Haystack Observatory VLBI Correlator

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Abstract

This report presents the status of the Haystack Correlator, focusing on its activities, its current and future hardware capabilities and its staff.

Figure 1. Haystack Mark IV Correlator

1. Introduction

The Haystack Observatory Mark IV VLBI correlator, located in Westford, Massachusetts, is supported by the NASA Space Geodesy Program and by the National Science Foundation. The available correlator time is divided approximately equally between processing geodetic VLBI observations for IVS and processing millimeter-wave radio astronomy observations for the Coordinated Millimeter VLBI Array. In addition to its role as an operational processor, the Haystack Correlator also serves as a development system for testing new correlation modes and hardware improvements and for diagnosing correlator problems encountered either at Haystack or one of the identical correlators at the U.S. Naval Observatory or at the Max Planck Institute for Radioastronomy. This flexibility is made possible by the presence on site of the team that designed the correlator hardware and software.

2. Summary of Activities

Since the last correlator report, major changes have occurred. As projected in the previous annual report, in December 1999 the Mark IIIA correlator was decommissioned and the Mark IV was brought on line. This transition, though difficult, has been a success. Geodetic production processing from Haystack experienced a short gap in service, and all correlation at Haystack is now done on the new Mark IV correlator. Since the transition, development efforts have focused on increasing the reliability and efficiency of operations and on enabling new modes of processing. Some examples of this development work include:

- Improve/repair capabilities of the Station Units (internal code and control software).
- Improve and increase capabilities, efficiency, accuracy and details of all aspects of the correlator control software (from tape drive control through operator interface).
- Examine and correct or enhance the quality, accuracy, and reporting of data.
- After testing, export software improvements to the Washington and Bonn sites.

3. Experiments done

Since the last report (July 99), 37 geodetic experiments have been processed, with 5 done on the Mark IIIA and 32 on the Mark IV. These are broken down into 4 CORE A's, 6 CORE 1's, 13 CORE B's and 5 CORE 3's (CORE 3's were all done on the Mark IV since they are recorded in a fanout mode that cannot be processed on a Mark IIIA). A collection of various test experiments comprise the remaining 9 (correlator tests, rack tests, station fringe tests, etc. ...).

4. Current/Future Hardware/Capabilities

Current hardware installed and functional on the new system are 6 tape units, 6 station units, 4 (operational) correlator boards, 1 crate, and miscellaneous other support hardware, with the ability to process all baselines for 6 stations at once in the standard geodetic modes. In the near future we plan to add two more tape and station units and fully enable the 2 crate mode, utilizing all 16 correlator boards. Other planned improvements:

- Add decoder as tool for examining recordings.
- Enable multiple streams and speedup factors in playback processing.
- Implement multiple speed parallel equalizers in playback drives.
- Address repeatability and reliability issues to reduce reprocessing requirements (mostly related to station unit).
- Improve capabilities and tools for examining correlator output and managing flow of data through system.

5. Staff:

Staff who participate in aspects of Mark IV development and operations include:

5.1. Software Development Team:

- John Ball - operator interface, playback
- Roger Cappallo - leader, system integration
- Kevin Dudevoir - correlation
- Colin Lonsdale - post processing
- Alan Whitney - system architecture

5.2. Operations Team:

- Peter Bolis - correlator maintenance
- Tom Buretta - playback drive maintenance
- Brian Corey - experiment correlation oversight, station evaluation, technique development
- Dave Fields - playback drive maintenance
- Ellen Lautenschlager - correlator operator
- Glenn Millson - correlator operator
- Art Niell - experiment correlation oversight, technique development
- Don Sousa - correlator operator, experiment setup, tape library and shipping
- Mike Titus - correlator operations oversight, experiment setup, computer services
- Ken Wilson - correlator maintenance, playback drive maintenance

6. Conclusion/Outlook:

Operationally, we hope that these and other improvements will increase efficiency and throughput in the near future. The potential for additional improvements in this area, and the possibility to record and process many new types of experiments, should be realized in the next phase of development and production work. Over the next year the Mark IV system is expected to attain its full potential, which will greatly increase the sensitivity, flexibility, output, and power of the correlator as a tool for the IVS community.