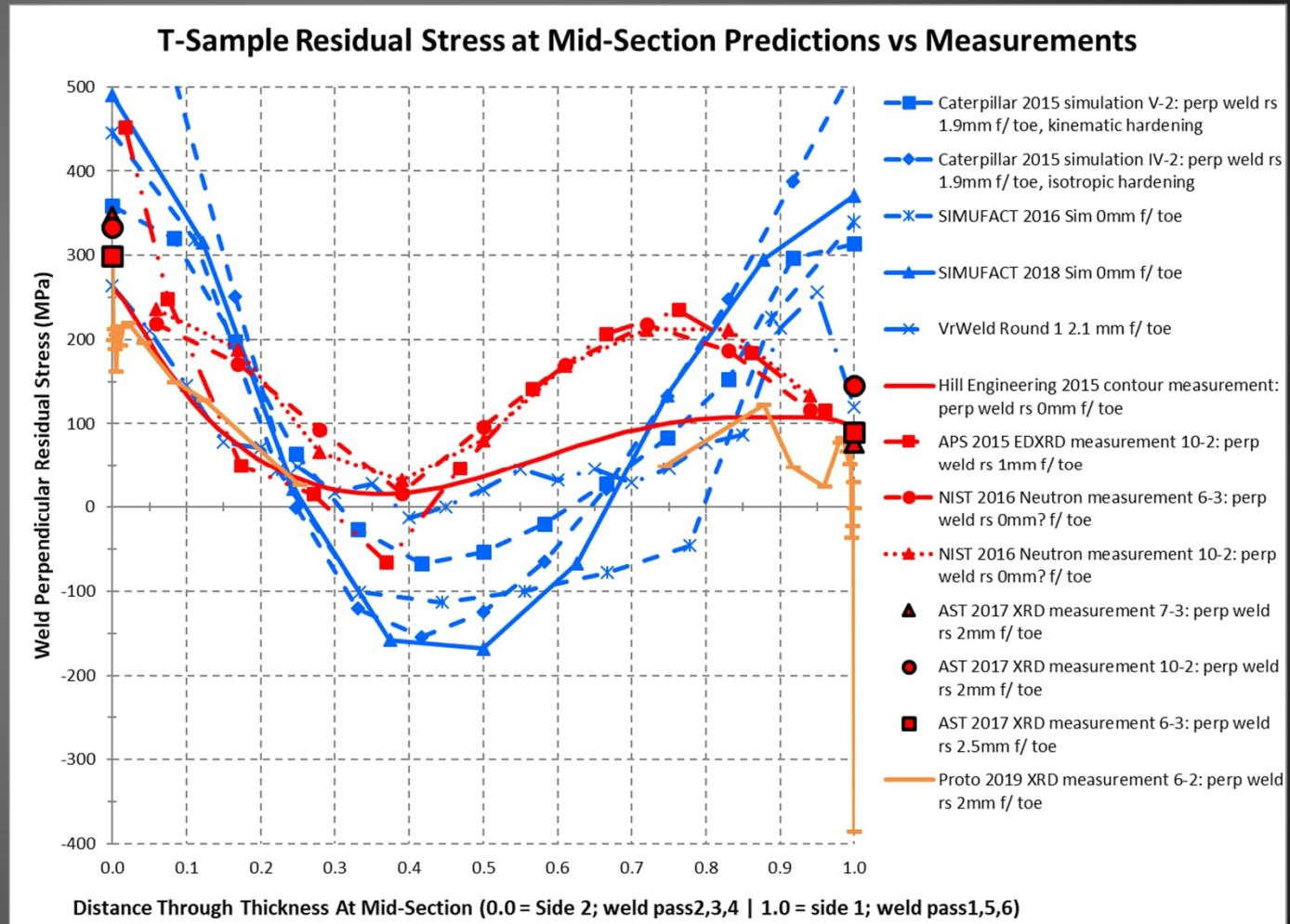
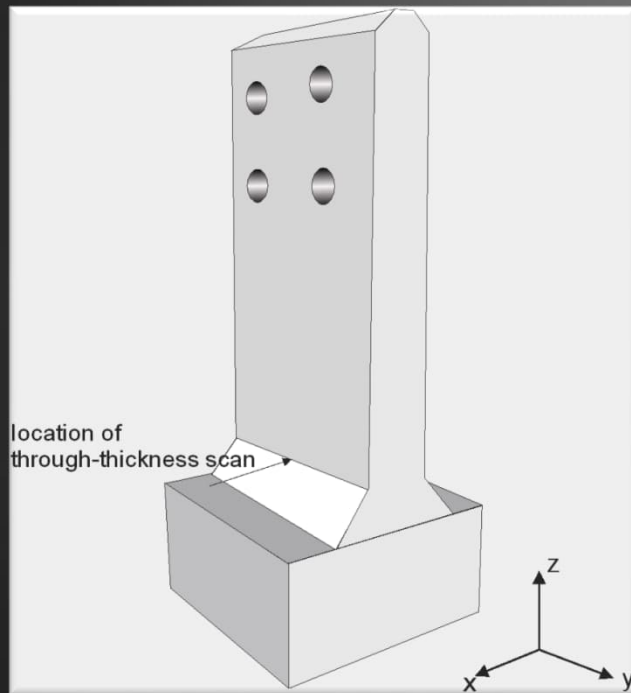


SAE FD&E Residual Stress Committee Update

11/2/2022

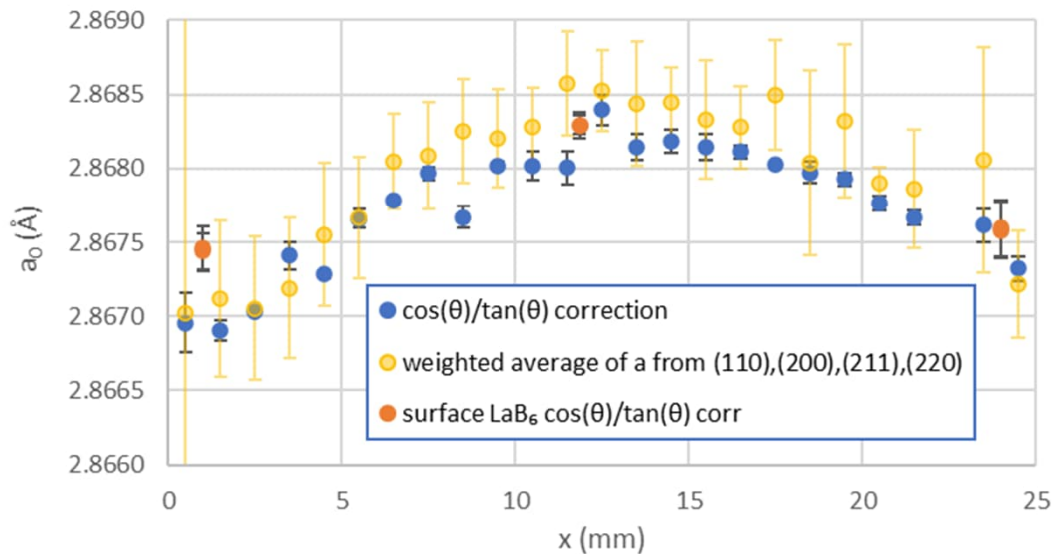
Casey Gales

T-Sample Residual Stress



Accurate A_0 Measurement

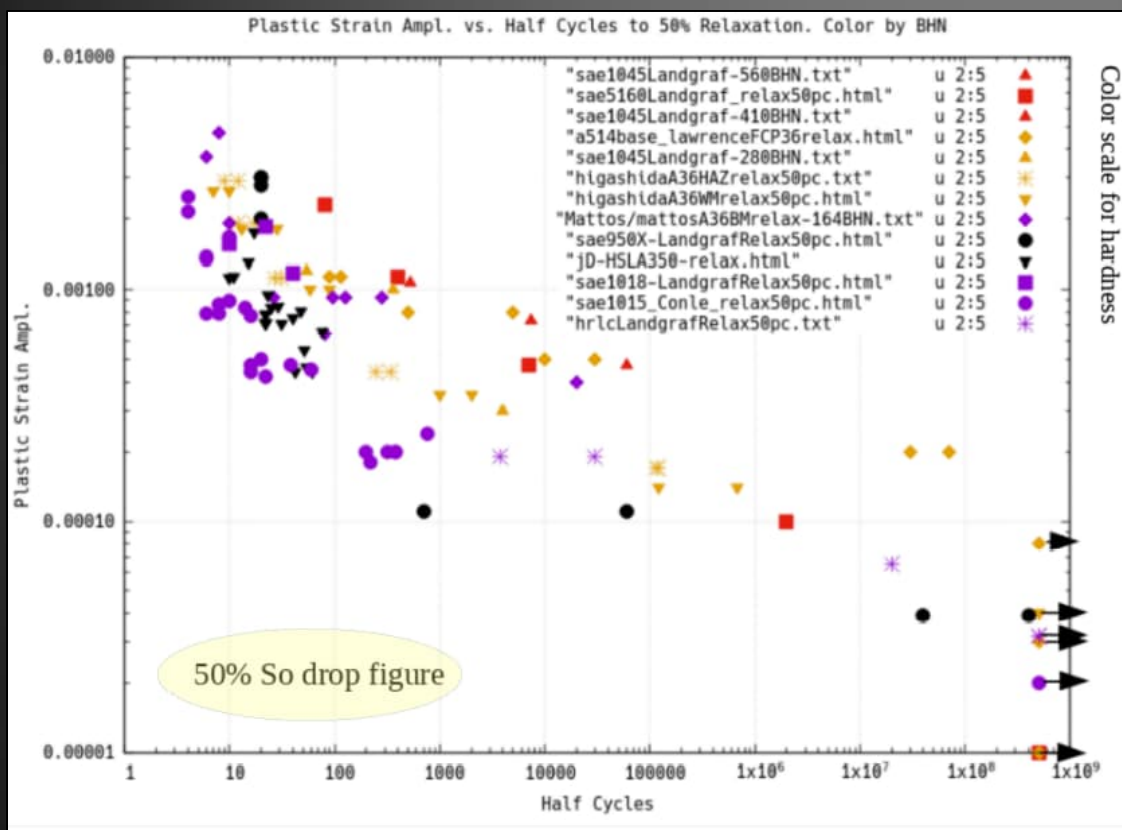
a_0 vs distance from side 1
using $\cos^2\theta/\sin\theta$ extrapolation



- Blue dots are industry standard (assumed flat part)
- Yellow and Orange Dots show measurement values with correction for non-flatness
 - Few more on the left side where discrepancies exist
- Ask APS and NIST to recalculate the measurements with the new a_0

*Plot courtesy of William Boyer at ProtoXRD

Residual Stress Relaxation Testing



- High Plasticity Loading (0.007)
 - 24 kN R = -1
 - Relaxed in 20 cycles
 - Published with SAE
- Lower Strain Amp Loads
 - 12.1 kN R = 0.1
 - Ran to 250K cycles and measure RS?
 - Hard to handle non-zero mean
 - 5 kN R = -1
 - Produced CI at 900K cycles
 - Run to 500K cycles and measure RS
 - Run at 20 cycles and measure RS?
 - Abstract with ICF

*Figure courtesy of Al Conle

Questions

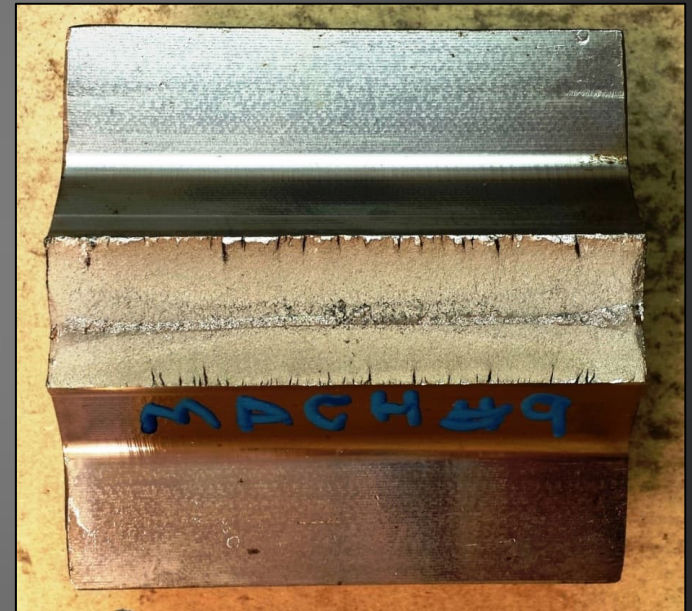
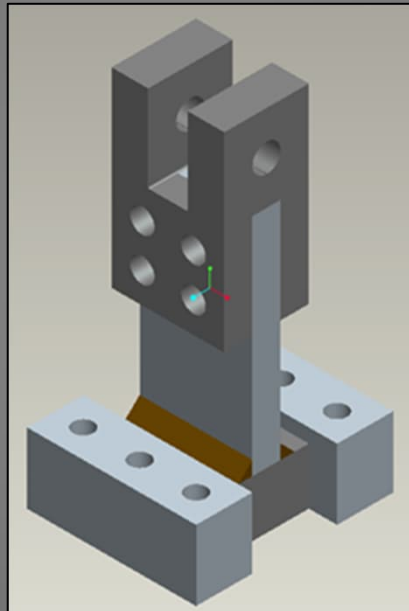
Thank you!

Casey Gales

galescaseye@johndeere.com

Total Life Recap

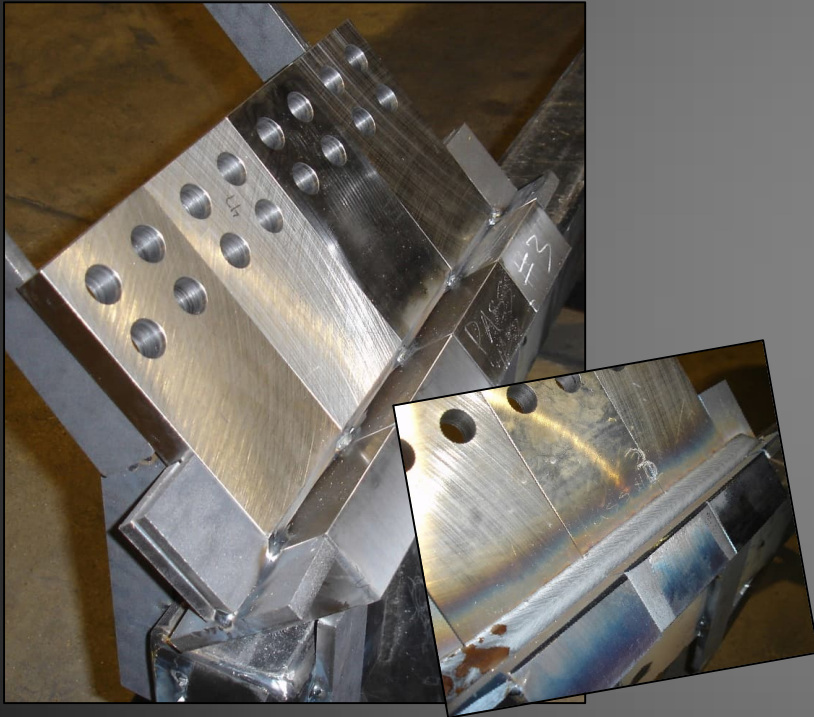
- Predict “Total Life”
- Combined Service Life
 - Variable Amplitude
 - Constant Amplitude
- Important Factors
 - Stress Concentration
 - Material Properties
 - Applied Stress
 - Residual Stress
 - And more



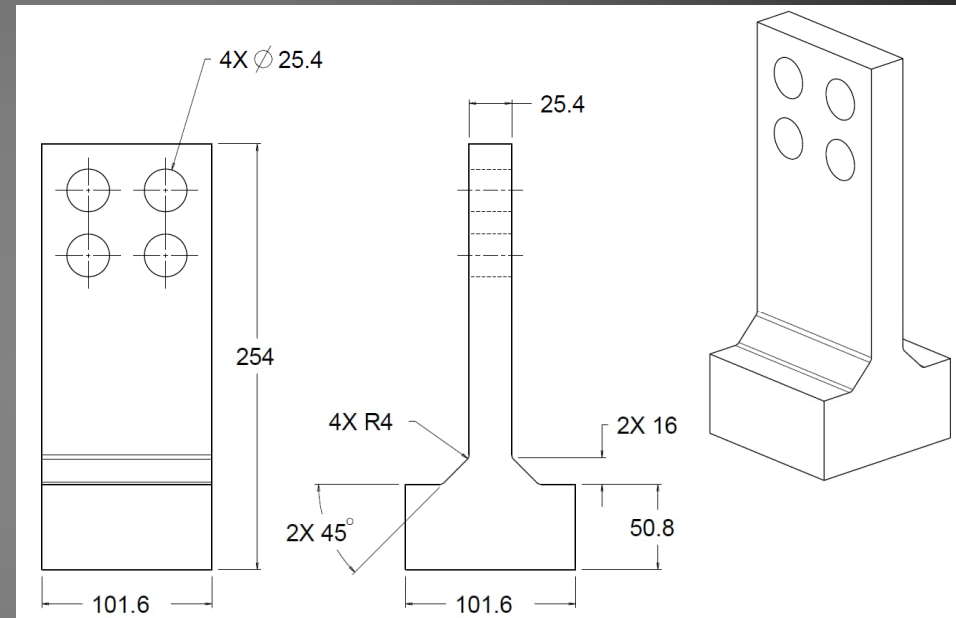
*SAE documentation is available

Testing courtesy of John Deere ADV Center

T-Sample Welding Process

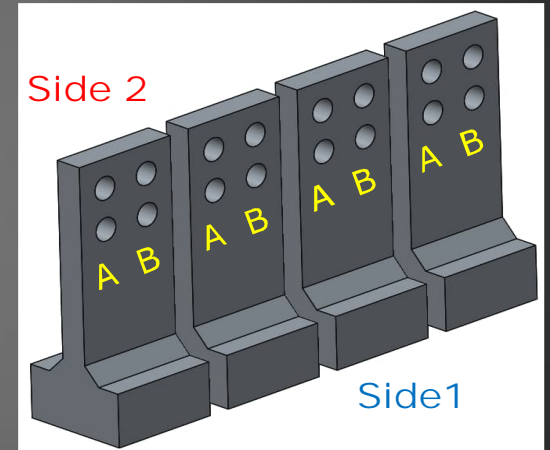
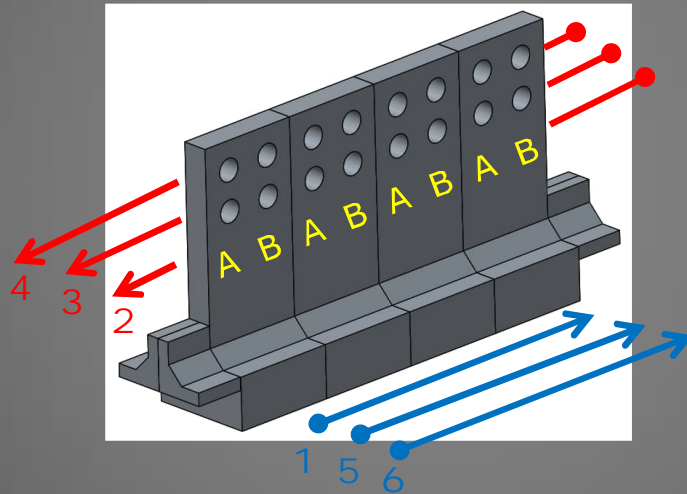
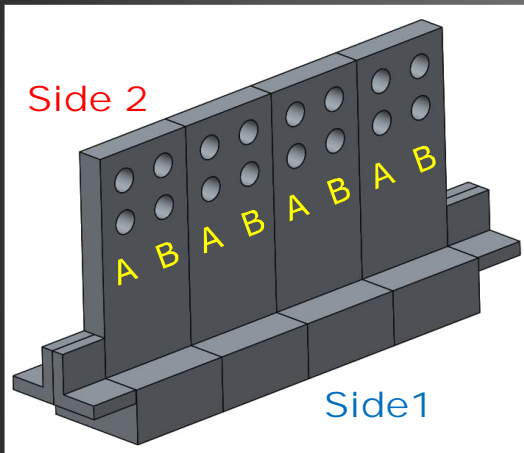


Welding courtesy of John Deere Davenport Works

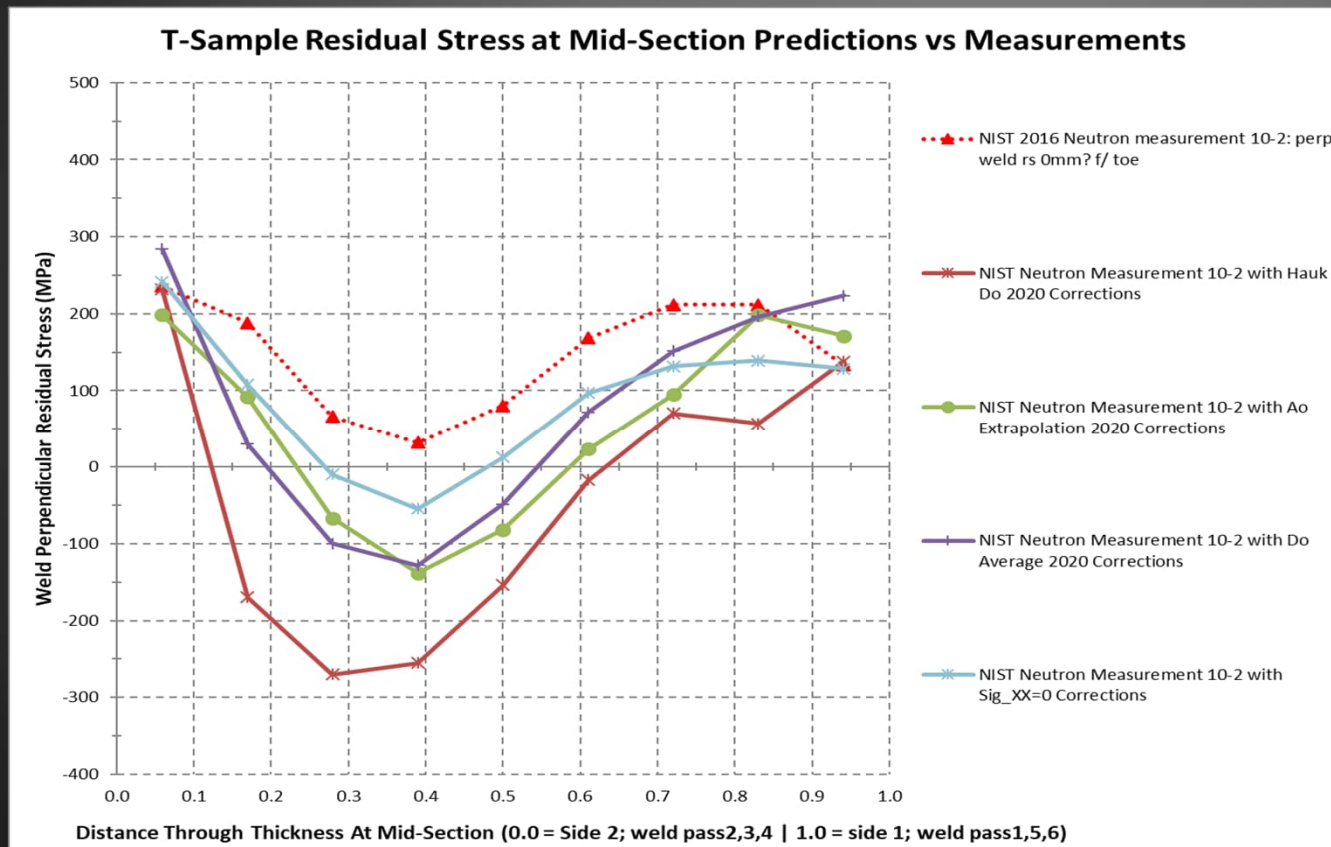


Parameter/Characteristic	Value
Welding Process	GMAW
Wire Type	Solid
Wire Diameter	0.062 inches
Shielding Gas	90% CO ₂ / 10% Ar
Base Material	A36
Filler Metal	ER70S-6
Welding Position	45 deg for all weld passes

Welding Process Animation



Residual Stress Profile with Update Do Data



- Red curve is original data
- Colors show the change in RS based on D_0 calculations
- Significantly affects results
- Pursuing direct measurements of D_0 vs thickness