MASSACHUSETTS INSTITUTE OF TECHNOLOGY

HAYSTACK OBSERVATORY

17 June 1991

TO : VLBA Acquisition Group

Telephone: 508-692-4764
Fax: 617-981-0590

FROM : Dan Smythe

SUBJECT : Head to tape contact at 320 IPS with thin tape

Acquisition Memo #146 reported loss of head-to-tape contact with thick (25-μm) tape due to flying at high speed and low tension. This experiment has been repeated with thin (16-μm) tape and at 56 kbpi, where spacing loss is more severe than at 33 kbpi. These tests were complicated by the difficulty of obtaining, and maintaining, a stable head contour. The heads were initially contoured with contouring tape at a vacuum setting of 12 inches of water, and later with Sony D1 tape at 10 inches at a speed of 80 ips, so that some of these results might be representative of a contour intermediate between 10 and 12 inches. From these experiments I have concluded that for recording at high speed and at high bit densities, it is important to keep the vacuum setting the same at all times. At lower vacuum, the tape flies off the head at high speed; and at higher tension, the heads quickly assume a contour that increases the tendency to fly. These results are tentative, and more study is required before specific conclusions can be reached, and before we can determine the optimum tape tension for operation at 320 ips.

Most of these conclusions are demonstrated in Fig. 1, where 2 dB of hysteresis occurs (for track 22) at 10 inches of water after the few minutes required to make measurements at 11, 12, and 14.5 inches of vacuum.

I also noted a forward-reverse asymmetry, as shown in Fig. 2, where flying is worse in forward than in reverse. This asymmetry did seem to diminish with continued shuttling at 80 ips, and might disappear entirely, if a stable equilibrium head contour could be obtained and maintained. This figure also shows evidence of flying at 160 ips comparable to that at 320 ips. The 6-dB difference in signal for these two tests is caused by the factor of two difference in reproduce bandwidth between playback at 160 ips and at 80 ips, and is to be expected.

Before these 56 kbpi measurements were made, I played back a recording at 270 ips in both directions and found the forward-reverse asymmetry shown in Fig. 3, which is the opposite from that in Fig. 2. Since the 320 ips results are for the record head stack in position 1 (on the right), and the 270 ips results are for the read stack in position 2 (on the left), this result suggests an asymmetry in the stack geometry. This conclusion needs to be checked by a more carefully controlled experiment by playing the same recording with the same stack in position 1 and in position 2. The 2-dB difference between 4-MHz reproduce at 160 ips in Fig. 2 and at 270 ips in Fig. 3 is the penalty paid for the higher bit density, and is recovered by using D1 or S-VHS tapes whose higher coercivity provides a higher signal-to-noise ratio than the Fuji H621 tape and similar tape that we have been using. (All of these experiments were performed with Ampex 741 S-VHS tape.)

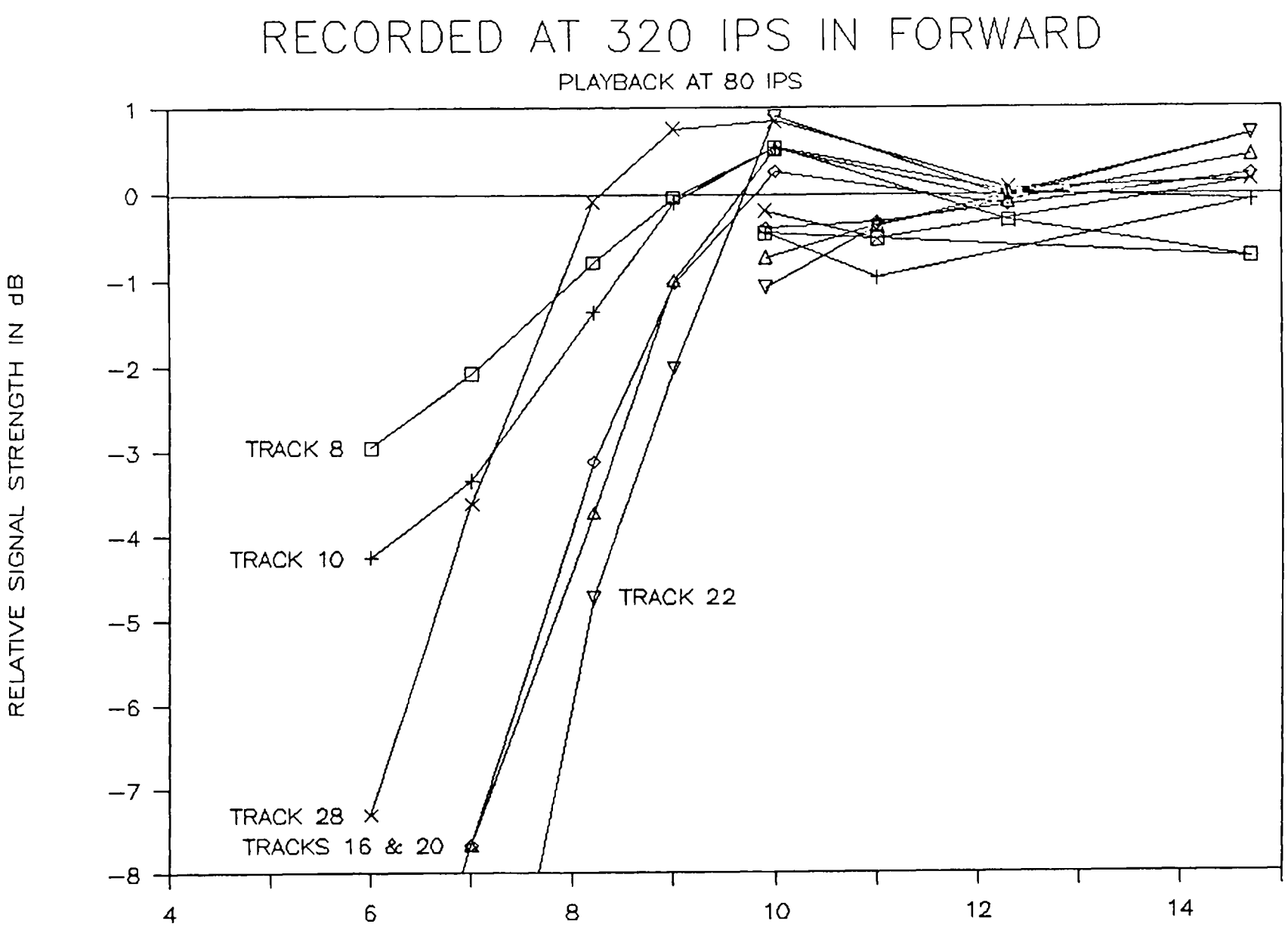
RECORDED AT 320 IPS IN FORWARD
PLAYBACK AT 80 IPS
RELATIVE SIGNAL STRENGTH IN dB
1
0
−1
−2
−3
−4
−5
−6
−7
−8
TRACK 8
TRACK 10
TRACK 22
TRACK 28
TRACKS 16 & 20
4
6
8
10
12
14
RECORD & PLAYBACK VACUUM IN INCHES OF WATER

FIGURE 1.

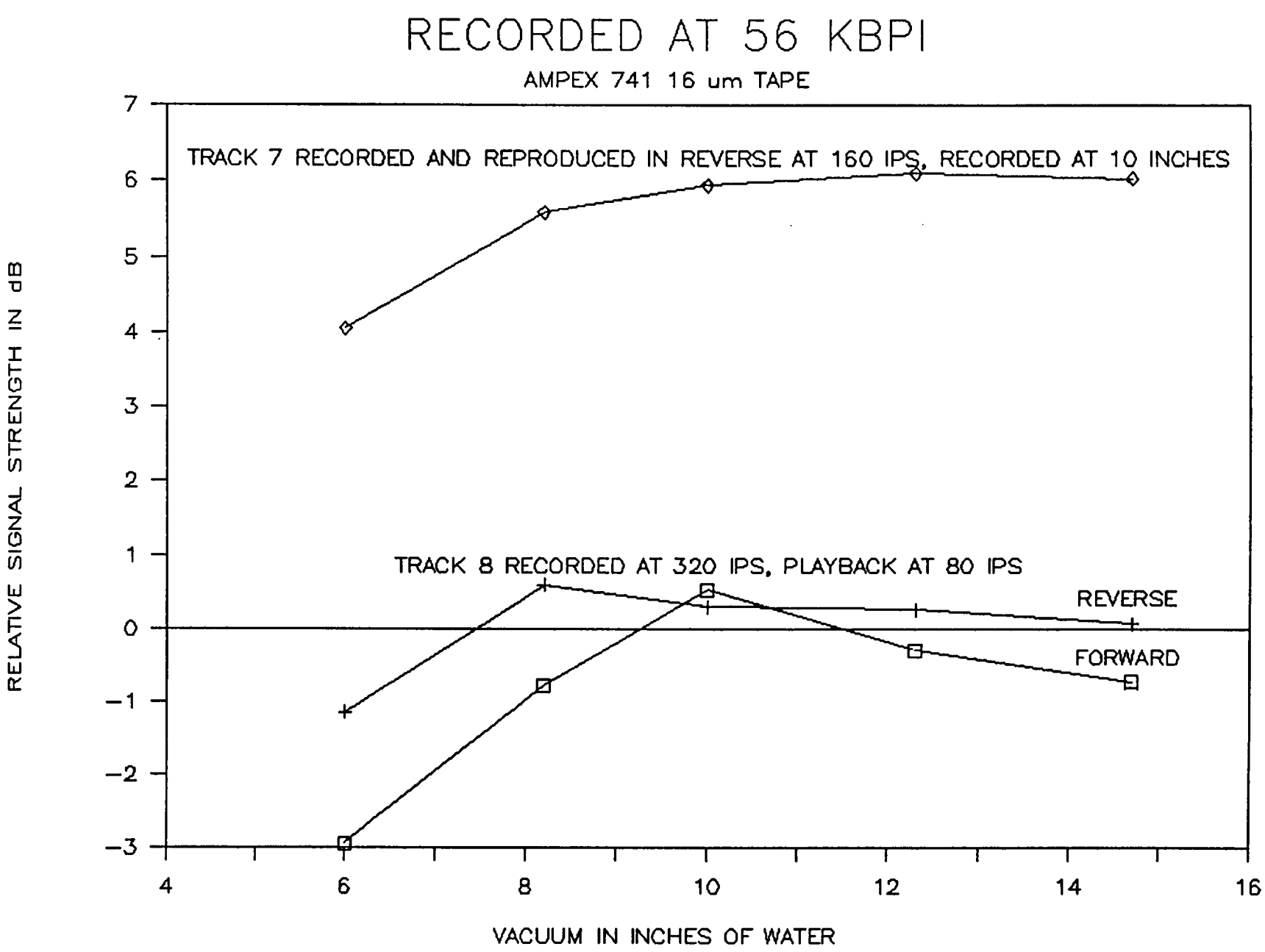
RECORDED AT 56 KBPI
AMPEX 741 16 um TAPE
TRACK 7 RECORDED AND REPRODUCED IN REVERSE AT 160 IPS, RECORDED AT 10 INCHES
TRACK 8 RECORDED AT 320 IPS, PLAYBACK AT 80 IPS
REVERSE
FORWARD
RELATIVE SIGNAL STRENGTH IN dB
VACUUM IN INCHES OF WATER
7
6
5
4
3
2
1
0
−1
−2
−3
4
6
8
10
12
14
16

FIGURE 2.

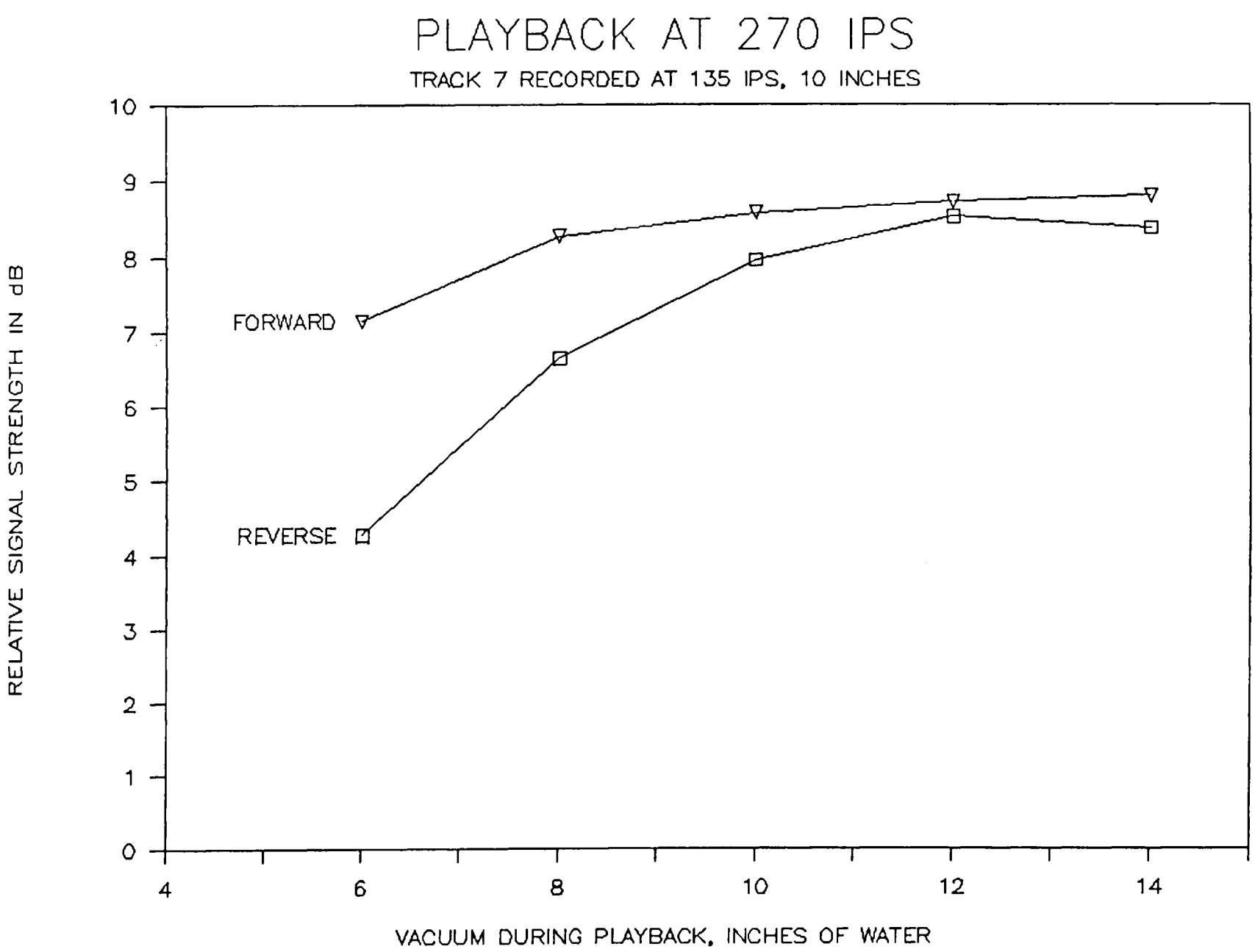
PLAYBACK AT 270 IPS
TRACK 7 RECORDED AT 135 IPS, 10 INCHES
RELATIVE SIGNAL STRENGTH IN dB
10
9
8
7
6
5
4
3
2
1
0
FORWARD
REVERSE
4
6
8
10
12
14
VACUUM DURING PLAYBACK, INCHES OF WATER

FIGURE 3.