

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
HAYSTACK OBSERVATORY
WESTFORD, MASSACHUSETTS 01886

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Telephone: 978-692-4764
Fax: 781-981-0590

To: Mark IV Group

From: D.L. Smythe

Subject: Reading and Writing at 320 Ips with Current Head Stacks

On many occasions, with currently available head stacks, I have demonstrated that it is possible to write at 320 ips 64 tracks that are readable at 80 ips on the Mark III correlator. I also have also demonstrated, with one currently available head stack, that it is possible to read at 280 ips, 32 tracks of a tape recorded at 80 ips, and Jean Casse has used the JIVE correlator to read 32 tape tracks at 320 ips, with three different head stacks, a tape recorded at 160 ips. (See EVNDOC #87.) I have not tried to read at 280 ips a tape recorded at 320 ips, but Jean Casse has used the JIVE correlator to read at 320 ips a tape recorded at 320 ips.* (See EVNDOC #87.) This memo is a summary of my experiences writing and reading at Mark IV data rates, together with a summary of the relevant results from EVNDOC #87.

Although it is possible to write and read tapes at 1 Gb/s, a system that works fine at 160 ips will not automatically write or read useable tapes at 1 Gb/s. Operation at 1 Gb/s requires that each recorder and playback unit be carefully tuned by an expert. Performance at this data rate is sensitive to the following factors:

- One bad track out of 64 is not acceptable.
- Some new head stacks have one or more heads that are unusable at 320 ips.
- If the head contour is not perfect, the tape will fly over one or more heads.
- If the tension is not correct, the tape will fly over the heads without making contact.
- An imperfection on the surface of the head stack can cause the tape to fly.
- Performance at 1Gb/s is more sensitive to the quality of the tape used for the recording.

For several years we have been writing data at 1Gb/s at GGAO and at Westford. Since August 1998, I have performed zero-baseline tests at 1 Gb/s on a total of 19 different Mark IV Formatters. The head stacks and head assemblies used for some of these 1 Gb/s tests have been installed at HARTRAO, Wettzell, and Matera. All 64 tracks of these recordings were readable at 80 ips, and the 56 tracks available to the Mark III correlator were correlated successfully. So these five stations should be fully capable of making good recordings at 1 Gb/s. Although these recordings are readable, they are not nearly as good as recordings made at 80 or 160 ips, because of the mutual coupling between adjacent heads.

Jean Casse at the EVN Mark IV data processor has reported extensive performance tests at 320 ips and reported the results in EVNDOC #87. Table 2 of that document summarizes the playback performance of 6 different head stacks at 320 ips. Half of these head stacks had one or more heads that were unusable at 320 ips, but were fine at 80 and 160 ips. The reasons for this sharp drop in performance at the highest speed has not been investigated, but could be caused by localized flying resulting from mechanical imperfections. It might be possible to get acceptable performance from all of the heads in some of these head stacks by re-adjusting the tape tension, by refining the contour of the heads, or both.

* This 320 ips recording was made on 23 March 1993 at GGAO during the first 1Gb/s fringe test.

In summary, it has been demonstrated that the Mark IV system with currently available head stacks can make useable recordings at 1Gb/s, and these recordings can be reproduced at 320 ips. It is not easy, but with care, it can be done. Haystack is working hard to refine the record and playback electronics to make this system more robust at Mark IV data rates. We are also investigating changes to the head stack design to improve Mark IV performance.