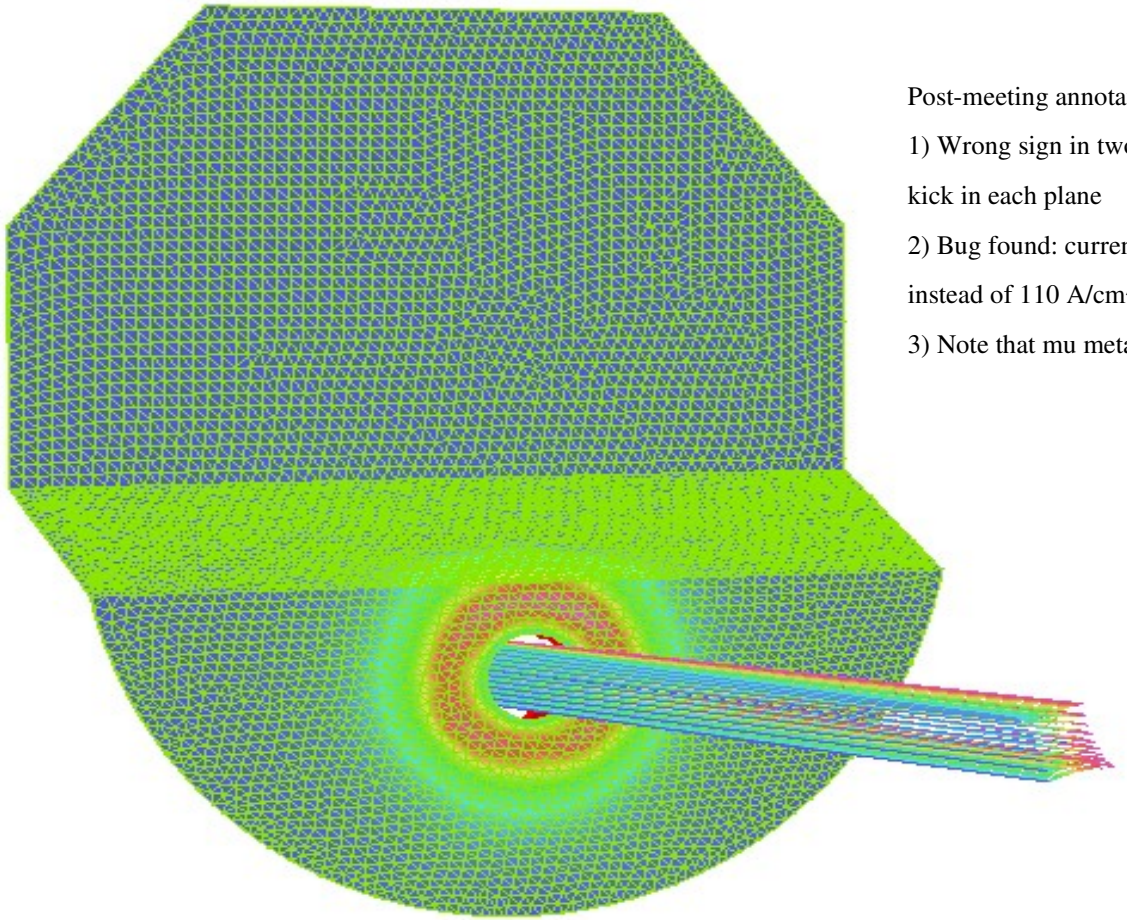
Initial Results from a 3D Magnetic Model of the Injector Cryomodule Entrance Shield

Jim Crittenden

ERL General Meeting, 2 April 2009



Post-meeting annotations:

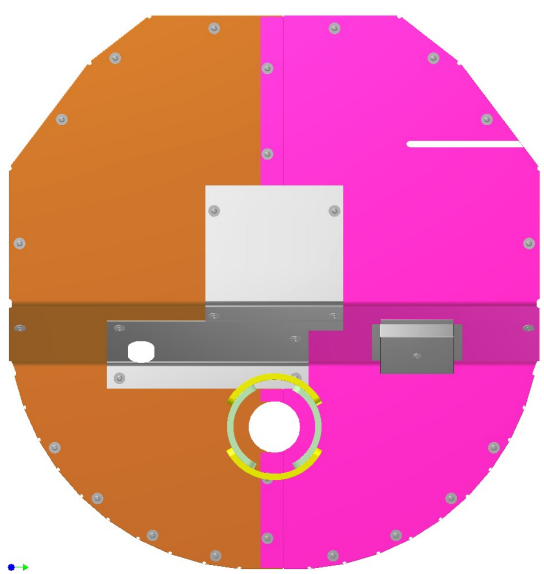
1) Wrong sign in two coils resulted in zero net kick in each plane

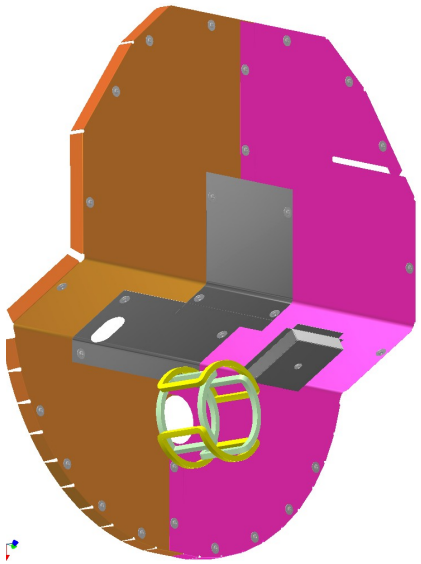
2) Bug found: current densities were 200 A/cm^2 instead of 110 A/cm^2

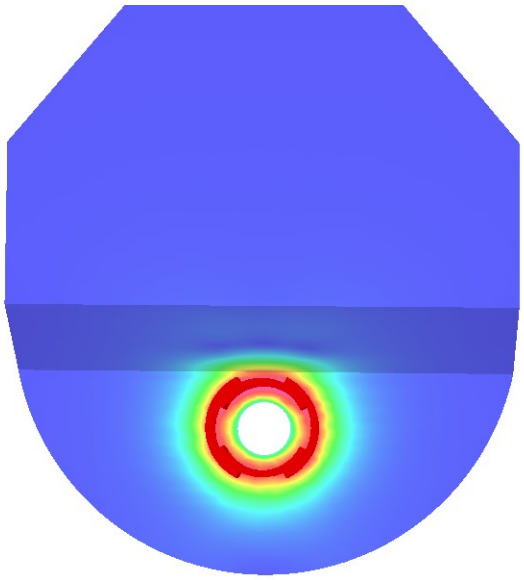
3) Note that mu metal thickness is 50 mils

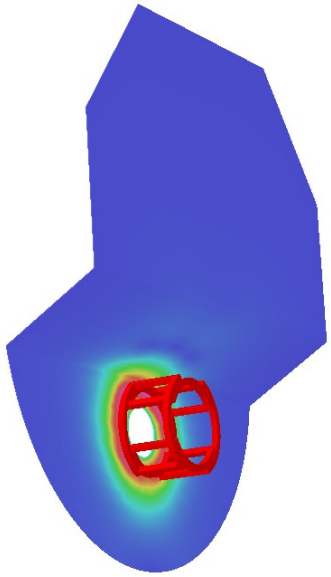
CAD and OPERA Model Comparison

CAD pictures from Eric Chojnacki



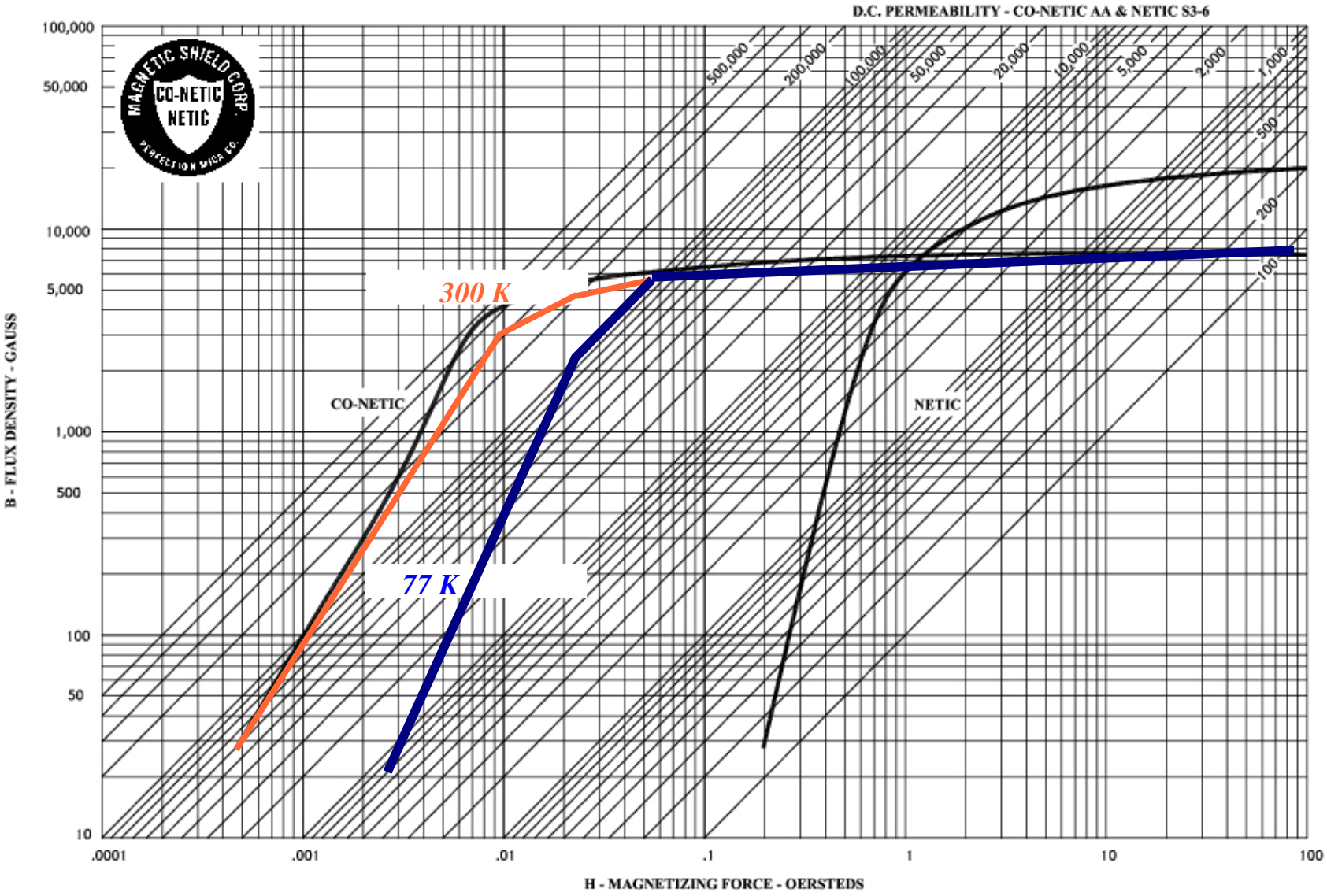






B-H Curve for AD-MU 80

Information and reasoning by Eric Chojnacki. "Magnetic Shielding in a Cryogenic Environment" by Arentz, Johnson and Dant



Field Components on Beam Axis

100 Amps in both horizontal and vertical corrector coils.

Shield at Z = 0 cm

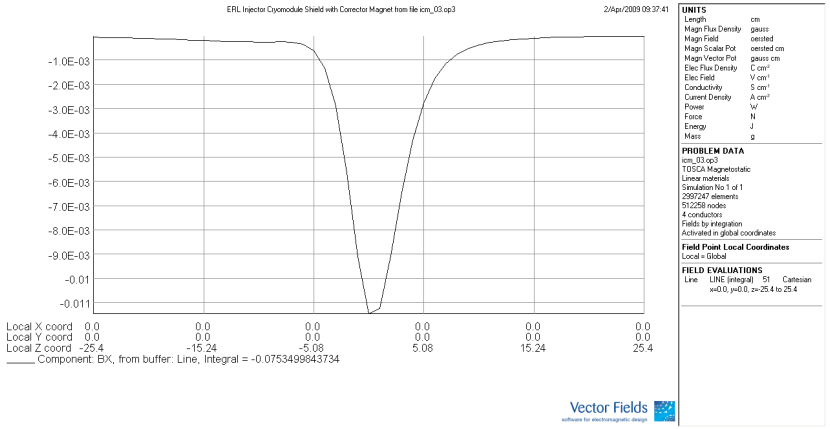
-25 < Z < 25 cm

Horizontal Component

$0 < B_X < 0.011$ Gauss

Integral: -0.08 Gauss-cm

(Calculation accuracy)

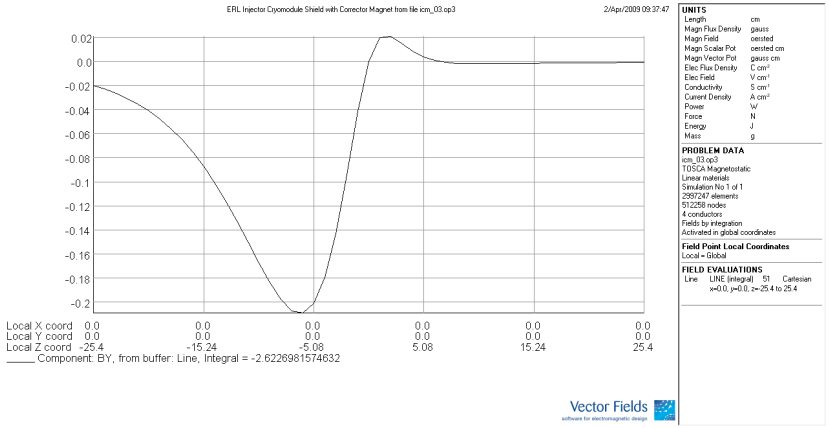


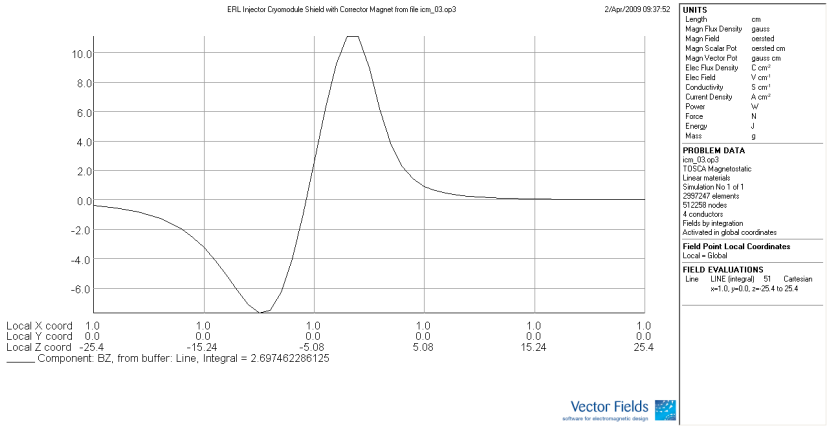
Vertical Component

$-0.02 < B_Y < 0.2$ Gauss

Integral: -2.7 Gauss-cm

(Contribution by shield)





Longitudinal Component

$-7 < B_Z < 11$ Gauss

Integral: 2.7 Gauss-cm

(Contribution by coil)

Systematic Check with Mu Metal Turned Off

100 Amps in both horizontal and vertical corrector coils.

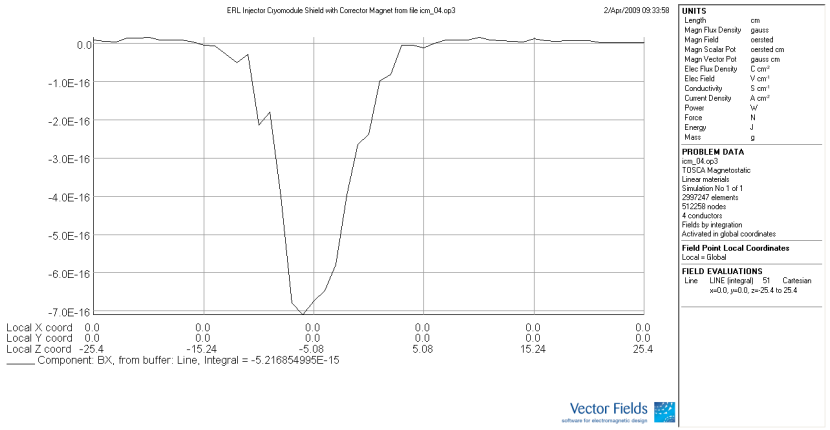
Shield at Z = 0 cm

-25 < Z < 25 cm

Horizontal Component

$B_X < 10^{-15}$ *Gauss*

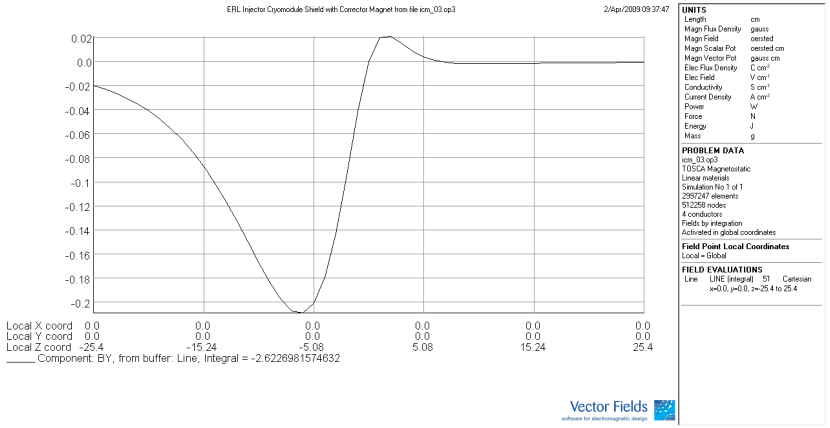
(Calculation accuracy)

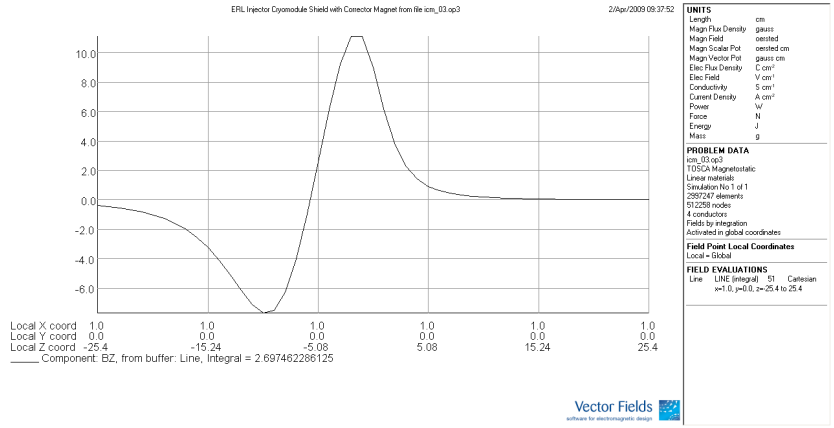


Vertical Component

$B_Y < 10^{-15}$ *Gauss*

(Calculation accuracy)





Longitudinal Component

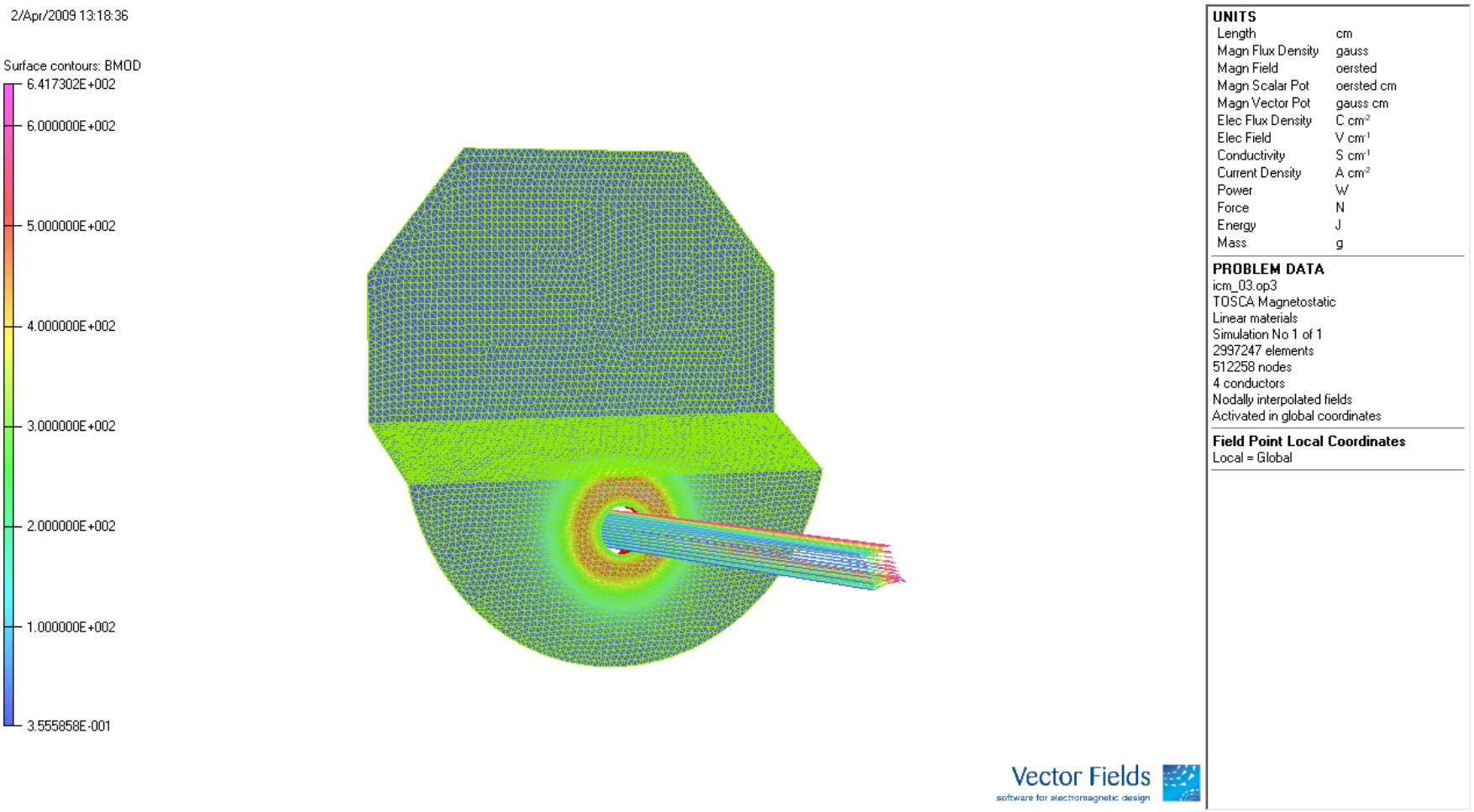
$-8 < B_Z < 8$ *Gauss*

(Contribution by coil)

Electron Tracking

250 keV electrons

11 x 11 entrance grid over 2 x 2 cm tracked for 75 cm



Preliminary Conclusions

- *The shape of the shield does not introduce as much distortion in the electron trajectories as observed*
- *The 3D model is available for further development*
- *All suggestions welcome*