

Present Status and Future Plan on the Chinese VLBI Network

Zhihan Qian¹, Shuhua Ye¹, Xiaoyu Hong¹, Xiuzhong Zhang¹, Jin Zhang²,
Xizheng Zhang², Hongbo Zhang²

¹) *Shanghai Astronomical Observatroy, CAS*

²) *National Astronomical Observatories, CAS*

Contact author: Zhihan Qian, e-mail: qzh@center.shao.ac.cn

Abstract

At present, the Chinese VLBI Network (CVN) includes two fixed VLBI stations, named Sheshan (Seshan) Station and Nanshan (Urumqi) Station, respectively, and a mobile VLBI station as well as a two-station VLBI correlator of the VLBA style. Recently, the disk based recording terminals have been successfully developed for VLBI observations. For the future astronomical, geodetic and space scientific applications, especially, for the forthcoming Chinese Lunar Exploration Project, a 50m and a 40m radiotelescope, which will be located in Beijing and Kunming, respectively, are under manufacture and will be completed in 2005/2006. A new 5-station VLBI correlator with the capability of expansion to 10 or more stations is under design and also will be completed in 2005/2006.

1. Present Status

The construction of the Chinese VLBI Network (CVN) started early in 1980s. Up to date, two fixed VLBI stations, Sheshan Station, near Shanghai and Nanshan Station, near Urumqi and one mobile VLBI station as well as a two-station VLBI correlator were completed. Recently, the VLBI disk based recording terminals, named the CVN Disk-RT, were successfully developed for the VLBI observations.

1.1. Sheshan VLBI Station

The Sheshan VLBI Station, located in the Song Jiang County, south-west of Shanghai, eastern China, about 30 km from downtown Shanghai, was completed in 1987. The antenna is mounted on a building (see Figure 1). The S/X-, C-, and K-bands work at Cassegrain focus through a beam-waveguide system and the L-band works at the prime focus after turning over of the subreflector. Its location is: Longitude: 121.20°E, Latitude: 31.10°N. The ground height of the site above sea level is about 5 meters. The main specifications of the station are as follows:

- Antenna diameter: 25m
- Antenna type: Beam-waveguide Cassegrain system
- Antenna efficiency (S/X): 0.30/0.50
- System noise temperature (S/X): 100K/55K
- Recording System: Mark IV, S2 RT, CVN Disk-RT, and Mark 5 (available in 2004)
- Maser: Two SHAO-masers



Figure 1. Sheshan 25m Radiotelescope

1.2. Nanshan VLBI Station

The Nanshan VLBI Station, located south-west of Urumqi, northwestern China, about 60 km from downtown Urumqi, was completed in 1994. Figure 2 shows the full view of the site. Its location is: Longitude: 87.18°E, Latitude: 43.47°N. The ground height of the site is about 2080 meters. The main specifications are as follows:

- Antenna diameter: 25m
- Antenna type: Cassegrain system
- Antenna efficiency (S/X): 0.50/0.54
- System noise temperature (S/X): 75K/45K
- Recording System: Mark IV, K4, CVN Disk-RT, and Mark 5 (available in 2004)
- Maser: Two SHAO-masers



Figure 2. A full view of Nanshan VLBI Station

1.3. Mobile VLBI Station

A mobile VLBI system was completed in 1999 and recently, it is located in the Yunnan Astronomical Observatory, NAO, CAS, about 10 km from downtown Kunming, southwestern China. Its antenna is mounted on a truck (in the middle of Figure 3), near a 10m radiotelescope which is used for solar observations (at the left of Figure 3). Its location is: Longitude: 102.80°E, Latitude: 25.02°N. The main specifications are as follows:

- Antenna diameter: 3m (Axis-offset)
- Antenna efficiency (S/X): 0.55/0.50
- System noise temperature (S/X): 120K/110K
- Recording System: S2 RT and CVN Disk-RT
- Maser: Two SHAO-masers



Figure 3. Mobile VLBI Station. It is located at the Yunnan Observatory. Its 3m antenna is on a truck and the VLBI terminal and hydrogen masers are in the right building (with white wall).

1.4. Disk Recording Terminal

Recently, The VLBI disk based recording terminals (CVN Disk-RTs) have been successfully developed for domestic VLBI observations. They have been demonstrated for both astronomical and spacecraft VLBI observations. The main specifications are as follows:

- Recording speed: 512Mb/s
- Playback speed: 256Mb/s
- Volume: 4X120GB (4 disks)
- Recording time: 16 hours (with the recording rate of 64 Mb/s)
- Format of input data: Mark IV

1.5. CVN Correlator

The CVN Correlator which is located at Shanghai Astronomical Observatory was completed in 2000 and its main specifications are as follows:

- Type: VLBA style, FX mode
- Station: Two
- Channel: 8/station
- Max. rate: 32 Mb/s/ch; 256 Mb/s/station
- Playback: P&G tape recorder and CVN Disk-RT
- Format of input: Mark IV and VLBA
- Format of output: FITS

2. Future Plan

For the astronomical, geodetic, and space scientific applications, especially, for the Chinese Lunar Exploration Project, two new VLBI stations equipped with a 50m and a 40m radiotelescopes, respectively, will be established in 2005/2006. For the first stage of the Chinese Lunar Exploration Project one important task of the CVN is the determination of the precise orbit of the lunar orbiter in cooperation with the Chinese Space Tracking Network. These two larger radiotelescopes also will be used for receiving scientific data from the lunar orbiter. A new 5-station VLBI correlator with the capability of real-time VLBI observations is under design and will be completed in 2006.

2.1. New VLBI Correlator

A new 5-station VLBI correlator with FX mode which possesses the capability of expansion to 10 or more stations is under manufacture and will be completed in 2005/2006. Its maximum data rate per station is 256 Mb/s with expansion to 1.0 Gb/s. Also, this correlator possesses the capability of data processing for real-time VLBI observations.

2.2. Miyun VLBI Station

A new VLBI station named Miyun Station with a 50m radiotelescope will be located nearby the existing Miyun Meter-wave Aperture Synthesis Radio Telescope in Miyun County, about 50 km from downtown Beijing. The 50m radiotelescope is under manufacture and will be installed at the site in late 2005. The model of the antenna is shown in Figure 4. The site location is: Longitude: 116.75°E; Latitude: 40.55°N. The main specifications of the station are as follows:

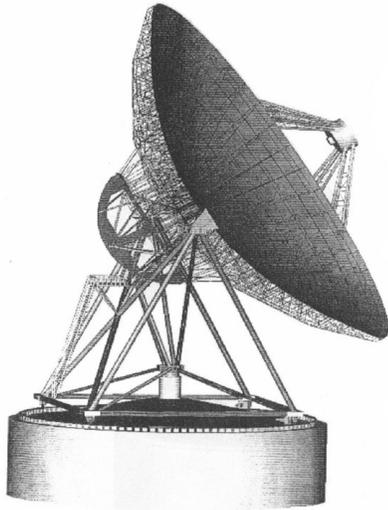


Figure 4. The model of 50m radiotelescope

- Antenna diameter: 50m (full panel for inner 30m and mesh from 30m to 50m)
- Antenna type: Prime feed
- Mount type: AZ-EL, with wheel-on-track machinery
- Bands: 92cm, 49cm, 18cm, 13/3.6 cm and 6cm
- Antenna efficiency (S/X): 0.50 at 13cm (50m); 0.48 at 3.6cm (inner 30m)
- Slew speed: AZ: $1.0^\circ/s$; EL: $0.5^\circ/s$
- Recording system: CVN Disk-RT and Mark 5
- Maser: SHAO-masers

2.3. Kunming VLBI Station

The Kunming VLBI Station will be equipped with a 40m radiotelescope. The selection of the site is under way. Probably, it will be located at the Yunnan Astronomical Observatory, NAO, CAS. The manufacture of the 40m radiotelescope has started. The designed structure is shown in Figure 5. The possible Location is: Longitude: $102.8^\circ E$, Latitude: $25.0^\circ N$. The 40m antenna will be installed at the site in late 2005. The main specifications of the station are as follows:

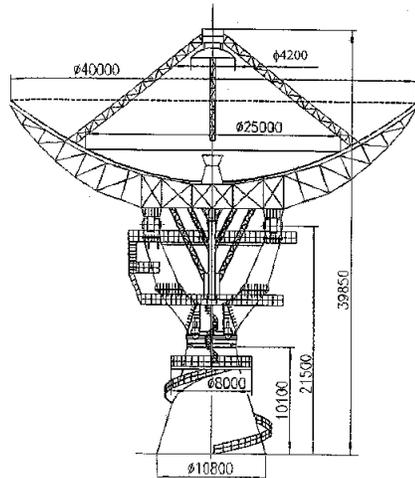


Figure 5. The designed structure of 40m radiotelescope

- Antenna diameter: 40m (full panel for Inner 25m and mesh from 25m to 40m)
- Antenna type: Cassegrain system
- Mount type: AZ-EL, concrete pedestal
- Bands: 13/3.6 cm and others (TBD)
- Antenna efficiency (S/X): 0.60 at 13cm; 0.40 at 3.6cm
- Slew speed: AZ: $1.0^\circ/s$; EL: $0.5^\circ/s$
- Recording system: CVN Disk-RT and Mark 5
- Maser: SHAO-masers