Model Update – 30/01/2013

Running Models

This week the following models have run and solved

Model 51 Step IV, Sol 240 MeV/c – No Return Yoke - South Side Buildings
Model 52 Step IV, Sol 240 MeV/c – Return Yoke - South Side Buildings
Model 53 Step **VI**, Sol 240 MeV/c – No Return Yoke - South Side Buildings

 Models 51 - 53 are now being run in flip mode (Models 54 - 56)

Model Update – 30/01/2013

AutoGen Plots

I spent a bit of time creating a program that autogenerates field plots of Bmod on a plane for the hall models. These plots are not great for quantitative analysis but are quite good for taking a first look.

The autogen produces plots in the x y and z planes at 1m intervals.

Model Update – 30/01/2013

These plots are available for everyone to see and view:

There's a link from the modelling home page:

http://www.hep.shef.ac.uk/research/mice/opera_models/

Or directly: (no relation to that small experiment in Switzerland)

http://www.hep.shef.ac.uk/research/mice/opera_models/atlas/

Each plot has 3 associated images.

A 2D plot with all structures turned off
A 2D plot with all structures turned on. (The fact that it is 'all' structures can be a problem as the code is not intelligent!)
A 3D plot will all structures turned on – this helps to visualise where plot plane is.

Note: I'm still finding a few bugs – sometimes file naming is not quite correct…

Model Update – 30/01/2013

Index of /research/mice/opera_models/atlas

Name	Last modified	Size	Description
Parent Directory		-	
model_51/	29-Jan-2013 12:03	-	
model_52/	28-Jan-2013 16:09	-	
model_53/	28-Jan-2013 13:40	-	

Apache/2.2.3 (Scientific Linux) Server at www.hep.shef.ac.uk Port 80

Index of /research/mice/opera_models/atlas/model_51

Name	Last modified	Size	Description
Parent Directory		-	
Hall/	29-Jan-2013 13:12	-	
SSB/	29-Jan-2013 14:13	-	

Apache/2.2.3 (Scientific Linux) Server at www.hep.shef.ac.uk Port 80

Model Update – 30/01/2013

Index of /research/mice/opera_models/atlas/model_51/Hall

Name	Last modified	Size	Description
Parent Directory		-	
XY_plane/	29-Jan-2013 13:12	-	
XZ_plane/	29-Jan-2013 12:30	-	
YZ_plane/	29-Jan-2013 13:57	-	

Apache/2.2.3 (Scientific Linux) Server at www.hep.shef.ac.uk Port 80

Index of /research/mice/opera_models/atla Index of /research/mice/opera_
box - Mozilla Thunderbird

Name	Last modified	Size	Description
Parent Directory		-	
y_-1000/	29-Jan-2013 12:13	-	
y_-2000/	29-Jan-2013 12:10	-	
y_-3000/	29-Jan-2013 12:09	-	
y_-4000/	29-Jan-2013 12:08	-	
y_-5000/	29-Jan-2013 12:06	-	
y_-6000/	29-Jan-2013 12:04	-	
y_0/	29-Jan-2013 12:17	-	
y_1000/	29-Jan-2013 12:20	-	
y_2000/	29-Jan-2013 12:22	-	
y_3000/	29-Jan-2013 12:25	-	

Name	Last
Parent Directory	
Bmod_0_1_XZplane_y_0_Structures_Off.png	29-Jan
Bmod_0_1_XZplane_y_0_Structures_On.png	29-Jan
Bmod_0_1_XZplane_y_0_Structures_On_XYZ.png	29-Jan
Bmod_0_5_XZplane_y_0_Structures_Off.png	29-Jan
Bmod_0_5_XZplane_y_0_Structures_On.png	29-Jan
Bmod_0_5_XZplane_y_0_Structures_On_XYZ.png	29-Jan
Bmod_0_10_XZplane_y_0_Structures_Off.png	29-Jan
Bmod_0_10_XZplane_y_0_Structures_On.png	29-Jan
Bmod_0_10_XZplane_y_0_Structures_On_XYZ.png	29-Jan
Bmod_0_50_XZplane_y_0_Structures_Off.png	29-Jan

30/01/2013

Auto Gen Figures

What I'm going to show are some pictures from the autogen for models 51 vs 52. Step IV solenoid 240 MeV/c – No Return Yoke vs Return Yoke

As a result some of the pictures are not really 'optimised'. I've not had a lot of time to really analyse these so there's real physics here, but maybe there will be some discussion that will come of these that will be useful?

Consider it a quick tour around some areas of interest...

Sanity Check - West Wall

Going over old territory z = 19000mm from step VI centre – 240 MeV/c Sol
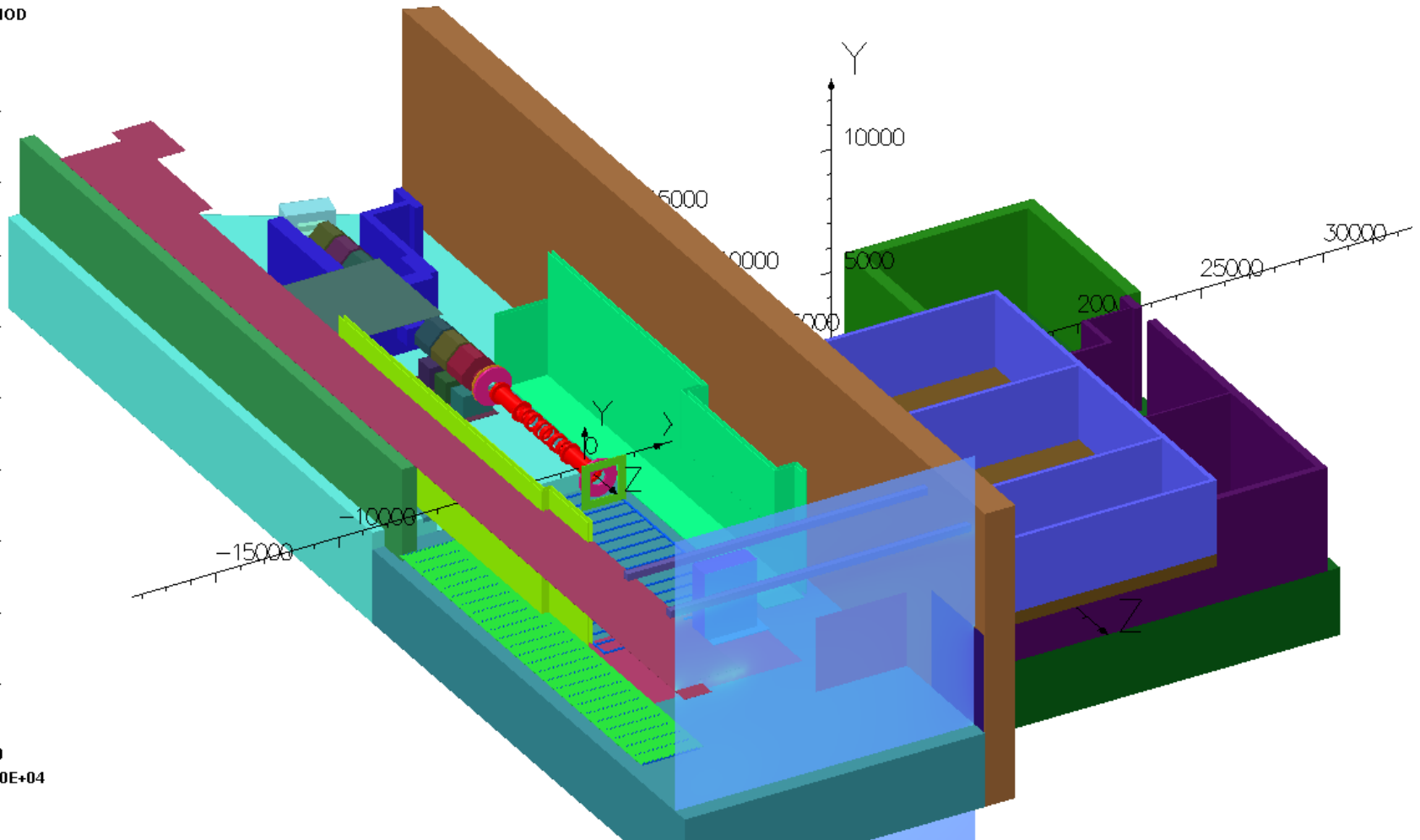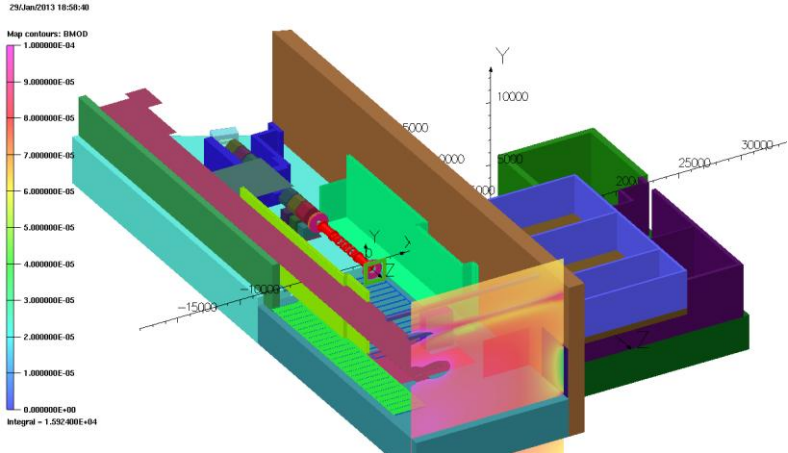
Model 51 – No Return Yoke
Z= 19000 XY Plane
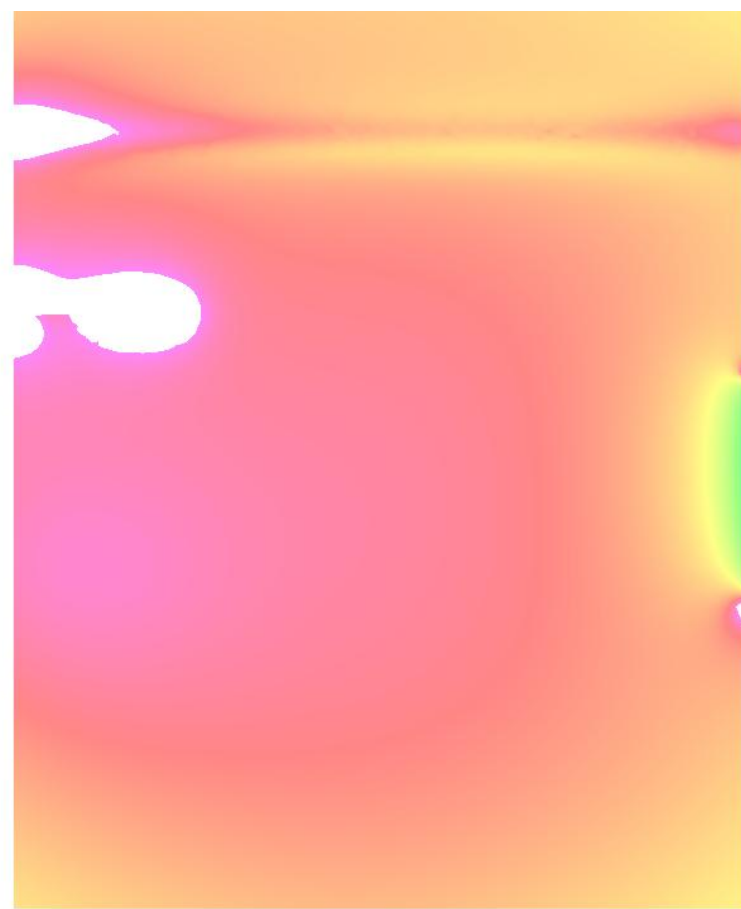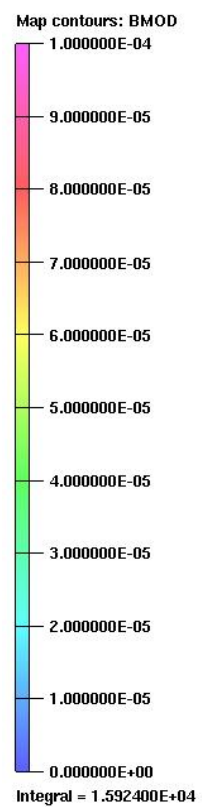
Model 52 – With Step IV Return Yoke
z=19000 XY Plane
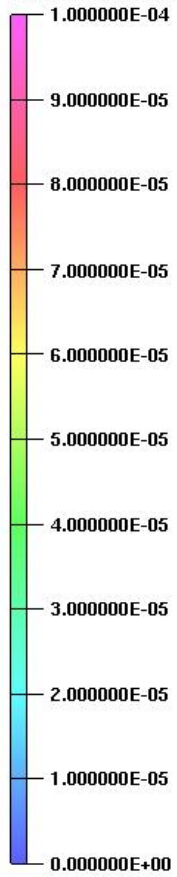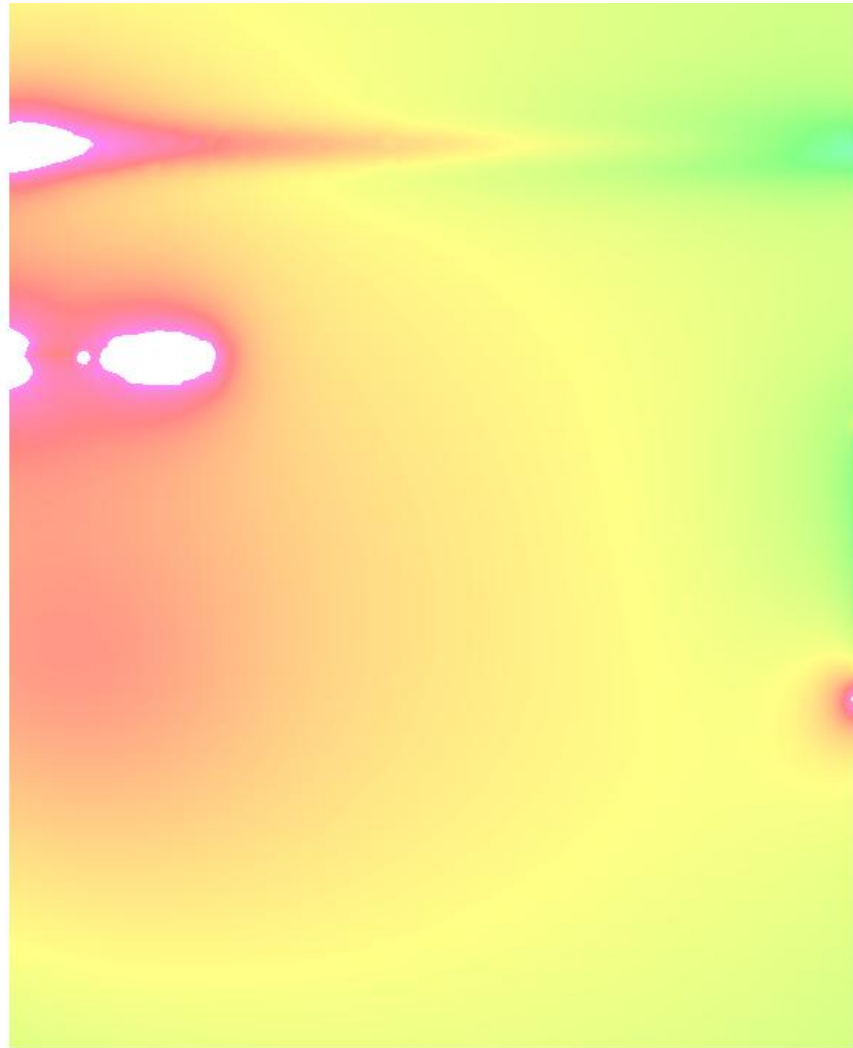
Field at Cryomech Compressor
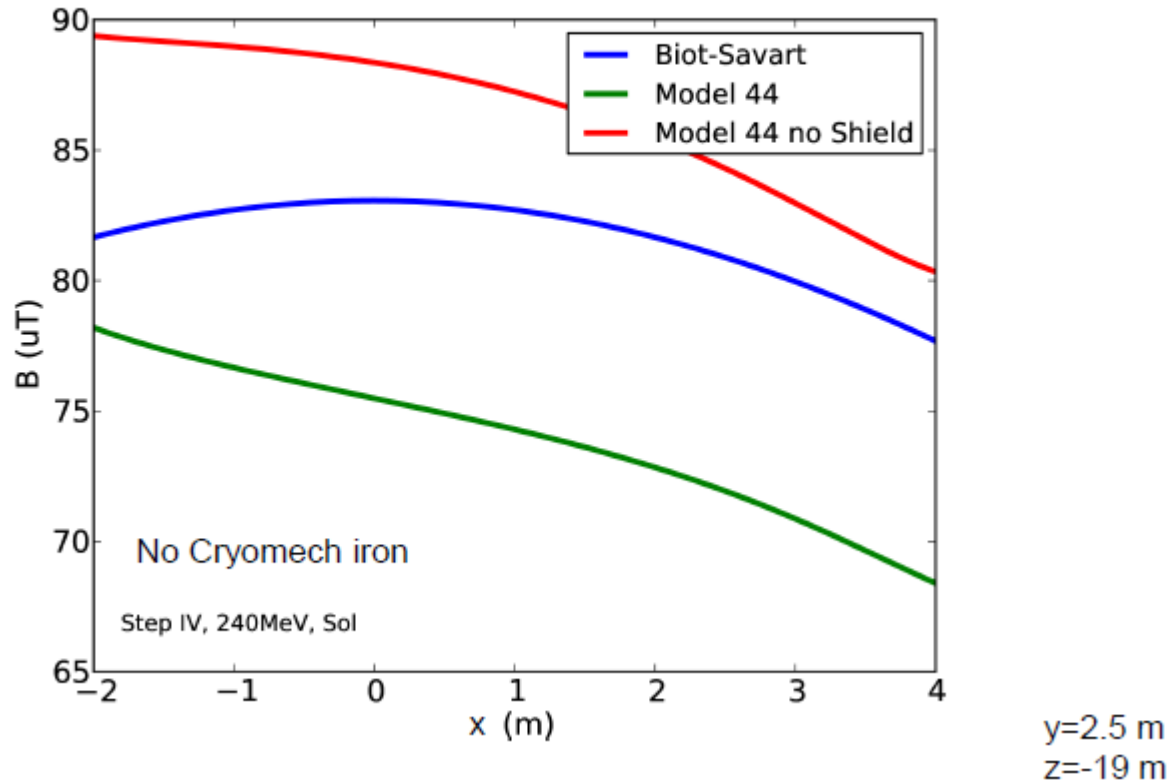
Lifted from Holger's presentation – 23/01/2013

Holger's Return Yoke

For comparison I was going to put in a slide from one of Holger's presentations but I couldn't find an image/plot where I was 100% sure I was seeing 240 MeV/c, Solenoid Bmod along the centre line of the shield.

General comment from 12/12/2012

"5 Gauss limit for large areas of MICE hall "

29/Jan/2013 12:17:16

Model 51 – No Return yoke – 1mT Air boundary – y=0 XZ Plane

Map contours: BMOD

| 1.000000E-03 |
| 9.000000E-04 |
| 8.000000E-04 |
| 7.000000E-04 |
| 6.000000E-04 |
| 5.000000E-04 |
| 4.000000E-04 |
| 3.000000E-04 |
| 2.000000E-04 |
| 1.000000E-04 |
| 0.000000E+00 |
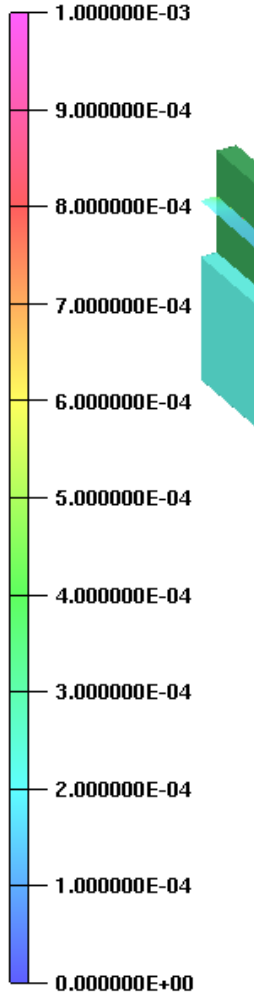
Integral = 1.911835E+07
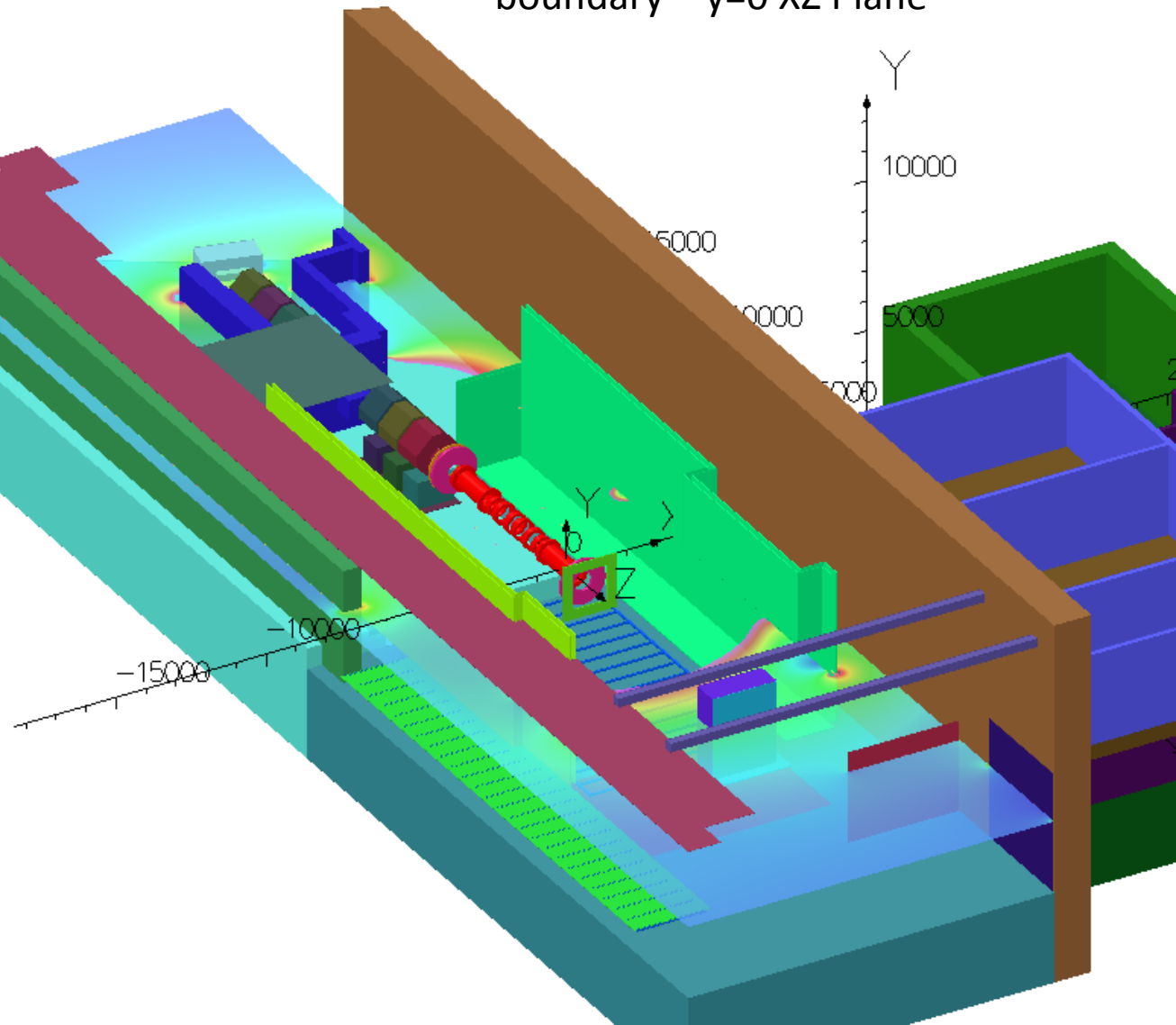
Model 51 – No Return yoke – 1mT Air boundary – y=0 XZ Plane

29/Jan/2013 17:52:51

Map contours: BMOD

	1.000000E-03
	9.000000E-04
	8.000000E-04
	7.000000E-04
	6.000000E-04
	5.000000E-04
	4.000000E-04
	3.000000E-04
	2.000000E-04
	1.000000E-04
	0.000000E+00

Integral = 1.911835E+07
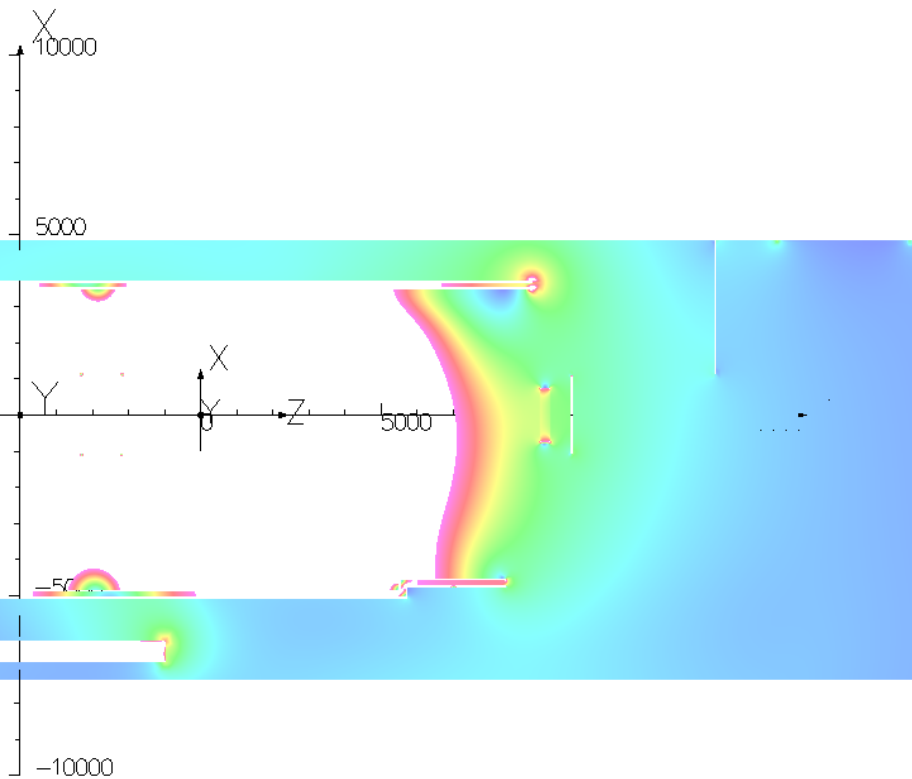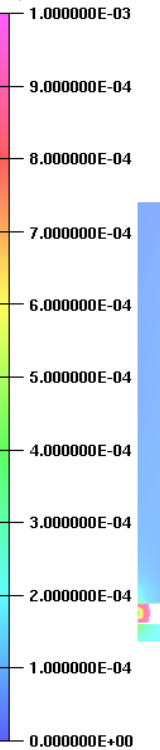
Opera

Model 52 – Step IV Return yoke – 1mT Air boundary – y=0 XZ Plane

Model 52 – Step IV Return yoke – 1mT Air boundary – x=0
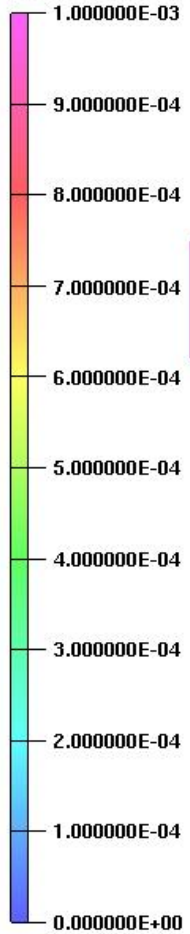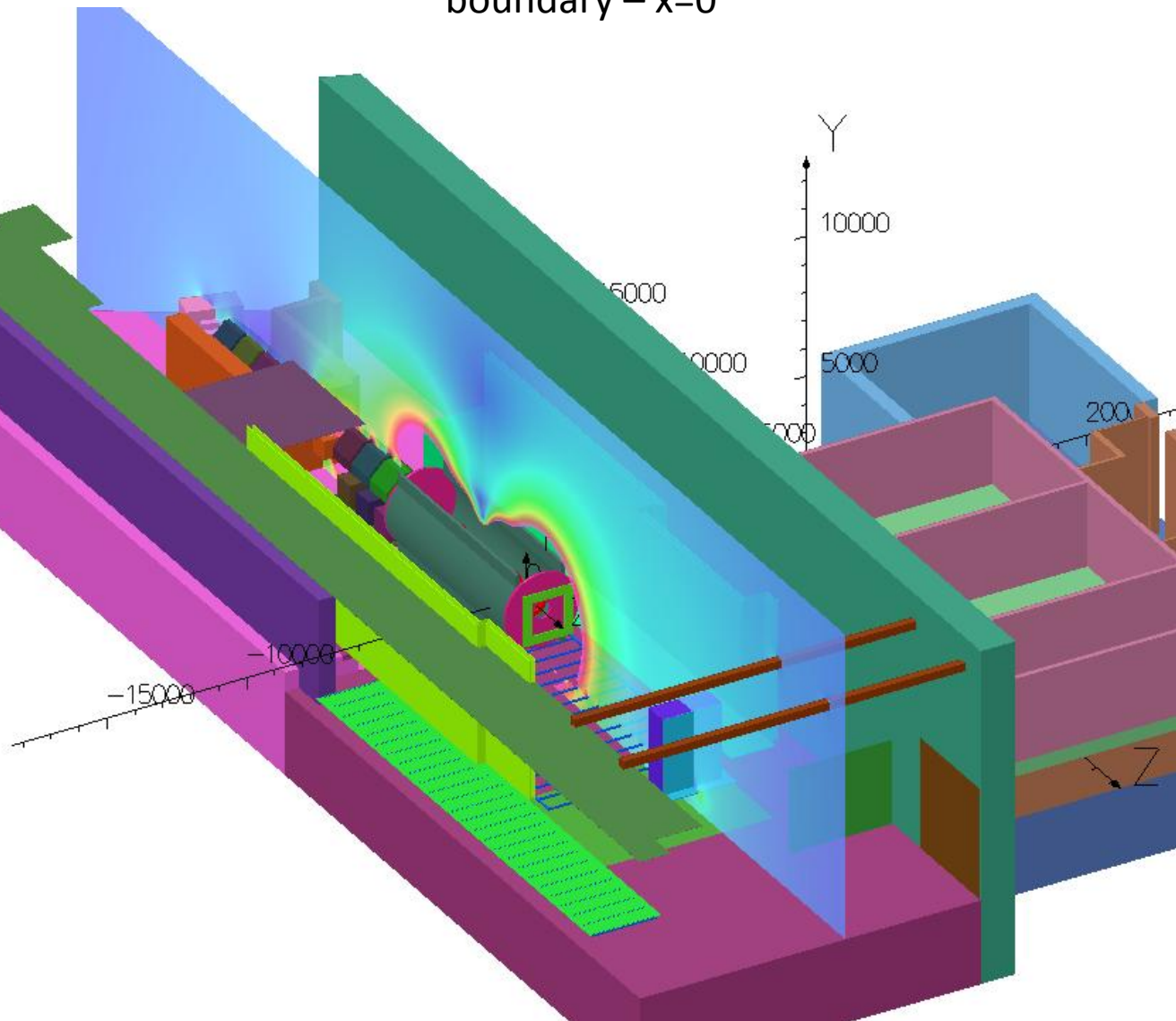
Model 52 – Step IV Return yoke – 1mT Air boundary - y=0 XZ plane

28/Jan/2013 16:21:53

Map contours: BMOD

1.000000E-03
9.000000E-04
8.000000E-04
7.000000E-04
6.000000E-04
5.000000E-04
4.000000E-04
3.000000E-04
2.000000E-04
1.000000E-04
0.000000E+00
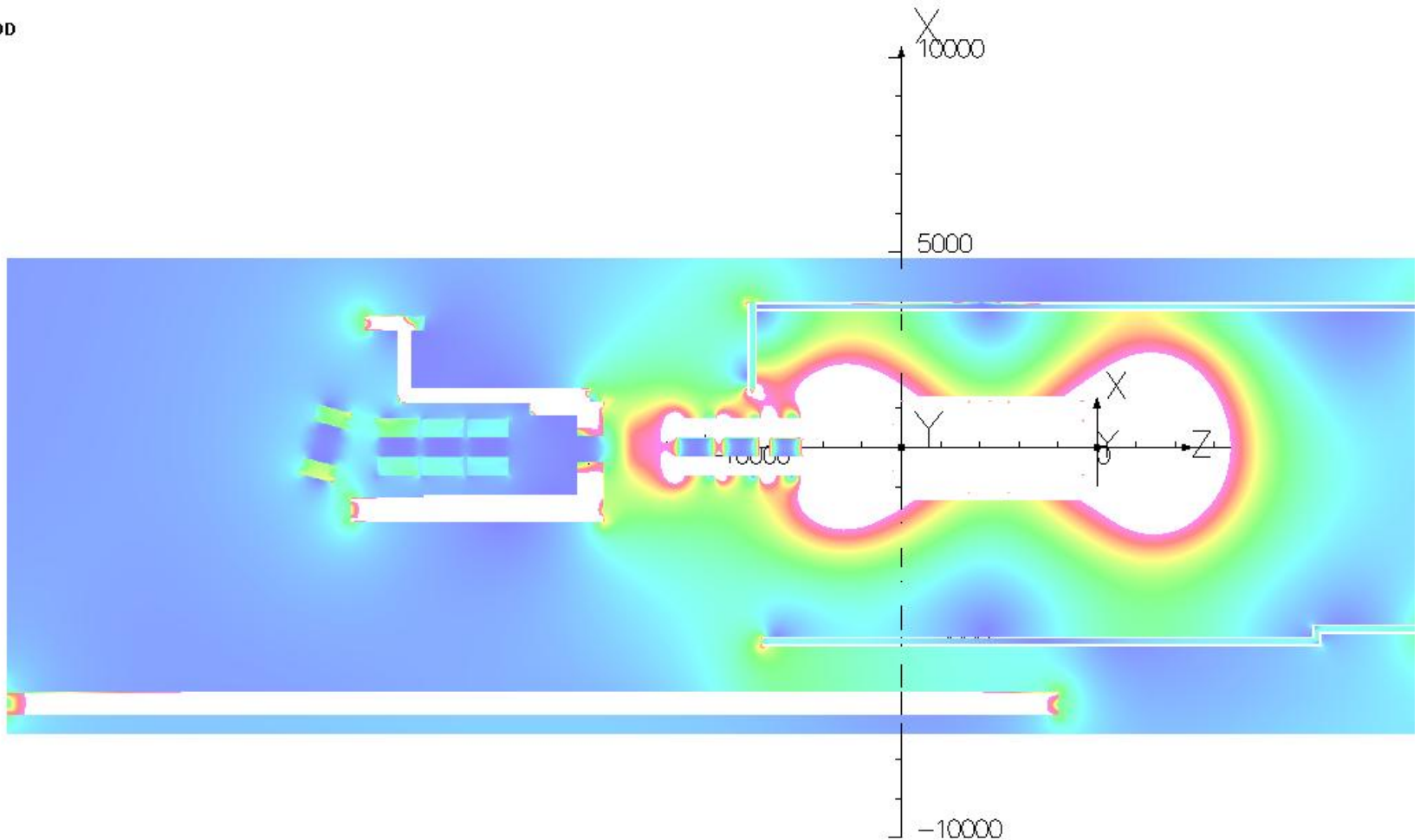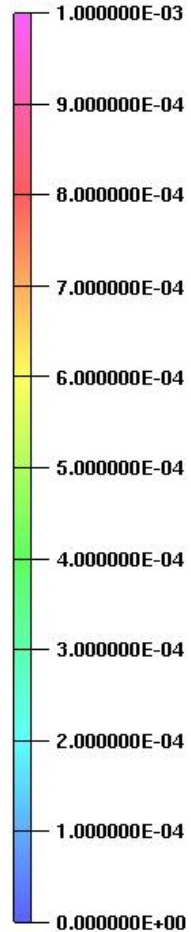
Integral = 1.929043E+07

28/Jan/2013 16:21:54

Map contours: BMOD

- 1.000000E-03
- 9.000000E-04
- 8.000000E-04
- 7.000000E-04
- 6.000000E-04
- 5.000000E-04
- 4.000000E-04
- 3.000000E-04
- 2.000000E-04
- 1.000000E-04
- 0.000000E+00
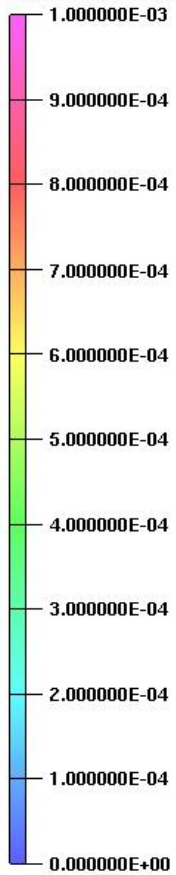
Integral = 1.929043E+07
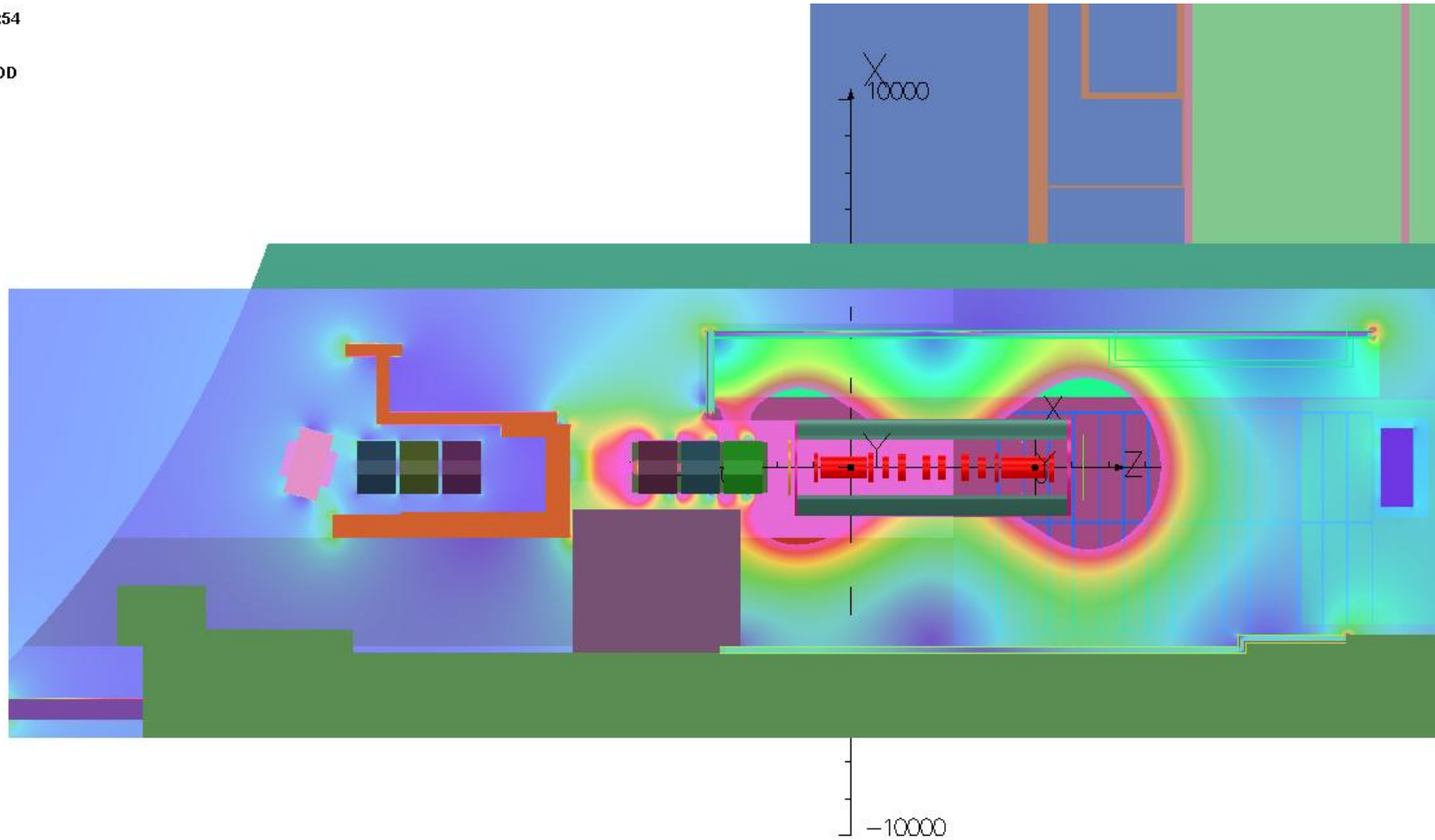
South Side Buildings

Step IV – No Return Yoke – y=0 XZ Plane
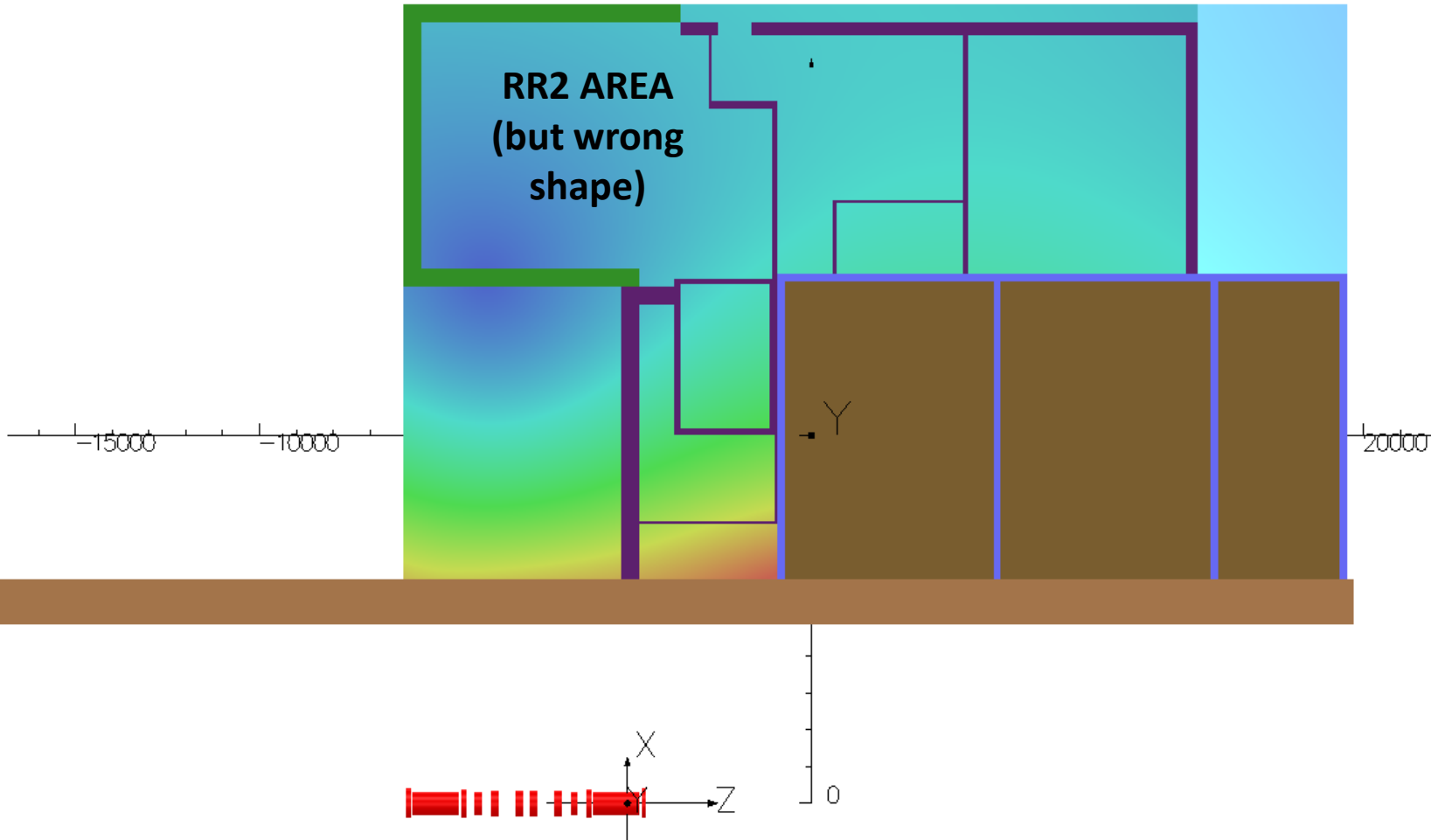
SSB

Step IV – No Return Yoke – y=0 XZ Plane
MLCR in region of High field – this region extend up towards ISIS control rooms
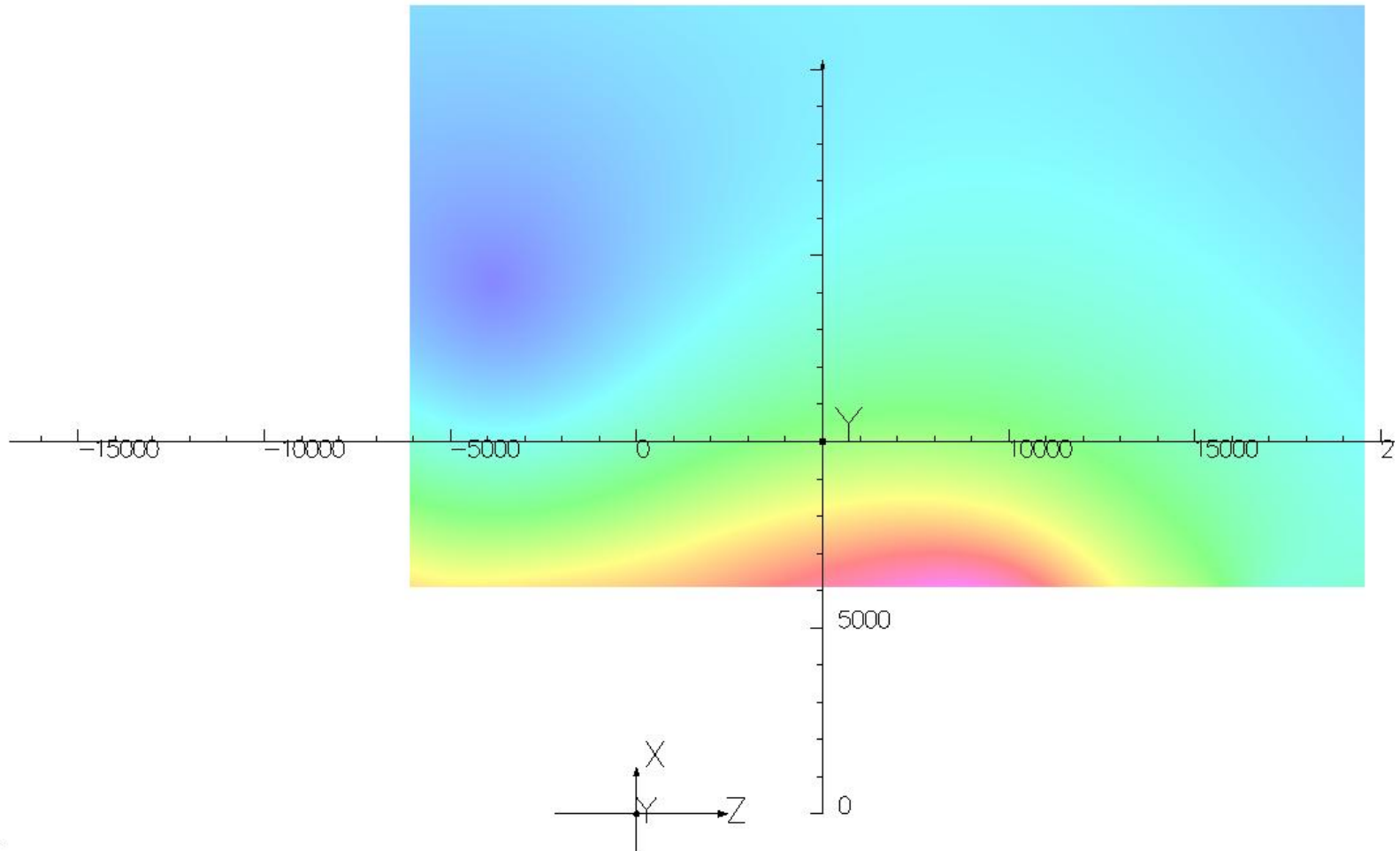
SSB

Step IV – With Return Yoke – y=0 XZ Plane
RR2 appears to be at higher field level?

29/Jan/2013 19:56:39

Map contours: BMOD

1.0 gauss

1.000000E-04
9.000000E-05
8.000000E-05
7.000000E-05
6.000000E-05
5.000000E-05
4.000000E-05
3.000000E-05
2.000000E-05
1.000000E-05
0.000000E+00

Integral = 2.677822E+04

Model 51
No Return Yoke
y=0 XZ Plane

-15000   -10000   20000   25000   Z

Y

X
Z
O

UNITS
Length   mm
Magn Flux Density   T
Magnetic Field   A/m
Magn Scalar Pot   A
Current Density   A/mm²
Power   W
Force   N

MODEL DATA
Hall_Test_51.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13777571 elements
19285041 nodes
12 conductors
Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   1026x625 Cartesian
          (nodal)
          x=6089.0 to   y=0.0   z=-6090.0 to
          21719.0   19551.0

Opera

Map contours: BMOD

1.0 gauss

1.000000E-04
9.000000E-05
8.000000E-05
7.000000E-05
6.000000E-05
5.000000E-05
4.000000E-05
3.000000E-05
2.000000E-05
1.000000E-05
0.000000E+00

Integral = 3.154075E+04

Model 52
With Return Yoke
y=0 XZ Plane

-15000   -10000   20000   25000   Z

Y

X
Z
O

UNITS
Length   mm
Magn Flux Density   T
Magnetic Field   A/m
Magn Scalar Pot   A
Current Density   A/mm²
Power   W
Force   N

MODEL DATA
Hall_Test_52.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13633714 elements
19486054 nodes
12 conductors
Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   1026x625 Cartesian
          (nodal)
          x=6089.0 to   y=0.0   z=-6090.0 to
          21719.0   19551.0

Opera

29/Jan/2013 19:56:38

Map contours: BMOD
1.00 gauss

1.000000E-04
9.000000E-05
8.000000E-05
7.000000E-05
6.000000E-05
5.000000E-05
4.000000E-05
3.000000E-05
2.000000E-05
1.000000E-05
0.000000E+00

Integral = 2.677822E+04

Model 51 –
No Return Yoke - y=0
XZ Plane

SUSPICIOUS? WHY IS
THE FIELD HIGHER
HERE?

29/Jan/2013 23:53:26

Map contours: BMOD
1.00 gauss

1.000000E-04
9.000000E-05
8.000000E-05
7.000000E-05
6.000000E-05
5.000000E-05
4.000000E-05
3.000000E-05
2.000000E-05
1.000000E-05
0.000000E+00

Integral = 3.154075E+04

Model 52 –
With Return Yoke - y=0
XZ Plane

UNITS
Length   mm
Magn Flux Density   T
Magnetic Field   A/m
Magn Scalar Pot   A
Current Density   A/mm²
Power   W
Force   N

MODEL DATA
Hall_Test_51.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13777571 elements
19285041 nodes
12 conductors
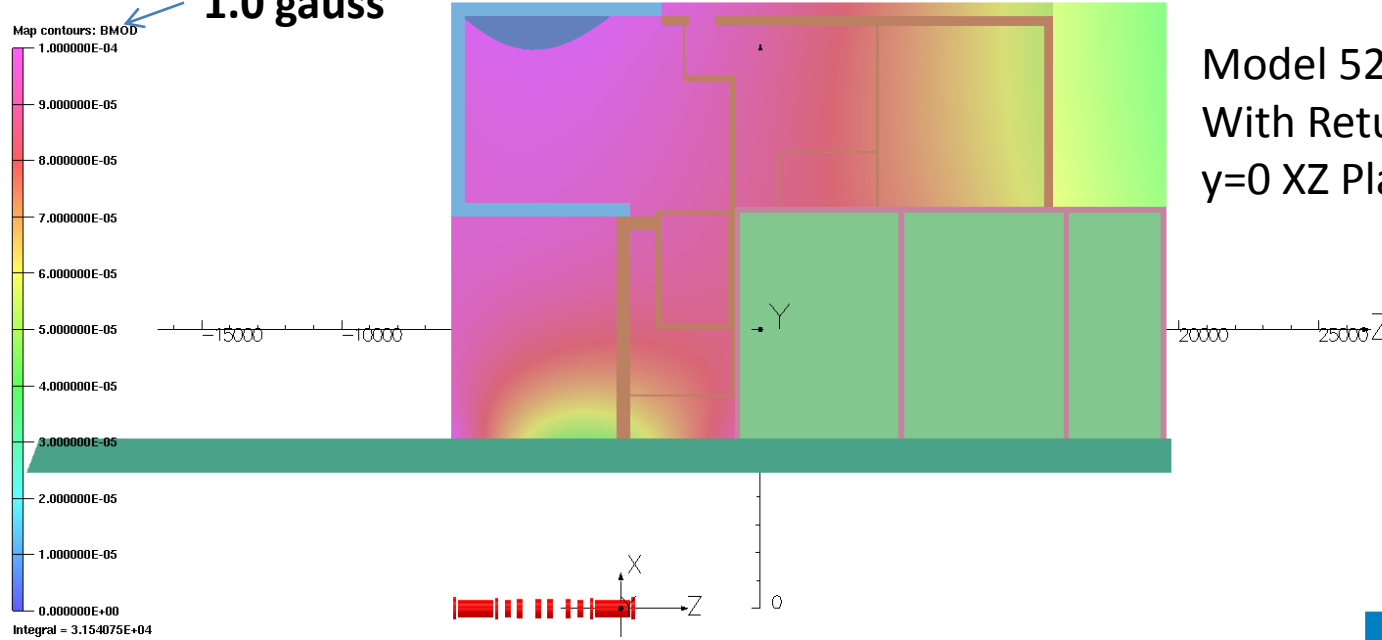Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   1026x625 Cartesian
          (nodal)
          x=6089.0 to   y=0.0   z=-6090.0 to
          21719.0   19551.0

Opera

UNITS
Length   mm
Magn Flux Density   T
Magnetic Field   A/m
Magn Scalar Pot   A
Current Density   A/mm²
Power   W
Force   N

MODEL DATA
Hall_Test_52.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13633714 elements
19486054 nodes
12 conductors
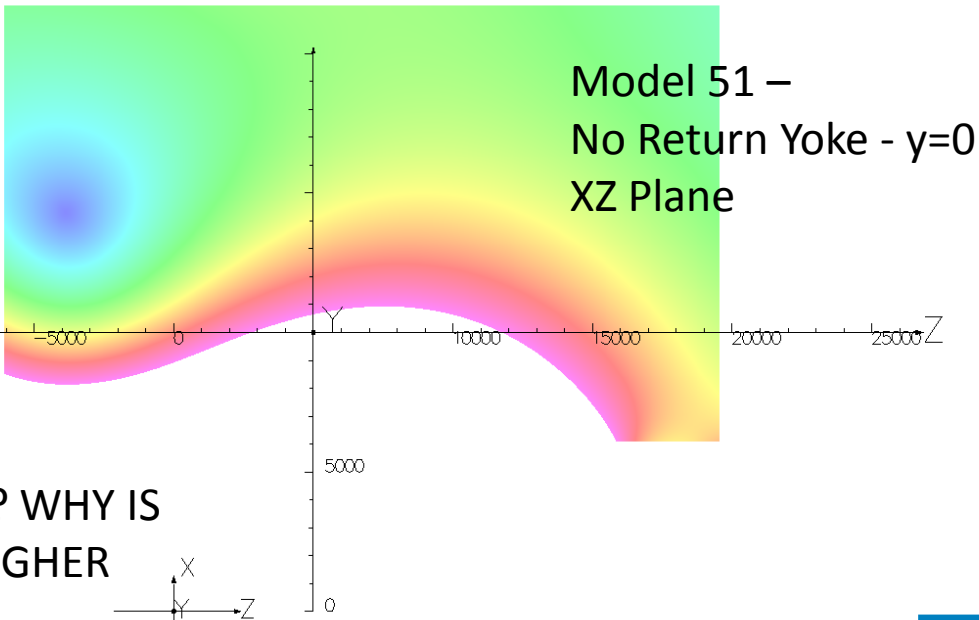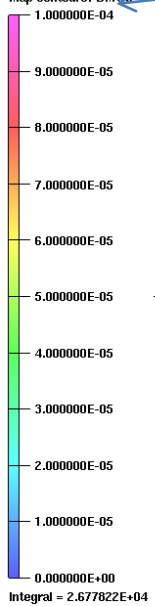Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   1026x625 Cartesian
          (nodal)
          x=6089.0 to   y=0.0   z=-6090.0 to
          21719.0   19551.0

Opera

ISIS Control Rooms

Model 51 – No Return Yoke - x=6000 YZ Plane

29/Jan/2013 20:13:43

Map contours: BMOD

2.91 gauss

2.909511E-04
2.500000E-04
2.000000E-04
1.500000E-04
1.000000E-04
5.000000E-05
0.000000E+00

Integral = 6.939463E+04

Model 51 –
No Return Yoke - x=6000
YZ Plane

UNITS

Length	mm
Magn Flux Density	T
Magnetic Field	A/m
Magn Scalar Pot	A
Current Density	A/mm²
Power	W
Force	N

MODEL DATA
Hall_Test_51.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13777571 elements
19285041 nodes
12 conductors
Nodally interpolated fields
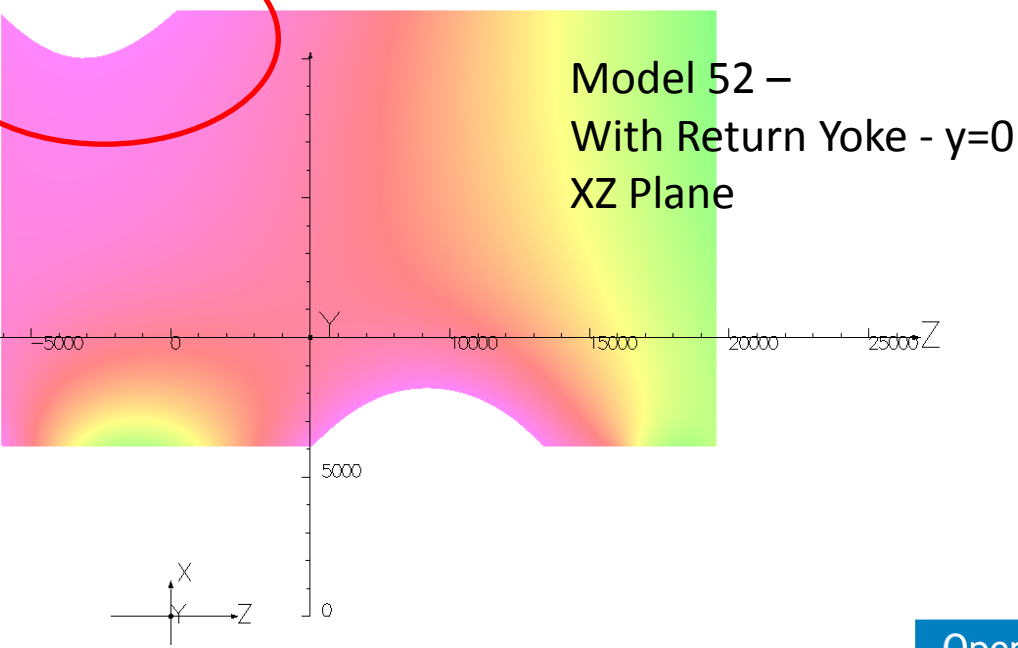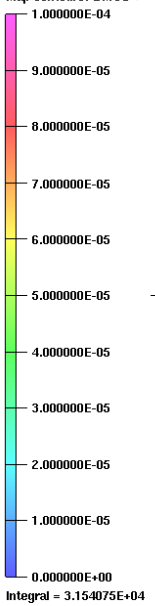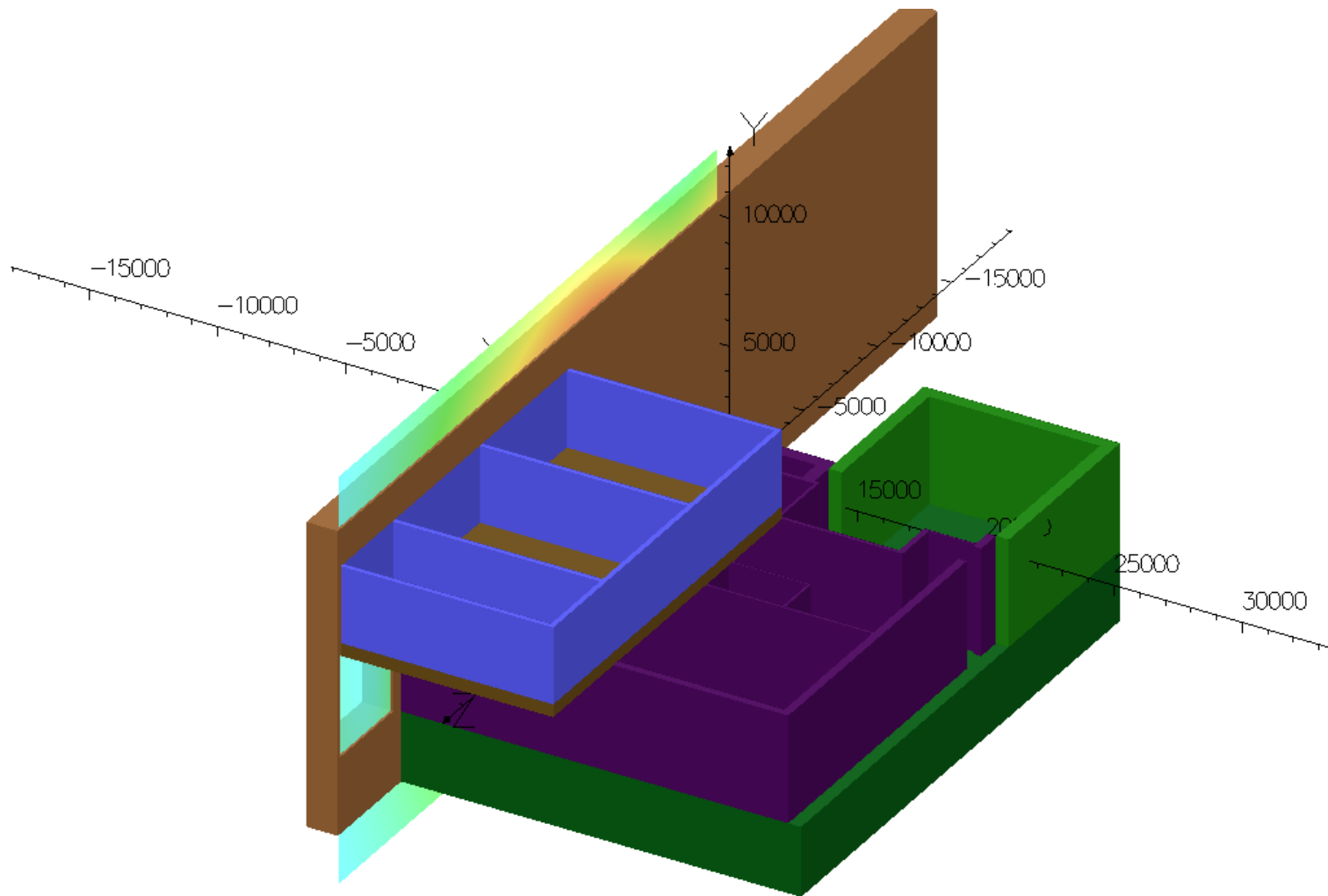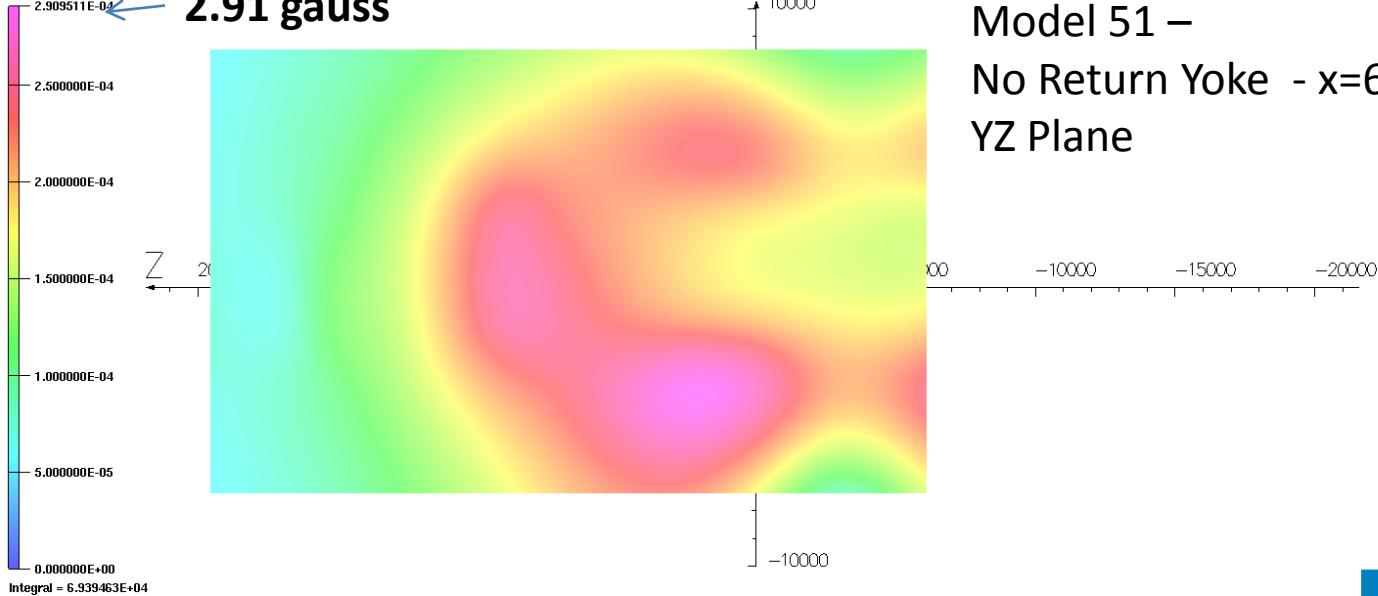Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   636x1026   Cartesian
(nodal)
x=6000.0   y=-7370.0 to   z=-6090.0 to
8526.0   19551.0

Opera

30/Jan/2013 00:11:17

Map contours: BMOD

1.82 gauss

1.826974E-04
1.600000E-04
1.400000E-04
1.200000E-04
1.000000E-04
8.000000E-05
6.000000E-05
4.000000E-05
2.000000E-05
0.000000E+00

Integral = 3.788060E+04

Model 52 –
With Return Yoke - x=6000
YZ Plane

UNITS

Length	mm
Magn Flux Density	T
Magnetic Field	A/m
Magn Scalar Pot	A
Current Density	A/mm²
Power	W
Force	N

MODEL DATA
Hall_Test_52.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13633714 elements
19486054 nodes
12 conductors
Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   636x1026   Cartesian
(nodal)
x=6000.0   y=-7370.0 to   z=-6090.0 to
8526.0   19551.0

Opera

ISIS Control Rooms

Model 51 – No Return Yoke - y=3000 XZ Plane

29/Jan/2013 19:58:25

Map contours: BMOD

2.352936E-04 ← **2.35 gauss**

2.000000E-04

1.500000E-04

1.000000E-04

5.000000E-05

0.000000E+00

Integral = 2.606917E+04

Model 51 –
No Return Yoke - y=3000
XZ Plane

UNITS
Length   mm
Magn Flux Density   T
Magnetic Field   A/m
Magn Scalar Pot   A
Current Density   A/mm²
Power   W
Force   N

MODEL DATA
Hall_Test_51.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13777571 elements
19285041 nodes
12 conductors
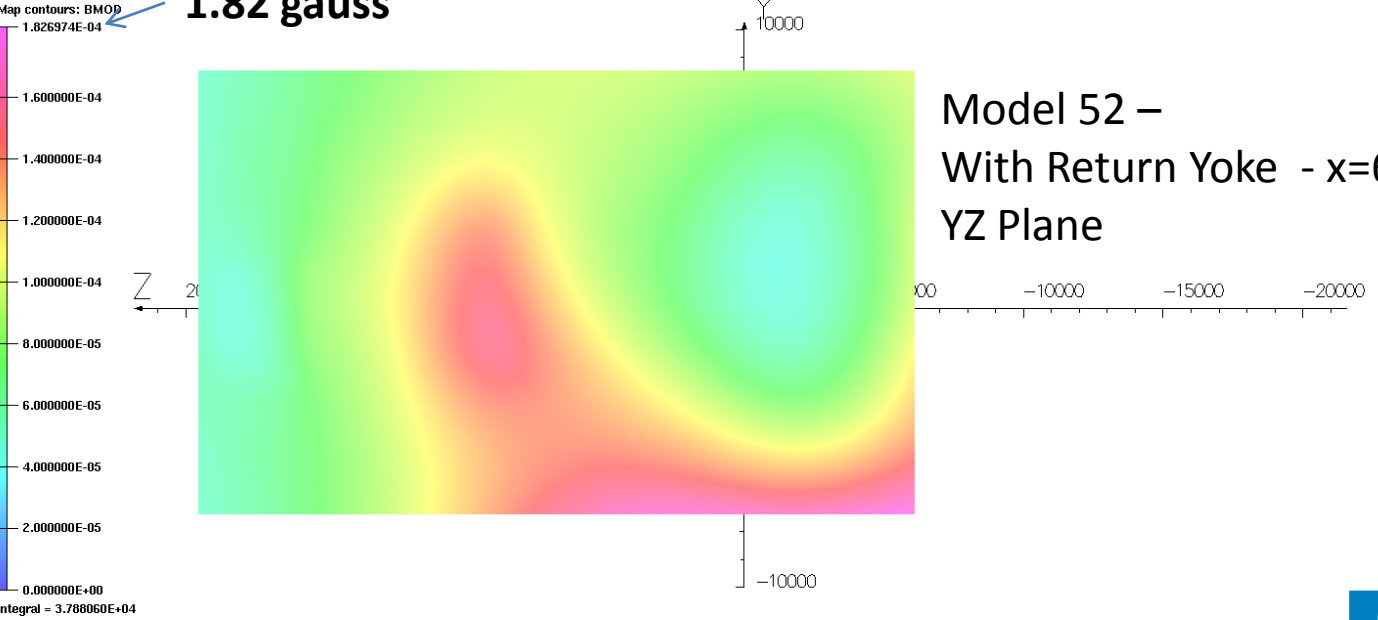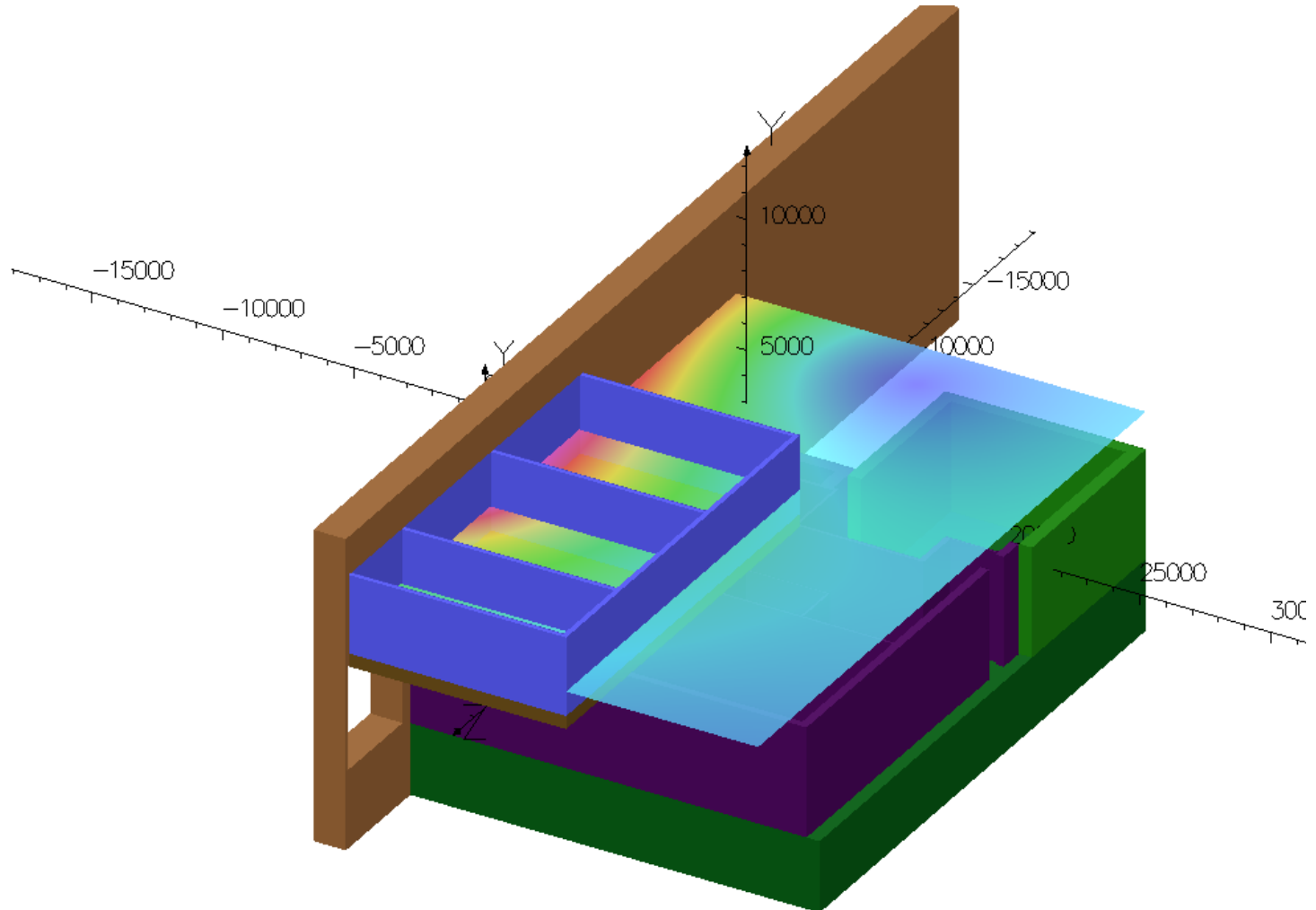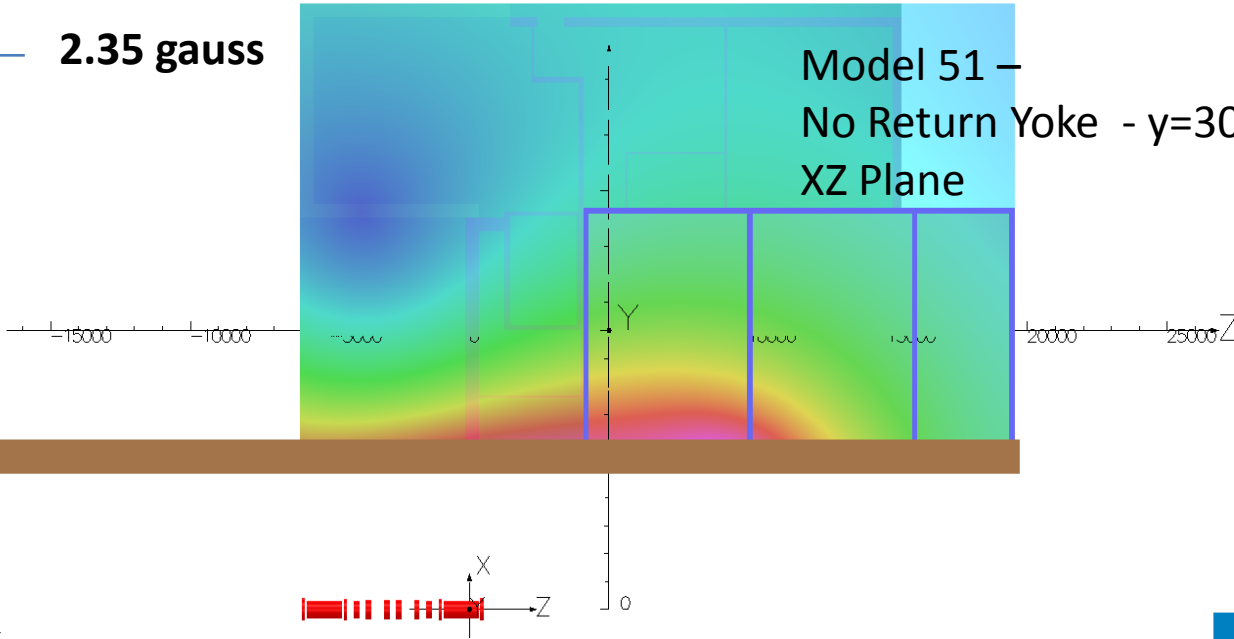Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   1026x625 Cartesian
                   (nodal)
                   x=6089.0 to   y=3000.0 z=-6090.0 to
                   21719.0   19551.0

Opera

29/Jan/2013 23:55:18

Map contours: BMOD

1.314531E-04 ← **1.31 gauss**

1.200000E-04

1.000000E-04

8.000000E-05

6.000000E-05

4.000000E-05

2.000000E-05

0.000000E+00

Integral = 3.082199E+04

Model 52 –
 With Return Yoke - y=3000
XZ Plane

UNITS
Length   mm
Magn Flux Density   T
Magnetic Field   A/m
Magn Scalar Pot   A
Current Density   A/mm²
Power   W
Force   N

MODEL DATA
Hall_Test_52.op3
TOSCA Magnetostatic
Nonlinear materials
Simulation No 1 of 1
13633714 elements
19486054 nodes
12 conductors
Nodally interpolated fields
Activated in global coordinates

Field Point Local Coordinates
Local = Global

FIELD EVALUATIONS
Cartesian CARTESIAN   1026x625 Cartesian
                   (nodal)
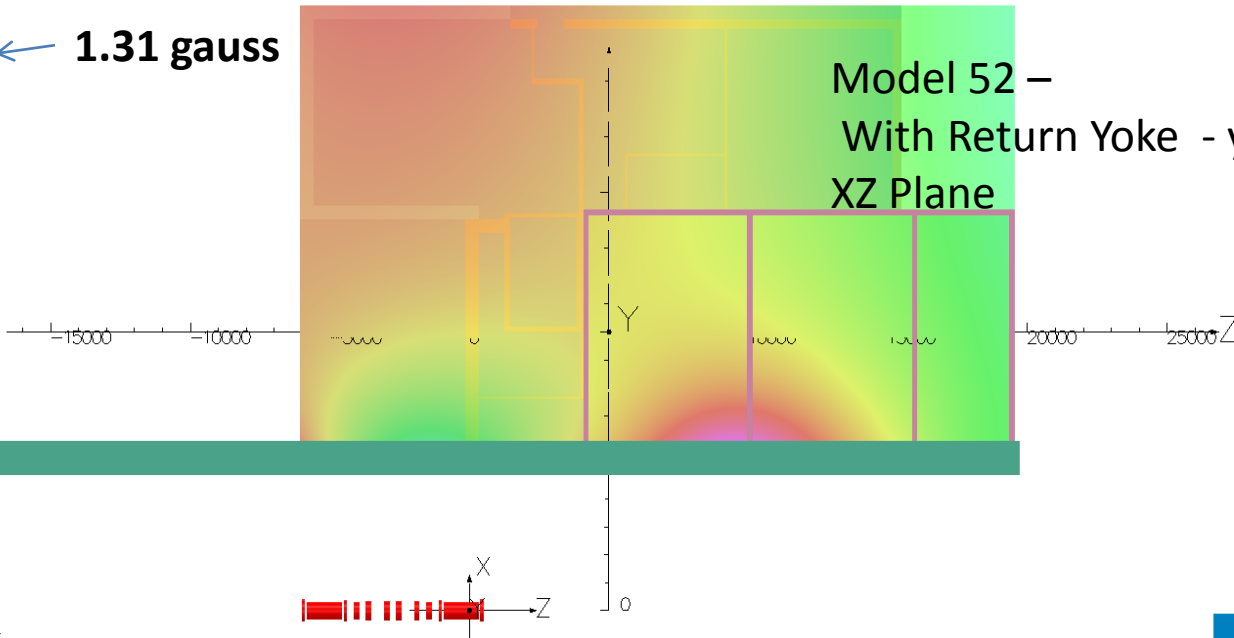   x=6089.0 to   y=3000.0 z=-6090.0 to
                   21719.0   19551.0

Opera

Conclusions

As usual the results are to be treated with care...

Model 51/52 agrees with Holger's earlier results for West Wall (no surprises but nice sanity check)

Field magnitude in centre of return yoke look similar to what is expected but plotting surfaces field component are different shape/position. Not clear if it there is a big different at the ends?

Probably something to discuss with Holger.

Rack Room 2 / SSB suprise? Step IV return yoke lowers peak field (good for racks in MLCR and hydrogen room) but the average field further away seems to increase. Unsure of the cause. Is this an artifact – Clearly needs an explanation.

Conclusions

ISIS control room- Quick glance seems to reveal that peak fields of 2-3 gauss are observed at the wall closest to MICE. These values drop rapidly as you go into control rooms. From the couple of plots I've viewed the Return Yoke reduces the maximum observed field by at least 40%. (This figure may change if other plots are considered.)

What is an acceptable minimum field level for ISIS?

In fact ,what is an acceptable minimum field level for us in the SSB?

Is there a way of drawing field away from this area that doesn't interfere with existing structures?