

T-Weld Testing (Machined Specimens)

SAE FD&E Semi-Annual Meeting
University of Wisconsin, Platteville
16 October 2014

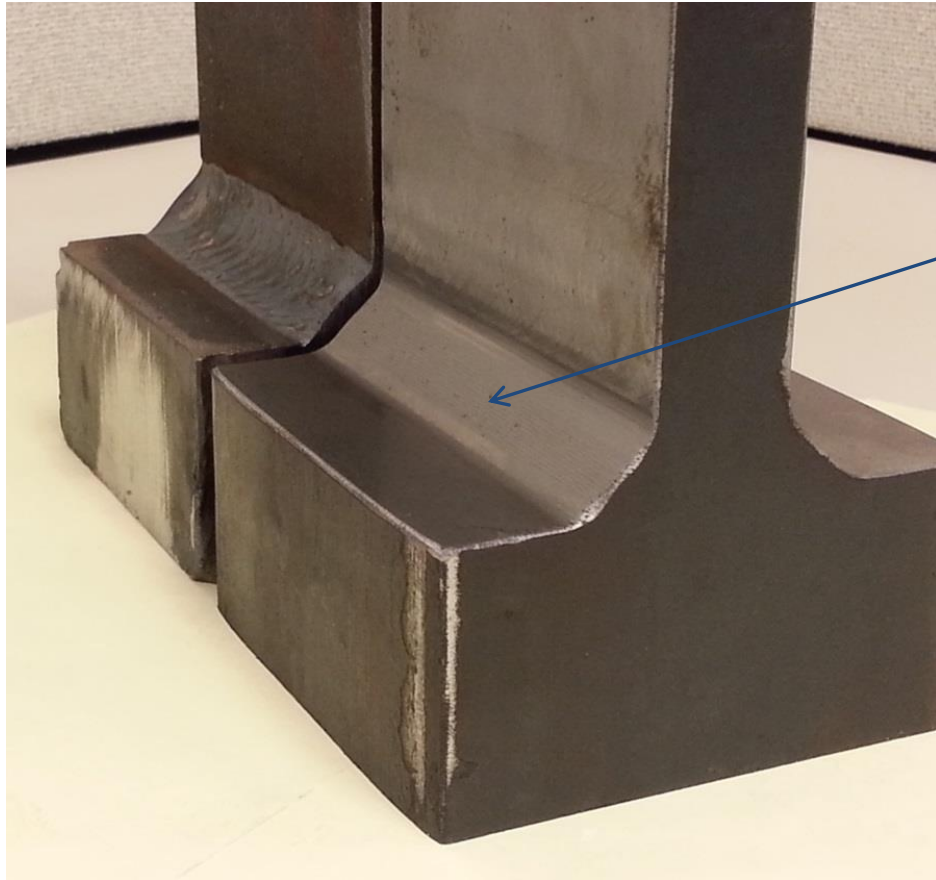
T-Weld Test Overview

- Test Log
- Test Set Up
- Specimen Photos / Loading Histories
- Variable Amplitude Load History Files
- Future Work
- Questions / Comments

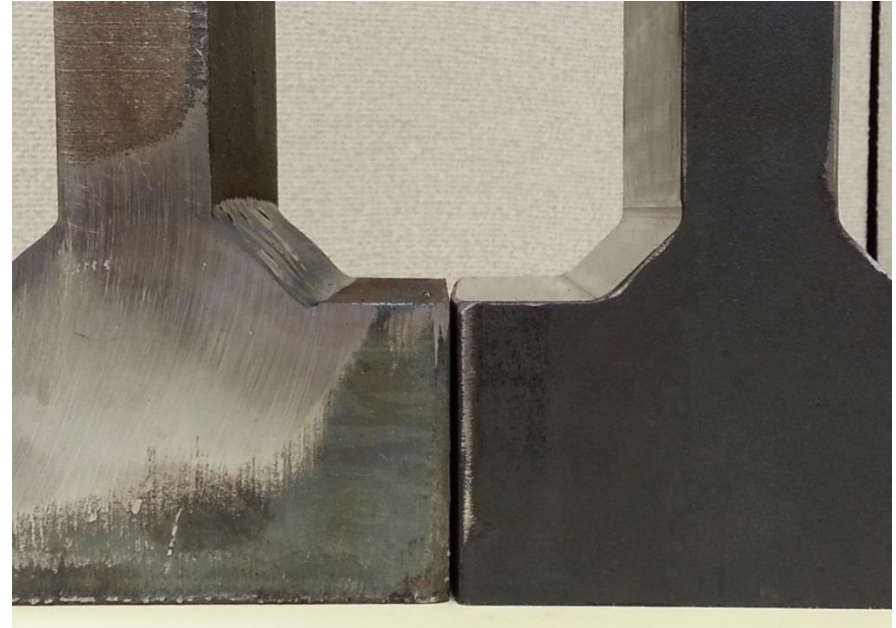
Test Log – Machined Specimens, Constant & Variable Amplitude Loading

Specimen	Designation	Load (kN)	R Ratio ($\sigma_{\min} / \sigma_{\max}$)	Cycles	Notes
19	MACH1	24	0.1	58481	Failure
23	MACH5	24	0.1	70011	Failure
22	MACH4-A	24	0.5	2471943	Run out
22	MACH4-B	24	0.3	266012	Failure
25	MACH7	24	0.3	218671	Failure
35	MACH12	24	0.3	200464	Failure
20	MACH2-A	14	0.1	3495011	Run out
20	MACH2-B	18	0.1	411745	Failure
24	MACH6	18	0.1	424431	Failure
26	MACH8	10.8	-1	214765	Failure
27	MACH9	10.8	-1	271951	Failure
29	MACH10_VA1	24	0.1	326135	Repeat Block (5k cycles @ R=0.1, 40k cycles @ R=0.5)
		24	0.5		
30	MACH11_VA2	24	0.1	301938	Repeat Block (5k cycles @ R=0.1, 40k cycles @ R=0.5)
		24	0.5		
32	MACH_VA2_TBS	Variable	Variable	28 Full Blocks	Repeat Time History, Trans x 3, Brkt x 1, and Susp x 2
33	MACH_VA3_TBS	Variable	Variable	29 Full Blocks	Repeat Time History, Trans x 3, Brkt x 1, and Susp x 2

Welded and Machined Specimens

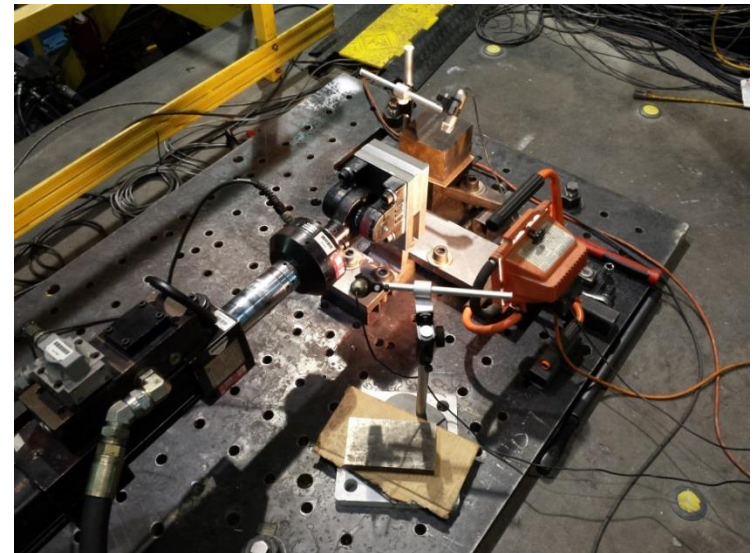
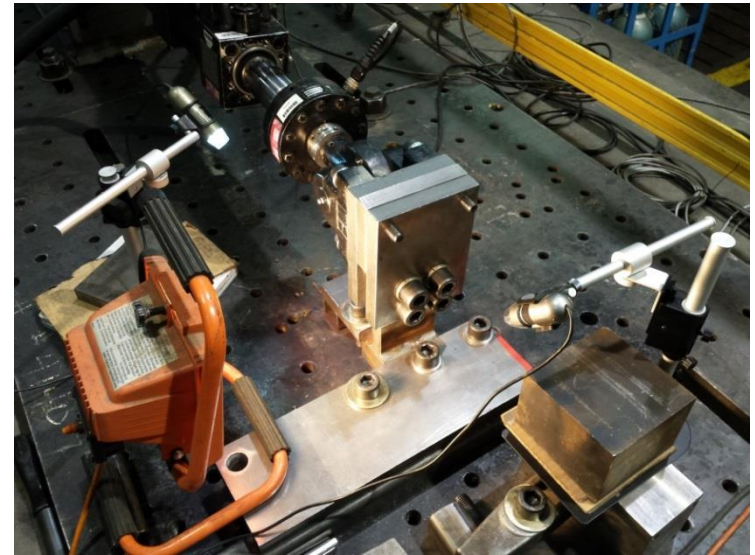


Machined T-Bar Replicates
Welded Specimen Geometry

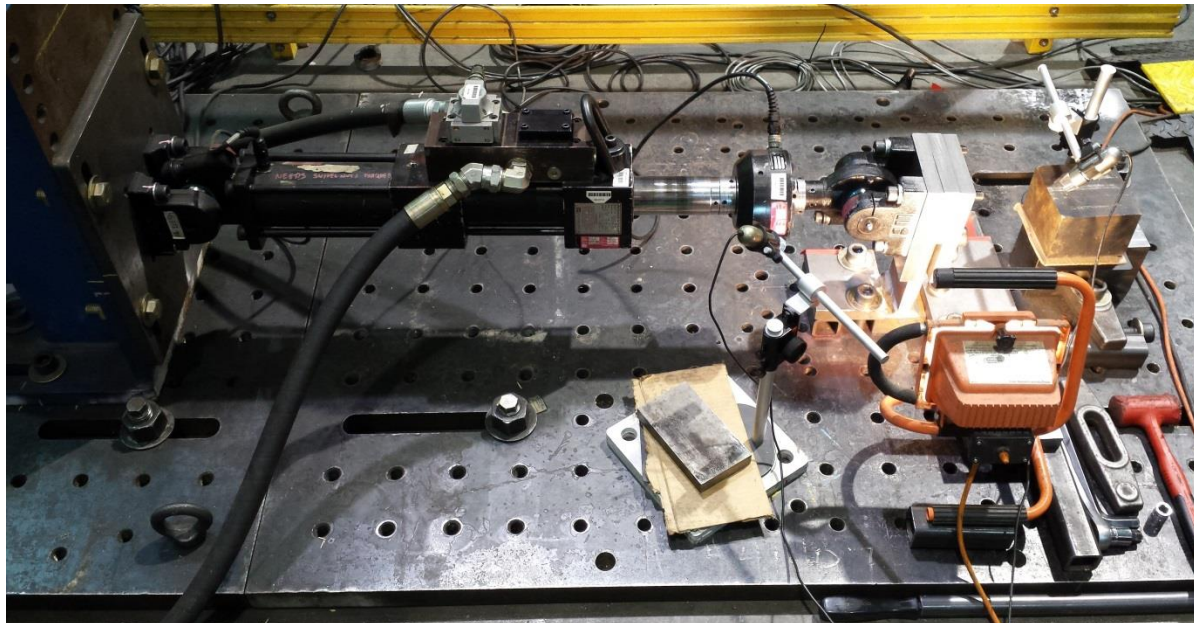
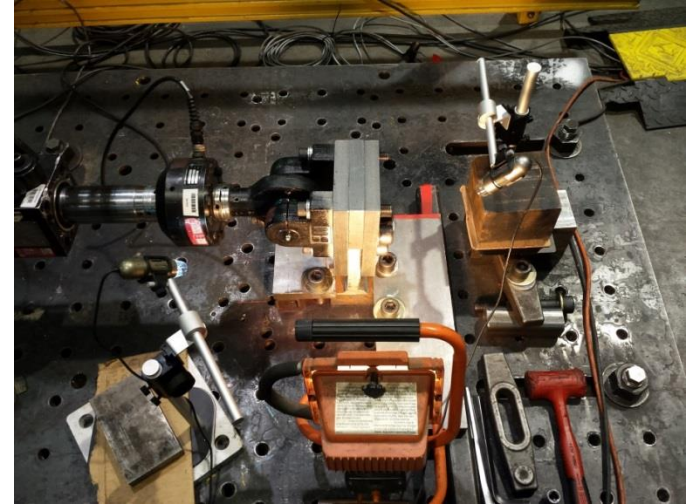


T-Weld Test Set Up

- MTS FlexTest IIm Controller
 - Load Control
 - Collecting Load & Displacement
 - Running tests at 5.1 Hz
- MTS 793 Series Software
 - Basic Testware (constant amplitude)
 - MultiPurpose Testware (block loading)
 - RPC Pro (variable amplitude loading TBS)
- MTS 244 Series Hydraulic Actuator
 - 11 Kip (50 kN) x 10" (254 mm) stroke
 - 252.25 Series dual stage servo valve
 - MTS Load cell and LVDT
- SOMAT eDAQ Lite
 - Record time history file with strain
- Dino-Lite USB Cameras / Laptop
 - Capture time-lapse video at weld toe



SAE FD&E T-Weld Test Set Up



T-Weld Test Set Up Video



I AIN'T BROKE
BUT I'M BADLY BENT

Video - USB Cameras

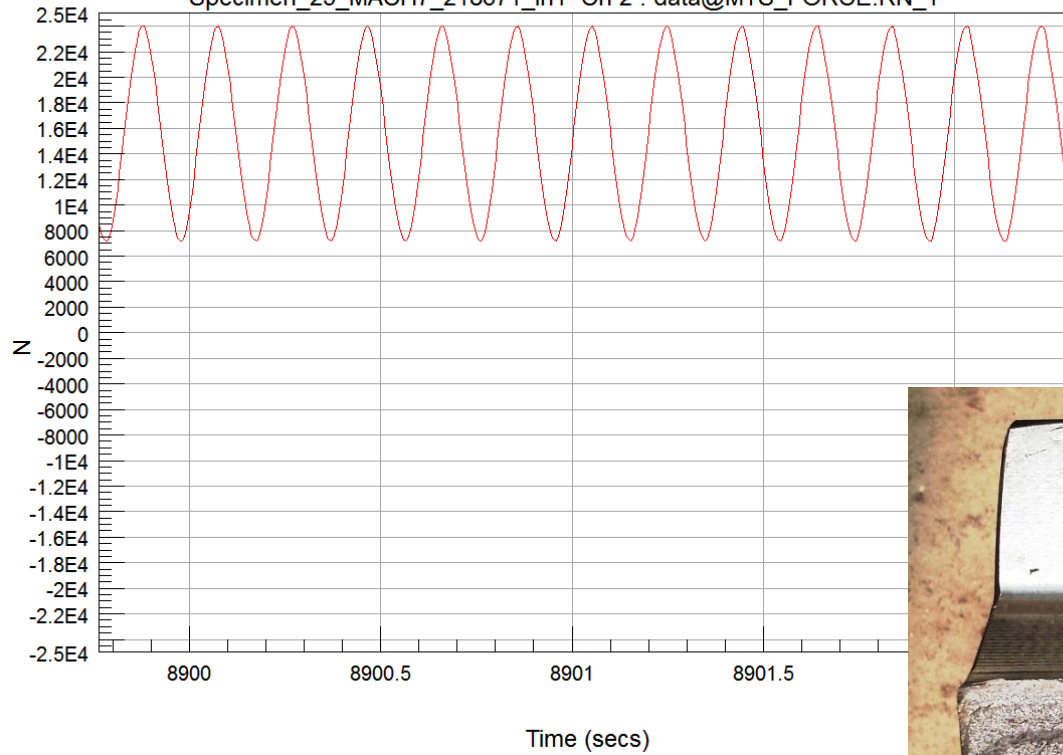


Machined T-Weld Specimens

- 24 kN, $R = 0.3$
- 24 kN, $R = 0.1$
- 18 kN, $R = 0.1$
- 10.8 kN, $R = -1$
- 24 kN, Variable Amplitude, Block Loading
- 24 kN (Max/Min), Variable Amplitude,
Time History File (Tx3, Bx1, Sx2)

24 kN, R= 0.3

Specimen_25_MACH7_218671_in1 Ch 2 : data@MTS_FORCE.RN_1

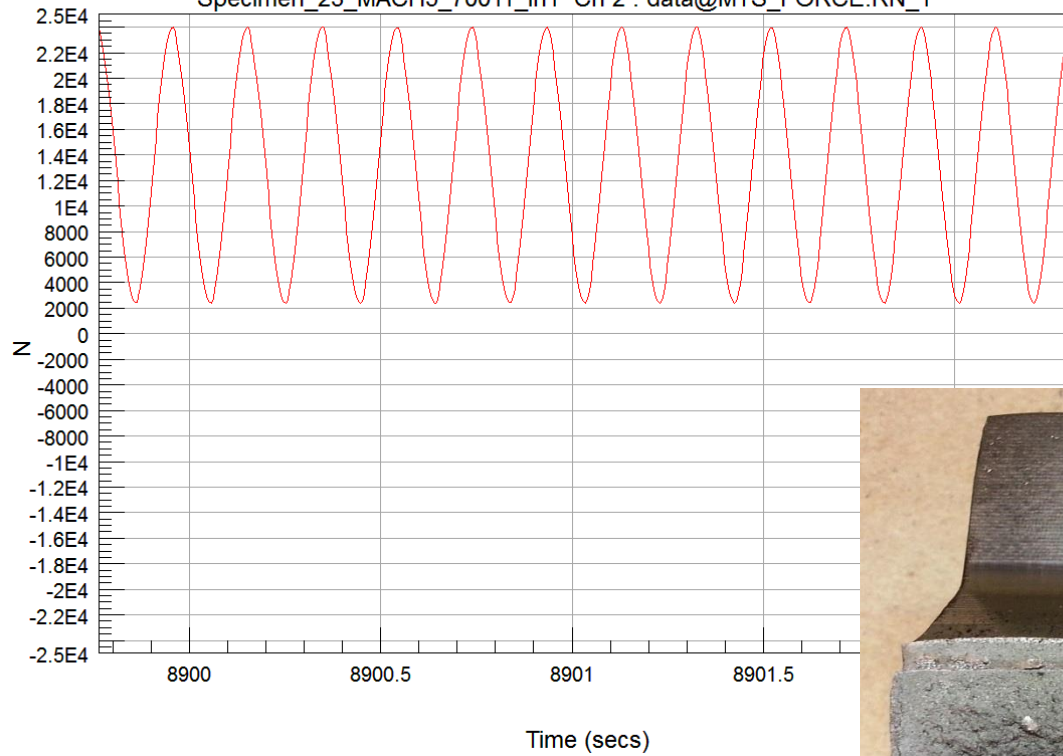


Highest Mean Load -
Crack Has Not Reached Free End



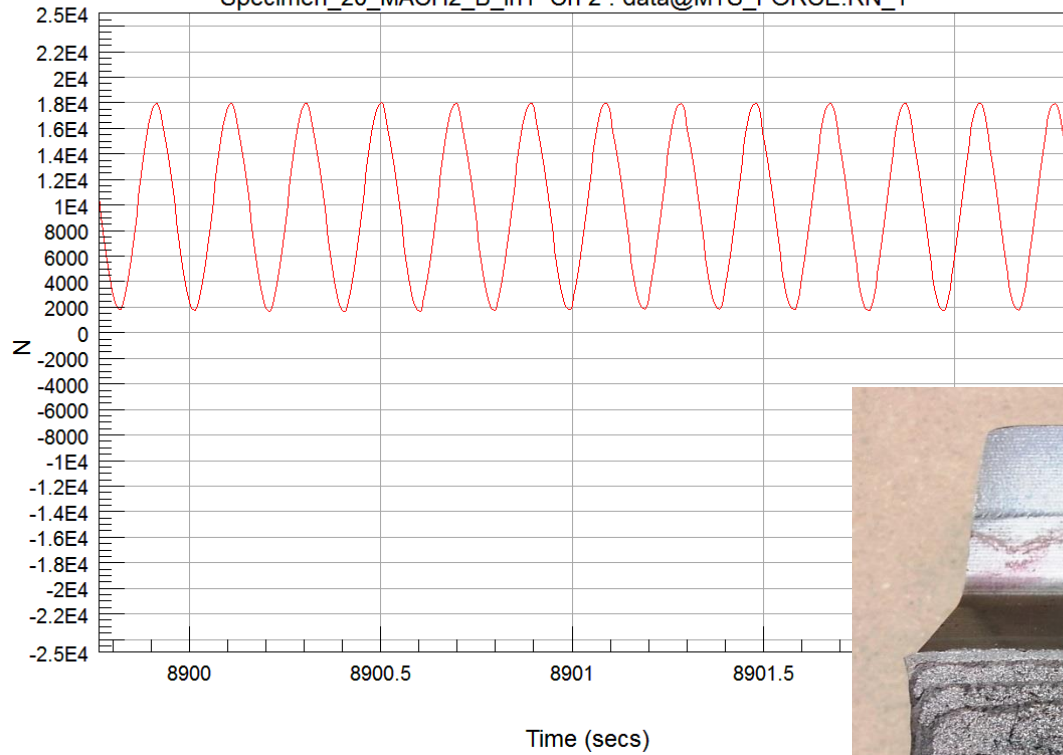
24 kN, R= 0.1

Specimen_23_MACH5_70011_in1 Ch 2 : data@MTS_FORCE.RN_1



18 kN, R= 0.1

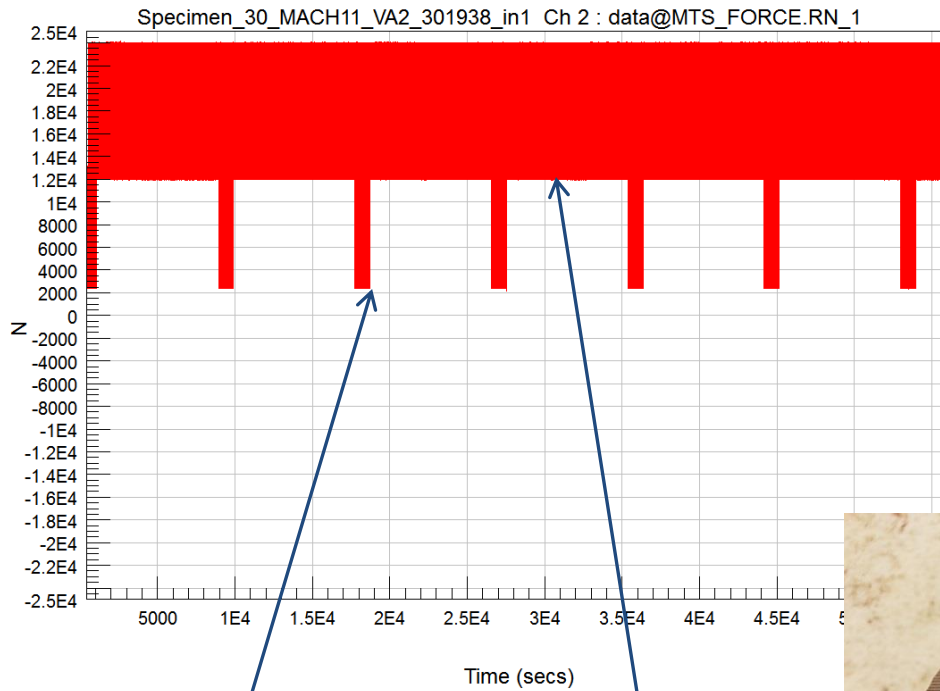
Specimen_20_MACH2_B_in1 Ch 2 : data@MTS_FORCE.RN_1



Lowest Mean Load -
Crack Has Reached Free End



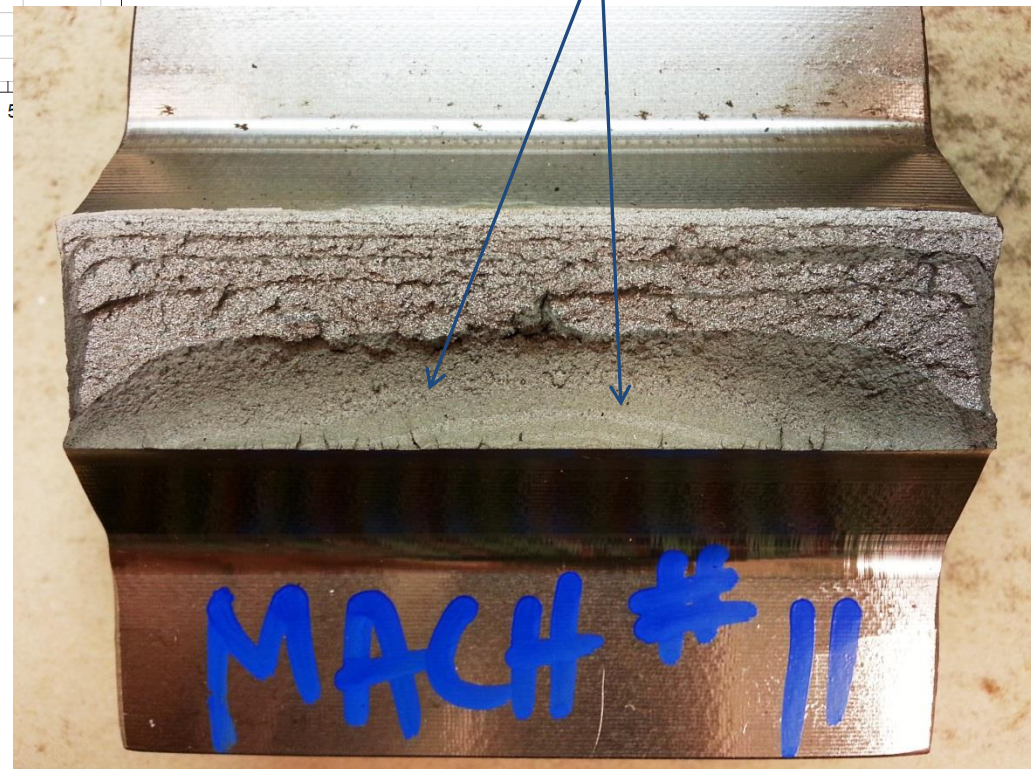
24 kN, VA, Block Loading, R= 0.1 (5k cycles) / R= 0.5 (40k cycles)



5,000 Cycles
24 kN, R= 0.1

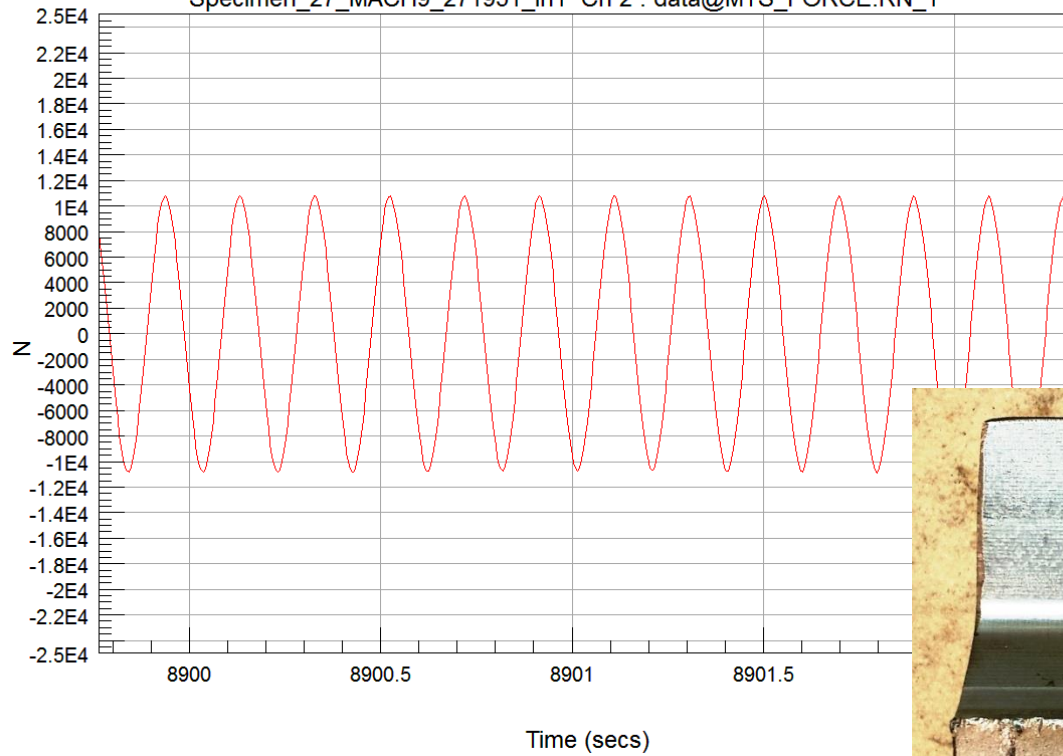
40,000 Cycles
24 kN, R= 0.5

Marker Bands



10.8 kN, R= -1

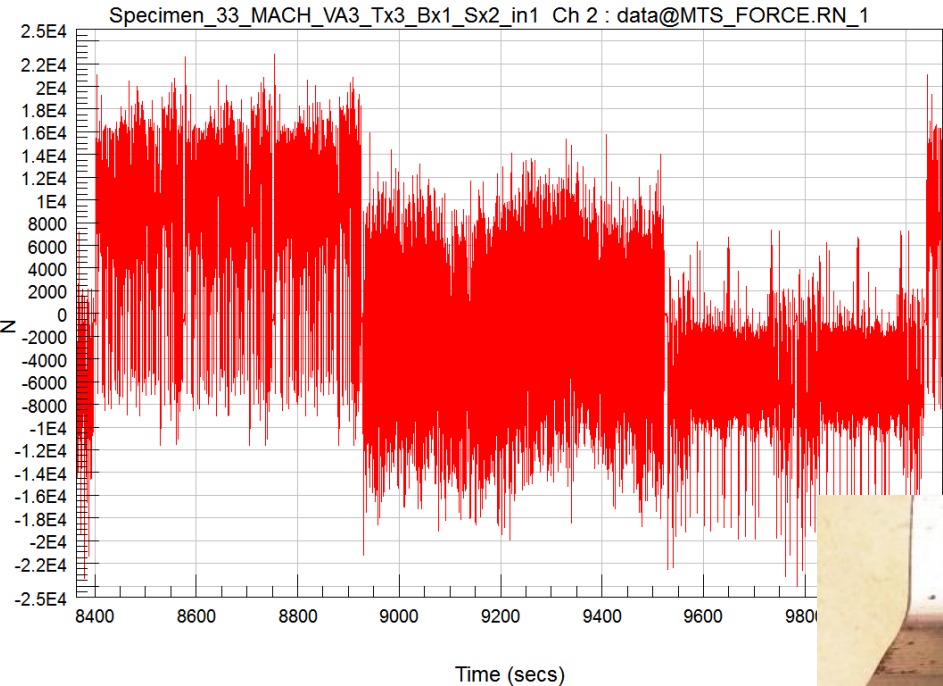
Specimen_27_MACH9_271951_in1 Ch 2 : data@MTS_FORCE.RN_1



Marker Bands



24 kN Max / 24 kN Min, VA, Time History Profile (Trans x3, Brkt x1, Susp x2)



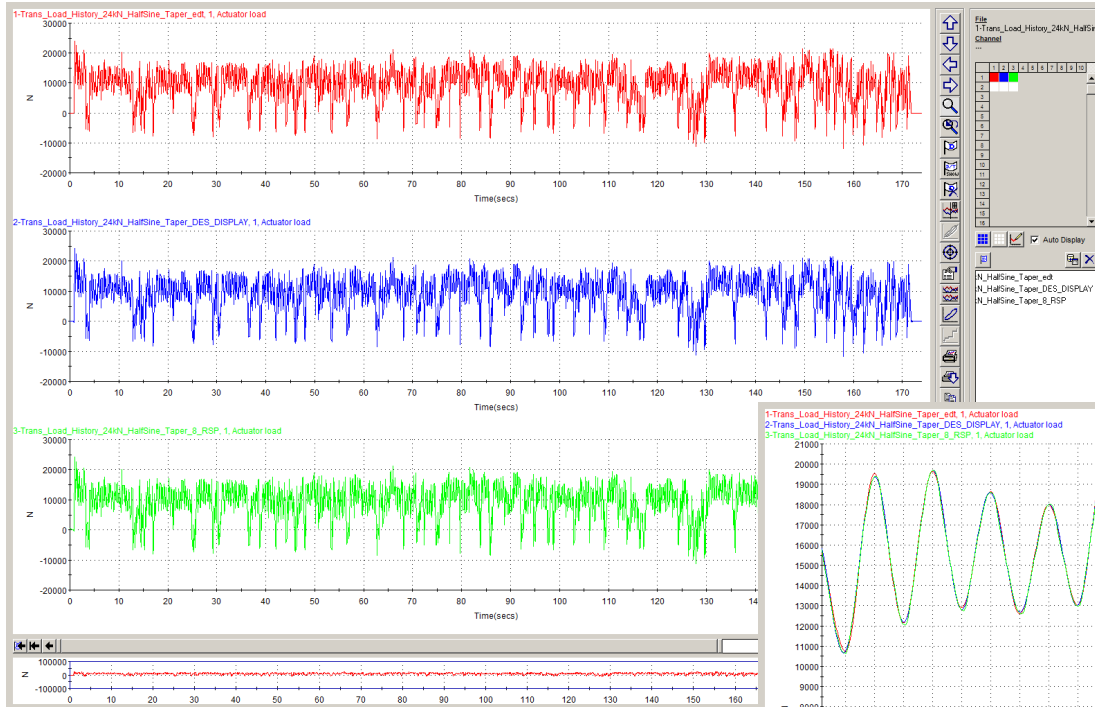
Side of First Cycle In Compression

Marker Bands

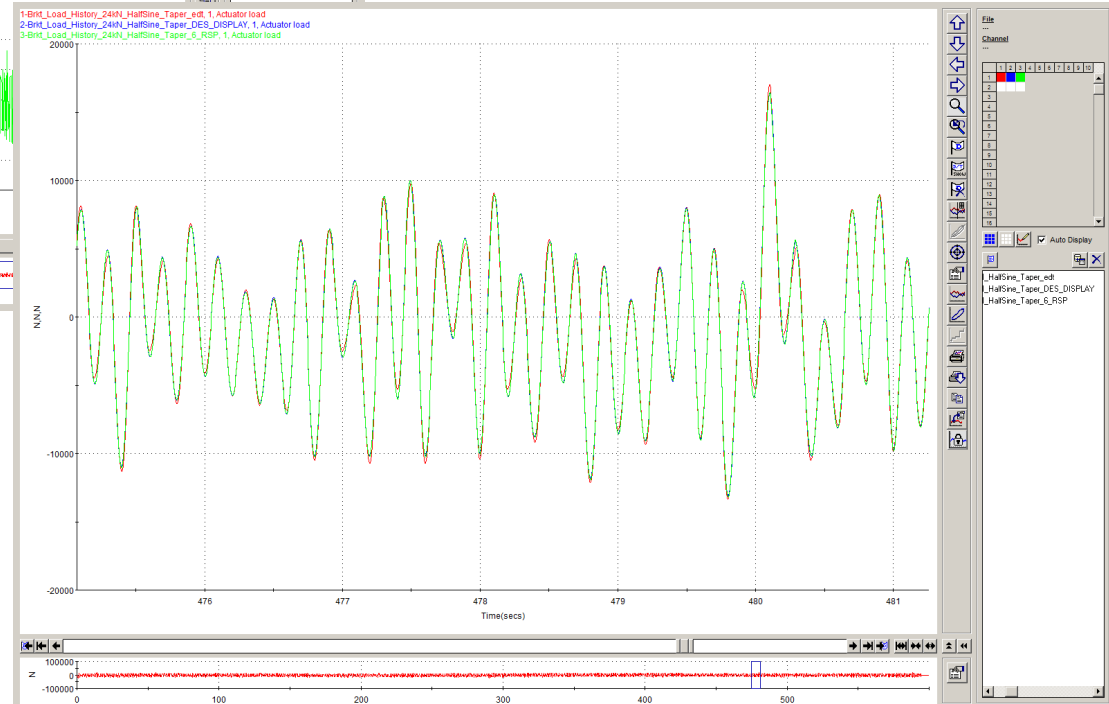
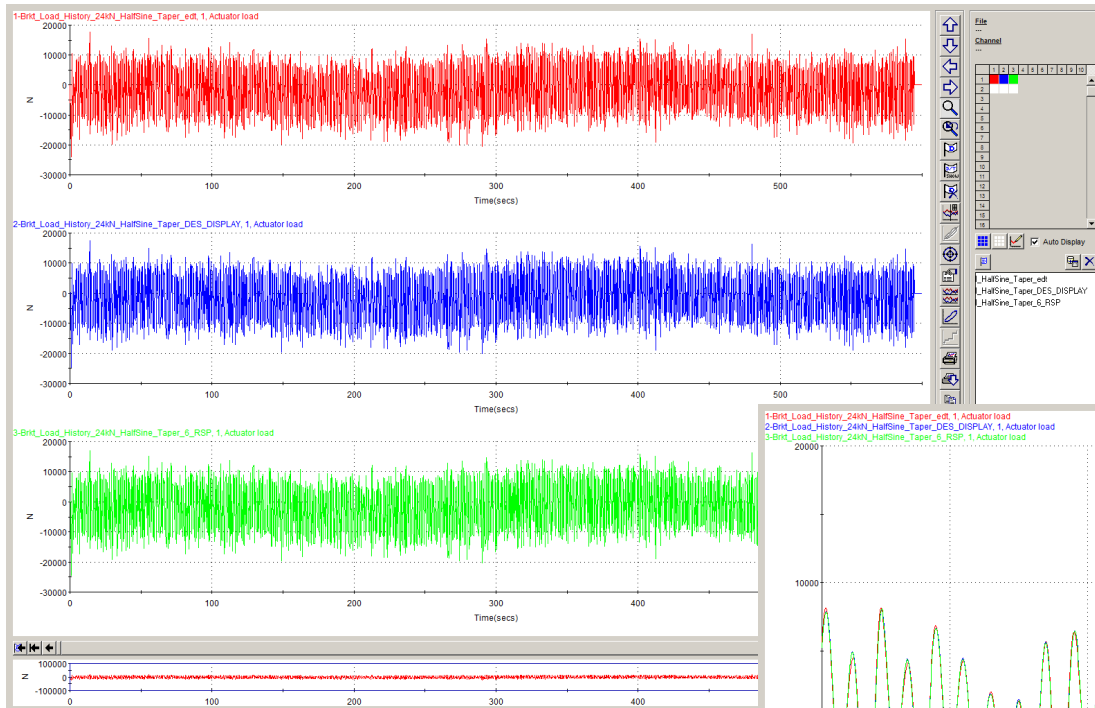
Side of First Cycle In Tension



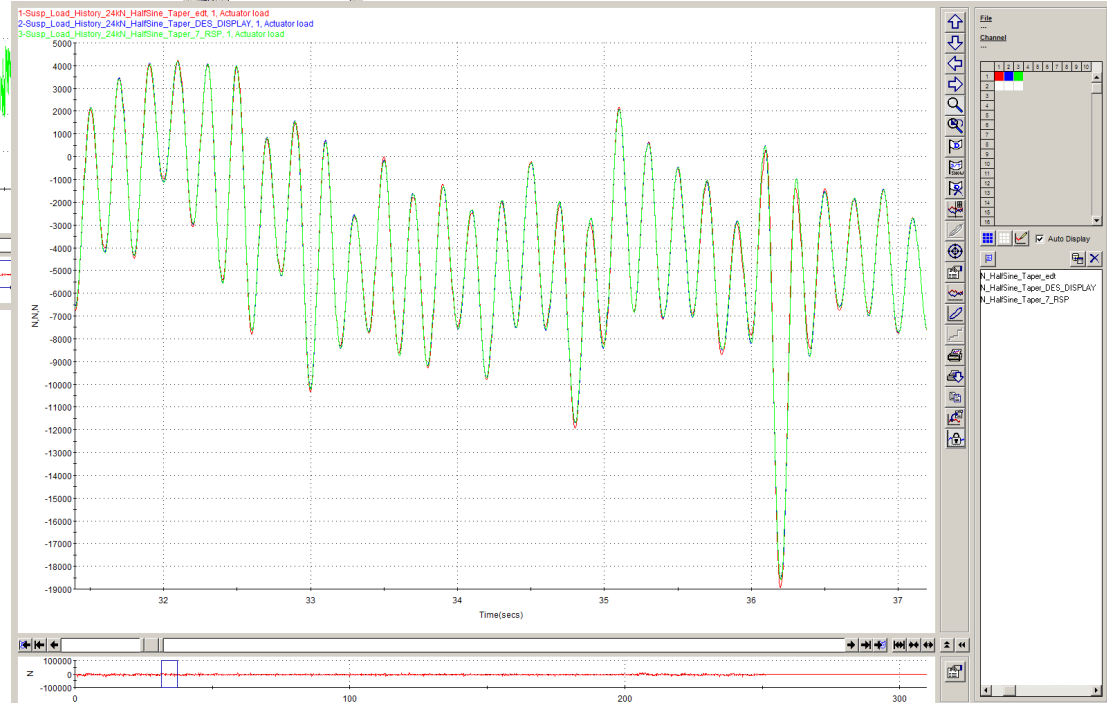
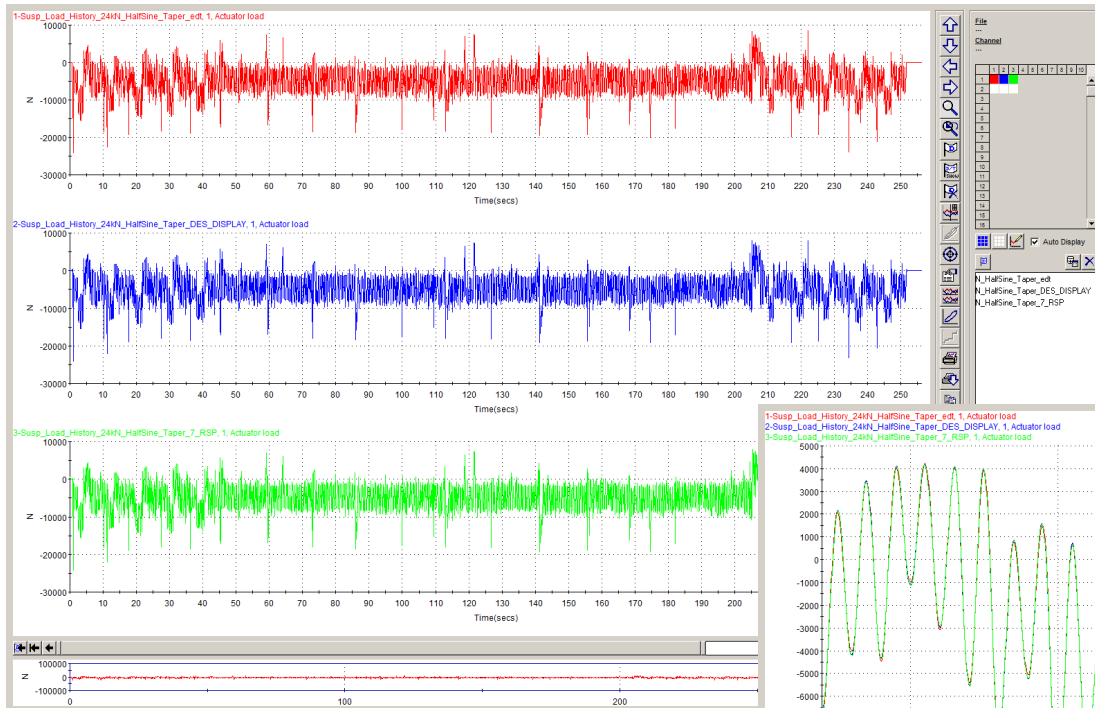
RPC Iterations – Transmission Time History



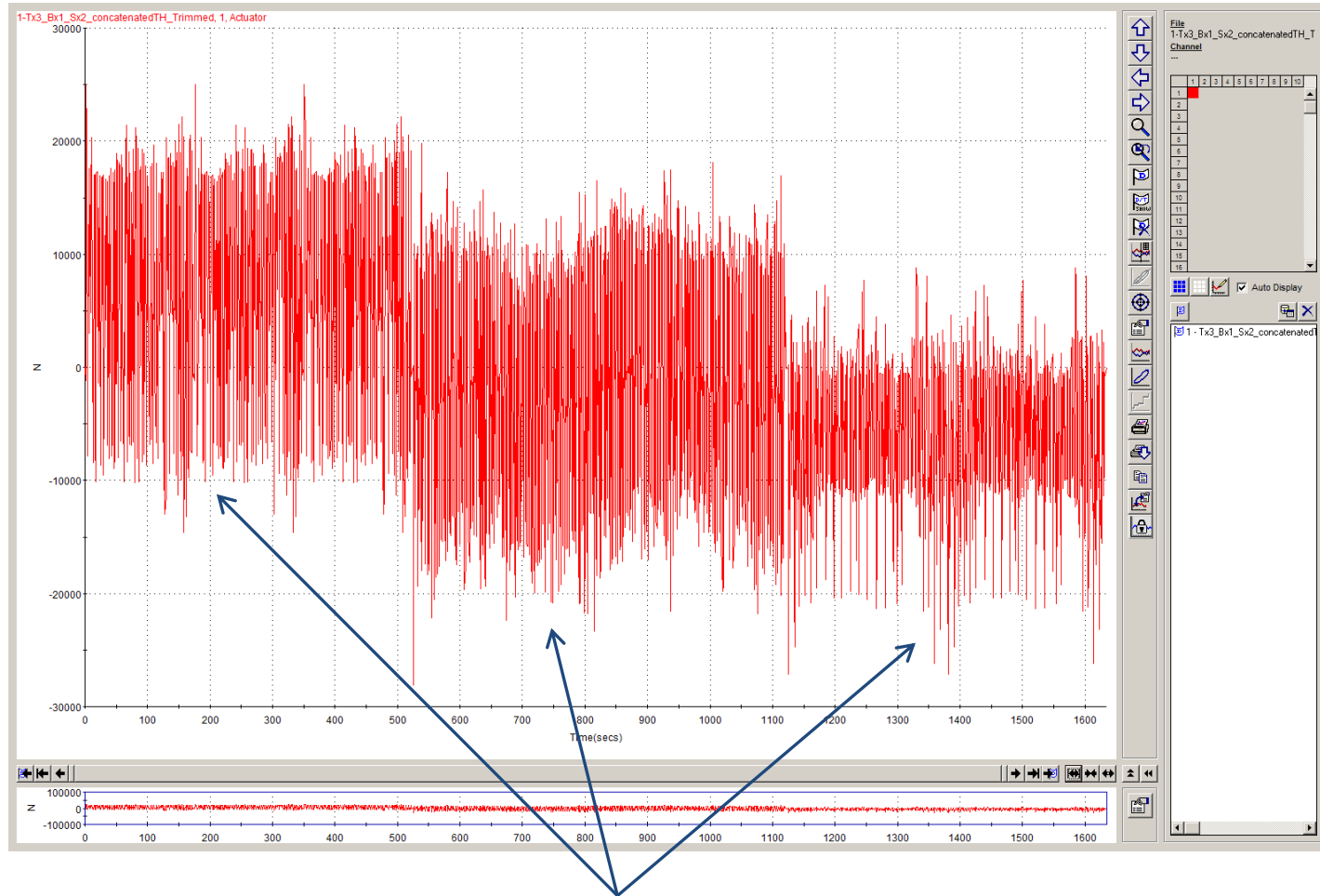
RPC Iterations – Bracket Time History



RPC Iterations – Suspension Time History

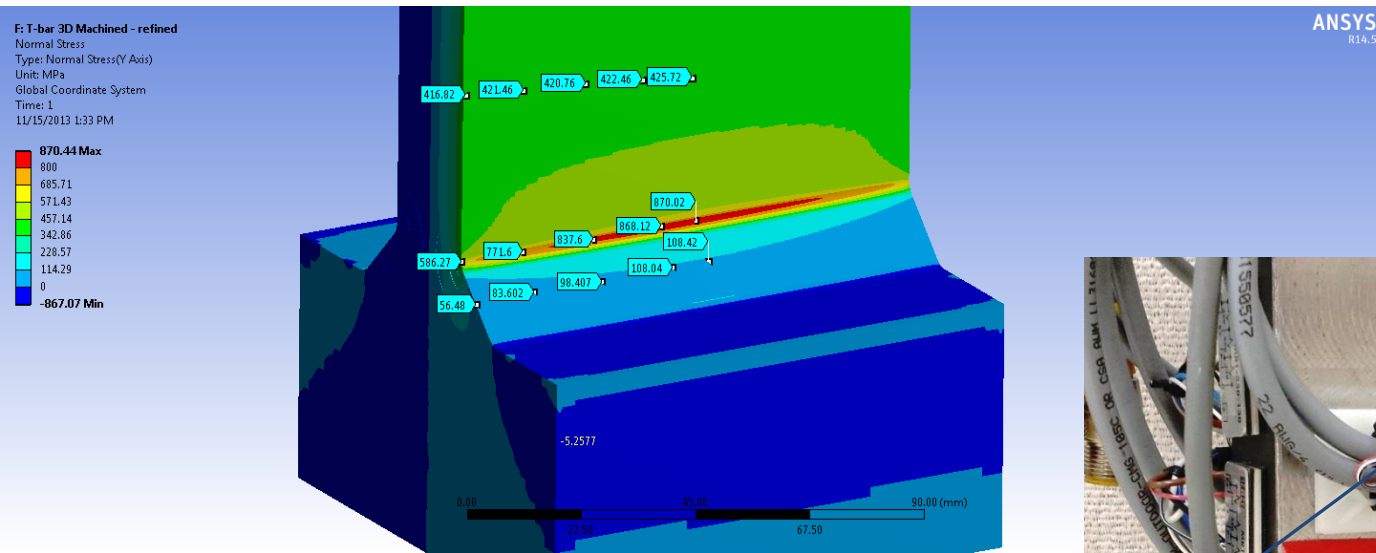


RPC Iterations – Final Drive



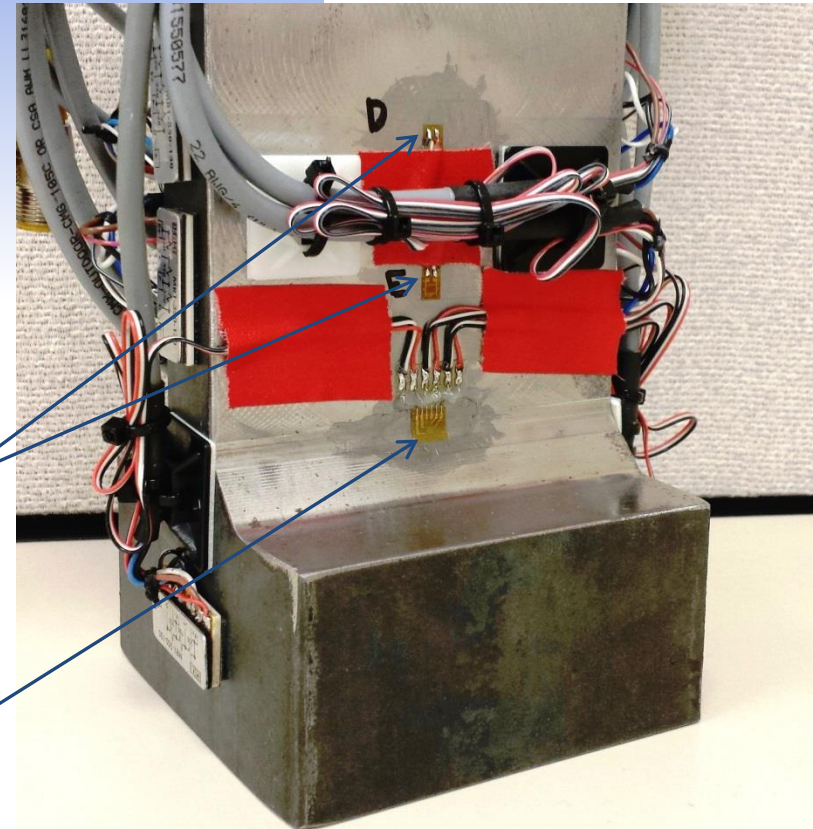
Complete Drive File –
3 Repeats of Transmission, 1 Repeat of Bracket, 2 Repeats of Suspension

Recently Completed - Test Strain Gaged T-Bar Specimen & Compare to FEA 3D Model



Single Strain Gages To
Measure Stress Gradient
(Same Location Front & Back)

0-45-90 Strain Gage Rosette
Installed Near Max Stress



Questions?