

The development of VLBI in China and its relationship with the EVN

Xiaoyu Hong^{*†}, Shuhua Ye, Tongshan Wan, Dongrong Jiang, Zhihan Qian

Shanghai Astronomical Observatory, Chinese Academy of Sciences, China

E-mail: xhong@shao.ac.cn

Rendong Nan

National Astronomical Observatories, Chinese Academy of Sciences, China

E-mail: nrd@bao.ac.cn

Na Wang

Xinjiang Astronomical Observatory, Chinese Academy of Sciences, China

E-mail: na.wang@xao.ac.cn

Zhiqiang Shen

Shanghai Astronomical Observatory, Chinese Academy of Sciences, China

E-mail: zshen@shao.ac.cn

Hongbo Zhang

National Astronomical Observatories, Chinese Academy of Sciences, China E-mail:

hbzhang@bao.ac.cn

Min Wang

Yunnan Astronomical Observatory, Chinese Academy of Sciences, China

E-mail: wm@ynao.ac.cn

A brief introduction of the development of Very Long Baseline Interferometry (VLBI) in China since 1980s is presented in this paper. The first two VLBI stations located in Shanghai and Urumqi were built in 1987 and 1993, respectively. Each station operates a radio telescope with a diameter of 25 meter. These two stations have been benefited greatly from the collaborations with European colleagues, especially from Prof. Richard T. Schilizzi. Shanghai and Urumqi telescopes became the full members of the European VLBI Network (EVN) since 1994. Prof. Richard T. Schilizzi played an important role in establishing the exchange and cooperation between European and Chinese astronomers and engineers in the field of VLBI research and technique. In 2006, two new radio telescopes were built near Beijing (diameter of 50 meter) and near Kunming (diameter of 40 meter), which mainly serve for VLBI tracking of the Chinese lunar exploration satellites. Another new radio telescope with a diameter of 65 meter is under construction in the western suburb of Shanghai. An initial effort for space VLBI is being considered in China. We are looking forward to seeing more close cooperation between Europe and China in future.

Resolving the Sky - Radio Interferometry: Past, Present and Future -RTS2012

April 17-20, 2012

Manchester, UK

1. Chinese VLBI Network in the past and the relationship with the EVN

As early as 1970s, Professor YE Shuhua from Shanghai Astronomical Observatory (SHAO) started to layout the VLBI development in China. After several years' preparation efforts, a 6-meter radio telescope was stood in the SHAO in 1981. The first VLBI experiment at L band (18 cm) was successfully carried out together with the 100-meter Effelsberg telescope (Germany) in November, 1981.

Following these pioneering works, a 25-meter antenna was built and accomplished the testing in the factory in 1984. This telescope was installed at the foot of the Seshan hill in 1986, about 30 km away from the Shanghai city. It started routine international VLBI experiments since November, 1987. Seven years later, another 25-meter radio telescope was installed at Nanshan, near Urumqi, the capital of Xinjiang Province, China. It is affiliated to the Urumqi Observatory. The Urumqi telescope produced the first light in 1993.

Professor R.T. Schilizzi is the critical and indispensable person in establishing and developing the cooperation between European and Chinese radio astronomers. In the beginning of the cooperation, he visited China many times, helped to build the VLBI instruments in Shanghai and expanded the relationship between Chinese observatories and the EVN. Benefited from the efforts of Prof. Schilizzi and his colleagues, Shanghai 25m telescope became an associated member of the EVN in 1990, soon later, both Shanghai and Urumqi stations became the full members of the EVN in 1994. These two VLBI stations also joined the International VLBI Service (IVS) in 1999.

The collaboration in radio astronomy between the Royal Netherlands Academy of Arts and Sciences (KNAW) and the Chinese Academy of Sciences (CAS) benefits a lot from the efforts of our European colleagues in VLBI research field, generation by generation. The collaborations cover broad scopes, including developing VLBI technologies and sciences, personal exchange, training young engineers and astronomers. The collaborative agreements between the Dutch and Chinese Academies are very productive and have continued till now.

The L- and C-band cryogenic receivers of the Shanghai station were designed and assembled in ASTRON, the Netherlands, in cooperation with the ASTRON experts. The electronic-VLBI (e-VLBI), a next-generation VLBI technique, experiments have been successfully carried out between Shanghai VLBI Station and the Joint Institute for VLBI in Europe (JIVE, the Netherlands), and the Australia Telescope National Facility (ATNF) in 2008. Since then Shanghai station routinely participated the EVN e-VLBI observations.

2. Recent development of the VLBI in China

In 2006, two new radio telescopes have been constructed near Beijing and Kunming respectively for the purpose of VLBI tracking of the first Chinese lunar satellite CE-1, The Chinese VLBI Network (CVN) consists of four radio telescopes (Shanghai, Urumqi, Beijing and Kunming) and a correlator in Shanghai. Digital VLBI terminals, hardware and software correlators were developed in Shanghai Observatory. The observed data of the CVN were transferred to the data processing center in SHAO through fiber links where the data were correlated, the generated delays and delay

*Speaker.

†

rates of the satellite on six baselines were sent to Beijing flight control center with a time lag of about 5 minutes.

Deep-space exploration and high-sensitivity radio observations require a large telescope, which promotes the construction of a new 65-meter radio telescope near Shanghai. The mechanical structure of the 65-meter telescope has been completed. In 2012 October the telescope successfully performed the testing experiments. The L-, S-, C- and X-band receivers are due to be installed in December 2012, and the telescope is expected to commission in 2013. The equipment of the receivers at higher frequency bands will be considered in near future and the operation of the active surface control system will commenced in a few years.

There are two other huge telescopes (and project), the 500-meter FAST which is under the construction in Guizhou province, and the 110-meter telescope which has been proposed by Xinjiang Observatory. They will join the VLBI families after completion and will significantly improve the VLBI detection capacity.

In addition to the ground-based radio telescopes, a proposal for developing the Space VLBI has been put forward in China. That involves two 10-meter radio telescopes onboard the satellites working at 8, 22 and 43 GHz frequency bands. The phase-0 of the project has been funded to build a prototype of the space telescope, and to evaluate technique feasibilities.

3. Concluding remark

In the end, we acknowledge the international cooperation and assistance from European VLBI community, especially from Prof. Schilizzi. We are looking forward to seeing more close cooperation between Europe and China in the future.