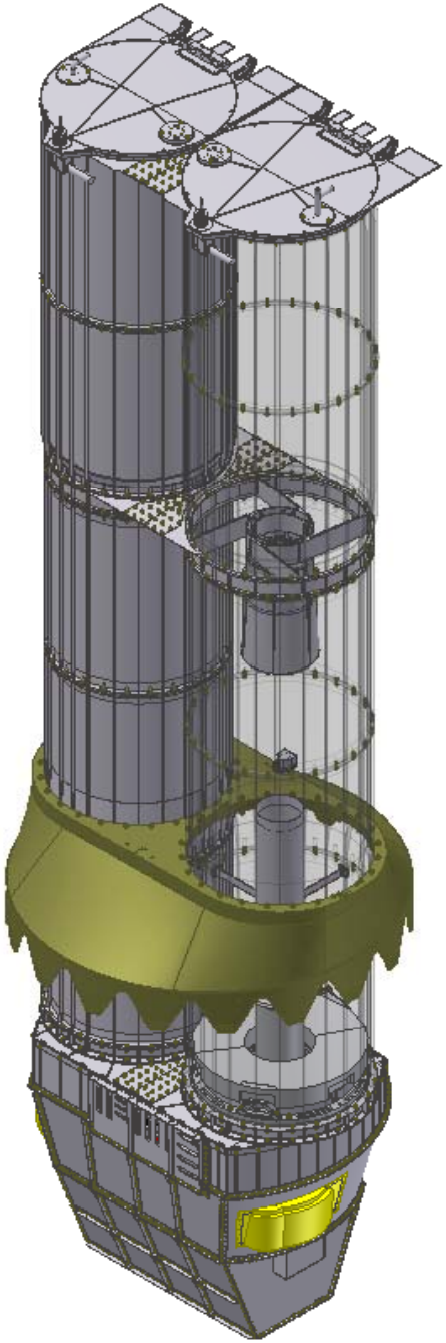
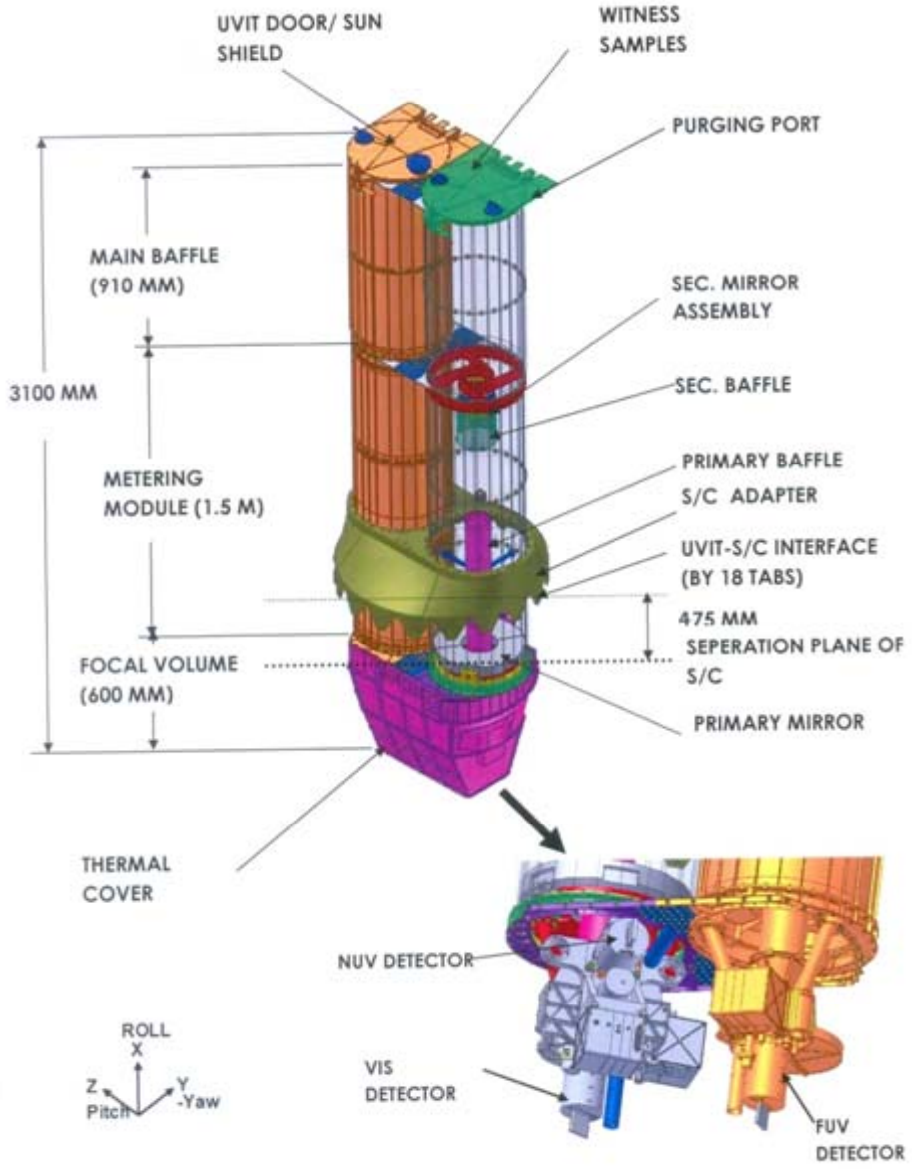
Thermal Control of the UVIT payload on Astrosat

P.K. Mahesh, Indian Institute of Astrophysics, Bangalore

Meeting of the PMB @ IIA

on 8-6-2012





UVIT PAYLOAD

Comparison of design goals and predictions by analysis

Design Goals	Prediction by Analysis
Temperature of telescope tubes to be between 18deg C and 22deg C	17.5(Minimum) and 22.8(Maximum) in cold invar case
Axial variation of temperature on telescope tubes to be within +/-2deg C	2.3deg C on NUV side in cold focal case and cold invar cases.
Circumferential variation of temperature on telescope tubes to be within 5deg C	2.8deg C in cold focal case.
Temporal variation of temperature at a given point within 1000secs (~15 minutes) (in quasi steady state) to be within 0.3deg C	0.77deg C (TT2 bottom portion in FUV side) in hot focal case (Maximum) and 0.02deg C (TT2 top portion in NUV side) in hot focal case (Minimum)

Comparison of design goals and predictions by analysis (Contd).

Temperature (during operation) of detectors (CPU's) between 0deg C and 20deg C	16.4(Minimum) 17.9(Maximum)
Temperature (during operation) of High Voltage Units (HVU's) between 0deg C and 30deg C	12.7(Minimum) 18.4(Maximum)
Duty cycle of heaters not to exceed 65%	64% in MB1 in cold invar case.

Heat Dissipation of UVIT Components

Sl. no	Component name	Heat dissipation
1	Filter motor	0.5 W (3 no's)
2	Detector	1.67 W (3 no's)
3	High voltage box	3.2 W (3 no's)
Total heat dissipation		16.1 W

List of control heaters

Sl. No	Component name	Control heaters (W)	Cut- in temperature (°C)	Cut- off temperature (°C)
1.	Main baffle 1	68.75	0	10
2.	Main baffle 2	51.25	18	22
3.	TT1- 1	4.5	19	21
4.	TT1- 2	5.25	19	21
5.	TT2- 1	8.125	19	21
6.	TT2- 2	5	19	21
7.	TT3- 1	10.5	19	21
8.	TT3- 2	2.25	19	21
9.	Primary heater plate	4.5	19	21
10.	Spider ring	7.5	19	21
11.	Bottom ring - Inside	3	19	21
12.	Bottom ring – Outside	4.5	19	21
13.	Focal volume – FUV side	19	16	19
14.	Focal volume – NUV side	11.25	16	19

Total heater power is 205.375 W.

Other Heaters

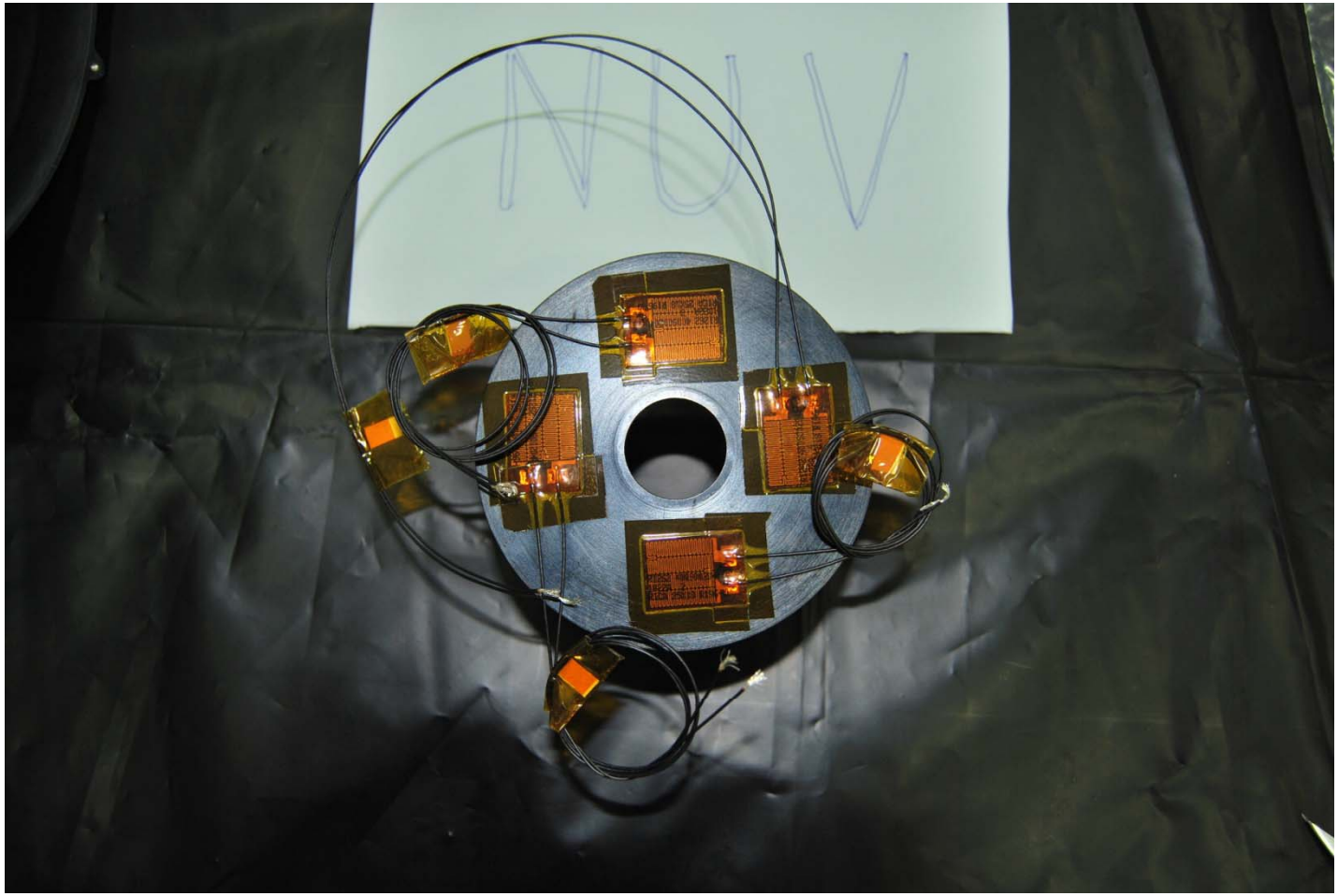
- De-contamination heaters (7W for each Primary mirror and secondary mirror and 15W for FUV and NUV filter wheel)
- Heaters for CPU for use during launch (15W each)
- Heater of 30W to maintain the filters of the Far Ultra-Violet (FUV) channel at a temperature of 35deg C. This is to avoid the geocoronal line in the spectrum.

Details of thermistors

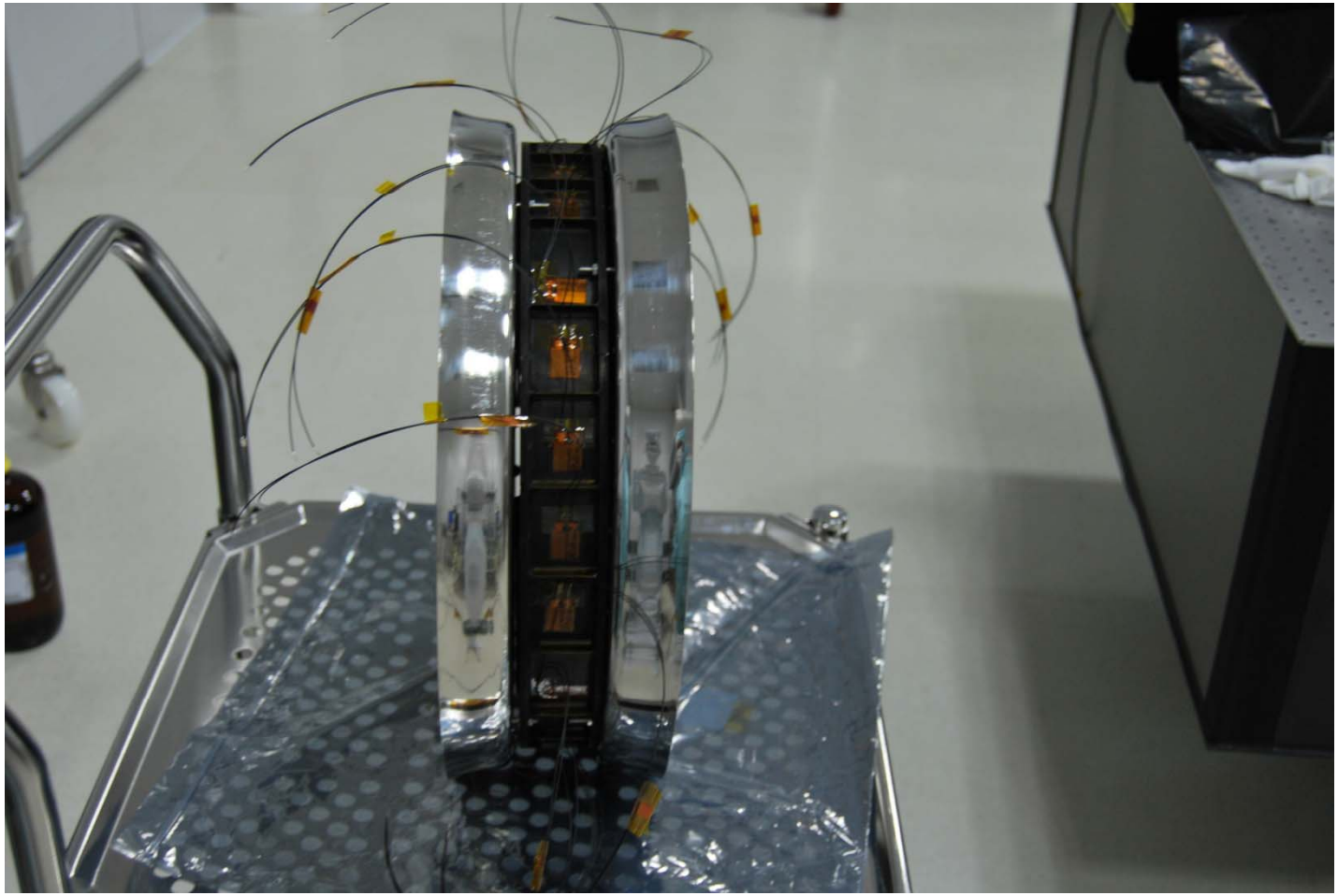
- No. of thermistors-75
- Control thermistors-50
- Monitoring thermistors-25

Primary heater plate

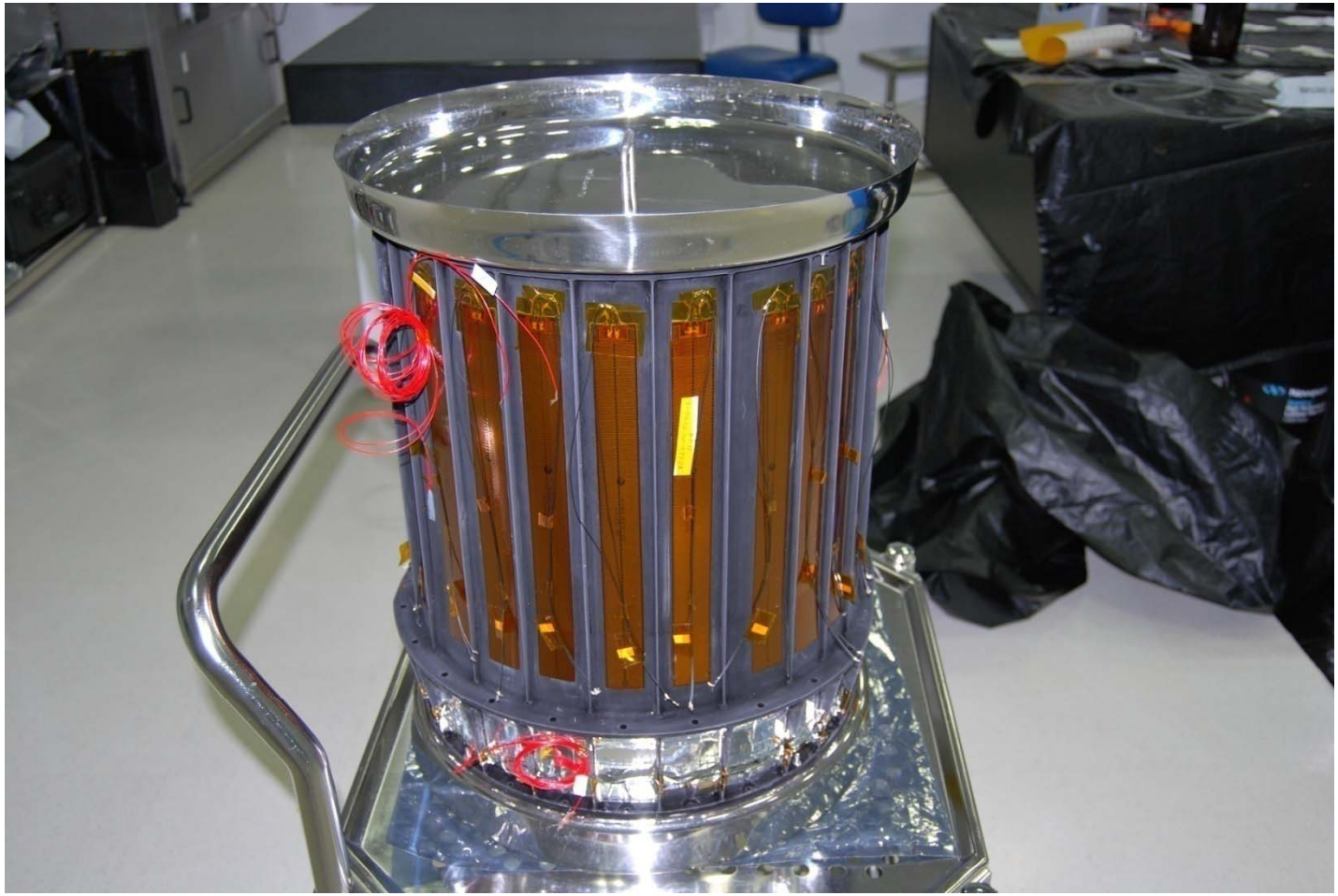
Secondary heater plate



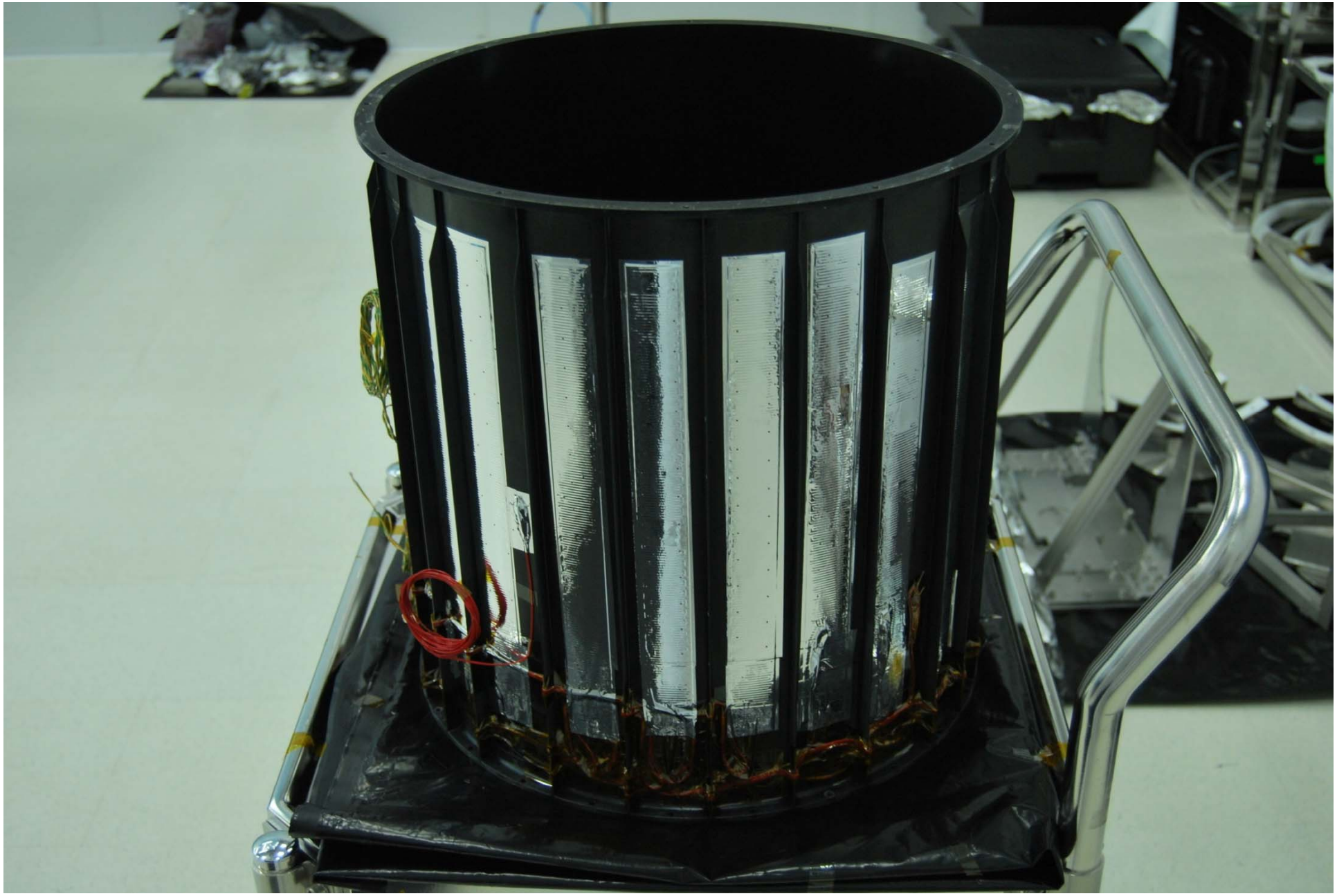
Spider



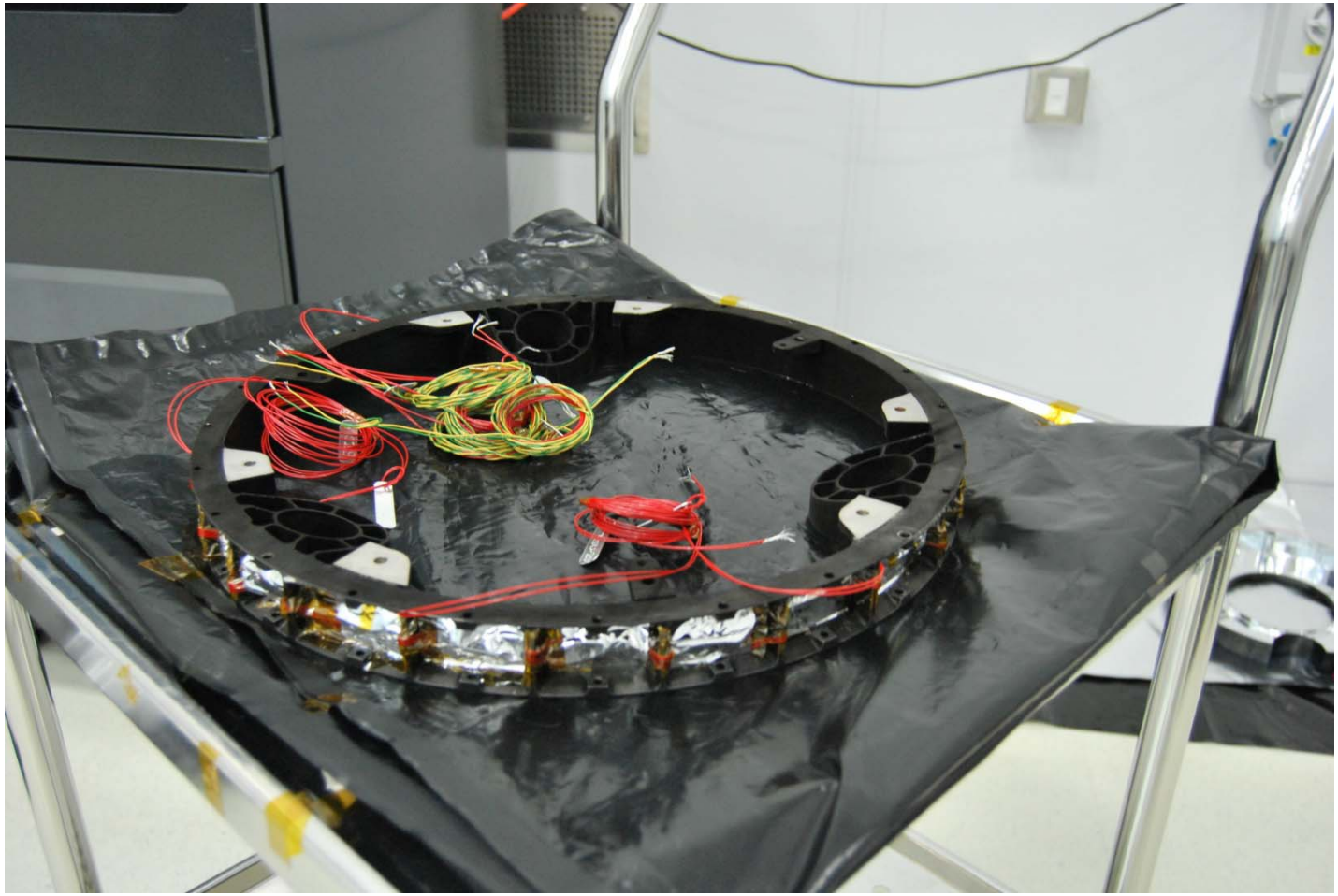
Telescope tube



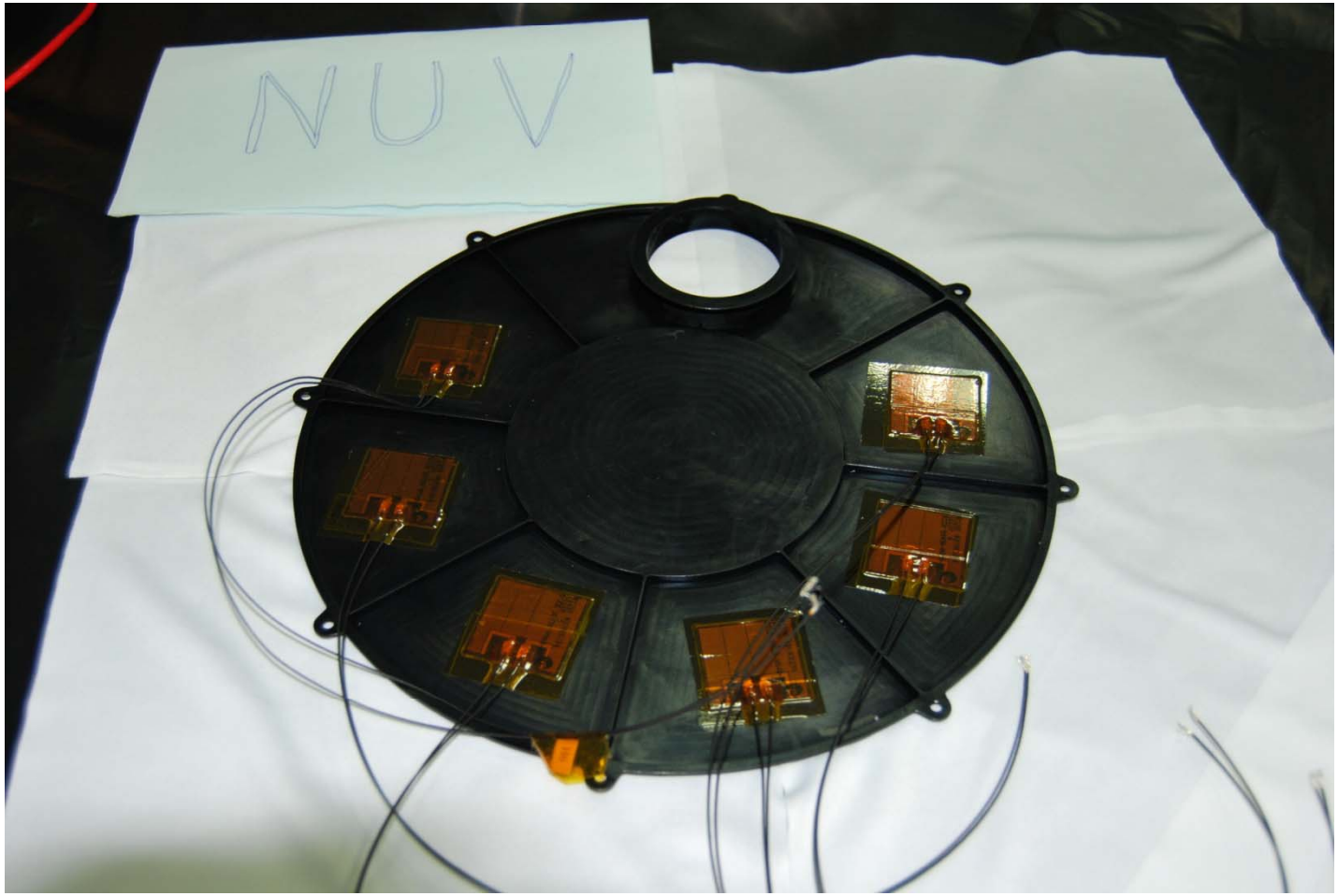
Telescope tube



Bottom Ring



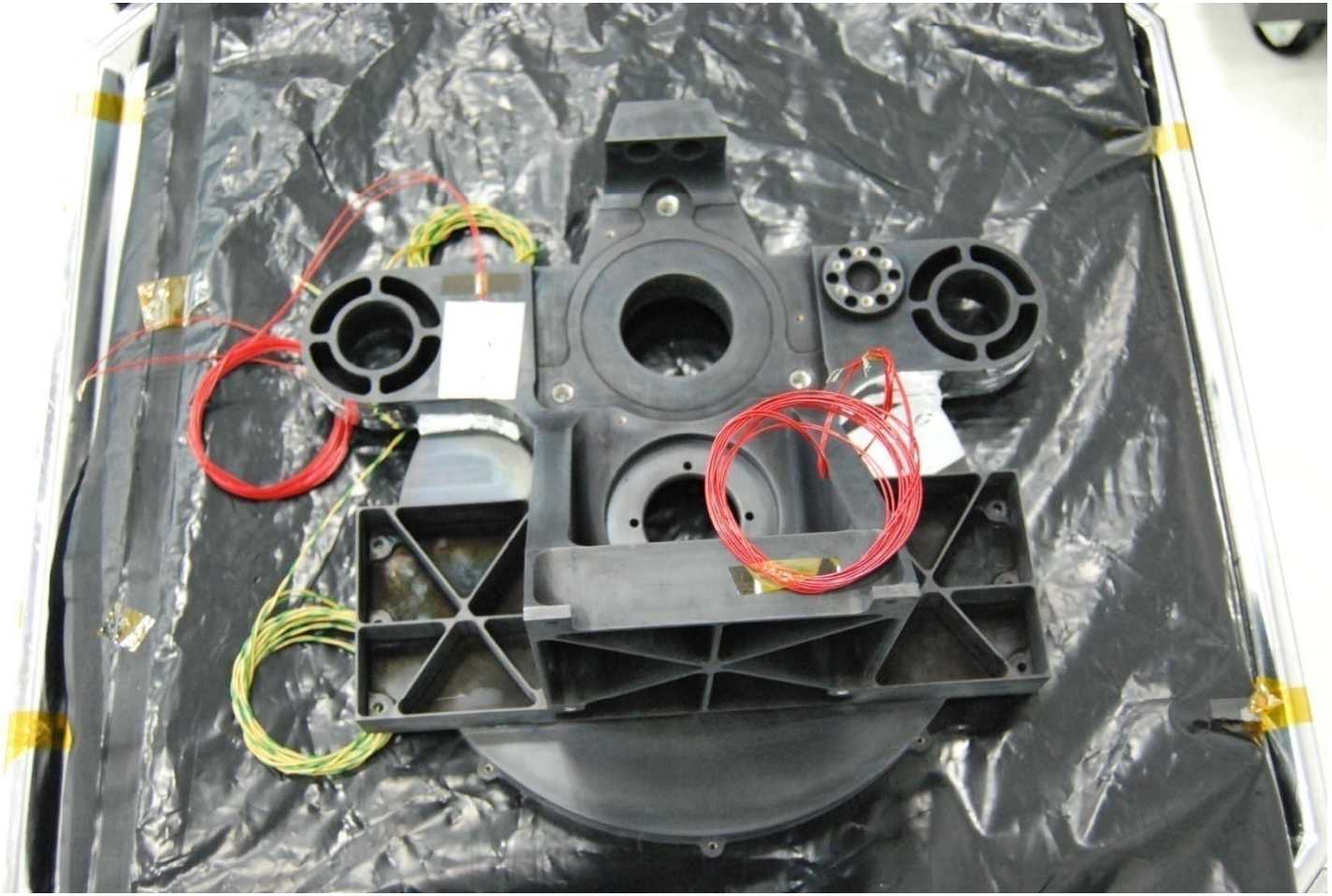
NUV Filter wheel cover



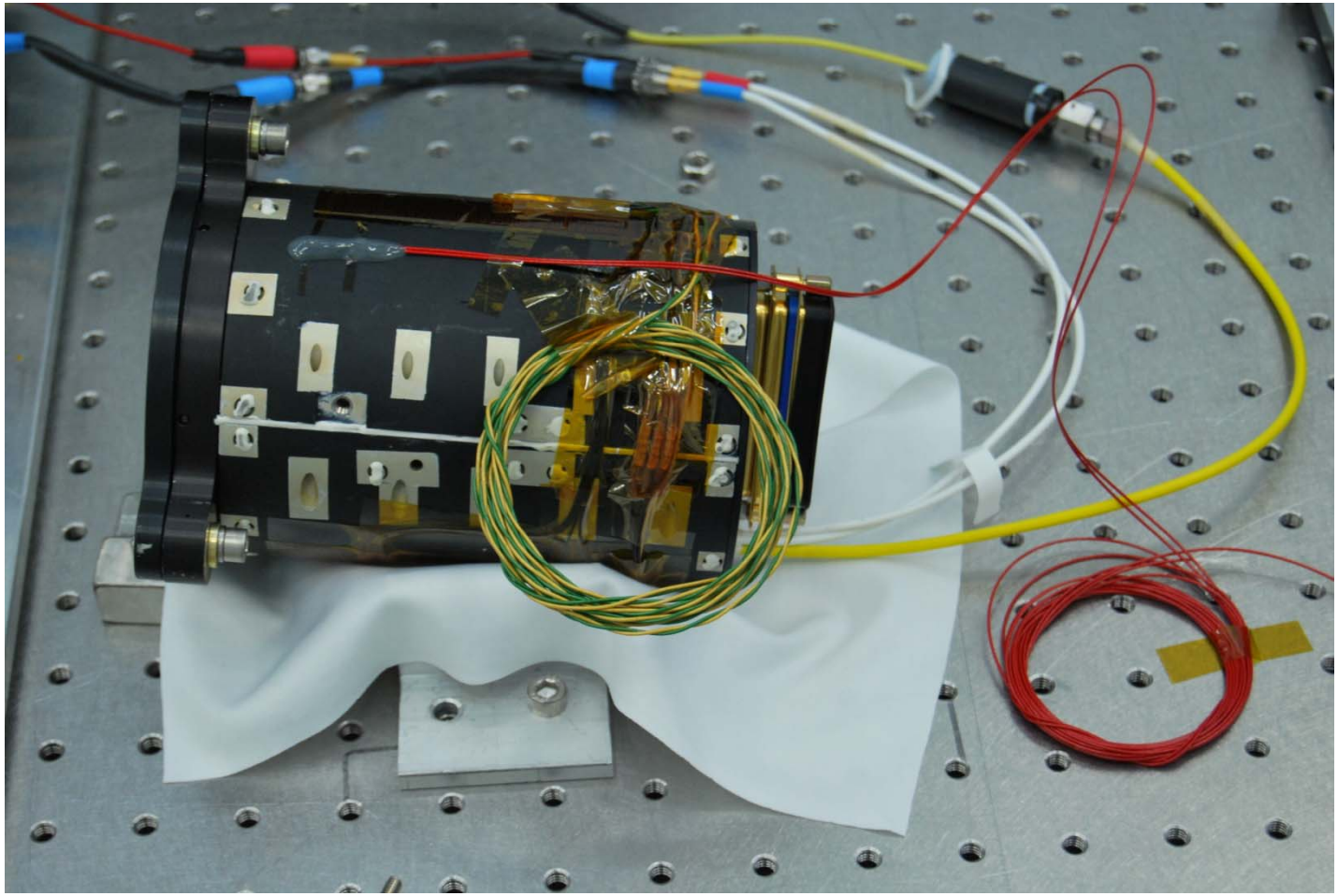
FUV filter wheel cover

Detector Mount Bracket

Detector Mount Bracket



Camera Proximity Unit

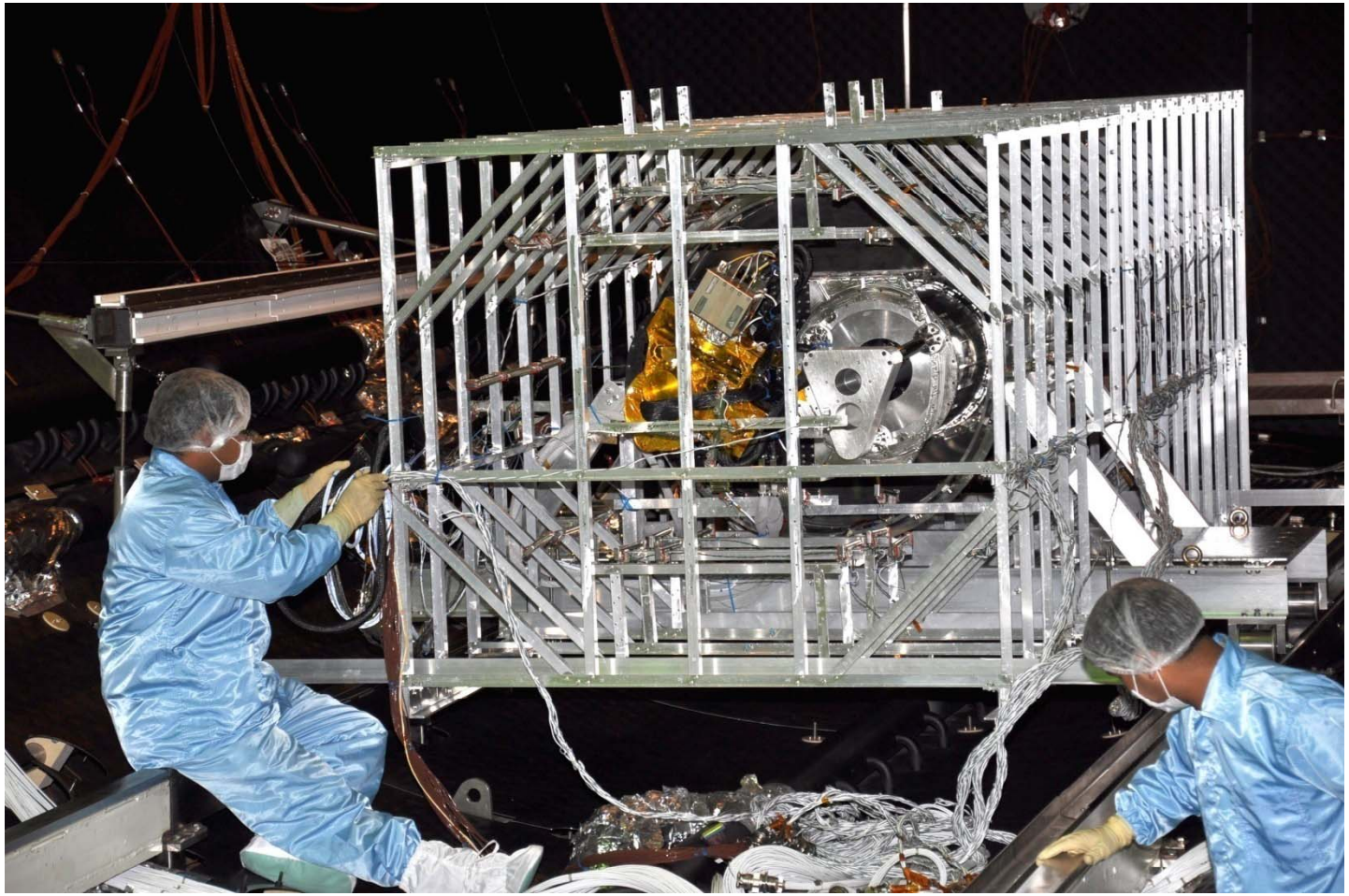


Tests done.

- Thermo-vacuum test: Checked and confirmed the thermal insulation between focal volume and optical cavity.
- Checked and quantified the change in length of the telescope metering structure.

  Thermal shift of focus 0.03375 mm/deg C
  (Temperature of laboratory was changed from 15deg C to 26deg C)

Cage for IR lamps
(For thermovacuum test)



Pending work

- Interconnection of heaters and thermistors at the following interfaces/junctions:

1. Junctions of door and main baffle 1
2. Junctions of spider and main baffle
3. Spiders
4. Junctions of TT2's and
5. FUV filter cover.

Pending work……

- Check connections of heaters and thermistors
- Clamps for mounting MLI at MB tie and thermal cover
- Fix MLI on payload-after vibration and thermovac tests
- Fix OSR-at SHAR