

# VLBA ACQUISITION MEMO #325

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To: VLBA Data Acquisition Group

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Subject: Elastic modulus in the radial direction for thin tapes

The elastic modulus in the radial direction has been measured by compressing layers of thin tape about 1.5 mm thick using the apparatus shown in Figure 1. The apparatus was able to apply a force (1.1-4.5 Newtons) on a small area of tape ( $1.9 \times 10^{-6} \text{m}^2$ ). Since the deflections were small the measurements were made under a microscope. The pressures applied on the sample ranged from 595 KPa to 2368 KPa. The results of the measurements are given in Table 1.

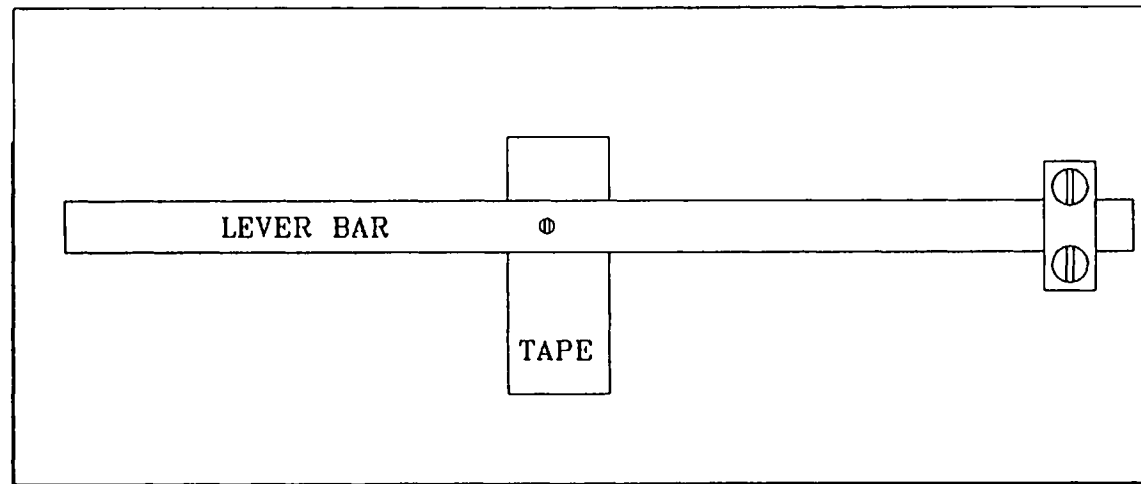
Tape	# Samples	Direction	Young's Modulus $\text{Pa}$	RMS Error $\text{Pa} \times 10^8$
Ampex 741	5	radial	$2.65 \times 10^8$	$\pm 0.28(10.5\%)$
3M	5	radial	$1.47 \times 10^8$	$\pm 0.10(6.8\%)$
Sony D1K	5	radial	$1.71 \times 10^8$	$\pm 0.20(11.74\%)$

Notes: 1. 1 psi = 6894.76 Pa  
2. No correction has been made for edge effects which are probably small since the pin diameter (2.5 mm) is significantly larger than the thickness of the tape stack (1.5 mm).

Figure 2 shows the variation of modulus with pressure for 3M tape. The increasing modulus with pressure is consistent with the measurements of Willet and Poesch (Journal of Applied Mechanics, Vol. 55, Pg 365, June 1988). A low radial modulus (high radial compliance) aids in the stability of the tape pack according to the theory given in VLBA Acquisition Memos 228, 319, and 322.

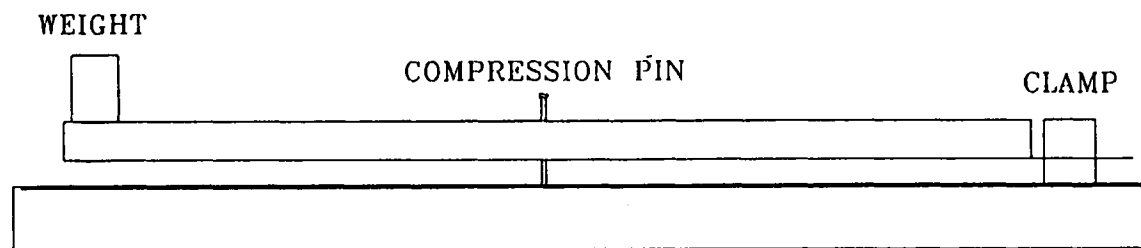


Figure 1: Apparatus to Measure Elastic Modulus in Radial Direction



TOP VIEW

Stress is applied to the tape by a weight on the end of the lever bar. The deflection is measured by using a microscope and focusing on the top of the compression pin. The tape is stacked about 1.5 mm high.



FRONT VIEW

Figure 2: 3M Radial Modulus Data

