

Summary of visit of Jeff Peterson and Kevin Bandura to NAOC, Beijing and Bai Qi, Inner Mongolia, Monday Sept 27, 2010 to Friday Oct 1, 2010.

Monday we met in Beijing with the CRT team in China to discuss mechanical design of the telescope and feed antenna development.

Present were:

-Prof Xuele Chen, leader of the CRT effort in China  
-Yougang Wang and Fangquan Wu, NAOC junior faculty who are working full time on CRT.

-Yichao Li, Bin Yue and Xin Wang, NAOC graduate students.

-Prof Huli Shi, from NAOC, who has built radio telescopes in the past and helped develop China's 'GPS' system. Also attending some meetings were several of Shi's graduate students.

-Prof. Zhiping Chen, a mechanical engineer from Hangzhou Dianzi University, along with Post doc Rui Lui and graduate student Yang.

Prof Zhiping Chen presented options for mechanical design of the cylindrical reflector.

Ideas examined included:

- 1) use of thick wall (5 mm) galvanized pipe of diameter 114 mm as columns. These would be planted in 2 m deep concrete and not need guy wires. These are used as light poles in China and are available in lengths up to 8 m.
- 2) use of concrete power poles.
- 3) use of deep TEE shaped ribs, formed at a factory to the parabolic shape.
- 4) use of slit-expanded aluminum as the surface material.

Peterson presented the suspended mesh concept, and delivered samples of mesh, stiffener battens and winches used in the Pittsburgh prototype.

To decide among cylinder mechanical options it was decided to build short sections of several prototypes in Hangzhou. We decided to build off-axis prototypes.

The discussion then turned to feeds. Peterson passed around a prototype foursquare feed along with TAMP960LN amplifiers. We talked about how to attach the amplifiers directly to the antenna petals.

We discussed the issue of edge illumination. We decided that since the cylinder only spills at the two sides, and since low-l sensitivity benefits from a strong edge

illumination, we should use a stronger edge illumination than is typical for dishes. We settled on -4 db as a working number.

Tuesday we drove to the solar radio telescope near Bai Qi, which is the site that has been proposed for the next-step prototype. Present for this outing were Xuelei Chen, Zhiping Chen, Yougang Wang, Fangquan Wu, Jeff Peterson, and Kevin Bandura. The CMU group had previously sent receivers and an ADC board. The NAOC group experimented with these during the summer, but as there is no detailed documentation, and the NAOC members did not have prior experience on this, they encountered many problems. The purpose of this trip was for the CMU group to work with the NAOC team to install these on-site. The system will be used to make interferometric measurements of the sky and RFI.

We succeeded in getting the receivers set up and working, using small Yagi antennas pointed at the Sun. We used an RF filter, Minicircuits VBFZ-780, which attenuated low frequency RFI but not the cell phone band from 930 to 960.

We got the ADC to work in it's PC, but only single channel sampling worked. The faster multi-channel sampling code is written specifically for Intel CPUs and the PC we had available had AMD CPUs. This means we did succeed in getting spectra from single Yagis, but not interference fringes.

The CMU team will send an Intel PC, loaded with tested multi-channel sampling software.

We used a spectrum analyzer to monitor the receiver output for several hours and noticed that bursts of strong interference were fairly common (5-10 %). These completely overloaded the receiver producing a thicket of inter-modulation products across the spectrum. We did not have time to track down the source of the interference. Similar interference had been seen once during the April trip to the site. This leads to the concern that the quiet spectra taken in April at the IM4 location might have been a chance sample with the interference off. We would need to track down and understand the sporadic interference before building in this area. If the duty cycle of this interference increases it could make the site very difficult to use.

Thursday we returned to Beijing and continued discussions of the foursquare feed. Peterson described a configuration to build, and tests to be made: Calibrated E and H plane patterns at 400, 500, 600, 700, 800, 900, and 1000 MHz. The CMU team left an antenna, LNA modules, and ferrite cores to use as output baluns. If time allows the antenna testers will try adding capacitive loading at the petal gaps, since that seemed to give a wide band match in EGDES memo 013. Prof. Shi will arrange to have tests carried out at the 54 Institute antenna range.

Friday we set up the receivers in the lab and discovered that if the filter is used and the LNA removed from the signal path the receivers do not overload in Beijing. We

found a fairly quiet band. In this configuration the system temperature is about 1000K, and that should allow fringes from the sun to be detected using the yagis. This way the system can be tested in the Beijing before deployment to candidate sites.

Prof. Zhiping Chen's group will build a faraday cage to enclose the PC for site tests.

We will conduct further tests at Bai Qi, and also investigate other sites. Construction at Bai Qi could not begin until May, which gives us some time. If a site can be identified where we could stay through the completion of CRT, that is well worth some site testing effort. Sites near FAST and PaST will be tested. CMU will send the part numbers of our site testing system.

### Photos

- 1) Chalk board from presentation by Peterson on foursquare feeds.
- 2) NAOE students and faculty discuss foursquare antenna.
- 3) Bandura and Wu set up receivers at Bai Qi.
- 4) Zhiping Chen adjusts Yagi mounted to pedestal for radio dish.
- 5) Group photo from Beijing meeting.
- 6) Dark sky at Bai Qi allows nice view of Milky Way.





