SKA SWG Update

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Head of Scientific Services

14 October 2025

SKA Science Update

- Community Engagement plans: Webinar series
- Mid and Low Construction/commissioning updates
- SKAO Science Book
  - Chapter revision strategy

Science Community Webinars

- Aim to improve clarity and regularity of communications
  - Triannual webinars – highest priority from 2024 SWG survey
    - Recordings provided
    - Follow-up synced newsletter (incl. information arising from Q&A)
    - Presented twice to cover all SKA time-zones in real-time
    - Led by Chief Scientist (Naomi)
  - Improvements to Science Users web pages
    - content update
    - news update section
    - webinar recordings/newsletter all available

Science Community Webinars

- Content will vary; may include
  - Latest milestones & future timeline
  - Commissioning and Verification updates
  - Operations planning updates
  - SKA Regional Centre updates
  - Science Data Processor updates (demos, pipelines)
  - SKAO planned activities over the next 4 months
  - **Q & A (plenty of time allocated)**
- Webinars, not normal zoom meetings
  - Registration in advance (code of conduct, …), curated Q&A

Science Community Webinars

- Inaugural webinar – November (expect hiccups!).
  - Final Dates/Times to be confirmed, but for now:
    - Tues Nov 18 at ~09 UT
    - Tues Nov 18 at ~19 UT (content repeat, fresh Q&A)
- Registration details etc will be sent via swg-all initially
  - plan to set up a separate sign-up email for future webinars


SKAO
SKA-Mid "Recent" Progress
SWG chairs meeting
System Science Team
Dish Structure Team
Dish and System AIV Teams
Tuesday 14 October 2025
For Project Use Only

Context: two major SKA-Mid activities in parallel

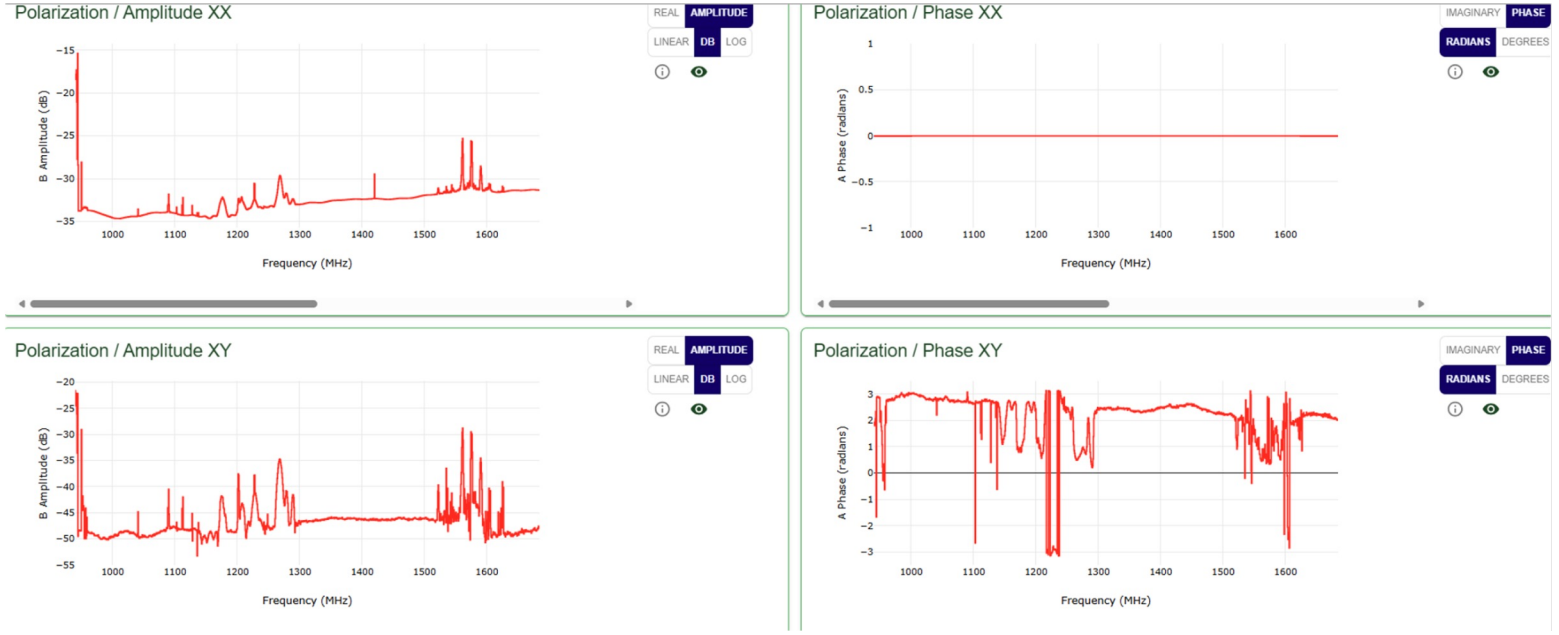
- Dish Structure Qualification (SKA063)
  - Test of a major redesign effort aimed at improving the stiffness of the dish and therefore the pointing
  - En route to Critical Design Review
    - Servo system
    - Pointing and tracking (optical/radio)
    - Surface accuracy (photogrammetry/holography)
    - Radio-frequency performance
    - EMC
- Towards first interferometry with 3(4) dishes
  - Full system test
  - Adds to recent single-dish demonstration
    - dish control
    - time and frequency distribution
    - cross-correlation

MID AIV Progress

The scans were processed through the demonstrator correlator for the Mid-CBF (Correlator and Beam-Former), and the processed signals ingested by the SDP (Science Data Processor) to produce CASA Measurement Set format datasets (MSv2).

The CASA MS file was successfully retrieved from the dashboard and was processed with CASA Python tools.

Pointing at Zenith - A series of drift scans (auto-correlation mode were obtained using the Band 2 receiver (950 - 1760 MHz)

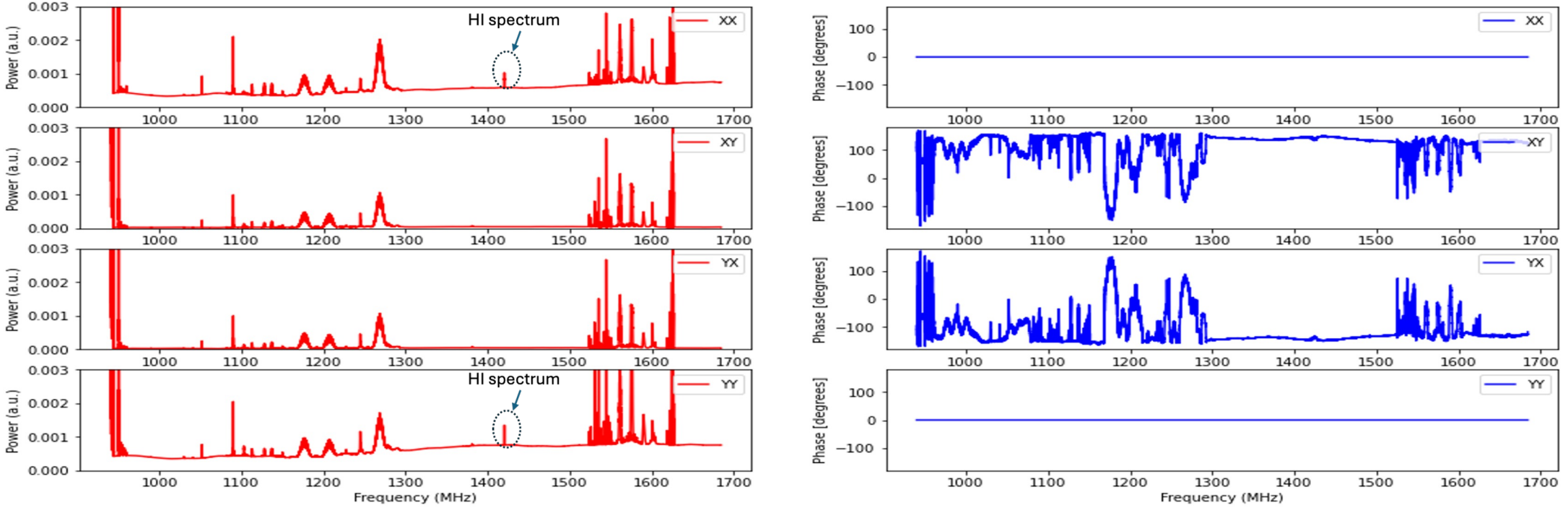


SKA001 On-Sky Stow Position Drift Scan Data Reduction

First end to end scan test with single Dish SKA001 under TMC control on 25th July, providing full polarisation (XX, XY, YX, YY) correlations.

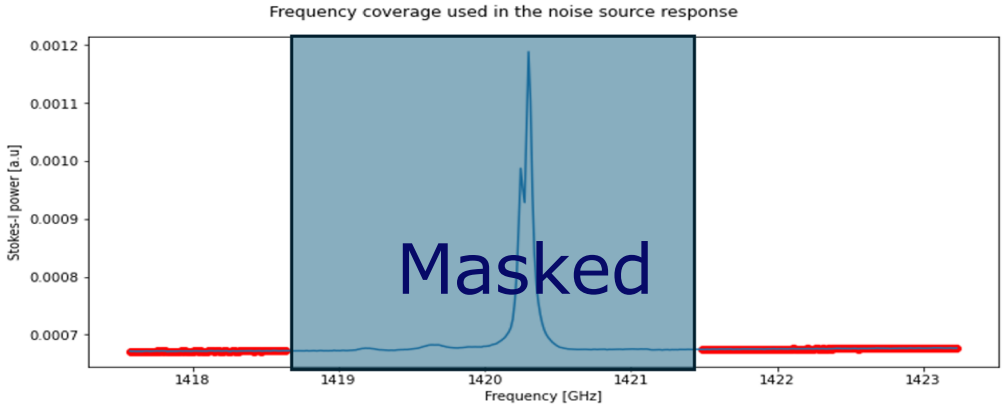
The data product dashboard for site: https://k8s.mid.internal.skao.int/shared-ska-dataproducts/dashboard/

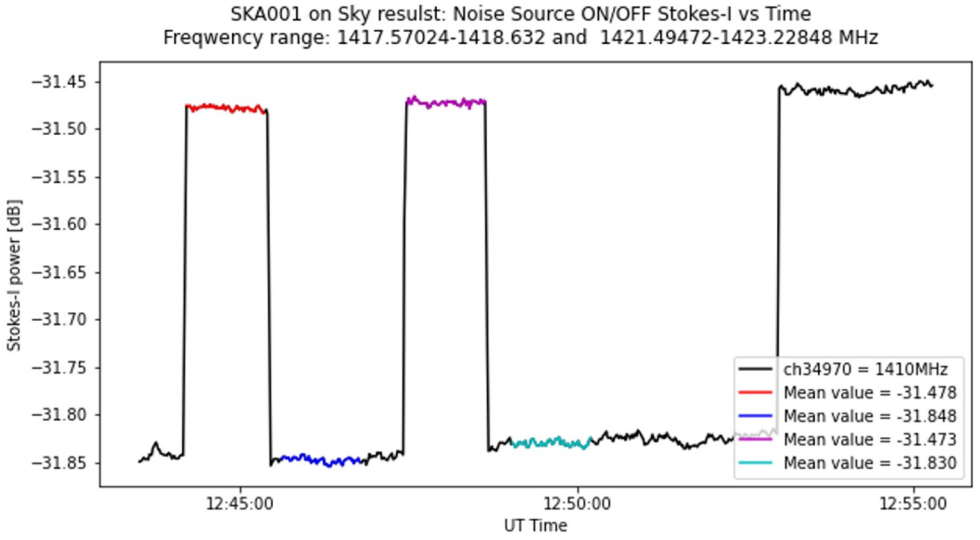
The CASA MS file was successfully retrieved from the dashboard and was processed with CASA Python tools.



- Most of the signals are RFI:
  - GSM (~960 MHz), avionics (ADS-B 1090 MHz), GNSS (~1150-1300 MHz), communication satellites (~1500-1650 MHz).
  - These are all polarised, so seen in X/Y
- Astronomical signals:
  - Galactic neutral hydrogen at ~1420 MHz, unpolarised, so not seen in X/Y.
  - Galactic synchrotron continuum - not easy to see, but implied from X/Y phase (synchrotron radiation is polarised)

System Noise Verification with the Noise Source





$$P_{NS\_ON} = G(T_{NS} + T_{sys})$$
$$P_{NS\_OFF} = G \cdot T_{sys}$$
$$\Longrightarrow \quad T_{sys} = \frac{T_{NS}}{(Y-1)}$$

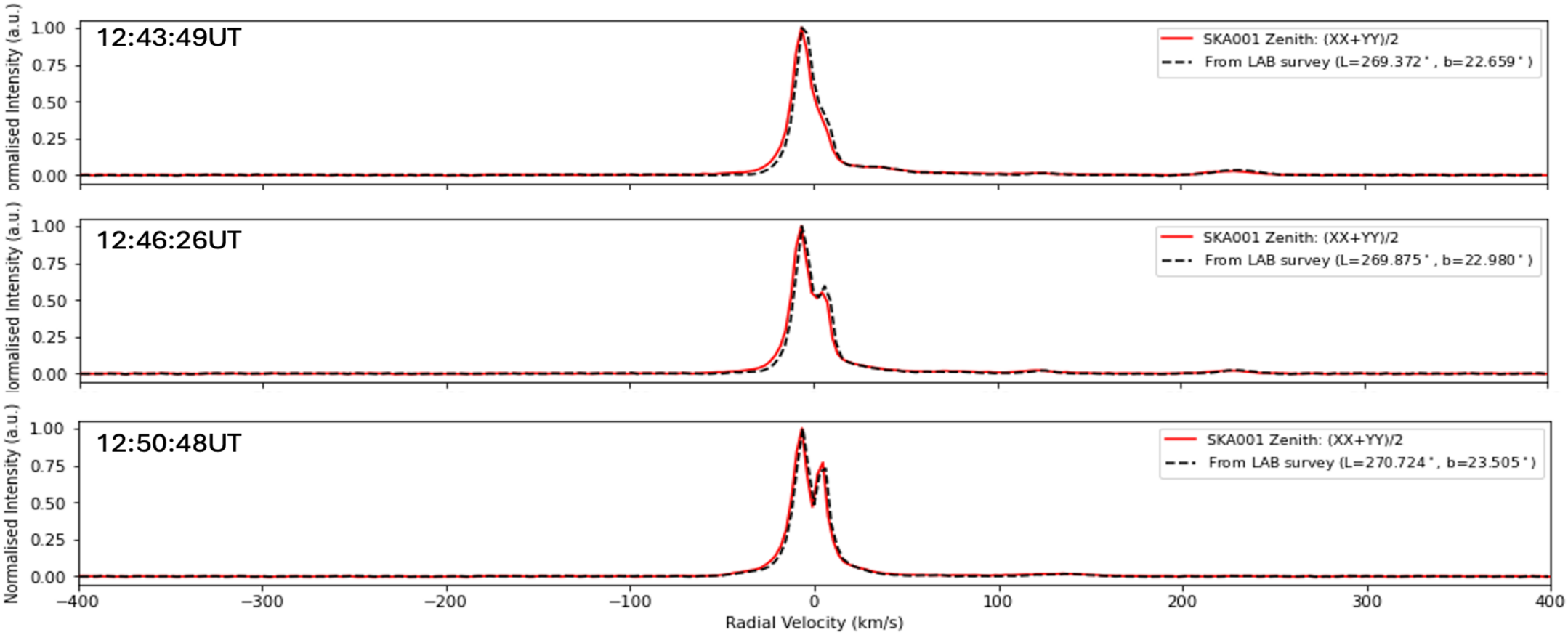
From the SPF test results doc, the cal noise source temperature is about T_{NS}=1.5K

$$Y = \frac{P_{NS\_ON}}{P_{NS\_OFF}} = 1.09 \Longrightarrow T_{sys} = \frac{T_{NS}}{(Y-1)} = \frac{1.5}{0.09} = 16.7\text{K}$$

According to the Band 2 qualification report (measured and estimated), the expected T_sys is approximately 15 K. Although SKA001 has not yet been fully established or optimised, the measured value is sufficiently close to the expected value.

Initial exploratory HI profile analysis – Trial based preliminary investigation

In the stowed position, the beam is expected to point toward the zenith, though not precisely. A manual trial-and-error comparison with the Leiden/Argentine/Bonn (LAB) survey HI profile suggests Az 90° / El 89.2° as plausible coordinates. It has been shown that SKA001 is functional as a Single-Dish radio telescope, apart from pointing functionality. Further investigation will follow once the dish is fully operational.



- Line profile is a doppler effect, resulting from differential rotation of HI gas in the Galaxy, V_{LSR} corrections were applied

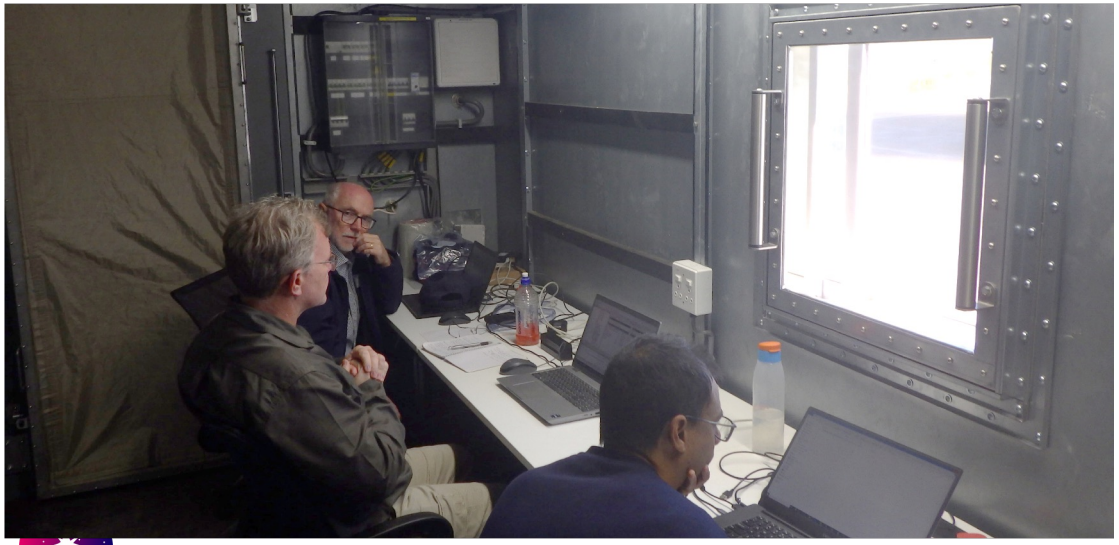
LAB HI profiles were downloaded from: https://www.astro.uni-bonn.de/hisurvey/euhou/LABprofile/index.php

Dish Structure - Construction

- Successful integration of SPFBand2, SPFRx123, SPFHe, SPFVac, Networks, DFN, EMISC, Feed Indexer.
- AIV Remote operation of AA0.5 dishes in place with restrictions.

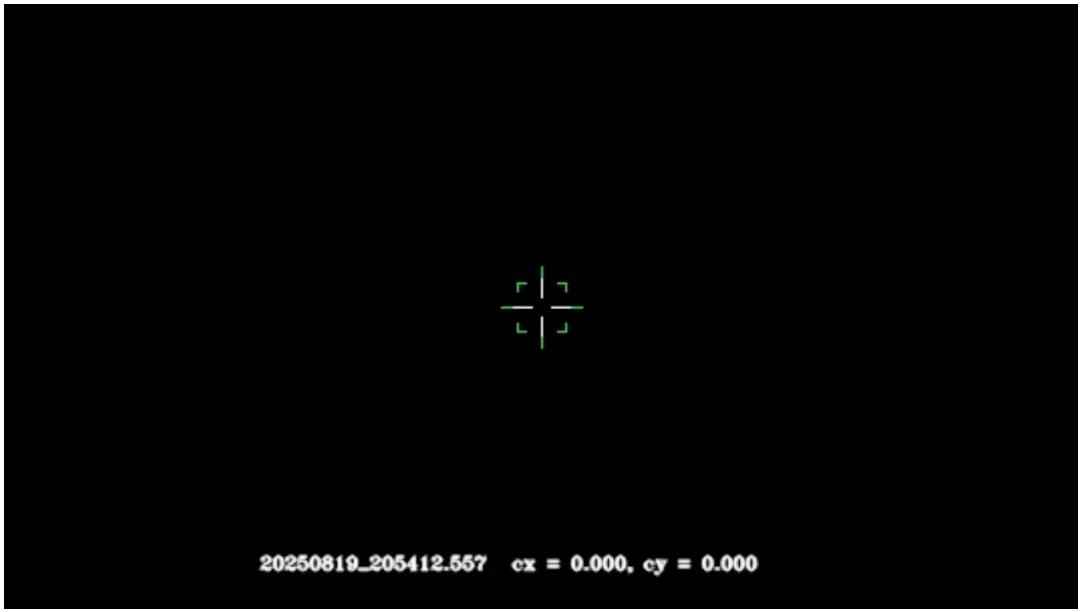
Dish Structure - Qualification

- Wombat developed Qualification SW for DS (DiSQ)
- Qualification readiness was accessed during May and further Control System development work identified.
- Highest priority functional fixes done and basic performance assessed, enough for fringes.
- Performance optimisation underway by combined SKAO / CETC Team.
- Formal qualification starting in early 2026.

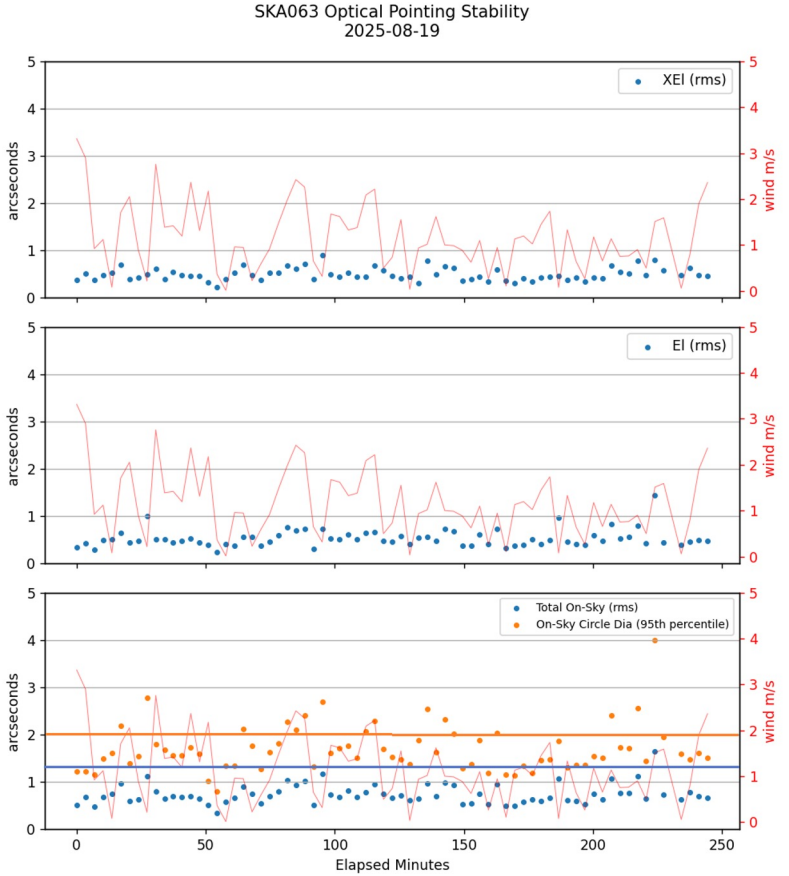


Dish Structure - Early pointing results

- Data from Pointing model calibration, 72 sources over 4 hrs in low wind.
- No pointing model or Tilt corrections.
- Feed from Optical camera mounted on Dish
- Shows source coming into the FOV, stabilising, tracked for 60 sec and then moving to next target. Green box 30”
- Centroid (cx, cy) in pixels @ 1.2”/pixel



- Prelim analysis of pointing stability under



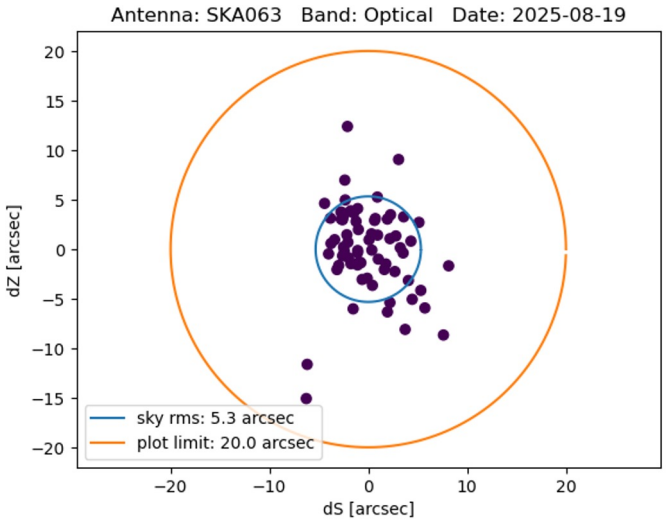
Very first optical pointing results

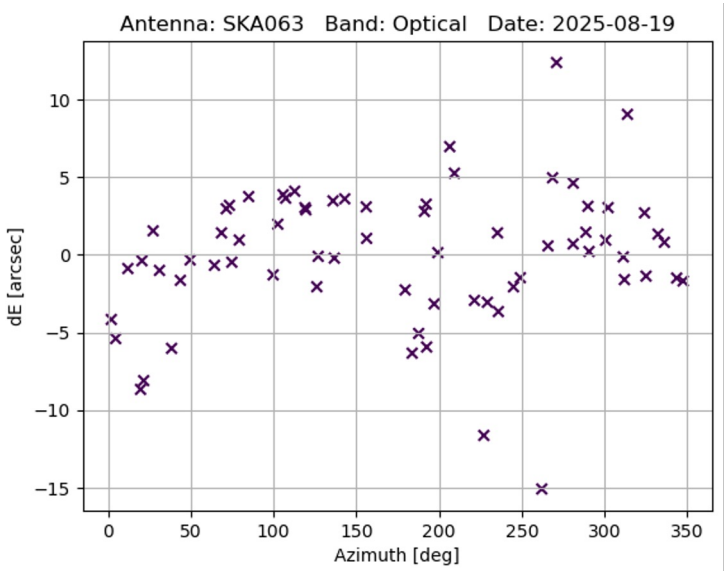
Low wind conditions.

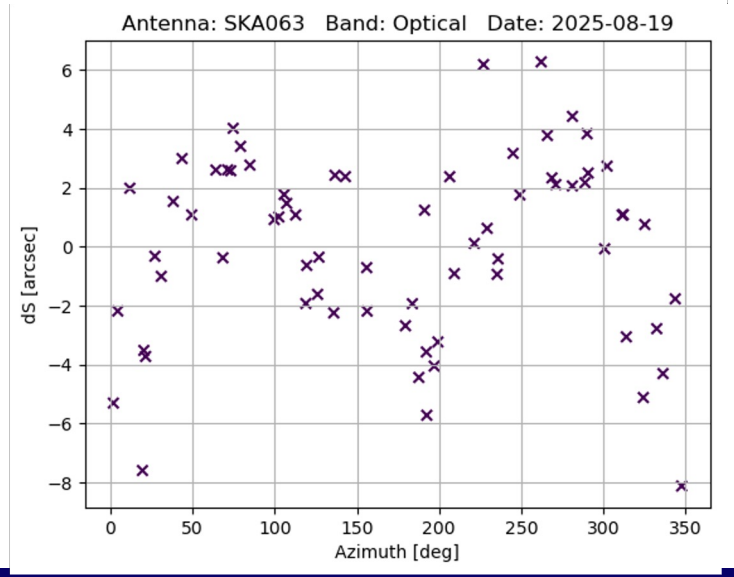
Standard 6-term geometrical model for an Alt-Az mount and two empirical flexure terms.

In-house analysis script (Jpoint).

69 out of 72 target stars.





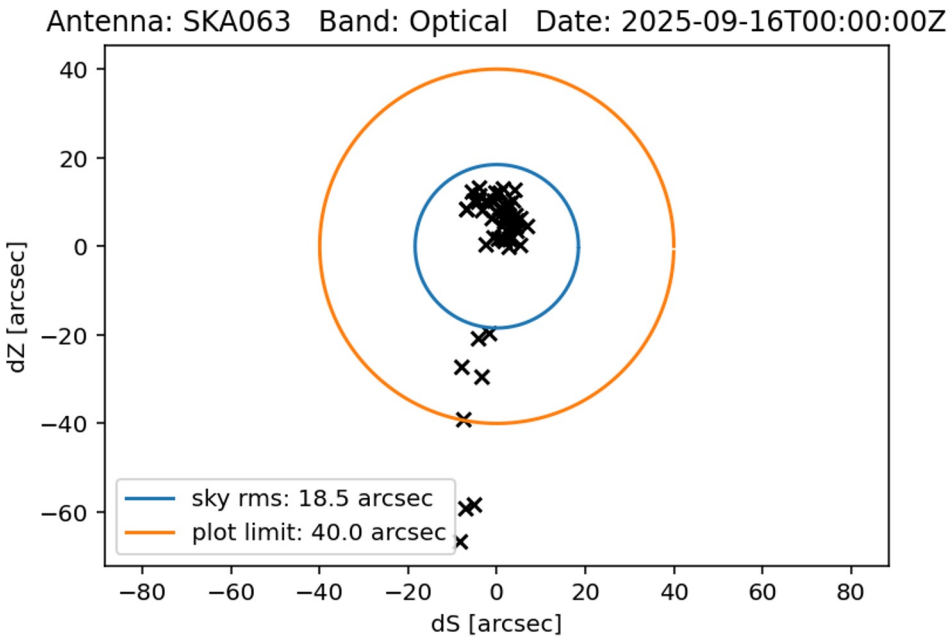


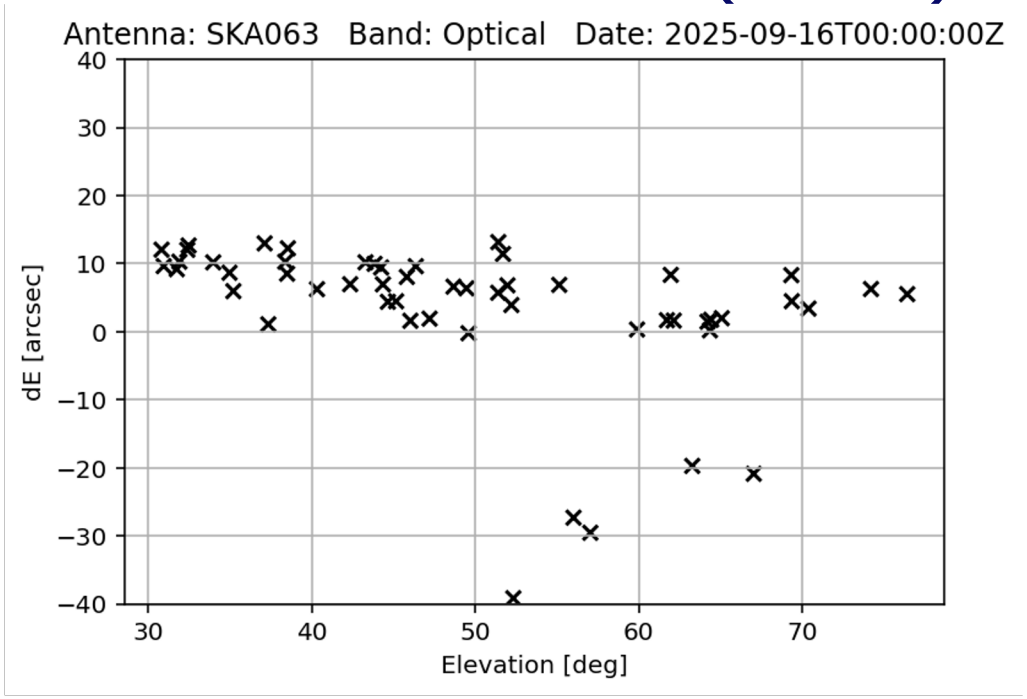
Sky RMS = 5.33″
Popn SD = 5.76″
RMS El = 4.36″
RMS XEl = 3.06″

Subsequent optical pointing observations

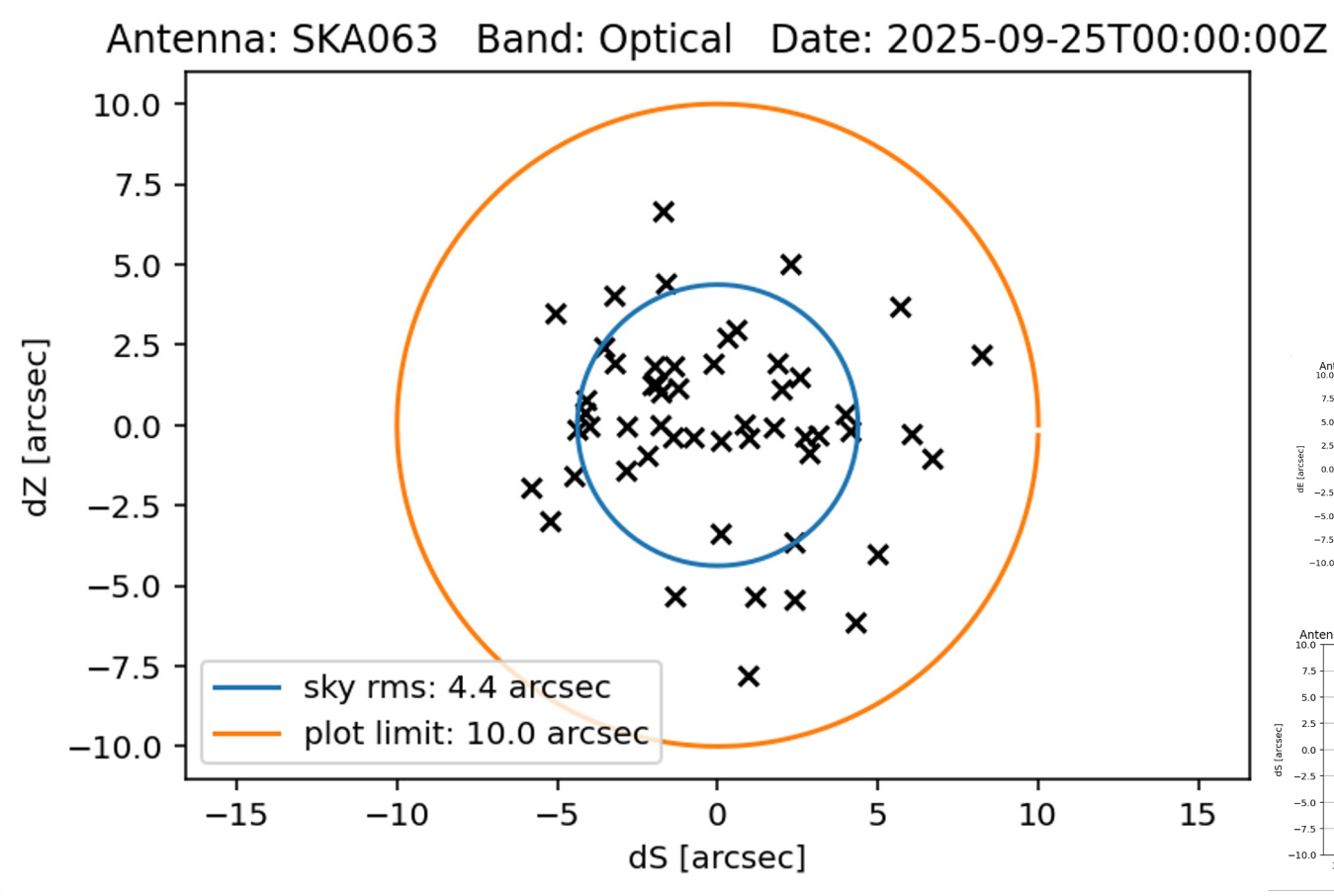
Apparent elevation-dependent offset in elevation…

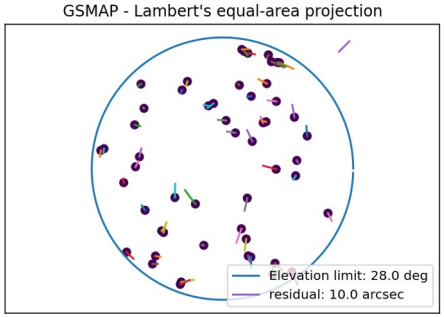
Problem with weather station - refraction model (GIGO)

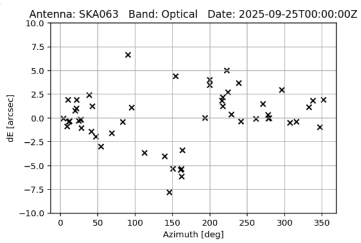


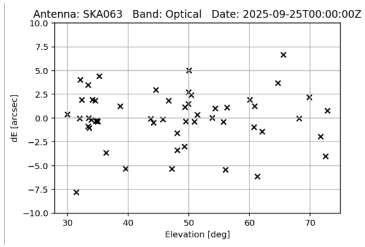


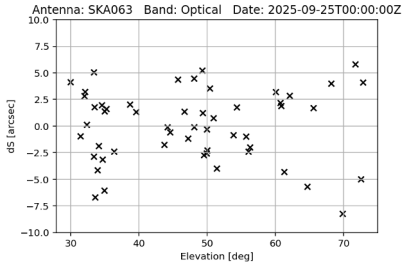
Most recent observation - wind gusting ~5 m/s

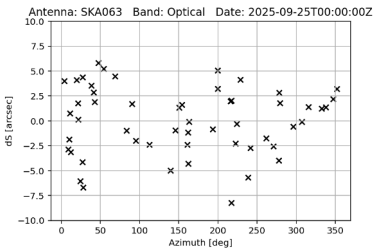












Questions?

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

SKAO

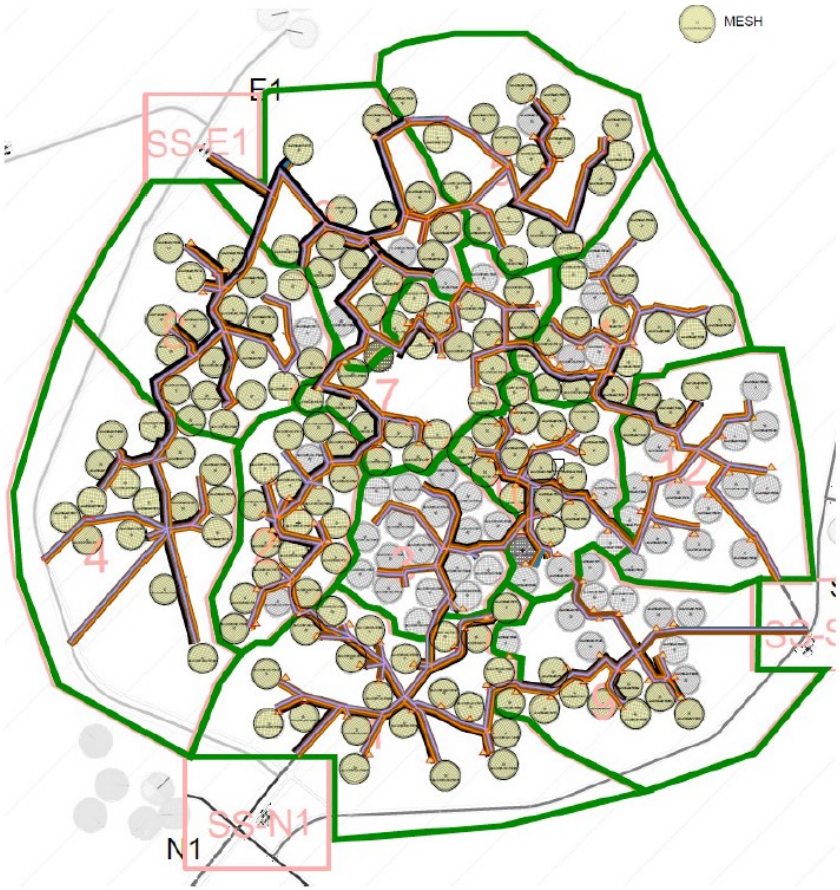
www.skao.int

For Project Use Only

SKA-Low update

- Most of core mesh laid
- > 14,500 antennas now deployed (all 4096 for AA1)

- AA0.5 testing continues (interferometric, tied array, software pipelines, calibrator fields)
- Preparing for AA1 commissioning (identifying tests, developing plans, …)

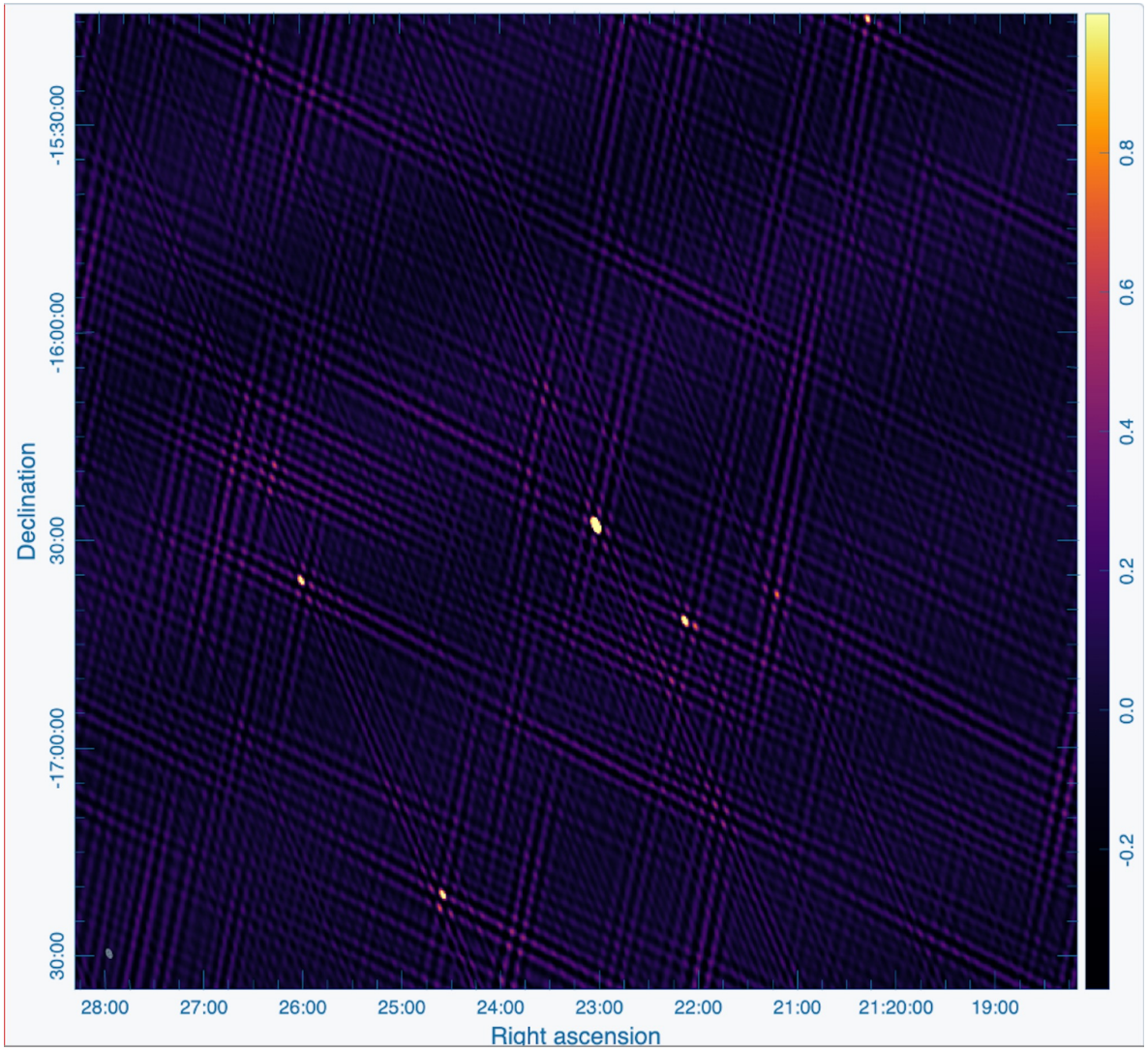


SKA-Low update

A calibrator field

Basic flagging and calibration (delays, bandpass, no selfcal)

5 min. snapshot, 75 MHz BW (125-200 MHz), all 4 AA0.5 stations

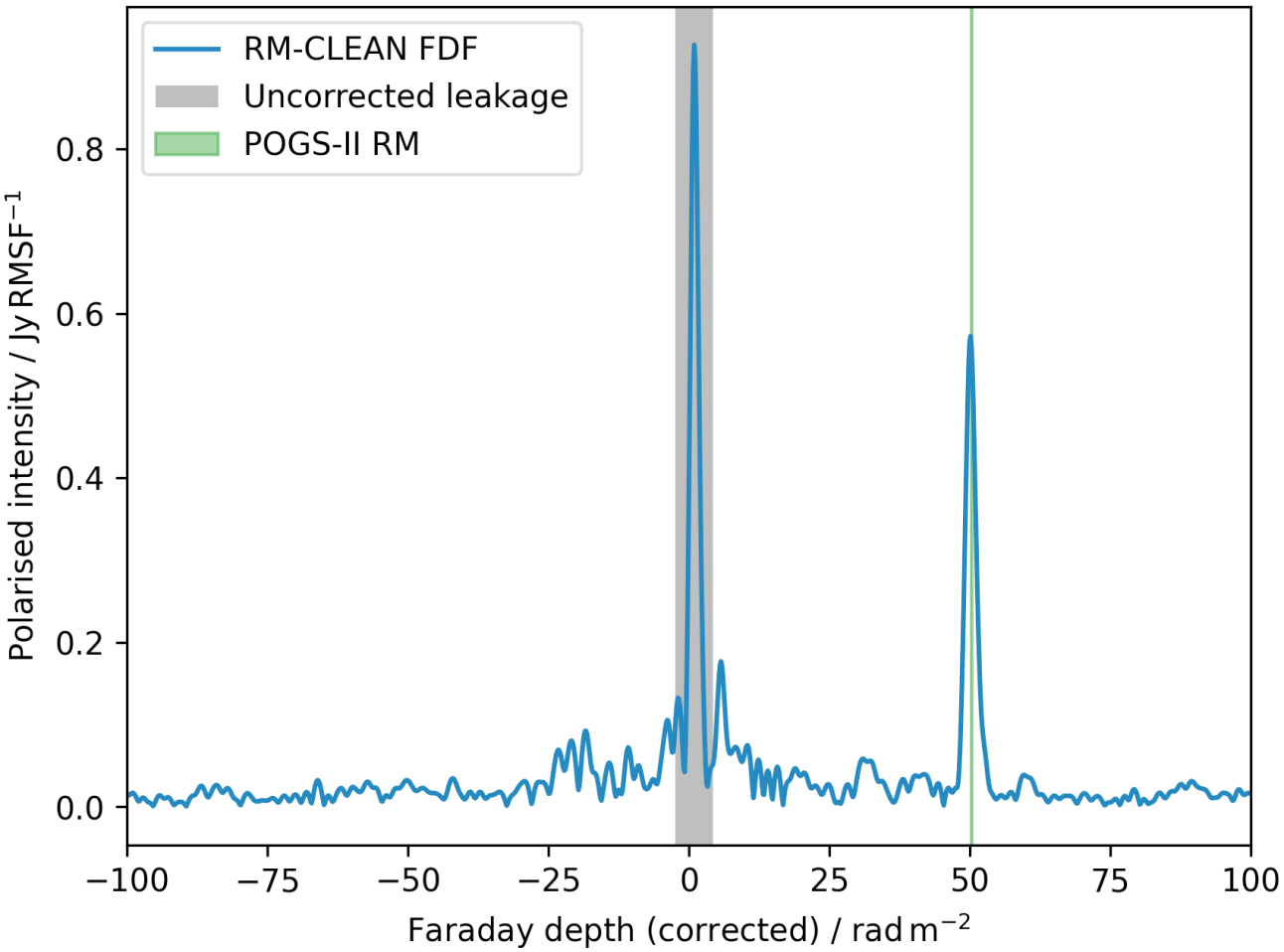


Thanks to George Heald for the update

SKA-Low update

A polarisation spectrum, recovered the expected RM for the known reference source (AGN)

POGS-II = Polarised GLEAM Survey (POGS) II



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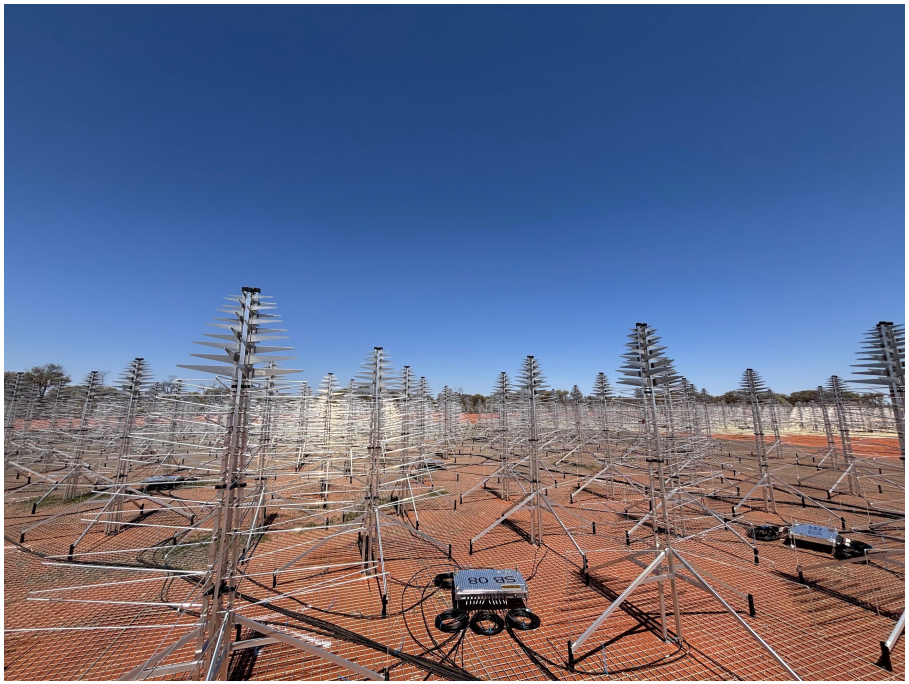
SKA-Low update

Early PST testing, using two stations combined



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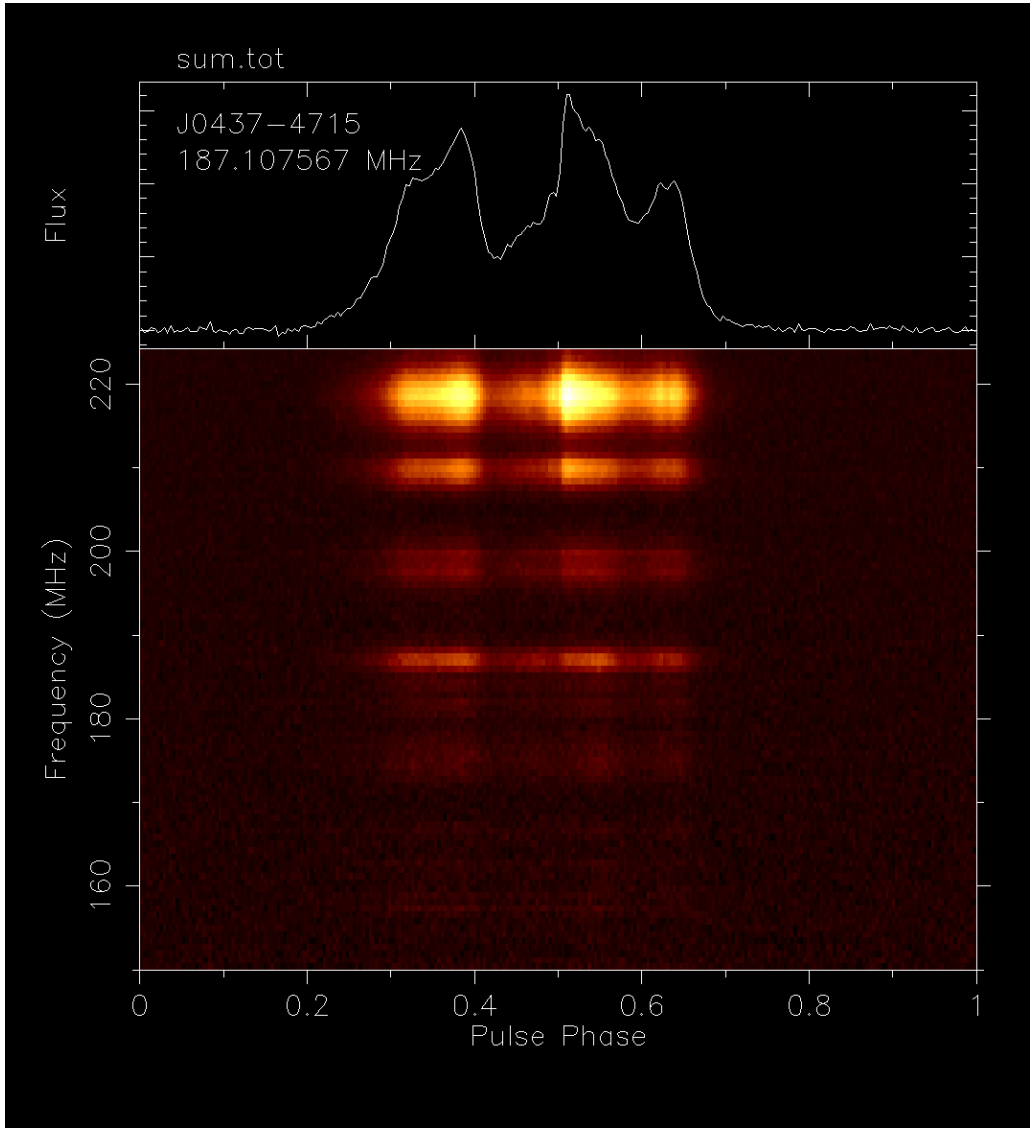


Updated SKAO Science Book

"Advancing Astrophysics II"

- An up-to-date coverage of the science questions that will be addressed by the *Design Baseline (AA4) SKA telescopes*.
- **Current status:**
  - 241 chapters planned for the book (link)
- **Book structure:**
  - Organised into broad themes: traditional scale-based
  - Will include overview section from each SWG
- **Timeline**
  - Chapter draft submission deadline 31st October 2025
    - Full Instructions for Authors and LaTeX template
  - Final submission deadline Mon 17th October 2025
  - Reviewers' assignment Q4 2025
  - Peer review round Q1 2026 (tentative)
    - Inviting SKAO community, relatively light touch
  - Further editing round Q2 2026 (tentative)
  - Completion by July 2026 Council meeting (target)

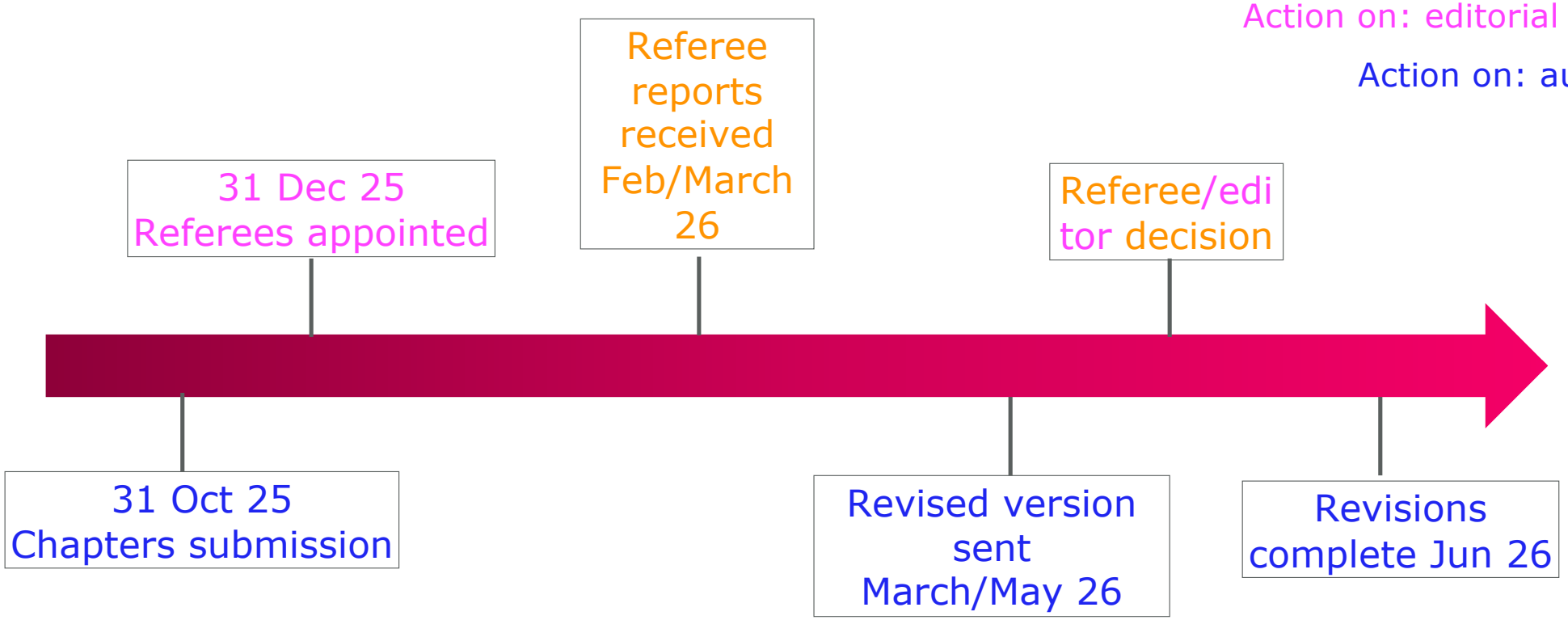
- Support strategic direction of the Observatory, by providing detailed science requirements to inform:
  - the path from AA* to AA4
  - The Observatory Development Plan

Proposed timeline for submission and revision

Action on: referees

Action on: editorial board

Action on: authors



Reviewers

Members of the community with expertise relevant to the paper, not co-authors or conflict of interest

- "Light" review in the period Jan 26 2025-March 26
  - Draft Instructions for referees can be found here. Please comment!

- Check that the revised version addresses the comments and make final decision

Editorial board

- Appoint referees in the period end of October-end of December
- Chase referee reports if necessary
- Check referee reports and decision(s)

Assigning editors

- Every paper needs an editor, which means every editors will have several papers!
- How do we do it?
  - Papers from an SWG to be split between editors appointed for that SWG.
  - Maximum 7-8 papers per editor -> additional editors recruited based on the expected numbers of submissions
  - SKAO to handle conflict of interest papers or to reduce excess load

Appointing referees

- We foresee a large number O(200) papers!
- We need a streamlined and efficient method for assigning referees
  - Option for authors to suggest possible reviewers at submission
  - Editors can also add more possible names from their own knowledge of the community/paper searches, etc.
  - Tags (keywords) on papers to help identify the expertise required. Current list of keywords is here
  - Authors of other papers with matching keywords can be asked to review

Impending deadlines:

- 15th Oct (tomorrow!): deadline to modify the keyword list
- Please also review and comment on the guidance for reviewers!
- Call for volunteer referees sent 16th Oct- 31st Oct
- 20th Oct: Chapter submission opens
- 31st October: deadline for **draft** submission (al least title, abstracts, authors, keywords
  - By this date we want all editors apointed and added as Committee members
  - Editors can start identifying referees, but not send to review yet
- 17th November: deadline for **amending the submission**
  - Editors can send papers to review as they are now the final version

Appointing referees

- SKAO will export title lists, author lists, and potential reviewers lists to share with editors outside of the submission platform (Oxford Abstracts) to plan and coordinate the work between different editors
- Editors will have access to all submissions through the Oxford Abstracts platform as “committee members”
- Editors will be able to assign referees directly from the Oxford Abstract platform – although they could informally message potential referees beforehand
- The platform also allows to check if a referee already has been assigned to another paper
- Disclaimer: There does not seem to be a way to restrict access for Committee Members to just some submissions - we trust them to be “outstanding citizens” regarding their own papers!

Editorial board and referees acknowledgment

- Editorial board members to be explicitly acknowledged on the book
  - arXiv HTML list (as done for conference proceedings) will give a way to cite the whole book
    - Editors will figure as authors of this index list
  - The book will also appear on the SKAO website, with editorial board explicitly stated
- Reviewers list to also appear on the book, with no mention of which papers they reviewed (opt out option)

Any Other Business

- Feedback on observing modes rollout – Shari's email
- News from SWG Chairs?
- …

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SKAO

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www.skao.int/en/science-users