High Power Hg Target Conceptual Design Review

Hg Target Interface with Solenoid

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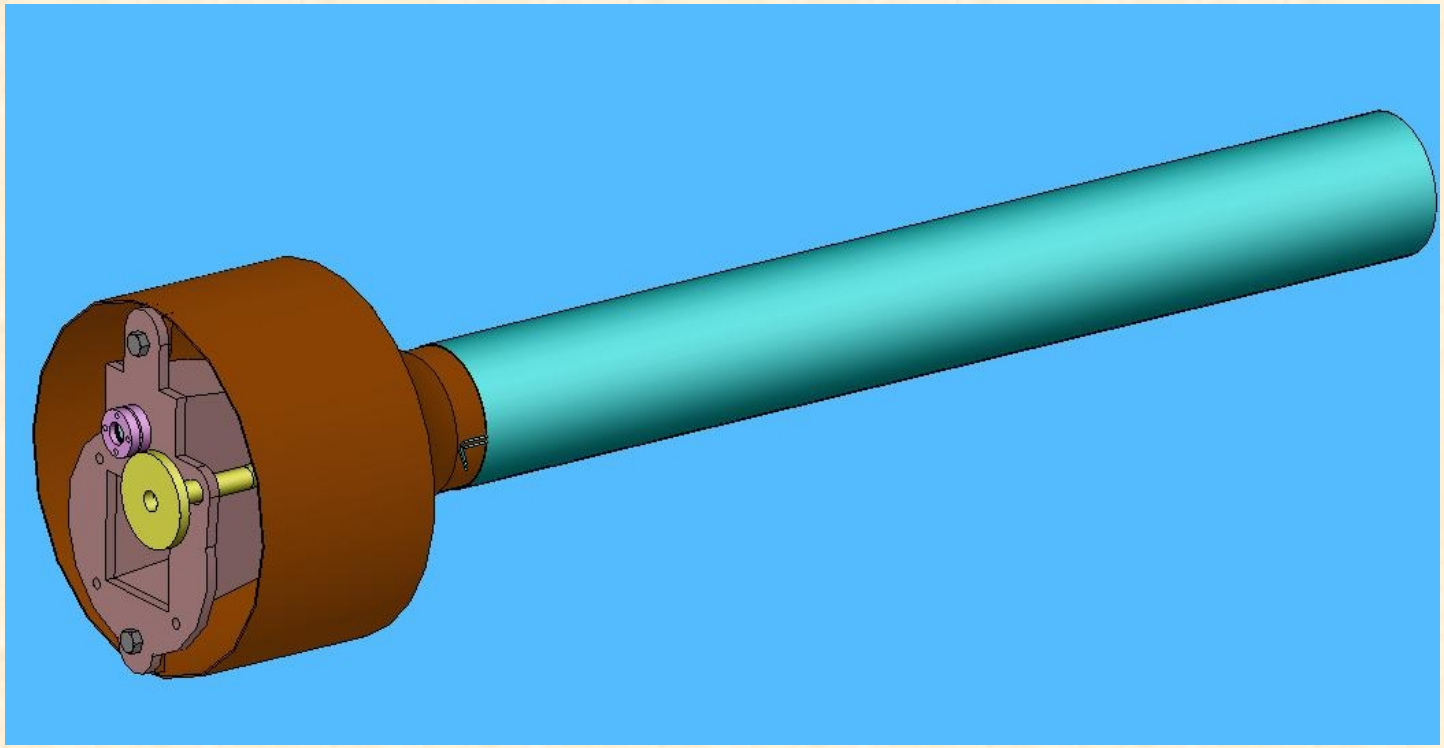
Outline

- **Target module insertion**
- **Solenoid thermal insulation**
- **Solenoid operational cycle**
- **Solenoid orientation changes**
- **Field plots**
- **Solenoid / target base support structures**

Target Module Insertion

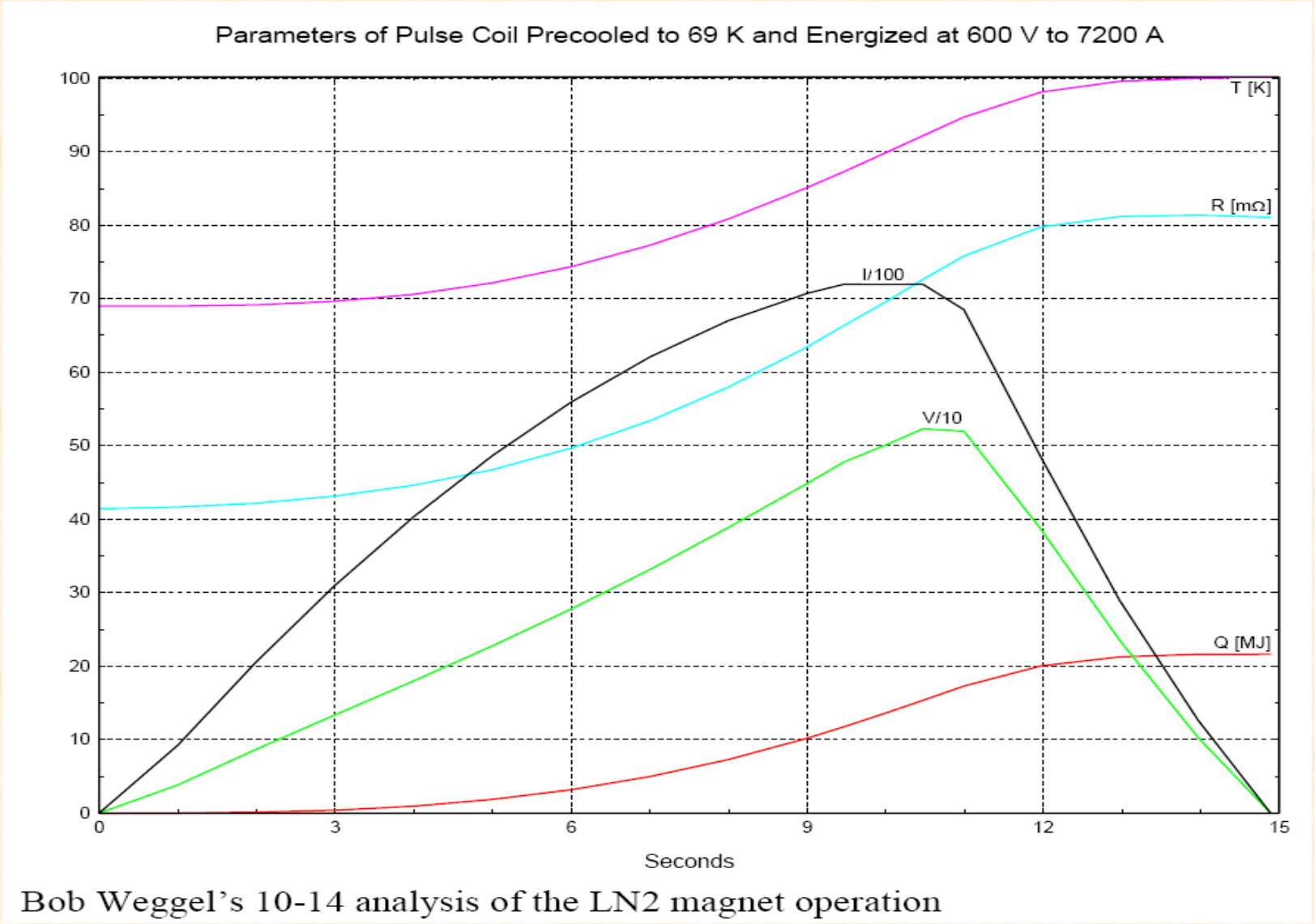
- **Primary and secondary containment mechanically fastened (weight ~ 160 lbs)**
- **Flexible metal hoses probably already attached**
- **Can be inserted either before magnet aligned to beam or after**



Solenoid Thermal Insulation

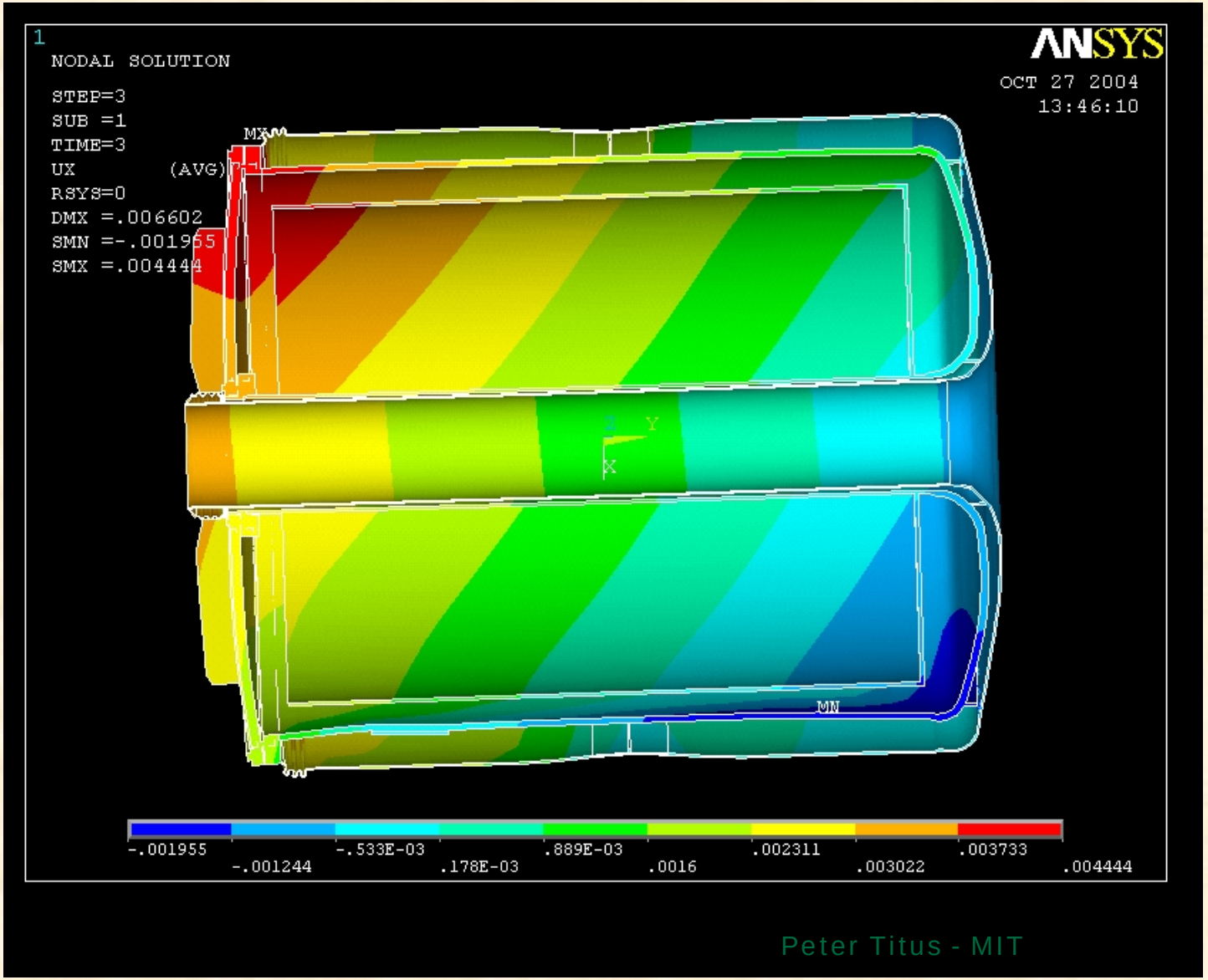
- **Original solenoid design incorporated insulating bore tube (G-10)**
- **Removal of G-10 tube provided more room for target module components**
- **Insulation replaced by addition of flexible foil heater (silicone or kapton) 0.007" – 0.060" thick outside the secondary tube**
- **May only need on one end of secondary containment tube**
- **Requires controllable power supply**

Magnet Operational Cycle



Bob Weggel's 10-14 analysis of the LN2 magnet operation

Magnet Positional Changes During Max Field



Peter Titus - MIT

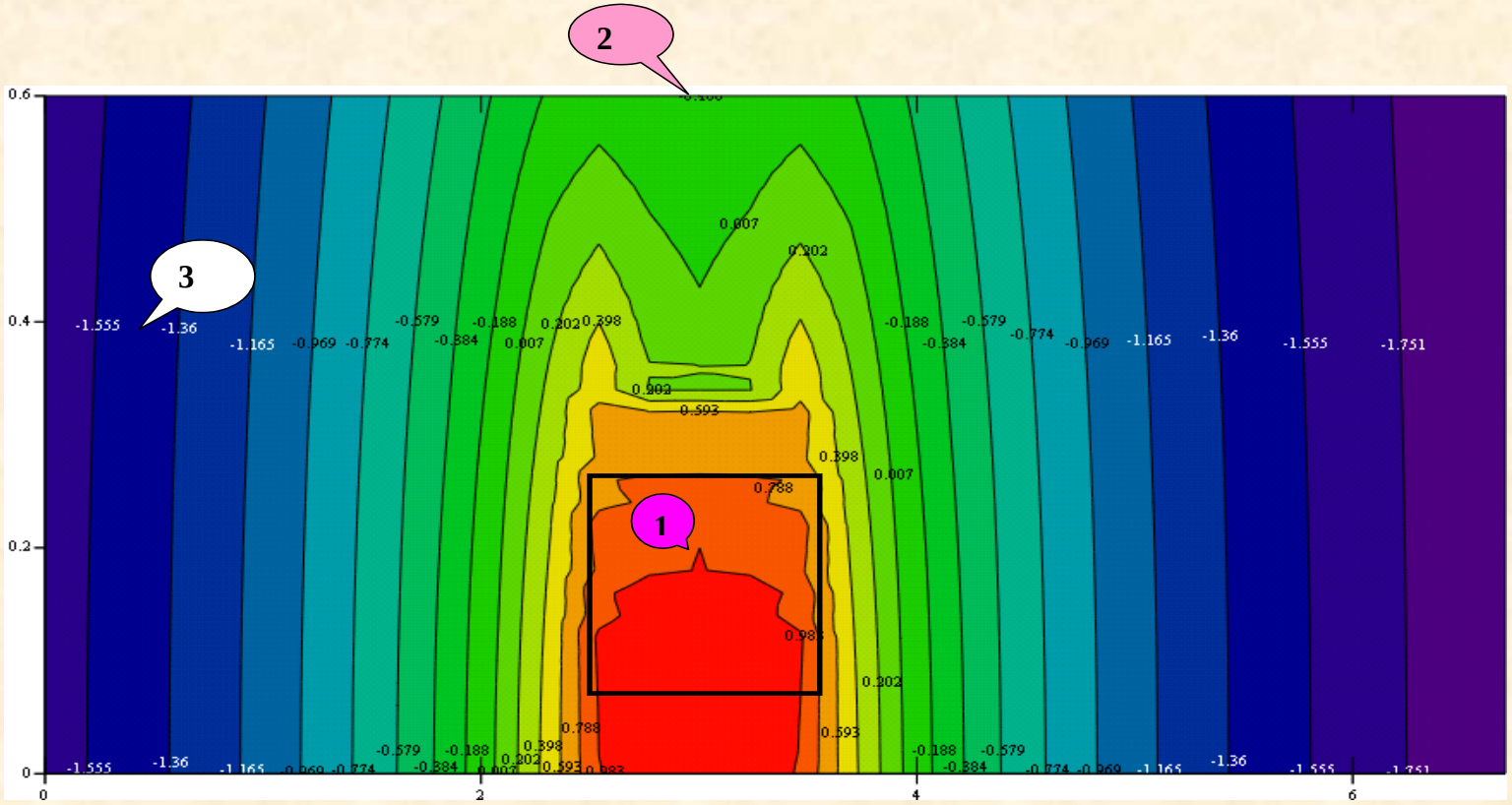
Consequences of Magnet Movement

- **Vertical movement summary**
  - **Upbeam end: -3 mm**
  - **Downbeam end: +1.2 mm**
  - **Z=0 position: -0.9 mm**
  - **3.5mrad tilt over assumed 1200mm length**
  - **Position of zero vertical movement at Z=+257mm**
- **No compensation in design (nozzle position) for Z=0 movement**
- **Actual movements to be measured during solenoid testing**

Design Alternatives

- **Magnet movement must be accommodated by target system**
  - **Target can float within magnet or be small enough that movement does not produce contact**
- **Space constraints within target secondary containment push toward maximizing secondary diameter and floating with magnet**
  - **Tilt changes accommodated by flex metal hoses**

Magnet Field Plot

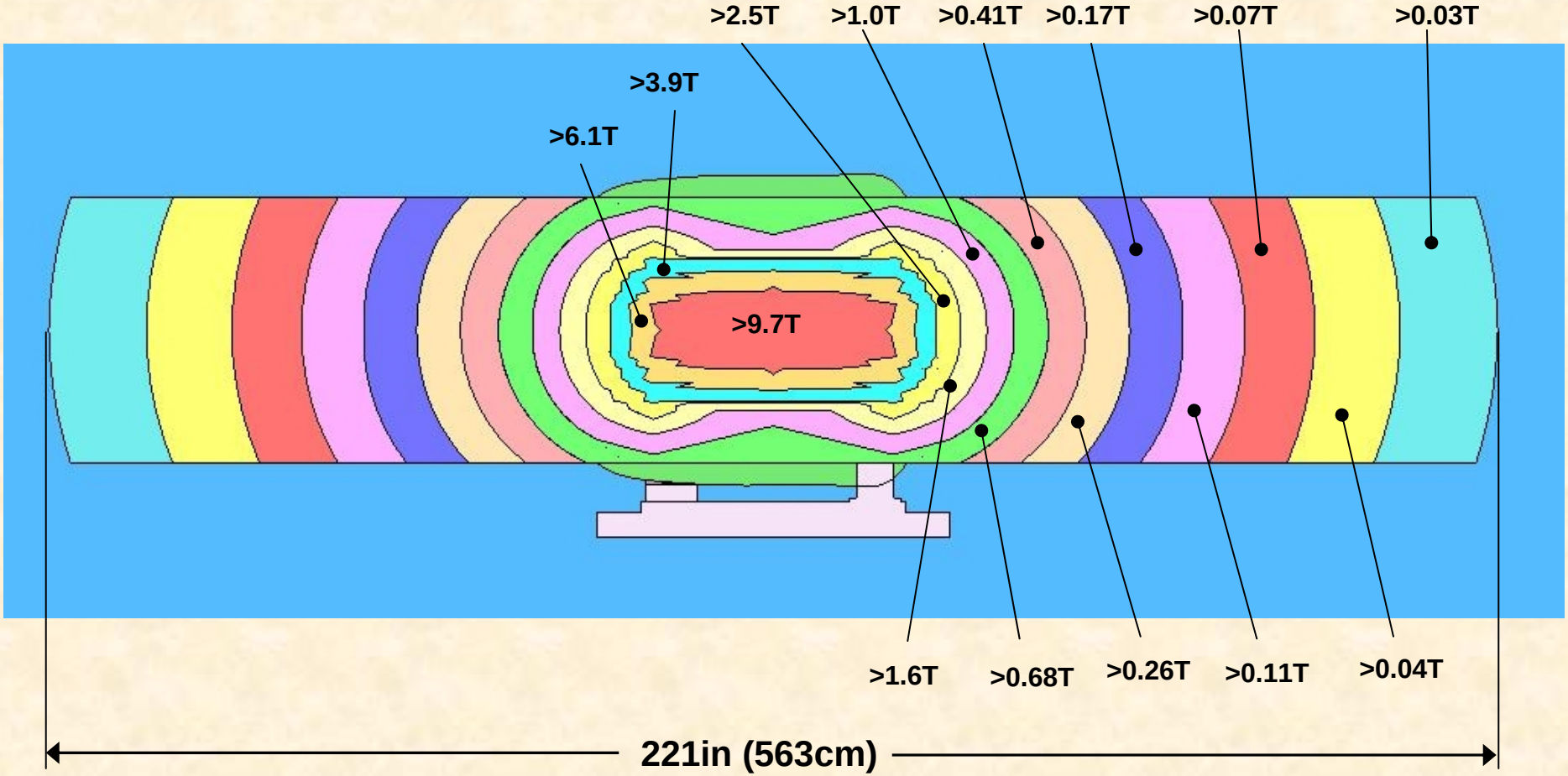


$\left(xyz_0, xyz_1, \log\left(xyz_2\right)\right)$

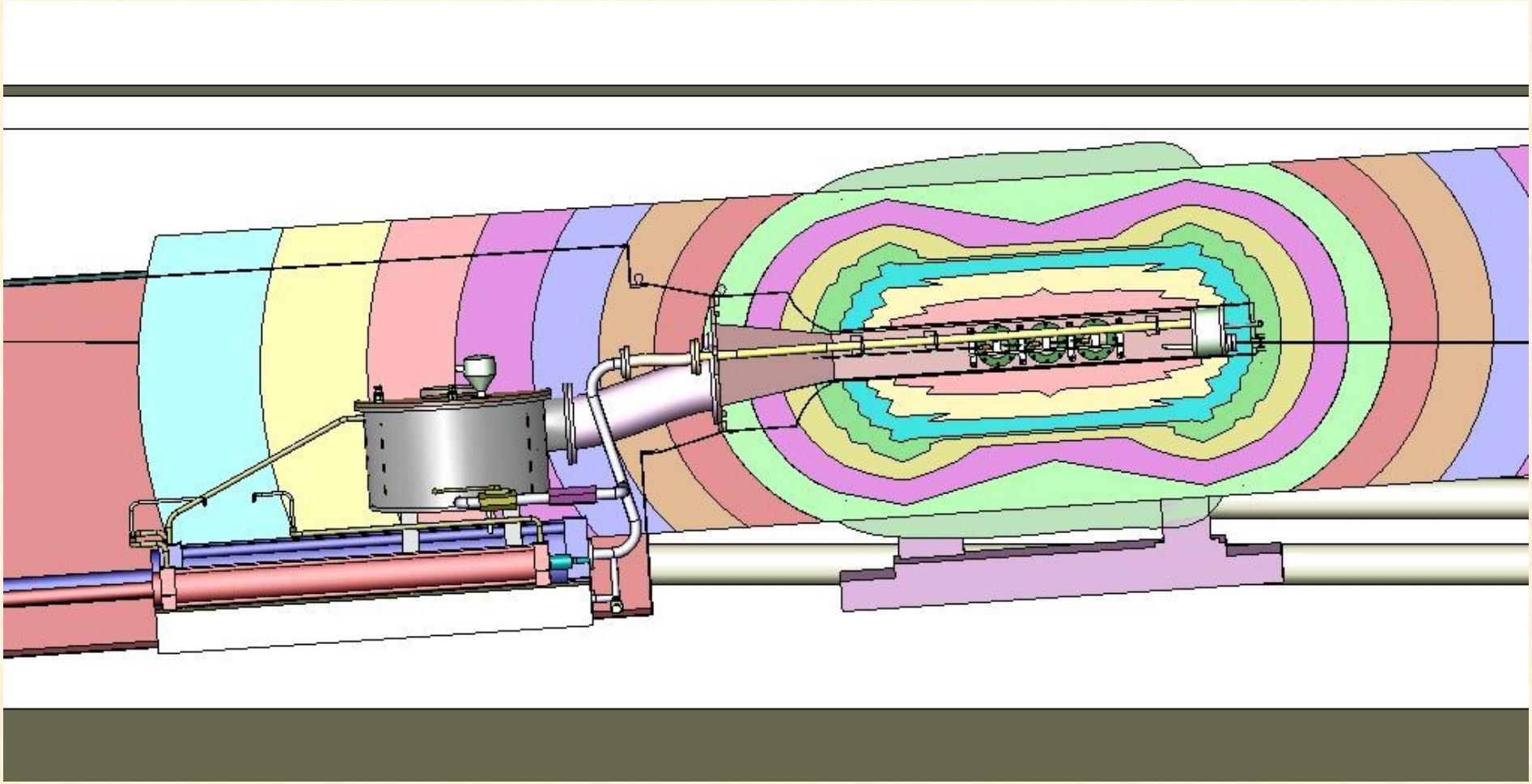
Magnetic field distribution: the axes are in meters; the rectangle is one half of the solenoid.

- **The volume within the conductor is > 9.7 T (red), > 6.1 T (orange).**
- **The field at Z=0, R=0.6 is >0.6 T, at R=1.0 (base support structure), B> ~0.1 T (1000 G).**
- **The field at Z=-2.5, R=0.4 (pump motor) is 0.03<B<0.07 T (300-700 G).**

Fields with Solenoid



Field Near Equipment



Issues

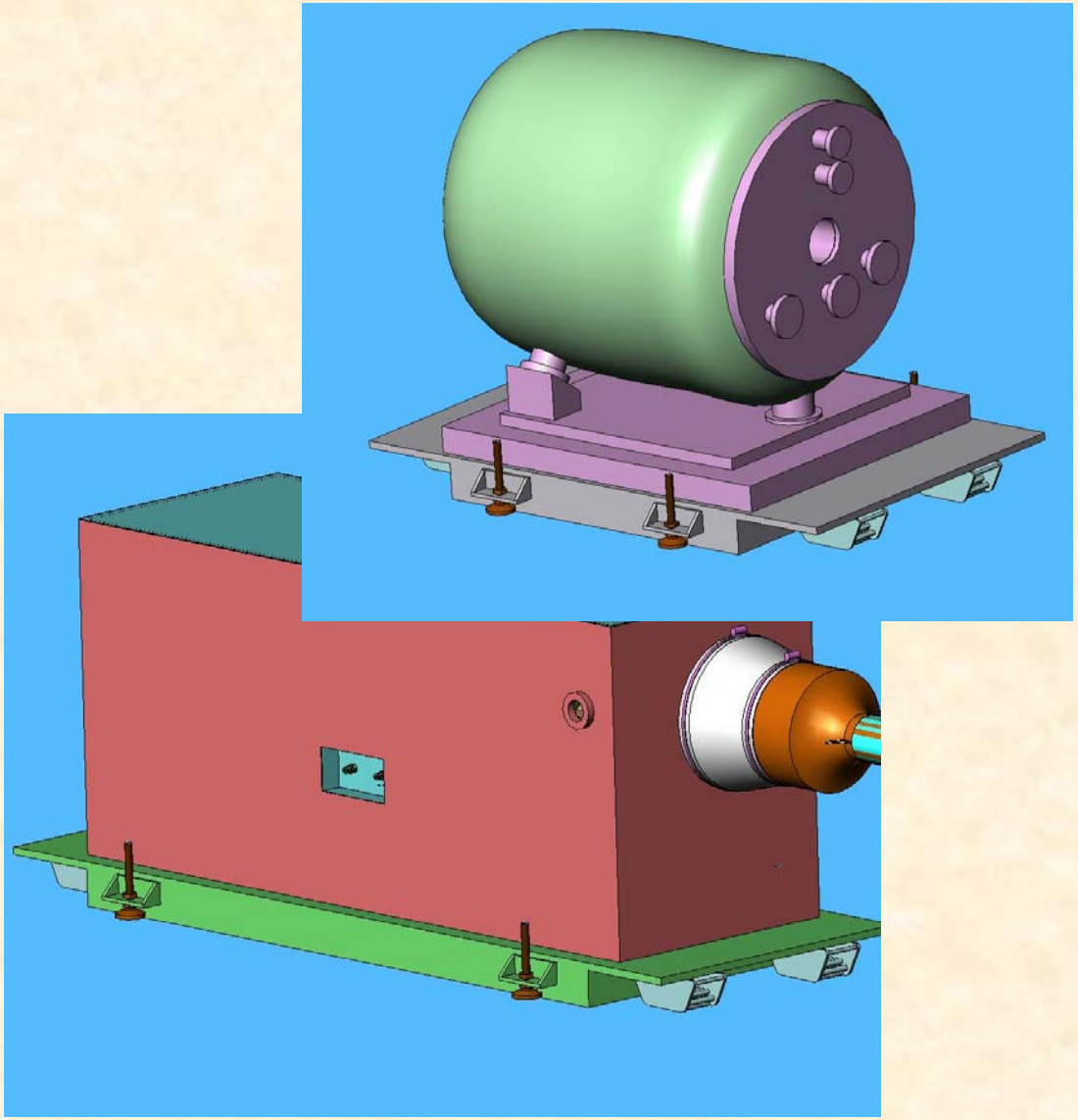
- **Position hydraulic pump to minimize field effects**
- **Max field at cylinders between 0.17T & 0.26T**
- **Need steel cover plates for magnetic shielding over cylinders?**
- **Remote valve or sensor concerns?**

Magnet & Target Base Supports

- **Flexible metal hoses somewhat decouple the target module from the delivery system**
- **Only the magnet & target module must be precisely positioned relative to beam**
  - **Hg delivery system does not have to tilt or be exactly in line with magnet**
  - **Downbeam window on secondary containment should be oversized to accommodate delivery system misalignment**
- **Base material will be carbon steel or aluminum, depending on cost**

Base Supports

- **Magnet & Hg system will have independent mobility and leveling features**
- **Independent base supports should make equipment installation less complex**



Recommendations

- **Change from a common base support to independent supports for solenoid and Hg delivery systems**
- **Both should incorporate mobility and tilt/leveling features**
- **Increase size of secondary downbeam window to accommodate Hg system misalignment**