

An Introduction to the Sheshan VGOS Station Project

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Abstract SHAO has set up a team to push forward the building of the Sheshan VGOS station. The task of the team is to present the station construction scheme based on the VGOS ‘standard’ and to investigate the capabilities of domestic companies and companies abroad for developing the different parts of the new station system. This report will introduce the progress of the team’s work.

Keywords Sheshan, VGOS, project

Project Status

In 2012, a project team, Sheshan VGOS Station Project, was established to push forward the construction of the Sheshan VGOS Station. In 2013, the team had received the operation fund from SHAO to support the pre-stage investigation under the name of “Study on the Key Technology of the Sheshan VLBI2010 Station Construction”. The team consisted of members from two divisions: Division of Center for Astrodynamics Research including Chengli Huang (head), Jinling Li, Zhihan Qian, and Guangli Wang; and Division of Science and technology for Radio Astronomy including Weimin Zheng (head), Fengchun Shu, Xiuzhong Zhang, and Qingyuan Fan.

This team is to present “Shanghai Sheshan VLBI2010 Antenna Technical Specifications Requirements”, to investigate the capabilities of the home industry according to the discussion of technical specifications, the comparison and the evaluation of

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the antenna design proposals, the antenna location, and the creation of a construction plan.

The team has completed the following work: (1) The selection of the Sheshan VGOS station. The station will be located in the courtyard of the existing 25-m radio telescope. Considering that the Sheshan 25-m antenna has a long history of participating in international geodetic VLBI sessions since 1988, this site is important in the Global Geodetic VLBI Network. The 25-m antenna is about thirty years old and, at some point in time, will break down. It is necessary to build a new VGOS antenna near to the old one and as its successor. In addition, an IGS station is located in this courtyard as well. (2) The RFI investigation. According to the measurement in 2010 at the Tianma 65-m telescope, which is not far from Sheshan25, RFI occurs in S-band. It is difficult to use continuous broadband at S-band for VLBI observations. The Superconducting Filter is planned for use in the reduction of the RFI effects. (3) In the second half of 2013, consulting domestic manufacturers, determining the antenna design, and forming a construction plan.

Now the main technical specifications of the antenna and other parts consist of the following:

- Diameter: 13 m
- RF frequency range: 2–14 GHz, upgradable to Ka band
- Polarization: H&V Linear polarizations
- Optics: Ring focus
- Aperture efficiency: >50%
- Surface accuracy: <0.3mm
- Pointing accuracy: <18''
- Antenna mount: az-el turntable mount
- Slew rate: Az 12°/s, 3°/s²; El 6°/s, 3°/s²
- Slew range: Az –270°...+270°; El 0°...90°

- Reference point stability: ± 0.3 mm
- Signal path length stability: ± 0.3 mm
- Primary operating conditions:
 - Wind speed: 11 m/s
 - Temperature: $-10^{\circ}\text{C} \dots +50^{\circ}\text{C}$
 - Humidity: 0...100%
 - Rainfall: 50 mm/hr
- Antenna reliability:
 - Continuous operation:
 - 3,000 long slews per day
 - for more than 30 days
 - Antenna mechanical structure's lifetime:
 - >20 yr
 - Motors and gear boxes MTBF: >2 yr
 - Maintenance and repair: <10 days/yr
- System temperature: <40K excluding ATM noise
- Receiver temperature:
 - <20K cryogenic front end output
- Digital UDC, 8 channels
 - Input 8 ch (four bands, two polarizations each)
 - Output 8 ch
 - (70–512 MHz, 512–1024 MHz,
 - 70–1024 MHz)
- DAS and recording system
 - Input: 8 IF
 - sampling rate/IF:
 - 4 Gbps (BW 1 GHz, 2-bit sampling)
 - Total recording rate: 32 Gbps
- Time/Frequency: shared
- Meteorological system: shared

Now SHAO has determined to build the VGOS station by self-raised funds at Sheshan, near Shanghai. We are preparing for choosing an antenna manufacturing contractor. The Sheshan VGOS station will participate in IVS VGOS observations in the second half of 2015.