

Sheshan VLBI Station Report for 2005

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Abstract

The Sheshan VLBI Station (also known as SESHAN25 in geodetic community), operated by the Shanghai Astronomical Observatory (SHAO), Chinese Academy of Sciences (CAS), is situated in a western suburb of Shanghai. It is a member of IVS, EVN and APT. The present report summarizes various activities on observations and equipment development at the Sheshan VLBI Station during 2005. Observing sessions in 2005 consisted of 44 VLBI sessions organized by the IVS, EVN, APT as well as the Eastern Asia VLBI Network (EAN). The antenna control system was updated in July 2005. A new L-band cryogenic receiver with dual circular polarizations which was developed at ASTRON in Dwingeloo, the Netherlands, was taken in operation in October 2005. The main reflector was re-adjusted in November 2005 using microwave holography. A new S/X feed was installed in December 2005. Optical fiber linking the Sheshan station and the host institute (SHAO) will be available in the first half of 2006.

1. General Information

The Sheshan VLBI Station (also called SESHAN25 in Geodetic community) is located at Sheshan, 30 km west of Shanghai. An antenna with a diameter of 25 meter is in operation. The telescope has been in full operation since 1987. It is one of the major astronomical facilities of the Chinese National Astronomical Observatories. The Sheshan VLBI Station is a member of the IVS, EVN and APT. There is a correlator center and an analysis center of IERS of various geodetic observations in the host institute (SHAO).



Figure 1. Overview of Sheshan 25m Radio telescope.

2. Brief description of Sheshan Station Facilities

- owner and operating agency : Shanghai Astronomical Observatory (SHAO)

- year of construction (or running) : 1987
- diameter of main reflector d : 25 m
- Longitude and Latitude of station site : $121^{\circ}11'58''$ E, $31^{\circ}05'57''$ N
- Elevation of radio telescope : 5 m above sea level
- Antenna type : Cassegrain beam wave-guide
- Seat-rack type : Azimuth-pitching ring
- Surface accuracy^a : 0.52 mm (rms)
- Azimuth slewing speed^b : 1 deg/sec
- Azimuth slewing range^b : $-78^{\circ}, 430^{\circ}$
- Elevation slewing speed^b : 0.6 deg/sec
- Elevation slewing range^b : $5^{\circ}, 88.5^{\circ}$
- VLBI rack type : VLBA4
- FS version : 9.7.7
- Time standard : H-maser MHM-2010

^a: after panel readjustment in November 2005;

^b: after antenna control system update in July 2005;

3. Technical Staff of the Sheshan VLBI Station

Table 1 lists the Sheshan VLBI Station staff who are involved in VLBI operations and technical developments. A senior engineer Quanbao Ling joined the VLBI group in September 2005; he is devoted to the development and maintenance of the VLBI terminal system. Hong Yu became a post-doctoral fellow in early 2005; he is majoring at antenna control system. Two young engineers, Bo Xia and Wei Gou, have been working on day-to-day operations of the antenna since September 2005. Microwave engineer Songlin Chen will leave the group in January 2006.

4. Development and Maintenance Activities in 2005

Development and maintenance activities at the Sheshan VLBI Station in 2005 are presented in time sequence.

4.1. Update of the Antenna Control System in July

We have updated the antenna control system in July 2005. The new control system is more flexible than the old one. It slews faster than before and is expected to minimize observing problems due to antenna tracking. The new system has been working in a good condition since October 2005. A general description of the new control system is given in Section 2.

Table 1. Staff working at the Sheshan VLBI Station

Name	Background	Position & Duty	Contact
Xiaoyu Hong	astrophysics	Head of station, Professor	xhong@shao.ac.cn
Qingyuan Fan	ant. control	Chief Engineer, Professor	qyfan@shao.ac.cn
Wenren Wei	electronics	Professor	wwr@shao.ac.cn
Shiguang Liang	microwave	Professor	sgliang@shao.ac.cn
Zhuhe Xue	software	Professor	zhxue@shao.ac.cn
Xinyong Huang	microwave	Senior Engineer	xhuang@shao.ac.cn
Quanbao Ling	electronics	Senior Engineer	qling@shao.ac.cn
Tao An	astrophysics	VLBI friend	antao@shao.ac.cn
Songlin Chen	microwave	Engineer	slchen@shao.ac.cn
Bin Li	microwave	Engineer	bing@shao.ac.cn
Weihua Wang	astrophysics	Assistant Researcher	whwang@shao.ac.cn
Jinqing Wang	electronics	Engineer	jqwang@shao.ac.cn
Huihua Li	electronics	Engineer	hhlee@shao.ac.cn
Lingling Wang	software	Engineer	llwang@shao.ac.cn
Ruiming Tu	electronics	Engineer	trmshao@shao.ac.cn
Hong Yu	ant. control	Post doctor	yuhong@shao.ac.cn
Bo Xia	electronics	Operator	bxia@shao.ac.cn
Wei Gou	electronics	Operator	gouwei@shao.ac.cn

4.2. Changes in the Recording System (REC) since September

Six BBC's and one IF Distributor at the Sheshan VLBI Station were used for testing a new-built 50 m radio telescope in Beijing in late August 2005. Therefore there are only eight BBCs (BBC01–BBC08) and one IF distributor available at the Sheshan VLBI Station since September 2005. For the sake of geodetic purposes, schedulers of the IVS sessions specially designed BBC patching for the SESHAN25 telescope. A new power supply of Mark 5A (for two disk banks with 250 G) will be installed in spring of 2006.

We kept updating the FS software system with the latest version. The current working version 9.7.7 runs well at the Sheshan VLBI Station. The Mark 5A recording system also worked well in IVS and EVN sessions in 2005. In addition we have bought a spare SWT FS computer for software testing and development.

4.3. Installation of a New, Cryogenically Cooled L-band Receiver in September

A new L-band receiver with cryogenic, dual-circular polarization front-end was designed and developed at ASTRON in Dwingeloo and at the Sheshan VLBI Station. The new L-band receiver was installed at the SESHAN25 telescope in September 2005. It replaced the old receiver and has been playing a full role in the past EVN Oct'05 sessions. Quick responses from the EVN NME experiment at L-band (N05L5) showed that the polarizations of the L-band receiver at the Shanghai Station had been swapped. We adjusted the patching of the LHCP and RHCP starting from session EK022B.

4.4. Adjustment of Antenna Panels in November

After the EVN Oct/Nov05 sessions, we have used microwave holography to determine the overall shape of the dish, making use of a 12 GHz transmitter on a geostationary satellite as a reference signal. This project was carried out from 5th to 18th November 2005 with the help of Mr. Michael Kesteven from Australia.

Before adjustments, the surface accuracy (rms) was about 1.2 mm. Most of the deviation was confined to one quadrant. The amplitude distribution in the aperture plane shown in the holography results was not symmetrical; the sub-reflector has also been deviated from the optical axis (as defined by the outer ring of panels) by 15 mm and was also tilted by several degrees from the optical axis.

The measurement and adjustment activities were completed on 18th November 2005. Based on the holography results, individual panels were adjusted to obtain the best overall surface shape. All evidences showed that the antenna performance after adjustments has been much improved, based on the holography data and the sidelobe patterns. The sub-reflector was centralized; it is only tilted by a small amount now. The magnitude was directed by the holography; it was confirmed by the appearance of fairly symmetric sidelobes. The final surface accuracy (rms) is about 0.52 mm.

4.5. Testing Performance of the New H-maser MHM-2010 in December

A new H-maser (MHM-2010) was first used in July 2004. It has been running well for more than one year. In July 2005 we tested its performance including frequency stability and accuracy. The results indicate that it matches the technical specifications and is working in good conditions.

Table 2. VLBI receivers of SESHAN25 antenna

Band	RF (MHz)	Type	η_A^a (%)	SEFD(Jy)	Pol.
18 cm	1600–1740	Cryogenic	40	580 ^a	dual circ. pol.
13 cm	2150–2350	room temp.	25	1792 ^b	right circ. pol.
6 cm	4700–5150	Cryogenic	54	640 ^c	dual circ. pol.
3.6 cm	8200–9000	Cryogenic	46	660 ^d	right circ. pol.
1.3 cm	22100–22600	Cryogenic	~ 20	2185 ^e	dual circ. pol.

Measuring date : ^a: measured on 18 October 2005; ^b: measured on 14 October 2003; ^c: measured on 23 October 2005; ^d: measured in January 2006; ^e: measured on 28 September 2004.

5. Future Plan

The Sheshan VLBI Station will take on following actions in 2006 for the purpose of keeping a good working condition.

1. A new S/X band feed was fixed in December 2005. A set of new S/X receivers are in development and will be installed in the first half of 2006. It has a wider working frequency range compared with the old one (the currently using one).

2. Fibre link between the Sheshan station and the headquarter (SHAO) is expected to be accomplished in the first half of 2006.