

## **SKA SWG Update 15th Feb 2022**

Attending co-chairs: Paolo Serra, Adriano Ingallinera, Andrei Mesinger, Barbara Catinella, Divya Oberoi, Eduard Kontar, Fernando Camilo, Francoise Combes, Jan Forbrich, Jason Hessels, Mark Sargent, Marta Spinelli, Natasha Hurley-Walker, Patrick Woudt, Stefano Camera, Stijn Buitink, Valentina Vacca

SKAO: Robert Braun, Anna Bonaldi, Jeff Wagg, Tyler Bourke, Philippa Hartley (Notes)

Apologies: Aris Karastergiou

### **SKAO Establishment progress (Robert)**

In terms of establishing the Observatory, things are moving ahead well. Staff numbers are growing apace in the UK, Aus and South Africa. Many roles are currently being filled and in advertisement. The SOC in Perth and EOC and SOC in Cape Town are in development and an IAU-endorsed Centre has been created with the aim of protecting the skies for astronomy research.

### **SKA-LOW (Jeff)**

Last week there was a two day internal project meeting on early construction and prototyping for SKA-LOW. Since last face to face (2019) much progress has been made. Ant Schinkel began with an update. SKA-LOW will be situated about 600 km North East of Perth: in an area the size of the Netherlands but with a very low population. Access to a new property to the East of the original location has been arranged to host part of the spiral arm pattern, which will result in an increased maximum baseline length (about 73km), and better visibility sampling.

Prototyping has been conducted at the MWA site. AAVS1: a full station of SKALA2.0 antennas, which were an early version but suffered from a poor bandpass response. This would have been non-optimal especially for EoR Science. SKALA4.1 is the most recent iteration, which improves the bandpass and also improves on directivity. Tests have been conducted from various groups, including Curtin/ICRAR, INAF, CSIRO, ASTRON, U. Malta, Cambridge, KLAASA in China, SKAO.

Low station calibration: a global sky model (+Sun) has been used in combination with embedded element patterns (EEPs) to conduct low station calibrations. Antenna amplitude calibration to 3% accuracy. Intra-station complex gains stable to 6%.

AAVS2 polarisation properties of beam: this is early work but shows promise. EEPs used with forward modelling to compute X and Y complex antenna gains, which are used to calibrate XX, XY, YX and YY. Promising results.

Sensitivity analysis: using AAVS2 station which has a pseudo random distribution of antennas. All sky images with 0.14s timestamps and quiet Sun used as flux density calibration. Difference images taken and related to SEFD, which is in turn related to the array sensitivity. Sun transit plots highlight the differences due to where we are looking in the Galaxy. Sensitivity is expected to exceed L1 requirements for the entire frequency range.

Vogel layout: a variation to the stations' layouts proposed by Robert B. , which aims to reduce the receiver resonances that arise in a pseudo-random layout. Some of the recent work has used simulations to compare the performance of the respective layouts. This early study shows that the Vogel layout appears to give improvements. At lower frequencies there is a much lower EEP variability – and better behaved EEPs – for the Vogel layout.

Robert: Also need to bear in mind the properties of the station beam that results from a layout. Minimising resonances while confined to a fixed station diameter tends to place the antennas on a regular grid, but this creates severe station sidelobes. The Vogel layout reduces resonances but also maintains quite a good station beam pattern.

Station layouts: previous work (B. Mort, M. Seljak, R. Laing) has performed array-level imaging simulations to study the required number of unique station layouts. Early results show around 10-20 unique layouts might be adequate, while 512 would always be optimal. Measures of far sidelobes confusion noise show that at 50 MHz the Vogel layout again shows improvements.

Further simulation work is ongoing, in addition to prototyping work leading up to Array Assembly 0.5. Testing array-level imaging and calibration, prior to building SKA-LOW.

Jason: Tsys simulations will be important

Robert: These are indeed being studied

Jason: Different science cases may want a different station beam. E.g. tapering of sidelobes will be more important for some science cases than others.

Robert: Tapering only affects the near sidelobes; here we are looking far beyond to the all-sky sidelobes

Divya: what will the AA0.5 timescale be?

Jeff: Planned for 2024

Divya: Why are there such large differences in the calibration scatter shown in Slide 8?

Jeff/Robert: The top plot shows the scatter when using an average EEP, while the bottom shows the scatter when using the individual EEPs.

## **SKA SRC Containerisation Workshop (Anna)**

Part of a series of events focused on the kind of technologies and techniques that are likely to be used at the SRCs. Containers are anticipated to be used at the SRCs in order to deploy science pipelines. The whole software code and environment can be ported to the SRCs with no need to have any prior installation performed.

The first event ran over a period of 2.5 weeks but took place only on five of those days, in order to fit within people's schedules. A good diversity of countries was represented. The level of seniority was spread across career stages, but most participants were less than 5 years post-PhD. We found that we tended to attract participants with prior knowledge rather than those with no familiarity.

We had ~120 active participants, and all the material remains available via Indico web pages. Slack channels were very active, with a channel for each talk in addition to an 'installation' slack channel. This worked very well to provide support for participants, who were required to install software in order to follow tutorials. Speakers were brilliant in helping with installation support.

We are currently collecting feedback from participants in order to identify what went well and what we can improve, in addition to ideas for future events.

Adriano: Attended the course and would like to thank Anna and the organisers for a very enjoyable course, plus for the ongoing availability of the course material.

## **SKA Banners (Tyler)**

The SKA banners are currently being refreshed where needed. Aiming for a deadline of the end of Feb.

### **Upcoming meetings:**

See slide 24: several ongoing and upcoming; please pass along upcoming meetings for sharing.

### **AOB:**

Andrei: Requests to join the SWG. We have discussed having a web-based mechanism for this - what is the status of this?

Robert: We are currently switching across to a completely new web interface for the Observatory, and we will begin to add new content once we have transferred our old one. Our

apologies that this is taking longer than expected. Goal for the new live website is 9th/10th March (next Council meeting).

Barbara: A joint workshop between HI and Magnetism, towards the end of March, Currently collecting abstracts: please circulate a call, with a deadline of 25th Feb.

Thanks all and please send suggestions for future topics.