

32T Test Plan – Interim Real-time Computer (RTC) (14)

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1 Introduction

Real-time calibration and imaging requires a computer system with sufficient input bandwidth to cope with the correlator output, and sufficient computational capability to apply a minimal direction-independent calibration across the entire bandwidth; the imaging task is similar in scope to that required by a full 512T RTC, and as a result only a sub-set of the 192 channels will be imaged. This subset may be formed by integration in the visibility domain to reduce resolution, or by imaging some fraction of the raw channels. This plan is responsive to requirement #14 contained in the memo “MWA 32-T Objectives and Quality Assurance Evaluation Criteria”, dated 4 September 2009 (46-03001.99).

2 References

The basic hardware is common to that used for the current real-time correlator. This equipment is documented as *DataCaptureSoftwareCorrelation32T* in the 32T project book.

A document distributed to 32T mailing lists and attached here (*RTS and Correlator Integration at Haystack*) describes the integration task performed at Haystack which indicates the system performance requirements.

3 Measurement Description

A necessary but not sufficient measurement is that the system is capable of ingesting the data at the correlator output rate.

An operational RTC is a requirement for all of the imaging tasks (4a, 5a, 5b and 6). The capability of calibrating the entire bandwidth would be considered a necessary measurement, how many simultaneous channels must be imaged is not stated, we will aim to image the entire bandwidth.

3.1 Frequency Resolution

The task aims to image the entire bandwidth of the instrument, but not at the native resolution, some degree of channel integration will be required to make the problem tractable.

3.2 Time Resolution

The calibration task must be performed at the 8 second cadence, but the output image time resolution will be several minutes. This is the mode of operation of the 512T.

3.3 Instrumental Polarization

The basic imaging task will not convert the image from instrumental polarization, but the sub-integrations will have to be suitably weighted to permit integration. The RTS will need to be capable of performing this image weighting.

3.4 Wide-field Correction

Wide-field (WF) correction in the image domain will be performed at the very least on each sub-integration, and may be performed on each 8 second cadence. The 32T system has such short baselines, and such a poor PSF, compared to 512T that a less precise WF correction may be possible without a significant impact on image dynamic range. Nevertheless the computational capabilities to resample the image into a frame free of wide-field distortion will be demonstrated.

4 Resources Required

4.1 Staffing

The RTS system will require careful construction, testing and integration with the correlator and the monitor and control system. It is suggested that at least one member from each element be present for integration and testing

4.2 Hardware

To demonstrate the RTC performance

- Operational correlator.
 - Current system assumes channel ordering consistent with that provided by 512T.
- Monitor and Control system – must at least provide RTS with pointing parameters.
- The current 4 data capture machines. The exclusive use of these machines will be a requirement. This implies NO raw data capture capability will exist while the RTC is being installed
- Minimal extension of current computational capability (REQUIRED).
 - An extra CPU (dual core Xeon E5205 1.86GHz) for each CPU.

4.3 Software

Operational RTS
Operational Monitor and Control system with frequency and pointing control capability.

4.4 Execution Time and Constraints

As imaging quality is not a constraint it is possible to install and test the RTC in times of poor ionospheric weather. Considerable time will be required to test and shakedown the system (40 hours off site testing at Curtin). RTC / RTS depends on a complex internode communication protocol which will need to be tested on site (40 hours on site).

5 Success Criteria

A system capable of ingesting the required rate from the correlator, calibrating all input channels and imaging, integrating and correcting wide field errors at reduced frequency resolution and several minute time resolution over the full bandwidth of the input data.

6 Attachment

(1) Integration tests at Haystack.

Revision History

Rev Ltr	Date	Author	Description
01	2009-09-28	SMO	First draft of 14.
02	2009-09-28	SMO	Corrections added attachment
03	2009-09-29	SMO	Corrections
04	2010-01-05	RFG	Formatting