

The 32 Tile Array

Discussion Summary

Divya Oberoi

Frank Briggs

Merv Lynch

Randall Wayth

Primary Motivation

- *Provide a definite short term goal to focus on*
- Provide an end-to-end proof-of-concept demonstration
- Risk mitigation exercise
- Early experience with instrument and data
- Early science capability
- PR value

Approach

- Too short of time and people to do *all* that could be done with the 32T system
- Timeline – if it takes too long, it is too late
- Maximize returns – asking the most pertinent questions and assigning the right priorities

Short fuse...

- All 32 tiles deployed and commissioned in 9 months – September 2007
 - At the minimum, some rudimentary receiver and data acquisition capability compatible with 32T objectives required on the same time scale
 - Minimal set of tools to examine and analyse data
-
- very first tile delivered Feb/Mar 07
 - delivery of tiles can be in June

Priorities

Critical, Important and Useful

- Critical - must have an answer to before we proceed with the full array
- Important - important but if push comes to shove, we should be able to drop them and live with the system, even if do not have firm answers to these questions
- Useful - useful and interesting, should be done if time and resources permit
- Level of difficulty - Difficult, Moderate and Easy

Phased activity

- 1st tile + receiver on the ground can already do something very useful – RFI monitoring, tile beam response (sky scans)
- As more tiles become functional the sophistication of experiments and outcomes grows
- 32T continues to be operated and remains useful well into the 500T phase. Only source of real data for some time to come

Action Items

- A compendium of current thinking/information on 32T system
 - Description of the 32T array, layout, sensitivity
 - Infrastructure requirements/desirements (No. of trailers/sea-tainers, power generation, homestead facilities)
 - Deployment expectations
 - Operations expectations
 - Connectivity to outside world
 - 2nd - 3rd Wk. Jan
- Walk through a scenario of how things would happen
- List of things to do
- Work package wise list of critical, important and useful things
- Resources needed
- Interface definitions

1st tile tasks

- to do:
 - need to be delivered and assembled
 - needs goals for data capture. what do we want to do with it?
- Issues/decisions
 - who assembles, does the measurements?
 - which beamformer?
 - which data capture device?
- owner: Brian C

32 tile tasks

- specs for site
 - how coplanar? how flat for individual tiles? Alignment of tiles to N/S?
 - Merv has mentioned that 5cm over 5m is a target he has used.
 - action: Randall come up with these specs
 - location of site needs to be determined
- coordination of delivery of tiles to site. owner: Brian
- building to house the equipment
 - can we use a shipping container? aircon etc. owner: Merv
- power requirements, installation, distribution. owner: Judd

32 tile tasks ...

- assembly
 - who assembles?
 - what equipment? do we need welders for the ground plane?
 - do we need to prepare the ground? How flat? aligning the tiles or flatness and N/S accuracy? Do we need survey equipment and expertise?
 - owner: Merv
 - **do we get local companies to build groundscreen? Need a cost analysis. Need specs for GS requirements.**
 - owner: David H

32 tile tasks

- thermal management for node hardware. owner: Frank
- receiver schedule. Will it be on time? expected answer in 3 weeks. owner: Frank
- Data transport layer:
 - still some parts of the system to be finalised.
 - ORPHAN issue
- clock. need to design, create and distribute clock signal. owner: ??

32 tile correlator

- lots of stuff to do, will be difficult to get this done by Sep.
- will need some other device to capture the data if correlator isn't ready
- will decide if we need a backup plan for correlator later.
 - owner: Roger.
- need a computer to capture output of the correlator onto disk. owner: Judd

Required hardware

- what is all the “stuff” we need to glue this all together?

Required software

- tile control
- node control
- observing control
- uvfits writer
- realtime data monitors
- customised analysis software (beyond what miriad etc can do) e.g. for ionosphere, instrumental cal.

Issues

- RFI measurement, compatibility and mitigation
- budget:
 - who pays for trips
 - who pays for hardware
- there are many interface control docs that need to be defined
- network connection to the outside world
- who will be operating the array? how will it be run?
 - e.g. campaign mode.

Antennas

Critical	Moderate	Tsys/sensitivity
Critical	Difficult	Beam patterns -- any problem frequencies?
Critical	Easy	Equipment durability -- Failure rate and causes, lightning susceptibility, attractiveness to fauna, large and small, as nesting site, chew toy, back scratcher, etc.
Important	Difficult	Variability of complex signal gain from bowtie to bowtie, and from tile to tile
Important	Moderate	Effectiveness of BF phase switching in removing common-mode effects
Important	Easy	Tile installation and site preparation procedures -- Can they be made more efficient and/or less costly?
Important	Moderate	Effectiveness of monitoring satellite signals to test health of Beamformers and antenna elements
Useful	Difficult	Temporal and thermal stability of electronics, as deduced from auto- and cross-corr amplitude and phases

Digital Systems

- Digital receiver (F. Briggs to elaborate)
- Data transport
 - performance (including BW vs. distance; error rates)
- PFB board
 - data reception
 - data routing
 - fine PFB functionality
 - cube rotator functionality
 - data transmission
- Correlator board
 - data reception
 - routing
 - basic correlation cell
 - data transmission
 - control
 - excluded are: voltage beamformer, long term accumulator

32 Tile Priorities

Critical

- beam shape (stability in time/freq/temp/pol, parameterisability)
- peeling (dealing with and estimating sidelobe confusion)

Important

- calibration sources (polarised & unpolarised GSM)
- calibration source properties (including ionospheric effects)

Useful

- M&C (error / failure recognition, etc.)
- calibration using satellites (orbcomm, FR)

32T Objectives

- Engineering tests - evaluate hardware performance
- Test system integration aspects
- Provide a platform for building and exercising software
- Get a feel for efficacy of calibration algorithms
- Get a feel for the real data and the sky
- Oil the path for the full system, give an opportunity for unanticipated problems to crop up
- Some focused science experiments
- Identify problem areas and take remedial measures in time
- Build up confidence in the array design and calibration approach

Work packages involved

Antennas	Real time computer	Inst. Calib	EOR Imaging	Field Dep
Receiver Node	Binner	All Sky Monitor	EOR PSM	
Clock	Mapper	Helio. FR	Infrastruct	
Monitor & Control	Imaging Survey	IPS	Sys design integration	
Data transport	GSM vis. Prediction	Solar Imaging	Array Ops	
Correlator	Iono Calib	EOR RTS	Mgment	

From Work Package Managers

- A prioritized list of questions we need answers to
- An assessment of effort involved, is it feasible?
- Timelines