

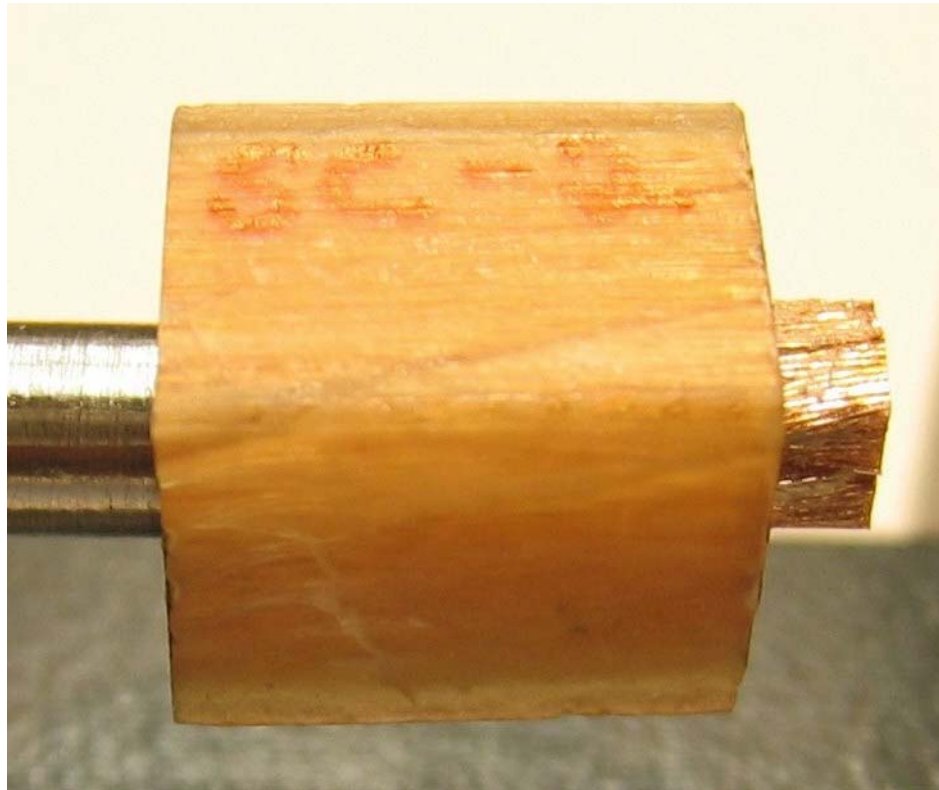
NCSX Composite Coil Testing

Tests Performed During the Week
of 15 March 2004

Tests Performed

- Plug Longitudinal Shear
- Three Point Flexure Beyond Yield

Plug Longitudinal Shear



Plug Longitudinal Shear

- Tested several length samples: 0.5", 0.25", 0.15"
- Tested several diameter punches: 0.187", 0.125"
- Various aspect ratios tested:
 - If the sample length is too long with respect to the punch diameter – the material crushes and ultimately the sample bursts.

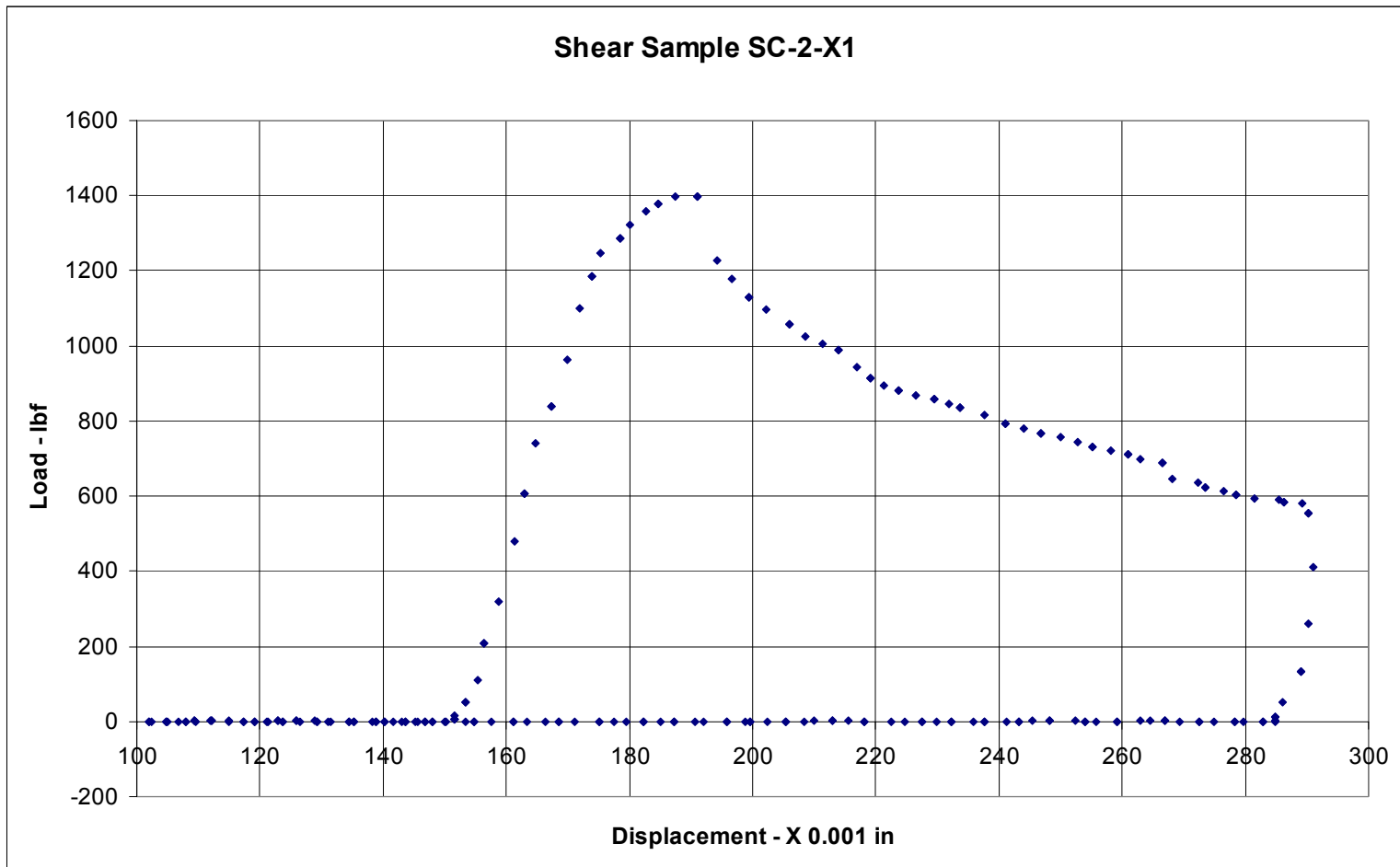
Aspect Ratio too Large



Correct Aspect Ratio



Load – Displacement Curve



Sample	Depth	Punch Dia	Hole Dia	Shear Area	Load	Slope	Shear			
							Modulus	Avg	SD	
							Ksi			
	in	in	in	sq in	sq in	lbf/in				
SC-2-X1	0.490	0.187	0.250	0.2879	0.0275	56432	96.06			
SC-2-X2	0.475	0.187	0.250	0.2791	0.0275	71084	121.00			
SC-1-X1	0.485	0.187	0.250	0.2849	0.0275	85355	145.29			
SC-3-X1	0.491	0.187	0.250	0.2885	0.0275	63596	108.25			
SC-4-X1	0.492	0.187	0.250	0.2890	0.0275	79615	135.52			
SC-5-X1	0.485	0.187	0.250	0.2849	0.0275	55498	94.47			
SC-6-X1	0.492	0.187	0.250	0.2890	0.0275	104470	177.83			
									125.49	29.94

Sample	Depth	Punch Dia	Hole Dia	Shear Area	Load	Slope	Shear		
							Modulus	Avg	SD
							in	in	in
SC-1-X3	0.264	0.125	0.155	0.1037	0.0123	56738	144.48		
SC-3-X3	0.280	0.125	0.155	0.1100	0.0123	58216	148.25		
SC-4-X3	0.268	0.125	0.155	0.1052	0.0123	50288	128.06		
SC-5-X3	0.270	0.125	0.155	0.1060	0.0123	59974	152.72		
SC-6-X3	0.254	0.125	0.155	0.0997	0.0123	46824	119.24		
								138.55	14.26

Three Point Flexure Beyond Yield

- Bare impregnated conductor samples were cycled four times below or just to yield.
- The samples were then cycled to nearly an inch beyond yield.
- Six samples were tested at room temp.
- Three samples were tested at LN2 temp.

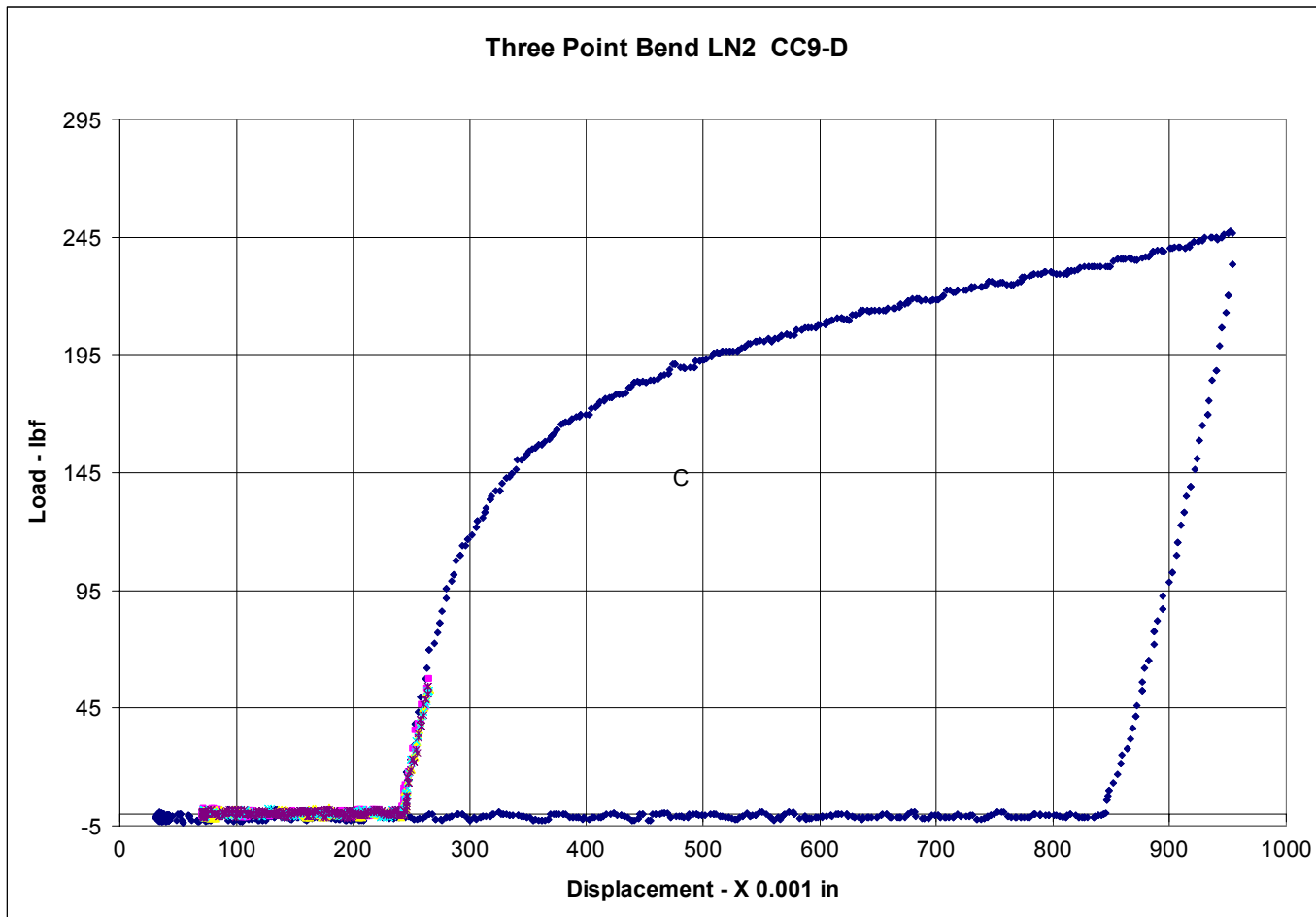
Room Temp. Samples



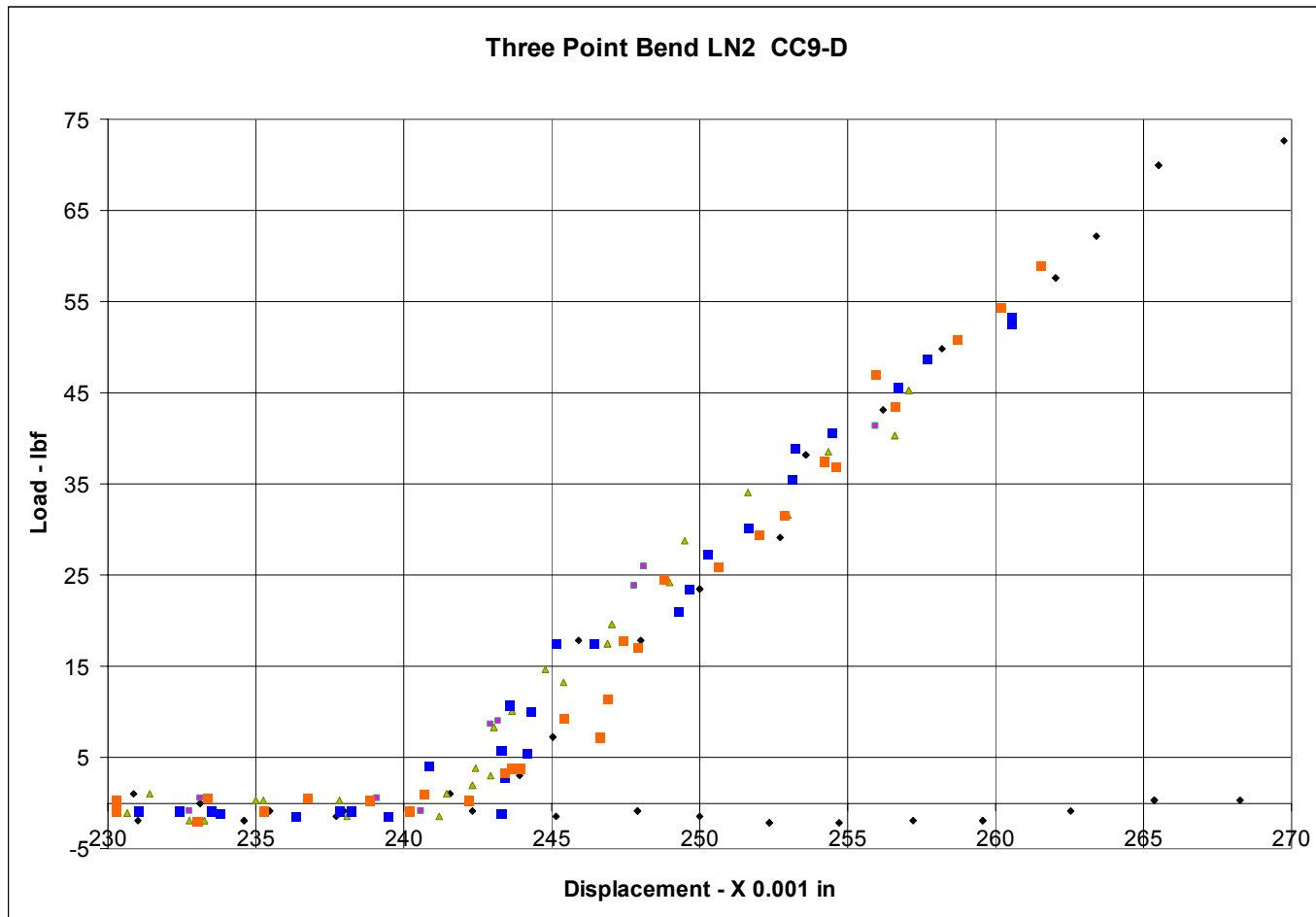
Bend Detail



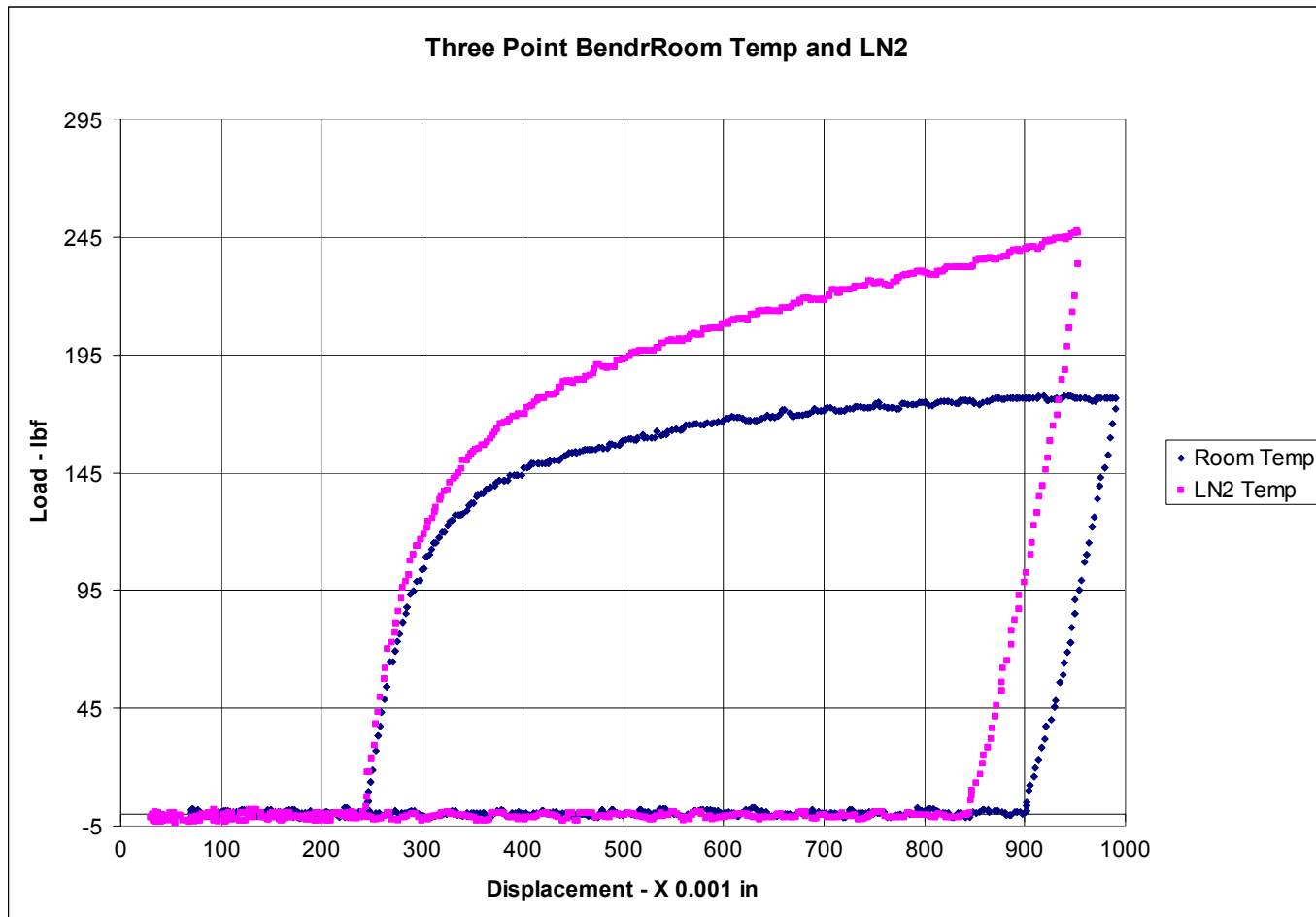
LN2 Sample Data- 5 Cycles



Detail of Elastic Region



Comparison of RT and LN2



Tangent Modulus of Elasticity (ASTM D-790)

Sample	Temp	Span	Width	Depth	Slope	Modulus	Average	Std Dev
#	C	L in	b In	d in	m lbf/in	E _b 10E6 psi		
CC-7-C	25.5	6	0.309	0.356	2350	9.102		
CC-8-C	25.5	6	0.316	0.347	2259	9.239		
CC-9-C	25.5	6	0.321	0.347	2118	8.528		
CC-10-C	25.5	6	0.316	0.347	2437	9.967		
CC-11-C	25.5	6	0.316	0.345	2560	10.653		
CC-12-C	25.5	6	0.307	0.353	2828	11.309		
	25.5						9.80	1.04

LN2 Samples

Sample	Temp	Span	Width	Depth	Slope	Modulus	Average	Std Dev
#		L	b	d	m	Eb		
	C	in	In	in	lbf/in	10E6 psi		
CC-7-D	-196	6	0.310	0.345	2969	12.595		
CC-8-D	-196	6	0.319	0.344	2582	10.737		
CC-9-D	-196	6	0.323	0.342	2734	11.426		
	-196						11.586	0.94