VLBA ACQUISITION MEMO #208

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To: VLBA Data Recording Group

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Subject: Tests of a method to support thick and thin tape on a processor transport

Introduction

A mechanical model for the head profile was given in Acquisition Memo #141. This model predicted the difficulty of going from thick to thin tape and Acquisition Memo #168 used the same model to show that it should be possible to go from 25 to 13 micron tape by operating at higher vacuum. The basic model was approximately confirmed by:

1] Comparing computed and measured profiles - see Acquisition Memo #147.

2] Showing that there is initial contact in going from a head worn with 25-micron tape to very thin 6-micron tape - a quick, previously undocumented test.

Further tests of theoretical model

We have recently performed more tests to try and verify the model in a more quantitative manner. In these tests we first recorded signals with a wavelength of 1 micron on a thin (13 micron) tape with the headstack conditioned for the thin tape. The playback level was measured and then the headstack was conditioned with Sony V16B (27-micron tape) at various vacuum pressures. The head-to-tape separation on the thin tape was then inferred from measurements of the (55 dB/wavelength) reproduce loss. Figure 1 shows the model parameterized for various conditioning vacuum levels with thick tape of the head-to-tape separation for initial playback of the thin tape as a function of vacuum. In order to make the model fit the data (also shown on Figure 1) moderately well, it was necessary to make Young's modulus higher for the thin tape than the value assumed for thick tape. We also attempted to measure Young's modulus by measuring the longitudinal extension of a 20 foot length of tape as a function of pulling force. We obtained values of

$1.07 \pm 0.1 \times 10^6$ PSI for the thin tape

$1.0 \pm 0.1 \times 10^6$ PSI for the thick tape

However, since the tape is a composite material consisting of a base film, magnetic layer and backcoat this method provides only a rough check.

The agreement between theory and measurement is really quite good when it is realized that small head-to-tape separation results from the difference of much larger numbers which characterize the head and tape profiles for thick and thin tape respectively. The limitations of the theory are:

1] The effect of flying is ignored and was found to be significant at vacuum below 4 inches for a tape speed of 40 IPS.

2] Head to tape friction is ignored.

The main limitations of the measurements were:

1] With the 13 μm tape not enough time was allowed for conditioning with the thick tape. This problem was corrected for the measurements of 16 μm tape for which the conditioning was repeated to test for consistent results.

2] The head profile was changing during the measurements with the thin tapes resulting in some inconsistency.

Conclusion

Having confirmed the model we are reasonably confident that satisfactory playback of thick and thin tape can be maintained by:

Playback of FUJI H621 at 16 inches vacuum.

Playback of 16 μm VLBA tape at 6 inches vacuum.

At a vacuum lower than six inches we are starting to see a small amount (<0.05 μm) at 135 IPS. Also operation at even lower vacuum would require a new vacuum shut-off switch (this switch was temporarily disabled for our measurements at low vacuum levels).

In order to implement the above scheme on the MKIIIA playback transports it would probably be useful to install a switch to allow rapid change of vacuum levels and make it easy for the operators to select the vacuum level appropriate for the tape being processed.

It might also be possible to use this method to allow a field site to record either thick or thin tape - but it is important that this method be more thoroughly tested with all three types of VLBA tape, now on order, before considering this option.

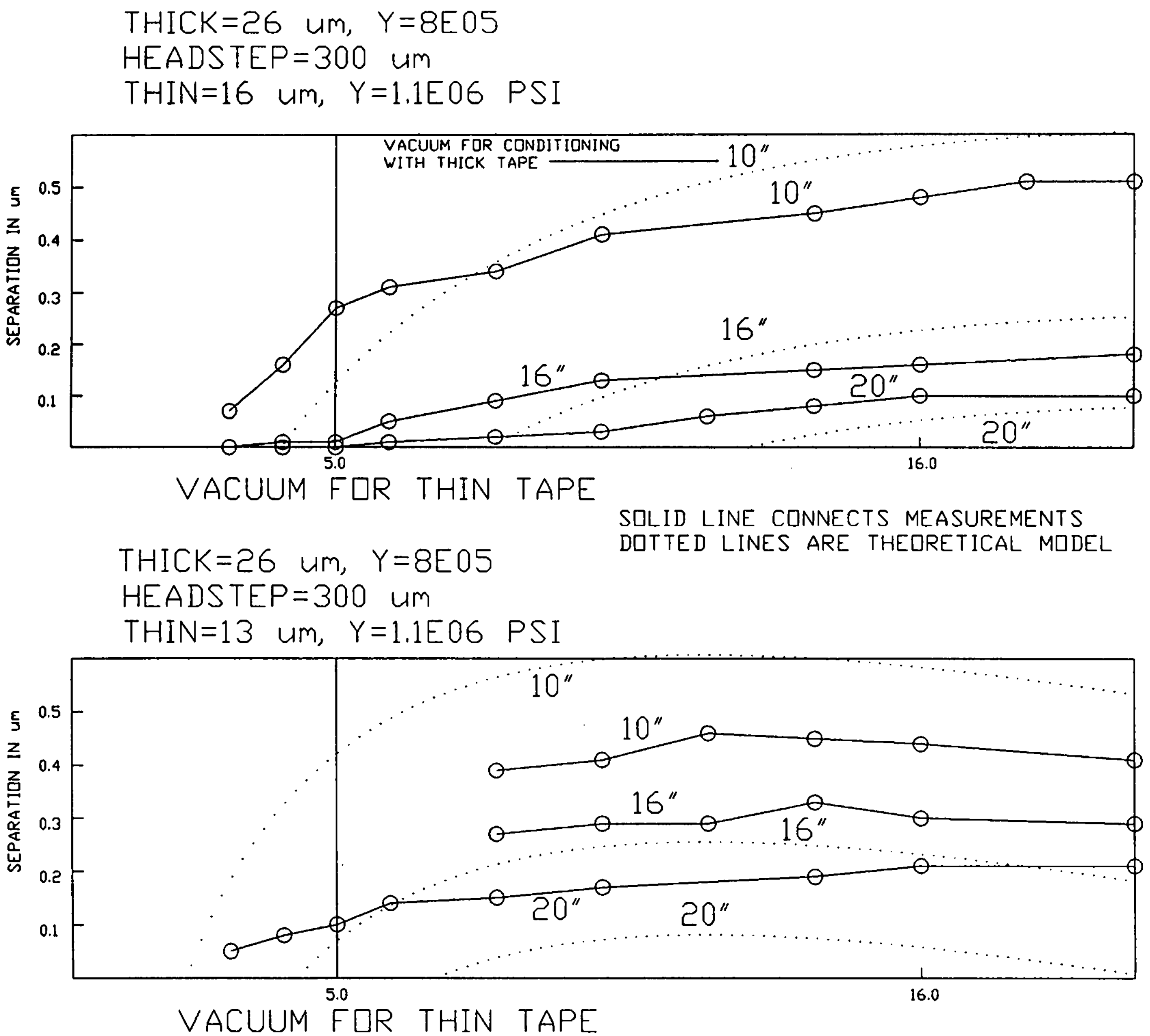

FIG. 1 SPACING FOR REPLAY OF THIN TAPE AFTER RUNNING A LONG TIME WITH THICK TAPE