Corrector Designs for Superconducting Solenoid for e-lens

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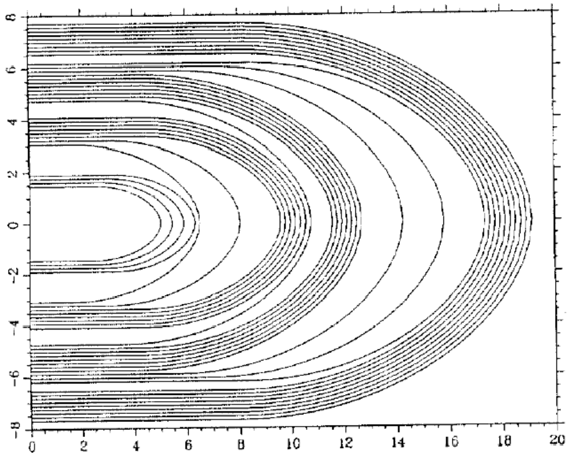
Design Considerations for e-lens correctors

- Short correctors must create a dipole field of 0.02 T and long correctors 0.006+ T (both horizontal and vertical)

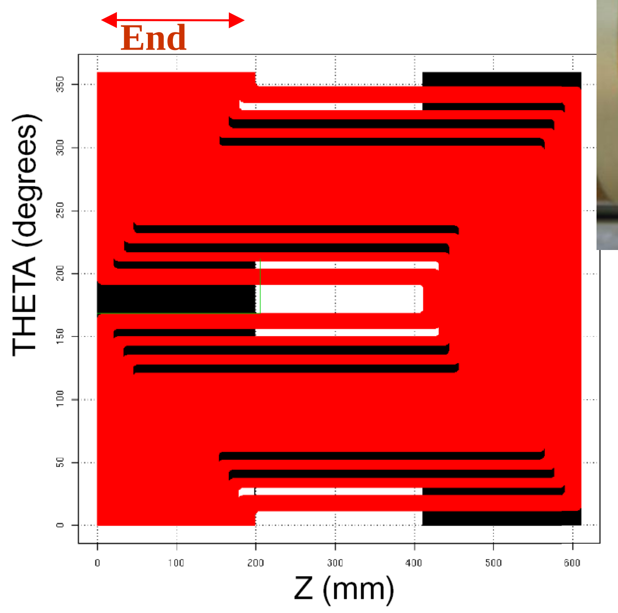
- Should have a minimum layers to minimize schedule and cost

- Should have low operating current to minimize heat load (more important for stand alone test)

Design Types for Conductor Dominated



Conventional Design
•Optimize end for field quality
•End takes significant space
•About 1 coil dia wasted in dipoles

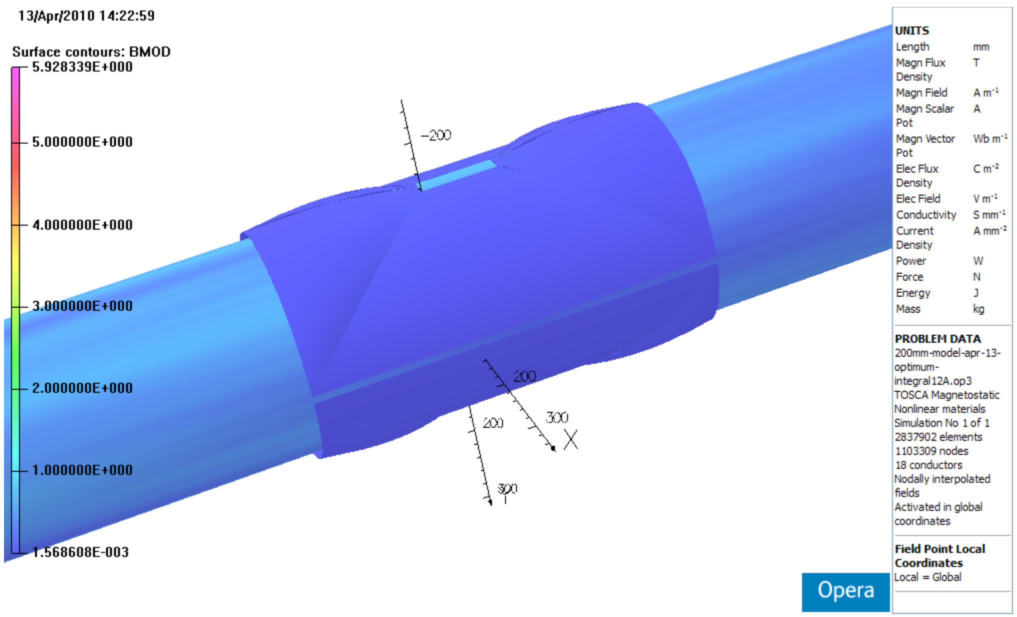


Serpentine Design (B. Parker)
• Easy to bring leads out
• ~2-d design
• Used in most magnets (default)
• End takes space (relevant only in short magnets)

Optimum Integral
• Most optimum use of space
• Full length used at midplane
• Spacers in body and ends are modulated to obtain integral cosine theta distribution
• Leads do not come out easily in a single layer design
• Developed and used in AGS corrector (in helical magnet)

Optimum Integral Design

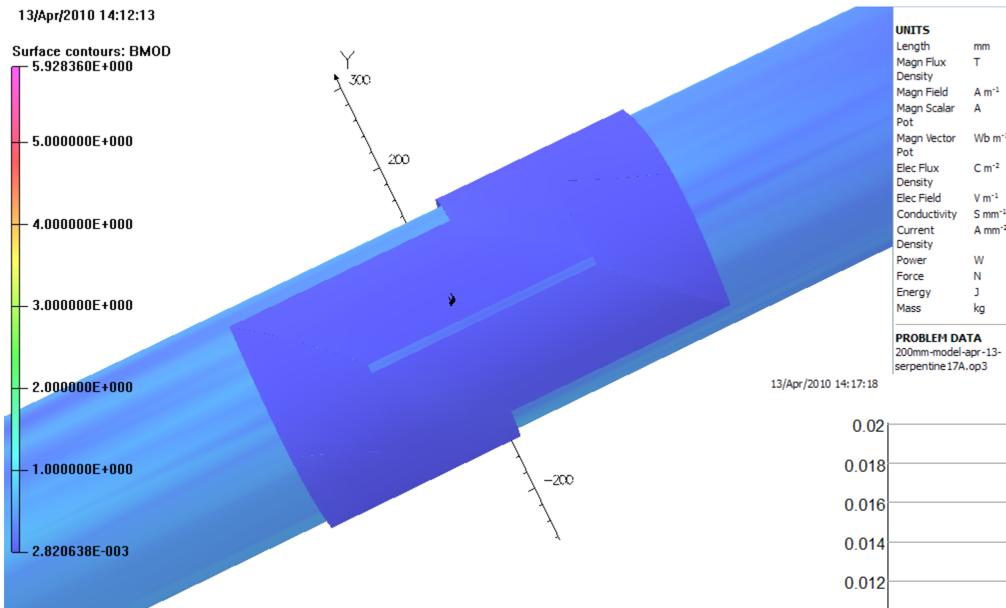
One layer each for horizontal and vertical dipole correctors

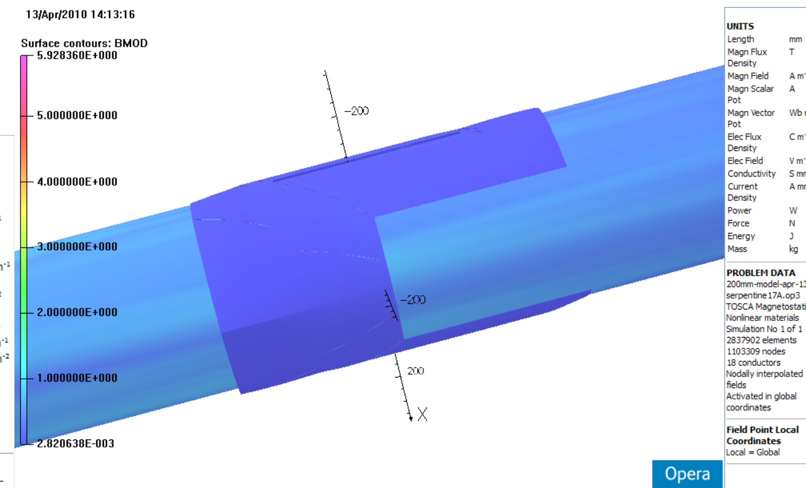


Desired Field is obtained at 9.4 A

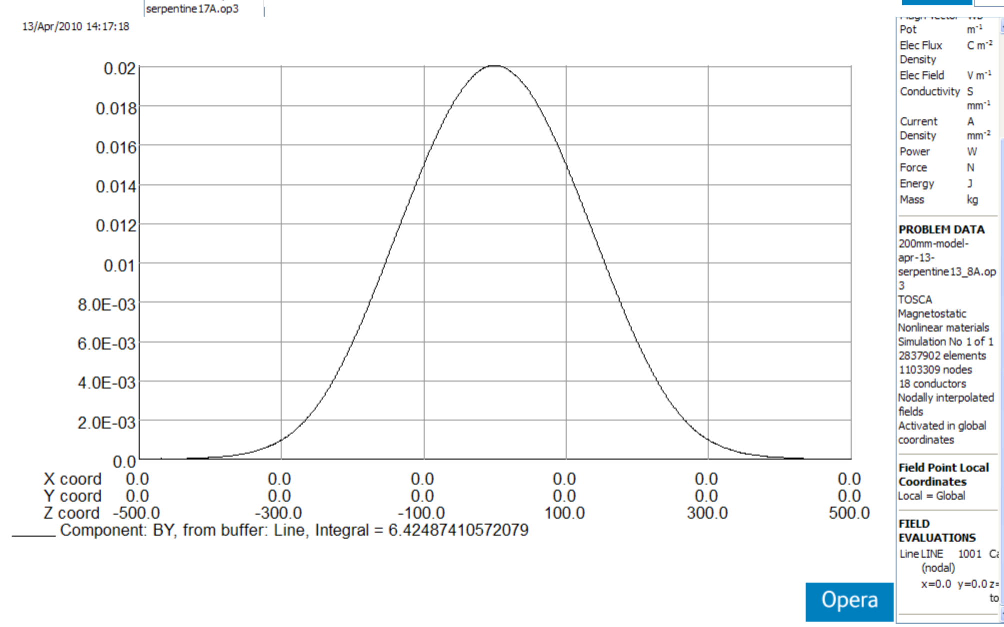
Serpentine Design

One layer each for horizontal and vertical dipole correctors





Desired Field is obtained at 13.8 A (~50% more than optimum integral)

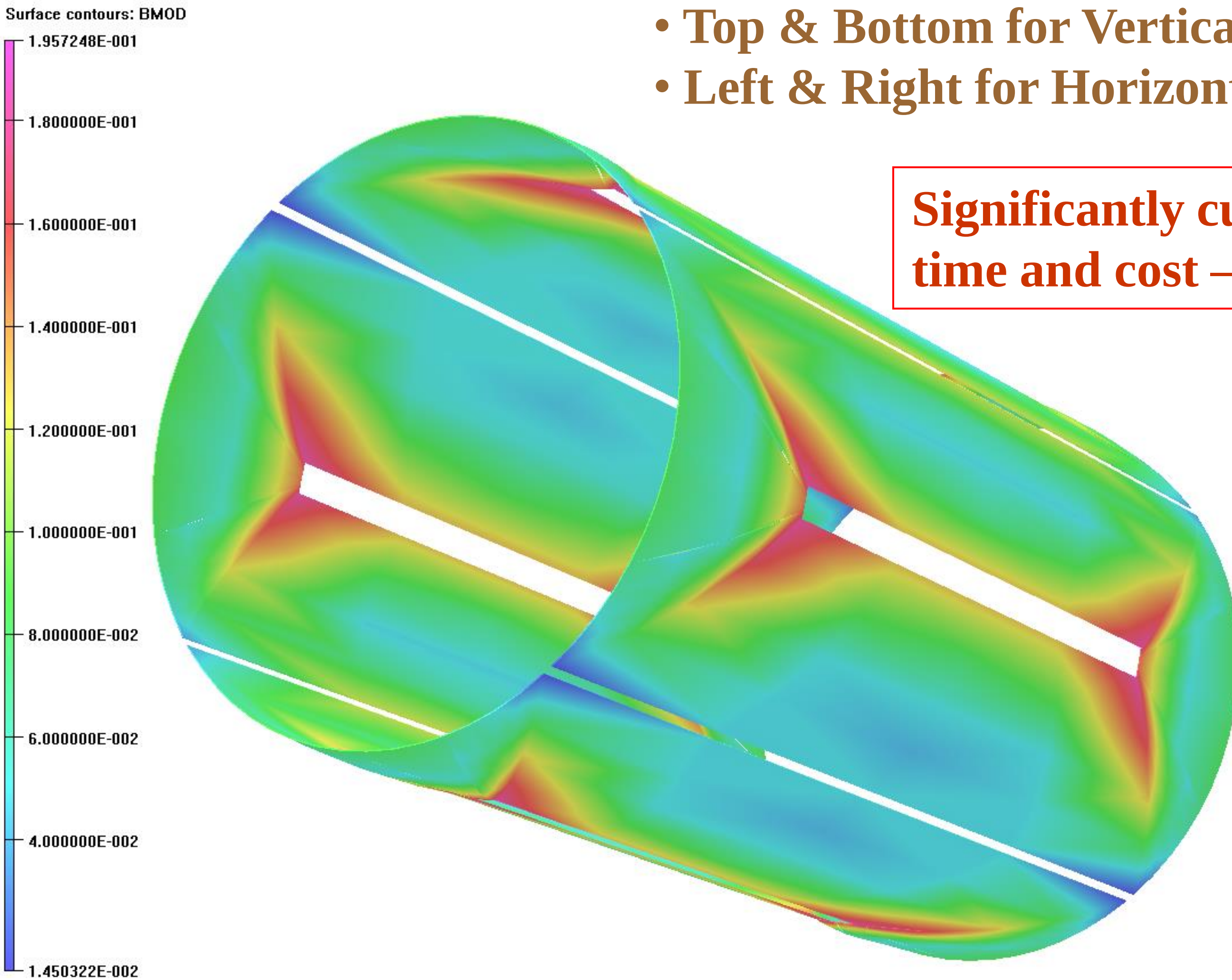


Optimum Integral Design (take 2)

Both horizontal and vertical dipole correctors are accommodated in a single layer

- **Top & Bottom for Vertical**
- **Left & Right for Horizontal**

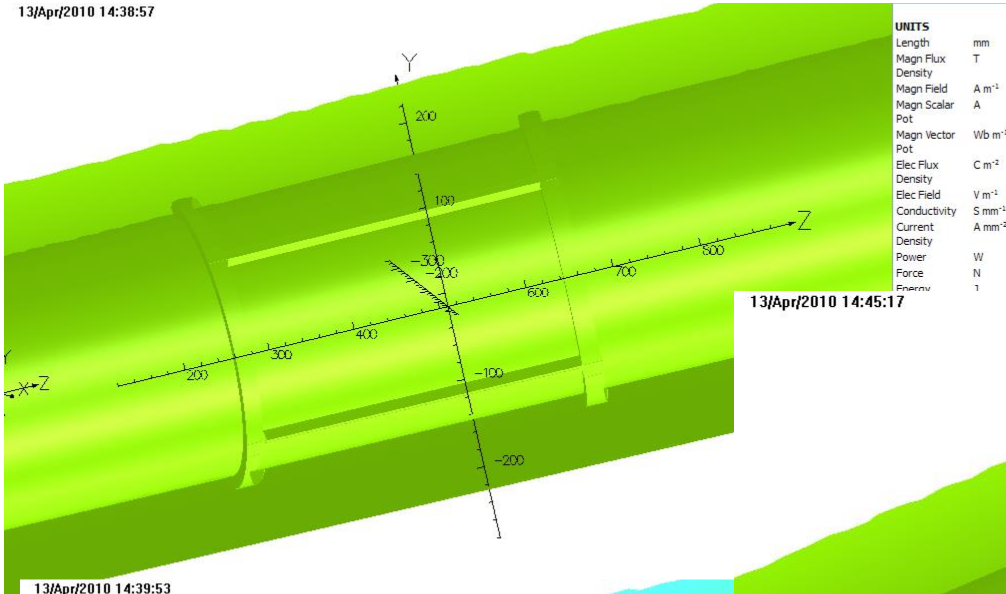
Significantly cuts down on construction time and cost – the main motivation

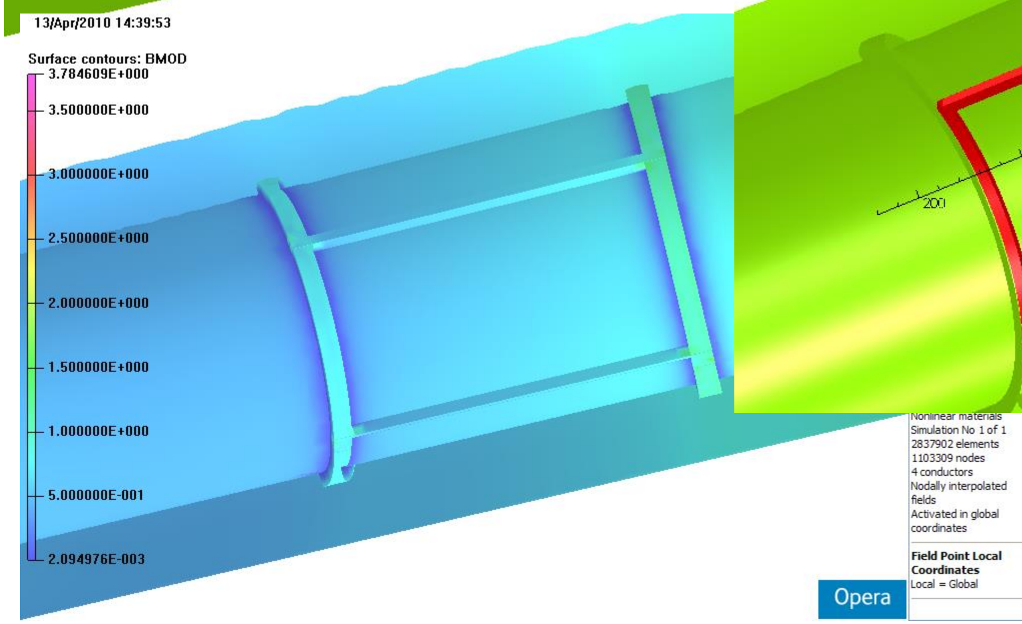


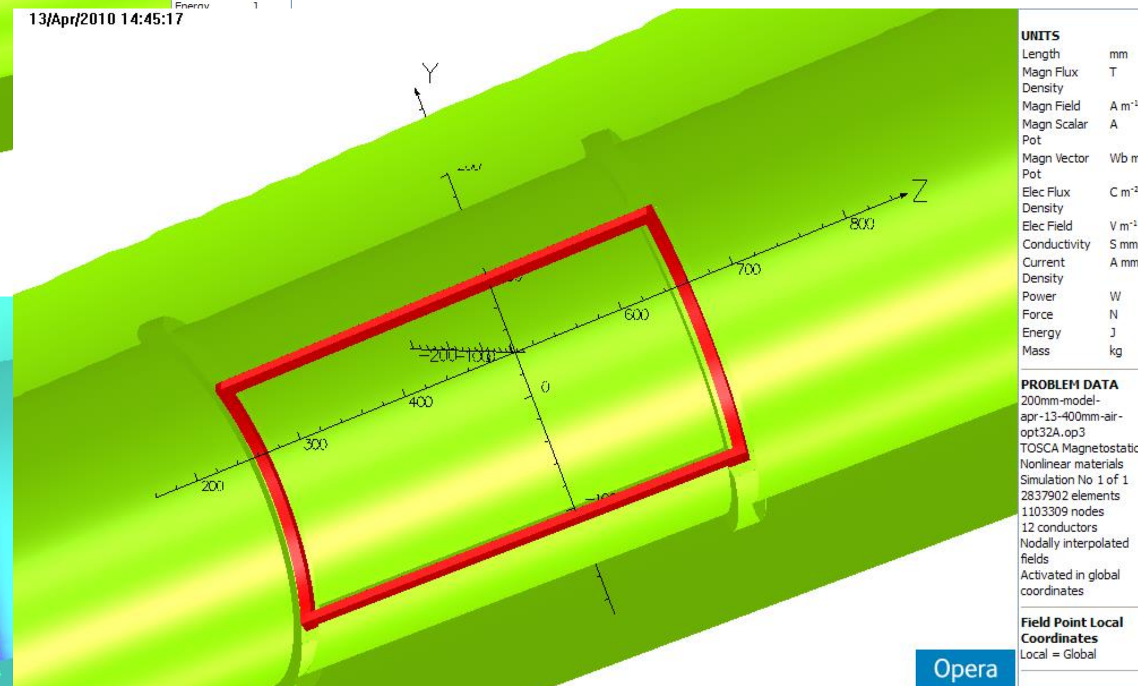
Down side:

- Higher operating current
- Field Quality (not a major issue)

Iron Dominated Corrector Design





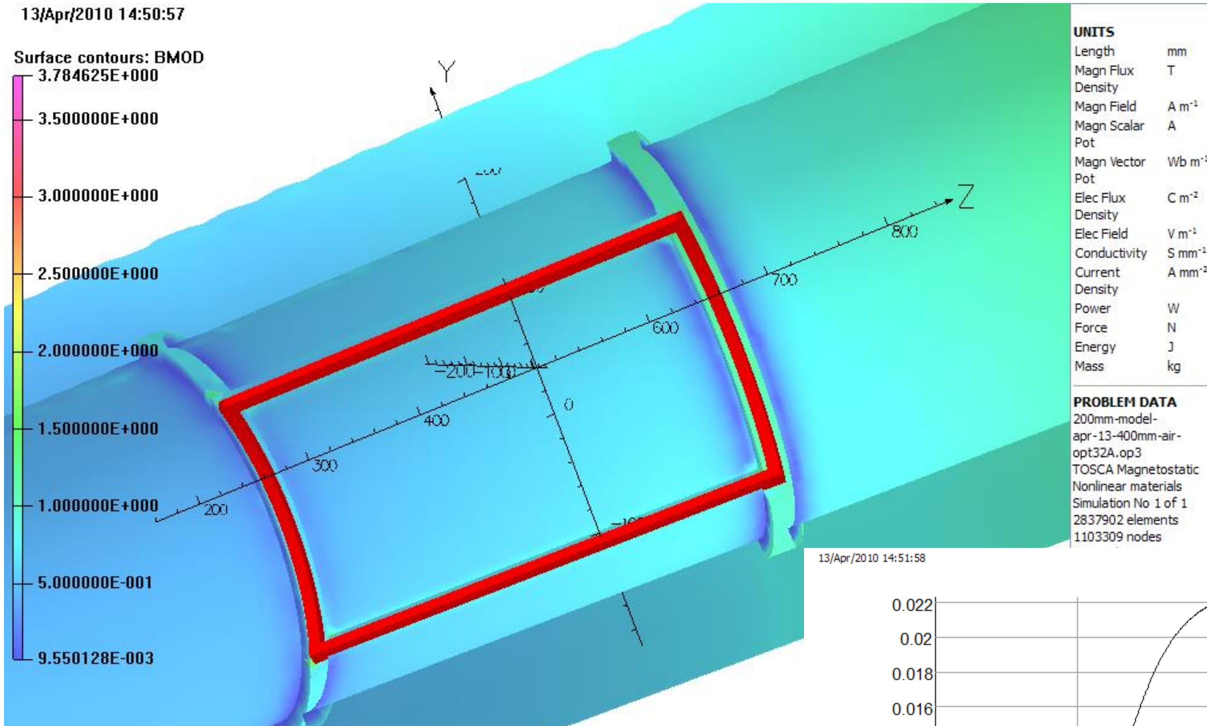


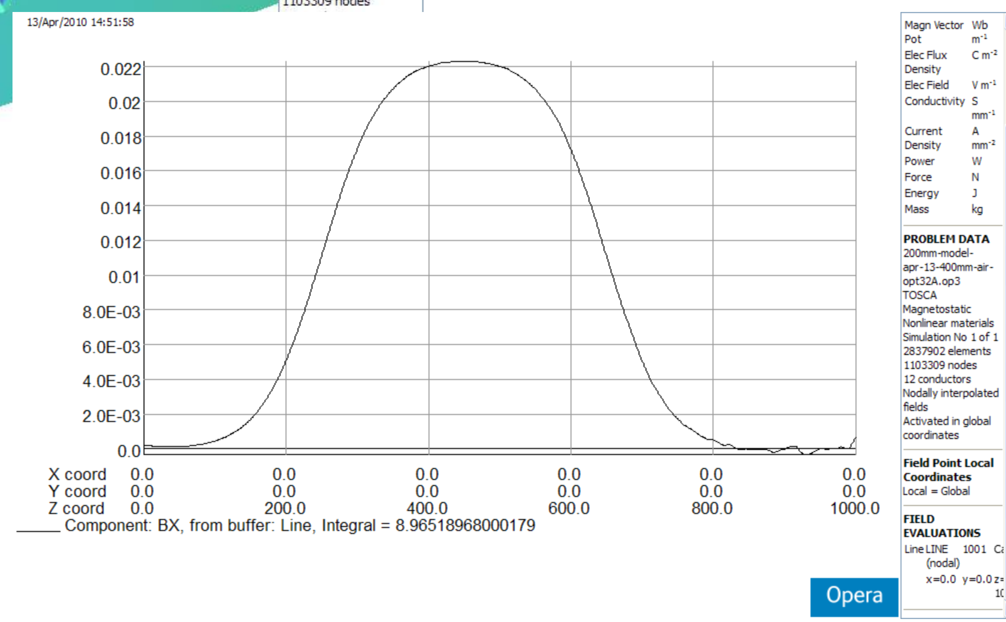
- Cut a slot in the iron and put corrector coil there
- There is still enough mu left in the iron to generate 0.02 T field

Benefits

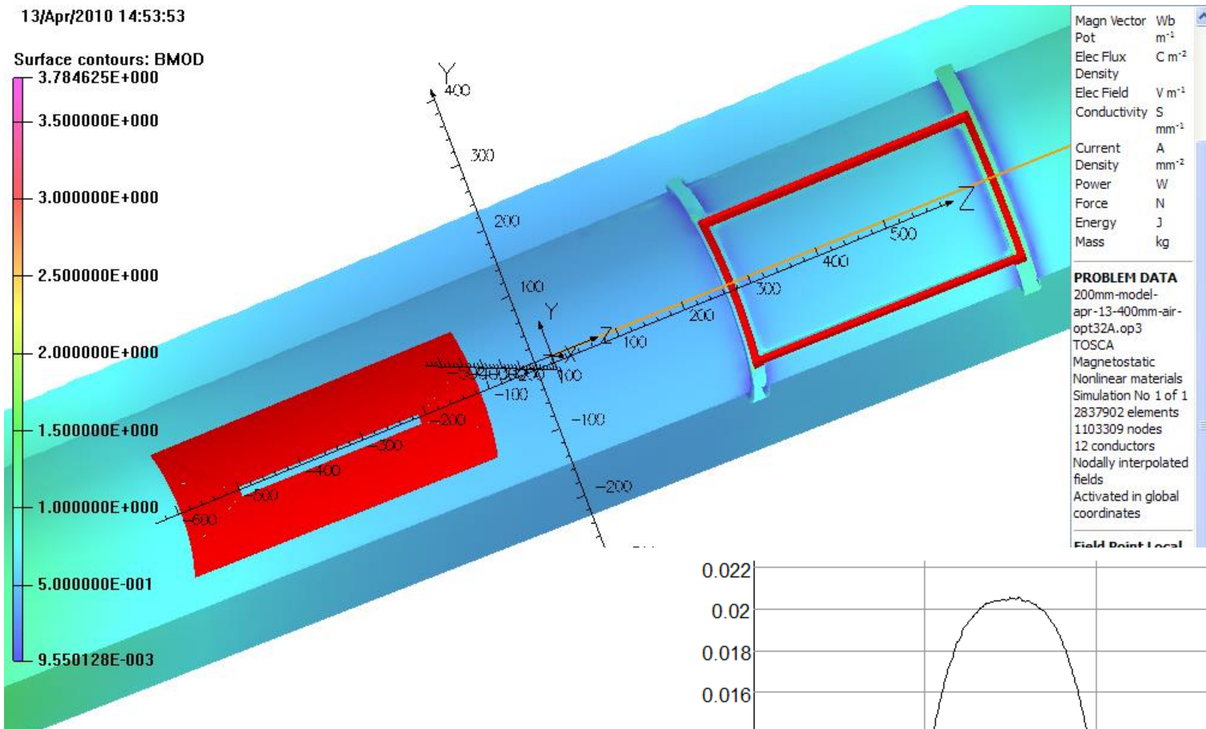
- Lower current
- Possibly easier and cheaper

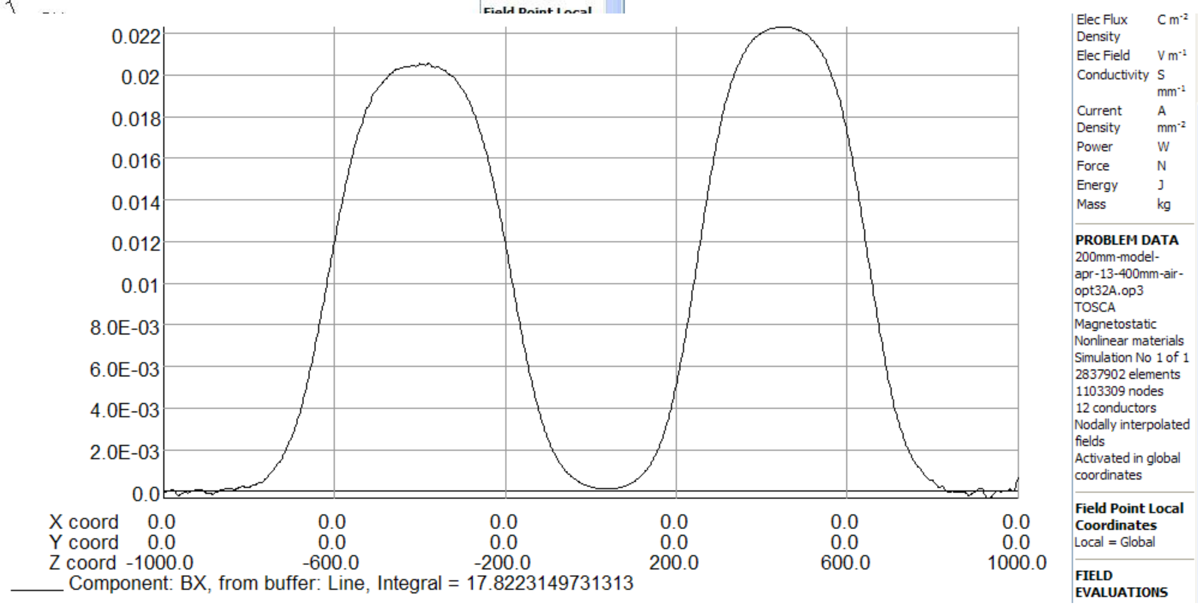
Field in Iron Dominated Corrector Design





Two Designs – side by side





Topic for Discussions

- How do we construct iron dominated design

- Comparison of two designs