

# Tsukuba 32-m VLBI Station

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## Abstract

This report summarizes the improvement of devices and observation activities at Tsukuba 32 m station. We had 31 international, 11 domestic and 32 Intensive UT1 sessions during this year. We have installed the disk-based K-5 recording system connected to the Internet. Also we have started some preliminary experiments with a high-speed network, Super-SINET, for realtime observation and mass data transfer. For the first stage of future e-VLBI, we plan to use these systems for regular domestic experiments in 2004.

## 1. General Information

The Tsukuba 32 m VLBI station (TSUKUB32) is located at “Geographical Survey Institute” (GSI) in Tsukuba Science City, a core area of public and private scientific research institutes, about 50 km northeast of the capital Tokyo. GSI started VLBI experiments in 1981 with a 5 m-mobile station. Through the history of experiments, GSI had also operated a 3.8 m-mobile station and the Kashima-26 m station. TSUKUB32 has been in operation since 1998. Since then GSI has shifted

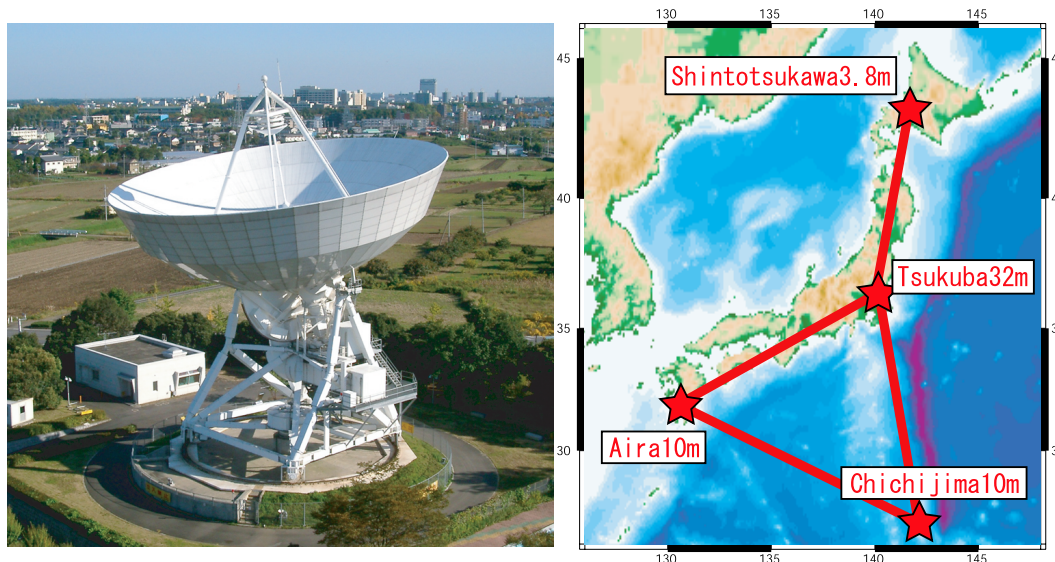


Figure 1. Tsukuba 32 m VLBI station and GARNET (GSI VLBI network)

its aim of experiments from mobile observations toward fixed regular ones. TSUKUB32 has been operational as a main dish of GSI with three other permanent stations, Aira, Shintotsukawa and Chichijima, performing geodetic VLBI experiments on a regular basis in a variety of international, domestic and other scientific experiments (Table 4). The network of the GSI VLBI stations is named GARNET (GSI Advanced Radiotelescope Network). The main purposes of this network are to define the framework of Japan and to monitor the plate motions for the advanced study of crustal deformations. For this reason the four fixed stations including TSUKUB32 are placed to surround the Japanese mainland (Figure 1).

Table 1. Location and address of Tsukuba 32m VLBI station

Latitude (deg)	36.1031 N
Longitude (deg)	140.0887 E
Altitude	44.7 m
Address	Geographical Survey Institute(Kitasato 1 Tsukuba Ibaraki 305-0811 JAPAN)
Web	<a href="http://vldb.gsi.go.jp/sokuchi/vlbi/english/">http://vldb.gsi.go.jp/sokuchi/vlbi/english/</a>

## 2. Component Description

The current configuration of TSUKUB32 is shown in Table 2. In 2003 we have installed the K-5 sampling/recording system in parallel with the K-4 and Mark IV (VLBA). The backend K-series systems have been developed at Communication Research Laboratory (CRL). In addition, we have already realized the remote-controlled system with K-4 and used it within GARNET. The remote-controlled system is also applied to the K-5 system easily. The combination of the remote-controlled system with K-5 will provide the increase of the number of experiments. Some preliminary experiments for the K-5 system were held with CRL and GIFU University.

Table 2. Configuration of Tsukuba 32m antenna

Site 8-letter code	TSUKUB32	2-letter	Ts
IERS DOMES number	21730S007	CDP number	7345
Site Position (ITRF2000)	before Apr. 1999	Site Position (+43.7 mm UP)	after Apr. 1999
X (m)	-3957408.752	X (m)	-3957408.779
Y (m)	3310229.367	Y (m)	3310299.390
Z (m)	3737494.789	Z (m)	3737494.815
X band SEFD (Jy)	320	S band SEFD (Jy)	360
X band Tsys (K)	50 (Zenith)	S band Tsys (K)	75 (Zenith)
Az slew 3.0 deg/sec	Range 10.0 - 710.0	El slew 3.0 deg/sec	Range 5.0 - 88.0
S-band w/BPF	2215-2369 MHz	X1-band	7780-8280 MHz
X2-band	8180-8680 MHz	X3-band	8580-8980 MHz

## 3. Staff

Table 3 shows the regular operating staff of VLBI group at GSI. Four new staff members have joined this year because both regular observations and correlation works have been increased. Shigeru Matsuzaka is a member of IVS Directing Board (Networks Representative). Hiromichi Tsuji is the supervisor of VLBI group. Yoshihiro Fukusaki is in charge of the analysis of SYOWA experiments, although he is not a regular member. Kouhei Miyagawa, former chief of analysis, moved from our group in April 2003.

Table 3. Staff working at GSI VLBI group

Name	Position	Jobs
Kazuhiro TAKASHIMA	Leader of VLBI group	Management
Takashi TSUTSUMI	Collocation chief	Collocation, Operation
Morito MACHIDA	Analysis chief	Correlation, Operation
Masayoshi ISHIMOTO	Network chief	Network, e-VLBI, Operation
Kozin WADA	Operation chief	Experiments coordination, Operation
Shinobu KURIHARA	Operator	Analysis, Operation

#### 4. Current Status and Activities

Table 4. The regular experiments at Tsukuba 32 m VLBI station in 2003

Experiment	Code	Number
IVS-R	R1054,56,60,61,62,66,67,70,73,74,76,77,79,85,86,87,90,100,R4073	19
IVS-T	T2013,2014,2015,2022	4
VLBA	RDV37,38,39,40,41,42	6
APSG	APSG12,13	2
JADE	JD0301-0311	11
UT1	K03102-K03354	32
Total		74

As for the regular experiments listed in Table 4, we have added 17 experiments, which were for UT1 and JADE experiments with the K-4 system, compared with last year. The number of other regular experiments with the Mark IV (VLBA) system has been constant over the past few years.

In 2003, domestic experiments using GARNET were carried out totally 11 times. A series of the experiments is named JADE (Japanese Dynamic Earth observation by VLBI). The main purpose of JADE experiment is to monitor the plate motions around Japan periodically once a month. One of the most remarkable results was detection of Tokachioki Earthquake event which occurred on September 26th (Fig 2). The JADE experiments are opened to any VLBI stations with the K-4 recording system. As a result, many Japanese VLBI stations, such as GIFU11, TOMAKO11, KASHIM11, KASHIM34, MIZNAO10 and VERAMIZSW have participated in JADE experiments. All these results are available on GSI VLBI Web site (<http://vldb.gsi.go.jp/sokuchi/vlbi/sess/index.html>).

Totally 32 Intensive UT1 sessions were carried out with the TSUKUB32-WETTZELL baseline every Saturday using the K-4 system. The sessions are scheduled as the complement to the KOKEE-WETTZELL baseline. Since UT1 session is still vacant on Sunday and Thursday, we will try to fill up all days through a week.

The TSUKUB32 station has been connected to very-high speed optical fiber network (2.4Gbps) named Super-SINET managed by National Institute of Informatics (NII). The network is used for realtime observation and mass data transfer in VLBI. Though the network is still under construc-

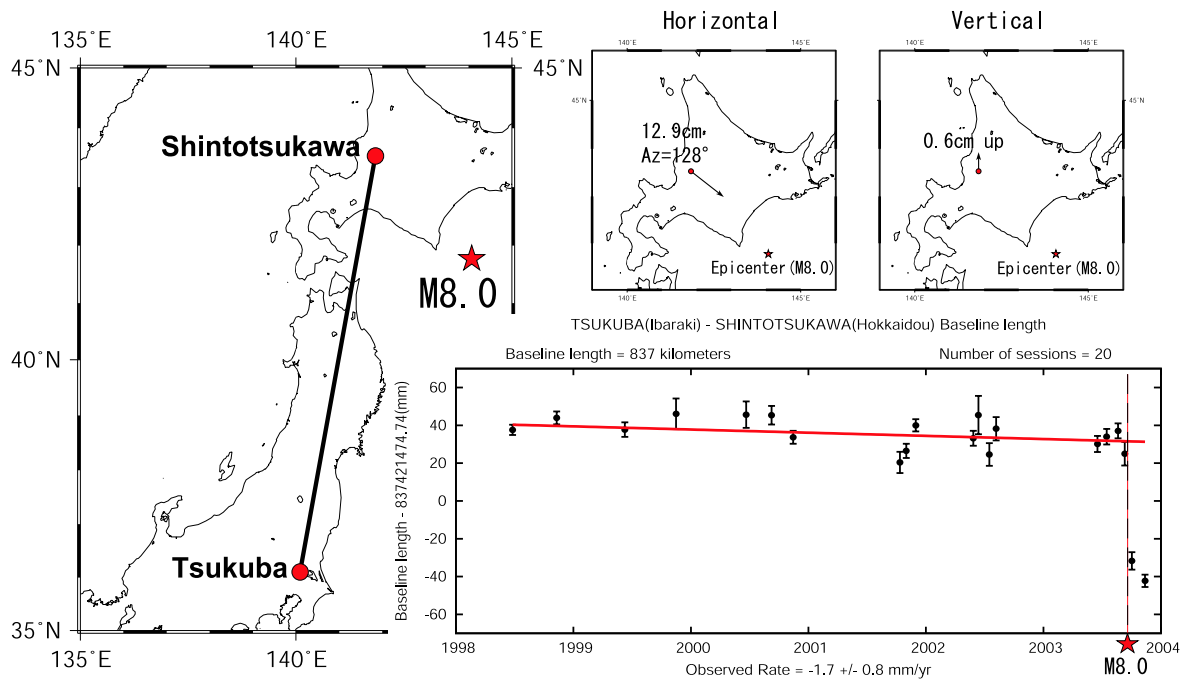


Figure 2. Tokachioki Earthquake and the result of JADE experiment

tion, it has already started to carry out some experiments. Practical scientific experiments had been held with the TSUKUB32-USUDA64 (JAXA) baseline for the realtime celestial object survey, planned by National Astronomical Observatory of Japan (NAOJ), from January to March. Also the real time fringe test had been done successfully with the TSUKUB32-GIFU11 baseline on November 11th.

## 5. Future Plans

At the beginning of 2004, we are ready to install K-5 systems to other GARNET stations. This means that it is the transition period from tape-based to hard disk-based recording system. Basically we plan to replace K-4 systems with K-5 to use for regular basis in domestic experiments until 2005. In addition, we plan to install software correlator for the K-5 system in Tsukuba with the high-speed network. We are also developing the compatibility of Mark 5 and K-5 in cooperation with CRL. With this advanced technique, K-5 system can be used in international regular experiments in the near future.

## References

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- [2] K. Takashima, S. Kurihara, M. Ishihara, K. Nemoto, M. Iwata, K. Shiba, M. Onogaki, and K. Kobayashi: Status and Results of GSI Domestic VLBI Networks, Bull. Geograph. Surv. Inst., Vol. 46, pp.1-9, March 2000