

===== **Tianlai teleconf (12 March 2015) summary** =====

**Attendance:** NAOC , Fermilab, CMU, UW, LAL, Obs. Paris, Nançay, IRFU-SPP  
NAOC: Xuelei Chen, Yidong Xu, Jiao Zhang , Fengquan WU (by phone- Xinjiang) +...  
Zhiping Chen  
UW (Wisconsin) : P. Timbie , Le Zhang  
Fermilab: A. Stebbins CMU: Jeff Peterson  
Obs. Paris: J.M. Martin, P. Colom Obs. Nançay: S. Torchinsky  
IRFU: C. Magneville  
LAL: R. Ansari, J.E. Campagne, Qizhi Huang

This meeting web page and documents:  
<https://indico.lal.in2p3.fr/event/2802/>  
(modification pw = tian21cmctc)

**A- First analysis of PAON-4 (Qizhi Huang)**

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The observations with PAON-4 have been started at the end of february, after repair of optical fibers. The computer used for configuring boards through USB needs to be replaced.  
several bright sources (CygnusA, CasA, and the Crab pulsar have been observed, at several declinations in some cases to map the beam in North-South direction.  
Preliminary analysis shows that system (antenna + electronic) works as expected -  
The antenna alignment (in the N-S plane), the dish beam (~ 3.5 deg @1400 MHz) and system temperature (~100 - 120 K) are OK.  
Qizhi presents a first analysis: auto-correlation signal as a function of time, fringes in time,frequency plane, an analysis a fringes @1400 MHz for determining the system temperature (see slides)

**B- Tianlai data analysis and Archive Center (A. Stebbins)**

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following Xuelei request, an estimate of the data flow from Tianlai arrays was made (R. Ansari/C. Magneville/A. Stebbins). A segmentation of the data processing into different levels has been defined:

- L0 : data production on site
- L1 : data reorganization , first step of data reduction (through time averaging) and RFI mitigation
- L2 : RFI cleaning, calibration, map making
- L3 : foreground removal, HI signal extraction

Albert will continue investigating the possibility to setup the Tianlai Archive Center (TAC) and the L2 processing center at Fermilab. Xuelei has mentioned this possibility during the Beijing (IHEP) - Chicago (Fermilab) collaboration meeting. RA suggest that the US collaborators try to formalize more the idea of having the TAC at Fermilab. That would be a significant step toward an operational international collaboration.  
We need to have a more complete estimate of the needed computing and storage resources, and hence the corresponding cost - The cost of ~5 c / GB is mentioned by Albert.  
Questions:  
- Do we need / can we keep a copy of the L0 data set ?  
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**C- Tianlai 16 dish array configuration (X. Chen, J. Zhang)**

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Xuelei gives the planning for the dish array: The dishes will be shipped to the site in the next few days. Fengquan WU is already at the site, preparing the dish installation. Recent photos of the sites taken by Fengquan were shown (see the attached photos) . Xuelei list the main questions regarding the array configuration:

- (1) the choice of array configuration (rectangular, circular)
- (2) spacing between the dishes
- (3) position relative to the cylinders--is it important to be in the due east-west, or it is Ok to be slightly north or south from the east-west line?
- (4) Is it important for the dishes to all have the same elevations, and same elevations as cylinders?

Although the 16 dishes could be installed on the western side of the area, there is more space available on the East side.

====> **There is no specific advantage to put the array on the western side, so it is decided that the 16 dish array will be located on the eastern part of the site, where there is more room for the array expansion.**

The terrain is not totally flat (up to 1-2 meter difference in height). Is this level of non flatness going to be a problem for the array operation and map making ? The terrain can be made flat, but there will be additional costs. Jeff prefers to have the array over a flat area, to avoid the w-term in the cross-correlations, as this will create a slightly non symmetric beam shape in the N-S direction. Albert & Reza thinks that the difference in the antenna positions along the vertical (Oz) can be easily taken into account in the map making code. Another question is the additional delay which might affect the computation of correlations. However, the corresponding delay would be about  $\Delta z / c \sim 10^{-8} \text{ s} = 10 \text{ ns}$ , which is negligible compared to the digitization frame length on which the FFT is performed.

====> **It seems to be no show stopper if the dishes are not put over a perfectly flat surface, or not exactly aligned in the E-W direction, as long as the dish positions (x,y,z) are precisely known. The dish axis should however be correctly aligned.**

Dish array configuration: Jiao presents few slides comparing several array configurations (regular, irregular, circular) with different base spacing for dishes (see slides). The regular array has many redundant baselines, which is an advantage for calibration and identifying problems, while the irregular / circular arrays have many different baselines, which is useful for map making and for a more smooth synthesized beam. Most people are in favor of the circular configuration (Jeff, Albert, Reza), although the redundant baselines would also have some benefits. Peter mentions the Max redundancy analysis by PAPER experiment. Transit observations close to the zenith seems a good option to start with, in order to debug the array, get the calibration right and produce the first maps (foreground an HI maps). In a second phase, we could then change the array configuration for an annular configuration as was suggested by Albert to make deep observations toward the equatorial north pole.

====> **The "circular configuration" shown by Jiao (a dish in center, surrounded by 6 dishes in a hexagonal configuration, surrounded by 9 dishes, regularly arranged over a second circle. It is however decided to push the base spacing to 8.5 - 9 meters.**

This 8.5 - 9 m base spacing should be enough to avoid some dishes shadowing other dishes for pointing at least at 45 deg from the zenith, so the antenna should be able to cover the sky from 0 declination up to 90 deg (polar).

There are some concern about the cross talk between dishes. Jeff suggest to experiment with some kind of shields around dishes and/or feeds.

#### **D- HIEMICA component separation (Le ZHANG)**

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Le presents few slides showing the principle of the method as well as its performance to extract the HI signal when the foreground components can be modeled with a single frequency behavior - The method determine this from the data (see slides). This subject should be re discussed in more detail in a future meeting.