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Mini-TOW (Technical Operations Workshop)

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Abstract

This paper summarizes discussions and activities at the Mini-TOW (Technical Operations Workshop) held during the 2002 IVS General Meeting. Specific topics include roundtable discussions, a GSI correlator tour, a tape recorder session, an RFI session and a final panel discussion.

1. Introduction

The Mini-TOW (Technical Operations Workshop) was held during the 2002 IVS General Meeting on Wednesday, February 6, 2002 from 14:30 to 18:00 at the Geographical Survey Institute, Tsukuba, Japan.

Present were the host Kazuhiro Takashima, GSI, and Network Coordinator Ed Himwich, NVI. VLBI experts Brian Corey and Dan Smythe from MIT Haystack were available for group discussions and technical sessions. Kerry Kingham, USNO, represented the correlator during roundtable discussions. See Appendix A for Kerry's comments on Mark 4 correlator operations and the new IVS observing schedule. Rich Strand, GCGO, was discussion chairman representing IVS network stations. See table 1 for a full list of the participants.

2. Roundtable Discussions

Kerry Kingham discussed the need for operators to make complete remarks in e-mail for any possible data loss. Comments in the data log are still useful but the post-session briefing e-mail is required. The new Mark 4 correlator operation for the rapid-return "R" sessions requires advance setup and these data loss comments are now necessary so that the setup can be completed before the tapes arrive. The USNO is still seeing data loss or problems that have not been described or mentioned. These data "hits" often cost the correlator an investment in time and resources to research and correct.

Matt Harms, Honeywell-TSI operator at Kokee Park, raised the issue of observing with a warm receiver. Jay Redmond, Honeywell-TSI, who repairs dewars, said that the moving parts in the dewar refrigerators are the cause of most failures. Helium leaks and compressor filters are also problems. Rich Strand, GCGO, mentioned two different scenarios for a failure during a session. One occurs when the session is running and the receiver starts to warm, and the other occurs when the receiver is already at ambient before the session starts. The least amount of time to cool is nine hours, and fully warming up a receiver prior to recooling adds several more hours. If the decision is made not to recool, the warm-up can be deliberately slowed by keeping the compressor running. Data are lost when observing is halted to recool, or some data are effectively lost when

Table 1. Participants Mini-TOW IVS GM 2002 Japan

Name	Affiliation	Country
Mario Bérubé	NRC	Canada
Brian Corey	MIT Haystack	USA
Yoshihiro Fukuzaki	GSI	Japan
Ray Gonzalez	NVI, Inc./GSFC	USA
Matt Harms	Honeywell-TSI/Kokee Park	USA
Ed Himwich	NVI, Inc./GSFC	USA
Kerry Kingham	USNO	USA
Charles Naudet	JPL/DSN	USA
Hiro Osaki	CRL	Japan
Matti Paunonen	FGI	Finland
Jay Redmond	Honeywell-TSI/GGAO	USA
Duk-Gyoo Roh	KAO	Korea
Dan Smythe	MIT Haystack	USA
Rich Strand	GCGO	USA
Hiroshi Takaba	Gifu University	Japan
Kazuhiro Takashima	GSI	Japan
Gino Tuccari	CNR	Italy
Alex Volvach	CAO	Ukraine

observing warm due to degraded system sensitivity. Brian Corey explained data loss from warm receivers. The schedules are generated to achieve a minimum SNR for each scan. If the target SNR is low, weak sources may fall below the sensitivity of the network as the receiver warms and the SEFD goes up [1]. Quality code summaries in correlator reports are a poor indicator of the impact on the VLBI data of observing warm, as the quality code is not adversely affected by low sensitivity unless fringes are too weak to be detected. These summaries therefore are not useful as guidelines for when to observe warm. The final VLBI geodetic solution is the most important indicator of the effect of observing warm.

Final resolution of the discussion was stated by Ed Himwich. Stations should continue to observe warm but refer the problem to IVS. A decision would be made to have the station continue to observe or halt for re-cooling. This would depend on SNR requirements for the network, total number of warm receivers, and the possibility of a successful cool-down.

3. GSI Correlator Tour

Kazuhiro Takashima gave a tour of the GSI K4 Correlator [2]. This system uses the HP 9000 to process three stations, three baselines at 512 Mbps. The GSI VLBI correlator runs unattended using an automatic correlation process and tape changers.

4. Tape Recorder Session

The tape recorder session was held in the GSI Tsukuba VLBI operations building by Dan Smythe. The discussion included basic recorder pretests for checking recorder performance. Also included was a detailed discussion of thin tape and the special recorder alignments needed to prevent damage [3]. Vacuum shift tests and head calibration demonstrations were held. This workshop was conducted in two sessions due to class size. The reference files used in the class can be found in table 2.

Table 2. Additional reference material for the Haystack-Metrum recorder

ftp://web.haystack.mit.edu/pub/mark4/memos/267.pdf (pdf file)
ftp://web.haystack.mit.edu/pub/mark4/DAS/reccheck.text (plain text)

ftp://web.haystack.mit.edu/pub/mark4/DAS/RecFund.pdf

ftp://web.haystack.mit.edu/pub/mark4/DAS/RecFundV.pdf

ftp://web.haystack.mit.edu/pub/mark4/recorder/RecFund/TrackLayout.pdf

ftp://web.haystack.mit.edu/pub/mark4/recorder/RecFund/headlocpasses.pdf

ftp://web.haystack.mit.edu/pub/mark4/recorder/RecFund/headstackdef.pdf

5. RFI Session

The RFI session was led by Brian Corey at the GSI Tsukuba 32m radio telescope. The discussion included finding and analyzing a strong S-band interfering signal coming from Tsukuba City. Even though a signal may appear to be very strong on a spectrum analyzer, its total power may be less than the total noise power in the RF or IF band if the signal has a narrow bandwidth. Such a signal that is outside the observing passband does not affect the VLBI data directly. If an out-of-band signal is strong enough that it raises the overall power level significantly, however, it can cause front-end overload and thereby affect the in-band VLBI data indirectly through amplifier compression. (In order to avoid saturation effects, the general recommendation is that the receiver output 1-dB compression point be at least 10 dB higher than the signal level. In an X-band receiver, the phase cal pulse is typically $\sim$10 dB stronger than the average system noise level when the pulse is on. The X-band 1-dB point should therefore be $>$20 dB higher than the average system noise level, in order to avoid phase cal intermodulation effects caused by amplifier saturation.) In-band RFI is normally more of a concern than out-of-band because it decreases the system sensitivity and it can bias the group delays measured at the correlators [4]. In-band RFI that raises the system power by $>$10% in one or more frequency channels should be identified at the stations. This is most easily done by a combination of Tsys measurements, spectrum measurements with an analyzer, and observation of variable power levels in channels due to intermittent RFI. Site specific RFI sources were discussed by the participants. This workshop was conducted in two sessions due

to class size.

6. Final Panel Discussion

The final panel discussion was chaired by the IVS Network Coordinator Ed Himwich. After a brief feedback on the day's activities a discussion started on the new IVS observing schedule that includes the rapid-return sessions. Kerry Kingman remarked that the new NEOS, now R4, do not work because the tapes are one week behind. The R1 tapes are on the same plane as the R4 from Ny-Ålesund and that causes a problem. The Ny-Ålesund observing schedule doesn't allow days off. The new IVS sessions have new names, start times, etc. Dan Smythe and Ed Himwich discussed observing strategy but no useful ideas emerged. Ed said he would continue this panel discussion with the IVS Board.

The Mini-TOW ended at 18:00 and the participants were bused back to the Epochal Conference Center.

7. Appendix A

Kerry Kingham, USNO correlator notes:

1. All experiments designated "IVS-R" (i.e., R1s and R4s) are "RAPID" experiments. The tapes should be shipped immediately by express paths.
2. The correlators are setting these experiments up before the tapes arrive and they use the network station's e-mail messages as the primary source of information about the experiment operations at the network station. Please be complete, and note any missed scans or other problems during the experiment. Logs are the secondary source of information.
3. The Mark 4 correlators are more log-dependent than the old Mark IIIAs. Please get the logs to cddisa in a timely and complete manner.
4. At the Washington Correlator, we stop everything to do the Intensives (Kokee and Wettzell daily 1 hour experiments) as soon as the last tape (typically Wettzell) arrives. The "R" experiments are next in importance and also start processing within an hour of the arrival of the last tape. This is why it is important that we get all of the appropriate information (particularly e-mails and logs) from the stations as soon as possible, so we can be ready when the tapes arrive.
5. The correlators can be of some help in diagnosing problems at your station. We can look at a spectrum of the passband for RFI or spurious signals; we can check playback quality of the recordings; and we can do a limited amount of phase-cal analysis which can indicate spurious phase-cal signals, reflections, etc., although tracking down the source is up to the station. We can do what we can, but we are, typically, thousands of kilometers away!
6. The correlators are trying to improve our feedback to the stations, and changes are being made to the experiment reports to try and deliver more information from the correlators to both the Network Stations and Analysis Centers. Comments are welcome.

References

[1] Dave Shaffer RadioMetrics: Calibration, Field System Manual, April, 1984. For IVS workshop version with notes, 1998 VLBI TOW Haystack Proceedings, Amplitude Calibration, pages 5-9.

[2] Misao Ishihara, et al.: Tsukuba VLBI Center, 1999 IVS Annual Report.

[3] Don Sousa, MIT Haystack and Bruce Thornton, NVI: 1998 VLBI TOW Haystack Proceedings, THIN TAPE

[4] Dave Shaffer, "RFI: Effects on Bandwidth Synthesis," in IVS 2000 General Meeting Proceedings, available at http://ivscc.gsfc.nasa.gov/publications/gm2000/shaffer/.