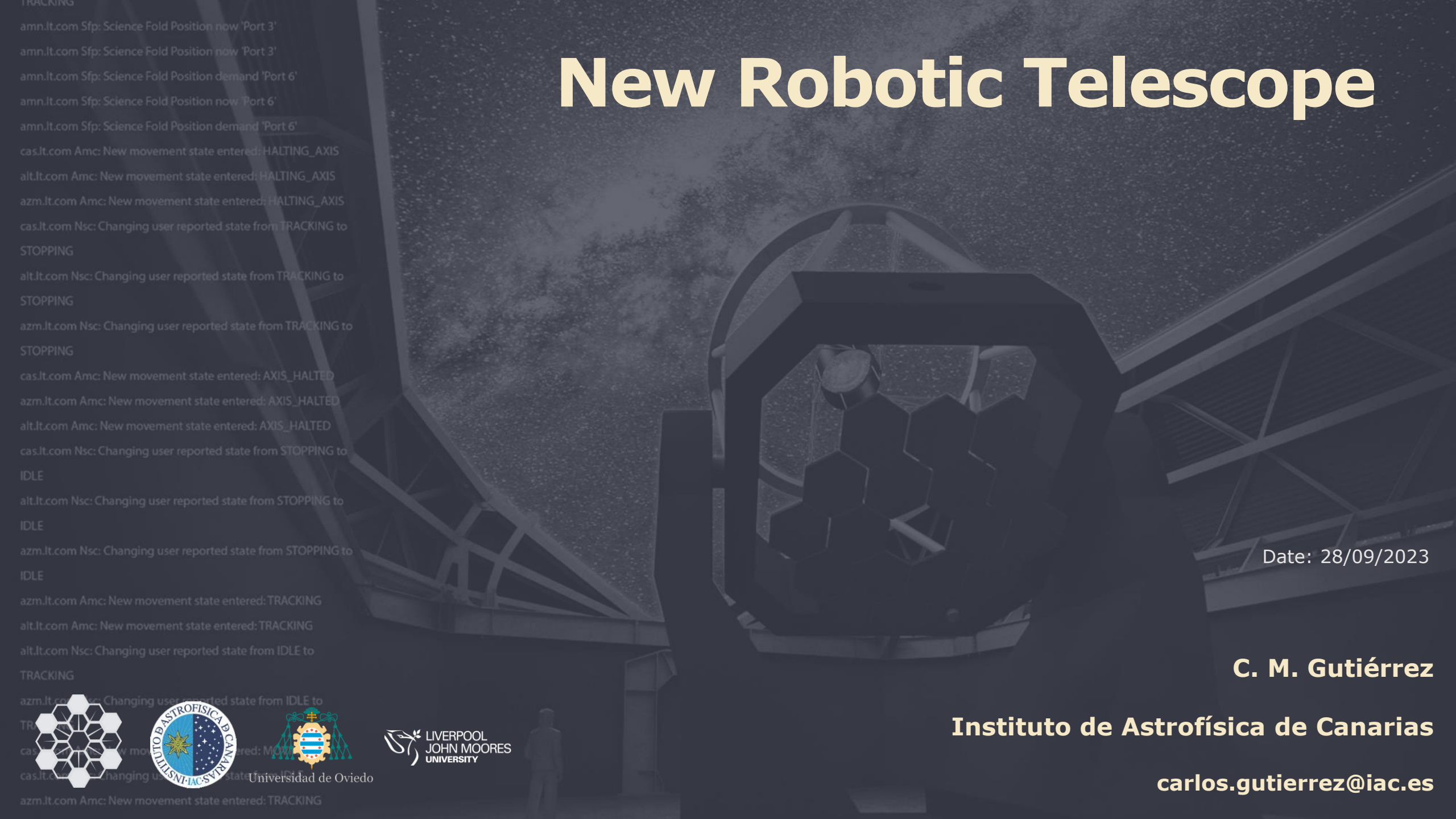


New Robotic Telescope

Date: 28/09/2023

C. M. Gutiérrez

Instituto de Astrofísica de Canarias

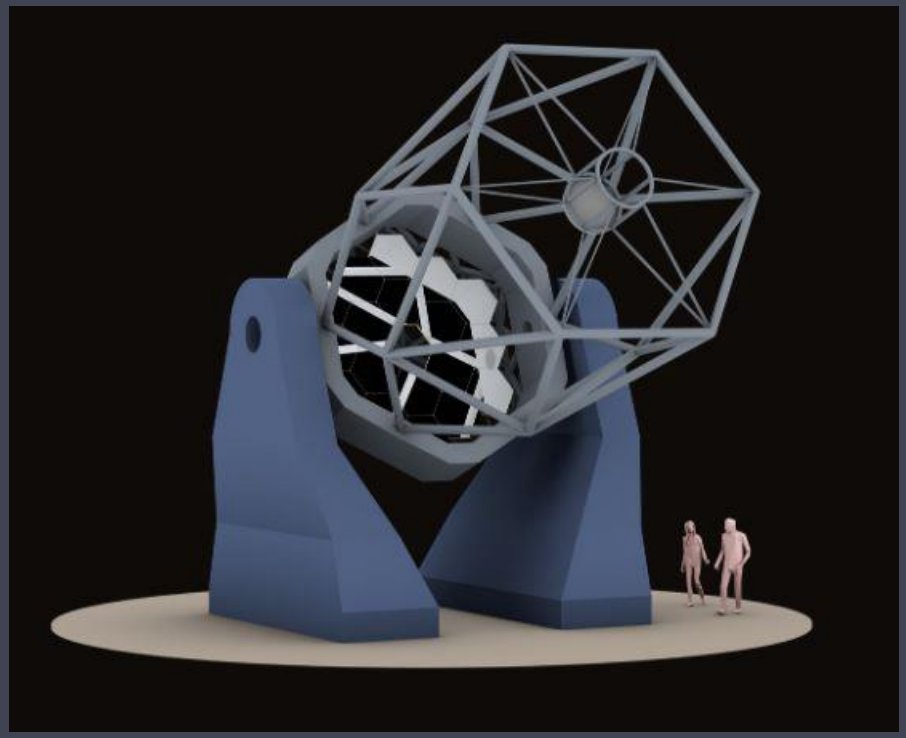
carlos.gutierrez@iac.es

Universidad de Oviedo

LIVERPOOL JOHN MOORES UNIVERSITY

NEW ROBOTIC TELESCOPE

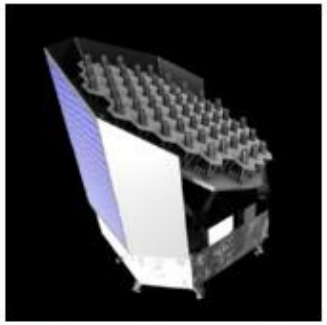
- International collaboration to build the largest (∅ 4 m) entirely robotic telescope in the world
- Quick response (on target in 30 s)
- Sited at ORM in La Palma
- Based on the success of the LT and GTC
- Standard for future telescopes



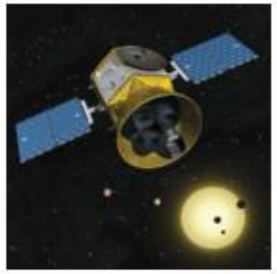
NEW ROBOTIC TELESCOPE

- A 4 m aperture diameter, robotic mode
- A Ritchey–Chretien design (f/2 prime focus, f/10 total)
- Fast slewing requirement, i. e. lightweight structure (~60 TM)
- Rapid response (30 sec on target)
- FoV ~ 5’-30' diameter at Cassegrain focus
- Full optical and near IR ranges
- Focal stations at direct and folded Cassegrain.
- Image elongation no greater than 0.2" in ten minutes
- Optimal image quality dominated by seeing (median ~0.7“ in La Palma)

NEW ROBOTIC TELESCOPE

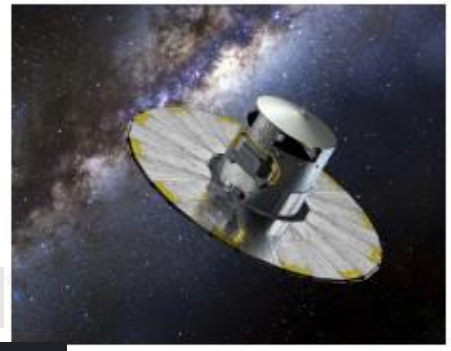


PLATO: launch **2026**



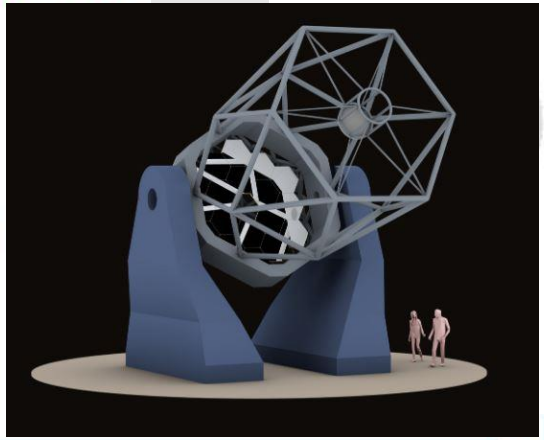
TESS: launch **2018**

SVOM: launch **2024**



Gaia DR2 2018 DR3 2021

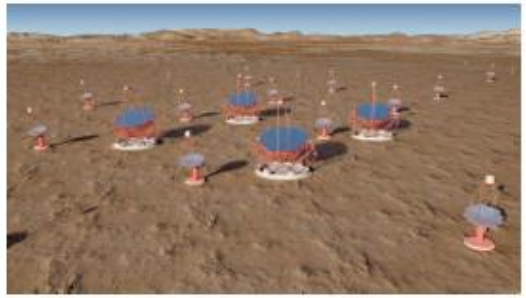
ALIGO/aVirgo full sensitivity 2022



NRT

LSST: science first light 2021

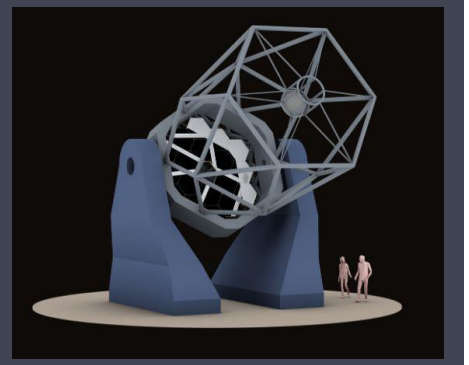
CTA completed ~2023

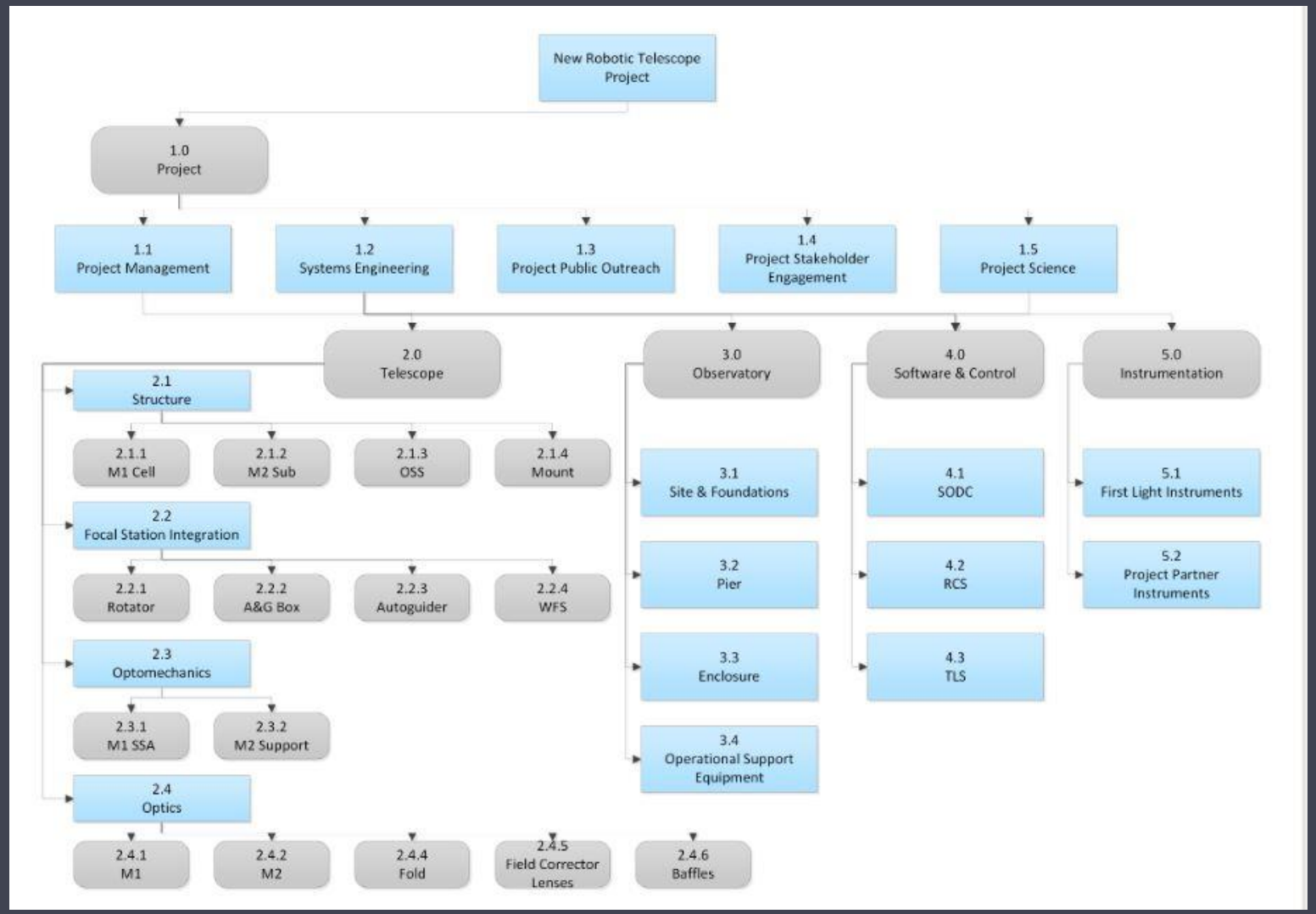


SKA phase 1 completed 2020


INSTITUTO DE ASTROFISICA DE CANARIAS · IAC ·

NEW ROBOTIC TELESCOPE



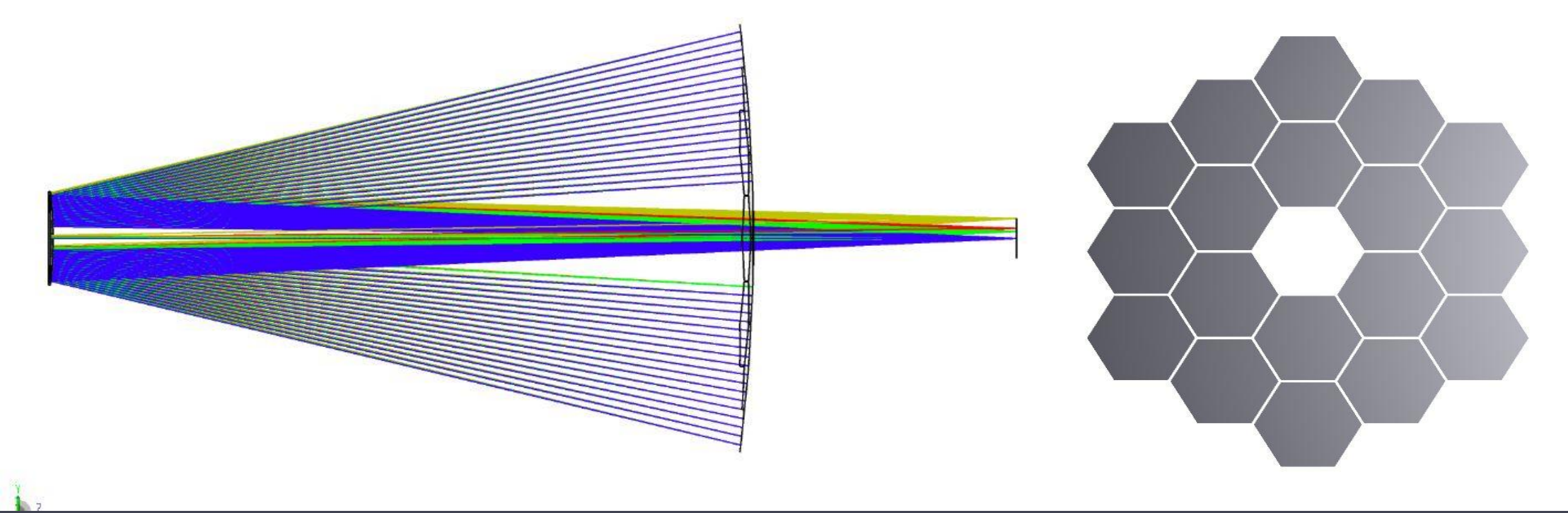



TEC
NASA
NRT
Nuevo
Telescopio
Robótico

IACTEC

NEW ROBOTIC TELESCOPE: OPTICS

- A 4 m primary monolithic mirror ~5,500 kg.
- That can be largely reduced by constructing it out of hexagonal segments (the segments can be much thinner).

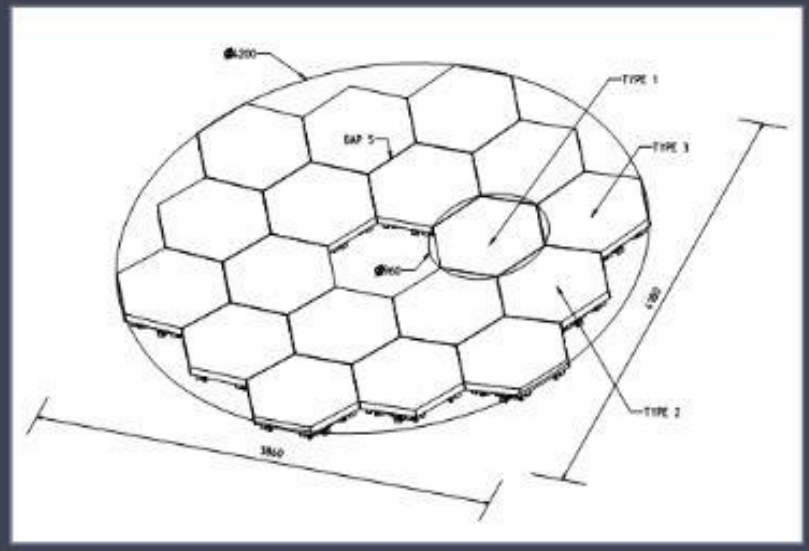


HEX-18 possibility to produce them at IAC; optomechanics similar to GTC

NEW ROBOTIC TELESCOPE: OPTICS

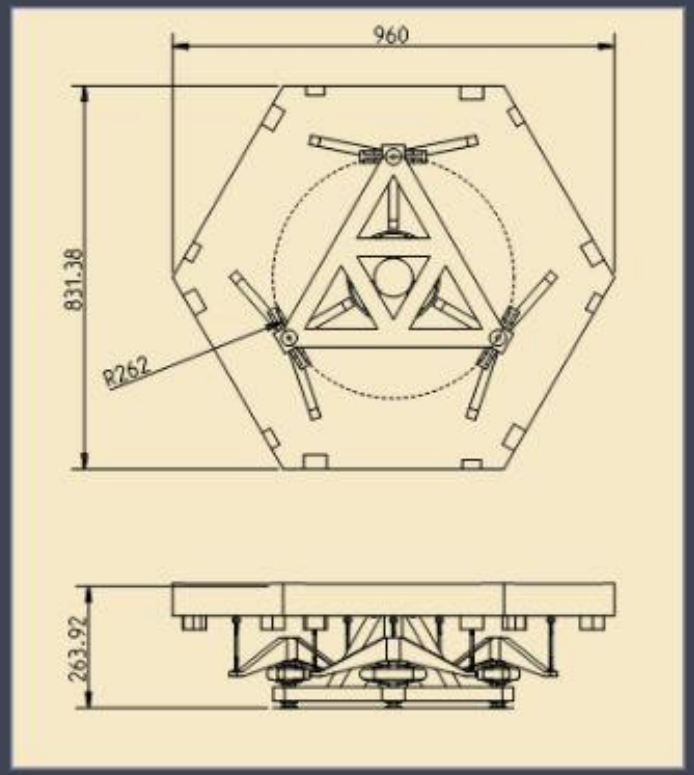
	Distance (mm)	Radius (mm) (edge)	RoC (mm)	Conic
M1	-6657.69	2090	-16770	-1.020449
M2	6657.69	455.3 (465.3)	-4257.7	-2.331897
BFD	1650	264.7		
Fold mirror	850	190 (200)		
Focal plane		194.6		

- Richey-Chretien optical configuration
  - f/10.635
  - Plate scale 220µm/arcsec
- Ø4.18m, 18 segment primary mirror
  - Segment adjustment – Tip, tilt, piston
- Multiple instruments at Cassegrain focal station
  - 1x Straight Through Instrument
  - 6 x Folded Port Instruments
- Back Focal Distance (BFD) of 2.5m
- Cassegrain focal station field of view
  - 30 arcmin - straight through port
  - 14 arcmin - folded ports

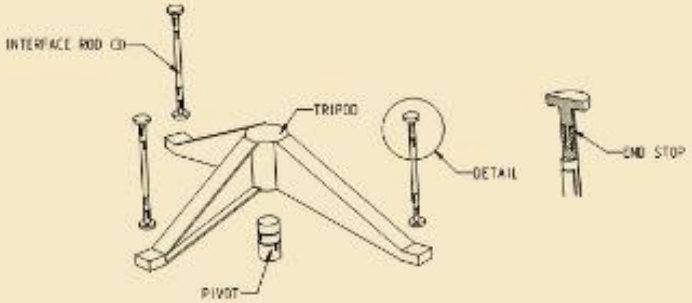


NEW ROBOTIC TELESCOPE: M1

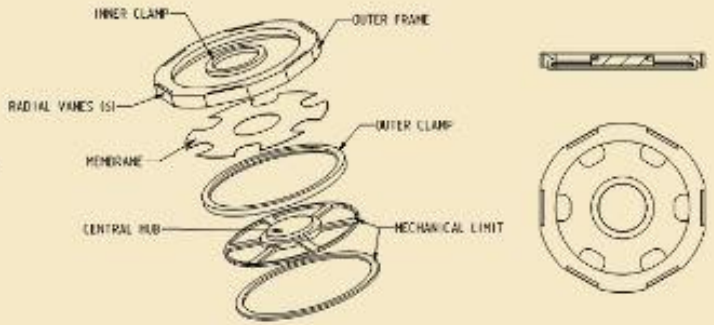
- Segment support design
  - 9 points axial Whiffle Tree
  - 3 tripods
  - Membrane based lateral support
  - 120Kg per segment assembly

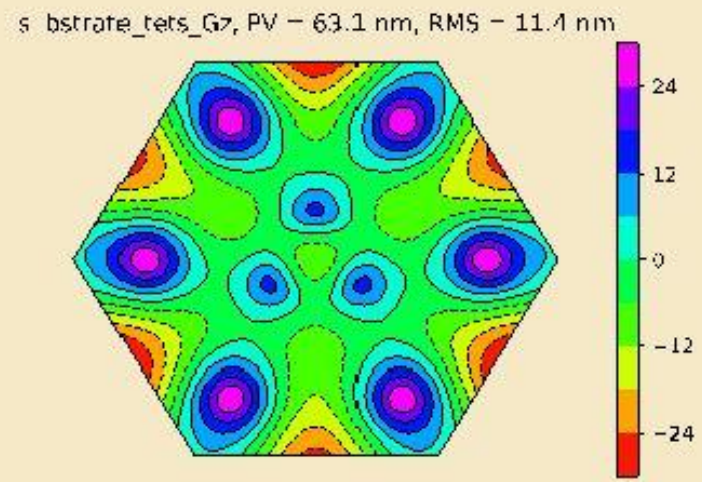


Axial support

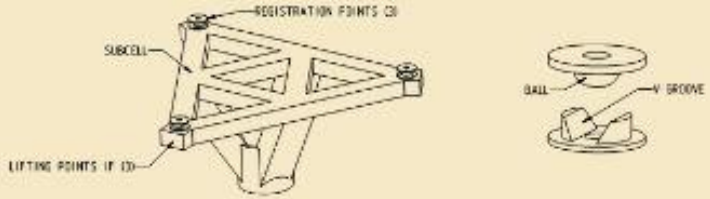


Lateral support

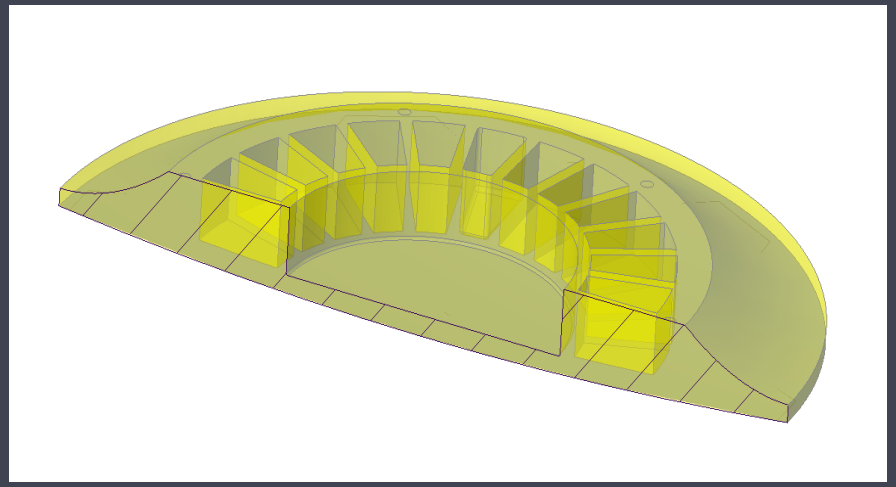




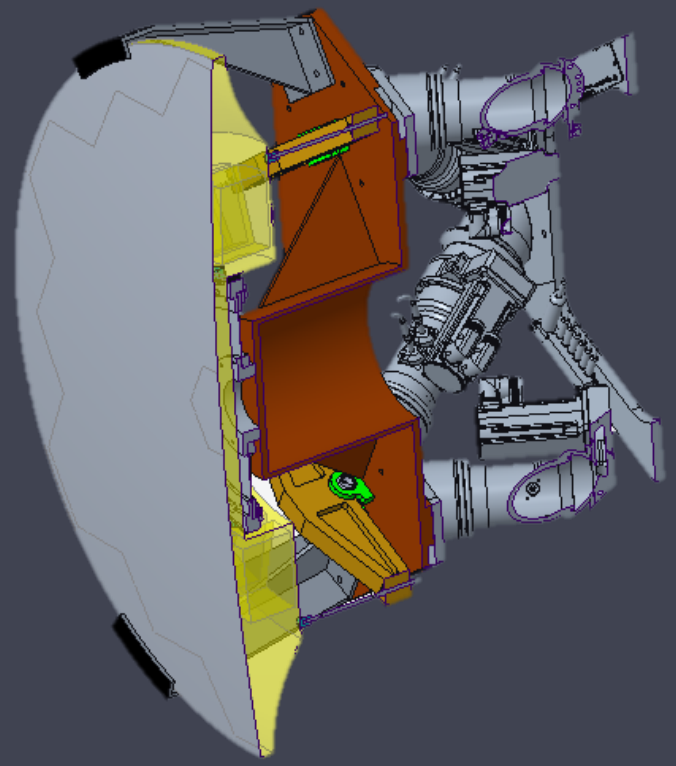
Subcell



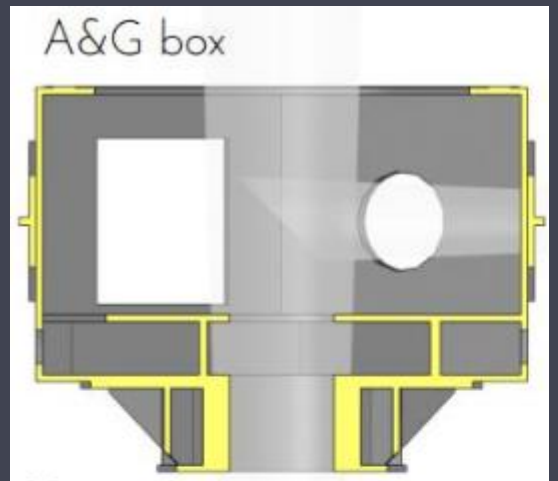
NEW ROBOTIC TELESCOPE: M2

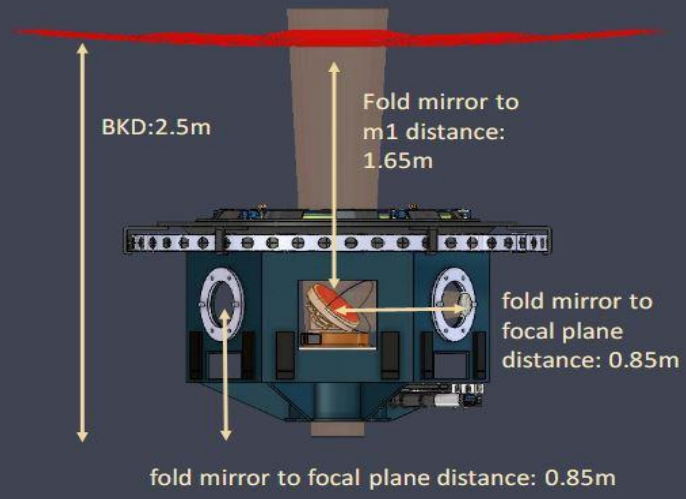


- Lightweighted substrate
- 6 points axial support
- Membrane lateral support
- Hexapod for focus and corrections in tilt and decentre
- 250Kg assembly mass (incl hexapod)



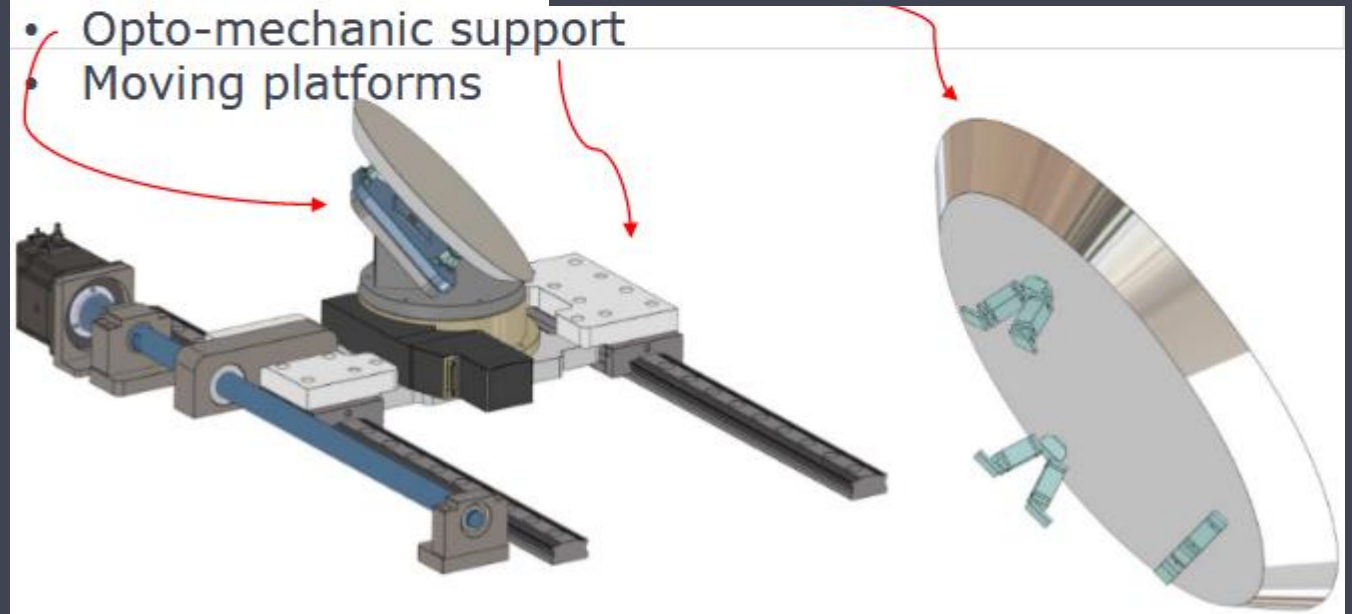
NEW ROBOTIC TELESCOPE: focal stations



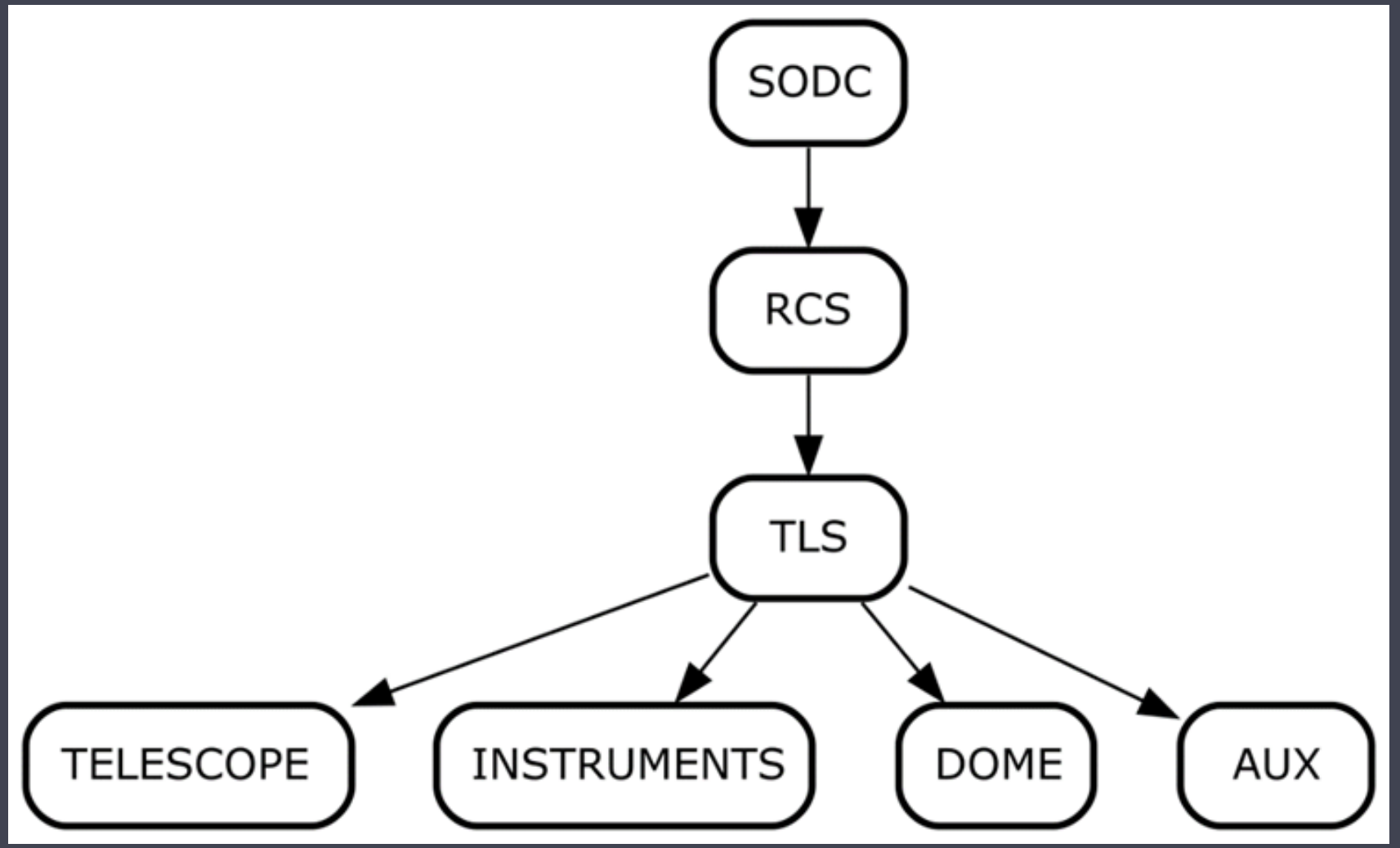


Scope

- Fold mirror
- Opto-mechanic support
- Moving platforms



NEW ROBOTIC TELESCOPE: CONTROL SYSTEM



NEW ROBOTIC TELESCOPE: STRUCTURE

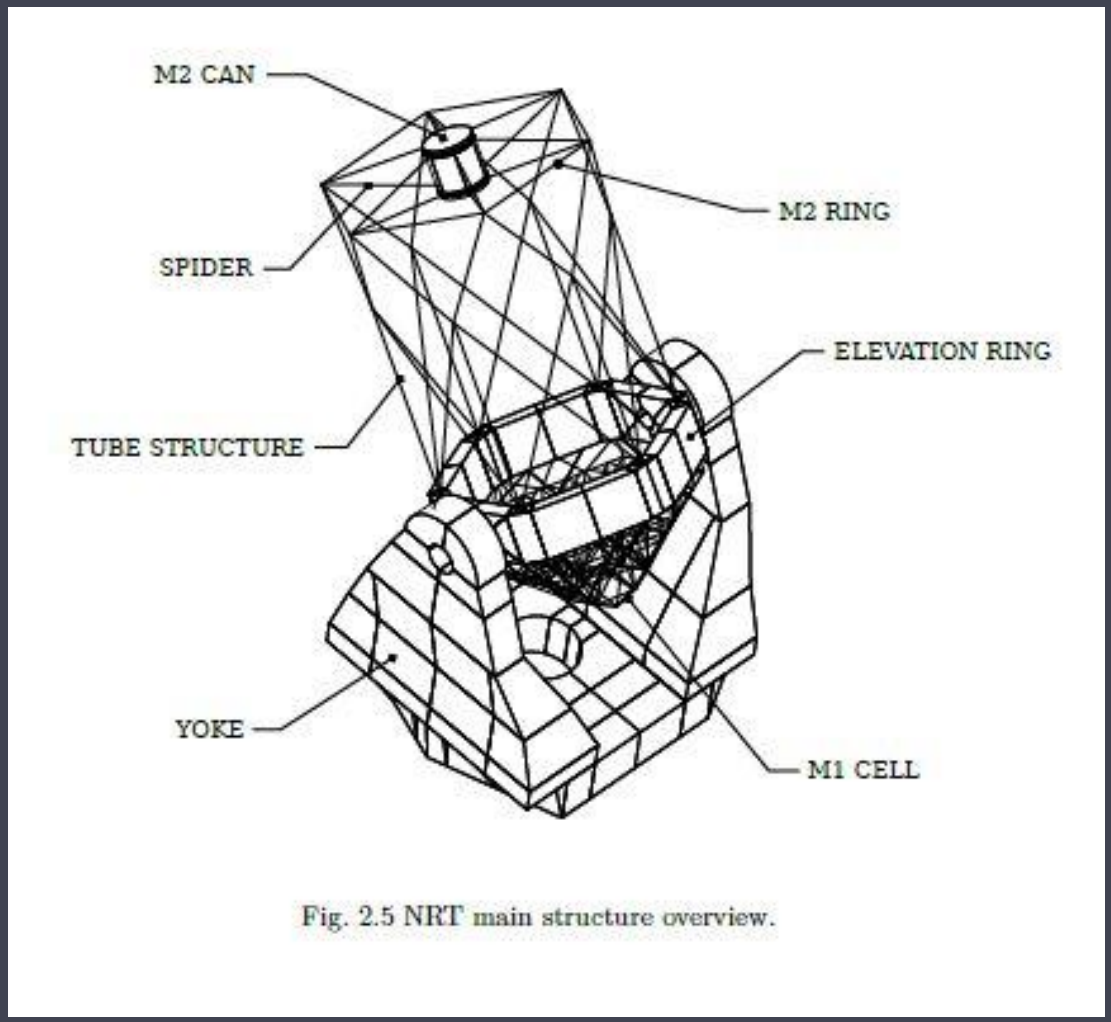
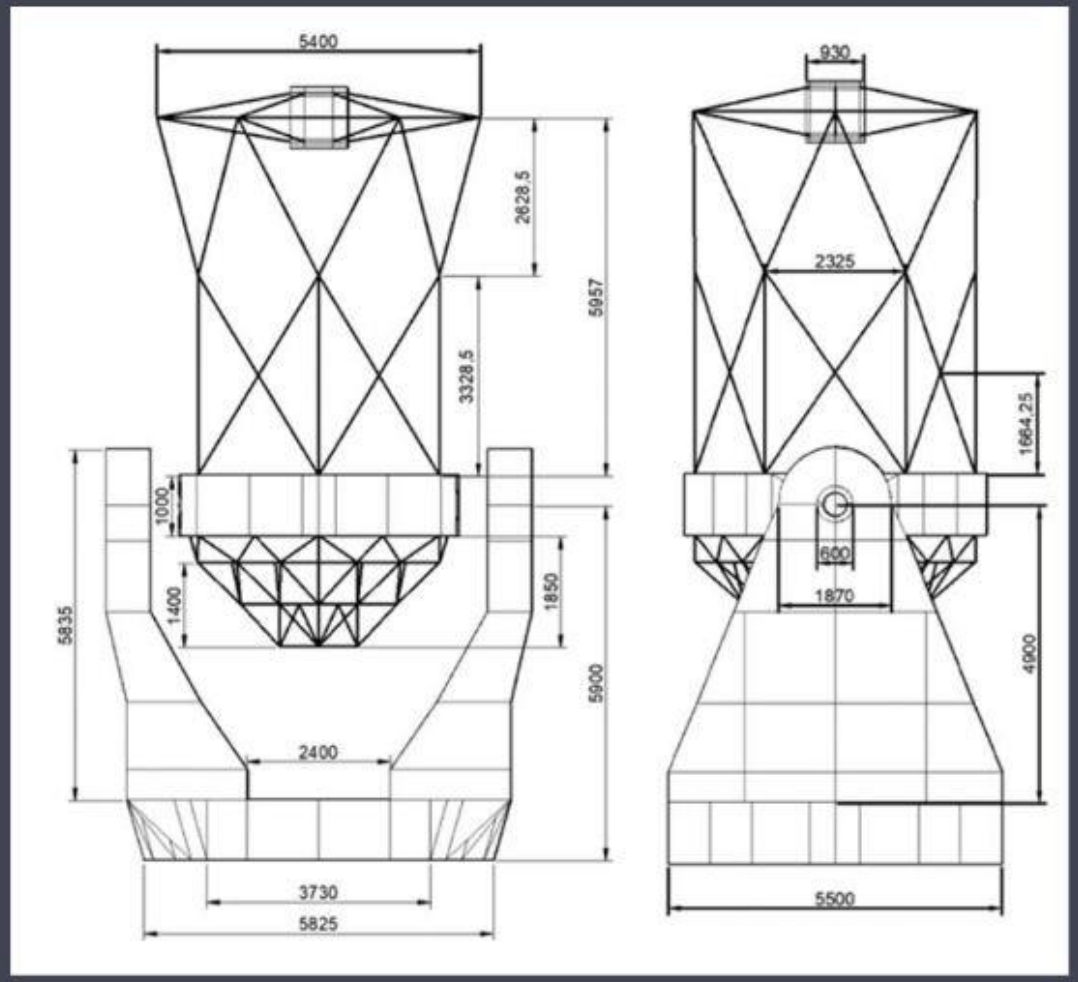


Fig. 2.5 NRT main structure overview.

NEW ROBOTIC TELESCOPE: STRUCTURE



High level

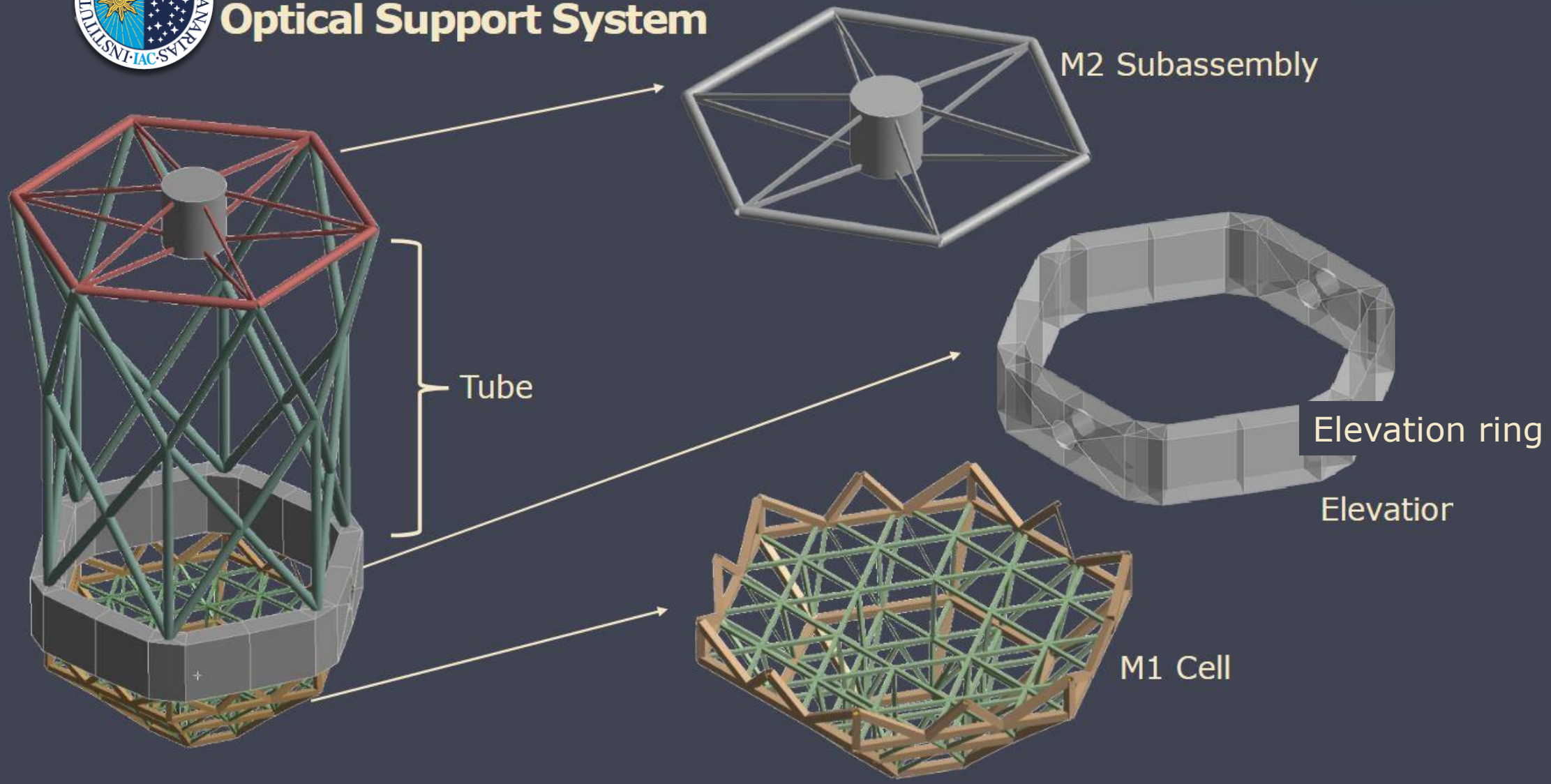
- Range of motion (±270º for azimuth axis and 20-90º for elevation axis)
- Fast time to target (<30 s) with 5 arcsec RMS blind pointing accuracy
- Provide a clear optical path with low obscuration while maintaining alignment

Key metrics

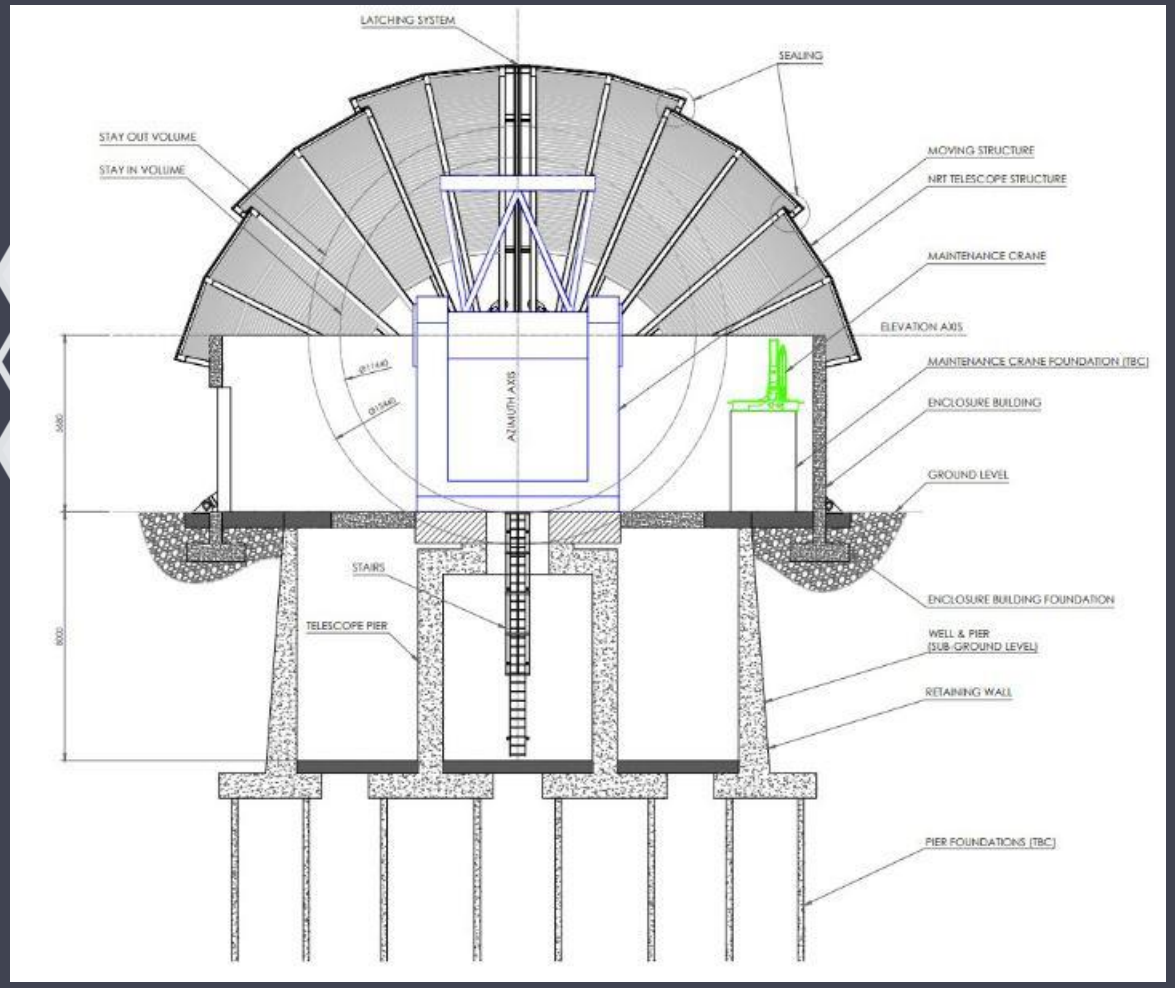
- Locked Rotor Frequency >= 10 Hz as a target
- M1 – M2 decentre < 2-3 mm
- M1 – M2 piston < 2-3 mm
- M1 – M2 tip-tilt < 1-2 arcmin

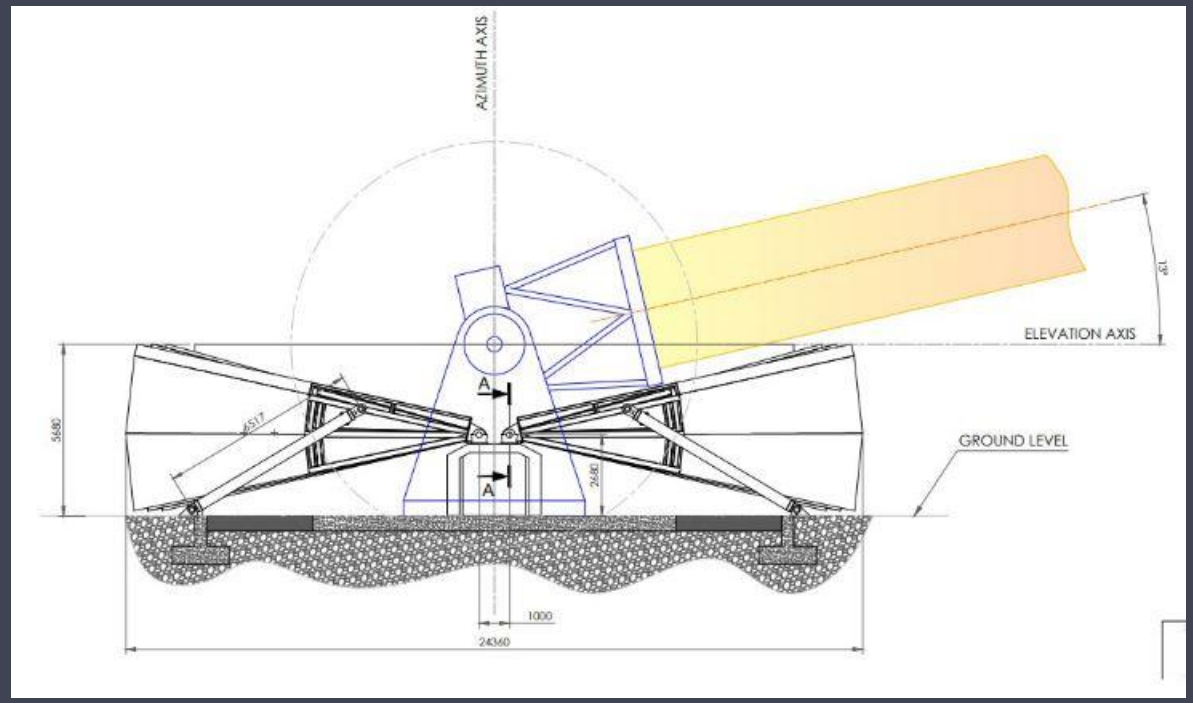
NEW ROBOTIC TELESCOPE

Optical Support System



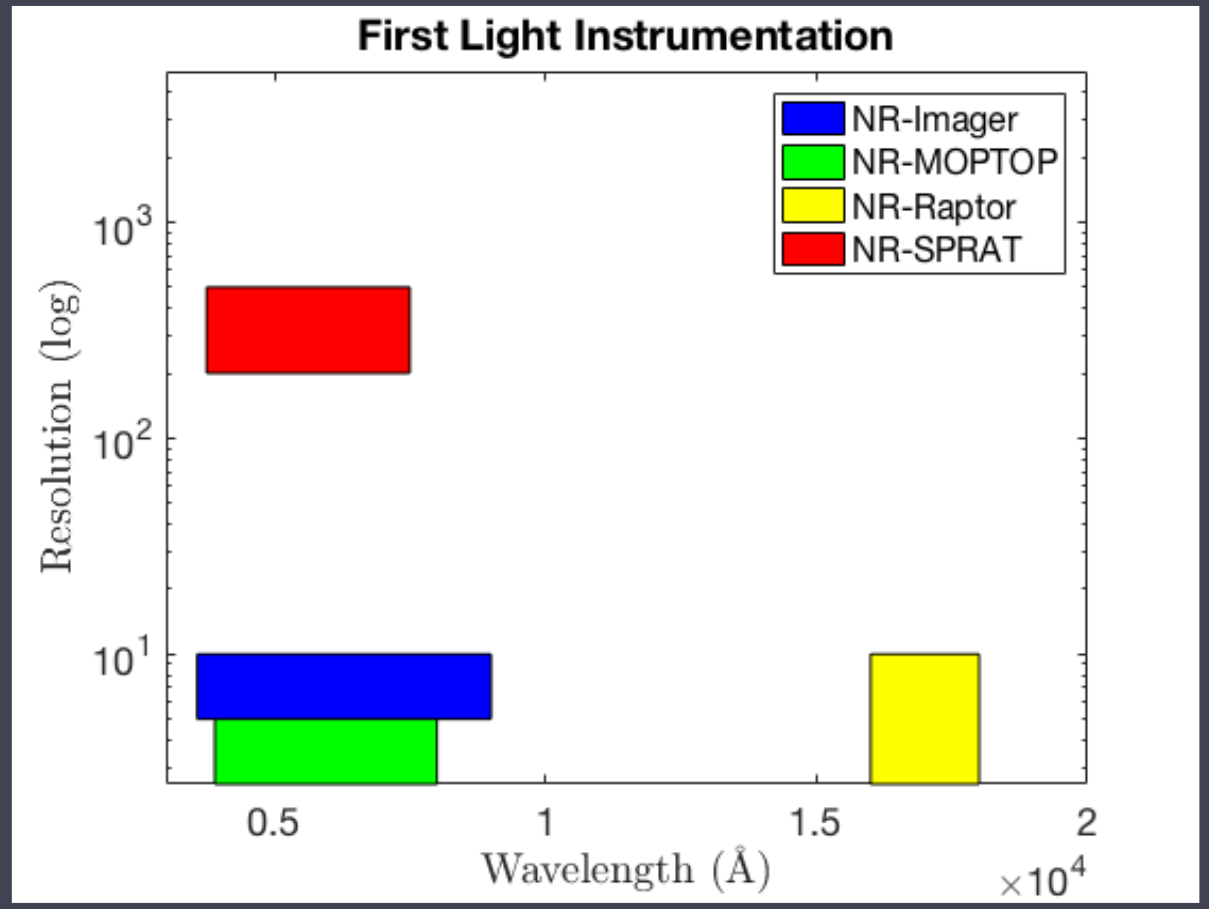
NEW ROBOTIC TELESCOPE : ENCLOSURE

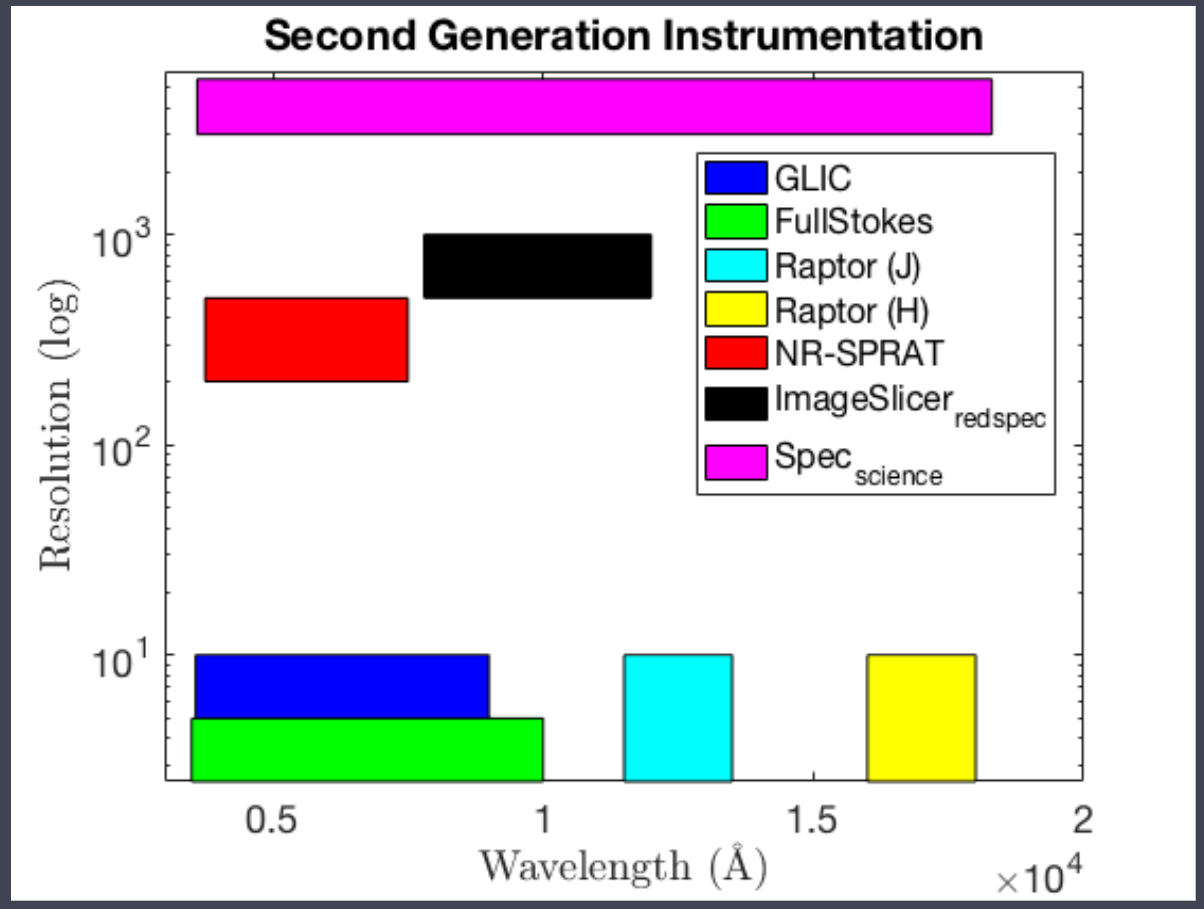




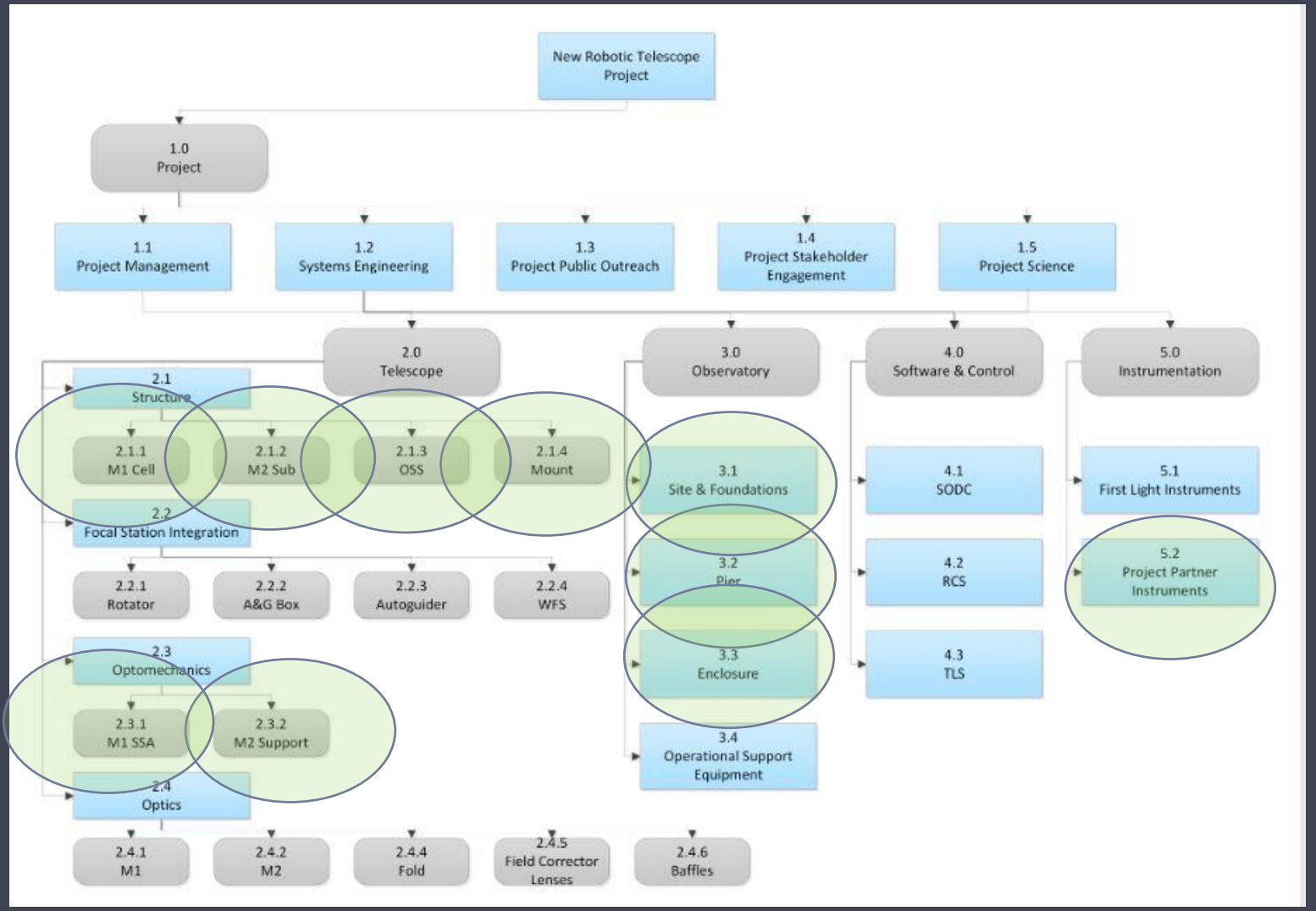
NEW ROBOTIC TELESCOPE: ENCLOSURE

NEW ROBOTIC TELESCOPE: instruments





NEW ROBOTIC TELESCOPE



NRT timeline

2018 – 2020

- Funding.
- Conceptual design.

2021 – 2024

- Complete consortium.
- Preliminary design.
- Detailed design.

2024 – 2026

- Construction of the telescope and first light instrumentation.

2026 – 2027

- Integration, first light and commissioning.

SUMMARY

1. Key astronomical facility (power: ∅ 4 m and quick response: 30 s) for time domain astronomy.
2. Semented apertura formed by 18 hexagons (~1 m each)
3. Sited at ORM with superb atmospheric conditions.
4. Standard for a future generation of large robotic telescopes.
5. Trigger of CSOA.