SKA SWG Update

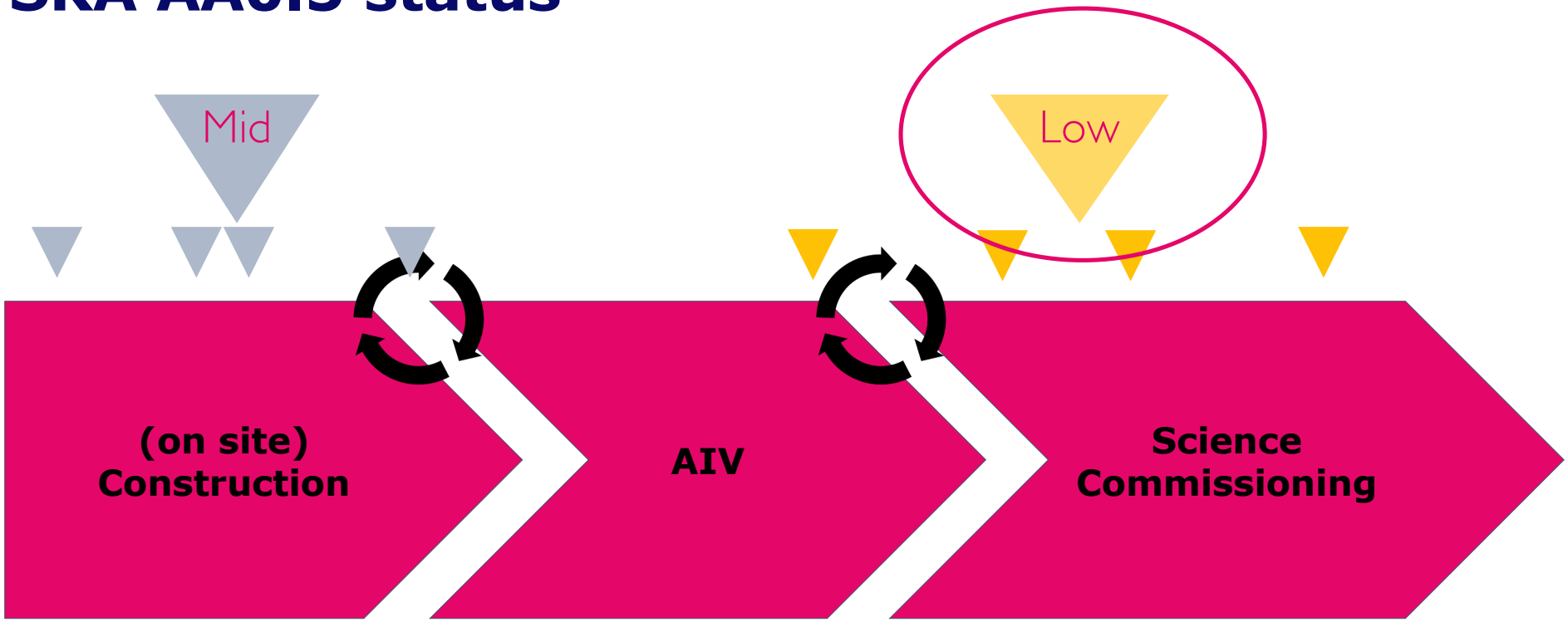
Dr A. Bonaldi
Observatory Scientist

20/5/25

SKA Science Update

- Construction Update
  - From SKA construction Update 2025 – 6-7 May
- Science Data Challenges
- SKA 2025 science meeting
- Updated SKAO Science Book
- AOB

SKA AA0.5 status



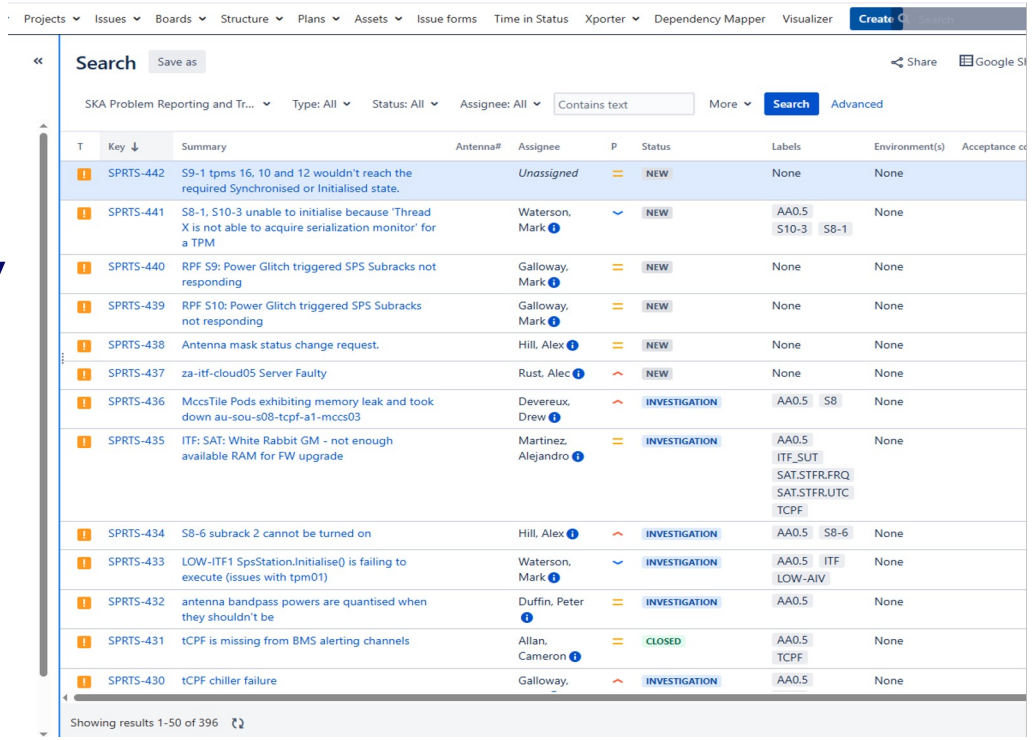
Engineering commissioning and Site Acceptance Tests

Includes Test Cases, Verification Events, Qualification

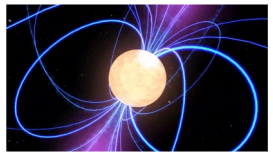
Structured around a Commissioning Plan for each Array Assembly

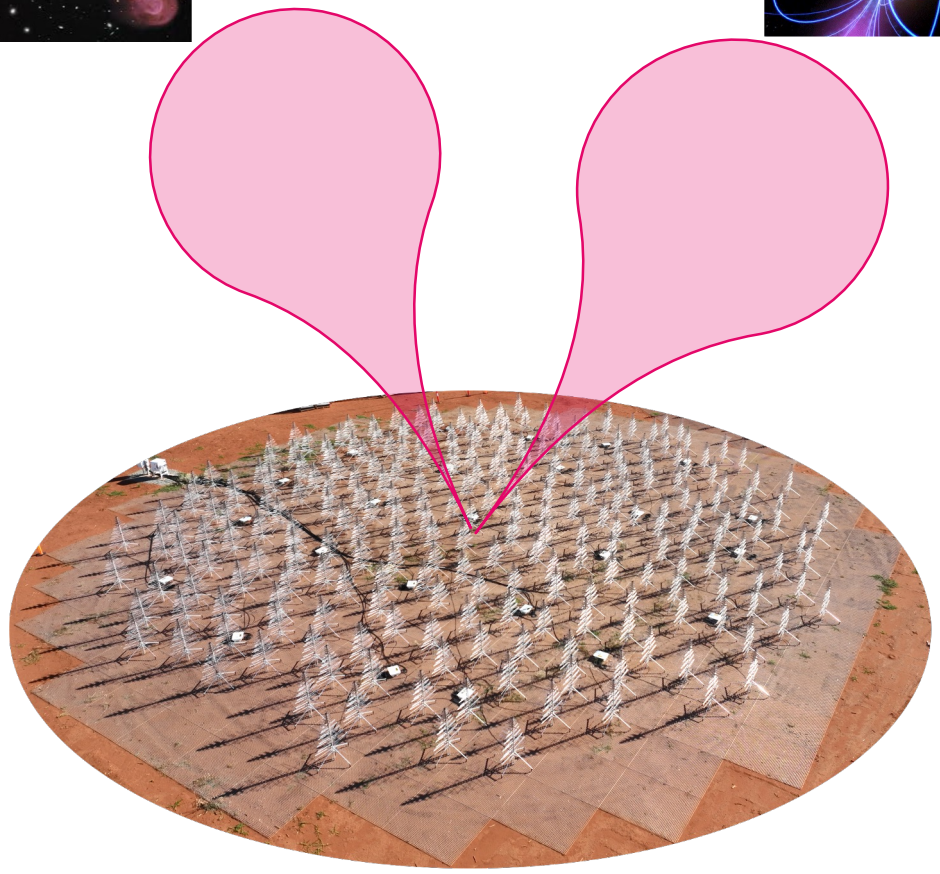
SKA Low AA0.5 construction and AIV

- Construction/assembly plans followed & expanded/improved by site tech teams
- AIV and Science Operations teams successfully using the system
  - As single stations like AAVS
  - As an end-end integrated array
- 440+ issues raised, 234 closed
- Basic performance continues to achieve expectations
- Final design element (Power and Signal Distribution) “done”
  - RFI testing looks good



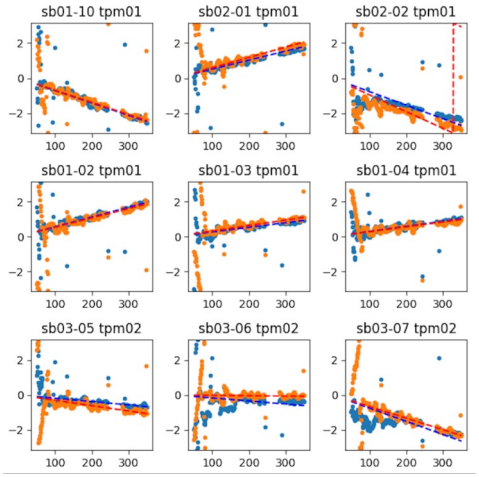
Single station behaviour

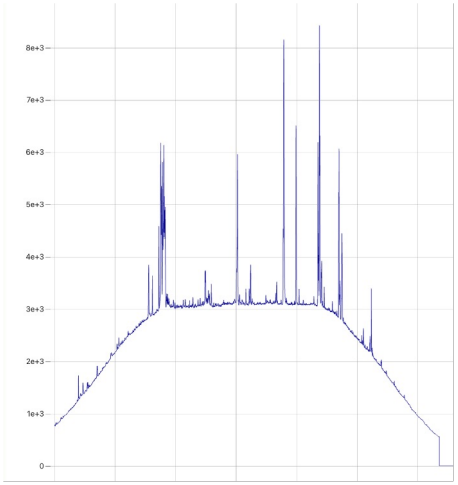




Commissioning outcomes so far:

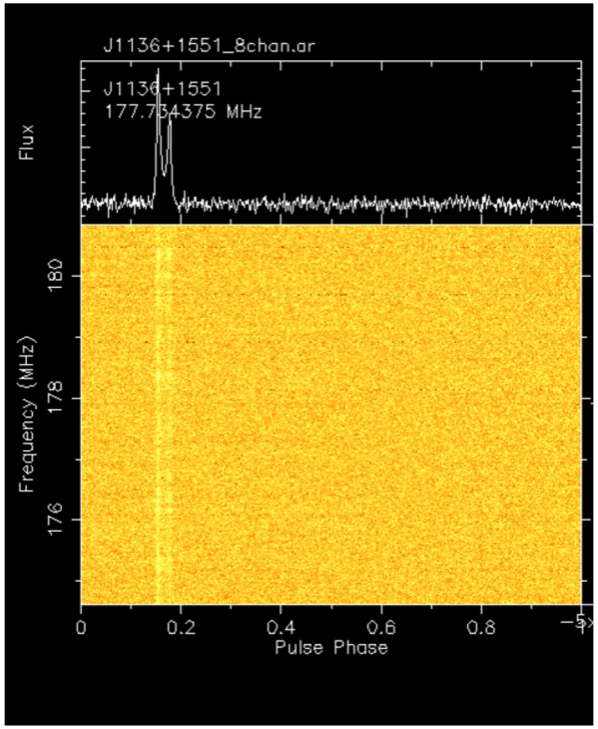
- Good calibration solutions for each antenna within a station
- Per-antenna delays for pointing and tracking are fit for purpose
- Beam shape and sensitivity are approximately as expected

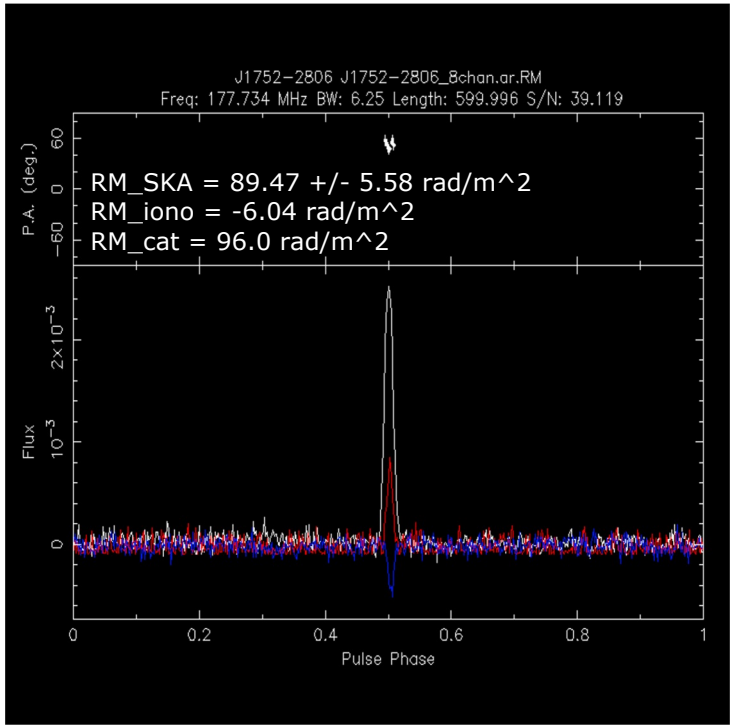


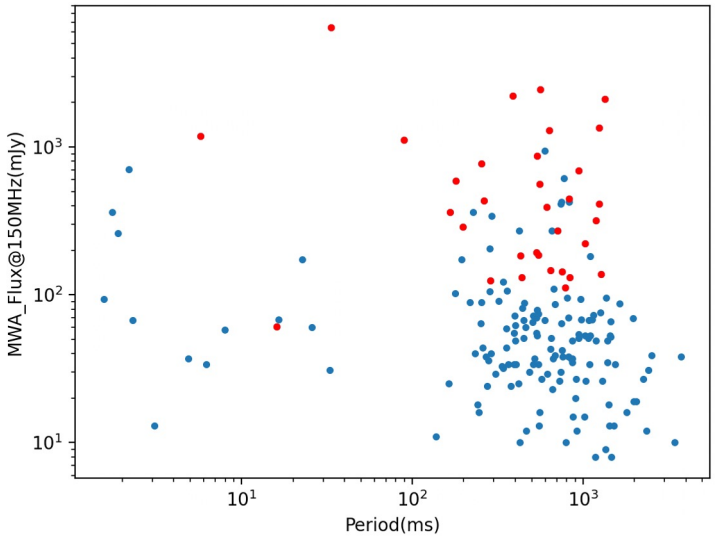


Low Science Commissioning: Pulsar detections

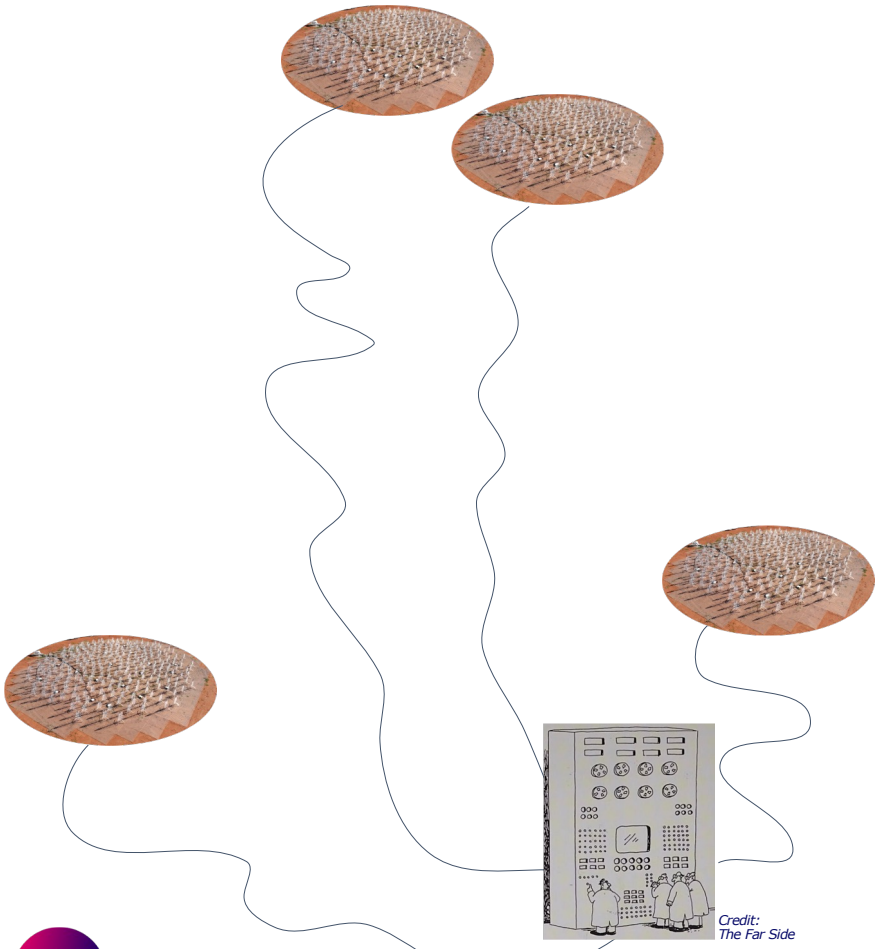
Detected **37** known pulsars so far! Including in linear/circular polarization.
So far, mostly using single stations to test pulsar detection capabilities.





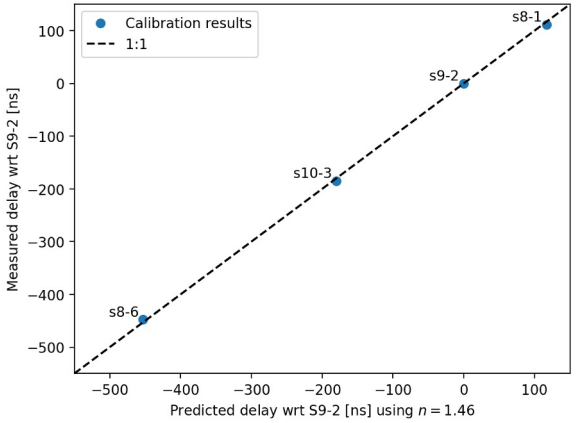


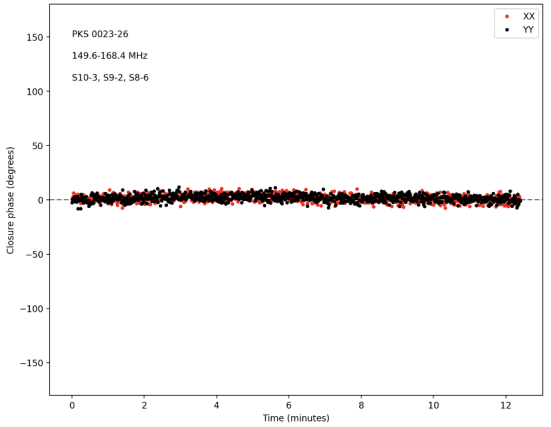
Array-level performance



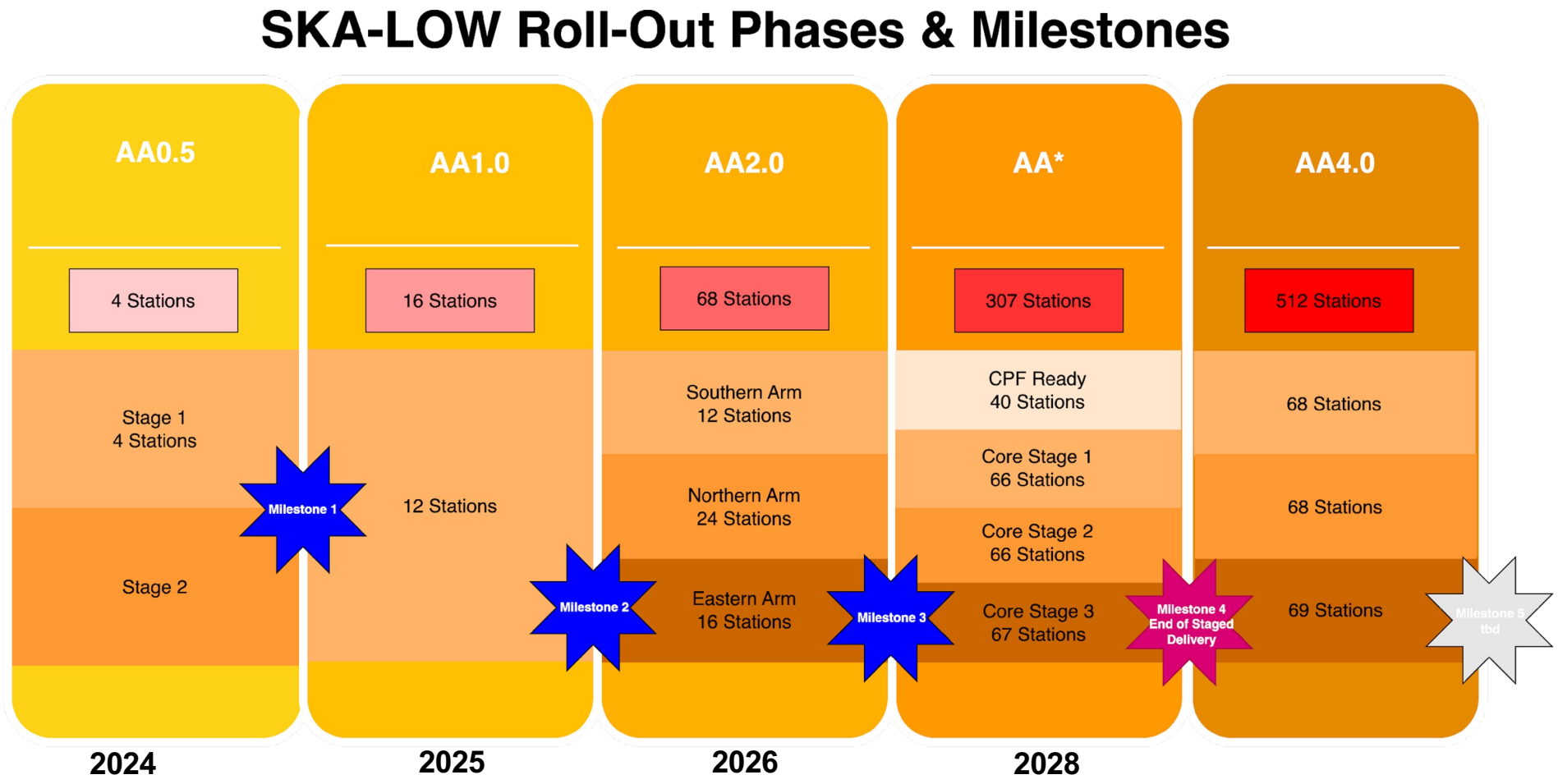
Commissioning outcomes so far:

- Interferometric fringes detected
- Per-station delays determined to be stable and match fibre lengths
- Closure phase verified (indicating that visibilities can be calibrated)
- First image produced!
- Initial tied-array beamforming tests are promising

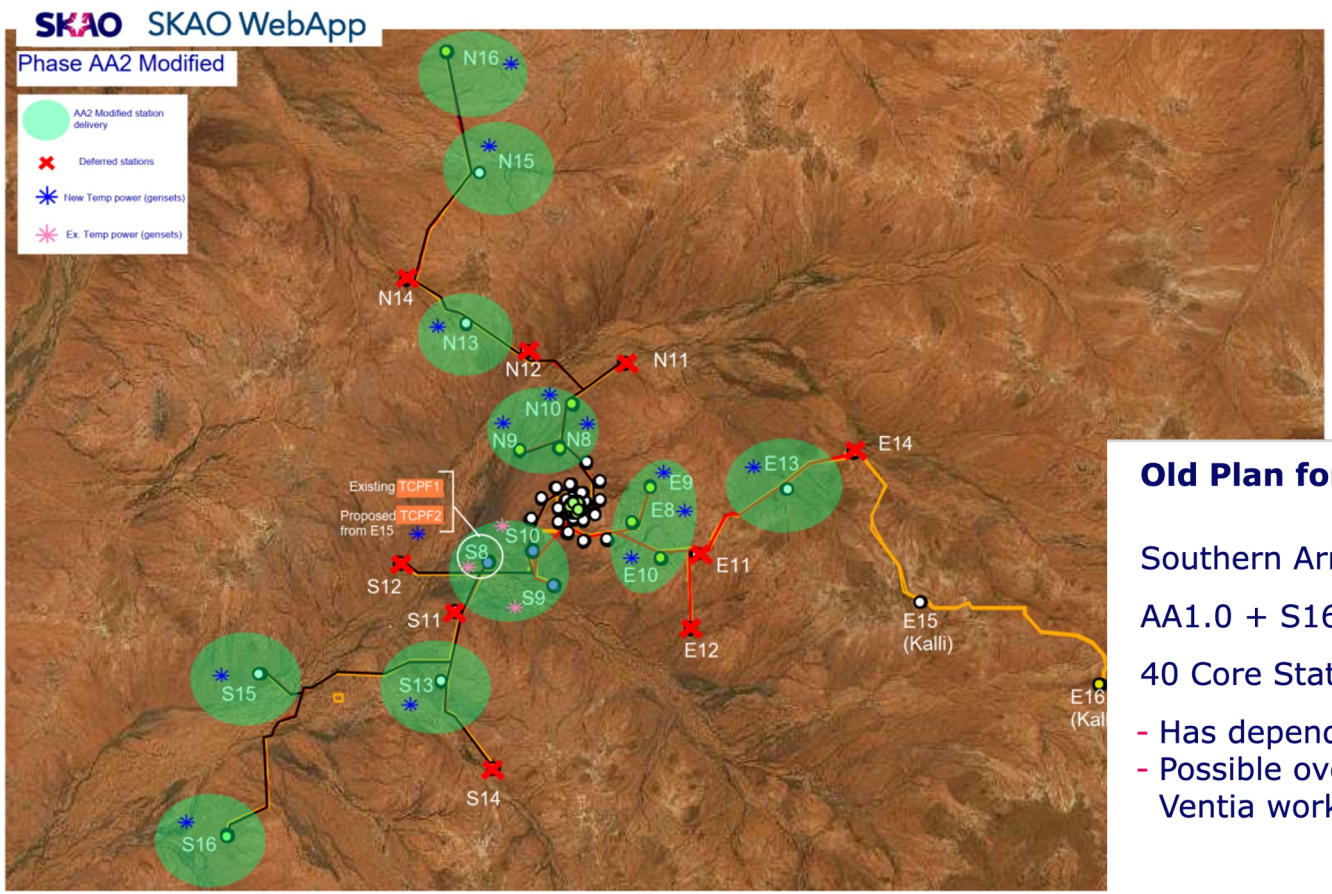




SKA-Low


SKA-LOW Roll-Out Phases & Milestones
AA0.5
4 Stations
Stage 1
4 Stations
Stage 2
AA1.0
16 Stations
12 Stations
AA2.0
68 Stations
Southern Arm
12 Stations
Northern Arm
24 Stations
Eastern Arm
16 Stations
AA*
307 Stations
CPF Ready
40 Stations
Core Stage 1
66 Stations
Core Stage 2
66 Stations
Core Stage 3
67 Stations
AA4.0
512 Stations
68 Stations
68 Stations
69 Stations
Milestone 1
Milestone 2
Milestone 3
Milestone 4
End of Staged
Delivery
Milestone 5
tbd
2024
2025
2026
2028

Modified approach for AA2.0



Justification of change: mitigate the delay due to delivery of critical system components, particularly CPF that provides processing power for the Core

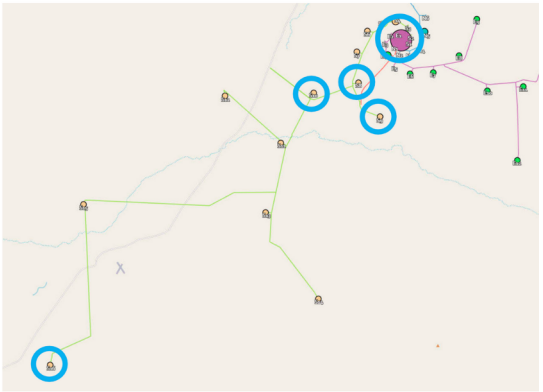
Old Plan for AA2.0

Southern Arm:

AA1.0 + S16

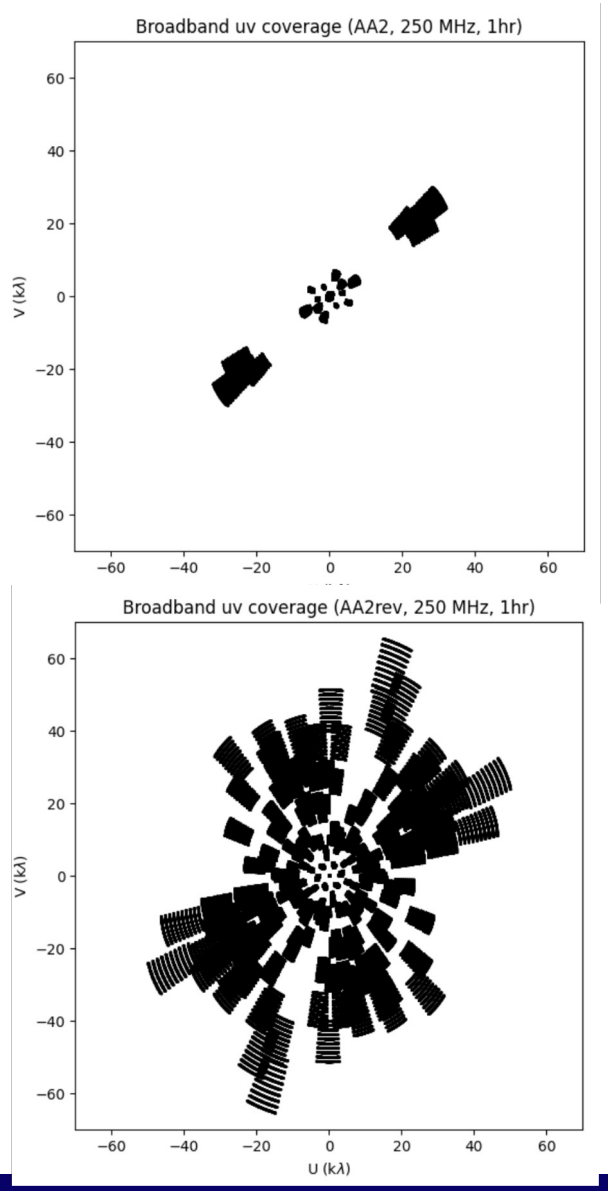
40 Core Stations

- Has dependency on CPF
- Possible overlap with Ventia work in core

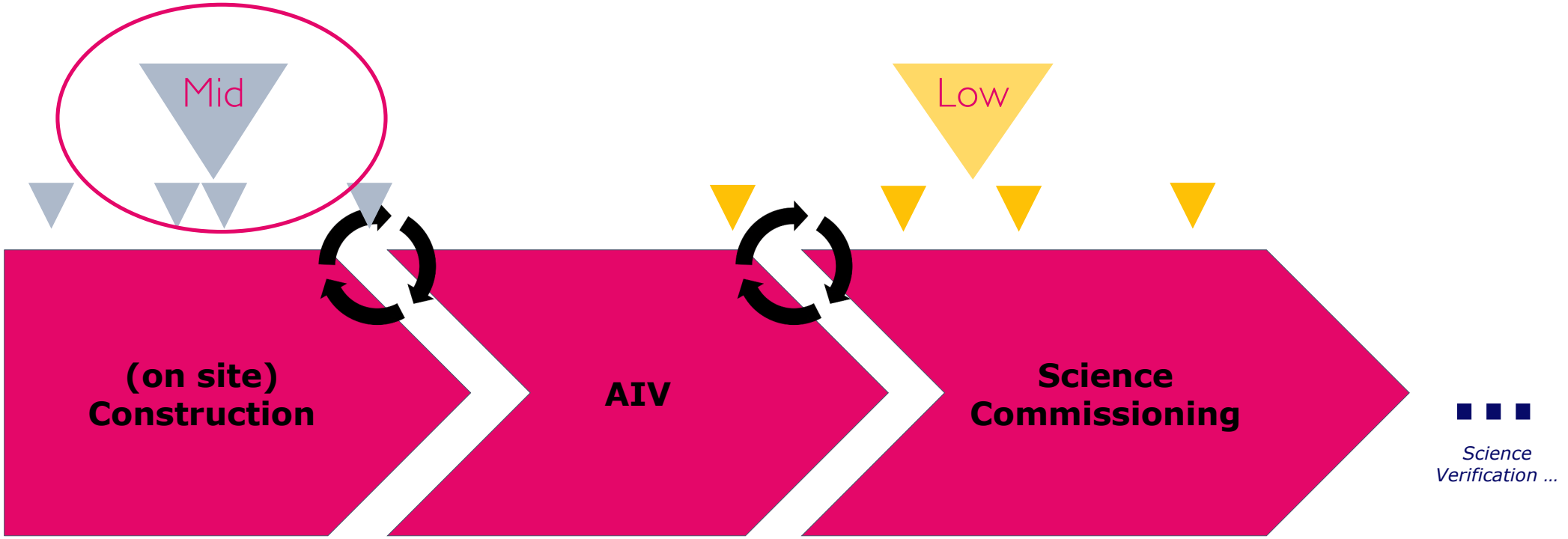


AA2 Modified: UV coverage

- Significantly better interferometric imaging capability in AA2
  - More time for SDP developments on self-calibration
  - Implications on the SDP pipelines
- More distributed collecting area
  - Still 40 stations in the core (AA* Phase 1): more balanced core/remote deployment
  - Better aligned with the MID roll-out plan
- AA* layout unchanged!!



SKA AA0.5 status



Engineering commissioning and Site Acceptance Tests

Includes Test Cases, Verification Events, Qualification

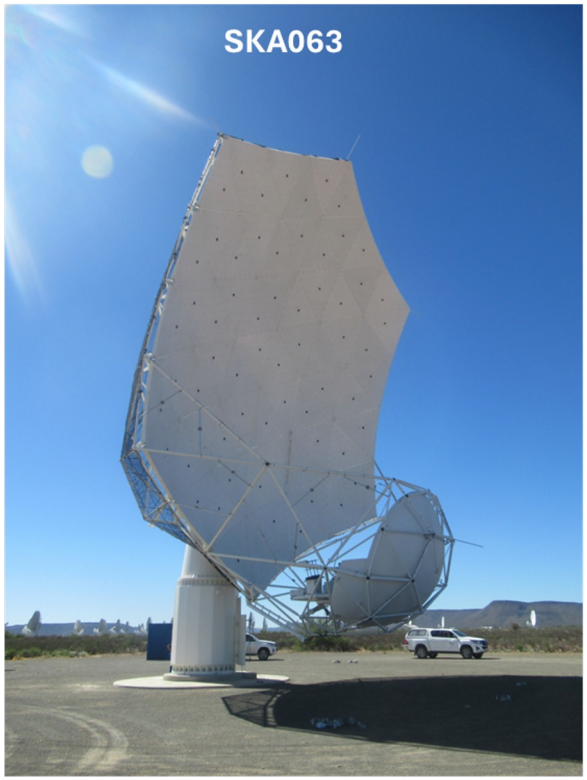
Structured around a Commissioning Plan for each Array Assembly

SKA-Mid AA0.5 construction and AIV

- 3 dish structure built
- 4 more on site awaiting assembly
- ITF test readiness review completed
  - AIV starts!

- Dish structure: delay due to need to refine the installation and initial testing procedure, safety protocols, RFI compliance of work on site – **all being resolved**

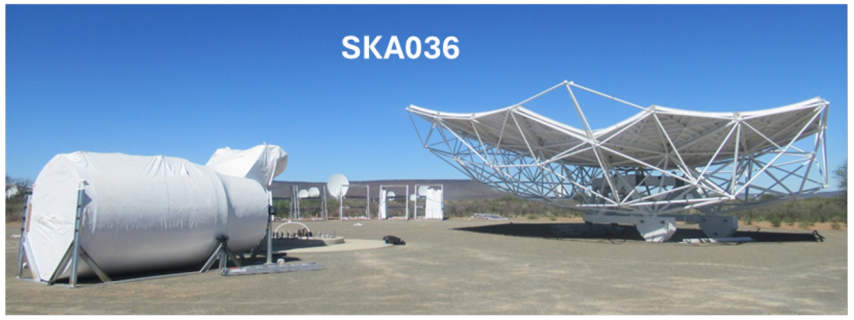
Dish Structure AA0.5



- Commissioning/site acceptance ongoing
- Site acceptance test complete
- SKAO qualification ongoing prior to handover to AIV

- 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

- Now on its pedestal



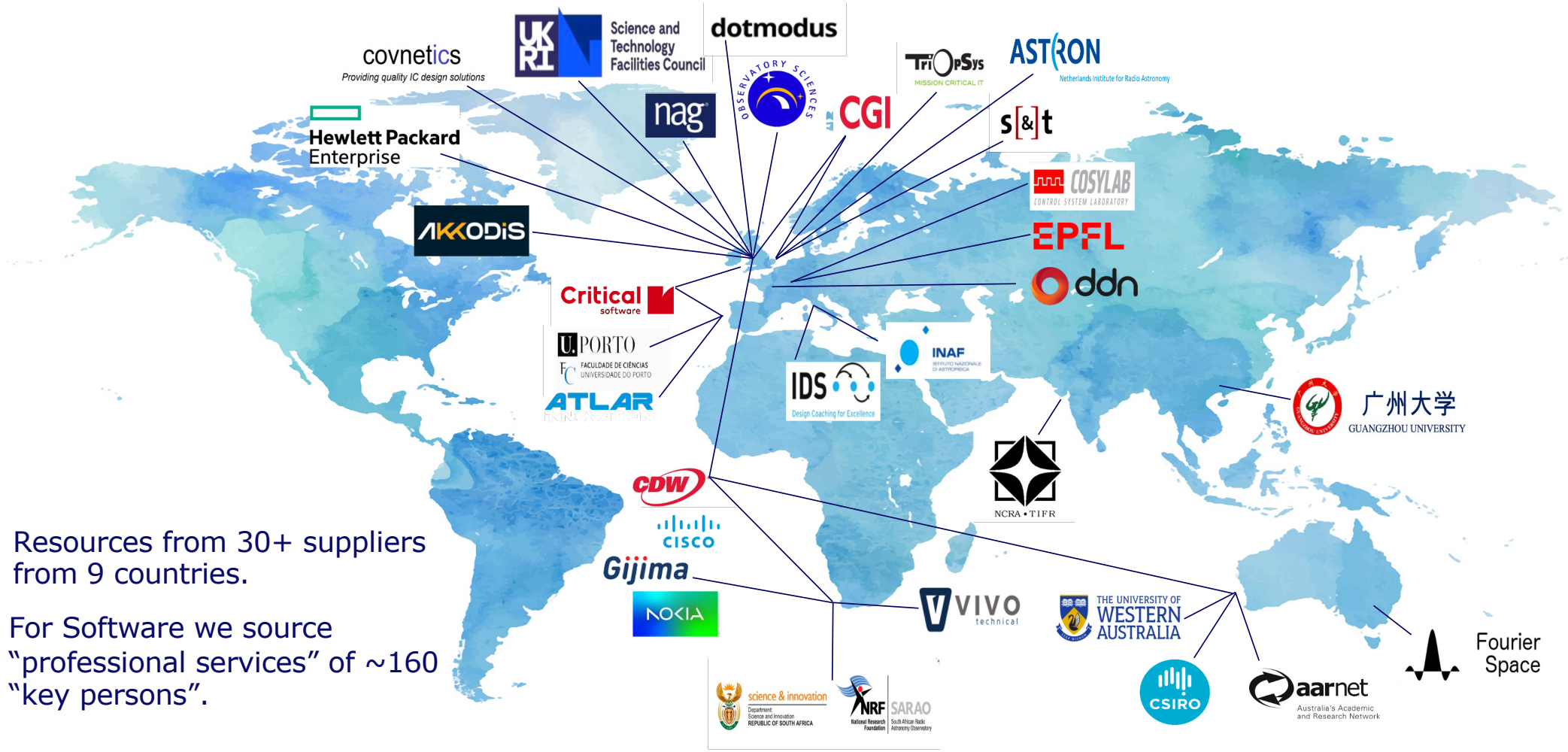
- Panel installation and day time photogrammetry
- Working a plan to do filter cabinet installation via door/hatch prior to Big Lift (no Drive System on site)

1

Mid – key upcoming activities

- ITF testing start – May 2025
- Final AA0.5 system installations – June 2025
- SKA063 qualification complete – Q3 2025
- SKA001 and SKA100 handover to system AIV – Q4 2025
- Targeting achieving fringes by the end of 2025

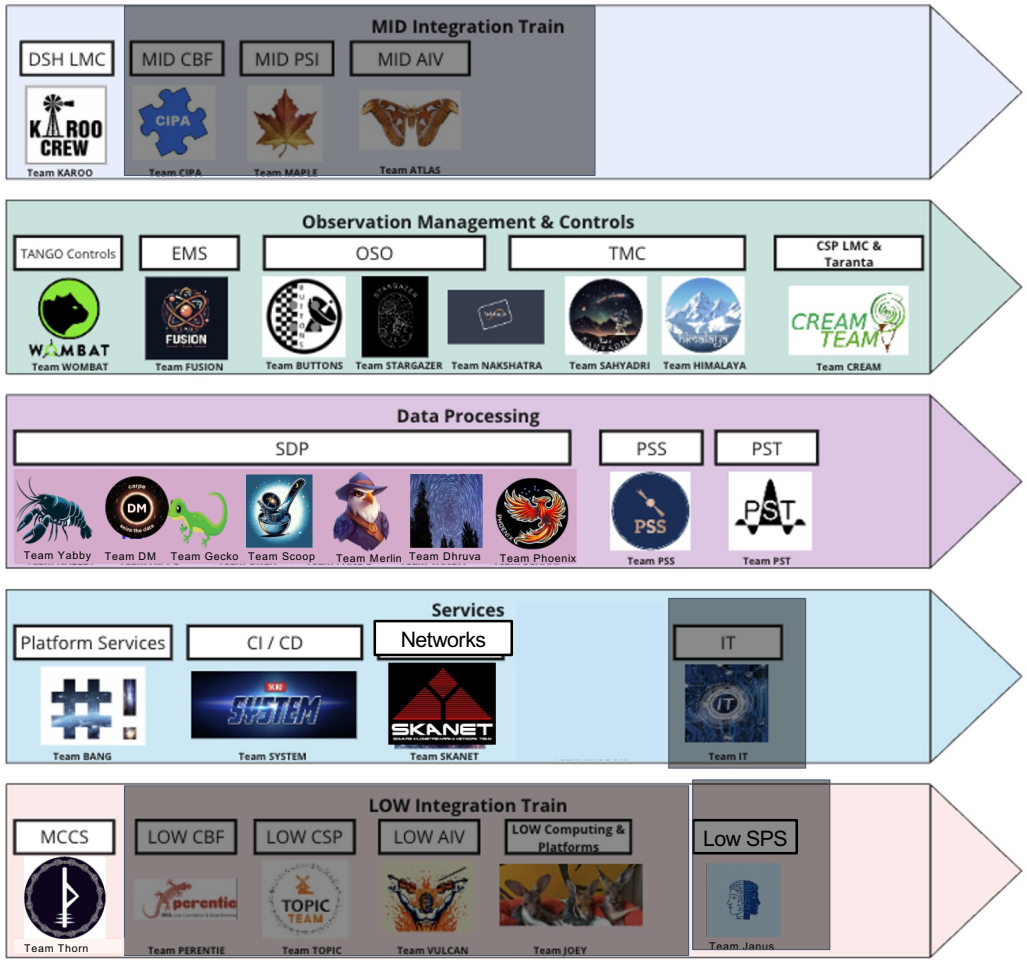
Computing & Software Supplier Ecosystem



- Resources from 30+ suppliers from 9 countries.
- For Software we source "professional services" of ~160 "key persons".

How we deliver Computing and Software

- Coordinated effort of 31 globally distributed teams.
- Guided by the Scaled Agile Framework (SAFe™).
- Construction C&S Teams are present in 5 of the 6 Agile Release Trains (ARTs)
- SRCNet is the 6th ART working towards the SKA regional Centre Network.
- Content, technical and process alignment between the ARTs is managed by the Solution Team & ART Program Teams.
- All ARTs follow the same 3-month planning, prioritisation and delivery cadence → Planning Increment (PI).
- Work is shared with stakeholders through frequent system demos throughout the PI.



Computing and Software Highlights

- We are rapidly maturing as a delivery organisation helped by solid construction progress
- SKA-Low AA0.5 is a working telescope controlled by SKAO software and being actively used by Science Commissioning.
  - ***"…even with the 'bugs', everything is working really well, with many aspects of the system being reliable and of high quality."- George Heald** (March 2025)*
- The software is deployed on Low AA0.5 computing hosted in the Science Processing Centre (SPC) in Pawsey and connected to the Remote Processing Facilities (RPF) in the field.

- SKA-Mid has a 4 receptor system under test in the Integration Test Facility (ITF) running on SKAO software.
- The Mid AA0.5 cluster and platform are ready for product installation in the Karoo Array Processing Building (KAPB).

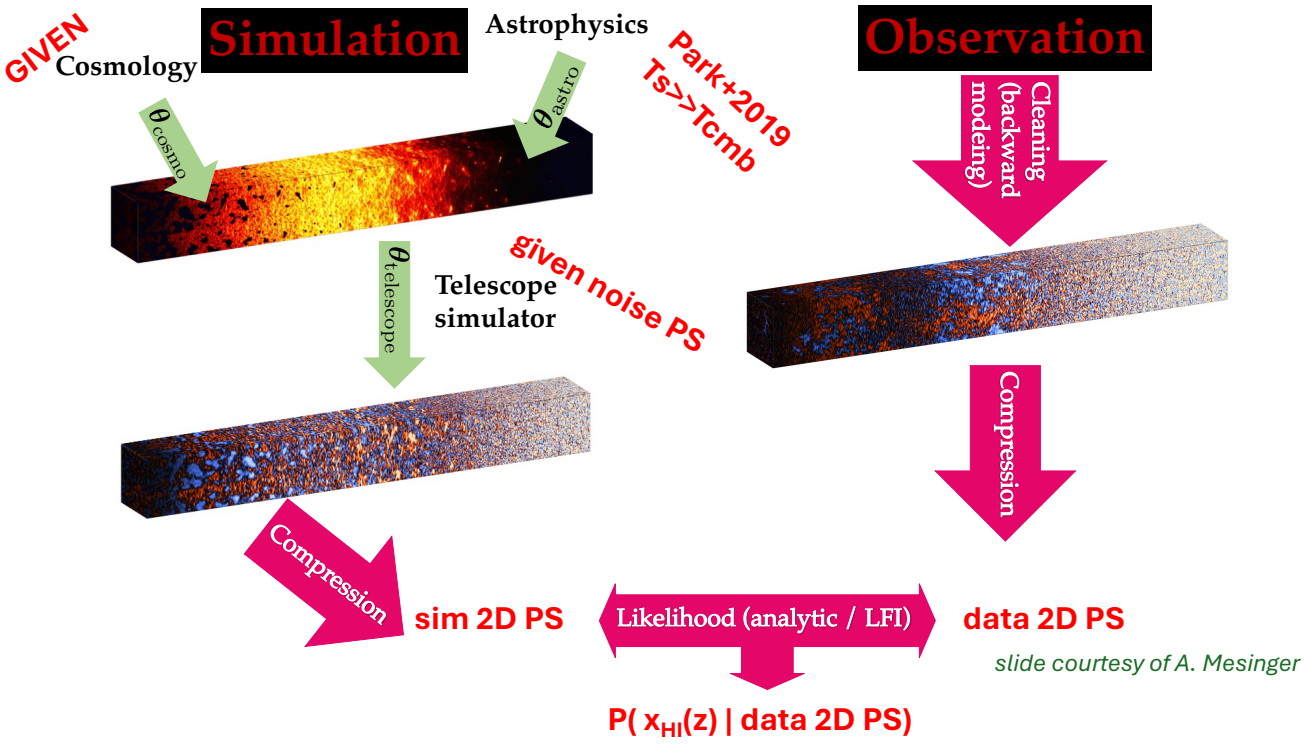
- And as is every agile project's dream…. **WE HAVE REAL USERS!!**

MCCS software developers on the SKA-Low site in Sep 2024

TMC developers from india visiting the Mid site after a week workshop with the Mid AIV team

SKA Science Data Challenge 3b

EoR Inference

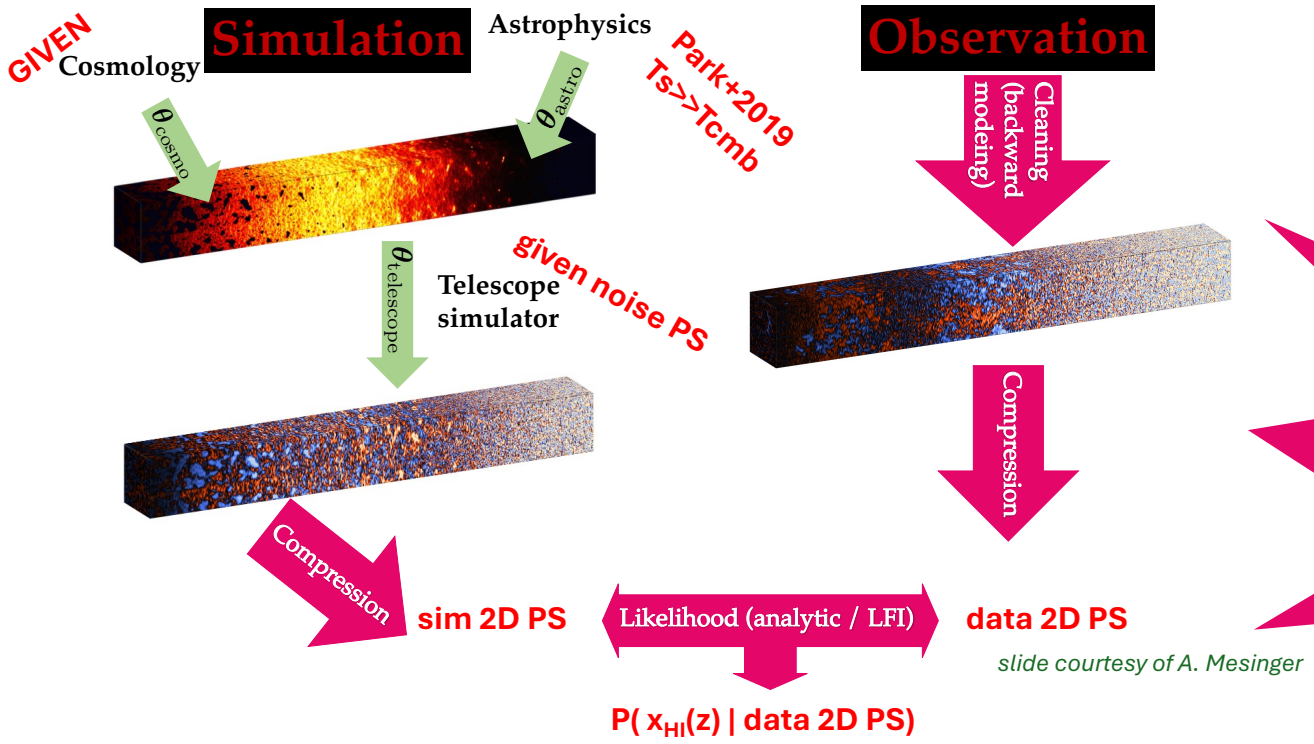


slide courtesy of A. Mesinger

- The datasets:
  - PS1: Power spectra of EoR1 + noise + SKA-Low for Simulator 1
  - PS2: Power spectra of EoR1 + noise + SKA-Low for Simulator 2
  - PS3: Power spectra of EoR1 + noise + foreground residual + SKA-Low for Simulator 1/2
  - IM1: imaging product corresponding to PS3 (includes foreground residual)

SKA Science Data Challenge 3b

EoR Inference



slide courtesy of A. Mesinger

- Deadline: **30th May 2025**!
- Score is not important – no "winner" this time
- We will be investigating how consistent is the outcome given by different pipelines

Preliminary results to be presented at the Gorlitz meeting, Omkar Bait's presentation (currently Wed18 June at 11.20 CEST)!

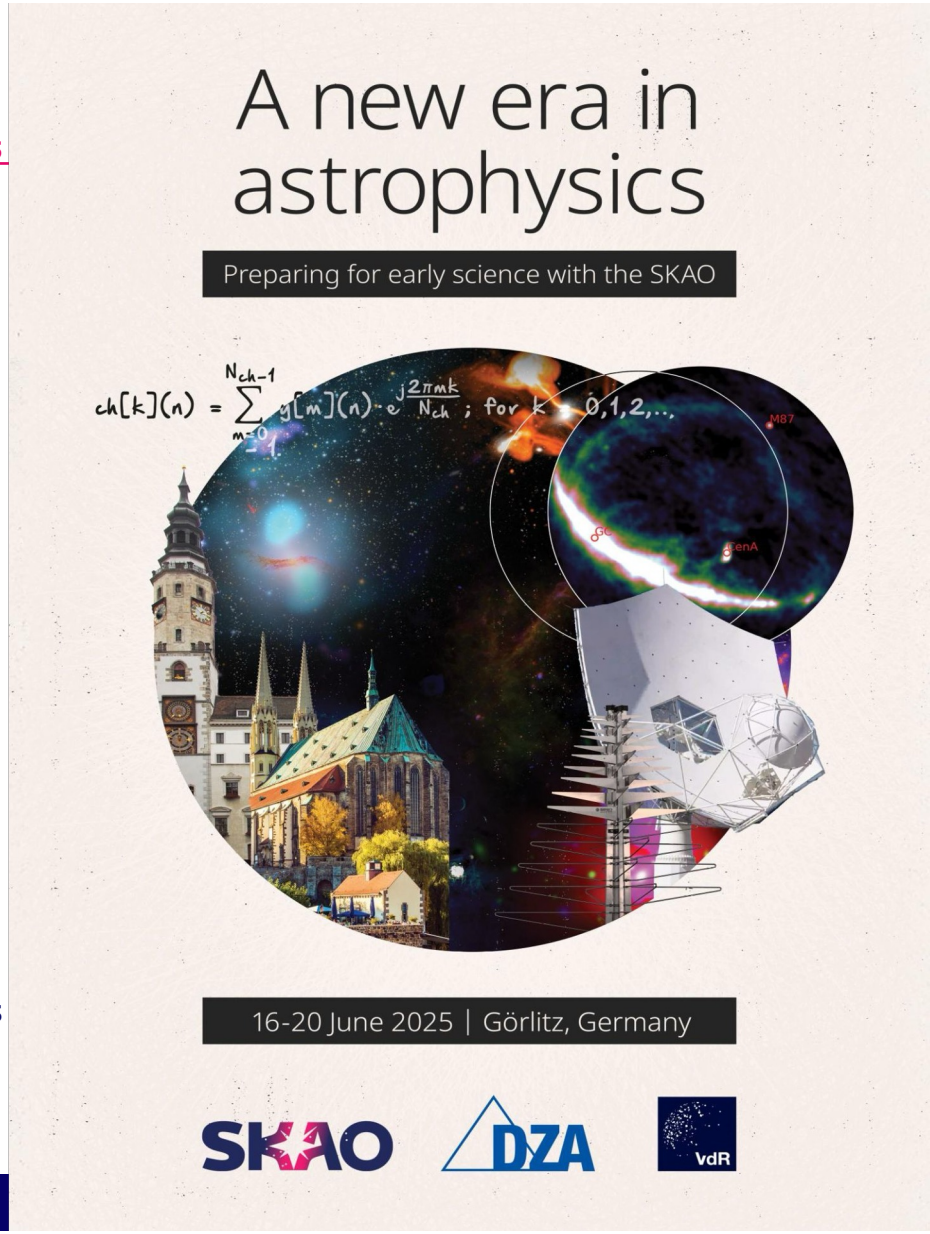
2025 Science Meeting

SKAOsci2025 website: https://www.skao.int/en/science-users/skao-science-meeting-2025

Theme:

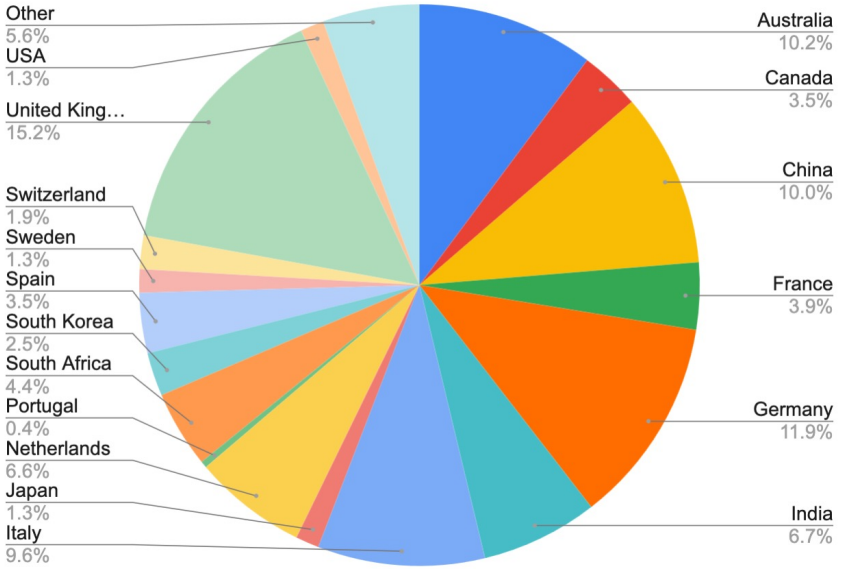
- ***"A New Era in Astrophysics": Preparing for early science with SKAO"***
- *(updated following SEAC-11 recommendation)*
- Preparing for the exciting science to come from early SKA observing cycles

- **Aims:**
  - *Refocused talk programme:*
    - A talk programme that will generate excitement for the early science opportunities with AA*
  - *As originally planned:*
    - Support and encourage SWG discussion and collaboration via parallel session programme
    - Preparing future observers: information sessions led by SKAO Science Operations team, who will share detailed telescope capabilities, operational policies and observer tools during both plenary sessions and bespoke SWG-based discussion opportunities



Participation

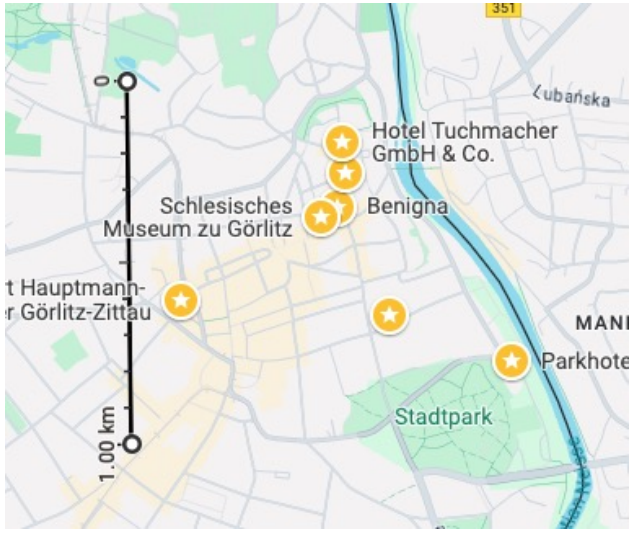
- High level of interest in attending in person
  - Cf. 2019 (SKAO Science Meeting) and 2023 (ngVLA and SKAO): 270 and 312 in-person participants, respectively
- Worked with EOC to increase capacity from 370 -> 500
  - Following a second site visit to ensure suitability
  - At the time of writing, **475 in-person attendees** now registered
  - 30 countries represented
- Online participation fully supported
  - Each session will be live-streamed with questions taken both from the room and online
  - Dedicated online poster gallery will be launched just before the meeting starts: on Thursday 12th June
    - An opportunity for attendees to browse posters in advance, perhaps while travelling
  - Online participant interaction via programme platform and A *New Era* slack workspace
    - Channels set up include dedicated place to direct questions to SKAO staff
    - Looking at how to capture queries and feedback in the most accessible and convenient way



Gerhart-Hauptmann-Theatre, location of the plenary sessions

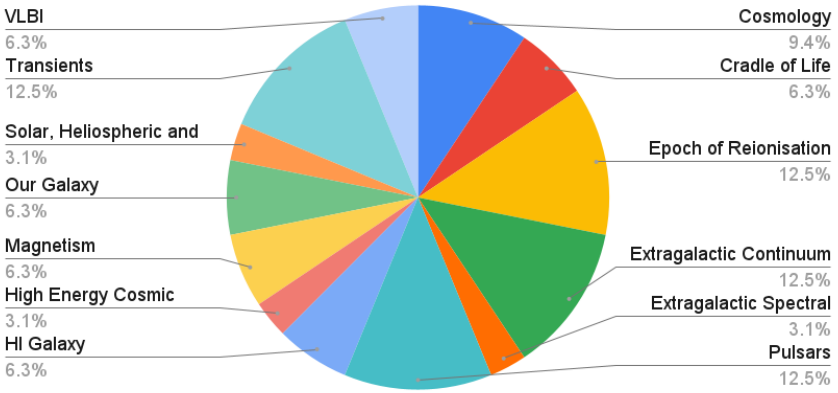
Event planning

- The meeting is being facilitated through a huge amount of hard work by the event organising team, involving colleagues from both the SKAO and our partners at the the DZA
  - Ensuring that the large number of attendees will be able to get the most out of the week
- Venues are located within a *~square kilometre* area
  - Proactive solutions to ensure attendees are able to navigate the town easily to the various talk locations and events
  - Large number of support staff will be on-hand throughout the week across the venues
- Full Audio/Visual support in all venues for remote attendance
- Rich social programme, building in plenty of opportunities for networking, including
  - Early Career Researcher lunch
  - Welcome reception located in Poland
    - Gorlitz's sister town of Zgorzelec is just over the footbridge across the Polish border
  - Emphasis on wellbeing and sustainability



Science programme

- Full confirmed programme and abstract book online:
  - https://www.skao.int/en/science-users/skao-science-meeting-2025/594/programme
  - (All registered attendees have access to the full version of the programme, which will include links to live and recorded presentations and the online poster gallery)
  - 32 plenary science talks
  - "Observing with the SKAO" special plenary session (see previous presentation)
  - Parallel sessions across eight rooms
    - SWGs organized into eight groupings based on size and overlap
    - 180 parallel session talks
    - SWG-led discussion sessions
    - "Observing with SKAO" Q&A sessions facilitated by Operations team
  - 212 posters
    - ~150 physical posters
    - All to be available online (to registered attendees)
    - 1 minute lightning talk per poster



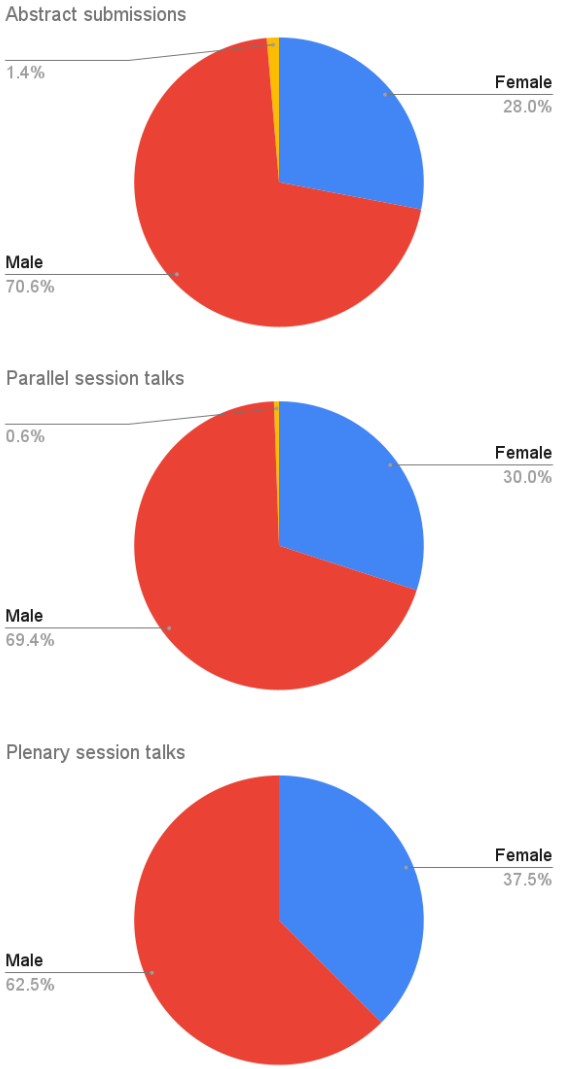
Plenary session talks

Talk selection process

- Double-blind review
- Four reviewers per abstract
- Two review criteria:
  - i) background and motivation of the science
  - ii) how well the abstract links the science to the use of the SKA **AA*** telescopes
- 619 abstracts
  - High overall standard of submissions
  - Strong links in the overall body of abstracts to SKAO AA*-specific science
- Abstracts ranked by averaged “background and motivation” score (normalised for reviewer scores)
- Those with only weak links to the SKA telescopes filtered out (relatively few)
- Huge thanks to SOC for support and efforts during the whole programming process

Demographics

- In-depth discussions held with SOC around how to approach demographic representation, to ensure diversity is achieved in a fair way.
- Tracked **SWG, gender, country of affilation, career stage**
- Used *submissions* (as opposed to SWG membership) as baseline SWG distribution
- Decision, with consensus, to *apply gender overrepresentation with care*
  - Concerns (from several women) that gender overrepresentation can result in underrepresentation of other demographics
  - Parallel session talks:
    - Gender tracked but female speakers not boosted w.r.t. to submissions baseline split
  - Plenary session talks:
    - Gender boosted to ~40:60% F:M, up from ~30:70. Rationale: Important opportunity for people to see potential role models
- Plenary talks balanced using equally weighted SWG submission share and SWG share above talk slot threshold in ranking
- Plenary talks underwent some rebalancing for country of affiliation



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
    - Identified following review and consolidation by SWG chairs of over 350 Expressions of Interest
- **Book structure:**
  - Organised into broad themes: traditional scale-based
  - Will include overview section from each SWG
- **Timeline (subject to refinement after Görlitz):**
  - Chapter submission deadline 30 September 2025 (confirmed)
    - Full Instructions for Authors and LaTeX template
  - Peer review round Q4 2025
    - Inviting SKAO community, relatively light touch
  - Further editing round Q1 2026
    - Editorial board: SKAO Scientific Services team and SWG co-chairs
  - Publishing April 2026
    - Beginning work with SKAO Comms team to investigate publishing options

Any Other Business

- News from SWG Chairs?
- …

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

www.skao.int/en/science-users