

AMTD-II test preparation

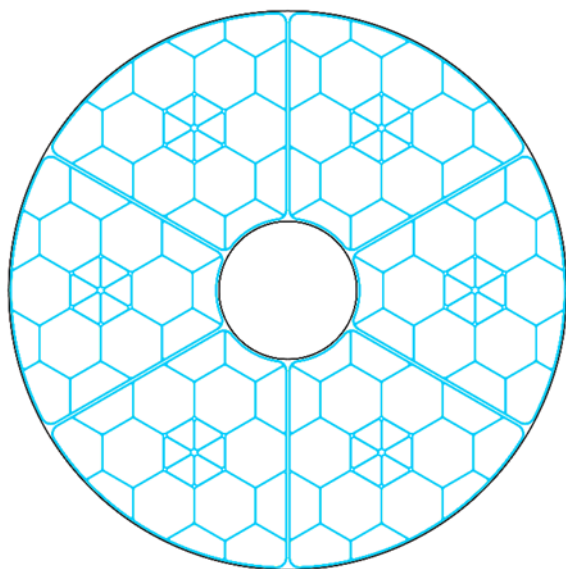
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NASA Marshall Space Flight Center

Mirror tech days

11-18-2014



Objectives



Perform optical test from 293° to 253° Kelvin (~20° to -20° C) to validate thermal model.

Perform vibration and acoustic test to validate model.

Facility modification is underway.

Goal: readiness in 2015.



AMTD-II mirrors



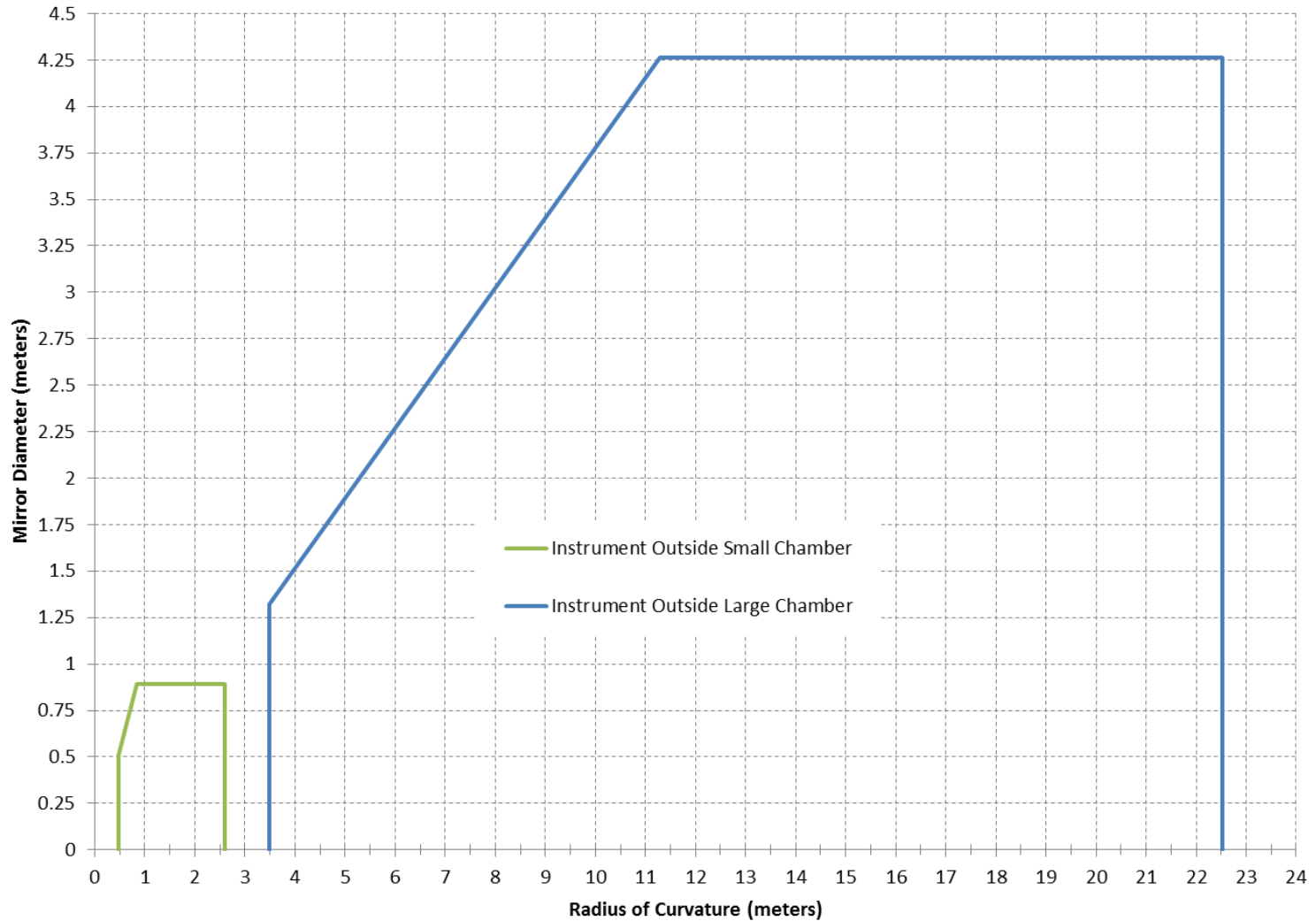
	ROC (m)	dia. (m)	R/#
Schott Zerodur	3.2	1.2	R/2.67
Exelis ULE	3.5	1.5	R/2.3
Xinetics SiC	16	1.35	R/11.8
Current large chamber test configuration	> 3.5	< 4.25	slower than R/2.7

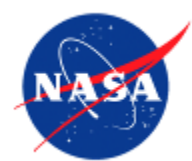


> 3.5m ROC and slower than R/2.7



XRCF Current Mirror Test Capabilities (Inside Helium Shroud)





X-ray cryogenic facility (XRCF)



History

Testing grazing-incidence x-ray telescopes (Chandra, Solar X-ray Imager, Solar B) since 1992.

Cryogenic optical interferometric testing of normal incidence, visible & IR telescope optics & components since 1999.

Large test chamber:

7.3 x 22.9 m (O.D. x L) horizontal cylinder

6 x 18.3 m (I.D. x L) test volume

4.25 x 9.4 m (I.D x L) Helium shroud

527 m: x-ray guide tube

Cryo shroud enclosure: 20K to 320K

Refrigeration system: 2 gaseous helium refrigerators; each capable of ~1 kW at 20K.

Vacuum systems: 10^{-8} Torr

Clean Rooms:

6000 sq. ft. Class 2,000

2000 sq. ft. Class 10,000

Onsite machine shop

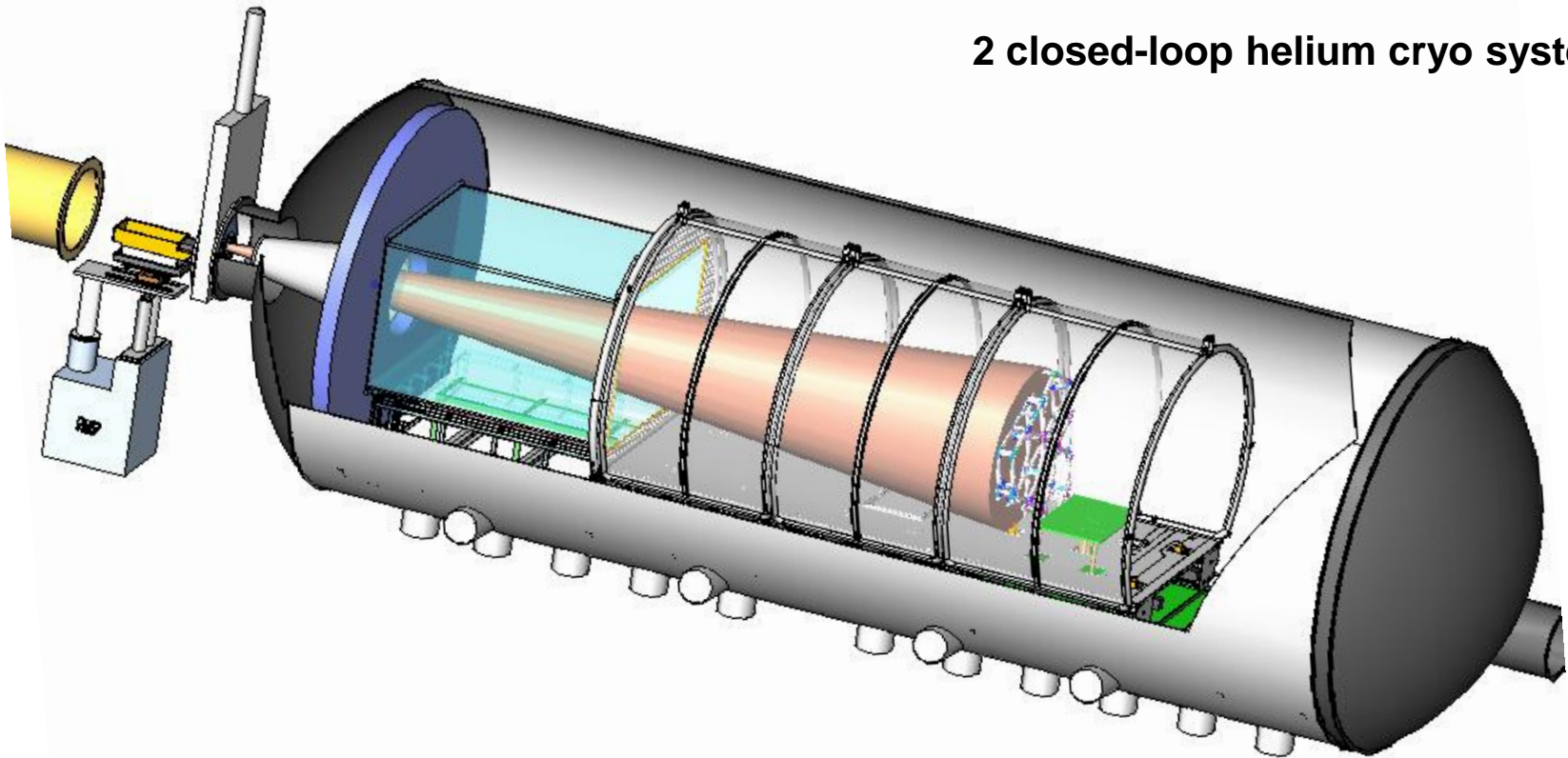
JWST PMSA test configuration

4 m dia., 16 m ROC

6 x 18.3 m test volume

4.25 m dia. Helium cooled shroud

2 closed-loop helium cryo systems





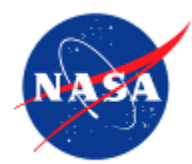
JWST mirror segments at XRCF





XRCF clean room

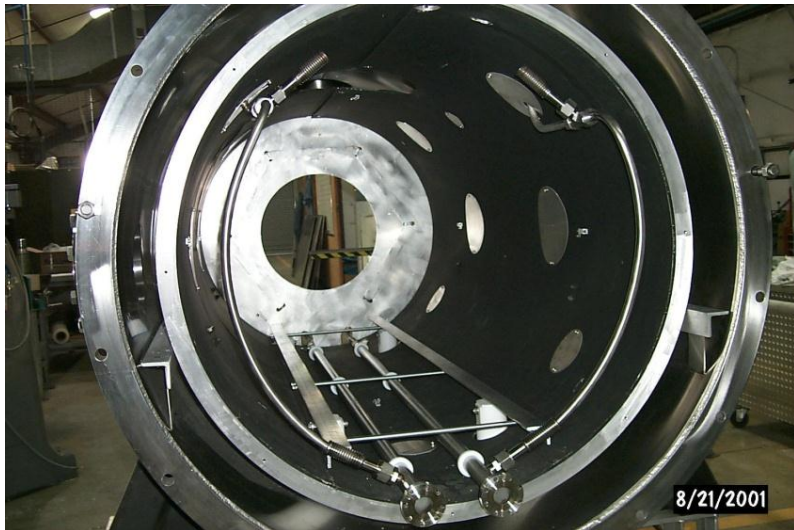




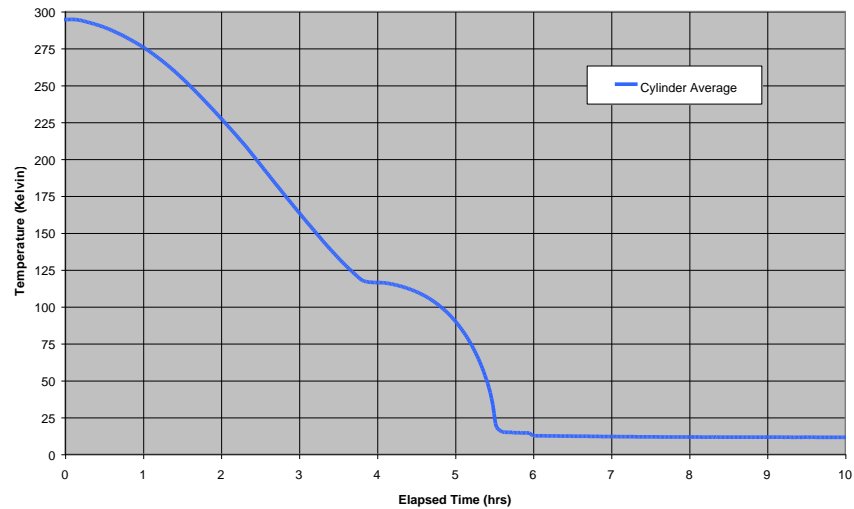
1x3 m optical test chamber



Vacuum Chamber: 1x3 m cylinder with helium shroud.
Optical View Ports: BK7 window; 150 mm dia. clear aperture.
Precision stage to provide interferometer pointing and alignment.
Operational Pressure: < 5 E-6 Torr
Temperature Range: 300 to 12K
Typical cryo optical test: 290, 200, 100, 70, 50, 30K, 2 cycles; 3 weeks duration.

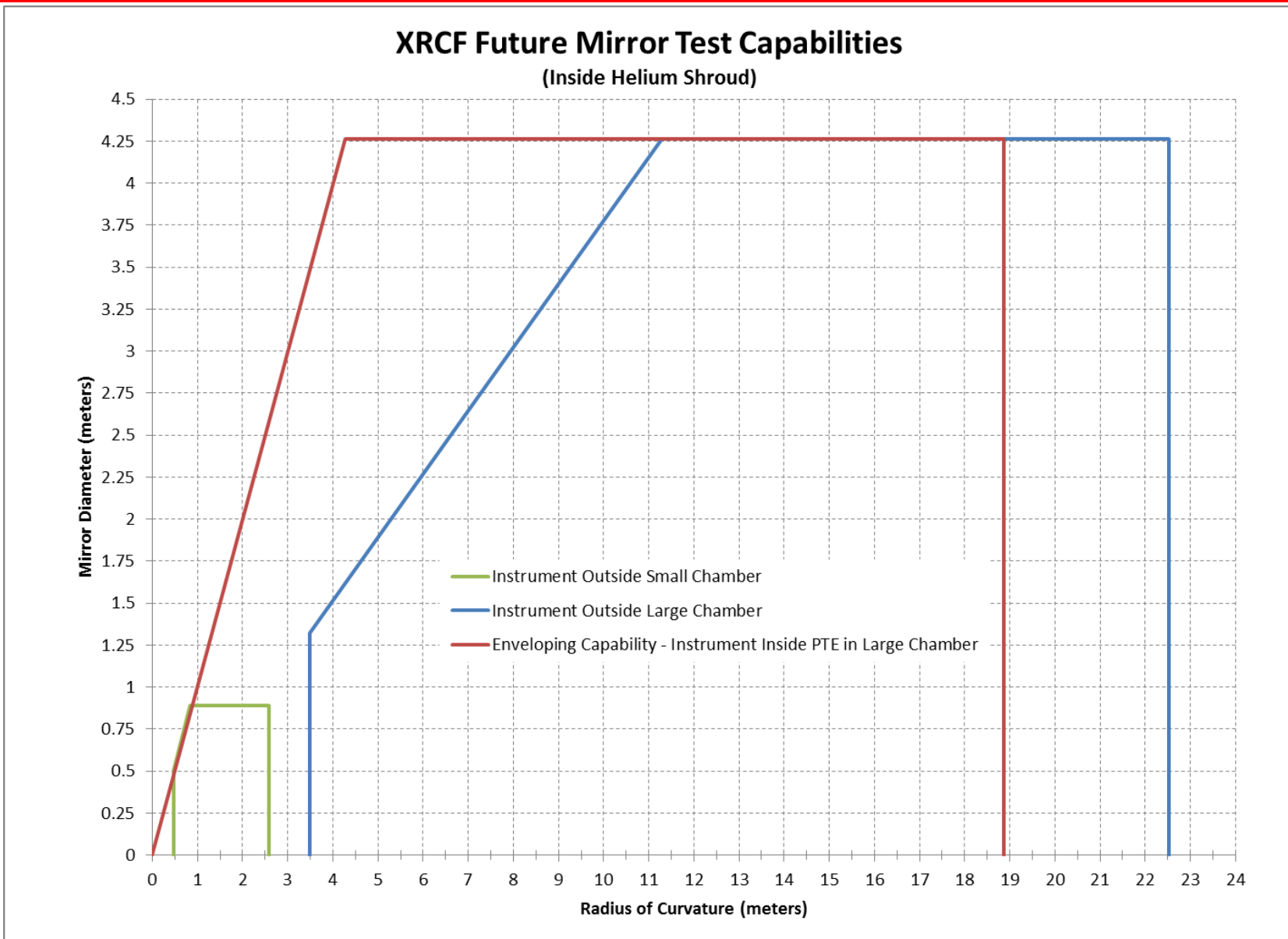


CryoOptical Test Chamber
Shroud Verification Test



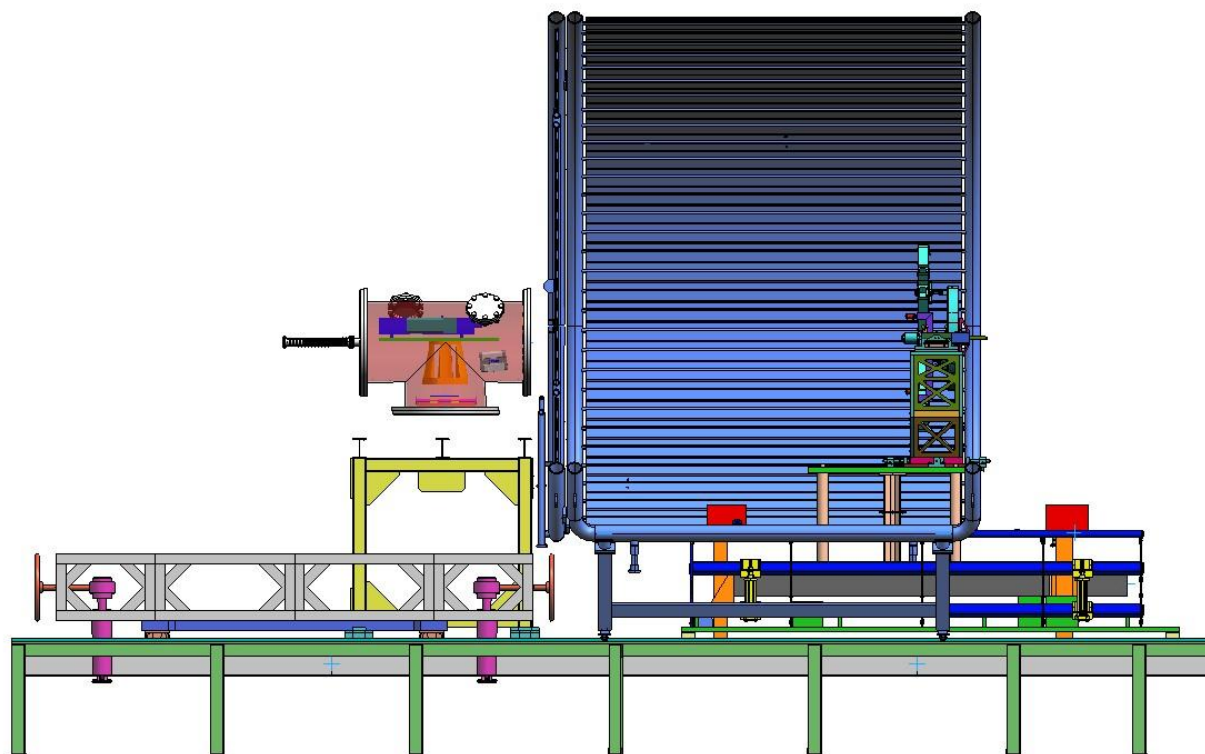
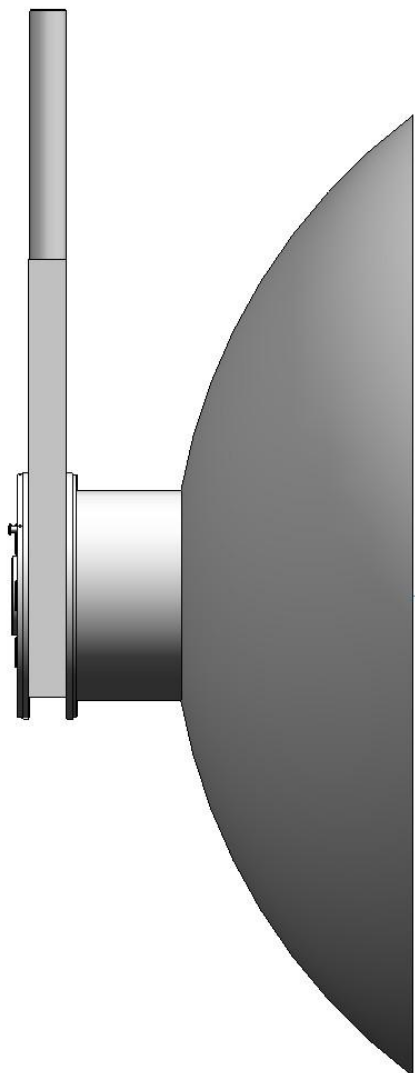


Pressure tight enclosure (PTE) = R/1



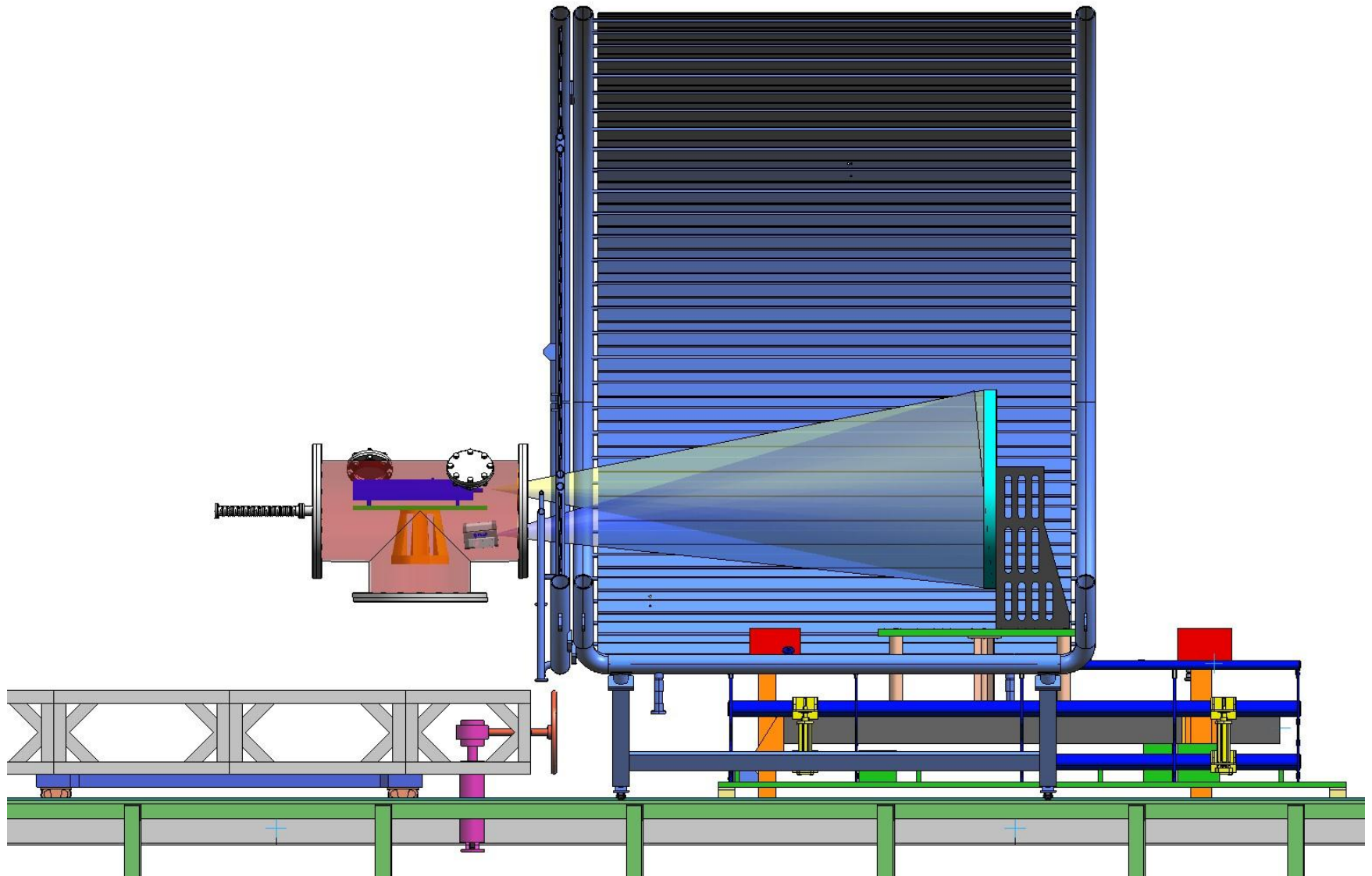


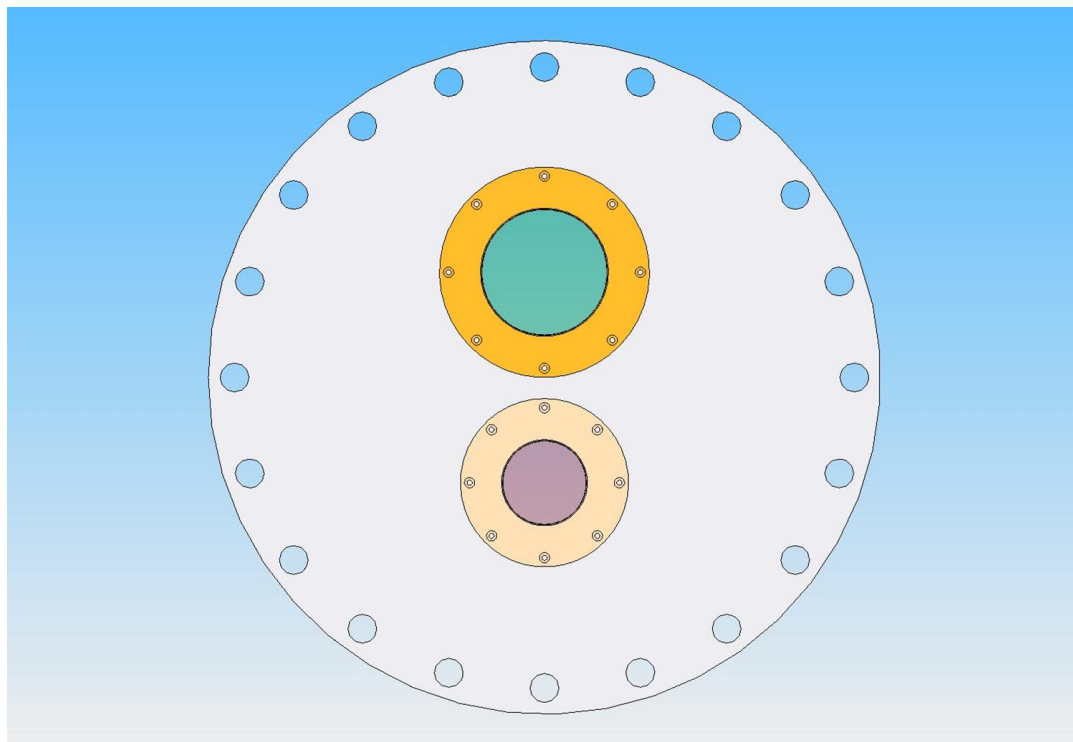
Proposed AMTD-II mirror test configuration





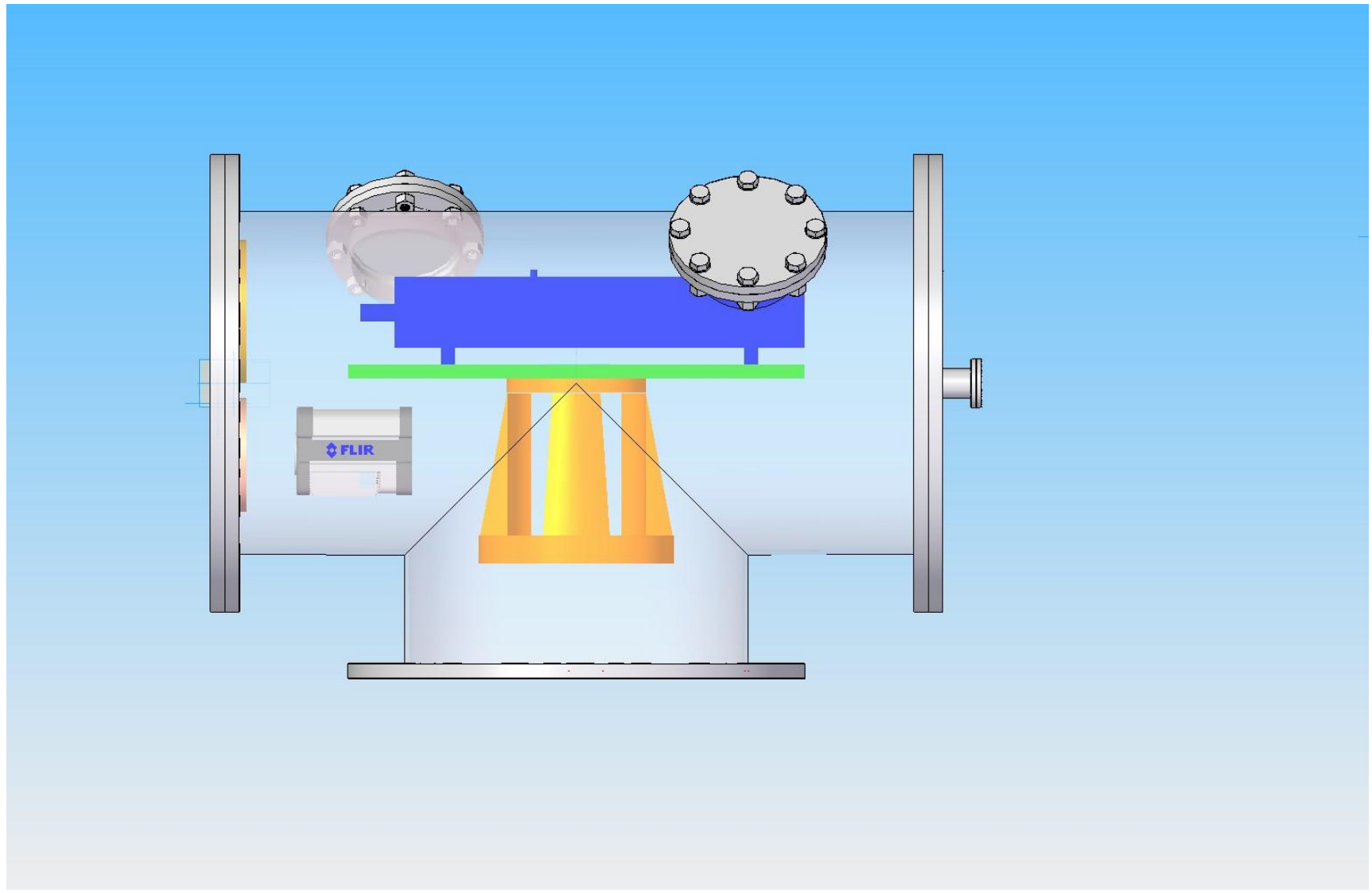
Pressure tight enclosure (PTE) test configuration





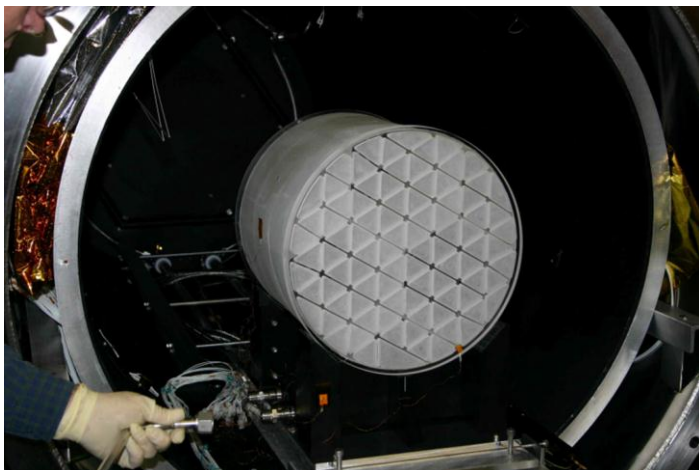
150mm clear aperture
BK7 window

100mm sapphire window
• IR camera

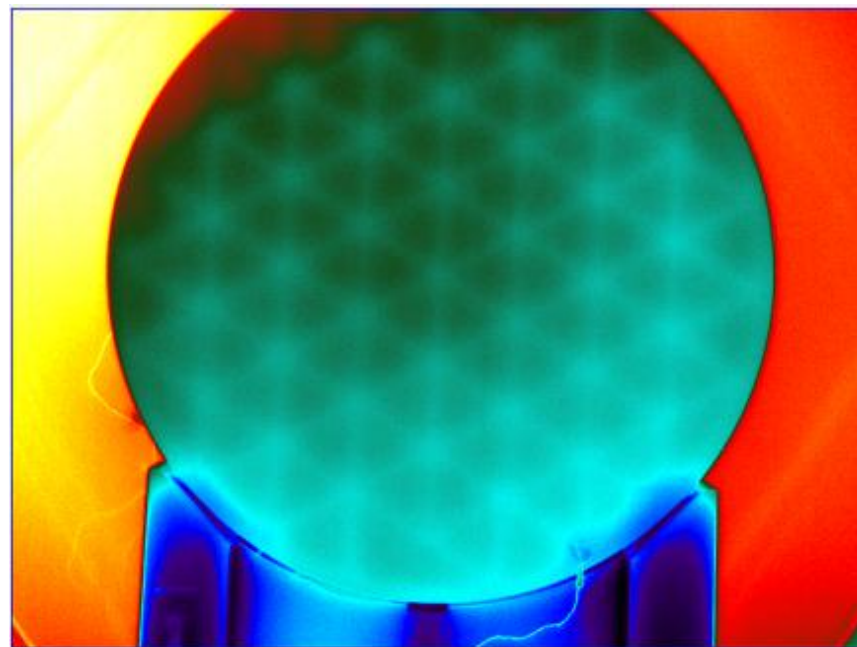




- Repeat stack core mirror optical test in small chamber with front to rear thermal gradient.
- Modal test with interferometer.



Improve IR thermal capability to record temperature gradient.





JWST Backplane stability test article (BSTA)





Thank you



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PhaseCam 5010 interferometer with modal capability

- 1954 x 1967 pixels
- Effective array: 977 x 983 pixels
- PV uncalibrated accuracy: 15 nm
- RMS uncalibrated accuracy: 3 nm
- PV repeatability: 0.24 nm
- RMS repeatability: 0.05 nm
- PV precision: 2.64 nm
- RMS precision: 0.51 nm

