SKA Project Status Update

ICALEPCS 2023

Nick Rees

on behalf of the SKA Software Collaboration

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Nick Rees

T. Dijkema, S. Van Der Tol, S. Wijnholds ASTRON, Dwingeloo, The Netherlands
P. Osório, D. Regateiro, B. Ribeiro, H. Ribeiro Atlar Innovation, Pampilhosa da Serra, Portugal
M. Lukkezen, C. Salvoni CGI Nederland B.V., Rotterdam, The Netherlands
D. Acosta, G. Berriman, S. Ellis, C. Gallacher, N. Quinn, J. Sawdy, T. Swain CGI IT UK Ltd, Leatherhead, United Kingdom
M. Colciago, I. Novak Cosylab Switzerland GmbH, Brugg, Switzerland
M. Droog, J. Taylor Covnetics Limited, Nuneaton, United Kingdom
M. Paulo, M. Santos Critical Software S.A., Coimbra, Portugal
G. Hodosan Csillagászati és Földtudományi Kutatóközpont, Budapest, Hungary
D. Mitchell, S. Ord CSIRO Space & Astronomy Business Unit, Marsfield, Australia
D. Maia, B. Morgado Faculdade de Ciências da Universidade do Porto, Porto, Portugal
J. Cantos, W. Gauvin, A. Jameson, W. van Straten Fourier Space Pty Ltd, Kew East, Australia
F. Wang Guangzhou University, Guangzhou, P.R.China
J. Carrivick, C. Gray, N. Steyn, J. Strauss, R. Tobar International Centre for Radio Astronomy Research, Crawley/Perth, Australia
G. Brajnik Interaction Design Solutions, Udine, Italy
V. Alberti, C. Baffa, M. Canzari, M. Di Carlo, E. Giani, G. Marotta Istituto Nazionale di Astrofisica (INAF), Roma, Italy
P. Thiagaraj, R. Uprade NCRA-TIFR, Pune, India
A. Child, A. Clemens, E. Scott Observatory Sciences Ltd, St Ives, United Kingdom
A. Dayanand, A. Deolalikar, A. Dubey, N. Gupta, J. Kolatkar, M. Lalwani, T. Phadtare, V. Shelake, O. Verma Persistent Systems Limited, Pune, India
B. Mcilwrath, C. Pearson, N. Thykkathu Rutherford Appleton Laboratory, Didcot, United Kingdom
S. Valame Sanikaizen Solutions, Pune, India
C. Christelis, P. Dube, B. Ojur, D. Petrie, J. Venter South African Radio Astronomy Observatory (SARAO), Observatory, South Africa
. Ambaum, J. Guzman SKA Observatory, Kensington, Australia
K. Ngoasheng SKA Observatory, Observatory, South Africa
T

A. Avison, J. Banner, R. Barnsley,M. Bartolini, R. Beer, R. Bolton, R. Brederode, A. Bridger, A. Brown, M. Caiazzo, A. Clarke, J. Collinson, M. Deegan, D. Fenech, P. Griffiths, J. Hammond, P. Harding, D. Hayden, A. Holt, M. Jeavons, R. Joshi, T. Juerges, R. Laing, R. Leadbetter, P. Lewis, S. Lloyd, E. Mampuru, L. Mann, J. Masih, M. Miccolis, B. Mort, J. Muller, A. Noutsos, P. Prior, A. Reader, N. Rees, S. Rice, R. Schofield, P. Shepherd, J. Stoddart, W. Swart, L. Tirone, S. Twum, S. Ujjainkar, S. Vrcic, B. Wallace, E. Wang, M. Waterson, P. Wortmann, U. Yilmaz SKA Observatory, Macclesfield, United Kingdom
H. Groot Science and Technology Experts Pool B.V., Delft, The Netherlands
G. Mant The Science and Technology Facilities Council (STFC), Swindon, United Kingdom
M. Ambekar, S. Bajare, A. Dange, Y. Kamble, J. Kumbhar, V. Kumthekar, T. Nanaware, D. Pandey, B. Parakh, M. Patil, A. Patkar, M. Sharma, M. Shirore, A. Sonawane, R. Tayade Tata Consultancy Services Limited, Pune, India
M. Nijhuis TriOpSys b.v., Utrecht, The Netherlands
L. Bartlett, A. Biggs, T. Kenny, P. Klaassen, V. Pursiainen, S. Williams UK Astronomy Technology Centre, Edinburgh, United Kingdom
V. Allan, J. Allotey, M. Ashdown, J. Coles, F. Dulwich, Q. Gueuning, C. Lu, B. Nikolic, V. Stolyarov University of Cambridge Astrophysics Group, Cambridge, United Kingdom
R. Braddock, J. Harvey, L. Levin-Preston, S. Melhuish, M. Mickaliger, R. Oberland, B. Shaw, B. Stappers University of Manchester Department of Physics and Astronomy, Manchester, United Kingdom
K. Adamek, S. Etemadi Tajbakhsh, G. Jagwani, A. Karastergiou, A. Naidu, A. Taqi, C. Williams, D. Wright University of Oxford, Oxford, United Kingdom
V. Mohile Vivek Satishchandra Mohile, Pune, India
K. Govender, F. Graser, K. Kirkham, A. Odendaal, D. Schaff Vivo Resources CC t/a Vivo Technical, Somerset West, South Africa;


The M81 group
Credit: Keesscherer; NRAO


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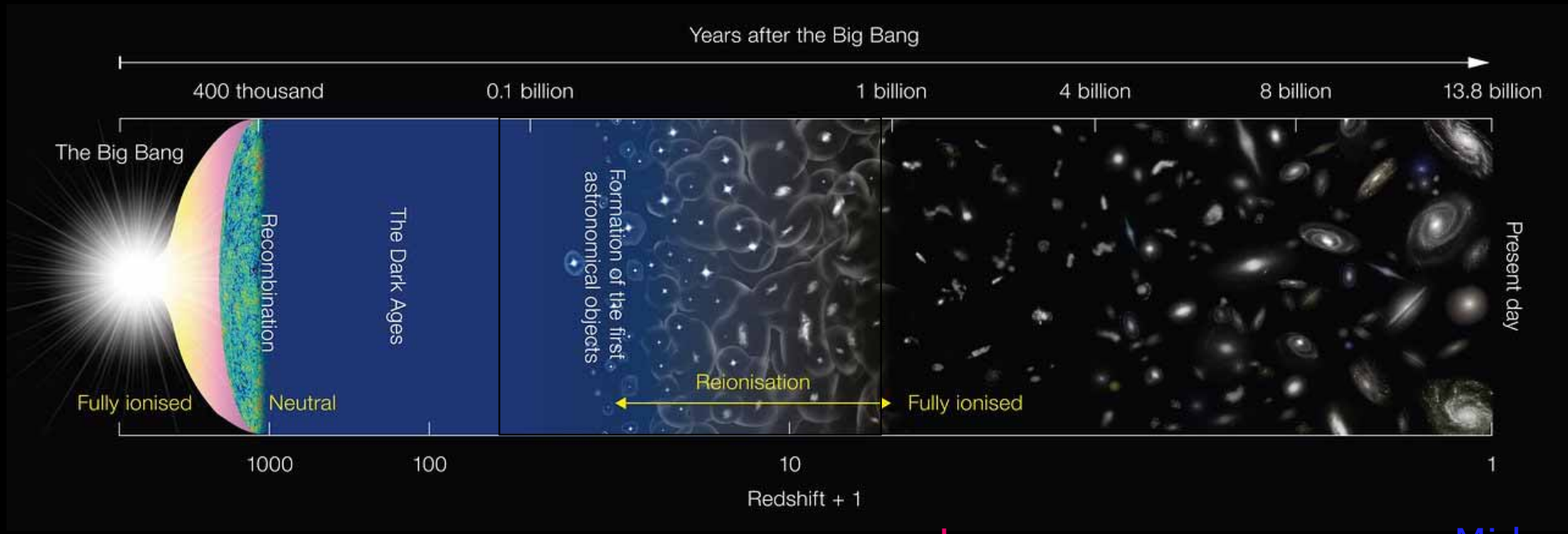
Credit: Keesscherer; NRAO

Credit: NAOJ



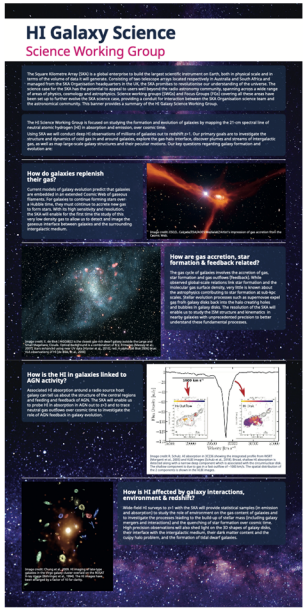
Low

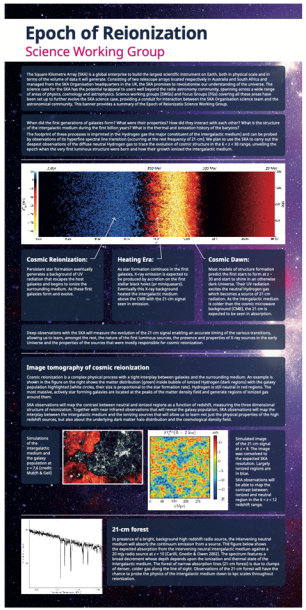
Mid

For illustrative purposes

Tracing neutral hydrogen right back to *Cosmic Dawn and the Epoch of Reionisation*

Science Working Groups cover the science areas that will be addressed with the SKA telescopes





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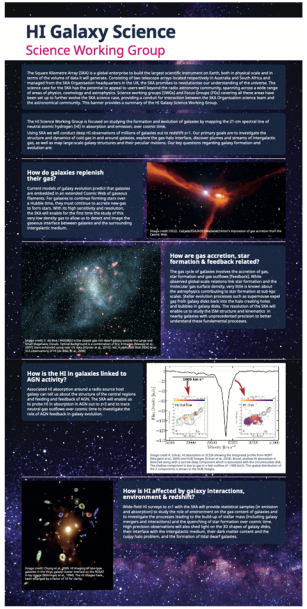

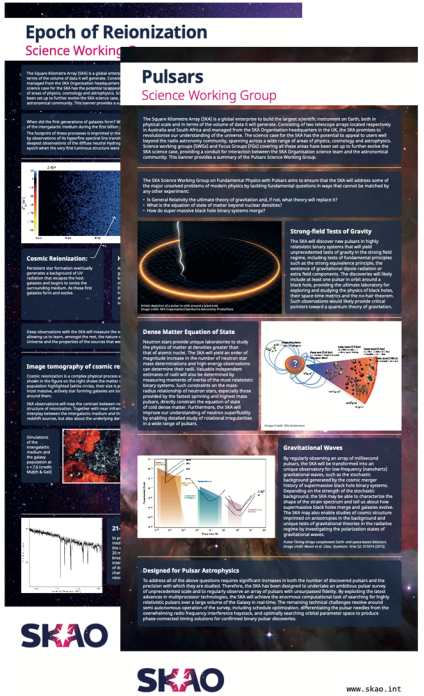

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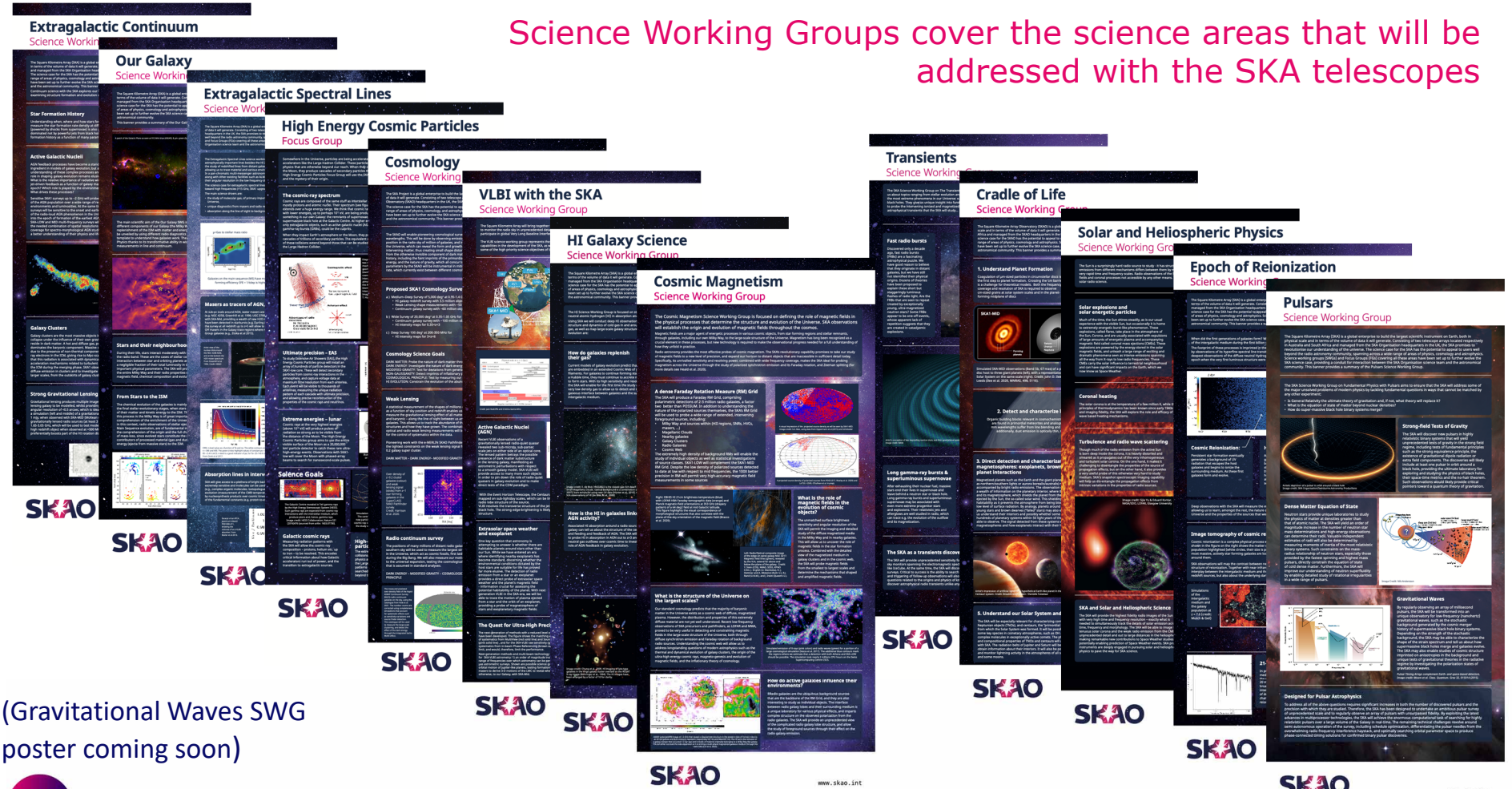
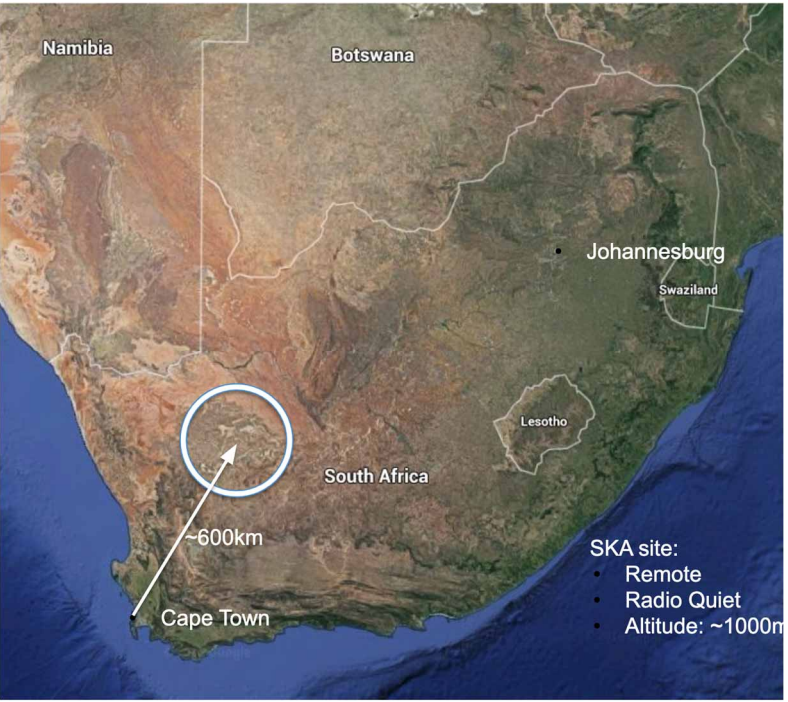
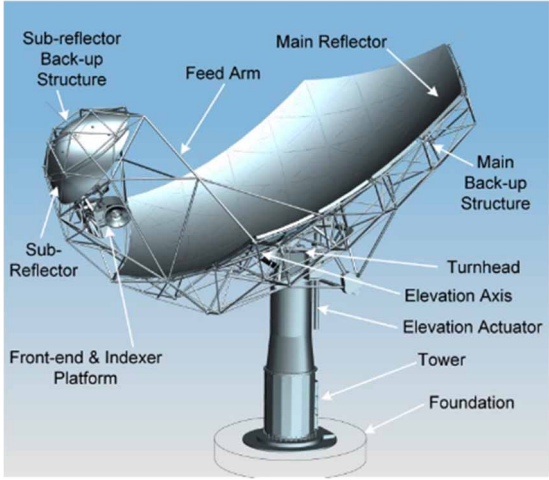


(Gravitational Waves SWG poster coming soon)

SKA MID Telescope



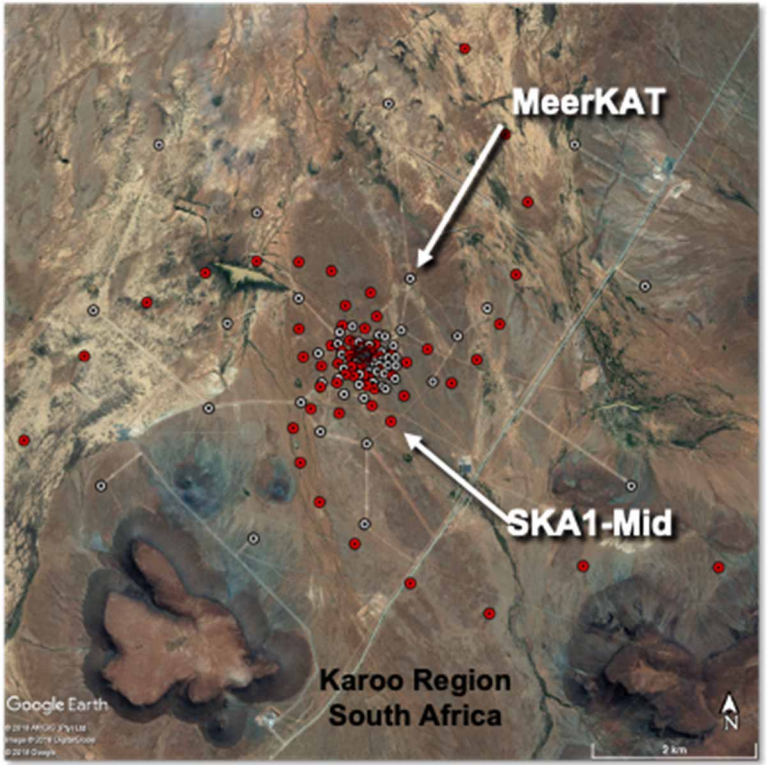
- 133 SKA 15m dishes
- 64 MeerKAT 13.5m dishes
- Maximum baseline 150 km
- 3 logarithmic spiral arms
- ~ 50% within ~2 km randomly distributed



First on-site dish prototype April 2019

MeerKAT antennas in the Karoo

SKA MID Telescope



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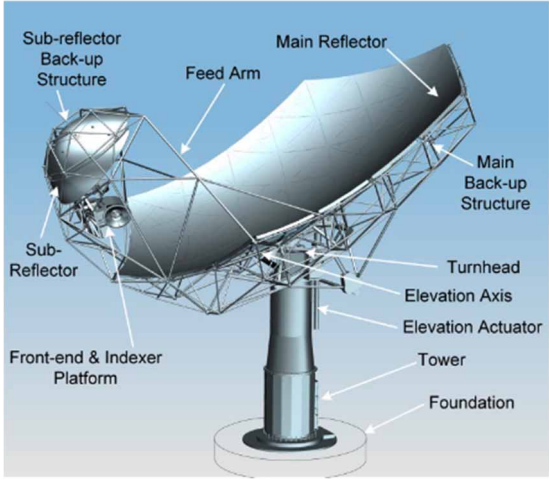

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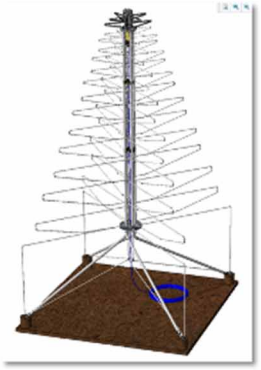
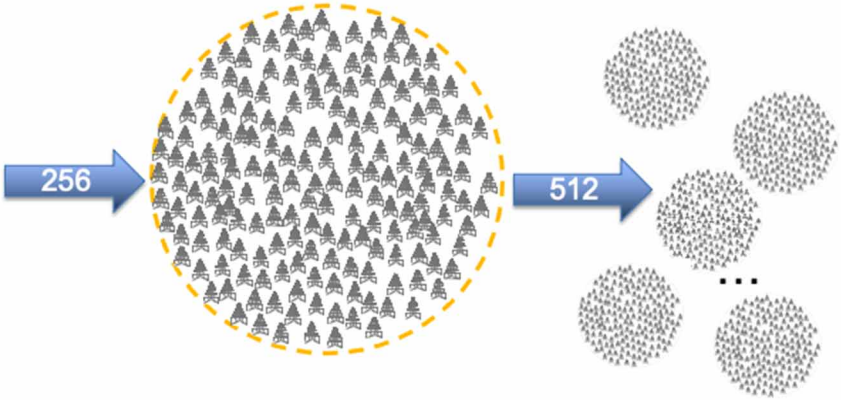
SKA LOW Telescope





SKA1-Low Antenna/Receptor

Antenna Beam

SKA1-Low *"Station"*

Station Beam

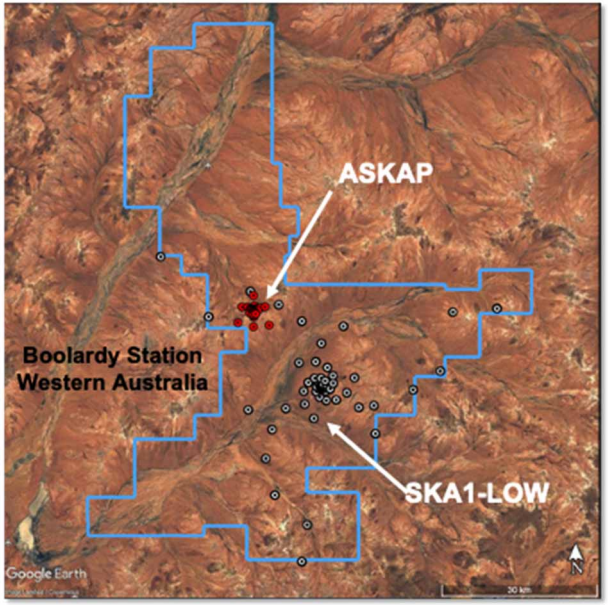
SKA1-Low "Array"

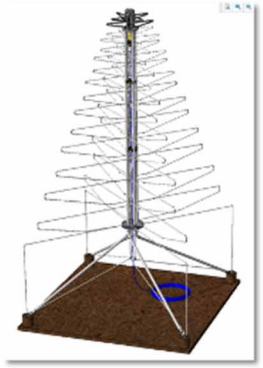
Correlation and *Tied-array Beams*

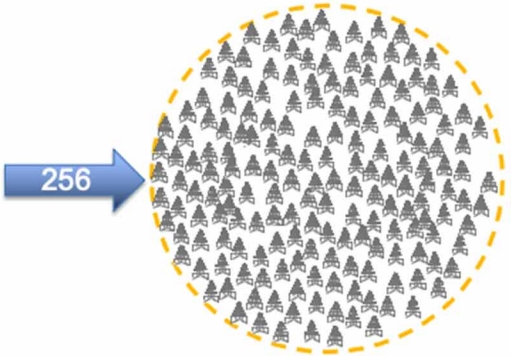
512 aperture array stations
Maximum baseline 65 km
3 modified spiral arms
~ 50% within ~1 km
randomly distributed
Others in clusters of 6 stations arranged randomly over an area 100 to 150 m in diameter

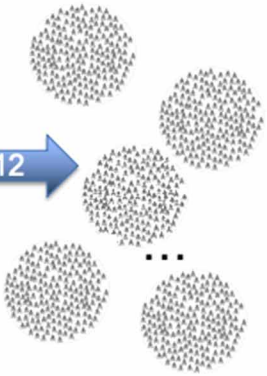
- 256 antennas per station
- 38m station diameter

SKA LOW Telescope









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Construction Strategy

- **Target**: To build the SKA Baseline Design (197 Mid dishes; 512 Low stations: AA4)
- Not all funding yet secured, therefore following Staged Delivery Plan (AA*)
- Develop the earliest possible working demonstration of the architecture and supply chain (AA0.5).
- Then maintain a continuously working and expanding facility that demonstrates the full performance capabilities of the SKA Design.

Milestone Event (earliest)		SKA-Mid (end date)	SKA-Low (end date)
Construction Approval		2021 Jul site access AA0.5 xxx 2022	2021 Jul site access AA0.5 Dec 2022
AA0.5	4 dishes 6 stations	2025 Jan begin: 2024 xxx	2024 Nov Begin: 2024 xxx
AA1	8 dishes 18 stations	2026 Jan Begin 2025 xxx	2025 Nov Begin 2024 xxx
AA2	64 dishes 64 stations	2027 Jan Begin 2025 xxx	2026 Oct Begin 2025 xxx
AA*	144 dishes 307 stations	2027 Oct Begin 2025 xxx	2028 Jan Begin 2025 xxx
Operations Readiness Review		2028 Jan	2028 Apr
End of Staged Delivery programme		2028 Jul	2028 Jul
AA4	197 dishes 512 stations	TBD	TBD

Dates from Integrated Project Schedule Version July 2023;
schedule modelling projects ~2 months per year shift in schedule for the project execution

First data release to the community expected in 2026/27 (for science verification)

Current Status – SKA-Low

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Environmental impact and cost reductions

AAVS2 Antenna delivered on site in 2019. Fit for purpose, but room for improvement.

AAVS3 Antenna delivered on site in 2023. Elimination of zip ties, expanded polystyrene, reduction in cardboard

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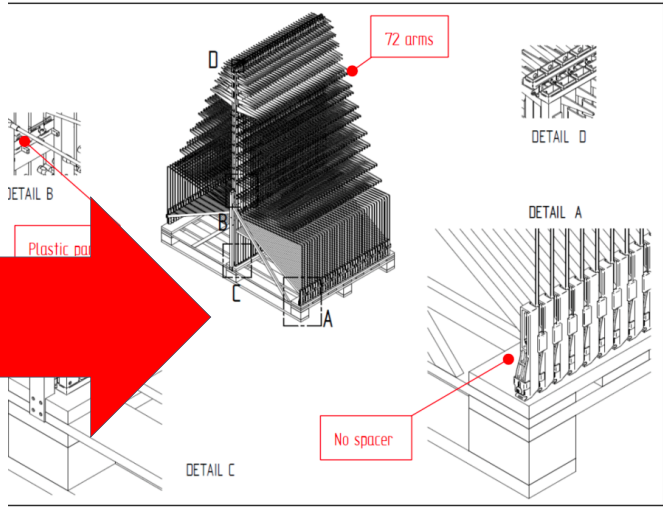

Future improvements in packing density and durability:

- From 40 Antennas/pallet to 72
- Reduction of ~250 containers (from over 600 to under 400)
- Zero cardboard waste

Current Status – SKA-Mid

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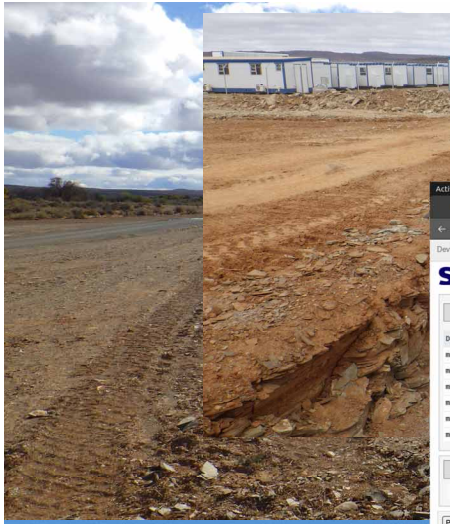

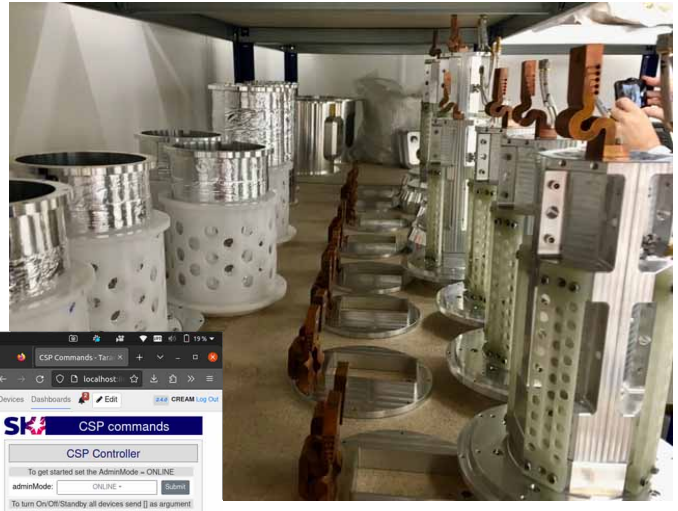

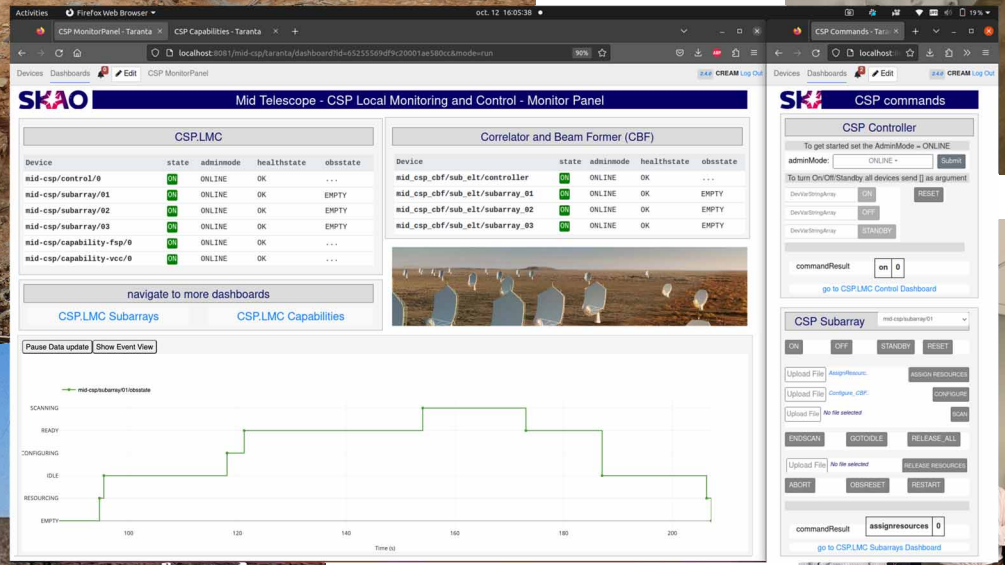

SKAO Software status

What can the SKAO Software do today:

- Preliminary end-to-end software for both SKA-Mid and SKA-Low
- Execute operational modes of both telescopes, including set up and run a simple (simulated) observation
- Handle (simulated) real time data ingest and some pointing calibration
- Run a simple pipeline to process simulated imaging
- Support future observation through sensitivity calculator
- Run in the various environment needed (hardware and software test facilities) using a common platform
- Pulsar Search Software and other Data Processing pipelines are being prepared but will be integrated at a later stage.

SKA Software Current Focus

- Working with the assembly, integration and Verification (AIV) teams to deliver suitable monitoring and control systems for AA0.5 needs. AA0.5 is a very limited interferometer (4 SKA-Mid Dishes and 6 SKA-Low stations), with no scaling issues. We have working examples of most code components, but still struggle with system level integration.
- Supporting the rollout of a new test station for SKA-Low (known as AAVS3).
- Supporting the installation and testing of the first dishes for SKA-Mid.
- Developing the scaled processing needed for later Array Releases (AA2 and AA*)
- Developing the basic observing modes needed - such as interferometric pointing calibration for the SKA-Mid dishes.
- Integrating the signal chains from digitization through to science data processing.
- Improving the team’s ability to deliver software efficiently.

Where to find more information

- MO2BCO01 - Driving Behavioural Change of Software Developers in a Global Organisation Assisted by a Paranoid Android
- MO2BCO03 - Strategy and tools to test software in the SKA project: the CSP-LMC case
- MO2BCO05 - Enabling Transformational Science through Global Collaboration and Innovation using the Scaled Agile Framework
- MO4BCO01 - Using BDD Testing in SKAO: Challenges and Opportunities - see Giorgio and Verity paper
- TUMBCMO09 - Front-End Monitor and Control Web Application for large telescope infrastructures: a comparative analysis
- TH1BCO03 - The Tango Controls Collaboration Status in 2023
- TH1BCO04 - Asynchronous Execution of Tango Commands in the SKA Telescope Control System
- TH2AO06 - SKA Tango Operator
- THMBCMO14 - Development of the SKA control system, progress and challenges
- THSDSC05 - The SKAO Engineering Data Archive: From basic design to prototype deployments in Kubernetes
- FR2BCO02 - A Lean UX approach for developing effective monitoring and control UIs: a case study for the SKA CSP.LMC subsystem
- FR2BCO03 - Taranta project - Update and current status

Finally…. We are hiring

United Kingdom:

- https://recruitment.skao.int/vacancies.html
  - Software Product Manager
  - Release Train Engineer
  - Graduate Software Engineer (Multiple roles)

Australia:

- https://jobs.csiro.au/search/?createNewAlert=false&q=ska
  - Control Software Manager (open until filled)
  - Controls Software Engineer
  - Computing and Software Engineers and Developers (Multiple roles)
  - DevOps Engineer
  - Platform Engineer

South Africa:

- https://www.sarao.ac.za/vacancies/
  - Senior Control Software Engineer
  - Control Software Engineer
  - Senior Network Engineer
  - Network Engineer
  - Senior Pipeline Engineer
  - Pipeline Engineer
  - Senior Signal Processing Engineer
  - Signal Processing Engineer

Thank you!

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