2019 SKA Shanghai Meeting: Concluding our Past, Realising our Future

Report of Contributions

Contribution ID: **1** Type: **Talk**

Design of Extremely Low Noise Amplifier with GaAs HEMTs for SKA Band 2 Receiver

Cryogenic low noise amplifiers (LNAs) are in high demand for highly sensitive detection in radio astronomy and quantum technology research and development. This presentation describes the design and testing of an extremely low noise amplifier based on 3-stage GaAs HEMTs and a microwave integrated circuit. Utilizing computer-aided design techniques, lumped passive components were adapted to integrate with GaAs low noise transistors to optimize the noise and return losses. This LNA design achieved an extremely low noise temperature of 1.0 K, larger than 40 dB gain, and low input and output return losses < -10 dB, in a wide bandwidth from 900 MHz to 2000 MHz at a physical temperature of 15 K. It realized high gain and an excellent gain stability of 0.03% RMS simultaneously, and meets the stringent requirements of the Square Kilometer Array receivers.

Suggested duration

15

Primary author: Dr JIANG, Nianhua (National Research Council of Canada)

Co-author: Dr KNEE, Lewis (National Research Council of Canada)

Presenter: Dr JIANG, Nianhua (National Research Council of Canada)

Session Classification: Instrumentation Programme

Track Classification: Instrumentation

Contribution ID: **2** Type: **Talk**

Scheduling - just another operational data source.

The foundations of scheduling observations and activities require information on the state of the system and the requirements for processing to "speak the same language". Multiple different data sources affect the future state of resources that are required to achieve an automated scheduling system. We demonstrate the abstraction of information to be presented in a standardised manner, independent of data source, to ensure that scheduling - amongst other operational requirements - has access to this information. The model demonstrates how resource availability can be used optimally during construction, commissioning and performance analysis of the system.

Suggested duration

15min

Primary author: SPANN, Rupert (SARAO)

Presenter: SPANN, Rupert (SARAO)

Session Classification: Science Operations I

Track Classification: Science Operations

Contribution ID: **3** Type: **Talk**

Traceability equals more up time - speeding up problem solving.

One of the major factors in resolving issues (from engineering design through commissioning to operations) is the time it takes to assimilate information and the ability to achieve a cohesive and coherent picture in order to find a solution. Information captured during project phases are not easily accessible to others, as very often information is siloed in different structures and systems serving specific requirements. Traceability and accessibility of information from initial engineering design through to operations requires standardising information interfacing - allowing information discovery between project stages and between contributing facilities. Thus reducing the impact of delays and down time within the organisation. The current methodologies are contrasted with current technological capabilities, research that benefit human capacities, and how the new model simultaneously accommodates the migration to AI/neuromorphic systems.

Suggested duration

20min

Primary author: SPANN, Rupert (SARAO)

Presenter: SPANN, Rupert (SARAO)

Session Classification: Engineering Operations II

Track Classification: Engineering Operations

Contribution ID: **4** Type: **Talk**

VLBI as commissioning tool

Incorporating the SKA as an element in a VLBI array is on the road map - although not until later in the project.

In this talk I will demonstrate that, based on VLBI experiments conducted with the MeerKAT SKA precursor, it might be beneficial to attempt (small scale) VLBI during commissioning instead.

The reason is that VLBI has the unique capability to uncover issues in several aspects of the signal chain and/or the beamformer implementation that would be very hard to unambiguously detect using only the instrument itself.

Suggested duration

15 minutes (12min + questions)

Primary author: VERKOUTER, Harro (Joint Institute for VLBI - ERIC)

Presenter: VERKOUTER, Harro (Joint Institute for VLBI - ERIC)

Session Classification: Commissioning II

Track Classification: Commissioning

Contribution ID: **5** Type: **Talk**

The Low Frequency Array: operational challenges and lessos learned

LOFAR combines signals from 51 phased array antenna stations distributed in The Netherlands and across Europe up to a maximum baseline of about 2000 kilometers. It covers the largely unexplored low-frequency range from 10-240~MHz and provides several unique observing capabilities. Every second, tens of gigabytes of data flow through a massive ICT infrastructure from the stations to the correlation facility located in the north of The Netherlands. The post-correlator raw data is further processed on a supercomputer through a variety of processing pipelines. Final data products are shared with the community through a distributed long-term archive system, which hosts the largest astronomical data collection to date. In order to exploit the new frequency regime with unprecedented resolution and sensitivity, LOFAR faces several non-trivial technical and operational challenges. These are presented and discussed in this talk, along with the important lessons learned which will be important reference for next generation observing facilities, such as SKA.

Suggested duration

20 min + questions

Primary author: Dr PIZZO, Roberto (ASTRON)

Presenter: Dr PIZZO, Roberto (ASTRON)

Session Classification: Science Operations II

Track Classification: Science Operations

Contribution ID: **6** Type: **Talk**

MeerKAT engineering update and lessons from integration

DRAFT ABSTRACT

MeerKAT became an operational instrument in March 2018, and was formally inaugurated four months later. It has already done some important scientific observations and several papers have been published.

Although MeerKAT is a working telescope, its full capabilities are still being constructed and integrated by the engineering and commissioning teams. Many technical and organisational challenges have been found and overcome to deliver these new features.

In this talk Thomas Abbott, programme manager for MeerKAT, will describe the structure of the teams inside SARAO, highlights of our work over the last two years, and lessons learned that will be applicable to the construction, integration and verification of SKA-1.

DRAFT ABSTRACT

Suggested duration

30-45 minutes including questions

Primary author: ABBOTT, Thomas (SKA SA)

Presenter: ABBOTT, Thomas (SKA SA)

Session Classification: Engineering Operations I

Track Classification: Engineering Operations

Contribution ID: **7** Type: **Talk**

HI Intensity Mapping with MeerKAT and 1/f noise analysis

HI Intensity Mapping (HIIM) as a probe of cosmological large-scale structures (LSS) is considered promising and has been test with cross-correlation with optical galaxy survey using Green Bank Telescope (GBT) and Parkes Telescope. MeerKAT and SKA have the potential to achieve largest and deepest HIIM survey in the near future. However, HIIM is also most challenging due to the bright foreground emission and instrumental effect. We proposed a pilot survey with MeerKAT array to test our data analysis pipeline. In the meanwhile, we also measured the instrumental noise feature, such as 1/f noise, by tracking the South Celestial Pole (SCP). With the noise feature measurement, we can build the noise model for the future HIIM survey with MeerKAT.

Suggested duration

15 min - 20 min

Primary author: Dr LI, Yi-Chao (University of the Western Cape)

Presenter: Dr LI, Yi-Chao (University of the Western Cape)

Session Classification: Science Operations II

Track Classification: Science Operations

Contribution ID: **8** Type: **Talk**

Welcome Address

Contribution ID: **9** Type: **Talk**

The experience of commissioning ASKAP

The Australian SKA Pathfinder is a precursor telescope designed specifically for surveys. It has a wide field of view and rapid survey speed as a result of phased array feed technology. The telescope became fully operational this year and is located at Australia's SKA site, the Murchison Radio-astronomy Observatory. We are currently conducting pilot surveys that demonstrate the capability of the telescope and provide science teams with an opportunity to assess data quality. Many challenges were encountered during the construction and commissioning process and these will be summarised in the context of the SKA project. Key themes include maintaining active engagement with astronomers and the value of conducting early science projects to thoroughly test hardware, firmware and software during construction.

Suggested duration

30 min

Primary author: HOTAN, Aidan (CSIRO)

Presenter: HOTAN, Aidan (CSIRO)

Session Classification: Commissioning II

Track Classification: Commissioning

Contribution ID: **10** Type: **Talk**

Distributed Radio Interferometric Calibration using SAGECal

The SKA will deliver tremendously high data rates when it becomes operational. In order to handle that amount of data, processing pipelines should be very efficient. SAGECal is one of the popular interferometric calibration tools capable of handling such data rates. SAGECal uses GPU acceleration and distributed computing using MPI in order to this. In order to meet the challenges posed by the SKA, SAGECal needs big data analytics to improve its robustness and scalability. Big data frameworks such as Apache Spark is a good option for these tasks.

In this work, we have integrated SAGECal into a big data ecosystem, namely Apache Spark. We set up a cluster for benchmarking and deployed it to SURFsara HPC Cloud platform. In order to deploy the services, such as Apache Spark and Apache Hadoop, we have developed a tool which makes the deployment easier (see https://github.com/NLeSC/lokum and https://github.com/NLeSC/baklava). All other components used in this work are publicly available at https://github.com/nlesc dirac. The setup consists of Apache Spark components, a master node and slave nodes, and storage units. Measurement sets (MS) from radio astronomical observations are stored in a Hadoop Distributed File System (HDFS) and processed by Apache Spark. As SAGECal is written in C/C++/CUDA and Apache Spark does not have a native support for this language, we have used Java Native Interface (JNI) to generate a compatible version of SAGECal.

Previously, we presented the use of these tools in a virtual cluster which was created by Docker swarm. This time, we will present our results using a real cluster. We will also present the adaptation of SAGECal code base for the Apache Spark platform. Moreover,the performance comparison of MPI and Apache Spark versions of SAGECal will be shown. The technical details of the setup and the software architecture will be also be presented.

Suggested duration

Primary authors: DIBLEN, Faruk (Netherlands eScience Center); YATAWATTA, Sarod (Kapteyn Institute)

Presenter: DIBLEN, Faruk (Netherlands eScience Center)

Session Classification: Science Operations I

Track Classification: Science Operations

Contribution ID: **11** Type: **Talk**

Commissioning the Very Large Array and the Jansky Very Large Array

As a post-doc at the Very Large Array in the late 1970s, and as the Project Scientist of the Expanded Very Large Array (now the Jansky Very Large Array), I was intimately involved the the engineering and science commissioning of both instruments. The commissioning processes for these two projects were notable for their lack of structure and formality. That this apparently uncoordinated, undirected approach worked well is incontestable –both projects were completed 'on time, on budget, and on spec'.

In this presentation, I will discuss the reasons why this approach worked so well for the VLA and JVLA. The major factors were the extremely experienced and stable key staff, all working in the same building close to, or at, the array, for the duration of the construction phase for both projects. This experience and proximity resulted in highly efficient lines of communication, thus greatly reducing the need for formal meetings, reports, etc. Almost equally important was the informal and relaxed approach to obtaining test time on the array, and in the test reporting process.

Due to the size, distribution, and complexity of the SKA construction, the commissioning process for this project must necessarily be more formal and structured than that for the highly centralized VLA and EVLA. Nevertheless, I will argue that there is great benefit in giving easy and open commissioning and testing access to the array during the construction/commissioning process. The bottom line is: 'Hire experienced and committed individuals, and let them do their work with a minimum of oversight and management'.

Suggested duration

30 minutes

Primary author: Dr PERLEY, Richard (National Radio Astronomy Observatory)

Presenter: Dr PERLEY, Richard (National Radio Astronomy Observatory)

Session Classification: Commissioning II

Track Classification: Commissioning

Contribution ID: **12** Type: **Talk**

Peggy's Talk

- How is the allocation of telescope/antenna 'possession' to engineering functions (maintenance, repair, upgrade) versus observing done at the JVLA, and how has this changed over the evolution of the telescope?
- How many staff are involved in maintenance and repair as opposed to development/upgrade?
- What is the ratio of routine maintenance downtime to repair downtime currently on the JVLA, and how has this changed over time (if you have records)
- What skills mix does the engineering team have?
- Is there good career progression within, into, and out of the engineering team?
- What training, ab initio and recurrent, is provided for the engineering team?
- How is the engineering team organised, and how has this changed?
- Are there any 'permanent' contractors involved? What parts of the system do they support?
- What support agreements do you have with in-kind suppliers (e.g. the correlator - DRAO?)
- How are safe working practices enforced?
- Is there a separate quality team or person involved in engineering activities?
- What documentation is used during engineering activities?
- What has turned out to be more/less reliable than expected over the lifetime of the VLA?
- What has turned out to be easier/harder to maintain and repair?
- Does the engineering team develop and maintain design standards for JVLA upgrades based on their experiences (reliability, maintainability)

Suggested duration

30 minutes

Primary author: Dr PERLEY, Peggy (NRAO)

Presenter: Dr PERLEY, Peggy (NRAO)

Session Classification: Engineering Operations I

Track Classification: Engineering Operations

Contribution ID: **14** Type: **Talk**

The ”feed indexer”: lesson learnt and facilities for testing and commissioning

The feed indexer was designed and manufactured in Italy for both dish prototypes installed in China (SKA-P) and South Africa (SKA-MPI). A third prototype was developed and verified at the SAM plants in order to improve their electromechanical performances and to speed the mass production. Tools for rapid-testing and a rotation and elevation control system based on open source real-time technologies (TANGO-Linux-Ethercat) have been developed. The software architecture created for the test facility demonstrates the feasibility of an antenna control based on TANGO and therefore, completely aligned with the other SW components of SKA.

Suggested duration

25’

Primary authors: AURIGEMMA, Renato (SAM-Società Aerospaziale Mediterranea); BONETTI, Francesco Paolo (SAM-Società Aerospaziale Mediterranea); GRAMICCIA, luciano (SAM Società Aerospaziale Mediterranea)

Presenter: AURIGEMMA, Renato (SAM-Società Aerospaziale Mediterranea)

Session Classification: Engineering Operations I

Track Classification: Engineering Operations

Contribution ID: **15** Type: **Talk**

China SKA Regional Centre Prototyping

Thursday, 28 November 2019 14:42 (19 minutes)

The Square Kilometre Array (SKA) is the largest radio telescope to be built by astronomers. The key factor that promotes the SKA to achieve milestones in science frontier research is the capability of properly processing the SKA data and converting the data to scientific products. SKA Observatory (SKAO) will only produces pre-calibrated data which are not science-ready for publication. Instead, in-depth data analysis and astronomical software development will be performed in a number of geographically distributed SKA Regional Centres (SRCs) which also provide long-term data archive storage, computing resource and technique support for the SKA users. As the starting of the SKA Phase I (SKA1) is approaching, the focus of SRCs is in a transition from design to implementation. The SRC prototyping includes construction of multiple proto-SRCs, understanding the data challenge, resource estimate with inputs from the science user forum. China SKA Regional Centre (CSRC) is one of the important components of the global SRC network, and also one of the prominent contribution from the China SKA team. Chinese scientists are actively involved in the software development and analysis of the SKA pathfinder data which are crucial for operating CSRC in an efficient manner. CSRC will also be expanded its capacity to serve East Asia regional users, and gradually develops into one of the major SRCs in the world, making profound contribution to the entire SKA community. Shanghai Astronomical Observatory is leading the preparation of the CSRC prototyping work. A CSRC prototype has been built under the financial support from the Ministry of Science and Technology of China and the Chinese Academy of Sciences. Shanghai municipality expresses her strong desire to host the China SKA Regional Centre. CSRC will be an integrated organisation of domestic and international resource, including the participation of the astronomer community in SKA science and technique, computing and data storage resource in industries, educational resource in universities. In this talk, I will present the progress and plan of China SKA Regional Centre.

Suggested duration

Primary author: Prof. AN, Tao (Shanghai Astronomical Observatory)

Presenter: Prof. AN, Tao (Shanghai Astronomical Observatory)

Session Classification: SKA Regional Centres (session)

Track Classification: SKA Regional Centres

Contribution ID: **17** Type: **Talk**

Planning the Verification of the SKA1 Telescopes

This presentation will provide a short overview of the work that the AIV Consortium has conducted during the pre-construction phase, to plan the verification of the SKA1-MID and SKA1-LOW Telescopes. In order to minimise risk, the telescopes are rolled-out sequentially in terms of number of Dishes/Stations and functionality, thereby providing a framework for the delivery of products during the construction phase. The presentation will also draw on the MeerKAT verification experience to highlight valuable lessons learned that are directly applicable to SKA1-MID.

Suggested duration

20 mins

Primary author: Dr LORD, Richard (SARAO)

Presenter: Dr LORD, Richard (SARAO)

Session Classification: Commissioning II

Track Classification: Commissioning

Contribution ID: **18** Type: **Talk**

SKA-VLBI capacity and technique

VLBI will be one of the observing modes of the SKA Observatory. An important effort has been made to incorporate the VLBI capability in the design of the SKA correlators. JUMPING JIVE Project has supported this process assessing the designs during the Critical Design Reviews and helping to refine the technical and operational requirements for the VLBI capability. Moreover, JUMPING JIVE has also helped to define the VLBI element for the SKA telescopes as well as the interfaces with the different SKA elements.

Suggested duration

15 min

Primary authors: Mrs GARCIA MIRO, Cristina (SKAO); AN, Tao (Shanghai Astronomical Observatory); Dr REYNOLDS, Cormac (CSIRO Astronomy and Space Science)

Co-authors: PARAGI, Zsolt (Joint Institute for VLBI in Europe); CHRYSOSTOMOU, Antonio (SKA)

Presenters: Mrs GARCIA MIRO, Cristina (SKAO); AN, Tao (Shanghai Astronomical Observatory)

Contribution ID: **19** Type: **Talk**

SRC Data Storage Pilot

Thursday, 28 November 2019 14:04 (19 minutes)

Provisioning long-term storage capacity will be a core function of SKA regional centres (SRCs). Commercial Cloud storage accumulates significant costs over time and typical HPC processing scenarios require moving the data products elsewhere for preservation. The same applies to the storage of large test and simulation data sets, which is of immediate interest prior to SKA construction. Later, during the operational phase, Observatory Data Products (ODPs) and derived Advanced Data Products (ADPs) will be made available through SRCs only.

The new compute cluster and storage pilot at SHAO provides an opportunity to work with a prospective SRC facility already during the SKA design phase. We will report on an example workflow implemented by ICRAR and originally deployed on the currently most powerful supercomputer Summit at ORNL. It is now redeployed at SHAO for more general use and features a large-scale imaging pipeline, starting from the generation of simulated visibilities all the way to the analysis of an image cube.

Suggested duration

20 min

Primary author: DOLENSKY, Markus (ICRAR)

Co-authors: AN, Tao (Shanghai Astronomical Observatory); LAO, Baoqiang (Shanghai Astronomical Observatory, Chinese Academy of Sciences); TOBAR, Rodrigo (International Centre for Radio Astronomy Research); Mr PALLOT, Dave (ICRAR); WICENEC, Andreas (ICRAR)

Presenter: DOLENSKY, Markus (ICRAR)

Session Classification: SKA Regional Centres (session)

Track Classification: SKA Regional Centres

Contribution ID: **20** Type: **Talk**

MeerKAT Science Commissioning

An overview of the last year of commissioning activities for MeerKAT. The focus will be the role of the science teams - commissioning itself, the Science Data Processing (SDP) group, and the Radio Astronomy Research Group (RARG).

I will discuss our approach to problem solving, the toolsets in use, unforseen challenges, and describe some of the trickiest issues we encountered.

Suggested duration

20 - 30 minutes

Primary author: RATCLIFFE, Simon (SKA South Africa)

Presenter: RATCLIFFE, Simon (SKA South Africa)

Session Classification: Commissioning II

Track Classification: Commissioning

Contribution ID: **21** Type: **Talk**

Science capabilities of the MWA

There have been many operational improvements to the MWA in the last year that enhance the scientific capabilities of the telescope and underpin the array's importance as a SKA-Low precursor instrument. This update will give an overview of the array and current science focus.

Suggested duration

20 min

Primary author: Ms WALKER, Mia (Curtin University)

Presenter: Ms WALKER, Mia (Curtin University)

Session Classification: Science Warm Up

Track Classification: Science Warm Ups

Contribution ID: **23** Type: **not specified**

The Measurements and Calibrations for Radio Telescope

The report mainly discusses the measurement and calibration methods of large radio telescopes. The topic is related to the antenna's pointing, sub-reflector position and main reflector shape measurement and modeling methods. The SKA-P holography measurement is also disscussed detailly. The methods are adopted on several radio telescopes include CVN , and other 13m telescopes.

Suggested duration

Primary authors: Dr WANG, Jinqing (SHAO); Dr WU, Yang (CETC54); Dr KESTEVEN, Michael (CSIO)

Presenter: Dr WANG, Jinqing (SHAO)

Session Classification: Engineering Operations II

Track Classification: Engineering Operations

Contribution ID: **24** Type: **Talk**

Science Operations for the VLA and VLBA; Application to SKA

The Very Large Array (VLA) and Very Long Baseline Array (VLBA) have been operated by the National Radio Astronomy Observatory for several decades now. Both instruments comprise distributed operations at some level, requiring coordination across sites, departments, divisions, and groups. We illustrate the complexity of a distributed operational model using the example of Science Operations, which encompasses all aspects of operations required to deliver science-quality data from the telescopes through to interfacing with the user community. We split the topic into three main areas: telescope performance and support, time allocation and scheduling, and user support. Telescope support includes maintenance of individual antenna pointing, electronics, the correlator, and calibration data, as well as commissioning activities for new observing modes and instrumentation. These activities are array-specific, but require communication with, and understanding of, telescopes that can be geographically separated by thousands of miles. Time allocation is performed through Observatory-wide processes across multiple telescopes, while the scheduling of each of those telescopes has its own characteristics and challenges. User support can encompass elements common to all NRAO instruments, such as the software tools used by both staff and users, at the same time as requiring technical expertise in each individual telescope. We will present an overview of the current status of Science Operations for the VLA and VLBA, and will describe lessons learned from the decades of experience gained so far.

Suggested duration

30 minutes

Primary authors: BUTLER, Bryan (NRAO); Dr CHANDLER, Claire (National Radio Astronomy Observatory)

Presenter: BUTLER, Bryan (NRAO)

Session Classification: Science Operations II

Track Classification: Science Operations

Contribution ID: **25** Type: **Talk**

Australian SRC Design Study Program

Thursday, 28 November 2019 13:45 (19 minutes)

I will provide an overview of the Australian SRC Design Study Program. The program funded by the Australian Government and CSIRO brings together the key partners - CSIRO, ICRAR and Pawsey. In the upcoming 3 years the program will focus on assisting several pilot SKA precursor science projects (ASKAP and MWA) with their software, compute and data needs, as well as working on the SRC system prototyping as part of regional and international collaborative SRC effort.

Suggested duration

15 min

Primary authors: KITAEFF, Slava (UWA-CSIRO); QUINN, Peter (ICRAR)

Presenter: KITAEFF, Slava (UWA-CSIRO)

Session Classification: SKA Regional Centres (session)

Track Classification: SKA Regional Centres

Contribution ID: **26** Type: **Talk**

Machine Learning for Scientific Discovery

Our ability to capture and store data is increasing, so is the information we are capturing. With the petabytes of data being captured and to be captured in the future with SKA, analysing this data and extracting information from them in the traditional way will not suffice. It is inevitable, to use machine learning to understand the underlying information captured in the data. These algorithms will play an important role in making scientific discoveries from the data being collected.
In this talk, we present ways of discovering physical phenomenon by using machine learning algorithms on data collected through radio telescopes. We will discuss the use of supervised machine learning algorithms to predict the free parameters of star formation histories and also better understand the relations between the different input and output parameters. We made use of deep learning to capture the non-linearity in the parameters. Our models are able to predict with low error rates and gives the advantage of predicting in real time once the model has been trained.
The other class of machine learning algorithms viz. unsupervised learning prove to be very useful to uncover patterns in the data. We explore how we used such unsupervised techniques on solar radio telescope data from MWA which is precursor to SKA, to identify patterns and anomalies and also link such findings to theories, which help to better understand the nature of the elements being studied. We highlight the challenges faced in terms of data size, availability, features, processing ability and importantly, the interpretability of results.

Suggested duration

20 mins

Primary author: SURANA, Shraddha (ThoughtWorks)

Co-authors: Mr OBEROI, Divya (NCRA); Mr WADADEKAR, Yogesh (NCRA)

Presenter: SURANA, Shraddha (ThoughtWorks)

Session Classification: Science Operations II

Track Classification: Science Operations

Contribution ID: **27** Type: **not specified**

Summary of PEP

Presenter: MCMULLIN, Joseph (SKA Organisation)

Session Classification: System Design Baseline

Contribution ID: **28** Type: **Talk**

VLBI with White Rabbit Time and Frequency Distribution

As part of the H2020 ASTERICS project, we have researched the suitability for VLBI of the White Rabbit system for time and frequency distribution. Tests were performed on a link of 169km, which included optical amplification, and on a 35km dark fibre link. The equipment used on the short link is identical to the SADT design for UTC distribution in SKA1-Low and SKA1-Mid, apart from the addition of a 'low jitter daughter board' to the WR switches, and a clean-up oscillator on the station side WR switch. Using this setup, fringes have been obtained between the Dwingeloo radio telescope (using the WSRT H-maser as a remote clock) and several other EVN stations.

Suggested duration

20 minutes

Primary author: BOVEN, Paul (JIVE)

Co-authors: Dr KOELEMEIJ, Jeroen (VU/OPNT b.v.); Mrs VAN TOUR, Chantal (OPNT b.v.); Dr SZOMORU, Arpad (JIVE); Dr SMETS, Rob (SURFnet)

Presenter: BOVEN, Paul (JIVE)

Session Classification: Instrumentation Programme

Track Classification: Instrumentation

Contribution ID: **30** Type: **Talk**

Integrated dissemination system of frequency, time and data for radio astronomy

For radio telescope array application, the precise time and frequency reference largely determine the quality of the observation. Here, we demonstrate an integrated dissemination system which can achieve the highly-stable frequency dissemination, time synchronization and data transfer simultaneously over a single optical fiber link. With this system, the time and frequency reference signal in one site can be recovered at the remote site. Using one optical fiber can save a lot of fiber resources, and makes the system simpler. The test of the integrated system was carried out over the 28 km fiber link, part of the e-Merlin Array Telescopes, which consisted of two 14 km buried fibers between Jodrell Bank and Pickmere, and looped back at Pickmere. And it have been experimentally demonstrated that the frequency transfer stability is 2×10^{-14}/s, the time synchronization uncertainty issub-nanosecond, and the error bit rate of data transfer is 10^{-7}.

Suggested duration

Primary authors: Prof. WANG, Bo (Tsinghua University); Mr CHEN, Yufeng (Tsinghua University); Prof. WANG, Lijun (Tsinghua University); Prof. GRAINGE, Keith (The University of Manchester); Dr OBERLAND, Richard (University of Manchester); Dr WHITAKER, Richard (University of Manchester)

Presenter: Prof. WANG, Bo (Tsinghua University)

Session Classification: Instrumentation Programme

Track Classification: Instrumentation

Contribution ID: **36** Type: **Poster**

Spark and Dask Performance Analysis Based on ARL Image Library

Significant scientific discoveries are currently being driven by the analysis of large volumes of image data, and the SKA-square kilometer array telescope is one of them in astronomy. At present, there are many computation and transmission frameworks supporting such tasks, but the specific performance of the frameworks for astronomical science data processing (SDP) remains to be verified. In this paper, we evaluate two popular frameworks, Spark and Dask, using a standard image processing pipeline of SKA SDP. The evaluation is carried out from multiple angles such as total cores, data size and the number of threads per process. And then we find that the task scheduling models can be further improved by genetic algorithm, which leads to a local optimal solution. More contributions of this paper consist of some basic ideas of the coordination between computation topology model, data transmission model of processors and physical machines, and also the routing model.

Suggested duration

Primary authors: Mr FU, Kaiyu (Shanghai Jiao Tong University); Dr LI, Qiuhong (Fudan University); Ms FAN, Siyu (Shanghai Jiao Tong University); Ms LI, Ting (Shanghai Jiao Tong University); Dr HUANG, Tian (University of Cambridge); Dr LUO, Yuan (Shanghai Jiao Tong University, China)

Presenter: Mr FU, Kaiyu (Shanghai Jiao Tong University)

Track Classification: SKA Regional Centres

Contribution ID: **37** Type: **Talk**

Experience Learned from Initial Scale-Out Prototyping Efforts

As observed by computer scientists in SKA science data processor (SDP) consortium, the designed capability of scientific data processing is significantly reduced in the current design of SDP by focusing only on high-priority scientific observation tasks, and reducing the number of effective baselines of the antenna. SDP consortium reduced the sustainable requirement of imaging computation for scientific data processing to 25 PFlops. Under the assumption of 10% computational efficiency, the peak performance requirement is 260 PFlops and the computational power consumption is 4.3 MW. However, as the existing design basically refers to the general purpose computer designs, e.g. Tianhe 2 and other supercomputing centres, features of SKA SDP were not fully considered in the current design. There seems no sufficient effort in research on SKA SDP design in full scale under the constraints of computing, data movements, storage and power efficiency. Simple application goal adjustment in current design only temporarily avoids the limitation of budget reduction, and does not technically solve the bottleneck of large-scale computing and data transmission of SKA scientific data processing. Similar to the situation of existing SKA SDP design, some bottlenecks in FAST telescope, a SKA pathfinder project were found during the actual operation of the FAST telescope, e.g. the actual amount of observation data was several orders of magnitude larger than earlier model. As such, we have to handle the challenges by working on scale-out prototyping to compose a SKA-SDP application specific system. Experience Learned from Initial Scale-Out Prototyping Efforts are summarised in the talk in the areas of computing hardware platform, system software framework, data processing as well as operational scheduling.

Suggested duration

15 minutes

Primary author: Prof. ZHU, Yongxin (Chinese Academy of Sciences/Shanghai Jiao Tong University)

Presenter: Prof. ZHU, Yongxin (Chinese Academy of Sciences/Shanghai Jiao Tong University)

Session Classification: Instrumentation Programme

Track Classification: Instrumentation

Contribution ID: **38** Type: **Talk**

Controls to Manage Radio Frequency Interference in a Radio Astronomy Environment

The Square Kilometre Array (SKA) project is an international effort to build the world's largest and most sensitive radio telescope. Although the SKA mid-frequency telescopes in South Africa will be located in an Astronomy Geographic Advantage (AGA) Area, the effective management of radio frequency interference (RFI) in the protected radio quiet zone (RQZ) will be crucial to the success of the project. Various RFI Controls and Management Tools have been developed internally to assist the SARAO RFI Team in this regard. RFI Policies and Procedures form the cornerstone of these tools. Equipment required on site is RFI Qualified in South Africa using either an Anechoic or Reverberation Chamber. The telescope protection thresholds (Continuum, Spectral Line and Saturation Thresholds) are applied to the measurements to produce RFI Controls in the form of a Permits, Certificates of Conformance (CoCs) or Non-Compliance Records (NCRs) accordingly. Each measurement report is filed and linked in a searchable RFI Reports Database, while an RFI Dashboard and automated mailing notification system ensures RFI Controls are tracked in a timely manner. RFI Detections and RFI Figure of Merit Dashboards have been developed to visually present the RFI environment as a function of time (day of the week, or month of the year, special activities on site, etc.).

Suggested duration

20 minutes

Primary author: Dr OTTO, Abraham Johannes (SKA-SA)

Co-authors: VAN DER MERWE, Carel (SKA-SA); TIPLADY, Adrian (SKA South Africa)

Presenter: Dr OTTO, Abraham Johannes (SKA-SA)

Session Classification: Engineering Operations II

Track Classification: Engineering Operations

Contribution ID: **40** Type: **Talk**

Scientific reproducibility in the Spanish SKA Regional Centre prototype

Thursday, 28 November 2019 14:23 (19 minutes)

The SKA Regional Centres (SRCs) will be at the core of the exploitation of SKA data, being the place where the science will be done and hence should constitute a collaborative framework where researchers can share their experiments. At the IAA-CSIC we are leading the Spanish effort to host an SRC. We are developing a prototype with a special focus on addressing the challenge of handling SKA data to extract scientific knowledge in a reproducible way (i.e. following the Scientific Method). Currently, the Open Science initiative is encouraging the development of new solutions to enhance knowledge sharing and collaboration as well as to ensure transparency, as basic factors to achieve scientific reproducibility. Our objective is therefore that Big Data science becomes Open Science in the SRCs. In this talk, we will present the activities that we have carried out so far to develop the IAA-CSIC SRC prototype fully aligned with the Open Science Principles.

Suggested duration

20 min

Primary author: SÁNCHEZ EXPÓSITO, Susana (IAA-CSIC)

Co-authors: VERDES-MONTENEGRO , Lourdes (IAA-CSIC); GARRIDO SÁNCHEZ, Julian (IAA-CSIC); LUNA, Sebastián; MOLDÓN, Javier (IAA-CSIC); DARRIBA, Laura (IAA-CSIC)

Presenter: SÁNCHEZ EXPÓSITO, Susana (IAA-CSIC)

Session Classification: SKA Regional Centres (session)

Track Classification: SKA Regional Centres

Contribution ID: **48** Type: **Talk**

Aperture Array Integrated Receiver

AAIR is a project developped for MFAA consortium "Middle Frequency Aperture Array", part of SKA Advanced Instrumentation Program. AAIR aims the miniaturization and integration inside chips, or ASIC "Application Specific Integrated Circuit", radiofrequency features including fast digitization. With AAIR project, cheaper cost is then highlight and power consumption is naturally brought in the forefront for the aperture array in the middle frequency of SKA.
At last, AAIR is a R&D long-term project which was funded by the French research national agency for 816 keuros. This project was developped with powerfull collaboration team from Nançay radioastromy station, Bordeaux Astrophysic Laboratory (LAB), Netherland institute for radioastromy (ASTRON), and NXP Company.

Suggested duration

Primary author: Mr RAKOTOZAFY HARISON, Sangitiana (Observatoire de Paris)

Co-authors: BOSSE, Stéphane (Station de Radioastronomie de Nançay); Dr DA SILVA, Bruno (Observatoire de Paris); Mr BARTH, Séverin (Observatoire de Paris)

Presenter: Mr RAKOTOZAFY HARISON, Sangitiana (Observatoire de Paris)

Session Classification: Instrumentation Programme

Track Classification: Instrumentation

Contribution ID: **49** Type: **Talk**

CADC, CANFAR and a Canadian SRC

Thursday, 28 November 2019 15:01 (19 minutes)

This talk will present the CADC's current activities related to the development of science platform infrastructure, open software and data sharing standards in astronomy (image cutouts, VO services, interactive work sessions, batch processing, data models, user database services, etc.). These activities are directly influenced by and in support of our participation in the CIRADA project and are informing our understanding of what an SKA Regional Centre should look like. It will also present Canada's current expectations around how an SKA Regional Centre fits into the broader picture of data science in Canadian astronomy.

Suggested duration

Presenter: GAUDET, Séverin (National Research Council Canada)

Session Classification: SKA Regional Centres (session)

Contribution ID: **50** Type: **Talk**

Compute & Storage requirements for SKA Regional Centres

Thursday, 28 November 2019 15:20 (19 minutes)

The Horizon 2020 AENEAS project was formed to develop a science-driven functional design for a distributed federated European SKA Regional Centre. Here I will present some of the technical assessment work from the AENEAS project sizing the compute and storage requirements for the European SRC. This exercise used a ground-up approach to determine the volume of both primary and secondary data products that would need to be archived by an SRC, as well as the processing load incurred by the high priority science objectives of the SKA project.

Presenter: Prof. SCAIFE, Anna (University of Manchester)

Session Classification: SKA Regional Centres (session)

Contribution ID: **51** Type: **Talk**

Plans and Progress towards an Indian SRC

Thursday, 28 November 2019 15:39 (19 minutes)

India is one of the countries that will potentially host an SKA regional centre . In preparation to hosting a full fledged SRC, we have proposed to develop a prototype SRC during 2019-2023. This prototype will contain sufficient storage and compute to meet the requirements of processing data from the uGMRT, an SKA pathfinder telescope. I will describe ongoing efforts at developing an end to end continuum processing pipeline for archival GMRT data obtained with two different backends. I will describe our choices for the software stack and our efforts at automatic all aspects of the data processing.

Suggested duration

Presenter: Prof. WADADEKAR, Yogesh (NCRA)

Session Classification: SKA Regional Centres (session)

Contribution ID: **52** Type: **Talk**

Showcasing what has been done⋯

Thursday, 28 November 2019 09:00 (30 minutes)

Presenter: JACKSON, Carole (ASTRON)

Session Classification: Splinter Sessions

Contribution ID: **53** Type: **Talk**

WBSPF/ASPFR Update

Thursday, 28 November 2019 09:30 (15 minutes)

Presenter: HOVEY, Gary (National Research Council)

Session Classification: Splinter Sessions

Contribution ID: **54** Type: **Talk**

PAF Update

Thursday, 28 November 2019 09:45 (15 minutes)

Presenter: BARKER, Steve (CSIRO)

Session Classification: Splinter Sessions

Contribution ID: **55** Type: **Talk**

MFAA Update

Thursday, 28 November 2019 10:00 (15 minutes)

Presenter: CAO, rui (KLAASA)

Session Classification: Splinter Sessions

Contribution ID: **56** Type: **Talk**

Design of Extremely Low Noise Amplifier with GaAs HEMTs for SKA Band 2 Receiver

Thursday, 28 November 2019 11:30 (15 minutes)

Presenter: JIANG, Frank (NRC-Herzberg)

Session Classification: Splinter Sessions

Contribution ID: **57** Type: **Talk**

VLBI with White Rabbit Time and Frequency Distribution

Thursday, 28 November 2019 11:45 (15 minutes)

Presenter: BOVEN, Paul (JIVE)

Session Classification: Splinter Sessions

Contribution ID: **58** Type: **not specified**

Integrated dissemination system of frequency, time and data for radio astronomy

Thursday, 28 November 2019 12:00 (15 minutes)

Presenter: WANG, Bo (Tsinghua university)

Session Classification: Splinter Sessions

Contribution ID: **59** Type: **Talk**

Framing the SODP

Thursday, 28 November 2019 14:00 (20 minutes)

Presenter: DIAMOND, Philip (SKA Organisation)

Session Classification: Splinter Sessions

Contribution ID: **60** Type: **Talk**

Design of Extremely Low Noise Amplifier with GaAs HEMTs for SKA Band 2 Receiver

Presenter: JIANG, Frank (NRC-Herzberg)

Session Classification: Splinter Sessions

Contribution ID: **61** Type: **Talk**

VLBI with White Rabbit Time and Frequency Distribution

Presenter: BOVEN, Paul (JIVE)

Session Classification: Splinter Sessions

Contribution ID: **62** Type: **Talk**

Integrated dissemination system of frequency, time and data for radio astronomy

Presenter: WANG, Bo (Tsinghua university)

Session Classification: Splinter Sessions

Contribution ID: **63** Type: **Talk**

Aperture Array Integrated Receiver

Presenter: RAKOTOZAFY HARISON, Sangitiana (Observatoire de Paris / Station de Radiastronomie de Nançay)

Session Classification: Splinter Sessions

Contribution ID: **64** Type: **Talk**

Some Viewpoints of Reliability and Security Challenges of SDHP

Presenter: LUO, Yuan (Shanghai Jiao Tong University, China)

Session Classification: Splinter Sessions

Contribution ID: **65** Type: **Talk**

Experience Learned from Initial Scale-Out Prototyping Efforts

Presenter: ZHU, Yongxin (Chinese Academy of Sciences/Shanghai Jiao Tong University)

Session Classification: Splinter Sessions

Contribution ID: **66** Type: **Talk**

Procurement in the SKA - Background

Thursday, 28 November 2019 14:30 (30 minutes)

Presenter: STEVENSON, Tim (SKA Office)

Session Classification: Aspects of Procurement

Contribution ID: **67** Type: **Talk**

Contract structure and WBS

Thursday, 28 November 2019 15:00 (20 minutes)

Presenter: CASSON, Andrea (SKA Organisation)

Session Classification: Aspects of Procurement

Contribution ID: **68** Type: **Talk**

Schedule

Presenter: LIU, Qiqi

Session Classification: Aspects of Procurement

Contribution ID: **69** Type: **Talk**

Q&A

Thursday, 28 November 2019 15:20 (25 minutes)

Session Classification: Aspects of Procurement

Contribution ID: **70** Type: **Talk**

Bluering

Thursday, 28 November 2019 10:15 (15 minutes)

Presenter: HAMPSON, Grant (CSIRO)

Session Classification: Splinter Sessions

Contribution ID: **71** Type: **Talk**

Smart Front Ends

Thursday, 28 November 2019 10:30 (15 minutes)

Presenter: BENTUM, Mark (ASTRON)

Session Classification: Splinter Sessions

Contribution ID: **72** Type: **Talk**

High energy-efficiency signal processing technology for MFAA

Thursday, 28 November 2019 10:45 (15 minutes)

Presenter: CAO, rui (KLAASA)

Session Classification: Splinter Sessions

Contribution ID: **73** Type: **not specified**

Aperture Array Integrated Receiver

Thursday, 28 November 2019 12:15 (15 minutes)

Presenter: RAKOTOZAFY HARISON, Sangitiana (Observatoire de Paris / Station de Radiastronomie de Nançay)

Session Classification: Splinter Sessions

Contribution ID: **74** Type: **not specified**

Some Viewpoints of Reliability and Security Challenges of SDHP

Thursday, 28 November 2019 12:30 (15 minutes)

Presenter: LUO, Yuan (Shanghai Jiao Tong University, China)

Session Classification: Splinter Sessions

Contribution ID: **75** Type: **not specified**

Experience Learned from Initial Scale-Out Prototyping Efforts

Thursday, 28 November 2019 12:45 (15 minutes)

Presenter: ZHU, Yongxin (Chinese Academy of Sciences/Shanghai Jiao Tong University)

Session Classification: Splinter Sessions

Contribution ID: **76** Type: **Talk**

Accommodating science beyond the SKA1 design

Thursday, 28 November 2019 14:20 (20 minutes)

Presenter: BRAUN, Robert (SKA Organisation)

Session Classification: Splinter Sessions

Contribution ID: **77** Type: **Talk**

Panel Discussion on the AIP

Thursday, 28 November 2019 14:40 (1h 20m)

Reframing AIP to a realistic and visible program to the SKA council and science community –how can we do this together?

How do we do the above and cohere with other major array developments –ngVLA, DS1000 etc⋯

Presenters: HOVEY, Gary (National Research Council); BOWEN, Mark (CSIRO); BARKER, Steve (CSIRO)

Session Classification: Splinter Sessions