

VLBA ACQUISITION MEMO #236

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Subject: Tape elastic constant check via tape winding

The elastic constants of magnetic tape can be checked by winding the tape and measuring the change in the number of rotations with tension (see Acquisition Memo #134). Figure 1 shows the measured change in rotations scaled to a 10" vacuum change. The rotation changes were measured by marking the tape at various footages and then winding at 8,10, and 12" vacuum. At each tension the angular position of the markers were measured relative to reference marks. Also shown on Figure 1 is a computer model based on the finite-difference method described by Willett and Poesch (Journal of Applied Mechanics, Vol. 55, June 1988, page 365-371). Various curves are plotted with the radial modulus variation of their Figure 5. The curve marked 80 (for the modulus ratio at 0 interlayer pressure) is that of Willett and Poesch, while the others are scaled versions. The curve marked 0 is the computer model for which the radial modulus is so high that the rotation change is only due to the stretching of the tape and the accompanying thickness change via Poisson's ratio.

While this check can be performed without any special equipment beyond the Model 96, it doesn't appear that it can clearly distinguish between tapes which pack well and those which have problems packing. It does confirm the interlayer pressure dependence of the radial modulus as given by Willett and Poesch. Models without pressure dependence were tried but failed to fit the data. The effects of Poisson's ratios are relatively small but the values given by Willett and Poesch were included in the model. The thin tapes tested appear to have a somewhat higher radial modulus than that given in Willett and Poesch's curve of their Figure 5, presumably this is because they have smoother backcoats than the tape used by Willett and Poesch (who do not identify the type of tape they tested).

Atch: Figure 1 &
Willett & Poesch's Figure 5

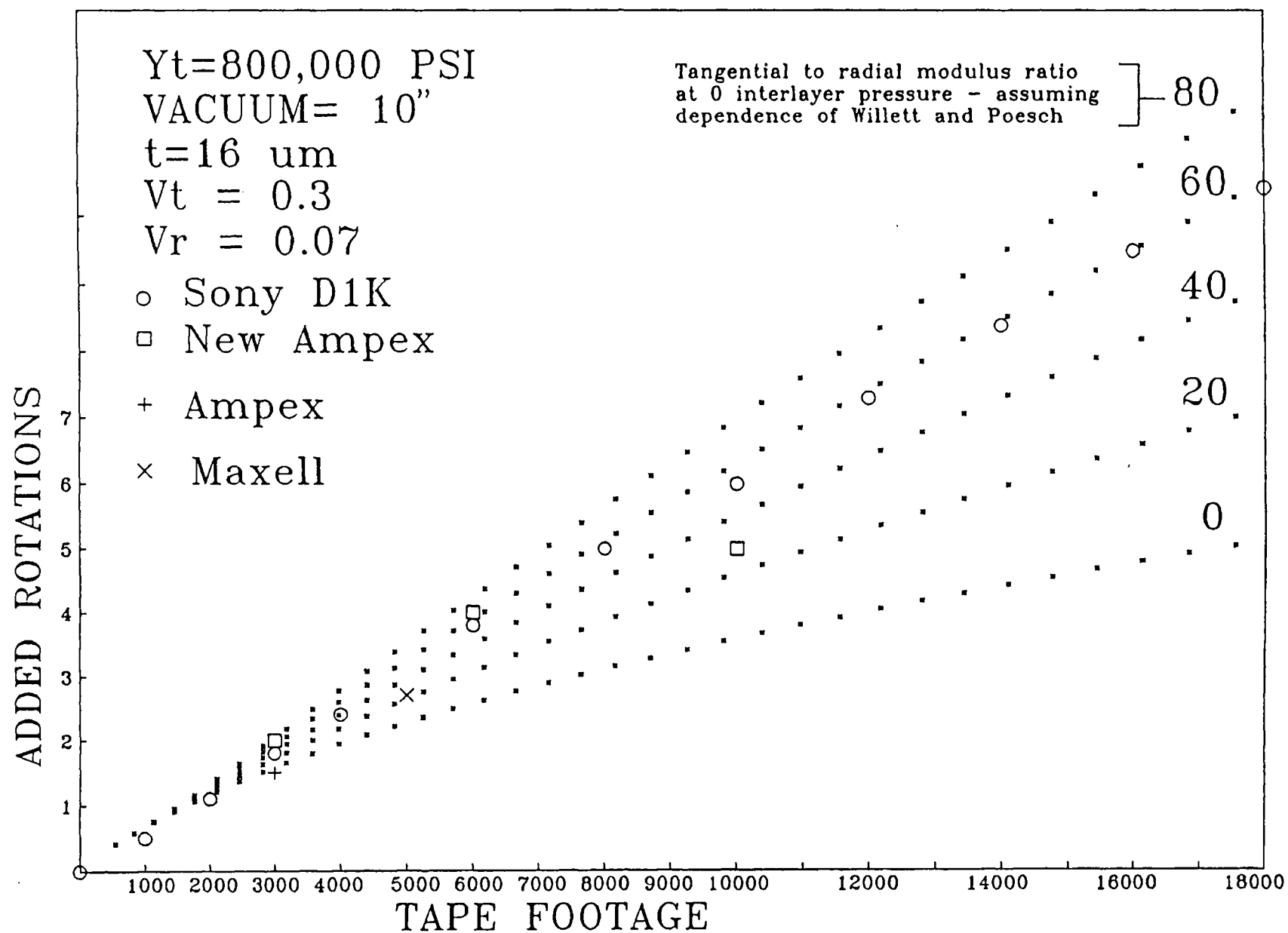


Figure 1. Winding model and measurements

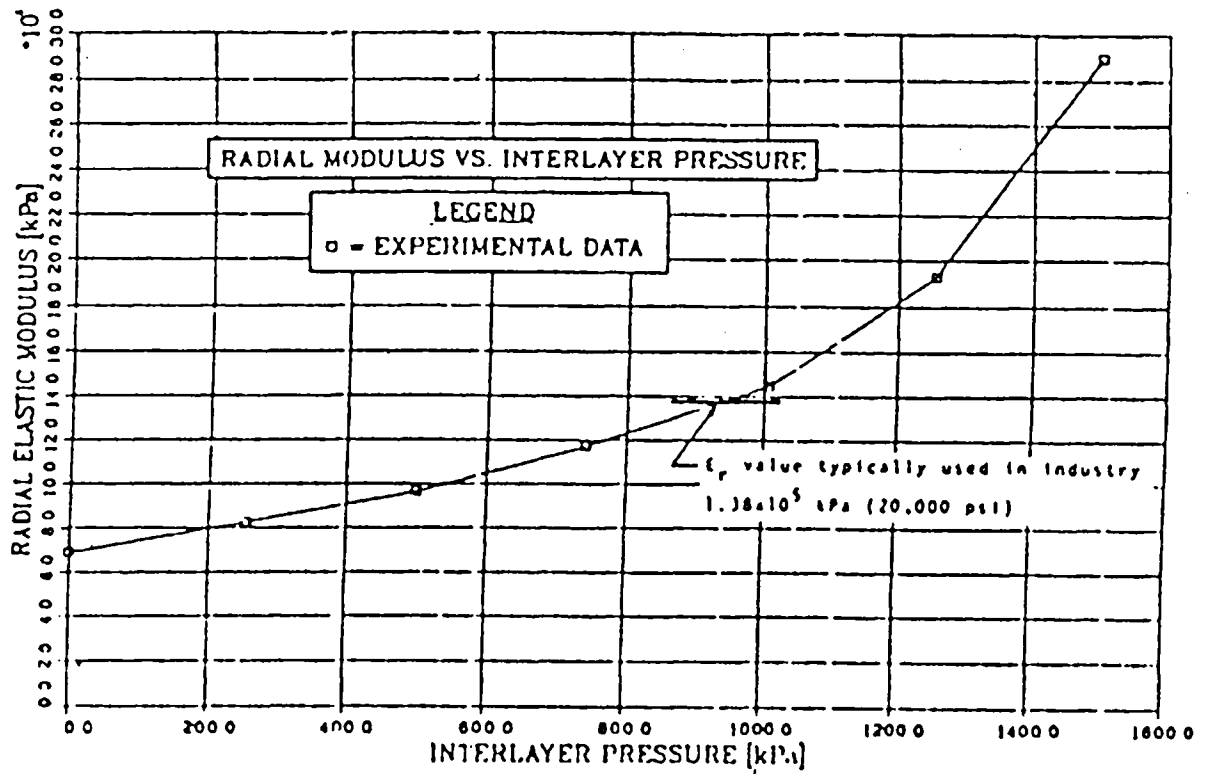


Fig. 5 Experimental radial modulus data

from Willett & Poesch

144 psi