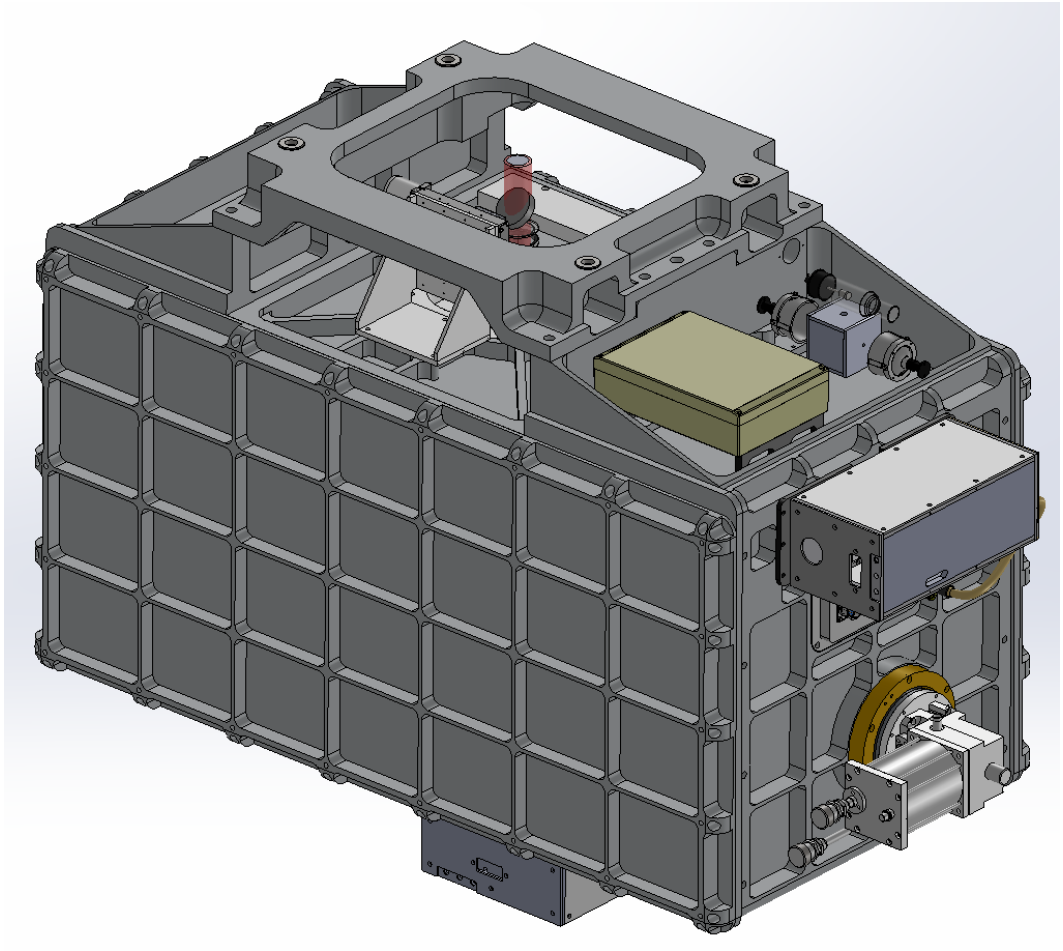
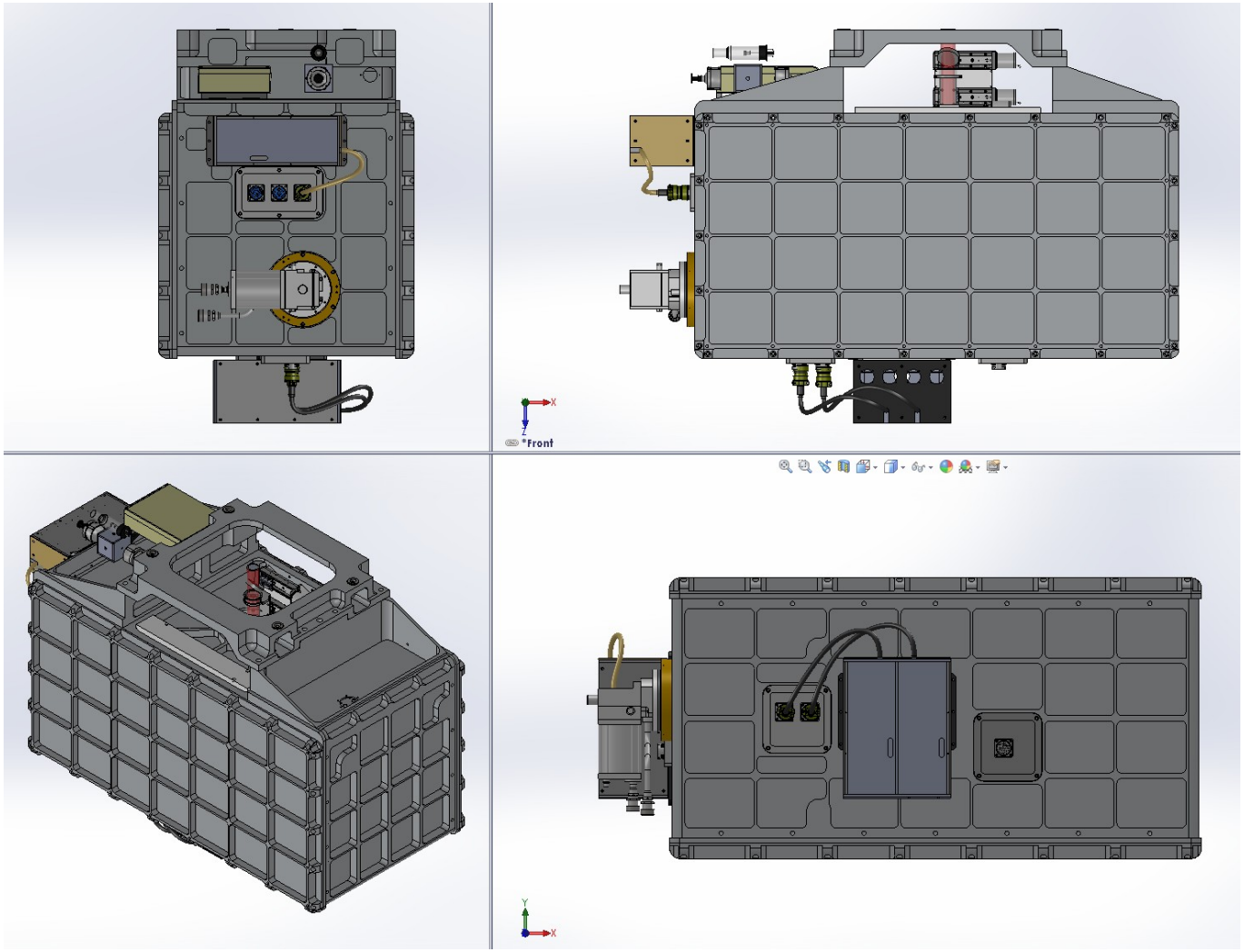
iSHELL Design Review
Cryostat & Optics Bench



Dan Kokubun

11/8/2013

Overview



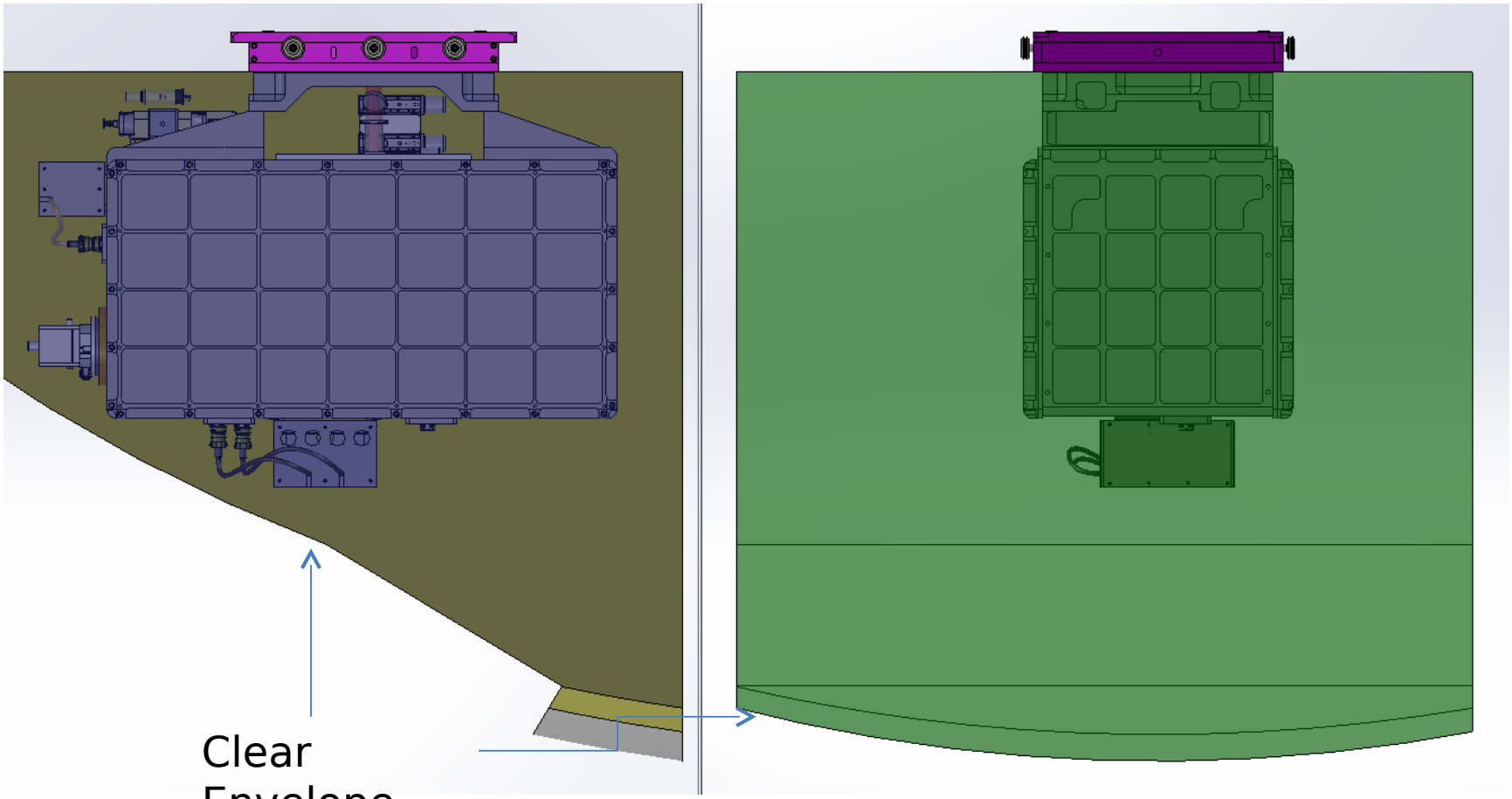
3/8” tapped holes on covers, bottom, and sides.

Can be used for:

- handles
- Jigs
- protective frame
- feet.

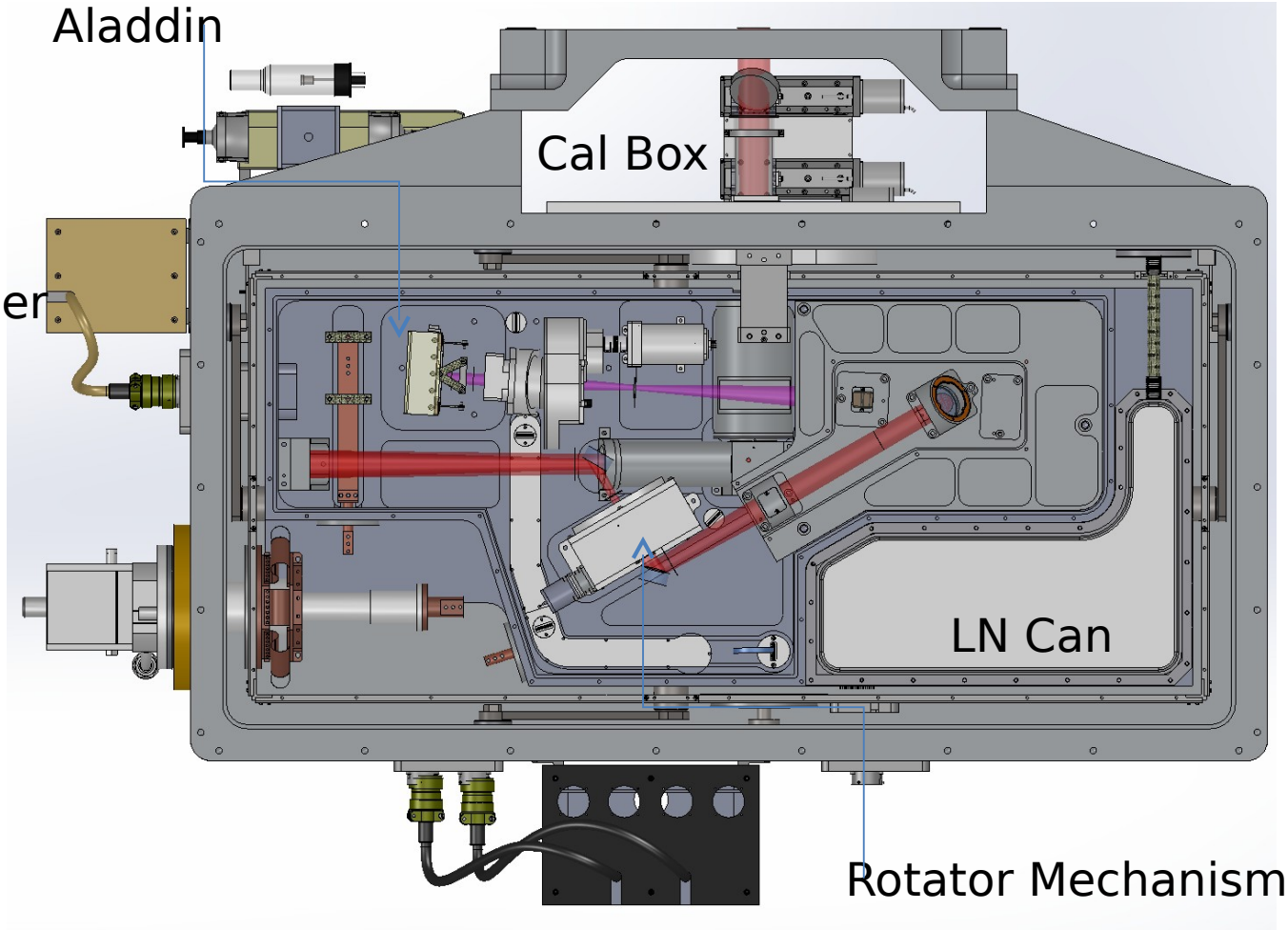
Overview – Telescope Clear Envelope

- Telescope clear envelope shown around instrument.
- Estimated Weight: 1040 lbs
- CG: within 2” of optical axis



Overview

Cal Box dust cover not shown

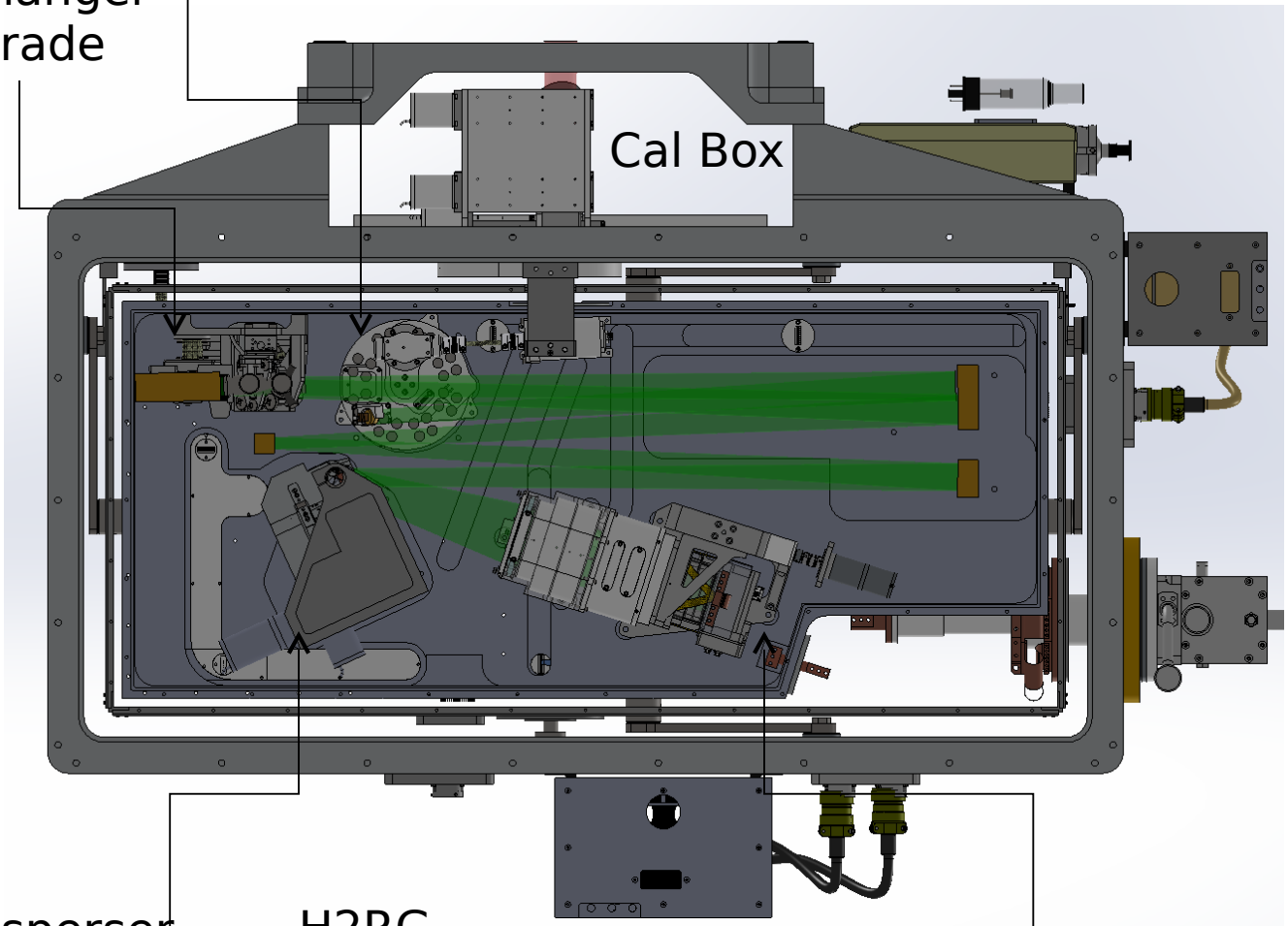


Overview

Order Sorting Mechanism

IG Changer *upgrade

Cal Box dust cover not shown

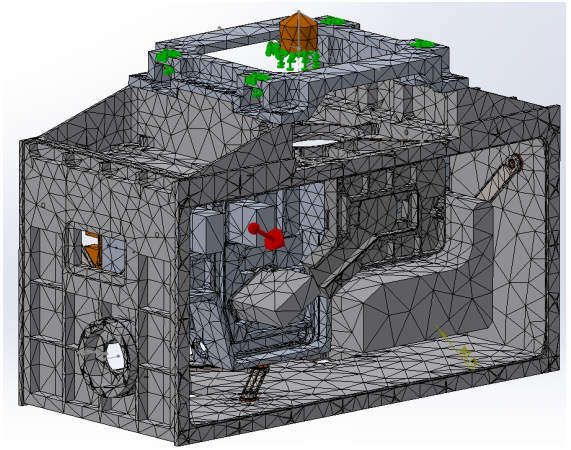


X Disperser Mechanism

H2RG Controller

H2RG

FEA - Flexure Study

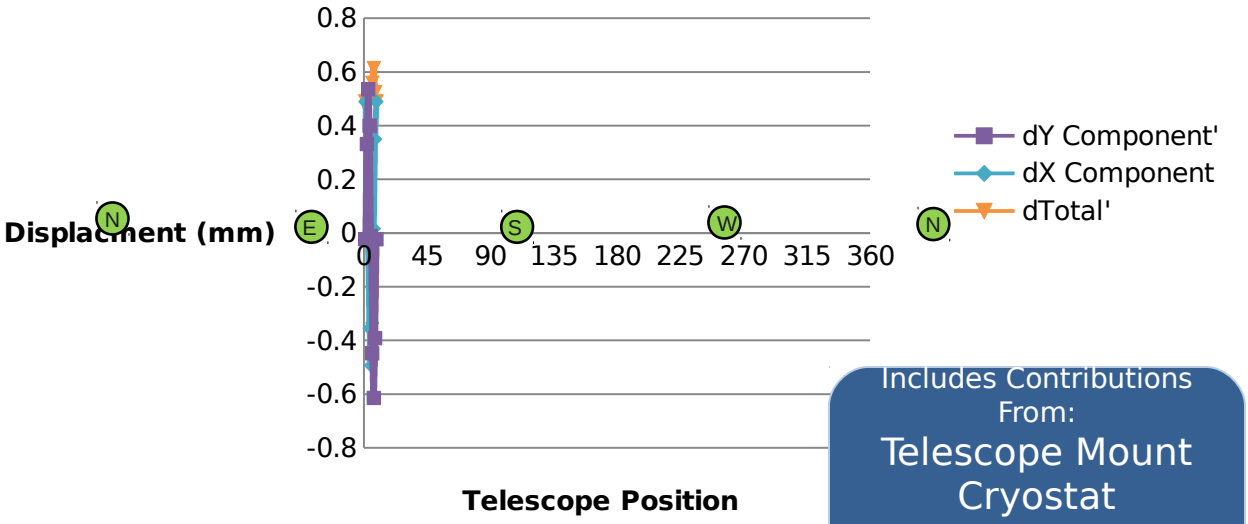


Requirement: Co-alignment of the cold stop and telescope exit pupil to within 1% of their diameters...

This is equivalent to 2.4mm image displacement at the secondary

- Worst case gravity vectors used (60° from zenith)
- The resulting angular deflection of the optical axis is expressed as image displacement at the secondary
- Maximum contribution is 0.61 mm ; *25% of the allowable displacement*

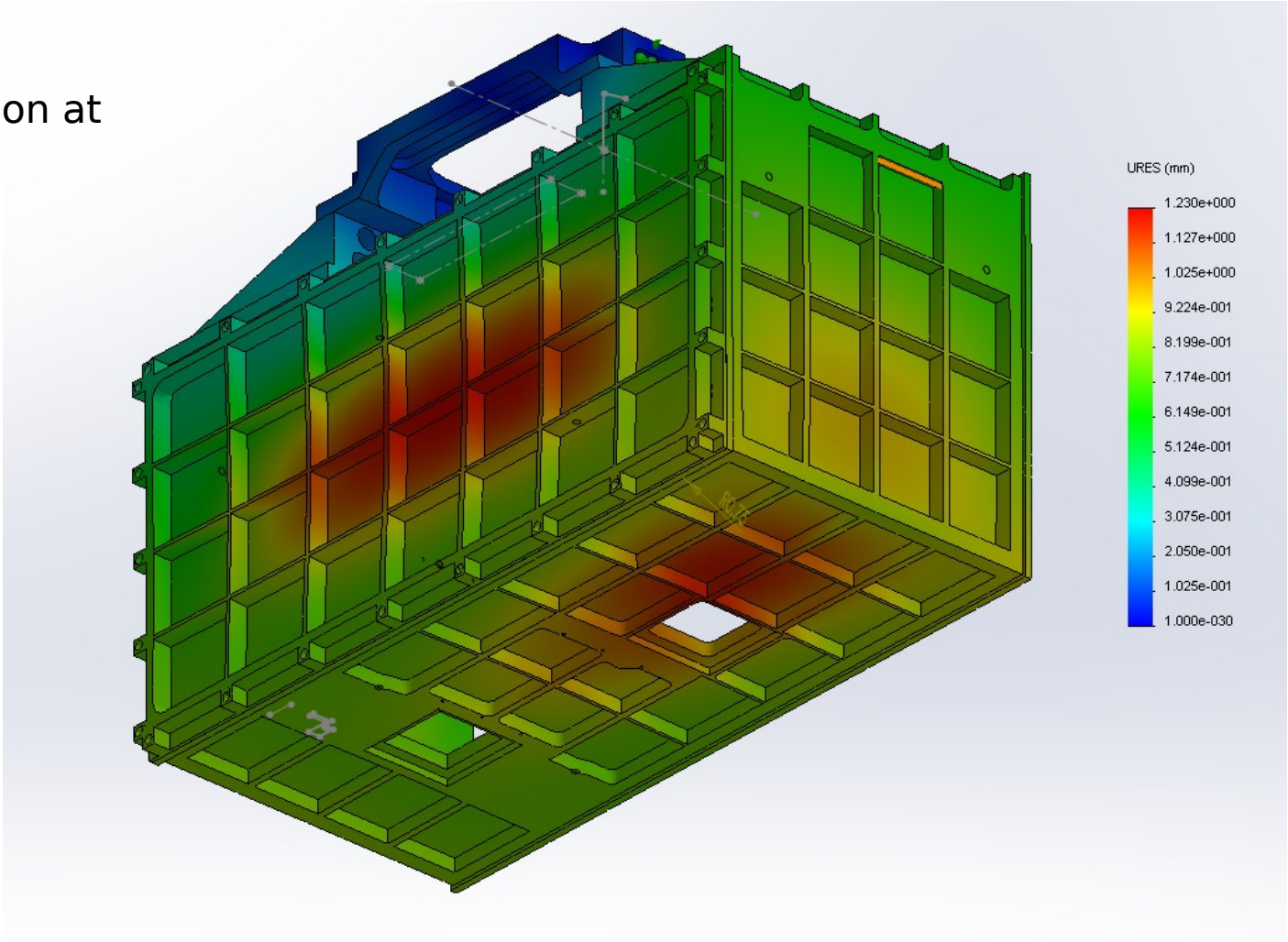
Image Displacement at Secondary Telescope Pointing - 60 deg from Zenith



Includes Contributions From:
Telescope Mount
Cryostat
Trusses
Optical Bench

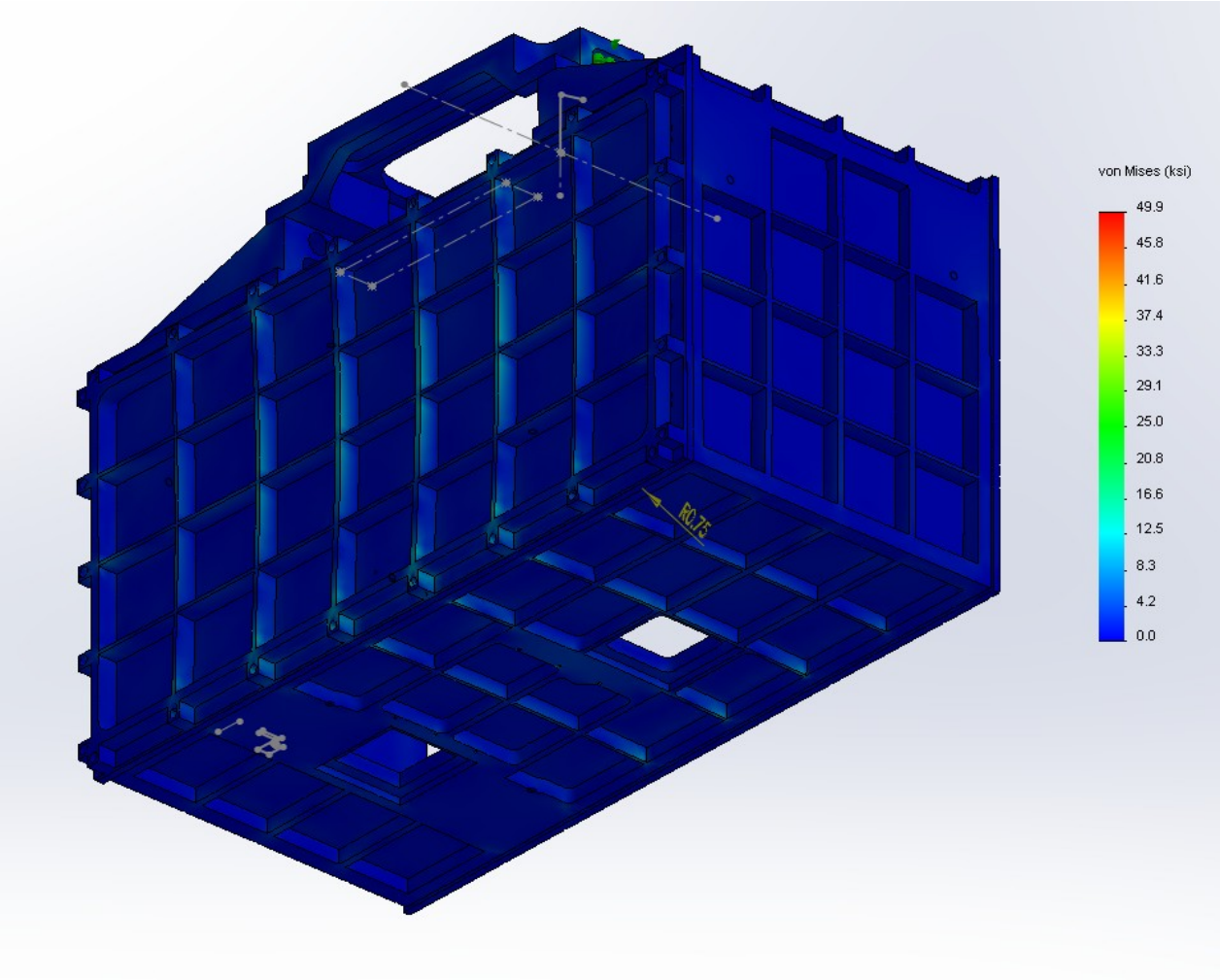
FEA - Stiffness Under Vacuum

Maximum deflection at center of cover is 1.2mm



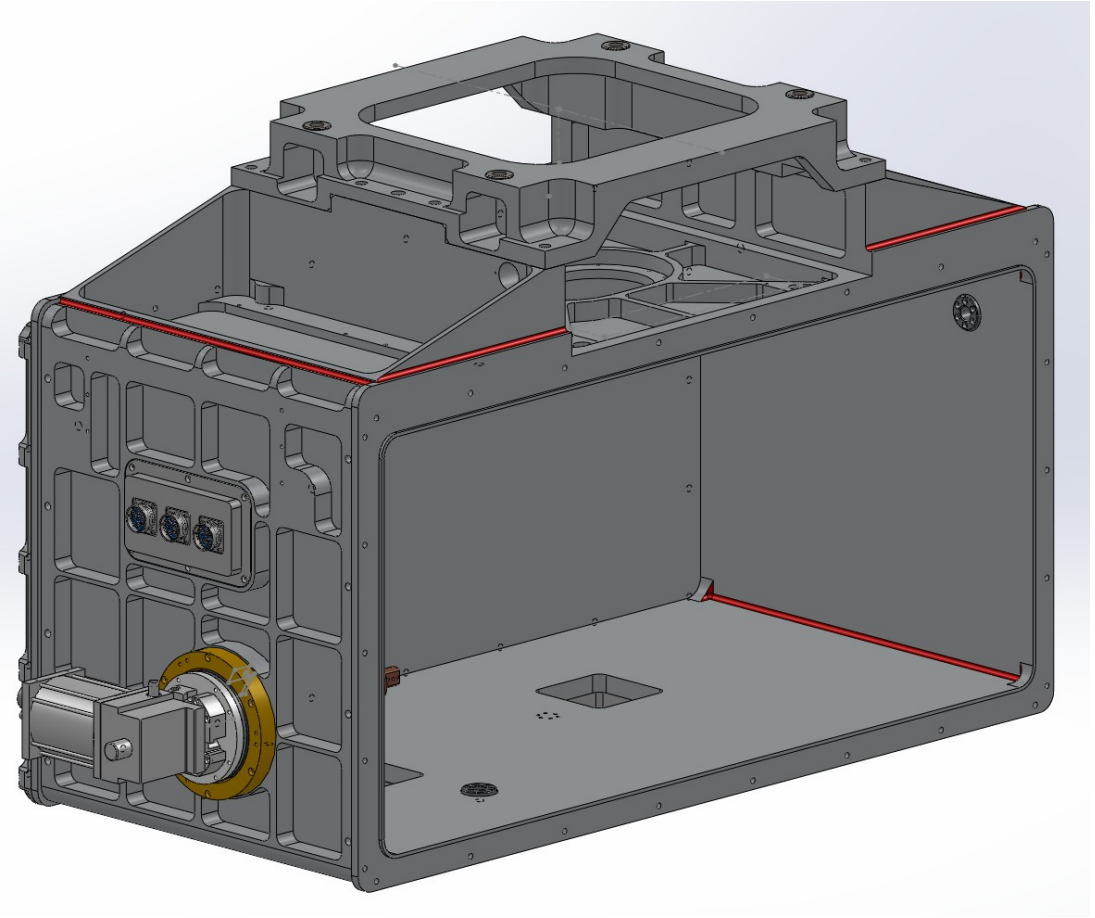
FEA - Stiffness Under Vacuum

- Maximum stress at ribs on cover is < 15 kpsi; safety margin of 2.7 for 6061-T6
- Stress points on bottom around 11 kpsi; safety margin of 2 for 50XX-T0



Cryostat - *Housing*

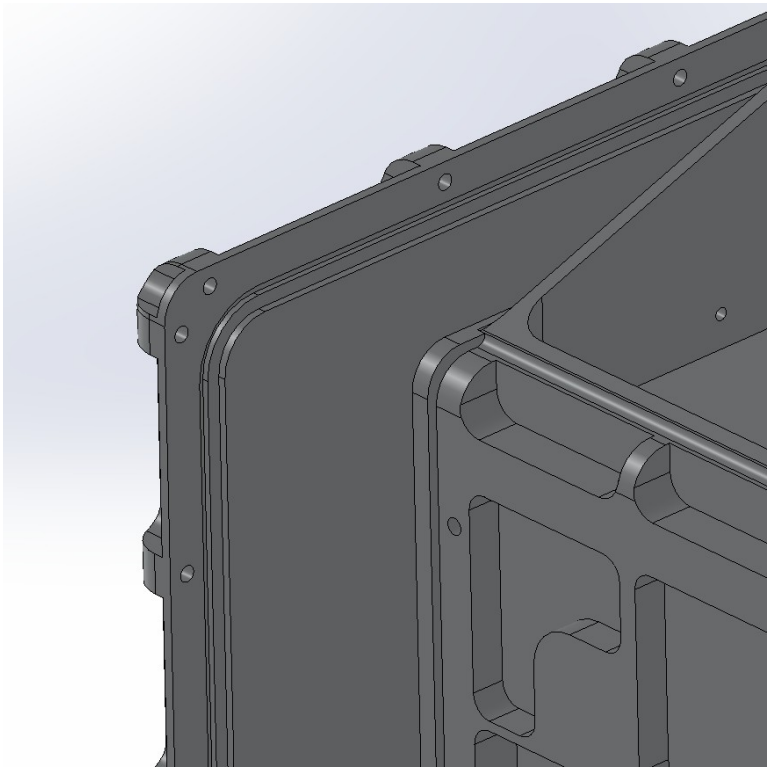
- Welded Structure (welds shown in red)
- Cryostat design has been developed in cooperation with the cryostat vendor.
- Parts milled from billet
- Inserts for Truss mounts screwed in place
- Will use 5083-T0 or 5056-T0 to avoid heat treating
- Elastic Modulus for all alloys are about the same so deflections will be identical
- Inside surfaces are polished
- Outside surfaces are painted



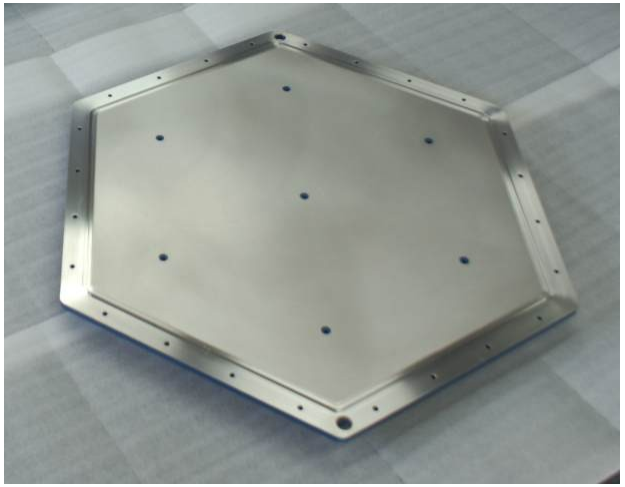
	Tensile Yield	Notes
AL 5083-T0	21 kpsi	No heat treat
AL 5056-T0	22 kpsi	No heat treat
AL 6061-T6	40 kpsi	Heat treat required post welding. Severe warping

Cryostat Cover

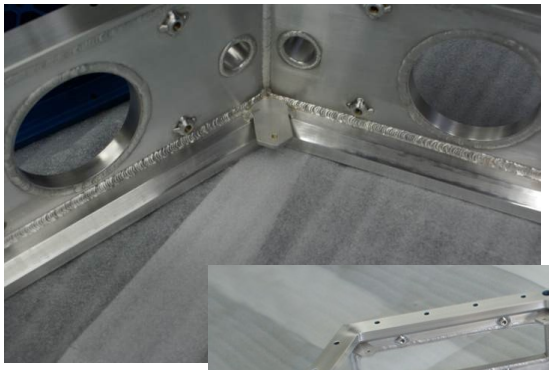
- Step on cover supports walls under vacuum
- Dovetail O-ring groove to retain o-ring.
- O-ring groove in cover
- 3/16” dia o-rings

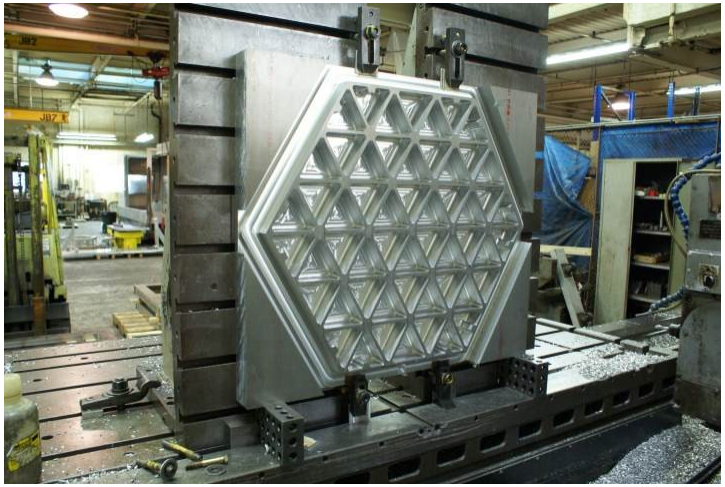


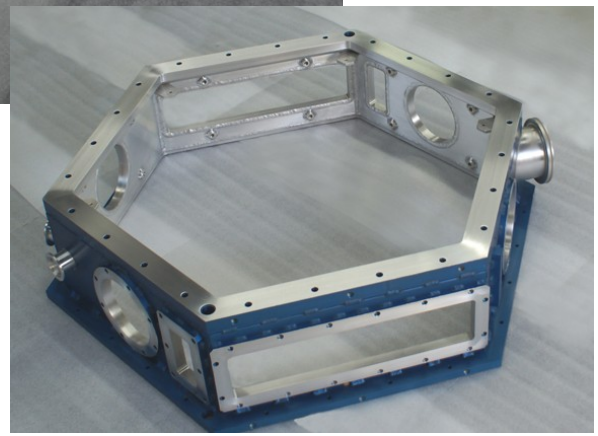
Cryostat Vendor – *Meyer Tool & Manufacturing*



- AURA One Degree Instrument (ODI)
- Vacuum rated welds
- O-ring grooves with dovetail
- Large Capacity Milling Machines
- Vacuum testing capability

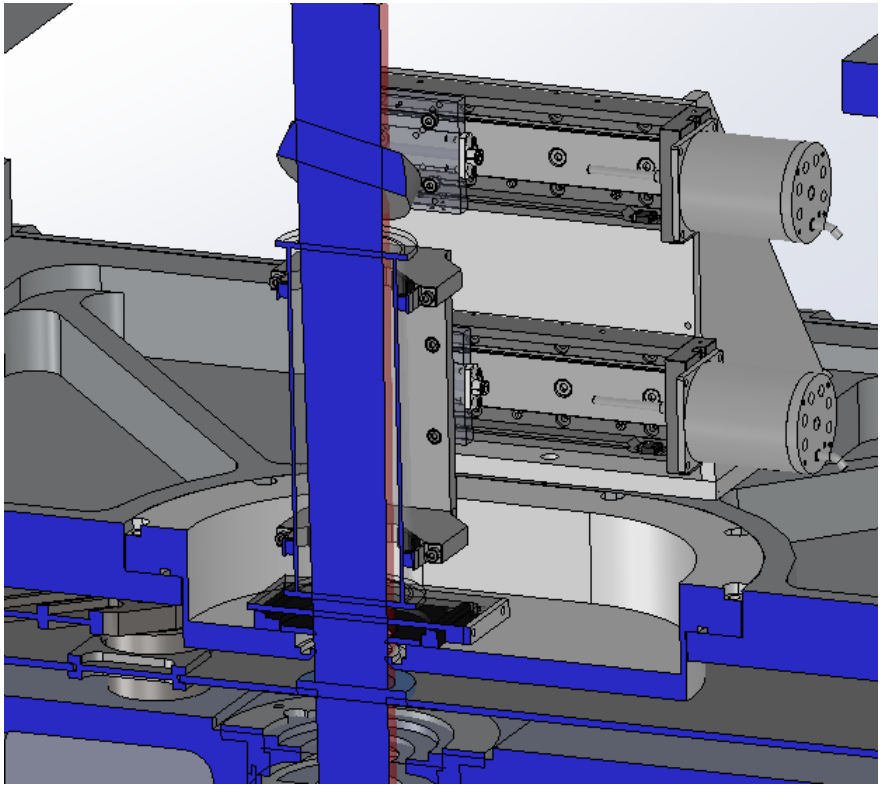






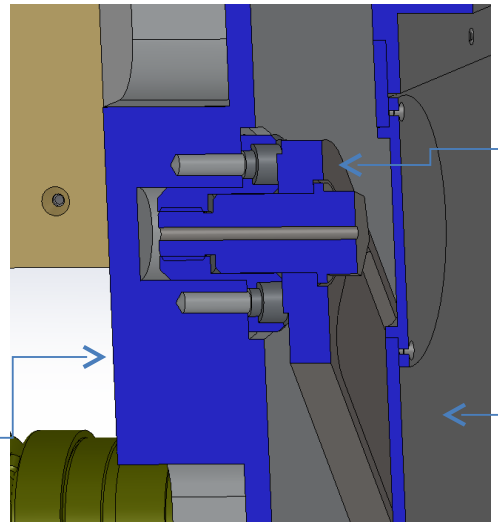
Cryostat - *Window*

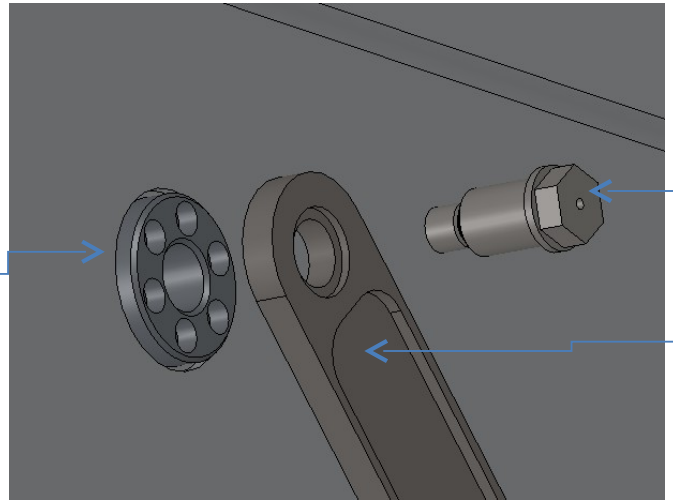
- Window mount is inset to allow space for a gas tube used for calibration
- A motorized door covers the window when it is not in use
- Debris cup to be installed on the back of the fold mirror
- Window bezel reduces the amount of debris falling onto window.



Cryostat – *Warm Side Truss Mounts*

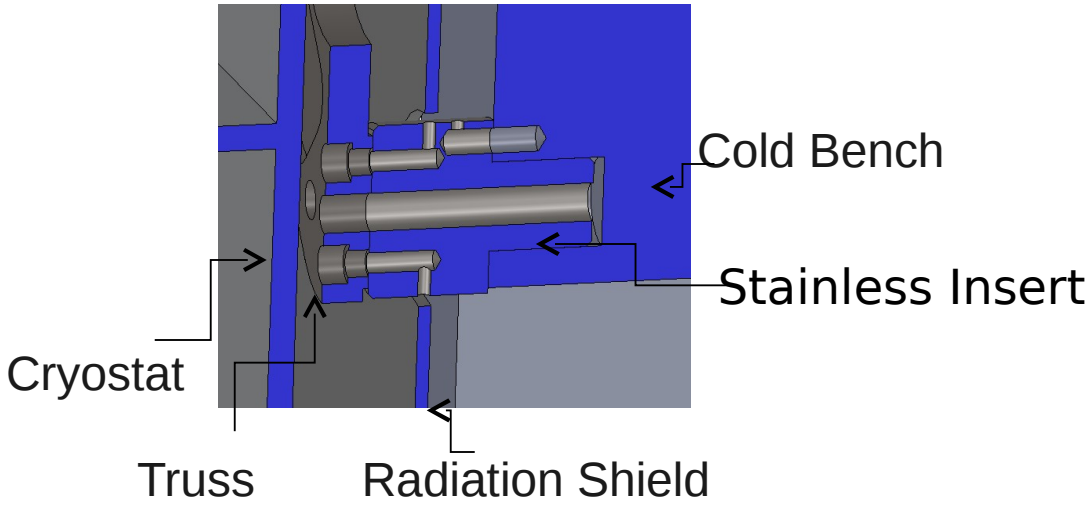
- Warm Side Mount
  - Custom shoulder screw
  - Use loose fitting threads for better fitment
  - Stainless insert in cryostat wall

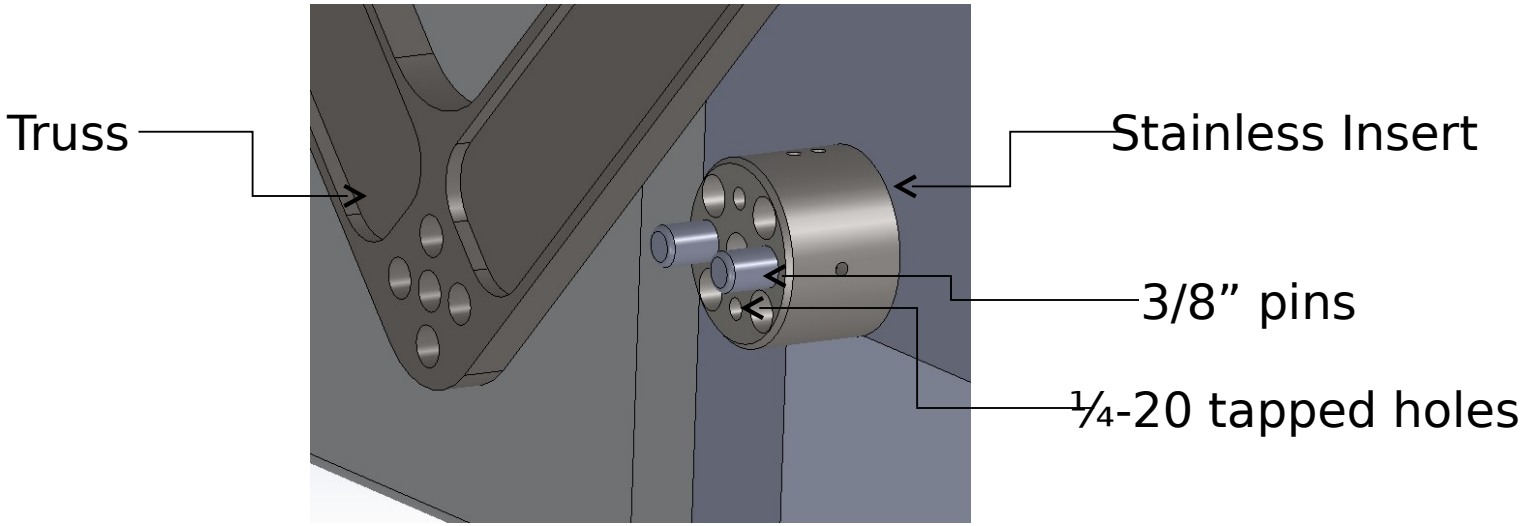




Cryostat – *Cold Side Truss Mounts*

- Cold Side
  - Two 3/8” pins, two ¼-20 screws
  - Stainless insert in bench with clocking pin

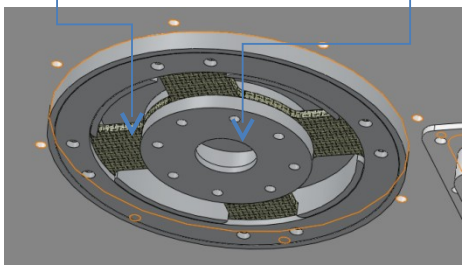




Cryostat – *Radiation Shield*

G-10 Spokes (4x)

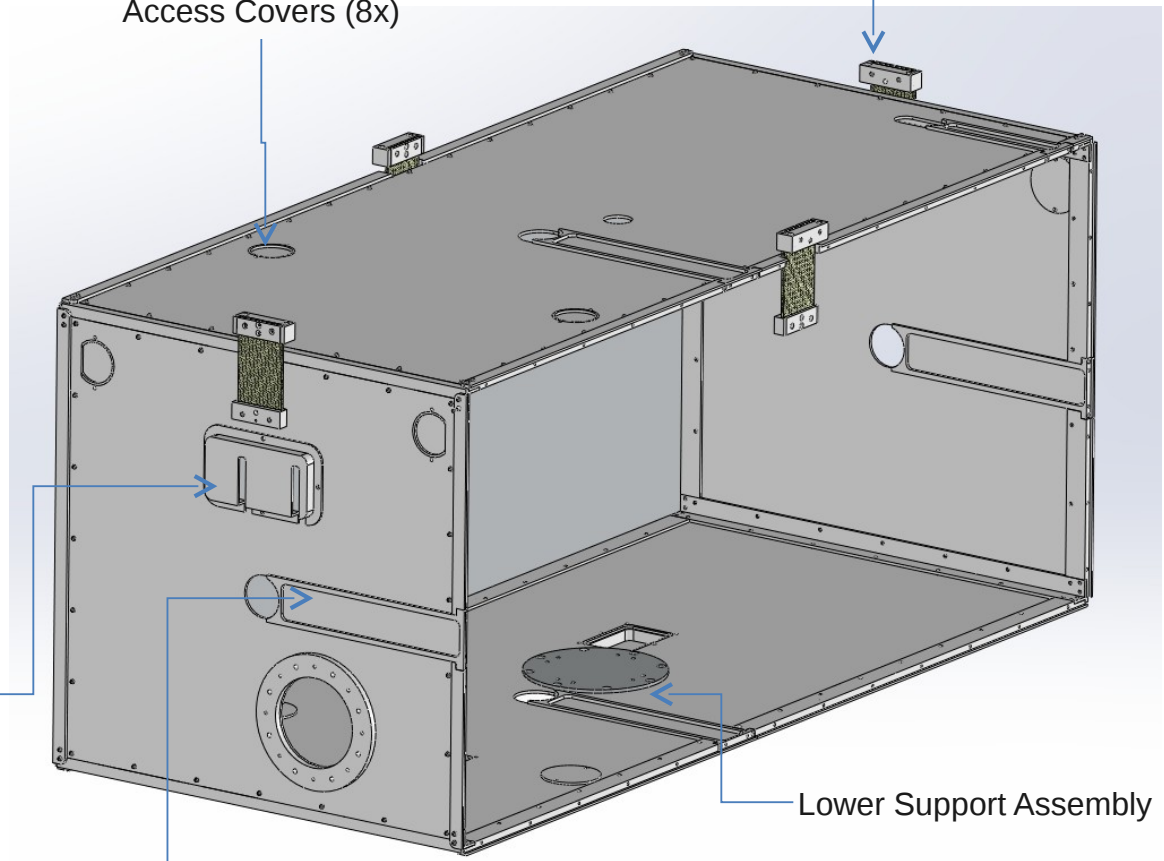
Support Pin
Bearing Surface



- Lower Support Assembly
- Support pin mounted to the cryostat will provide mechanical support to the bottom of the radiation shield
- Small thermal cross section at bearing surface

Truss Mount Bolt
Access Covers (8x)

G-10 Mount Tabs (4x)
1.9W Heat Load – similar to Spex

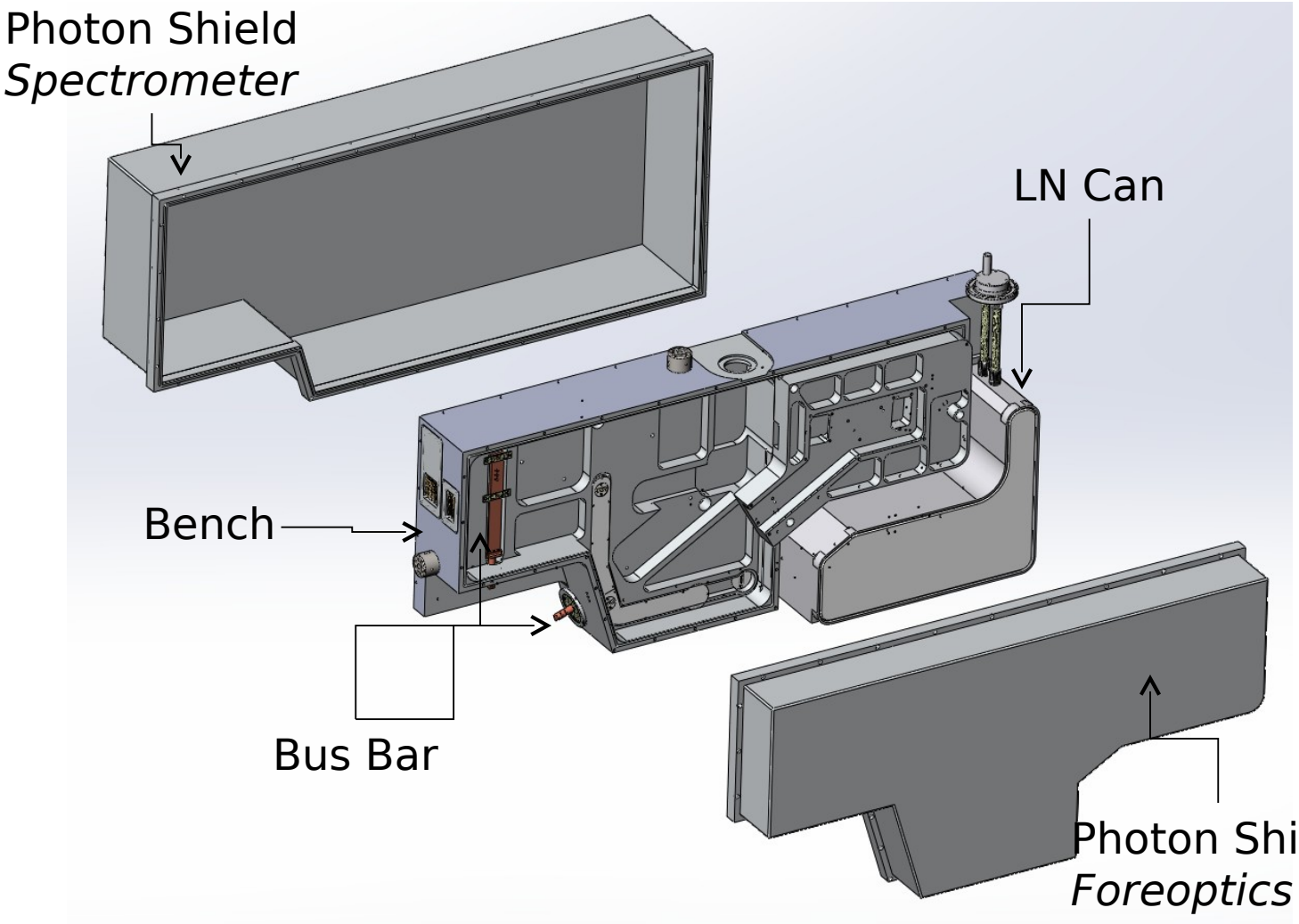


Wire Harness
Access Panels (3x)

Lower Support Assembly

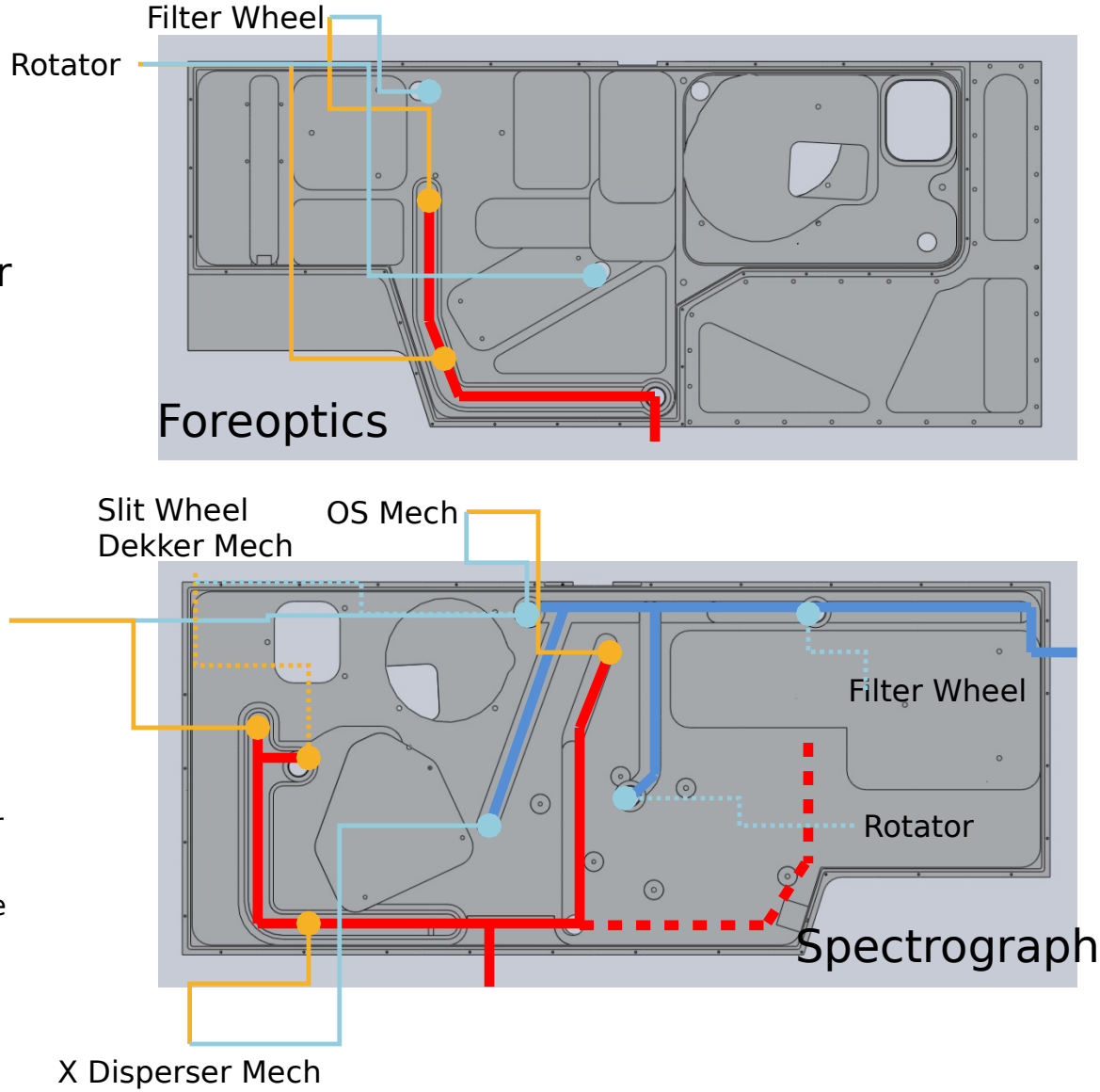
Truss Clearance Slots
With Covers (4x)

Optics Bench



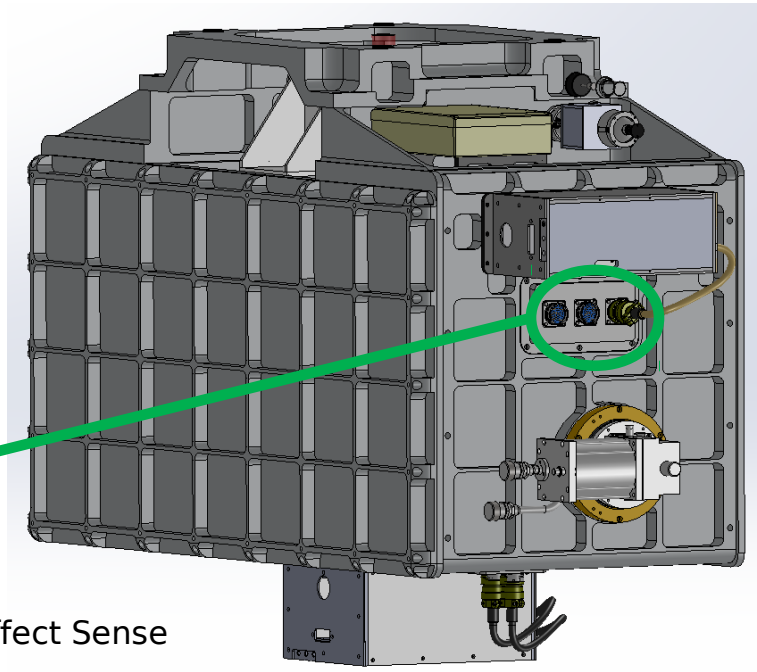
Optics Bench – *Wire Routing*

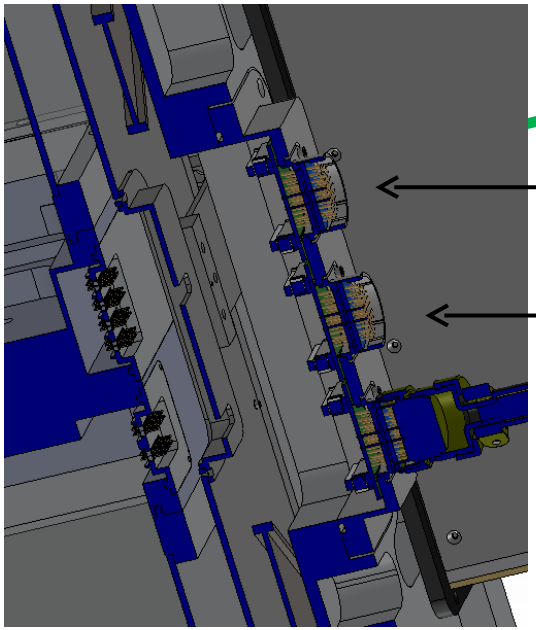
- All wires in covered channels
- Motor power and heater wires routed together
- Hall effect sensors and temperature sensors routed together
- Light tight bulkhead connectors



Optics Bench – *Connectors*

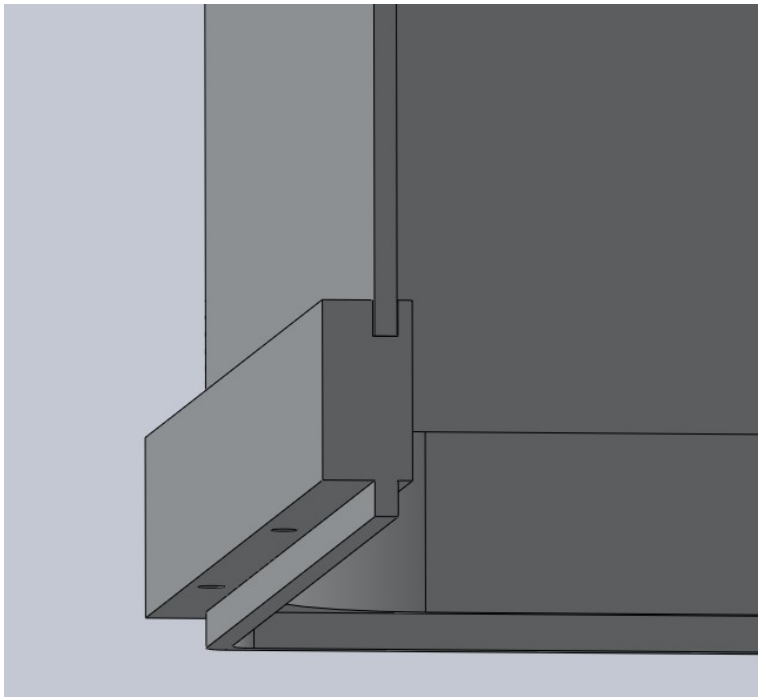
- External access to wire harnesses
- Hermetic connectors epoxied to a single plate
- Radiation shield access panel
- Epoxied bulkhead headers on the bench wall

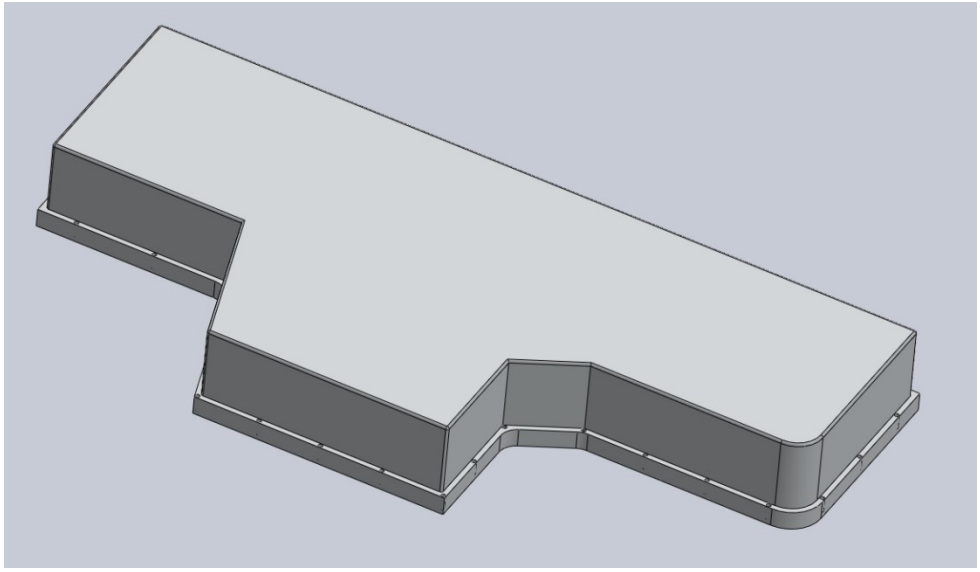




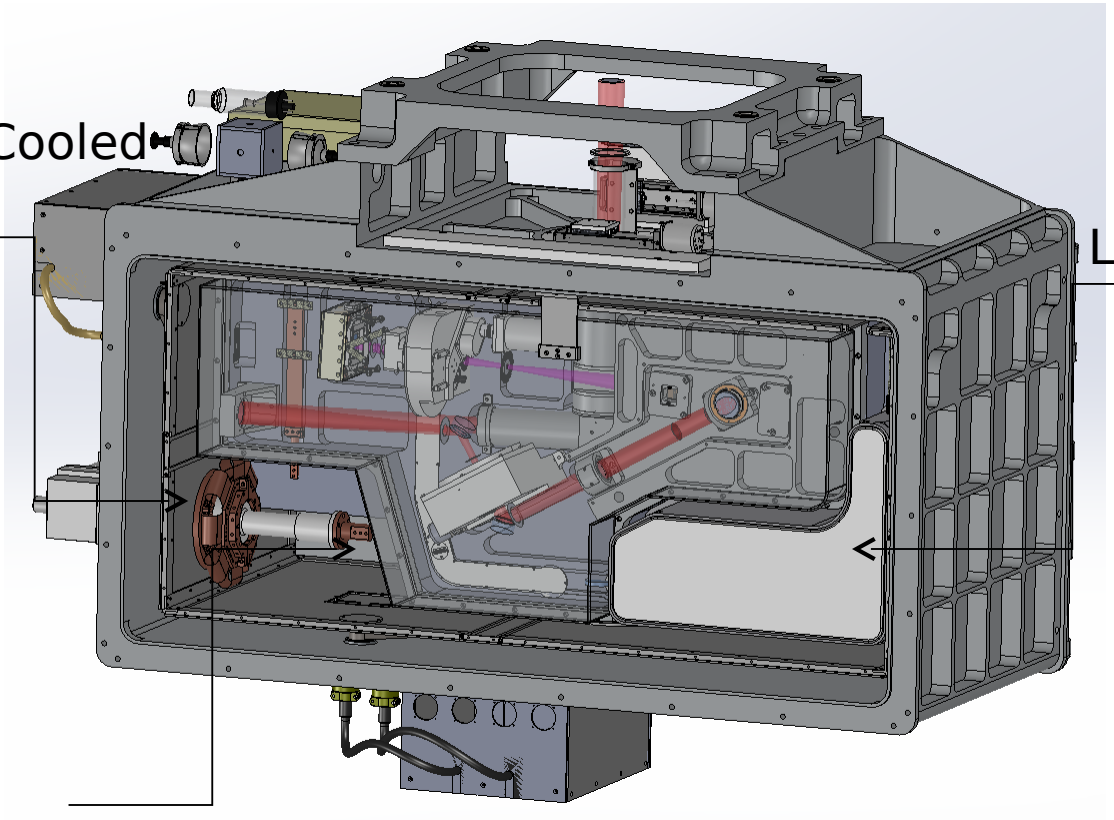
Optics Bench – *Photon Shield*

- Welded Pan (3mm thk)
- Machined Flange
- Pan welded to flange
- Painted inside, polished outside
- Qty 31 of #10 captive screws (~4” spacing)
- Guide pins used to align tongue and groove during installation



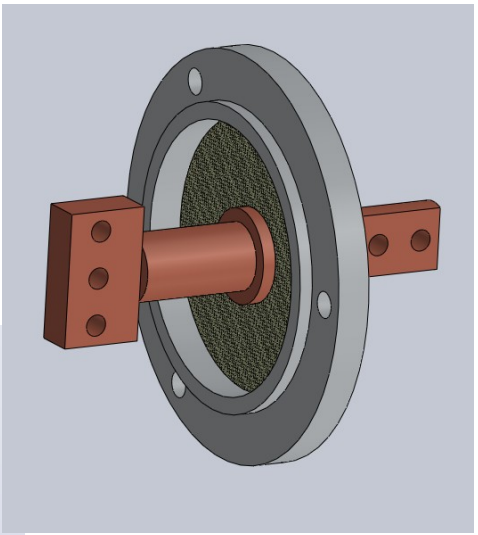


Thermal Design – *Hybrid Overview*

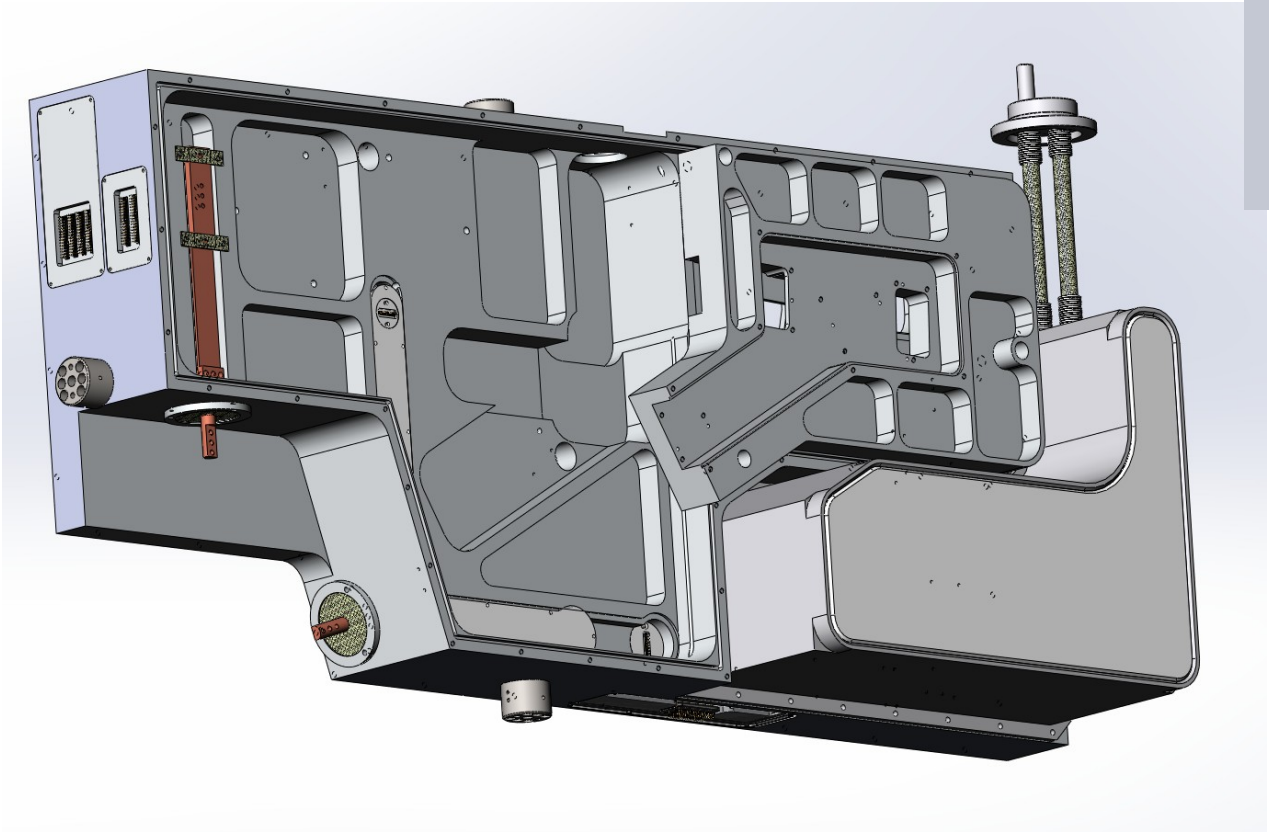


Thermal Design – *LN Can*

- LN Can – milled from billet and welded
- LN Neck – Welded bellows, stainless tubes
- Cooling Bus Bar mouned with G-10 tabs
- Bus Bar Feedthru epoxied to G-10 disk

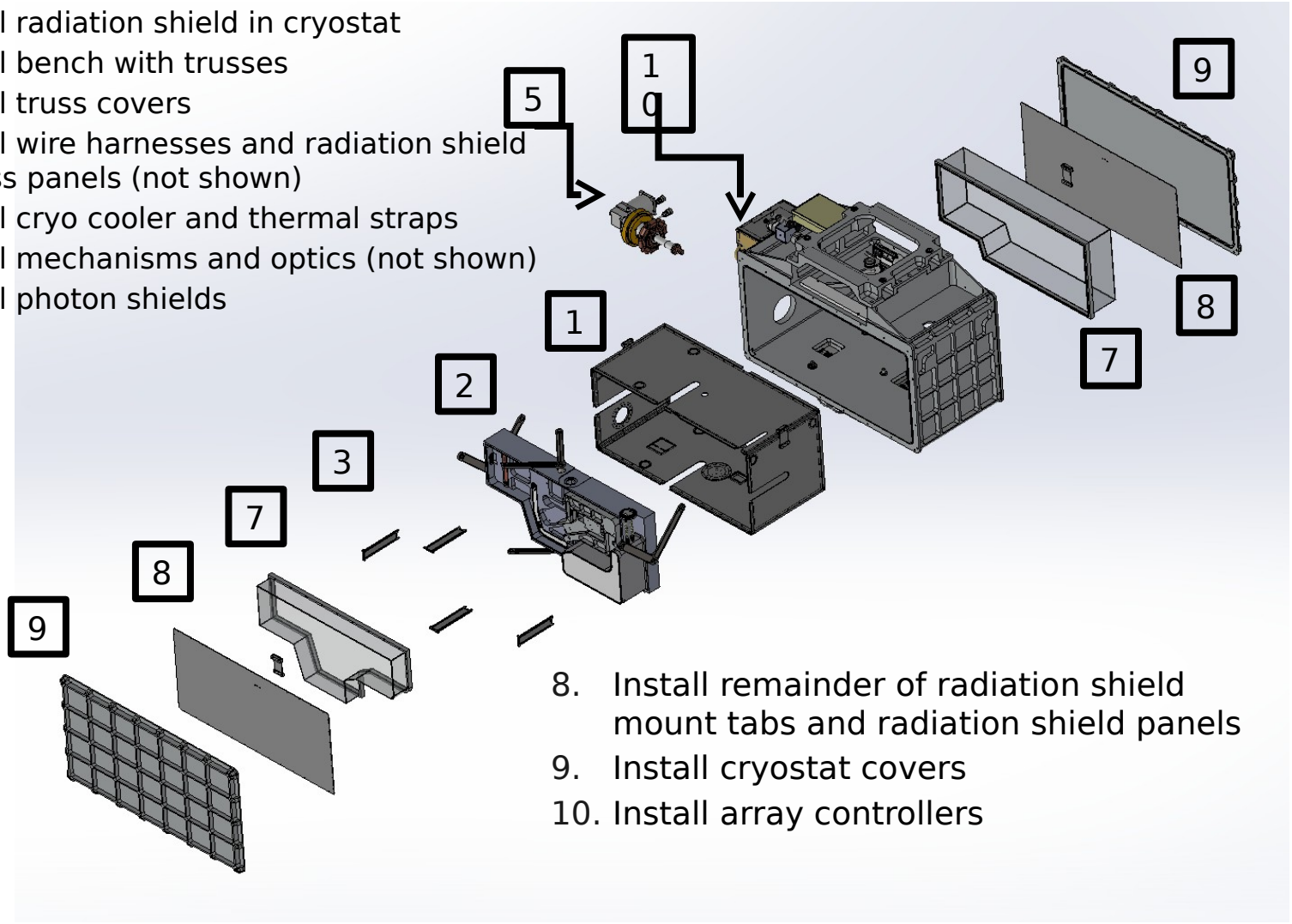


Bus Bar Feed Thru



Assembly

1. Install radiation shield in cryostat
2. Install bench with trusses
3. Install truss covers
4. Install wire harnesses and radiation shield access panels (not shown)
5. Install cryo cooler and thermal straps
6. Install mechanisms and optics (not shown)
7. Install photon shields



8. Install remainder of radiation shield mount tabs and radiation shield panels
9. Install cryostat covers
10. Install array controllers