

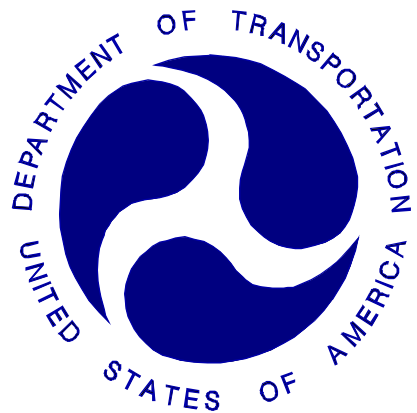
REPORT NUMBER: TWG-CAL-13-08

NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

General Motors LLC
2013 Chevrolet Traverse
Four Door SUV

NHTSA NUMBER: MD0117TWG2
CALSPAN TEST NUMBER: CT2013-08

PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
BUFFALO, NEW YORK 14225



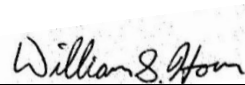
May 3, 2013

FINAL REPORT

Alpha Technology Associate, Inc.
2810 Old Lee Highway, Suite 120
Fairfax, VA 22031

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-12-D-00260, Alpha Technology PO 4GC158. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

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9. Performing Organization Name and Address Calspan Corporation Transportation Sciences Center P.O. Box 400 Buffalo, New York 14225				10. Work Unit No.		
				11. Contract or Grant No. DTNH22-12-D-00260		
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15. Supplementary Notes						
16. Abstract This side impact Out-Of-Position test was performed in conjunction with a New Car Assessment Program (NCAP). This test was conducted at the Calspan Test Facility in Buffalo, New York, on May 2, 2013.						
Injury Summary						
HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
8.858	N/A	N/A	0.178	0.842	0.069	0.004
17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position			18. Distribution Statement <u>Copies of this report are available from:</u> Alpha Technology Associate, Inc 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031 Phone: (703) 876-0010 Fax: (703) 876-0120 Attn: Mai Lan Aram			
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SECTION 1

PURPOSE AND SUMMARY OF TEST:

1.1 PURPOSE

The purpose of this test was to obtain data from a static out-of-position side impact using a vehicle that had undergone a New Car Assessment Program (NCAP) sponsored test requested by the National Highway Traffic Safety Administration (NHTSA). This test was performed under NHTSA contract No. DTNH22-12-D-00260 and through Alpha Technology Associate, Inc. PO 4GC158.

1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2013 Chevrolet Traverse four door SUV on an out-of-position Hybrid III 3 Year Old anthropomorphic test device (ATD) was evaluated. The test was performed by Calspan on May 2, 2013. Pre-and post-test photographs of the vehicle and ATD can be found in Appendix A.

Three high-speed digital cameras were used to document the side airbag deployment event. Images were recorded at rates of 1000 frames per second. One camera was placed perpendicular to the right-front seat centerline to capture the deployment event from the side. The second camera was placed parallel to the right-front seat centerline to capture the deployment event from the front. The third camera was placed $\frac{3}{4}$ to the front to also capture the deployment event.

The Hybrid III 3 Year Old anthropomorphic test device (ATD) was placed in the front center of the vehicle, kneeling and facing rearward with its left arm on the passenger seat and its right arm on the driver's seat according to the modified ATD placement instructions specified by Alpha Technology Associate, Inc. who referenced the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG). This specific test was a modified version of procedure 3.3.3.2. (per customer request). The modified aspect being the location of the ATD in the center of the vehicle as opposed to the conventional outboard edge as specified in procedure 3.3.3.2.

The Hybrid III 3 Year Old ATD was instrumented with head x, y and z accelerometers (primary). In addition, six upper axial neck forces, and moment load cell sensors and six lower axial neck force and moment load cell sensors were utilized.

Seventeen channels of data were recorded using an on-board data acquisition system. Appendix A contains photographs. Appendix B contains ATD response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The Hybrid III 3-Year-Old ATD was placed on the center console of the vehicle between the driver and passenger seats, kneeling and facing rearward. The ATD's legs were positioned parallel to the seats centerlines. The ATD's left arm was placed on the passenger seat and its right arm on the driver's seat in a position attempting to simulate a child talking to persons in the rear of the vehicle. The Driver and Passenger seat backs were adjusted to the manufacturers design angle with the ATD positioned in a natural upright position whilst remaining as close as possible to the driver seat to maximize contact between ATD and the airbag. This orientation is a modified version of section 3.3.3.2 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

SECTION 2

DATA SHEET NO. 1 TEST SUMMARY

TEST CONFIGURATION INFORMATION:

Seating Position:	PX	On Front Center Console
Test:	3.3.3.x	Rearward Facing Hybrid III 3-Year-Old Child Dummy on Front Center Console
Airbag:	Seat	Seat mounted – inside seam
Booster Block:	N/A	N/A
ATD Type/Serial No.:	139	HIIL 3 Year Old Child Dummy

Number of Data Channels:	17	
Number of Cameras:	0	<u>Real Time</u>
	3	<u>High Speed Digital</u>
	0	<u>High Speed Film</u>

PRE-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	None
Upper Torso Contact:	None
Lower Torso Contact:	None
Left Knee Contact:	Center Console
Right Knee Contact:	Center Console

POST-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Dashboard/Steering wheel
Upper Torso Contact:	Dashboard/Steering wheel
Lower Torso Contact:	None
Left Knee Contact:	Center Console
Right Knee Contact:	Center Console

DATA SHEET NO. 2
VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2013 Chevrolet Traverse Four Door SUV

NHTSA No. : MD0117TWG2 VIN: 1GNKVGKD9DJ105954 Color: Charcoal gray

Engine Data: V6 cylinders; - CID; 3.6 Liters; - cc

Placement: - Longitudinal or In-Line; Transverse Transverse or Lateral

Transmission Data: 6 speeds; - Manual; X Automatic; X Overdrive

Final Drive: - Rear Wheel Drive; - Front Wheel Drive; X Four Wheel Drive

Safety Belt Features – Driver X Pretensioner (Shoulder); X Load Limiter; X Adj. Anchorage

Safety Belt Features - Passenger - Pretensioner (Shoulder); - Load Limiter; - Adj. Anchorage

Major Options: X A/C; X Pwr.Strg.; X Pwr. Brakes

X Pwr. Windows; X Pwr. Door Locks; X Tilt Wheel

Date Received: 11/26/2012; Odometer Reading 244.6 Km

Selling Dealer: Elm Chevrolet Company, Inc.

& Address: 301 E Church St, Elmira, NY 14901

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: General Motors LLC

Date of Manufacture 10/12

GVWR: 2,930 kg; GAWR: 1,450 kg FRONT; 1,600 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P255/65R18

*Recommended Cold Tire Pressure: 240 kpa Front 240 kpa Rear

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P255/65R18; Manufacturer: Goodyear

Tire Pressure with Maximum Capacity Vehicle Load: Front 300 kPa Rear: 300 kPa

Treadwear: 540; Traction: A; Temperature: B

VEHICLE CAPACITY DATA:

Type of Front Seats: - Bench; X Bucket; - Split Bench

Number of Occupants: 2 Front; 6 Rear; 8 Total

Vehicle Capacity Weight (VCW) = 692.0 Kg

No. of Occupants x 68.04 kg = 544.32 Kg

Rated Cargo/Luggage Weight (RCLW) = 136.0 Kg

*Tire pressure used for test

‡Vehicle had previously undergone a New Car Assessment Program Frontal NCAP Test.

DATA SHEET NO. 3
HIII 3YO CHILD DUMMY POSITIONING IN VEHICLE

Measurement	Value
Total Fore/Aft Travel (mm)	240
Test Distance Rearward of Full-Forward (mm)	150
Total Fore/Aft Travel (Detents)	24
Placed in Position #	15

Seat Back Angle	SA (°)	Value
Head CG to Door Panel/Side Window	HD (mm)	725
Head to Passenger Seat Back Centerline	HSC (mm)	355
Head to Driver Seat Back Centerline	HSC (mm)	350
Head to Roof, Z (top of the head)	HZ (mm)	215
Head to Header	HHD (mm)	460
Back to Dash	BD (mm)	510
Chest to Seatback	CS (mm)	170
Arm to Arm	CS (mm)	410

DATA SHEET 4

HIII 3YO CHILD DUMMY INJURY CRITERIA VALUES

NHTSA No.: MD0117TWG2

Channel	Max	Time (ms)	Min	Time (ms)
V1P2 Head x [g , CFC_1000]	6.939	10.800	-11.119	12.500
V1P2 Head y [g , CFC_1000]	14.965	16.150	-7.703	63.000
V1P2 Head z [g , CFC_1000]	6.517	26.450	-12.091	16.300
V1P2 Headform Resultant [g, CFC_1000]	19.154	16.200	0	0
V1P2 Upper Neck Moc [N-m, CFC_600]	4.251	191.100	-18.462	39.400
V1P2 Upper Neck Ntf [N-m, CFC_600]	0.178	6.850	0	0
V1P2 Upper Neck Nte [N-m, CFC_600]	0.842	38.450	0	0
V1P2 Upper Neck Ncf [N-m, CFC_600]	0.069	193.250	0	0
V1P2 Upper Neck Nce [N-m, CFC_600]	0.004	2.100	0	0
V1P2 Upper Neck Nij [Nij, CFC_600]	0.842	38.450	0	0
V1P2 Upper Neck Fx [N , CFC_1000]	99.278	60.700	-238.295	37.950
V1P2 Upper neck Fy [N , CFC_1000]	75.054	30.300	-121.937	40.550
V1P2 Upper neck Fz [N , CFC_1000]	763.005	8.350	-16.144	196.300
V1P2 Neck F Res	764.197	8.350	0	0
V1P2 Upper Neck Mx [N-m , CFC_600]	5.227	85.250	-12.703	30.500
V1P2 Upper Neck My [N-m , CFC_600]	4.251	191.100	-18.462	39.400
V1P2 Upper Neck Mz [N-m , CFC_600]	4.245	183.150	-8.057	120.750
V1P2 Neck M Res	18.521	39.350	0	0
V1P2 Lower Neck Fx F [N , CFC_1000]	97.136	26.100	-123.832	13.750
V1P2 Lower Neck Fy F [N , CFC_1000]	91.459	6.350	-132.963	15.150
V1P2 Lower Neck Fz F [N , CFC_1000]	765.165	8.300	-24.361	198.500
V1P2 Lower Neck Res	768.075	8.300	0	0
V1P2 Lower Neck Mx F [N-m , CFC_600]	5.661	80.450	-11.388	55.500
V1P2 Lower Neck My F [N-m , CFC_600]	6.972	187.250	-22.123	62.450
V1P2 Lower Neck Mz F [N-m , CFC_600]	6.028	36.500	-6.686	116.450
V1P2 Lower Neck Res	23.359	61.850	0	0
Curtain Airbag Volts	24.98	1.05	0	0
Torso/Pelvis Airbag Volts	34.85	1.30	0	0
Front Center Airbag Volts	33.62	0.85	0	0
Curtain Airbag Current	3.39	0.40	-0.01	33.80
Torso/Pelvis Airbag Current	3.38	0.4	0	3.35
Front Center Airbag Current	3.35	0.4	-0.01	48.9

DATA SHEET 4

HIII 3YO CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2013 Chevrolet Traverse Four Door SUV

NHTSA No.: MD0117TWG2

HEAD INJURY CRITERIA (HIC)

	HIC15			
	HIC(15)	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position PX – Center Console	8.858	6.150	21.150	12.834

THORAX CRITERIA

	Critical Values	Actual	Time(ms)
Maximum Deflection (mm)	N/A	N/A	N/A
Maximum Deflection Rate (m/s)	N/A	N/A	N/A

Position PX (Center Console) - Neck Injury Summary (HIII 3YO – In Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.178	6.850	373.926	19.959	0.079
Nte	0.842	38.450	344.916	-237.690	-18.339
Ncf	0.069	193.250	-14.930	-29.868	4.227
Nce	0.004	2.100	-6.097	-4.355	-0.033

Peak Tension (CFC1000) 763.005 N

Peak Compression (CFC1000) -16.144 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120 N	Extension (mCVe)	27 N-m	Tension	2070 N
Compression (CVc)	2120 N	Flexion (mCVf)	68 N-m	Compression	2520 N

Appendix A

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***Please note that the photo placards reference 3.3.3.2 however this test was a modified version and should be referenced as 3.3.3.x**



Figure A-1: Right ¾ Front View of Vehicle, As Received

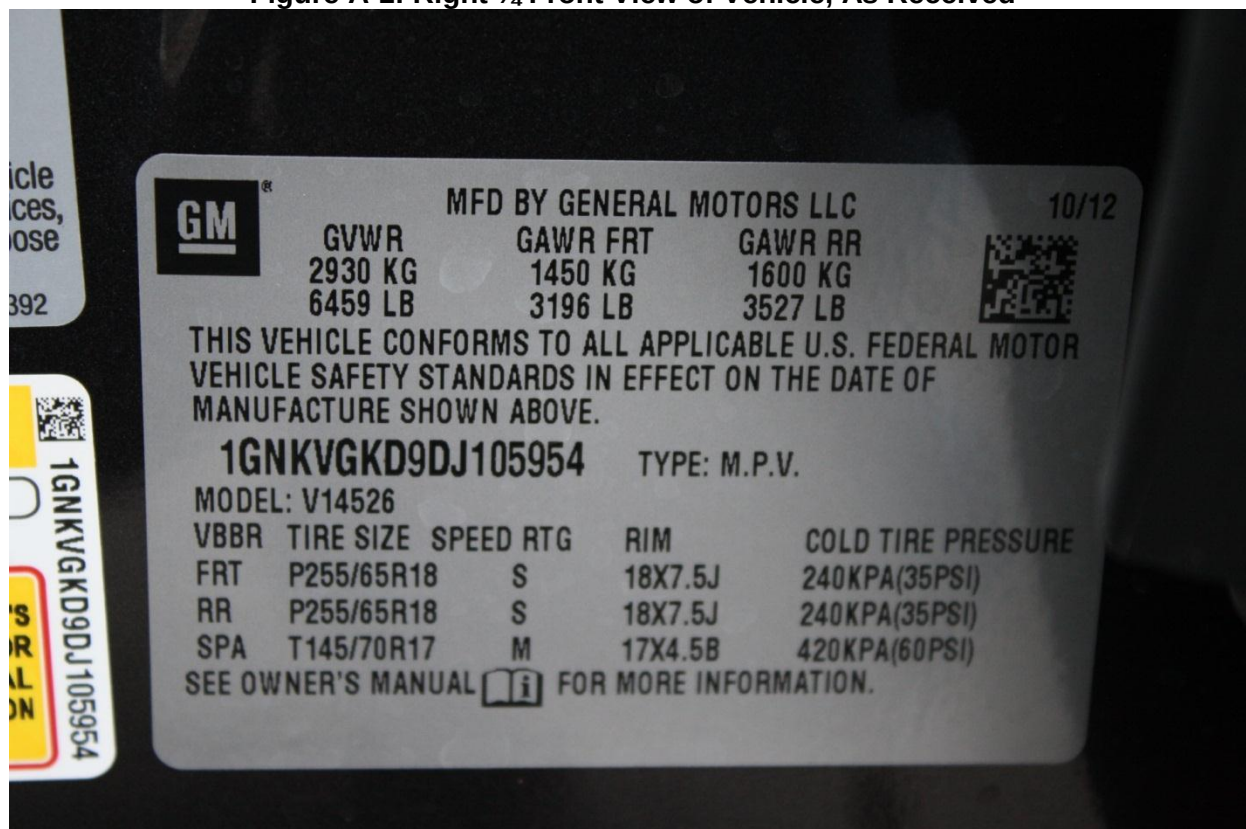


Figure A-2: Vehicle Certification Placard



Figure A-3: Pre-Test Vehicle Left Side View



Figure A-4: Post-Test Vehicle Left Side View



Figure A-5: Pre-Test HIII 3 Year Old Dummy Left Side View



Figure A-6: Post-Test HIII 3 Year Old Dummy Left Side View



Figure A-7: Pre-Test HIII 3 Year Old Dummy Left Side Close-up View



Figure A-8: Post-Test HIII 3 Year Old Dummy Left Side Close-up View



Figure A-9: Pre-Test HIII 3 Year Old Dummy Left $\frac{3}{4}$ Front View



Figure A-10: Post-Test HIII 3 Year Old Dummy Left $\frac{3}{4}$ Front View

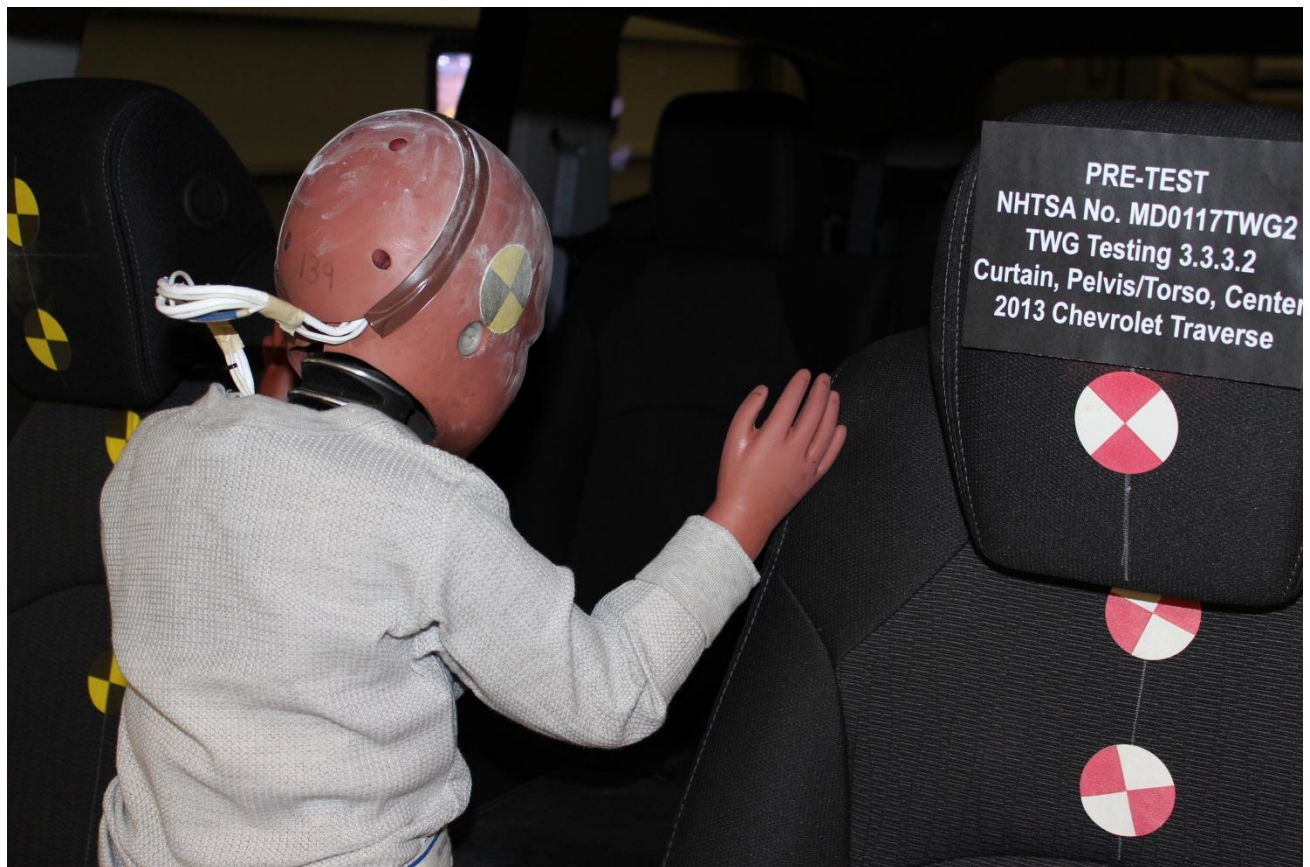


Figure A-11: Pre-Test HIII 3 Year Old Dummy Left $\frac{3}{4}$ Front Close-up View



Figure A-12: Post-Test HIII 3 Year Old Dummy Left $\frac{3}{4}$ Front Close-up View

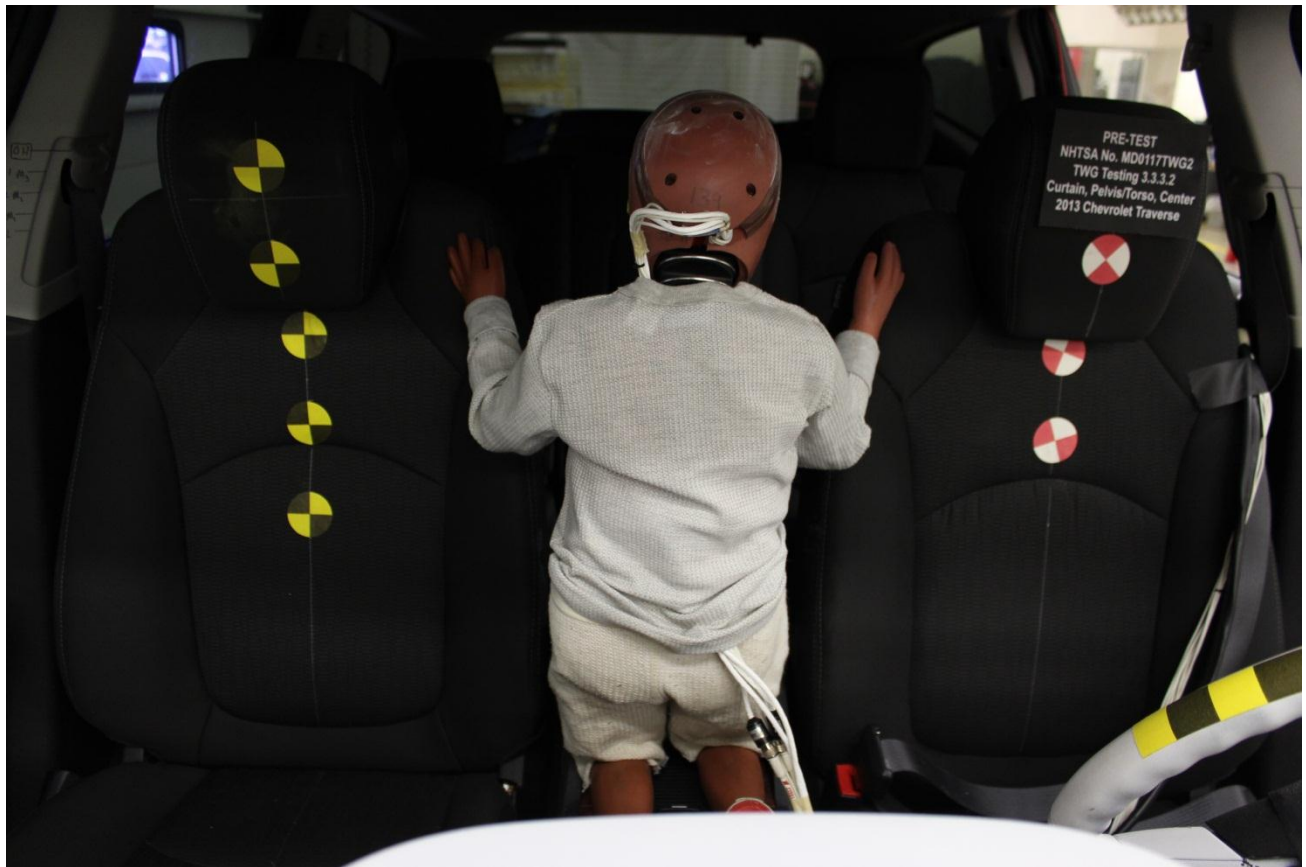


Figure A-13: Pre-Test HIII 3 Year Old Dummy Front View



Figure A-14: Post-Test HIII 3 Year Old Dummy Front View



Figure A-15: Pre-Test HIII 3 Year Old Dummy Front Close-up View



Figure A-16: Pre-Test HIII 3 Year Old Dummy Right $\frac{3}{4}$ Front View



Figure A-17: Post-Test HIII 3 Year Old Dummy Right $\frac{3}{4}$ Front View



Figure A-18: Pre-Test HIII 3 Year Old Dummy Right Side View

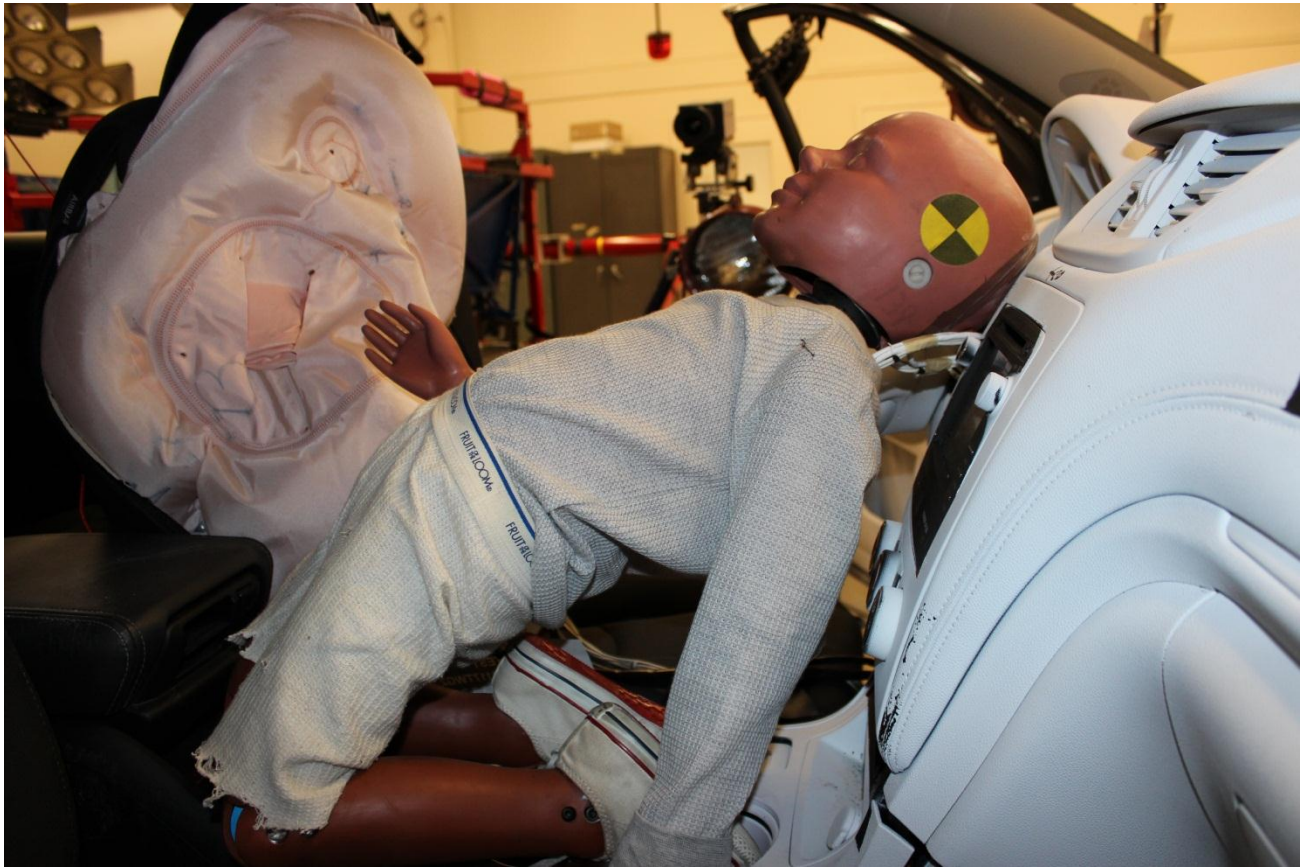


Figure A-19: Post-Test Hill 3 Year Old Dummy Right Side View



Figure A-20: Post-Test Left ¾ Front View



Figure A-21: Pre-Test HIII 3 Year Old Dummy Rear View



Figure A-22: Post-Test HIII 3 Year Old Dummy Rear View



Figure A-21: Post-Test Airbag Front View



Figure A-22: Post-Test Curtain Airbag Right Side View



Figure A-23: Post-Test Curtain Airbag Right $\frac{3}{4}$ Rear View



Figure A-24: Post-Test Center Airbag Right $\frac{3}{4}$ Front View



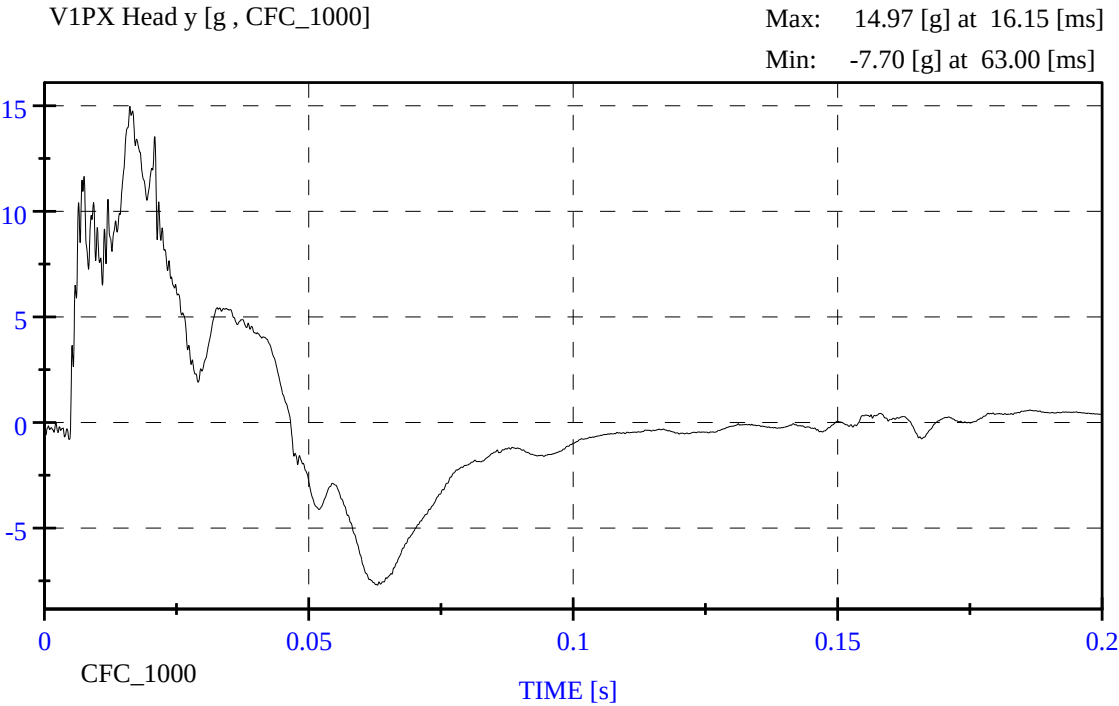
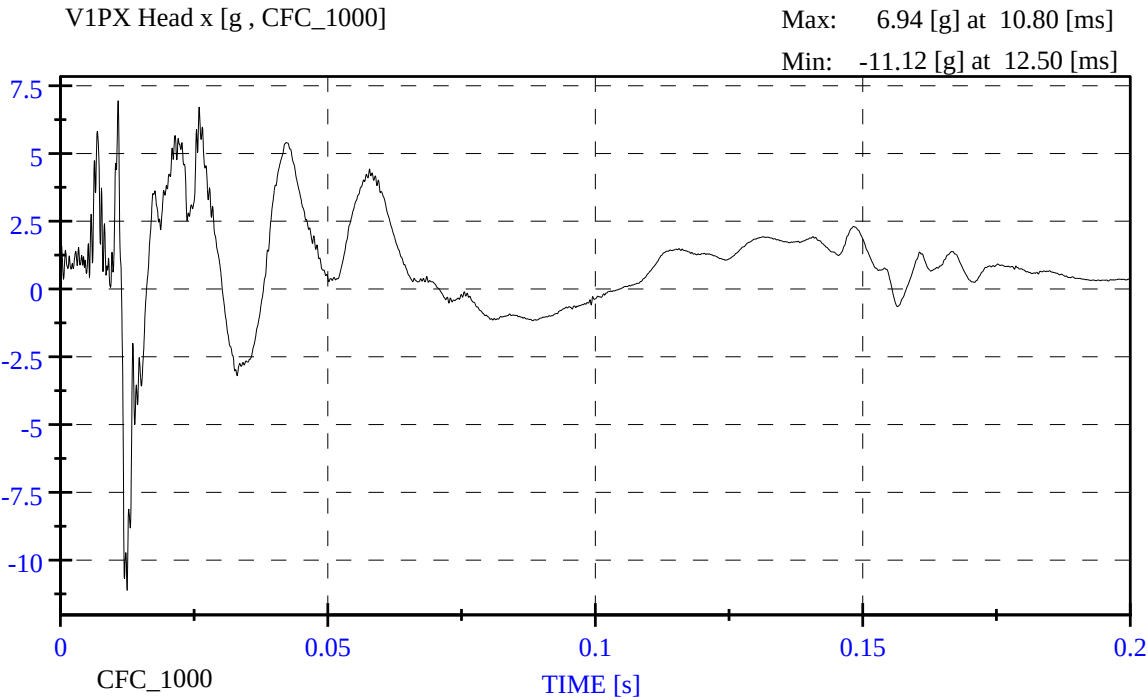
Figure A-25: Post NCAP Left Side View

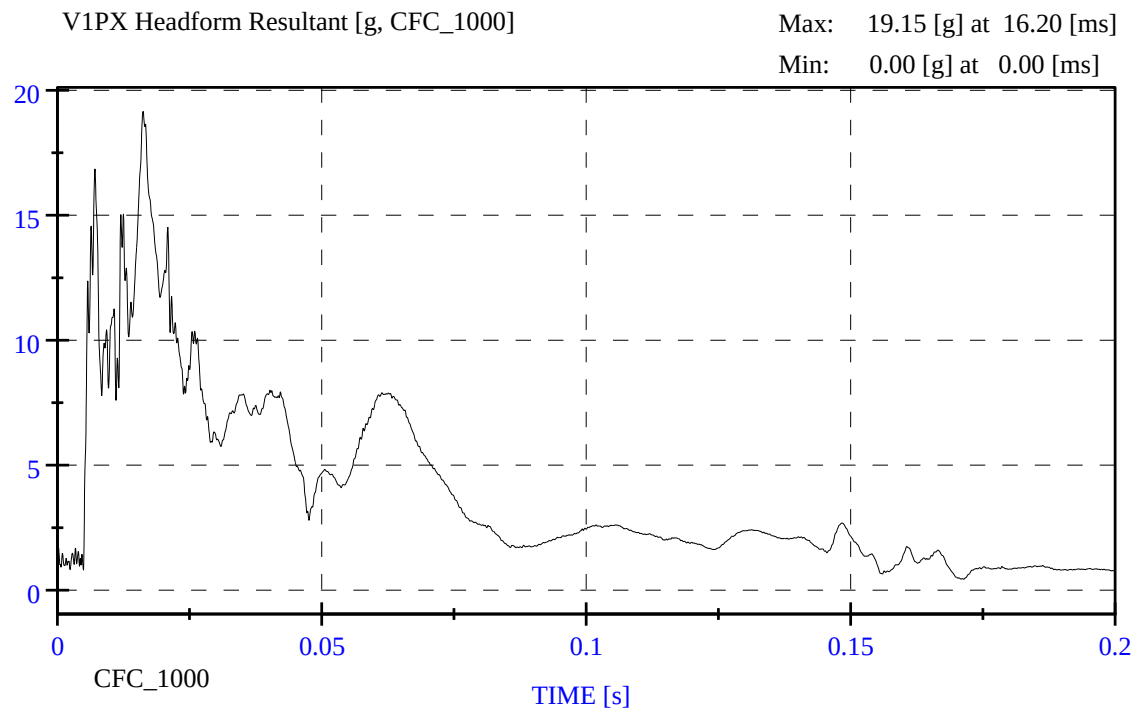
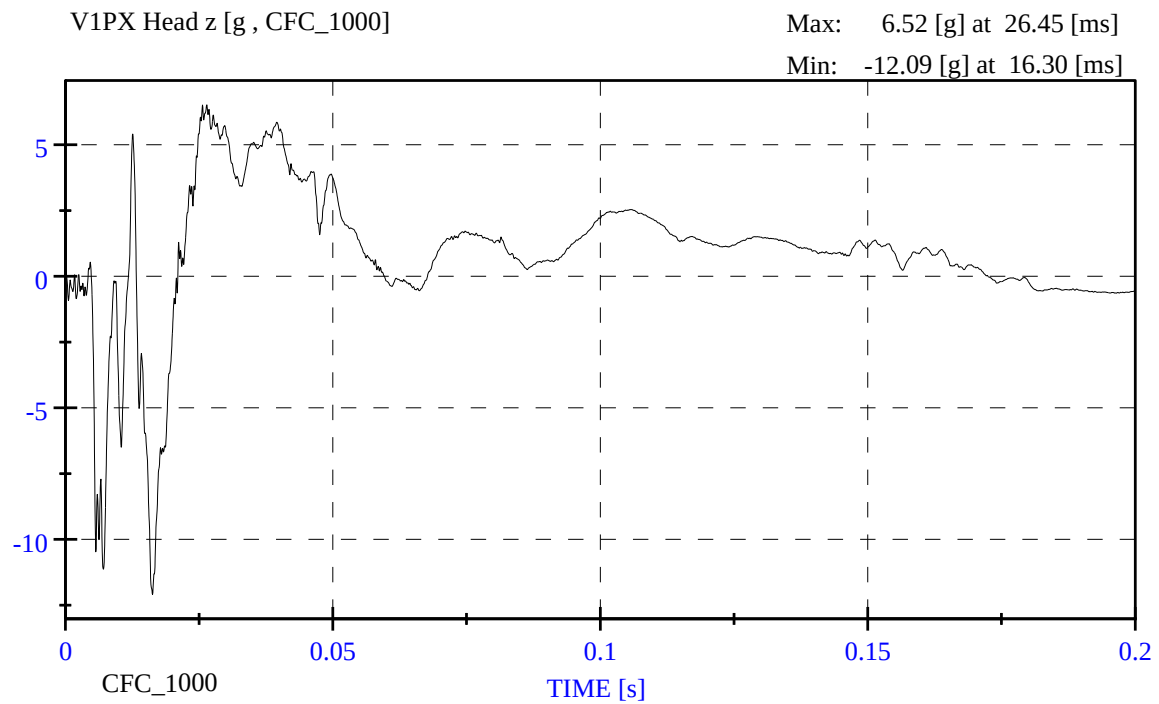
Appendix B

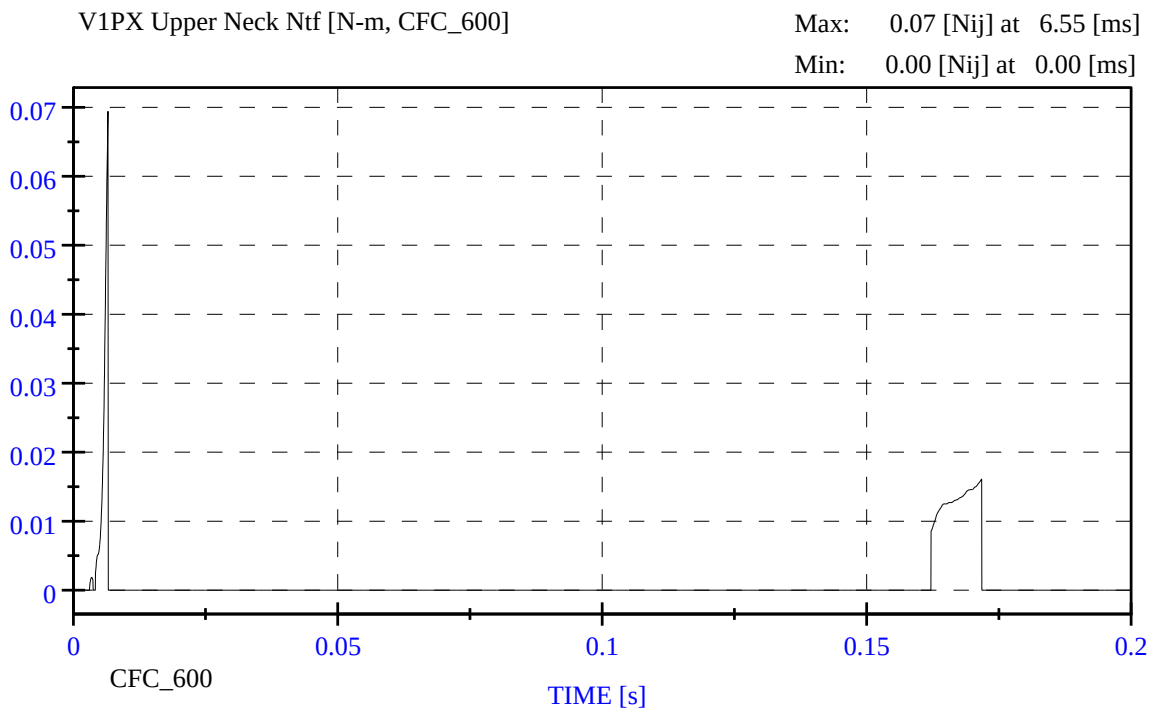
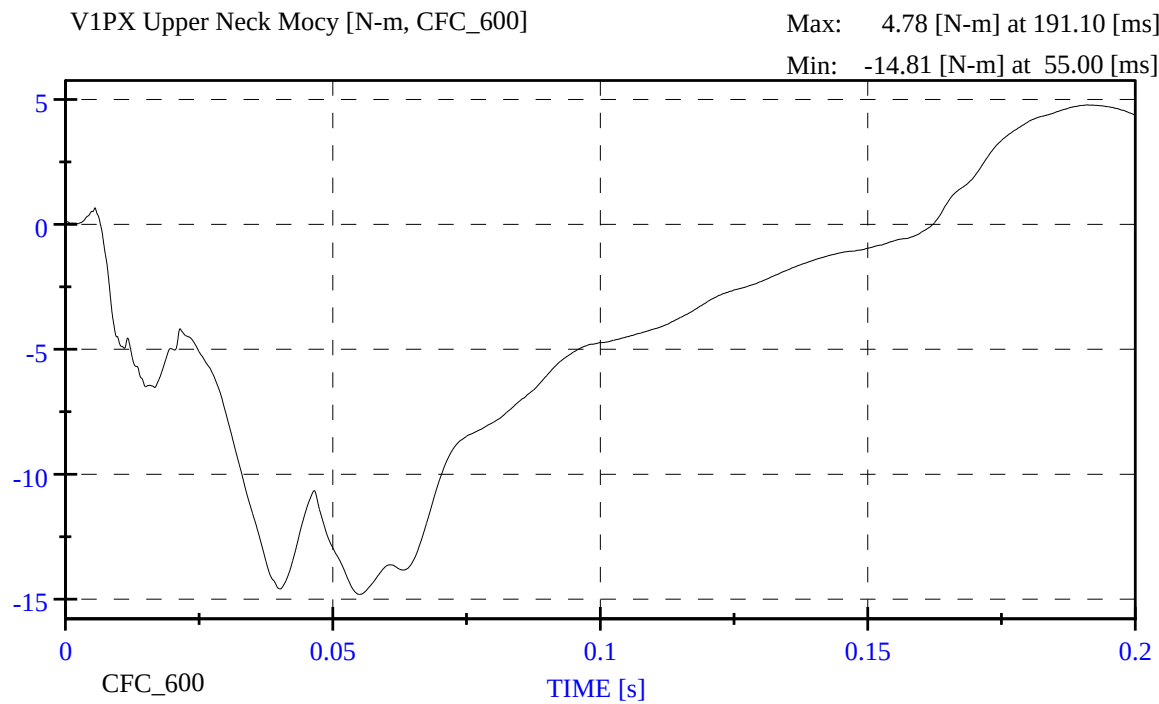
Vehicle and Dummy Plots

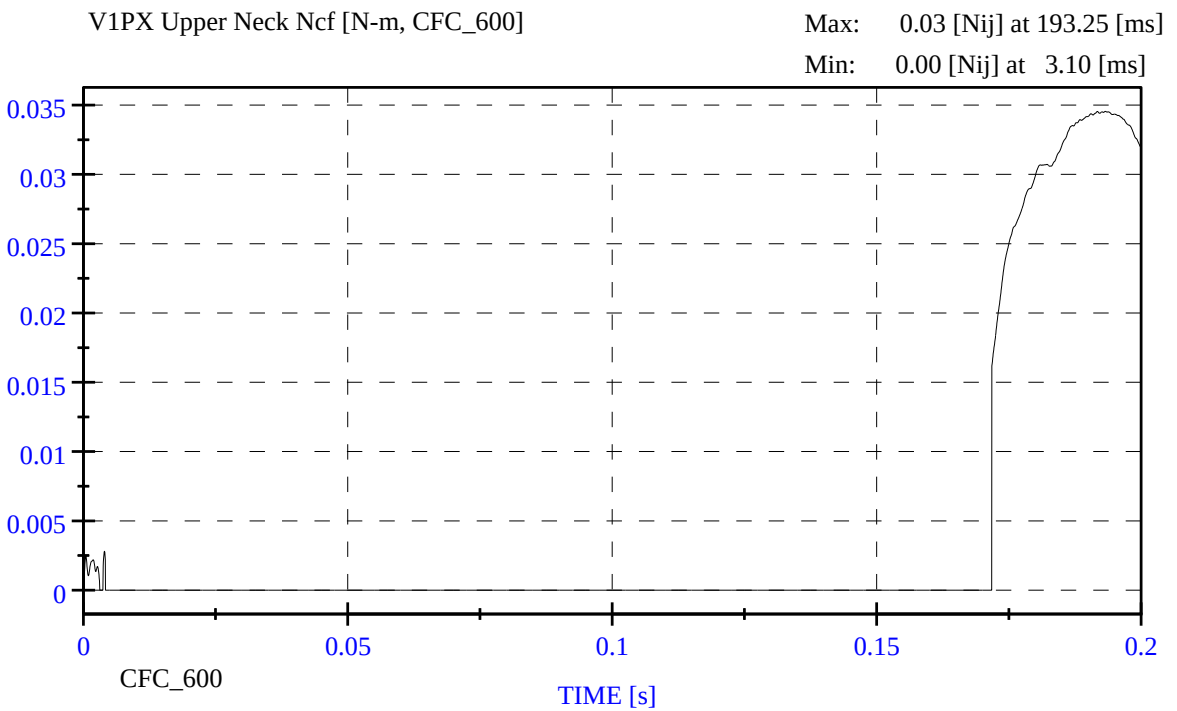
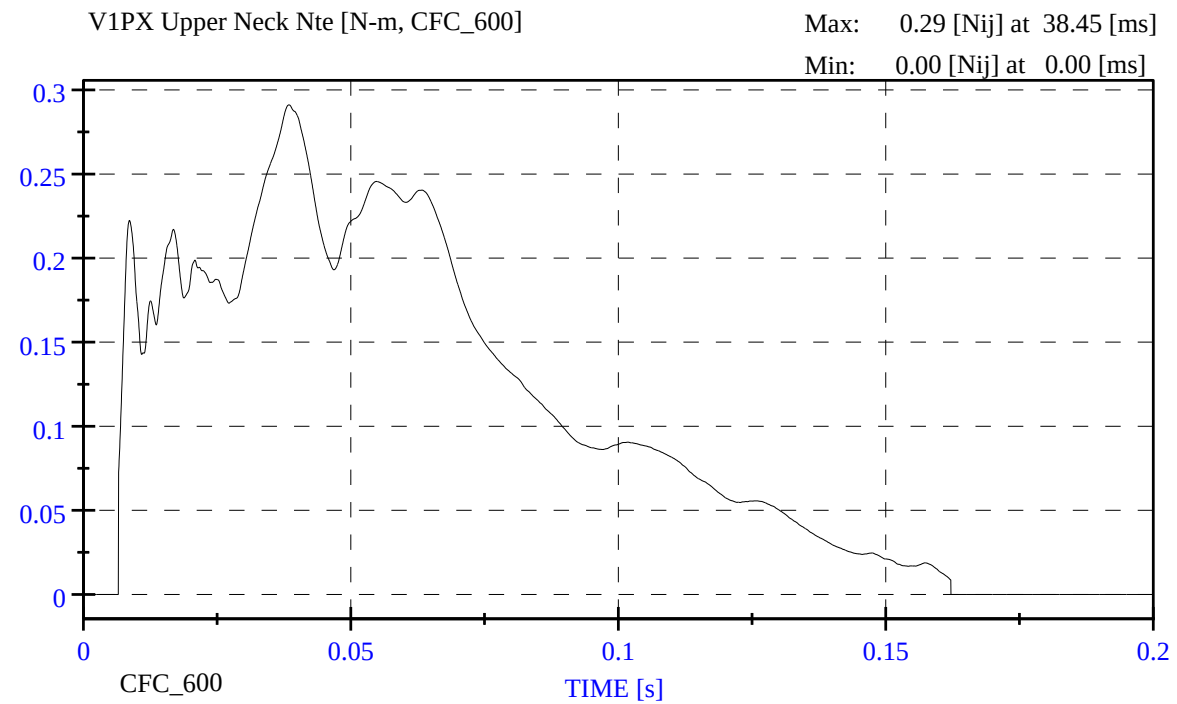
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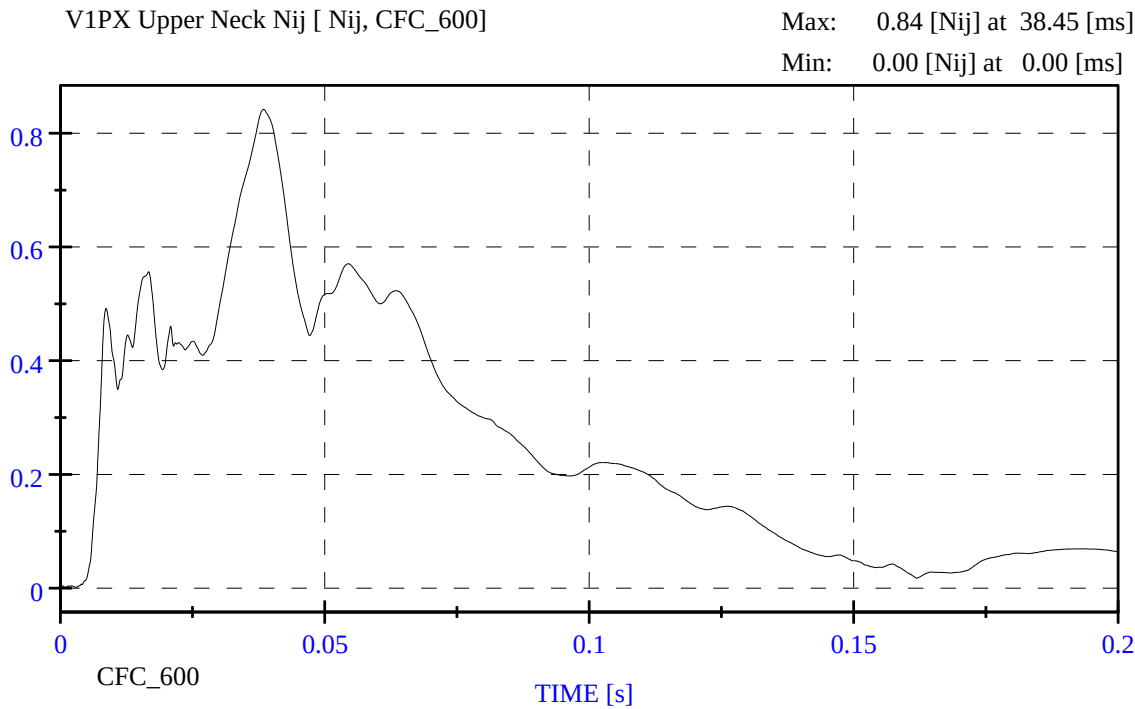
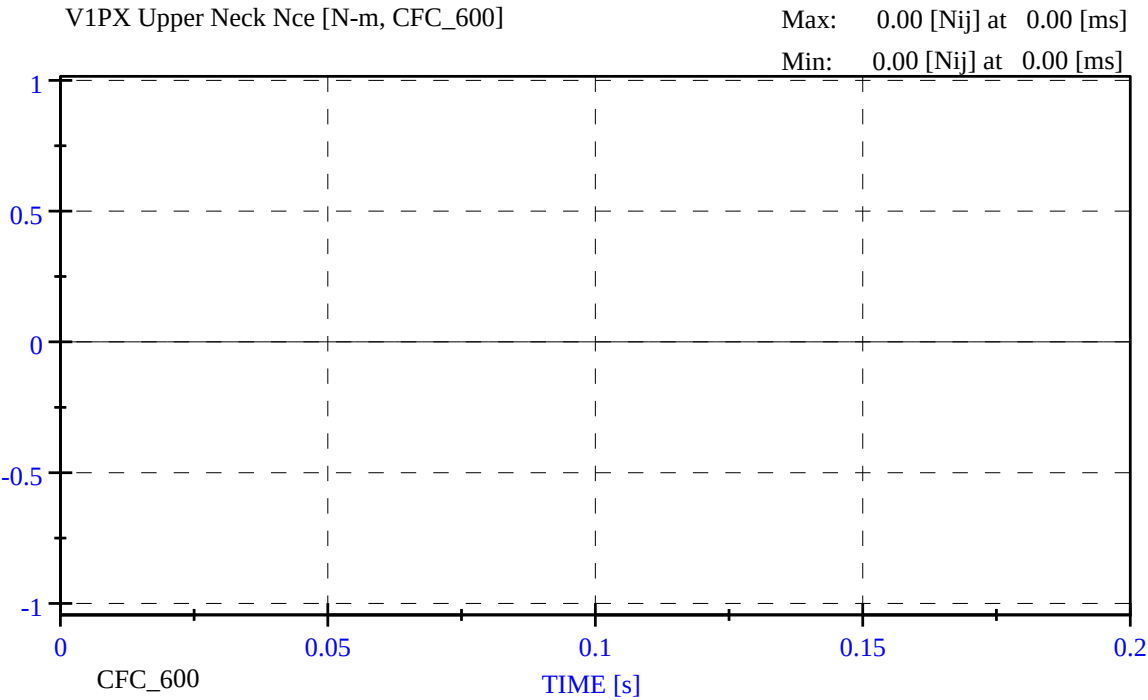
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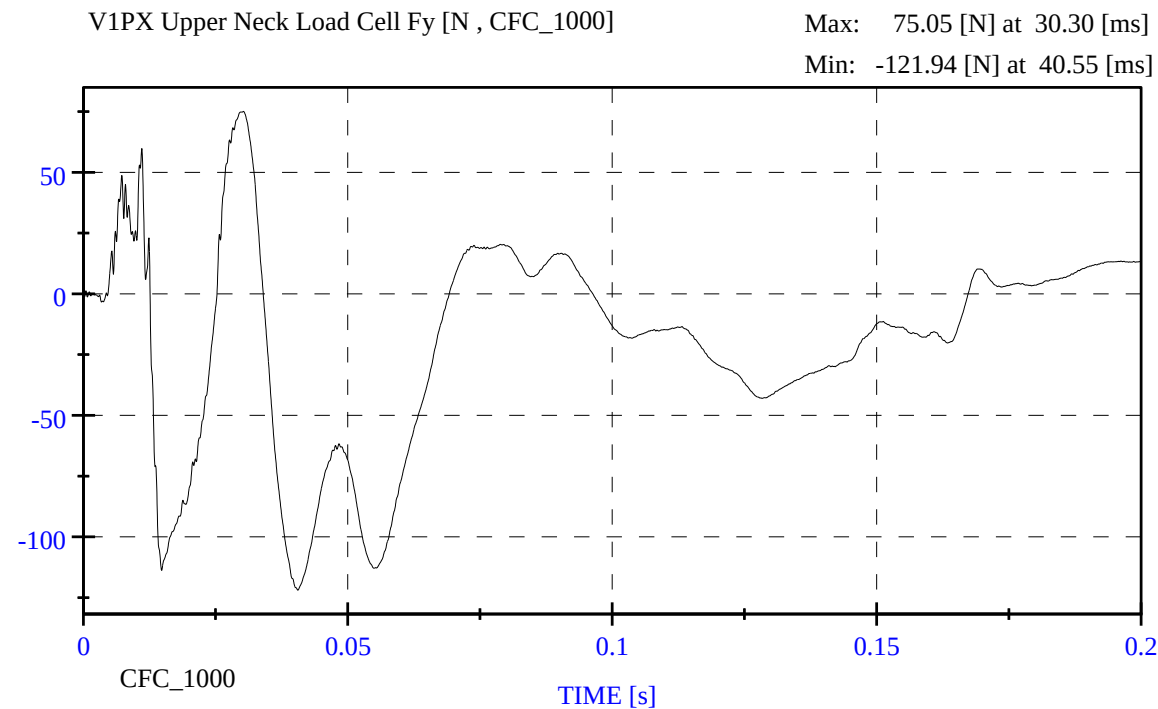
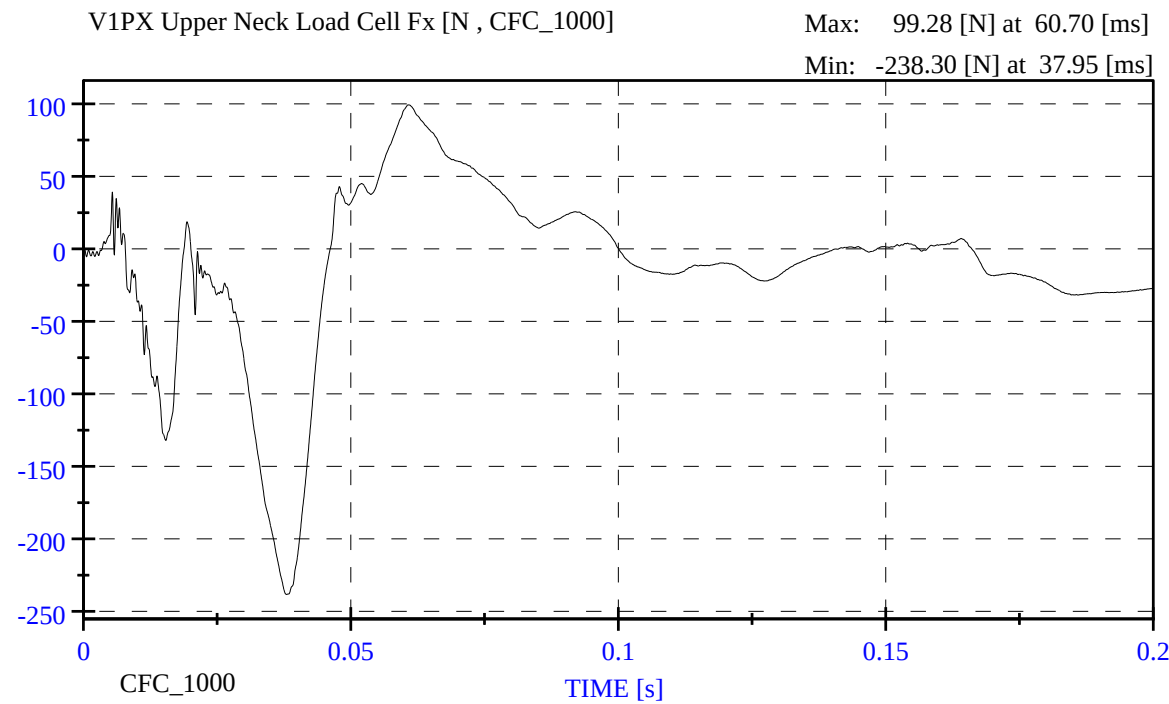


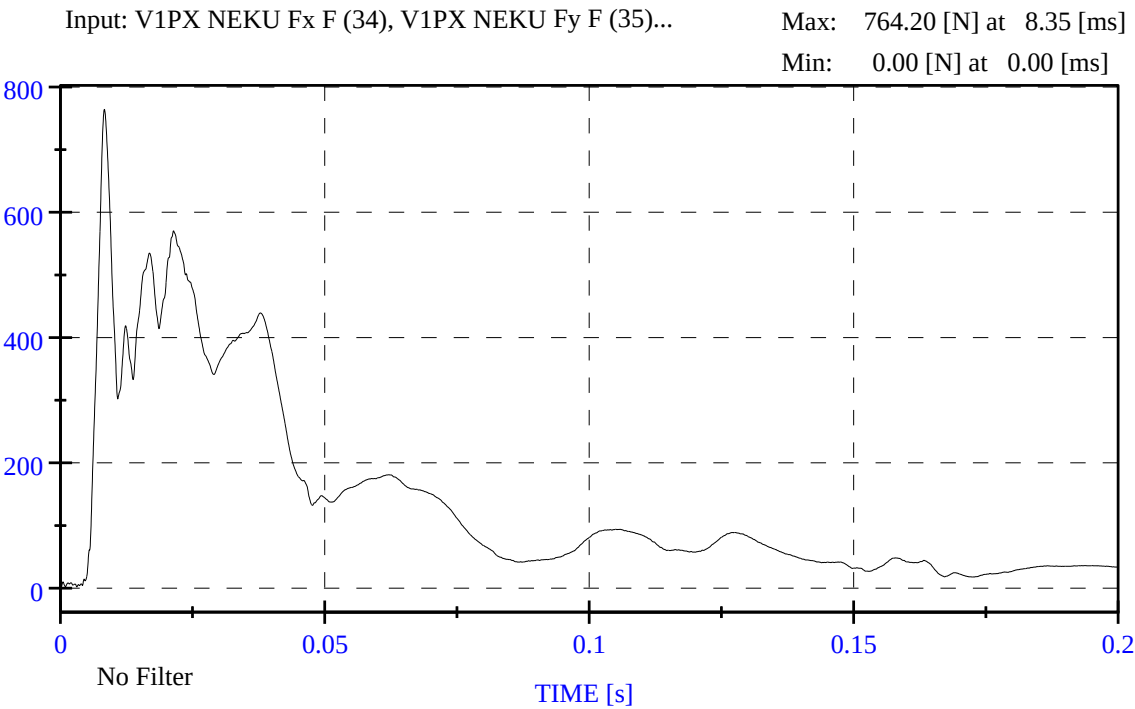
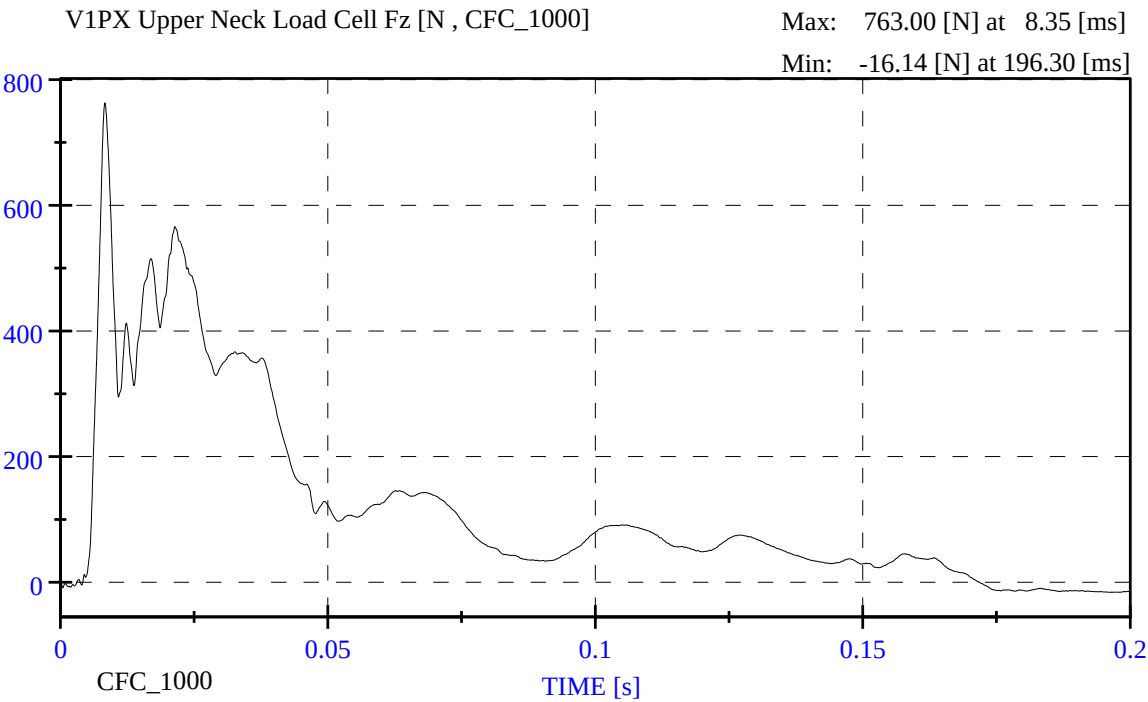


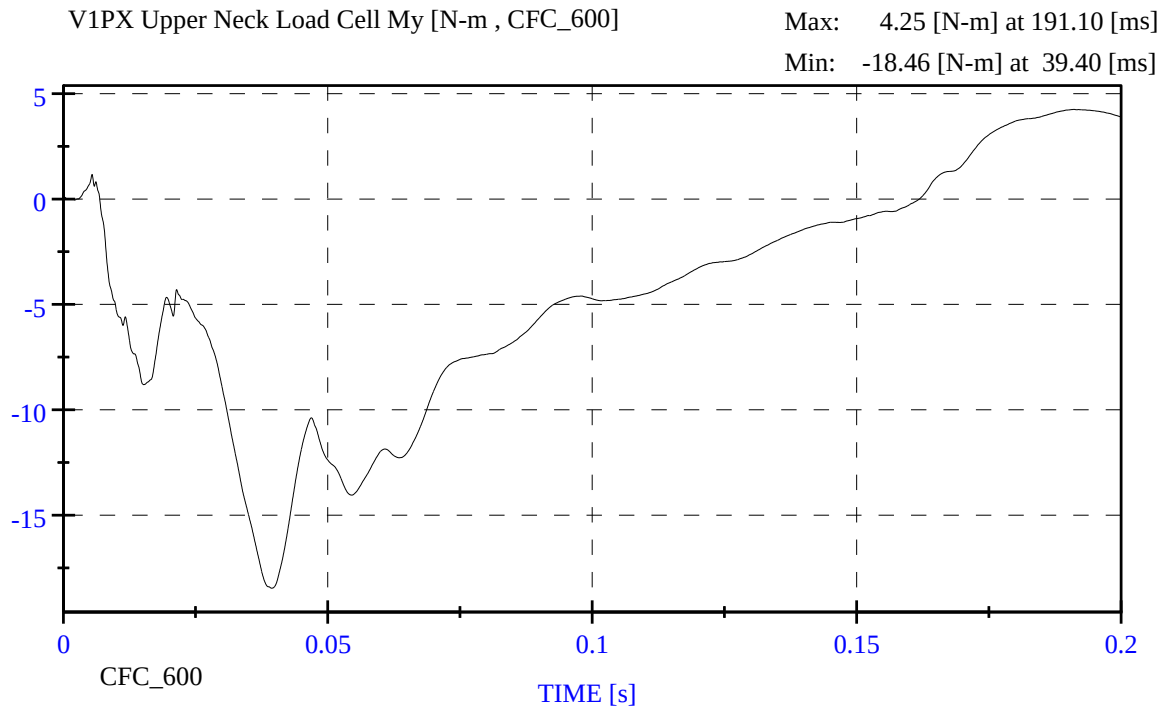
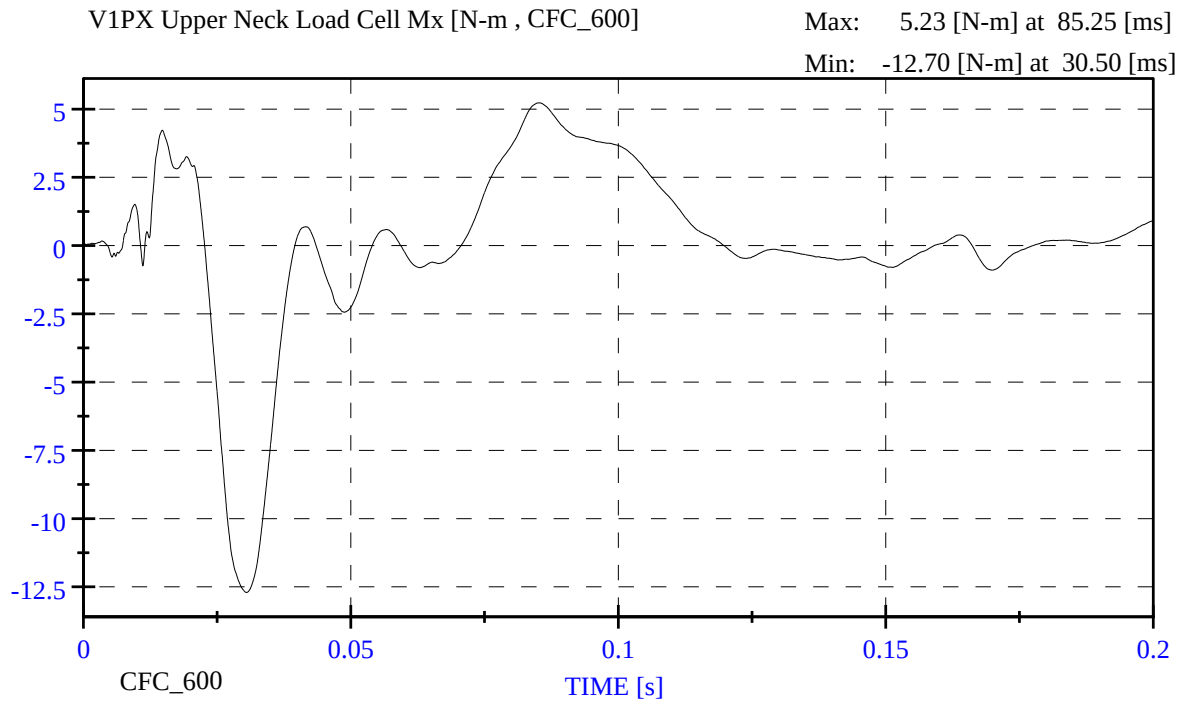


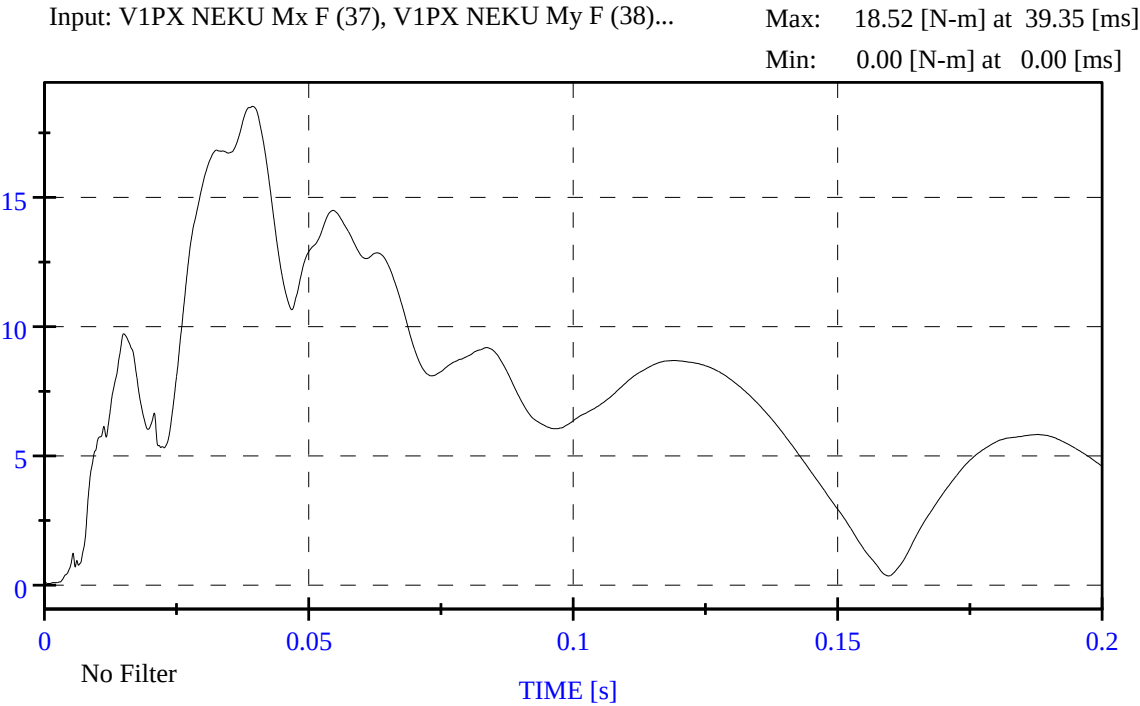
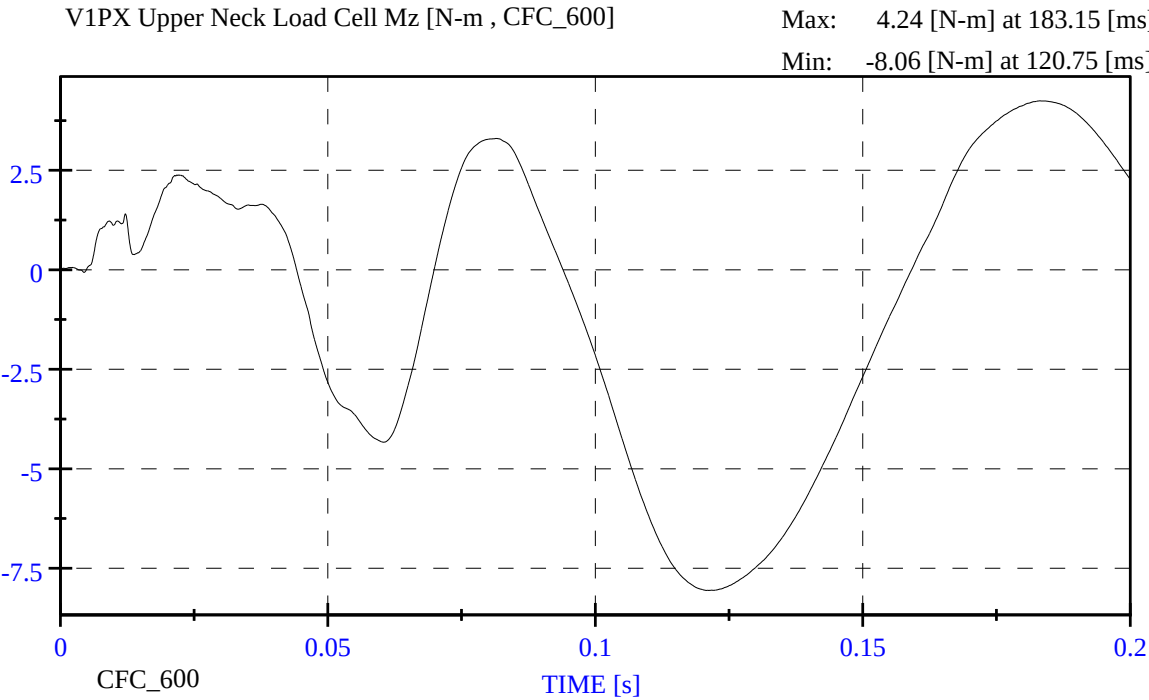


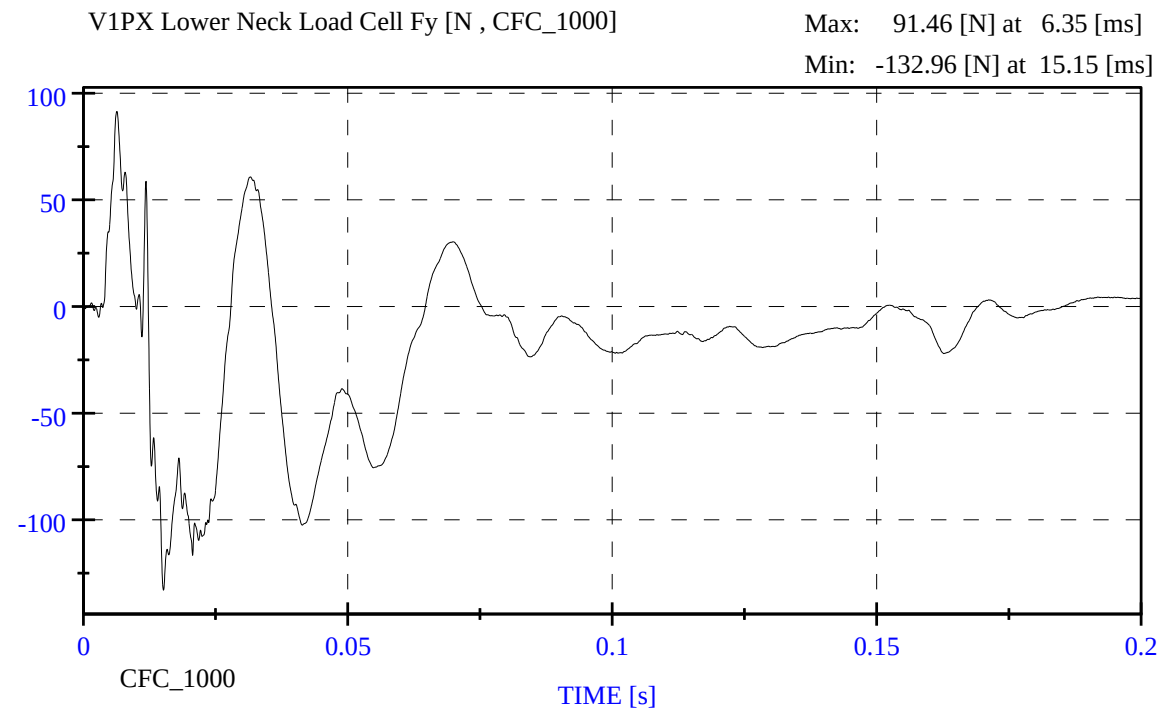
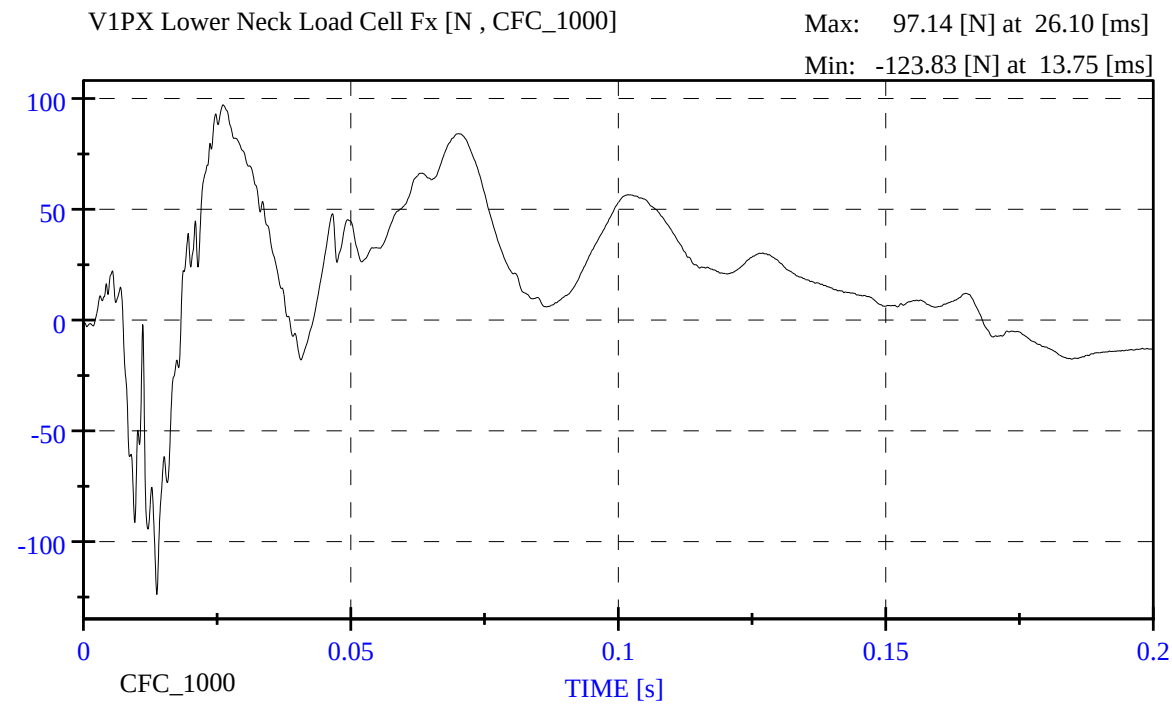


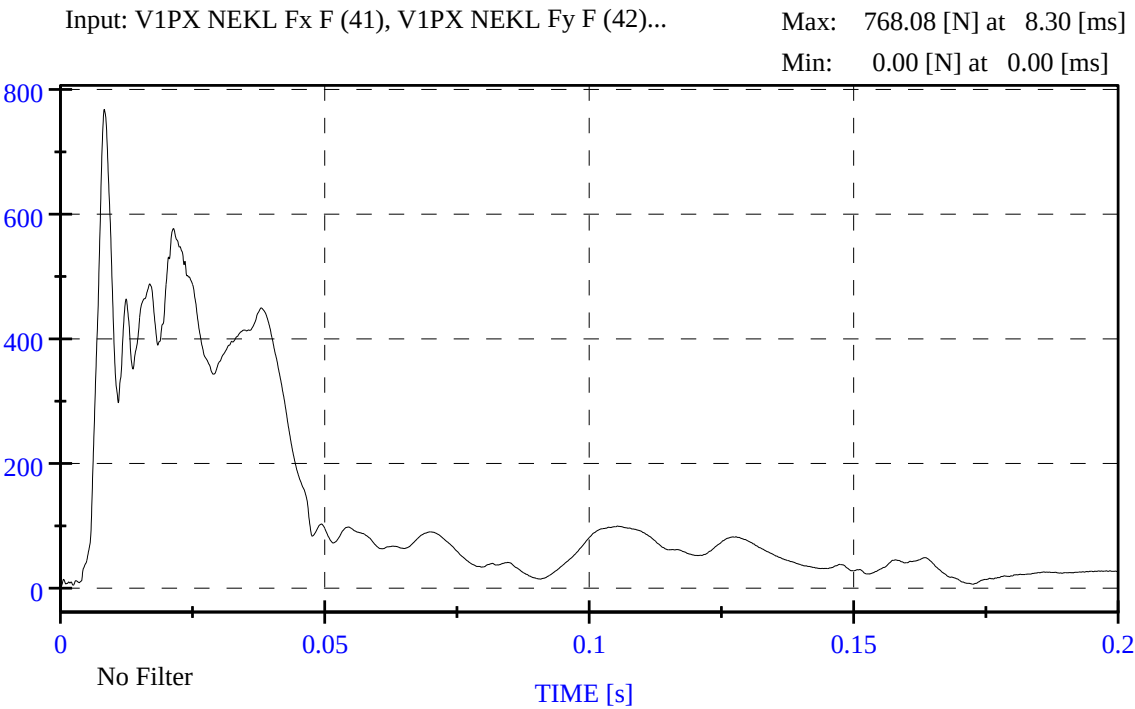
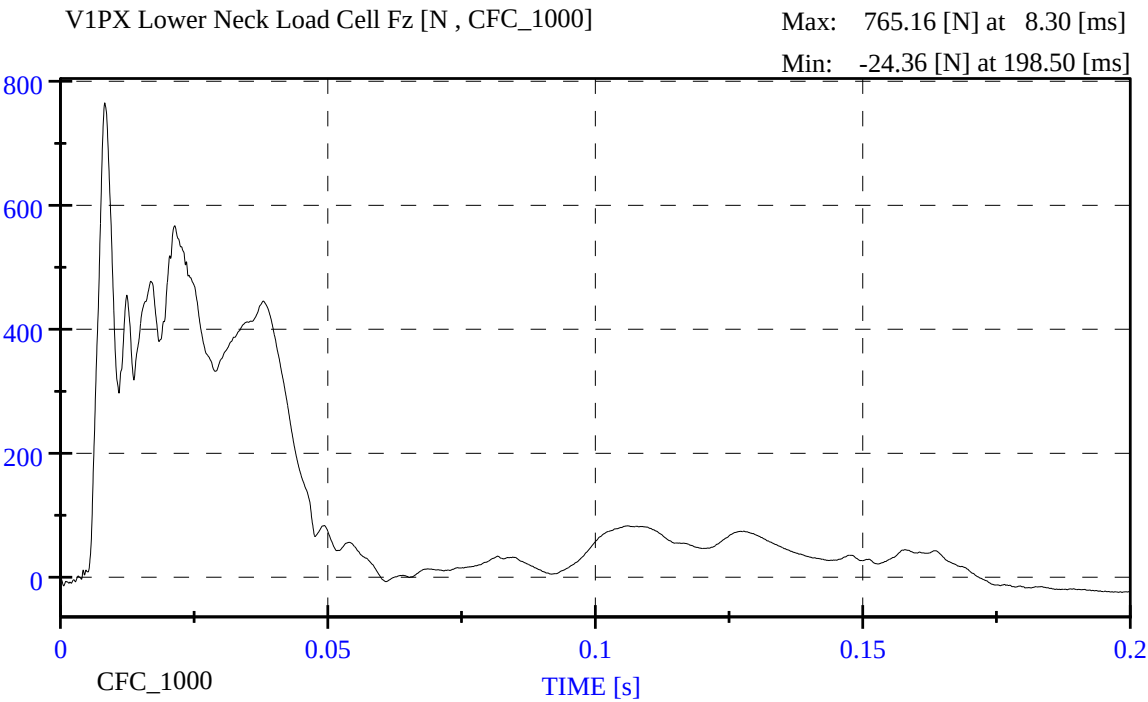


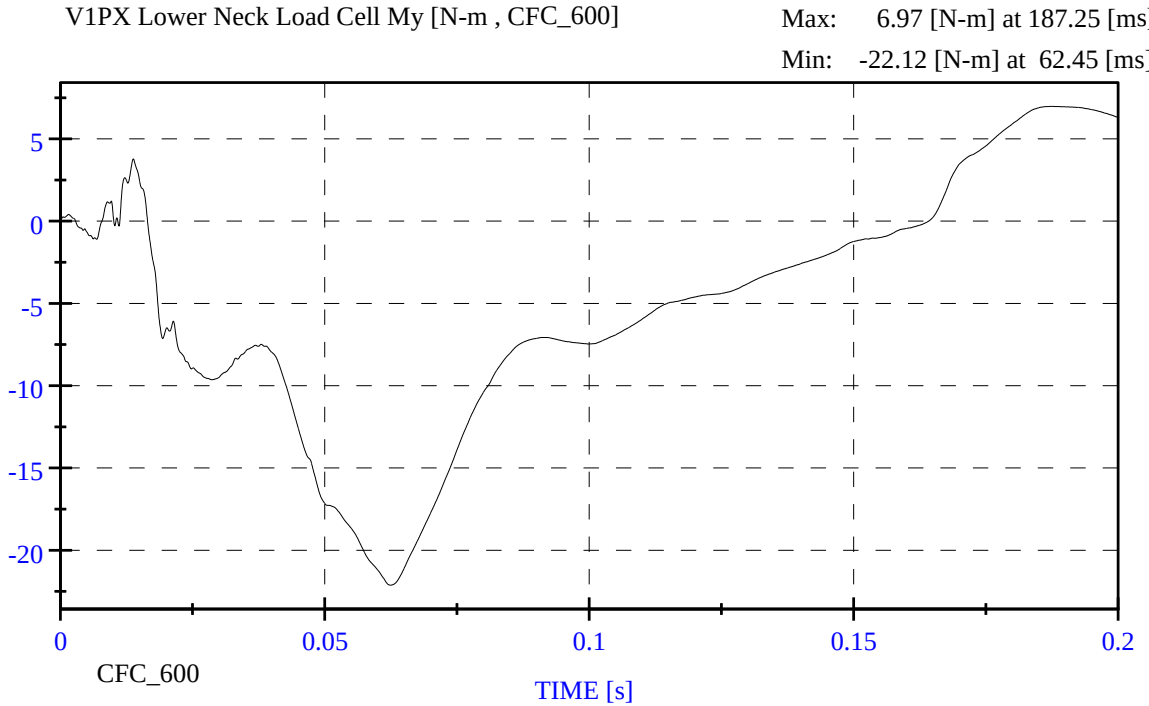
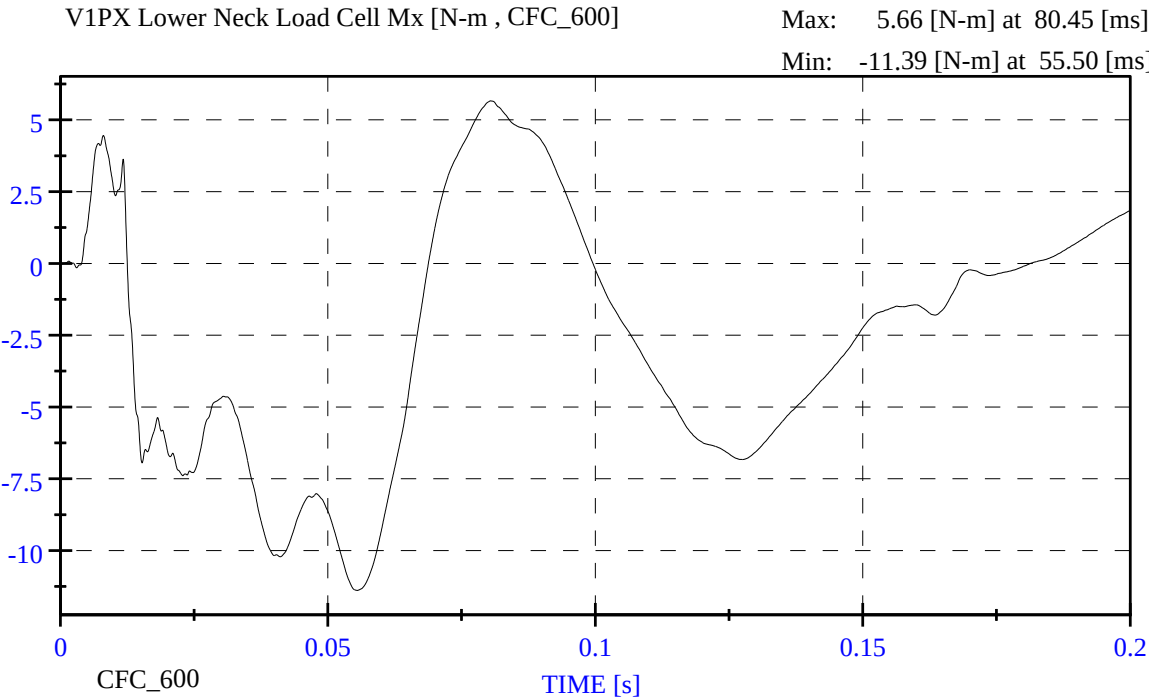


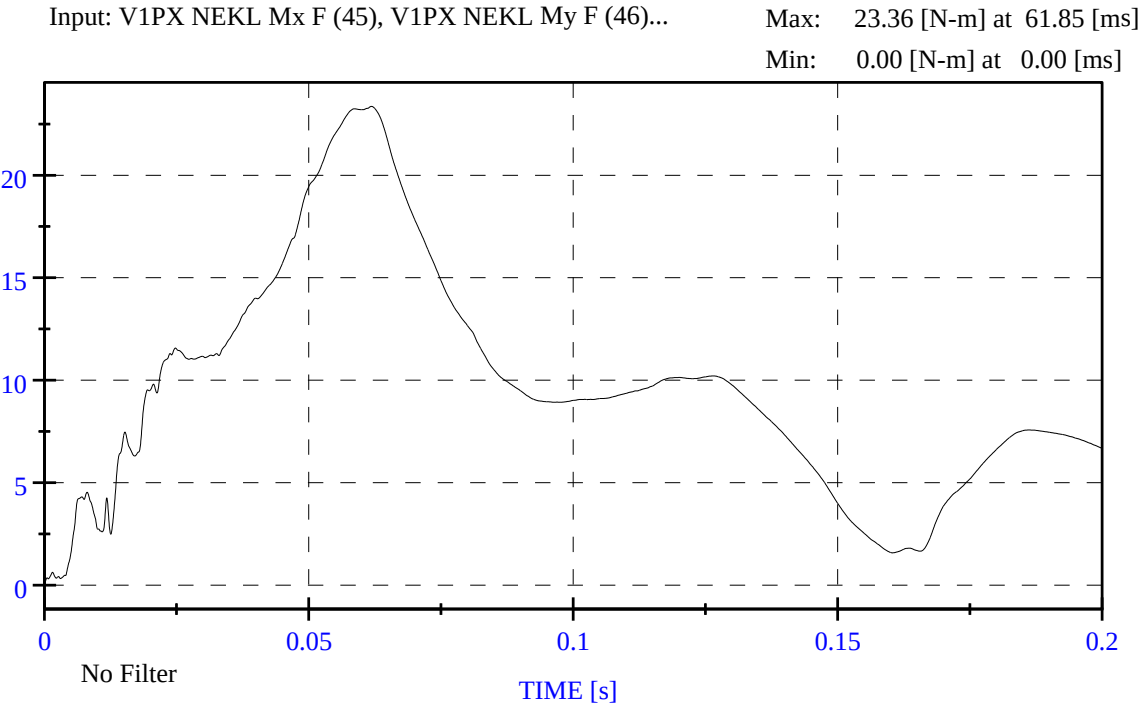
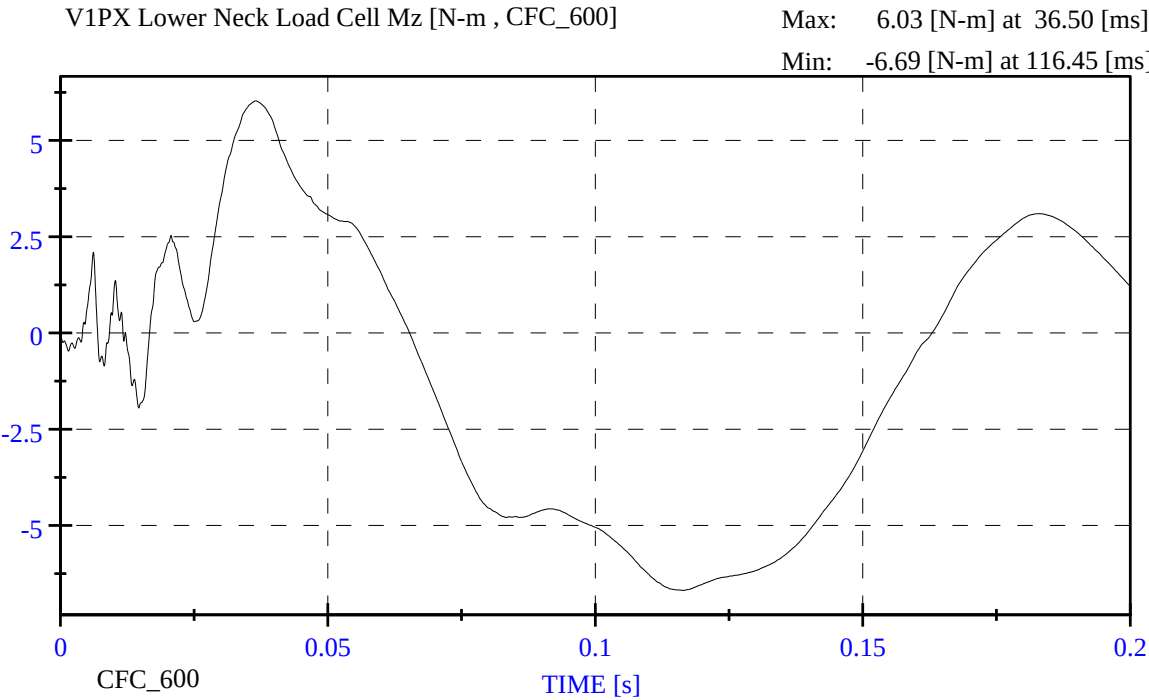


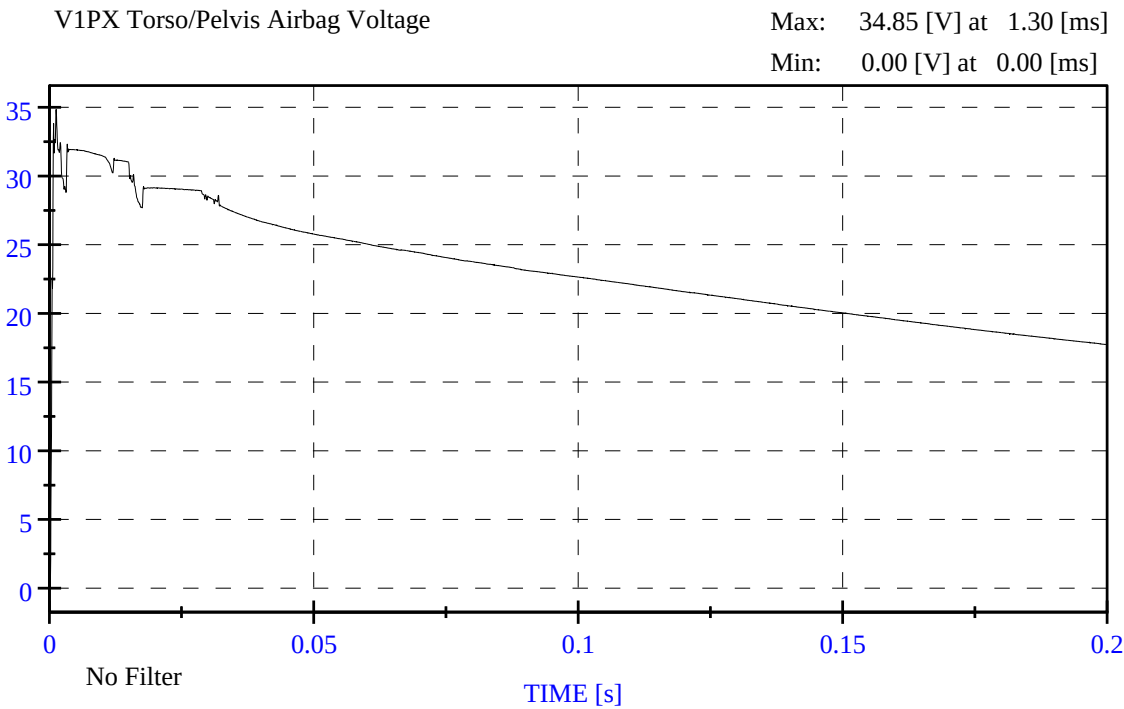
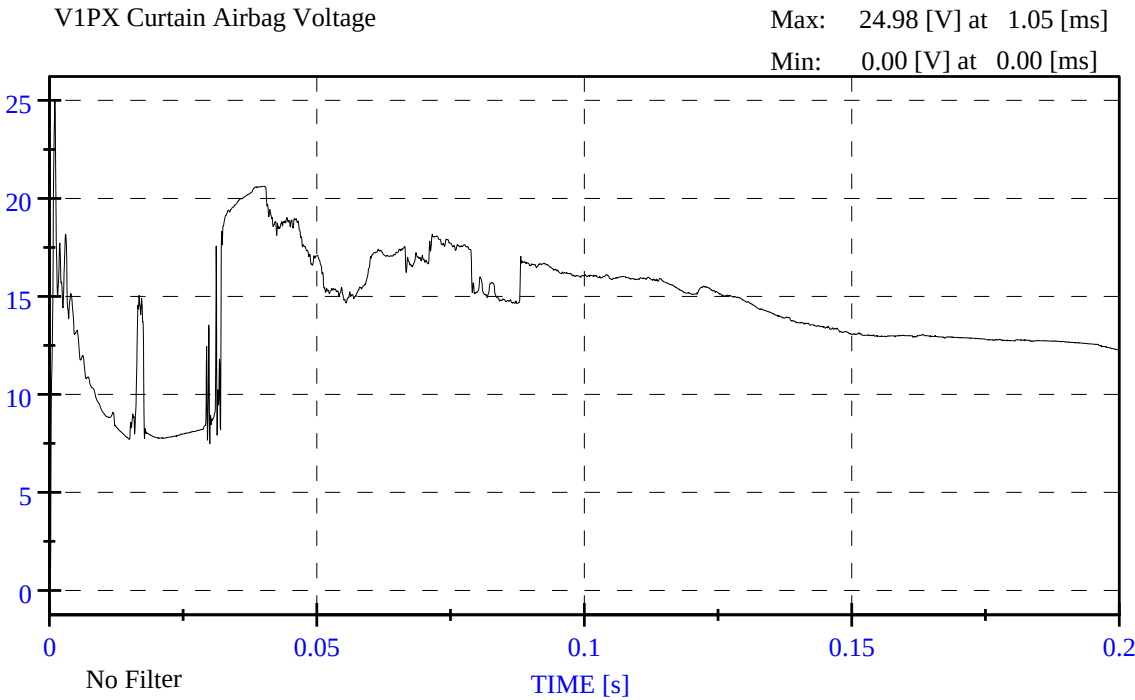


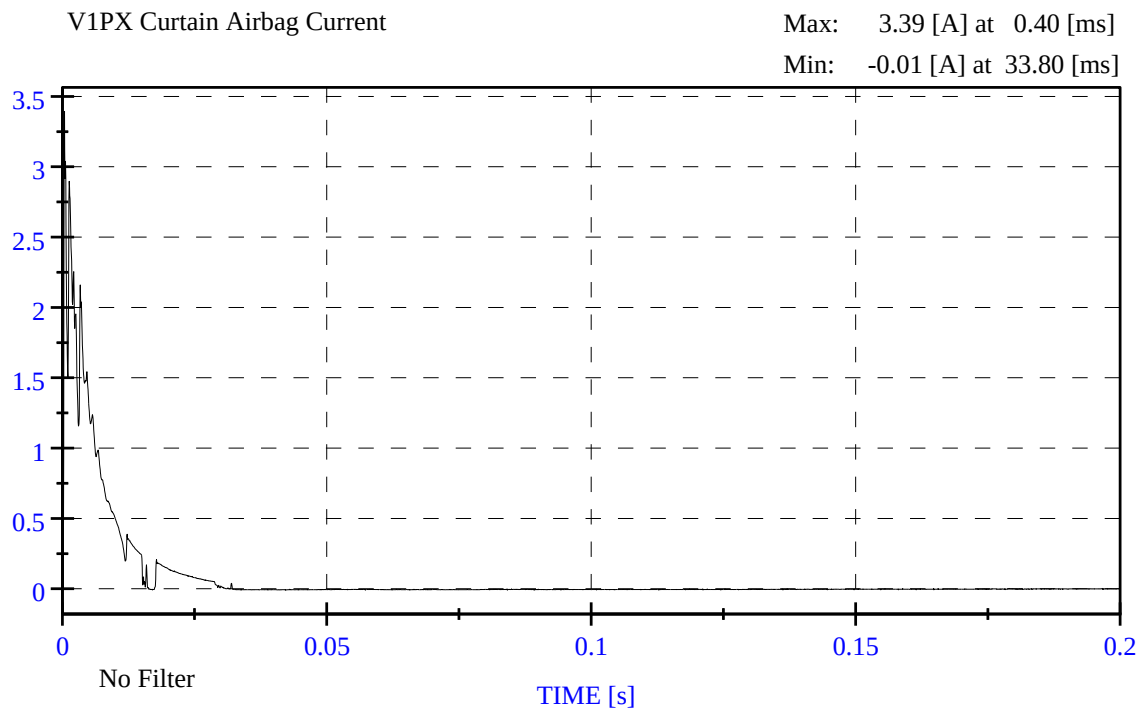
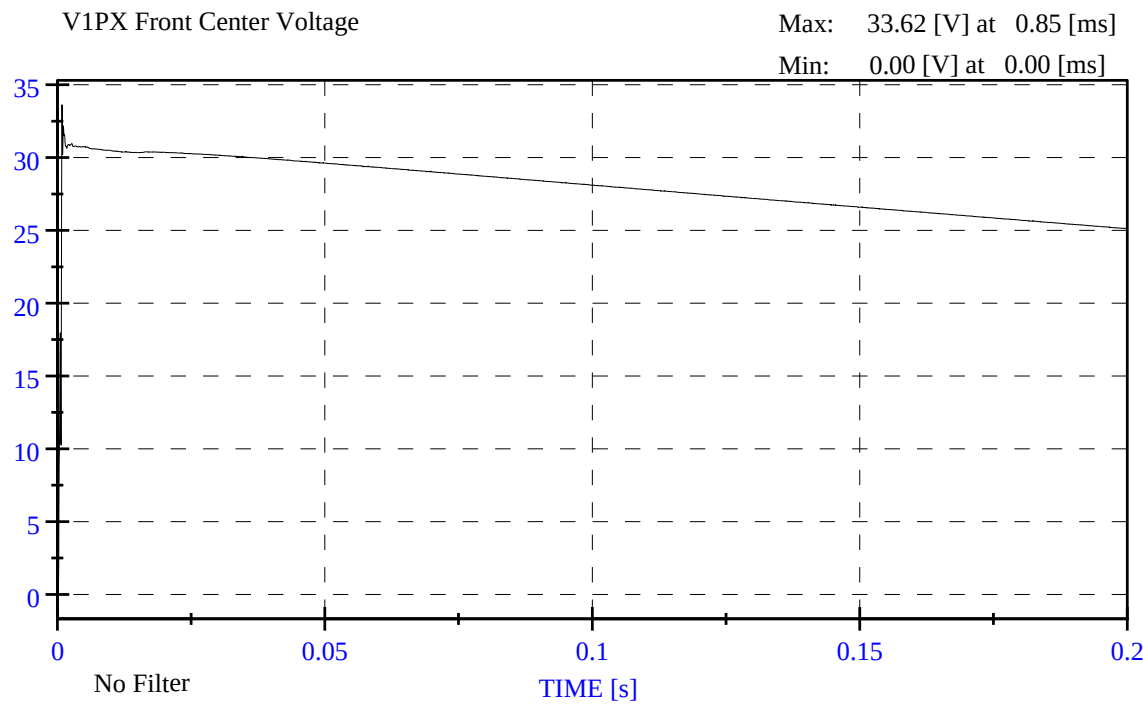


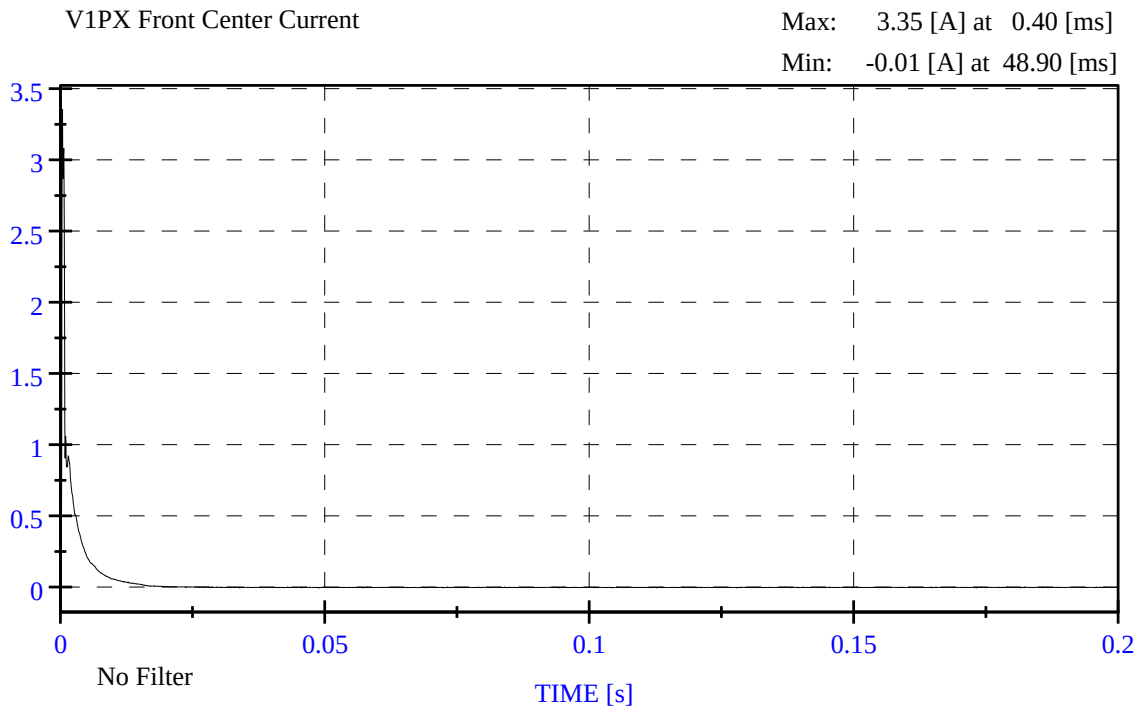
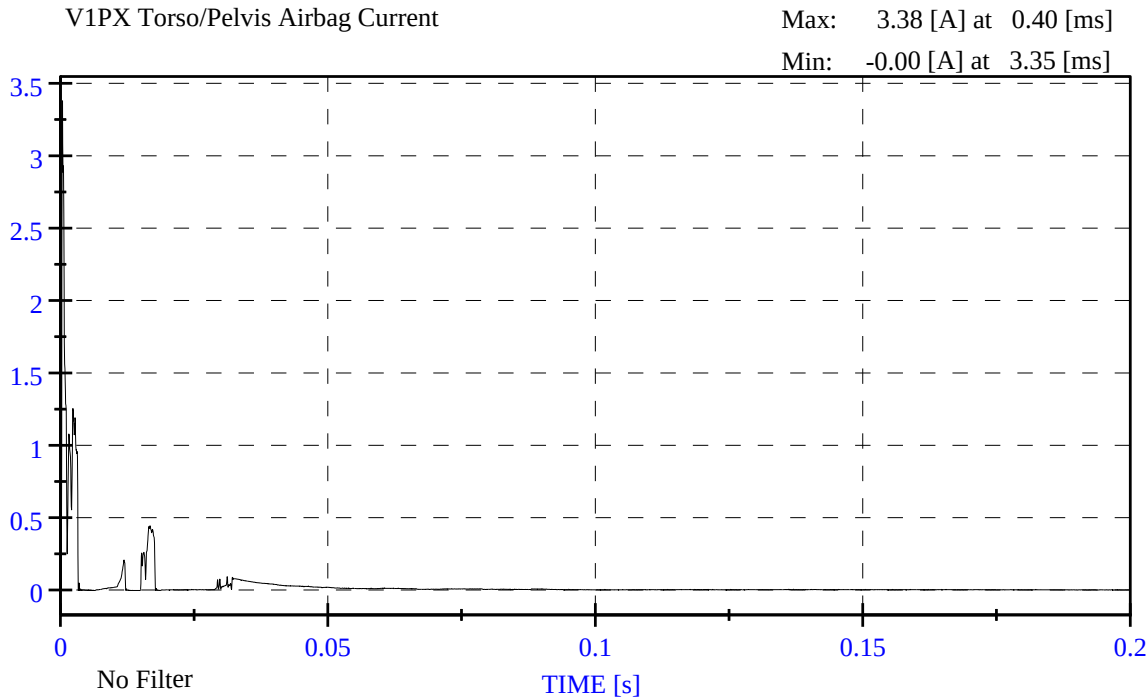












Appendix C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

P572C INSTRUMENTATION

	POSITION #X (Center) SERIAL NO.: MD0117TWG2		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
HEAD AX	AC-P64001	ENDEVCO	01/08/2013
HEAD AY	AC-P51687	ENDEVCO	01/08/2013
HEAD AZ	AC-P52154	ENDEVCO	01/08/2013
UPPER NECK FX	LC-125	DENTON	4/22/2012
UPPER NECK FY	LC-125	DENTON	4/22/2012
UPPER NECK FZ	LC-125	DENTON	4/22/2012
UPPER NECK MX	LC-125	DENTON	4/22/2012
UPPER NECK MY	LC-125	DENTON	4/22/2012
UPPER NECK MZ	LC-125	DENTON	4/22/2012
LOWER NECK FX	LC-121	DENTON	4/22/2012
LOWER NECK FY	LC-121	DENTON	4/22/2012
LOWER NECK FZ	LC-121	DENTON	4/22/2012
LOWER NECK MX	LC-121	DENTON	4/22/2012
LOWER NECK MY	LC-121	DENTON	4/22/2012
LOWER NECK MZ	LC-121	DENTON	4/22/2012
Curtain Bag Voltage	KT Minidau timer	N/A	N/A
Curtain Bag Current	KT Minidau timer	N/A	N/A