Effects of a superconducting lead endcap on the magnetic field profile for the nEDM search

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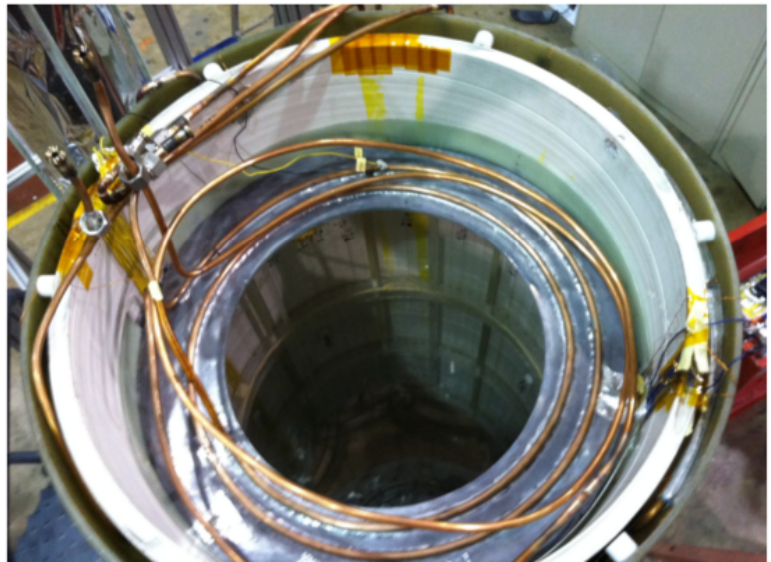
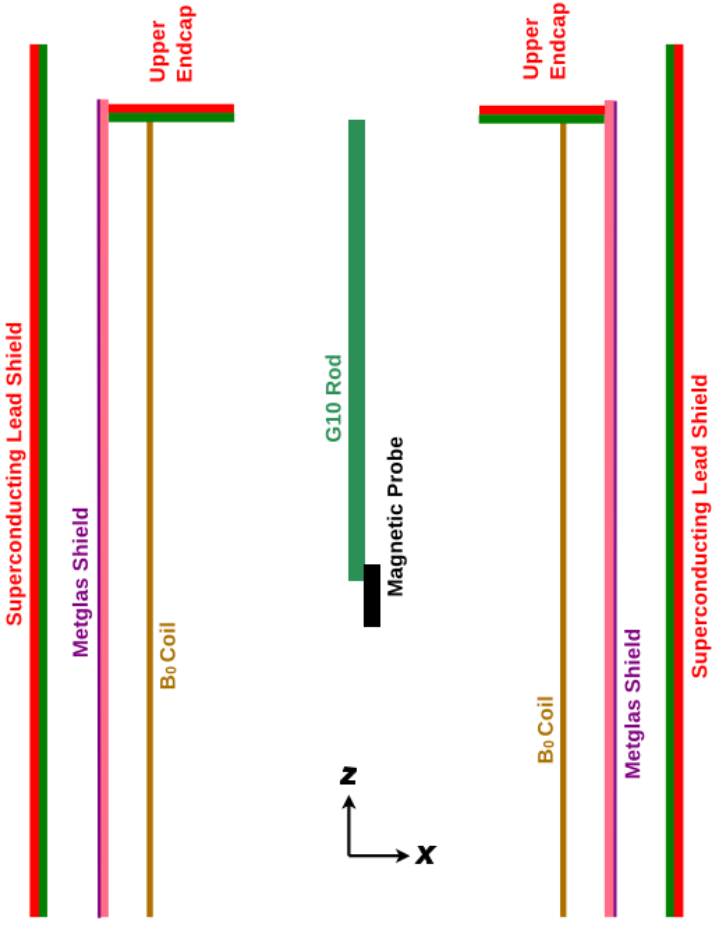
  - edge effects will be more important in the future - third-scale model is shorter, so ends are closer to measurement cells
- installed a lead endcap on the top end

the half-scale model

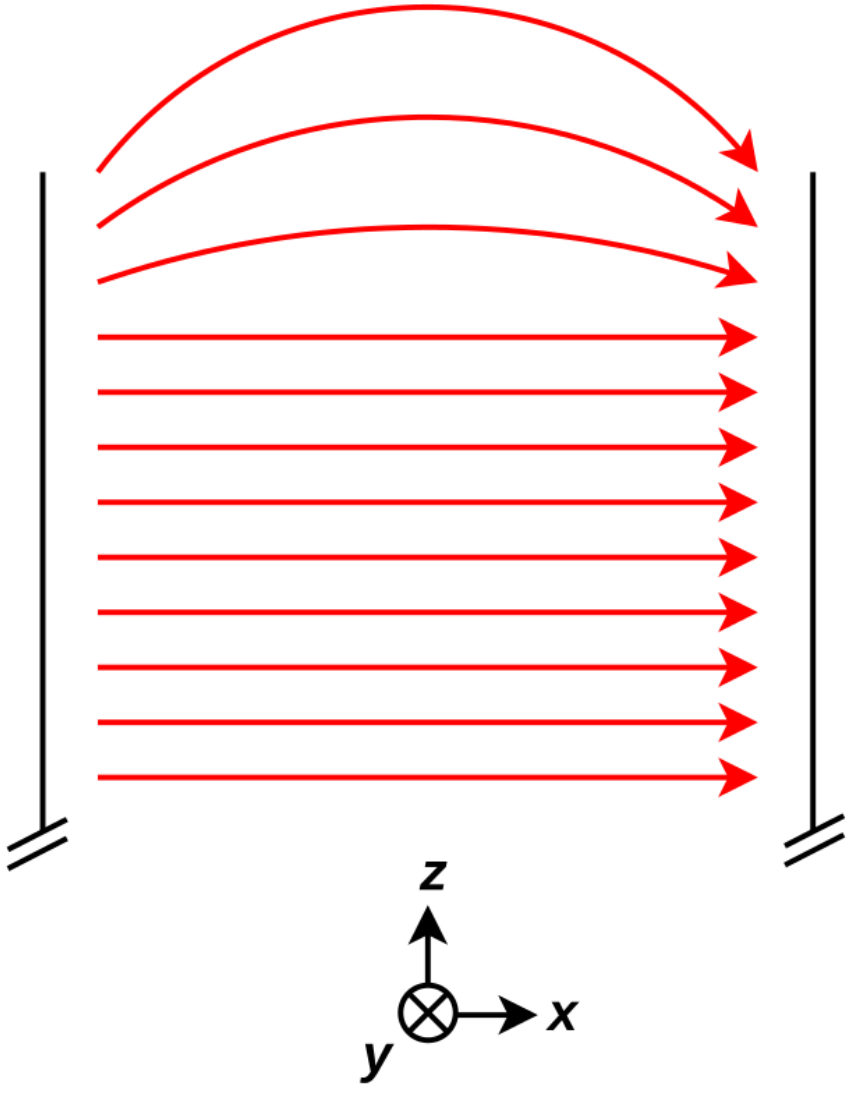


inside the half-scale model



- B_0 coil: $\cos\theta$ coil geometry
  - **B** field in x direction
- ferromagnetic Metglas shield
- superconducting axial shield
- superconducting top endcap

edge effects and the superconducting endcap



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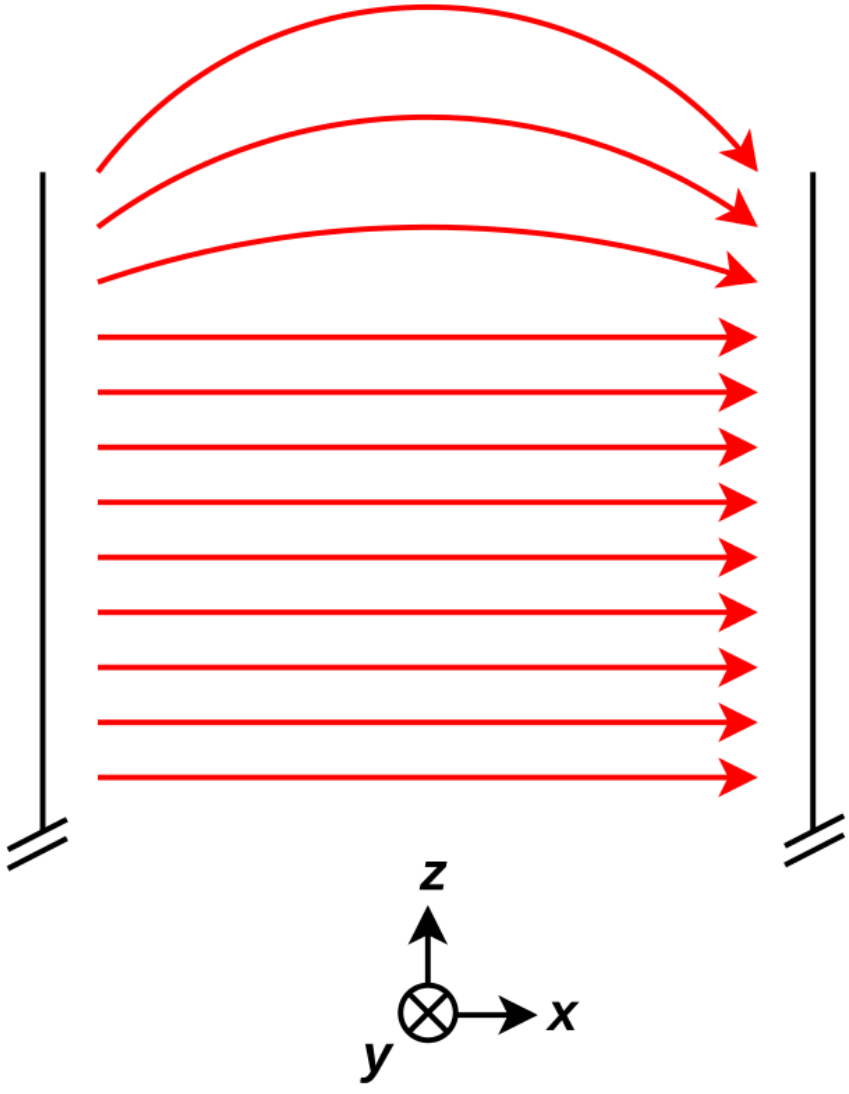

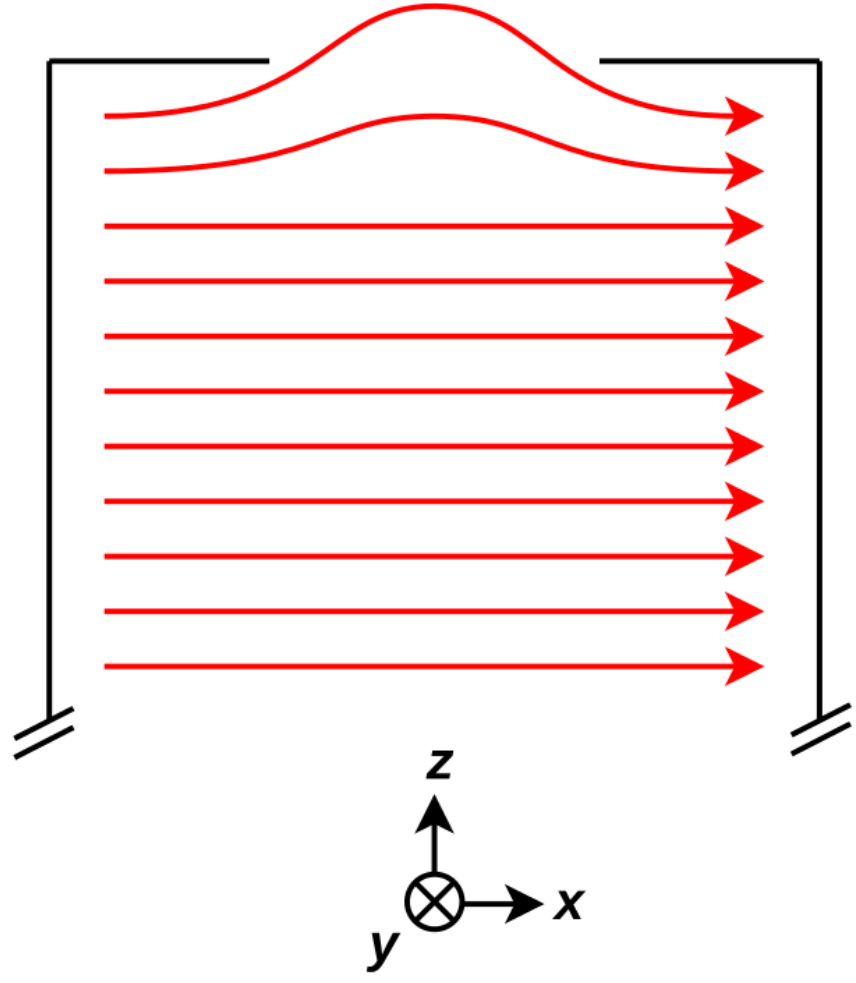

overview of the data analysis

- B_z vs. z is an indicator of field uniformity near the endcap

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- identified systematic errors and applied relevant corrections (`plotter`)
- compared with expected field profiles (`plotter`)

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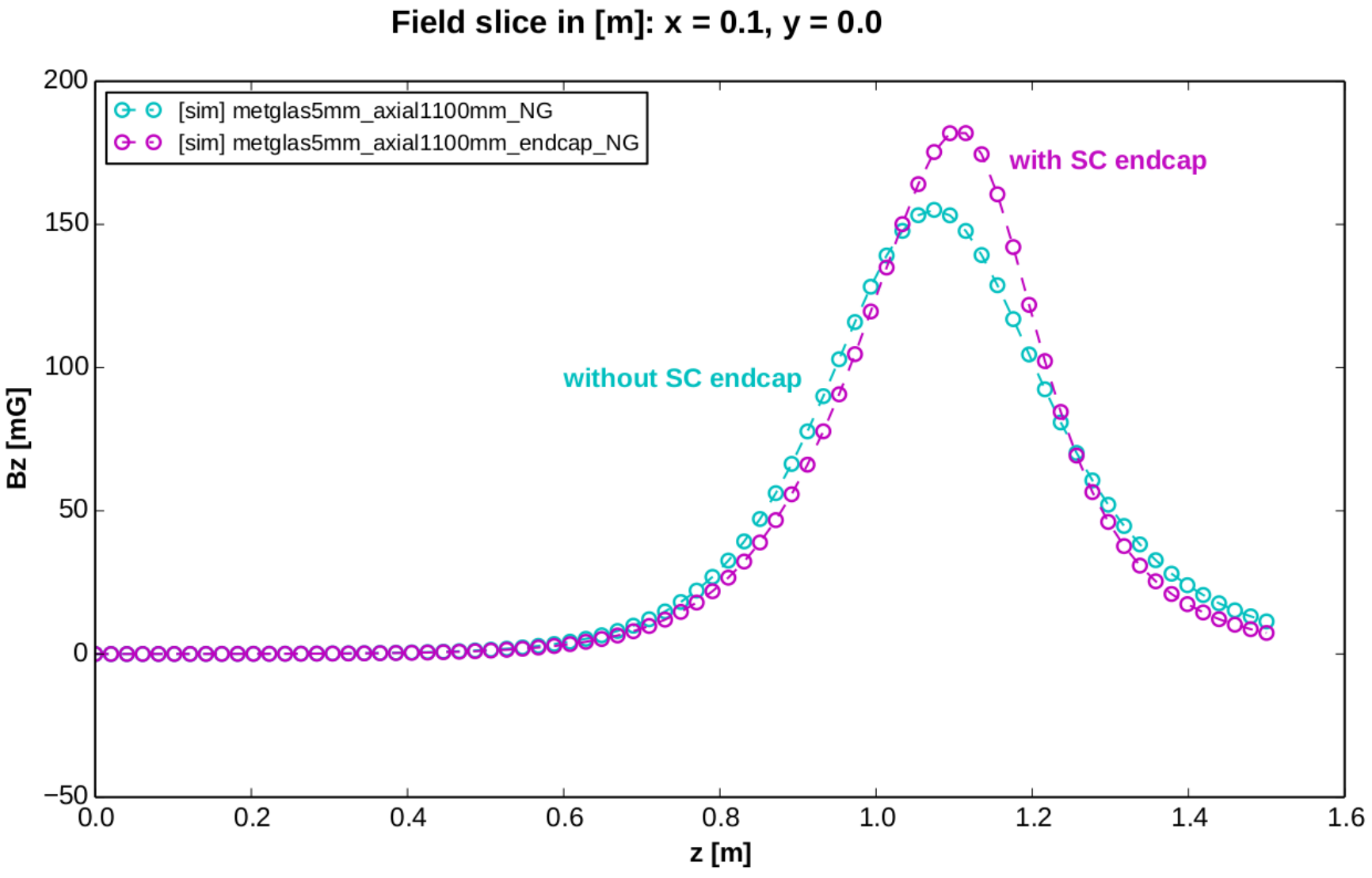
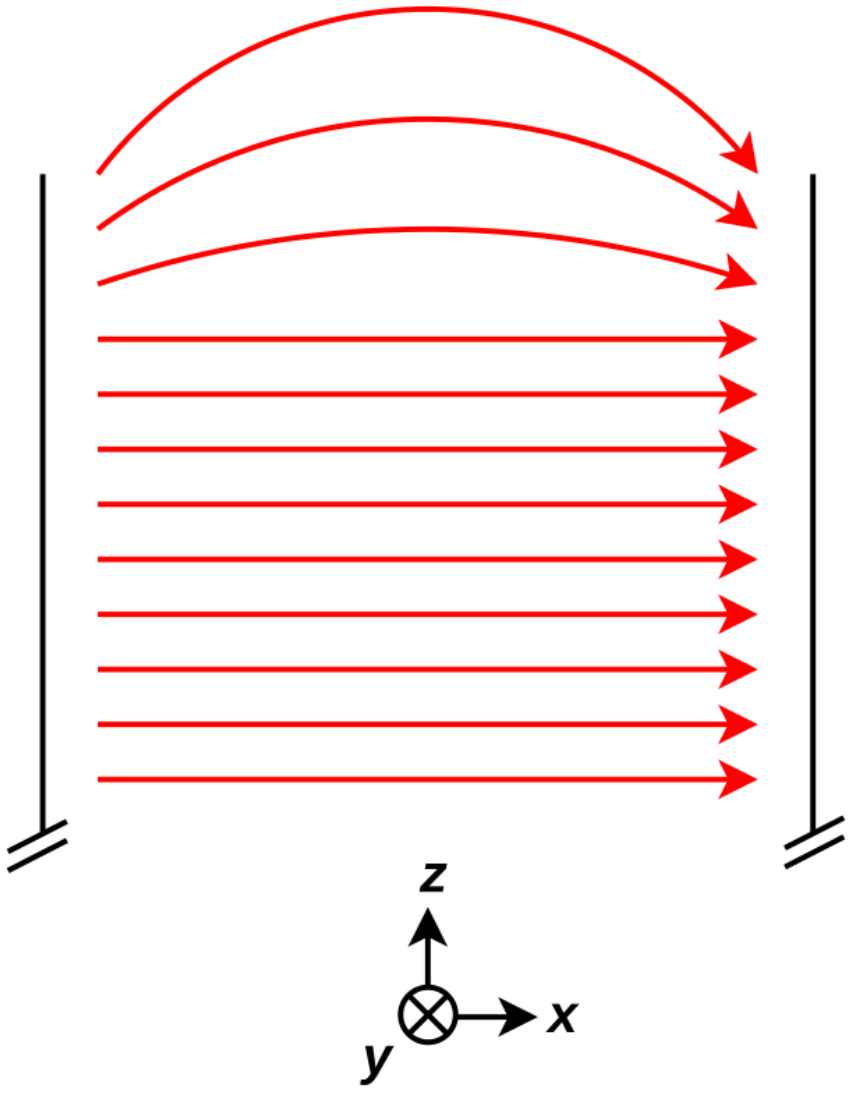
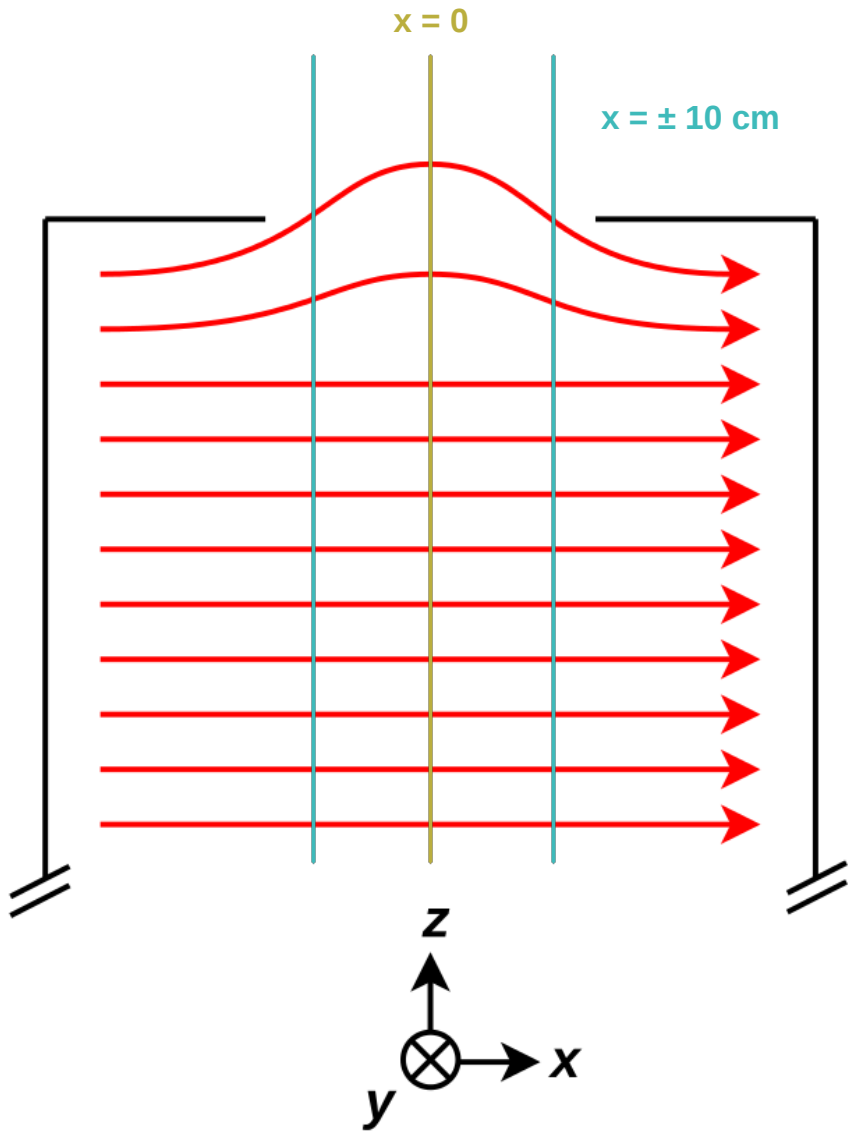
simulations of endcap effect



correction: probe x centering





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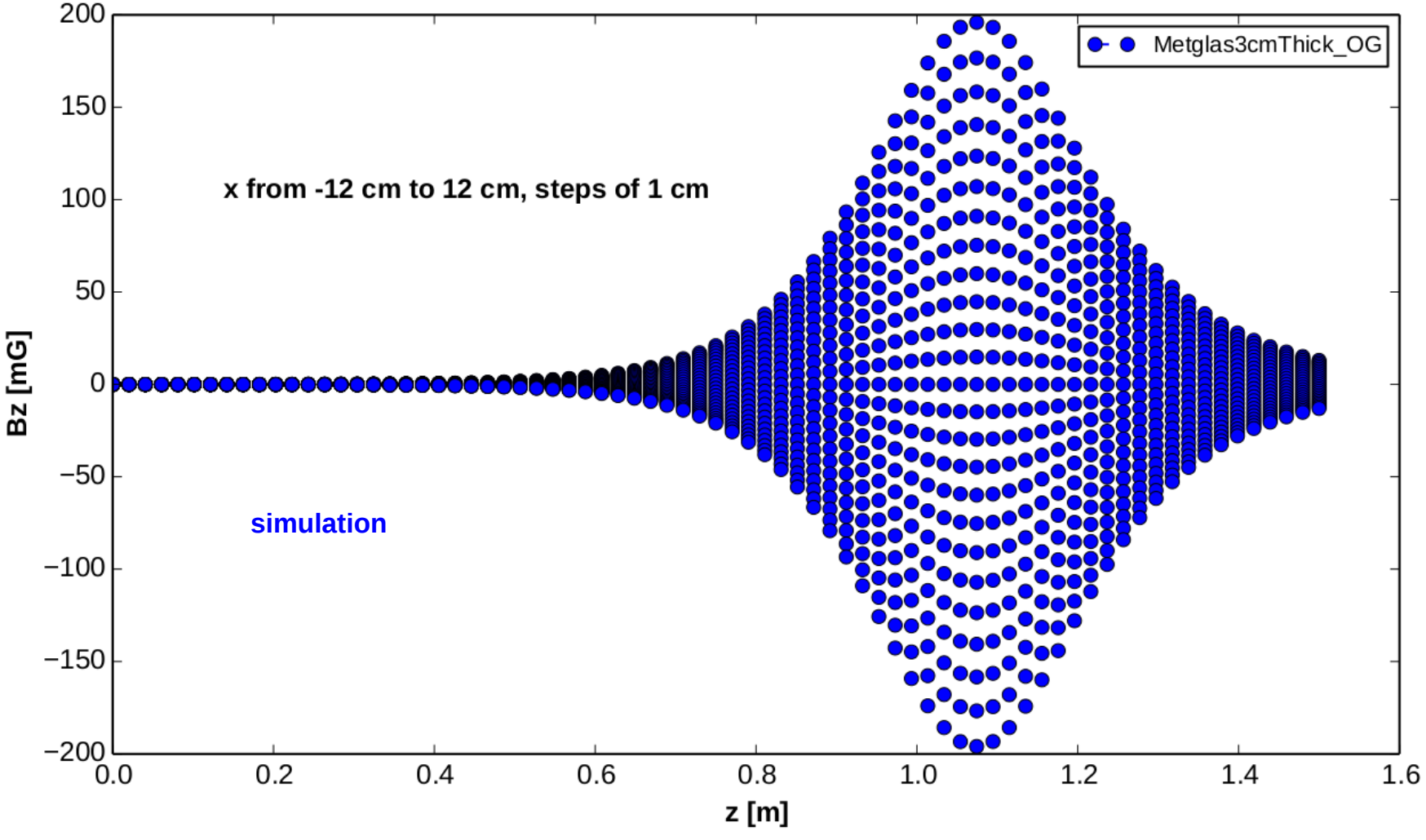
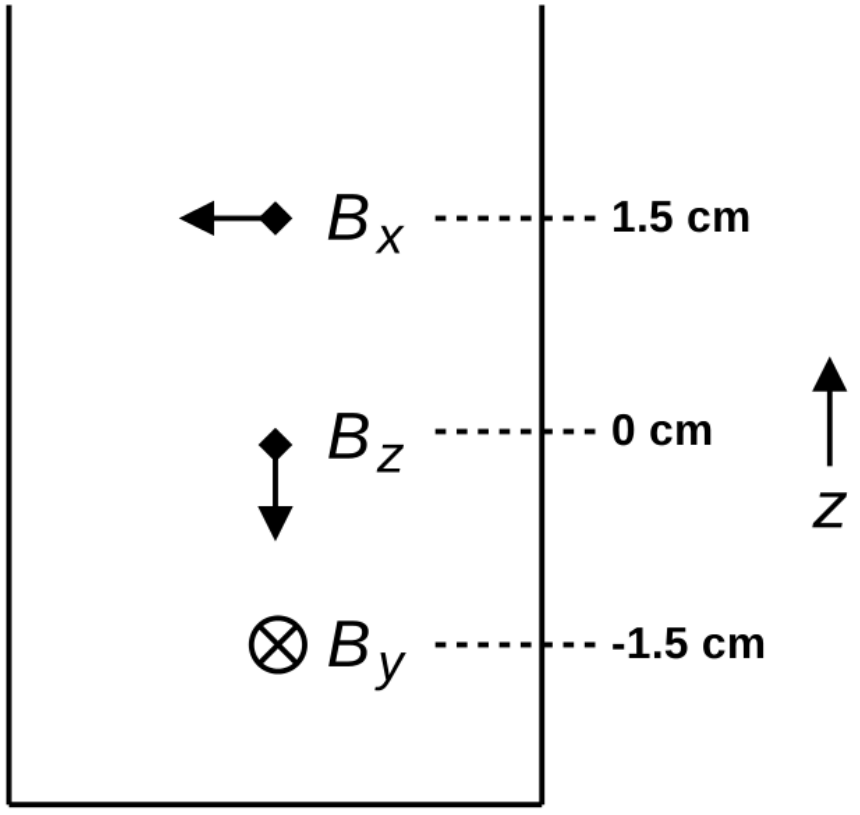


correction: probe axis offset



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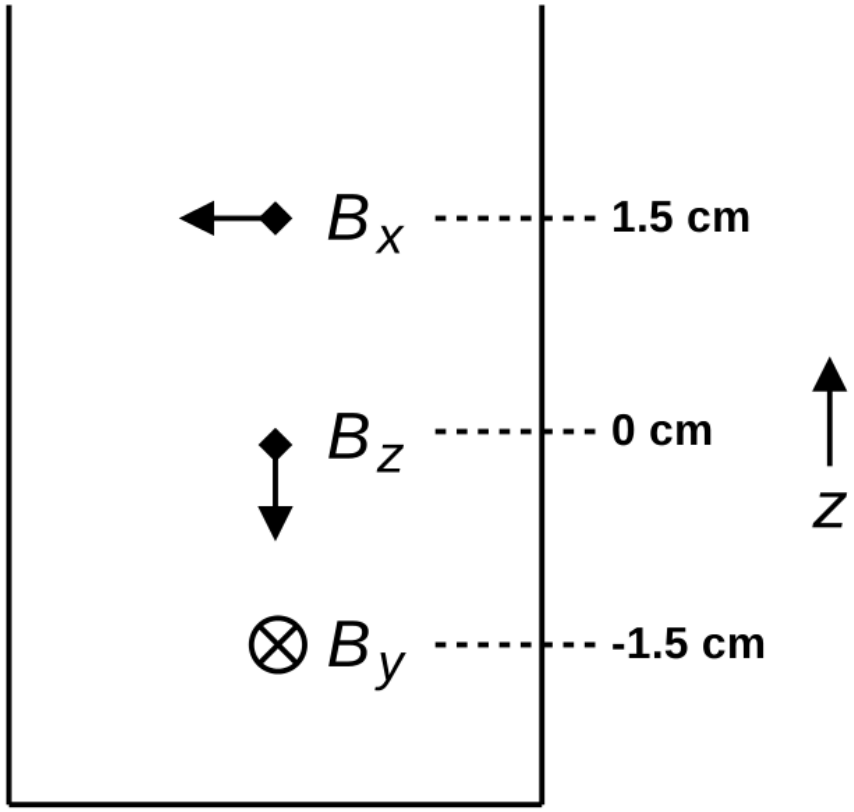

- 3 separate 1-axis probes
- incomplete vector map

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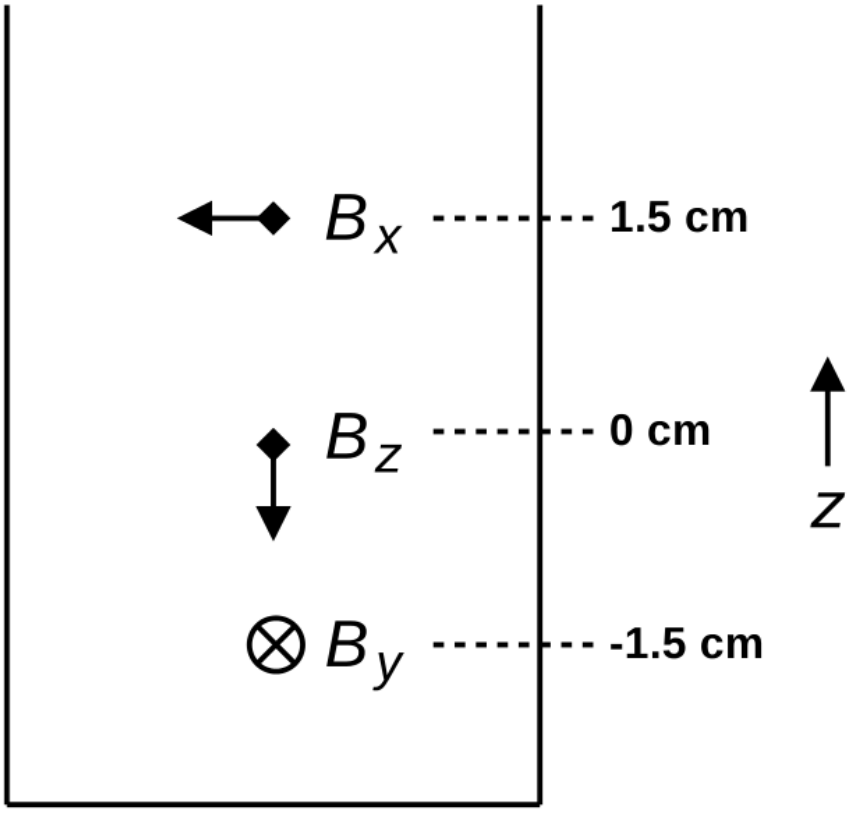
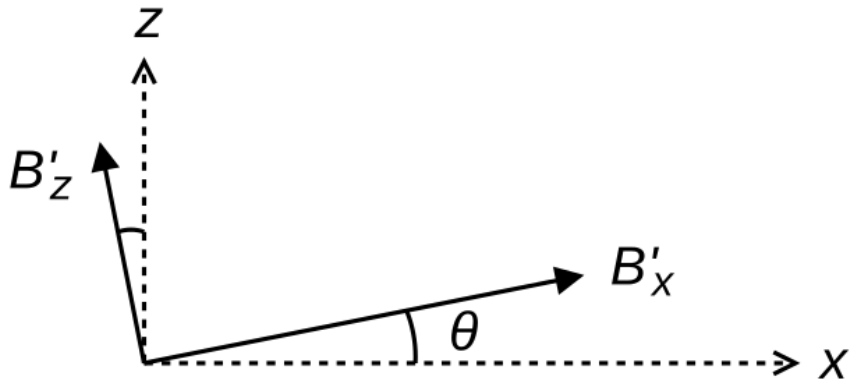


- 3 separate 1-axis probes
- incomplete vector map
- need to store z-axis offset vector along with z array

correction: probe tilt



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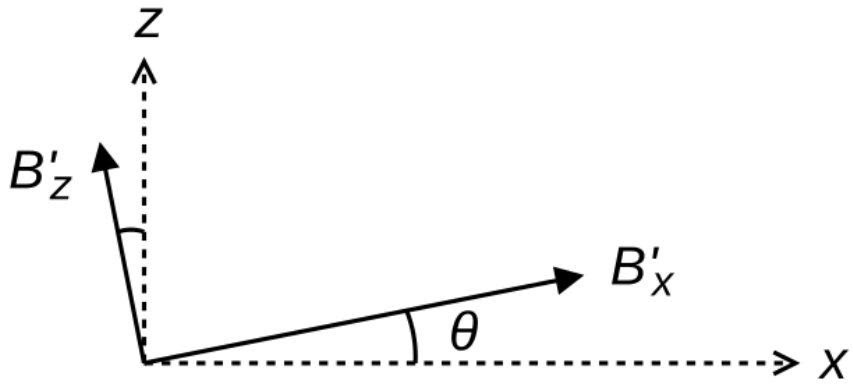

$$B_x = B'_x \cos\theta - B'_z \sin\theta, \quad B_z = B'_z \cos\theta + B'_x \sin\theta \qquad (1)$$

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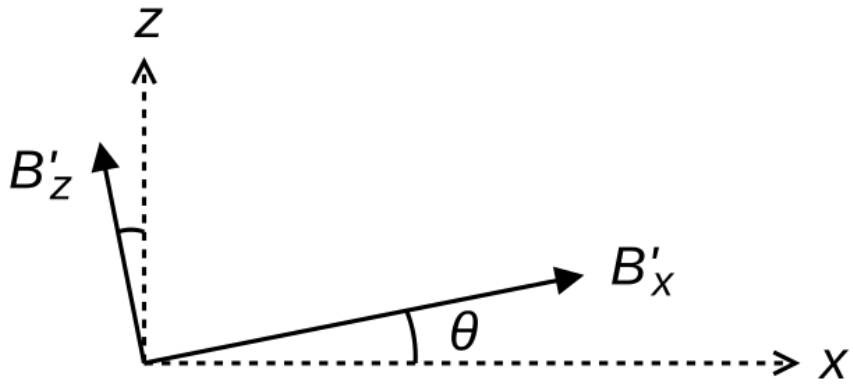

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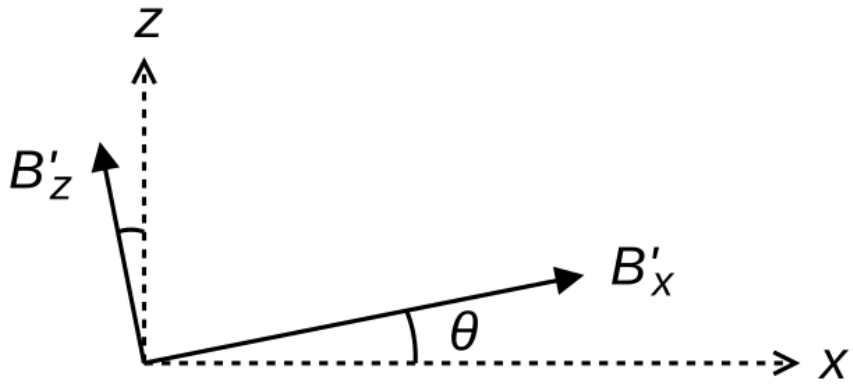

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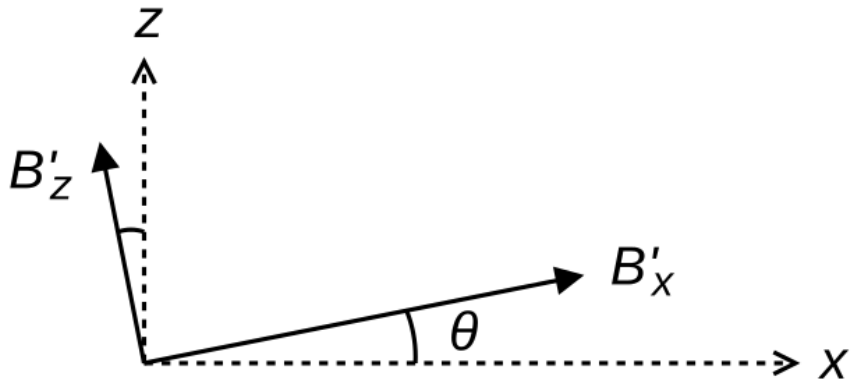

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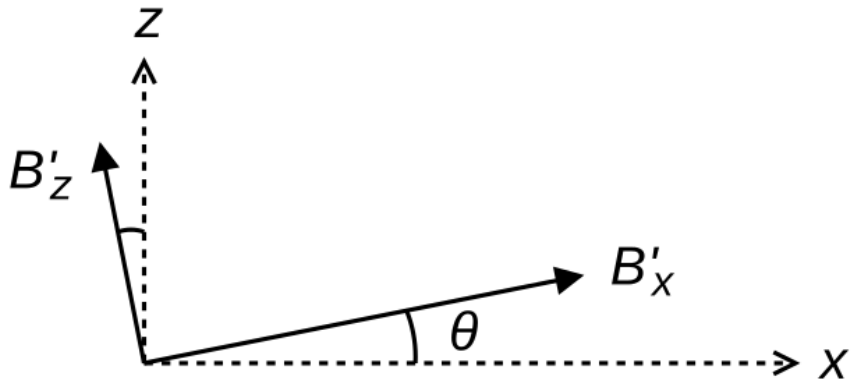

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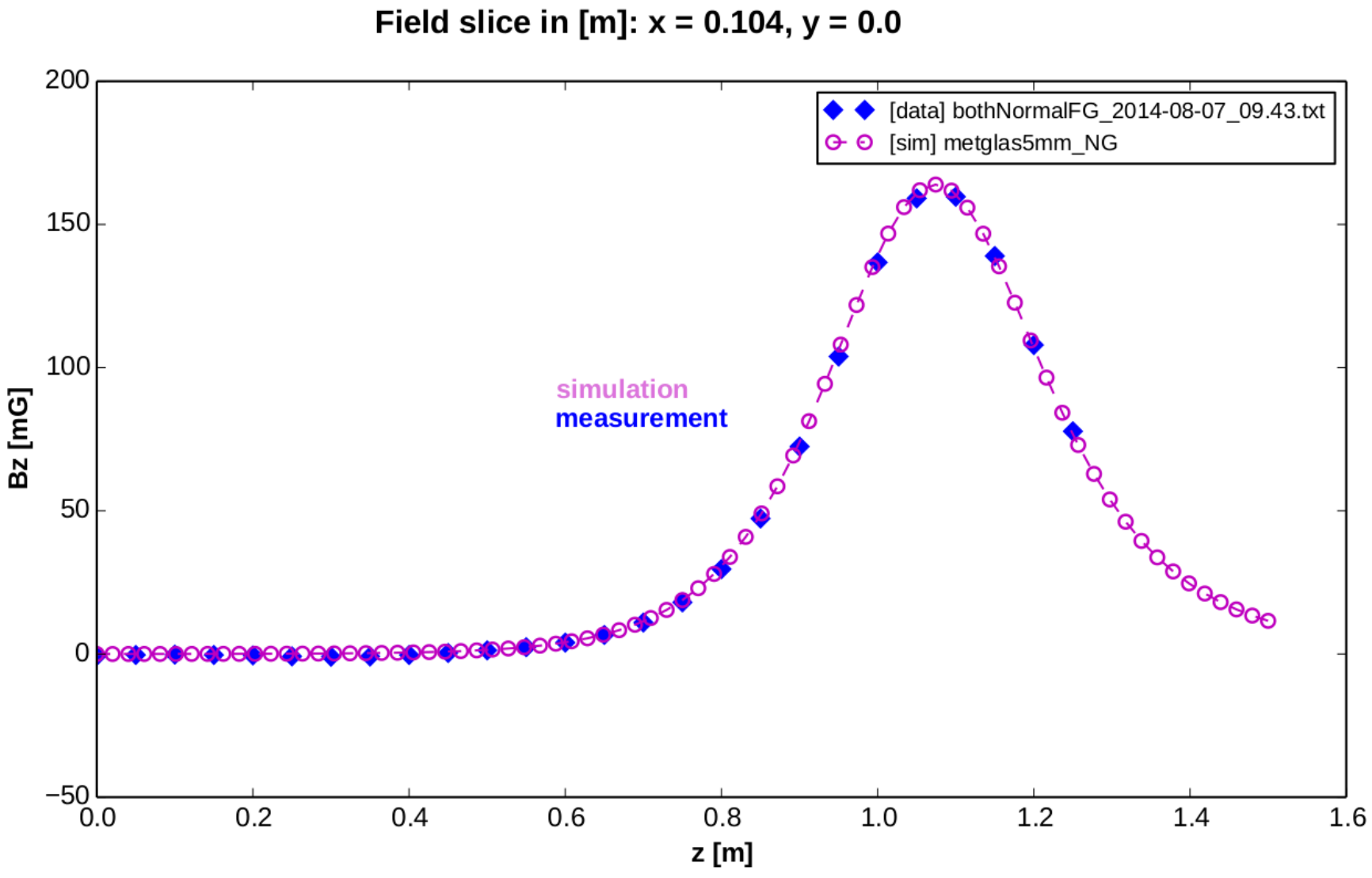
$$\theta = -\frac{B'_z}{B'_x}$$

comparison: axial shield normal, endcap normal



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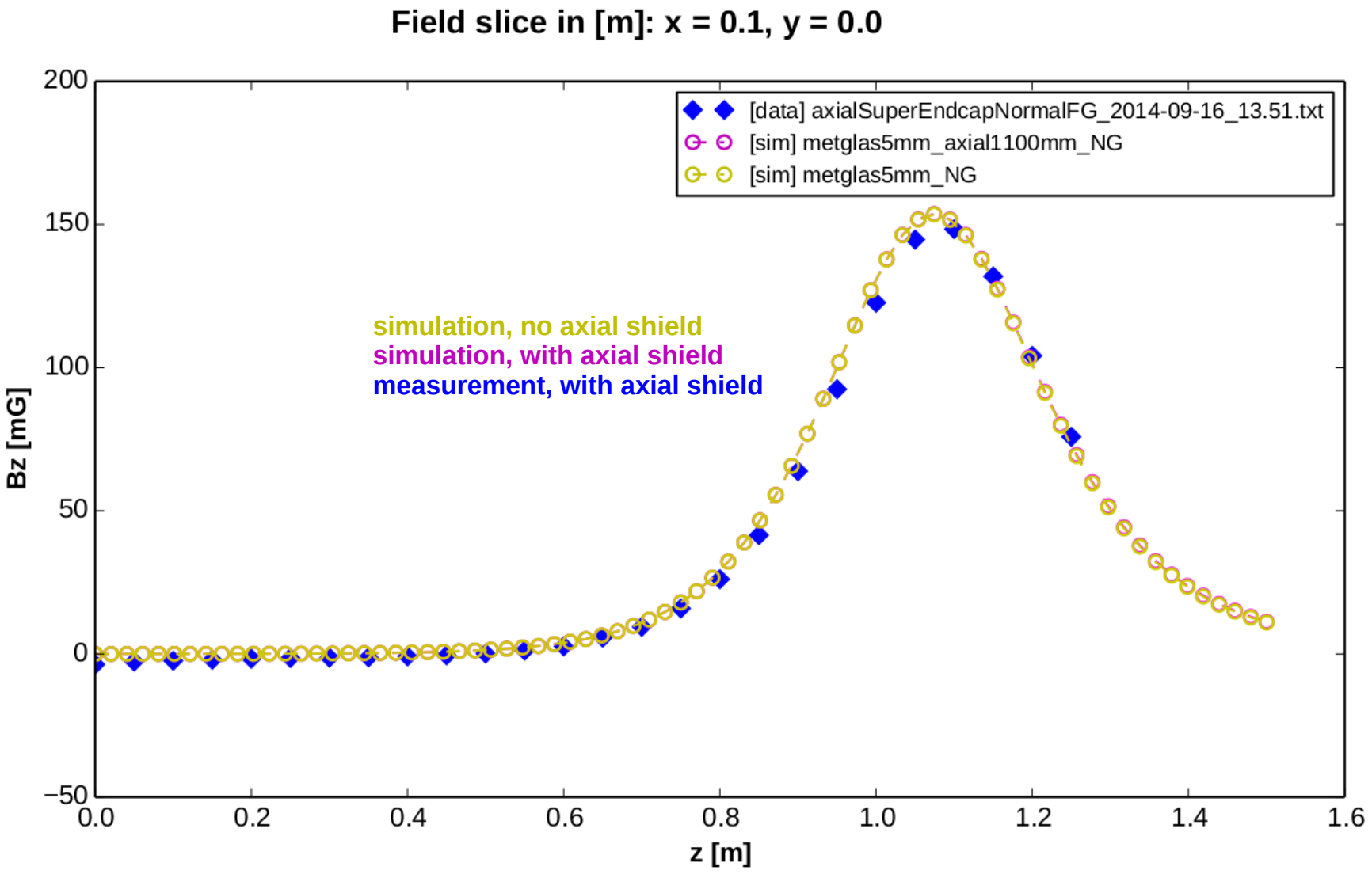

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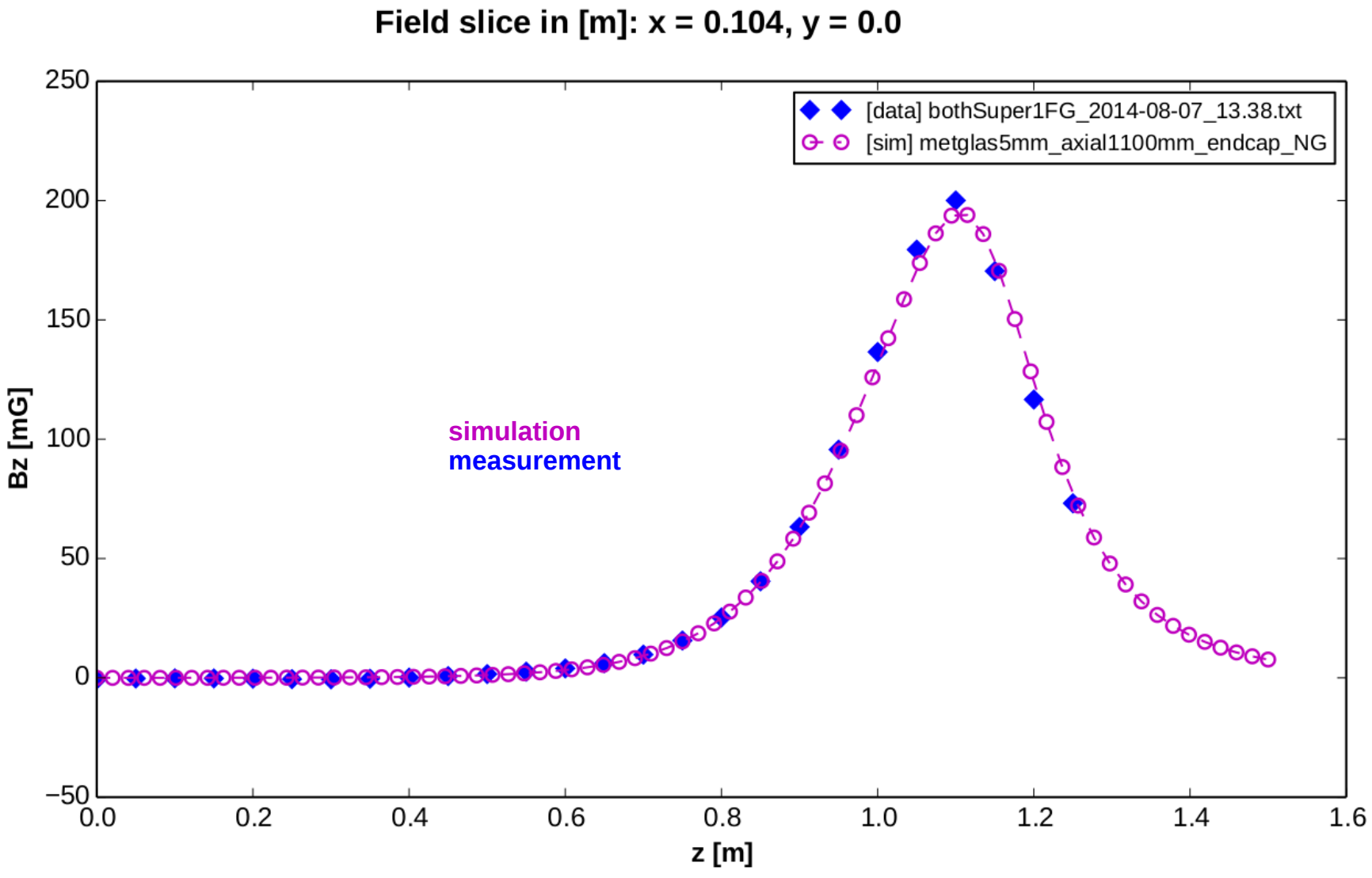
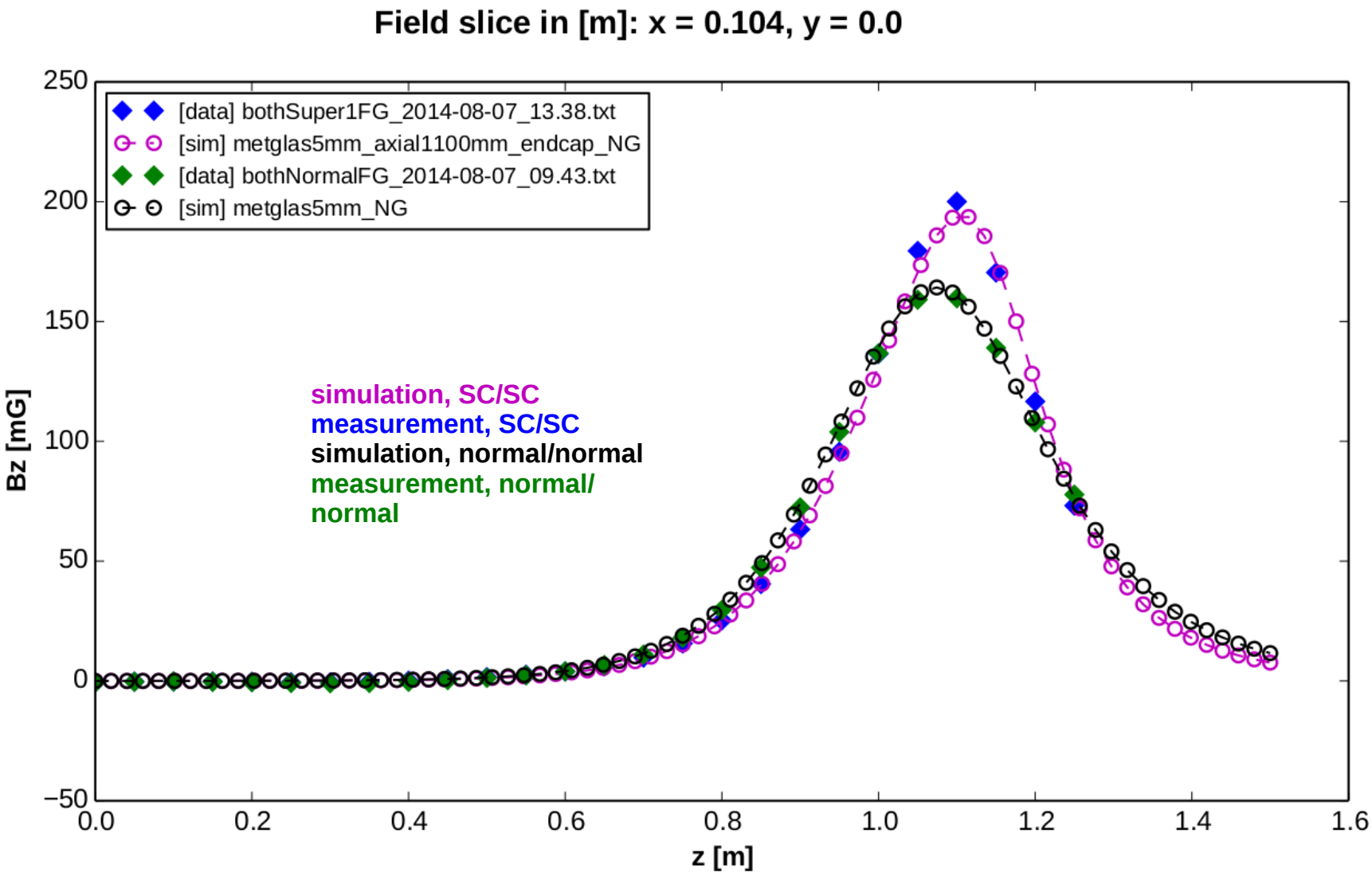


comparison: SC/SC with normal/normal



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- motivates further simulated studies with different endcap geometries

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- our endcap seems to shift the B_z peak away from magnet center

ongoing and future work

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- new model with top and bottom endcaps

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- analysis of field gradients in measurement cell volumes

acknowledgments

- Arthur R. Adams SFP Fellowship
- Caltech SURF Program
- National Science Foundation