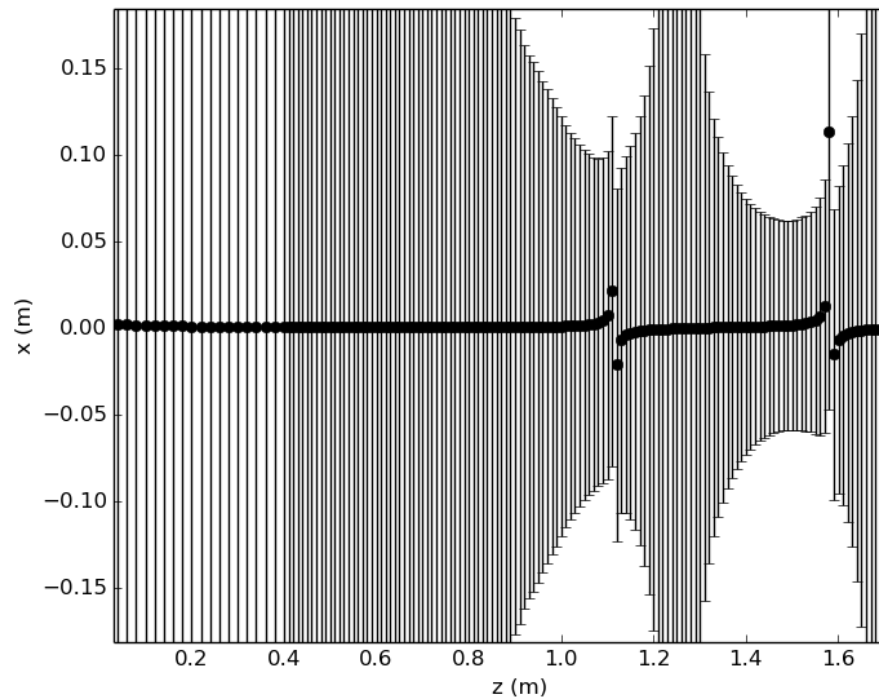


$$\text{Fit: } B_y \cong my + c + \alpha B_x + \beta B_z$$

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All Probes Together...(FC2@150A)



Need to understand why Minuit errors are so large.....

→ Also need to understand survey so values can be translated into “real” co-ordinates