REPORT NUMBER: TWG-CAL-18-04

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

Ford Motor Co.
2018 Ford EcoSport

NHTSA NUMBER: M20180202TWG3
CALSPAN TEST NUMBER: CT2018-04

PREPARED BY:
CALSPAN CORPORATION
4455 Genesee St.
BUFFALO, NEW YORK 14225

November 14, 2018

DRAFT REPORT

Alpha Technology Associate, Inc.
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Fairfax, VA 22031

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Approval Date: November 14, 2018

FINAL REPORT ACCEPTANCE BY:

Accepted By: _____

Acceptance Date: _____

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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 July 19, 2018.

Injury Summary

HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate (m/s)	Peak Tension (CFC1000)	Peak Compression (CFC1000)	NIJ (NTF)	NIJ (NTE)	NIJ (NCF)	NIJ (NCE)
30.53	0.95	0.27	1064.729	-523.471	0.548	0.624	0.493	0.699

17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position	18. Distribution Statement Copies of this report are available from: 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

19. Security Classification of Report UNCLASSIFIED	20. Security Classification of Page UNCLASSIFIED	21. No. of Pages 36	22. Price

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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 previously undergone a New Car Assessment Program (NCAP) sponsored side MDB impact test requested by the National Highway Traffic Safety Administration (NHTSA). This test was performed under NHTSA contract No. DTNH22-13-D-00311L and through Alpha Technology Associate, Inc.

1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2018 Ford EcoSport on an out-of-position 3-Year-Old ATD were evaluated. The test was performed by Calspan on July 19, 2018. Pre-and post-test photographs of the vehicle and ATD can be found in Appendix A.

One high-speed digital camera was used to document the side airbag deployment event. Images were recorded at rates of 1000 frames per second. The cameras were placed perpendicular to the right-rear passenger seat centerline to capture the deployment event.

The 3-Year-Old anthropomorphic test device (ATD) was placed in the right rear (passenger) seat laying with its back on the seatpan and its arm against the seatback according to the 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 orientation complies with section 3.3.3.4 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.

The 3-Year-Old ATD was instrumented with head x, y and z accelerometers. In addition, a six axis upper and lower neck load cell sensor was utilized to record the resulting neck forces and moments during the event.

Twenty Seven 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.

SECTION 2

DATA SHEET NO. 1
TEST SUMMARY

TEST CONFIGURATION INFORMATION:

Seating Position:	P3	Right Rear Seating Position
Test:	3.3.3.4	Roof Rail Mounted – HIII 3YO Lying On Seat
Airbag: 1	Curtain	Roof Rail Mounted – Passenger Side
Airbag: 2	Seat/Torso	Rear Passenger Seat Mounted – Outside Seam
Booster Block:	N/A	N/A
ATD Type/Serial No.:	139	3-Year-Old

Number of Data Channels:	27	
Number of Cameras:	0	Real Time
	1	High Speed Digital

PRE-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Seatpan
Upper Torso Contact:	Seatpan & Seatback
Lower Torso Contact:	Seatpan & Seatback
Knee Contact:	Seatpan
Foot Contact:	Seatpan

POST-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Torso Airbag & Seatpan
Upper Torso Contact:	Seatpan
Lower Torso Contact:	Seatpan
Knee Contact:	Seatpan
Foot Contact:	Seatpan

DATA SHEET NO. 2
VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2018 Ford EcoSport SUV

NHTSA No. : M20180202TWG3 ; VIN: MAJ3P1RE7JC175171 Color: Silver

Engine Data: I4 cylinders; - CID; 1.0 Liters; - cc

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

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

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

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

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

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

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

Date Received: 4/13/2018 ; Odometer Reading 209.215 Km

Selling Dealer: Kayser Ford Lincoln

& Address: P.O. Box 1526 Madison WI 53701

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Ford Motor Co.

Date of Manufacture 11/17

GVWR: 1810 kg; GAWR: 955 kg FRONT; 865 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: 205/60R16

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

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: 205/60R16 ; Manufacturer: Bridgestone

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

Treadwear: 600 ; Traction: A : Temperature: A

VEHICLE CAPACITY DATA:

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

Number of Occupants: 2 Front; 3 Rear; 5 Total

Vehicle Capacity Weight (VCW) = 375 Kg

No. of Occupants x 68.04 kg = 340.2 Kg

Rated Cargo/Luggage Weight (RCLW) = 34.8 Kg

*Tire pressure used for test

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

DATA SHEET NO. 3
3-Year-Old Dummy POSITIONING IN VEHICLE

NHTSA No. M20180202TWG3

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

Seat Back Angle (headrest post)	SA (FIXED)	Value
Airbag Module Width	AMW (mm)	-
Airbag Width	ABW (mm)	-
Airbag Module Length	AML (mm)	-
Airbag Length	ABL (mm)	-
Top of Airbag Module to Head/Neck Junction	AN (mm)	-
Head CG to Door Panel/Side Window	HD (mm)	80
Head to Seat Back Centerline	HSC (mm)	-
Head to B-Pillar (cg)	HB (mm)	668
Head to Roof, Z (top of the head)	HZ (mm)	780
Head to Header	HHD (mm)	-
Chest to Dash	CD (mm)	-
Chest to Seatback	CS (mm)	-
Right Arm to Seat Back Centerline	RACL (mm)	-
Right Arm to Seat Back Centerline	RACL (deg)	-
Left Arm to Door Panel	LA (mm)	-
Knee to Knee	KK (mm)	-
Toe to Toe	TT (mm)	-
Right Knee to Seat Cushion Centerline	KSCR (mm)	-
Left Knee to Seat Cushion Centerline	KSCL (mm)	-
Right Toe to Seat Cushion Centerline	TSCR (mm)	-
Left Toe to Seat Cushion Centerline	TSCL (mm)	-

DATA SHEET 4
3-Year-Old Dummy INJURY CRITERIA VALUES

NHTSA No.: M20180202TWG3

Channel	Units	Max	Time (ms)	Min	Time (ms)
V1P3 Head x [CFC_1000]	g's	4.58	45.00	-35.76	8.25
V1P3 Head y [CFC_1000]	g's	35.77	8.30	-9.78	62.65
V1P3 Head z [CFC_1000]	g's	16.49	8.25	-2.57	56.50
V1P3 Headform Resultant [CFC_1000]	g's	53.12	8.30	0.01	-3.30
V1P3 Upper Neck Mocy [CFC_600]	Nm	23.30	165.70	-17.41	272.65
V1P3 Upper Neck Ntf [CFC_600]	-	0.55	71.20	0.00	-50.00
V1P3 Upper Neck Nte [CFC_600]	-	0.62	77.80	0.00	-50.00
V1P3 Upper Neck Ncf [CFC_600]	-	0.49	149.55	0.00	-50.00
V1P3 Upper Neck Nce [CFC_600]	-	0.70	273.10	0.00	-46.30
V1P3 Upper Neck Nij [CFC_600]	-	0.70	273.10	0.00	-22.50
V1P3 Upper Neck Fx [CFC_1000]	N	153.71	40.25	-676.00	93.20
V1P3 Upper neck Fy [CFC_1000]	N	116.72	122.30	-427.73	80.15
V1P3 Upper neck Fz [CFC_1000]	N	1064.73	73.75	-523.47	138.60
V1P3 Neck Force Resultant [CFC_1000]	N	1223.91	77.85	0.28	-17.70
V1P3 Upper Neck Mx [CFC_600]	Nm	23.28	147.25	-16.73	38.65
V1P3 Upper Neck My [CFC_600]	Nm	23.30	165.70	-17.41	272.65
V1P3 Upper Neck Mz [CFC_600]	Nm	12.99	124.40	-14.83	39.75
V1P3 Neck Moment Resultant [CFC_600]	Nm	31.20	150.20	0.01	-41.10
V1P3 Lower Neck Fx F [CFC_1000]	N	172.78	19.50	-19.59	245.10
V1P3 Lower Neck Fy F [CFC_1000]	N	6.91	7.30	-154.15	24.30
V1P3 Lower Neck Fz F [CFC_1000]	N	30.98	108.20	-657.13	15.25
V1P3 Lower Neck Force Resultant [CFC_1000]	N	673.59	15.35	0.02	-10.10
V1P3 Lower Neck Mx F [CFC_600]	Nm	0.05	136.80	-29.77	26.20
V1P3 Lower Neck My F [CFC_600]	Nm	2.70	273.45	-12.54	18.90
V1P3 Lower Neck Mz F [CFC_600]	Nm	6.19	139.95	-12.51	58.60
V1P3 Lower Neck Moment Resultant [CFC_600]	Nm	31.34	25.50	0.00	-31.35
Curtain Airbag Volts	V	20.33	0.55	-10.13	0.00
Torso/Pelvis Airbag Volts	V	11.48	0.60	-26.22	0.00
Front Center Airbag Volts	V	-	-	-	-
Curtain Airbag Current	A	1.30	0.70	-2.22	39.55
Torso/Pelvis Airbag Current	A	2.29	0.35	-1.19	0.00
Front Center Airbag Current	A	-	-	-	-

DATA SHEET 4

3-Year-Old DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2018 Ford EcoSport NHTSA No.: M20180202TWG3

HEAD INJURY CRITERIA (HIC)

	HIC15			
	HIC(15)	t_1 (msec)	t_2 (msec)	Average Acceleration t_1 to t_2
Position P3	30.53	6.20	18.85	22.59

THORAX CRITERIA

	Critical Values	Actual	Time(ms)
Maximum Deflection (mm)	36	0.95	55.55
Maximum Deflection Rate (m/s)	8.0	0.27	17.75

Position P3 - Neck Injury Summary (H3 – 3 year Old – In Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.548	71.200	1006.421	-320.664	4.997
Nte	0.624	77.800	1043.142	-492.750	-3.564
Ncf	0.493	149.550	-408.579	-55.293	20.407
Nce	0.699	273.100	-116.462	-21.334	-17.400

Peak Tension (CFC1000) 1064.729 **N** **Peak Compression (CFC1000)** -523.471 **N**

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120.00 N	Extension (mCVe)	27.00 N-m	Tension	1130.00 N
Compression (CVc)	2120.00 N	Flexion (mCVf)	68.00 N-m	Compression	1380.00 N

Appendix A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

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

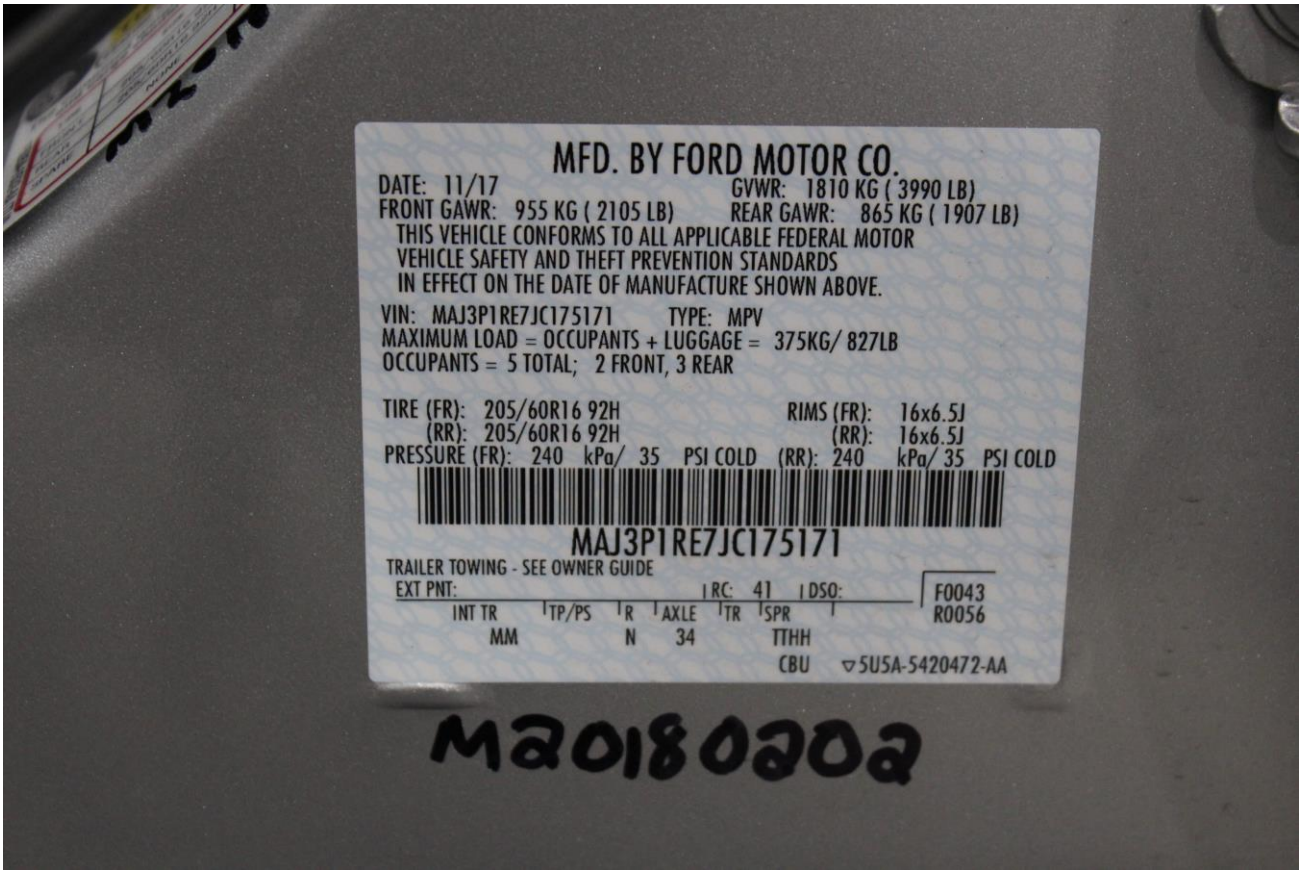


Figure A-2: Vehicle Certification Placard

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

Figure A-4: Post-Test 3-Year-Old Left Side View

Figure A-5: Pre-Test 3-Year-Old Left Side Close-up View

Figure A-6: Post-Test 3-Year-Old Left Side Close-up View

Figure A-7: Pre-Test 3-Year-Old Front View

Figure A-8: Post-Test 3-Year-Old Front View

Figure A-9: Pre-Test 3-Year-Old Left ¾ Front View

Figure A-10: Post-Test 3-Year-Old Left ¾ Front View

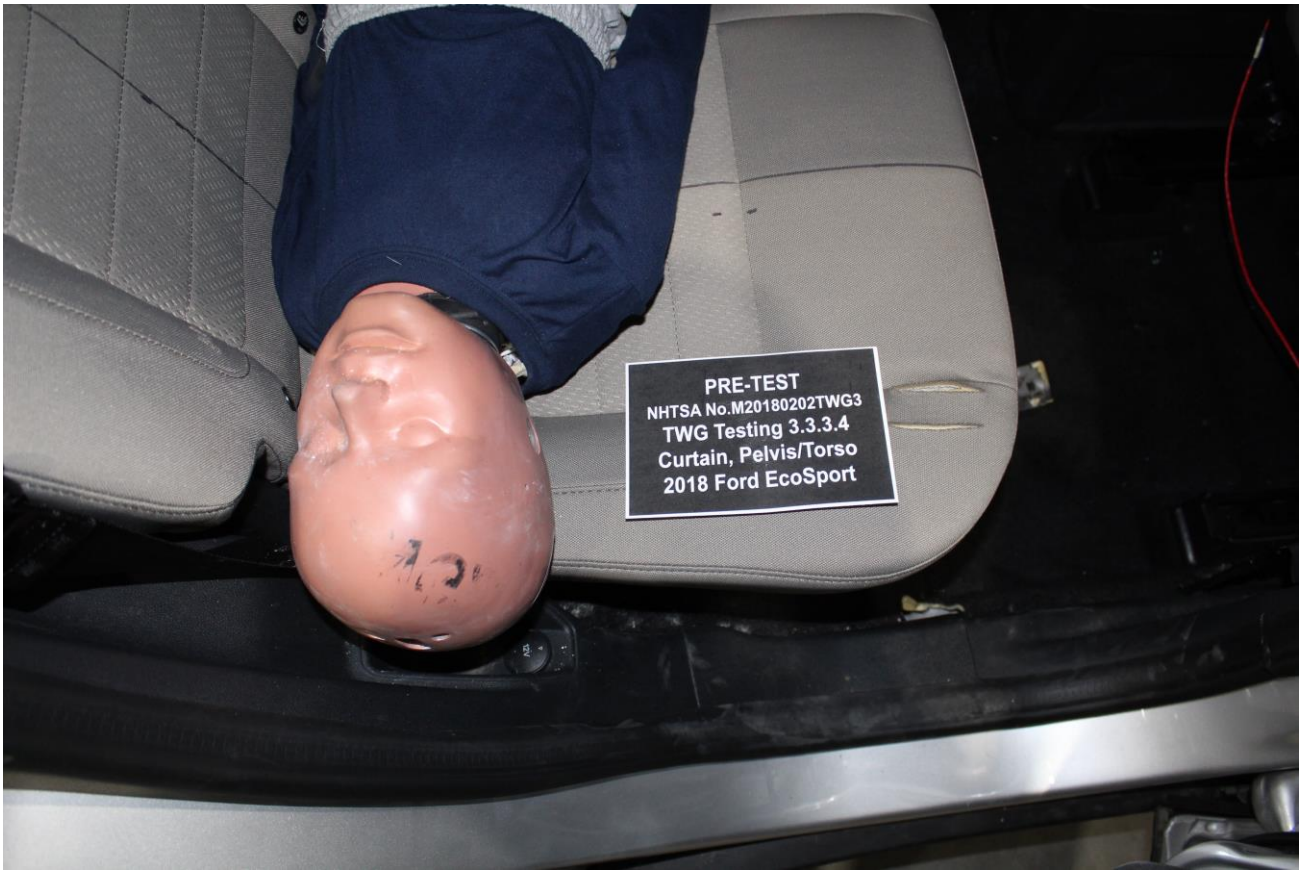


Figure A-11: Pre-Test 3-Year-Old Right Side View

Figure A-12: Post-Test 3-Year-Old Right Side View

Figure A-13: Post-Test Curtain Airbag View

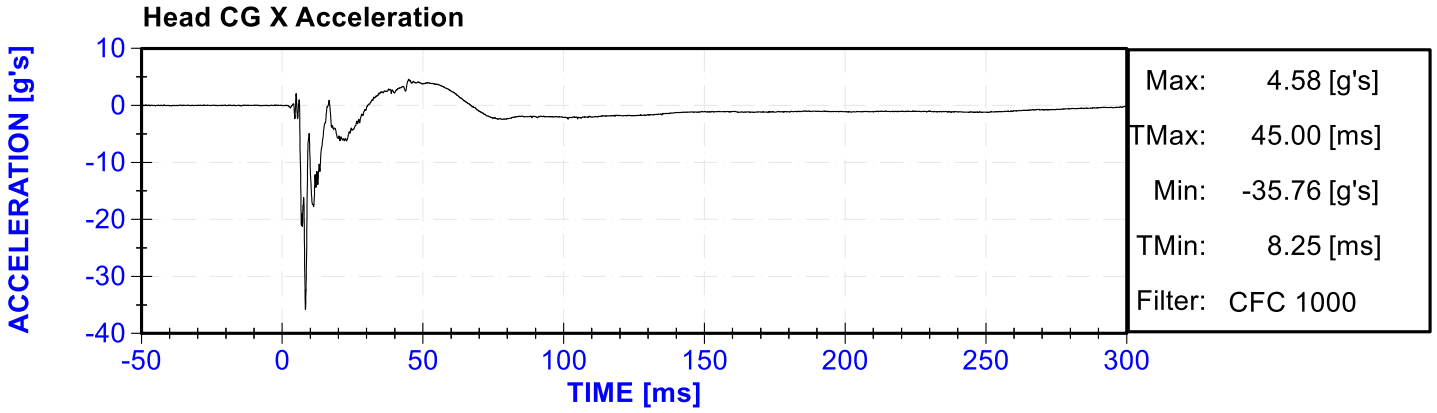
Figure A-14: Post-Test Seat Airbag View

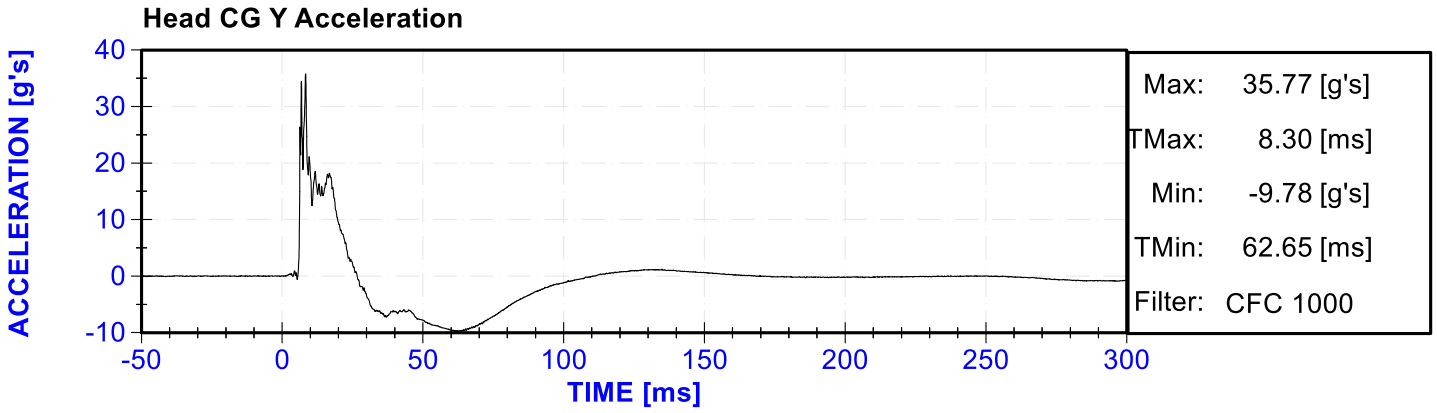
Figure A-15: Impact Event

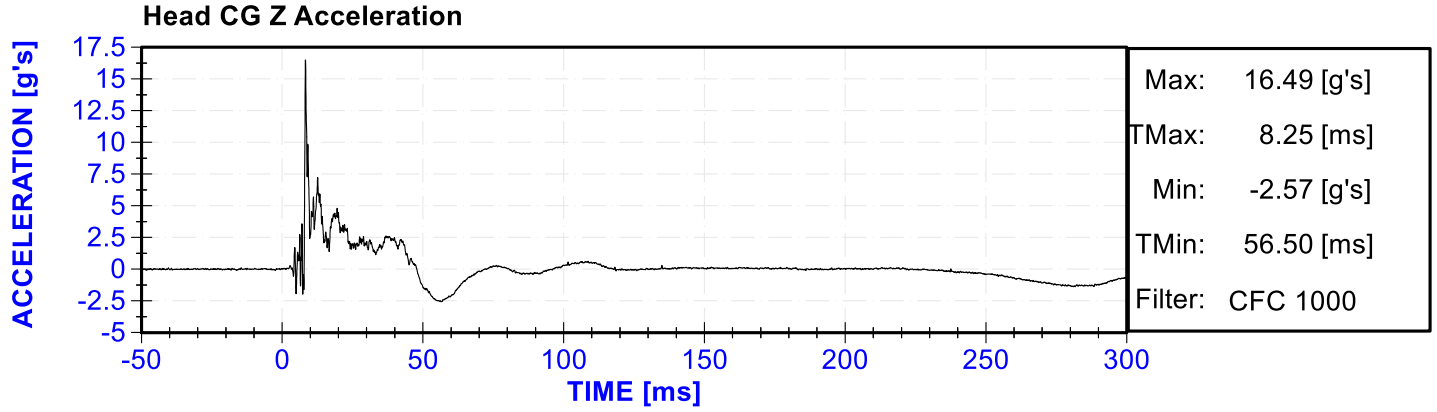
APPENDIX B

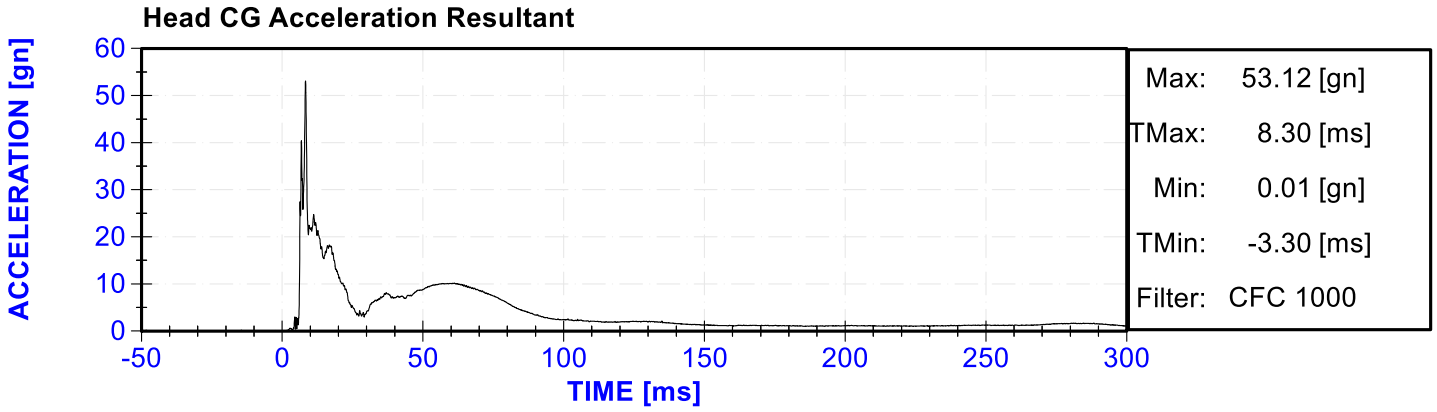
VEHICLE & DUMMY RESPONSE DATA TRACES

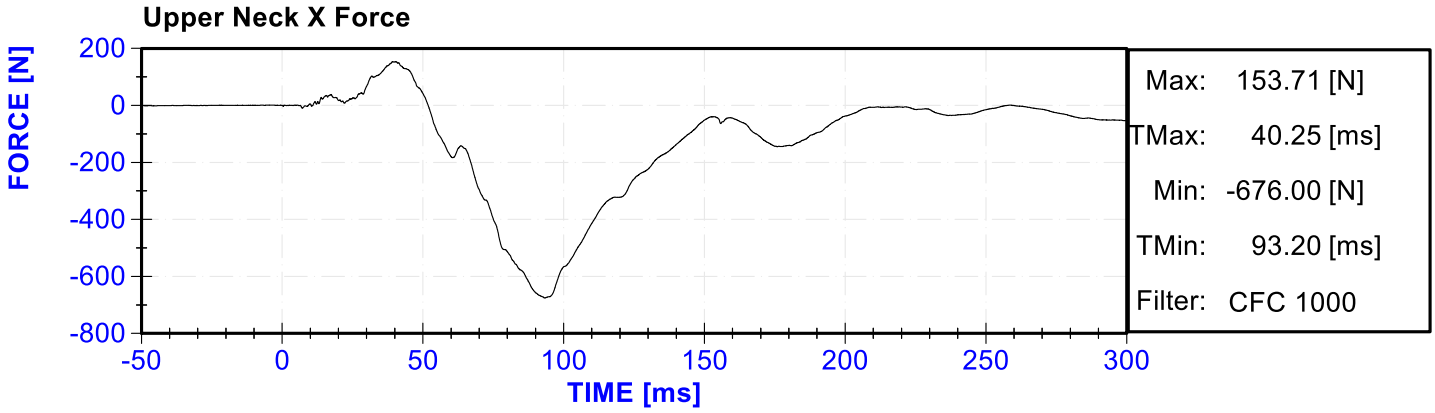
Table of Data Plots

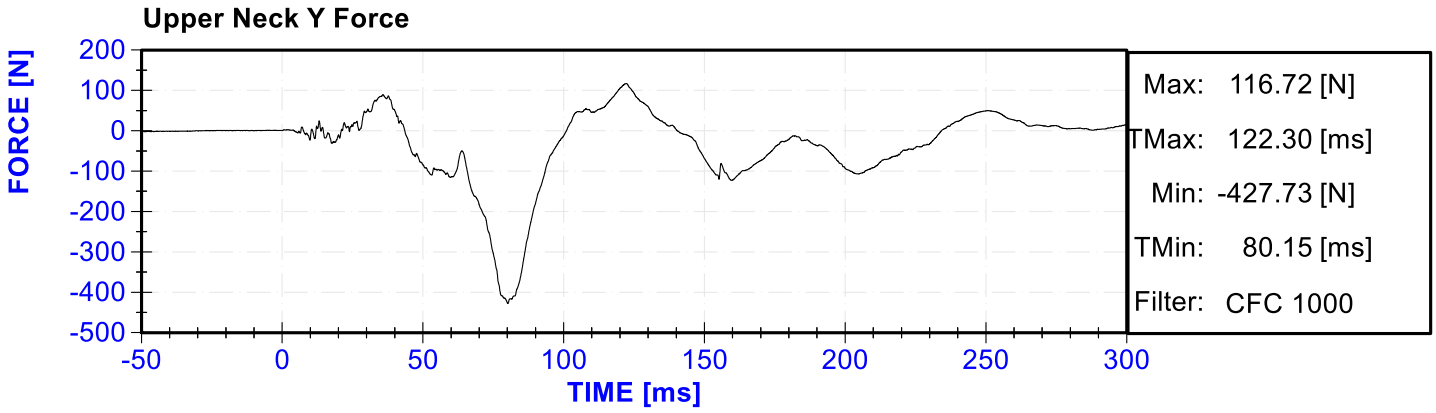

Head CG X Acceleration
ACCELERATION [g's]
10
0
-10
-20
-30
-40
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 4.58 [g's]
TMax: 45.00 [ms]
Min: -35.76 [g's]
TMin: 8.25 [ms]
Filter: CFC 1000


Head CG Y Acceleration
ACCELERATION [g's]
40
30
20
10
0
-10
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 35.77 [g's]
TMax: 8.30 [ms]
Min: -9.78 [g's]
TMin: 62.65 [ms]
Filter: CFC 1000


Head CG Z Acceleration
ACCELERATION [g's]
17.5
15
12.5
10
7.5
5
2.5
0
-2.5
-5
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 16.49 [g's]
TMax: 8.25 [ms]
Min: -2.57 [g's]
TMin: 56.50 [ms]
Filter: CFC 1000


Head CG Acceleration Resultant
ACCELERATION [gn]
60
50
40
30
20
10
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 53.12 [gn]
TMax: 8.30 [ms]
Min: 0.01 [gn]
TMin: -3.30 [ms]
Filter: CFC 1000


Upper Neck X Force
FORCE [N]
200
0
-200
-400
-600
-800
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 153.71 [N]
TMax: 40.25 [ms]
Min: -676.00 [N]
TMin: 93.20 [ms]
Filter: CFC 1000


Upper Neck Y Force
FORCE [N]
200
100
0
-100
-200
-300
-400
-500
-50
0
50
100
150
200
250
300
TIME [ms]
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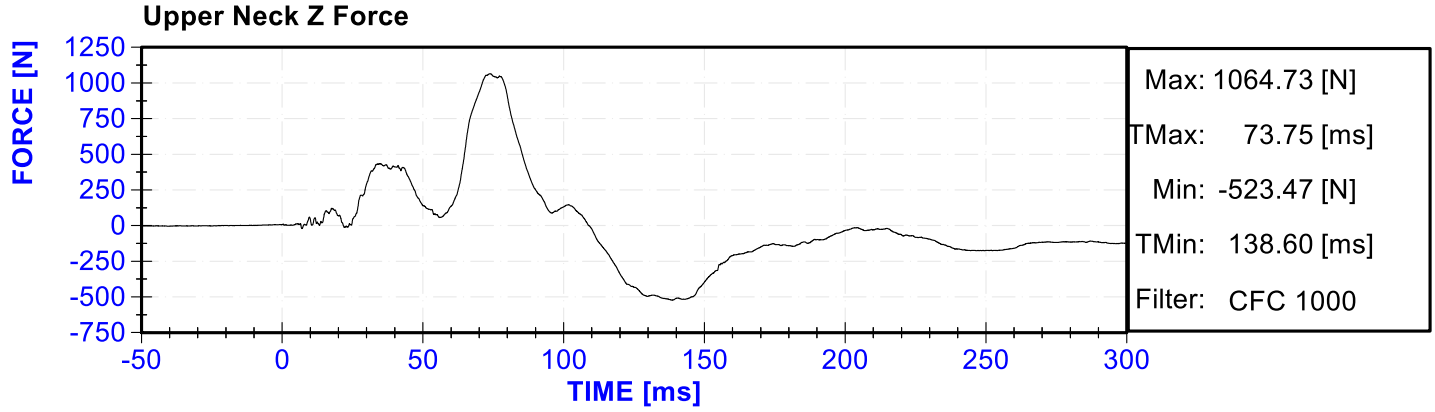
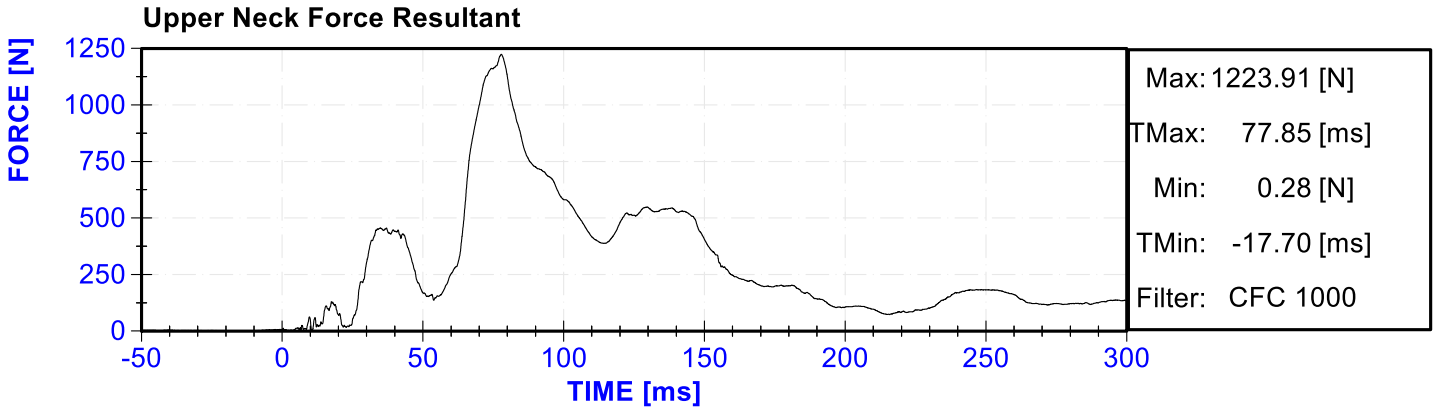
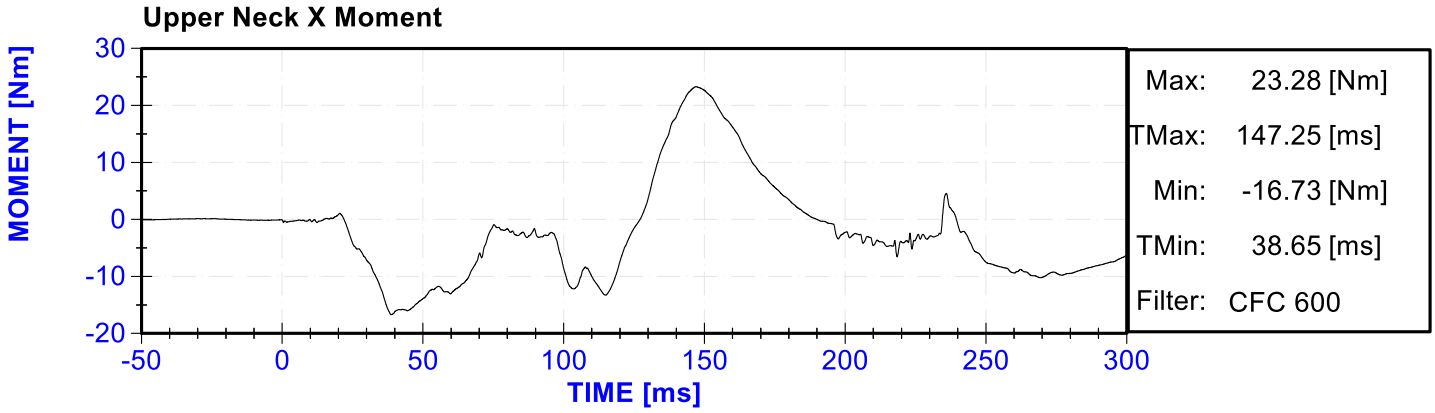
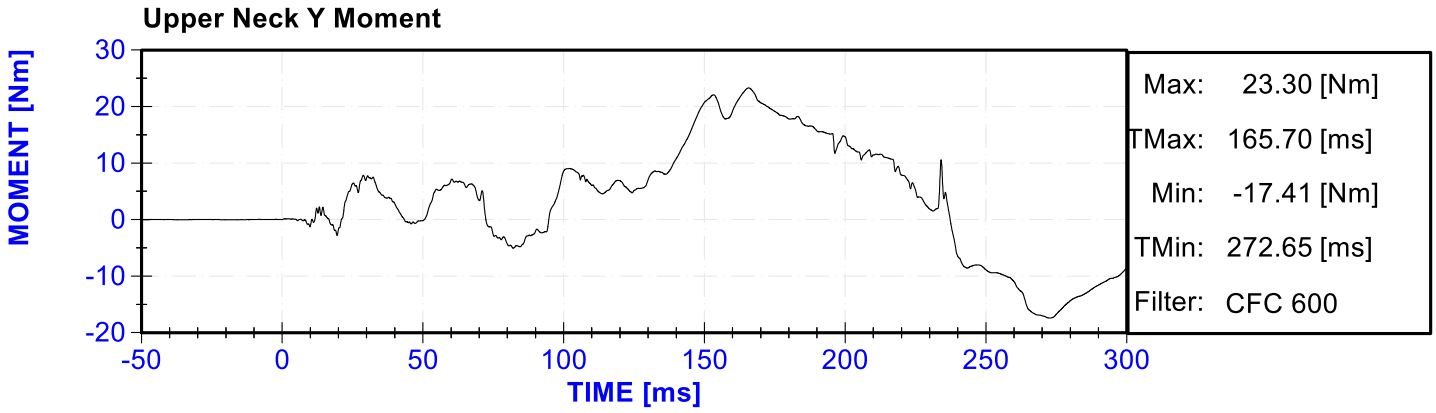
Filter: CFC 1000


Upper Neck Z Force
FORCE [N]
1250
1000
750
500
250
0
-250
-500
-750
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 1064.73 [N]
TMax: 73.75 [ms]
Min: -523.47 [N]
TMin: 138.60 [ms]
Filter: CFC 1000


Upper Neck Force Resultant
FORCE [N]
1250
1000
750
500
250
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 1223.91 [N]
TMax: 77.85 [ms]
Min: 0.28 [N]
TMin: -17.70 [ms]
Filter: CFC 1000


Upper Neck X Moment
MOMENT [Nm]
30
20
10
0
-10
-20
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 23.28 [Nm]
TMax: 147.25 [ms]
Min: -16.73 [Nm]
TMin: 38.65 [ms]
Filter: CFC 600


Upper Neck Y Moment
MOMENT [Nm]
30
20
10
0
-10
-20
-50
0
50
100
150
200
250
300
TIME [ms]
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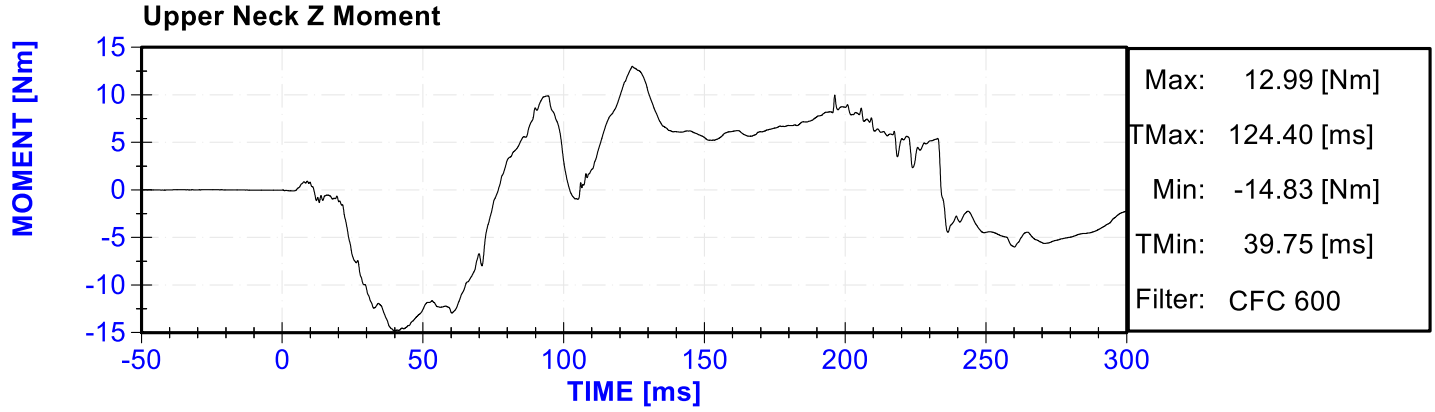
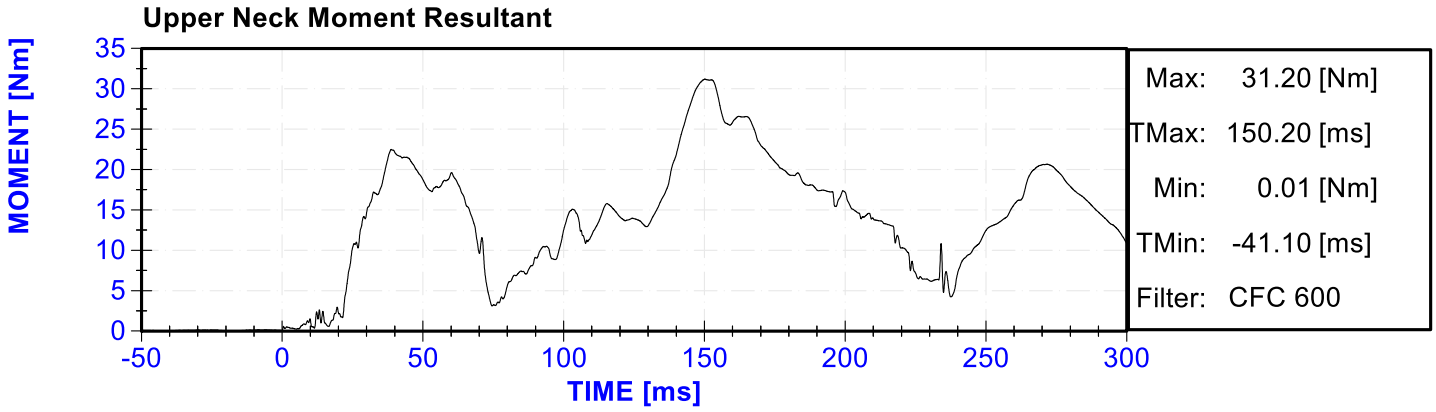
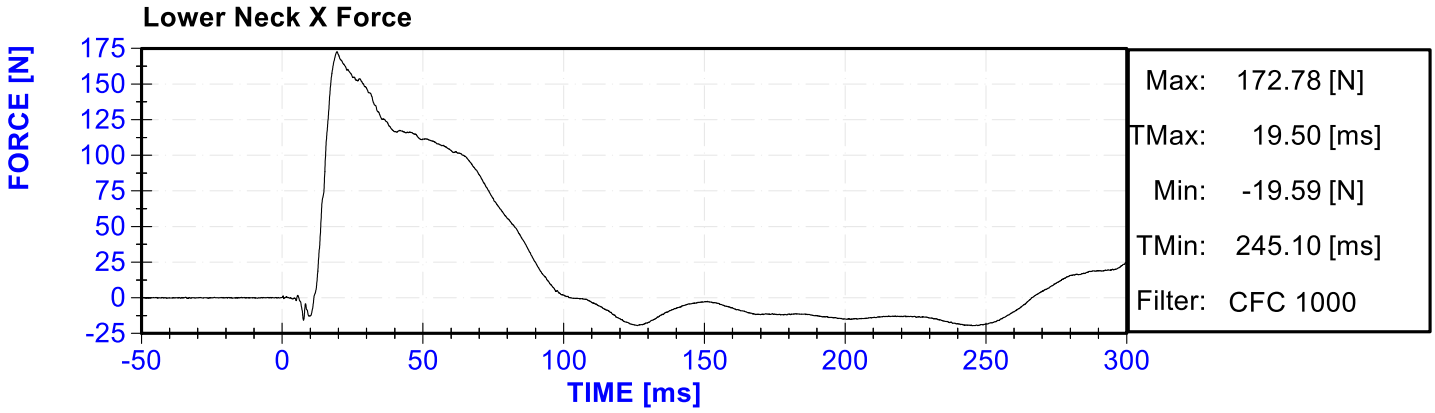
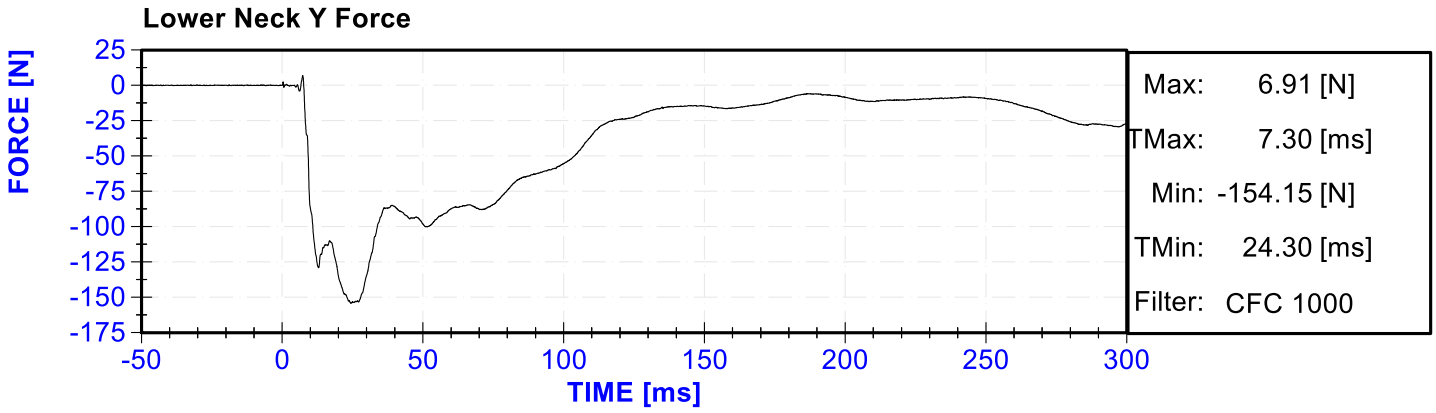
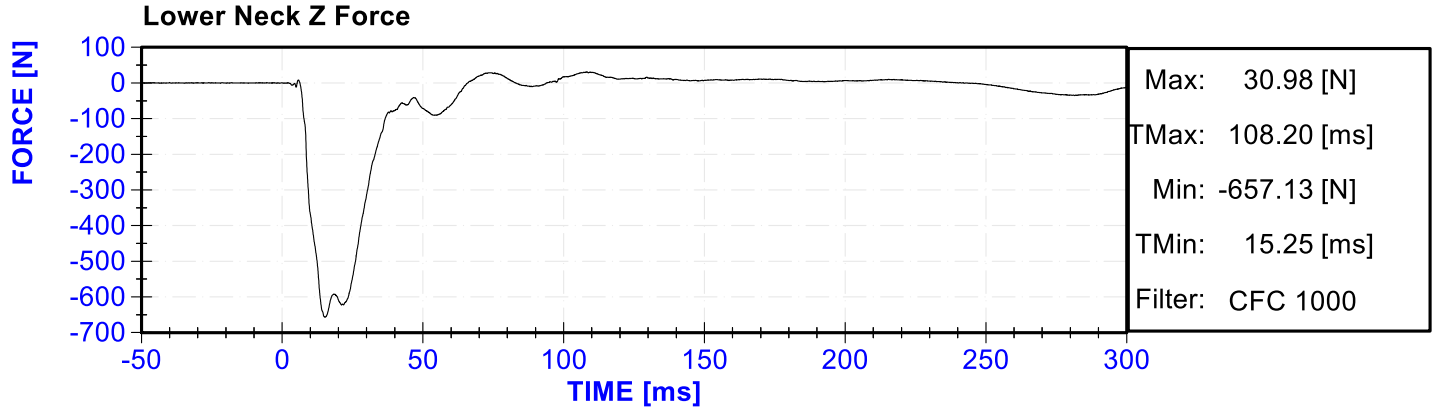
TMin: 272.65 [ms]
Filter: CFC 600

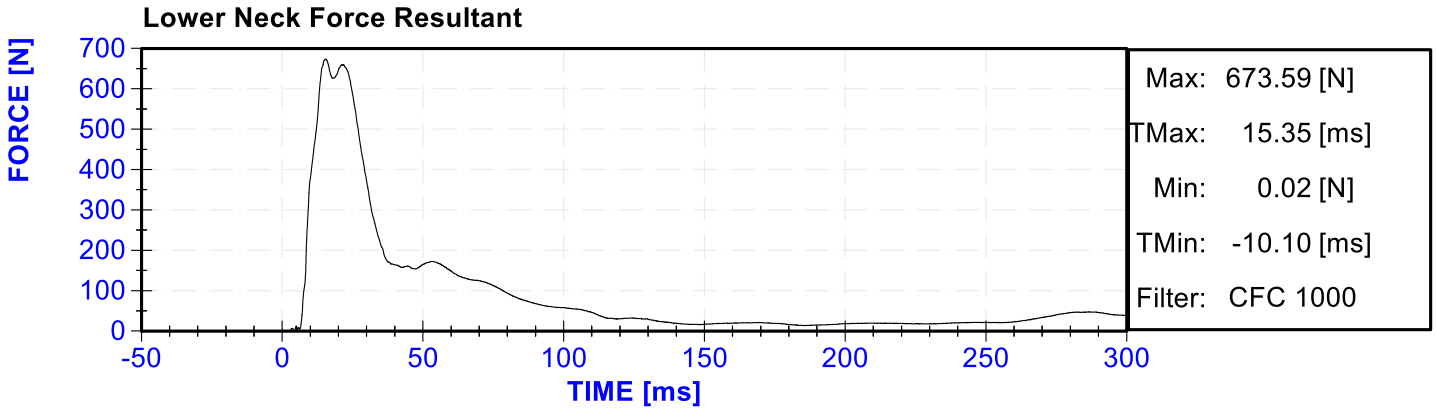

Upper Neck Z Moment
MOMENT [Nm]
15
10
5
0
-5
-10
-15
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 12.99 [Nm]
TMax: 124.40 [ms]
Min: -14.83 [Nm]
TMin: 39.75 [ms]
Filter: CFC 600

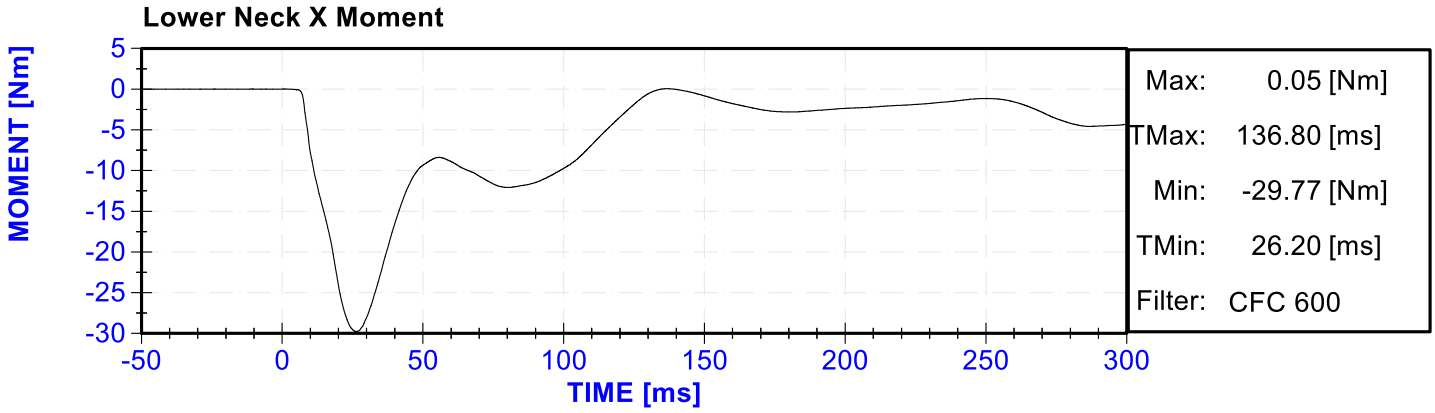

Upper Neck Moment Resultant
MOMENT [Nm]
35
30
25
20
15
10
5
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 31.20 [Nm]
TMax: 150.20 [ms]
Min: 0.01 [Nm]
TMin: -41.10 [ms]
Filter: CFC 600

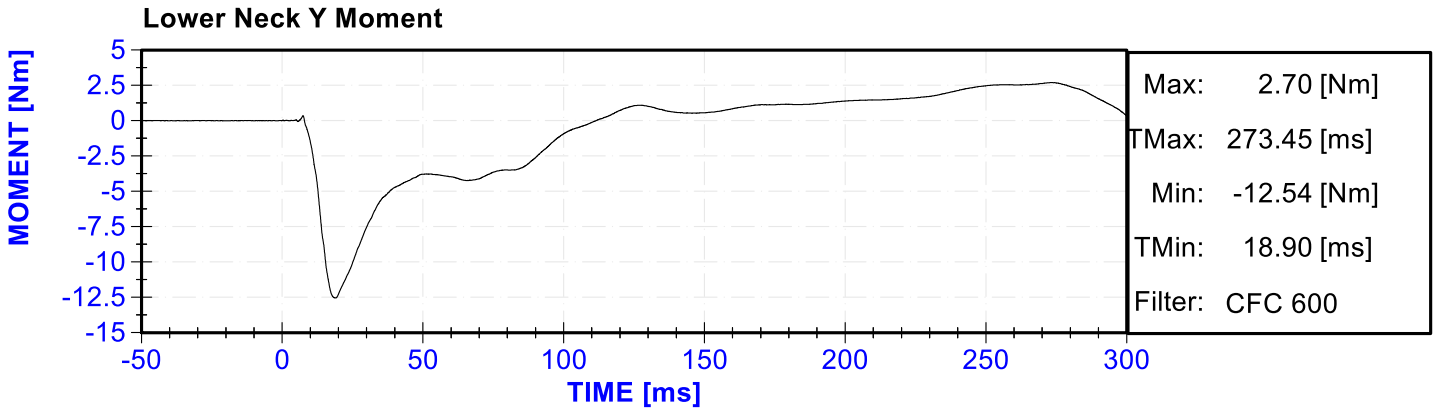

Lower Neck X Force
FORCE [N]
175
150
125
100
75
50
25
0
-25
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 172.78 [N]
TMax: 19.50 [ms]
Min: -19.59 [N]
TMin: 245.10 [ms]
Filter: CFC 1000

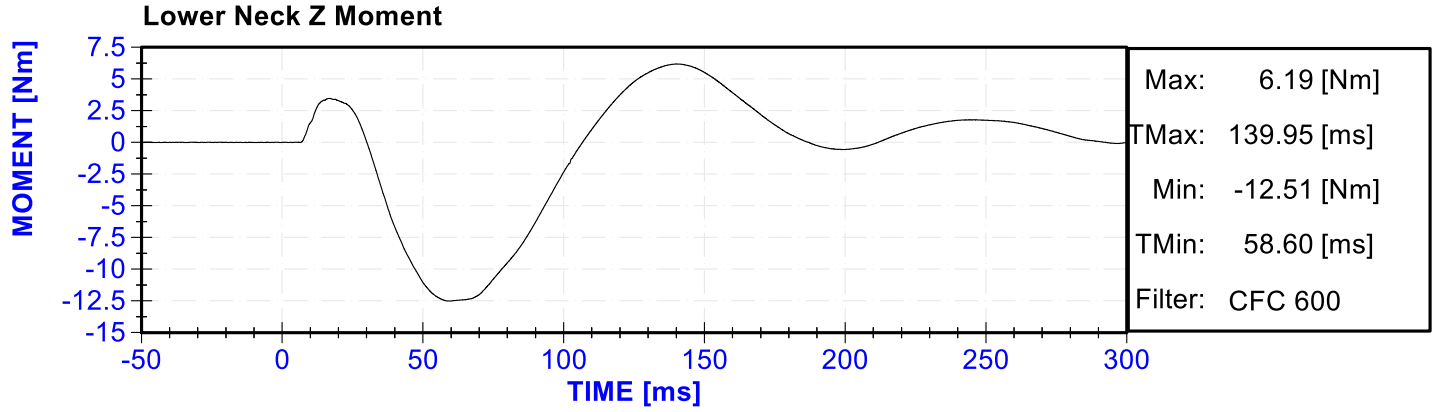

Lower Neck Y Force
FORCE [N]
25
0
-25
-50
-75
-100
-125
-150
-175
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 6.91 [N]
TMax: 7.30 [ms]
Min: -154.15 [N]
TMin: 24.30 [ms]
Filter: CFC 1000

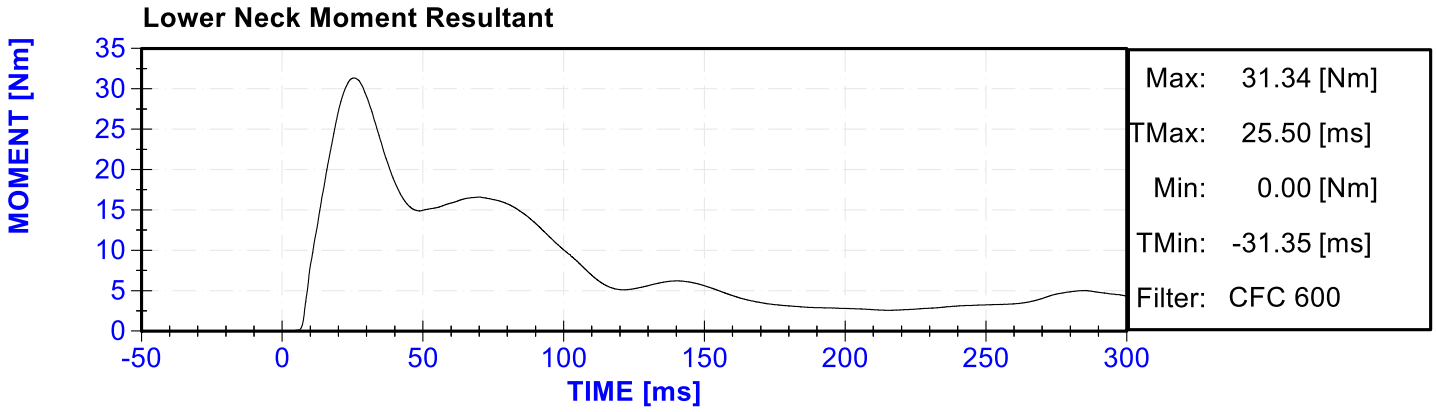

Lower Neck Z Force
FORCE [N]
100
0
-100
-200
-300
-400
-500
-600
-700
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 30.98 [N]
TMax: 108.20 [ms]
Min: -657.13 [N]
TMin: 15.25 [ms]
Filter: CFC 1000


Lower Neck Force Resultant
FORCE [N]
700
600
500
400
300
200
100
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 673.59 [N]
TMax: 15.35 [ms]
Min: 0.02 [N]
TMin: -10.10 [ms]
Filter: CFC 1000

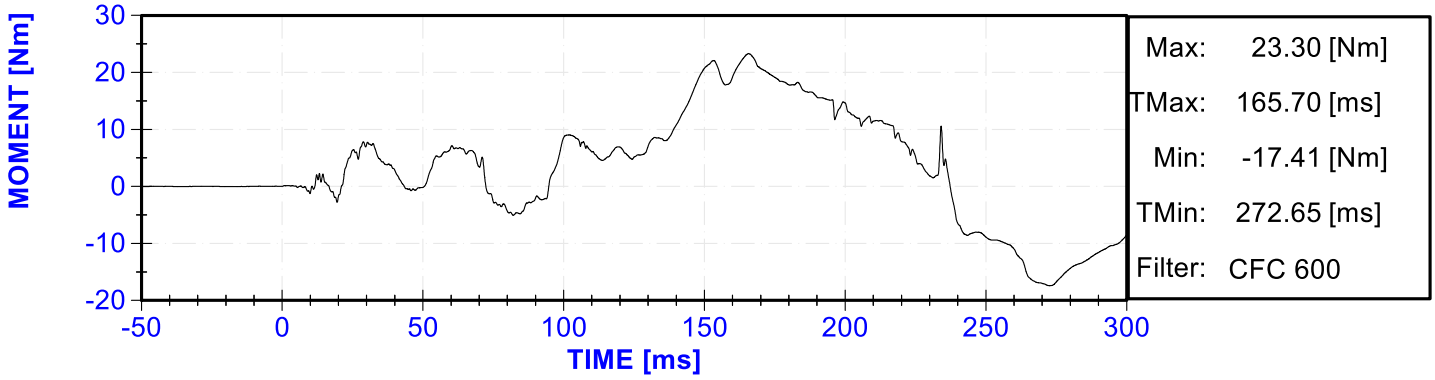

Lower Neck X Moment
MOMENT [Nm]
TIME [ms]
Max: 0.05 [Nm]
TMax: 136.80 [ms]
Min: -29.77 [Nm]
TMin: 26.20 [ms]
Filter: CFC 600


Lower Neck Y Moment
MOMENT [Nm]
TIME [ms]
Max: 2.70 [Nm]
TMax: 273.45 [ms]
Min: -12.54 [Nm]
TMin: 18.90 [ms]
Filter: CFC 600

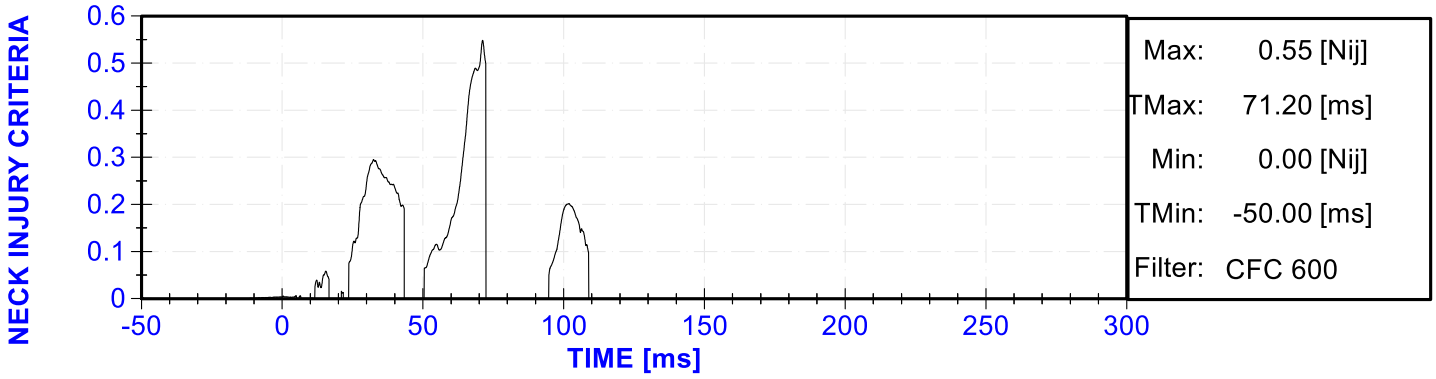

Lower Neck Z Moment
MOMENT [Nm]
TIME [ms]
Max: 6.19 [Nm]
TMax: 139.95 [ms]
Min: -12.51 [Nm]
TMin: 58.60 [ms]
Filter: CFC 600


Lower Neck Moment Resultant
MOMENT [Nm]
TIME [ms]
Max: 31.34 [Nm]
TMax: 25.50 [ms]
Min: 0.00 [Nm]
TMin: -31.35 [ms]
Filter: CFC 600

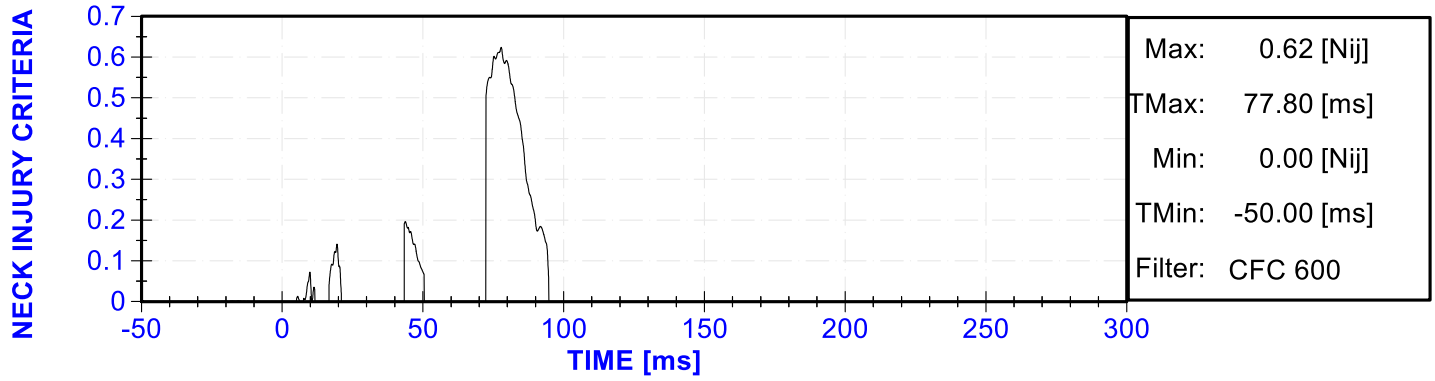
Total Moment about the OC



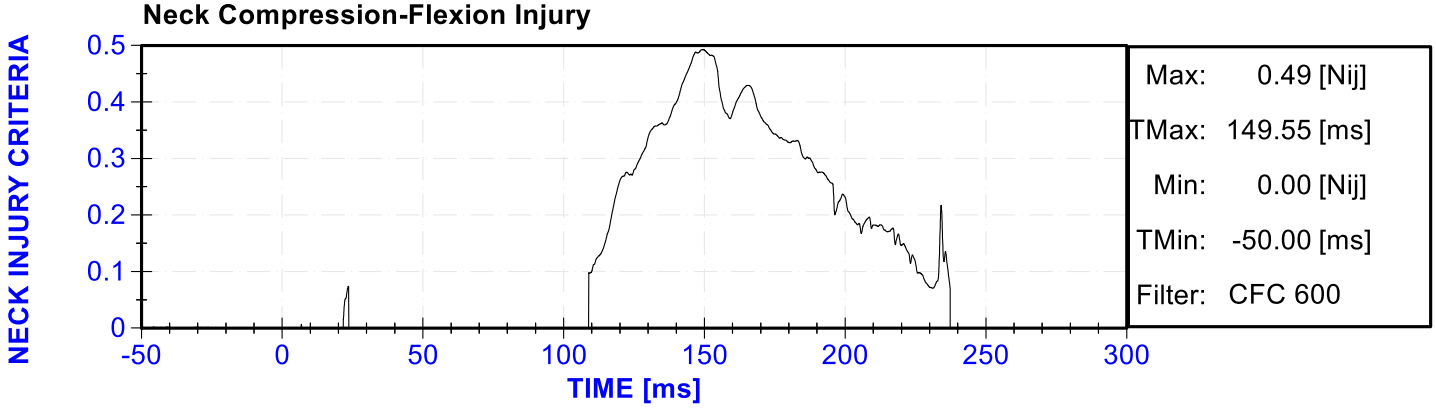
Neck Tension-Flexion Injury

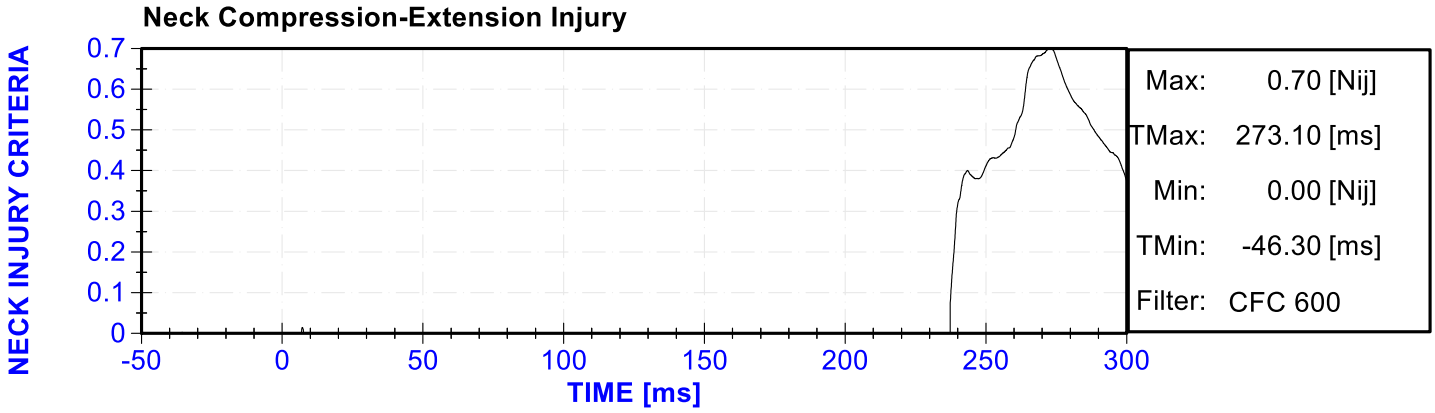


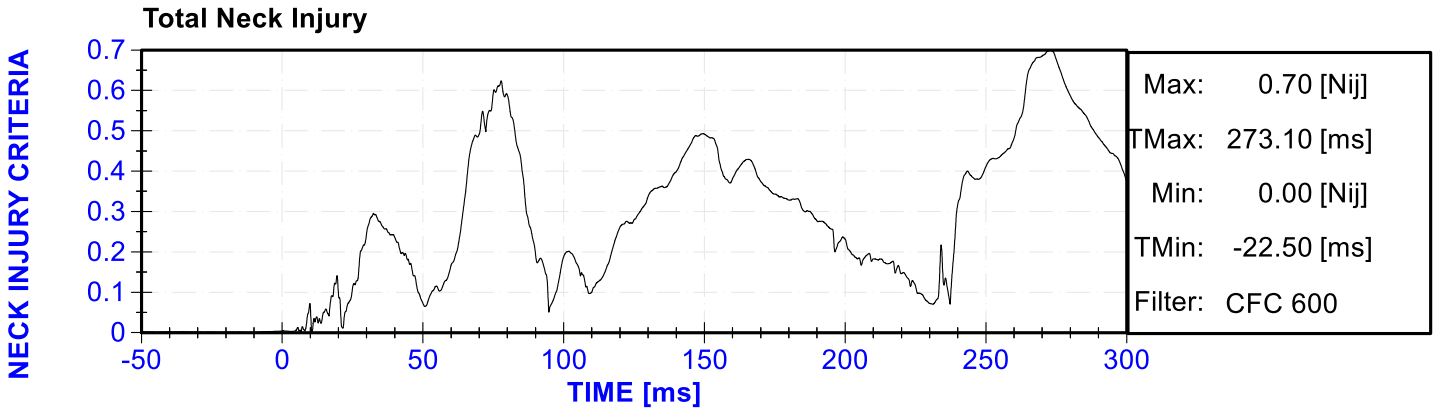
Neck Tension-Extension Injury

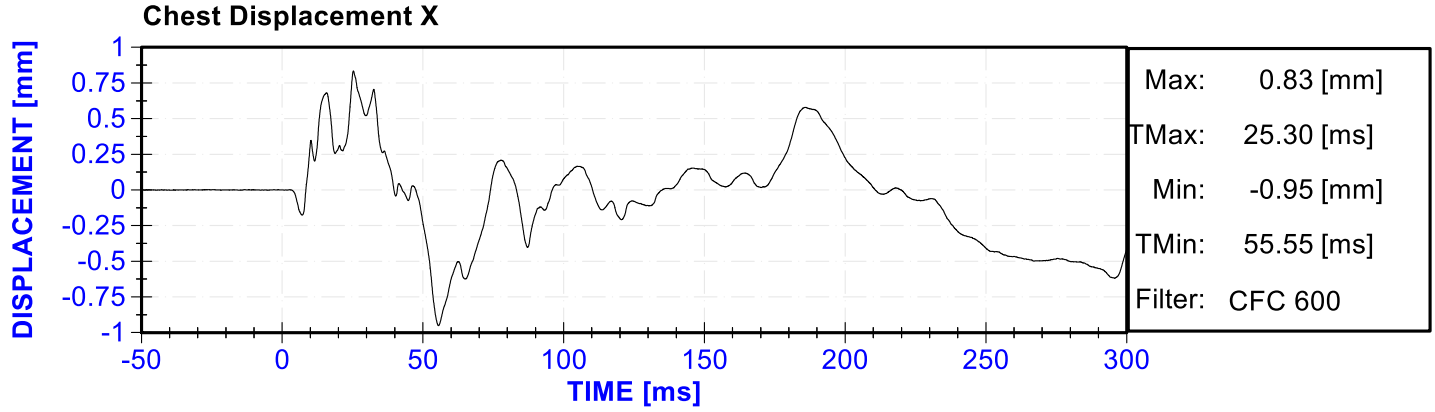


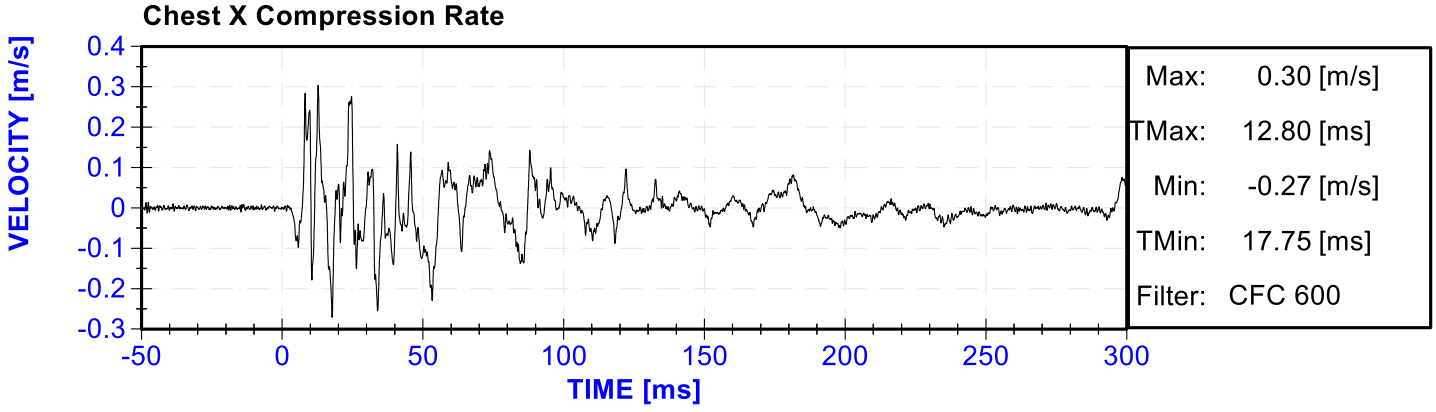
Neck Compression-Flexion Injury

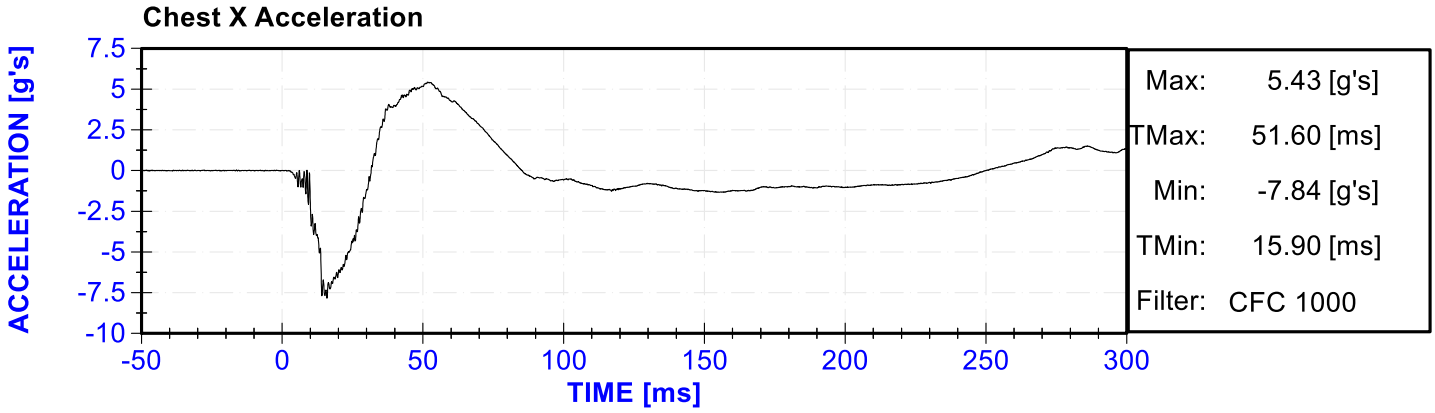


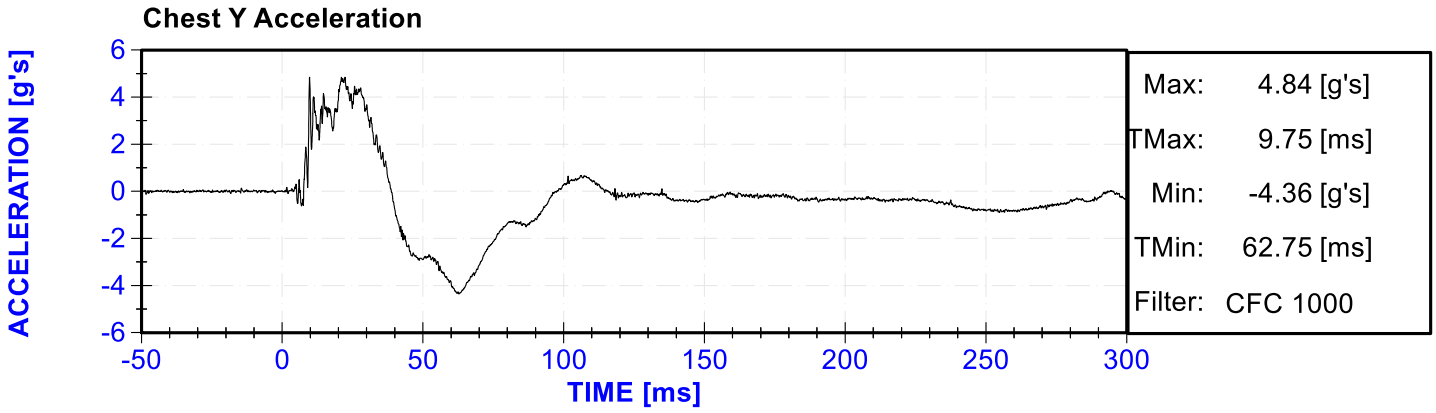

Neck Compression-Extension Injury
NECK INJURY CRITERIA
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 0.70 [Nij]
TMax: 273.10 [ms]
Min: 0.00 [Nij]
TMin: -46.30 [ms]
Filter: CFC 600

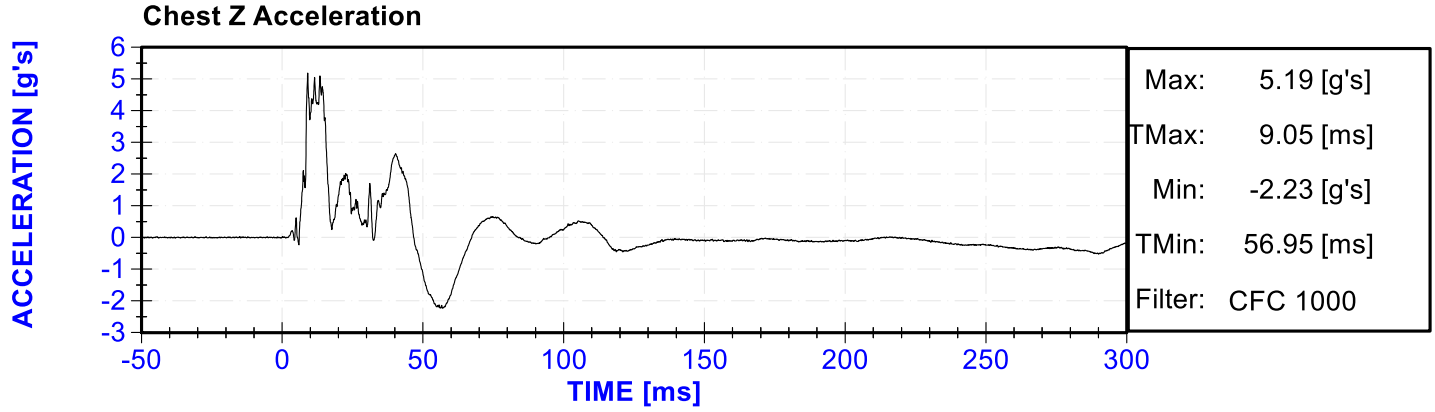

Total Neck Injury
NECK INJURY CRITERIA
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 0.70 [Nij]
TMax: 273.10 [ms]
Min: 0.00 [Nij]
TMin: -22.50 [ms]
Filter: CFC 600

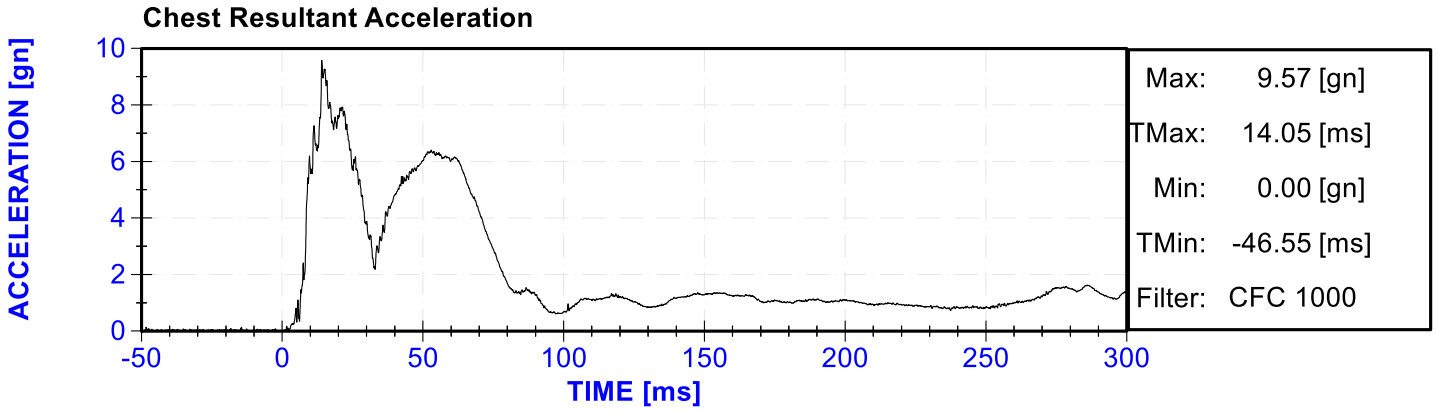

Chest Displacement X
DISPLACEMENT [mm]
1
0.75
0.5
0.25
0
-0.25
-0.5
-0.75
-1
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 0.83 [mm]
TMax: 25.30 [ms]
Min: -0.95 [mm]
TMin: 55.55 [ms]
Filter: CFC 600


Chest X Compression Rate
VELOCITY [m/s]
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 0.30 [m/s]
TMax: 12.80 [ms]
Min: -0.27 [m/s]
TMin: 17.75 [ms]
Filter: CFC 600

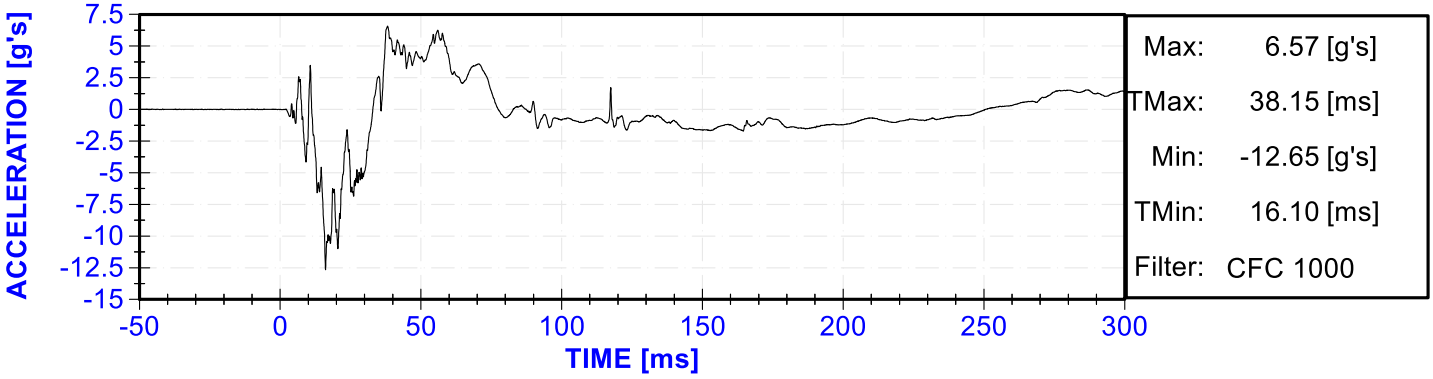

Chest X Acceleration
ACCELERATION [g's]
7.5
5
2.5
0
-2.5
-5
-7.5
-10
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 5.43 [g's]
TMax: 51.60 [ms]
Min: -7.84 [g's]
TMin: 15.90 [ms]
Filter: CFC 1000


Chest Y Acceleration
ACCELERATION [g's]
6
4
2
0
-2
-4
-6
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 4.84 [g's]
TMax: 9.75 [ms]
Min: -4.36 [g's]
TMin: 62.75 [ms]
Filter: CFC 1000

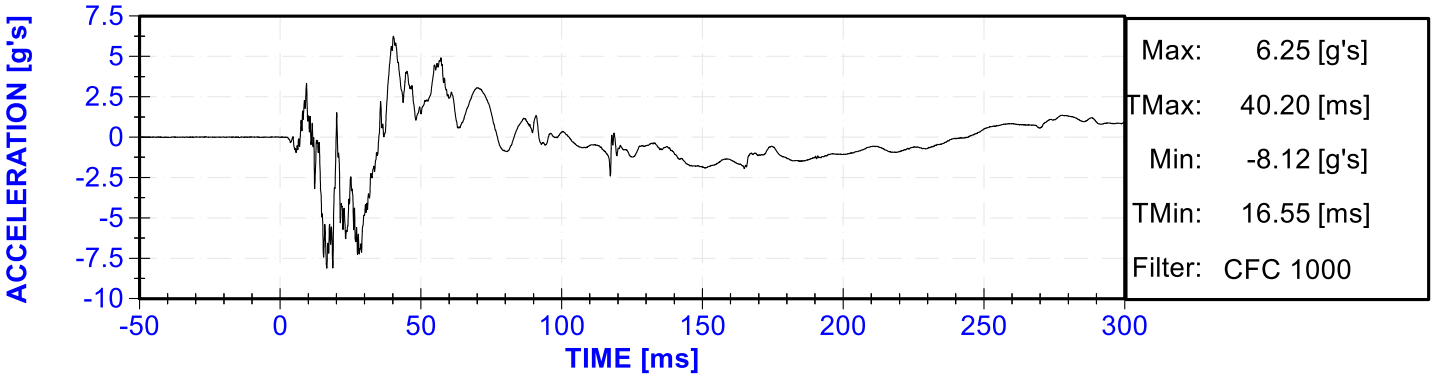

Chest Z Acceleration
ACCELERATION [g's]
6
5
4
3
2
1
0
-1
-2
-3
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 5.19 [g's]
TMax: 9.05 [ms]
Min: -2.23 [g's]
TMin: 56.95 [ms]
Filter: CFC 1000


Chest Resultant Acceleration
ACCELERATION [gn]
10
8
6
4
2
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 9.57 [gn]
TMax: 14.05 [ms]
Min: 0.00 [gn]
TMin: -46.55 [ms]
Filter: CFC 1000

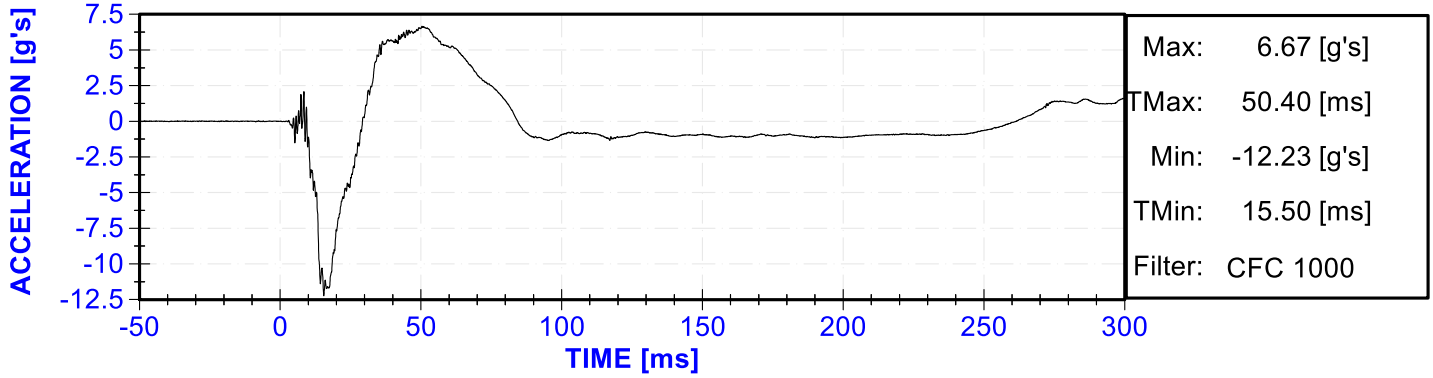
Upper Sternum X Acceleration



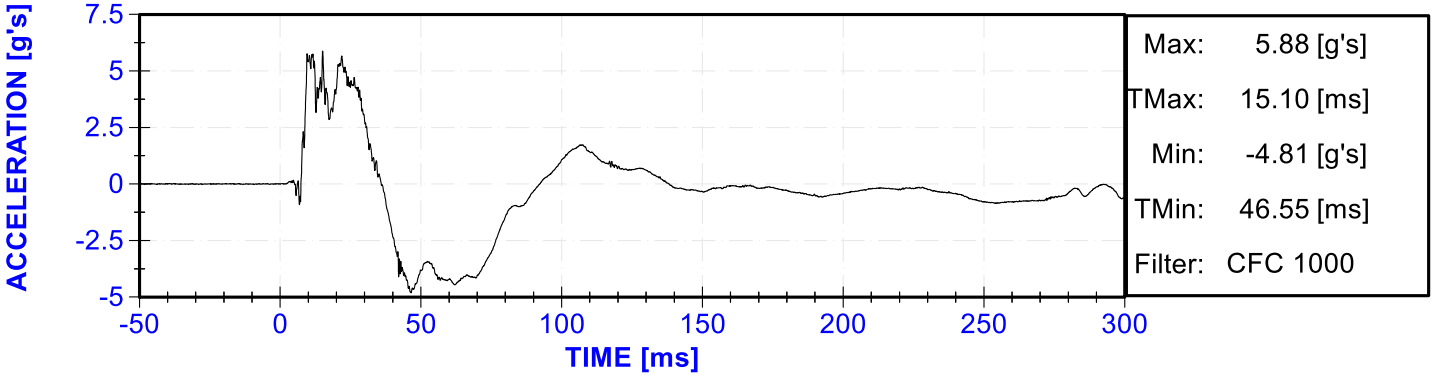
Lower Sternum X Acceleration

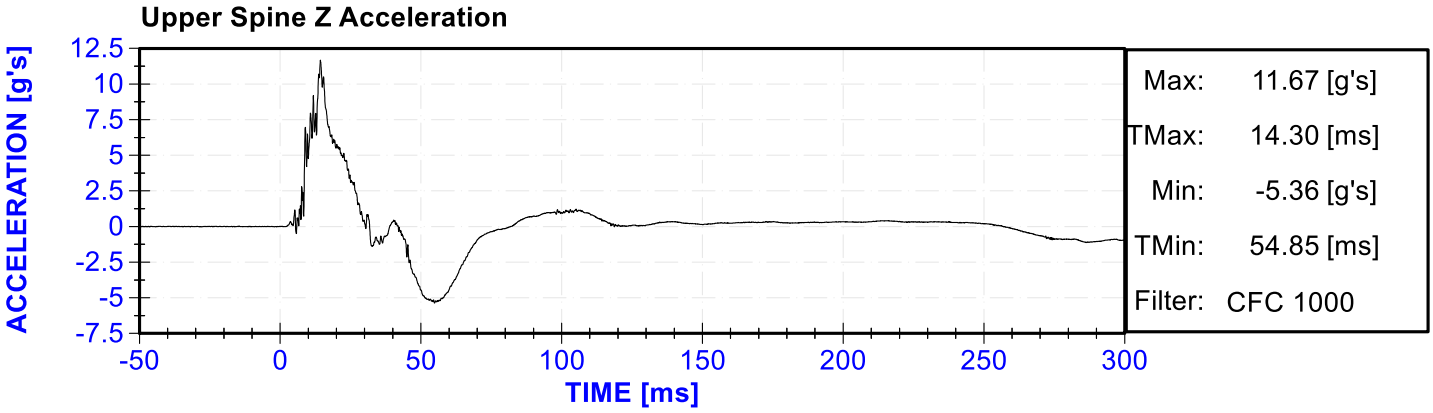


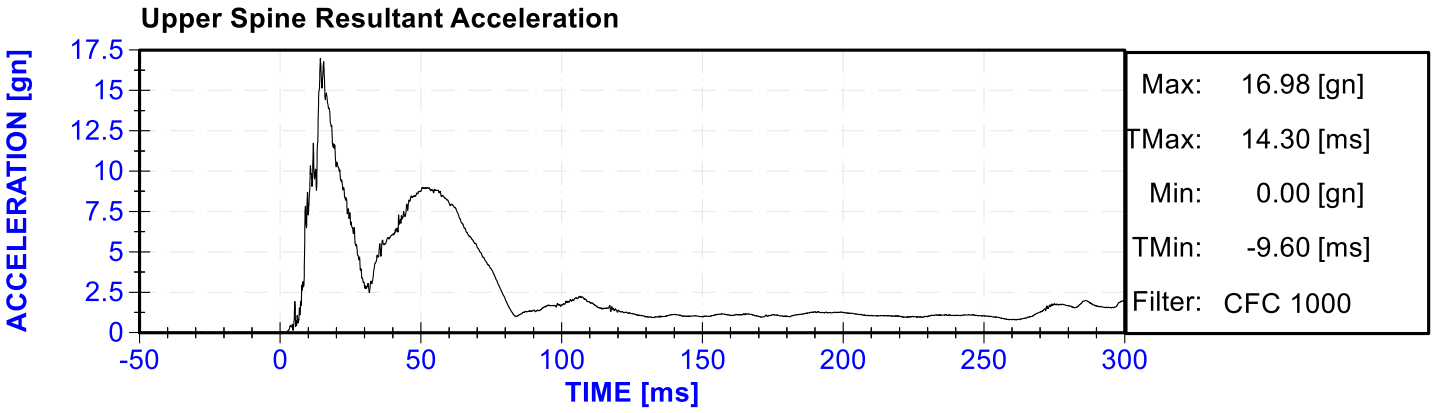
Upper Spine X Acceleration

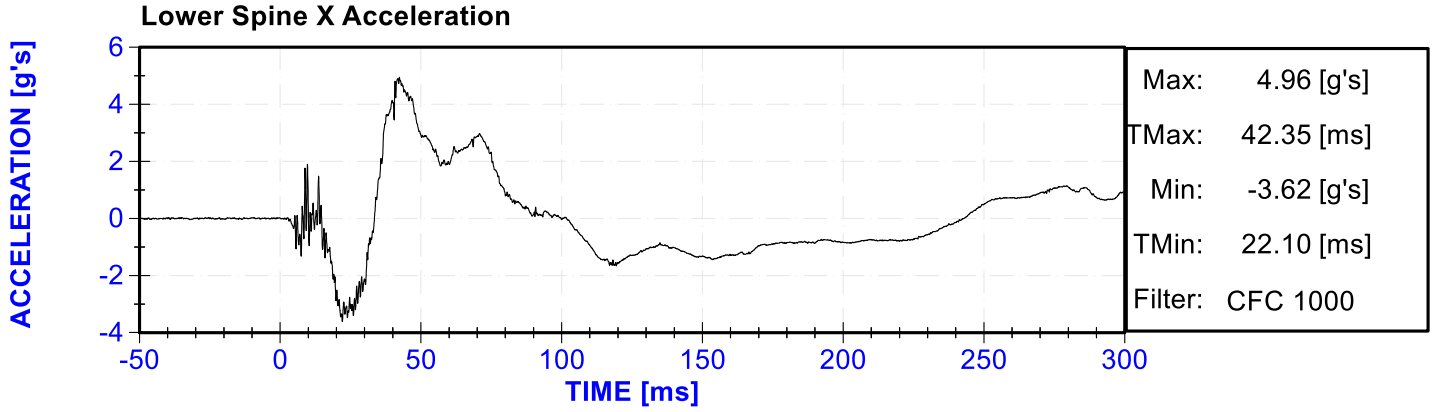


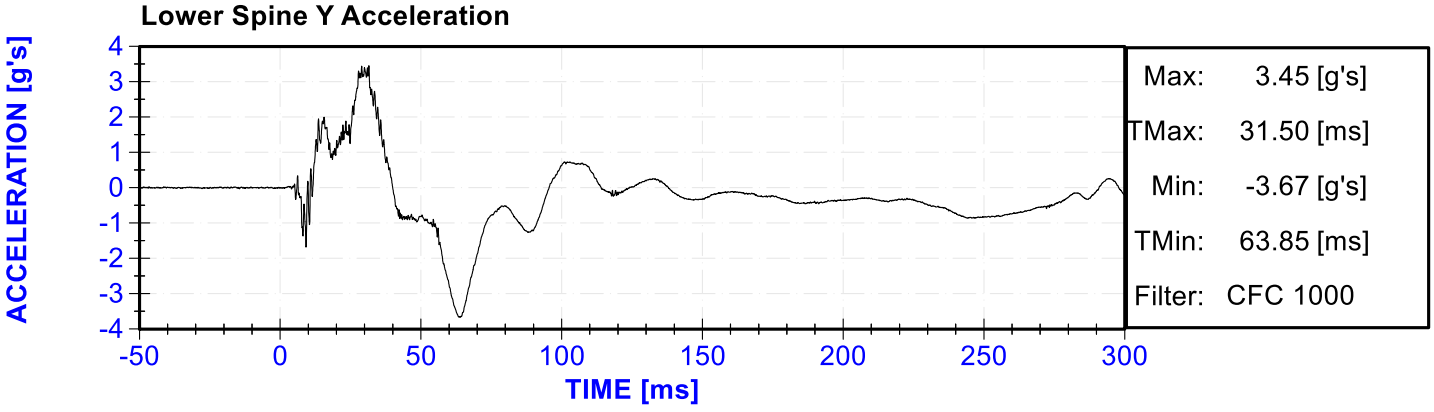
Upper Spine Y Acceleration



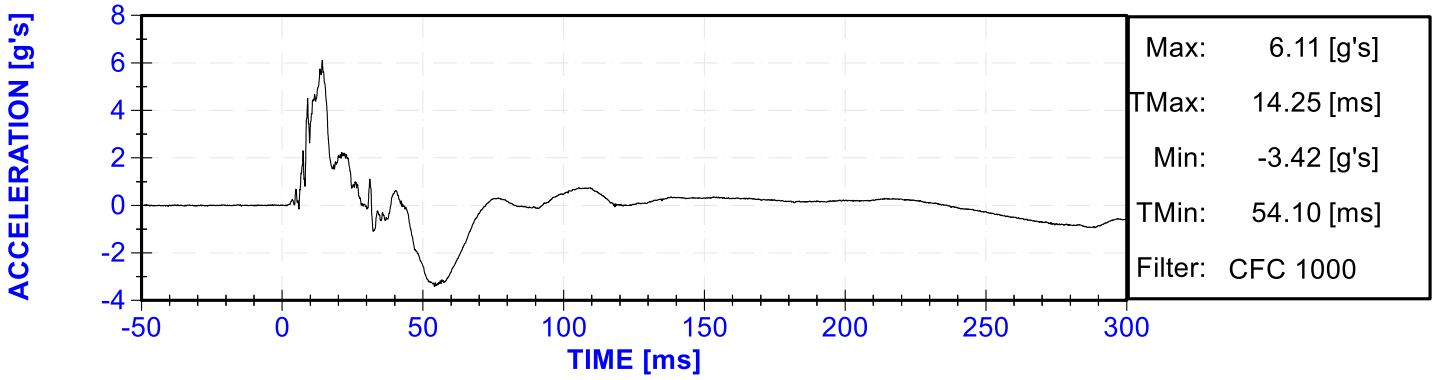

Upper Spine Z Acceleration
ACCELERATION [g's]
12.5
10
7.5
5
2.5
0
-2.5
-5
-7.5
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 11.67 [g's]
TMax: 14.30 [ms]
Min: -5.36 [g's]
TMin: 54.85 [ms]
Filter: CFC 1000


Upper Spine Resultant Acceleration
ACCELERATION [gn]
17.5
15
12.5
10
7.5
5
2.5
0
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 16.98 [gn]
TMax: 14.30 [ms]
Min: 0.00 [gn]
TMin: -9.60 [ms]
Filter: CFC 1000

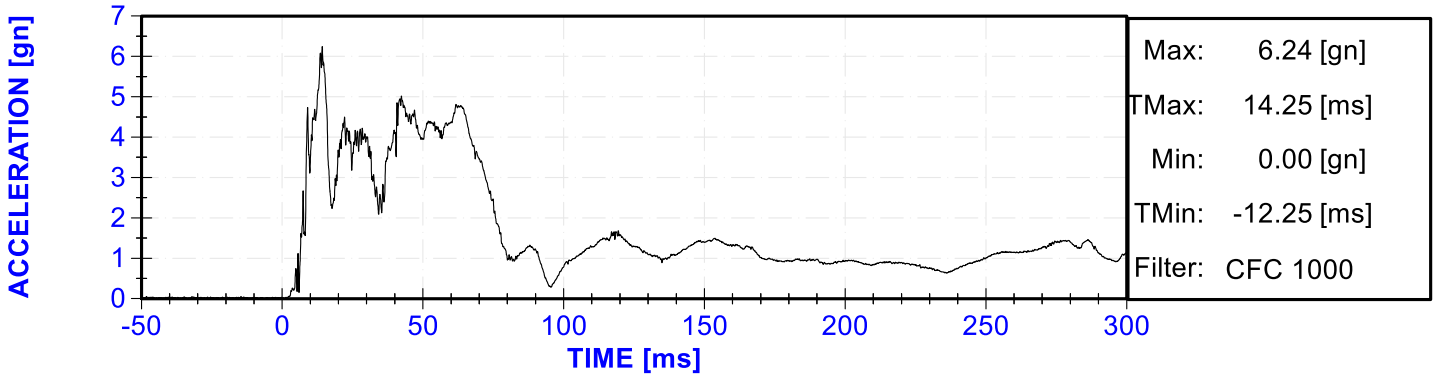

Lower Spine X Acceleration
ACCELERATION [g's]
6
4
2
0
-2
-4
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 4.96 [g's]
TMax: 42.35 [ms]
Min: -3.62 [g's]
TMin: 22.10 [ms]
Filter: CFC 1000


Lower Spine Y Acceleration
ACCELERATION [g's]
4
3
2
1
0
-1
-2
-3
-4
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 3.45 [g's]
TMax: 31.50 [ms]
Min: -3.67 [g's]
TMin: 63.85 [ms]
Filter: CFC 1000

Lower Spine Z Acceleration

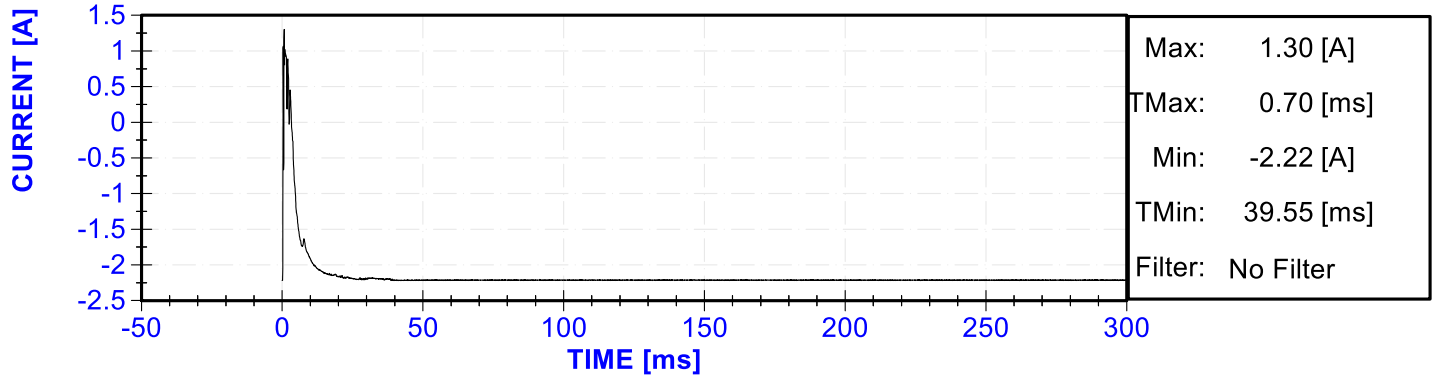


Lower Spine Resultant Acceleration



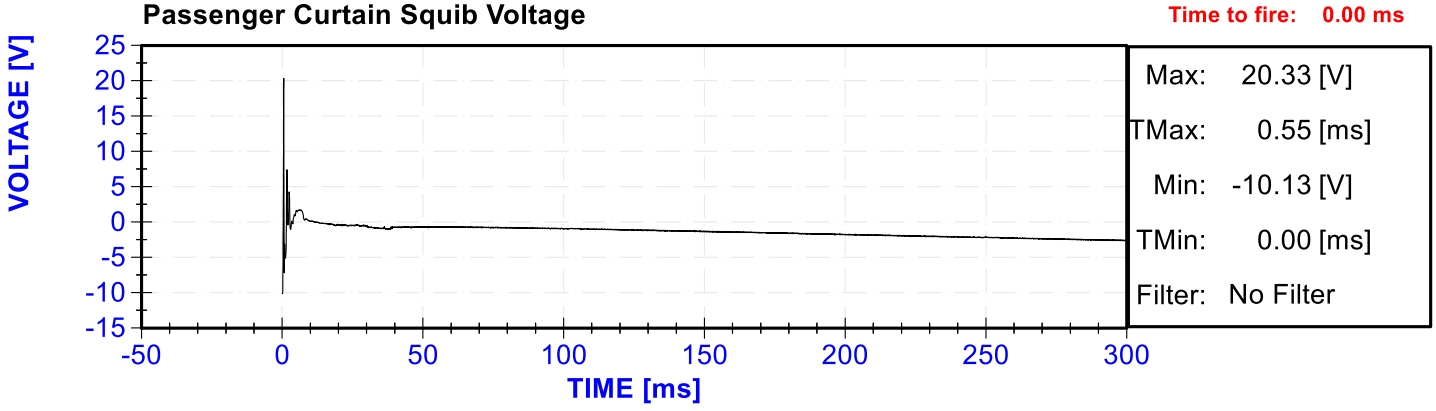
Passenger Curtain Squib Current

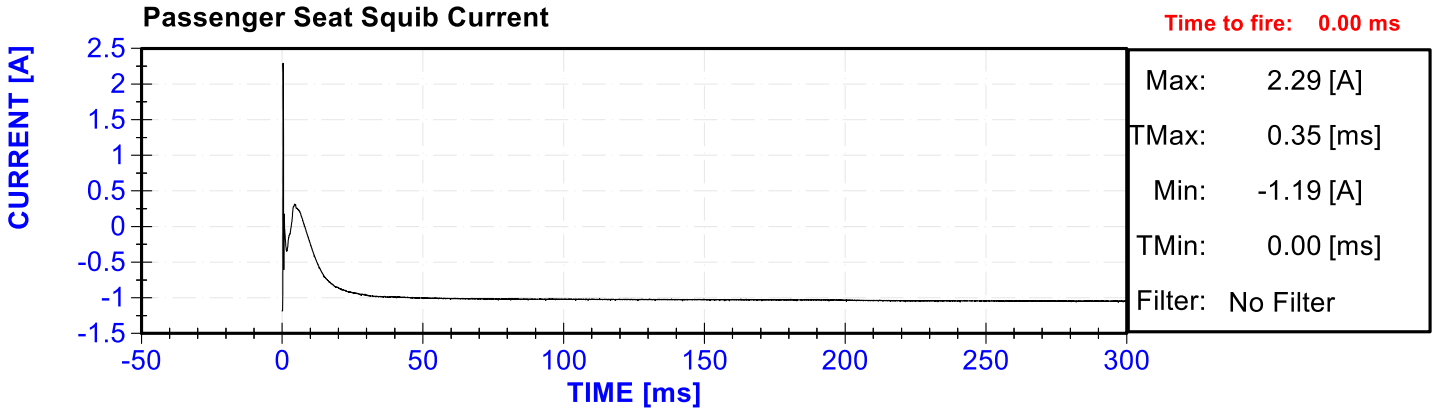
Time to fire: 0.00 ms

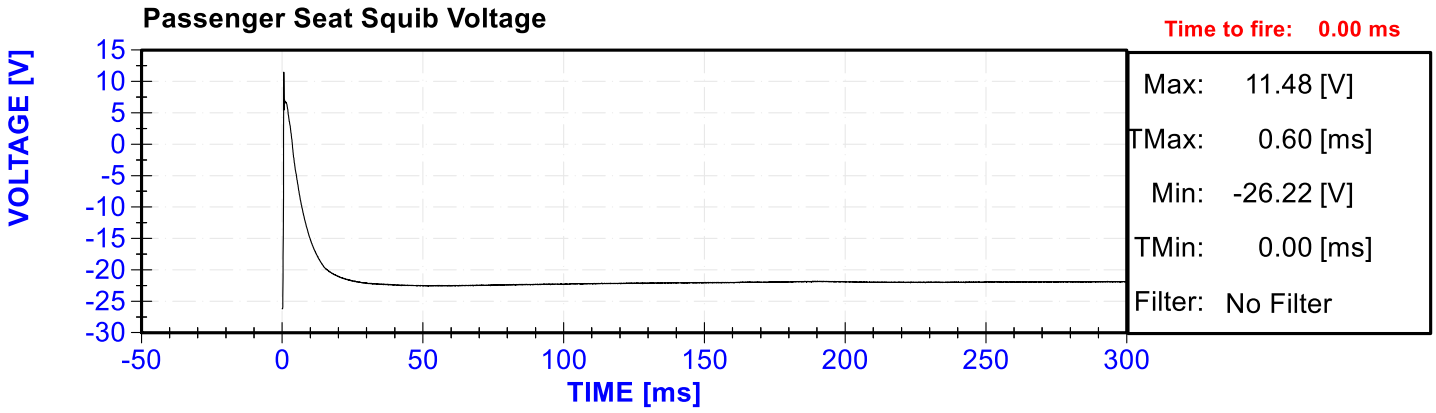


Passenger Curtain Squib Voltage

Time to fire: 0.00 ms




Passenger Seat Squib Current
Time to fire: 0.00 ms
CURRENT [A]
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 2.29 [A]
TMax: 0.35 [ms]
Min: -1.19 [A]
TMin: 0.00 [ms]
Filter: No Filter


Passenger Seat Squib Voltage
Time to fire: 0.00 ms
VOLTAGE [V]
15
10
5
0
-5
-10
-15
-20
-25
-30
-50
0
50
100
150
200
250
300
TIME [ms]
Max: 11.48 [V]
TMax: 0.60 [ms]
Min: -26.22 [V]
TMin: 0.00 [ms]
Filter: No Filter

APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

	POSITION 3 (Rear Right Passenger) SERIAL NO.: 139 M20180202TWG3		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Head X Acceleration	AC-P64001	ENDEVCO 7264CT	7/3/2018
Head Y Acceleration	AC-P51687	ENDEVCO 7264CT	7/3/2018
Head Z Acceleration	AC-P15321	ENDEVCO 7264	7/3/2018
Head Redundant X Acceleration	-	-	-
Head Redundant Y Acceleration	-	-	-
Head Redundant Z Acceleration	-	-	-
Upper Neck X Force	LC-125Fx	FTSS IF-234	7/12/2018
Upper Neck Y Force	LC-125Fy	FTSS IF-234	7/12/2018
Upper Neck Z Force	LC-125Fz	FTSS IF-234	7/12/2018
Upper Neck X Moment	LC-125Mx	FTSS IF-234	7/12/2018
Upper Neck Y Moment	LC-125My	FTSS IF-234	7/12/2018
Upper Neck Z Moment	LC-125Mz	FTSS IF-234	7/12/2018
Lower Neck X Force	LC-208 Fx	Humanetics 3303	7/12/2018
Lower Neck Y Force	LC-208 Fy	Humanetics 3303	7/12/2018
Lower Neck Z Force	LC-208 Fz	Humanetics 3303	7/12/2018
Lower Neck X Moment	LC-208 Mx	Humanetics 3303	7/12/2018
Lower Neck Y Moment	LC-208 My	Humanetics 3303	7/12/2018
Lower Neck Z Moment	LC-208 Mz	Humanetics 3303	7/12/2018
Curtain Bag Voltage	ABT squib volts	AutoLab System	-
Curtain Bag Current	ABT squib amps	AutoLab System	-
Seat/Torso Bag Voltage	ABT squib volts	AutoLab System	-
Seat/Torso Bag Current	ABT squib amps	AutoLab System	-