Summary of the ARDRA session on Calibration and Imaging

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1 Summary from the Session Coordinator

At ARDRA, we have had some very useful sharing of information on the area of calibration and imaging. While it is encouraging that various groups (developing algorithms as well as pipelines) have made significant progress towards high-dynamic range, high fidelity wide-band, wide-field imaging, there is scope for harnessing our collective wisdom for the challenging path towards the SKA. Some key challenges include:

- Processing time is a major bottleneck.

- Large data volumes and its efficient handling.

- Correction of direction-dependent effects are often limited by processing resources.

- There is a class of new and advanced algorithms meant for wide-field imaging – WSClean, AW-Projection, W-snapshots so on and so forth. But there has not been a systematic comparison or benchmarking of these promising algorithms against real data from various instruments.

- Instrumental calibration – ON and OFF-axis.

- Even in the area of automated pipelines, the efforts have largely been limited to optimising the processing for a particular instrument and/or using a particular algorithm/package. While most of the algorithms are public, it is a rather time-intensive exercise to familiarise with all such packages. Direct comparison on efficiency between packages is often difficult given there are a large range of parameter set against which to optimise image processing. This is more or less why a fair/rigorous comparison across most modern algorithms and packages is missing. The advantage of a collective effort cannot be overstated.

It was proposed that we constitute a working group for understanding and addressing of these issues. A major impediment would however be the lack of an

integrated platform on which to develop/test/share our softwares. At CSIRO, the SDP team is working on alleviating this issue by adhering to established s/w engineering practices. We could discuss about extending these principles to design testing & development platform for this proposed group. The aim would be to enable members of the group to easily share their softwares as well as experiment with those provided by others in a seamless/automated manner thereby reducing the learning curve and associated overheads significantly. **Eric Bastholm** is taking the lead on this.

We would also require some careful thought on ensuring adequate interactions between group members. Tele-cons are useful, but the cadence and time should be carefully decided. Perhaps a fortnightly meeting may be okay to begin with. For interactions requiring quick turn-around times, I find a chat based app like Slack quite useful. Creation of the Slack channel is an action item on me (done! see link https://join.slack.com/t/calibrationan-5oo8557/signup).

Of course, no such communication can replace the benefits of a face-to-face meeting. Hence people-movement would be necessary from time to time. This group should also play a key role in training students for SKA era science. Regular Workshops and schools that facilitate cross-pollination across different domains of science and engineering (including industry) would go a long way in building the expertise that SKA would require.

The related financial overheads will require us to seek support and mandate from our host organisations and also reach out to other funding agencies interested in the SKA. This I have requested **Yogesh Wadadekar** to coordinate with appropriate people from NCRA, while **Wasim Raja** will explore this with relevant officials in CSIRO.

The constitution of this working group and action items for it is being discussed in a Slack channel – https://join.slack.com/t/calibrationan-5oo8557/signup.

2 Comments & Suggestions from participants

2.1 Eric Bastholm

Thanks Wasim for putting this together.

Although the effort to develop some type of framework for consistently testing and comparing different software is not without cost to the participant's organisations (time and money) the benefits could be significant to the community. We can talk with interested parties later for details and to formulate some requirements, but my initial thoughts are that a testing and experimentation framework that could run different software against equivalent parameters and report results in a directly comparable and repeatable way would go a long way to achieving what you describe above. Ideally, it would be platform agnostic and be able to be run on cloud services as well as specific hardware. Containerisation may be a way to meet this goal.

We could also consider a website/forum to record discussions, ideas, and information.

3 Follow-up activities since ARDRA

In the weeks following ARDRA, a few of us have made good progress on collaborative exercises:

- A core group has been constituted and discussions ongoing on a slack channel as to an efficient way of working across continents – **Eric Bastholm, Ishwara Chandra, Lijo T. George, Ruta Kale, Huib Intema, Yogesh Wadadekar, Divya Oberoi, Wasim Raja**. We expect this group to grow with time.

- A container for YANDAsoft (A software package for reducing interferometric data developed at CSIRO as part of ASKAP data reduction) has been installed in one of the machines at the NCRA – **Ishwara Chandra, Lahur Paulus, Stephen Ord, Wasim Raja**.

- Processing uGMRT data – **Ishwar Chandra** and **Lijo T. George** from NCRA have initiated tests on uGMRT data using YANDAsoft.

- Working out modalities for a common s/w platform to facilitate sharing/testing of codes across different people – **Eric Bastholm** is leading this discussion.