VLBA ACQUISITION MEMO # 262

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To: VLBA Data Acquisition Group

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Subject: Vacuum column air bearing clearance

Figure 1 shows the geometry of the vacuum loop along with the pressure profile. For a flexible tape the radius of curvature r is given by

$r = T/P$

T = tape tension

P = pressure difference between sides of tape

When the loop is stationary (low tape speeds) air must leak between the tape and the wall so that

$T\phi = P_w d$

P_w = = average pressure difference in thin film region between tape and wall

d = length of film

h = film thickness

ϕ = tape exit angle

If $P_w = P$ and $d \simeq h/\phi$ then

$$h \propto \frac{T\phi^2}{P} = R\phi^2$$

R = radius of vacuum loop (1.25")

Comparing measured and calculated values

Exit Angle	Measured Clearance	Calculated
8°	0.02"	0.025"
12°	0.05"	0.055"
22°	0.15"	0.186"
2°	-	40 microns
1.4°	-	20 microns

where the last 2 exit angles are those for the front and back of the loop in the current recorder configuration. With high speed tape motion the film can collapse owing to the shallow exit angle as discussed in VLBA Acquisition Memo #257. Increasing the exit angle from 2° and 1.4° to 3 and 2.4 degrees would increase the clearance and avoid the film collapse. The calculated critical angle for film collapse at 320 and 7" vacuum is 2.2°. However, the increased angles may result in audible "honking" sounds due to reel action. Originally the loop exit angles were larger but were recently reduced to stop the honking. The scotchflex surface (see Figure 2) used on the standard Metrum transports has a glass beaded surface in which the top of the glass spheres are about 20 microns above binder. Further work is needed to find the best compromise angles.

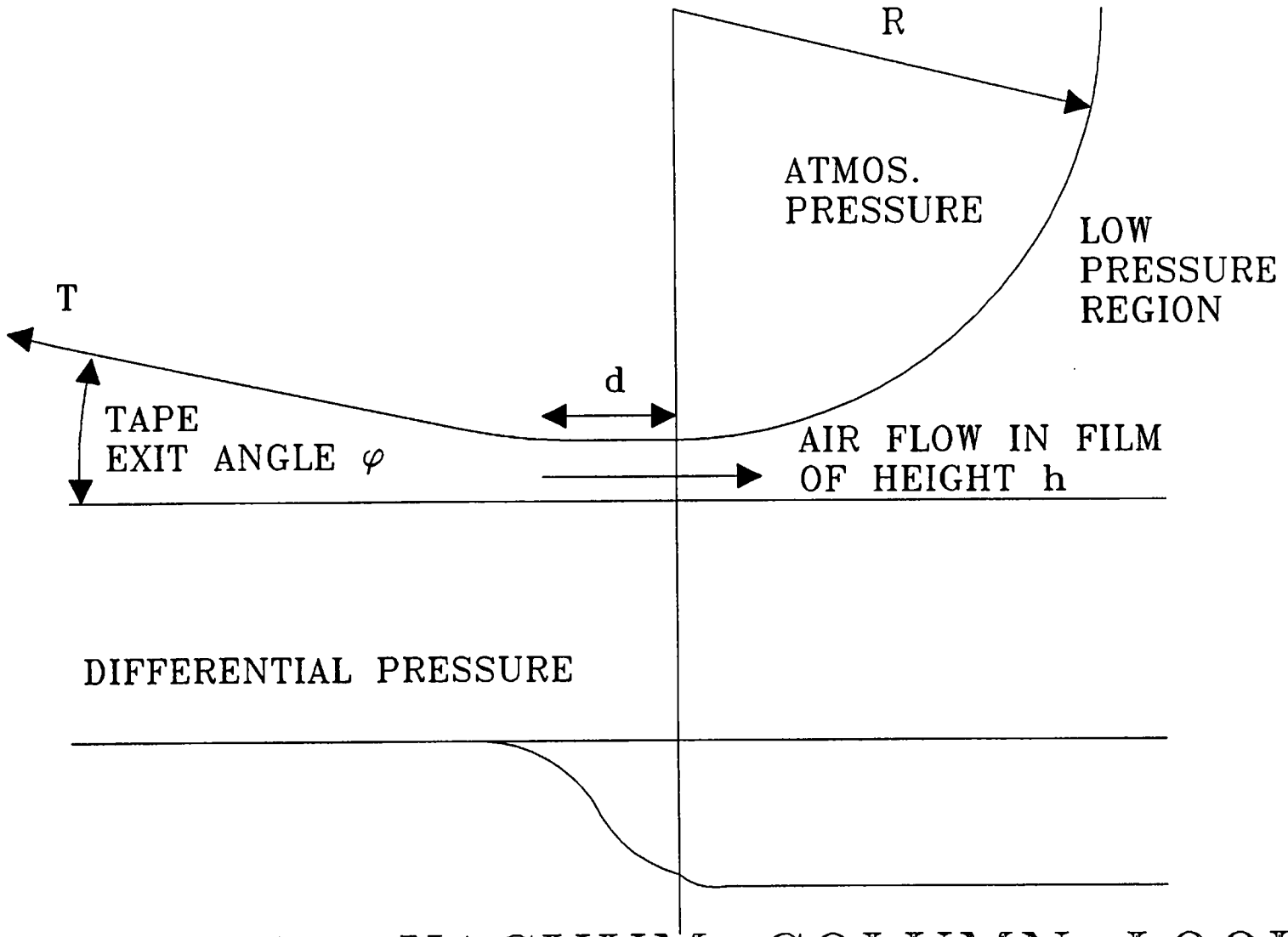

Figure 1 VACUUM COLUMN LOOP

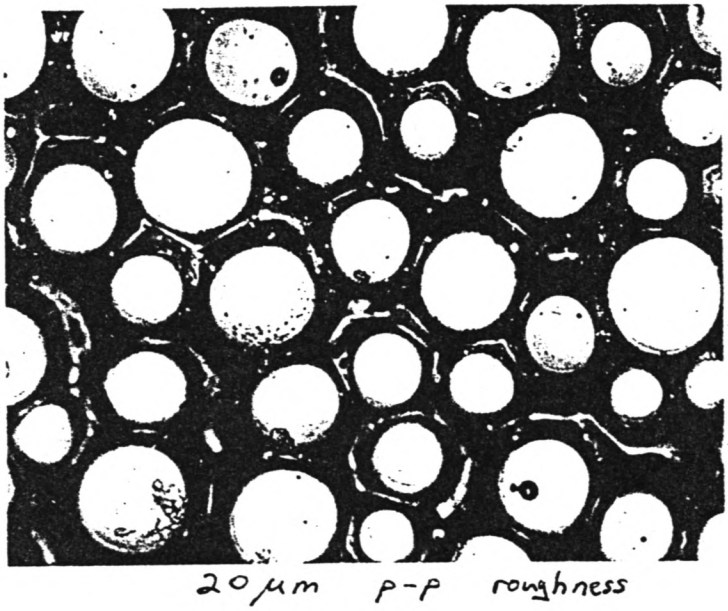

FIGURE 2. SCOTCHFLEX -
MAGNIFIED X 160