ILC IR FINAL FOCUS & ATF2 MAGNET DESIGN

Prepared by Andy Marone

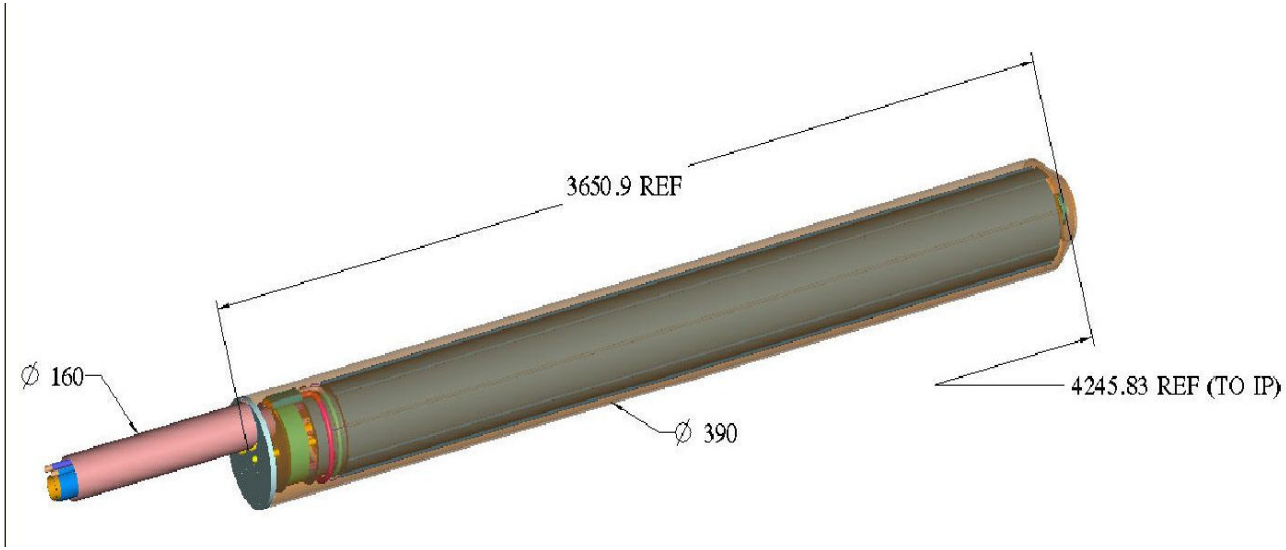
DISCUSSION OUTLINE

- ILC magnet design relatively unchanged since last workshop.
- Review ILC design and design assumptions.
- Service cryostat design status
- Interface regions
- Some magnet support considerations.
- Some Remaining engineering tasks
- ATF2 Design

Design Work

- Since the refunding the work effort has been to design the ATF2 magnet assembly.
- Finish the winding machine upgrade to start winding the full length ILC prototype QDO coil (now underway)
- Redesign the coil wrapping machine for ILC type coils (completed and in service)
- Detail design and manufacture the ATF2 coil support tube.
- Start winding ATF2 coils (now underway)
- Complete detailed design of service cryostat.

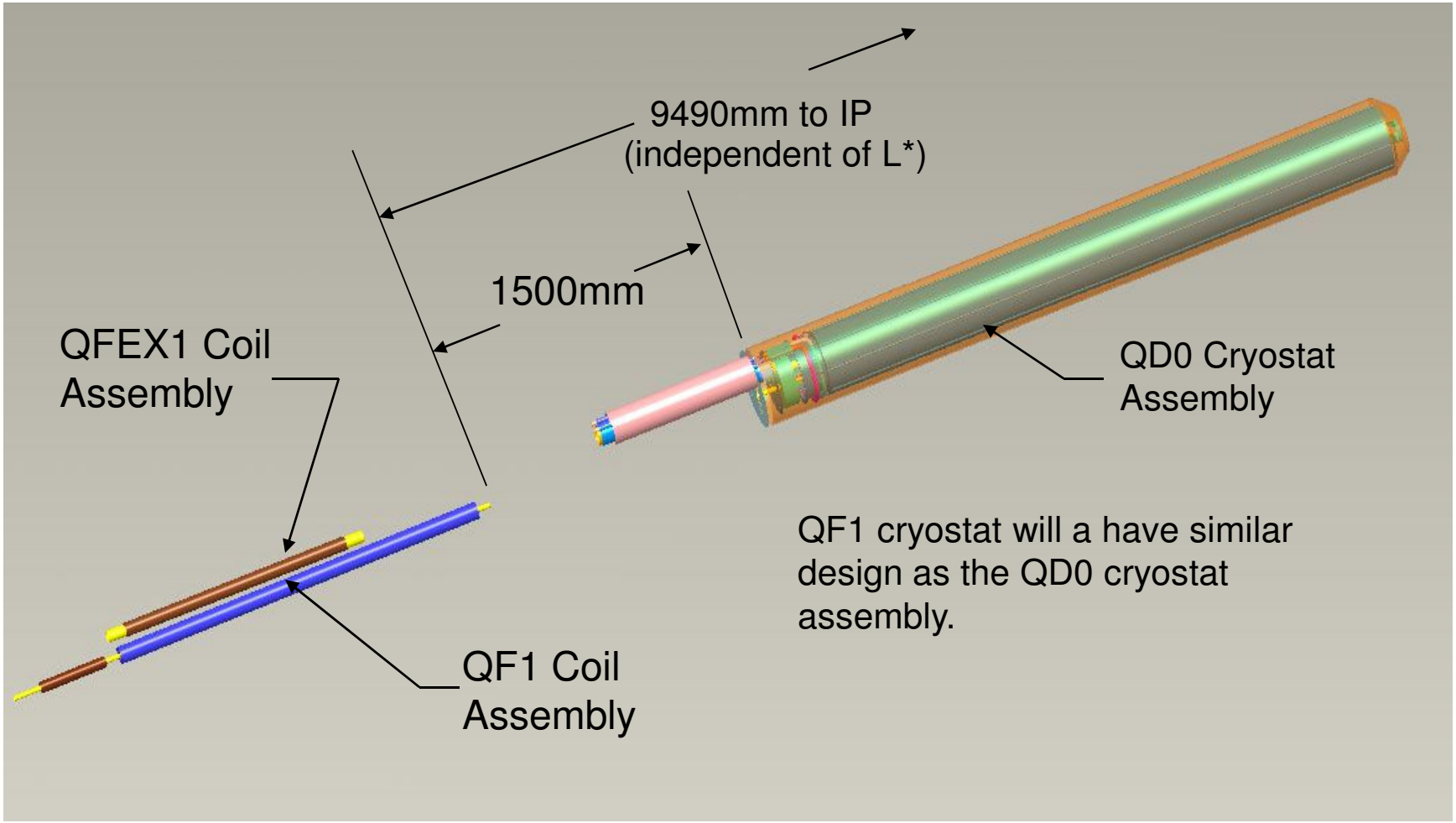
QD0 CRYOSTAT



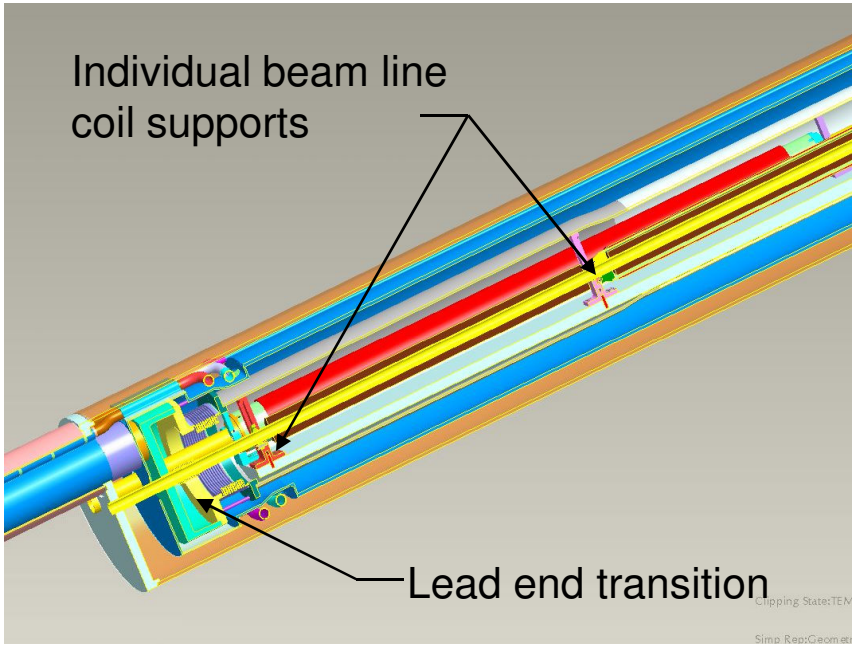
- Overall dimensions of QD0 cryostat.
- Sized and shown for L*= 4500mm.
- For L*= 3500mm distance to IP would be 3245mm, all other dims. remain constant.

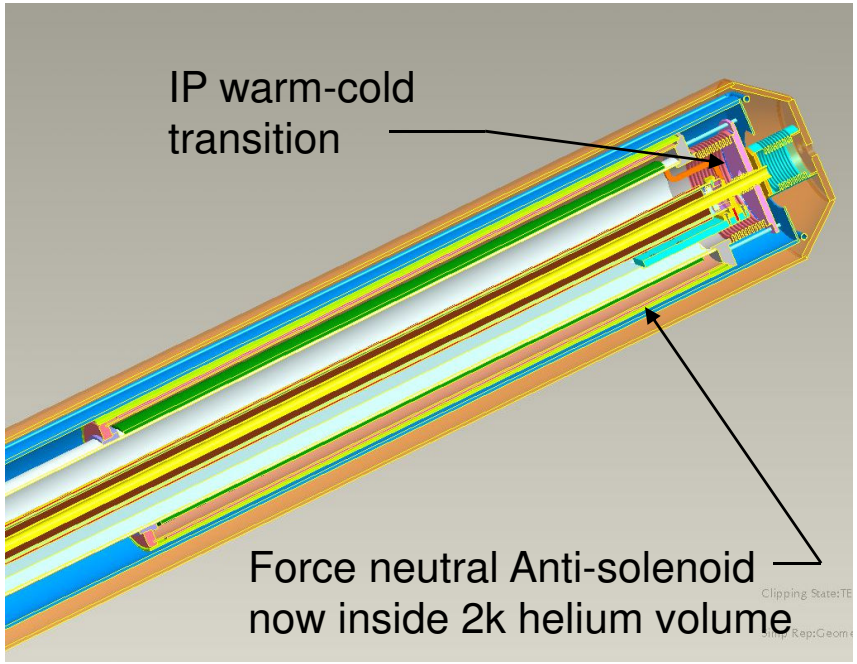
CURRENT OVERALL DESIGN

L* = 4500mm

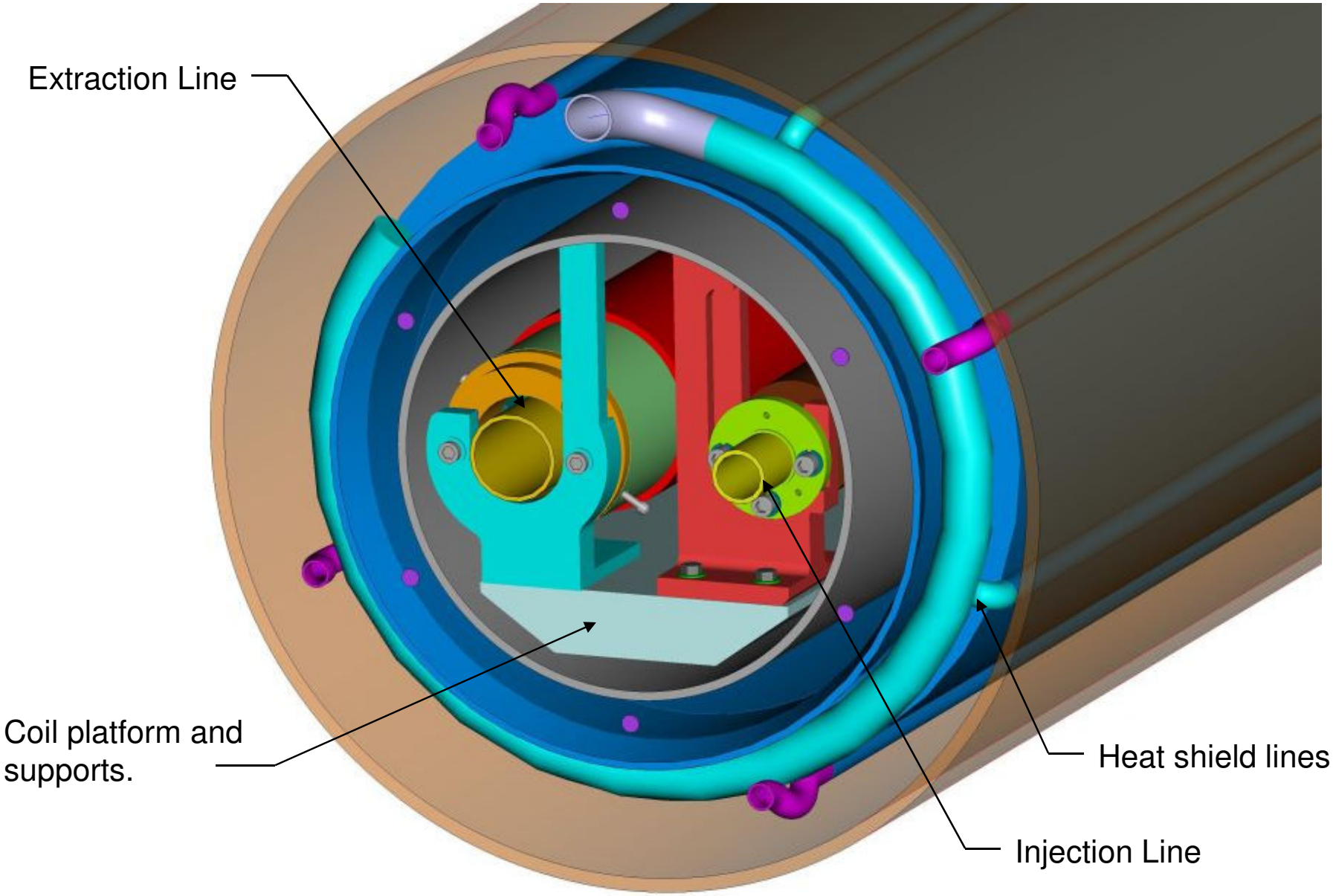


QD0 Design



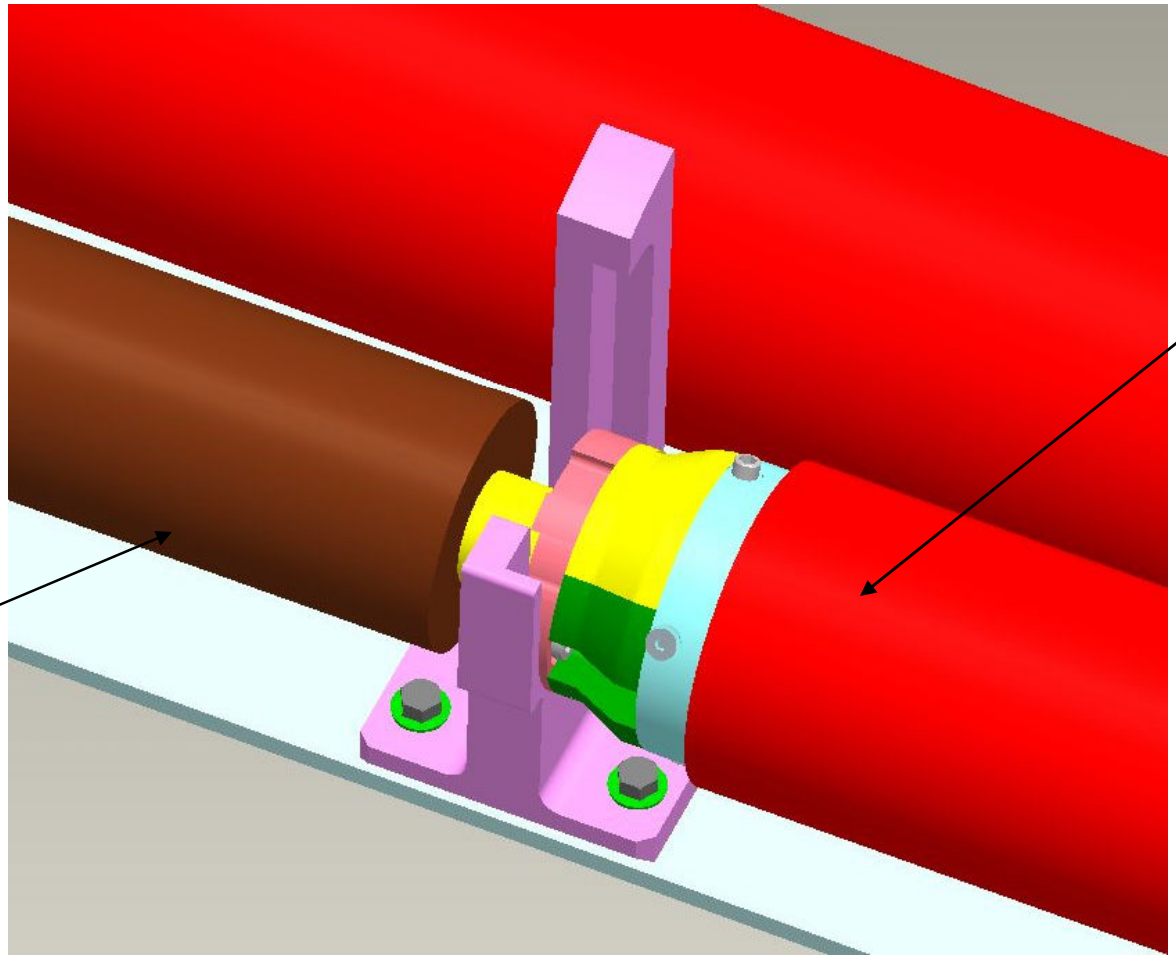


All vessels sized for up to a 4500mm L*, any larger L* would require an increase in the diameter of each vessel.



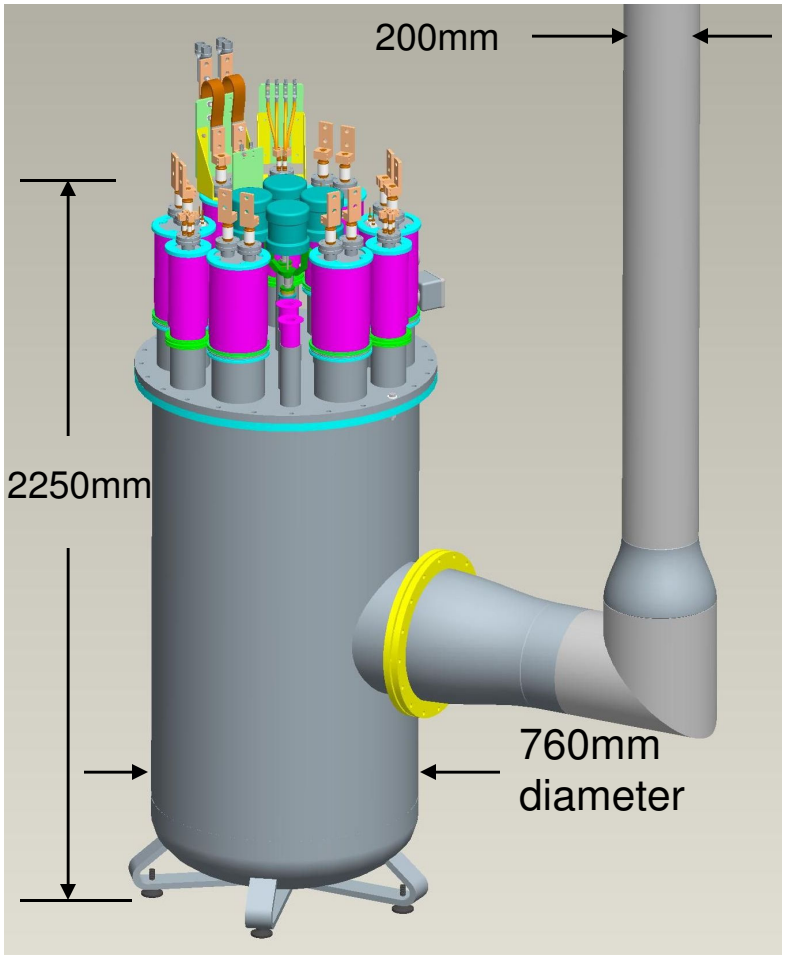
View looking in non-IP end of cold mass

QD0-SD0 SUPPORT



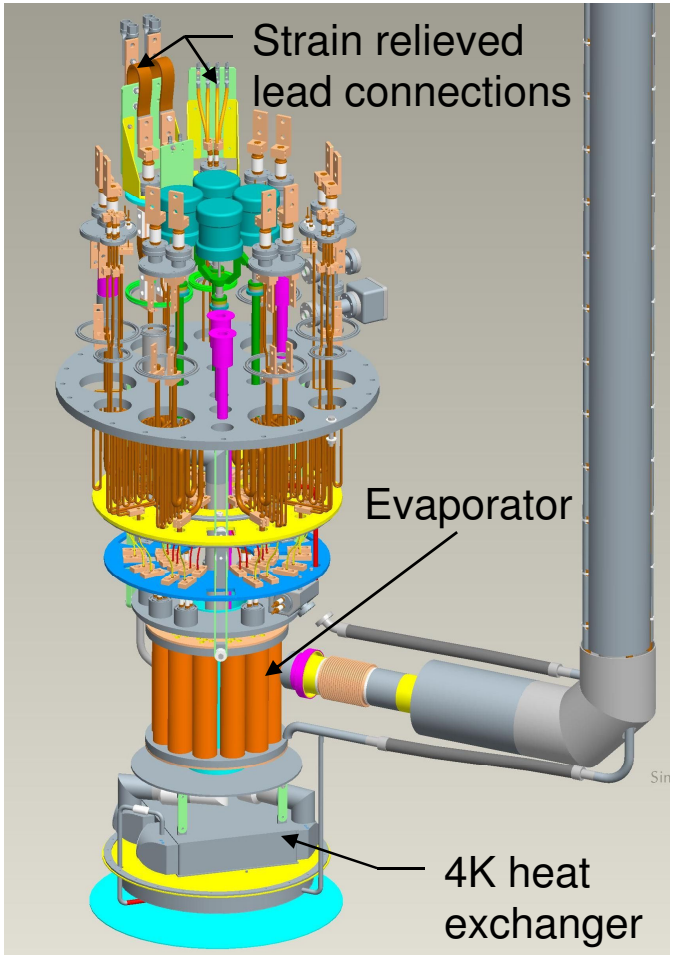
SERVICE CRYOSTAT DESIGN STATUS

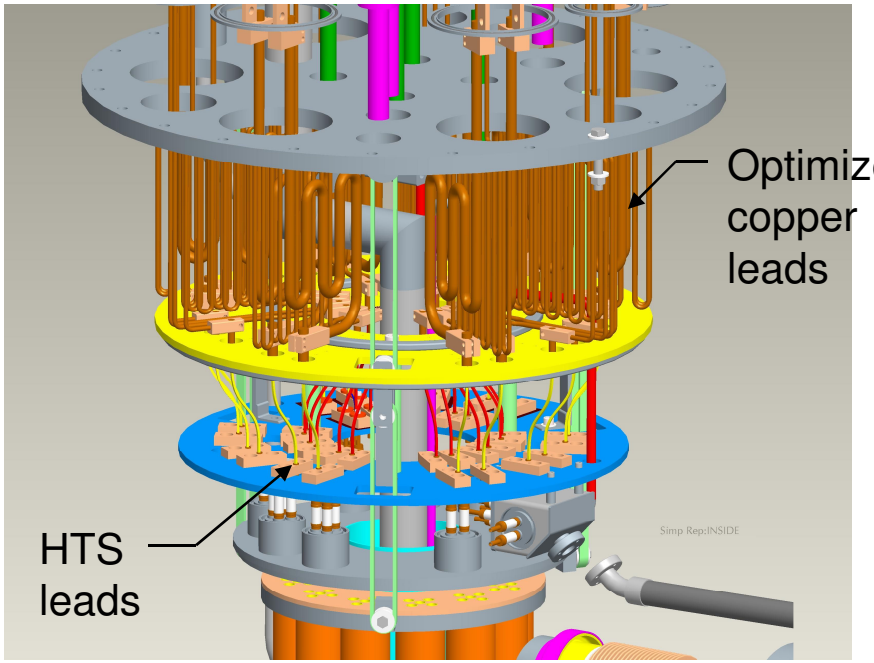
- Basic design completed
- (12) 1000 A leads
- (24) 100 A leads
- Possible revision of evaporator and heat exchanger (may lower overall height)
- More work on transfer line required



Overall service cryostat dimensions

Service cryostat inner construction

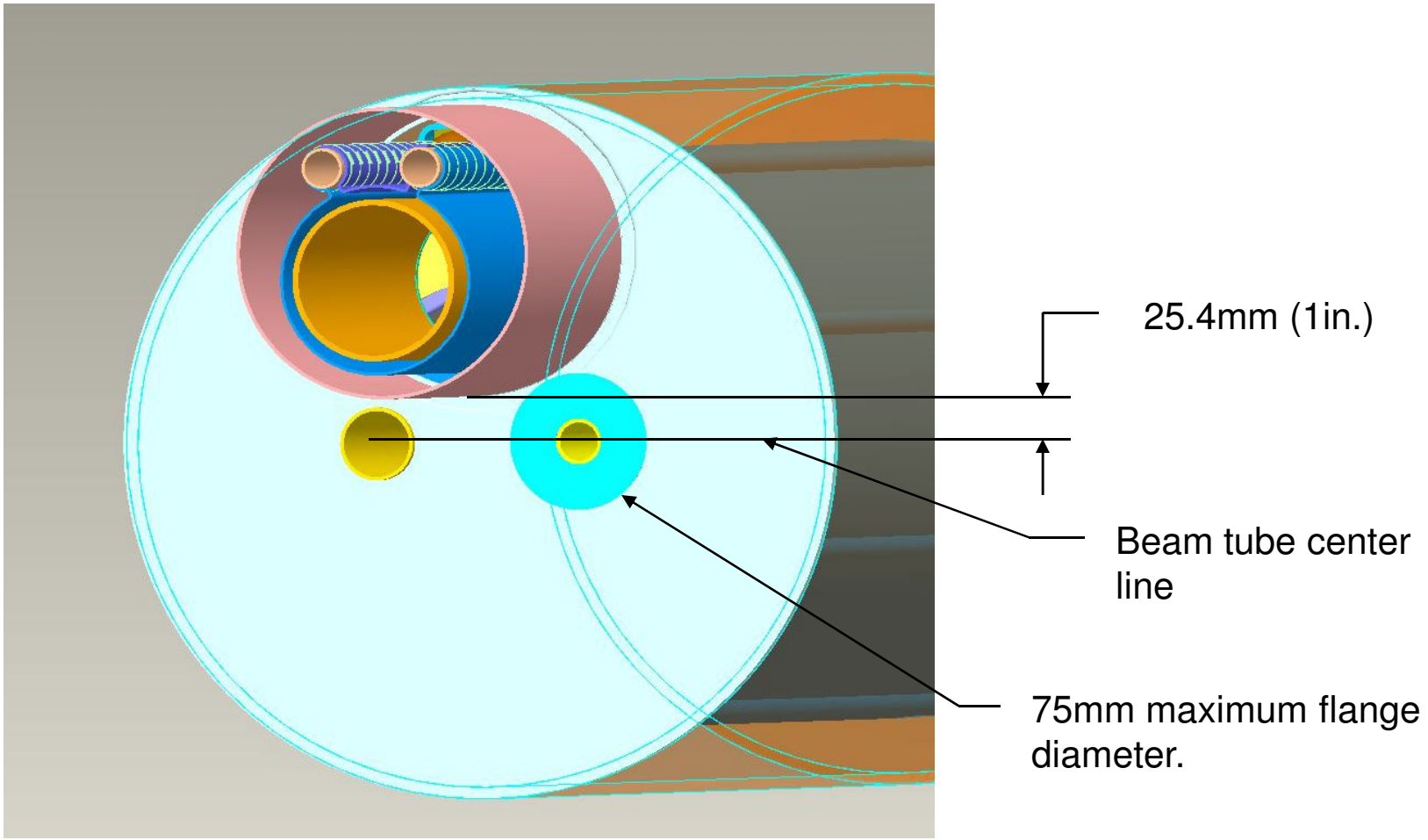




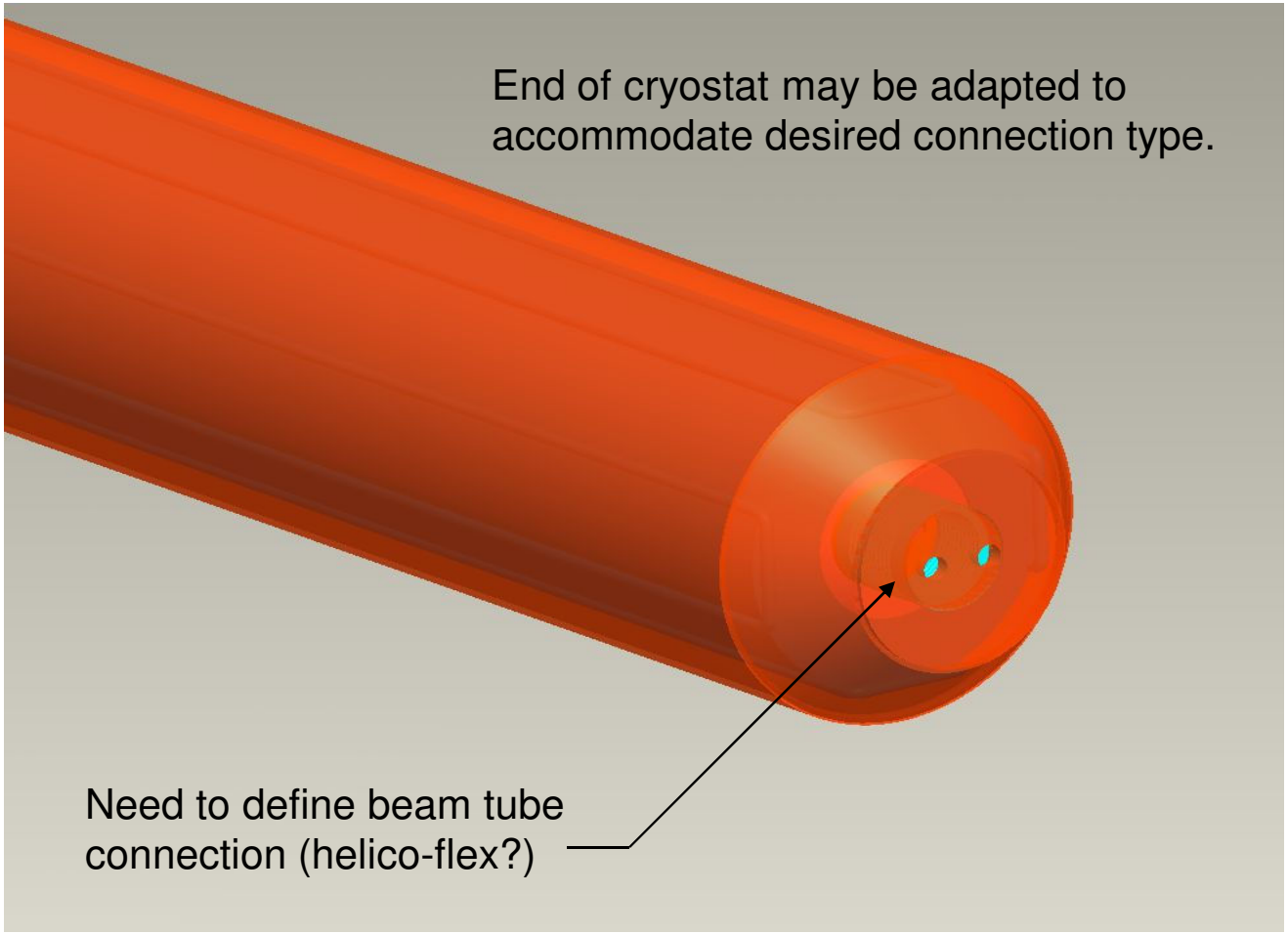
MAGNET INTERFACE REGIONS

- Non-IP end beam tube connections.
- IP-end connections.
- Internal Cryostat support.
- Now that magnet support designs in the detectors has progressed, perhaps some initial assumptions of design constraints no longer apply.

LEAD-END (NON-IP) BEAM TUBE CONNECTIONS

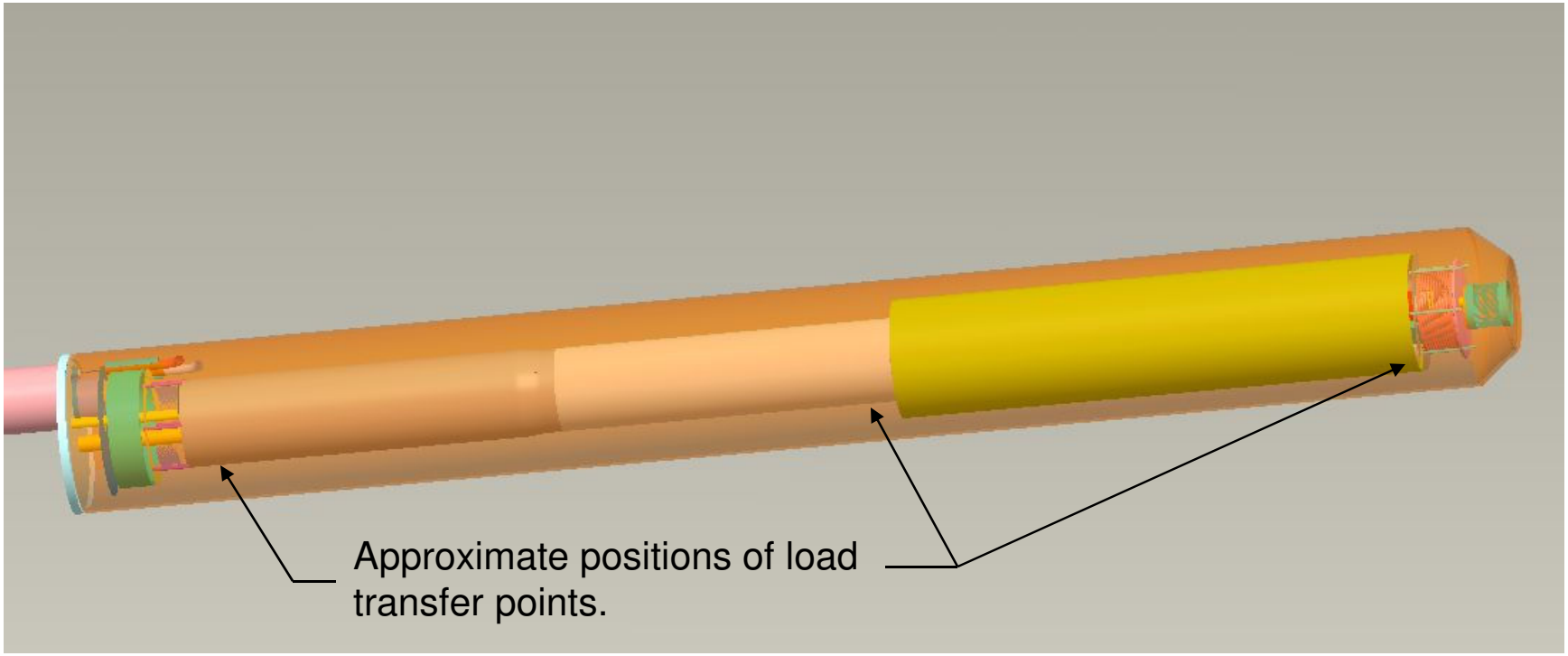


IP-END BEAM TUBE CONNECTION

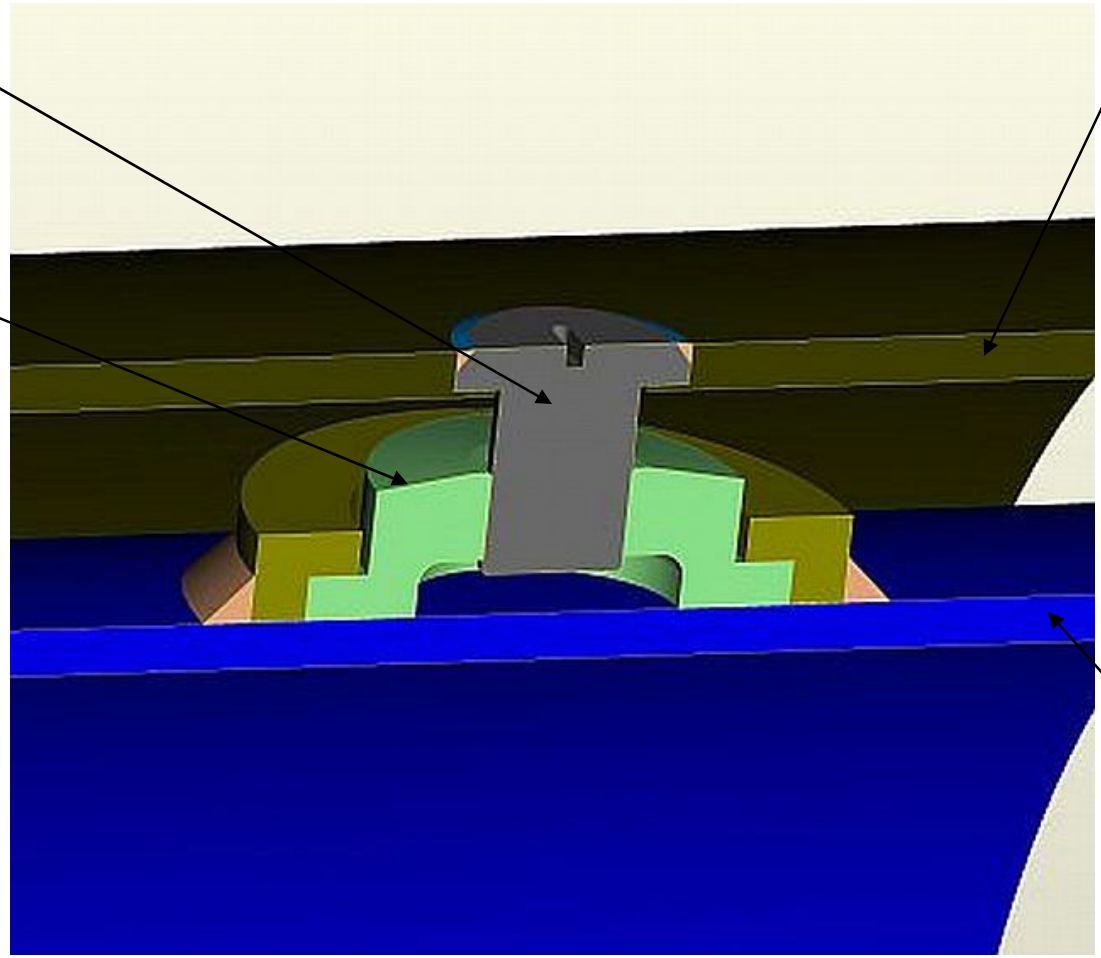


CRYOSTAT SUPPORT

IDEAL AXIAL POSITIONS FOR CRYOSTAT SUPPORT TO BE PLACED



Internal Support Design

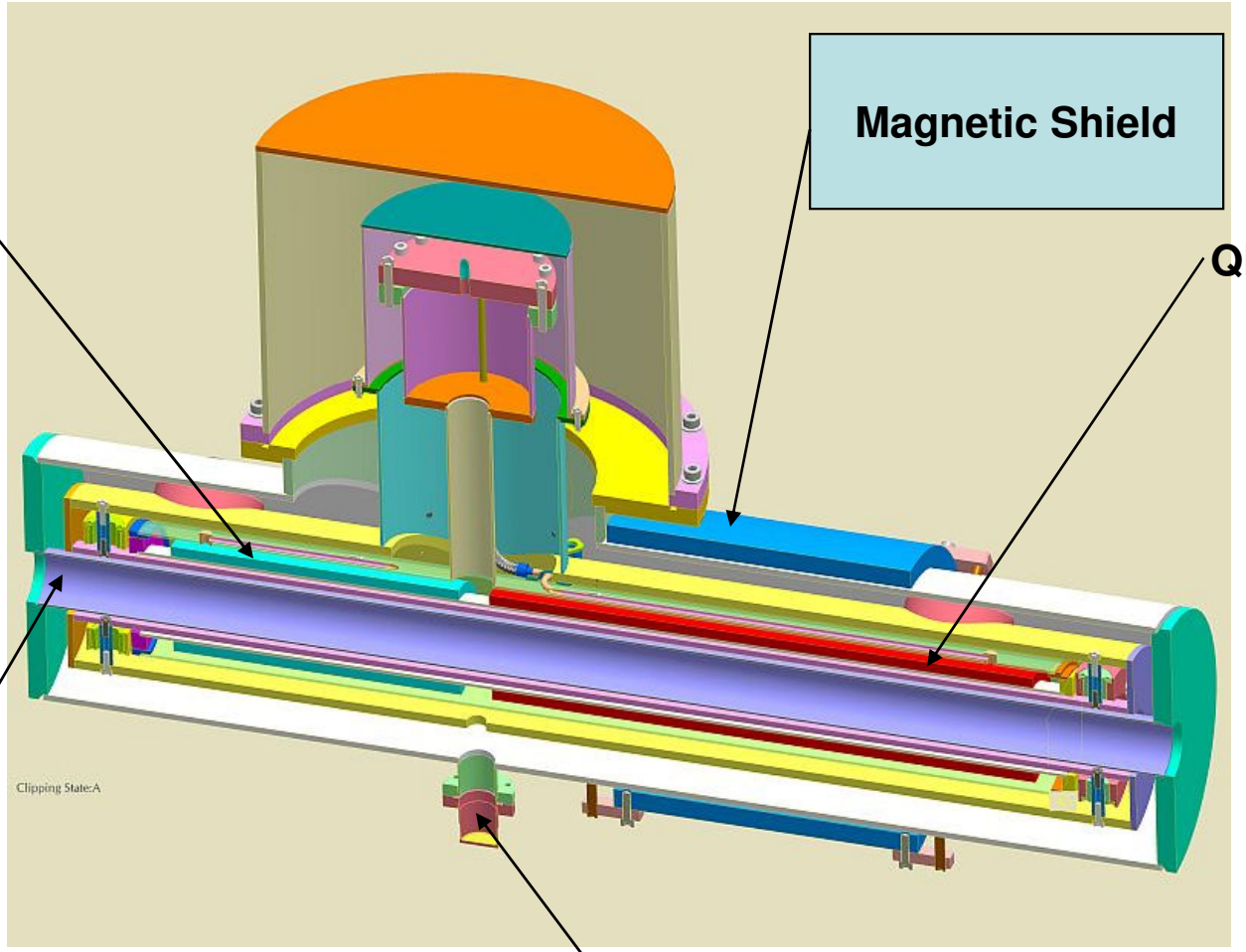


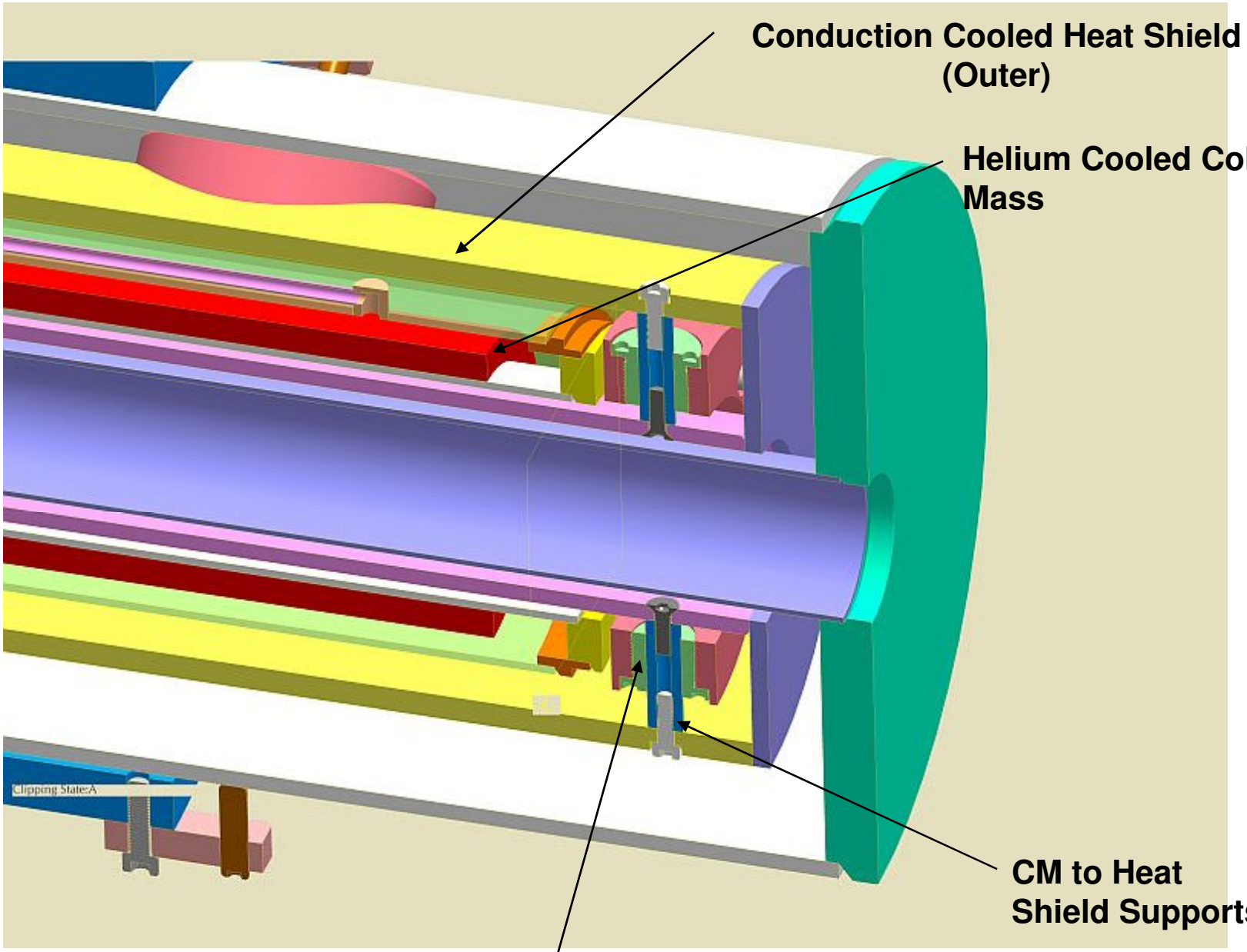
Each axial location with 4 typical supports 90 degrees apart

SOME REMAINING ENGINEERING / DESIGN

- Add internal cold mass supports.
- Vibration analysis
- Lead bus design
- Detailed transfer line design
- Interface connection design
- Cryostat support connection and adjustment design

ATF2 Full Cross Section

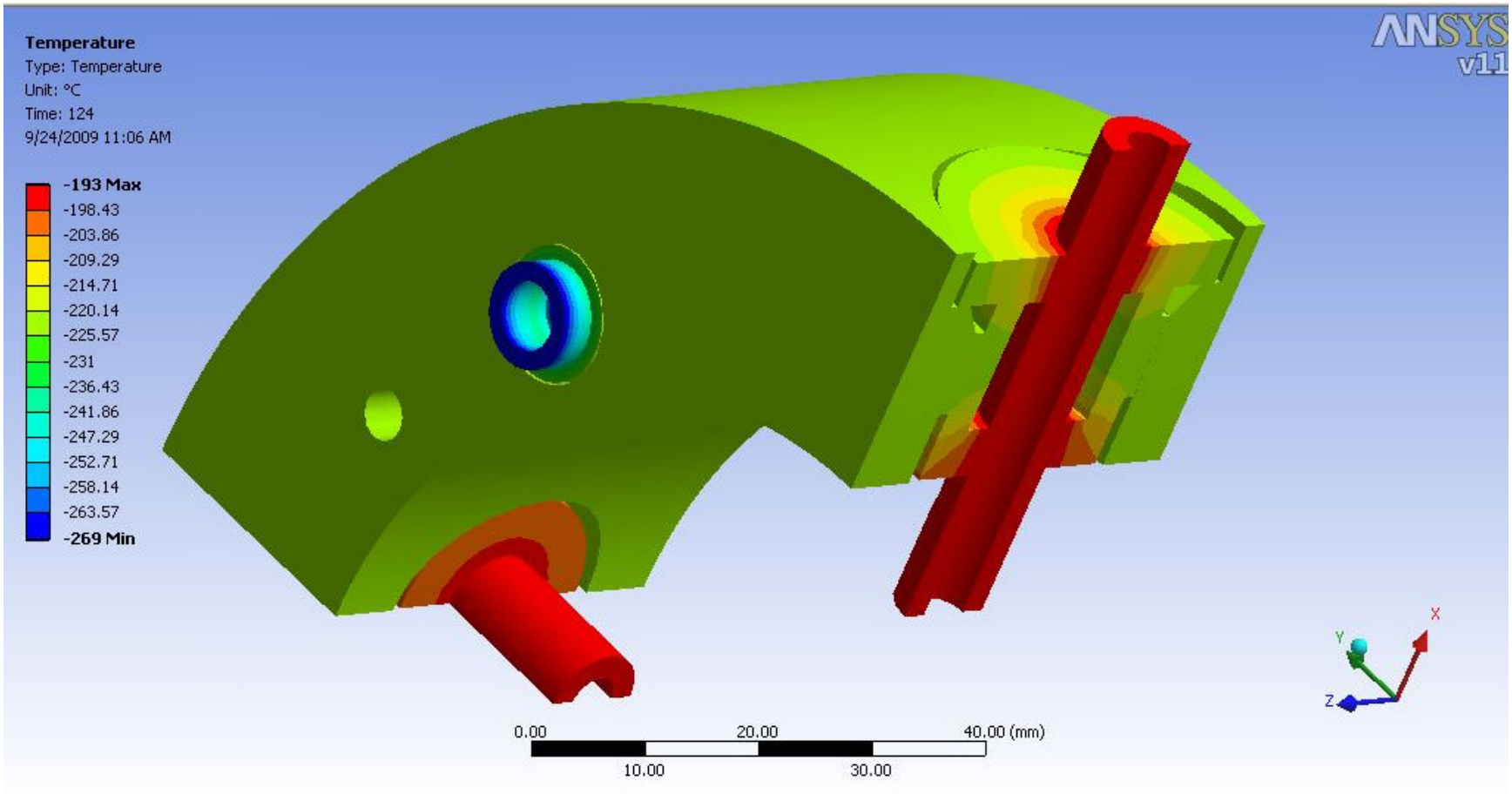


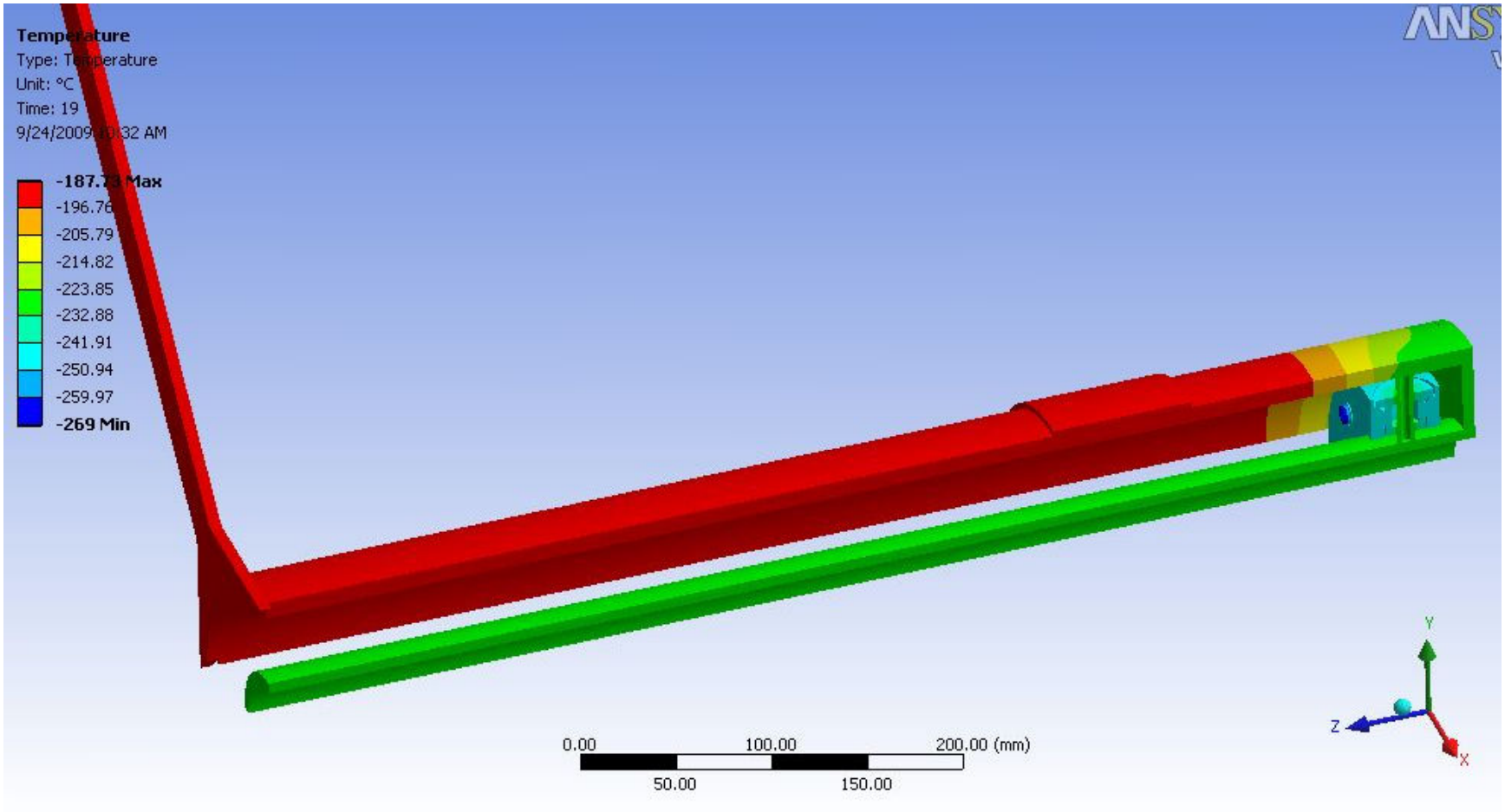

Conduction Cooled Heat Shield (Outer)
Helium Cooled Cold Mass
CM to Heat Shield Supports
Inner Heat Shield
Clipping State:A

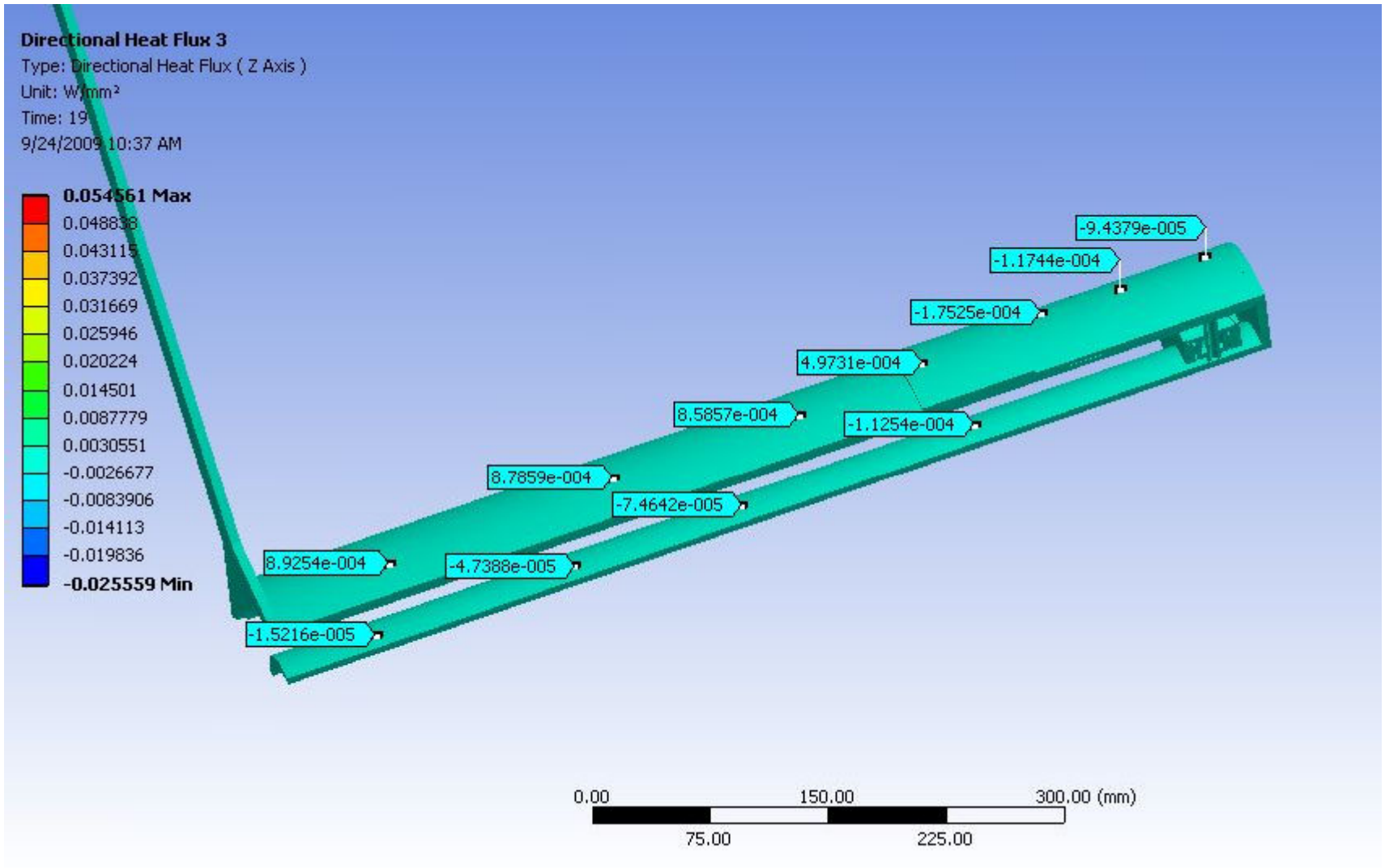
ATF2 Comments

- Designed to operate @ 2K or 4.5K
- Compatible with either service cryostat operation or cryocooler operation.
- Cryocooler and lead assembly not designed.
- Interface with service cryostat well conceptually designed.
- Currently analyzing/optimizing support and heat shield designs.

Heat Load Analysis
Inner Fixed supports




Temperature
Type: Temperature
Unit: °C
Time: 19
9/24/2009 10:32 AM
-187.73 Max
-196.76
-205.79
-214.82
-223.85
-232.88
-241.91
-250.94
-259.97
-269 Min
0.00
100.00
200.00 (mm)
50.00
150.00
Y
Z
X


Directional Heat Flux 3
Type: Directional Heat Flux (Z Axis)
Unit: W/mm²
Time: 19
9/24/2009 10:37 AM
0.054561 Max
0.048838
0.043115
0.037392
0.031669
0.025946
0.020224
0.014501
0.0087779
0.0030551
-0.0026677
-0.0083906
-0.014113
-0.019836
-0.025559 Min
-9.4379e-005
-1.1744e-004
-1.7525e-004
4.9731e-004
8.5857e-004
-1.1254e-004
8.7859e-004
-7.4642e-005
8.9254e-004
-4.7388e-005
-1.5216e-005
0.00
150.00
300.00 (mm)
75.00
225.00

Initial Analysis Summary

- From results the heat shield was designed with copper and g-10 section.
- Approx. 95% of heat load is conduction through supports.
- With 80K heat shield operation heat load to a 4.5K cold mass would be about 2.5 watts.
- The current heat load to the heat shield from the cryostat is about 10 watts, further analysis of these components has yet to be done.