Kashima VLBI Correlators

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Abstract

Tape-based correlation system of KSP has been used for processing of domestic VLBI experiments and Antarctica VLBI experiments. Except for KSP VLBI correlation system, overall activity in Kasihma/CRL related with VLBI correlator is introduced. Development of software correlators and status of giga-bit VLBI system are also described.

1. General Information

This component used to be titled "KSP-VLBI Correlation Center" until the previous issue. However the "Key Stone Project" had already closed and the correlators are now operated by VLBI group of Kashima Space Research Center. Thus the title was changed to Kashima VLBI Correlators. Corresponding to the change of title, the view of description was expanded from KSP correlation system to overall correlator related activity at Kashima/CRL.

The KSP correlation system (Kiuchi[a], 1999) is capable to process 4 stations 6 baselines tape-based VLBI data simultaneously. The data rate per station is 64 Mbps, 128 Mbps, or 256 Mbps with 16 channels 1 bit sampled data. We have other 6 one-baseline correlator units for real-time VLBI of the KSP (Kiuchi[b] et al., 1999), although it was not used after the shutdown of KSP. Then, for upgrading processing capability of correlation system at Geographical Survey Institute (GSI) from 3 baselines to 6 baselines, 3 correlation units and one recorder interface units were loaned to GSI.

2. Experiments Processed by KSP System

Figure 1 shows the view of operation room of KSP correlation system.

Figure 1. Operation room of KSP correlation system

The names of experiments processed by the KSP correlator in 2003 are as follows:

JADE series: Geographical Survey Institute (GSI) has been organizing domestic geodetic VLBI experiments with its own stations. Additionally GSI accepts any stations to join the exper-

iments in omnibus style. This type of experiments are named JADE series and it is useful for Universities to determine their antenna coordinates in the ITRF and to perform geodetic study with single antenna. One of the cases is 11m antenna in Gifu University. However, correlation processing facility is limited at GSI and CRL. Then correlation processing between Gifu and other stations were performed with KSP correlator at Kashima.

SYOWA series: National Institute of Polar Research (NIPR), GSI, and National Astronomical Observatory (NAOJ) have been organizing a series of VLBI experiments to measure the Antarctica plate motion. Hobart, HartRAO, and Japanese Syowa VLBI stations were joined. The data observed at Hobart and HartRAO were originally recorded by S2 recorder, then the data are copied to K4 tapes at Mitaka. And several sessions of this series of experiments were processed by KSP correlator in Kashima.

3. Giga-bit Correlators GICO-I and GICO-II

Correlation processor with 1 giga-bps system (Nakajima et al. 2001) was developed in combination with 1 Gbps VLBI data recorder GBR-1000. And the next upgraded giga-bit correlator GICO-II (Nakajima[a] et al., 2000), which has 2 correlator chip sets accepting 2 Gbps data stream, was developed and it has been used for the first real-time giga-bit VLBI system on GALAXY network three years before (Nakajima[b] et al., 2000). These giga-bit VLBI system was used for verification of capability for geodetic VLBI application in 2003 (Takeuchi et al., 2003). Giga-bit VLBI system is displayed in Figure 2.

Figure 2. The Giga-bit VLBI system. The system in the left tall rack is GICO-I and that in the right short rack is GICO-II.

4. Software Correlators

PC-based data VLBI system named "K5 system" has been developed (Kondo et al., 2003). The data compatibility between K5 and Mark 5 has been confirmed in some recording modes and intercontinental e-vlbi experiment for UT1 measurement has been performed on Kashima-Haystack baseline (Koyama et al., 2003; Whitney and Koyama 2003). The K5 VLBI system is composed of 4 PCs with each IP-VLBI sampler board. One IP-VLBI sampler board has 4 channels with various

sampling modes. The IP-VLBI board has also been used for VLBI experiments for spacecraft navigation (Ichikawa et al.,2003). The detail of the spacecraft observation will be discussed in the IVS General Meeting in 2004. Giga-bit sampler with VSI interface is also under development and corresponding high speed FX type software correlator has been also developed for the GIGA bit sampling data (Kimura and Nakajima. 2002, Kimura et al., 2003). This software correlator has flexibility to choose any lag number and is optimized to perform any number of baselines of Giga-bit data within a constant time interval, when the same number of PCs with observation stations are used for processing. Another activity in software correlator is "VLBI@HOME" project (Figure 3), which performs correlation processing with screen saver mode. It is a kind of approach for distributed correlation processing like a SETI@HOME. VLBI data might be processed on many office PCs in the darkness of midnight in near future.

Figure 3. Logo mark of VLBI@home.

5. Staff

- Tetsuro Kondo is responsible for overall operations and performance, and he is developing software correlator for geodetic purpose.
- Yasuhiro Koyama is in charge of correlation processing system and working for e-VLBI on intercontinental baseline.
- Junichi Nakajima is in charge of giga-bit VLBI system.
- Mamoru Sekido is in charge of KSP correlation system and working for VLBI application for spacecraft navigation.
- Shinobu Arimura is in charge of routine correlation processing operation with KSP correlators.
- Moritaka Kimura is working for development of hardware giga-bit correlator and a high speed giga bit software correlator.
- Hiroshi Takeuchi is working for development of VLBI correlation system in screen saver mode.

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