

# MERIT Hg System Final Design Review

## Hg Target System Design Interfaces

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**MERIT Collaboration Meeting**

**MIT Plasma Science & Fusion Center**

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# Primary Hg System Interfaces

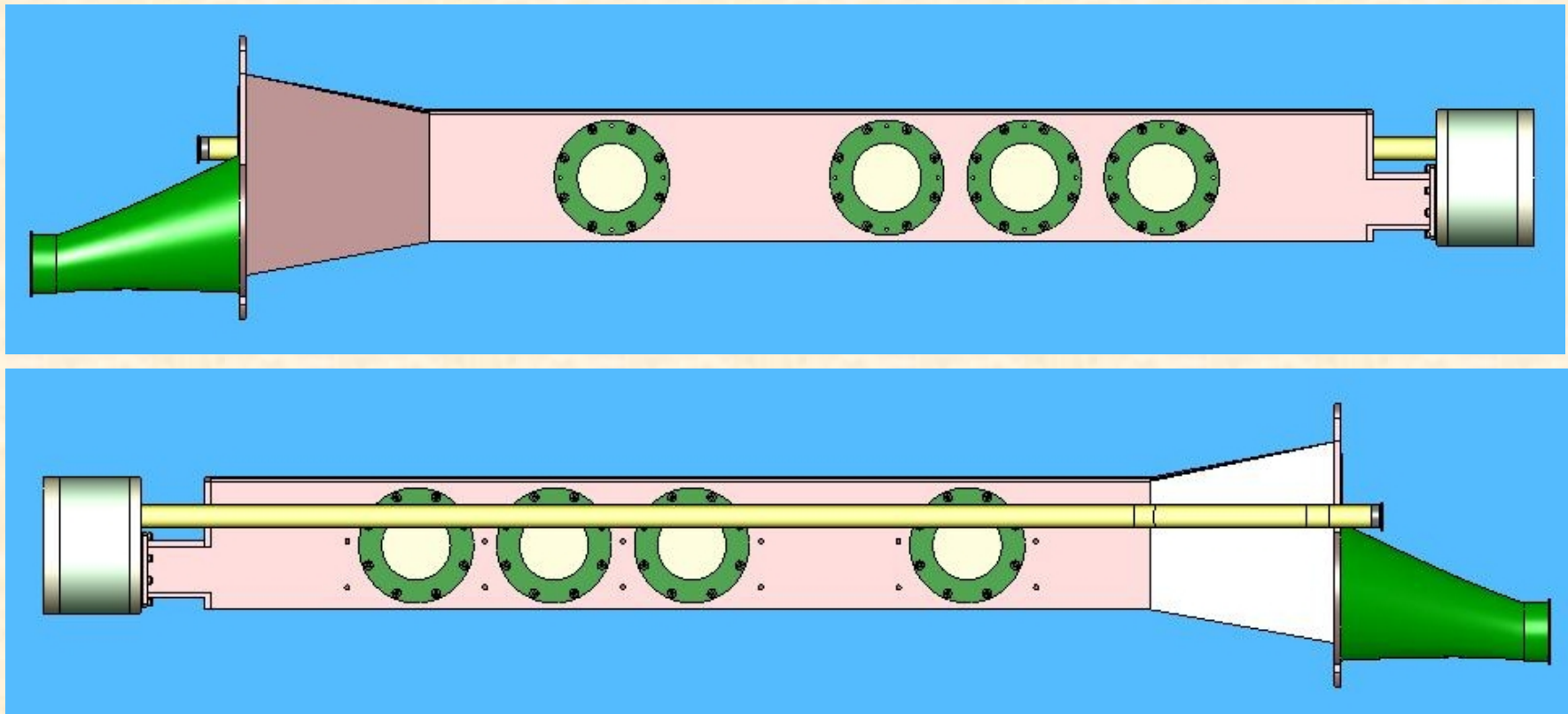
- **Facility**
- **Optical diagnostics**
- **Magnet**

# Facility Interfaces

- **Require 30kW power supply**
  - 460V/3PH U.S.
  - 380V/3PH CERN
  - Delivery system will have on-board 110V, 24V power supplies
- **Anchor baseplate to floor?**

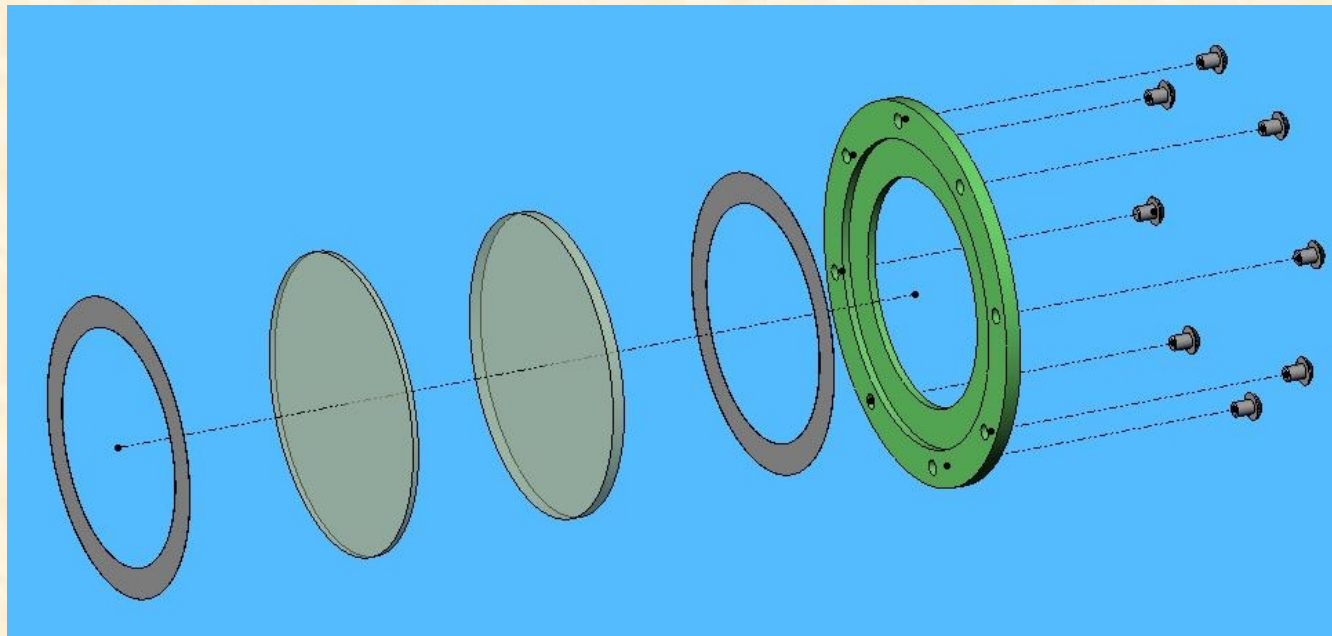
# Primary Containment As Fabricated

- No reflector, no optics or optics mounting shelf
- Interface drawings will be provided to BNL



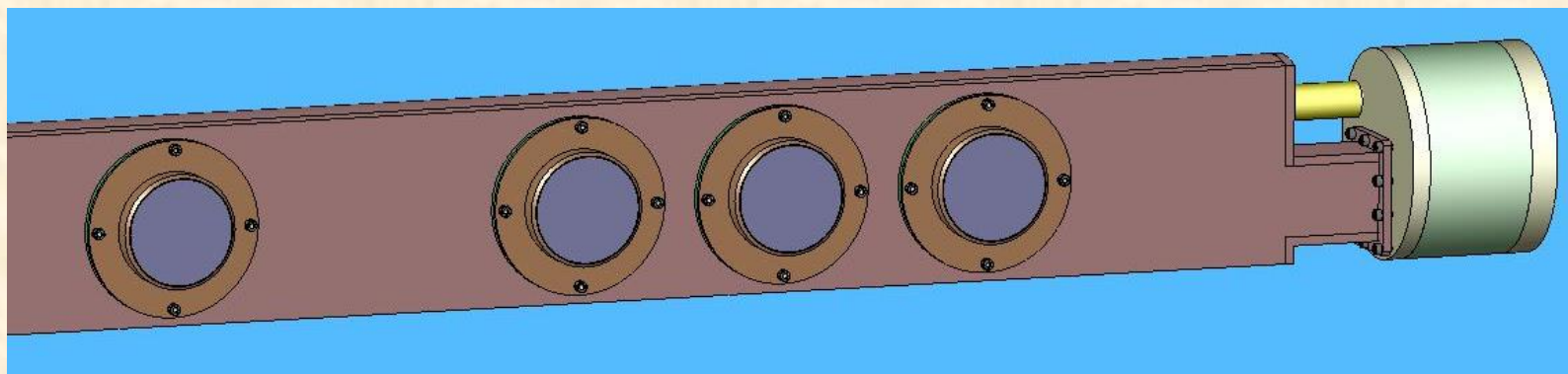
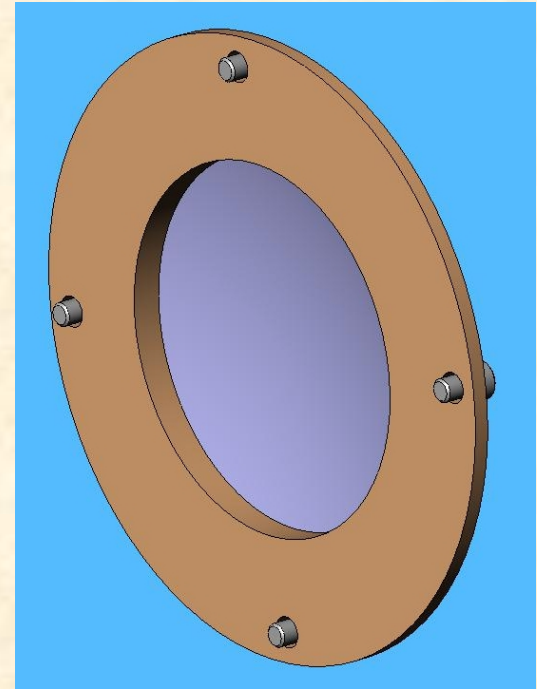
# Optical Viewing Windows

- 2mm Quartz backed by 4mm Lexan
  - **Can Lexan be used alone?**
- Face seals
- Mechanical fasteners
- Assemblies provided on both sides of primary containment as part of delivery system fabrication



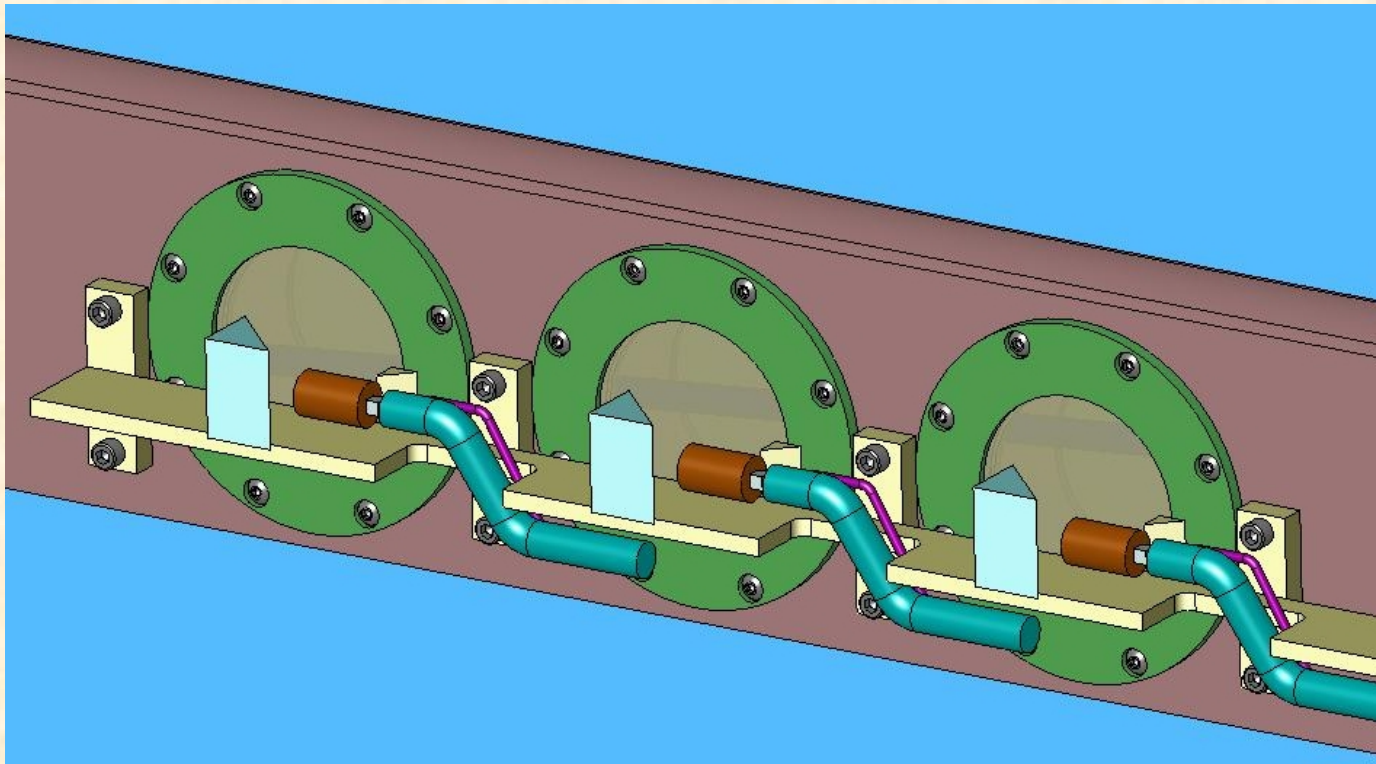
# Optical Reflector Windows

- **BNL to provide mirror and adjustment mechanism**
- **Mechanically attaches to viewport cover plate**
- **Interface drawing to be provided by ORNL**



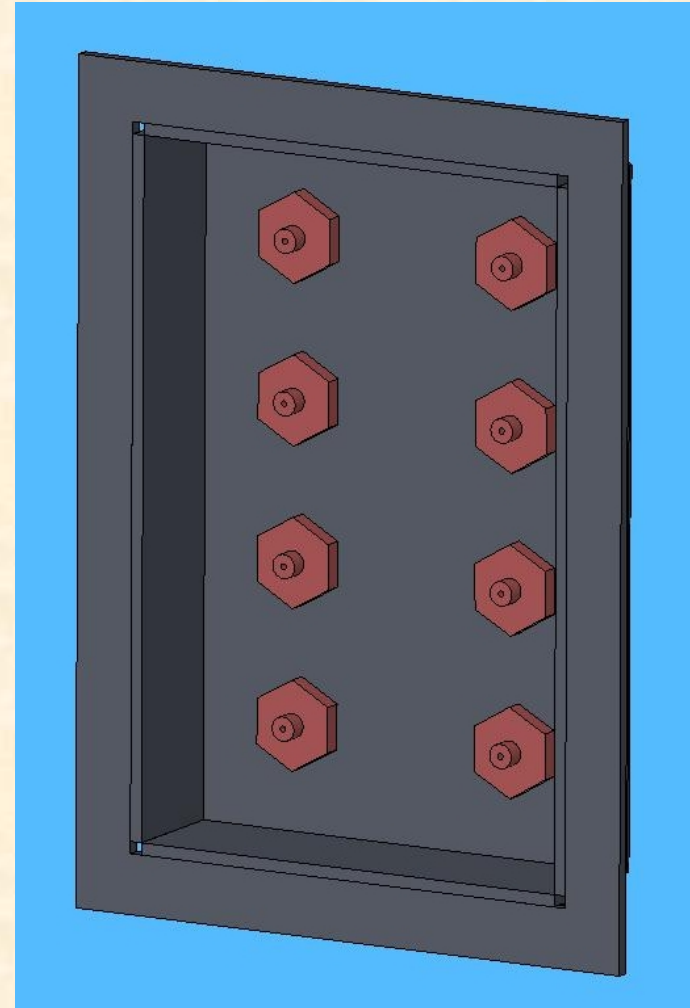
# Optical Components

- **BNL to provide splitters, prisms, lenses, bracket, mounting hardware & adjustment mechanisms**



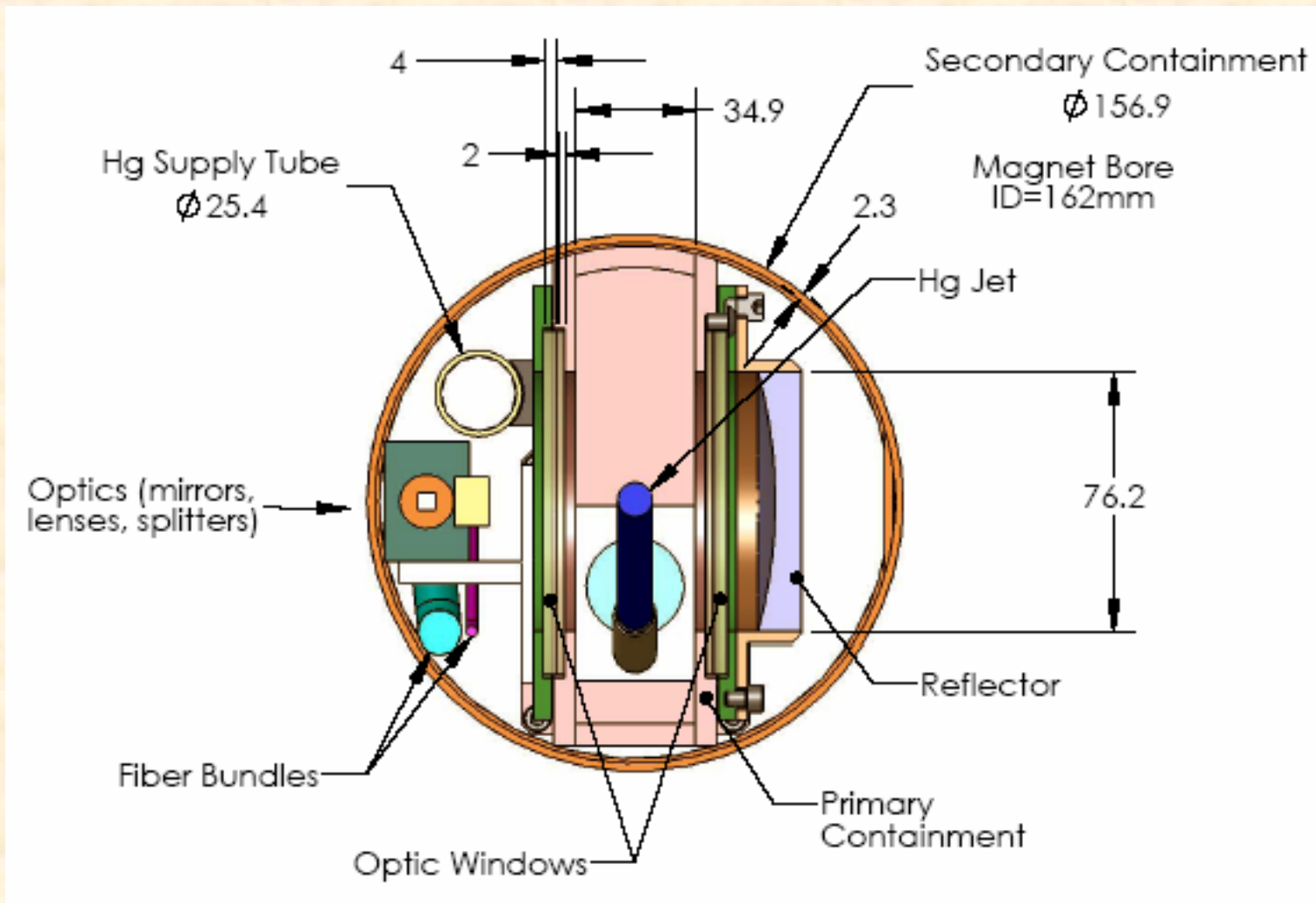
# Fiber Bundle Bulkhead Fittings

- **Eight connector holes provided based on BNL-supplied info**
- **BNL provides connectors**





# Z=0 Section Cut

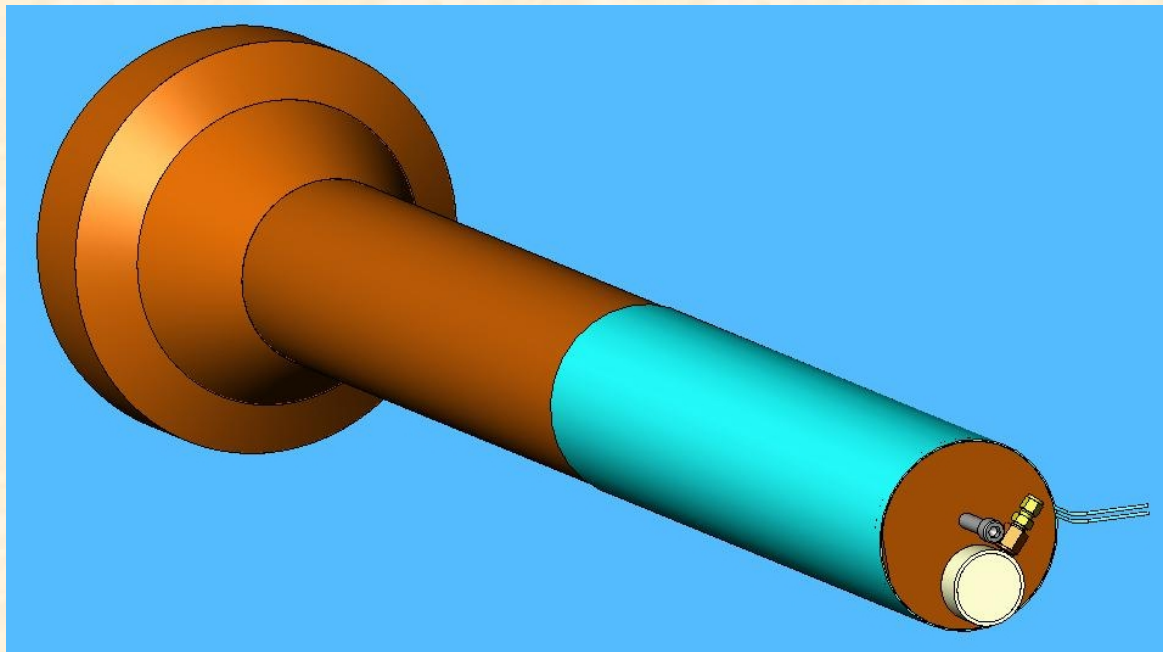


# Magnet Bore Bore'd Out

- **Magnet designed with G-10 bore tube to insulate inner wall during cooling cycle**
- **G-10 tube did not allow enough room for optics**
- **Removal of bore tube requires a substitute insulator covering the upstream 20cm of the bore**
- **Current approach uses a Watlow kapton heater foil**
  - **Thickness = 0.2mm (0.007inch)**

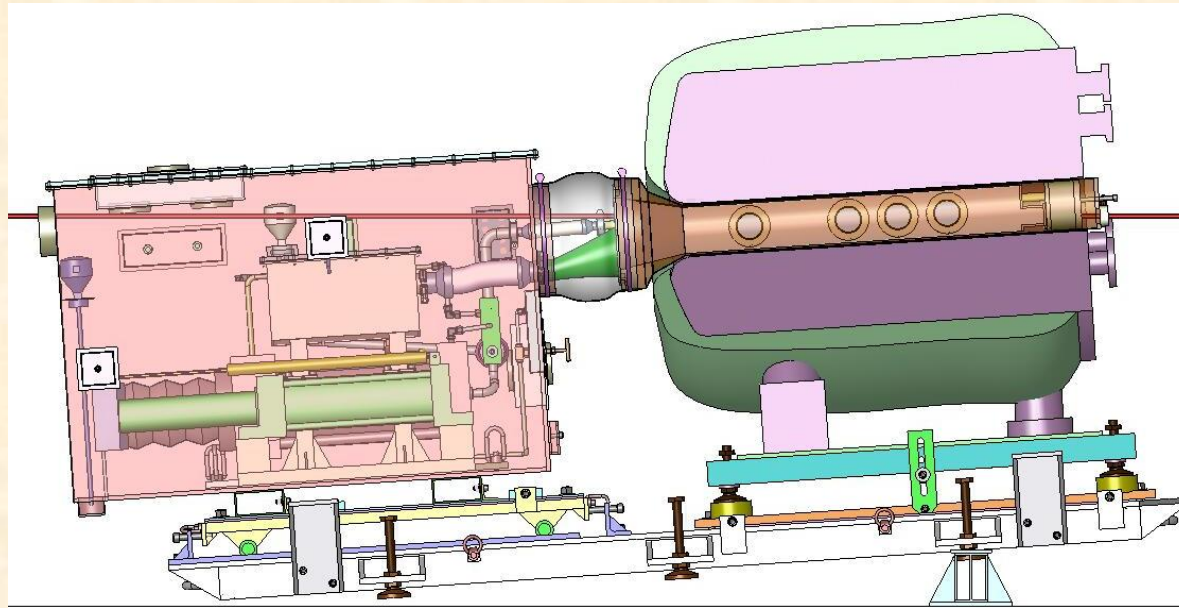
# Solenoid Interface

- **Clearance**
  - Magnet ID = 162mm
  - Secondary OD = 157mm (157.5mm with foil)
- **Centering secondary containment within bore will require some sort of annular wedges, perhaps mechanical fastening to magnet end plate**



# Hg System / Magnet Alignment

- Baseplate has jackscrews to precisely adjust cart axial position
- Flex metal hoses may allow nozzle to move relative to magnet
  - Add means of attaching secondary containment to magnet end plate

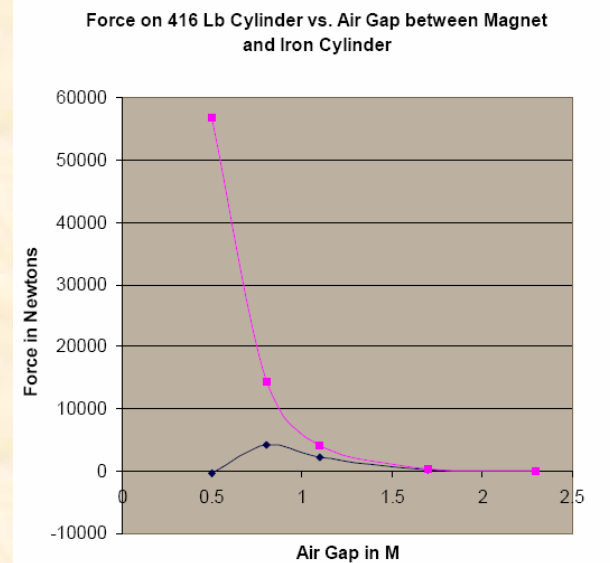
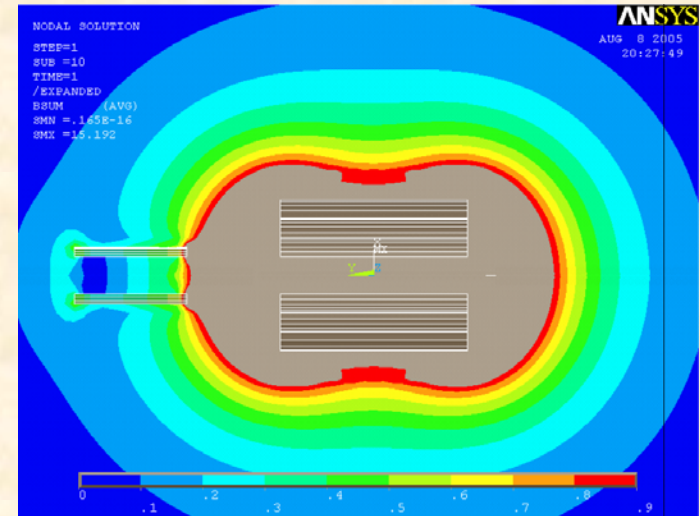


# Integrated Systems Testing

- **Prefer to perform prototypic installation sequence where magnet will be operated**
  - Target transporter, common baseplate, tilt & elevate
- **If physical constraints at MIT prevent prototypic operations, we should conduct installation-only tests at another MIT location**

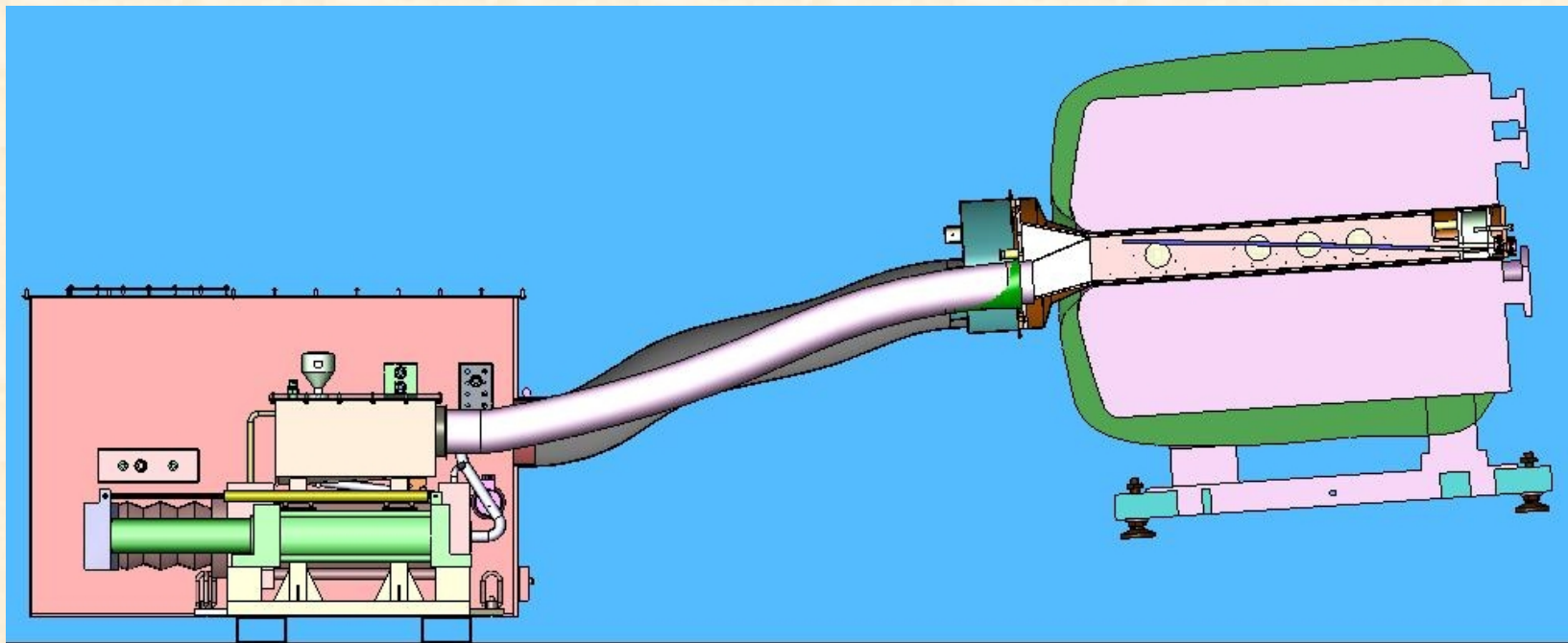
# Magnetic Force Analysis

- P. Titus performed Ansys analysis of attractive forces between magnet and single iron cylinder
- Force nearly 13000lb
- Further analysis showed force decreases significantly with separation distance  $> 1\text{m}$



# Possible Solutions

- Restrain Hg system and magnet
- Increase separation distance
  - Design concept initiated
- Use non-magnetic hydraulic cylinders, at higher cost
  - Chose this option after reviewing syringe vendor quotes



# Final Interface Issues

- **Final dimensions of secondary containment not known until syringe vendor completes design**
  - Design review required to be held within 30 days of award
- **Vertical dimensions the most critical and may slightly change some baseplate dimensions**