

REPORT NUMBER: R&D-CAL-15-004

**MOVING BARRIER TO VEHICLE CRASH TEST IN SUPPORT OF NHTSA'S
FRONTAL OBLIQUE OFFSET PROGRAM
OBLIQUE MOVING DEFORMABLE BARRIER INTO RIGHT FRONT OF A**

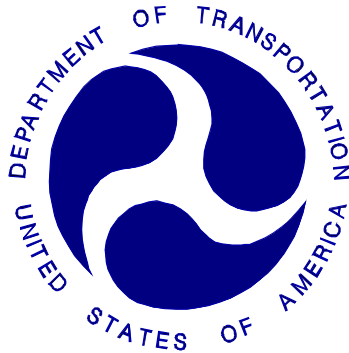
2015 Volvo S60

90.1KPH, 15 DEGREE ANGLE, 35% OVERLAP

TEST DATE: 09/24/2015

NHTSA No: R20155913

**CALSPAN CORPORATION
TRANSPORTATION TEST OPERATIONS
P.O. BOX 400
BUFFALO, NEW YORK 14225**



FINAL REPORT SUBMITTED:

May 19, 2016

PREPARED FOR:

**U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Vehicle safety Research
1200 New Jersey Ave, SE
Room W46-446
Washington, DC 20590**

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Prepared by: Vanessa Hansen
Vanessa Hansen, Test Engineer

Date: May 19, 2016

Approved by: Edward J. Dutton
Edward J. Dutton, Operations Manager
Transportation Test Operations

Date: May 19, 2016

FINAL REPORT ACCEPTANCE BY VEHICLE SAFETY RESEARCH, OFFICE OF
STRUCTURAL AND RESTRAINTS RESEARCH DIVISION:

Date: _____

TOM, Vehicle Crash Testing
NHTSA, Office of Structures and Restraints Research
Date: _____

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract A test was conducted in accordance with Contract DTNH22-14-D-00359. The Test consisted of a Oblique Moving Deformable Barrier (OMDB) traveling at a target speed of 90.12 kph into a stationary 2015 Volvo S60 four door sedan. The struck vehicle was positioned 15 degrees relative to the moving barrier and impacted 35% of the right side of the vehicle. The test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301, and foot well intrusion performance. The test was conducted at the Calspan Corporation's Transportation Test Operation's facility in Buffalo, New York on September 24, 2015. The OMDB impact velocity was 90.15 kph and the ambient temperature at the test vehicle at the time of impact was 21°C. The target vehicle post-test maximum crush was 472 mm. The test vehicle's performance was as follows: <table border="1"> <thead> <tr> <th>Measurement Description</th><th>Units</th><th>Driver THOR</th><th>Pass. THOR</th></tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td><td>N/A</td><td>173.18</td><td>240.62</td></tr> <tr> <td>Brain Injury Criteria (BrIC)</td><td>N/A</td><td>1.72</td><td>0.99</td></tr> <tr> <td>Peak Neck Tension</td><td>mm</td><td>1919.14</td><td>2497.46</td></tr> <tr> <td>Peak Resultant Chest Deflection</td><td>N/A</td><td>47.58</td><td>51.14</td></tr> <tr> <td>Peak Abdomen Deflection</td><td>N</td><td>-55.92</td><td>-54.79</td></tr> <tr> <td>Peak Resultant Acetabulum force</td><td>N</td><td>5026.01</td><td>3027.82</td></tr> <tr> <td>Peak Femur Force</td><td>N</td><td>-8430.47</td><td>-3996.79</td></tr> <tr> <td>Right Tibia Index</td><td>N</td><td>0.42</td><td>0.63</td></tr> </tbody> </table>				Measurement Description	Units	Driver THOR	Pass. THOR	Head Injury Criteria (HIC ₁₅)	N/A	173.18	240.62	Brain Injury Criteria (BrIC)	N/A	1.72	0.99	Peak Neck Tension	mm	1919.14	2497.46	Peak Resultant Chest Deflection	N/A	47.58	51.14	Peak Abdomen Deflection	N	-55.92	-54.79	Peak Resultant Acetabulum force	N	5026.01	3027.82	Peak Femur Force	N	-8430.47	-3996.79	Right Tibia Index	N	0.42	0.63
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DISCLAIMER

The contents of this report relate only to the specific product evaluated under the specific test conditions, as defined within this report. The findings and conclusions are those of the author(s) and not necessarily those of Calspan Corporation. For the purposes of this report, Calspan Corporation provided test services only and was not involved with the consulting, design or manufacture of any product. Calspan Corporation does not endorse products or manufacturers. Further, Calspan Corporation (to include: any of its affiliates, parent companies or subsidiaries) assumes no liability associated with the contents of this report or the use of this report.

Prepared by: Vanessa Hansen
Vanessa Hansen, Project Engineer

Date: May 19, 2016

Approved by: Edward J. Dutton
Edward J. Dutton, Test Engineer Director
Transportation Test Operations

Date: May 19, 2016

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SECTION 1
PURPOSE OF TEST

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

This 90.12 kph (56 mph) Moving Barrier into a test vehicle is part of the Frontal Offset Test outlined in Contract No. DTNH22-14-D-00359, Task Order 0001. The purpose of this test is to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

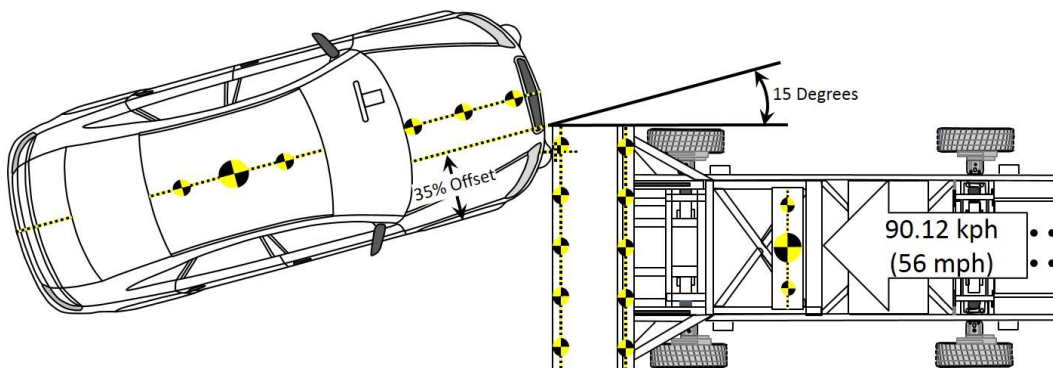
This test was conducted in accordance with the instructions set forth for a 15° angle, 35% offset moving barrier to vehicle impact, outlined in Contract No. DTNH22-14-D-00359, Task Order 0001. Data was obtained indicant of Federal Motor Vehicle Safety Standard FMVSS 208- Occupant Crash Protection, FMVSS 212 – Windshield Mounting, FMVSS 219 (partial) – Windshield Zone Intrusion, and FMVSS 301 – Fuel System Integrity, in addition to the requirements of Contract No. DTNH22-14-D-00359, Task Order 0001.

SECTION 2 SUMMARY OF TEST

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

A 2015 Volvo S60 four door sedan was impacted on the right front corner by an Oblique Moving Deformable Barrier (OMDB). This test vehicle was stationary and positioned at a target angle of 15° and at a target offset of 35% to the forward line of motion of the OMDB. The OMDB was towed down the test track in a full forward direction, without any crabbing, and at the targeted impact velocity of 90.12 kph (56.0 mph) into the test vehicle. The test vehicle's mass was 1,957 kg (4314.4 lbs), and the OMDB's mass was 2519 kg (5,552 lbs). The test was conducted by Calspan Corporation on September 24, 2015.



The test was documented by two (2) real time and fifteen (15) high-speed video cameras. Camera locations and other pertinent data are located in Data Sheet No. 6 of this report. Pre and post – test photographs of the test vehicle, OMDB, and test setup were taken using a digital still camera. Photographic documentation of the test is presented in Appendix A of this report.

One 50% adult male THOR-NT anthropomorphic test device (ATD) (Serial No. 015) was seated in the left, front (P1 -Driver's) seating position and one 50% adult male THOR-NT adult male ATD (Serial No. 016) was seated in the right front passenger seating position (P2). The driver and passenger were positioned according to instructions specified in the THOR seating procedures.

The driver was restrained with a 3 – point seat belt and frontal airbag. The passenger was restrained with a 3 – point seat belt, a frontal, curtain, and torso airbags. The driver's curtain and torso airbags were disabled.

SECTION 2 (CONTINUED)

SUMMARY OF TEST

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
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Two hundred and fifty eight (258) channels of data from the two ATD's, test vehicle and OMDB were collected using Kayser – Threde data acquisition systems. Appendix B contains dummy data plots, as well as vehicle and OMDB response data plots.

There was 87.5% total windshield retention, with 92.9% and 82.1% retention on the left and right sides, respectively. There appeared to be no intrusion into the protected zone of the windshield during any portion of the impact event. The maximum static crush of the vehicle was 429 mm at C6 to the right of the vehicle's centerline. The maximum crush of the structural bumper beam was 472 mm at B7, to the right of the vehicle's centerline. Full vehicle measurements are presented in Section 3 of this report.

All four vehicle doors remained closed and latched during the test. All doors remained operational after the impact event.

Structure observations include the following:

- Windshield had cracks throughout with minor separation along the bottom.
- The A-Pillar Buckled during impact
- Hood bent inwards and exposed part of the engine compartment

The driver ATD's visible contact points were:

- Head contacted the frontal airbag and his right hand
- Torso contacted the frontal airbag
- Left Knee contacted the knee bolster
- Right Knee contacted the knee bolster

The right front passenger ATD's visible contact points were:

- Head contacted the frontal and curtain airbag and headliner
- Torso contacted the frontal airbag, and right shoulder/arm contacted the passenger door
- Knees contacted the glove box

SECTION 2 (CONTINUED) CRASH VEHICLE SUMMARY

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

Primary Impact Data

Measured Parameter	Units	Value
OMDB Velocity at Impact	kph	90.15
OMDB Test Weight	kg	2519
OMDB Maximum Static Crush	mm	474
Vehicle Test Weight	kg	1957
Actual Vehicle Angle	degrees	15
Vehicle Maximum Static Crush	mm	472
Vertical Offset from Target Point (+ down / - up)*	mm	-8
Lateral Offset from Target Point (+ left / - right)*	mm	+16
Number of Data Channels		258
Number of Real-Time Cameras		2
Number of High-Speed Cameras		15

*Offsets are in relation to the vehicle coordinate system.

Dummy Contacts

	Driver	Picture Ref.	Passenger	Picture Ref.
Dummy Type	THOR, S/N: 015		THOR, S/N: 016	
Head Contact	Front Airbag & Right Hand	A49-A51	Front & Curtain Airbag, Headrest & Side Headliner	A70-A72
Upper Torso Contact	Front Airbag	N/A	Front Airbag,	N/A
Lower Torso Contact	None	N/A	None	N/A
Side Torso Contact	None	N/A	Arm contacted door	N/A
Left Knee Contact	Knee Bolster	A28	Glove Box	A52
Right Knee Contact	Knee Bolster	A28	Glove Box	A52

Data Anomalies

CHANNEL DESCRIPTION	EXPLANATION
Driver Front Neck Spring Tower Load Cell, Questionable spike 110ms to 112ms	Lock nut was loose, potentially causing mechanical noise
Driver Knee Left X Displacement, Questionable Spike 22.5ms to 34ms	Internal transducer issue
Driver Tibia Lower Right Z Force, Questionable spikes between 66.6ms to 86.8ms	Tightened pins in Amphenol connector

PRELIMINARY INJURY SUMMARY: Driver

Test Vehicle: R20155913-2015 Volvo S60

NHTSA No.: R20155913

Test Program: NHTSA R&D Right Oblique Offset 15deg/35%

Test Date: 9/24/2015

Driver: THOR Serial No. 015 Injury Summary

Location	Description	Unit	Source	Max	Min
Head	HIC 15ms		Compute	173.18	
	Brain Injury Criteria (BrIC)		Compute	1.72	
	Head Rotational Velocity X	Deg/s	60	2242.24	-763.87
	Head Rotational Velocity Y	Deg/s	60	2217.68	-1716.09
	Head Rotational Velocity Z	Deg/s	60	1900.23	-3583.29
Neck	Upper Neck Z-axis Force	N	1000	1919.14	-99.30
	Upper Neck Y-axis Moment	Nm	Thortest	178.02 ⁽¹⁾	-32.50 ⁽¹⁾
Chest	Upper Left Resultant Chest Deflection	mm	Thortest	23.32	
	Upper Right Resultant Chest Deflection	mm	Thortest	47.58	
	Lower Left Resultant Chest Deflection	mm	Thortest	18.40	
	Lower Right Resultant Chest Deflection	mm	Thortest	29.39	
Abdomen	Lower Left X-axis Deflection	mm	Thortest	0.10	-53.68
	Lower Right X-axis Deflection	mm	Thortest	0.08	-55.92
Acetabulum	Left Acetabulum Resultant Force	N	Compute	1805.04	0.04
	Right Acetabulum Resultant Force	N	Compute	5026.01	0.06
Femur	Left Femur Force, FZ	N	600	716.87	-3509.64
	Right Femur Force, FZ	N	600	436.90	-8430.47
Tibia	Left Upper Tibia, FZ	N	600	1217.23	-716.13
	Left Upper Tibia Index		Compute	0.56	
	Right Upper Tibia, FZ	N	600	251.42	-1066.21
	Right Upper Tibia Index		Compute	0.42	
	Left Lower Tibia, FZ	N	600	1163.62	-1097.28
	Left Lower Tibia Index		Compute	0.43	
	Right Lower Tibia, FZ	N	600	339.90 ⁽²⁾	-4917.72 ⁽²⁾
	Right Lower Tibia Index		Compute	0.46 ⁽²⁾	
Ankle	Left Ankle Rotation, RX	Deg	180	34.05	-18.24
	Left Ankle Rotation, RY	Deg	180	2.64	-16.20
	Left Ankle Dorsiflexion Moment, MY	Nm	Compute	16.67	-40.51
	Left Ankle In/Eversion Moment, MX	Nm	Compute	125.04	-39.56
	Right Ankle Rotation, RX	Deg	180	0.41	-26.57
	Right Ankle Rotation, RY	Deg	180	5.69	-18.06
	Right Ankle Dorsiflexion Moment, MY	Nm	Compute	18.92	-32.46
	Right Ankle In/Eversion Moment, MX	Nm	Compute	79.77	-19.34

Anomalies:

- (1) Front Neck Spring Tower Load Cell : Questionable spike 110ms to 112ms
- (2) Questionable data spikes between 66.6ms to 86.8ms

PRELIMINARY INJURY SUMMARY: Right Front Passenger

Test Vehicle: R20155913-2015 Volvo S60

NHTSA No.: R20155913

Test Program: NHTSA R&D Right Oblique Offset 15deg/35%

Test Date: 9/24/2015

Right Front Passenger: THOR Serial No. 016 Injury Summary

Location	Description	Unit	Source	Max	Min
Head	HIC 15ms		Compute	240.62	
	Brain Injury Criteria (BrIC)		Compute	0.99	
	Head Rotational Velocity X	Deg/s	60	585.59	-929.27
	Head Rotational Velocity Y	Deg/s	60	819.40	-2964.42
	Head Rotational Velocity Z	Deg/s	60	645.22	-664.66
Neck	Upper Neck Z-axis Force	N	1000	2497.46	-166.97
	Upper Neck Y-axis Moment	Nm	Thortest	27.38	-14.57
Chest	Upper Left Resultant Chest Deflection	mm	Thortest	51.14	
	Upper Right Resultant Chest Deflection	mm	Thortest	29.70	
	Lower Left Resultant Chest Deflection	mm	Thortest	39.81	
	Lower Right Resultant Chest Deflection	mm	Thortest	15.58	
Abdomen	Lower Left X-axis Deflection	mm	Thortest	0.05	-54.79
	Lower Right X-axis Deflection	mm	Thortest	0.34	-40.51
Acetabulum	Left Acetabulum Resultant Force	N	Compute	2616.34	0.07
	Right Acetabulum Resultant Force	N	Compute	3027.82	0.07
Femur	Left Femur Force, FZ	N	600	317.45	-3919.09
	Right Femur Force, FZ	N	600	402.72	-3996.79
Tibia	Left Upper Tibia, FZ	N	600	49.84	-2165.59
	Left Upper Tibia Index		Compute	0.63	
	Right Upper Tibia, FZ	N	600	227.02	-1275.75
	Right Upper Tibia Index		Compute	0.51	
	Left Lower Tibia, FZ	N	600	105.98	-3007.77
	Left Lower Tibia Index		Compute	0.73	
	Right Lower Tibia, FZ	N	600	70.90	-1777.37
	Right Lower Tibia Index		Compute	0.48	
Ankle	Left Ankle Rotation, RX	Deg	180	38.88	-6.11
	Left Ankle Rotation, RY	Deg	180	3.01	-36.36
	Left Ankle Dorsiflexion Moment, MY	Nm	Compute	8.22	-53.21
	Left Ankle In/Eversion Moment, MX	Nm	Compute	116.97	-10.99
	Right Ankle Rotation, RX	Deg	180	32.55	-14.42
	Right Ankle Rotation, RY	Deg	180	8.22	-27.43
	Right Ankle Dorsiflexion Moment, MY	Nm	Compute	20.33	-52.41
	Right Ankle In/Eversion Moment, MX	Nm	Compute	80.86	-62.12
Anomalies: None					

SECTION 3 DATA SHEETS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

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DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

VEHICLE INFORMATION

NHTSA No.	R20155913
Model Year	2015
Make	Volvo
Model	S60
Body Style	Four Door Sedan
VIN	YV1612TJ4F2356711
Body Color	Maroon
Odometer Reading (km/mi)	284.9 km / 177 mi
Engine Displacement. (L)	2.5
Type/No. Cylinders	I5
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	6-Speed
Overdrive	Yes
Final Drive	AWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
Anti-Lock Brakes (ABS)	Yes
All-Wheel Drive (AWD)	Yes
Traction Control System (TCS)	Yes

VEHICLE OPTIONS

Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	No
Other Optional Feature	-
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	Yes
Driver Torso/Pelvis Airbag	No
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Pass. Front Airbag	Yes
Pass. Curtain Airbag	Yes
Pass. Head/Torso Airbag	No
Pass. Torso Airbag	Yes
Pass. Torso/Pelvis Airbag	No
Pass. Pelvis Airbag	No
Pass. Knee Airbag	No
Driver Seat Belt Pretensioner	Yes
Pass. Seat Belt Pretensioner	Yes
Driver Load Limiter	Yes
Pass. Load Limiter	Yes
Other Safety Restraint	-

Does owner's manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Volvo Car Corporation
Date of Manufacture	12/14

GWR (kg)	2164
GAWR Front (kg)	1195
GAWR Rear (kg)	1030

VEHICLE SEATING AND WEIGHT CAPACITY

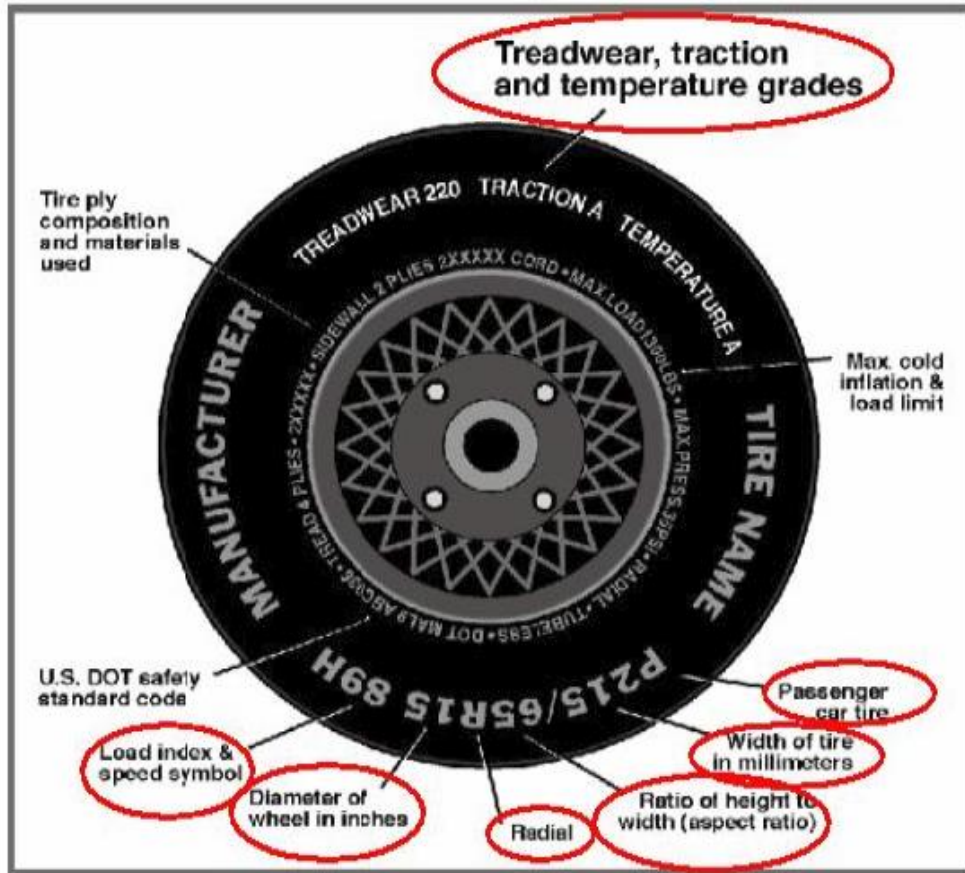
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench	--	
Number of Occupants	2	3	--	5
Capacity Wt. (VCW) (kg)				465
Cargo Wt. (RCLW) (kg)				124.8

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

Collect items circled in red, tire manufacturer, and tire name.



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	340	340
Cold Pressure (kPa)	260	260
Recommended Tire Size	215/50R17	215/50R17
Tire Size on Vehicle	215/50R17	215/50R17
Tire Manufacturer	Michelin	Michelin
Tire Model	Primary MXM4	Primary MXM4
Treadwear	500	500
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 polyester, 2 steel, 1 polyamide	2 polyester, 2 steel, 1 polyamide
Load Index/Speed Symbol	95V	95V
Tire Material	Rubber	Rubber
DOT Safety Code Right	F338 005X 2914	F338 005X 2914
DOT Safety Code Left	F338 005X 2914	F338 005X 2914

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	526	304		571	414	
Right	kg	490	331		540	432	
Ratio	%	62%	38%		57%	43%	
Totals	kg	1016	635	1651	1111	846	1957

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1651
Weight of 2 THOR ATDs	kg	190
Rated Cargo/Luggage Weight (RCLW)	kg	124.8
Calculated Vehicle Target Weight (TVTW)	kg	1965.8

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	695	696	705	713	1069
As Tested	mm	680	683	672	678	1205
Post Test	mm	UR	645	698	633	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2779
Total Vehicle Length at Left Side	mm	4531
Total Vehicle Length at Centerline	mm	4639
Total Vehicle Length at Right Side	mm	4531
Weight of Ballast in Cargo Area	kg	11.0
Weight of Vehicle Components Removed	kg	66
Amount of Stoddard Solvent in Fuel Tank	L	62.8

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:

Rear seats, rear door skin, motor, windows, trunk carpet, side door mirrors, tail light,
Jack, and pump kit.

DATA SHEET NO.1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

TARGET VEHICLE STRUCTURAL MEASUREMENT

	Elements		Pre-Test
1	Total Length	mm	4639
2	Total Width	mm	1824
3*	Bumper Top Height	mm	609
4*	Bumper Bottom Height	mm	492
5*	Longitudinal Member Top Height	mm	688
6	Distance Between Longitudinal Members	mm	1065
7	Longitudinal Member Width	mm	9
8*	Engine Top Height	mm	904
9*	Engine Bottom Height	mm	346
10	Engine and Gearbox Width	mm	500
11	Front Bumper-Engine Distance	mm	557
12*	Front Shock Absorber Fixing Height	mm	955
13*	Bonnet Leading Edge Height	mm	881
14	Front Shock Absorber Fixing Width	mm	1177
15	Front Bumper – Front Axle Distance	mm	948
16	Front Axle – A Pillar Distance	mm	528
17	A-Pillar – B-Pillar Distance	mm	1107
18	B-Pillar – Rear Axle Distance	mm	1143
19	B-Pillar – C-Pillar Distance	mm	1043
20*	Roof Sill Bottom Height	mm	1413
21*	Roof Sill Top Height	mm	1447
22*	Floor Sill Bottom Height	mm	435
23*	Floor Sill Top Height	mm	457

*Note: Height measurements are in reference to the ground.

DATA SHEET NO. 2

SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

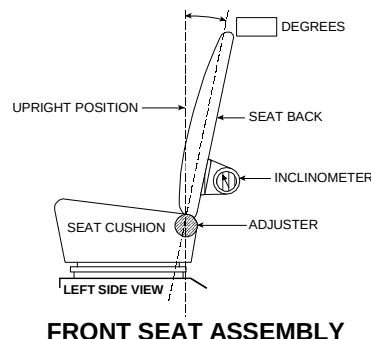
NHTSA No.: R20155913
 Test Date: 9/24/2015

NORMAL DESIGN RIDING POSITION

For adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.

Driver seat: The driver seat back was positioned according to the Nominal Design Riding position listed in FORM 1

Passenger Seat: The passenger seat back was positioned according to the Nominal Design Riding position listed in FORM 1



	UNIT	FORM 1 POSITION	AFTER ATD POSITIONING
Driver Seat Back Angle	deg	12	14
Passenger Seat Back Angle	deg	12	14

SEAT FORE/AFT POSITIONS

Describe the method used of determining seat fore/aft positions.

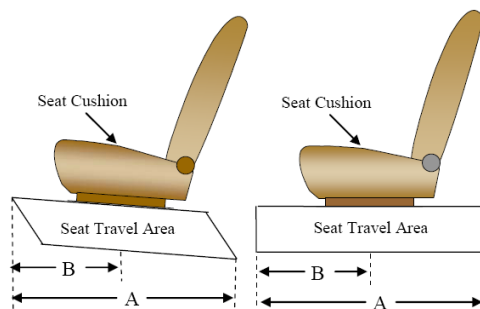
The driver's seat was positioned at its mid height position and at the mid-point of fore/aft travel. The passenger's seat was positioned at the mid-point of fore/aft travel.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	256	128
Passenger Seat	257	128

SEAT BELT UPPER ANCHORAGES

Describe the method of positioning seat belt upper anchorages. Belt anchorages were moved along the full range of motion, and marked on the B-Pillar to their respective possible positions. Photographic evidence can be found in Appendix A of this report. Zero is defined as the upper-most position.

	Total # of Positions	Placed in Position #
Driver Seat	4 (0-3)	0 – Uppermost
Passenger Seat	4 (0-3)	0 – Uppermost



DATA SHEET NO. 2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

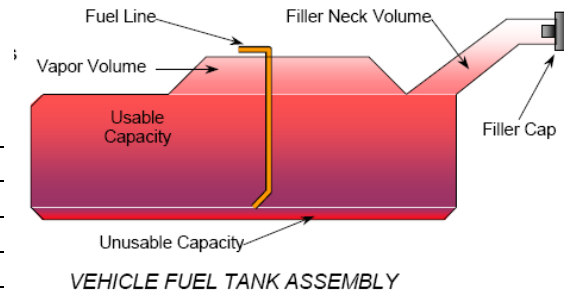
FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	67.5
Usable Capacity of "Optional Tank"	
93% of Usable Capacity	62.8
Actual Amount of Solvent Used	62.8
1/3 of Usable Capacity	22.5

FUEL PUMP

Describe the fuel system - what type of fuel pump, details about how it operates, etc.

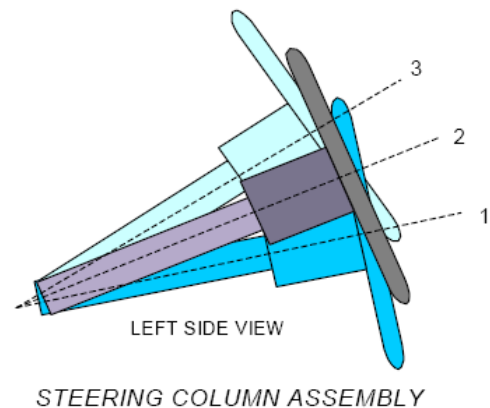
Fuel evacuated according to the specifications provided by the manufacturer in Form 1. Electric fuel pump operates when the ignition is in the 'on' position and the engine is running. The fuel filler neck is located above the right rear wheel.



STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. Describe how this measurement was taken.

The steering wheel was adjusted to the midpoint of tilt angle range and the midpoint of the telescoping travel



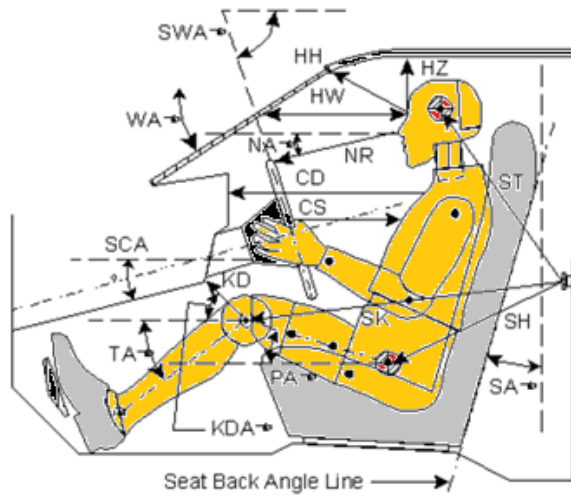
STEERING COLUMN POSITIONS

	Tilt (degrees)	Fore/Aft Position (mm)
Lowermost position No. 1	21	
Geometric center position No. 2	24	
Uppermost position No. 3	27	
Telescoping Steering Wheel Travel		45
Test Position	23	22

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

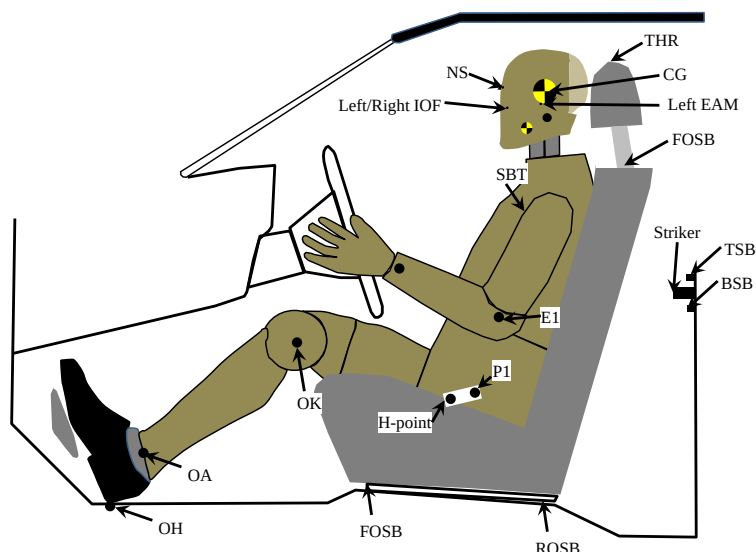


Code	Measurement Description	Driver (Serial # THOR 015)		Passenger (Serial # THOR 016)	
		Length (mm)	Angle(°)	Length (mm)	Angle (°)
WA°	Windshield Angle		27.5		
SWA°	Steering Wheel Angle		23		
SCA°	Steering Column Angle		67		
SA°	Seat Back Angle (on headrest post)		14.0		14.0
SA°	Seat Back Angle		15.3		15.3
HZ	Head to Roof (Z)	204	90	195	90
HH	Head to Header	418	19.1	415	19.7
HW	Head to Windshield	696	0	698	0
NR	Nose to Rim	481	15.6	690	27.5
CD	Chest to Dash	638		579	
CS	Chest to Steering Hub	370	1.7		
RA	Rim to Abdomen	208	0		
KDL	Left Knee to Dash	187	14.9	148	29.8
KDR	Right Knee to Dash	157	32.3	156	29.3
PA°	Pelvic Angle		33.7		33.6
TA°	Tibia Angle		38.7		42.3
SK	Striker to Knee	545	4.8	560	4.9
ST	Striker to Head	556	84.0	564	84.1
SH	Striker to H-Point	182	30.6	180	29.7
HAX°	Head Angle (X)		0.5		-0.1
HAY°	Head Angle (Y)		-2.4		-3.2
TAX°	T6 Angle (X)		0.9		0.3
TAY°	T6 Angle (Y)		22.5		19.7
TAX°	T1 (X)		1.6		0.9
TAY°	T1 (Y)		0.8		0.1
TAX°	T12 (X)		2.4		-0.8
TAY°	T12 (Y)		30.0		28.9

DATA SHEET NO.3 (CONTINUED) DUMMY CMM MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015



Description	Units	Driver			Passenger		
		X	Y	Z	X	Y	Z
Head CG	mm	2142	-451	-598	2142	445	-605
Nasion	mm	2237	-373	-600	2240	374	-609
Tip of Nose	mm	2238	-375	-564	2240	373	-573
Tip of Chin	mm	2227	-374	-463	2231	373	-474
Left EAM	mm	2148	-446	-569	2157	296	-575
Right EAM	mm	2149	-302	-563	2148	443	-576
Left IOF	mm	2233	-407	-563	2238	342	-571
Right IOF	mm	2233	-343	-560	2234	406	-571
Outboard Elbow	mm	2384	-620	-175	2282	648	-74
H-Point	mm	2357	-573	48	2357	573	46
H-Point Tool	mm	2281	-622	19	2278	622	24
Outboard Knee Bolt	mm	2743	-584	-91	2758	532	-91
Inboard Knee Bolt	mm	2763	-282	-69	2758	302	-83
Outboard Ankle Bolt	mm	3059	-586	185	3075	510	179
Outer Heel Point	mm	3077	-573	320	3056	481	321
Inboard Heel Point	mm	3105	-205	320	3055	249	314
Striker Top Bolt	mm	2167	-790	-56	2168	787	-55
Striker Bottom Bolt	mm	2176	-790	-22	2177	787	-20
Center Tip of Striker	mm	2200	-791	-45	2200	788	-44
Front Outboard Seat Anchor Bolt	mm	2675	-576	252	2674	571	253
Rear Outboard Seat Anchor Bolt	mm	2160	-579	340	2159	572	344
Outboard Head Restraint Post	mm	1947	-450	-388	1949	455	-386
Top of Head Restraint	mm	1990	-374	-677	1996	373	-676
Center of Steering Wheel	mm	2630	-373	-322			

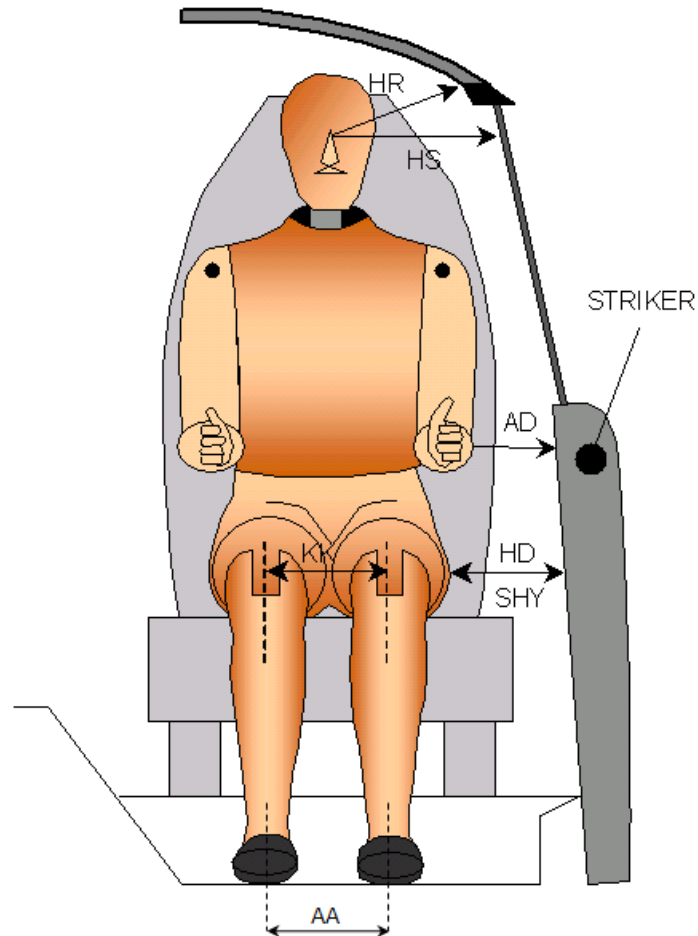
Reference point:

- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

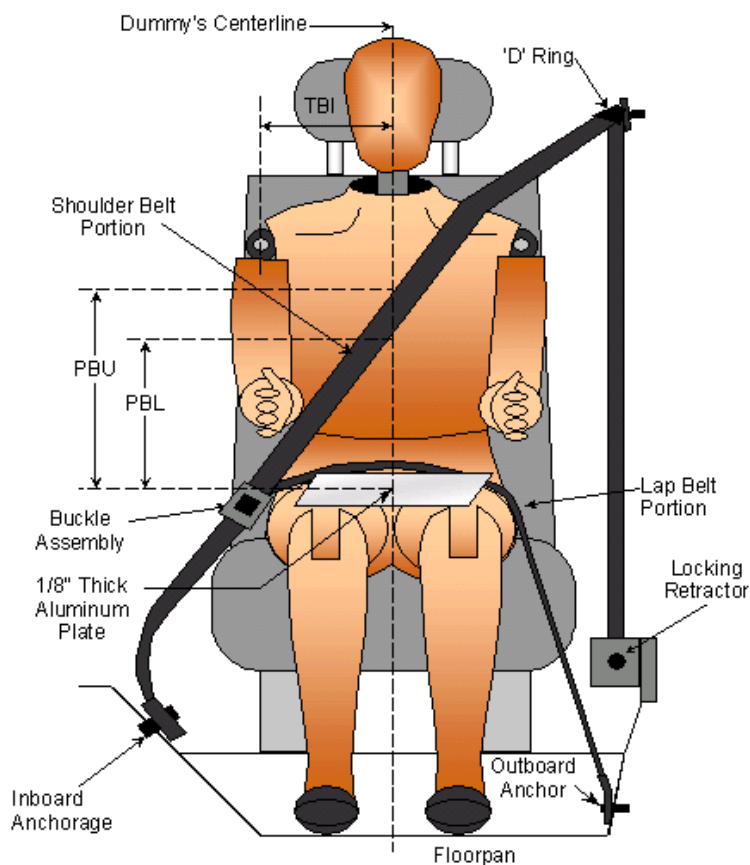


Code	Description	Units	Driver	Passenger
AD	Arm to Door	mm	108	53
HD	H-Point to Door	mm	133	128
HR	Head to Side Header	mm	203	198
HS	Head to Side Window	mm	348	345
KK	Knee to Knee	mm	345	270
SHY	Striker to H-Point (Y Direction)	mm	220	220
AA	Ankle to Ankle	mm	348	235

DATA SHEET NO. 5 SEAT BELT POSITIONING DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU — Top surface of reference to belt upper edge	mm	370	365
PBL — Top surface of reference to belt lower edge	mm	295	290

BELT LENGTH DATA

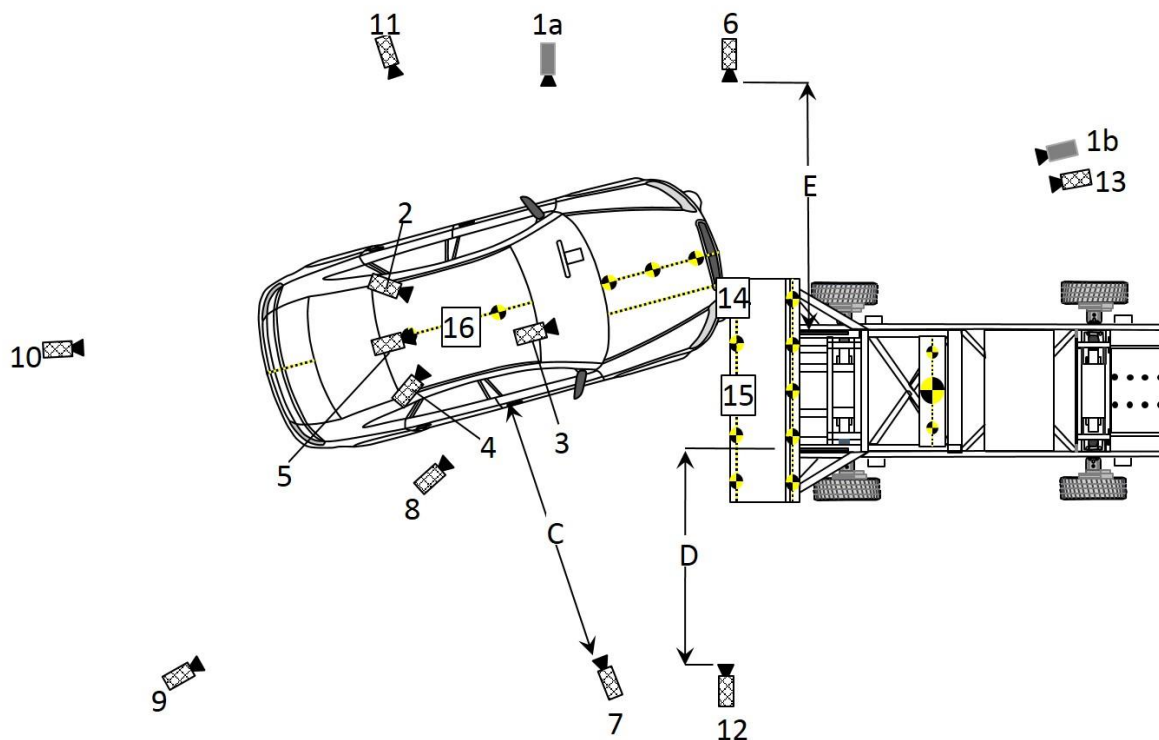
Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	848	865
Lap Belt Length as measured on ATD	mm	505	510
Remainder of belt on reel	mm	1107	1085
Total belt length for continuous webbing systems	mm	2460	2460

DATA SHEET NO. 6 **HIGH-SPEED CAMERA LOCATIONS AND DATA**

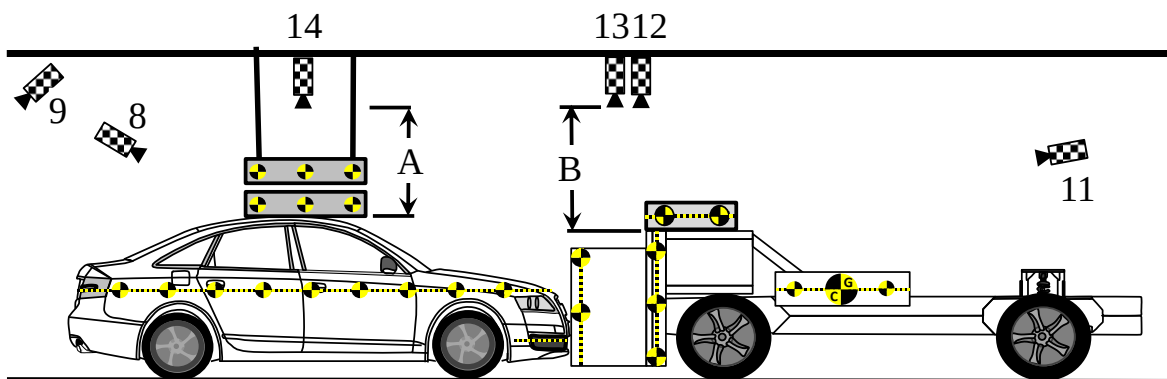
Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

HORIZONTAL LOCATION



VERTICAL LOCATION



A	mm	3857
B	mm	4140
C	mm	7808
D	mm	8162
E	mm	8164

DATA SHEET NO. 6 (CONTINUED)
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

CAMERA LOCATIONS

No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-Time Left Side	--	--	--	Zoom	60
2	Onboard Passenger Movement	7783	948	1264	12.5	1000
3	Onboard Passenger Lower Leg	6523	510	272	6.5	1000
4	Onboard Driver Movement	7759	380	1264	12.5	1000
5	Onboard Centerline	7785	661	1213	8	1000
6	Passenger Interaction	4920	9211	1068	20	1000
7	Driver Interaction	5539	7823	1457	28	1000
8	Target Vehicle Left Side Perpendicular (High)	8308	2288	3595	28	1000
9	Target Vehicle Driver Motion	12938	-6939	2520	24-70	1000
10	Rear View of Vehicle and OMDB	28750	0	3421	14	1000
11	Right Side Target Vehicle and OMDB	11155	9121	2714	24-70	1000
12	Front of Vehicle and OMDB	4907	-9247	1072	24	1000
13	Close-Up Impact Point	1242	3722	1251	28	1000
14	Overhead Impact Point View	4865	-1115	4733	28	1000
15	Overhead Vehicle View	7369	0	5327	15	1000
16	Overhead OMDB View	4678	0	5327	15	1000

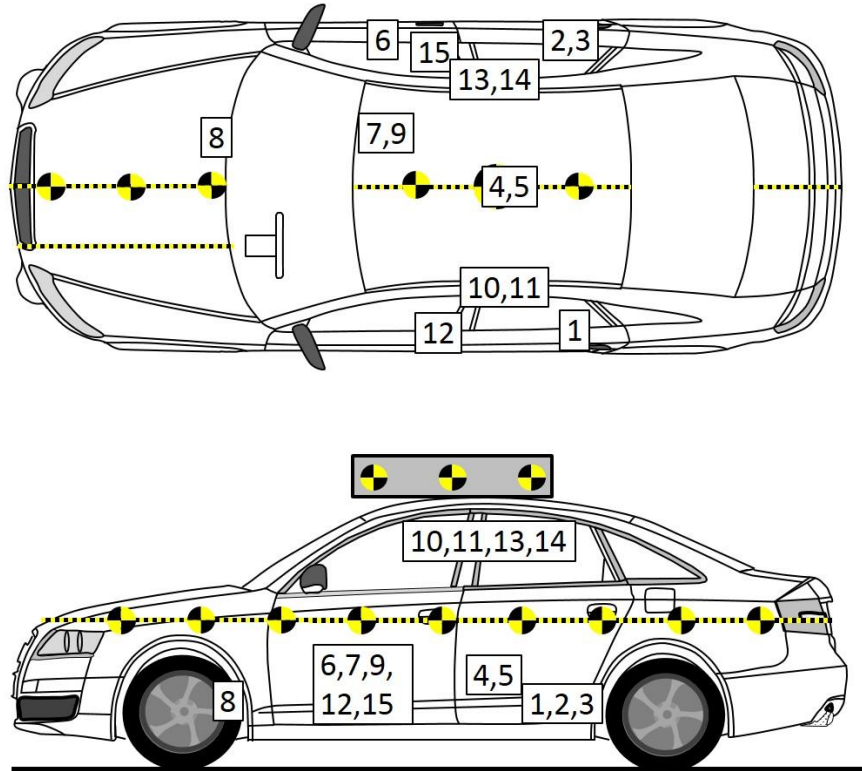
Reference Point:

- +X – From back of OMDB to front of OMDB
- +Y – Right of monorail center
- +Z – Up from ground

DATA SHEET NO. 7 **VEHICLE INSTRUMENTATION DATA**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS RELATIVE TO VCS

No.	Accelerometer Location	Axes	Units	Measurements (mm)		
				X	Y	Z
1	Left Rear Sill	X,Y	mm	1711	-707	234
2	Right Rear Sill	X,Y	mm	1731	703	235
3	Right Rear Sill Redundant	X,Y	mm	1707	703	235
4	Vehicle CG	X,Y,Z	mm	1951	-3	189
5	Vehicle CG Angular Displacement	X	mm	1963	0	198
		Y	mm	1952	11	197
		Z	mm	1952	1	190
6	Right Side Seat Track	X,Y,Z	mm	2203	550	297
8	Right Side Toe Pan	X,Y,Z	mm	3422	387	60
7	Right Side String Pot	N/A	mm	3330	367	232

Reference point:

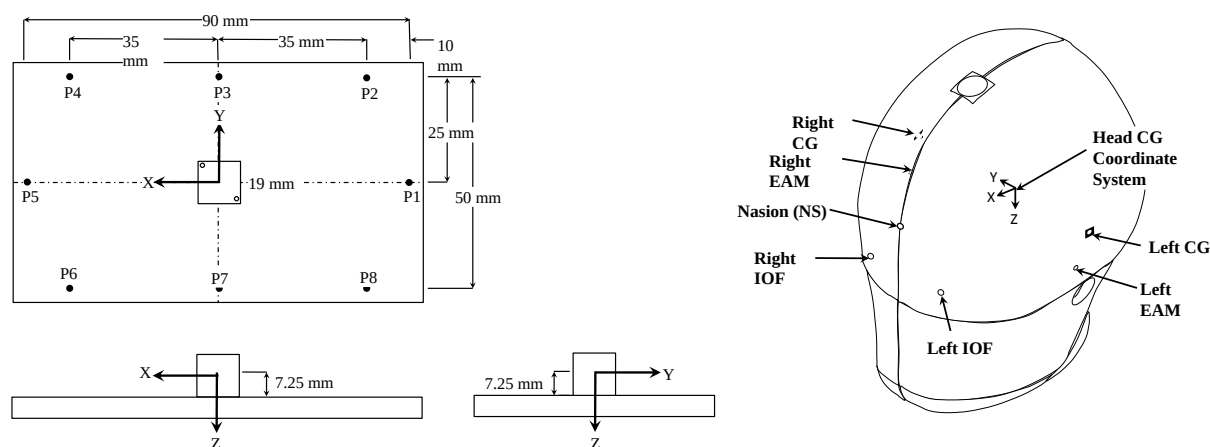
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 7 (Continued) **VEHICLE INSTRUMENTATION DATA**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

ANGULAR RATE SENSOR MOUNTING PLATE & THOR HEAT POINT DEFINITIONS



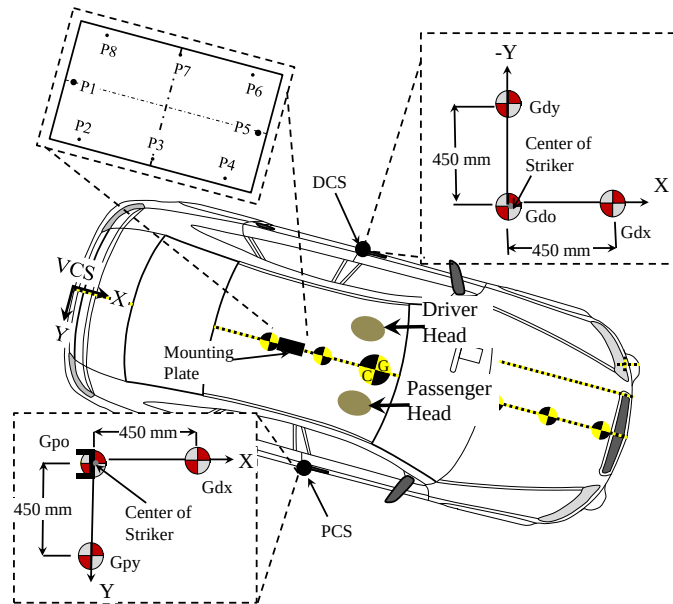
ARS MOUNTING PLATE - VEHICLE COORDINATE SYSTEM					
No.	Description	Units	Measurements (mm)		
			X	Y	Z
P1	Plate Point 1	mm	1907	0	205
P2	Plate Point 2	mm	1917	25	205
P3	Plate Point 3	mm	1952	25	205
P4	Plate Point 4	mm	1987	25	205
P5	Plate Point 5	mm	1997	0	206
P6	Plate Point 6	mm	1987	-25	206
P7	Plate Point 7	mm	1951	-25	205
P8	Plate Point 8	mm	1917	-24	205

HEAD POINTS IN RELATION TO HEAD CG COORDINATE SYSTEM					
Description	Units	X	Y	Z	
CG	mm	0	0	0	
Left CG	mm	0	-77	0	
Right CG	mm	0	77	0	
Left EAM	mm	7	-72	27	
Right EAM	mm	7	72	27	
Left IOF	mm	89	-32	28	
Right IOF	mm	89	32	28	
Nasion	mm	92	0	-10	

DATA SHEET NO. 7 (Continued)
VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015



ARS MOUNTING PLATE & ATD'S HEAD POINTS RELATIVE TO GLOBAL COORDINATE SYSTEMS

DESCRIPTION	DRIVER DCS			PASS. PCS		
	X	Y	Z	X	Y	Z
G ₀	0	0	0	0	0	0
G _x	-453	0	-2	-450	0	-5
G _y	0	452	-4	4	-450	1
P1	57	-838	-359	475	689	-361
P2	41	-860	-359	459	667	-361
P3	7	-850	-359	425	677	-361
P4	-27	-841	-359	391	686	-361
P5	-30	-814	-359	388	713	-361
P6	-13	-793	-359	404	734	-361
P7	21	-802	-359	438	725	-361
P8	54	-812	-359	472	715	-361
Left CG	-52	-341	-1162			
Right CG				132	320	-1172
Left EAM	-59	-344	-1134			
Right EAM				127	324	-1143
Left IOF	-151	-360	-1128	66	445	-1138
Right IOF	-168	-421	-1125	54	381	-1138
Nasion	-164	-391	-1164	56	414	-1176

DATA SHEET NO. 7 (CONTINUED)
VEHICLE INSTRUMENTATION DATA

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

No.	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Left Rear Sill	X	g	1.63	131.10	-38.94	40.95
		Y	g	3.02	84.80	-21.52	39.75
2	Right Rear Sill	X	g	2.72	101.20	-33.52	44.35
		Y	g	2.43	70.70	-19.29	46.50
3	Impact Side Rear Sill Redundant	X	g	2.91	109.50	-33.85	44.30
		Y	g	1.63	116.40	-18.15	46.75
4	Vehicle CG Acceleration	X	g	3.22	114.55	-39.76	53.75
		Y	g	8.80	31.60	-28.67	42.55
		Z	g	19.87	63.05	-18.08	80.90
5	Impact Side Seat Track	X	g	2.63	93.05	-37.13	44.00
		Y	g	2.94	56.00	-37.25	43.05
		Z	g	26.97	45.75	-19.76	25.50
6	Impact Side Seat Crossmember	X	g	6.37	78.95	-44.04	47.20
		Z	g	14.04	38.45	-30.58	74.50
7	Impact Side Toe Pan	X	g	16.73	9.25	-56.65	42.60
		Y	g	10.52	68.20	-59.91	41.00
		Z	g	20.42	38.80	-18.84	58.15
8	Angular Rate Sensors	X	Deg/s	548.96	43.00	-109.54	83.30
		Y	Deg/s	171.01	83.80	-562.33	44.50
		Z	Deg/s	11.26	8.30	-329.78	45.15
9	Driver Shoulder Displacement		mm	81.64	23.80	-142.09	99.10
10	Driver Shoulder Belt		N	4363.77	55.85	-29.93	9.20
11	Driver Lap Belt		N	6613.71	60.65	-28.22	12.45
12	Passenger Shoulder Displacement		mm	89.72	23.15	-64.15	91.85
13	Passenger Shoulder Belt		N	5297.15	62.45	-37.95	174.05
14	Passenger Lap Belt		N	3915.58	56.55	-510.49	80.80
15	Impact Side Floor String Pot		mm	53.05	289.25	-28.45	63.05

Note: See Appendix B for all vehicle data plots.

TIME TO FIRE RESTRAINT TIMING

No.	Description	Axes	Units	Time to Fire (ms)
1	Driver Air Bag Squib 1	*	A	8.40
2	Driver Air Bag Squib 2	*	A	13.90
3	Driver Curtain Airbag	*	A	13.90
4	Driver Torso Airbag	*	A	N/A
5	Driver Knee Airbag	*	A	N/A
6	Driver Pretensioner	*	A	7.85
7	Passenger Air Bag Squib 1	*	A	8.40
8	Passenger Air Bag Squib 2	*	A	18.40
9	Passenger Curtain Airbag	*	A	13.90
10	Passenger Torso Airbag	*	A	N/A
11	Passenger Knee Airbag	*	A	N/A
12	Passenger Pretensioner	*	A	7.90

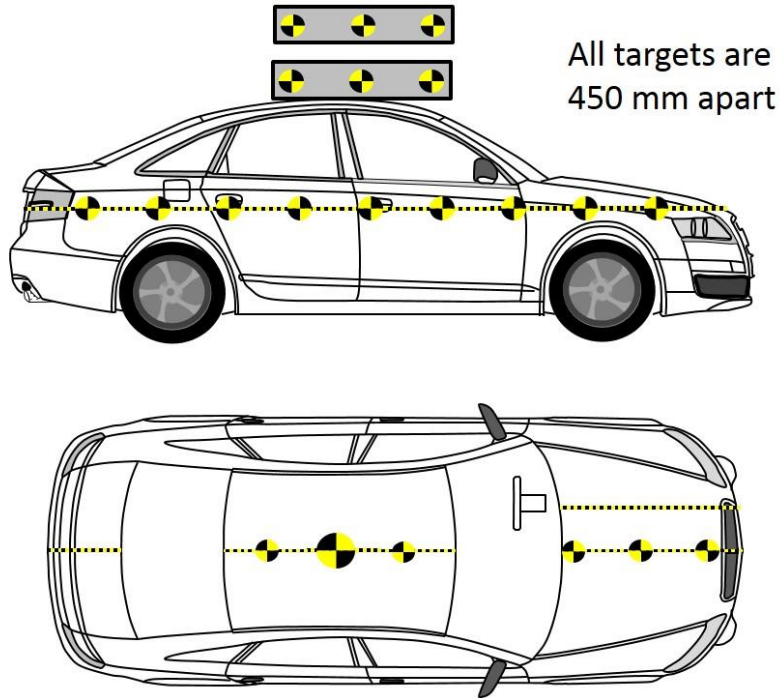
* The measurement indicates the time the voltage changed

DATA SHEET NO. 8 **PHOTOGRAPHIC REFERENCE TARGET LOCATIONS**

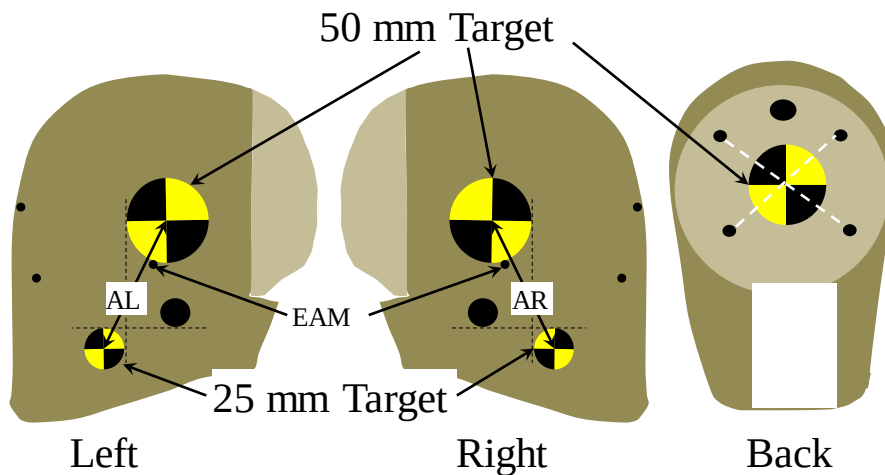
Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

VEHICLE TARGETS



ATD HEAD TARGETS



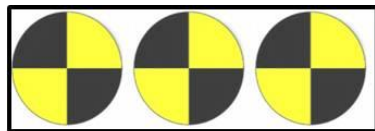
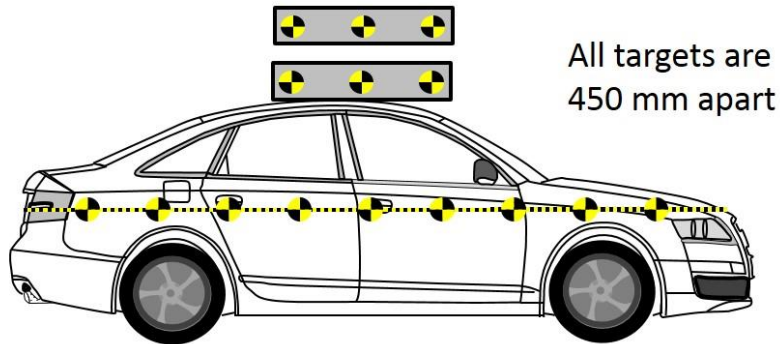
Target	Measurement
AL	85 mm
AR	85 mm

DATA SHEET NO. 8 (CONTINUED)
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

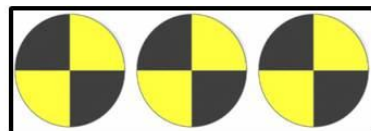
NHTSA No.: R20155913
 Test Date: 9/24/2015

OVERHEAD TARGET BARS



1 2 3

Vertical Target
Plane 1
(Driver's Side)



4 5 6

Vertical Target
Plane 2
(Passenger Side)

Target	Units	X	Y	Z
1	mm	2561	-392	-1236
2	mm	2107	-384	-1236
3	mm	1655	-374	-1240
4	mm	2575	366	-1231
5	mm	2124	356	-1230
6	mm	1670	352	-1224

Reference point:

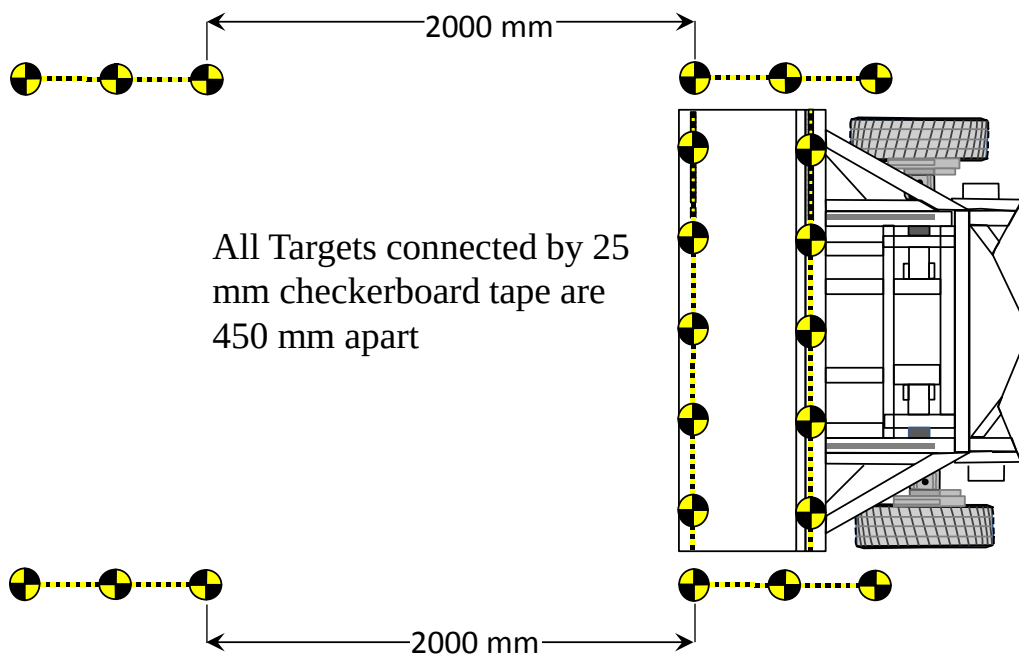
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO. 8 (CONTINUED)
PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

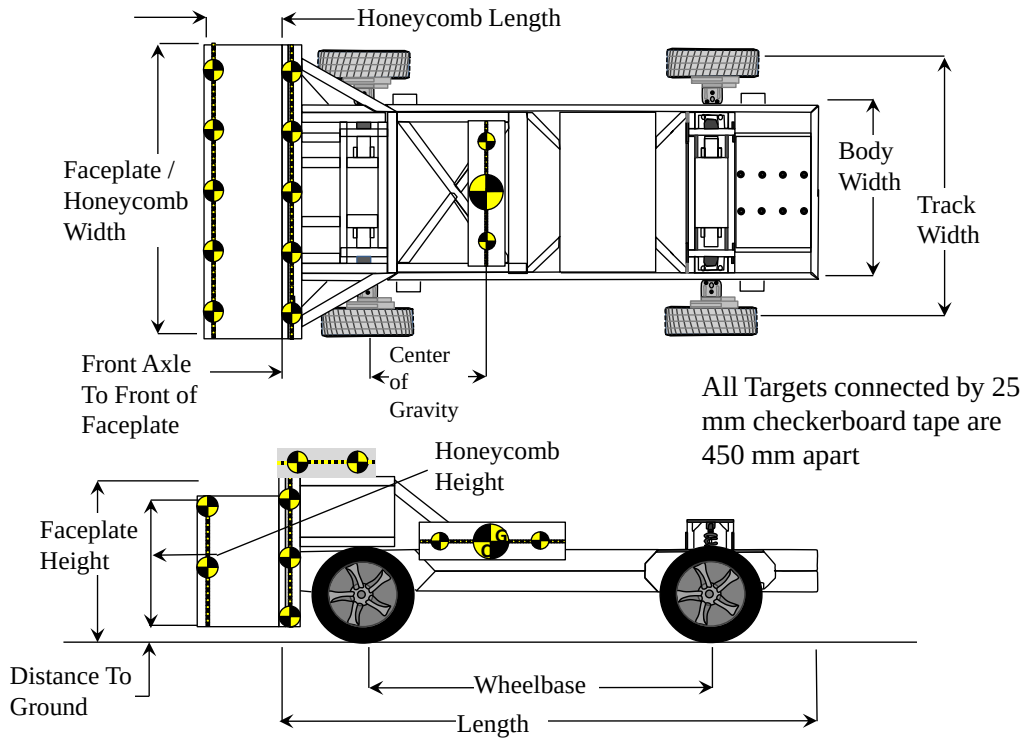
GROUND TARGETS LOCATED IN REFERENCE TO OMDB



DATA SHEET NO. 8 (CONTINUED)
OMDB PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015



Item	Units	Value	Item	Units	Value
Honeycomb Width	mm	2205	Faceplate Height	mm	1186
Honeycomb Length	mm	605	Faceplate to Ground	mm	81
Honeycomb Height	mm	947	Wheelbase	mm	2589
Left Front Axle to Front Faceplate	mm	600	Cart Length	mm	3993
Right Front Axle to Front Faceplate	mm	601	Body Width	mm	1301
Front Axle to CG	mm	926	Track Width	mm	1884

	Units	Front Axle	Rear Axle	Total
Left	kg	826	434	1260
Right	kg	792	467	1259
Ratio	%	64%	36%	
Total	kg	1618	901	2519
CG Aft of Front Axle	mm			926

Note: All targets on the OMDB honeycomb are 450mm apart

DATA SHEET NO. 9
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Accelerometers	105
Passenger Dummy Accelerometers	105
Vehicle Structure Accelerometers	27
SRS Inductive Pickups	12
OMDB Cart Accelerometers	9
Total	258

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	4
High-Speed Off-board	11
Real-Time Panning	2
Total	17

DATA SHEET NO. 10
POST TEST OBSERVATIONS

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Right Front Passenger
Dummy Type/Serial No.	THOR015	THOR016
Lower Leg Type	LX	LX
Lower Leg Serial No.	LX0038/LX0039	LX0018/ LX0019
Head Contact	Front Airbag & Right Hand	Frontal & Curtain Airbag, Headrest & Side Headliner
Upper Torso Contact	Front Airbag	Front Airbag & Arm hits door
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Glove Box
Right Knee Contact	Knee Bolster	Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Right Front Passenger
Locked/Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Closed & Operational	Closed & Operational
Rear Door Opening	Closed & Operational	Closed & Operational
Seat Track Shift (mm)	0	0
Seat Back Failure	No	No
Glazing Damage	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions	Photo Taken (Y/N)
Pillar Performance	A-Pillar Buckled	Y
Windshield Damage	Crack throughout with separation along bottom edge	Y
Window Damage	None	Y
Other Notable Effects	None	--

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver (Occupant 1)		Right Front Passenger (Occupant 2)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	Yes	Yes	Yes
Curtain Airbag	Yes	Disabled	Yes	Yes
Torso Airbag	Yes	Disabled	Yes	No
Knee Airbag	No	N/A	No	N/A
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Yes	Yes	Yes
Other				

DATA SHEET NO. 11 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4639	4407	232
2	Rear Surface of Vehicle (RSOV) to Front of Engine	mm	4082	3893	189
3	RSOV to Firewall	mm	3662	3551	111
4	RSOV to Upper Leading Edge of Right Door	mm	3164	3137	27
5	RSOV to Upper Leading Edge of Left Door	mm	3161	3152	9
6	RSOV to Lower Leading Edge of Right Door	mm	3167	3135	32
7	RSOV to Lower Leading Edge of Left Door	mm	3163	3156	7
8	RSOV to Upper Trailing Edge of Right Door	mm	2064	2043	21
9	RSOV to Upper Trailing Edge of Left Door	mm	2063	2058	5
10	RSOV to Lower Trailing Edge of Right Door	mm	2131	2102	29
11	RSOV to Lower Trailing Edge of Left Door	mm	2128	2122	7
12	RSOV to Bottom of "A" Post of Right Side	mm	3153	3131	23
13	RSOV to Bottom of "A" Post of Left Side	mm	3150	3142	8
14	RSOV to Firewall, Right Side	mm	3471	3422	49
15	RSOV to Firewall, Left Side	mm	3471	3468	3
16	RSOV to Steering Column	mm	2641	2701	-59
17	Center of Steering Column to "A" Post	mm	289	290	-2
18	Center of Steering Column to Headliner	mm	412	412	0
19	RSOV to Right Side of Front Bumper	mm	4565	4265	300
20	RSOV to Left Side of Front Bumper	mm	4564	4602	-38
21	Length of Engine Block	mm	377	381	-4
RD	RSOV to Right Side of Dash Panel	mm	2901	2866	35
CD	RSOV to Center of Dash Panel	mm	2940	2931	9
LD	RSOV to Left Side of Dash Panel	mm	2897	2891	6

UR* = Unrecoverable Data Point

DATA SHEET NO. 12
ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

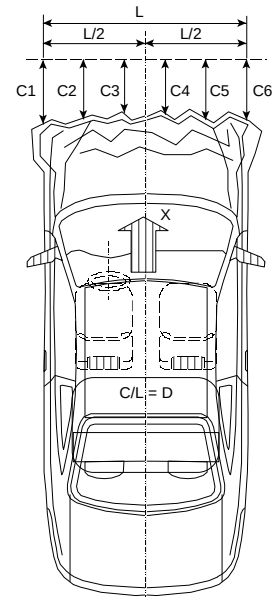
NHTSA No.: R20155913
Test Date: 9/24/2015

VEHICLE INFORMATION

VIN: YV1612TJ4F2356711 Wheelbase (mm): 2779
Vehicle Size Category: Passenger Test Weight (kg): 1957

ACCELEROMETER DATA

Accelerometer Locations: As Described in Data Sheet No. 7
Cal. Procedure/Interval: Calspan Procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (kph): 90.15
Velocity Change (kph): 90.15



CRUSH PROFILE

Collision Deformation Classification: 12FREE4
Midpoint of Damage: C5
Damage Region Length (mm): 1373
Impact Mode: Frontal 15° Angle, 35% Right Offset

Crush Measurements: Bumper Cover

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4407	4564	157
C2	Crush zone 2 at left side	mm	4577	4596	19
C3	Crush zone 3 at left side	mm	4624	4509	-115
C4	Crush zone 4 at right side	mm	4624	4359	-265
C5	Crush zone 5 at right side	mm	4580	4237	-343
C6	Crush zone 6 at right side	mm	4409	3980	-429
L	C1 to C6	mm	1373	1197	176

Crush Measurements: Bumper Cover Removed

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
B1	Bumper Beam 1 at left side	mm	4418	4490	72
B2	Bumper Beam 2 at left side	mm	4468	4445	-23
B3	Bumper Beam 3 at left side	mm	4458	4345	-113
B4	Bumper Beam 4 at left side	mm	4469	4262	-207
B5	Bumper Beam 5 at right side	mm	4474	4171	-303
B6	Bumper Beam 6 at right side	mm	4470	4076	-394
B7	Bumper Beam 7 at right side	mm	4459	3987	-472
B8	Bumper Beam 8 at right side	mm	4467	4082	-385
B9	Bumper Beam 9 at right side	mm	4419	4175	-244
L	B1 to B9	mm	1181	942	-239

DATA SHEET NO. 13
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

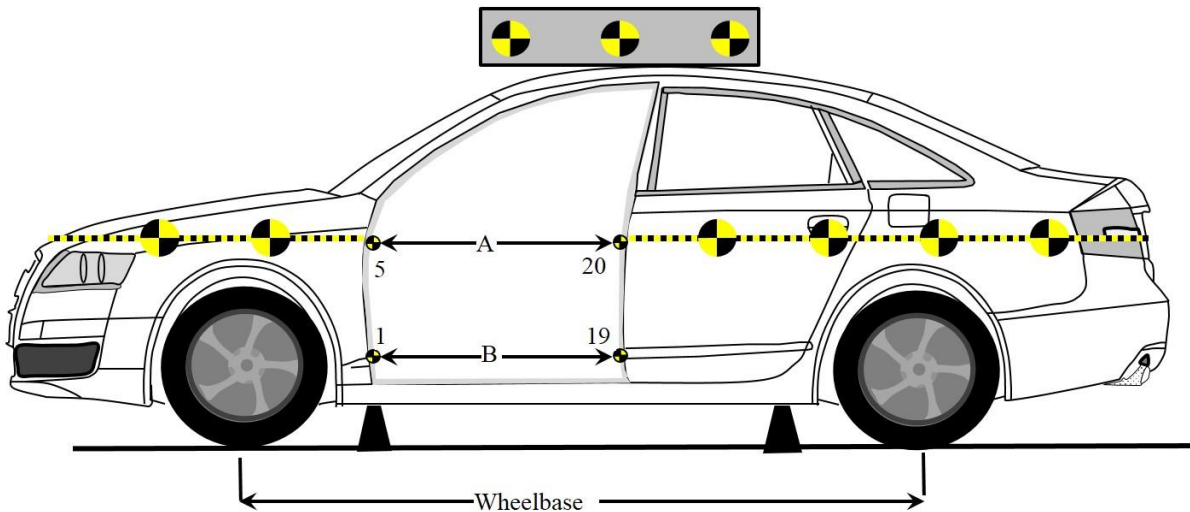
NHTSA No.: R20155913
 Test Date: 9/24/2015

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	883	883	0
B	Left Side Lower	mm	689	750	61
D	Right Side Upper	mm	882	862	-20
E	Right Side Lower	mm	692	740	48

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2779	2797	18
F	Right Side Wheelbase	mm	2779	2555	-224



DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

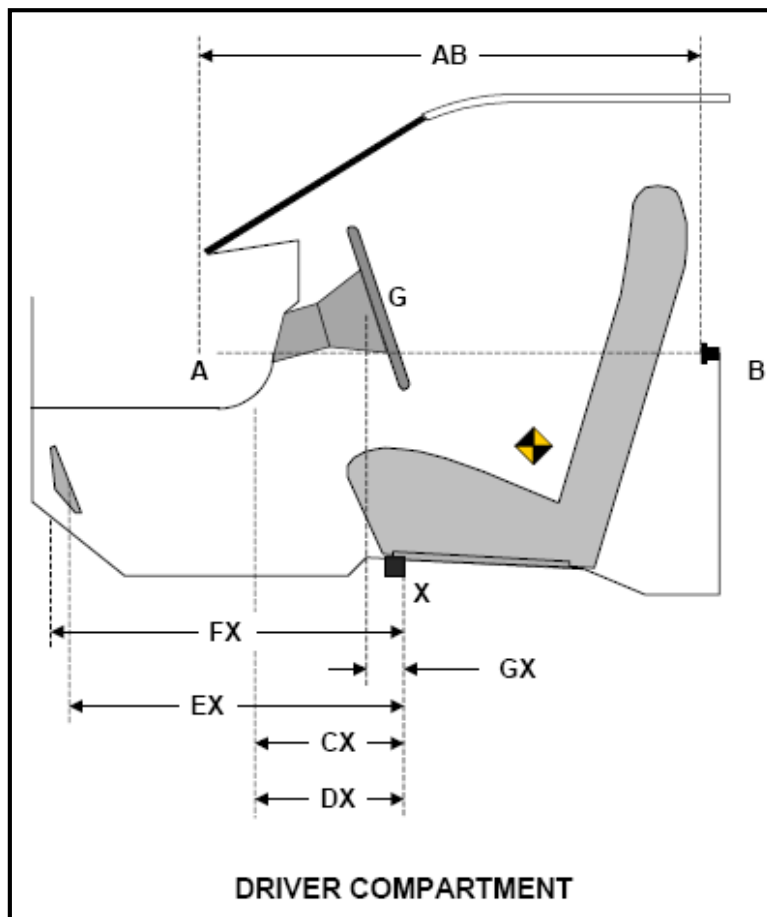
Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	768	769	1
CX	Left Knee Bolster to X	mm	222	224	2
DX	Right Knee Bolster to X	mm	200	203	3
EX	Brake Pedal to X	mm	477	459	-18
FX	Foot Rest to X	mm	610	538	-72
GX	Center of Steering Column Wheel Hub to X	mm	-45	17	62

X = Front of Seat Track (Stationary)

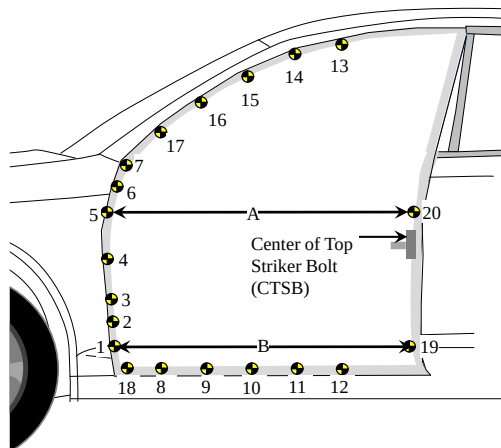


DATA SHEET NO.13 (CONTINUED) **VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

DRIVER SIDE DOOR SILL INTRUSIONS



- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

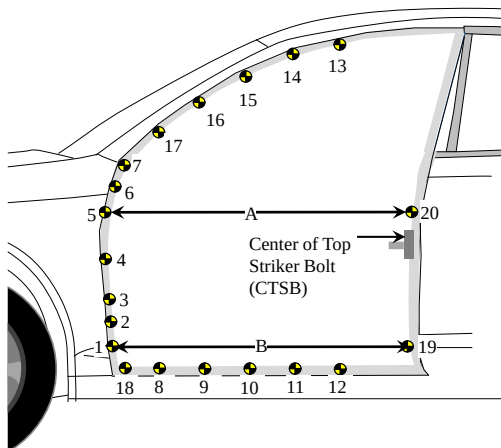
Point	Pre-Test			Post-Test			Difference		
	X	Y	Z	X	Y	Z	X	Y	Z
1	3044	-744	144	3042	-756	145	-2	-12	1
2	3055	-748	69	3053	-758	70	-2	-10	1
3	3051	-753	-7	3049	-762	-6	-2	-9	1
4	3043	-754	-156	3042	-761	-155	-1	-7	1
5	3035	-751	-308	3034	-756	-308	-1	-5	0
6	3016	-742	-384	3015	-745	-384	-1	-3	0
7	2960	-721	-457	2959	-722	-456	-1	-1	1
17	2868	-698	-520	2867	-697	-518	-1	1	2
16	2768	-673	-568	2765	-673	-568	-3	0	0
15	2662	-651	-613	2661	-650	-613	-1	1	0
14	2554	-630	-652	2553	-630	-653	-1	0	-1
13	2440	-612	-683	2440	-611	-683	0	1	0
20	2152	-743	-303	2151	-738	-302	-1	5	1
19	2355	-746	146	2354	-744	148	-1	2	2
12	2293	-746	80	2292	-742	81	-1	4	1
11	2446	-742	210	2448	-746	211	2	-4	1
10	2589	-744	211	2591	-748	213	2	-4	2
9	2745	-745	210	2744	-752	212	-1	-7	2
8	2893	-744	210	2894	-755	211	1	-11	1
18	2980	-745	202	2979	-755	203	-1	-10	1

DATA SHEET NO.13 (CONTINUED) **VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

PASSENGER SIDE DOOR SILL INTRUSIONS



- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

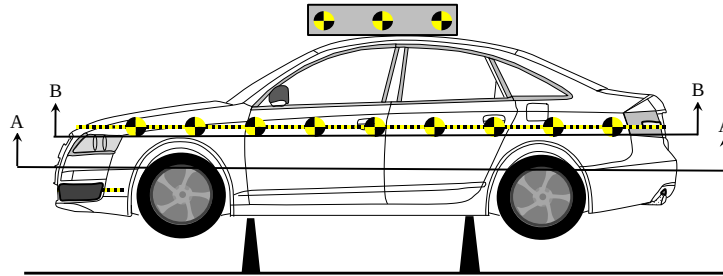
Point	Pre-Test			Post-Test			Difference		
	X	Y	Z	X	Y	Z	X	Y	Z
1	3044	740	145	3035	740	146	-9	0	1
2	3055	745	67	3036	747	69	-19	2	2
3	3051	749	-6	3026	754	-5	-25	5	1
4	3044	751	-157	3016	758	-156	-28	7	1
5	3036	748	-307	3015	753	-308	-21	5	-1
6	3016	739	-383	3001	741	-384	-15	2	-1
7	2957	719	-457	2948	722	-463	-9	3	-6
17	2865	696	-519	2860	698	-532	-5	2	-13
16	2764	675	-569	2764	675	-589	0	0	-20
15	2659	654	-615	2663	653	-635	4	-1	-20
14	2552	634	-652	2554	636	-667	2	2	-15
13	2444	617	-682	2444	620	-693	0	3	-11
20	2152	742	-305	2153	742	-304	1	0	1
19	2353	742	146	2355	742	146	2	0	0
12	2293	741	81	2295	742	81	2	1	0
11	2442	740	209	2442	742	209	0	2	0
10	2595	741	212	2595	740	214	0	-1	2
9	2747	740	212	2748	738	215	1	-2	3
8	2892	740	211	2895	738	216	3	-2	5
18	2980	741	204	2982	735	210	2	-6	6

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

VEHICLE EXTERIOR CRUSH PROFILE
SECTION A-A



Reference point:

- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
1	2133	-901	108	1	2129	-900	107
2	2238	-902	108	2	2256	-892	107
3	2298	-903	107	3	2420	-905	107
4	2398	-904	107	4	2574	-908	107
5	2494	-904	108	5	2771	-906	107
6	2555	-904	108	6	3052	-904	107
7	2648	-904	108	7	3173	-908	107
8	2764	-902	107	8	3270	-920	107
9	2894	-900	107	9	3312	-921	107
10	3061	-898	108	10	3771	-911	108
11	3238	-906	108	11	3892	-914	108
12	3319	-908	107	12	4058	-880	108
13	4041	-898	108	13	4147	-766	108
14	4137	-875	108	14	4314	-626	107
15	4241	-840	108	15	4401	-630	107
16	4346	-760	107	16	4474	-605	107
17	4431	-668	107	17	4545	-546	108
18	4503	-561	107	18	4554	-479	107
19	4577	-450	108	19	4483	-425	107
20	4613	-284	108	20	4424	-354	107
21	4625	-108	117	21	4312	-203	108
22	4626	-4	108	22	4211	-62	108
23	4626	37	108	23	4113	62	107
24	4620	200	108	24	4040	163	108
25	4586	429	108	25	4077	328	109

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

VEHICLE EXTERIOR CRUSH PROFILE
SECTION A-A (Continued)

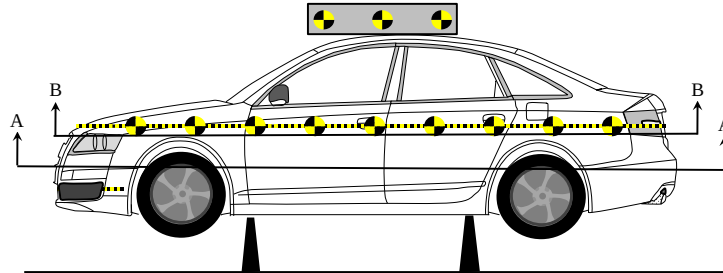
Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
26	4491	575	107	26	4168	404	108
27	4318	782	108	27	4232	399	109
28	4093	886	108	28	4233	438	108
29	4039	897	107	29	4174	449	107
30	3322	903	108	30	4119	459	107
31	3170	895	108	31	3975	521	107
32	3162	894	107	32	3856	564	108
33	3053	893	107	33	3836	714	107
34	2774	897	107	34	3834	797	107
35	2564	900	108	35	3808	927	107
36	2427	901	107	36	3784	964	108
37	2349	900	108	37	3739	842	108
38	2264	900	107	38	3635	845	107
39	2158	899	107	39	3449	841	107
				40	3288	843	107
				41	3274	946	108
				42	3258	953	108
				43	3170	909	108
				44	3107	903	108
				45	2932	904	108
				46	2673	910	107
				47	2402	912	107
				48	2215	912	108
				49	2112	910	107

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

VEHICLE EXTERIOR CRUSH PROFILE
SECTION B-B



Reference point:

- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
1	2108	-909	-151	1	2113	-909	-152
2	2269	-913	-152	2	2270	-891	-151
3	2468	-913	-152	3	2483	-901	-152
4	2617	-911	-151	4	2710	-909	-151
5	2816	-906	-152	5	2911	-907	-151
6	2992	-901	-152	6	3106	-905	-151
7	3186	-898	-151	7	3244	-910	-151
8	3465	-910	-150	8	3447	-918	-151
9	3615	-913	-151	9	3681	-920	-151
10	3701	-912	-152	10	3892	-896	-151
11	3829	-908	-151	11	4036	-858	-152
12	3927	-889	-150	12	4072	-848	-151
13	4048	-860	-153	13	4078	-744	-152
14	4129	-842	-151	14	4303	-534	-152
15	4239	-790	-150	15	4335	-477	-152
16	4391	-622	-151	16	4357	-462	-151
17	4441	-576	-151	17	4330	-389	-151
18	4521	-477	-152	18	4314	-295	-152
19	4570	-338	-151	19	4250	-194	-151
20	4580	-289	-151	20	4140	-41	-151
21	4596	-182	-151	21	4010	81	-152
22	4599	-124	-152	22	3990	163	-151
23	4603	-46	-151	23	4056	235	-151
24	4604	1	-151	24	4063	286	-152
25	4605	-1	-152	25	4074	347	-152

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

VEHICLE EXTERIOR CRUSH PROFILE
SECTION B-B (Continued)

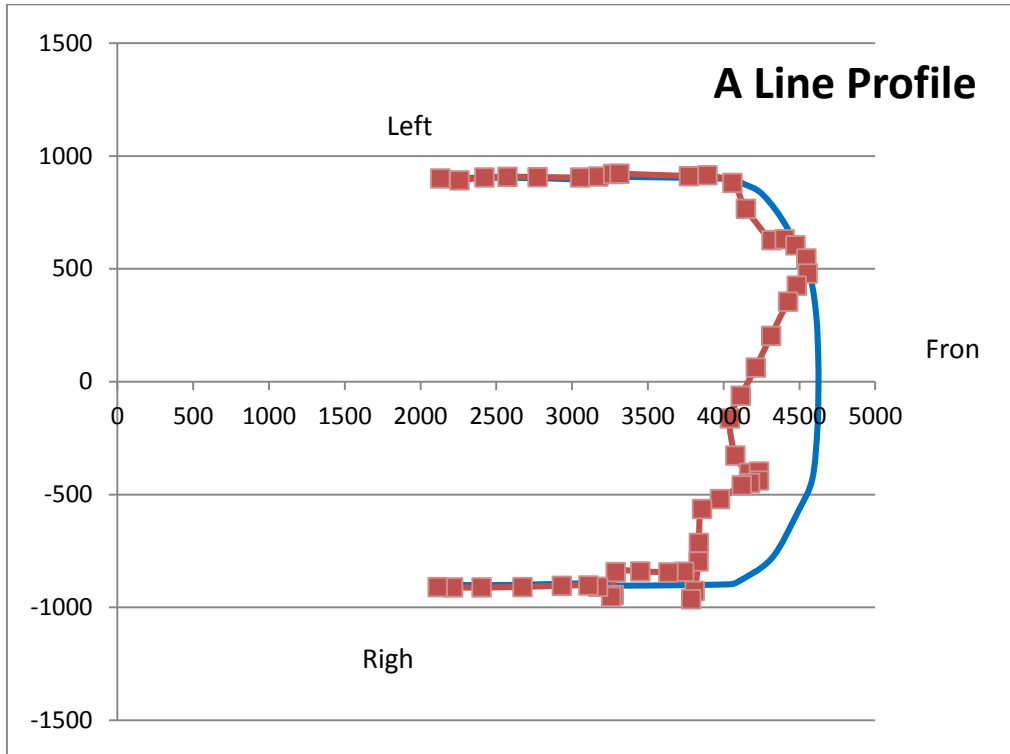
Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
26	4594	184	-152	26	3948	383	-152
27	4567	339	-151	27	3848	498	-151
28	4512	484	-152	28	3863	596	-151
29	4421	590	-151	29	3809	674	-152
30	4305	717	-152	30	3652	729	-151
31	4224	793	-152	31	3602	817	-152
32	4074	848	-152	32	3567	833	-152
33	3965	875	-151	33	3417	1065	-151
34	3795	906	-151	34	3290	1008	-151
35	3286	896	-152	35	3203	925	-152
36	3171	894	-152	36	3166	899	-152
37	3039	896	-152	37	3141	904	-152
38	2832	903	-152	38	2943	913	-151
39	2633	908	-151	39	2694	920	-152
40	2432	911	-151	40	2471	924	-151
41	2278	911	-151	41	2292	925	-152
42	2118	911	-152	42	2151	925	-151
				43	2095	924	-151

DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

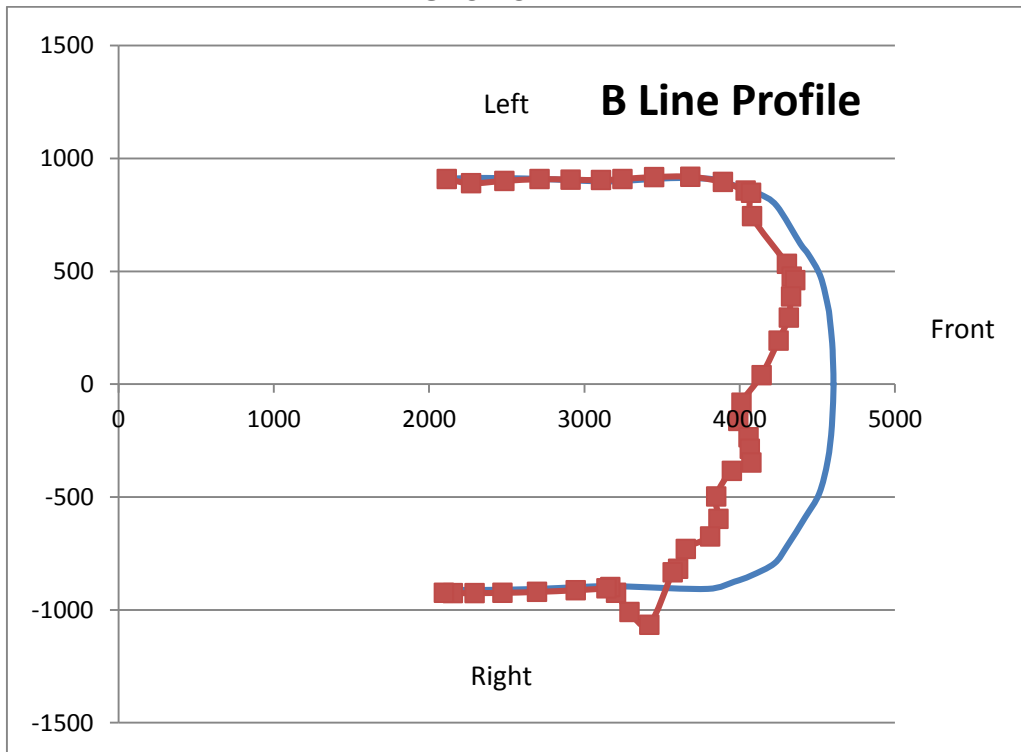
Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

VEHICLE EXTERIOR CRUSH PROFILE
SECTION A-A



SECTION B-B



DATA SHEET NO.13 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

STRUCTURAL BUMPER BEAM POINTS

	Point	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
		X	Y	Z	X	Y	Z	X	Y	Z
Structural Bumper Beam	B1	4418	-593	107	4490	-538	88	72	55	-19
	B2	4468	-454	107	4445	-400	73	-23	54	-34
	B3	4458	-305	108	4345	-290	61	-113	15	-47
	B4	4469	-154	108	4262	-164	45	-207	-10	-63
	B5	4474	-2	107	4171	-42	29	-303	-40	-78
	B6	4470	148	107	4076	74	15	-394	-74	-92
	B7	4459	298	109	3987	190	3	-472	-108	-106
	B8	4467	447	109	4082	292	10	-385	-155	-99
	B9	4419	588	107	4175	404	14	-244	-184	-93

Reference point:

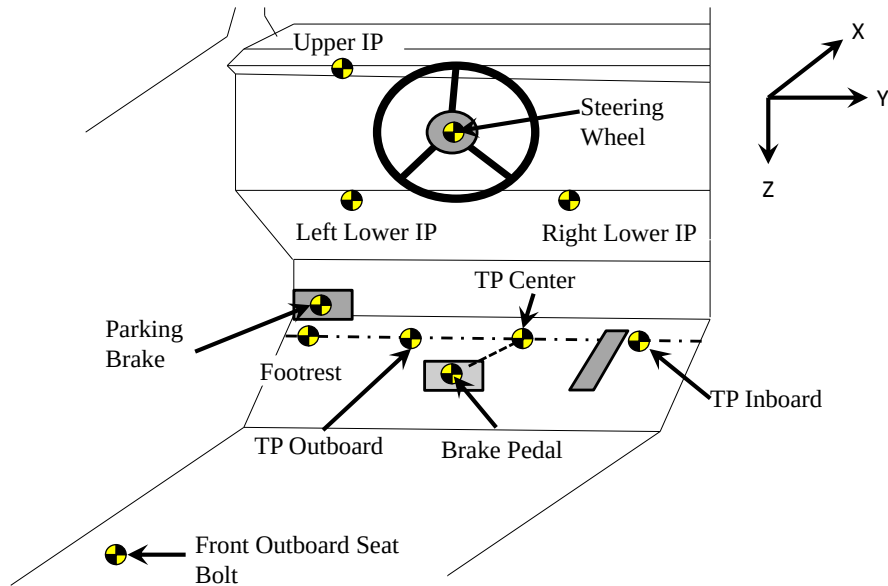
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO.13 (CONTINUED) **VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

DRIVER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
TP Inboard	3373	-179	144	3355	-216	120	-18	-37	-24
TP Center	3377	-331	145	3392	-355	160	15	-24	15
TP Outboard	3341	-483	150	3348	-505	154	7	-22	4
TP Footrest	3284	-582	135	3290	-600	139	6	-18	4
Brake Pedal	3152	-330	144	3137	-341	150	-15	-11	6
Left Lower IP	2897	-521	-170	2902	-530	-169	5	-9	1
Right Lower IP	2875	-224	-171	2881	-232	-167	6	-8	4
Upper IP	2887	-624	-206	2890	-634	-205	3	-10	1
Steering Wheel	2630	-373	-322	2695	-374	-320	65	-1	2
Front Outboard Bolt	2675	-576	252	2678	-579	253	3	-3	1
Emergency Brake									

Reference point:

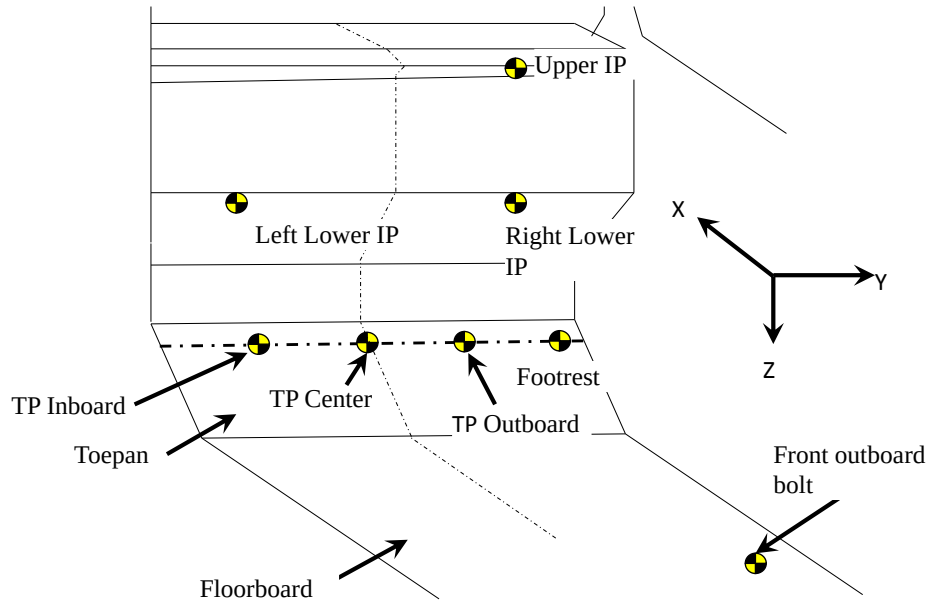
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO.13 (CONTINUED) **VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

PASSENGER FLOOR PAN MEASUREMENTS



Intrusion Location	Pre-Test (mm)			Post-Test (mm)			Difference (mm)		
	X	Y	Z	X	Y	Z	X	Y	Z
TP Inboard	3373	-179	144	3353	195	129	20	-375	15
TP Center	3377	-331	145	3346	345	115	31	-676	31
TP Outboard	3341	-483	150	3283	499	126	57	-982	23
TP Footrest	3284	-582	135	3214	593	131	70	-1175	4
Left Lower IP	2895	223	-138	2881	215	-160	-14	-8	-22
Right Lower IP	2916	524	-138	2890	515	-156	-26	-9	-18
Upper IP	2880	624	-266	2854	613	-284	-26	-11	-18
Front Outboard Bolt	2674	571	253	2672	565	251	-2	-6	-2

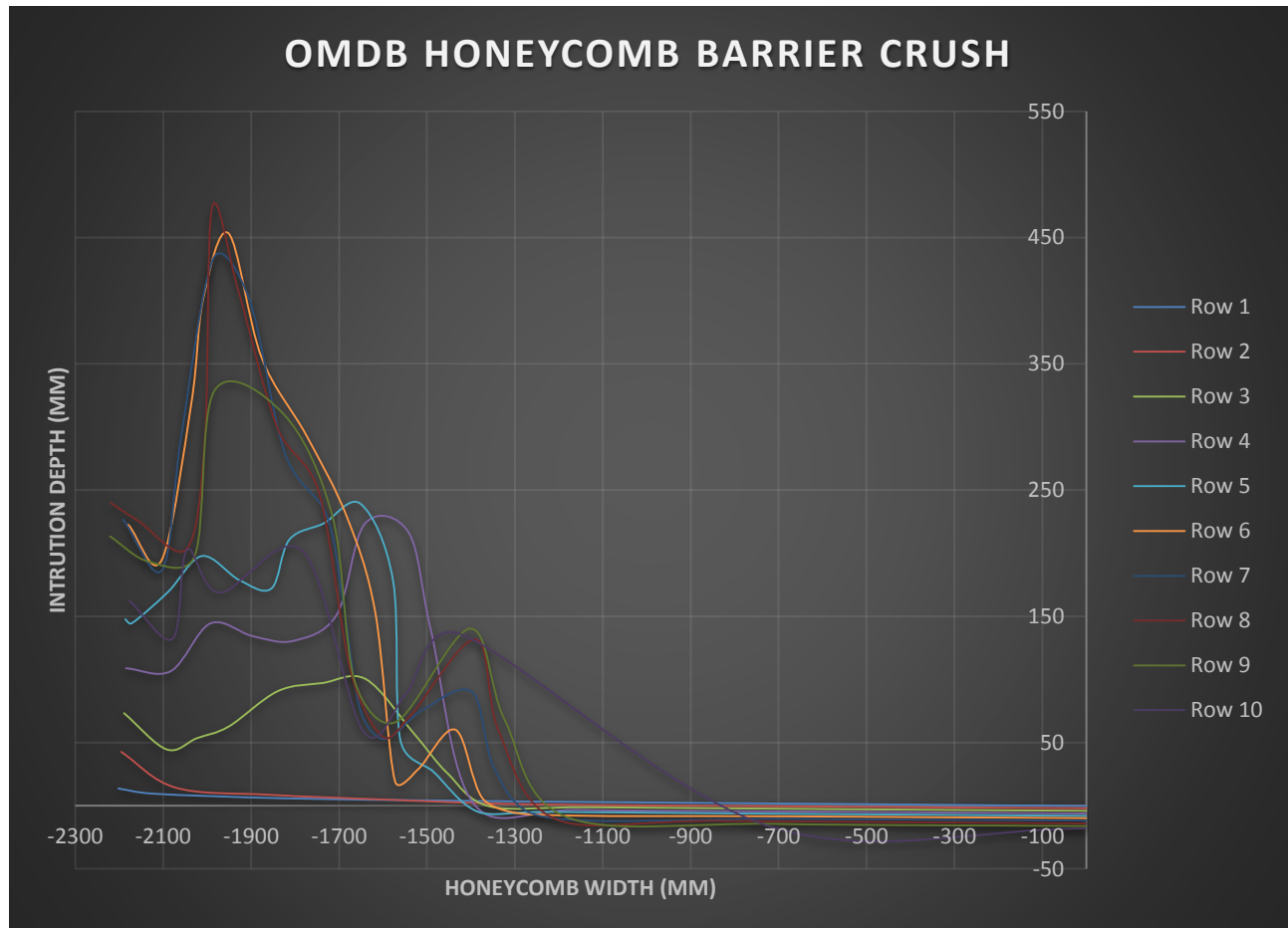
Reference point:

- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

DATA SHEET NO.14
OMDB CRUSH MEASUREMENTS

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015



DATA SHEET NO. 15
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015

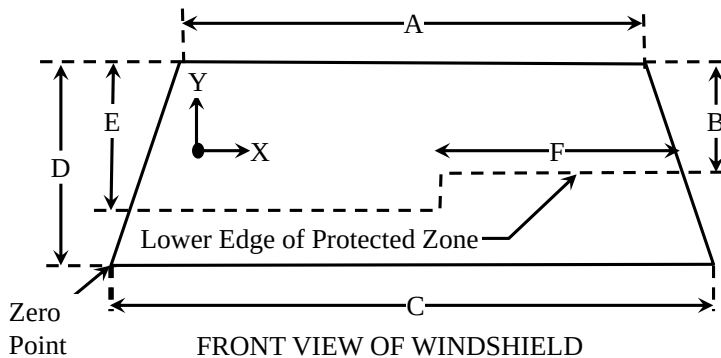
Please provide windshield mounting details. A 0.8 mm trim surrounds the top and side of windshield while a plastic shroud is on the bottom.

The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50% for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21°C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2179	2024	92.9
Right Side	2179	1789	82.1
Total	4358	3813	87.5



Item	Units	Value
A	mm	1214
B	mm	487
C	mm	1434
D	mm	855
E	mm	519
F	mm	549

AREAS OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.

- No penetration

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.

- No Penetration

X	Y

DATA SHEET NO. 15 (CONTINUED)
SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2015 Volvo S60 four door sedan
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
Test Date: 9/24/2015

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Ambient Temperature at Test Vehicle Time of Impact: 20° C

Test Time: 1:25 PM

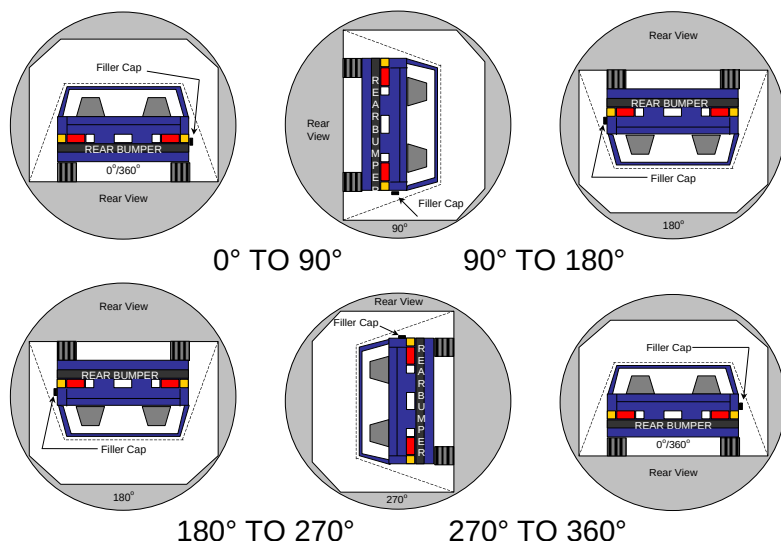
Stoddard Solvent Spillage Measurements

A.	From impact until vehicle motion ceases: (Maximum allowable = 1 oz.)	<u>0</u>	oz
B.	For the 5-minute period after motion ceases: (Maximum allowable = 5 oz.)	<u>0</u>	oz
C.	For the following 25 minutes: (Maximum allowable = 1 oz./minute)	<u>0</u>	oz
D.	Spillage	<u>0</u>	oz

DATA SHEET NO. 16 **FMVSS 301 STATIC ROLLOVER RESULTS**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015



1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.

2. The position hold time at each position is 300 seconds (minimum).

3. Details of Stoddard Solvent spillage: None

SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	72	300	372
90° to 180°	67	300	367
180° to 270°	68	300	368
270° to 360°	71	300	371

FMVSS 301 SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

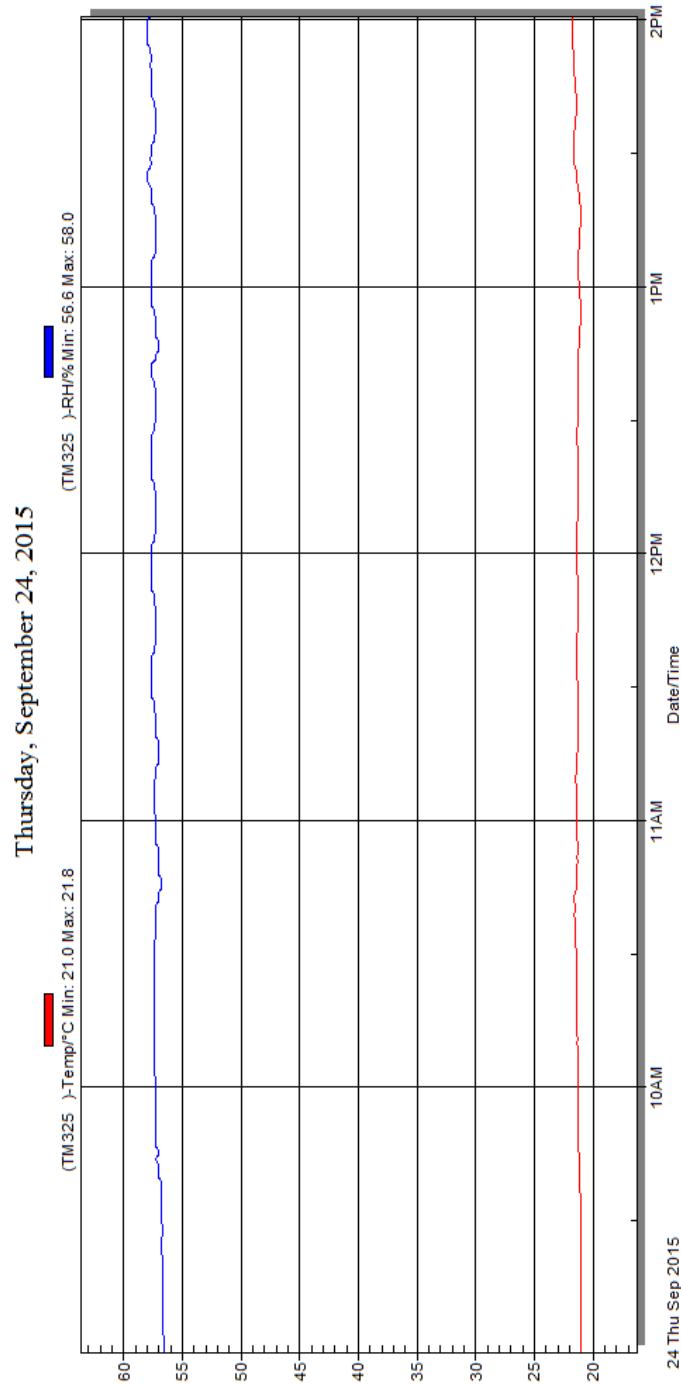
SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17 **DUMMY/VEHICLE TEMPERATURE STABILIZATION**

Test Vehicle: 2015 Volvo S60 four door sedan
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155913
 Test Date: 9/24/2015



Temperature Stabilization Chart/Data

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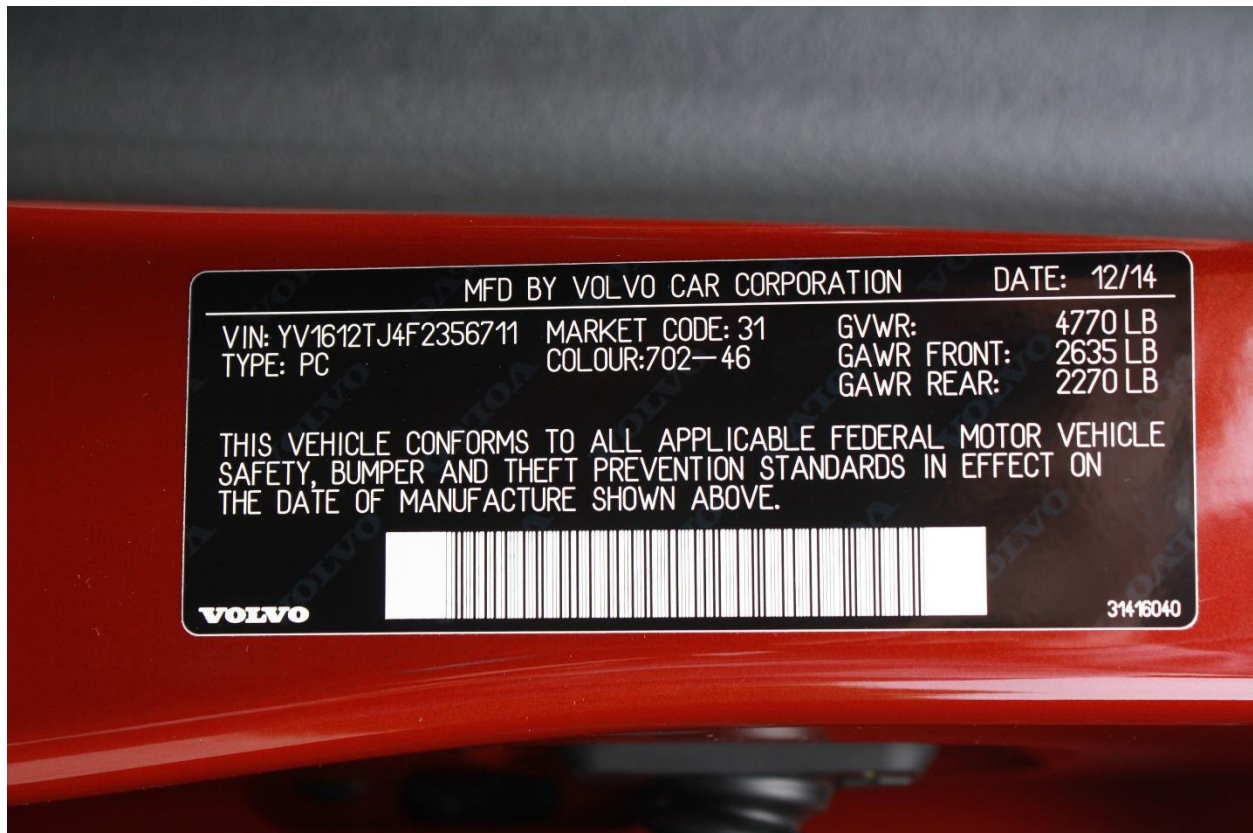
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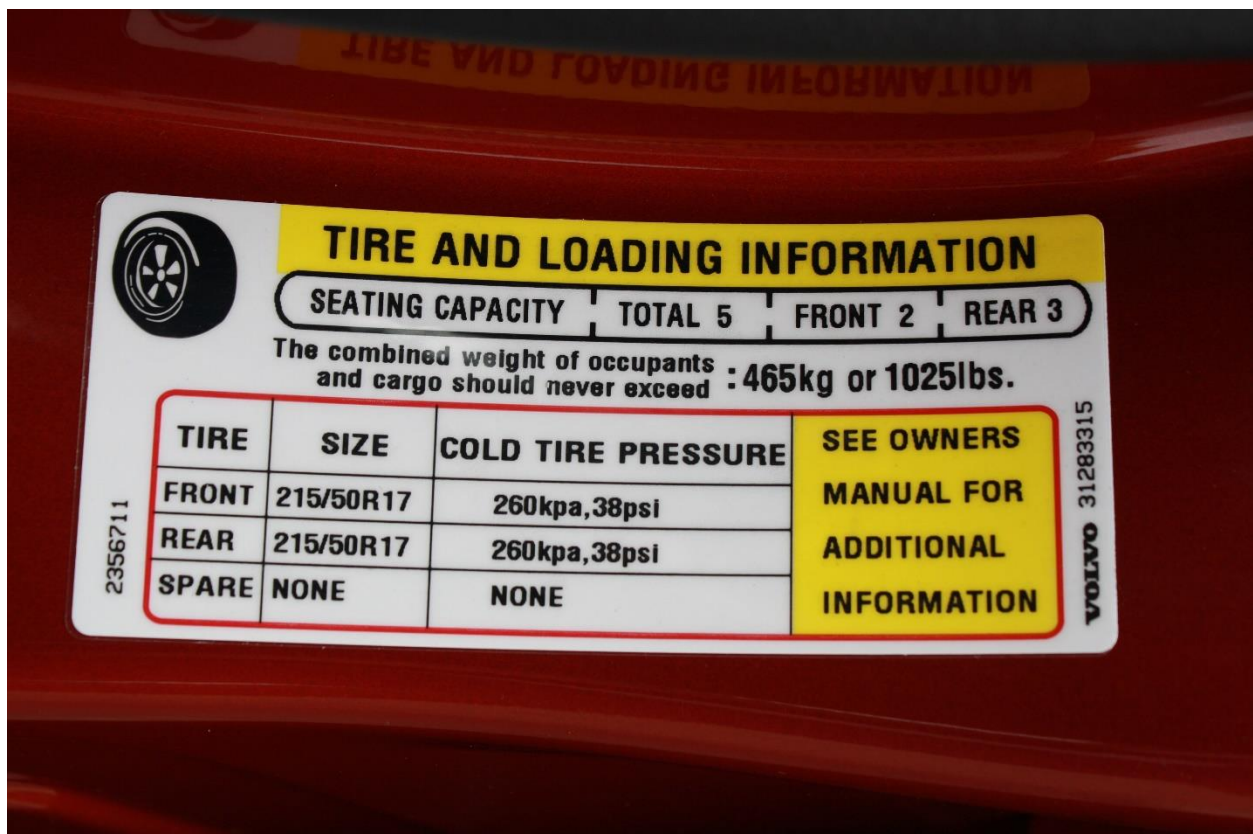
No. 001 As Delivered Right Front 3-4 View of Test Vehicle



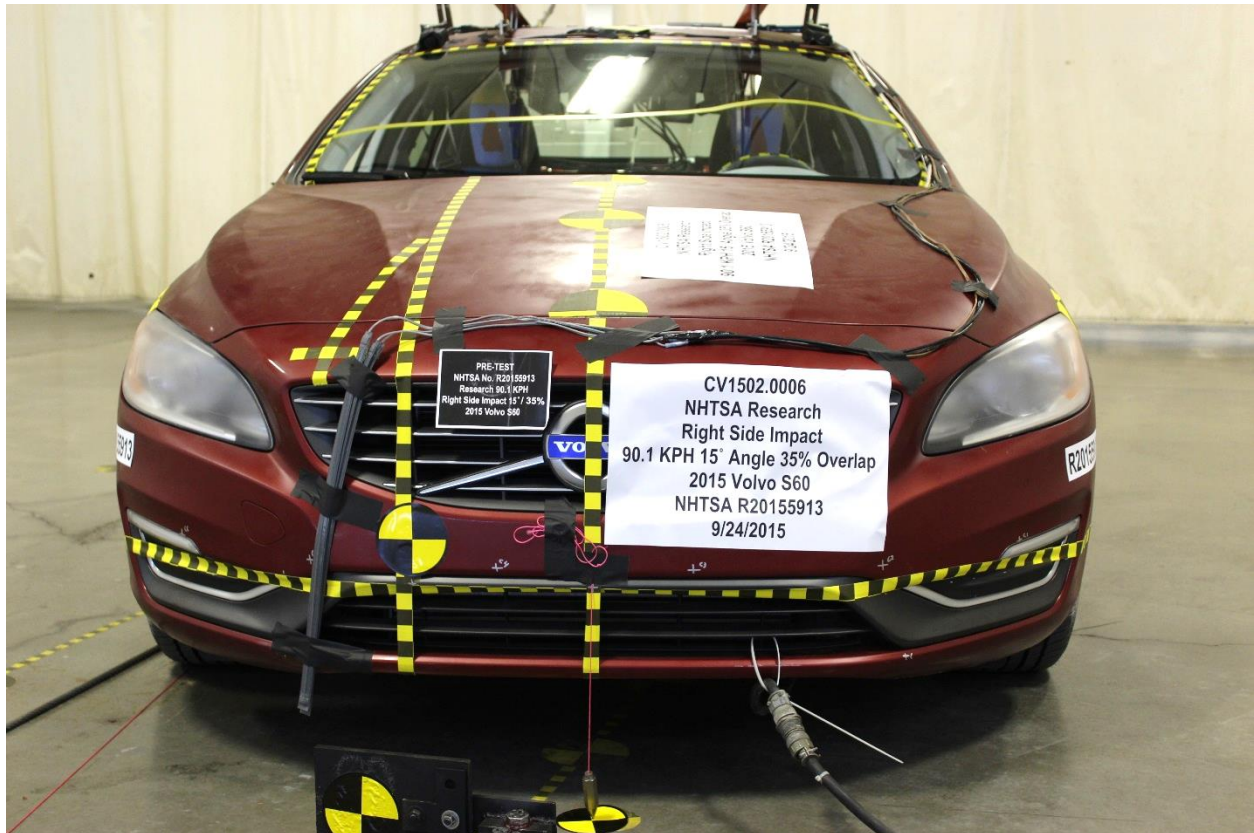
No. 002 As Delivered Left Rear 3-4 View of Test Vehicle



No. 003 Test Vehicle Certification Label



No. 004 Test Vehicle Tire Placard



No. 005 Pre-Test Front View of Test Vehicle



No. 006 Post-Test Front View of Test Vehicle



No. 007 Pre-Test Left Front 3-4 View of Test Vehicle



No. 008 Post-Test Left Front 3-4 View of Test Vehicle



No. 009 Pre-Test Left Side View of Test Vehicle



No. 010 Post-Test Left Side View of Test Vehicle



No. 011 Pre-Test Left Rear 3-4 View of Test Vehicle



No. 012 Post-Test Left Rear 3-4 View of Test Vehicle



No. 013 Pre-Test Rear View of Test Vehicle



No. 014 Post-Test Rear View of Test Vehicle



No. 015 Pre-Test Right Rear 3-4 View of Test Vehicle



No. 016 Post-Test Right Rear 3-4 View of Test Vehicle



No. 017 Pre-Test Right Side View of Test Vehicle



No. 018 Post-Test Right Side View of Test Vehicle



No. 019 Pre-Test Right Front 3-4 View of Test Vehicle



No. 020 Post-Test Right Front 3-4 View of Test Vehicle

2015.5 Volvo

S60 T5 AWD

PERFORMANCE

2.5L Turbo-Charged 5 Cyl Alloy Eng. w/CVT & DOHC
203 HP @ 5500 RPM and 266 lb-ft Torque @ 1800 RPM
ULEV II (Ultra Low Emissions Vehicle)
8-Speed Geartronic Auto. Trans. w/ 8-Speed Shift
All-Wheel Drive with Intell. Traction and DTC
Front McPherson Strut & Rear Multi-Link Suspension
Torque Vectoring Control w/ Adaptive Stability Control
Corner Traction Control through Torque Vectoring
Power Assisted Rack & Pinion Steering
Electronic Brake Distribution & Assistance
17" Alloy Wheels with All-Season Tires

AUDIO & TECHNOLOGY

Sensus with Integrated 7-inch Color LCD Monitor
160W High Performance Audio System w/ 8 Speakers
In-Dash Single CD w/ RDS & MP3 Capability
HD Radio / USB & AUX Inputs
Bluetooth Hands Free w/ Audio Streaming
SIRIUS Radio w/ 6-Month Complimentary Subscription

SAFETY & SECURITY

City Safety - Low Speed Collision Avoidance System
Universal High Strength Steel Safety Cage
Five 3-Point Safety Belts w/ Pretensioners
Front Safety Belts w/ Height Adj. & Force Limiters
Inflatable Curtain (IC) Head Impact Protection
Side Impact Protection System (SIPS) w/ Driver &
Front Passenger Dual Chamber Side Impact Airbags
Driver & Front Passenger Dual Stage Supplemental
Restraint System (AIRBAG)
Whiplash Protection System (WHIPS) in Driver &
Front Passenger Seats / 3 Padded Head Restraints
Security System w/ Backup Battery for Siren
Child Safety Locks in Rear Doors
Tire Pressure Monitoring System (TPMS)
LED Daytime Running Lights

LUXURY

8-Way Power Driver Seat w/3-Position Memory
Power Passenger Seat
Front Seat Adj. Lumber Support & Seat Back Pockets
Shimmer Graphite Aluminum Inlay
Electronic Ignition with Push Button Start & Stop
Leather & Silk Metal Clustering Wheel
Tilt & Telescopic Steering Wheel
Electronic Parking Brake
Dual Zone Electronic Climate Control
Heated Power Outside Rearview Mirrors w/ Memory
60/40 Folding Rear Seat w/Center Armrest Pass-Thru
Power Foldable Rear Seat Headrests
Rain-Sensing Windshield Wipers

AUTHORIZED RETAILER

MAGUIRE VOLVO 3725
270 ELMIRA RD
ITHACA, NY 14850

WARRANTY

48 Month/50,000 Mile Limited Warranty Coverage
144 Month Corrosion Protection "Unlimited Mileage"
Refer to Warranty Info Book for Specific Limitations.
VOLVO On-Call Roadside Assistance
Volvo Increased Protection: Ask Your Volvo Retailer
About an Extended Service Contract

MAINTENANCE

Complimentary Factory Scheduled Maintenance for the
First 3 Years or 36,000 Miles

ACCESSORIES

Enhance the driving pleasure with Volvo accessories.
Enrich the styling, integrate technology, boost
performance, or simply carry more cargo - from
function to fun, there's something for everyone.

To view full accessory product line -
Scan this Smartphone QR code
or visit www.volvocarsaccessories.com

ACCOLADES



IIHS recognizes
the S60 as a best
vehicle choice for
safety within its
size category

Volvo Cars of North America, LLC
www.volvocars.com/us



2015.5 PRICING

IMPORTER'S SUGGESTED LIST PRICE P.O.E.: \$35,450.00

MY15.5 Additional Features
Sensus Connect w/8-mb. Comp. Subscription
Volvo On-Call w/6-mb. Comp. Subscription
Power Lumber Support

Metallic Paint

Heated Front Seats 560.00

Destination Charge 940.00

Total Suggested Retail Price: \$37,450.00

EPA DOT

Fuel Economy and Environment

Gasoline Vehicle

Fuel Economy

23 MPG
Combined city/hwy

20 city 29 highway

4.3 gallons per 100 miles

You spend \$500 more in fuel costs over 5 years
compared to the average new vehicle.

Annual Fuel Cost \$2,300

Fuel Economy & Greenhouse Gas Rating (single only) **Smog Rating** (single only)

1 5 10 **1 5 10**

This vehicle emits 375 grams CO2 per mile. The best emits 0 grams per mile (bikes only). Producing and distributing fuel also create emissions; learn more at fuelconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 24 MPG and costs \$11,000 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$3.50 per gallon. MPG is miles per gallon (city only). Vehicle emissions are a significant cause of climate change and smog.

fuelconomy.gov
Calculate personalized estimates and compare vehicles

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE: VOLVO SERIES

U.S./CANADIAN PARTS CONTENT: 1%

MAJOR SOURCES OF FOREIGN PARTS CONTENT:

SWEDEN: 24%
BELGIUM: 23%

FOR THIS VEHICLE:

FINAL ASSEMBLY POINT: GHENT, BELGIUM

COUNTRY OF ORIGIN: SWEDEN

ENGINE PARTS: SWEDEN

TRANSMISSION PARTS: JAPAN

Note: Parts contents does not include final assembly, distribution, or other non-parts costs.

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score ★★★★★
Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash ★★★★★
Driver Passenger
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.

Side Crash ★★★★★
Front Seat Rear Seat
Based on the risk of injury in a side impact.

Rollover ★★★★★
Based on the risk of rollover in a single vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest. Source: National Highway Traffic Safety Administration (NHTSA). www.safercar.gov or 1-888-327-4236

VEHICLE IDENTIFICATION
Type & Chassis: 134 25811
Model Year: 2015
Color: 702 Flammen Red Me
VIN: YV1612TJ4F2356711

Port of Importation: Newark, NJ
Delivered by: Truck
DELIVERY ADDRESS
MAGUIRE VOLVO 3725
270 ELMIRA RD
ITHACA, NY 14850

Barcode: YV1612TJ4F2356711

The price shown does not include Gasoline, License and Title Fees, State and Local Taxes and Dealer Installed Options and Accessories. The factory reserves the right to modify price, design and equipment without previous notice.

No. 021 Monroney Label Photograph



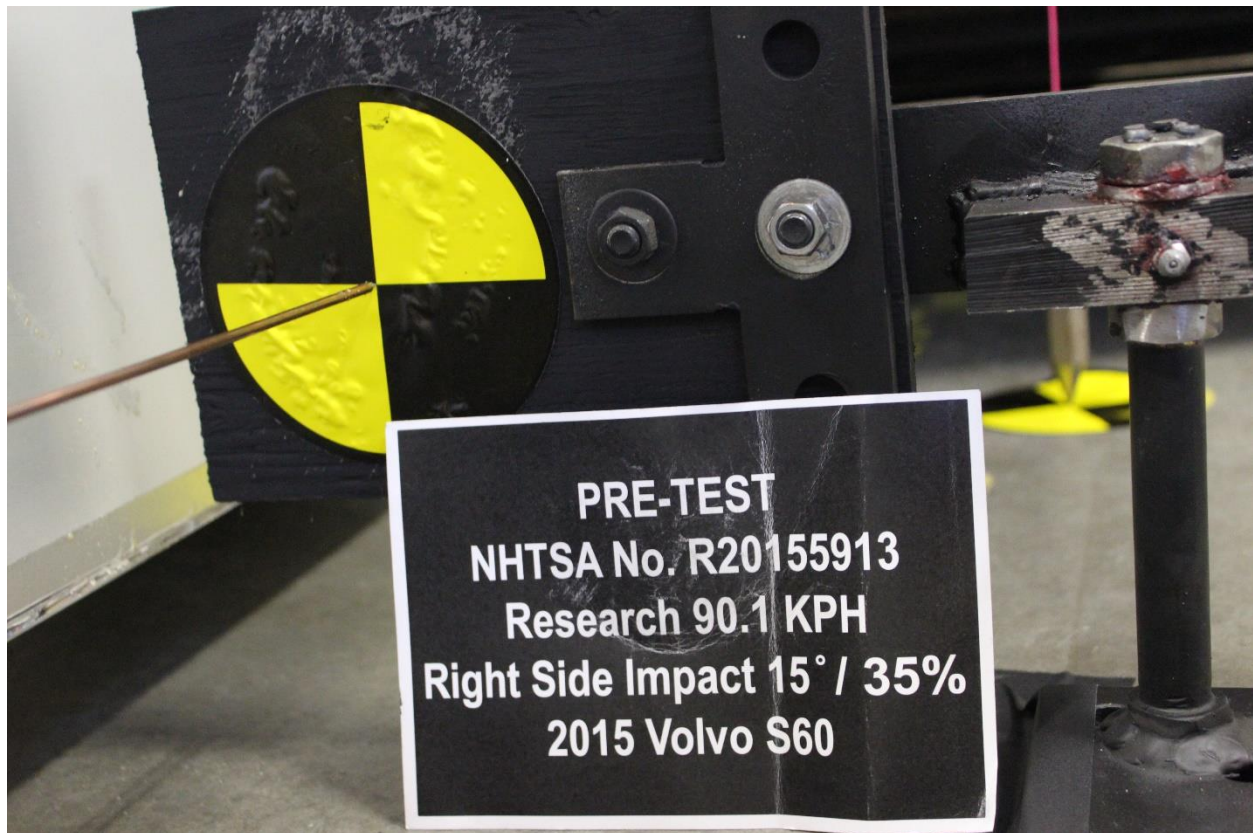
No. 022 Pre-Test Overhead View of OMDB against target vehicle at ideal Impact Point



No. 023 Pre-Test Left Side View of OMDB against target vehicle at ideal Impact Point



No. 024 Pre-Test Right Side View of OMDB against target vehicle at ideal Impact Point



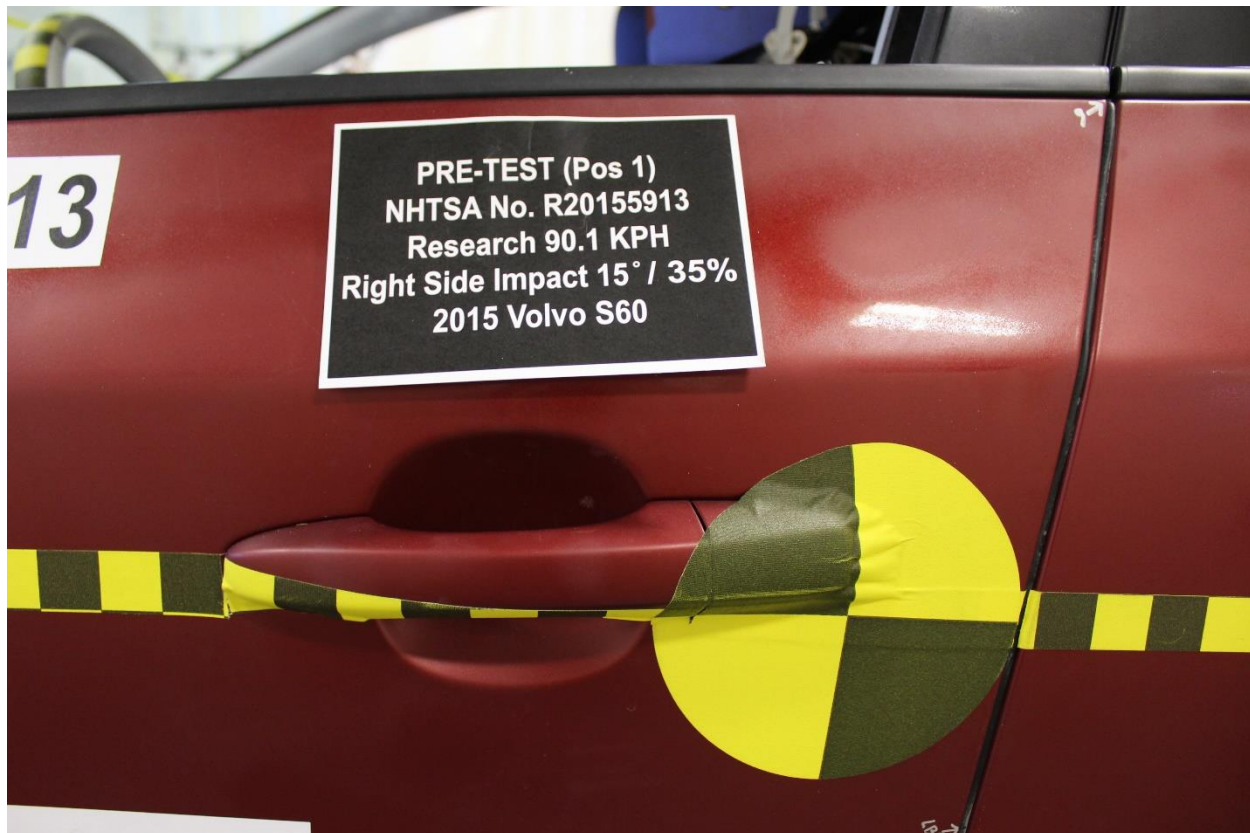
No. 025 Pre-Test Close-up View of Impact Point



No. 026 Post-Test Close-up View of Impact Point



No. 027 Post-Test Vehicle Overhead View



No. 028 Pre-Test Close-up View of Driver Door Latch



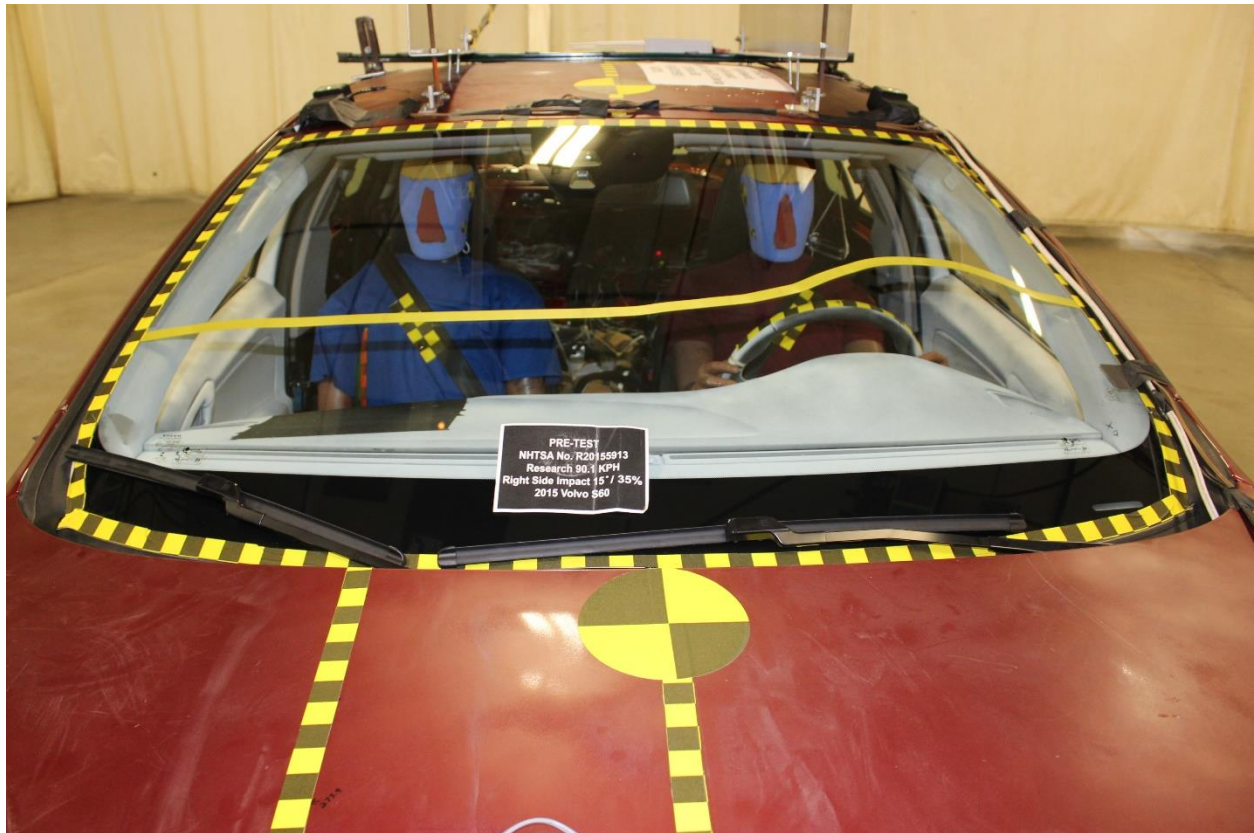
No. 029 Post-Test Close-up View of Driver Door Latch



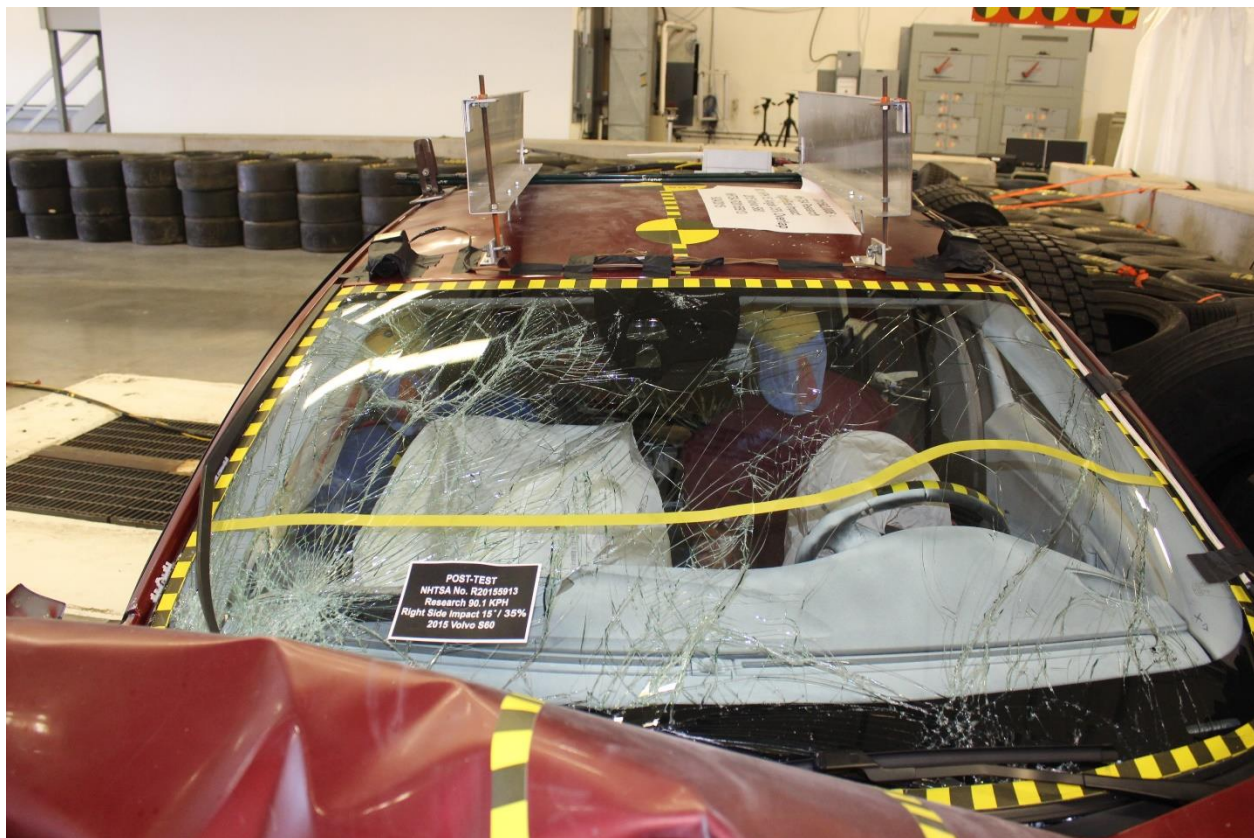
No. 030 Pre-Test Close-up View of Passenger Door Latch



No. 031 Post-Test Close-up View of Passenger Door Latch



No. 032 Pre-Test Windshield View



No. 033 Post-Test Windshield View



No. 034 Pre-Test View of Driver Inner Door Panel



No. 035 Post-Test View of Driver Inner Door Panel



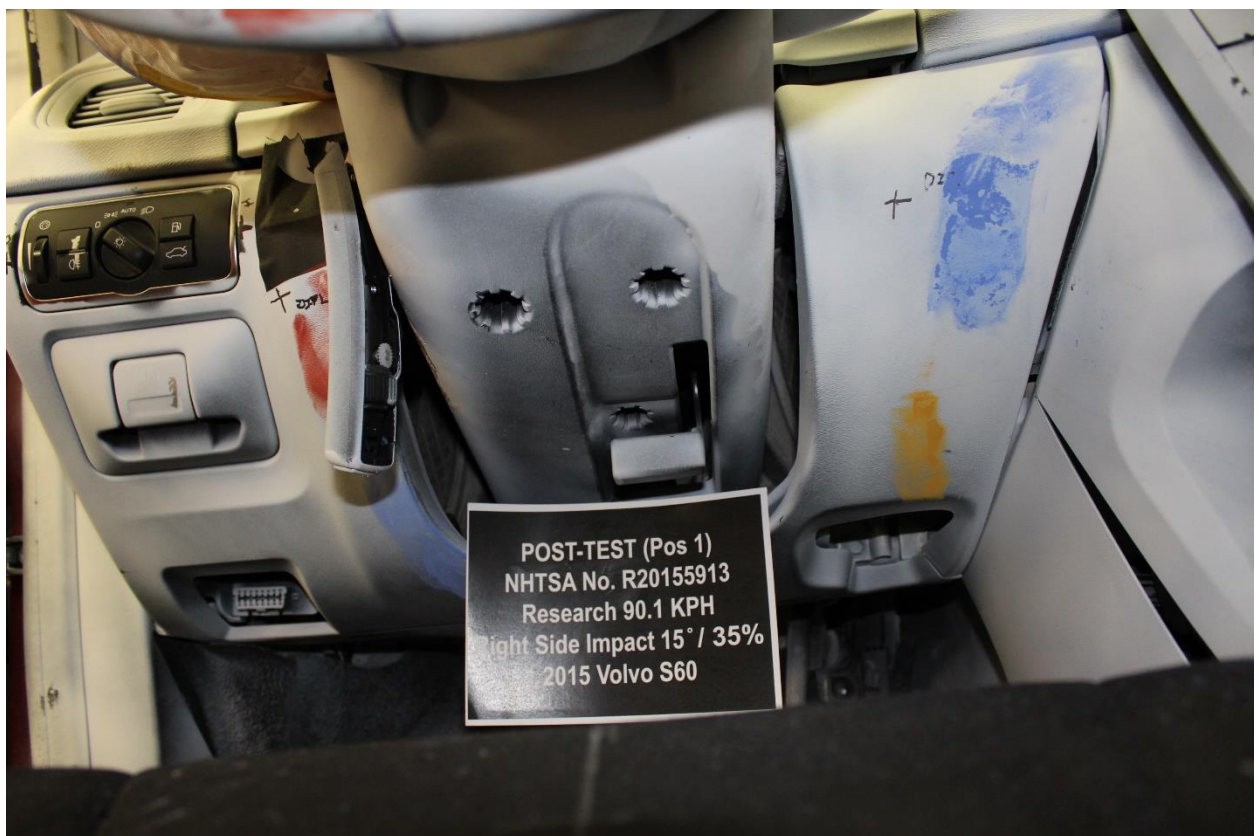
No. 036 Pre-Test View of Passenger Inner Door Panel



No. 037 Post-Test View of Passenger Inner Door Panel



No. 038 Pre-Test Overall View of Driver Knee Bolsters



No. 039 Post-Test Overall View of Driver Knee Bolsters



No. 040 Pre-Test Left Side View of Driver Knee Bolsters



No. 041 Post-Test Left Side View of Driver Knee Bolsters



No. 042 Pre-Test Right Side View of Driver Knee Bolsters



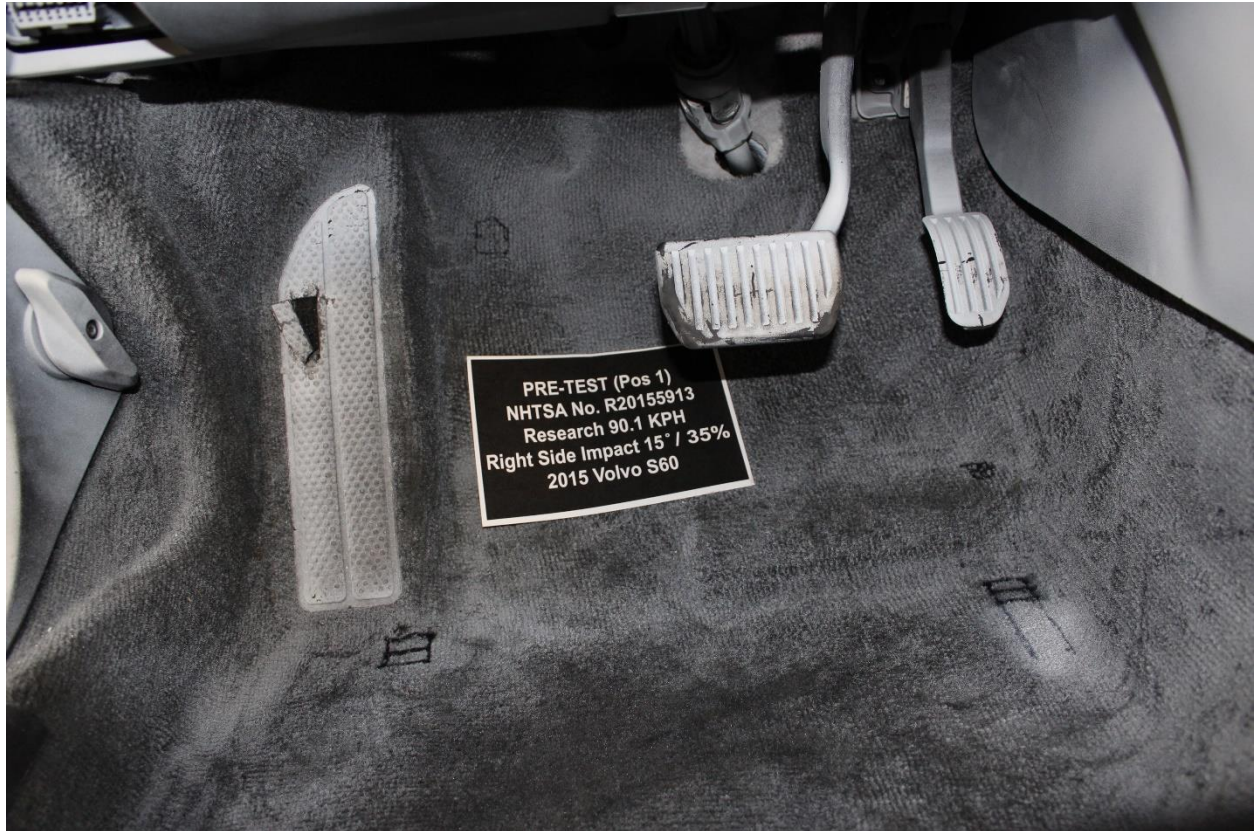
No. 043 Post-Test Right Side View of Driver Knee Bolsters



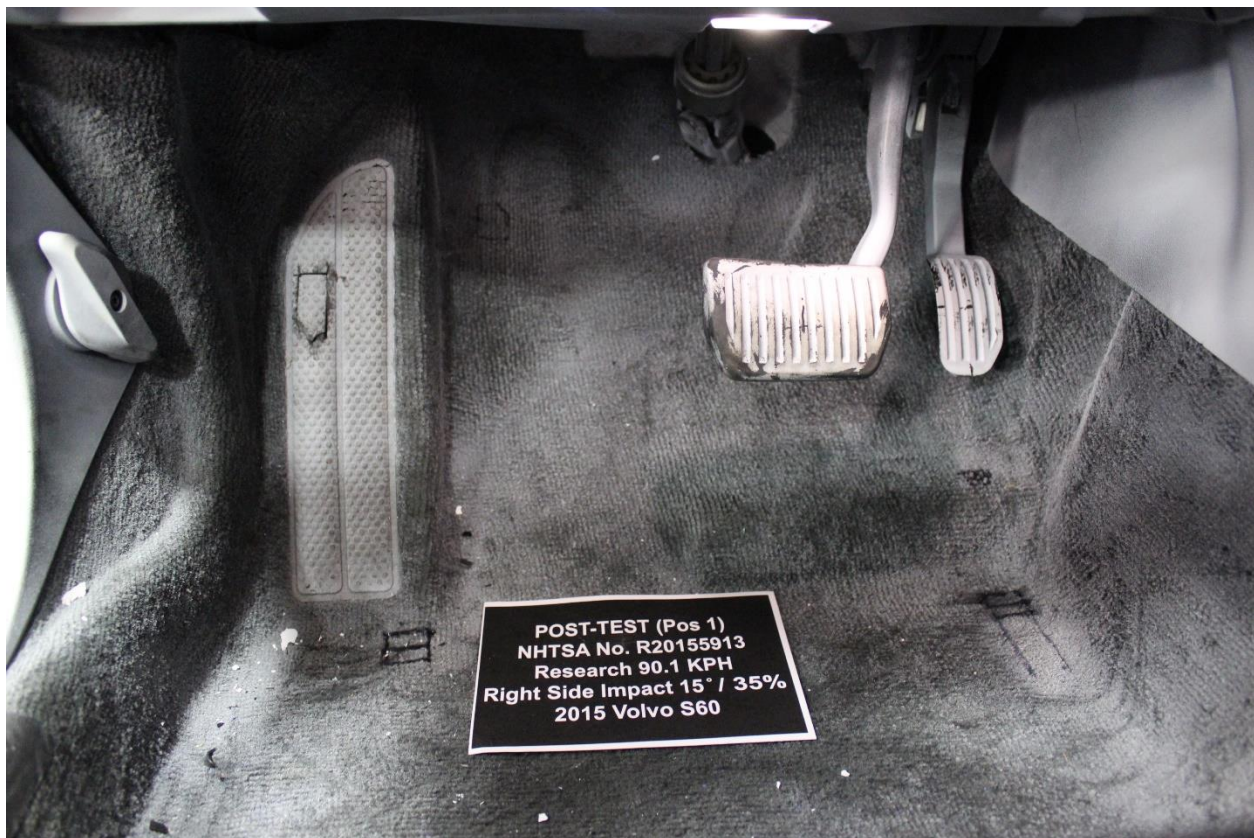
No. 044 Pre-Test View of Driver Floor pan at Left sill level, w/carpet



No. 045 Post-Test View of Driver Floor pan at Left sill level, w/carpet



No. 046 Pre-Test View of Driver Floor pan at Mid seat level, w/carpet



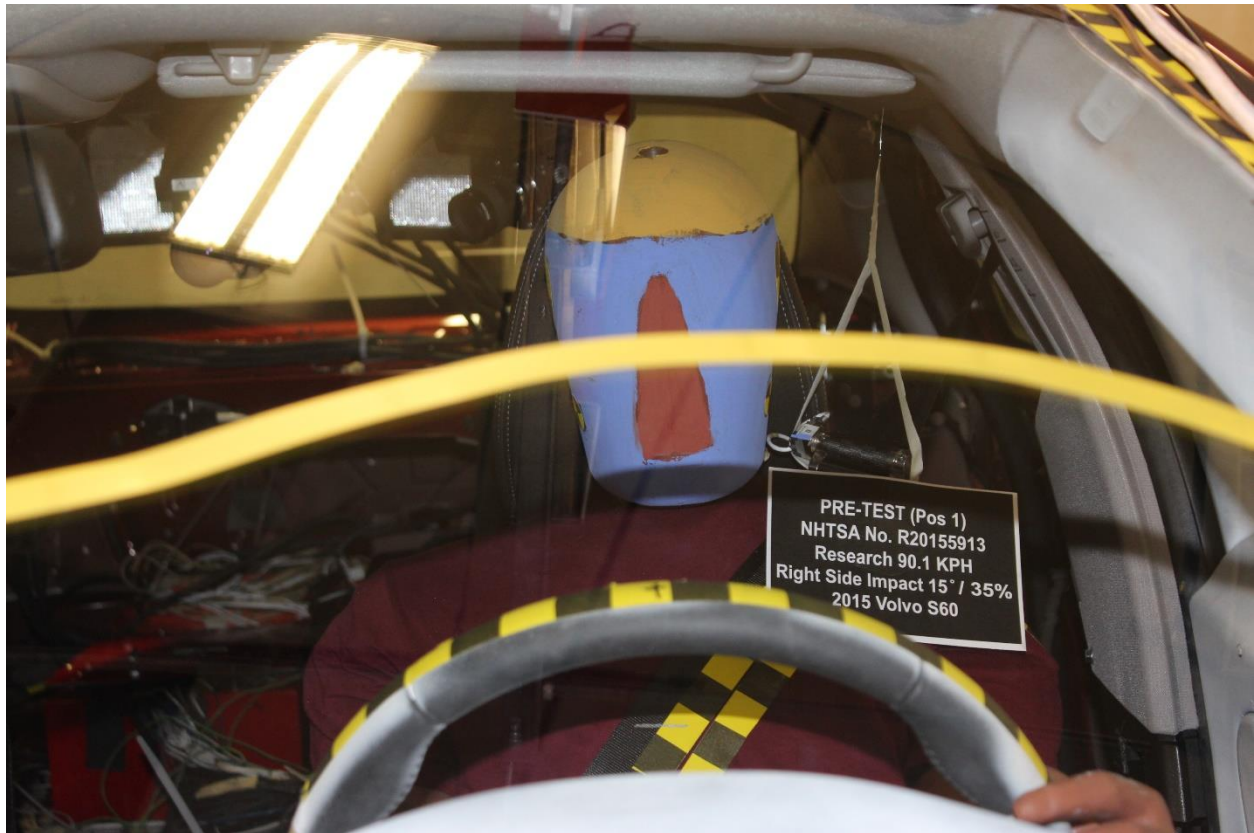
No. 047 Post-Test view of Driver Floor pan at Mid seat level, w/carpet



No. 048 Pre-Test View of Driver Floor pan at Right Side



No. 049 Post-Test View of Driver Floor pan at Right Side



No. 050 Pre-Test Driver Front Windshield View



No. 051 Post-Test Driver Front Windshield View



No. 052 Pre-Test Left Side View of Driver and Interior



No. 053 Post-Test Left Side View of Driver and Interior



No. 054 Pre-Test Left Side Driver Window View



No. 055 Post-Test Left Side Driver Window View



No. 056 Pre-Test Right Side View of Driver and Interior



No. 057 Post-Test Right Side View of Driver and Interior



No. 058 Pre-Test View of Driver Door Clearance



No. 059 Post-Test View of Driver Door Clearance



No. 060 Pre-Test View of Parking Brake



No. 061 Pre-Test Driver Seat Fore Aft Markings



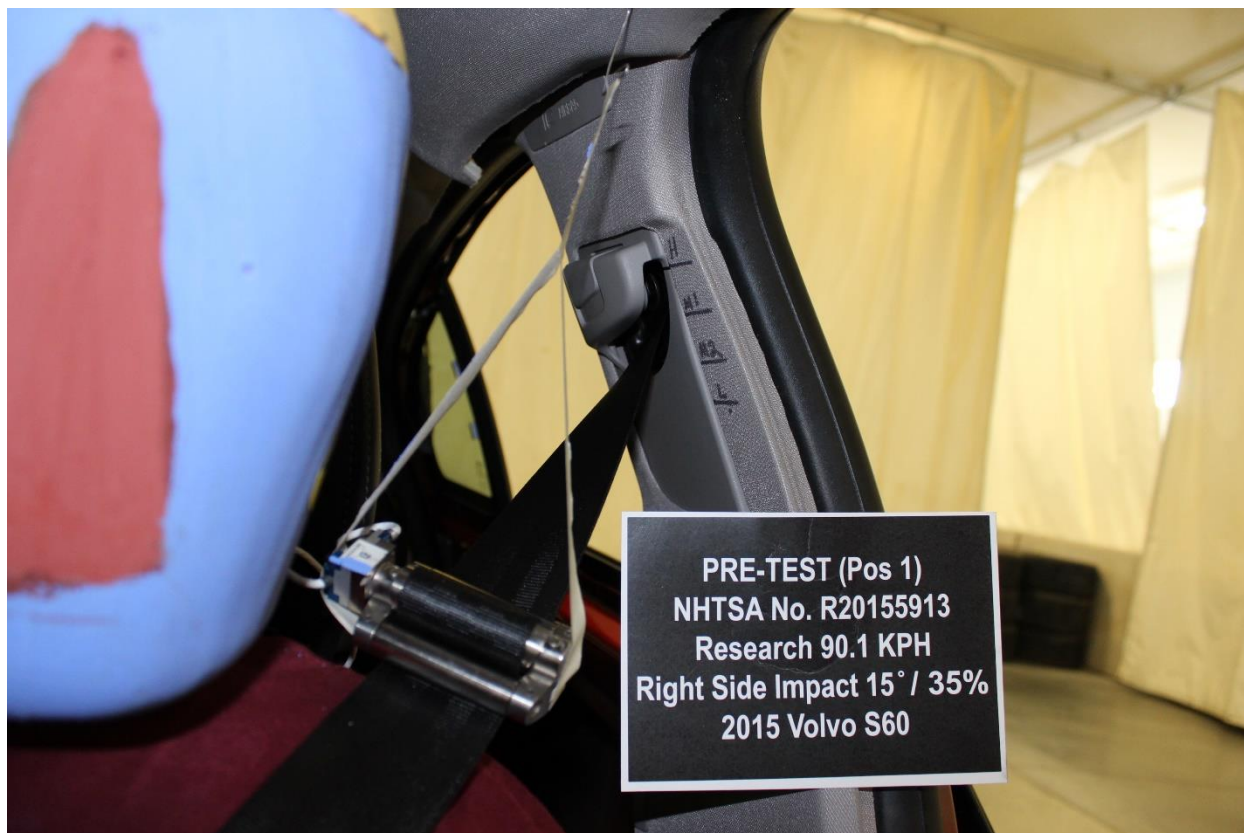
No. 062 Post-Test Driver Seat Fore Aft Markings



No. 063 Pre-Test Driver Seat Back Markings



No. 064 Pre-Test Overhead View of Driver Thighs on Seat



No. 065 Pre-Test Driver Adjustable D-Ring



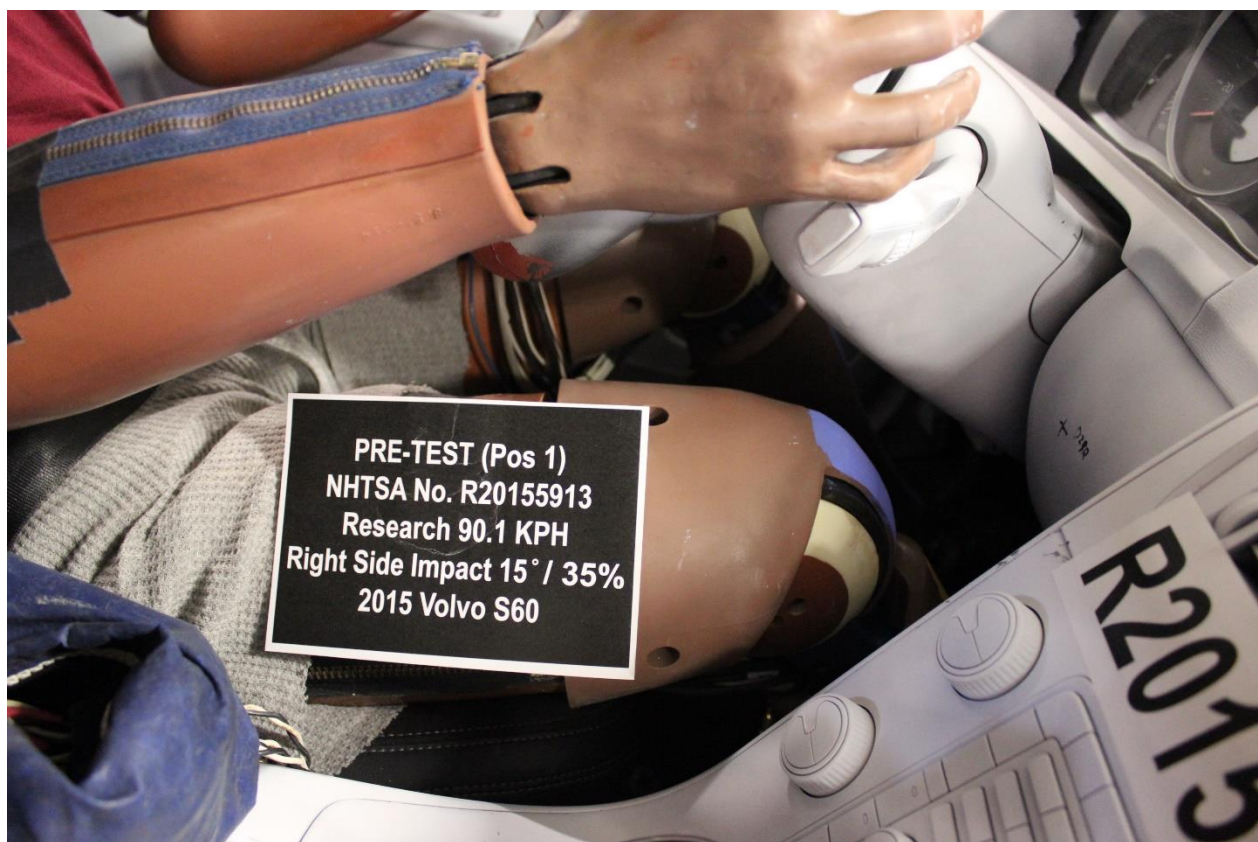
No. 066 Post-Test Driver Adjustable D-Ring



No. 067 Pre-Test Driver Feet



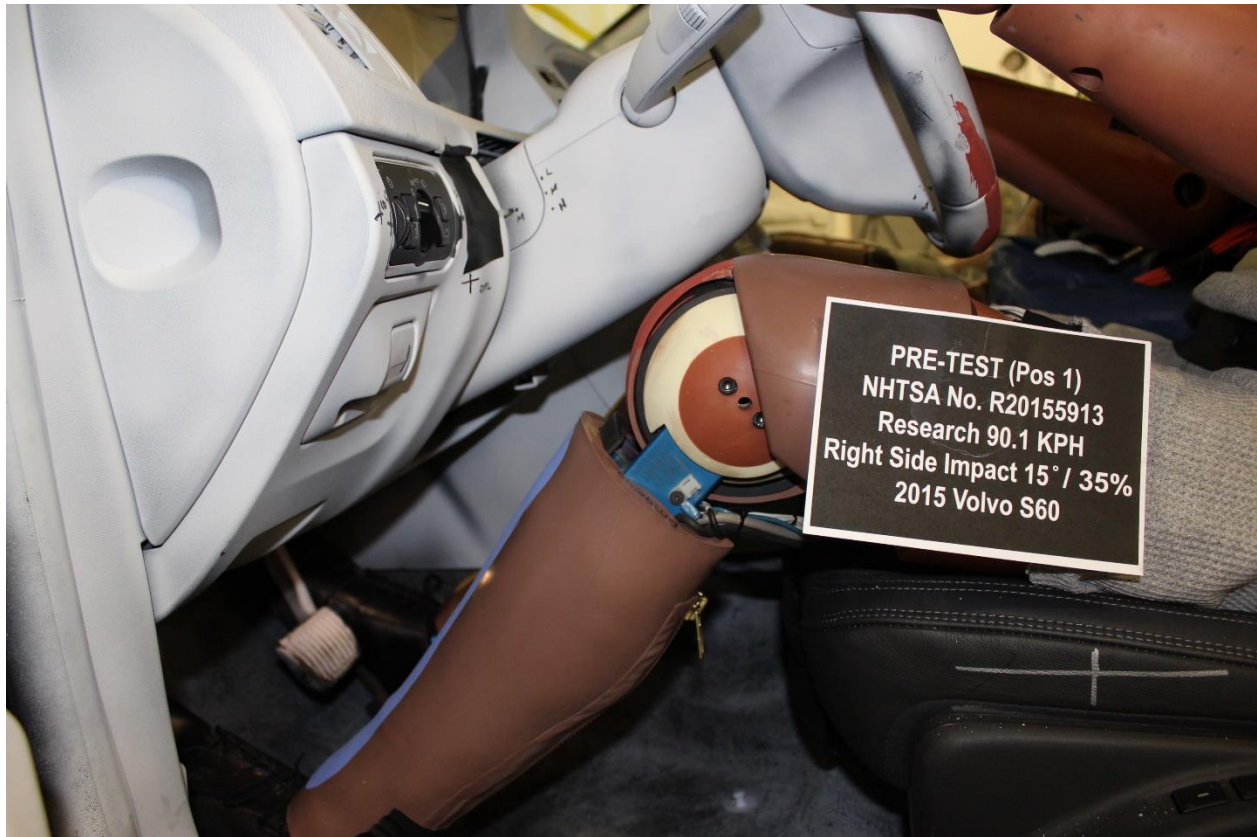
No. 068 Post-Test Driver Feet



No. 069 Pre-Test View of Driver Right Knee and Bolster



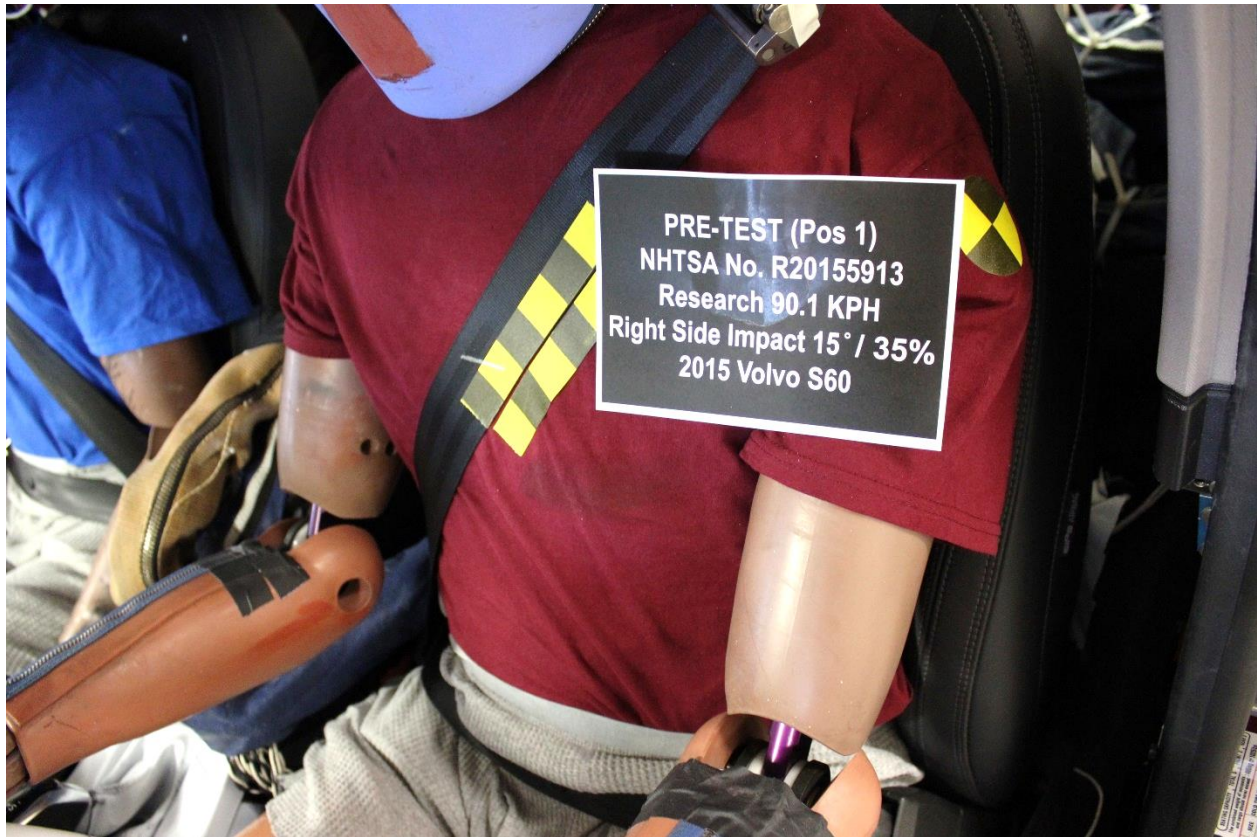
No. 070 Post-Test View of Driver Right Knee and Bolster



No. 071 Pre-Test View of Driver Left Knee and Bolster



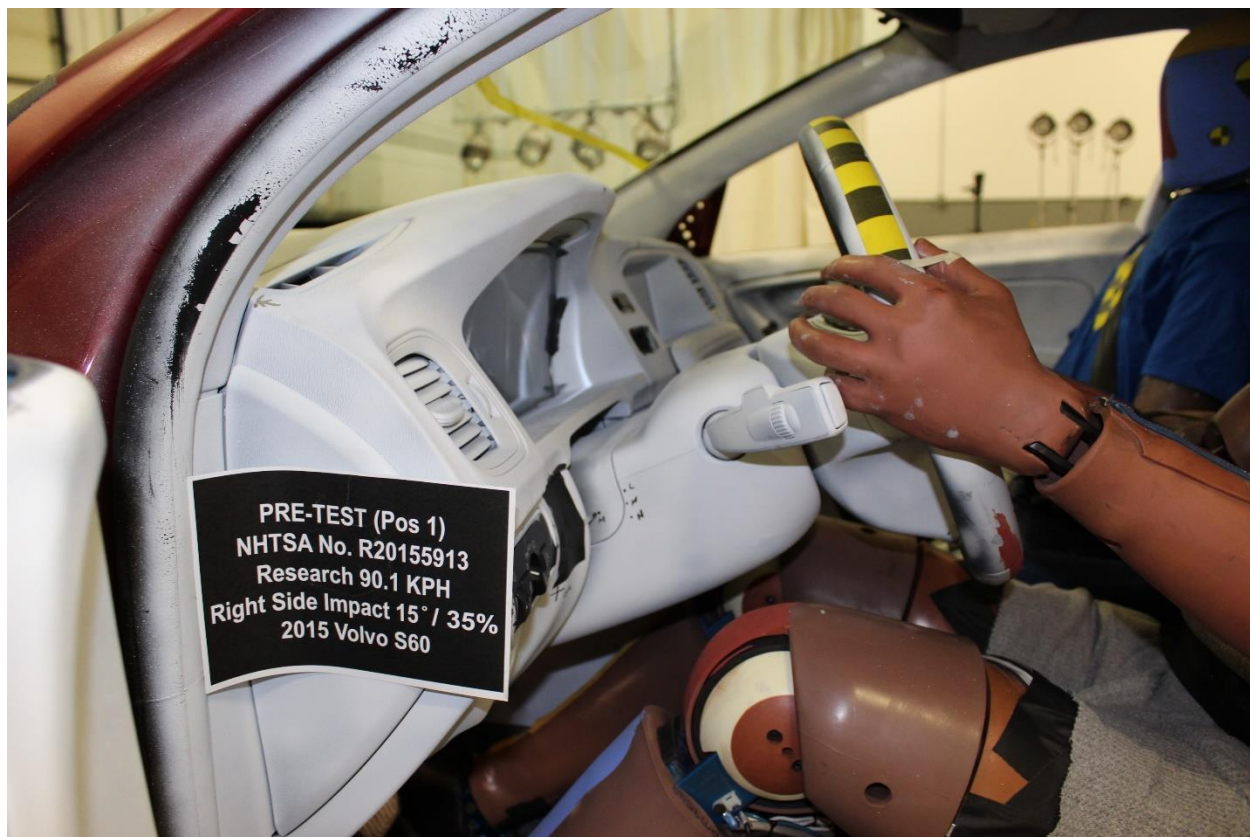
No. 072 Post-Test View of Driver Left Knee and Bolster



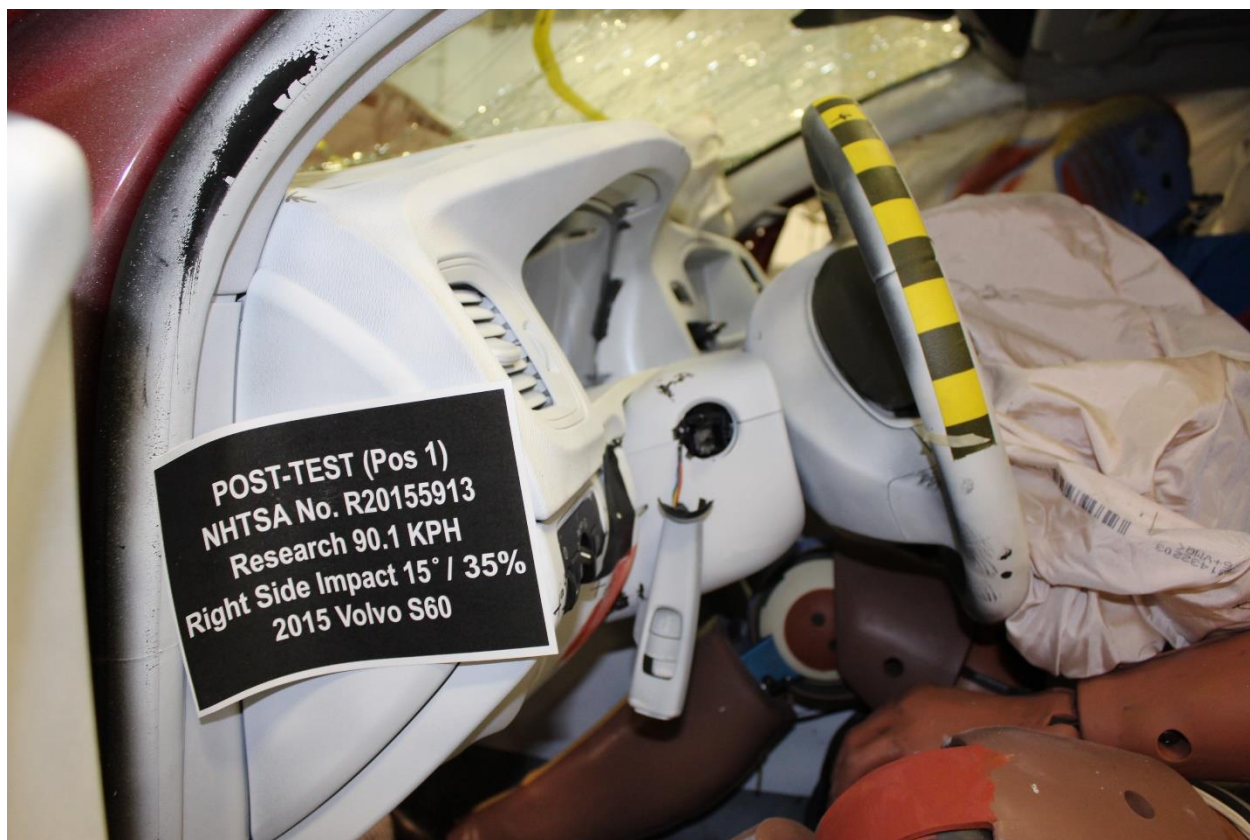
No. 073 Pre-Test View of Driver Abdomen



No. 074 Post-Test View of Driver Abdomen



No. 075 Pre-Test Left Side View of Steering Wheel set position



No. 076 Post-Test Left Side View of Steering Wheel set position



No. 077 Post-Test View of Driver Head Contact with Front Airbag

Photo Not Applicable

No. 078 Post-Test View of Driver Head Contact with Curtain Airbag



No. 079 Post-Test View of Driver Head Contact with Vehicle Interior – A

Photo Not Applicable

No. 080: Post-Test View of Driver Body Contact with Vehicle Interior - B

Photo Not Applicable

No. 081: Post-Test View of Driver Body Contact with Vehicle Interior - C



No. 082: Pre-Test Overall View of Passenger Knee Bolsters



No. 083: Post-Test Overall View of Passenger Knee Bolsters



No. 084: Pre-Test Left Side View of Passenger Knee Bolsters



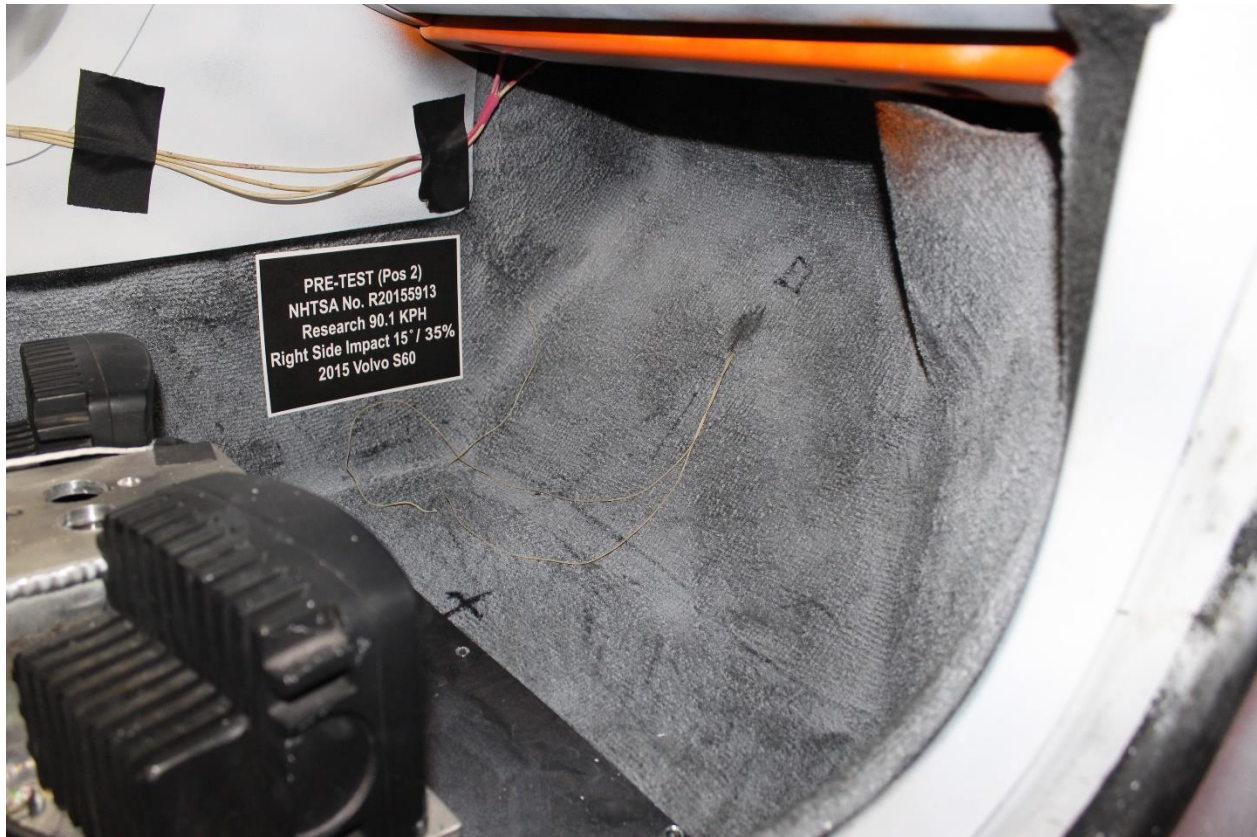
No. 085: Post-Test Left Side View of Passenger Knee Bolsters



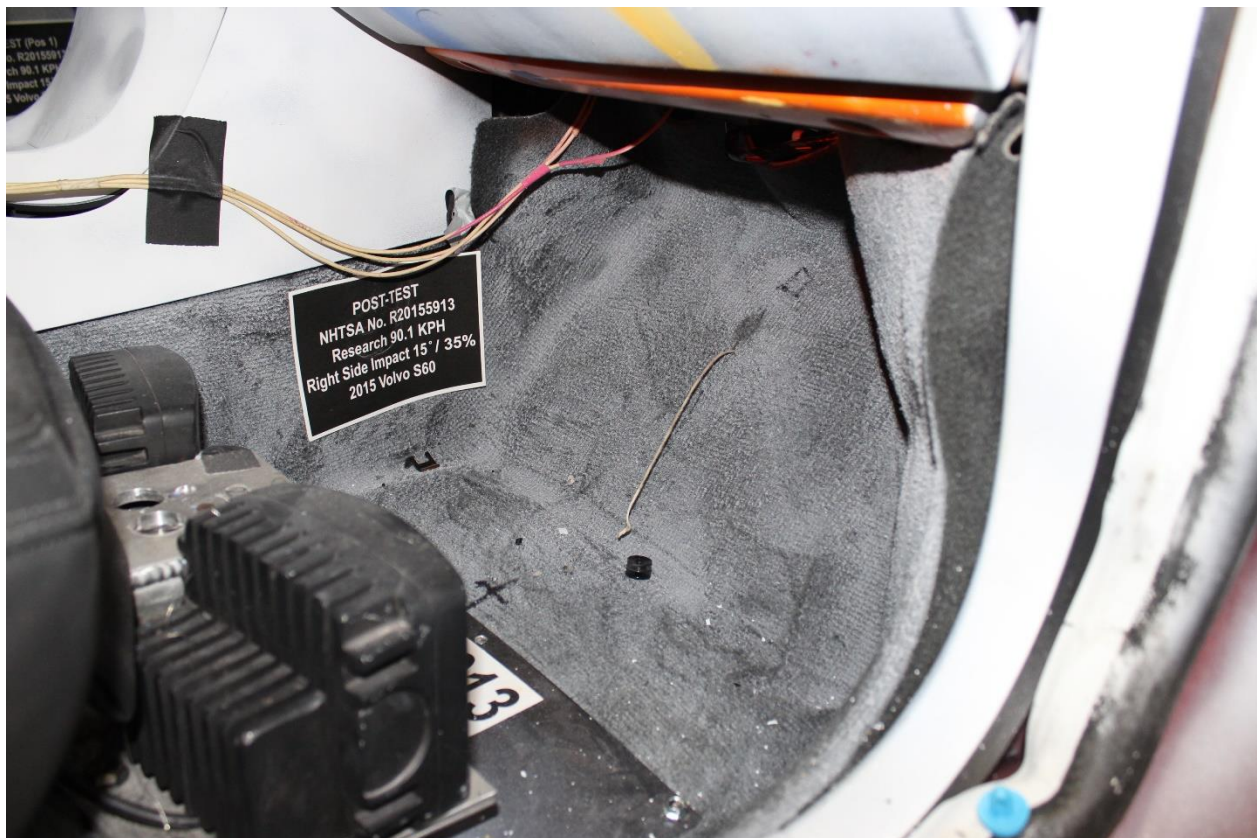
No. 086: Pre-Test Right Side View of Passenger Knee Bolsters



No. 087: Post-Test Right Side View of Passenger Knee Bolsters



No. 088: Pre-Test View of Passenger Floor pan at Right sill level, w/carpet



No. 089: Post-Test View of Passenger Floor pan at Right sill level, w/carpet



No. 090: Pre-Test View of Passenger Floor pan at Mid seat level, w/carpet



No. 091: Post-Test view of Passenger Floor pan at Mid seat level, w/carpet



No. 092: Pre-Test View of Passenger Floor pan at Left view



No. 093: Post-Test View of Passenger Floor pan at Left View



No. 094: Pre-Test Passenger Front Close-up View, Windshield



No. 095: Post-Test Passenger Front Close-up View, Windshield



No. 096: Pre-Test Left Side Passenger and Interior View



No. 097: Post-Test Left Side Passenger and Interior View



No. 98: Pre-Test Right Side Passenger Window View



No. 99: Post-Test Right Side Passenger Window View



No. 100: Pre-Test Right Side Passenger and Interior View



No. 101: Post-Test Right Side Passenger and Interior View



No. 102: Pre-Test View of Passenger Door Clearance



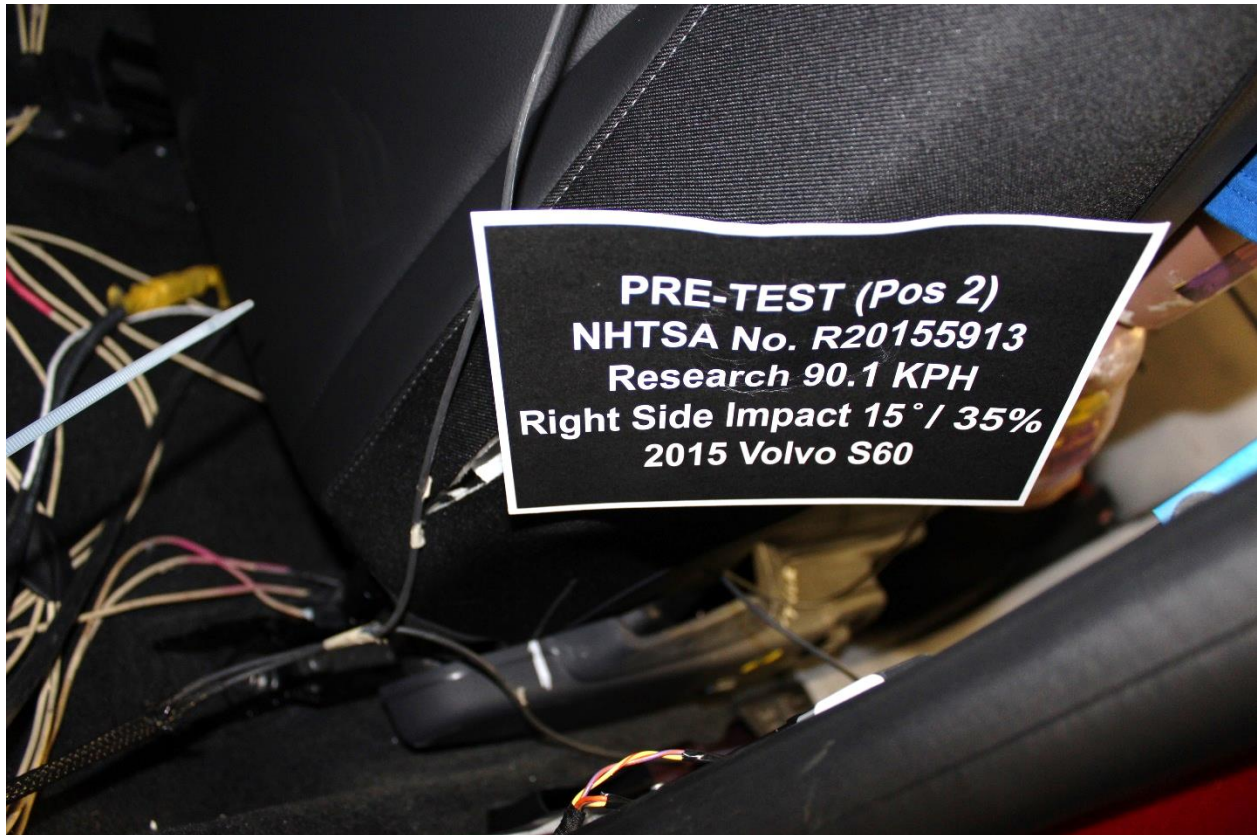
No. 103: Post-Test View of Passenger Door Clearance



No. 104: Pre-Test Passenger Seat Fore-Aft Markings



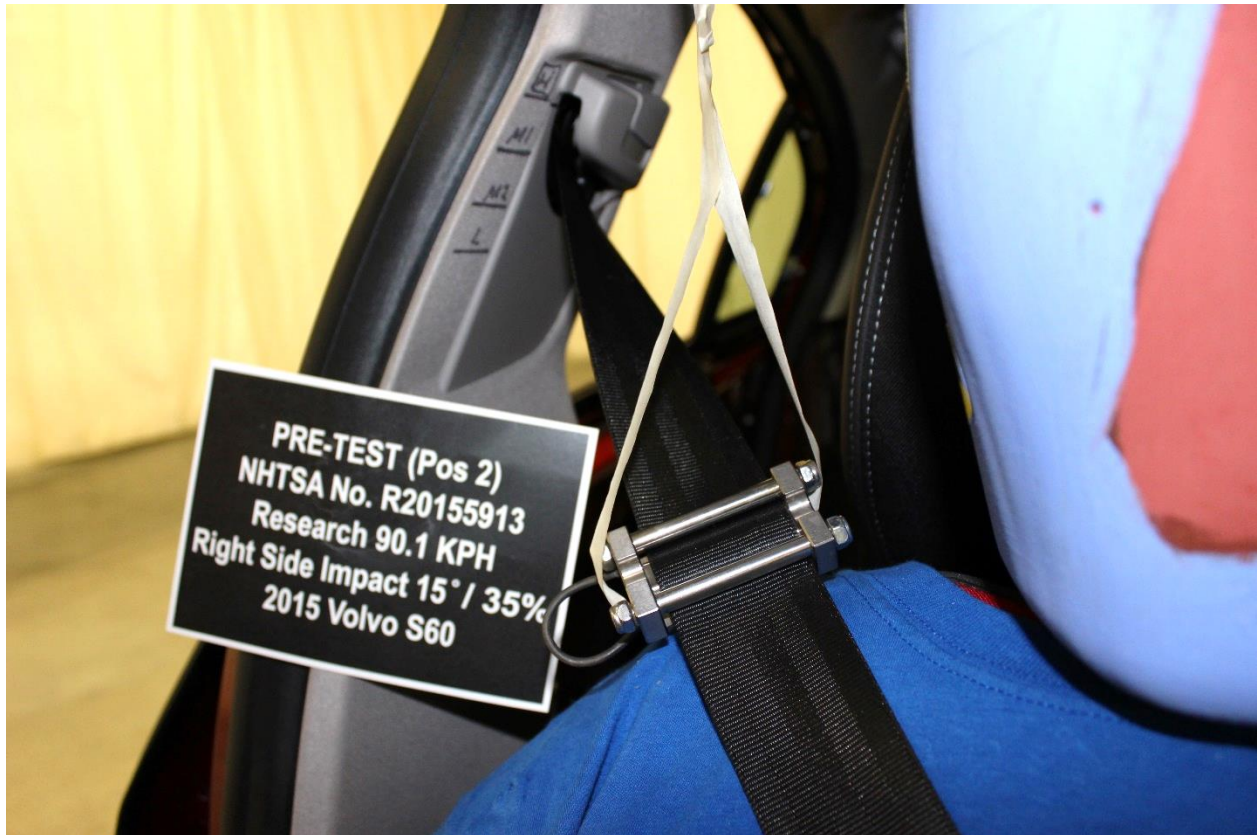
No. 105: Post-Test Passenger Seat Fore-Aft Markings (plastic moved not seat)



No. 106: Pre-Test Passenger Seat Back Markings



No. 107: Pre-Test Overhead View of Passenger Thighs on seat



No. 108: Pre-Test Passenger Adjustable D-ring

Photo Not Available

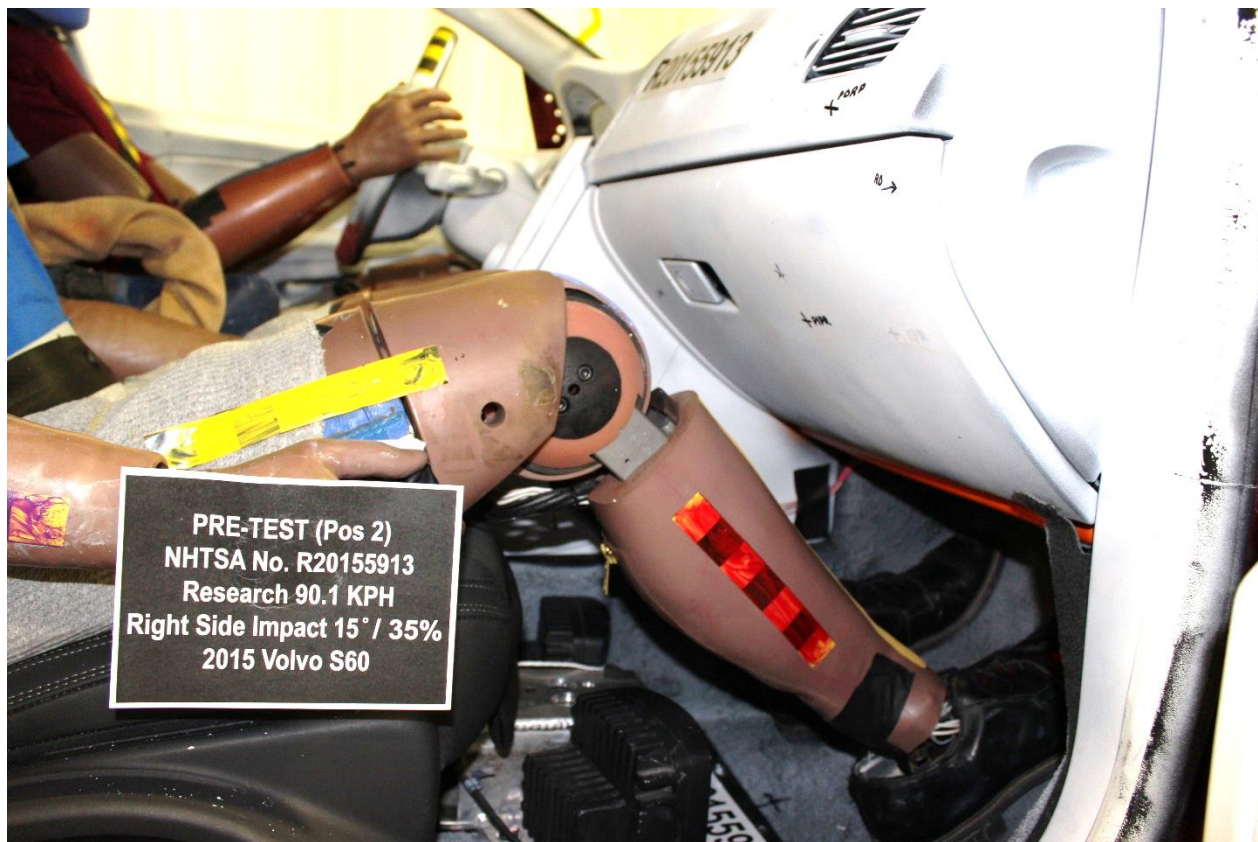
No. 109: Post-Test Passenger Adjustable D-ring



No. 110: Pre-Test View of Passenger Feet



No. 111: Post-Test View of Passenger Feet



No. 112: Pre-Test View of Passenger Right Knee and Bolster



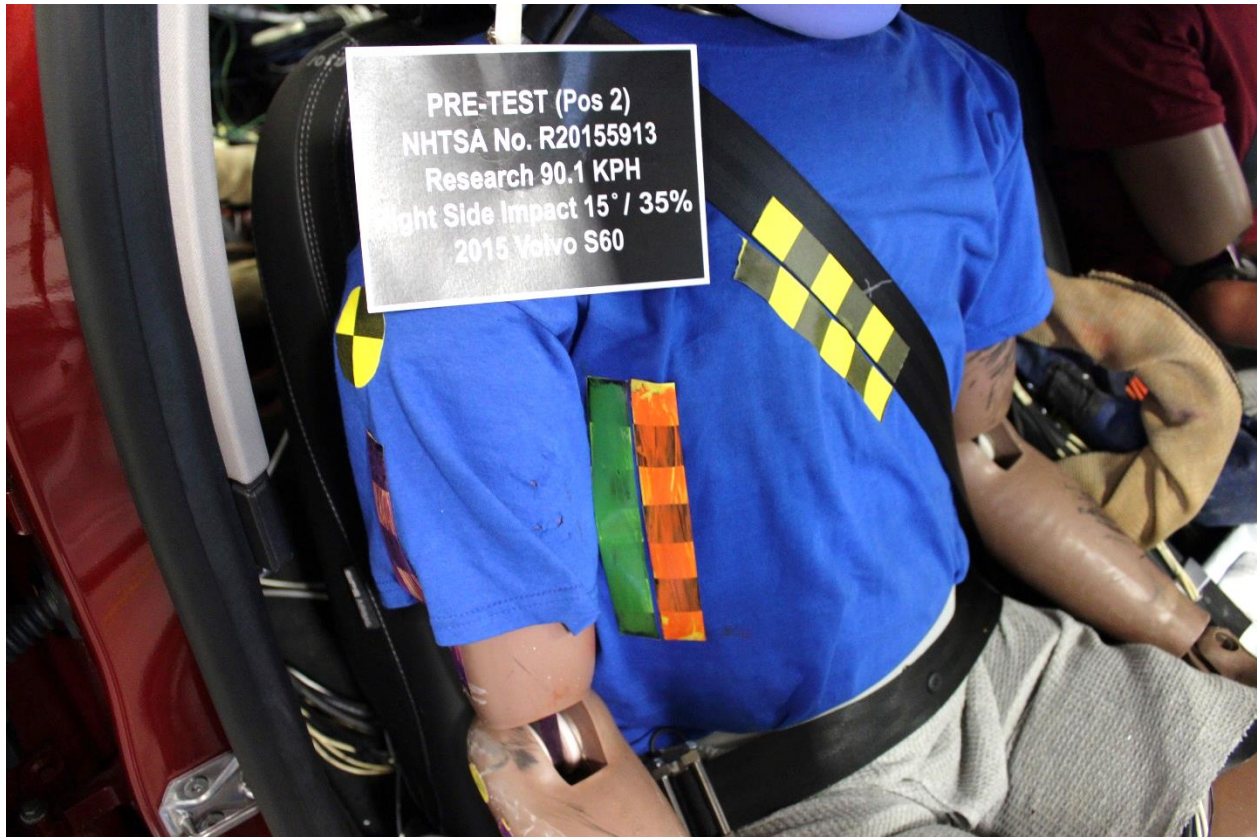
No. 113: Post-Test View of Passenger Right Knee and Bolster



No. 114: Pre-Test View of Passenger Left Knee and Bolster



No. 115: Post-Test View of Passenger Left Knee and Bolster



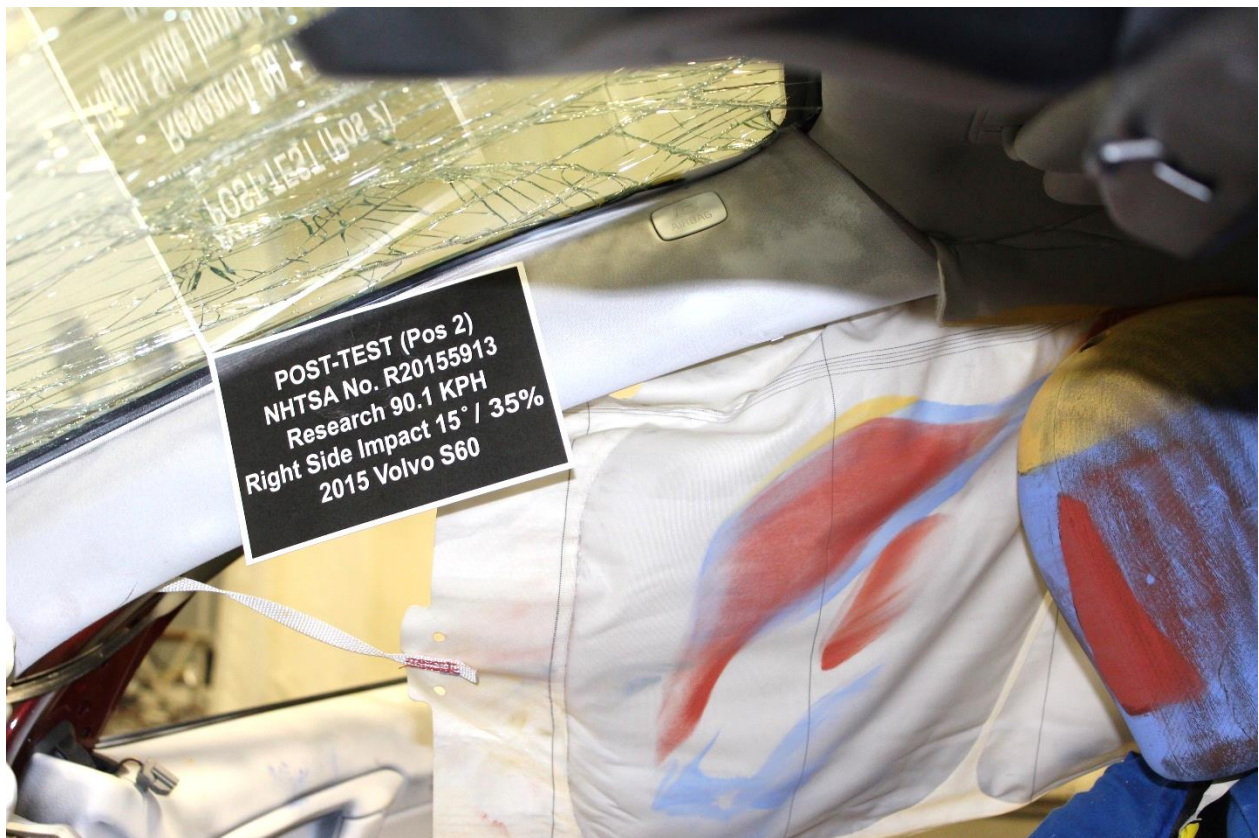
No. 116: Pre-Test View of Passenger Abdomen



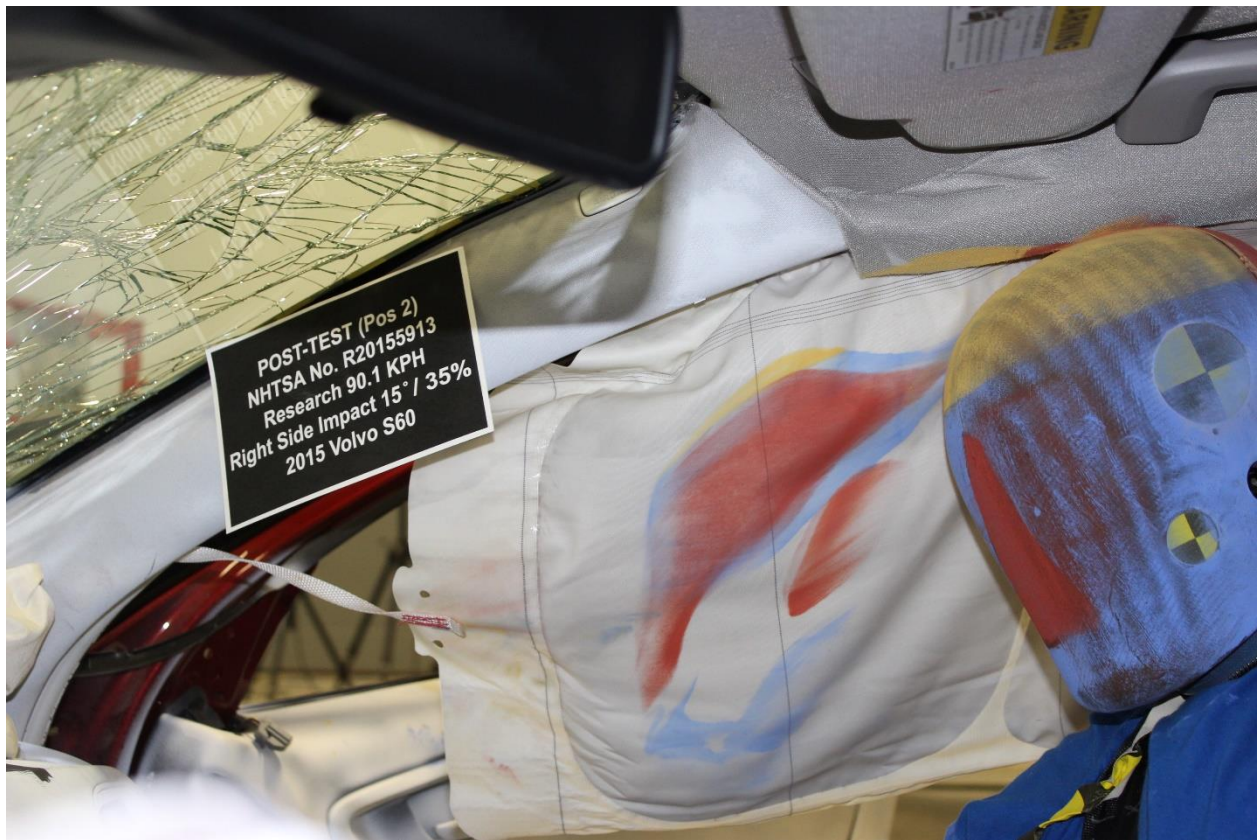
No. 117: Post-Test View of Passenger Abdomen



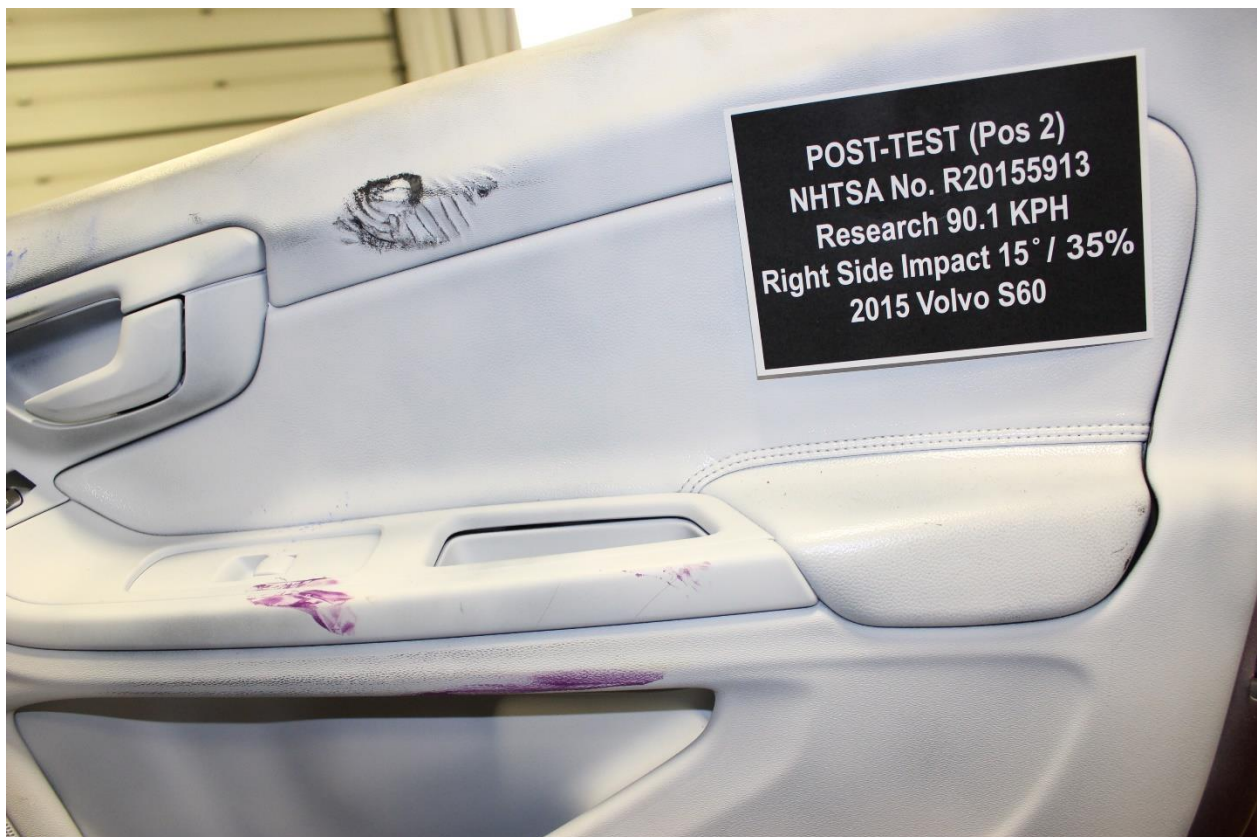
No. 118: Post-Test View of Passenger Head contact with Airbag – Front



No. 119: Post-Test View of Passenger Head contact with Airbag - Curtain



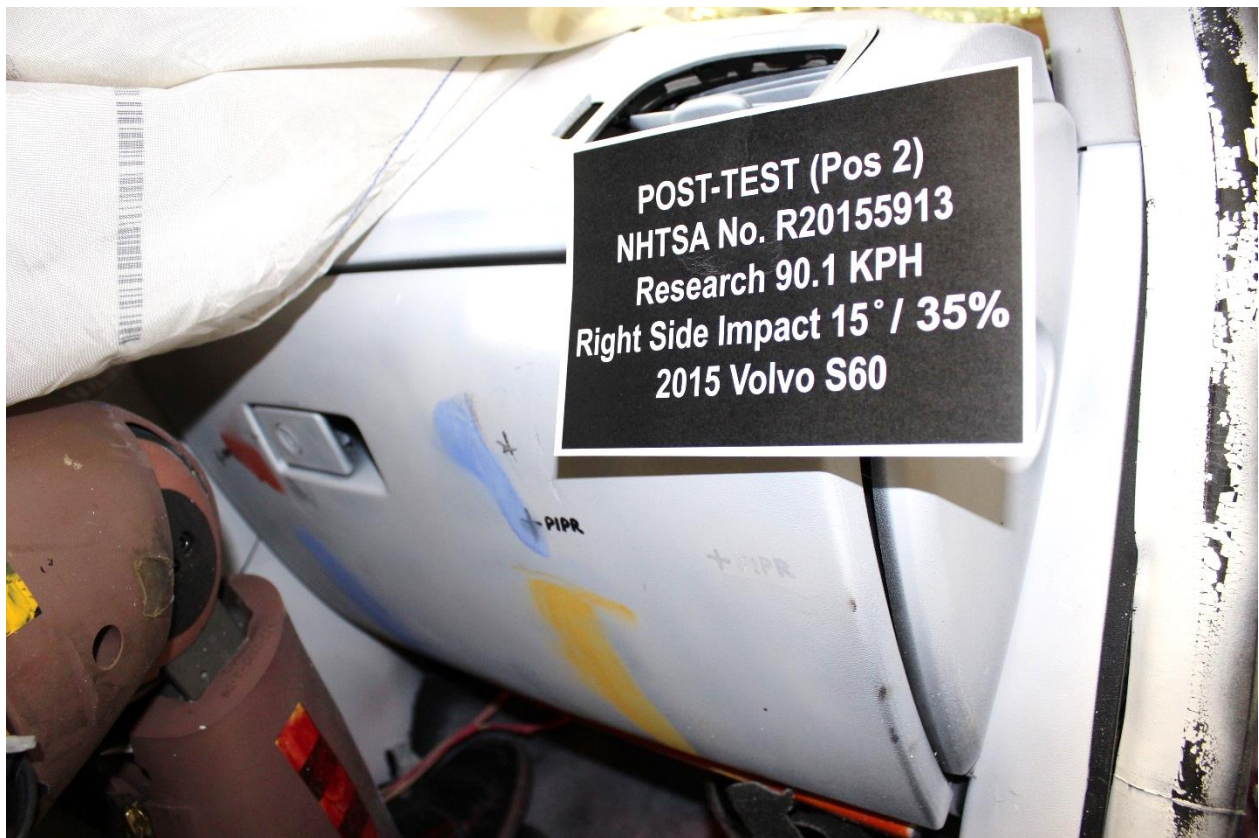
No. 120: Post-Test View of Passenger Head contact with Interior



No. 121: Post-Test View of Passenger Body contact with Interior

Photo Not Applicable

No. 122: Post-Test View of Passenger Head contact with Interior



No. 123: Post-Test Passenger Contact With Glovebox



No. 124: Pre-Test Ballast Locations



No. 125: Post-Test Speed Trap Readout



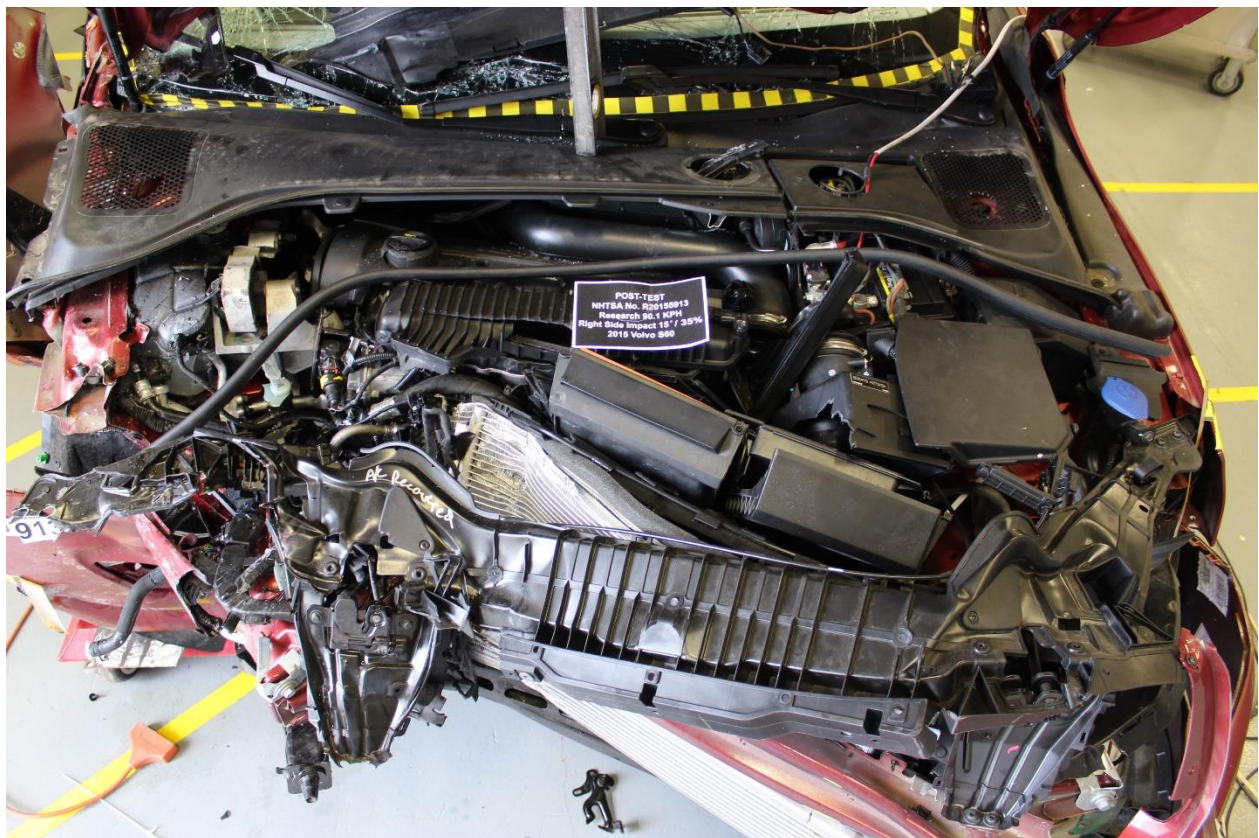
No. 126: Pre-Test View of Fuel Filler Cap



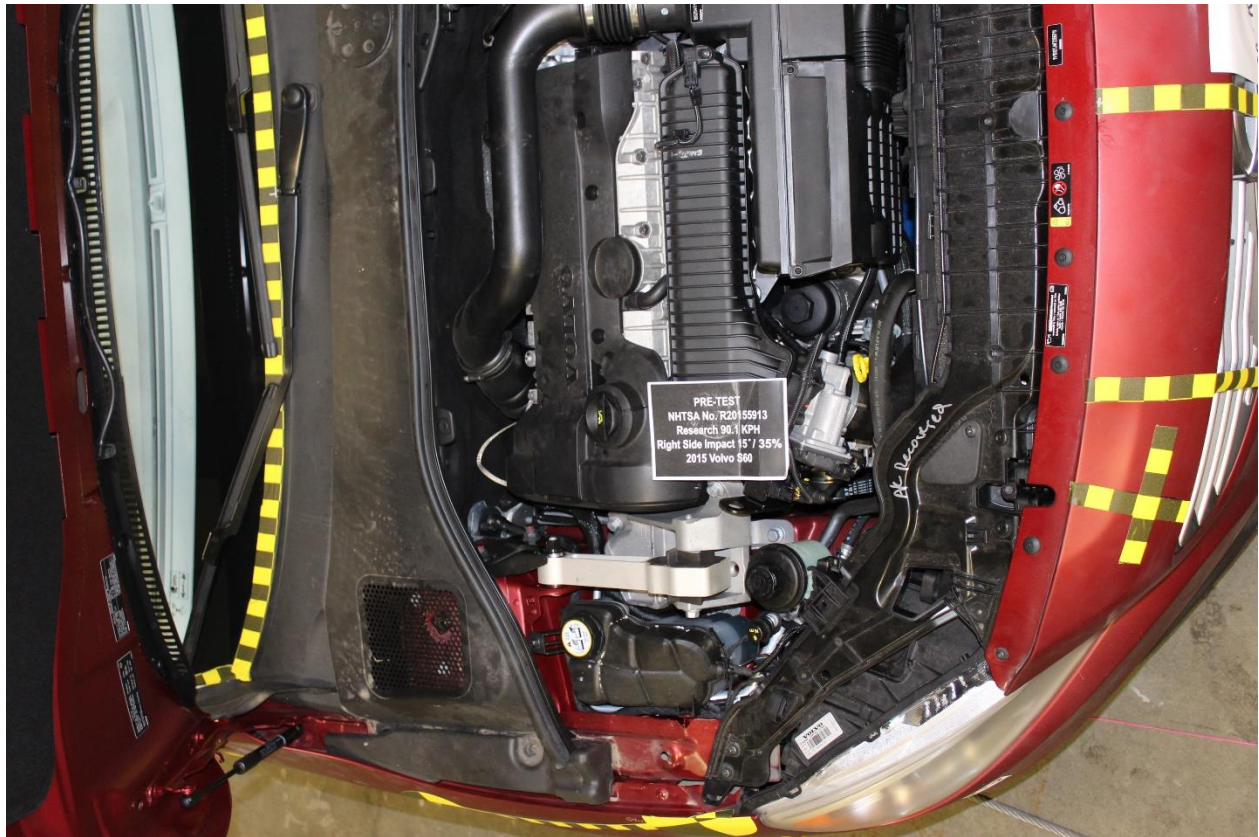
No. 127: Post-Test View of Fuel Filler Cap



No. 128: Pre-Test Engine Compartment View



No. 129: Post-Test Engine Compartment View



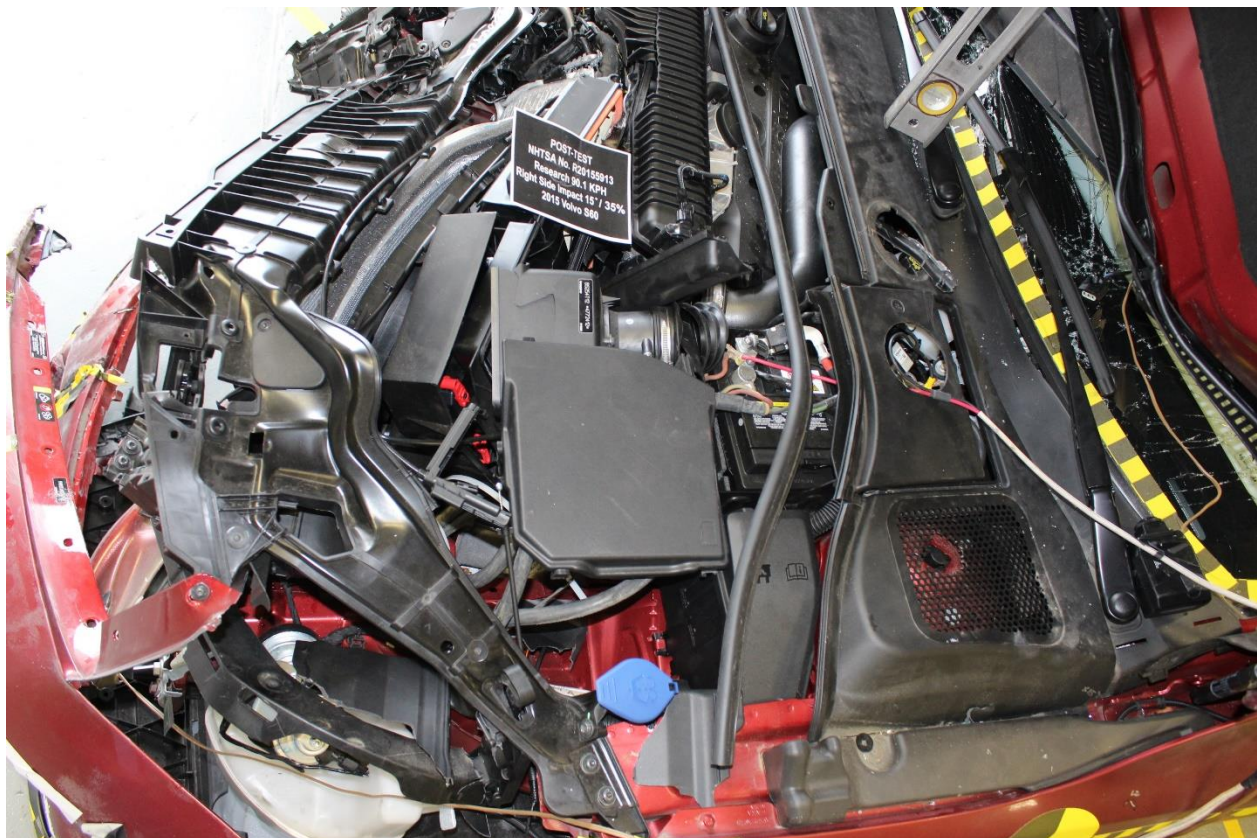
No. 130: Pre-Test Right Side Engine Compartment View



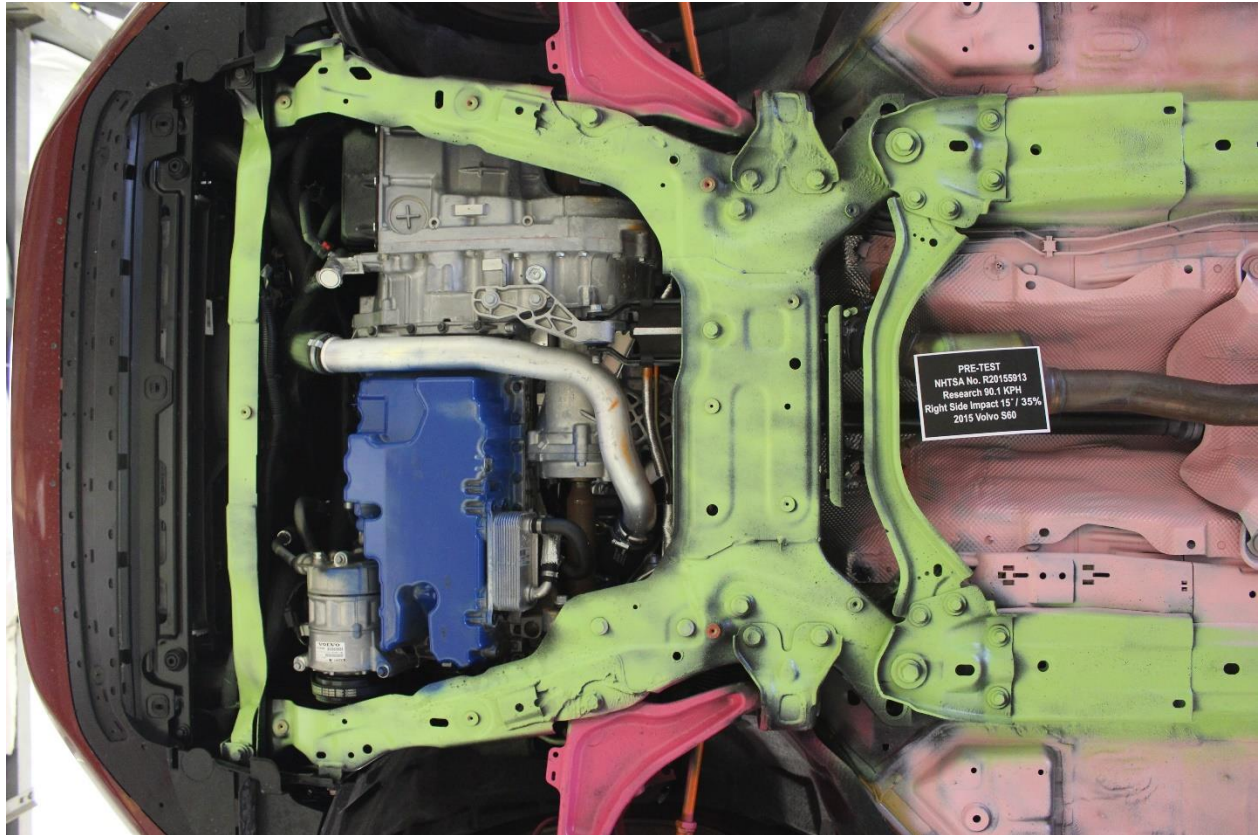
No. 131: Post-Test Right Side Engine Compartment View



No. 132: Pre-Test Left Side Engine Compartment View



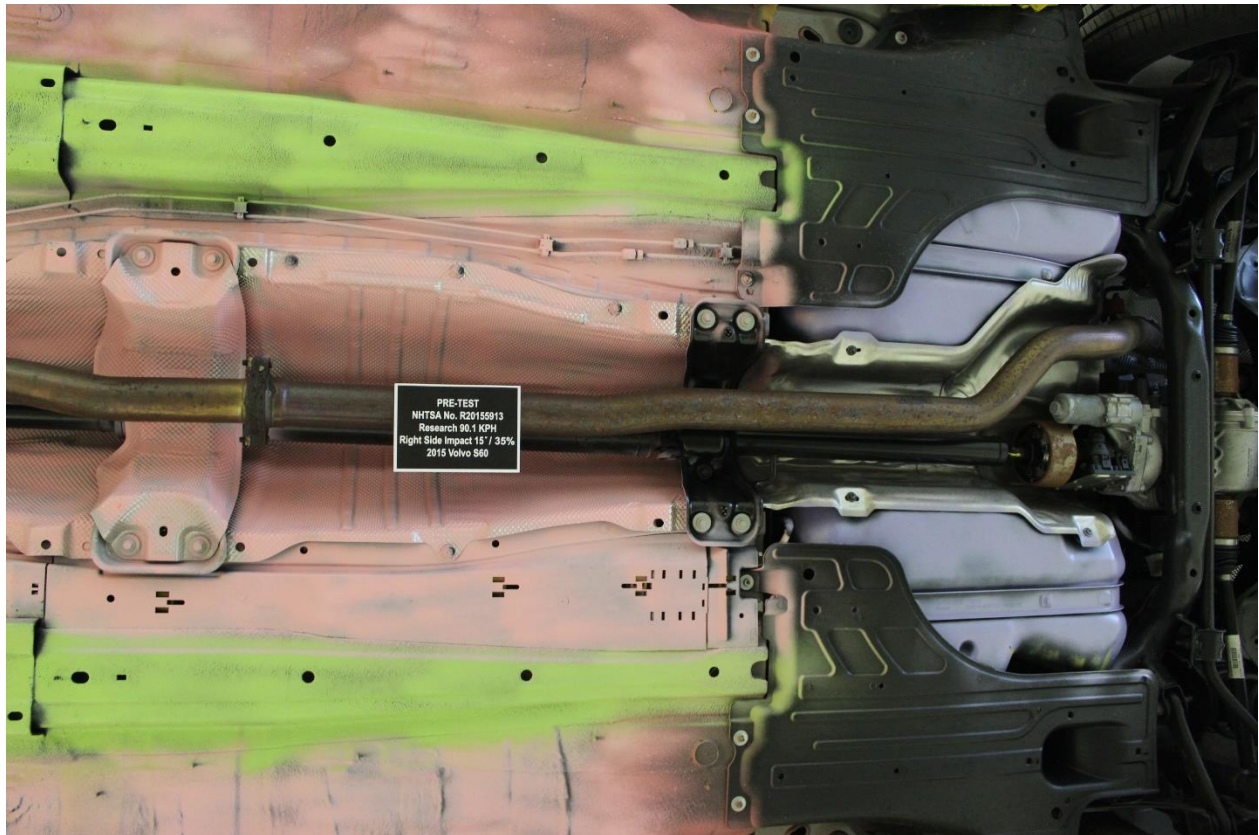
No. 133: Post-Test Left Side Engine Compartment View



No. 134: Pre-Test View of Front Underbody (perpendicular to vehicle)



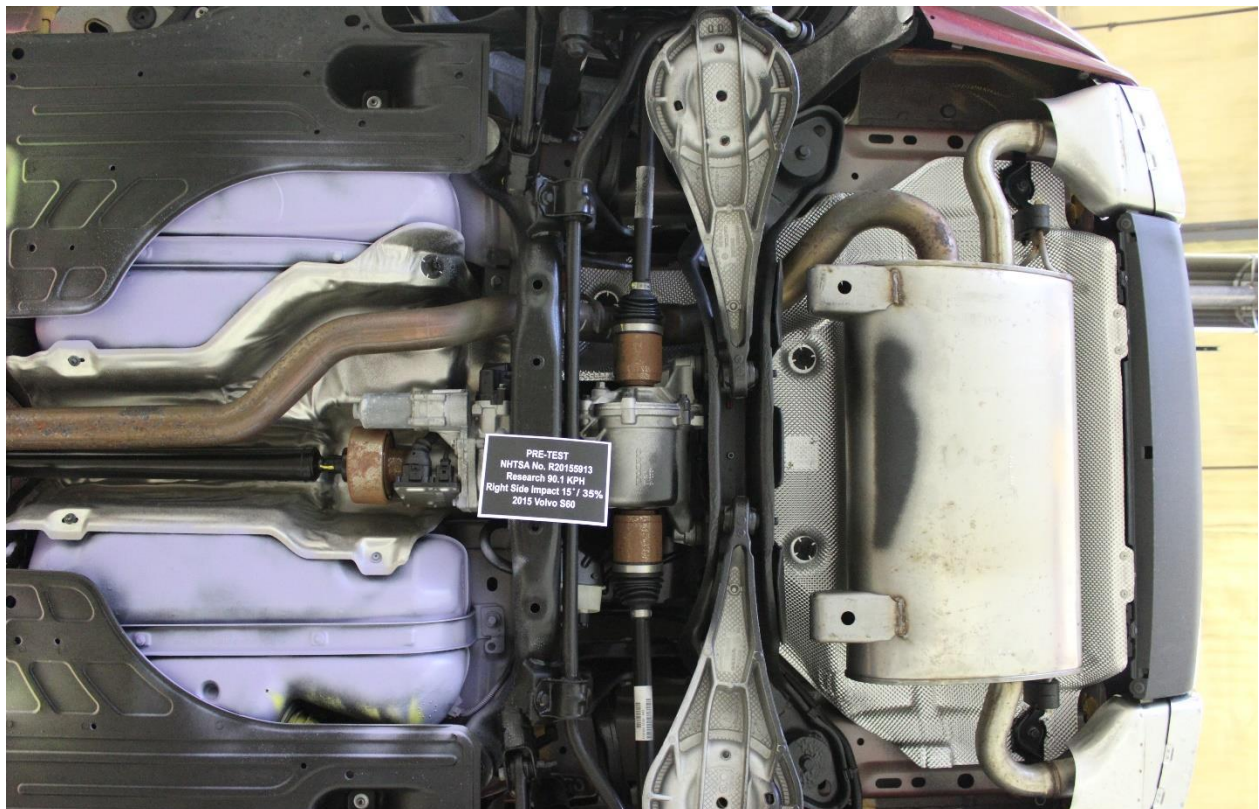
No. 135: Post-Test View of Front Underbody (perpendicular to vehicle)



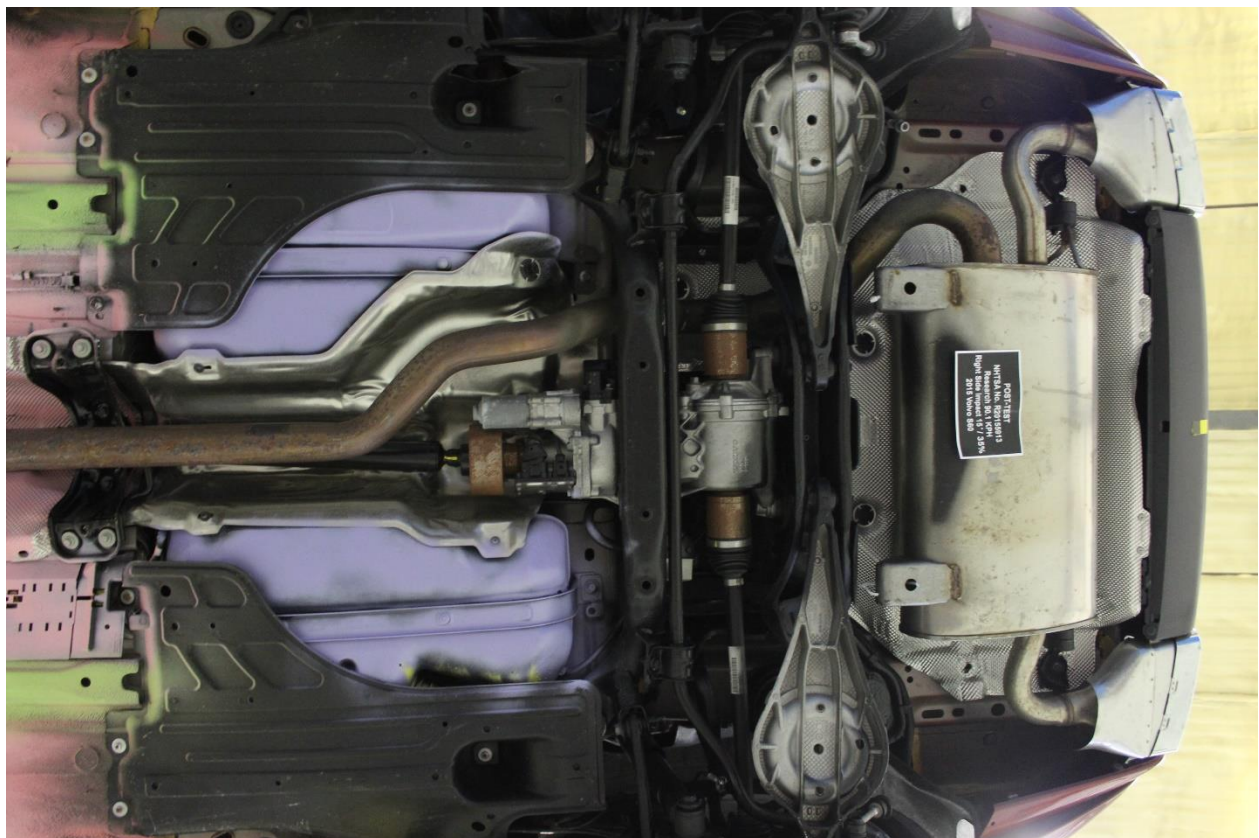
No. 136: Pre-Test View of Mid Underbody (perpendicular to vehicle)



No. 137: Post-Test View of Mid Underbody (perpendicular to vehicle)



No. 138: Pre-Test View of Rear Underbody (perpendicular to vehicle)



No. 139: Post-Test View of Rear Underbody (perpendicular to vehicle)



No. 140: Pre-Test View of Steering rack and or sway bar



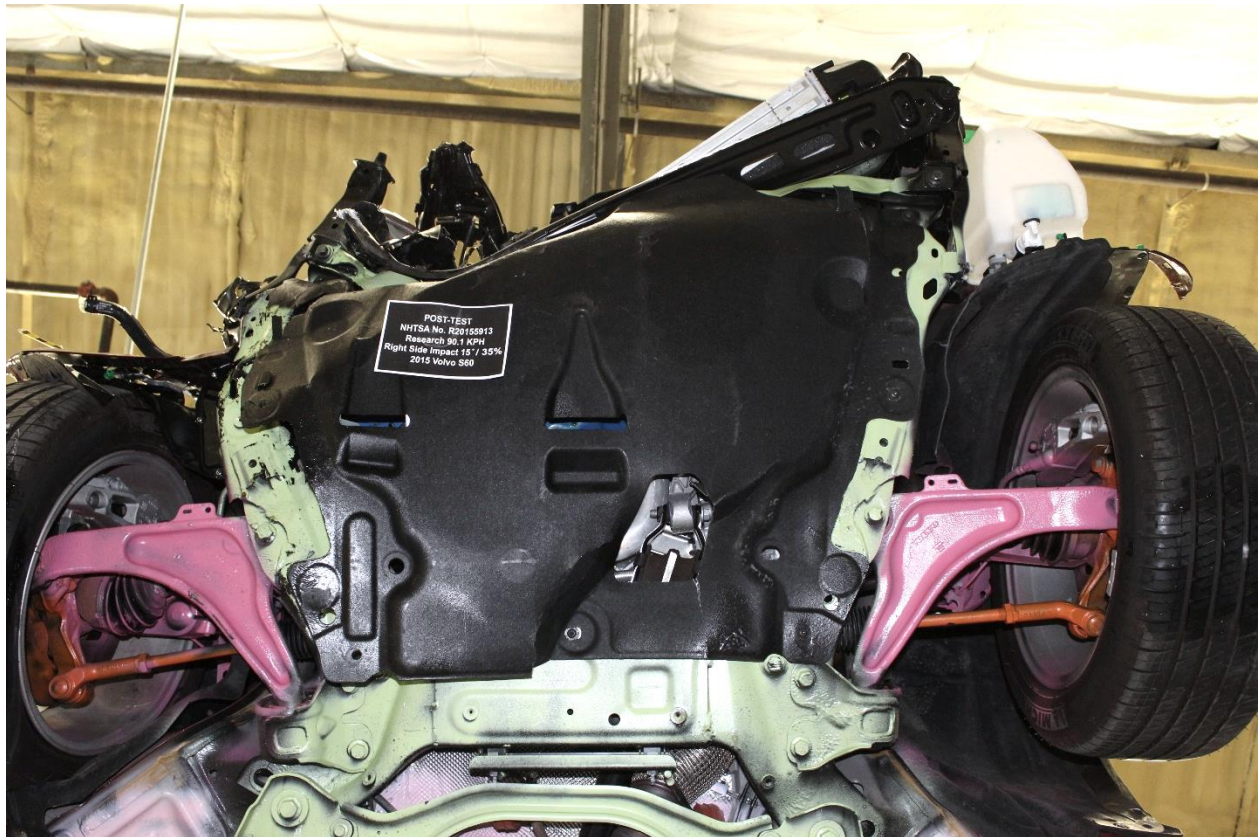
No. 141: Post-Test View of Steering rack and or sway bar



No. 142: Pre-Test Bumper to Rail Attachments and Crush Initiators



No. 143: Post-Test Bumper to Rail Attachments and Crush Initiators



No. 144: Post-Test View of Front Sub-Frame Deformation



No. 145: Pre-Test Frame Rail with tire removed



No. 146: Post-Test Frame Rail with tire removed



No. 147: Pre-Test View of Front Driver Wheel Well w/ Tire Removed



No. 148: Post-Test $\frac{3}{4}$ View of Front Driver Wheel Well w/ Tire Removed



No. 149: Post-Test Side View of Front Driver Wheel Well w/ Tire Removed



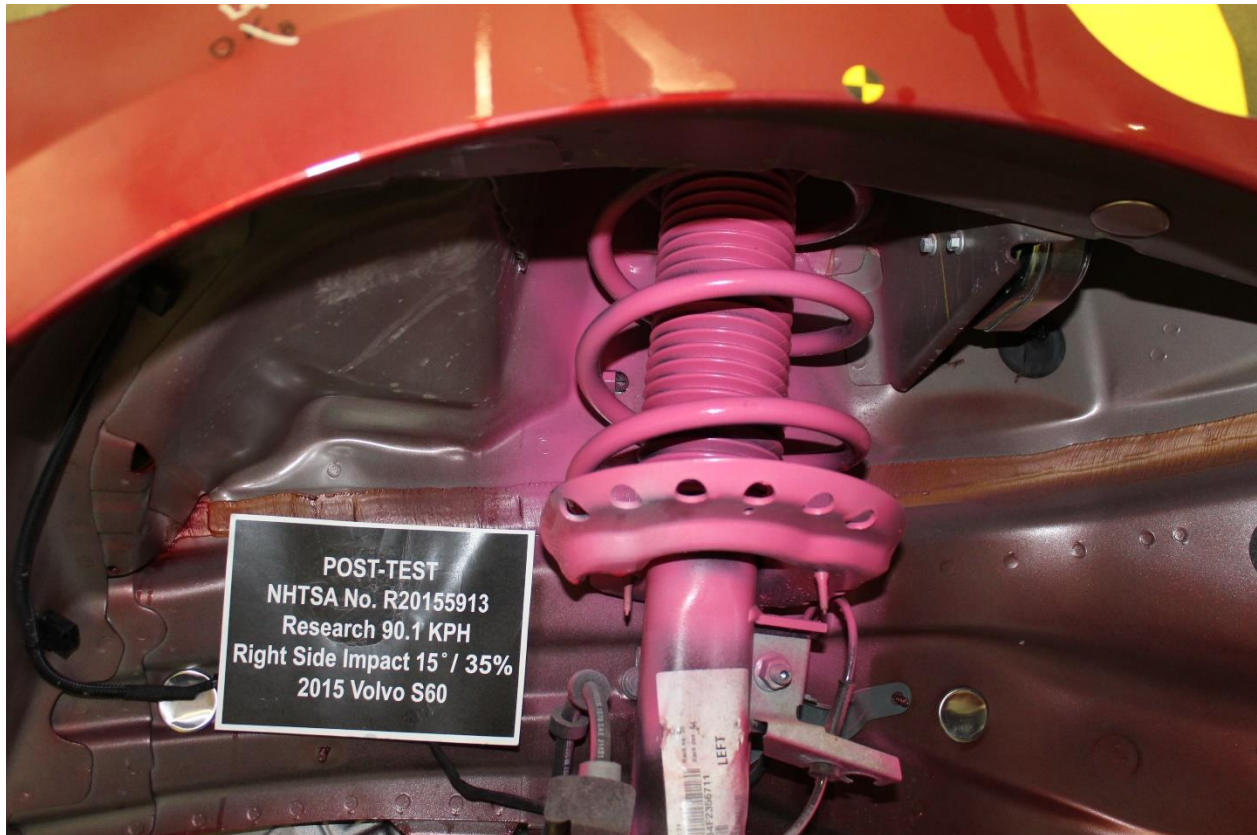
No. 150: Post-Test Right Side 3/4 Rear View of the Front Driver Wheel Well w/ Tire Removed



No. 151: Post-Test Looking Down at the Front Driver Shotgun



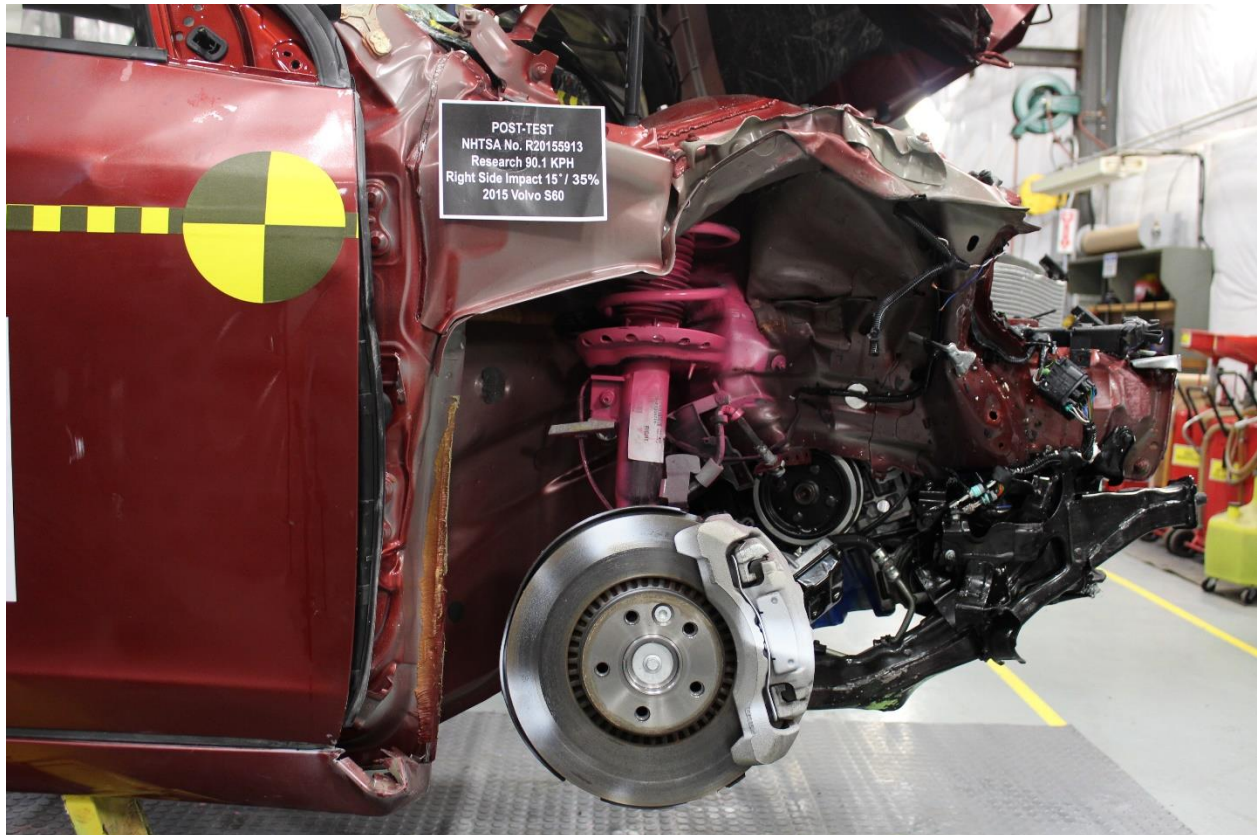
No. 152: Post-Test Right Side $\frac{3}{4}$ View of Front Driver Shotgun



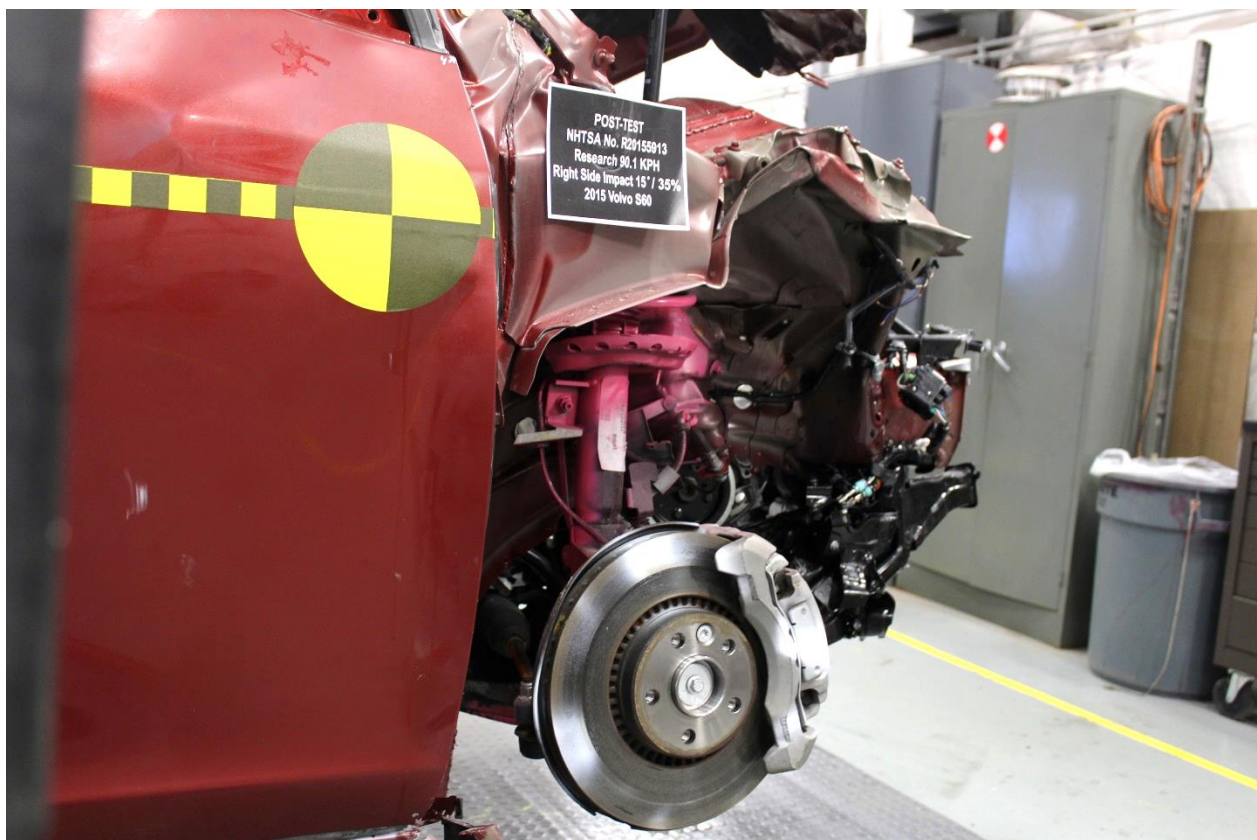
No. 153: Post-Test Front Driver Close up View of Suspension w/ Tire Removed



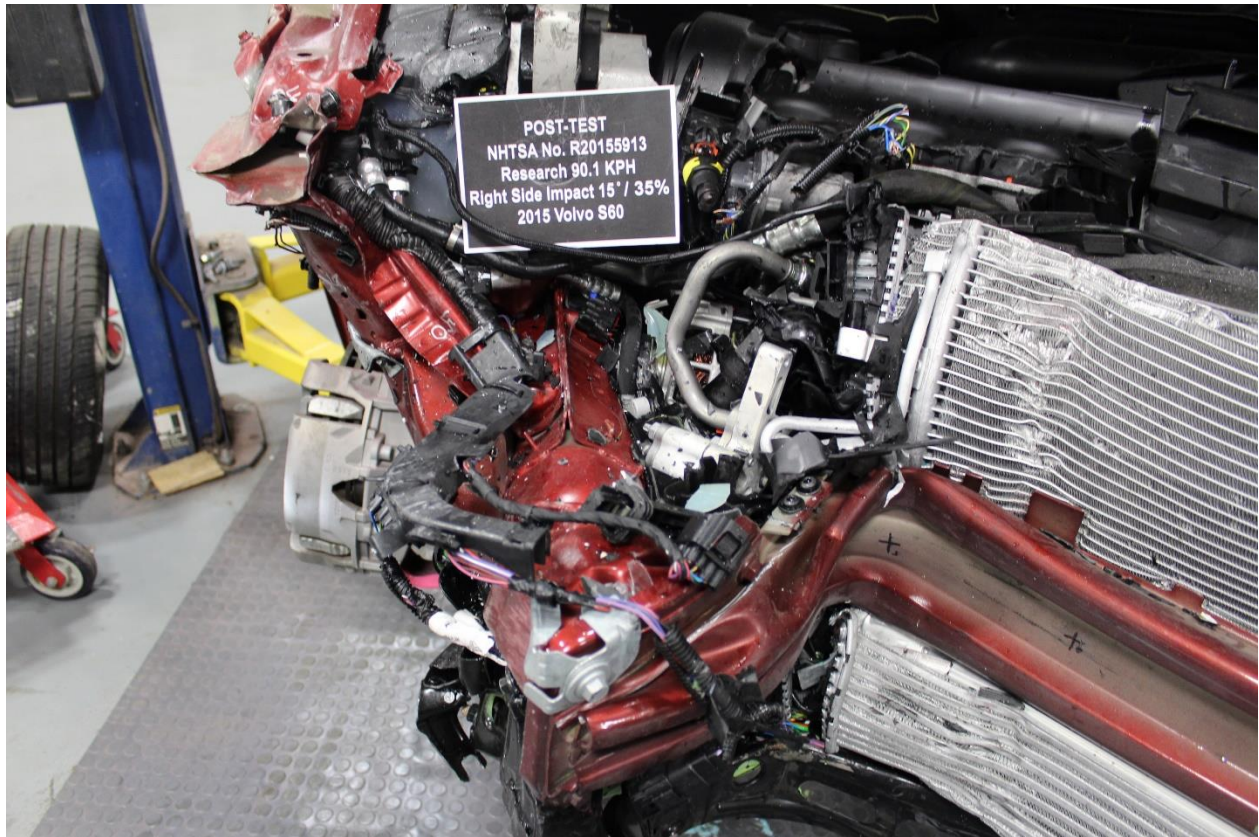
No. 154: Post-Test ¾ View of Front Passenger Wheel Well w/ Tire Removed



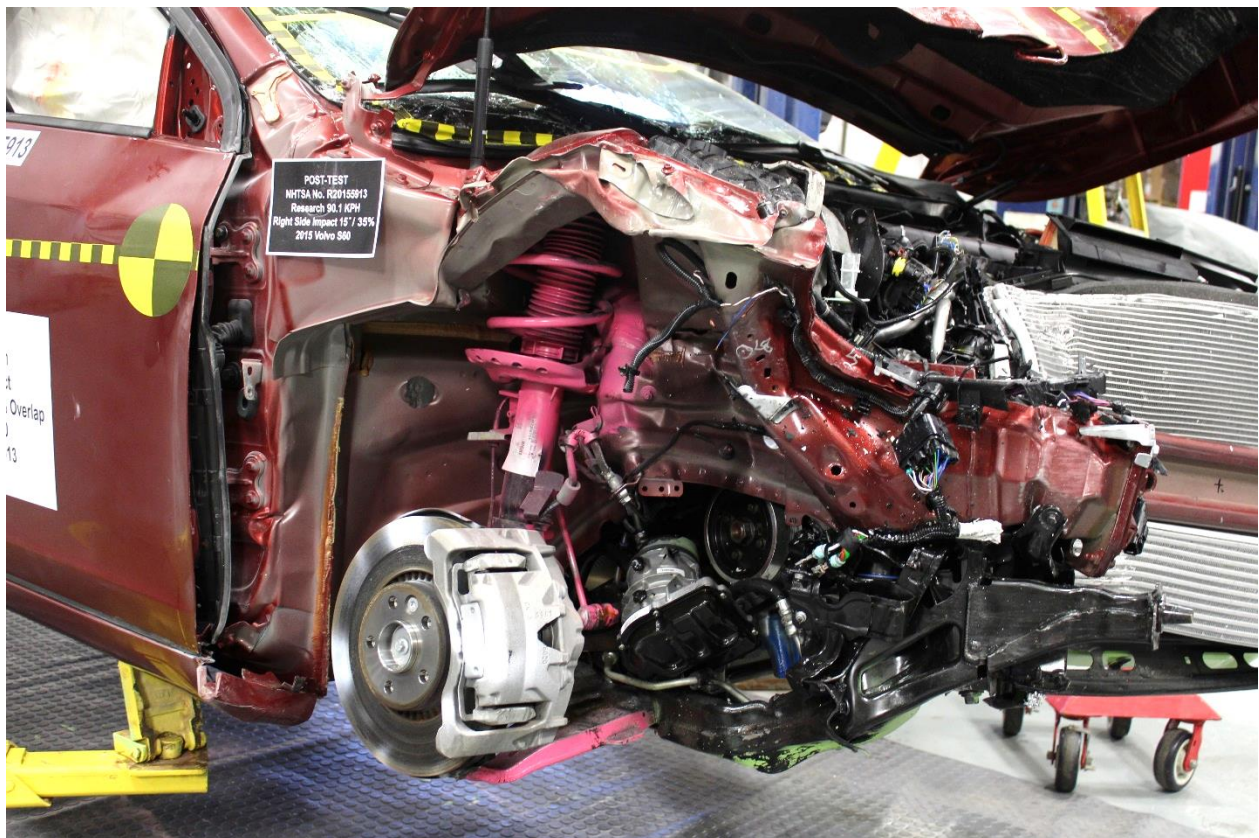
No. 155: Post-Test Side View of Front Passenger Wheel Well w/ Tire Removed



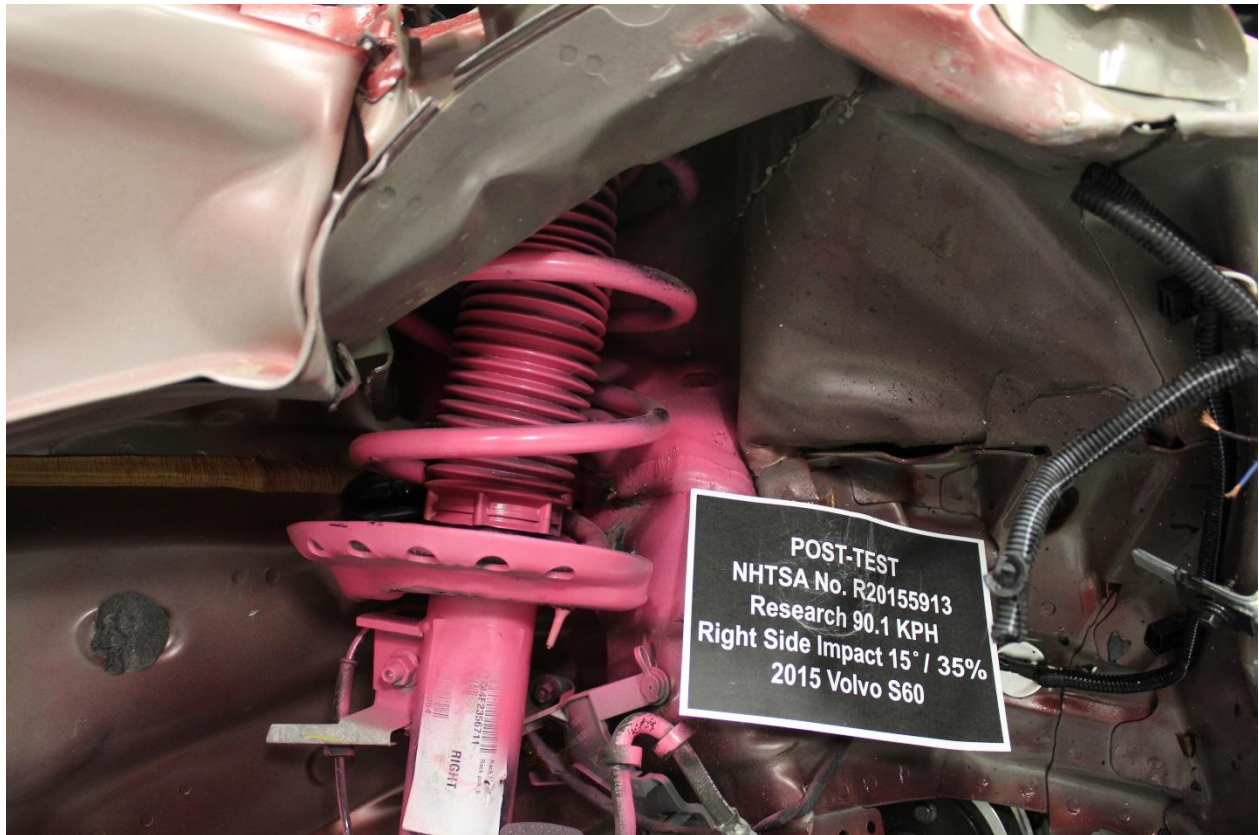
No. 156: Post-Test Right Side 3/4 Rear View of the Front Passenger Wheel Well w/ Tire Removed



No. 157: Post-Test Looking Down at the Front Passenger Shotgun



No. 158: Post-Test Right Side $\frac{3}{4}$ View of Front Passenger Shotgun



No. 159: Post-Test Front Passenger Close up View of Suspension w/ Tire Removed



No. 160: Post-Test View of Door Sill with Door Open- Struck Side



No. 161: Post-Test View of Deformation of A pillar-Struck Side



No. 162: Post-Test View of Deformation of B pillar-Struck Side



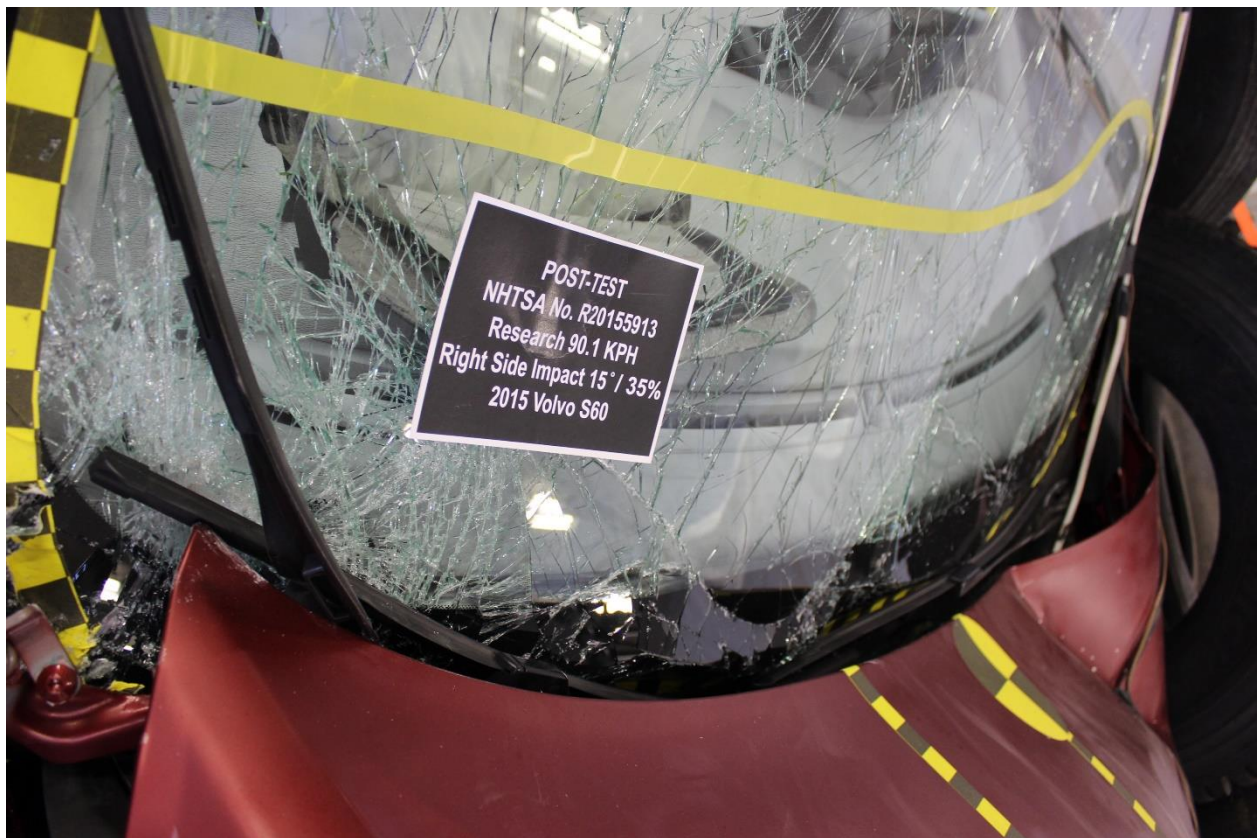
No. 163: Post-Test View of Deformation of C pillar-Struck Side



No. 164: Post-Test View of Wheel and/or Tire Deformation-Struck Side



No. 165: Post-Test View of Deformation of Rocker or Post-Struck Side



No. 166: Post-Test View of Windshield Separation



No. 167: Pre-Test Left Side View of OMDB



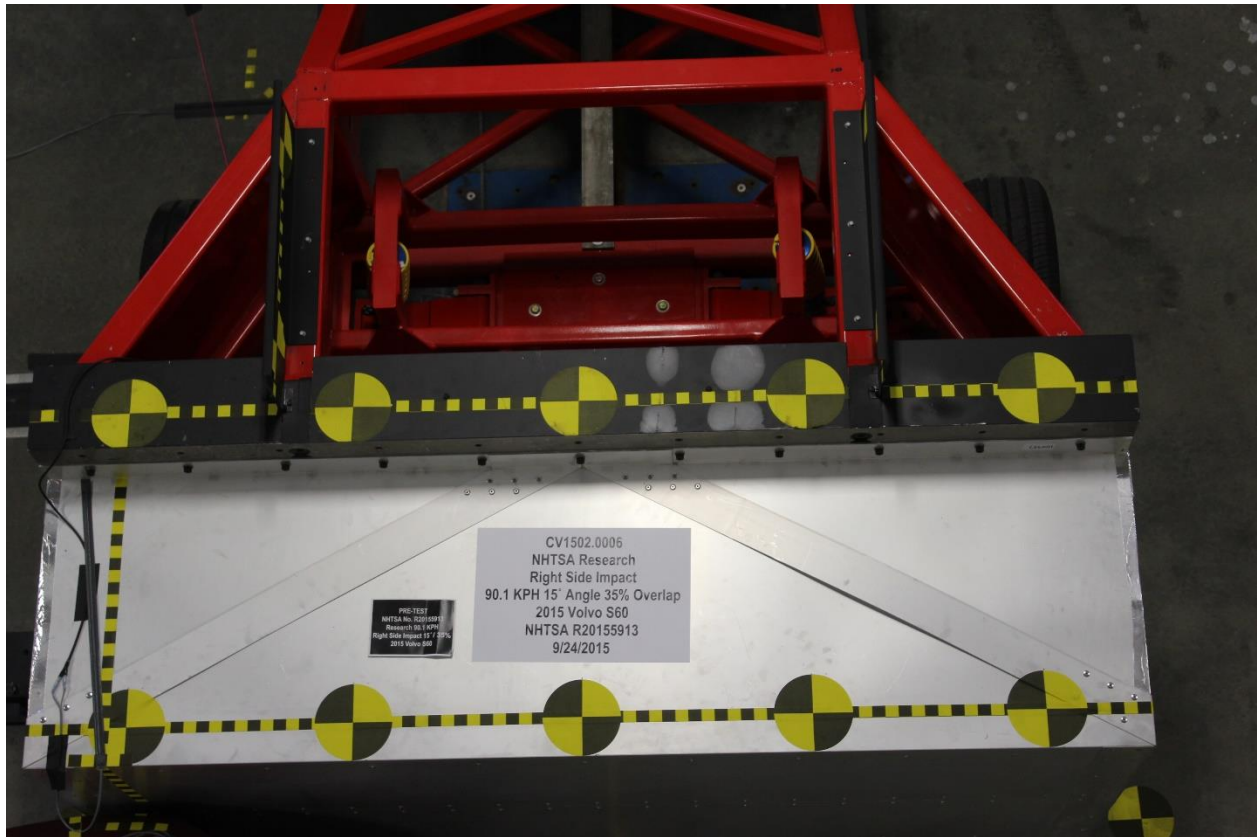
No. 168: Post-Test Left Side View of OMDB



No. 169: Pre-Test Right Side View of OMD



No. 170: Post-Test Right Side View of OMD



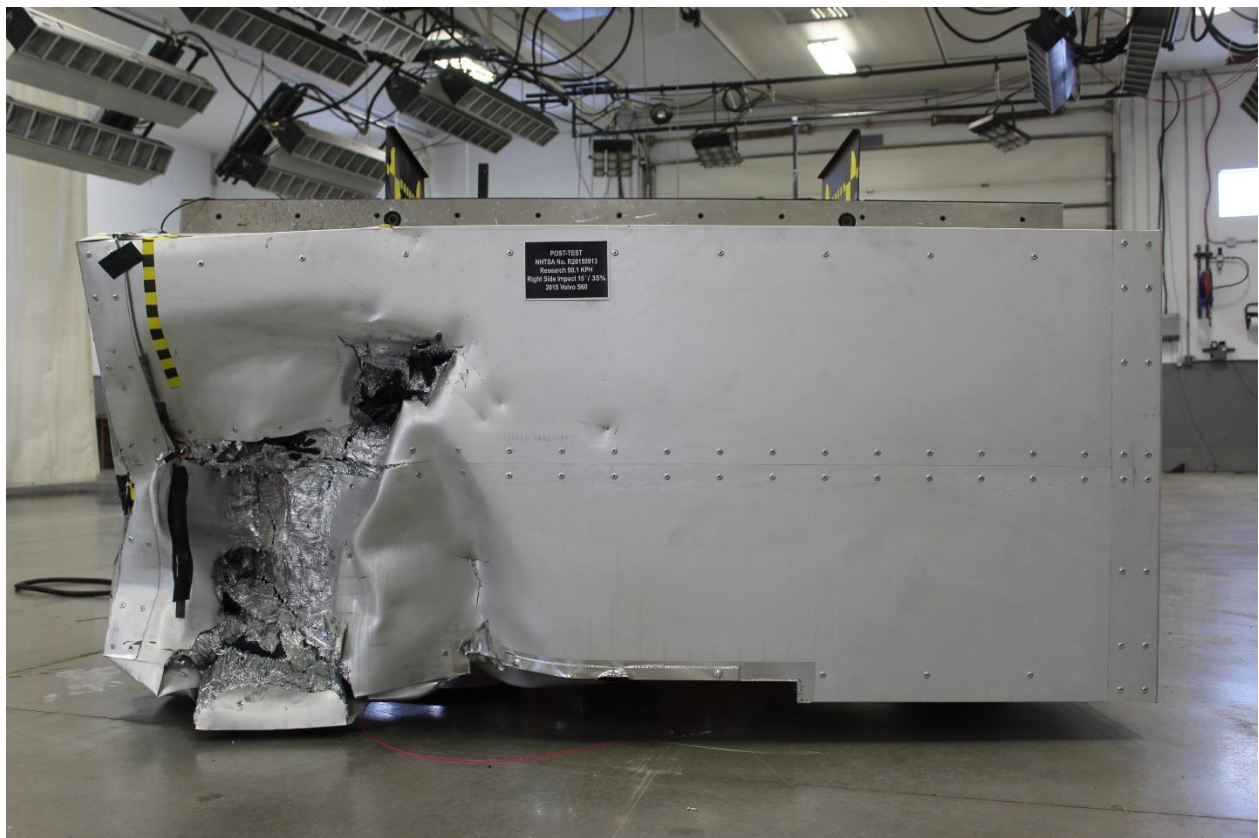
No. 171: Pre-Test Top View of OMDB



No. 172: Post-Test Top View of OMDB



No. 173: Pre-Test Front View of OMDB



No. 174: Post-Test Front View of OMDB



No. 175: Pre-Test Left Front $\frac{3}{4}$ View of OMDB



No. 176: Post-Test Left Front $\frac{3}{4}$ View of OMDB



No. 177: Pre-Test Right Front $\frac{3}{4}$ View of OMDB



No. 178: Post-Test Right Front $\frac{3}{4}$ View of OMDB



No. 179: Pre-Test Right Side View of OMDB



No. 180: Post-Test Right Side View of OMDB



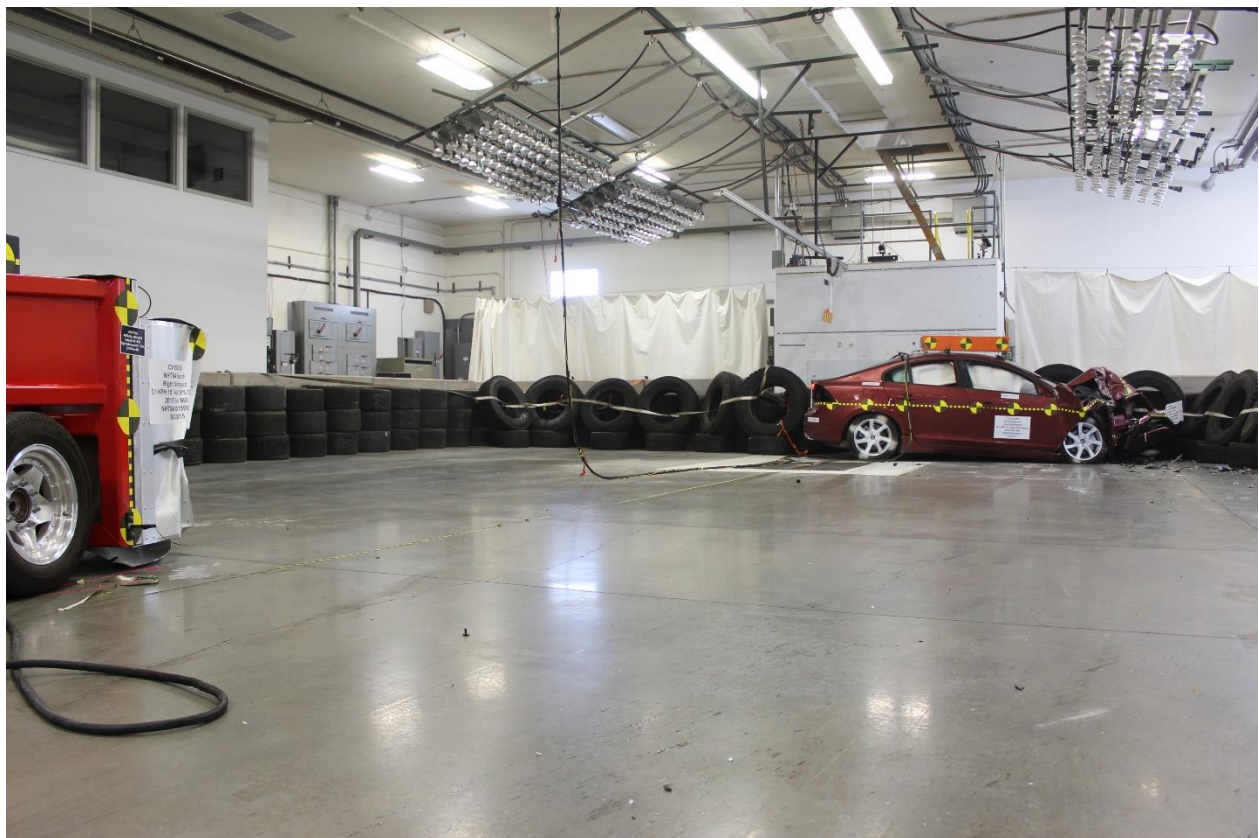
No. 181: Pre-Test Left Side View of OMDB



No. 182: Post-Test Left Side View of OMDB



No. 183: Pre-Test OMDB & Vehicle, Right Side



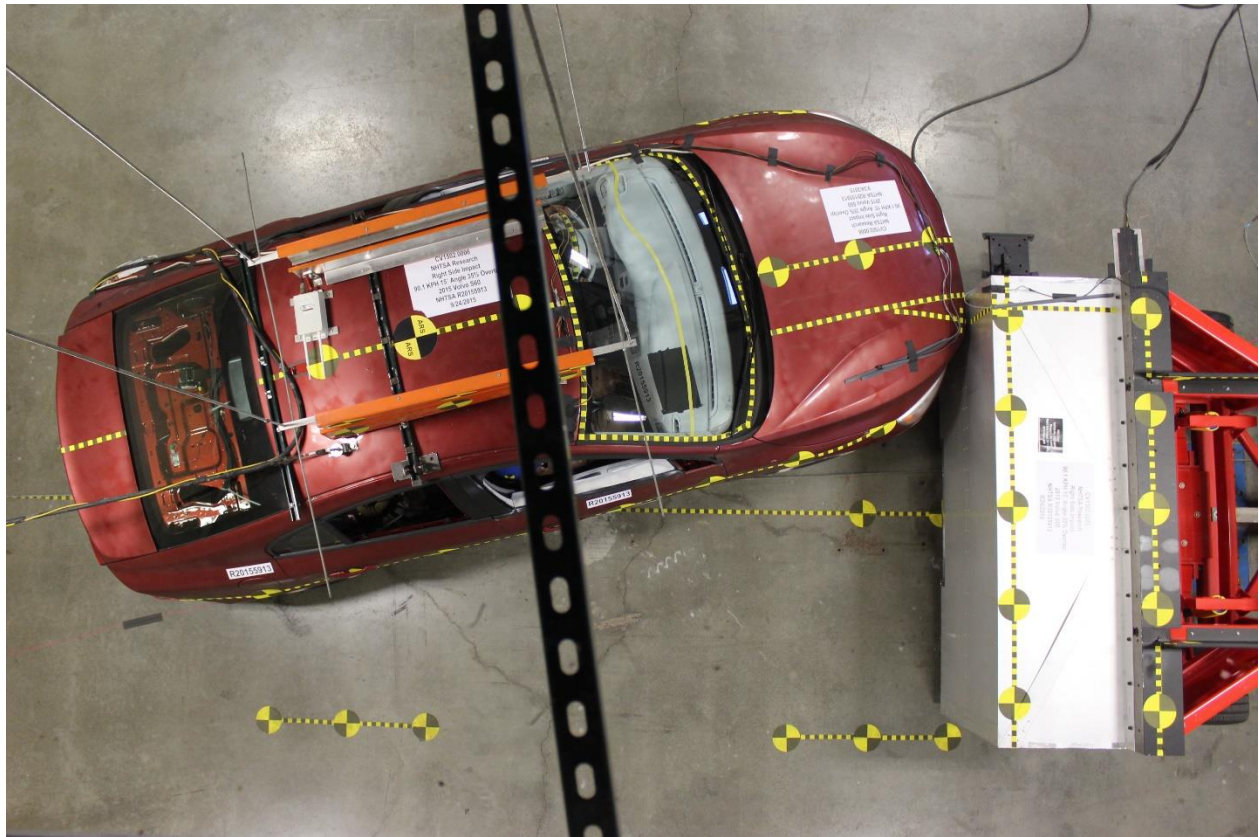
No. 184: Post-Test OMDB & Vehicle, Right Side



No. 185: Pre-Test OMDB & Vehicle, Left Side



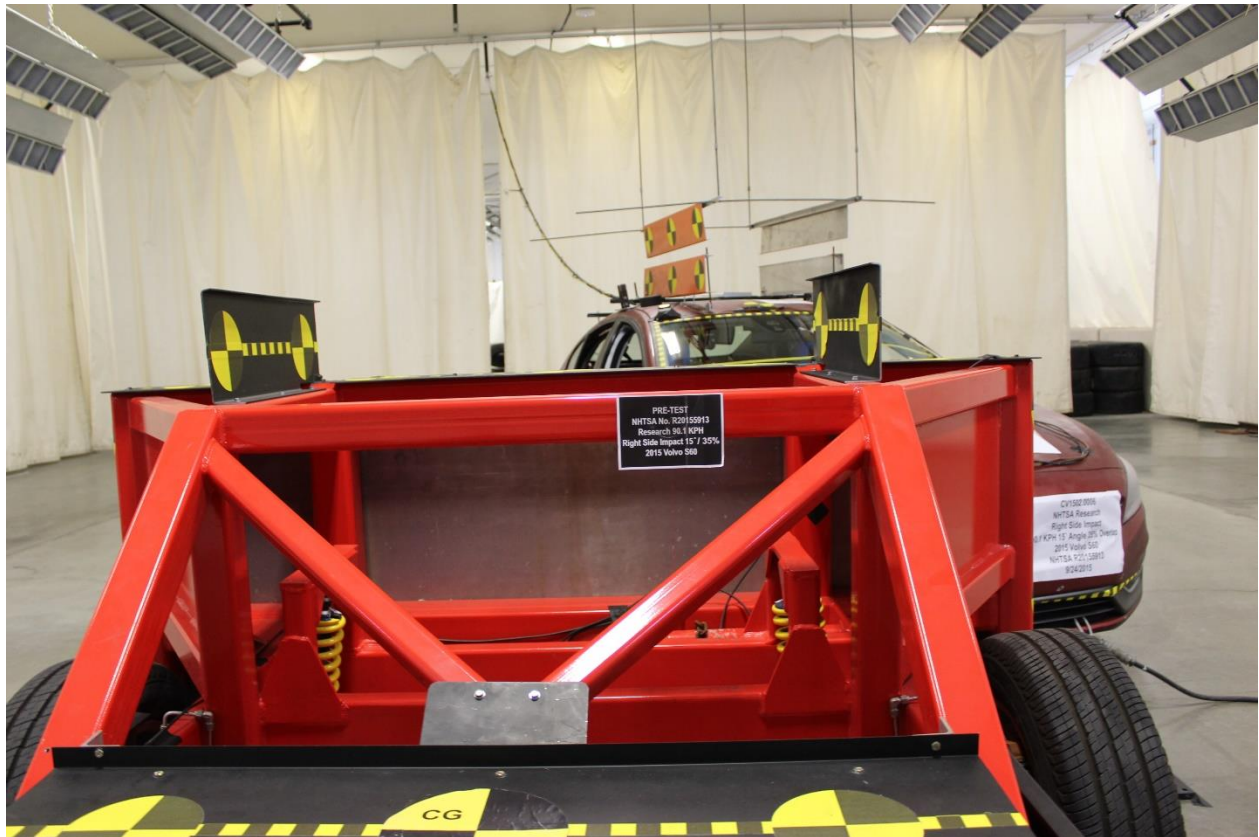
No. 186: Post-Test OMDB & Vehicle, Left Side



No. 187: Pre-Test OMDB & Vehicle, Top View



No. 188: Post-Test OMDB & Vehicle, Top View



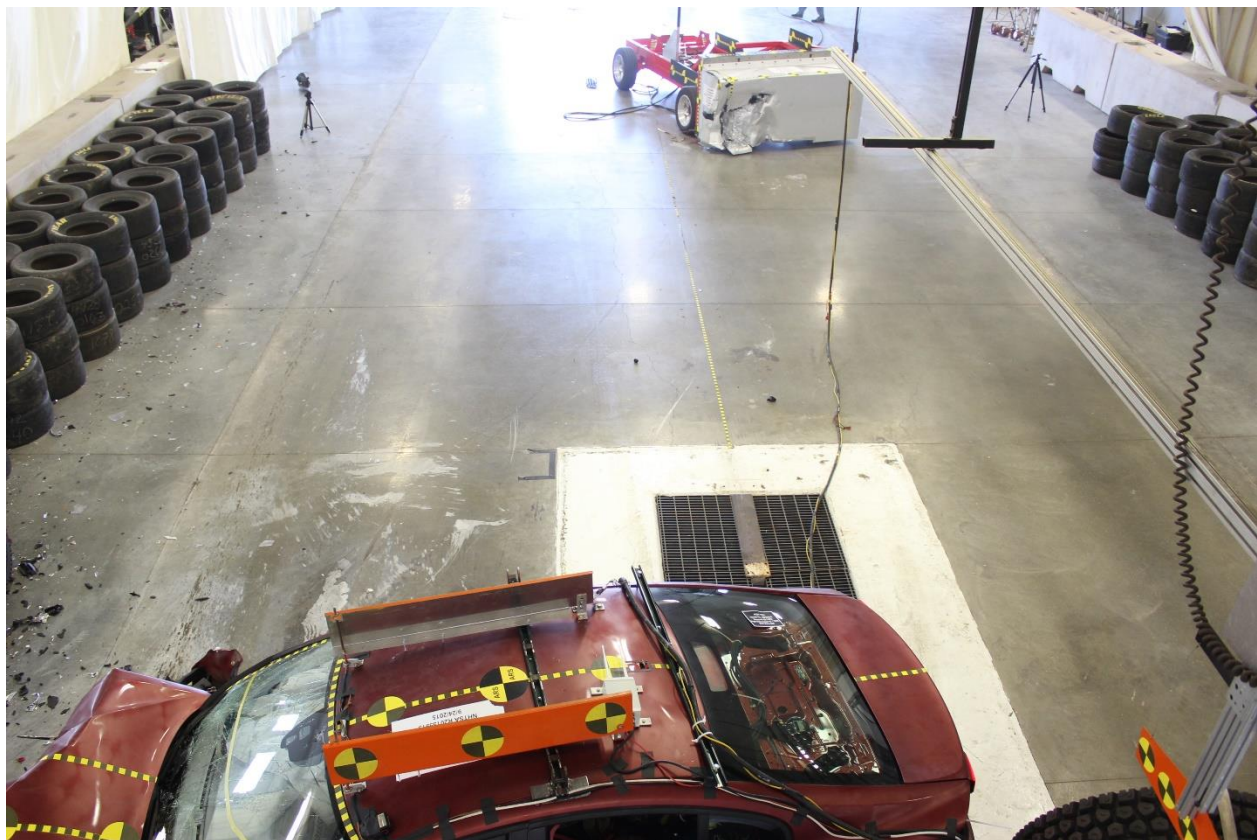
No. 189: Pre-Test OMDB & Vehicle, Rear View



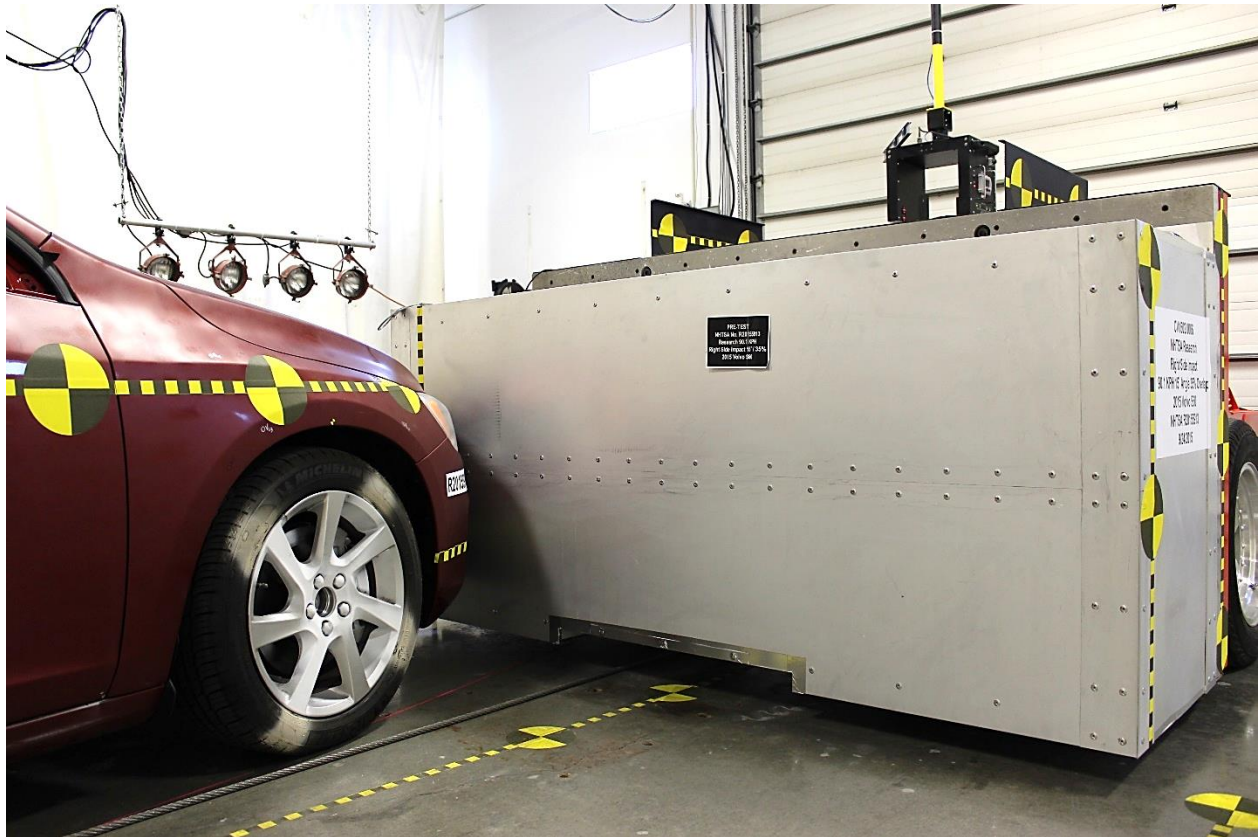
No. 190: Post-Test OMDB & Vehicle, Rear View



No. 191: Pre-Test OMDB & Vehicle, Front View



No. 192: Post-Test OMDB & Vehicle, Front View



No. 193: Pre-Test O MDB & Vehicle Alignment



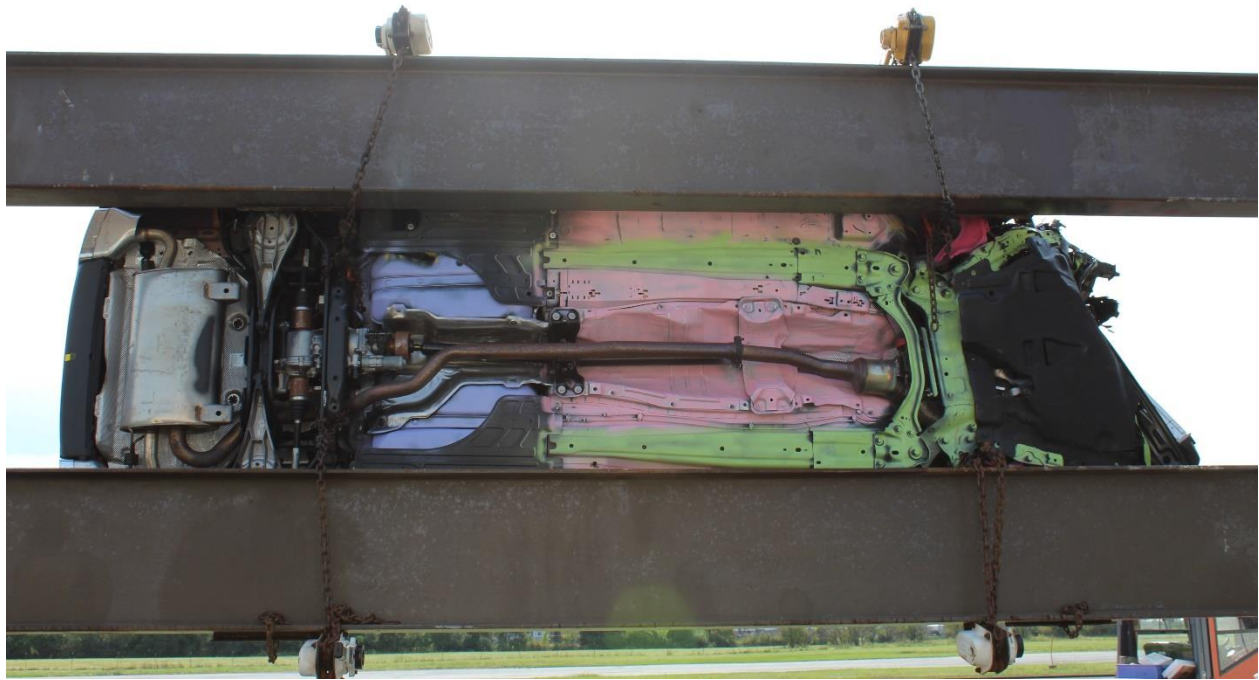
No. 194: Vehicle at 0 Degrees on Static Rollover Device



No. 195: Vehicle at 90 Degrees on Static Rollover Device



No. 196: Vehicle at 180 Degrees on Static Rollover Device



No. 197: Vehicle at 270 Degrees on Static Rollover Device



No. 198: Vehicle at 360 Degrees on Static Rollover Device



No. 199: Impact Photo



No. 200: Pre-Test Vehicle Bumper Left Side View



No. 201 Post-Test Vehicle Bumper Left View



No. 202 Pre-Test Vehicle Bumper Left Front View



No. 203 Post-Test Vehicle Bumper Left Front View



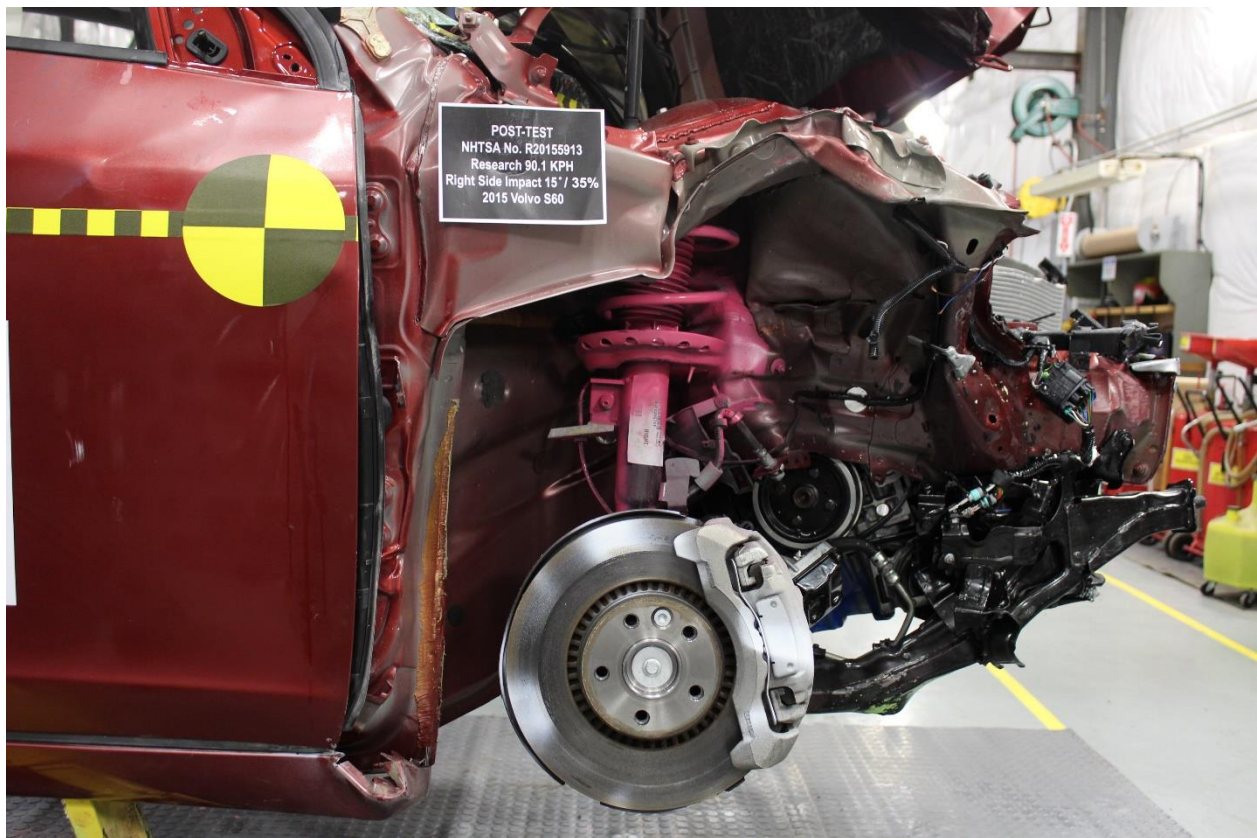
No. 204 Pre-Test Vehicle Bumper Front View



No. 205 Post-Test Vehicle Bumper Front View



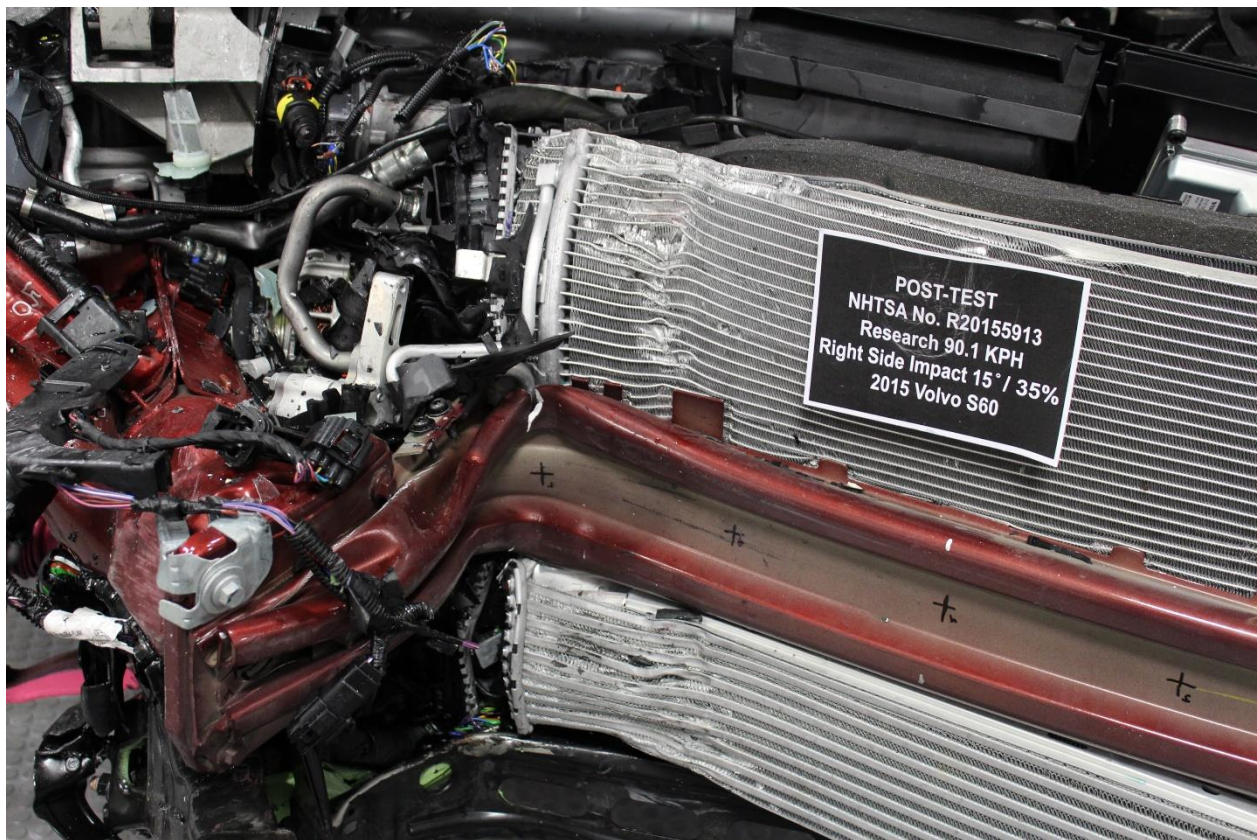
No. 206 Pre-Test Vehicle Bumper Right Side View



No. 207 Post-Test Vehicle Bumper Right View



No. 208 Pre-Test Vehicle Bumper Right Front View



No. 209 Post-Test Vehicle Bumper Right Front View

APPENDIX B
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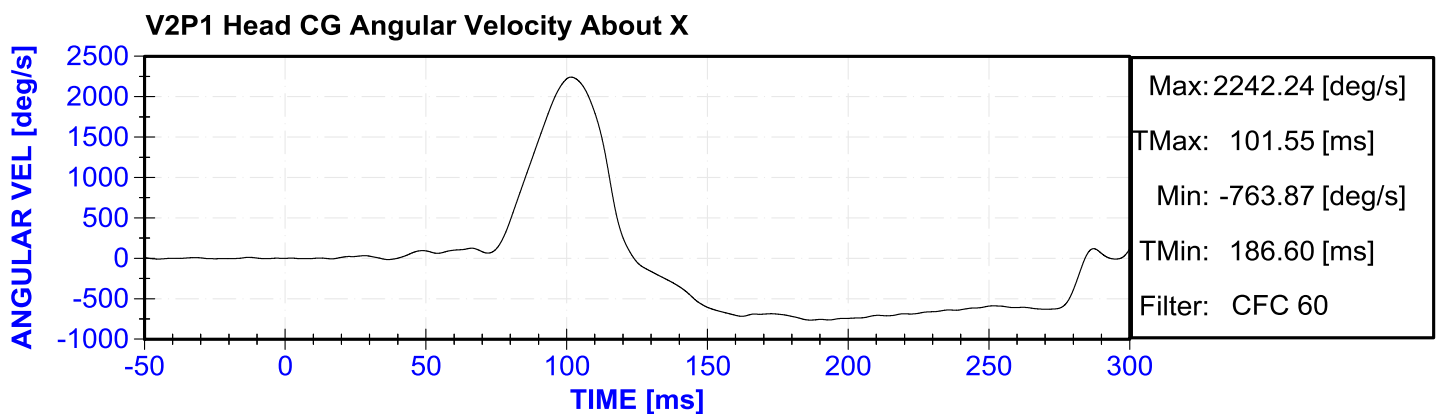
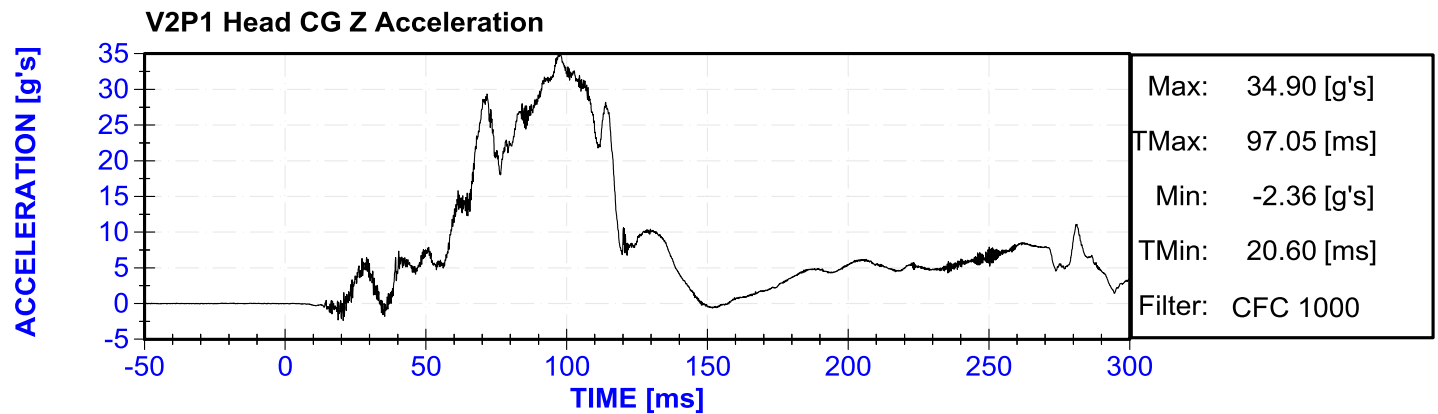
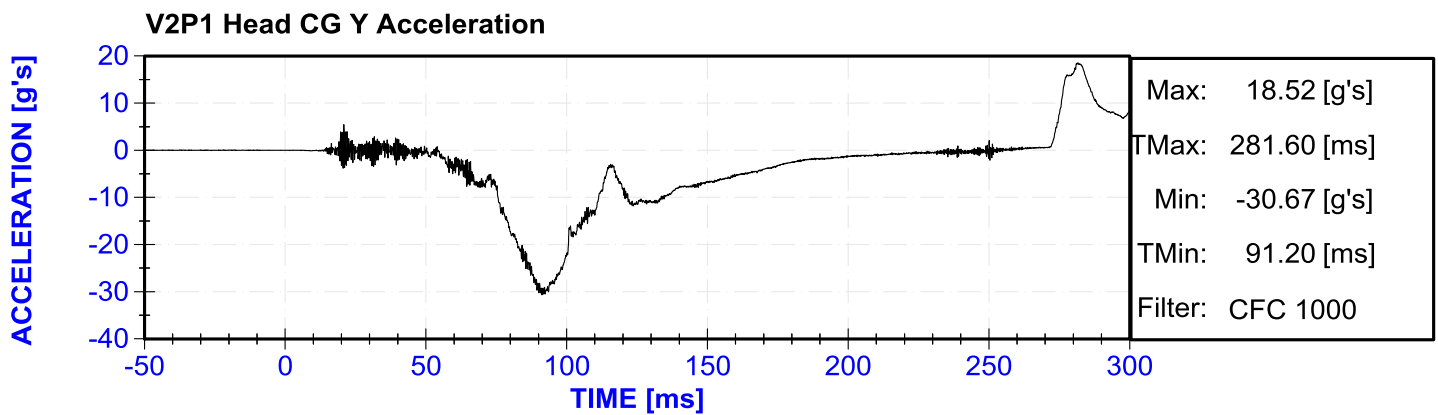
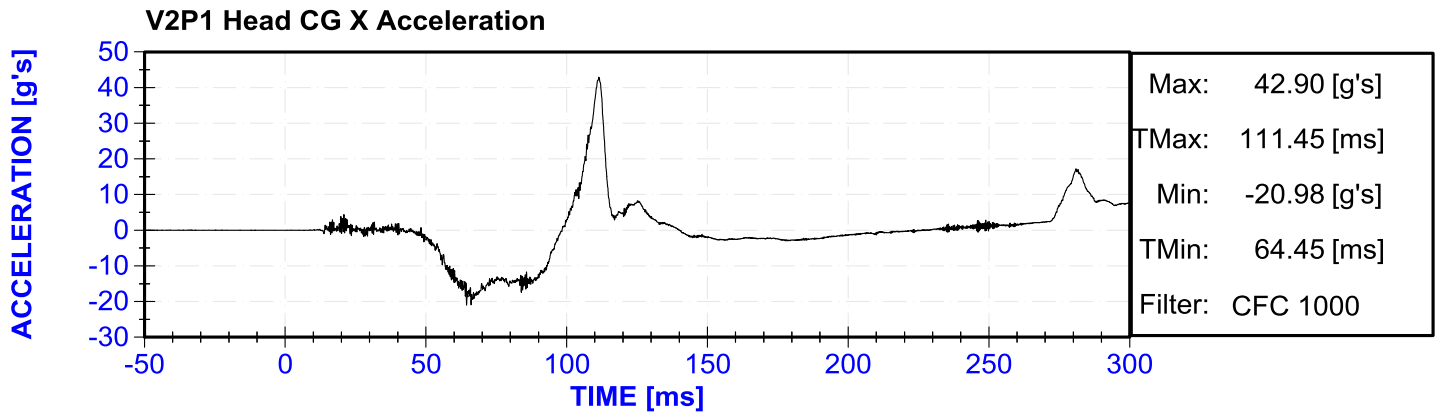
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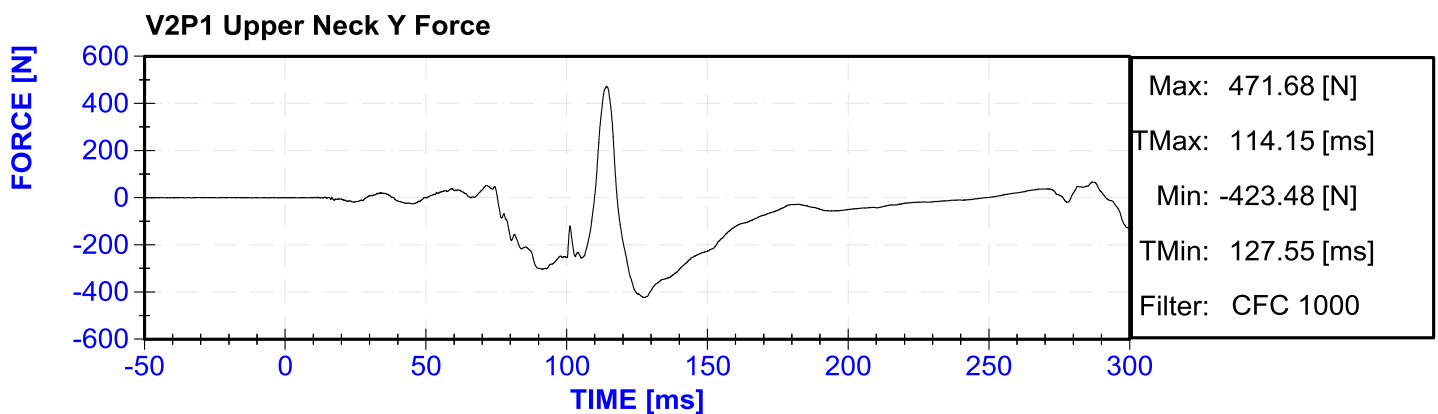
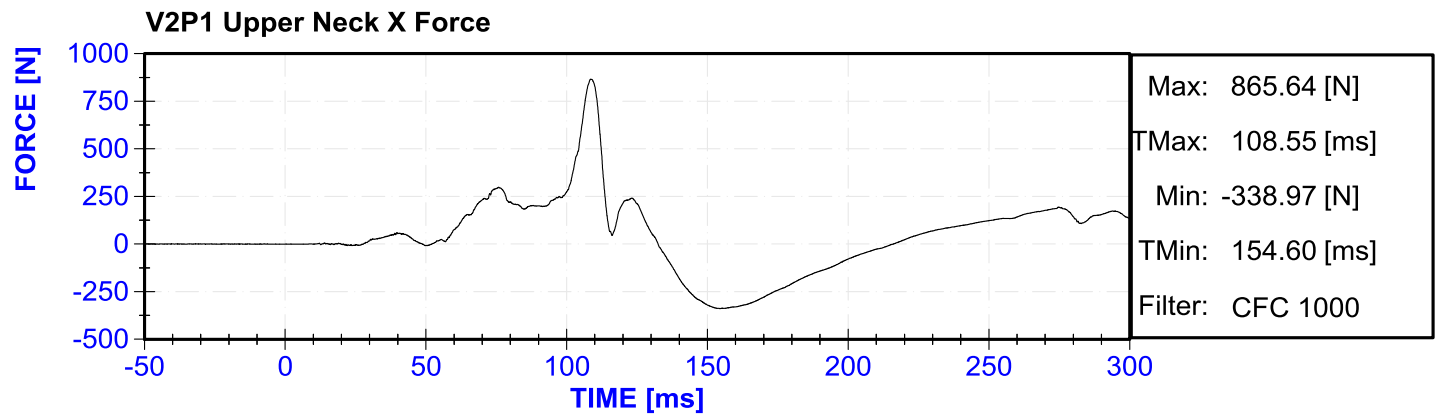
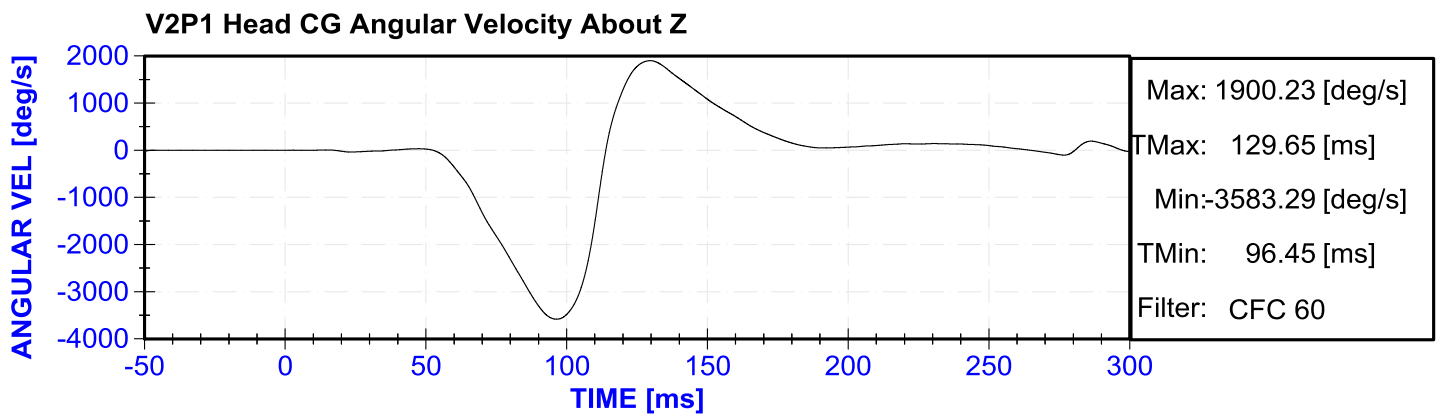
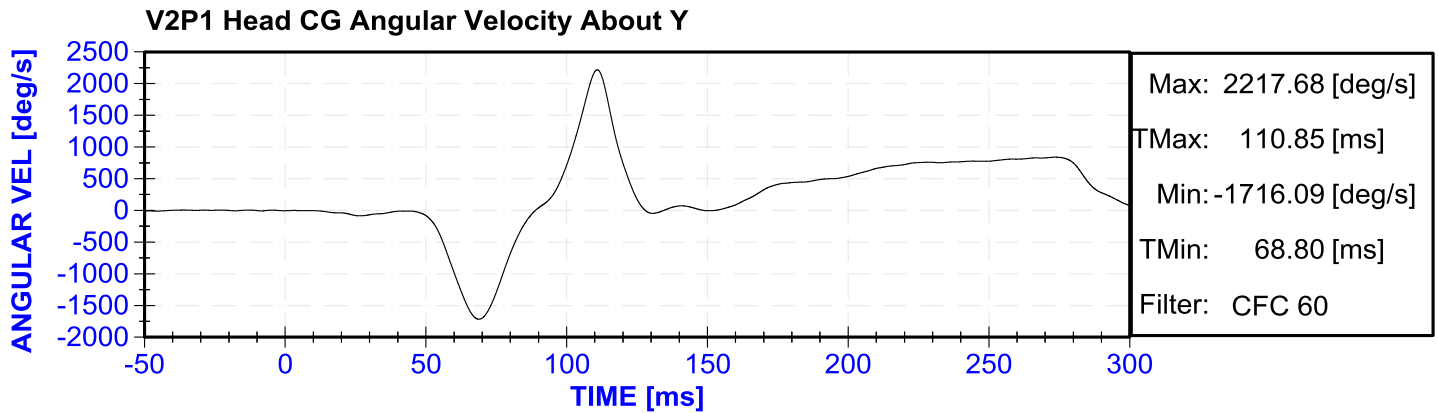
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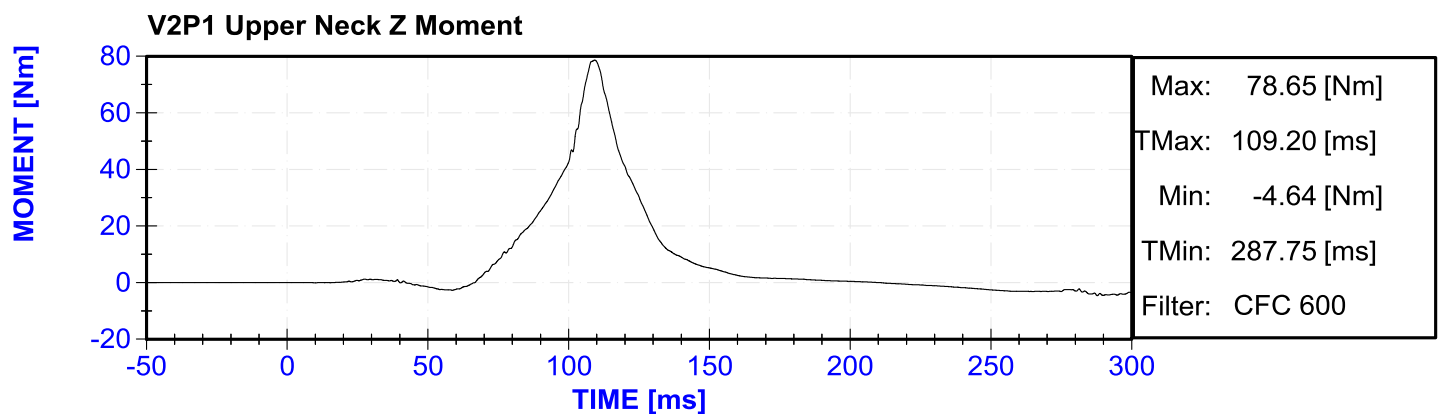
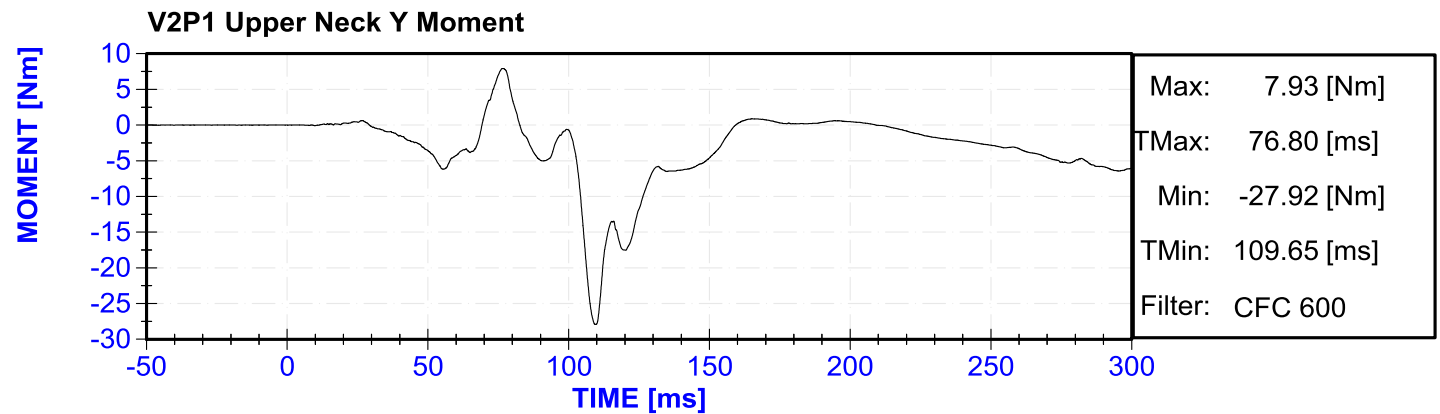
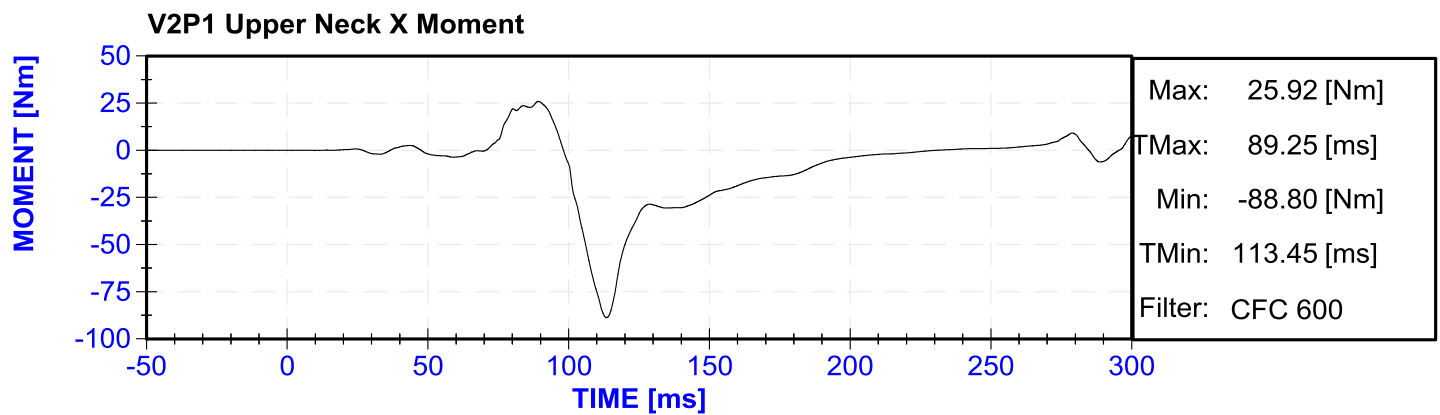
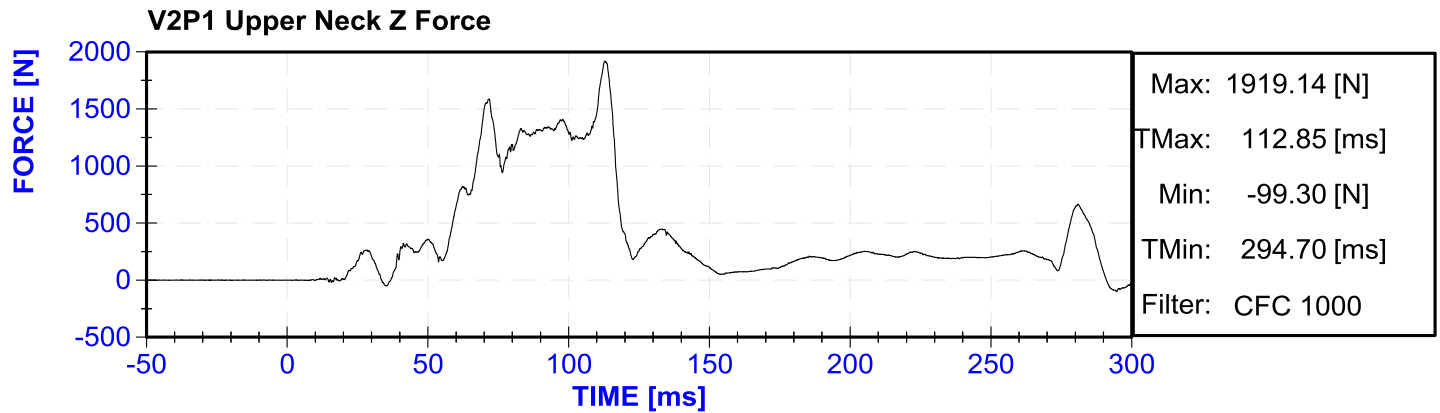
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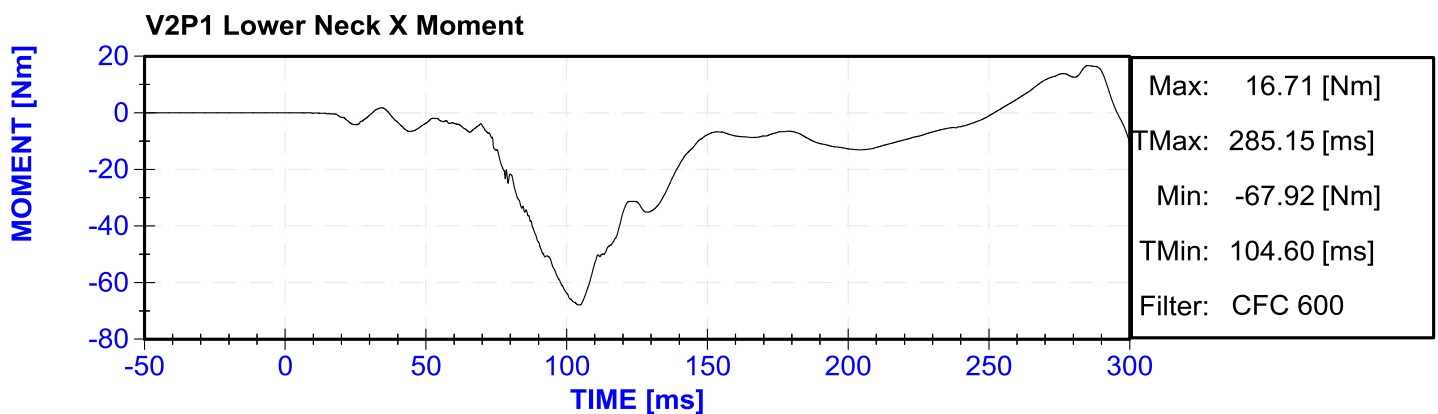
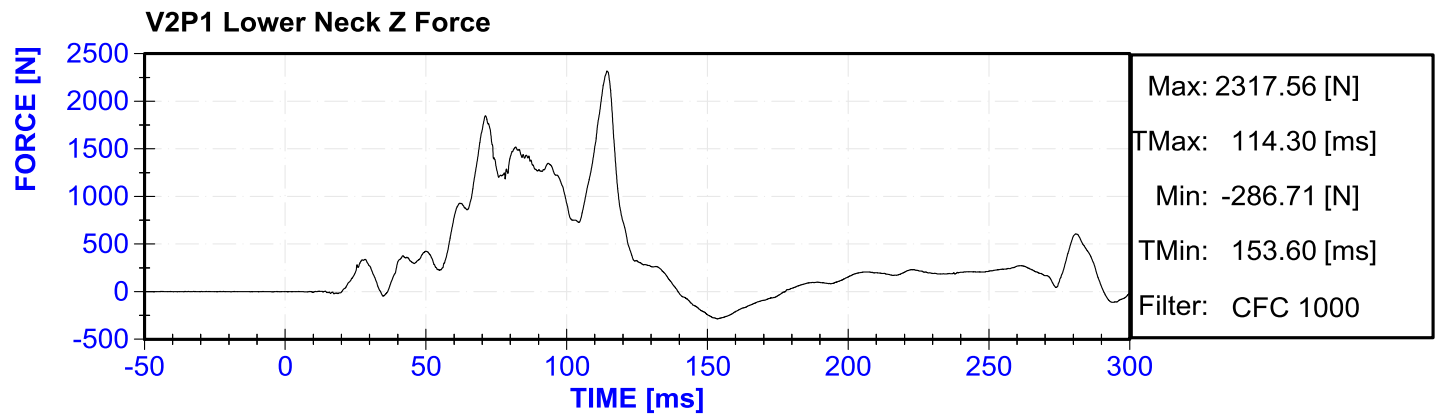
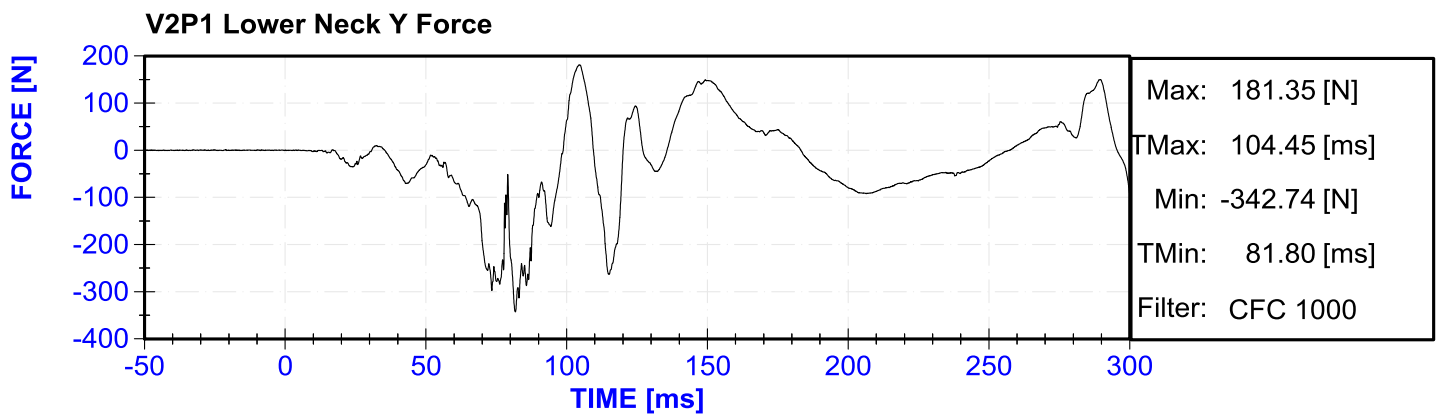
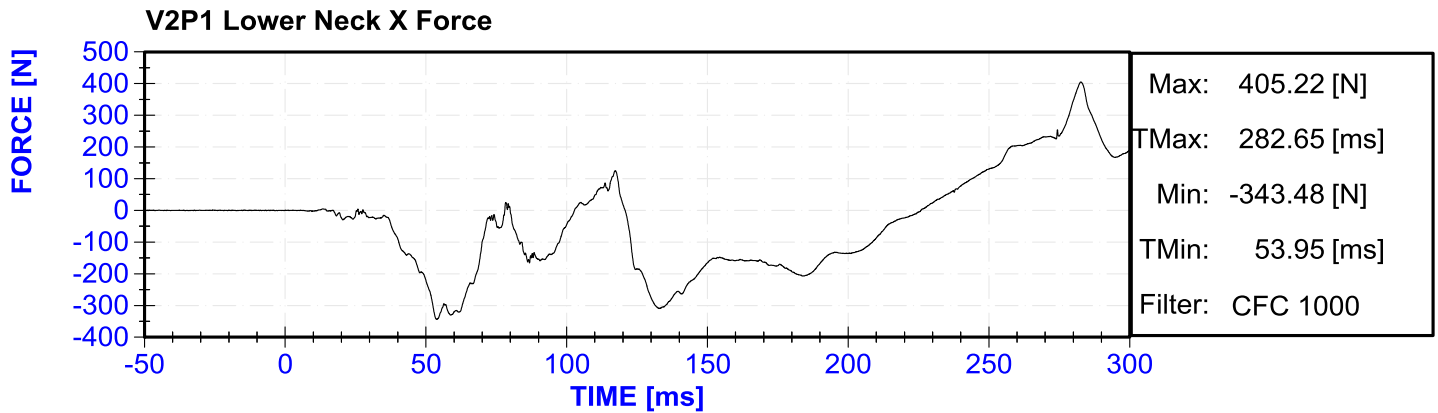
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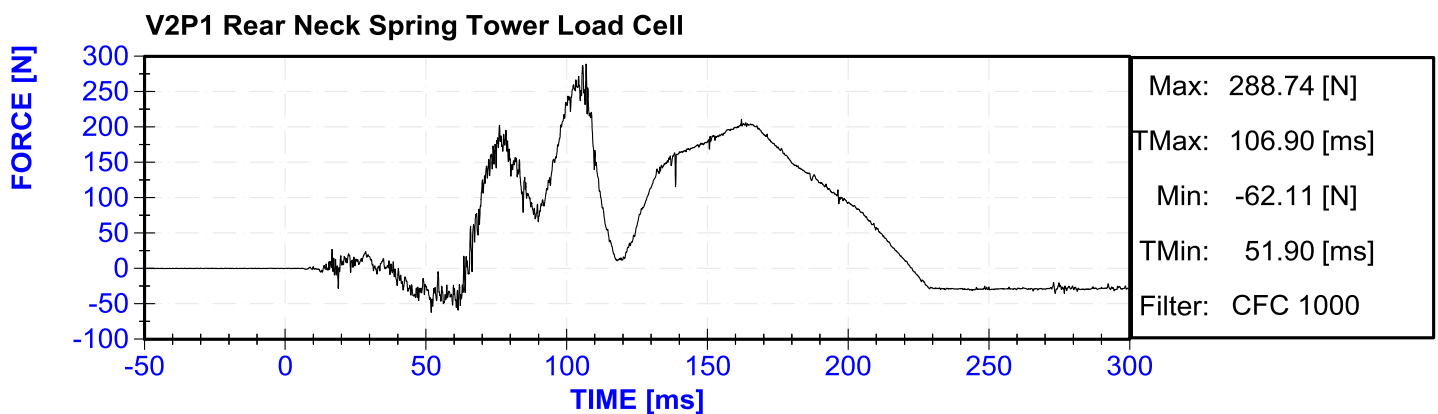
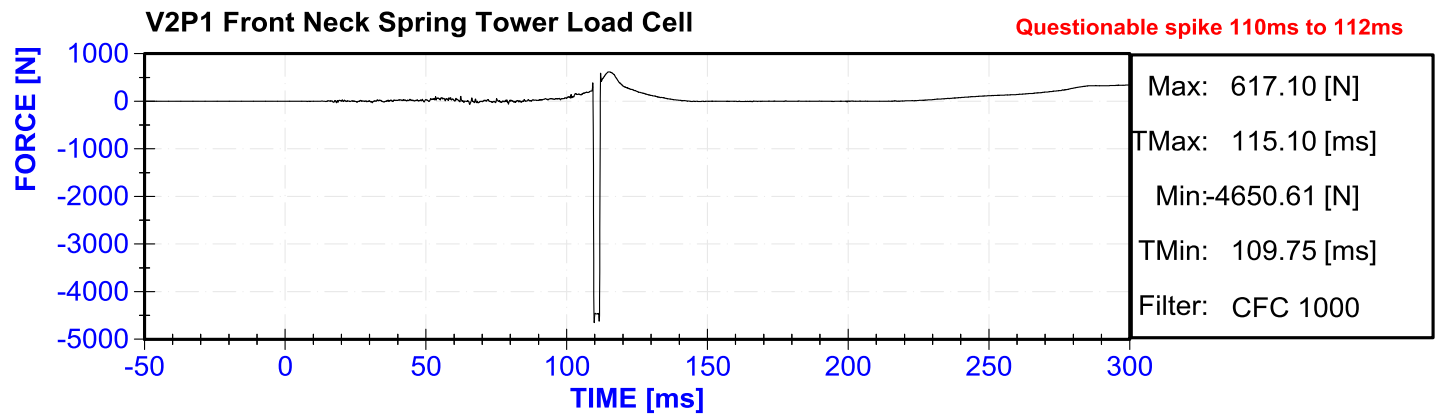
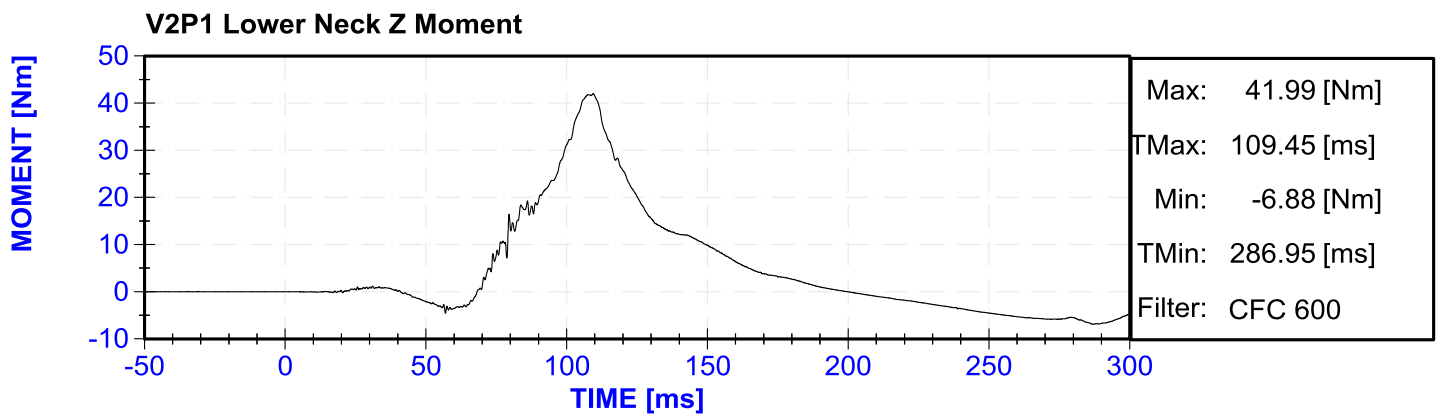
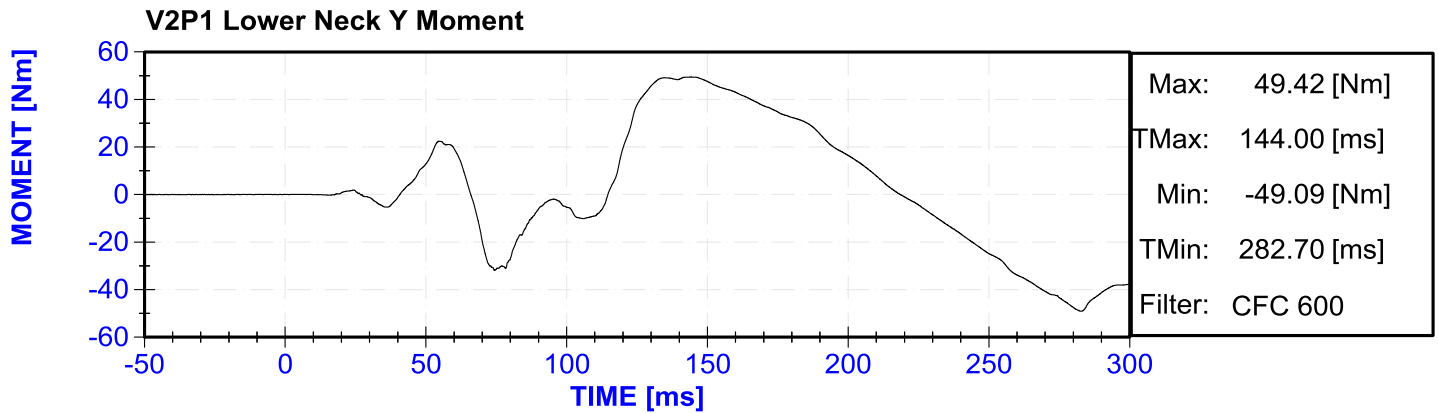
Plot 292	V2P2 Fz on head acting through the O.C. joint only	B-81
Plot 293	V2P2 My on head acting through the O.C. joint only	B-82
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Plot 298	V2P2 My on head acting through the total neck section	B-83
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Plot 300	V2P2 Chest Left Upper Dx	B-83
Plot 301	V2P2 Chest Left Upper Dy	B-84
Plot 302	V2P2 Chest Left Upper Dz	B-84
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Plot 321	V2P2 Abdomen Right Lower Dy	B-89
Plot 322	V2P2 Abdomen Right Lower Dz	B-89
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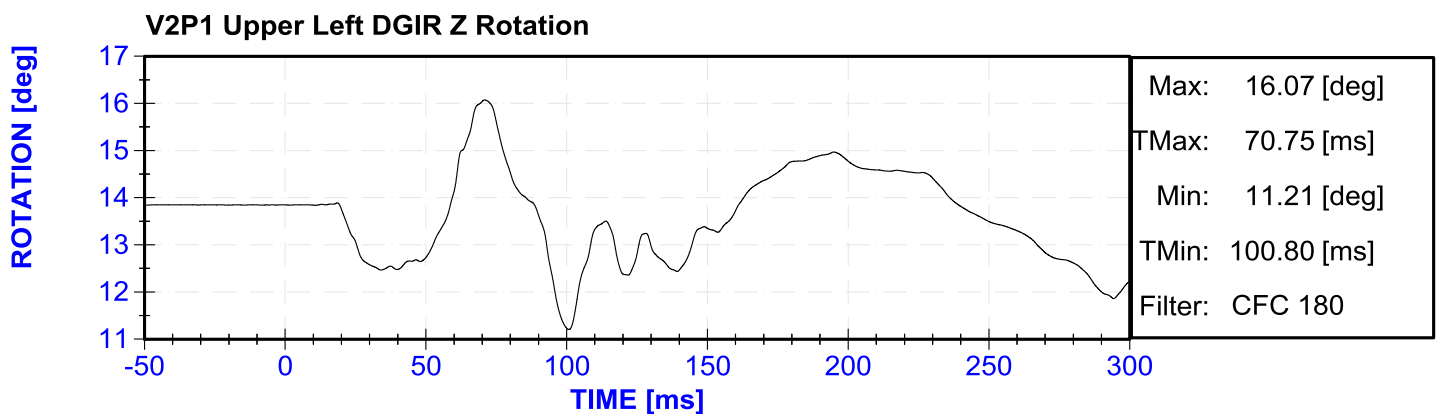
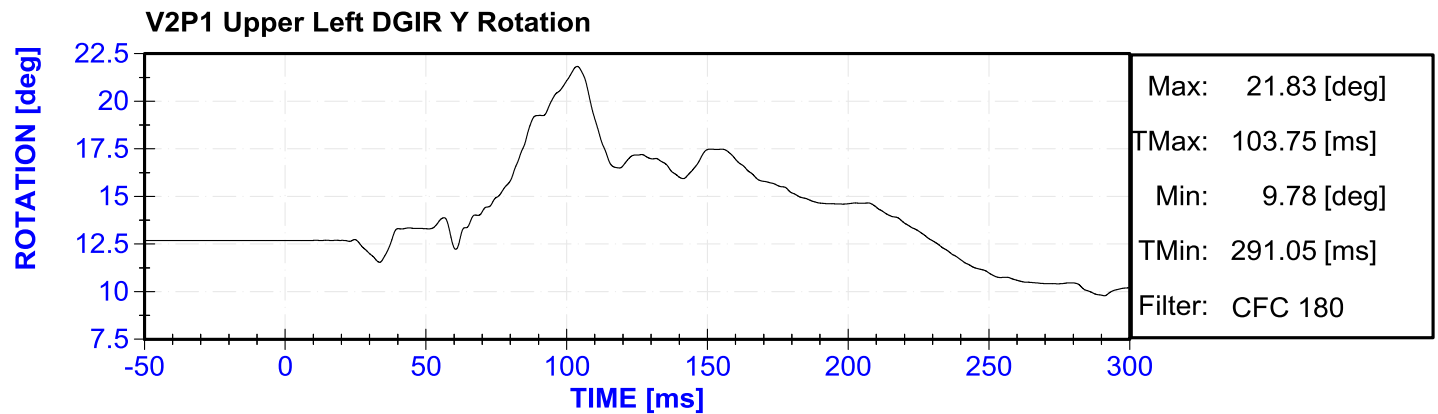
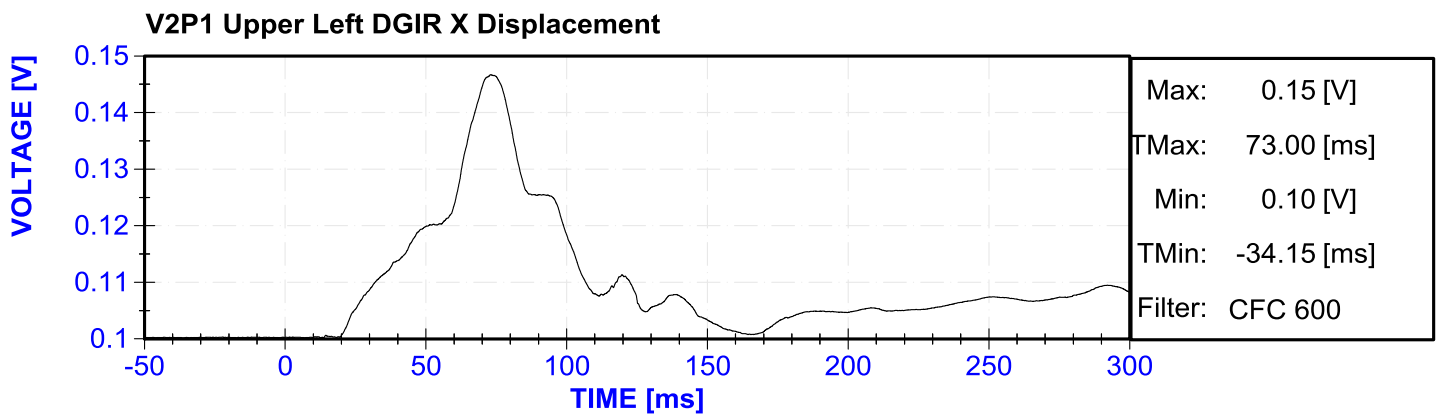
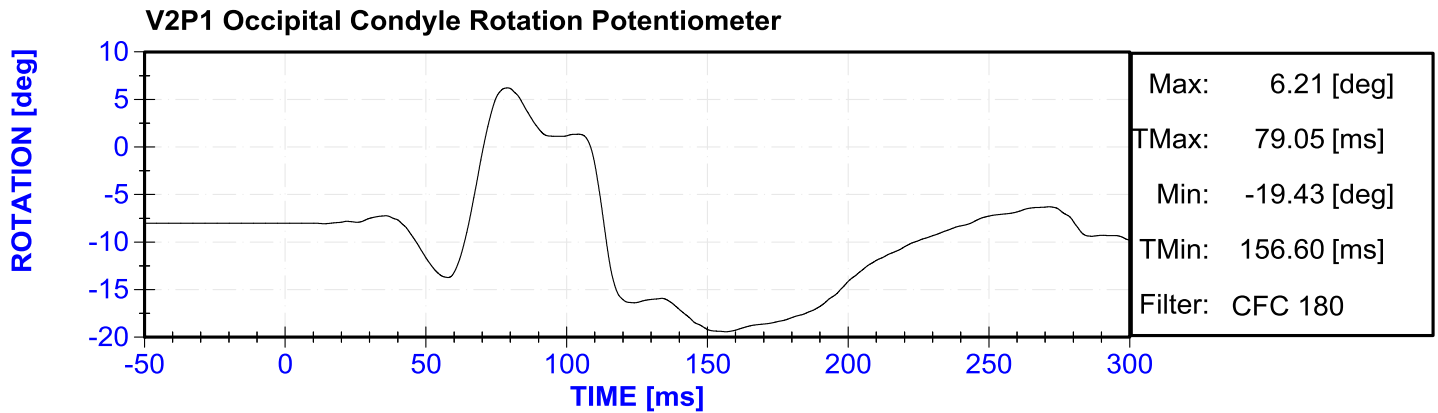




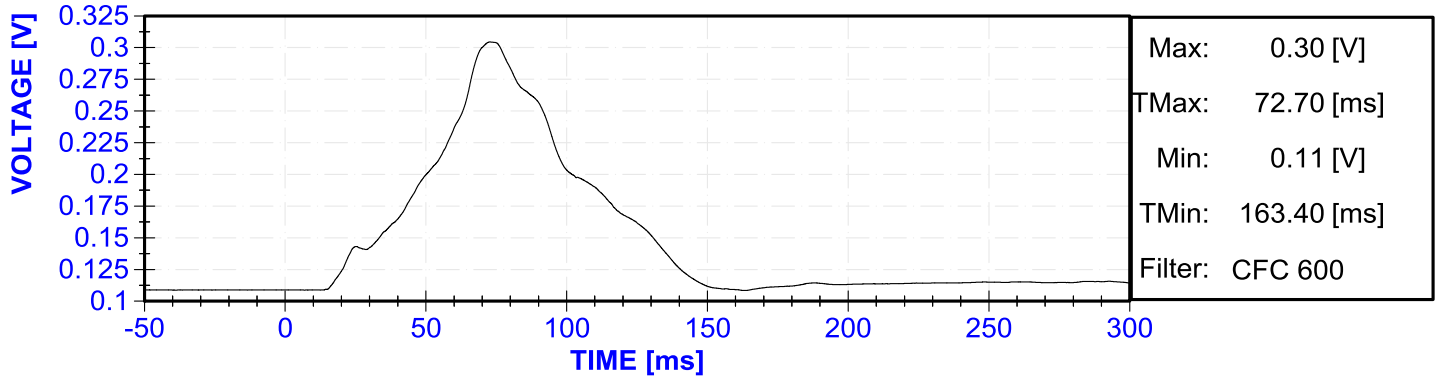




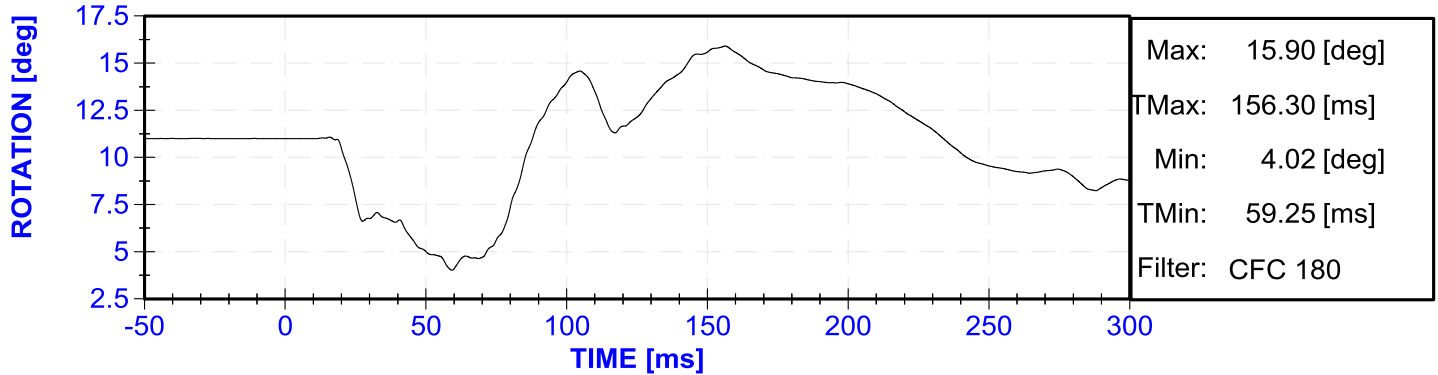




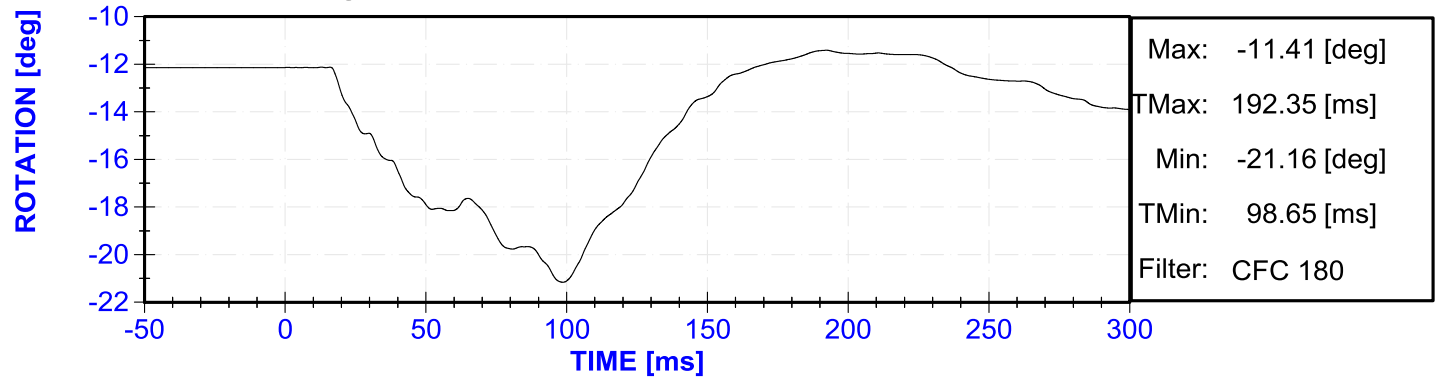
V2P1 Upper Right DGIR X Displacement



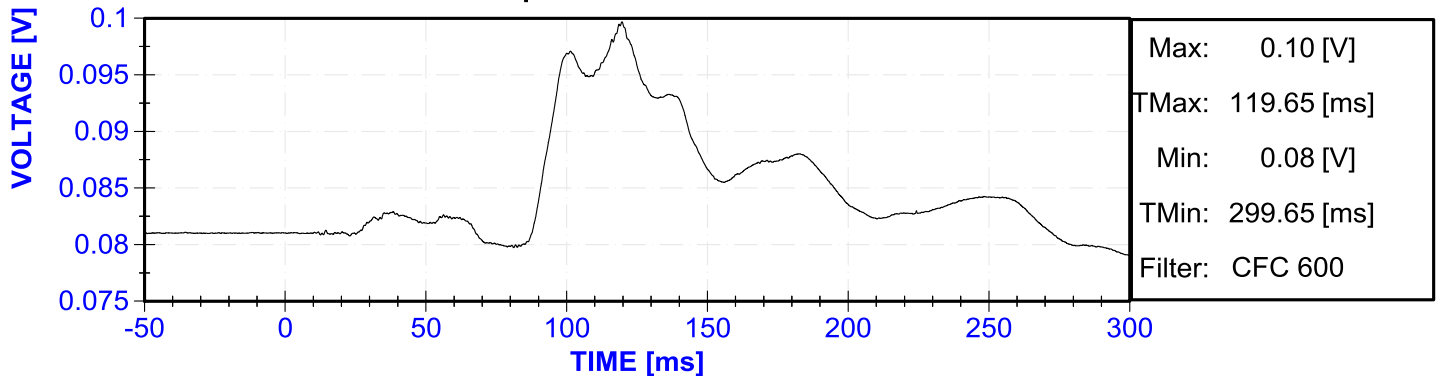
V2P1 Upper Right DGIR Y Rotation

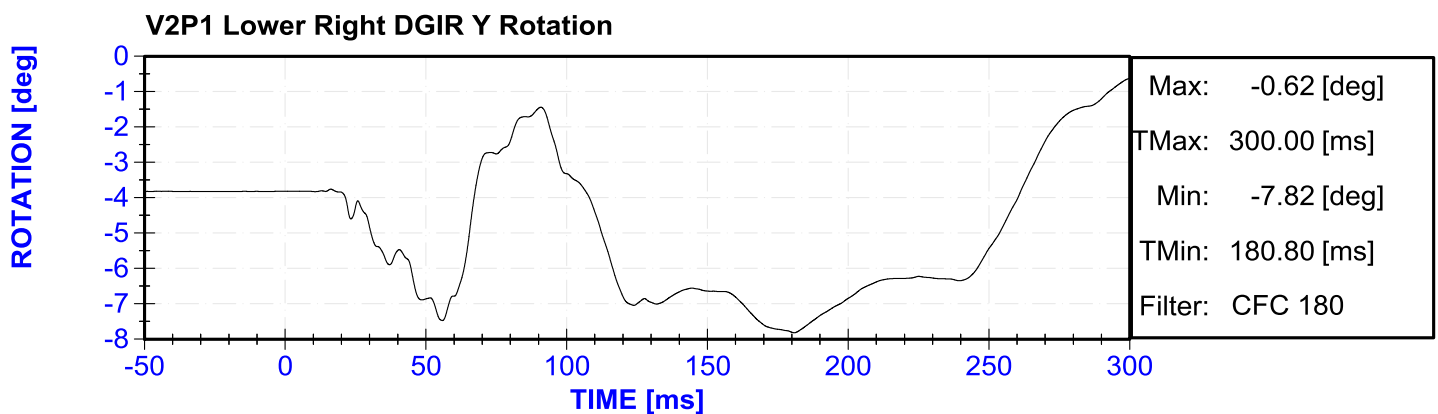
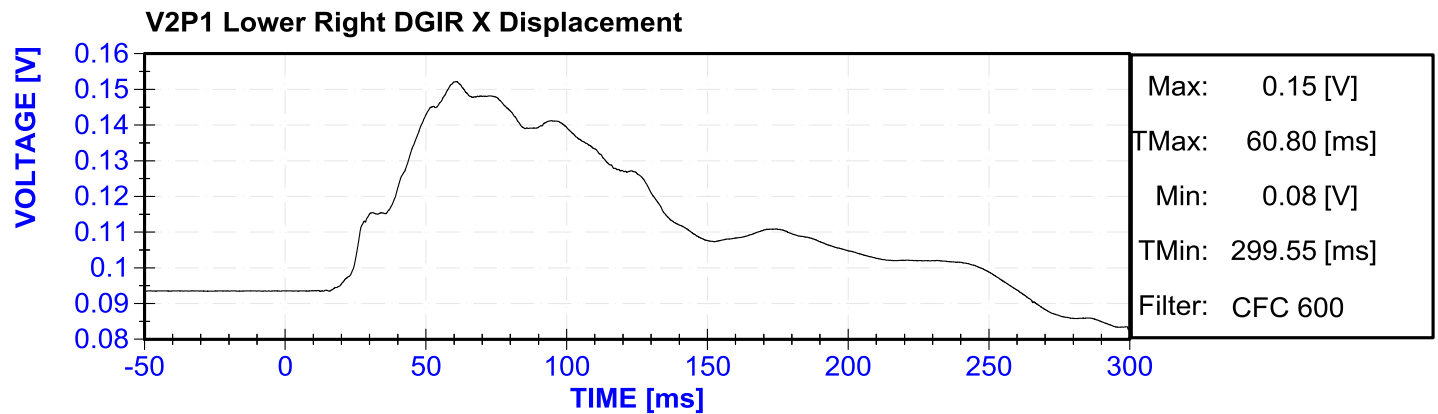
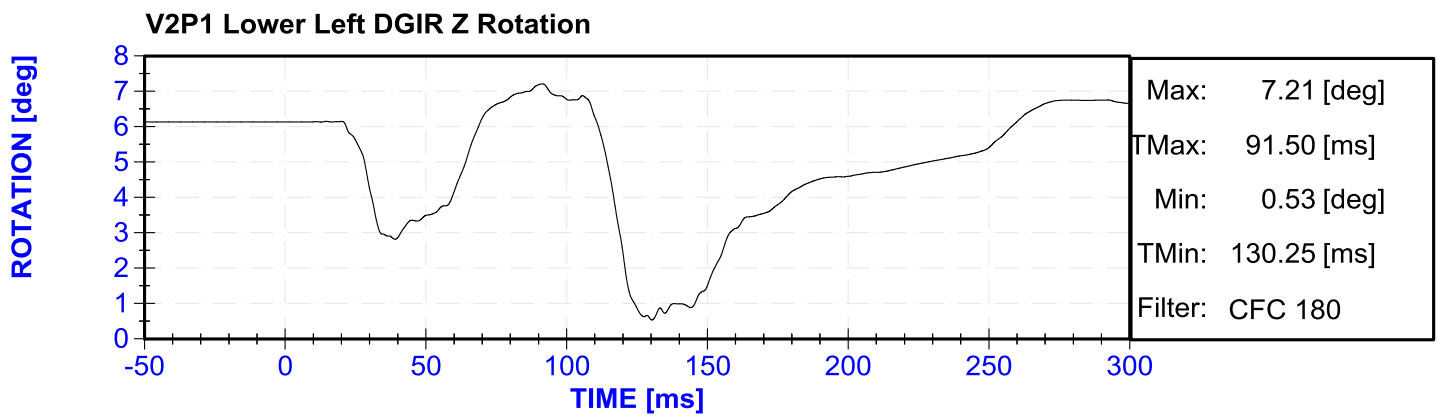
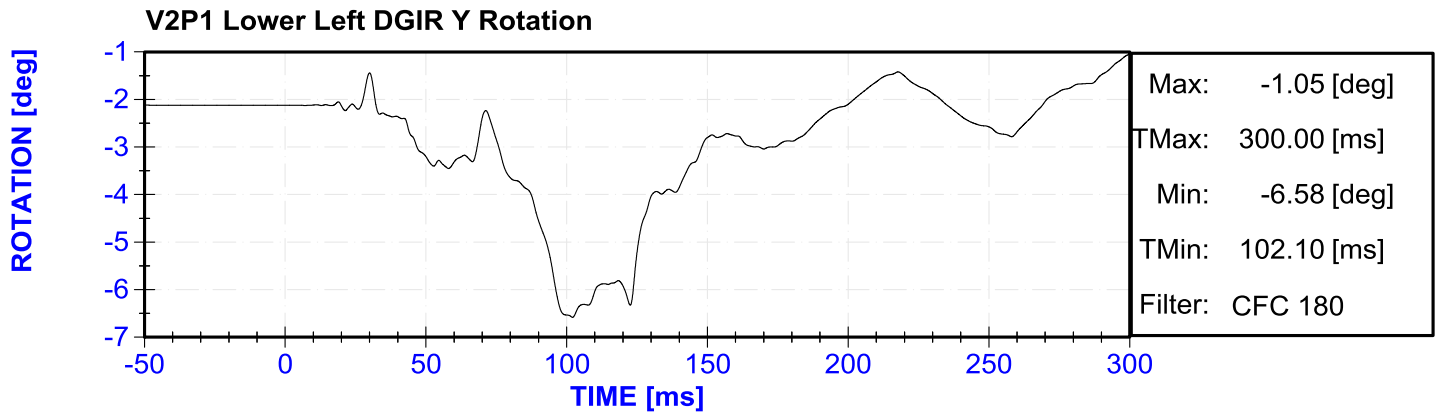


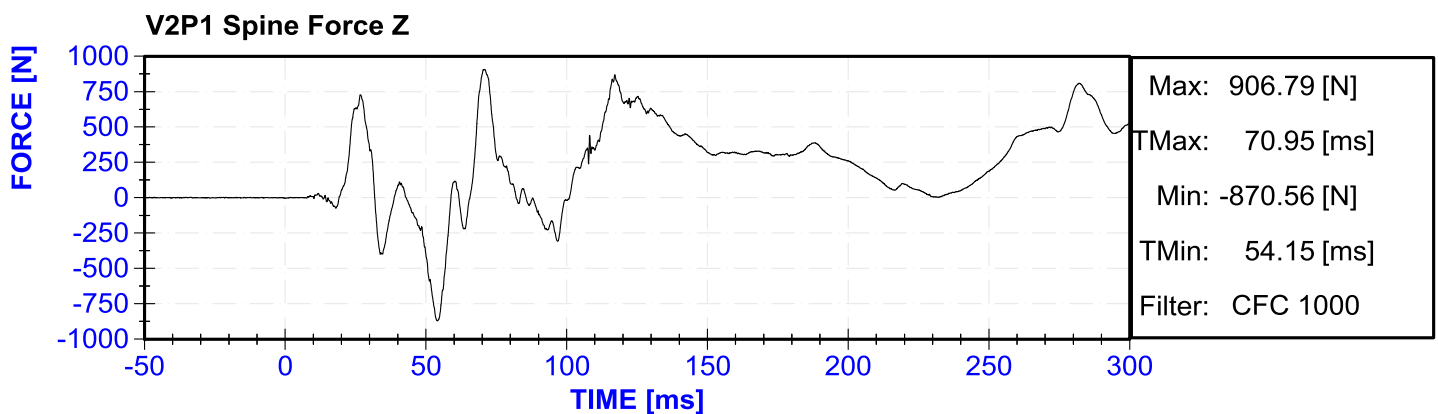
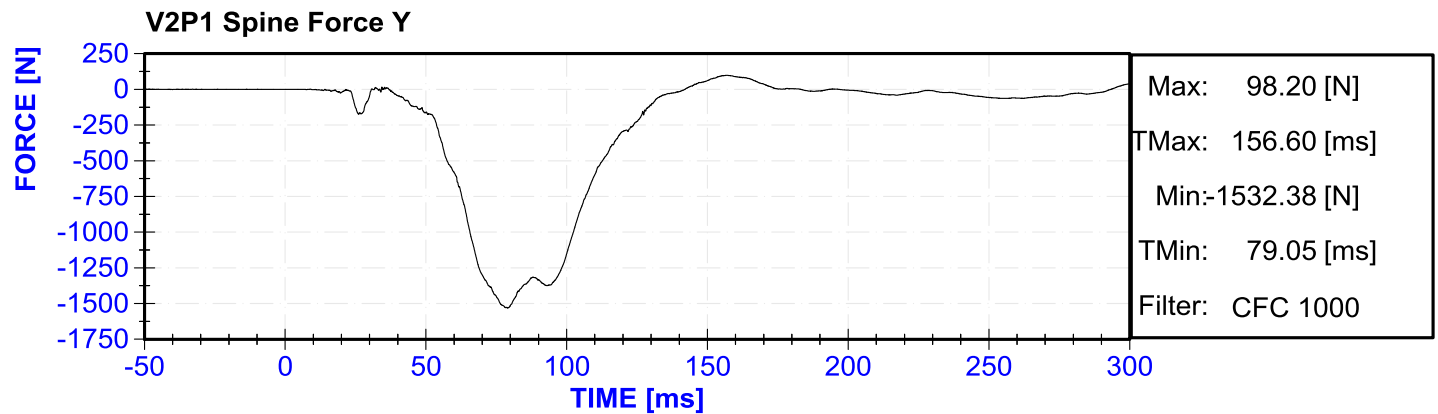
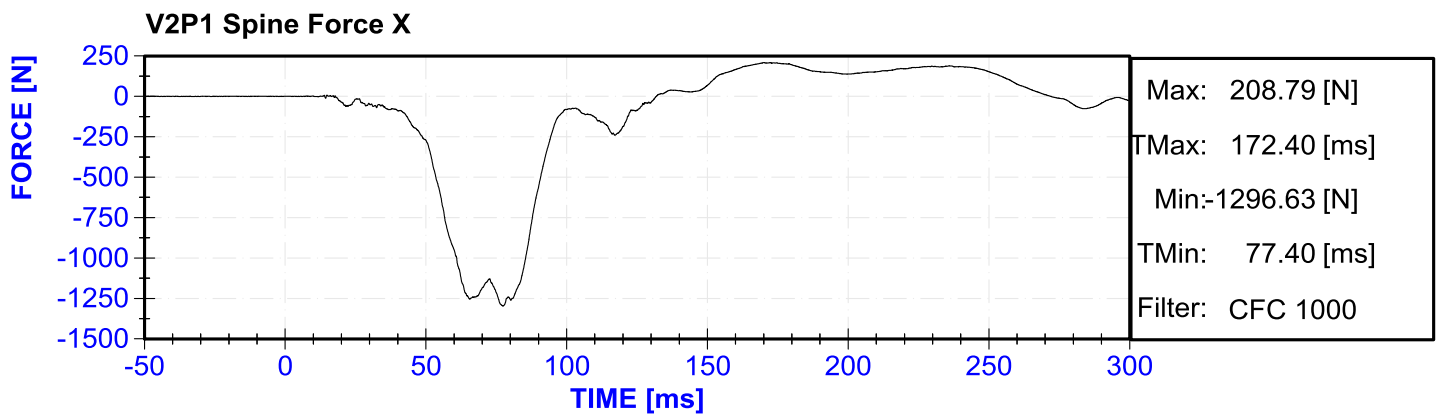
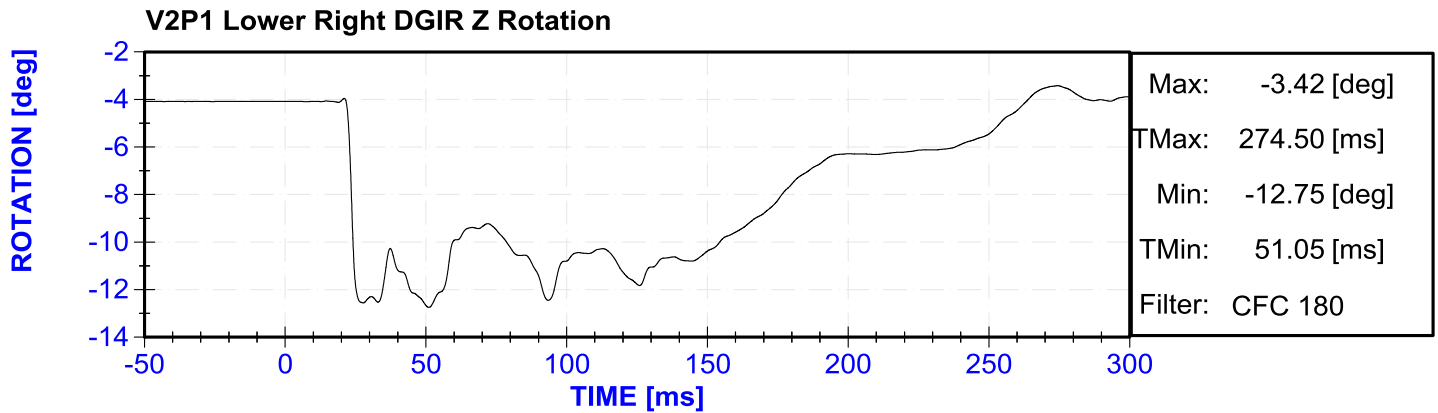
V2P1 Upper Right DGIR Z Rotation

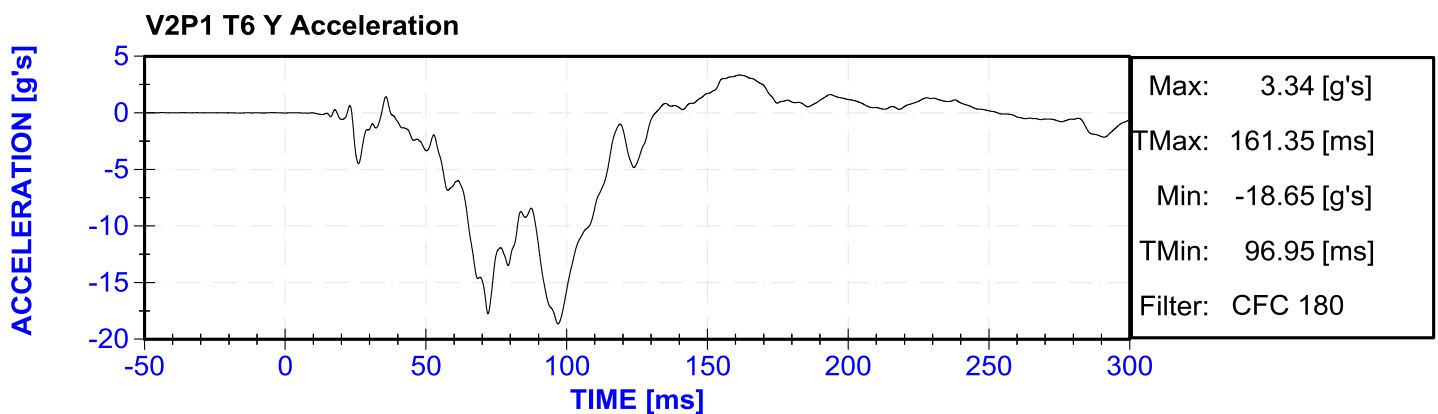
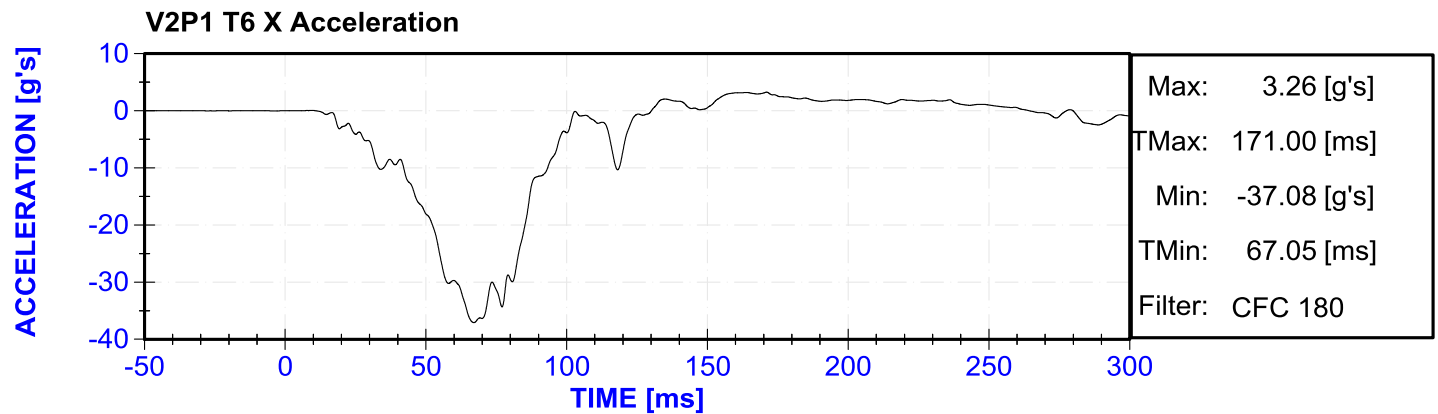
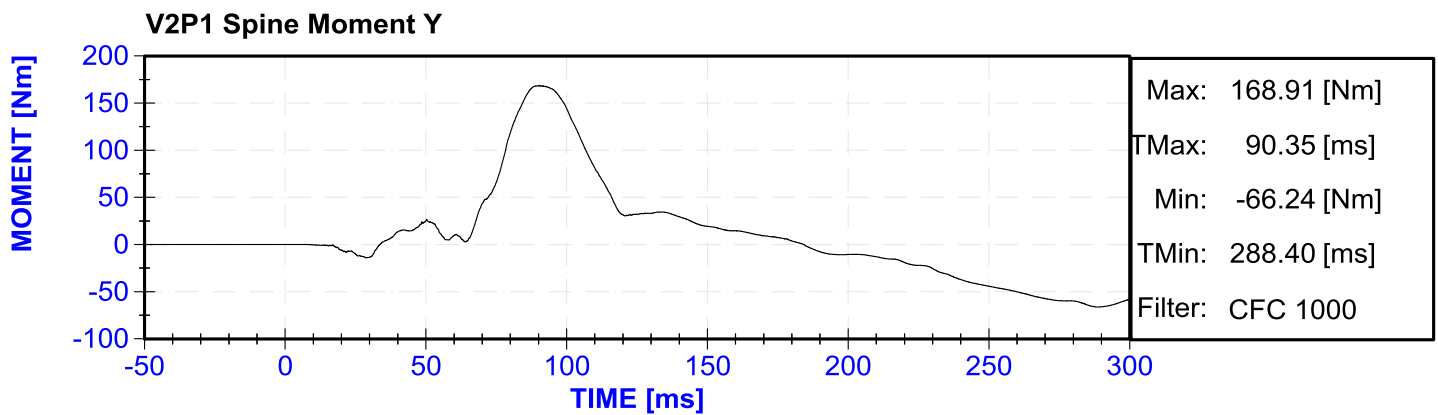
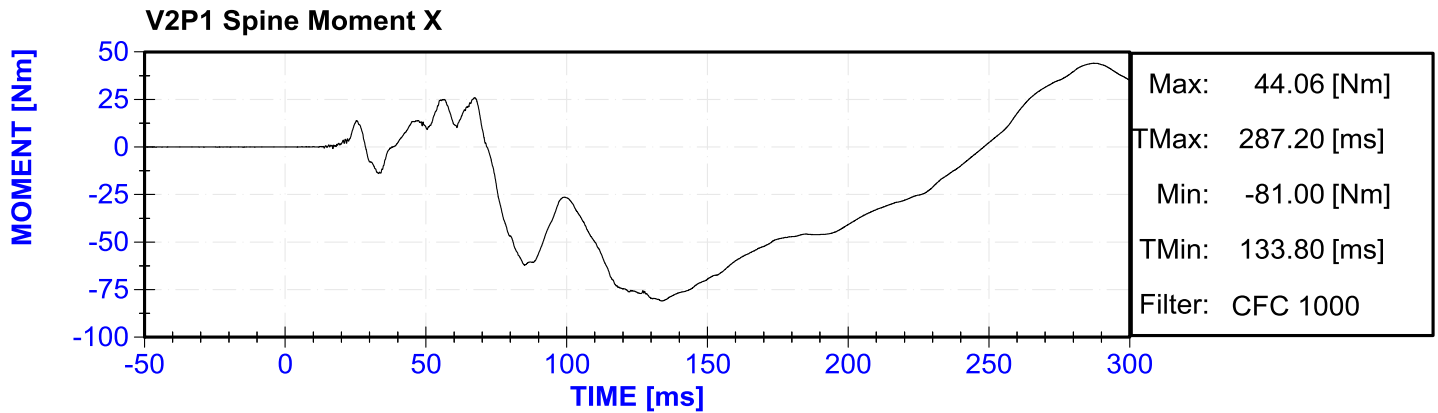


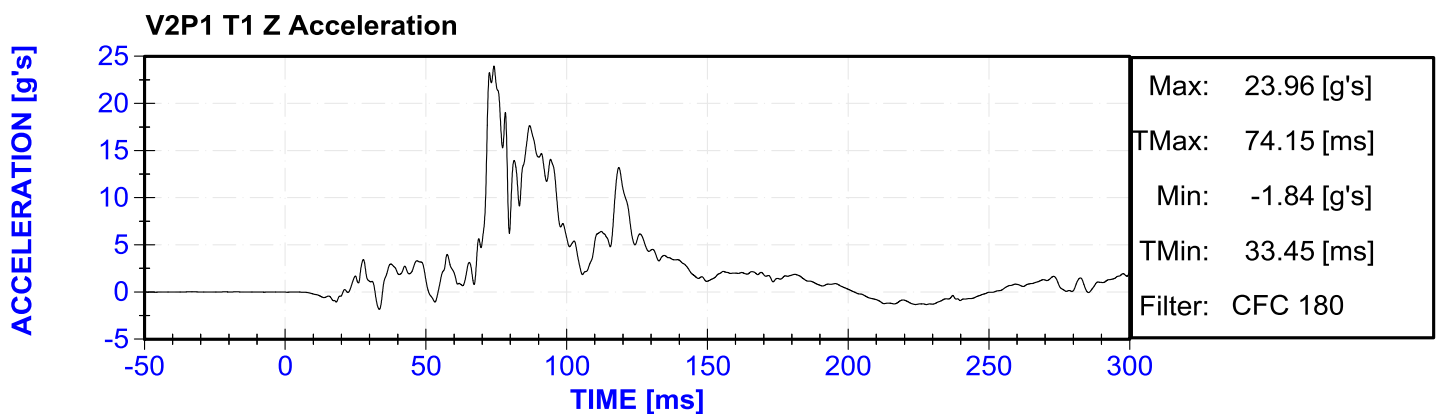
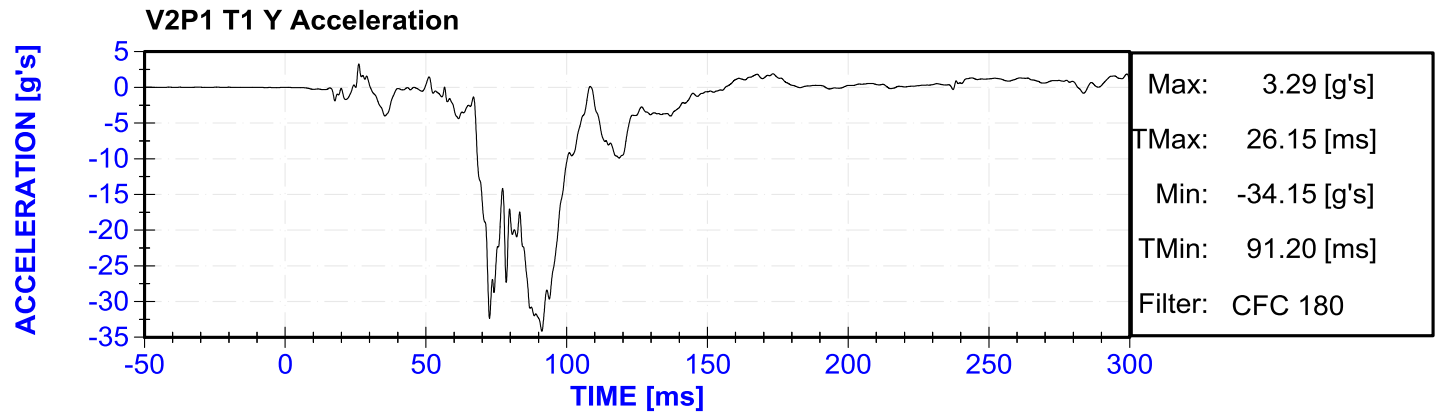
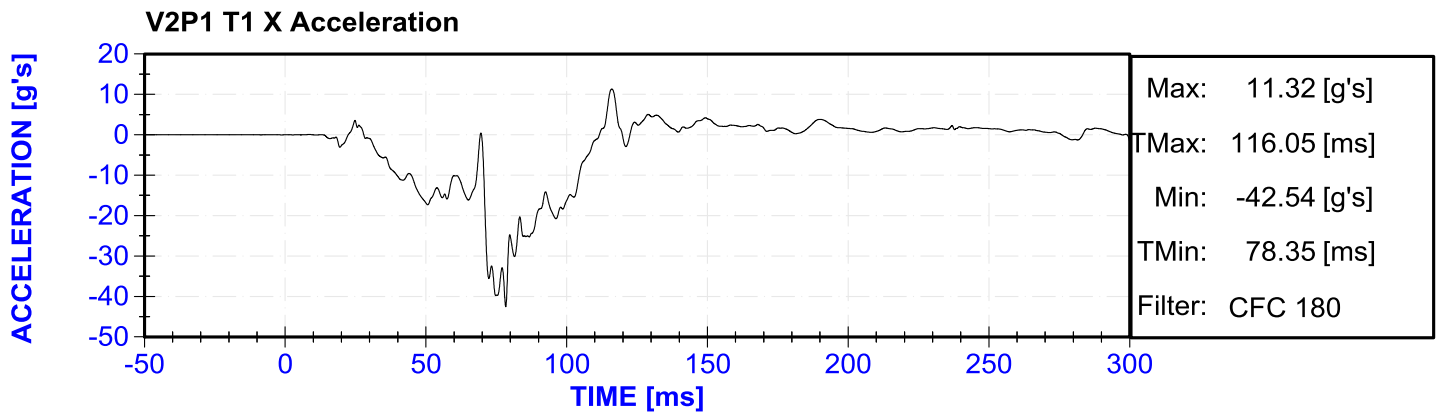
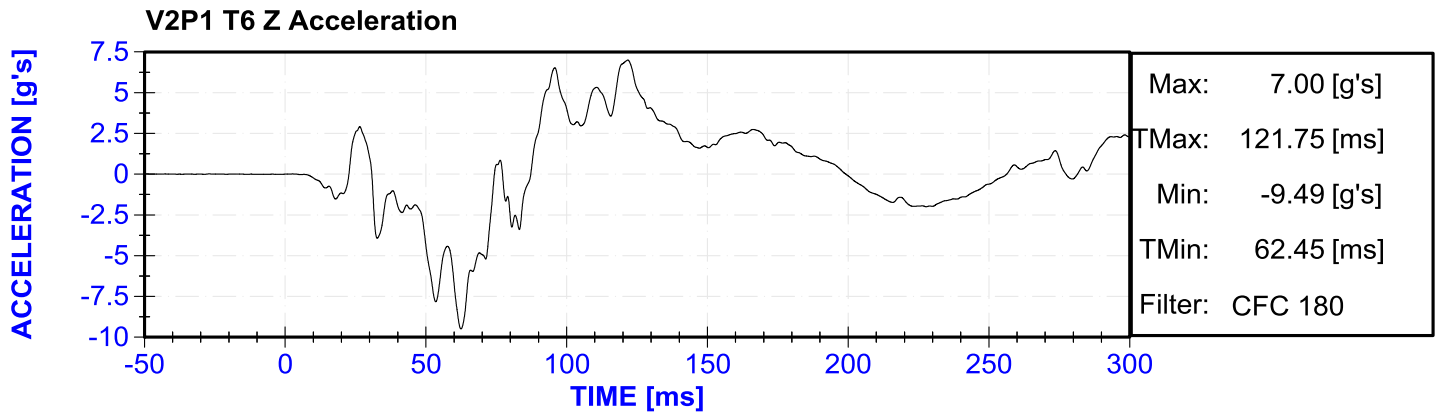
V2P1 Lower Left DGIR X Displacement

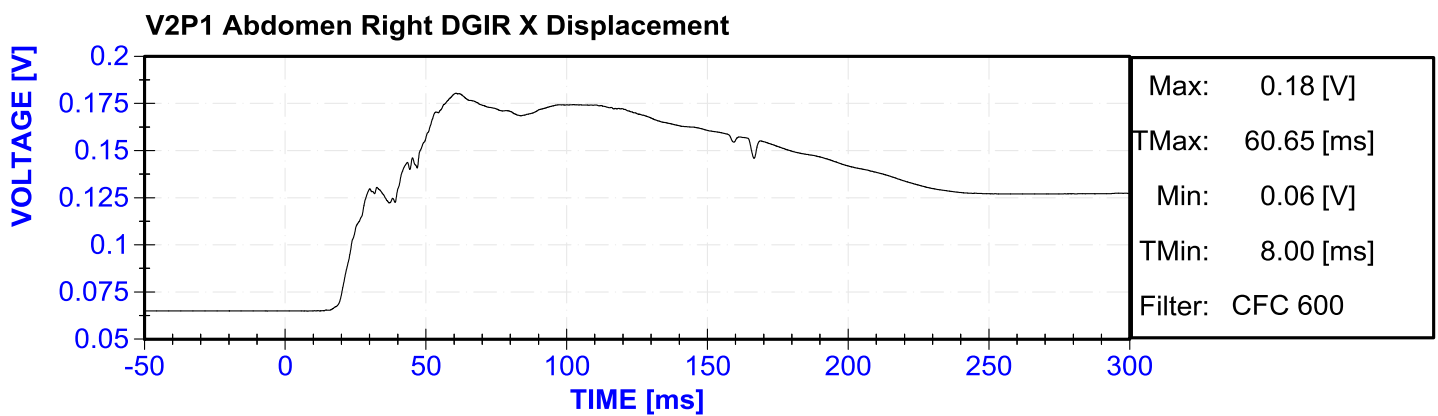
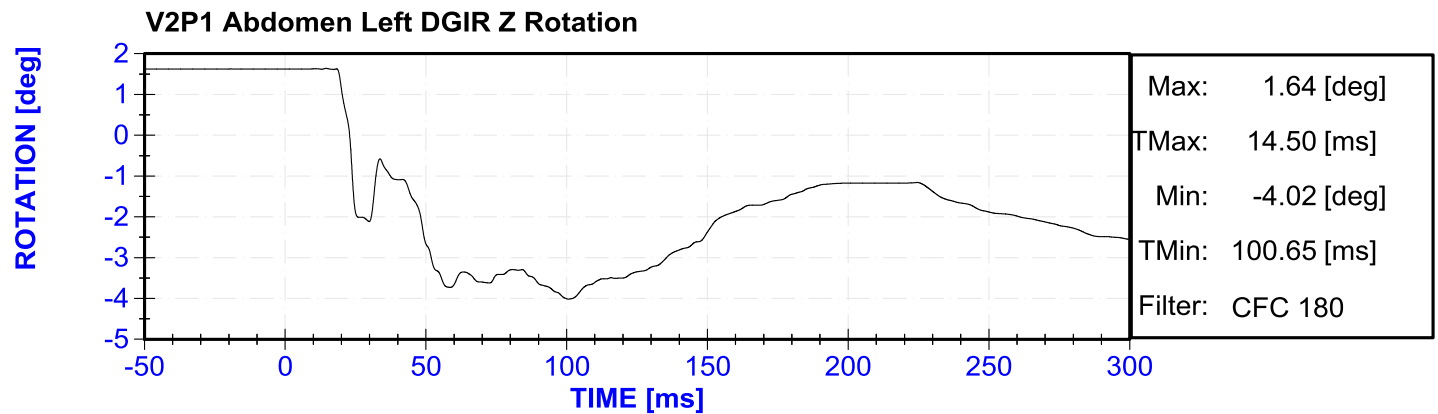
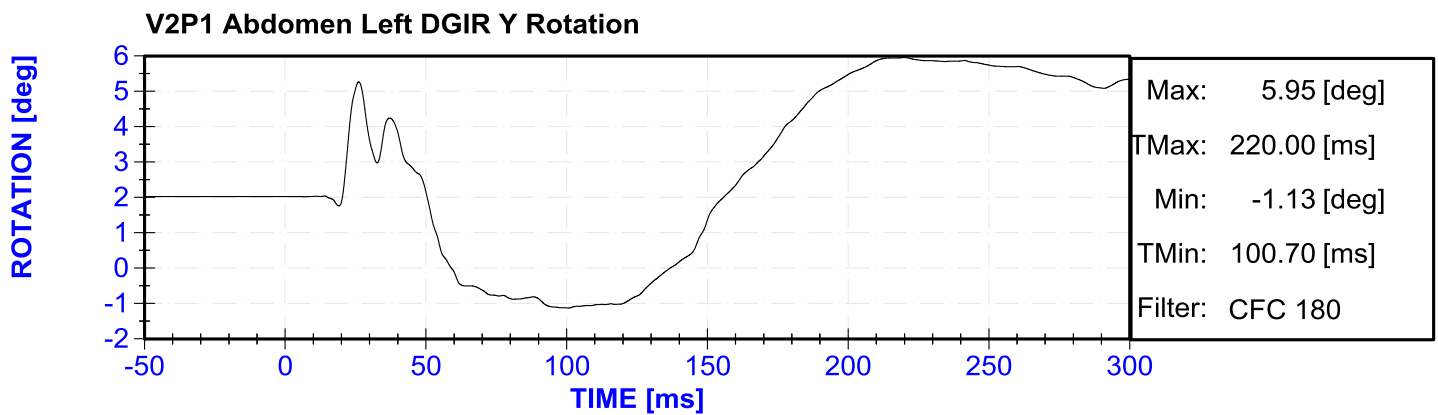
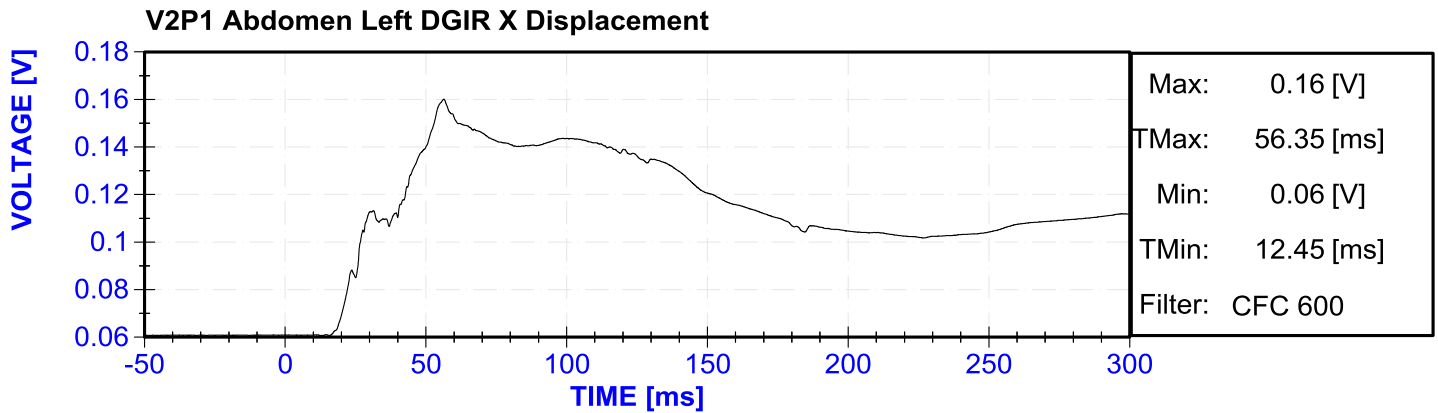


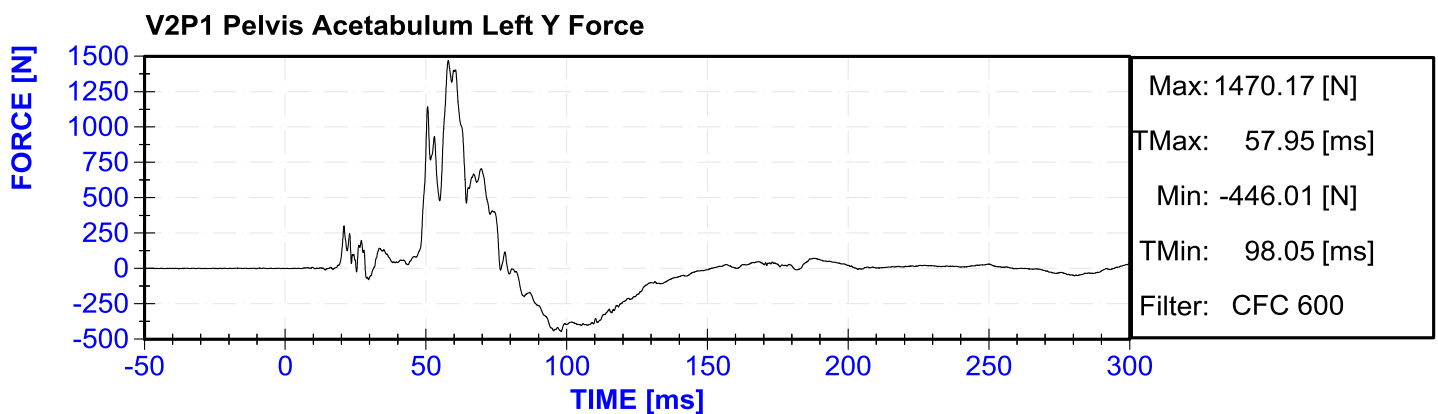
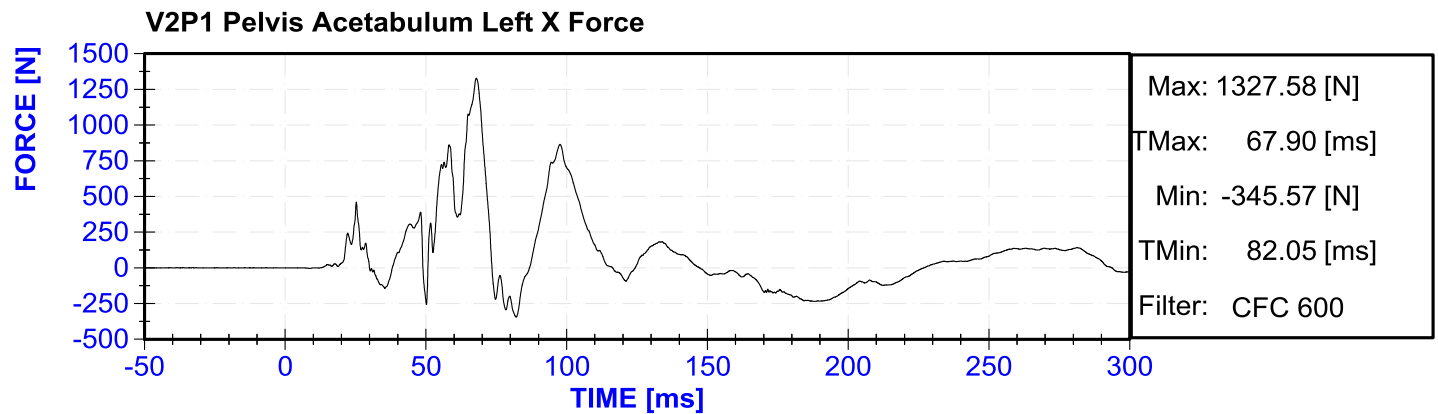
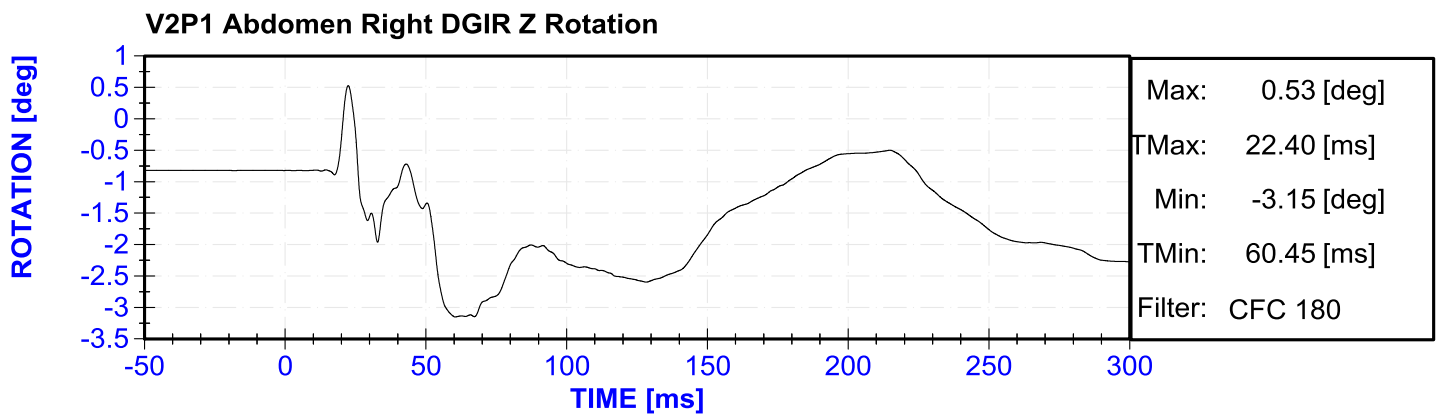
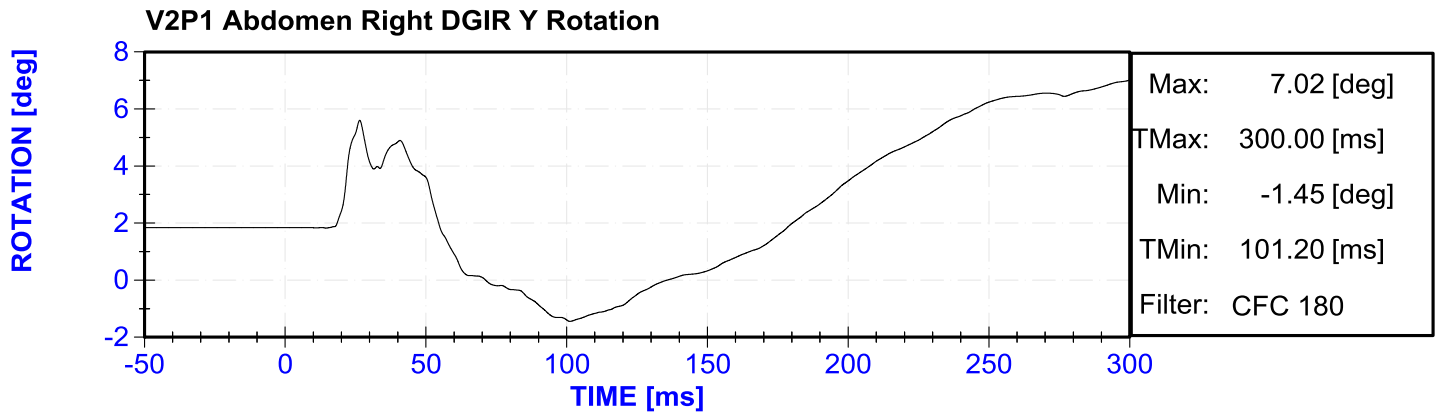


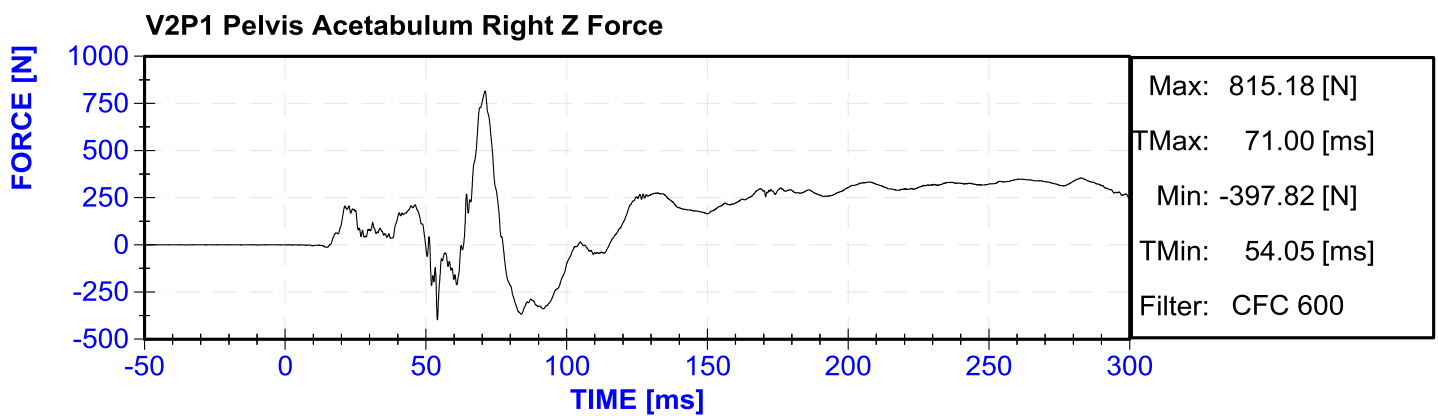
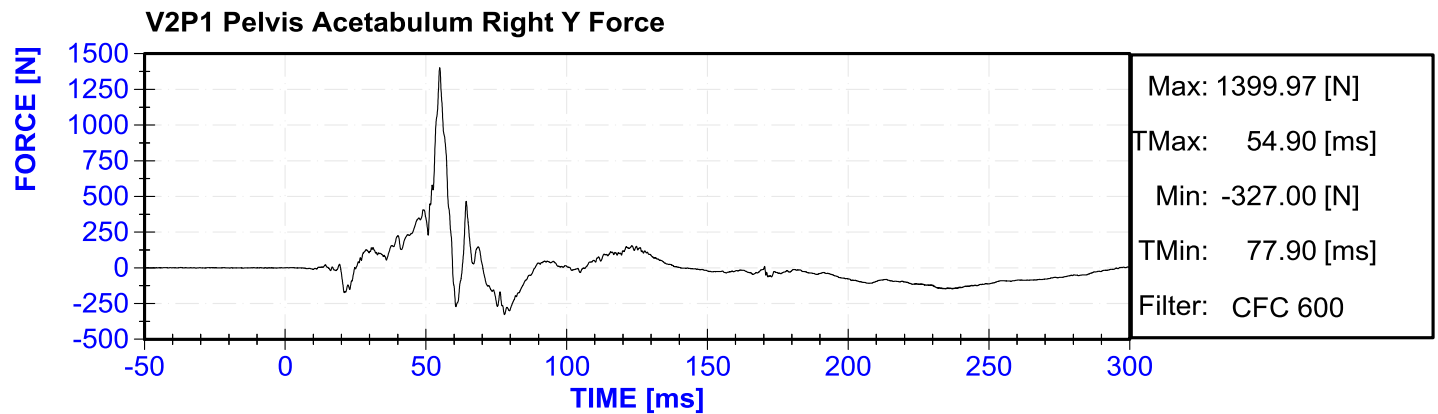
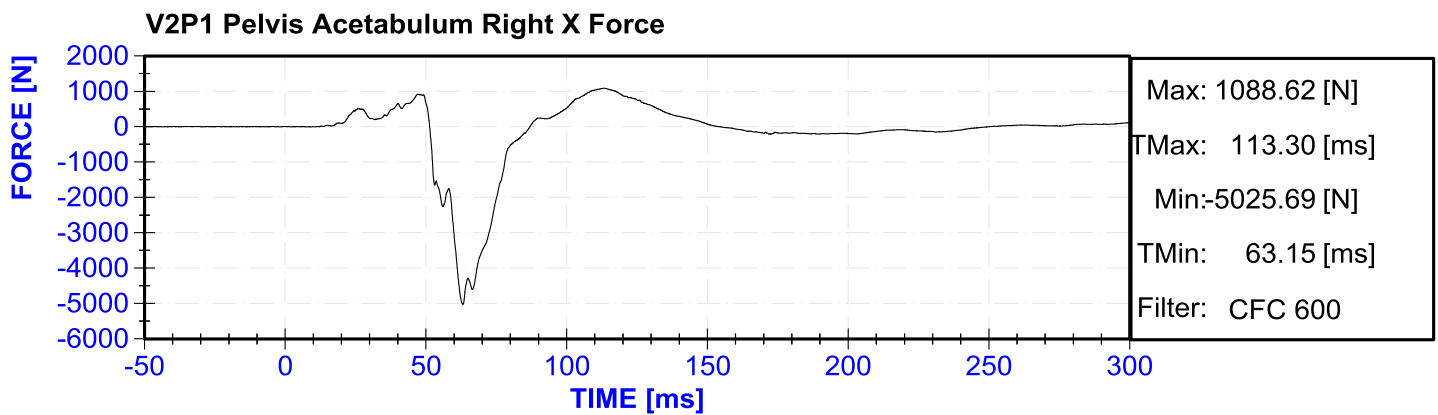
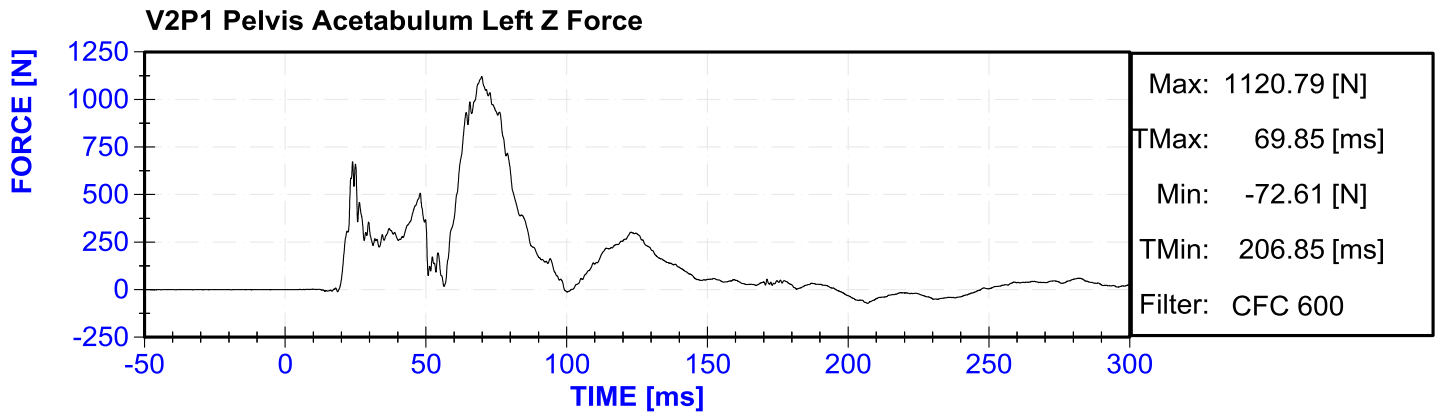


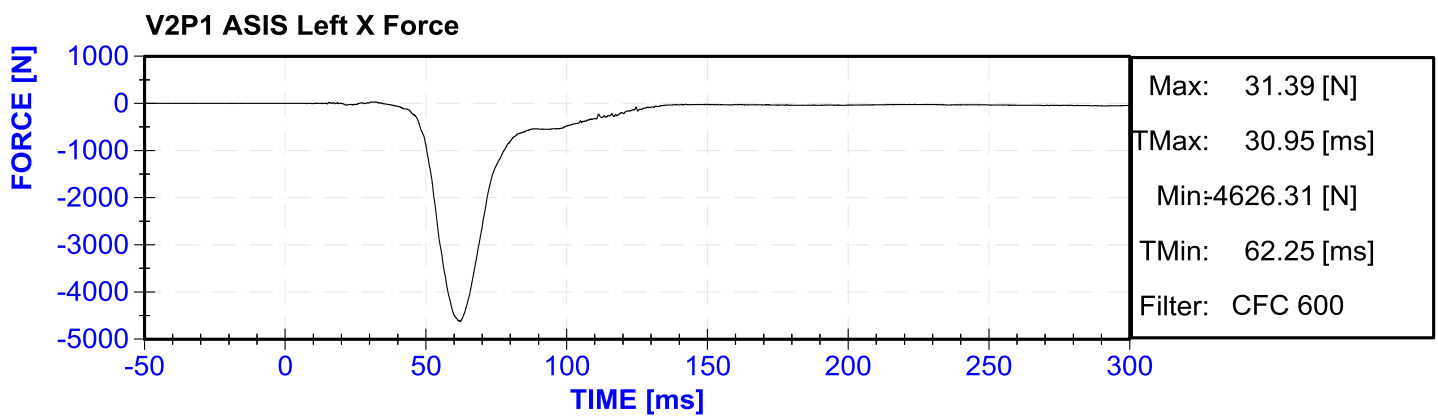
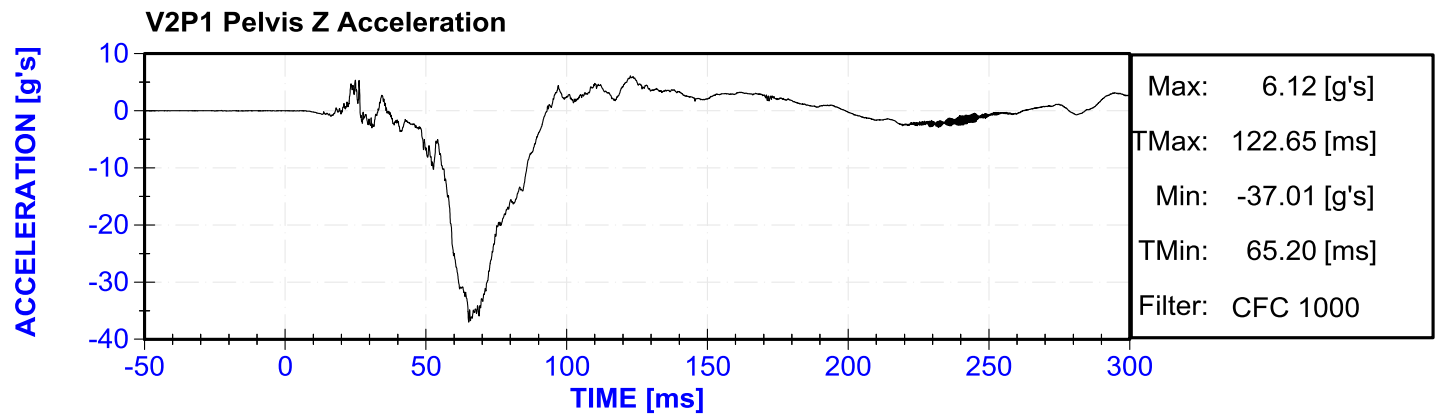
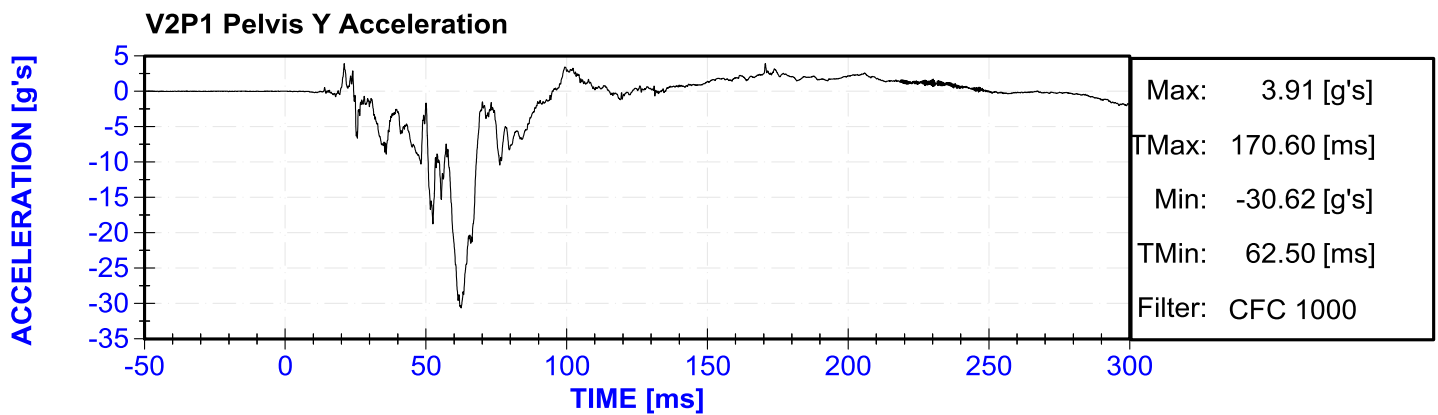
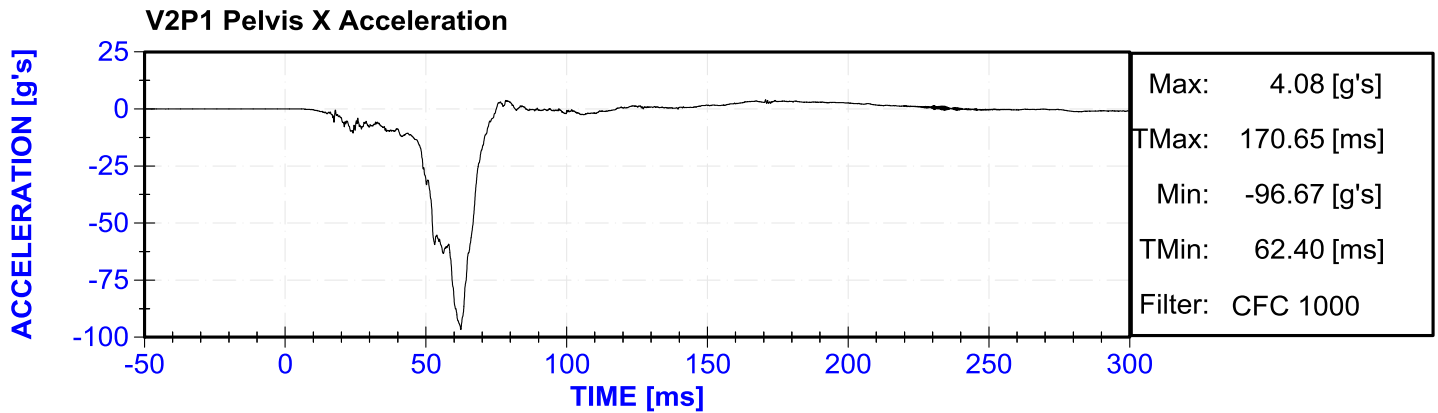


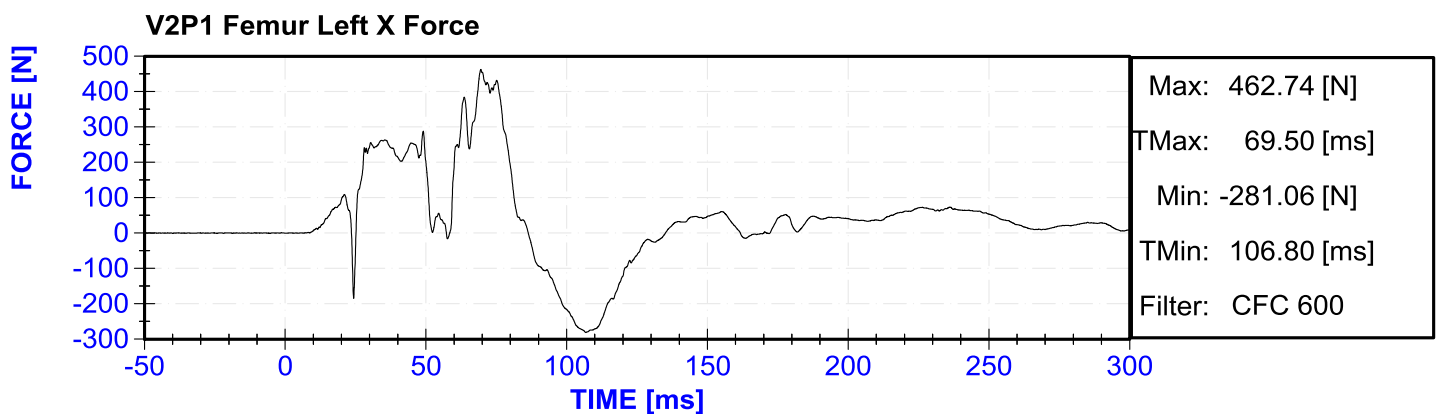
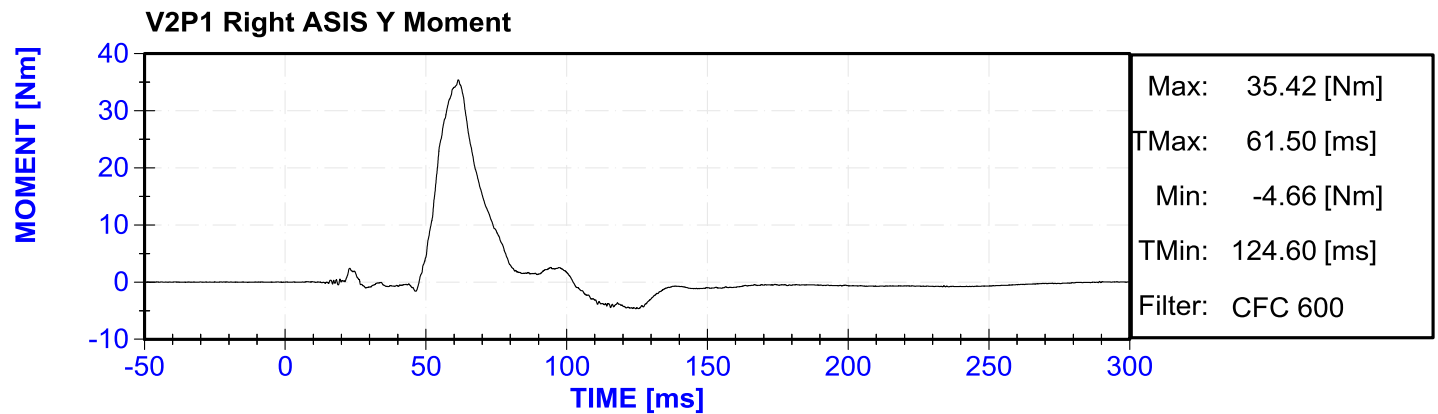
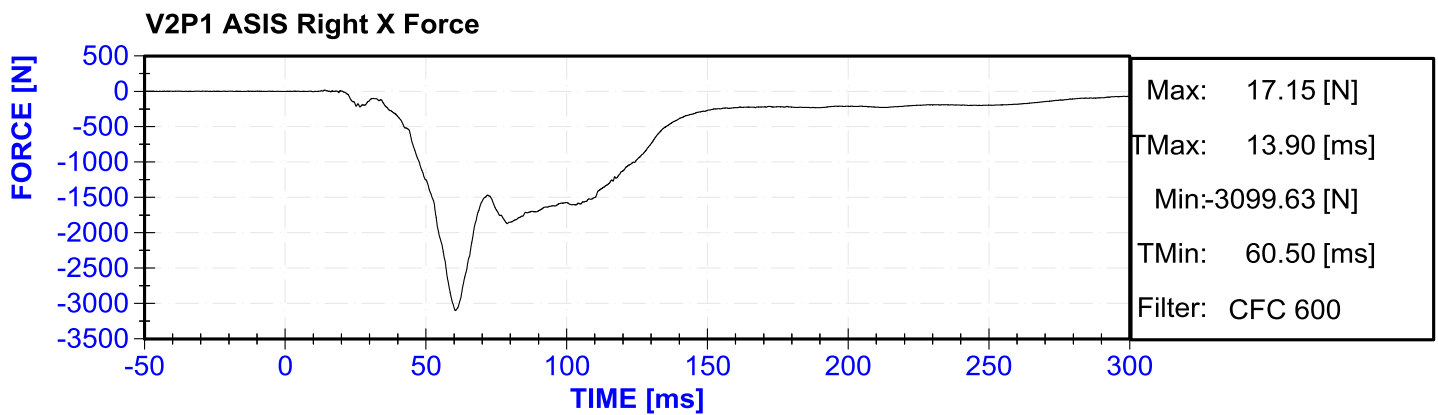
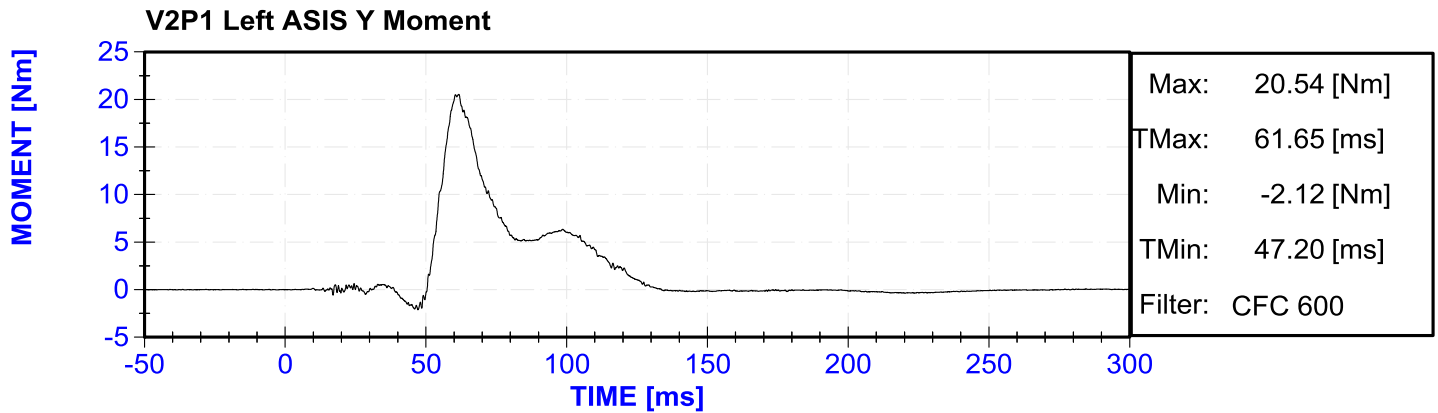


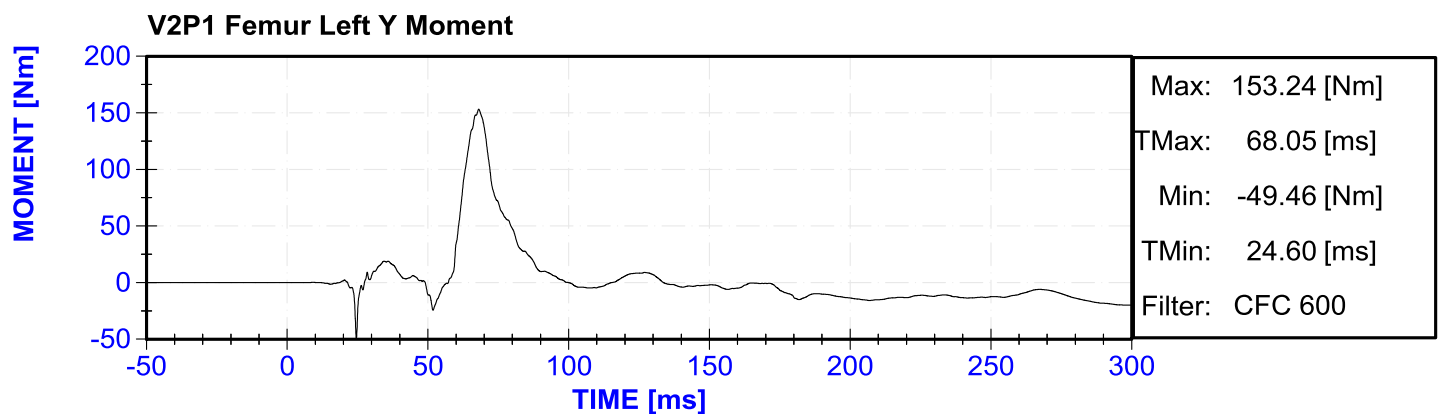
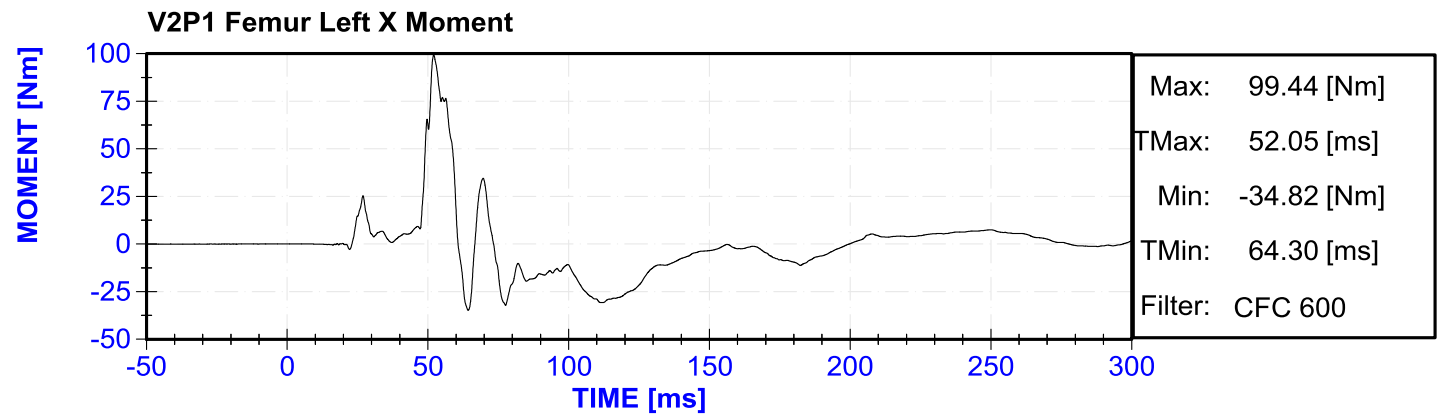
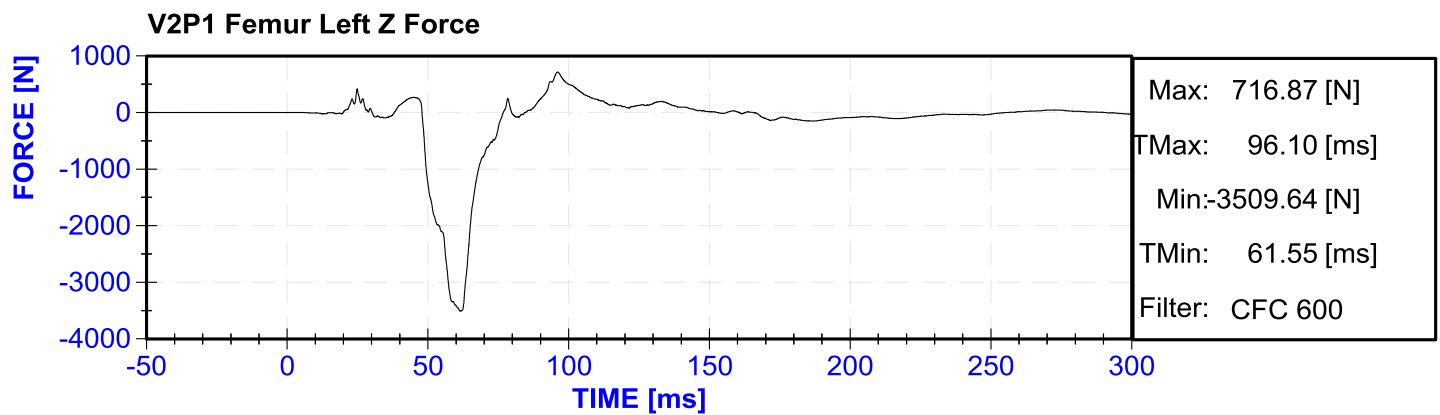
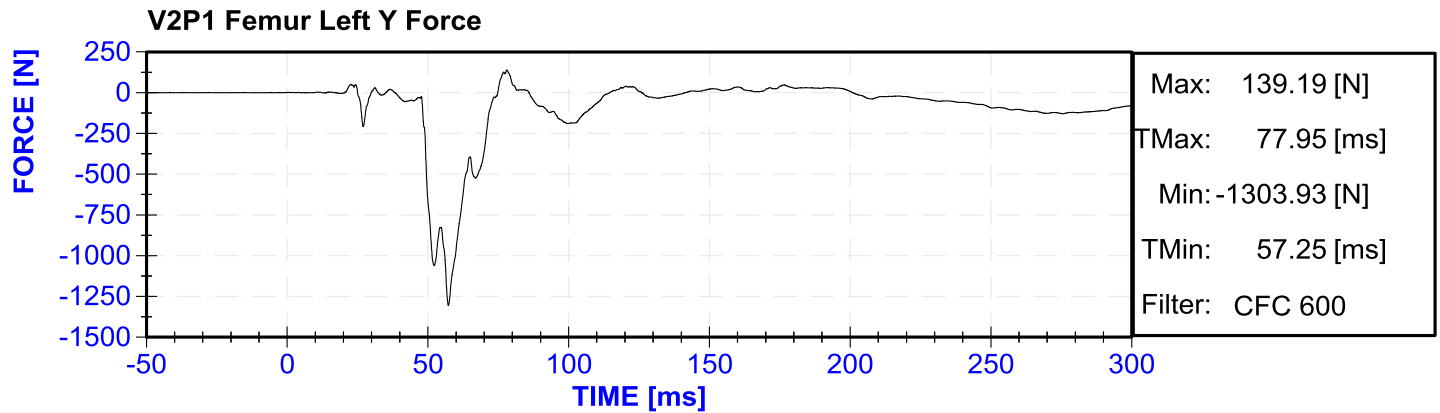


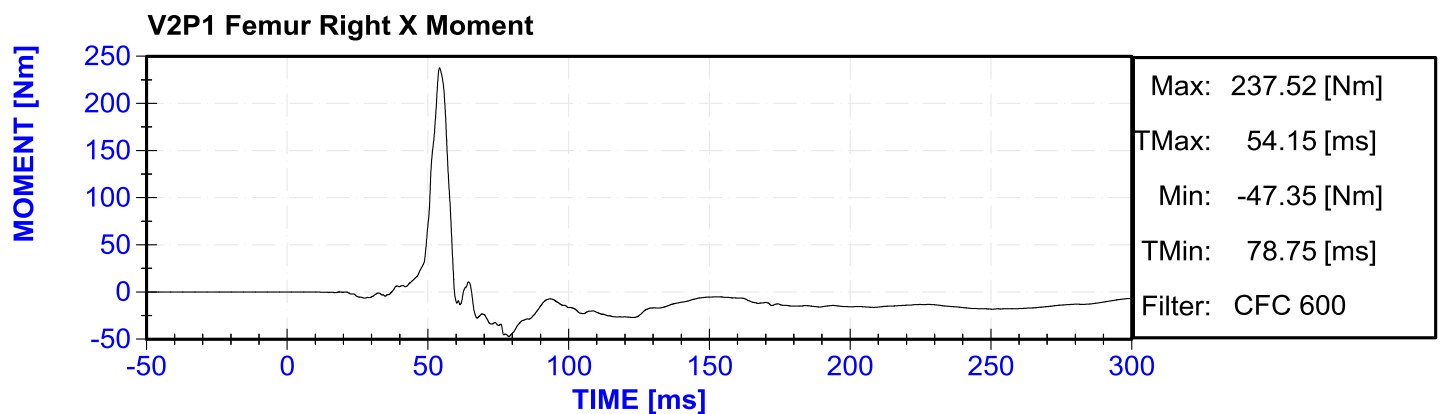
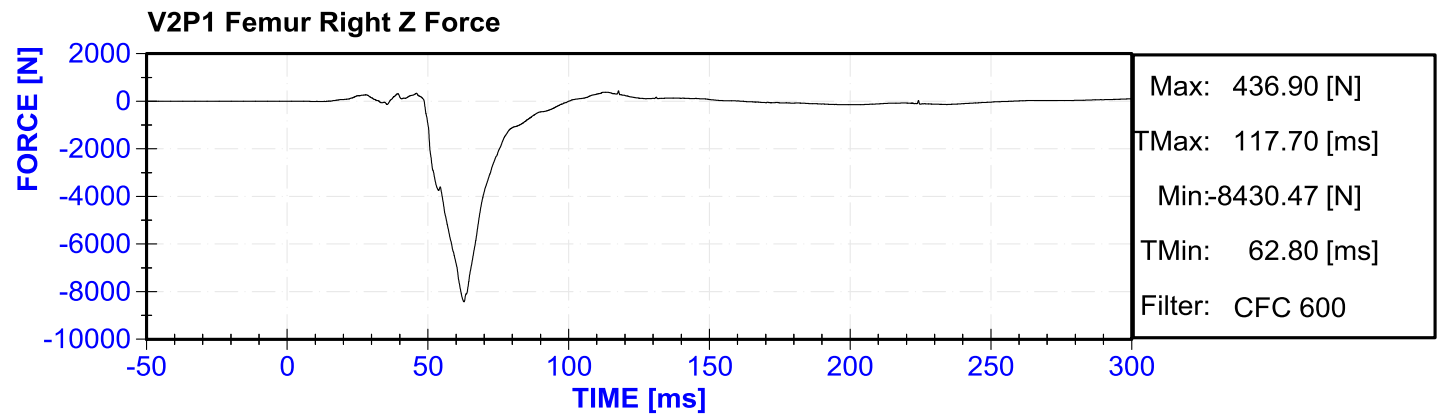
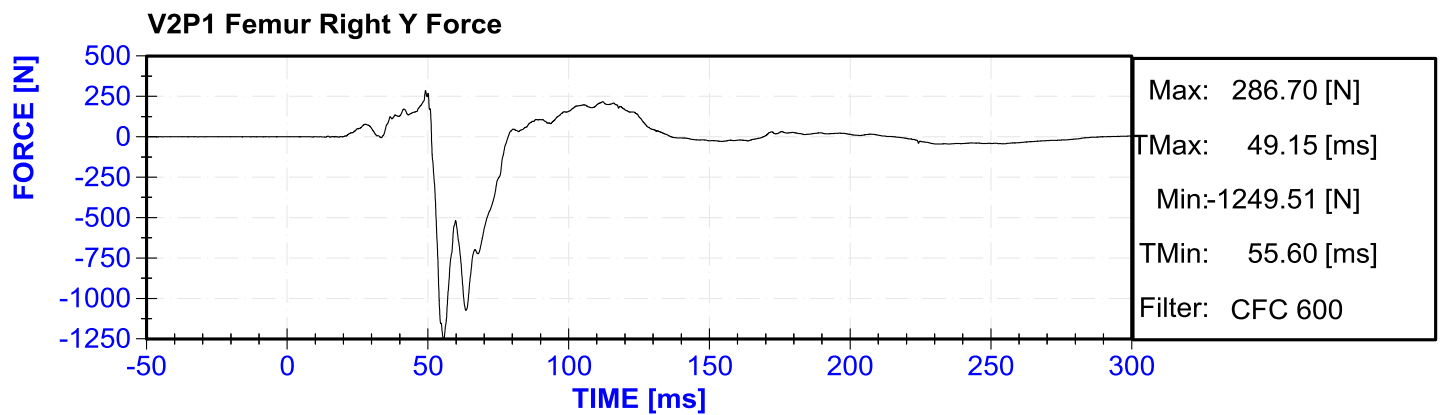
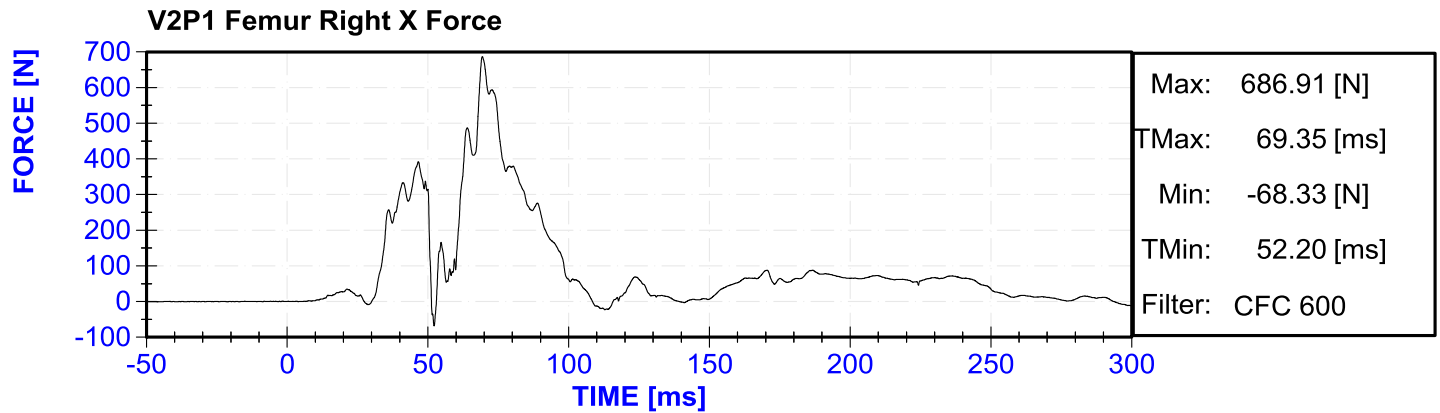


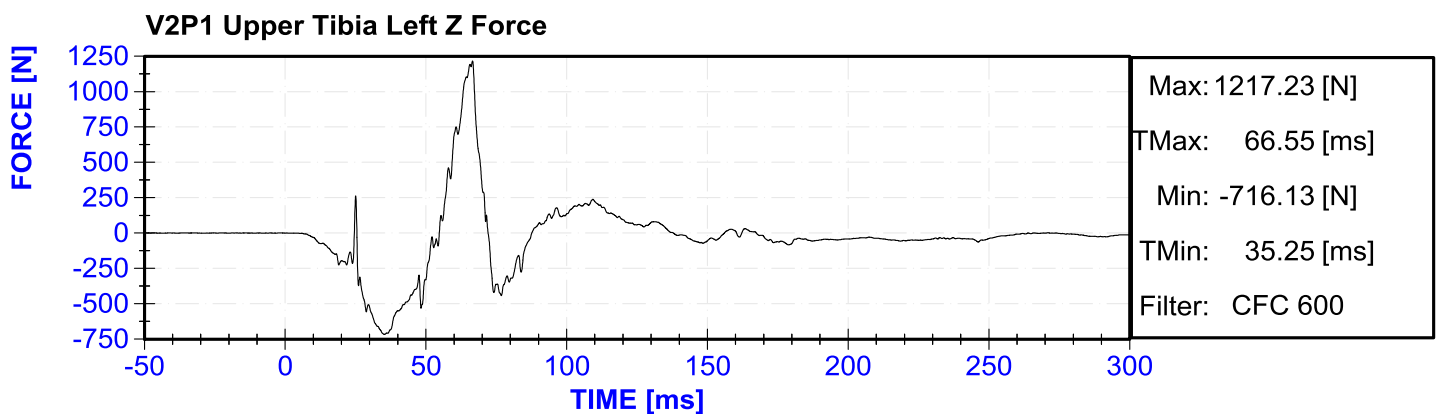
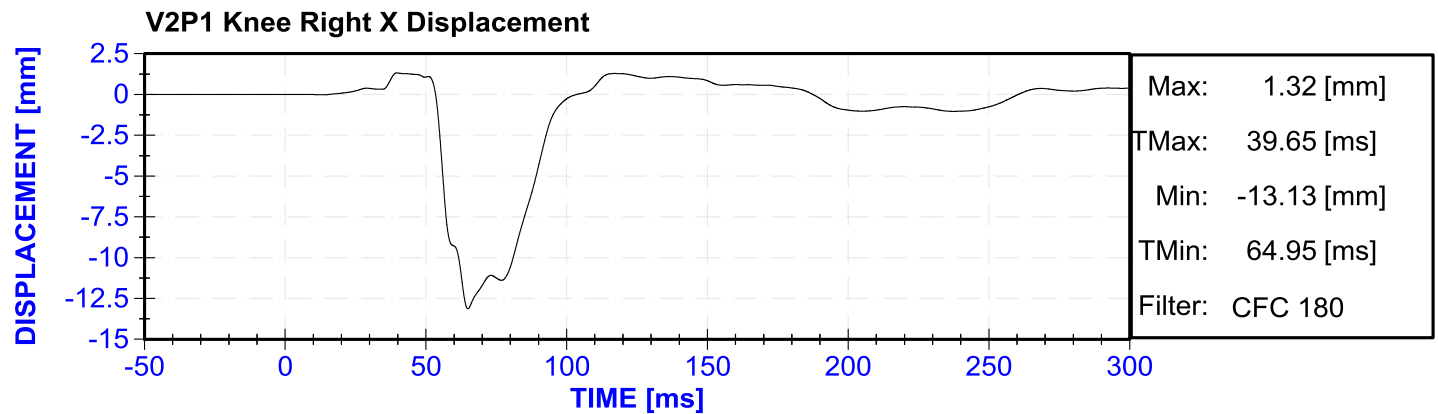
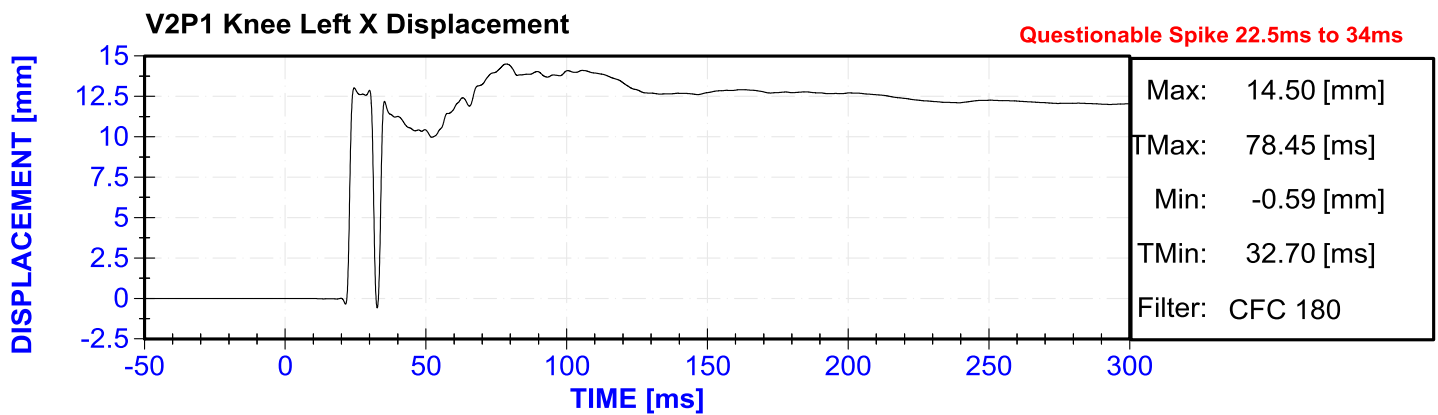
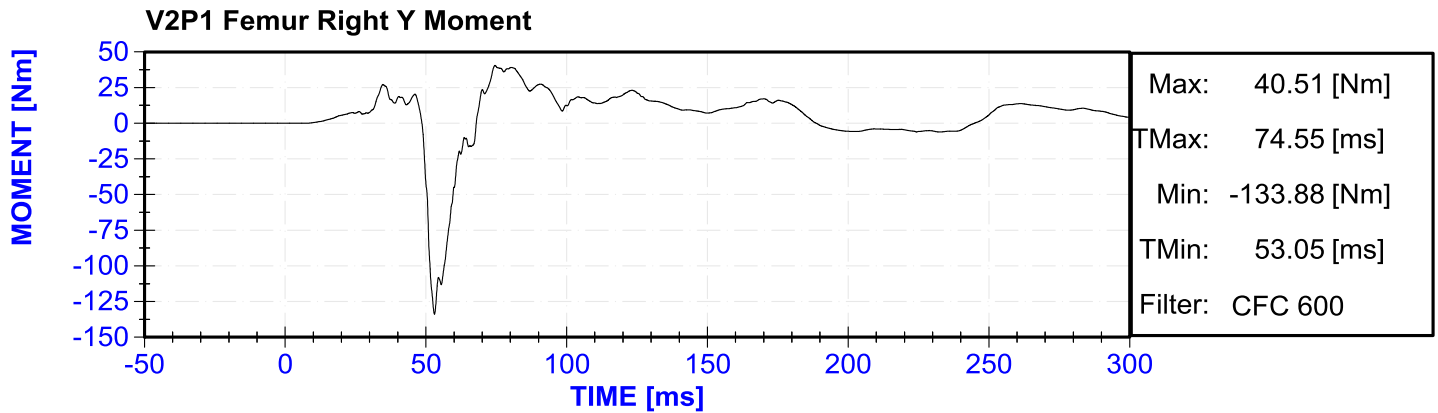


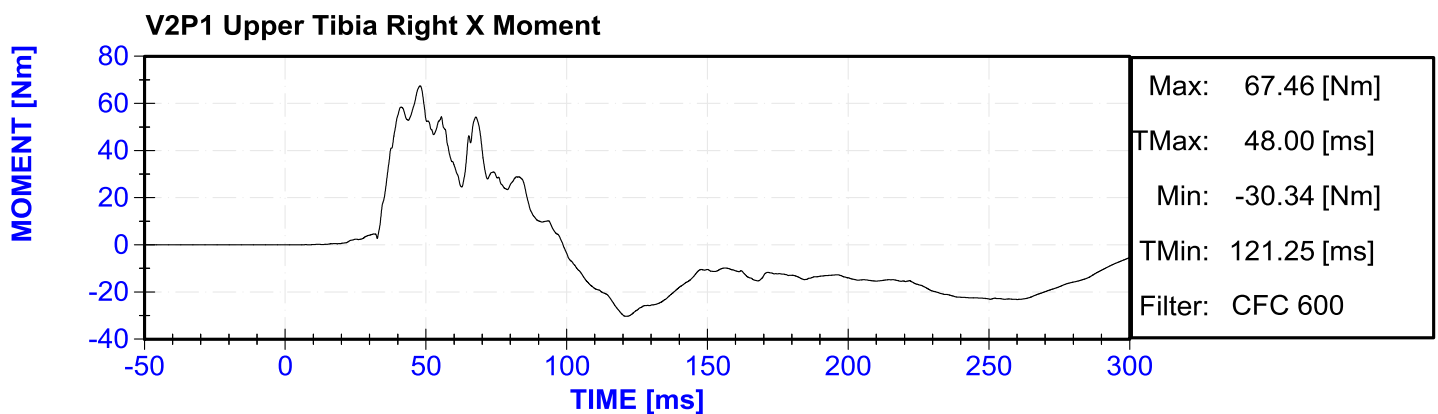
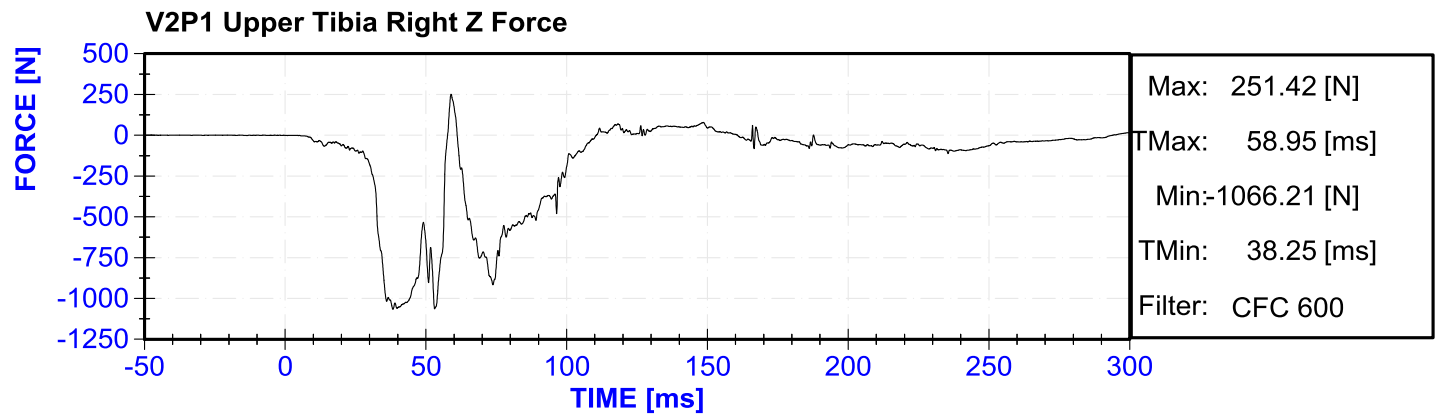
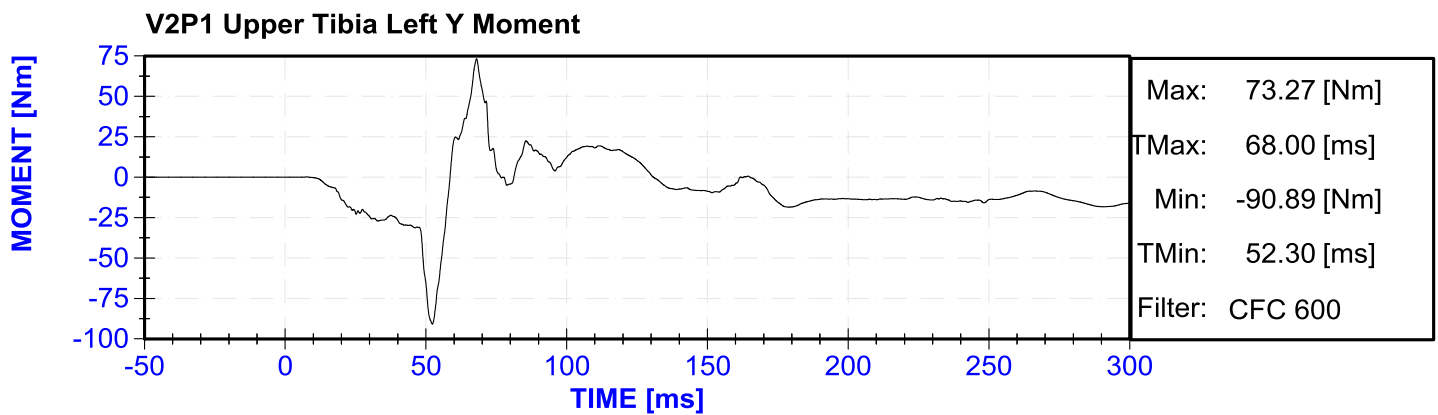
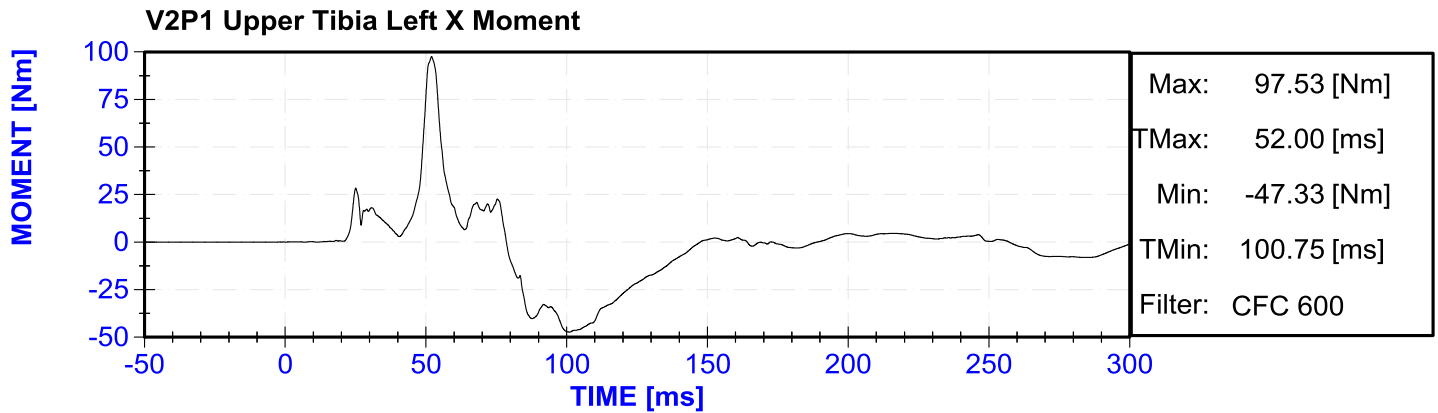


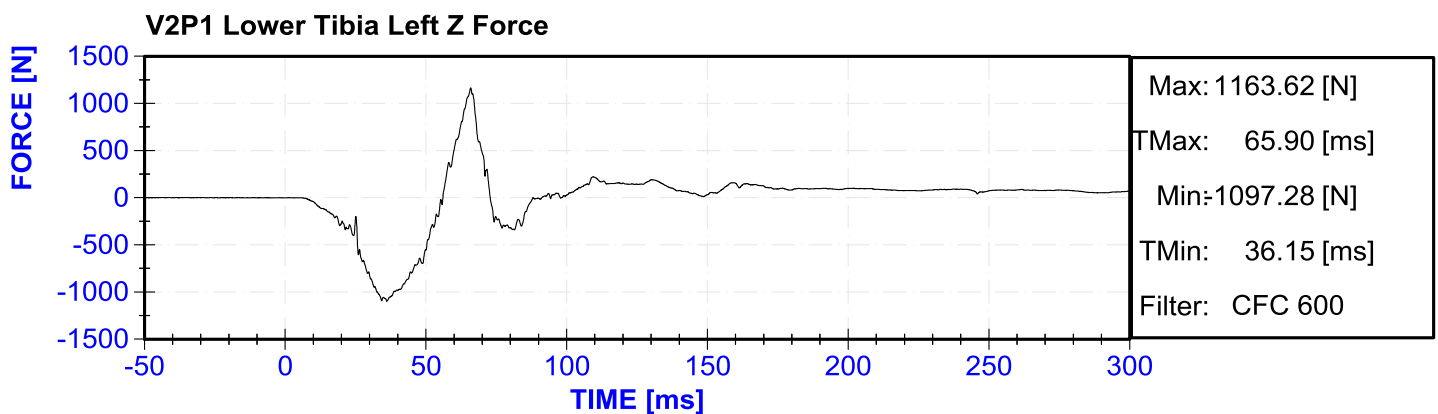
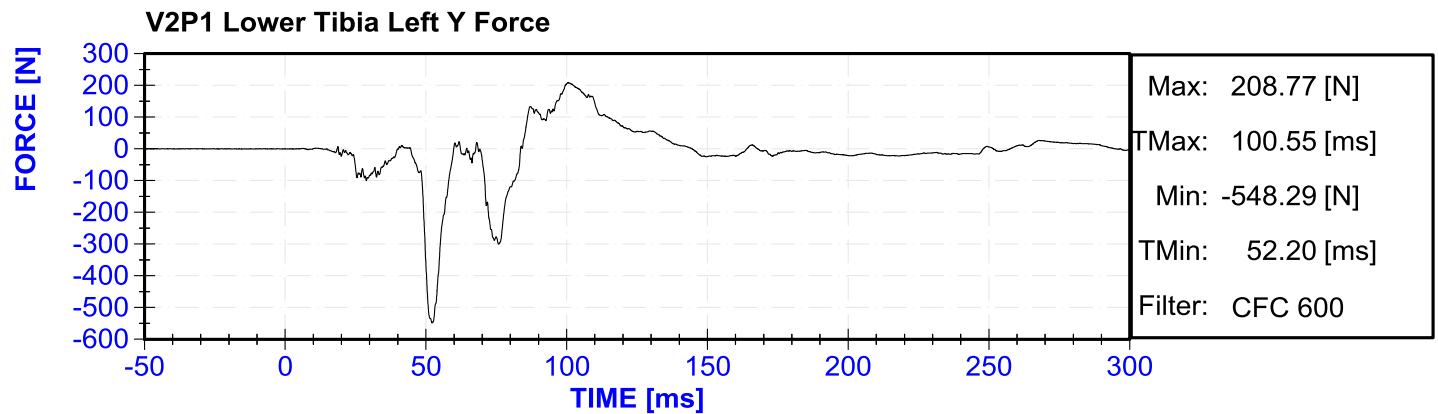
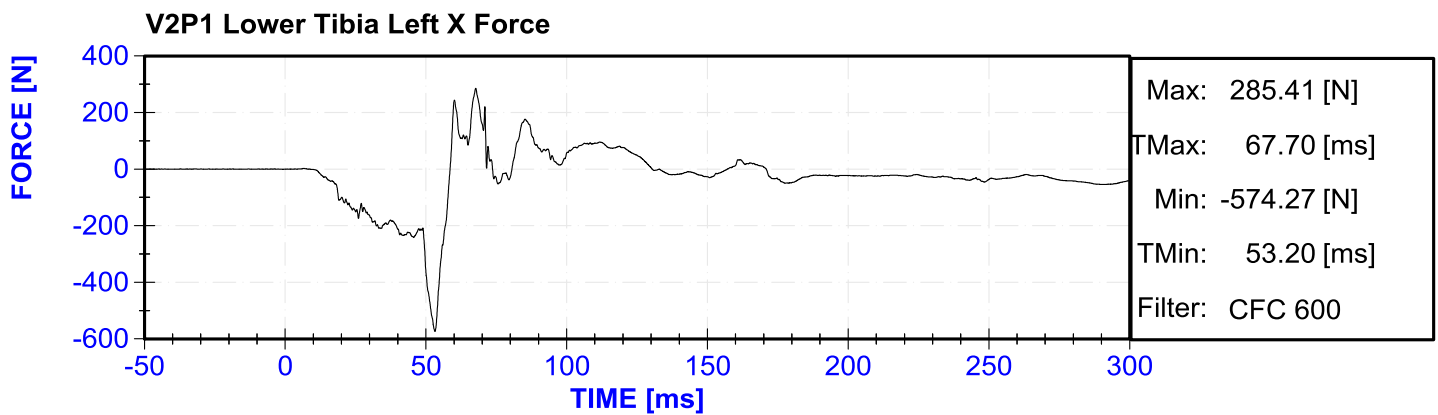
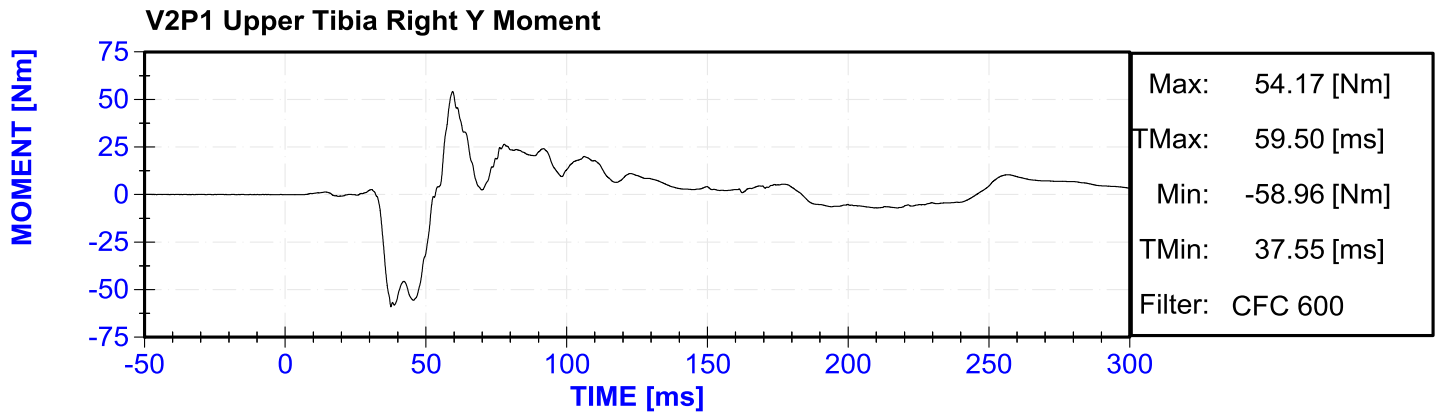


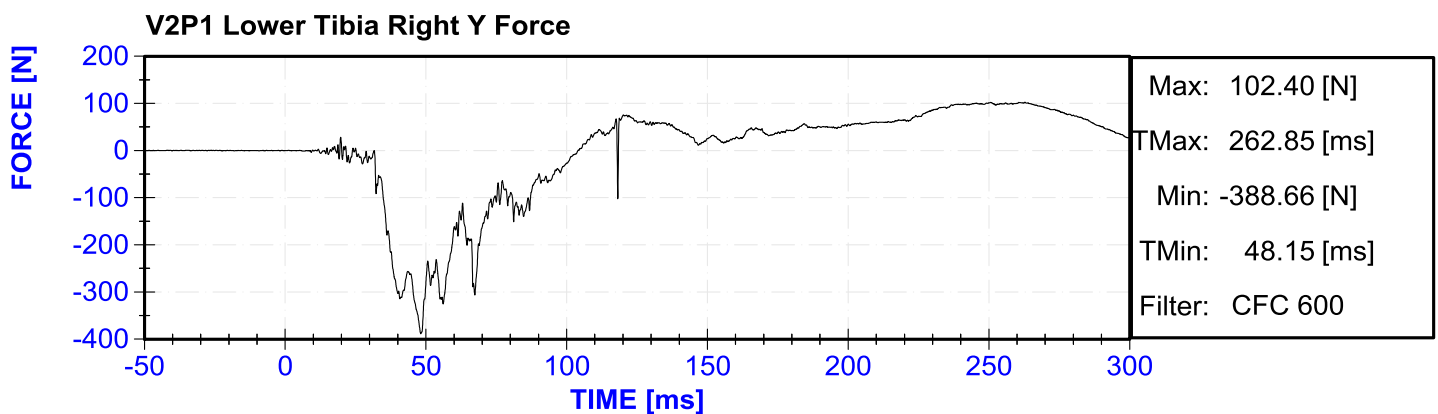
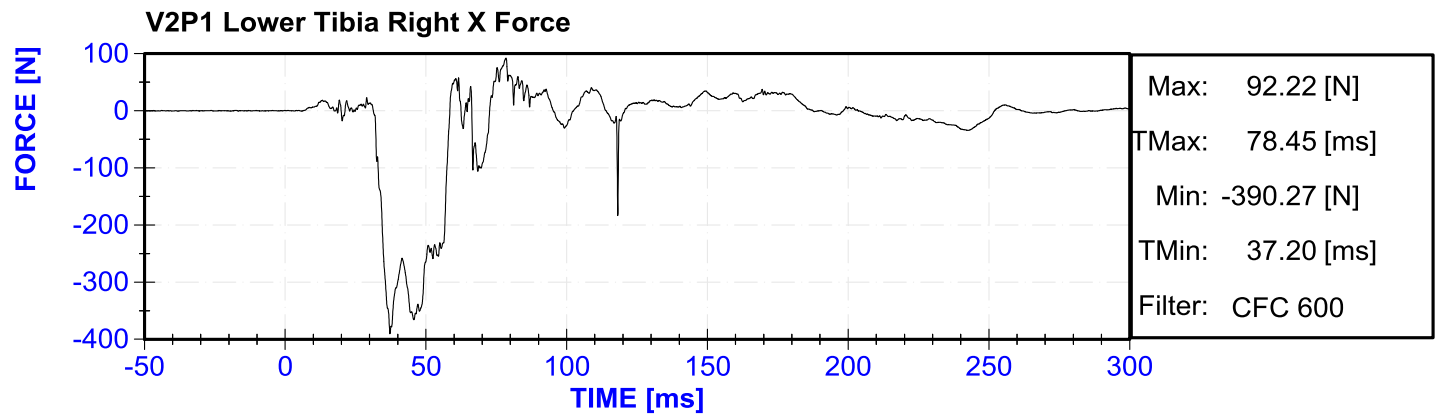
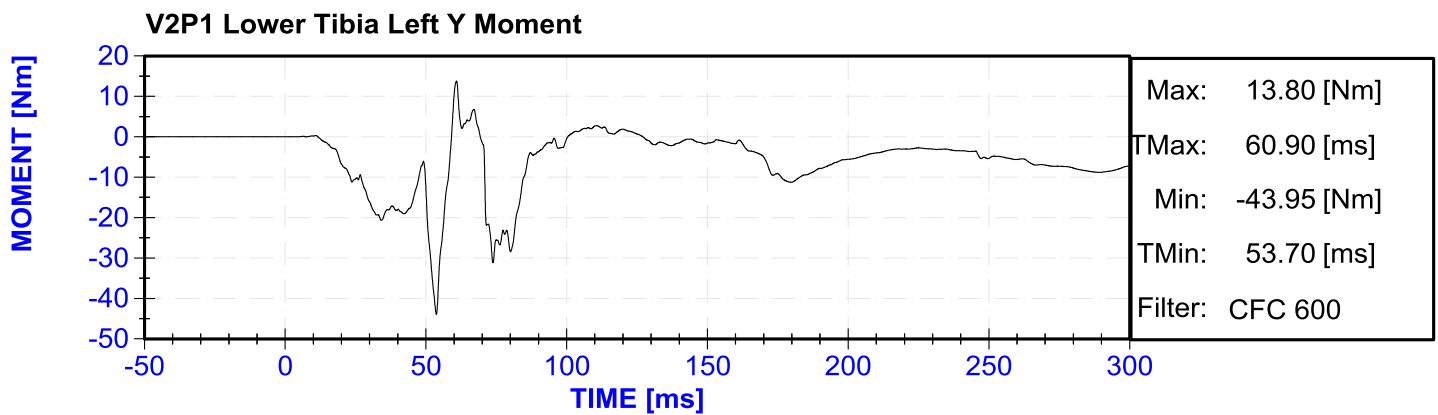
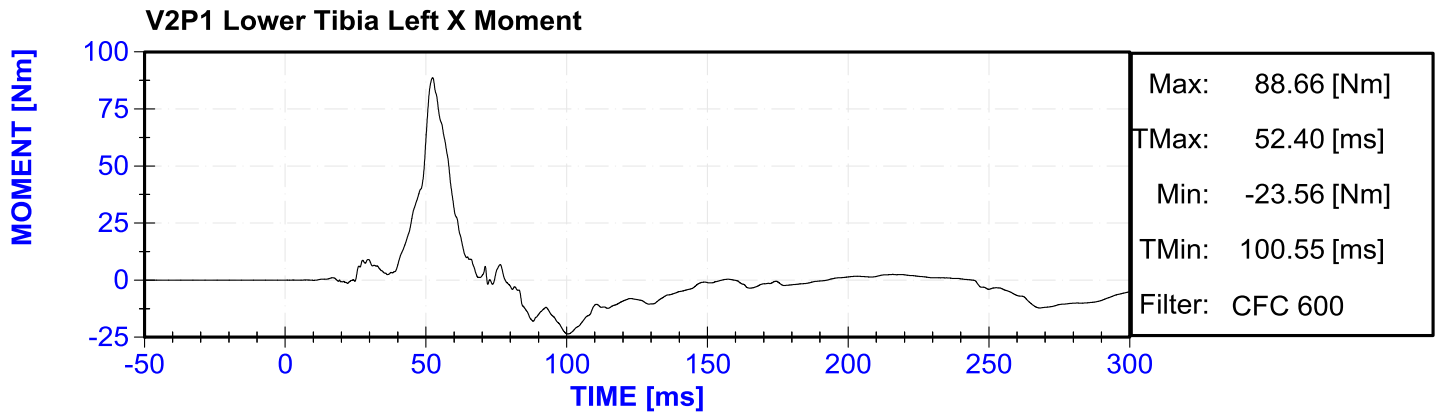


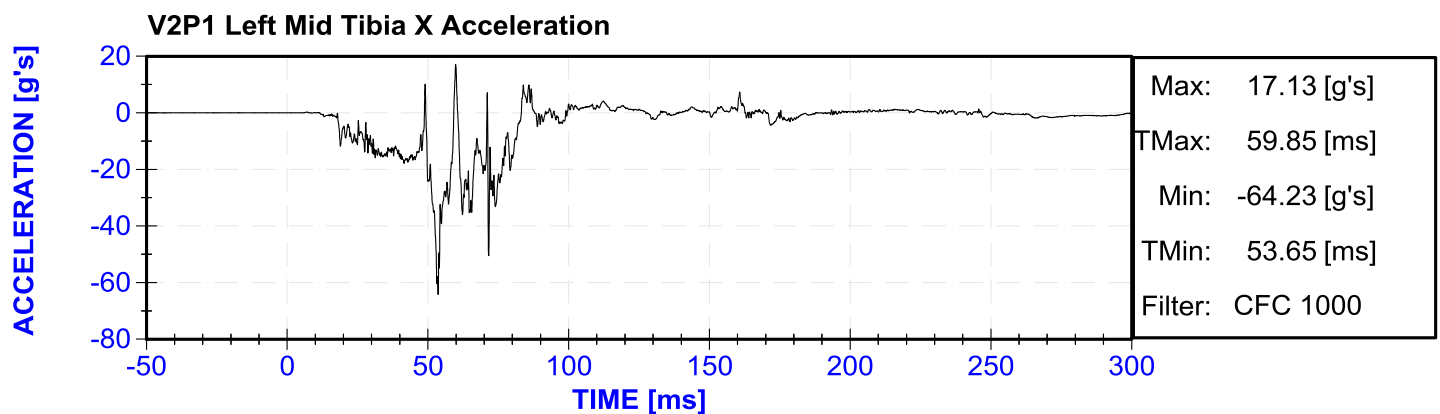
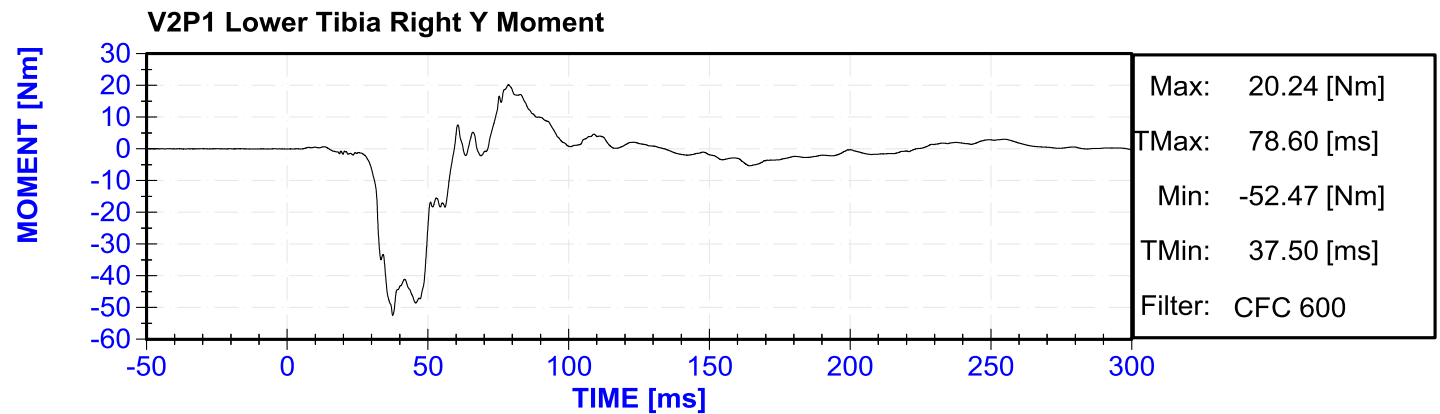
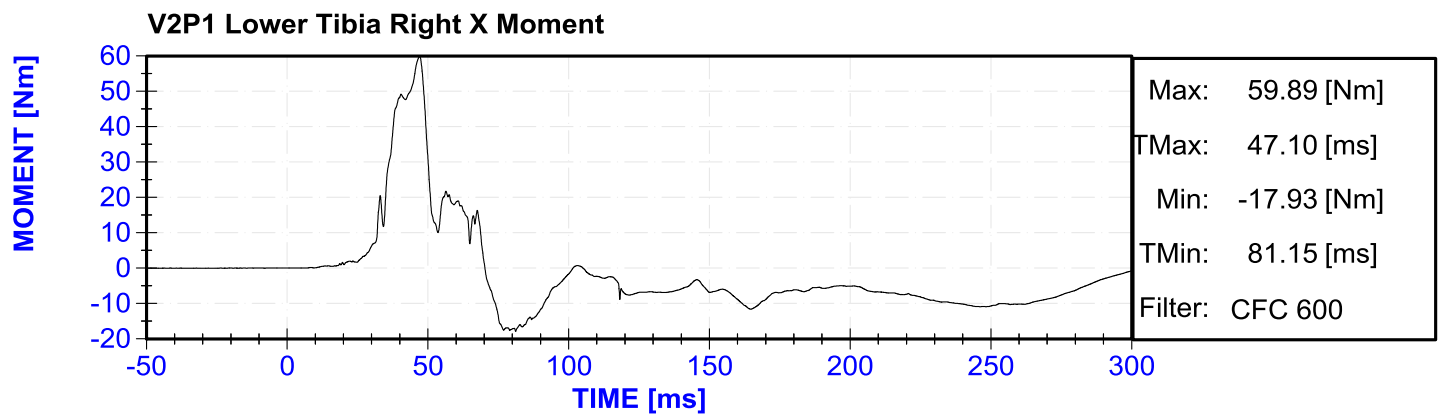
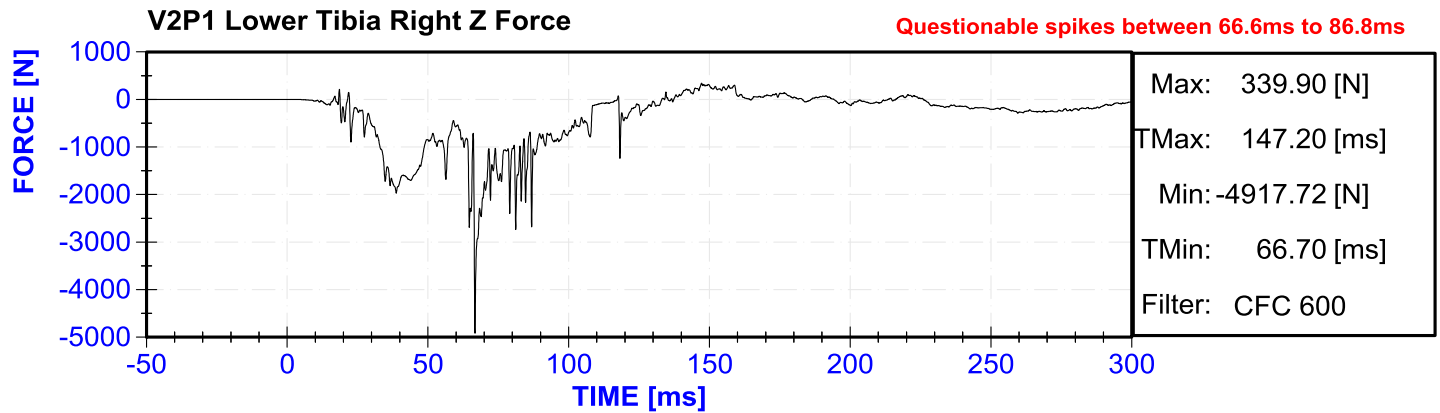


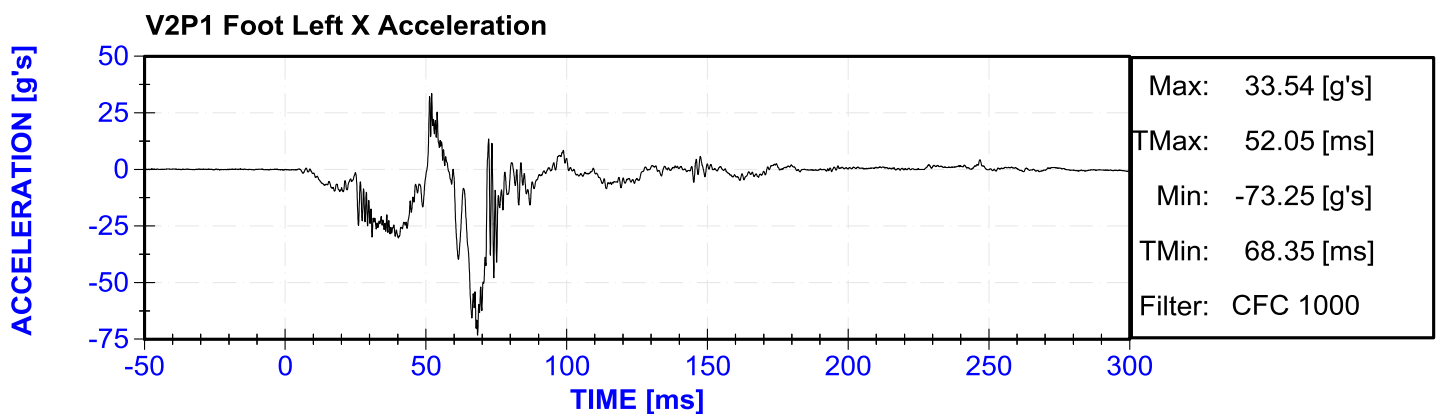
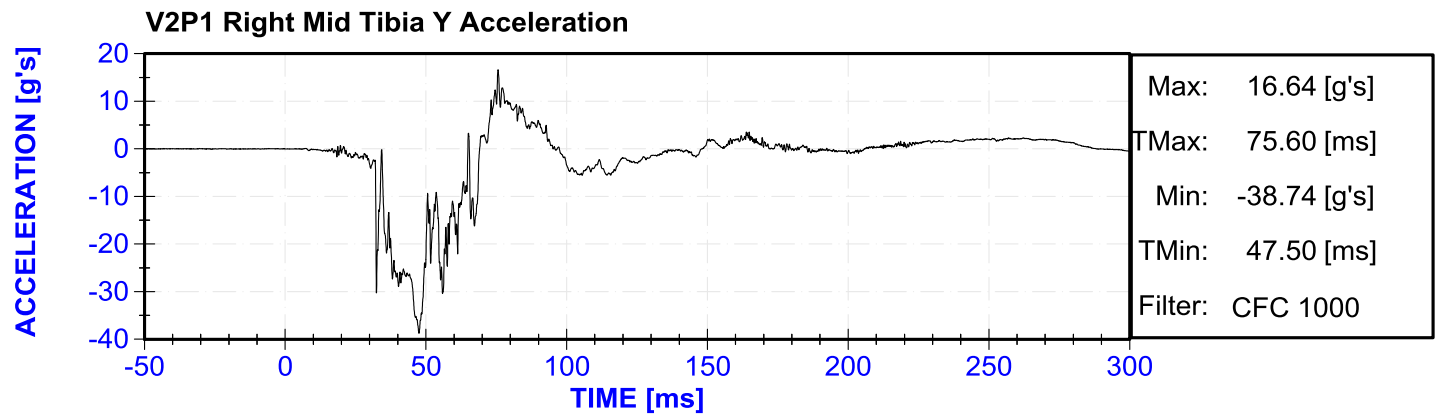
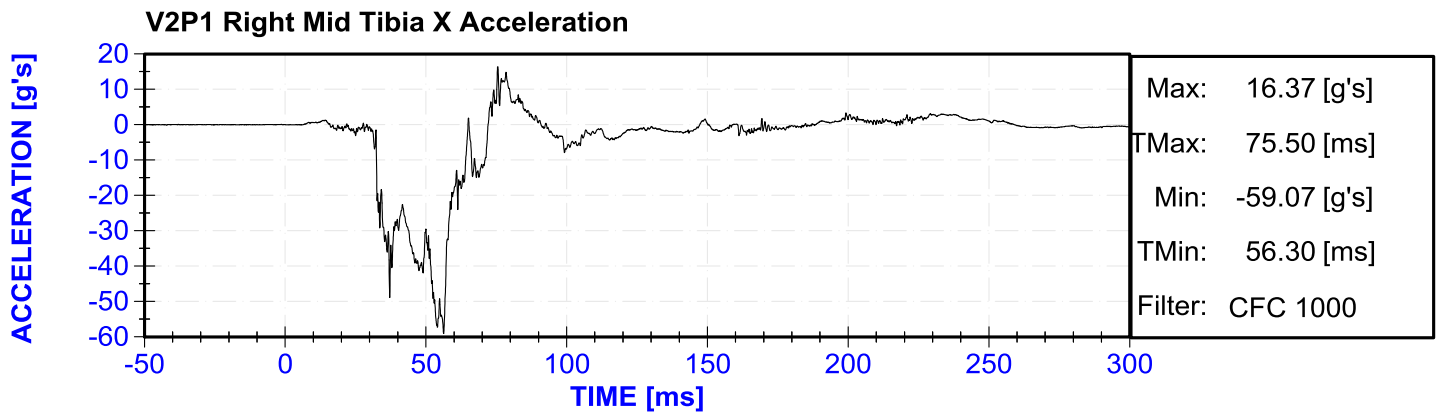
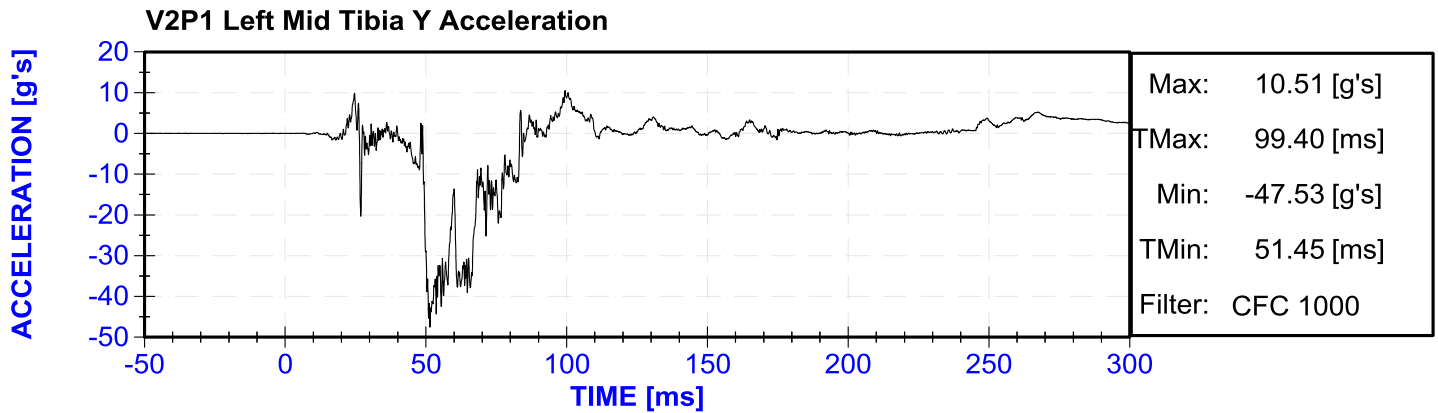


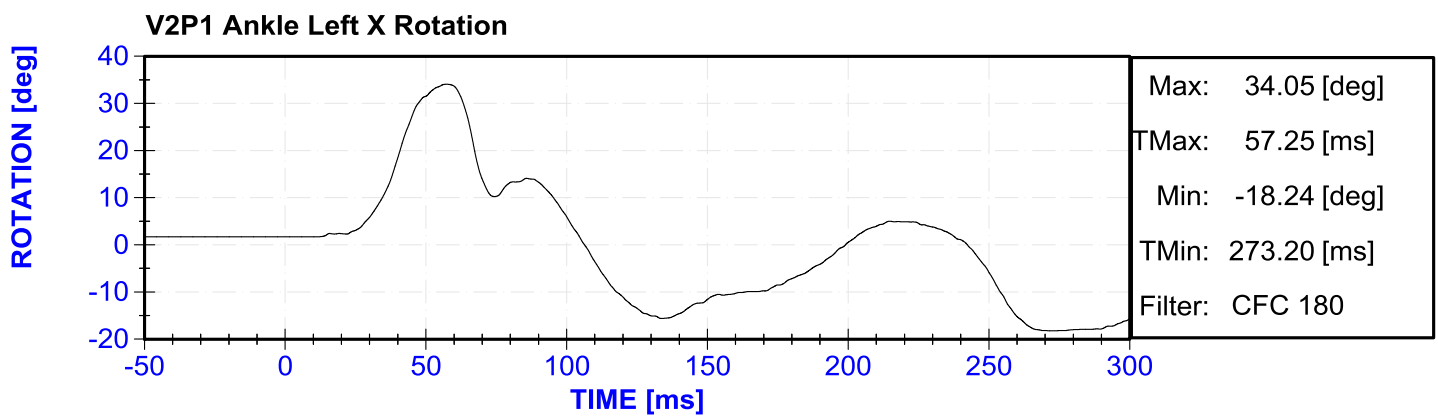
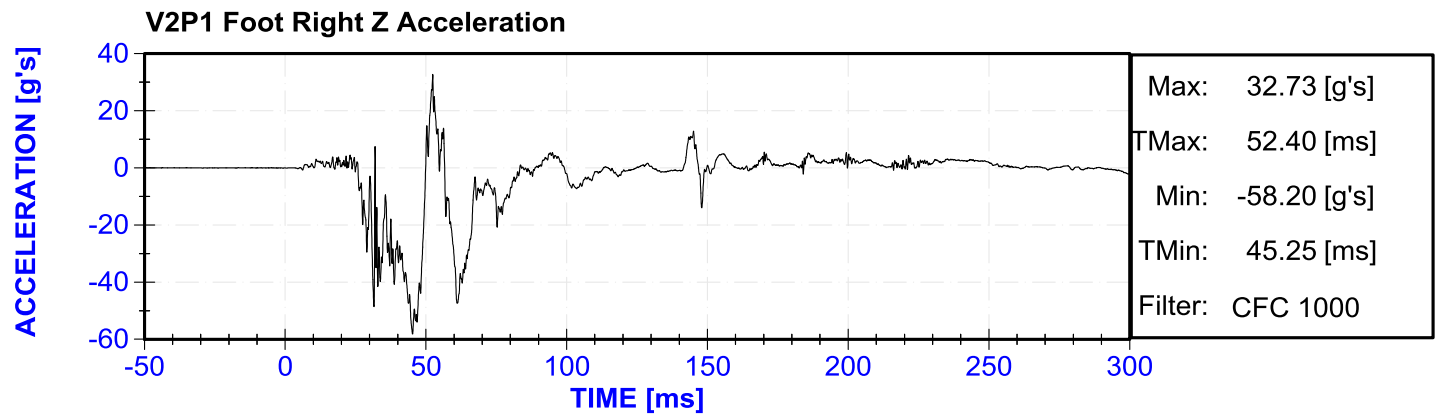
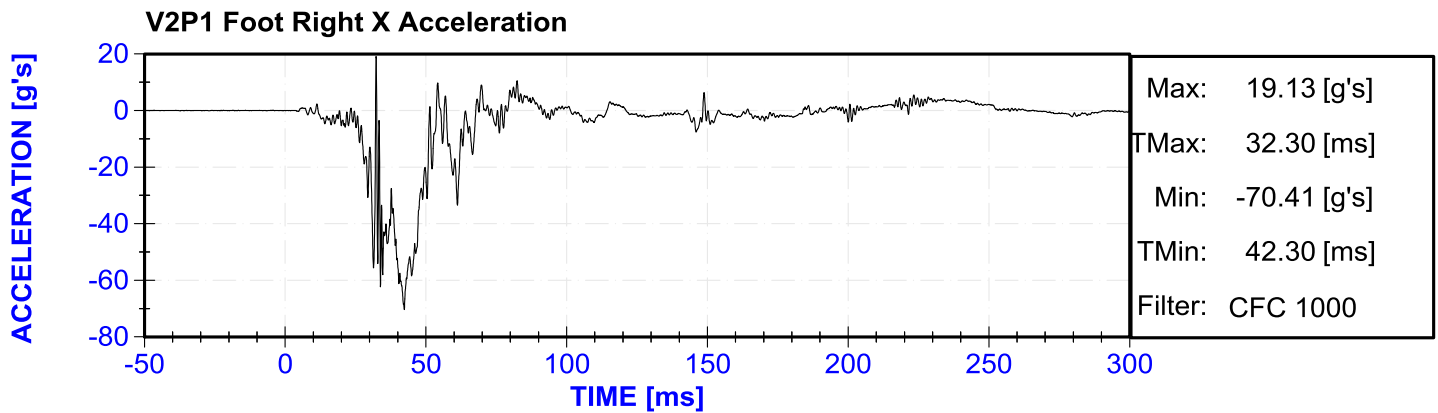
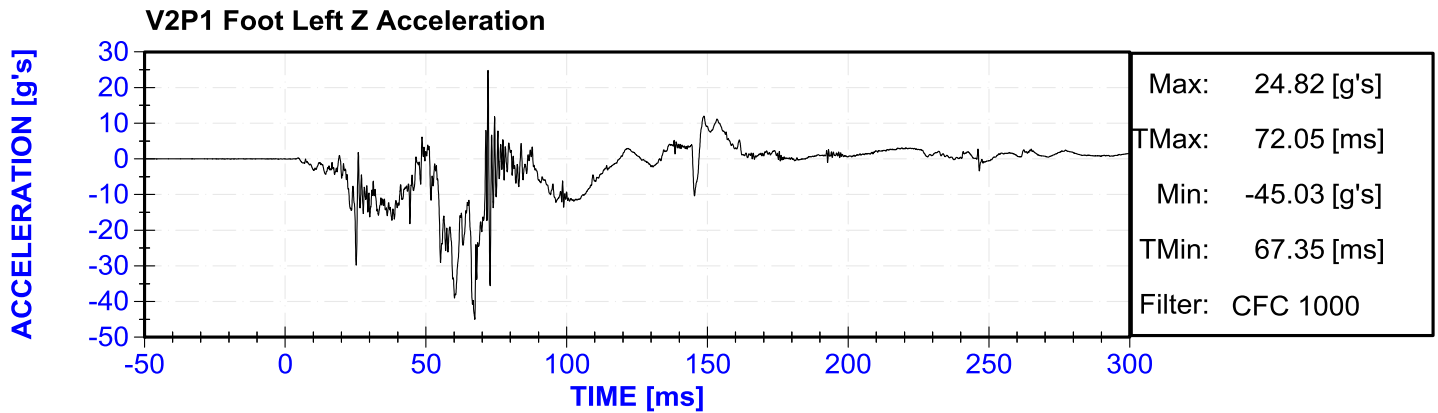


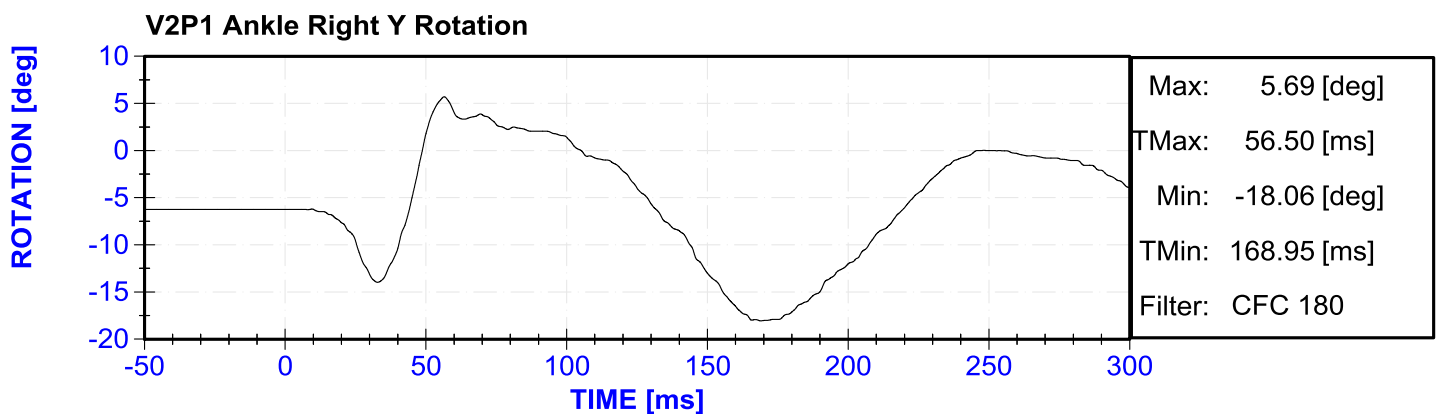
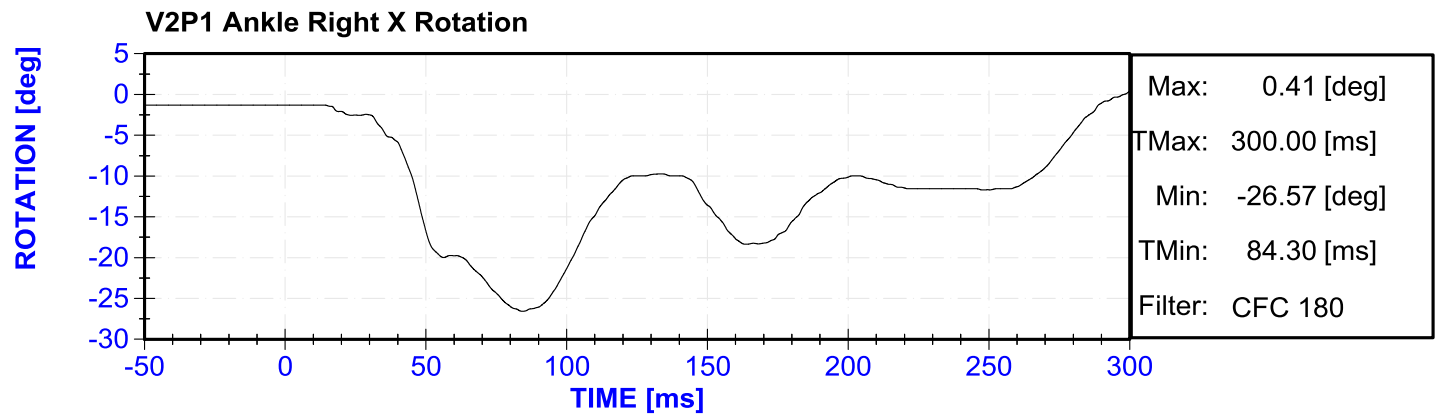
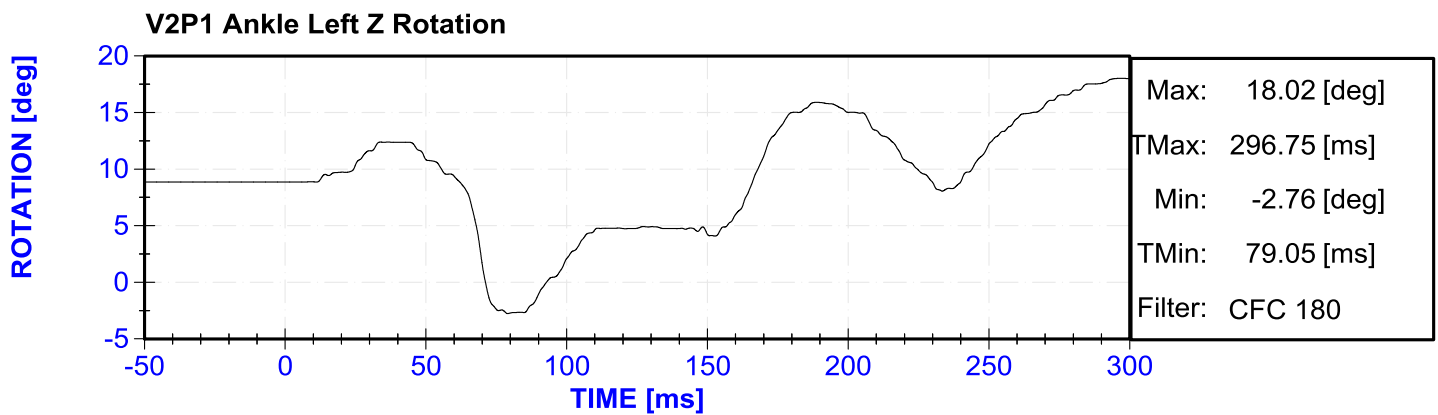
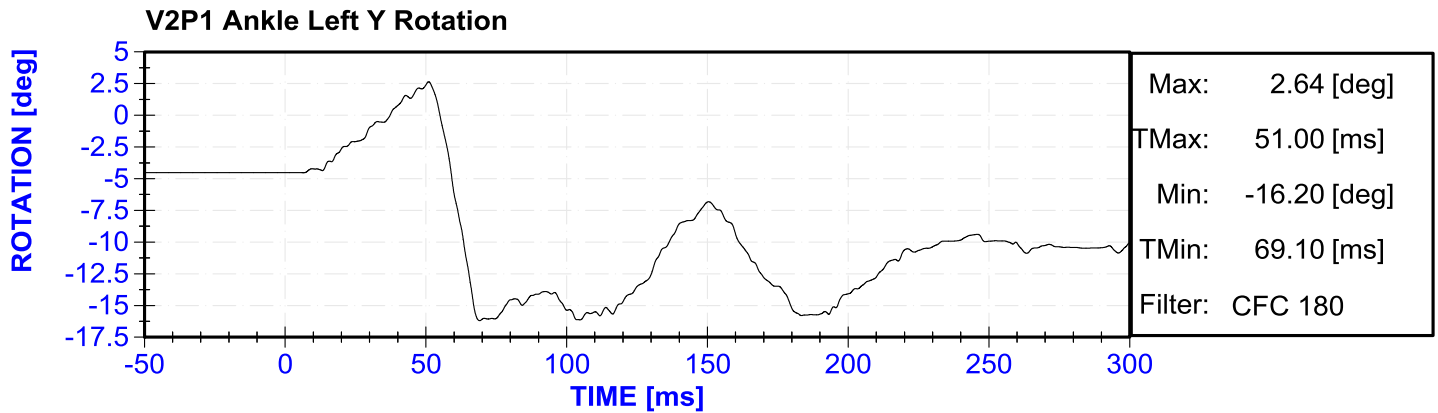


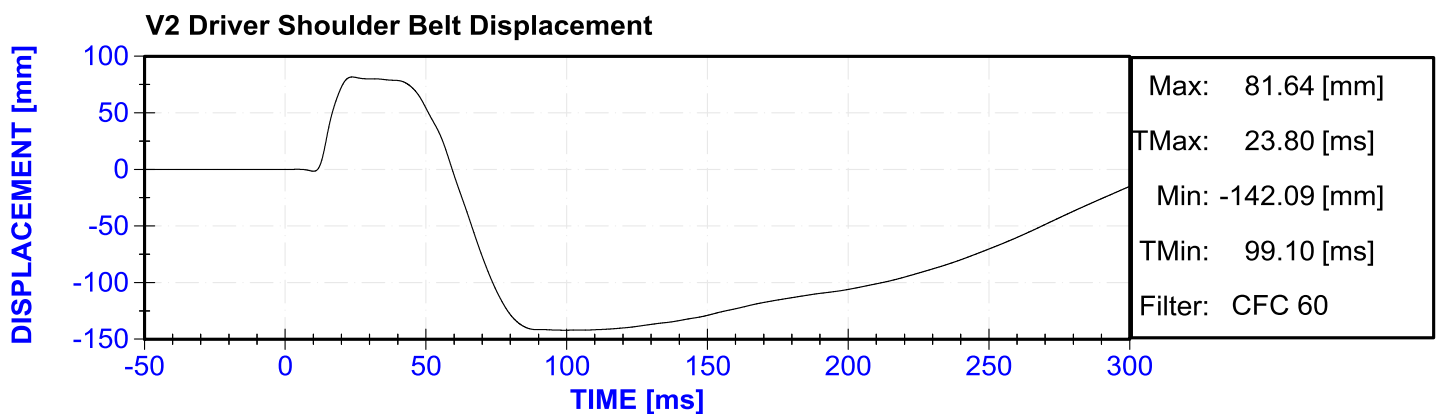
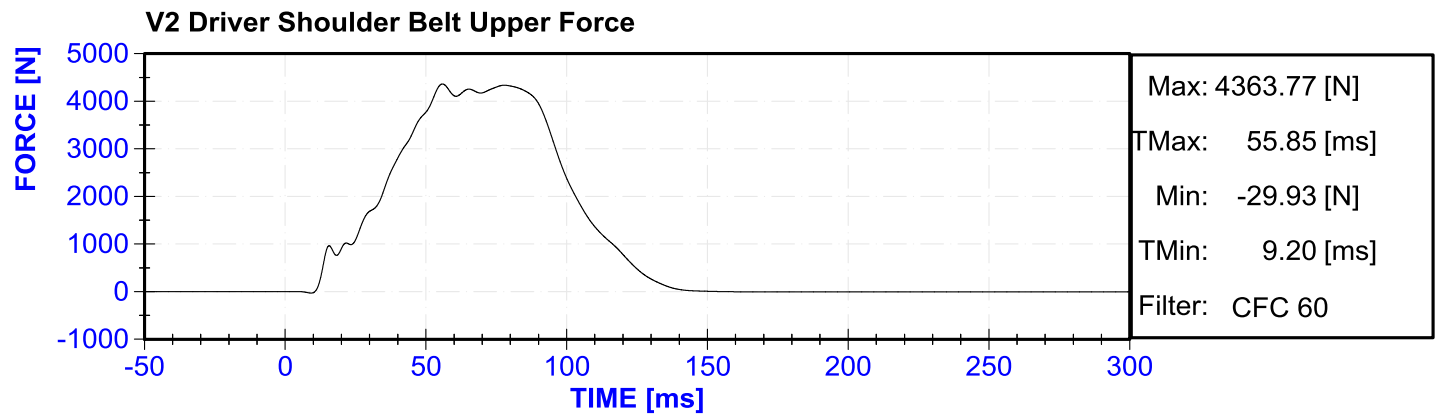
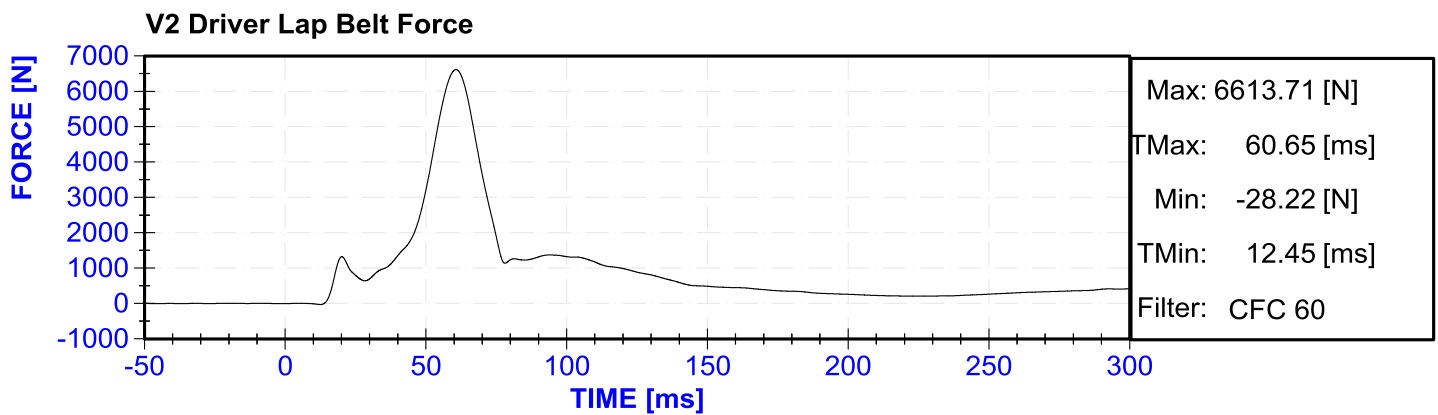
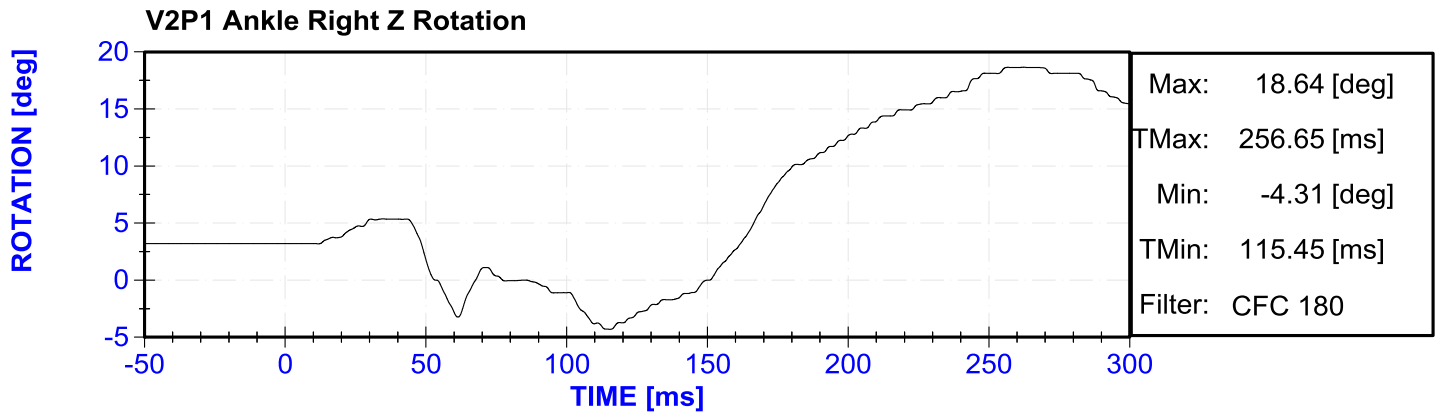


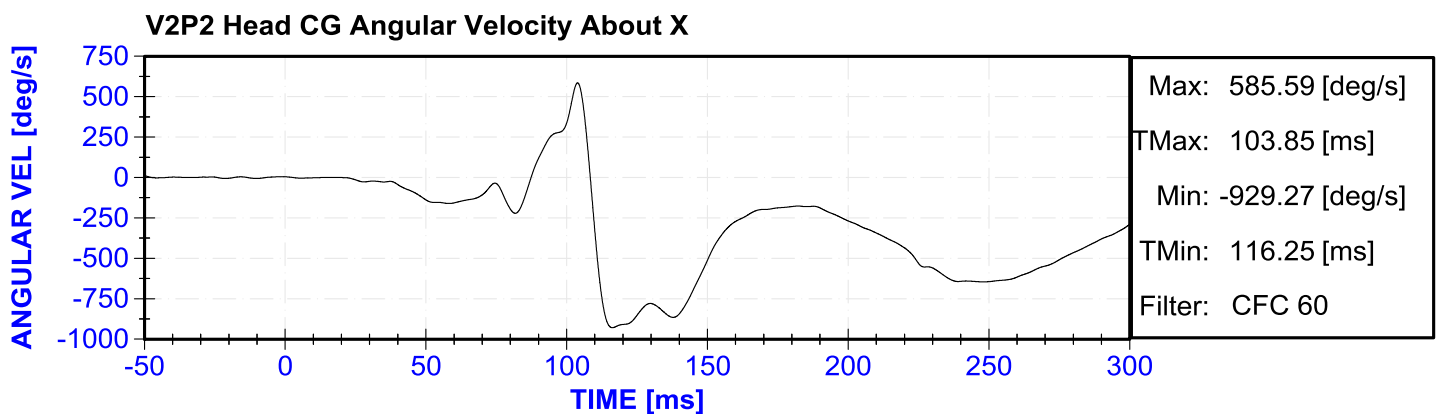
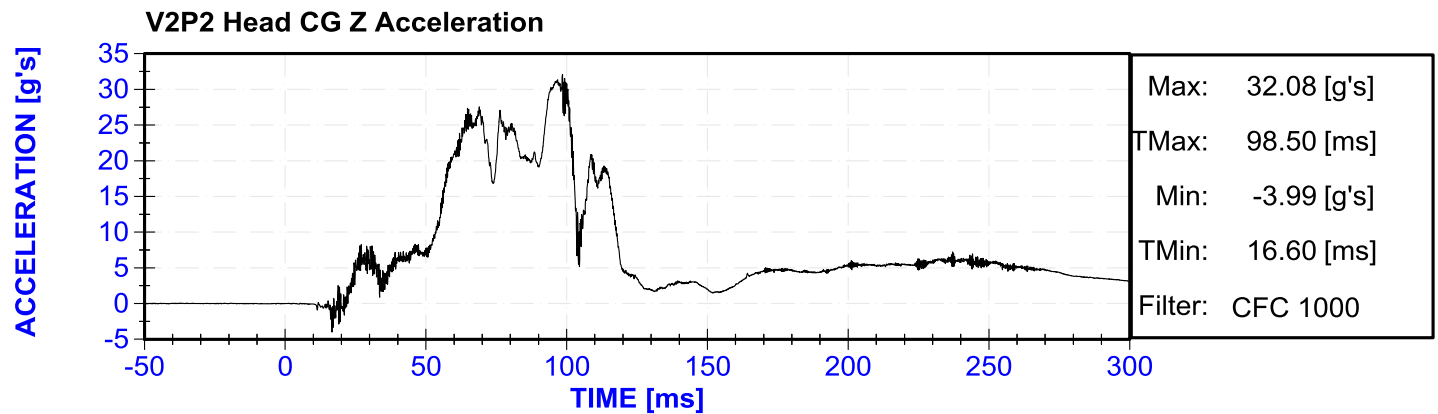
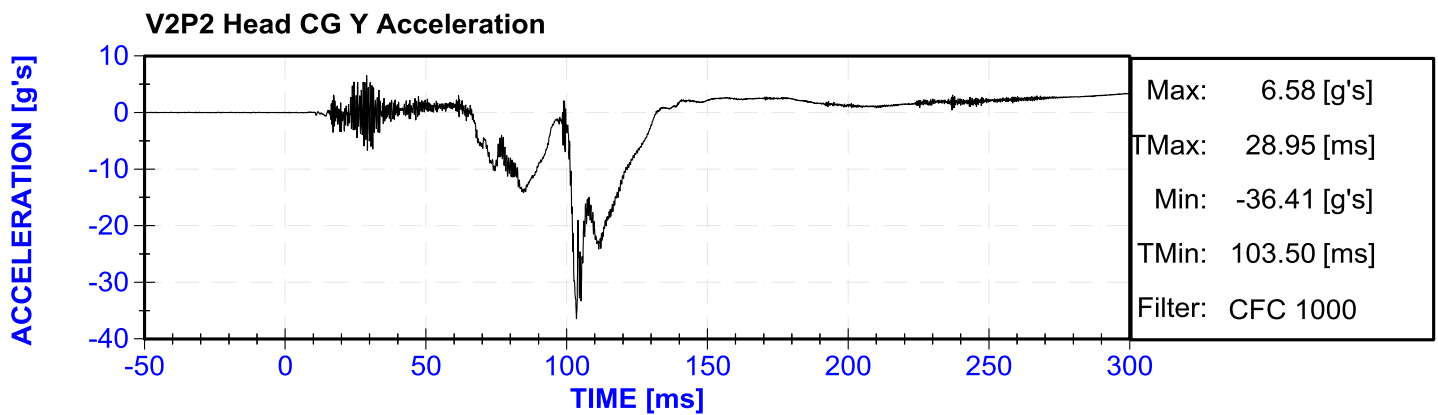
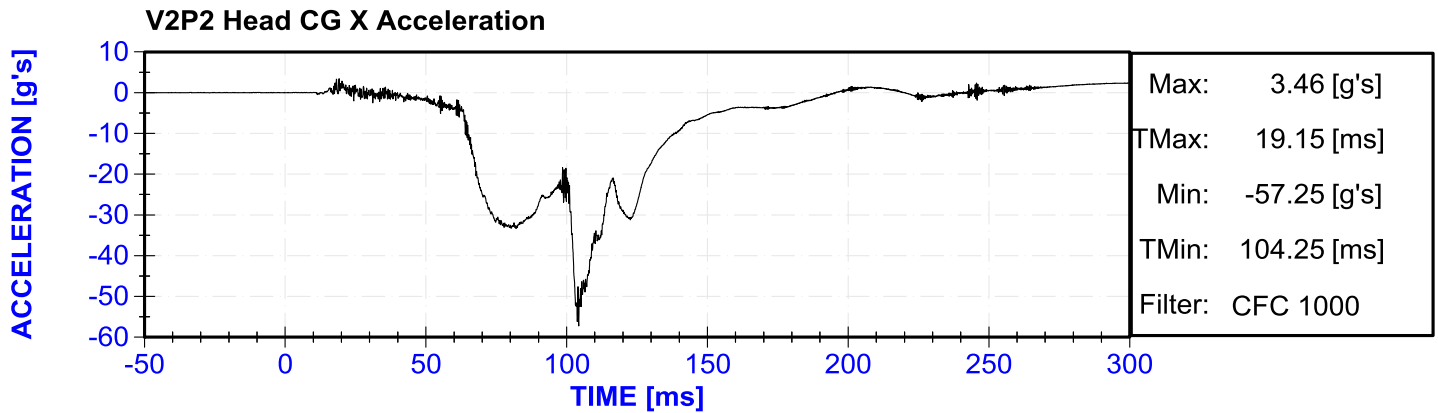


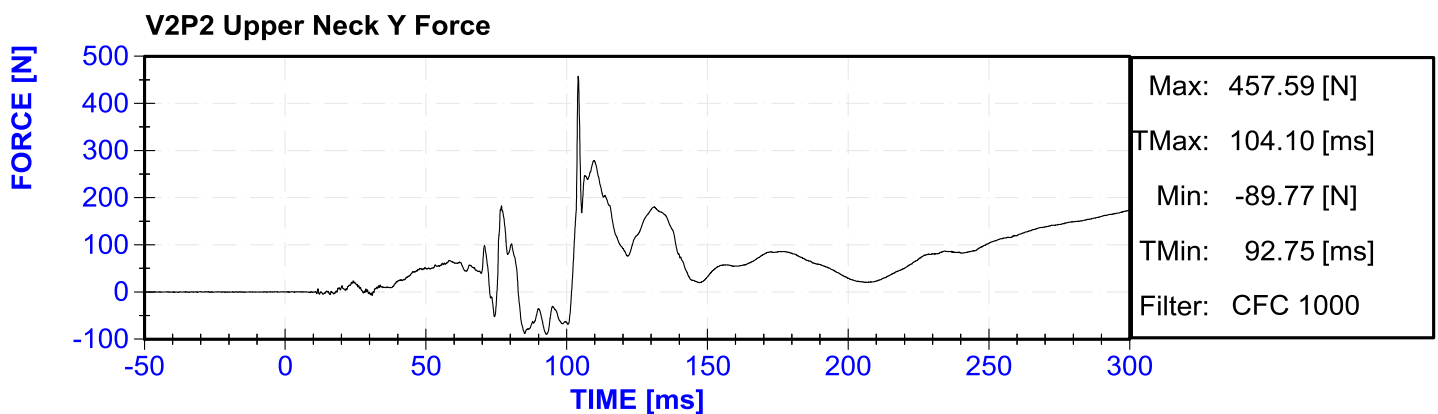
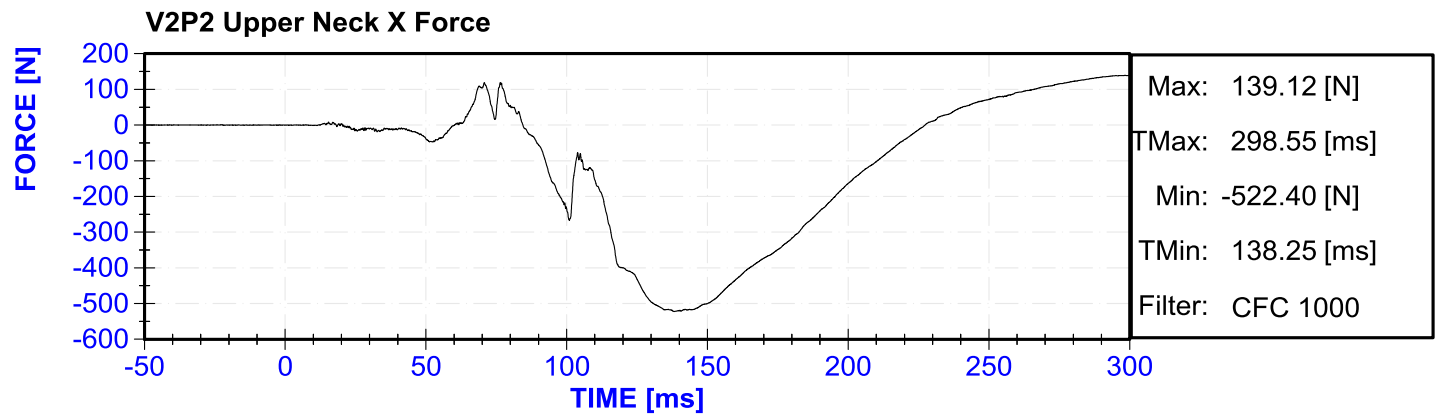
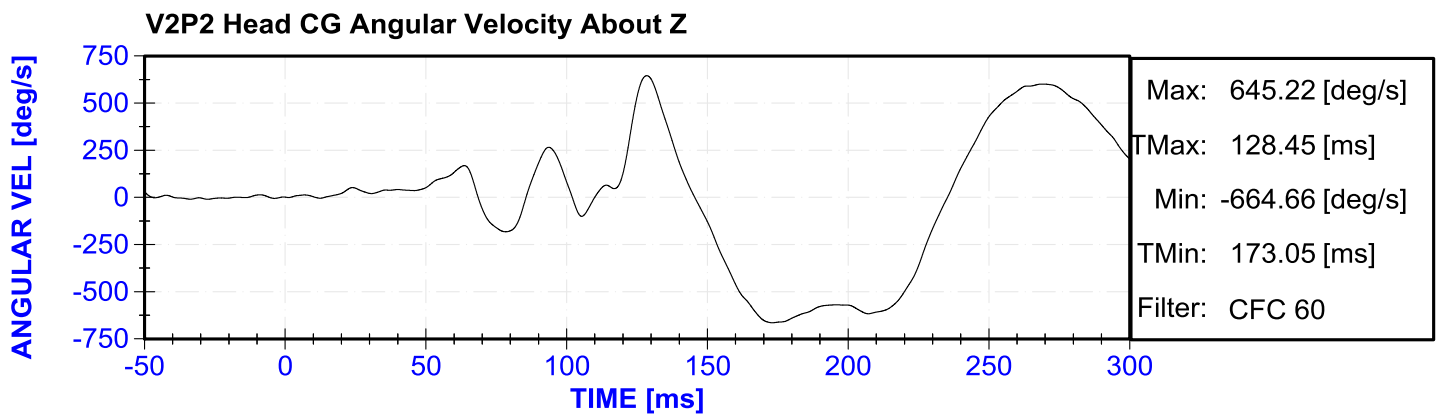
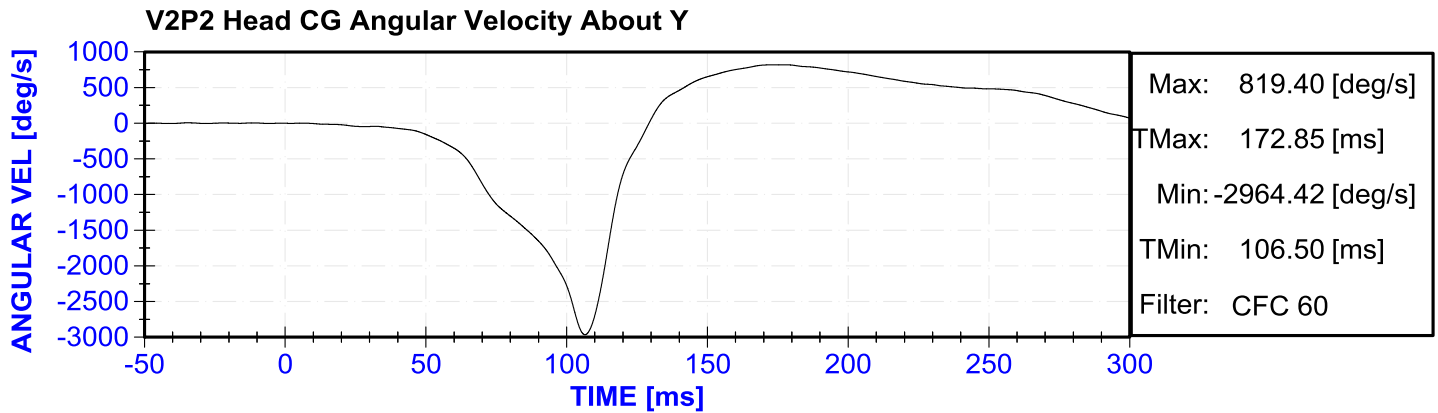


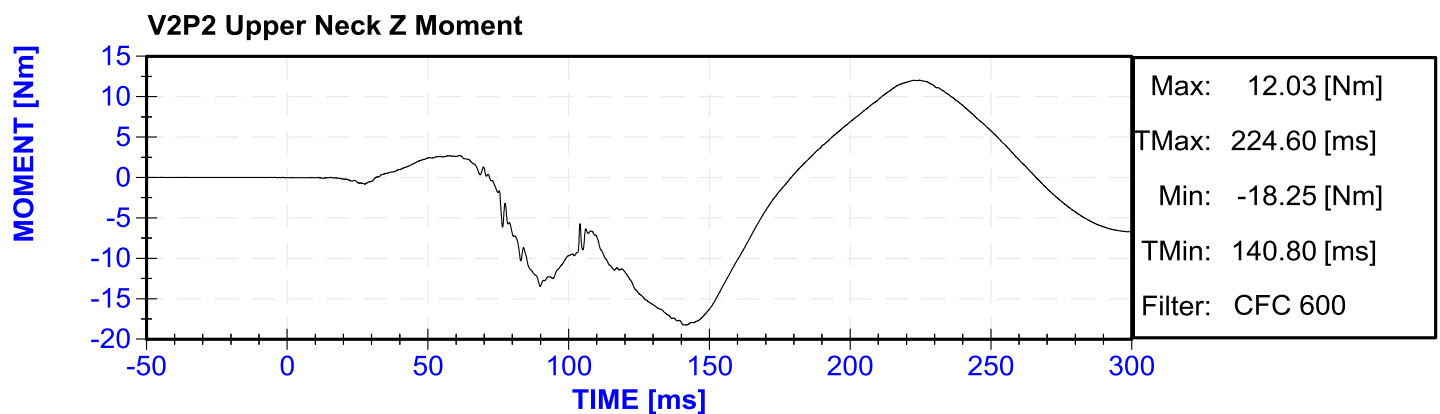
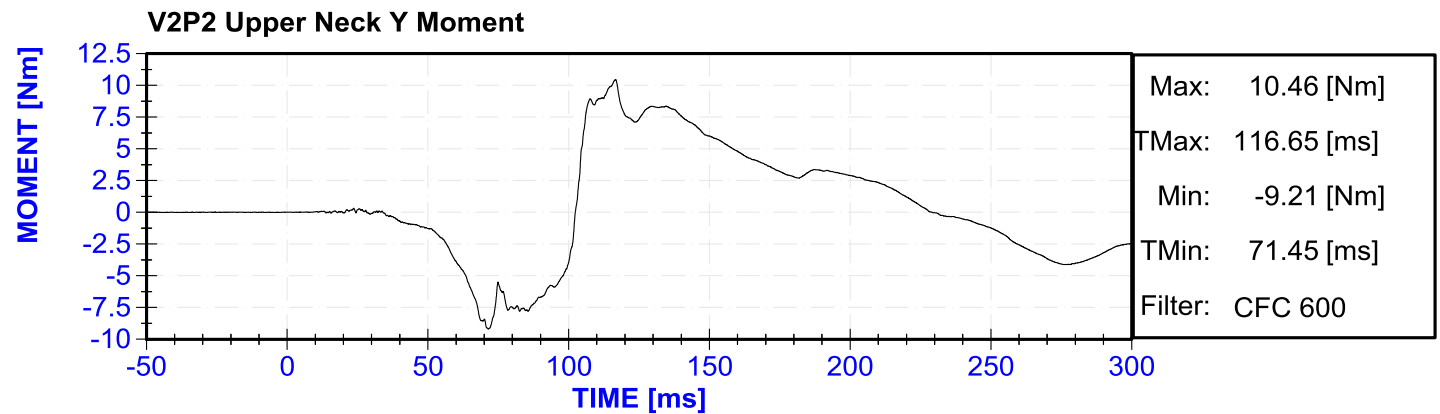
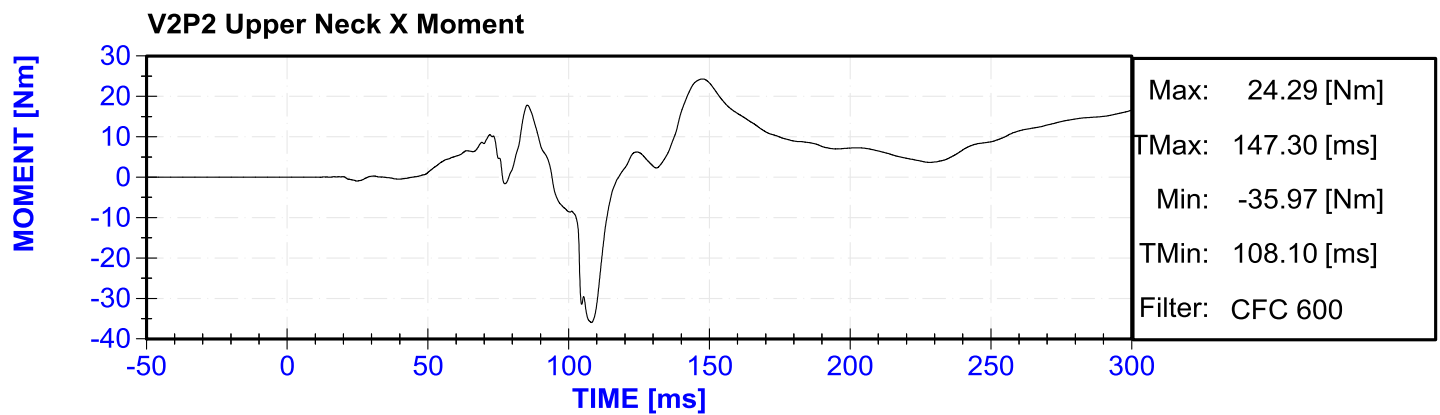
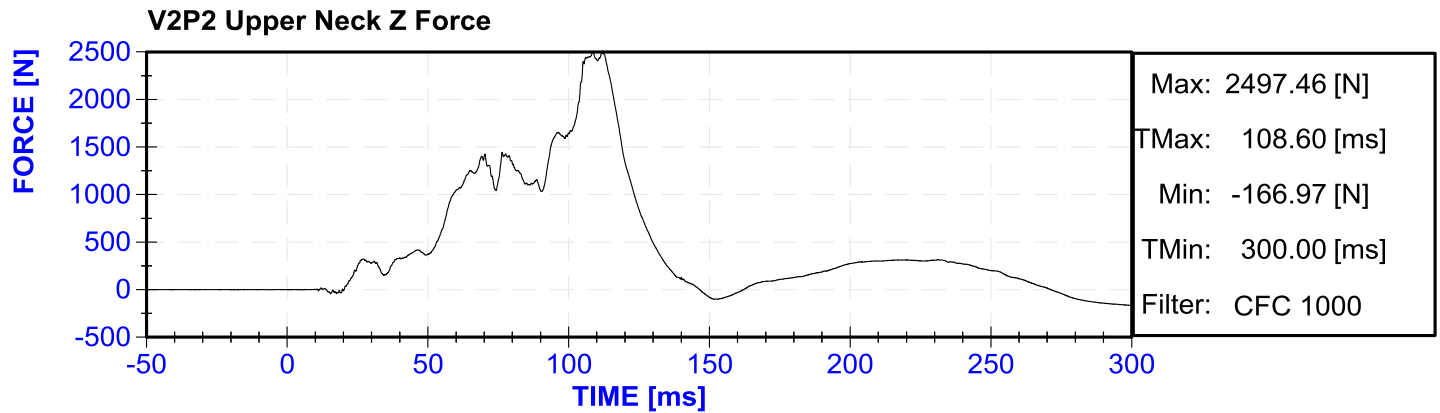


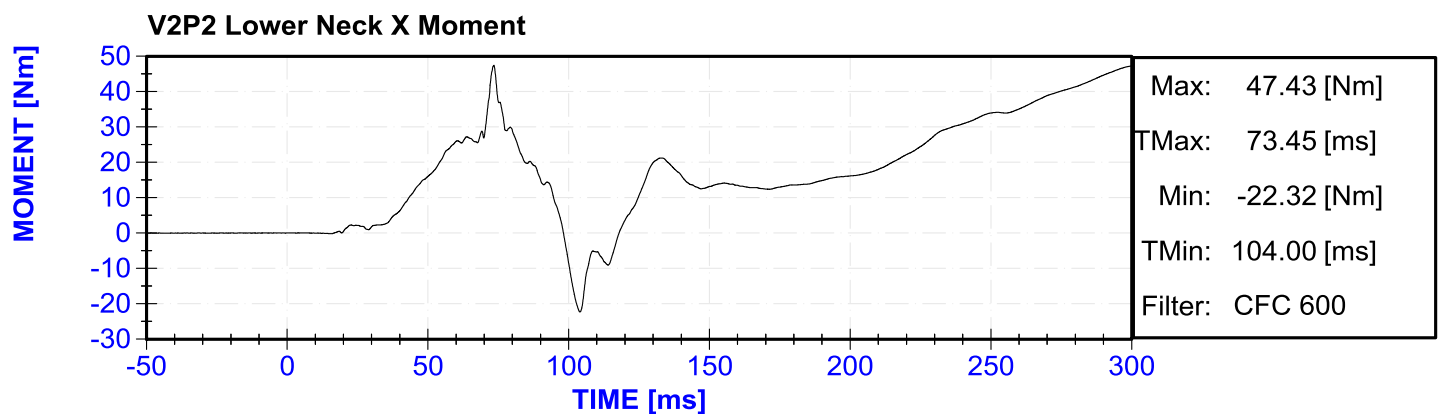
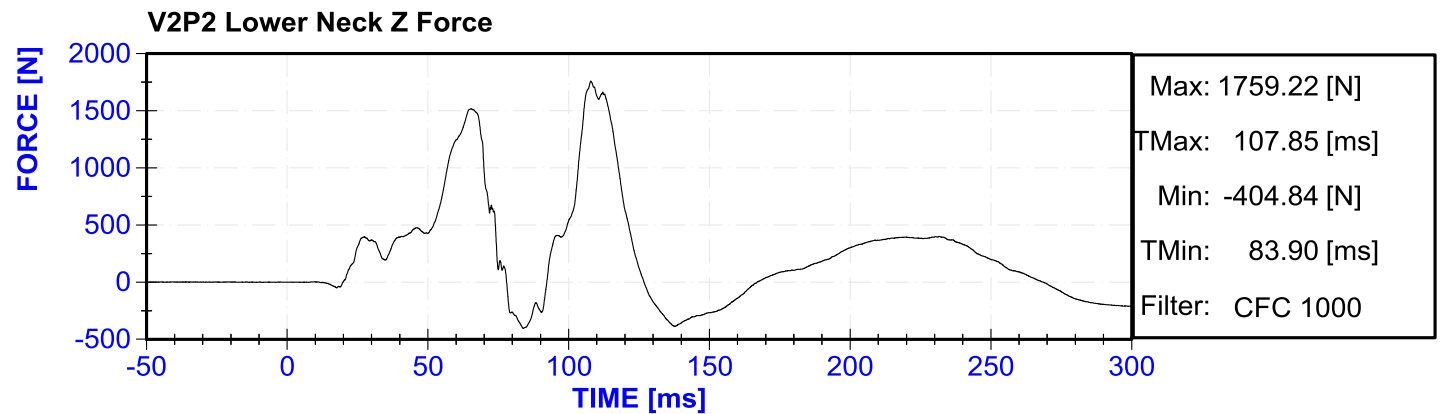
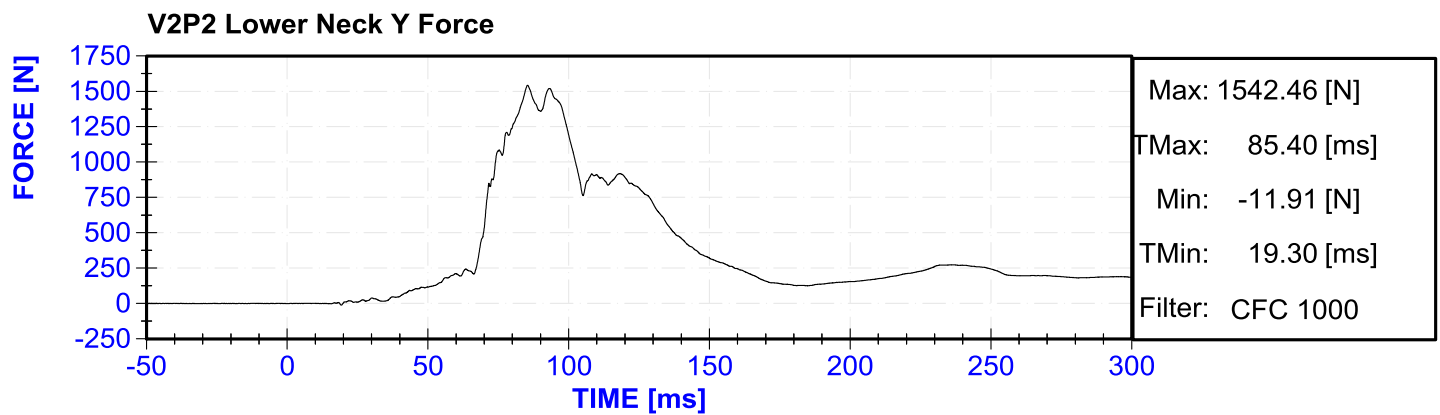
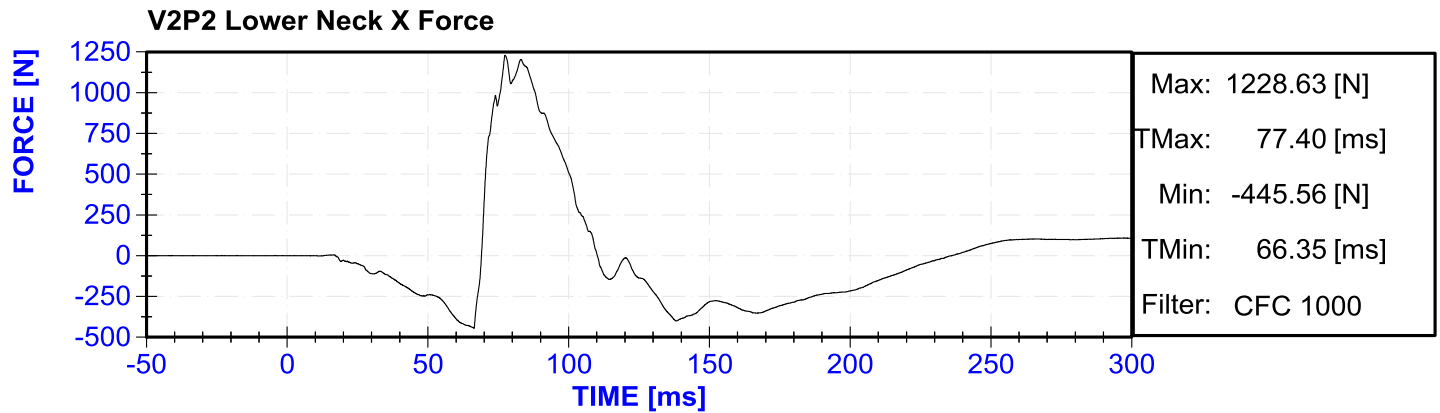


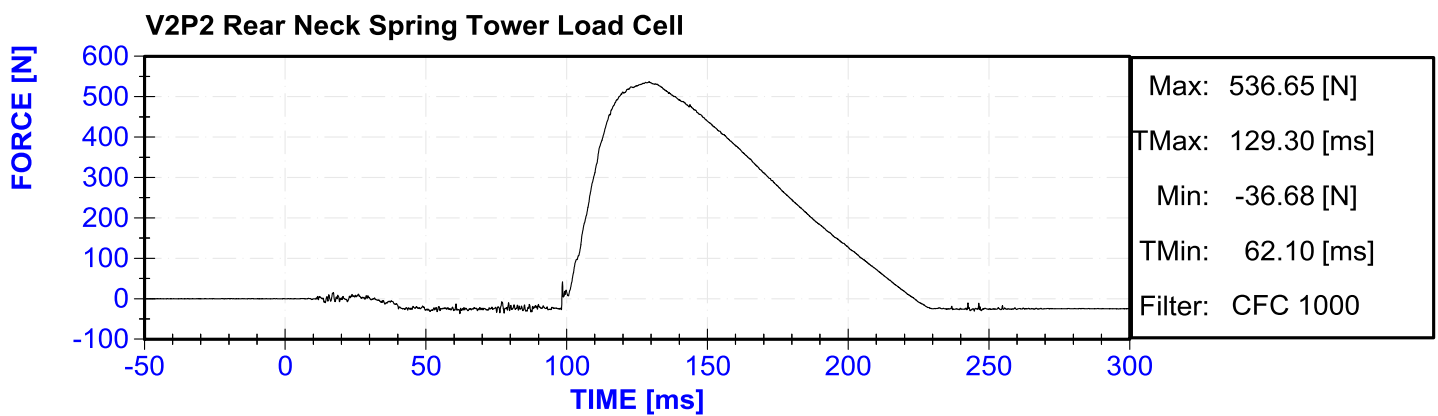
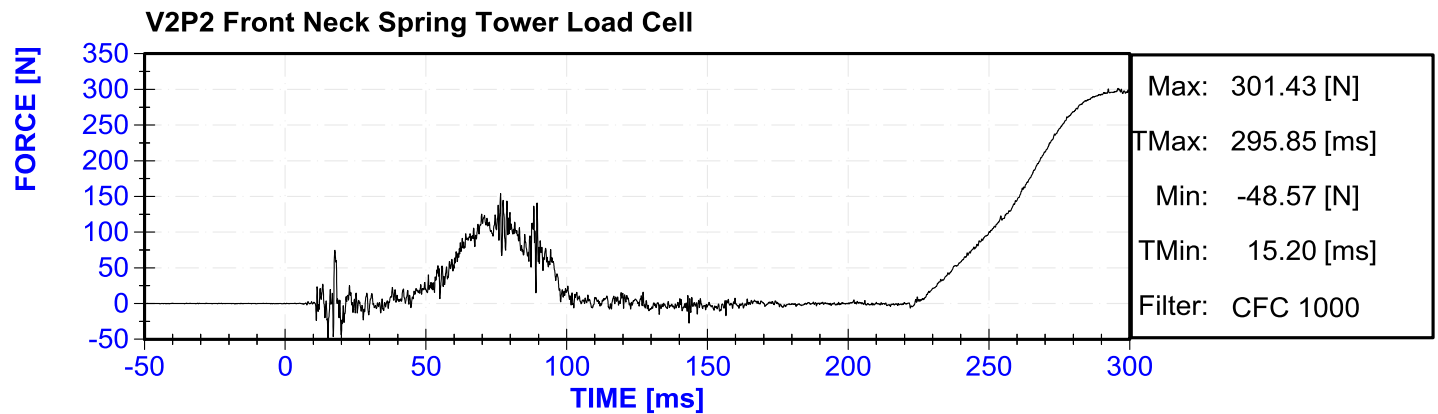
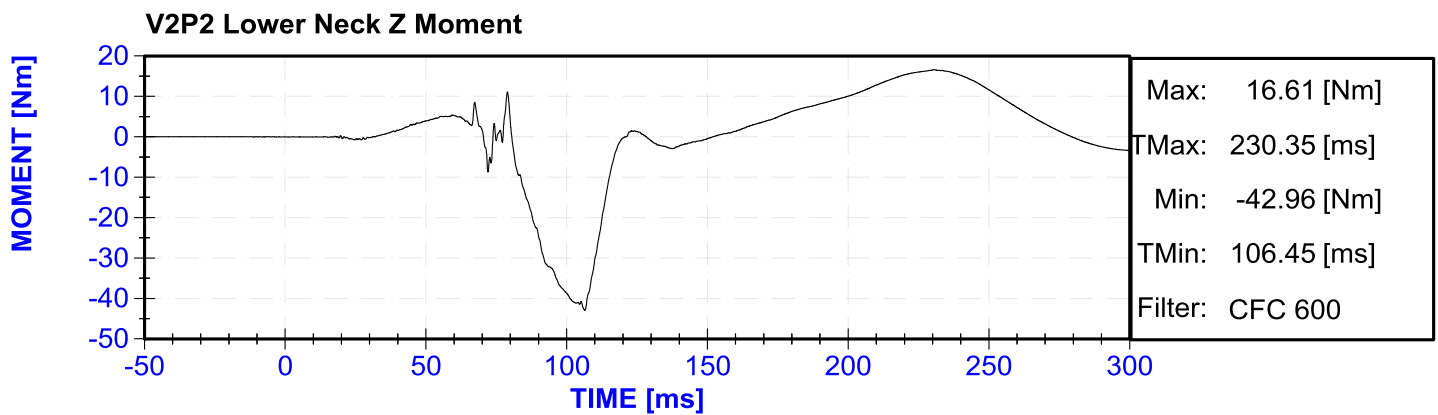
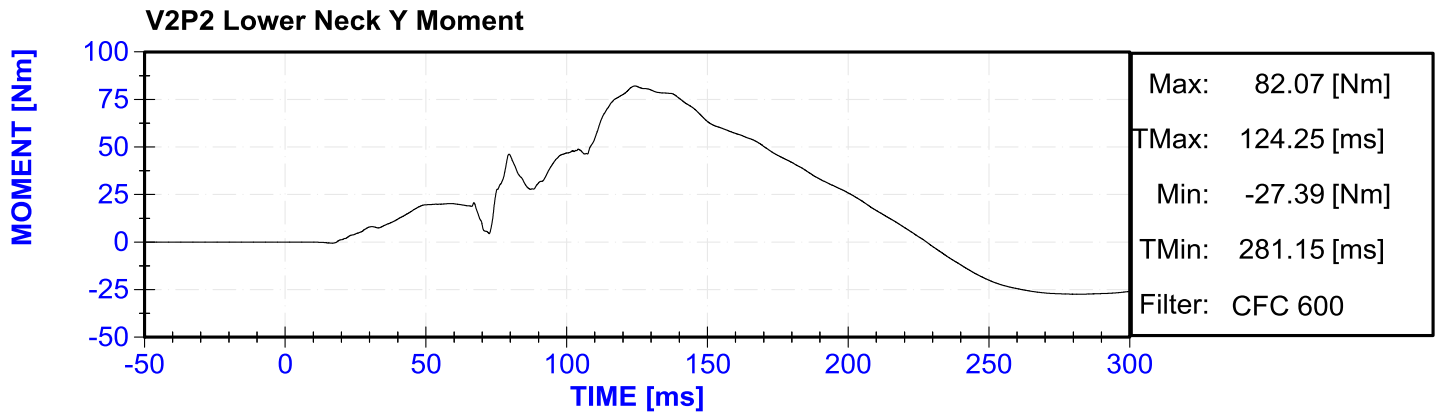


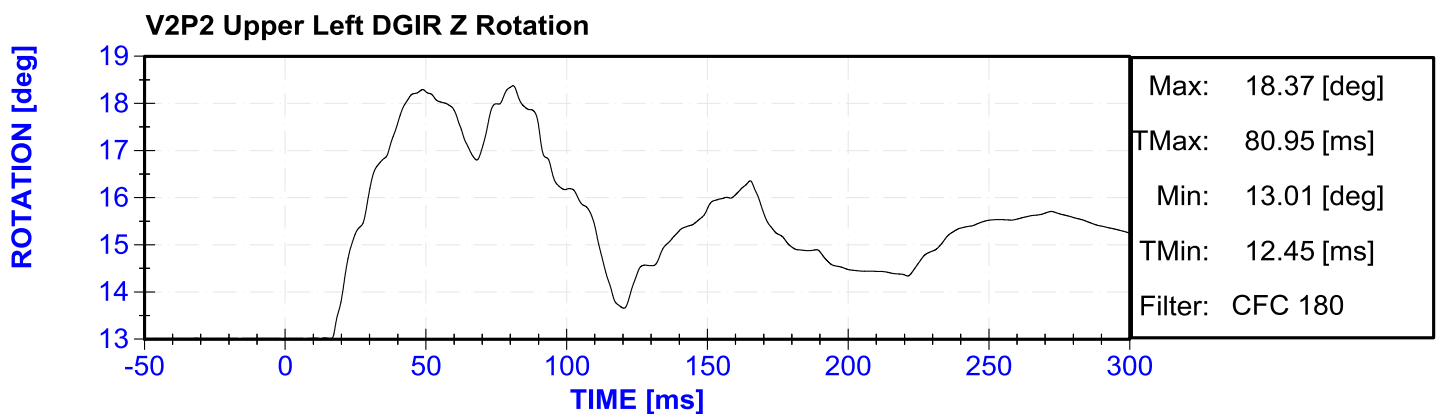
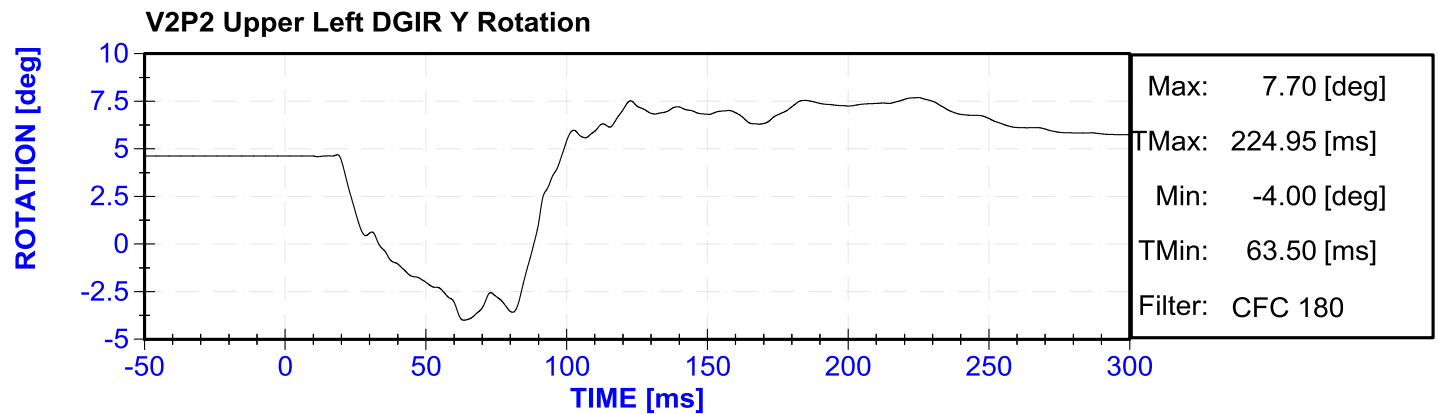
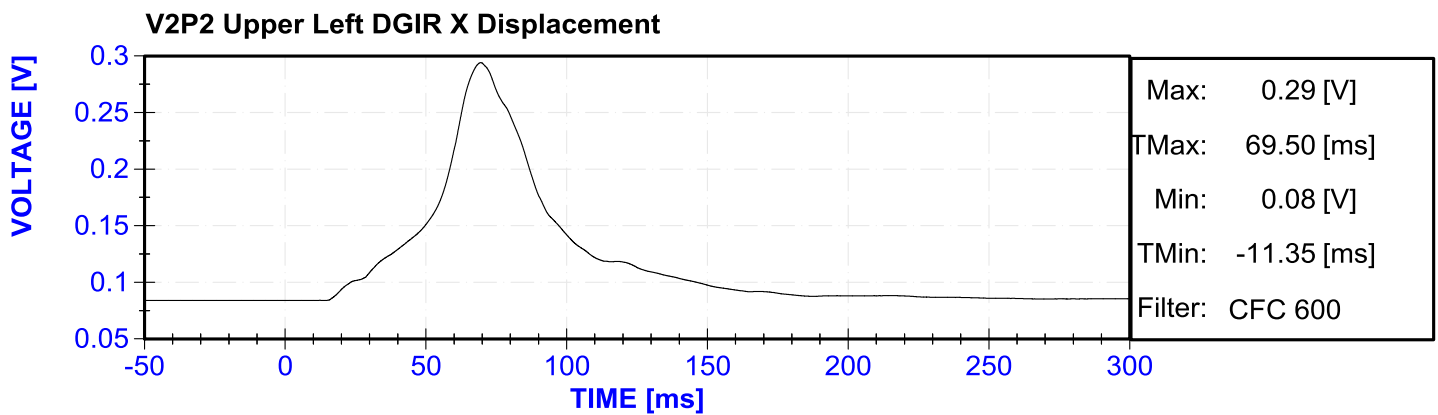
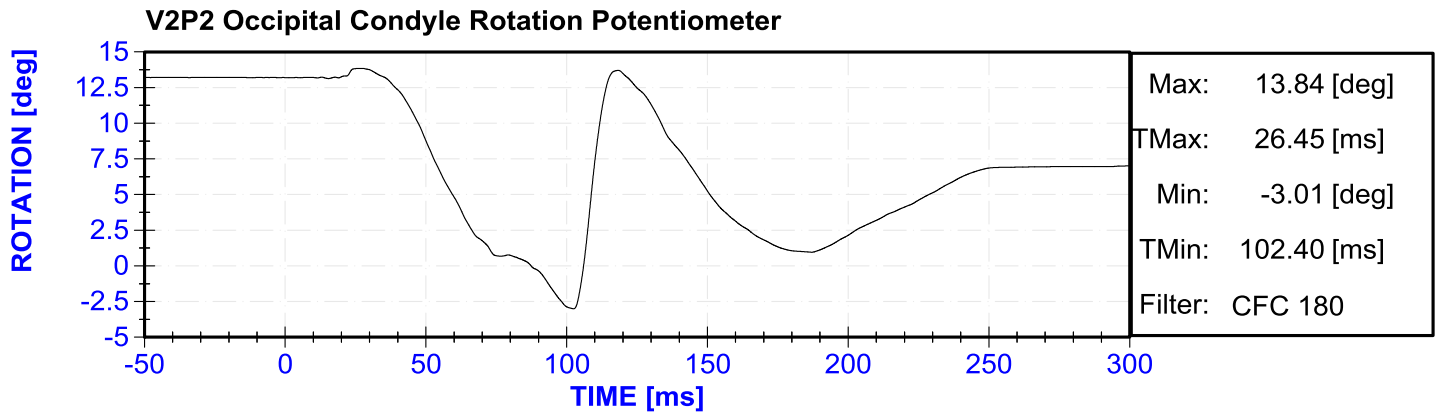




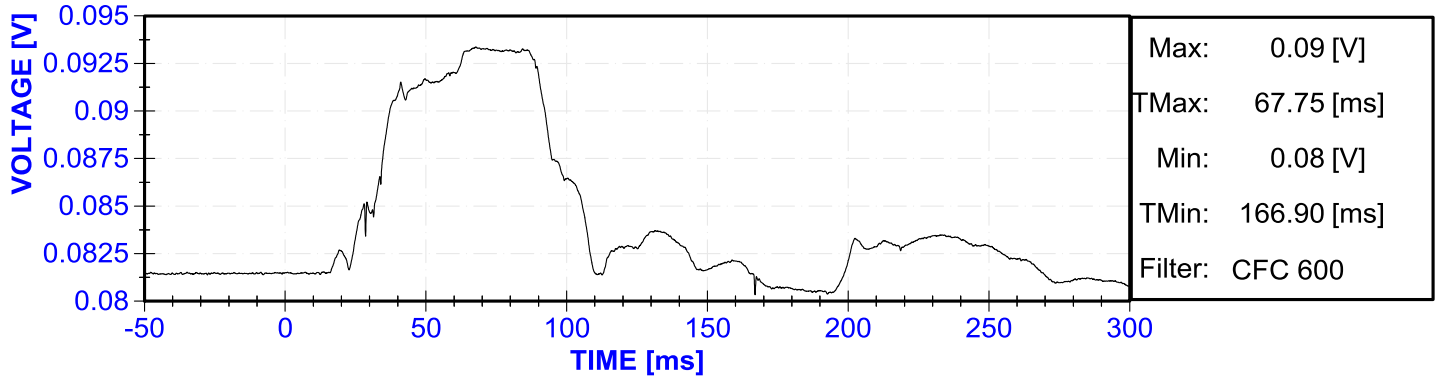




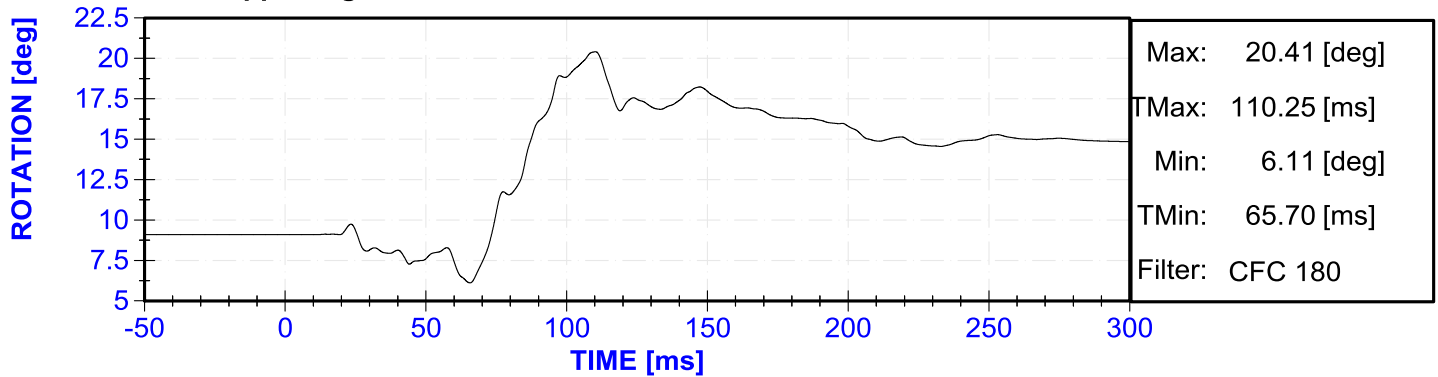




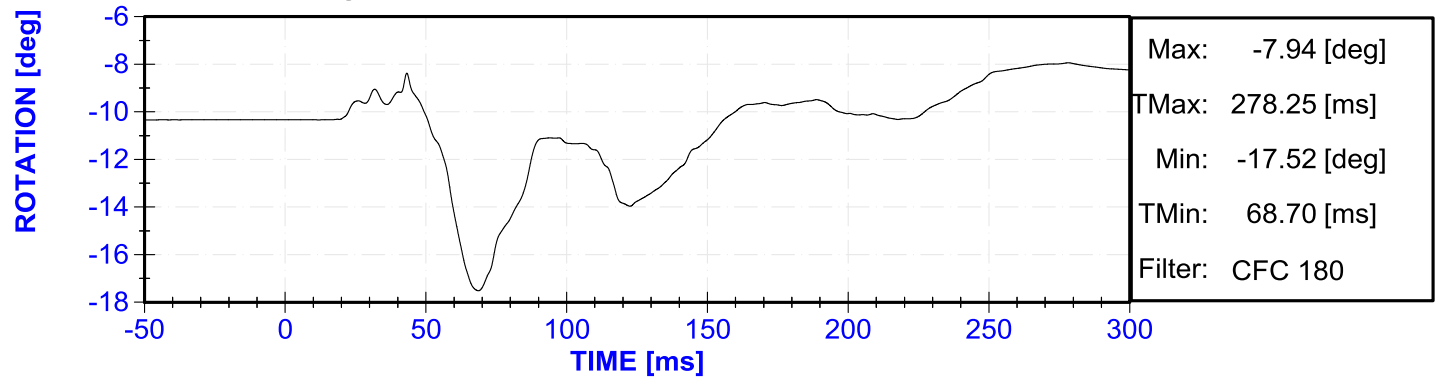
V2P2 Upper Right DGIR X Displacement



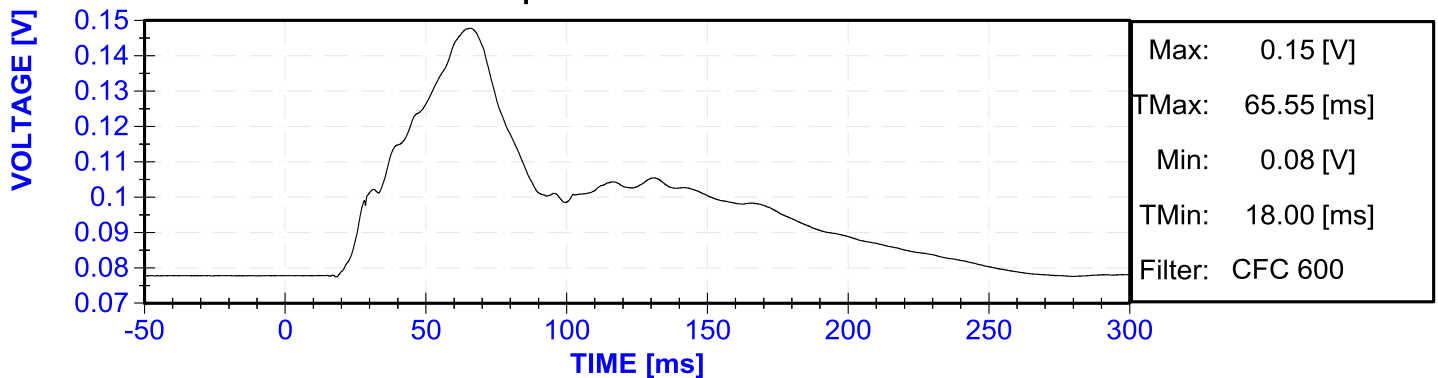
V2P2 Upper Right DGIR Y Rotation

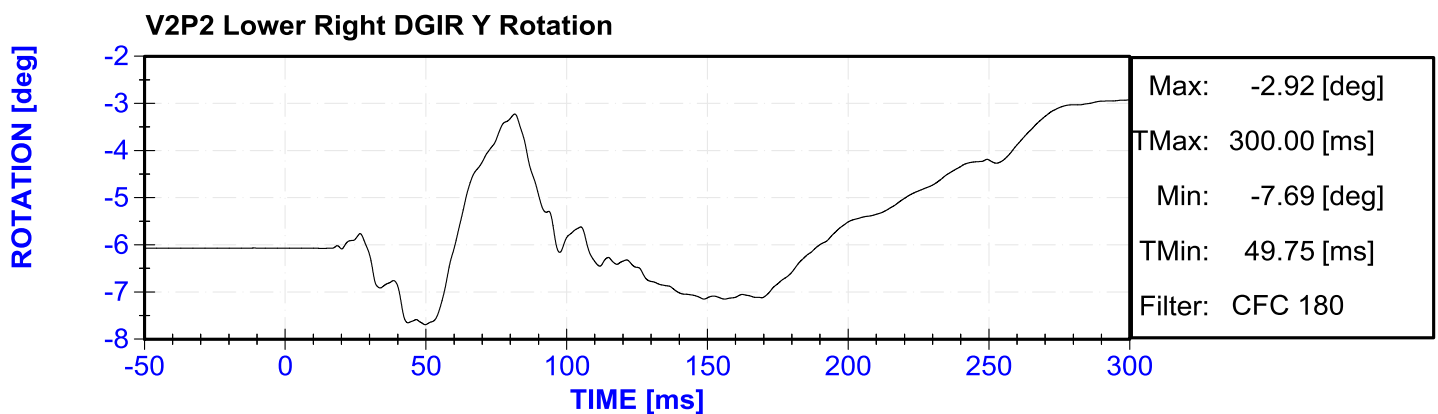
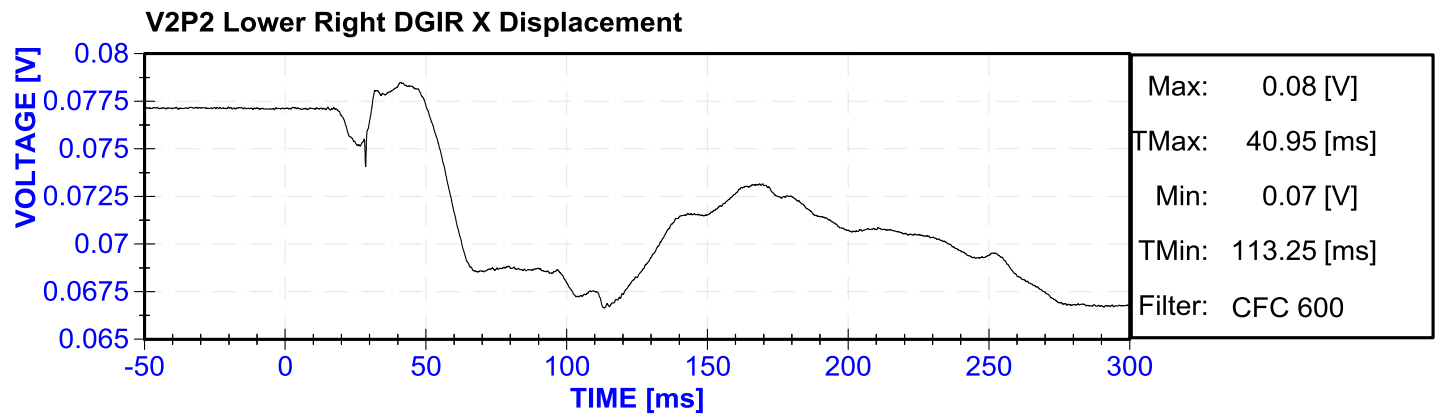
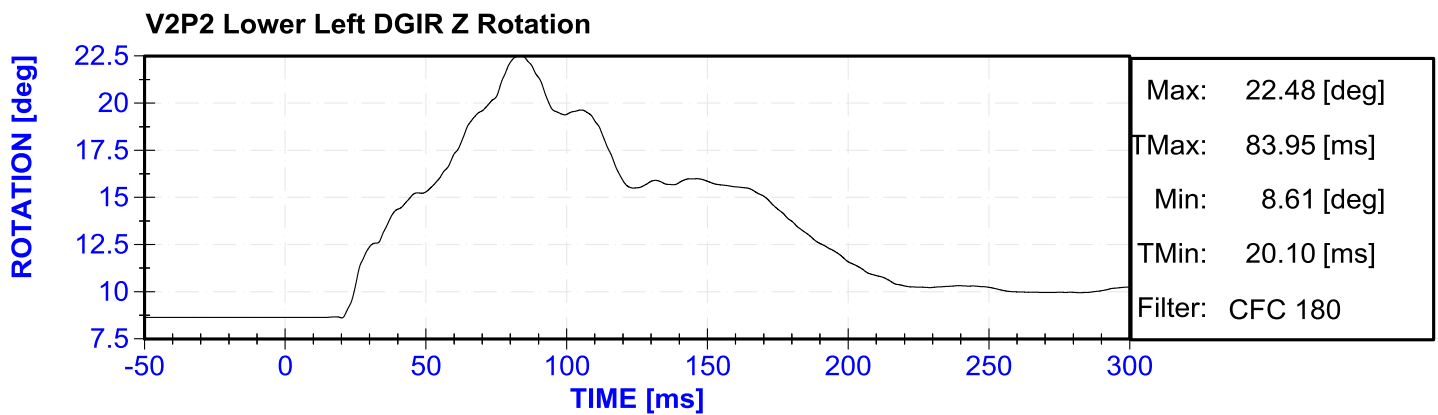
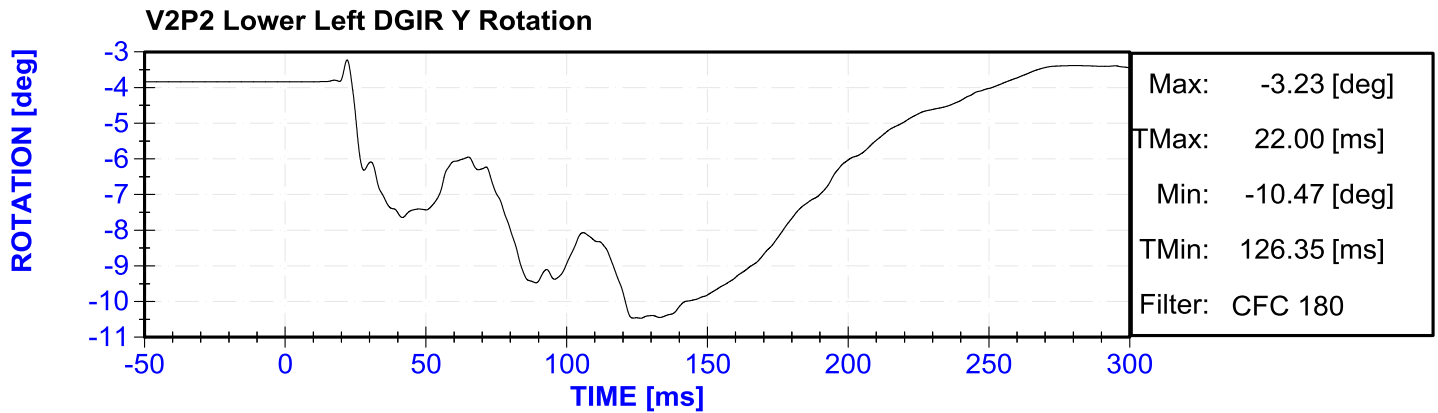


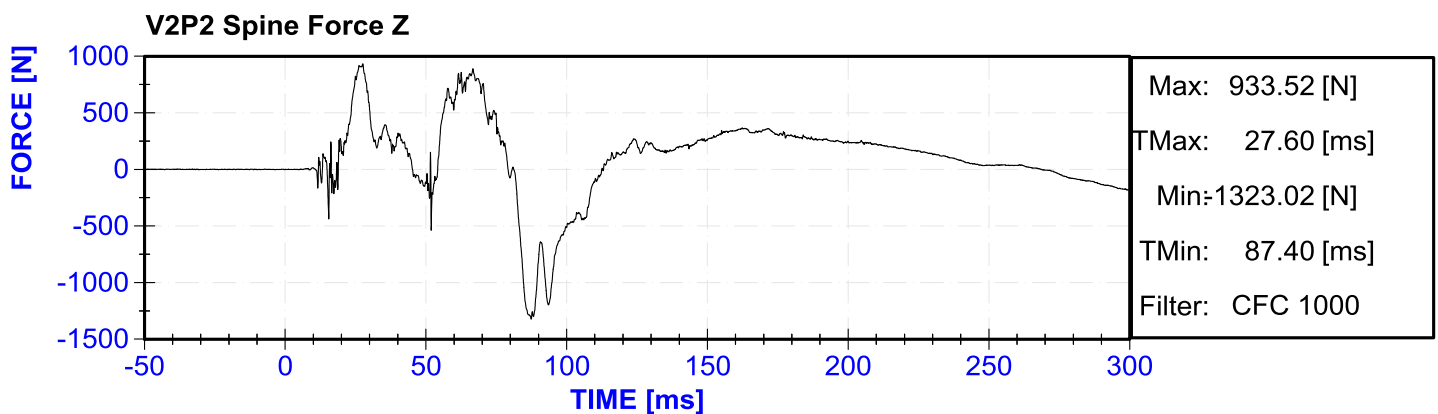
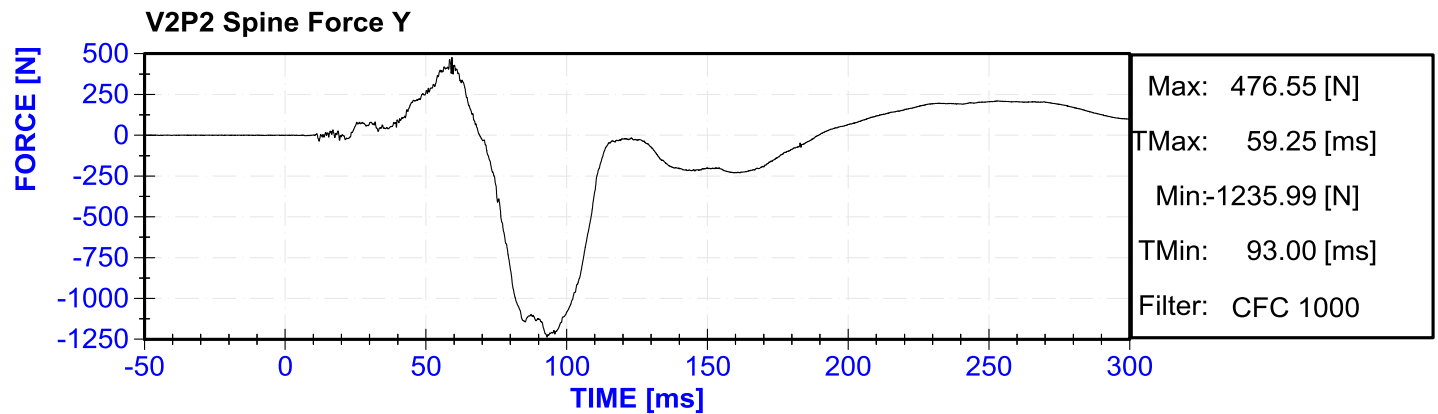
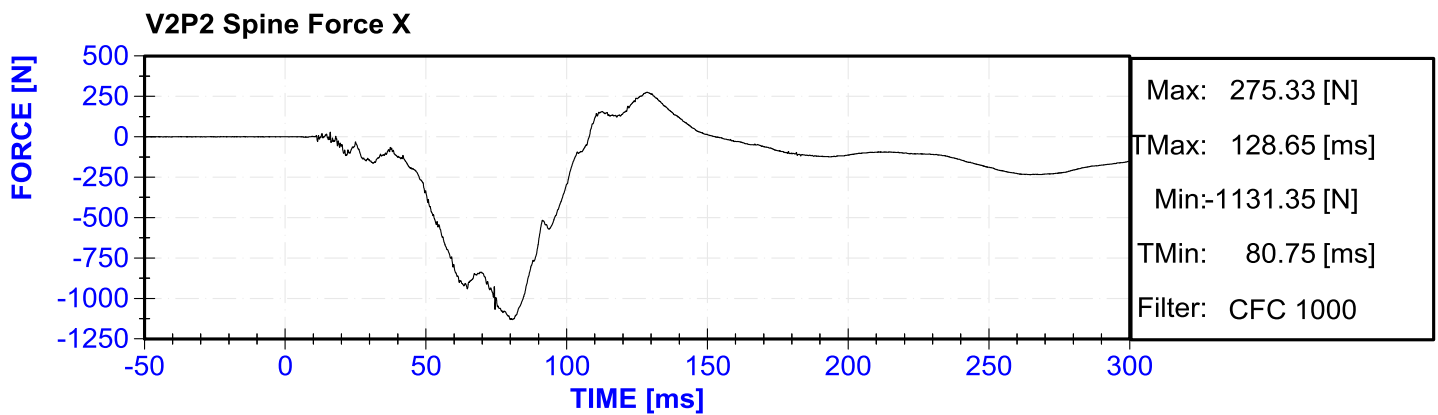
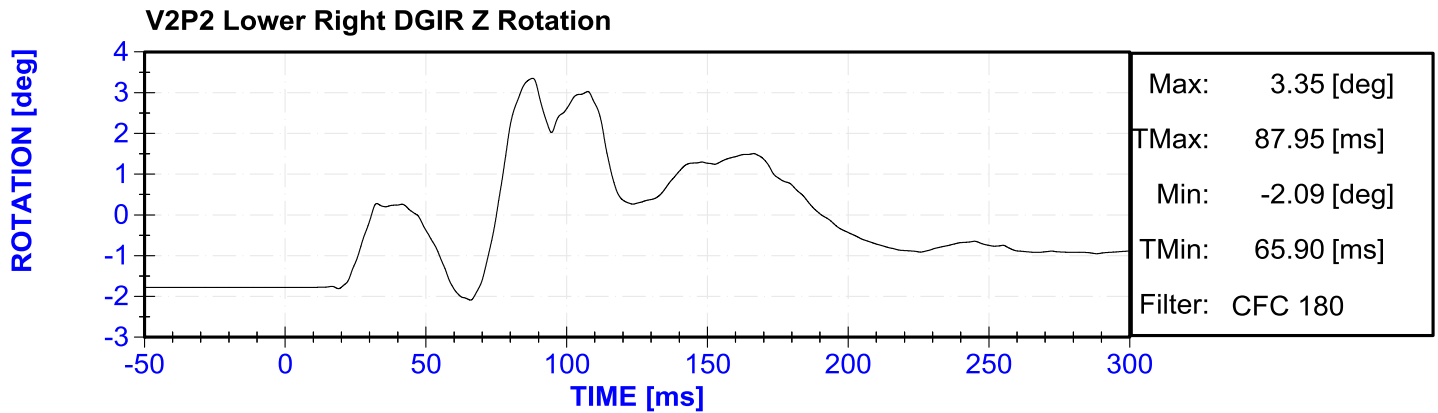
V2P2 Upper Right DGIR Z Rotation

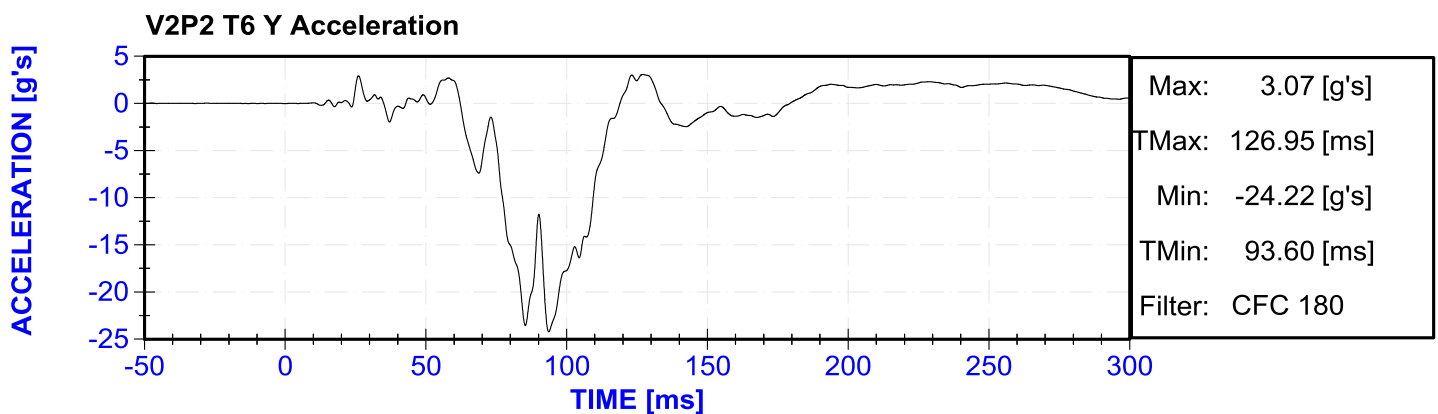
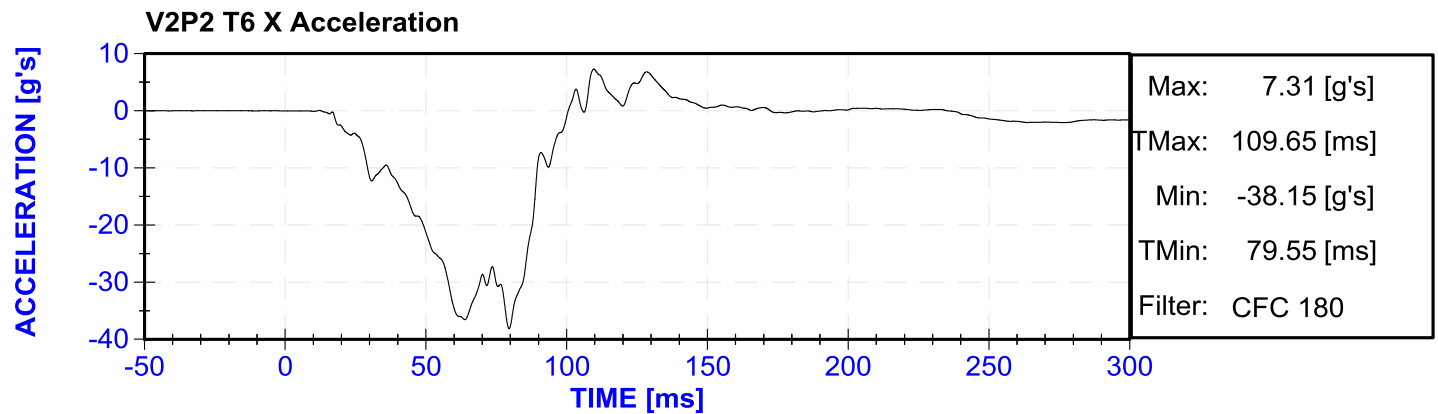
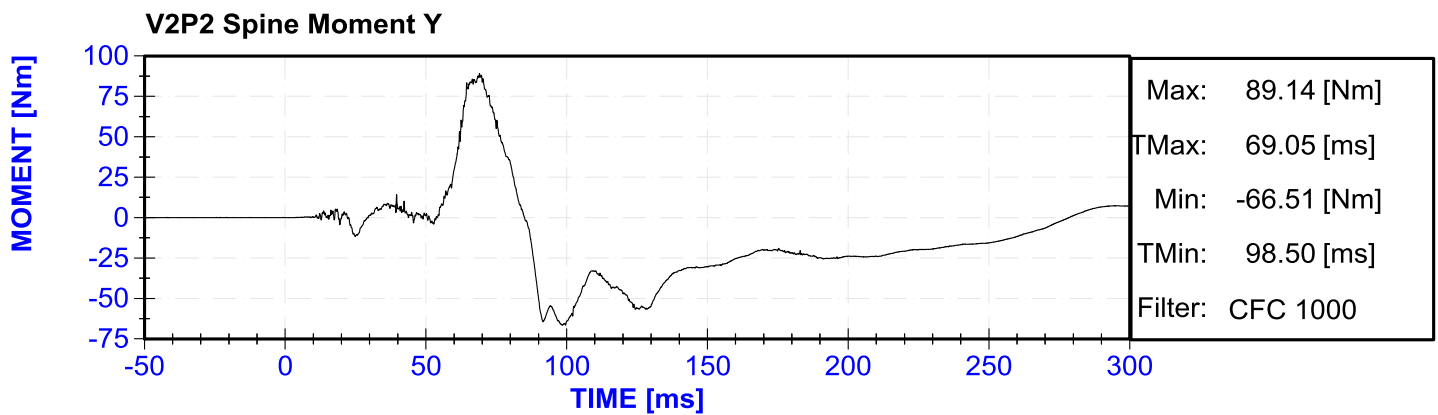
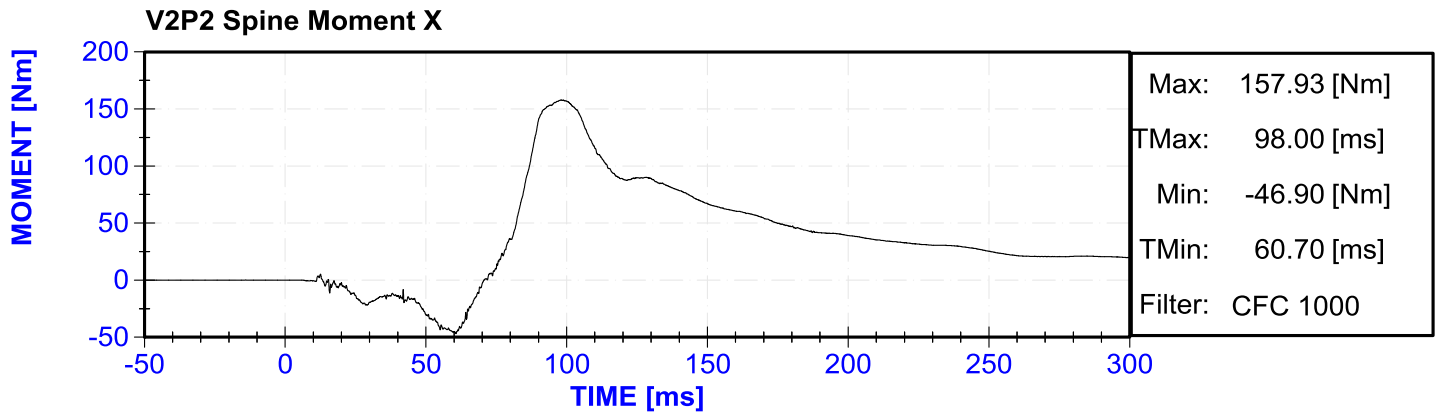


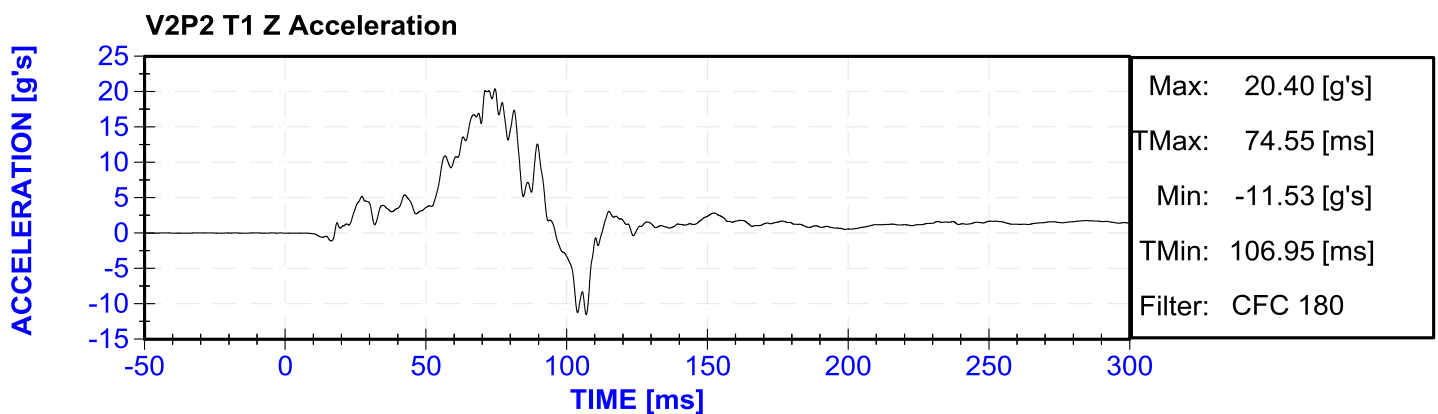
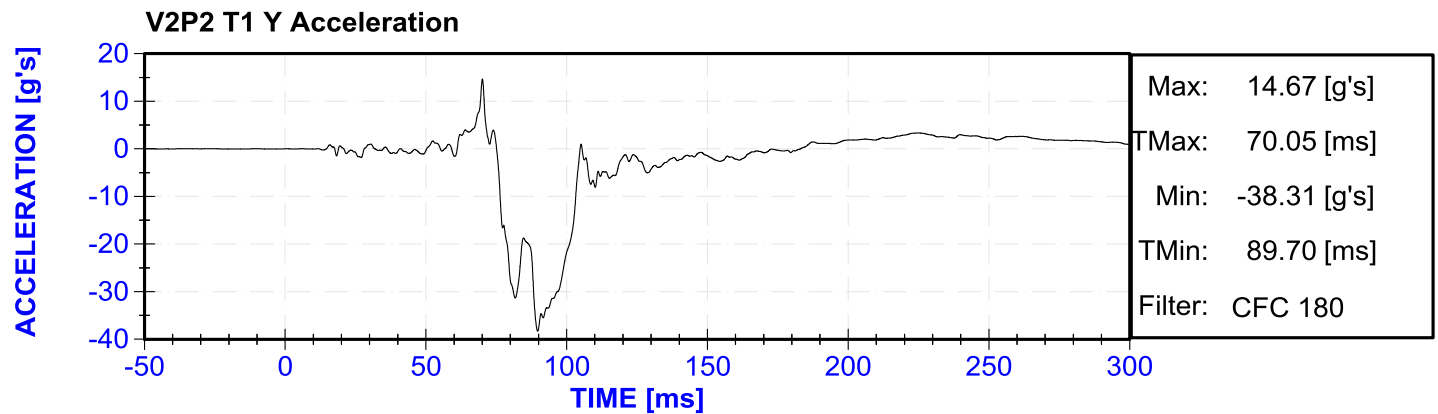
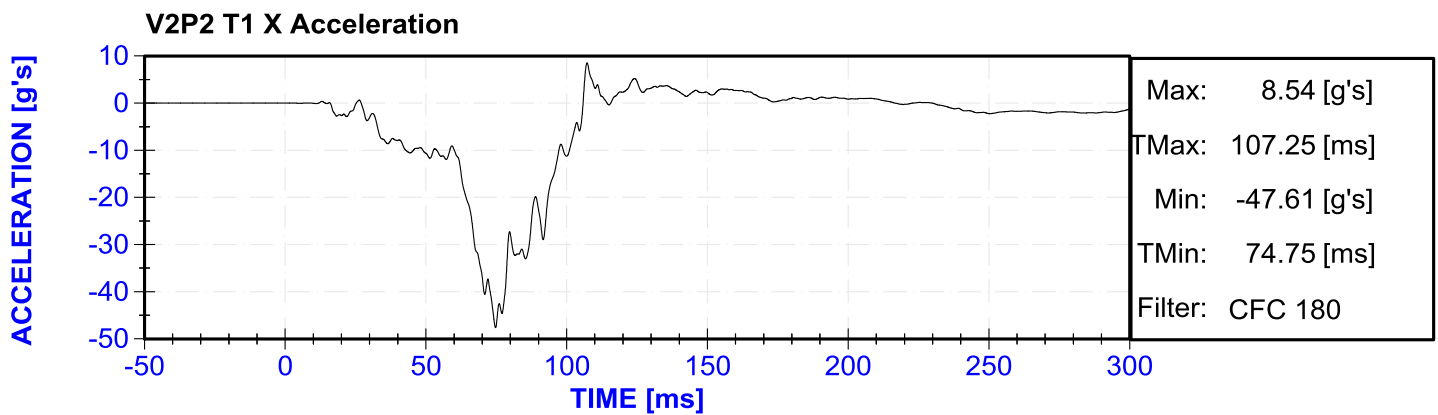
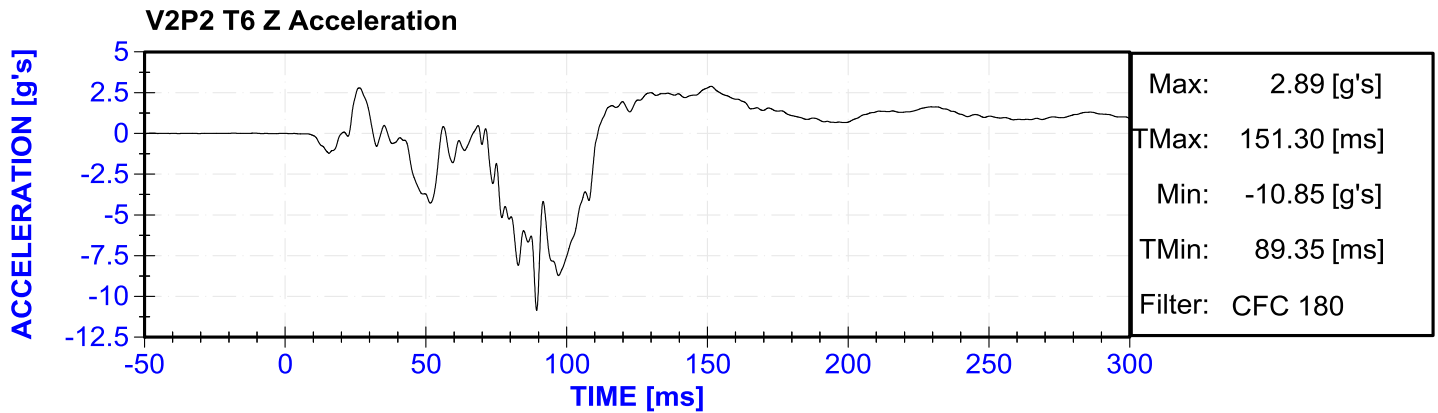
V2P2 Lower Left DGIR X Displacement

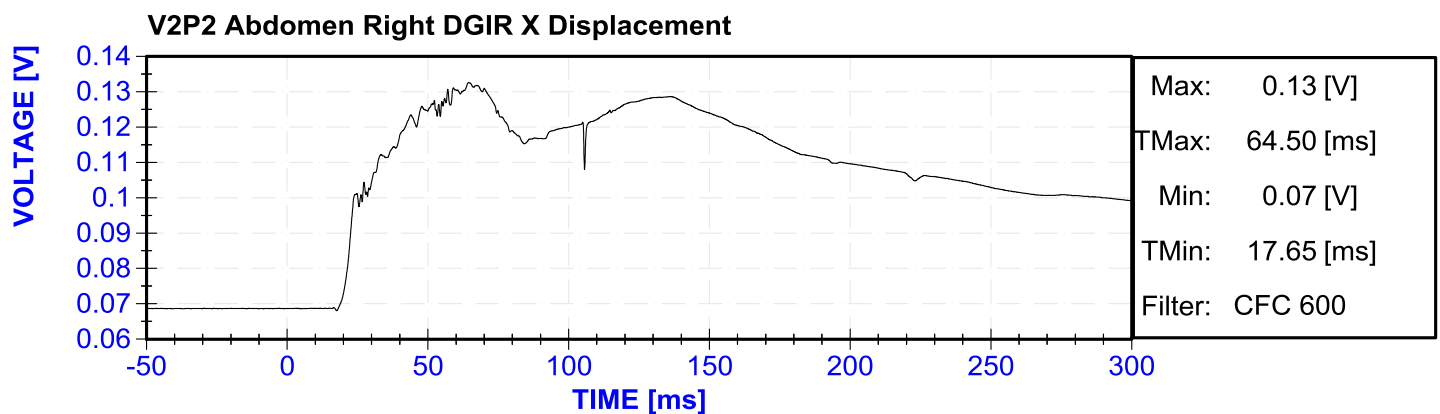
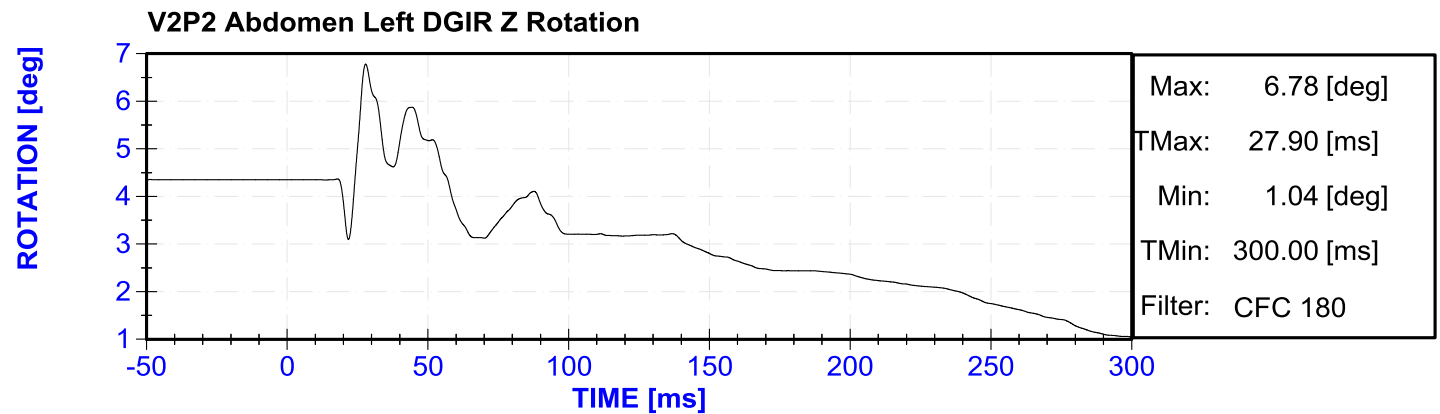
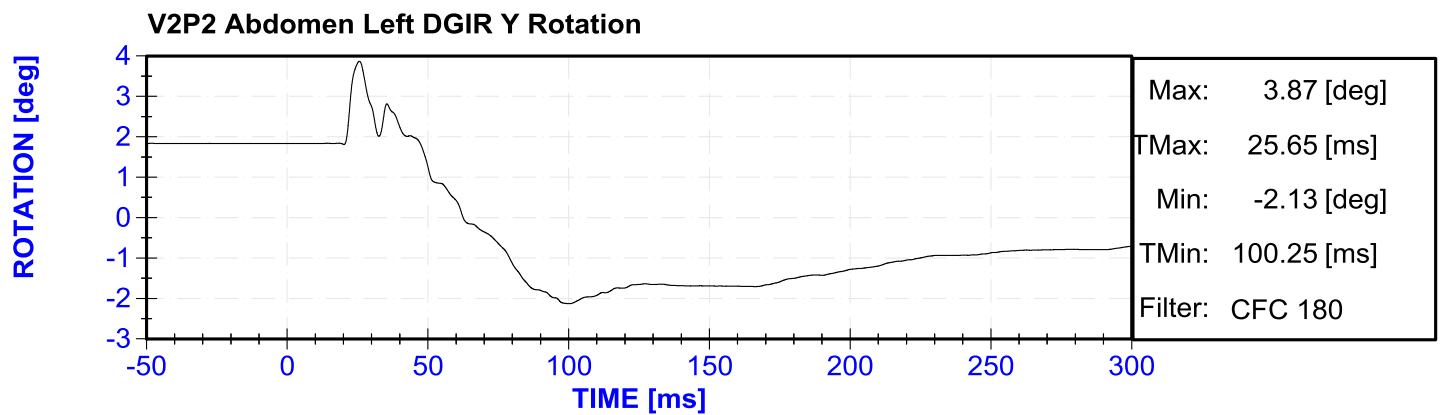
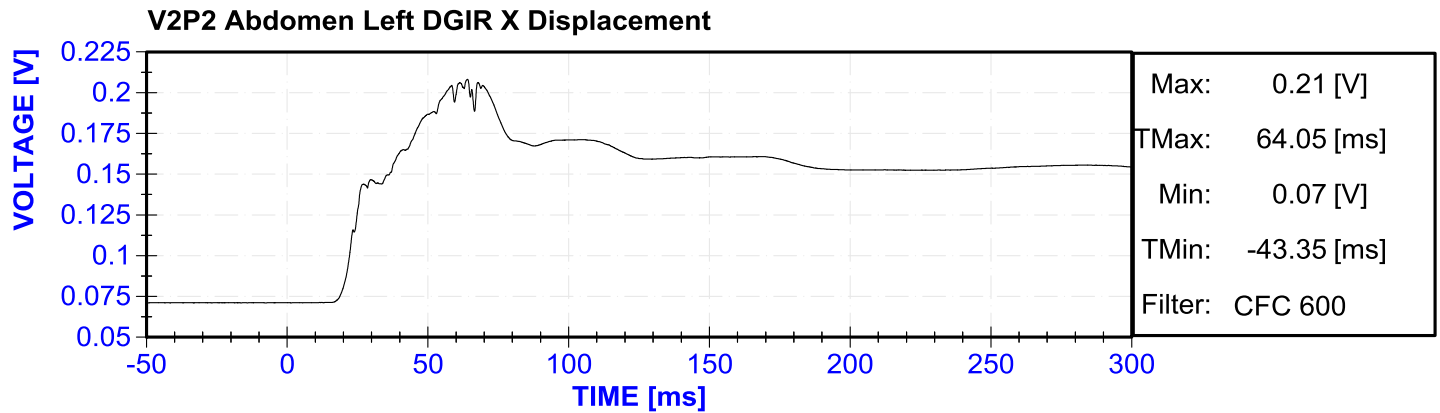


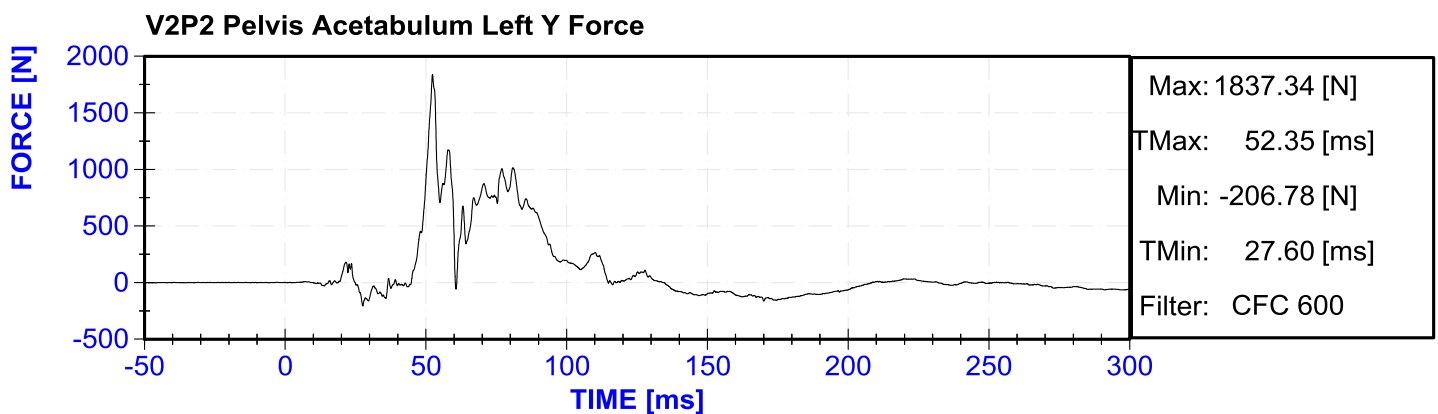
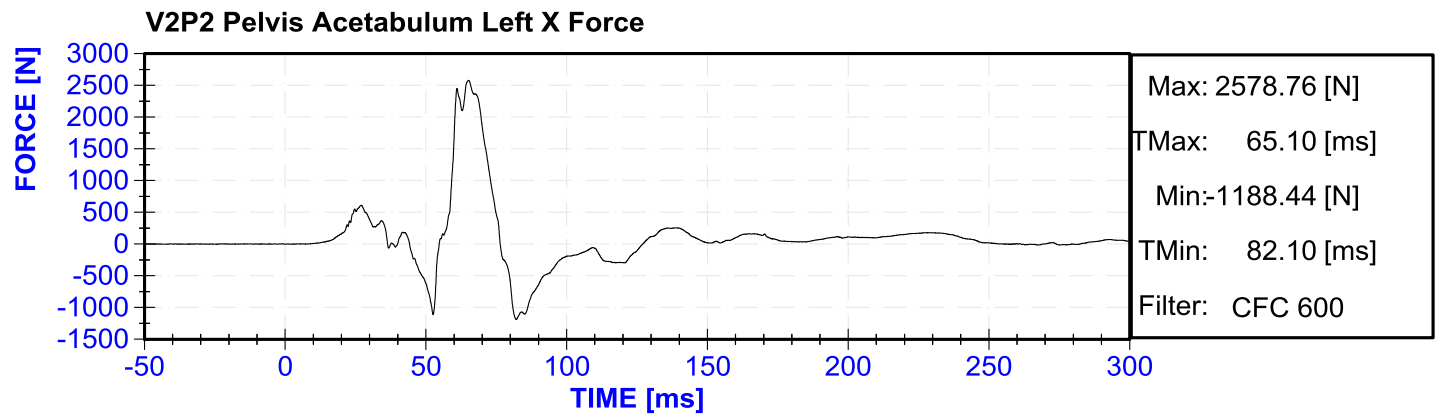
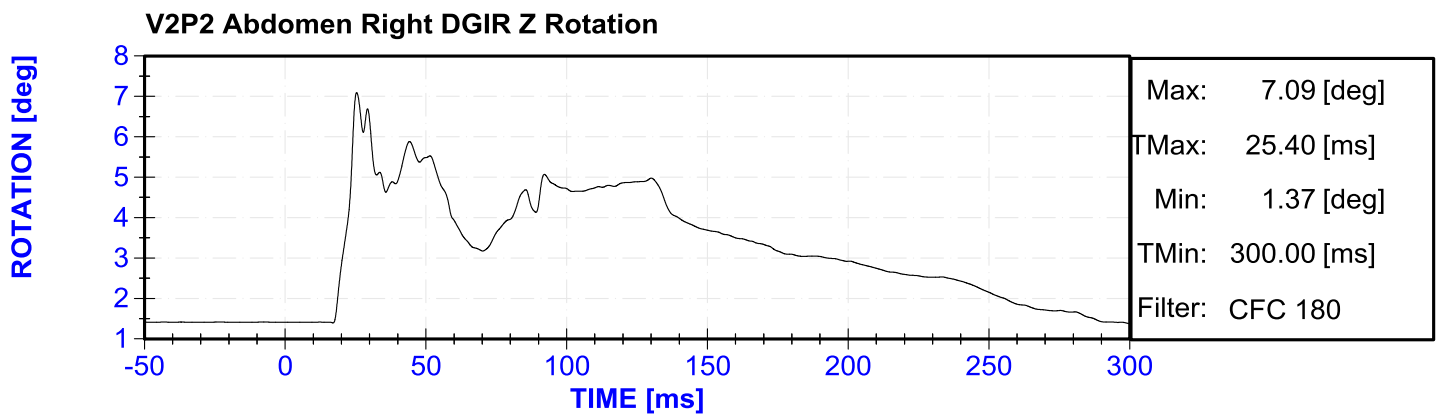
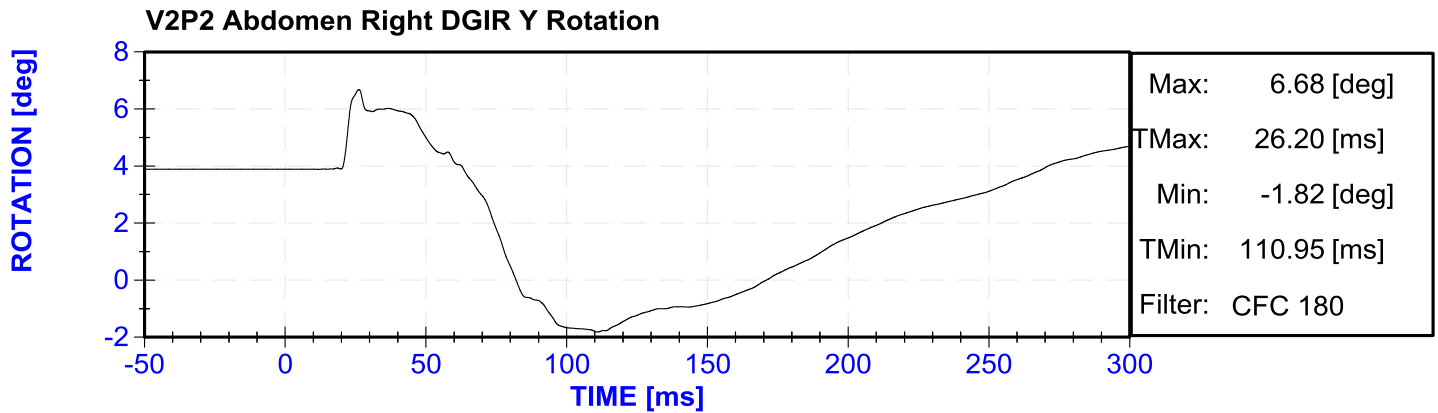


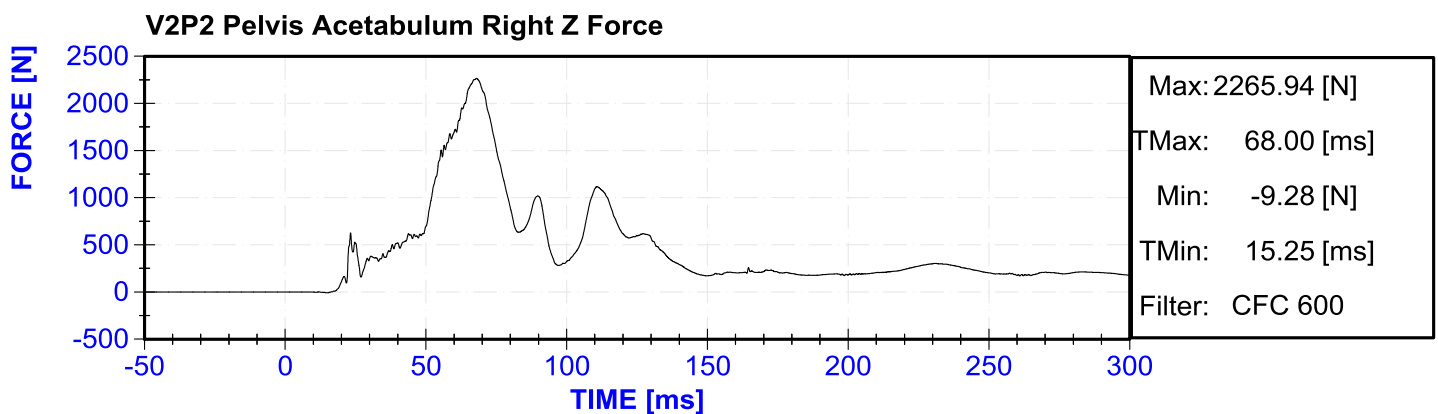
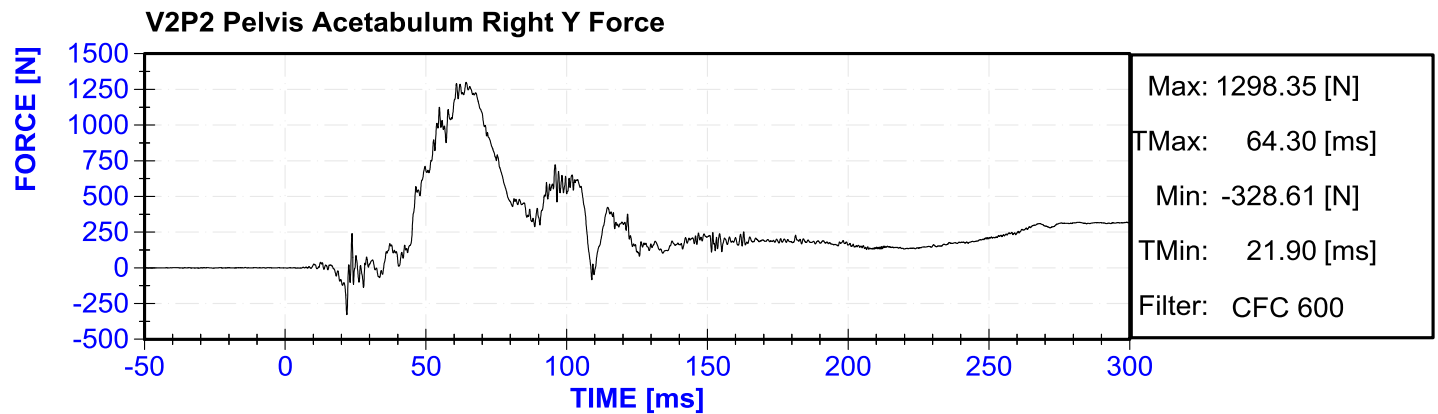
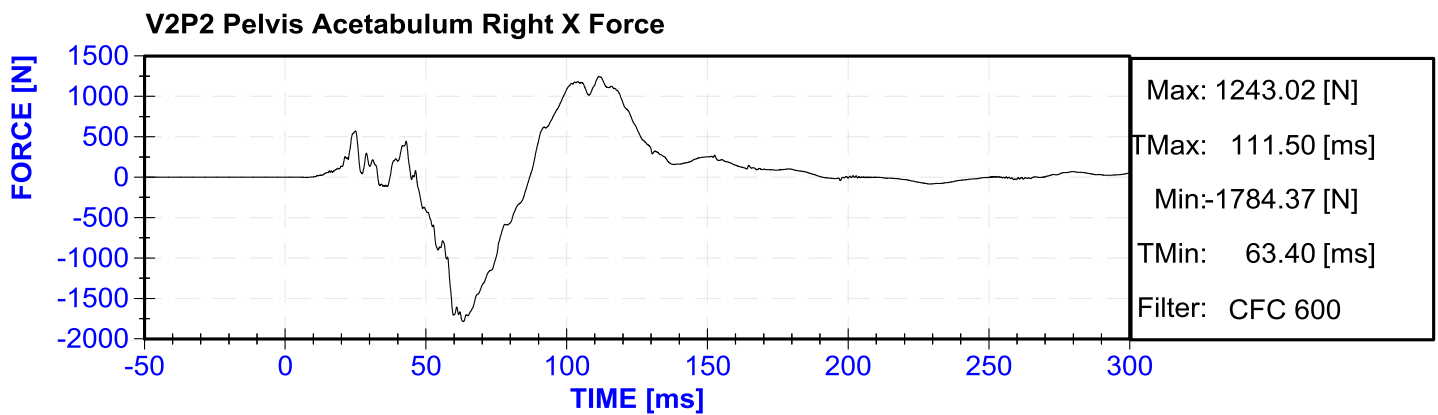
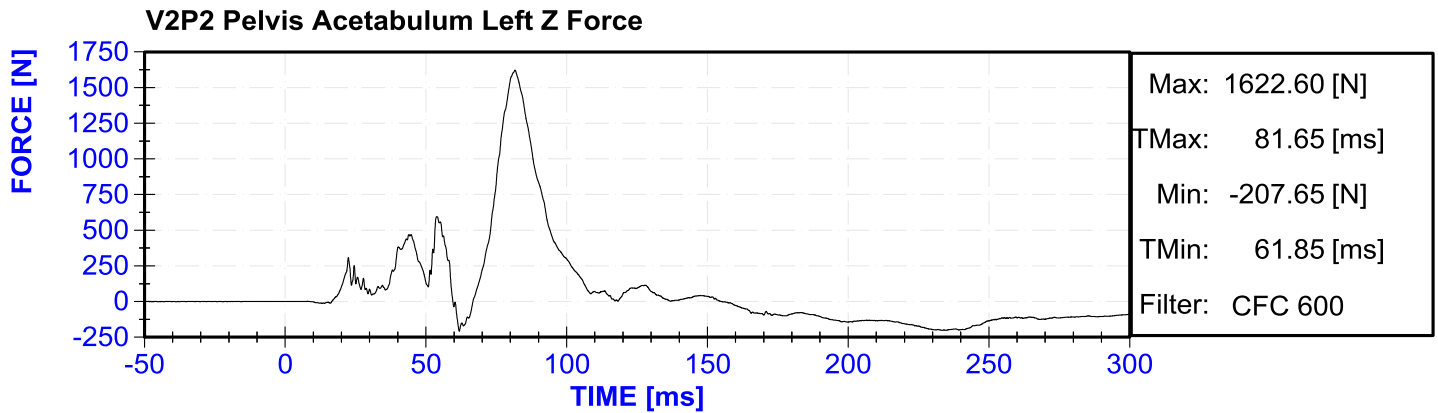


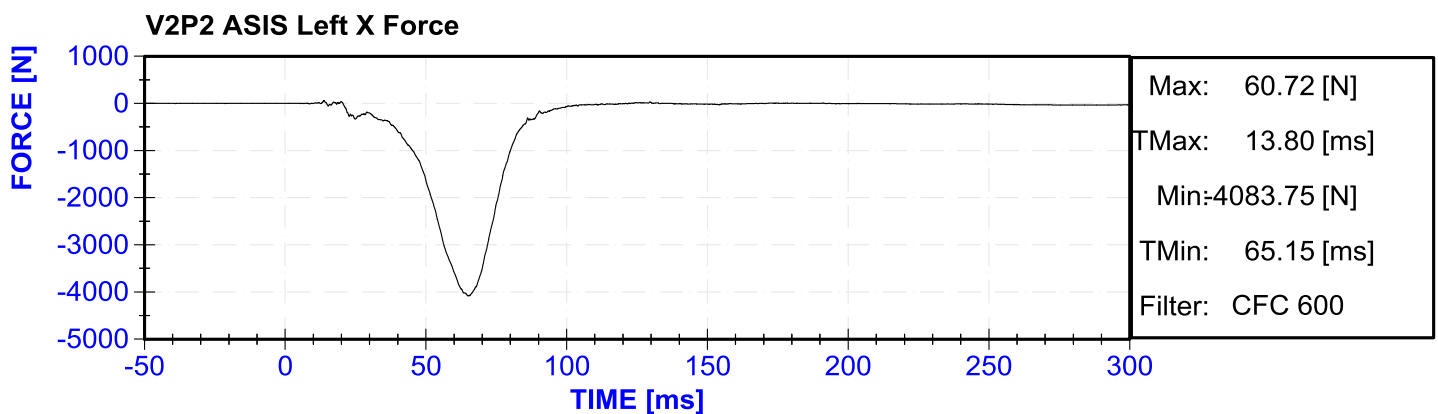
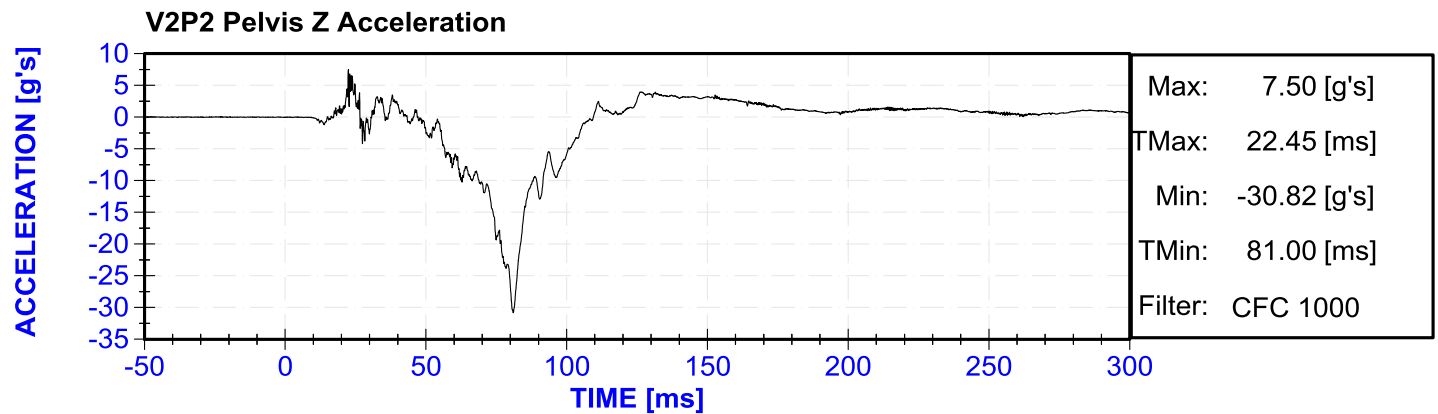
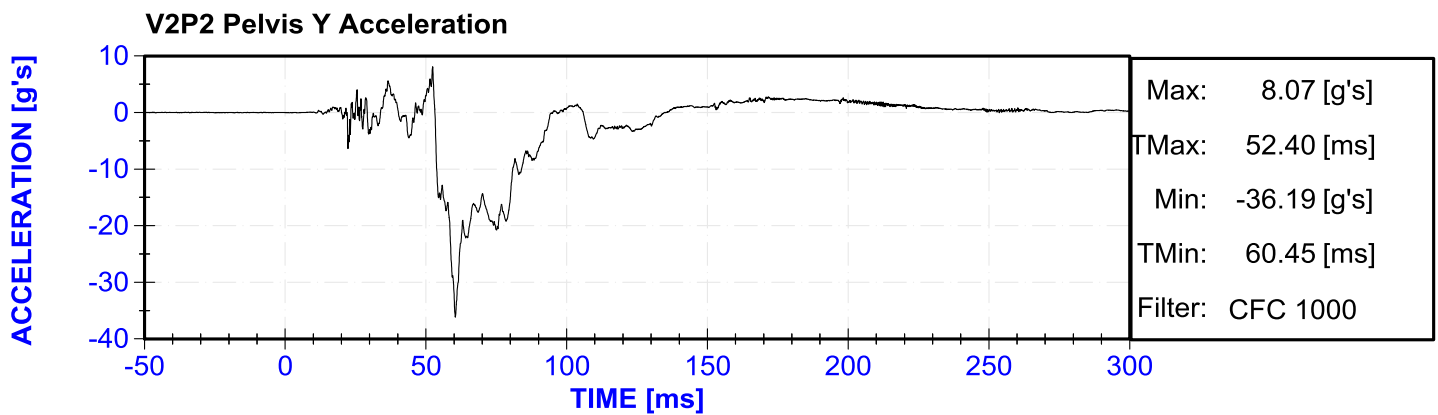
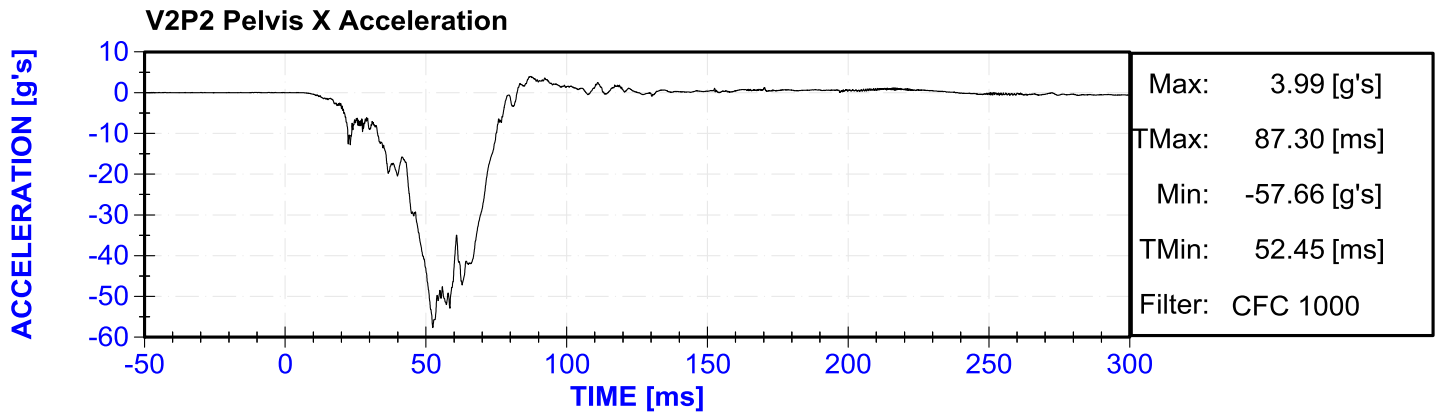


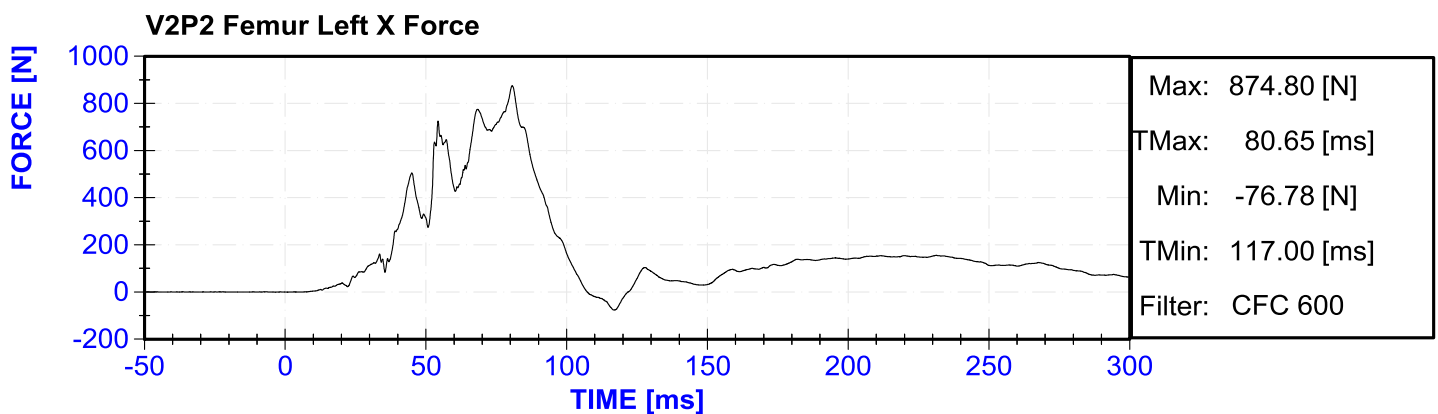
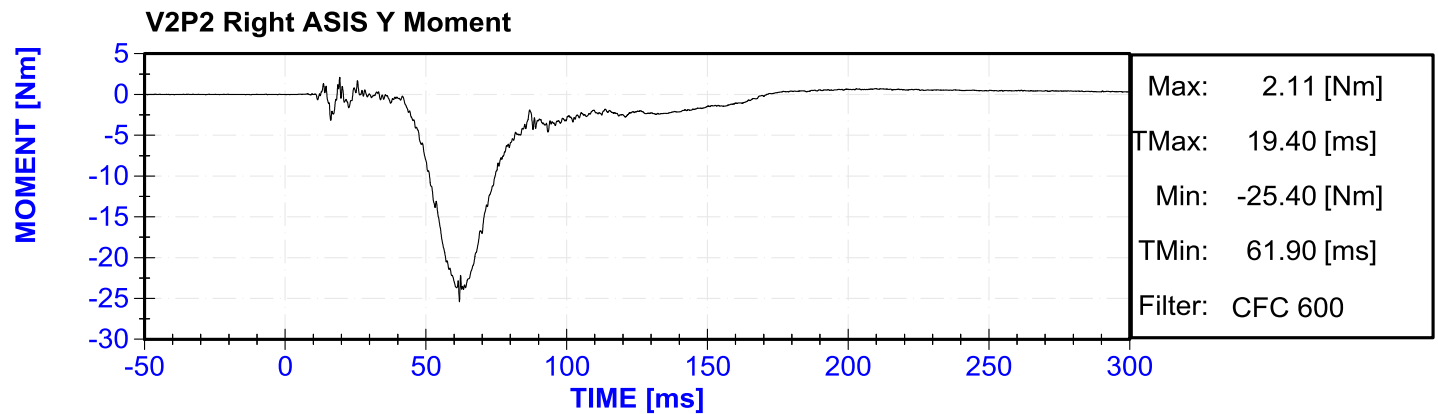
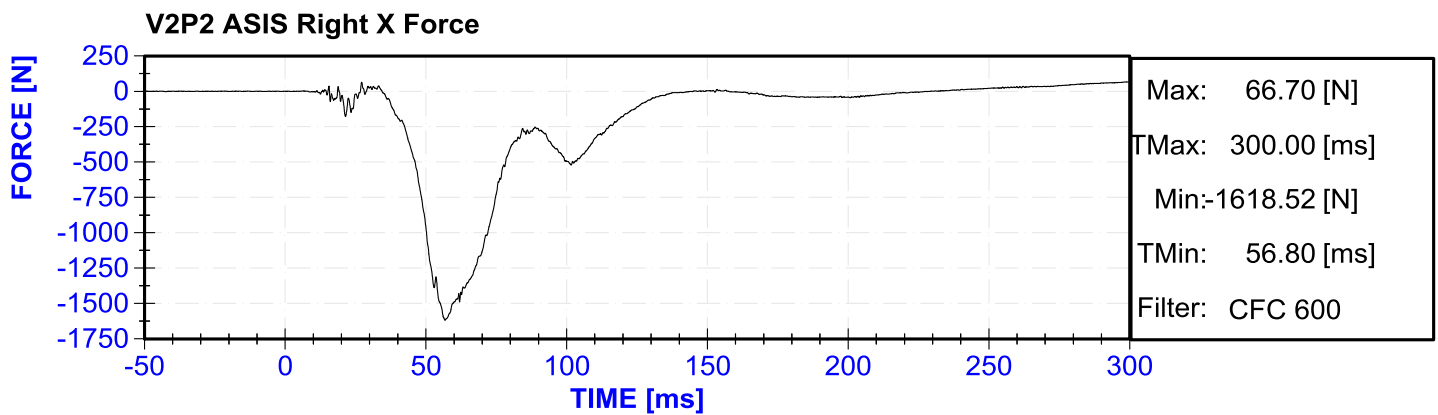
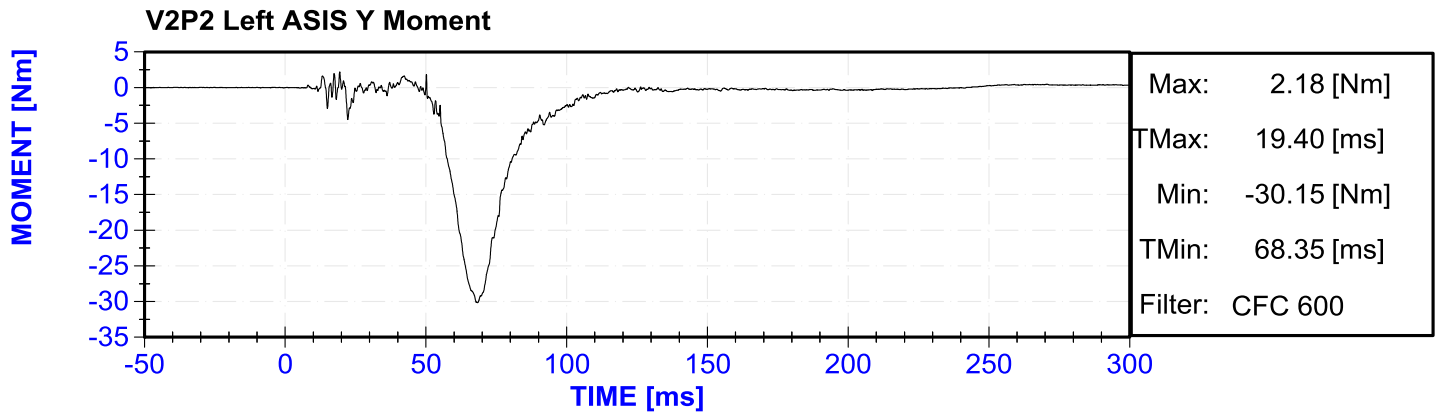


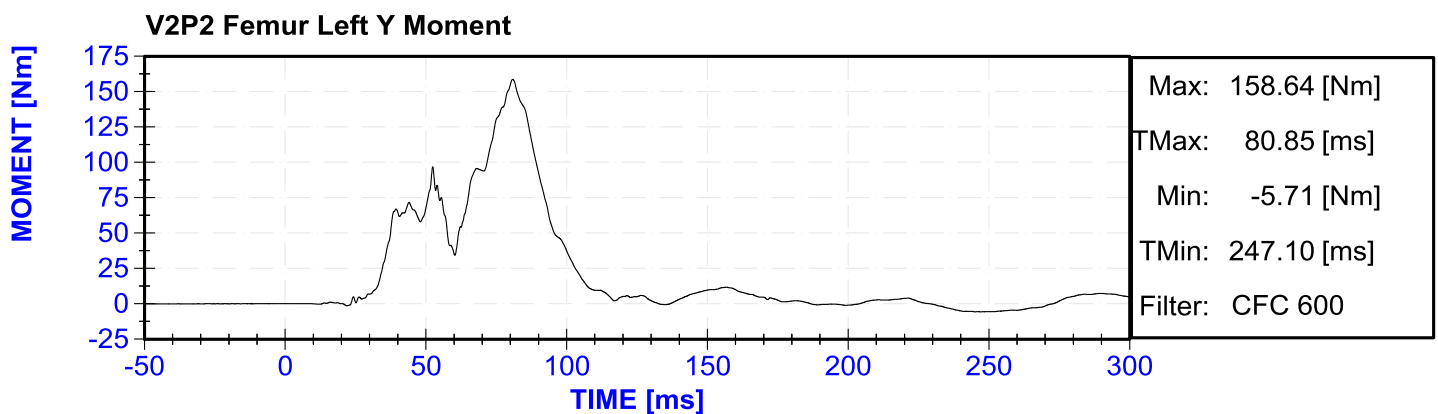
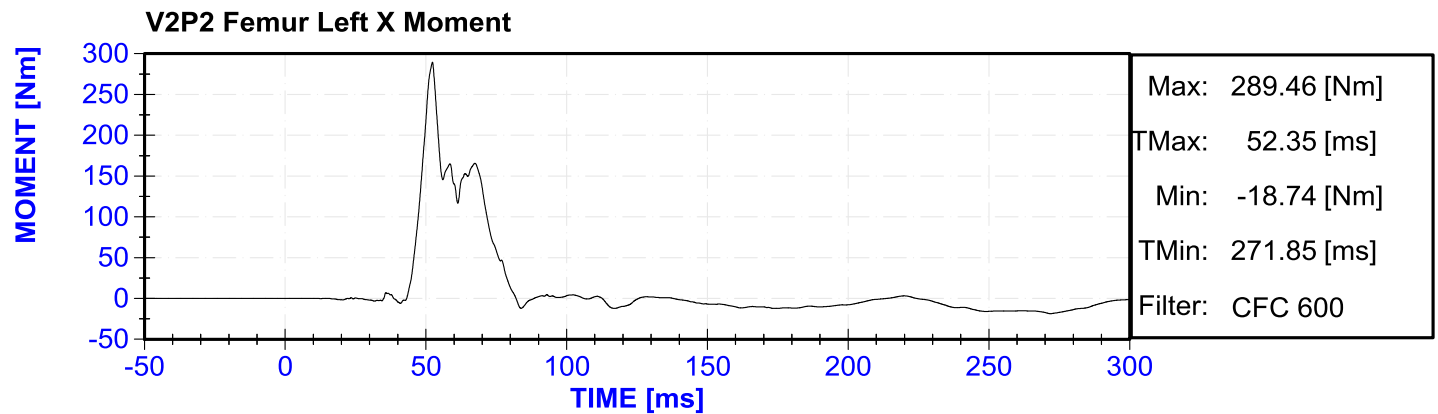
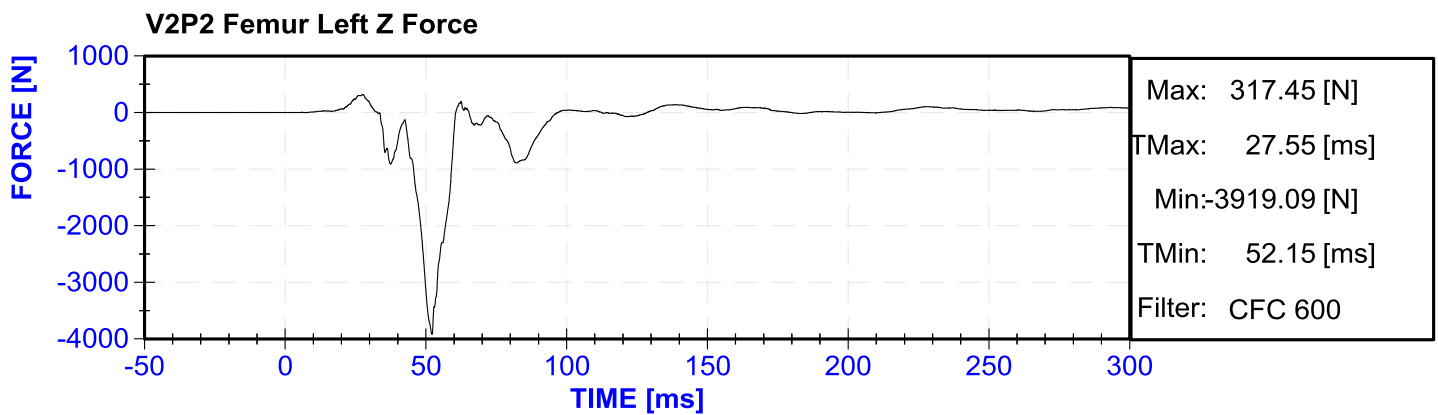
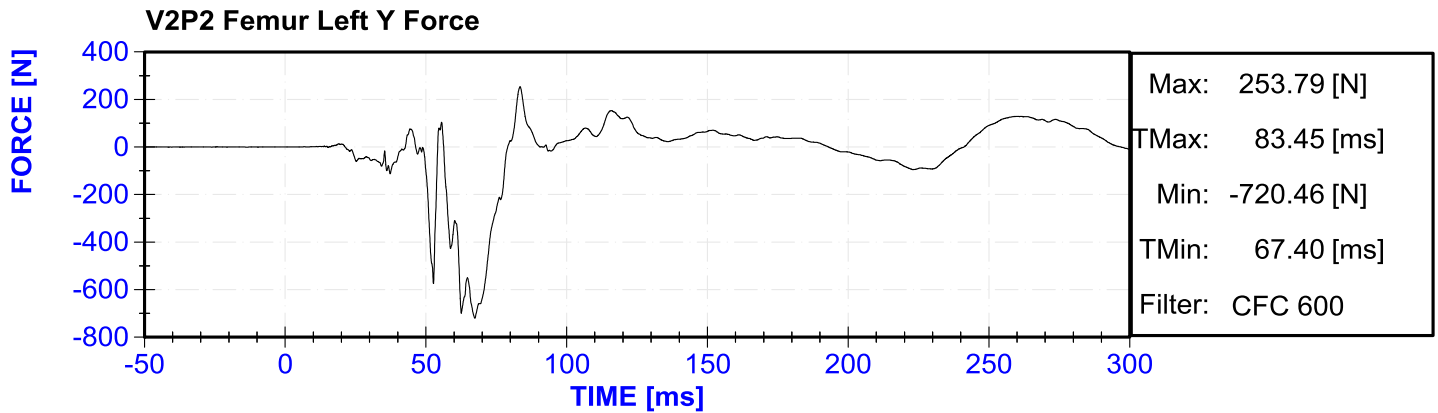


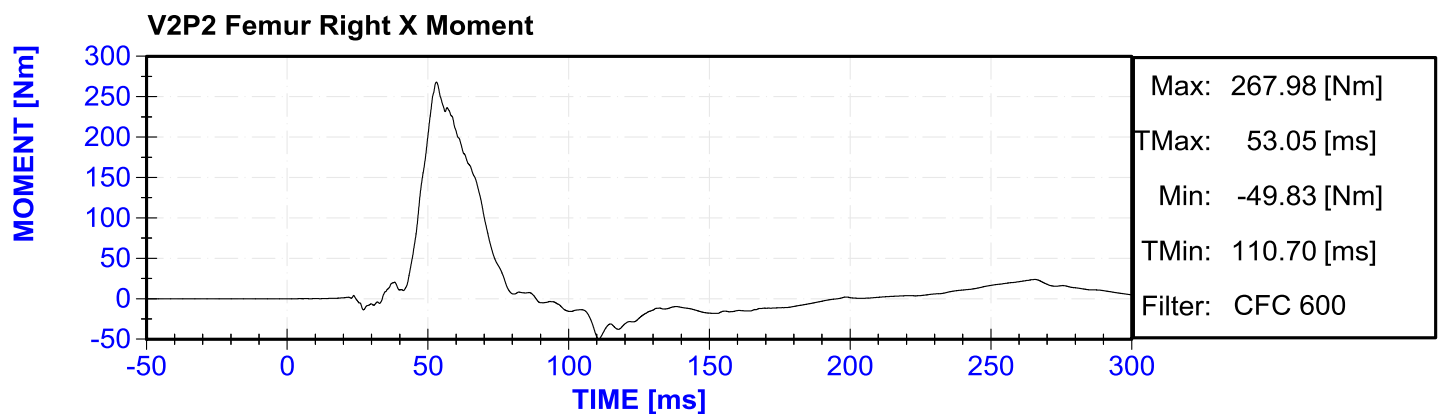
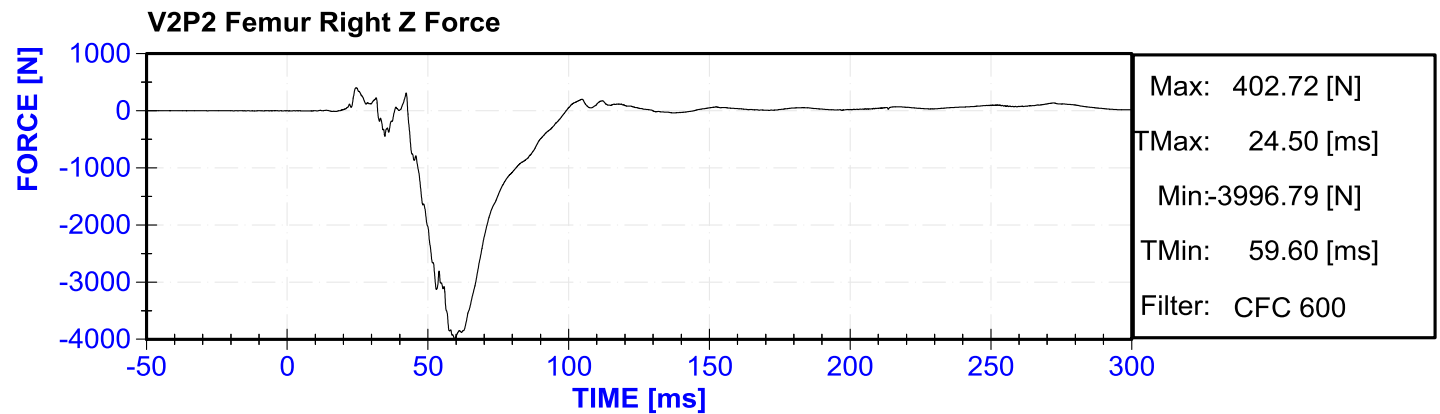
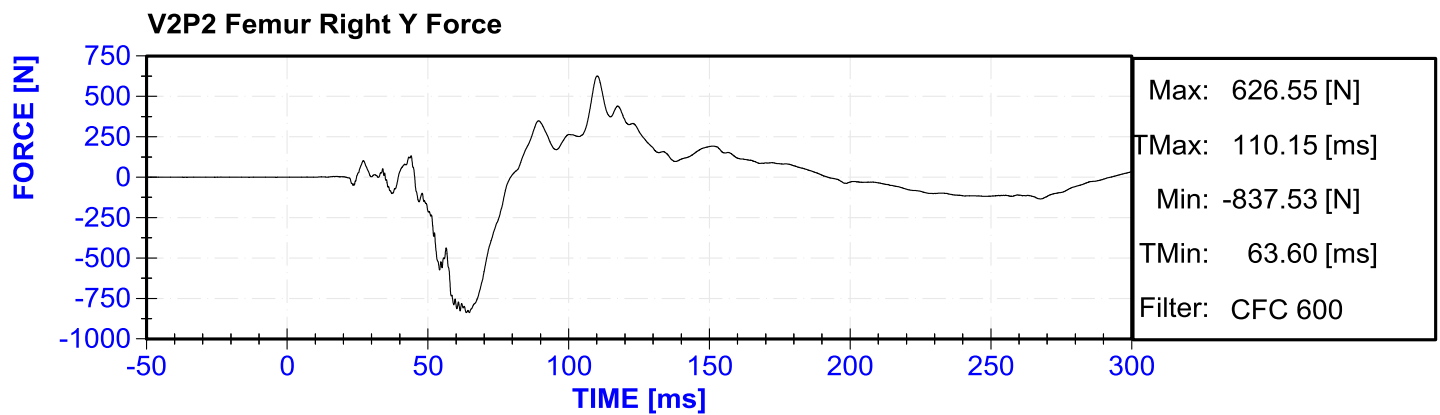
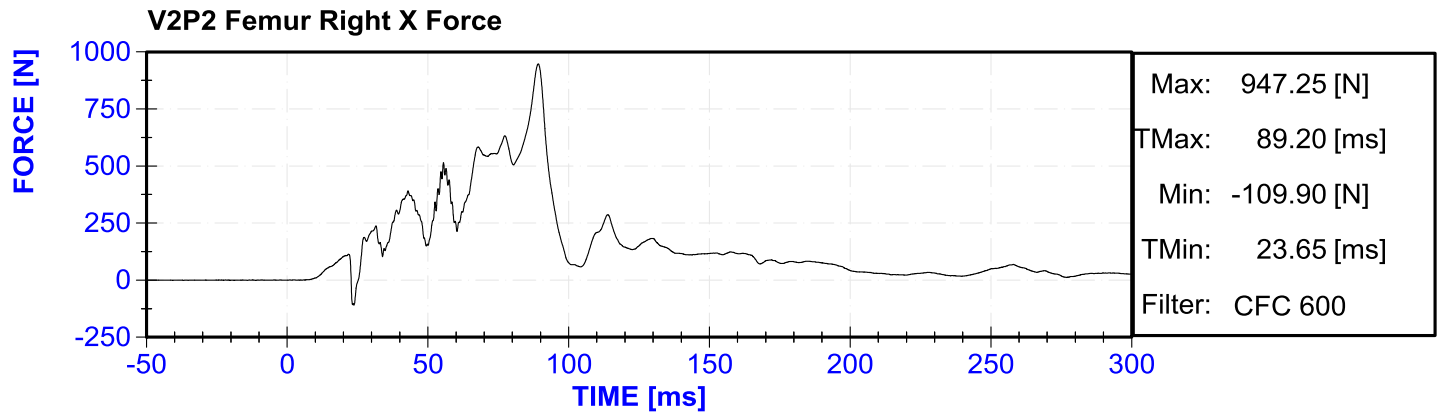


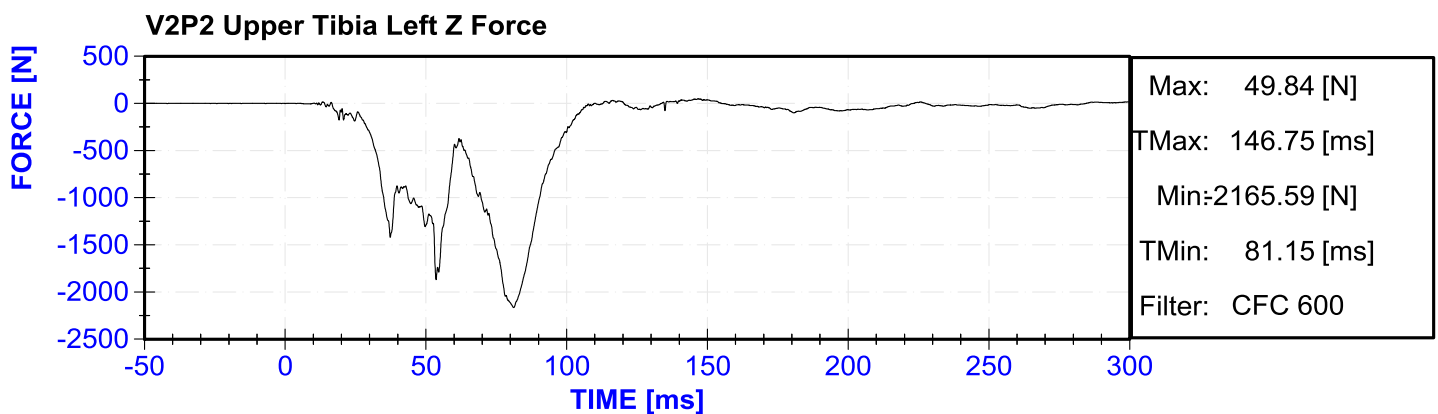
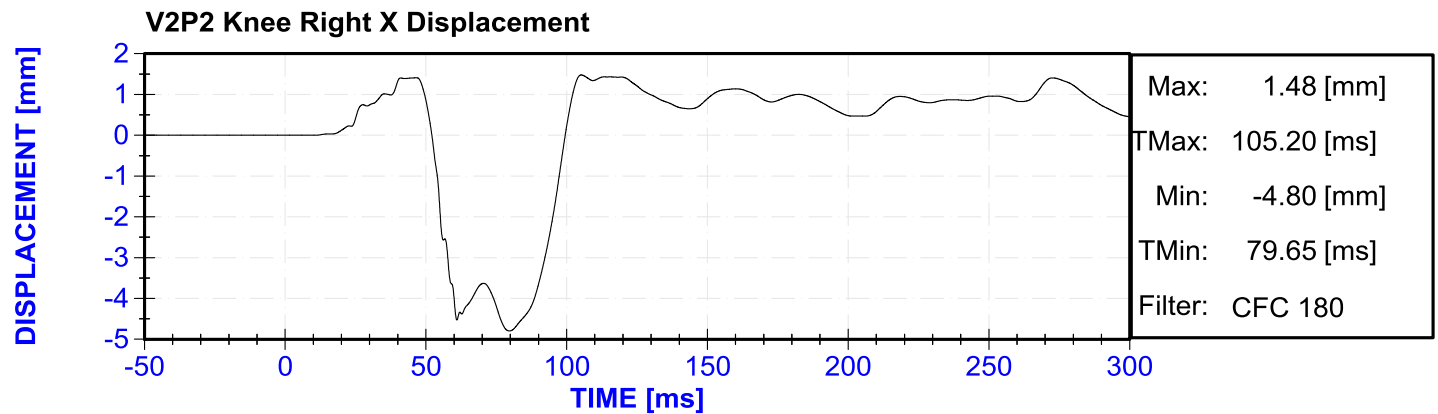
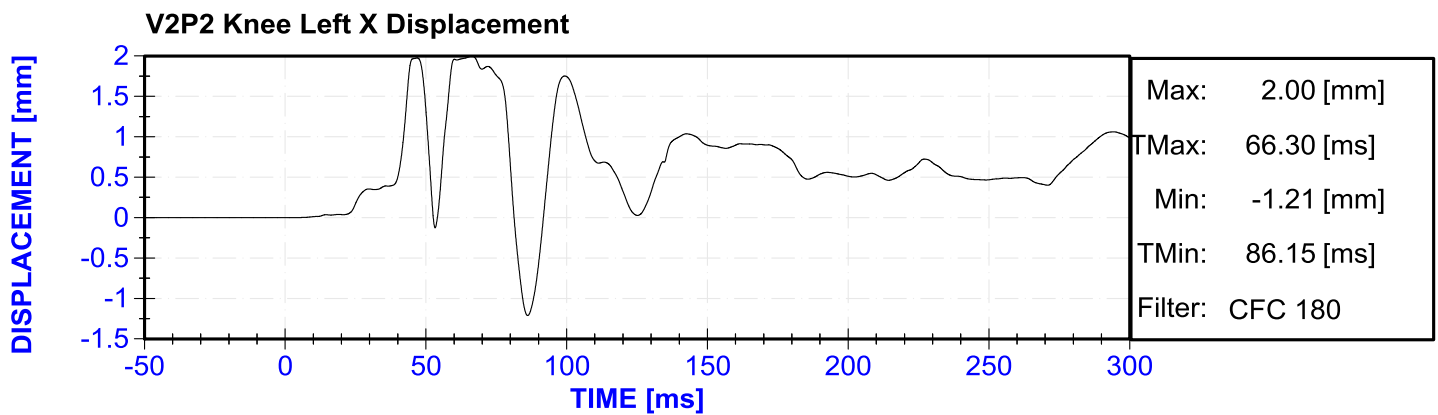
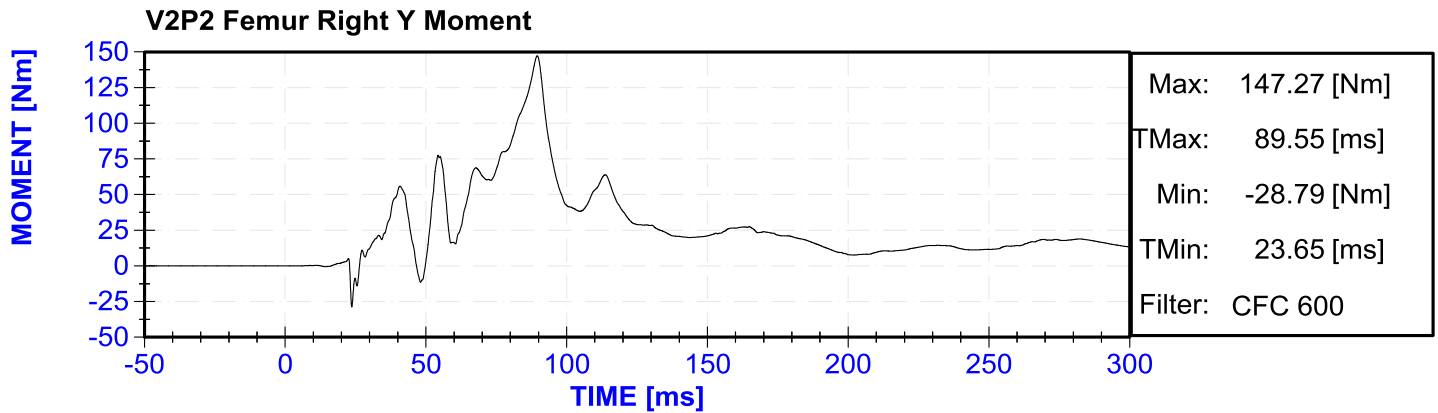


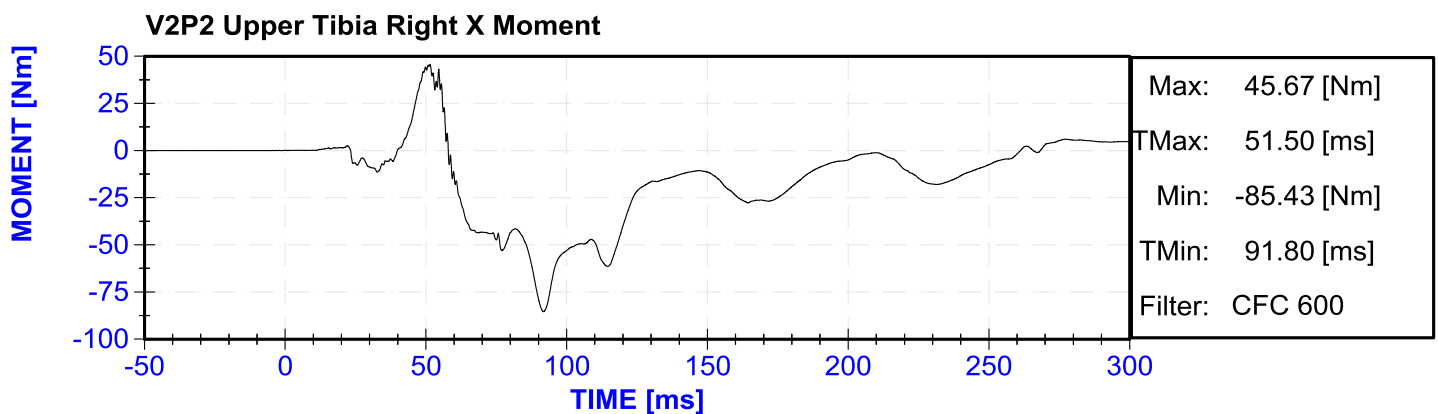
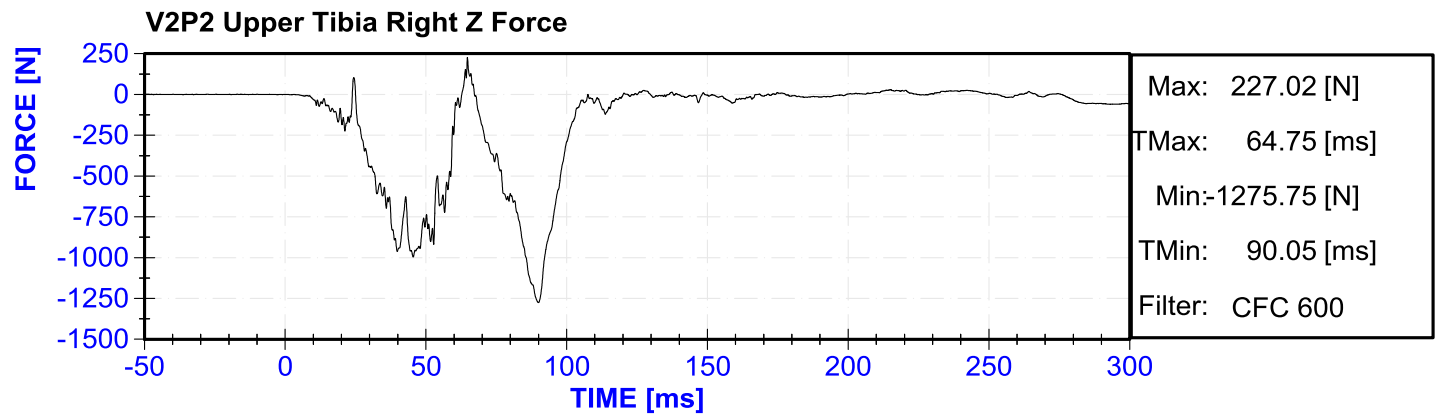
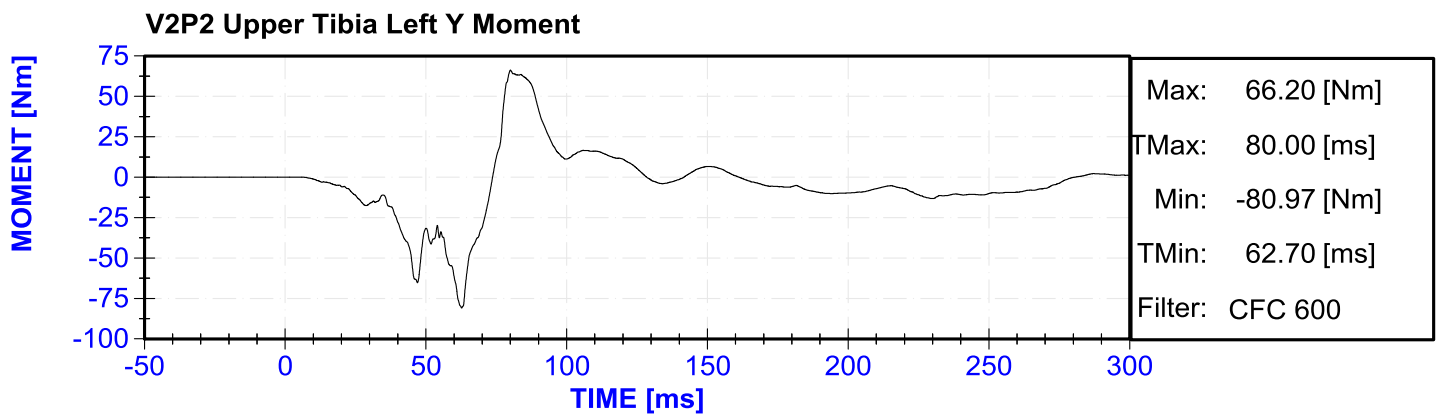
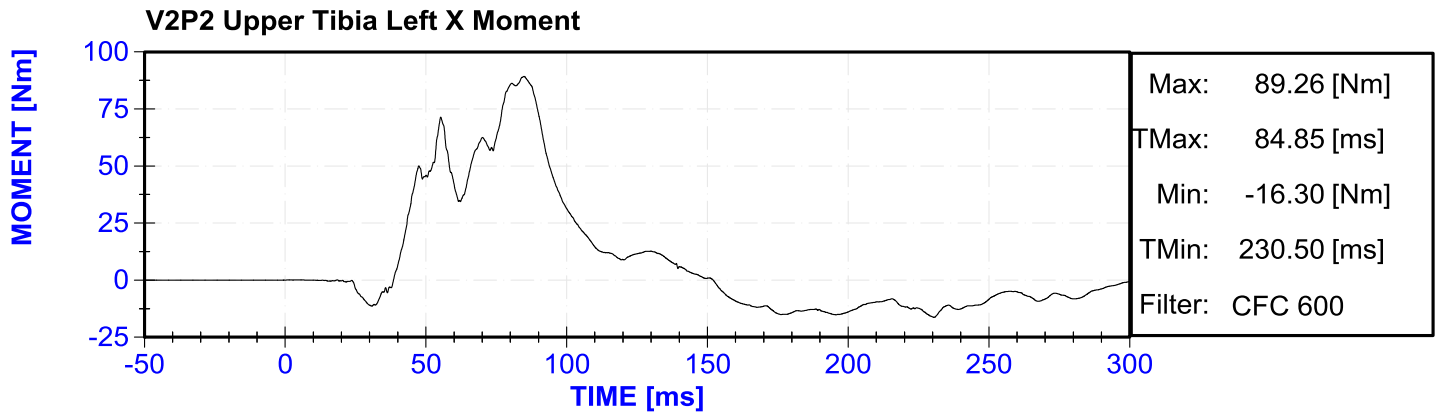


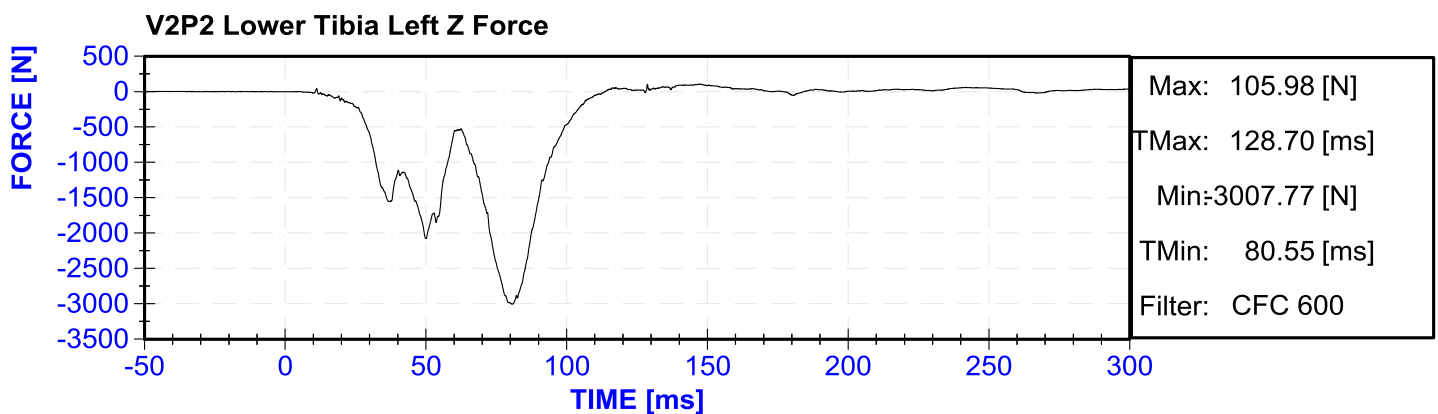
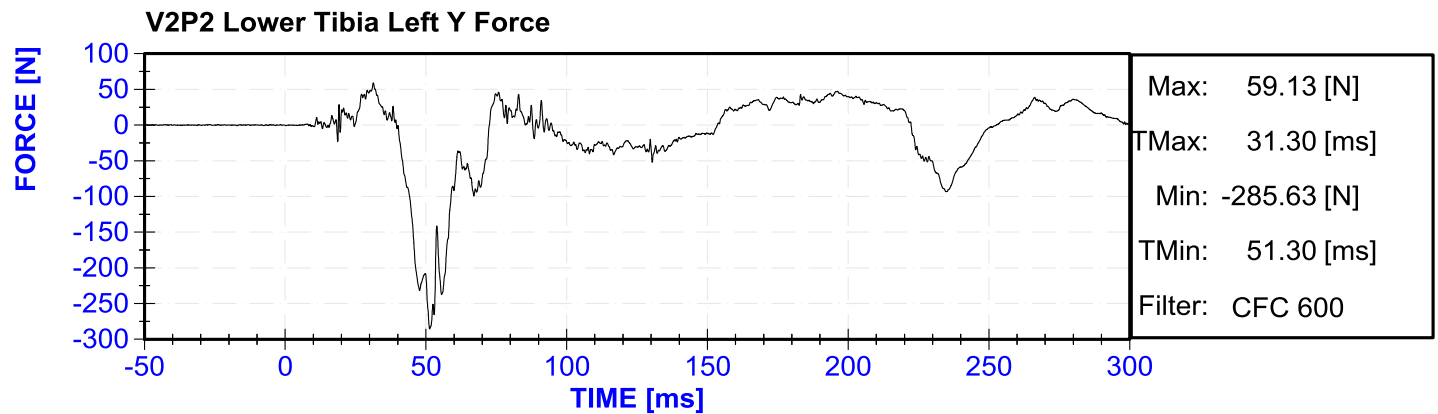
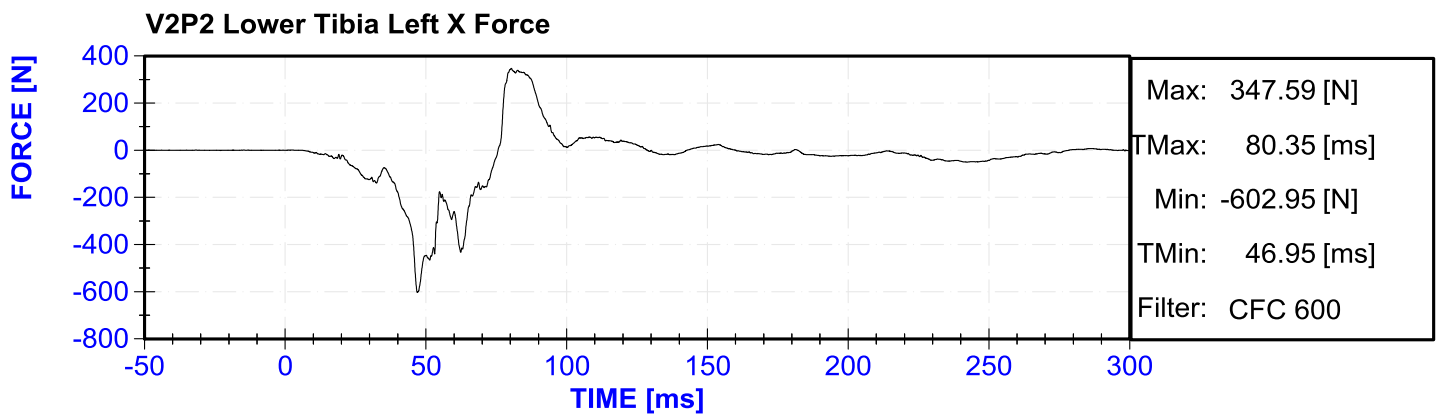
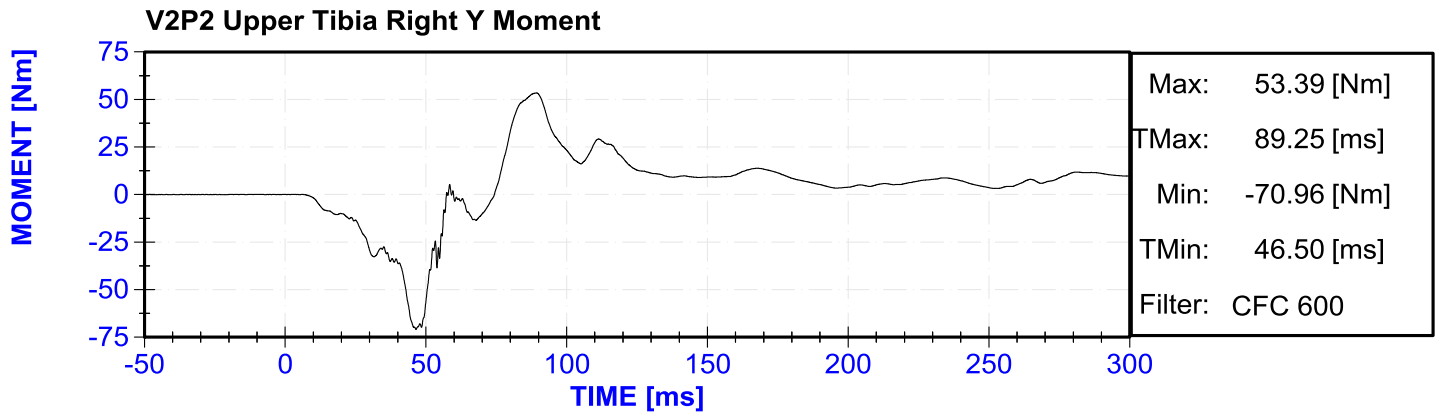


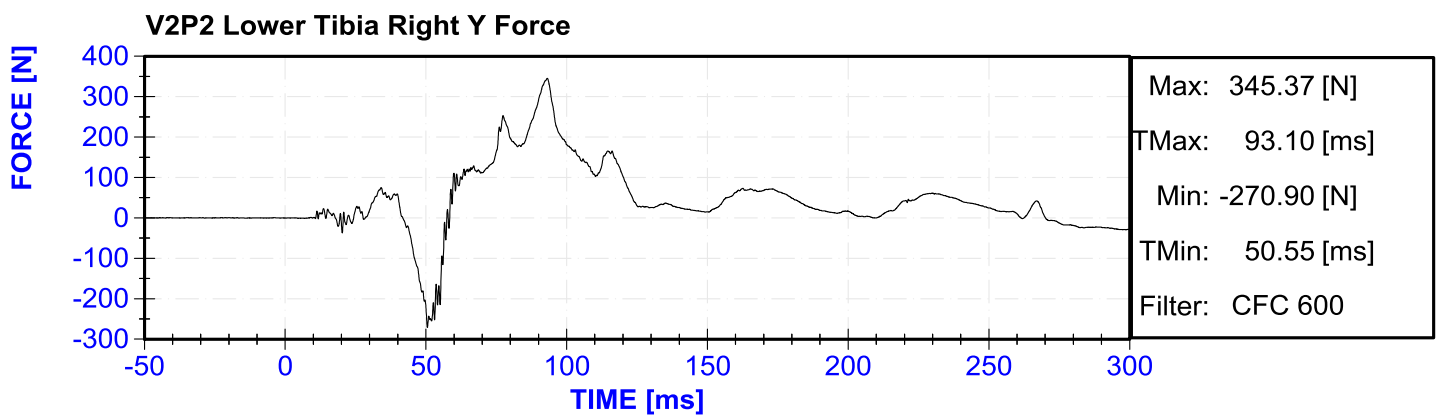
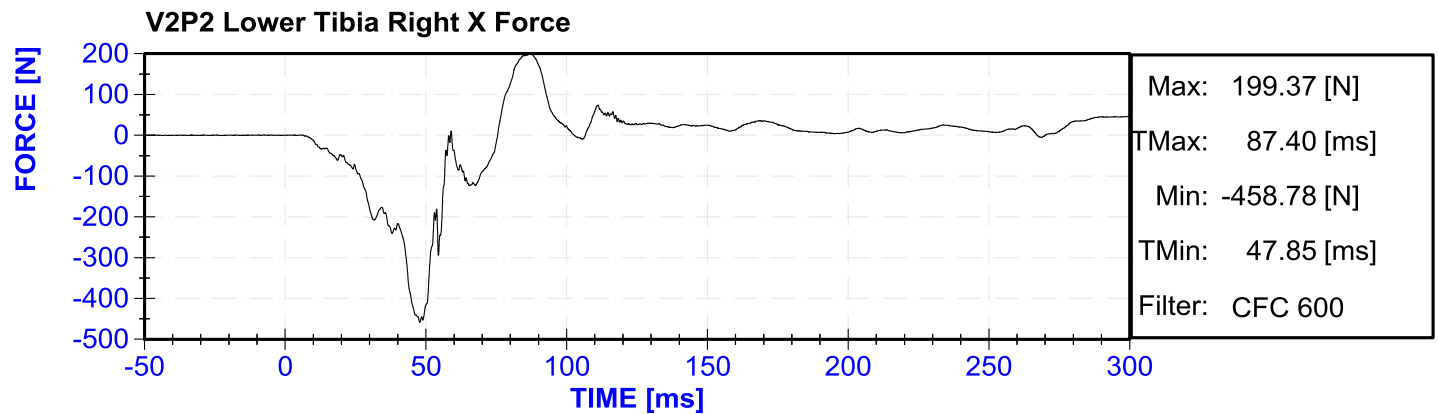
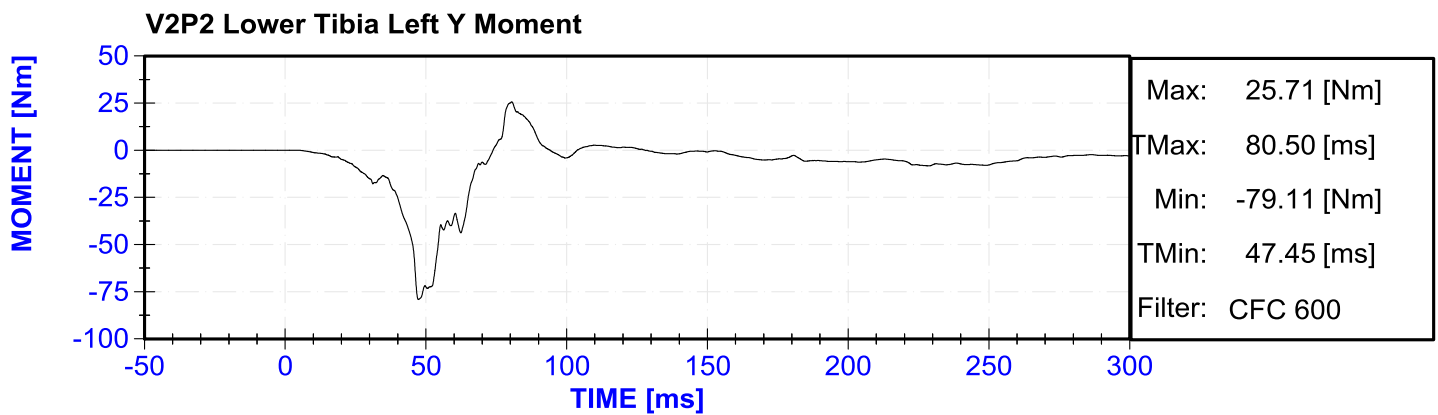
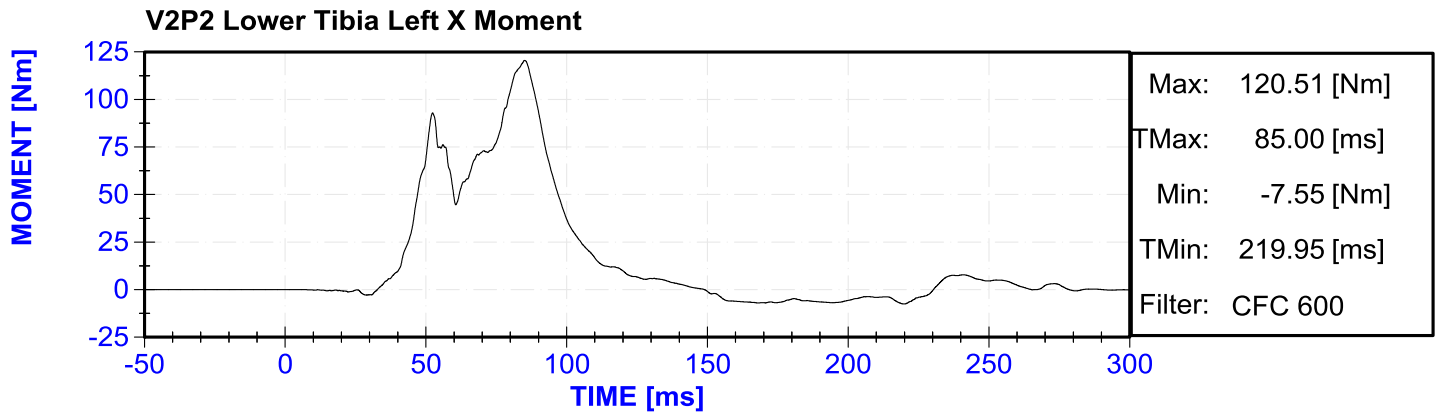


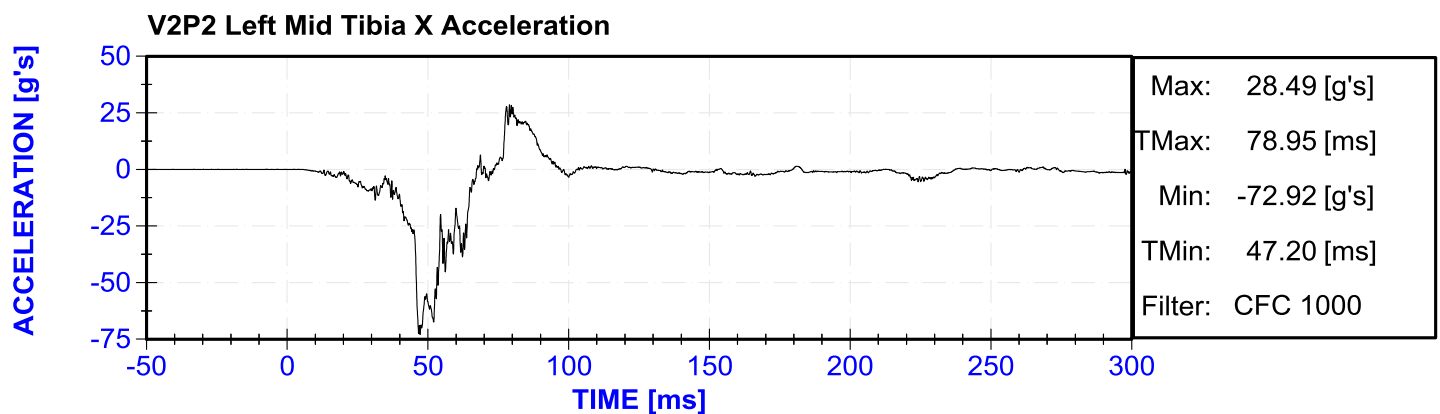
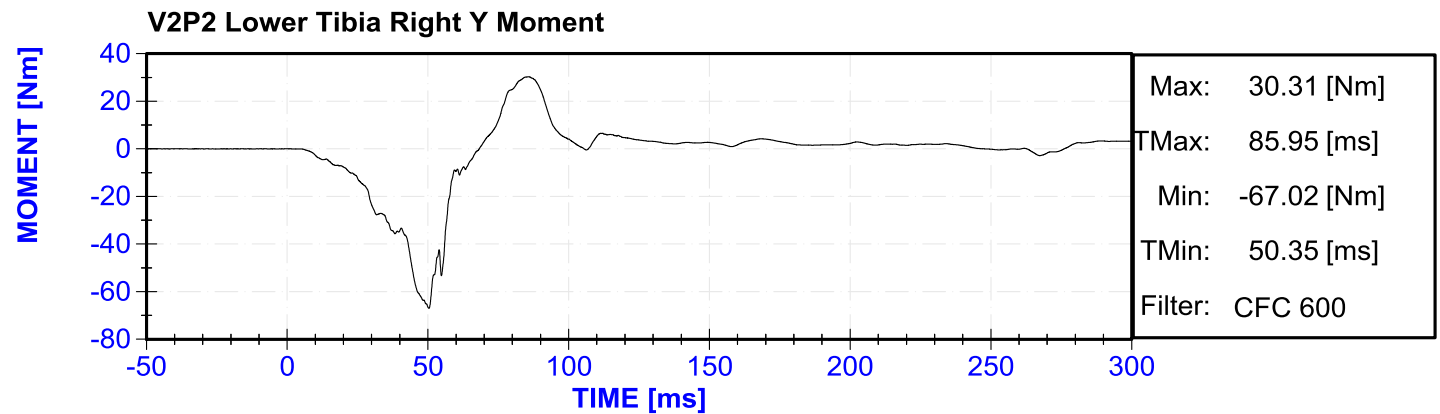
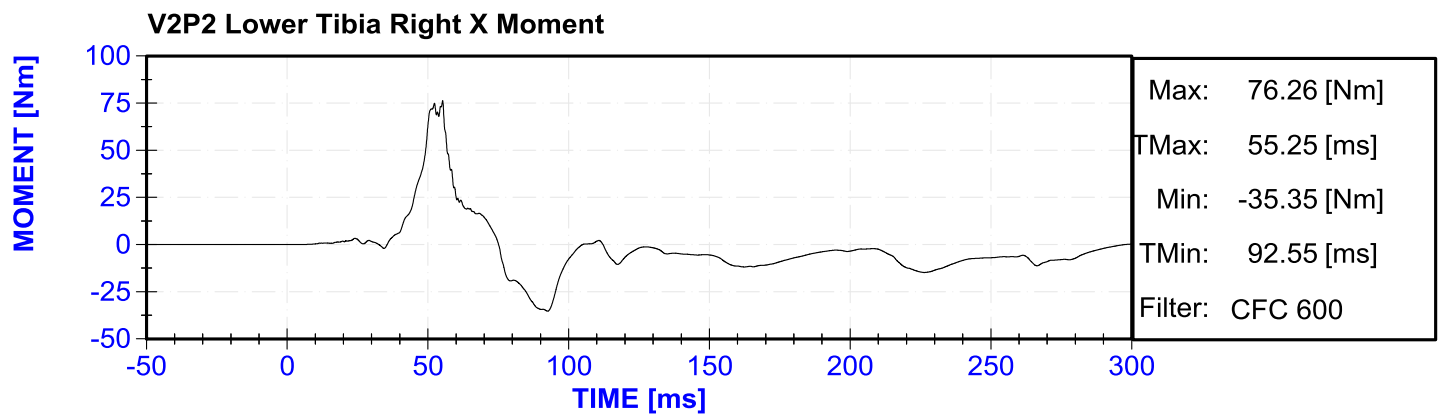
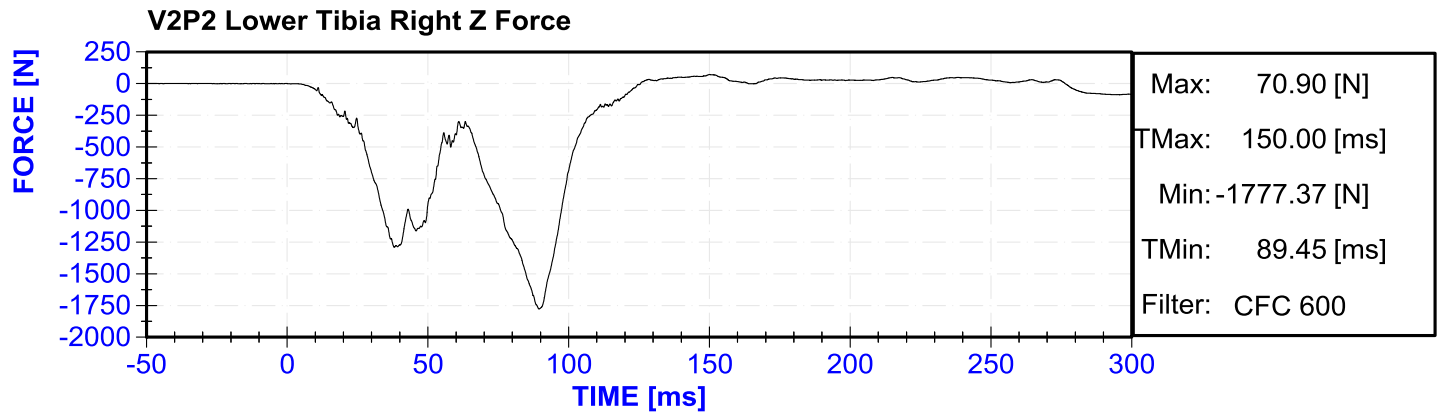


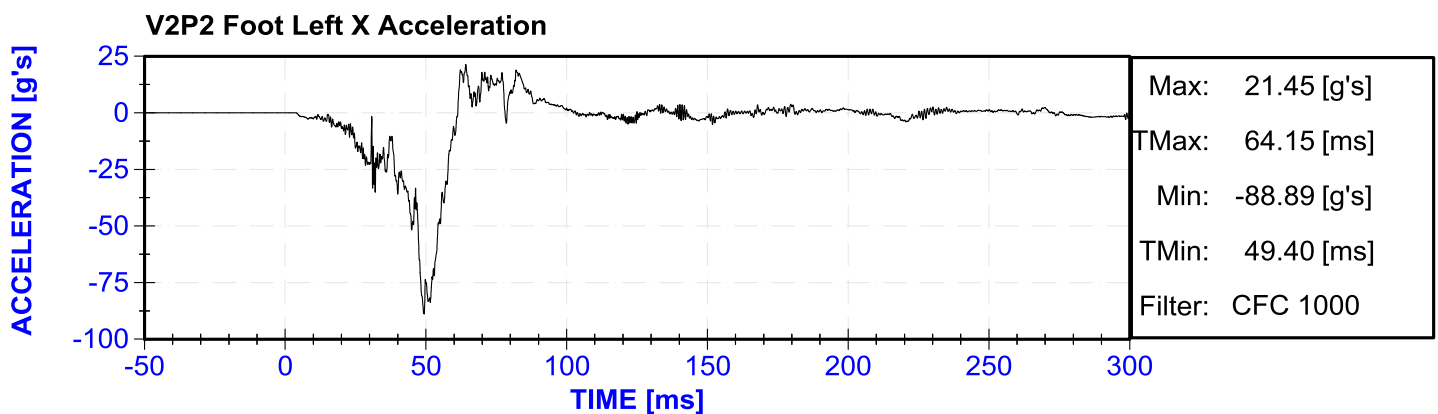
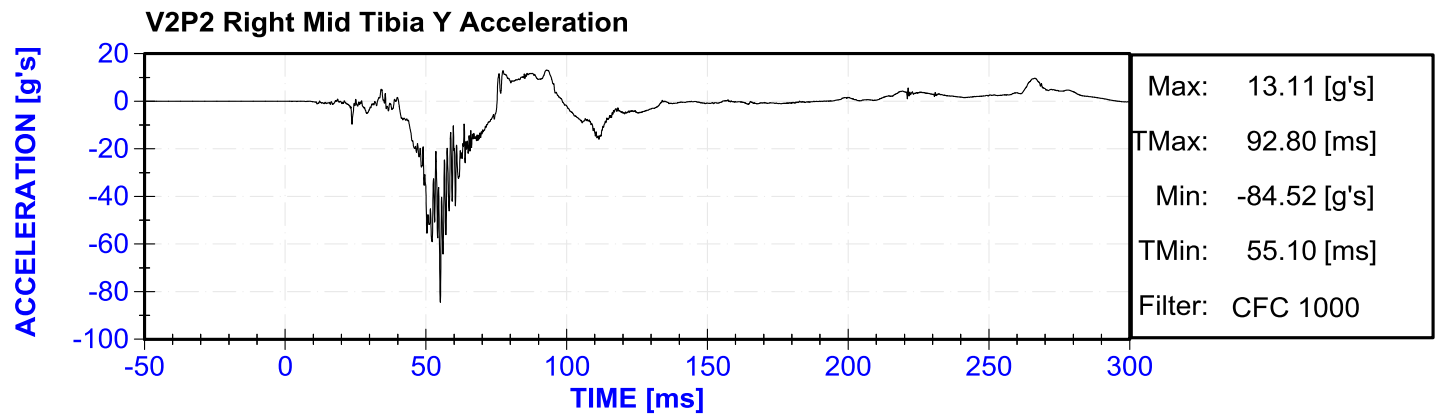
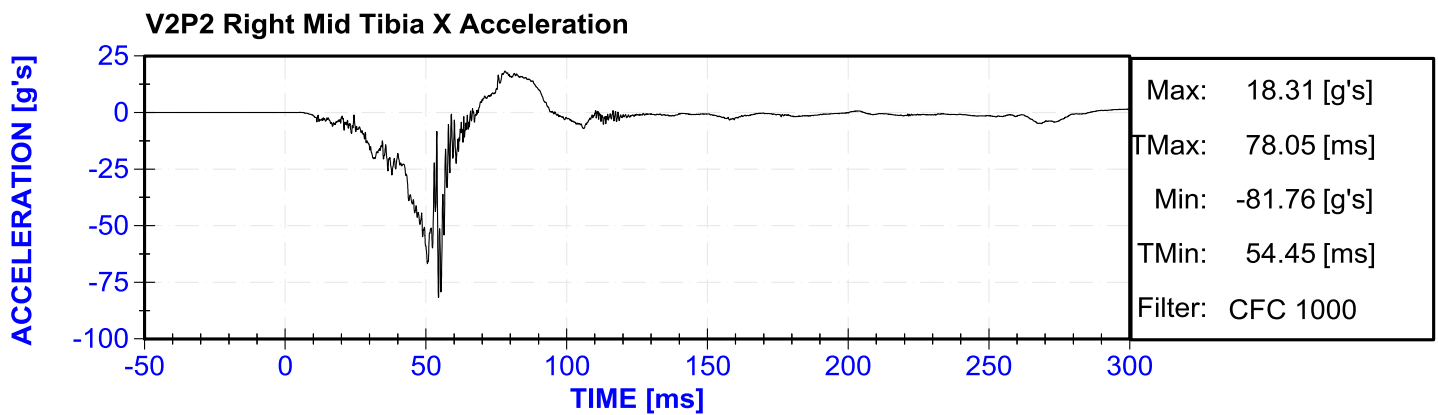
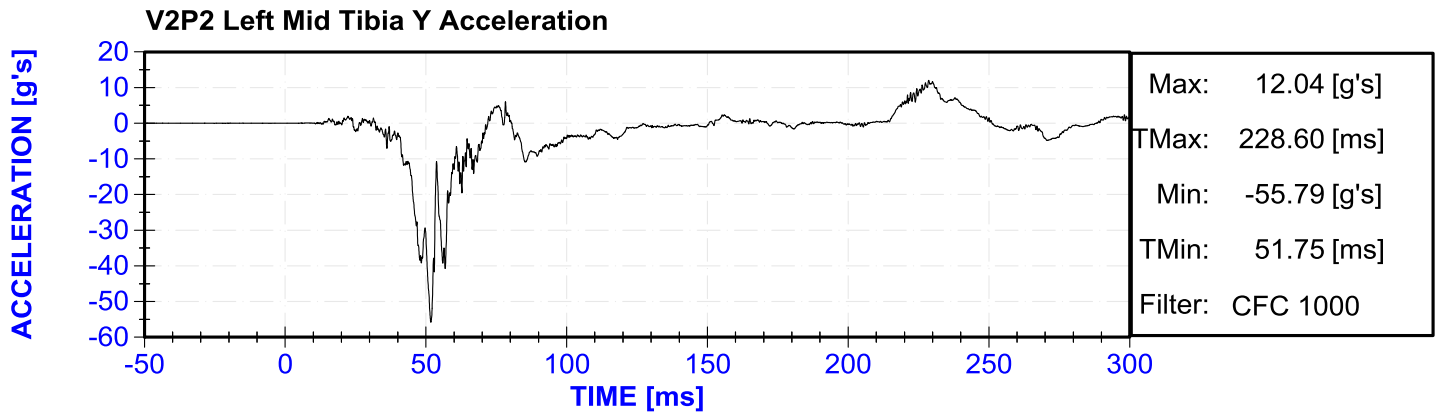


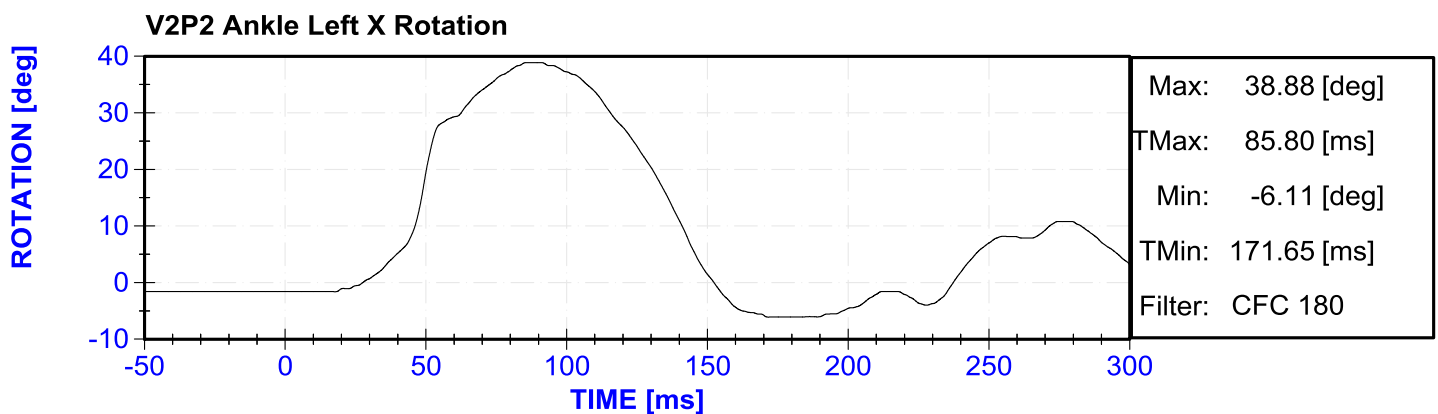
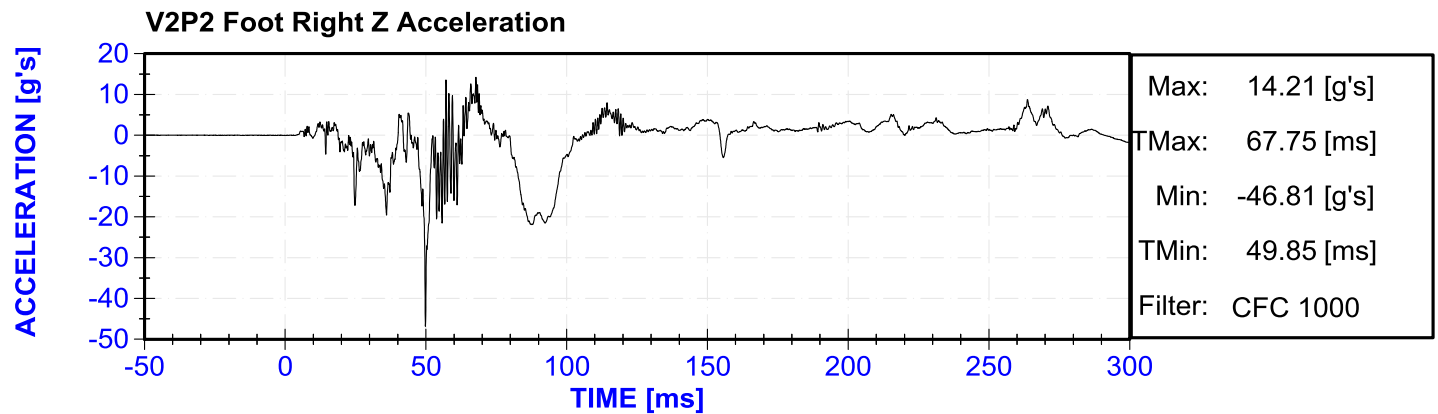
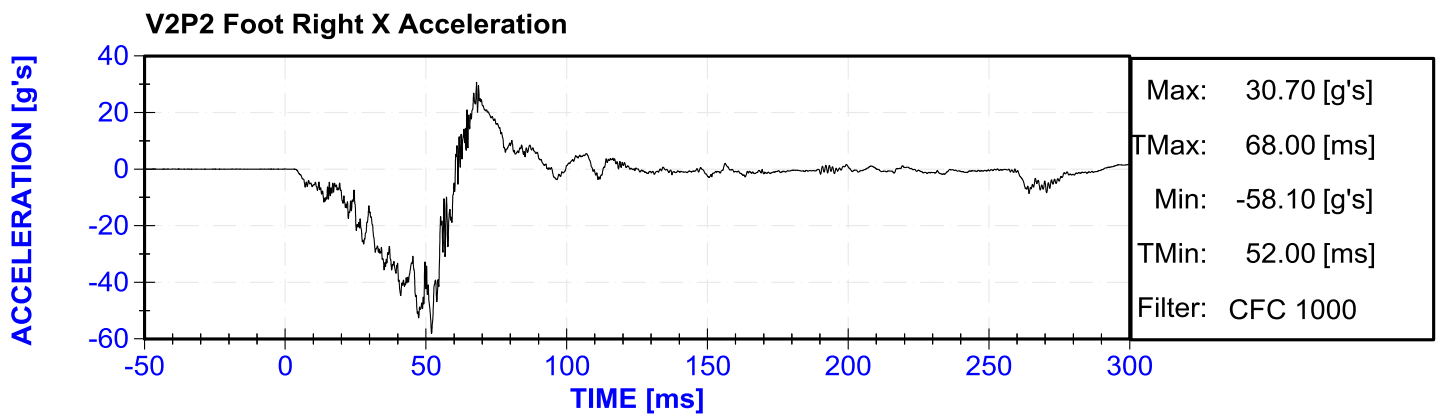
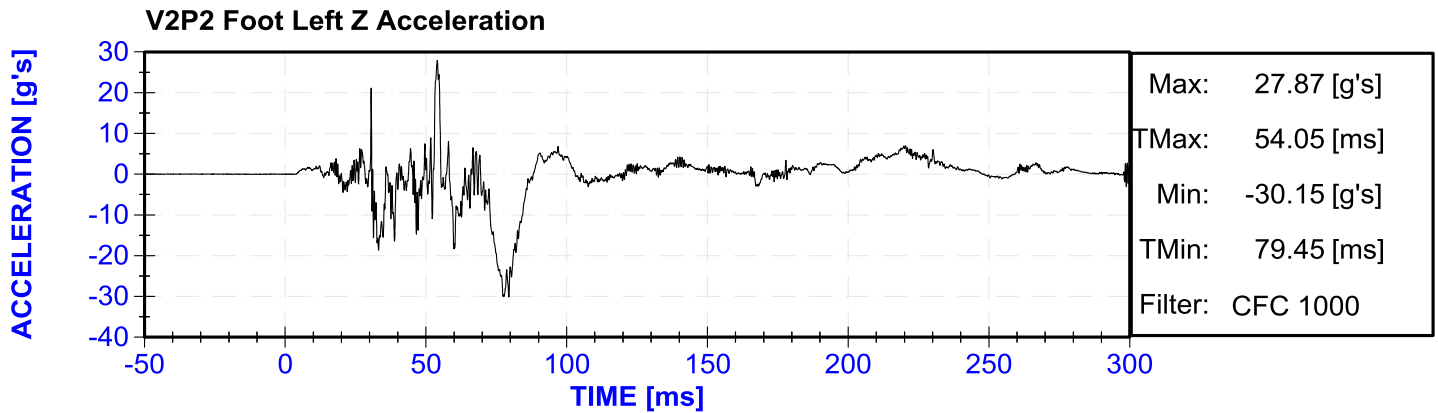


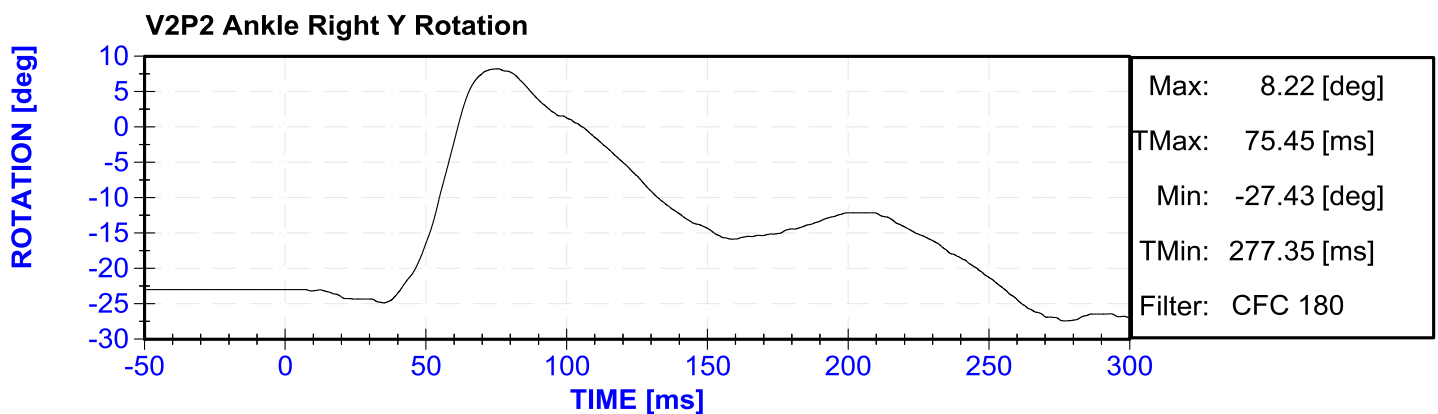
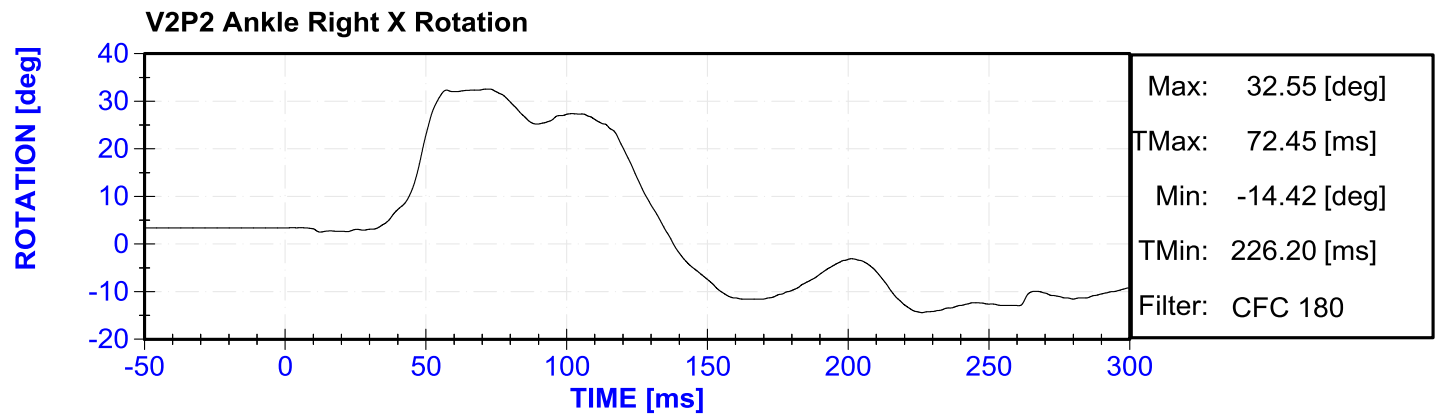
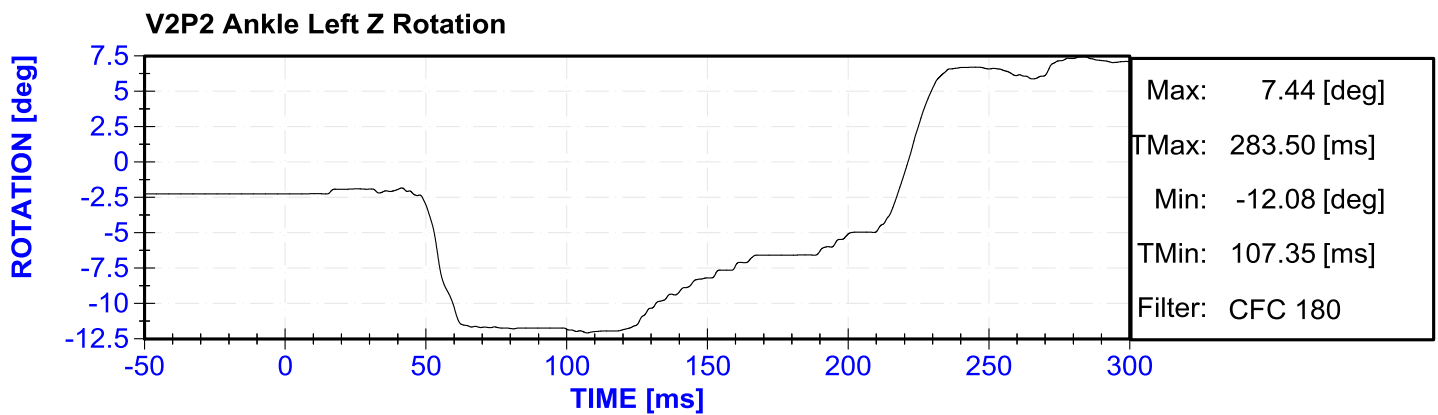
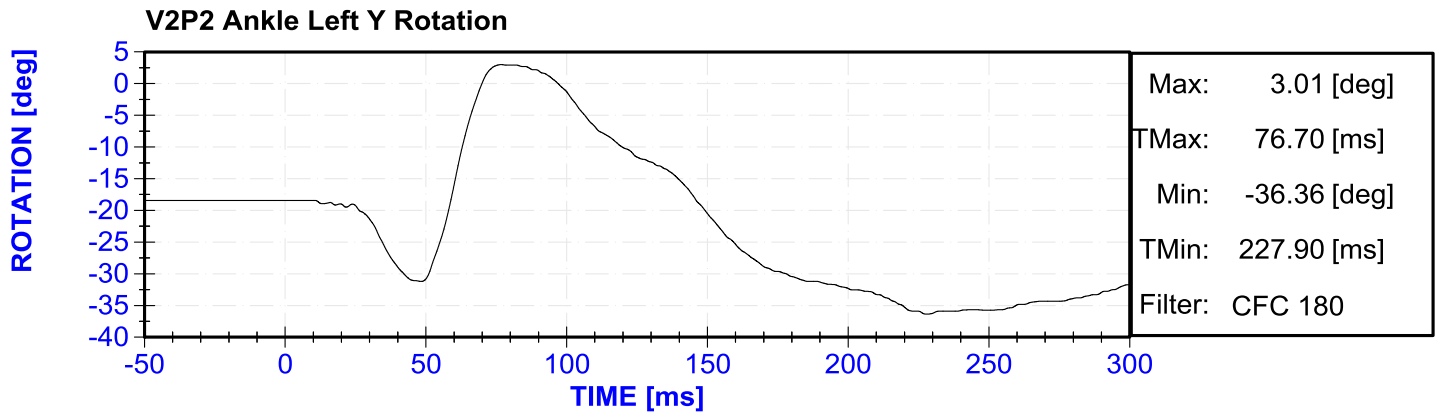


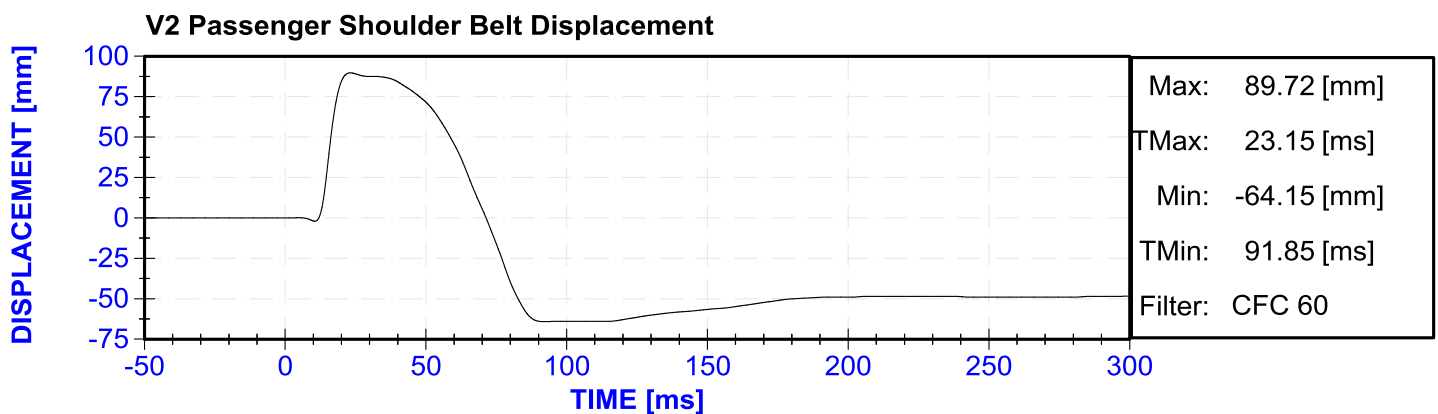
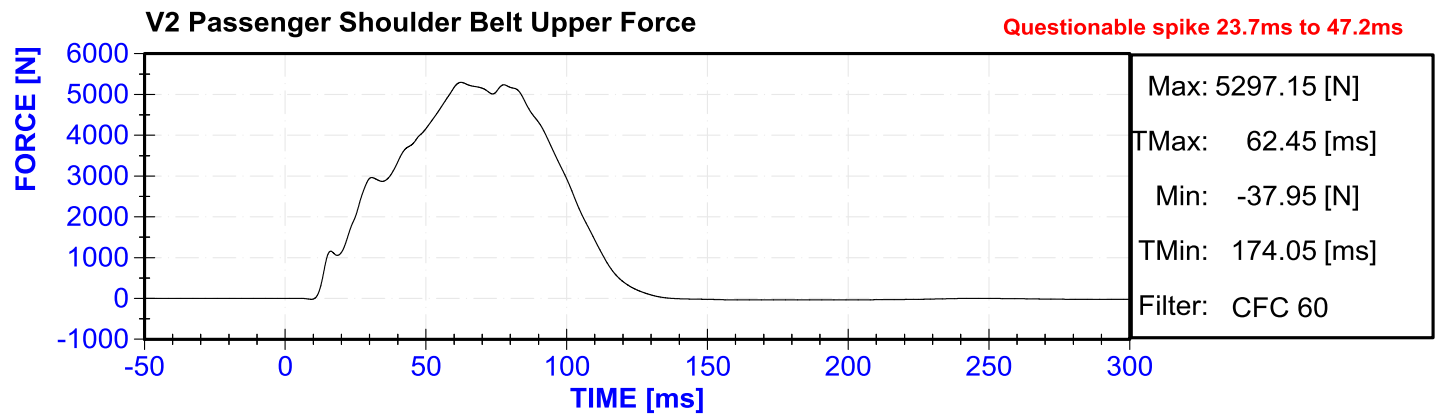
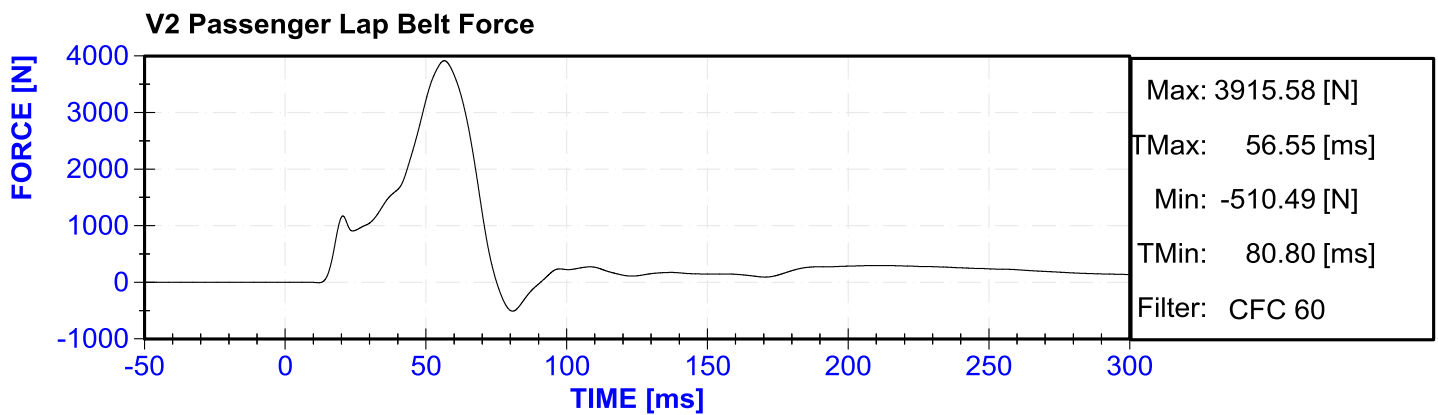
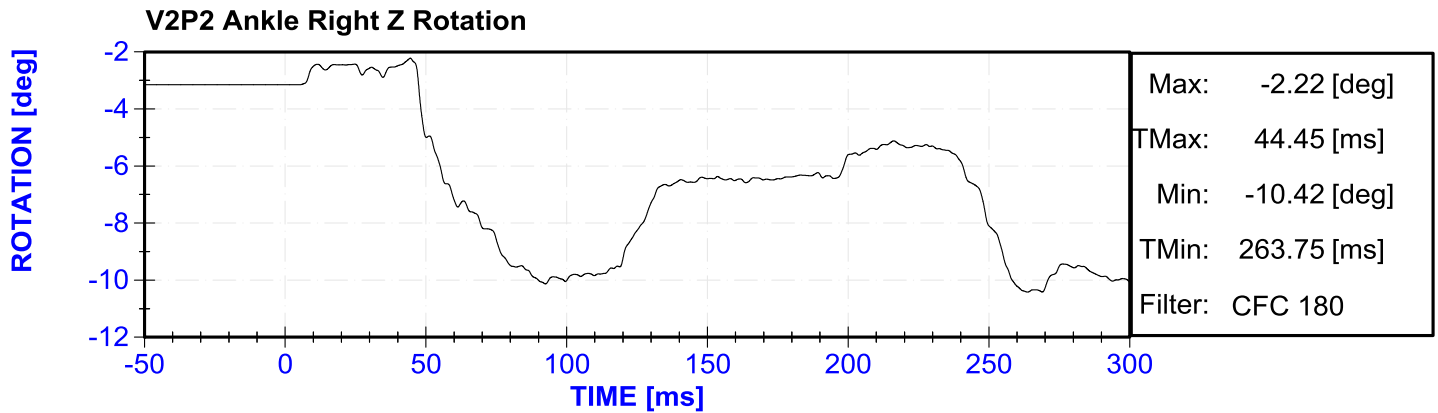


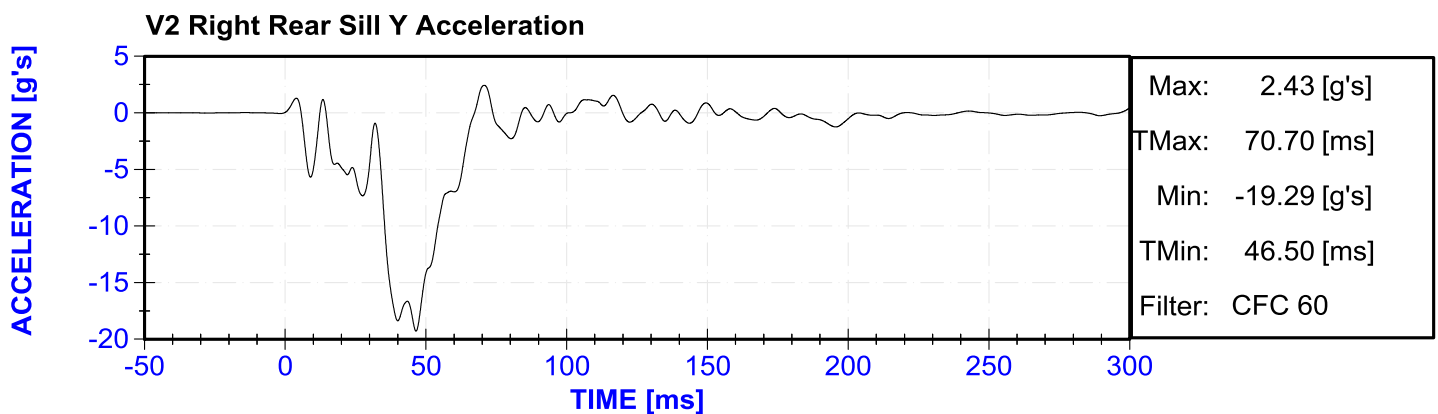
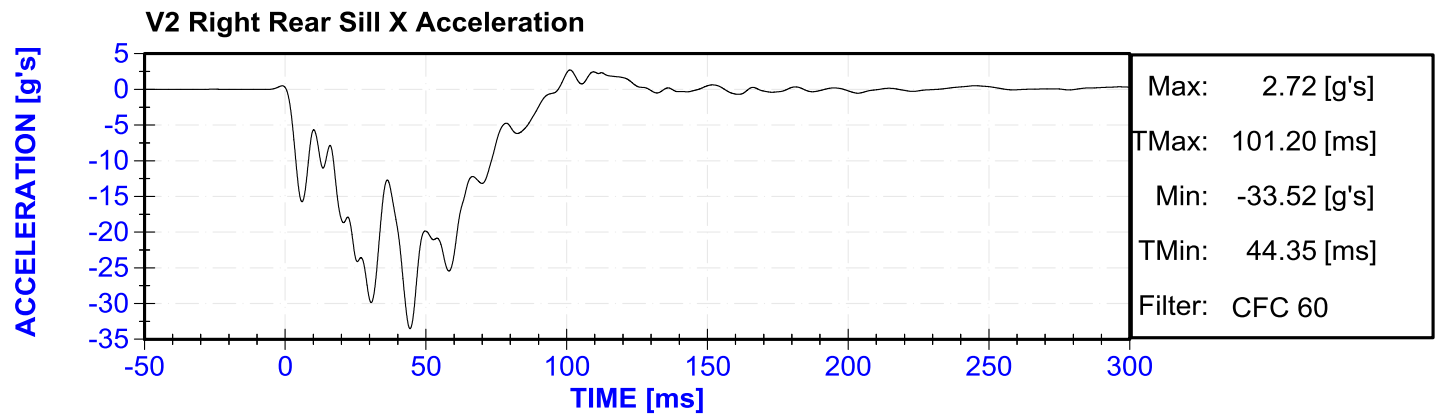
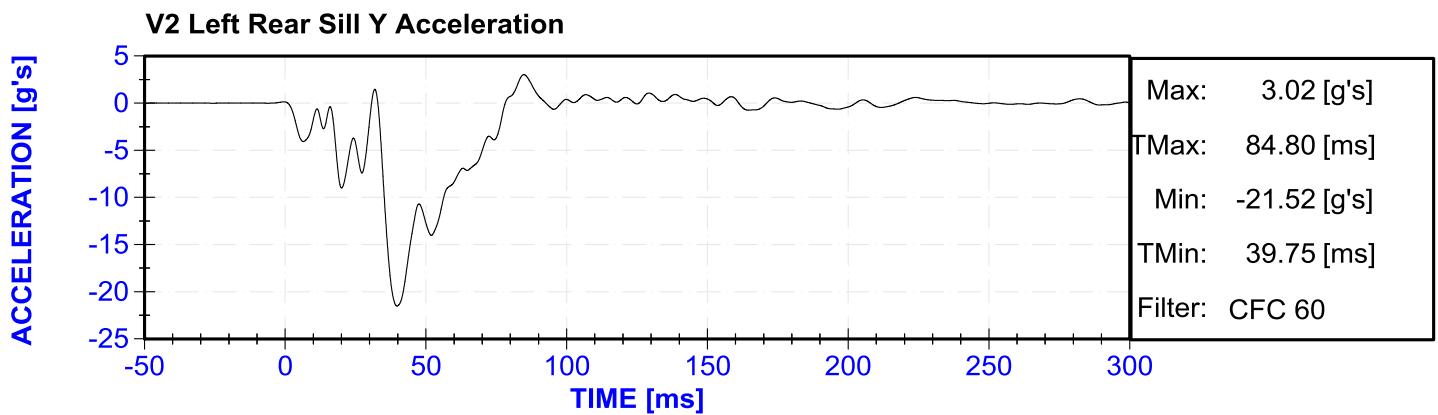
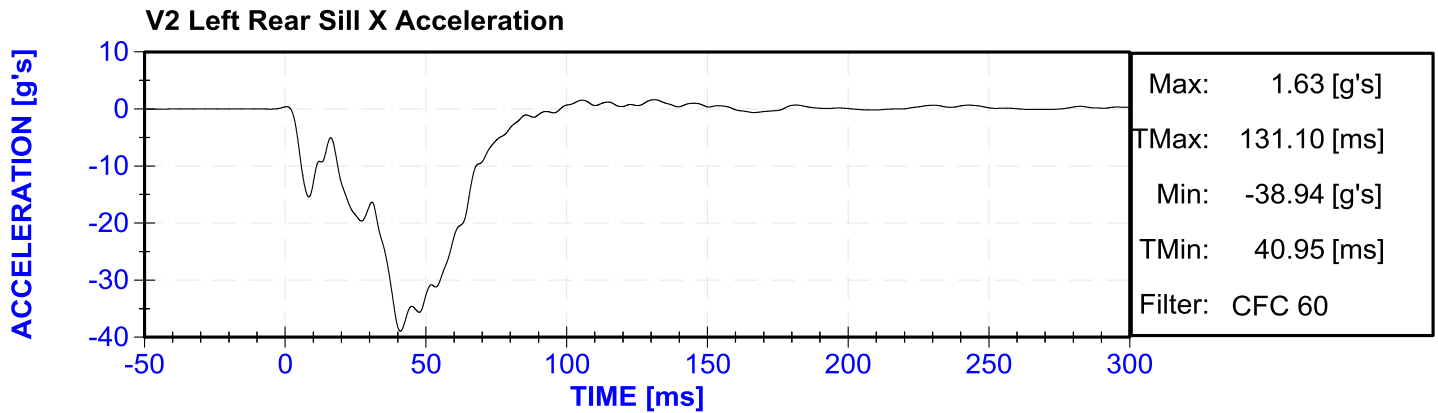


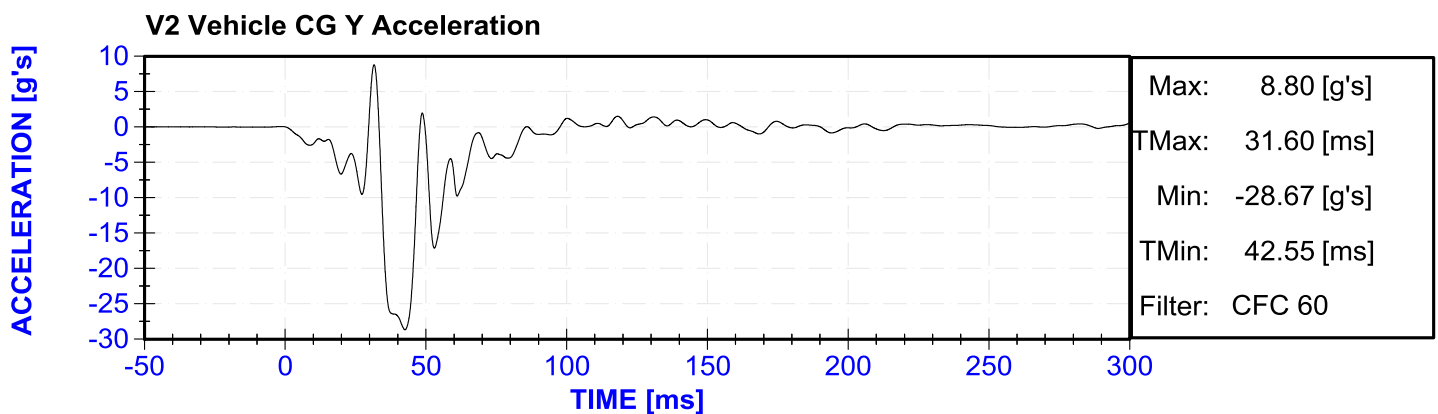
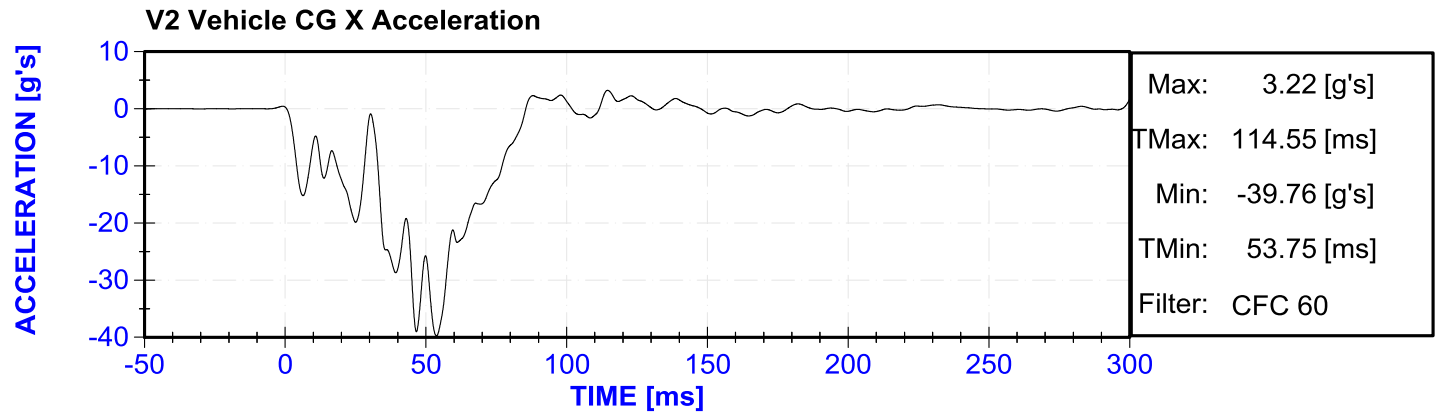
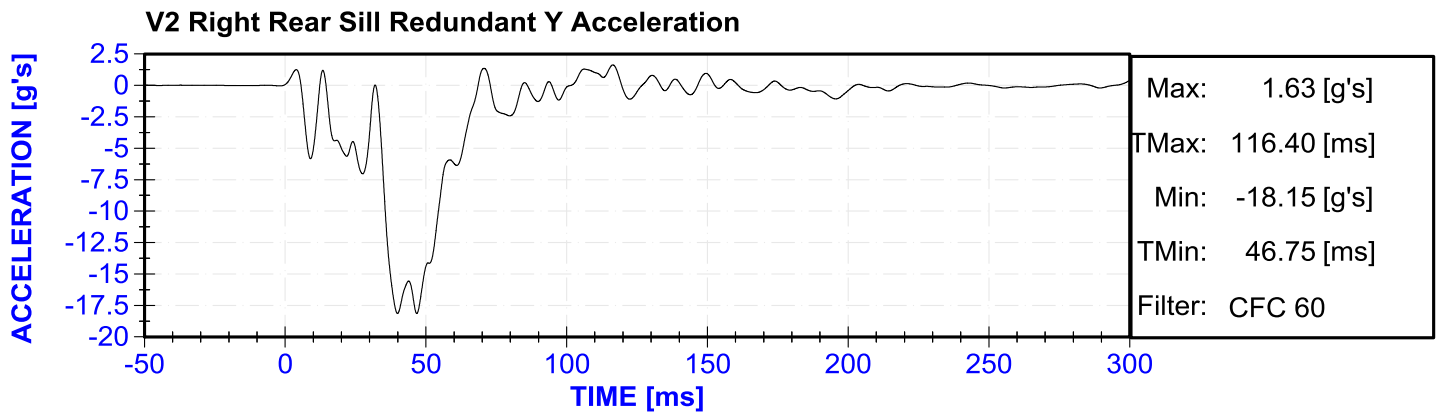
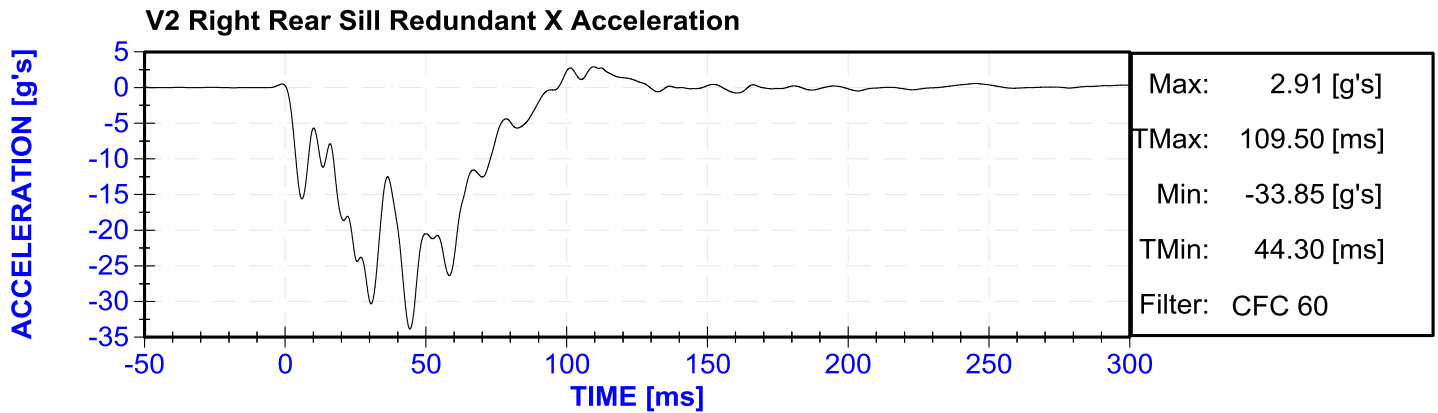


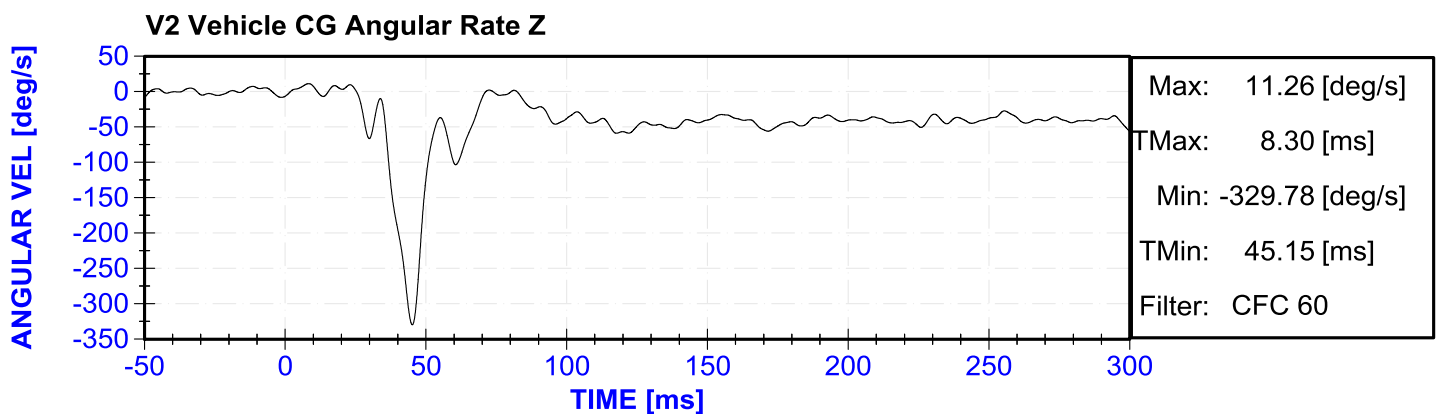
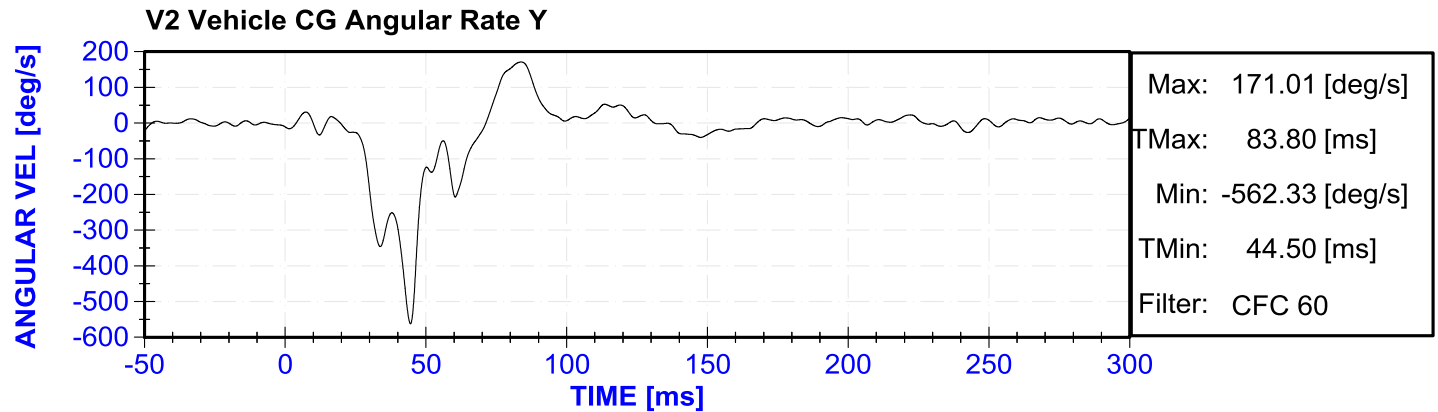
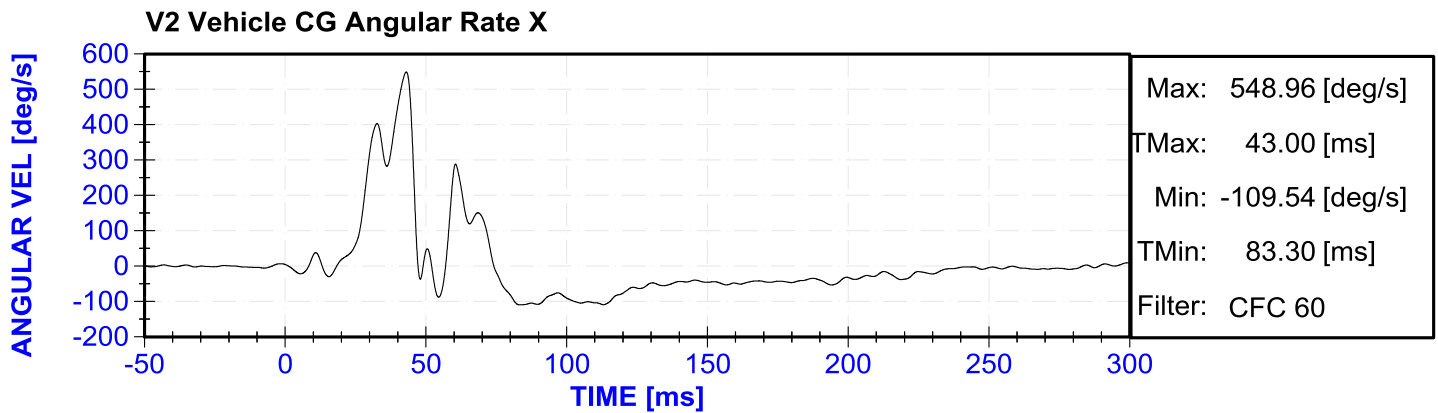
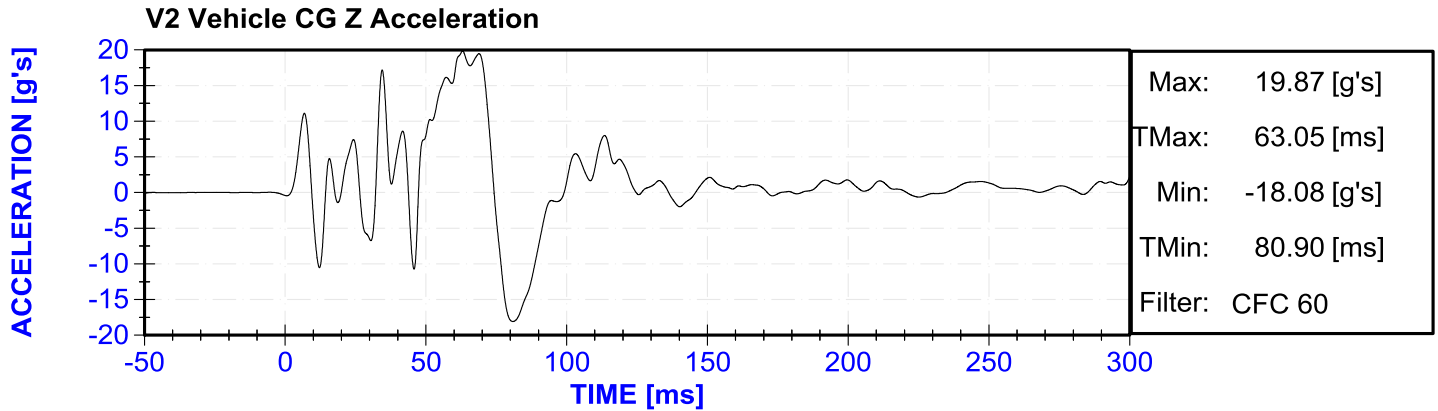


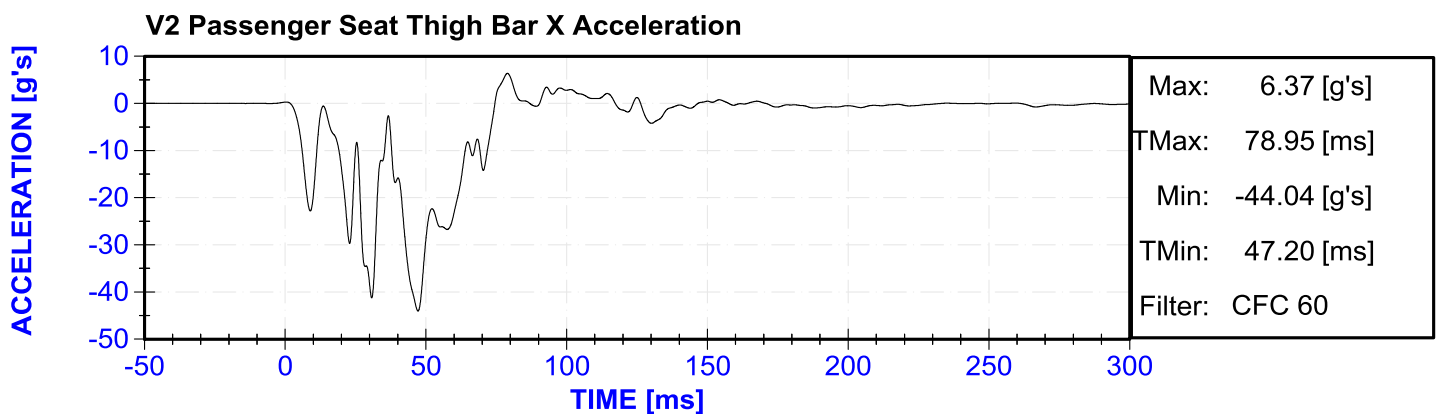
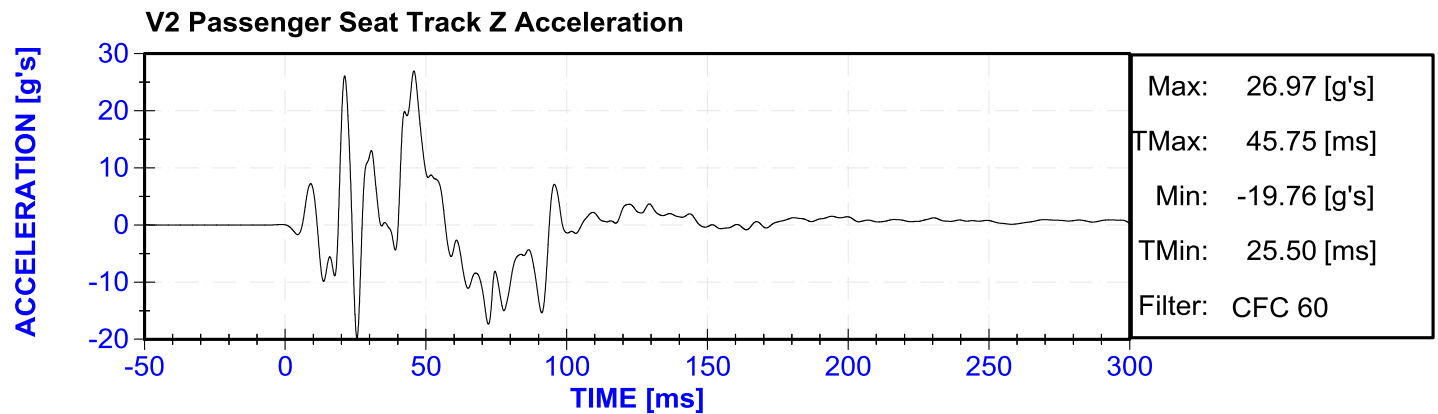
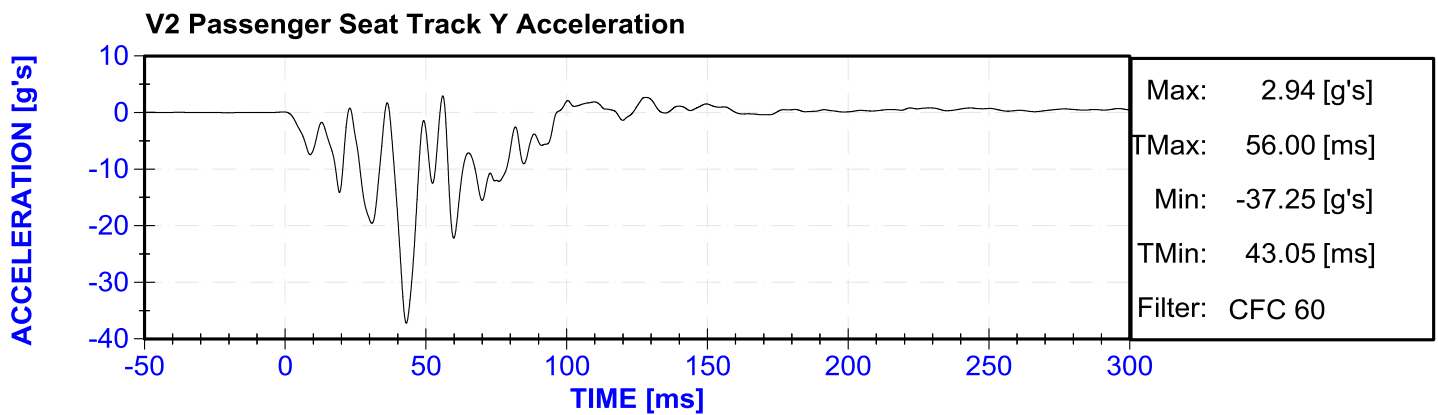
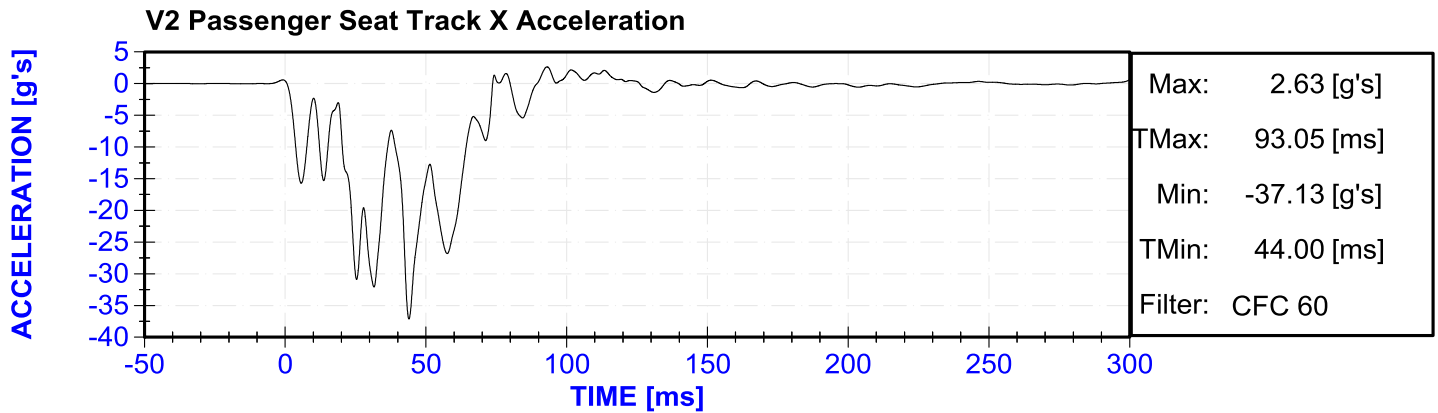


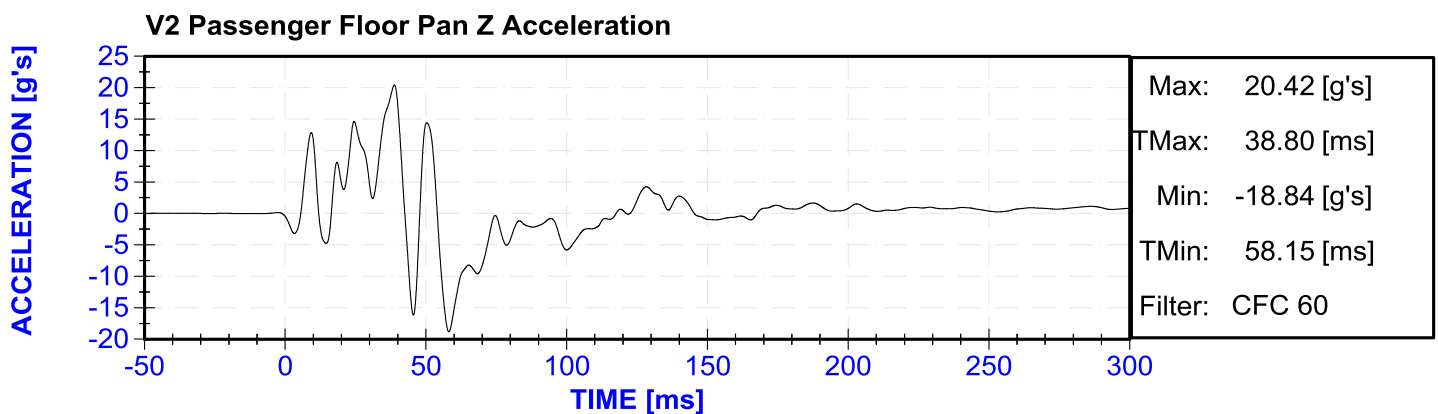
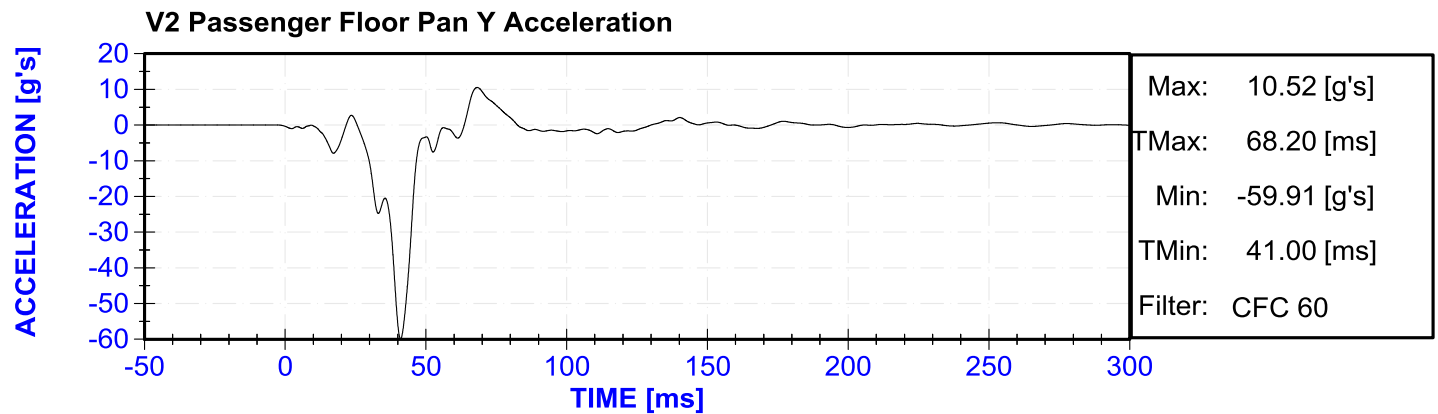
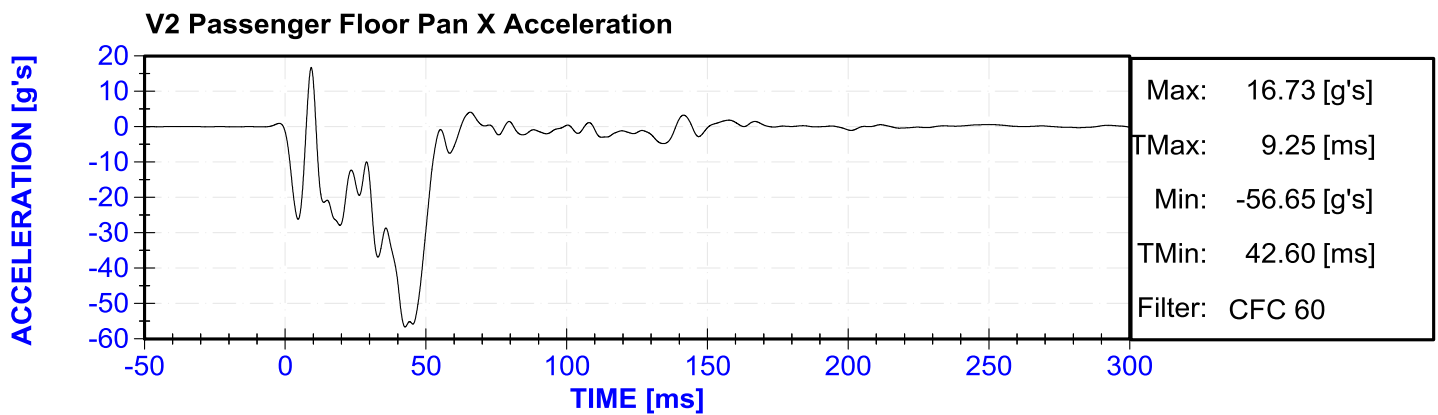
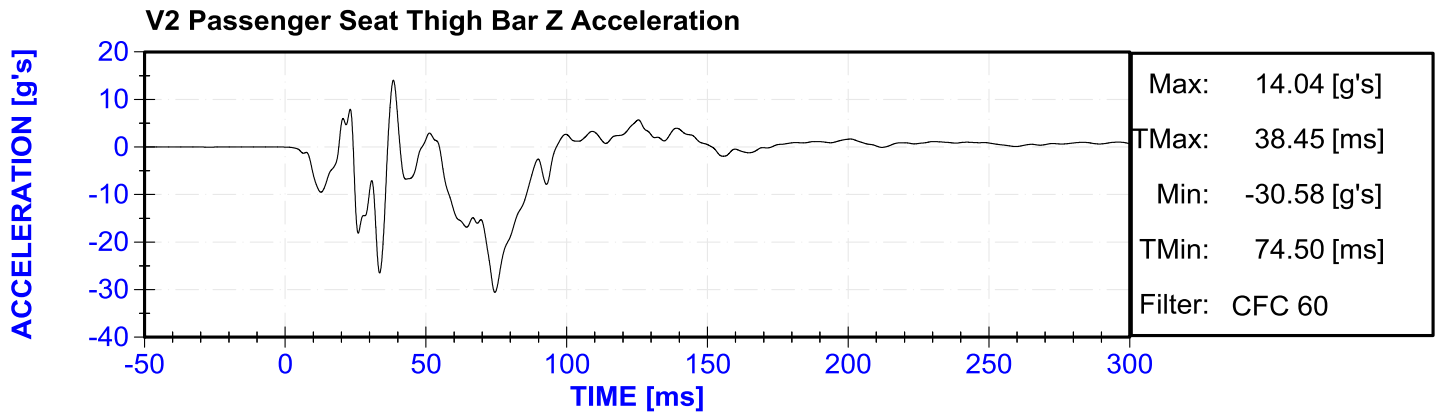


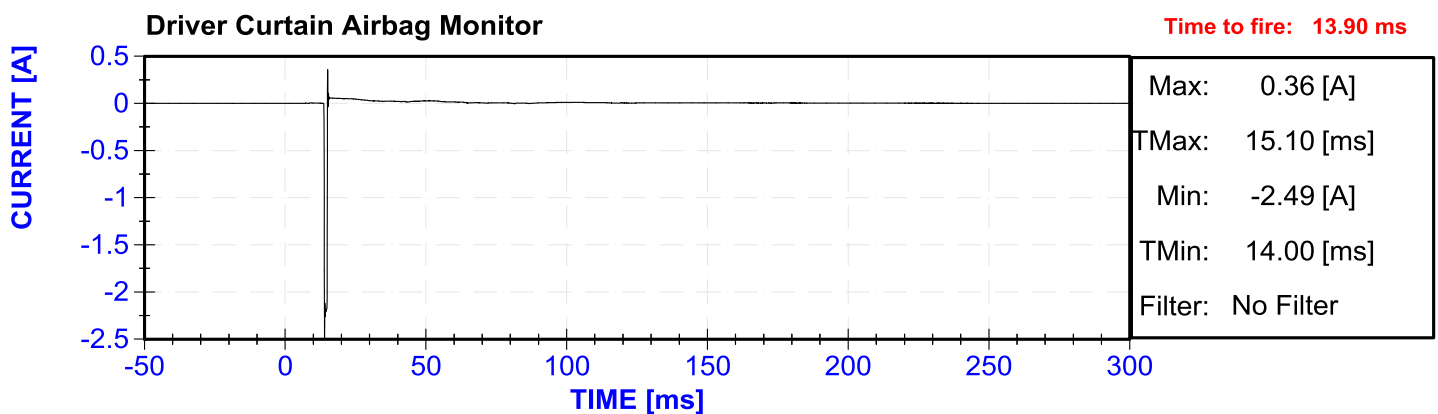
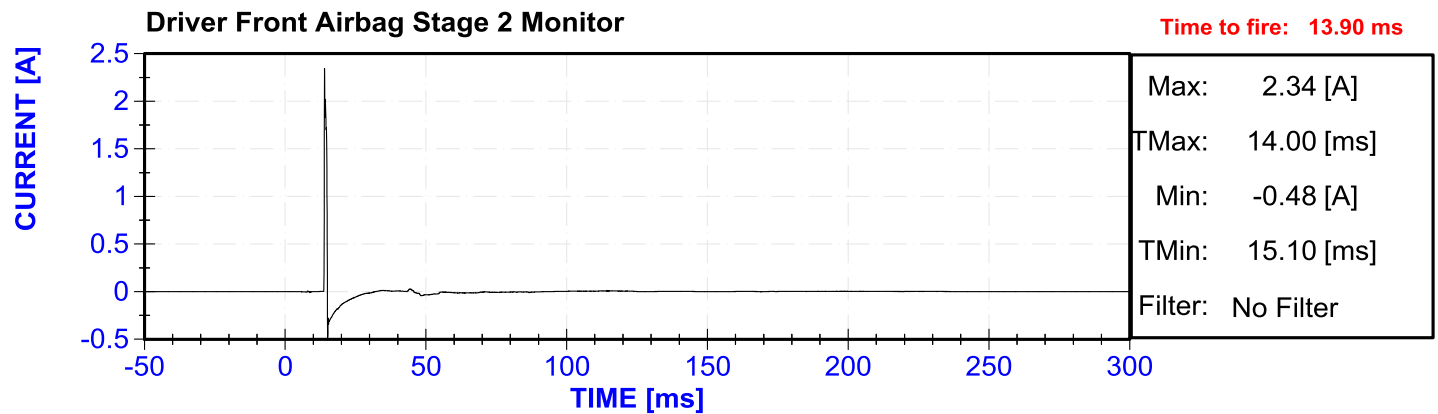
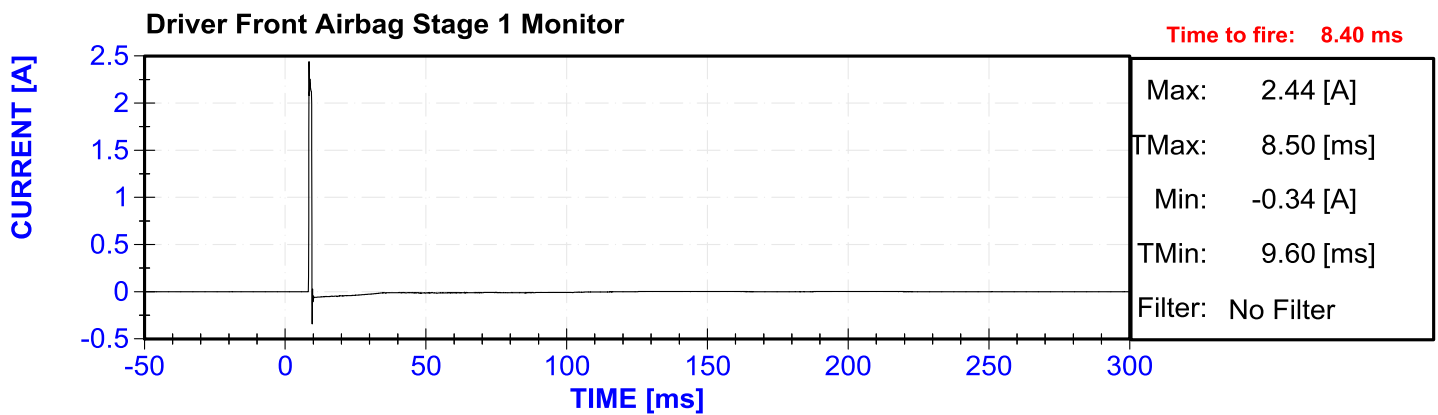
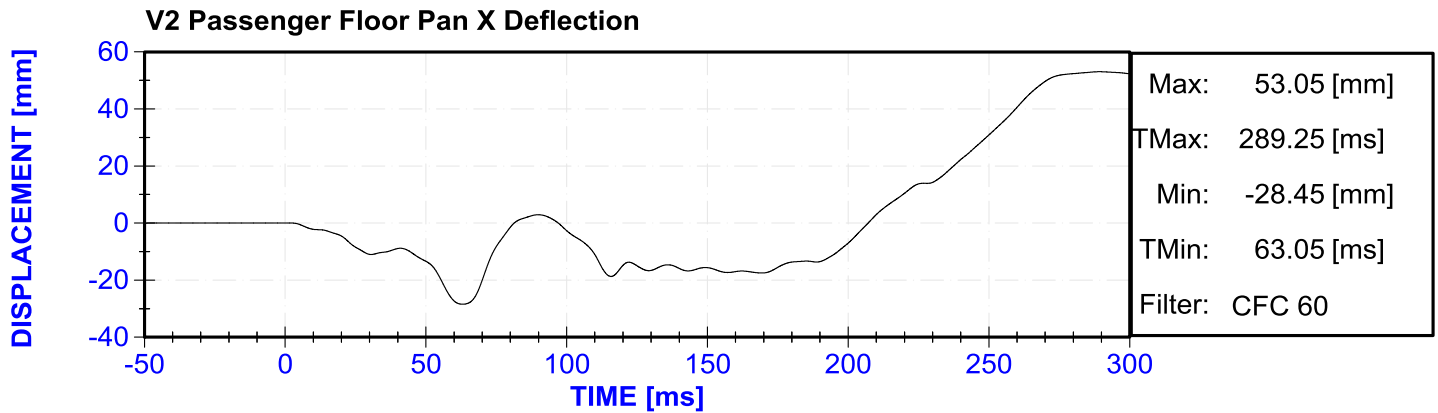


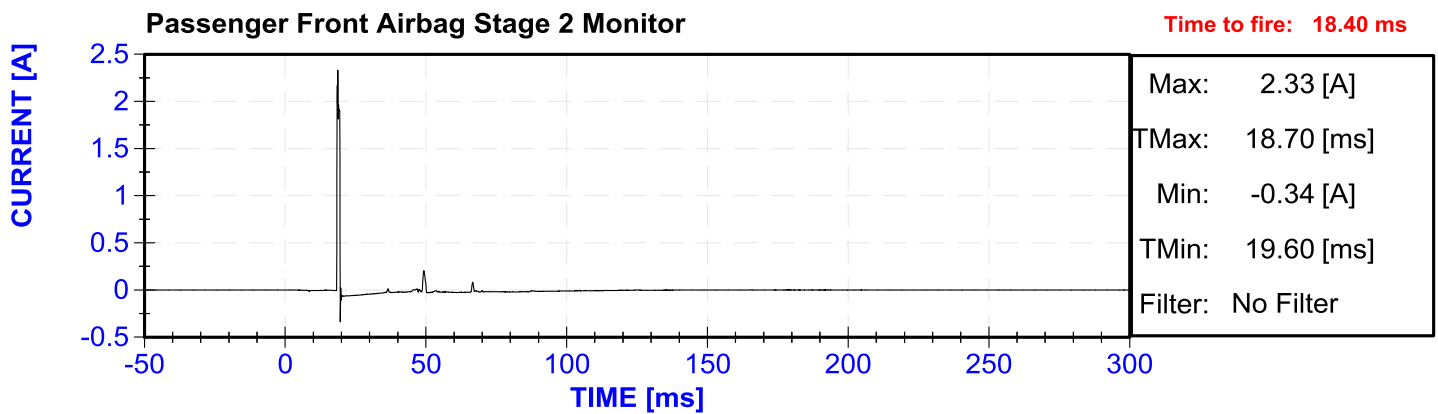
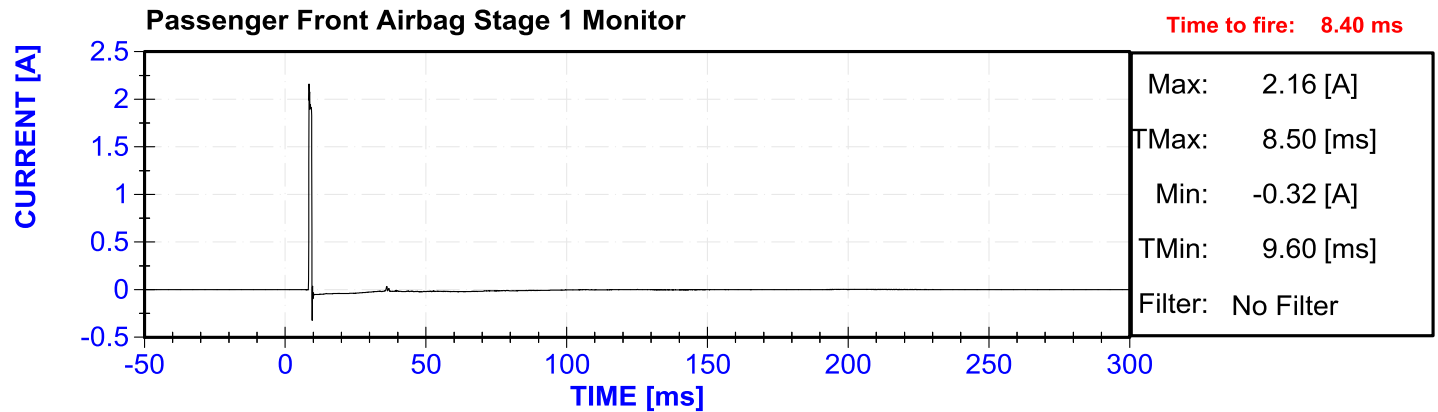
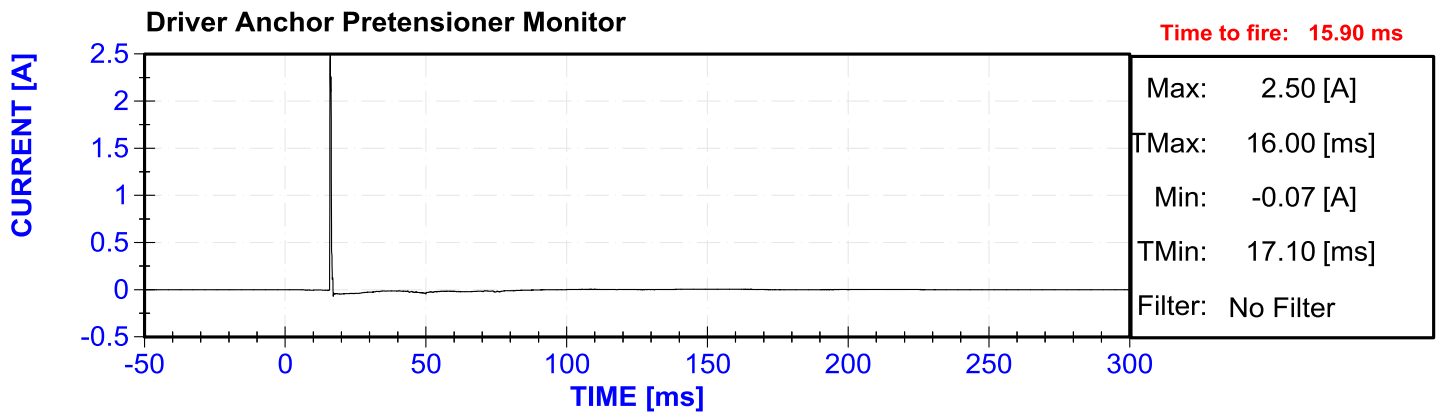
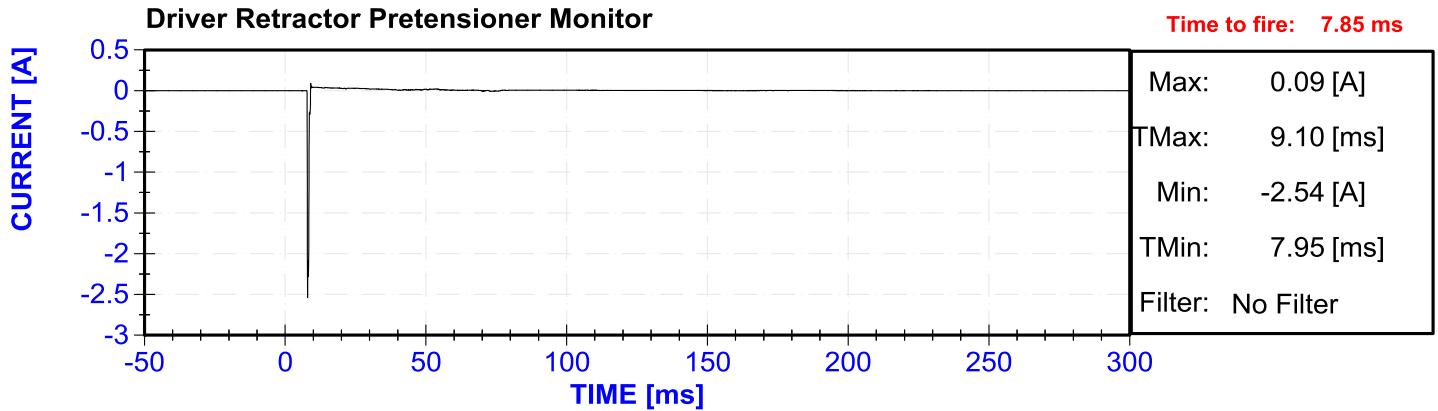


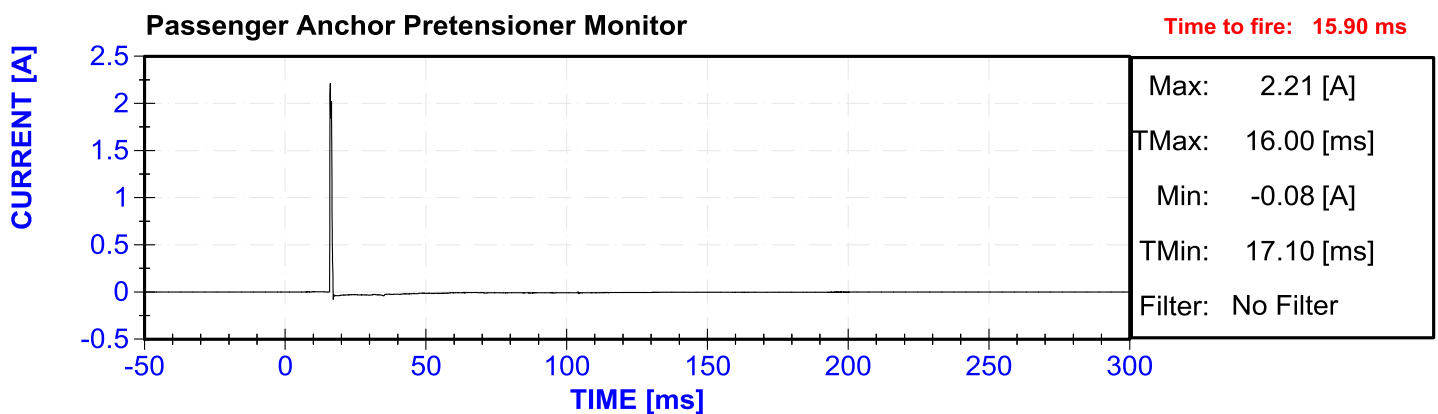
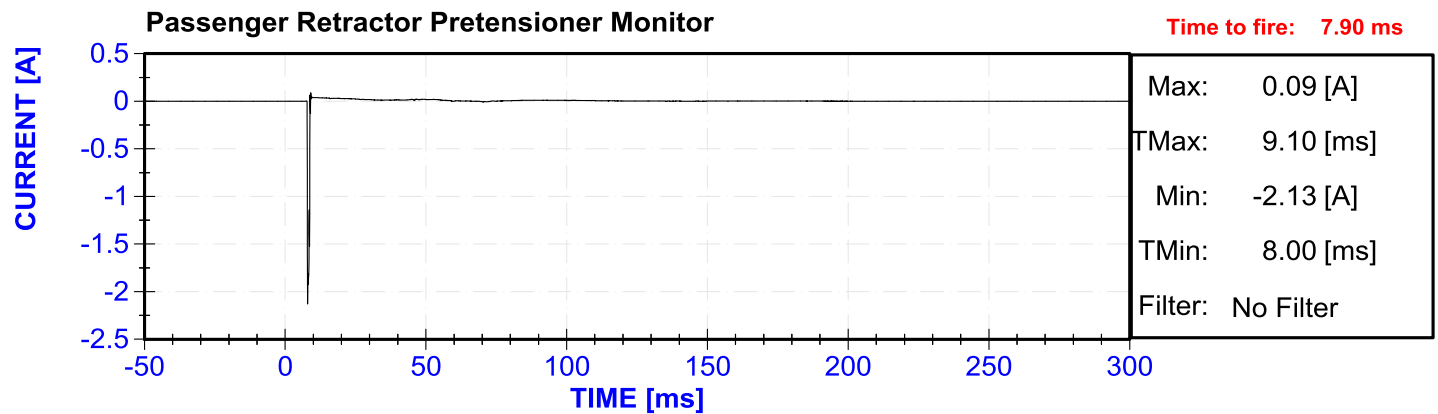
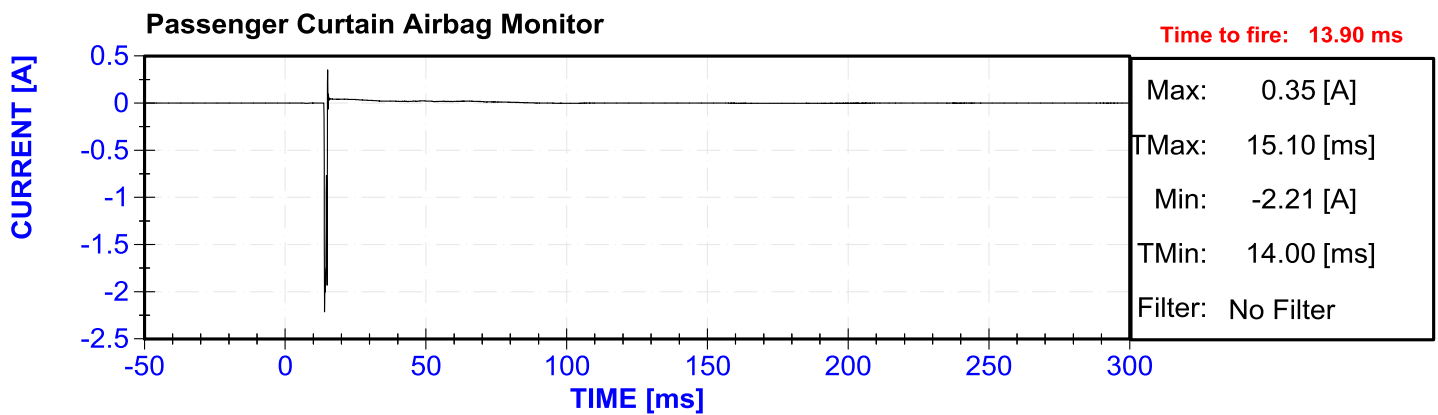
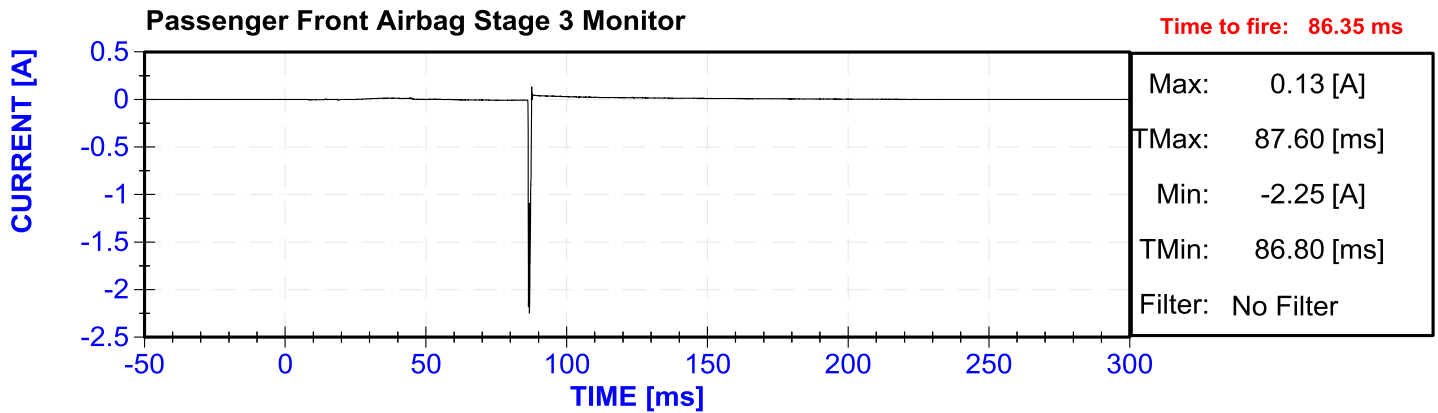


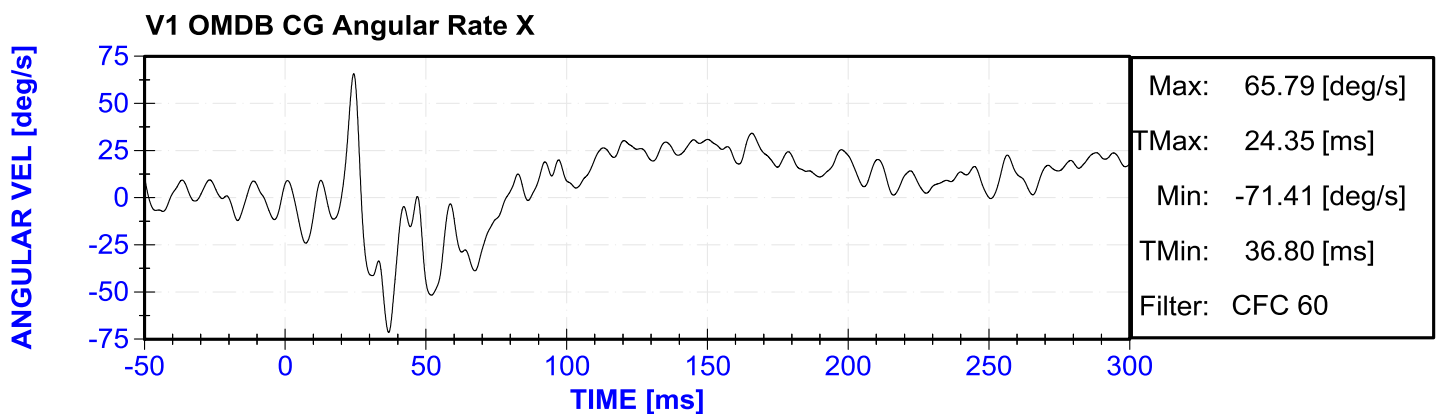
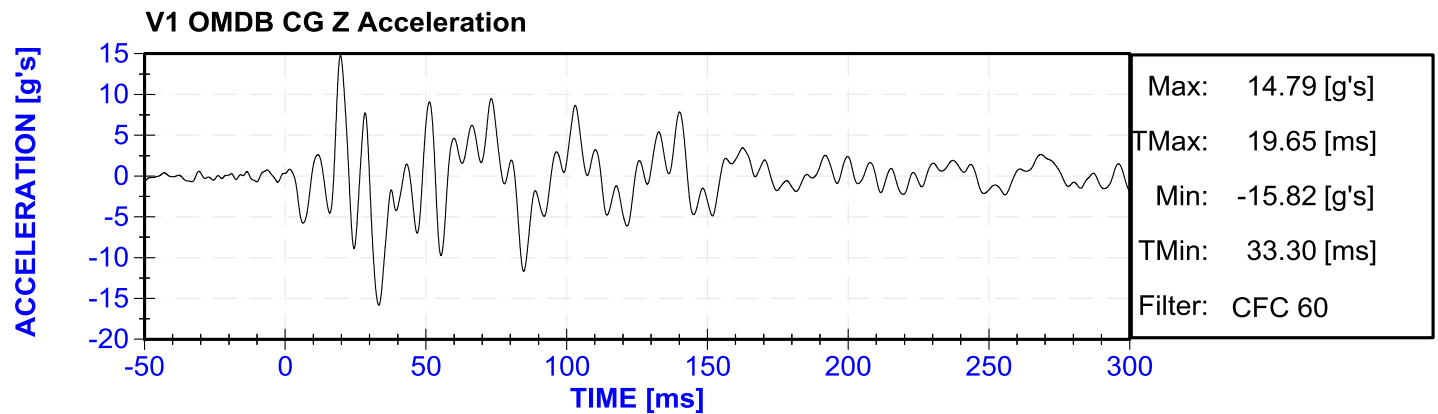
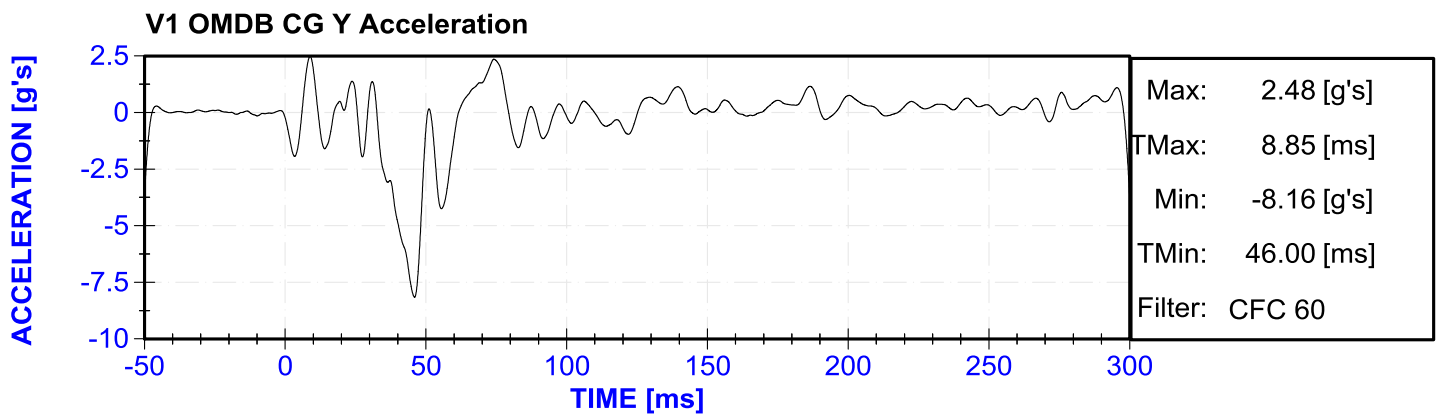
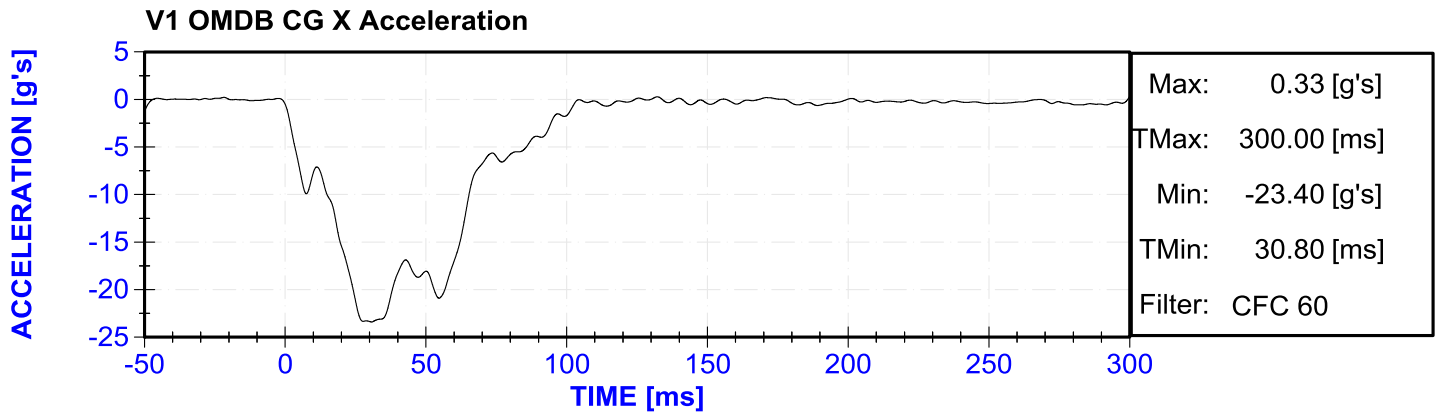


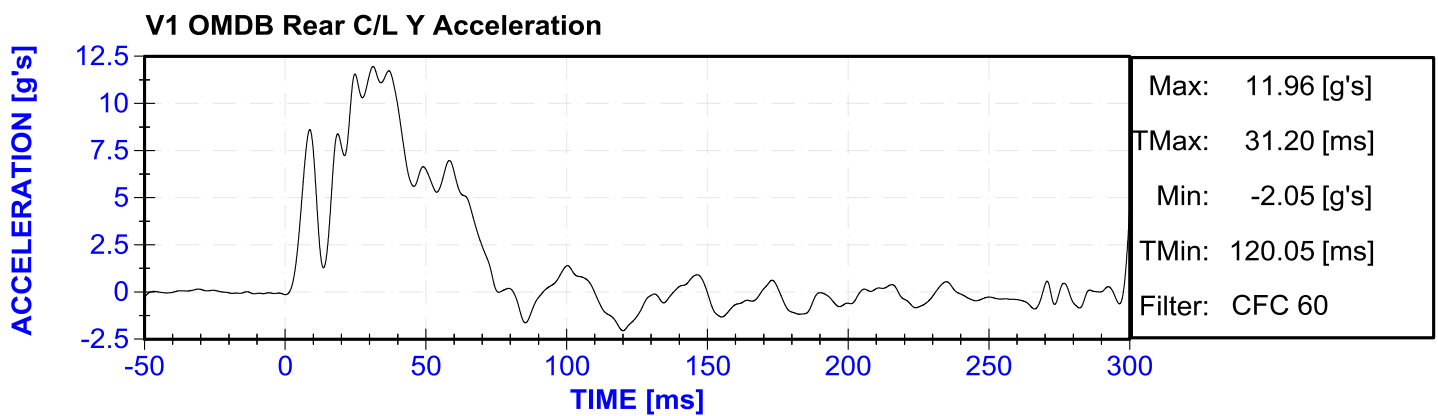
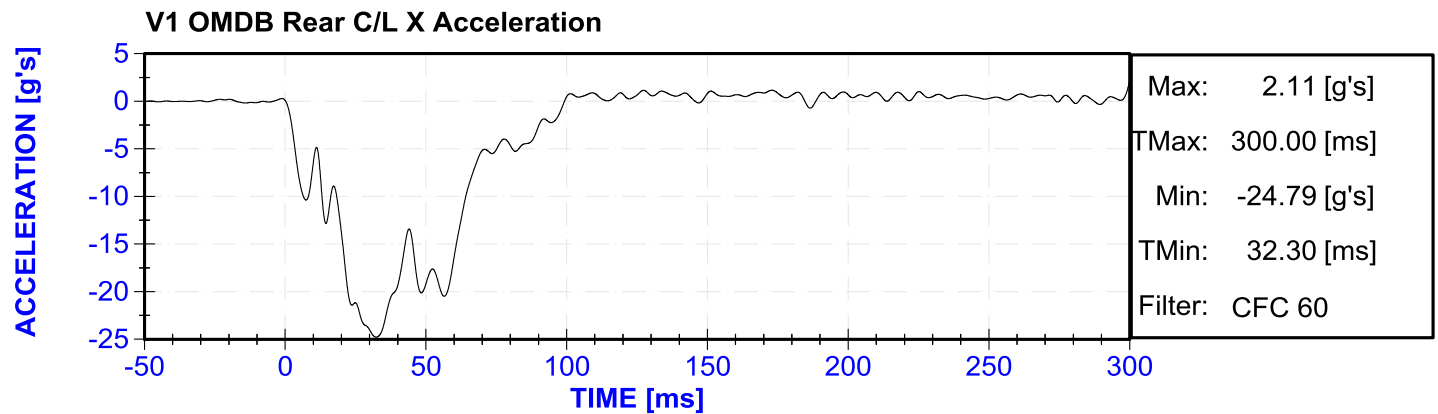
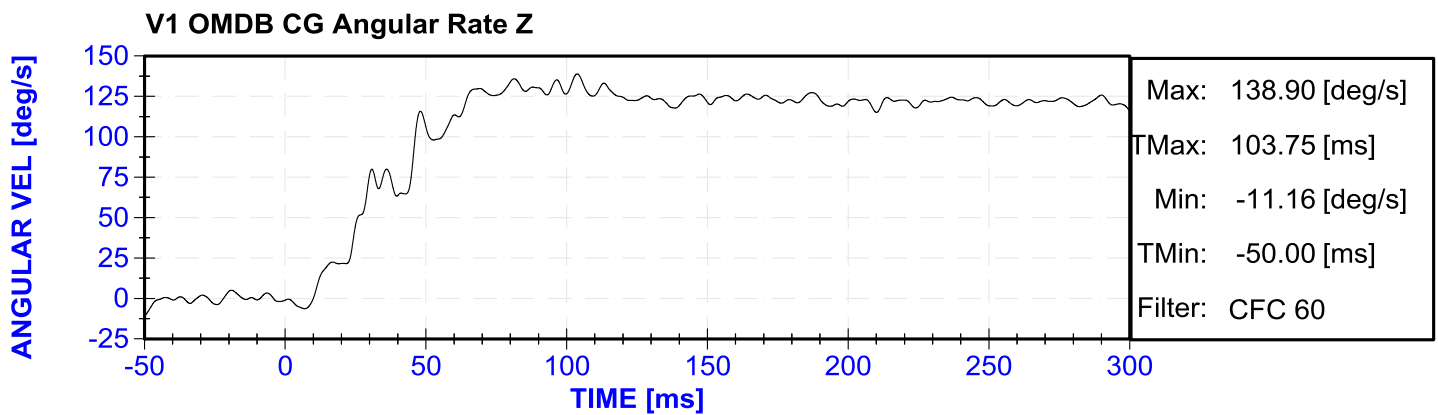
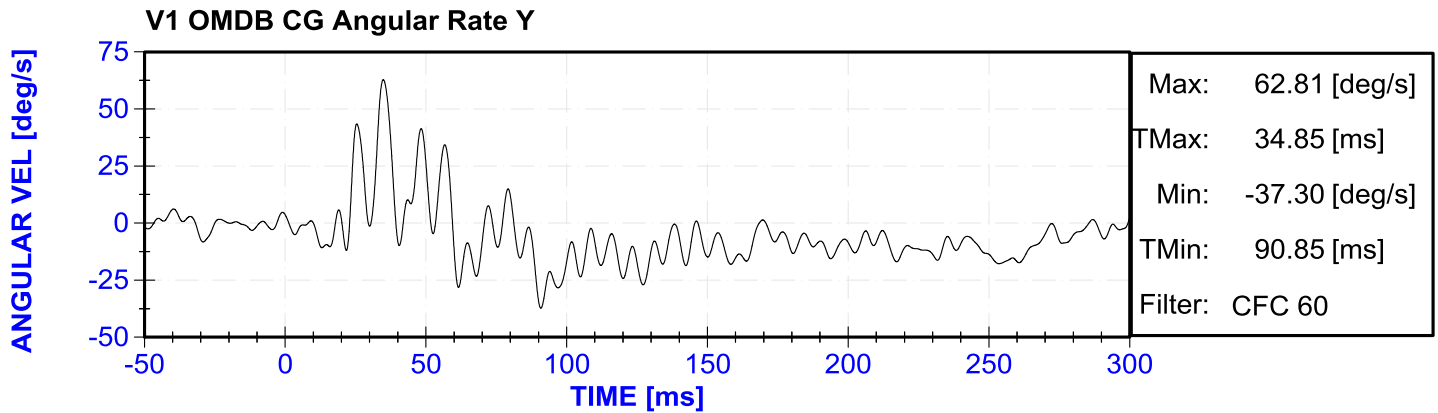


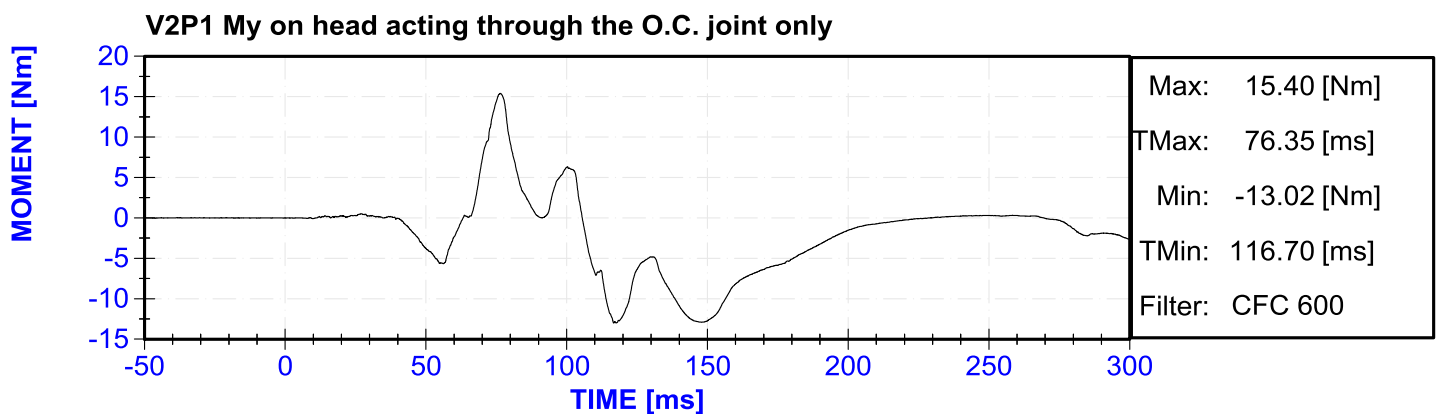
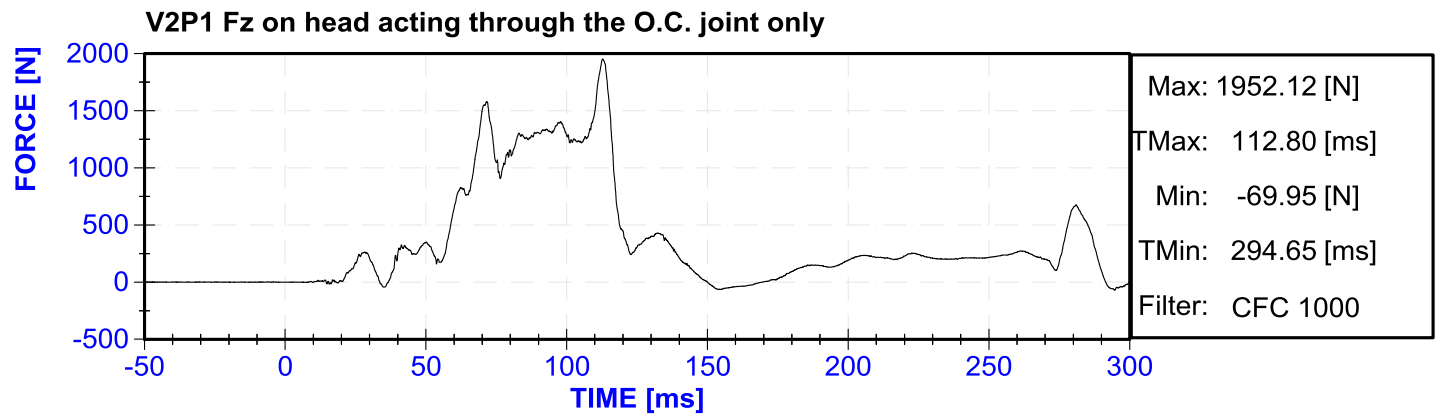
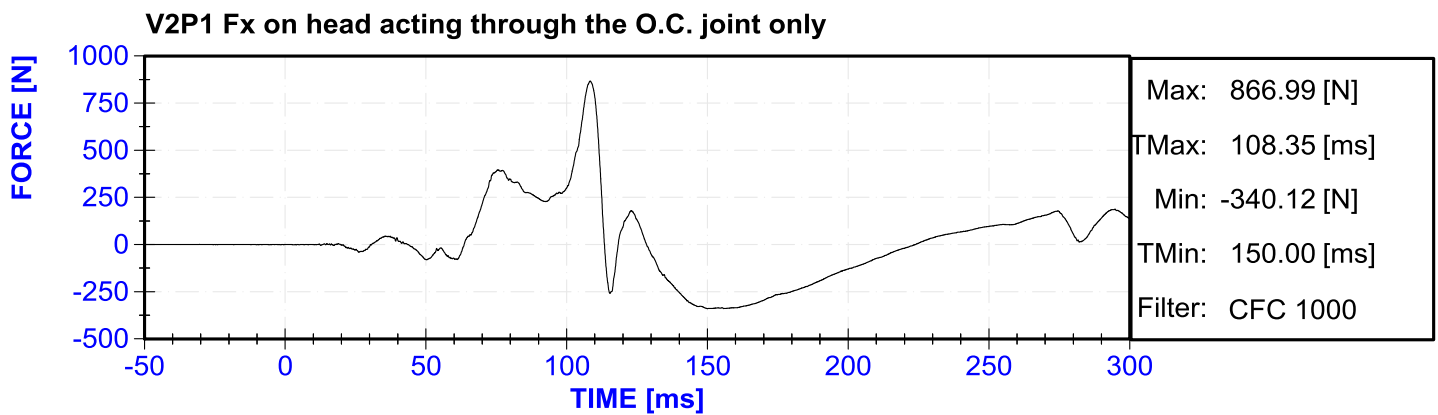
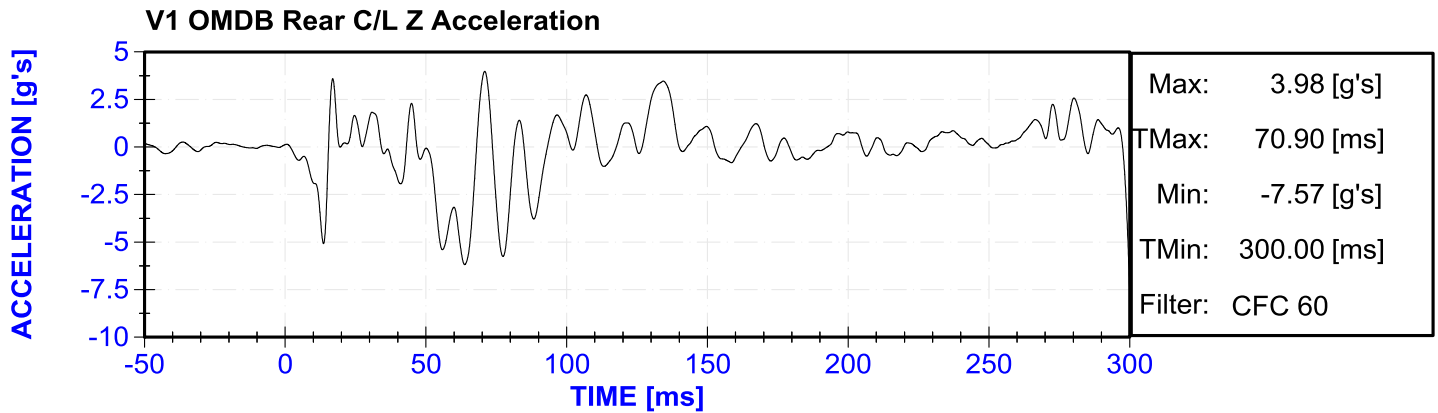


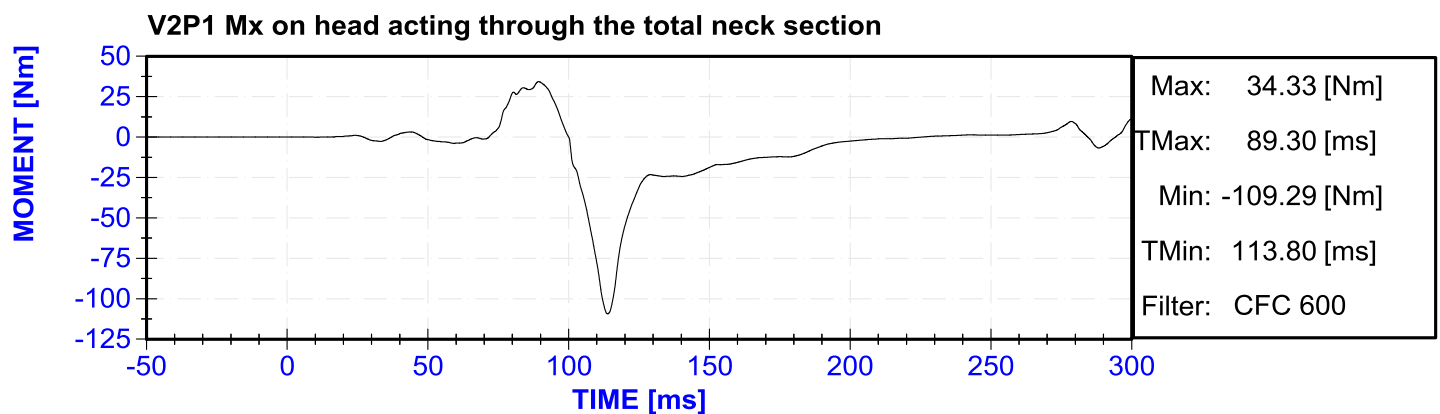
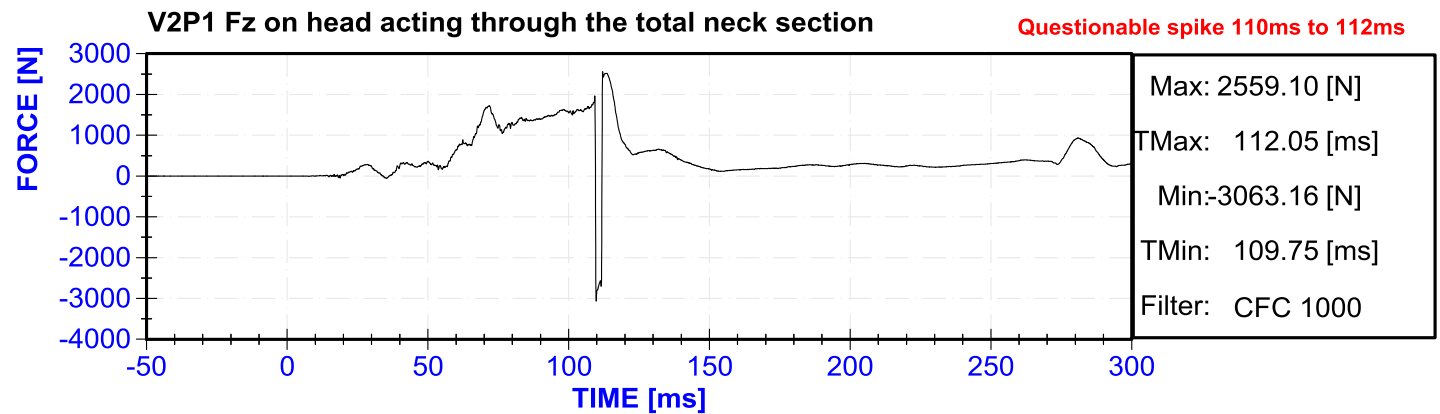
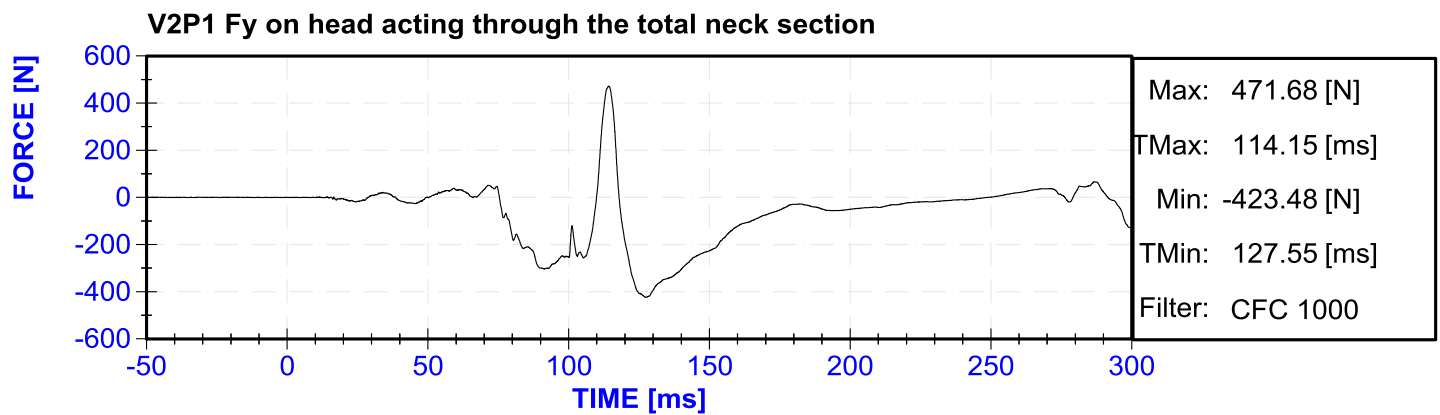
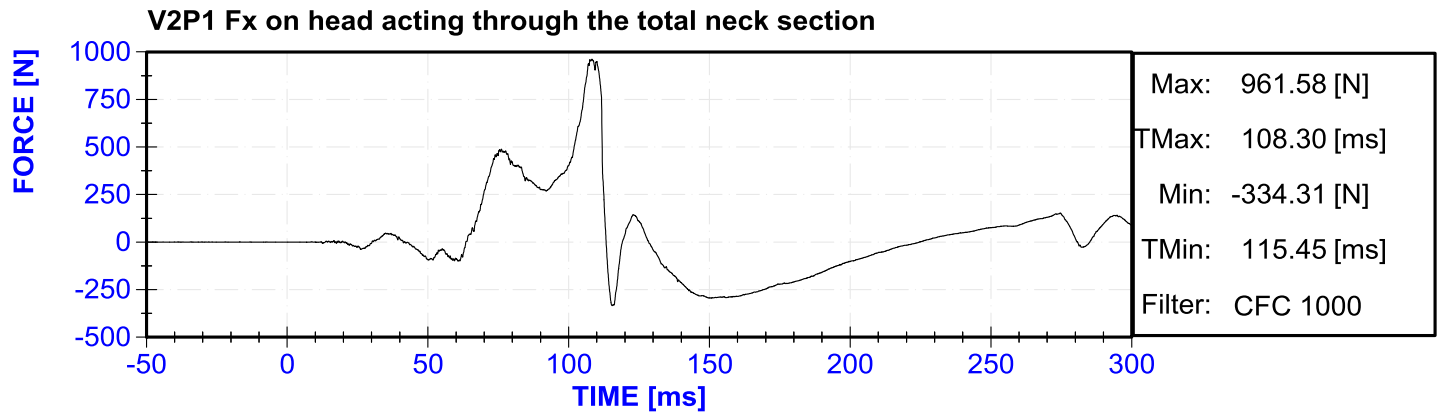






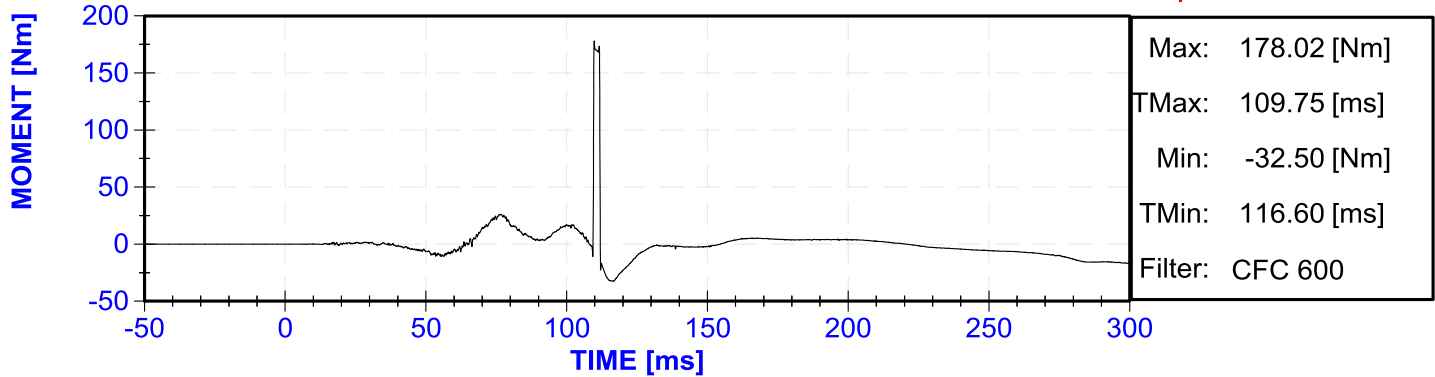




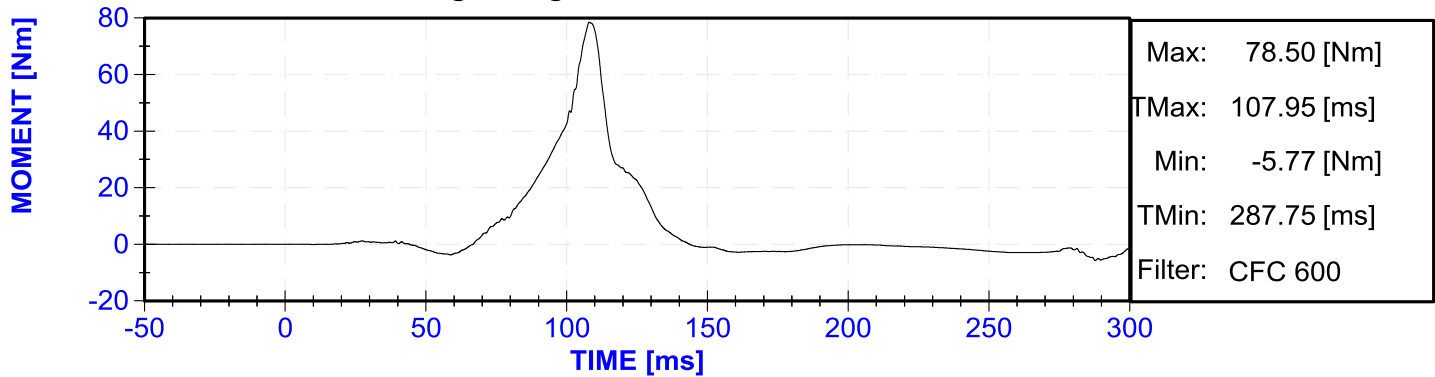


V2P1 My on head acting through the total neck section

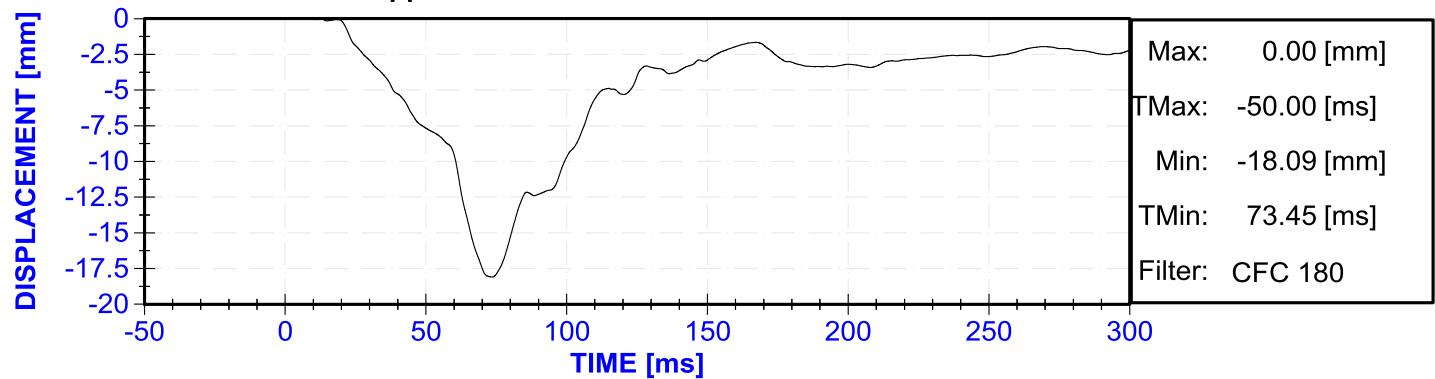
Questionable spike 110ms to 112ms



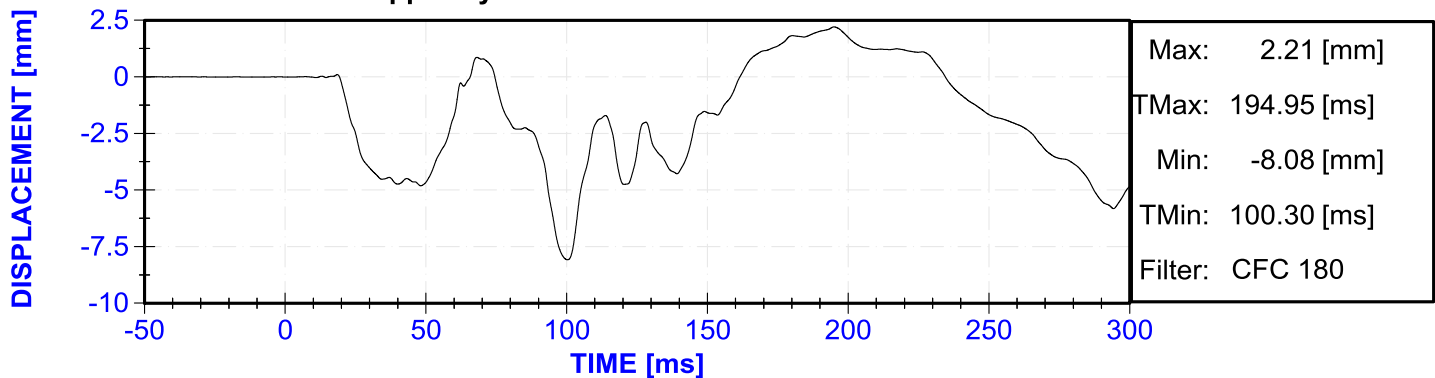
V2P1 Mz on head acting through the total neck section

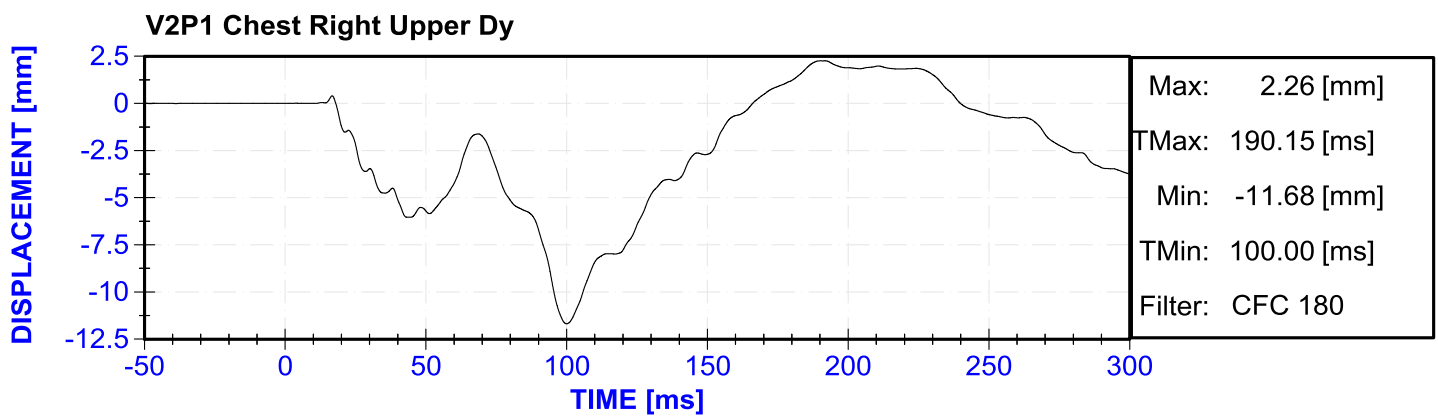
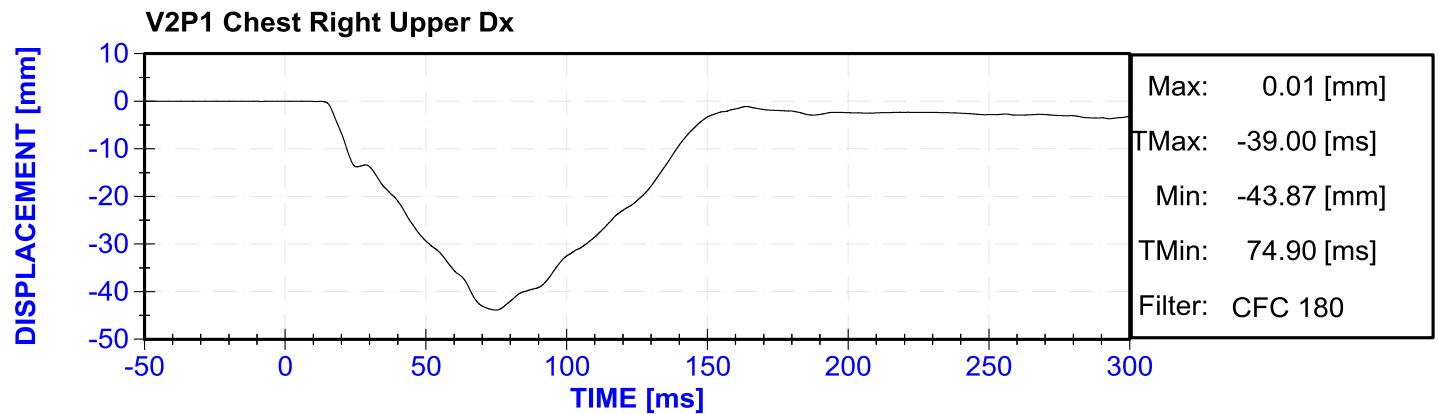
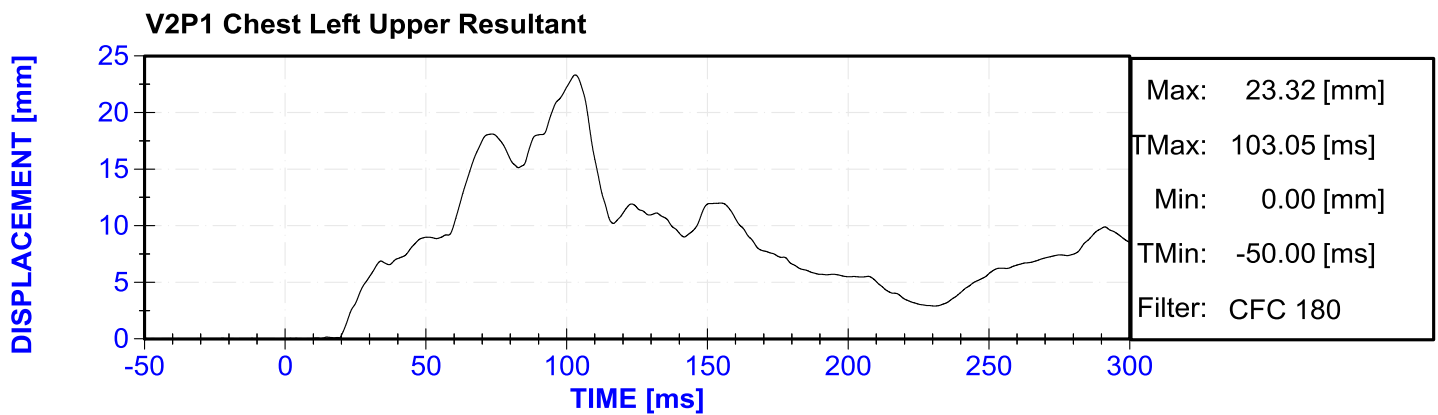
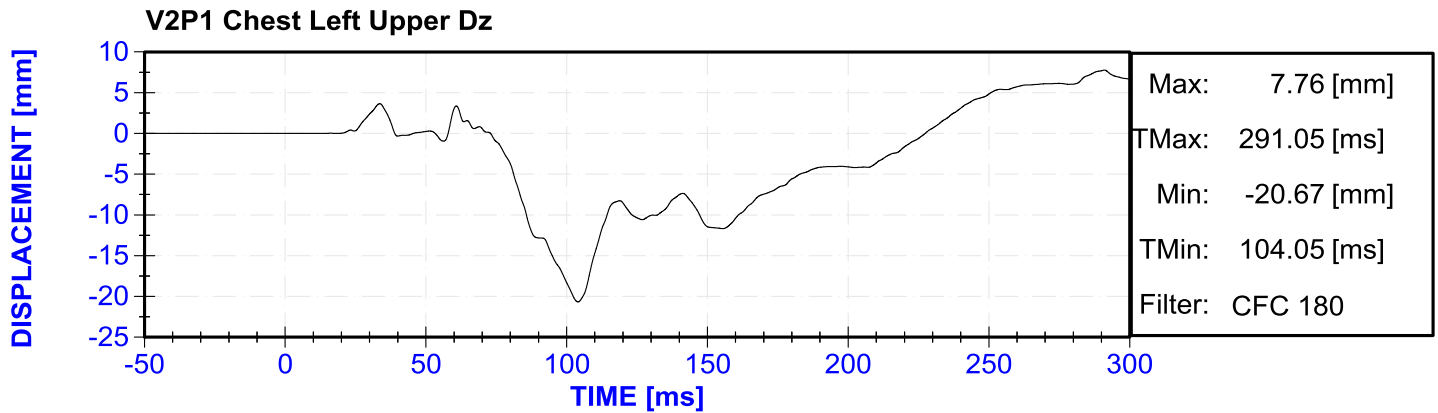


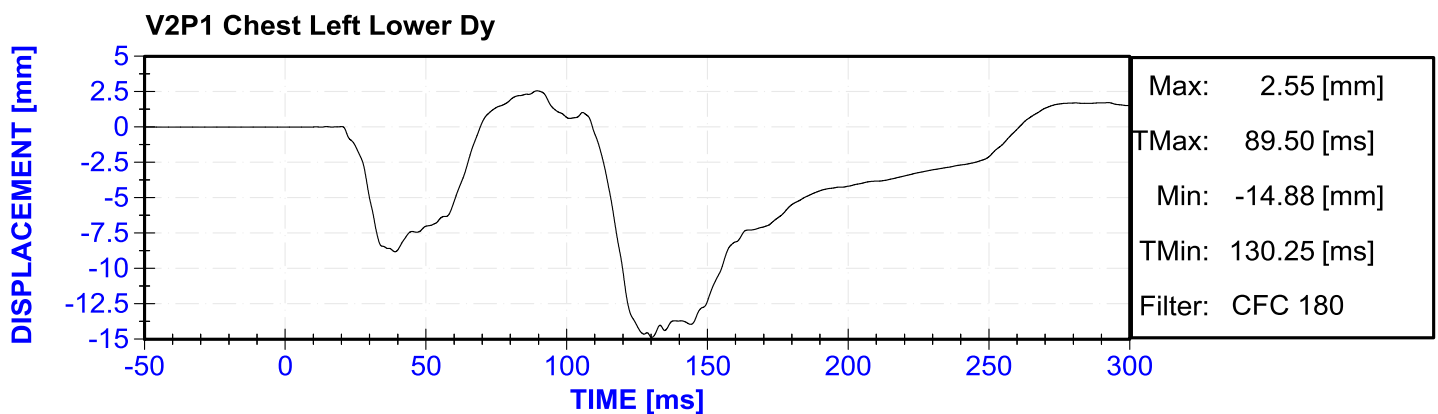
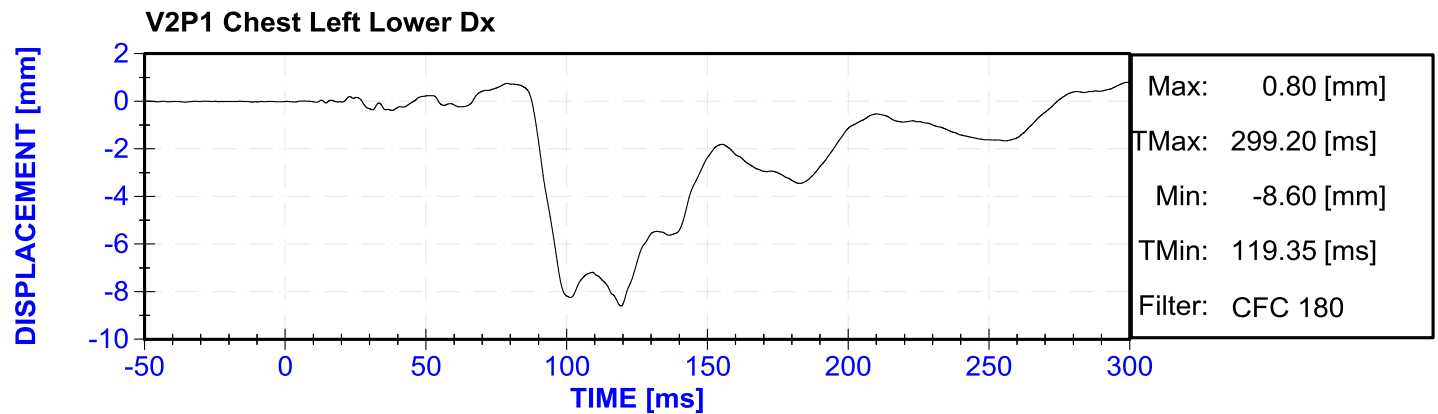
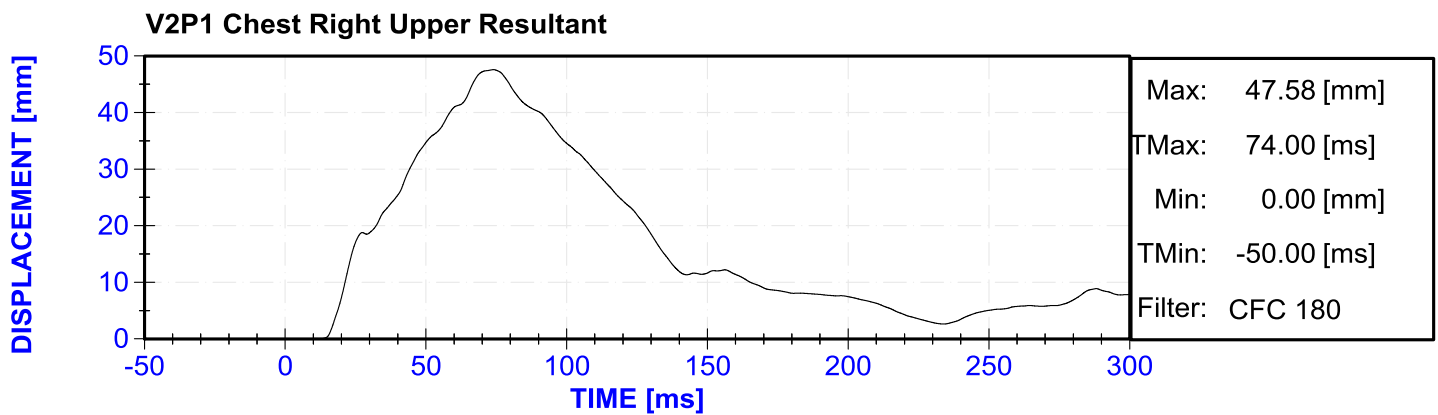
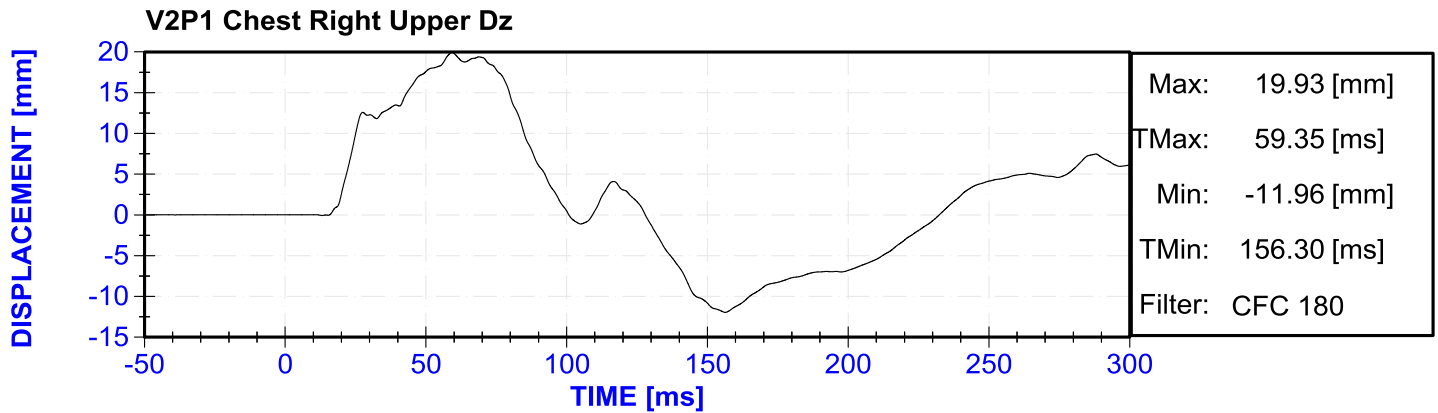
V2P1 Chest Left Upper Dx

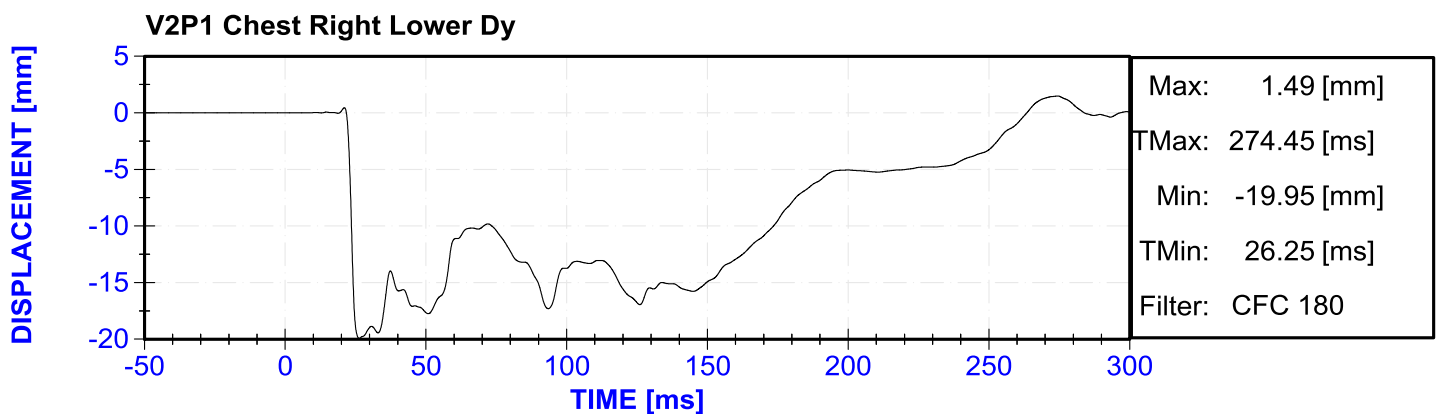
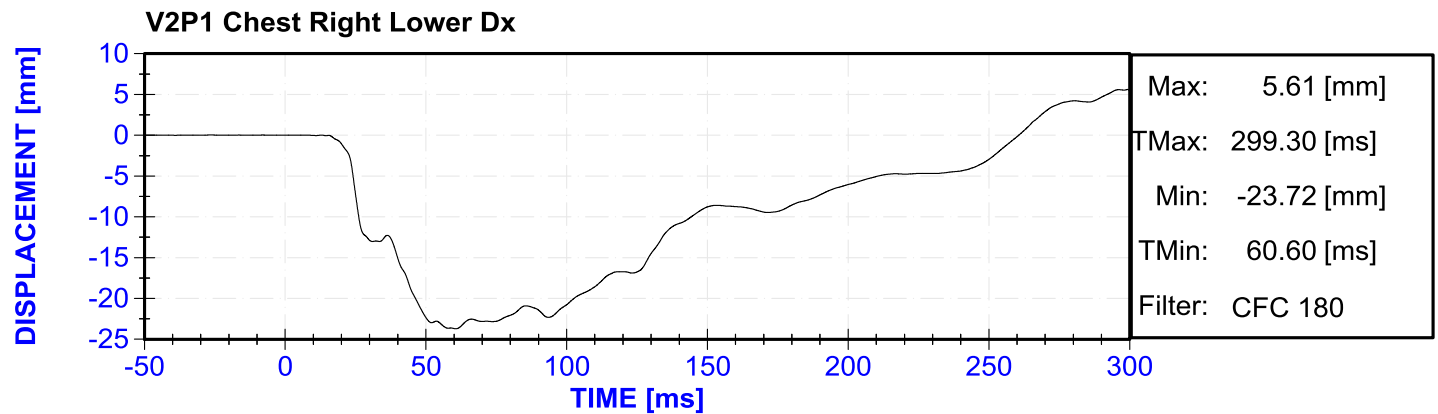
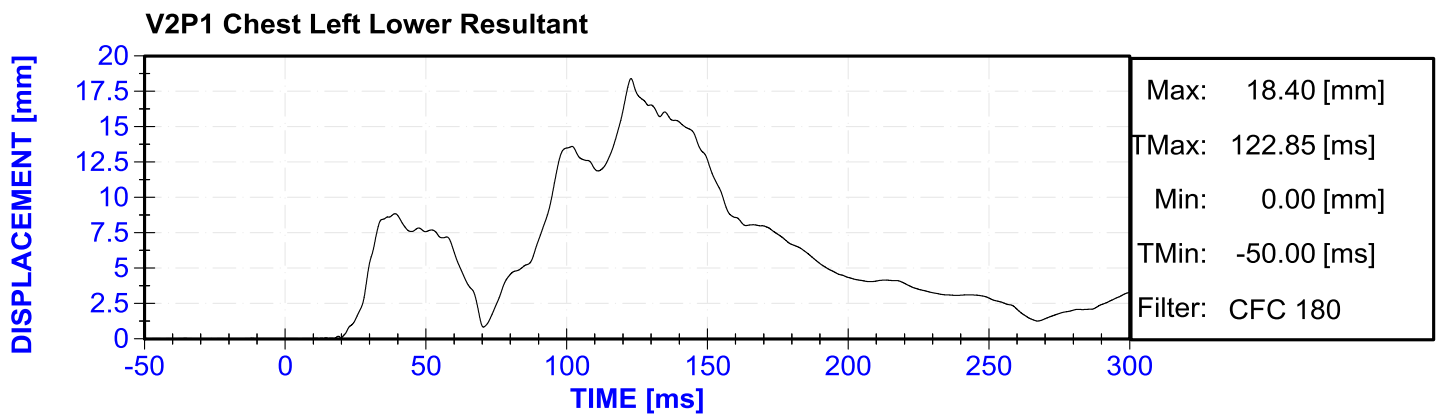
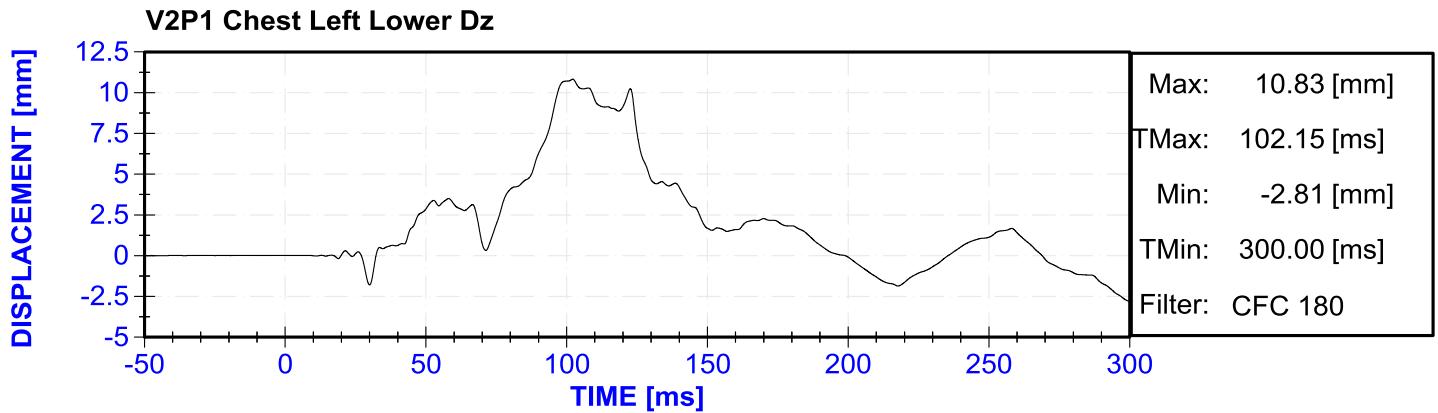


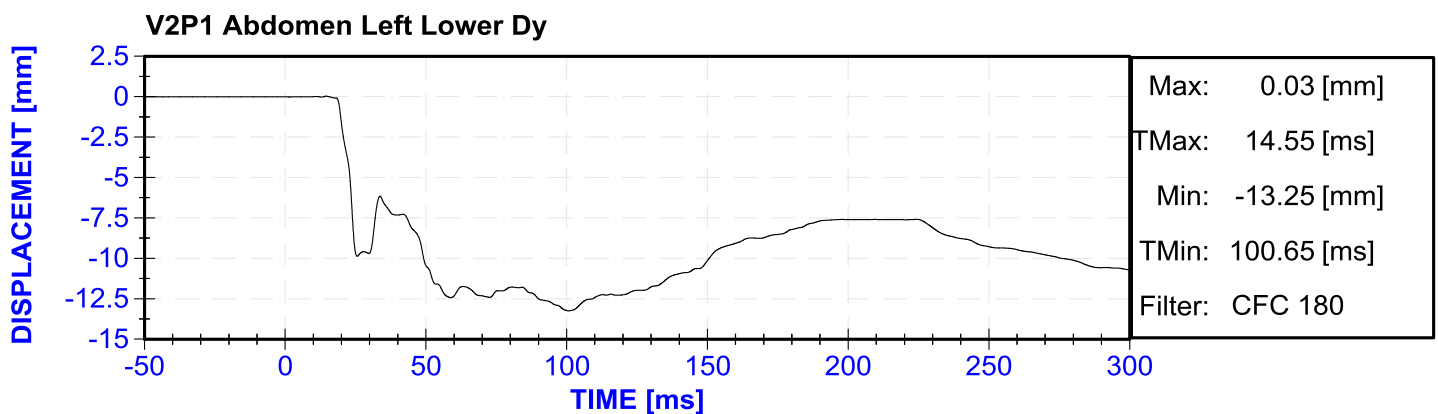
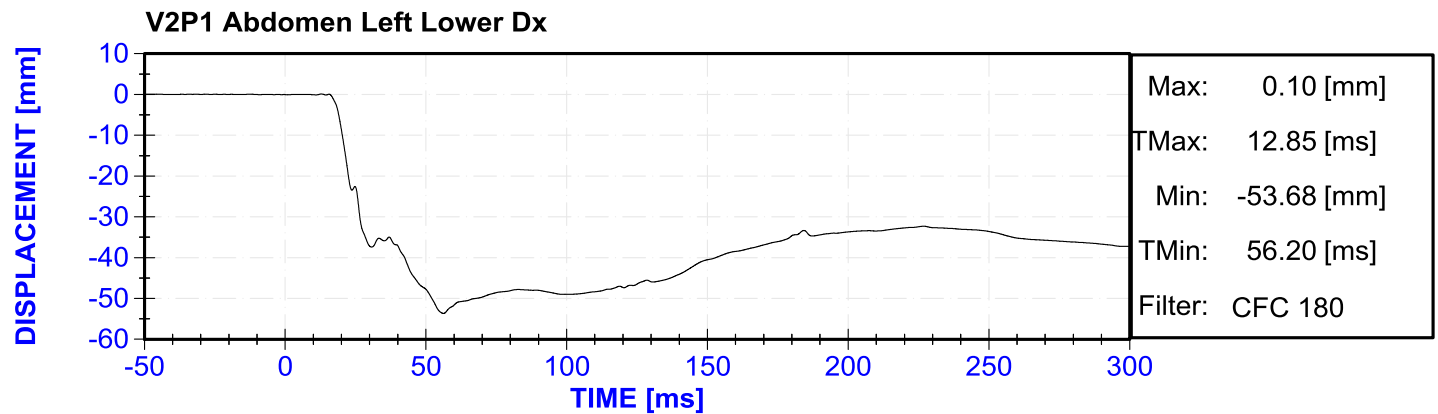
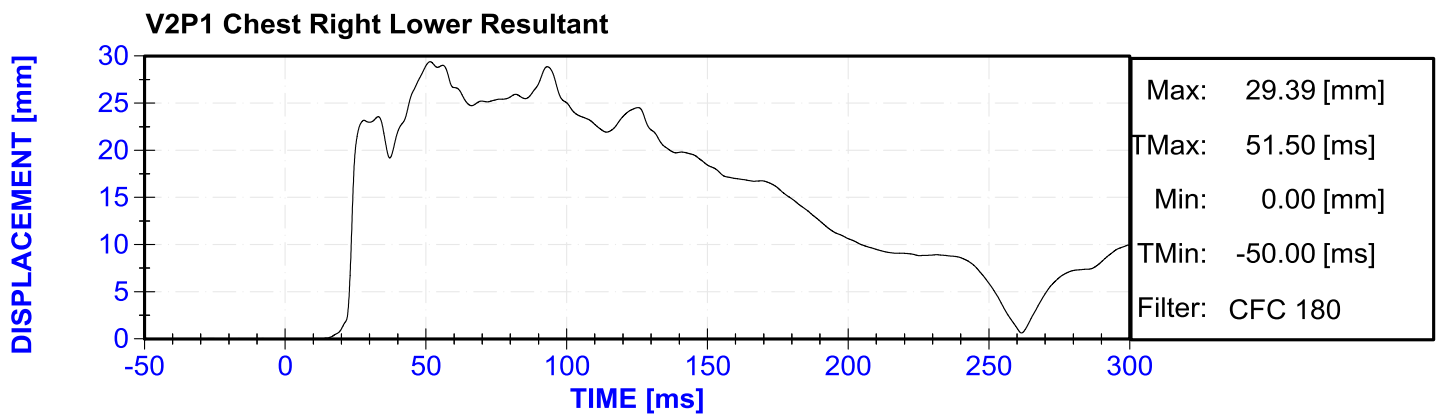
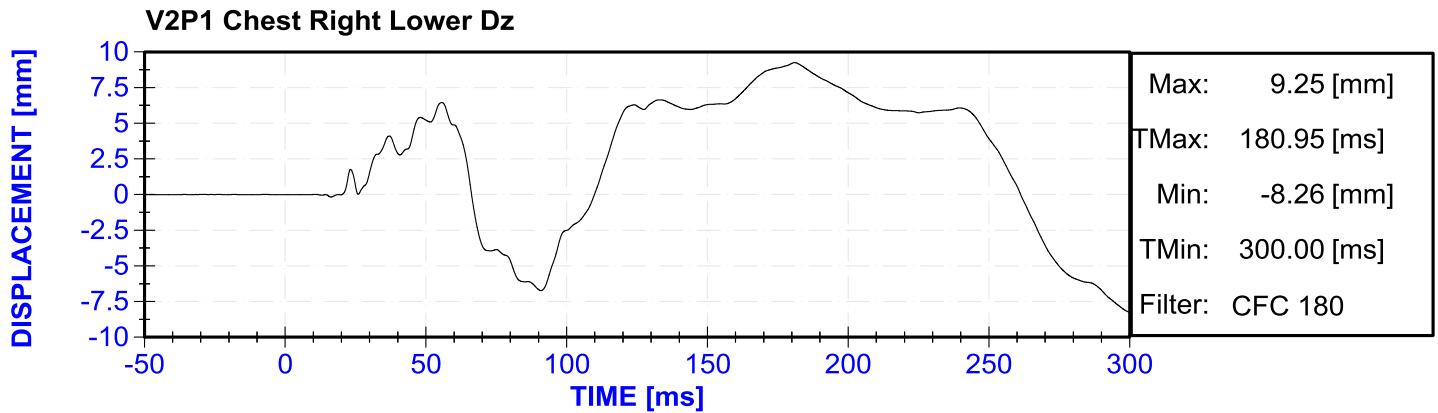
V2P1 Chest Left Upper Dy

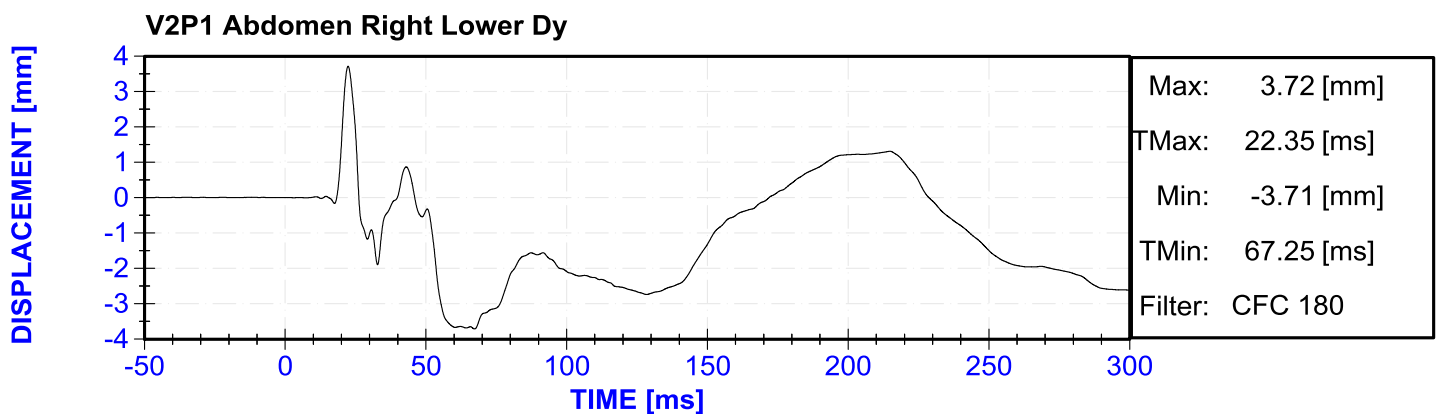
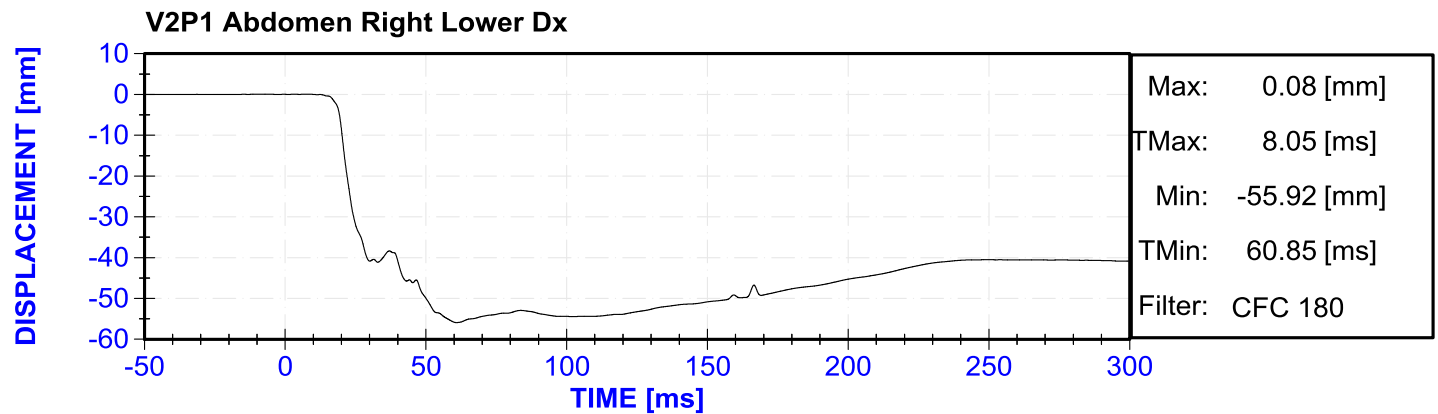
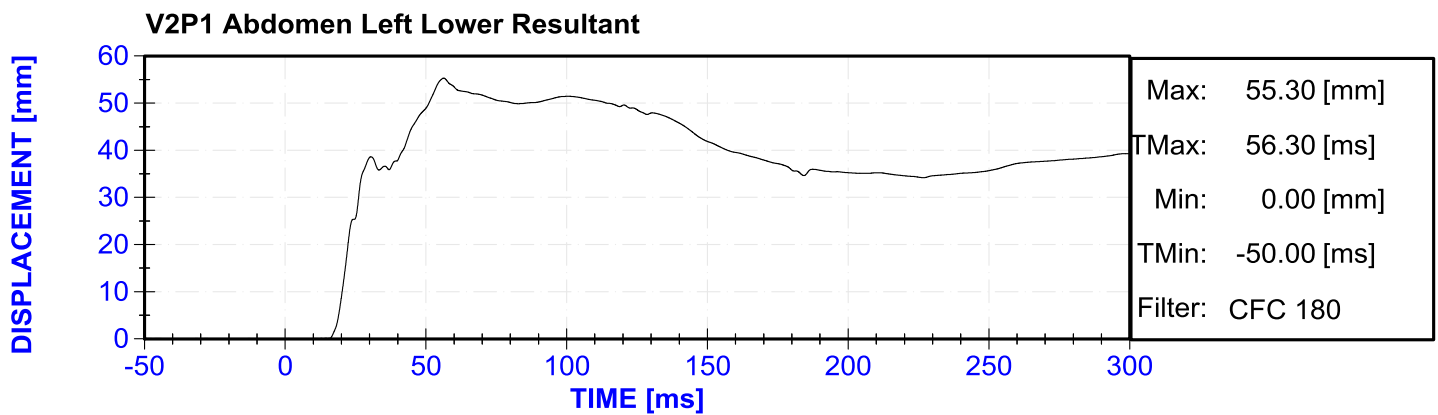
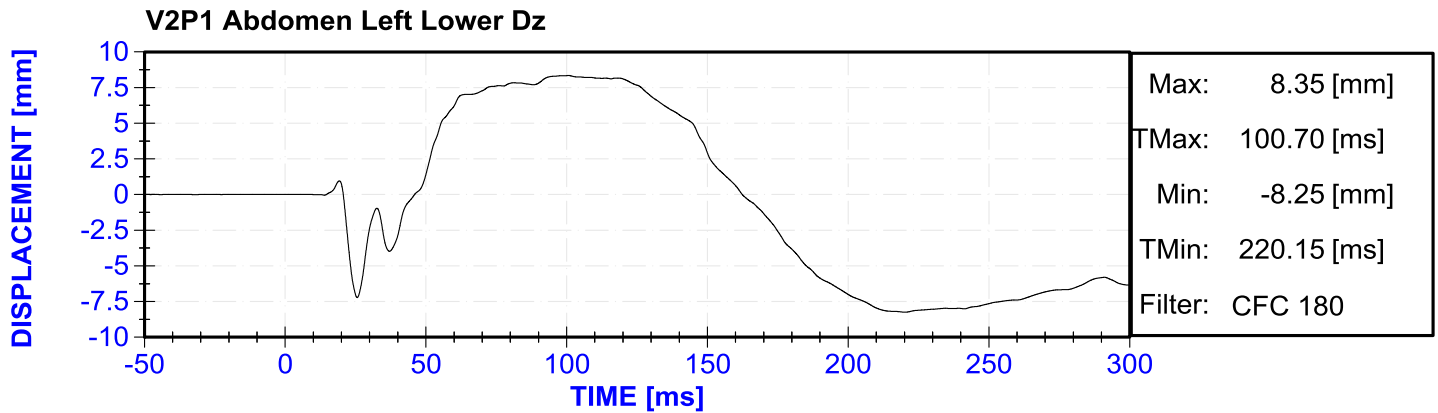


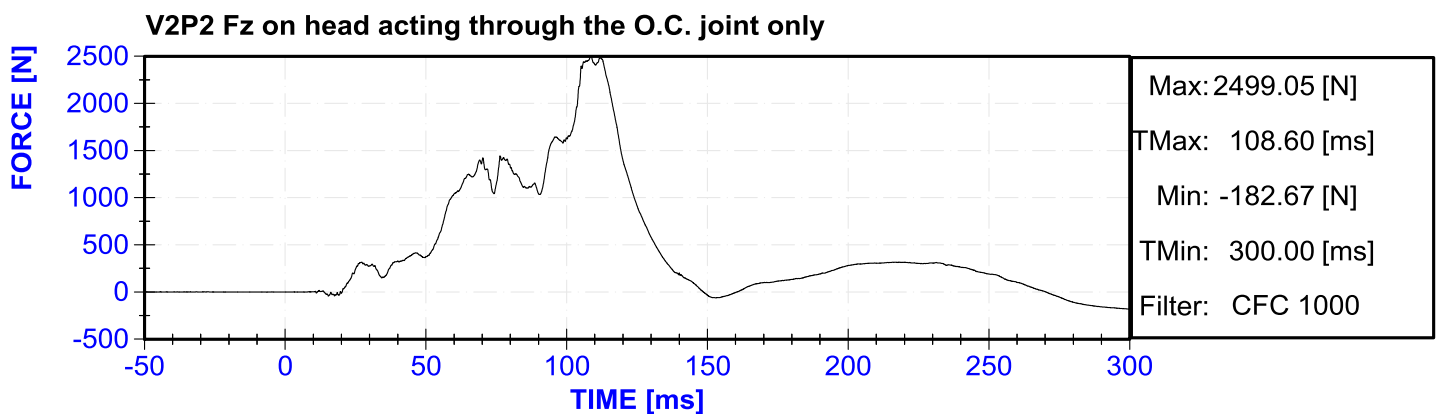
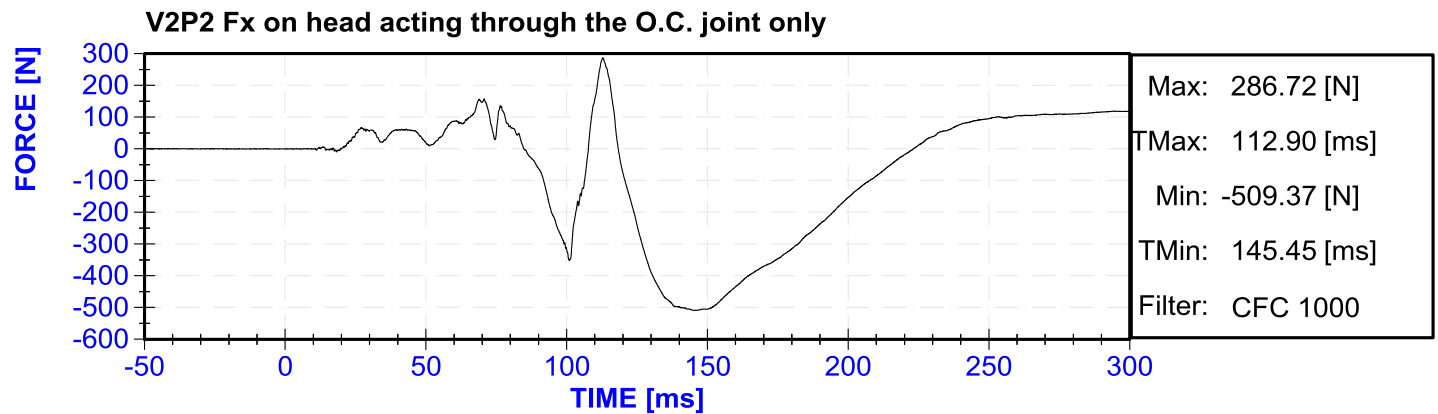
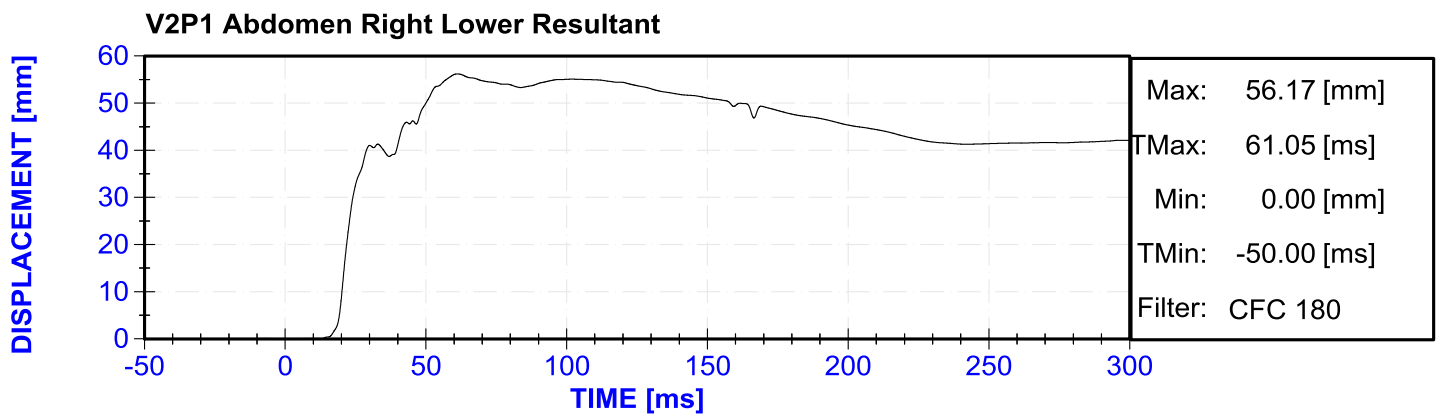
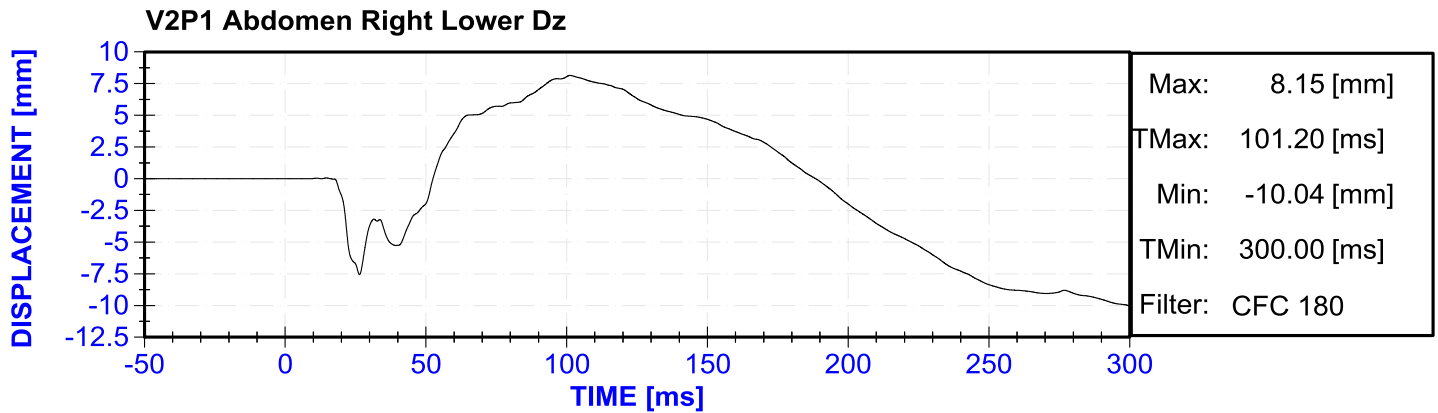




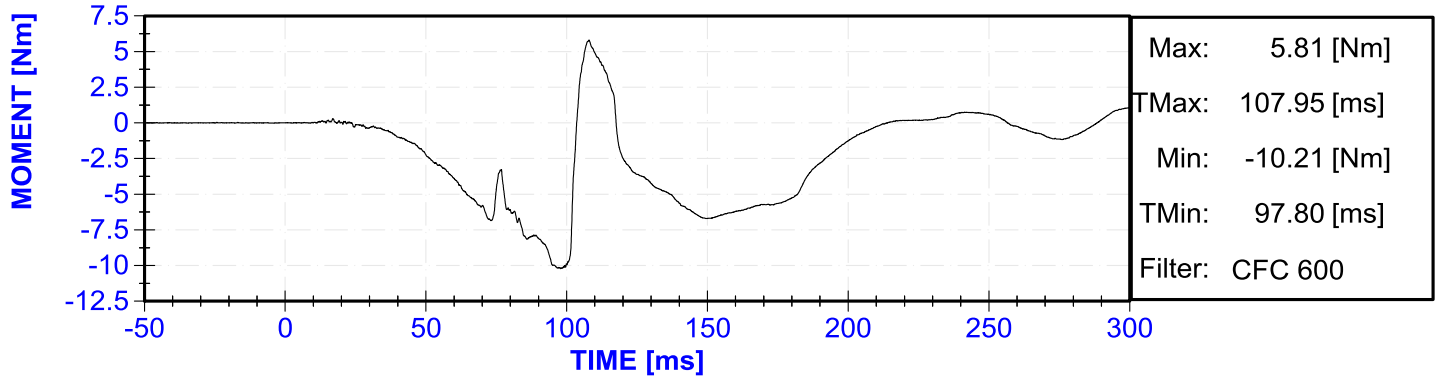




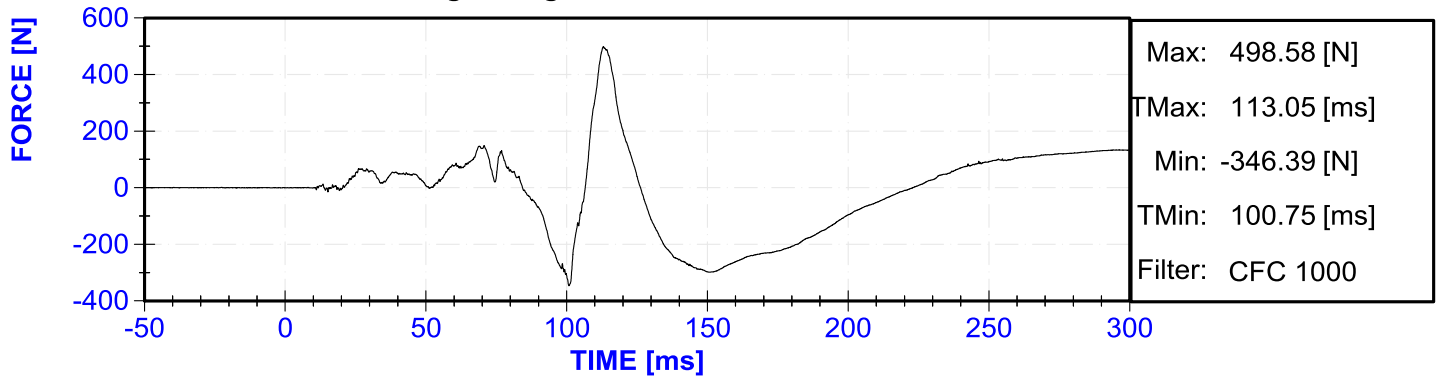




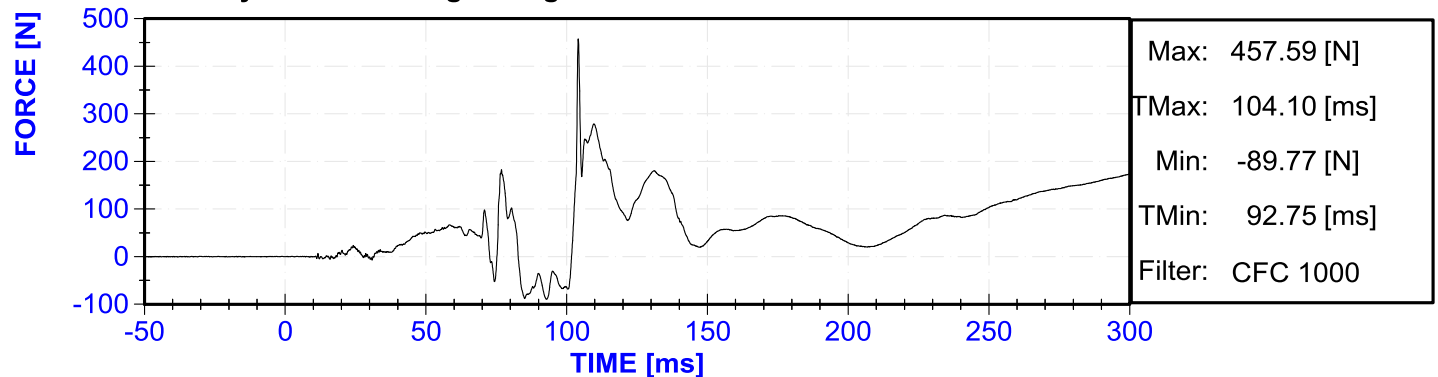
V2P2 My on head acting through the O.C. joint only



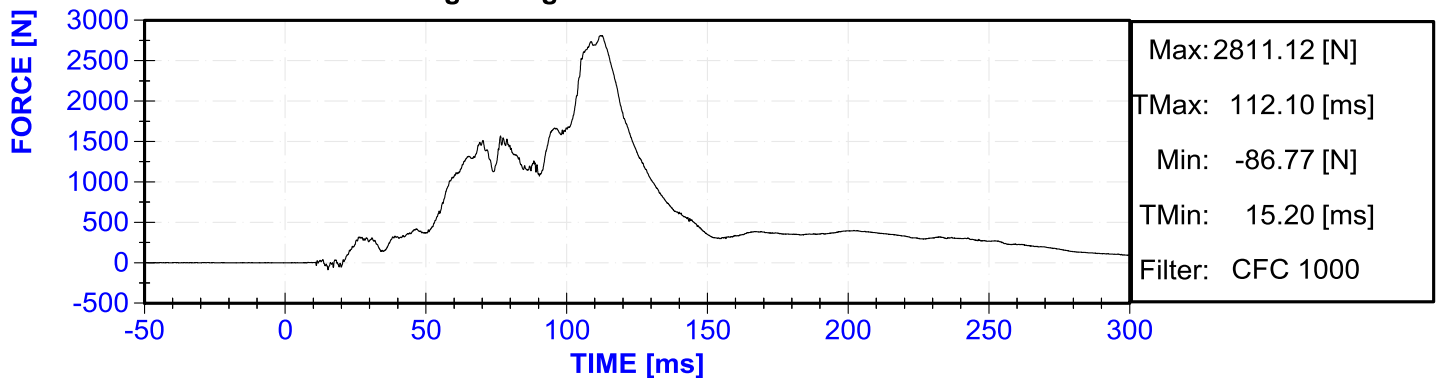
V2P2 Fx on head acting through the total neck section

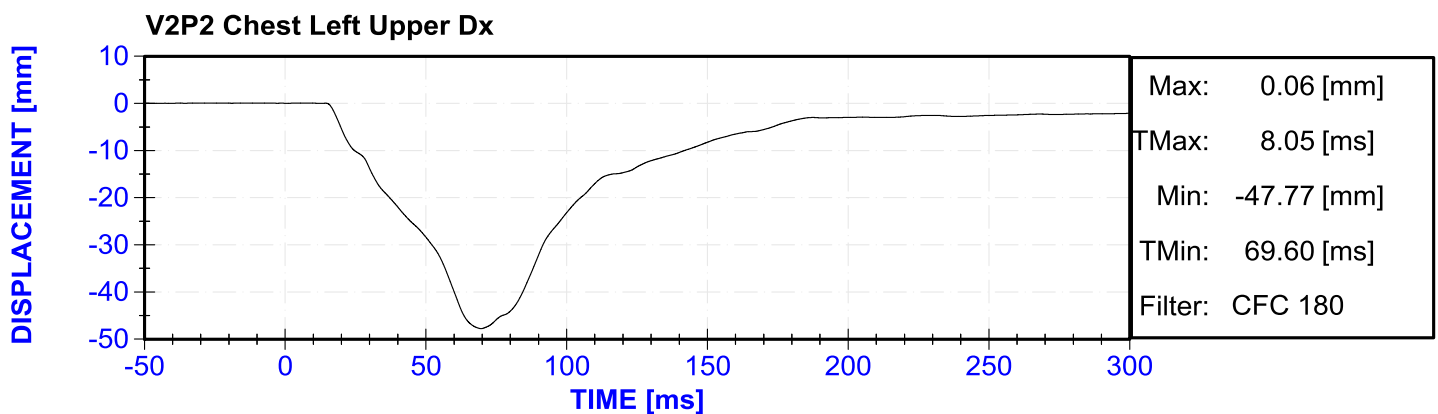
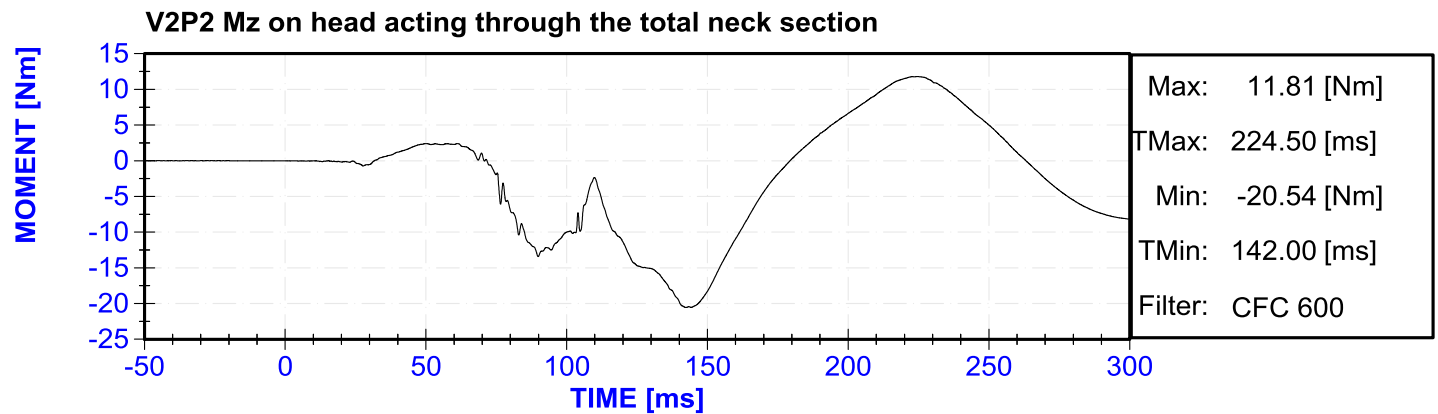
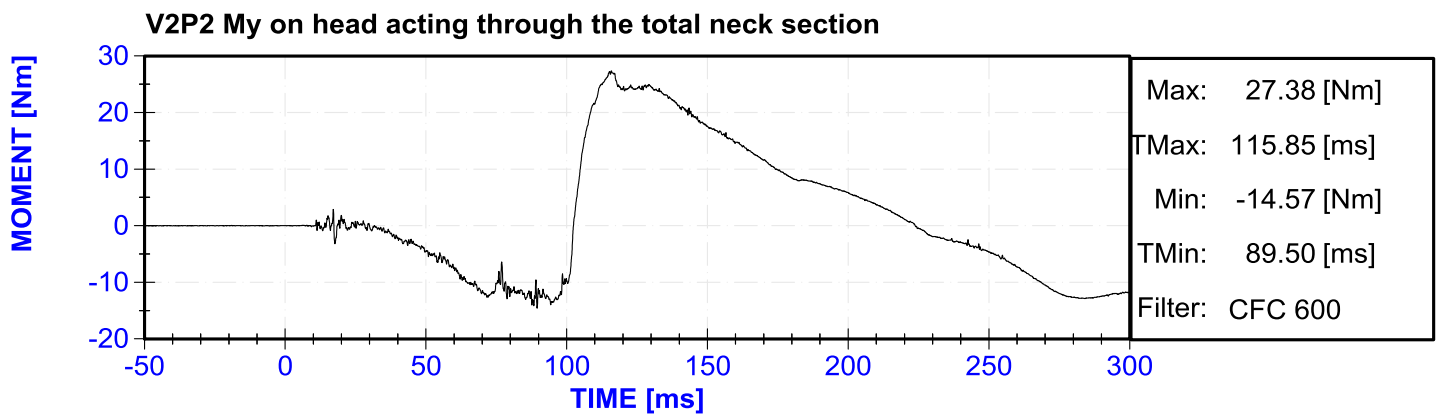
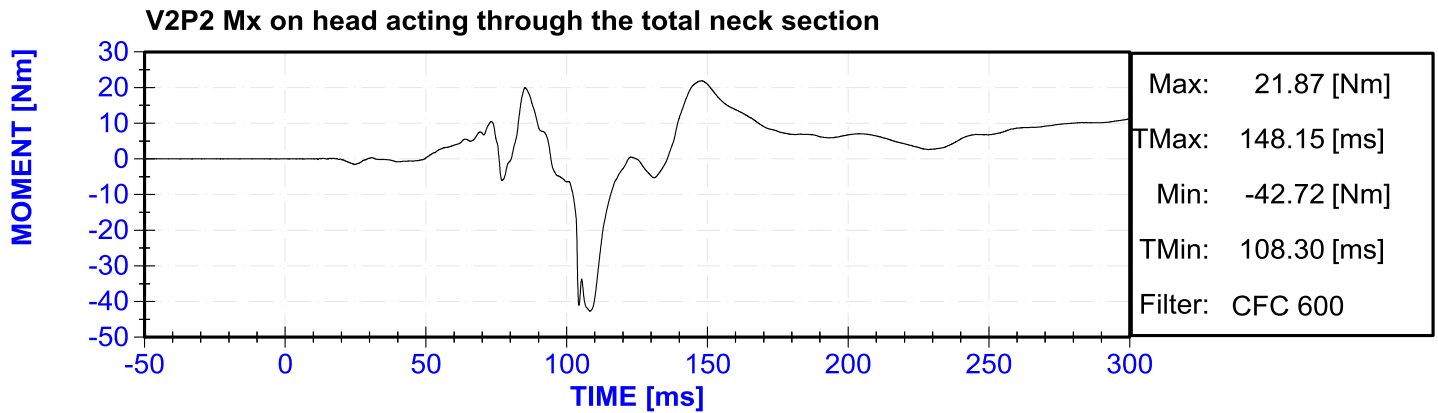


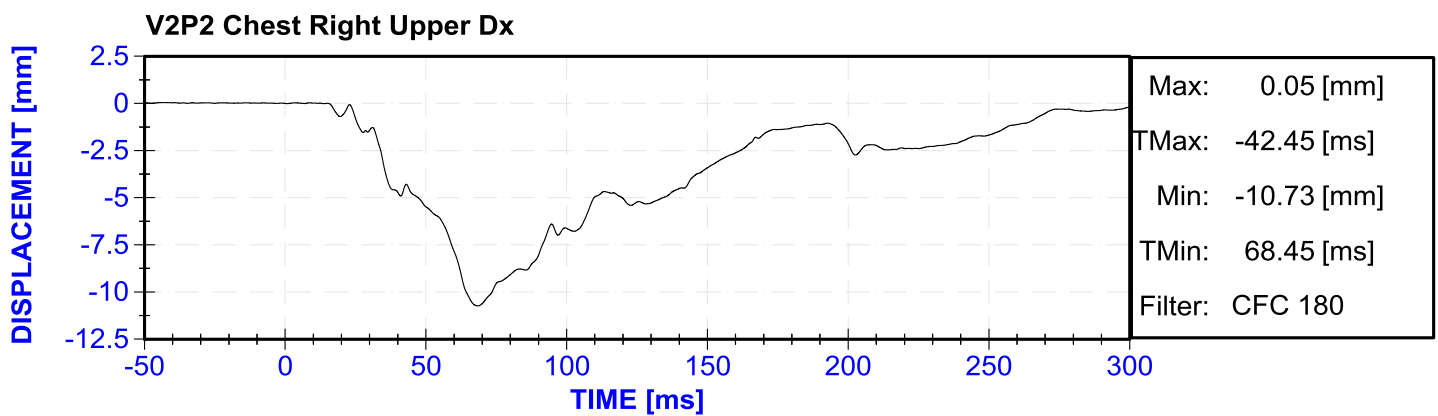
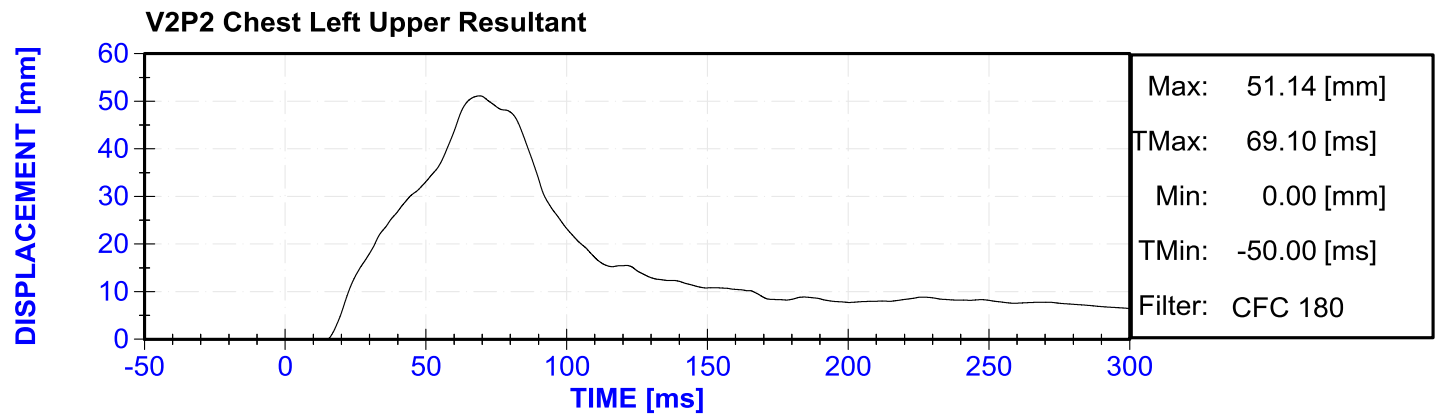
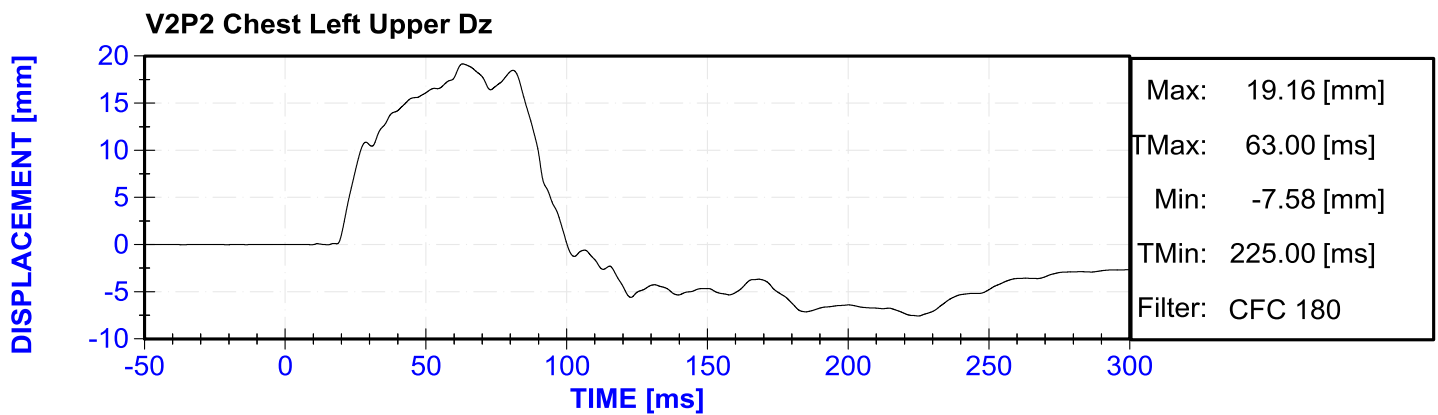
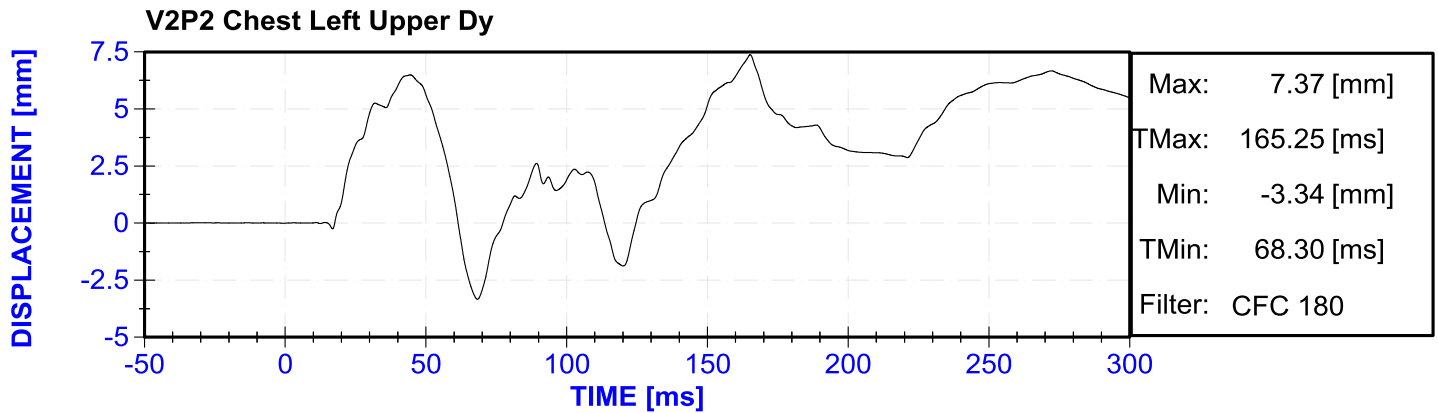
V2P2 Fy on head acting through the total neck section

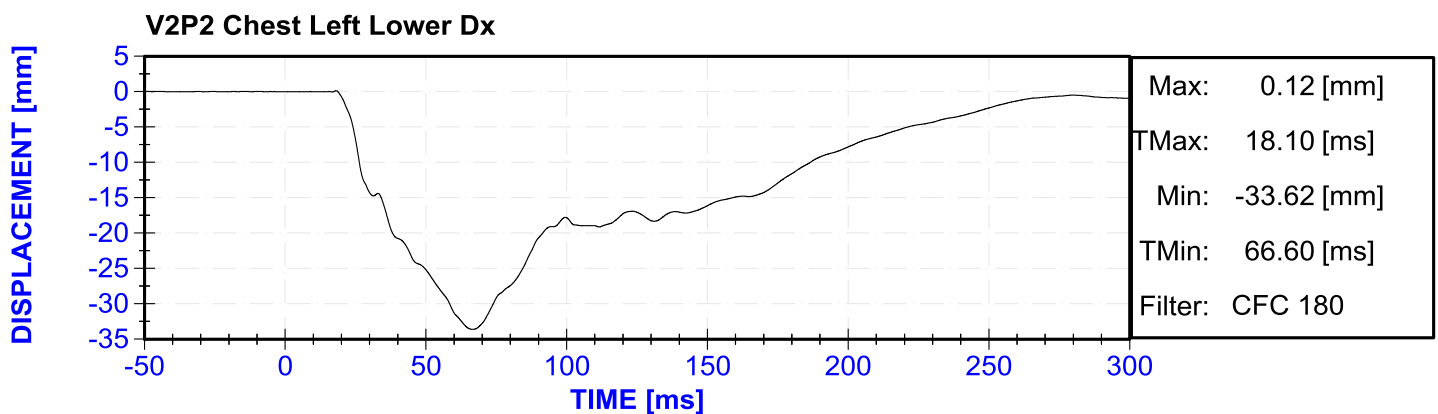
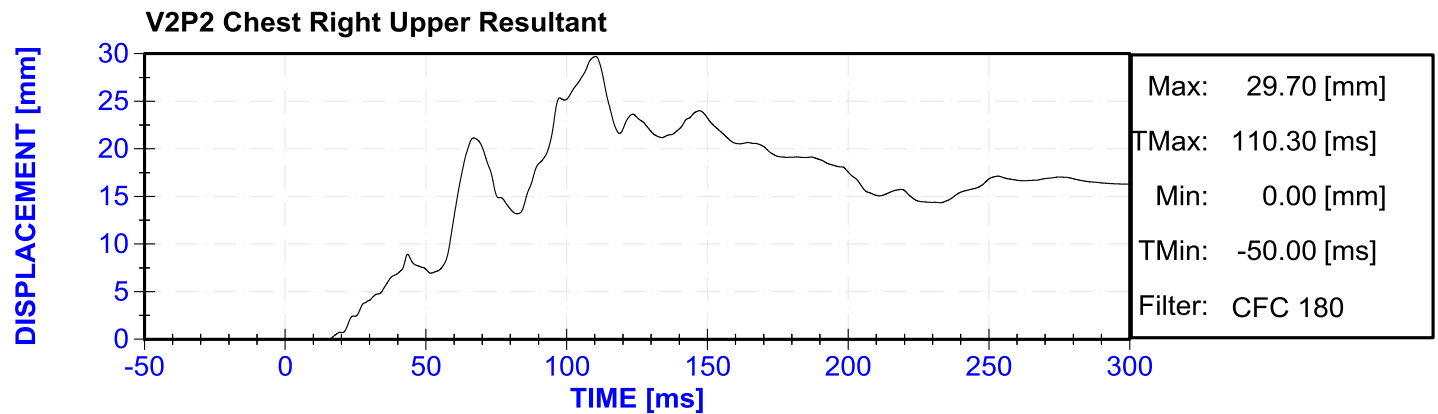
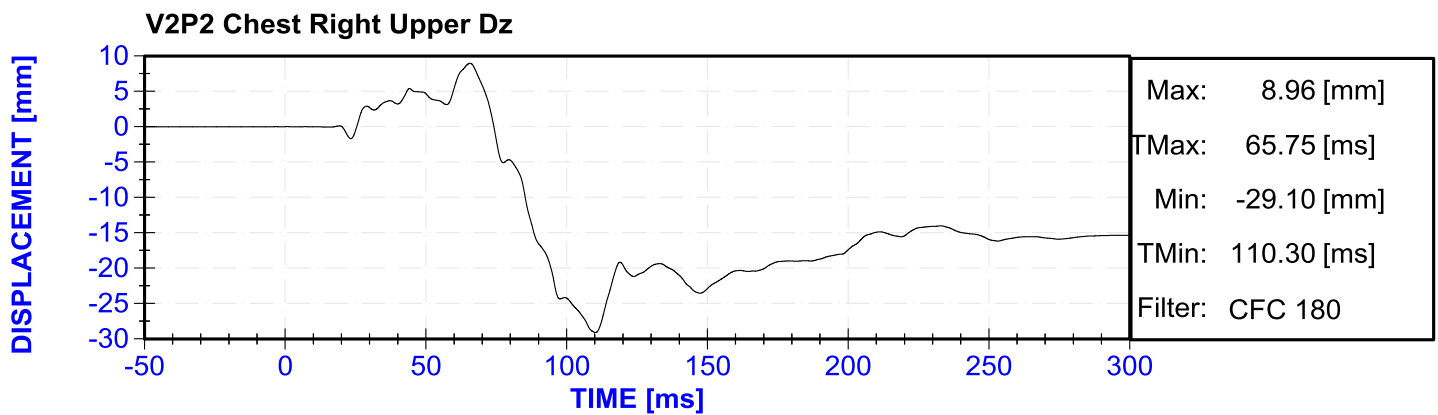
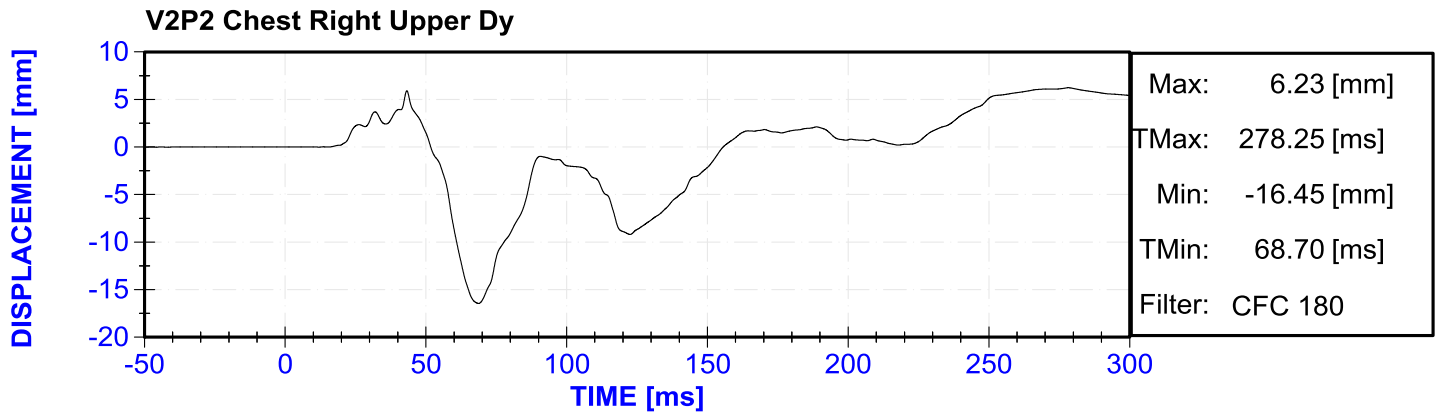


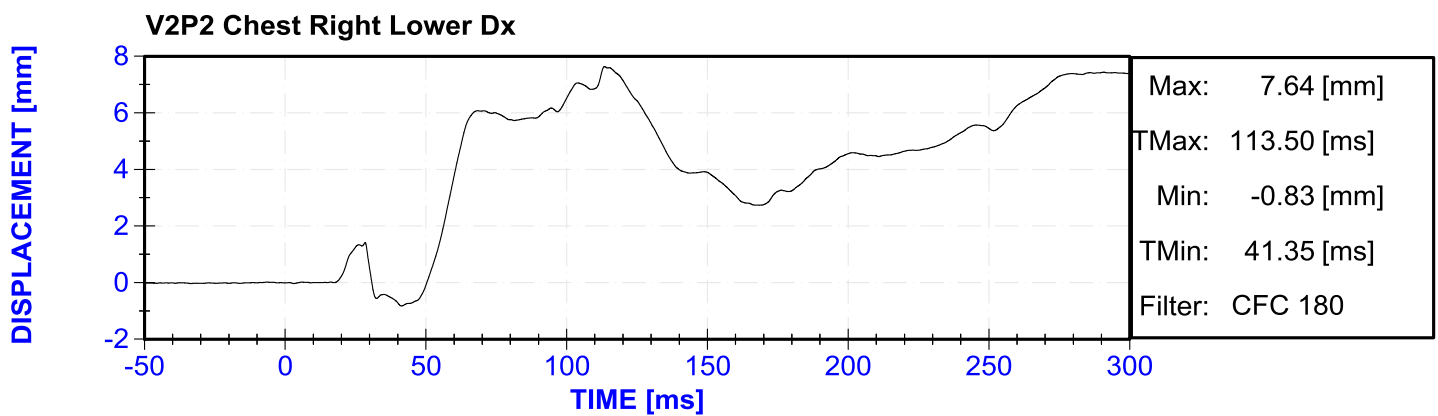
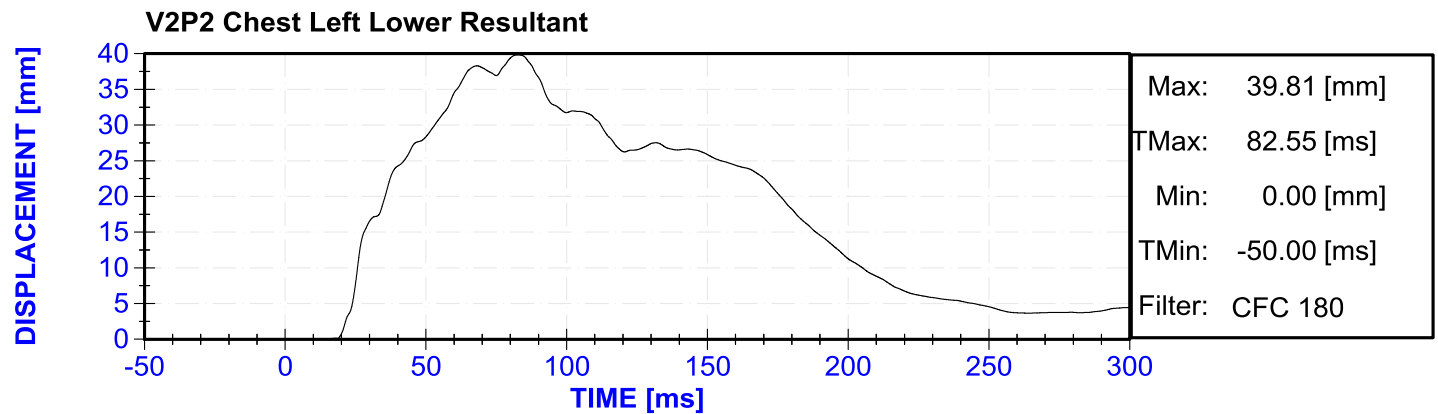
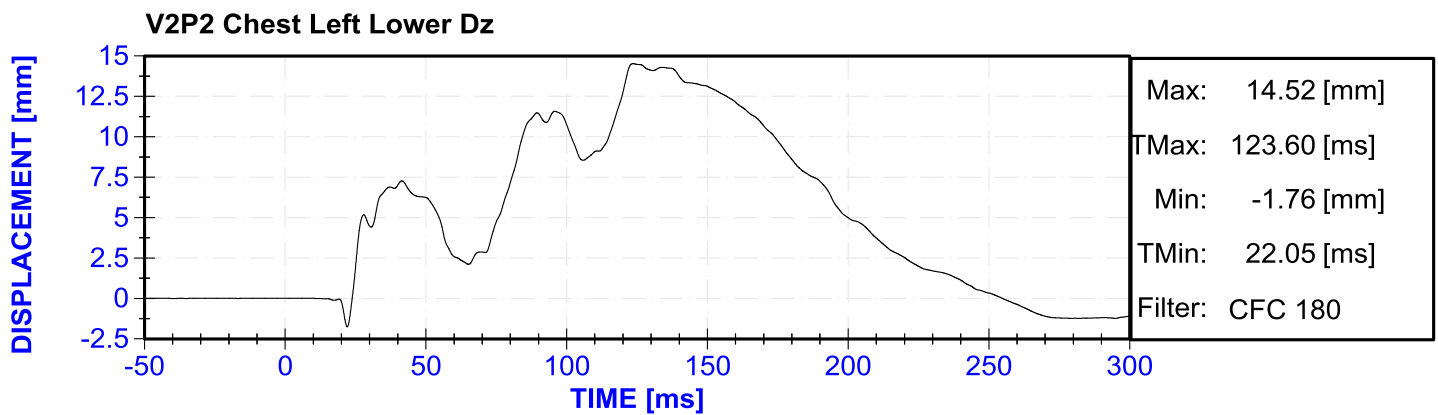
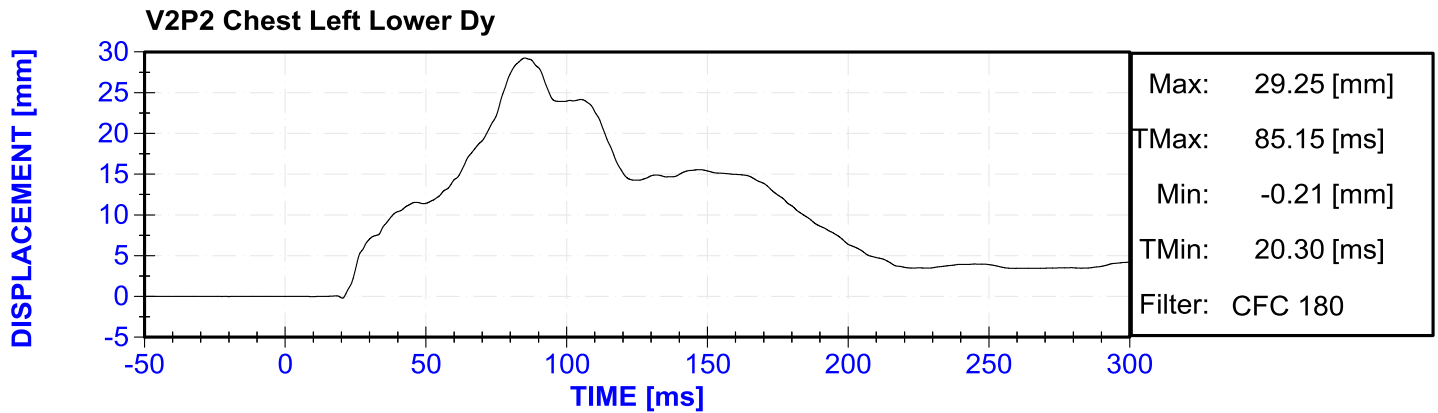
V2P2 Fz on head acting through the total neck section

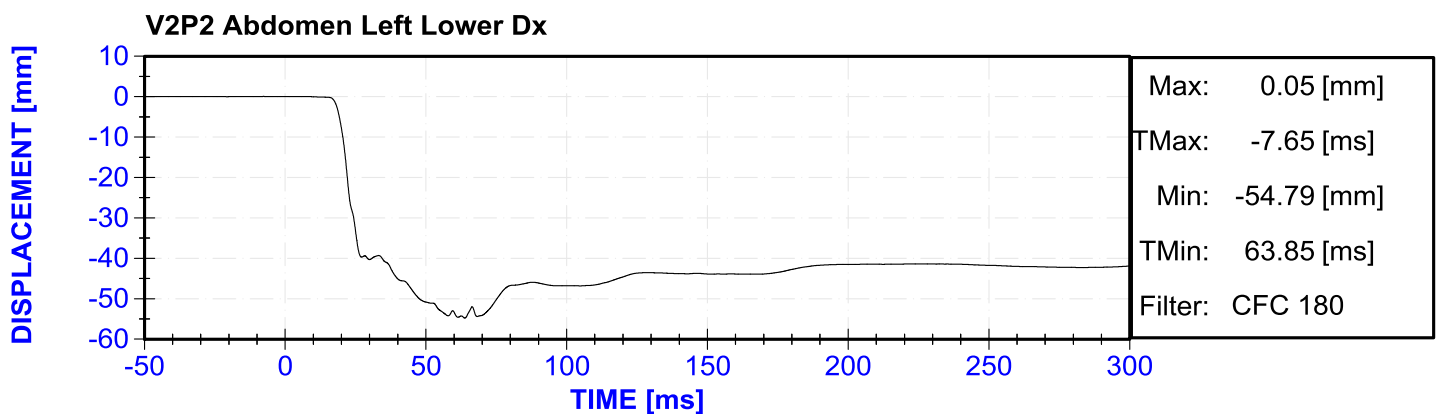
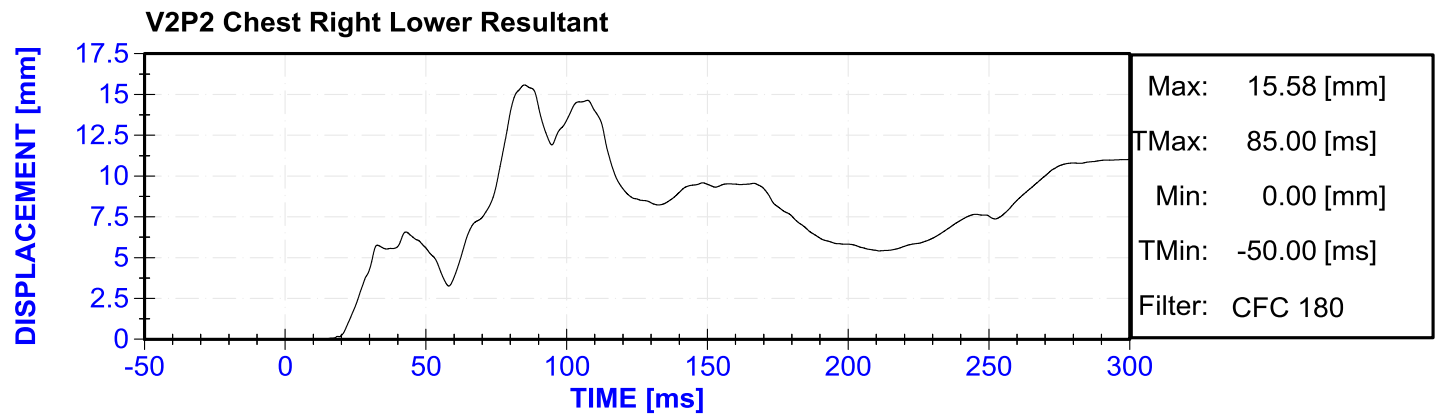
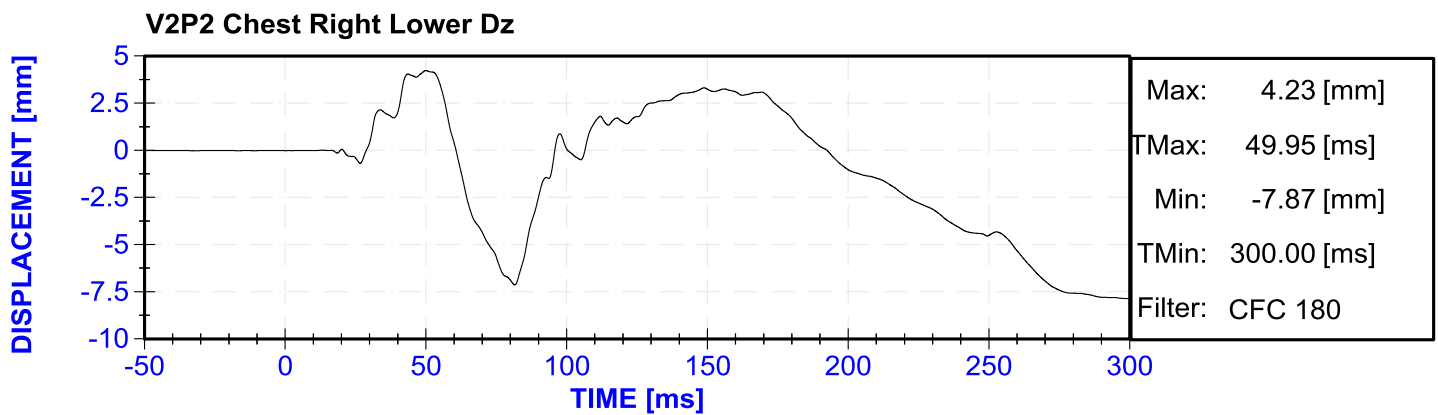
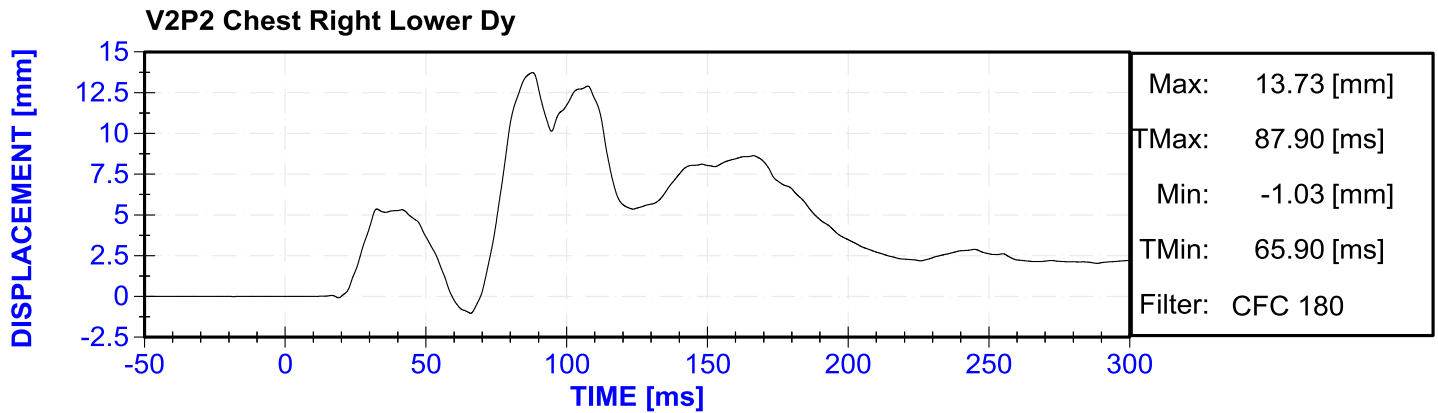


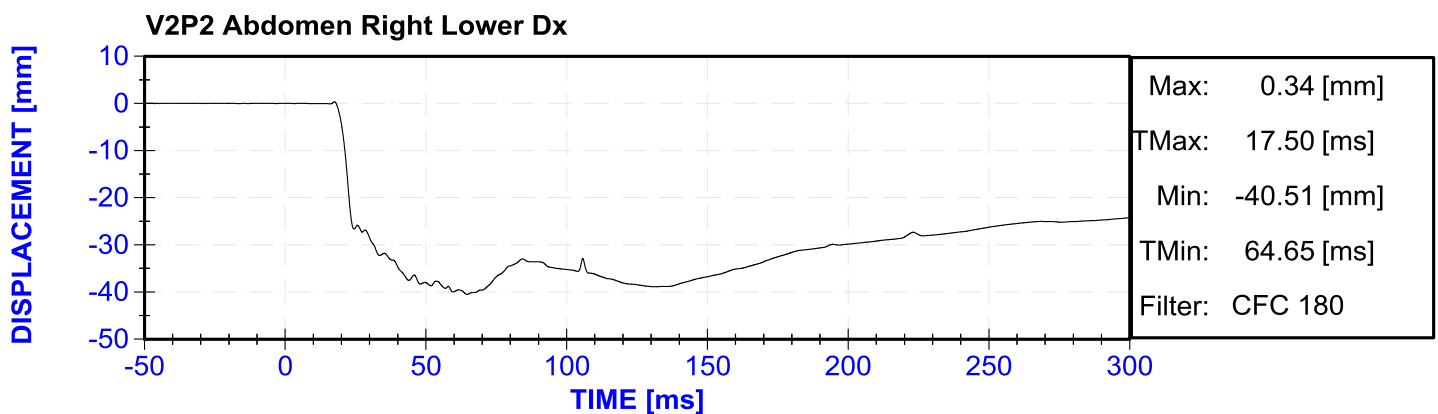
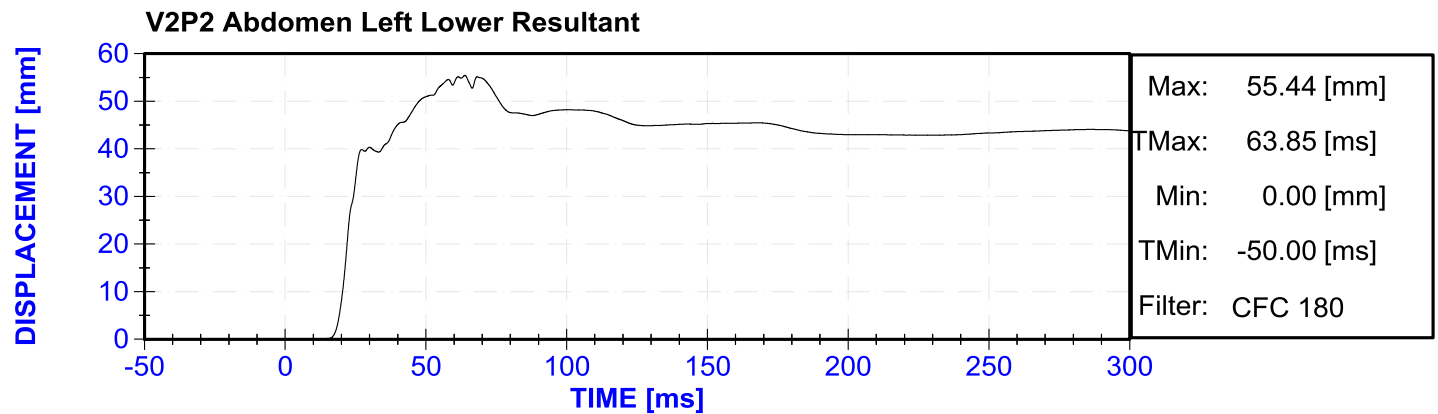
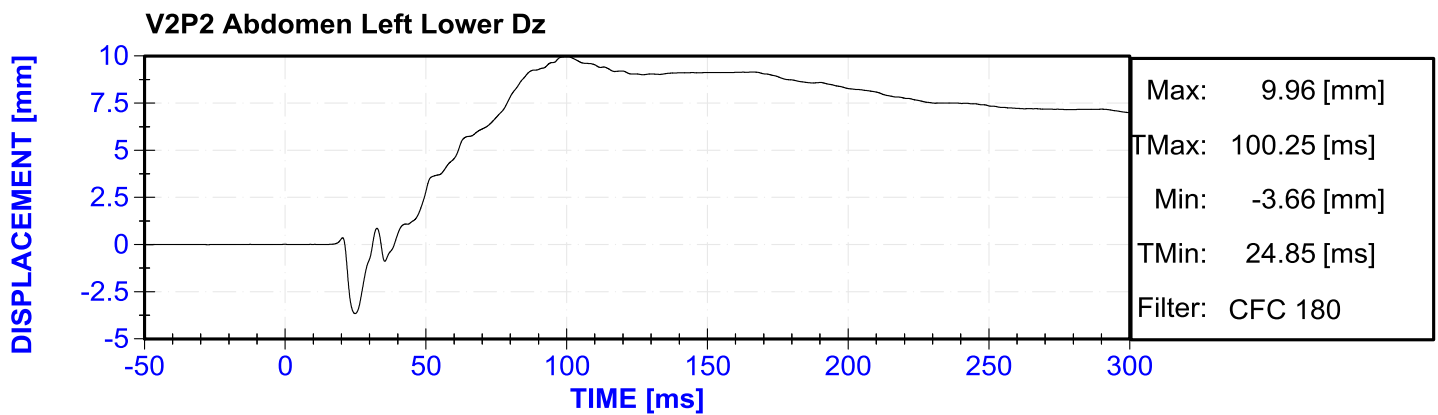
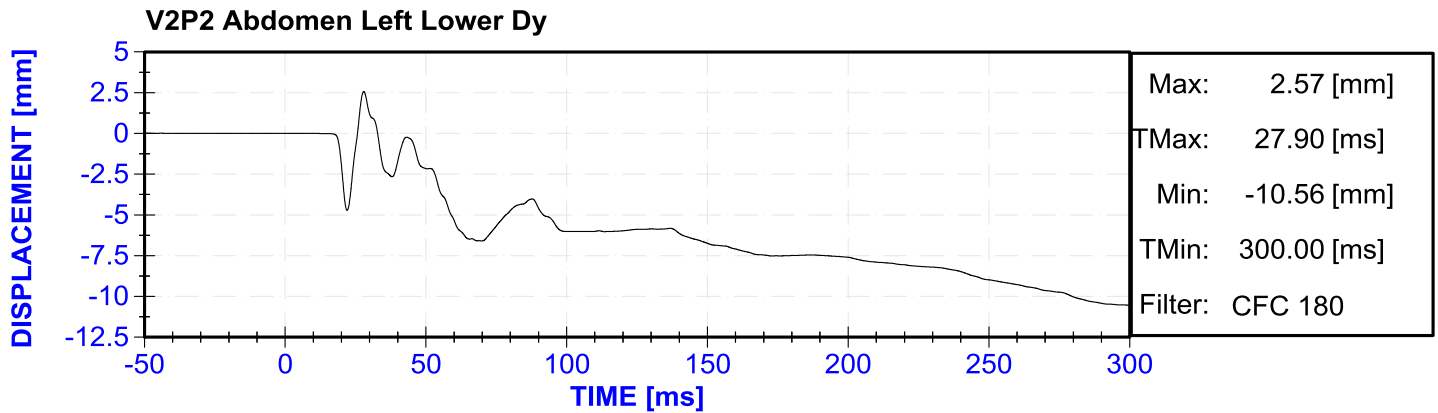


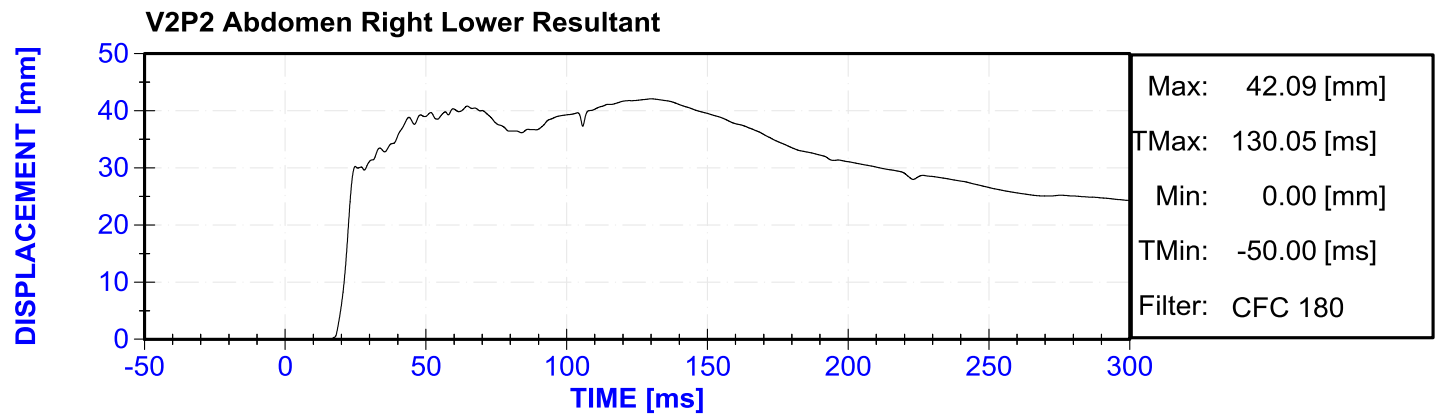
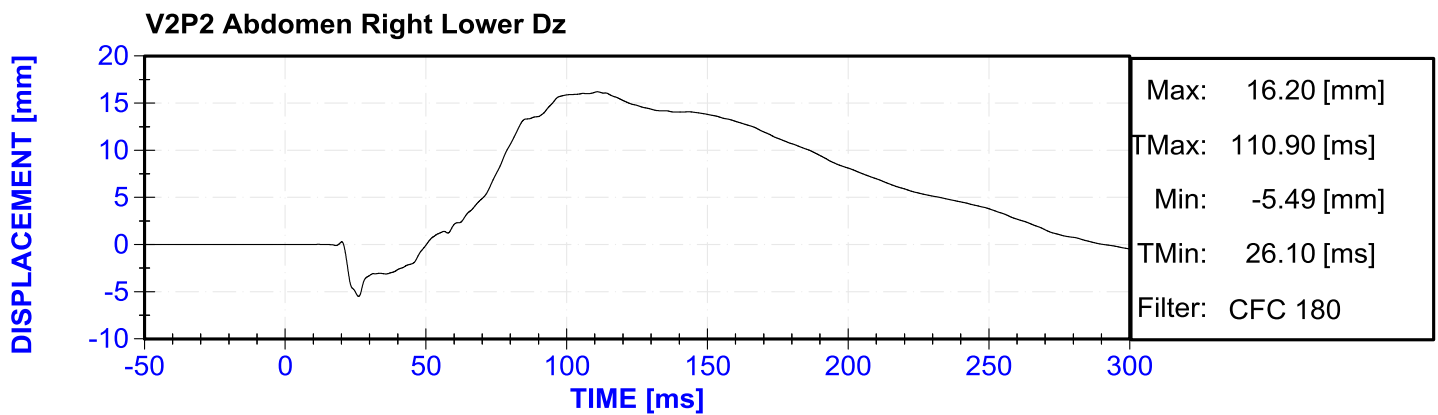
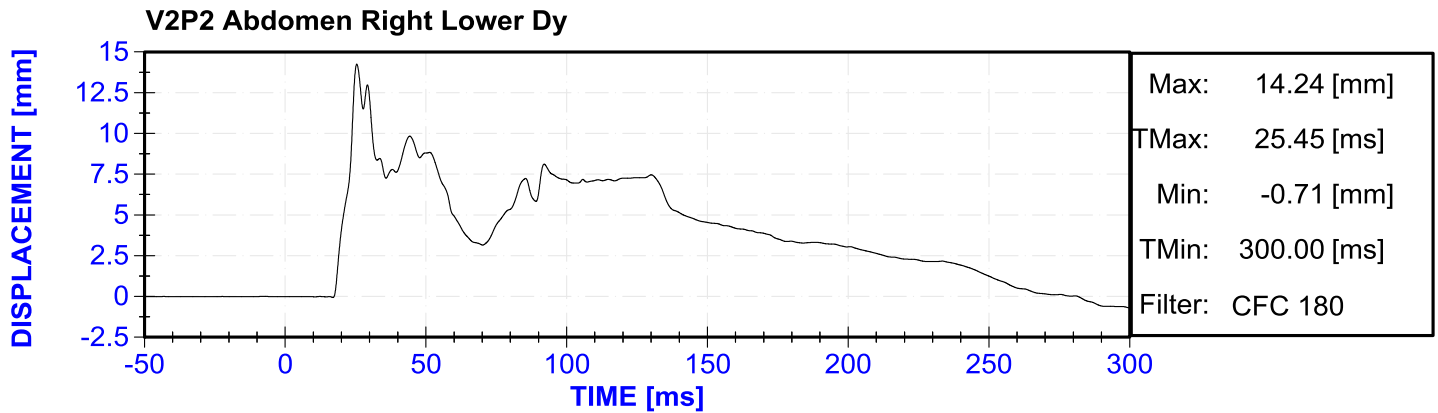












APPENDIX C

DUMMY CALIBRATION DATA

Table C-1: Dummy Information

TYPE	SERIAL NUMBER
THOR 50 TH Male	015
THOR 50 TH Male	016

Table C-2: THOR Ankle Zero Offset Information

THOR 50 th Male S/N: 015					
LFTX Left Ankle X	LFTY Left Ankle Y	LFTZ Left Ankle Z	RFTX Right Ankle X	RFTY Right Ankle Y	RFTZ Right Ankle Z
0.00893 deg	-15.7295 deg	-49.551 deg	-2.40521 deg	-12.1317 deg	-88.5479 deg
THOR 50 th Male S/N: 016					
LFTX Left Ankle X	LFTY Left Ankle Y	LFTZ Left Ankle Z	RFTX Right Ankle X	RFTY Right Ankle Y	RFTZ Right Ankle Z
2.16286 deg	-16.3445 deg	-44.58 deg	-3.53702 deg	-15.8108 deg	-46.565 deg

Table C- 3: THOR Dummy Initial Set-Up Information

THOR 50 th Male S/N: 015					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
Head CG Ax	Endevco	AC-P63993	2000	0.020850001	mV/V/g
Head CG Ay	Endevco	AC-P51641	2000	0.019360001	mV/V/g
Head CG Az	Endevco	AC-P52011	2000	0.019339999	mV/V/g
Head Wx	DTS	ARS-5921	18000	0.094919997	mV/deg/sec
Head Wy	DTS	ARS-6120	18000	0.093950002	mV/deg/sec
Head Wz	DTS	ARS-6640	18000	0.094540002	mV/deg/sec
Upper Neck Fx	Humanetics	LC-76Fx	8896.4	0.000231699	mV/V/N
Upper Neck Fy	Humanetics	LC-76Fy	8896.4	0.000234116	mV/V/N
Upper Neck Fz	Humanetics	LC-76Fz	13344.7	8.84E-05	mV/V/N
Upper Neck Mx	Humanetics	LC-76Mx	282.5	0.005946997	mV/V/Nm
Upper Neck My	Humanetics	LC-76My	282.5	0.005957618	mV/V/Nm
Upper Neck Mz	Humanetics	LC-76Mz	282.5	0.009966654	mV/V/Nm
Lower Neck Fx	Humanetics	LC-DM4552Fx	13344.7	0.00017042	mV/V/N
Lower Neck Fy	Humanetics	LC-DM4552Fy	13344.7	0.000169911	mV/V/N
Lower Neck Fz	Humanetics	LC-DM4552Fz	13344.7	7.10E-05	mV/V/N
Lower Neck Mx	Humanetics	LC-DM4552Mx	451.9	0.004082851	mV/V/Nm
Lower Neck My	Humanetics	LC-DM4552My	451.9	0.004110952	mV/V/Nm
Lower Neck Mz	Humanetics	LC-DM4552Mz	226	0.006743385	mV/V/Nm
Skull Spring Front Fz	Humanetics	LC-DI7617 Fz	4448.2	0.000498224	mV/V/N
Skull Spring Rear Fz	Humanetics	LC-80 Fz	4448.2	0.000868662	mV/V/N
Condyle Pot Ry	Sfernice	LC-DI7189	180	3.035299946	mV/V/deg
T1 Ax	Endevco	AC-P80336	2000	0.016559999	mV/V/g
T1 Ay	Endevco	AC-P80338	2000	0.01672	mV/V/g
T1 Az	Endevco	AC-P72696	2000	0.02044	mV/V/g

THOR 50 th Male (Continued) S/N: 015					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
T4 Ax	Endevco	AC-P80288	2000	0.020150001	mV/V/g
T4 Ay	Endevco	AC-P82328	2000	0.018279999	mV/V/g
T4 Az	Endevco	AC-P78985	2000	0.01835	mV/V/g
Thoracic Spine Fx	Denton	LC-92Fx	13344.7	0.000137193	mV/V/N
Thoracic Spine Fy	Denton	LC-92Fy	13344.7	0.000137958	mV/V/N
Thoracic Spine Fz	Denton	LC-92Fz	17792.9	5.26E-05	mV/V/N
Thoracic Spine Mx	Denton	LC-92Mx	677.9	0.002160616	mV/V/Nm
Thoracic Spine My	Denton	LC-92My	903.9	0.001779222	mV/V/Nm
Upper Left Thorax Dx	Humanetics	DS-DP1394	160 mm	Non-linear Scale	
Upper Left Thorax Ry	Sfernice	DS-DO7273	180	3.04979994	mV/V/deg
Upper Left Thorax Rz	Sfernice	DS-DP3884	180	3.048900049	mV/V/deg
Upper Right Thorax Dx	Humanetics	DS-DP1387	160 mm	Non-linear Scale	
Upper Right Thorax Ry	Sfernice	DS-DO7282	180	3.034099936	mV/V/deg
Upper Right Thorax Rz	Sfernice	DS-DO7285	180	3.021700075	mV/V/deg
Lower Left Thorax Dx	Humanetics	DS-DM1151	160 mm	Non-linear Scale	
Lower Left Thorax Ry	Sfernice	DS-DI2386	180	2.952900017	mV/V/deg
Lower Left Thorax Rz	Sfernice	DS-DI6129	180	3.087900113	mV/V/deg
Lower Right Thorax Dx	Humanetics	DS-DI4717	160 mm	Non-linear Scale	
Lower Right Thorax Ry	Sfernice	DS-DI2385	180	2.602899913	mV/V/deg
Lower Right Thorax Rz	Sfernice	DS-DO7286	180	3.08299996	mV/V/deg
Abdomen Left Dx	Humanetics	DS-DJ5441	192 mm	Non-linear Scale	
Abdomen Left Ry	Sfernice	DS-VR31	150	3.035200061	mV/V/deg
Abdomen Left Rz	Sfernice	DS-VR30	150	3.023399971	mV/V/deg
Abdomen Right Dx	Humanetics	DS-DI4778	192 mm	Non-linear Scale	
Abdomen Right Ry	Sfernice	DS-DI7754	150	3.015900031	mV/V/deg
Abdomen Right Rz	Sfernice	DS-DI7902	150	3.029200016	mV/V/deg
Pelvis Ax	Endevco	AC-P52130	2000	0.017099999	mV/V/g
Pelvis Ay	Endevco	AC-P51678	2000	0.020879999	mV/V/g
Pelvis Az	Endevco	AC-P63840	2000	0.0222	mV/V/g
Acetabulum Left Fx	Humanetics	LC-DM5055Fx	22241.1	0.000121887	mV/V/N
Acetabulum Left Fy	Humanetics	LC-DM5055Fy	13344.7	5.93E-05	mV/V/N
Acetabulum Left Fz	Humanetics	LC-DM5055Fz	13344.7	0.000163534	mV/V/N
Acetabulum Right Fx	Denton	LC-87Fx	22241.1	0.000124068	mV/V/N
Acetabulum Right Fy	Denton	LC-87Fy	13344.7	6.08E-05	mV/V/N
Acetabulum Right Fz	Denton	LC-87Fz	13344.7	0.000167363	mV/V/N
ASIS Left Fx	Humanetics	LC-DI4774 Fx	13000	6.84E-05	mV/V/N
ASIS Left My	Humanetics	LC-DI4774 My	325	0.003740923	mV/V/Nm
ASIS Right Fx	Humanetics	LC-DI4775 Fx	13000	6.77E-05	mV/V/N
ASIS Right My	Humanetics	LC-DI4775 My	325	0.003728923	mV/V/Nm
Femur Left Fx	Humanetics	LC-DT1833Fx	15000	0.000146287	mV/V/N
Femur Left Fy	Humanetics	LC-DT1833Fy	15000	0.000145733	mV/V/N
Femur Left Fz	Humanetics	LC-DT1833Fz	15000	7.36E-05	mV/V/N
Femur Left Mx	Humanetics	LC-DT1833Mx	350	0.006617429	mV/V/Nm
Femur Left My	Humanetics	LC-DT1833My	350	0.006614857	mV/V/Nm
Femur Right Fx	Humanetics	LC-DT1830Fx	15000	0.00014712	mV/V/N
Femur Right Fy	Humanetics	LC-DT1830Fy	15000	0.000147193	mV/V/N
Femur Right Fz	Humanetics	LC-DT1830Fz	15000	7.29E-05	mV/V/N
Femur Right Mx	Humanetics	LC-DT1830Mx	350	0.006648857	mV/V/Nm

THOR 50 th Male (Continued) S/N: 015					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
Femur Right My	Humanetics	LC-DT1830My	350	0.006598	mV/V/Nm
Knee Dx	Space Age	DS-D2103665B	33	23.88590015	mv/v/mm
Upper Tibia Fz	Denton	LC-DS8145 Fz	11120	9.56E-05	mv/v/N
Upper Tibia Mx	Denton	LC-DS8145 Mx	395	0.0074603	mv/v/Nm
Upper Tibia My	Denton	LC-DS8145 My	395	0.0074283	mv/v/Nm
Lower Tibia Fx	Denton	LC-78 Fx	11100	0.0001747	mv/v/N
Lower Tibia Fy	Denton	LC-78 Fy	11100	0.0001706	mv/v/N
Lower Tibia Fz	Denton	LC-78 Fz	11100	9.64E-05	mv/v/N
Lower Tibia Mx	Denton	LC-78 Mx	395	0.0074895	mv/v/Nm
Lower Tibia My	Denton	LC-78 My	395	0.007513	mv/v/Nm
Leg Ax	Endevco	AC-P74940	2000	0.016620001	mv/v/g
Leg Ay	Endevco	AC-P51732	2000	0.01896	mv/v/g
Ankle Rx	Contelec	DS-0382	180	3.178999992	mv/v/deg
Ankle Ry	Contelec	DS-0386	180	3.176100086	mv/v/deg
Ankle Rz	Contelec	DS-0543	180	3.198399907	mv/v/deg
Foot Ax	Endevco	AC-P68071	2000	0.02365	mv/v/g
Foot Az	Endevco	AC-P51294	2000	0.02195	mv/v/g
Knee Dx	Space Age	DS-D2103657B	30	24.01199937	mv/v/mm
Upper Tibia Fz	Denton	LC-DS8144 Fz	11120	9.63E-05	mv/v/N
Upper Tibia Mx	Denton	LC-DS8144 Mx	395	0.0074676	mv/v/Nm
Upper Tibia My	Denton	LC-DS8144 My	395	0.0074022	mv/v/Nm
Lower Tibia Fx	Denton	LC-77 Fx	11100	0.0001737	mv/v/N
Lower Tibia Fy	Denton	LC-77 Fy	11100	0.0001715	mv/v/N
Lower Tibia Fz	Denton	LC-77 Fz	11100	9.61E-05	mv/v/N
Lower Tibia Mx	Denton	LC-77 Mx	395	0.0074698	mv/v/Nm
Lower Tibia My	Denton	LC-77 My	395	0.0073378	mv/v/Nm
Leg Ax	Endevco	AC-P79622	2000	0.02118	mv/v/g
Leg Ay	Endevco	AC-P83316	2000	0.01946	mv/v/g
Ankle Rx	Contelec	DS-0385	180	3.178199986	mv/v/deg
Ankle Ry	Contelec	DS-0383	180	3.153099911	mv/v/deg
Ankle Rz	Contelec	DS-0401	180	3.186699934	mv/v/deg
Foot Ax	Endevco	AC-P72691	2000	0.02014	mv/v/g
Foot Az	Endevco	AC-P83310	2000	0.01946	mv/v/g

Table C- 3: THOR Dummy Initial Set-Up Information

THOR 50 th Male S/N: 016					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
Head CG Ax	Endevco	AC-P81382	2000	0.01759	mV/V/g
Head CG Ay	Endevco	AC-P80275	2000	0.020490001	mV/V/g
Head CG Az	Endevco	AC-P74947	2000	0.016690001	mV/V/g
Head Wx	DTS	ARS-6629	18000	0.094080002	mV/deg/sec
Head Wy	DTS	ARS-4735	18000	0.095700001	mV/deg/sec

THOR 50 th Male (Continued) S/N: 016					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
Head Wz	DTS	ARS-4069	18000	0.09311	mV/deg/sec
Upper Neck Fx	Humanetics	LC-75Fx	8896.4	0.000228159	mV/V/N
Upper Neck Fy	Humanetics	LC-75Fy	8896.4	0.000229418	mV/V/N
Upper Neck Fz	Humanetics	LC-75Fz	13344.7	8.76E-05	mV/V/N
Upper Neck Mx	Humanetics	LC-75Mx	282.5	0.005912656	mV/V/Nm
Upper Neck My	Humanetics	LC-75My	282.5	0.005966114	mV/V/Nm
Upper Neck Mz	Humanetics	LC-75Mz	282.5	0.009657586	mV/V/Nm
Lower Neck Fx	Humanetics	LC-79Fx	13344.7	0.000168262	mV/V/N
Lower Neck Fy	Humanetics	LC-79Fy	13344.7	0.000168472	mV/V/N
Lower Neck Fz	Humanetics	LC-79Fz	13344.7	7.02E-05	mV/V/N
Lower Neck Mx	Humanetics	LC-79Mx	451.9	0.003947435	mV/V/Nm
Lower Neck My	Humanetics	LC-79My	451.9	0.00396934	mV/V/Nm
Lower Neck Mz	Humanetics	LC-79Mz	226	0.006685855	mV/V/Nm
Skull Spring Front Fz	Humanetics	LC-130 Fz	4448.2	0.000493186	mV/V/N
Skull Spring Rear Fz	Humanetics	LC-DM2829Fz	4448.2	0.000514633	mV/V/N
Condyle Pot Ry	Sfernice	DS-0007	180	3.052179934	mV/V/deg
T1 Ax	Endevco	AC-P74948	2000	0.01686	mV/V/g
T1 Ay	Endevco	AC-P83429	2000	0.018139999	mV/V/g
T1 Az	Endevco	AC-P83430	2000	0.0177	mV/V/g
T4 Ax	Endevco	AC-P80268	2000	0.020920001	mV/V/g
T4 Ay	Endevco	AC-P81791	2000	0.01917	mV/V/g
T4 Az	Endevco	AC-P80269	2000	0.021170001	mV/V/g
Thoracic Spine Fx	Denton	LC-123Fx	13344.7	0.000139239	mV/V/N
Thoracic Spine Fy	Denton	LC-123Fy	13344.7	0.000140453	mV/V/N
Thoracic Spine Fz	Denton	LC-123Fz	17792.9	5.33E-05	mV/V/N
Thoracic Spine Mx	Denton	LC-123Mx	677.9	0.002083467	mV/V/Nm
Thoracic Spine My	Denton	LC-123My	903.9	0.001837305	mV/V/Nm
Upper Left Thorax Dx	Humanetics	DS-DS6356	160 mm	Non-linear Scale	
Upper Left Thorax Ry	Sfernice	DS-DJ4106	180	3.059499897	mV/V/deg
Upper Left Thorax Rz	Sfernice	DS-DJ4108	180	3.046100028	mV/V/deg
Upper Right Thorax Dx	Humanetics	DS-DM3232	160 mm	Non-linear Scale	
Upper Right Thorax Ry	Sfernice	DS-DI2381	180	3.058299888	mV/V/deg
Upper Right Thorax Rz	Sfernice	DS-DI2380	180	3.06040002	mV/V/deg
Lower Left Thorax Dx	Humanetics	DS-DP1389	160 mm	Non-linear Scale	
Lower Left Thorax Ry	Sfernice	DS-DP1972	180	3.044900019	mV/V/deg
Lower Left Thorax Rz	Sfernice	DS-DO7288	180	3.039200092	mV/V/deg
Lower Right Thorax Dx	Humanetics	DS-DP1393	160 mm	Non-linear Scale	
Lower Right Thorax Ry	Sfernice	DS-DO7275	180	3.038000083	mV/V/deg
Lower Right Thorax Rz	Sfernice	DS-DO7276	180	3.021999961	mV/V/deg
Abdomen Left Dx	Humanetics	DS-DJ5440	192 mm	Non-linear Scale	
Abdomen Left Ry	Sfernice	DS-DI7755	150	3.025599988	mV/V/deg
Abdomen Left Rz	Sfernice	DS-DI7901	150	3.057899885	mV/V/deg
Abdomen Right Dx	Humanetics	DS-DQ2304	192 mm	Non-linear Scale	
Abdomen Right Ry	Sfernice	DS-218	150	3.012799891	mV/V/deg
Abdomen Right Rz	Sfernice	DS-DI6580	150	2.744599944	mV/V/deg
Pelvis Ax	Endevco	AC-P82402	2000	0.01788	mV/V/g
Pelvis Ay	Endevco	AC-P82403	2000	0.01799	mV/V/g
Pelvis Az	Endevco	AC-P82332	2000	0.01715	mV/V/g

THOR 50 th Male (Continued) S/N: 016					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
Acetabulum Left Fx	Humanetics	LC-83Fx	22241.1	0.000120471	mV/V/N
Acetabulum Left Fy	Humanetics	LC-83Fy	13344.7	5.91E-05	mV/V/N
Acetabulum Left Fz	Humanetics	LC-83Fz	13344.7	0.000162964	mV/V/N
Acetabulum Right Fx	Denton	LC-84Fx	22241.1	0.000122579	mV/V/N
Acetabulum Right Fy	Denton	LC-84Fy	13344.7	5.82E-05	mV/V/N
Acetabulum Right Fz	Denton	LC-84Fz	13344.7	0.000165272	mV/V/N
ASIS Left Fx	Humanetics	LC-DT1000Fx	13000	6.88E-05	mV/V/N
ASIS Left My	Humanetics	LC-DT1000My	325	0.003827634	mV/V/Nm
ASIS Right Fx	Humanetics	LC-DT1001Fx	13000	6.94E-05	mV/V/N
ASIS Right My	Humanetics	LC-DT1001My	325	0.003849914	mV/V/Nm
Femur Left Fx	Humanetics	LC-DP4630Fx	15000	0.000142	mV/V/N
Femur Left Fy	Humanetics	LC-DP4630Fy	15000	0.0001419	mV/V/N
Femur Left Fz	Humanetics	LC-DP4630Fz	15000	7.16E-05	mV/V/N
Femur Left Mx	Humanetics	LC-DP4630Mx	350	0.0064409	mV/V/Nm
Femur Left My	Humanetics	LC-DP4630My	350	0.0064306	mV/V/Nm
Femur Right Fx	Humanetics	LC-DP3959Fx	15000	0.000142	mV/V/N
Femur Right Fy	Humanetics	LC-DP3959Fy	15000	0.0001422	mV/V/N
Femur Right Fz	Humanetics	LC-DP3959Fz	15000	7.24E-05	mV/V/N
Femur Right Mx	Humanetics	LC-DP3959Mx	350	0.006592	mV/V/Nm
Femur Right My	Humanetics	LC-DP3959My	350	0.0064729	mV/V/Nm
Knee Dx	Space Age	DS-017169	33	22.93870039	mv/v/mm
Upper Tibia Fz	Denton	LC-95 Fz	11120	9.60E-05	mv/v/N
Upper Tibia Mx	Denton	LC-95 Mx	395	0.0074226	mv/v/Nm
Upper Tibia My	Denton	LC-95 My	395	0.0073786	mv/v/Nm
Lower Tibia Fx	Denton	LC-139 Fx	11100	0.00017407	mv/v/N
Lower Tibia Fy	Denton	LC-139 Fy	11100	0.00017491	mv/v/N
Lower Tibia Fz	Denton	LC-139 Fz	11100	9.63E-05	mv/v/N
Lower Tibia Mx	Denton	LC-139 Mx	395	0.0074679	mv/v/Nm
Lower Tibia My	Denton	LC-139 My	395	0.007503	mv/v/Nm
Leg Ax	Endevco	AC-P67924	2000	0.02107	mv/v/g
Leg Ay	Endevco	AC-P51711	2000	0.01915	mv/v/g
Ankle Rx	Contelec	DS-0544	180	3.173100064	mv/v/deg
Ankle Ry	Contelec	DS-0527	180	3.160400083	mv/v/deg
Ankle Rz	Contelec	DS-0541	180	3.15340003	mv/v/deg
Foot Ax	Endevco	AC-P63979	2000	0.020310001	mv/v/g
Foot Az	Endevco	AC-P82182	2000	0.018090001	mv/v/g
Knee Dx	Space Age	DS-12070382	30	24.1260007	mv/v/mm
Upper Tibia Fz	Denton	LC-88 Fz	11120	9.33E-05	mv/v/N
Upper Tibia Mx	Denton	LC-88 Mx	395	0.0072837	mv/v/Nm
Upper Tibia My	Denton	LC-88 My	395	0.0071822	mv/v/Nm
Lower Tibia Fx	Denton	LC-140 Fx	11100	0.0001784	mv/v/N
Lower Tibia Fy	Denton	LC-140 Fy	11100	0.0001764	mv/v/N
Lower Tibia Fz	Denton	LC-140 Fz	11100	9.65E-05	mv/v/N
Lower Tibia Mx	Denton	LC-140 Mx	395	0.0076118	mv/v/Nm
Lower Tibia My	Denton	LC-140 My	395	0.0076405	mv/v/Nm
Leg Ax	Endevco	AC-P50100	2000	0.017660001	mv/v/g

THOR 50 th Male (Continued) S/N: 016					
Sensor	Manufacturer	Serial Number	Range	Sensitivity	Sensitivity Units
Leg Ay	Endevco	AC-P80922	2000	0.018160001	mv/v/g
Ankle Rx	Contelec	DS-0254	180	3.179399995	mv/v/deg
Ankle Ry	Contelec	DS-0525-1	180	3.179399995	mv/v/deg
Ankle Rz	Contelec	DS-0256	180	3.160899971	mv/v/deg
Foot Ax	Endevco	AC-P58836	2000	0.01903	mv/v/g
Foot Az	Endevco	AC-P72351	2000	0.021059999	mv/v/g

Table 4 – THOR IR-TRACC Polarity

In order to reduce the risk of damage to instrumentation, it is recommended that the 3D IR-TRACC units are not disconnected from the rib cage to conduct the polarity test. An alternate procedure for checking the IR-TRACC polarity is described below.

1. Using the data acquisition system control software, open a live view of each channel. If possible, view the DX, RY, and RZ components of a given quadrant simultaneously.
2. Record the initial reading of each channel
3. Perform the following motions on each of the four rib attachment locations and two abdomen attachment locations (specified by the hexagonal bolt attaching the blue ribs).
 - a. DX: Push inward (front-to-back). The IR-TRACC tube voltage should increase.
 - b. RY: Push downward (head-to-pelvis). The Y-axis potentiometer reading should decrease.
 - c. RZ: Push rightward (left-to-right). The Z-axis potentiometer should increase.
4. Record the final reading of each channel
5. If the “Measured” value (increase or decrease) does not match the “Expected” value, the polarity of the channel must be inverted.

THOR 50th Male 015

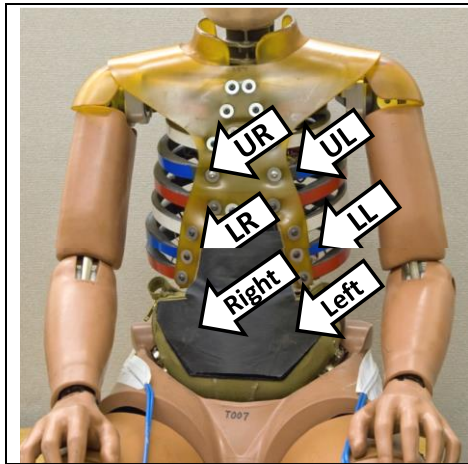


Figure 1. Manipulation to determine thoracic and abdominal IR-TRACC polarity.

Channel	Motion
DX	Push inward
RY	Push upward
RZ	Push rightward

Upper Right Thorax				Upper Left Thorax			
Channel	Initial Value	Expected Polarity	Recorded Polarity	Channel	Initial Value	Expected Polarity	Recorded Polarity
DX (V)	0.11203	+	+	DX (V)	0.10139	+	+
RY (Deg)	10.5792	+	+	RY (Deg)	11.7954	+	+
RZ (Deg)	-12.961	+	+	RZ (Deg)	13.0209	+	+
Lower Right Thorax				Lower Left Thorax			
Channel	Initial Value	Expected Polarity	Recorded Polarity	Channel	Initial Value	Expected Polarity	Recorded Polarity
DX (V)	0.09578	+	+	DX (V)	0.08445	+	+
RY (Deg)	-3.4367	+	+	RY (Deg)	-2.3055	+	+
RZ (Deg)	-5.1227	+	+	RZ (Deg)	5.23523	+	+
Abdomen Right				Abdomen Left			
Channel	Initial Value	Expected Polarity	Recorded Polarity	Channel	Initial Value	Expected Polarity	Recorded Polarity
DX (V)	0.06672	+	+	DX (V)	0.06328	+	+
RY (Deg)	2.86058	+	+	RY (Deg)	1.87899	+	+
RZ (Deg)	-0.8069	+	+	RZ (Deg)	1.53933	+	+

THOR 50th Male 016

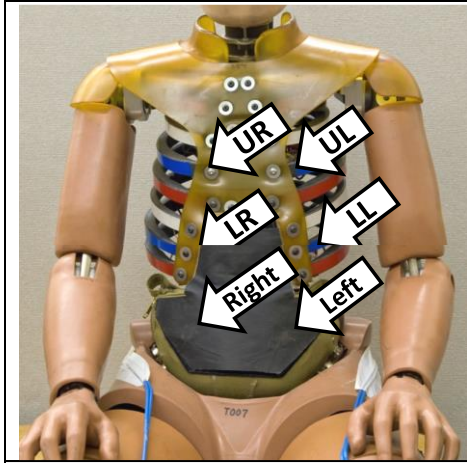


Figure 2. Manipulation to determine thoracic and abdominal IR-TRACC polarity.

Channel	Motion
DX	Push inward
RY	Push upward
RZ	Push rightward

Upper Right Thorax				Upper Left Thorax			
Channel	Initial Value	Expected Polarity	Recorded Polarity	Channel	Initial Value	Expected Polarity	Recorded Polarity
DX (V)	0.08380	+	+	DX (V)	0.85751	+	+
RY (Deg)	10.0137	+	+	RY (Deg)	4.55342	+	+
RZ (Deg)	-11.962	+	+	RZ (Deg)	11.7694	+	+
Lower Right Thorax				Lower Left Thorax			
Channel	Initial Value	Expected Polarity	Recorded Polarity	Channel	Initial Value	Expected Polarity	Recorded Polarity
DX (V)	0.08025	+	+	DX (V)	0.08125	+	+
RY (Deg)	-6.1346	+	+	RY (Deg)	-4.0026	+	+
RZ (Deg)	-2.2819	+	+	RZ (Deg)	7.84761	+	+
Abdomen Right				Abdomen Left			
Channel	Initial Value	Expected Polarity	Recorded Polarity	Channel	Initial Value	Expected Polarity	Recorded Polarity
DX (V)	0.07470	+	+	DX (V)	0.07571	+	+
RY (Deg)	3.52947	+	+	RY (Deg)	3.10074	+	+
RZ (Deg)	1.27844	+	+	RZ (Deg)	5.10226	+	+

Test Data/Sensor Repair Notes

THOR Inspection Checklist

Date: 9/22/2015		
NHTSA Representative: James Saunders		
Inspection Reporter: Mike Hartung		
Inspection type (check one): ☒ Pre-Test ☐ Post-Test		
Dummy S/N: 0015	Legs S/N: LX0038/LX0039	
Dummy Description: THOR-M 50th Male		
Date of last Certification: July 2015		
<u>Tests conducted:</u> Since last inspection: R20155143-2015 Highlander Since last certification: R20155509- Forester R20150227-2015 Ford F-150 R20155143-2015 Highlander		
<u>Known errors in data channels (no data, clipping, unexpected drops):</u> - 11KNSLLE00THDSXP, Knee Left X Displacement, Questionable Data after 29.7ms, SN:DS-D2103665B - 11TIBILELOTHFOXP, Tibia Lower Left X Force, Questionable spikes at 173ms and 181 ms, SN:LC-78 Fx - 11TIBILELOTHFOYP, Tibia Lower Left Y Force, Questionable spikes at 173ms and 181 ms, SN:LC-78 Fy - 11TIBILELOTHFOZP, Tibia Lower Left Z Force, Questionable spikes at 173ms and 181 ms, SN:LC-78 Fz -		
<u>Physical evidence of damage:</u> None New		
<u>Anecdotal evidence of damage:</u> None		
<u>Equipment delivered to Borrower:</u> THOR 0015 ATD 26 Accelerometers 3 Angular Rate Sensors 2 Skull Spring LC 1 Condyle Pot 1 Upper Neck LC 6 IRTraccs 12 Rotational Pots 1 Spine LC 2 Acetabulum LC 2 ASIS LC 2 Femur LC	<i>Continued</i> 2 LX Leg Assemblies 2 Upper Tibia LC 2 Lower Tibia LC 6 Ank1e Potentiometers 2 Knee Sliders 1 Neck Skin 1 Neck Foam 1 Tiltview Interface Cable 4 Tilt Sensors 1 H-Point Tool 1 Tool Box 1 Laptop	

Note: New Damage is Noted in Red

HEAD	
Y / N	Rear head cap mounts securely to head
Y / N	Head skin fits securely over skull
Y / N	Head skin shows no sign of tears or damage
Y / N	Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached
Y / N	Head securely mounted to OC joint
OTHER	
NECK	
Y / N	Neck cables slide freely through holes in neck plates
Y / N	Neck cables show no sign of fraying, broken strands, or kinking
Y / N	No evidence of de-bonding between neck pucks and plates
Y / N	No evidence of de-bonding or permanent compression in neck soft stop assemblies
Y / N	Neck securely attached to upper neck load cell
Y / N	Neck securely attached to lower neck load cell
Y / N	Neck pitch change joint mechanism mating teeth are engaged
OTHER	
SHOULDER	
Y / N	Urethane shoulder pads show no evidence of contact
Y / N	Clavicles securely attached to sternum and shoulder
Y / N	No evidence of de-bonding, tearing, or permanent compression of posterior soft stops
OTHER	
SPINE	
Y / N	No evidence of de-bonding between thoracic spine flex joint and metal plates
Y / N	No evidence of de-bonding between lumbar spine flex joint and metal plates
Y / N	Lumbar spine pitch change joint mechanism mating teeth are engaged
OTHER	
THORAX	
Y / N	No evidence of contact at top, bottom, or interior faces of rib damping material
Y / N	No evidence of de-bonding between rib damping material and ribs
Y / N	IRTRACCs securely attached to anterior ribs
Y / N	IRTRACCs securely attached to double gimbals, spine
Y / N	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration
Y / N	Ribs securely attached to posterior spine
Y / N	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners)
OTHER	
ABDOMEN	
Y / N	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper
Y / N	Upper abdomen insert securely attached to spine
Y / N	Upper abdomen insert shows no evidence of permanent set
Y / N	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper Multiple tears and broken stitches in lower abdomen bag.

		
Y / N	Lower abdomen insert securely attached to spine	
Y / N	Lower abdomen insert shows no evidence of permanent set	
OTHER	Heavy scuffing on front of right calf. Both thigh zippers detaching from flesh. Zippers detaching on left and right calves. Torn zippers/flesh on L & R forearms. 	
PELVIS		
Y / N	Pelvis flesh fits securely over pelvis bones	
Y / N	H-point tool fits securely into hole on both sides of pelvis	
OTHER		

FEMUR	
Y / N	Acetabular load cells firmly attached
Y / N	Femur load cells firmly attached
Y / N	No evidence of deformation of knee slider bump stop
Y / N	No cuts, tears, or scuffing of knee flesh
OTHER	
LOWER EXTREMITY (LX)	
Y / N	Rotational potentiometers in ankle securely attached
Y / N	Achilles tendon provides resistance to dorsiflexion
Y / N	No evidence of de-bonding, tearing, or permanent compression of ankle soft stops
Y / N	No cuts, tears, or scuffing of leg flesh
OTHER	
JACKET	
Y / N	Rib stiffeners show no sign of permanent deformation
Y / N	No evidence of tears or holes in jacket fabric, Velcro, or zippers
OTHER	

THOR Inspection Checklist

Date: 9/25/2015		
NHTSA Representative: James Saunders		
Inspection Reporter: Mike Hartung		
Inspection type (check one): ☐ Pre-Test ☒ Post-Test		
Dummy S/N: 0015	Legs S/N: LX0038/LX0039	
Dummy Description: THOR-M 50th Male		
Date of last Certification: July 2015		
<u>Tests conducted:</u> Since last inspection: R20155913-2015 Volvo S60 Since last certification: R20155509- Forester R20150227-2015 Ford F-150 R20155143-2015 Highlander <i>LX Leg Certification</i>	R20155913-2015 Volvo S60	
<u>Known errors in data channels (no data, clipping, unexpected drops):</u> - 11NECKFR00THFOZP, Front Neck Spring Tower Load Cell, Questionable spike 110ms to 112ms, SN:LC-DI7617 Fz - 11KNSLLE00THDSXP, Knee Left X Displacement, Questionable Spike 22.5ms to 34ms, SN:DS-D2103665B - 11TIBIRILOTHFOZP, Tibia Lower Right Z Force, Questionable spikes between 66.6ms to 86.8ms , SN:LC-77 Fz		
<u>Physical evidence of damage:</u> Neck Spring loose.		
<u>Anecdotal evidence of damage:</u> None		
<u>Equipment delivered to Borrower:</u> THOR 0015 ATD 26 Accelerometers 3 Angular Rate Sensors 2 Skull Spring LC 1 Condyle Pot 1 Upper Neck LC 6 IRTraccs 12 Rotational Pots 1 Spine LC 2 Acetabulum LC 2 ASIS LC 2 Femur LC	<i>Continued</i> 2 LX Leg Assemblies 2 Upper Tibia LC 2 Lower Tibia LC 6 Ank1e Potentiometers 2 Knee Sliders 1 Neck Skin 1 Neck Foam 1 Tiltview Interface Cable 4 Tilt Sensors 1 H-Point Tool 1 Tool Box 1 Laptop	

Note: New Damage is Noted in Red

HEAD	
Y / N	Rear head cap mounts securely to head
Y / N	Head skin fits securely over skull
Y / N	Head skin shows no sign of tears or damage
Y / N	Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached
Y / N	Head securely mounted to OC joint
OTHER	
NECK	
Y / N	Neck cables slide freely through holes in neck plates
Y / N	Neck cables show no sign of fraying, broken strands, or kinking
Y / N	No evidence of de-bonding between neck pucks and plates
Y / N	No evidence of de-bonding or permanent compression in neck soft stop assemblies
Y / N	Neck securely attached to upper neck load cell
Y / N	Neck securely attached to lower neck load cell
Y / N	Neck pitch change joint mechanism mating teeth are engaged
OTHER	Front Neck Spring jam nut was loose. Tightened.
SHOULDER	
Y / N	Urethane shoulder pads show no evidence of contact
Y / N	Clavicles securely attached to sternum and shoulder
Y / N	No evidence of de-bonding, tearing, or permanent compression of posterior soft stops
OTHER	
SPINE	
Y / N	No evidence of de-bonding between thoracic spine flex joint and metal plates
Y / N	No evidence of de-bonding between lumbar spine flex joint and metal plates
Y / N	Lumbar spine pitch change joint mechanism mating teeth are engaged
OTHER	
THORAX	
Y / N	No evidence of contact at top, bottom, or interior faces of rib damping material
Y / N	No evidence of de-bonding between rib damping material and ribs
Y / N	IRTRACCs securely attached to anterior ribs
Y / N	IRTRACCs securely attached to double gimbals, spine
Y / N	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration
Y / N	Ribs securely attached to posterior spine
Y / N	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners)
OTHER	
ABDOMEN	
Y / N	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper
Y / N	Upper abdomen insert securely attached to spine
Y / N	Upper abdomen insert shows no evidence of permanent set
Y / N	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper Multiple tears and broken stitches in lower abdomen bag.

		
Y / N	Lower abdomen insert securely attached to spine	
Y / N	Lower abdomen insert shows no evidence of permanent set	
OTHER		
PELVIS		
Y / N	Pelvis flesh fits securely over pelvis bones	
Y / N	H-point tool fits securely into hole on both sides of pelvis	
OTHER		
FEMUR		
Y / N	Acetabular load cells firmly attached	
Y / N	Femur load cells firmly attached	
Y / N	No evidence of deformation of knee slider bump stop	
Y / N	No cuts, tears, or scuffing of knee flesh	
OTHER	New heavy scuffing on left knee skin.	
		
LOWER EXTREMITY (LX)		
Y / N	Rotational potentiometers in ankle securely attached	
Y / N	Achilles tendon provides resistance to dorsiflexion	
Y / N	No evidence of de-bonding, tearing, or permanent compression of ankle soft stops	
Y / N	No cuts, tears, or scuffing of leg flesh	
OTHER	Heavy scuffing on front of right calf. Both thigh zippers detaching from flesh. Zippers detaching on left and right calves. Torn zippers/flesh on L & R forearms.	



JACKET

Y / N	Rib stiffeners show no sign of permanent deformation
Y / N	No evidence of tears or holes in jacket fabric, Velcro, or zippers
OTHER	

THOR Inspection Checklist

Date: 09/22/2015		
NHTSA Representative: James Saunders		
Inspection Reporter: Mike Hartung		
Inspection type (check one): ☒ Pre-Test ☐ Post-Test		
Dummy S/N: 0016	Legs S/N: LX0018/LX0019	
Dummy Description: THOR 50th Male		
Date of last Certification: July 2015		
<u>Tests conducted:</u> <u>Since last inspection:</u> R20155143-2015 Highlander <u>Since last certification:</u> R20155509- Forester R20150227-2015 Ford F-150 R20155143-2015 Highlander		
<u>Known errors in data channels (no data, clipping, unexpected drops):</u> 13CHSTRIUPTHVO0P, DGIR Upper Right X Displacement, Questionable spikes 22.7ms,73.3ms, SN:DS-DM3232 13ABDOLE00THVO0P, Abdomen Left DGIR X Displacement, Questionable spikes at 21.6ms, 48.1ms and 73.4ms, SN:DS-DJ5440		
<u>Physical evidence of damage:</u> None new		
<u>Anecdotal evidence of damage:</u> N/A		
<u>Equipment delivered to Borrower:</u> THOR 0016 ATD 2 LX Leg Assemblies 0018 & 0019 2 Lower Tibia Load Cells 2 Upper Tibia Load Cells 19 Rotational Potentiometers 1 Left Knee Slider Potentiometer 1 Right Knee Slider Potentiometer 25 Accelerometers 2 Achilles Load Cells	<i>Continued</i> 3 Angular Rate Sensors 2 Skull Spring Load Cells 1 Upper Neck Load Cell 1 Lower Neck Load Cell 6 IRTRACCs 1 Thoracic Spine Load Cell 1 Right Acetabulum Load Cell 1 Left Acetabulum Load Cell	2 ASIS Load Cells 2 Femur Load Cells 1 Interface Cable 1 IES Tilt Sensors 1 Laptop 1 H-Point Tool 1 Neck Foam Assembly 1 Neck Skin 1 Toolbox

Note: New Damage is in Red

HEAD	
Y / N	Rear head cap mounts securely to head
Y / N	Head skin fits securely over skull
Y / N	Head skin shows no sign of tears or damage
Y / N	Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached
Y / N	Head securely mounted to OC joint
OTHER	Rear head cap has a superficial cut and some scuffing. Head skin has scuffing. 
NECK	
Y / N	Neck cables slide freely through holes in neck plates
Y / N	Neck cables show no sign of fraying, broken strands, or kinking
Y / N	No evidence of de-bonding between neck pucks and plates
Y / N	No evidence of de-bonding or permanent compression in neck soft stop assemblies Permanent compression of the first neck soft stop 
Y / N	Neck securely attached to upper neck load cell
Y / N	Neck securely attached to lower neck load cell
Y / N	Neck pitch change joint mechanism mating teeth are engaged
OTHER	
SHOULDER	
Y / N	Urethane shoulder pads show no evidence of contact
Y / N	Clavicles securely attached to sternum and shoulder
Y / N	No evidence of de-bonding, tearing, or permanent compression of posterior soft stops
OTHER	Urethane Pads are both torn, completely through, near the neck. We put Gaffer's tape over the tears to protect.  LH shoulder bumper missing. RH shoulder bumper deformed



SPINE

Y / N	No evidence of de-bonding between thoracic spine flex joint and metal plates
Y / N	No evidence of de-bonding between lumbar spine flex joint and metal plates
Y / N	Lumbar spine pitch change joint mechanism mating teeth are engaged

OTHER	Small cut on the thoracic spine  Tears and rubbing damage to the front left Lumbar Spine. Tears also on rear sides – right side is pictured.    Damage is present on the surrounding metal structures of the Lumbar Spine  
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THORAX	
Y / N	No evidence of contact at top, bottom, or interior faces of rib damping material Both of the top two ribs, left and right, have contact damage 
Y / N	No evidence of de-bonding between rib damping material and ribs
Y / N	IRTRACCs securely attached to anterior ribs
Y / N	IRTRACCs securely attached to double gimbals, spine
Y / N	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration Urethane bib has signs of washer penetration repair and a tear 
Y / N	Ribs securely attached to posterior spine
Y / N	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners)
OTHER	There is heavy scuffing to the left upper arm, lower arm, and hand  The left hand and lower arm (inside and out) have cuts/punctures 

	The right lower arm (inside and out) has scuffing  The inside of the right hand has cuts and the thumb is tearing  The back of the right elbow has a small tear
ABDOMEN	
Y / N	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper
Y / N	Upper abdomen insert securely attached to spine
Y / N	Upper abdomen insert shows no evidence of permanent set
Y / N	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper Both sides have tears on the lower portion of the bag, and right side is torn near top 
Y / N	Lower abdomen insert securely attached to spine
Y / N	Lower abdomen insert shows no evidence of permanent set
OTHER	
PELVIS	
Y / N	Pelvis flesh fits securely over pelvis bones
Y / N	H-point tool fits securely into hole on both sides of pelvis
OTHER	
FEMUR	
Y / N	Acetabular load cells firmly attached
Y / N	Femur load cells firmly attached
Y / N	No evidence of deformation of knee slider bump stop
Y / N	No cuts, tears, or scuffing of knee flesh Scuffing to the right knee Slice on Right knee

		
OTHER		
LOWER EXTREMITY (LX)		
Y / N	Rotational potentiometers in ankle securely attached	
Y / N	Achilles tendon provides resistance to dorsiflexion	
Y / N	No evidence of de-bonding, tearing, or permanent compression of ankle soft stops	
Y / N	No cuts, tears, or scuffing of leg flesh Zipper pulling away from lower leg flesh of the left leg on both sides, and the front is scuffed.	
		Velcro strap torn from LH tibia flesh at ankle.

		
OTHER	front on left calf.	Heavy scuffing on left thigh. Puncture in
JACKET		
Y / N	Rib stiffeners show no sign of permanent deformation	
Y / N	No evidence of tears or holes in jacket fabric, Velcro, or zippers	
OTHER		

THOR Inspection Checklist

Date: 09/25/2015		
NHTSA Representative: James Saunders		
Inspection Reporter: Mike Hartung		
Inspection type (check one): ☐ Pre-Test ☒ Post-Test		
Dummy S/N: 0016	Legs S/N: LX0018/LX0019	
Dummy Description: THOR 50th Male		
Date of last Certification: July 2015		
<u>Tests conducted:</u> Since last inspection: R20155913-2015 Volvo S60 Since last certification: R20155509- Forester R20150227-2015 Ford F-150 R20155143-2015 Highlander <i>LX Leg Certification</i>	R20155913-2015 Volvo S60	
<u>Known errors in data channels (no data, clipping, unexpected drops):</u> None		
<u>Physical evidence of damage:</u> None new		
<u>Anecdotal evidence of damage:</u> N/A		
<u>Equipment delivered to Borrower:</u> THOR 0016 ATD 2 LX Leg Assemblies 0018 & 0019 2 Lower Tibia Load Cells 2 Upper Tibia Load Cells 19 Rotational Potentiometers 1 Left Knee Slider Potentiometer 1 Right Knee Slider Potentiometer 25 Accelerometers 2 Achilles Load Cells	<i>Continued</i> 3 Angular Rate Sensors 2 Skull Spring Load Cells 1 Upper Neck Load Cell 1 Lower Neck Load Cell 6 IRTRACCs 1 Thoracic Spine Load Cell 1 Right Acetabulum Load Cell 1 Left Acetabulum Load Cell	2 ASIS Load Cells 2 Femur Load Cells 1 Interface Cable 1 IES Tilt Sensors 1 Laptop 1 H-Point Tool 1 Neck Foam Assembly 1 Neck Skin 1 Toolbox

Note: New Damage is in Red

HEAD	
Y / N	Rear head cap mounts securely to head
Y / N	Head skin fits securely over skull
Y / N	Head skin shows no sign of tears or damage
Y / N	Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached
Y / N	Head securely mounted to OC joint
OTHER	Rear head cap has a superficial cut and some scuffing. Head skin has scuffing. 
NECK	
Y / N	Neck cables slide freely through holes in neck plates
Y / N	Neck cables show no sign of fraying, broken strands, or kinking
Y / N	No evidence of de-bonding between neck pucks and plates
Y / N	No evidence of de-bonding or permanent compression in neck soft stop assemblies Permanent compression of the first neck soft stop 
Y / N	Neck securely attached to upper neck load cell
Y / N	Neck securely attached to lower neck load cell
Y / N	Neck pitch change joint mechanism mating teeth are engaged
OTHER	
SHOULDER	
Y / N	Urethane shoulder pads show no evidence of contact
Y / N	Clavicles securely attached to sternum and shoulder
Y / N	No evidence of de-bonding, tearing, or permanent compression of posterior soft stops
OTHER	Urethane Pads are both torn, completely through, near the neck. We put Gaffer's tape over the tears to protect.  LH shoulder bumper missing. RH shoulder bumper deformed



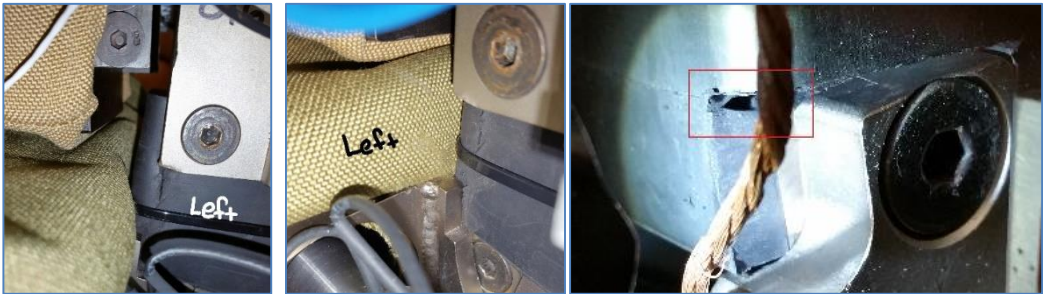
SPINE

Y / N	No evidence of de-bonding between thoracic spine flex joint and metal plates
Y / N	No evidence of de-bonding between lumbar spine flex joint and metal plates
Y / N	Lumbar spine pitch change joint mechanism mating teeth are engaged

OTHER



Tears and rubbing damage to the front left Lumbar Spine. Tears also on rear sides – right side is pictured.



Damage is present on the surrounding metal structures of the Lumbar Spine



THORAX	
Y / N	No evidence of contact at top, bottom, or interior faces of rib damping material Both of the top two ribs, left and right, have contact damage 
Y / N	No evidence of de-bonding between rib damping material and ribs
Y / N	IRTRACCs securely attached to anterior ribs
Y / N	IRTRACCs securely attached to double gimbals, spine
Y / N	Urethane bib is securely attached to ribs with no sign of tearing or washer penetration Urethane bib has signs of washer penetration repair and a tear 
Y / N	Ribs securely attached to posterior spine
Y / N	Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners)
OTHER	There is heavy scuffing to the left upper arm, lower arm, and hand  The left hand and lower arm (inside and out) have cuts/punctures 

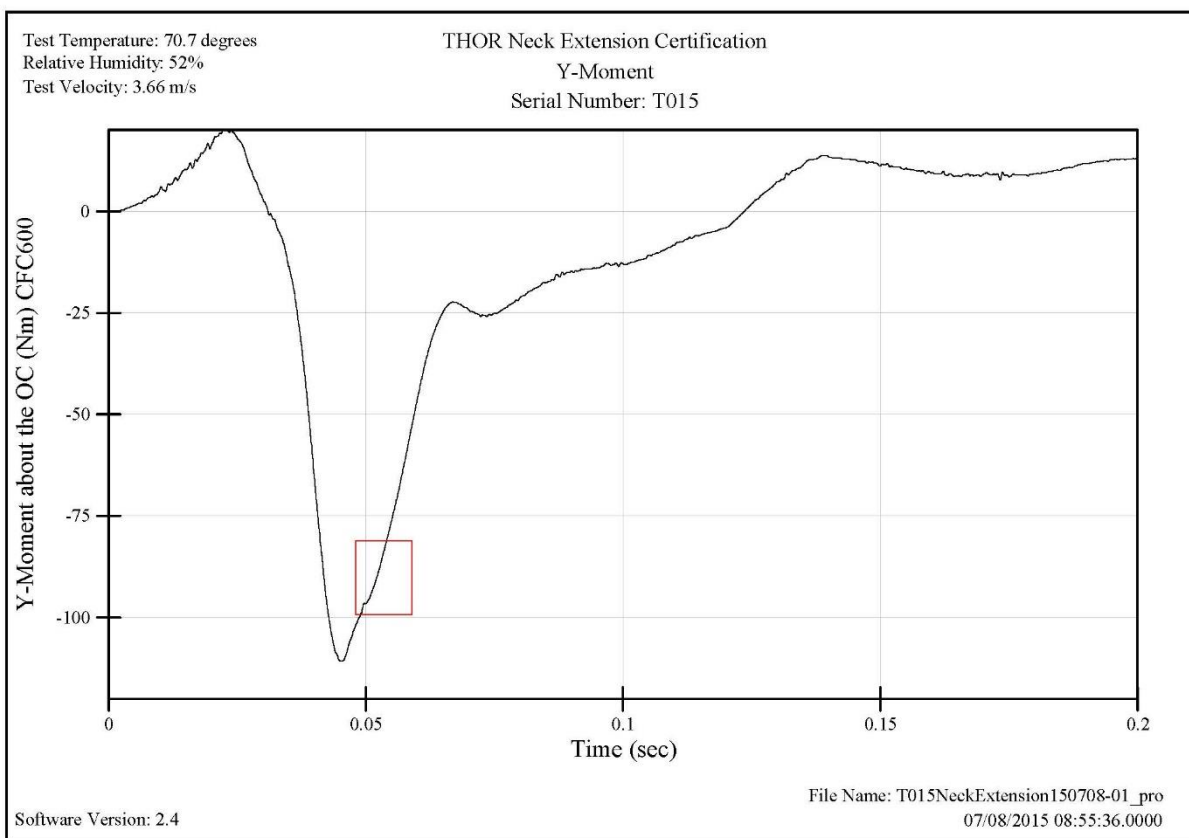
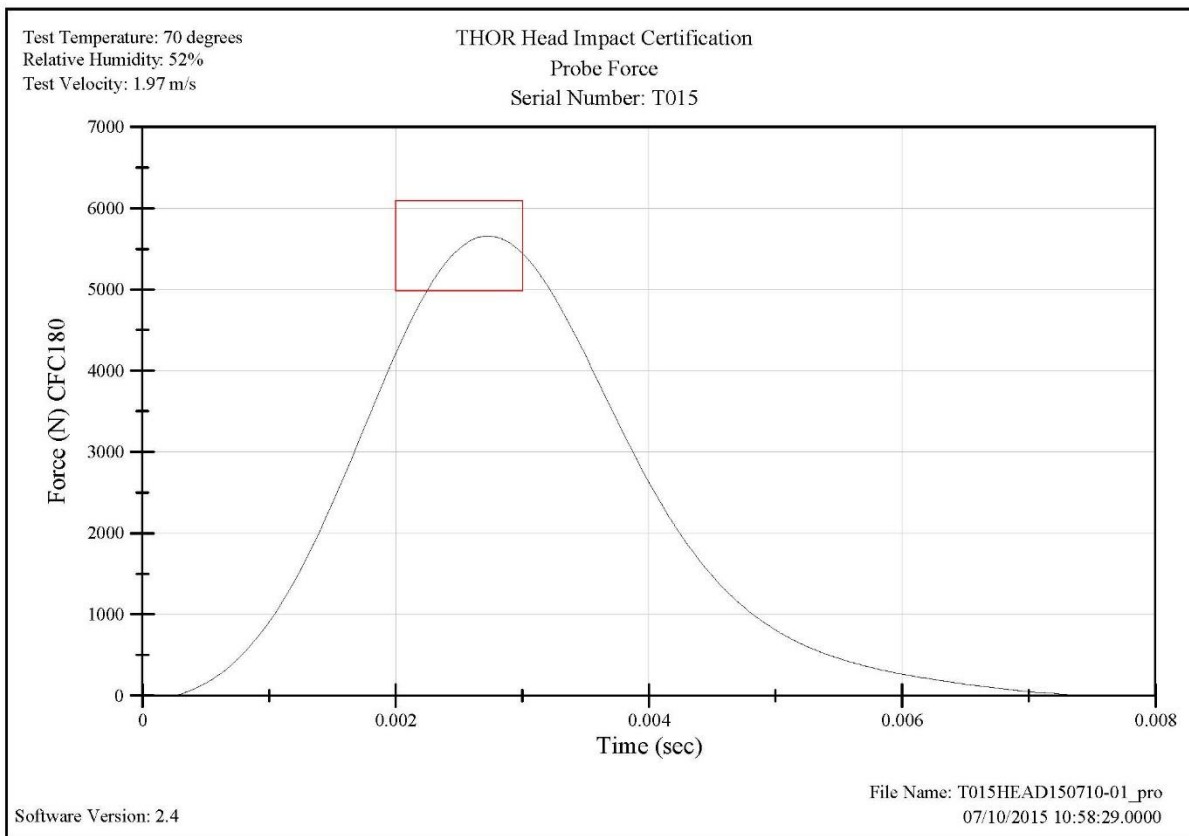
	The right lower arm (inside and out) has scuffing  The inside of the right hand has cuts and the thumb is tearing  The back of the right elbow has a small tear
ABDOMEN	
Y / N	No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper
Y / N	Upper abdomen insert securely attached to spine
Y / N	Upper abdomen insert shows no evidence of permanent set
Y / N	No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper Both sides have tears on the lower portion of the bag, and right side is torn near top 
Y / N	Lower abdomen insert securely attached to spine
Y / N	Lower abdomen insert shows no evidence of permanent set
OTHER	
PELVIS	
Y / N	Pelvis flesh fits securely over pelvis bones
Y / N	H-point tool fits securely into hole on both sides of pelvis
OTHER	
FEMUR	
Y / N	Acetabular load cells firmly attached
Y / N	Femur load cells firmly attached
Y / N	No evidence of deformation of knee slider bump stop
Y / N	No cuts, tears, or scuffing of knee flesh Scuffing to the right knee Slice on Right knee

		
OTHER		
LOWER EXTREMITY (LX)		
Y / N	Rotational potentiometers in ankle securely attached	
Y / N	Achilles tendon provides resistance to dorsiflexion	
Y / N	No evidence of de-bonding, tearing, or permanent compression of ankle soft stops	
Y / N	No cuts, tears, or scuffing of leg flesh Zipper pulling away from lower leg flesh of the left leg on both sides, and the front is scuffed.	
		Velcro strap torn from LH tibia flesh at ankle.

	 	
	front on left calf.	Heavy scuffing on left thigh. Puncture in
OTHER		
JACKET		
Y / N	Rib stiffeners show no sign of permanent deformation	
Y / N	No evidence of tears or holes in jacket fabric, Velcro, or zippers	
OTHER		

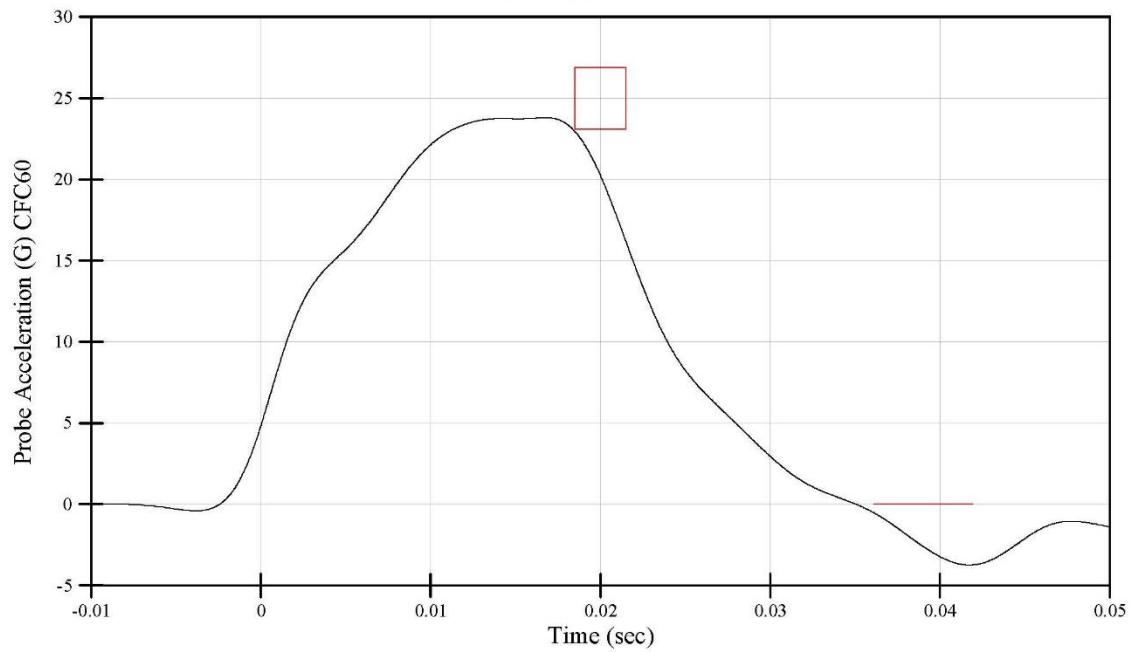
DUMMY CALIBRATIONS

50% ADULT MALE THOR015 DUMMY CALIBRATIONS



Test Temperature: 70.7 degrees
Relative Humidity: 52%
Test Velocity: 3.66 m/s

THOR Neck Extension Certification
Probe Acceleration
Serial Number: T015

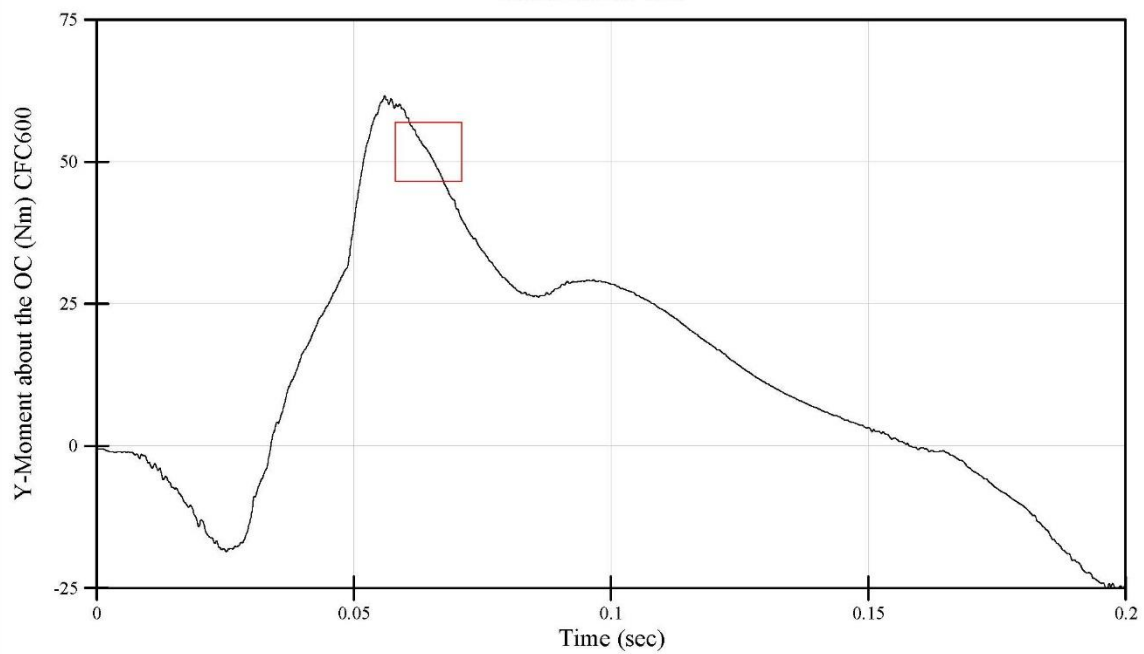


Software Version: 2.4

File Name: T015NeckExtension150708-01_pro
07/08/2015 08:55:36.0000

Test Temperature: 69.6 degrees
Relative Humidity: 51%
Test Velocity: 3.78 m/s

THOR Neck Flexion Certification
Y-Moment
Serial Number: T015

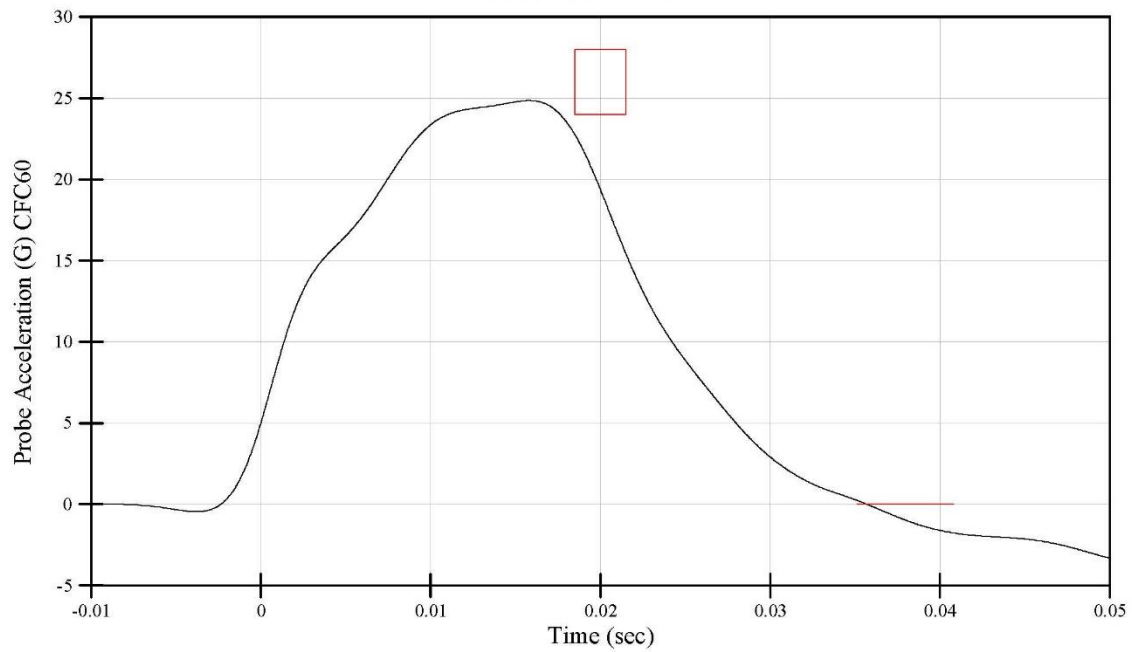


Software Version: 2.4

File Name: T015NeckFlexion150708-02_pro
07/08/2015 08:24:32.0000

Test Temperature: 69.6 degrees
Relative Humidity: 51%
Test Velocity: 3.78 m/s

THOR Neck Flexion Certification
Probe Acceleration
Serial Number: T015

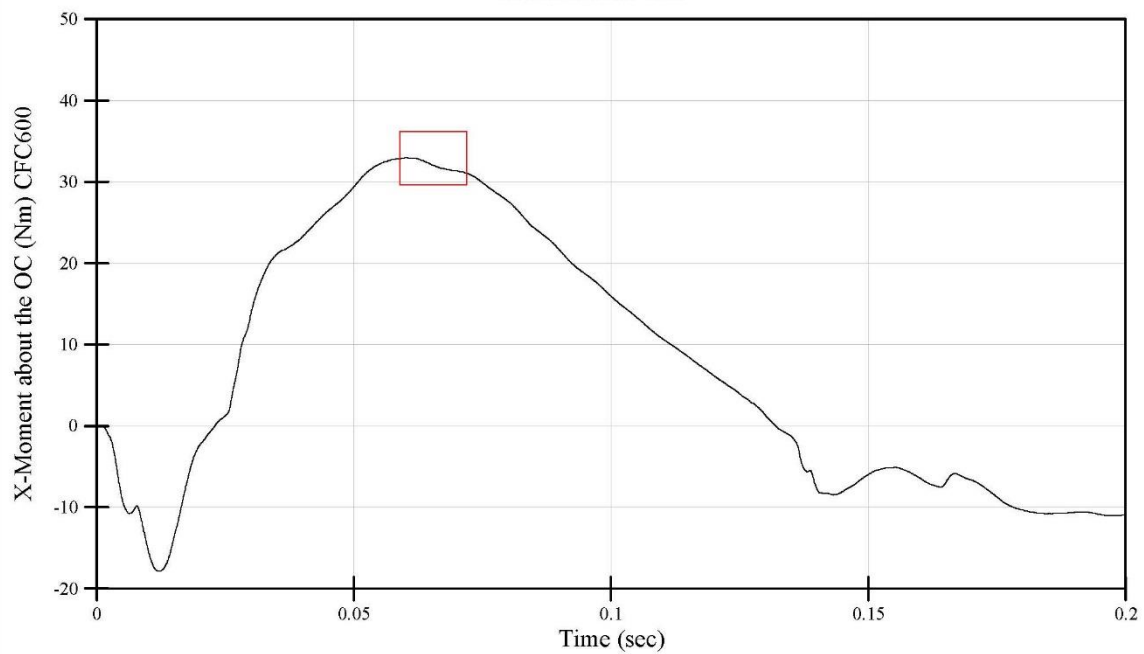


Software Version: 2.4

File Name: T015NeckFlexion150708-02_pro
07/08/2015 08:24:32.0000

Test Temperature: 70.5 degrees
Relative Humidity: 51%
Test Velocity: 2.86 m/s

THOR Neck Left Lateral Flexion Certification
X-Moment
Serial Number: T015



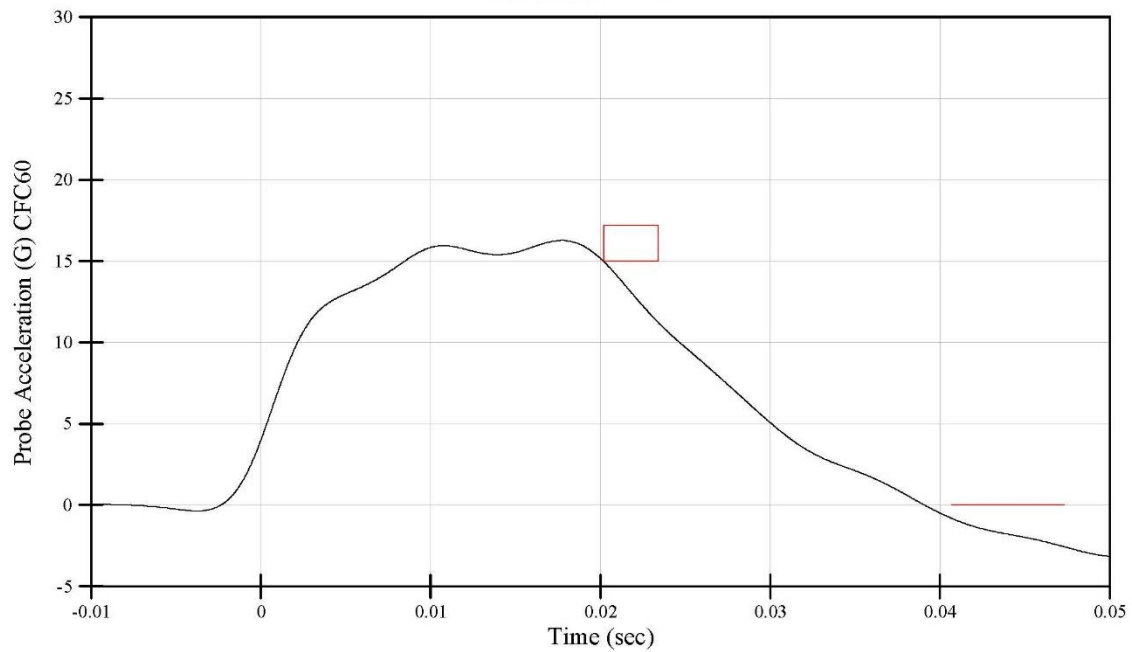
Software Version: 2.4

File Name: T015NeckLeft150708-01_pro
07/08/2015 09:59:03.0000

Test Temperature: 70.5 degrees
Relative Humidity: 51%
Test Velocity: 2.86 m/s

THOR Neck Left Lateral Flexion Certification

Probe Acceleration
Serial Number: T015



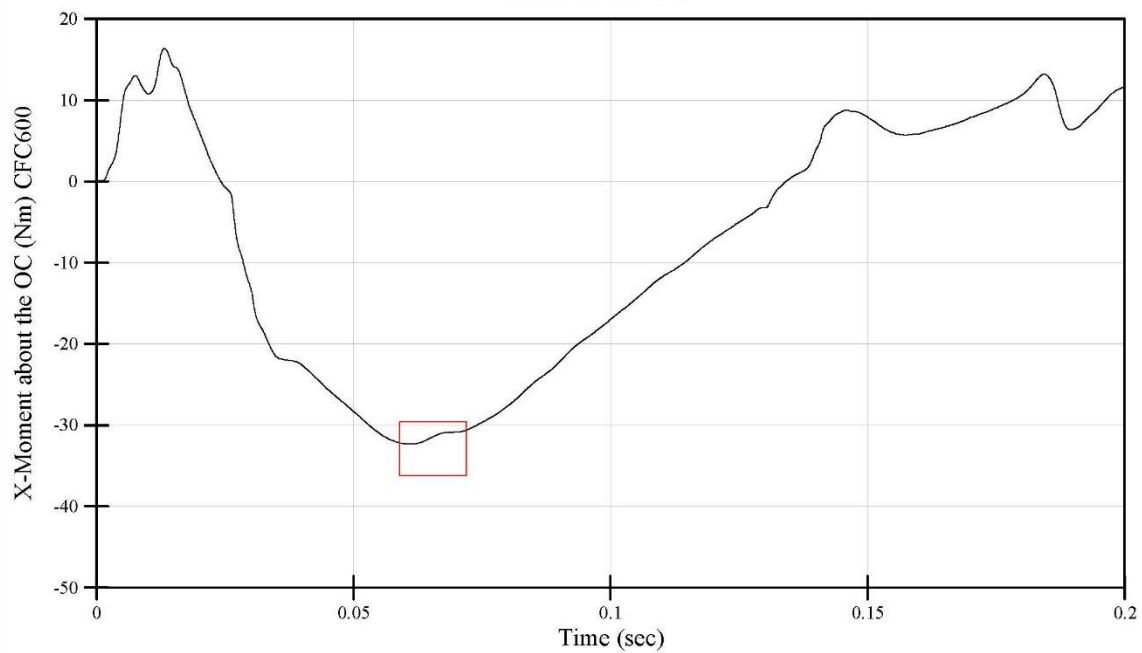
Software Version: 2.4

File Name: T015NeckLeft150708-01_pro
07/08/2015 09:59:03.0000

Test Temperature: 70.3 degrees
Relative Humidity: 52%
Test Velocity: 2.87 m/s

THOR Neck Right Lateral Flexion Certification

X-Moment
Serial Number: T015



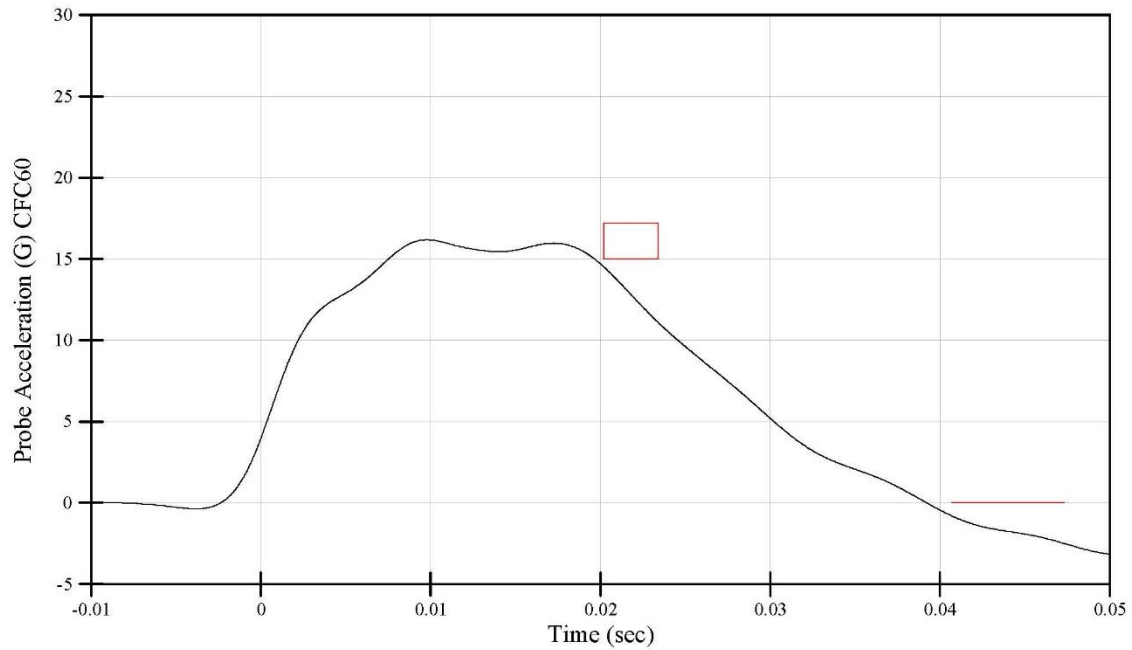
Software Version: 2.4

File Name: T015NeckRight150708-01_pro
07/08/2015 09:27:49.0000

Test Temperature: 70.3 degrees
Relative Humidity: 52%
Test Velocity: 2.87 m/s

THOR Neck Right Lateral Flexion Certification

Probe Acceleration
Serial Number: T015

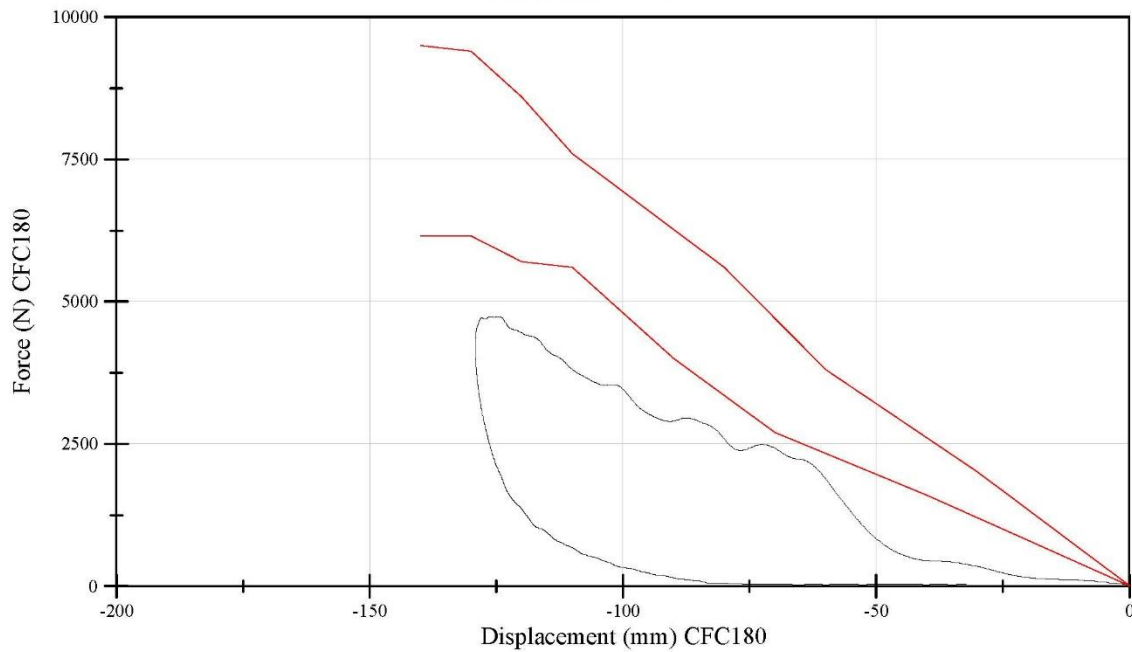


Software Version: 2.4

File Name: T015NeckRight150708-01_pro
07/08/2015 09:27:49.0000

Test Temperature: 70.2 degrees
Relative Humidity: 51%
Test Velocity: 6.63 m/s

THOR Upper Abdomen Certification Abdomen Displacement vs. Probe Force Serial Number: T015

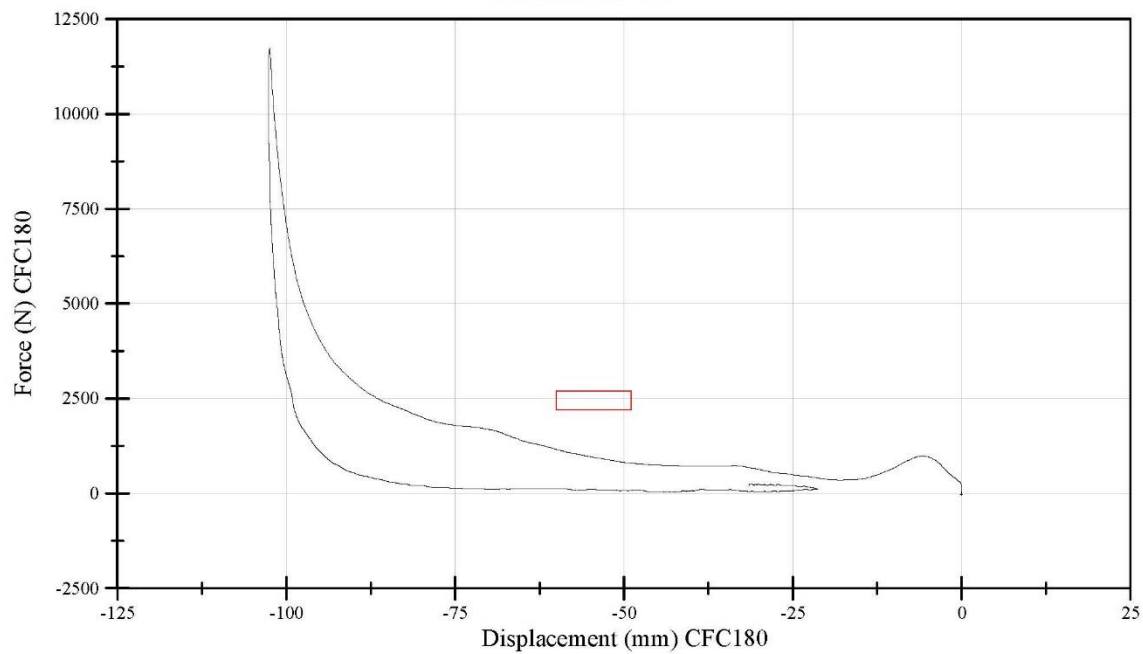


Software Version: 2.4

File Name: T015ABUP150709-01_pro
07/09/2015 15:52:54.0000

Test Temperature: 70.5 degrees
Relative Humidity: 52%
Test Velocity: 6.04 m/s

THOR Lower Abdomen Certification
Abdomen Displacement vs. Probe Force
Serial Number: T015

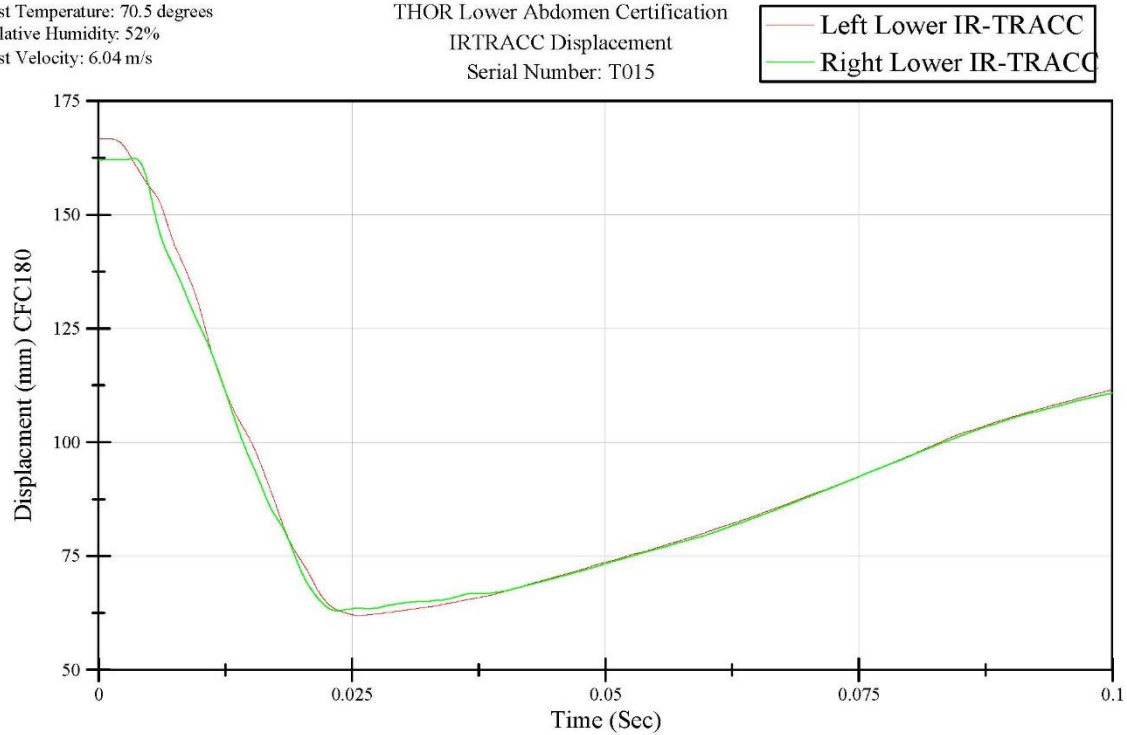


Software Version: 2.4

File Name: T015ABLR150709-04_pro
07/09/2015 14:46:27.0000

Test Temperature: 70.5 degrees
Relative Humidity: 52%
Test Velocity: 6.04 m/s

THOR Lower Abdomen Certification
IRTRACC Displacement
Serial Number: T015

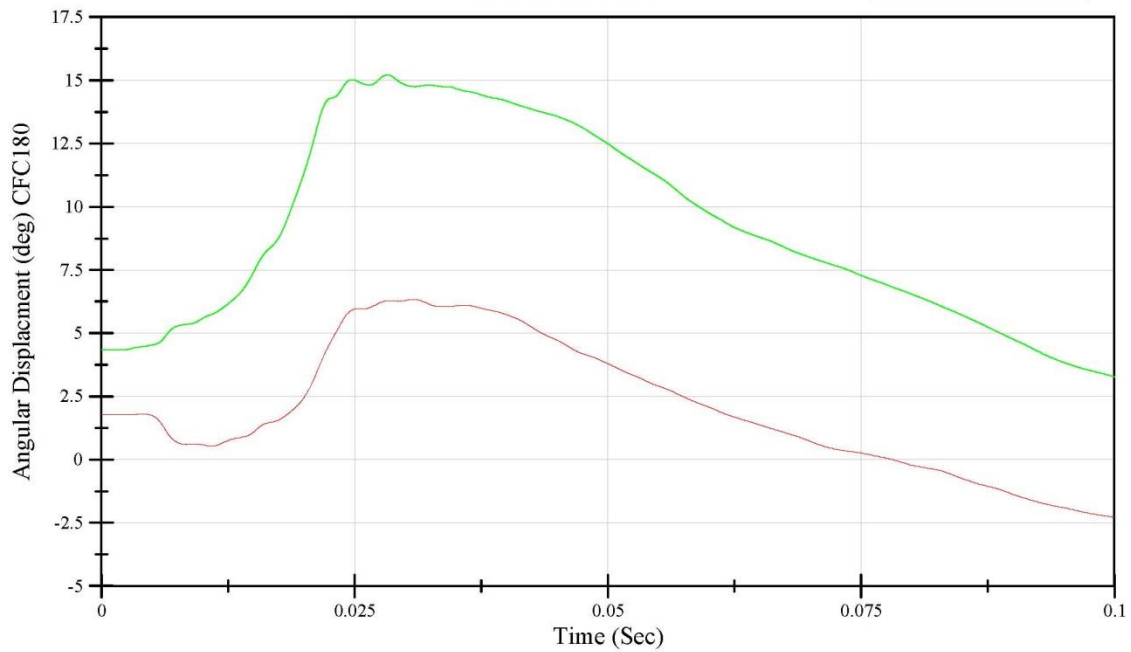


Software Version: 2.4

File Name: T015ABLR150709-04_pro
07/09/2015 14:46:27.0000

Test Temperature: 70.5 degrees
Relative Humidity: 52%
Test Velocity: 6.04 m/s

THOR Lower Abdomen Certification
Y-Pot Displacement
Serial Number: T015

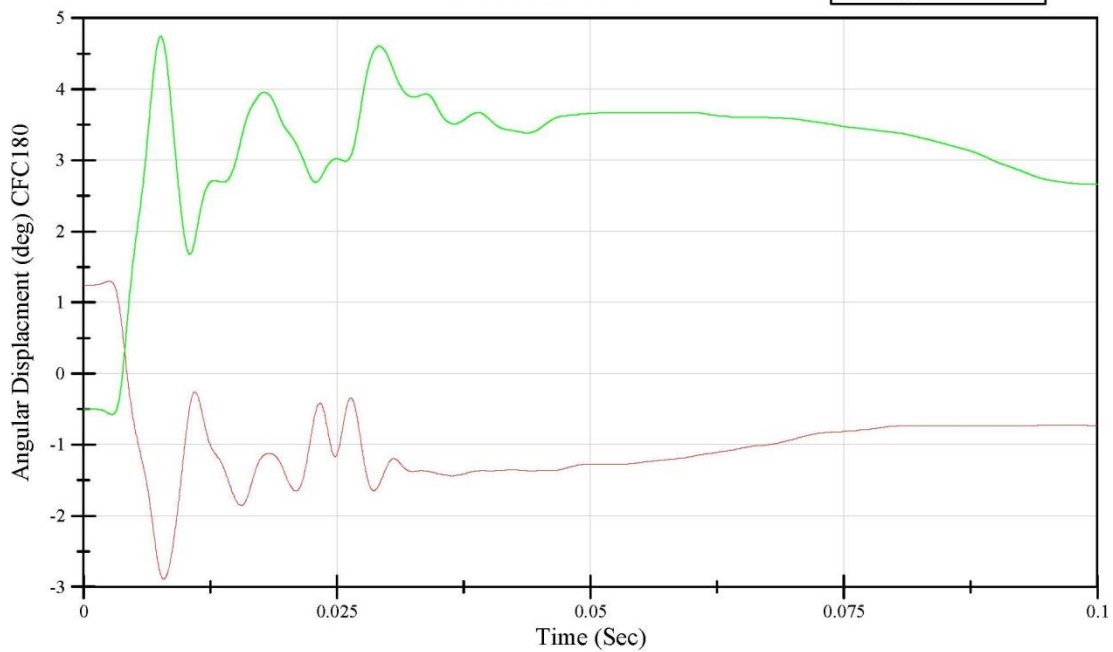


Software Version: 2.4

File Name: T015ABLR150709-04_pro
07/09/2015 14:46:27.0000

Test Temperature: 70.5 degrees
Relative Humidity: 52%
Test Velocity: 6.04 m/s

THOR Lower Abdomen Certification
Z-Potentiometer
Serial Number: T015

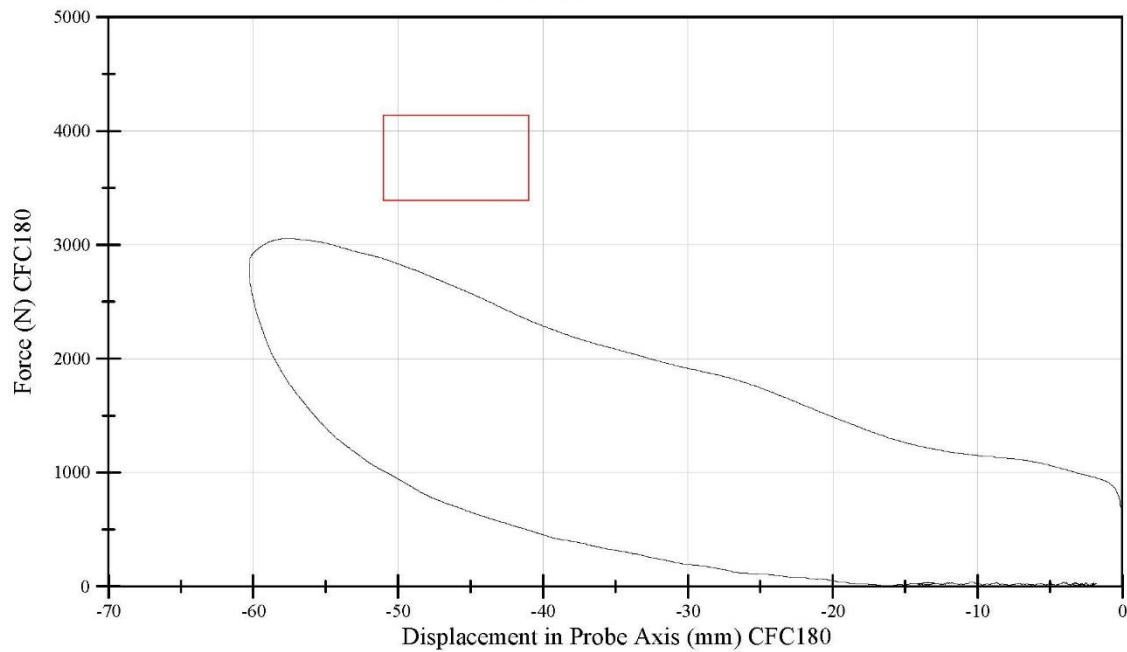


Software Version: 2.4

File Name: T015ABLR150709-04_pro
07/09/2015 14:46:27.0000

Test Temperature: 70.4 degrees
Relative Humidity: 52%
Test Velocity: 4.27 m/s

THOR Lower Left Oblique Thorax Certification
Thorax Displacement vs. Probe Force
Serial Number: T015

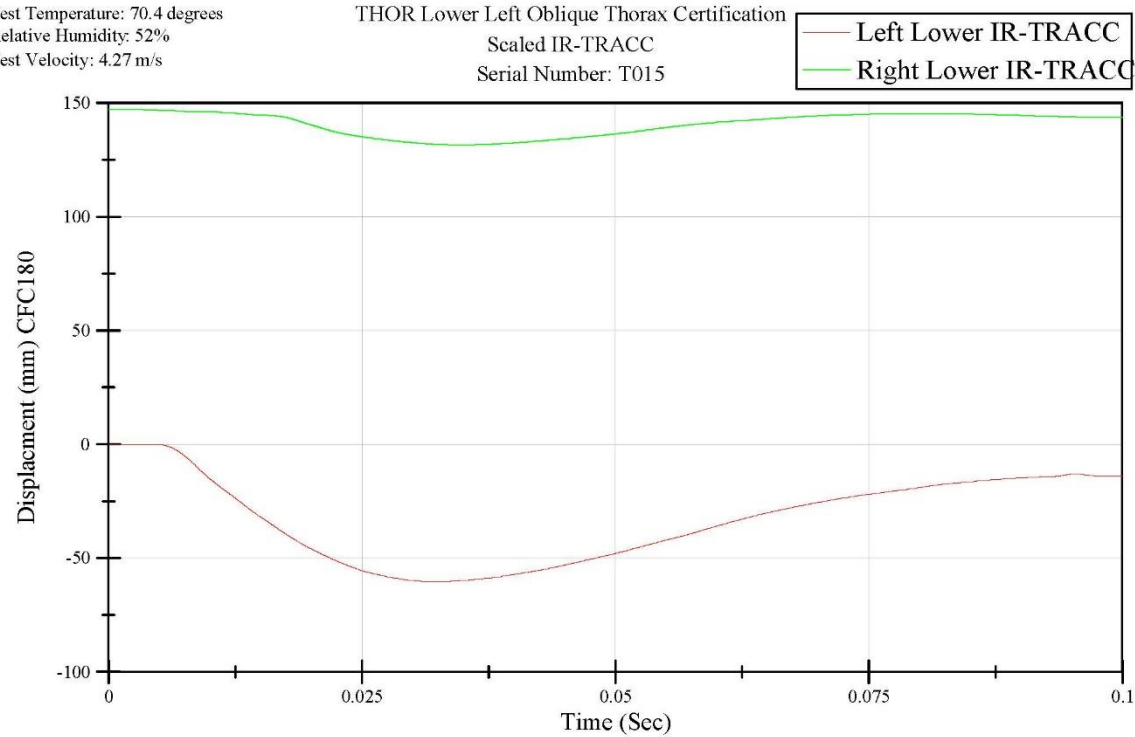


Software Version: 2.4

File Name: T015OBLE150710-01_pro
07/10/2015 14:01:12.0000

Test Temperature: 70.4 degrees
Relative Humidity: 52%
Test Velocity: 4.27 m/s

THOR Lower Left Oblique Thorax Certification
Scaled IR-TRACC
Serial Number: T015



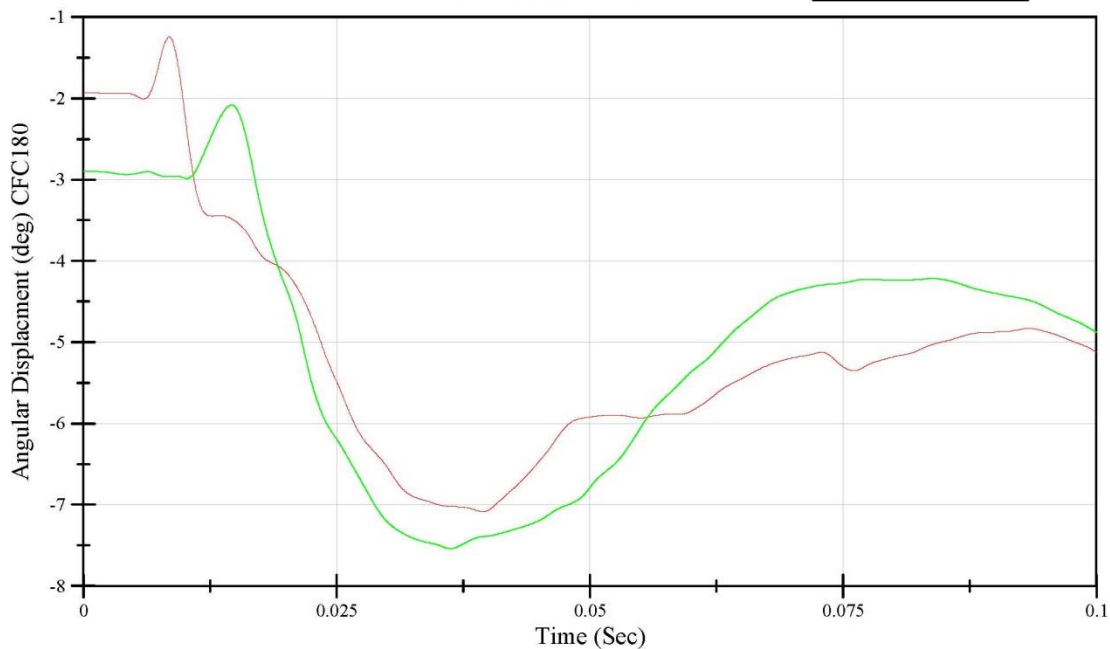
Software Version: 2.4

File Name: T015OBLE150710-01_pro
07/10/2015 14:01:12.0000

Test Temperature: 70.4 degrees
Relative Humidity: 52%
Test Velocity: 4.27 m/s

THOR Lower Left Oblique Thorax Certification
Y-Potentiometer
Serial Number: T015

Left Lower
Right Lower



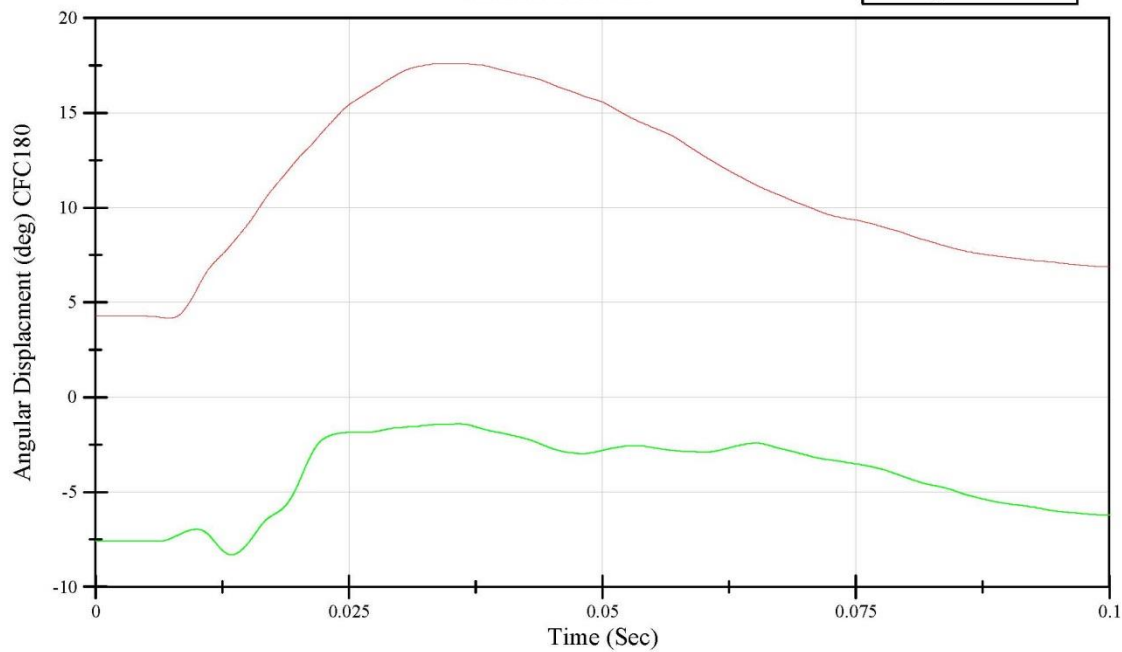
Software Version: 2.4

File Name: T015OBLE150710-01_pro
07/10/2015 14:01:12.0000

Test Temperature: 70.4 degrees
Relative Humidity: 52%
Test Velocity: 4.27 m/s

THOR Lower Left Oblique Thorax Certification
Z-Potentiometer
Serial Number: T015

Left Lower
Right Lower

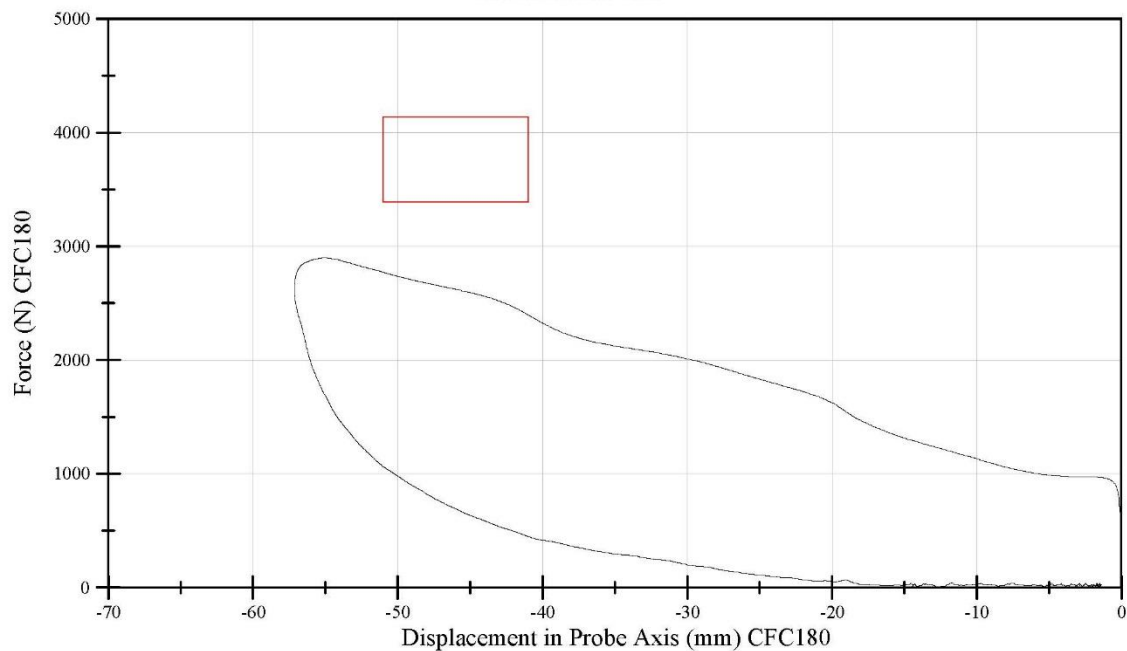


Software Version: 2.4

File Name: T015OBLE150710-01_pro
07/10/2015 14:01:12.0000

Test Temperature: 70.3 degrees
Relative Humidity: 51%
Test Velocity: 4.27 m/s

THOR Lower Right Oblique Thorax Certification
Thorax Displacement vs. Probe Force
Serial Number: T015

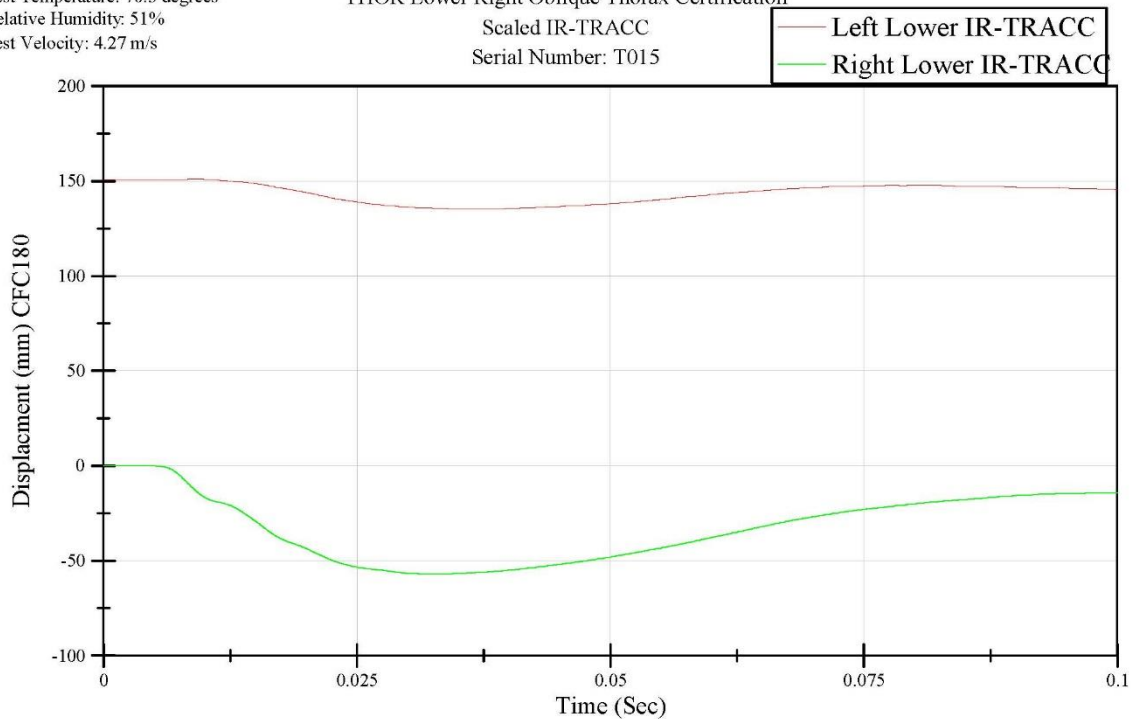


Software Version: 2.4

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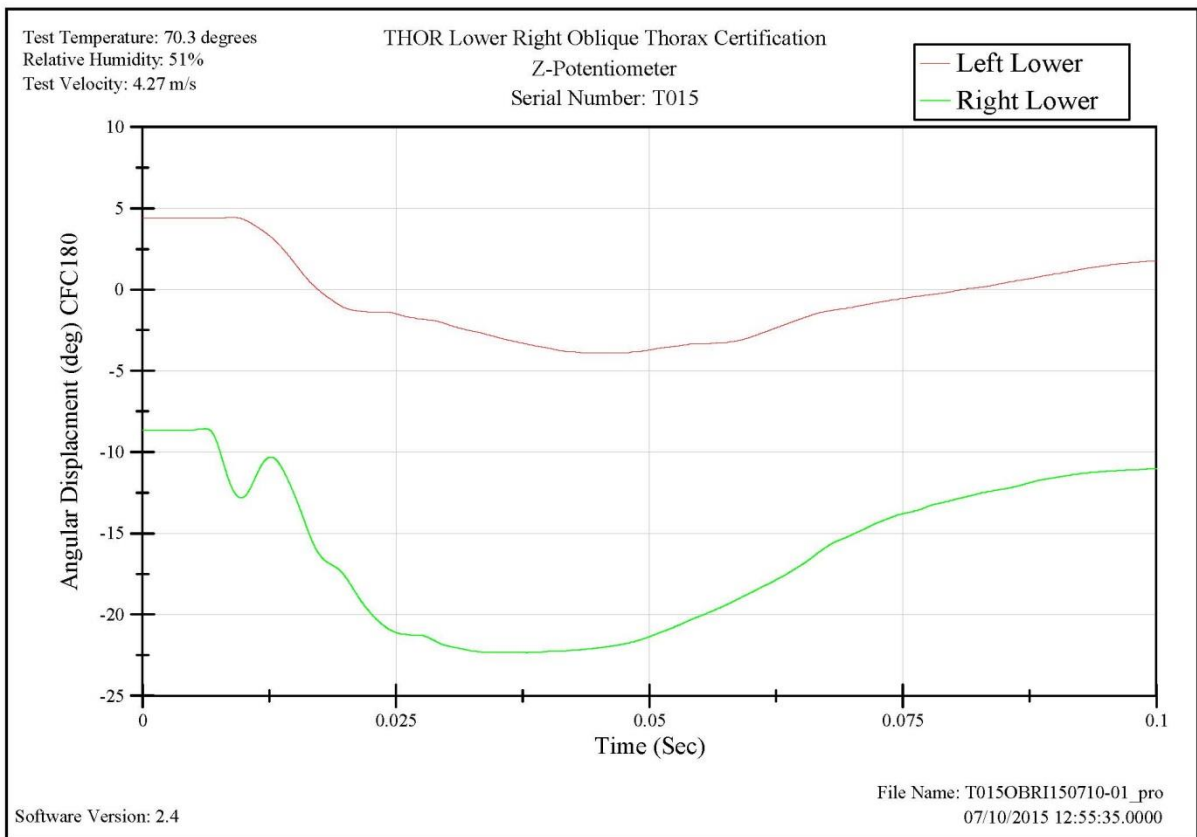
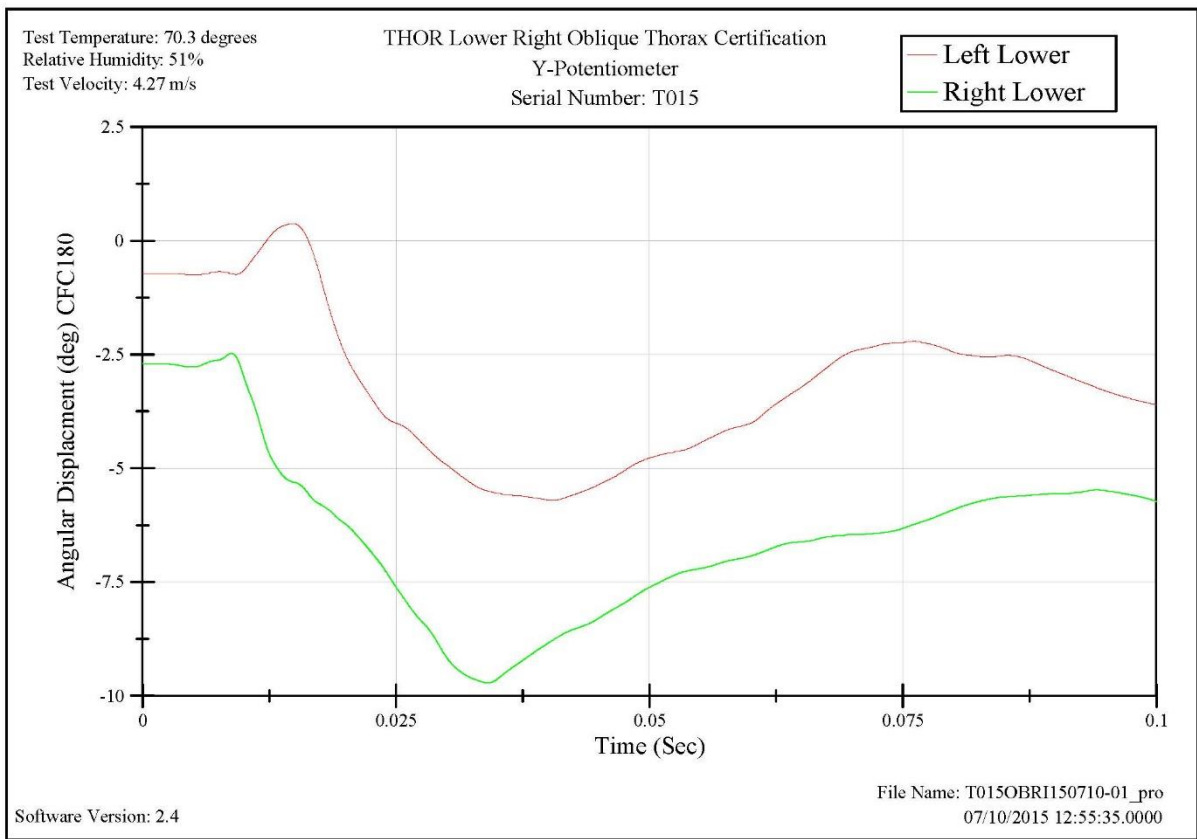
Test Temperature: 70.3 degrees
Relative Humidity: 51%
Test Velocity: 4.27 m/s

THOR Lower Right Oblique Thorax Certification
Scaled IR-TRACC
Serial Number: T015



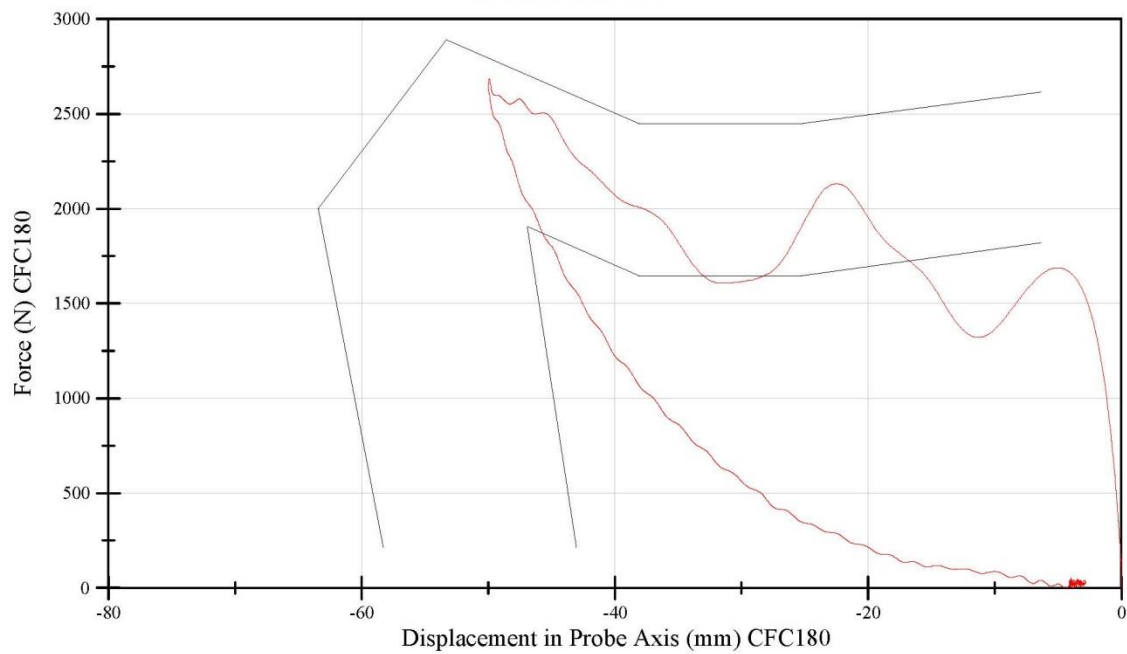
Software Version: 2.4

File Name: T015OBRI150710-01_pro
07/10/2015 12:55:35.0000



Test Temperature: 70.4 degrees
Relative Humidity: 53%
Test Velocity: 4.26 m/s

THOR Upper Thorax Certification
Thorax Response With Kroell Corridor
Serial Number: T015

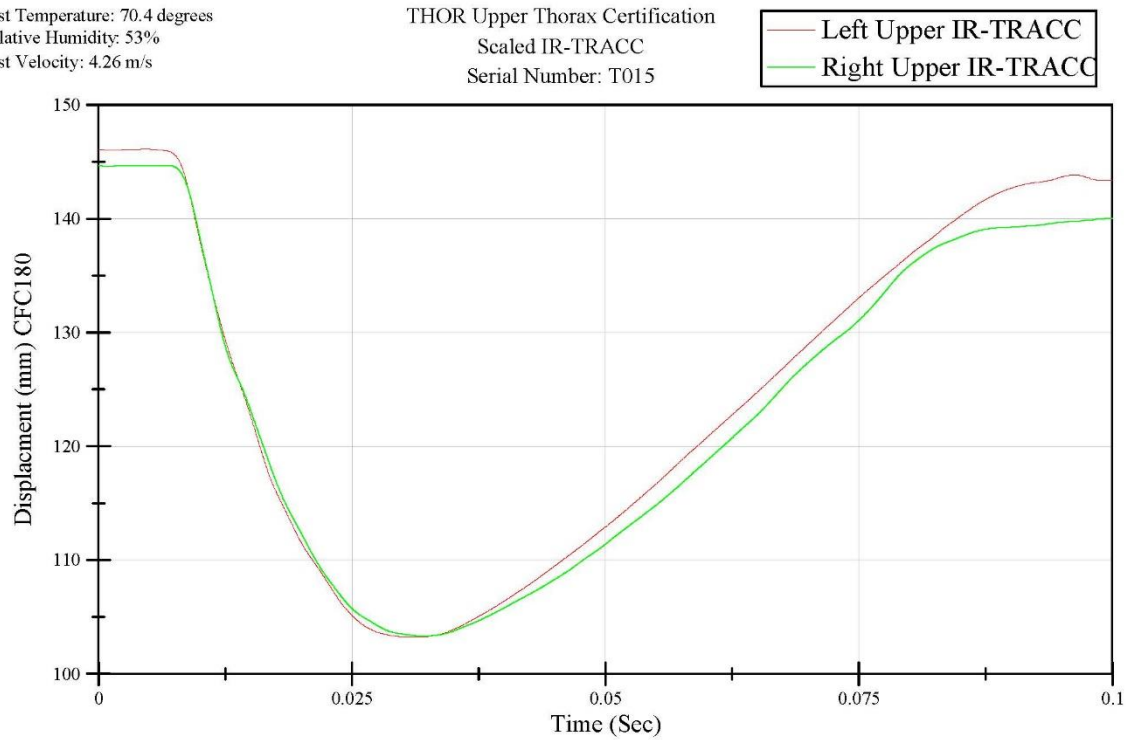


Software Version: 2.4

File Name: T015THUP150710-02_pro.tdms
07/10/2015 09:24:33.0000

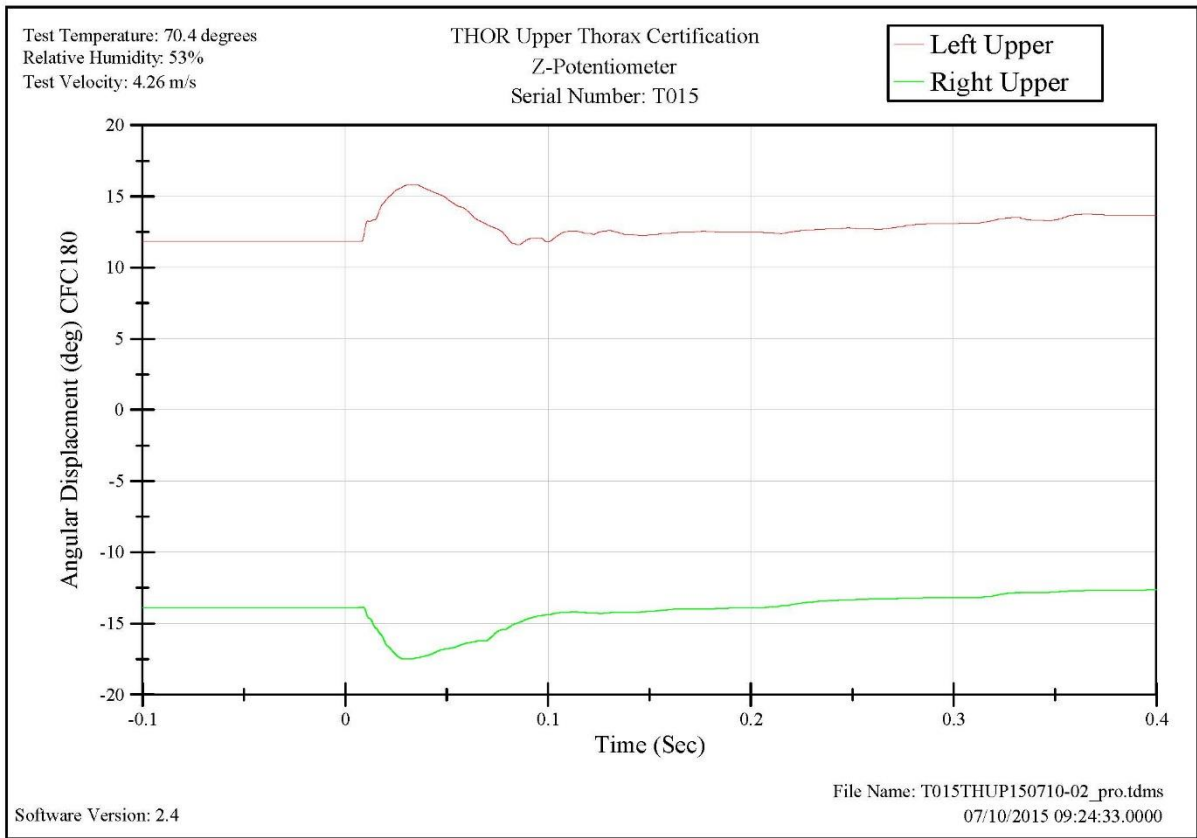
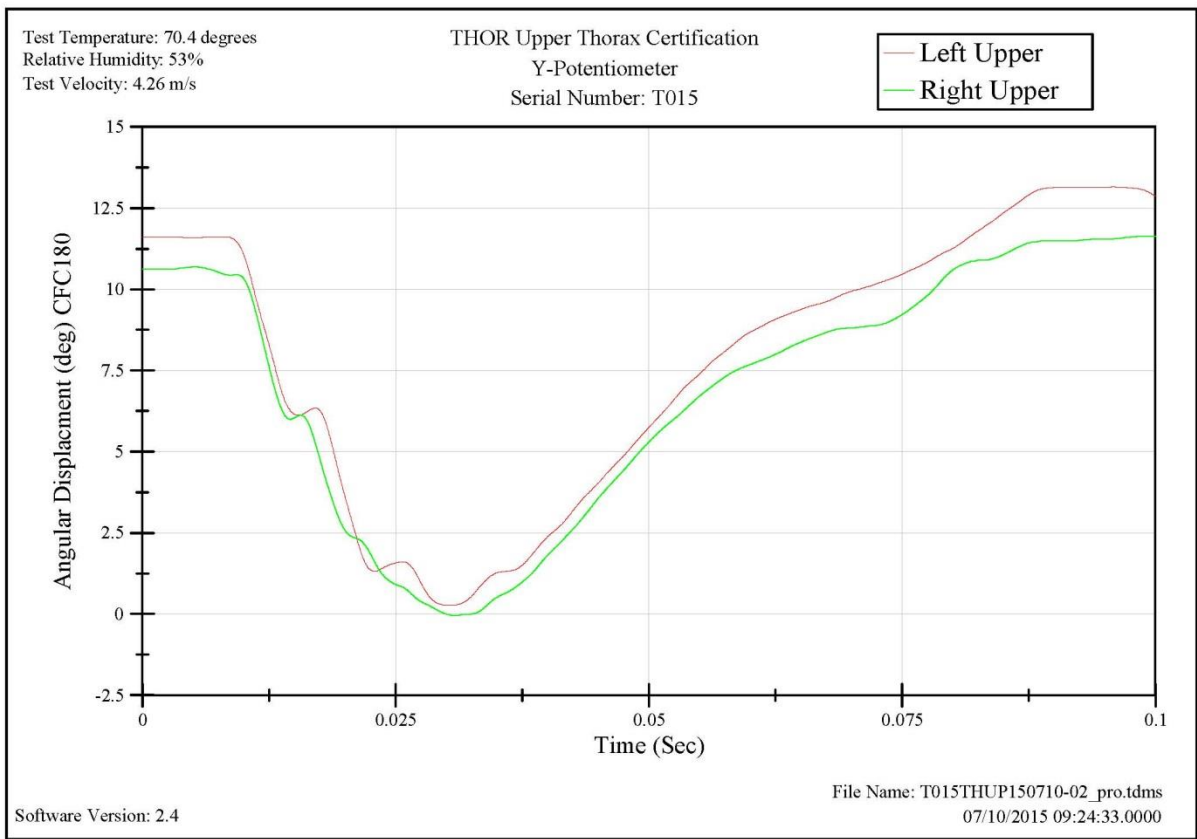
Test Temperature: 70.4 degrees
Relative Humidity: 53%
Test Velocity: 4.26 m/s

THOR Upper Thorax Certification
Scaled IR-TRACC
Serial Number: T015



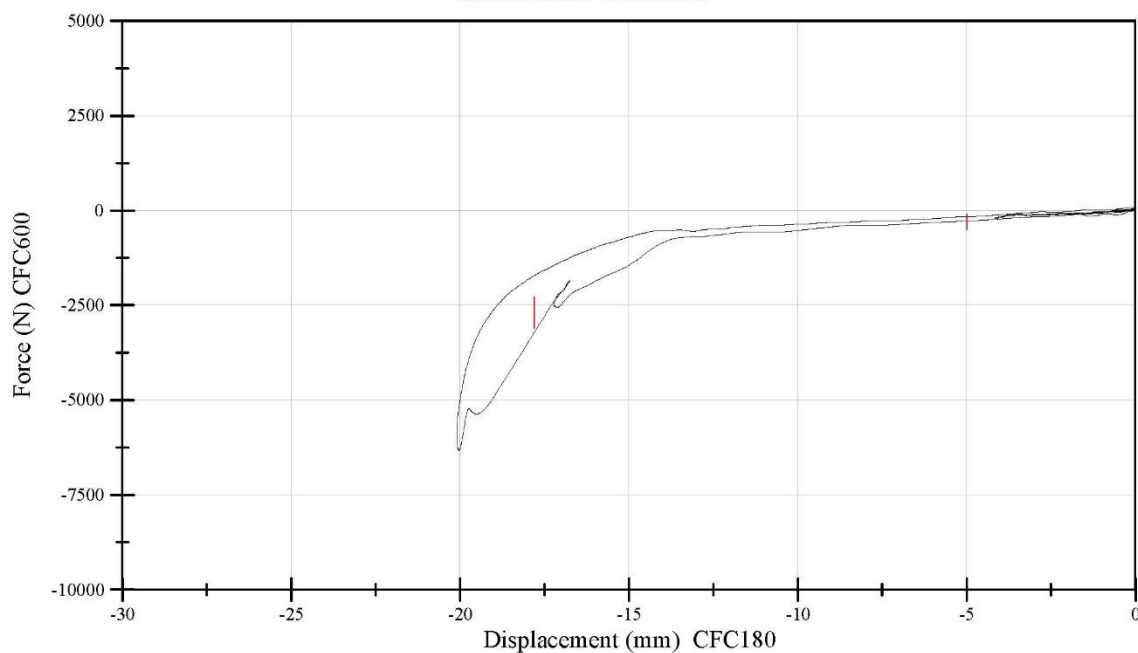
Software Version: 2.4

File Name: T015THUP150710-02_pro.tdms
07/10/2015 09:24:33.0000



Test Temperature: 71.4 degrees
Relative Humidity: 48%
Test Velocity: 2.77 m/s

THOR Right Knee Certification
Femur Force vs. Knee Displacement
Serial Number: D2103657B

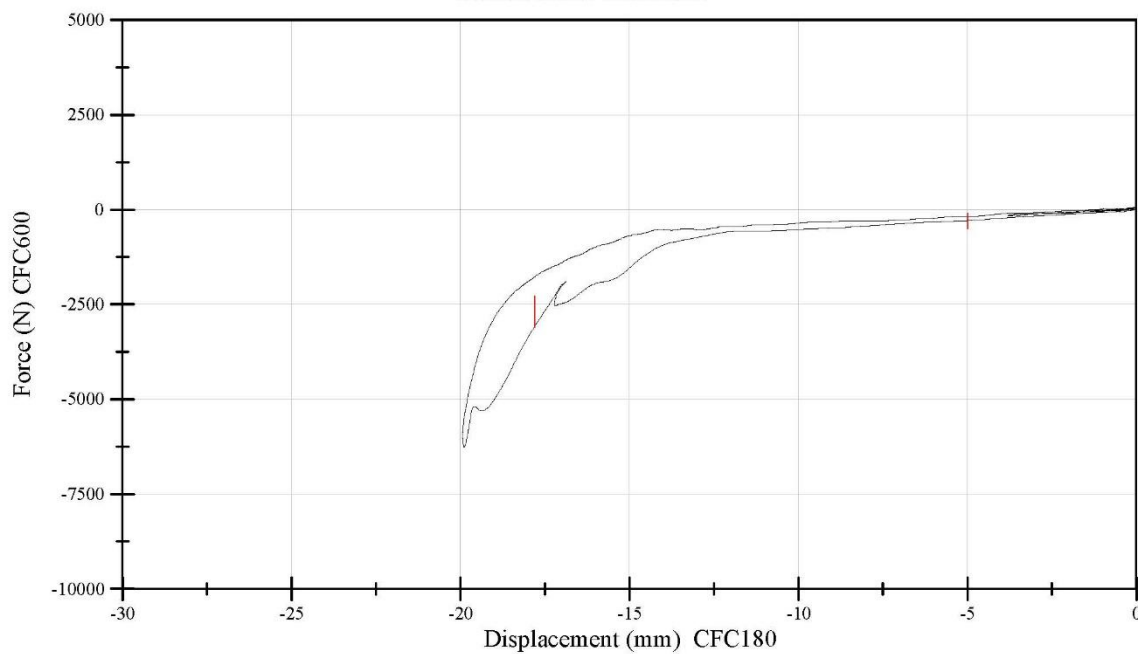


Software Version: 2.4

File Name: D2103657BKnee150407-01
01/01/0000 00:00:00.0000

Test Temperature: 70.2 degrees
Relative Humidity: 49%
Test Velocity: 2.77 m/s

THOR Left Knee Certification
Femur Force vs. Knee Displacement
Serial Number: D2103665B



Software Version: 2.4

File Name: D2103665BKnee150407-01processed
04/07/2015 13:14:07.0000



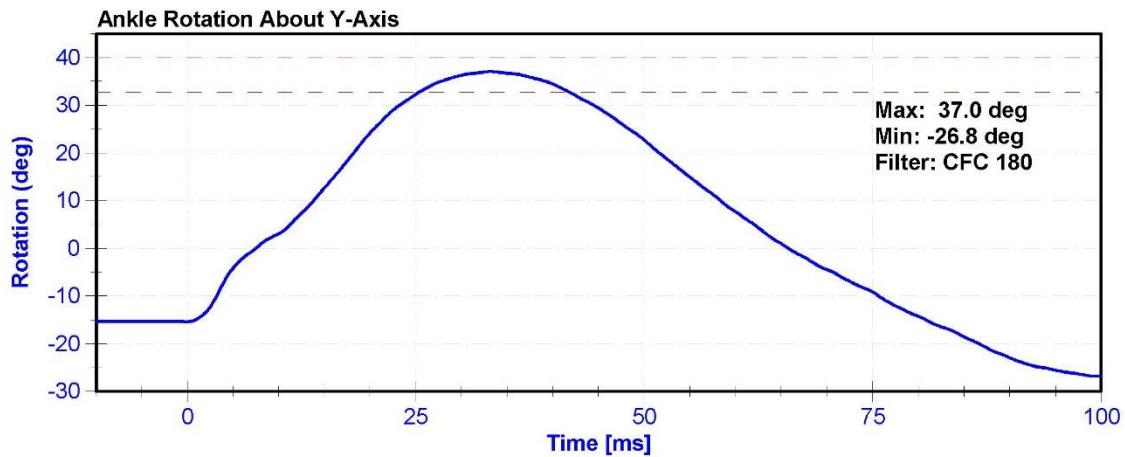
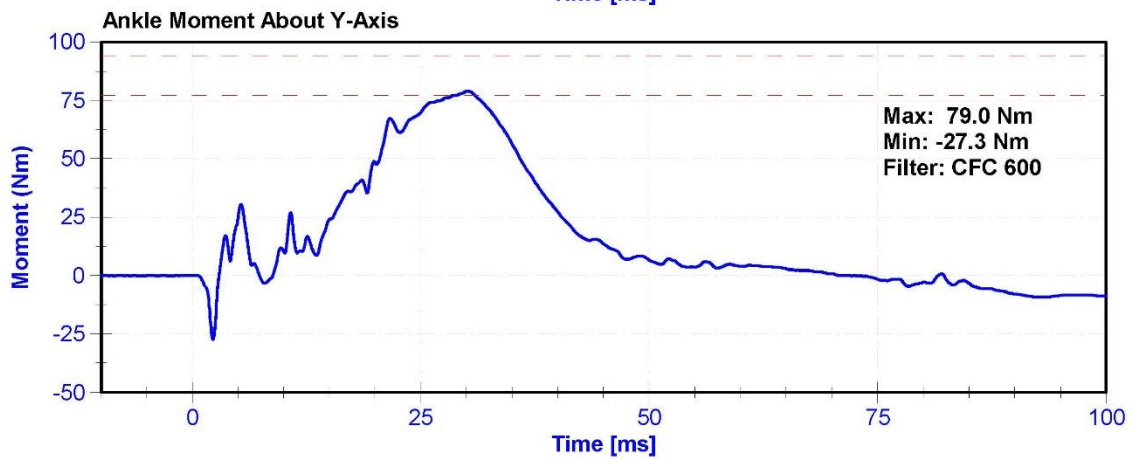
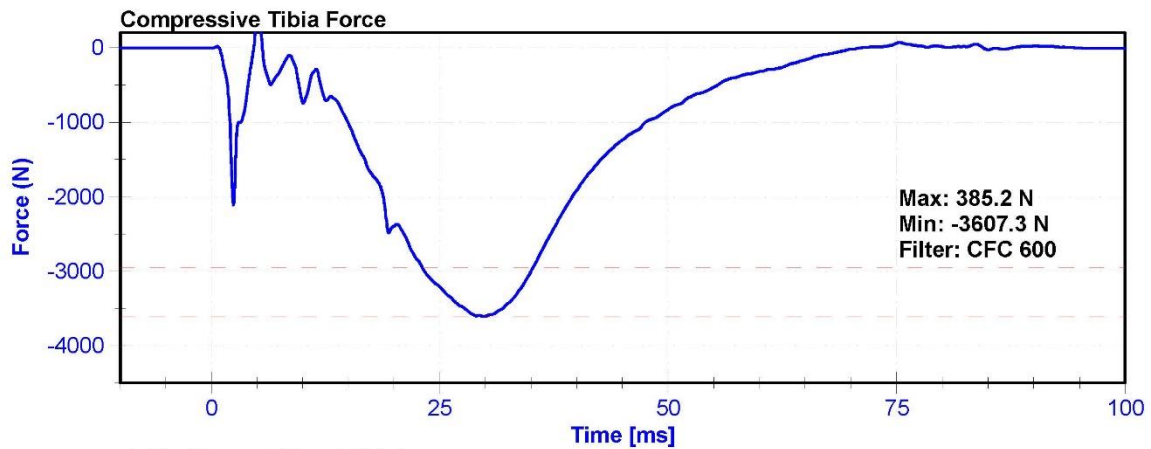
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	43.8	Pass
Velocity	4.9	5.1	m/s	4.948	Pass
Lower Tibia Compressive Force	-3,613	-2,956	N	-3607.3	Pass
Peak Moment about Y-Axis	77.1	94.2	Nm	79.03	Pass
Peak Rotation about Y-Axis	32.7	39.9	deg	37.03	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-77 Fz	2/20/2015	2/20/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0383	2/27/2015	2/27/2016





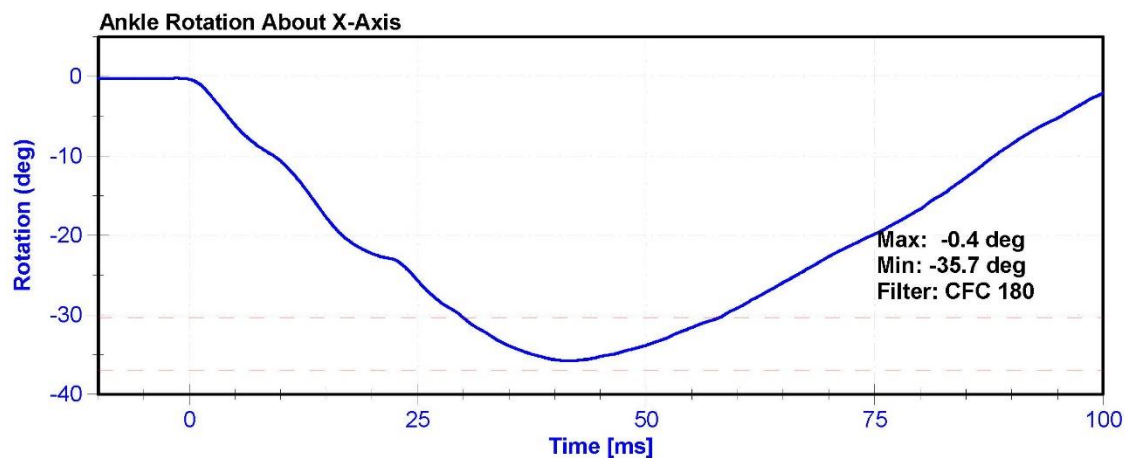
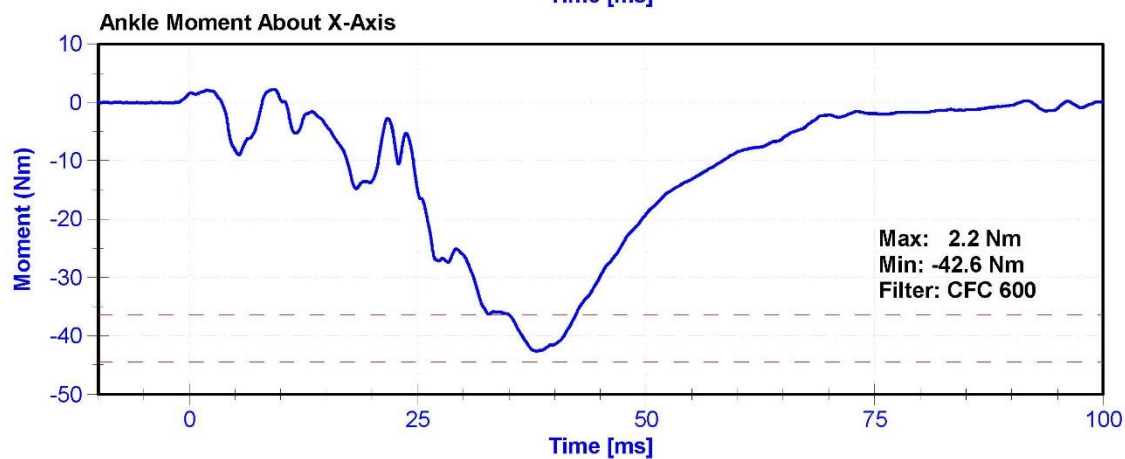
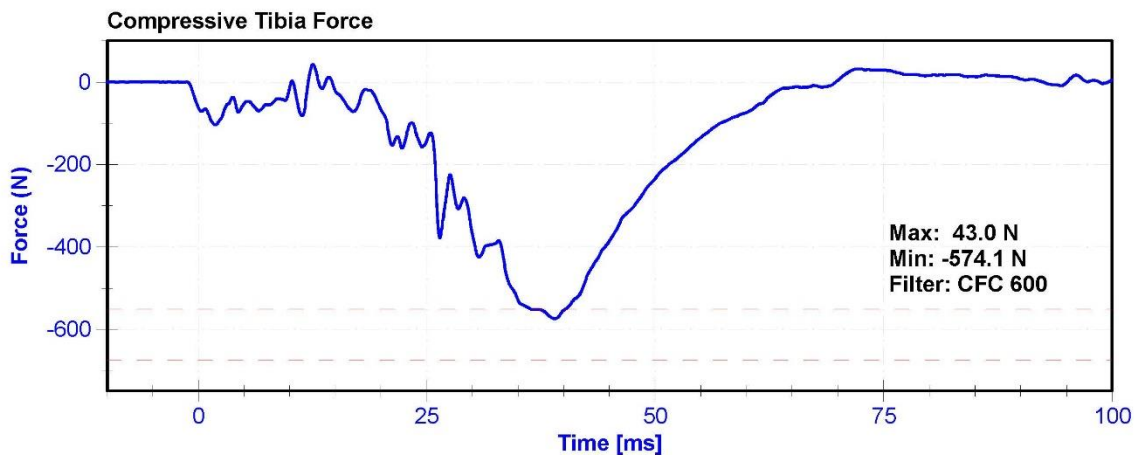
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	45.9	Pass
Velocity	1.9	2.1	m/s	1.934	Pass
Lower Tibia Compressive Force	-675	-552	N	-574.1	Pass
Peak Moment about X-Axis	-44.4	-36.3	Nm	-42.59	Pass
Peak Rotation about X-Axis	-37.0	-30.3	deg	-35.70	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-77 Fz	2/20/2015	2/20/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0385	2/27/2015	2/27/2016





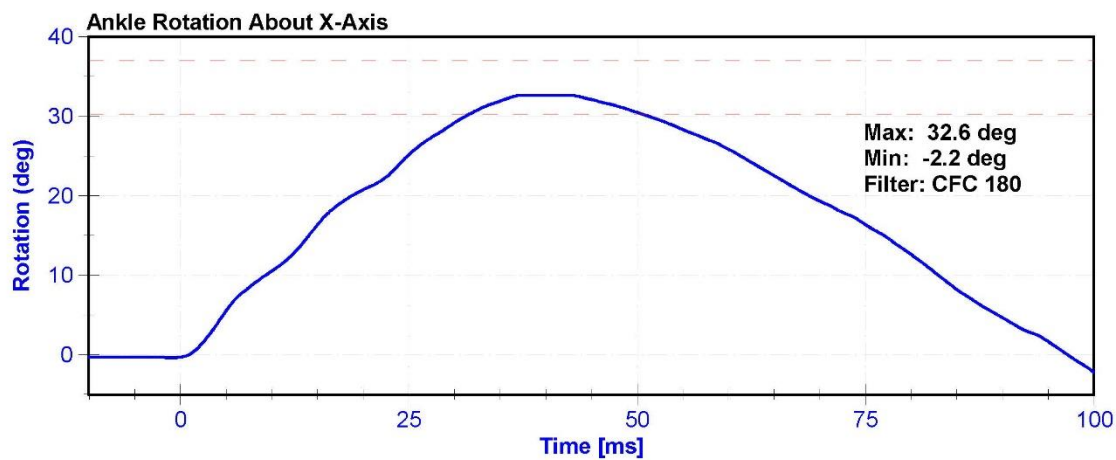
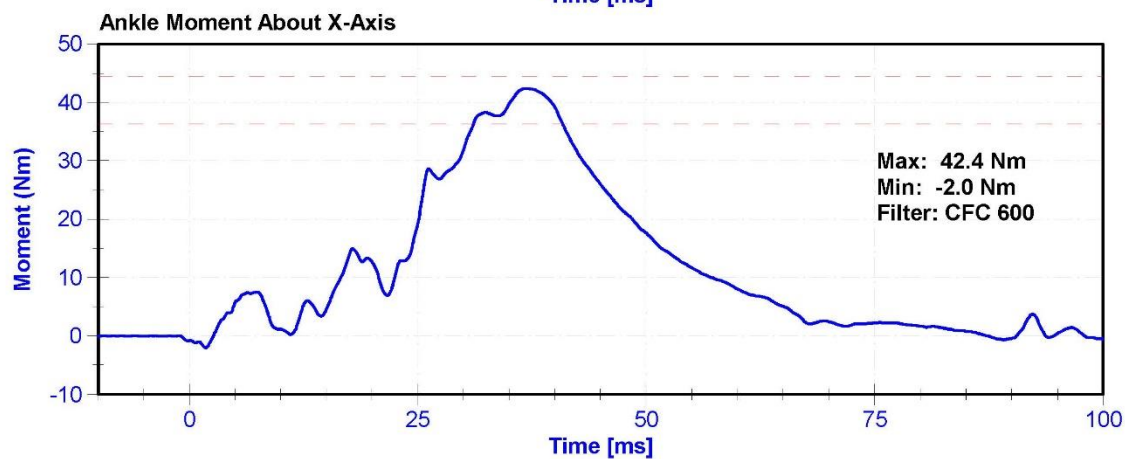
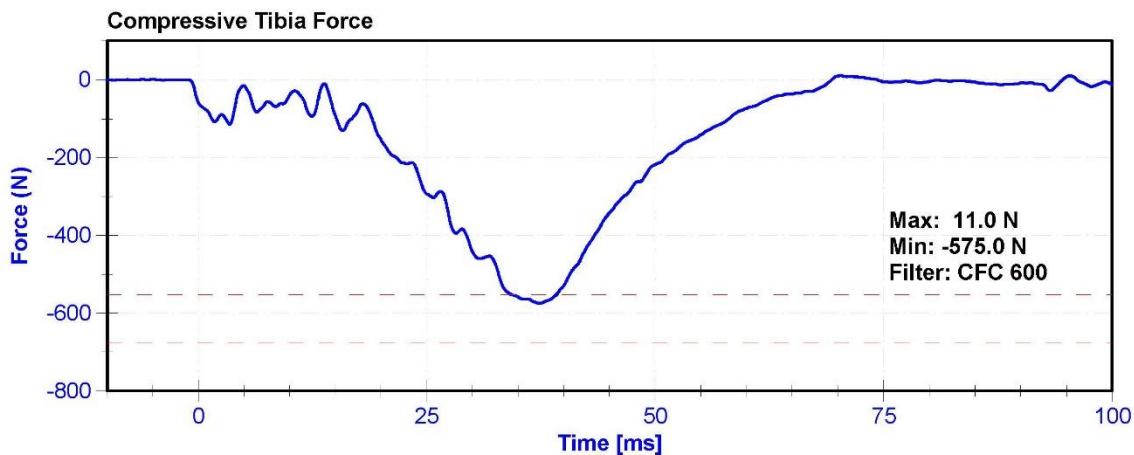
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	45.4	Pass
Velocity	1.9	2.1	m/s	1.924	Pass
Lower Tibia Compressive Force	-675	-552	N	-575.0	Pass
Peak Moment about X-Axis	36.3	44.4	Nm	42.38	Pass
Peak Rotation about X-Axis	30.3	37.0	deg	32.65	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-77 Fz	2/20/2015	2/20/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0385	2/27/2015	2/27/2016



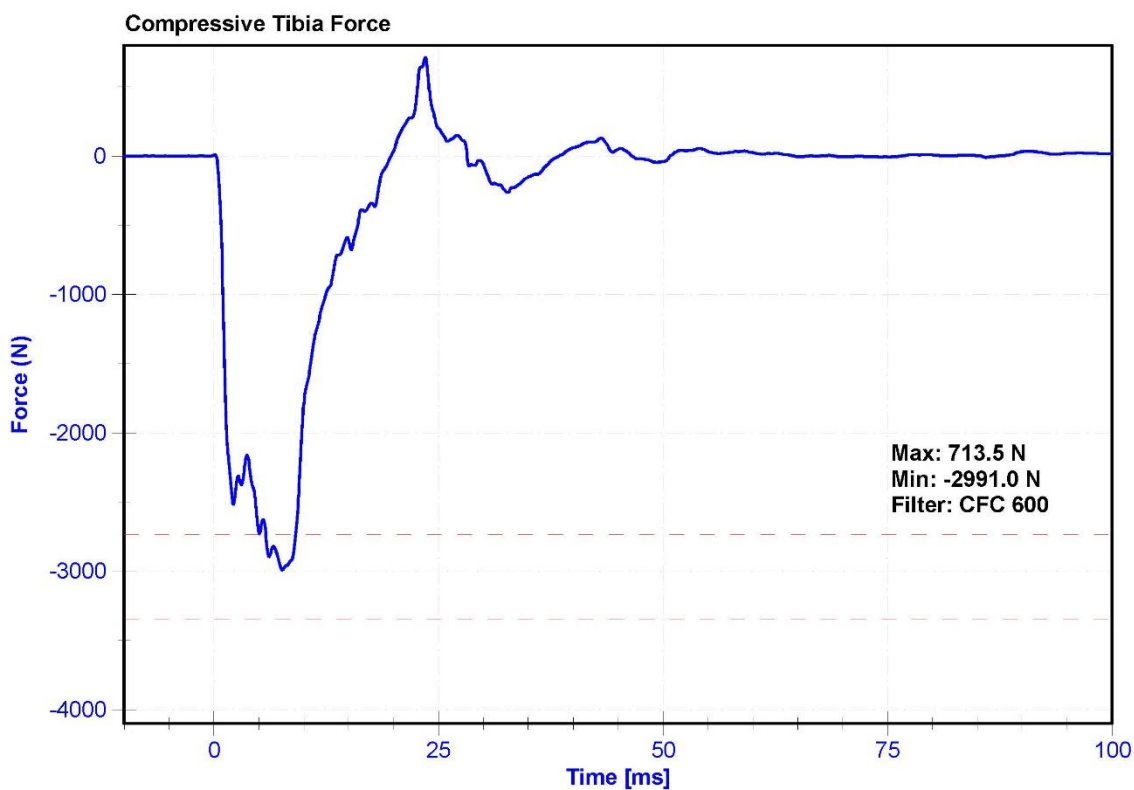
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	20.6	Pass
Humidity	10	70	%	59.2	Pass
Velocity	3.9	4.1	m/s	4.032	Pass
Lower Tibia Compressive Force	-3,346	-2,738	N	-2991.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-77 Fz	2/20/2015	2/20/2016



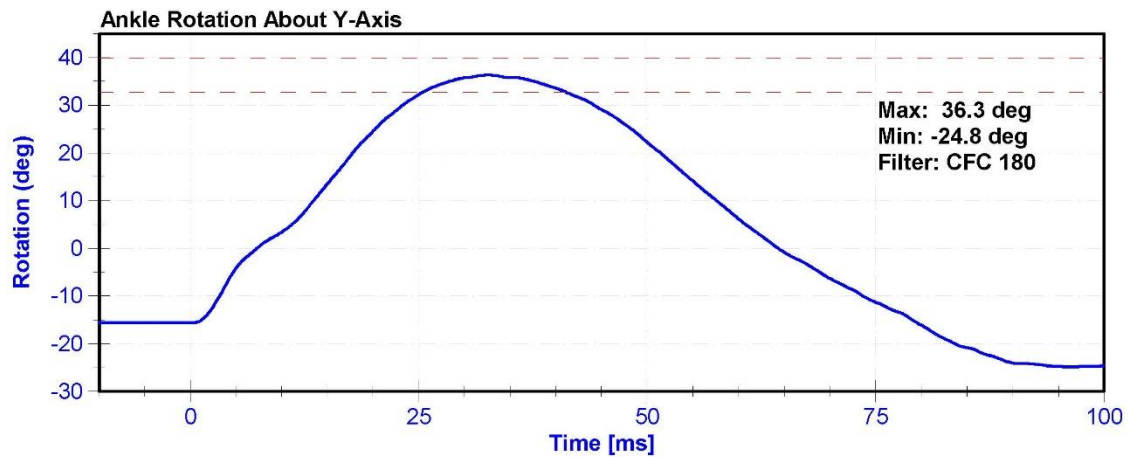
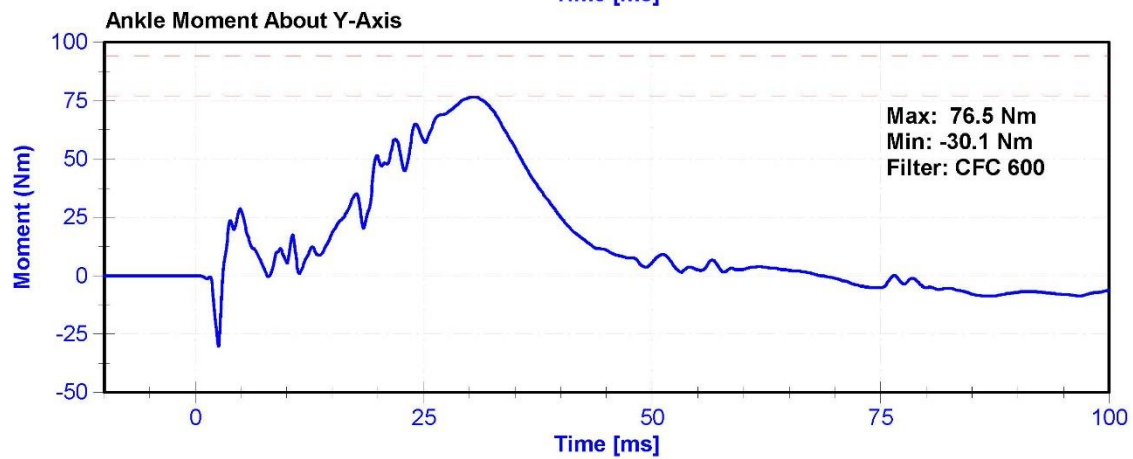
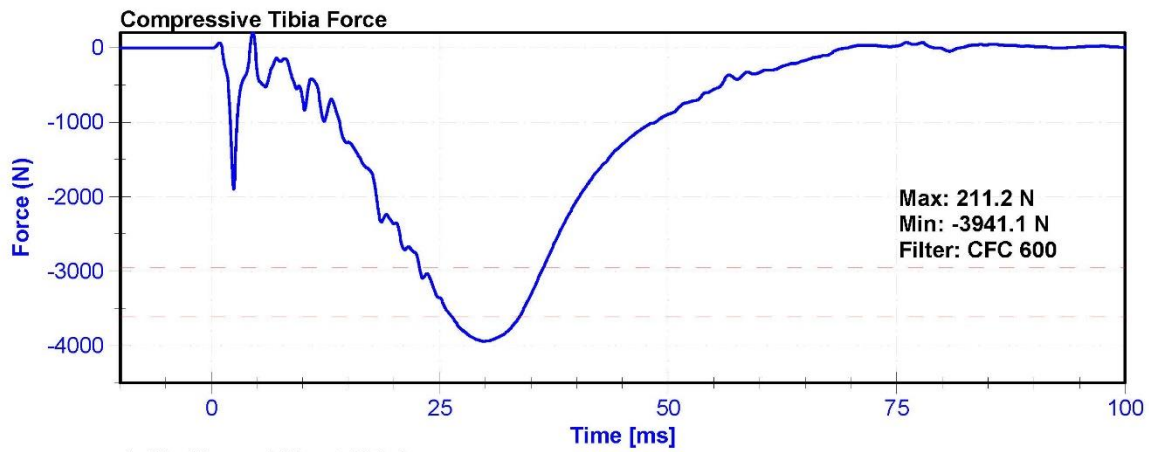
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	45.8	Pass
Velocity	4.9	5.1	m/s	4.980	Pass
Lower Tibia Compressive Force	-3,613	-2,956	N	-3941.1	Fail
Peak Moment about Y-Axis	77.1	94.2	Nm	76.52	Fail
Peak Rotation about Y-Axis	32.7	39.9	deg	36.32	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-78 Fz	2/20/2015	2/20/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0386	3/2/2015	3/1/2016



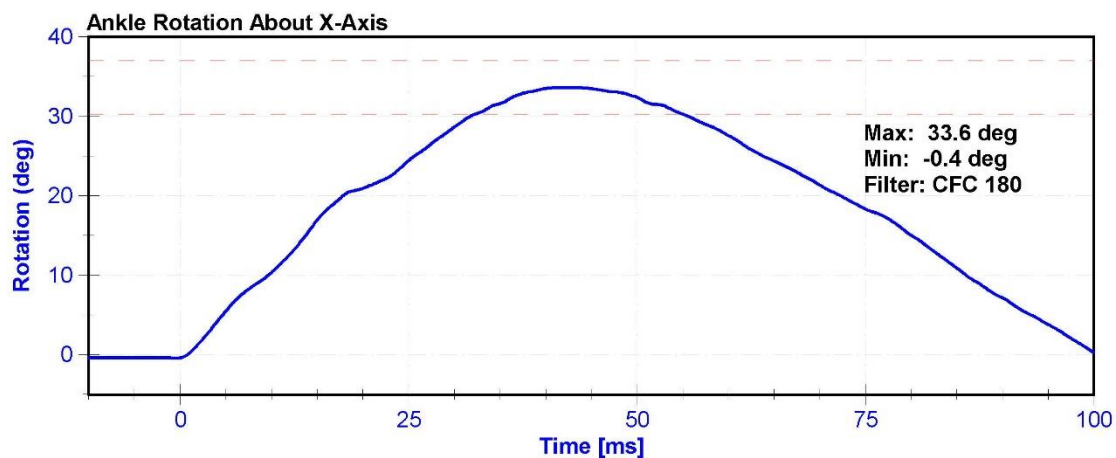
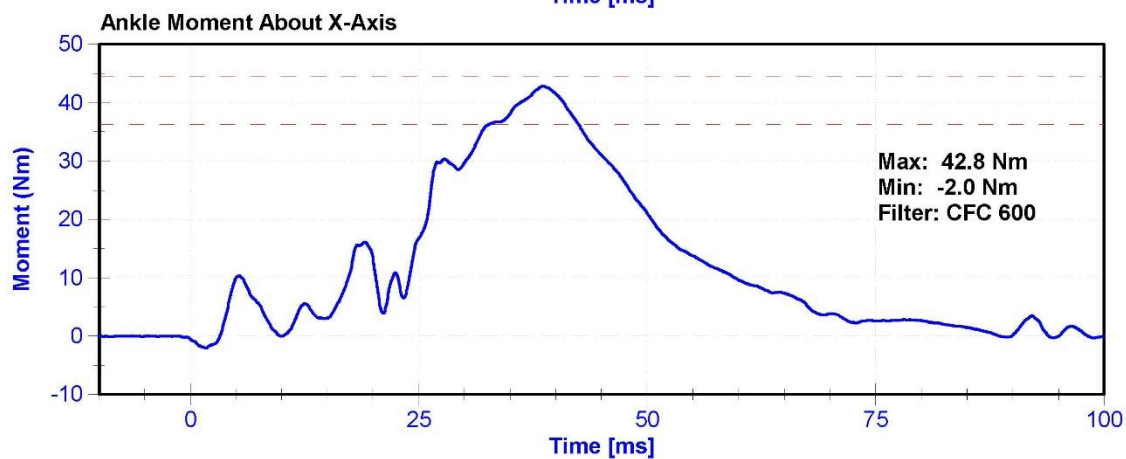
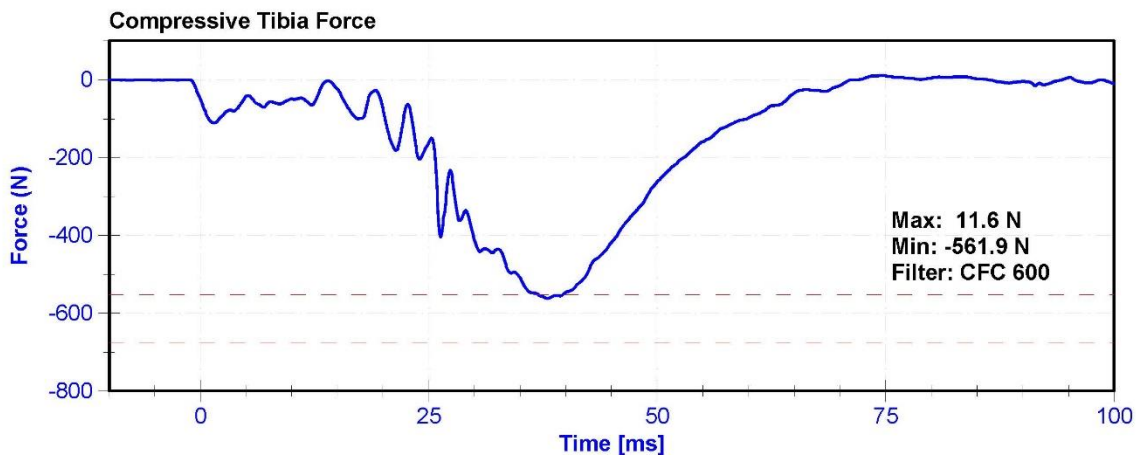
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	47.5	Pass
Velocity	1.9	2.1	m/s	1.929	Pass
Lower Tibia Compressive Force	-675	-552	N	-561.9	Pass
Peak Moment about X-Axis	36.3	44.4	Nm	42.77	Pass
Peak Rotation about X-Axis	30.3	37.0	deg	33.57	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-78 Fz	2/20/2015	2/20/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0382	3/2/2015	3/1/2016



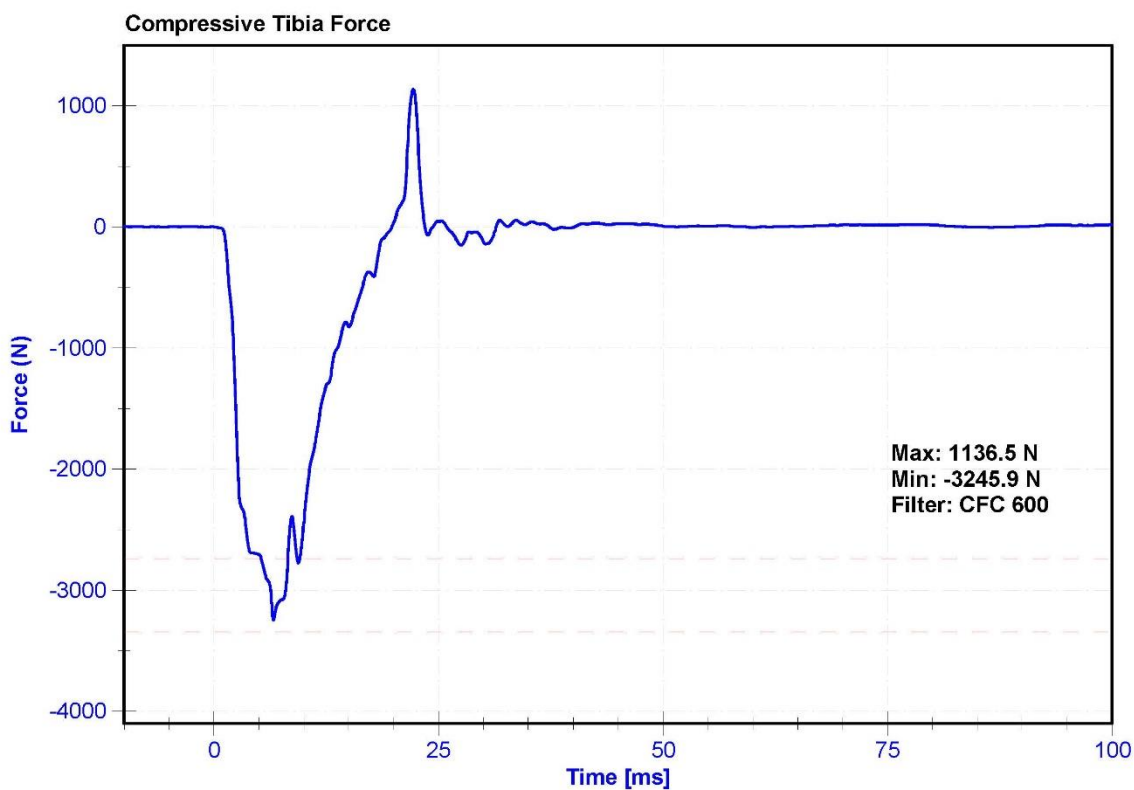
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	44.6	Pass
Velocity	3.9	4.1	m/s	4.032	Pass
Lower Tibia Compressive Force	-3,346	-2,738	N	-3245.9	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-78 Fz	2/20/2015	2/20/2016



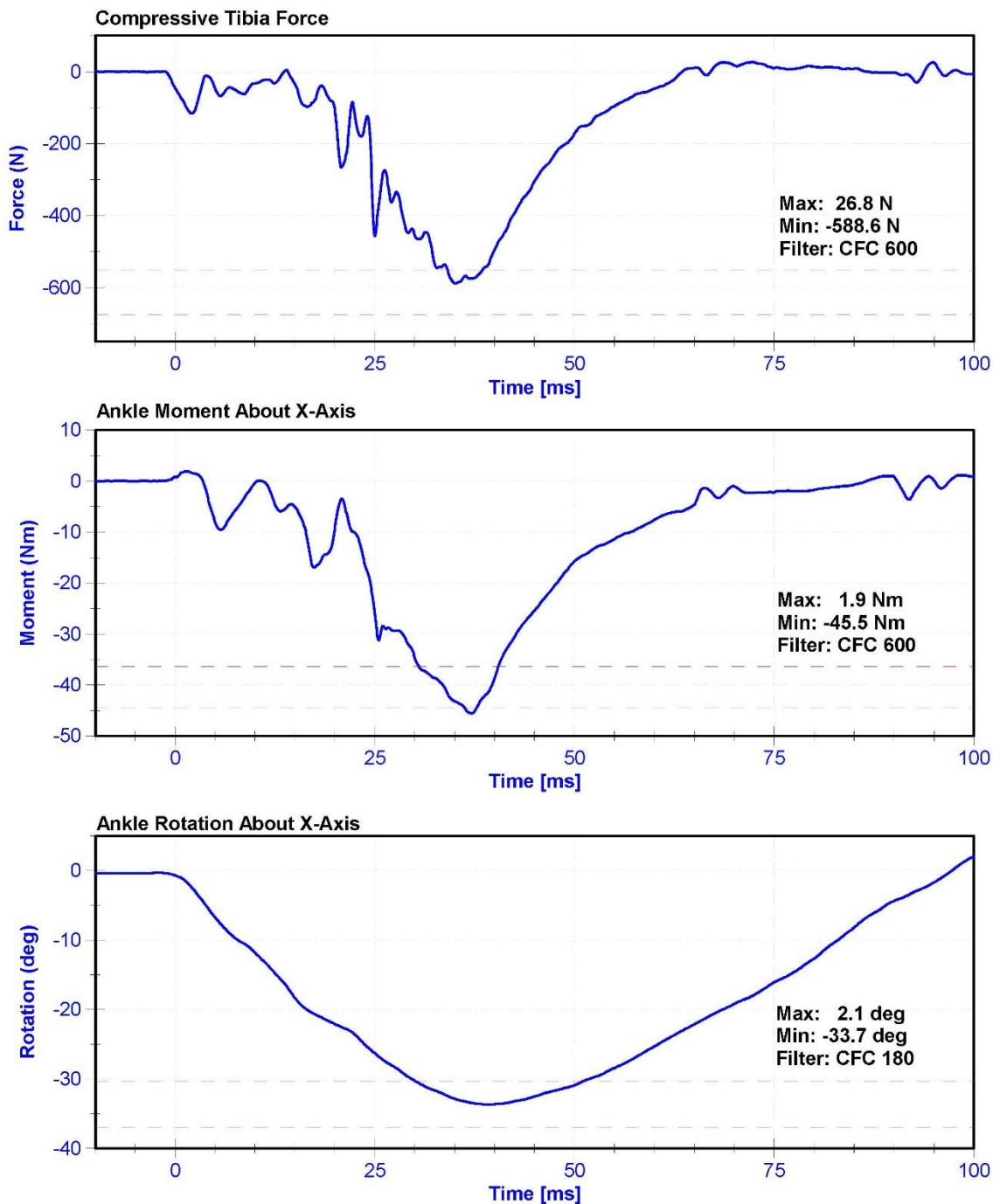
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0015	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	47.5	Pass
Velocity	1.9	2.1	m/s	1.949	Pass
Lower Tibia Compressive Force	-675	-552	N	-588.6	Pass
Peak Moment about X-Axis	-44.4	-36.3	Nm	-45.51	Fail
Peak Rotation about X-Axis	-37.0	-30.3	deg	-33.68	Pass

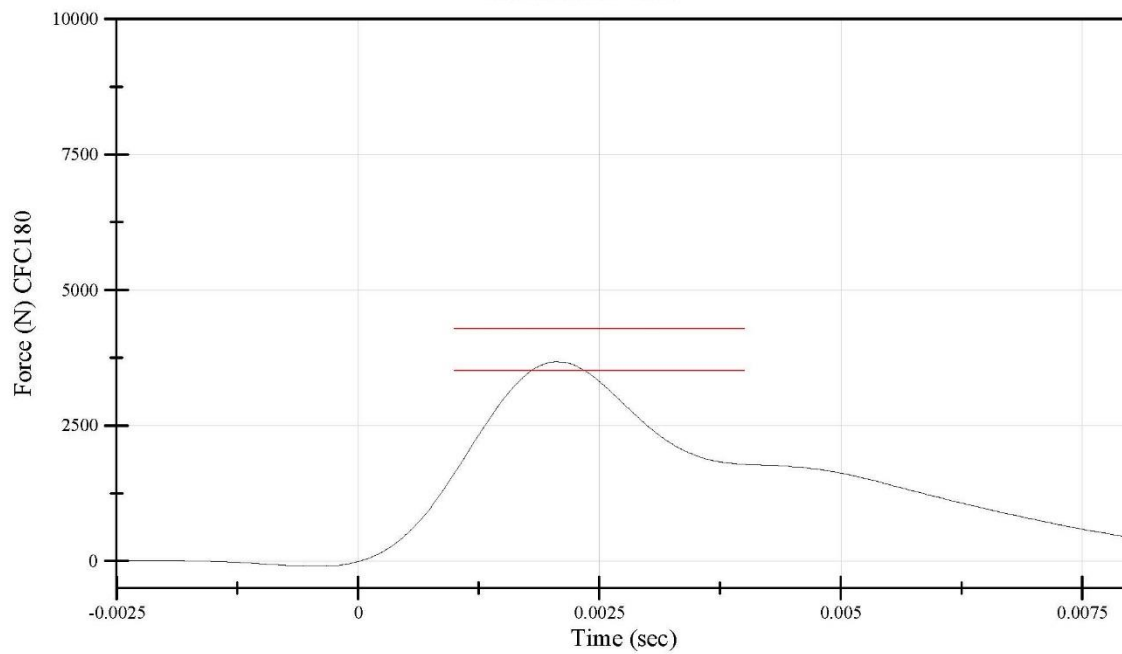
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-78 Fz	2/20/2015	2/20/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0382	3/2/2015	3/1/2016



Test Temperature: 70 degrees
Relative Humidity: 52%
Test Velocity: 2.64 m/s

THOR Left Femur Certification
Probe Force
Serial Number: T015

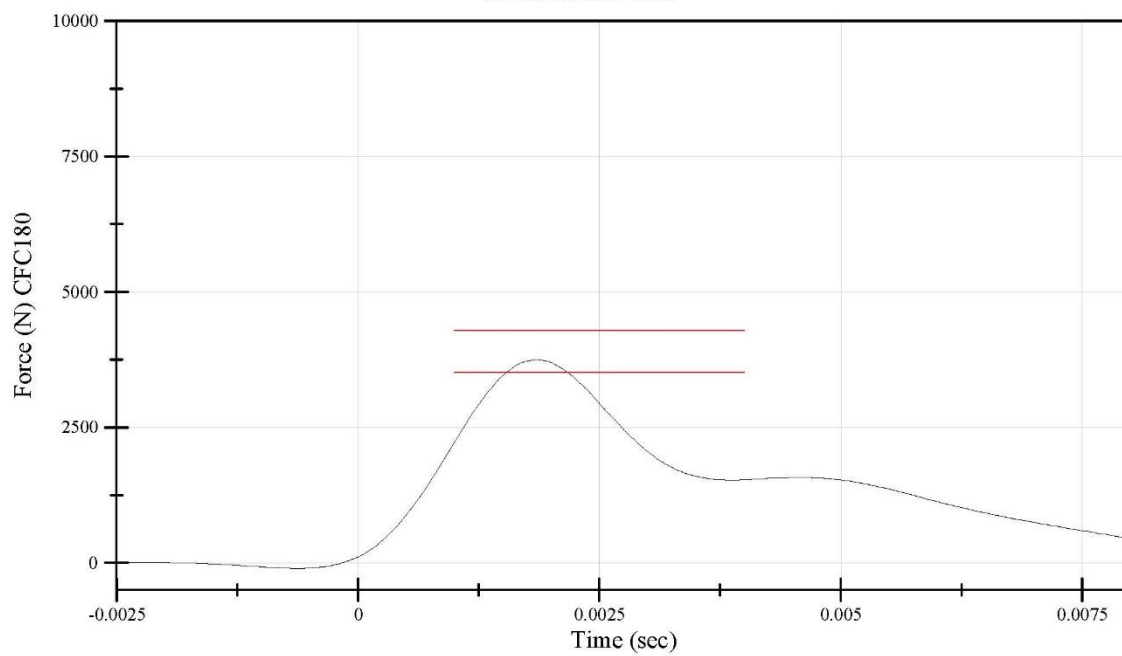


Software Version: 2.4

File Name: T015FELE150713-06_pro
07/13/2015 15:52:51.0000

Test Temperature: 69.9 degrees
Relative Humidity: 52%
Test Velocity: 2.64 m/s

THOR Right Femur Certification
Probe Force
Serial Number: T015

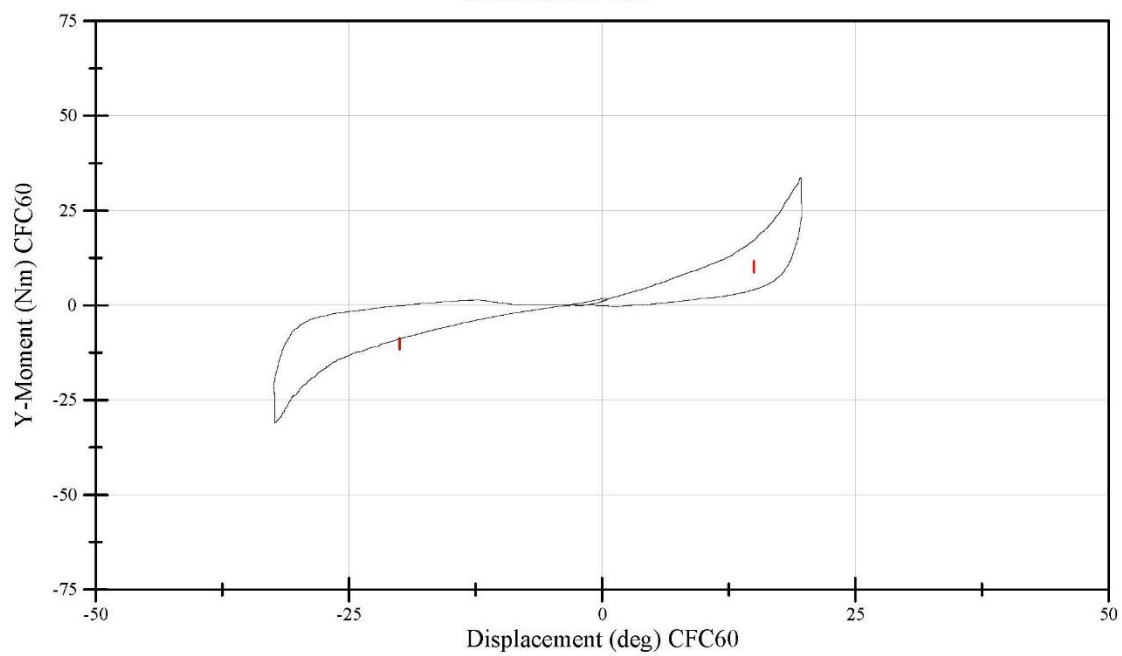


Software Version: 2.4

File Name: T015FERI150713-01_pro
07/13/2015 12:54:56.0000

Test Temperature: 69.6 degrees
Relative Humidity: 52%
Test Velocity: 0 m/s

THOR Occipital Condyle Quasi-Static Certification
Displacement vs. Torque
Serial Number: T015



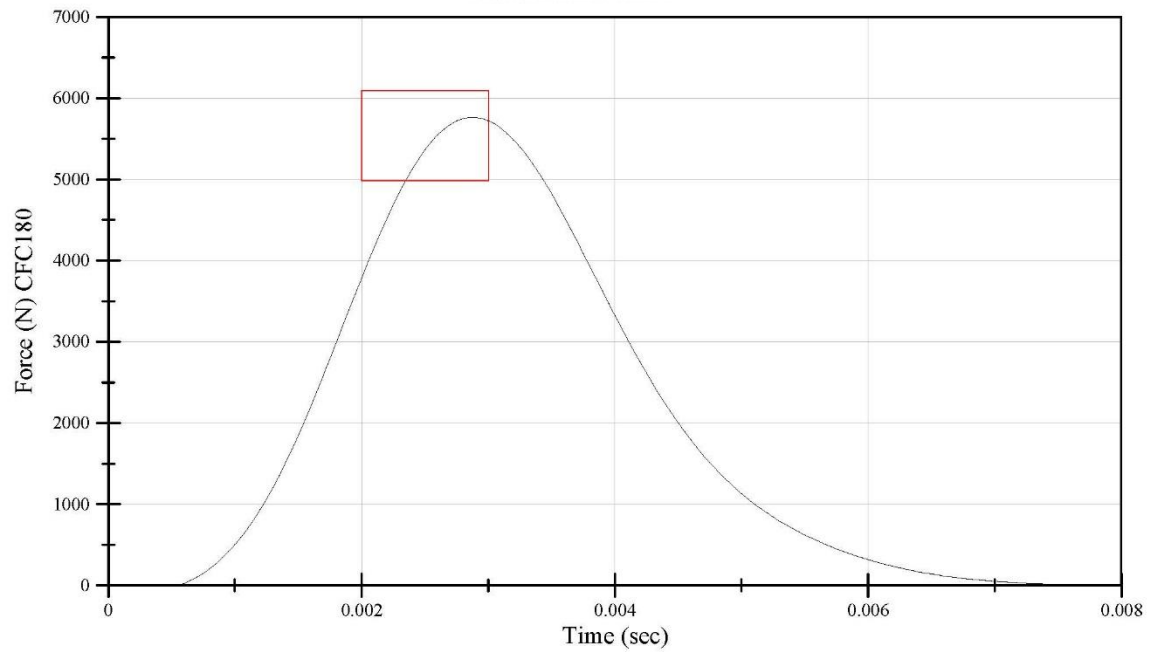
Software Version: 2.4

File Name: T015OCPot150701-03_pro
07/01/2015 13:24:58.0000

50% ADULT MALE THOR016 DUMMY CALIBRATIONS

Test Temperature: 69.8 degrees
Relative Humidity: 53%
Test Velocity: 1.98 m/s

THOR Head Impact Certification
Probe Force
Serial Number: T0016

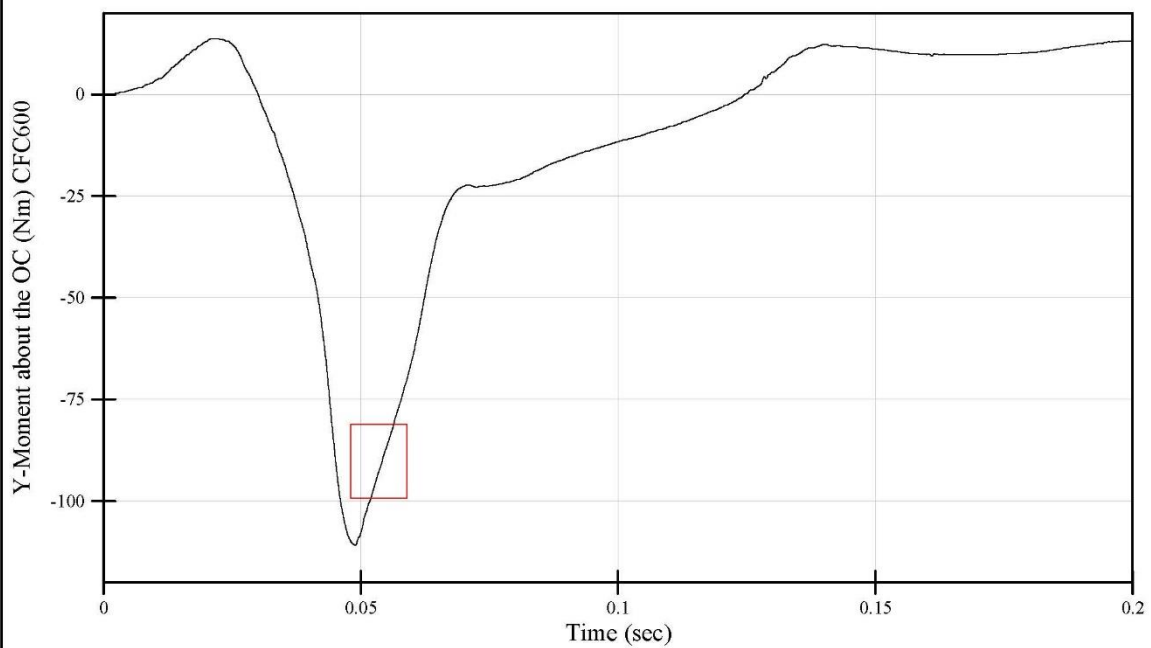


Software Version: 2.4

File Name: T0016HEAD150813-03_pro tdms
08/13/2015 12:52:18.0000

Test Temperature: 70.4 degrees
Relative Humidity: 53%
Test Velocity: 3.69 m/s

THOR Neck Extension Certification
Y-Moment
Serial Number: T0016

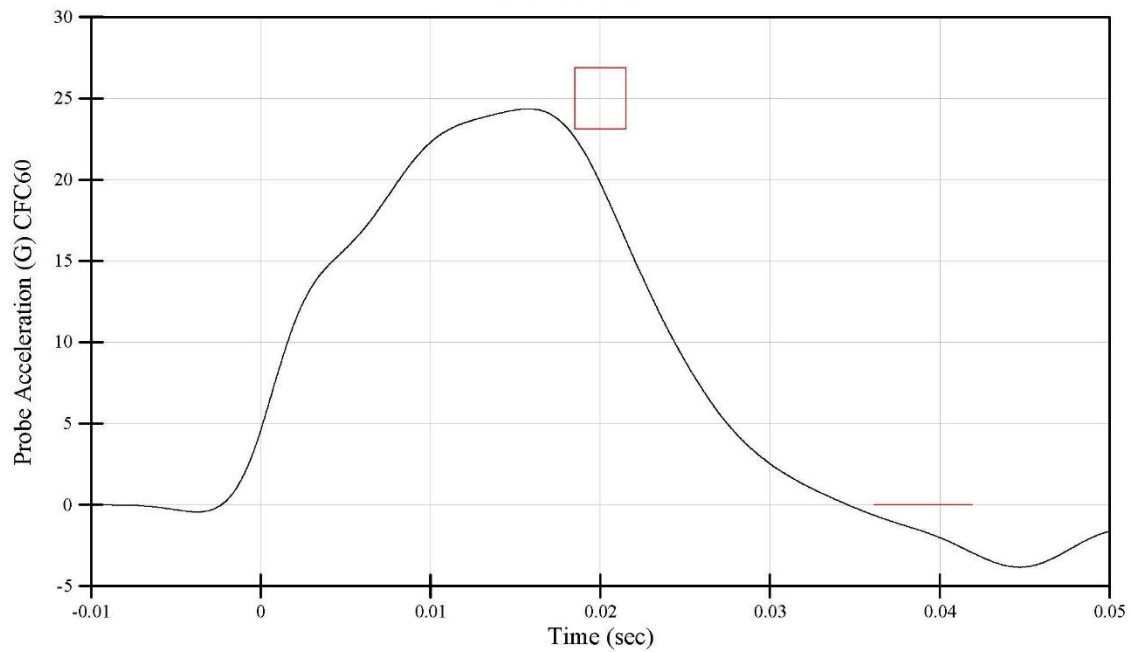


Software Version: 2.4

File Name: T0016NeckExtension150805-01_pro
08/05/2015 10:53:11.0000

Test Temperature: 70.4 degrees
Relative Humidity: 53%
Test Velocity: 3.69 m/s

THOR Neck Extension Certification
Probe Acceleration
Serial Number: T0016

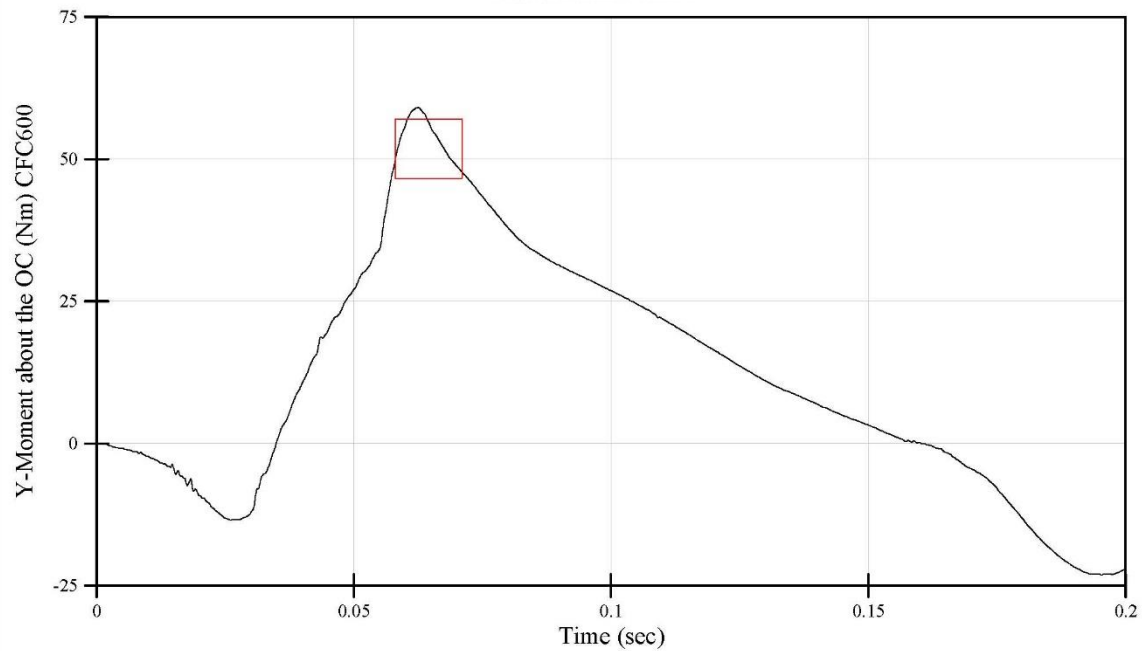


Software Version: 2.4

File Name: T0016NeckExtension150805-01_pro
08/05/2015 10:53:11.0000

Test Temperature: 70.6 degrees
Relative Humidity: 52%
Test Velocity: 3.78 m/s

THOR Neck Flexion Certification
Y-Moment
Serial Number: T0016

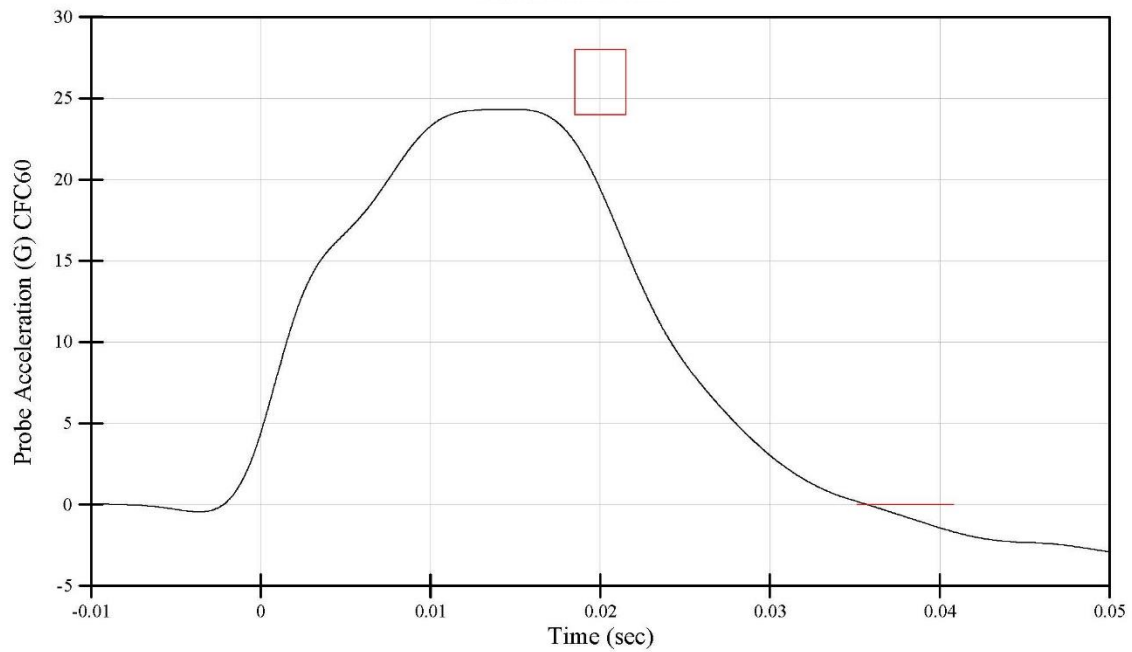


Software Version: 2.4

File Name: T0016NeckFlexion150805-01_pro
08/05/2015 10:24:56.0000

Test Temperature: 70.6 degrees
Relative Humidity: 52%
Test Velocity: 3.78 m/s

THOR Neck Flexion Certification
Probe Acceleration
Serial Number: T0016

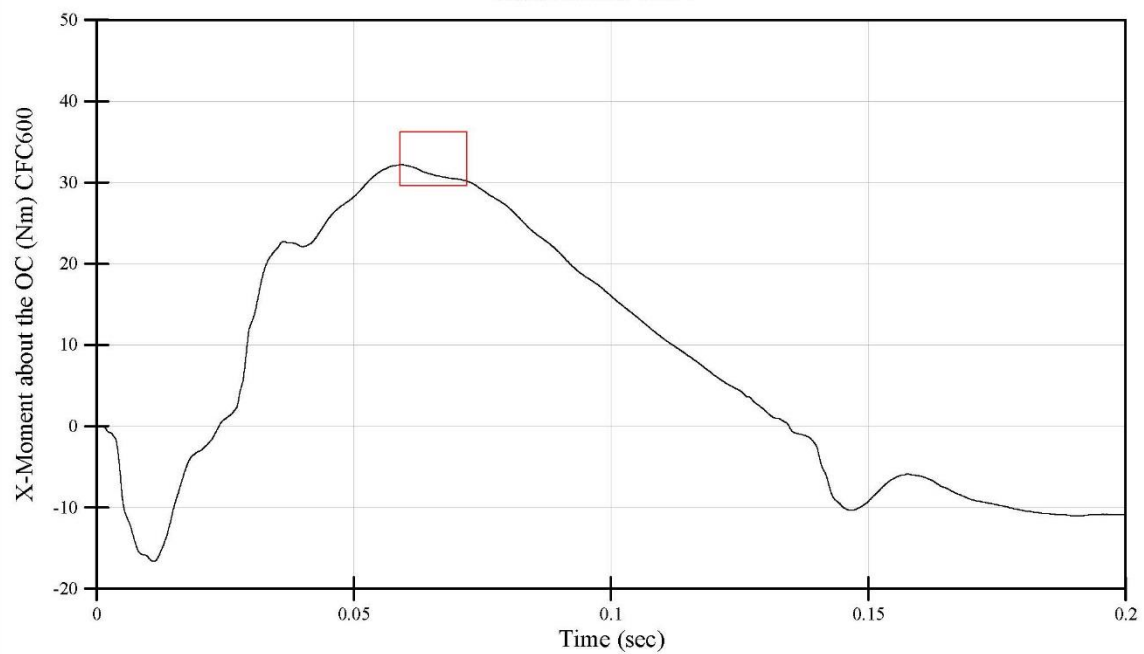


Software Version: 2.4

File Name: T0016NeckFlexion150805-01_pro
08/05/2015 10:24:56.0000

Test Temperature: 70.1 degrees
Relative Humidity: 51%
Test Velocity: 2.86 m/s

THOR Neck Left Lateral Flexion Certification
X-Moment
Serial Number: T0016



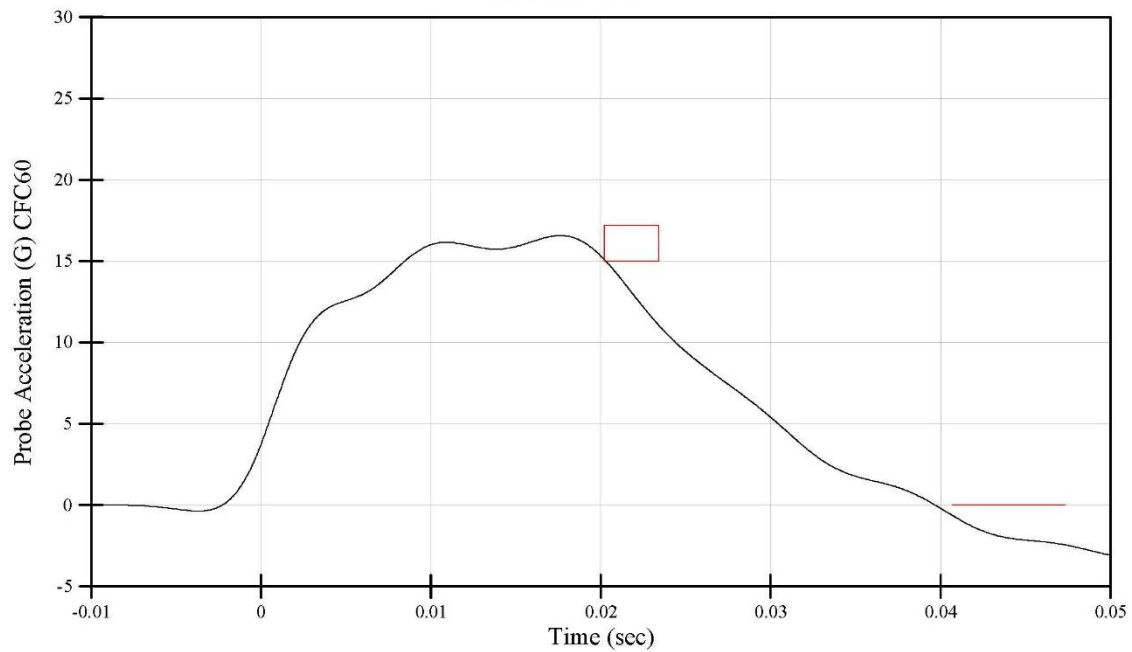
Software Version: 2.4

File Name: T0016NeckLeft150805-01_pro
08/05/2015 11:53:26.0000

Test Temperature: 70.1 degrees
Relative Humidity: 51%
Test Velocity: 2.86 m/s

THOR Neck Left Lateral Flexion Certification

Probe Acceleration
Serial Number: T0016



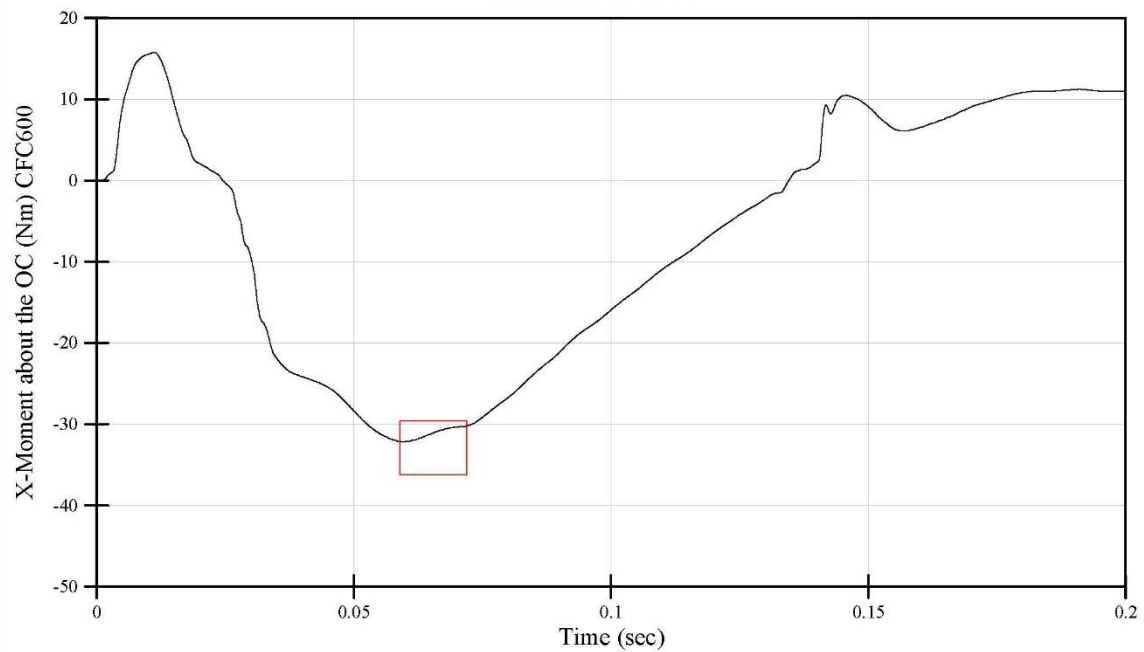
Software Version: 2.4

File Name: T0016NeckLeft150805-01_pro
08/05/2015 11:53:26.0000

Test Temperature: 70.2 degrees
Relative Humidity: 52%
Test Velocity: 2.87 m/s

THOR Neck Right Lateral Flexion Certification

X-Moment
Serial Number: T0016

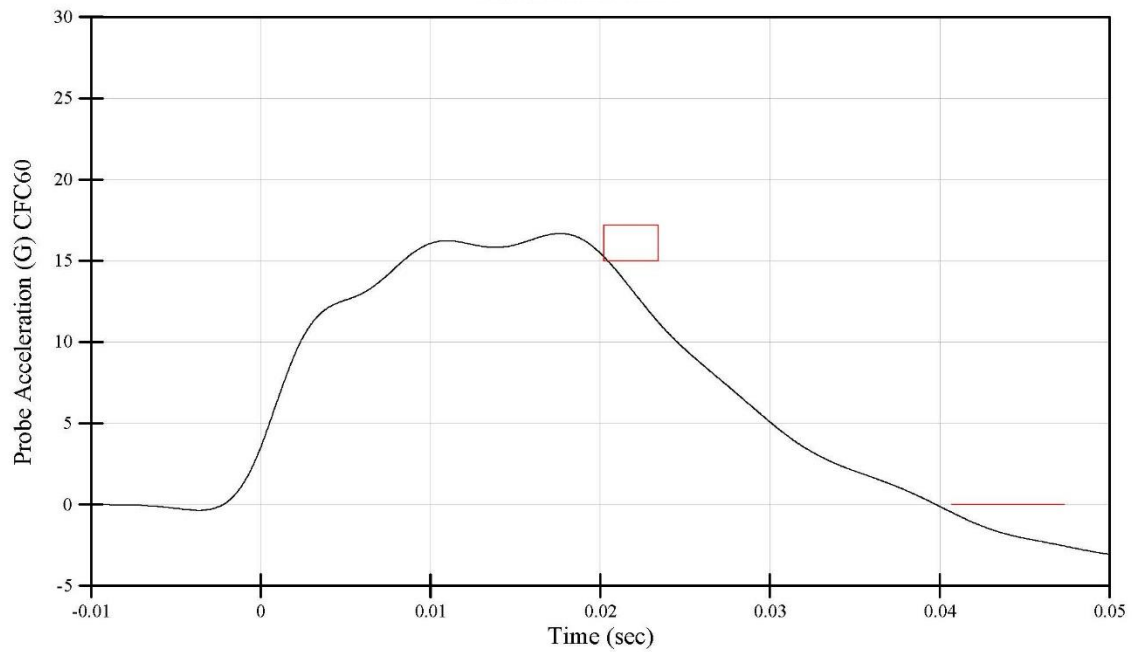


Software Version: 2.4

File Name: T0016NeckRight150805-01_pro
08/05/2015 11:24:43.0000

Test Temperature: 70.2 degrees
Relative Humidity: 52%
Test Velocity: 2.87 m/s

THOR Neck Right Lateral Flexion Certification
Probe Acceleration
Serial Number: T0016

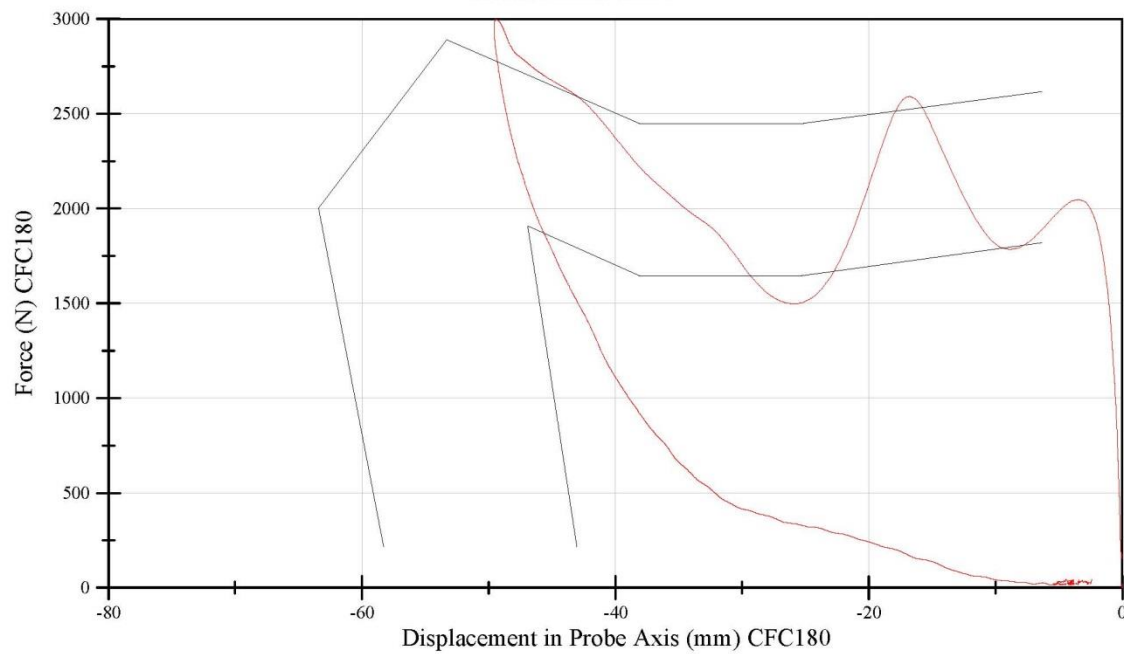


Software Version: 2.4

File Name: T0016NeckRight150805-01_pro
08/05/2015 11:24:43.0000

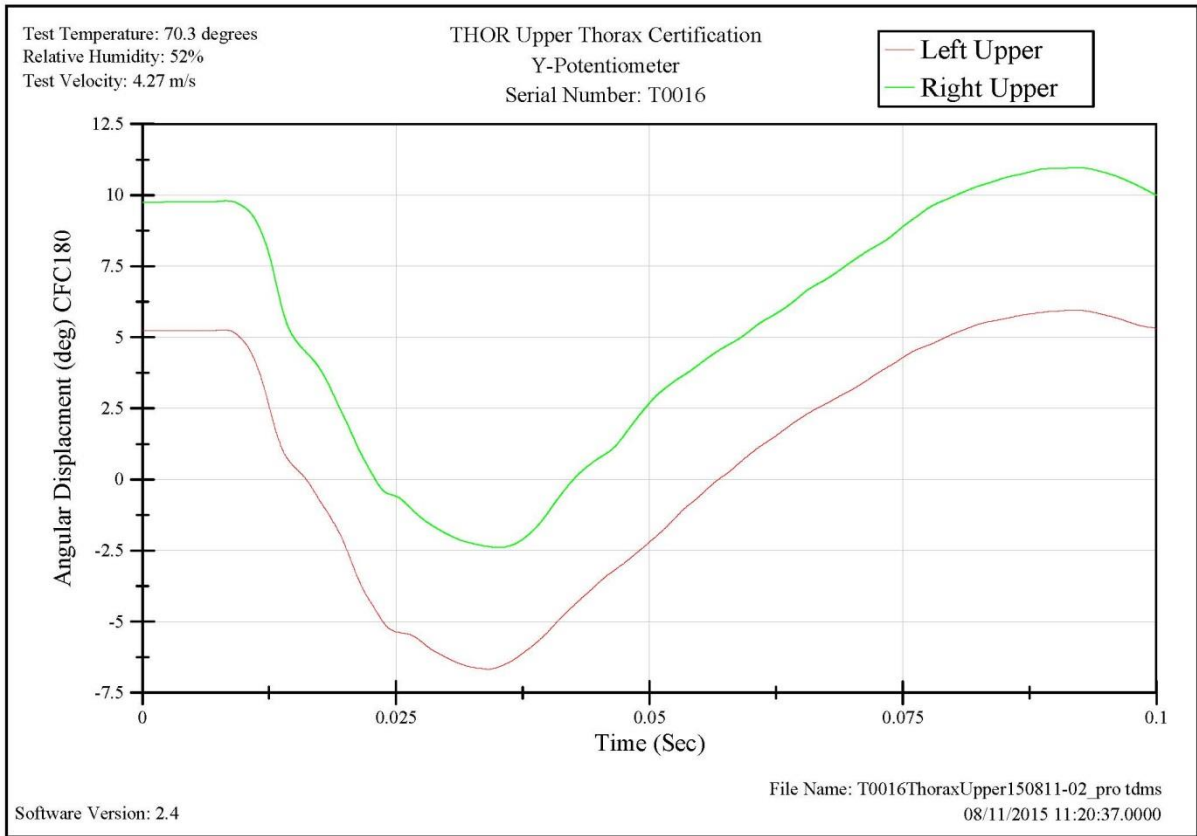
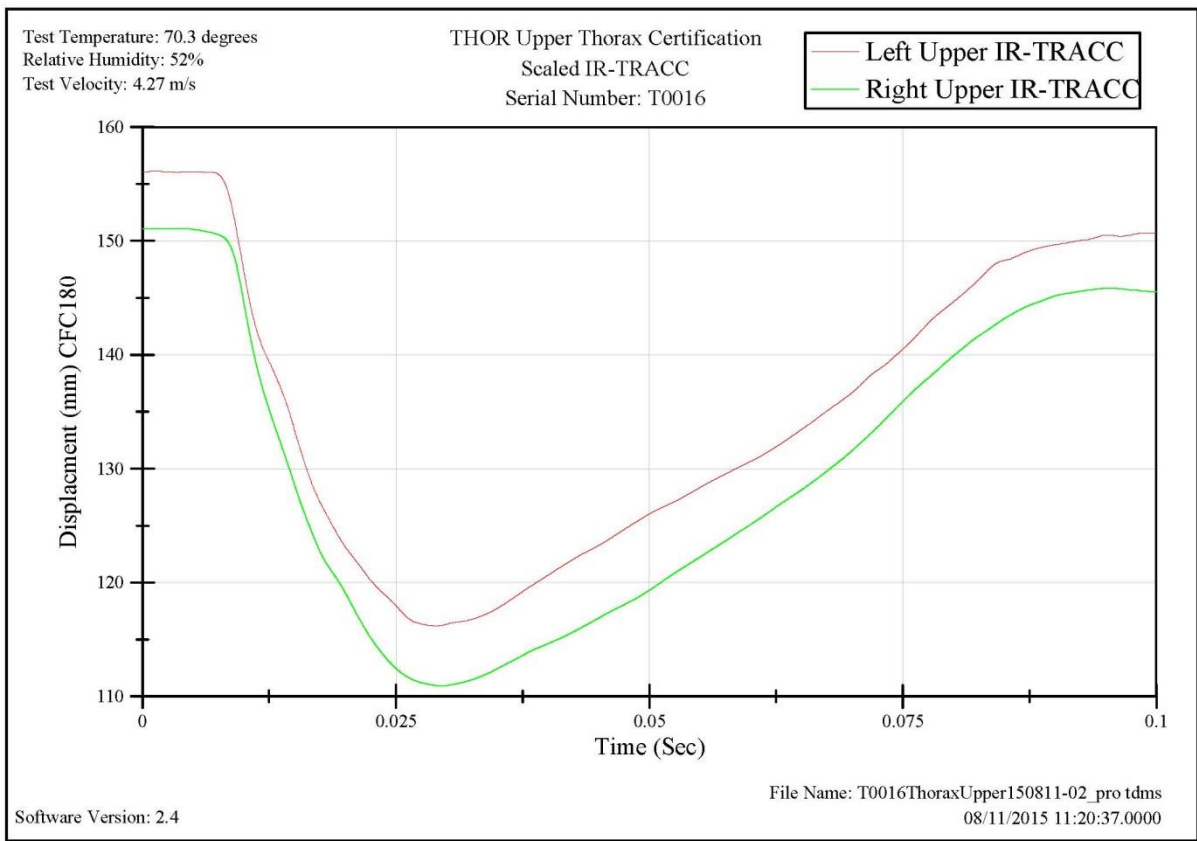
Test Temperature: 70.3 degrees
Relative Humidity: 52%
Test Velocity: 4.27 m/s

THOR Upper Thorax Certification
Thorax Response With Kroell Corridor
Serial Number: T0016



Software Version: 2.4

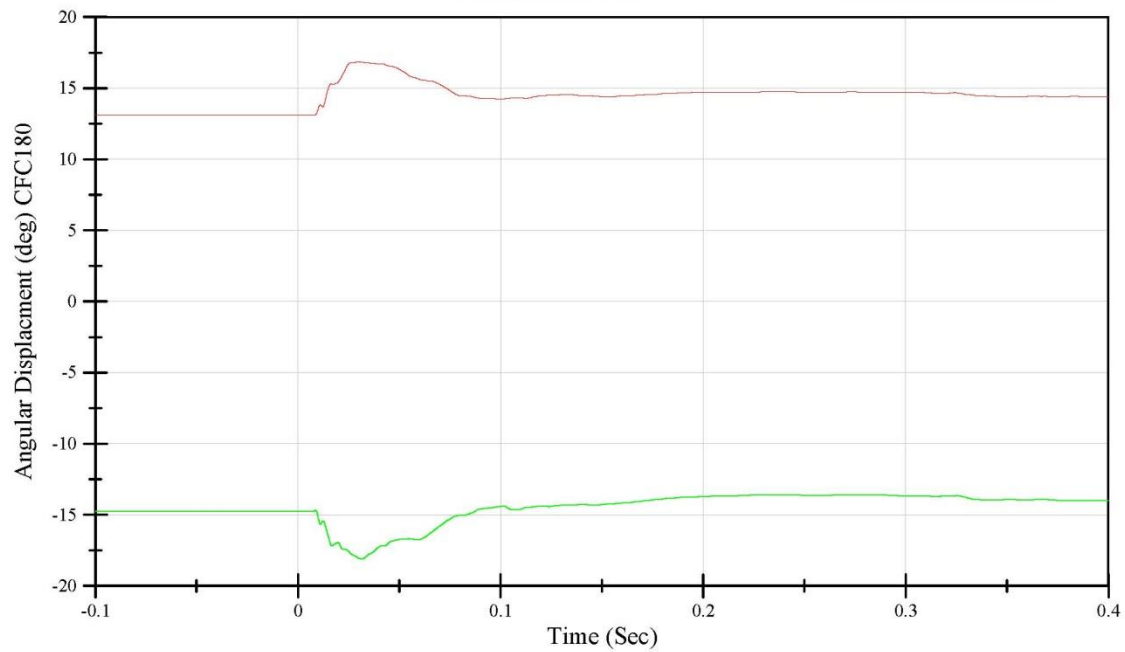
File Name: T0016ThoraxUpper150811-02_pro.tdms
08/11/2015 11:20:37.0000



Test Temperature: 70.3 degrees
Relative Humidity: 52%
Test Velocity: 4.27 m/s

THOR Upper Thorax Certification
Z-Potentiometer
Serial Number: T0016

Left Upper
Right Upper

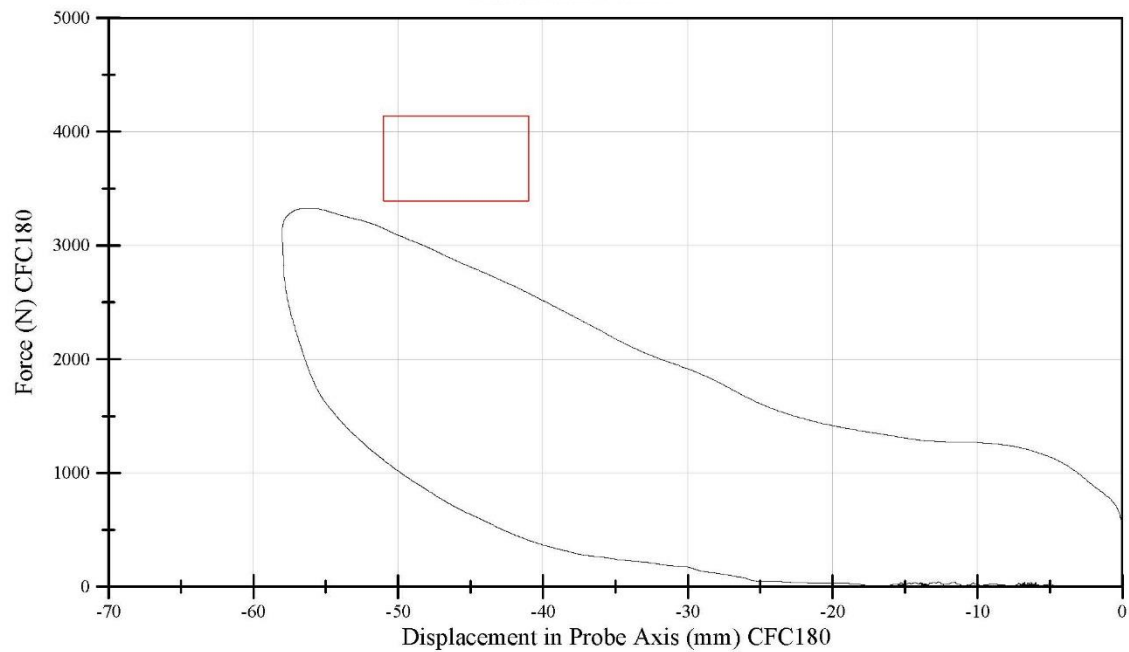


Software Version: 2.4

File Name: T0016ThoraxUpper150811-02_pro tdms
08/11/2015 11:20:37.0000

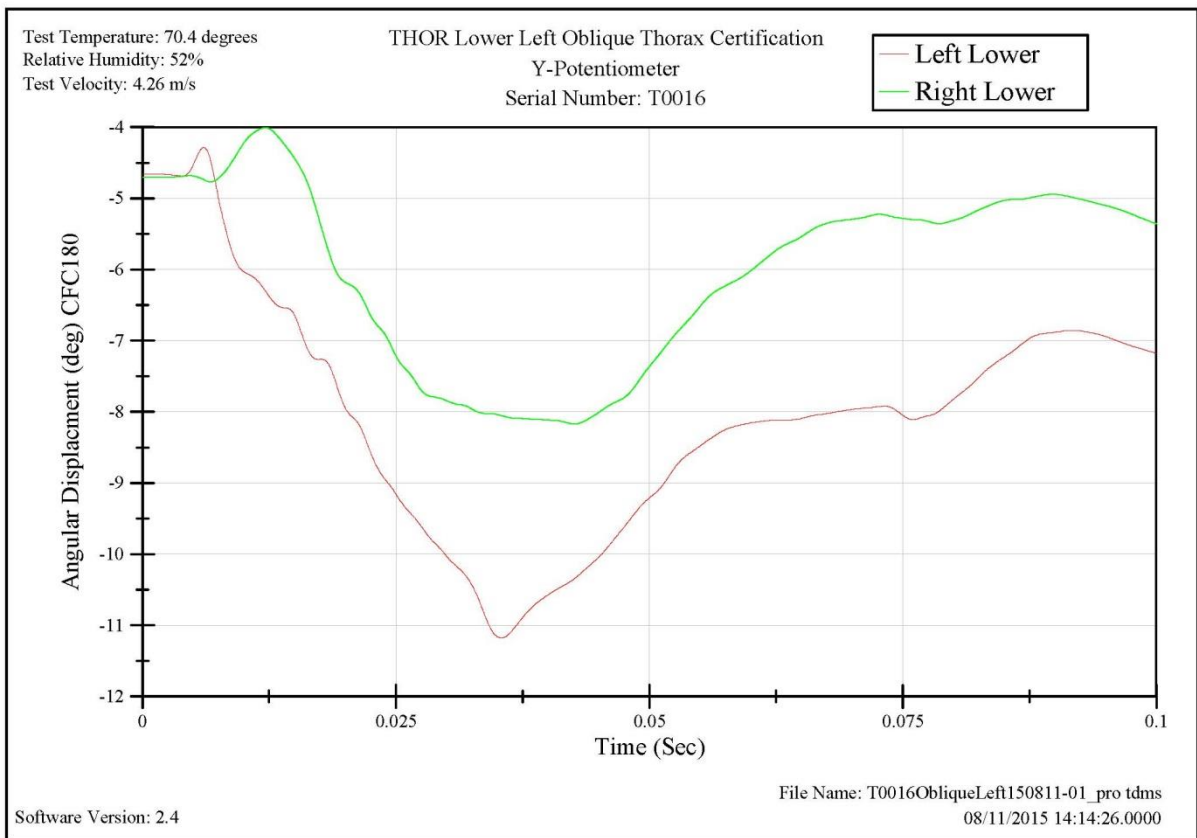
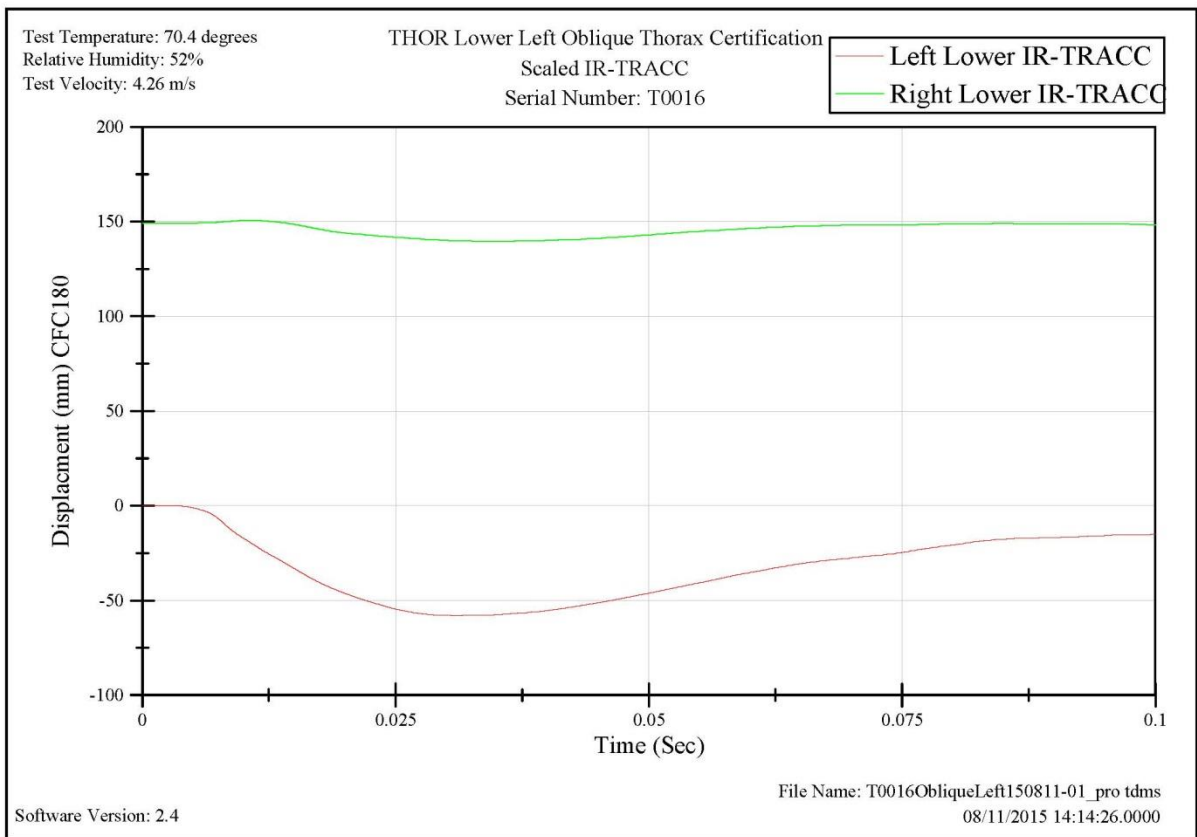
Test Temperature: 70.4 degrees
Relative Humidity: 52%
Test Velocity: 4.26 m/s

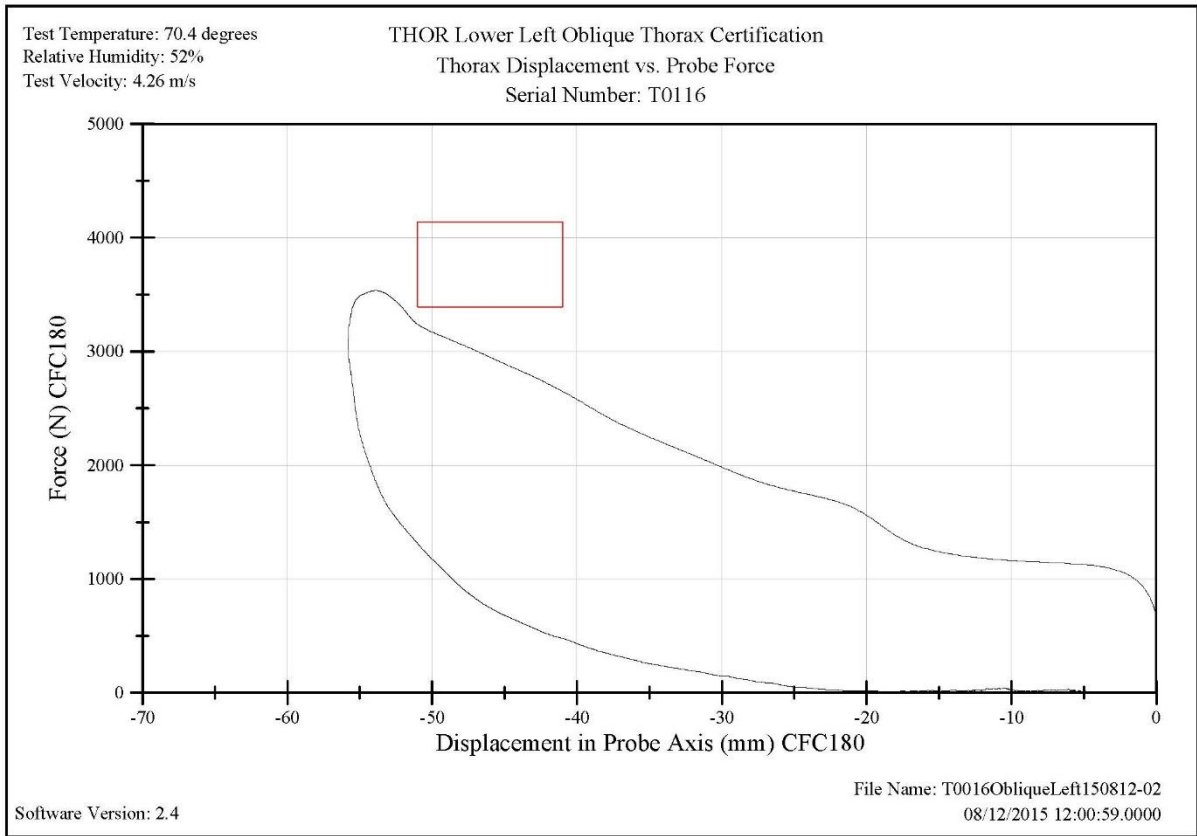
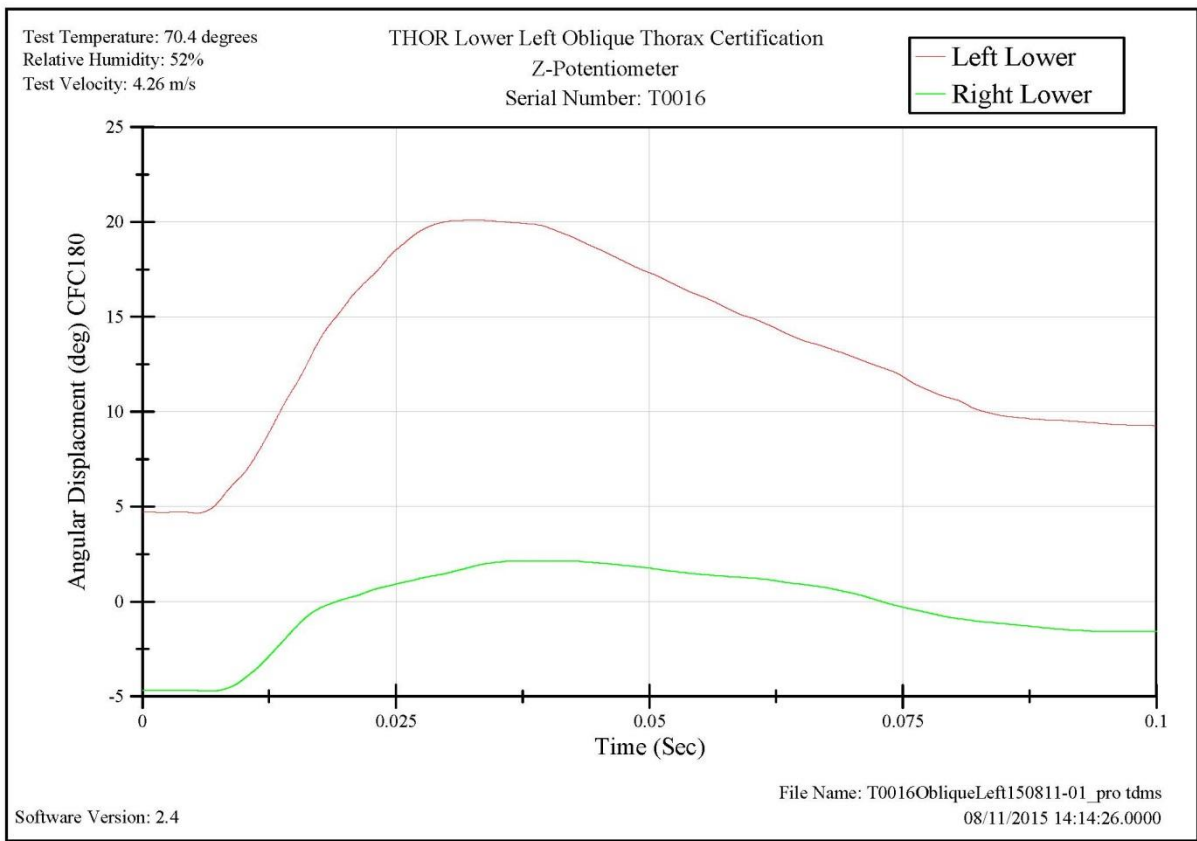
THOR Lower Left Oblique Thorax Certification
Thorax Displacement vs. Probe Force
Serial Number: T0016

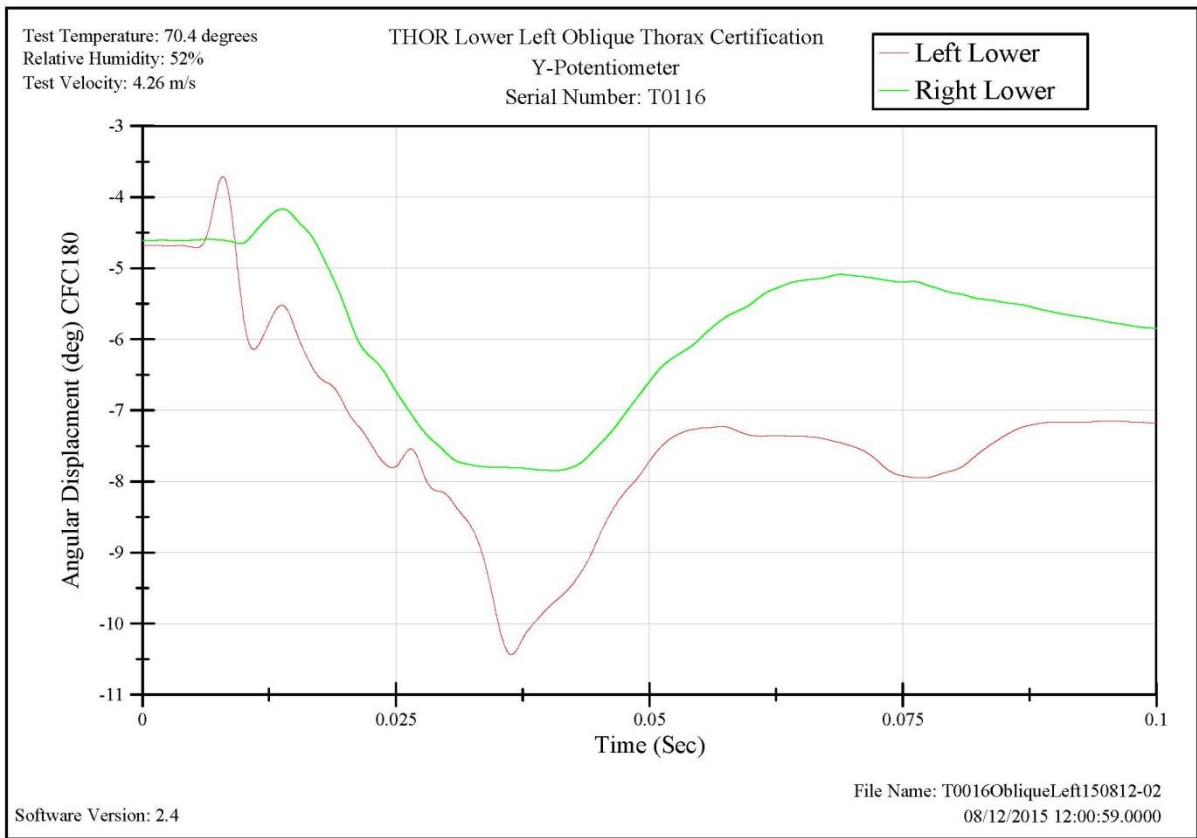
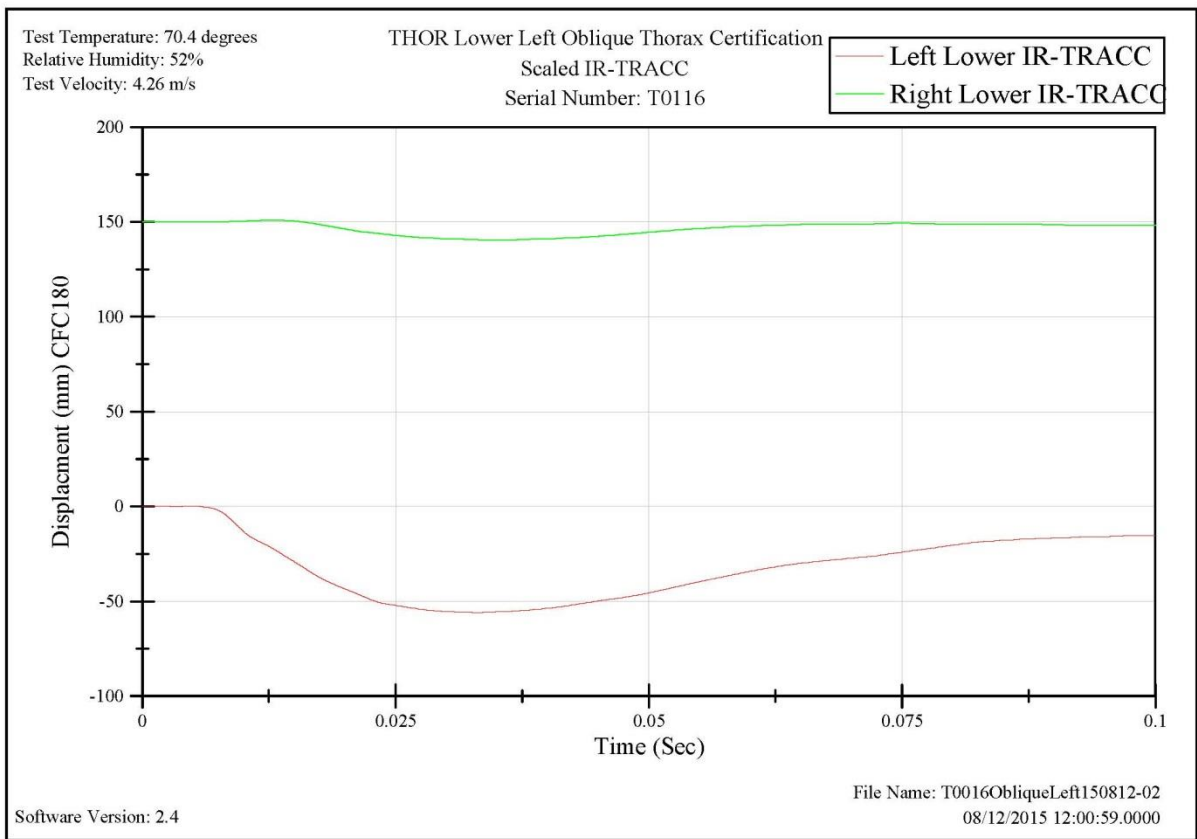


Software Version: 2.4

File Name: T0016ObliqueLeft150811-01_pro tdms
08/11/2015 14:14:26.0000



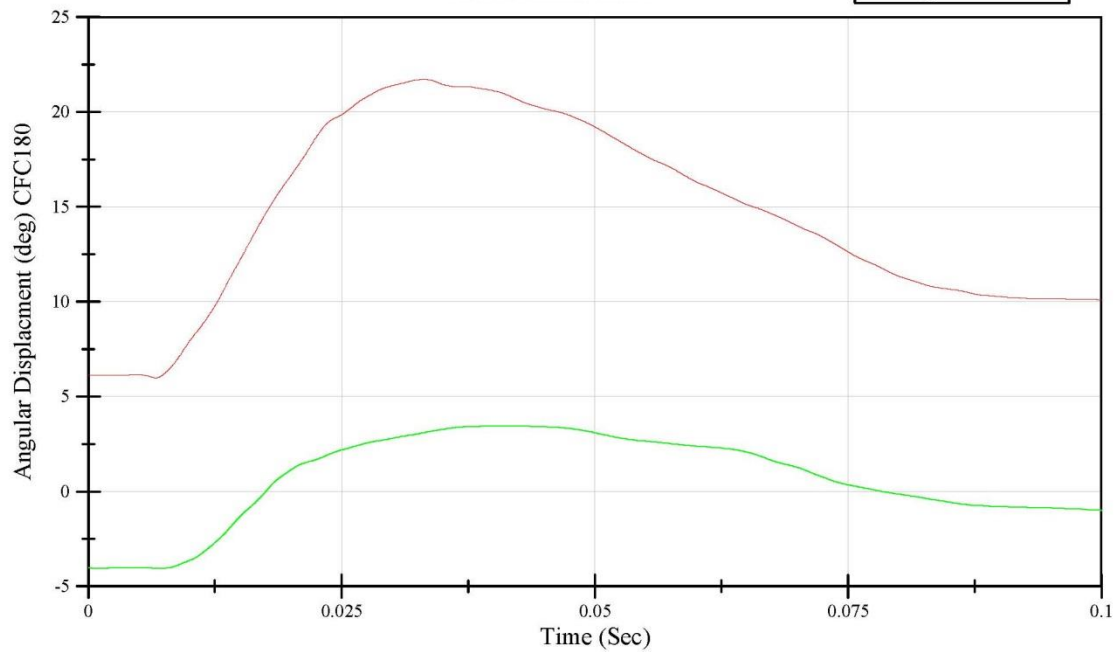




Test Temperature: 70.4 degrees
Relative Humidity: 52%
Test Velocity: 4.26 m/s

THOR Lower Left Oblique Thorax Certification
Z-Potentiometer
Serial Number: T0116

Left Lower
Right Lower

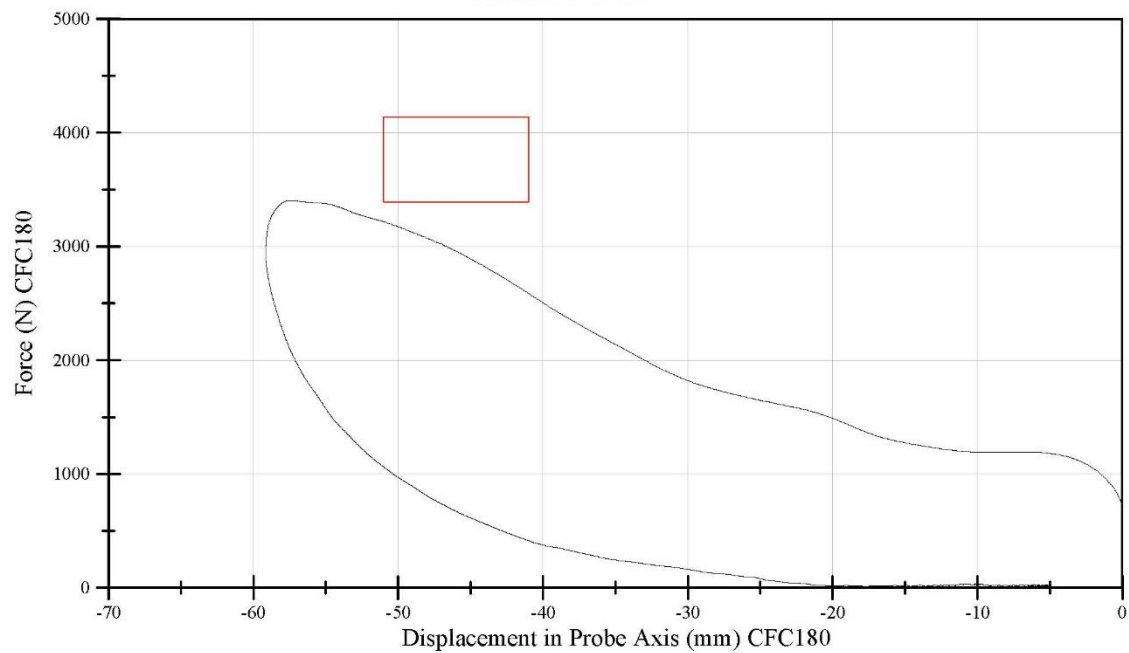


Software Version: 2.4

File Name: T0016ObliqueLeft150812-02
08/12/2015 12:00:59.0000

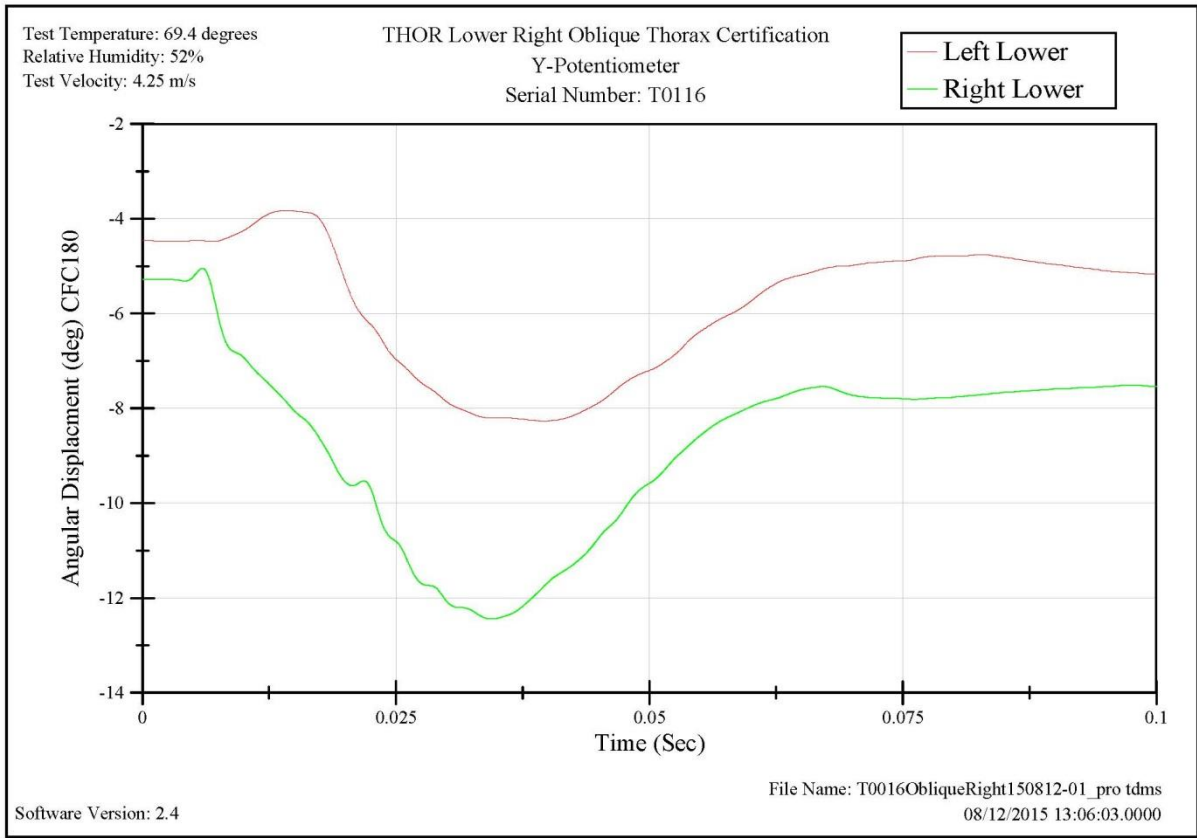
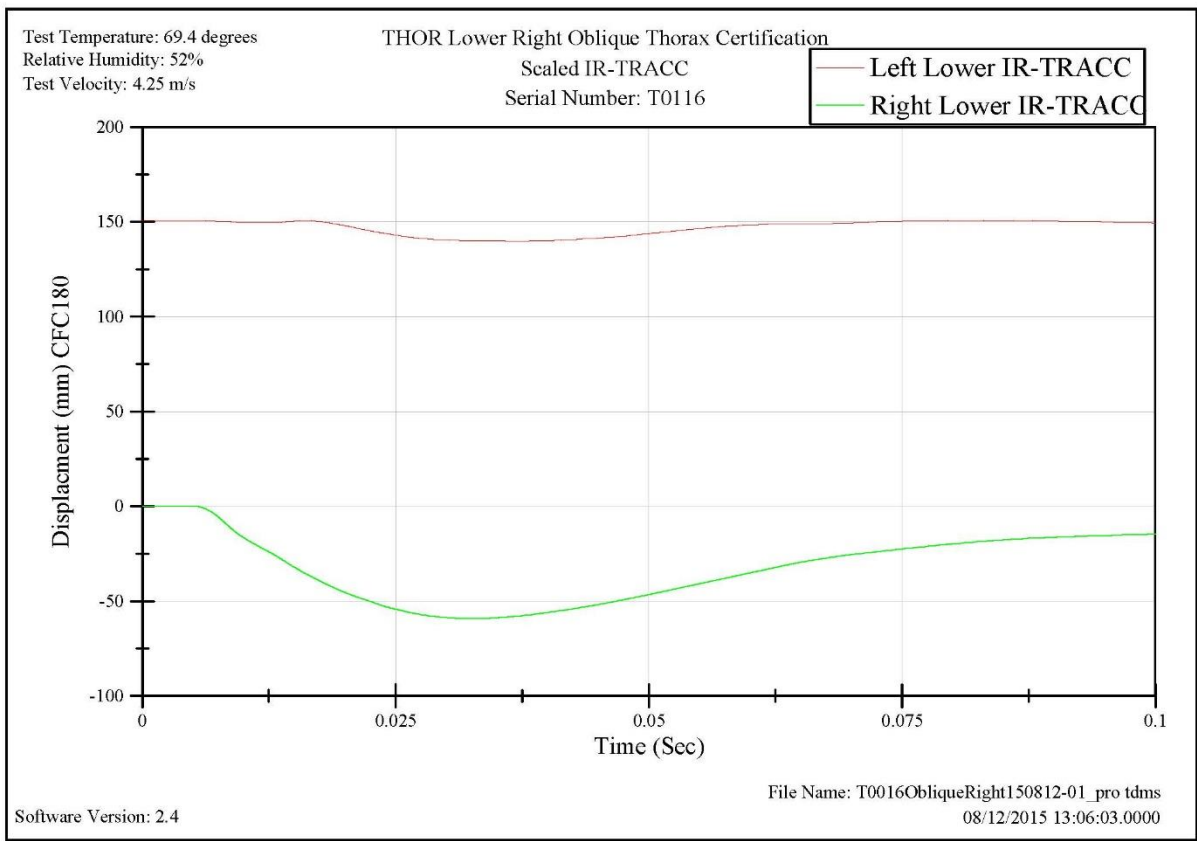
Test Temperature: 69.4 degrees
Relative Humidity: 52%
Test Velocity: 4.25 m/s

THOR Lower Right Oblique Thorax Certification
Thorax Displacement vs. Probe Force
Serial Number: T0116



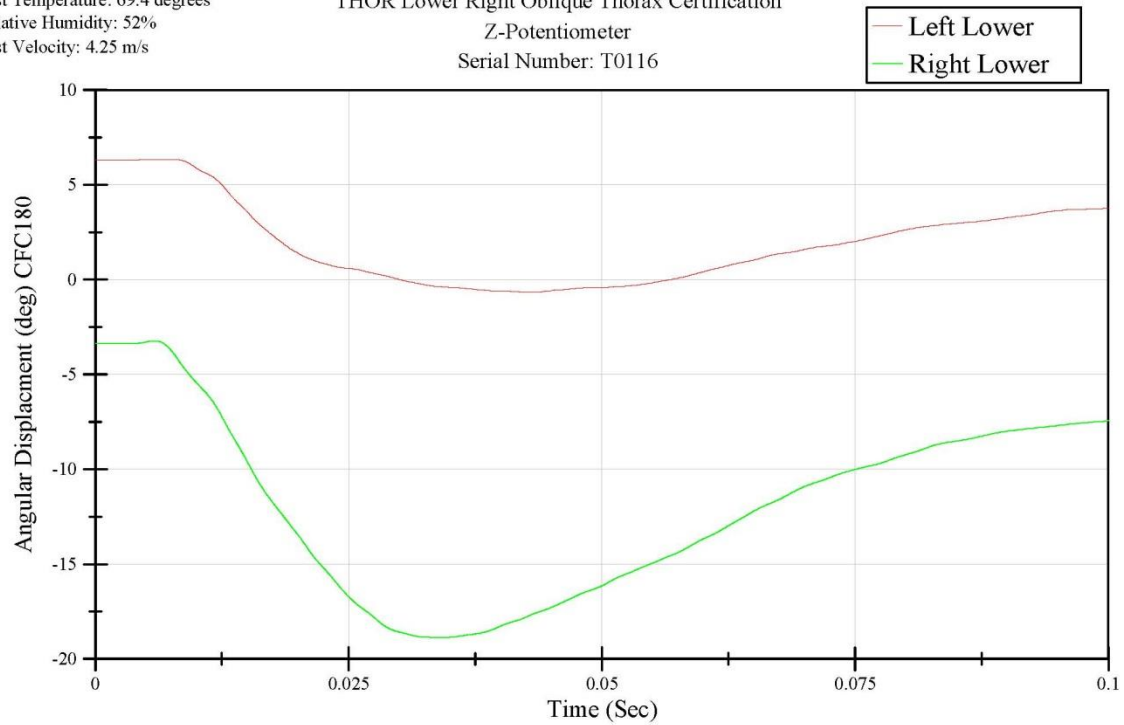
Software Version: 2.4

File Name: T0016ObliqueRight150812-01_pro tdms
08/12/2015 13:06:03.0000



Test Temperature: 69.4 degrees
Relative Humidity: 52%
Test Velocity: 4.25 m/s

THOR Lower Right Oblique Thorax Certification
Z-Potentiometer
Serial Number: T0116

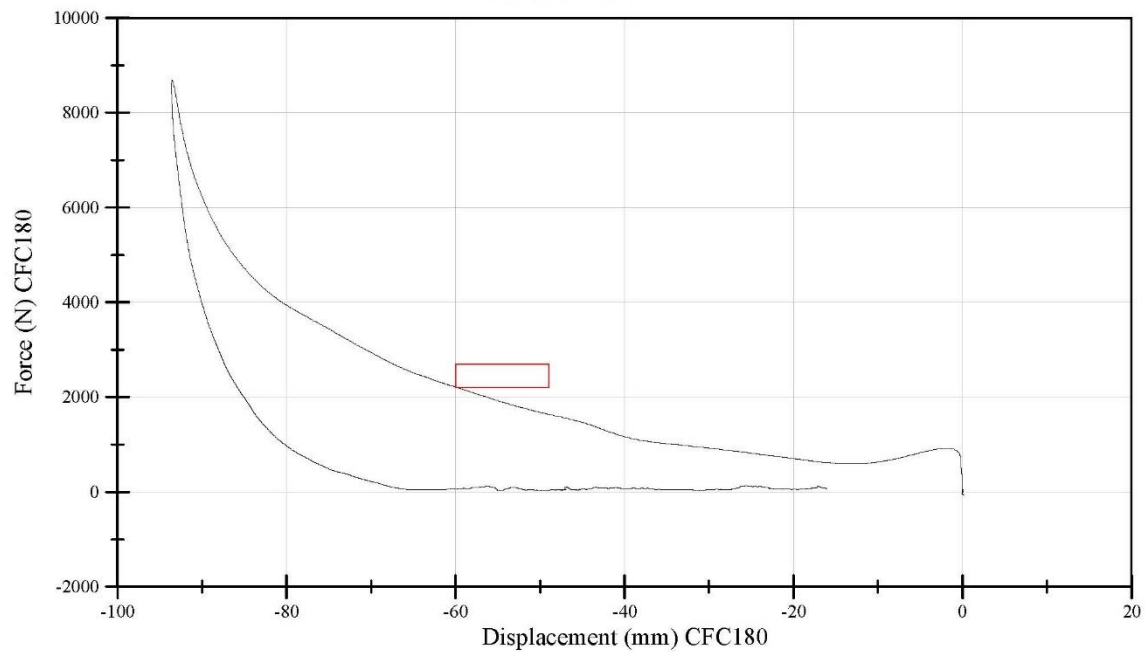


Software Version: 2.4

File Name: T0016ObliqueRight150812-01_pro tdms
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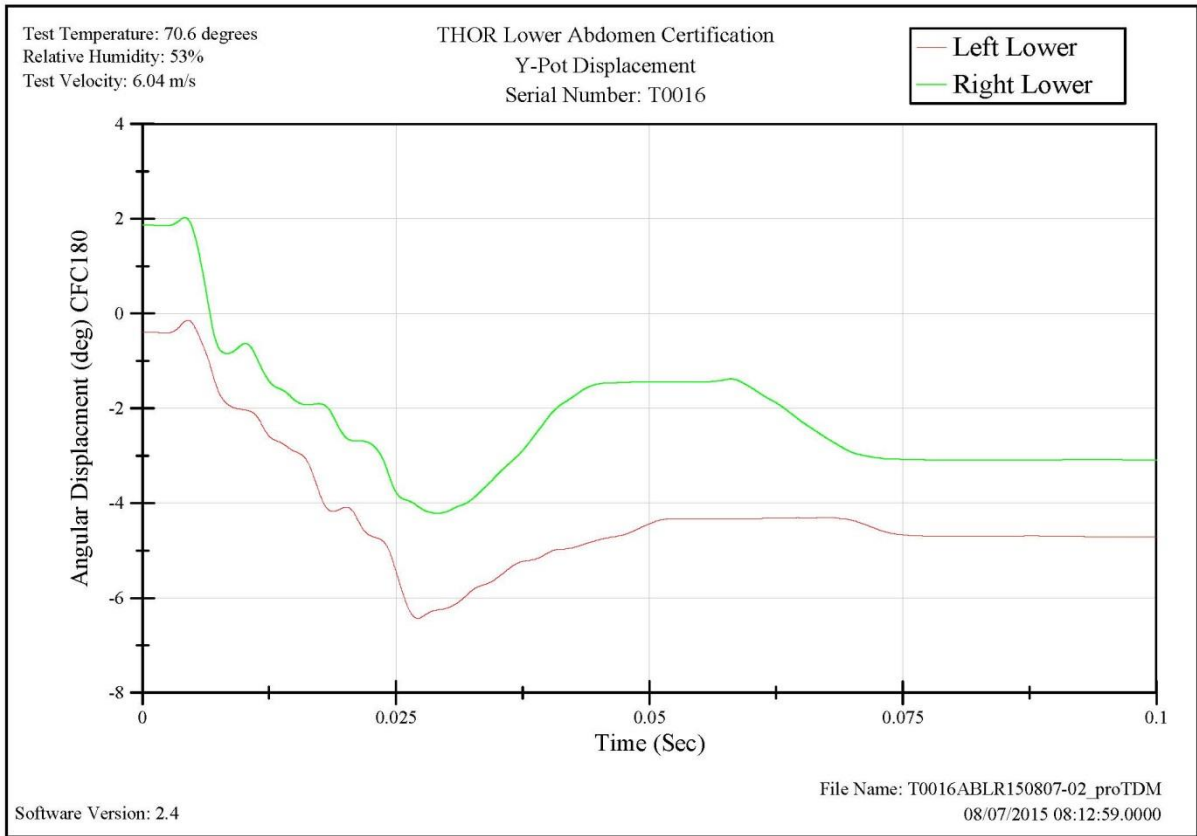
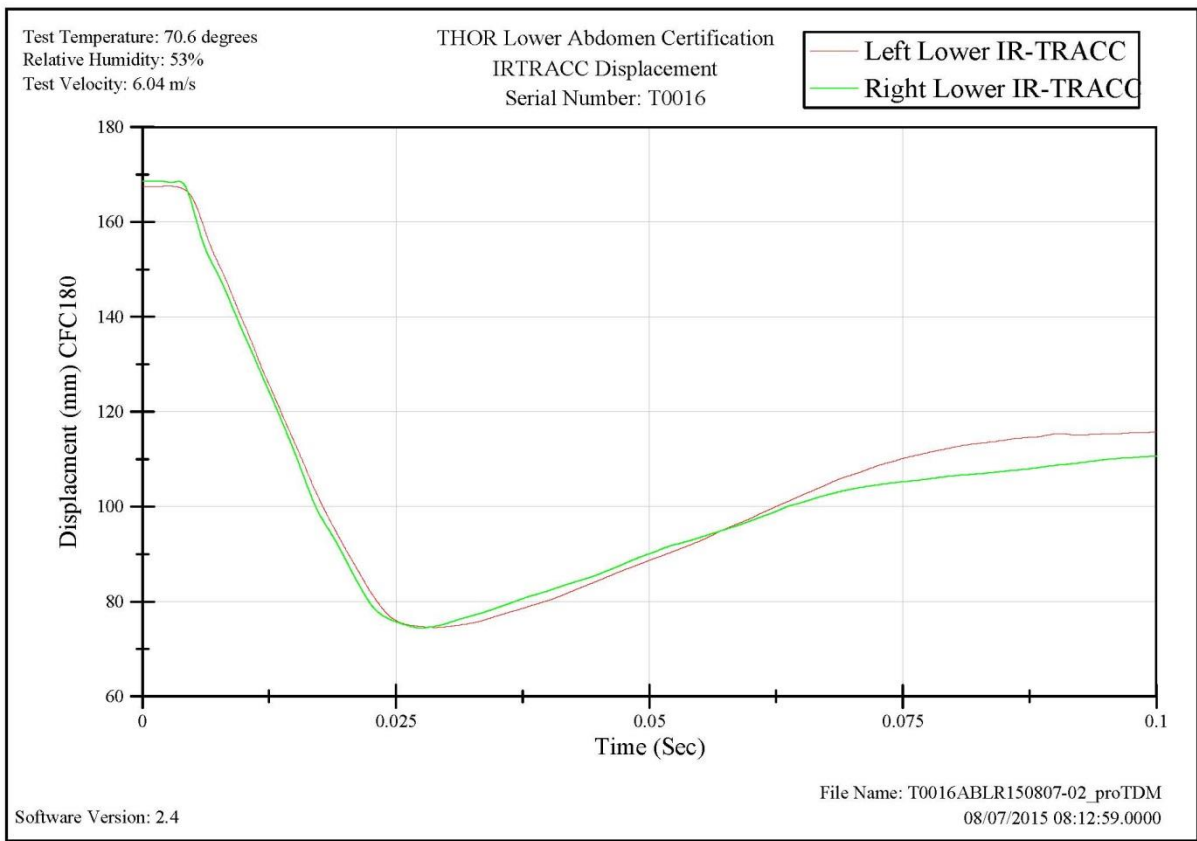
Test Temperature: 70.6 degrees
Relative Humidity: 53%
Test Velocity: 6.04 m/s

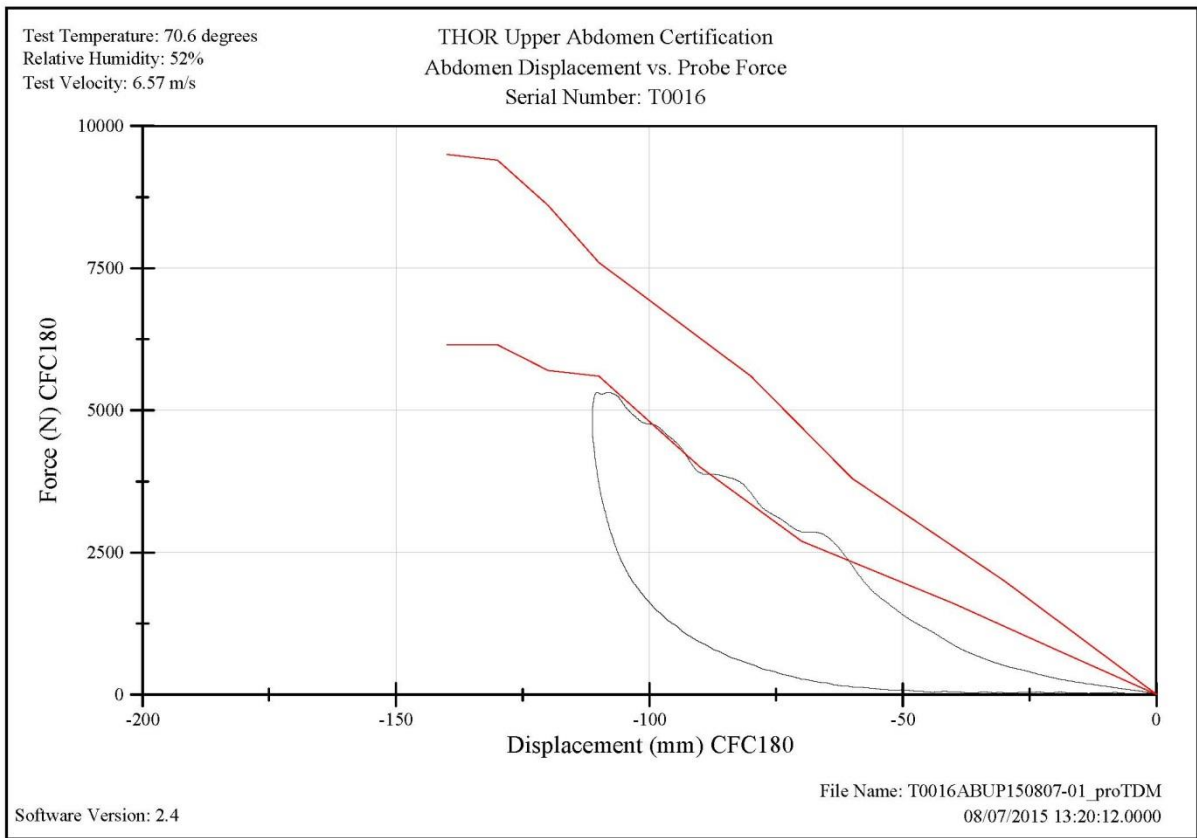
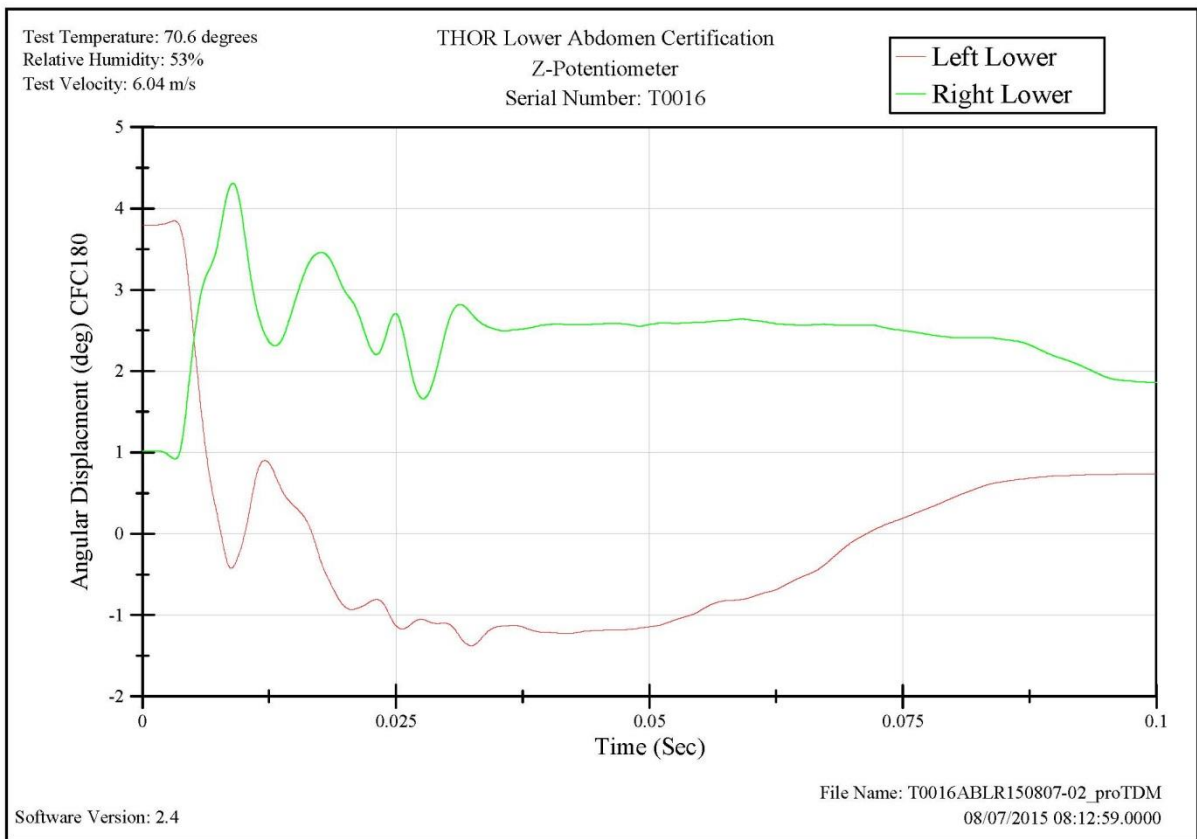
THOR Lower Abdomen Certification
Abdomen Displacement vs. Probe Force
Serial Number: T0016



Software Version: 2.4

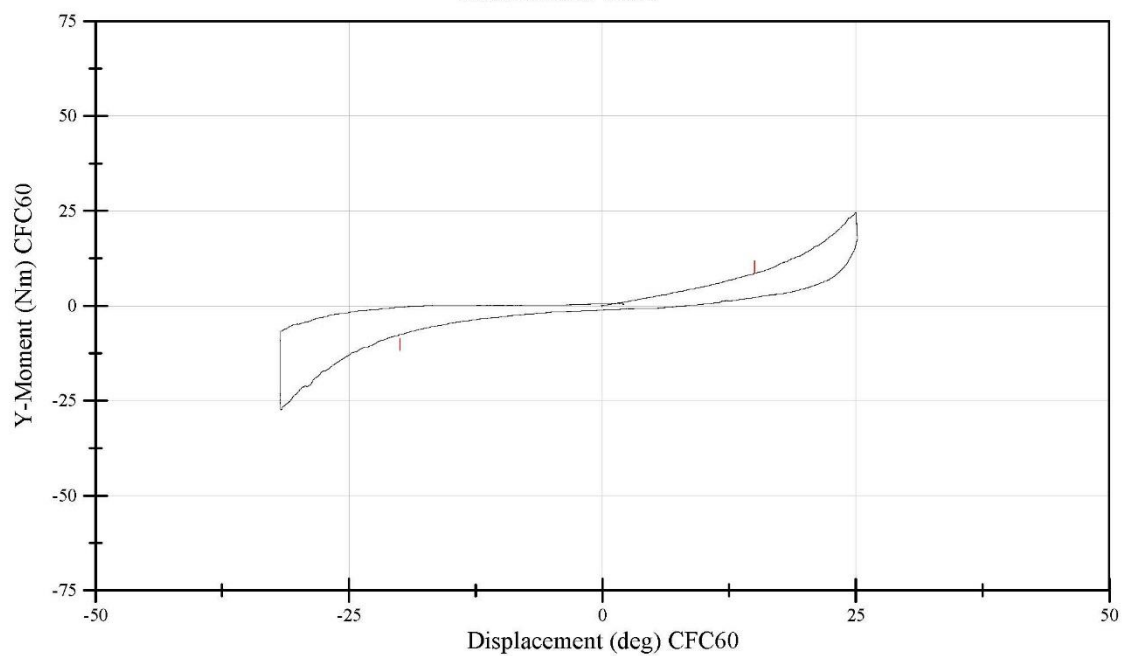
File Name: T0016ABLR150807-02_proTDM
08/07/2015 08:12:59.0000





Test Temperature: 70.1 degrees
Relative Humidity: 53%
Test Velocity: NOVALUE m/s

THOR Occipital Condyle Quasi-Static Certification
Displacement vs. Torque
Serial Number: T0016

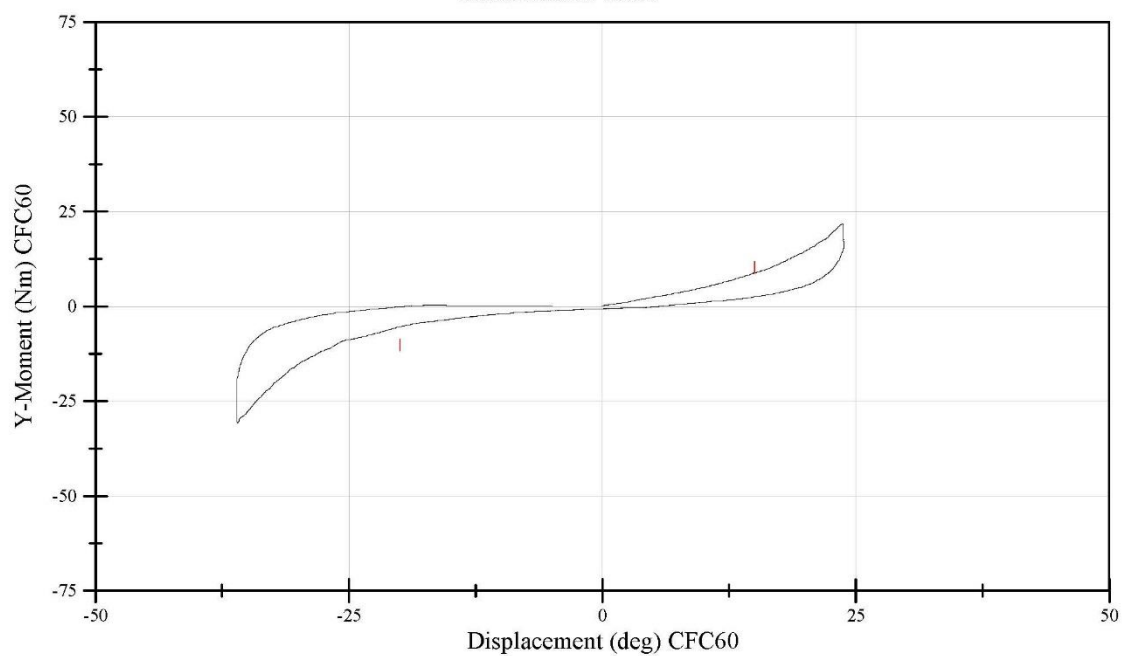


Software Version: 2.4

File Name: T0016OCPot150804-02_pro
08/04/2015 13:15:32.0000

Test Temperature: 70 degrees
Relative Humidity: 52%
Test Velocity: NOVALUE m/s

THOR Occipital Condyle Quasi-Static Certification
Displacement vs. Torque
Serial Number: T0016

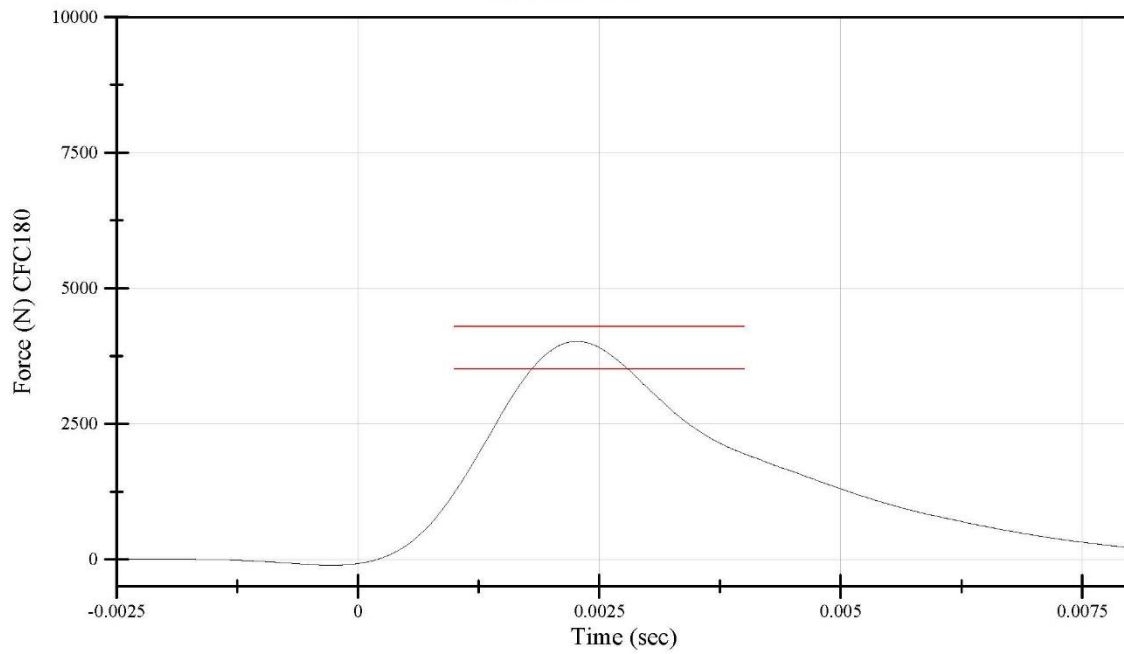


Software Version: 2.4

File Name: T0016OCPot150804-03_pro
08/04/2015 13:40:46.0000

Test Temperature: 70.2 degrees
Relative Humidity: 53%
Test Velocity: 2.63 m/s

THOR Left Femur Certification
Probe Force
Serial Number: T0016

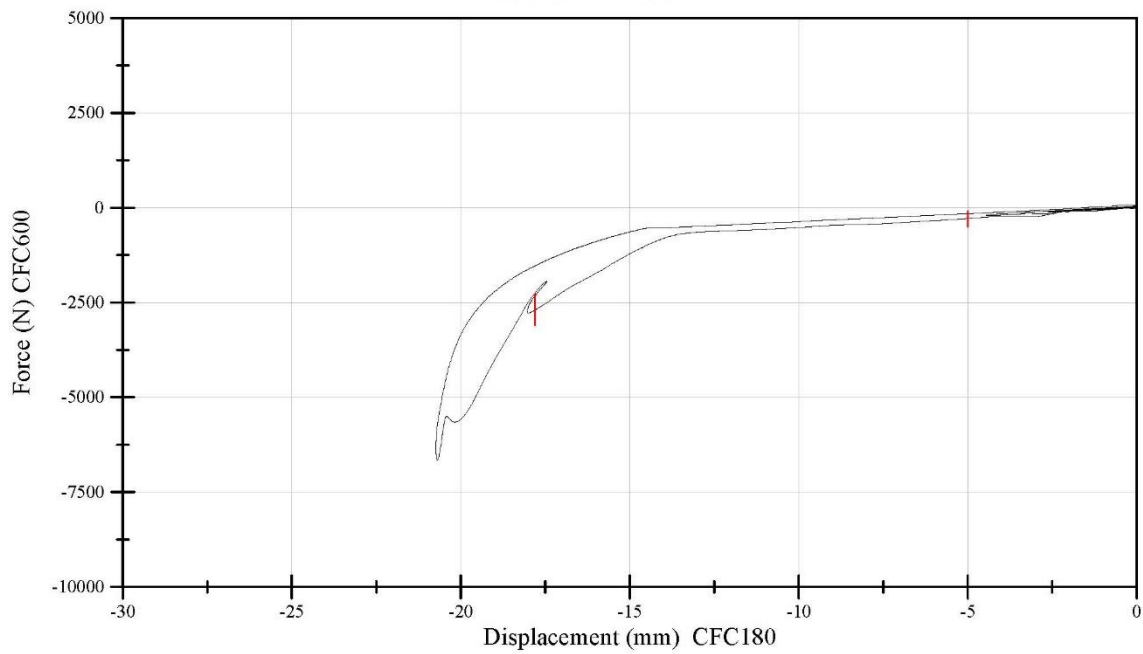


Software Version: 2.4

File Name: T0016LeftKnee150813-02_pro
08/14/2015 07:00:34.0000

Test Temperature: 71 degrees
Relative Humidity: 51%
Test Velocity: 2.76 m/s

THOR Left Knee Certification
Femur Force vs. Knee Displacement
Serial Number: 017169

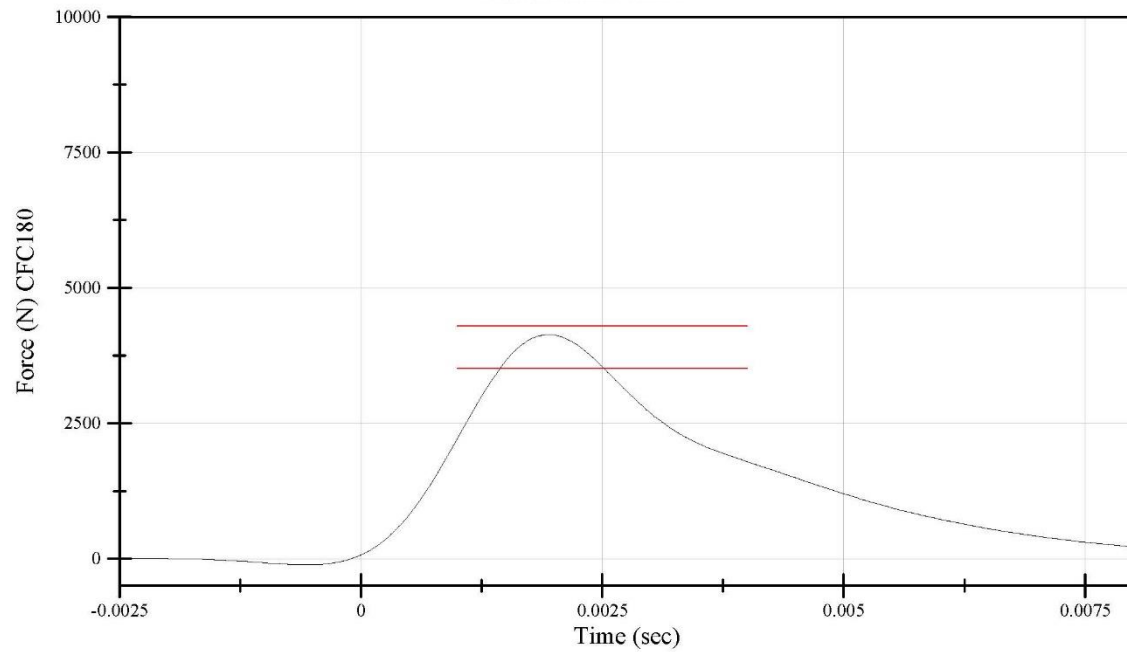


Software Version: 2.4

File Name: 017169Knee150708_01processed
07/08/2015 14:22:57.0000

Test Temperature: 69.7 degrees
Relative Humidity: 52%
Test Velocity: 2.63 m/s

THOR Right Femur Certification
Probe Force
Serial Number: T0016

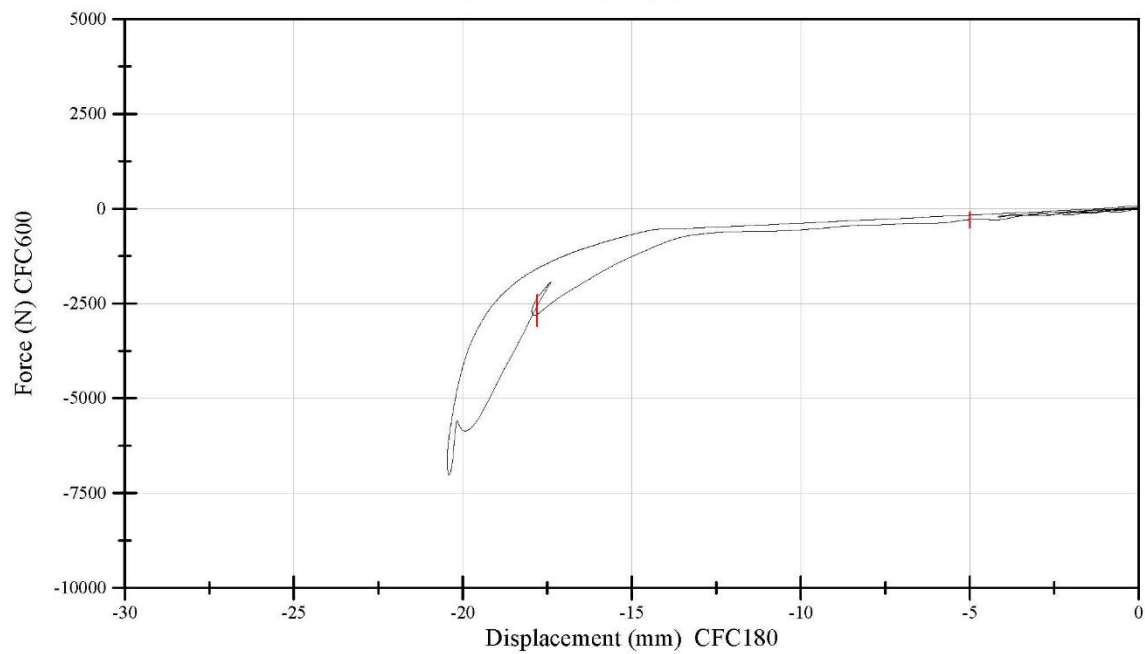


Software Version: 2.4

File Name: T0016RightKnee150814-01_pro
08/14/2015 07:48:52.0000

Test Temperature: 71 degrees
Relative Humidity: 50%
Test Velocity: 2.75 m/s

THOR Right Knee Certification
Femur Force vs. Knee Displacement
Serial Number: 12070382



Software Version: 2.4

File Name: 12070382Knee150708_01renamedprocessed
07/09/2015 06:31:18.0000



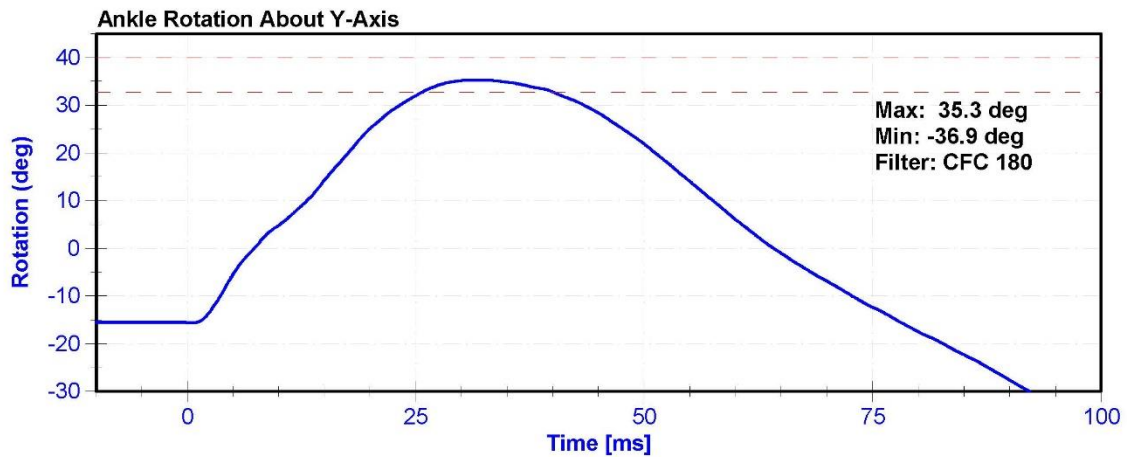
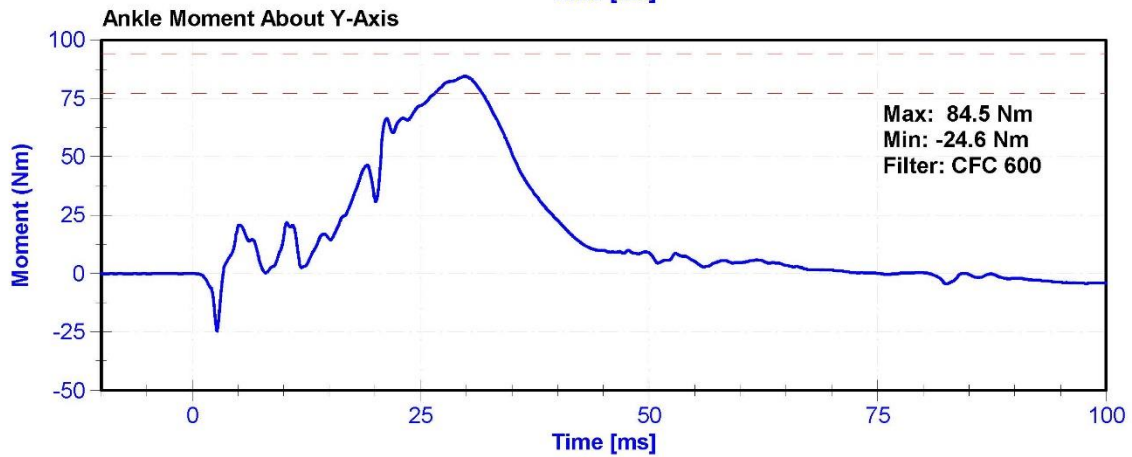
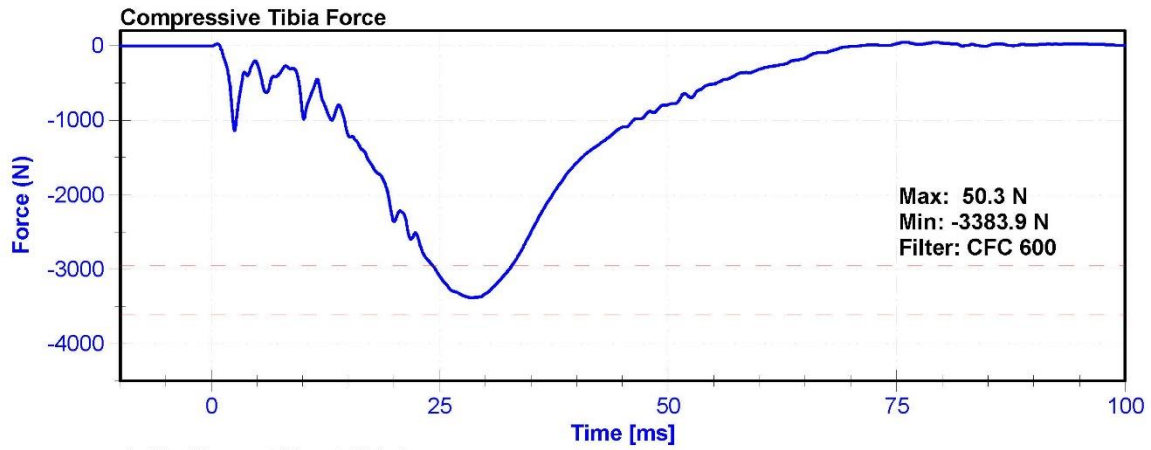
ATD Manufacturer	Huimanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	49.1	Pass
Velocity	4.9	5.1	m/s	4.916	Pass
Lower Tibia Compressive Force	-3,613	-2,956	N	-3383.9	Pass
Peak Moment about Y-Axis	77.1	94.2	Nm	84.46	Pass
Peak Rotation about Y-Axis	32.7	39.9	deg	35.27	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-140 Fz	3/3/2015	3/2/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0525-1	7/7/2015	7/6/2016



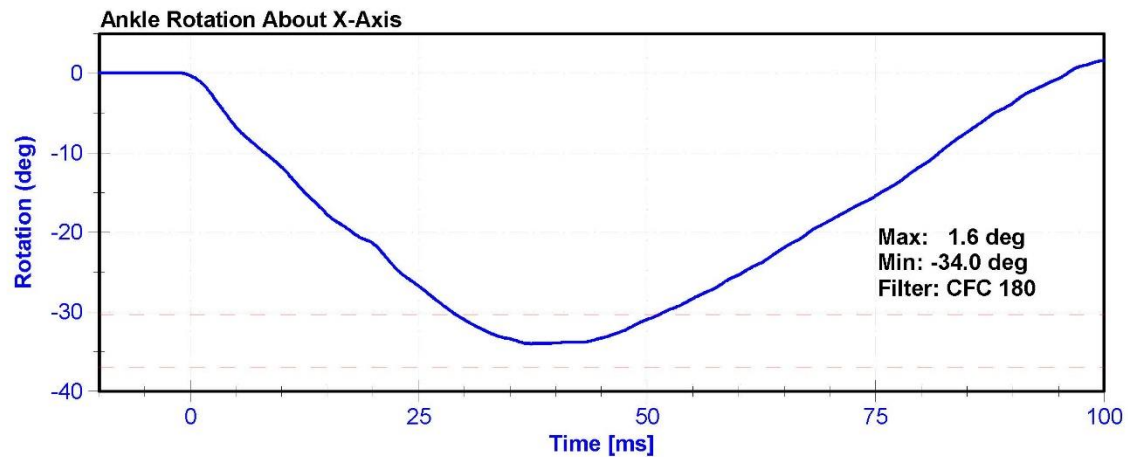
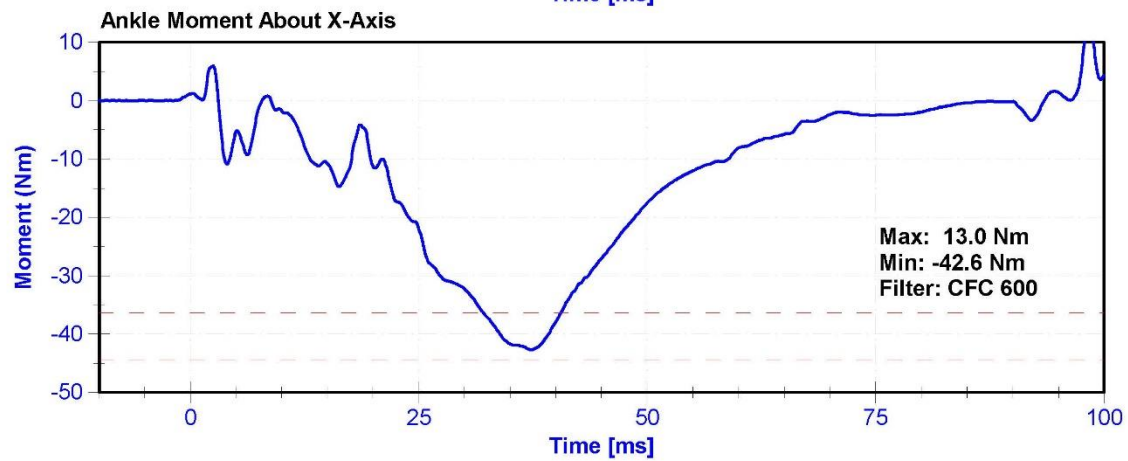
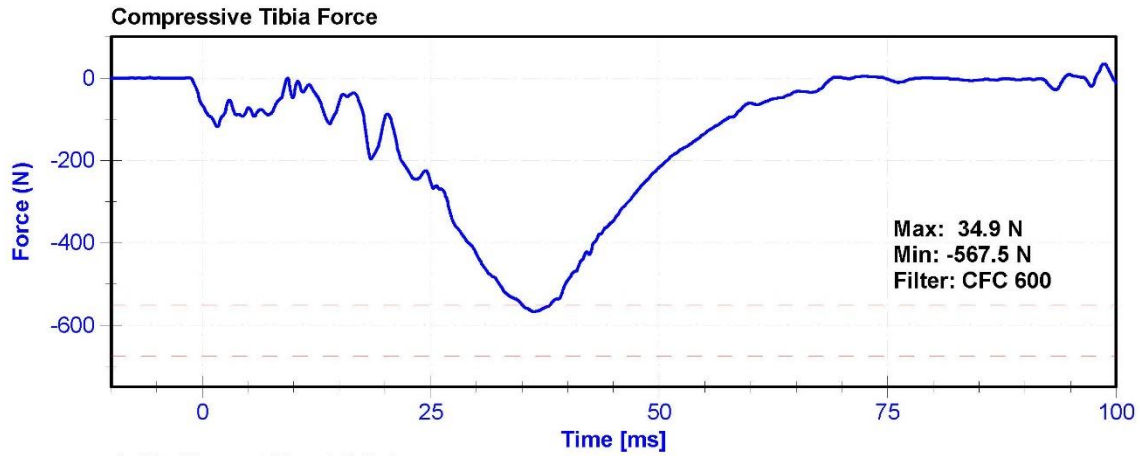
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.4	Pass
Humidity	10	70	%	46.1	Pass
Velocity	1.9	2.1	m/s	1.979	Pass
Lower Tibia Compressive Force	-675	-552	N	-567.5	Pass
Peak Moment about X-Axis	-44.4	-36.3	Nm	-42.63	Pass
Peak Rotation about X-Axis	-37.0	-30.3	deg	-33.99	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-140 Fz	3/3/2015	3/2/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0254	6/30/2015	6/29/2016



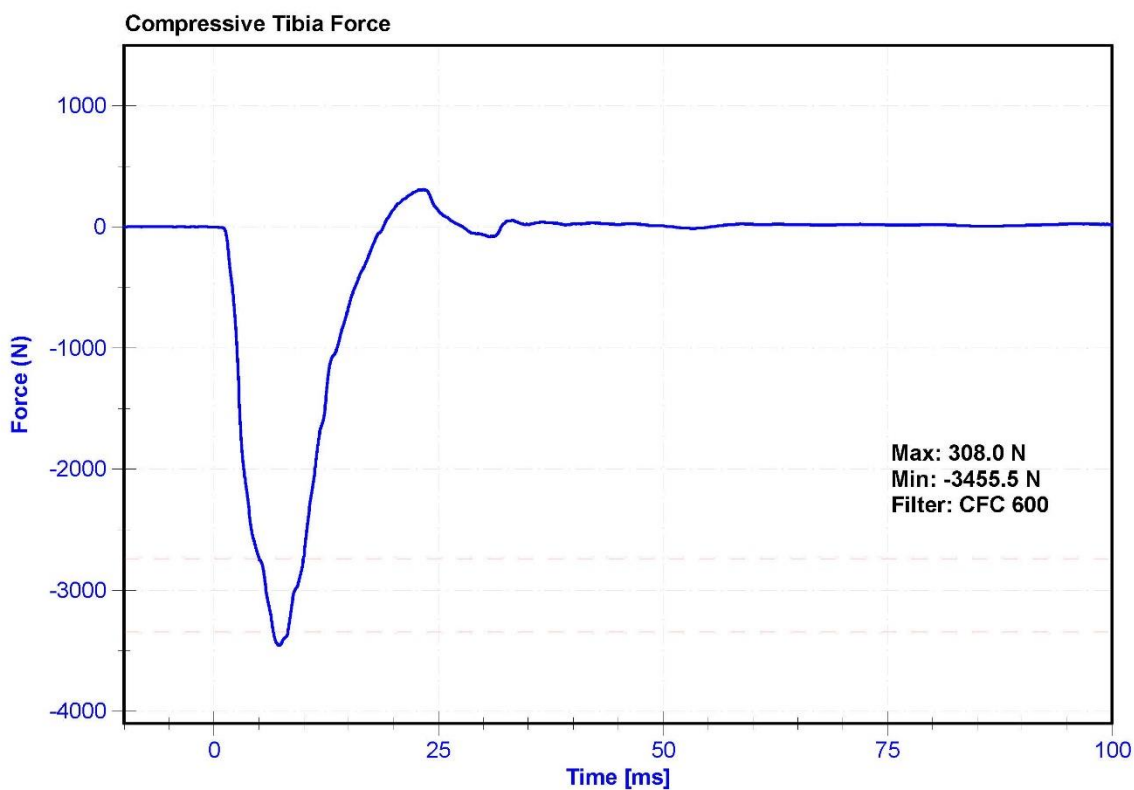
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	47.1	Pass
Velocity	3.9	4.1	m/s	3.948	Pass
Lower Tibia Compressive Force	-3,346	-2,738	N	-3455.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-140 Fz	3/3/2015	3/2/2016



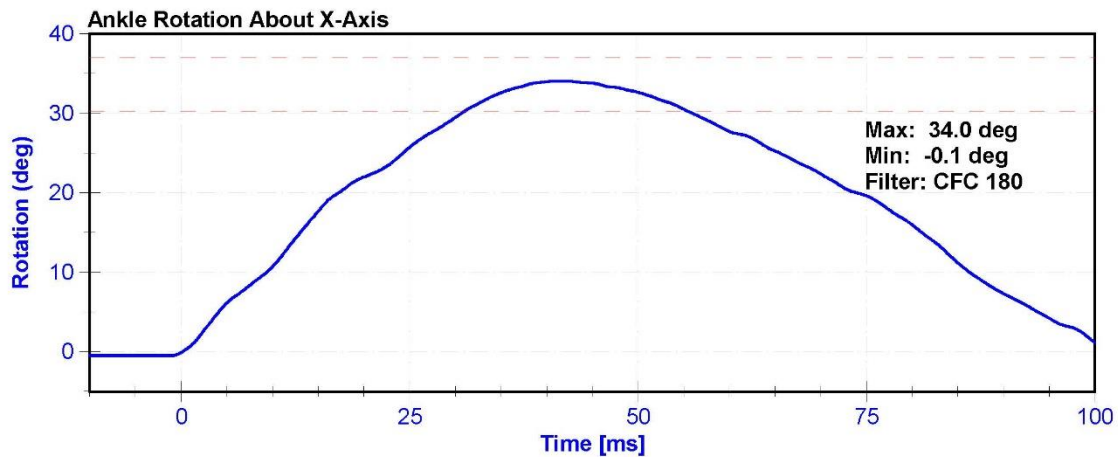
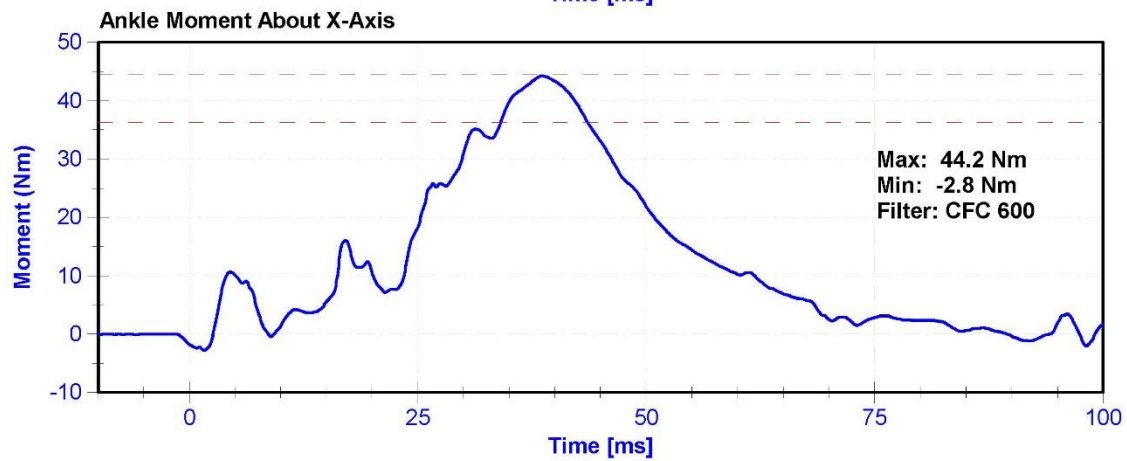
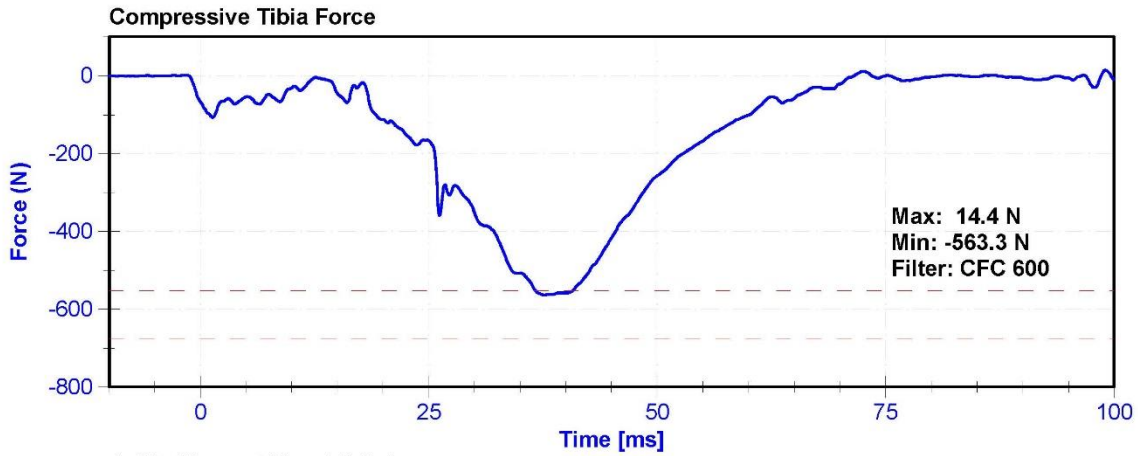
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	48.8	Pass
Velocity	1.9	2.1	m/s	1.969	Pass
Lower Tibia Compressive Force	-675	-552	N	-563.3	Pass
Peak Moment about X-Axis	36.3	44.4	Nm	44.20	Pass
Peak Rotation about X-Axis	30.3	37.0	deg	34.02	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-140 Fz	3/3/2015	3/2/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0254	6/30/2015	6/29/2016





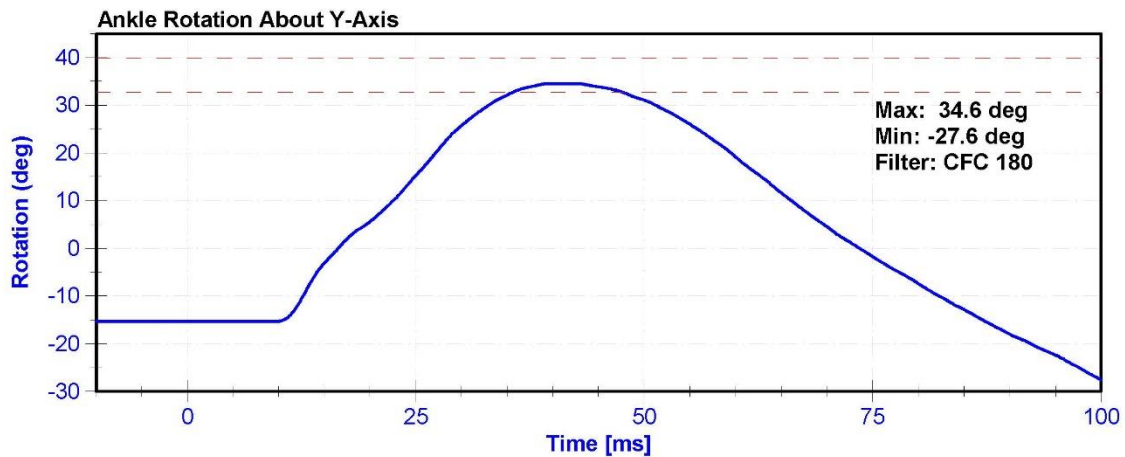
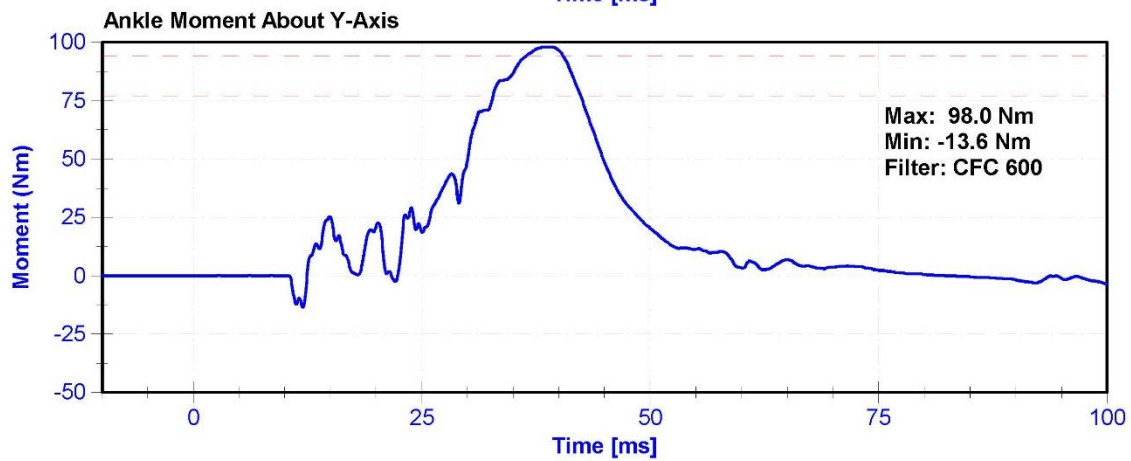
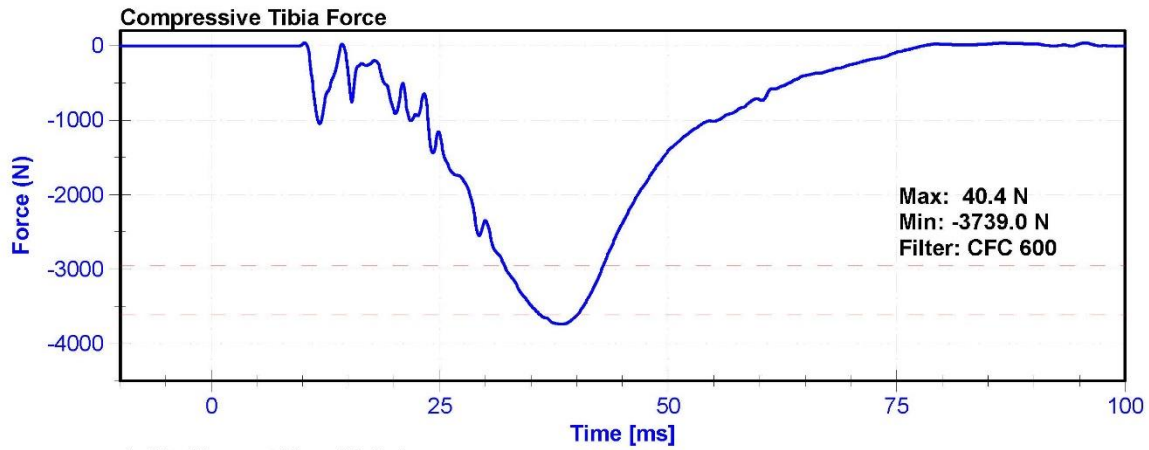
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	47.9	Pass
Velocity	4.9	5.1	m/s	4.980	Pass
Lower Tibia Compressive Force	-3,613	-2,956	N	-3739.0	Fail
Peak Moment about Y-Axis	77.1	94.2	Nm	97.98	Fail
Peak Rotation about Y-Axis	32.7	39.9	deg	34.60	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-139 Fz	6/16/2015	6/15/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0527	6/30/2015	6/29/2016



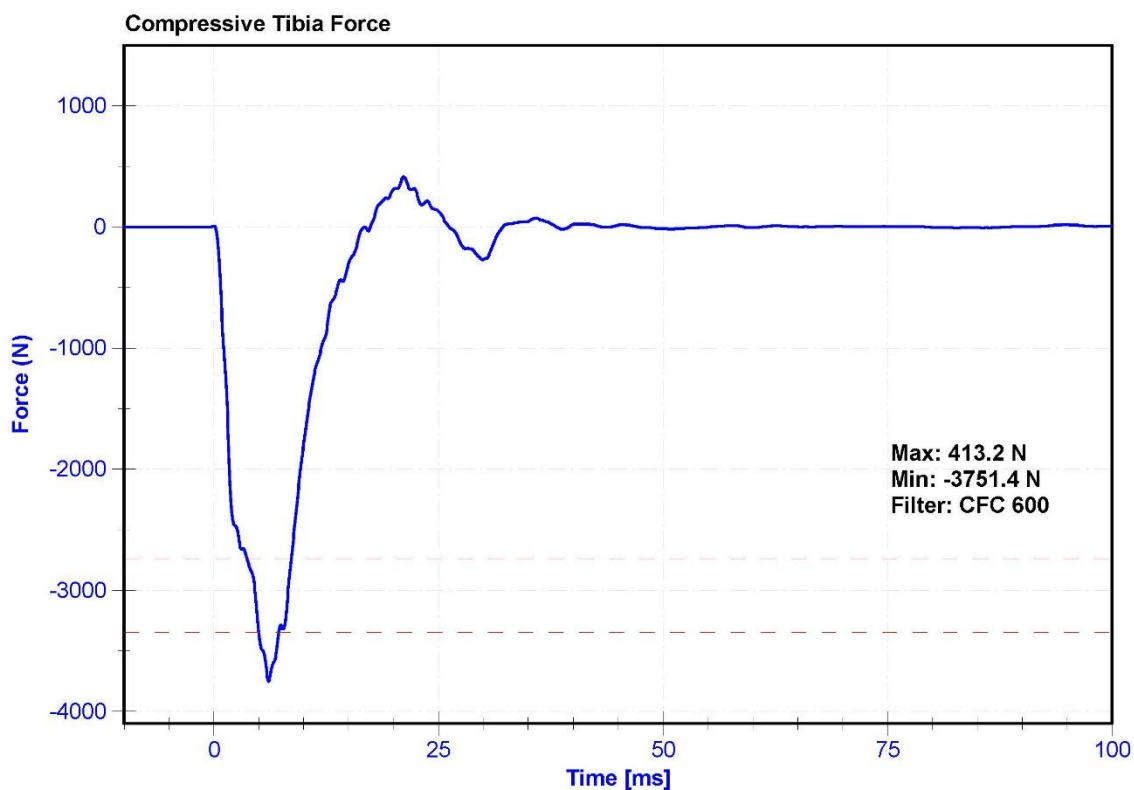
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	48.3	Pass
Velocity	3.9	4.1	m/s	3.948	Pass
Lower Tibia Compressive Force	-3,346	-2,738	N	-3751.4	Fail

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-139 Fz	6/16/2015	6/15/2016



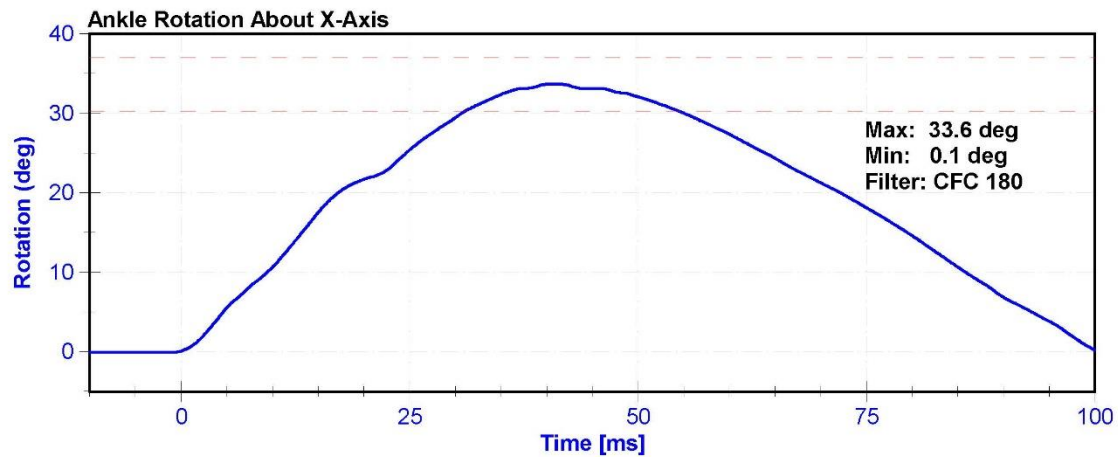
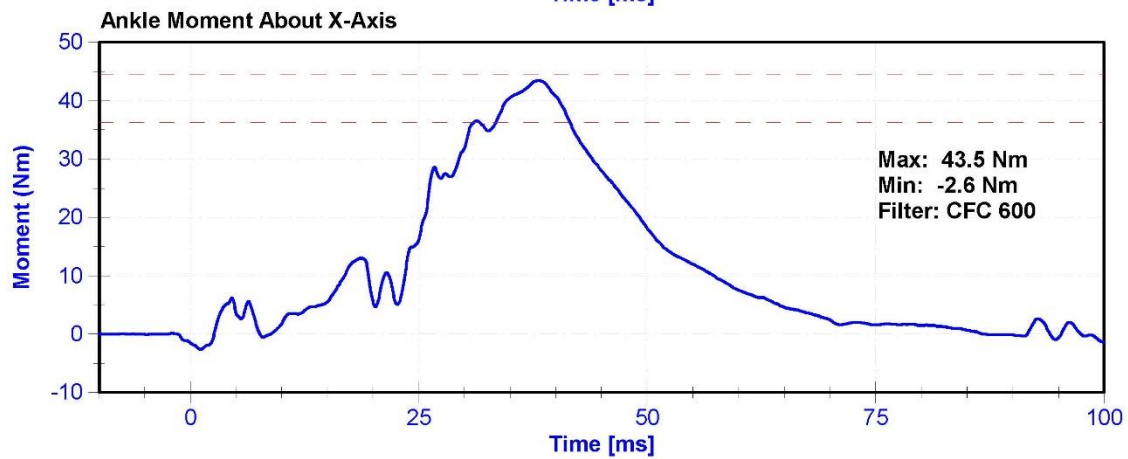
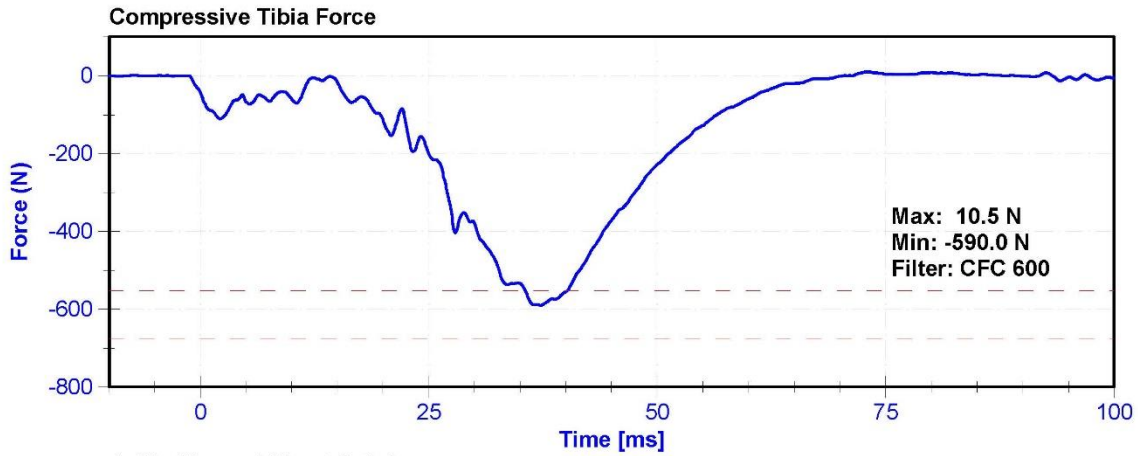
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	46.5	Pass
Velocity	1.9	2.1	m/s	1.944	Pass
Lower Tibia Compressive Force	-675	-552	N	-590.0	Pass
Peak Moment about X-Axis	36.3	44.4	Nm	43.49	Pass
Peak Rotation about X-Axis	30.3	37.0	deg	33.65	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-139 Fz	6/16/2015	6/15/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0544	6/30/2015	6/29/2016



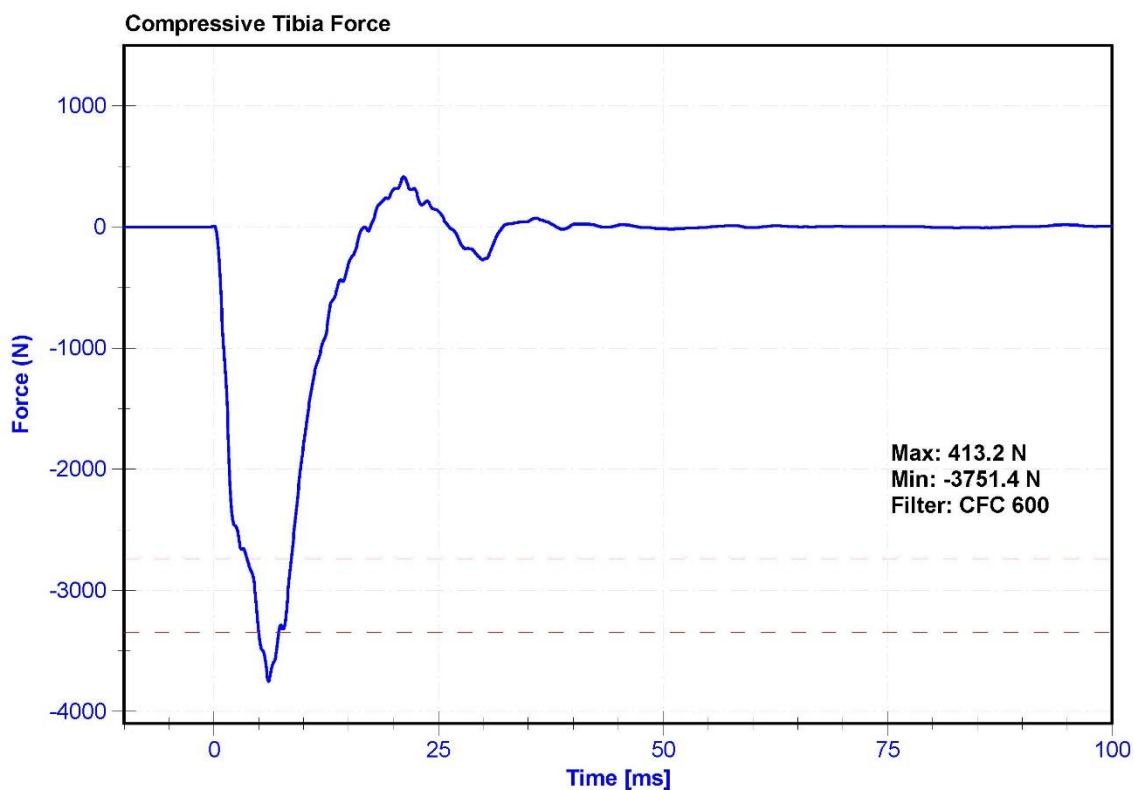
ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.3	Pass
Humidity	10	70	%	48.3	Pass
Velocity	3.9	4.1	m/s	3.948	Pass
Lower Tibia Compressive Force	-3,346	-2,738	N	-3751.4	Fail

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-139 Fz	6/16/2015	6/15/2016



ATD Manufacturer	Humanetics	Test Technician	M.Hartung
ATD Serial Number	0016	Laboratory Supervisor	M. Goehle

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.5	Pass
Humidity	10	70	%	48.7	Pass
Velocity	1.9	2.1	m/s	1.905	Pass
Lower Tibia Compressive Force	-675	-552	N	-599.8	Pass
Peak Moment about X-Axis	-44.4	-36.3	Nm	-45.89	Fail
Peak Rotation about X-Axis	-37.0	-30.3	deg	-33.03	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	ENDEVCO 7231CT	AC-C15018	7/15/2015	7/14/2016
Lower Tibia Load Cell	Denton 4929J	LC-139 Fz	6/16/2015	6/15/2016
Ankle Y Potentiometer	Contelec PD210-4B	DS-0544	6/30/2015	6/29/2016

