NEAR REAL-TIME UT1 MEASUREMENT BY USING e-VLBI TECHNIQUE

Tetsuro Kondo1, Yasuhiro Koyama1, Hiroshi Takeuchi1, Masaki Hirabaru2, Kazuhiro Takashima3
David Lapsley4, Kevin Dudevoir4, and Alan Whitney4

1 Kashima Space Research Center, National Institute of Information and Communications Technology, 893-1 Hirai, Kashima, Ibaraki 314-0012, Japan  
(e-mail: kondo@nict.go.jp)
2 National Institute of Information and Communications Technology, 4-2-1 Nukui-kita, Koganei, Tokyo 184-8795, Japan
3 Geographical Survey Institute, 1 Kitasato, Tsukuba, Ibaraki 305-0811, Japan
4 Haystack Observatory, MIT, Off Route 40, Westford, MA 01886-1299, USA

Abstract
Recent progress of e-VLBI technique and the increase of network speed made rapid UT1 measurements possible. On June 30, 2004 we performed a one-hour e-VLBI session with the baseline between Kashima and Westford stations to estimate UT1 as rapid as possible. Observation data were recorded with the K5 system at Kashima and the Mark-5 system at Westford. Immediately after the session was finished, Mark-5 data were transferred to Kashima through the Internet. The Mark-5 data were then converted to K5 format data. In the next step, the converted data were correlated with those recorded at Kashima by using the K5 software correlator combined with the network-distributed processing system named VLB@Home. Finally we succeeded to obtain estimated UT1 values in as short as 4.5 hours after the session was over. To shorten the turn-around time of UT1 estimation further, we are improving the K5 software correlator so as to correlate K5 data with Mark-5 data directly.
We are also developing software to send K5 data over network according to the standard data format (VLBI-E). In addition to the rapid UT1 measurement results, we will report about current status of these software developments.

VLBI Systems for e-VLBI

KASHIMA-WESTFORD e-VLBI Experiments

VLBI@Home Server

GEMnet

VLBI@Home Client PCs

BOSSNET+GLOWNET (GigE)

Linux/FreeBSD Clients

JGN (10Gbps)

TransPAC

10Gbps (since Aug. 2004)

JGNII, TransPAC, Internet2, Super-SINET

NOC

• Baseline Length = 9502km
• The first test : October 8, 2002
• Feasibility check to estimate UT1 : March 25, 2003
• UT1 challenge #1 (tsev6) : June 27, 2003
• UT1 challenge #2 (tsev8) : June 29, 2004

Tsukuba-Wettzell Intensive Experiments : August 29, 2004~

• Second Intensive session series on Sundays just started from August 2004
• Sunday sessions are intended to be e-VLBI
  – Initially, one e-VLBI session every month (the other sessions using K4)
  – Will migrate into weekly e-VLBI
• Plan to do e-VLBI in both Saturday and Sunday sessions

Conclusions

– Rapid turn-around estimation of UT1-UTC within a few hours was successfully demonstrated.
– Repeat/Regional Intensive e-VLBI sessions for UT1 will become operational and smooth as experiences accumulate.
– Next targets are to demonstrate real-time UT1 estimation > larger scale IVS sessions with e-VLBI

Acknowledgements

– JGMI, TransPAC, Internet2, Super-SINET
– Galaxy Network Team (NICT, DST, NTT, NAO, JAXA, Gifu Univ., Yamaguchi Univ.)
– Haystack Observatory, MIT
– Fundamentalabolation Wettzell, BKG
– Goddard Space Flight Center, NASA

Number of Days Required to Deliver Products

Situations in 2002 (January to August)

– Observation Started
– Observation Finished
– File conversion and transmission
– Software Correlation
– Bandwidth Synthesis Processing, Database Generation, Data Analysis

– Observations Started
– Observations Finished
– Data Transfer finished (~30Mbps)
– Correlation Processing Completed (used 20 CPUs)
– Data Analysis Completed: UT1-UTC sigma=22 microsec

– Solid line is from IERS Bulletin B

– Data analysis done by Goddard Space Flight Center, NASA

UT1 challenge #1 (tsev6) : June 27, 2003

Time Sequence (JST)

– 00:00 Observations Started
– 00:00 Observations Finished
– 04:20 File transmission from Kashima to Westford (~30MB)
– 06:28 Data transfer finished (~30Mbps)
– 09:16 Correlation Processing Completed (used 20 CPUs)
– 09:30 Data Analysis Completed: UT1-UTC sigma=22 microsec

– Solid line is from IERS Bulletin B

UT1 challenge #2 (tsev8) : June 29, 2004

Time Sequence (JST)

– 00:00 Observations Started
– 05:00 Observations Finished
– 05:13 Data transfer finished (from Haystack to Kashima)
– 05:18 Correlation Processing Completed (used 20 CPUs)
– 09:30 Data Analysis Completed: UT1-UTC sigma=22 microsec

– Solid line is from IERS Bulletin B

– Data analysis done by Goddard Space Flight Center, NASA

– New World Record!! 4.5 hours