

VLBA ACQUISITION MEMO #253

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

WESTFORD, MASSACHUSETTS 01886

21 May 1991

Telephone: 508-692-4764

Fax: 617-981-0590

To: VLBA Data Acquisition Group
From: Alan E.E. Rogers
Subject: 12 hours/tape at 128 Mb/s

Introduction

At the proposed density for the VLBA (tested at Haystack - see VLBA Acquisition Memos 150, 169, 195), a reel of 18,000 feet of 16- μ m tape lasts for 45 minutes per pass for a total of 10.5 hours at 128 Mb/s. This actually exceeds the VLBA specification of 12 hours when scaled to 100 Mb/s. In practice, however, 100 Mb/s is not a supported rate and if the tape is to last 12 hours some data would have to be written at a lower rate or the tape stopped between scans.

Tape Thickness

If 13- μ m tape can be procured then 12 hours can be reached with ease since a reel will hold 22,000 feet for a total of 12.8 hours.

Increased Longitudinal Density

A density increase from 56,000 bpi to 64,000 bpi is needed to reach the 12 hour goal. This can be implemented by reducing the tape speed from 80 to 70 IPS. However, with an equivalent spacing loss of 0.15 microns (see VLBA Acquisition Memo #184), the increased density will result in an extra loss of 1 dB at the short wavelength which drops from 0.9 to 0.8 microns. Unfortunately this is a dB of margin loss that we can not afford to lose (see VLBA Acquisition Memo #252) unless we can substantially improve the headstack efficiency (see VLBA Acquisition Memo #241).

Increased Number of Passes

Increasing the number of passes from 14 to 16 would get to 12 hours but with a reduction of the guardbands in the same direction from 10 to 3 μ m and a 25 μ m guardband between passes in the opposite direction. The 25 μ m is really needed to allow for tape anisotropy variations (see VLBA Acquisition Memo #129) and calibration errors, and reducing the guardband to 3 μ m in the same direction would compromise the ability to use signal power as a means of peaking up. Other methods of peaking (like using error rates or parity tones - proposed by Hans Hinteregger), are not supported by the present hardware and software. A 15 pass mode has been suggested by Hans, but requires a significant reduction in guardbands and will only make 11.25 hours unless the density is also increased to 60,000 bpi. A mode with an odd number of passes would incorporate a prepass or a rewind.

Larger Reels

Going from a 14" to a 16" reel would allow enough tape for 12 hours/tape, but would have the following disadvantages:

- 1] More expensive reels.
- 2] Greater chances of tape packing problems (see VLBA Acquisition Memo #229).
- 3] Will need to develop a new shipping container.
- 4] An added risk of industrial accident (serious injury could result from dropping a 16" reel).
- 5] Fewer companies are willing to supply the longer tape length without splices.

D2 Tape

The SNR loss in going to higher bit densities could be offset by using MIG heads and D2 tape. This is a future upgrade path for the VLBA. However, it will require new headstacks and a supply of D2 tape.

Conclusion

Trying to go to 13- μ m tape looks like the best option if 12 hours is essential without taking time out between scans or mixing data rates on one tape. With the exception of tape thickness and D2 tape, the changes to get to 12 hours require only software changes to implement. At the present time, we are starting to gain some experience at 56,000 bpi on the MkIII correlator and early indications are that we have little margin to spare for increased density. Future improvements in headstacks may, however, allow a gradual increase in bit density.