Alternate Coil Design Studies
Dipoles

NCSX Project Meeting

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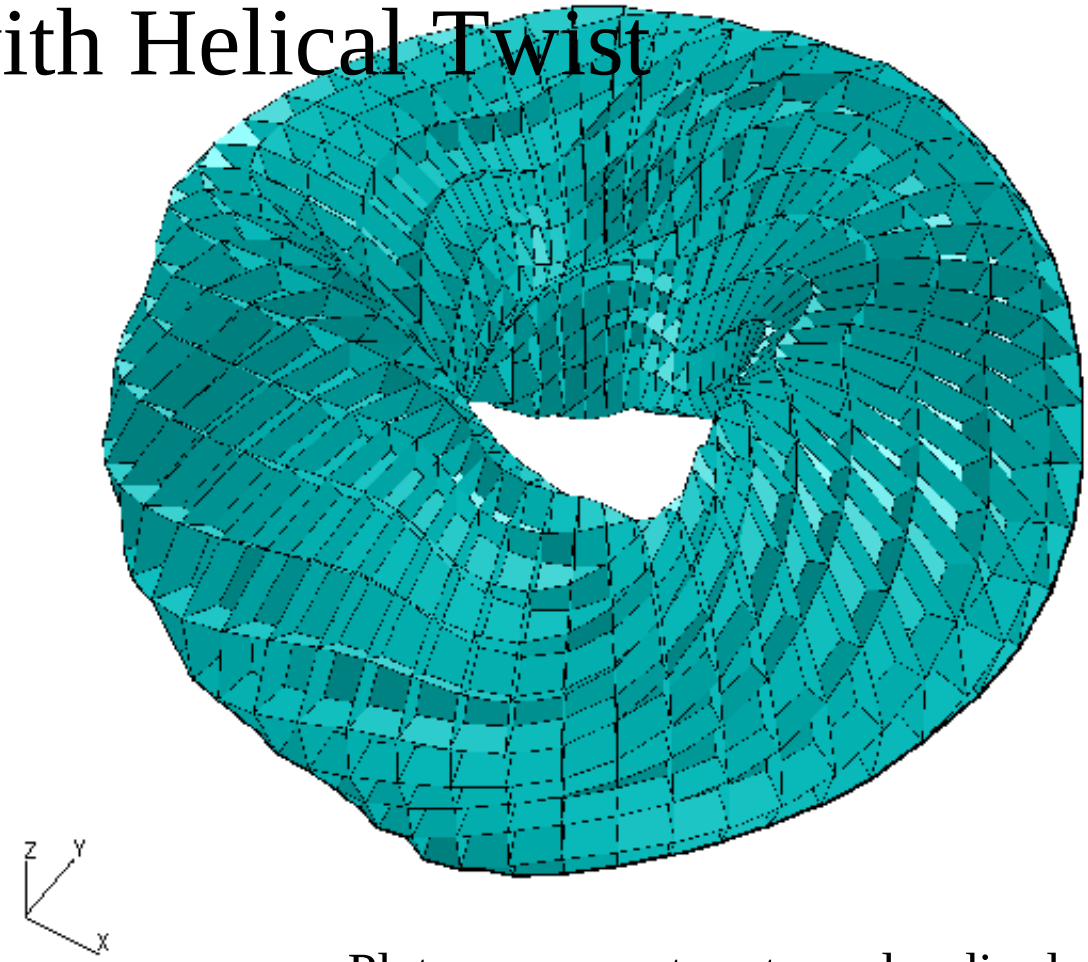
3-D Dipole Coil Configuration Motivation

- The present coil design method (NESCOIL) starts with a current potential solution on a continuous surface which is conformal to the plasma. The current potential solution is equivalent to a distributed dipole solution if the dipole is forced to be normal to the surface. However, Jim Bialek showed that if that condition were relaxed (allow abitrary orientation of dipoles) the resultant dipoles would not want to be normal.
- By representing each dipole by 3 separate small coils, in planes normal to the coil surface as well as lying on the coil surface, CURROPT could be used solve for currents

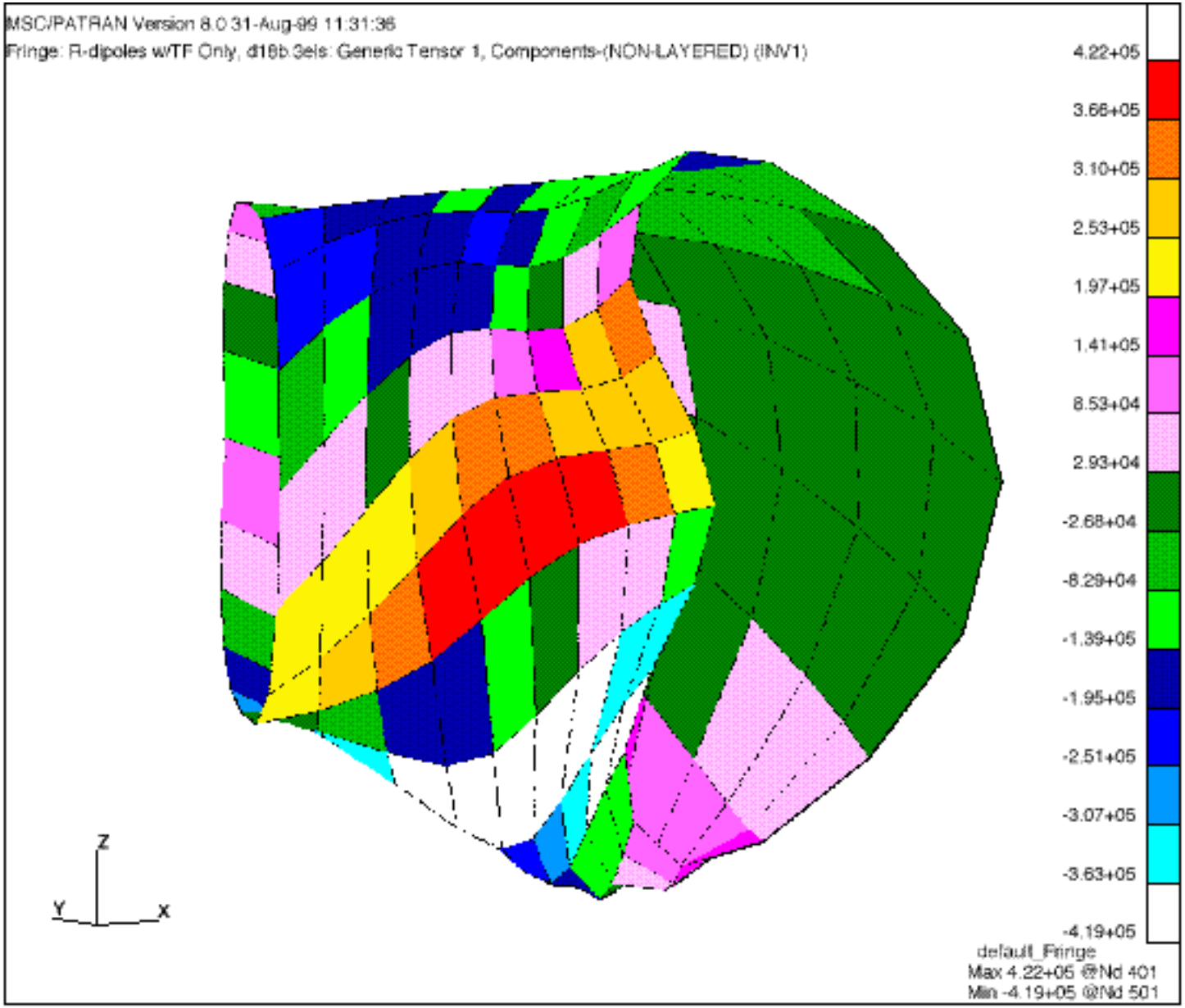
Dipole Configuration with Helical Twist

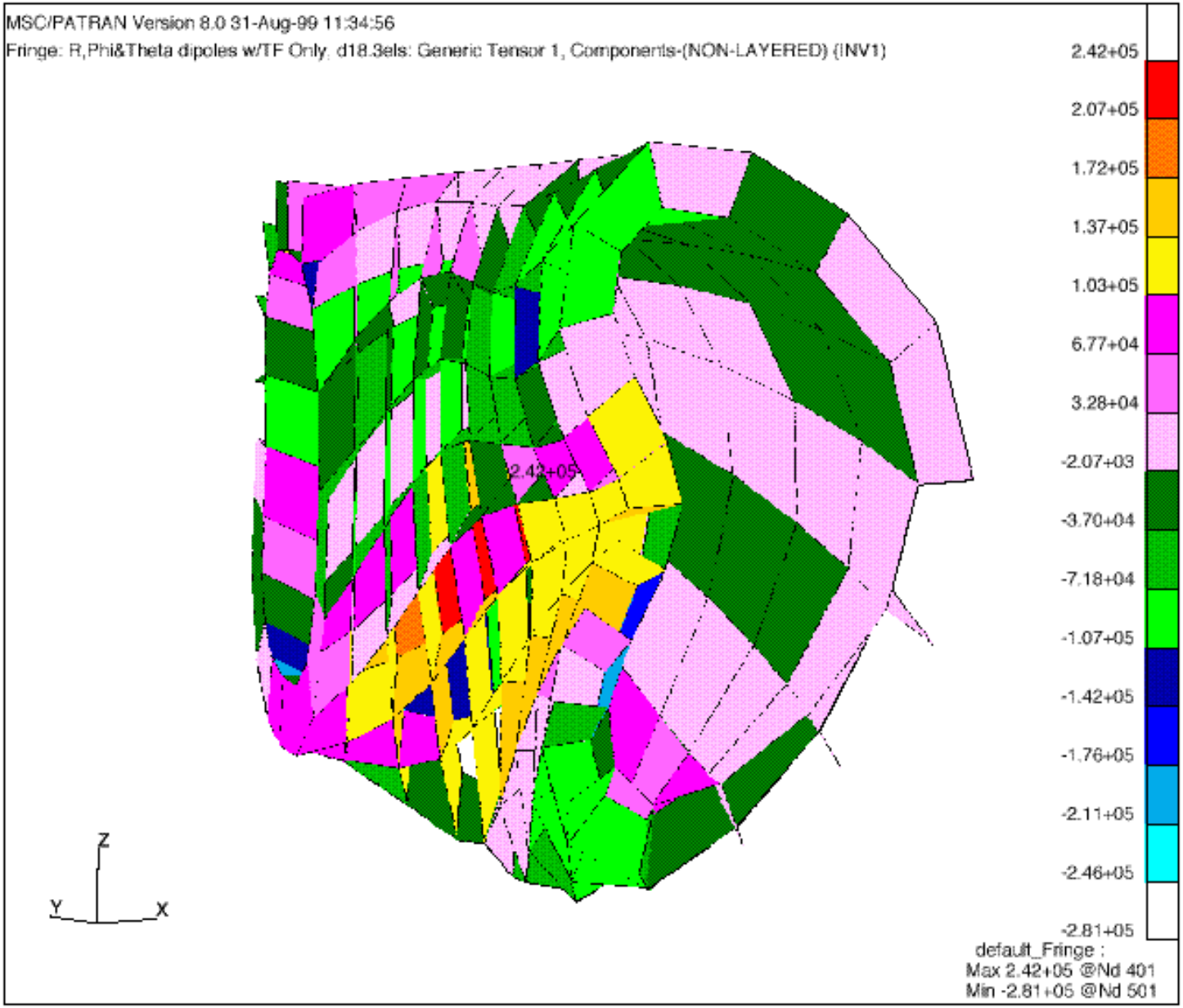


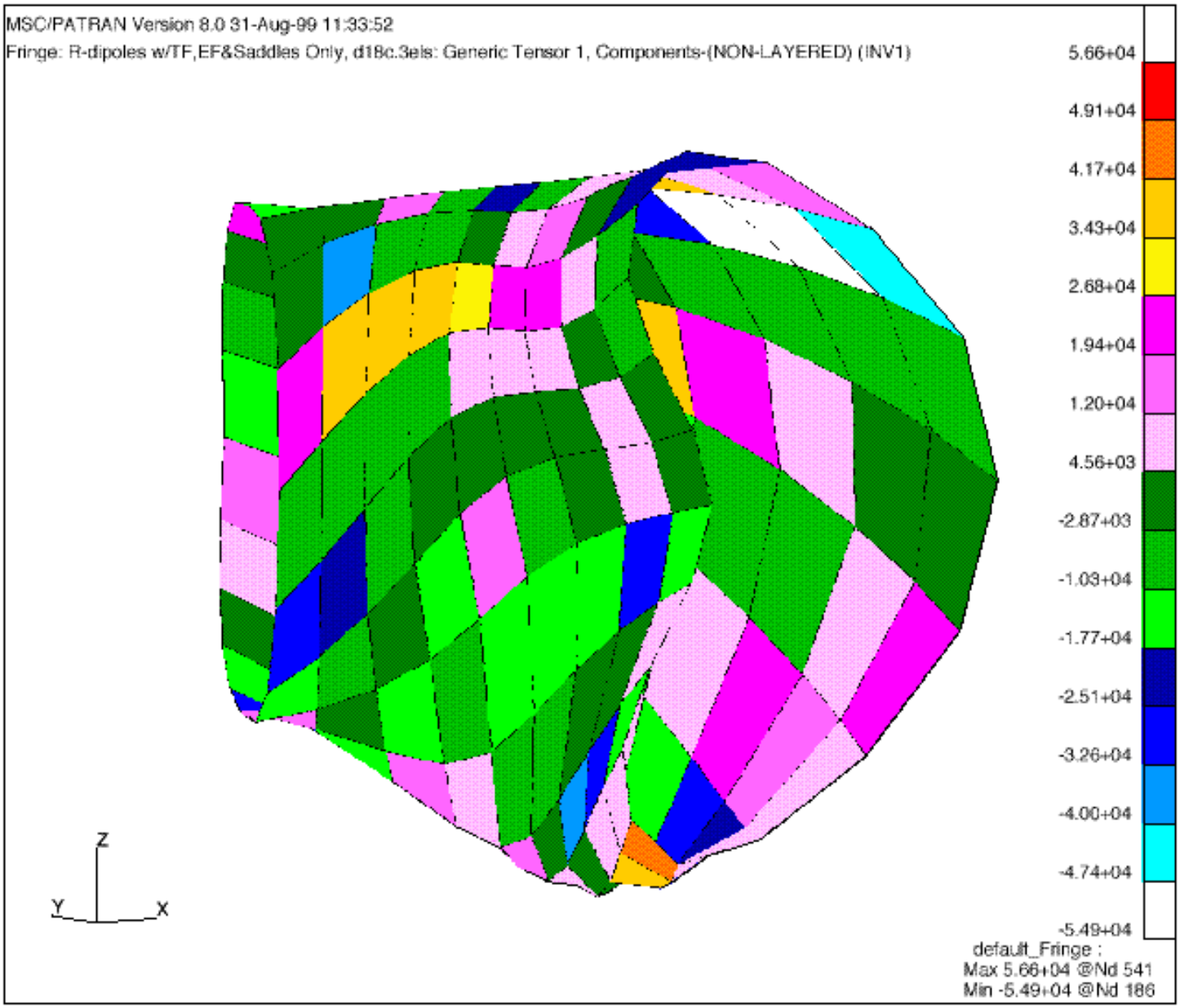
Plates represent rectangular dipole coils lying in constant r, th and phi planes

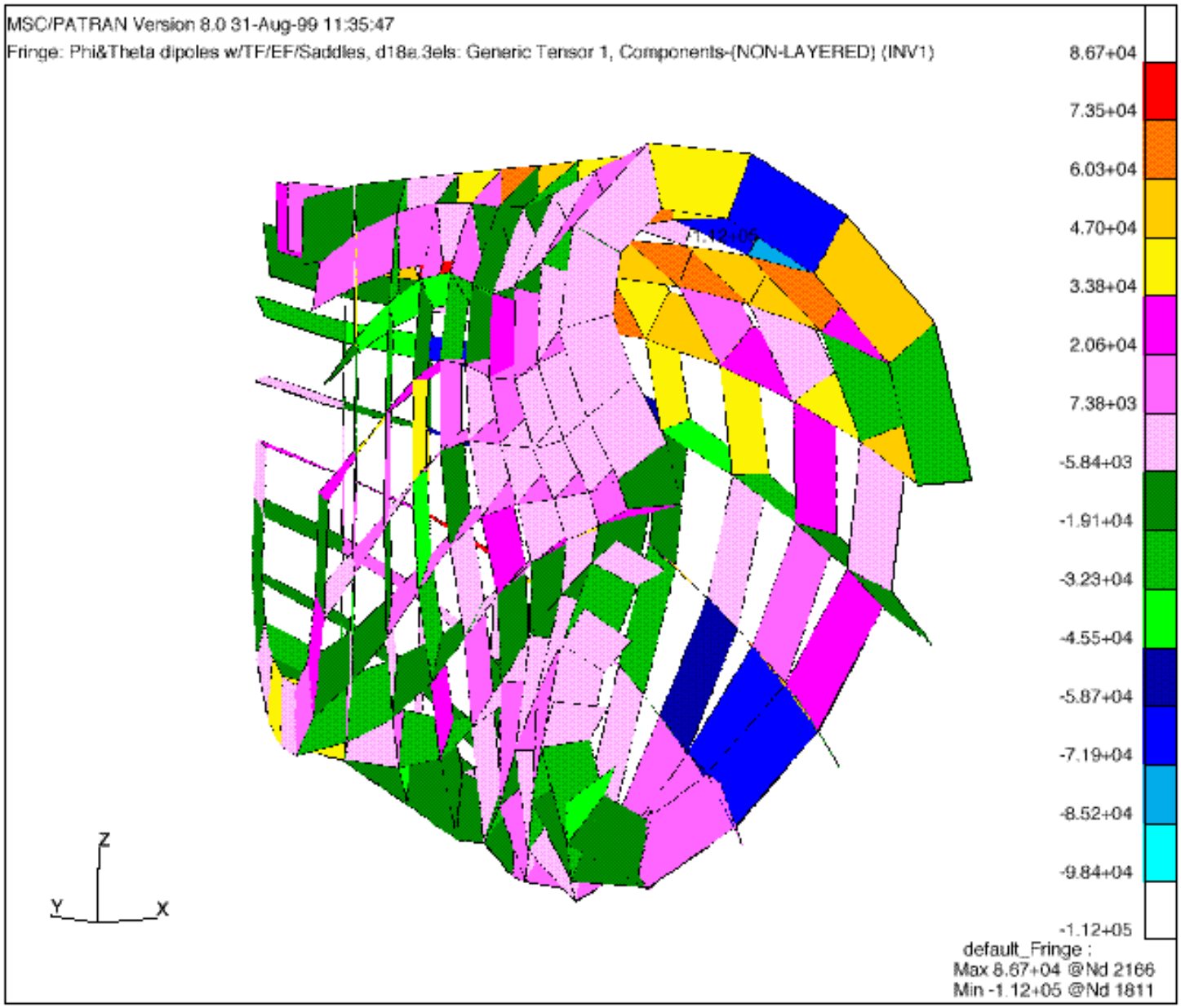
Results

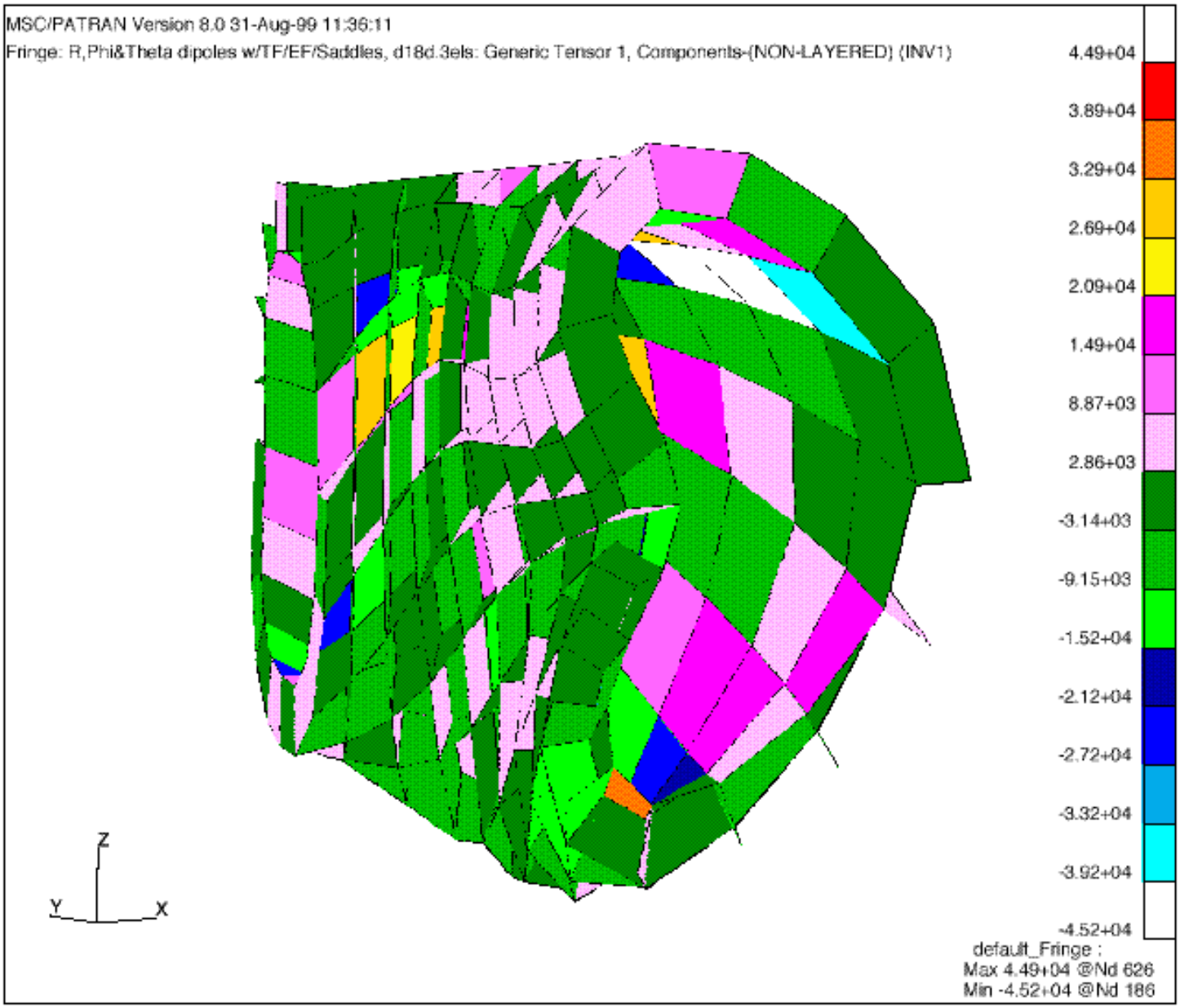
Dipole Configuration	Other Coils	Max Dipole Current KA	Field Error, % Max	Mean
None (Ref)	TF, EF & Saddles (4064_rev6_VAC)		9.07	1.74
R only	TF Only	422.0	7.04	0.94
R,Th & Phi	TF Only	281.0	6.46	0.93
R only	TF, EF & Saddles	56.6	3.70	0.52
Th & Phi only	TF, EF & Saddles	112.0	2.29	0.50
R,Th & Phi	TF, EF & Saddles	45.2	3.57	0.51


MSC/PATRAN Version 8.0 31-Aug-99 11:31:36
Fringe: R-dipoles wTF Only, d18b 3els: Generic Tensor 1, Components-(NON-LAYERED) (INV1)
4.22+05
3.66+05
3.10+05
2.53+05
1.97+05
1.41+05
8.53+04
2.93+04
-2.68+04
-8.29+04
-1.39+05
-1.95+05
-2.51+05
-3.07+05
-3.63+05
-4.19+05
default_Fringe
Max 4.22+05 @Nd 401
Min -4.19+05 @Nd 501
Z
Y
X


MSC/PATRAN Version 8.0 31-Aug-99 11:34:56
Fringe: R,Phi&Theta dipoles w/TF Only, d18.3els: Generic Tensor 1, Components-(NON-LAYERED) (INV1)
2.42+05
2.07+05
1.72+05
1.37+05
1.03+05
6.77+04
3.28+04
-2.07+03
-3.70+04
-7.18+04
-1.07+05
-1.42+05
-1.76+05
-2.11+05
-2.46+05
-2.81+05
2.42+05
Z
Y
X
default_Fringe :
Max 2.42+05 @Nd 401
Min -2.81+05 @Nd 501


MSC/PATRAN Version 8.0 31-Aug-99 11:33:52
Fringe: R-dipoles w/TF,EF&Saddles Only, d18c.3els: Generic Tensor 1, Components-(NON-LAYERED) (INV1)
5.66+04
4.91+04
4.17+04
3.43+04
2.68+04
1.94+04
1.20+04
4.56+03
-2.87+03
-1.03+04
-1.77+04
-2.51+04
-3.26+04
-4.00+04
-4.74+04
-5.49+04
default_Fringe :
Max 5.66+04 @Nd 541
Min -5.49+04 @Nd 186
Z
Y
X


MSC/PATRAN Version 8.0 31-Aug-99 11:35:47
Fringe: Phi&Theta dipoles w/TF/EF/Saddles, d18a.3els: Generic Tensor 1, Components-(NON-LAYERED) (INV1)
8.67+04
7.35+04
6.03+04
4.70+04
3.38+04
2.06+04
7.38+03
-5.84+03
-1.91+04
-3.23+04
-4.55+04
-5.87+04
-7.19+04
-8.52+04
-9.84+04
-1.12+05
Z
Y
X
default_Fringe :
Max 8.67+04 @Nd 2166
Min -1.12+05 @Nd 1811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Fringe: R,Phi&Theta dipoles w/TF/EF/Saddles, d18d.3els: Generic Tensor 1, Components-(NON-LAYERED) (INV1)
4.49+04
3.89+04
3.29+04
2.69+04
2.09+04
1.49+04
8.87+03
2.86+03
-3.14+03
-9.15+03
-1.52+04
-2.12+04
-2.72+04
-3.32+04
-3.92+04
-4.52+04
default_Fringe :
Max 4.49+04 @Nd 626
Min -4.52+04 @Nd 186
Z
Y
X

Conclusions

- Required dipole currents are too high to consider dipoles as the basic coil set
- Dipoles can possibly be used as trim coils with other saddle coils providing the major helical field to increase flexibility
  - Would probably not need or want full coverage of plasma to allow port access. For case investigate, dipole coverage could be limited to portion of outboard region
  - Most effective at trimming low order modes. Much less so for high order modes.