

The SKAO logo is rendered in a bold, white, sans-serif font. The letter 'A' is stylized with a starburst pattern and several small dots, suggesting a celestial or scientific theme. The background of the entire slide is a composite image showing a vast landscape with numerous radio telescope dishes in the foreground and a dense array of smaller antennas in the distance, all under a dark sky with a prominent rainbow.

SKA SWG Update

Robert Braun, SKAO Science Director

21 November 2023

SKA Science Update

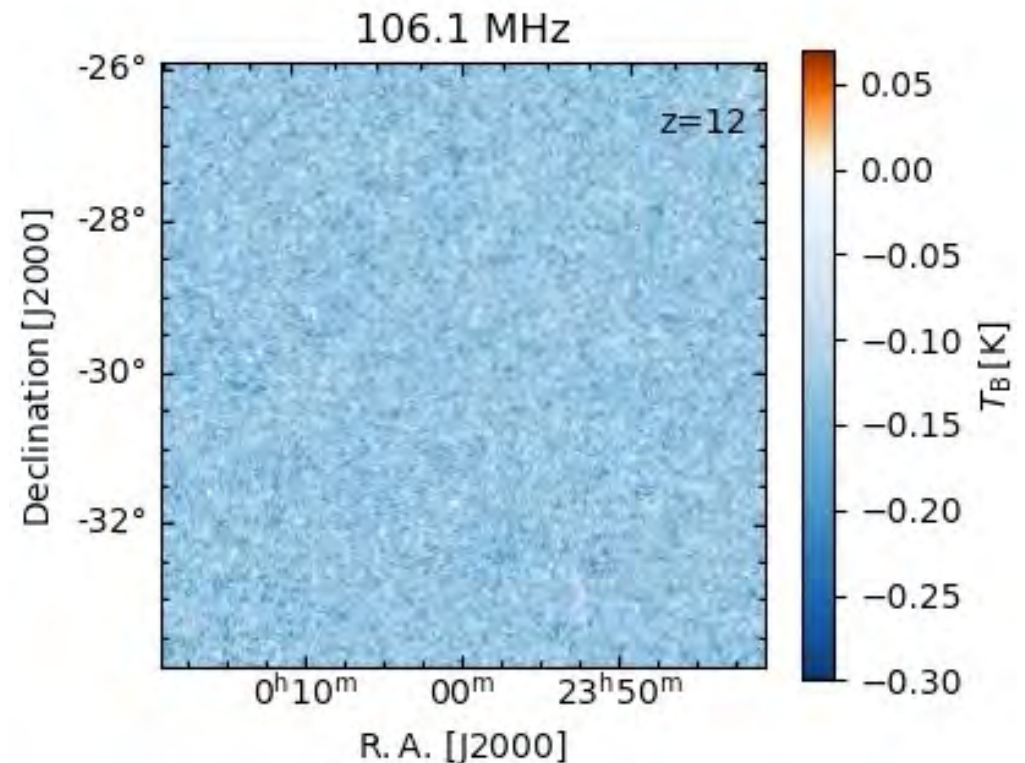
- Science Data Challenges
- SWG Co-chair refresh
- SKA Science Meetings
- AOB



Science Data Challenge 3

Developed in collaboration with SKA EoR SWG members

- SDC3a "**Foregrounds**" (SDC3a; SWG Coordinators: C. Trott, V. Jelic)
 - **Foreground removal** exercise
 - SDC3a submission deadline 30th Oct 2023
- SDC3b "**Inference**" (SDC3b; SWG Coordinators: A. Mesinger, G. Melema)
 - Extraction of **cosmological parameters**
 - SDC3b launching Q1 2024



SKAO Science Data Challenge 3

MAP OF WORLDWIDE PARTICIPATION



Participants



Computing facilities

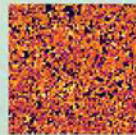



THE CHALLENGE IN NUMBERS

Teams analysing
7.5 TB
of simulated telescope data and a corresponding
60 GB
of image cubes representing different radio frequencies

234
registered participants in
16
countries

12
supercomputing centres providing resources globally

Teams are analysing data which simulates observations of the Epoch of Reionisation signal (left; bright areas are neutral hydrogen, and dark patches are ionised gas). It is obscured by foreground emission (right; orange dots are galaxies, and the ribbon-like shape is diffuse gas in our galaxy). While the features of each image appear equally bright here, in the data cube the background is millions of times fainter than the foreground.



SCD3 foregrounds

And the winner is...

- 20 submissions from teams around the world
- Score computed on the accuracy of EoR power spectrum and associated error bars $P_j \pm \Delta P_j$

$$SDC3a \text{ score} = \sum_j (Prob(P'_j)).$$

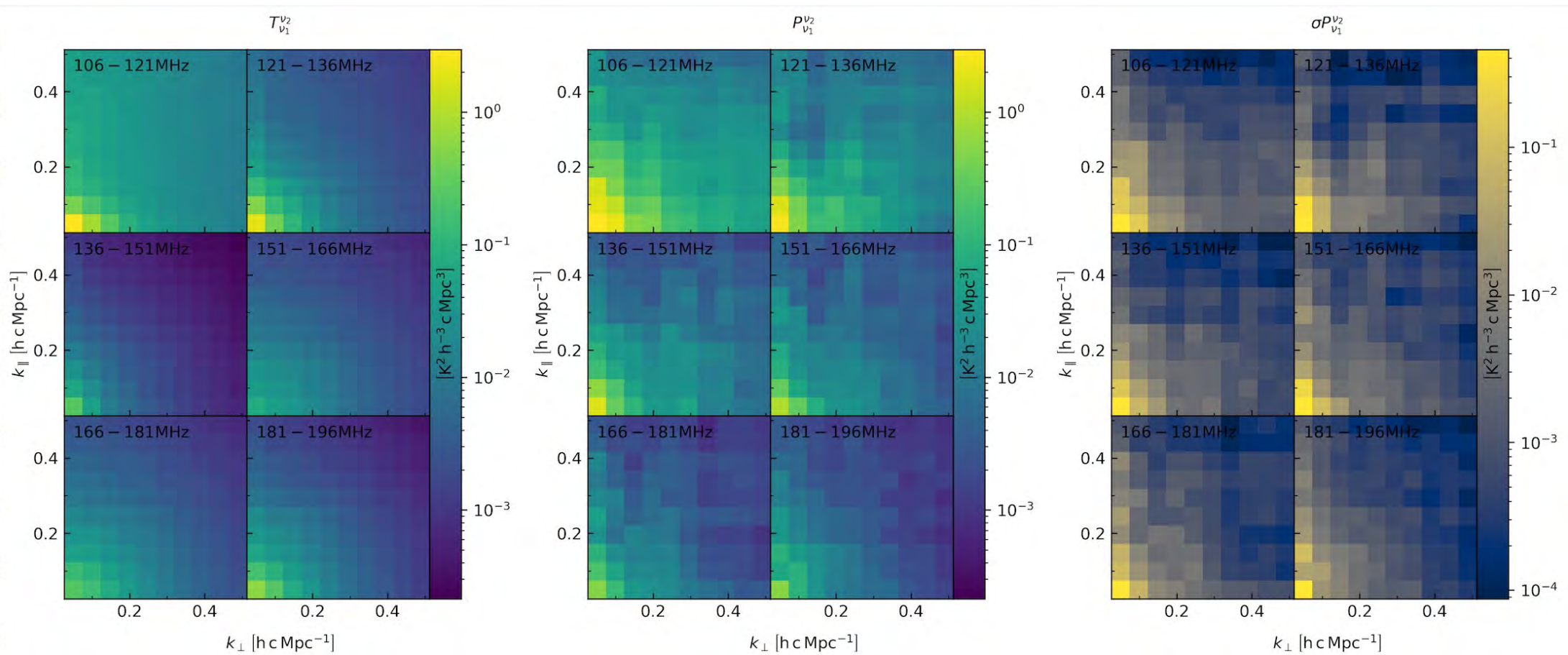
$$Prob(P'_j) = 1/[\sqrt{2\pi} \Delta P_j] \exp[-(P'_j - P_j)^2/2\Delta P_j^2].$$

- Congratulations to team HIMALAYA (China, School of Physics and Astronomy, Sun Yat-Sen University)

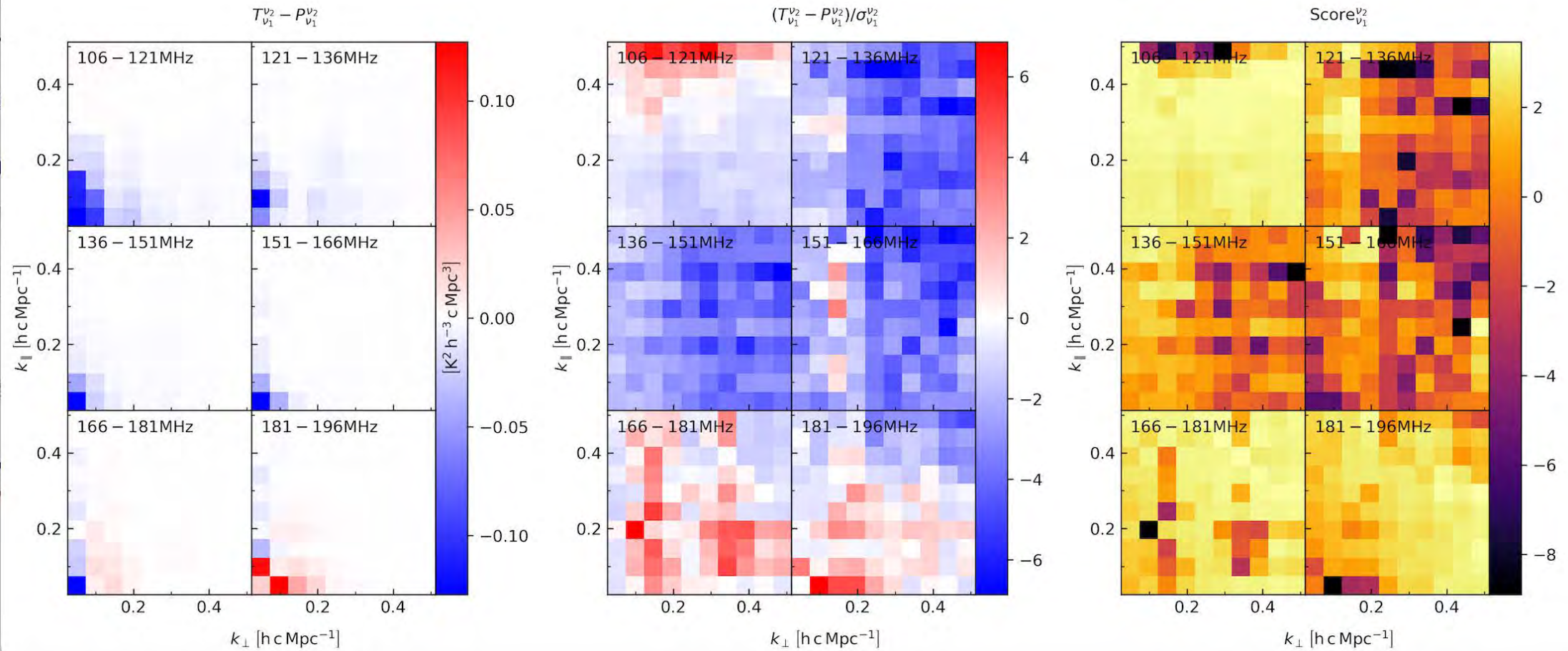
Rank	Team	Team Affiliations	Score
1	HIMALAYA	China	74758.5
2	DOTSS-21cm_ML-GPR	NL, DE, FR, IT, USA	71573.2
3	DOTSS-21cm_Advanced_ML-GPR	NL, DE, FR, IT, USA	71135.0
4	ERWA	China	63670.3
5	DOTSS-21cm_Avoidance	NL, DE, FR, IT, USA	51888.8
6	Shuimu-Tianlai	China	43421.7
7	Wizards_of_Oz_3D	Australia	33295.4
8	Akashganga	India, Israel	31864.5
9	REACTOR	China	21888.3
10	SKACH	Switzerland, Italy	12103.4
	KUSANAGI	Japan, China, Australia	
	Cantabrigians	UK	
	Hausos	China, France, Italy	
	KUSANAGIb	Japan, China, Australia	
	Nottingham-Imperial	UK	
	Pisano_Galaxy_Moppers	Italy, USA	
	HAMSTER	UK, South Africa	
	Foregrounds-FRIENDS	Spain, France	
	KORSDC	South Korea	
	SROT	India	



HIMALAYA's submission



HIMALAYA's results assessment



Reproducibility awards

SDC3

- Revised award system
- Reproducibility 'badges'
- Based on Software Sustainability Institute's six steps to reproducibility
- Simpler for teams to follow and achieve

How to make your script ready for publication

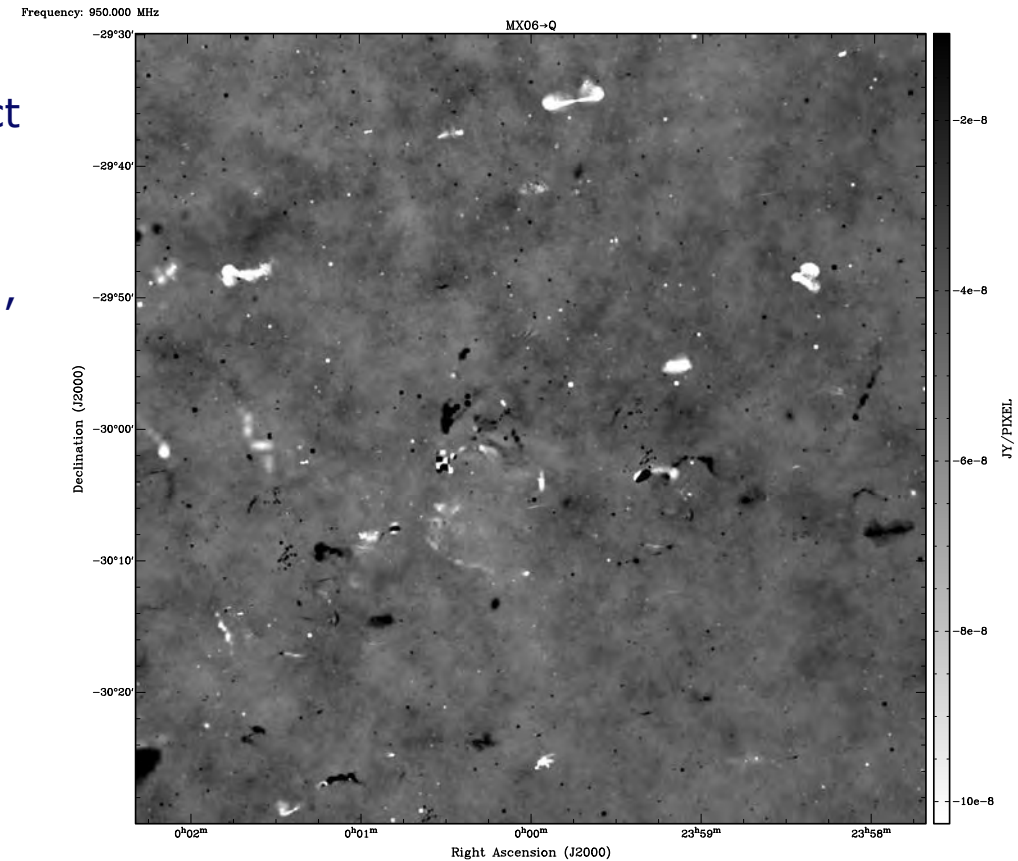


www.software.ac.uk/research-software-camps



Science Data Challenge 4 – Magnetism

- Developed in collaboration with Magnetism SWG (Akaori, Vernstrom, Vazza, ...)
 - Scope still being refined, but full Stokes compact plus diffuse sky model with IGM, ISM, and ionosphere propagation
 - 10 square deg, 950 – 1760 MHz, 3 arcsec beam, source finding and characterisation
 - 100 square deg, 100 – 350 MHz, 350 – 1760 MHz, 10 arcsec beam, source finding and characterisation
 - Thermal noise equivalent few 1000 h
- Sky and Propagation Models nearing completion and looking good
- Telescope and Error Models
 - Under development



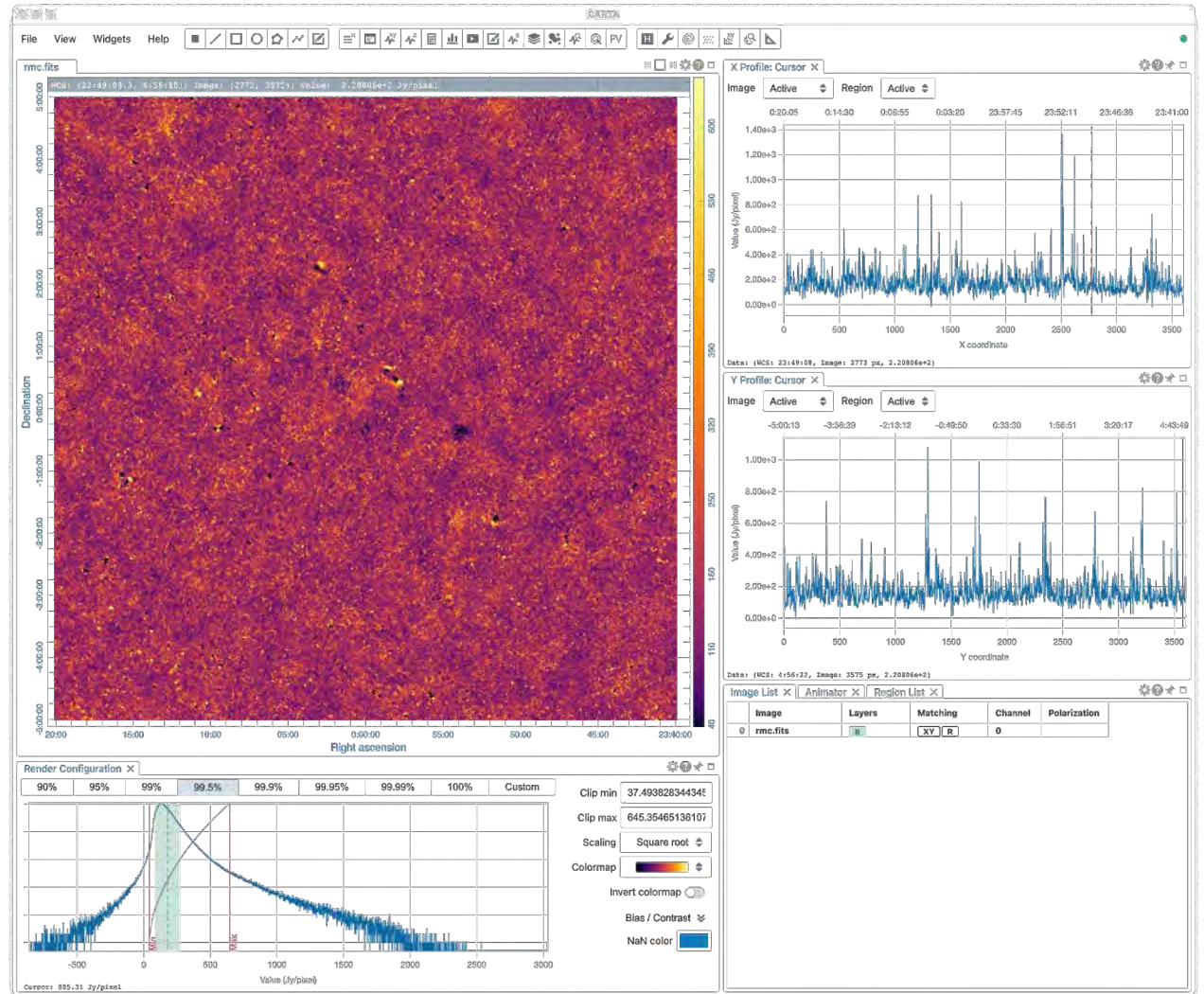
Propagated 1 deg² Stokes Q Sky Model at 950 MHz



Science Data Challenge 4 – Magnetism

- RM Sky Model of 100 deg² extending from $z = 0.01$ to 2.5 using Vazza et al simulations now ready (one realisation shown)
- Higher resolution MHD simulations underway (Franco Vazza) to improve realism

Projected RM(z) Sky Model ($z = 0.01 - 2.5$)



SKA SWG Co-Chairs Refresh

SWG	Incoming Co-Chair
SHI	Rohit Sharma
SHI	Pietro Zucca
VLBI	Jack Radcliffe
VLBI	Jun Yang
ExGal Spectral Line	Viviana Casasola
ExGal Spectral Line	Jacco van Loon
Magnetism	Jennifer West
Pulsars	Bhal Chandra Joshi

- Nominal 2-year term for SWG co-chairs
- Periodic refresh (staggered to provide continuity) is now underway, hand over dates still being coordinated
- Several more in the works (Grav. Waves, ExGal Continuum, Cosmology, EoR)



Science Meetings

- Science at Low Frequencies IX, 11 – 15 Dec 2023, Amsterdam
- MeerKAT @ 5, 20 – 23 February 2024, Stellenbosch
- SPARCS Workshop, 26 – 27 February 2024, Stellenbosch
- SKA Cosmology Conference, 18 – 22 March 2024, Les Diablerets
- African Astronomical Society Conference, 15 – 20 April 2024, Marrakech
- SPARCS XII: Pushing toward the final frontier, 6 – 10 May 2024, Bologna
- IAU GA, August 2024, Cape Town, various SKA Science events planned
- SKA Science Conference, June 2025, Gorlitz, planning underway



East-Asia SKA Workshop – Jeju Island, South Korea

- October 30 – November 3, 2023 (past meetings China 2019, Japan 2021)

<https://ska.kasi.re.kr/meetings/easka-2023>

- SKA representation by Jimi Green (SKA-Low Head of Sci-Ops) and Tyler Bourke (SKAO Project Scientist)
- Attended by about 80 participants, mainly from Korea/Japan/China with other international participants, and many early-career researchers
- Discussions on collaborative opportunities in SKA-related science, synergies among EA countries (e.g. VLBI), and potential SRC regional collaborations (incl. AU)
- Encouraging progress toward membership by Korea and Japan was presented.
- Main science topics covered: EoR, Cosmology, Galaxy formation, Galaxy Clusters, HI, Pulsars and GW, Time-domain, VLBI
- Next meeting potentially in 2024 in Thailand.



CHOSUN UNIVERSITY



Chungnam National University



Korea Astronomy and Space Science Institute

KNU KYUNGPŬOK NATIONAL UNIVERSITY

SEJONG UNIVERSITY



ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

YONSEI UNIVERSITY

FOUR BK21 Institute of Earth Atmosphere Astronomy

SKACH Cosmology in the Alps



18 – 22 March 2024, Les Diablerets, Switzerland

- The SKACH Cosmology in the Alps Conference will focus on radio cosmology studying the universe on large scales. It aims to bring together experts in the field together with junior researchers to foster interactions.
- If successful, the meeting will be held every two years
- In person only, 80-100 participants
- Invited and contributed talks, list of topics includes:
 1. Radio galaxy surveys
 2. Intensity mapping
 3. Gravitational Lensing / Cosmology
 4. Cosmic Dawn and the Epoch of Reionization
 5. Foregrounds and Magnetic Fields
 6. Instrumentation and current/future experiments
 7. Dark and Quiet Skies
 8. Diversity and Inclusion and Collaborating Across Borders



<https://indico.skatelescope.org/event/1098/>



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