BH Curve Effects on SiD Field Calculations

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Outline

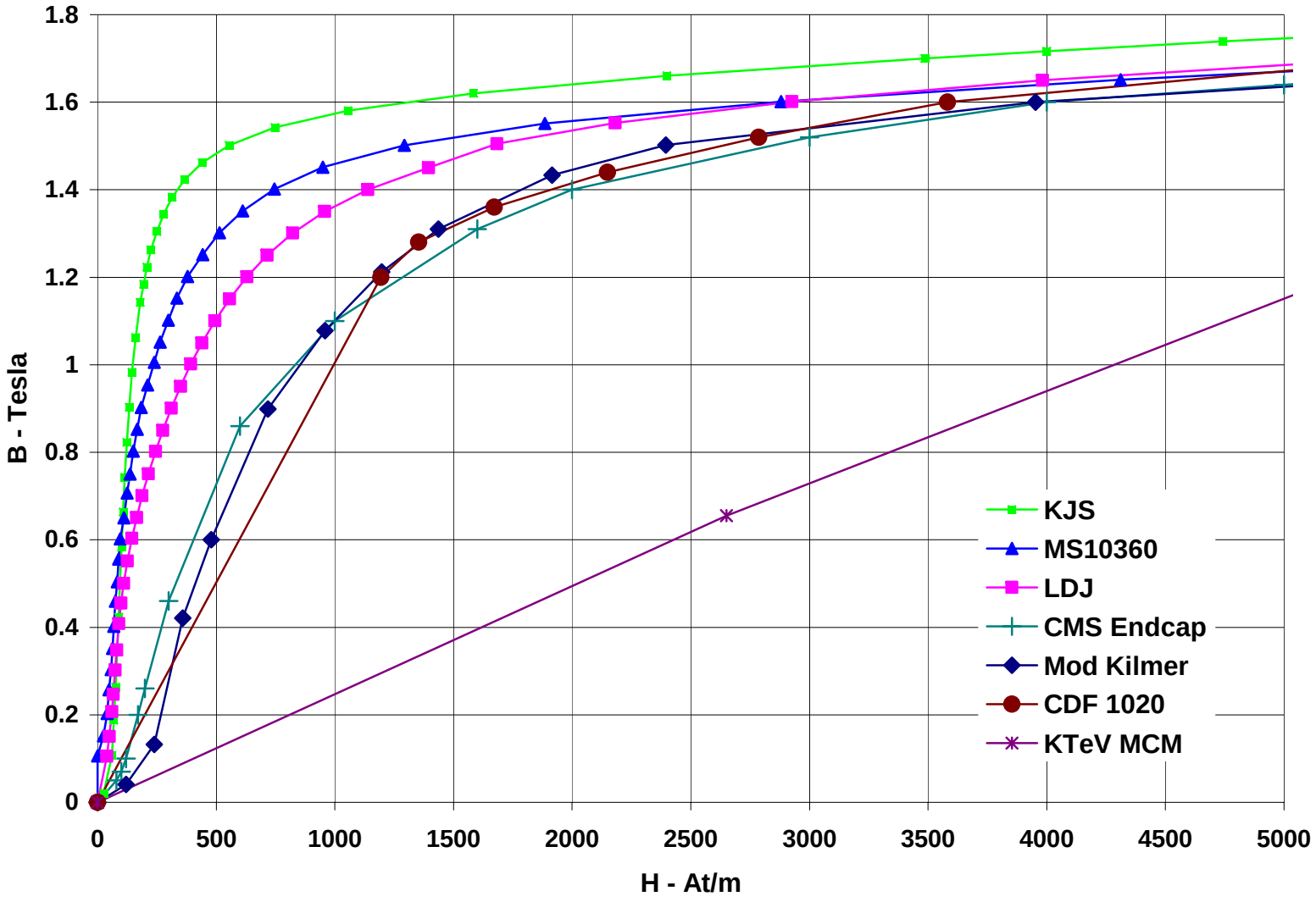
- **BH curves**
- **Effects on Axial Decentering Force**
- **Effects on Field Uniformity**
- **Effects on Fringe Field**

The BH Curves

- **Seven BH curves were used**

- **Three of these curves (KJS, LDJ, and MS10360) are from the Minos steels**
- **One curve (CMS) is from the CMS endwall steel**
- **One curve (CDF1020) is from the CDF solenoid**
- **One curve (Mod-Kilmer) is from early Minos R&D**
- **One curve (MCM) is from the Michigan Cyclotron Magnet steel used in the KTeV dipole**

BH Curves for Various Magnet Steels



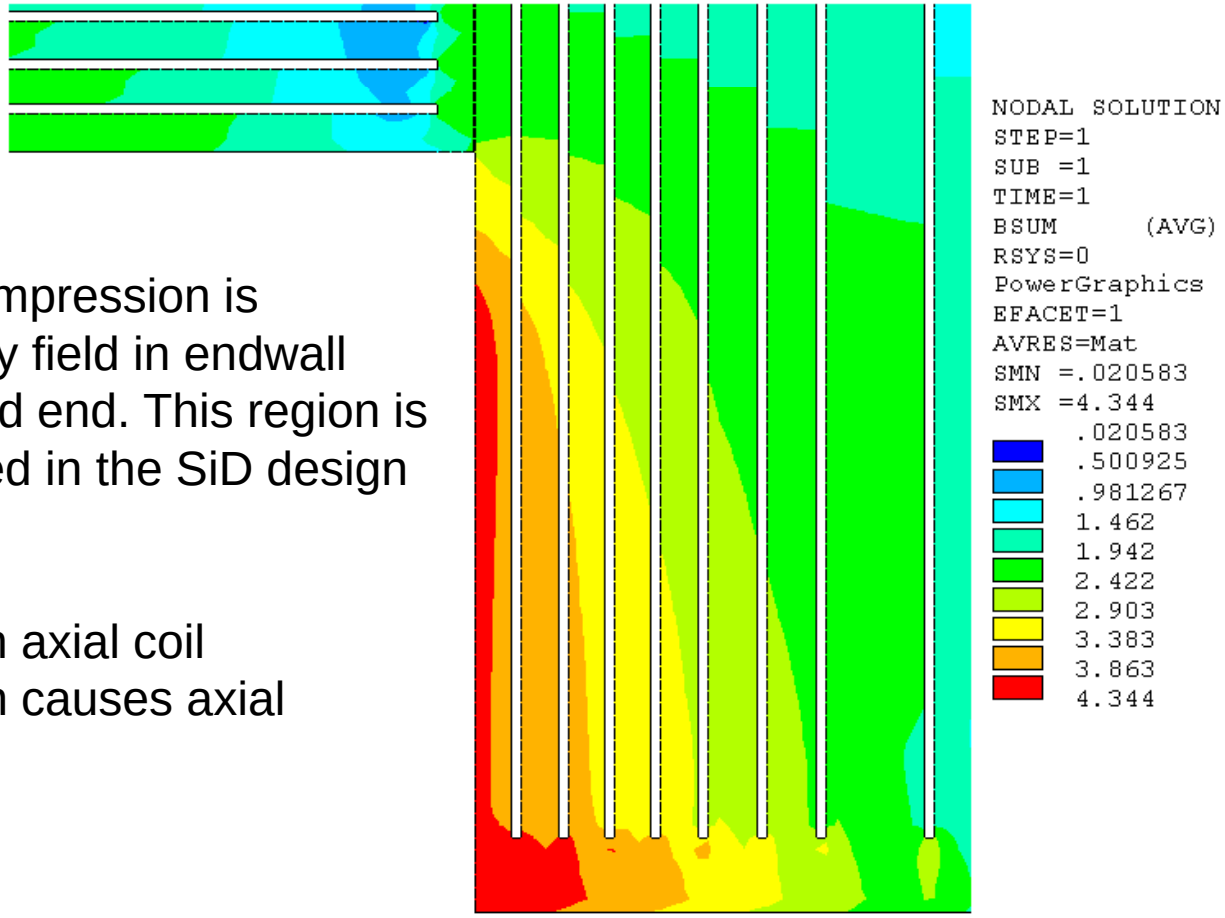
Axial Decentering

There are two sources:

1. **Axial misalignment of the solenoid within the steel flux return**

2. **Differences in BH between steel flux return components**

B-field in Endwall



Axial coil compression is influenced by field in endwall near solenoid end. This region is well saturated in the SiD design

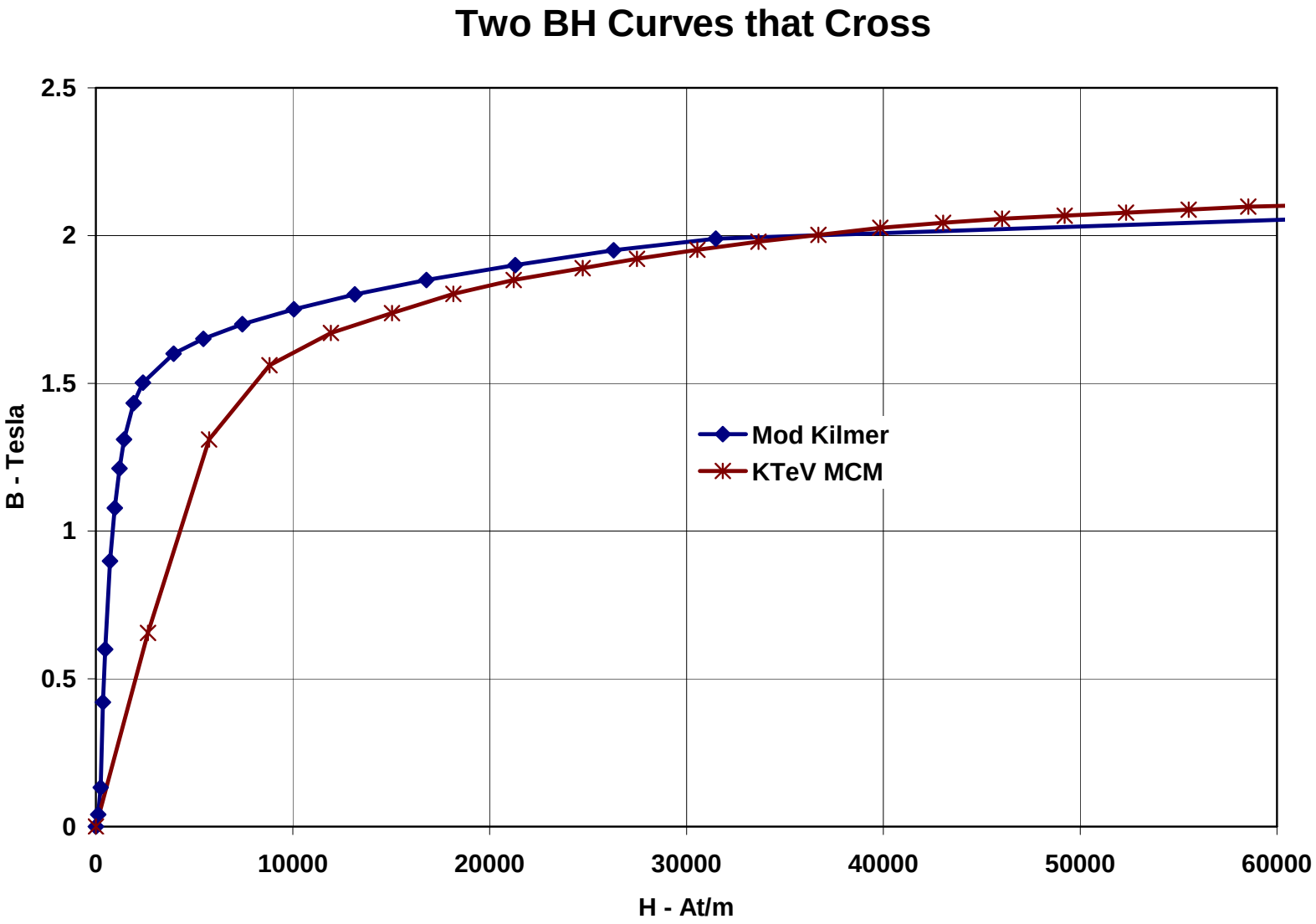
Imbalance in axial coil compression causes axial decentering

Axial decentering due to axial misalignment of coil within steel flux return

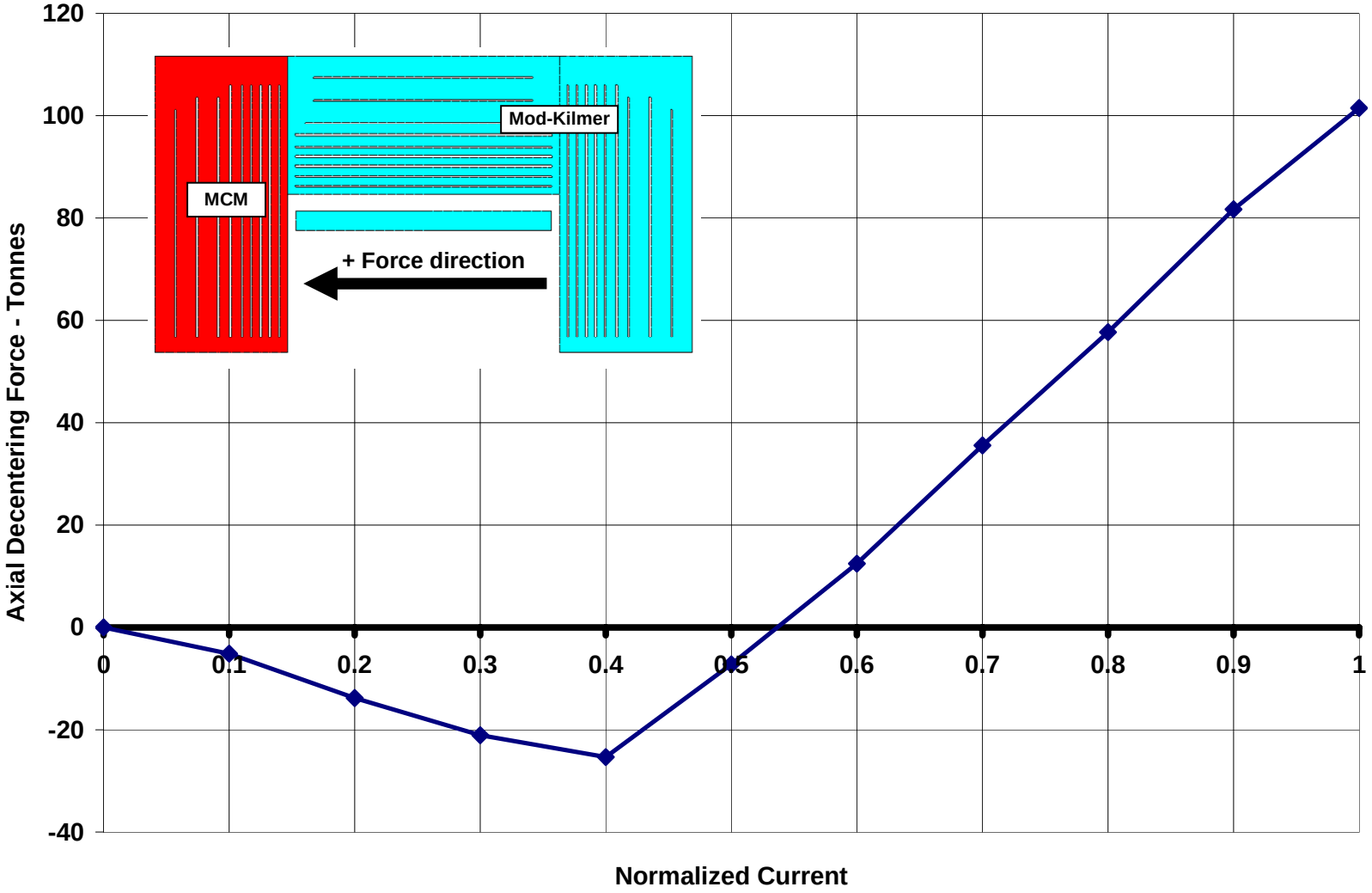
BH Curve	Central Field	Axial Decentering (tonnes/cm)
KJS	5.0408	227
LDJ	5.0021	205
MS10360	5.0258	220
CMS	5.0274	220
Mod_Kilmer	5.0071	212
CDF1020	5.0207	215
MCM	5.0069	213

Axial decentering due to differences in BH between steel flux return components (positive toward CMS endwall)

BH of Barrel and One Endwall	BH of Other Endwall	Axial Decentering (tonnes)
CMS	Endwall missing	14000
CMS	KJS	-177
CMS	MS10360	34
CMS	LDJ	-570
CMS	Mod_Kilmer	415
CMS	CDF1020	166
CMS	MCM	315


Two BH Curves that Cross
2.5
2
1.5
1
0.5
0
B - Tesla
0
10000
20000
30000
40000
50000
60000
H - At/m
Mod Kilmer
KTeV MCM

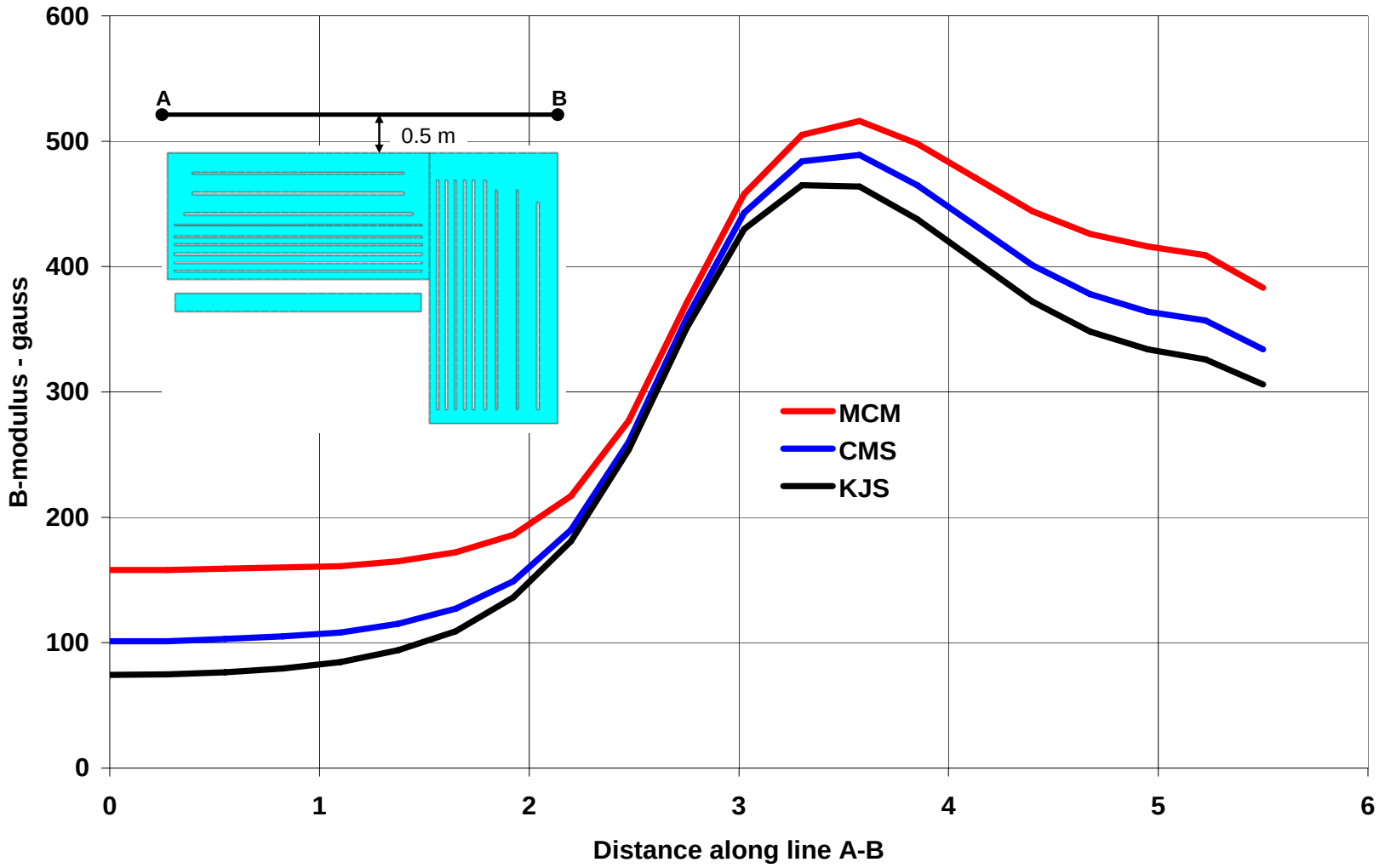
Axial Decentering Force On Coil - Force Reversal



Effect of BH on Field Uniformity

- **The difference in axial B-field at Z = 0 along the radius from 0 to 2 m is less than 1% for the KJS (best) and MCM (worst) BH curves**

Fringe Fields - Comparison of Results for Three Curves



Conclusions

- **BH of steel has small effect on axial decentering due to misalignment (~10%)**
- **BH differences in endwalls could cause large decentering forces even if no misalignment is present, though calculation here is extremely conservative**
- **BH of steel has negligible effect on central field, and field uniformity in tracking volume**
- **Largest effect of BH is on fringe fields (~100% between best and worst curves at some locations)**
- **Characterization of BH at high fields are important for calculations because steel is heavily saturated**