APPENDIX B

FOIL STRETCHING

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One possible source of anomalous resistance changes observed in records from shots 73-051 and 73-056 is deviations from uniaxial compression by lateral deformation. Lateral deformation will cause resistance changes due to changes in specimen dimensions and due to lattice imperfections generated by plastic deformation.

Stretching of the foil could be caused by a shock wave which is partly tilted with respect to the foil plane. The high shock speed, 11.4 mm/μsec, in sapphire causes especially high magnification of the relative tilt between impactor and target. For an impactor approaching at 0.4 mm/μsec, a 0.3 milliradian tilt would become $0.3x(\frac{11.4}{0.4}) = 8.6$ milliradians in sapphire. This means that the lateral particle velocity is $8.6 \times 10^{-3}\ u_p$. Stretching requires relative lateral motion in opposite directions of adjacent segments of the foil; so either one segment must be accelerated while the other is still at rest or the shock must be non-planar in order for stretching to take place.

Consider a slab element whose length L and cross-sectional area A are being altered by stretching. Conservation of mass requires $DA_oL_o = DAL$ where D is the mass density.