

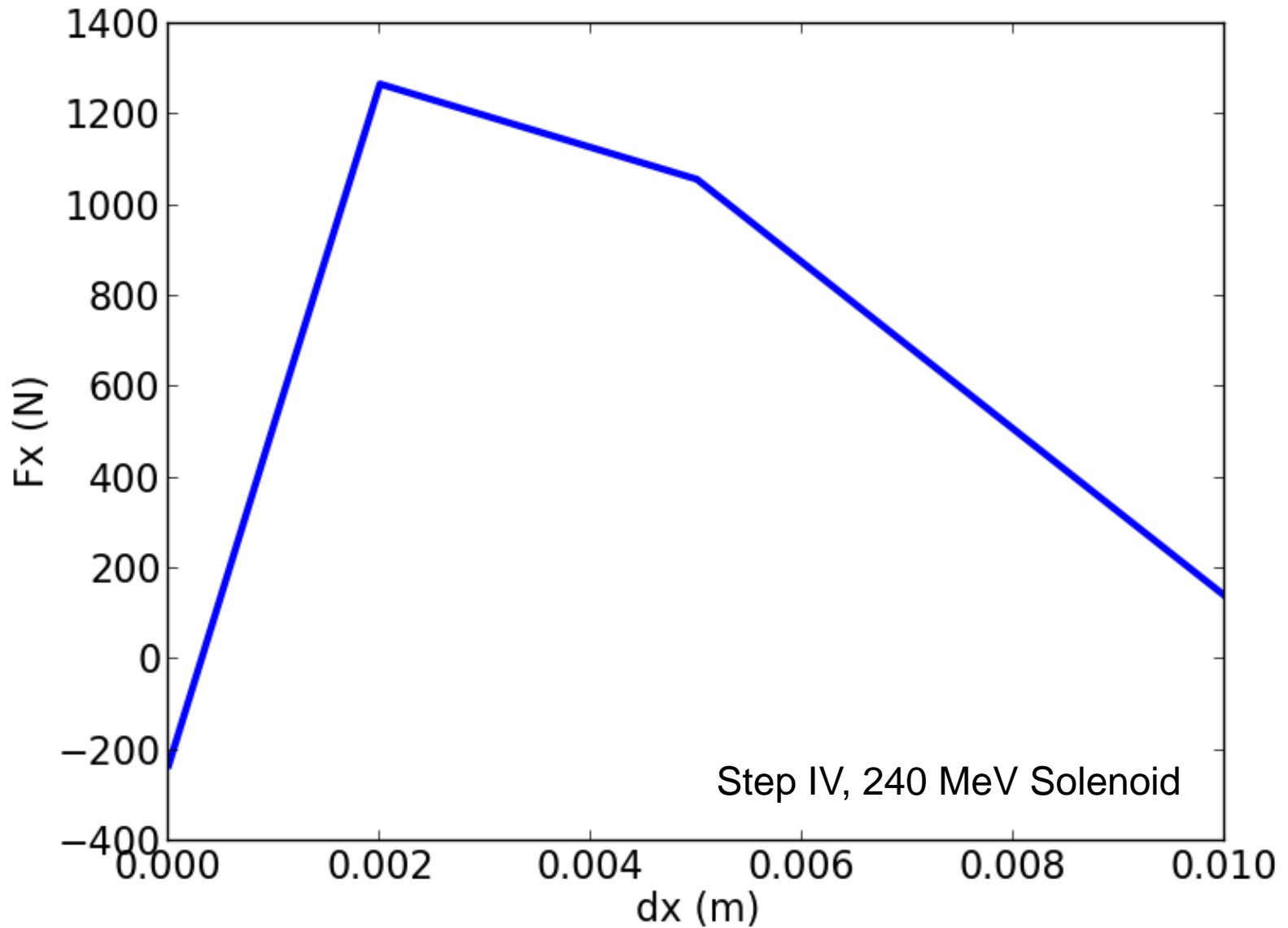
Effect of PRY on MICE Solenoids

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- (Conceptual Design for Step VI)
- Effect of PRY on solenoids
 - Forces
 - Quenches

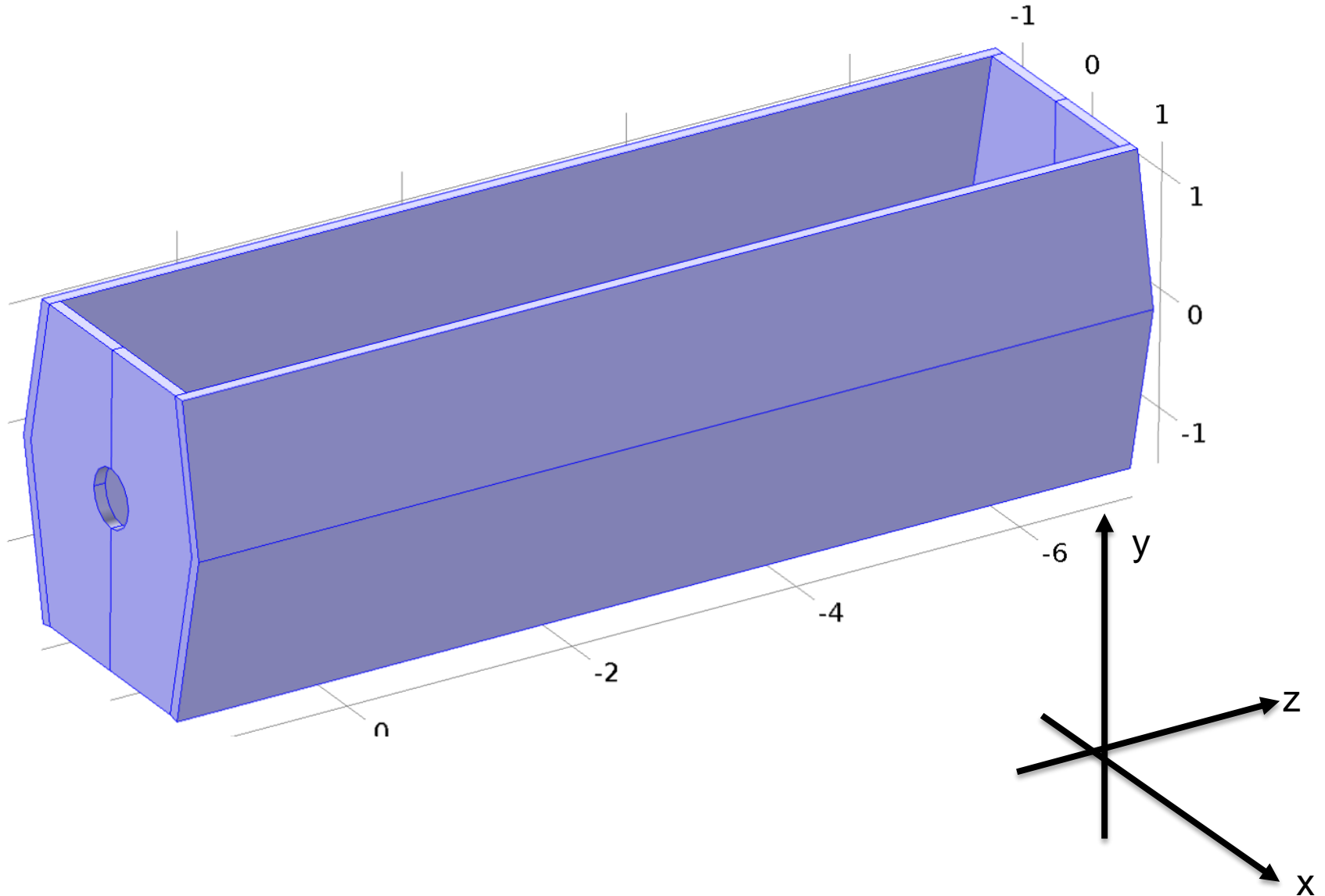
- Initial simulation:
 - 2 kN per mm misalignment
- The perfect approach: parametric study
 - dx, dy, dz: 1, 2, 5 and 10 mm
 - Plus rotations
- Problem: too complex
 - Disk space!
 - Too slow...
- Different approach?
 - Can we imagine worst case?

Force FC

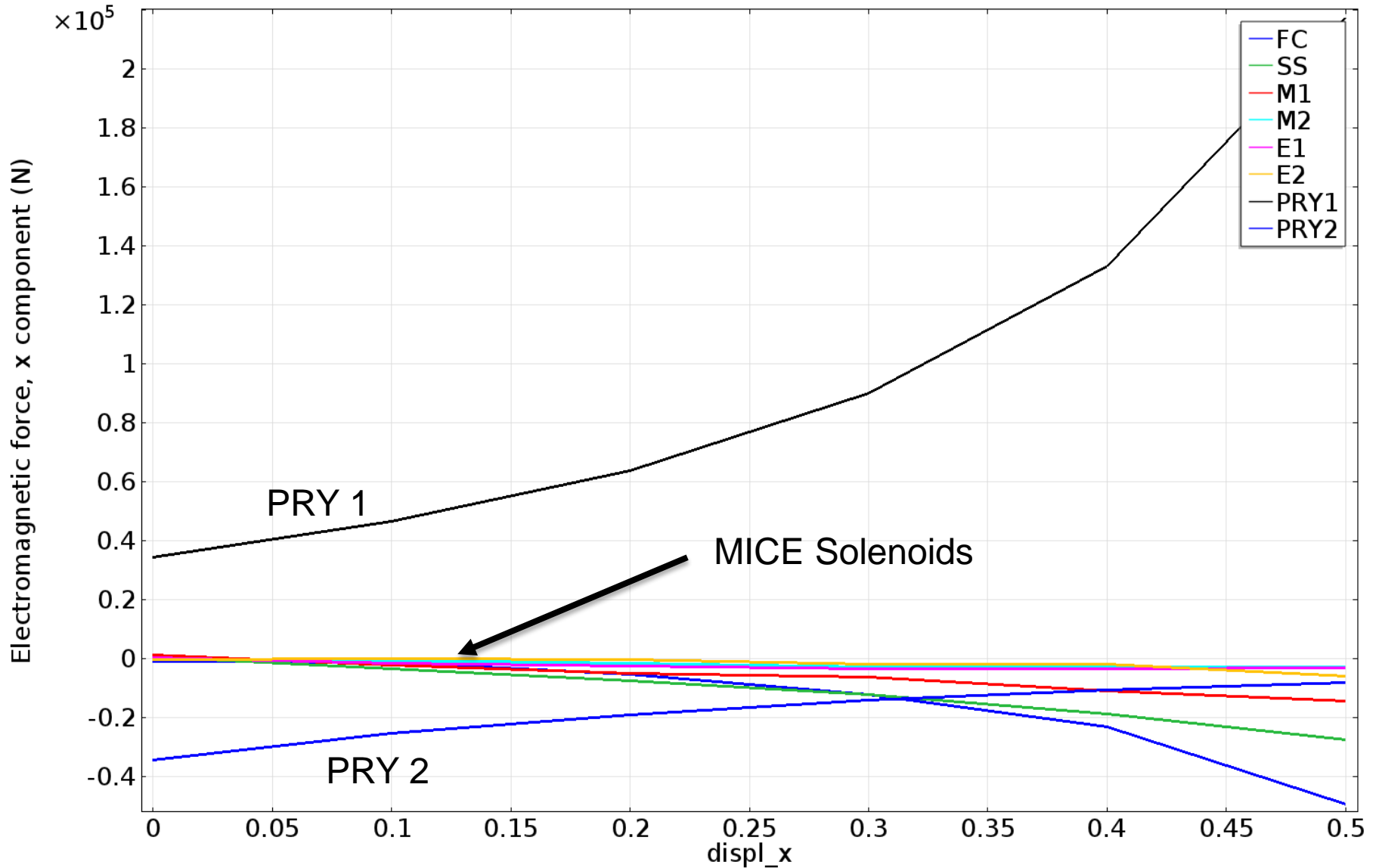


- Step IV
 - 240 MeV solenoid
 - 240 MeV Flip
- Misalignment:
 - dx, dy, dz: 0, 0.1m, ... 0.5m
- Rotations (x,y,z-axis): 0,3,6,9 degrees

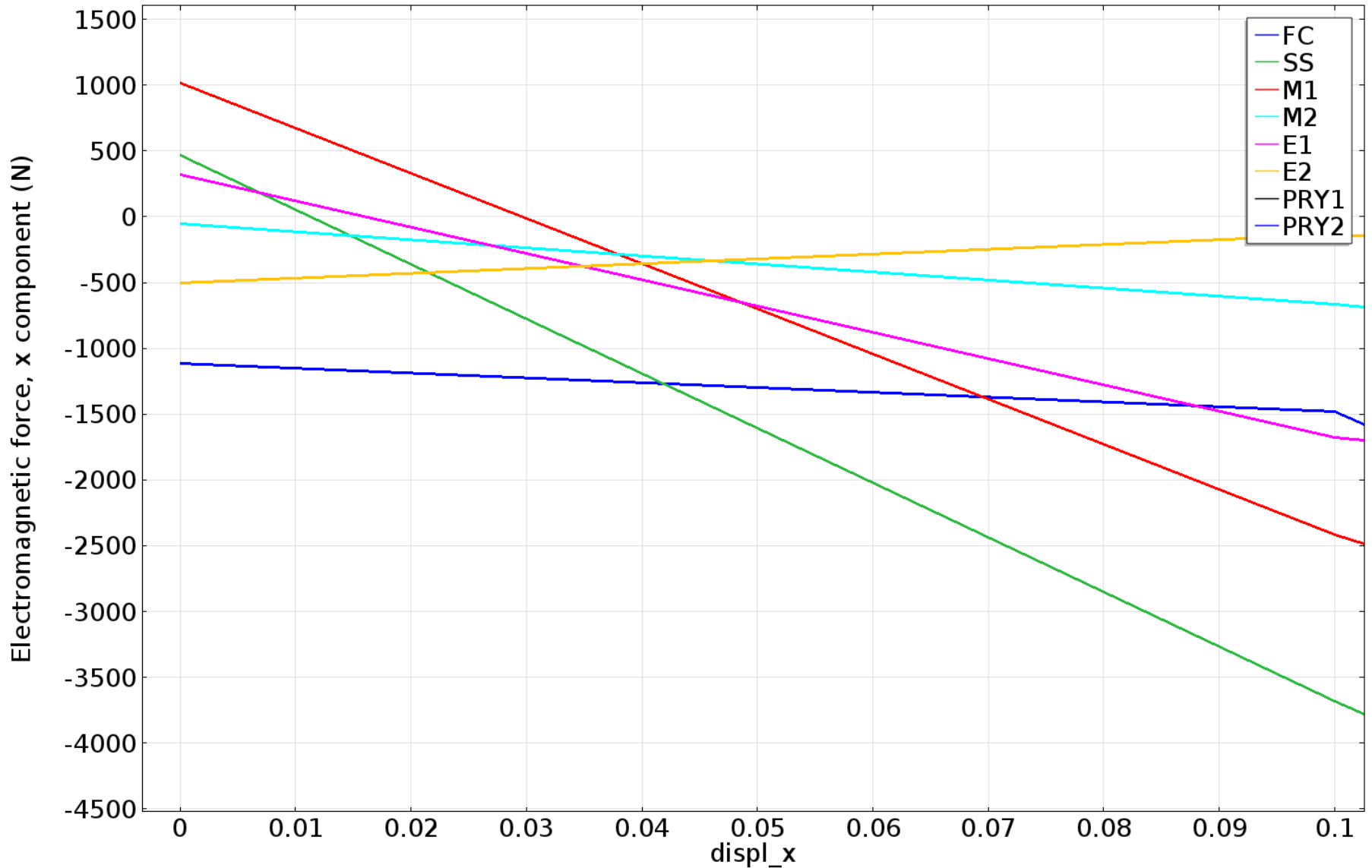
Coordinate System



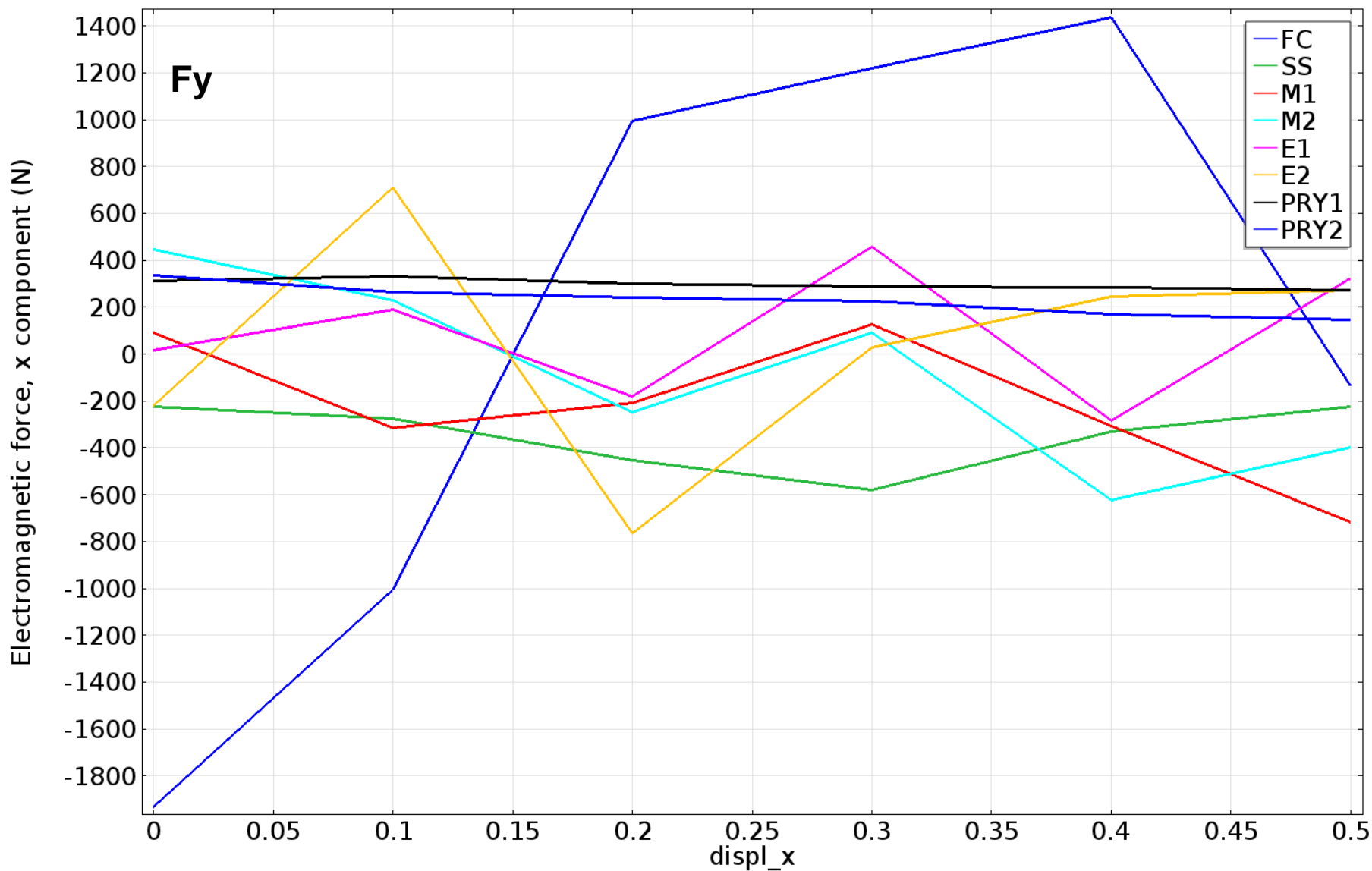
240 MeV Flip - Shift in x



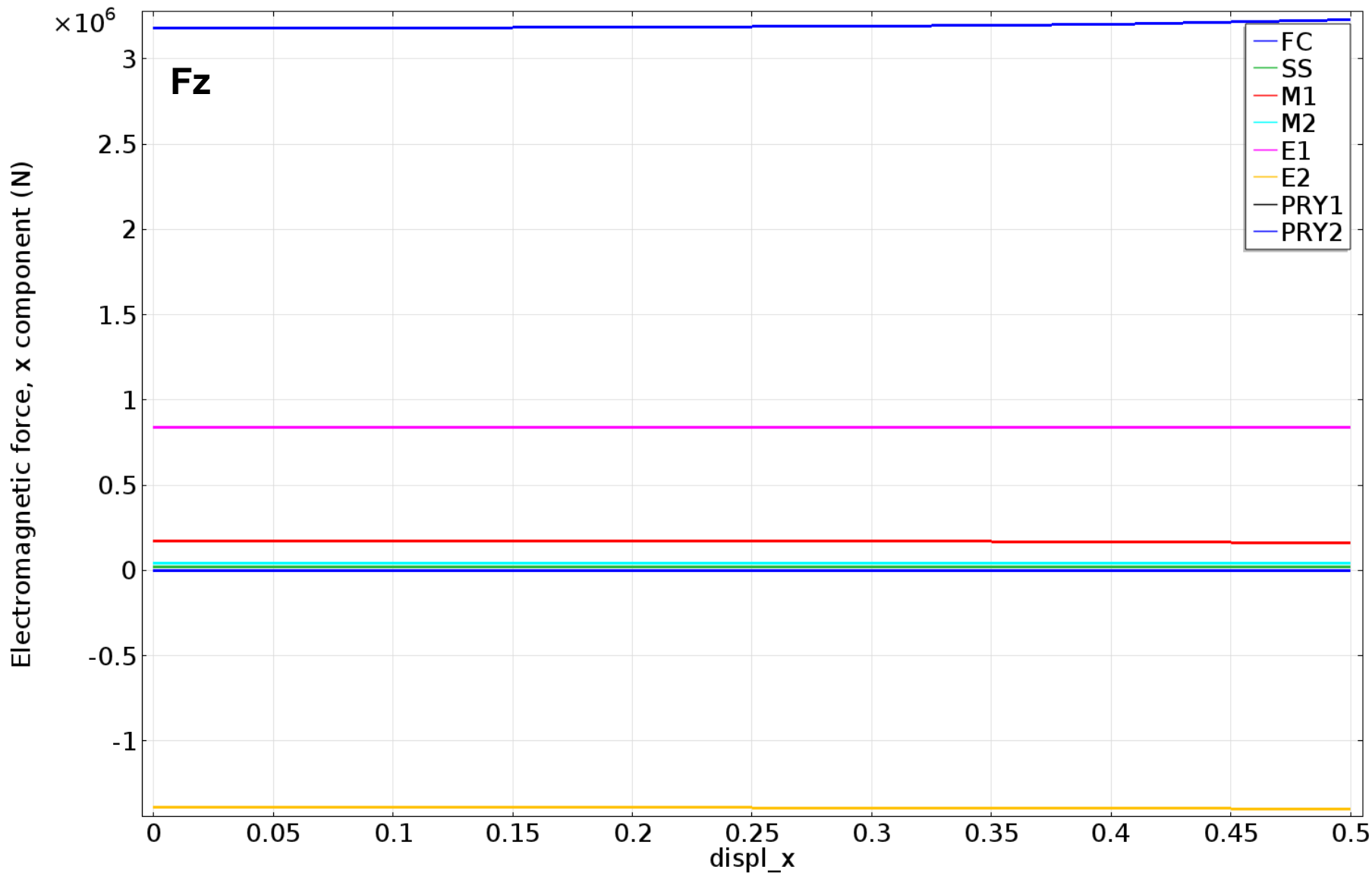
240 MeV Flip - Shift in x



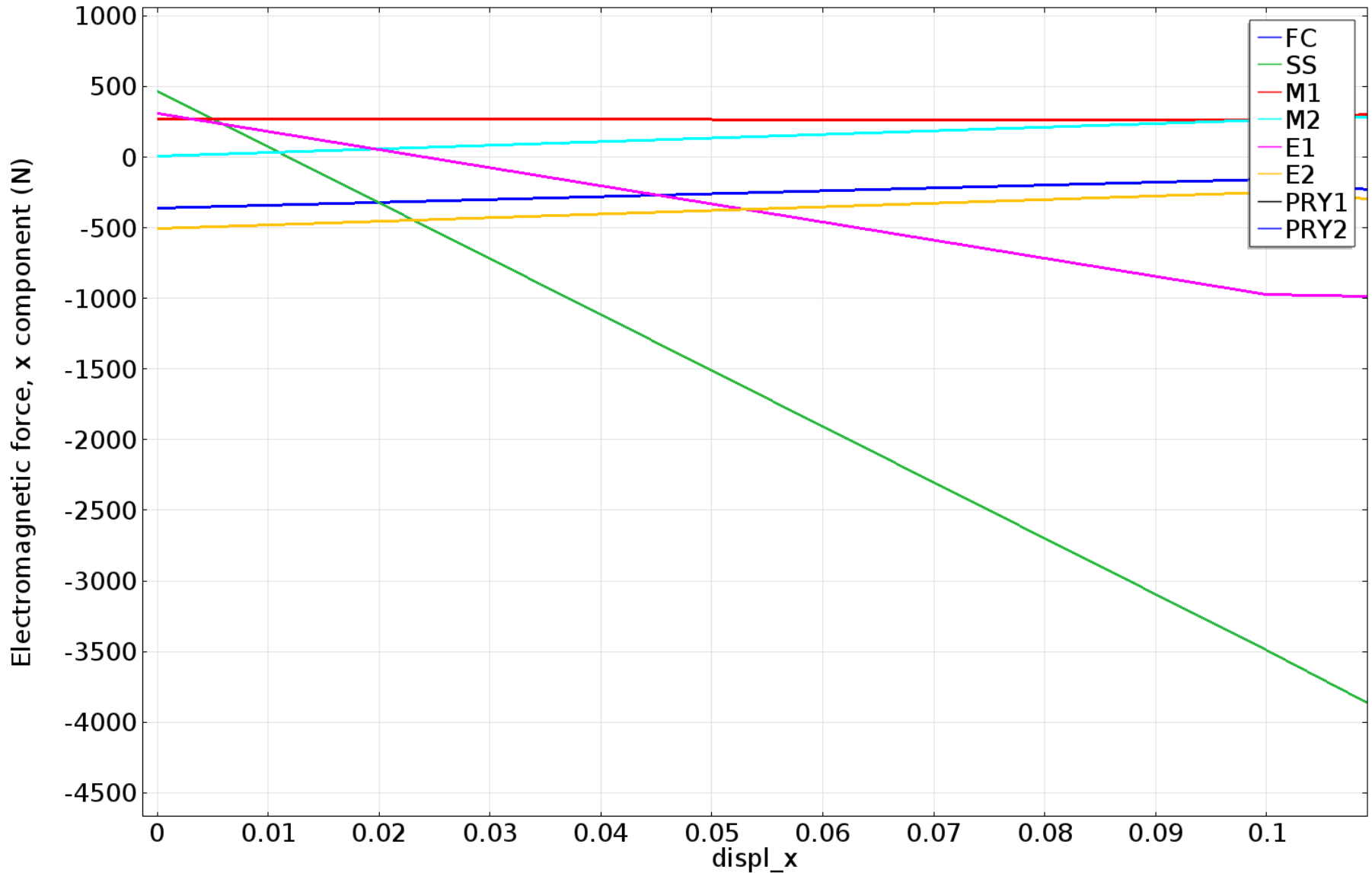
240 MeV Flip - Shift in x



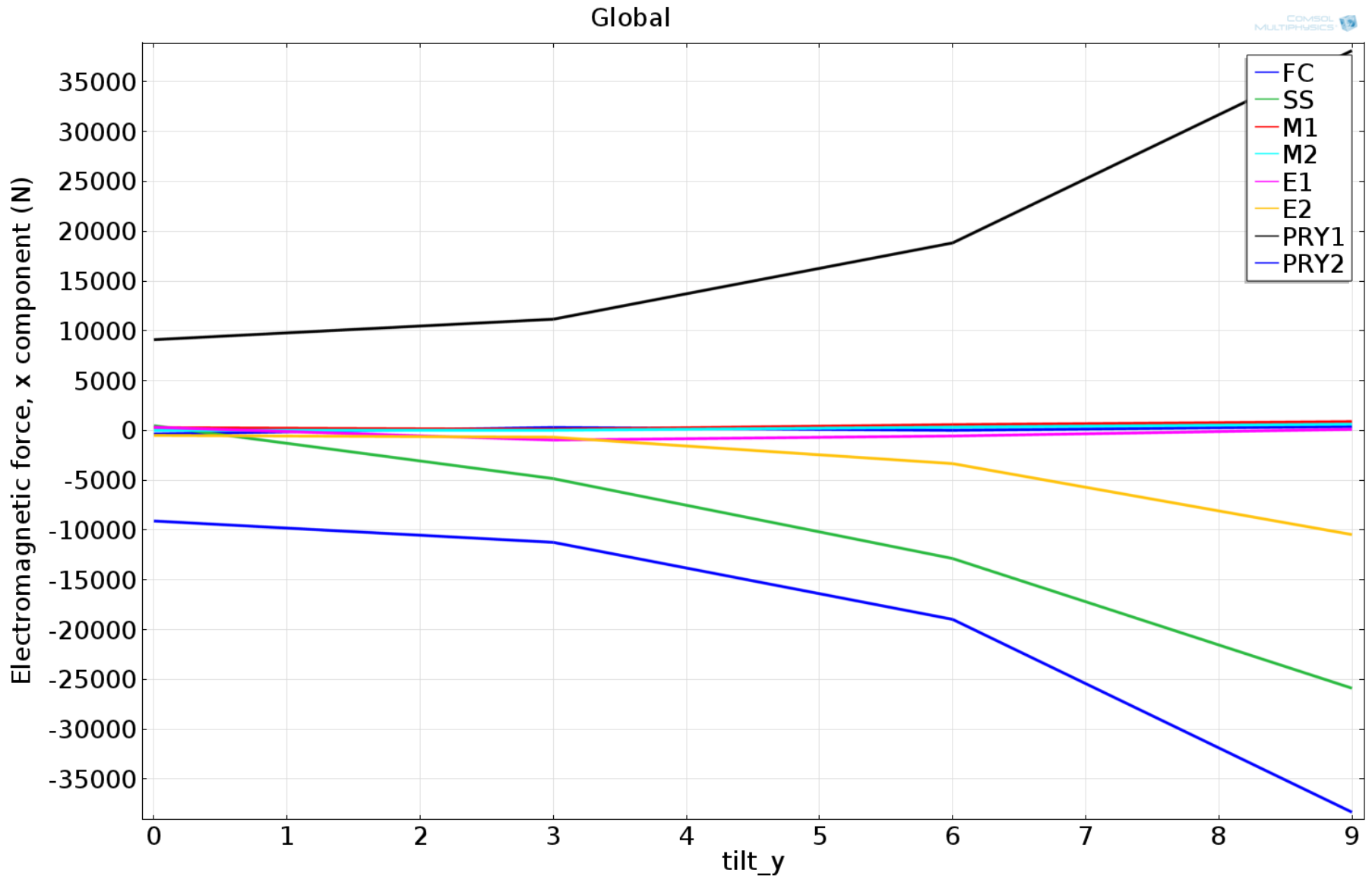
240 MeV Flip - Shift in x



240 MeV Solenoid - Shift in x

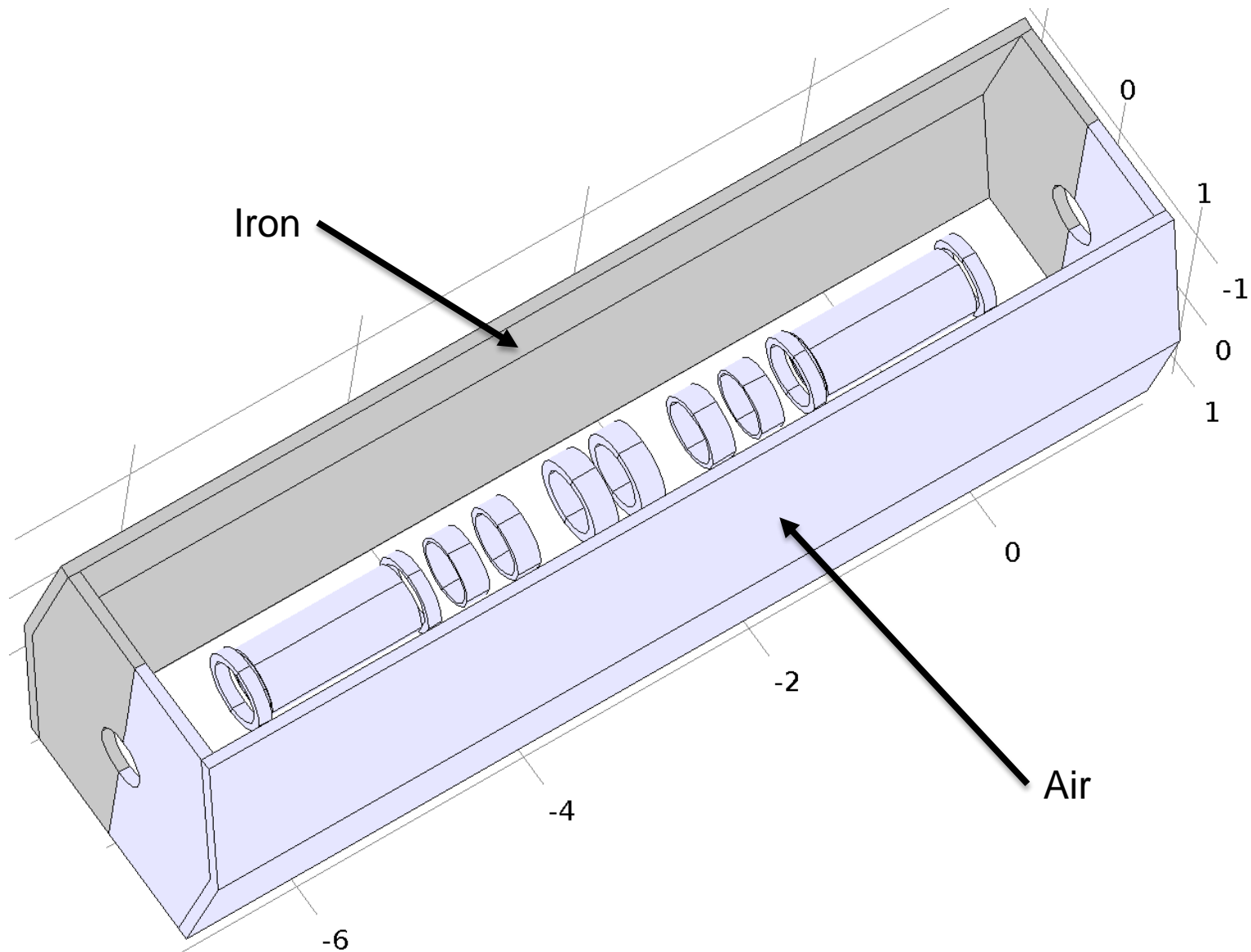


240 MeV Solenoid – Rot y



COMSOL MULTIPHYSICS

Half PRY Simulation



Half PRY Simulation



F_x

FC	M1	M2	E1	SS	E2
-586.816	494.1975	38.67561	-253.506	-6253.47	-3047.79

PRY1: $F_x=9706$ N

F_y

FC	M1	M2	E1	SS	E2
-596.057	87.1719	140.0893	52.81796	-158.542	-155.066

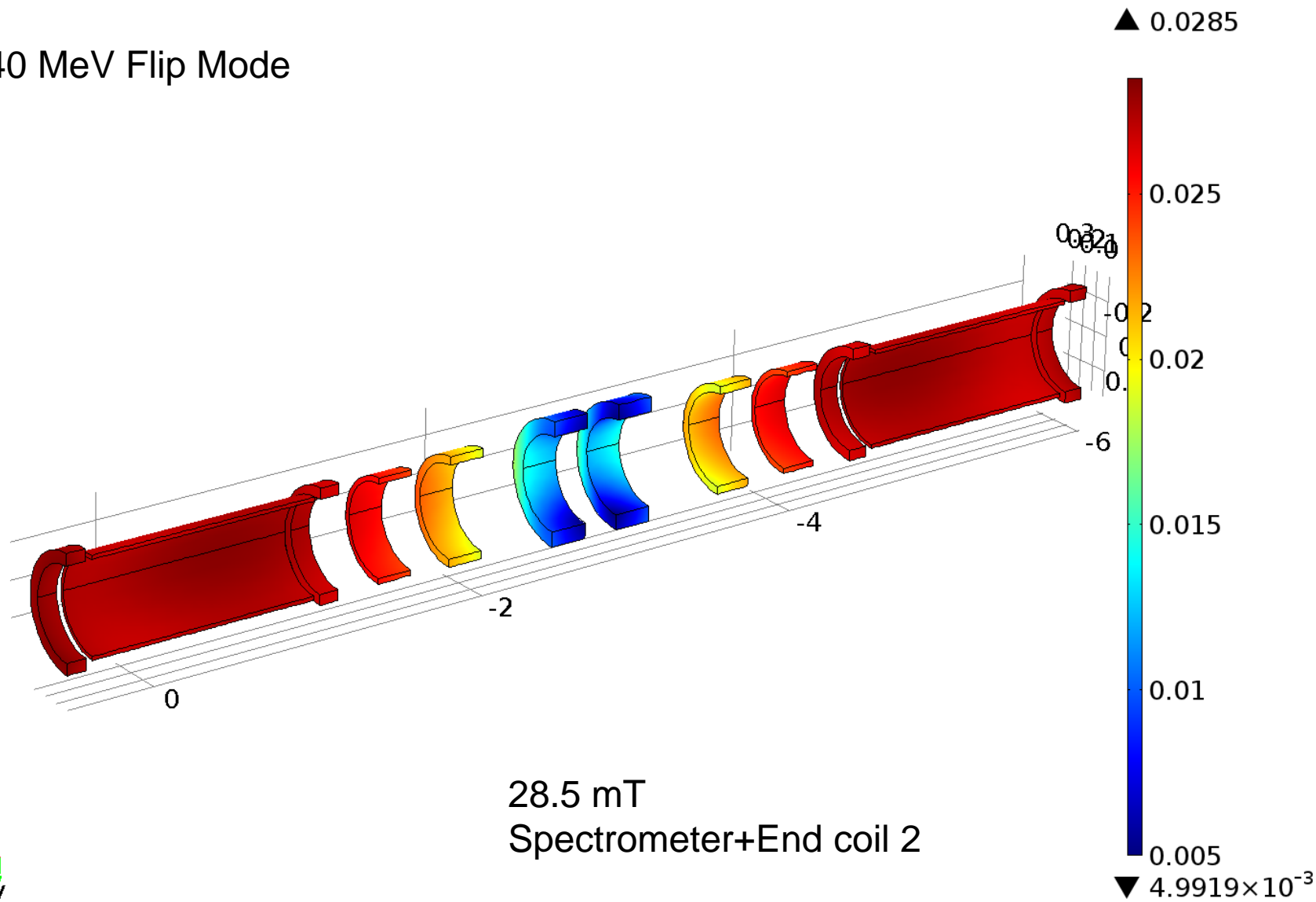
240 MeV Solenoid Mode

- Superconducting state: fct (B, J, T)
- Effect of PRY: changes B
- Simulation 1:
 - Step IV configuration with PRY
- Simulation 2:
 - Extrusion coupling: use magnetization of Simulation 1
 - No coil currents
- Done for 240 MeV flip and solenoid mode
- MICE: NbTi, Cu:Sc = 4

Effect of PRY on Quenches



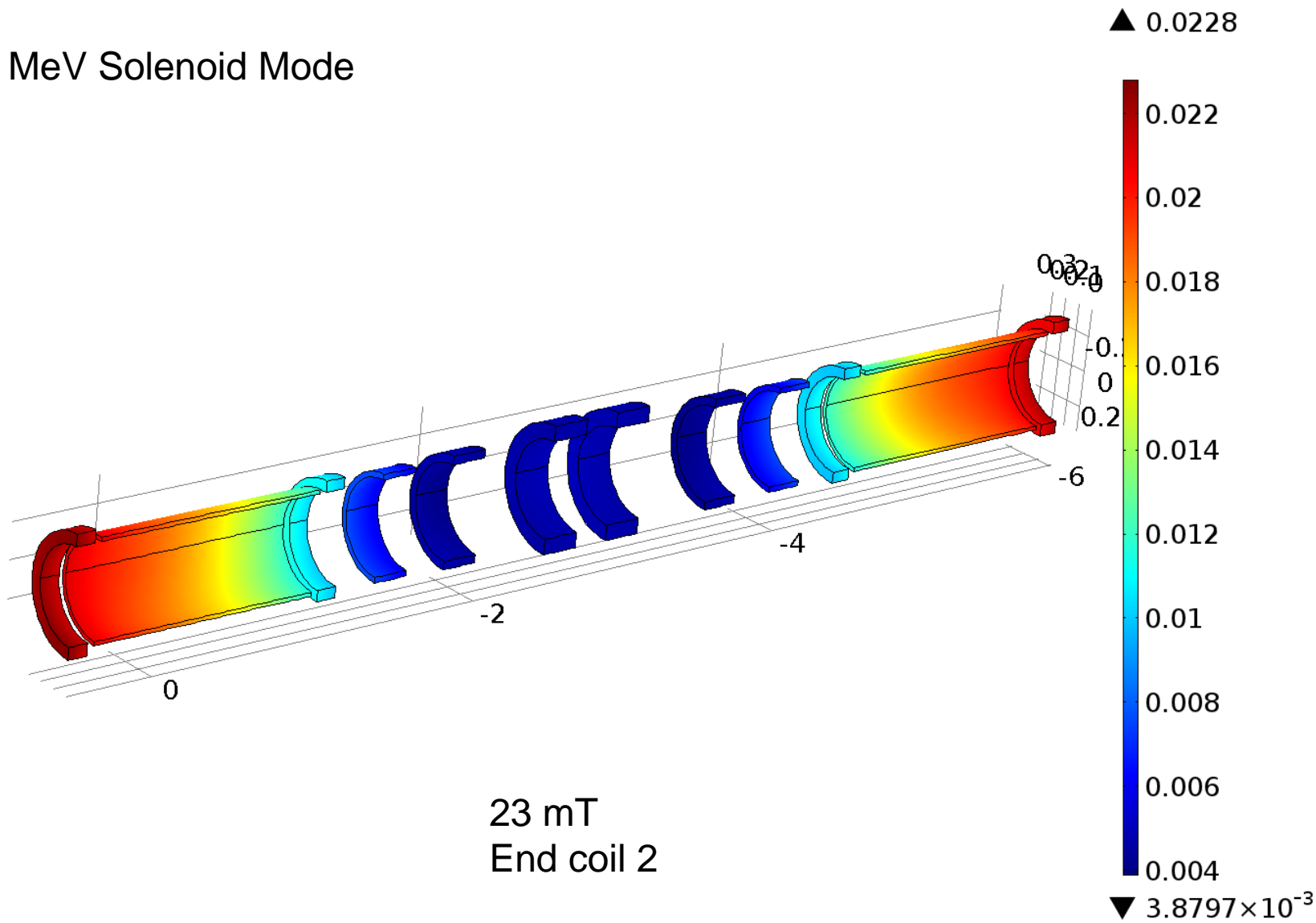
240 MeV Flip Mode



Effect of PRY on Quenches

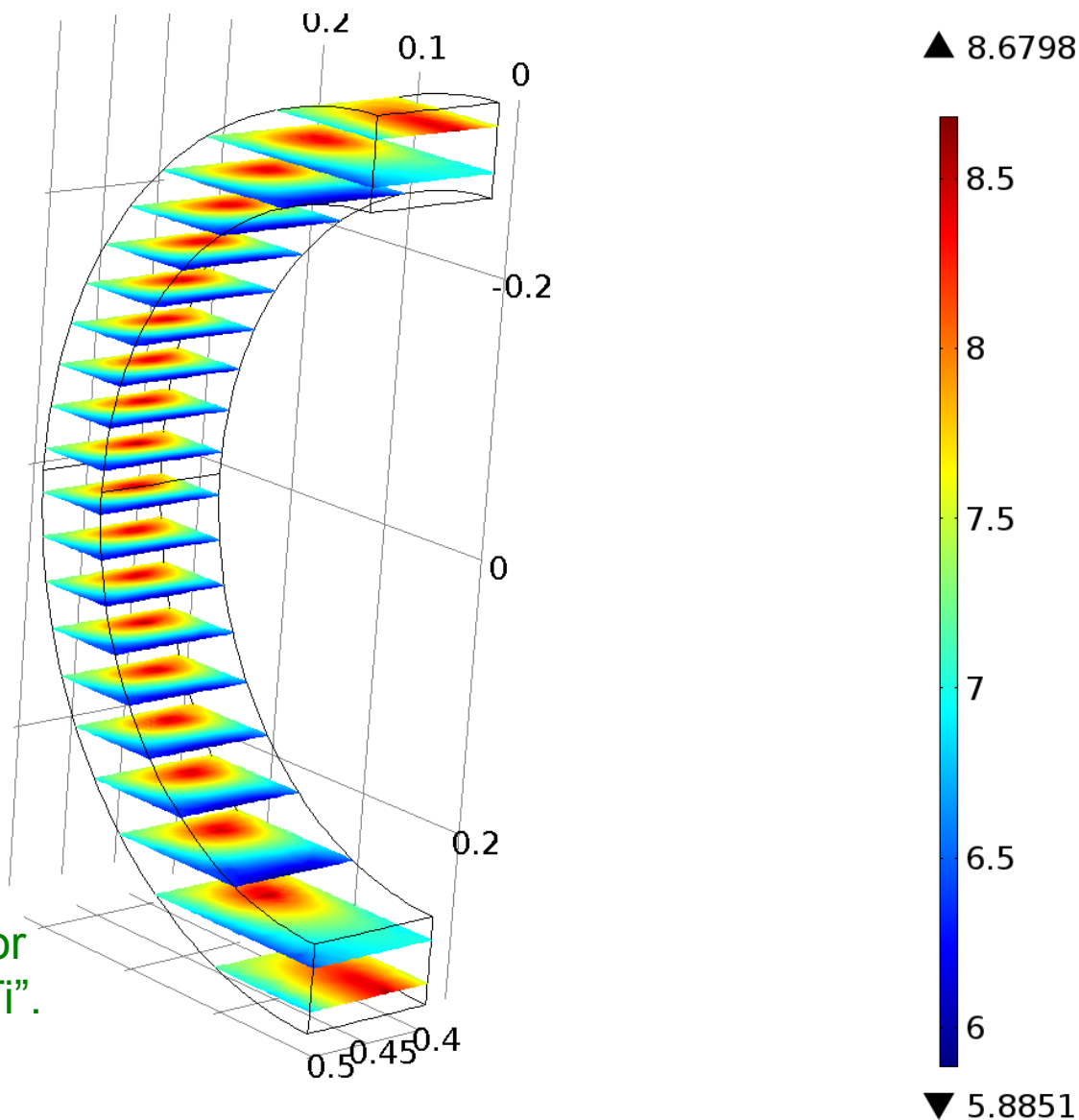


240 MeV Solenoid Mode



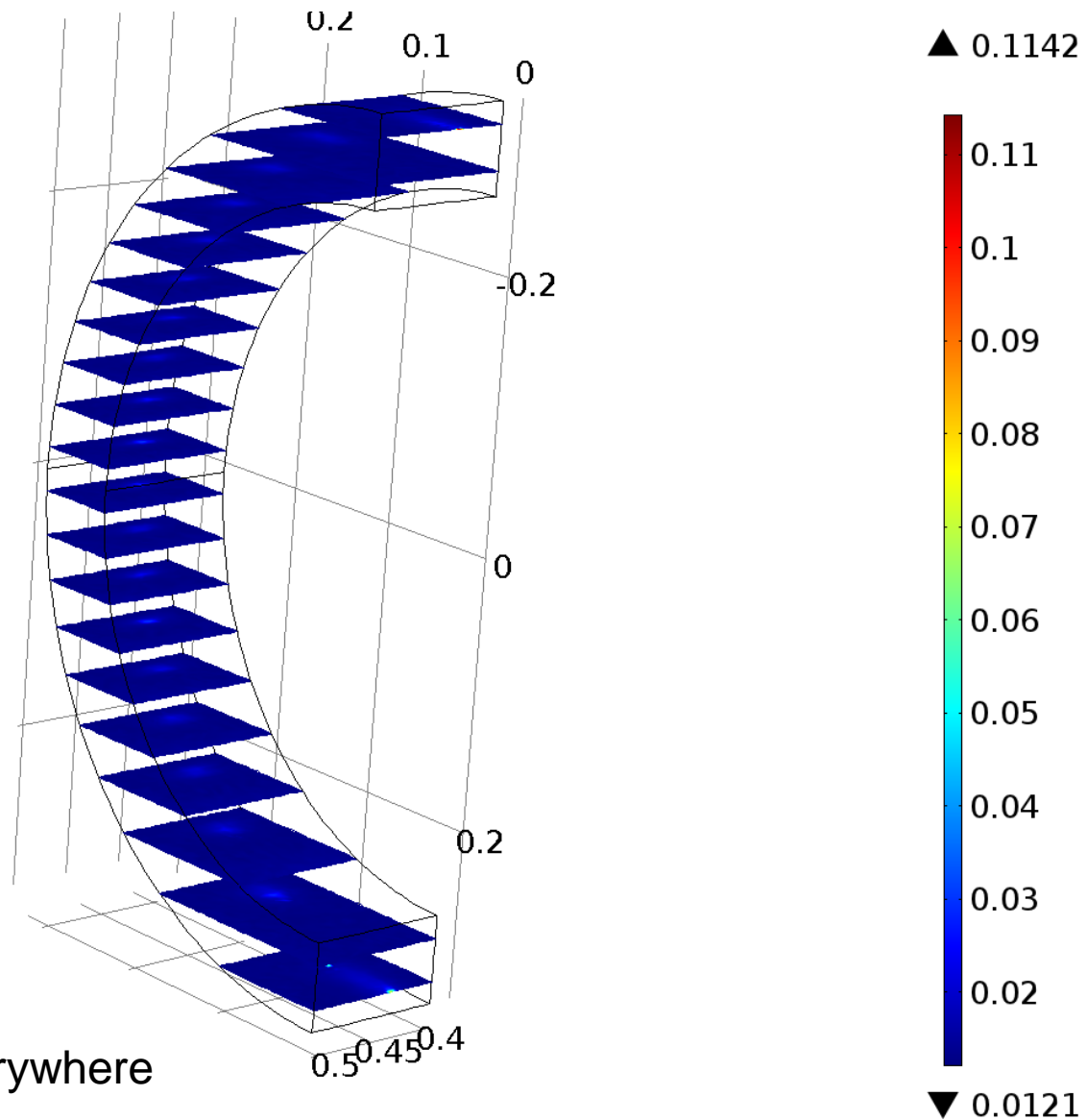
T_c End Coil 2

240 MeV Flip



L. Bottura, "A practical fit for the critical surface of Nb-Ti".
DOI: 10.1109/77.828413

ΔT_c End Coil 2

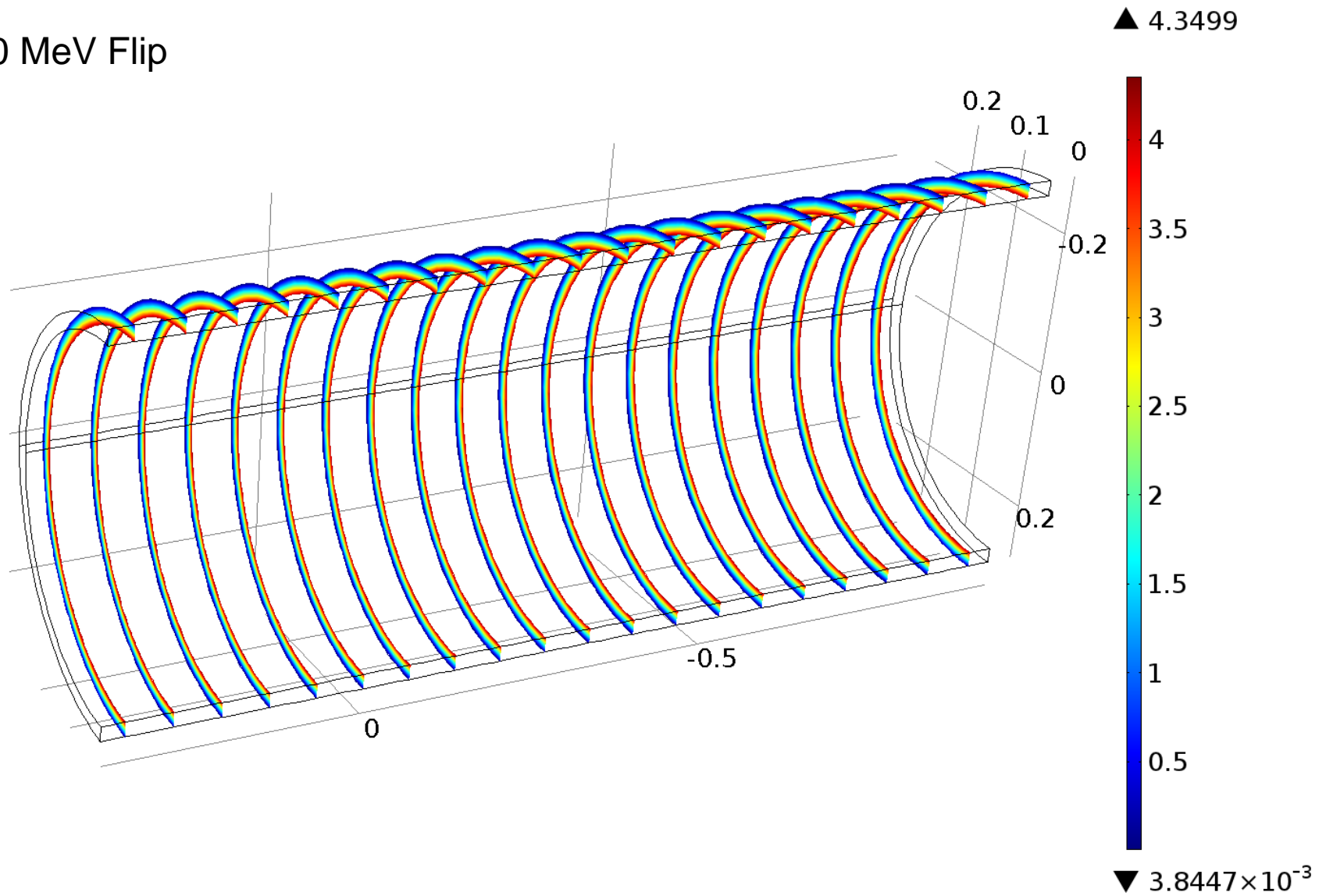


Assume ΔB of 30 mT everywhere

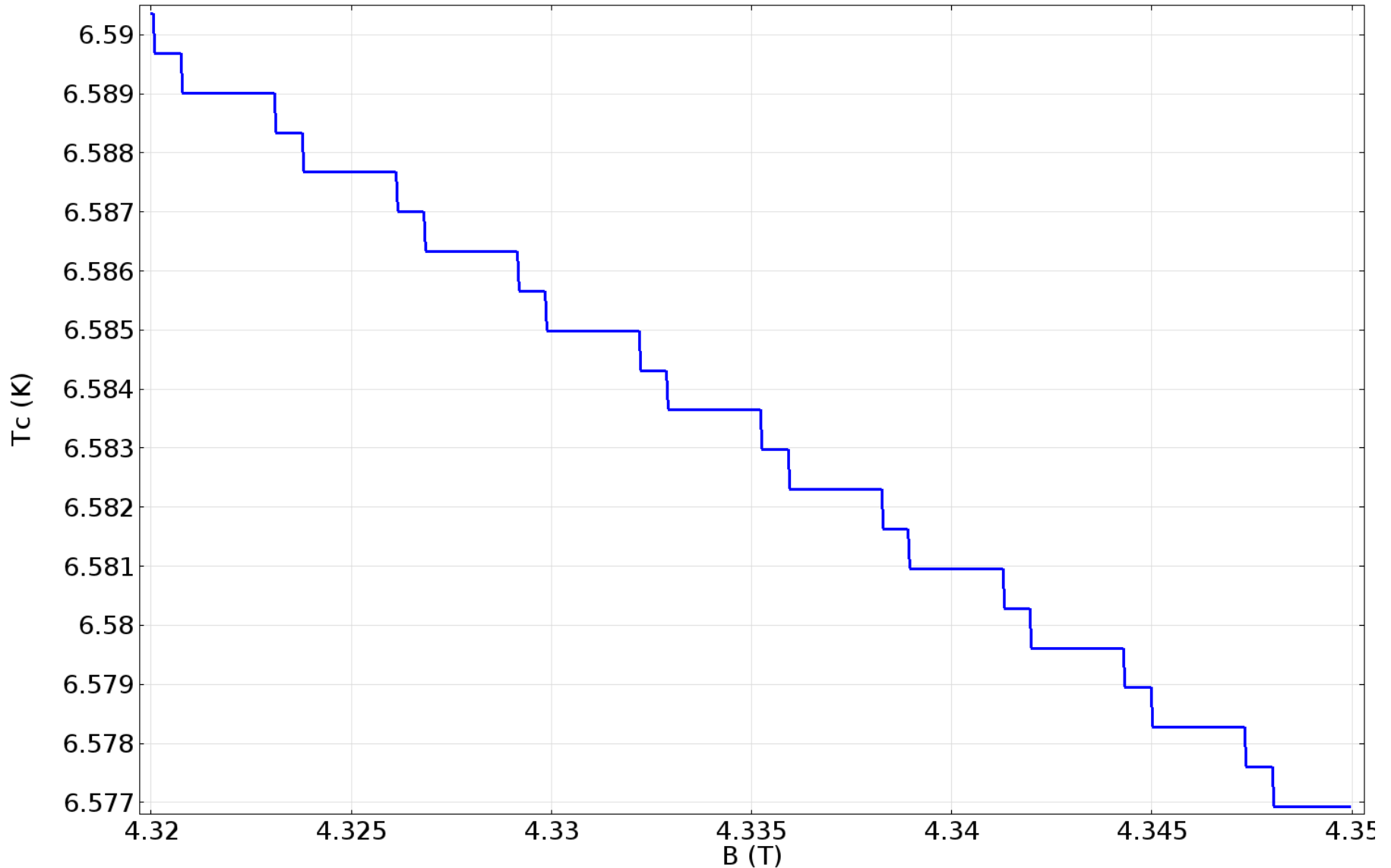
Spectrometer Solenoid, B



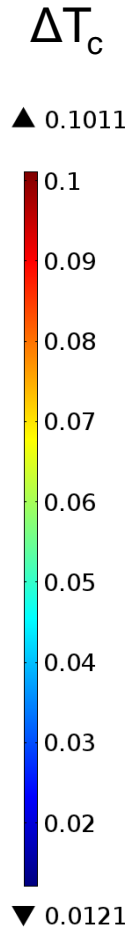
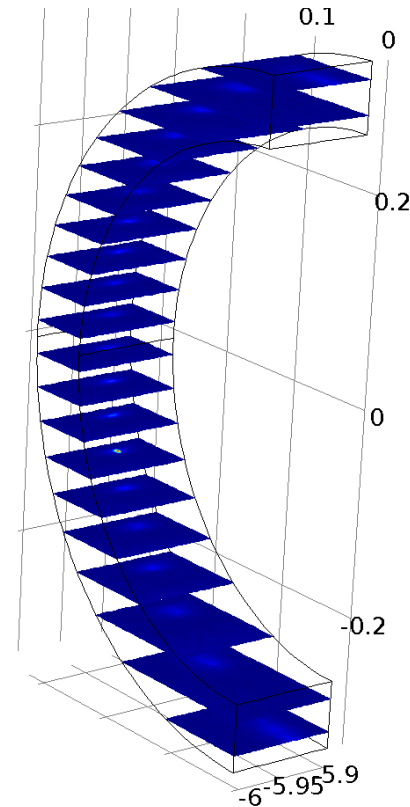
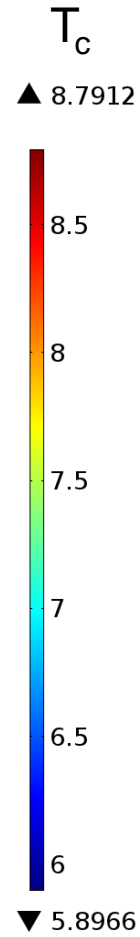
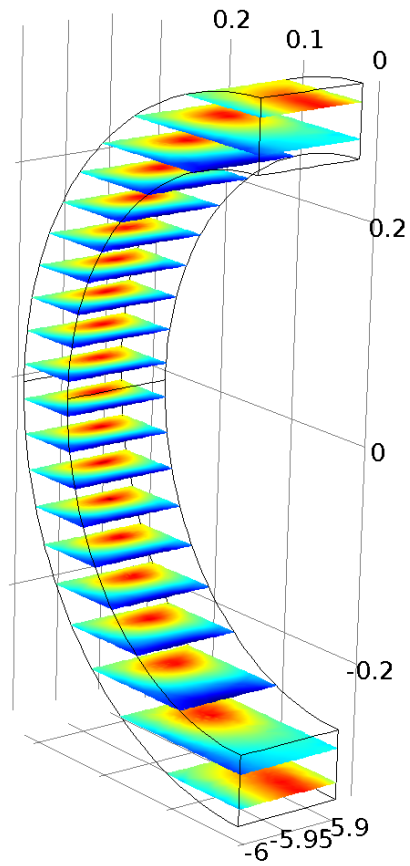
240 MeV Flip



Spectrometer Solenoid



240 MeV Solenoid, End Coil 2



- Forces: PRY seems to have limited effect on coils
 - ~ kN for several mm misalignment
- Quenches
 - PRY affects peak field on wire
 - Magnitude: 20-30 mT
 - Small effect on T_c
 - **Worst case scenario: unaltered J**