VLBA ACQUISITION MEMO # 319

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To: VLBA Data Acquisition Group

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Subject: Tape winding and stretched tape

Memo #228 considers the effect of thickness non-uniformity and tape winding instability. I now add an additional term to equation (6) of Memo #228 to account for a tape with stretched edge:

$$p_r \sim Y_t \, (y/r - s) \, (t/r) \, n \tag{6R}$$

where s = fractional stretch in the tape edge

Inequality (9) becomes:

$$\mu + \left(\frac{Y_t}{Y_r}\right) stn/r \le K\theta - \theta^2/2 \tag{9R}$$

and with n = r/t inequality (13) becomes (neglecting Poisson's ratio which has a small influence):

$$\mu + \left(\frac{Y_t}{Y_r}\right)s \le \left(\left(\frac{Y_t}{Y_r}\right)^2 t/(2r)\right) \tag{13R}$$

For a tape which is only stretched and is otherwise uniform:

$$s \le \left(\frac{Y_t}{Y_r}\right) t/(2r)$$

placing a limit of s ≤ 0.2% for $(Y_t/Y_r) = 40$.

The value of s for a given tape can be judged by determining the strain at which the "rippled" edge becomes flat. For example if the edge ripple can still be seen at 5" vacuum, s ~ 0.04% for 16 μm tape assuming $Y_t \sim 10^6$ psi.

The motivation for adding the effect of a stretched edge is a concern that an unstable pack, shipping deformation or I/O roller misalignment might result in stretched edges which in turn could produce a tape which will not pack satisfactorily.