

Tsukuba 32-m VLBI Station

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Abstract

The Tsukuba 32-m radio telescope is operated by Geographical Survey Institute (GSI) VLBI group. This report summarizes the observation activities and status of Tsukuba 32-m VLBI station. In 2006, we performed a total of about 140 domestic/international VLBI sessions. All of the observations were performed using the K5 system and we transferred the data of the international sessions to the correlator via high capacity global network. The VERA Ishigakijima (VERAISGK) station of the National Astronomical Observatory of Japan (NAOJ) participated in our geodetic sessions since February 2006.

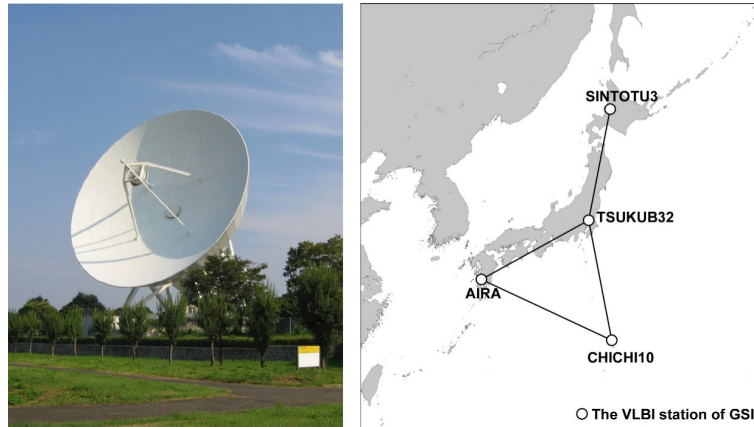


Figure 1. Tsukuba 32-m VLBI station and GARNET (GSI VLBI network)

1. General Information

The Tsukuba 32-m VLBI station (TSUKUB32) is located at GSI in Tsukuba Science City about 50 km to the northeast of the capital Tokyo and hosts a lot of public and private scientific research institutes. GSI started VLBI experiments with a 5-m mobile station in 1981. In its experiment history, GSI had also operated a 3.8m-mobile station and Kashima-26 m station. TSUKUB32 was constructed in 1998. This was a turning point, as GSI shifted its aim of experiments from the existing mobile stations to fixed regular ones. Since then, GSI has been performing various domestic/international VLBI sessions with TSUKUB32 as main dish together with three other permanent VLBI stations, AIRA, CHICHI10 and SINTOTU3. These four stations, owned and operated by GSI, form GSI's domestic VLBI network named GARNET (GSI Advanced Radio telescope NET work). We have performed our domestic VLBI observations using GARNET. A series of the observations is named JADE (Japanese Dynamic Earth observation by VLBI). The main purposes of JADE observation are to define the reference frame for Japan and to monitor the plate motions for the advanced study of crustal deformations. For this reason the GARNET stations, centered around TSUKUB32, are placed to surround the Japanese mainland.

2. Component Description

Table 1 shows TSUKUB32's current configuration. In 2006, we performed all domestic/international sessions using the K5 system and the automatic observation system, with the K5 system directly recording Linux files using control utilities from FS9 (version.FS-9.9.0) and checking the raw observation data. In 2005, we added hot-ejectable Serial ATA disks so that observation data can be shipped to a correlator during an observing session. But disk failures often occurred due to frequent disk swapping; sometimes we failed to observe a session. Therefore we changed to transferring the data to the correlator over the network without using hot-ejection.

Table 1. Configuration of Tsukuba 32m antenna

Site 8-letter code	TSUKUB32	2-letter	Ts
IERS DOMES number	21730S007	CDP number	7345
Site Position	ITRF2005	S band SEFD (Jy)	360
X(m)	-3957408.779	X band SEFD (Jy)	320
Y(m)	3310229.403	K band SEFD (Jy)	not measured
Z(m)	3737494.800	S band Tsys (K)	75 (Zenith)
S-band w/BPF	2215-2369 MHz	X band Tsys (K)	50 (Zenith)
X1-band	7780-8280 MHz	K band Tsys (K)	75(Zenith)
X2-band	8180-8680 MHz	Az slew 3.0 deg/sec	Range 10.0 - 710.0
X3-band	8580-8980 MHz	El slew 3.0 deg/sec	Range 5.0 - 88.0
K-band	20.5-25.5 GHz		

3. Staff

Table 2 shows the regular operating staff of GSI VLBI group. Masayoshi Ishimoto (former network chief) left our group and Etsuro Iwata and Hiromi Shigematsu joined in April 2006. Yoshihiro Fukuzaki is in charge of the analysis of SYOWA experiments and elected member of the IVS Directing Board (Networks Representative).

Table 2. Staff list of the GSI VLBI group

Name	Position	Jobs
Kazuhiro TAKASHIMA	Leader of VLBI group	Management
Etsuro IWATA	Network chief	Network
Morito MACHIDA	Analysis chief	Correlation
Hiromi SHIGEMATSU	Correlation chief	Correlation
Junichi FUJISAKU	Operation chief	Experiments coordination, Operation
Kensuke KOKADO	Operator	Baseline Analysis, Operation
Daisuke TANIMOTO	Operator	Operation, Field System
Yoshihira FUKUZAKI	Researcher	IVS DB, SYOWA Station

4. Current Status and Activities

As for the regular sessions listed in Table 3, TSUKUB32 performed a total of 143 domestic/international VLBI sessions in 2006. We have added 5 sessions, which were for IVS-R sessions and IVS-INT2 sessions with K5 system, as compared with 2005.

Table 3. The regular sessions at Tsukuba 32-m VLBI station in 2006

Sessions	Code	Number
IVS-R	R1207,R1209 ... R1254,R1255	31
IVS-T	T2043,T2044	2
IVS-R&D	RD0606	1
VLBA	RDV58,RDV60	2
APSG	APSG18,19	2
JADE	JD0601-0612	12
IVS-INT2	K06007,K06014 ... K06350,K06351	92
S-JADE	S06174	1
Total		143

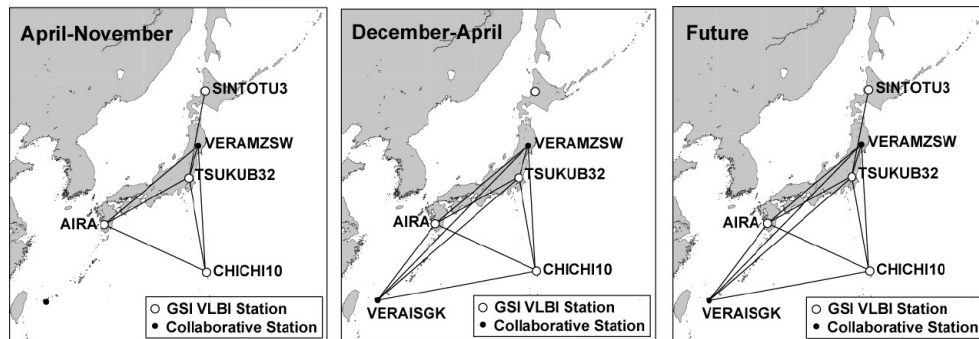


Figure 2. The core network of JADE sessions

We performed JADE sessions every month. A number of Japanese VLBI stations, such as VERAMZSW, MIZNAO10 of NAOJ and GIFU11 of the Gifu University participated in JADE sessions. The VERAISGK station of NAOJ on Ishigakijima island participated in several JADE sessions (JD0602, JD0603, JD0604 and JD0612) in 2006. The purpose was to improve the precision of the terrestrial reference frame of the southwest island of Japan. There was no K5 system in VERAISGK, so we moved the K5 system of SINTOTU3 and performed the observation during winter, because SINTOTU3 cannot perform the observation due to heavy snow. All results of these sessions are available on GSI VLBI Web site (<http://vldb.gsi.go.jp/sokuchi/vlbi/sess/index.html>).

We also performed S06174 session, a special domestic VLBI session in which USUDA VLBI station of Japan Aerospace Exploration Agency (JAXA) and four stations of GSI participated.

In addition to the sessions listed in Table 3, we performed several other observations. Optical-connected real-time VLBI observations were performed in cooperation with universities and re-

search institutes in Japan including the Gifu University and the NAOJ. The data were transferred via a dedicated high-speed optical fiber network (2.4 Gbps) called “Super-SINET”.

GSI made a joint-research agreement with Tsukuba University for installing the K-band receiver in TSUKUB32 antenna. We installed and adjusted the receiver for actual operation.



Figure 3. The K-band receiver of TSUKUB32

5. Future Plans

Since 2005, TSUKUB32 has performed observations using the K5 system (K5/VSSP). In 2006, TSUKUB32 continued the installation and adjustment of the new K5 system (K5/VSSP32), which enables us to record in 32 Msps mode, but it is not completed. Therefore we will set it up completely and perform all domestic/international sessions using the new K5 system. The current K5 system of TSUKUB32 is scheduled to be moved to VERAISGK station and we will include VERAISGK in all domestic sessions. Table 4 shows the K5 system specifications. We will set up the K-band receiver system completely in collaboration with Tsukuba University and will then perform tests with optical-connected real-time VLBI observations for astrometry using this receiver.

Table 4. The specifications of the K5 system

	K5/VSSP	K5/VSSP32
# of CH per unit	4	4
Max sampling rate	16 Msps/ch	32 Msps/ch
# of AD bit	1,2,3,4	1,2,3,4
Max data rate per unit	64 Mbps	256 Mbps
Output I/F	PCI-bus	USB 2.0

References

- [1] J. Fujisaku, S. Kurihara, K. Takashima: Tsukuba 32m VLBI station, IVS 2004 Annual Report, February 2004
- [2] J. Fujisaku, K. Kokado, K. Takashima: Tsukuba 32m VLBI station, IVS 2005 Annual Report, February 2005