



SKA-Mid: Commissioning Plans for the next year

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SWG Chairs Meeting, March 18th 2025



Outline

- What is AA0.5?
- Current Schedule
- Dish design
- Dish tests
- SKA-Mid commissioning group



Construction Strategy

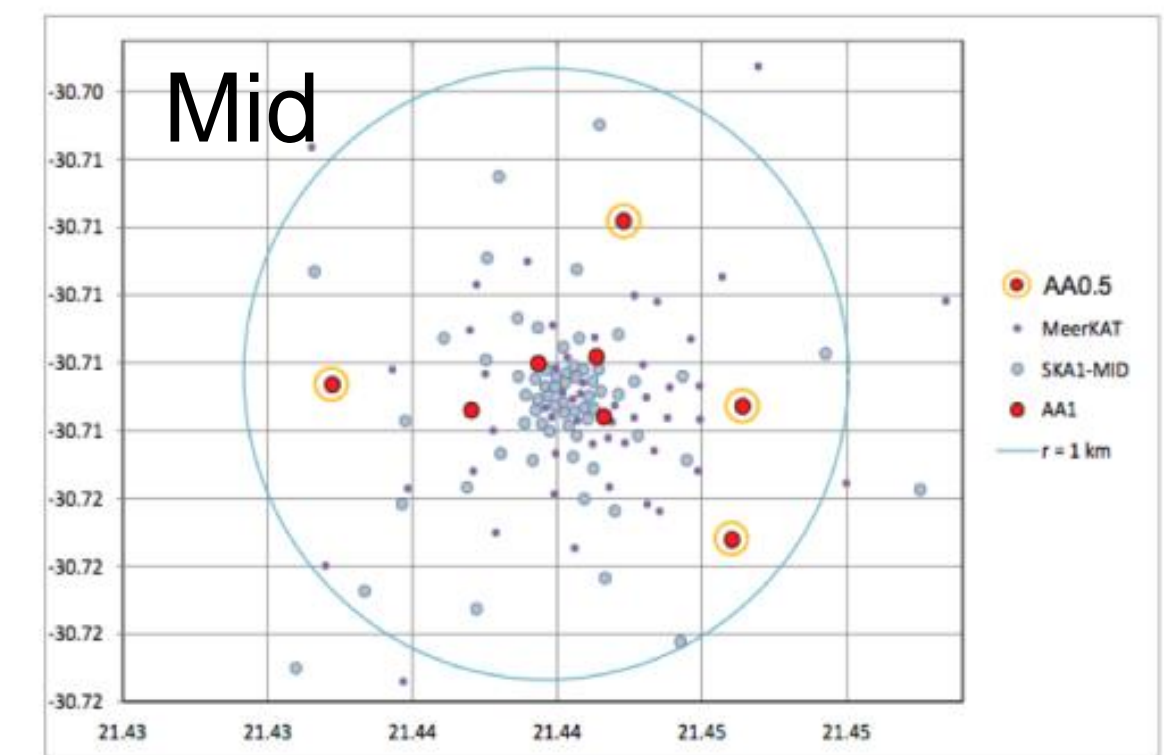
- **Target:** build the SKA Baseline Design (197 Mid dishes; 512 Low stations: AA4)
- Following Staged Delivery Plan (AA*)
- Develop AA0.5 to prove capability
- Expand to AA* and support the case for SKA Baseline Design (AA4)
- **Mid slip - Dish manufacture, RFI, Visas**

Milestone Event (earliest)		SKA-Mid	SKA-Low
Construction Approval		2021 Jul	2021 Jul
AA0.5 AIV start	4 dishes 4 stations	2026 Jan	2024 Jul
AA0.5 end	4 dishes 4 stations	2026 Jul	2025 Jun
AA1 end	8 dishes 16 stations	2027 Feb	2026 Jan
AA2 end	64 dishes 64 stations	2028 Jan	2026 Nov
AA* end	144 dishes 307 stations	2028 Nov	2028 May
Operations Readiness Review		2029 Feb	2028 Jul
End of Staged Delivery programme		Formal end of construction (including contingency): 2029 Mar	
AA4	197 dishes 512 stations	TBD	TBD



Path to interferometry

Why Array Assembly (AA)0.5?



- Deployment of **minimal** (4 dish/station) short-baseline array on-site as early as possible
- (Almost) all sub-systems (including control and data processing software)
 - Includes Dish/Station (cannot be tested in a lab environment)
- Verify fundamentals of system performance
 - in a realistic operating environment (Radio Frequency Interference, wind, temperature, ...)
- Test interfaces
- Develop AIV (Assembly, Integration and Verification), Commissioning, Operations teams and procedures
- Identify failures to meet requirements, lack of reliability
- Fix problems as soon as they are found, ideally before mass production
- Verify the supply chain



AA0.5 Science Commissioning Priorities

1. Interferometry

- Generate visibilities
- Calibrate (dish/station and array)
- Make simple images

2. Tied-array beamforming

- Dump voltage data



(Most) analysis using standard off-line tools for interferometric imaging and pulsar timing.



Integration and test: where are we now?

Pure software
integration

AA0.5 Mid dish 1
AA0.5 Low stations

AA0.5 Interferometry

Software
deployment

Dish/Station
Test

Prototype System
Integration (PSI)

Integration Test
Facility (ITF)

Array Assembly
(AA) 0.5

Ad hoc integration
of two or more sub-
systems in the lab

Integration of almost
all the system in
the lab; verification

Full system test on
the sky with a small
number of dishes/stations

AA = Array Assembly

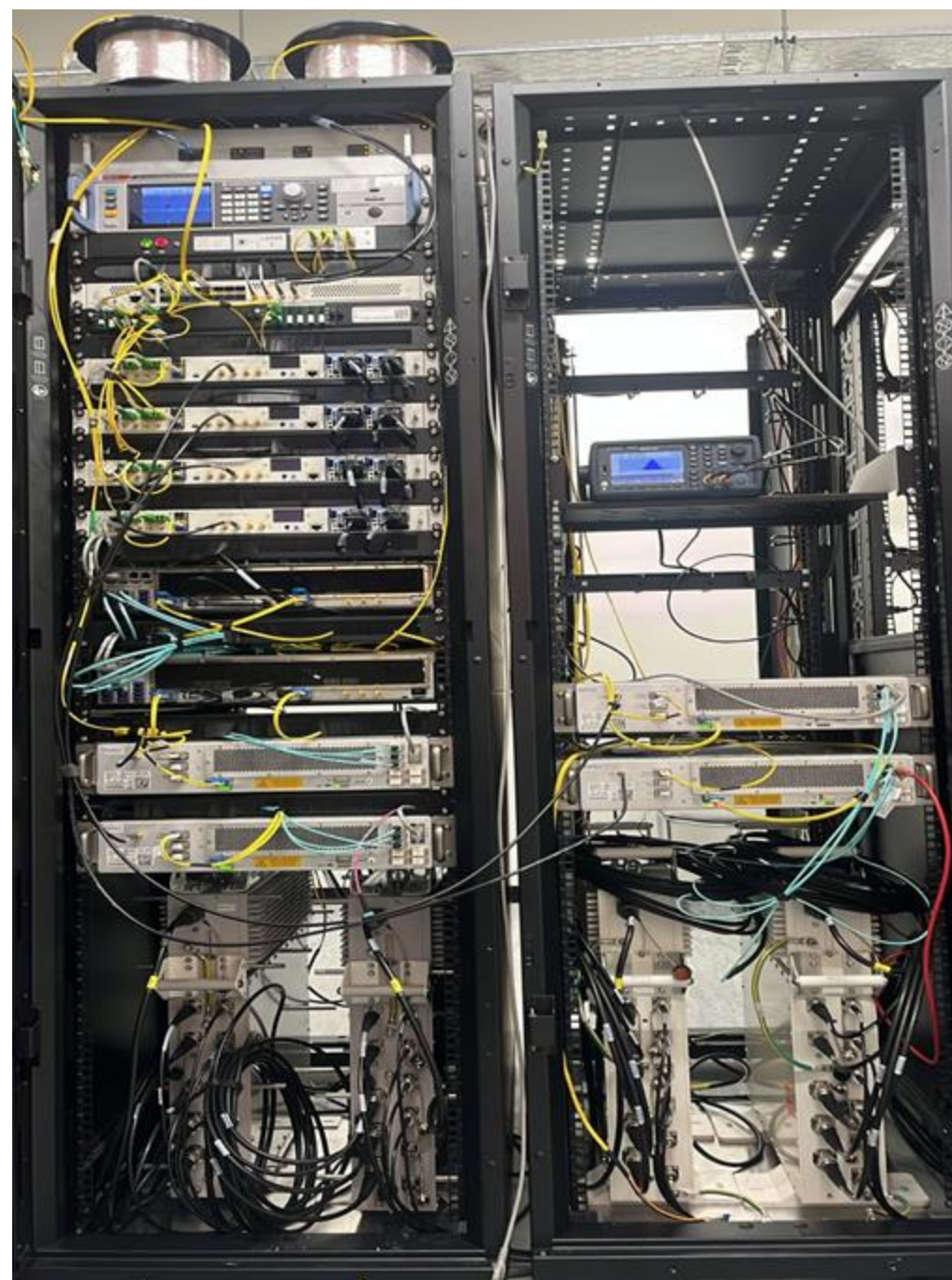
Mid

Low (George's talk)

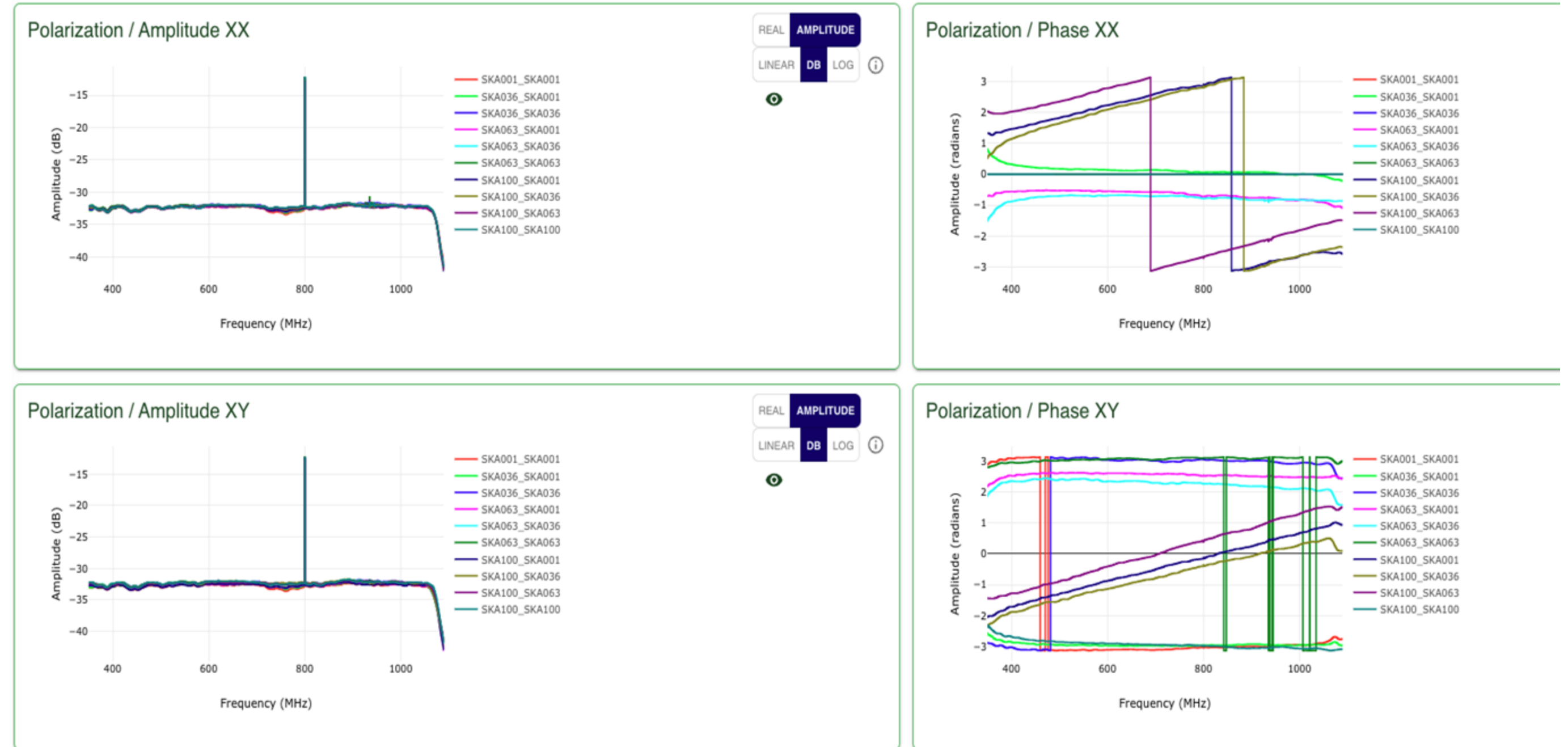


Status of MID Telescope AIV: MID ITF

- 4 Receptor (simulating 4 AA0.5 Dishes) system now integrated in the ITF, with auto and cross correlation visibilities visible on SDP signal displays and data product dashboards.
- Input signals from the sky simulator as the noise source and signal tone into the 4 SPFRx.



RS123
(Sampler) +
RXPU
(Packetiser) =
SPFRx



These are single display plots for all baselines for the 4 receptor system. Correlation is shown by the flat phase plot, with common delays and cable lengths.

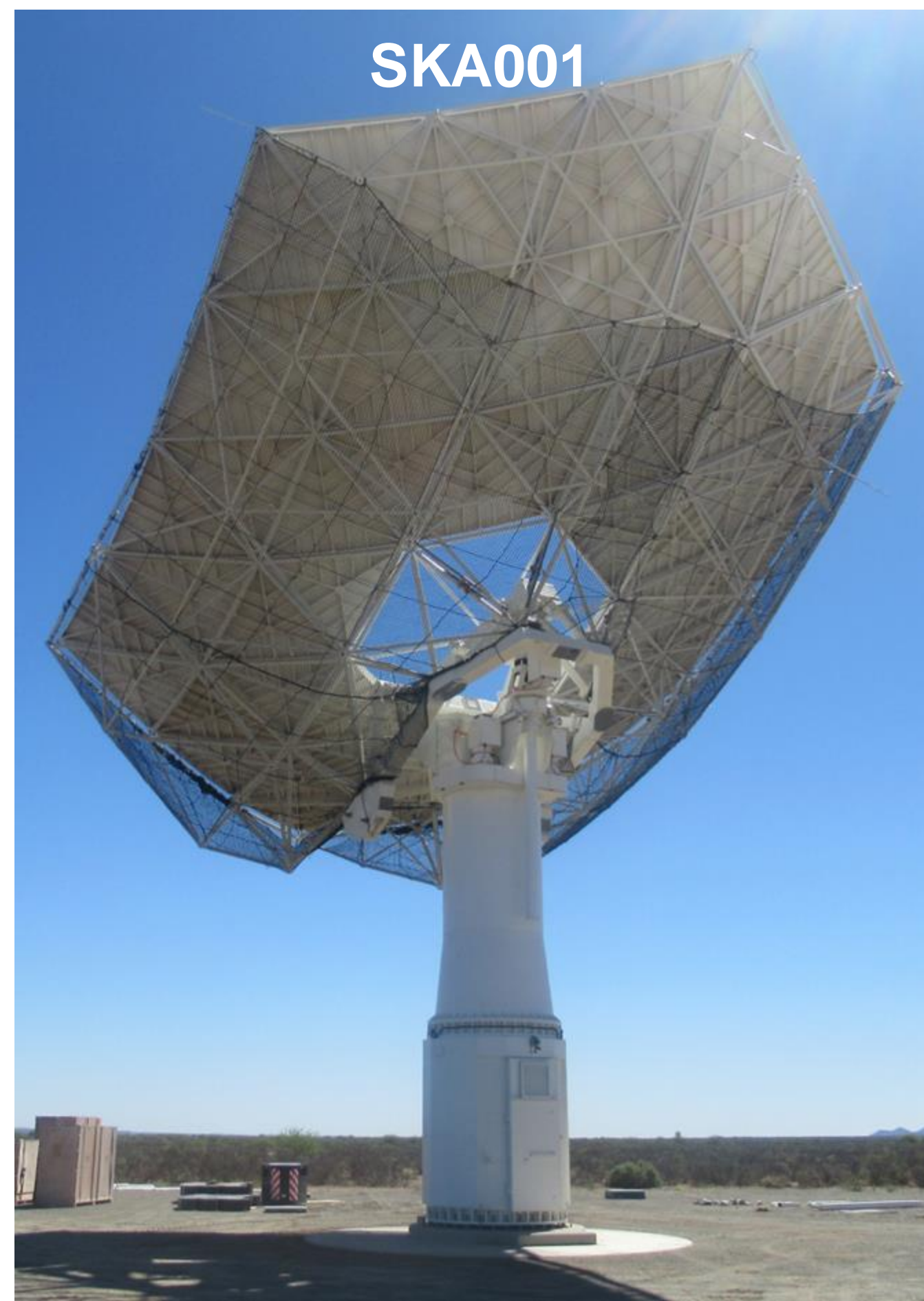
Construction Activities – Dish Structure – AA0.5

SKA063



- Commissioning / site acceptance ongoing
-Photogrammetry, Feed Indexer commissioning, Control loop tuning, power measurements, Servo Functional
- Official CETC54 Site Acceptance Test will start (April)
- SKAO qualification prior to handover to DISH AIV team

SKA001



- Cabling in preparation for Power On / electrical Certificate of Compliance
- Sub reflector, Feed Indexer, Azimuth & elevation IO unit installation and encoder adjustment work in progress

SKA100



- Jackscrew & Safety net & cabling installation & integration testing complete
- Big Lift

SKA036



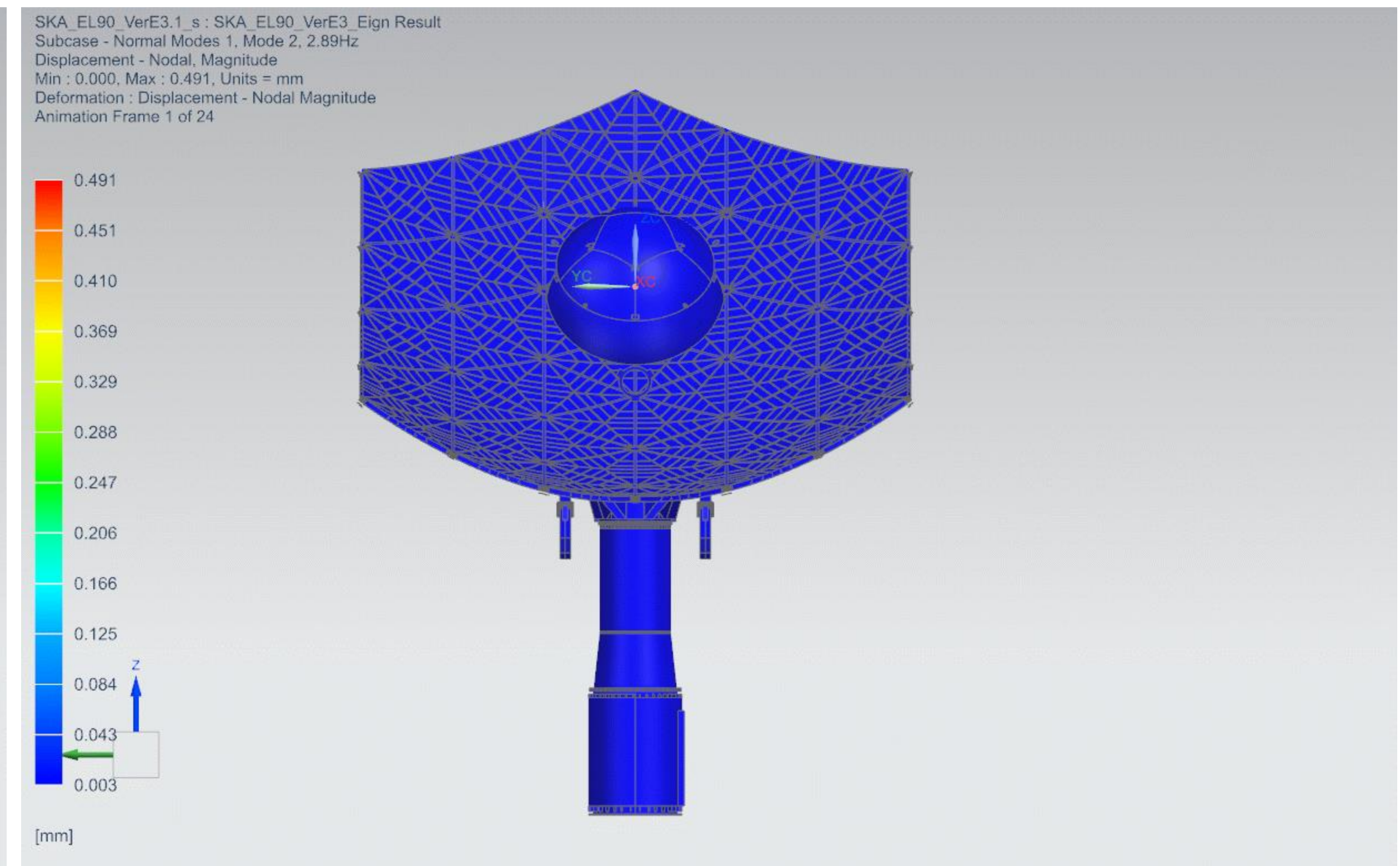
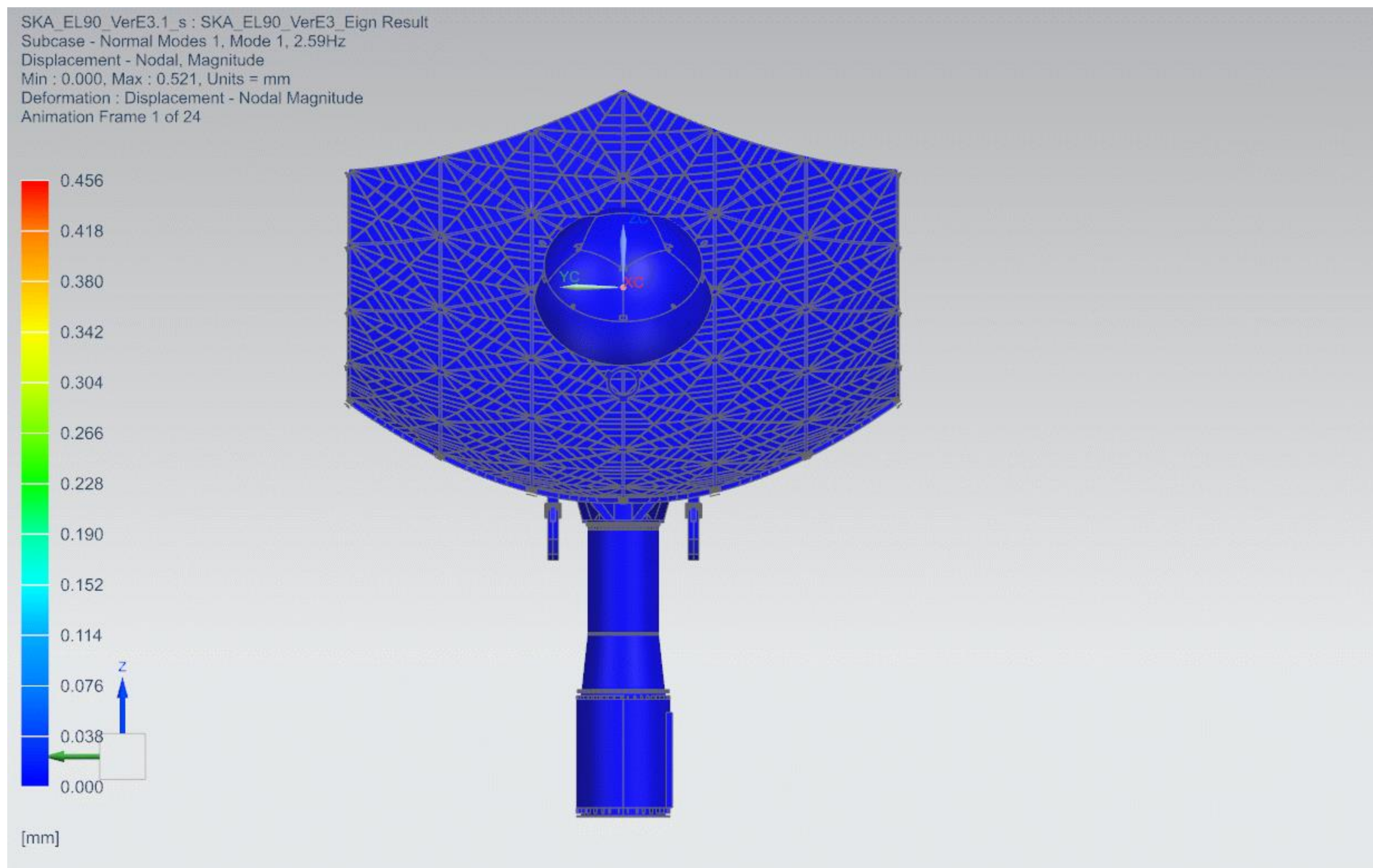
- Panel installation and day time photogrammetry
- Working a plan to do filter cabinet installation via door/hatch prior to Big Lift (no Drive System on site)



Key Design Change: Dish Pointing under Wind Load

- Most important error source for dynamic range requirements
- Non-compliant based on SKA-MPI measurements
- Led to analysis and redesign of dish structure (CETC/SKAO)
 - Elevation cradle
 - Pedestal
 - Foundation
 - Tiltmeter
- Finite-element analysis predicts higher stiffness
- Improved CFD model of wind loading → revised worst-case loads → foundation design





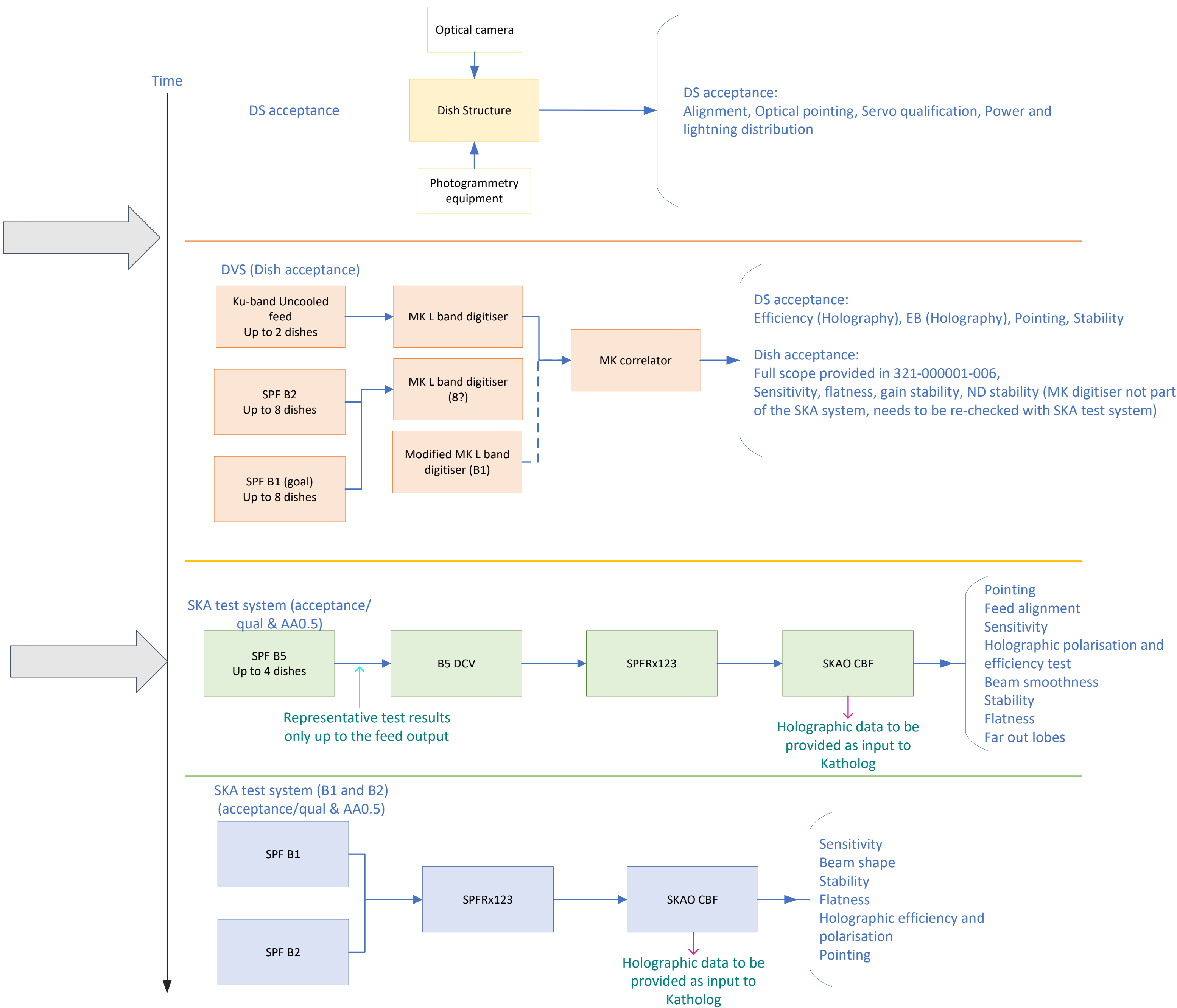
First two eigenfrequencies $> 2.5\text{Hz}$, as required



Dish Tests

SARAO staff (Dish Structure and Dish AIV) + backup from SKAO System Science Group

Science Commissioning in parallel with AIV



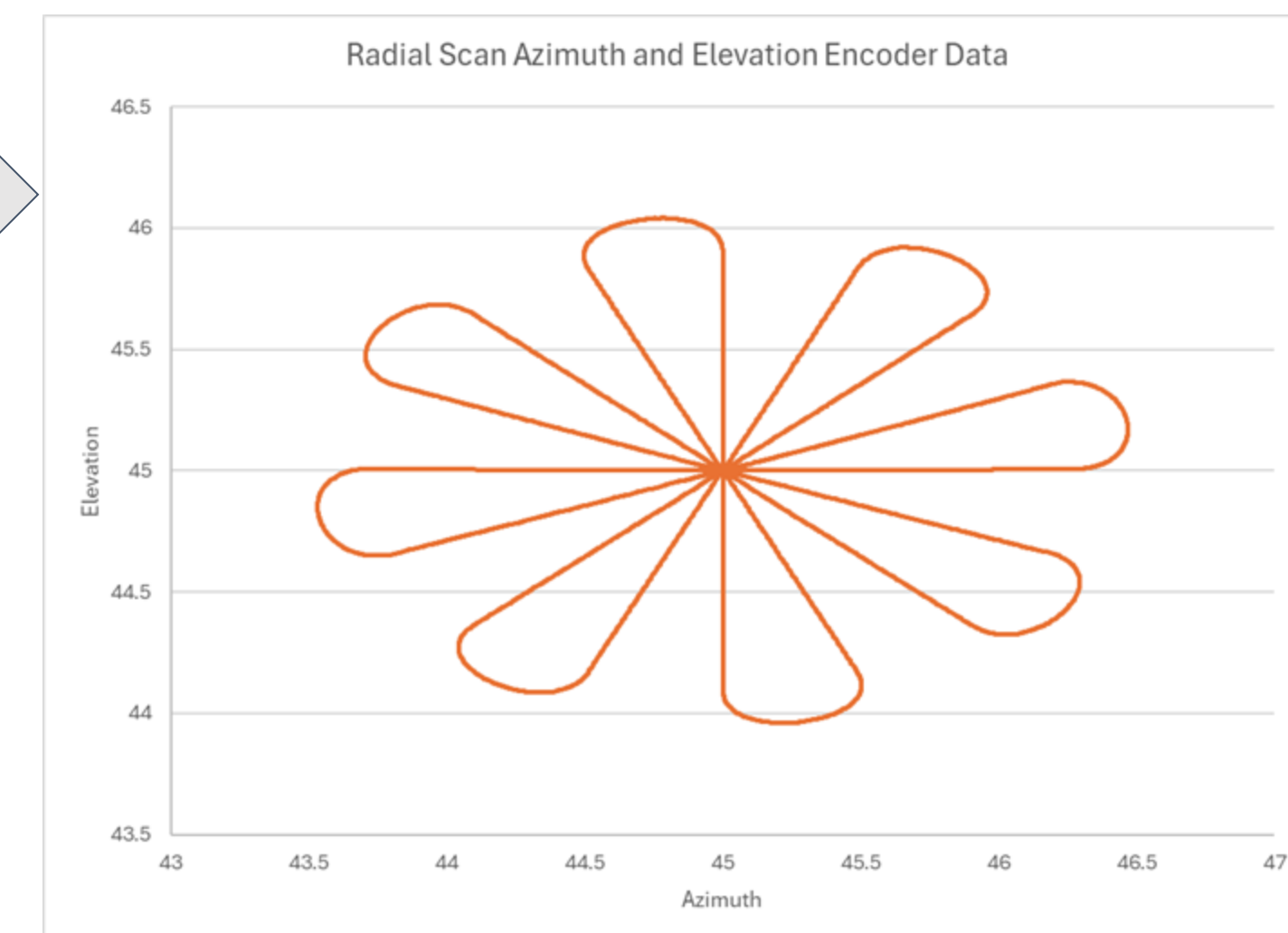
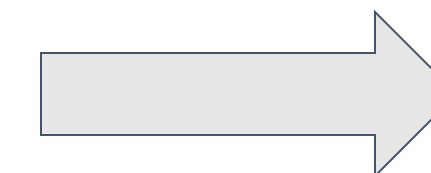
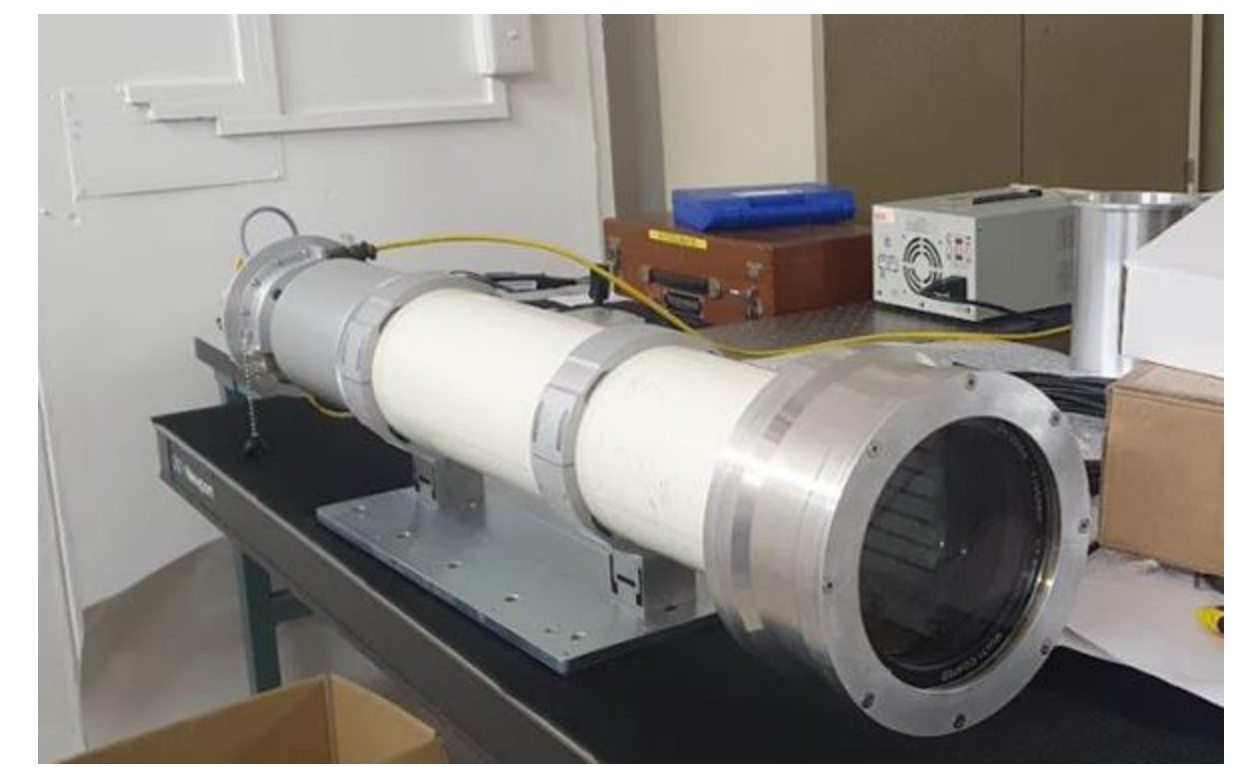
Planned next steps (Dish Qualification)

- Dynamic model including predicted wind loads from CFD and new FEA
- Functional and servo tests, now on SKA063 at site
 - Tracking (command-actual encoder)
 - Sweep tests
 - Step response
- Optical pointing tests
- Radio pointing
- Interferometric holography



Preparation for tests on SKA063

- New Optical Pointing Telescope (SARAO)
- Closer collaboration between SKAO and CETC-54 in control system development
- Elevation jackscrew rework
- DisQ software to interface directly with the Dish Structure Controller for qualification tests



Commissioning Management

Startup of science commissioning group in ZA is tied to AA0.5.

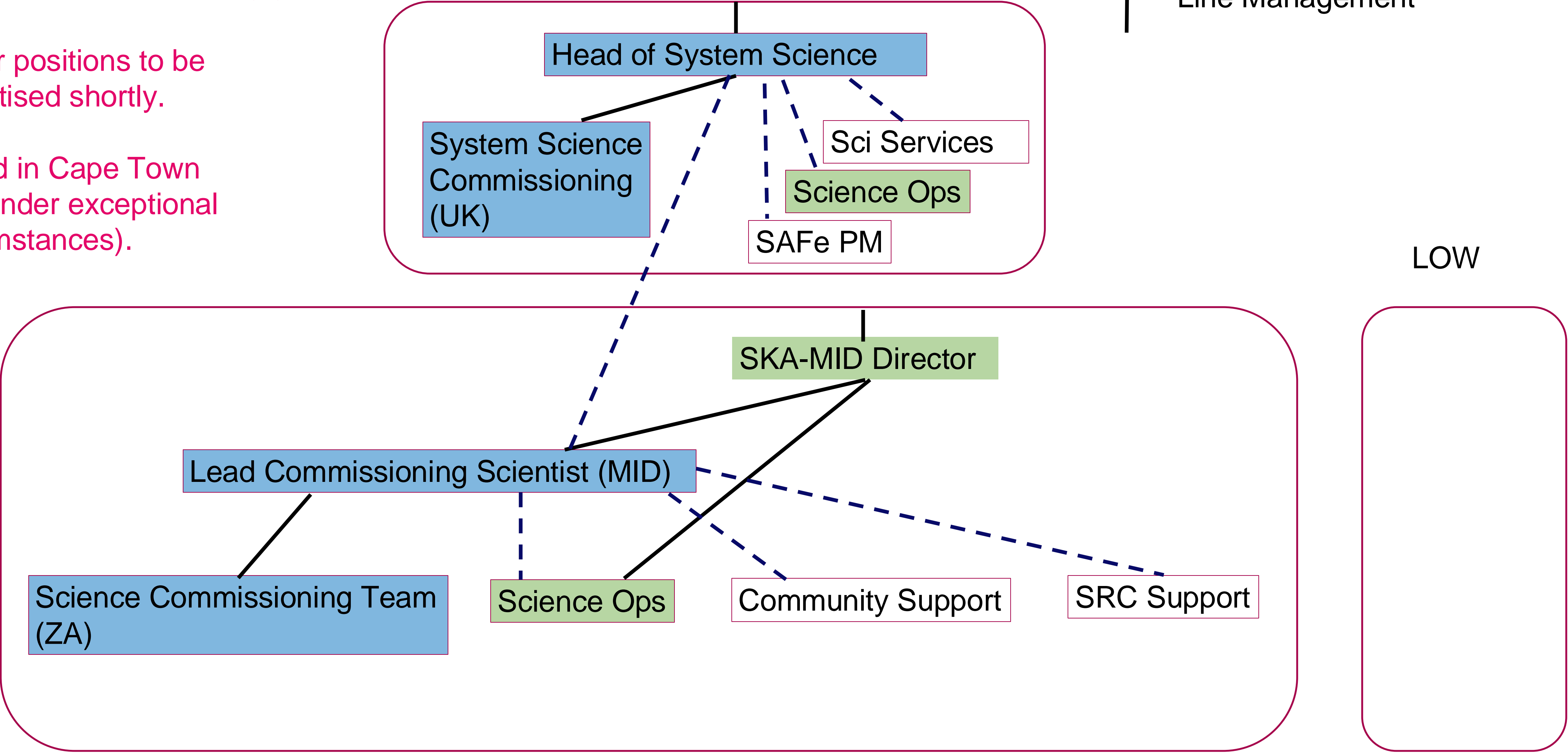
Junior positions to be advertised shortly.

Based in Cape Town (UK under exceptional circumstances).

Functional

Line Management

LOW



Come and work with us and/or tell your friends!

We recognise and acknowledge the Indigenous peoples and cultures that have traditionally lived on the lands on which our facilities are located.



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