

**REPORT NUMBER: R&D-CAL-15-003**

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

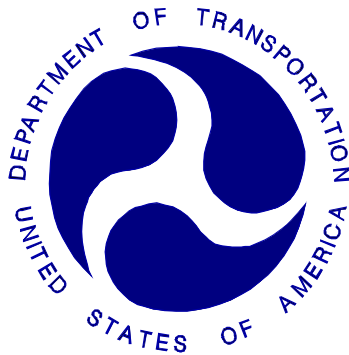
**2015 Toyota Highlander**

**90.1KPH, 15 DEGREE ANGLE, 35% OVERLAP**

**TEST DATE: 09/21/2015**

**NHTSA No: R20155143**

**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 Date: May 19, 2016  
Vanessa Hansen, Test Engineer

Approved by: Edward J. Dutton Date: May 19, 2016  
Edward J. Dutton, Operations Manager  
Transportation Test Operations

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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<b>15. Supplementary Notes</b>																																									
<b>16. Abstract</b> 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 Toyota Highlander SUV. 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 21, 2015. The OMDB impact velocity was 90.33 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 538 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 (HIC<sub>15</sub>)</td> <td>N/A</td> <td>157.09</td> <td>230.90</td> </tr> <tr> <td>Brain Injury Criteria (BrIC)</td> <td>N/A</td> <td>1.22</td> <td>0.92</td> </tr> <tr> <td>Peak Neck Tension</td> <td>mm</td> <td>2413.61</td> <td>2139.61</td> </tr> <tr> <td>Peak Resultant Chest Deflection</td> <td>N/A</td> <td>50.51</td> <td>48.98</td> </tr> <tr> <td>Peak Abdomen Deflection</td> <td>N</td> <td>-65.47</td> <td>-47.95</td> </tr> <tr> <td>Peak Resultant Acetabulum force</td> <td>N</td> <td>3404.47</td> <td>3017.70</td> </tr> <tr> <td>Peak Femur Force</td> <td>N</td> <td>-5054.28</td> <td>-5276.51</td> </tr> <tr> <td>Right Tibia Index</td> <td>N</td> <td>0.54</td> <td>0.37</td> </tr> </tbody> </table>						Measurement Description	Units	Driver THOR	Pass. THOR	Head Injury Criteria (HIC <sub>15</sub> )	N/A	157.09	230.90	Brain Injury Criteria (BrIC)	N/A	1.22	0.92	Peak Neck Tension	mm	2413.61	2139.61	Peak Resultant Chest Deflection	N/A	50.51	48.98	Peak Abdomen Deflection	N	-65.47	-47.95	Peak Resultant Acetabulum force	N	3404.47	3017.70	Peak Femur Force	N	-5054.28	-5276.51	Right Tibia Index	N	0.54	0.37
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## DISCLAIMER

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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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Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

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**SECTION 1  
PURPOSE OF TEST**

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

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.

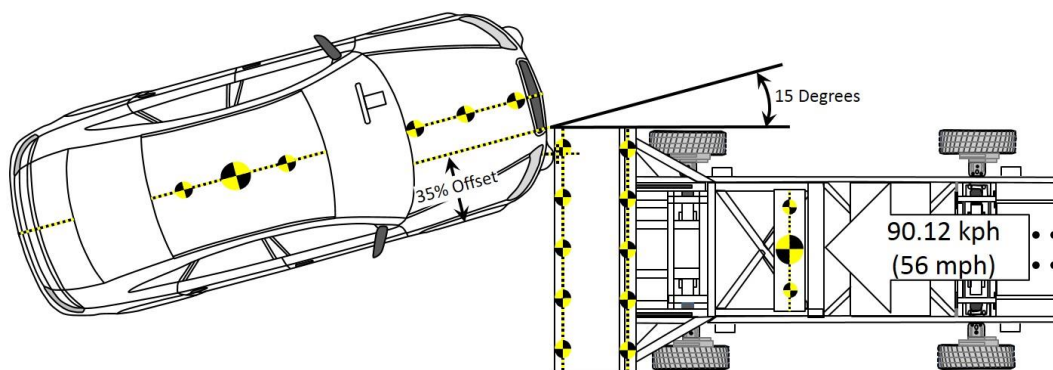
This test was conducted in accordance with the instructions set forth for a 15° angle, 35% offset moving barrier to vehicle impact, outlined in Contract No. DTNH22-14-D-00359, Task Order 0001. Data was obtained indicant of Federal Motor Vehicle Safety Standard FMVSS 208-Occupant Crash Protection, FMVSS 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 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

A 2015 Toyota Highlander SUV 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 2,317 kg (5,108.1 lbs), and the OMDB's mass was 2519 kg (5,552 lbs). The test was conducted by Calspan Corporation on September 21, 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, frontal and knee 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 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
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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 91.2% total windshield retention, with 100% and 82.3% 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 538 mm at C6 to the right of the vehicle's centerline. The maximum crush of the structural bumper beam was 477 mm at B9, 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 passenger side.
- 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 shoulder
- Torso contacted the frontal airbag
- Left Knee contacted the knee bolster and knee airbag
- Right Knee contacted the knee bolster and knee airbag

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

- Head contacted the frontal and curtain airbag and side 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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**Primary Impact Data**

Measured Parameter	Units	Value
OMDB Velocity at Impact	kph	90.33
OMDB Test Weight	kg	2519
OMDB Maximum Static Crush	mm	436
Vehicle Test Weight	kg	2317
Actual Vehicle Angle	degrees	15
Vehicle Maximum Static Crush	mm	538
Vertical Offset from Target Point (+ down / - up)*	mm	0
Lateral Offset from Target Point (+ left / - right)*	mm	+8
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 Shoulder	A49-A51	Front & Curtain airbag, 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 passenger door	N/A
Left Knee Contact	Knee Bolster & Knee Airbag	A28	Glove Box	A52
Right Knee Contact	Knee Bolster & Knee Airbag	A28	Glove Box	A52

### Data Anomalies

CHANNEL DESCRIPTION	EXPLANATION
Driver Knee Left X Displacement, Questionable Data after 29.7ms	Re-splice cable and repaired
Driver Tibia Lower Left X Force, Questionable spikes at 173ms and 181 ms	Amphenol connector ground pin cam loose
Driver Tibia Lower Left Y Force, Questionable spikes at 173ms and 181 ms	Amphenol connector ground pin cam loose
Driver Tibia Lower Left Z Force, Questionable spikes at 173ms and 181 ms	Amphenol connector ground pin cam loose
Passenger DGIR Upper Right X Displacement, Questionable spikes 22.7ms,73.3ms	Could be an internal grounding issue
Passenger Abdomen Left DGIR X Displacement, Questionable spikes at 21.6ms, 48.1ms and 73.4ms	Removed IRTRACC and clean inside to tubes to insure there was no loose debris

**PRELIMINARY INJURY SUMMARY: Driver**

Test Vehicle: R20155143 - 2015 Toyota Highlander NHTSA No.: R20155143  
 Test Program: NHTSA R&D Right Oblique Offset 15deg/35% Test Date: 9/21/2015

**Driver: THOR Serial No. 015 Injury Summary**

Location	Description	Unit	Source	Max	Min
<b>Head</b>	HIC 15ms		Compute	157.09	
	Brain Injury Criteria (BrIC)		Compute	1.22	
	Head Rotational Velocity X	Deg/s	60	2896.88	-923.70
	Head Rotational Velocity Y	Deg/s	60	805.13	-1375.95
	Head Rotational Velocity Z	Deg/s	60	1398.05	-2077.88
<b>Neck</b>	Upper Neck Z-axis Force	N	1000	2413.61	-493.81
	Upper Neck Y-axis Moment	Nm	Thortest	17.75	-26.13
<b>Chest</b>	Upper Left Resultant Chest Deflection	mm	Thortest	20.72	
	Upper Right Resultant Chest Deflection	mm	Thortest	50.51	
	Lower Left Resultant Chest Deflection	mm	Thortest	25.00	
	Lower Right Resultant Chest Deflection	mm	Thortest	34.64	
<b>Abdomen</b>	Lower Left X-axis Deflection	mm	Thortest	0.04	-65.47
	Lower Right X-axis Deflection	mm	Thortest	0.01	-57.66
<b>Acetabulum</b>	Left Acetabulum Resultant Force	N	Compute	3119.16	0.03
	Right Acetabulum Resultant Force	N	Compute	3404.47	0.06
<b>Femur</b>	Left Femur Force, FZ	N	600	607.39	-733.86
	Right Femur Force, FZ	N	600	268.46	-5054.28
<b>Tibia</b>	Left Upper Tibia, FZ	N	600	228.93	-984.22
	Left Upper Tibia Index		Compute	0.42	
	Right Upper Tibia, FZ	N	600	241.02	-1498.43
	Right Upper Tibia Index		Compute	0.54	
	Left Lower Tibia, FZ	N	600	230.76 <sup>(1)</sup>	-1203.02 <sup>(1)</sup>
	Left Lower Tibia Index		Compute	0.28 <sup>(1)</sup>	
	Right Lower Tibia, FZ	N	600	3718.86 <sup>(2)</sup>	-3802.14 <sup>(2)</sup>
	Right Lower Tibia Index		Compute	0.62 <sup>(2)</sup>	
<b>Ankle</b>	Left Ankle Rotation, RX	Deg	180	5.05	-22.36
	Left Ankle Rotation, RY	Deg	180	5.87	-12.16
	Left Ankle Dorsiflexion Moment, MY	Nm	Compute	62.62 <sup>(3)</sup>	-51.04 <sup>(3)</sup>
	Left Ankle In/Eversion Moment, MX	Nm	Compute	48.28 <sup>(4)</sup>	-194.48 <sup>(4)</sup>
	Right Ankle Rotation, RX	Deg	180	24.74	-19.20
	Right Ankle Rotation, RY	Deg	180	16.07	-8.42
	Right Ankle Dorsiflexion Moment, MY	Nm	Compute	43.87	-70.00
	Right Ankle In/Eversion Moment, MX	Nm	Compute	120.96	-20.59

**Anomalies:**

- (1) Questionable spikes at 173ms and 181 ms
- (2) Questionable spikes at 27.4ms, 49.3ms and 65.5ms
- (3) Tibia Lower Left X Force : Questionable spikes at 173ms and 181 ms
- (4) Tibia Lower Left Y Force : Questionable spikes at 173ms and 181 ms

**PRELIMINARY INJURY SUMMARY: Right Front Passenger**

Test Vehicle: R20155143-2015 Toyota Highlander NHTSA No.:R20155143  
 Test Program:NHTSA R&D Right Oblique Offset 15deg/35% Test Date:09/21/2015

**Right Front Passenger: THOR Serial No. 016 Injury Summary**

Location	Description	Unit	Source	Max	Min
<b>Head</b>	HIC 15ms		Compute	230.90	
	Brain Injury Criteria (BrIC)		Compute	0.92	
	Head Rotational Velocity X	Deg/s	60	165.29	-626.69
	Head Rotational Velocity Y	Deg/s	60	1032.00	-2588.06
	Head Rotational Velocity Z	Deg/s	60	1032.09	-721.89
<b>Neck</b>	Upper Neck Z-axis Force	N	1000	2139.61	-584.58
	Upper Neck Y-axis Moment	Nm	Thortest	20.80	-22.83
<b>Chest</b>	Upper Left Resultant Chest Deflection	mm	Thortest	48.98	
	Upper Right Resultant Chest Deflection	mm	Thortest	23.10 <sup>(5)</sup>	
	Lower Left Resultant Chest Deflection	mm	Thortest	43.02	
	Lower Right Resultant Chest Deflection	mm	Thortest	11.06 <sup>(6)</sup>	
<b>Abdomen</b>	Lower Left X-axis Deflection	mm	Thortest	1.03 <sup>(7)</sup>	-55.86 <sup>(7)</sup>
	Lower Right X-axis Deflection	mm	Thortest	0.08	-47.95
<b>Acetabulum</b>	Left Acetabulum Resultant Force	N	Compute	1805.23	0.06
	Right Acetabulum Resultant Force	N	Compute	3017.70	0.04
<b>Femur</b>	Left Femur Force, FZ	N	600	372.84	-3701.93
	Right Femur Force, FZ	N	600	781.77	-5276.51
<b>Tibia</b>	Left Upper Tibia, FZ	N	600	393.70	-1558.89
	Left Upper Tibia Index		Compute	0.50	
	Right Upper Tibia, FZ	N	600	247.51	-1193.47
	Right Upper Tibia Index		Compute	0.31	
	Left Lower Tibia, FZ	N	600	229.37	-2412.72
	Left Lower Tibia Index		Compute	0.63	
	Right Lower Tibia, FZ	N	600	86.48	-2156.19
	Right Lower Tibia Index		Compute	0.37	
<b>Ankle</b>	Left Ankle Rotation, RX	Deg	180	27.47	-4.23
	Left Ankle Rotation, RY	Deg	180	7.41	-21.52
	Left Ankle Dorsiflexion Moment, MY	Nm	Compute	71.49	-92.37
	Left Ankle In/Eversion Moment, MX	Nm	Compute	42.27	-48.22
	Right Ankle Rotation, RX	Deg	180	5.15	-10.55
	Right Ankle Rotation, RY	Deg	180	15.18	-12.34
	Right Ankle Dorsiflexion Moment, MY	Nm	Compute	37.26	-42.80
	Right Ankle In/Eversion Moment, MX	Nm	Compute	37.09	-6.49

**Anomalies:** (5) DGIR Upper Right X Displacement : Questionable spikes 22.7ms,73.3ms  
 (6) DGIR Lower Right X Displacement: Questionable spikes 20.5ms to 74.2ms  
 (7) Questionable spikes at 21.6ms, 48.1ms and 73.4ms

**SECTION 3  
DATA SHEETS**

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
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**DATA SHEET NO. 1  
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**VEHICLE INFORMATION**

NHTSA No.	R20155143
Model Year	2015
Make	Toyota
Model	Highlander
Body Style	SUV
VIN	5TDBKRFH5FS175984
Body Color	Red
Odometer Reading (km/mi)	259.1 km / 161 mi
Engine Displacement. (L)	3.5
Type/No. Cylinders	V6
Engine Placement	Transverse
Transmission Type	Auto
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	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Pass. Front Airbag	Yes
Pass. Curtain Airbag	Yes
Pass. Head/Torso Airbag	No
Pass. Torso Airbag	No
Pass. Torso/Pelvis Airbag	Yes
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	Toyota Motor Manufacturing, Indiana, INC.
Date of Manufacture	6/15

GVWR (kg)	2720
GAWR Front (kg)	1340
GAWR Rear (kg)	1585

**VEHICLE SEATING AND WEIGHT CAPACITY**

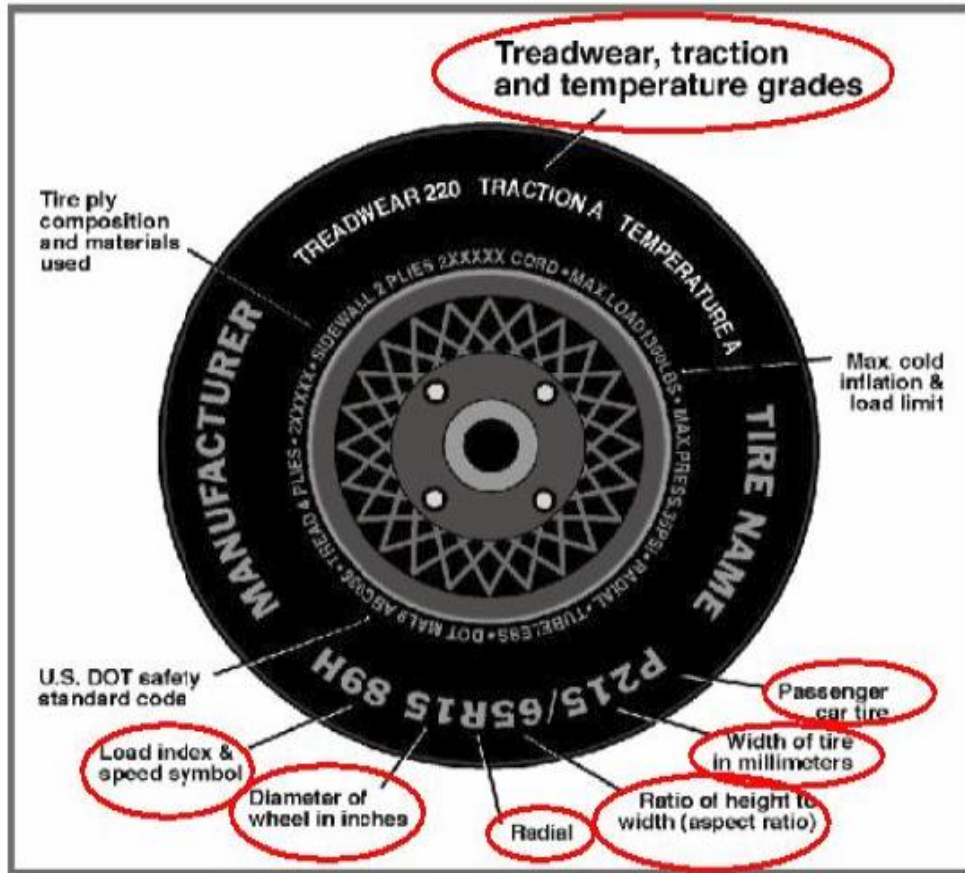
Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	Split Bench	
Number of Occupants	2	3	3	8
Capacity Wt. (VCW) (kg)				645
Cargo Wt. (RCLW) (kg)				100.68

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

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



Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	240	240
Recommended Tire Size	245/60R18	245/60R18
Tire Size on Vehicle	245/60R18	245/60R18
Tire Manufacturer	Michelin	Michelin
Tire Model	Latitude Tour	Latitude Tour
Treadwear	600	600
Traction	A	A
Temperature Grades	B	B
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Polyester, 1 Polyamide, 2 Steel	2 Polyester, 1 Polyamide, 2 Steel
Load Index/Speed Symbol	105T	105T
Tire Material	Rubber	Rubber
DOT Safety Code Right	AP4A 005X 2115	AP4A 005X 2115
DOT Safety Code Left	AP4A 005X 2115	AP4A 005X 2115

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**TEST VEHICLE WEIGHTS**

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	558	469		610	552	
Right	kg	545	455		588	567	
Ratio	%	54	46		51.7	48.3	
Totals	kg	1103	924	2027	1198	1119	2317

**TARGET TEST WEIGHT CALCULATION**

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2027
Weight of 2 THOR ATDs	kg	198
Rated Cargo/Luggage Weight (RCLW)	kg	100.68
Calculated Vehicle Target Weight (TVT <sub>W</sub> )	kg	2325.68

**TEST VEHICLE ATTITUDES AND CG**

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	908	909	904	903	1273
As Tested	mm	892	889	875	876	1349
Post Test	mm	852	791	936	821	

**GENERAL TEST VEHICLE DATA**

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	2,793
Total Vehicle Length at Left Side	mm	4,773
Total Vehicle Length at Centerline	mm	4,856
Total Vehicle Length at Right Side	mm	4,773
Weight of Ballast in Cargo Area	kg	30
Weight of Vehicle Components Removed	kg	76
Amount of Stoddard Solvent in Fuel Tank	L	67.4

**LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT:**

Trunk carpeting, jack, tail light, rear panels, and third row seats.

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**TARGET VEHICLE STRUCTURAL MEASUREMENT**

	Elements		Pre-Test
1	Total Length	mm	4856
2	Total Width	mm	1896
3*	Bumper Top Height	mm	640
4*	Bumper Bottom Height	mm	517
5*	Longitudinal Member Top Height	mm	638
6	Distance Between Longitudinal Members	mm	1109
7	Longitudinal Member Width	mm	90
8*	Engine Top Height	mm	990
9*	Engine Bottom Height	mm	274
10	Engine and Gearbox Width	mm	529
11	Front Bumper-Engine Distance	mm	509
12*	Front Shock Absorber Fixing Height	mm	1049
13*	Bonnet Leading Edge Height	mm	1014
14	Front Shock Absorber Fixing Width	mm	1228
15	Front Bumper – Front Axle Distance	mm	962
16	Front Axle – A Pillar Distance	mm	500
17	A-Pillar – B-Pillar Distance	mm	1117
18	B-Pillar – Rear Axle Distance	mm	1174
19	B-Pillar – C-Pillar Distance	mm	998
20*	Roof Sill Bottom Height	mm	1593
21*	Roof Sill Top Height	mm	1704
22*	Floor Sill Bottom Height	mm	452
23*	Floor Sill Top Height	mm	505

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

**DATA SHEET NO. 2**  
**SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL**

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

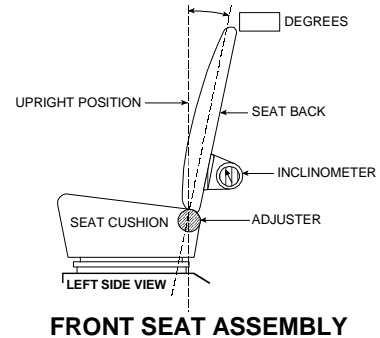
NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	3.0	5.9
Passenger Seat Back Angle	deg	3.0	5.6

**SEAT FORE/AFT POSITIONS**

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

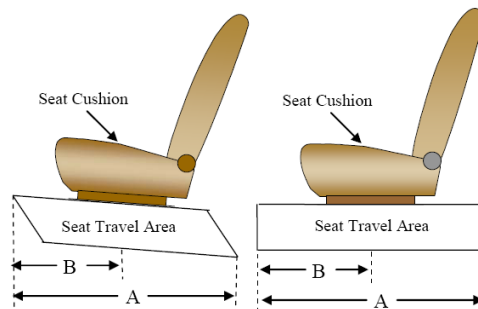
The driver's seat was positioned at its mid height position and at the mid-point of fore/aft travel. The passenger's seat was positioned at the mid-point of fore/aft travel.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	262	131
Passenger Seat	27 (0-26)	13

**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
Passenger Seat	4	0



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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

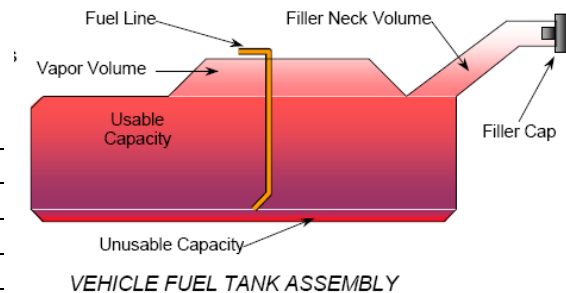
**FUEL TANK CAPACITY**

	<b>Liters</b>
Usable Capacity of "Standard Tank"	72.5
Usable Capacity of "Optional Tank"	
93% of Usable Capacity	67.4
Actual Amount of Solvent Used	67.4
1/3 of Usable Capacity	24.1

**FUEL PUMP**

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

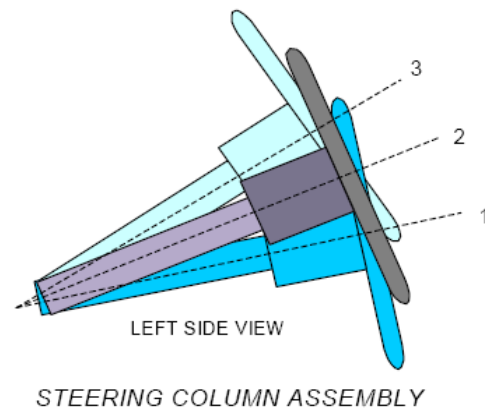
Fuel evacuated according to the specifications provided by the manufacturer in Form 1. Electric fuel pump operates when the ignition is in the 'on' position and the engine is running. The fuel filler neck is located above the right rear wheel.



**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



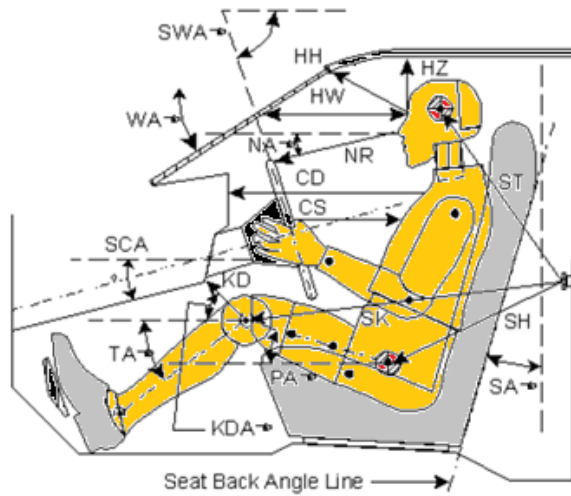
**STEERING COLUMN POSITIONS**

	<b>Tilt (degrees)</b>	<b>Fore/Aft Position (mm)</b>
Lowermost position No. 1	24.2	
Geometric center position No. 2	26.1	
Uppermost position No. 3	28.0	
Telescoping Steering Wheel Travel		40
Test Position	26.1	20

**DATA SHEET NO. 3**  
**DUMMY LONGITUDINAL CLEARANCE DIMENSIONS**

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

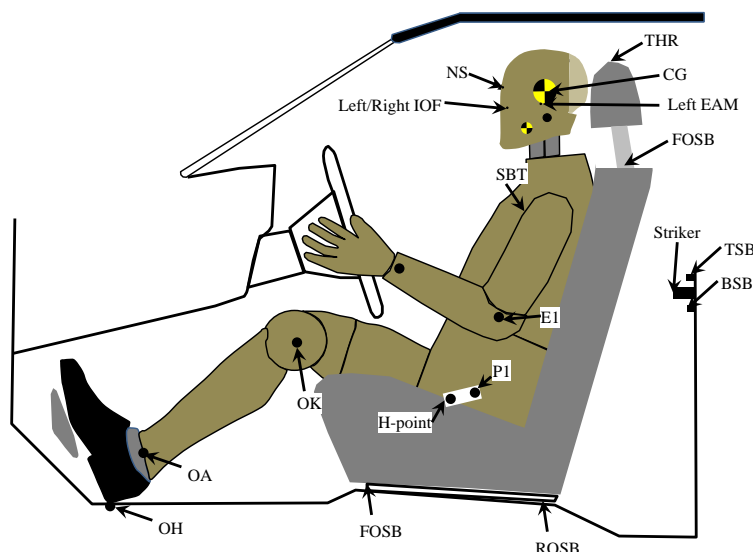


Code	Measurement Description	Driver (Serial # THOR 015)		Passenger (Serial # THOR 016)	
		Length (mm)	Angle(°)	Length (mm)	Angle (°)
WA°	Windshield Angle		31.4		
SWA°	Steering Wheel Angle		26.7		
SCA°	Steering Column Angle		63.3		
SA°	Seat Back Angle (on headrest post)		5.9		5.6
SA°	Seat Back Angle		20.2		19.5
HZ	Head to Roof (Z)	241	90	216	90
HH	Head to Header	460	19.9	440	18.2
HW	Head to Windshield	704	0	684	0
NR	Nose to Rim	508	16.1	689	29.6
CD	Chest to Dash	597		575	
CS	Chest to Steering Hub	385	0		
RA	Rim to Abdomen	204	0		
KDL	Left Knee to Dash	125	18.9	92	33.5
KDR	Right Knee to Dash	123	22.8	101	30.5
PA°	Pelvic Angle		31.6		33.2
TA°	Tibia Angle		46.3		46.4
SK	Striker to Knee	636	-5.1	681	-5.4
ST	Striker to Head	474	-84.8	498	-83.9
SH	Striker to H-Point	304	-37.0	304	-32.0
HAX°	Head Angle (X)		0.2		-0.5
HAY°	Head Angle (Y)		-3.1		-3.3
TAX°	T6 Angle (X)		-1.1		1.1
TAY°	T6 Angle (Y)		21.2		22.5
TAX°	T1 (X)		-0.6		1.6
TAY°	T1 (Y)		0.4		2.5
TAX°	T12 (X)		0.3		-0.3
TAY°	T12 (Y)		29.0		31.7

### DATA SHEET NO.3 (CONTINUED) DUMMY CMM MEASUREMENTS

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



Description	Units	Driver			Passenger		
		X	Y	Z	X	Y	Z
Head CG	mm	2411	-476	-782	2421	477	-802
Nasion	mm	2508	-400	-784	2518	403	-803
Tip of Nose	mm	2507	-400	-748	2518	400	-768
Tip of Chin	mm	2495	-400	-650	2505	400	-667
Left EAM	mm	2417	-472	-753	2433	326	-769
Right EAM	mm	2419	-326	-752	2426	474	-773
Left IOF	mm	2502	-431	-747	2515	371	-765
Right IOF	mm	2502	-368	-747	2512	436	-766
Outboard Elbow	mm	2631	-619	-352	2558	666	-268
H-Point	mm	2611	-594	-127	2626	601	-146
H-Point Tool	mm	2537	-641	-160	2552	649	-180
Outboard Knee Bolt	mm	3002	-621	-254	3046	564	-243
Inboard Knee Bolt	mm	3023	-303	-226	3049	338	-233
Outboard Ankle Bolt	mm	3293	-625	51	3328	545	61
Outer Heel Point	mm	3298	-596	191	3315	511	194
Inboard Heel Point	mm	3344	-221	188	3316	269	192
Striker Top Bolt	mm	2,335	-837	-330	2,335	836	-328
Striker Bottom Bolt	mm	2,336	-838	-289	2,336	837	-288
Center Tip of Striker	mm	2368	-838	-310	2368	835	-307
Front Outboard Seat Anchor Bolt	mm	2,853	-600	152	2,852	599	152
Rear Outboard Seat Anchor Bolt	mm	2,337	-636	165	2,339	638	164
Outboard Head Restraint Post	mm	2217	-484	-647	2226	482	-670
Top of Head Restraint	mm	2286	-400	-892	2298	400	-911
Center of Steering Wheel	mm	2913	-397	-500			

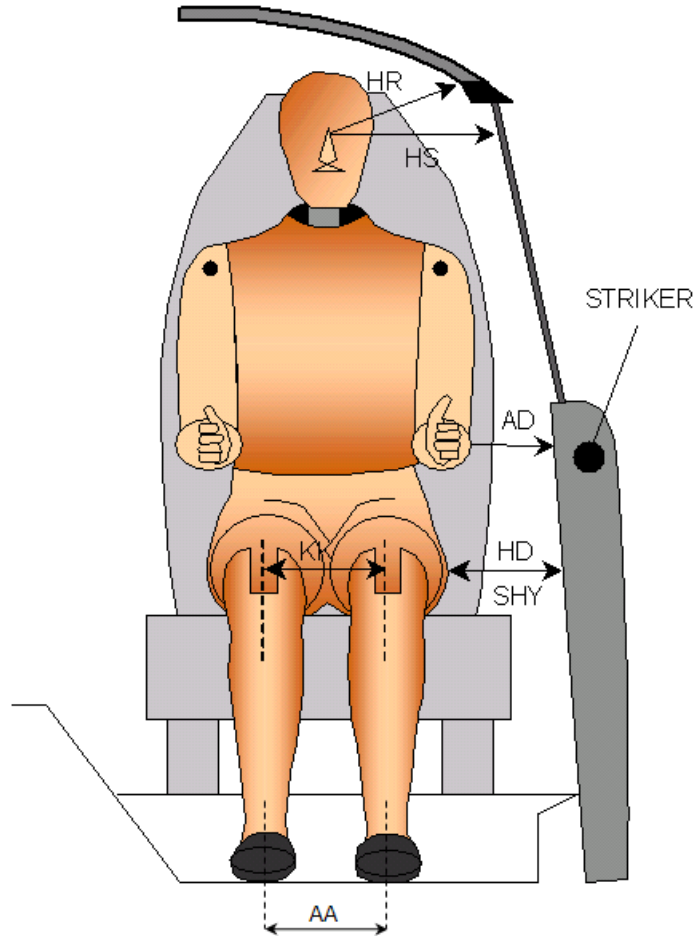
Reference point:

- +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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

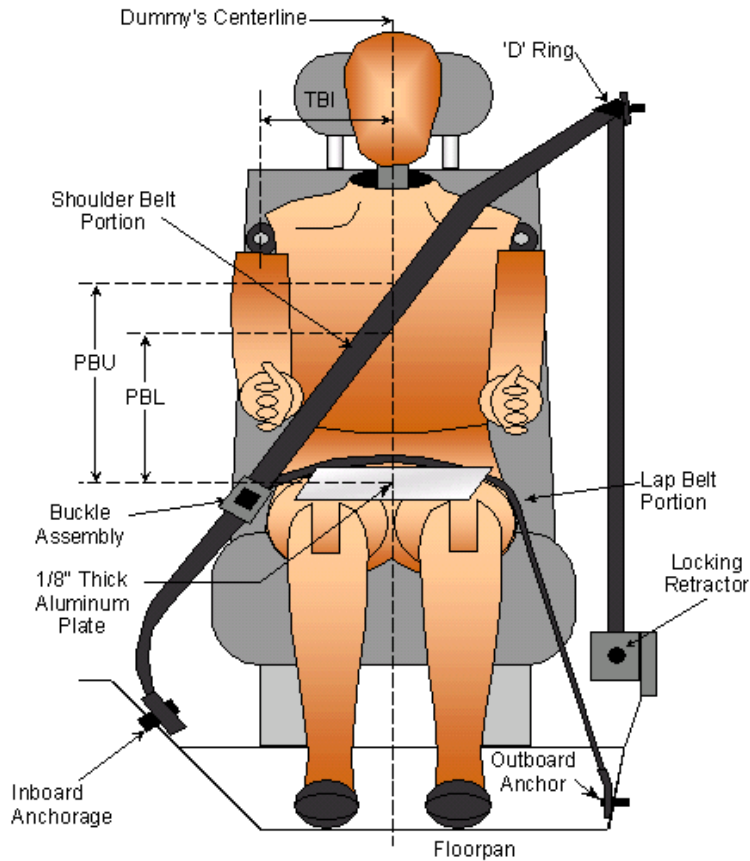


Code	Description	Units	Driver	Passenger
AD	Arm to Door	mm	146	48
HD	H-Point to Door	mm	134	122
HR	Head to Side Header	mm	238	214
HS	Head to Side Window	mm	358	334
KK	Knee to Knee	mm	375	270
SHY	Striker to H-Point (Y Direction)	mm	240	240
AA	Ankle to Ankle	mm	375	240

**DATA SHEET NO. 5  
SEAT BELT POSITIONING DATA**

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



**SEAT BELT POSITIONING MEASUREMENTS**

Measurement Description	Units	Driver	Passenger
<b>PBU</b> — Top surface of reference to belt upper edge	mm	380	360
<b>PBL</b> — Top surface of reference to belt lower edge	mm	305	285

**BELT LENGTH DATA**

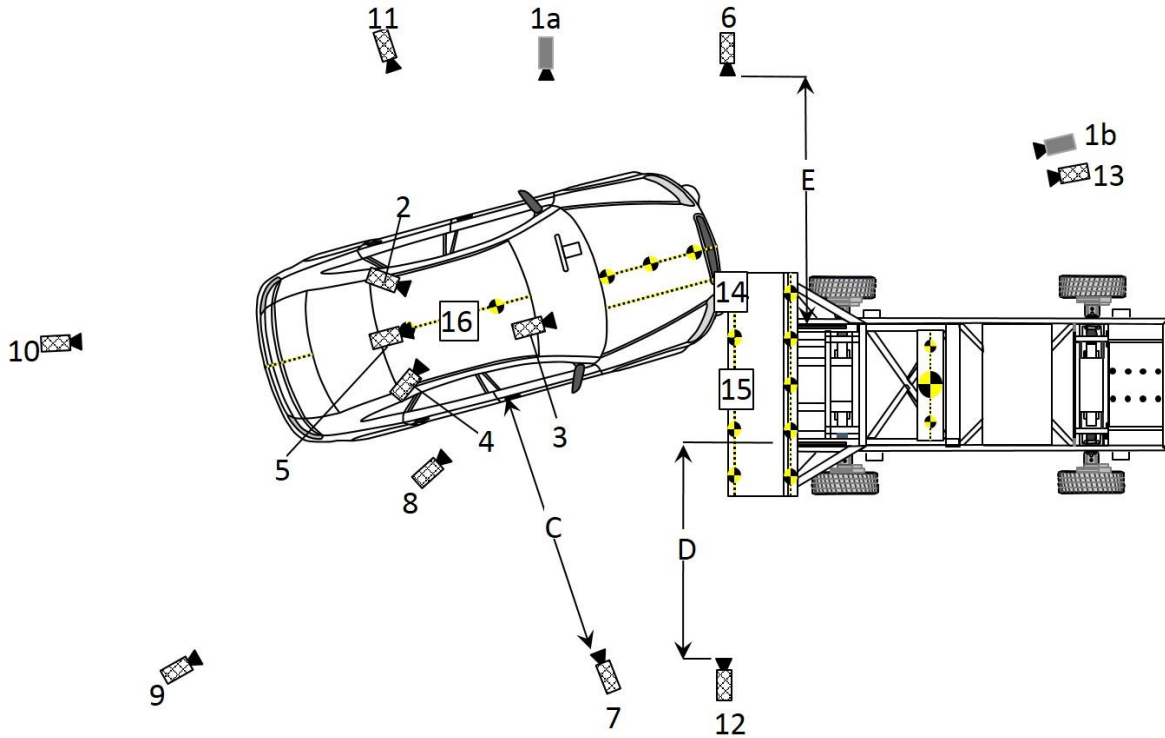
Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	855	875
Lap Belt Length as measured on ATD	mm	955	985
Remainder of belt on reel	mm	790	740
Total belt length for continuous webbing systems	mm	2600	2600

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

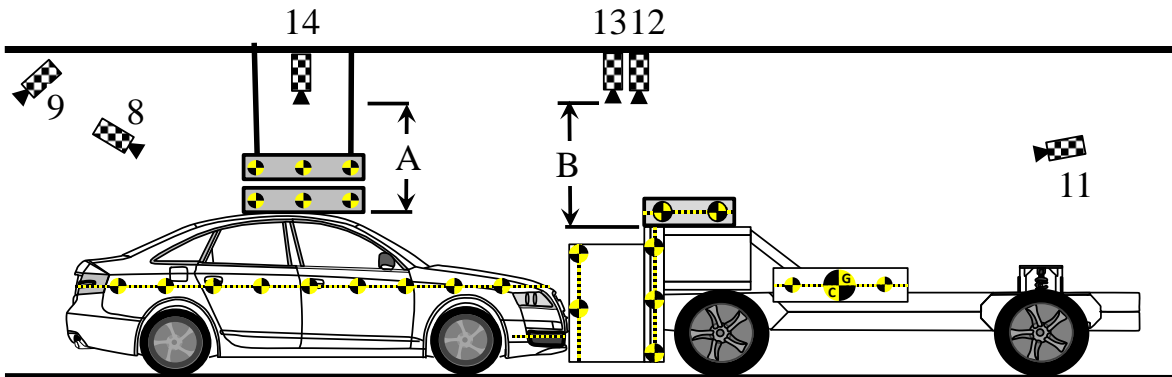
Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**HORIZONTAL LOCATION**



**VERTICAL LOCATION**



A	mm	3655
B	mm	4123
C	mm	7878
D	mm	8162
E	mm	8164

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	7690	982	1454	12.5	1000
3	Onboard Passenger Lower Leg	6847	525	477	6.5	1000
4	Onboard Driver Movement	7622	447	1454	12.5	1000
5	Onboard Centerline	7811	657	1402	8	1000
6	Passenger Interaction	4920	9211	1068	20	1000
7	Driver Interaction	5539	-7725	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	974	3539	1290	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

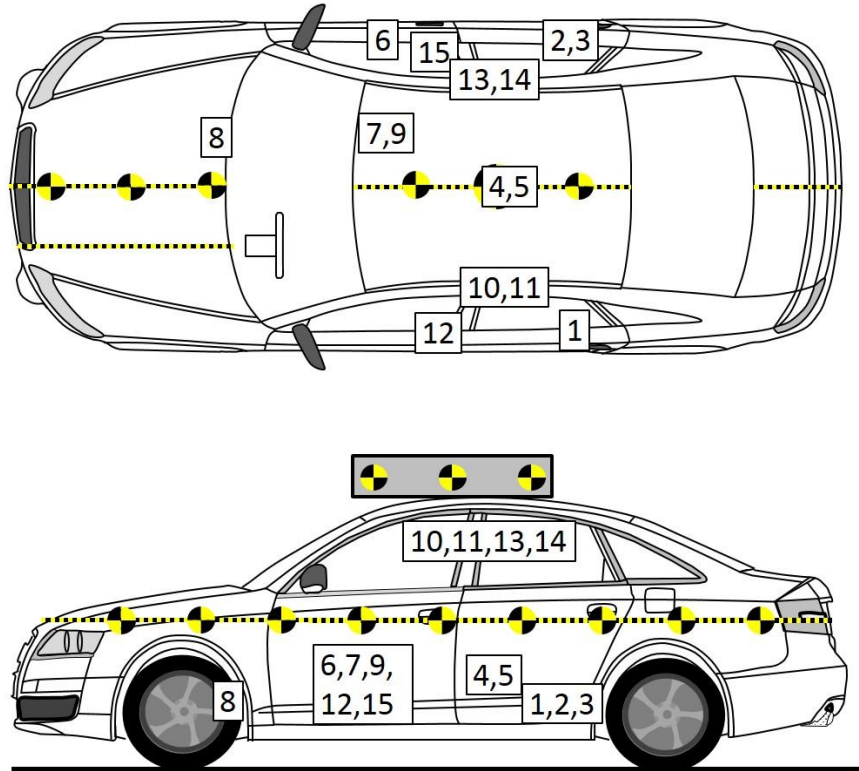
Reference Point:

- +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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



**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	1916	-749	151
2	Right Rear Sill	X,Y	mm	1931	749	151
3	Right Rear Sill Redundant	X,Y	mm	1927	749	152
4	Vehicle CG	X,Y,Z	mm	2169	2	176
5	Vehicle CG Angular Displacement	X	mm	2,180	3	182
		Y	mm	2,168	13	180
		Z	mm	2,169	2	176
6	Right Side Seat Track	X,Y,Z	mm	2536	596	111
8	Right Side Toe Pan	X,Y,Z	mm	3652	395	8
7	Right Side String Pot	N/A	mm	3652	396	3

Reference point:

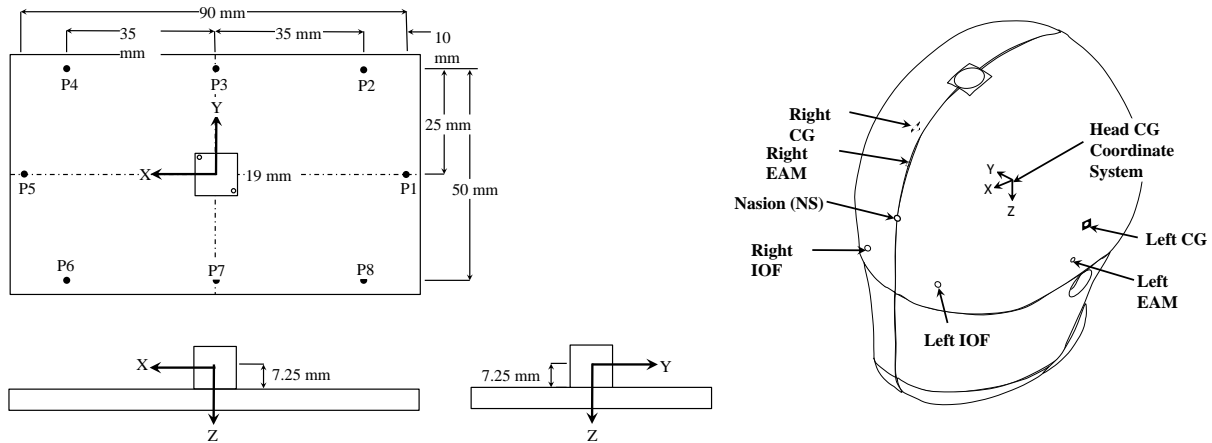
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**ANGULAR RATE SENSOR MOUNTING PLATE & THOR HEAT POINT DEFINITIONS**



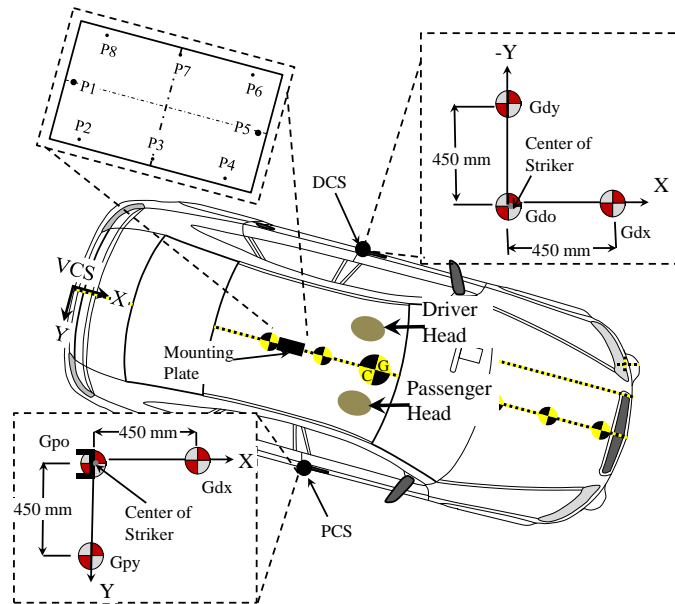
ARS MOUNTING PLATE - VEHICLE COORDINATE SYSTEM					
No.	Description	Units	Measurements (mm)		
			X	Y	Z
P1	Plate Point 1	mm	2,123	2	190
P2	Plate Point 2	mm	2,133	27	191
P3	Plate Point 3	mm	2,169	27	191
P4	Plate Point 4	mm	2,204	27	191
P5	Plate Point 5	mm	2,214	2	190
P6	Plate Point 6	mm	2,204	-23	190
P7	Plate Point 7	mm	2,169	-23	190
P8	Plate Point 8	mm	2,134	-24	190

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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



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

DESCRIPTION	DRIVER DCS			PASS. PCS		
	X	Y	Z	X	Y	Z
Go	0	0	0	0	0	0
Gx	450	0	2	-451	0	1
Gy	-4	-448	7	2	-445	-4
P1	17	849	-413	418	758	-414
P2	33	870	-412	402	737	-413
P3	68	861	-412	368	746	-414
P4	101	852	-412	334	755	-413
P5	104	825	-413	331	782	-414
P6	89	803	-413	346	803	-415
P7	54	813	-414	380	794	-415
P8	21	822	-414	414	786	-415
Left CG	167	311	-1385			
Right CG				8	375	-1406
Left EAM	174	314	-1356			
Right EAM				3	380	-1377
Left IOF	267	330	-1350	-55	502	-1369
Right IOF	284	392	-1350	-69	439	-1370
Nasion	281	359	-1388	-67	472	-1407

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

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

No.	Description	Axes	Units	Positive Direction		Negative Direction	
				Max	Time (ms)	Max	Time (ms)
1	Left Rear Sill	X	g	1.73	145.00	-39.00	42.25
		Y	g	2.85	6.90	-19.66	45.10
2	Right Rear Sill	X	g	1.15	149.95	-40.47	44.00
		Y	g	2.08	7.15	-18.45	46.15
3	Impact Side Rear Sill Redundant	X	g	1.26	141.60	-40.61	44.00
		Y	g	2.19	7.10	-18.90	46.35
4	Vehicle CG Acceleration	X	g	1.97	141.15	-52.30	44.20
		Y	g	2.44	123.70	-30.48	45.60
		Z	g	25.09	53.10	-18.69	81.75
5	Impact Side Seat Track	X	g	6.09	36.05	-69.06	41.25
		Y	g	10.07	27.75	-33.28	44.25
		Z	g	25.71	51.10	-11.96	70.00
6	Impact Side Seat Crossmember	X	g	41.20	20.15	-62.51	42.15
		Z	g	200.99	20.50	-176.36	24.90
7	Impact Side ToePan	X	g	32.80	41.35	-174.98	37.05
		Y	g	72.93	37.15	-41.47	42.95
		Z	g	72.76	37.10	-17.89	24.45
8	Angular Rate Sensors	X	Deg/s	151.37	56.45	-148.73	48.40
		Y	Deg/s	734.75	47.20	-252.31	62.25
		Z	Deg/s	12.43	25.65	-107.73	300.00
9	Driver Shoulder Displacement		mm	131.38	24.10	-1.43	6.80
10	Driver Shoulder Belt		N	4849.72	54.80	-32.36	6.10
11	Driver Lap Belt		N	6508.27	63.55	-1.37	-50.00
12	Passenger Shoulder Displacement		mm	84.79	23.55	-0.98	7.25
13	Passenger Shoulder Belt		N	5620.05	67.10	-15.49	6.10
14	Passenger Lap Belt		N	3510.82	56.75	-175.01	98.55
15	Impact Side Floor String Pot		mm	0.05	-0.10	-40.80	71.00

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	16.85
2	Driver Air Bag Squib 2	*	A	26.85
3	Driver Curtain Airbag	*	A	16.85
4	Driver Torso Airbag	*	A	16.85
5	Driver Knee Airbag	*	A	16.85
6	Driver Pretensioner	*	A	6.85
7	Passenger Air Bag Squib 1	*	A	16.85
8	Passenger Air Bag Squib 2	*	A	26.85
9	Passenger Curtain Airbag	*	A	16.85
10	Passenger Torso Airbag	*	A	16.85
11	Passenger Knee Airbag	*	A	N/A
12	Passenger Pretensioner	*	A	6.85

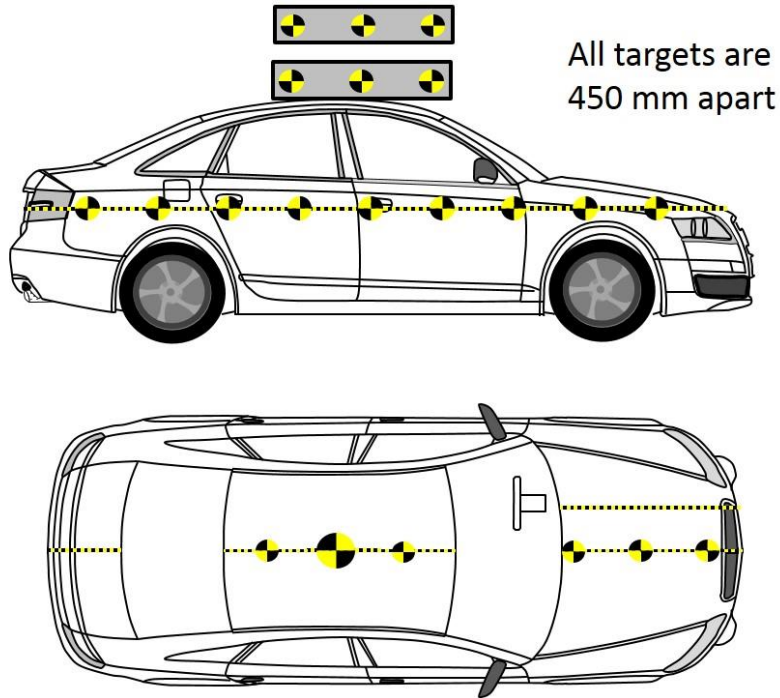
\* The measurement indicates the time the voltage changed

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

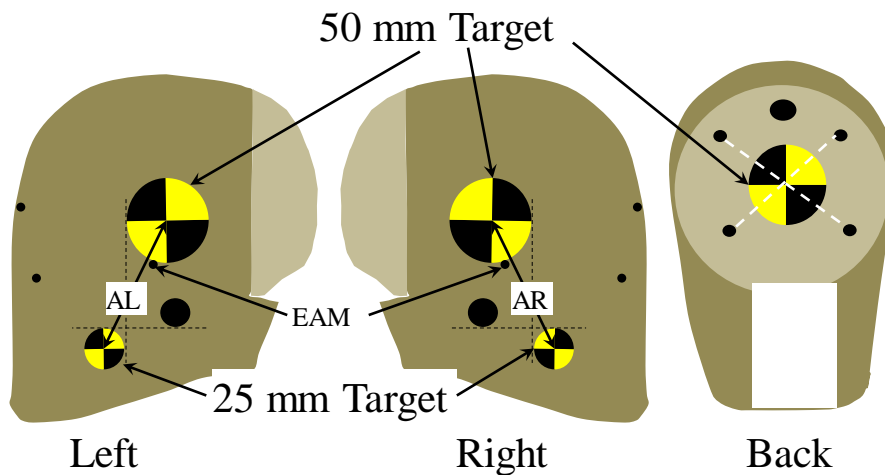
Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**VEHICLE TARGETS**



**ATD HEAD TARGETS**



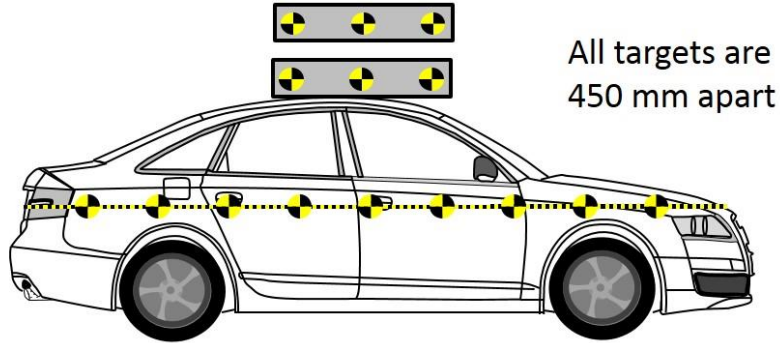
Target	Measurement
AL	85 mm
AR	85 mm

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

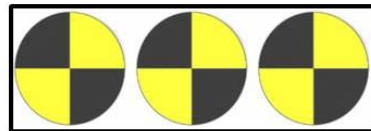
NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	2817	-403	-1450
2	mm	2366	-400	-1454
3	mm	1914	-396	-1462
4	mm	2824	408	-1455
5	mm	2372	411	-1455
6	mm	1917	419	-1452

Reference point:

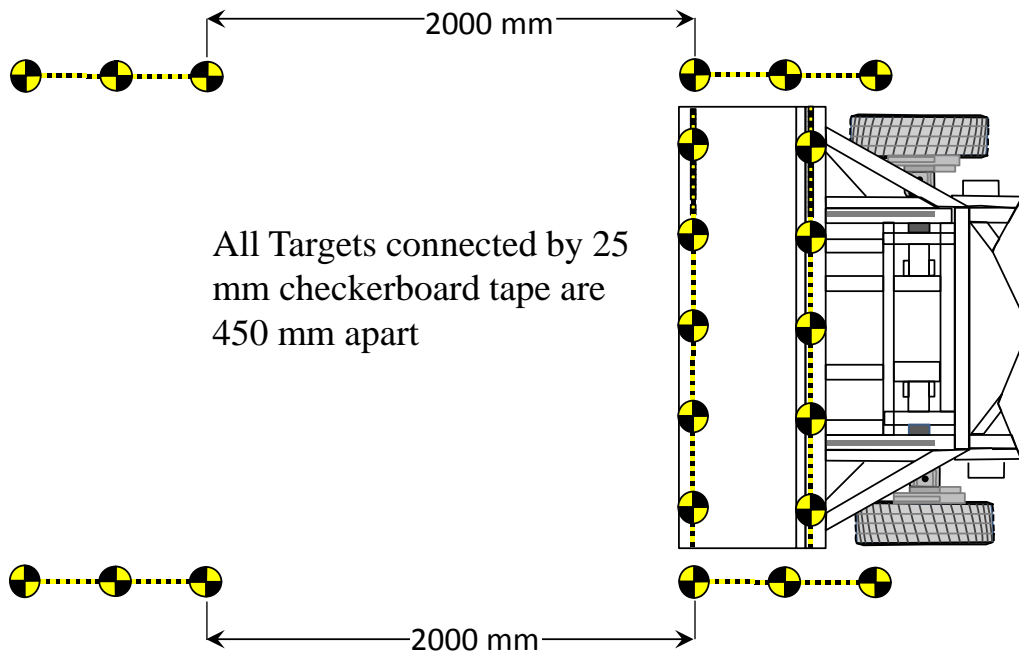
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

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

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

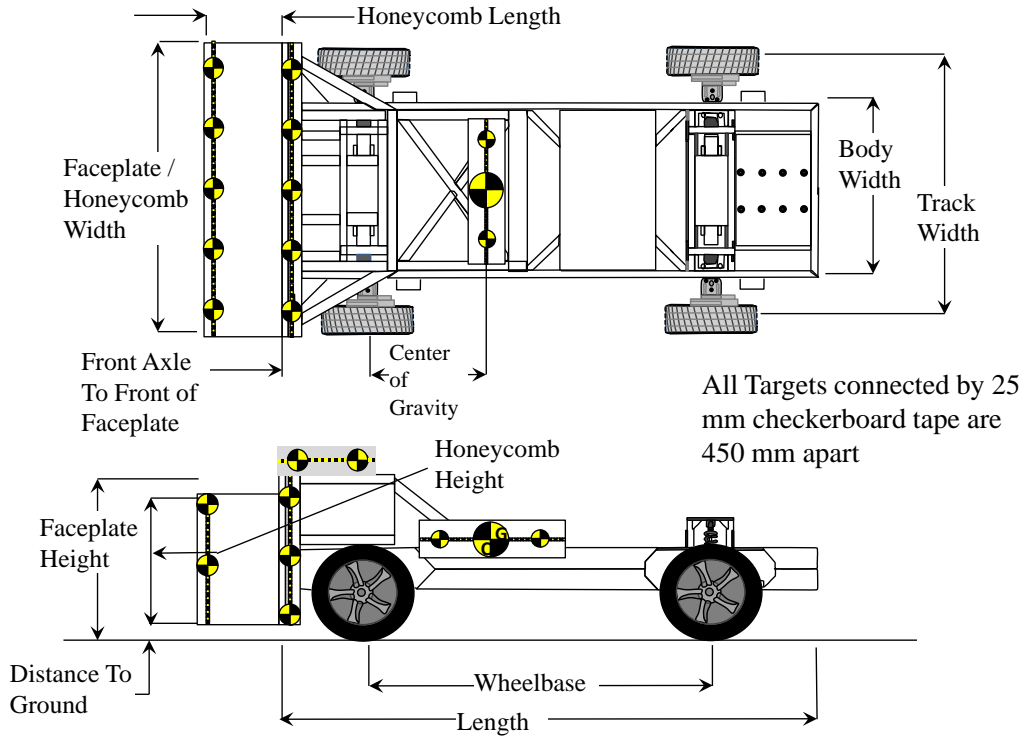
**GROUND TARGETS LOCATED IN REFERENCE TO OMDB**



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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



Item	Units	Value	Item	Units	Value
Honeycomb Width	mm	2205	Faceplate Height	mm	1190
Honeycomb Length	mm	605	Faceplate to Ground	mm	88
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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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
<b>Total</b>	<b>258</b>

**CAMERA COVERAGE**

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

**DATA SHEET NO. 10  
POST TEST OBSERVATIONS**

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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 Shoulder	Front & Curtain Airbag, Side Headliner
Upper Torso Contact	Front Airbag	Shoulder contact with Front & Curtain Airbag
Lower Torso Contact	None	Side Door, Torso Pelvis Airbag
Left Knee Contact	Knee Bolster & Knee Airbag	Glove Box
Right Knee Contact	Knee Bolster & Knee Airbag	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	Remained in Good Condition	Y
Windshield Damage	Cracks throughout with Minor Separation	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	Yes
Knee Airbag	Yes	Yes	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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	4856	4540	316
2	Rear Surface of Vehicle (RSOV) to Front of Engine	mm	4347	4114	233
3	RSOV to Firewall	mm	3914	3835	79
4	RSOV to Upper Leading Edge of Right Door	mm	3389	3372	17
5	RSOV to Upper Leading Edge of Left Door	mm	3389	3383	6
6	RSOV to Lower Leading Edge of Right Door	mm	3328	3310	18
7	RSOV to Lower Leading Edge of Left Door	mm	3326	3323	3
8	RSOV to Upper Trailing Edge of Right Door	mm	2284	2267	17
9	RSOV to Upper Trailing Edge of Left Door	mm	2284	2278	6
10	RSOV to Lower Trailing Edge of Right Door	mm	2300	2289	12
11	RSOV to Lower Trailing Edge of Left Door	mm	2301	2297	4
12	RSOV to Bottom of "A" Post of Right Side	mm	3451	3441	10
13	RSOV to Bottom of "A" Post of Left Side	mm	3452	3447	5
14	RSOV to Firewall, Right Side	mm	3951	3745	207
15	RSOV to Firewall, Left Side	mm	3954	3944	11
16	RSOV to Steering Column	mm	2925	2940	-15
17	Center of Steering Column to "A" Post	mm	289	269	21
18	Center of Steering Column to Headliner	mm	426	436	-10
19	RSOV to Right Side of Front Bumper	mm	4810	4222	588
20	RSOV to Left Side of Front Bumper	mm	4810	4765	45
21	Length of Engine Block	mm	461	388	73
RD	RSOV to Right Side of Dash Panel	mm	3142	3123	19
CD	RSOV to Center of Dash Panel	mm	3111	3105	6
LD	RSOV to Left Side of Dash Panel	mm	3128	3128	-1

UR\* = Unrecoverable Data Point

**DATA SHEET NO. 12**  
**ACCIDENT INVESTIGATION DIVISION DATA**

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

**VEHICLE INFORMATION**

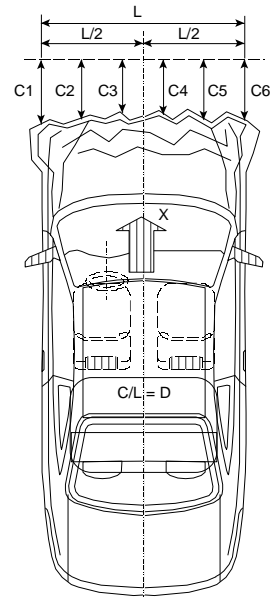
VIN: 5TDBKRFH5FS175984 Wheelbase (mm): 2,793  
Vehicle Size Category: Passenger Test Weight (kg): 2,317

**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): 90.33  
Velocity Change (kph): 90.33

**CRUSH PROFILE**

Collision Deformation Classification: 12FZEW3  
Midpoint of Damage: C5  
Damage Region Length (mm): 1485  
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	4675	4766	-91
C2	Crush zone 2 at left side	mm	4812	4725	87
C3	Crush zone 3 at left side	mm	4843	4594	249
C4	Crush zone 4 at right side	mm	4841	4439	402
C5	Crush zone 5 at right side	mm	4805	4273	532
C6	Crush zone 6 at right side	mm	4648	4110	538
L	C1 to C6	mm	1485	1355	130

**Crush Measurements: Bumper Cover Removed**

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
B1	Bumper Beam 1 at left side	mm	4699	4737	38
B2	Bumper Beam 2 at left side	mm	4732	4696	-36
B3	Bumper Beam 3 at left side	mm	4755	4645	-110
B4	Bumper Beam 4 at left side	mm	4771	4589	-182
B5	Bumper Beam 5 at right side	mm	4775	4522	-253
B6	Bumper Beam 6 at right side	mm	4774	4450	-324
B7	Bumper Beam 7 at right side	mm	4760	4369	-391
B8	Bumper Beam 8 at right side	mm	4731	4299	-432
B9	Bumper Beam 9 at right side	mm	4699	4222	-477
L	B1 to B9	mm	1190	1056	-134

**DATA SHEET NO. 13**  
**VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

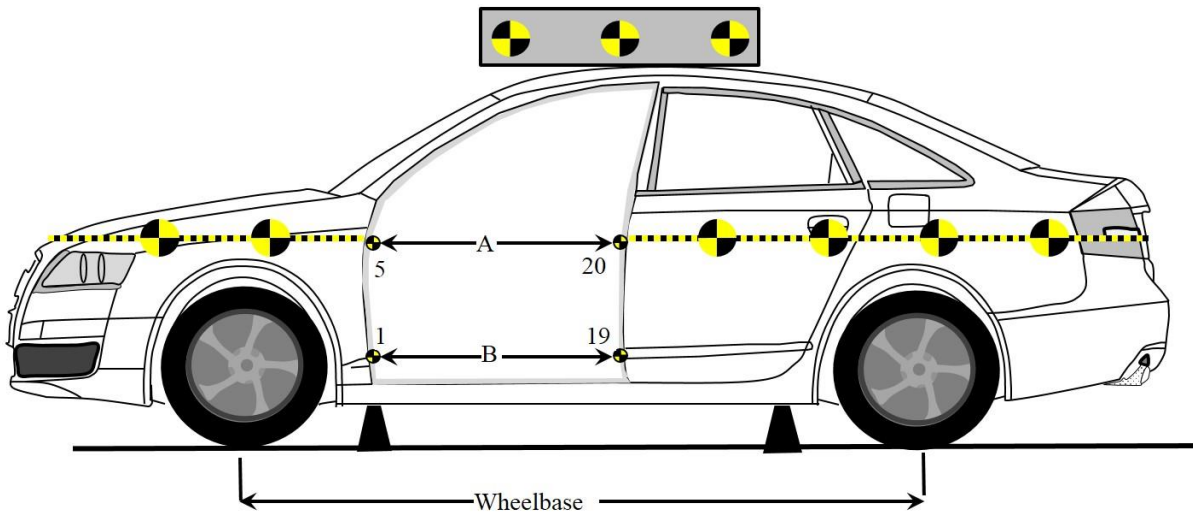
NHTSA No.: R20155143  
Test Date: 09/21/2015

**DOOR OPENING WIDTH**

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	884	887	3
B	Left Side Lower	mm	799	800	1
D	Right Side Upper	mm	885	881	-4
E	Right Side Lower	mm	800	799	-1

**WHEELBASE MEASUREMENTS**

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2793	2819	26
F	Right Side Wheelbase	mm	2793	2580	-213



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

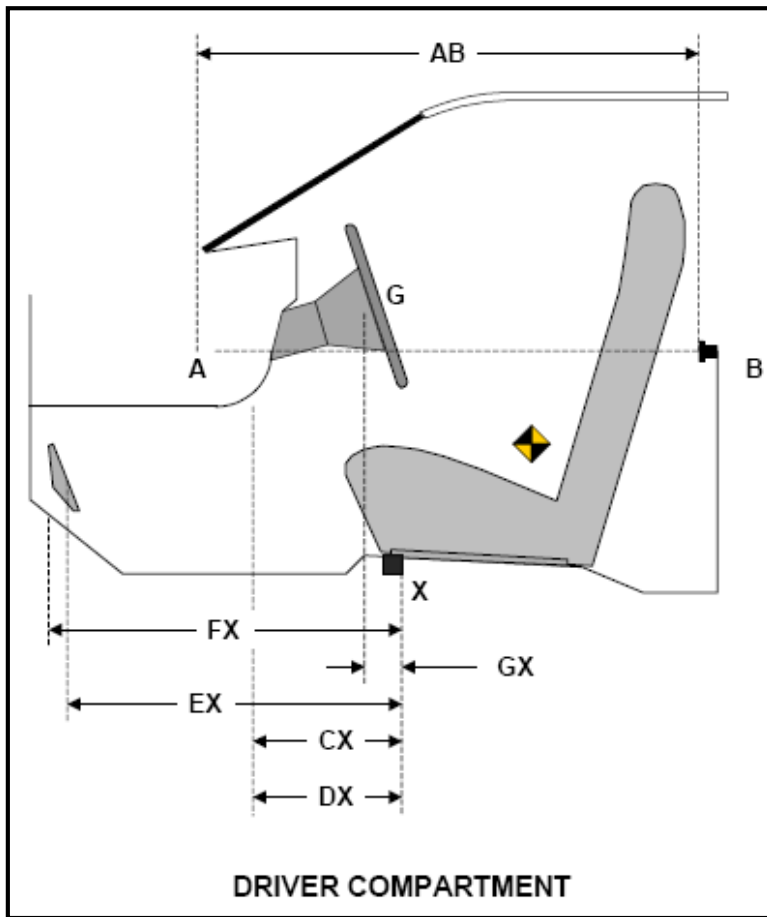
Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**DRIVER COMPARTMENT INTRUSION**

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	839	839	0
CX	Left Knee Bolster to X	mm	263	276	13
DX	Right Knee Bolster to X	mm	263	269	6
EX	Brake Pedal to X	mm	579	564	-15
FX	Foot Rest to X	mm	649	645	-4
GX	Center of Steering Column Wheel Hub to X	mm	60	79	19

*X = Front of Seat Track (Stationary)*

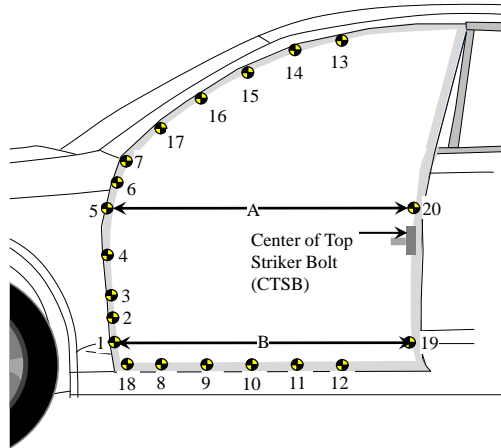


**DATA SHEET NO.13 (CONTINUED)  
VEHICLE INTRUSION MEASUREMENTS**

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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

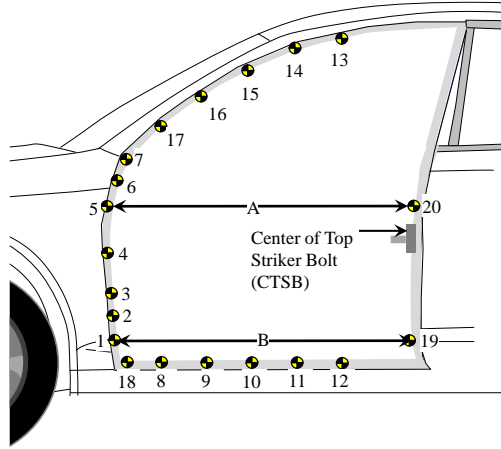
Point	Pre-Test			Post-Test			Difference		
	X	Y	Z	X	Y	Z	X	Y	Z
1	3278	-773	4	3276	-789	2	-2	-16	-2
2	3278	-777	-68	3276	-792	-71	-2	-15	-3
3	3279	-778	-144	3277	-790	-147	-2	-12	-3
4	3272	-777	-294	3270	-788	-297	-2	-11	-3
5	3264	-773	-445	3263	-782	-448	-1	-9	-3
6	3260	-764	-519	3258	-774	-522	-2	-10	-3
7	3250	-750	-594	3247	-761	-597	-3	-11	-3
17	3165	-726	-696	3164	-732	-698	-1	-6	-2
16	3049	-703	-765	3048	-708	-767	-1	-5	-2
15	2931	-678	-829	2930	-682	-831	-1	-4	-2
14	2808	-659	-882	2807	-662	-884	-1	-3	-2
13	2678	-645	-916	2677	-648	-918	-1	-3	-2
20	2380	-779	-445	2376	-783	-445	-4	-4	0
19	2480	-775	5	2476	-783	6	-4	-8	1
12	2530	-767	83	2527	-776	82	-3	-9	-1
11	2678	-762	141	2676	-773	140	-2	-11	-1
10	2828	-762	142	2825	-775	140	-3	-13	-2
9	2980	-762	142	2977	-776	140	-3	-14	-2
8	3127	-761	142	3125	-778	140	-2	-17	-2
18	3233	-764	104	3230	-781	101	-3	-17	-3

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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

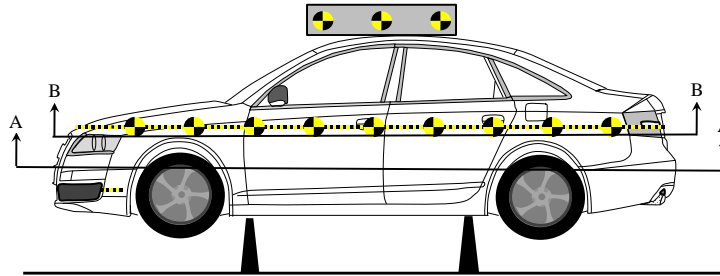
Point	Pre-Test			Post-Test			Difference		
	X	Y	Z	X	Y	Z	X	Y	Z
1	3276	774	7	3273	762	-2	-3	-12	-9
2	3276	777	-70	3273	770	-79	-3	-7	-9
3	3277	777	-144	3273	773	-153	-4	-4	-9
4	3269	777	-295	3265	777	-306	-4	0	-11
5	3262	773	-444	3258	774	-453	-4	1	-9
6	3258	763	-519	3255	766	-528	-3	3	-9
7	3247	749	-595	3245	752	-605	-2	3	-10
17	3170	724	-688	3171	726	-701	1	2	-13
16	3050	702	-759	3052	701	-772	2	-1	-13
15	2931	679	-824	2935	679	-836	4	0	-12
14	2808	658	-880	2811	658	-889	3	0	-9
13	2676	643	-914	2678	643	-921	2	0	-7
20	2377	775	-443	2377	773	-445	0	-2	-2
19	2476	772	7	2475	764	6	-1	-8	-1
12	2527	763	84	2526	754	83	-1	-9	-1
11	2677	760	143	2676	749	141	-1	-11	-2
10	2827	761	143	2825	748	139	-2	-13	-4
9	2977	762	144	2976	745	139	-1	-17	-5
8	3129	760	145	3125	743	138	-4	-17	-7
18	3230	766	106	3231	749	95	1	-17	-11

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	2295	-922	68	1	2294	-925	69
2	2393	-923	68	2	2482	-928	68
3	2671	-926	69	3	2756	-933	69
4	2915	-930	69	4	2956	-936	68
5	3143	-932	68	5	3054	-937	68
6	3359	-939	68	6	3146	-937	68
7	3435	-940	69	7	3360	-945	68
8	3487	-953	69	8	3410	-948	68
9	4294	-929	68	9	3490	-964	68
10	4340	-921	69	10	3740	-955	69
11	4405	-907	69	11	3919	-937	69
12	4505	-873	69	12	4093	-924	69
13	4618	-791	69	13	4199	-929	69
14	4712	-671	68	14	4257	-900	68
15	4770	-577	69	15	4279	-771	69
16	4803	-439	68	16	4310	-557	68
17	4825	-286	68	17	4402	-552	68
18	4837	-129	69	18	4532	-553	68
19	4840	-16	69	19	4551	-645	69
20	4843	1	68	20	4595	-724	68
21	4839	146	68	21	4617	-738	68
22	4825	317	69	22	4664	-684	68
23	4804	459	68	23	4759	-626	68
24	4776	569	68	24	4735	-558	69
25	4706	684	69	25	4705	-439	69

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**VEHICLE EXTERIOR CRUSH PROFILE  
SECTION A-A (Continued)**

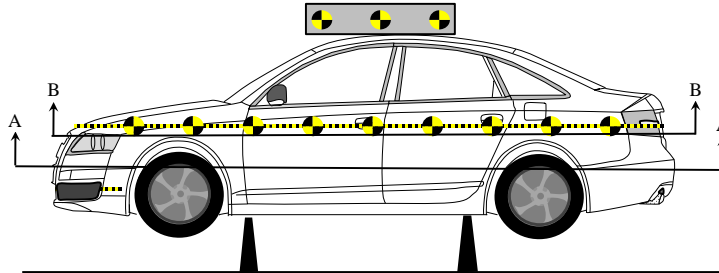
Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
26	4611	801	68	26	4681	-389	68
27	4512	871	68	27	4498	-203	69
28	4392	911	68	28	4426	-82	68
29	4290	928	68	29	4359	19	69
30	3531	953	-68	30	4229	214	68
31	3456	952	-69	31	4118	451	52
32	3396	951	-69	32	4086	614	68
33	3215	939	-68	33	4110	746	67
34	2944	937	-68	34	4089	800	67
35	2599	935	-69	35	3959	810	69
36	2297	930	-68	36	3861	791	69
				37	3740	818	69
				38	3572	844	69
				39	3468	869	68
				40	3422	922	68
				41	3410	946	67
				42	3364	941	69
				43	3352	935	68
				44	3209	929	68
				45	3037	926	69
				46	2977	925	68
				47	2760	922	69
				48	2536	920	69
				49	2288	918	68

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	2300	-948	-372	1	2298	-948	-372
2	2390	-949	-372	2	2452	-945	-373
3	2530	-950	-372	3	2656	-949	-373
4	2698	-948	-372	4	2879	-945	-372
5	2886	-943	-372	5	2999	-940	-373
6	3120	-933	-372	6	3210	-930	-372
7	3342	-921	-372	7	3384	-922	-372
8	3555	-924	-373	8	3563	-926	-372
9	3771	-930	-373	9	3827	-929	-372
10	3898	-922	-373	10	4082	-890	-372
11	4058	-895	-373	11	4203	-846	-372
12	4172	-860	-372	12	4237	-751	-372
13	4240	-860	-372	13	4477	-560	-372
14	4337	-847	-373	14	4542	-453	-372
15	4448	-753	-372	15	4565	-334	-372
16	4575	-591	-373	16	4573	-279	-372
17	4713	-402	-373	17	4419	-123	-372
18	4758	-189	-372	18	4316	-21	-372
19	4769	27	-372	19	4220	82	-372
20	4758	186	-372	20	4131	213	-373
21	4731	348	-373	21	4136	296	-373
22	4656	481	-372	22	4060	355	-373
23	4528	653	-372	23	3932	398	-372
24	4393	805	-372	24	3851	477	-373
25	4318	855	-372	25	3763	623	-372

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**VEHICLE EXTERIOR CRUSH PROFILE  
SECTION B-B (Continued)**

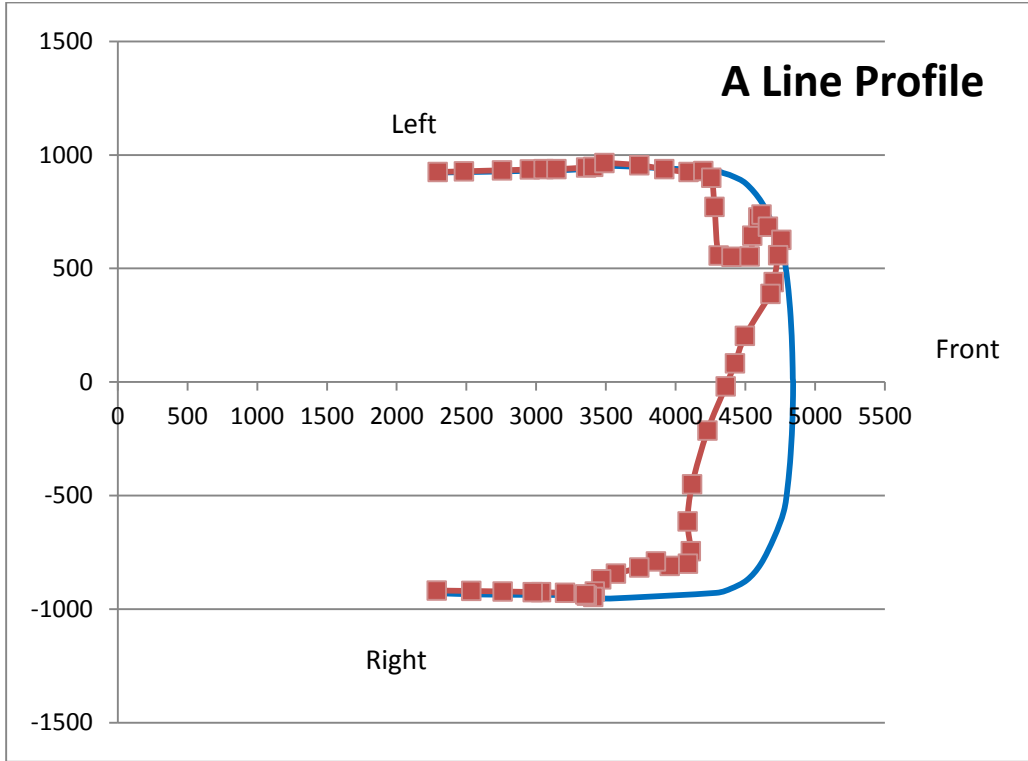
Point	Pre-Test			Point	Post-Test		
	X	Y	Z		X	Y	Z
26	4172	855	-373	26	3696	722	-372
27	4009	902	-372	27	3635	810	-372
28	3891	919	-372	28	3573	890	-372
29	3776	926	-372	29	3476	891	-372
30	3574	921	-373	30	3432	881	-372
31	3354	917	-372	31	3381	908	-373
32	3028	933	-372	32	3374	929	-372
33	2694	942	-373	33	3306	930	-373
34	2384	943	-373	34	3160	936	-372
35	2303	942	-372	35	3056	941	-372
				36	2875	946	-372
				37	2664	950	-372
				38	2487	950	-372
				39	2288	947	-373

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

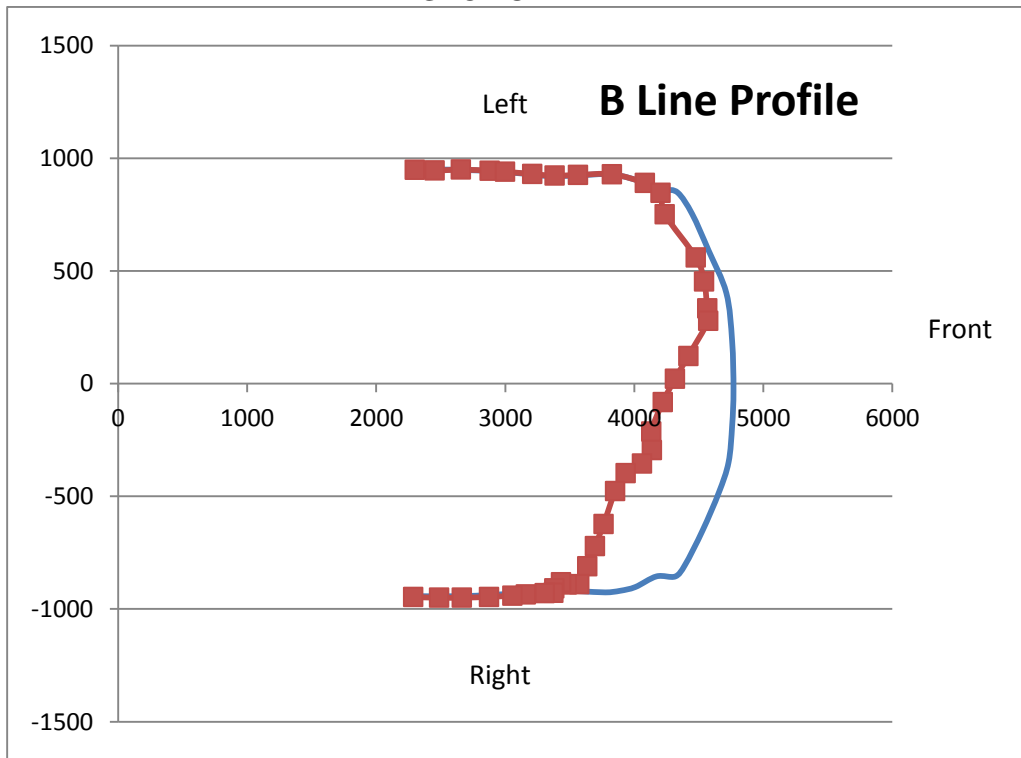
Test Vehicle: 2015 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

**VEHICLE EXTERIOR CRUSH PROFILE**  
**SECTION A-A**



**SECTION B-B**



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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	4699	-610	58	4737	-587	35	38	23	-23
	B2	4732	-461	68	4696	-442	11	-36	19	-57
	B3	4755	-314	67	4645	-304	-19	-110	10	-86
	B4	4771	-164	68	4589	-168	-47	-182	-4	-115
	B5	4775	-18	69	4522	-39	-72	-253	-21	-141
	B6	4774	133	66	4450	88	-100	-324	-45	-166
	B7	4760	282	68	4369	206	-119	-391	-76	-187
	B8	4731	432	68	4299	339	-135	-432	-93	-203
	B9	4699	580	69	4222	469	-148	-477	-111	-217

Reference point:

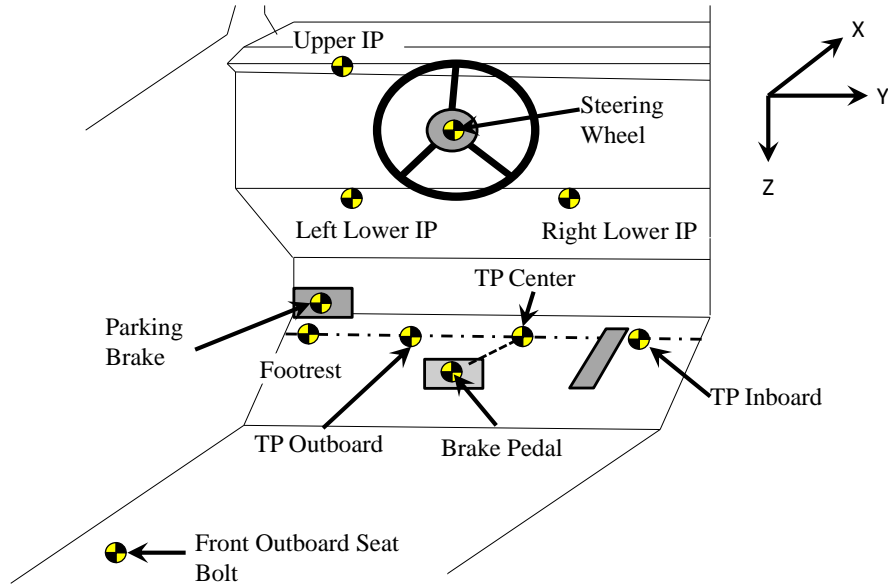
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	3610	-213	8	3578	-239	-5	32	26	12
TP Center	3639	-365	7	3620	-386	-2	19	21	9
TP Outboard	3583	-515	6	3577	-532	-1	6	18	6
TP Footrest	3499	-614	5	3495	-635	0	4	21	5
Brake Pedal	3432	-365	5	3415	-385	-8	17	21	13
Left Lower IP	3115	-550	-298	3127	-554	-296	-12	4	-3
Right Lower IP	3116	-245	-297	3120	-250	-293	-4	5	-4
Upper IP	3,113	-645	-313	3,120	-650	-312	-6	6	0
Steering Wheel	2913	-397	-500	2929	-424	-494	16	-27	6
Front Outboard Bolt	2853	-600	152	2851	-612	153	2	12	-1
Emergency Brake	3,279	-638	-52	3,282	-651	-53	-3	14	1

Reference point:

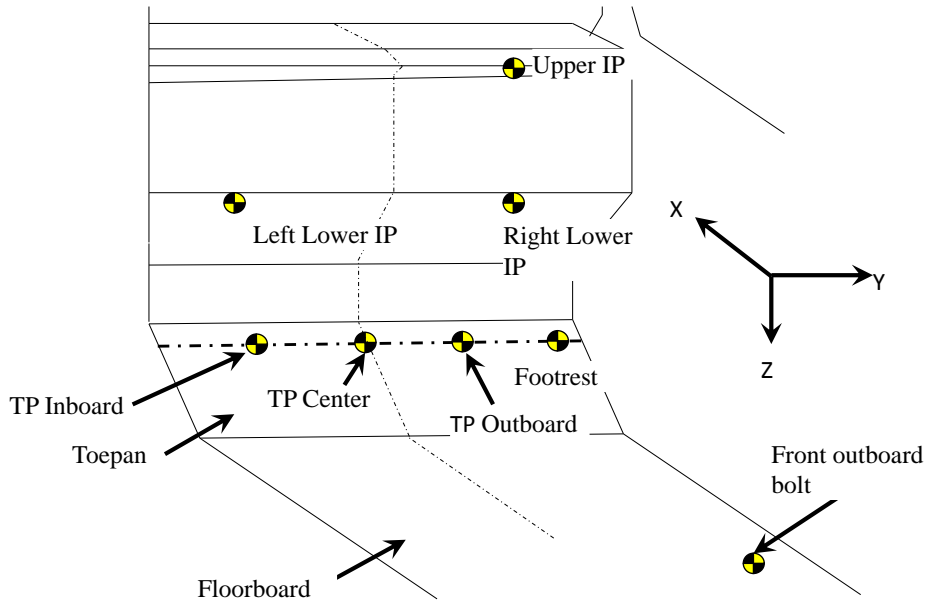
- +X – From the rear of the vehicle to the front of the vehicle
- +Y – From the left side of the vehicle to the right side of the vehicle
- +Z – From the top of the vehicle to the bottom of the vehicle

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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

**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	3650	243	5	3494	206	-29	156	37	35
TP Center	3652	396	3	3517	352	-38	135	44	42
TP Outboard	3542	547	6	3486	509	-25	56	37	31
TP Footrest	3481	645	5	3422	608	-18	59	37	23
Left Lower IP	3118	245	-266	3121	238	-276	-3	7	10
Right Lower IP	3147	545	-267	3143	539	-281	3	6	14
Upper IP	3122	643	-327	3110	639	-336	12	4	9
Front Outboard Bolt	2852	599	152	2848	583	155	3	16	-3

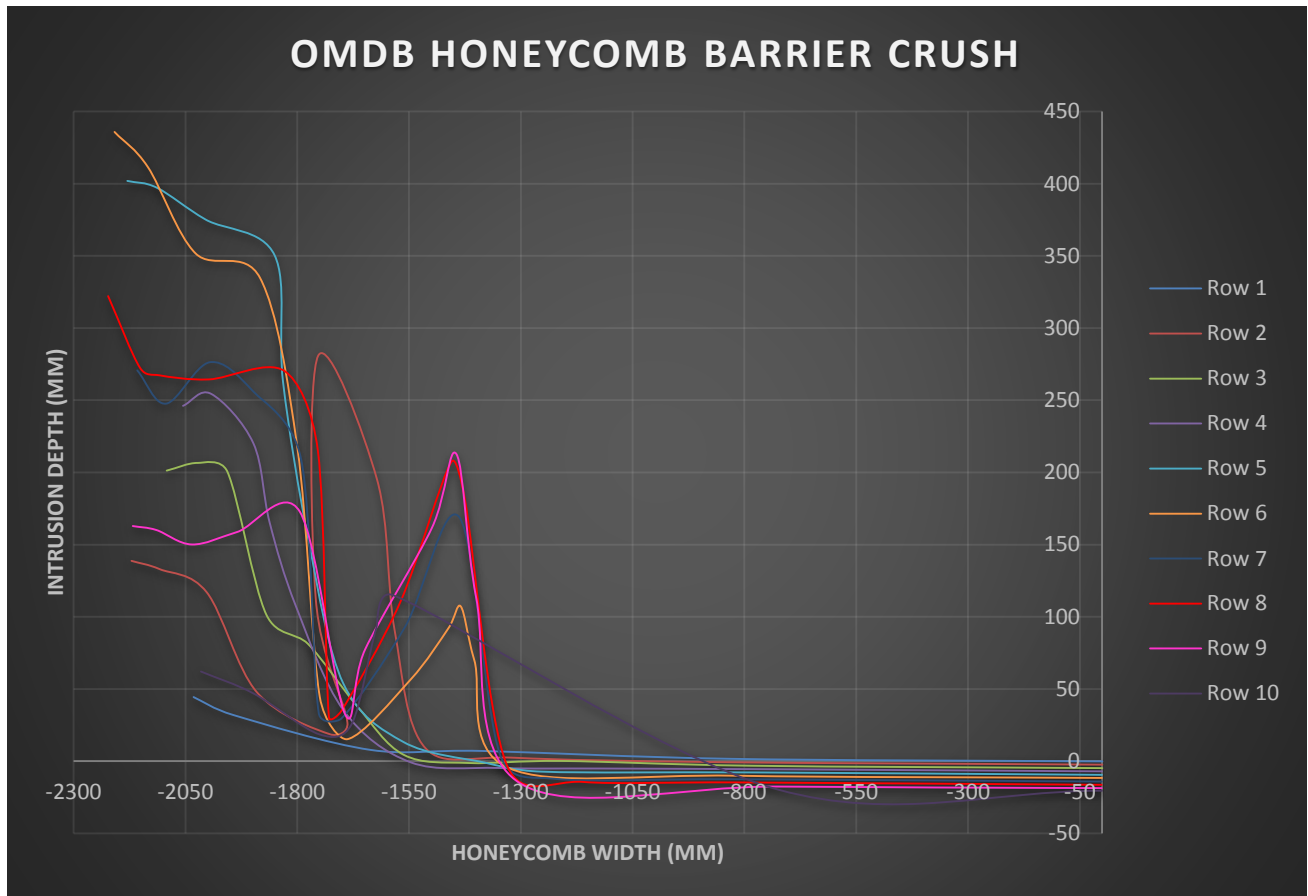
Reference point:

- +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 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015



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

Test Vehicle: 2015 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015

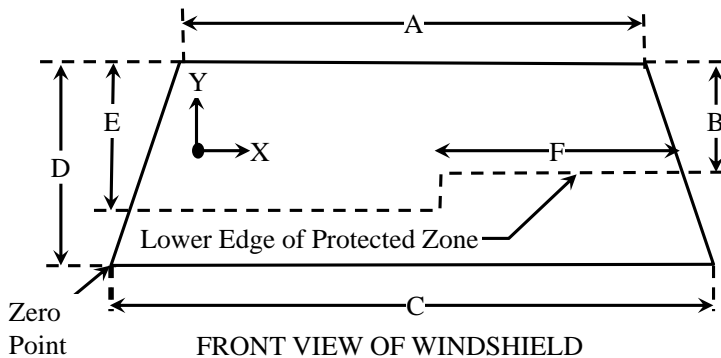
*Please provide windshield mounting details. A 0.8 mm trim surrounds the top and side of windshield while a plastic shroud is on the bottom.*

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	2264	2264	100%
Right Side	2264	1864	82.3%
Total	4528	4128	91.2%



Item	Units	Value
A	mm	1276
B	mm	471
C	mm	1598
D	mm	827
E	mm	503
F	mm	462

**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 Toyota Highlander SUV  
Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
Test Date: 09/21/2015

**FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA**

Ambient Temperature at Test Vehicle Time of Impact: 21.1° C

Test Time: 11:04 AM

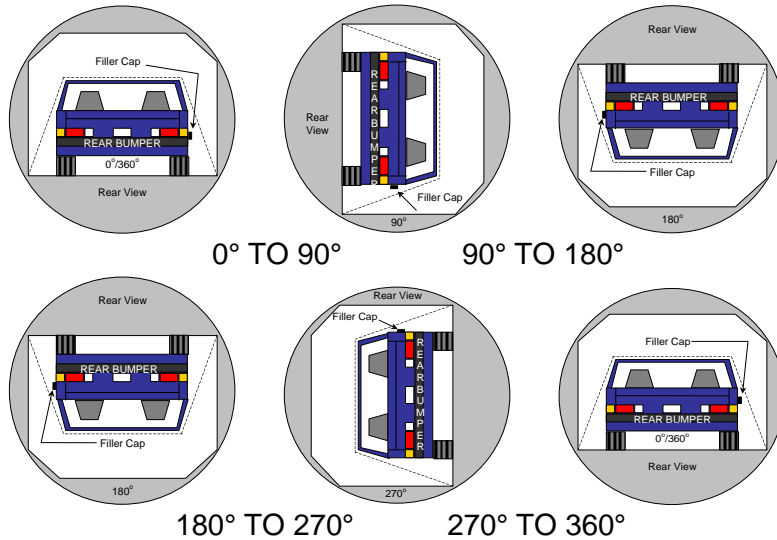
Stoddard Solvent Spillage Measurements

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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



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°	75	300	375
90° to 180°	63	300	363
180° to 270°	64	300	364
270° to 360°	70	300	370

**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	

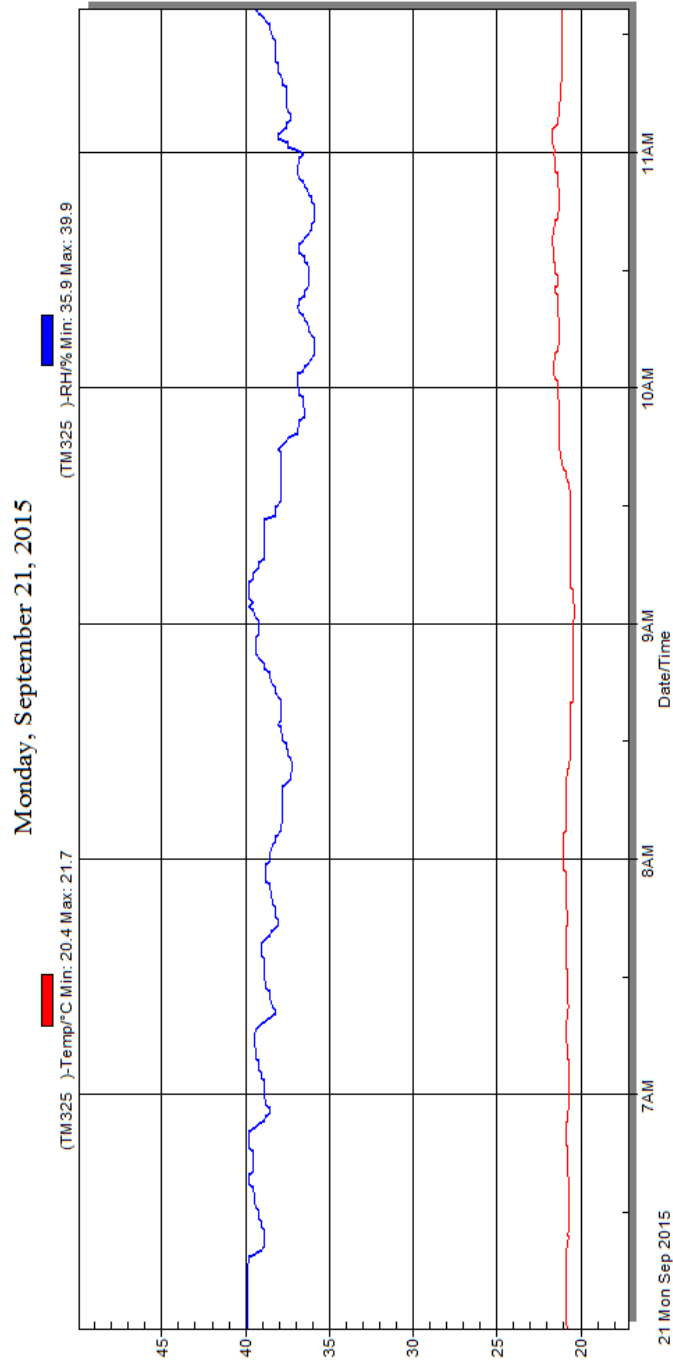
**SOLVENT SPILLAGE LOCATION TABLE**

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 Toyota Highlander SUV  
 Test Program: R&D 90.1kph, 15° / 35% Right Oblique Offset

NHTSA No.: R20155143  
 Test Date: 09/21/2015



**Temperature Stabilization Chart/Data**

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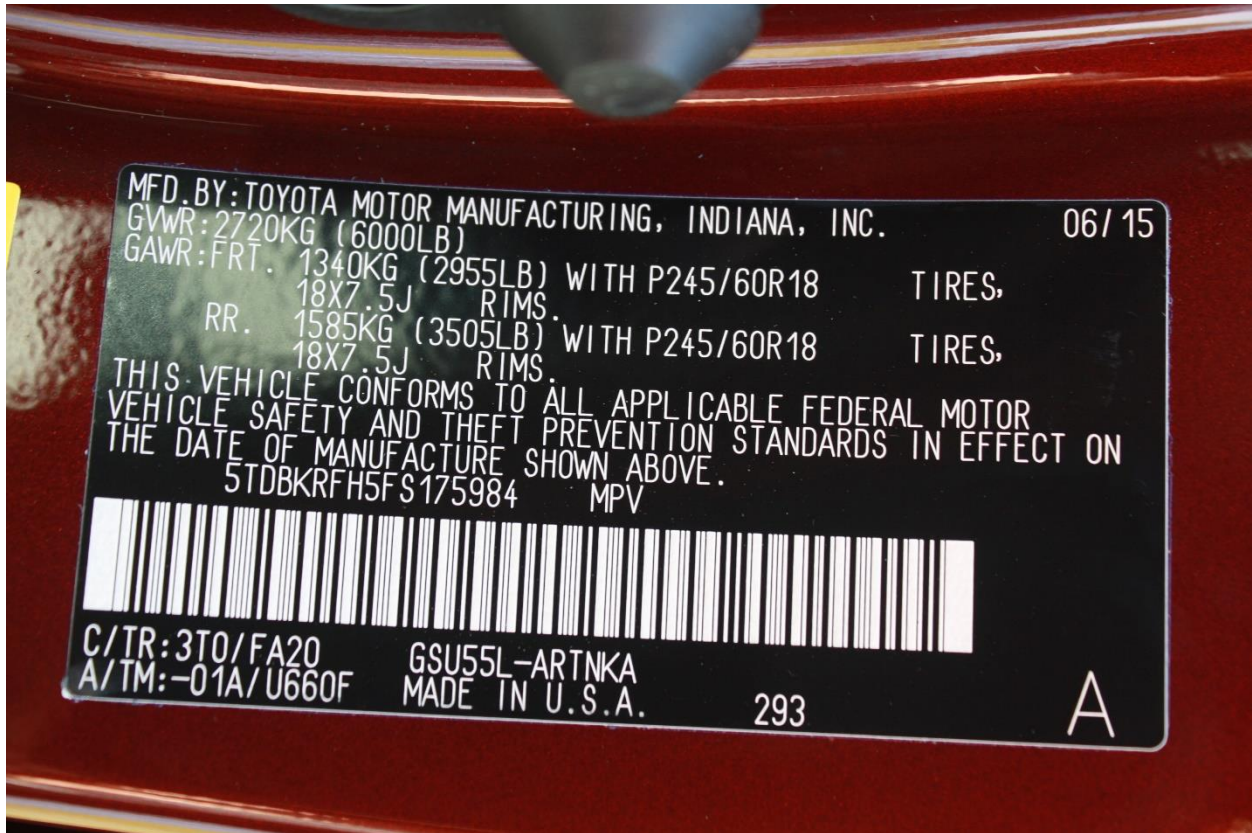
TABLE OF PHOTOGRAPHS (Continued)		
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181	Pre-Test Left Side View of OMDB	A-101
182	Post-Test Left Side View of OMDB	A-101
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185	Pre-Test OMDB & Vehicle, Left Side	A-103
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187	Pre-Test OMDB & Vehicle, Top View	A-104
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191	Pre-Test OMDB & Vehicle, Front View	A-106
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194	Vehicle at 0 Degrees on Static Rollover Device	A-107
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199	Impact Photo	A-110
200	Pre-Test Vehicle Bumper Left Side View	A-111
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208	Pre-Test Vehicle Bumper Right Front View	A-115
209	Post-Test Vehicle Bumper Right Front View	A-115



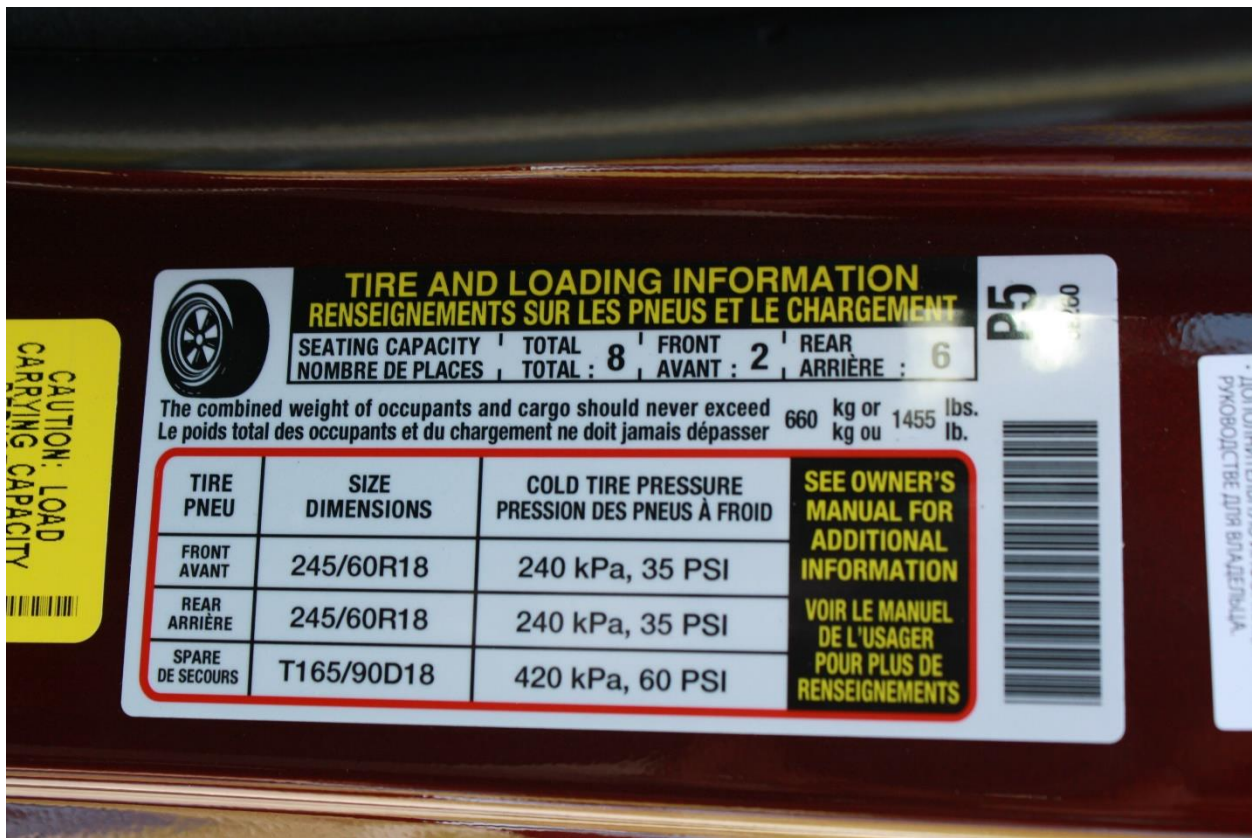
**No. 001 As Delivered Right Front 3-4 View of Test Vehicle**



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



No. 003 Test Vehicle Certification Label



No. 004 Test Vehicle Tire Placard



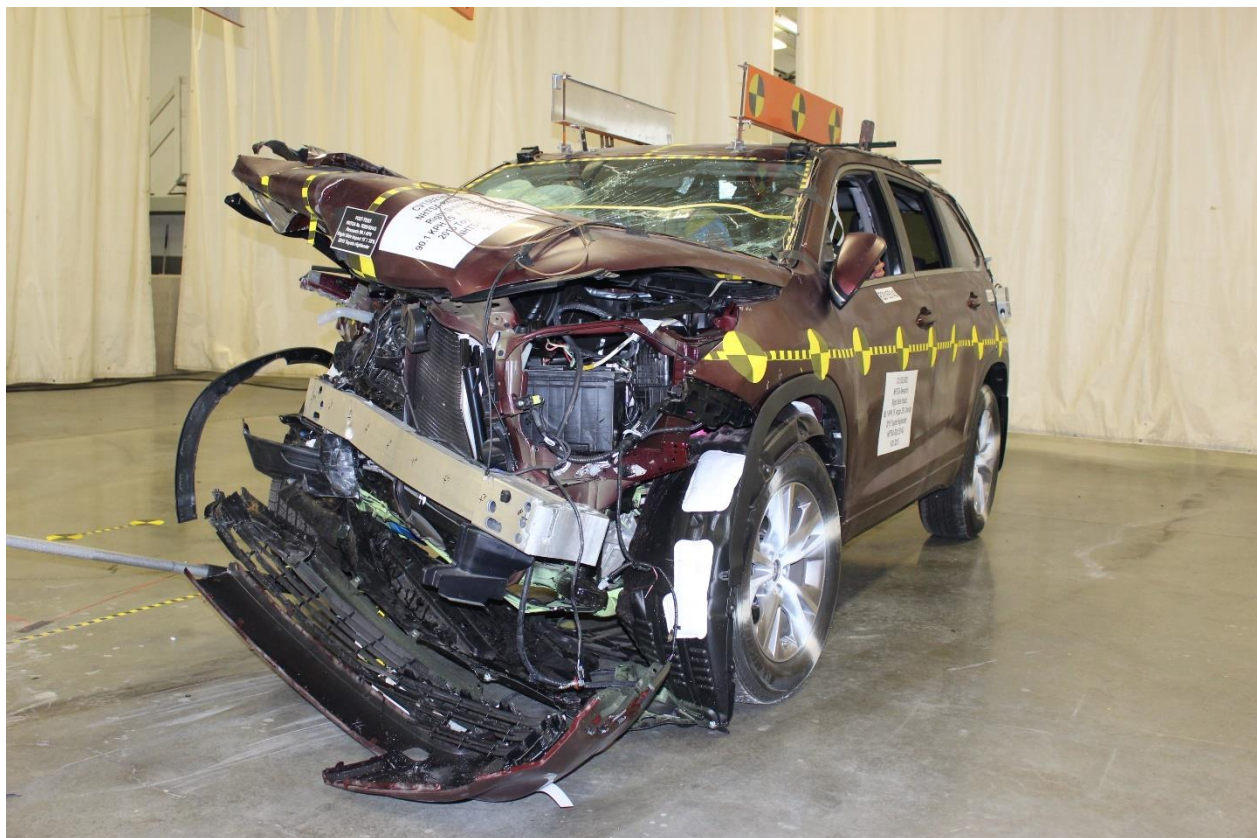
**No. 005 Pre-Test Front View of Test Vehicle**



**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**

**TOYOTA**  
Let's Go Places

DESC: **HIGHLANDER** LE Plus - V6 AWD  
VIN: **5TDBKRFH5FS175984**  
YR/MDL: 2015/6949E  
CLR: OOH LA LA ROUGE MICA/FA20 (03T0/20)  
PORT/PLANT: Princeton, NJ/TMM RAILHEAD:

**STANDARD EQUIPMENT**

**MECHANICAL & PERFORMANCE**

- 5.0L i-Force V6 Engine with Dual VVT-i
- 6-Spd Auto Trans; 2,000-lb Tow Capacity
- Front Independent McPherson Strut & Rear Double Wishbone Suspension
- Ultra-Low Emission Vehicle (ULEV-II)
- Power-Assisted 4-Wheel Disc Brakes
- 18" Alloy WP2540R18 TireTemp Spare
- Dynamic Torque Control All-Wheel Drive
- Hill-Slope & Downhill Assist Control

**SAFETY & CONVENIENCE**

- Star Safety System: Includes Enhanced Vehicle Stability Control, Traction Control, Anti-Lock Brake System, Electronic Brake-Force Distribution, Brake Assist & Smart Stop Technology
- 6 Airbags: Dr & Fr Pgr Adv Airbag Sys, Dr & Fr Pgr Seat-Mounted Side, Dr Knee, Pgr Seat-Curtain & 3-Rw Side Curtain Airbags
- Whiplash Injury Lessening Front Seats
- Remote Keyless Entry; Engine Immobilizer
- LATCH w/ Anchors & Tethers for Children
- Child Protector Rear Door Locks

**EXTERIOR**

- SmogChromer Auto On/Off Hights; Foglights
- LV Wintshield; Priv Glass-Rr, Side, Qtr
- 6 Hatch Windows; Folding Heated Pwr Side Mirrors; Front Wiper w/De-Icer
- Adj. Power; Luggage w/Up-Rear Window

**INTERIOR**

- Seating for 8; Cloth/SoftTex 6-Wy Pwr Dr Seat w/Inbar, 4-Wy Pgr Seat, 2nd & 3rd Row 60/40 Split Fold-Flat Seats w/Recline
- Backup Camera with 8.1" Display
- Entune Plus w/8.1" Touch Screen/AM/FM/CD/MP3/USB/AUX, HD, & XM All Access 3-mo Trial Bluetooth Phone & Streaming Music
- 3.5-inch Multi-Info Display w/Veh Info
- 5-Speed Automatic A/C - Driver, Pgr, Rr
- Steering W/VAudio, Phone & VRoc Cntrl
- Overhead Map Light; Conversation Mirror
- Roll-Top Console/Arm Rest, In-Dash Shelf
- 4 Cup & 4 Bottle Holders; 8-12V Outlets
- 8" Full Tank of Gas\*

**MANUFACTURER'S SUGGESTED RETAIL PRICE \$34,750.00**

**OPTIONAL EQUIPMENT**

- FE 50 State Emissions 200.00
- CF All Weather Floor Mats & Cargo Mat 225.00

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

**Side Crash ★★★★★**  
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

**EPA DOT Fuel Economy and Environment** Gasoline Vehicle

**Fuel Economy**  
20 MPG combined city/hwy  
18 city  
24 highway  
5.0 gallons per 100 miles

**You spend \$2,000 more in fuel costs over 5 years** compared to the average new vehicle.

**Annual fuel cost \$2,600**

**Fuel Economy & Greenhouse Gas Rating (scale 1-10)**  
1 5 10 Best

**Smog Rating (scale 1-10)**  
1 5 10 Best

**DELIVERY PROCESSING AND HANDLING FEE 885.00**

**TOTAL \$36,060.00**

The New Vehicle Limited Warranty provides 3-year/36,000-mile basic coverage, 5-year/60,000-mile powertrain coverage, and 10-year/unlimited-mile corrosion perforation coverage. See Warranty and Maintenance Guide for details. An extended service contract may be available for the vehicle. Ask dealer for details.

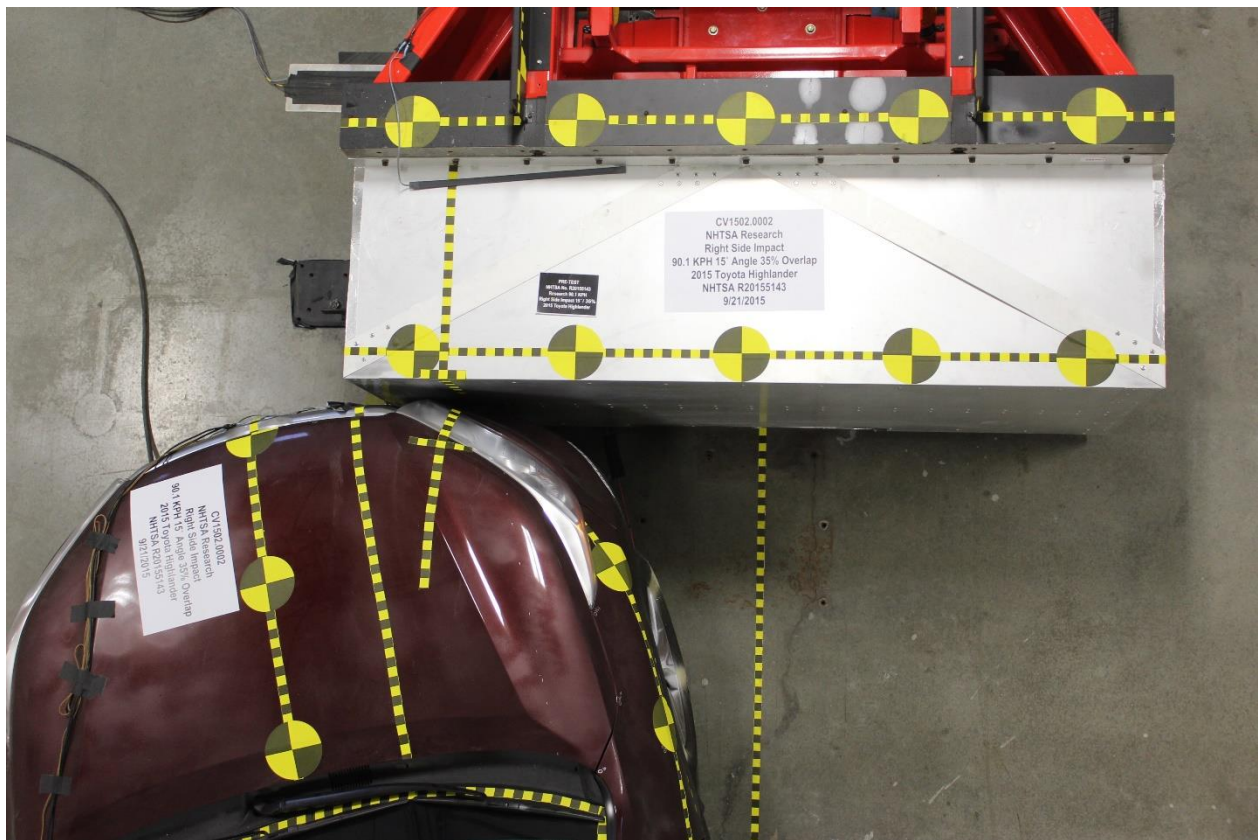
Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Destination, license and title fees, applicable federal, state and local taxes and dealer and distributor installed options and accessories are not included in the manufacturer's suggested retail price.

ToyotaCare, which covers normal factory-scheduled maintenance for two years or 25,000 miles, whichever occurs first, is included as part of the base price of the vehicle for qualifying buyers. See participating dealer for details and coverage details.

Dealer Name / Address: 31177 Ship to  
MAGUIRE TOYOTA  
375 ELMIRA ROAD  
ITHACA NY 14850

**fuelconomy.gov**  
Calculate personalized estimates and compare vehicles.

No. 021 Monroney Label Photograph



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



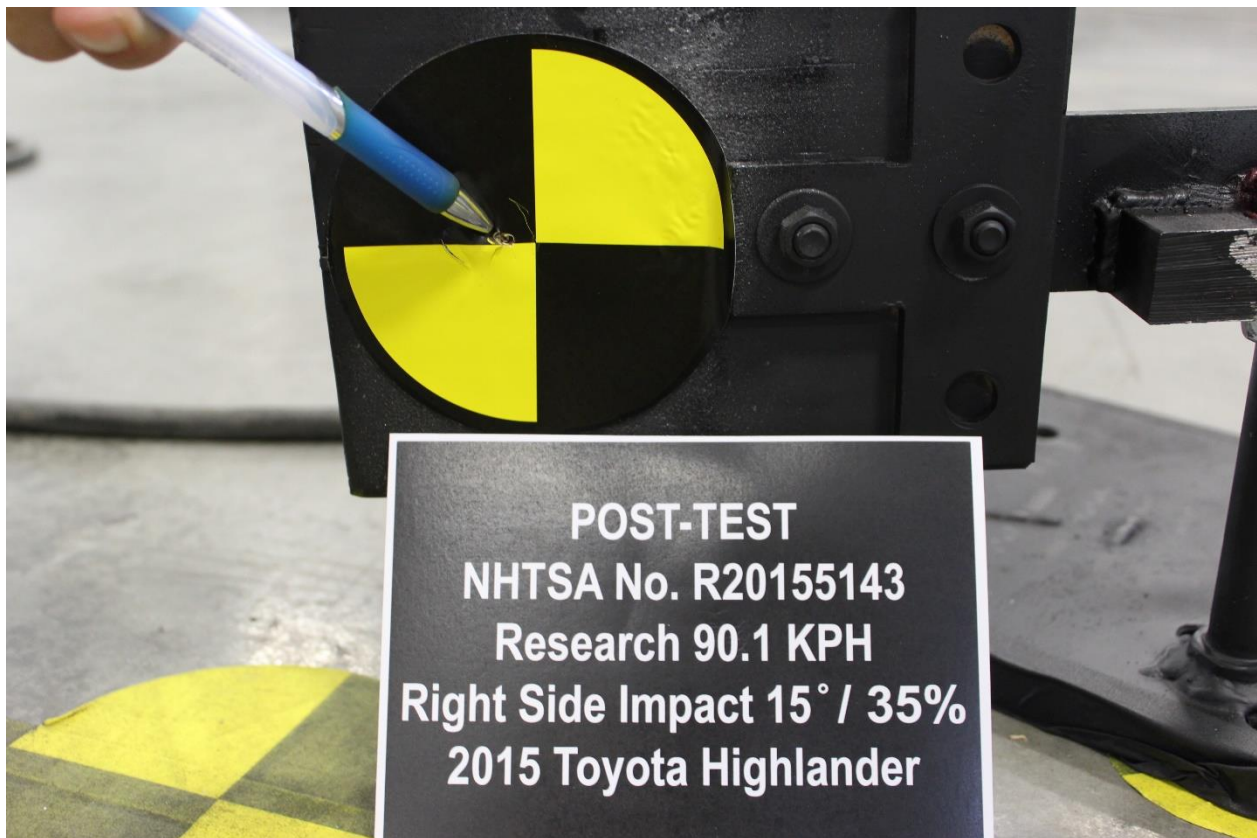
**No. 023 Pre-Test Left Side View of OMDB against target vehicle at ideal Impact Point**



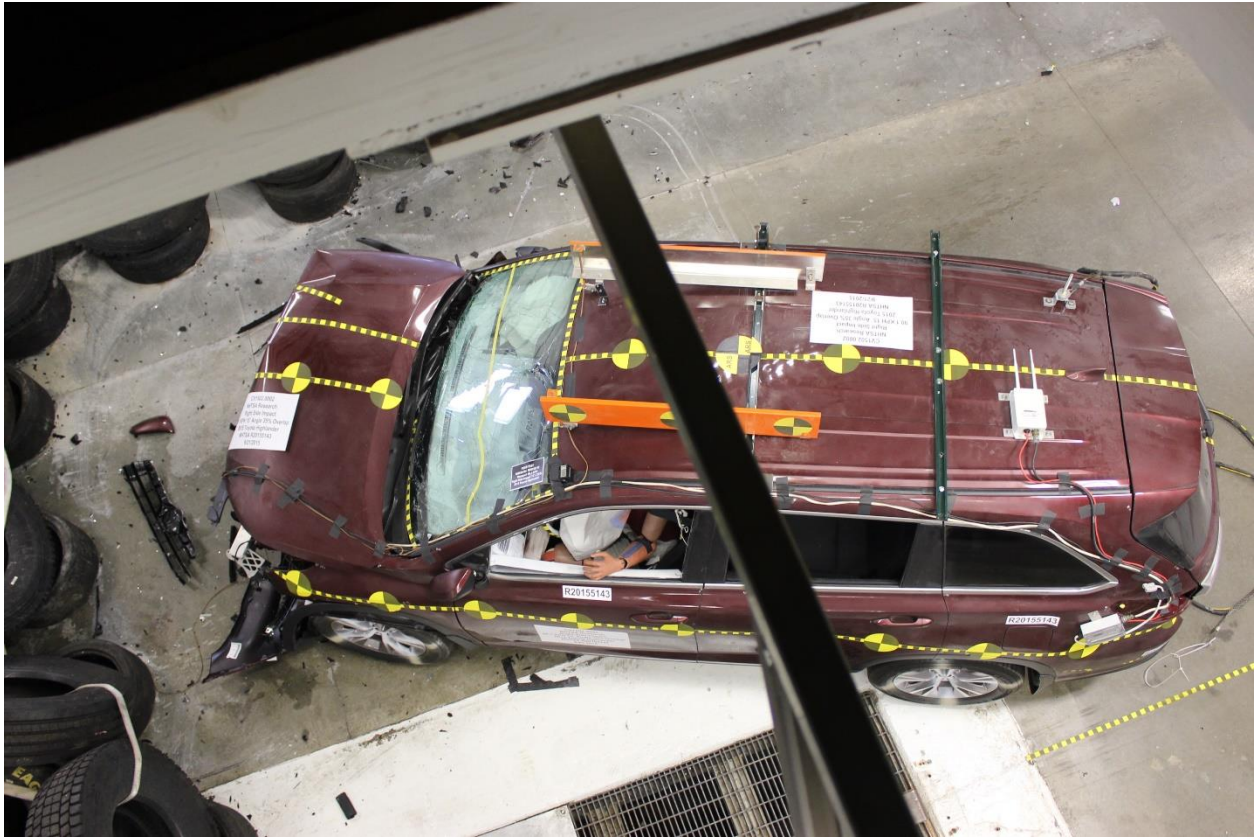
**No. 024 Pre-Test Right Side View of OMDB against target vehicle at ideal Impact Point**



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



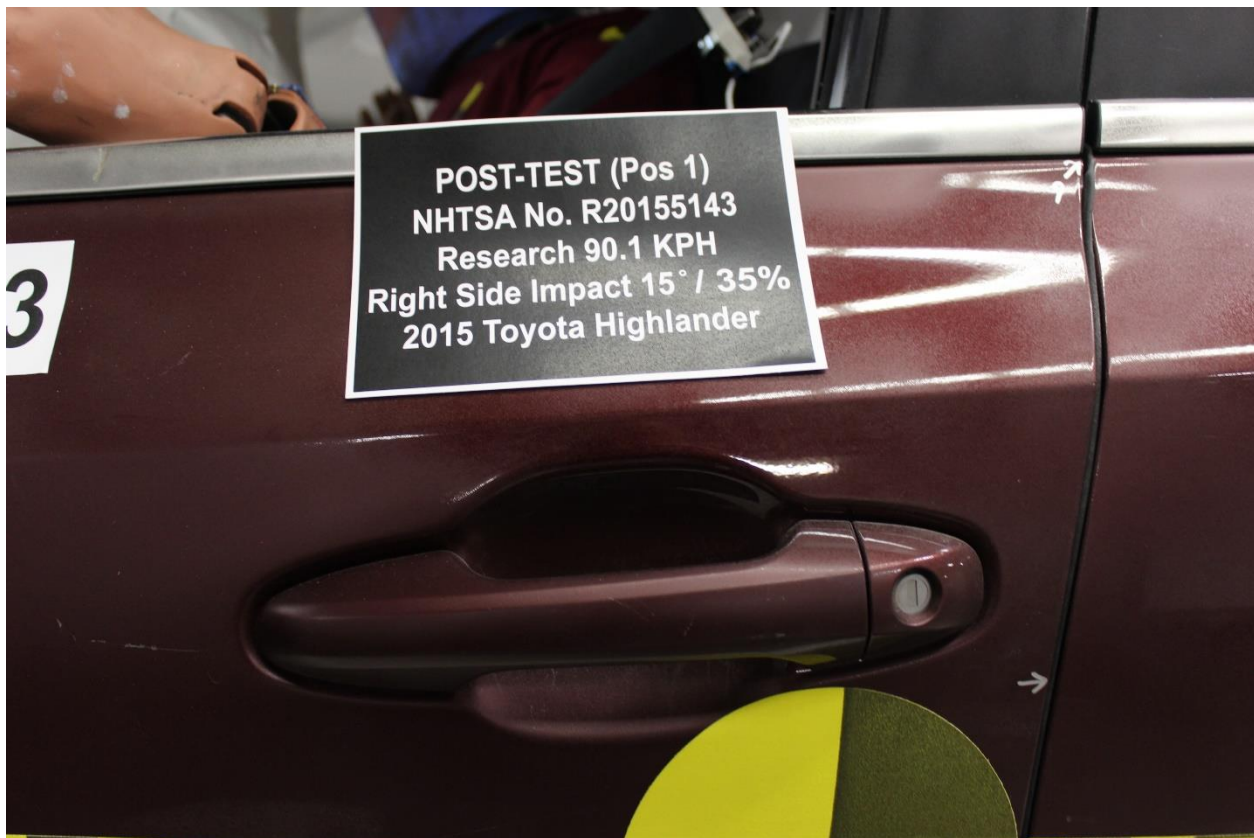
No. 026 Post-Test Close-up View of Impact Point



**No. 027 Post-Test Vehicle Overhead View**



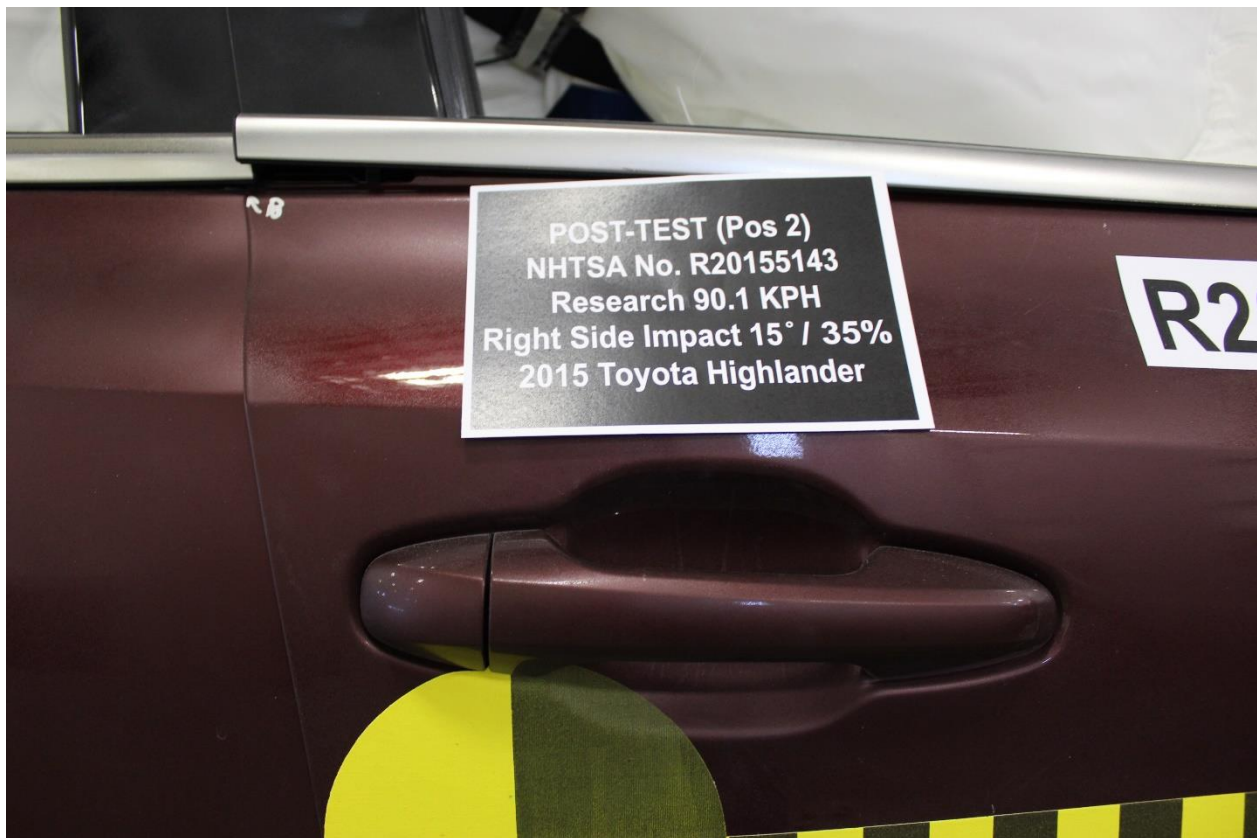
No. 028 Pre-Test Close-up View of Driver Door Latch



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**



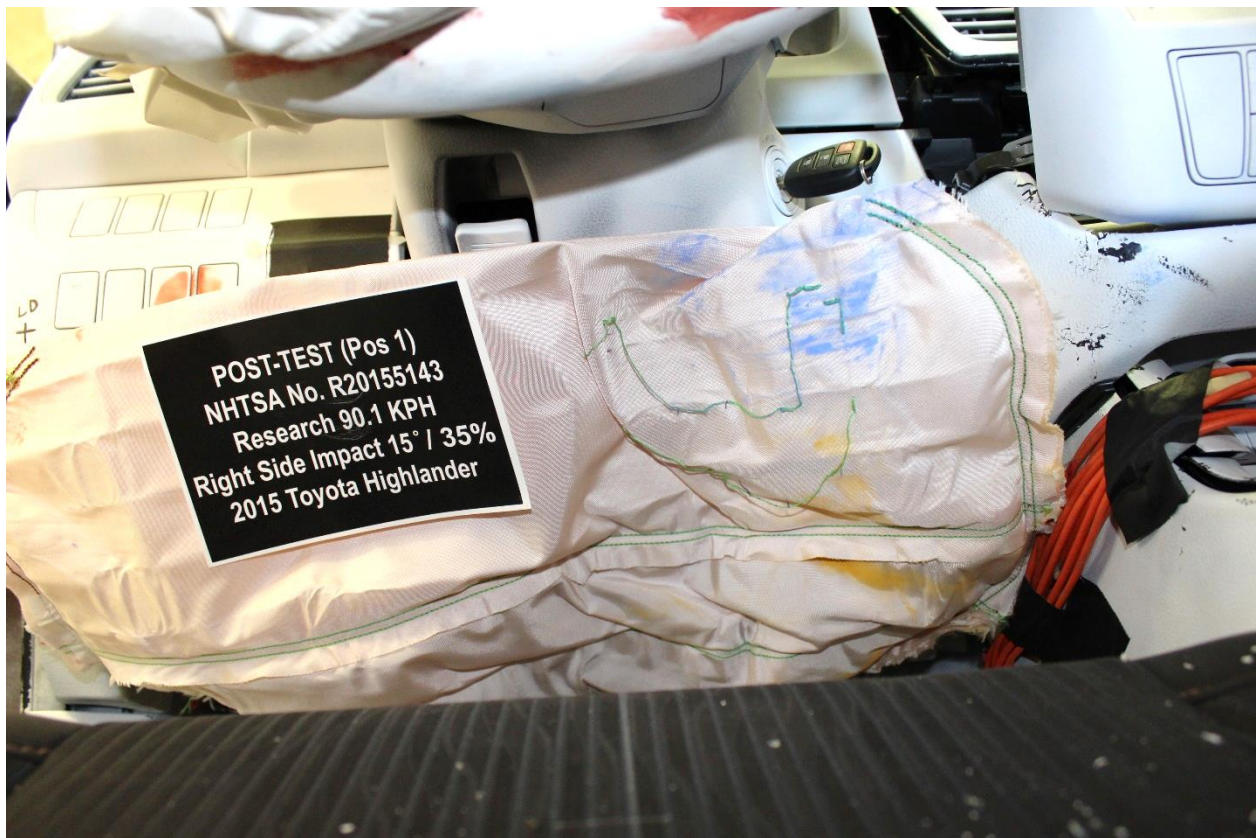
**No. 036 Pre-Test View of Passenger Inner Door Panel**



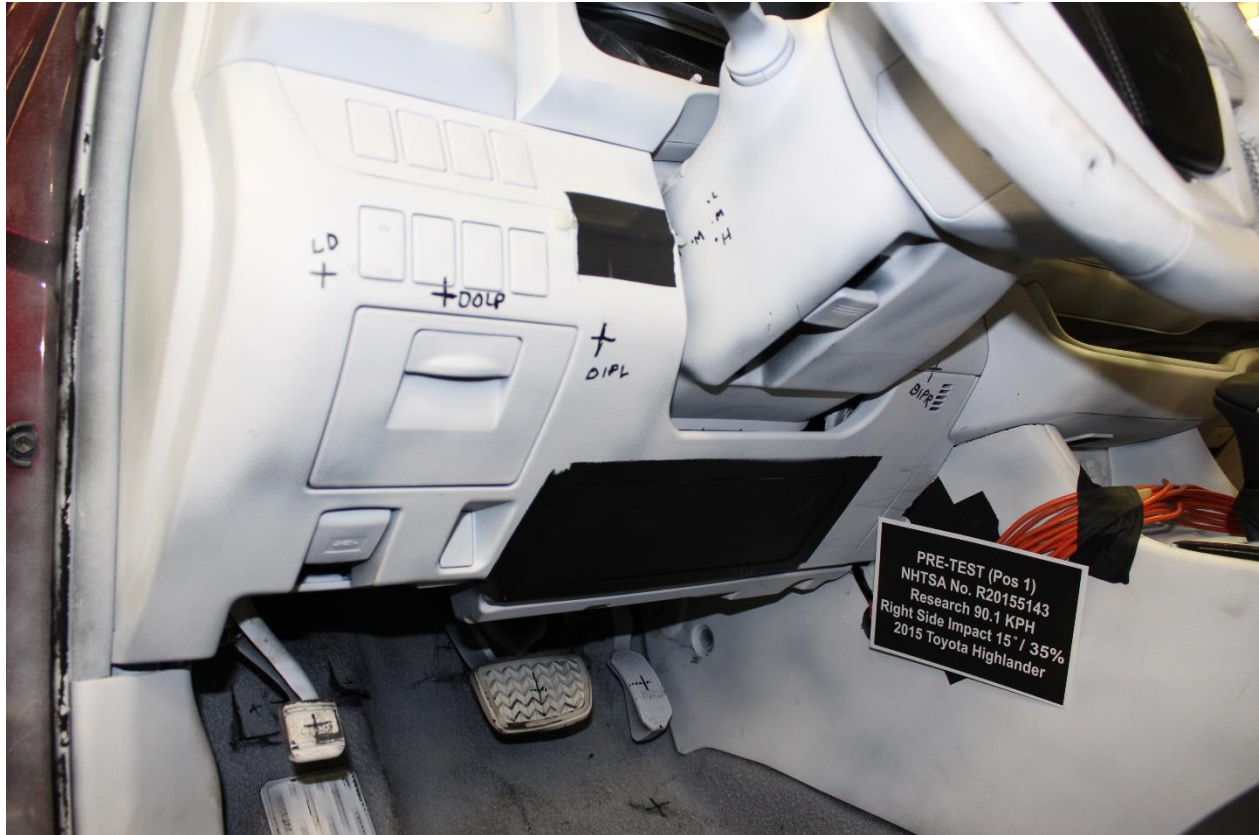
**No. 037 Post-Test View of Passenger Inner Door Panel**



**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

**Photo Not Available**

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**



PRE-TEST (Pos 1)  
NHTSA No. R20155143  
Research 90.1 KPH  
Right Side Impact 15' / 35%  
2015 Toyota Highlander

R20155143

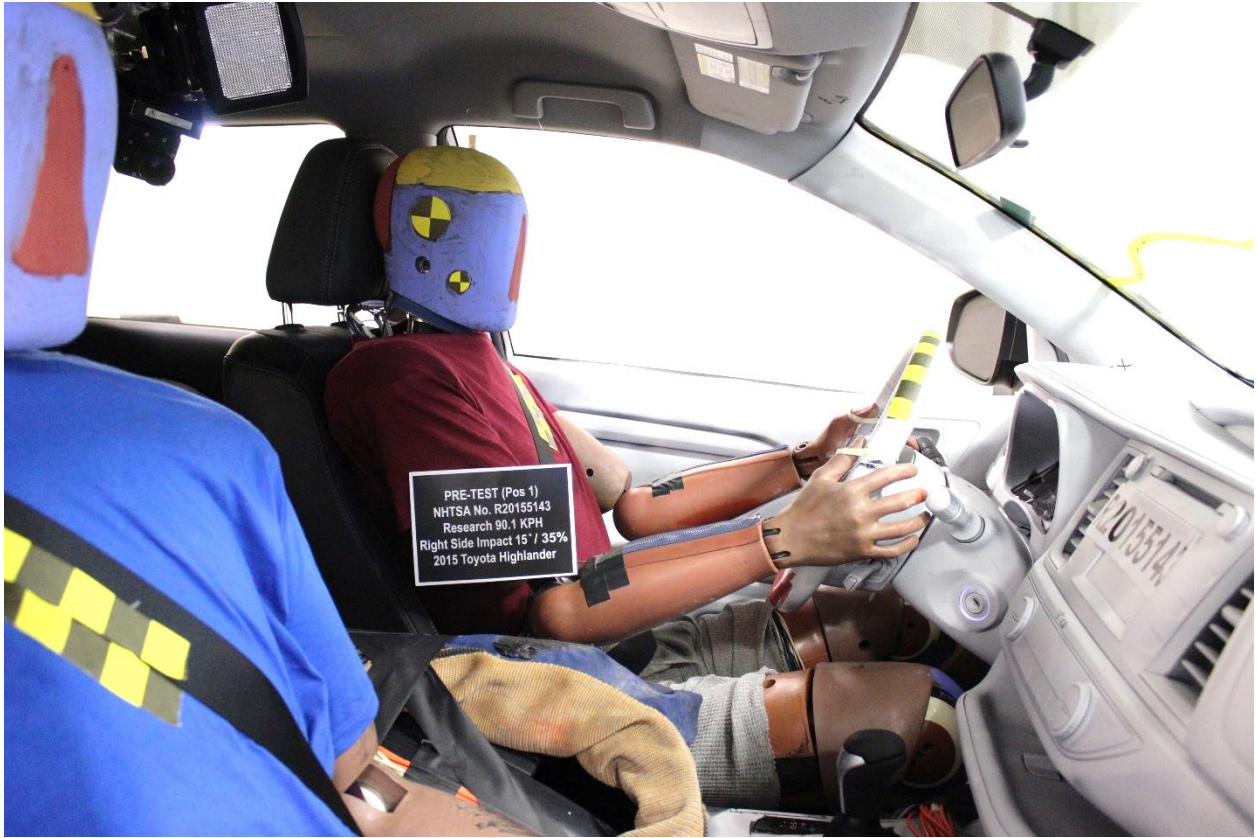
No. 054 Pre-Test Left Side Driver Window View



POST-TEST (Pos 1)  
NHTSA No. R20155143  
Research 90.1 KPH  
Right Side Impact 15' / 35%  
2015 Toyota Highlander

R20155143

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



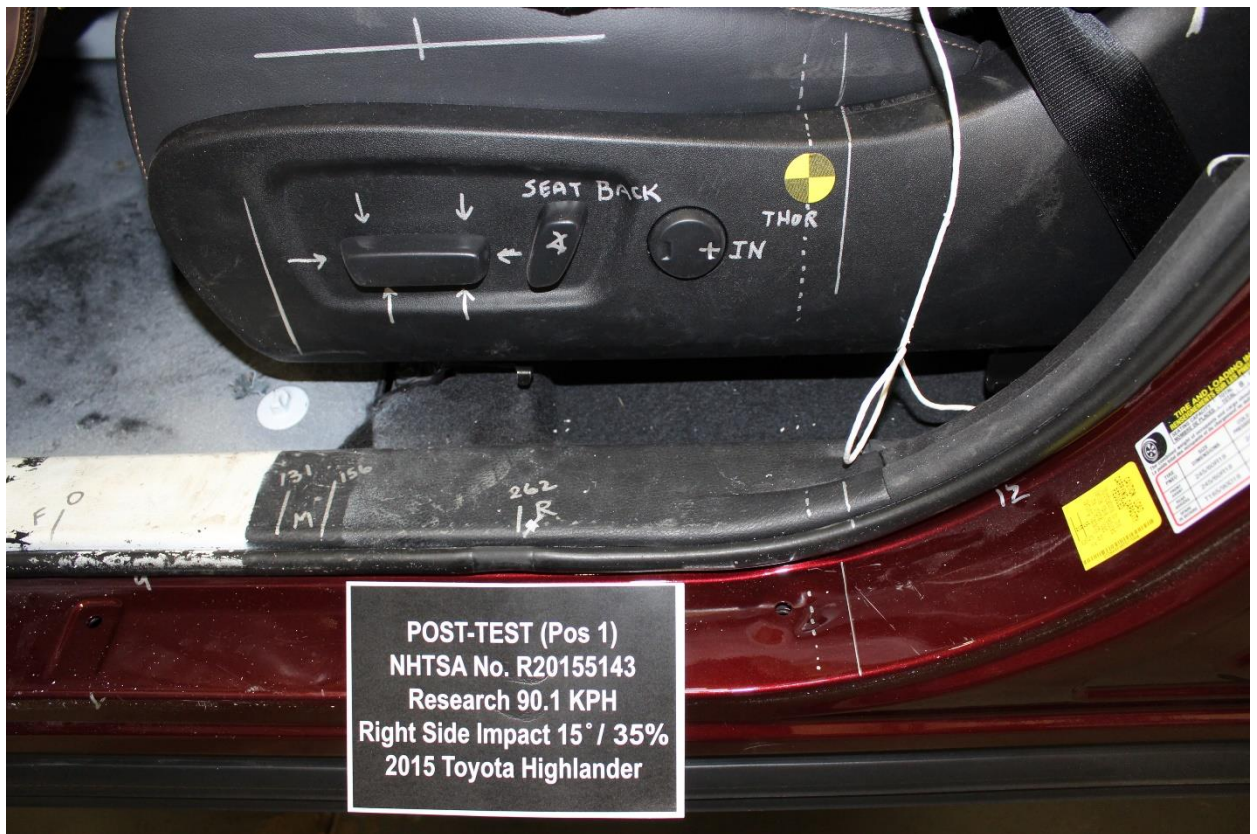
No. 059 Post-Test View of Driver Door Clearance



**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**



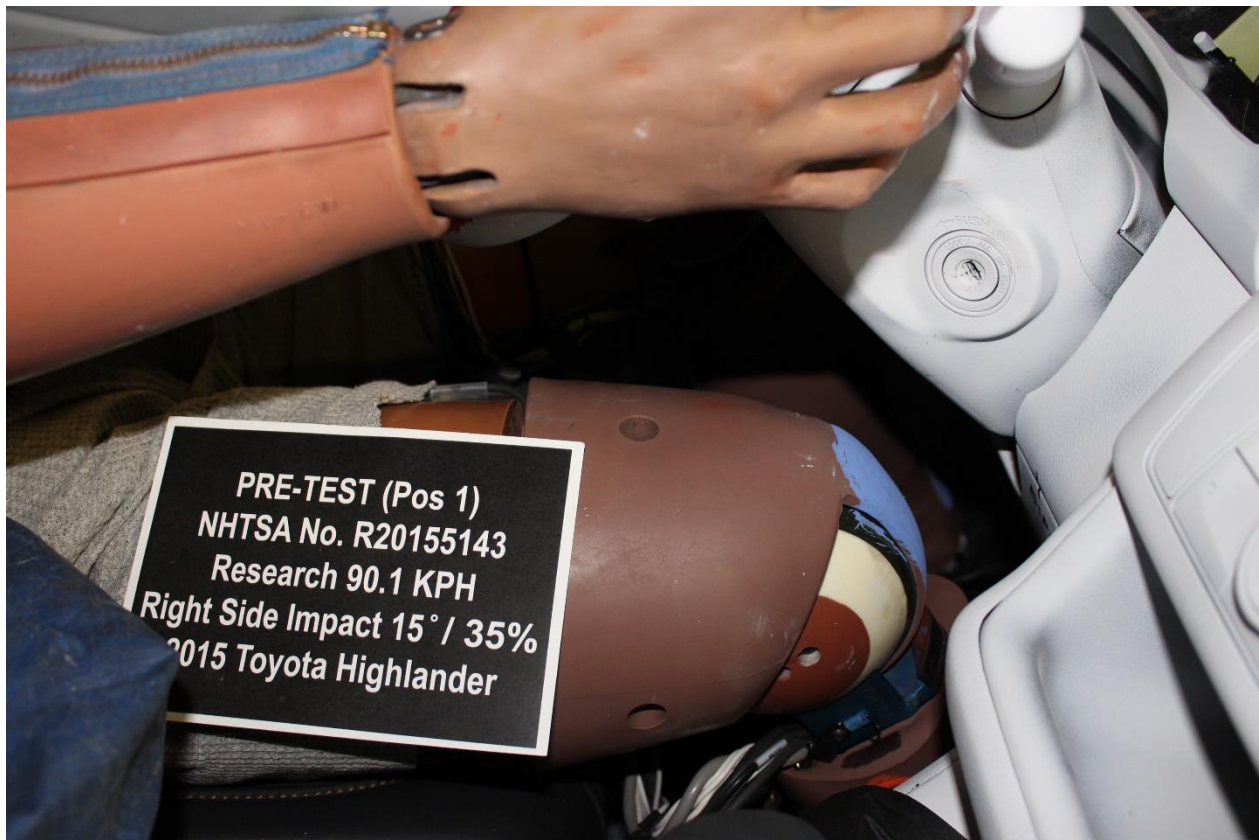
**No. 066 Post-Test Driver Adjustable D-Ring**



**No. 067 Pre-Test Driver Feet**

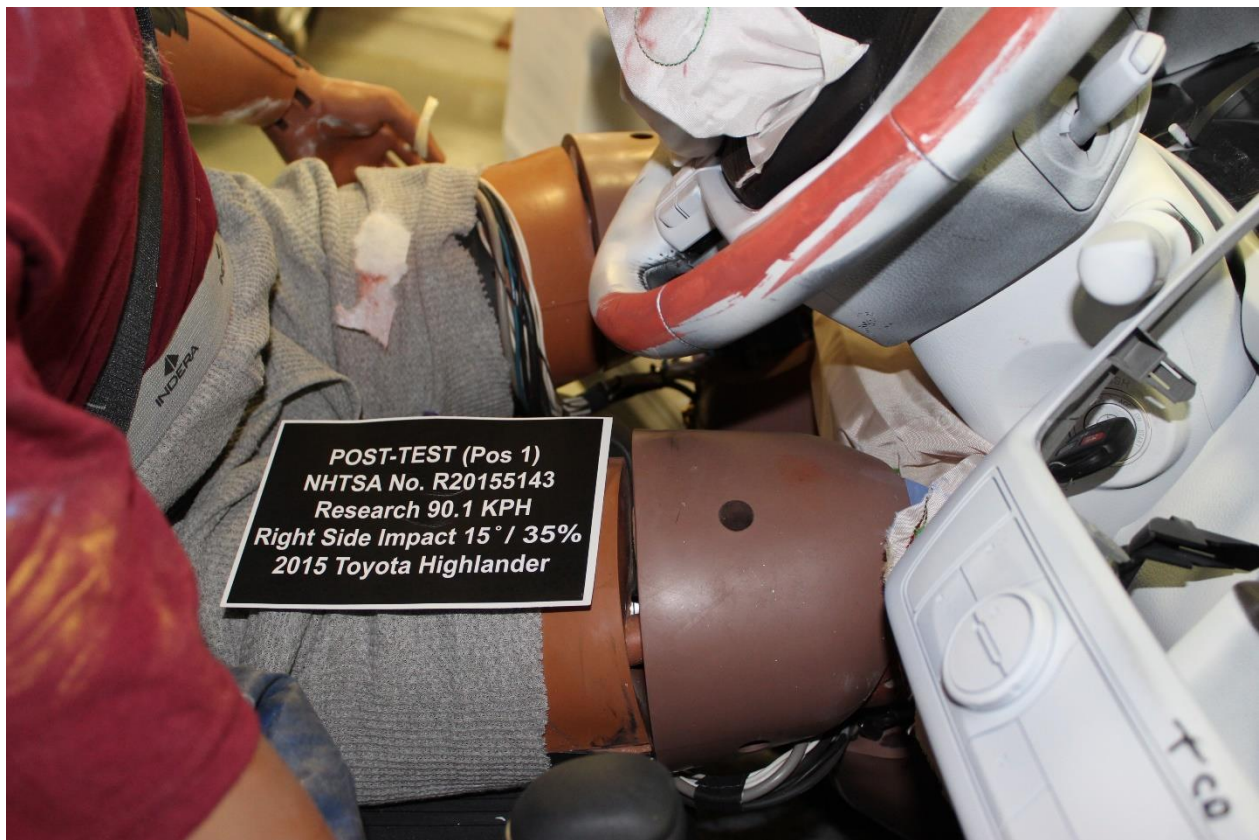


**No. 068 Post-Test Driver Feet**



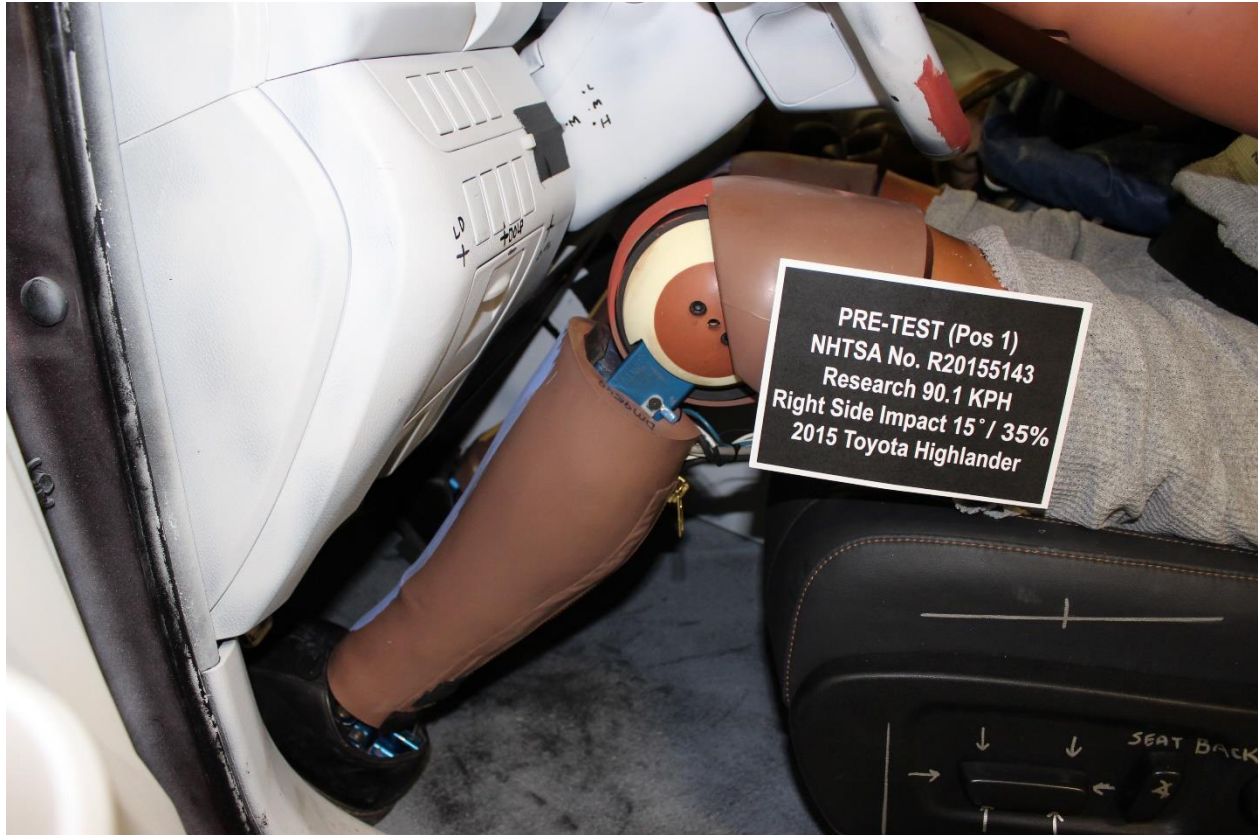
**PRE-TEST (Pos 1)**  
**NHTSA No. R20155143**  
**Research 90.1 KPH**  
**Right Side Impact 15° / 35%**  
**2015 Toyota Highlander**

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



**POST-TEST (Pos 1)**  
**NHTSA No. R20155143**  
**Research 90.1 KPH**  
**Right Side Impact 15° / 35%**  
**2015 Toyota Highlander**

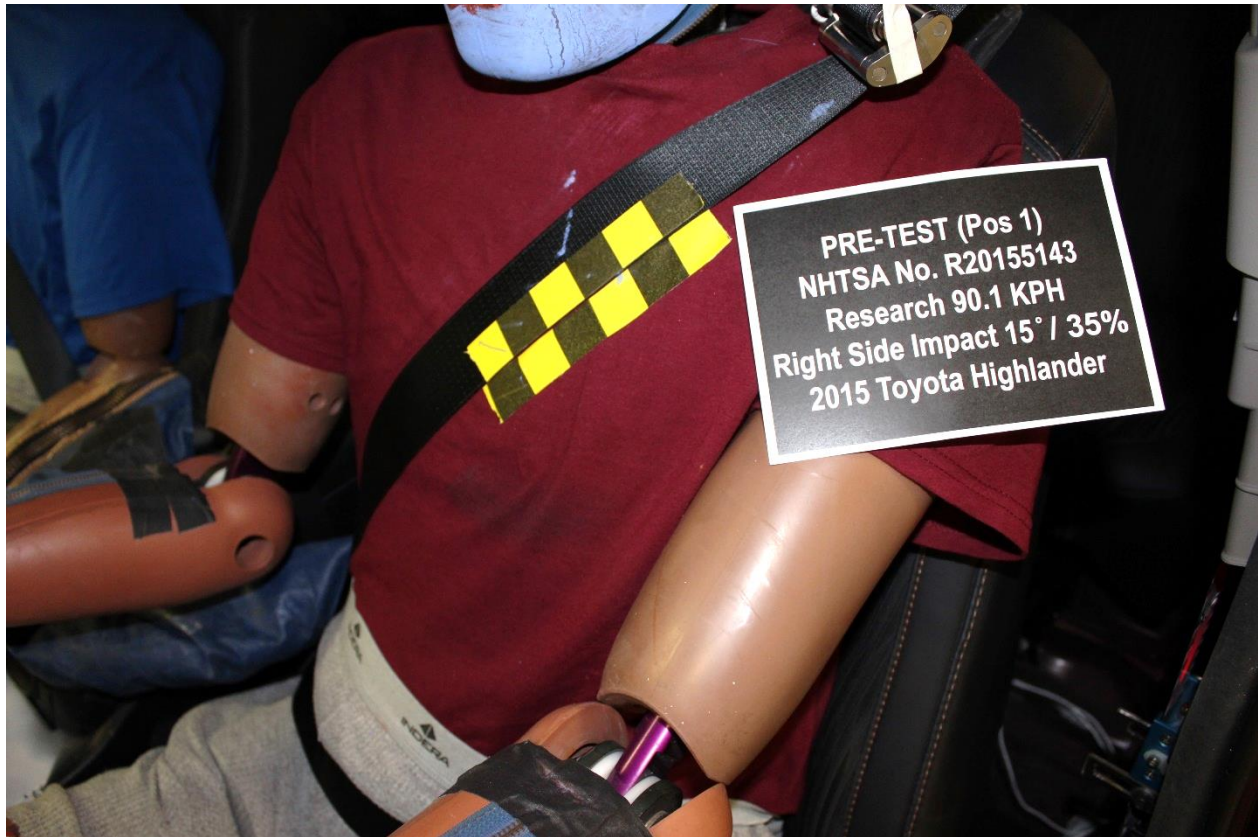
**No. 070 Post-Test View of Driver Right Knee and Bolster**



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



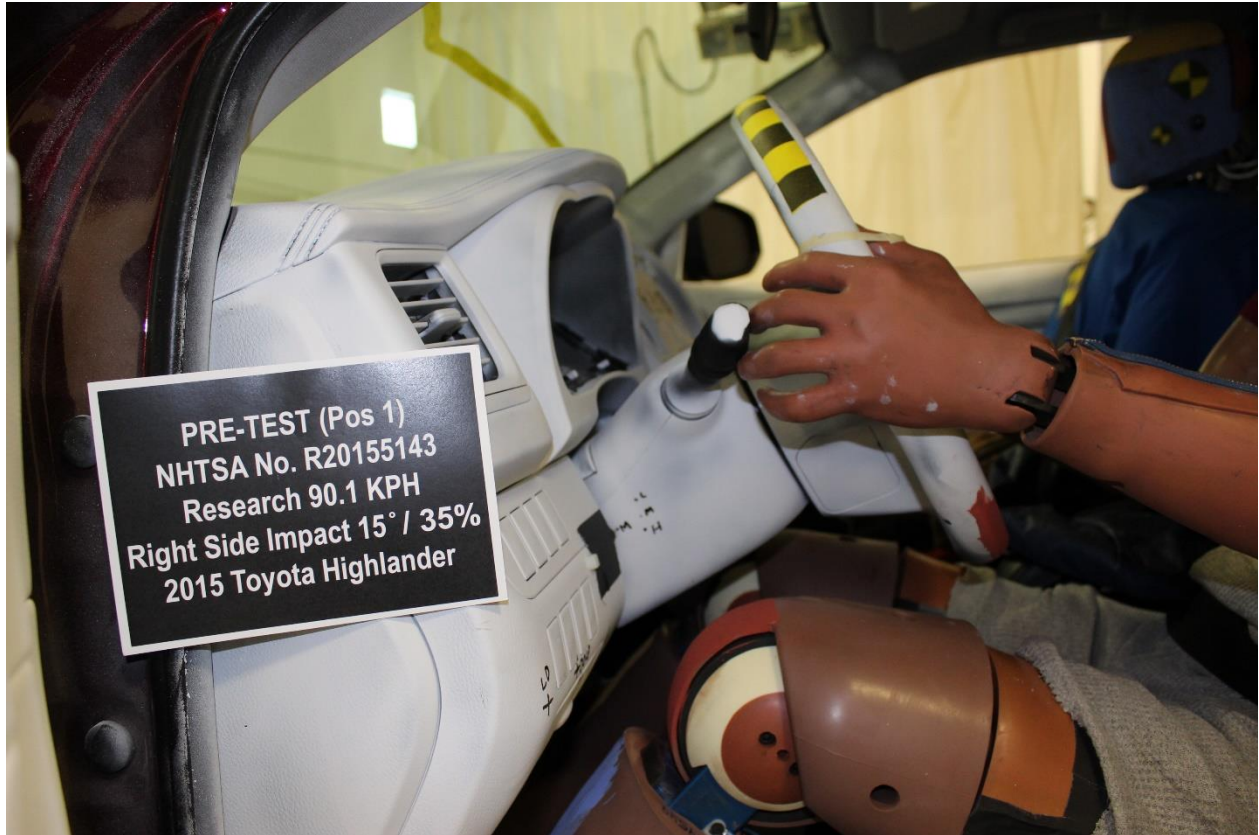
**No. 072 Post-Test View of Driver Left Knee and Bolster**



**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**

**Photo Not Applicable**

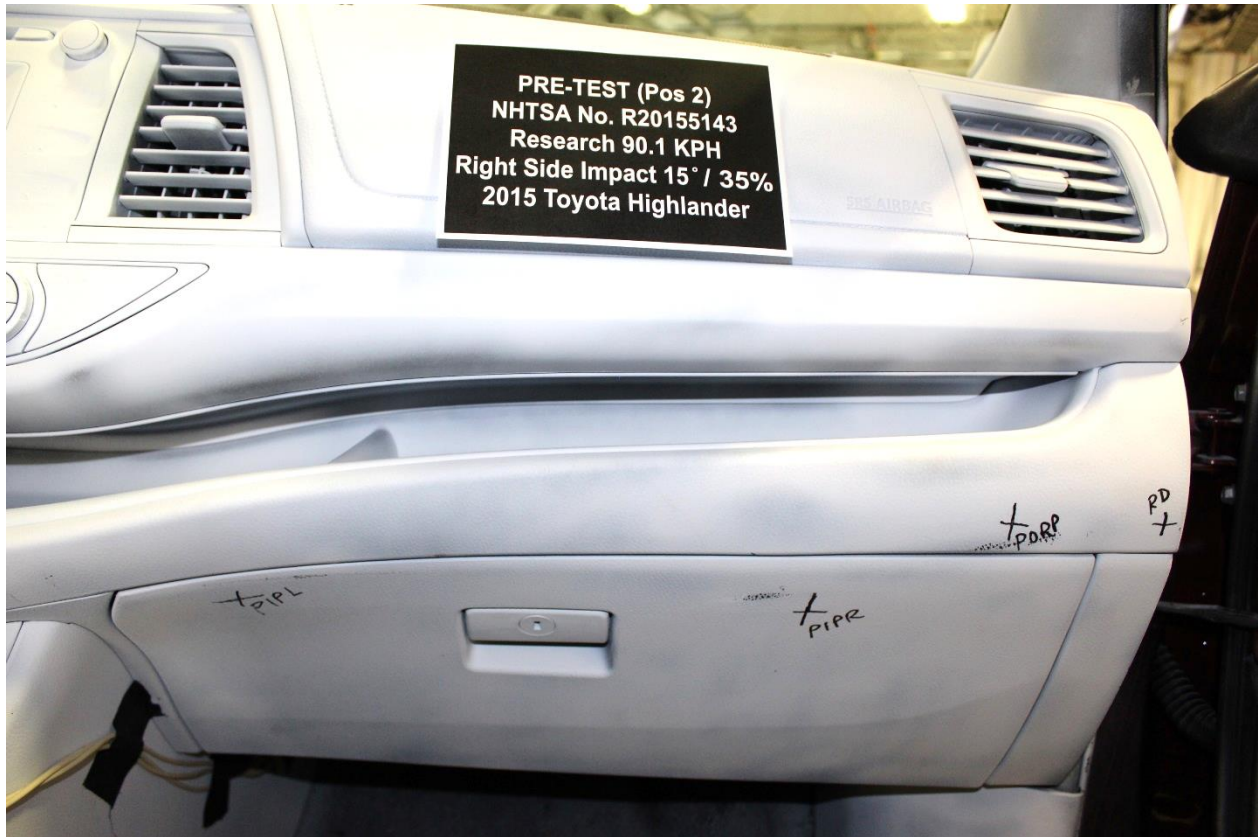
**No. 079 Post-Test View of Driver Head Contact with Vehicle Interior – A**

**Photo Not Applicable**

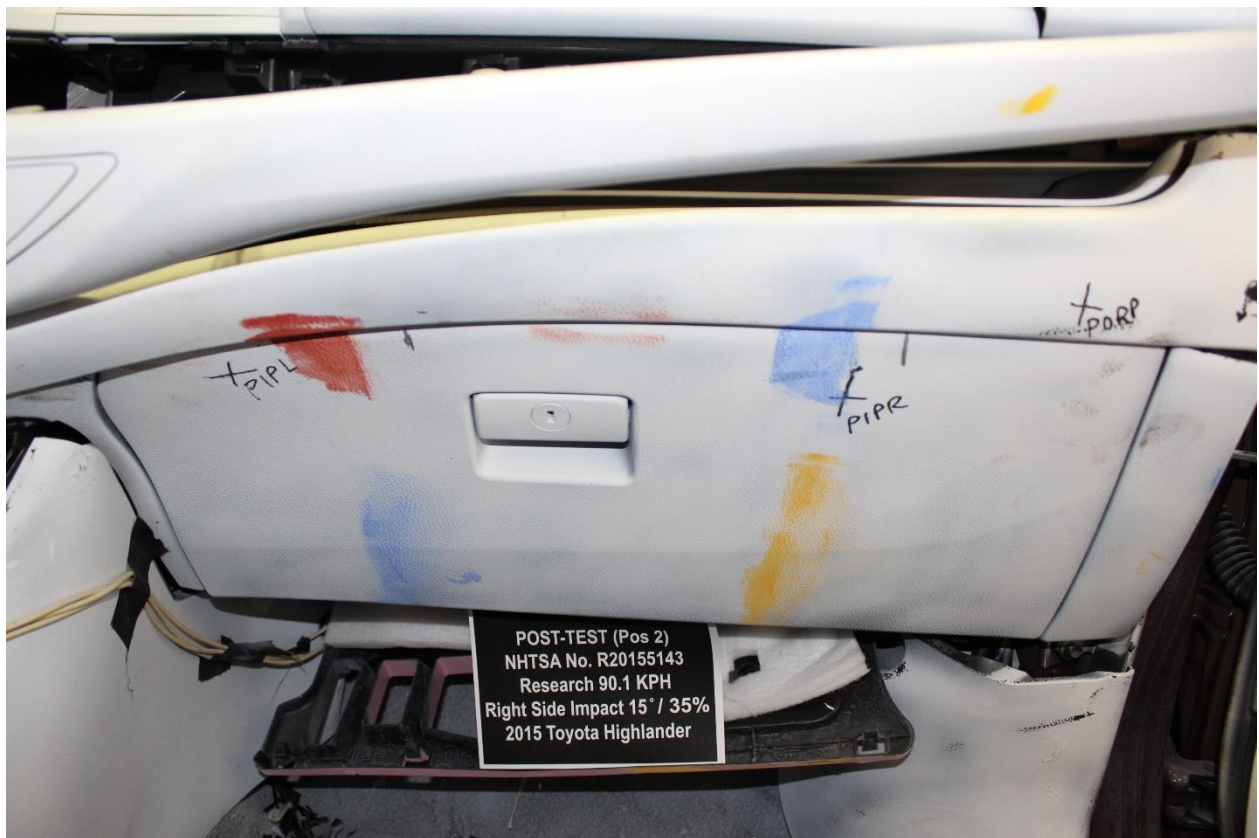
**No. 080: Post-Test View of Driver Body Contact with Vehicle Interior - B**

# **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**



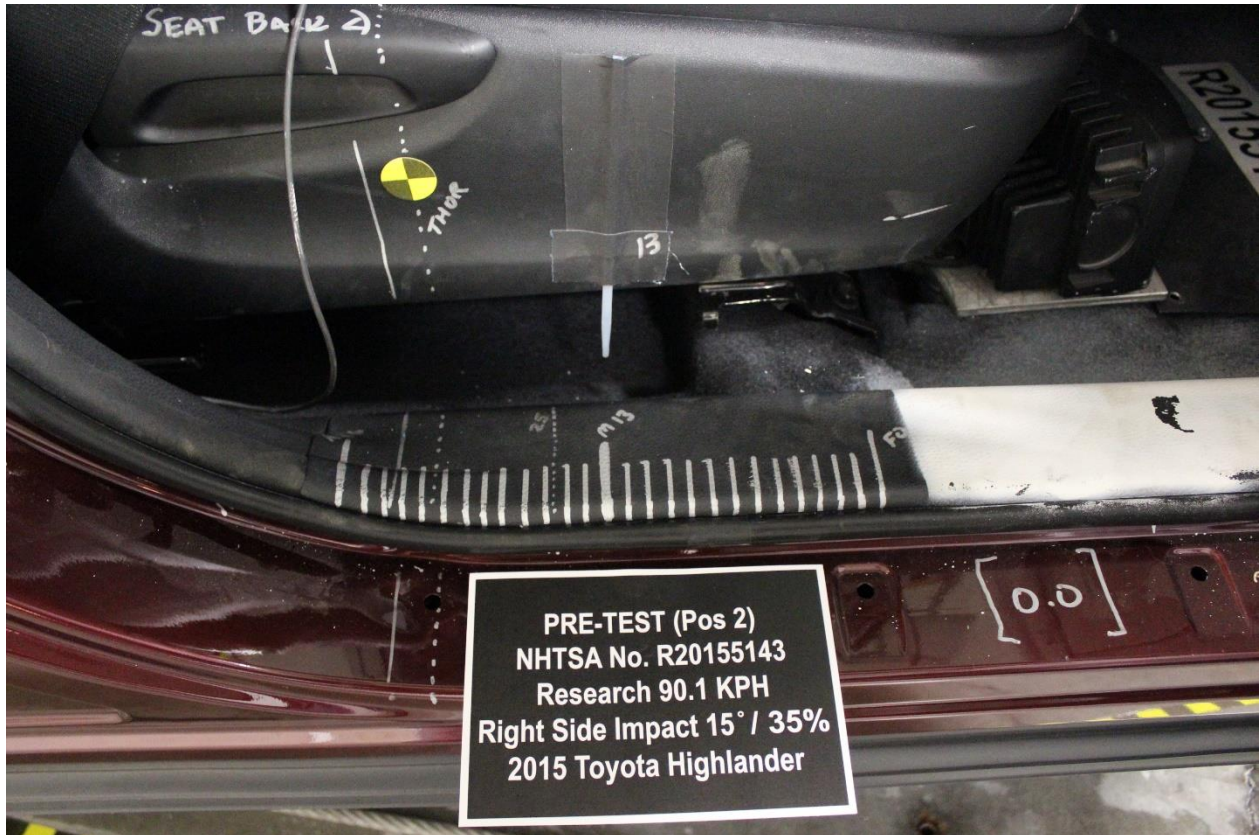
**No. 101: Post-Test Right Side Passenger and Interior View**



**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**



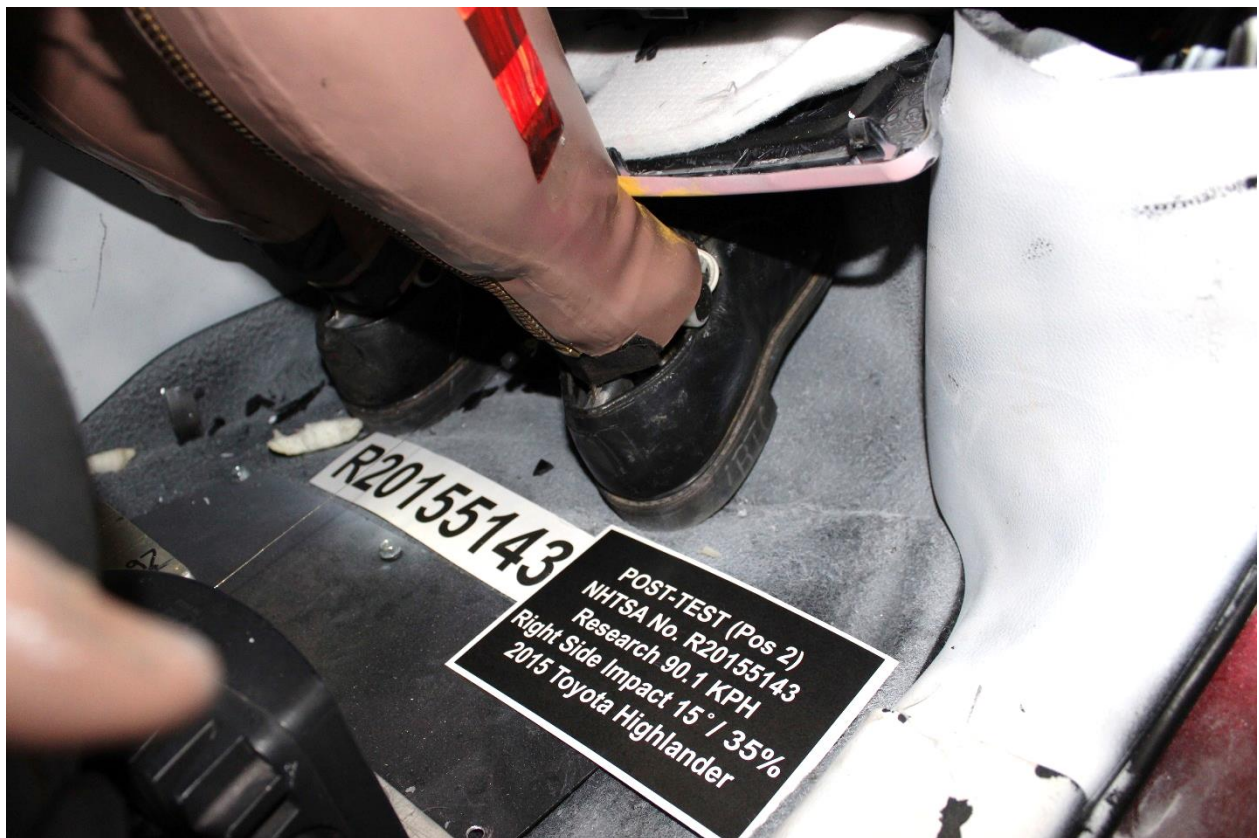
**No. 108: Pre-Test Passenger Adjustable D-ring**



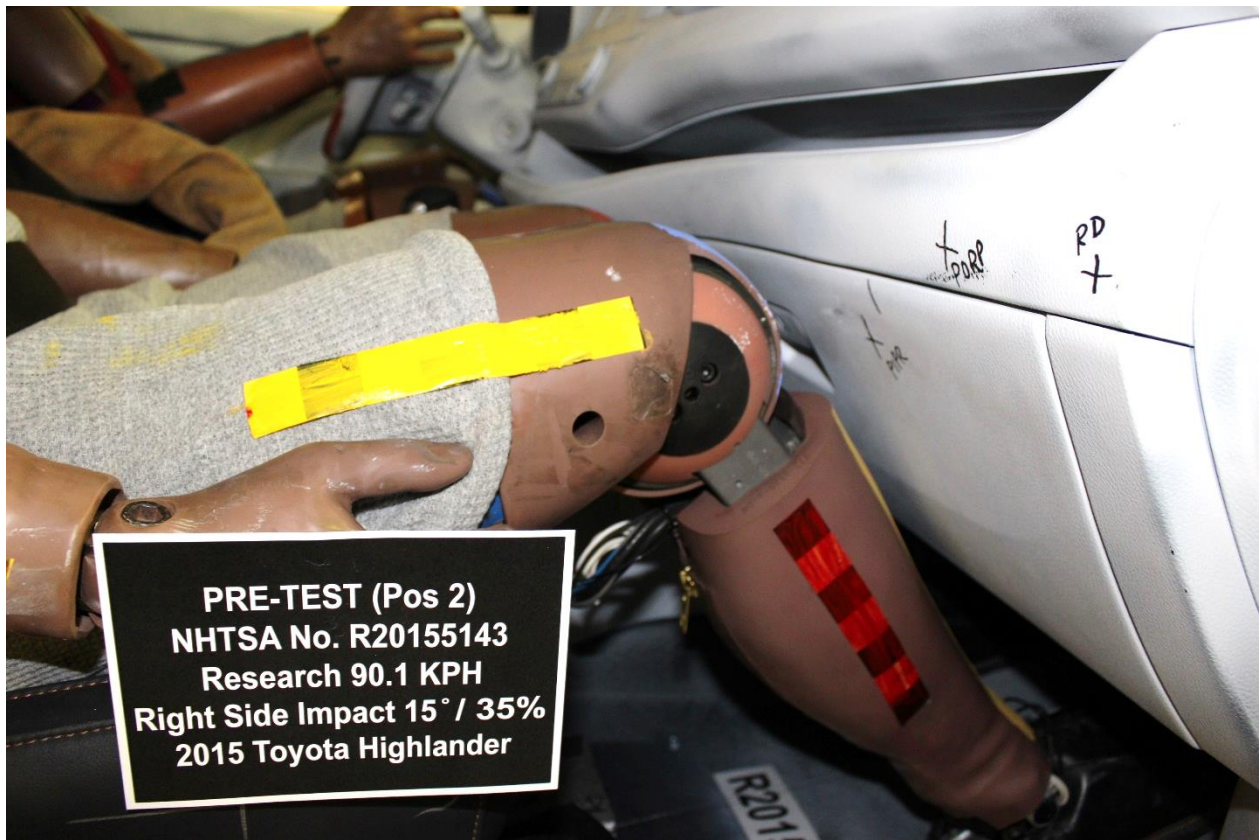
**No. 109: Post-Test Passenger Adjustable D-ring**



No. 110: Pre-Test View of Passenger Feet

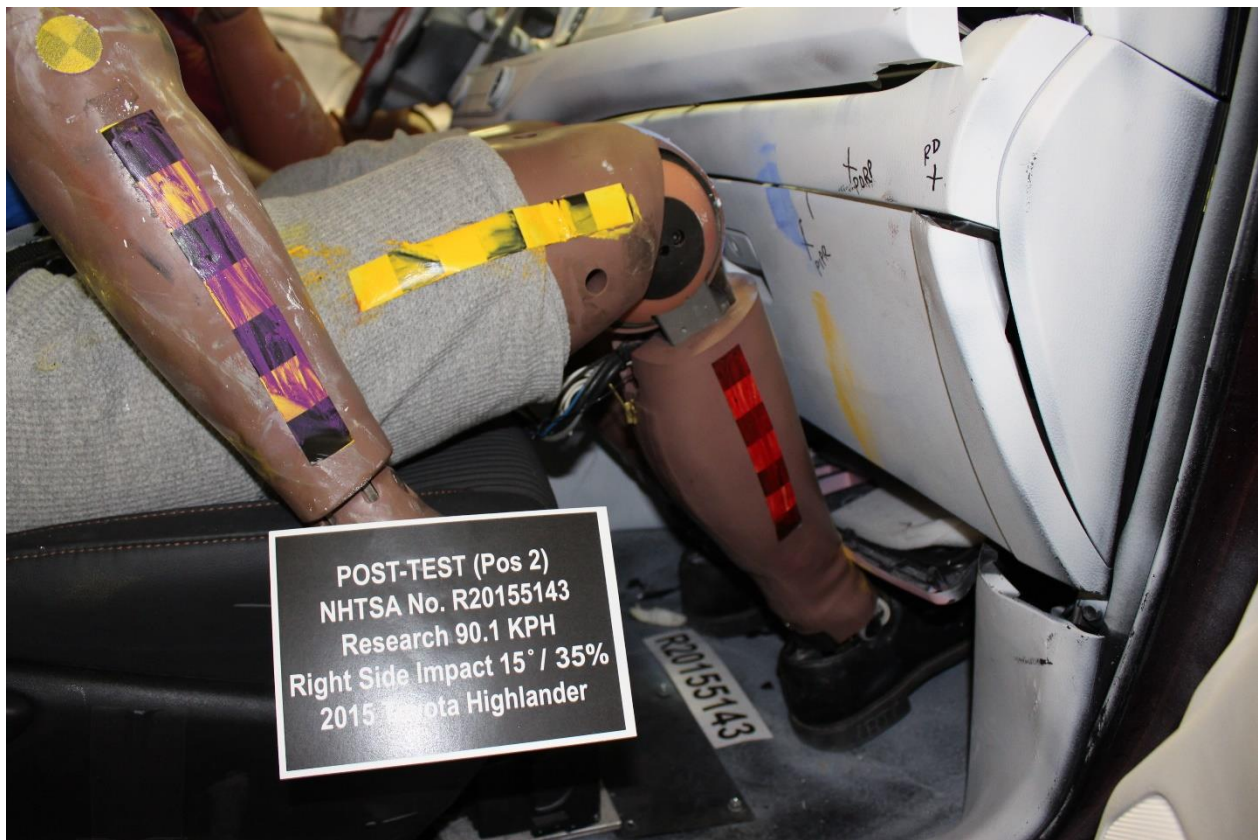


No. 111: Post-Test View of Passenger Feet



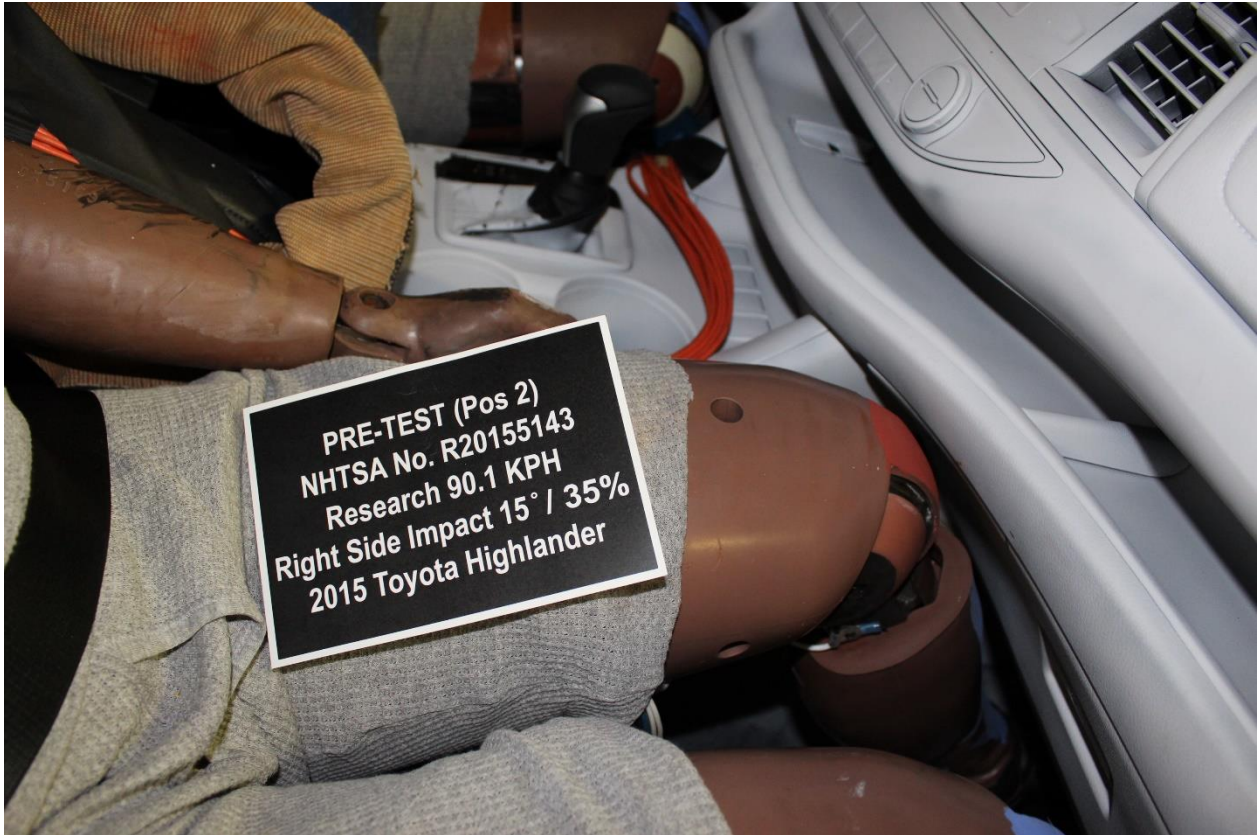
**PRE-TEST (Pos 2)**  
**NHTSA No. R20155143**  
**Research 90.1 KPH**  
**Right Side Impact 15° / 35%**  
**2015 Toyota Highlander**

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

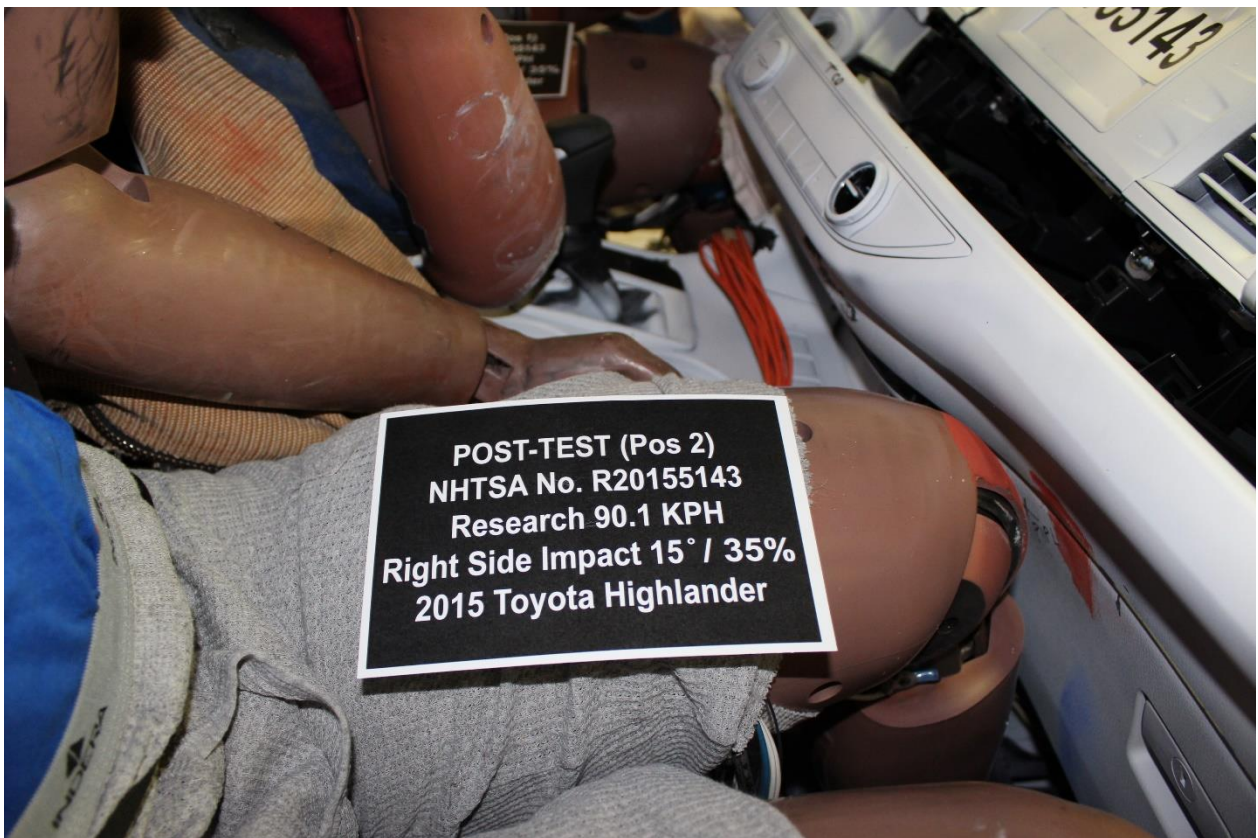


**POST-TEST (Pos 2)**  
**NHTSA No. R20155143**  
**Research 90.1 KPH**  
**Right Side Impact 15° / 35%**  
**2015 Toyota Highlander**

**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**



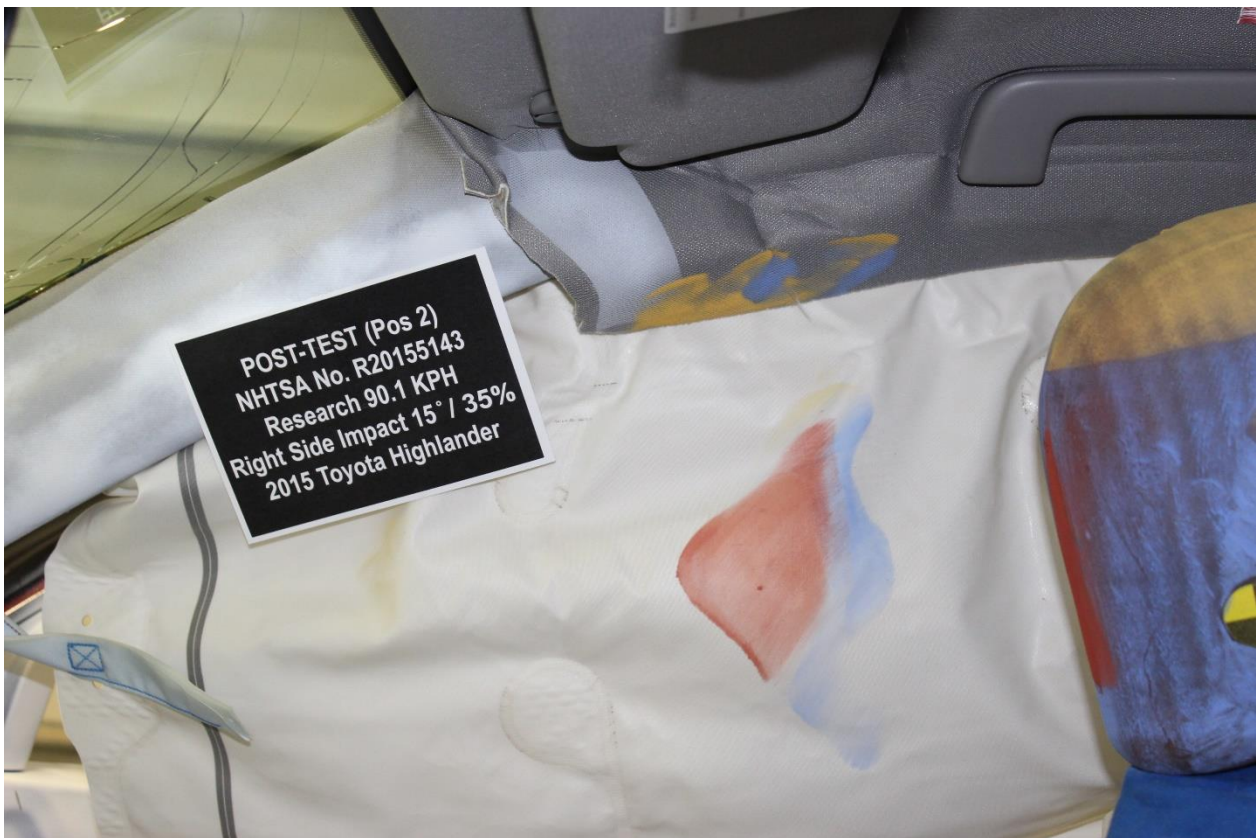
**No. 116: Pre-Test View of Passenger Abdomen**



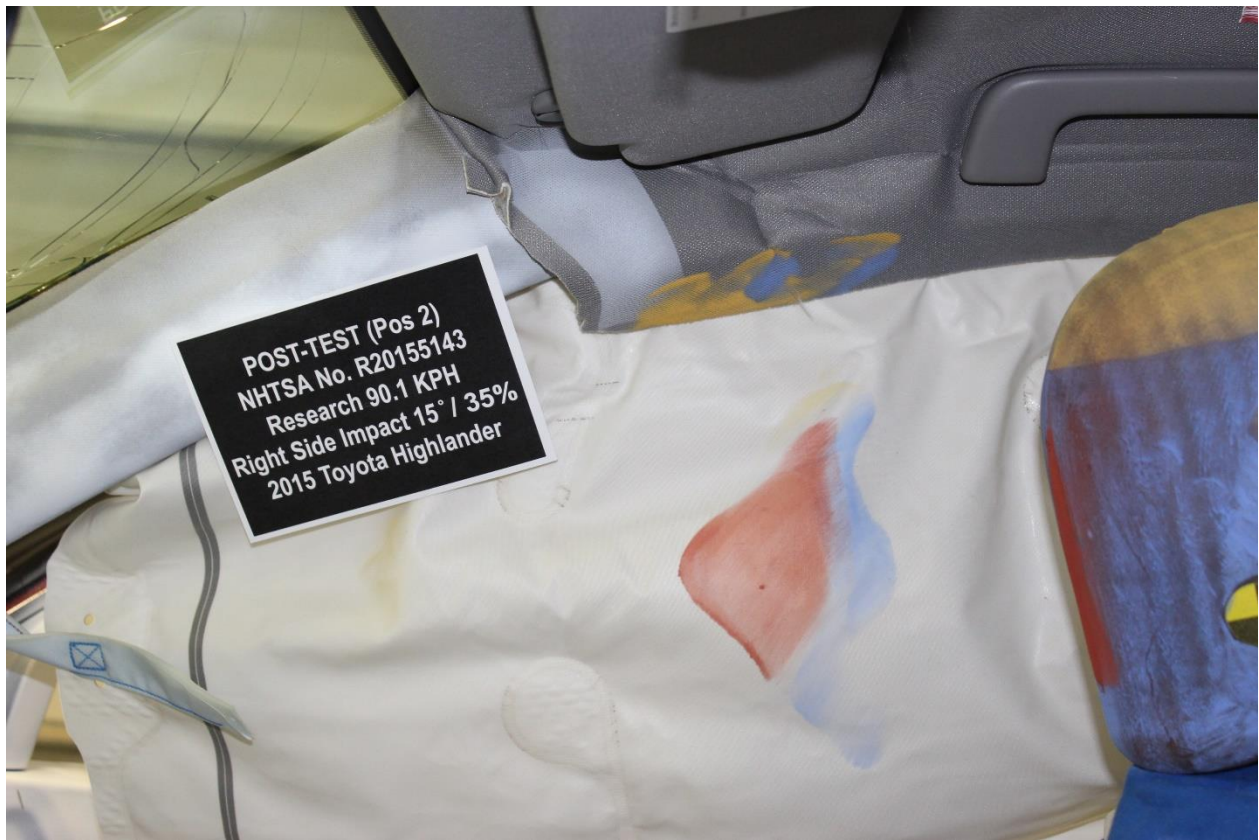
**No. 117: Post-Test View of Passenger Abdomen**



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



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



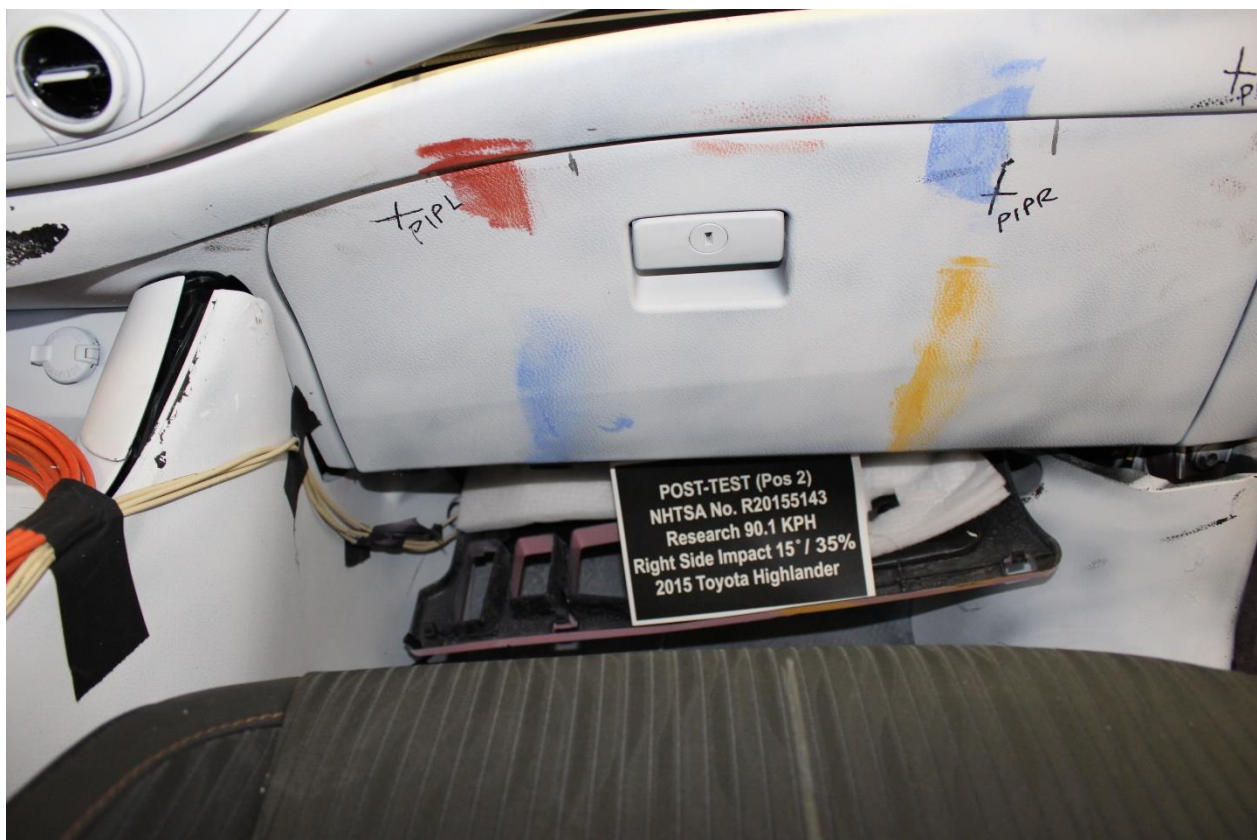
**No. 120: Post-Test View of Passenger Head contact with Interior**



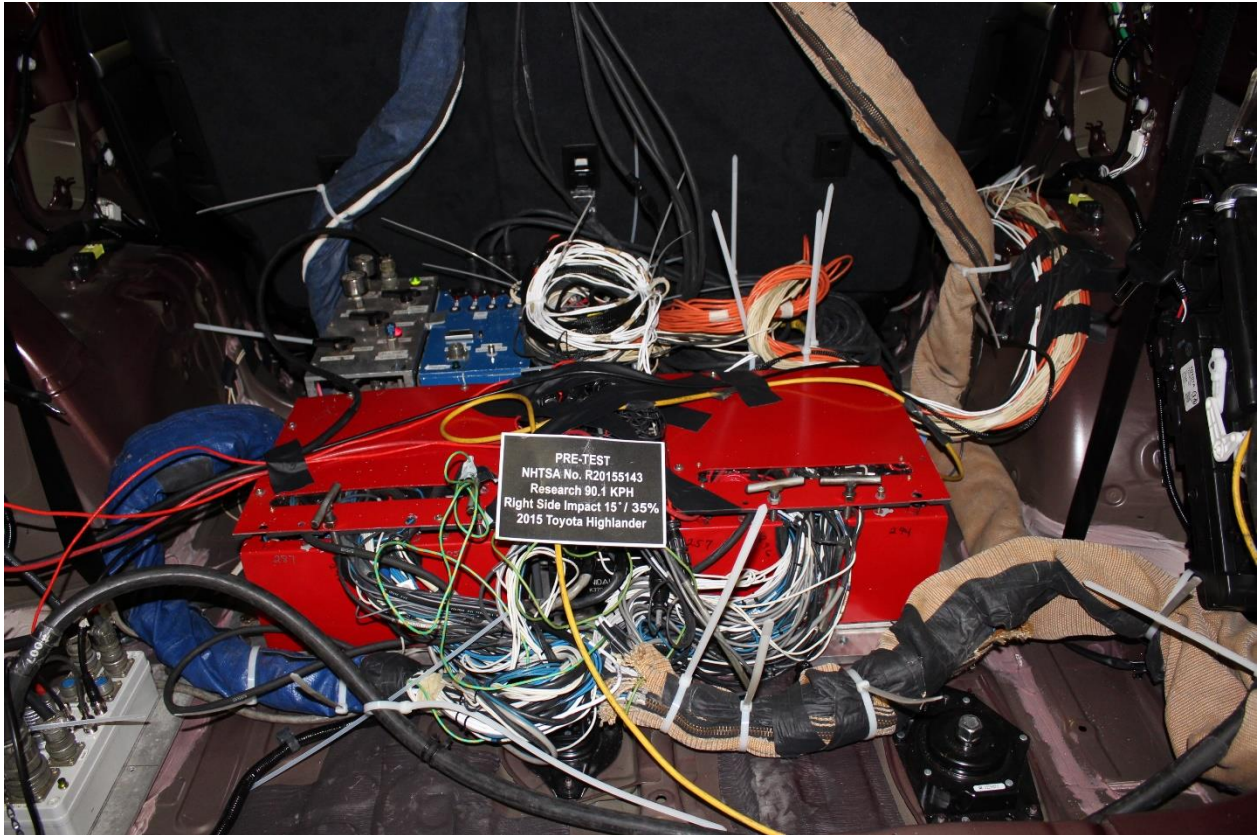
**No. 121: Post-Test View of Passenger Body contact with Interior**

# 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**



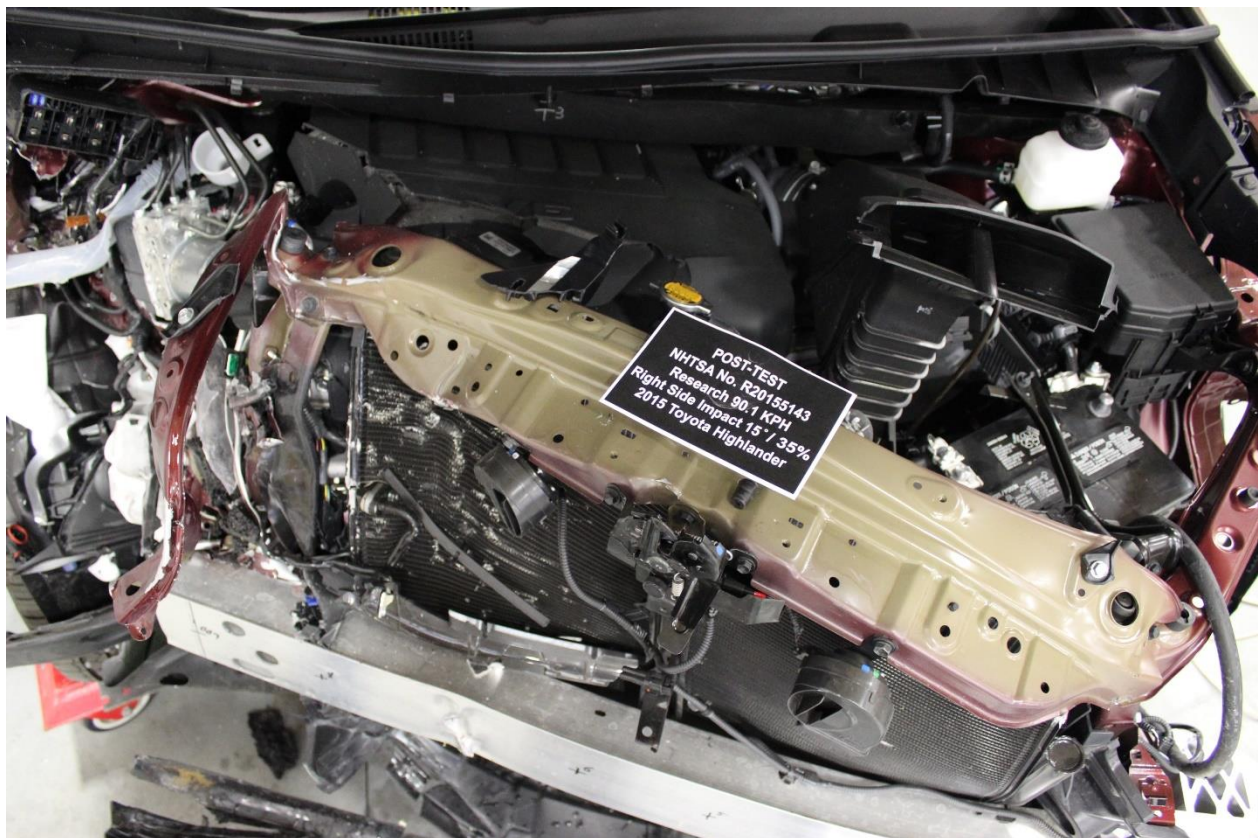
No. 126: Pre-Test View of Fuel Filler Cap



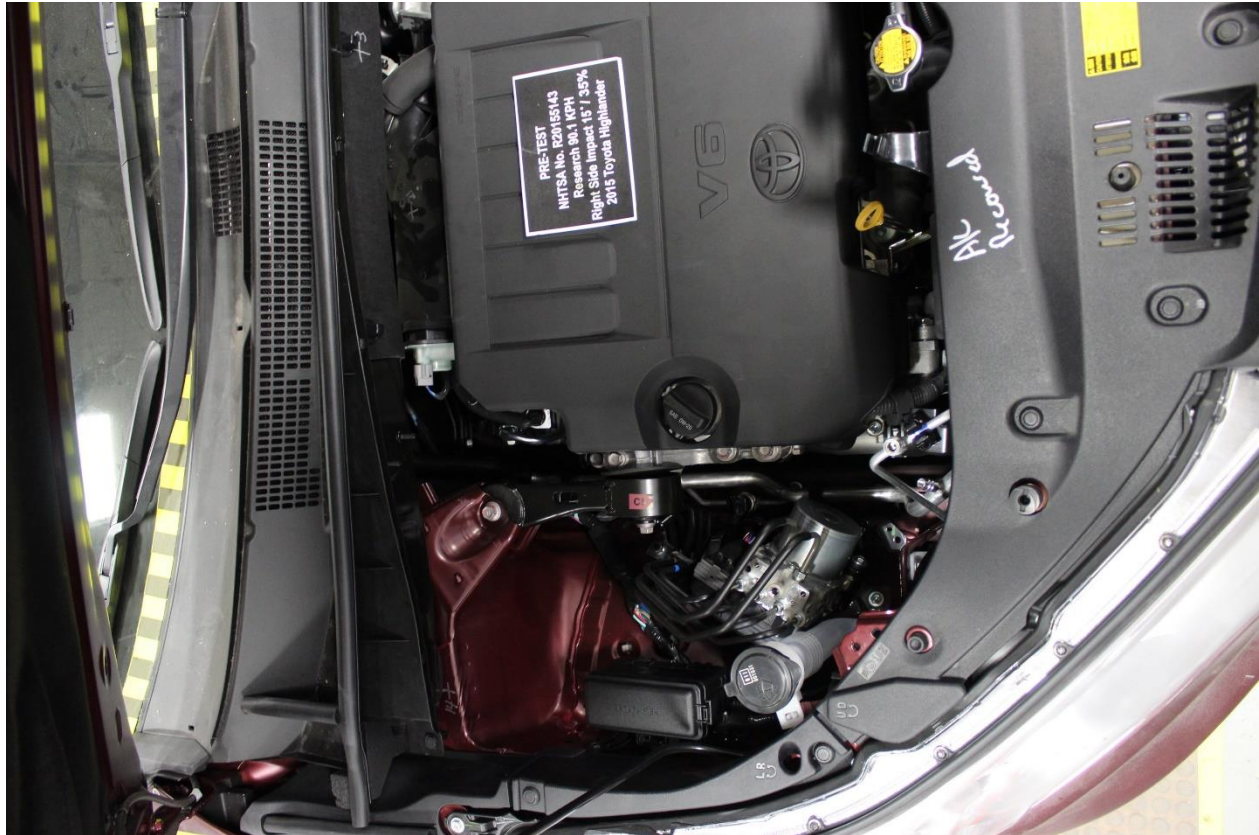
No. 127: Post-Test View of Fuel Filler Cap



No. 128: Pre-Test Engine Compartment View



No. 129: Post-Test Engine Compartment View



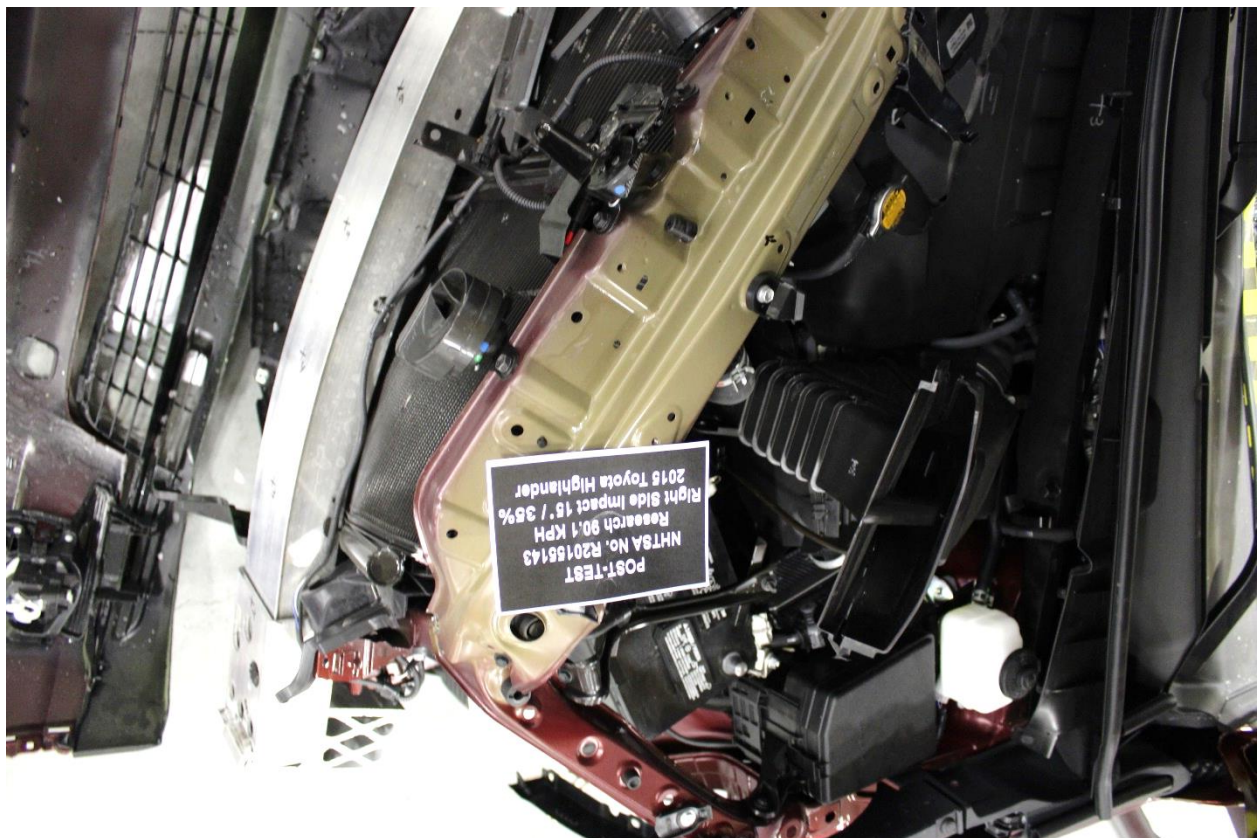
**No. 130: Pre-Test Right Side Engine Compartment View**



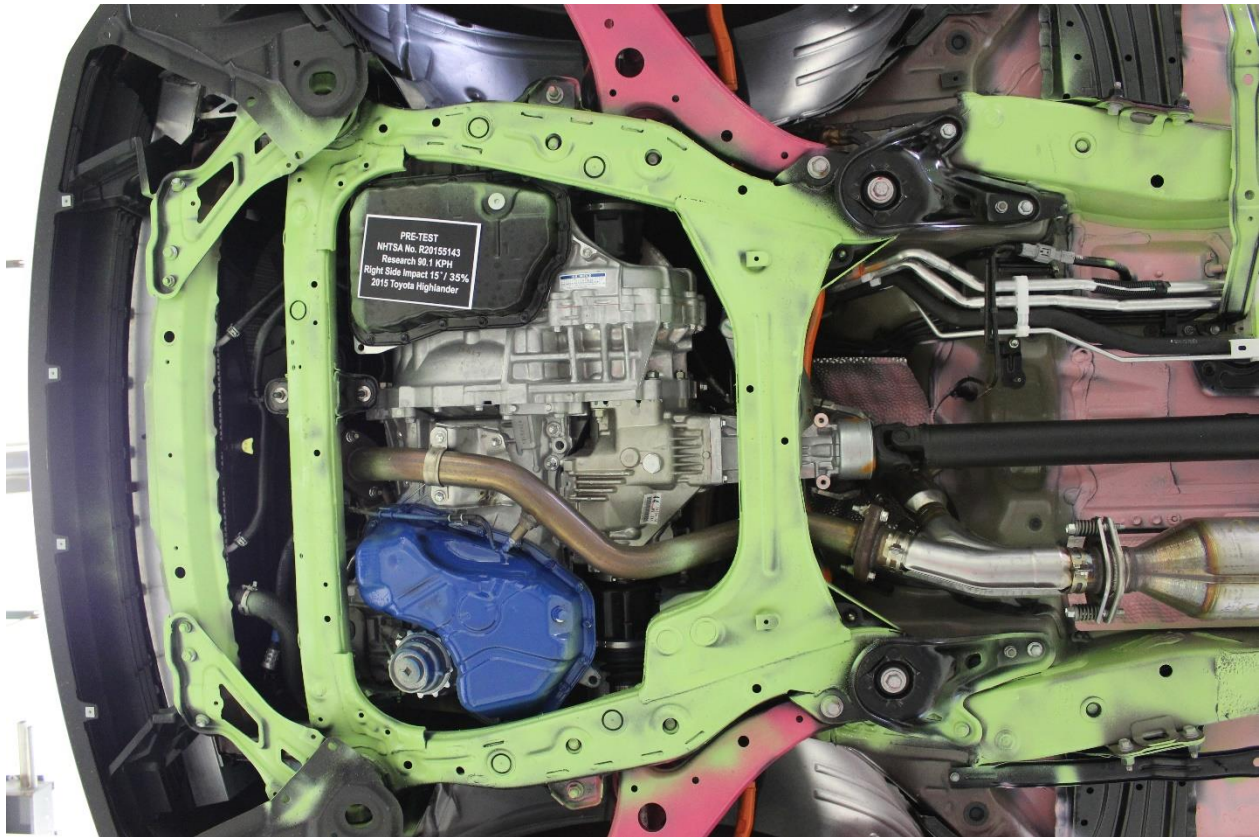
**No. 131: Post-Test Right Side Engine Compartment View**



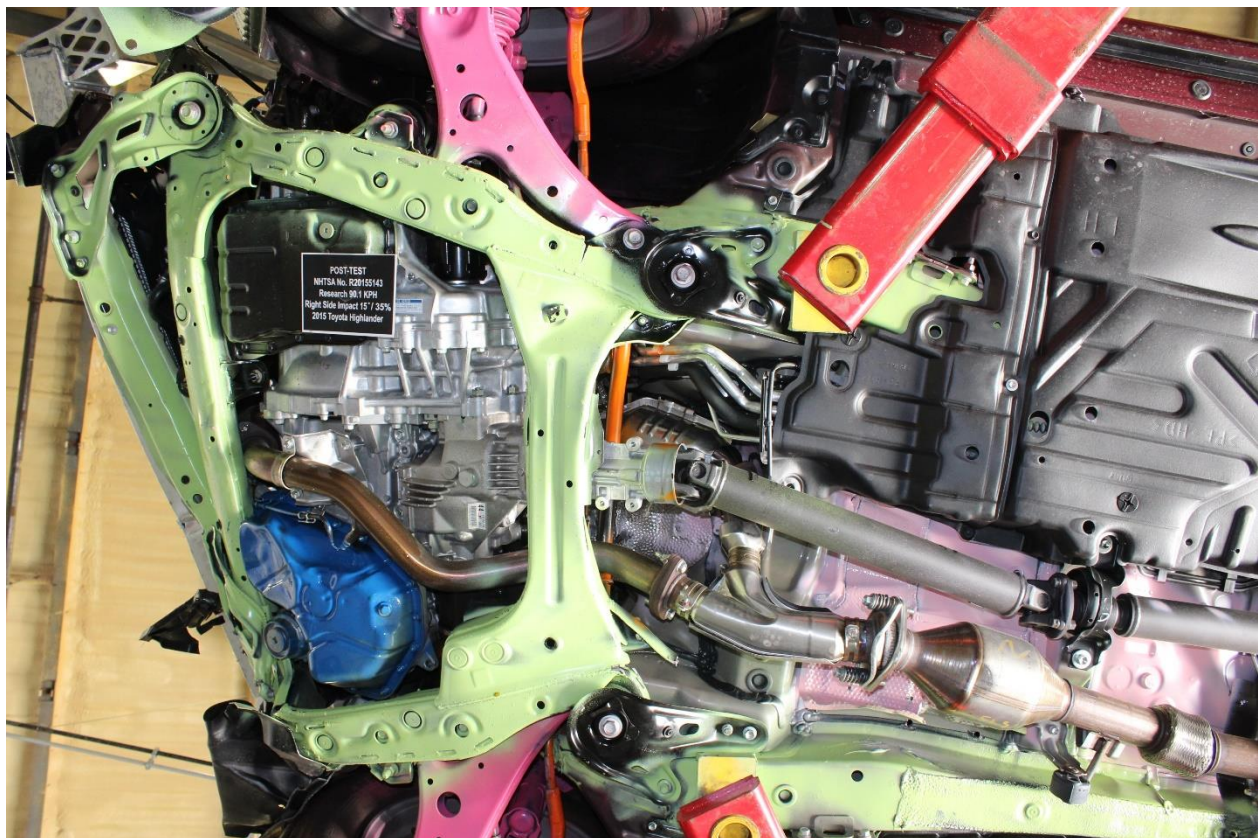
**No. 132: Pre-Test Left Side Engine Compartment View**



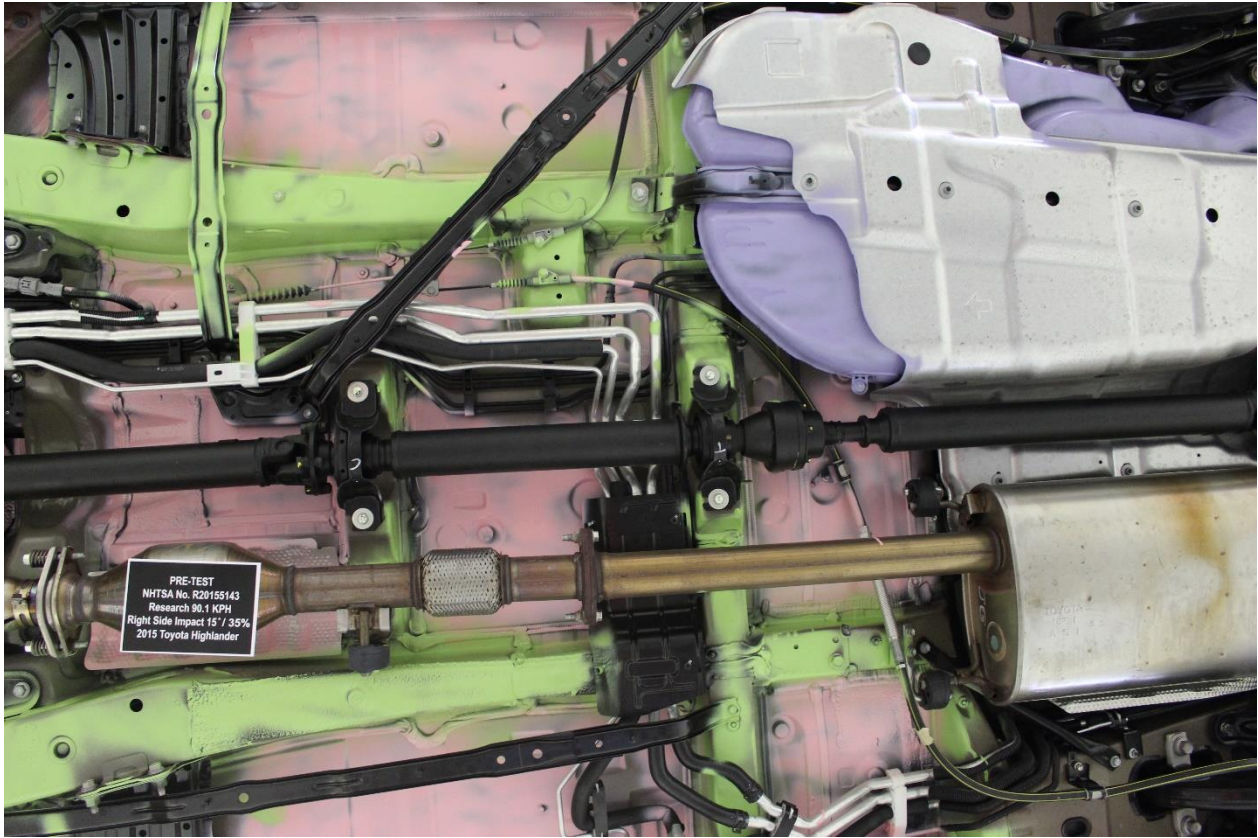
**No. 133: Post-Test Left Side Engine Compartment View**



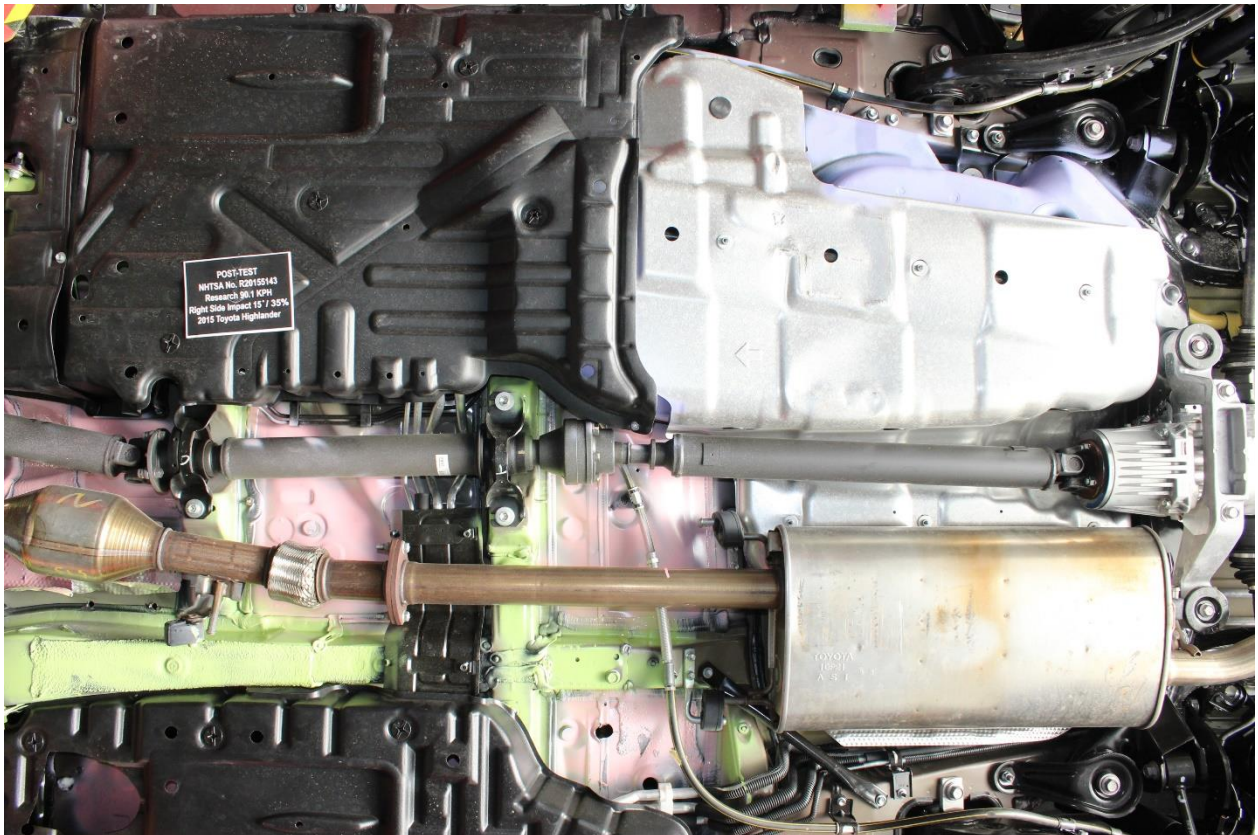
**No. 134: Pre-Test View of Front Underbody (perpendicular to vehicle)**



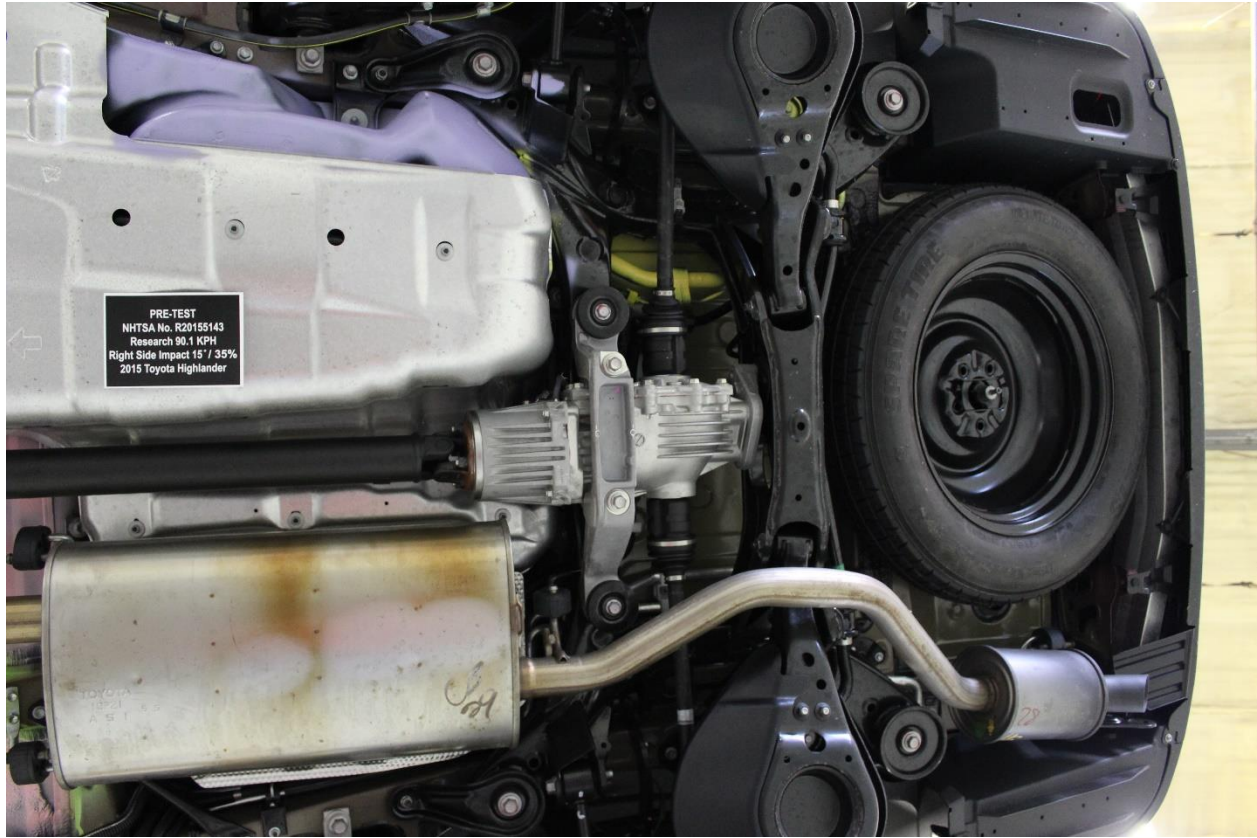
**No. 135: Post-Test View of Front Underbody (perpendicular to vehicle)**



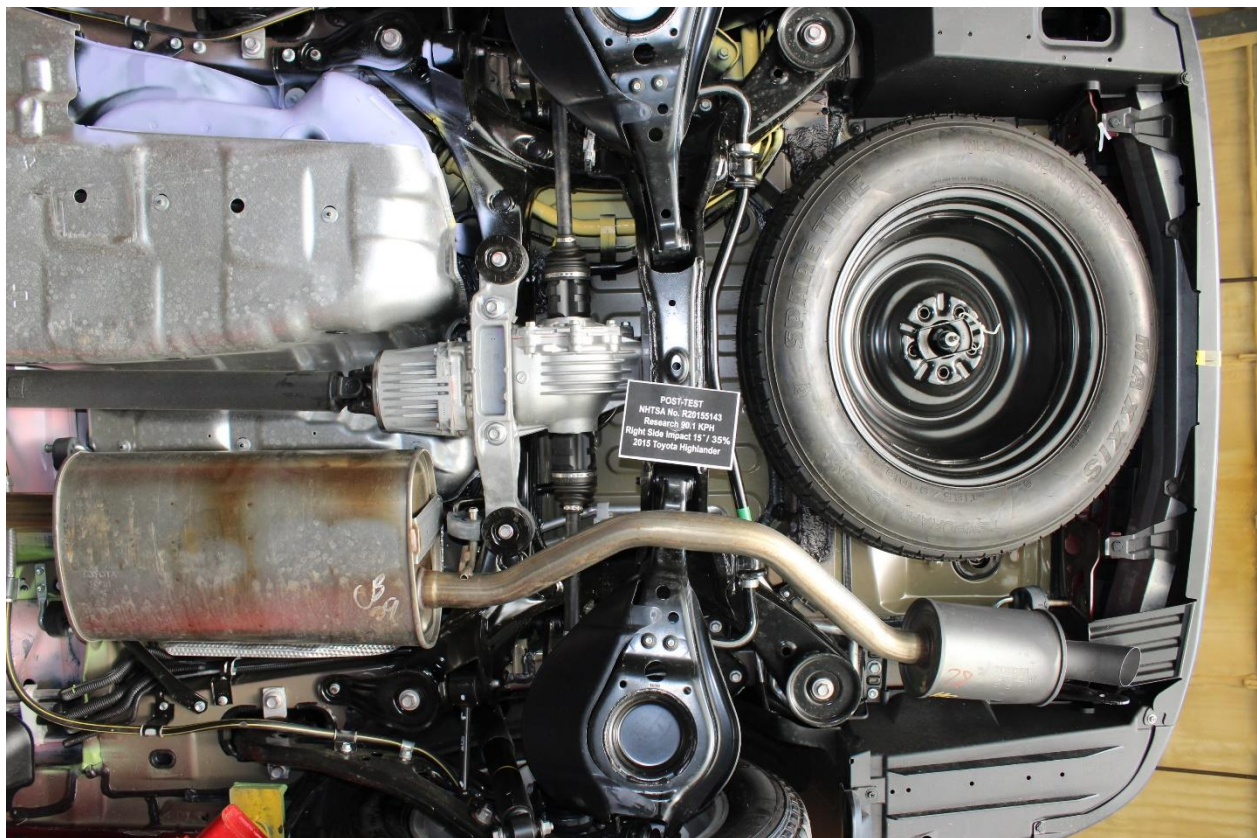
**No. 136: Pre-Test View of Mid Underbody (perpendicular to vehicle)**



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



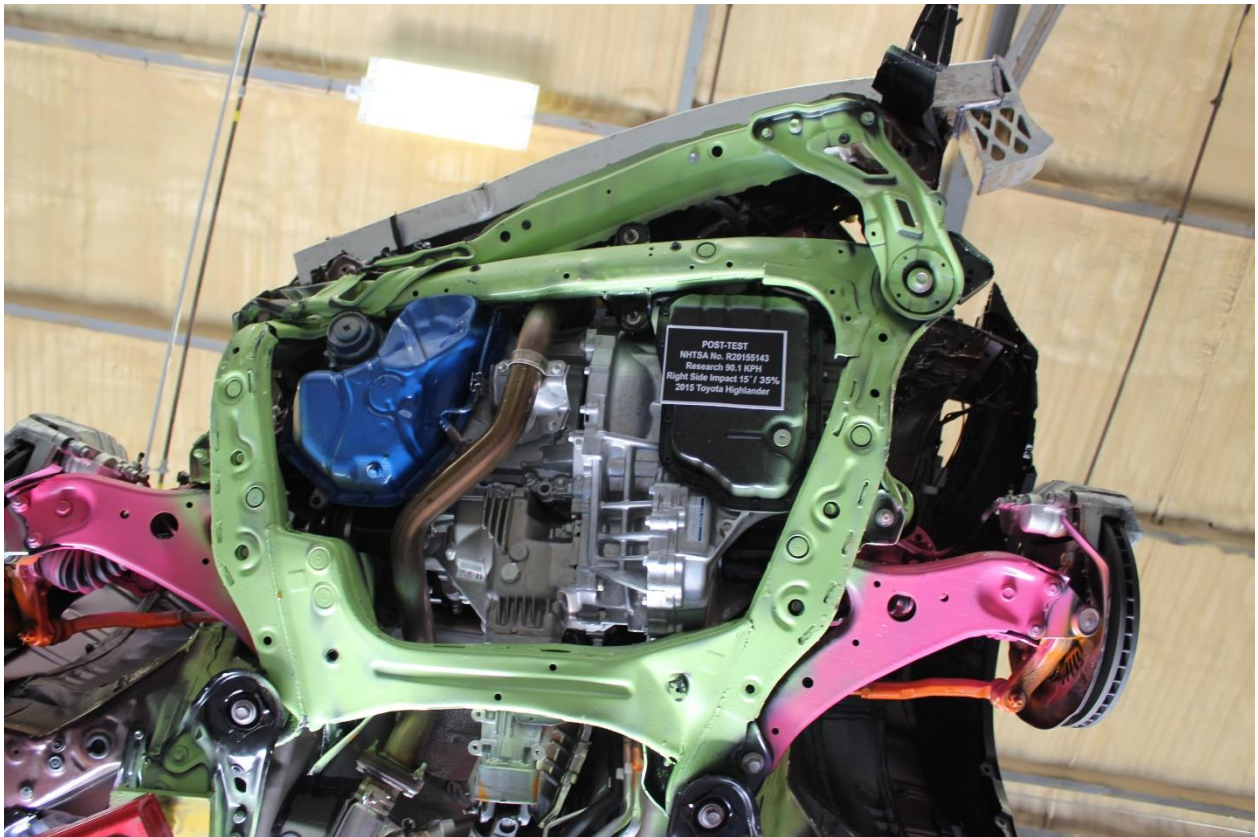
**No. 138: Pre-Test View of Rear Underbody (perpendicular to vehicle)**



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



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



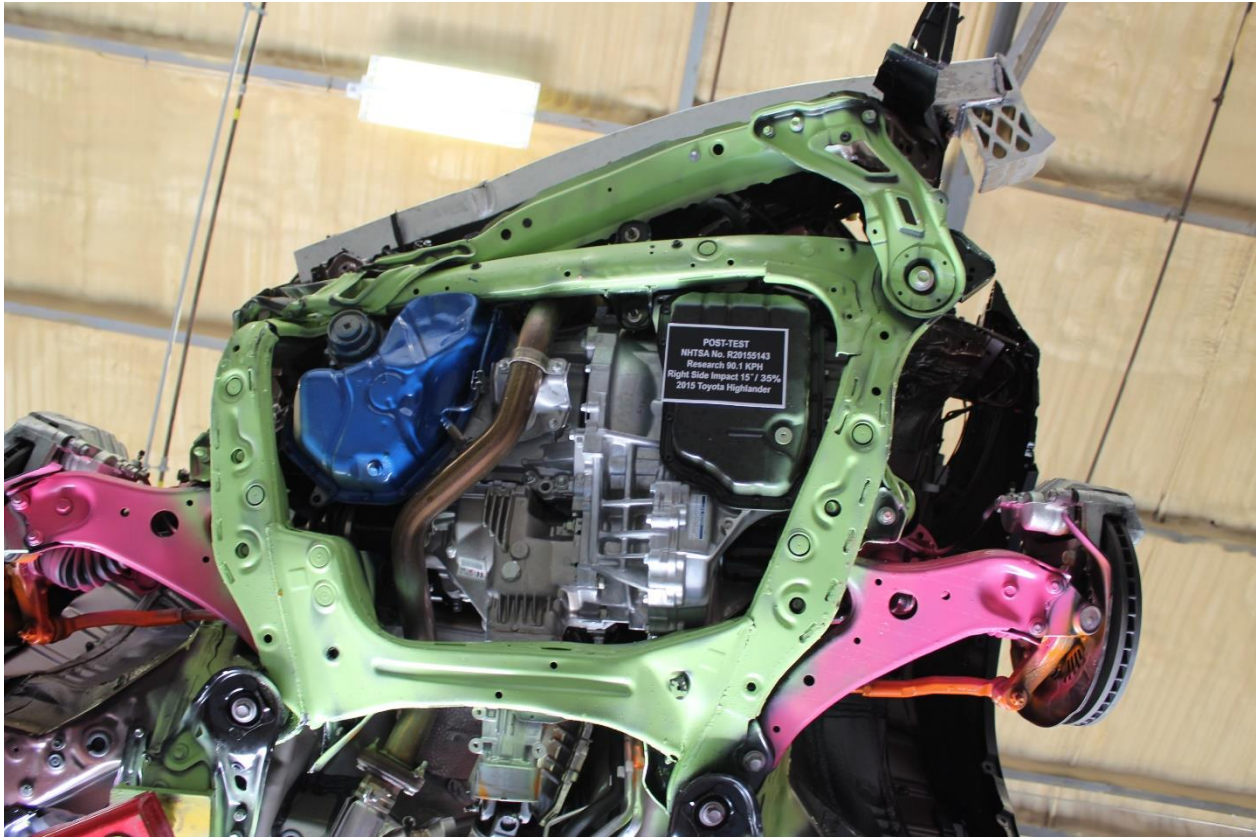
**No. 141: Post-Test View of Steering rack and or sway bar**



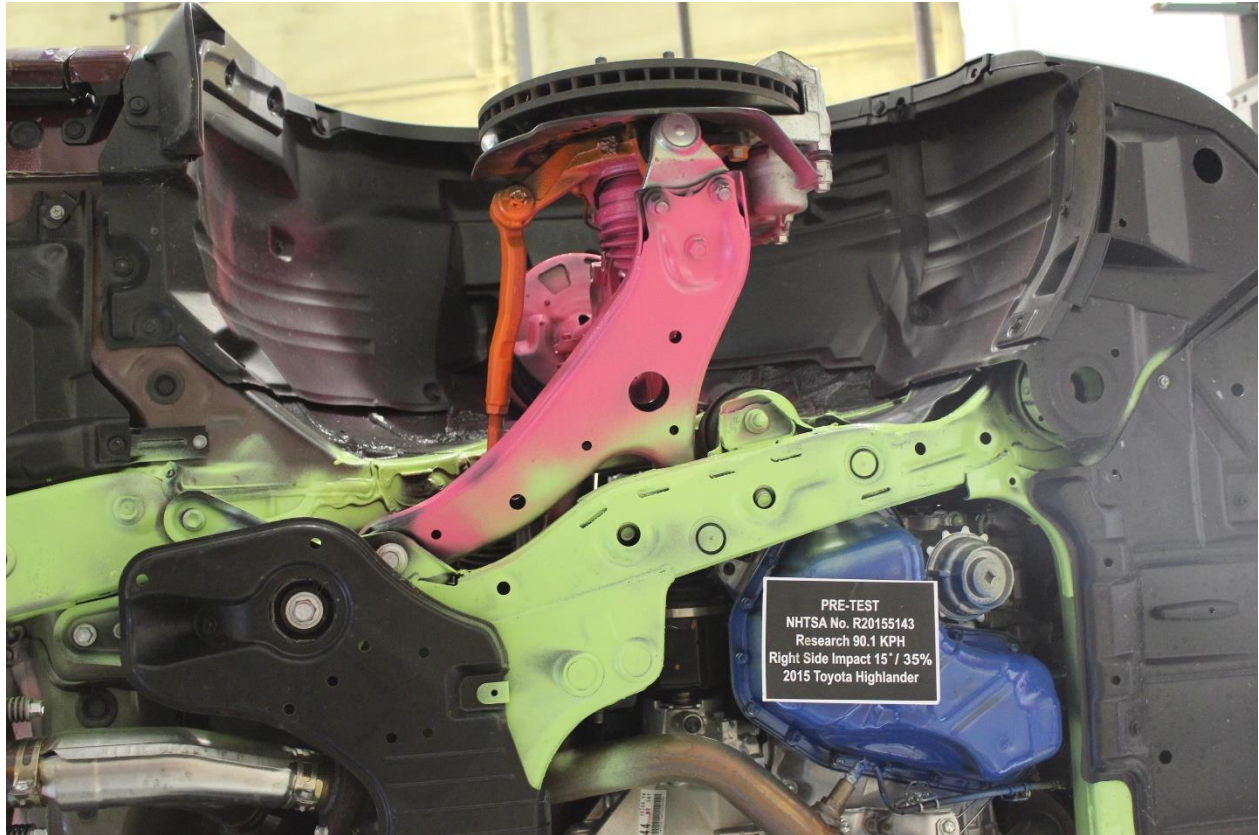
**No. 142: Pre-Test Bumper to Rail Attachments and Crush Initiators**



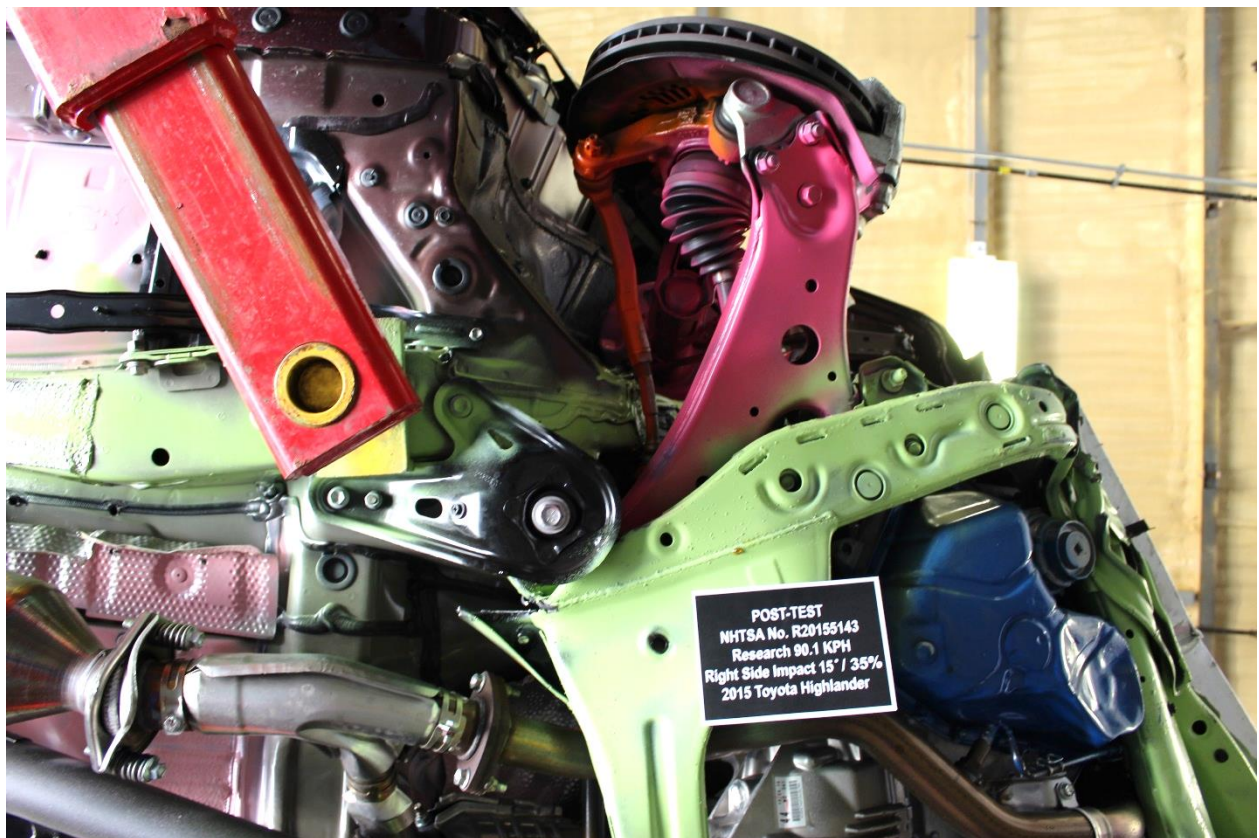
**No. 143: Post-Test Bumper to Rail Attachments and Crush Initiators**



**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**



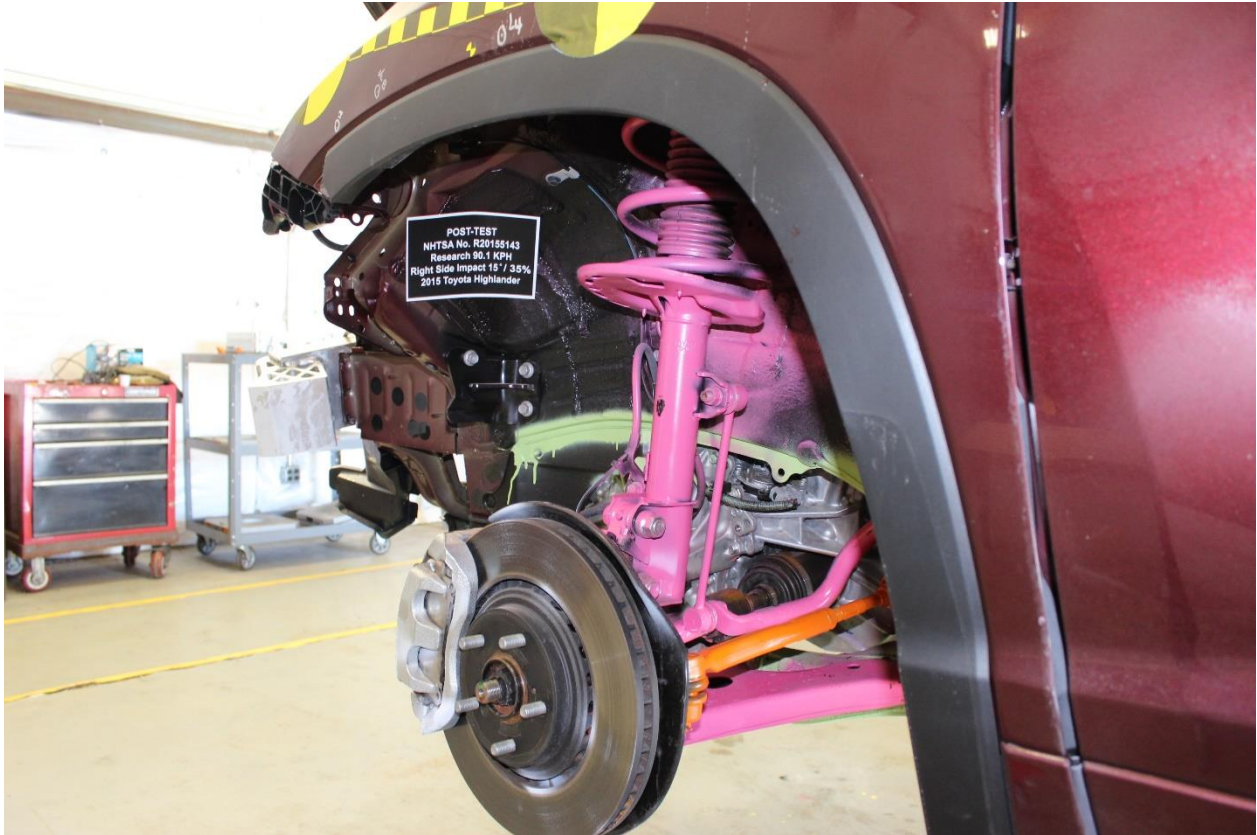
**No. 147: Pre-Test View of Front Driver Wheel Well w/ Tire Removed**



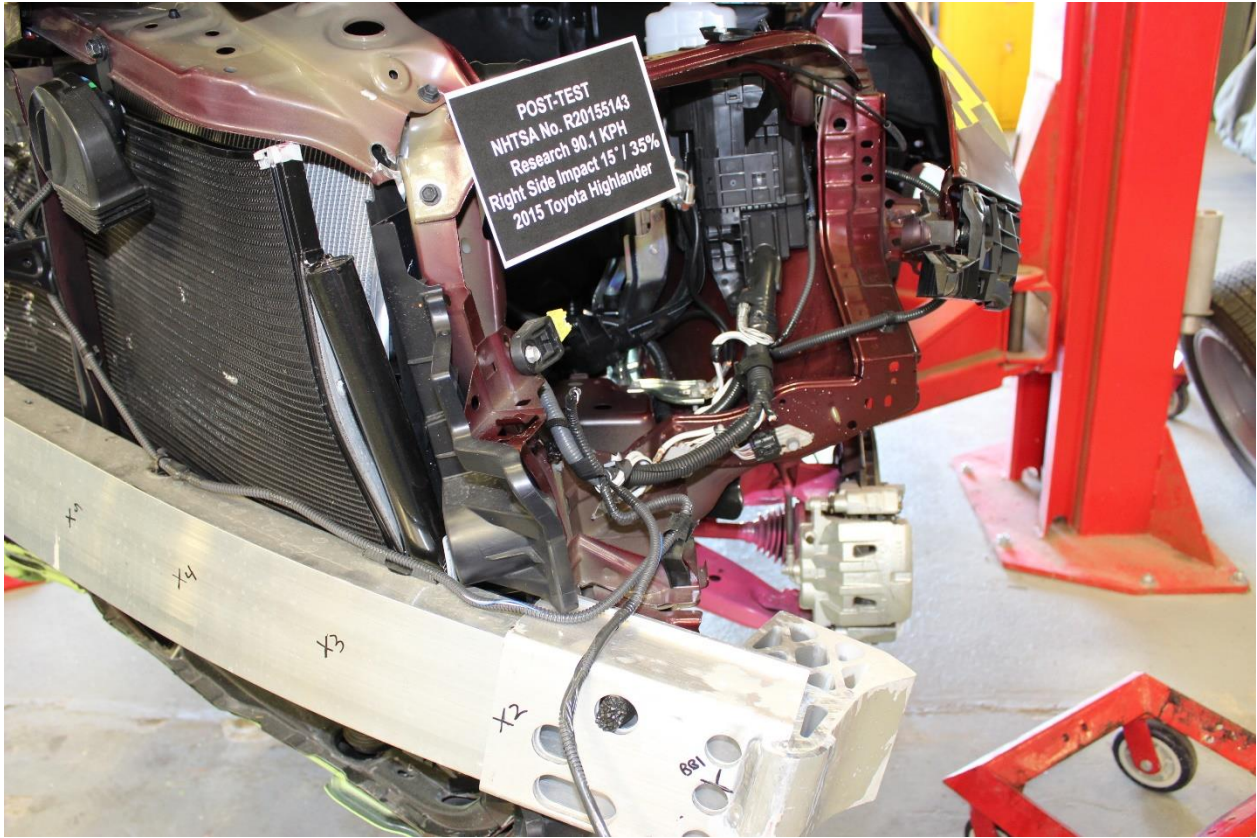
**No. 148: Post-Test ¾ View of Front Driver Wheel Well w/ Tire Removed**



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



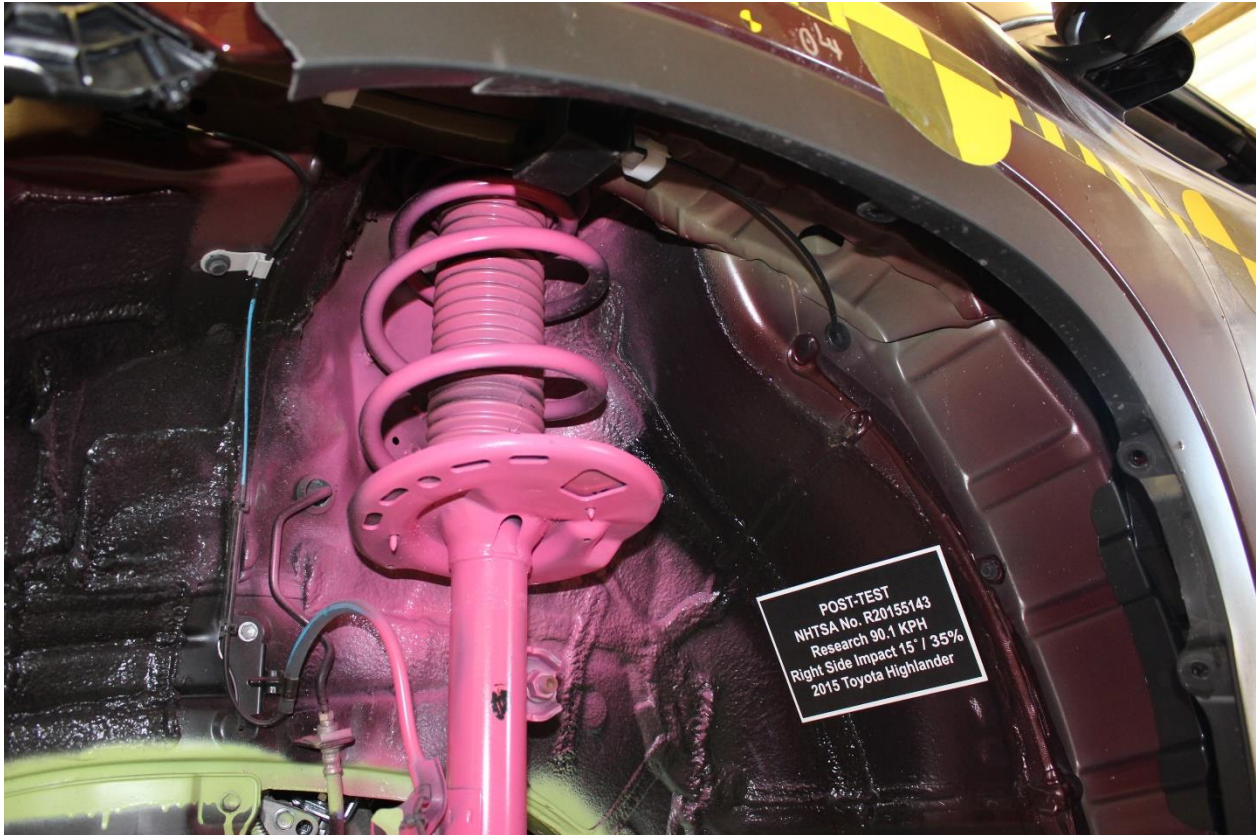
**No. 150: Post-Test Right Side 3/4 Rear View of the Front Driver Wheel Well w/ Tire Removed**



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



**No. 152: Post-Test Right Side 3/4 View of Front Driver Shotgun**



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



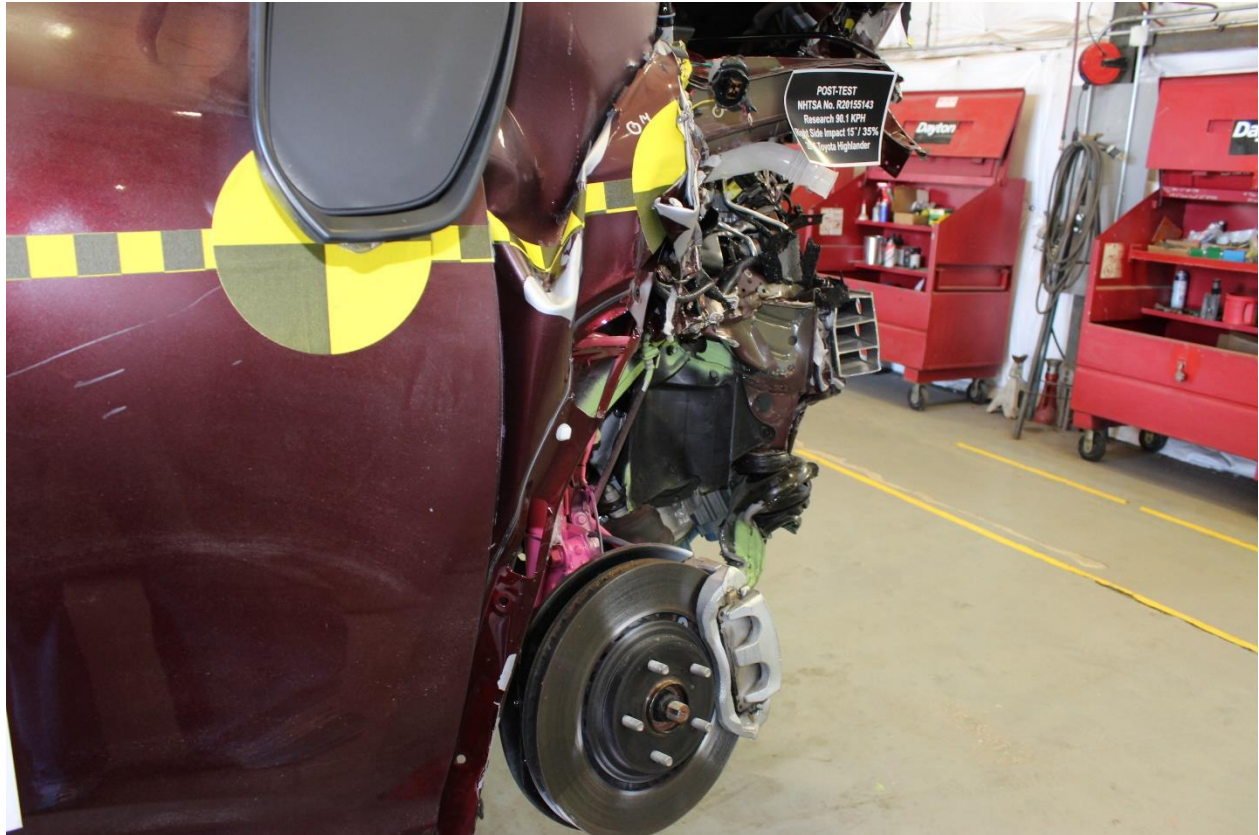
**No. 154: Post-Test ¾ View of Front Passenger Wheel Well w/ Tire Removed**



Overlap  
der  
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POST-TEST  
NHTSA No. R09155143  
Research No. 1 KPH  
Right Side Impact 15 / 35%  
2015 Toyota Highlander

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



POST-TEST  
NHTSA No. R09155143  
Research No. 1 KPH  
Right Side Impact 15 / 35%  
2015 Toyota Highlander

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 ¾ 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



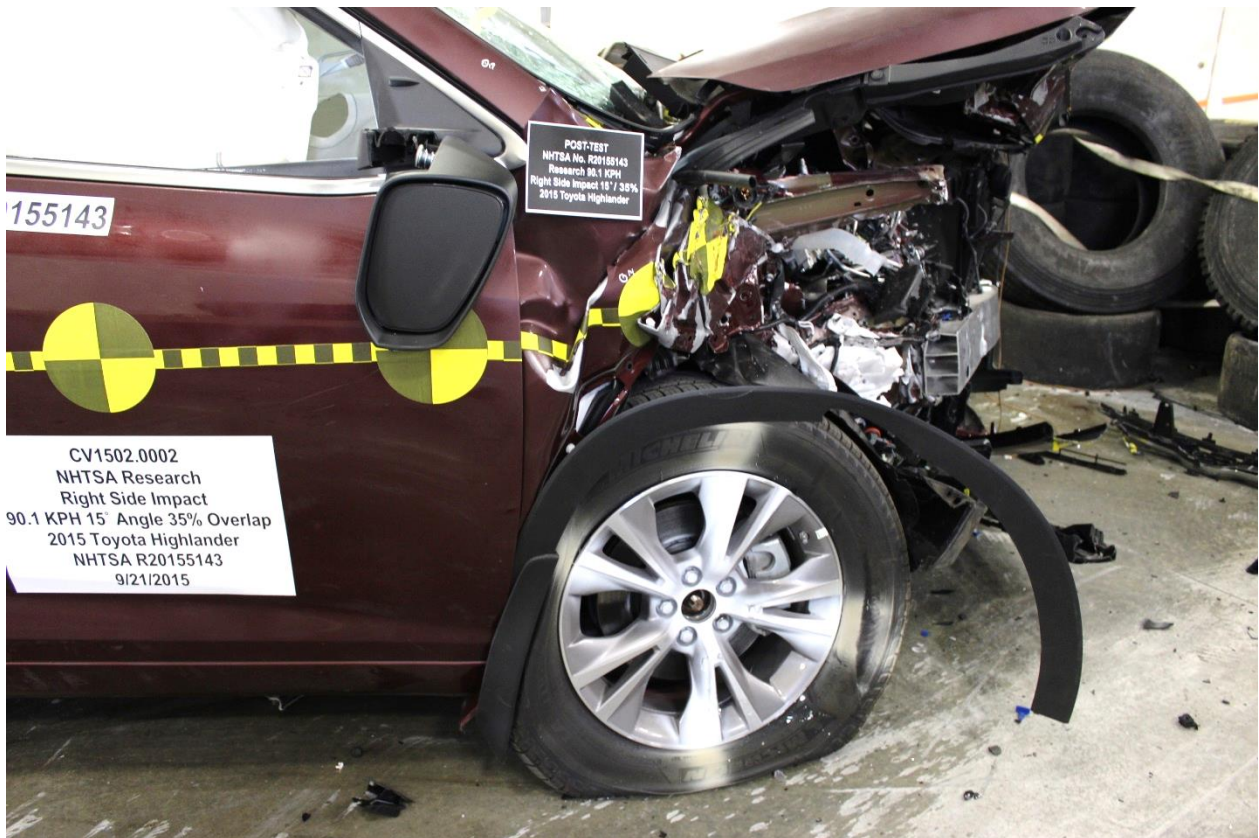
**No. 161: Post-Test View of Deformation of A pillar-Struck Side**



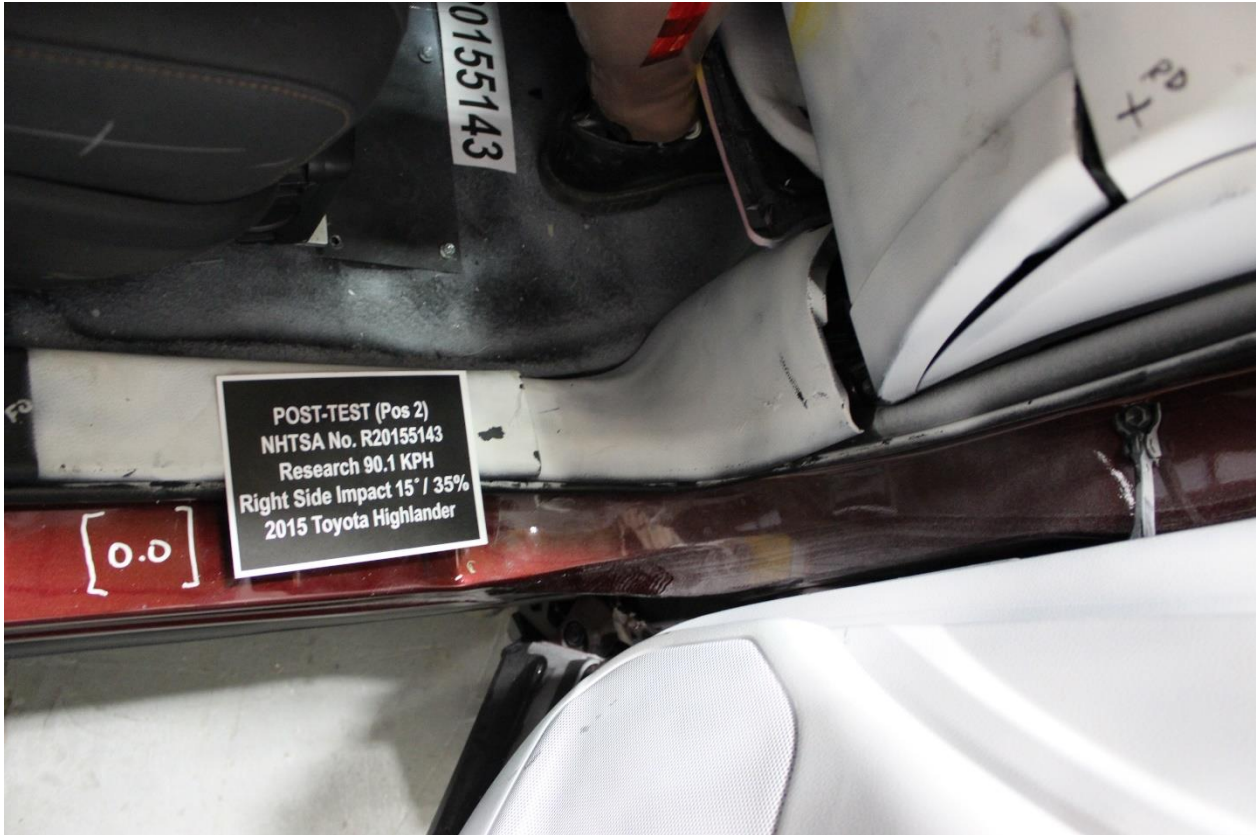
**No. 162: Post-Test View of Deformation of B pillar-Struck Side**



**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**



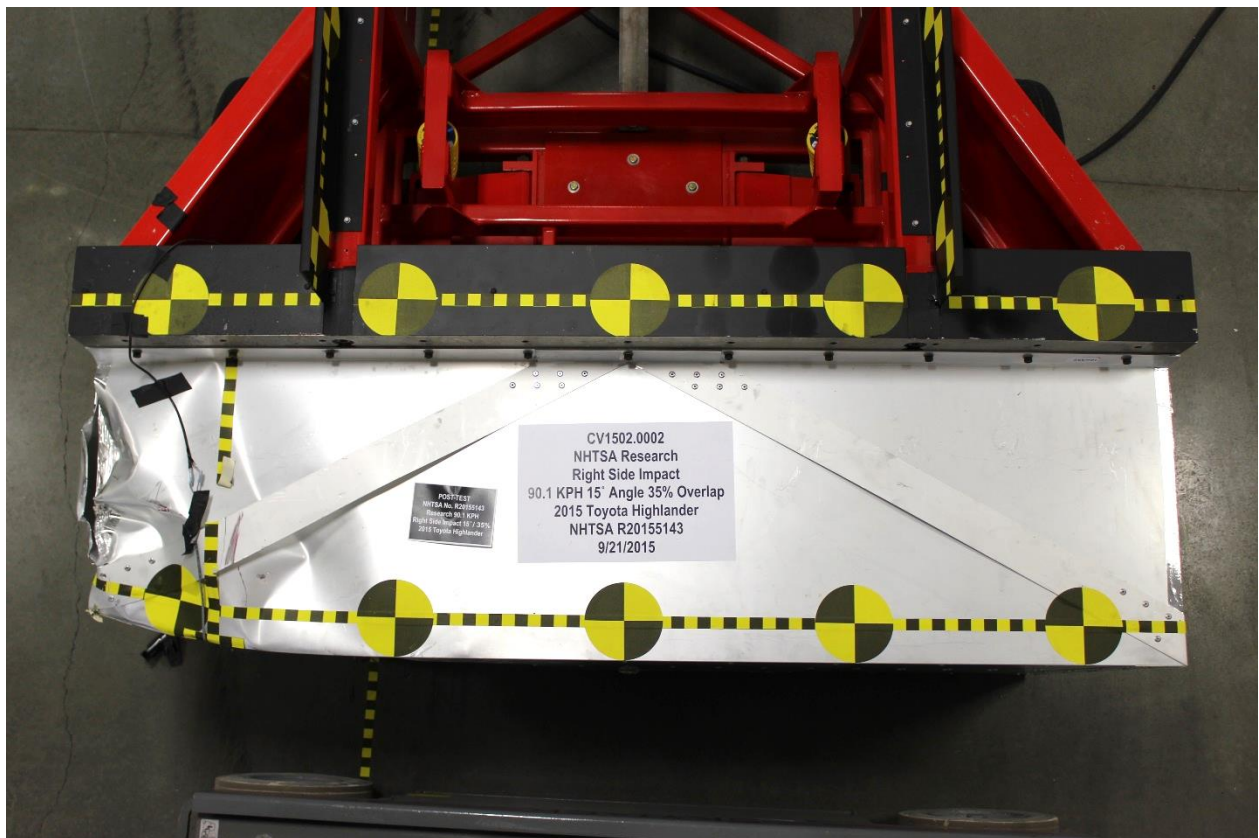
**No. 169: Pre-Test Right Side View of OMDB**



**No. 170: Post-Test Right Side View of OMDB**



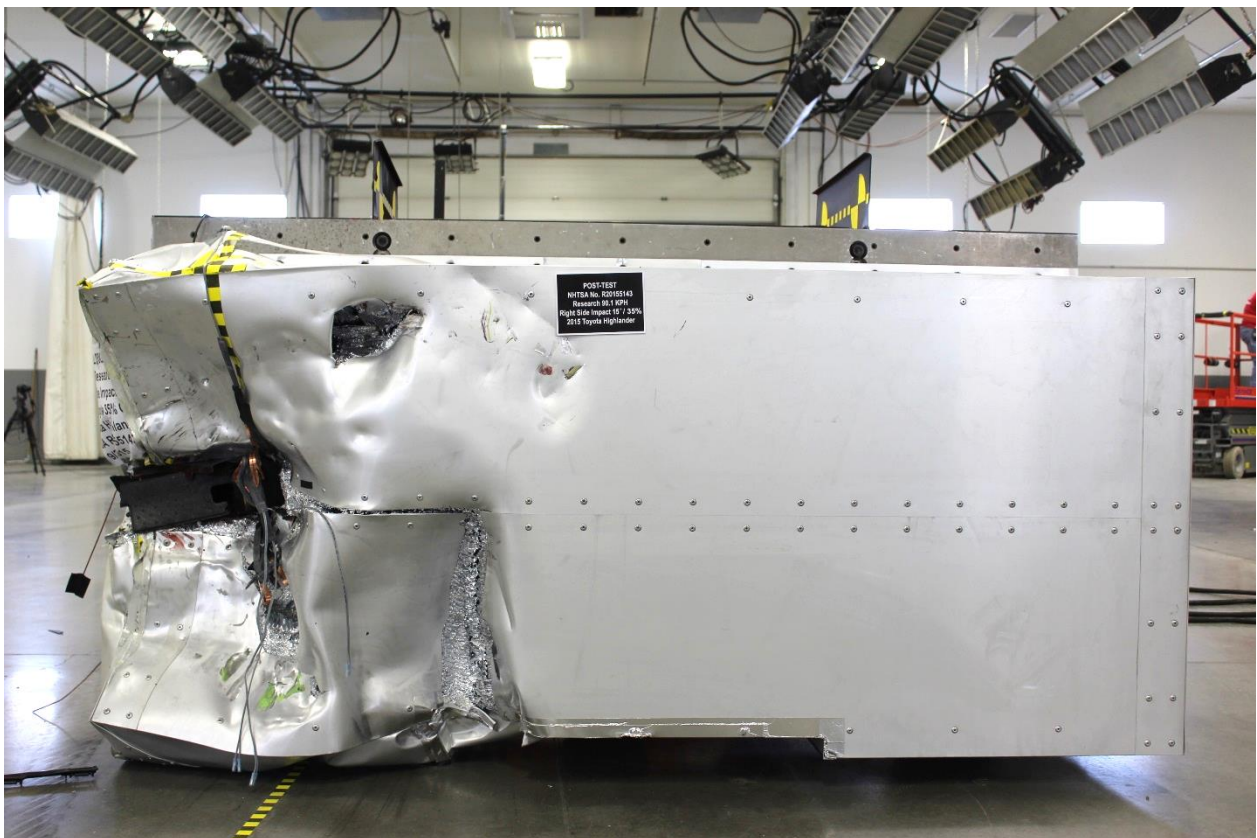
**No. 171: Pre-Test Top View of OMDB**



**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**



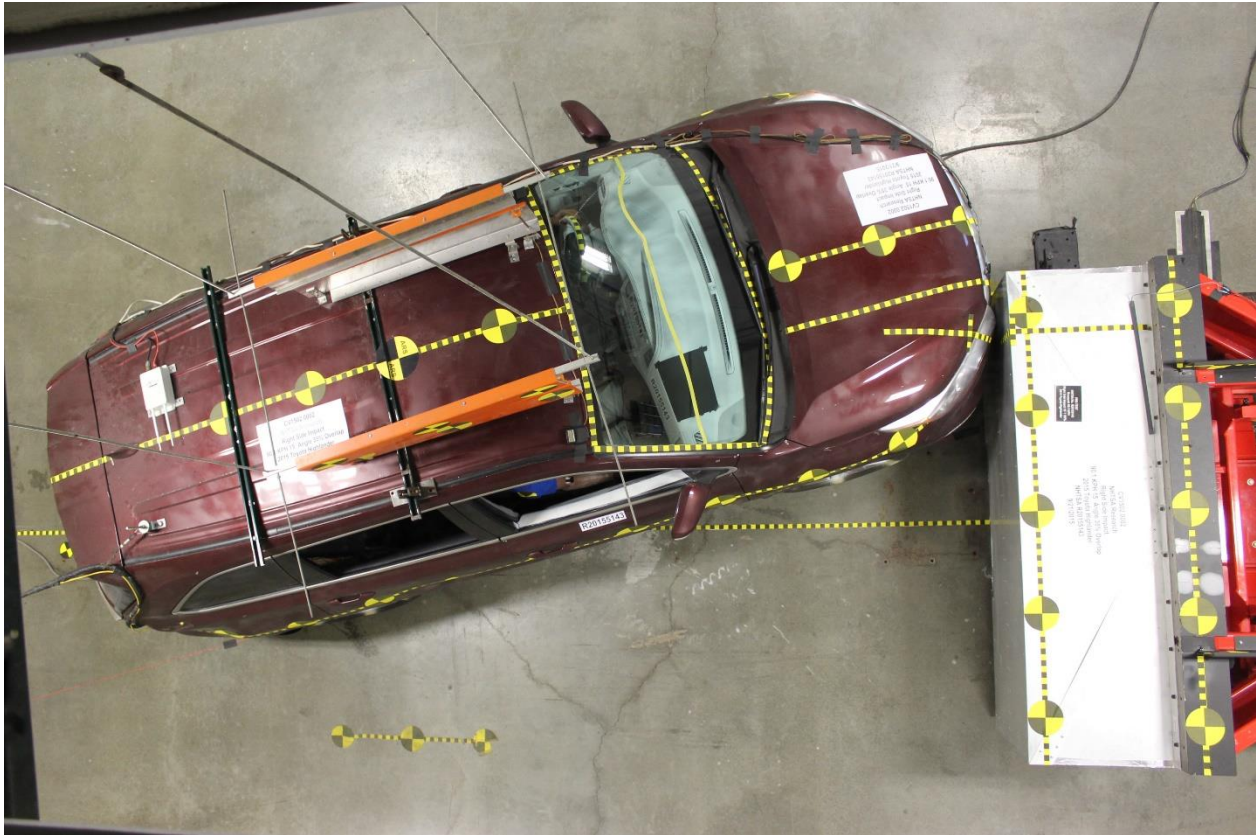
**No. 184: Post-Test OMDB & Vehicle, Right Side**



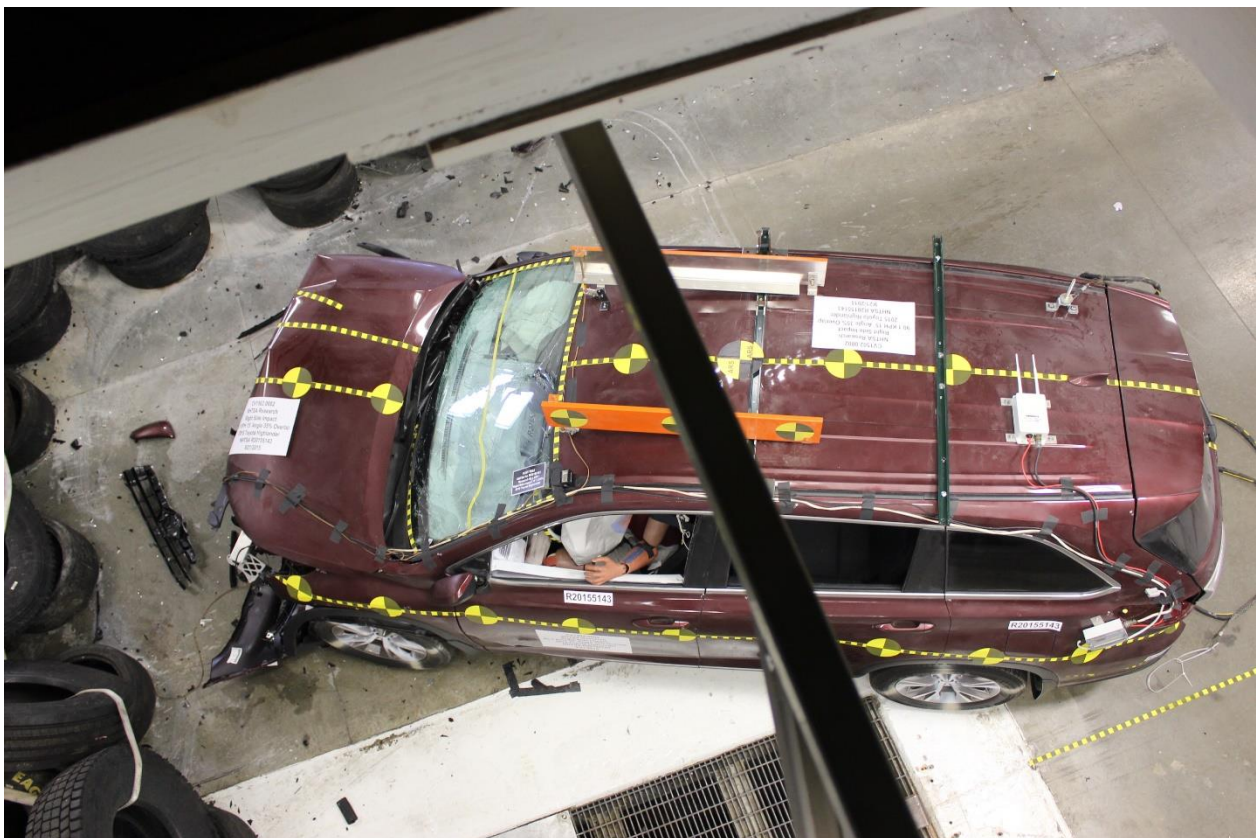
**No. 185: Pre-Test OMDB & Vehicle, Left Side**



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



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



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



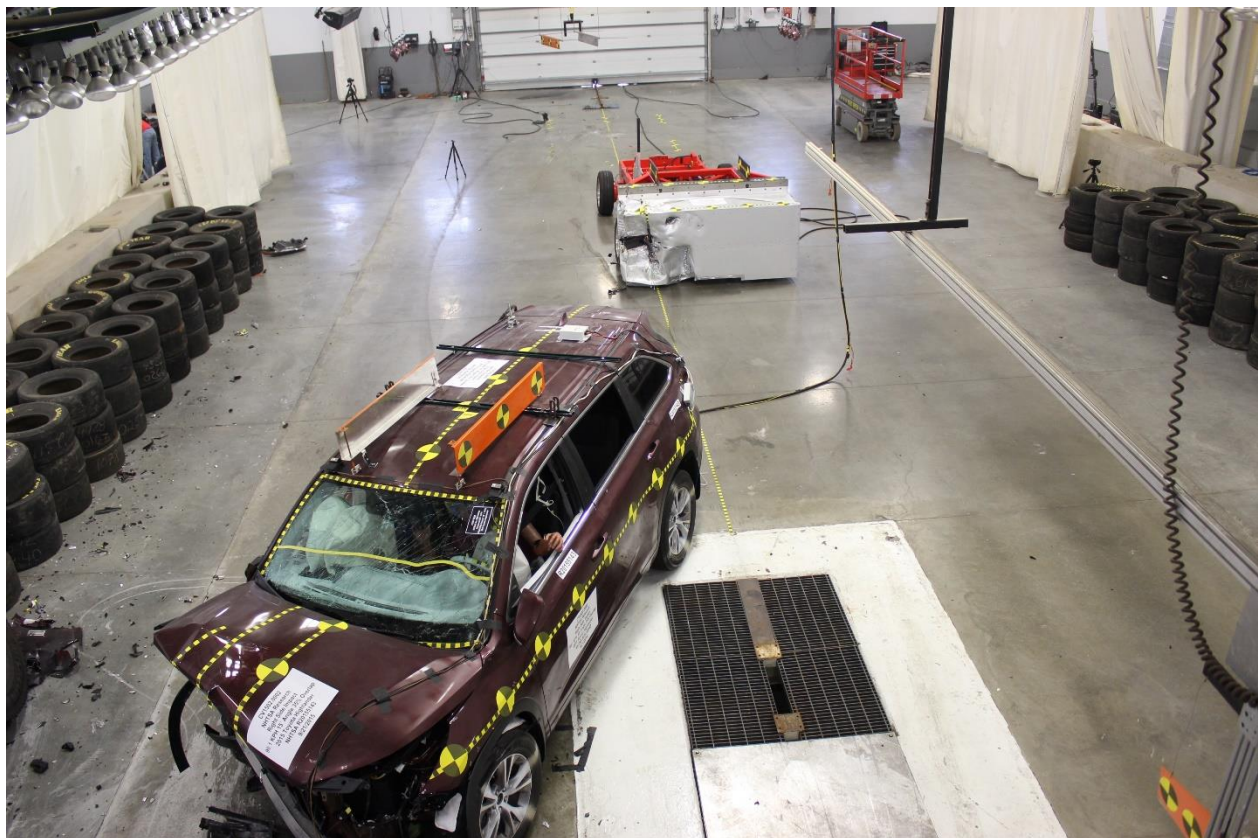
**No. 189: Pre-Test OMDB & Vehicle, Rear View**



**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 OMDB & 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**



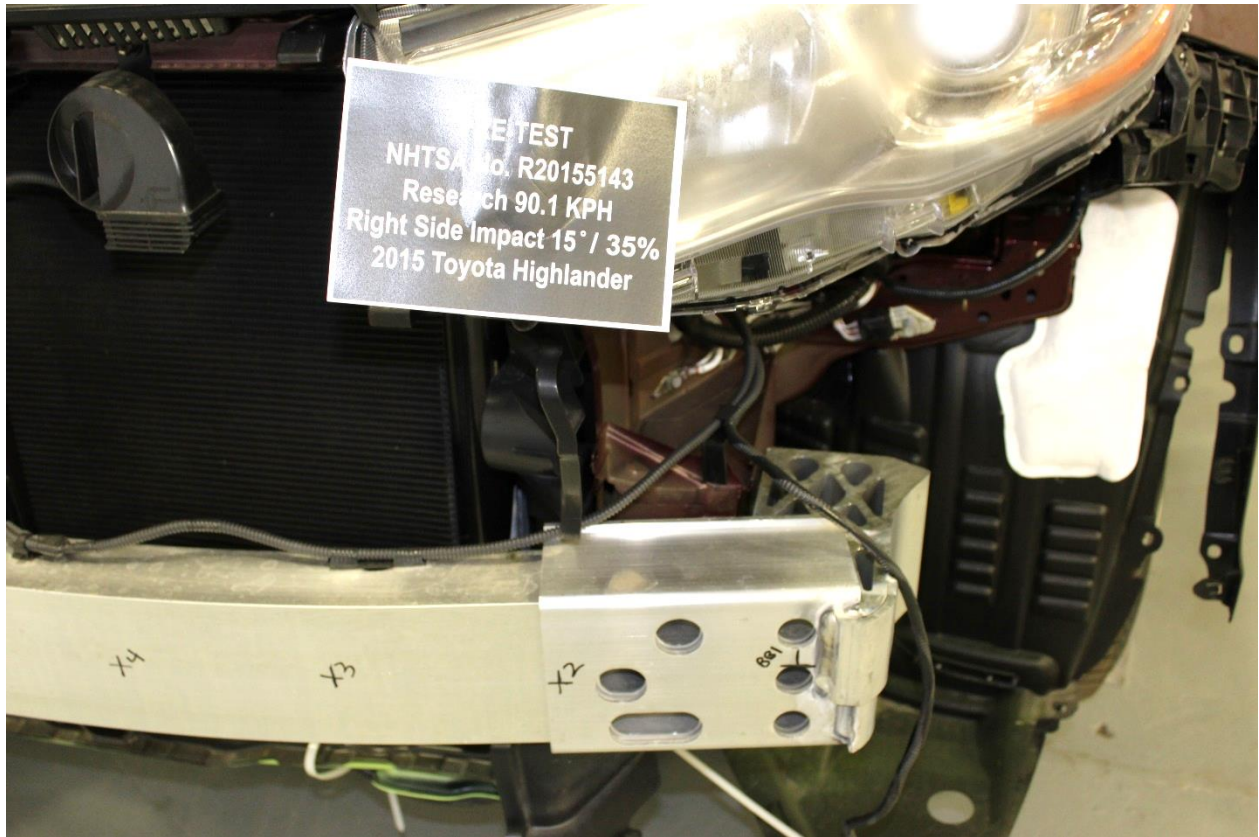
**No. 199: Impact Photo**



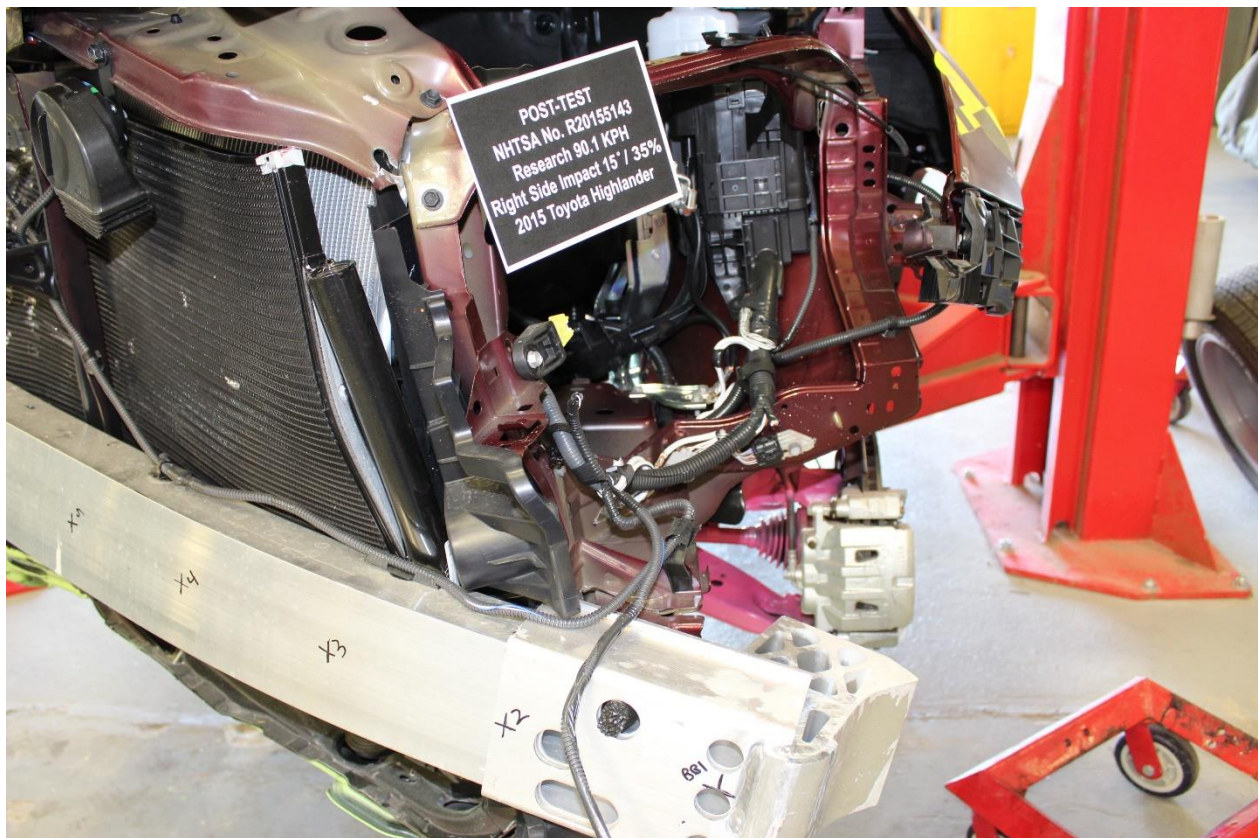
No. 200: Pre-Test Vehicle Bumper Left Side View



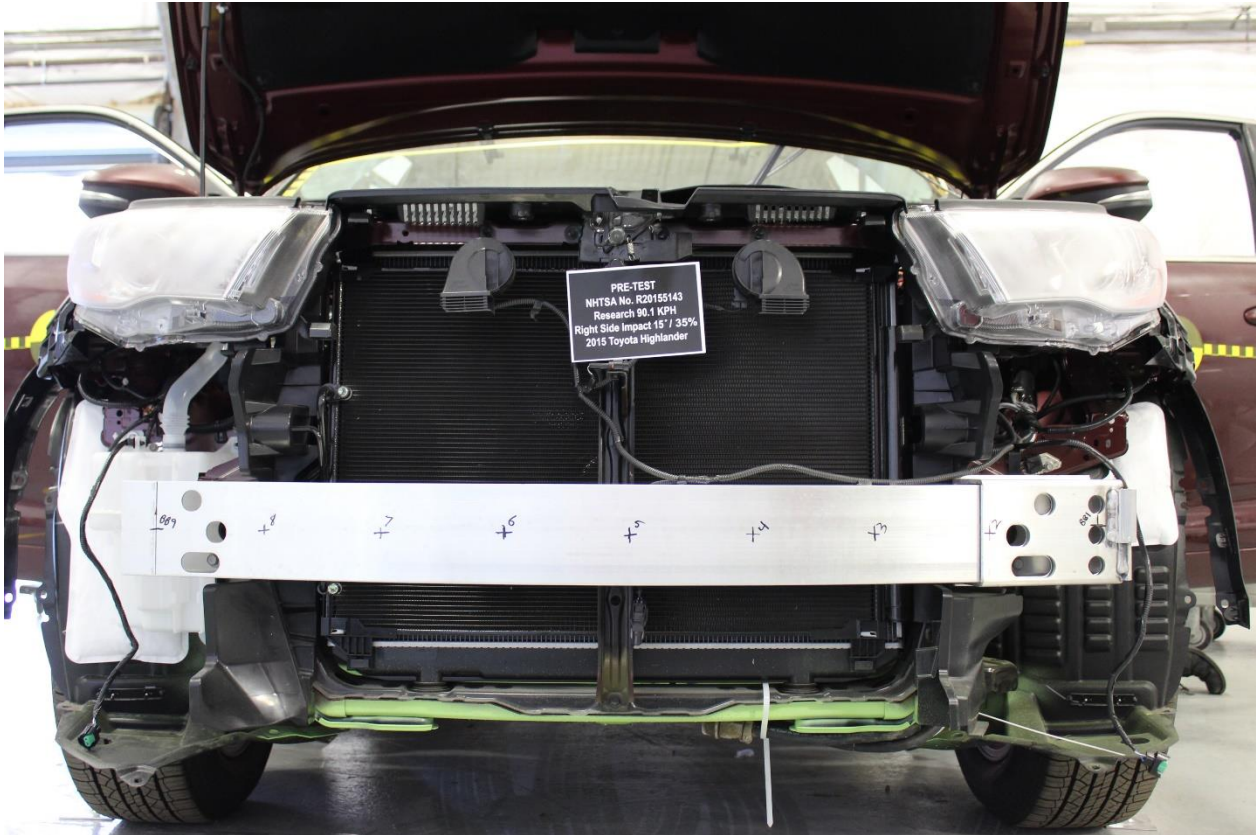
No. 201 Post-Test Vehicle Bumper Left View



**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**



PRE-TEST  
NHTSA No. R20155143  
Research 90.1 KPH  
Right Side Impact 15' / 35%  
2015 Toyota Highlander

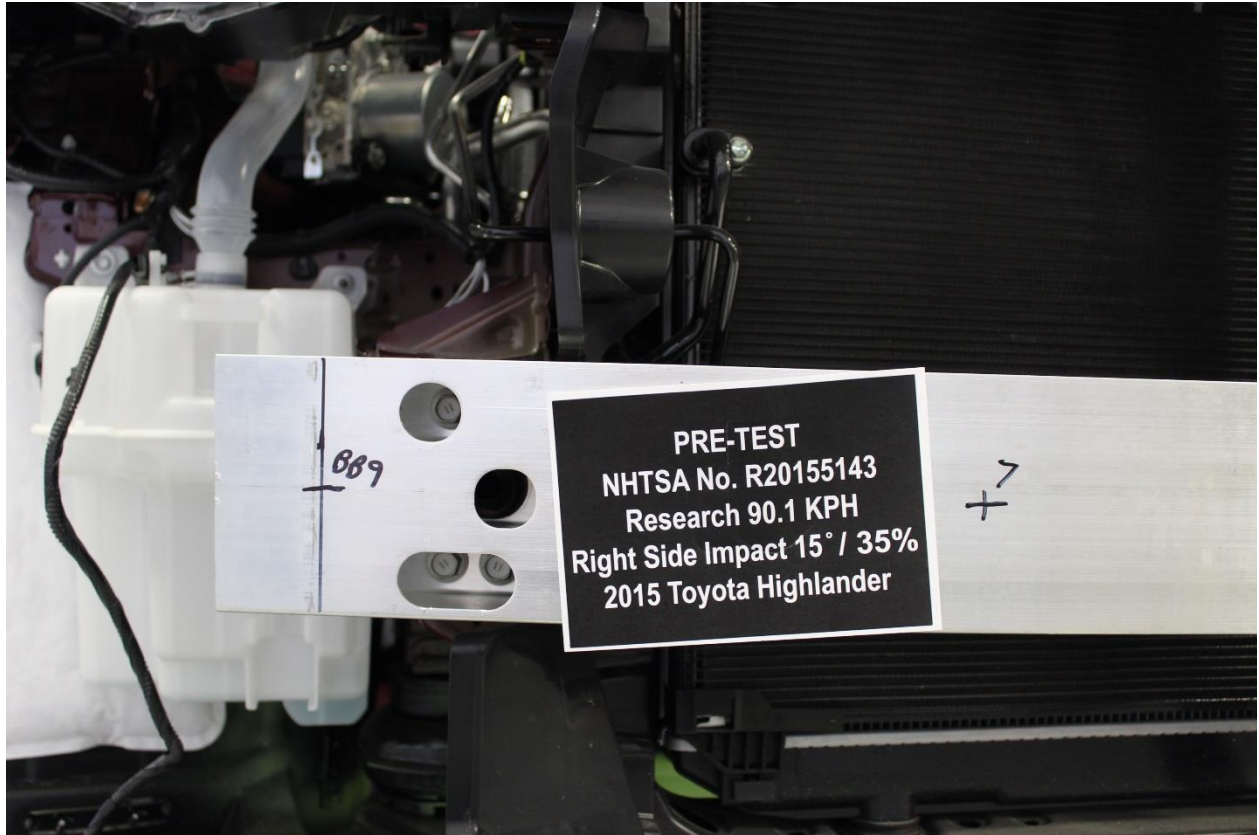
No. 206 Pre-Test Vehicle Bumper Right Side View



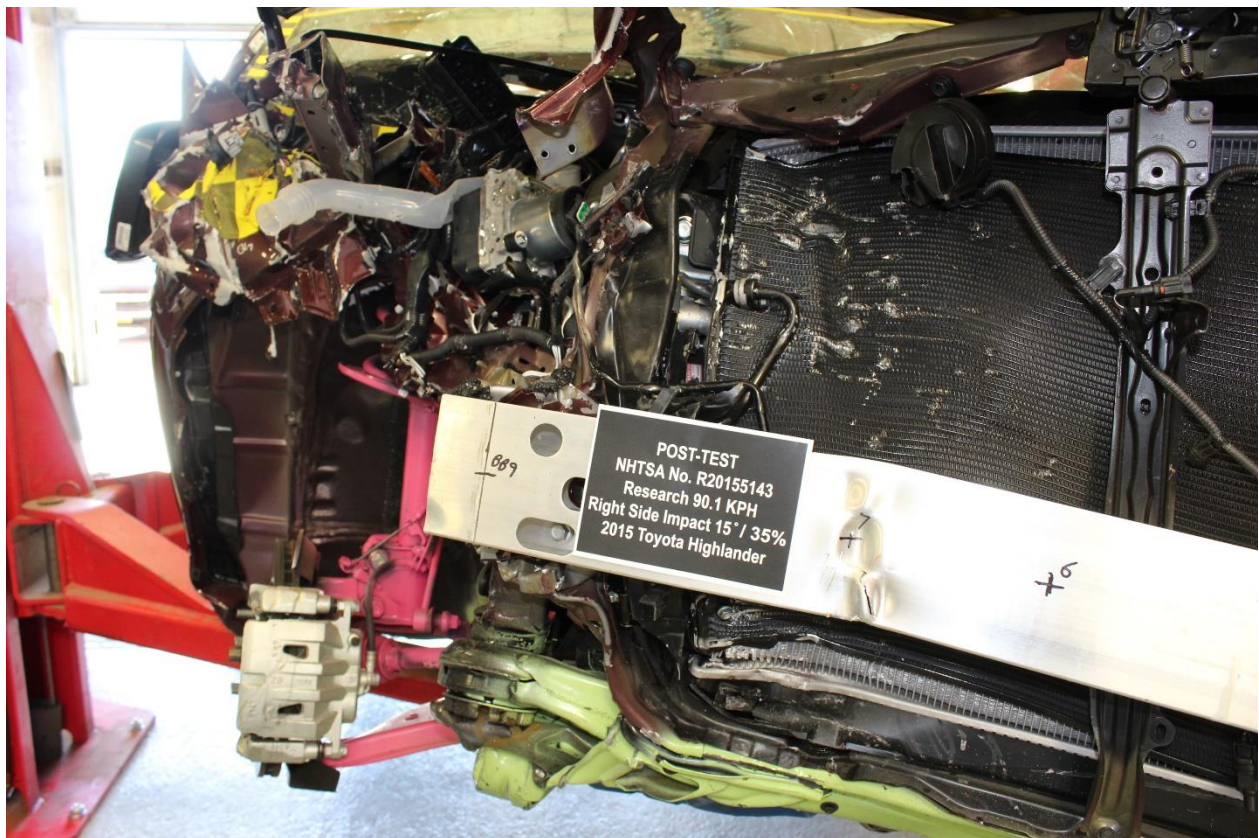
Overlap  
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POST-TEST  
NHTSA No. R20155143  
Research 90.1 KPH  
Right Side Impact 15' / 35%  
2015 Toyota Highlander

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**

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**VEHICLE & DUMMY RESPONSE DATA TRACES**

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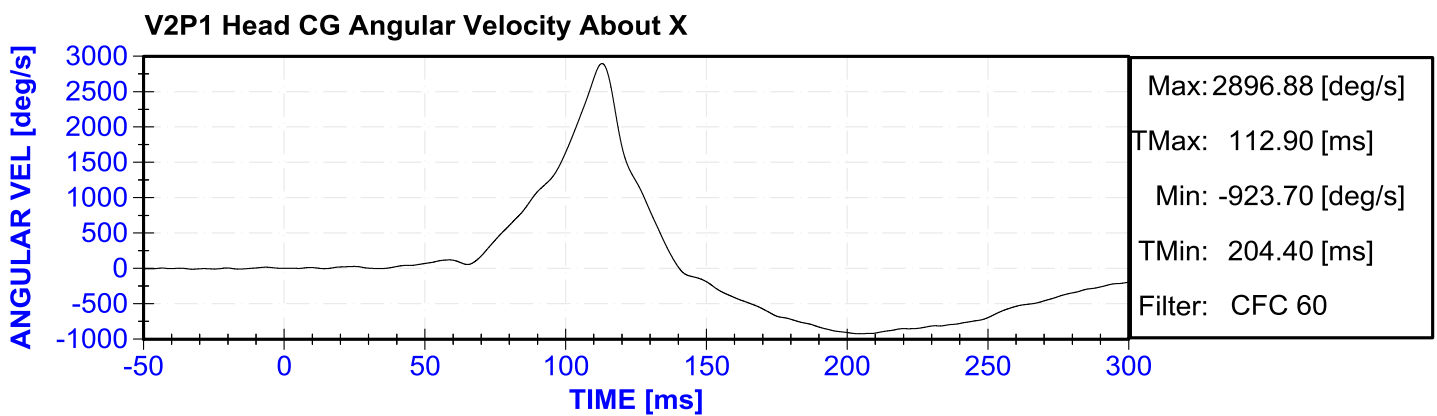
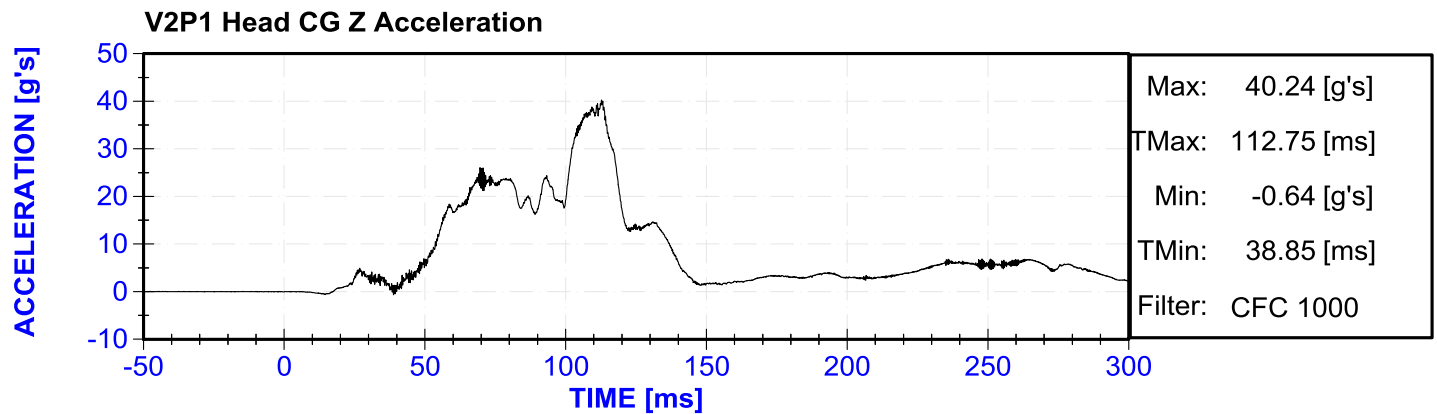
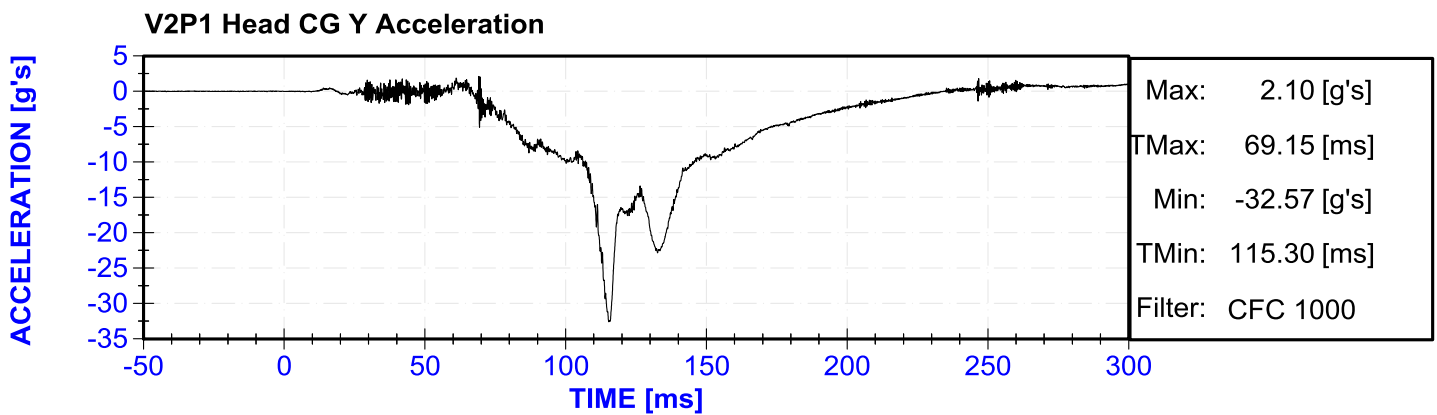
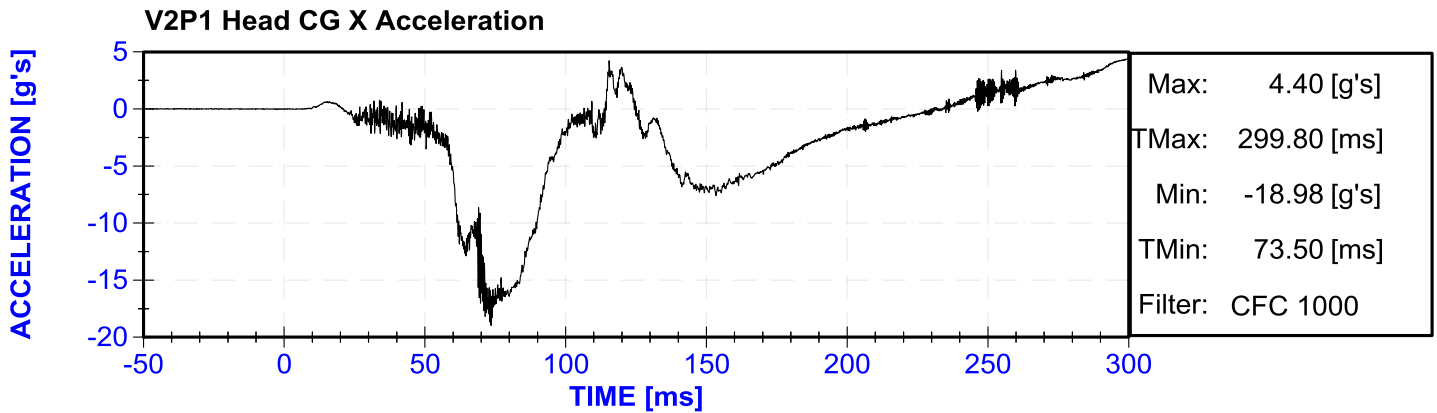
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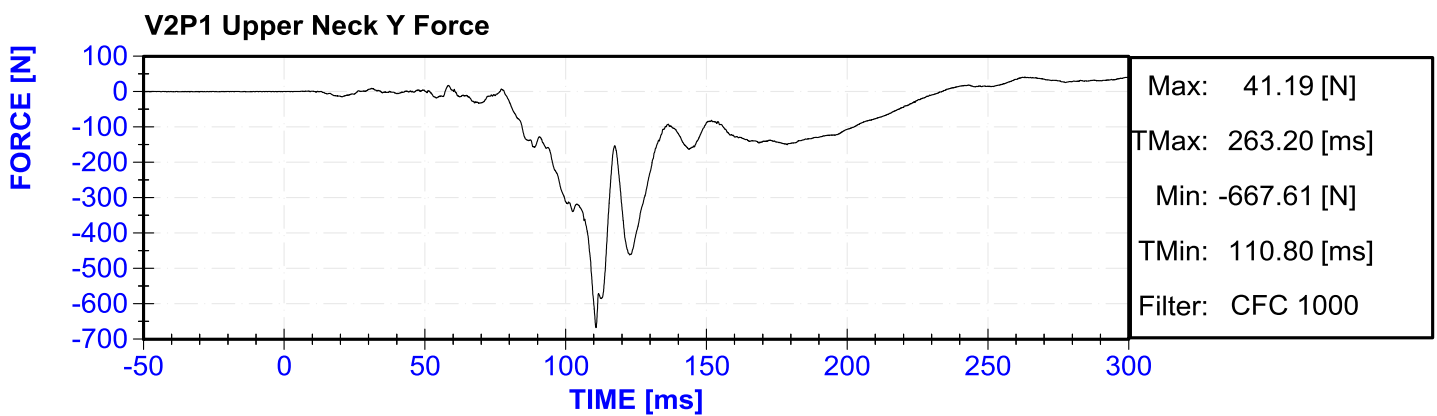
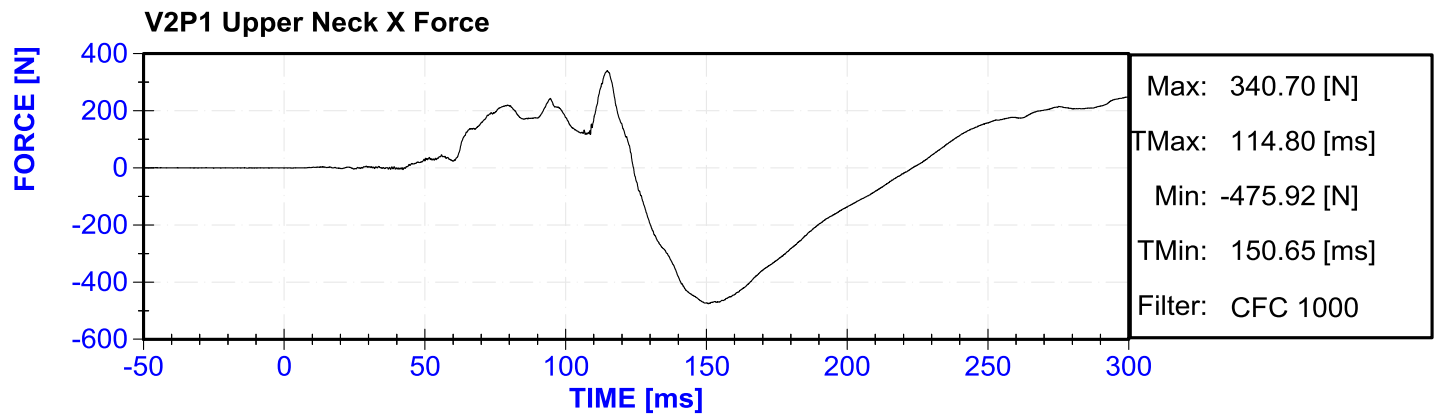
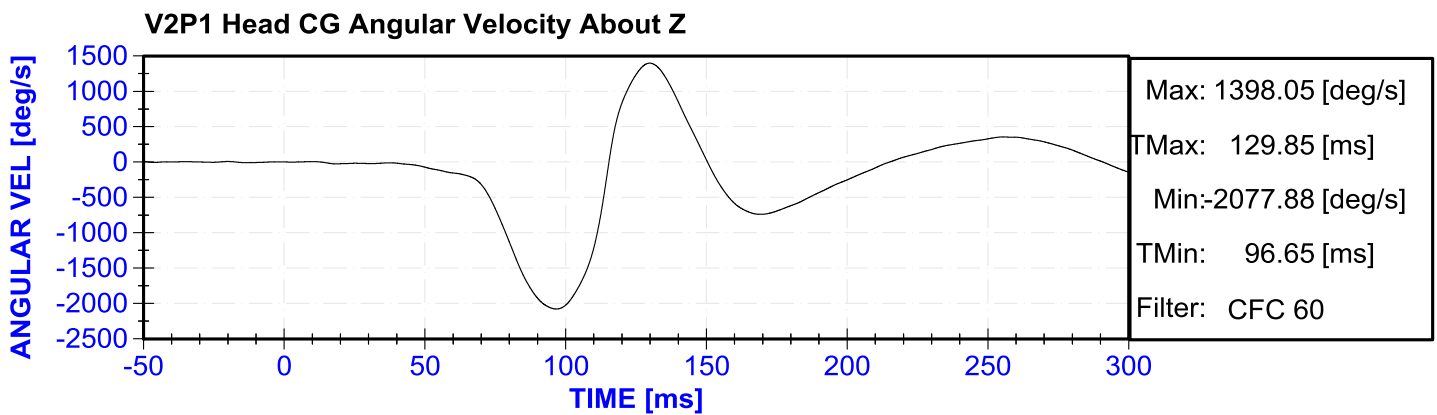
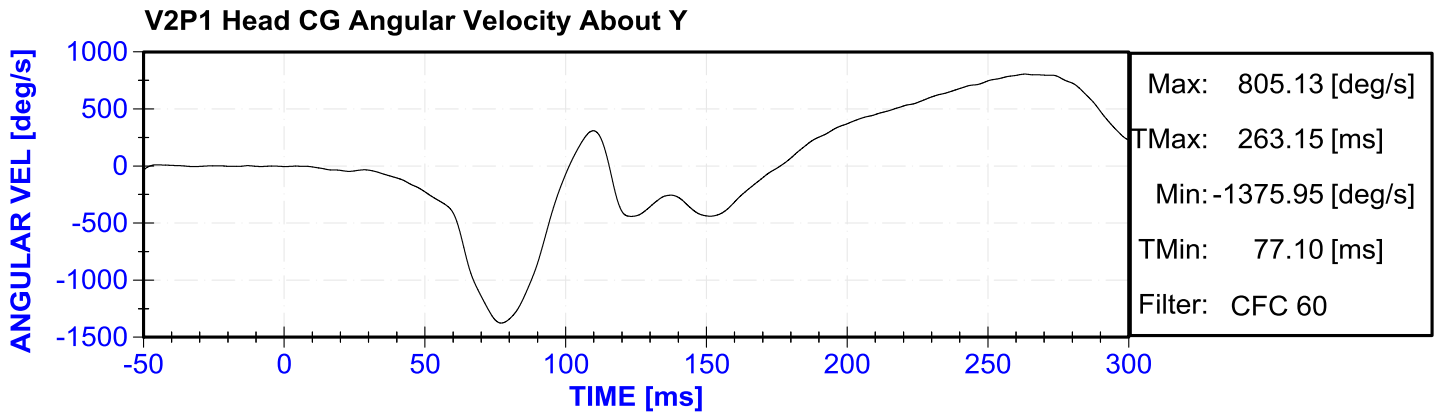
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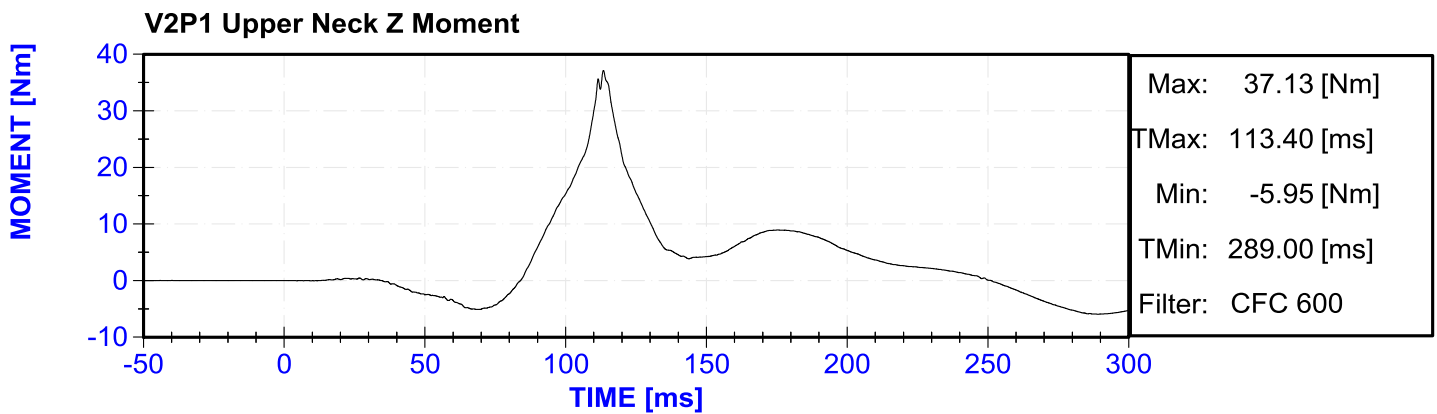
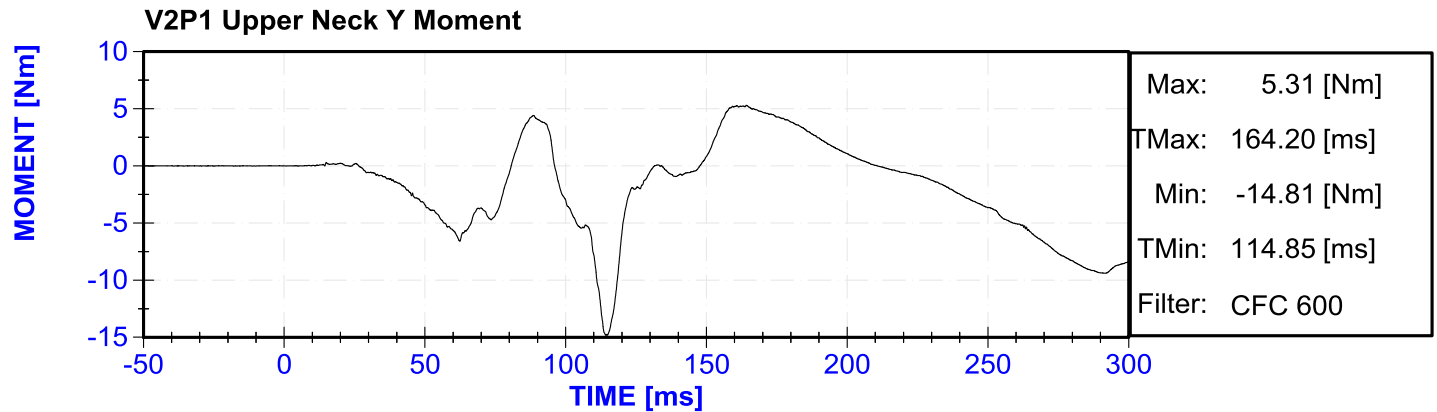
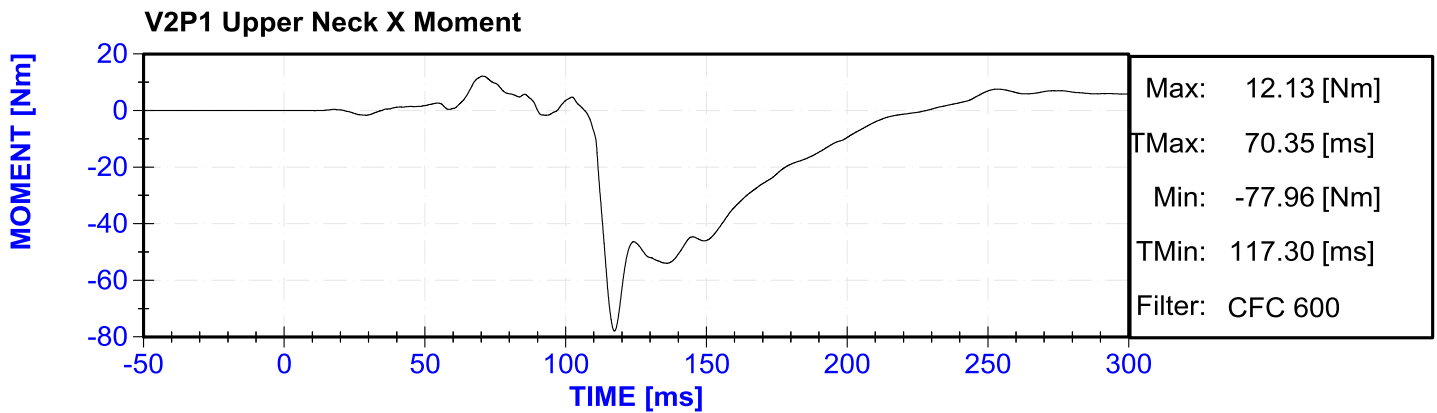
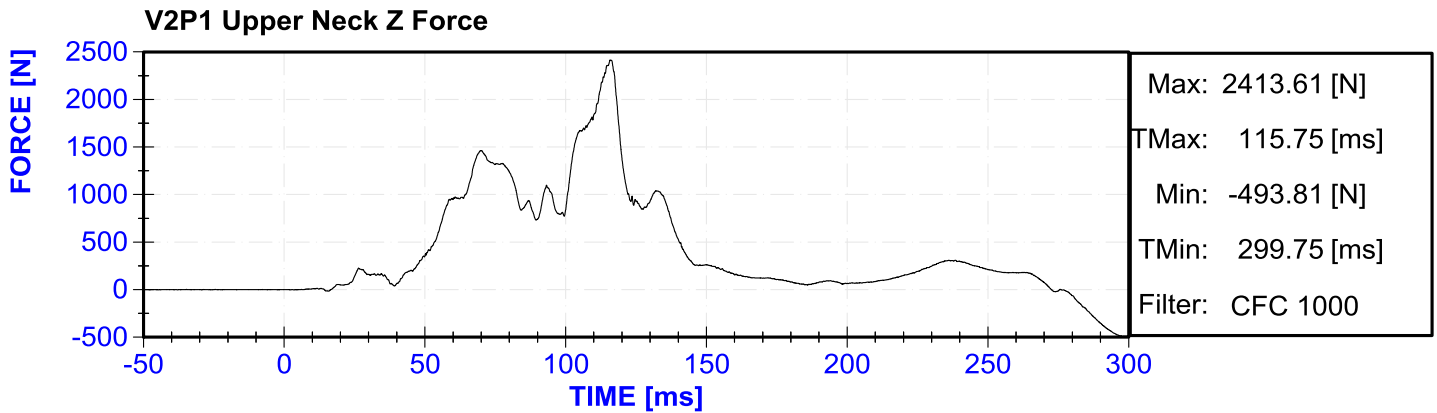
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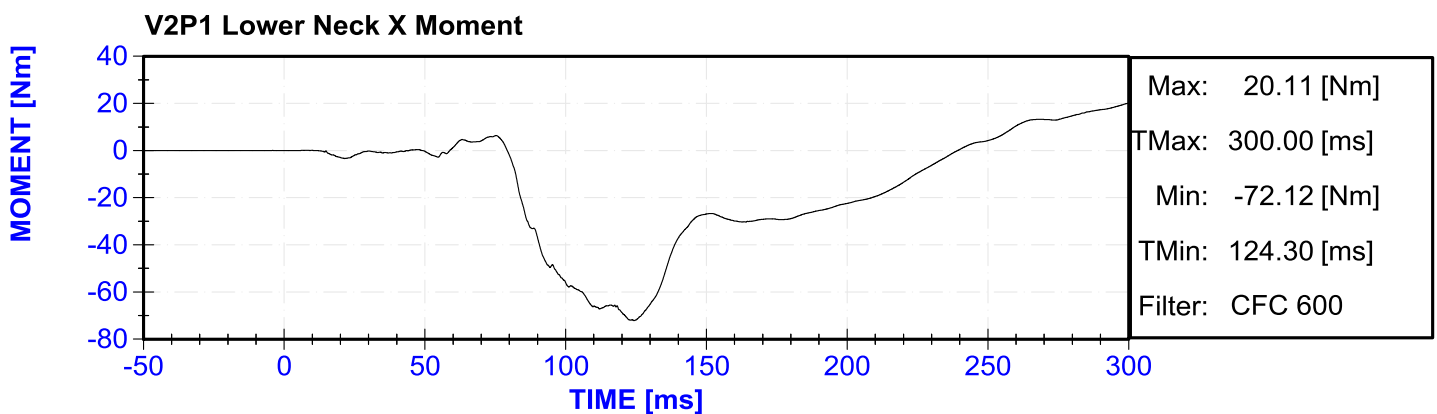
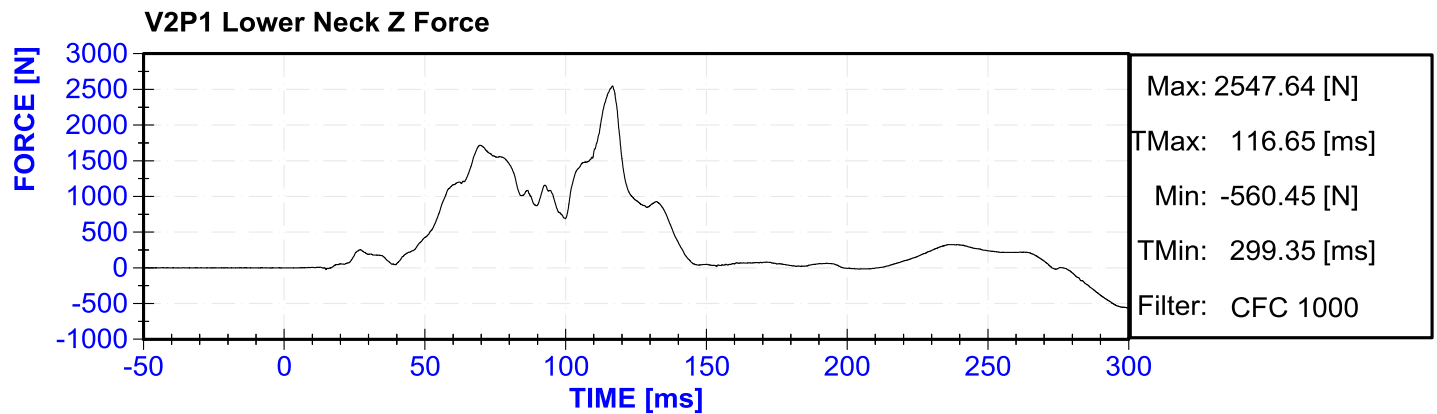
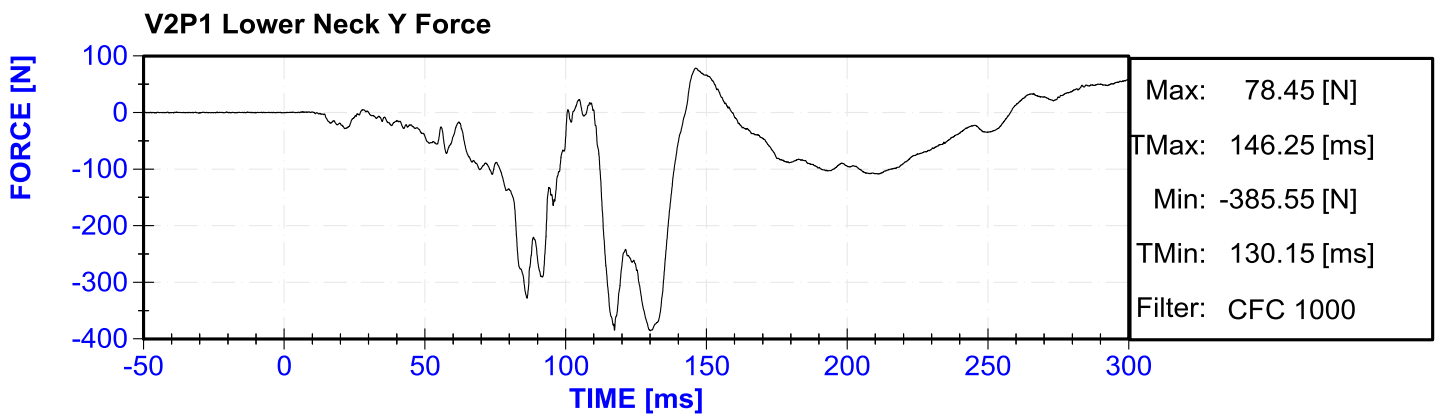
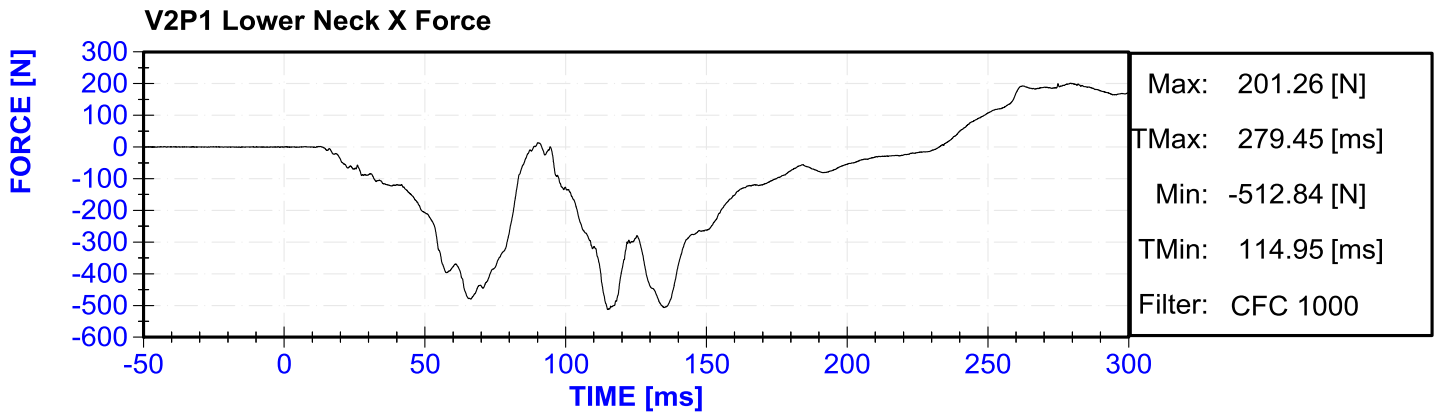
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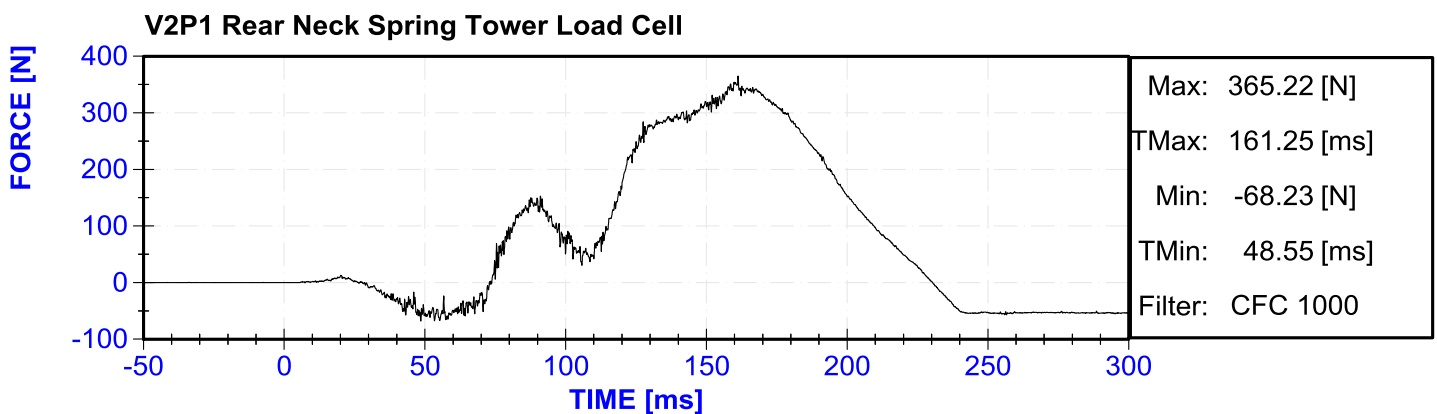
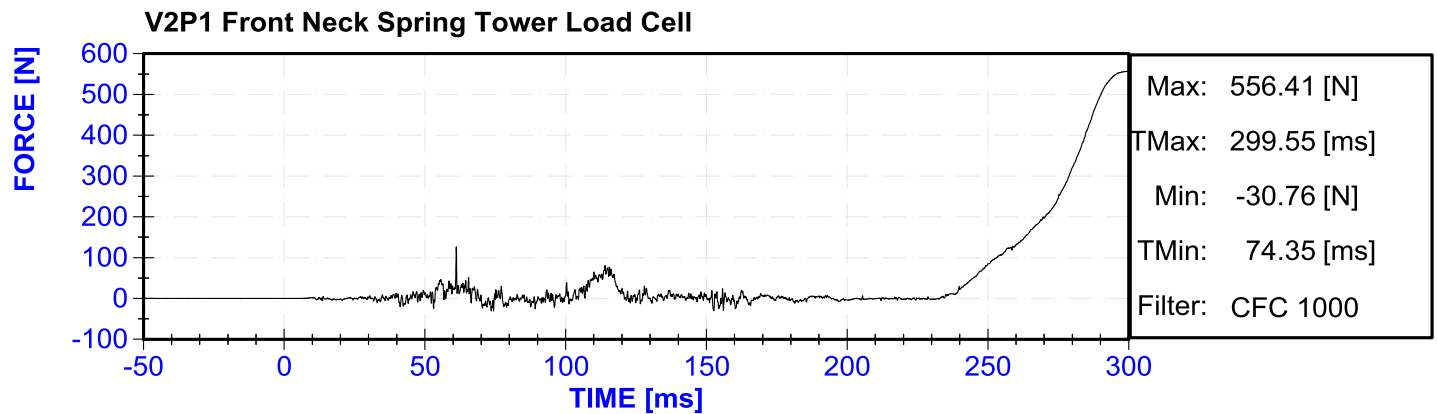
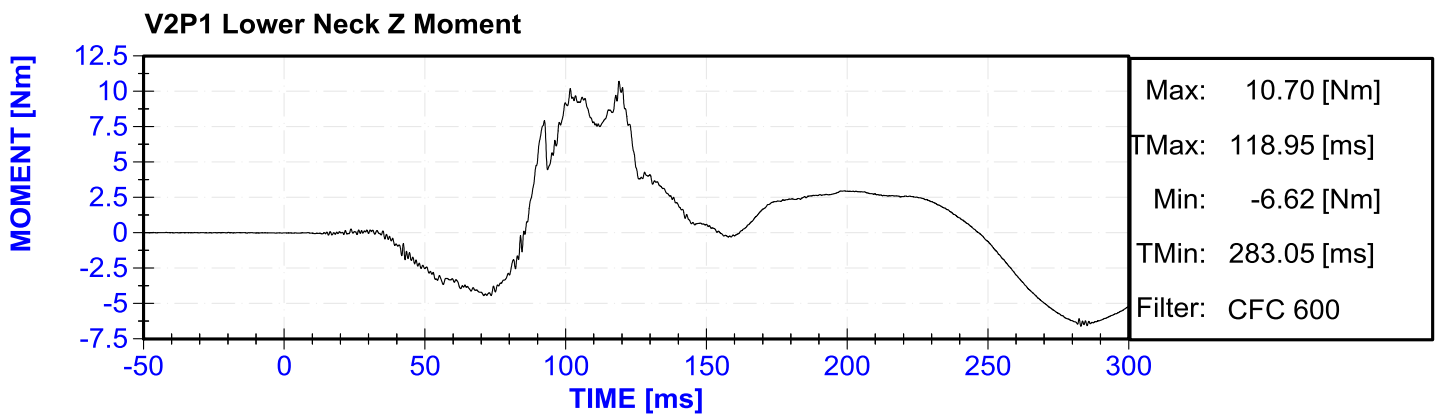
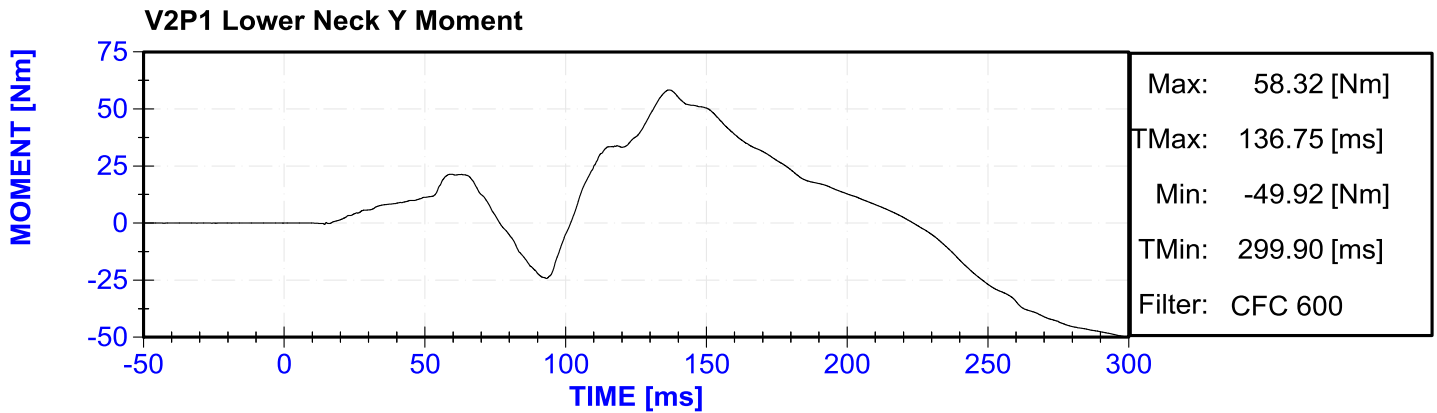
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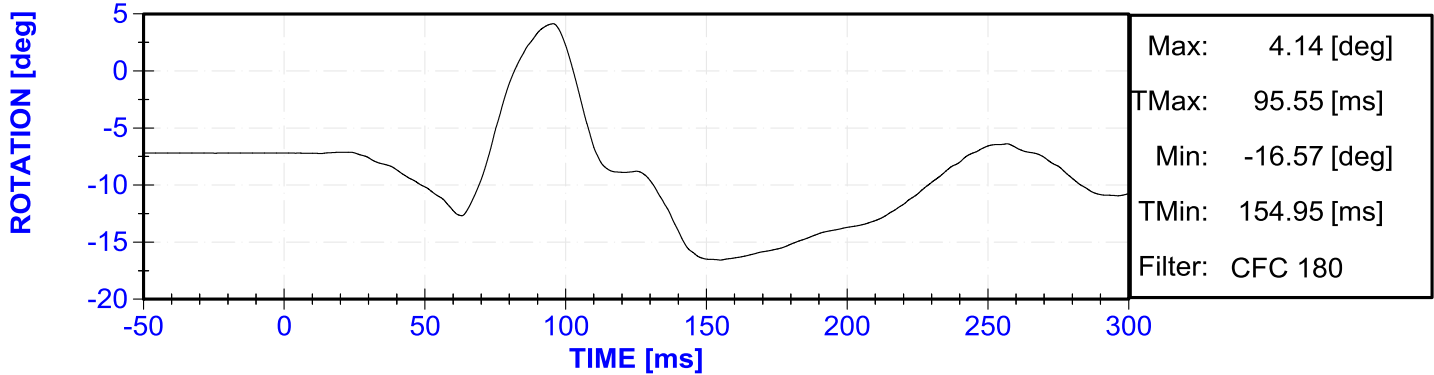




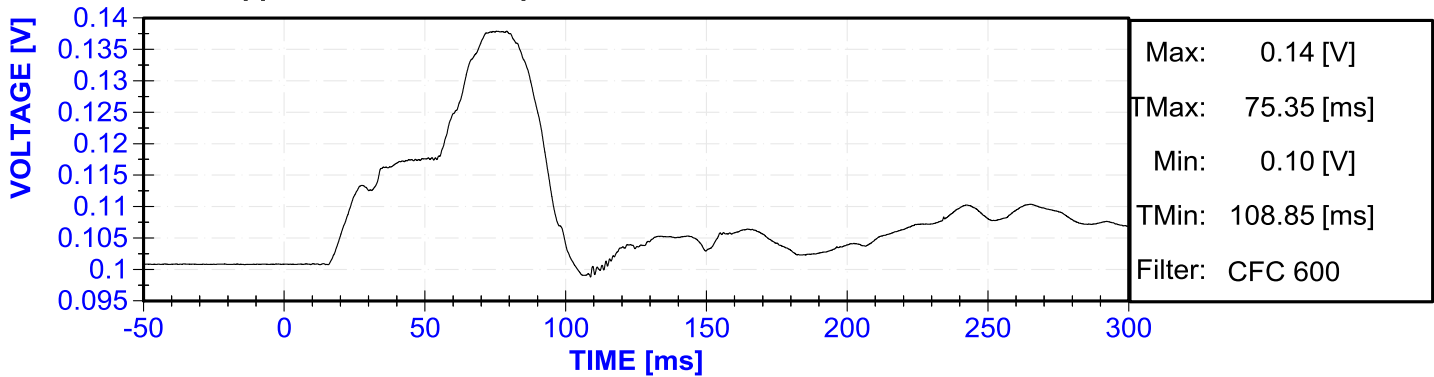




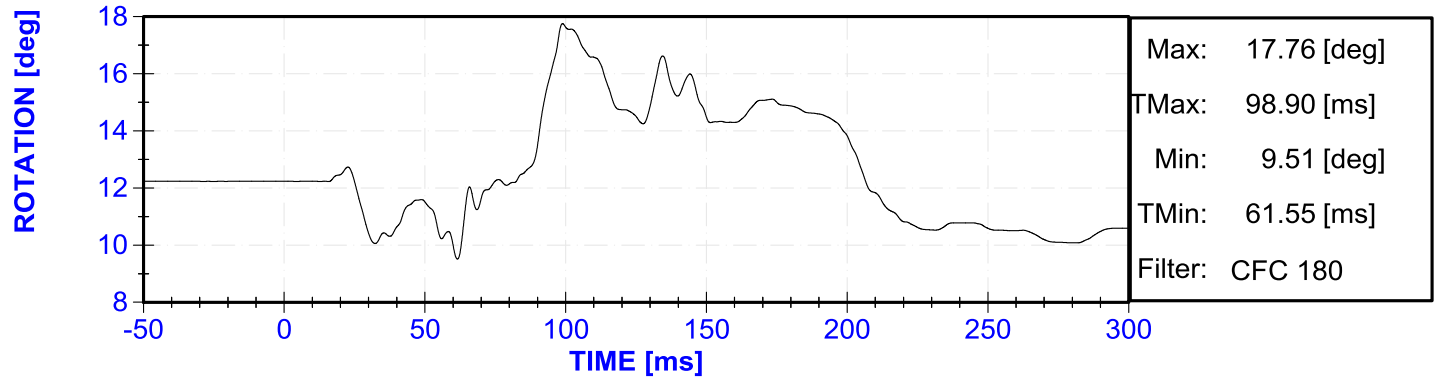
V2P1 Occipital Condyle Rotation Potentiometer



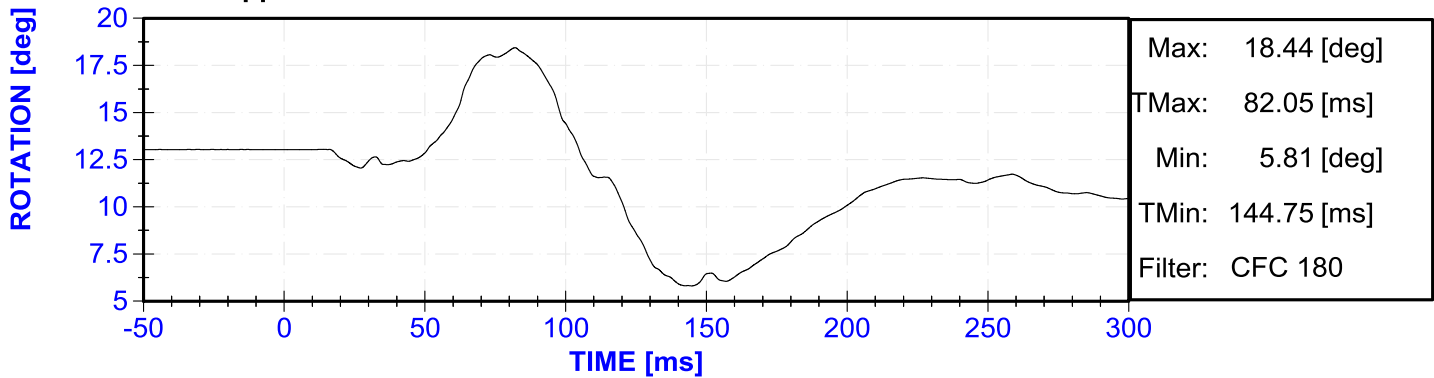
V2P1 Upper Left DGIR X Displacement



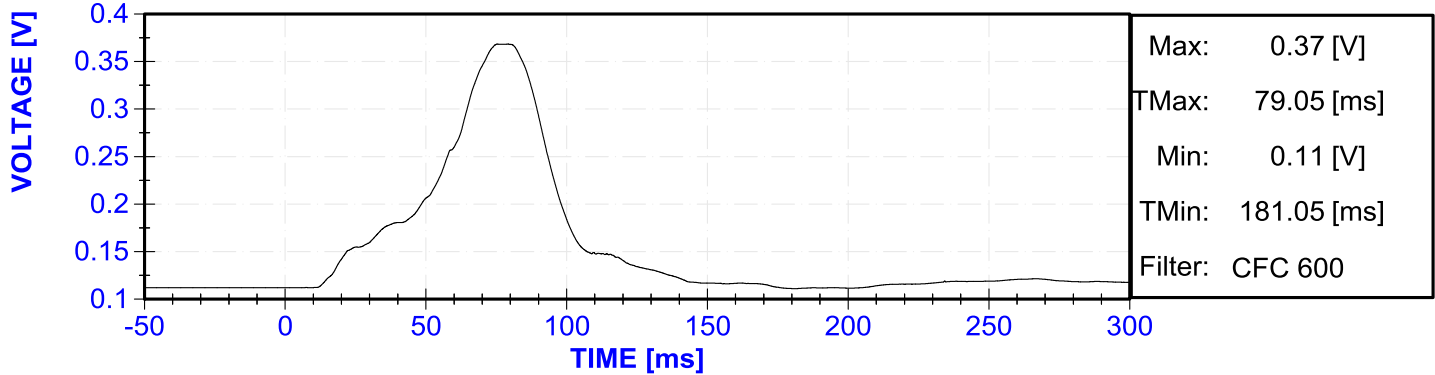
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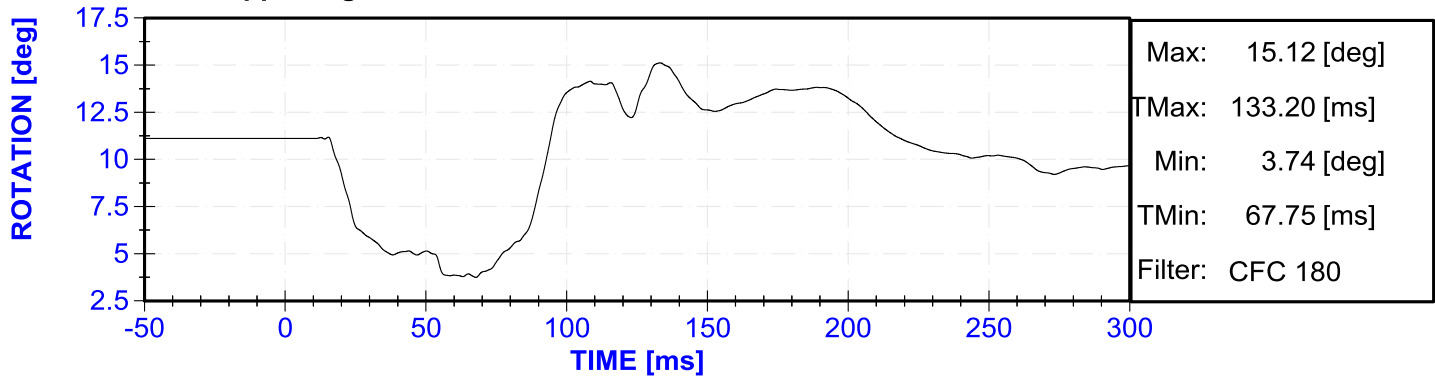
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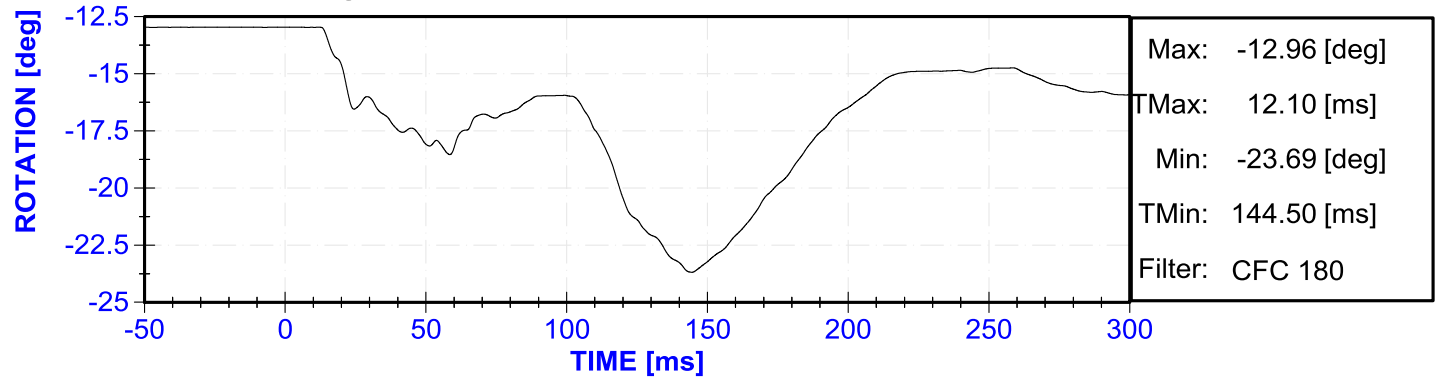
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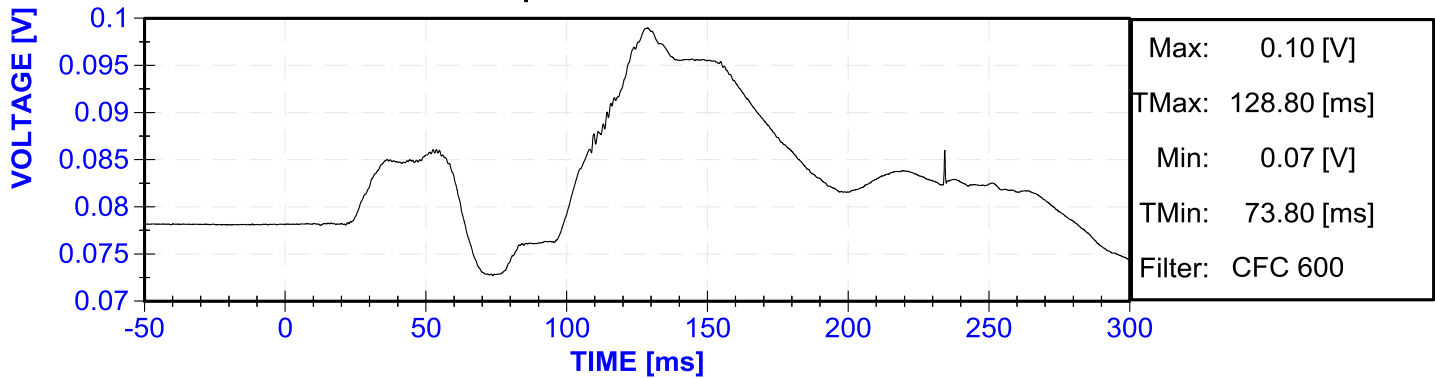
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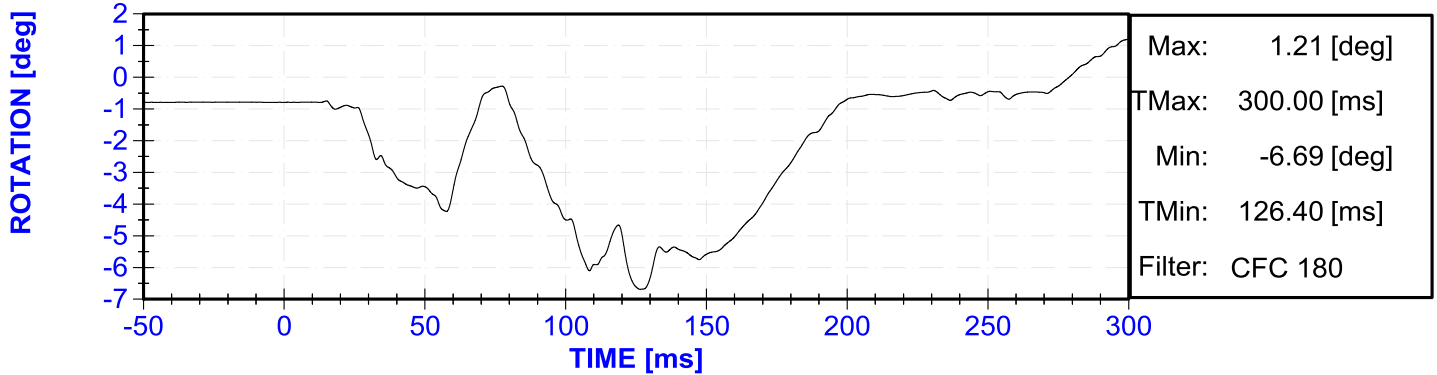
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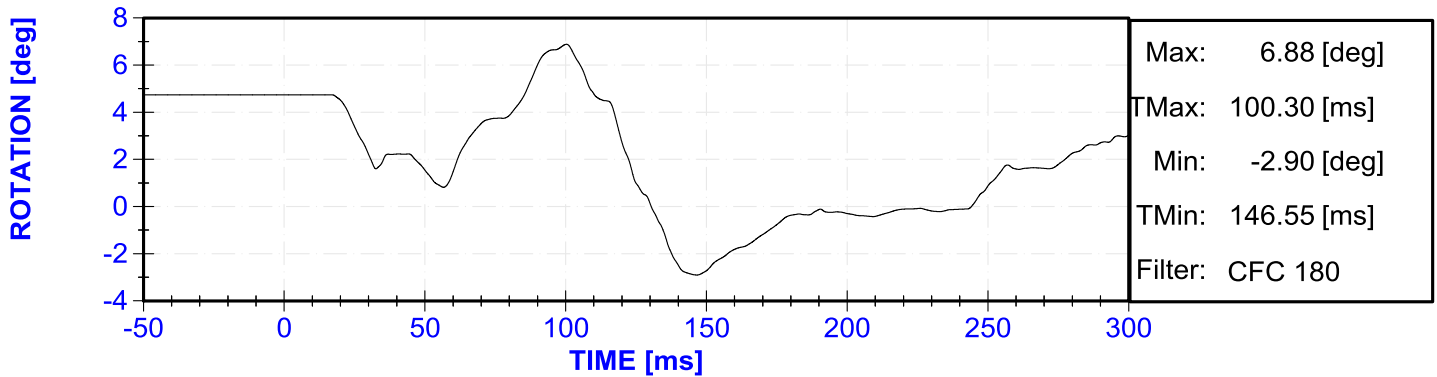
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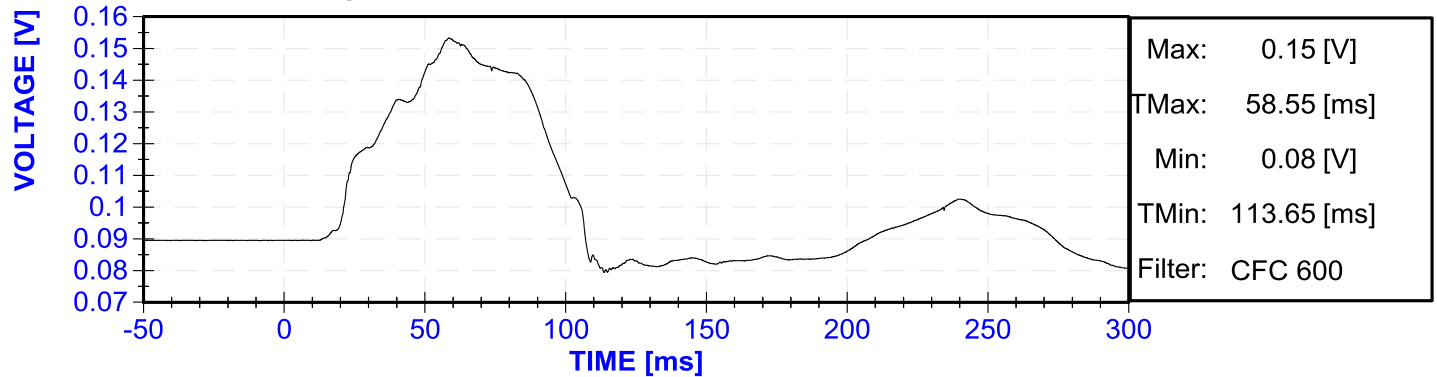
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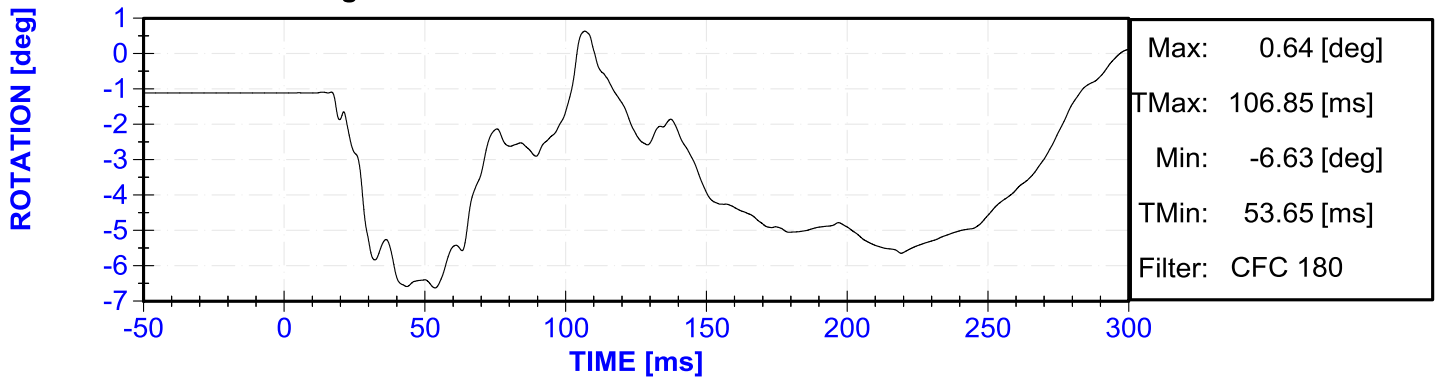
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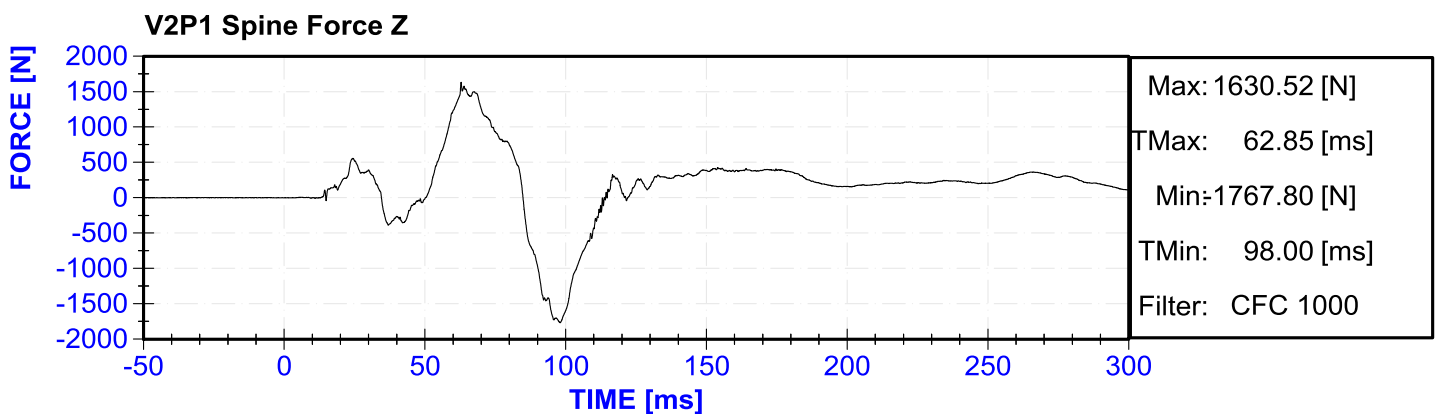
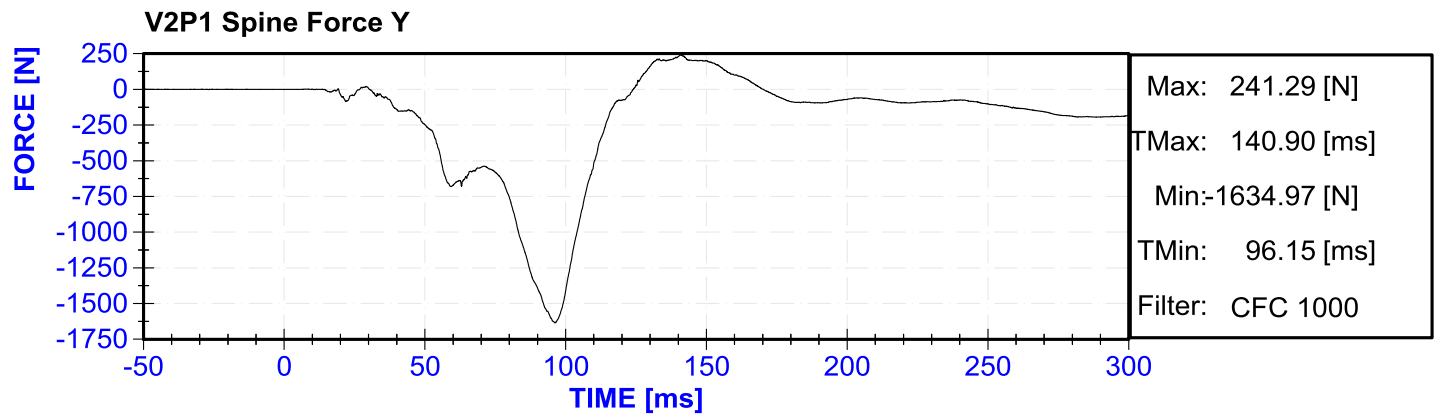
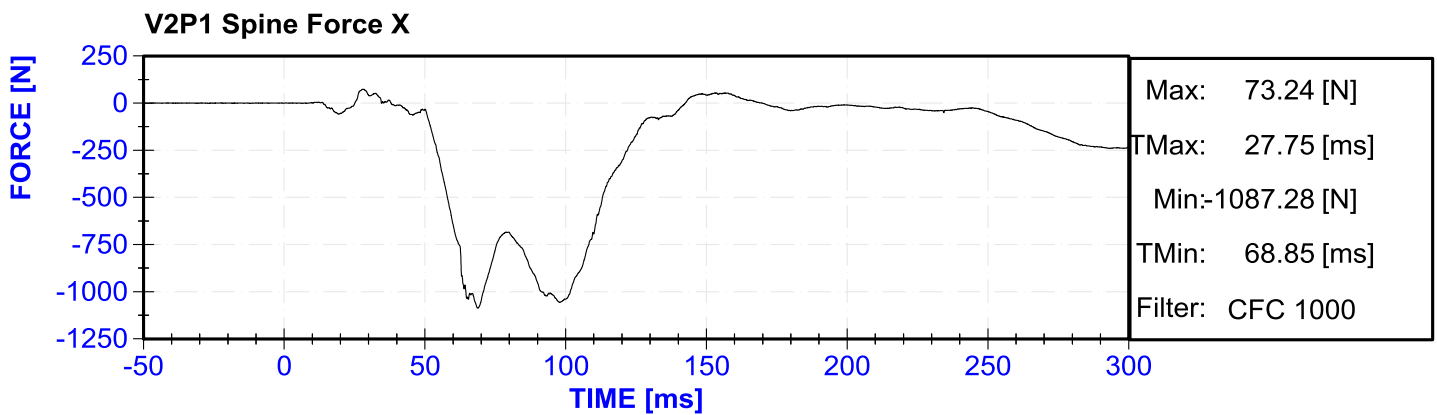
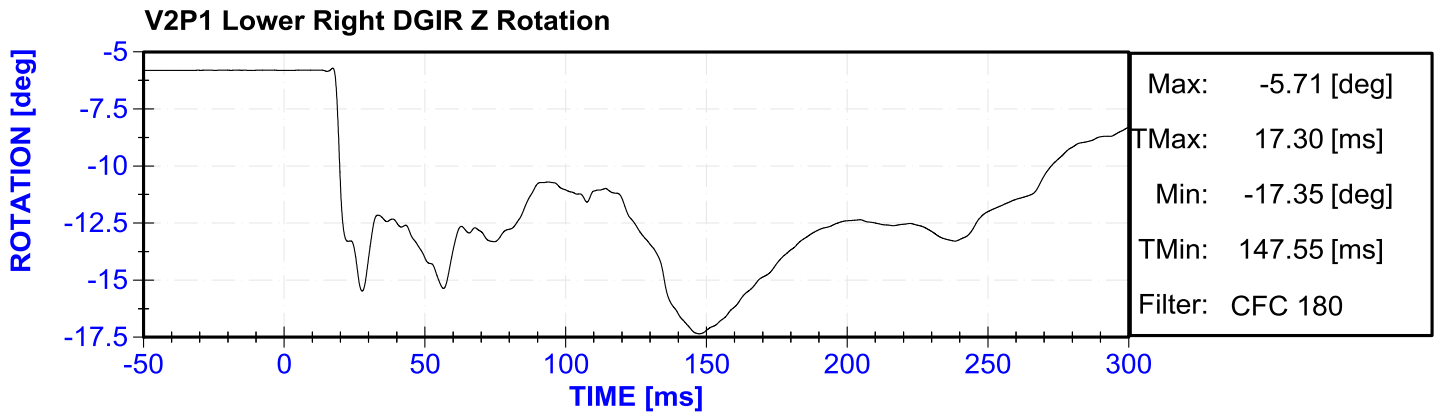


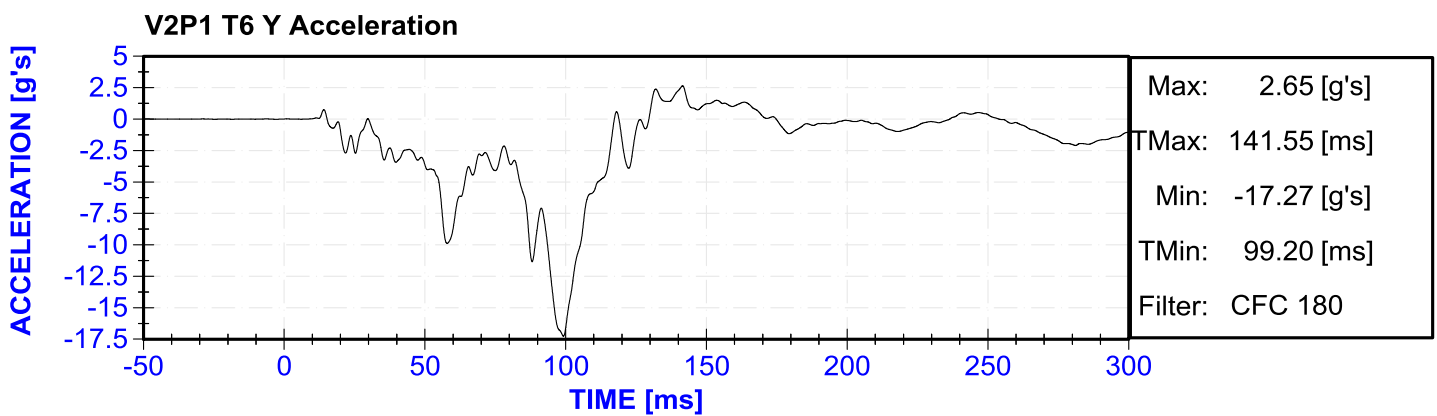
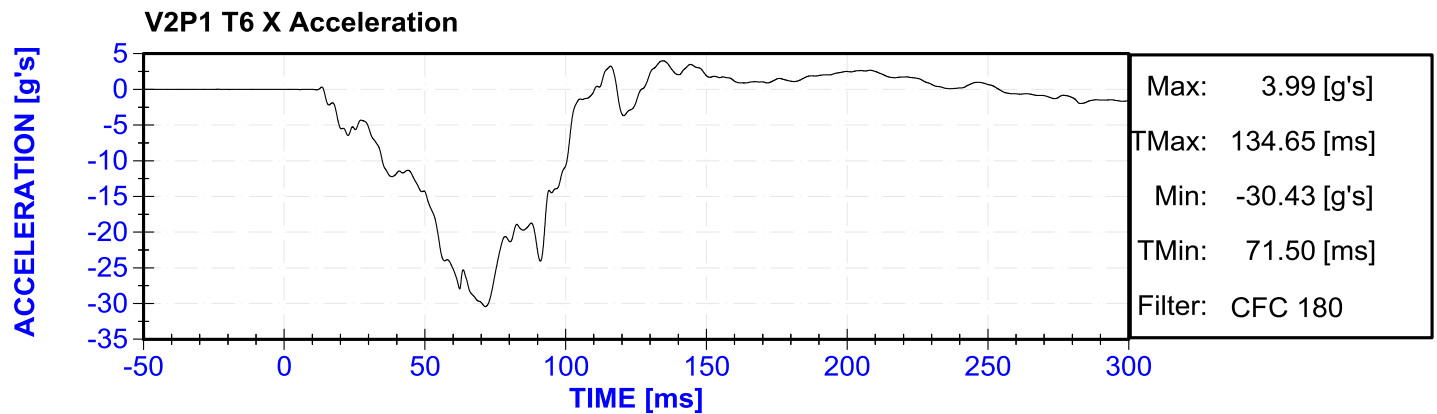
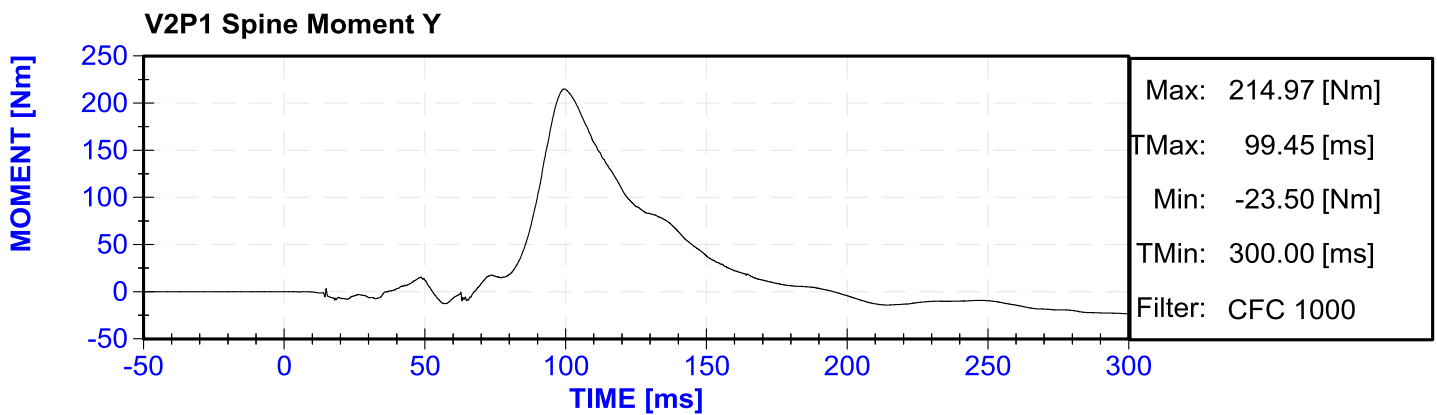
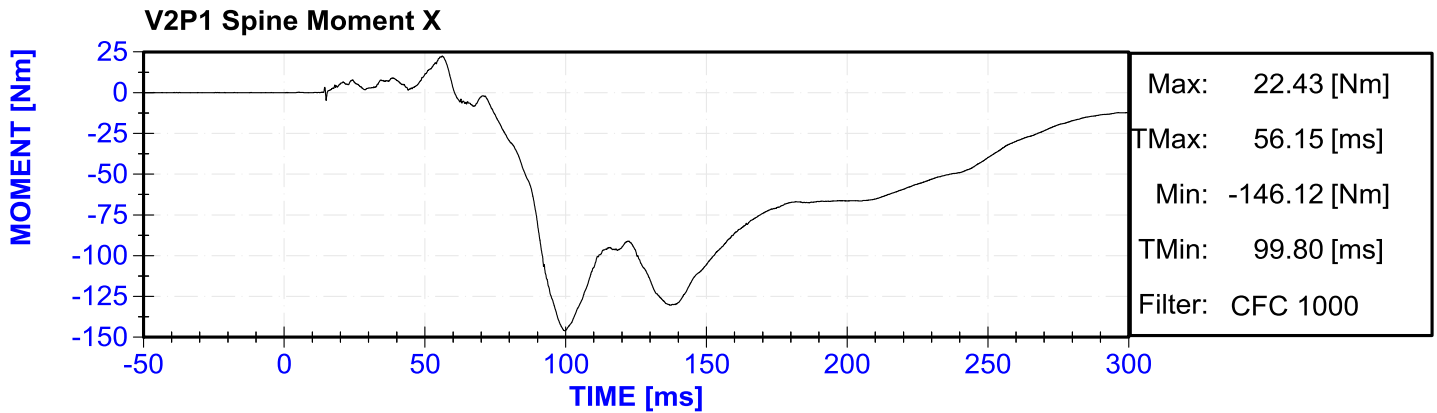
V2P1 Lower Right DGIR X Displacement

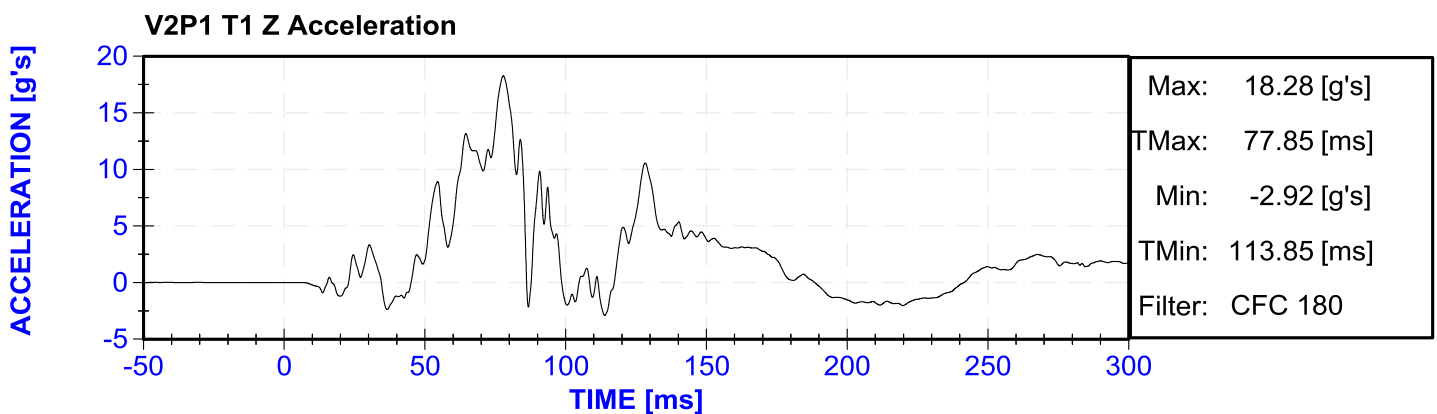
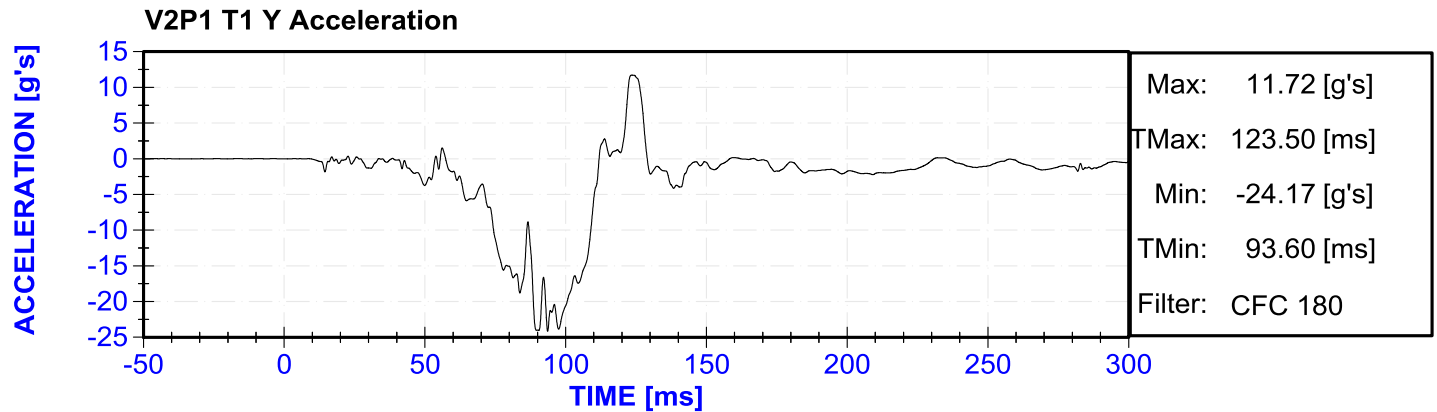
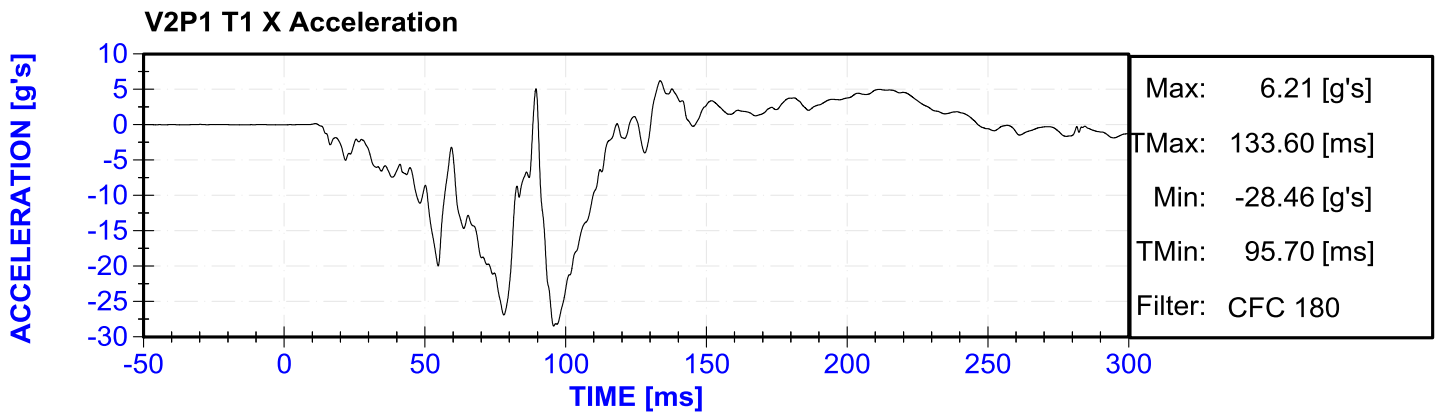
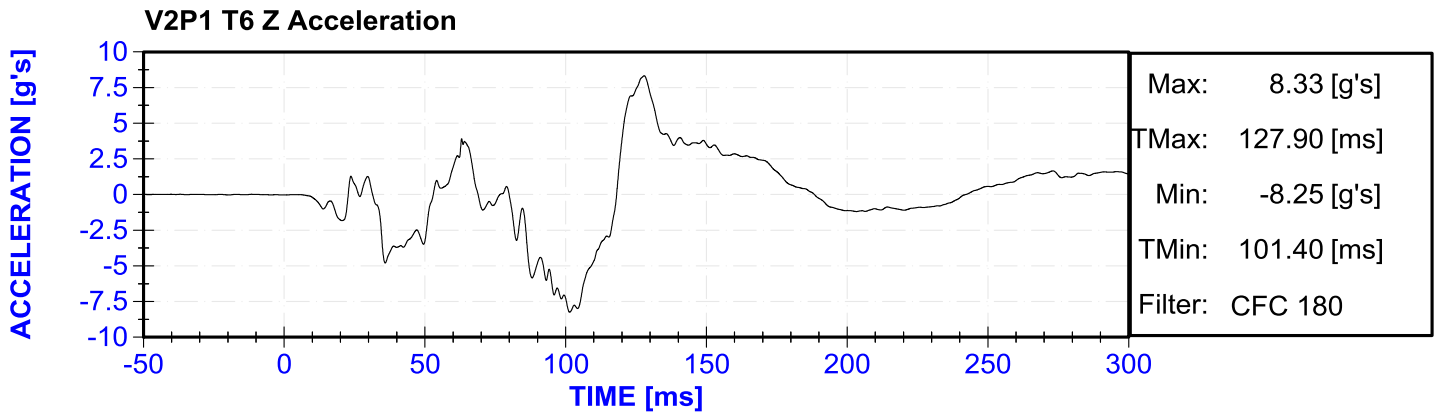


V2P1 Lower Right DGIR Y Rotation

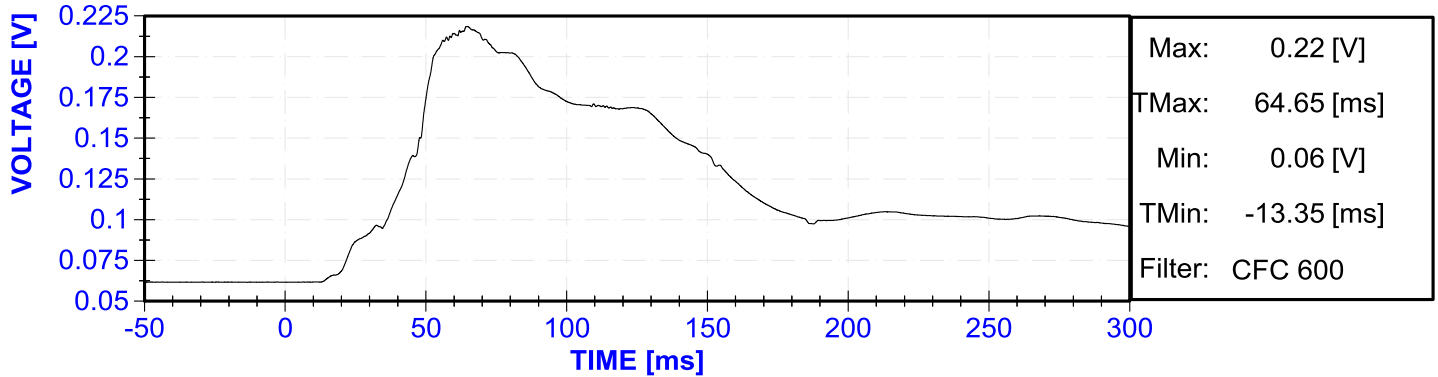




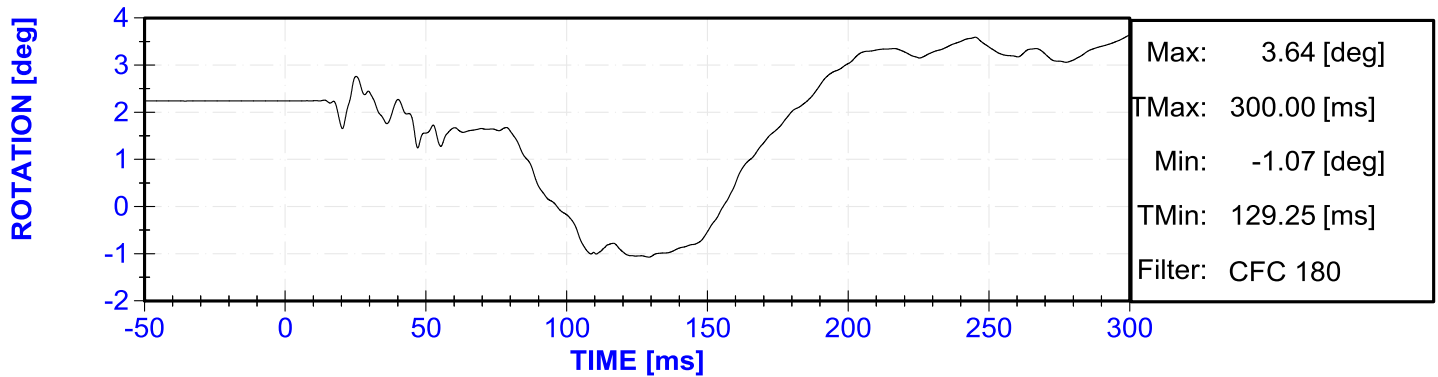




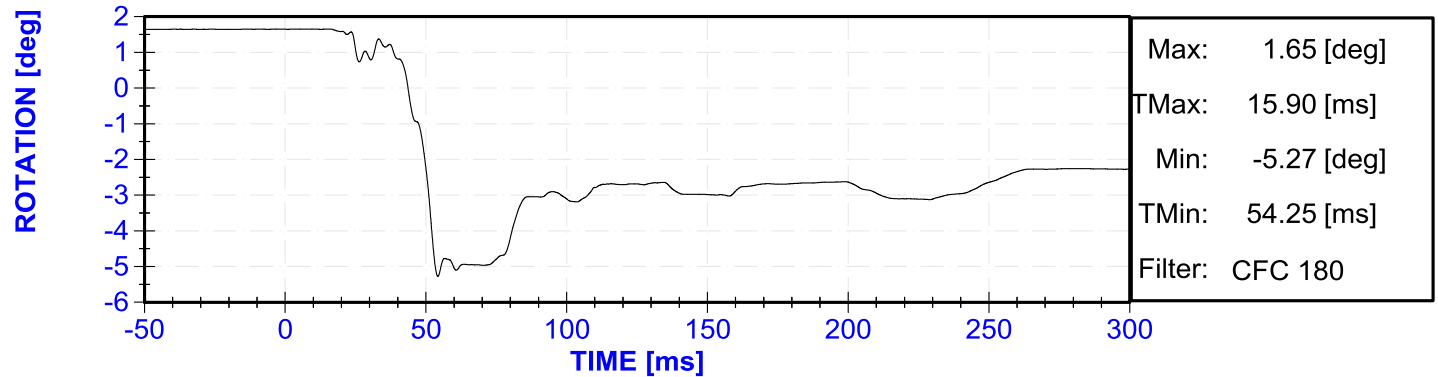
V2P1 Abdomen Left DGIR X Displacement



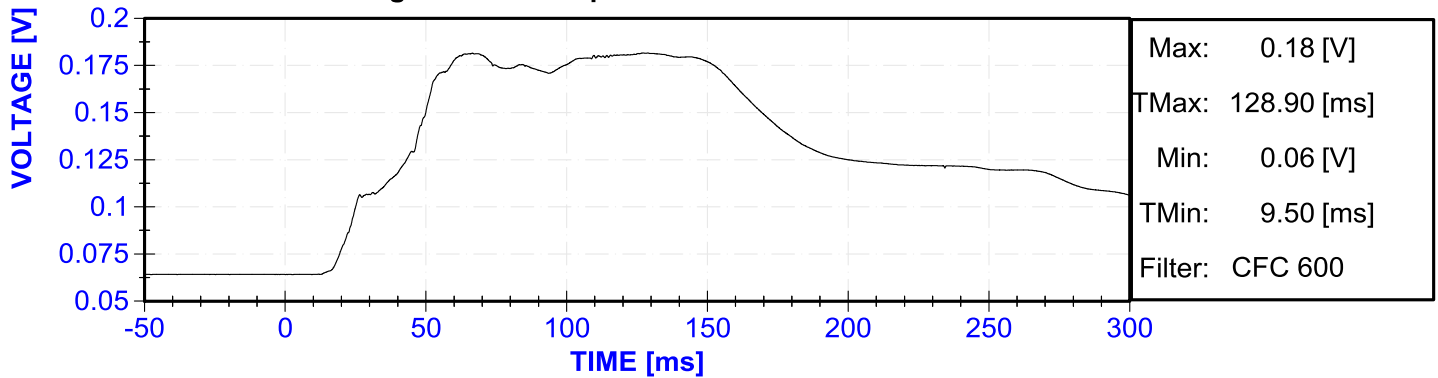
V2P1 Abdomen Left DGIR Y Rotation

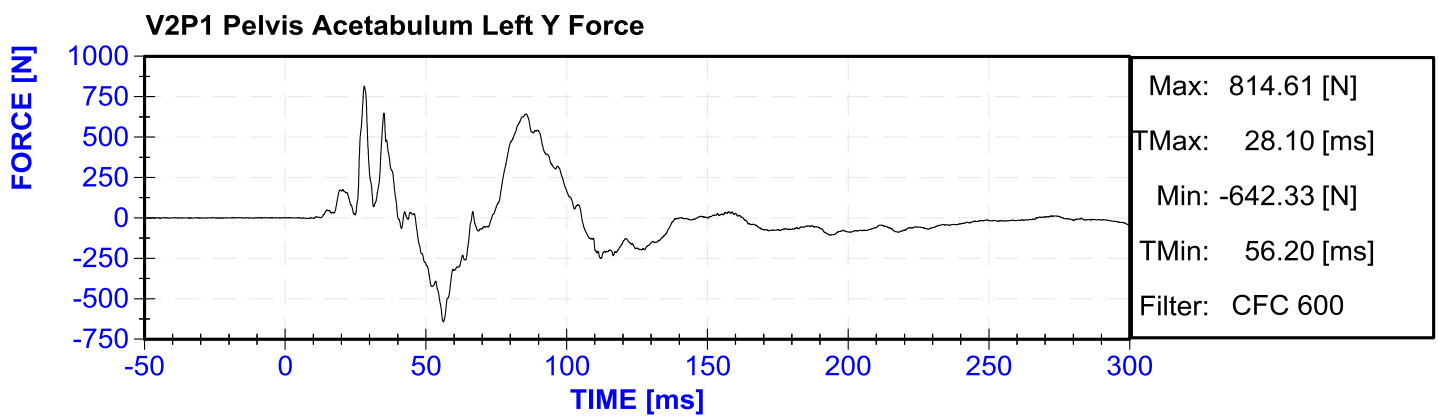
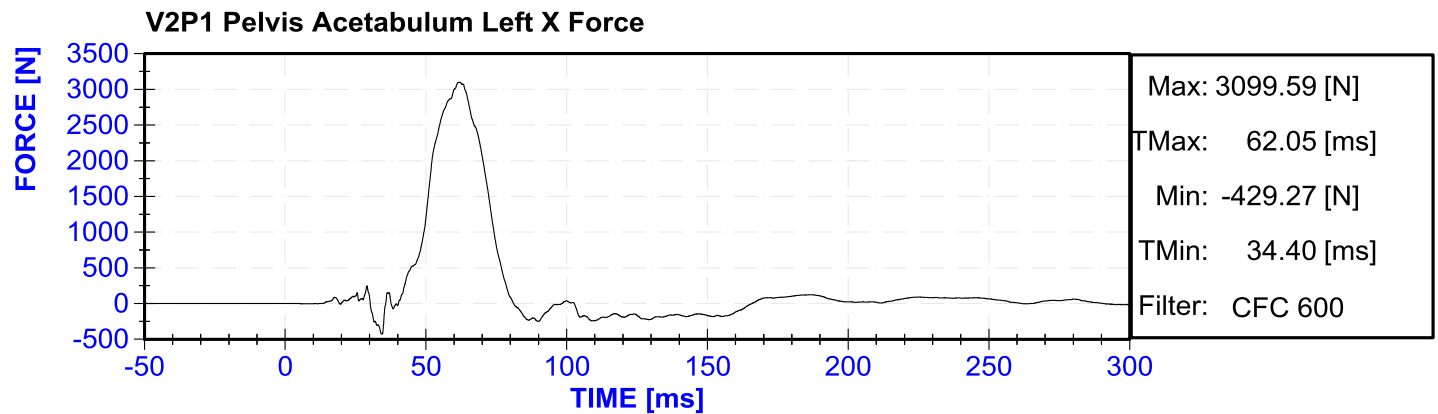
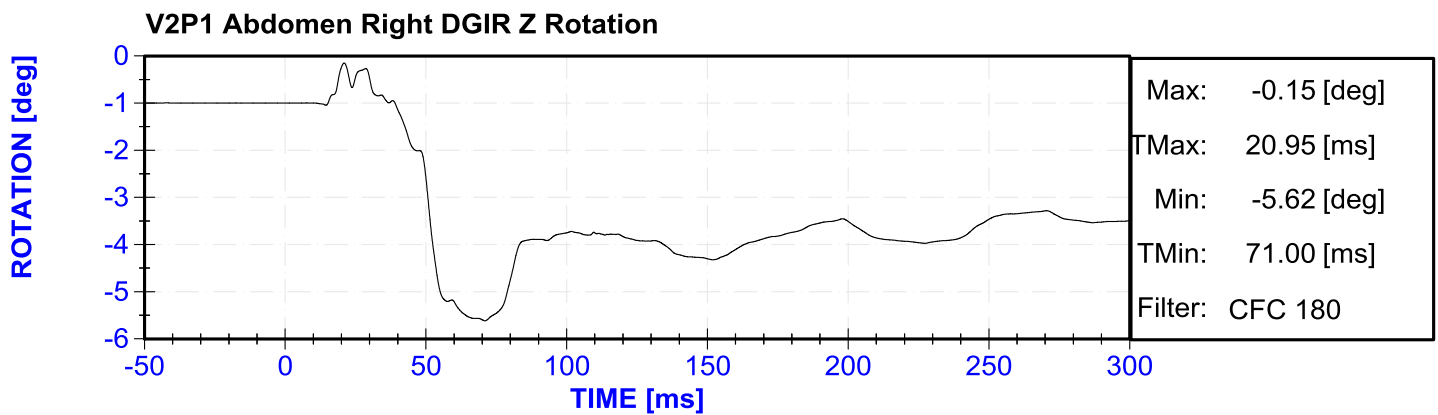
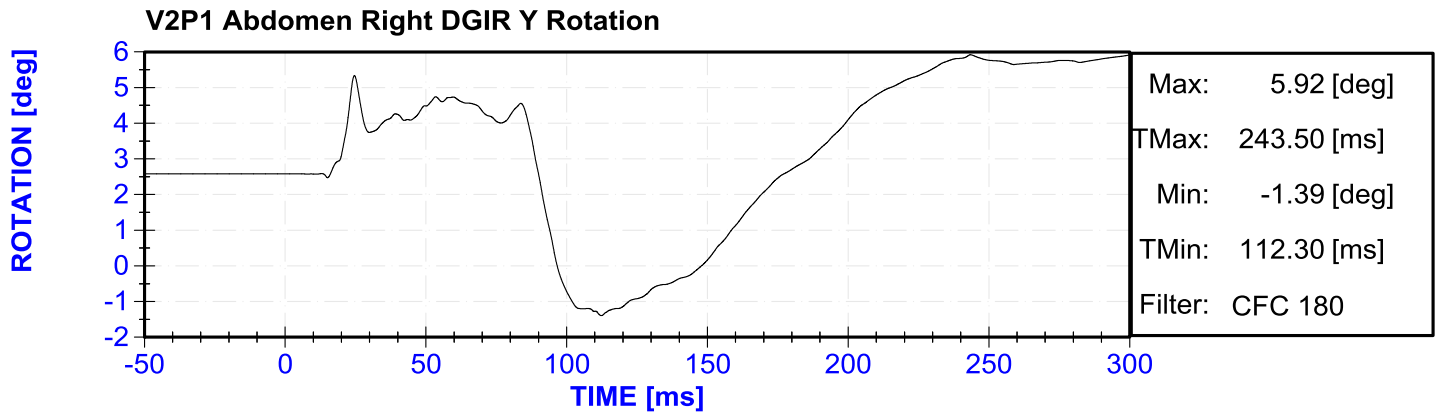


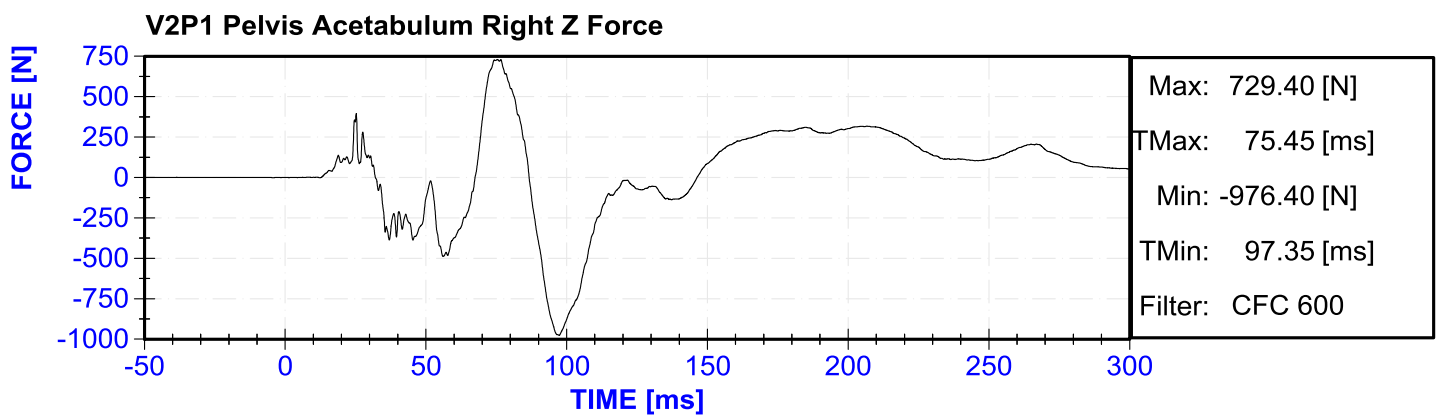
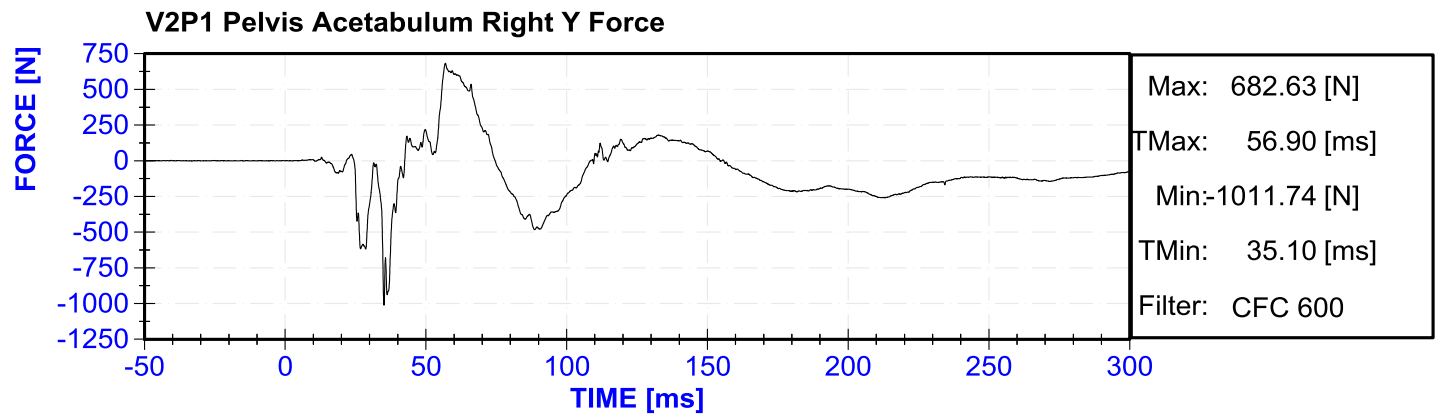
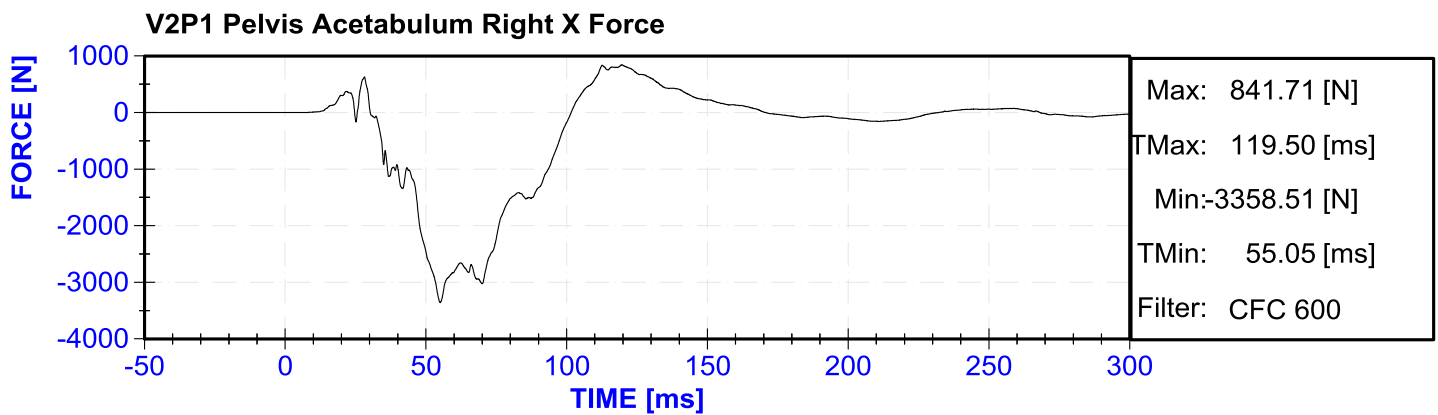
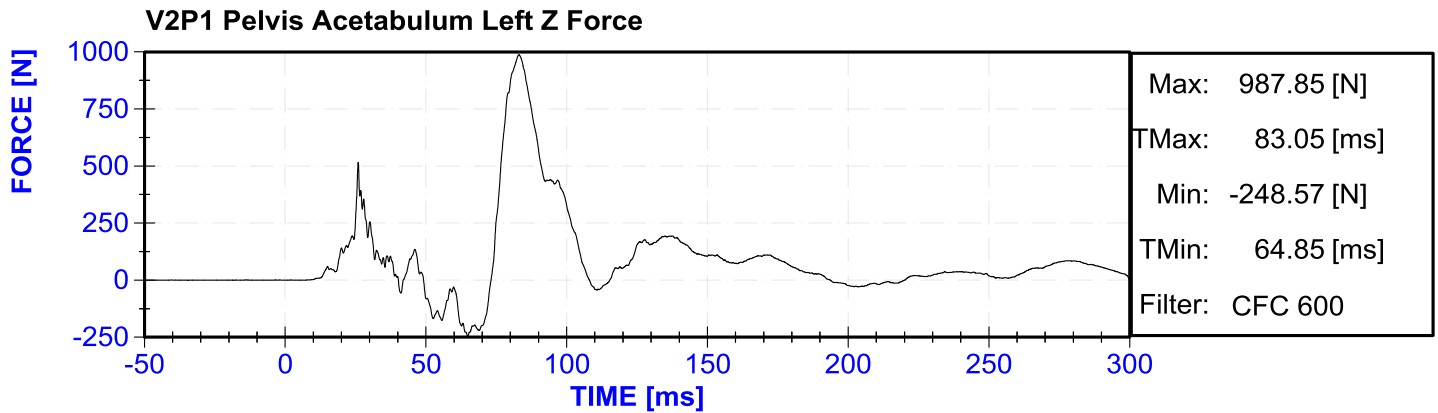
V2P1 Abdomen Left DGIR Z Rotation

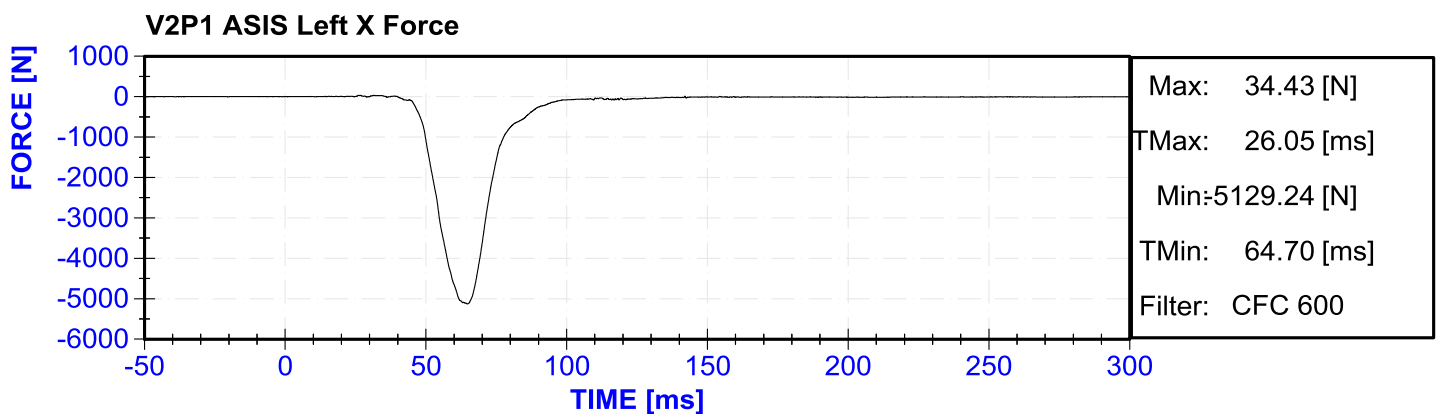
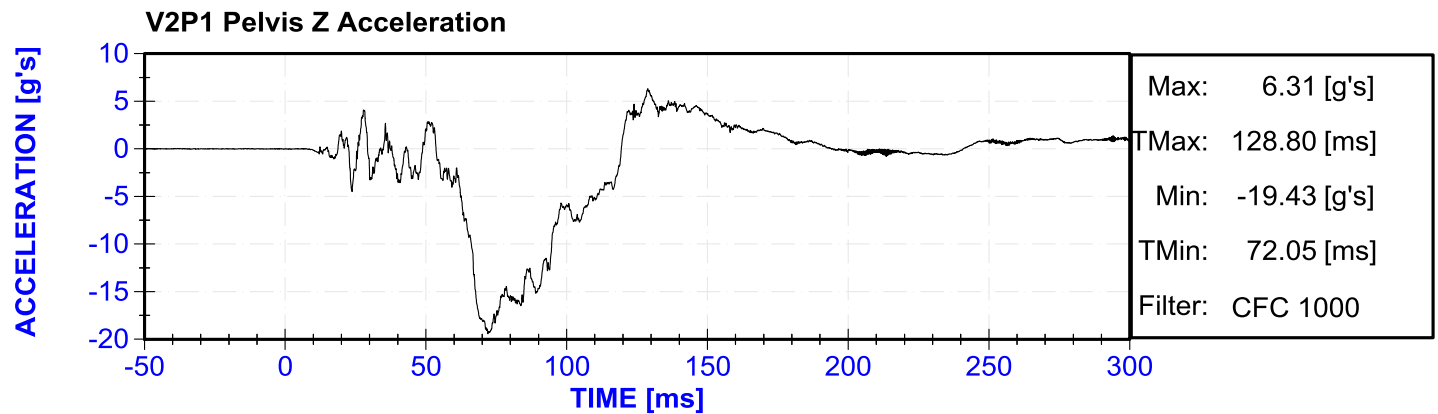
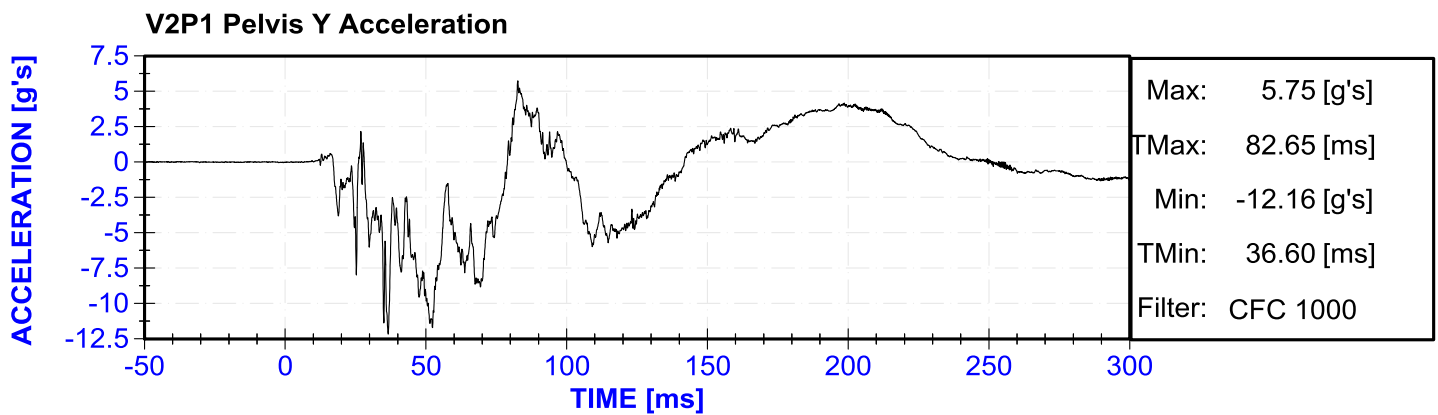
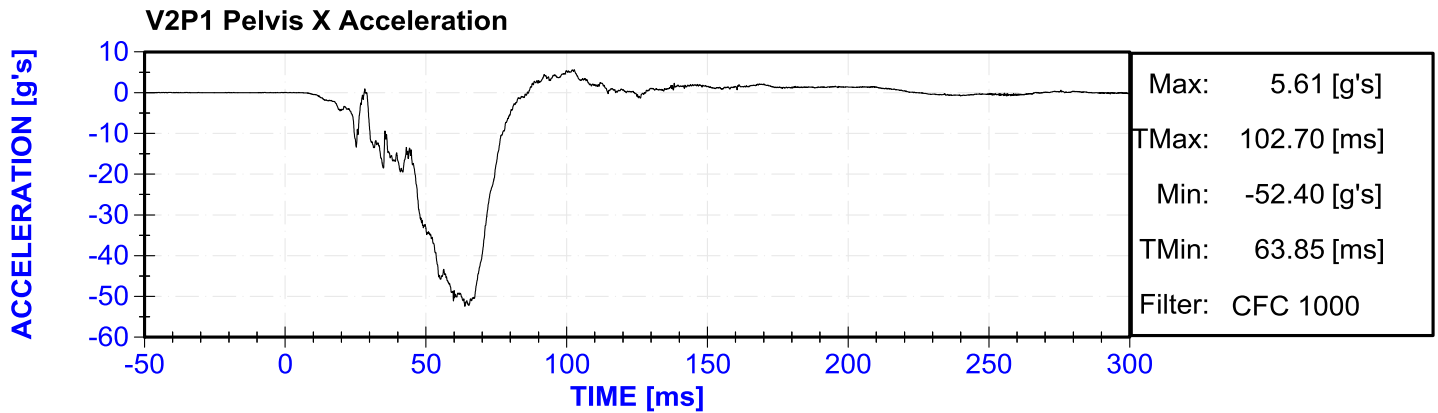


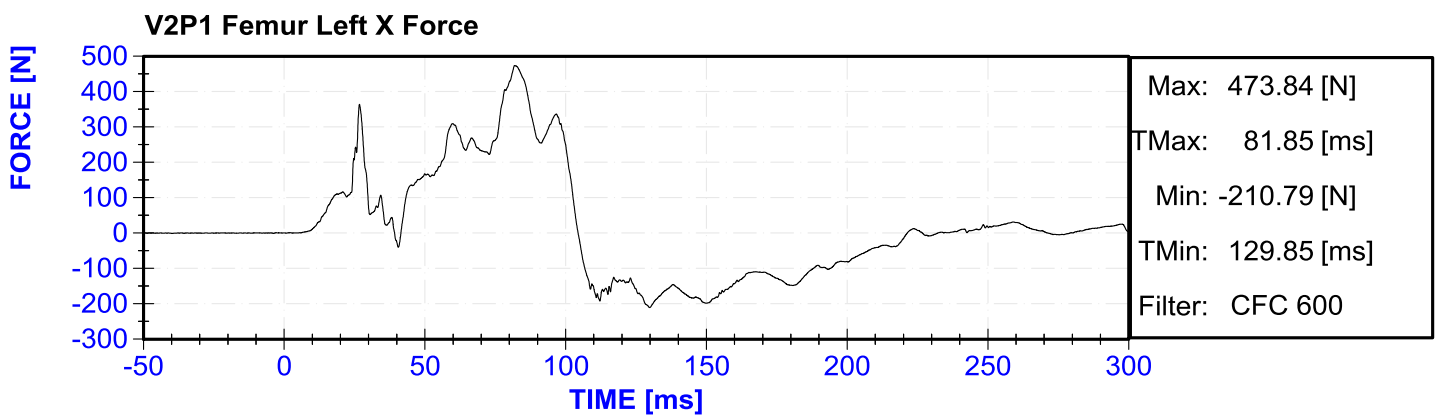
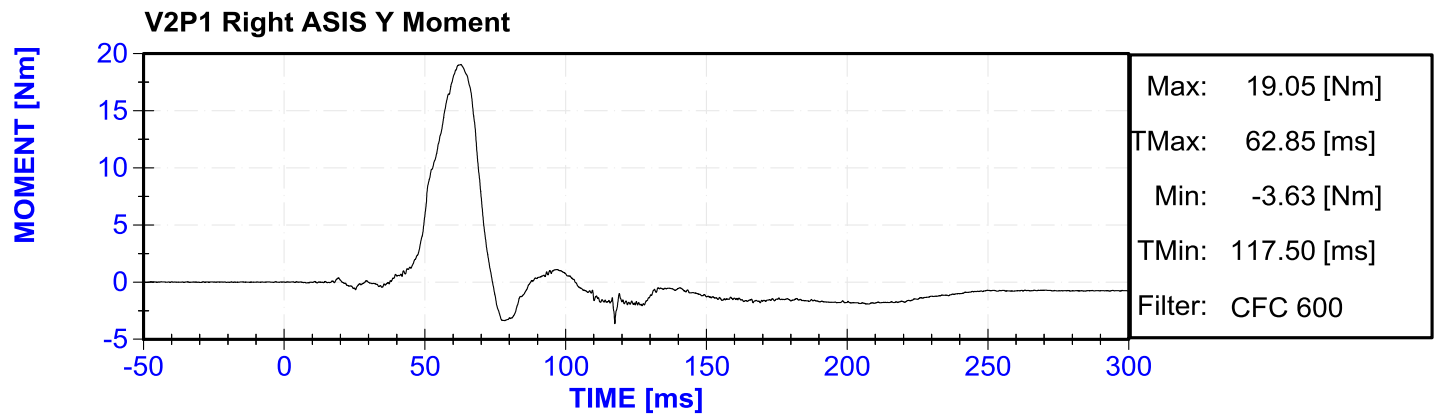
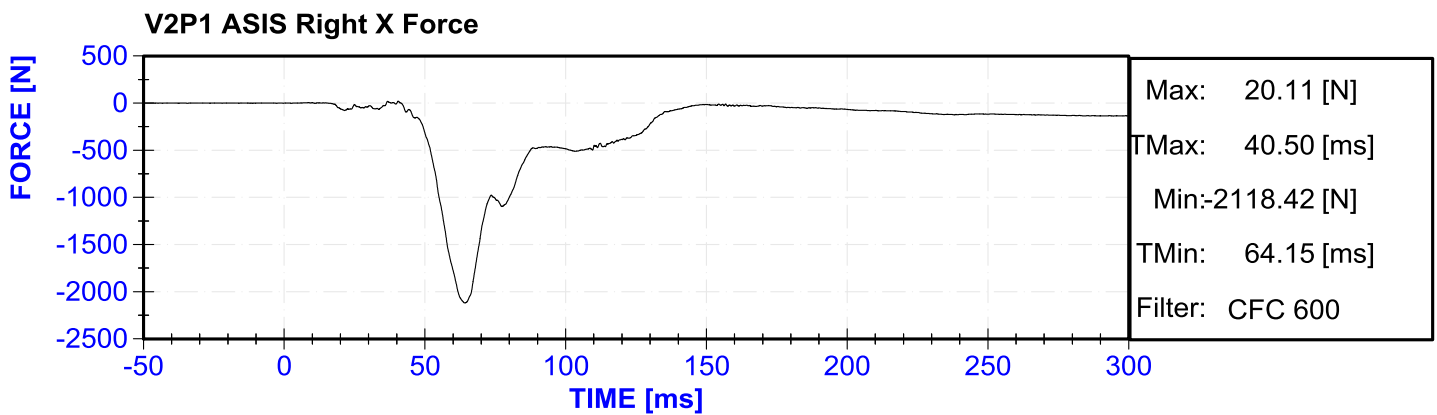
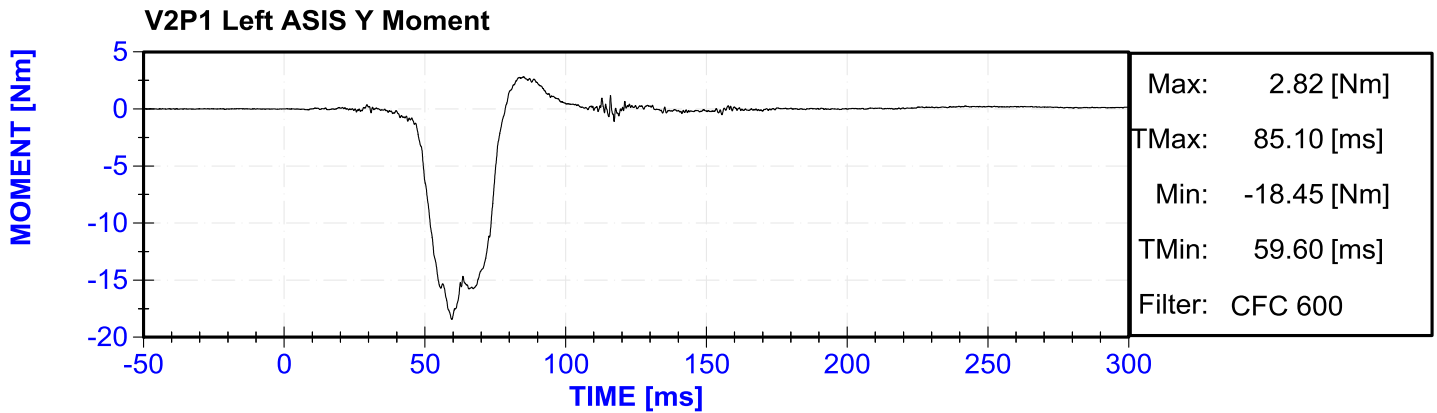
V2P1 Abdomen Right DGIR X Displacement

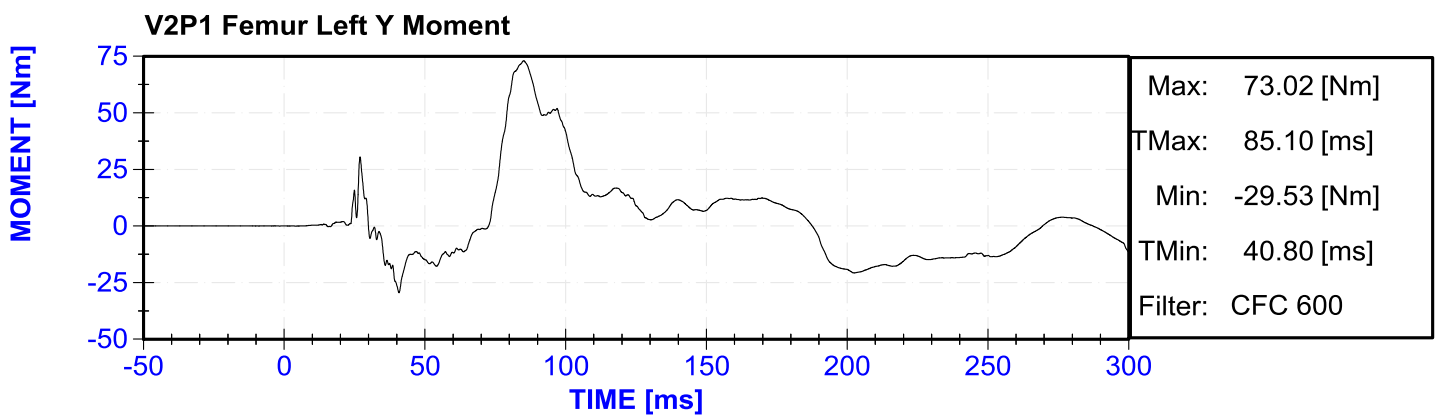
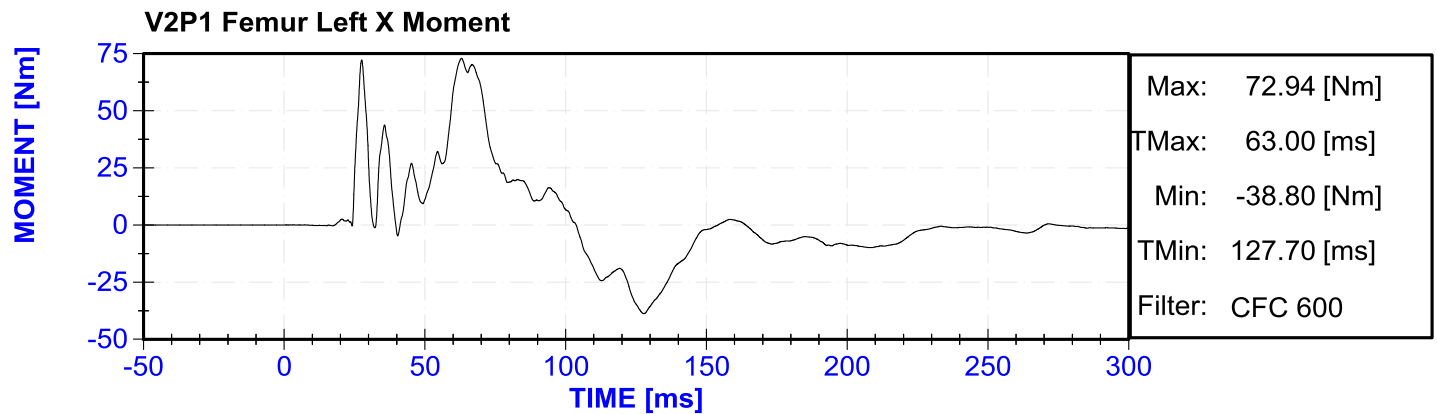
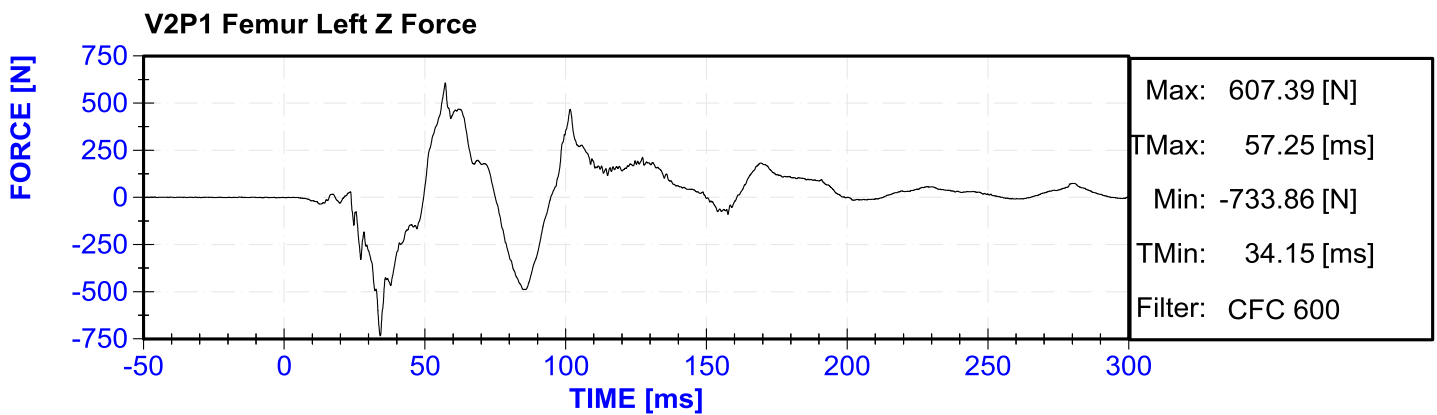
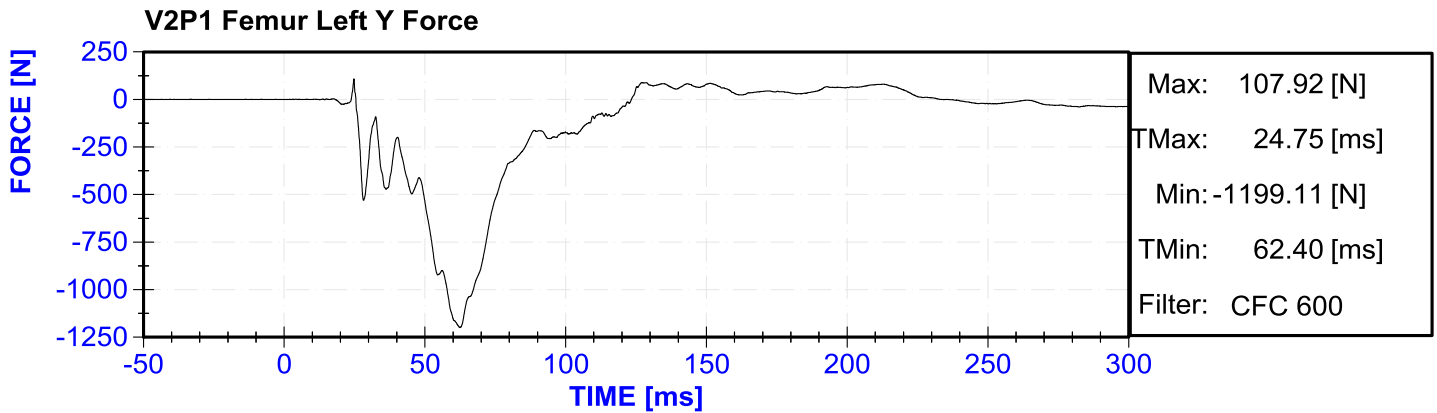


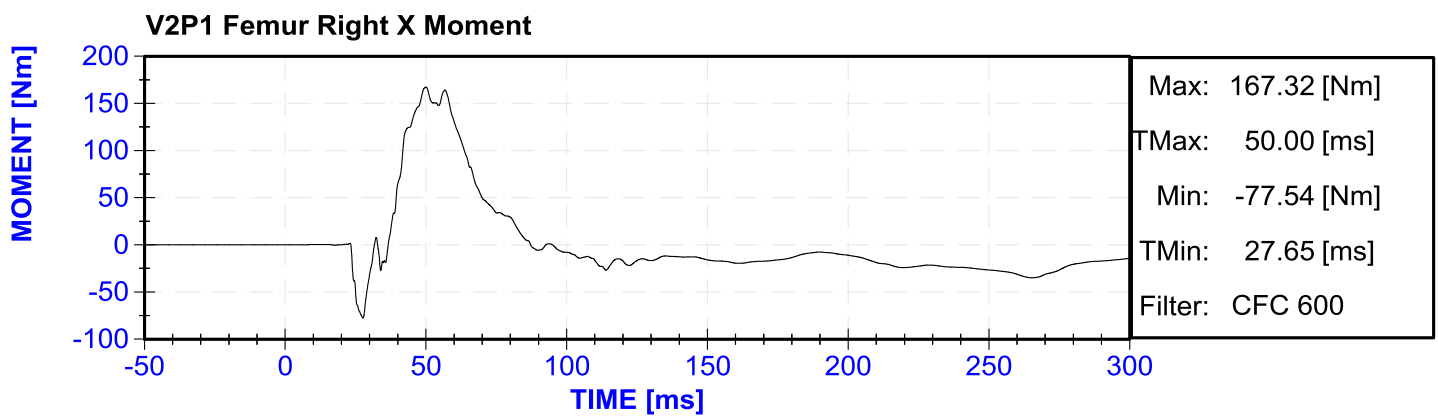
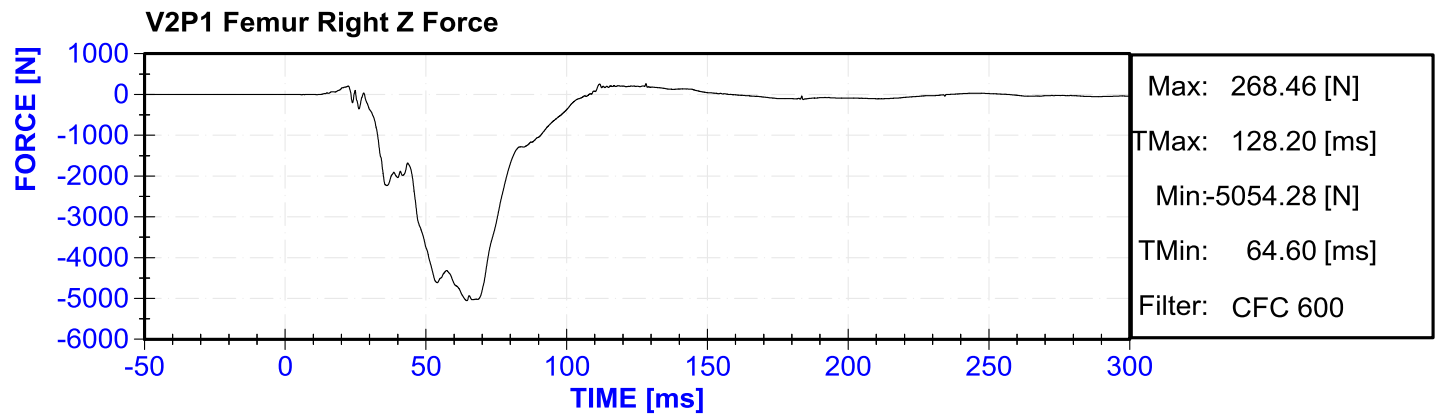
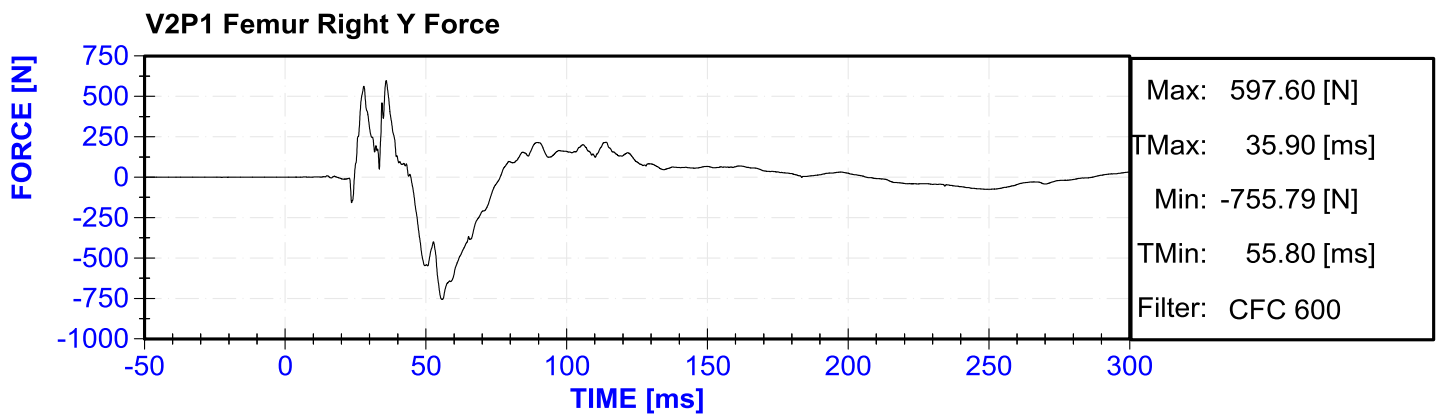
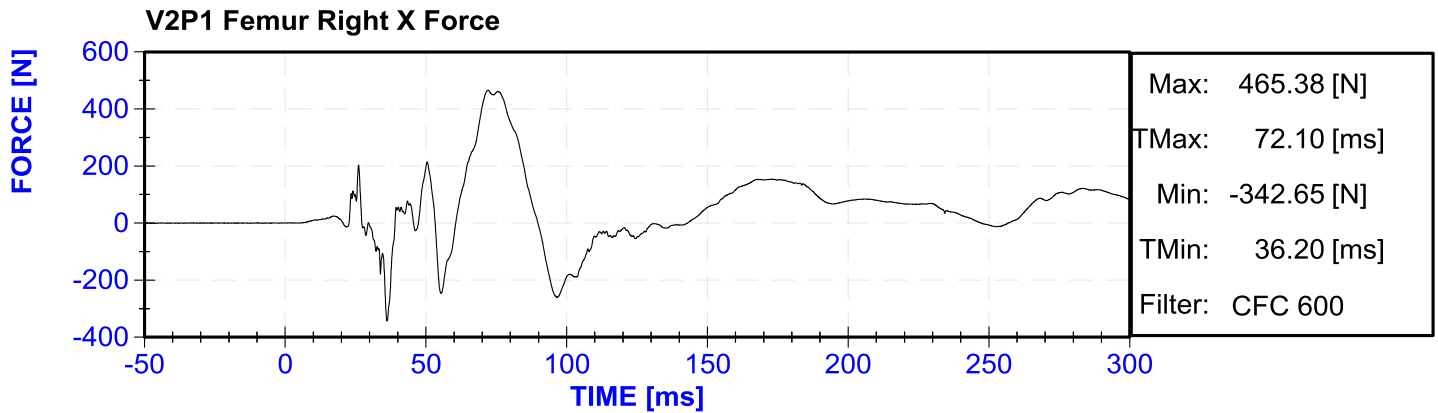




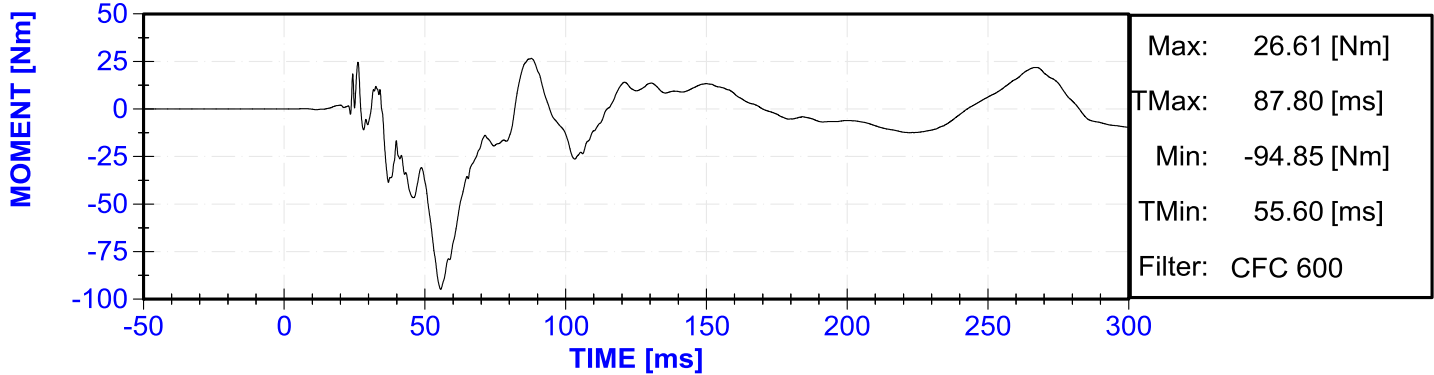




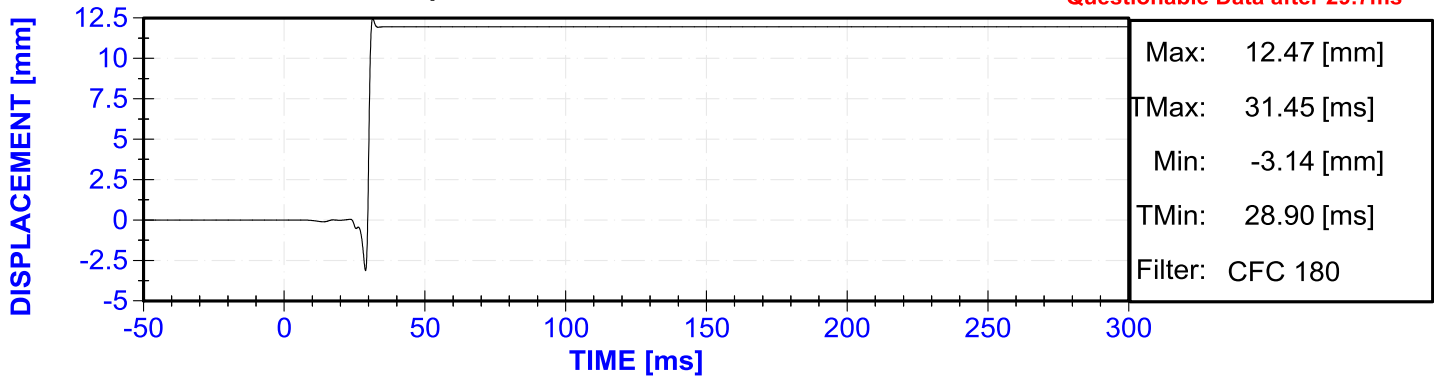




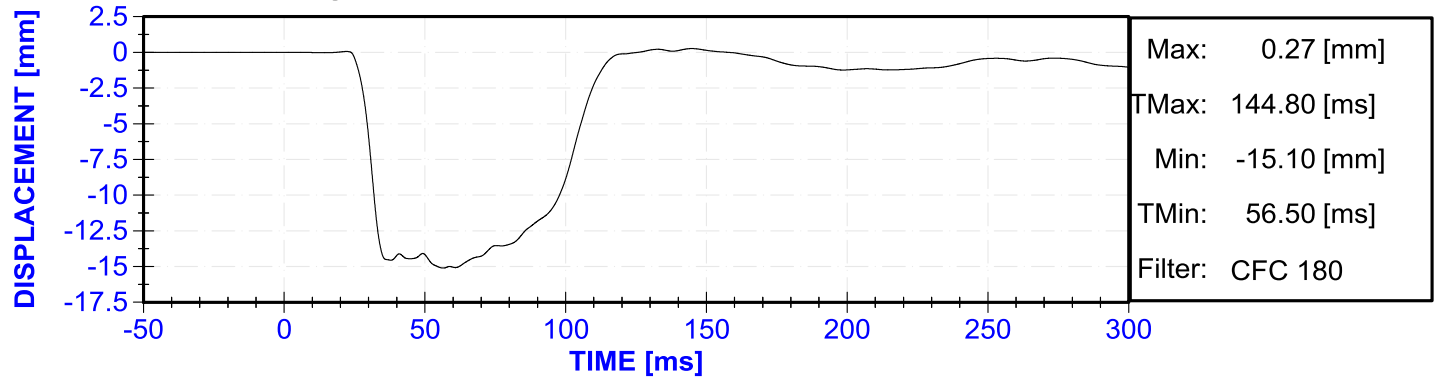
V2P1 Femur Right Y Moment



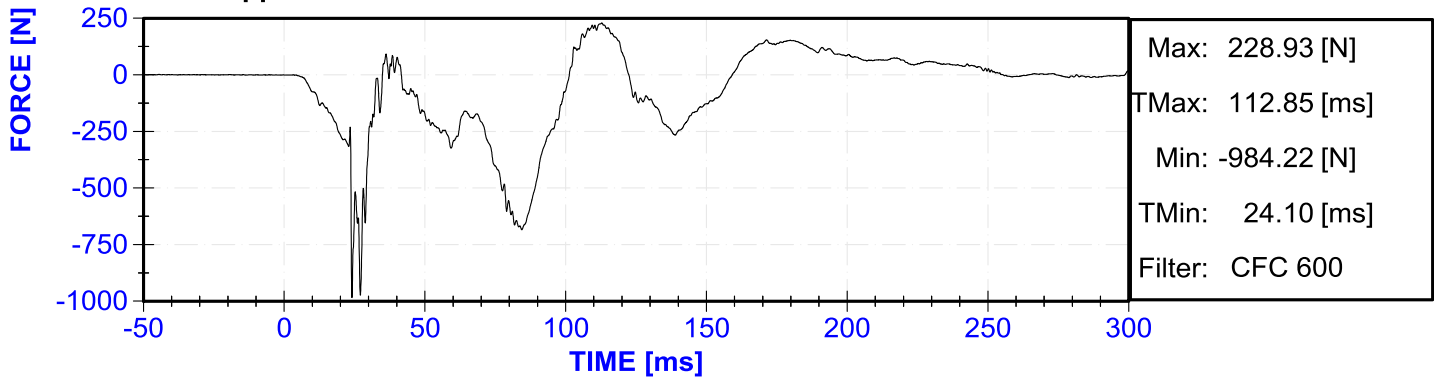
V2P1 Knee Left X Displacement

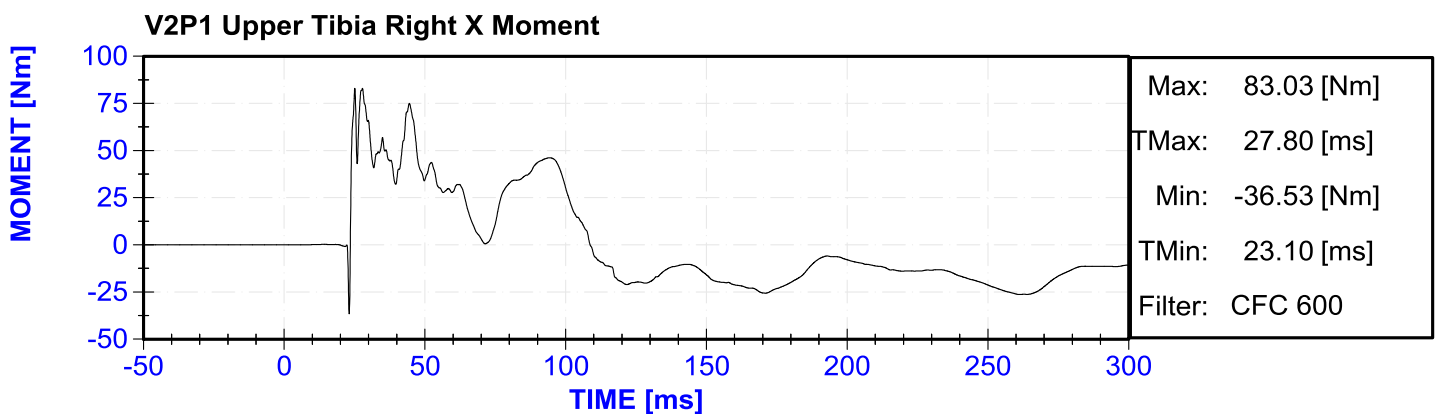
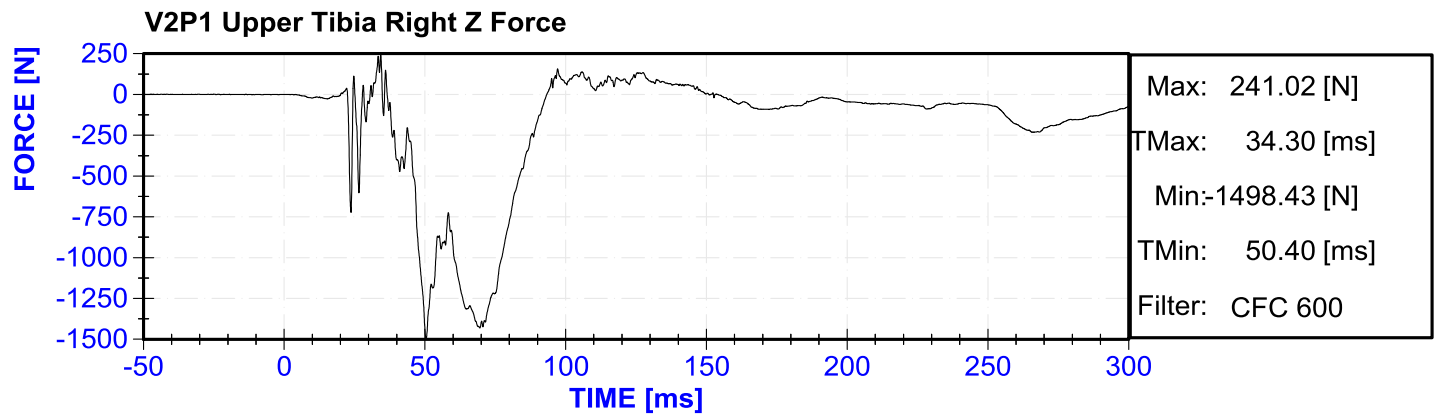
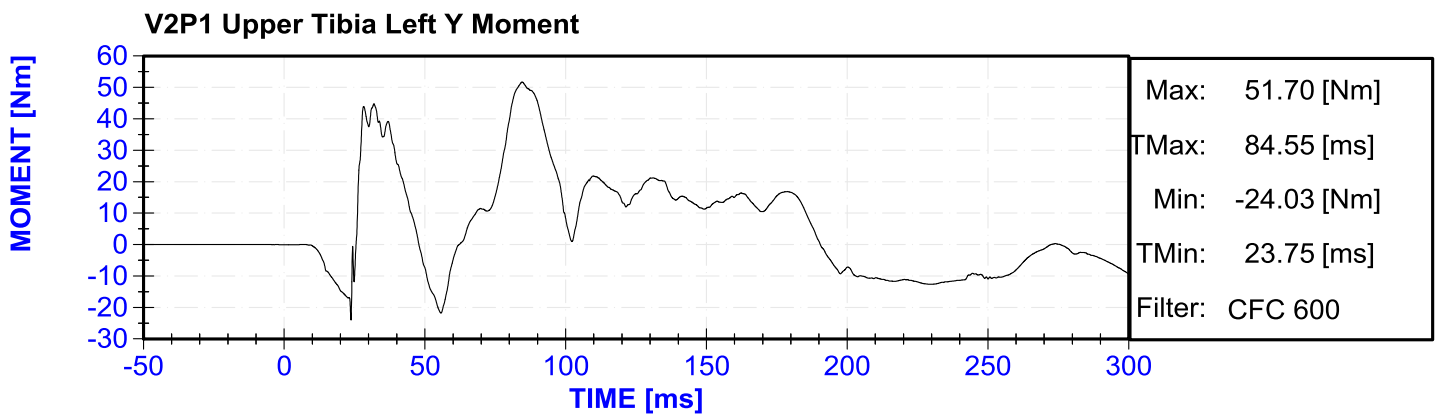
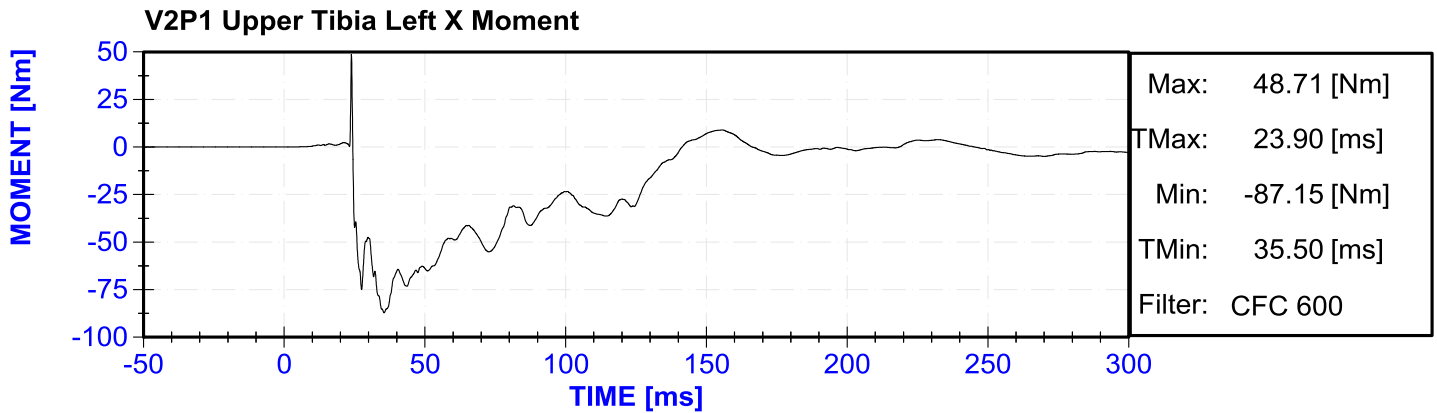


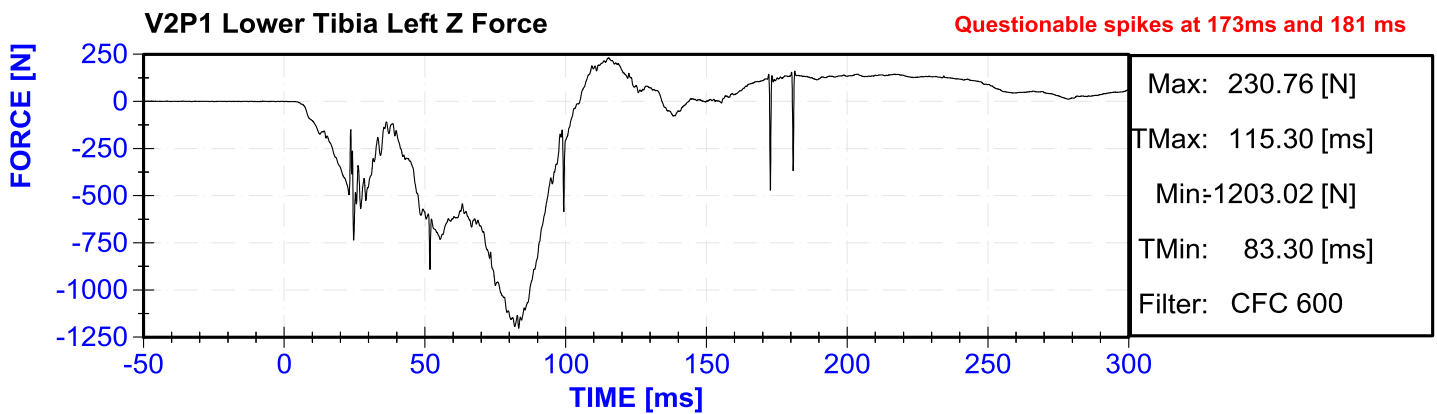
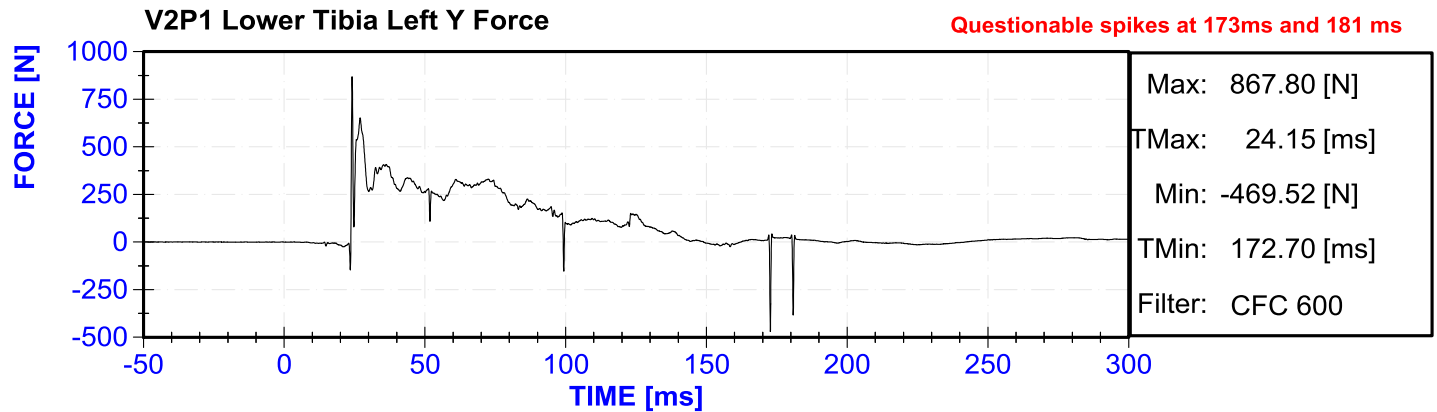
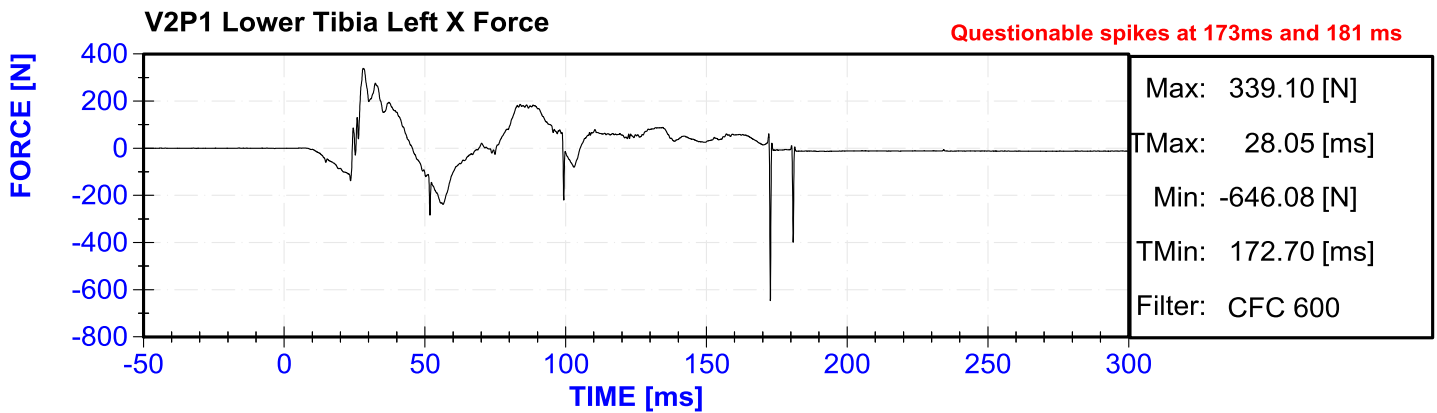
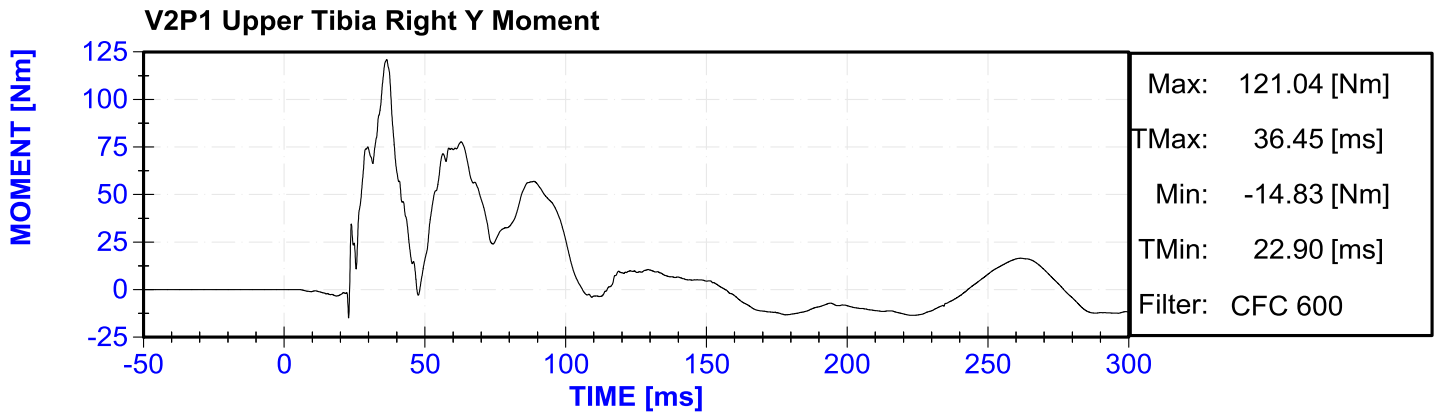
V2P1 Knee Right X Displacement

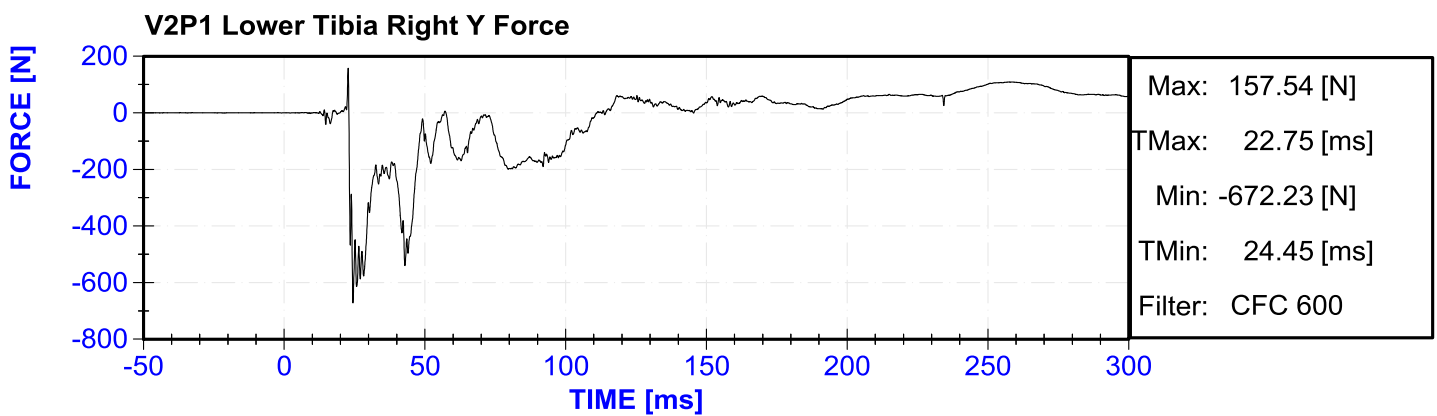
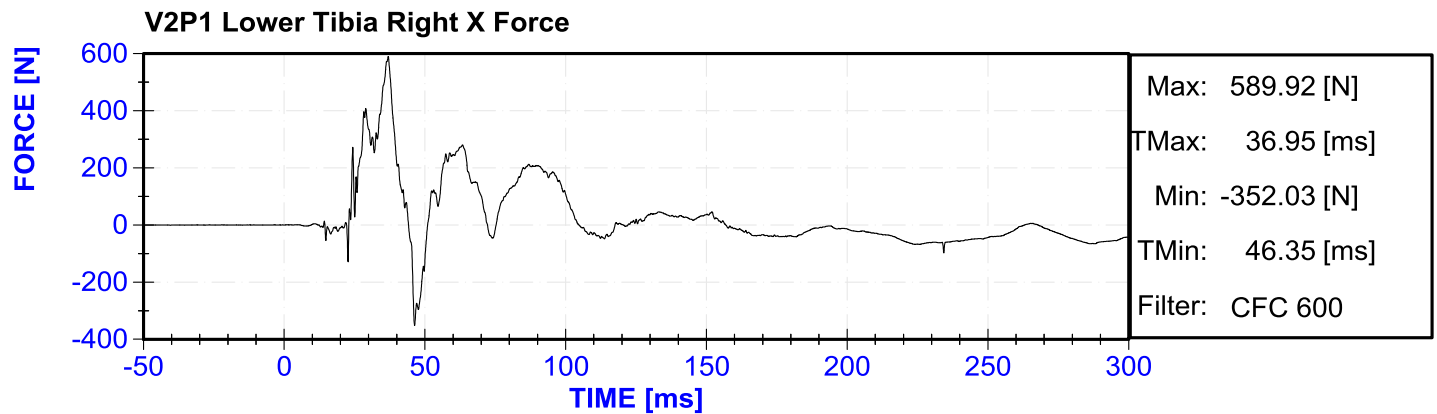
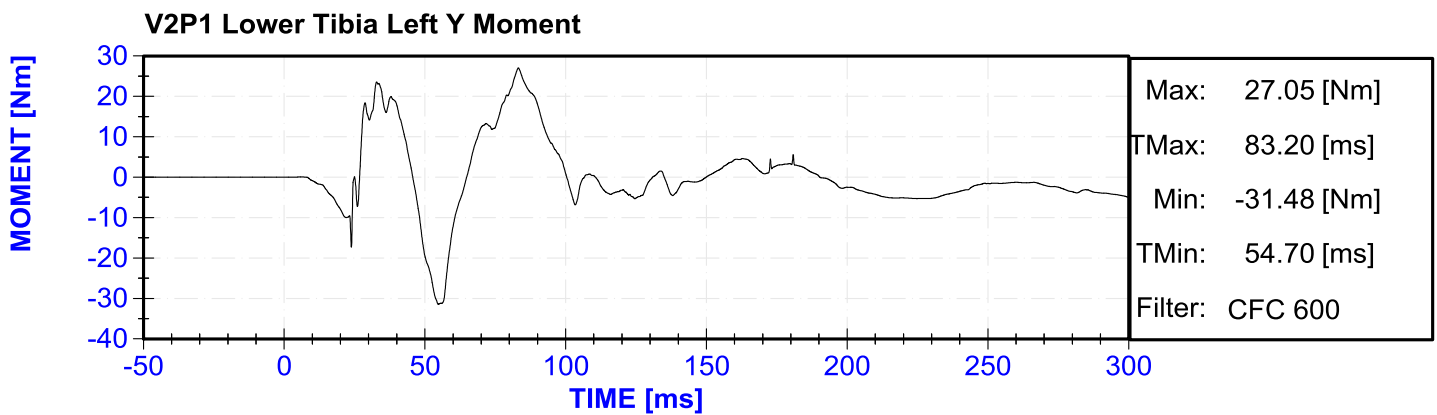
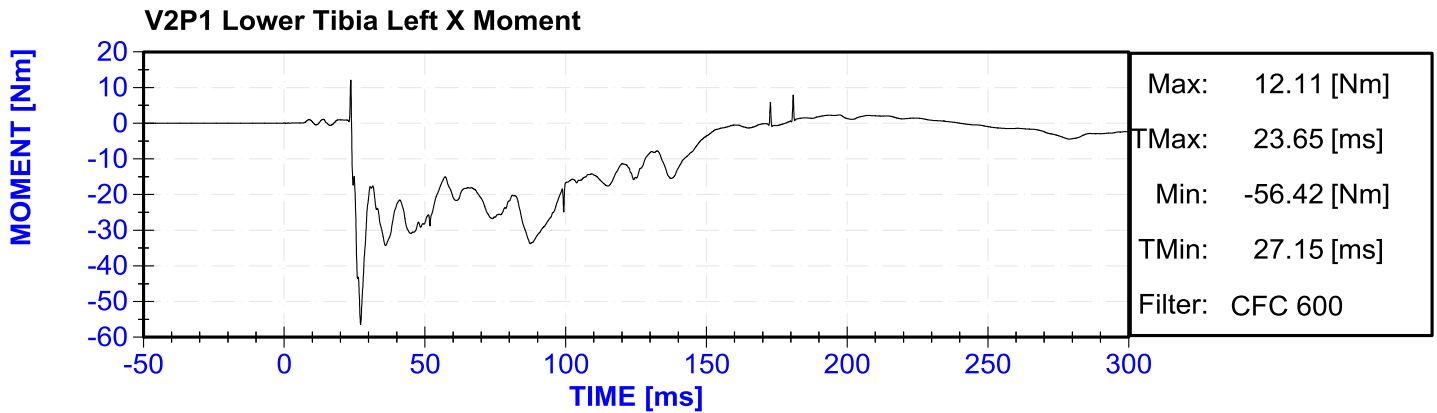


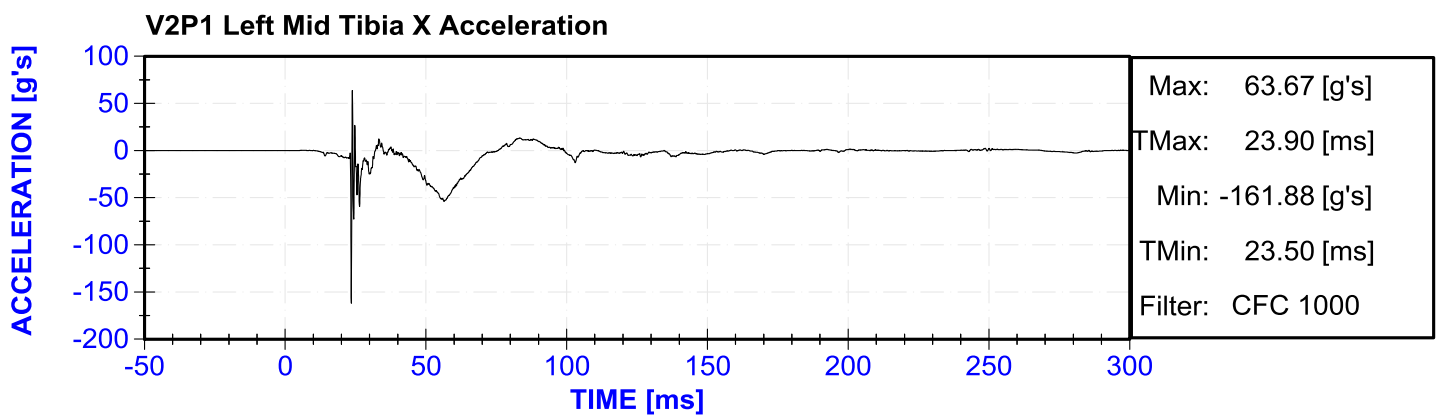
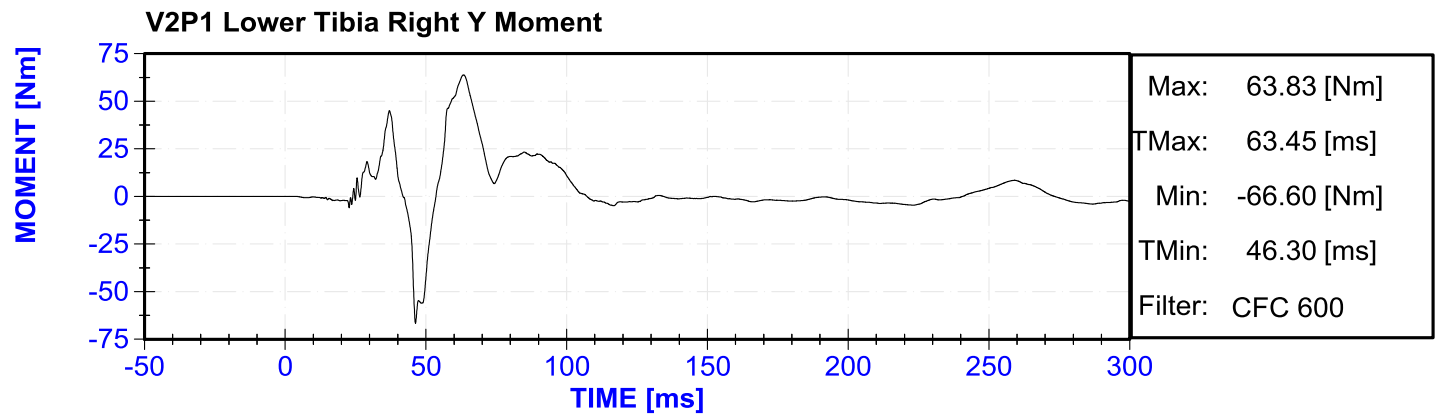
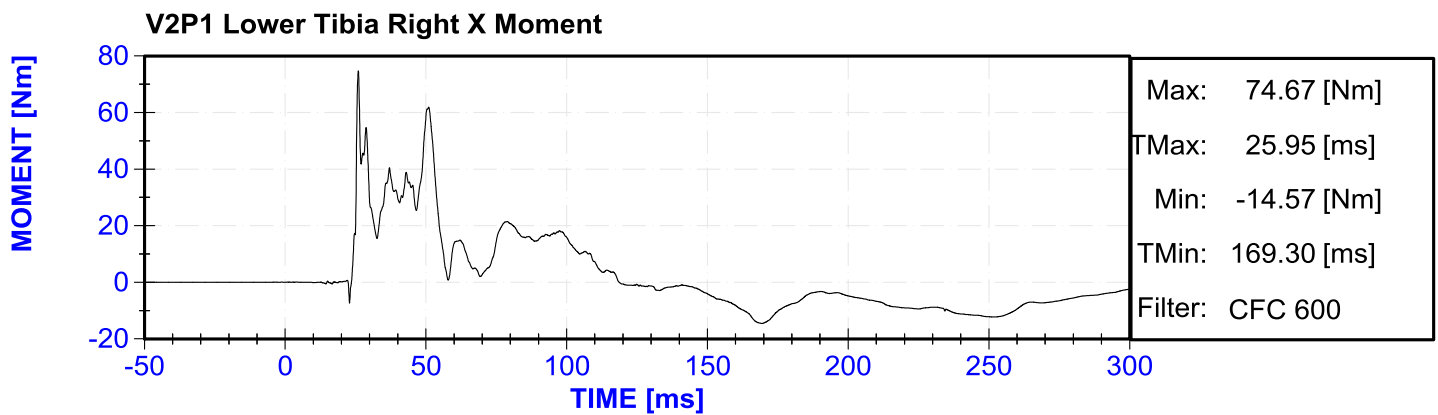
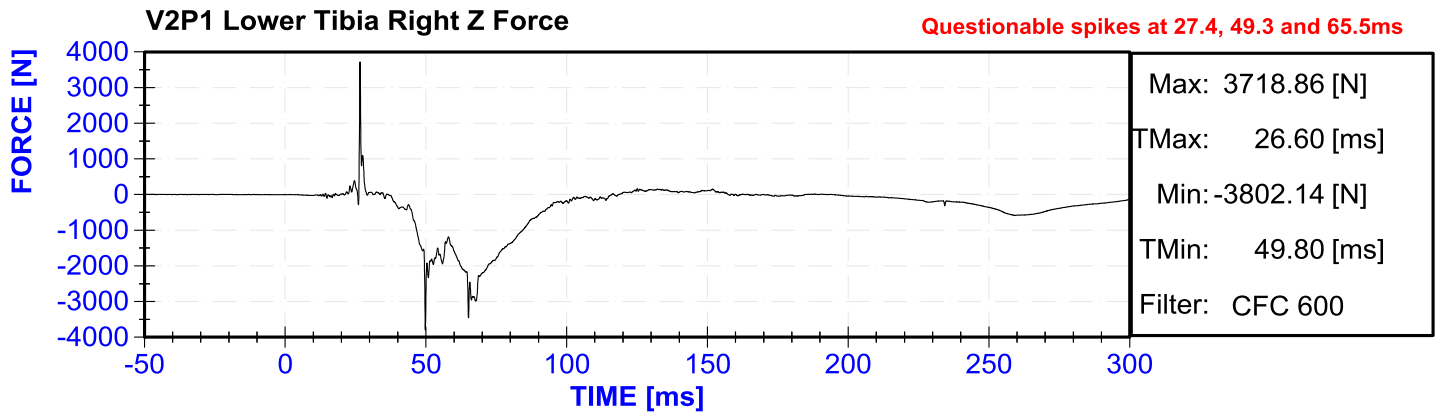
V2P1 Upper Tibia Left Z Force

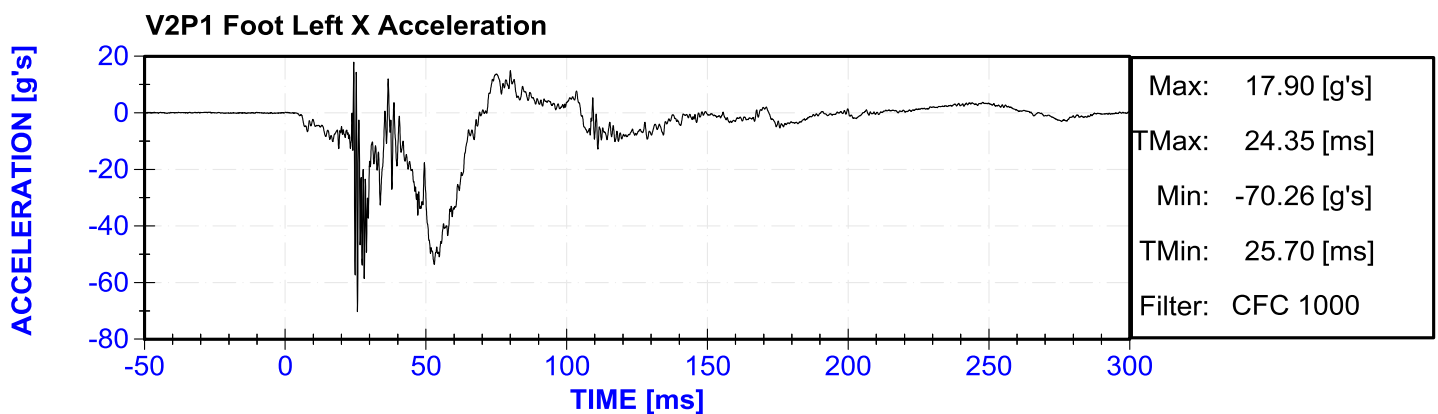
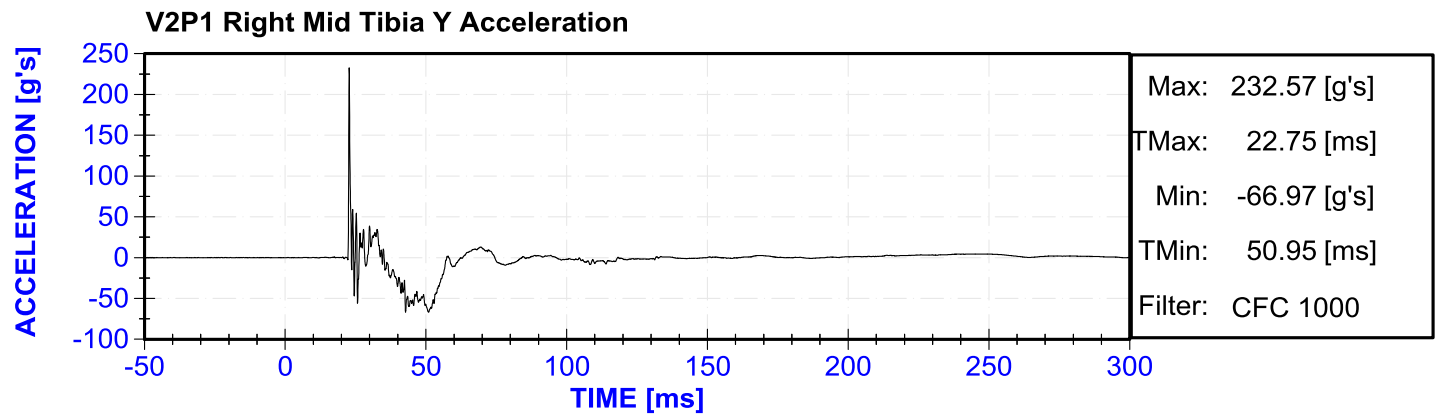
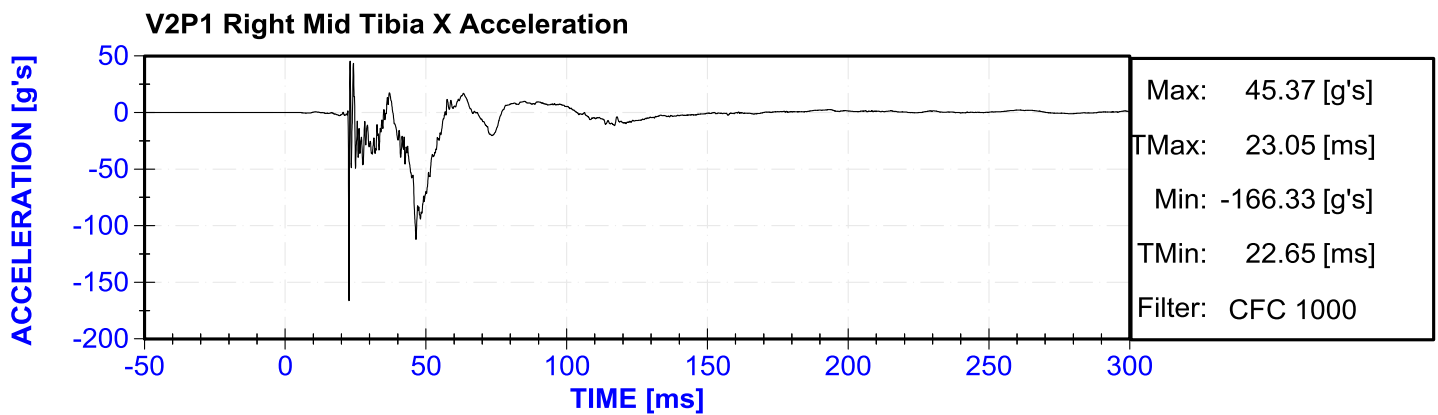
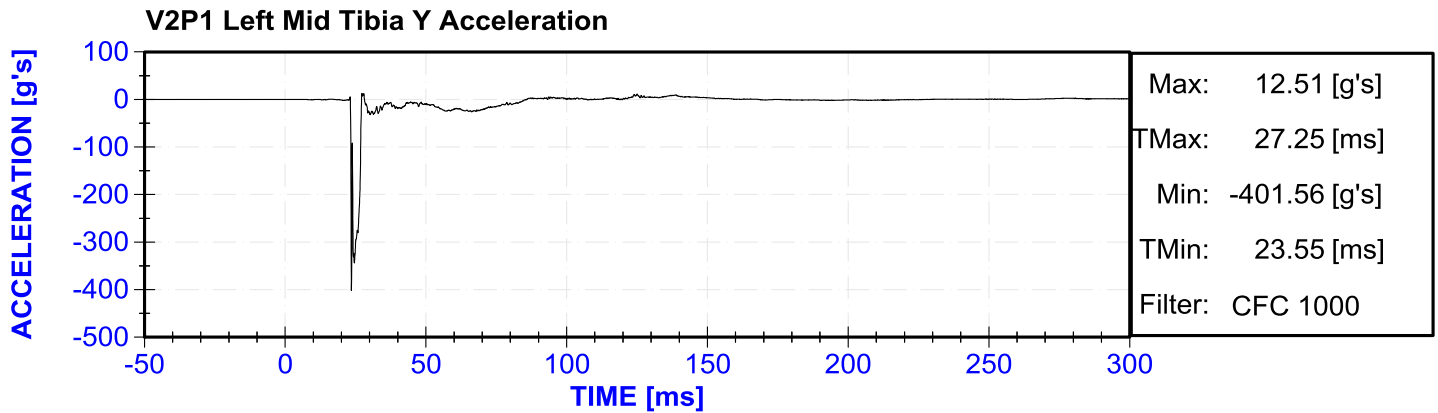


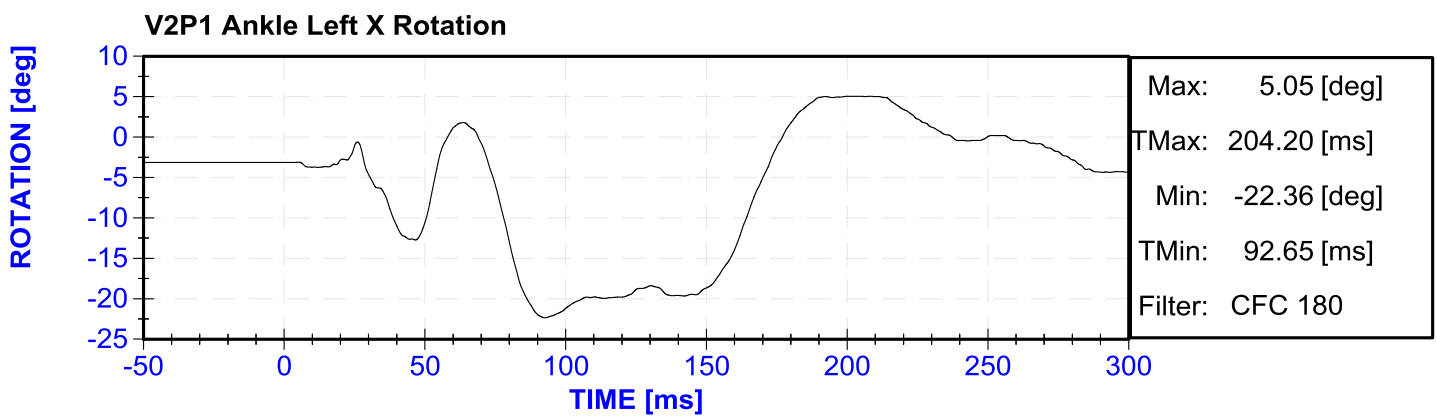
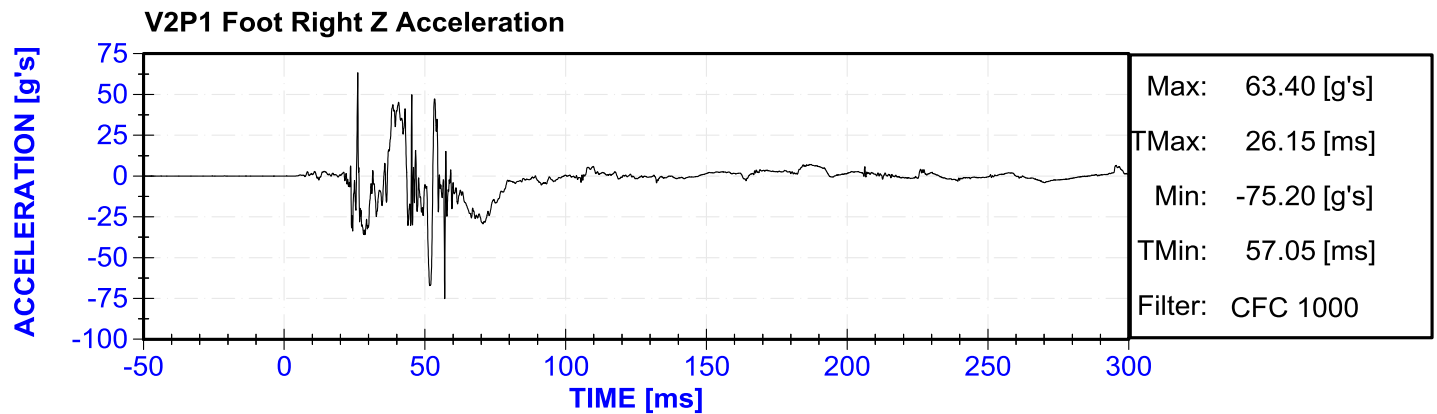
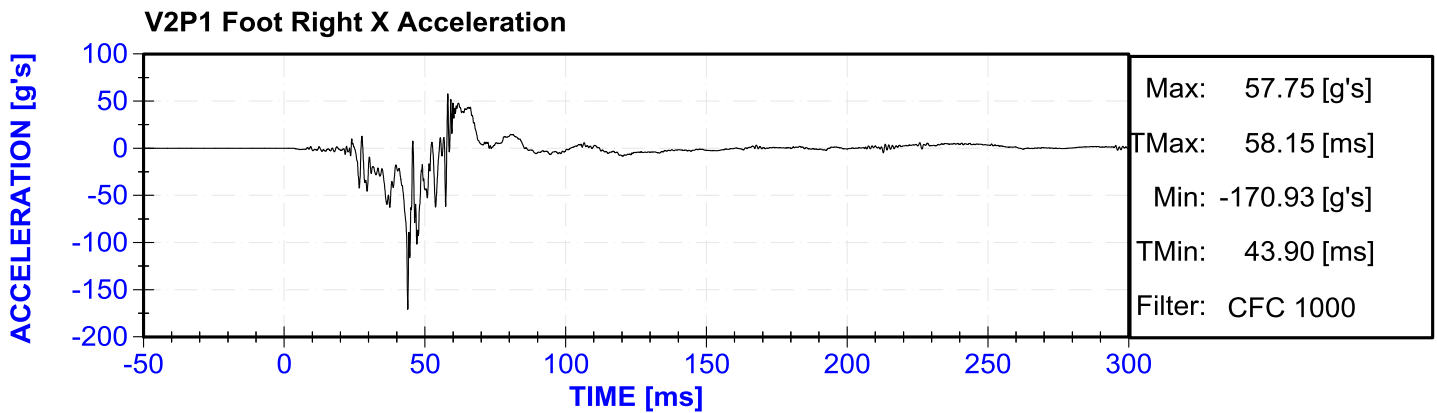
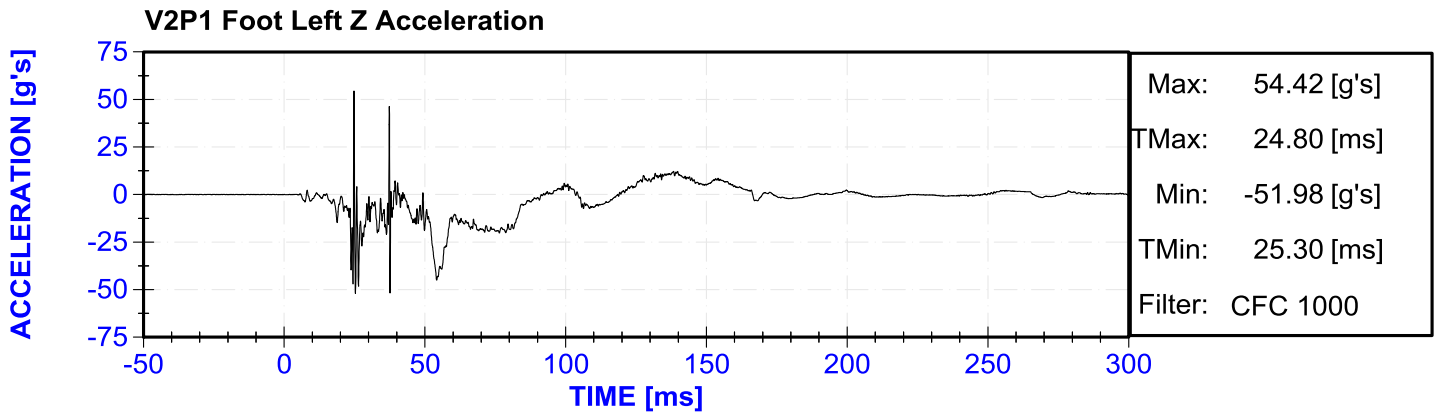


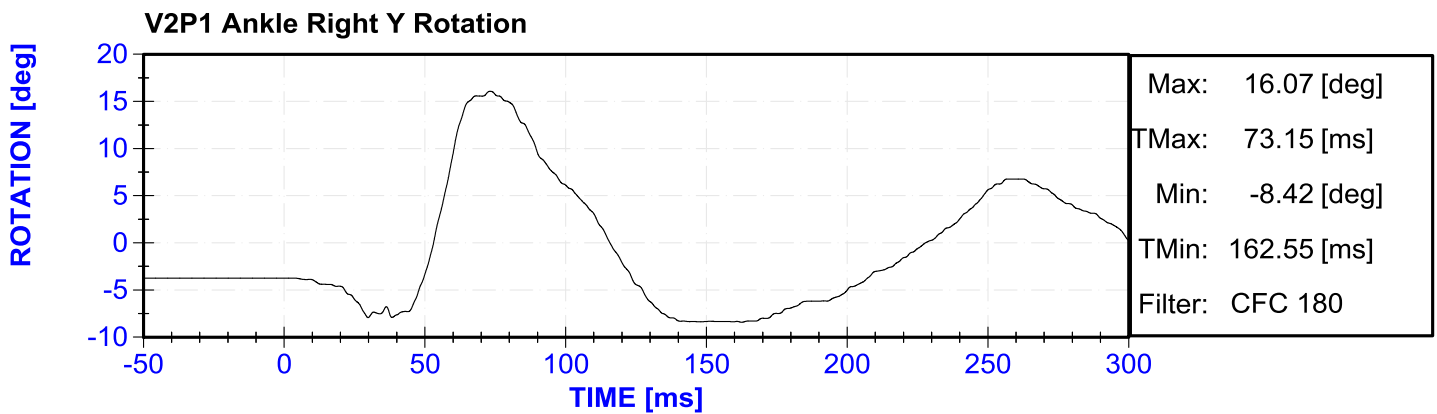
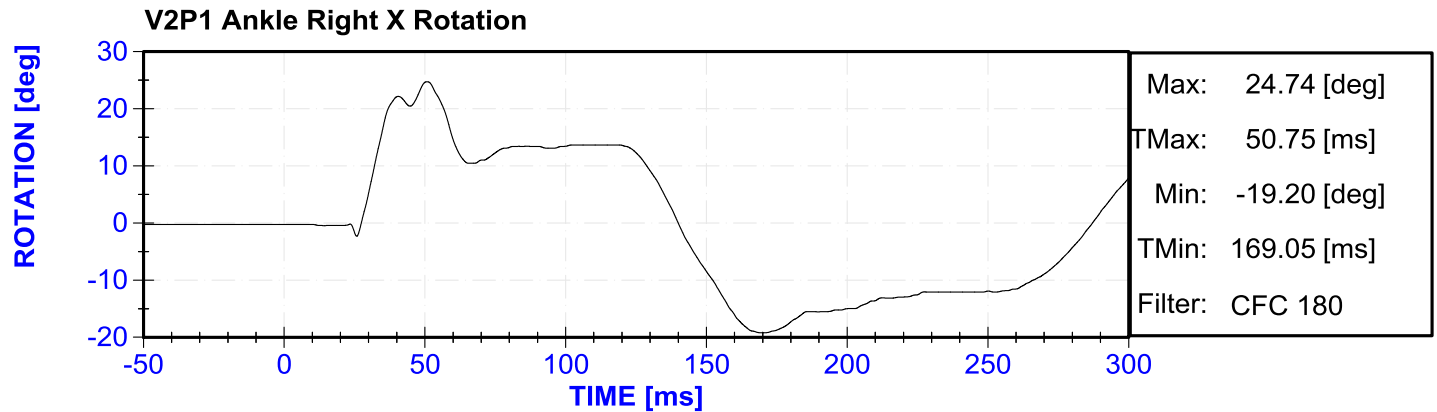
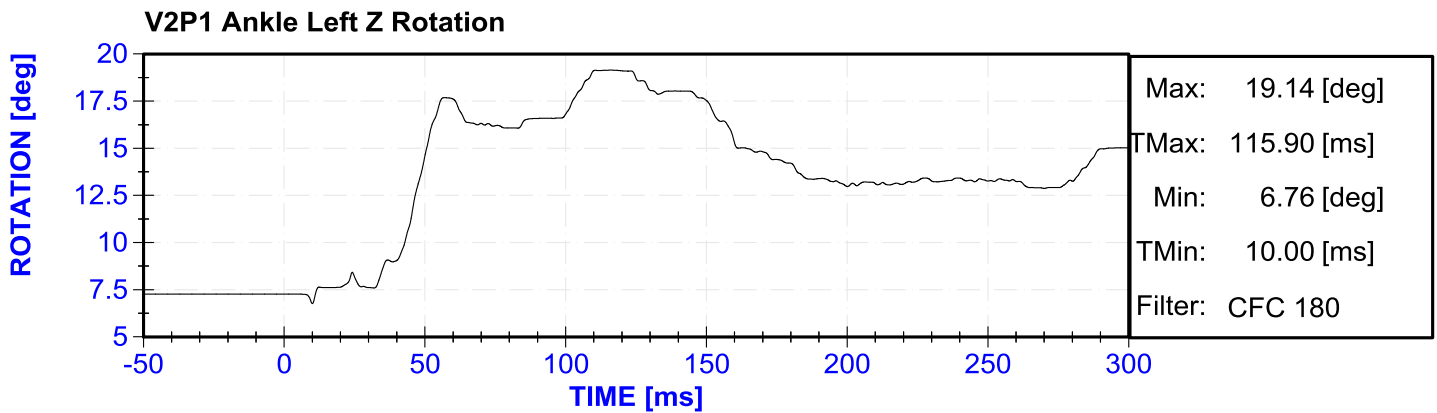
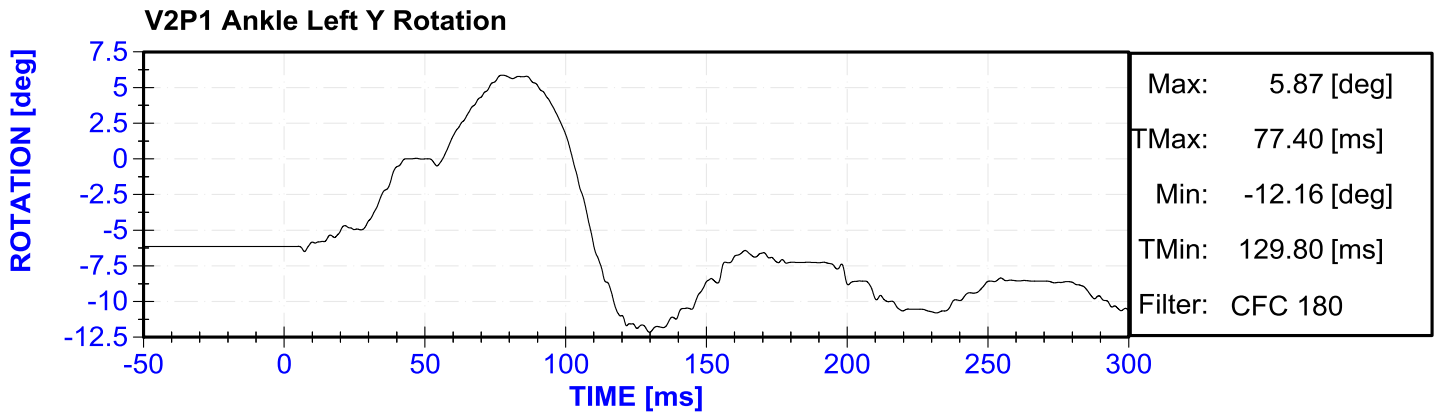


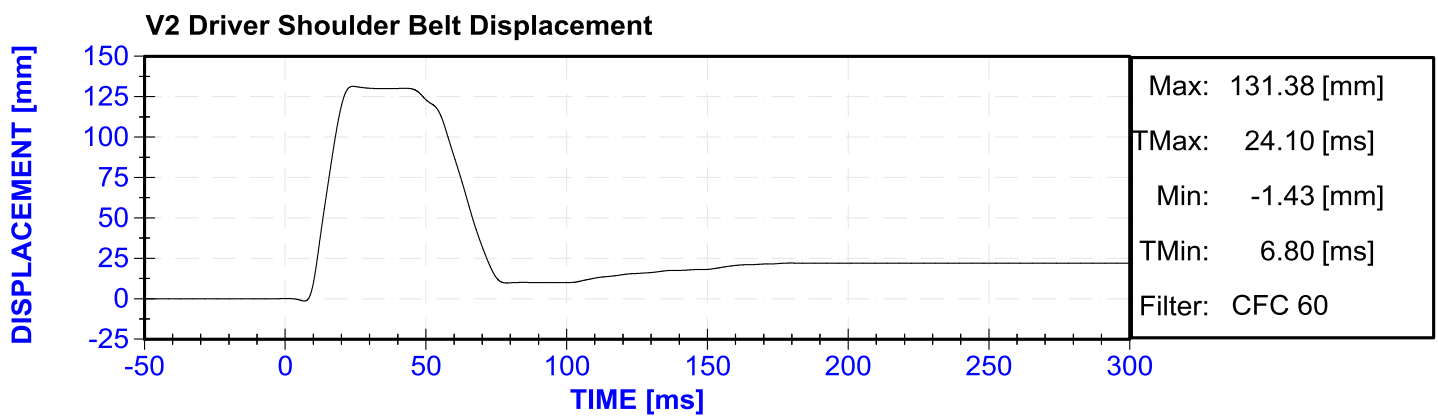
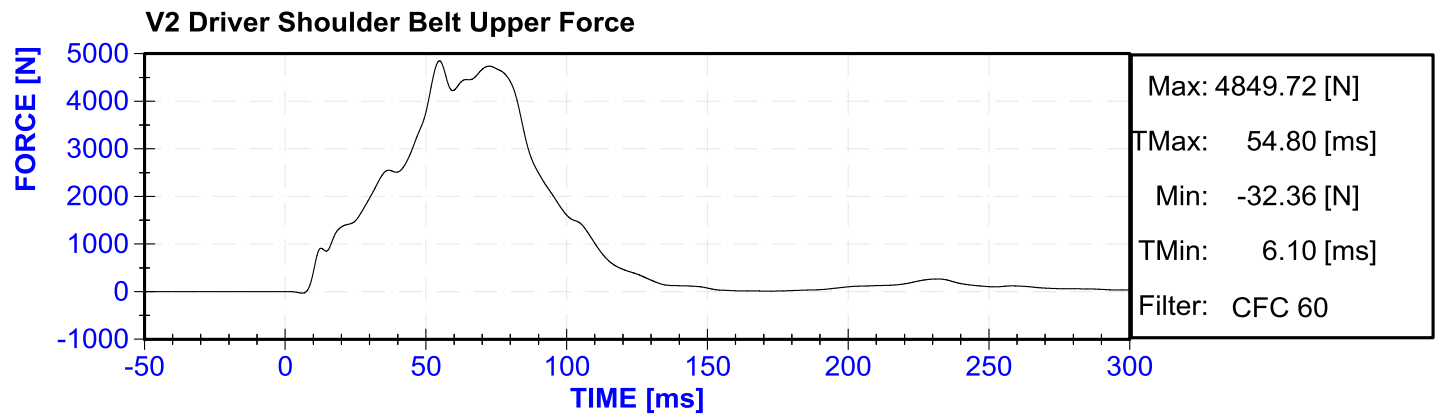
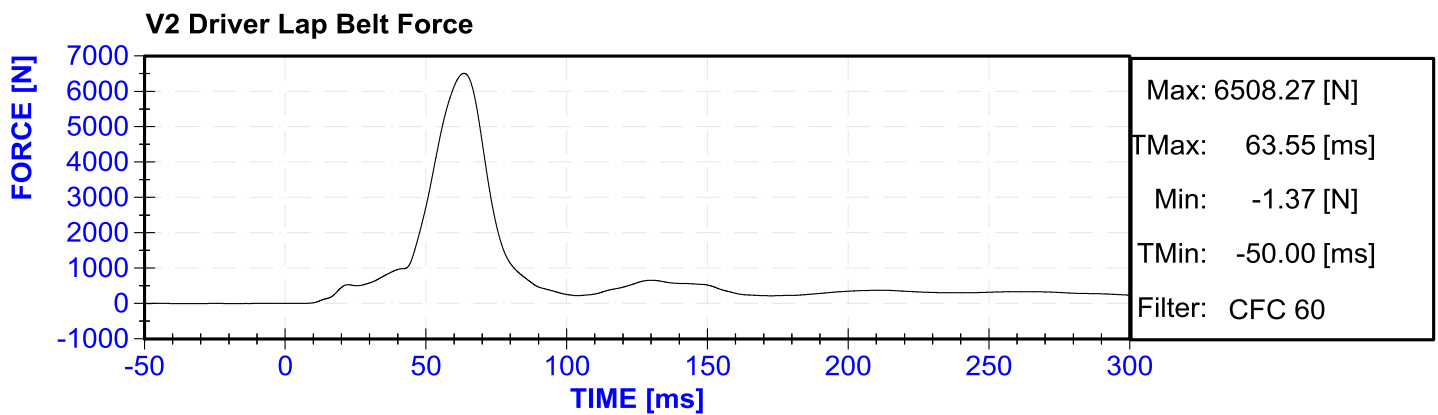
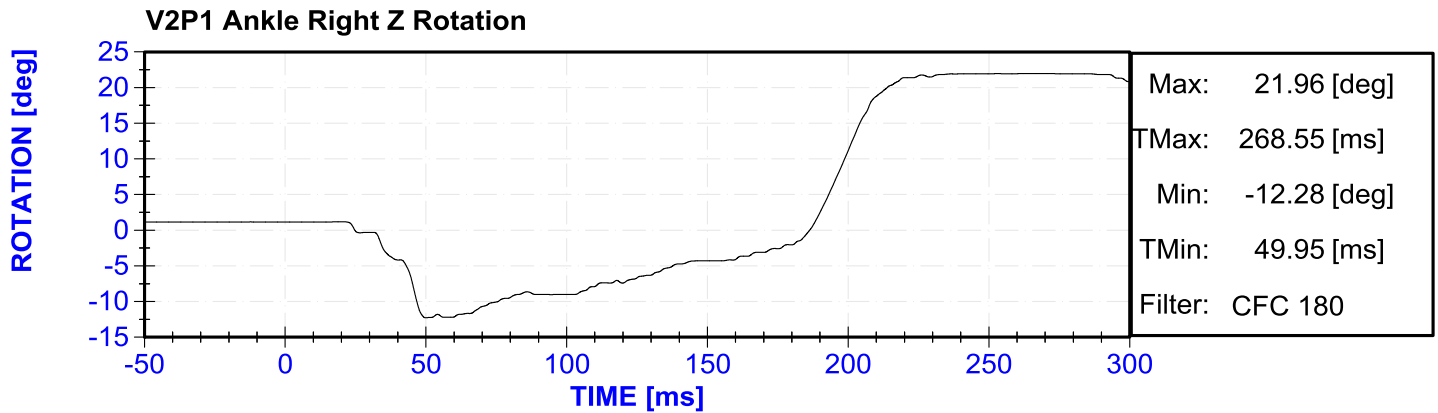


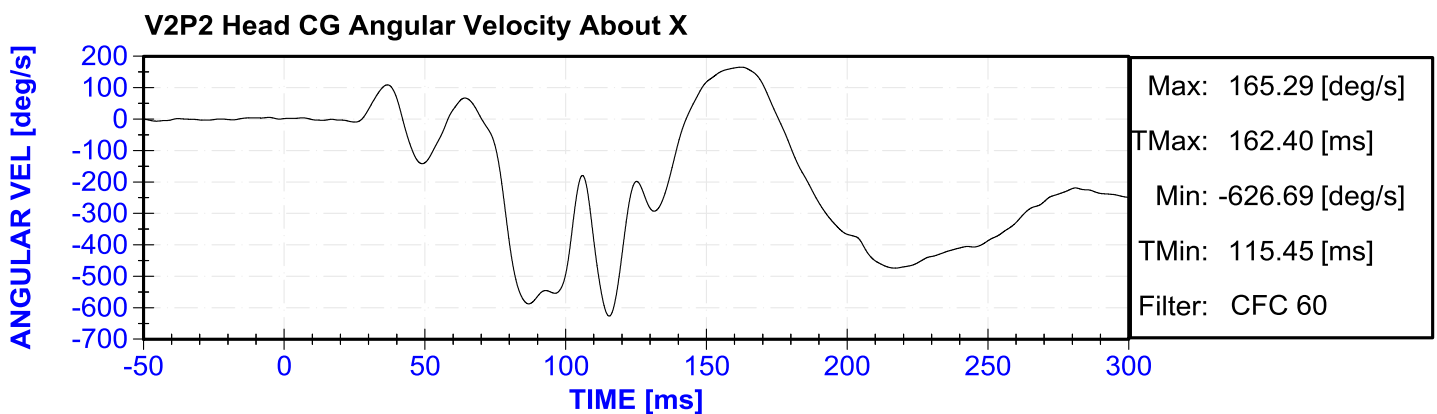
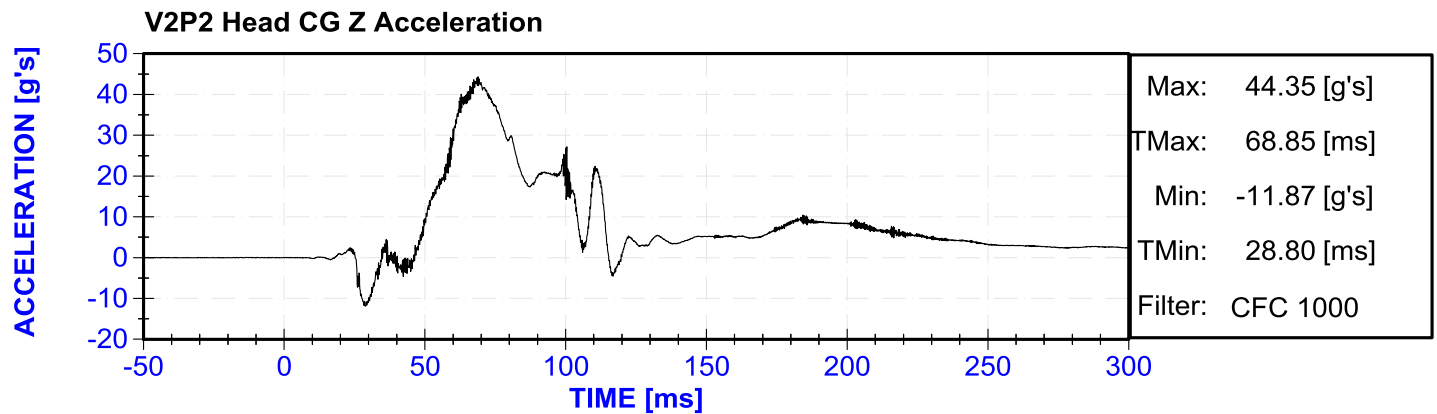
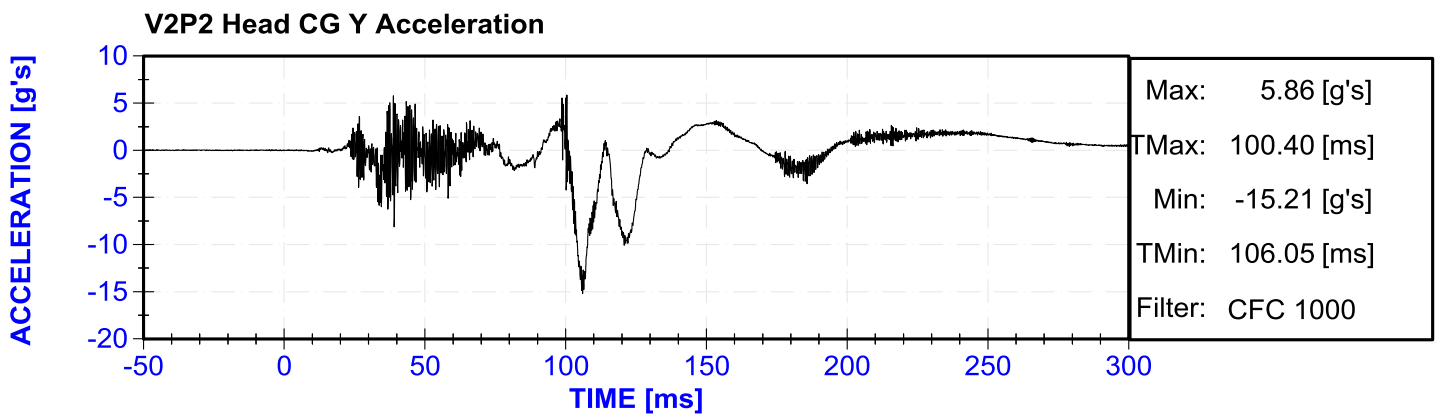
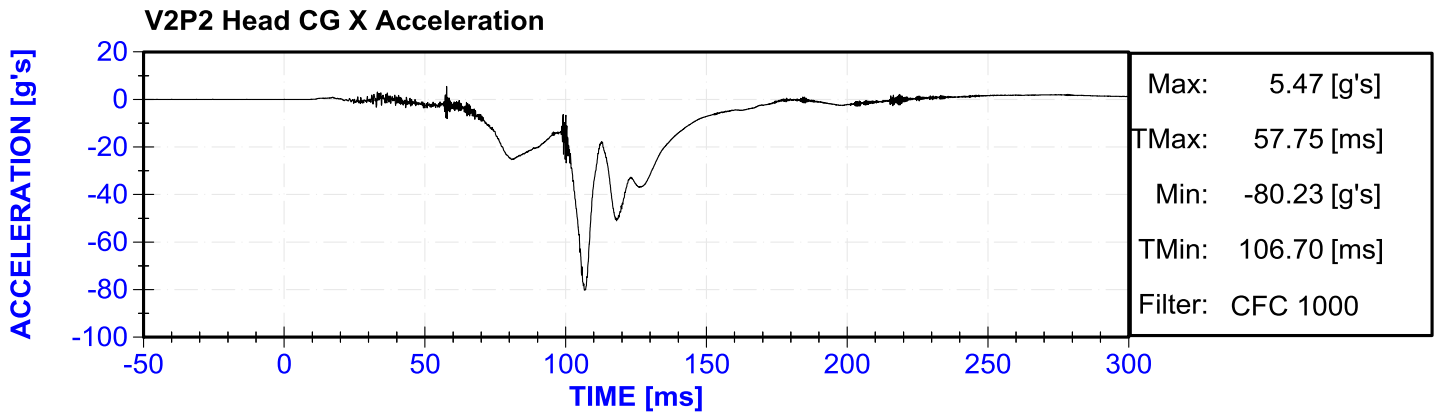




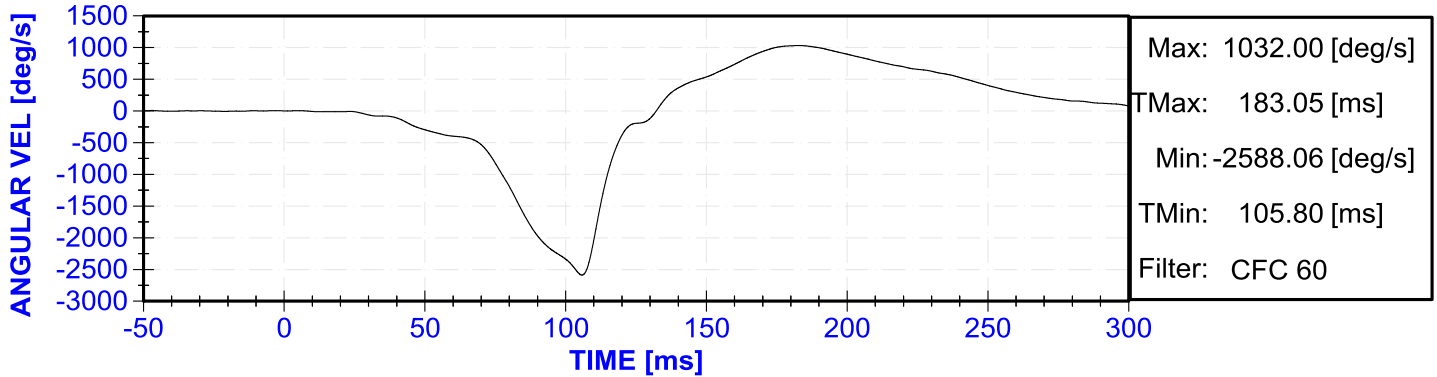




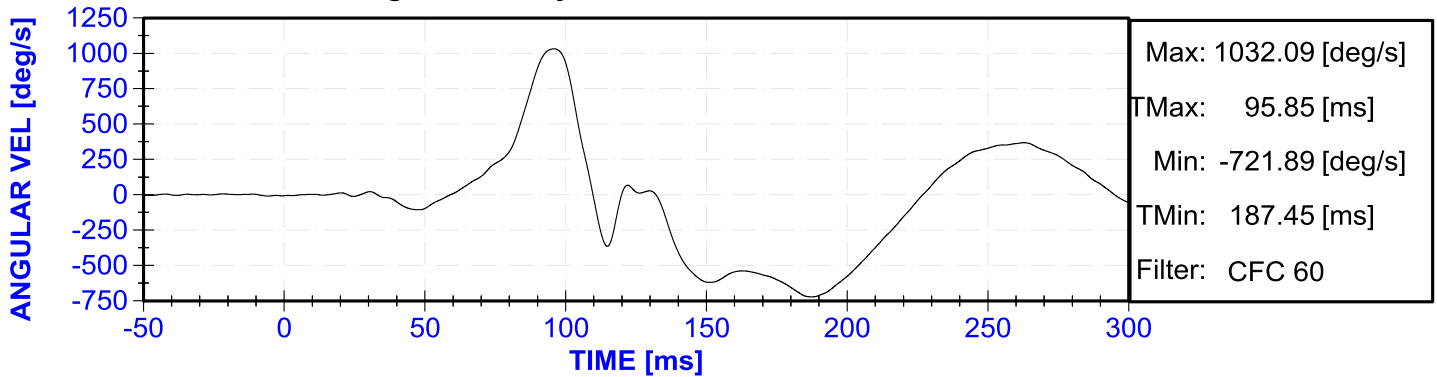




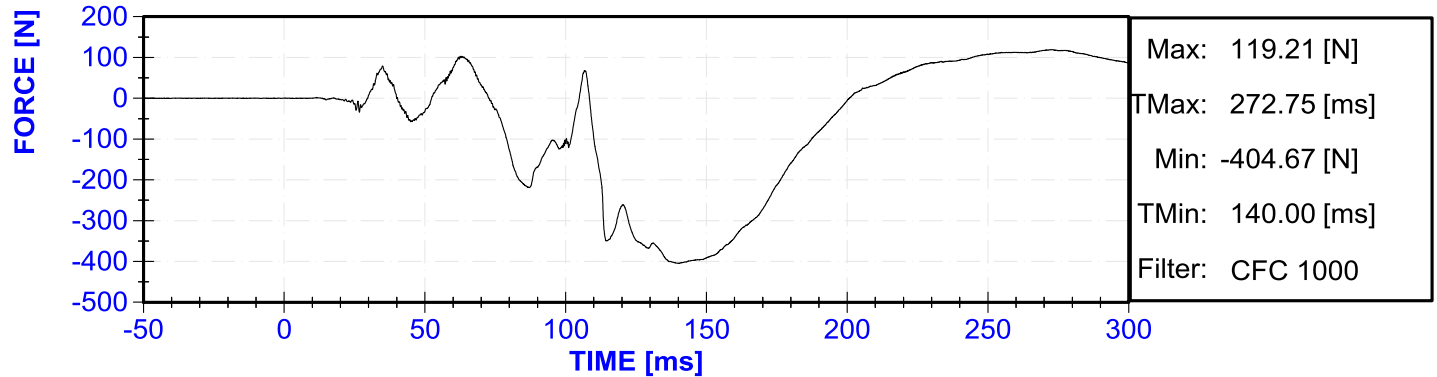
V2P2 Head CG Angular Velocity About Y



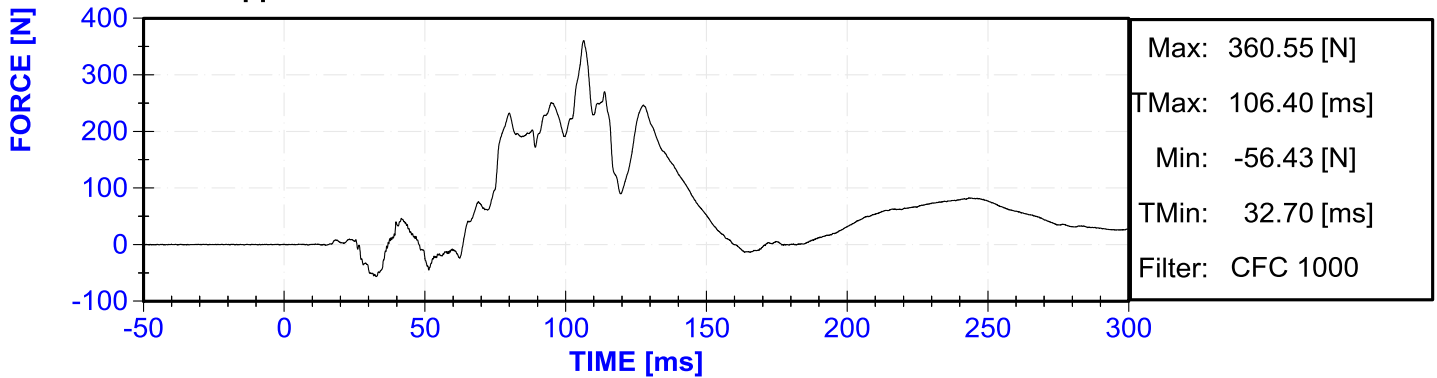
V2P2 Head CG Angular Velocity About Z



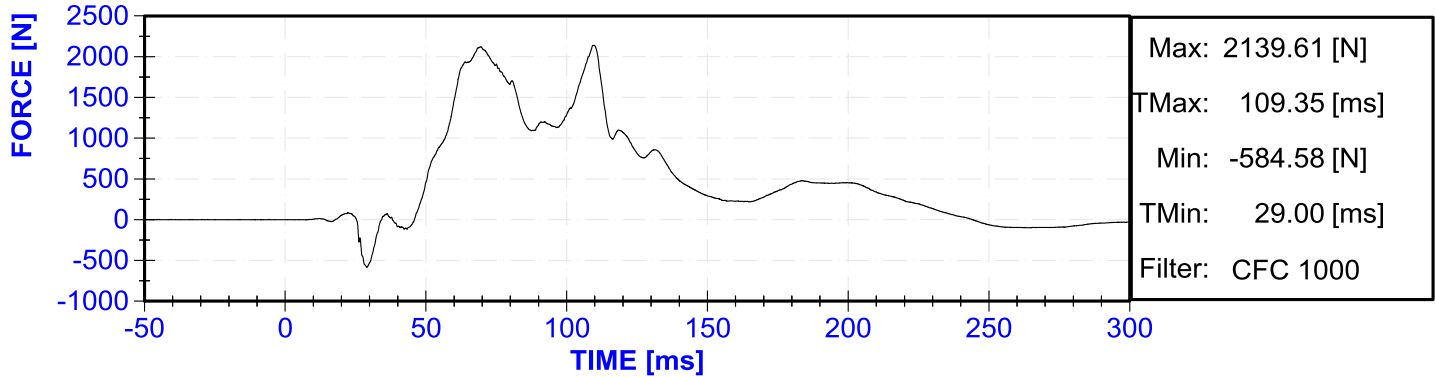
V2P2 Upper Neck X Force



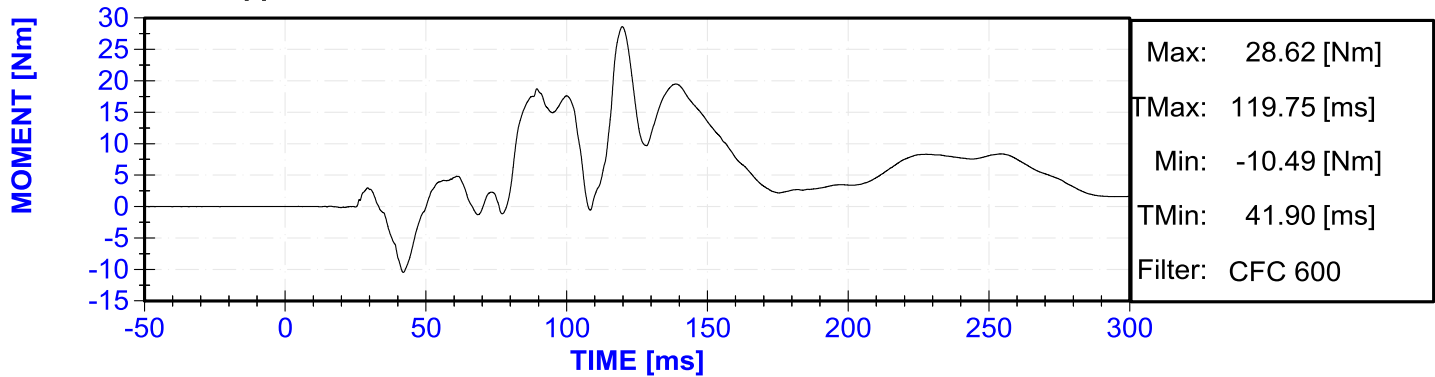
V2P2 Upper Neck Y Force



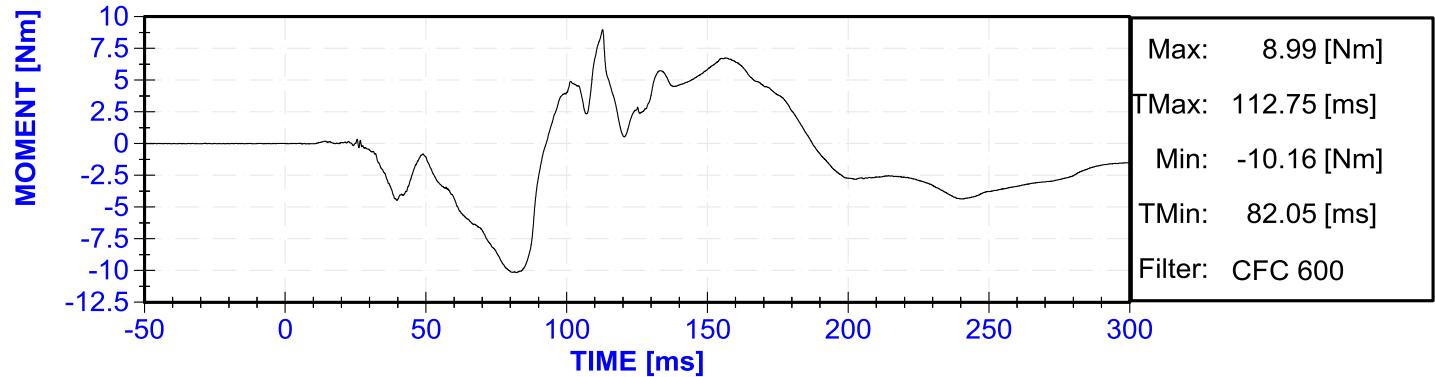
V2P2 Upper Neck Z Force



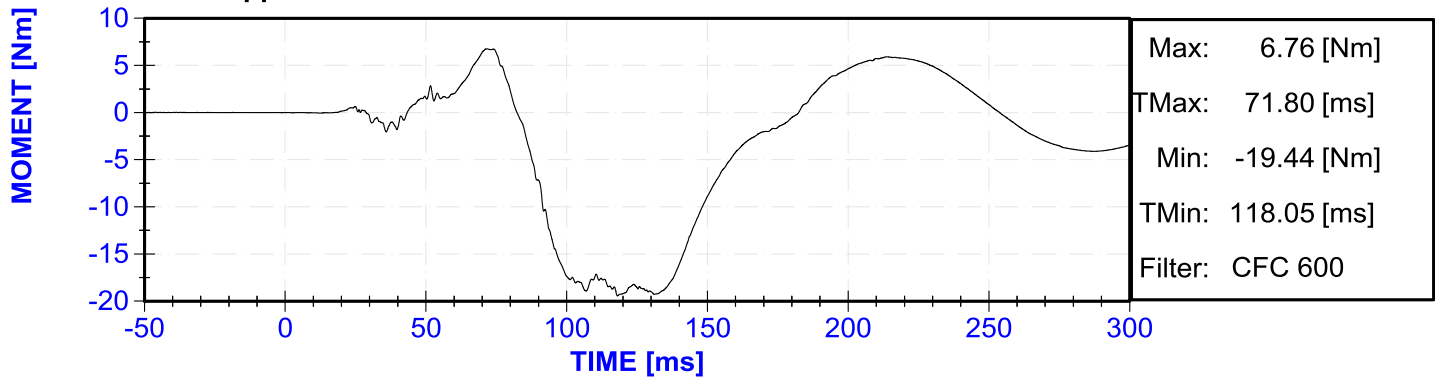
V2P2 Upper Neck X Moment

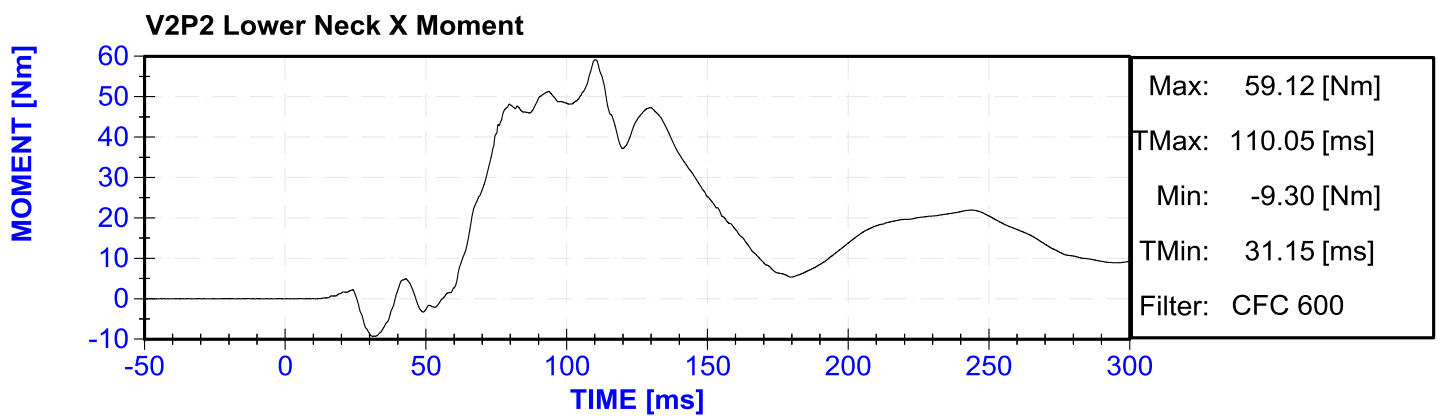
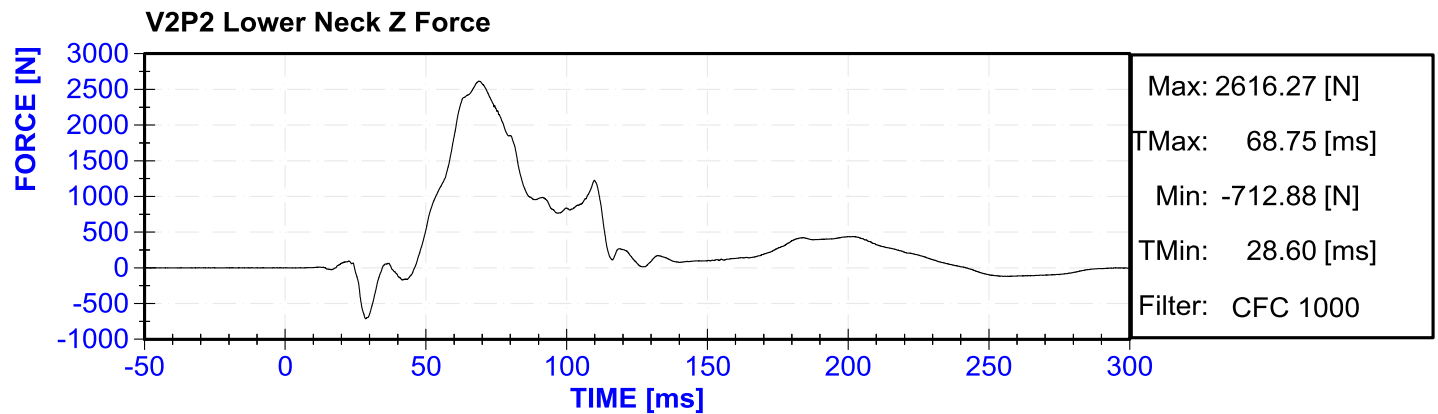
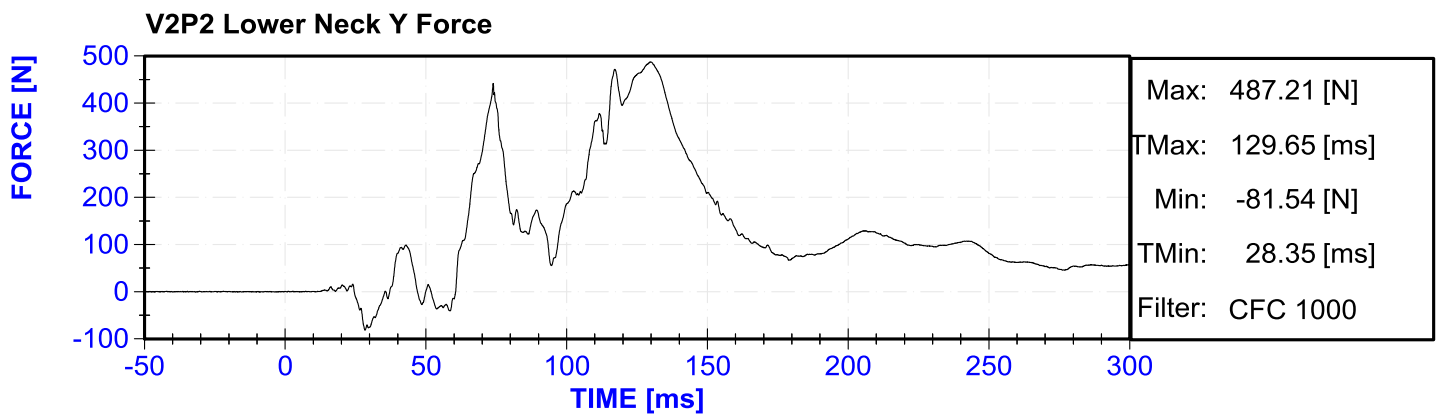
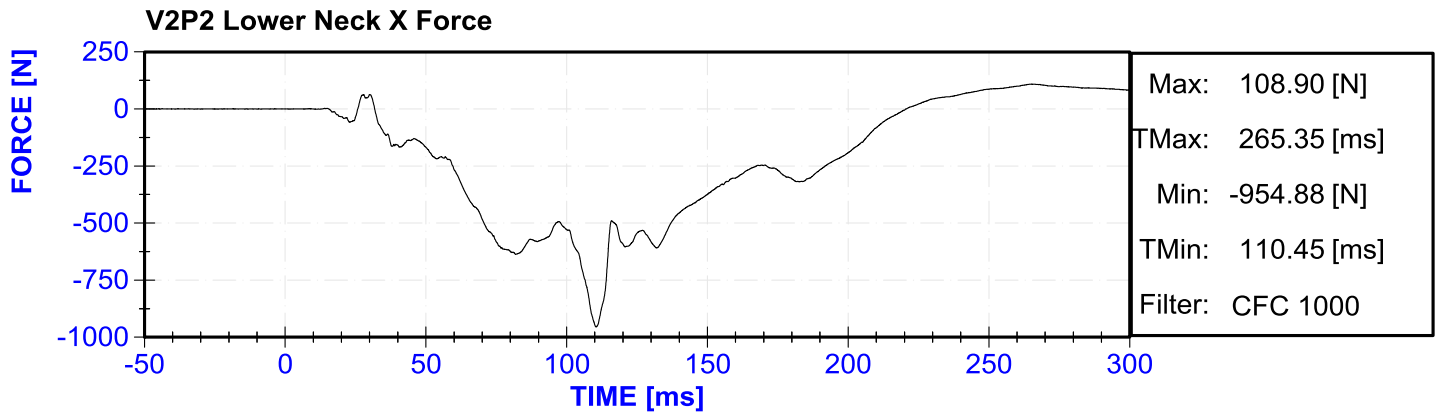


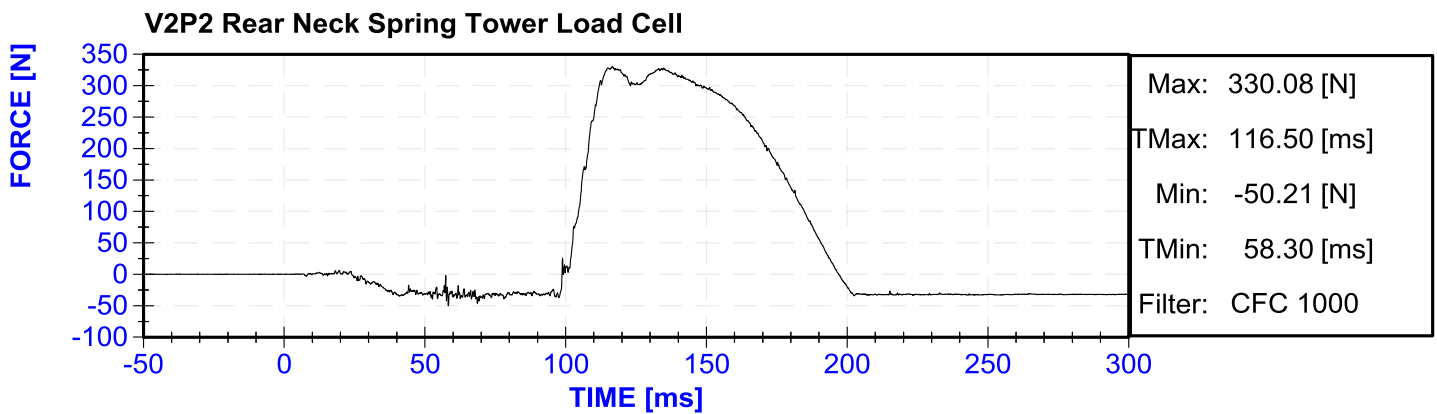
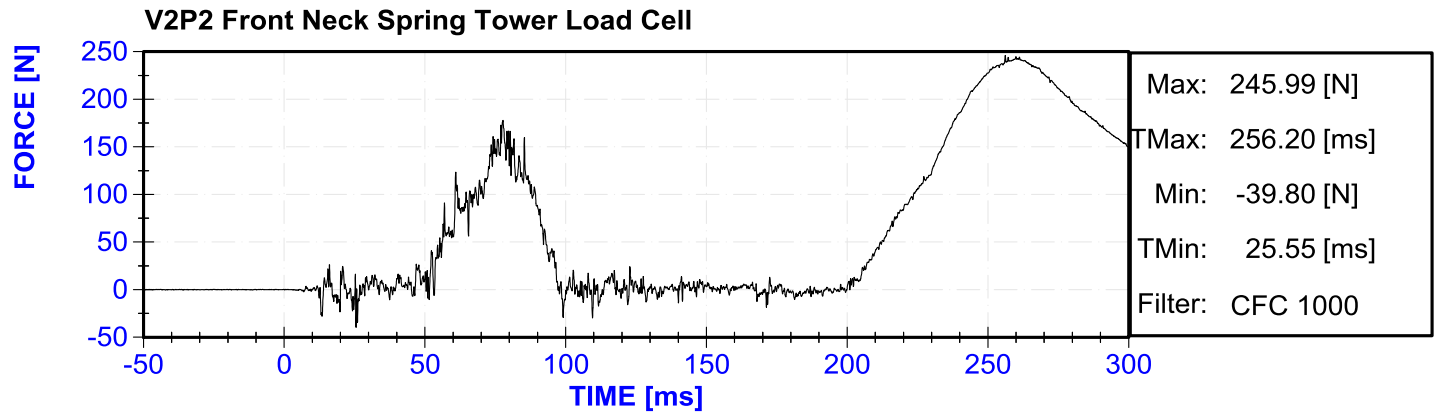
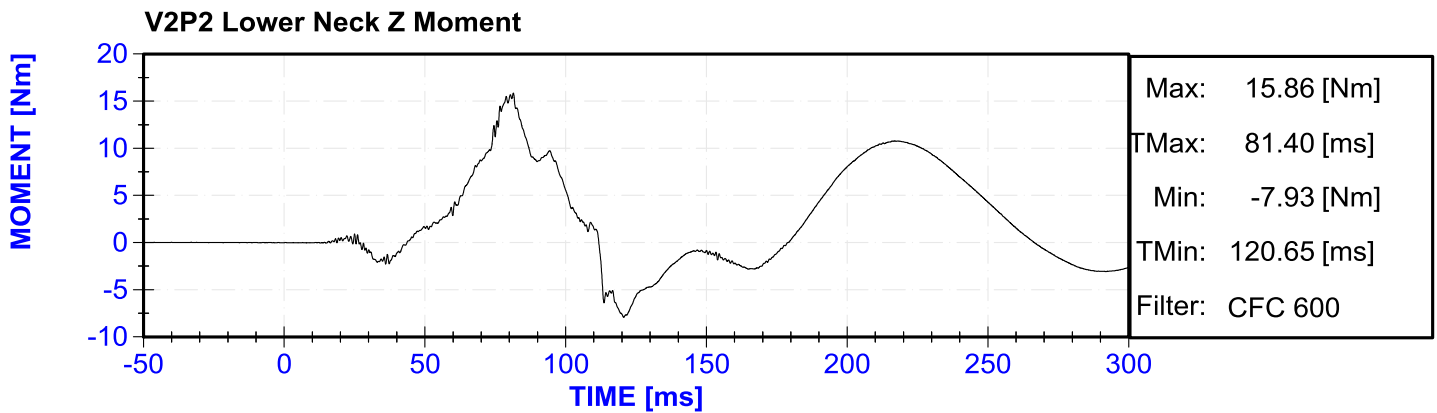
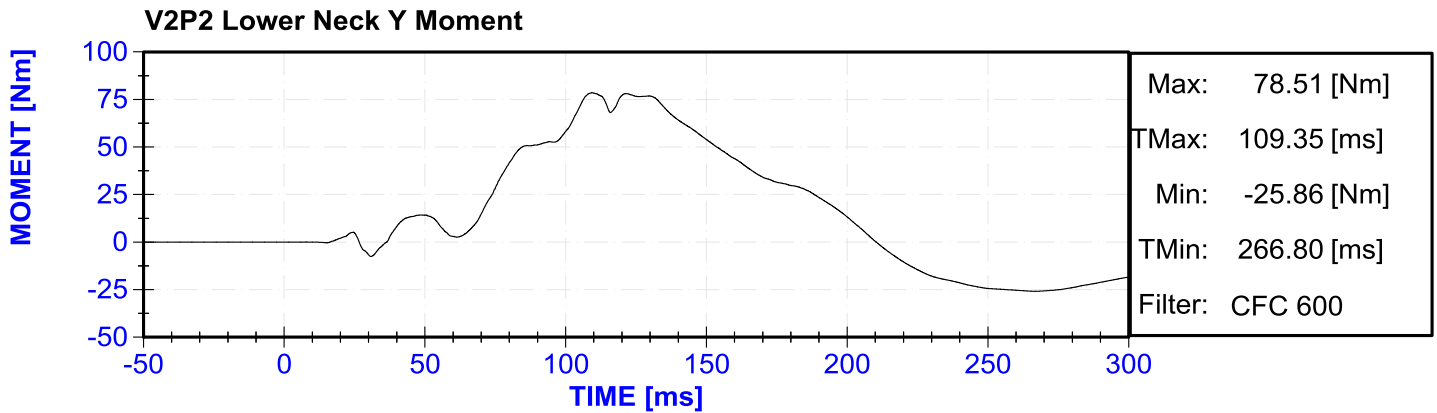
V2P2 Upper Neck Y Moment



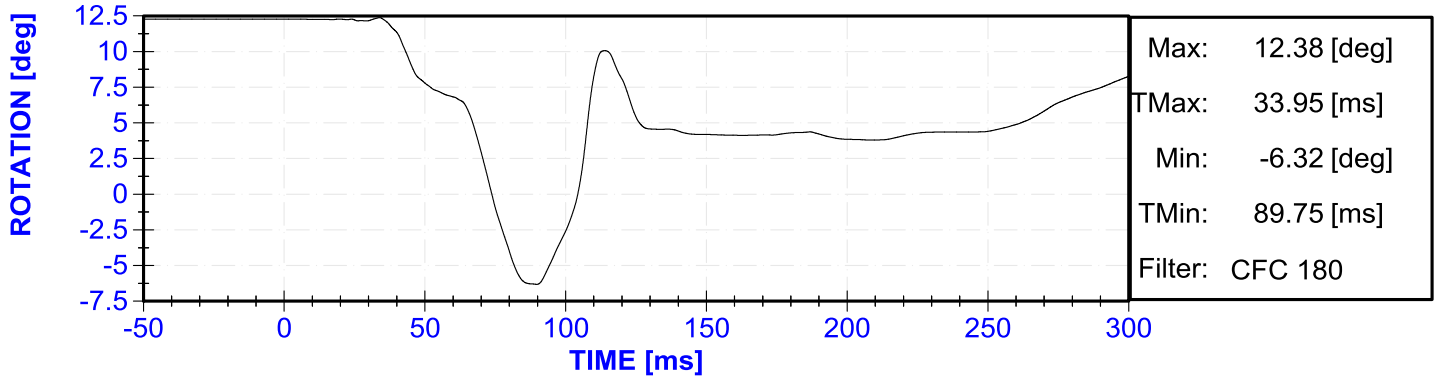
V2P2 Upper Neck Z Moment



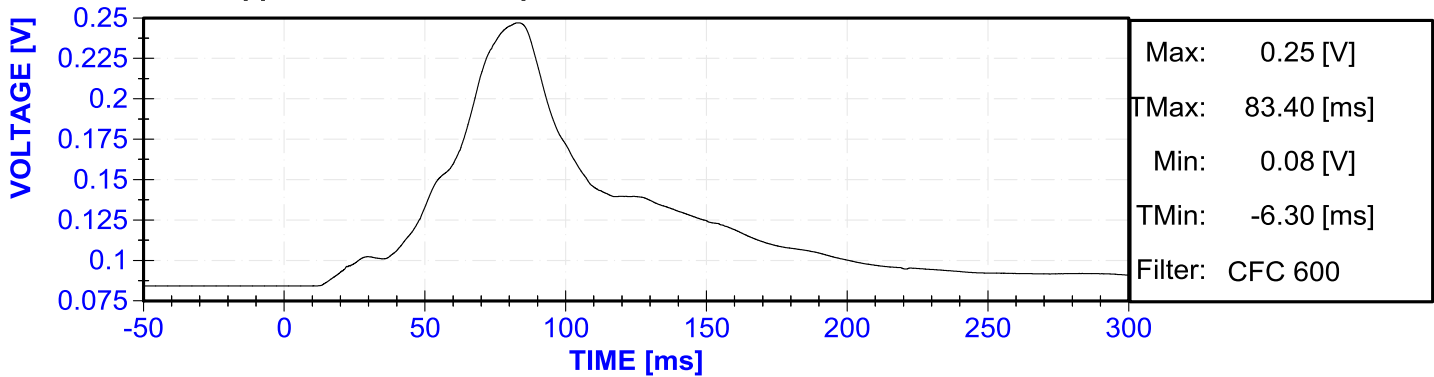




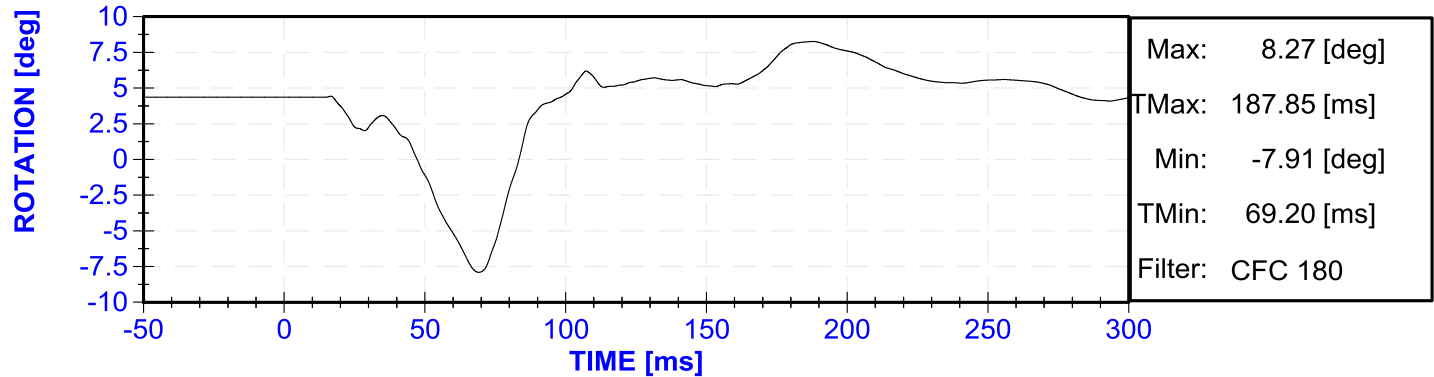
V2P2 Occipital Condyle Rotation Potentiometer



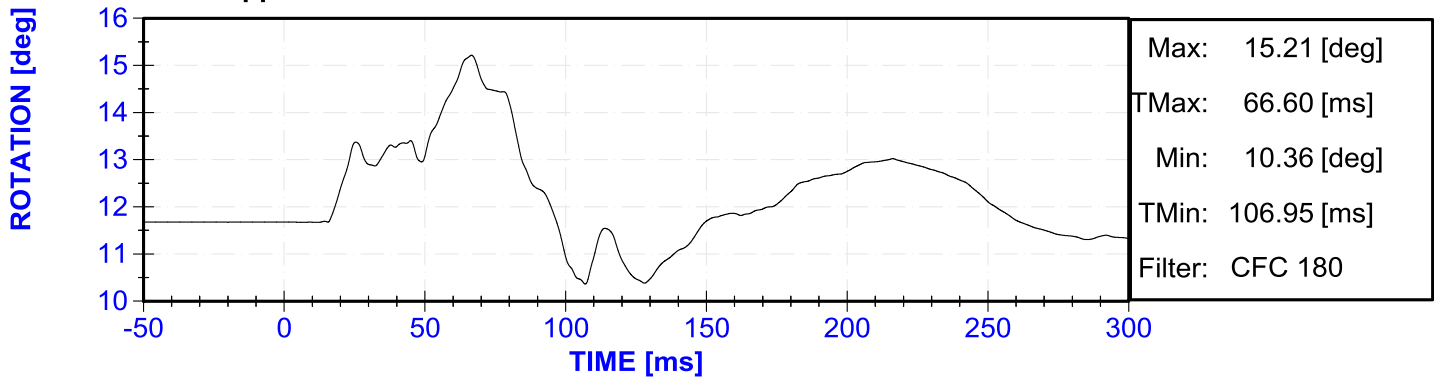
V2P2 Upper Left DGIR X Displacement



V2P2 Upper Left DGIR Y Rotation

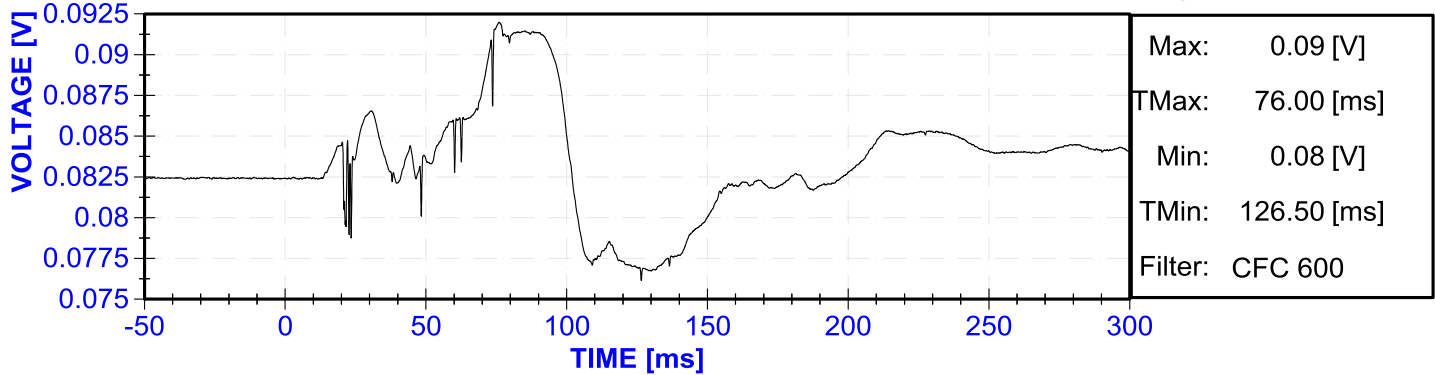


V2P2 Upper Left DGIR Z Rotation

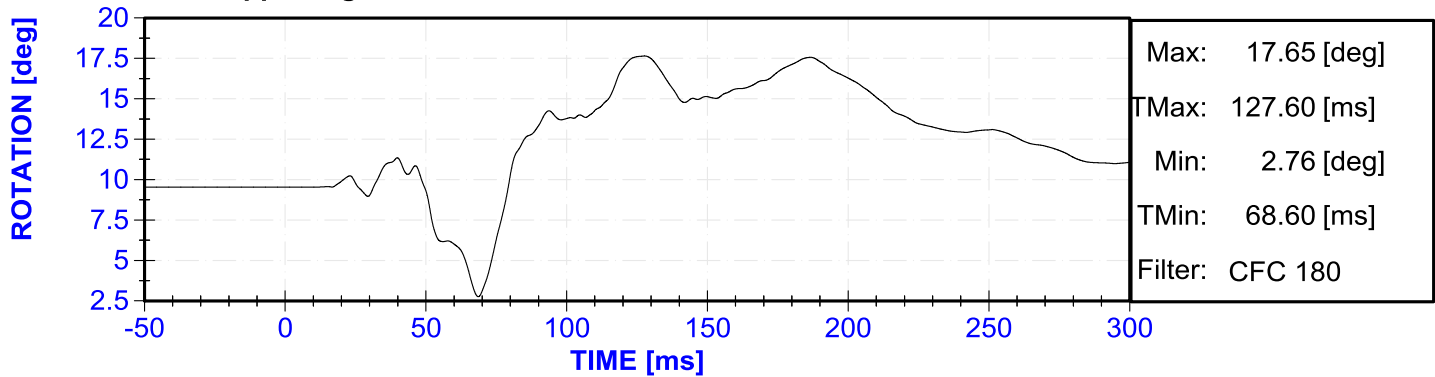


V2P2 Upper Right DGIR X Displacement

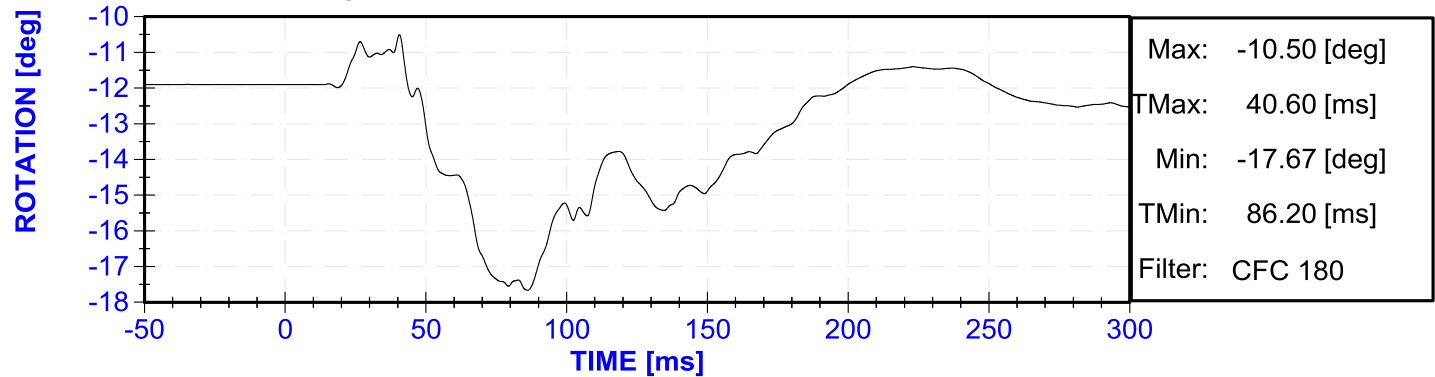
Questionable spikes 22.7ms, 73.3ms



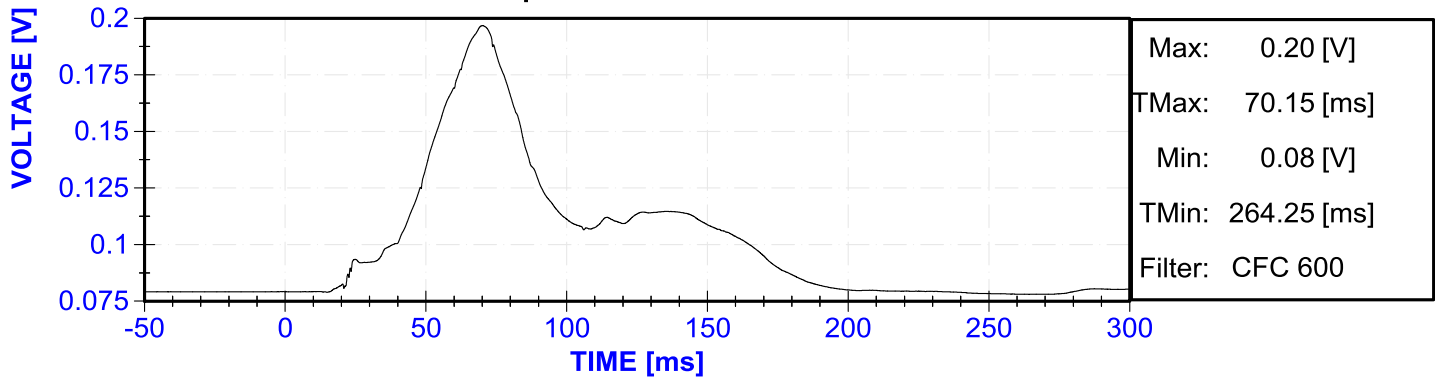
V2P2 Upper Right DGIR Y Rotation



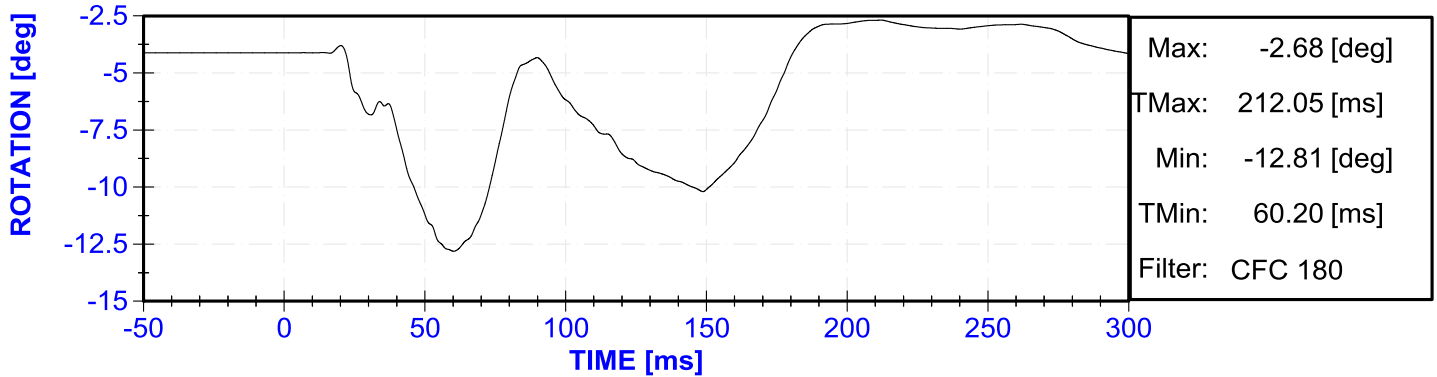
V2P2 Upper Right DGIR Z Rotation



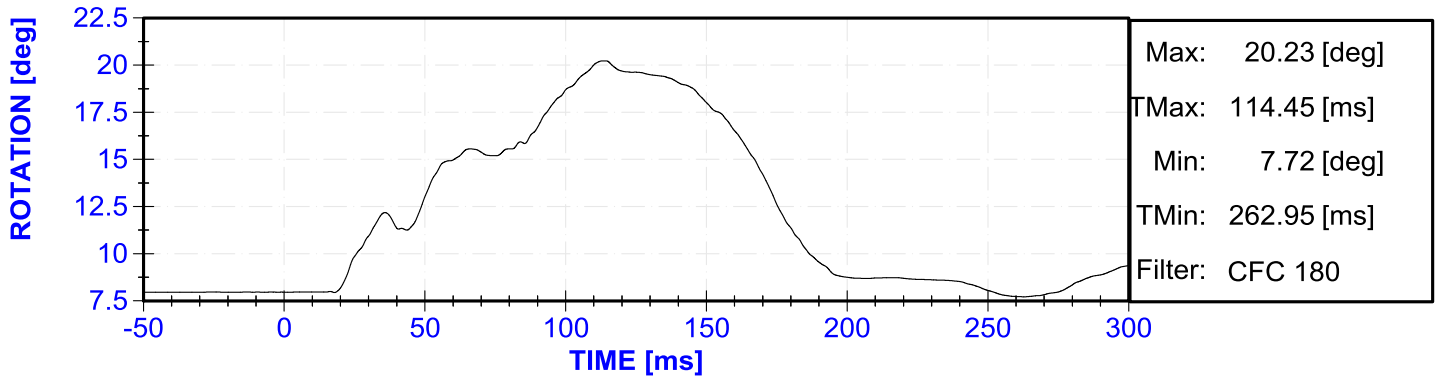
V2P2 Lower Left DGIR X Displacement



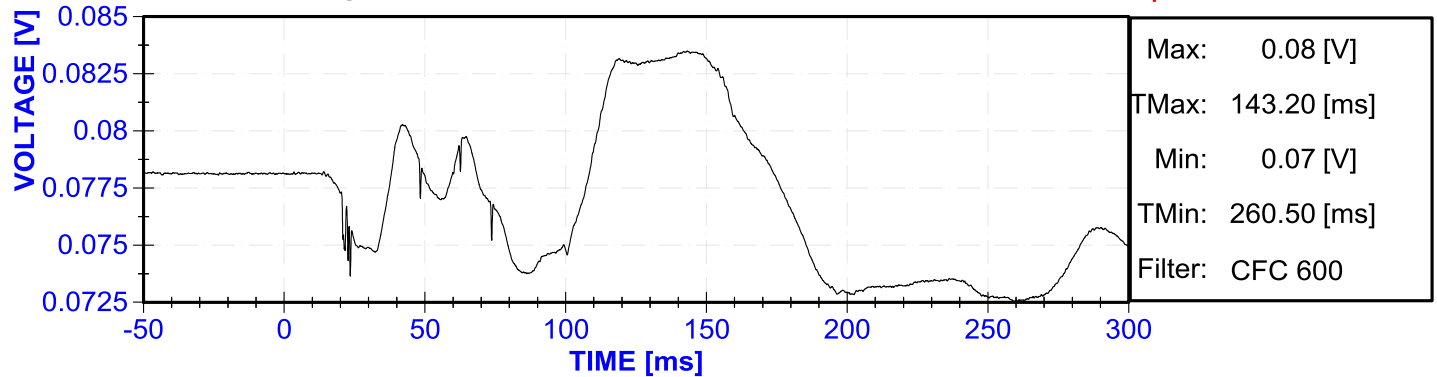
V2P2 Lower Left DGIR Y Rotation



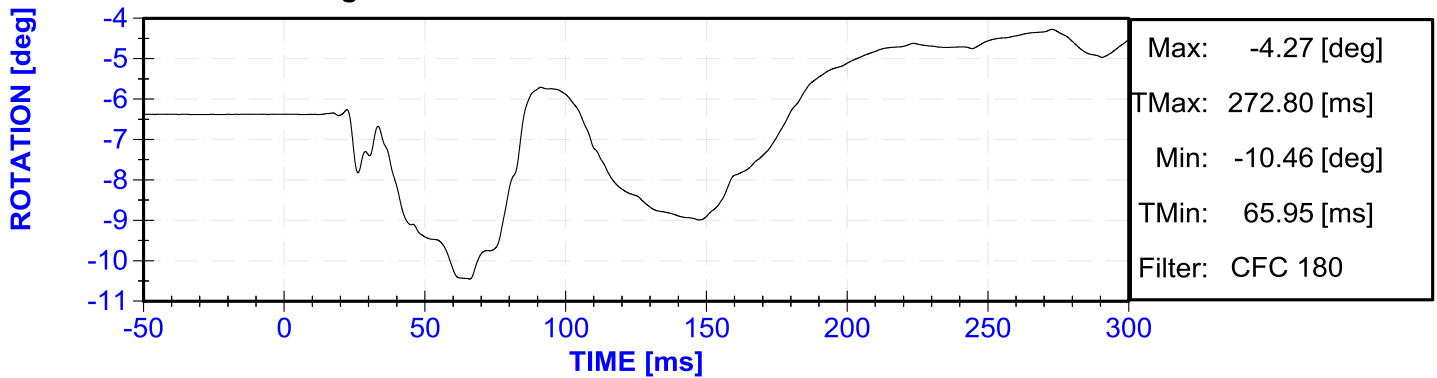
V2P2 Lower Left DGIR Z Rotation

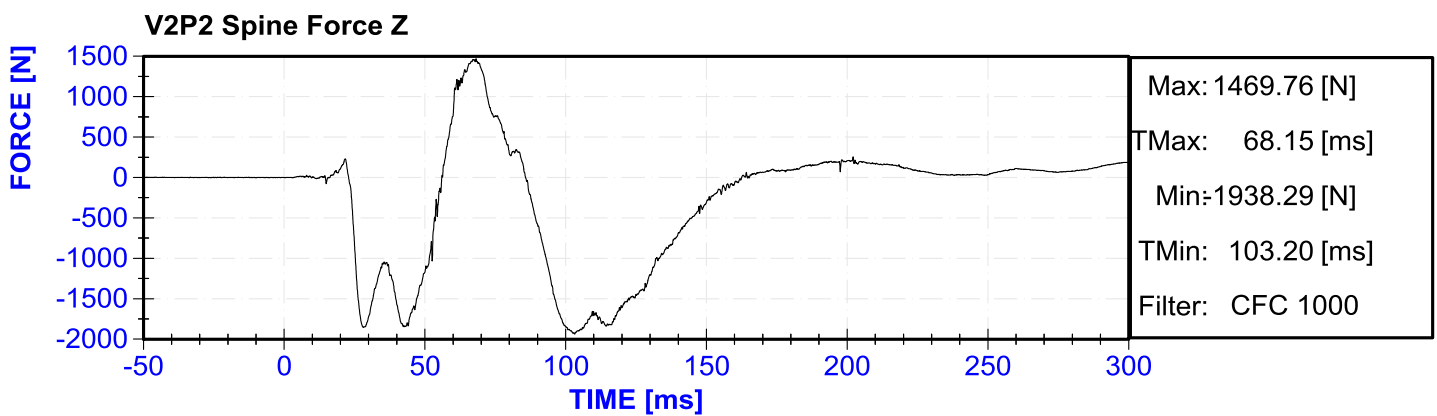
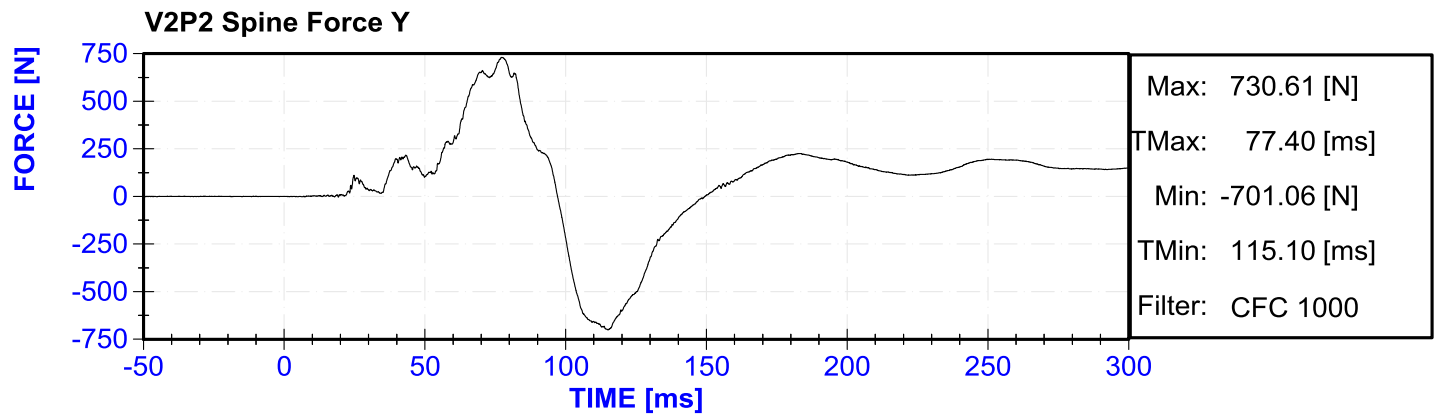
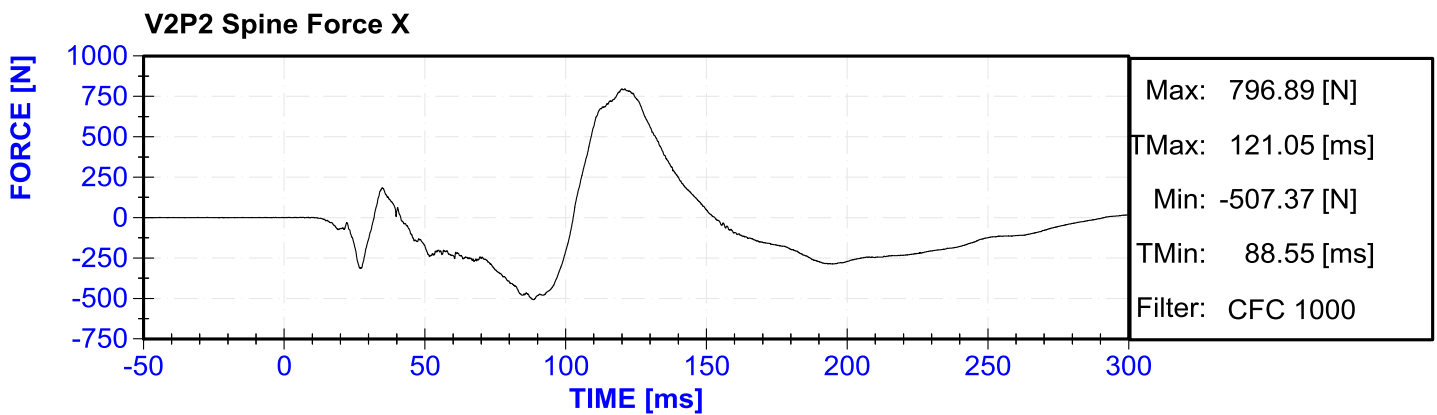
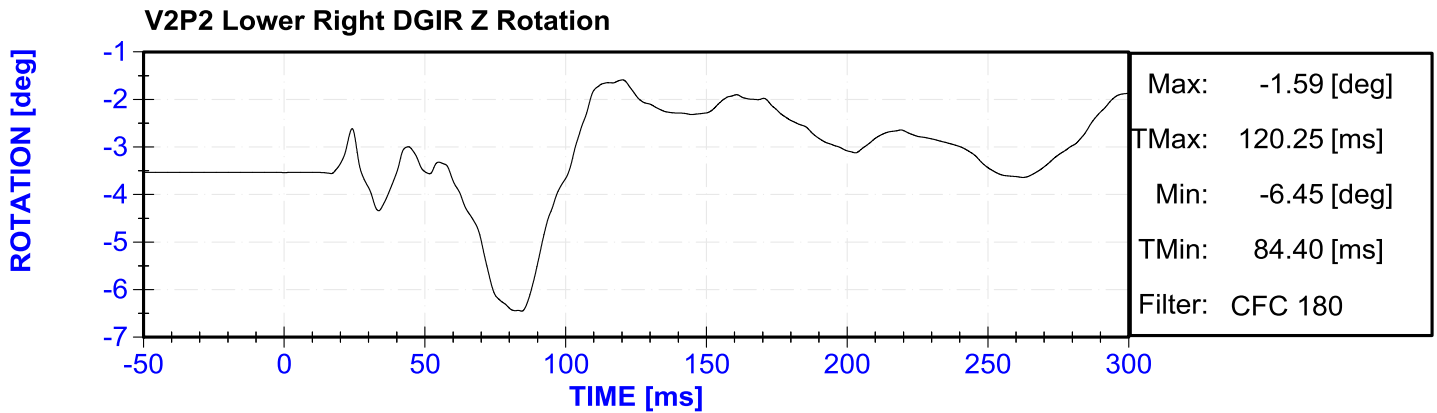


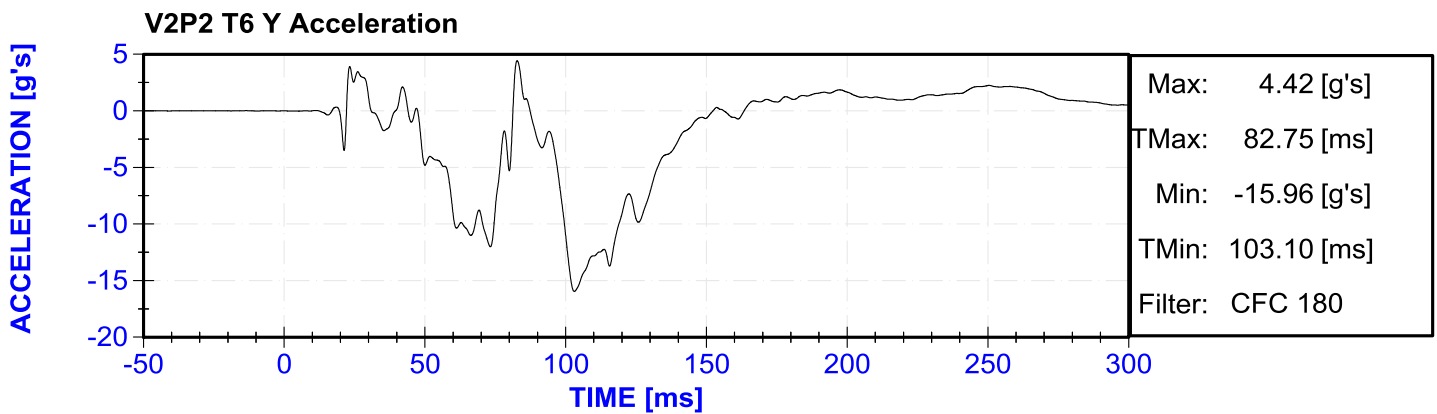
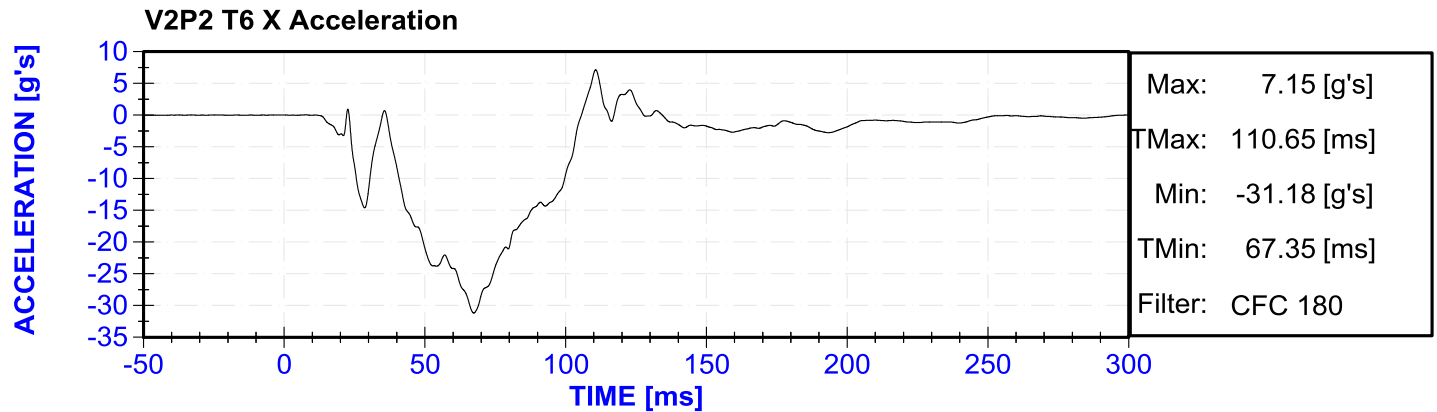
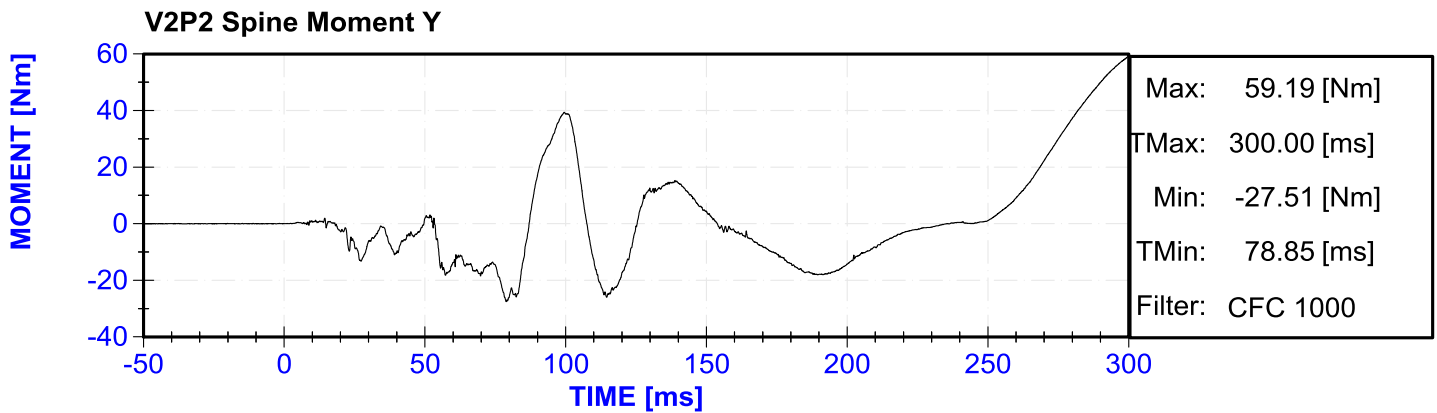
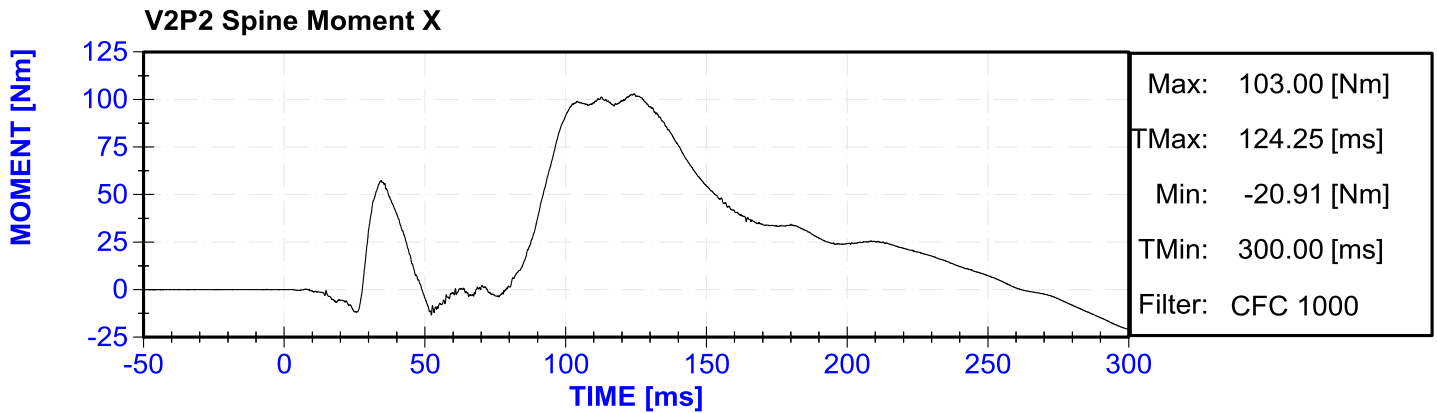
V2P2 Lower Right DGIR X Displacement

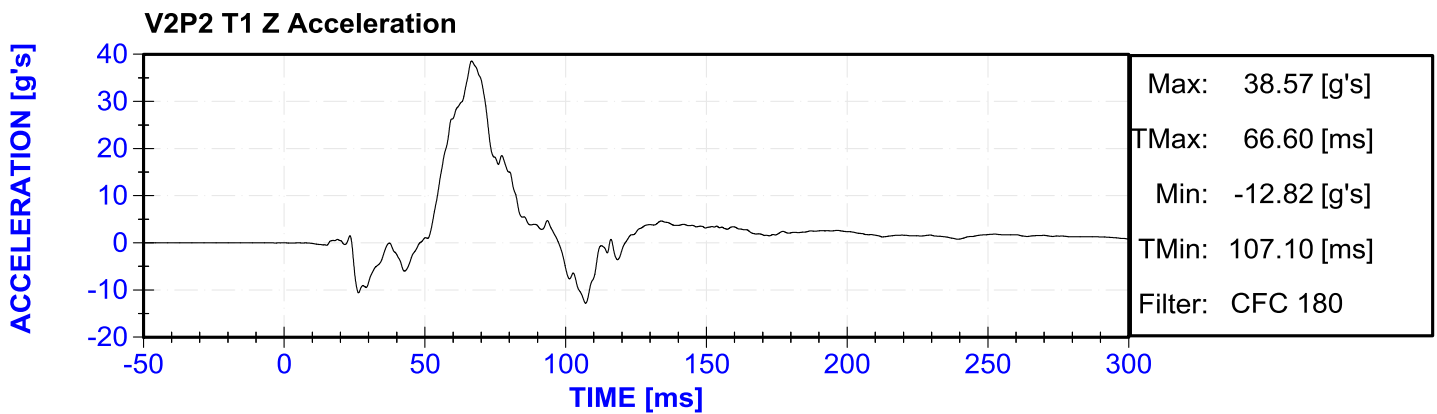
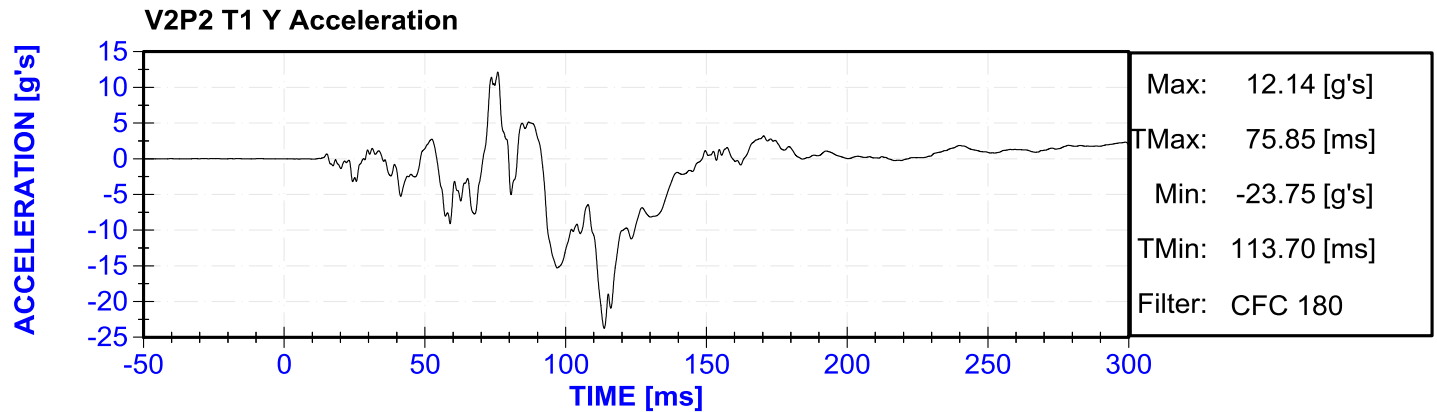
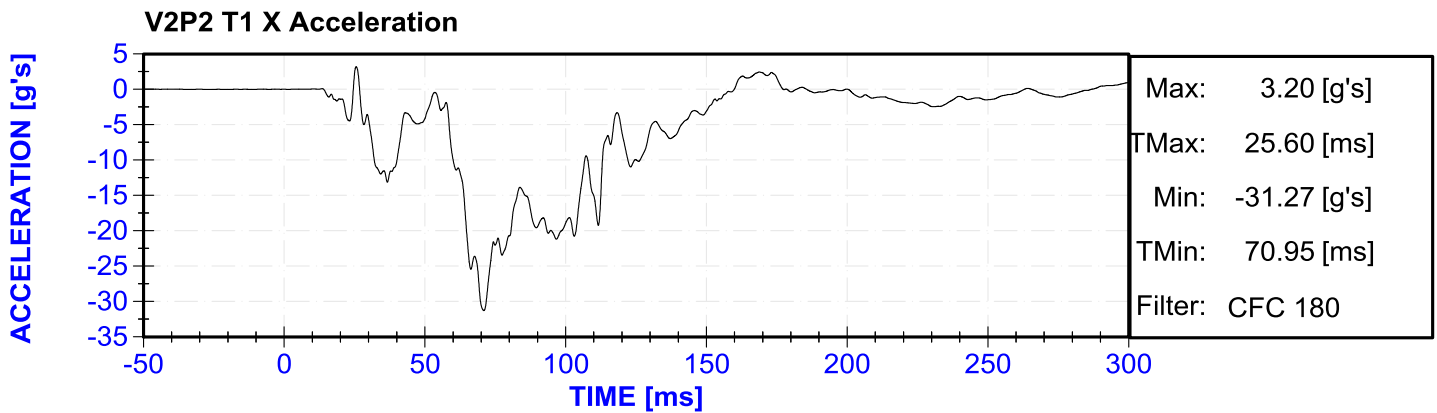
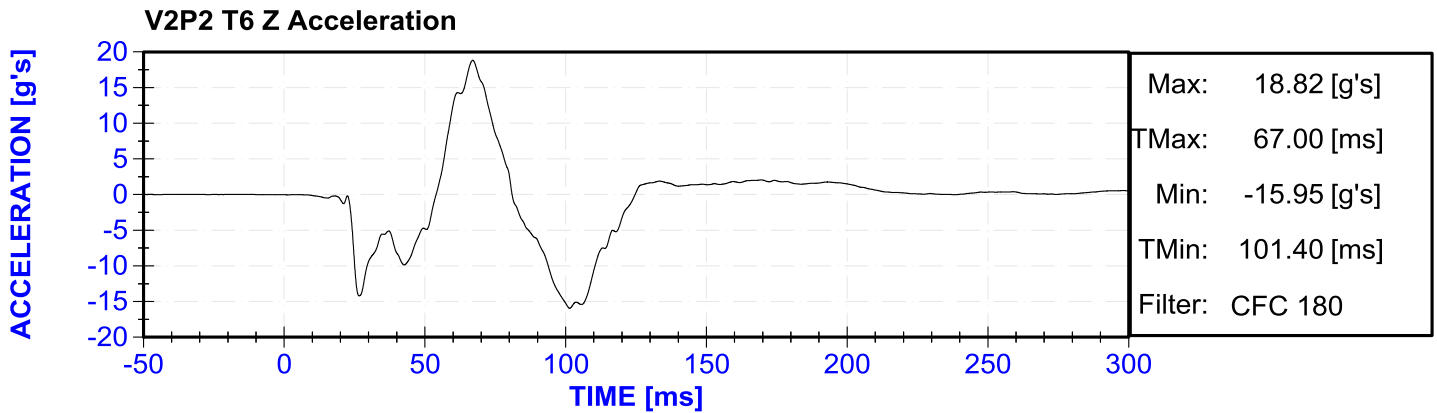


V2P2 Lower Right DGIR Y Rotation



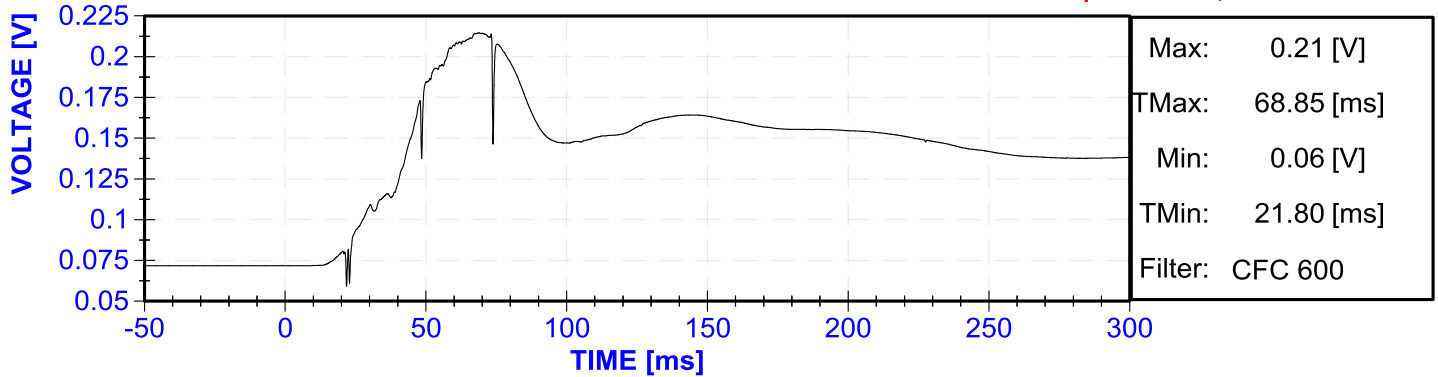




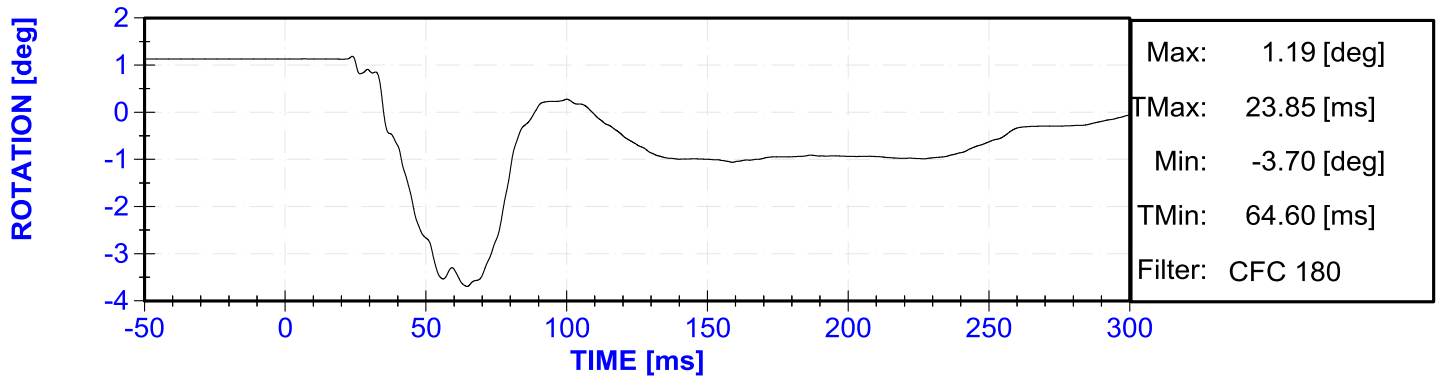


V2P2 Abdomen Left DGIR X Displacement

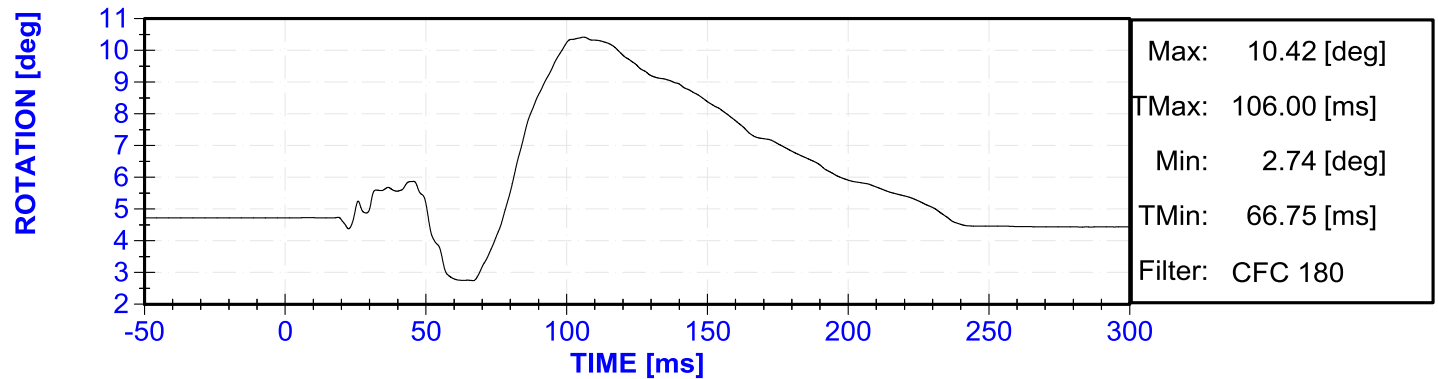
Questionable spikes at 21.6, 48.1 and 73.4ms



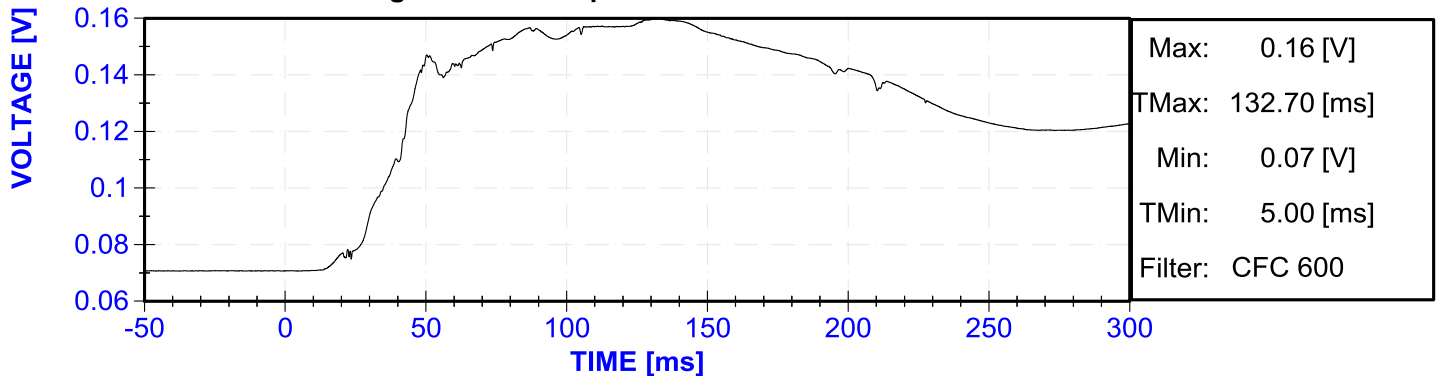
V2P2 Abdomen Left DGIR Y Rotation

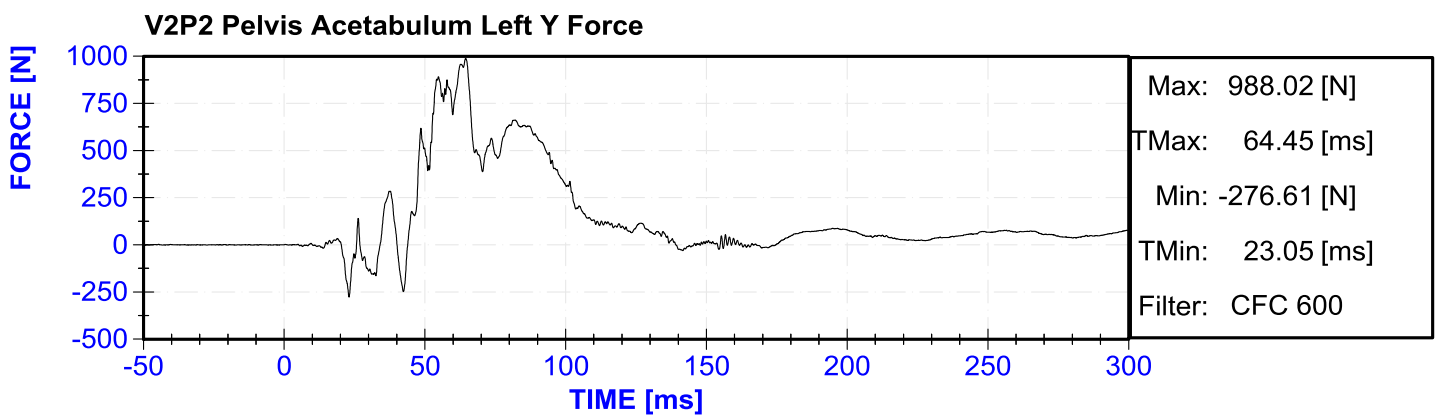
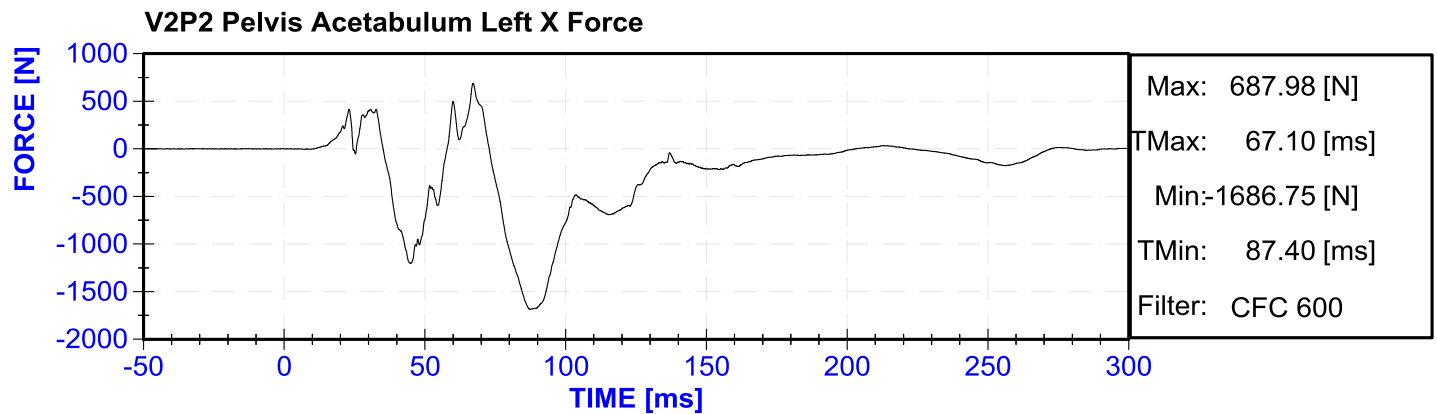
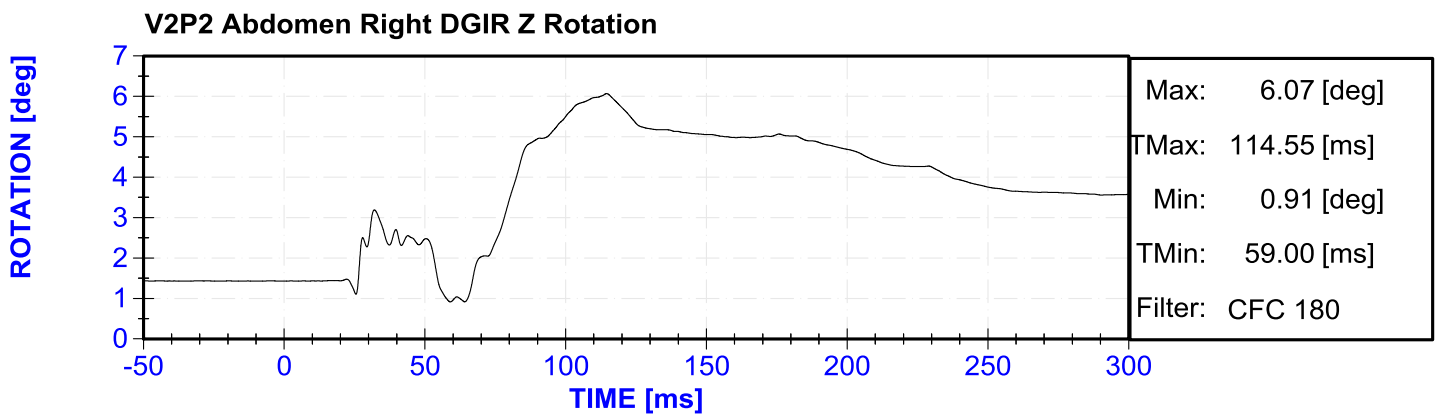
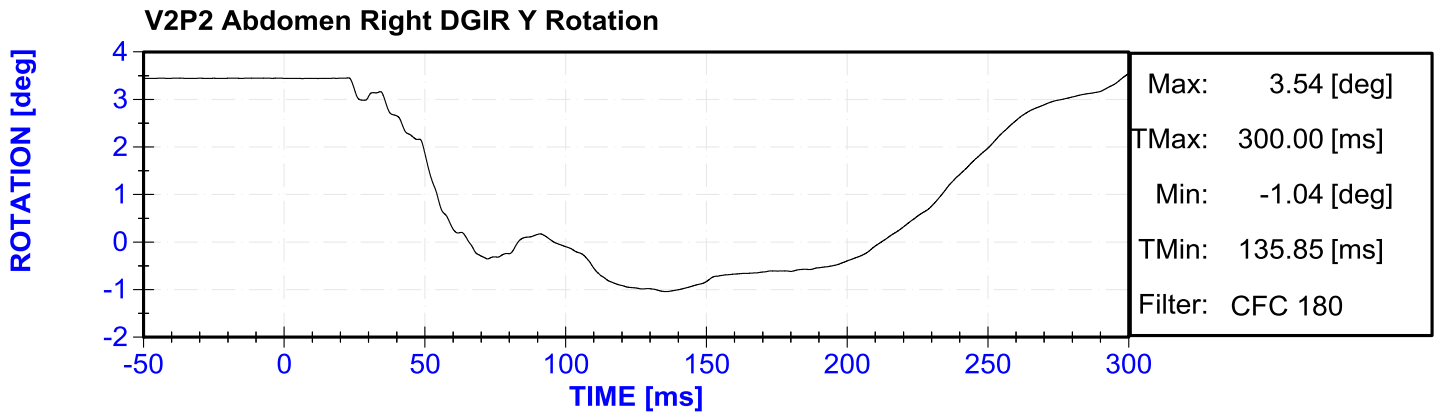


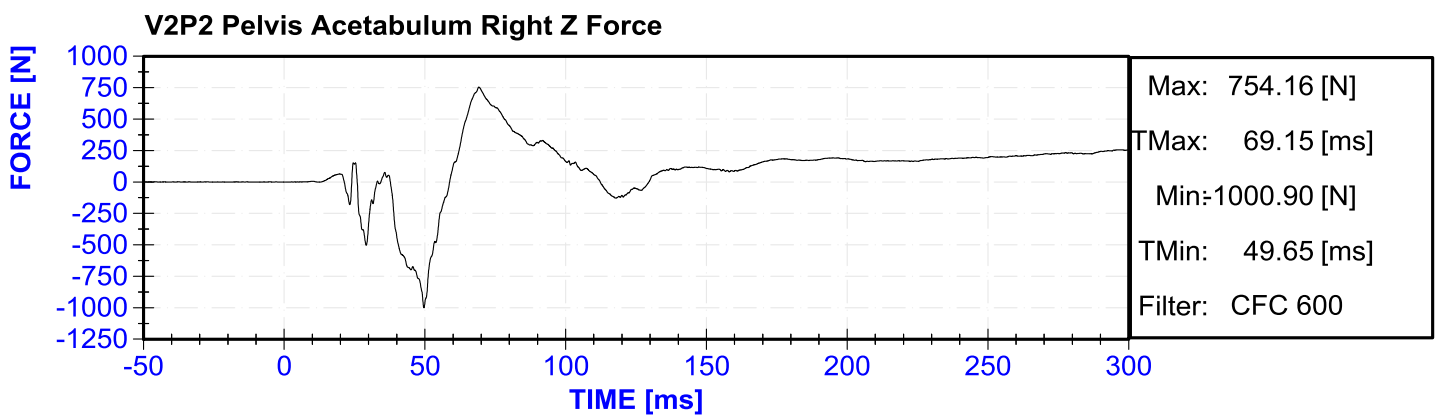
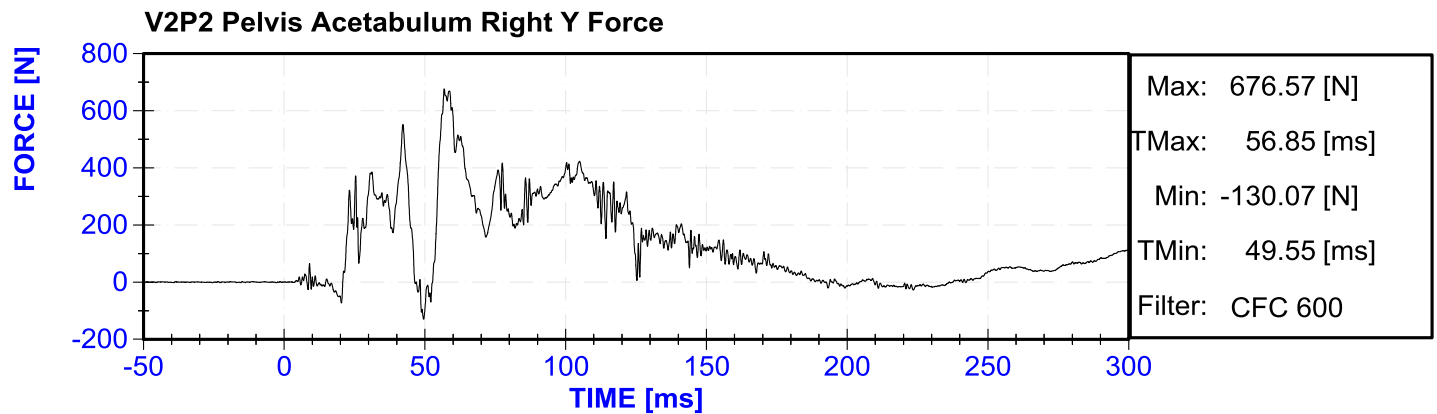
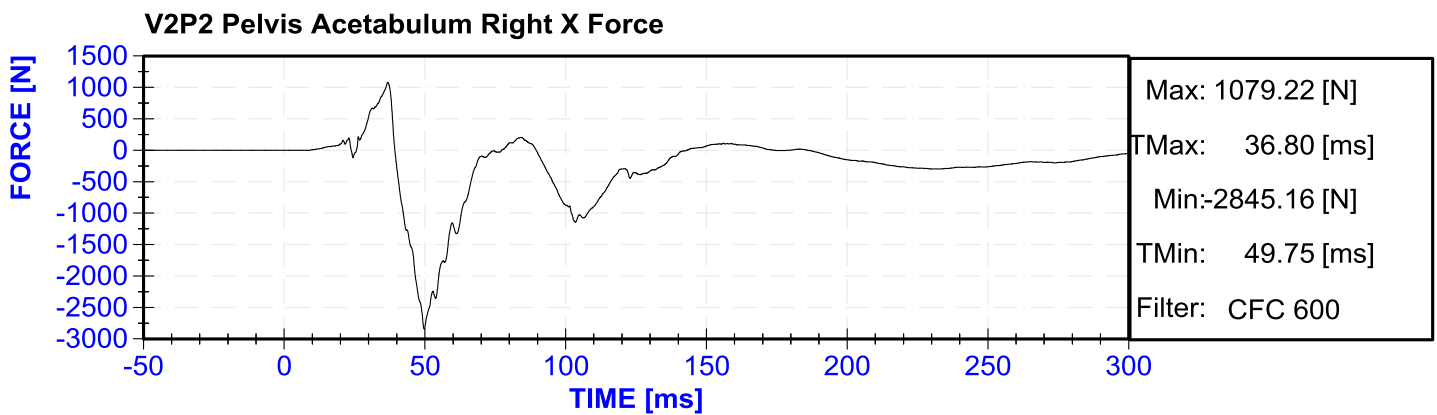
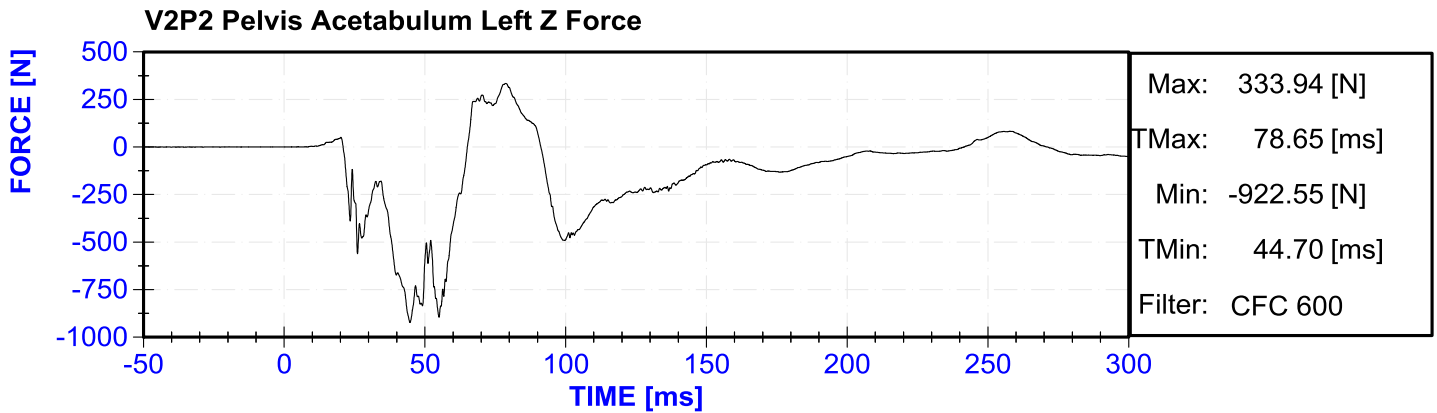
V2P2 Abdomen Left DGIR Z Rotation

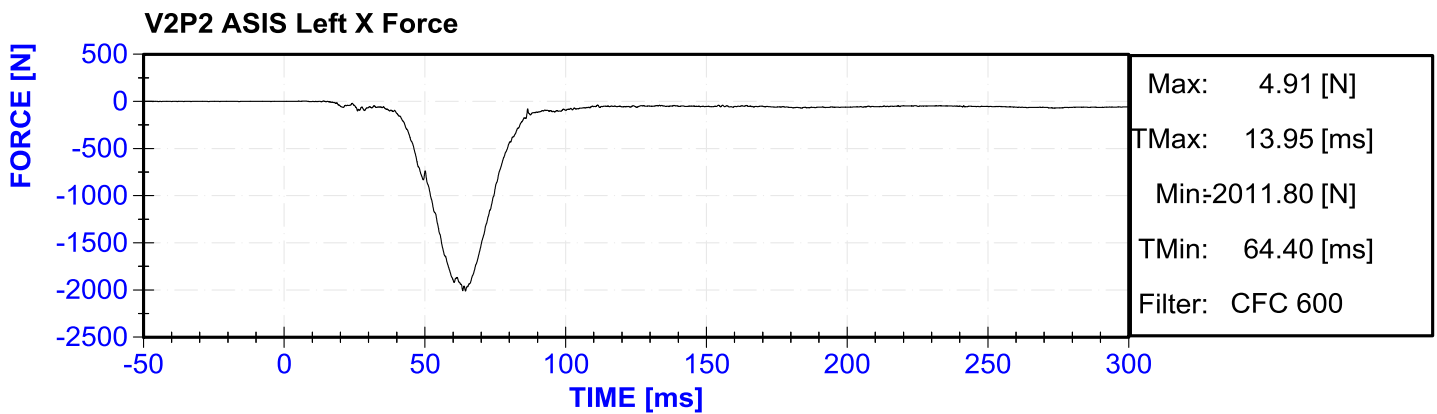
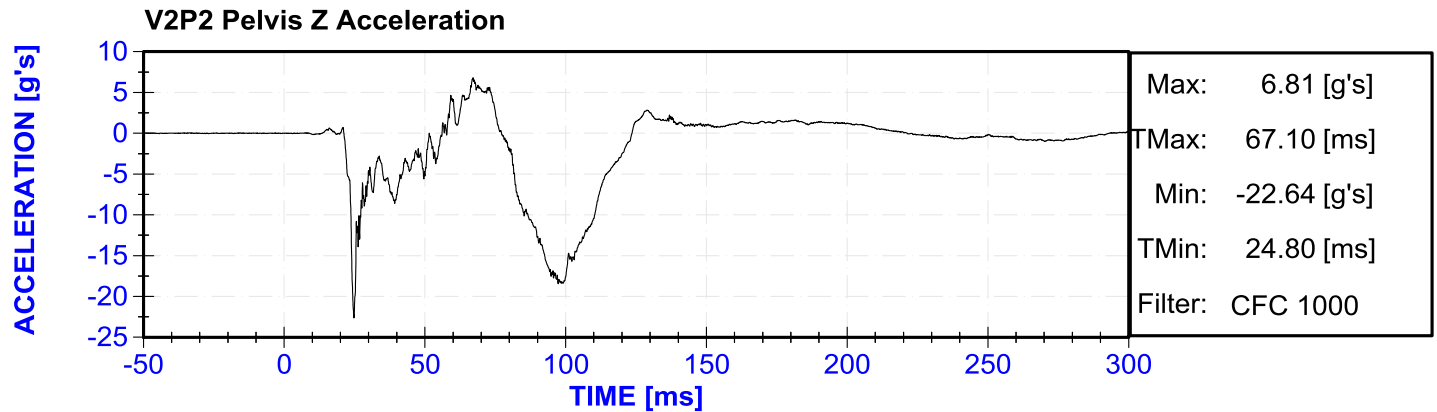
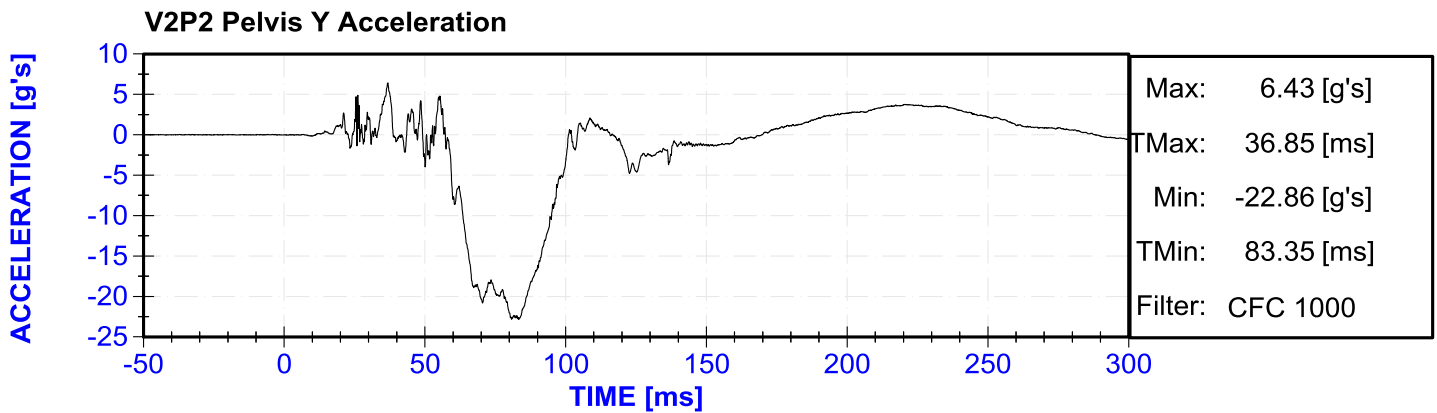
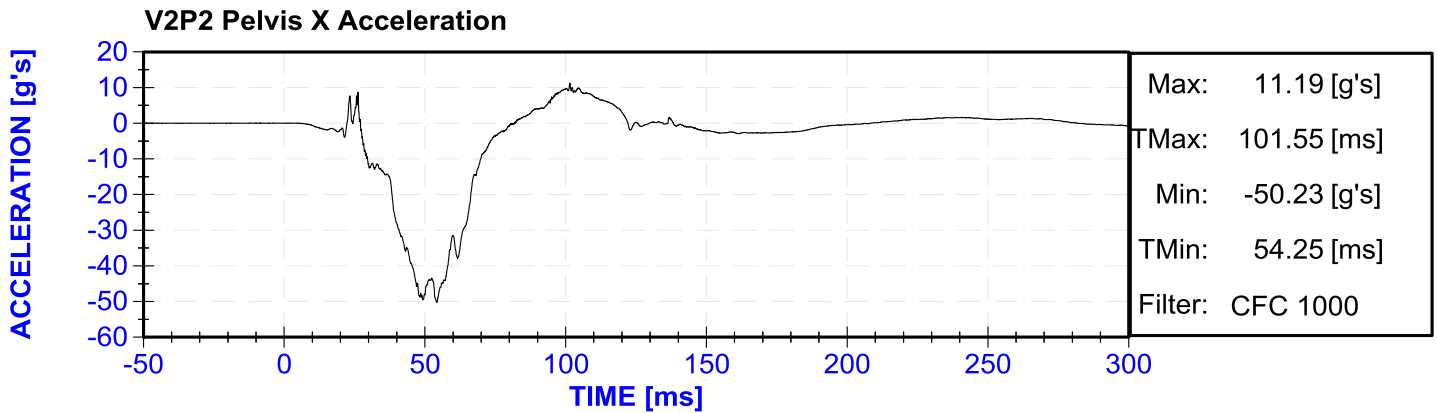


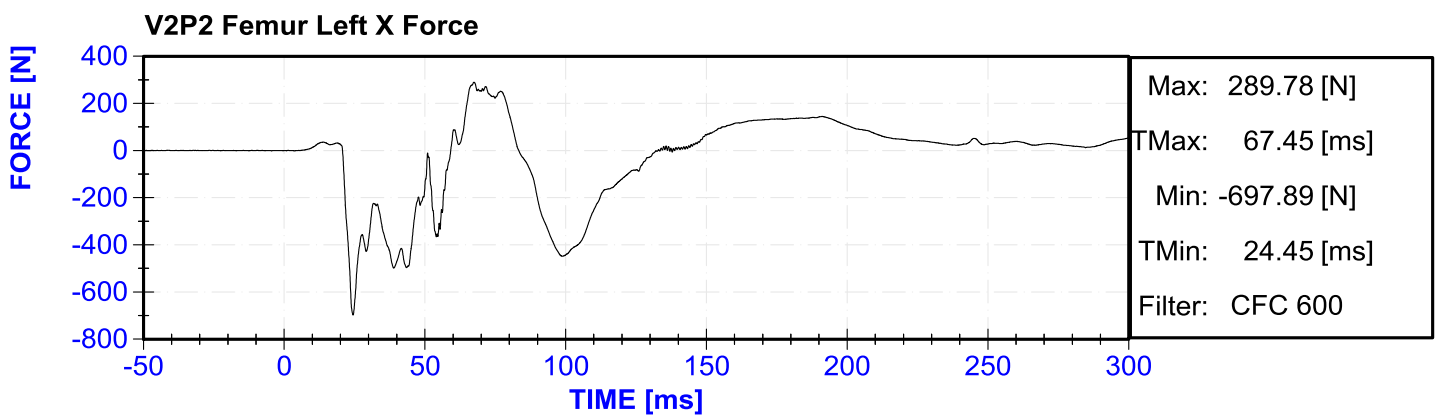
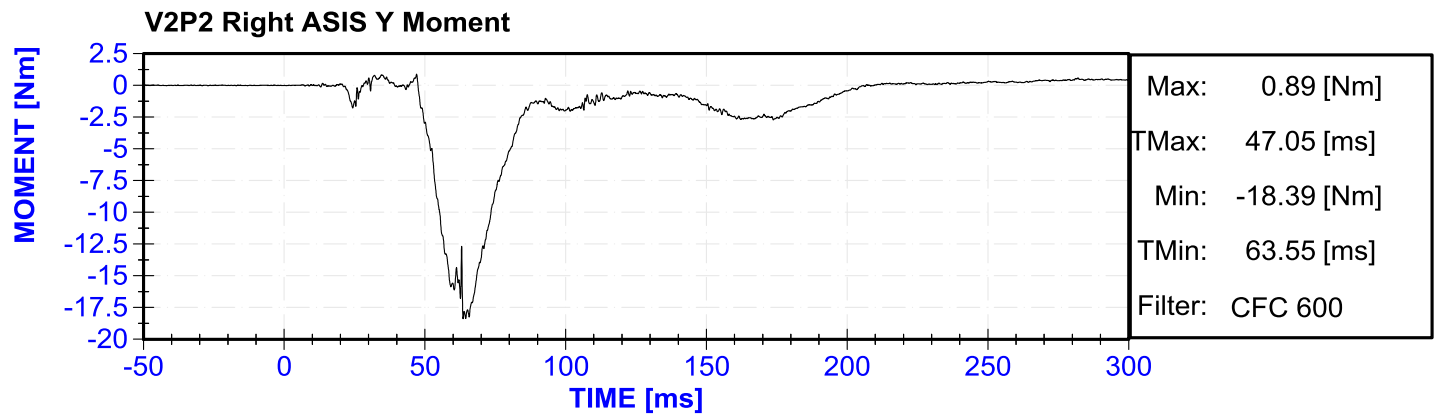
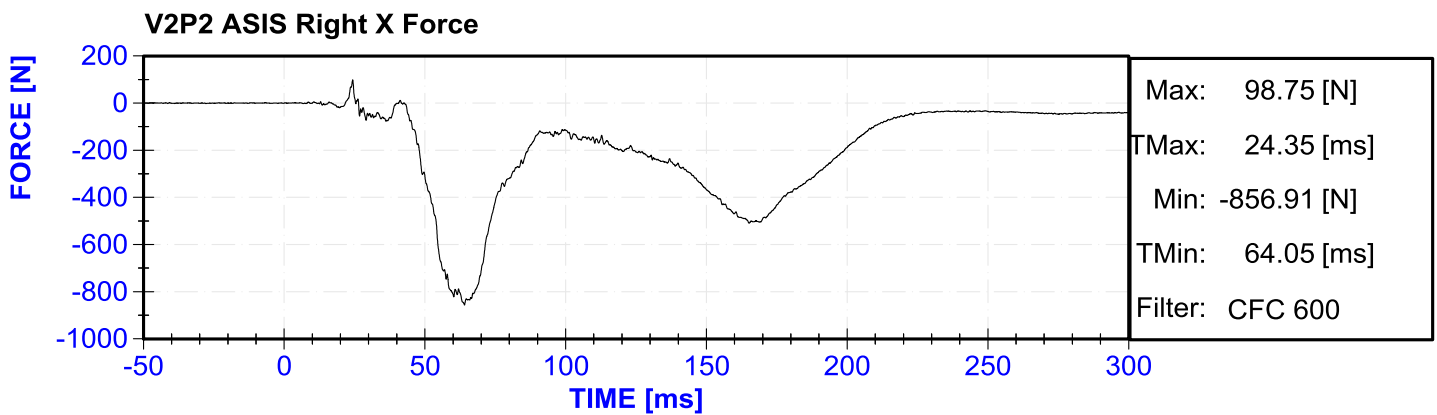
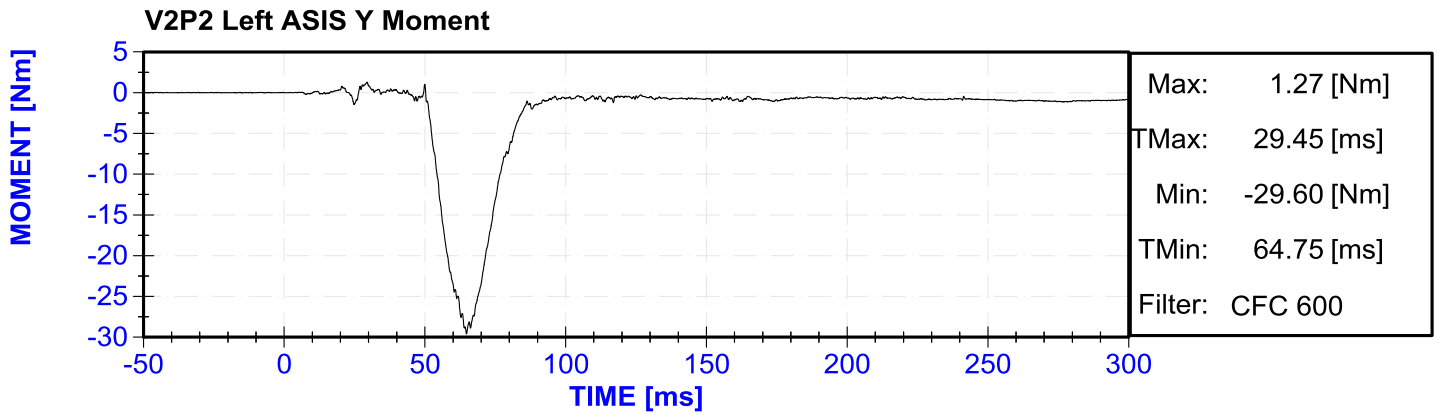
V2P2 Abdomen Right DGIR X Displacement

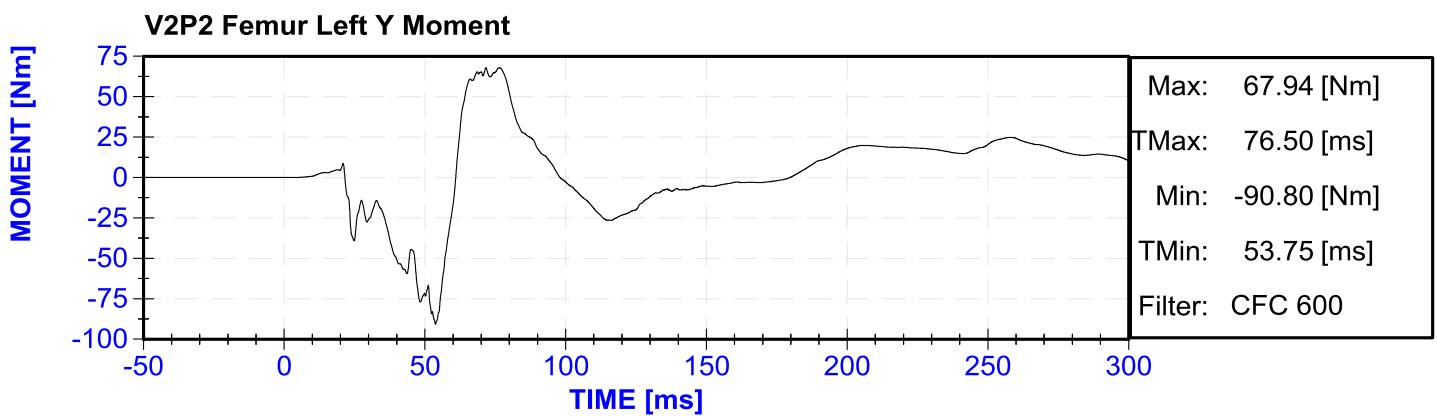
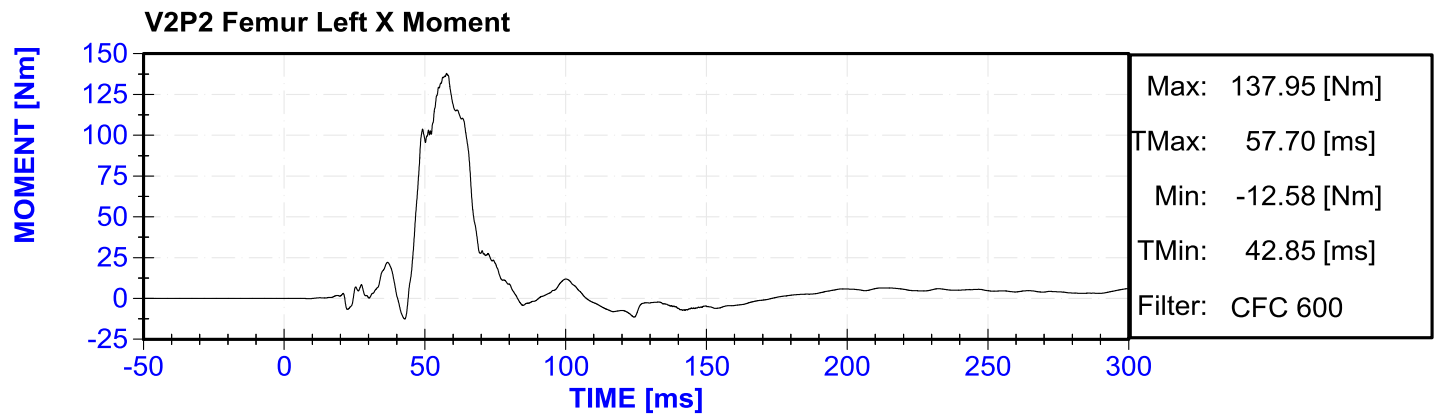
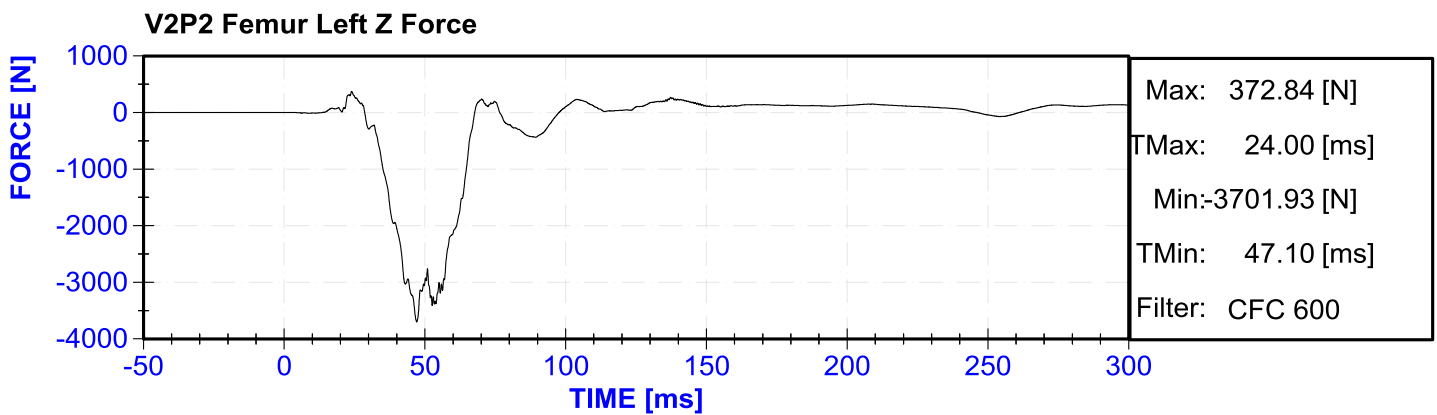
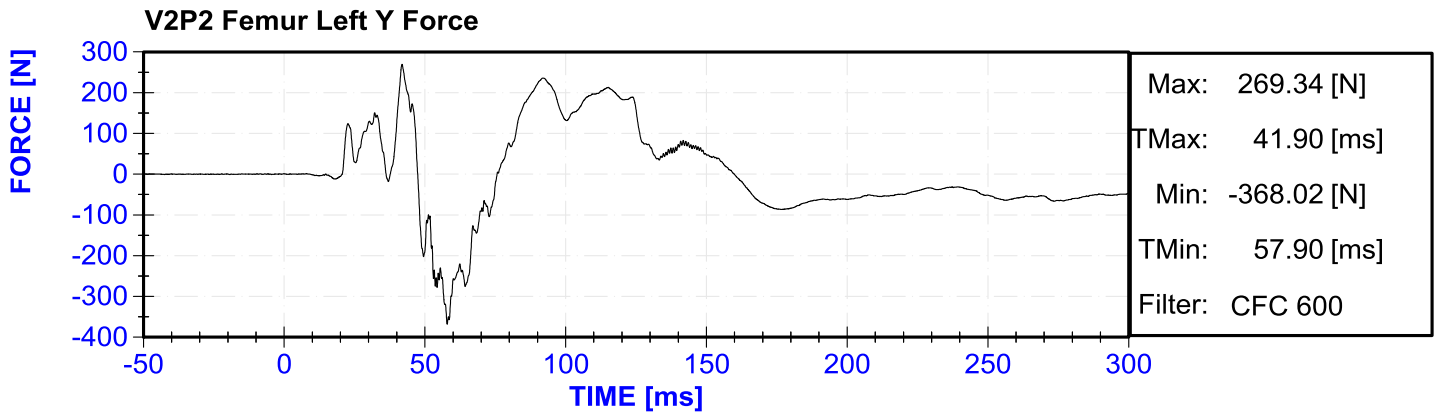


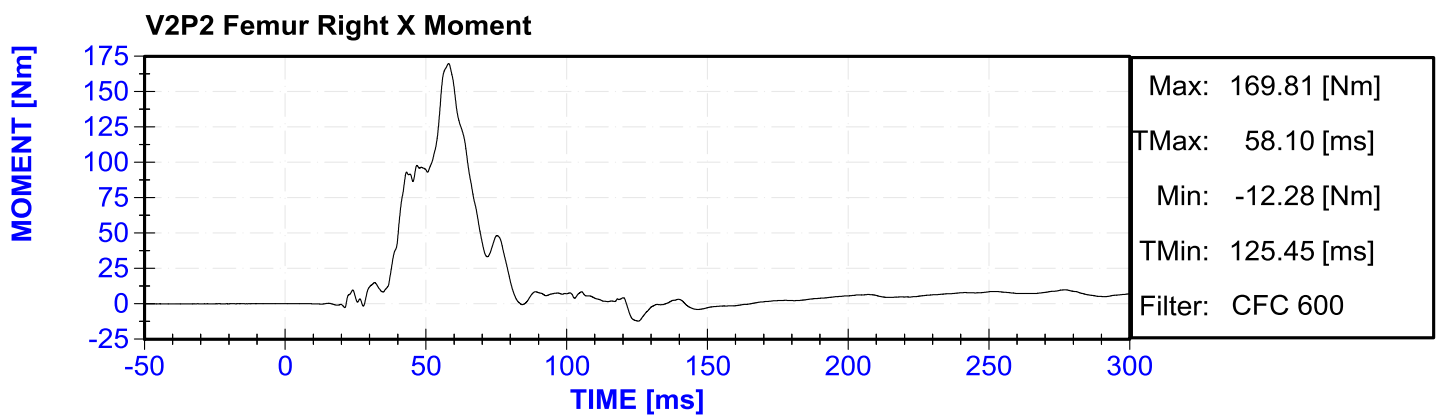
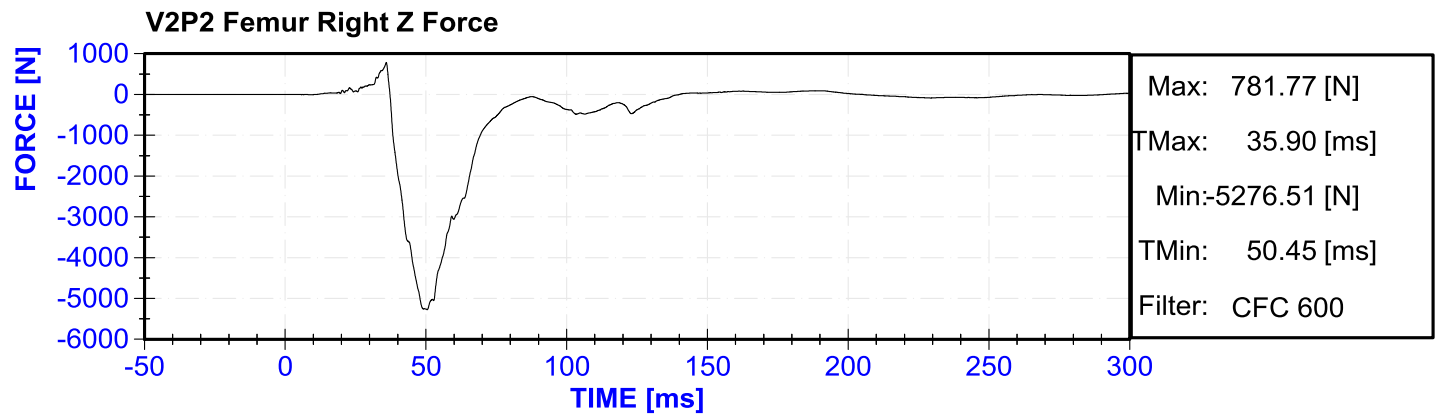
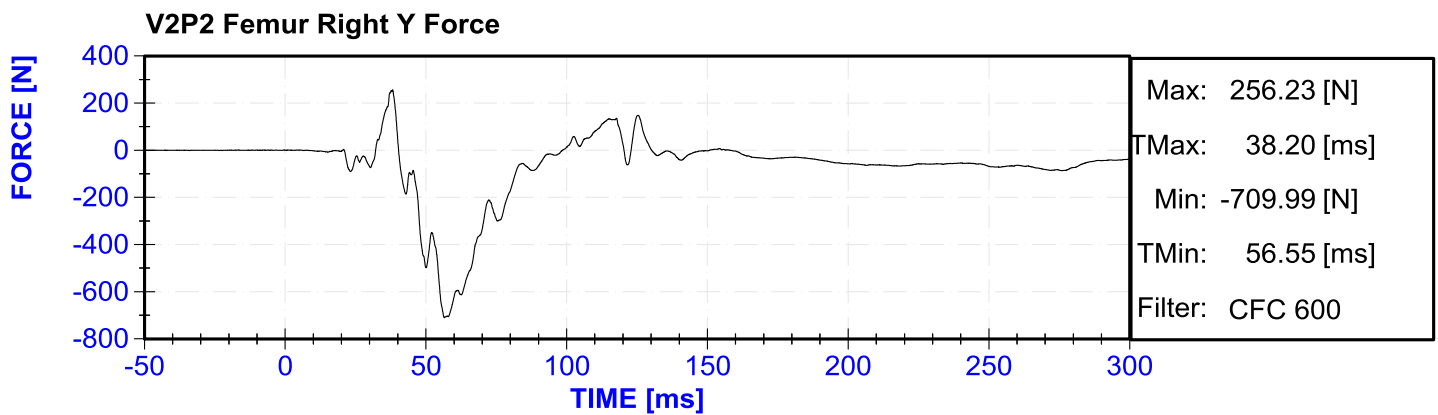
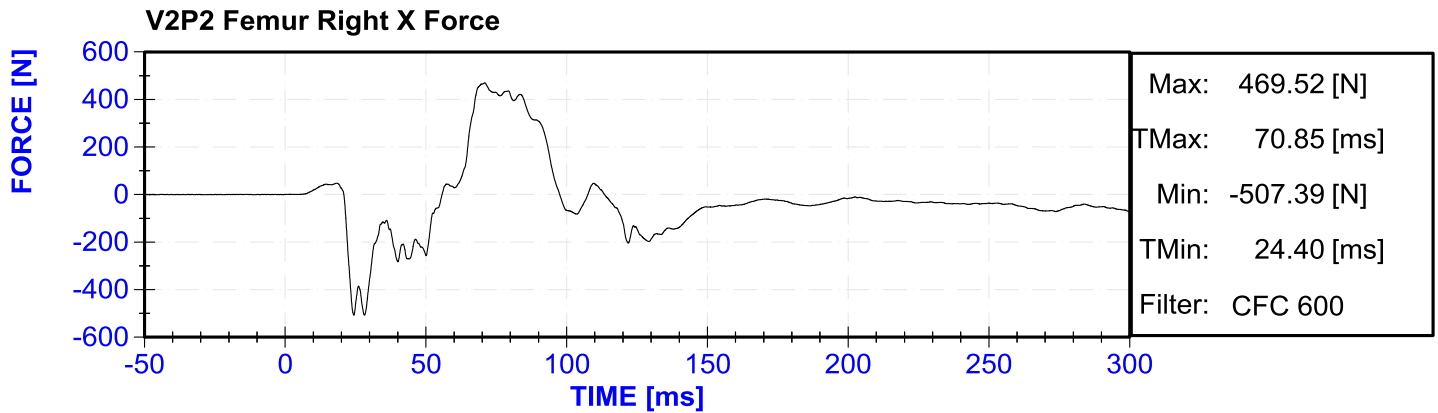


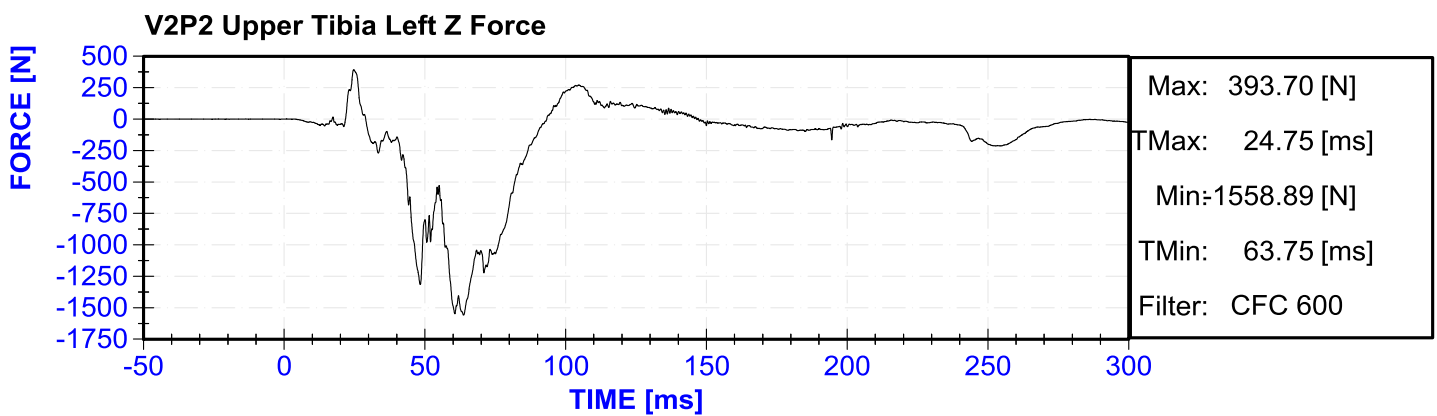
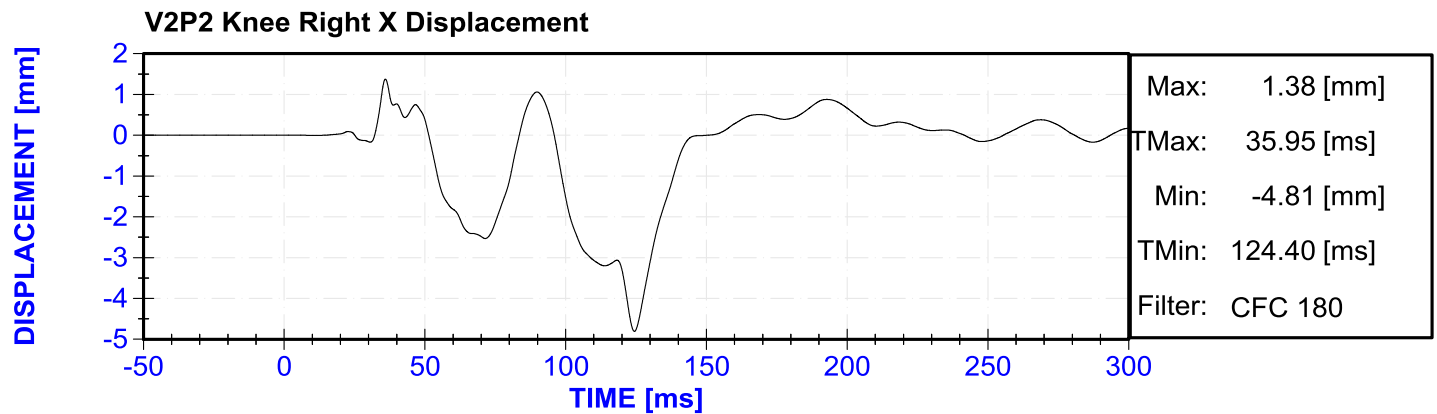
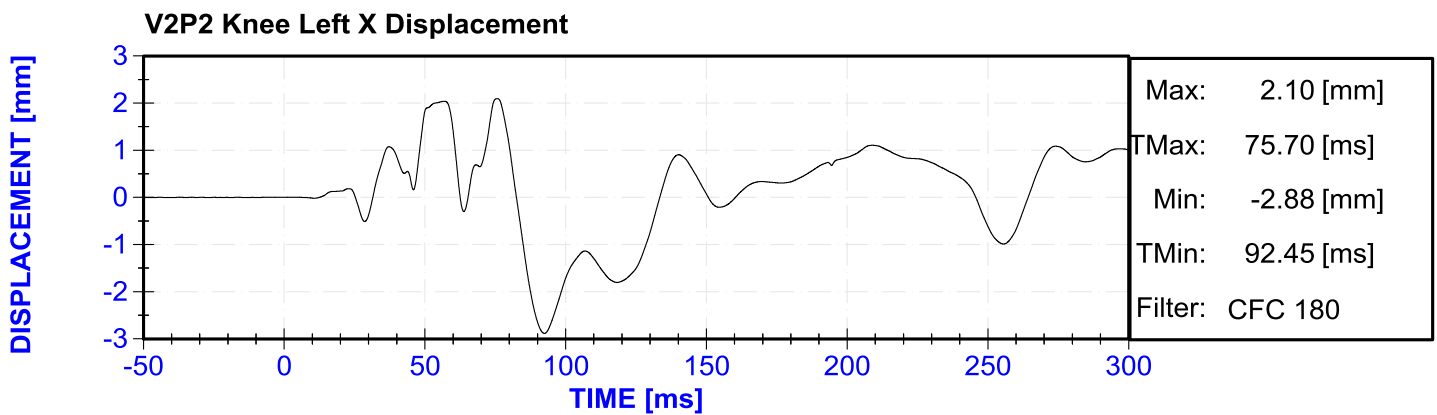
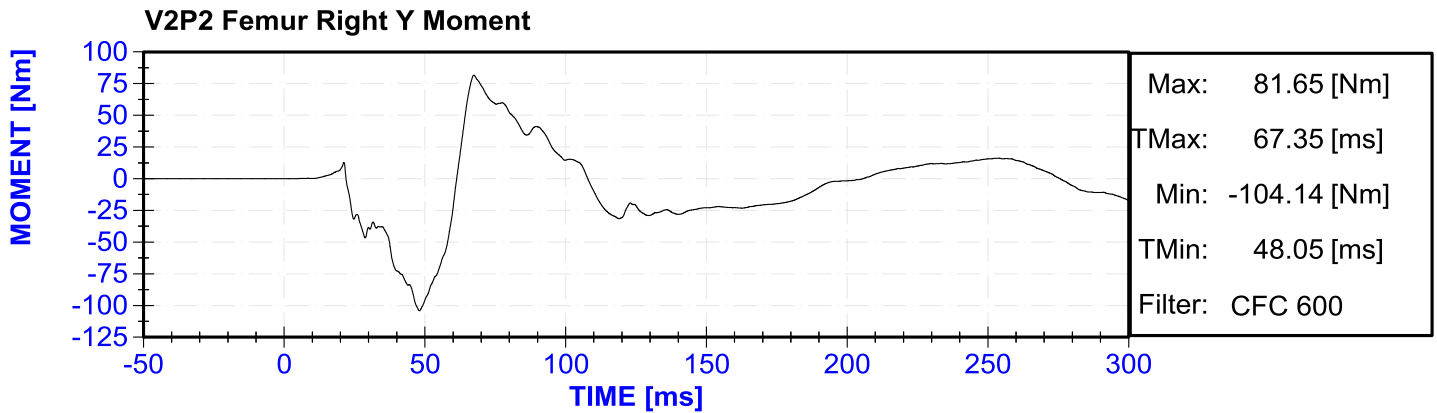


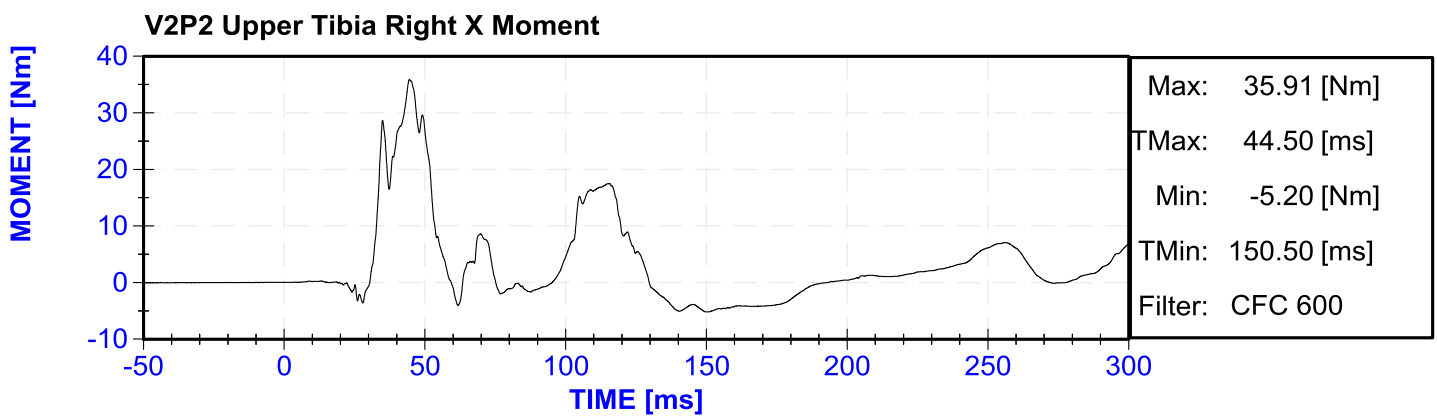
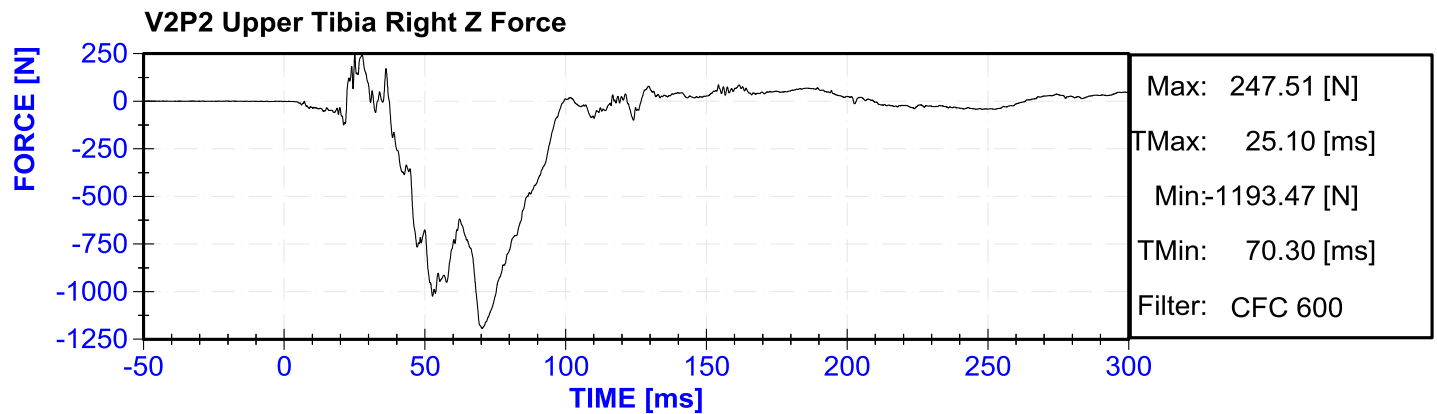
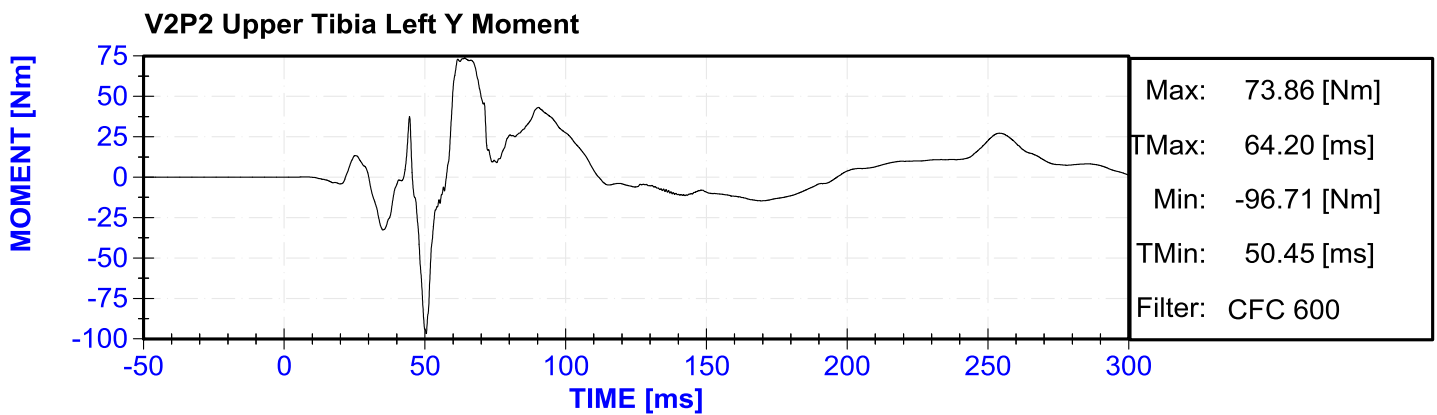
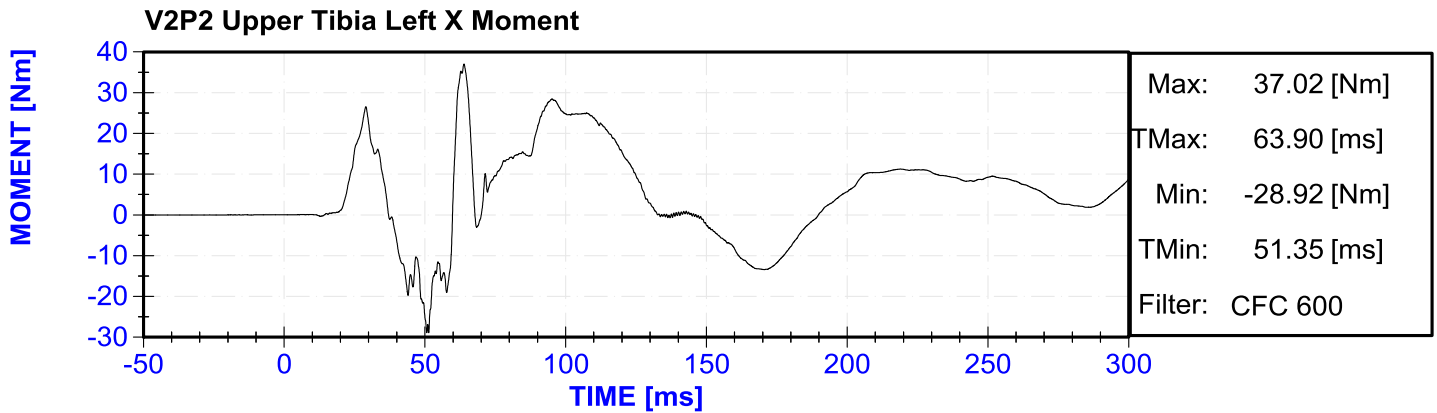


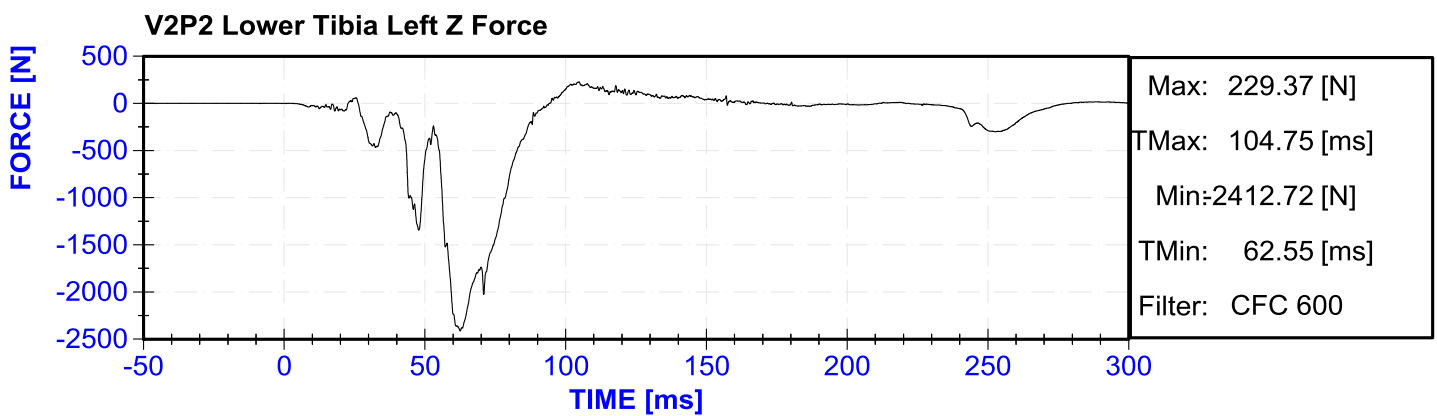
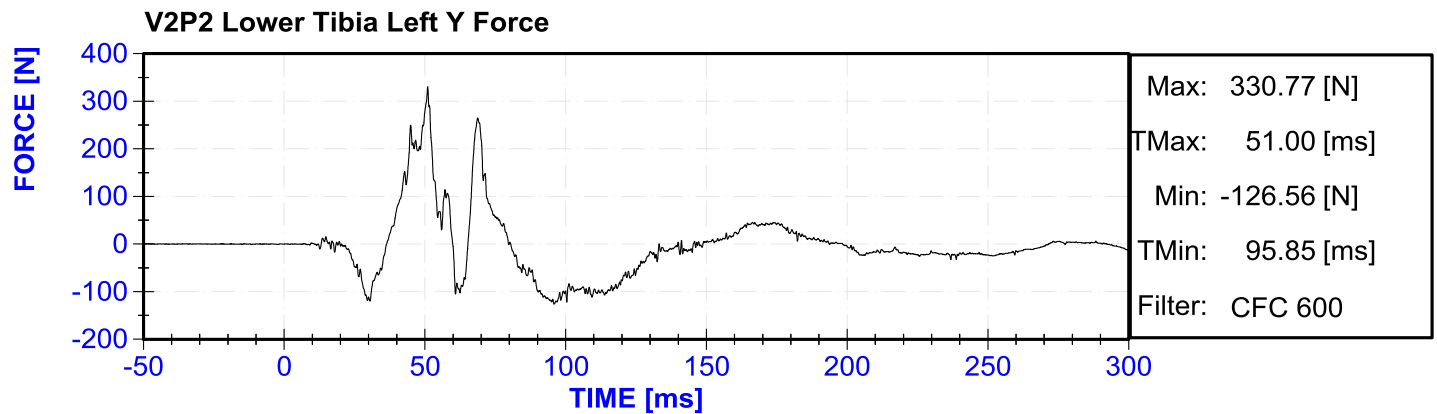
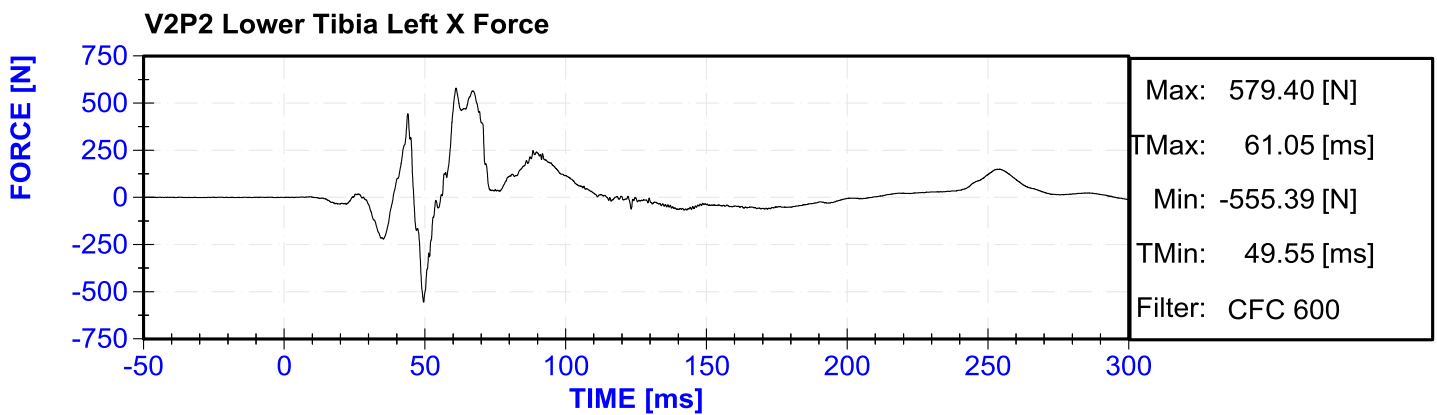
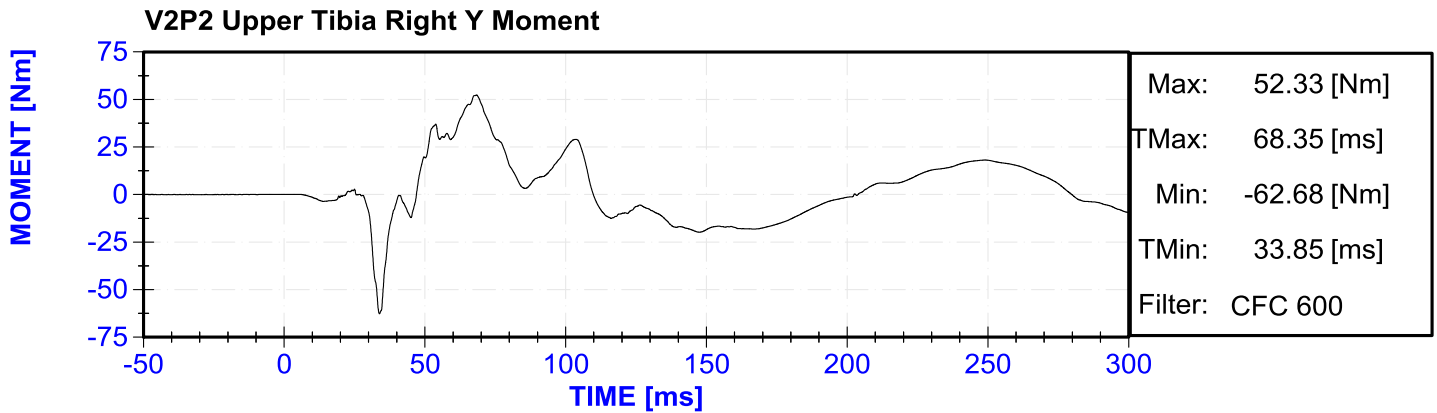


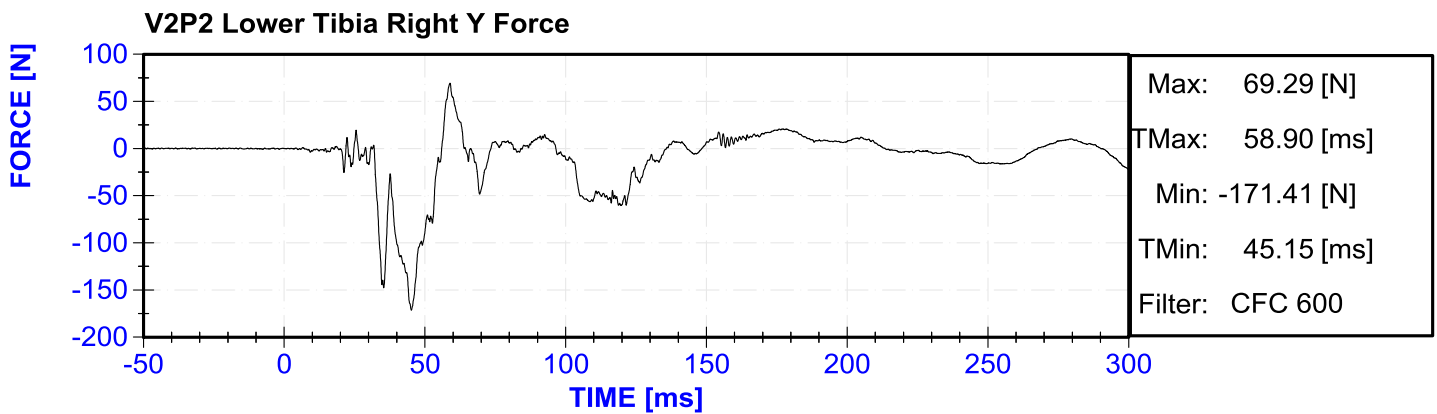
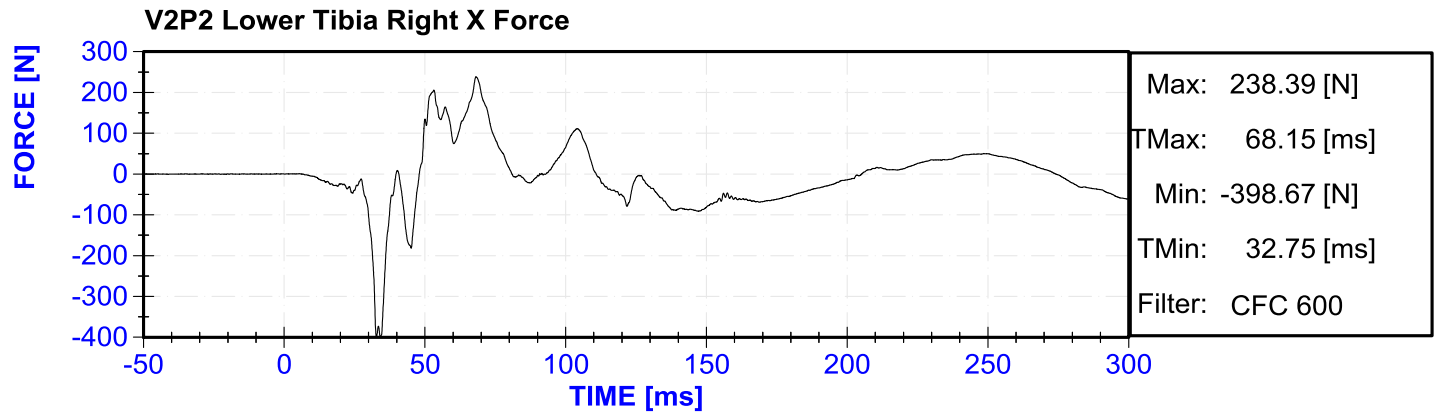
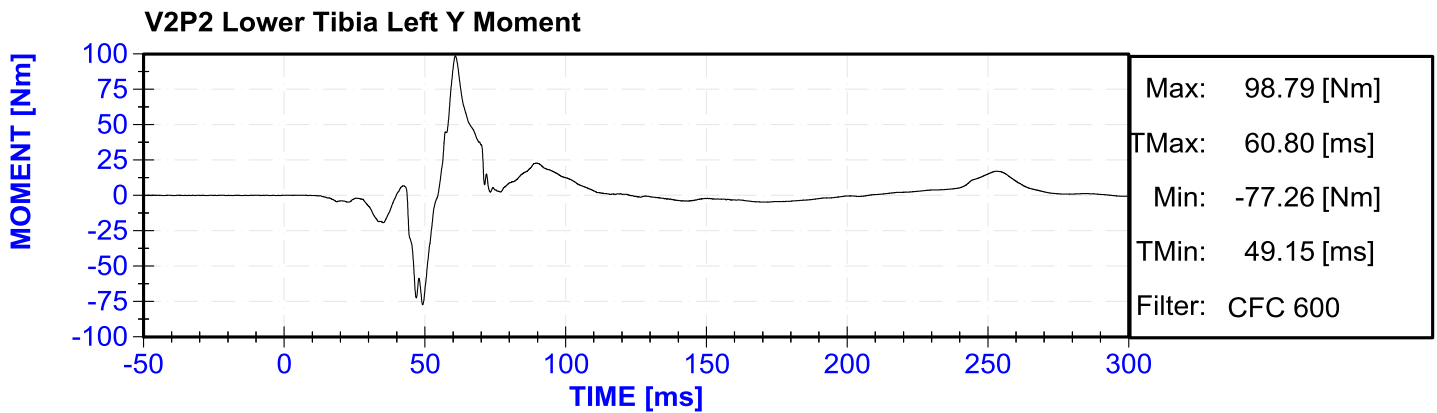
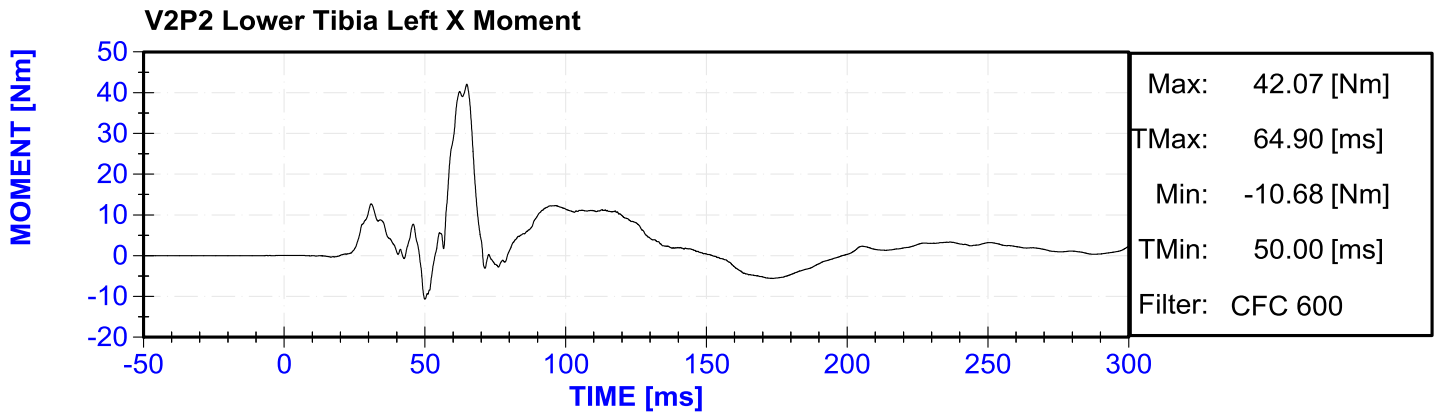


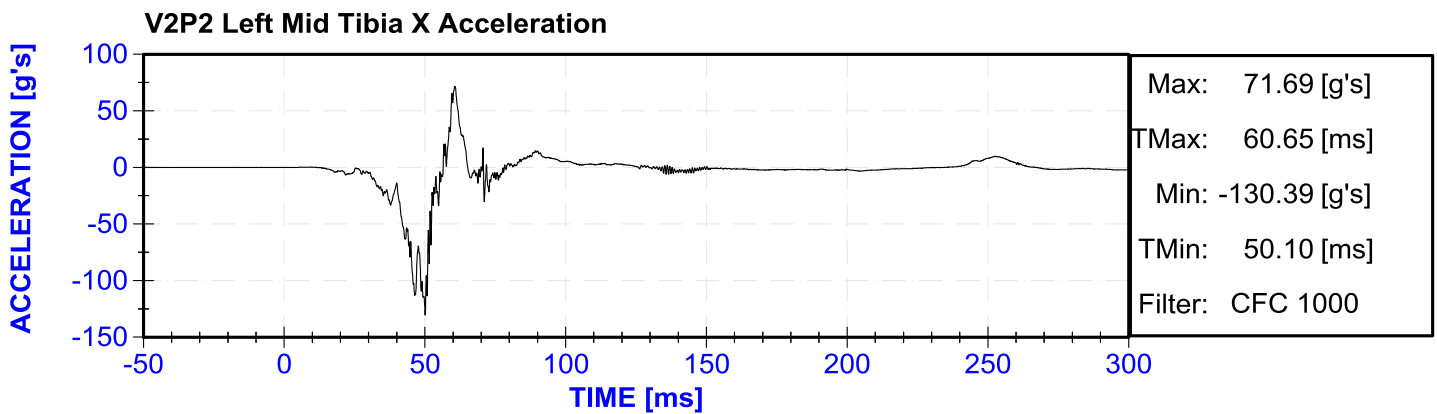
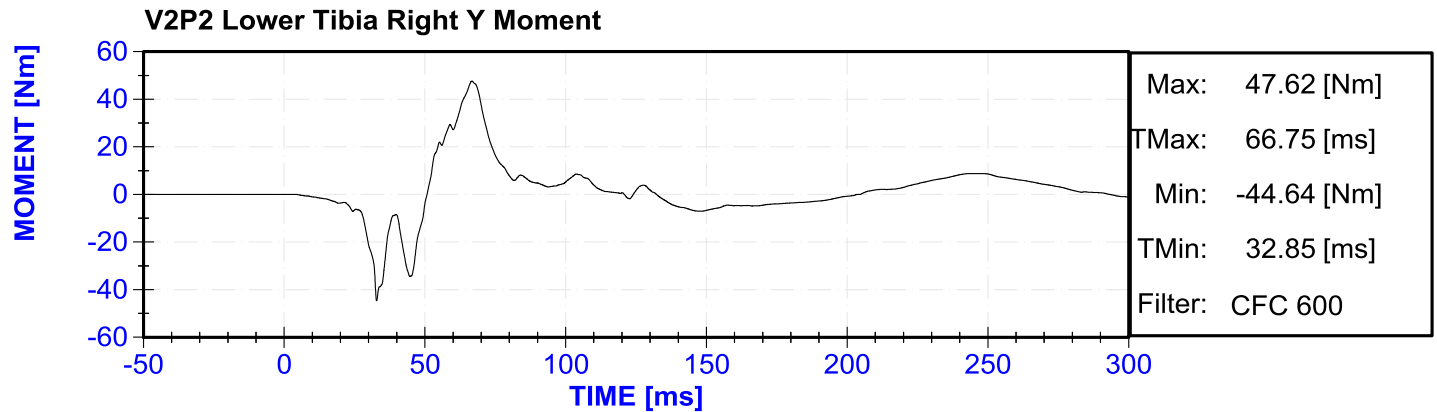
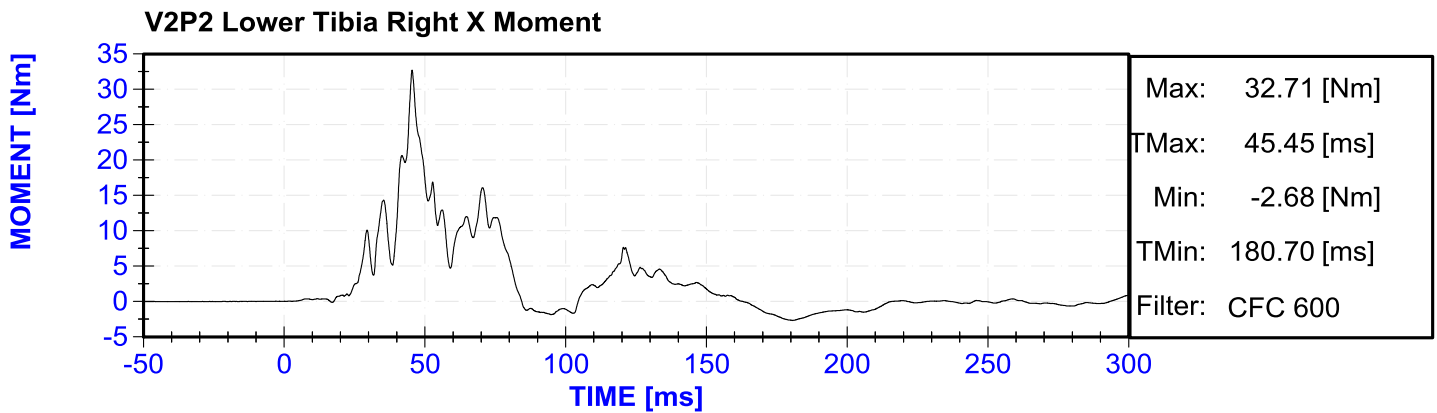
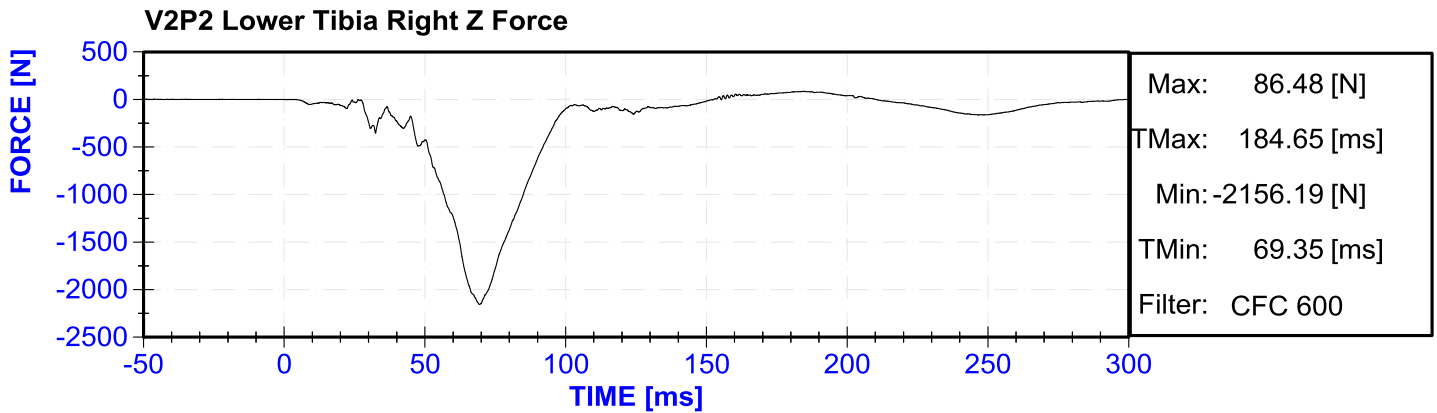


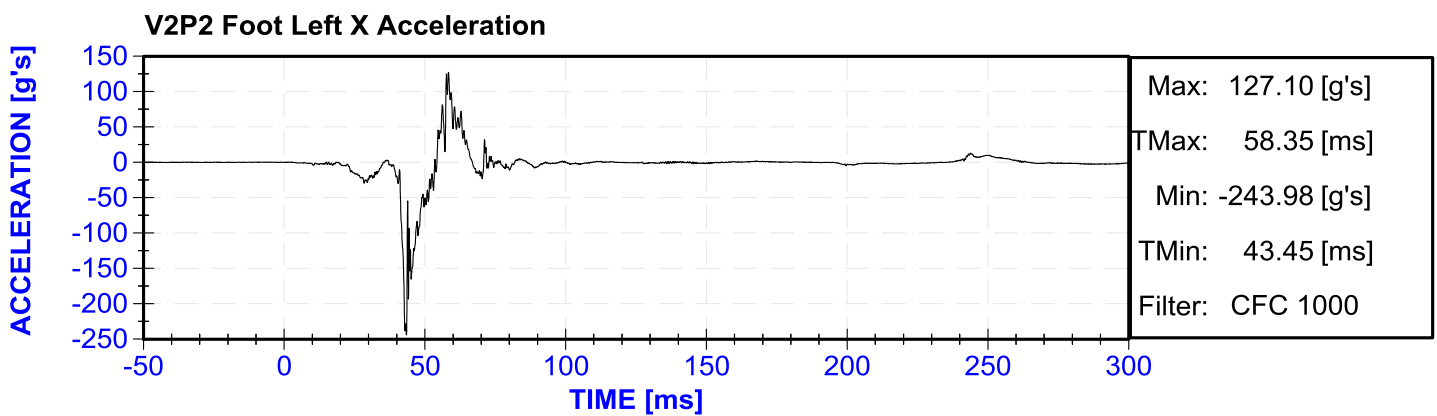
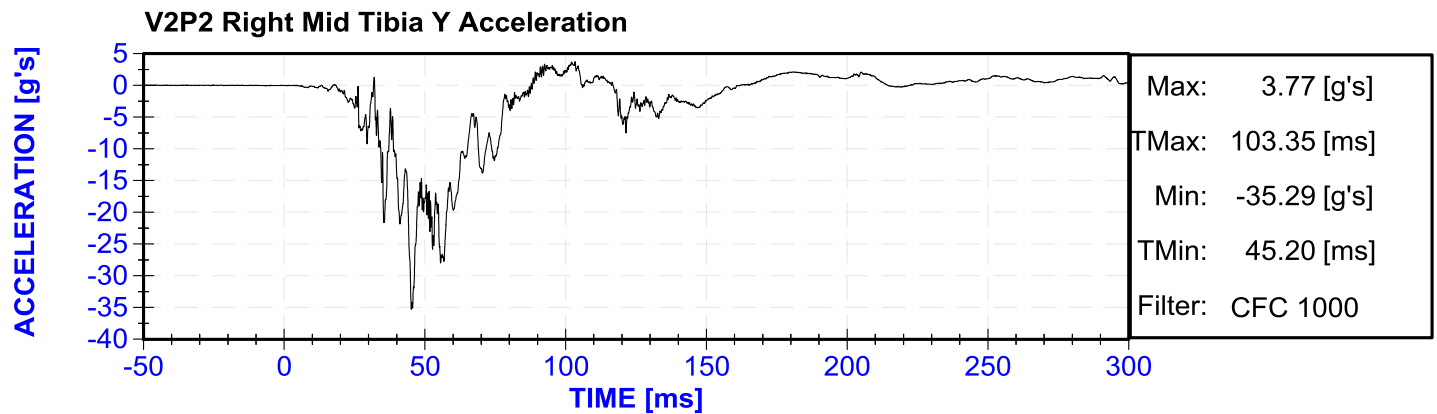
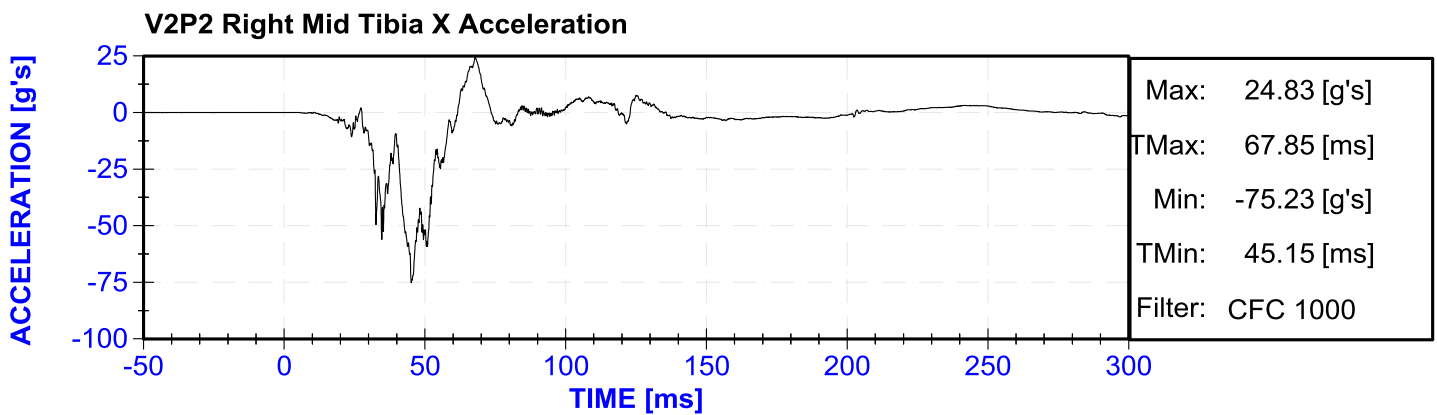
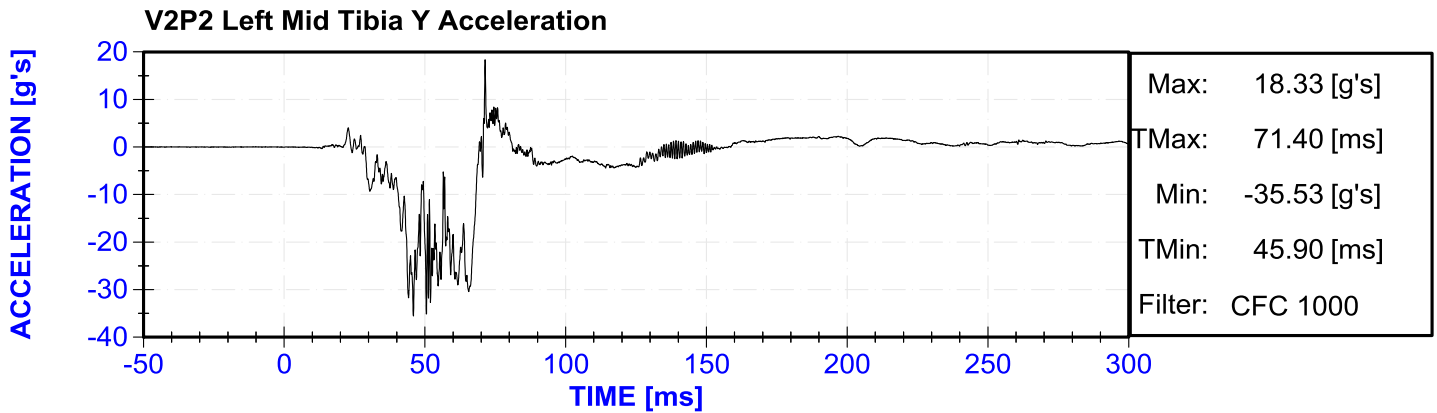


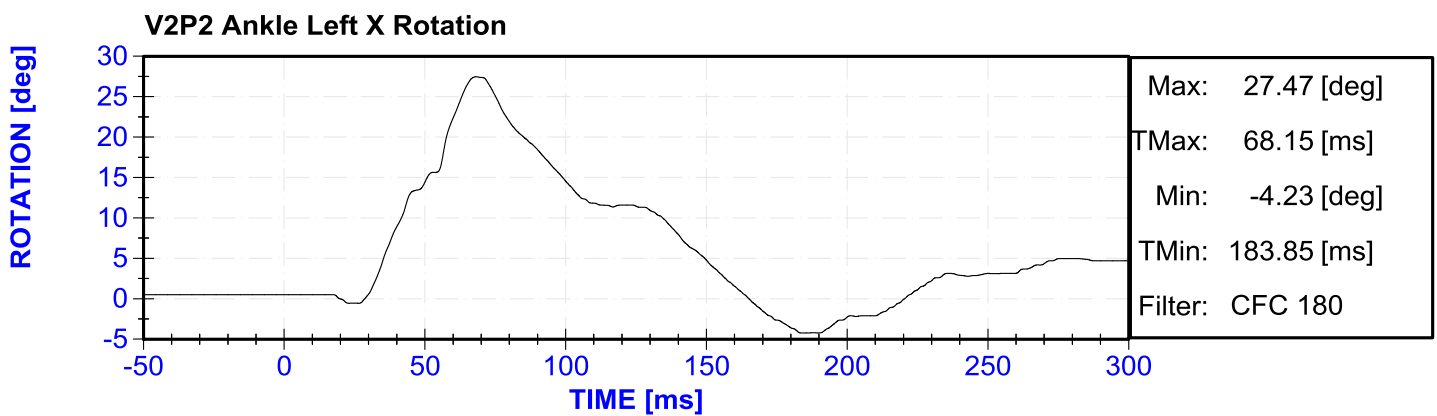
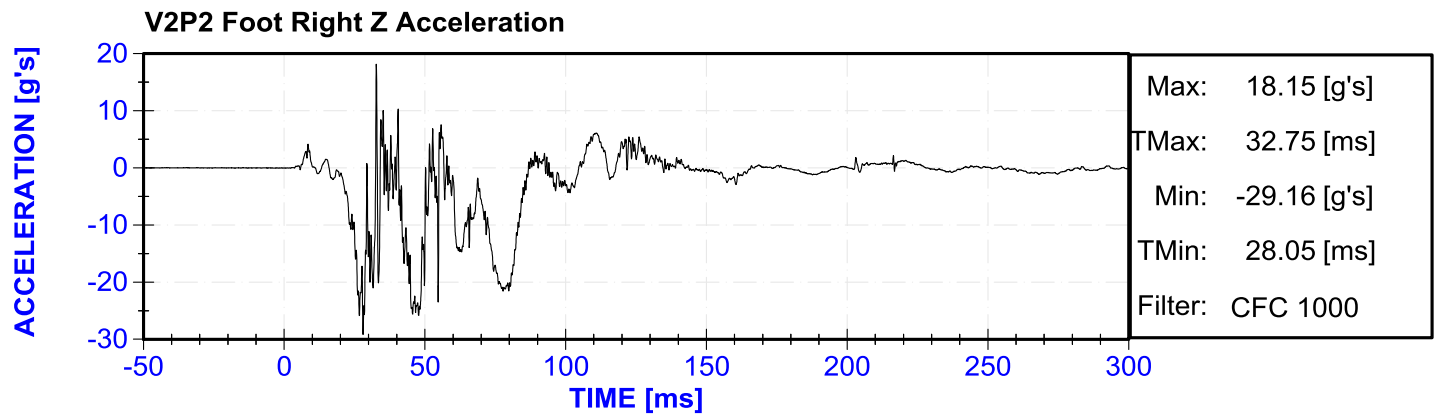
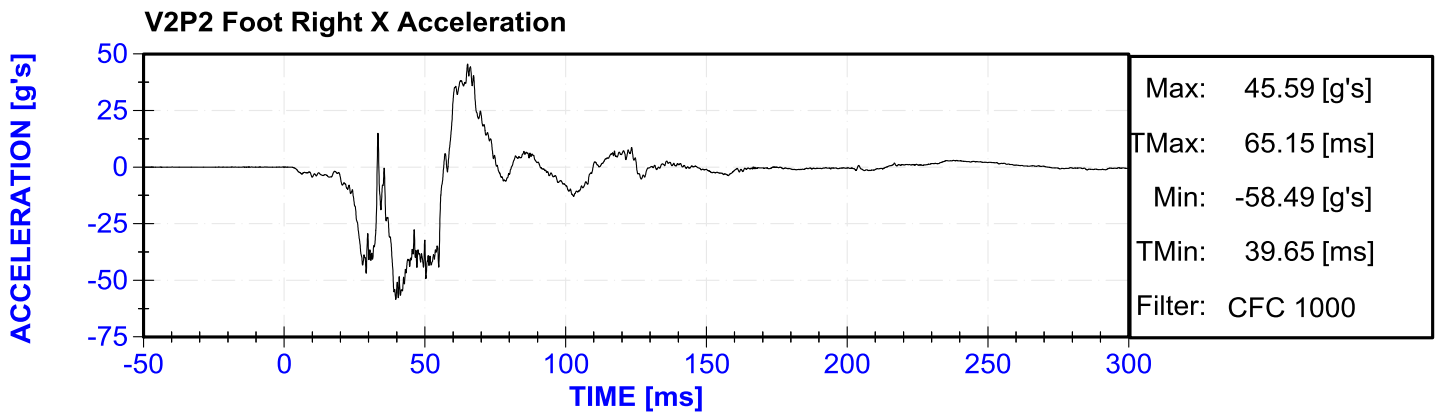
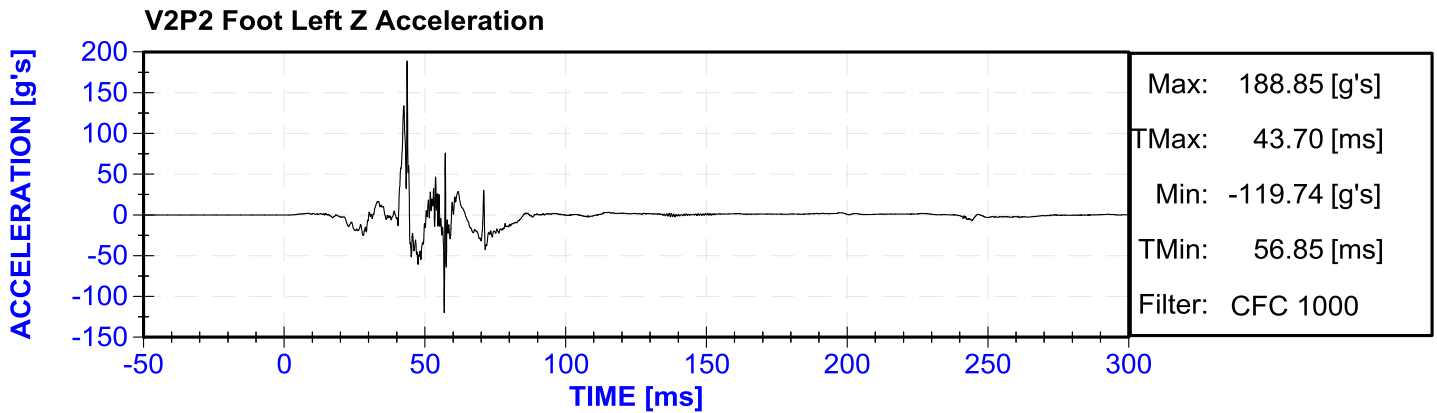


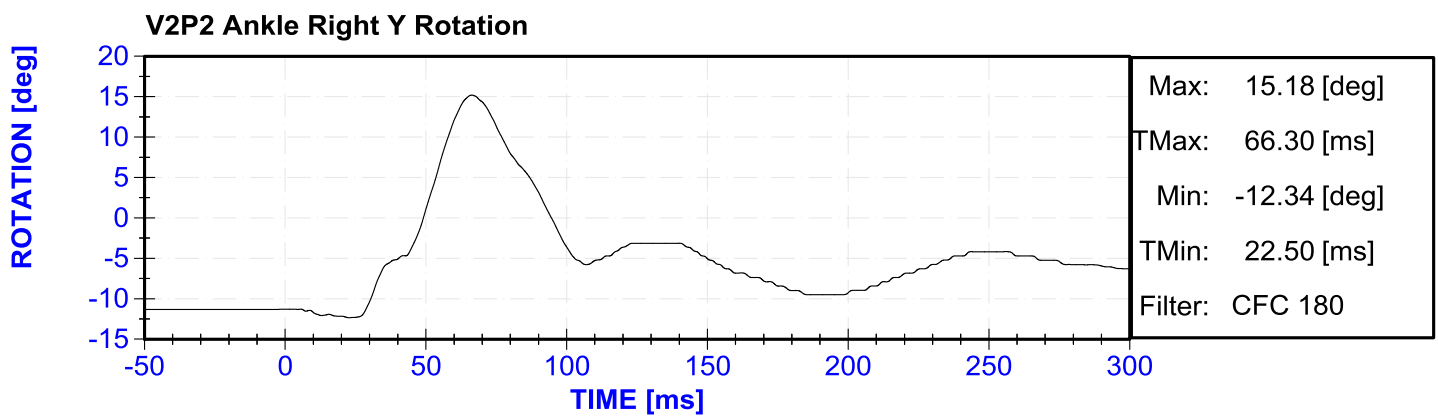
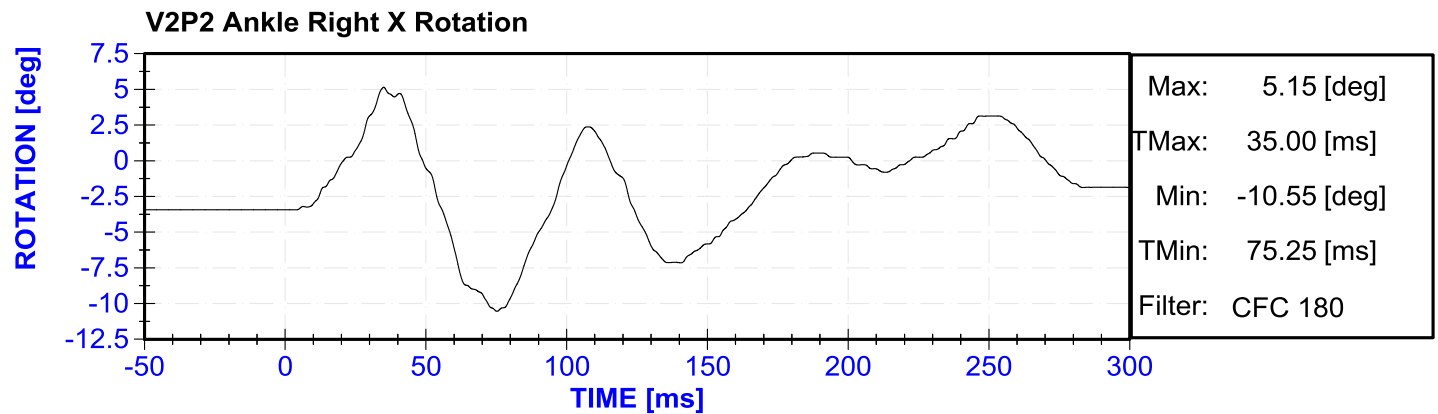
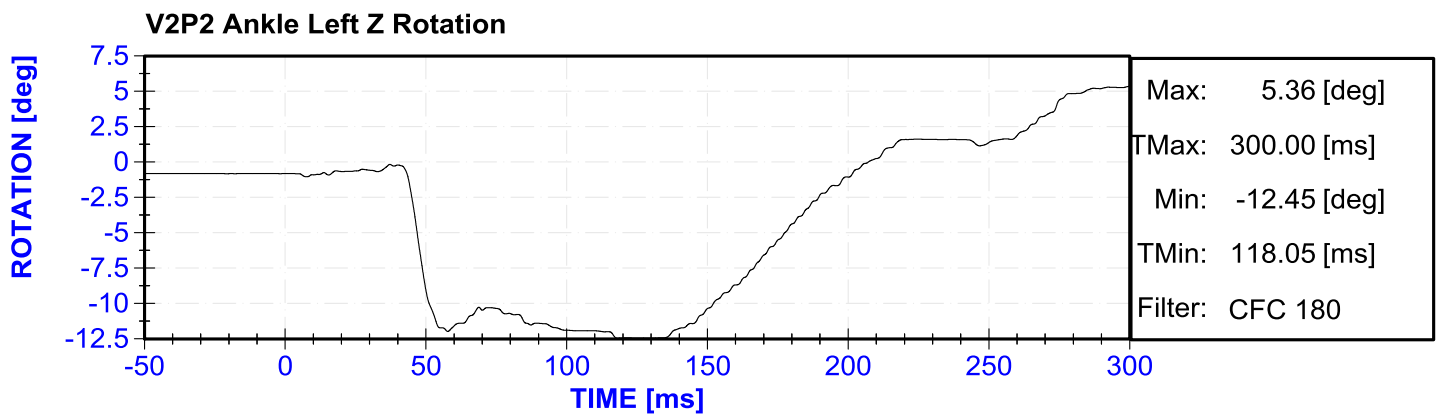
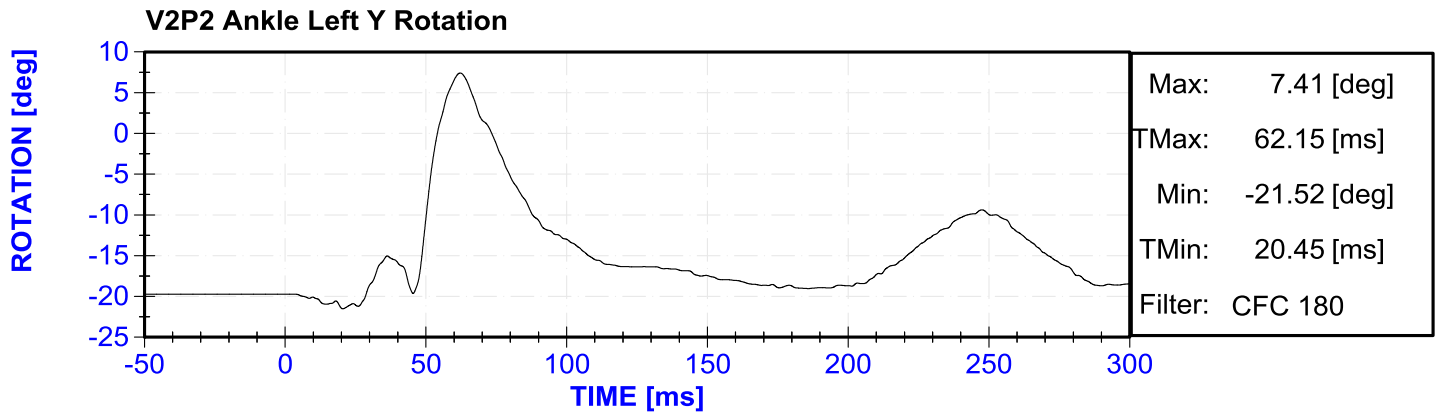


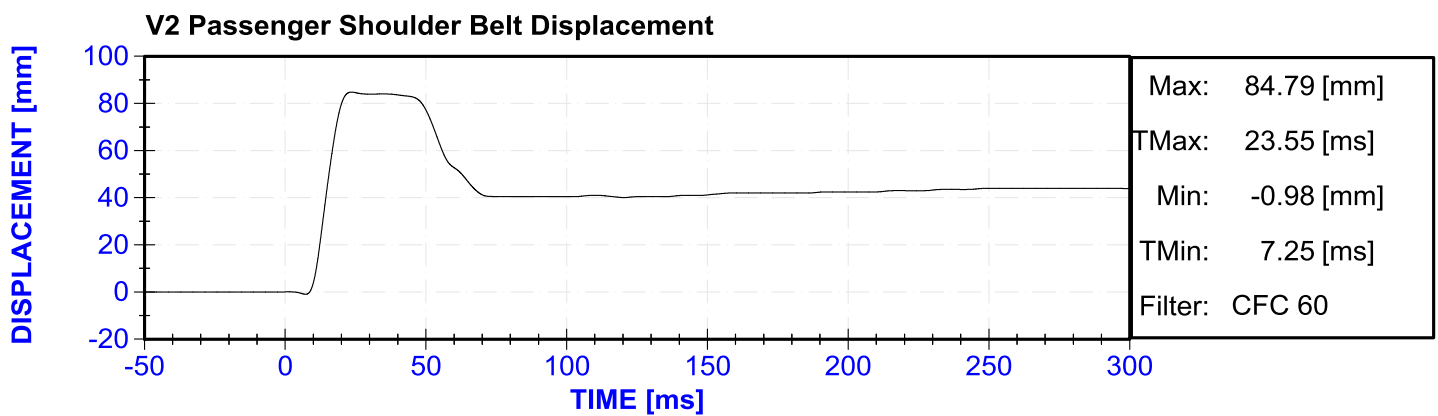
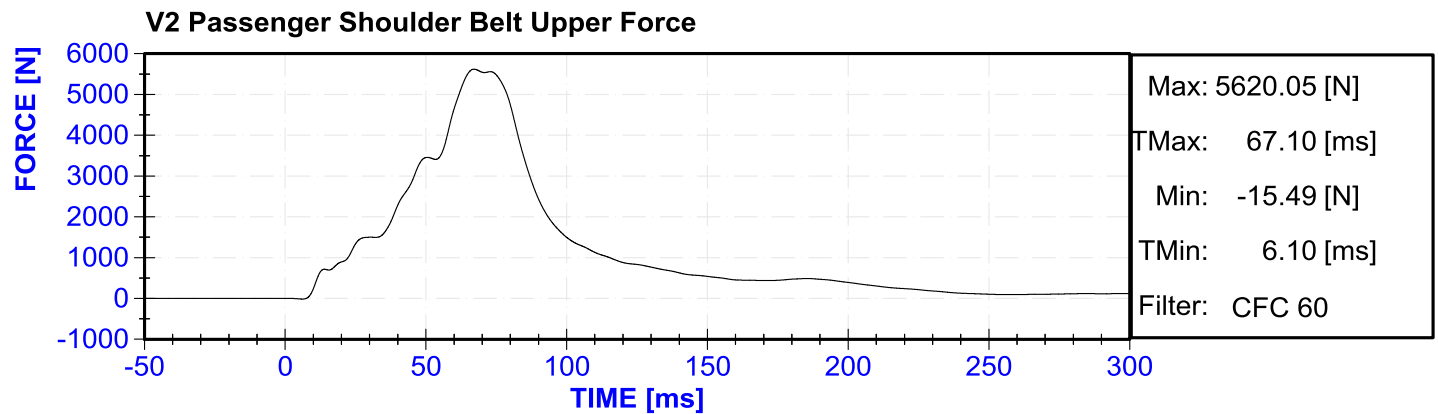
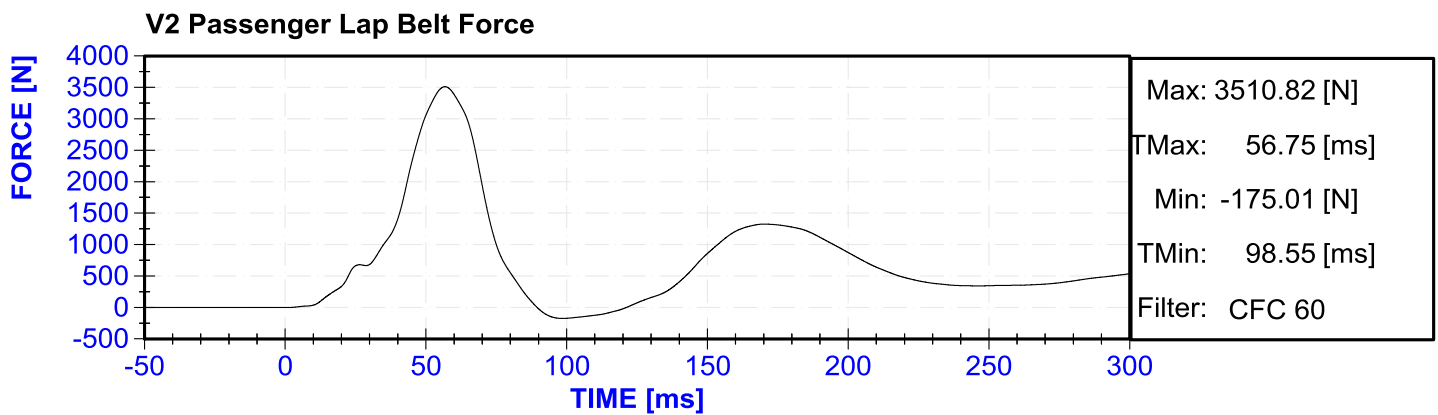
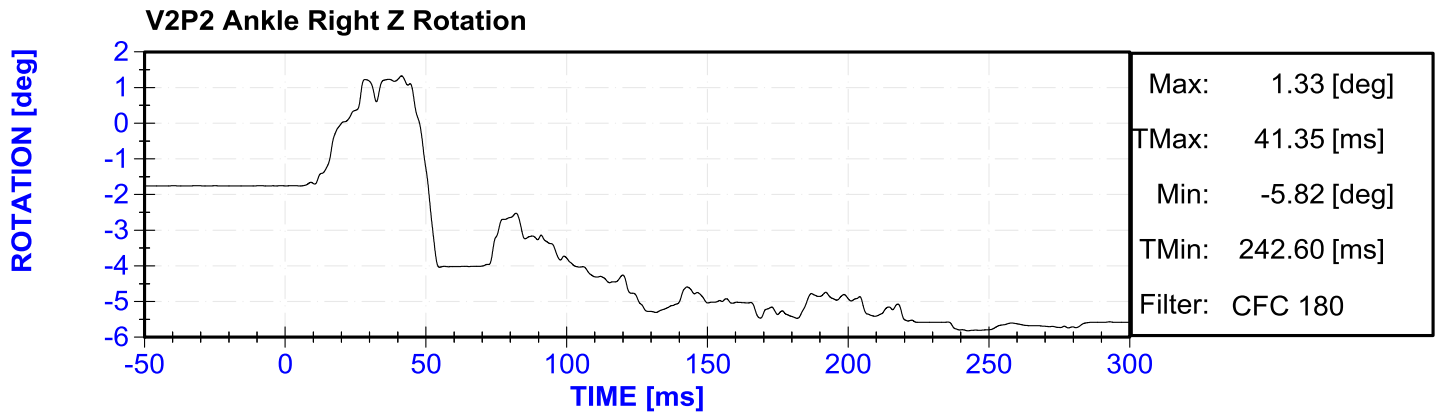


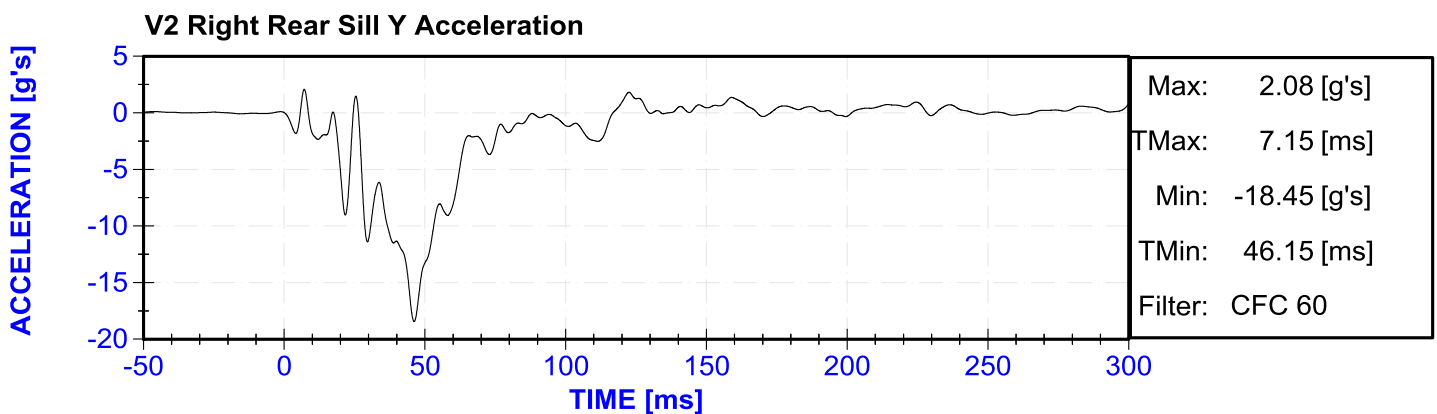
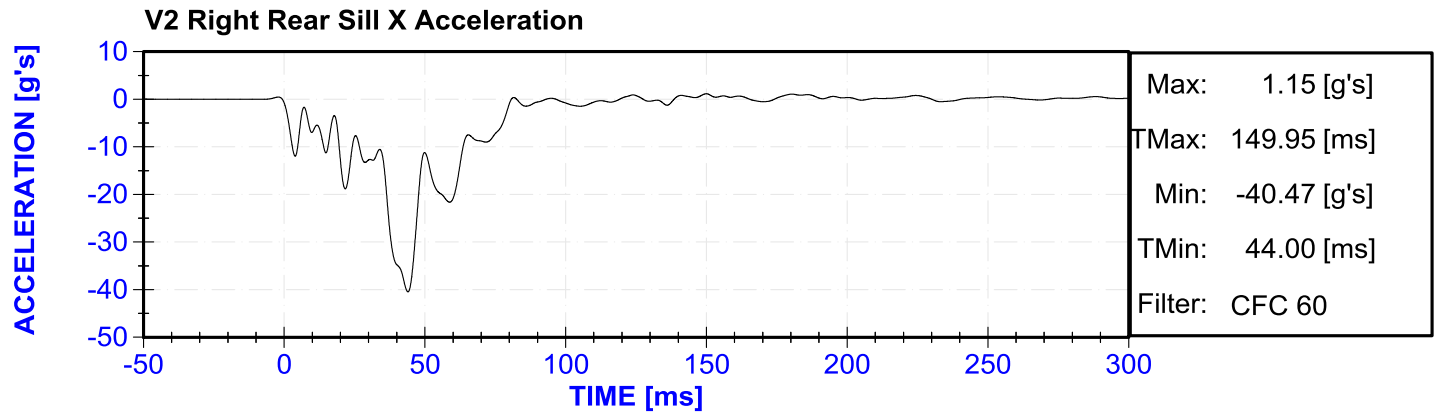
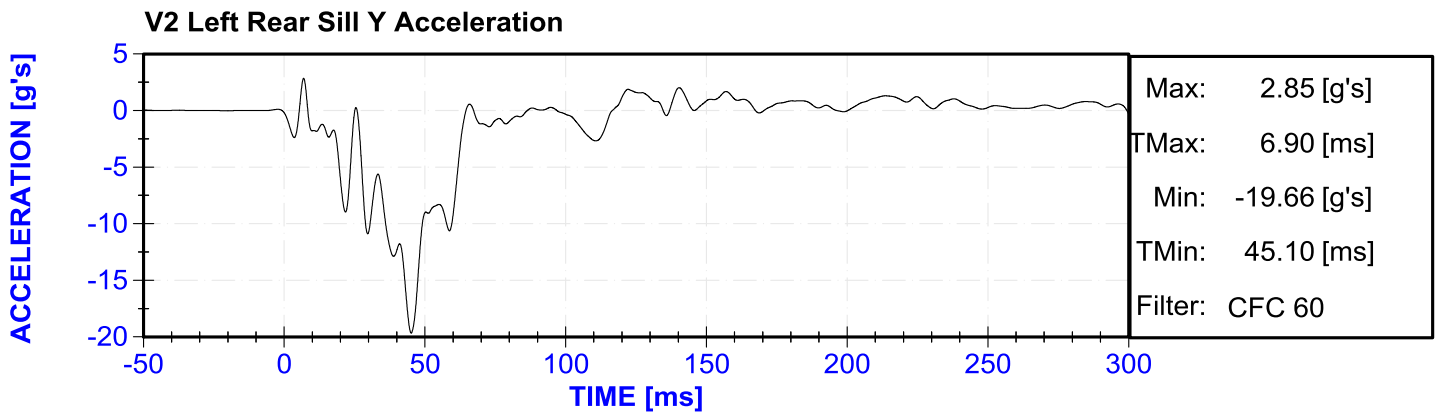
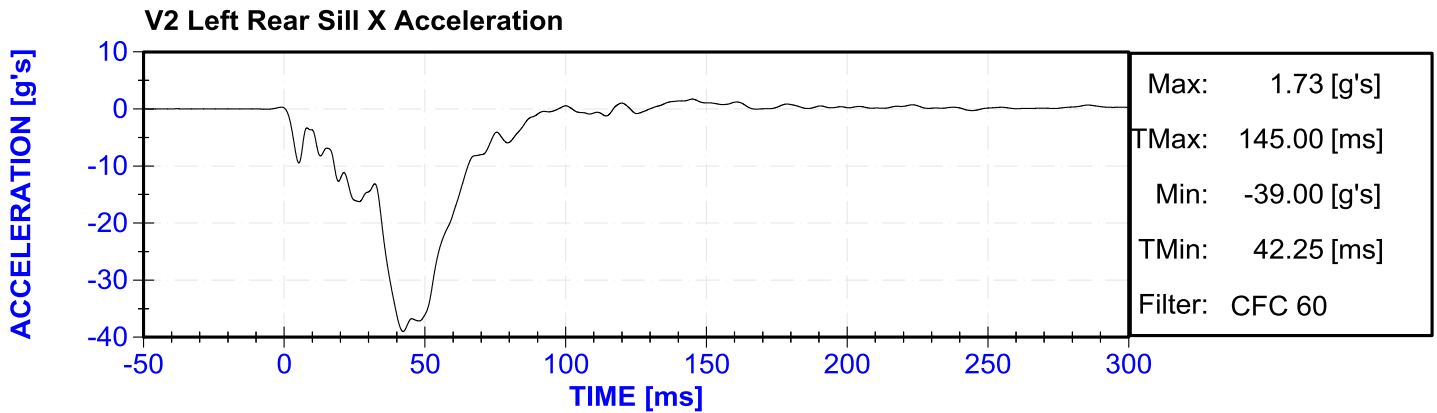


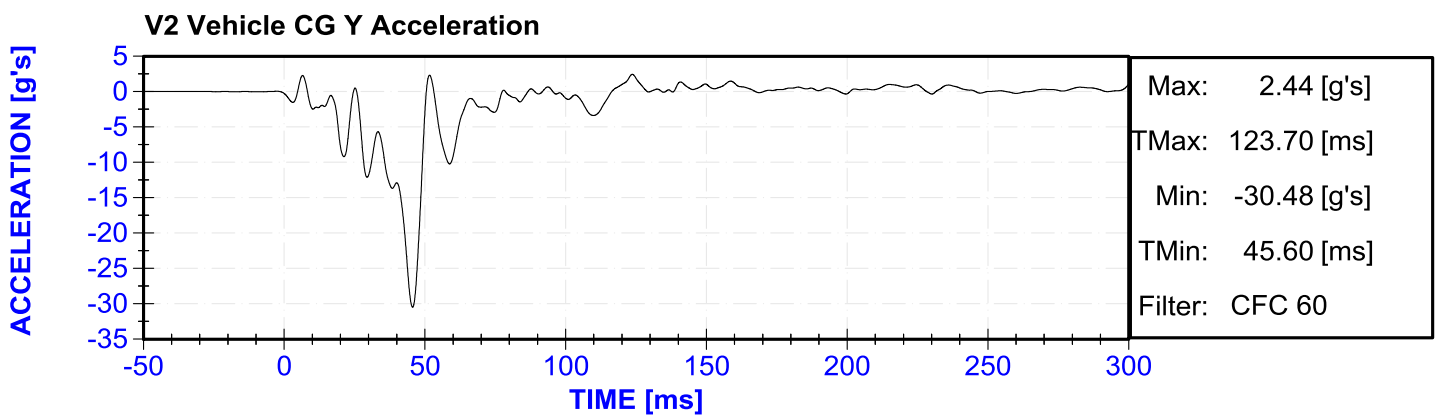
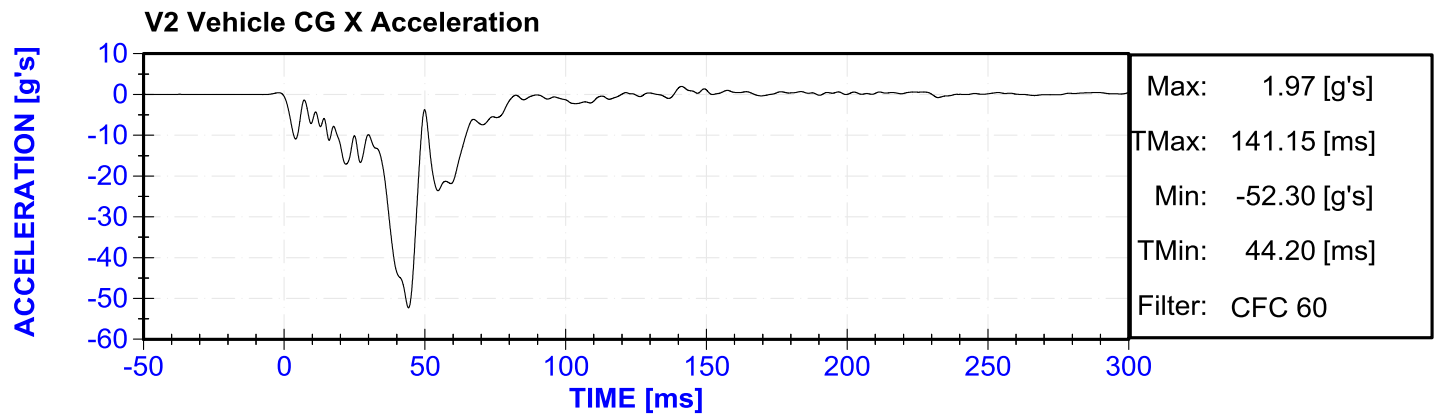
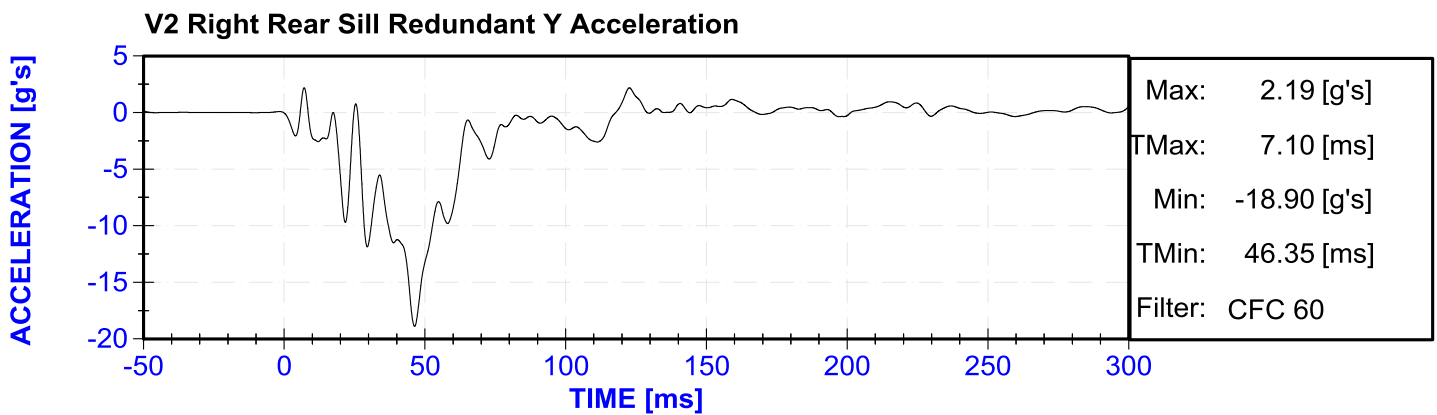
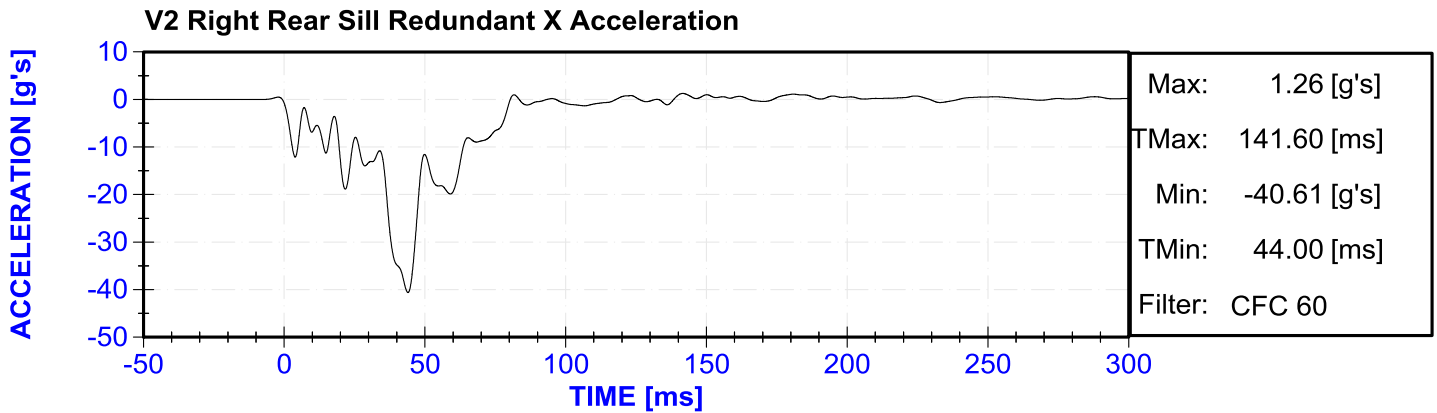




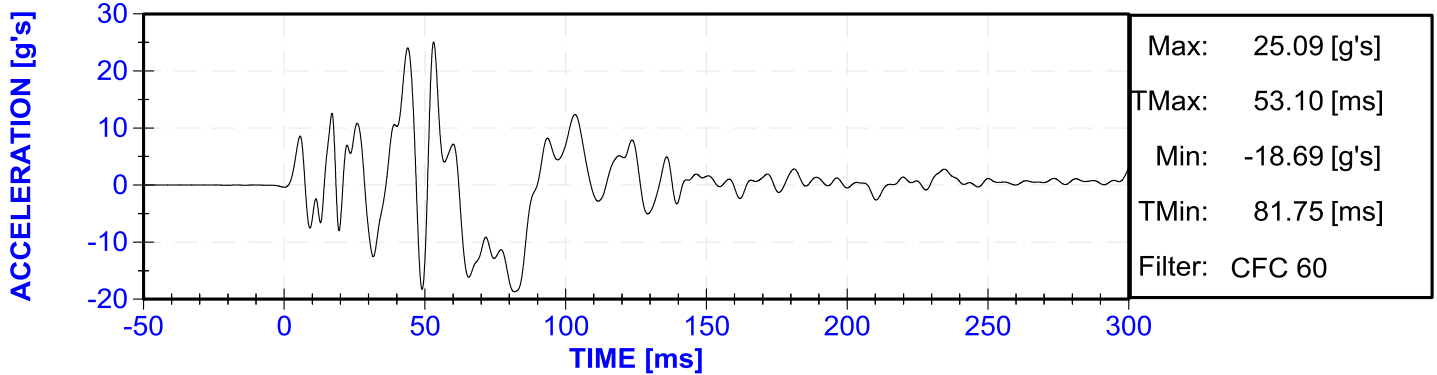




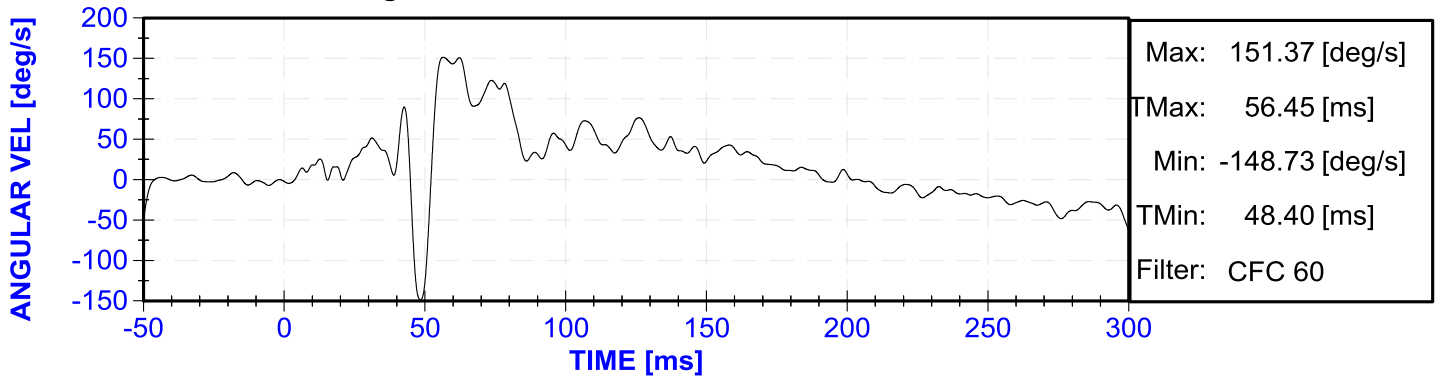




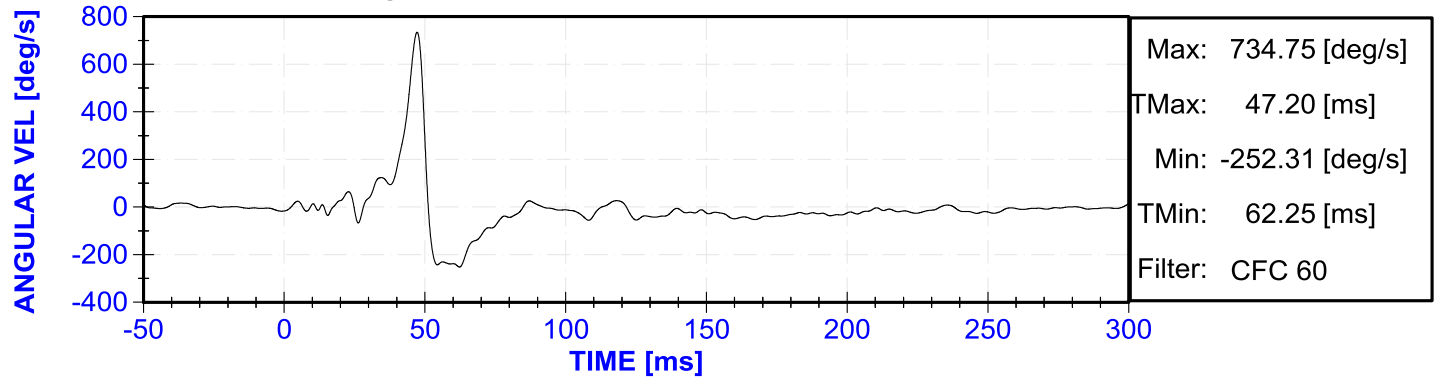
V2 Vehicle CG Z Acceleration



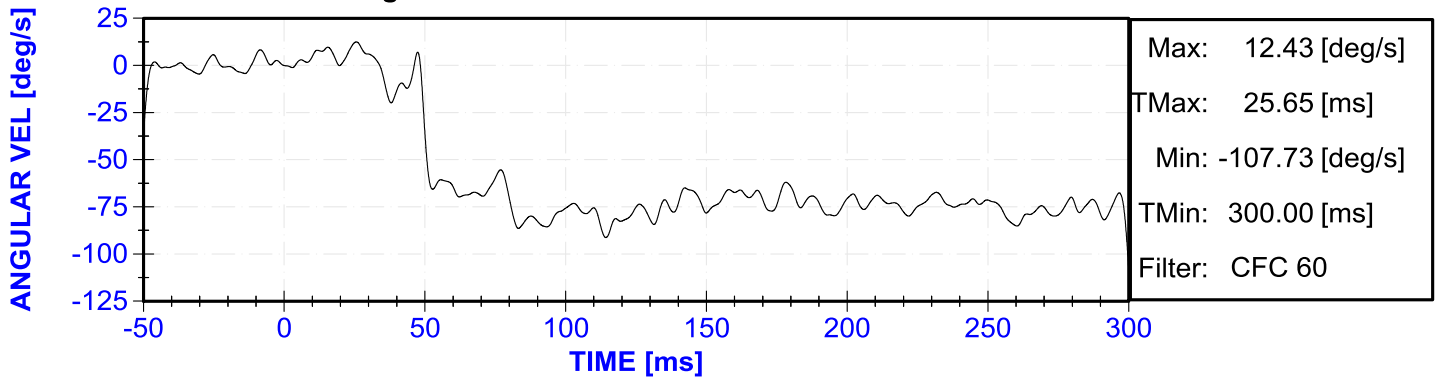
V2 Vehicle CG Angular Rate X

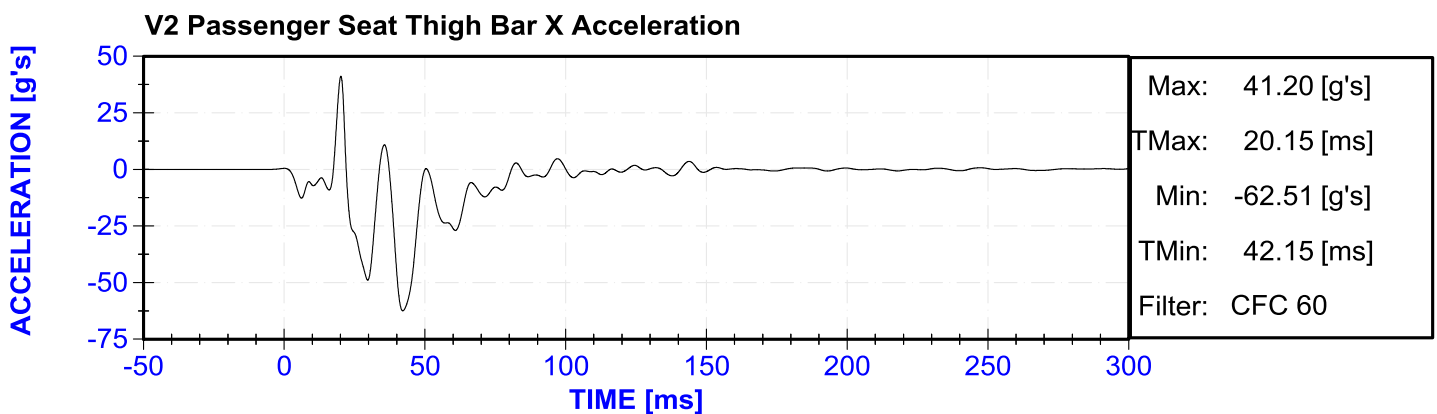
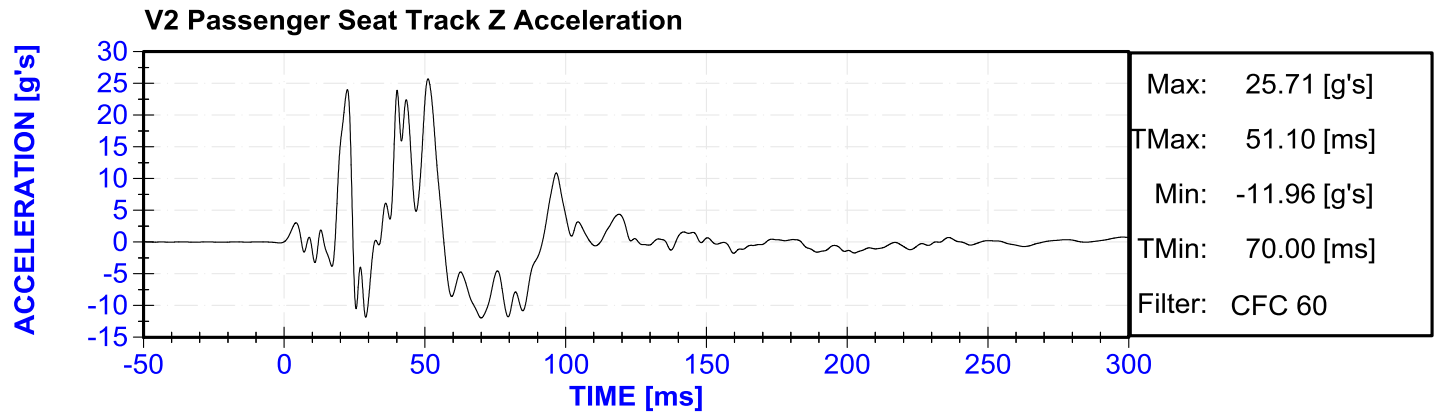
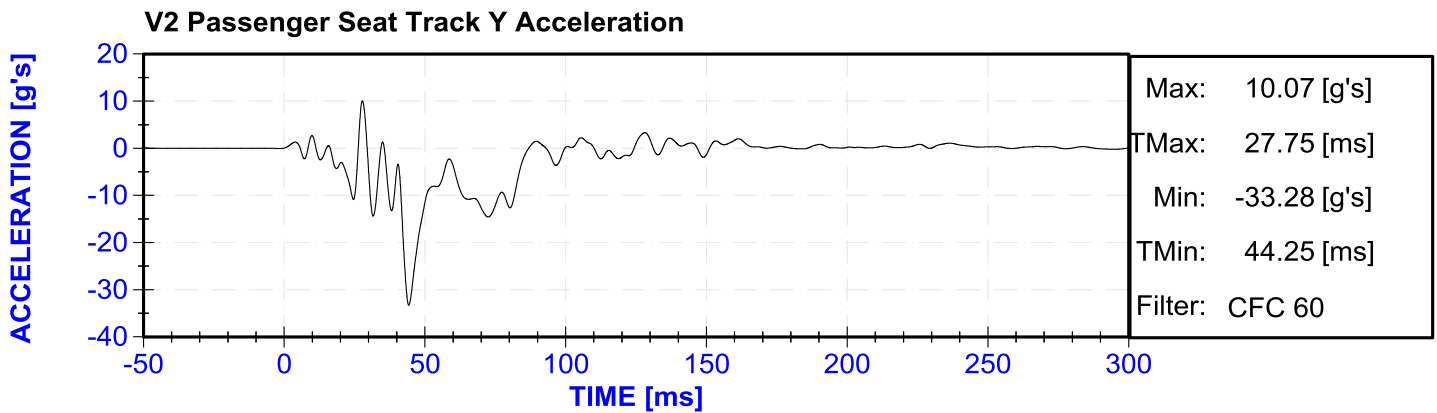
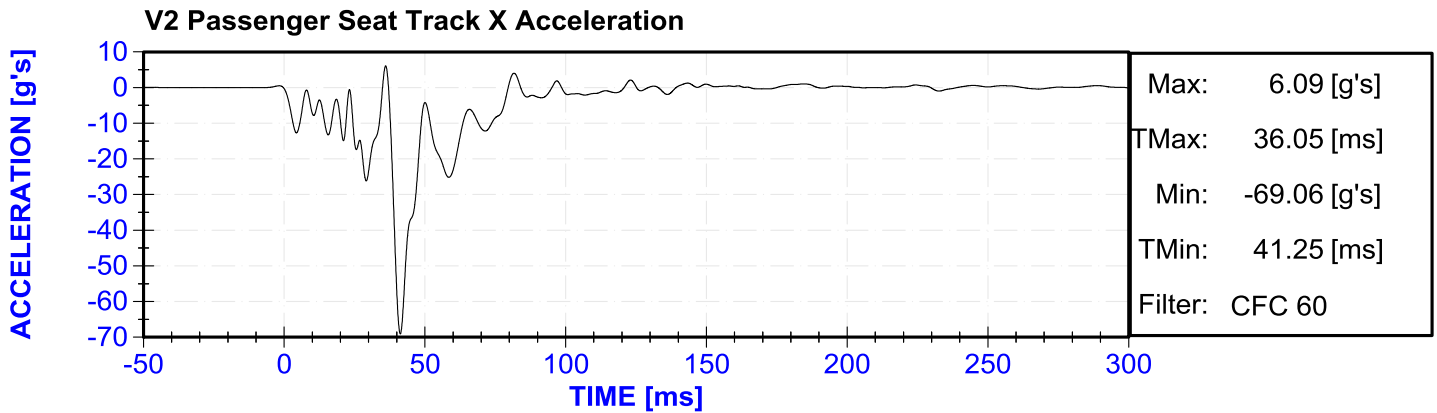


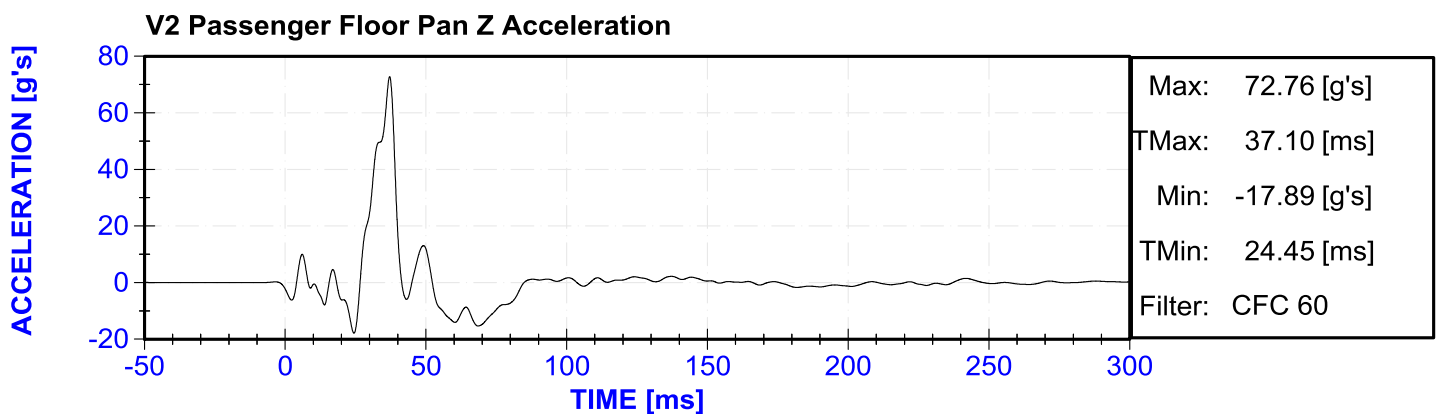
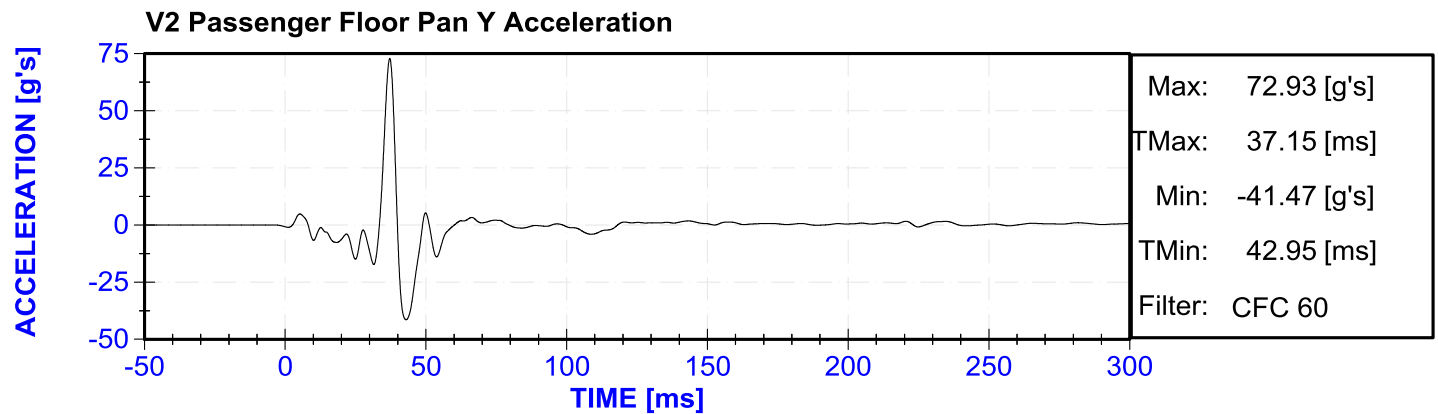
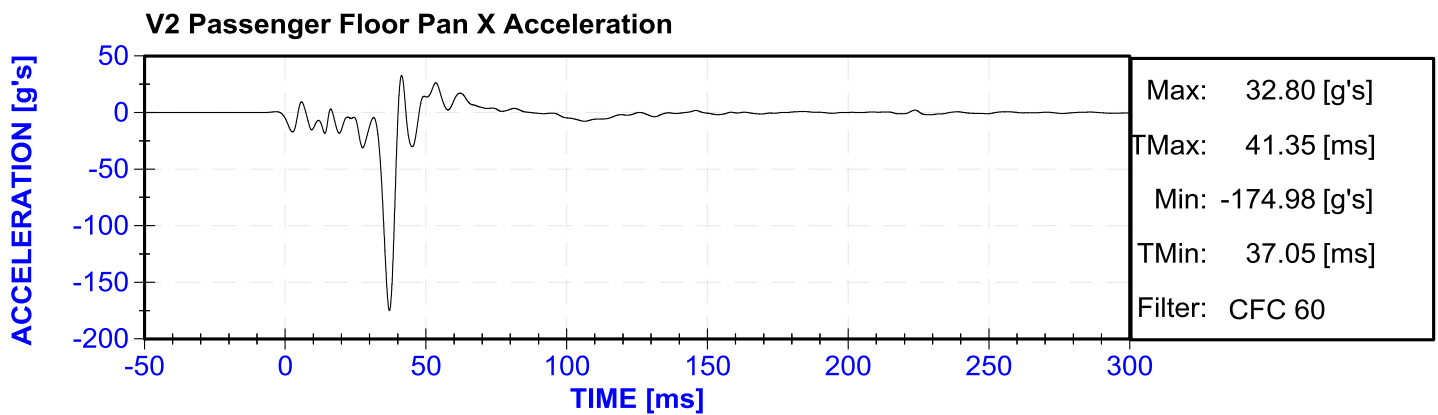
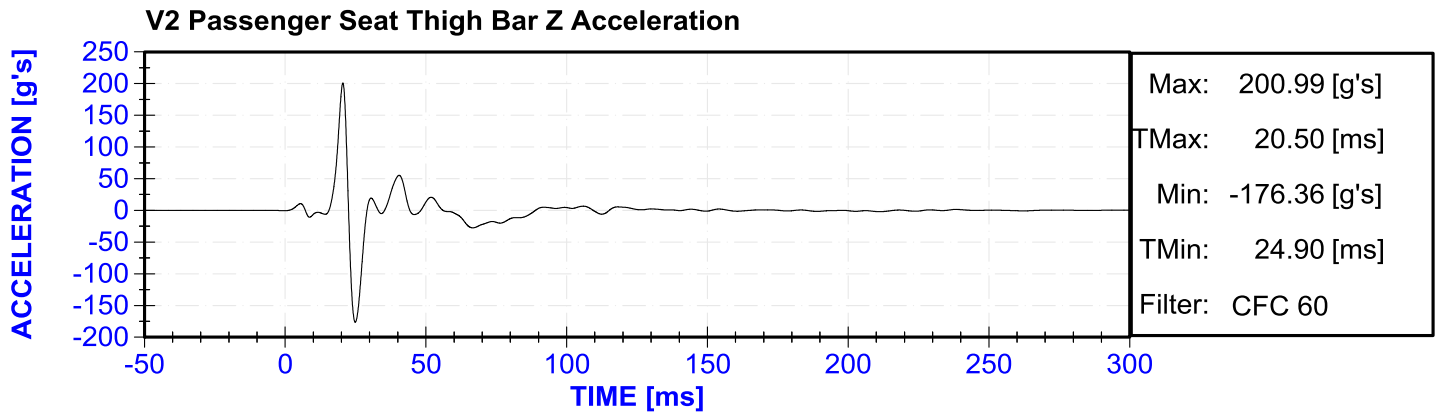
V2 Vehicle CG Angular Rate Y



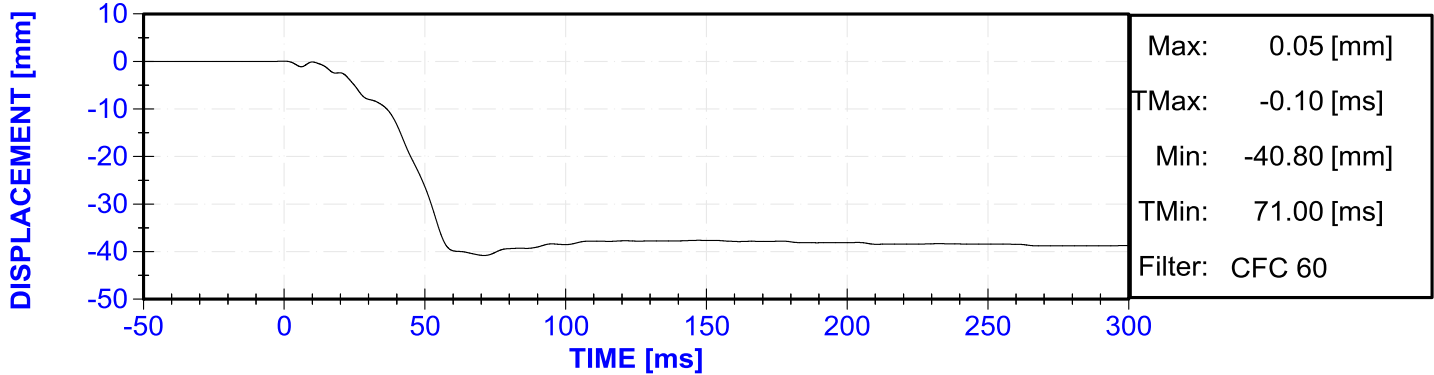
V2 Vehicle CG Angular Rate Z



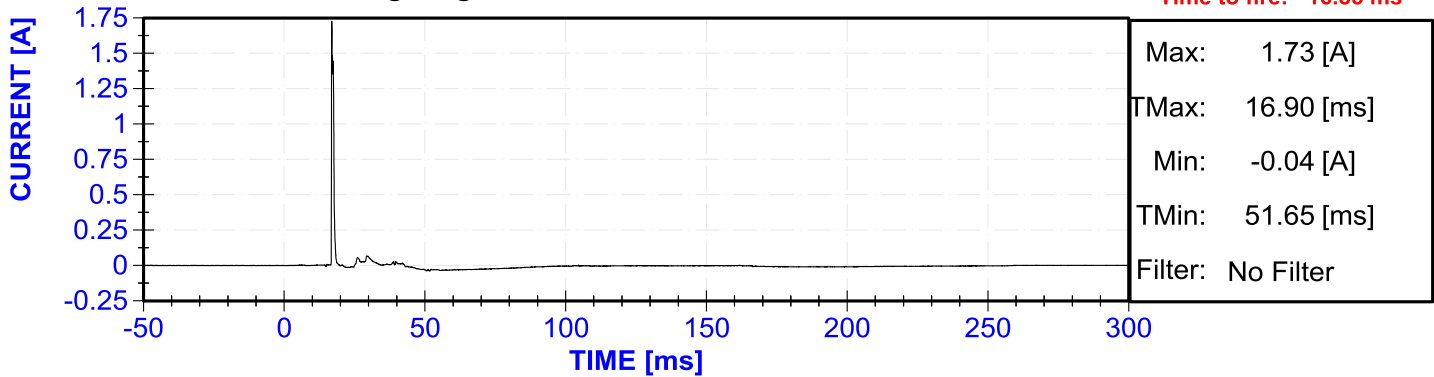




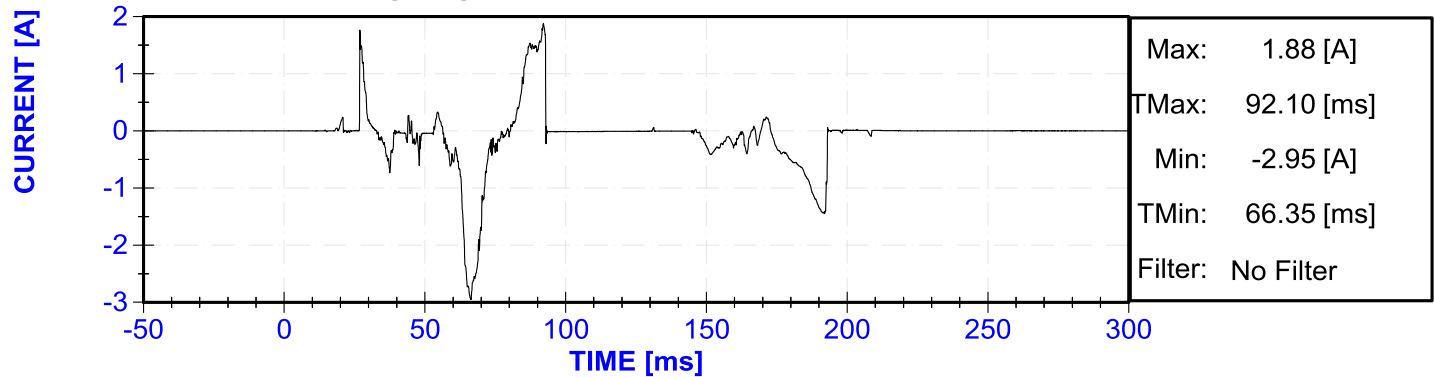
V2 Passenger Floor Pan X Deflection



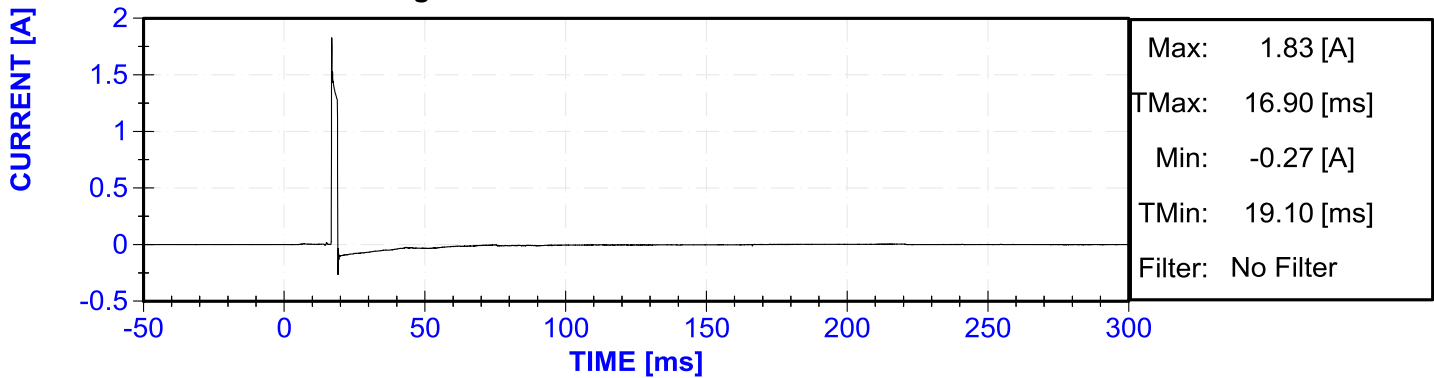
Driver Front Airbag Stage 1 Monitor

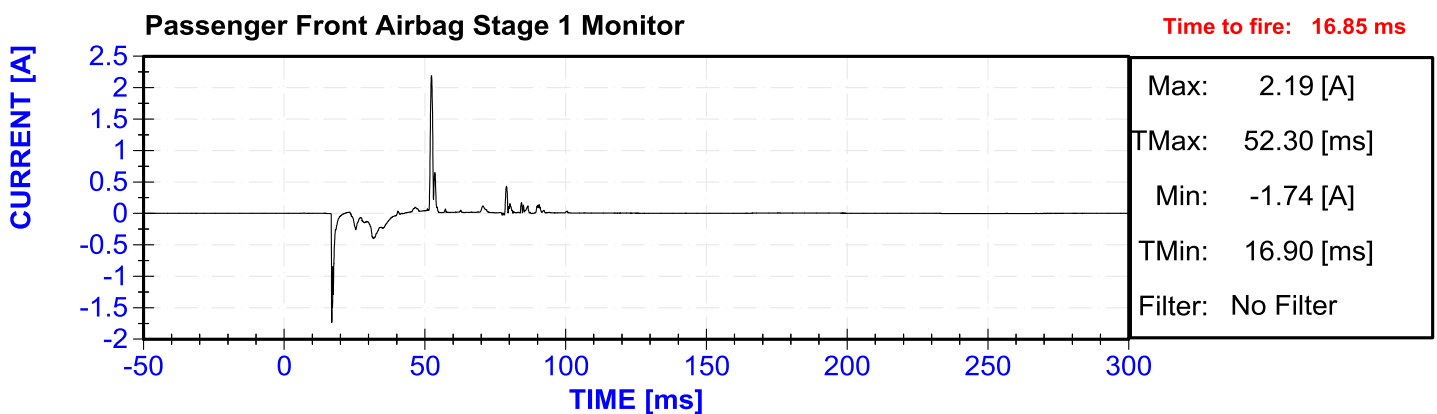
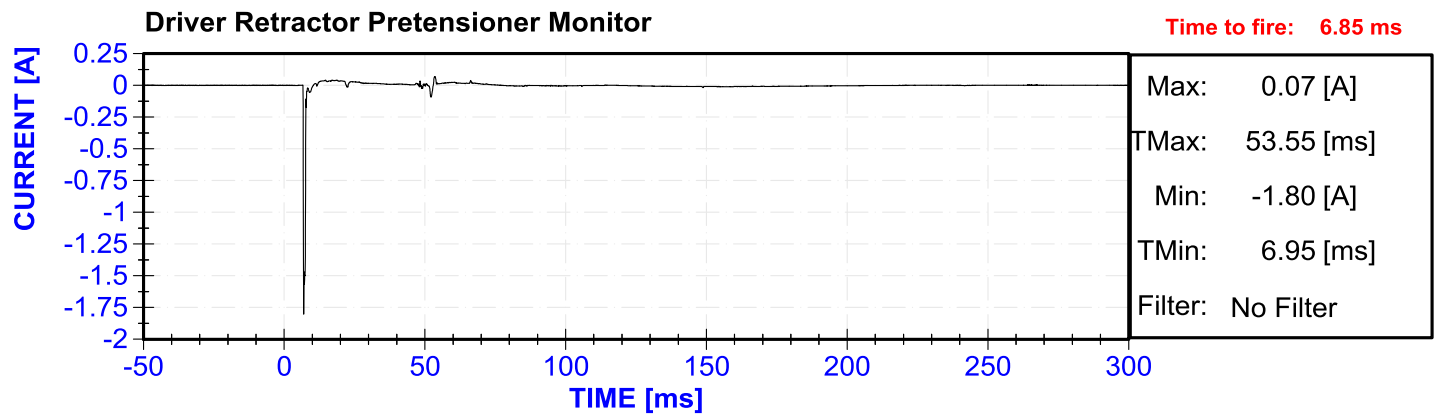
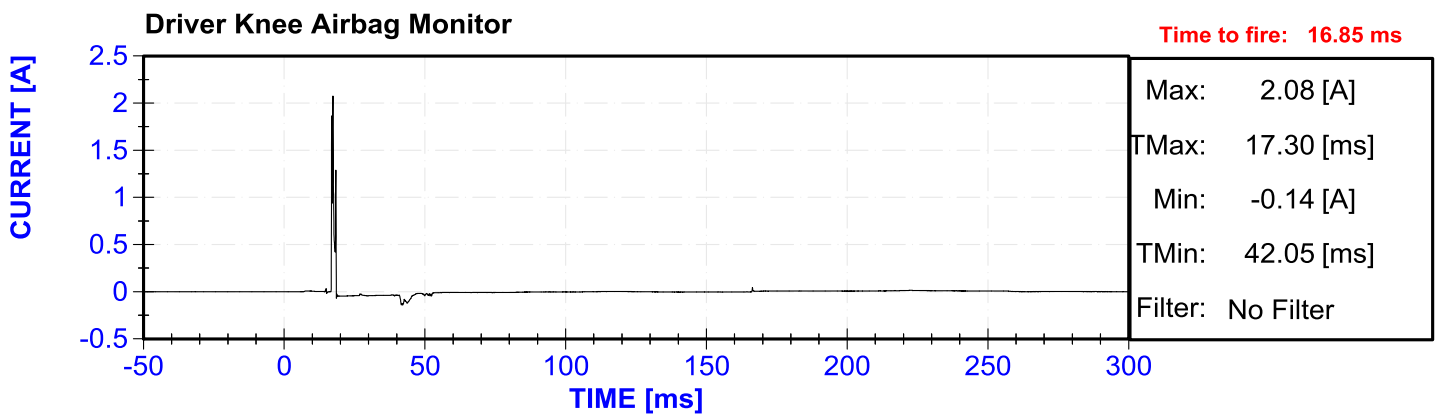
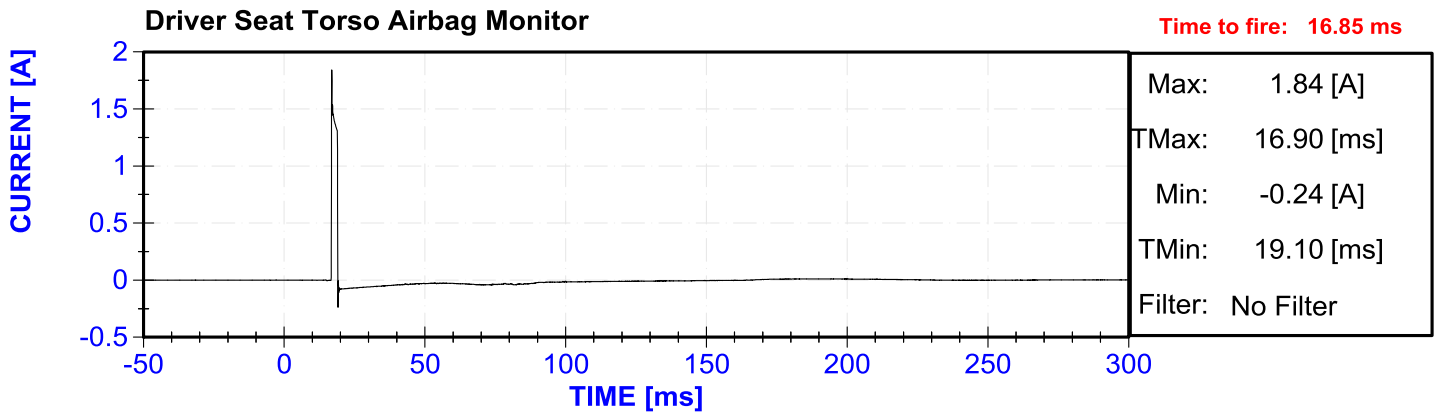


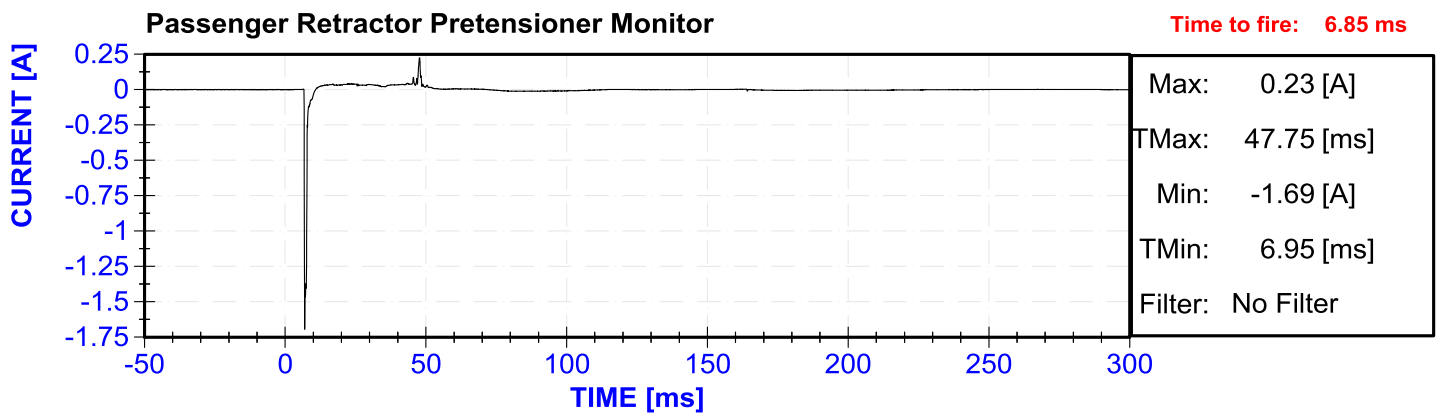
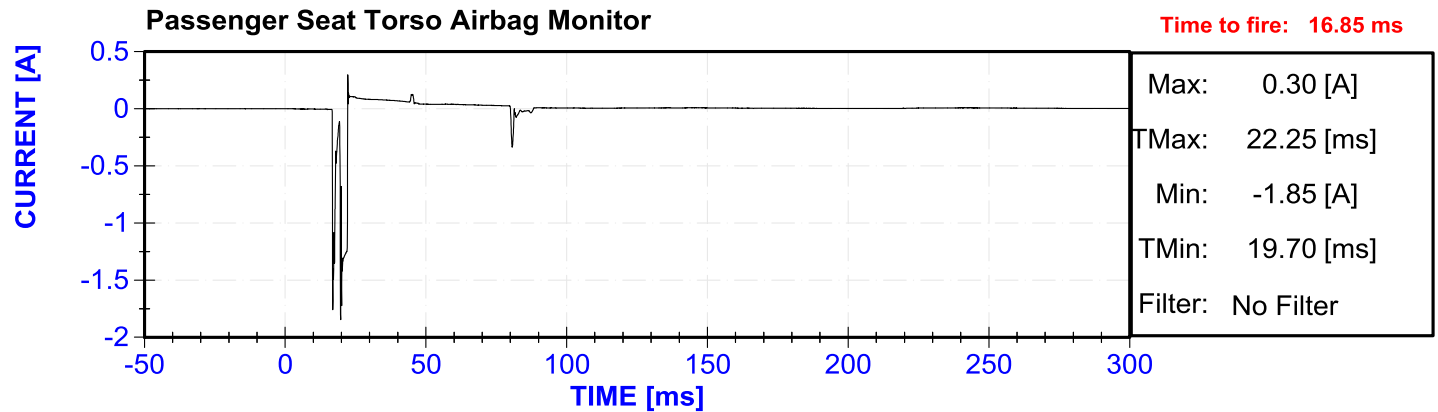
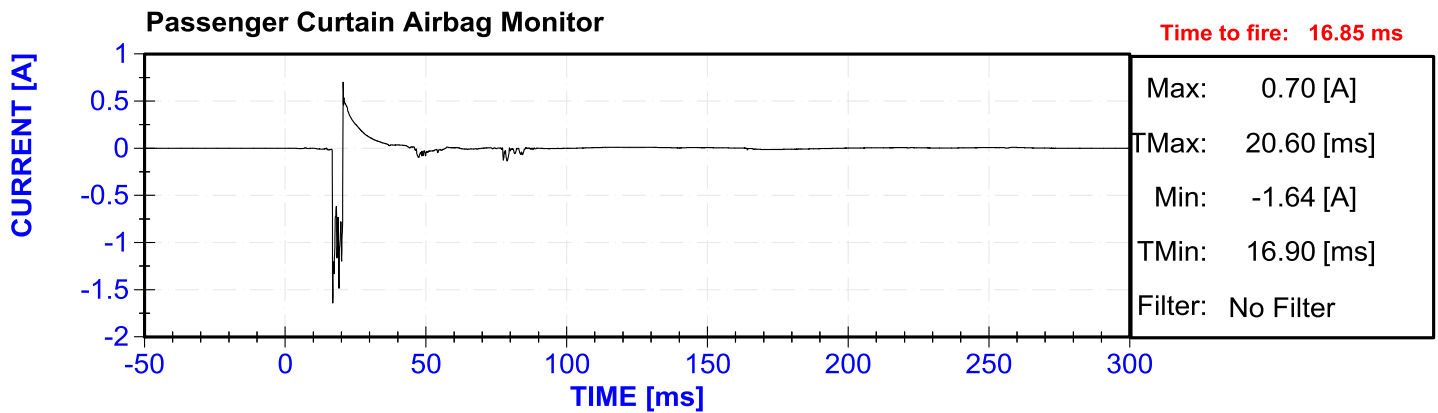
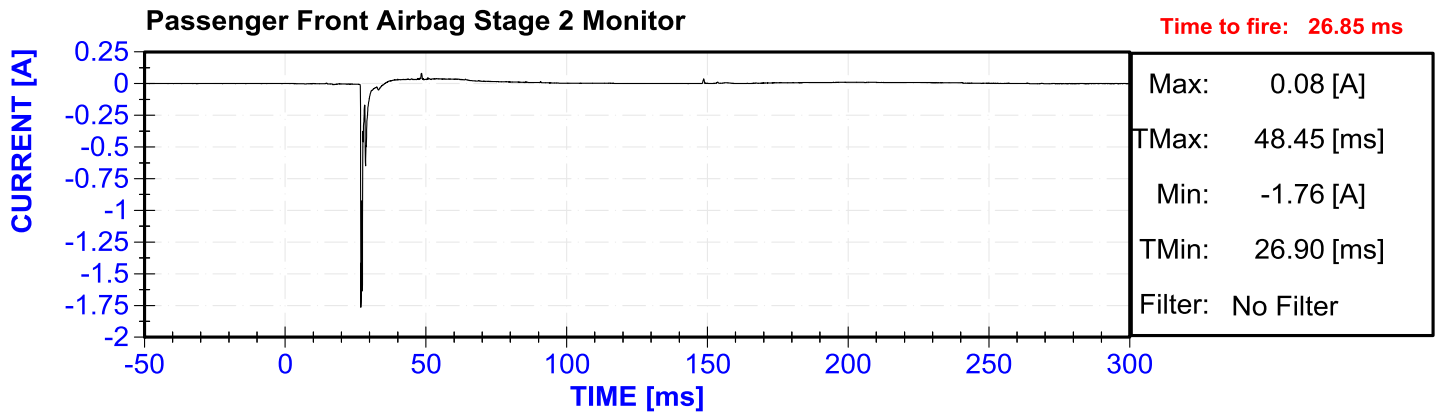
Driver Front Airbag Stage 2 Monitor

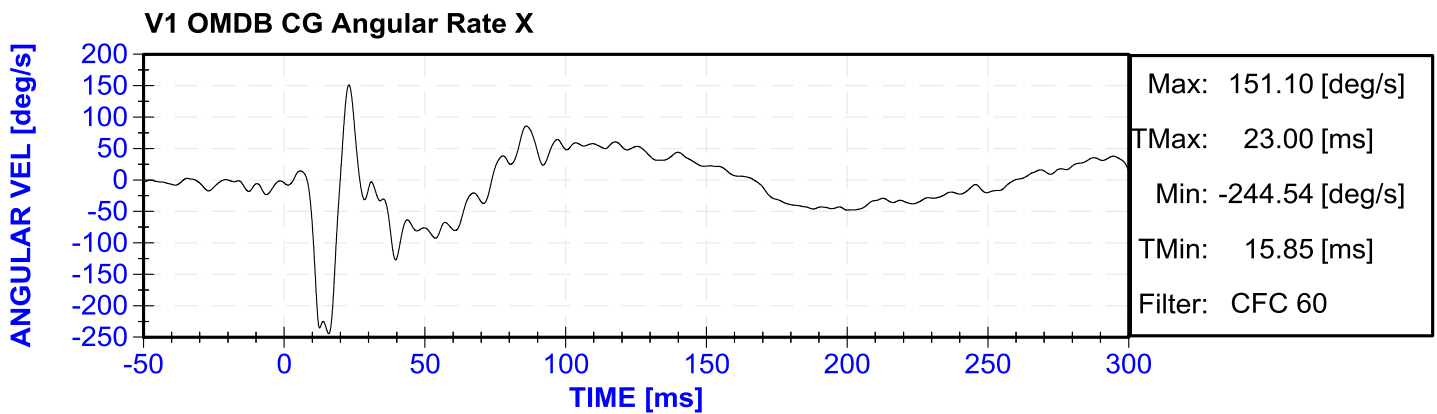
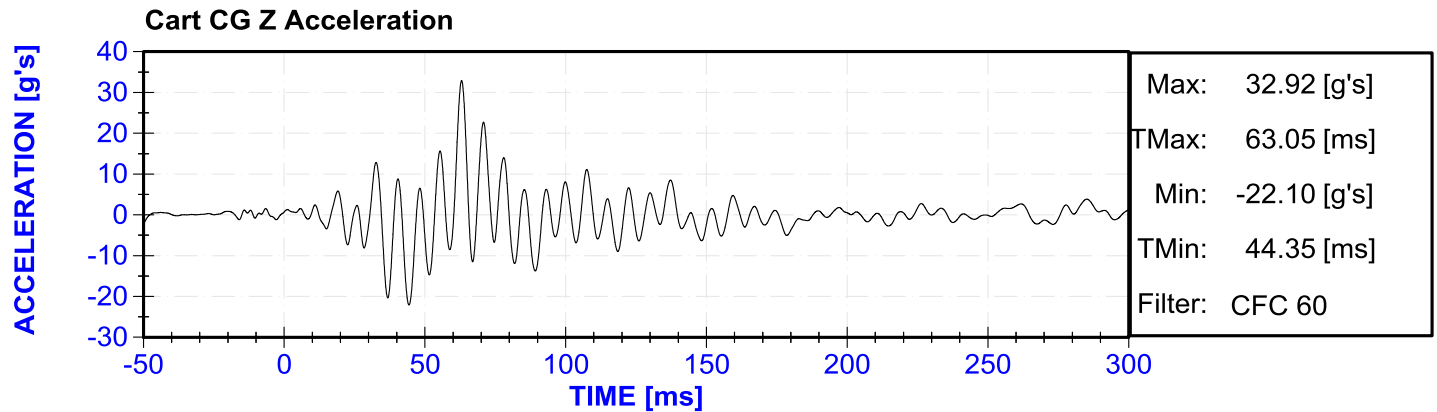
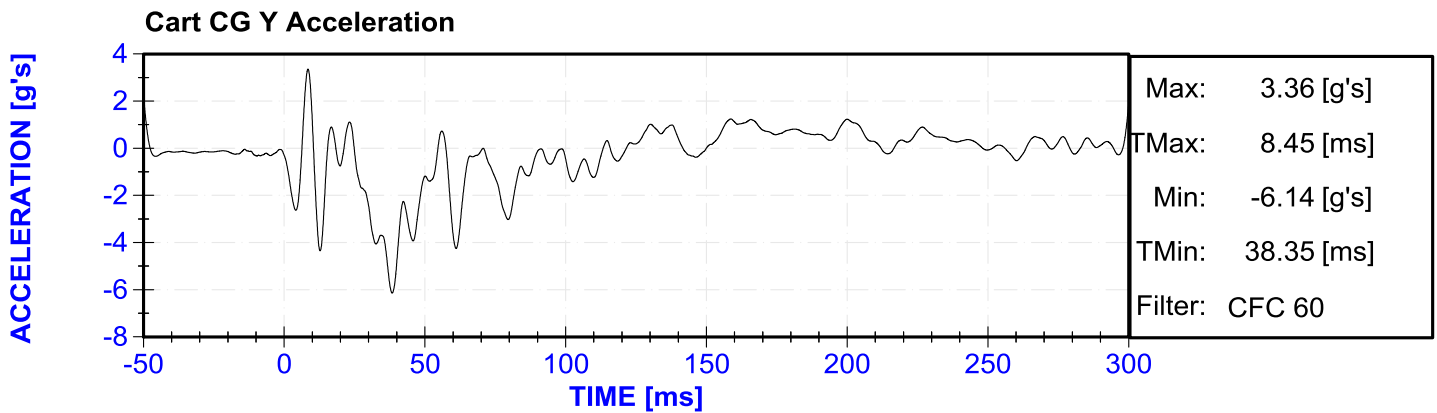
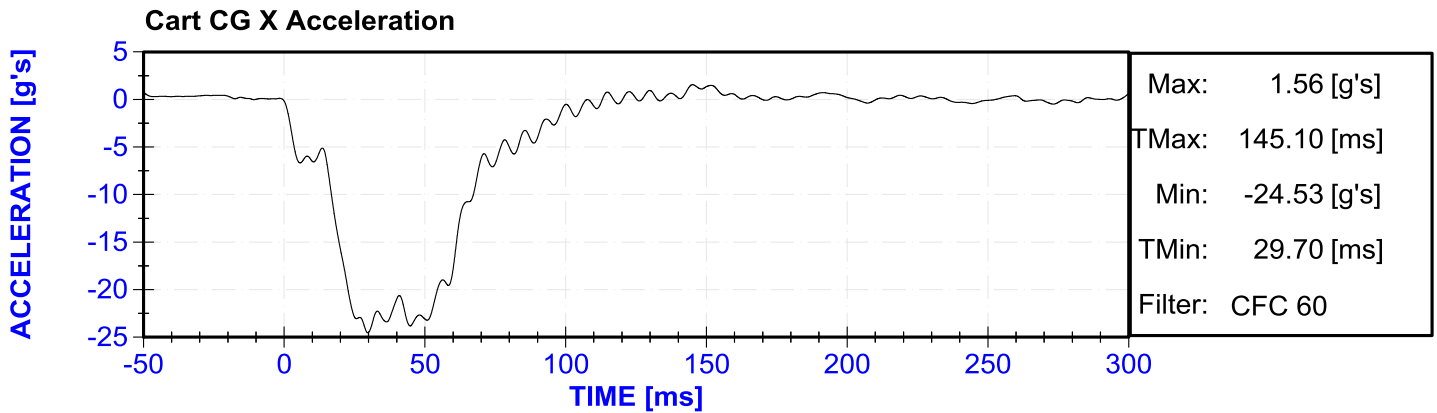


Driver Curtain Airbag Monitor

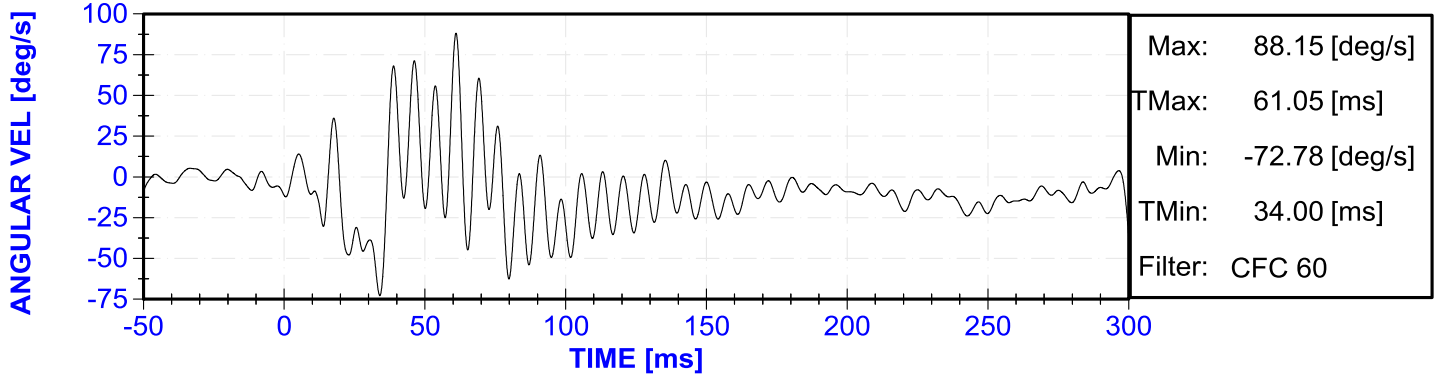




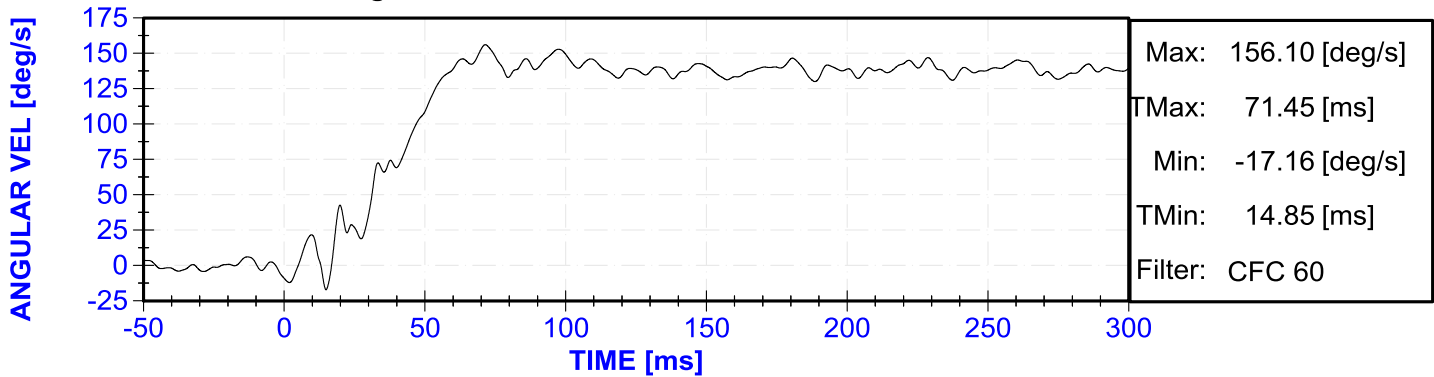




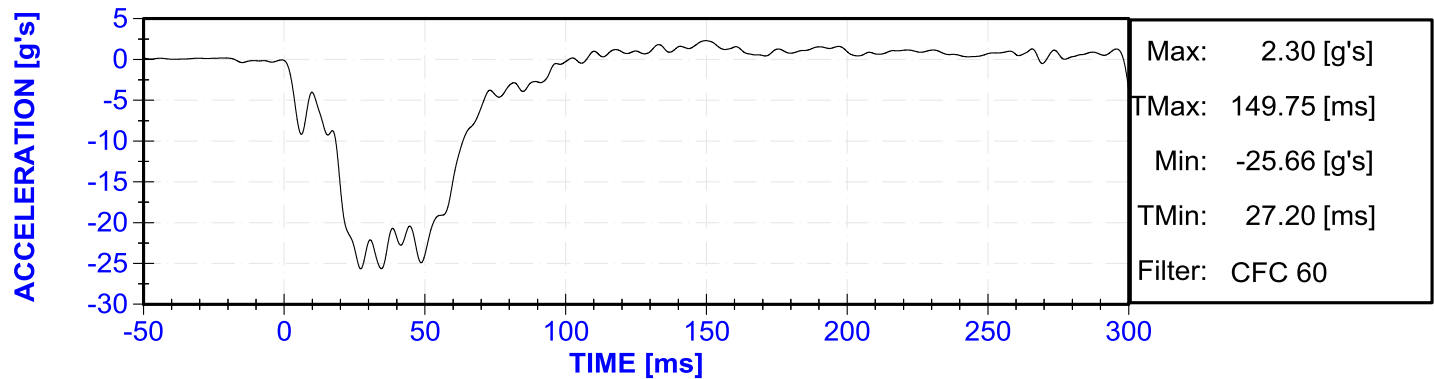
V1 OMDB CG Angular Rate Y



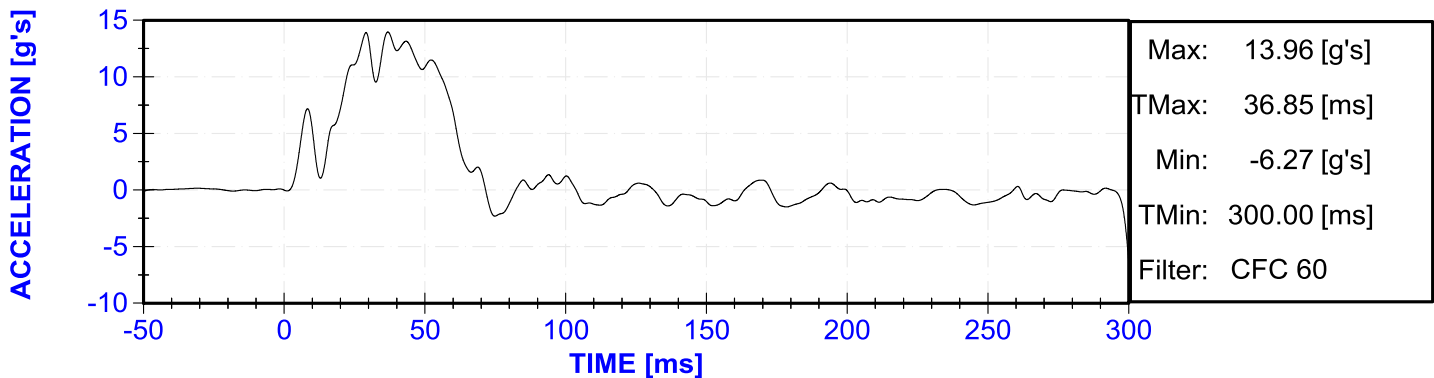
V1 OMDB CG Angular Rate Z

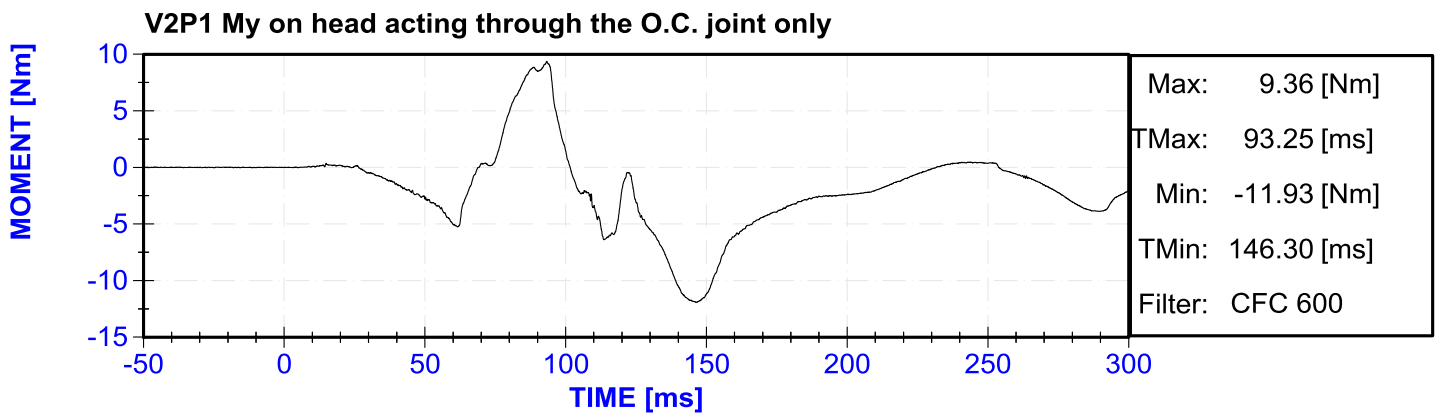
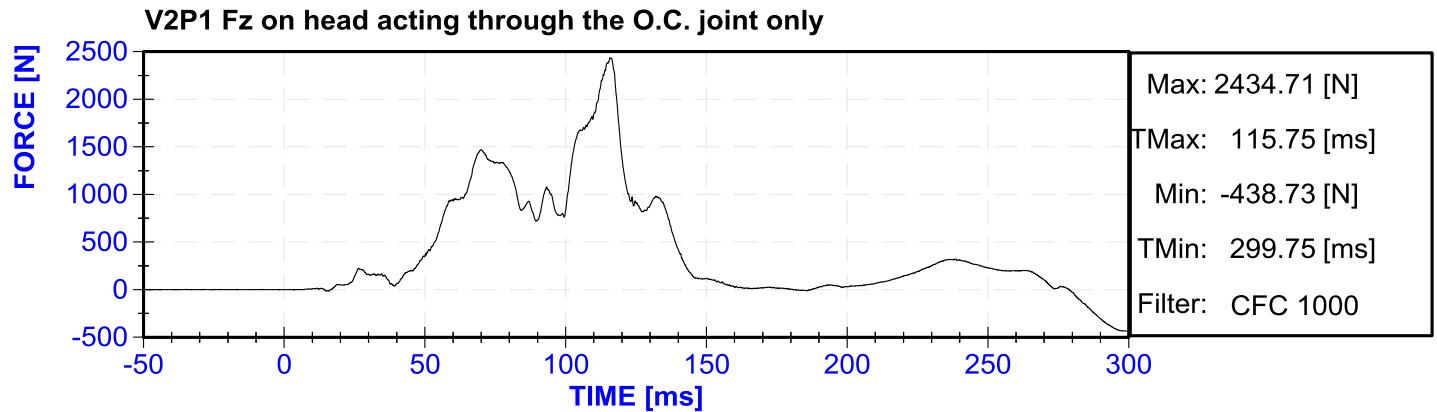
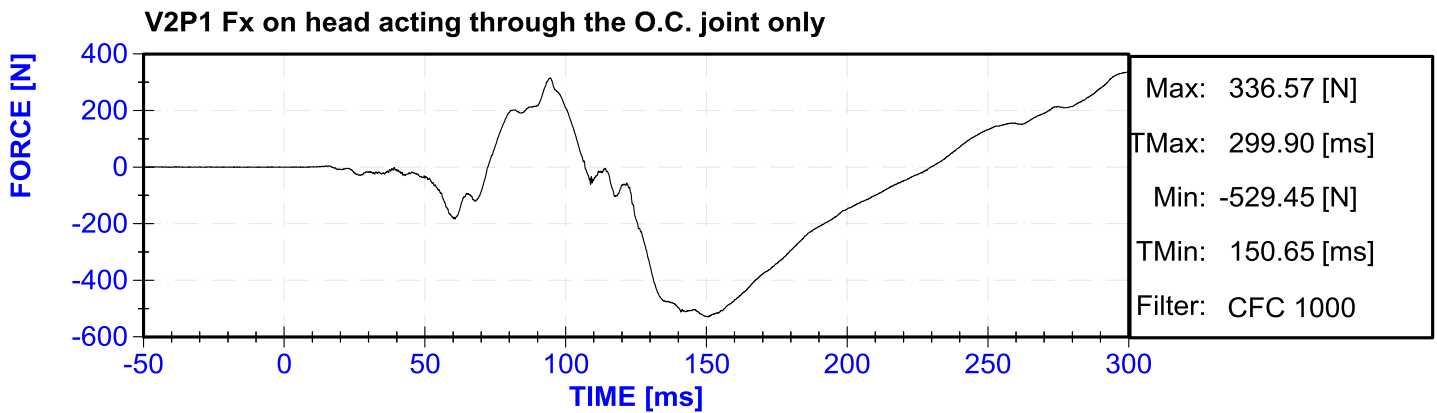
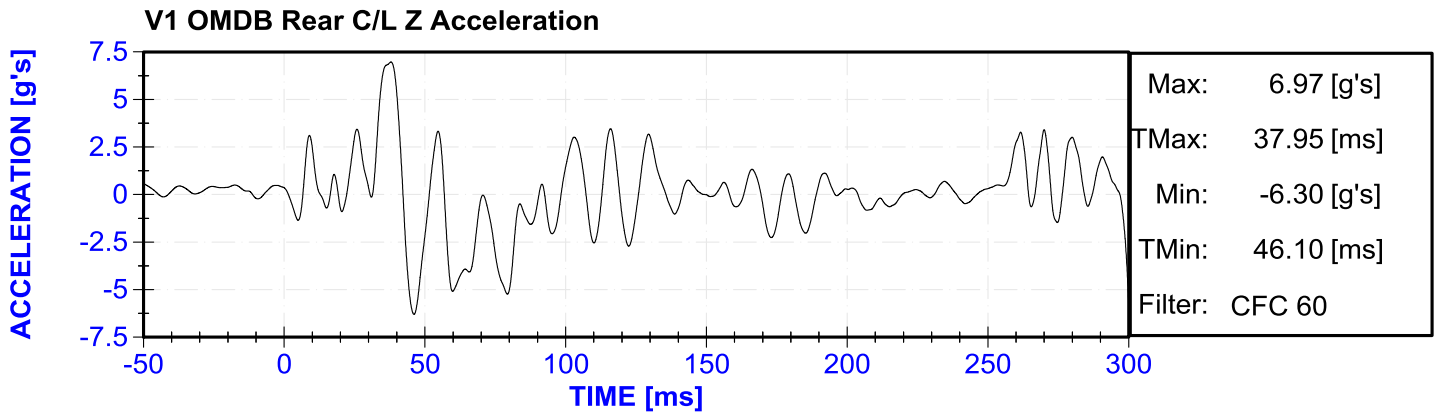


V1 OMDB Rear C/L X Acceleration

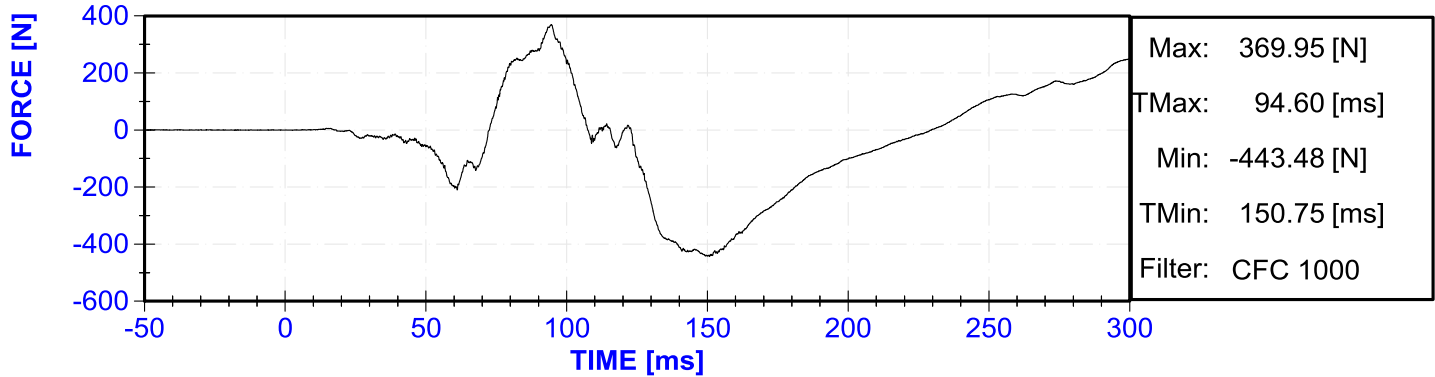


V1 OMDB Rear C/L Y Acceleration

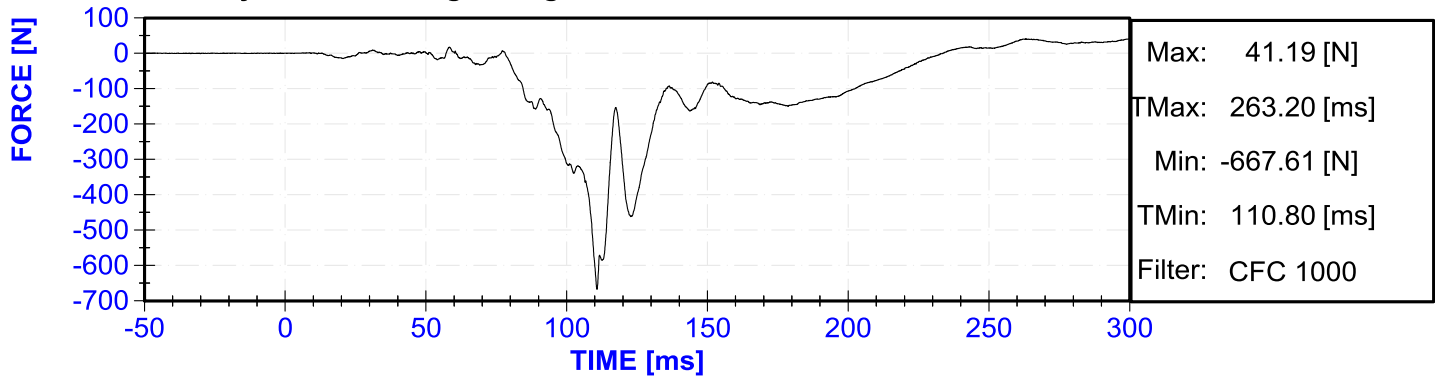




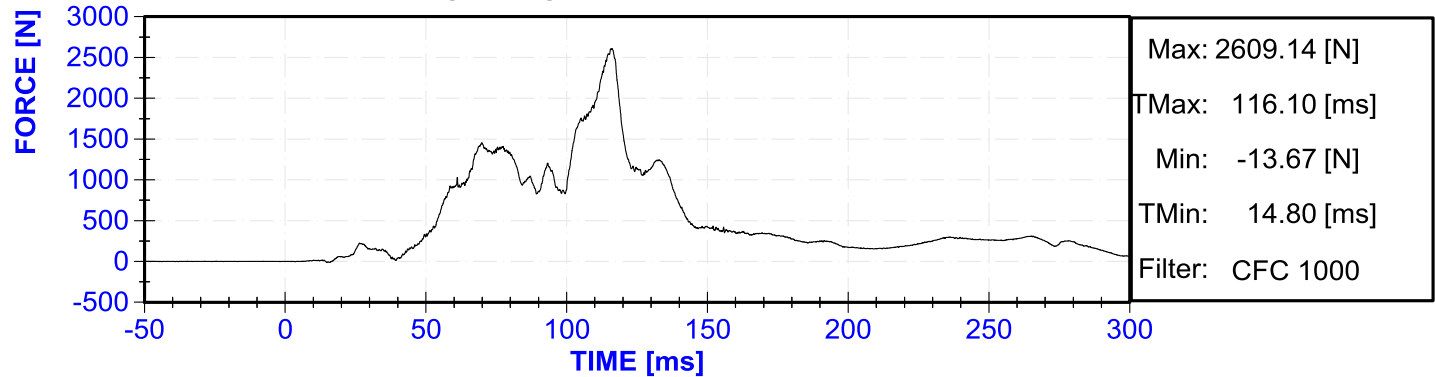
V2P1 Fx on head acting through the total neck section



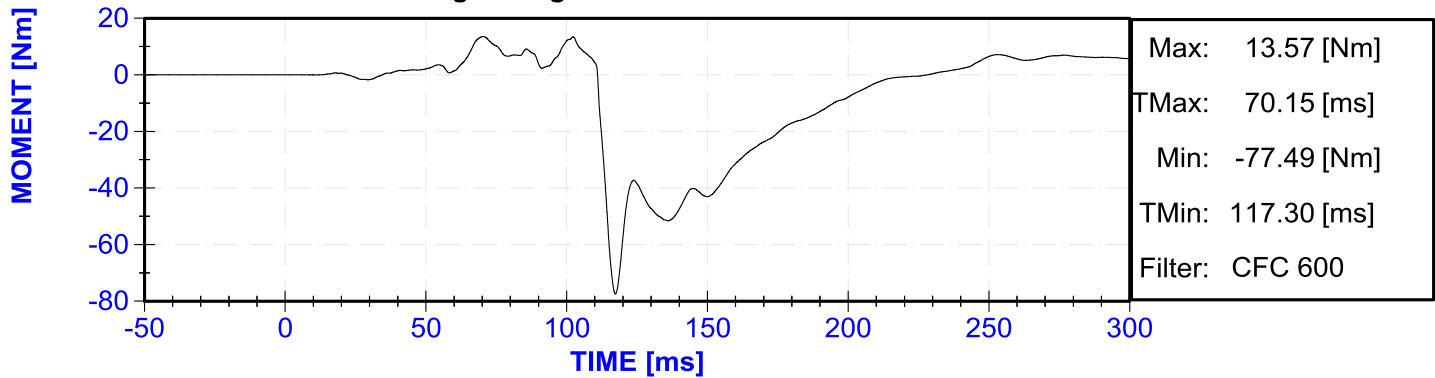
V2P1 Fy on head acting through the total neck section



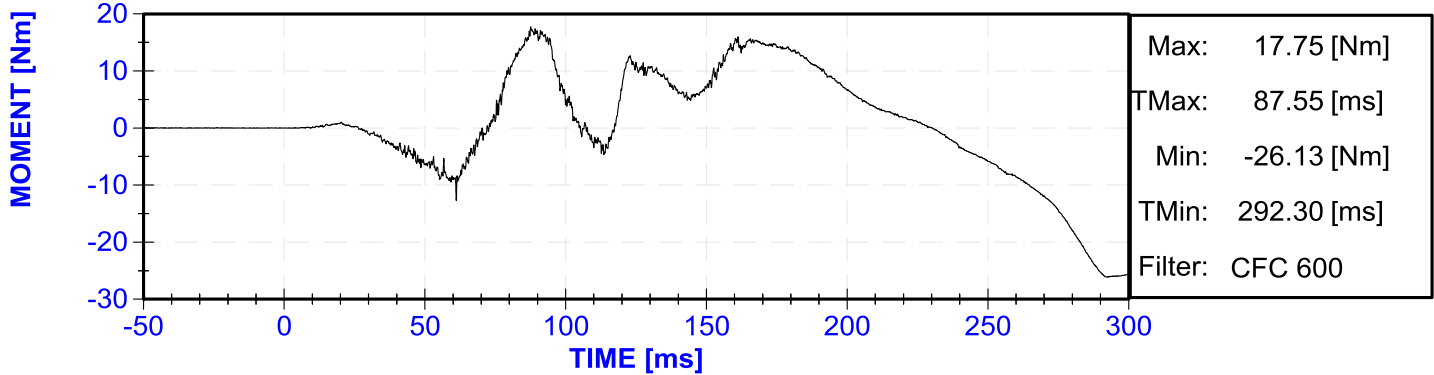
V2P1 Fz on head acting through the total neck section



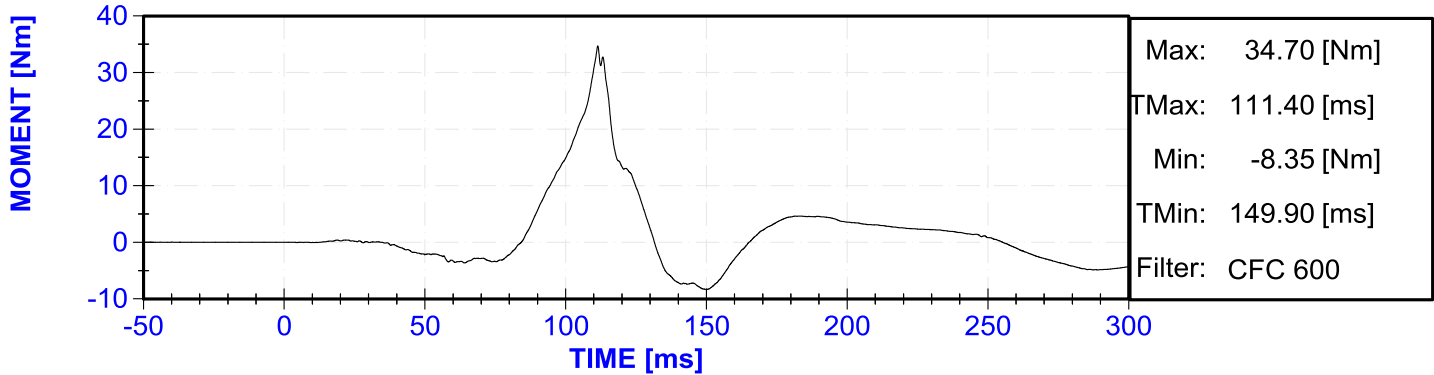
V2P1 Mx on head acting through the total neck section



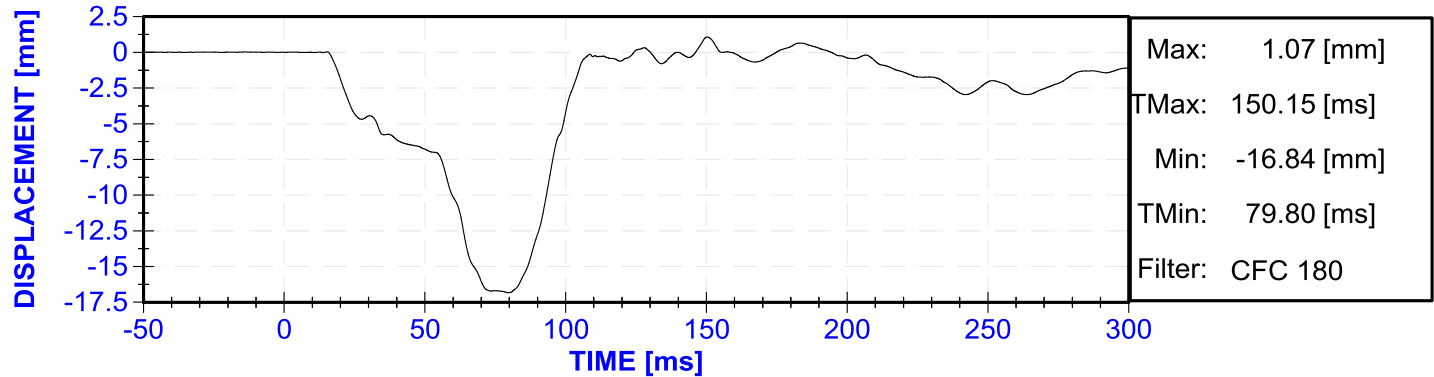
V2P1 My on head acting through the total neck section



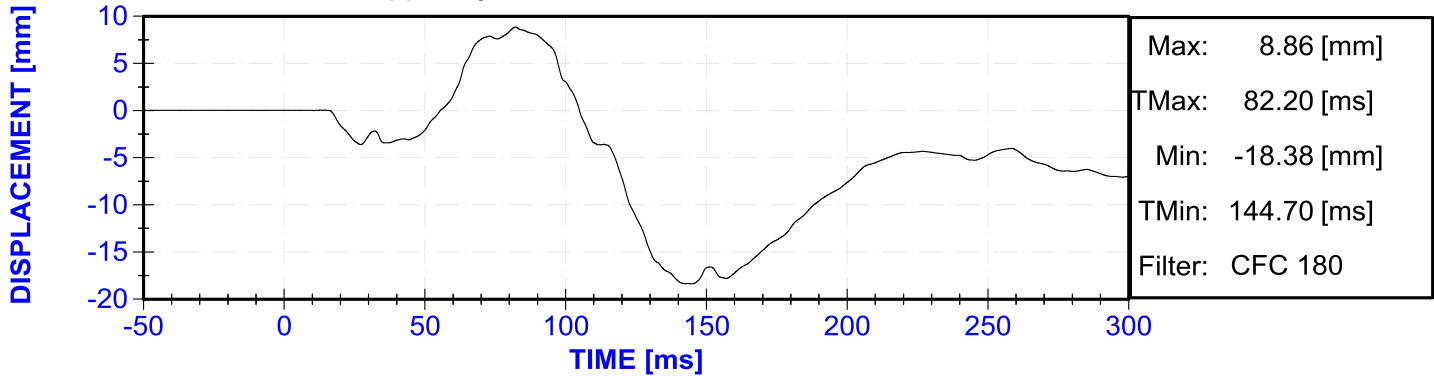
V2P1 Mz on head acting through the total neck section

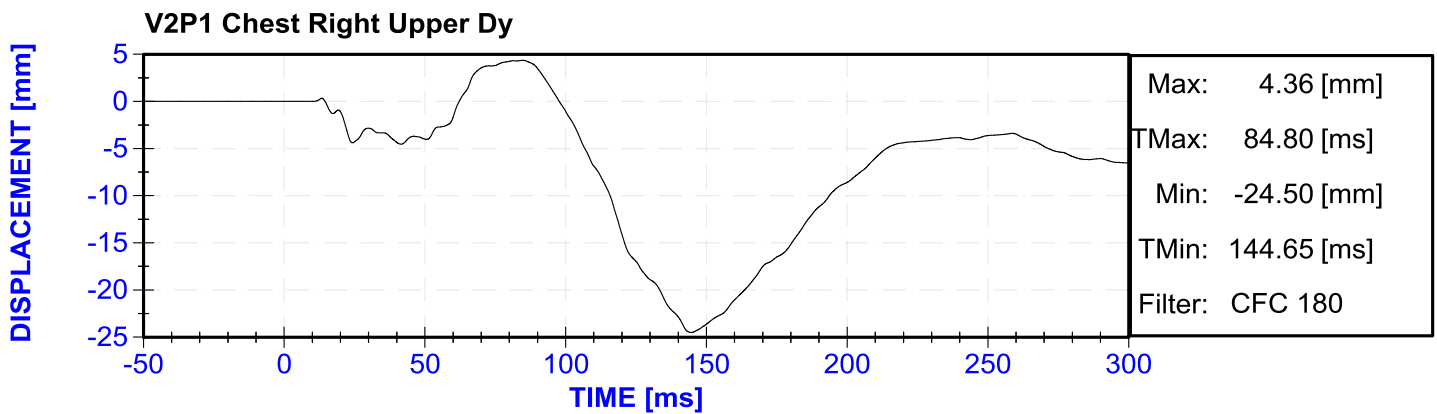
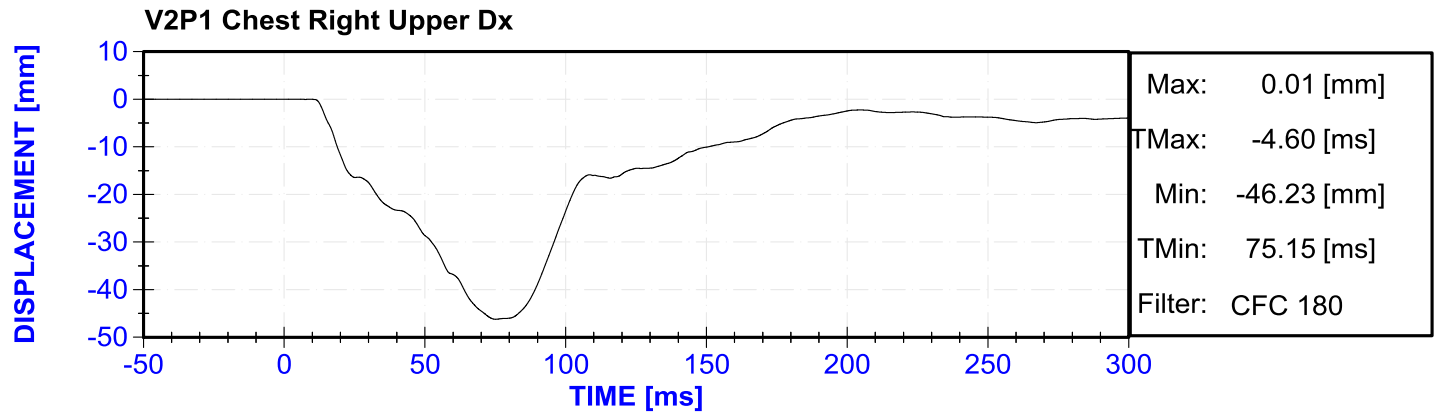
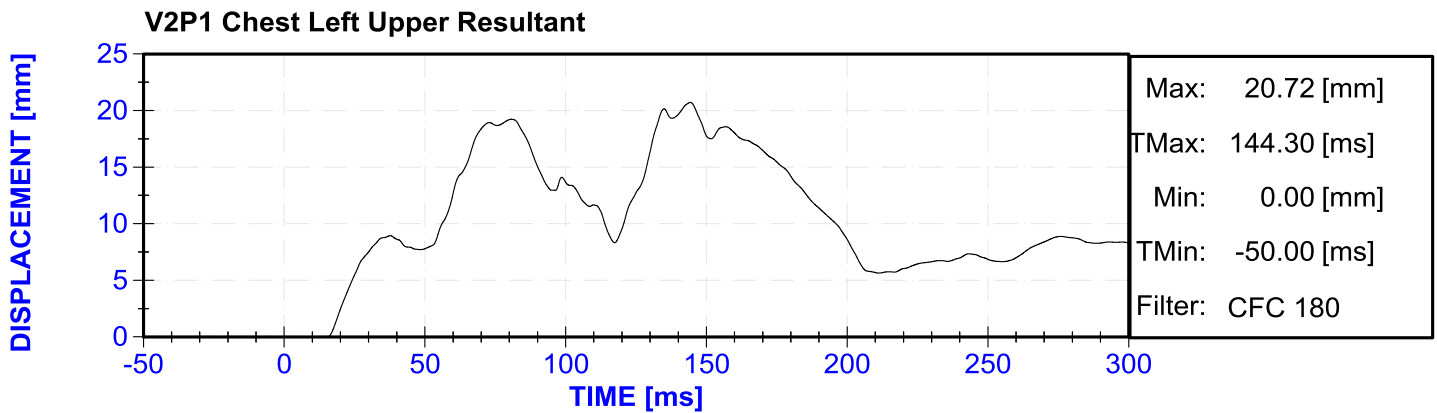
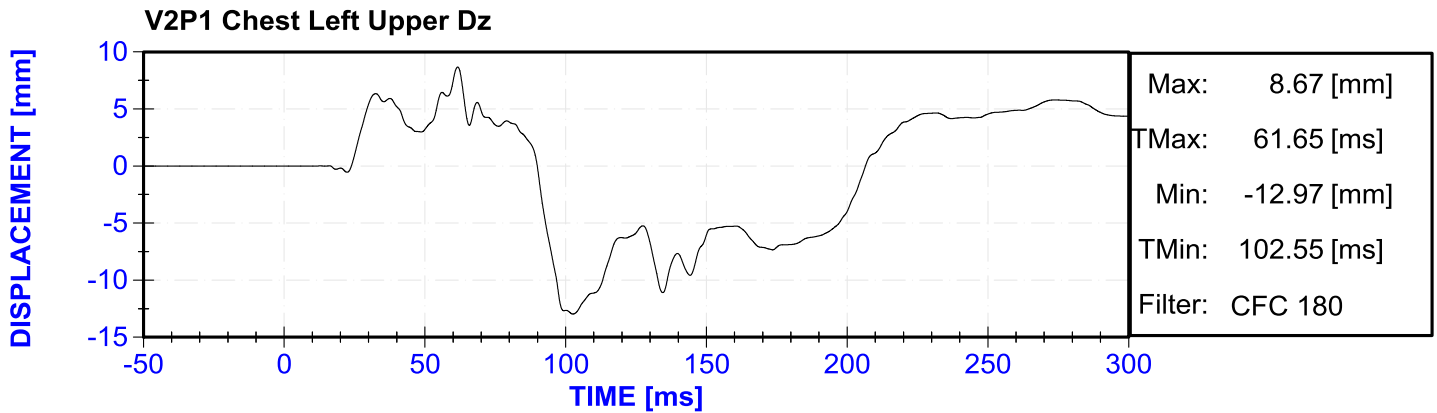


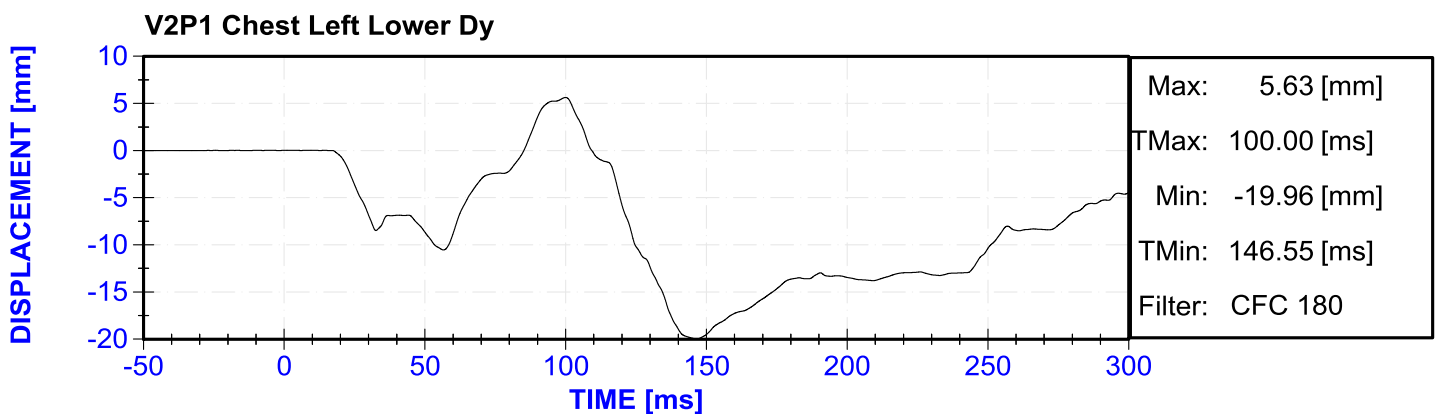
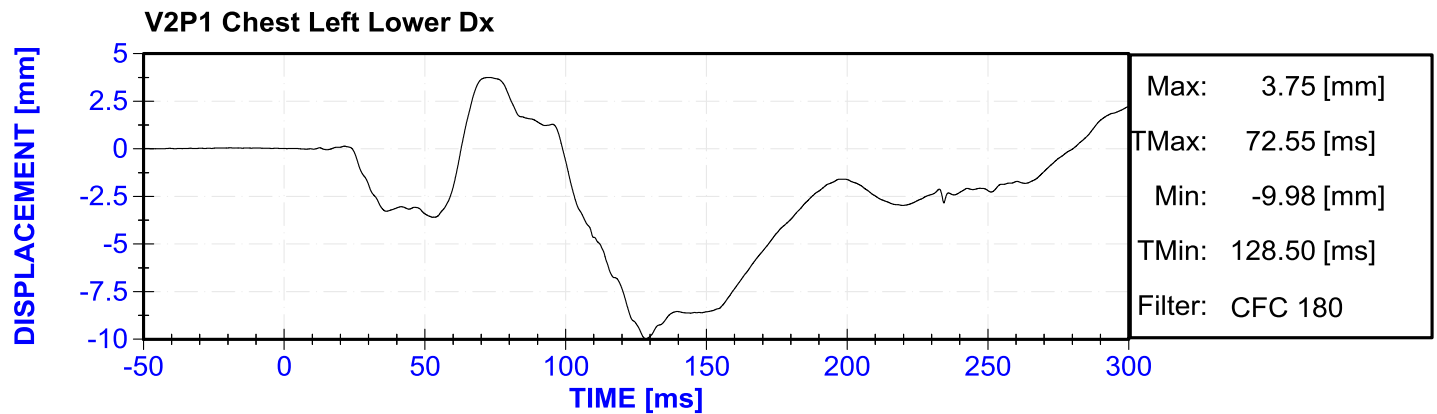
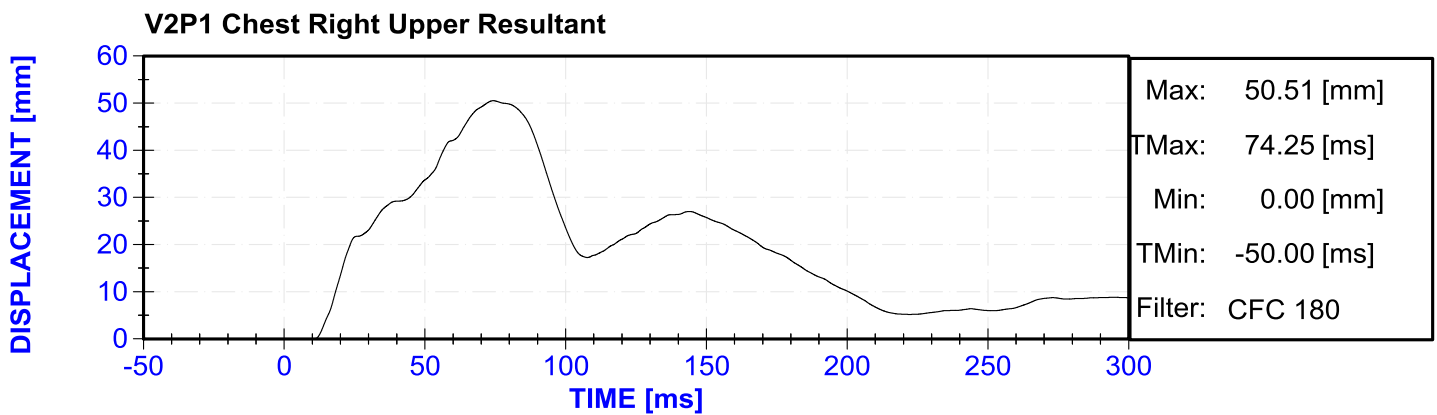
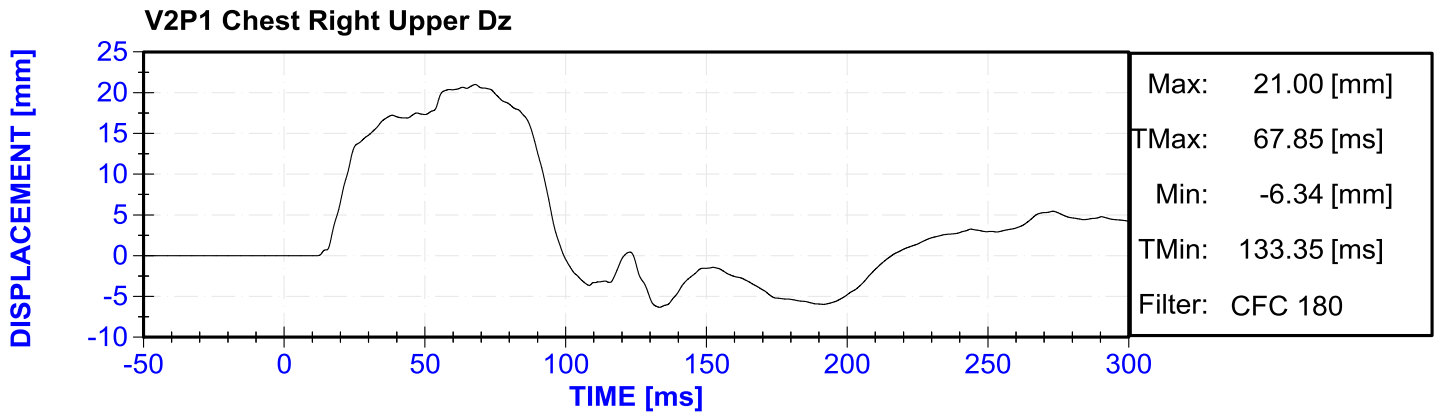
V2P1 Chest Left Upper Dx

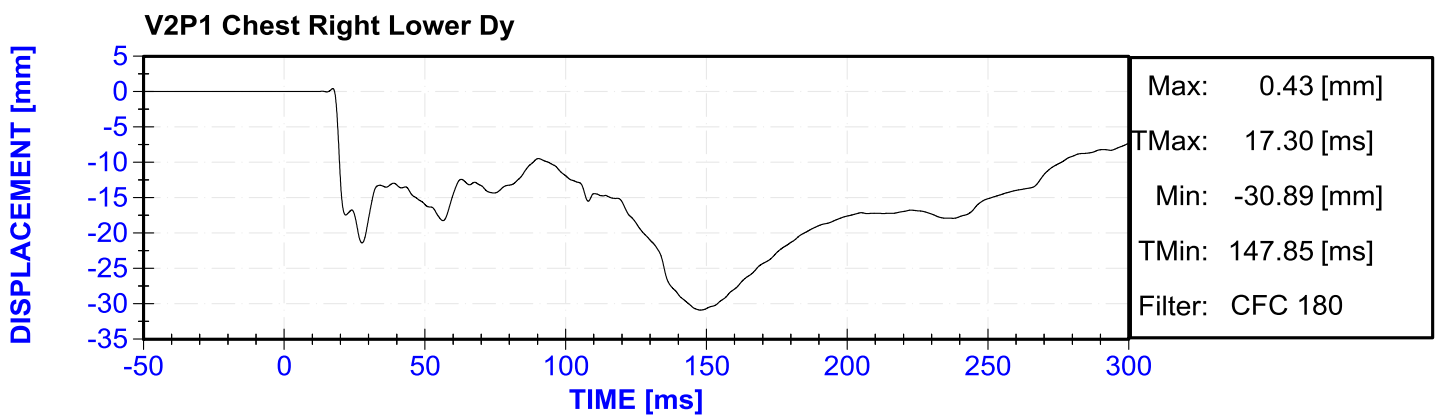
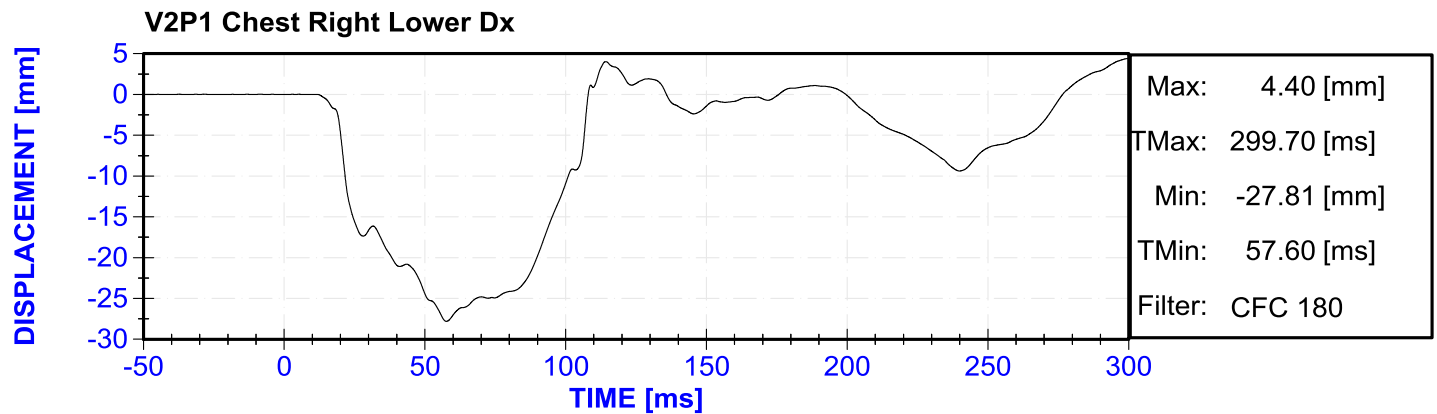
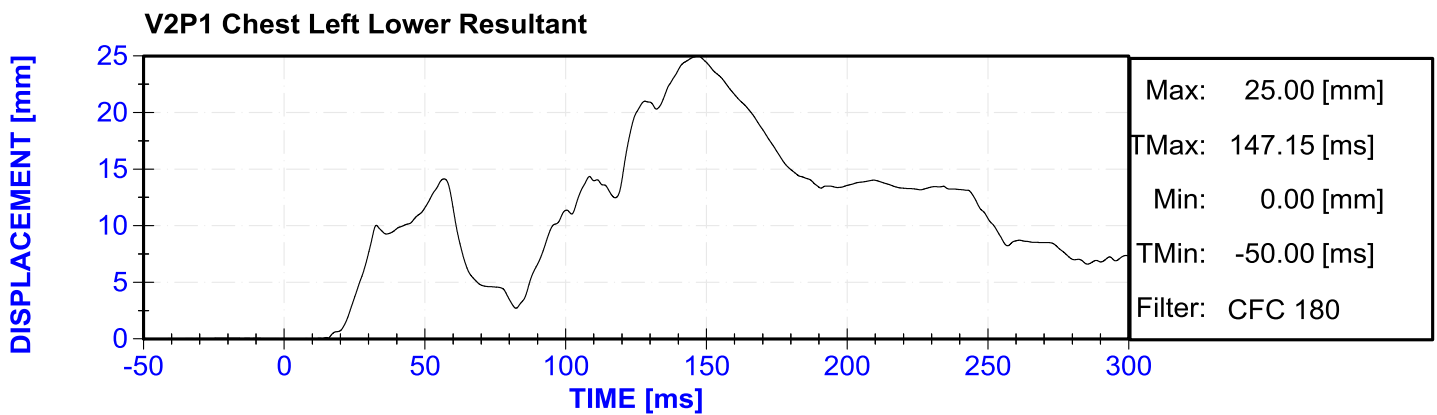
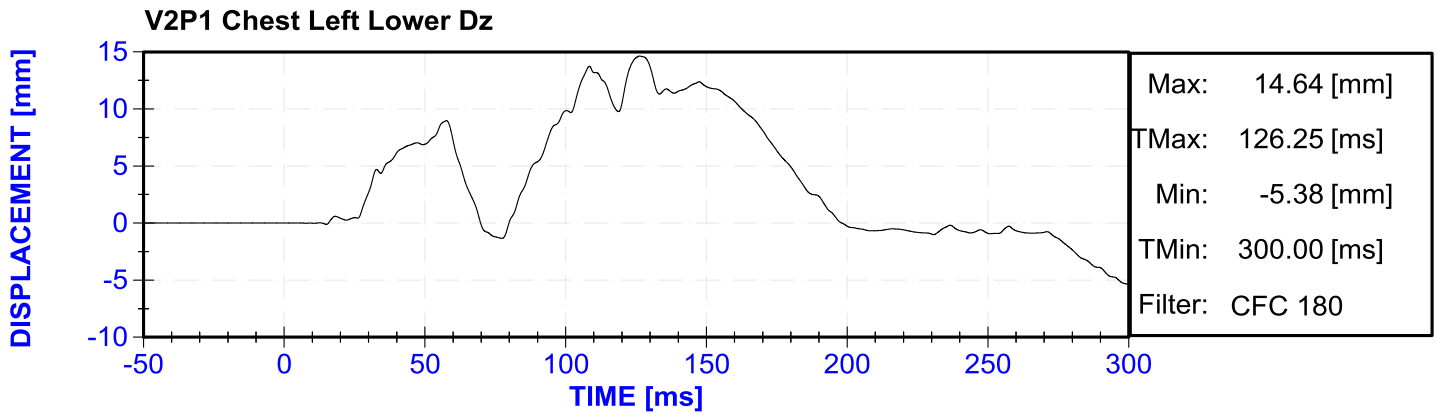


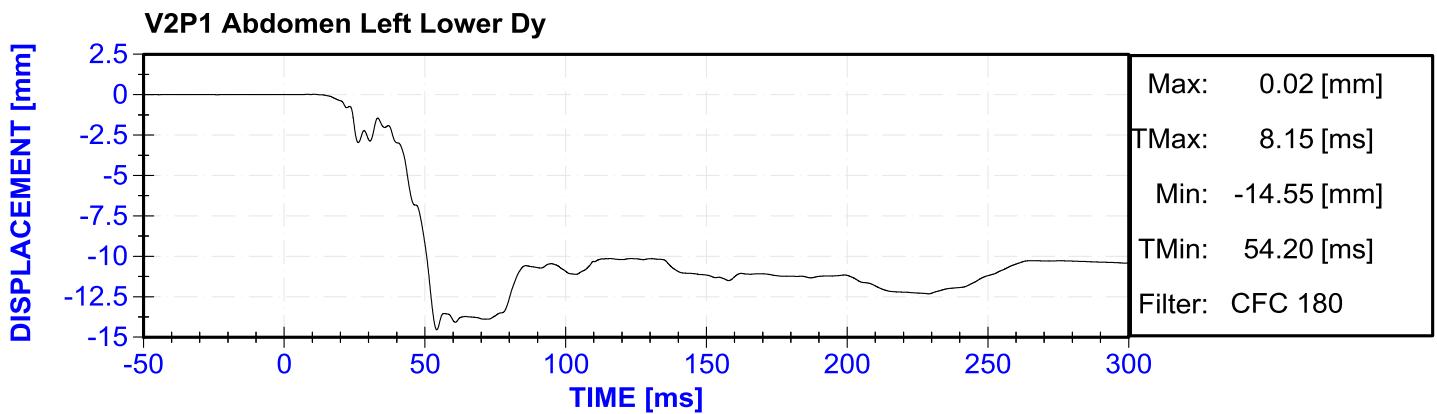
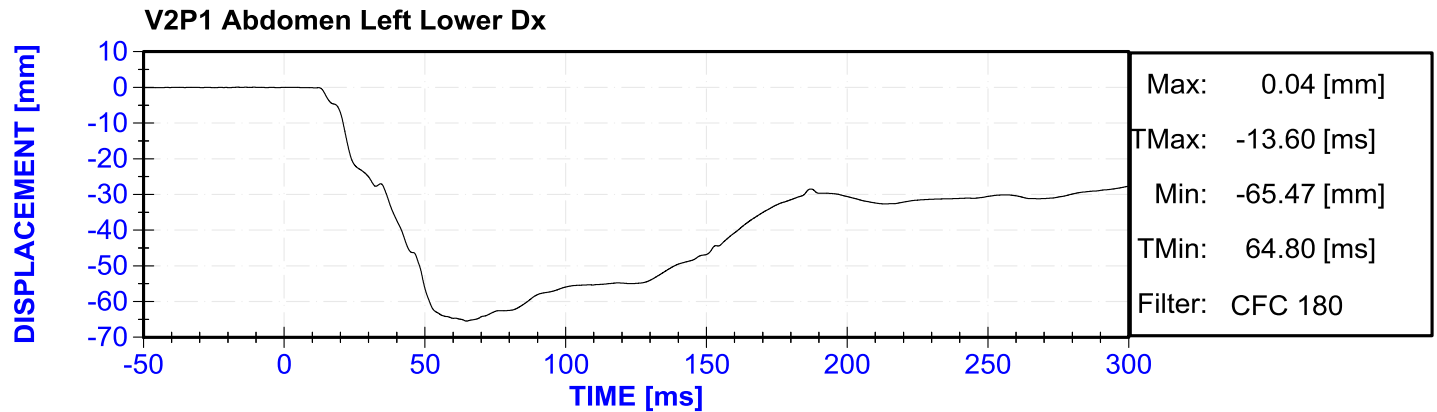
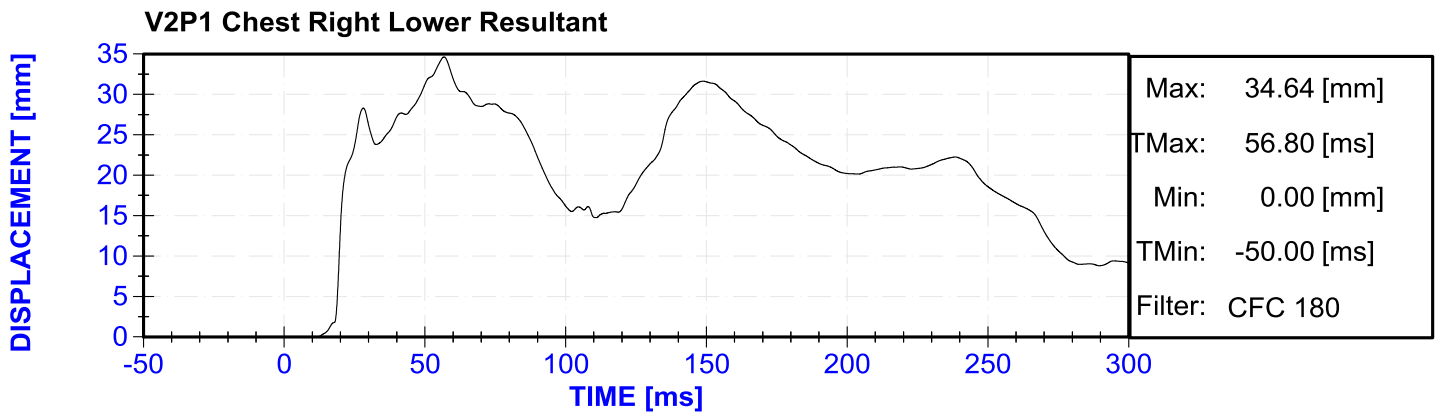
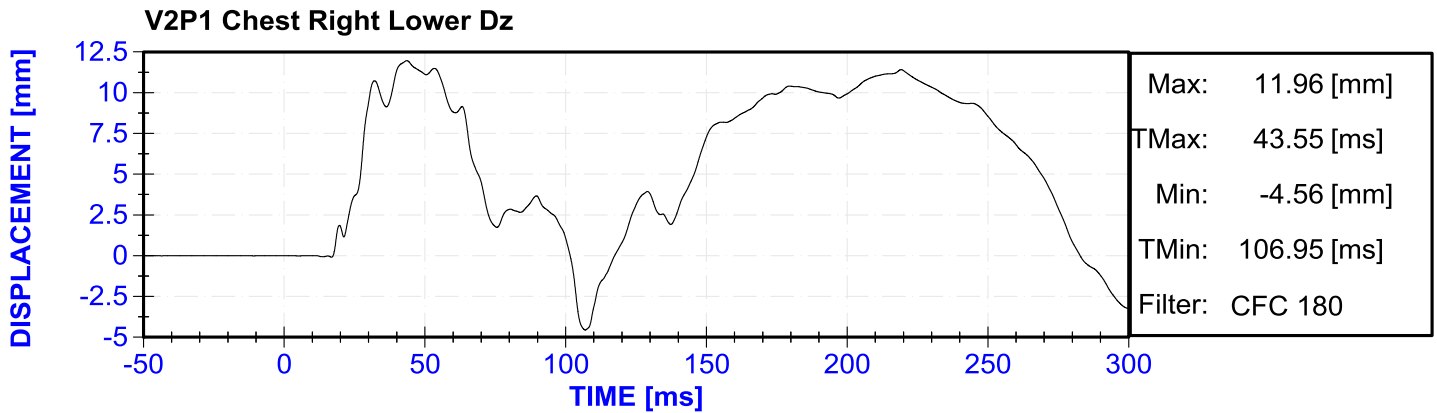
V2P1 Chest Left Upper Dy

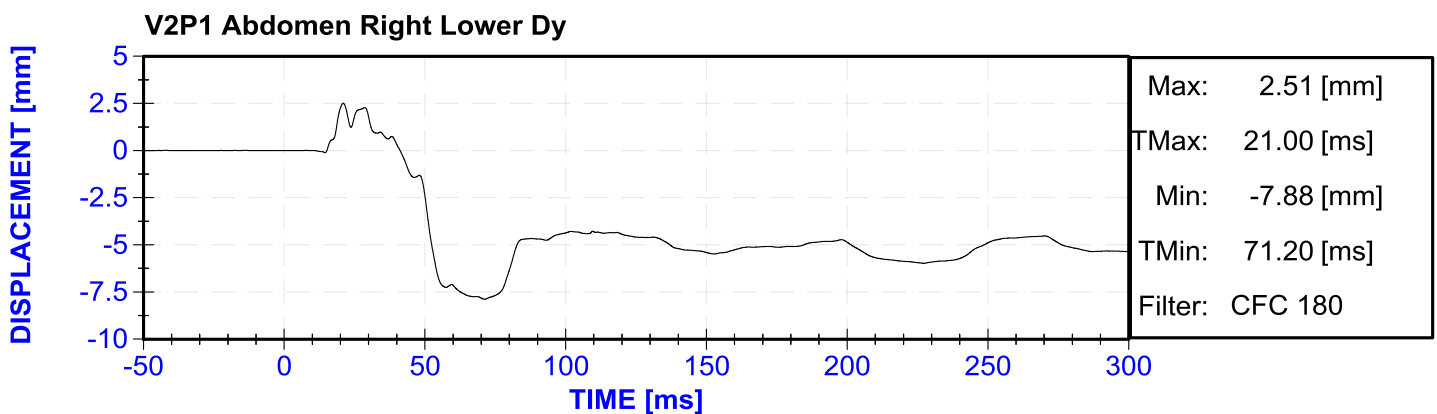
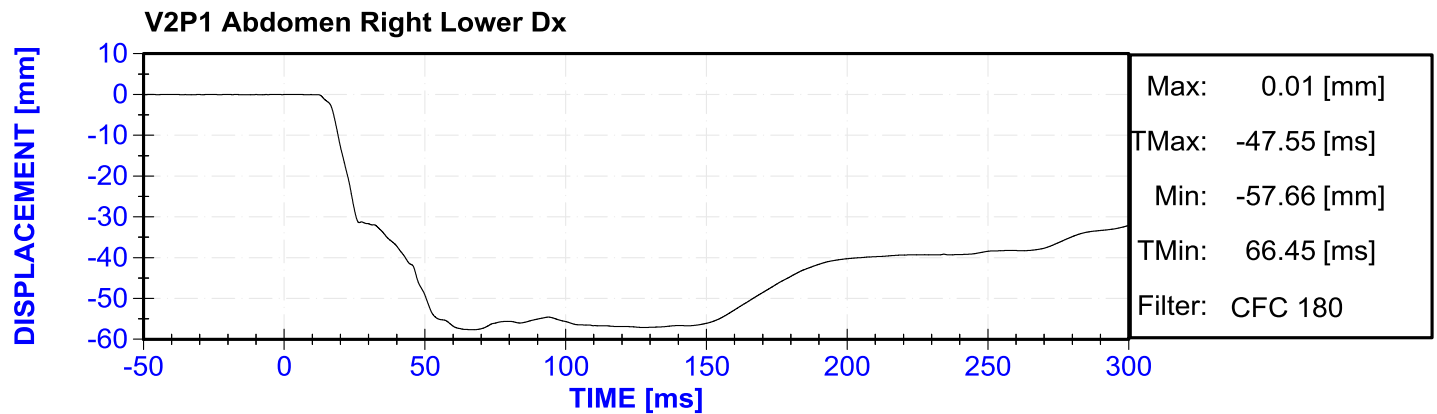
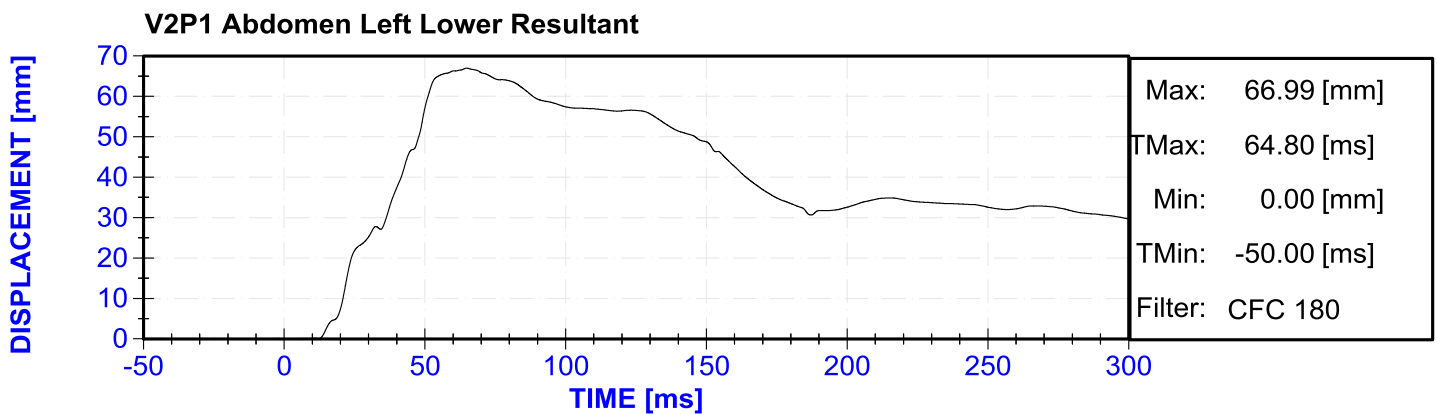
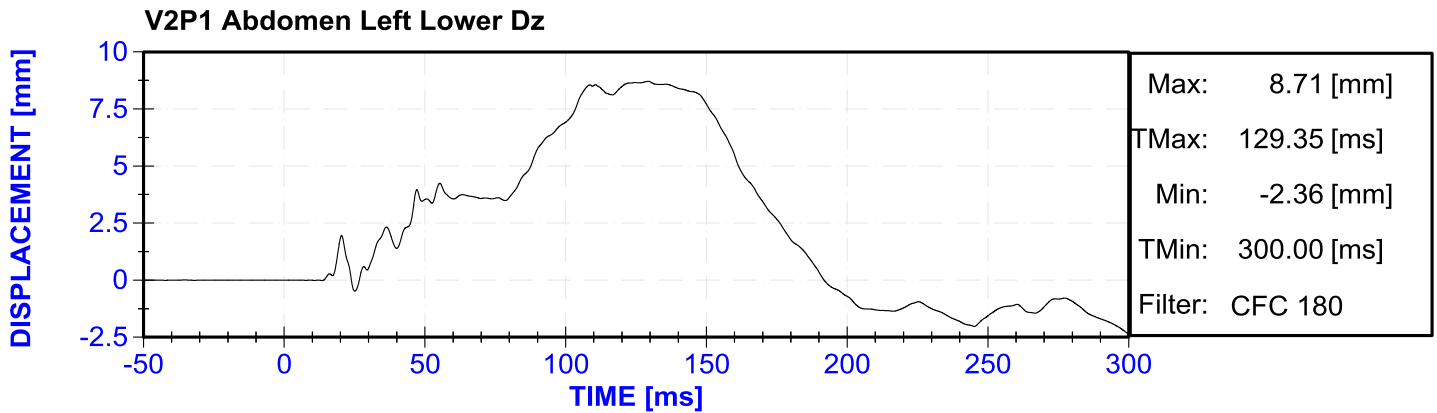


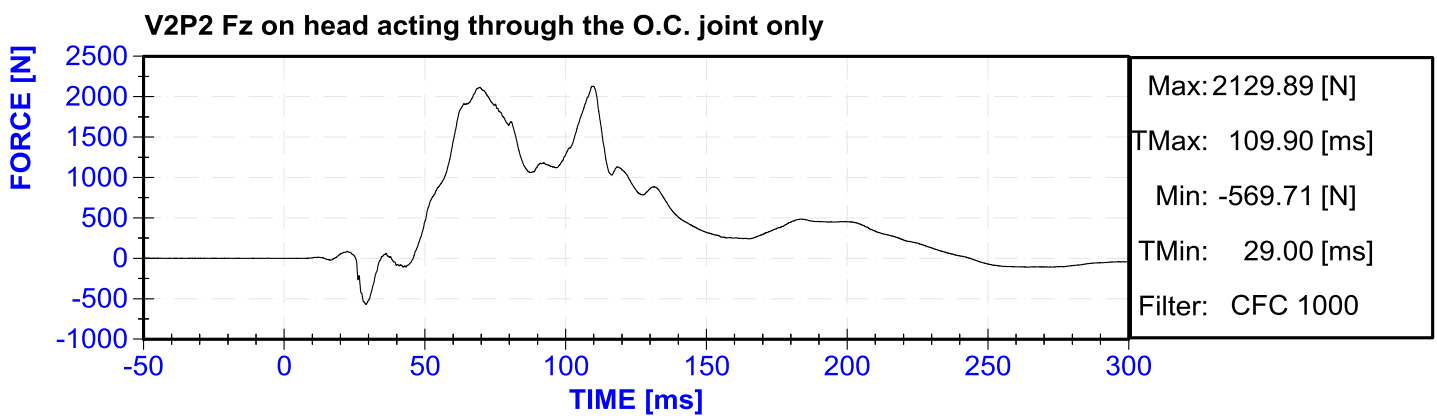
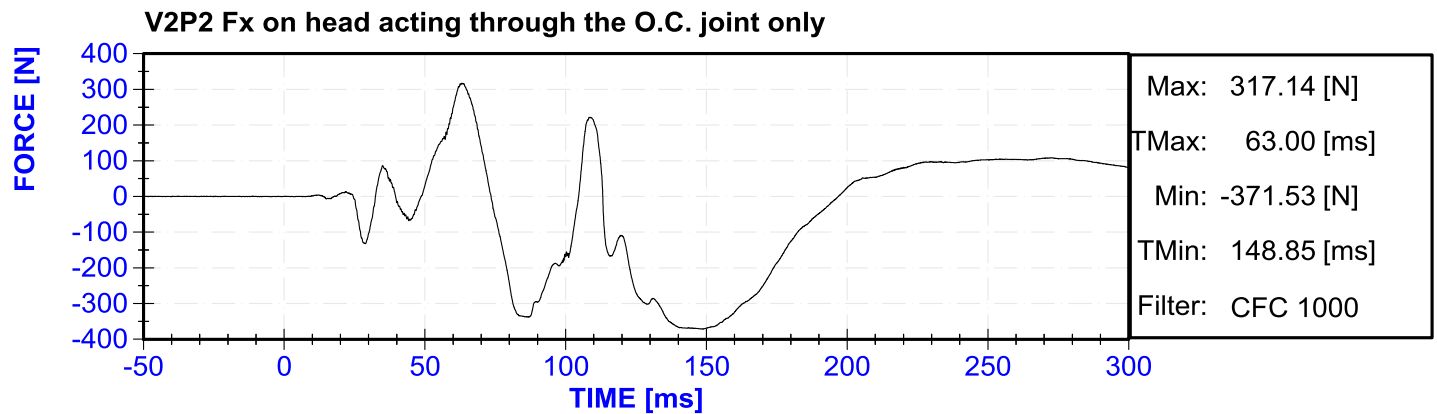
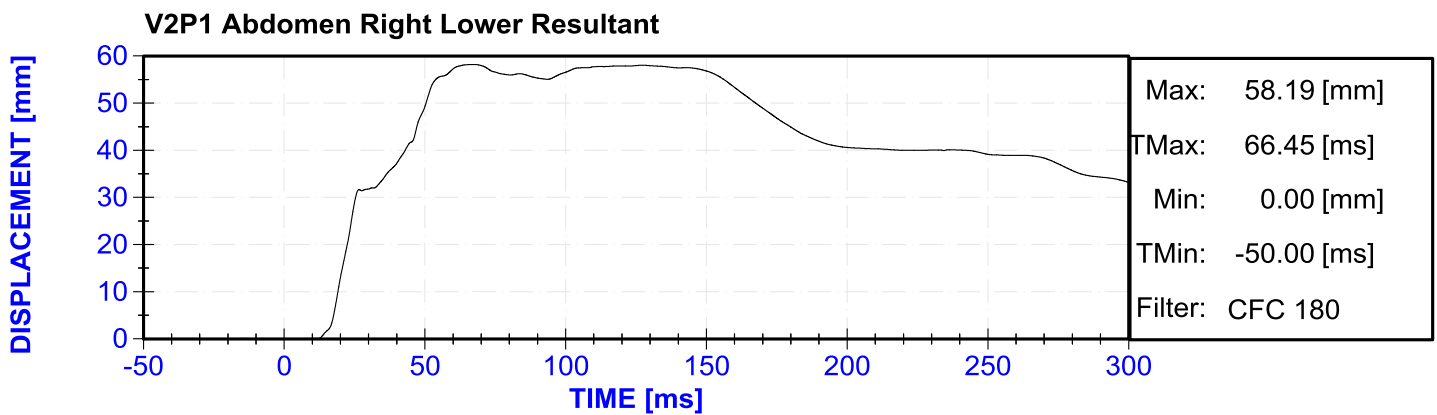
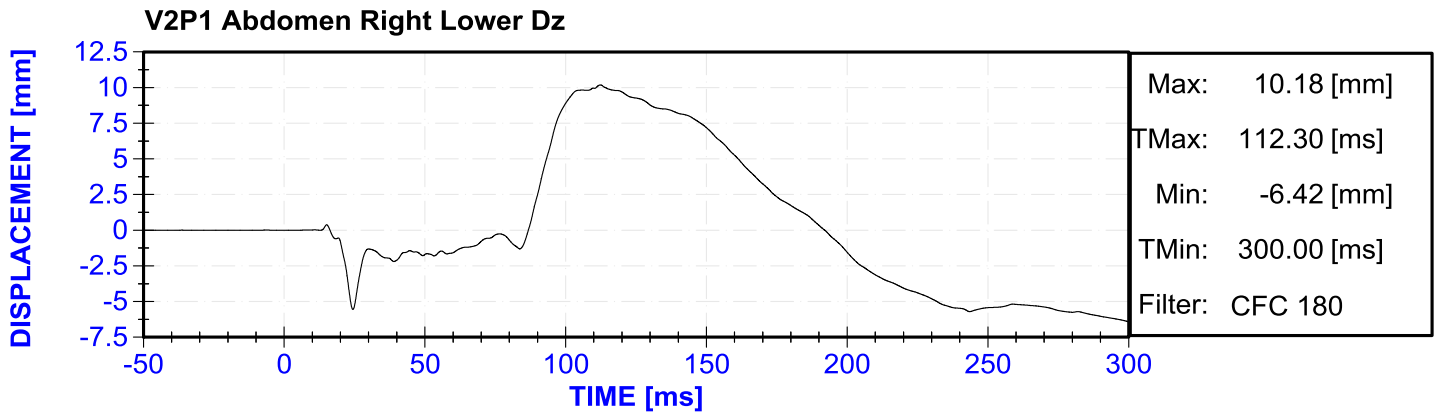




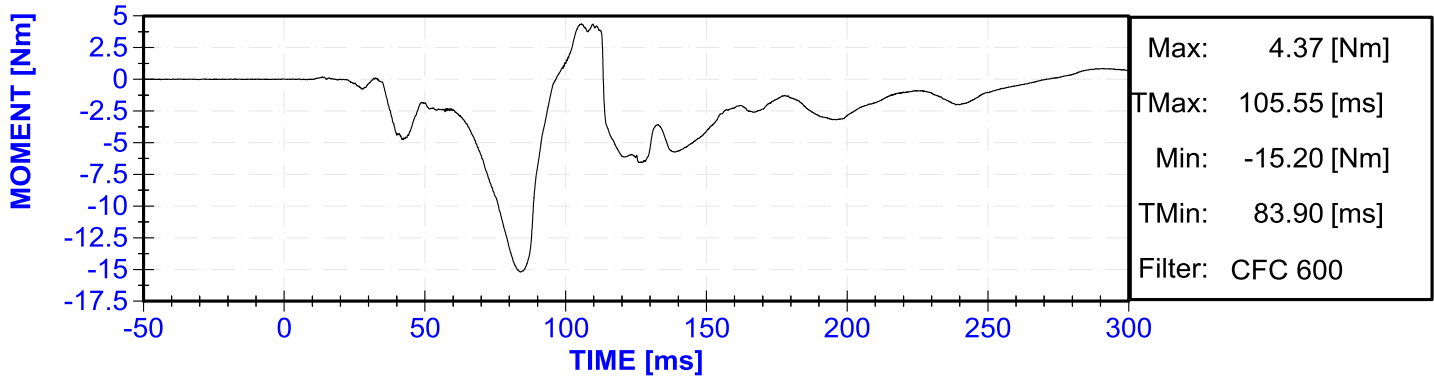




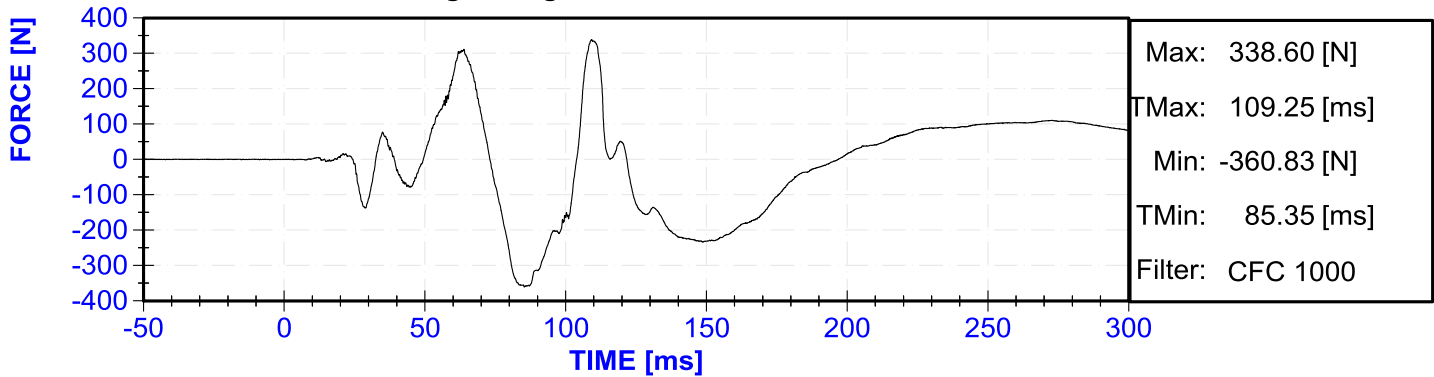




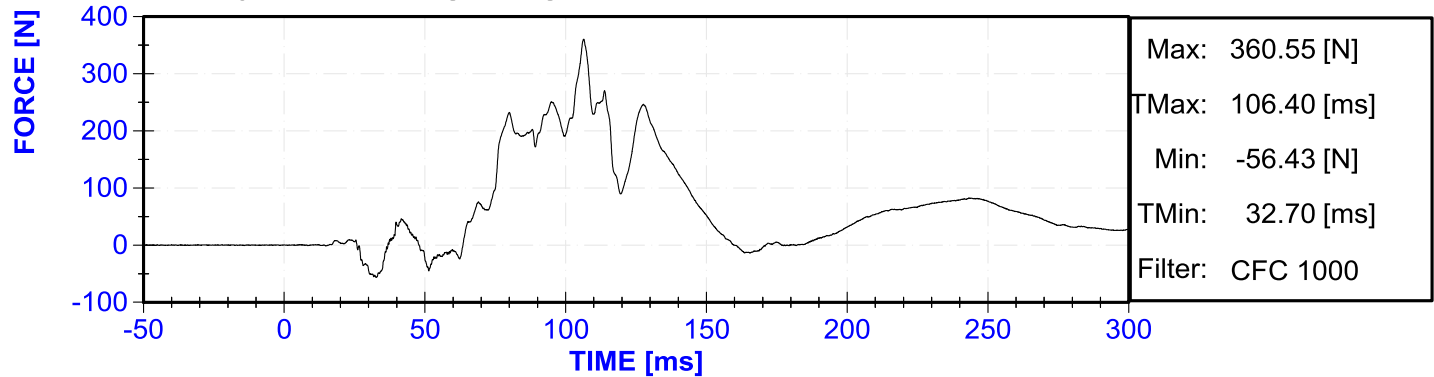
V2P2 My on head acting through the O.C. joint only



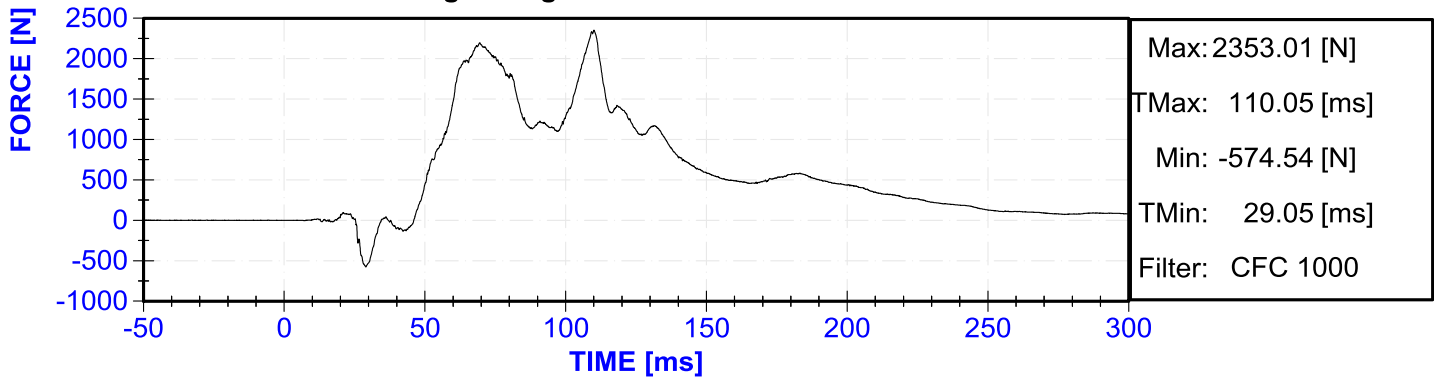
V2P2 Fx on head acting through the total neck section



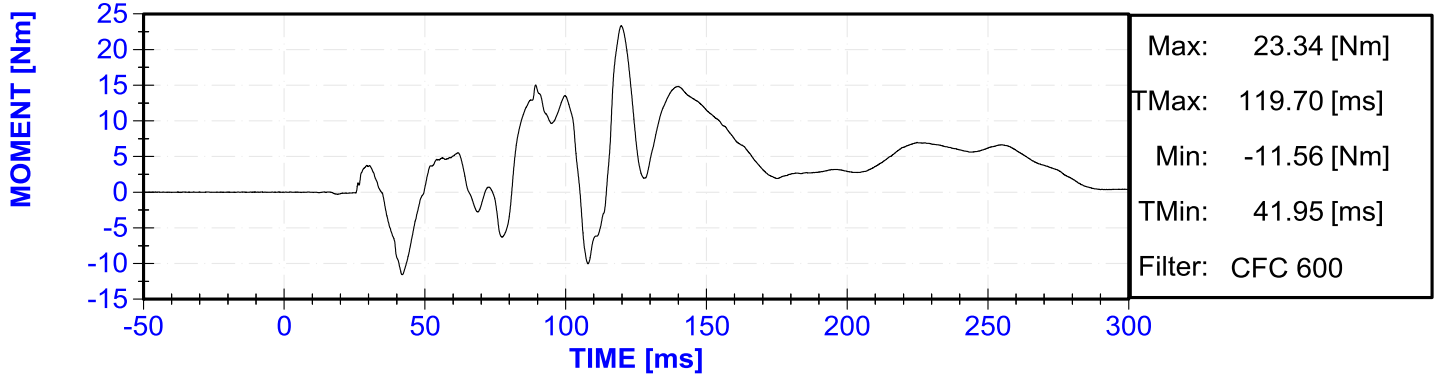
V2P2 Fy on head acting through the total neck section



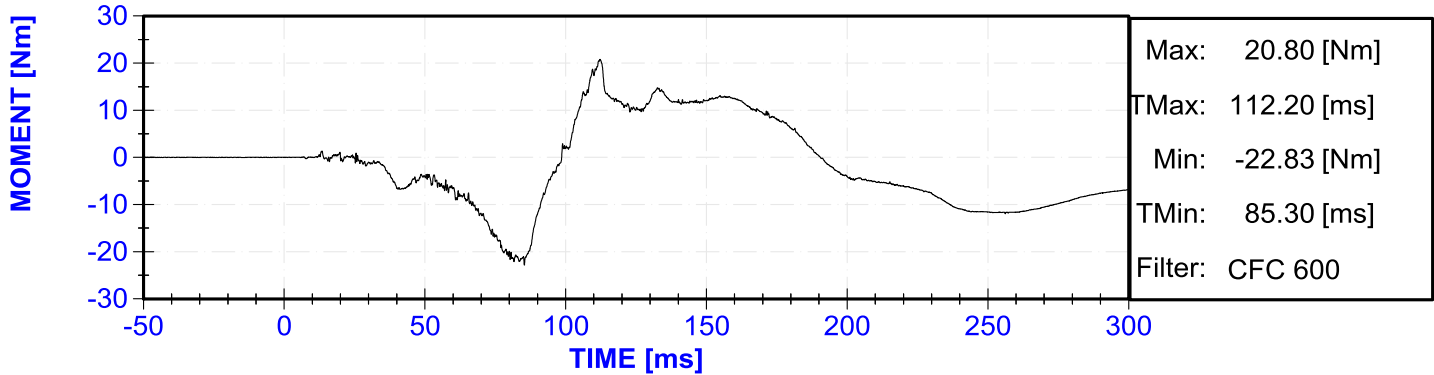
V2P2 Fz on head acting through the total neck section



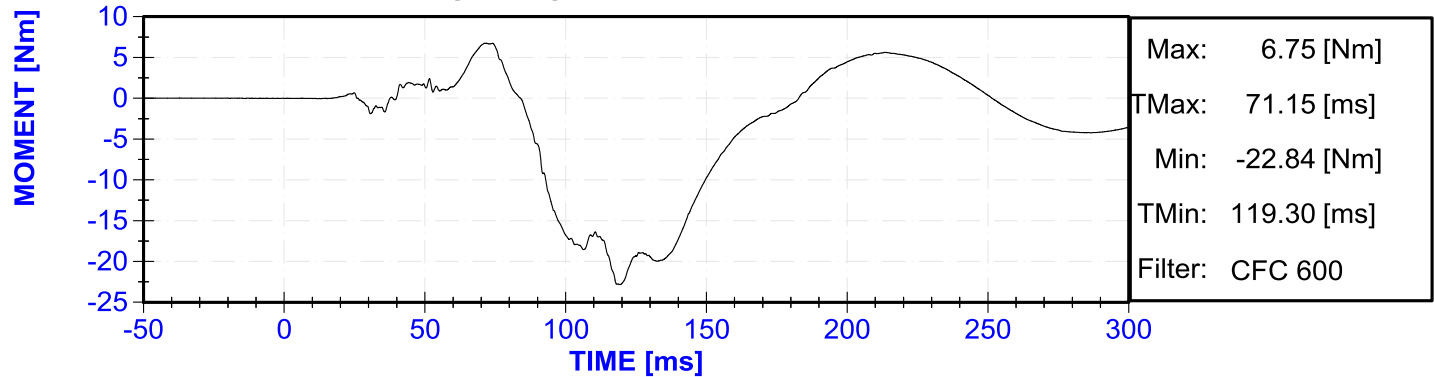
V2P2 Mx on head acting through the total neck section



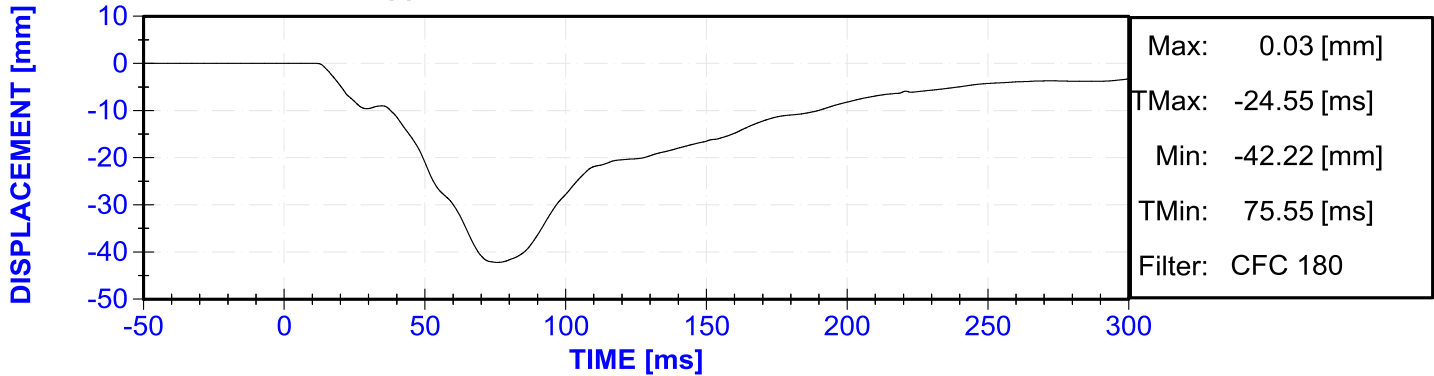
V2P2 My on head acting through the total neck section

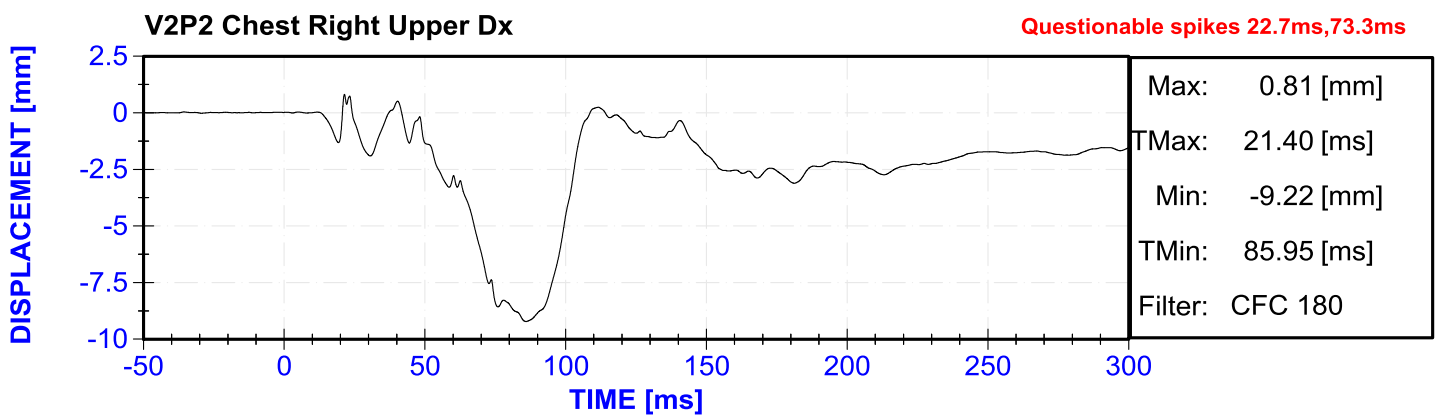
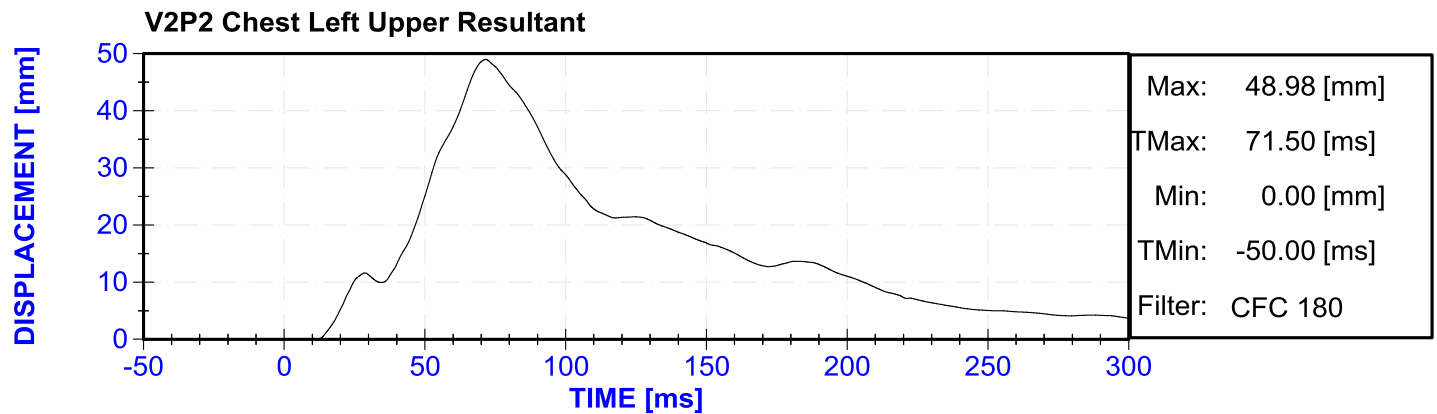
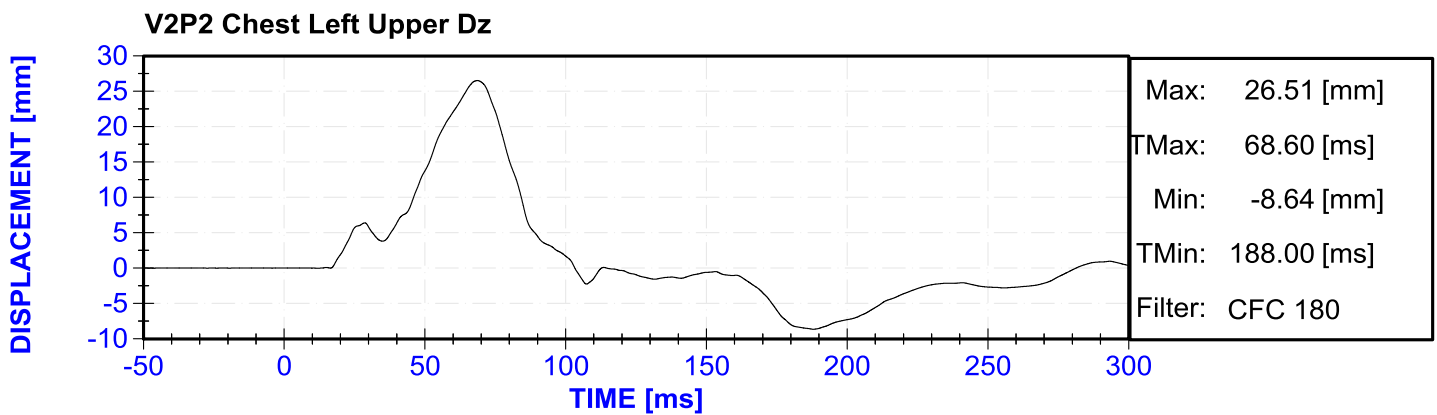
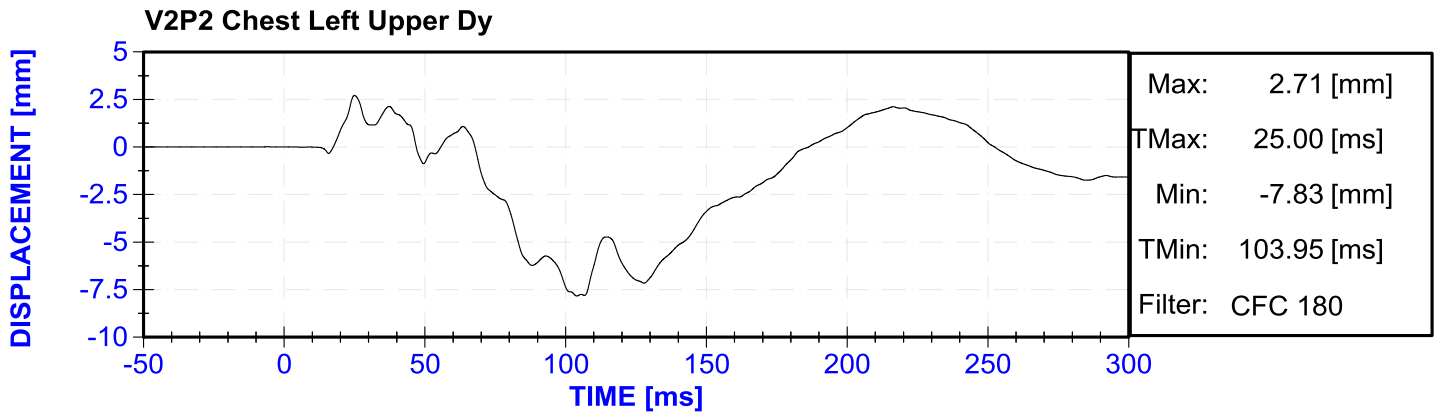


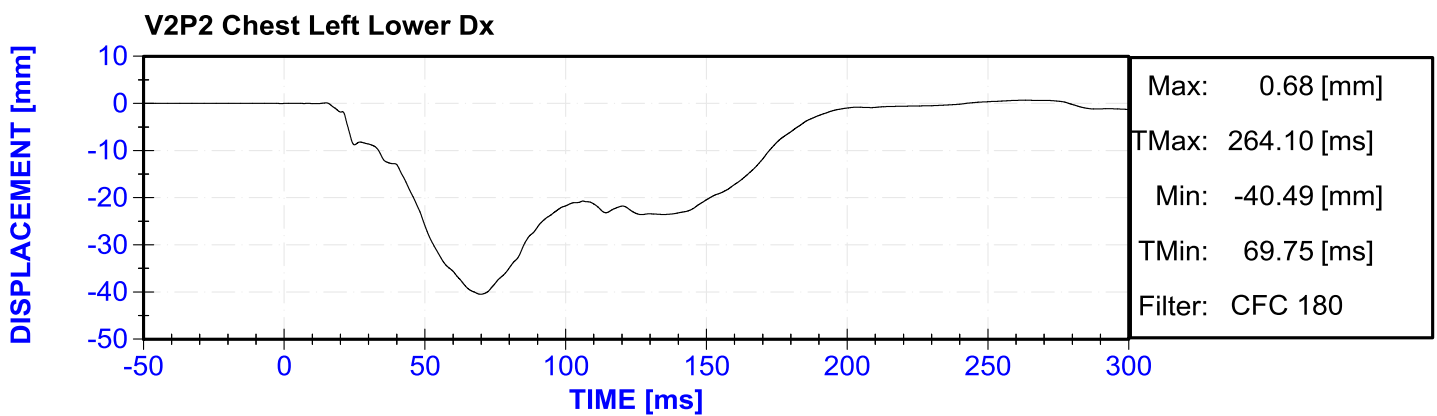
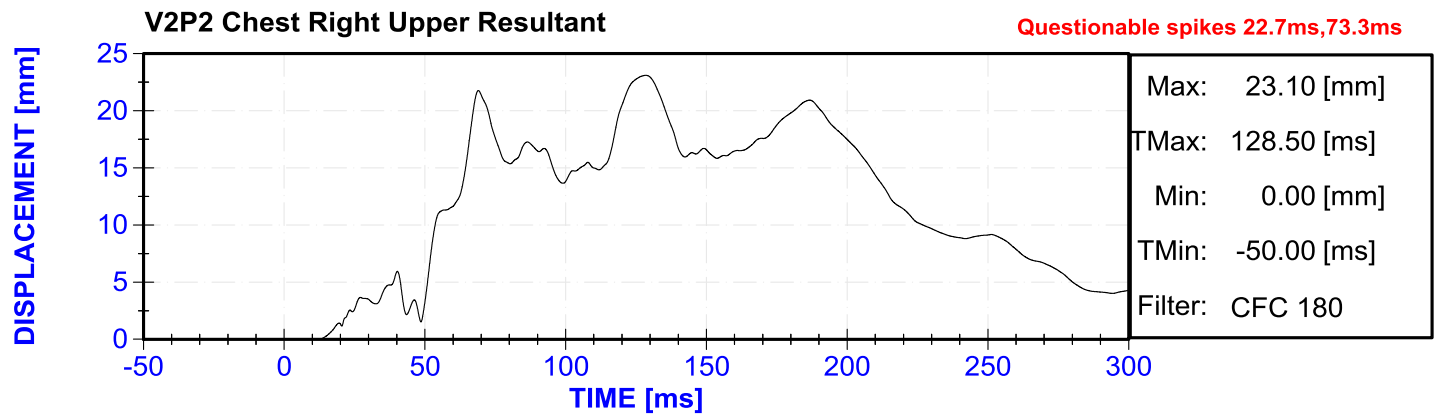
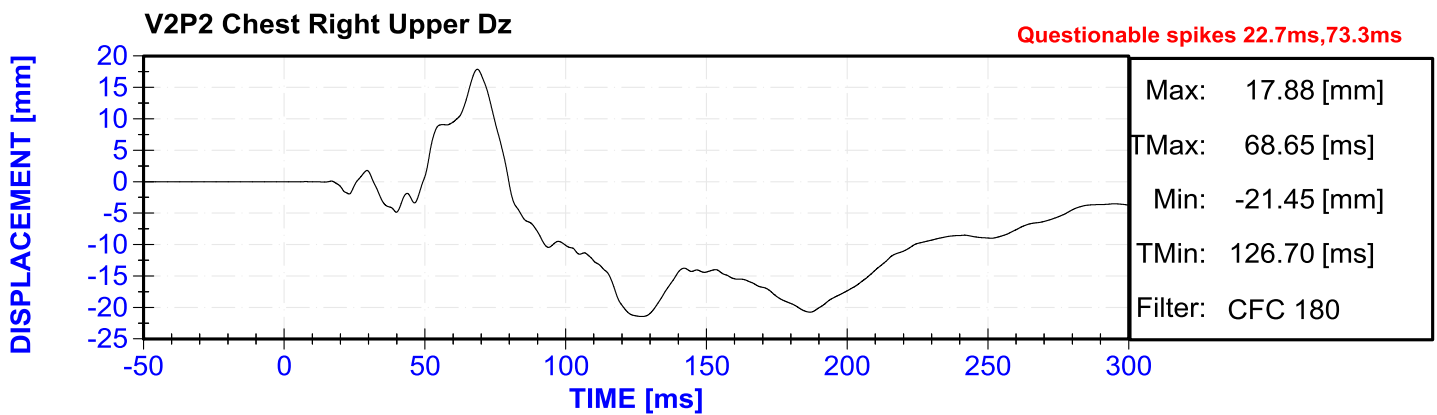
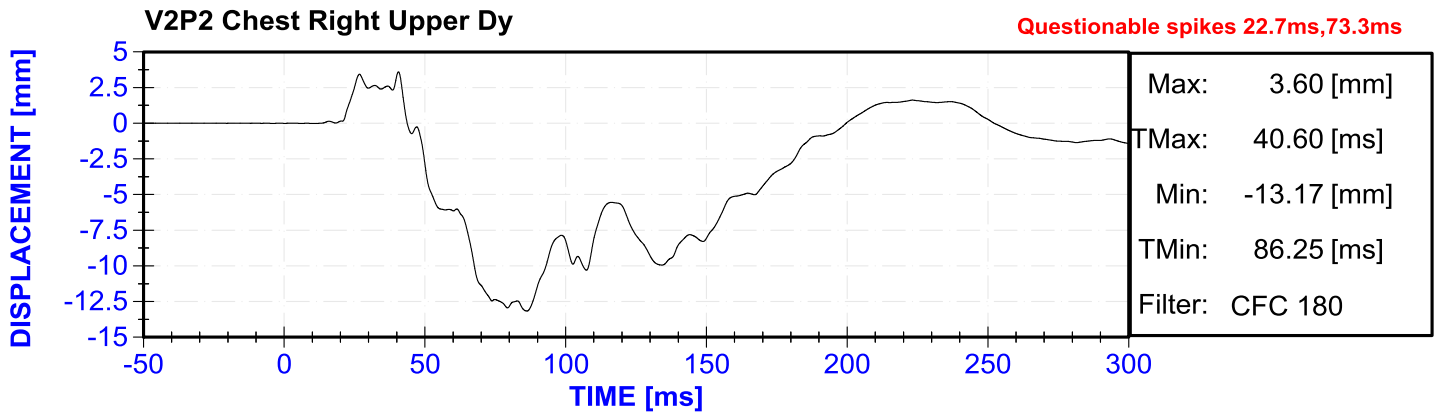
V2P2 Mz on head acting through the total neck section

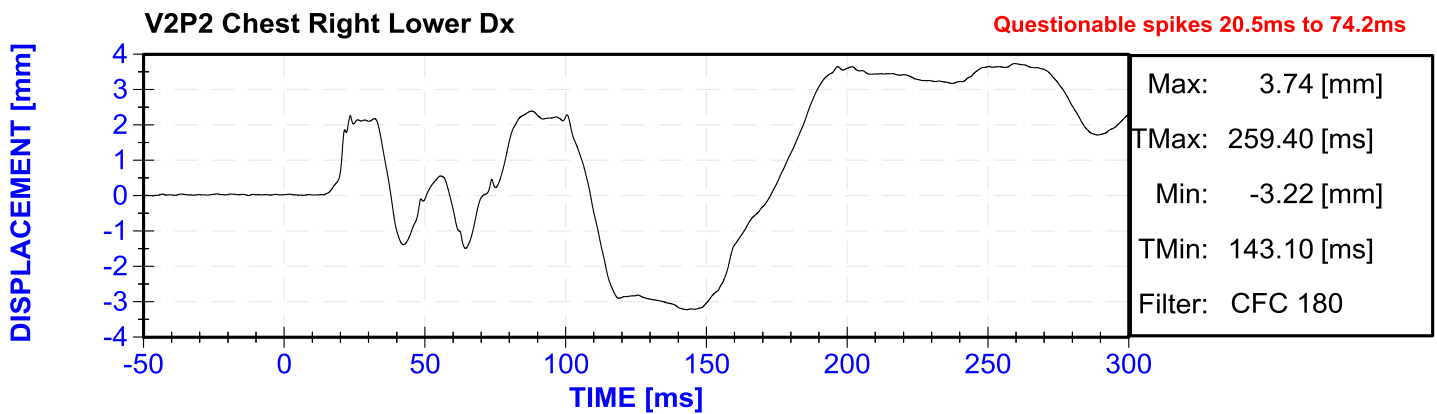
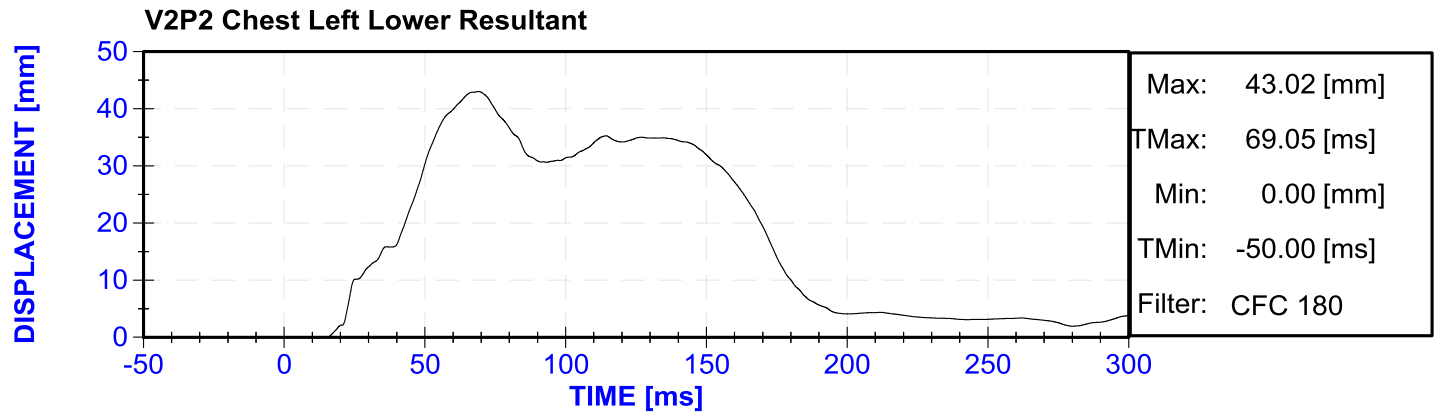
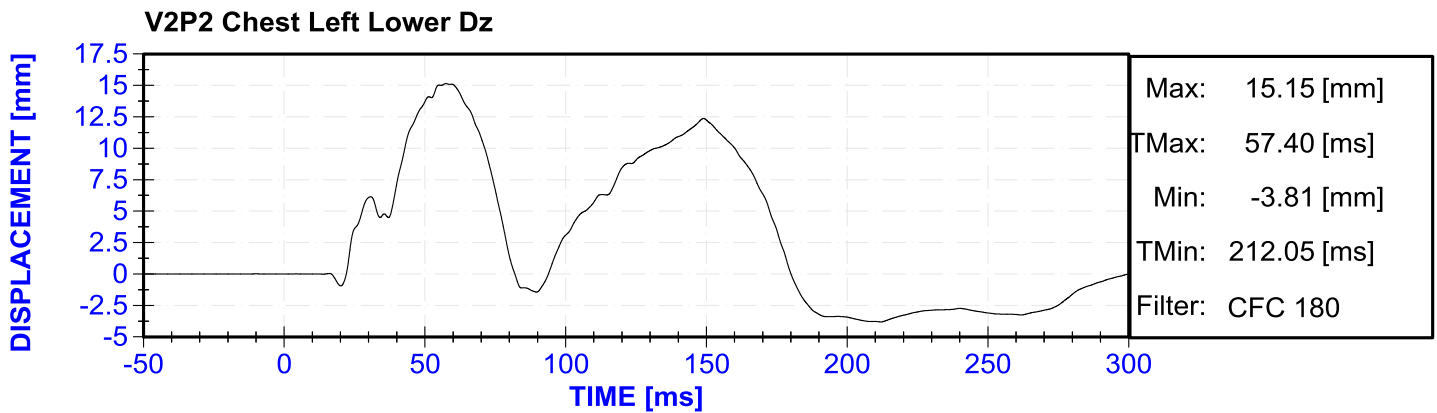
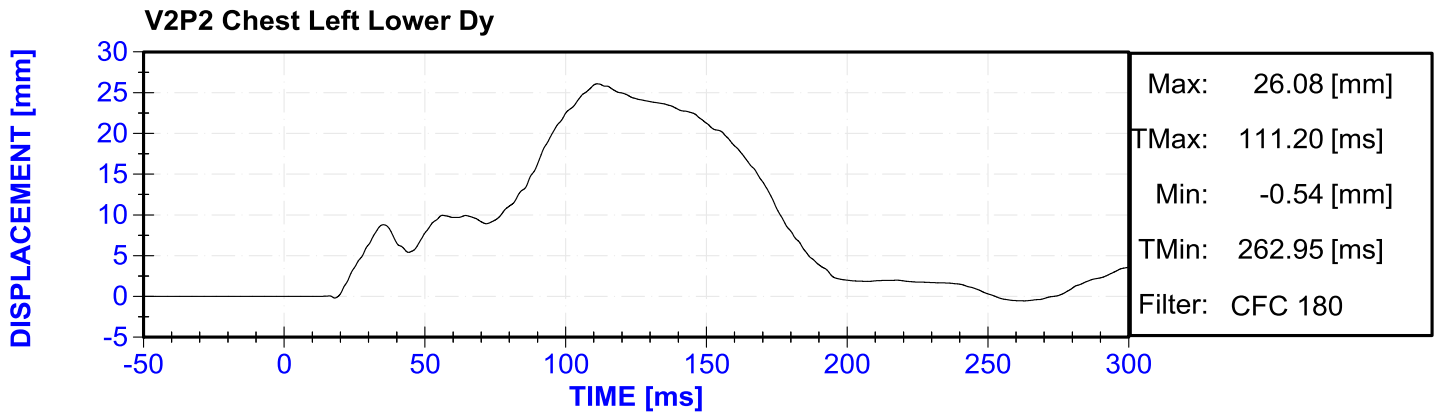


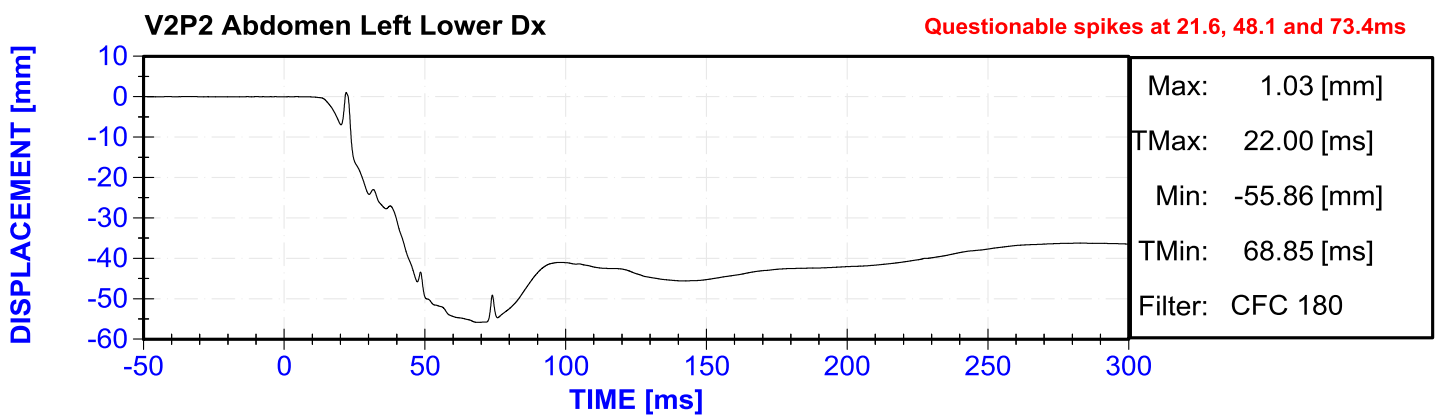
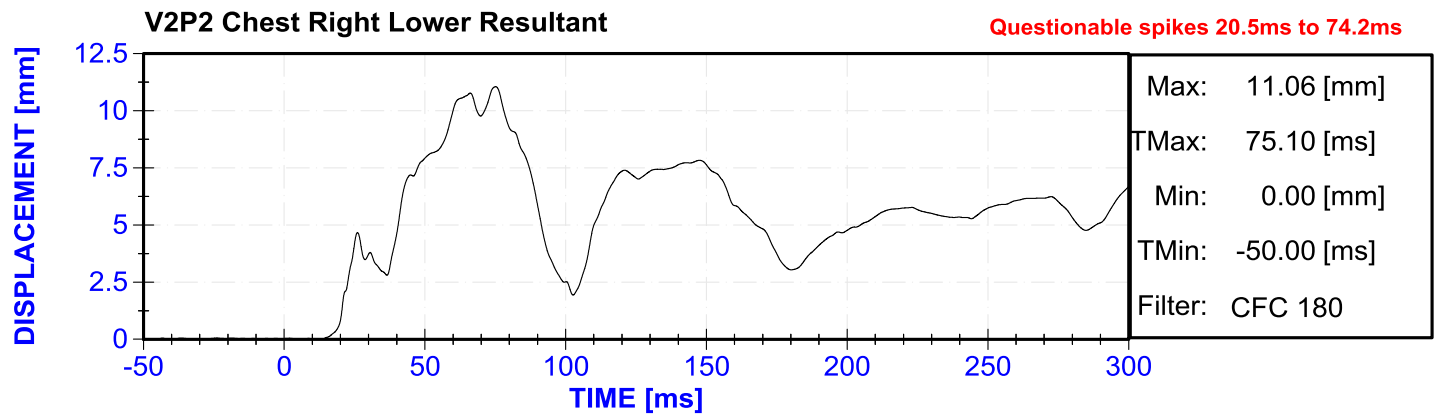
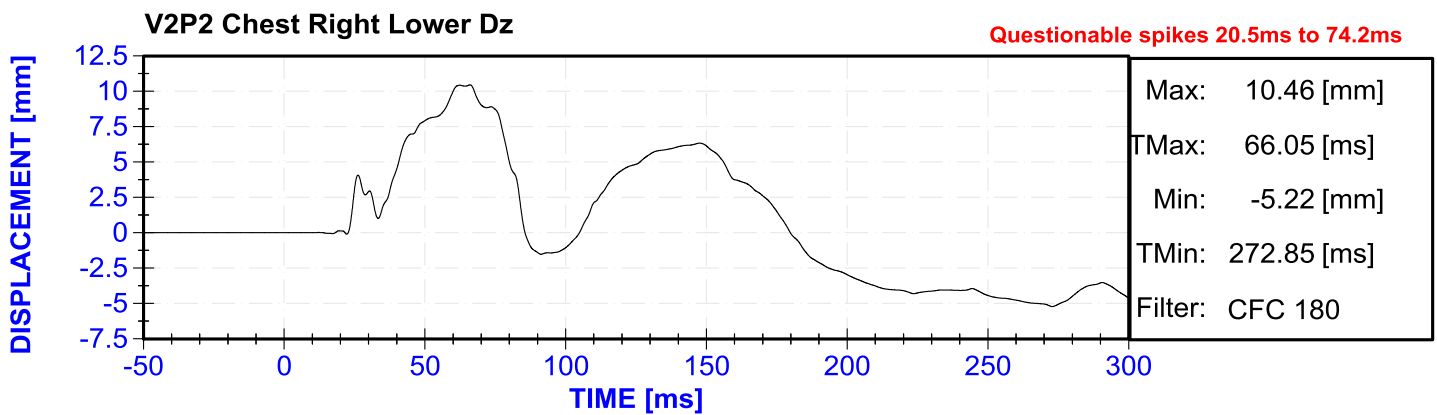
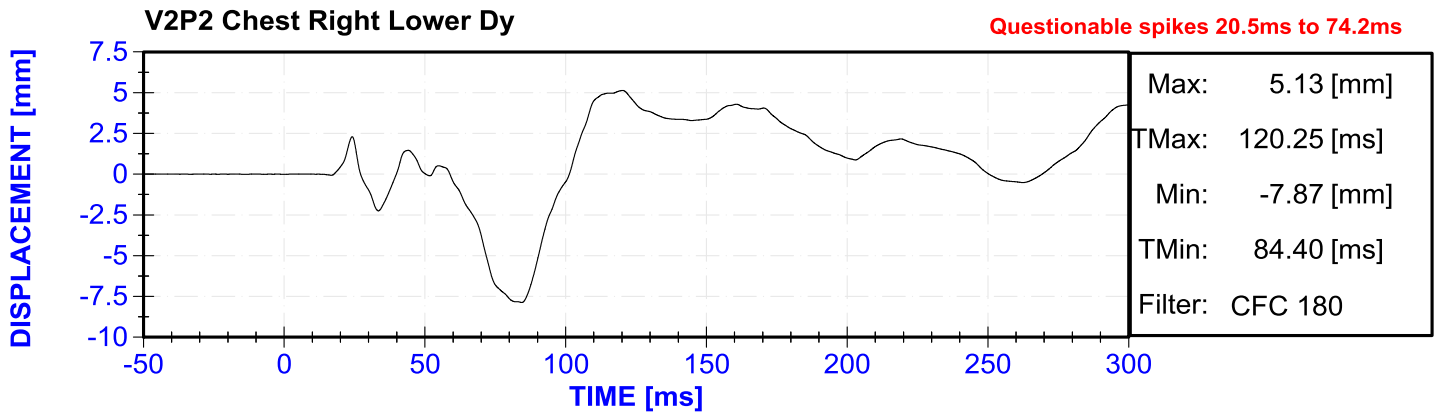
V2P2 Chest Left Upper Dx

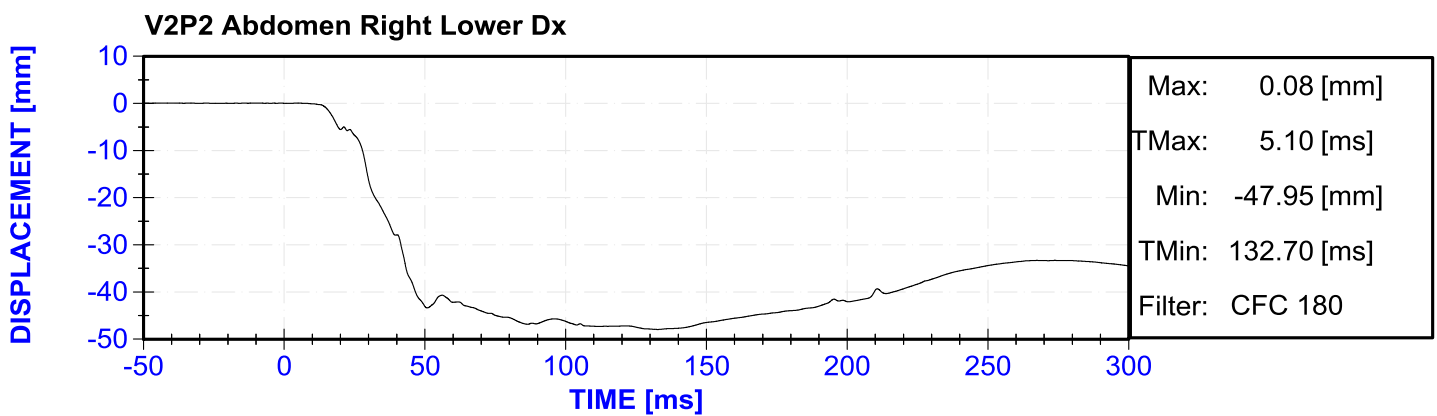
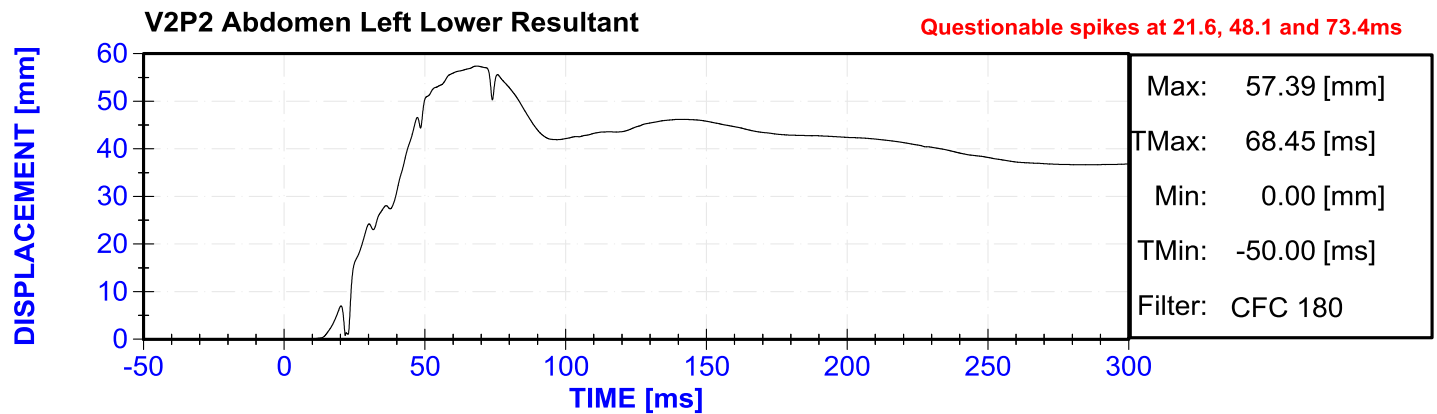
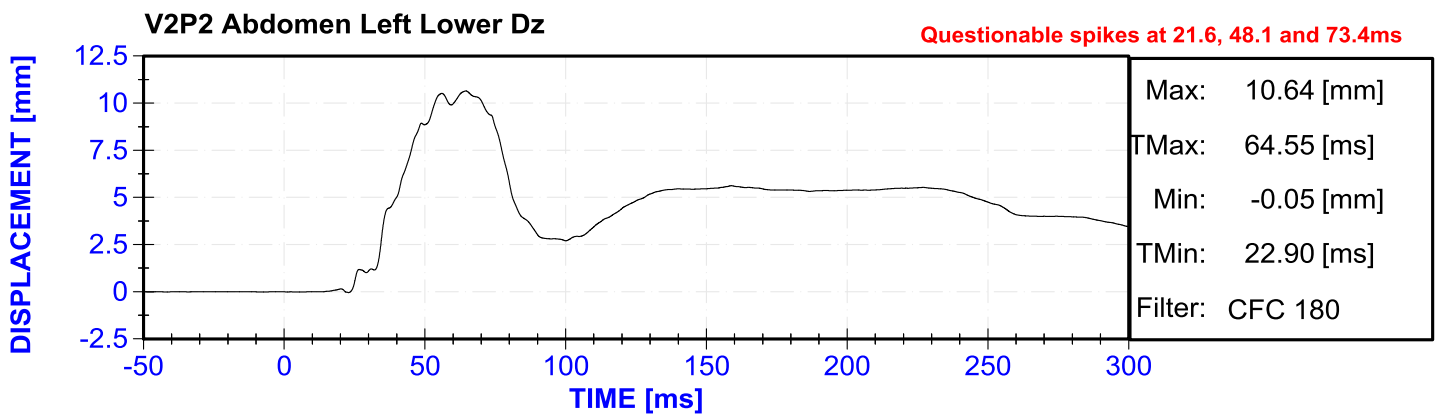
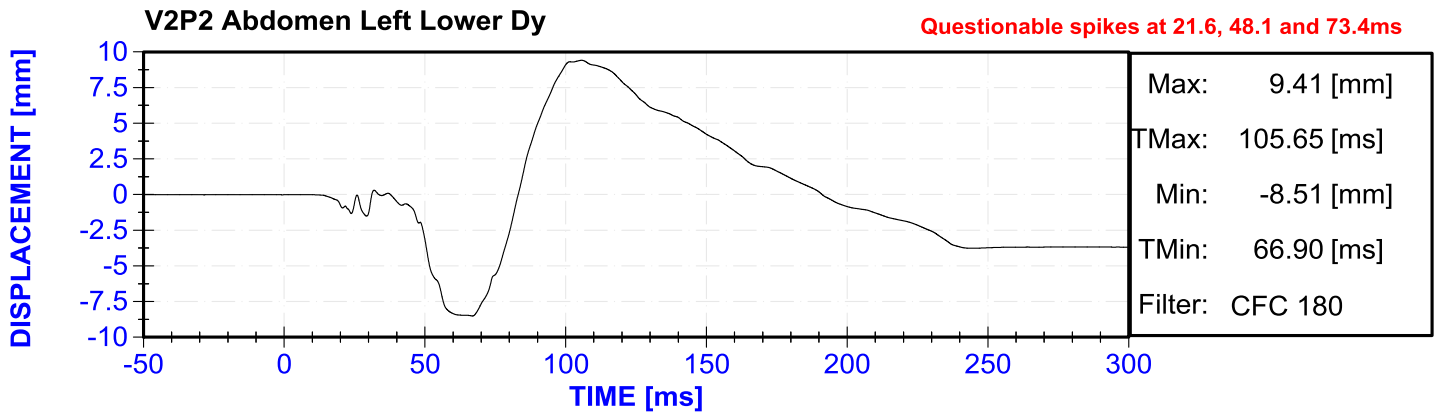


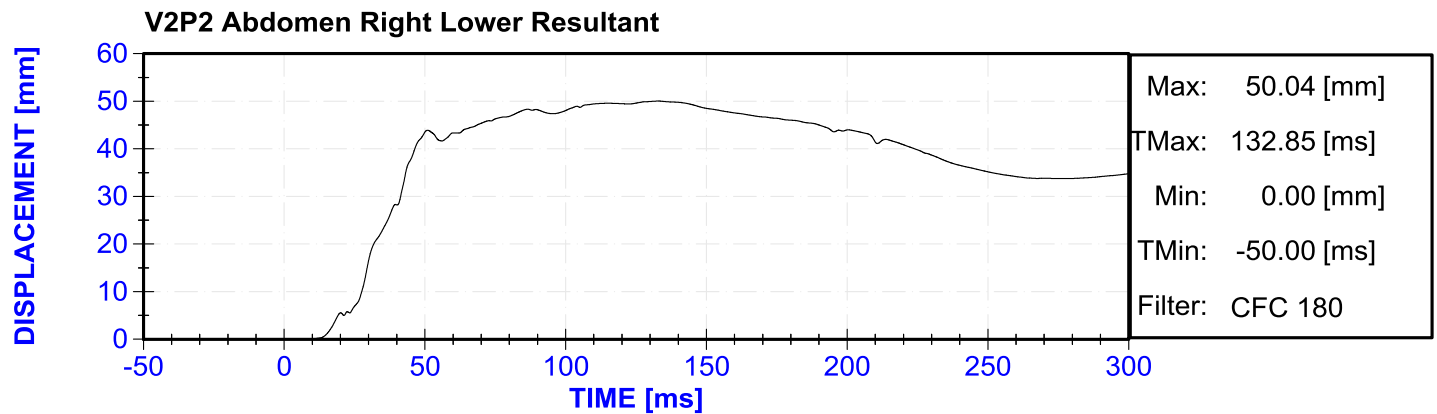
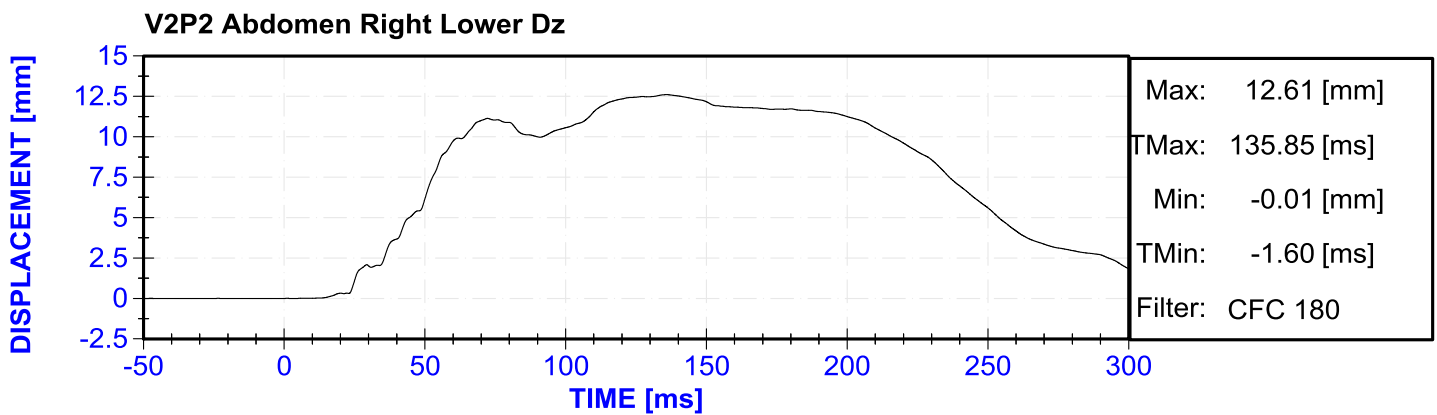
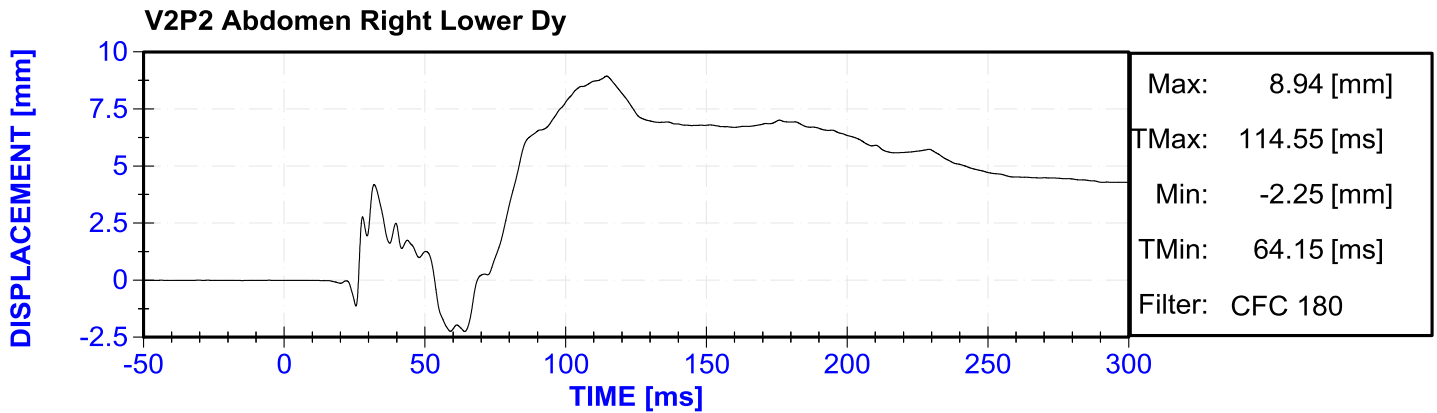












## APPENDIX C

### DUMMY CALIBRATION DATA

Table C-1: Dummy Information

TYPE	SERIAL NUMBER
THOR 50 <sup>TH</sup> Male	015
THOR 50 <sup>TH</sup> Male	016

Table C-2: THOR Ankle Zero Offset Information

THOR 50 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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<sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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 <sup>th</sup> 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<sup>th</sup> 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 <sup>th</sup> 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 50<sup>th</sup> Male 015

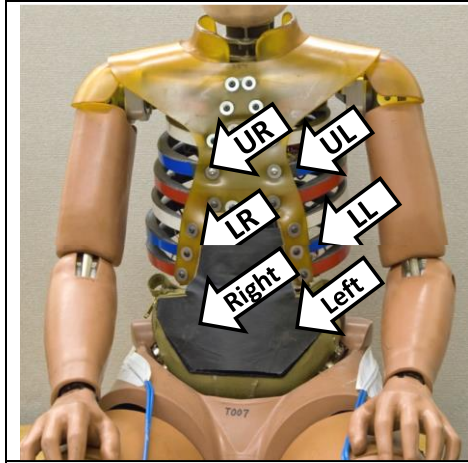


Figure 1. Manipulation to determine thoracic and abdominal IR-TRACC polarity.

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 50<sup>th</sup> Male 016

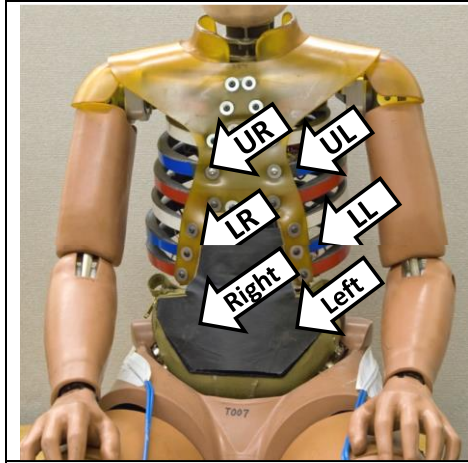


Figure 2. Manipulation to determine thoracic and abdominal IR-TRACC polarity.

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	+	+


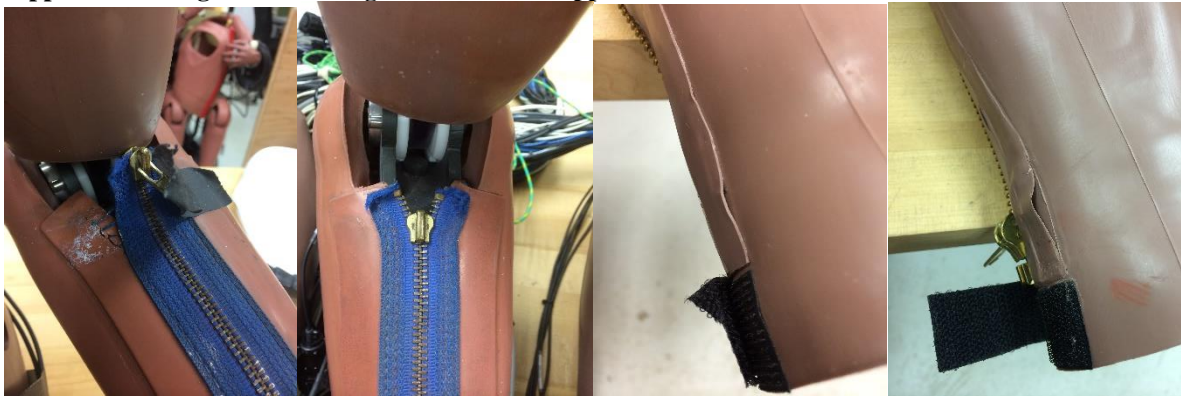
**Test Data/Sensor Repair Notes**

# THOR Inspection Checklist

Date: <b>9/17/2015</b>	
NHTSA Representative: <b>James Saunders</b>	
Inspection Reporter: <b>Mike Hartung</b>	
Inspection type (check one): <input checked="" type="checkbox"/> Pre-Test <input type="checkbox"/> Post-Test	
Dummy S/N: <b>0015</b>	Legs S/N: <b>LX0038/LX0039</b>
Dummy Description: <b>THOR-M 50<sup>th</sup> Male</b>	
Date of last Certification: <b>July 2015</b>	
<u>Tests conducted:</u> <u>Since last inspection:</u> <b>R20150227-2015 Ford F-150</b> <u>Since last certification:</u> <b>R20155509- Forester</b> <b>R20150227-2015 Ford F-150</b>	
<u>Known errors in data channels (no data, clipping, unexpected drops):</u> <ul style="list-style-type: none"> <li>- <b>11TIBILELOTHFOXP, Tibia Lower Left X Force, Questionable spikes at 58ms, 90.8ms and 201ms, SN:LC-78 Fx</b></li> <li>- <b>11TIBILELOTHFOYP, Tibia Lower Left Y Force, Questionable Spikes at 57.6, 91.2 and 201 ms, SN:LC-78 Fy</b></li> <li>- <b>11TIBILELOTHFOZP, Tibia Lower Left Z Force, Questionable spikes throughout, SN:LC-78 Fz</b></li> </ul>	
<u>Physical evidence of damage:</u> <b>None New</b>	
<u>Anecdotal evidence of damage:</u> <b>None</b>	
<u>Equipment delivered to Borrower:</u> <b>THOR 0015 ATD</b> <b>26 Accelerometers</b> <b>3 Angular Rate Sensors</b> <b>2 Skull Spring LC</b> <b>1 Condyle Pot</b> <b>1 Upper Neck LC</b> <b>6 IRTraccs</b> <b>12 Rotational Pots</b> <b>1 Spine LC</b> <b>2 Acetabulum LC</b> <b>2 ASIS LC</b> <b>2 Femur LC</b>	<i>Continued</i> <b>2 LX Leg Assemblies</b> <b>2 Upper Tibia LC</b> <b>2 Lower Tibia LC</b> <b>6 Ankle Potentiometers</b> <b>2 Knee Sliders</b> <b>1 Neck Skin</b> <b>1 Neck Foam</b> <b>1 Tiltview Interface Cable</b> <b>4 Tilt Sensors</b> <b>1 H-Point Tool</b> <b>1 Tool Box</b> <b>1 Laptop</b>

**Note: New Damage is Noted in Red**

<b>HEAD</b>	
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	
<b>NECK</b>	
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	
<b>SHOULDER</b>	
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	
<b>SPINE</b>	
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	
<b>THORAX</b>	
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	
<b>ABDOMEN</b>	
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 <b>Multiple tears and broken stitches in lower abdomen bag.</b>

	
Y / N	Lower abdomen insert securely attached to spine
Y / N	Lower abdomen insert shows no evidence of permanent set
OTHER	<b>Zippers detaching on left and right calves. Torn zippers/flesh on L &amp; R forearms.</b>
	
<b>PELVIS</b>	
Y / N	Pelvis flesh fits securely over pelvis bones
Y / N	H-point tool fits securely into hole on both sides of pelvis
OTHER	
<b>FEMUR</b>	
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	
<b>LOWER EXTREMITY (LX)</b>	
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	
<b>JACKET</b>	
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: <b>9/22/2015</b>	
NHTSA Representative: <b>James Saunders</b>	
Inspection Reporter: <b>Mike Hartung</b>	
Inspection type (check one): <input type="checkbox"/> Pre-Test <input checked="" type="checkbox"/> Post-Test	
Dummy S/N: <b>0015</b>	Legs S/N: <b>LX0038/LX0039</b>
Dummy Description: <b>THOR-M 50<sup>th</sup> Male</b>	
Date of last Certification: <b>July 2015</b>	
<u>Tests conducted:</u> Since last inspection: <b>R20155143-2015 Highlander</b> Since last certification: <b>R20155509- Forester</b> <b>R20150227-2015 Ford F-150</b> <b>R20155143-2015 Highlander</b>	
<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> <b>None New</b>	
<u>Anecdotal evidence of damage:</u> <b>None</b>	
<u>Equipment delivered to Borrower:</u> <b>THOR 0015 ATD</b> <b>26 Accelerometers</b> <b>3 Angular Rate Sensors</b> <b>2 Skull Spring LC</b> <b>1 Condyle Pot</b> <b>1 Upper Neck LC</b> <b>6 IRTraccs</b> <b>12 Rotational Pots</b> <b>1 Spine LC</b> <b>2 Acetabulum LC</b> <b>2 ASIS LC</b> <b>2 Femur LC</b>	<i>Continued</i> <b>2 LX Leg Assemblies</b> <b>2 Upper Tibia LC</b> <b>2 Lower Tibia LC</b> <b>6 Ankle Potentiometers</b> <b>2 Knee Sliders</b> <b>1 Neck Skin</b> <b>1 Neck Foam</b> <b>1 Tiltview Interface Cable</b> <b>4 Tilt Sensors</b> <b>1 H-Point Tool</b> <b>1 Tool Box</b> <b>1 Laptop</b>

**Note: New Damage is Noted in Red**

<b>HEAD</b>	
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	
<b>NECK</b>	
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	
<b>SHOULDER</b>	
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	
<b>SPINE</b>	
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	
<b>THORAX</b>	
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	
<b>ABDOMEN</b>	
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 <b>Multiple tears and broken stitches in lower abdomen bag.</b>



**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

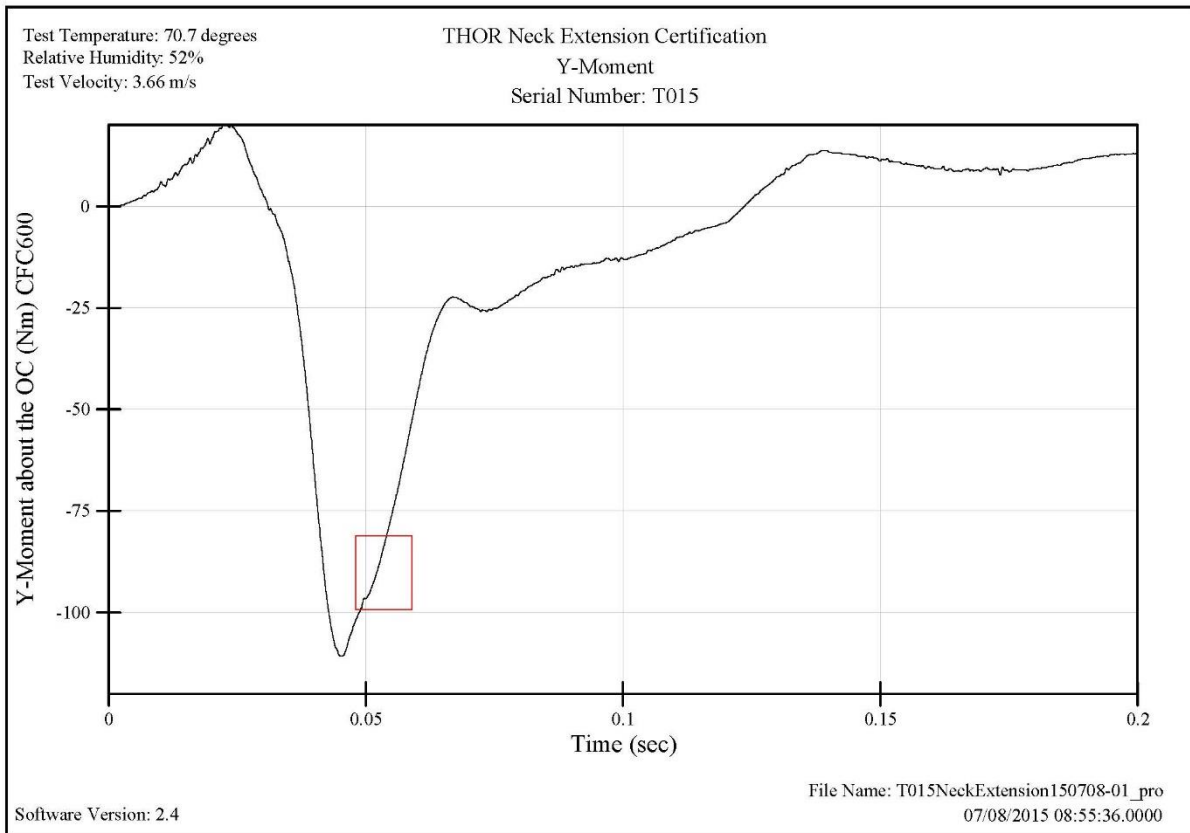
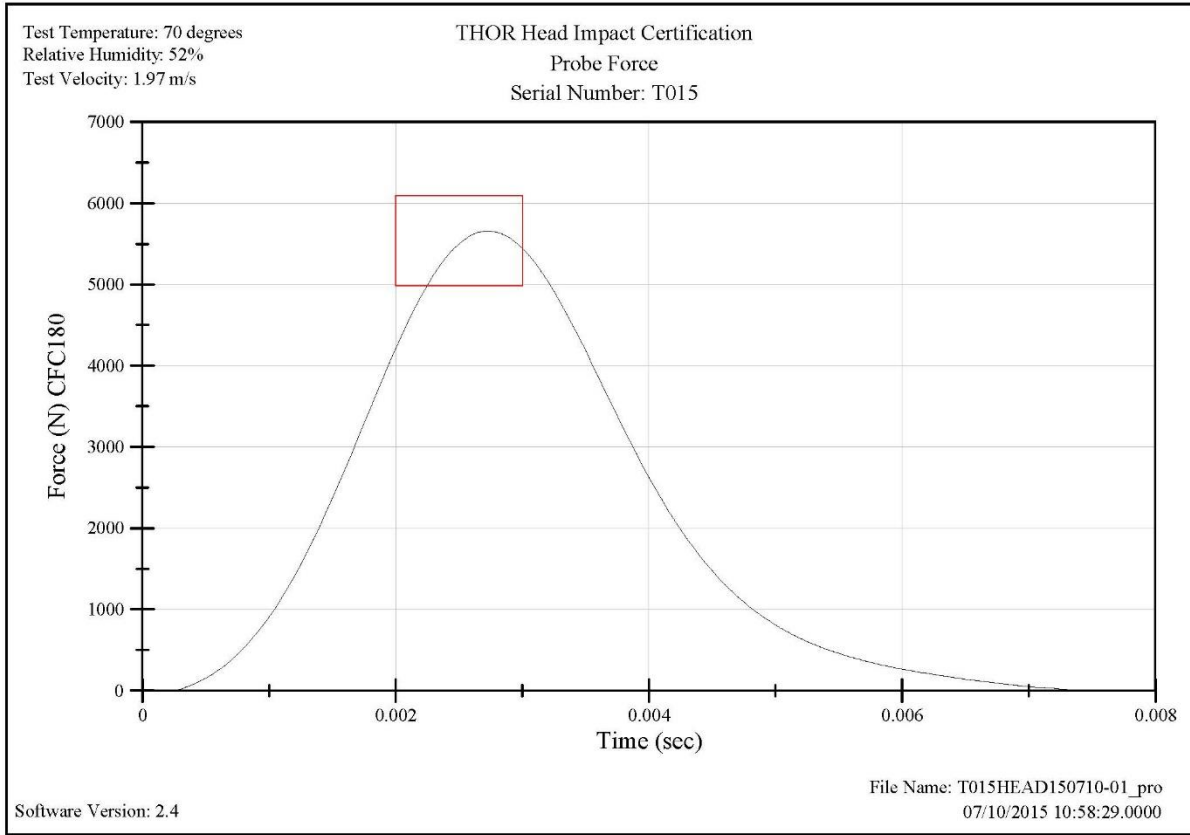
**Y / N** H-point tool fits securely into hole on both sides of pelvis

**OTHER**

<b>FEMUR</b>	
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	
<b>LOWER EXTREMITY (LX)</b>	
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	
<b>JACKET</b>	
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	

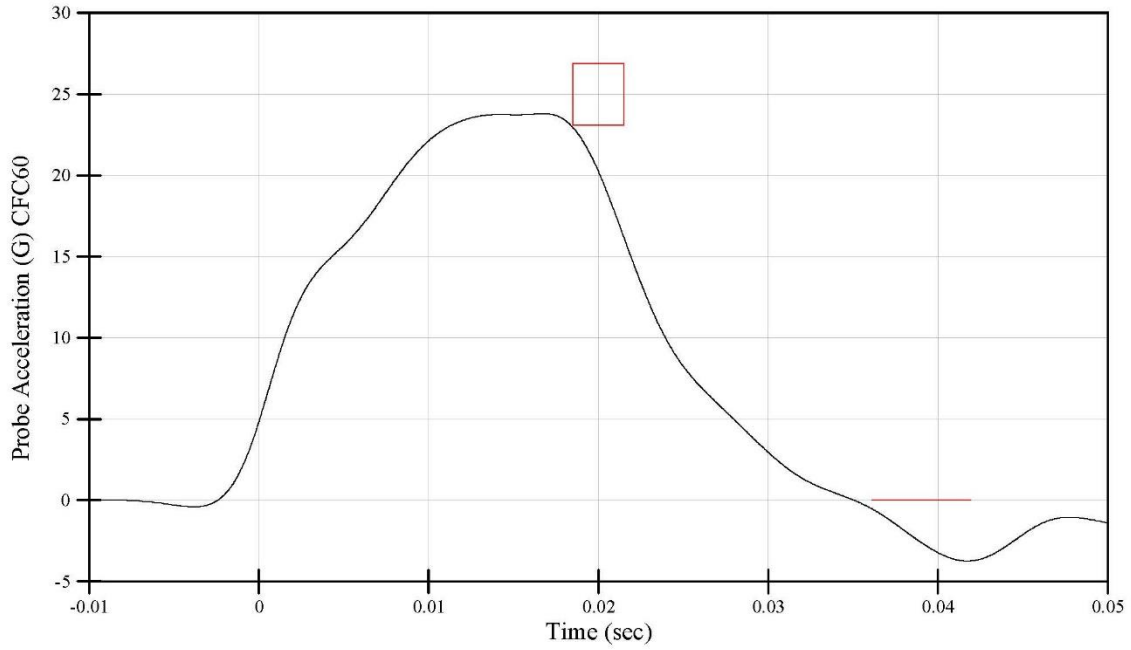
## DUMMY CALIBRATIONS

# 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

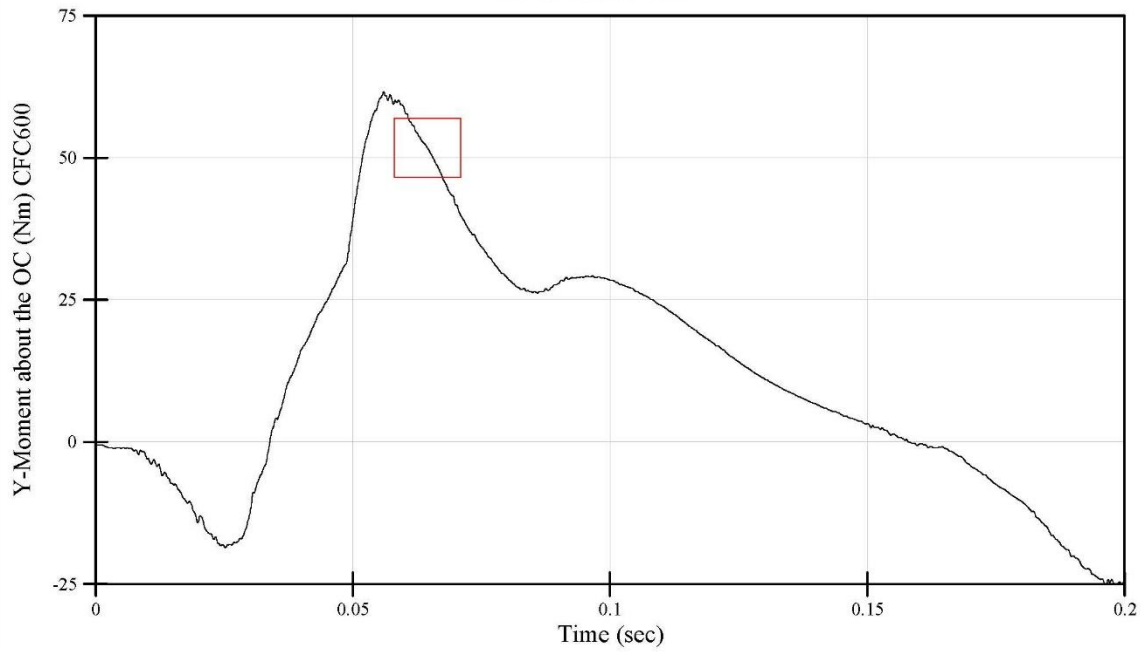


Software Version: 2.4

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

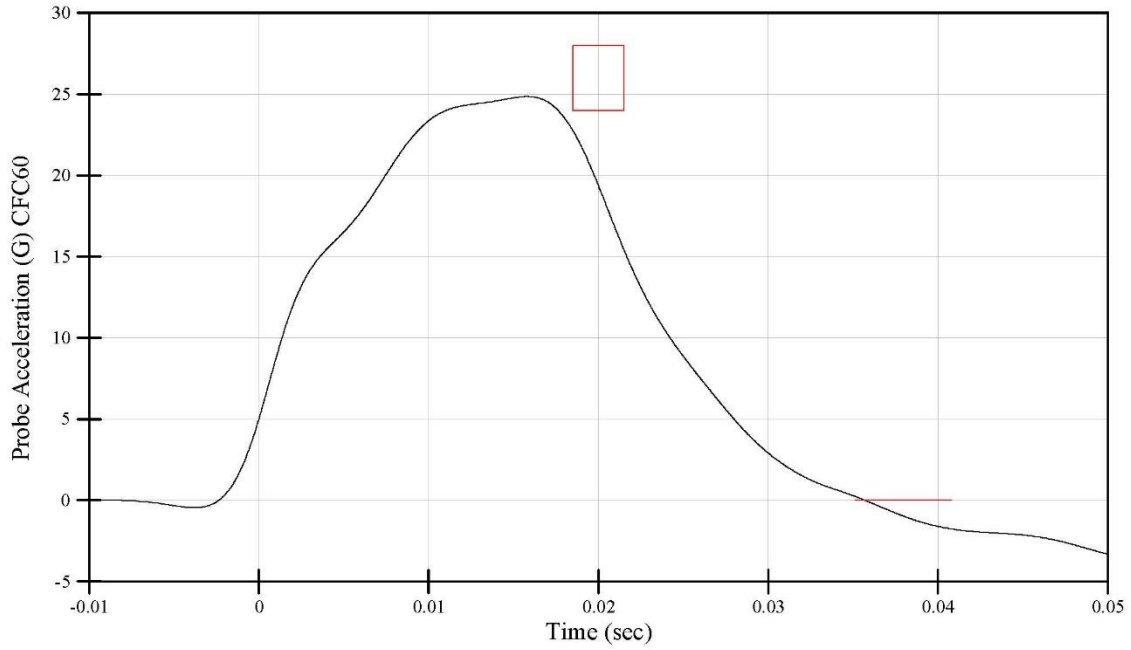


Software Version: 2.4

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

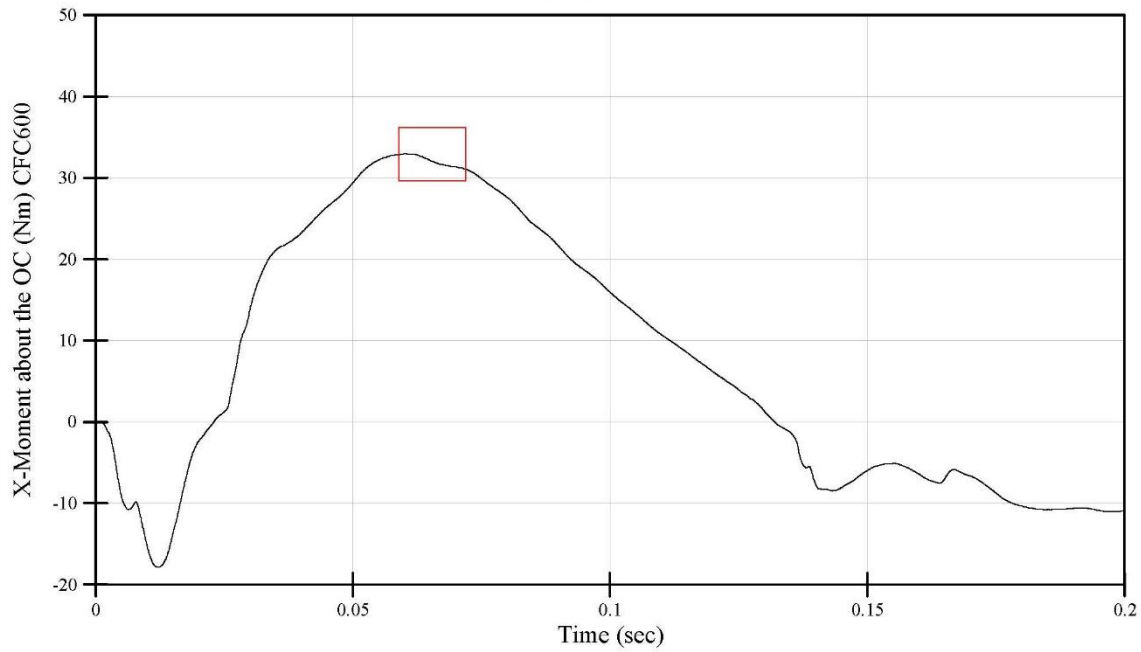


Software Version: 2.4

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

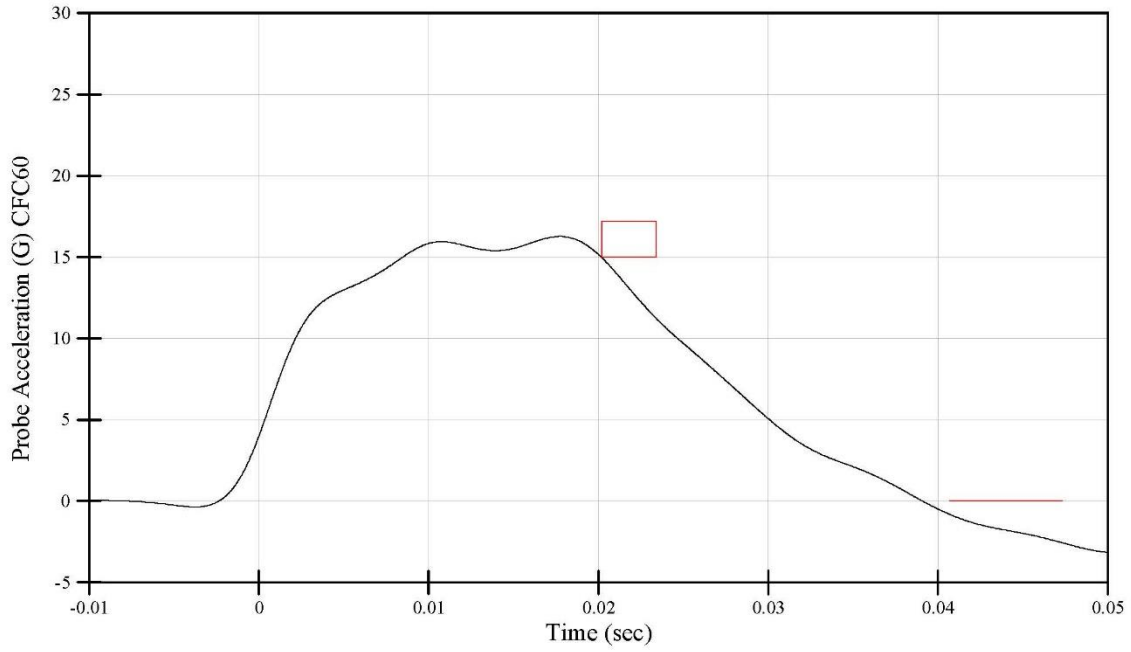


Software Version: 2.4

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

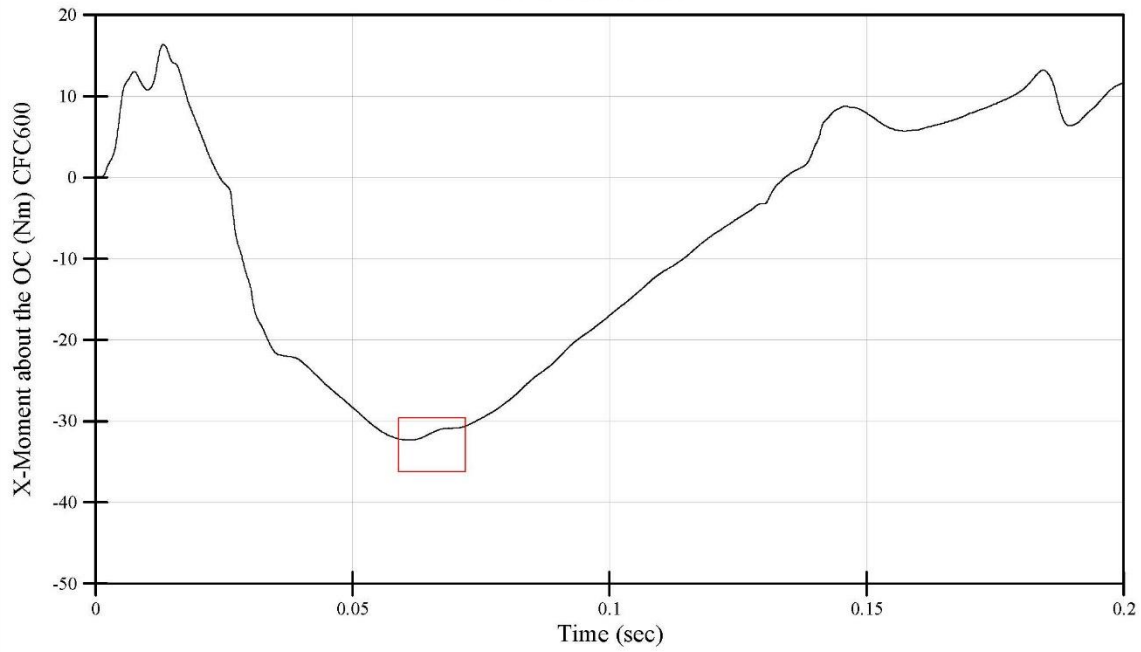


Software Version: 2.4

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



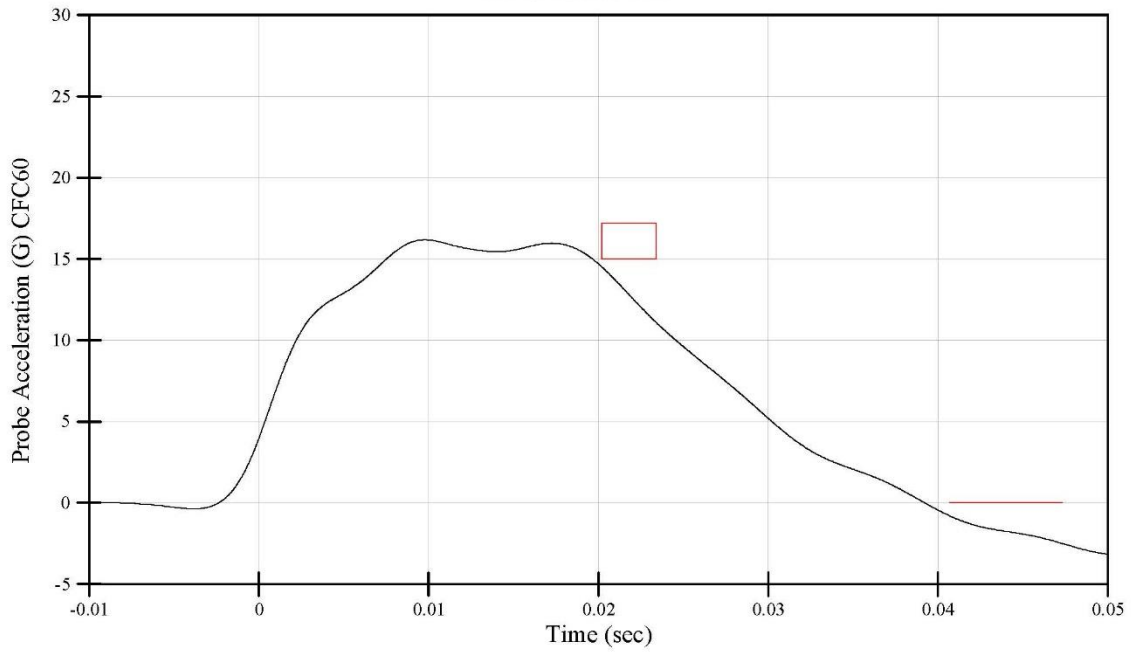
Software Version: 2.4

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

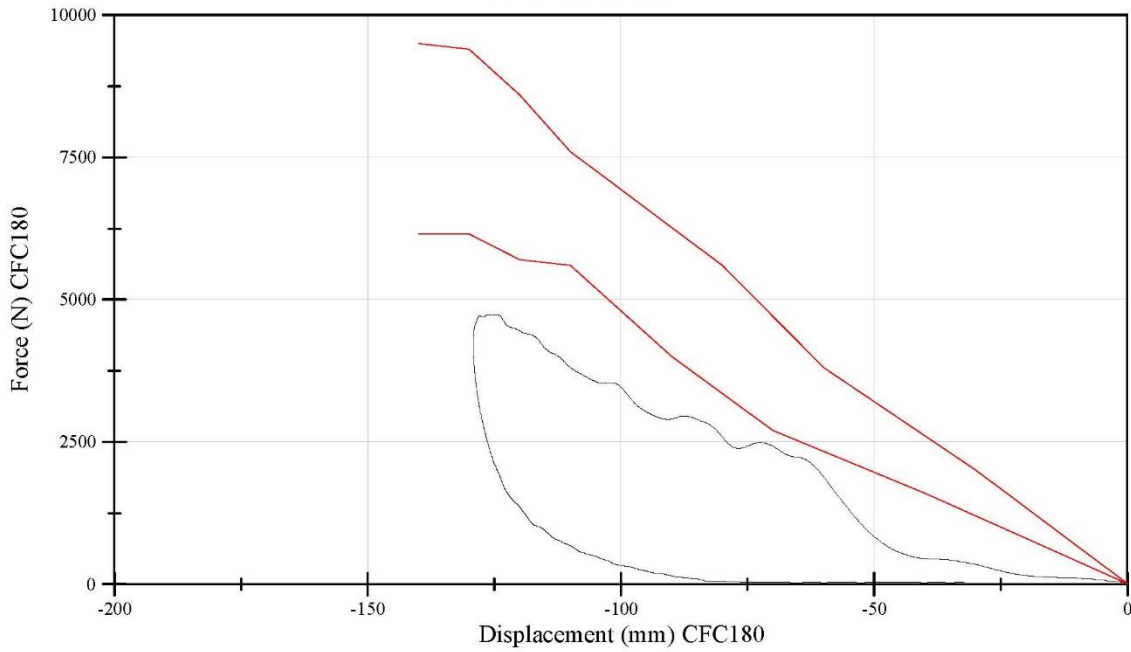


Software Version: 2.4

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

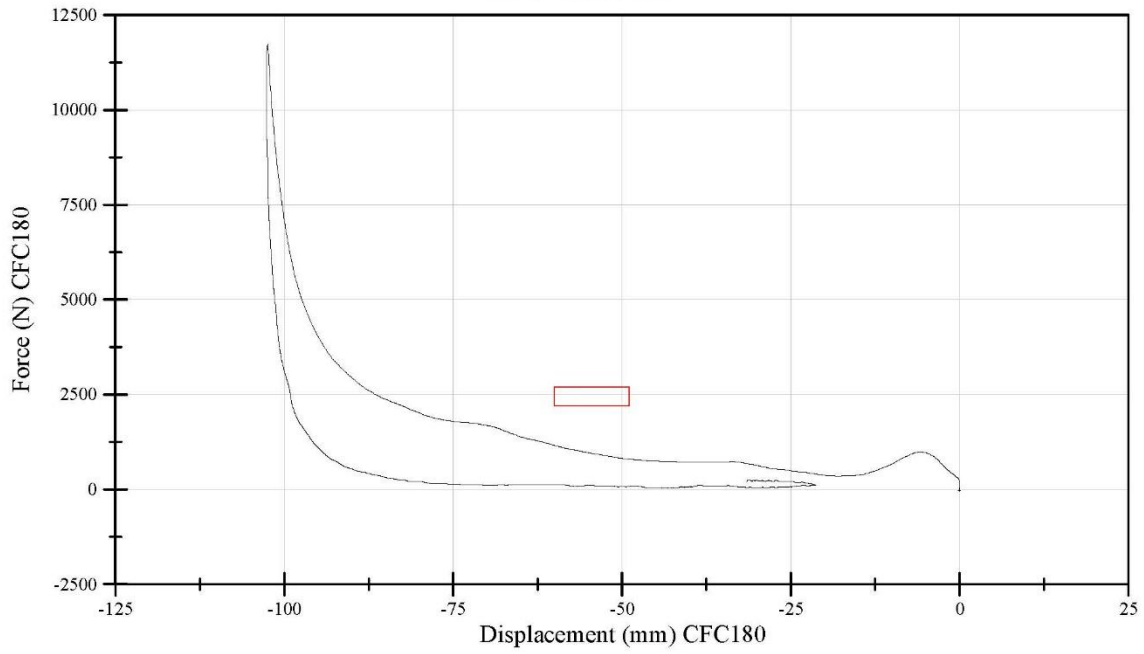


Software Version: 2.4

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



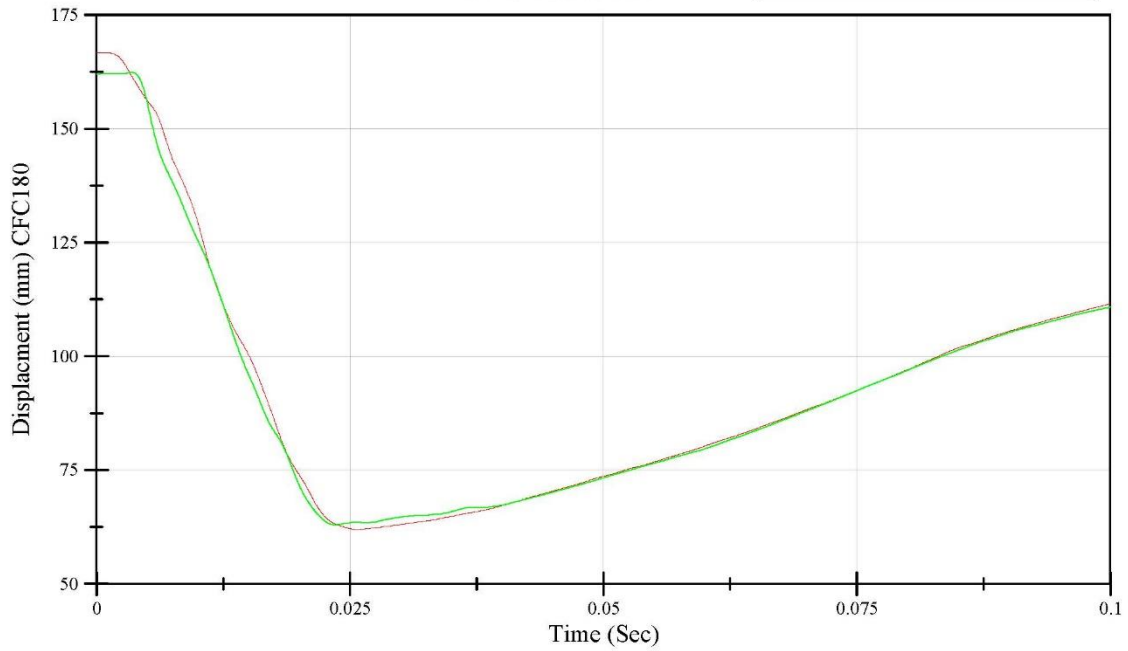
Software Version: 2.4

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07/09/2015 14:46:27.0000

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

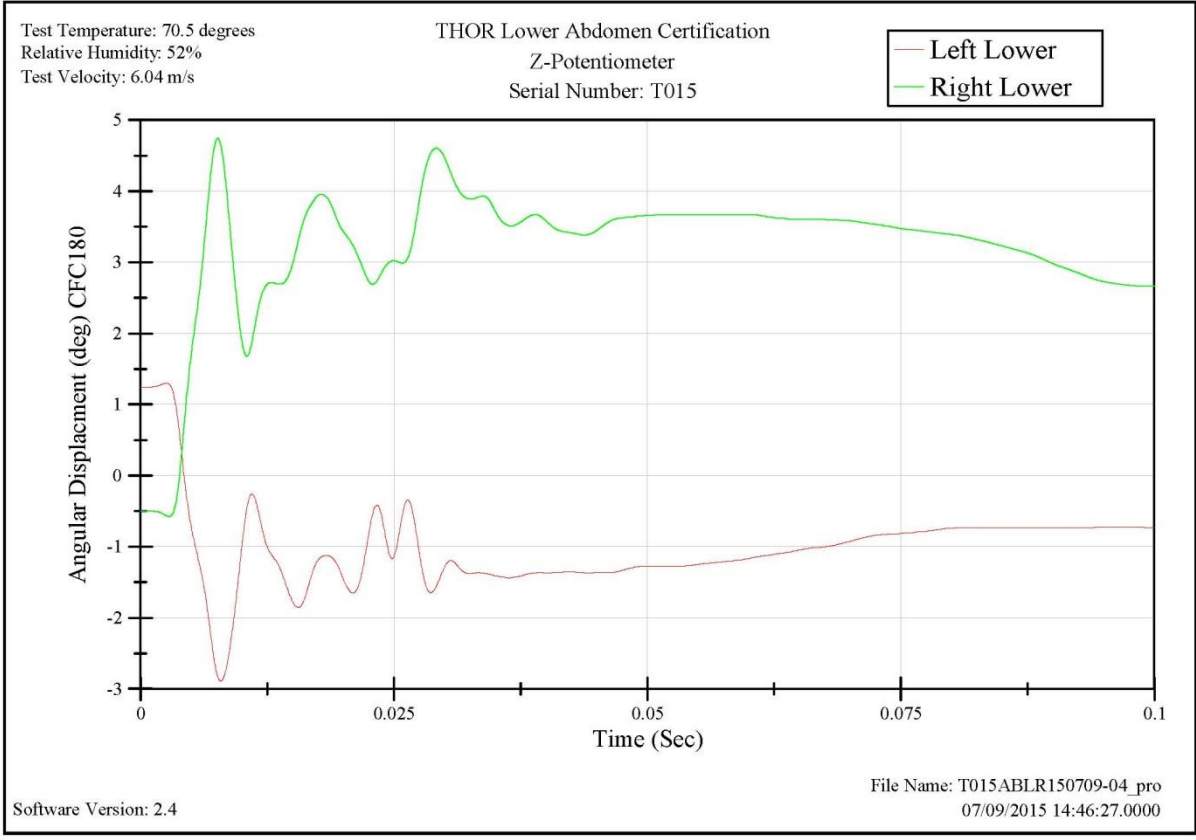
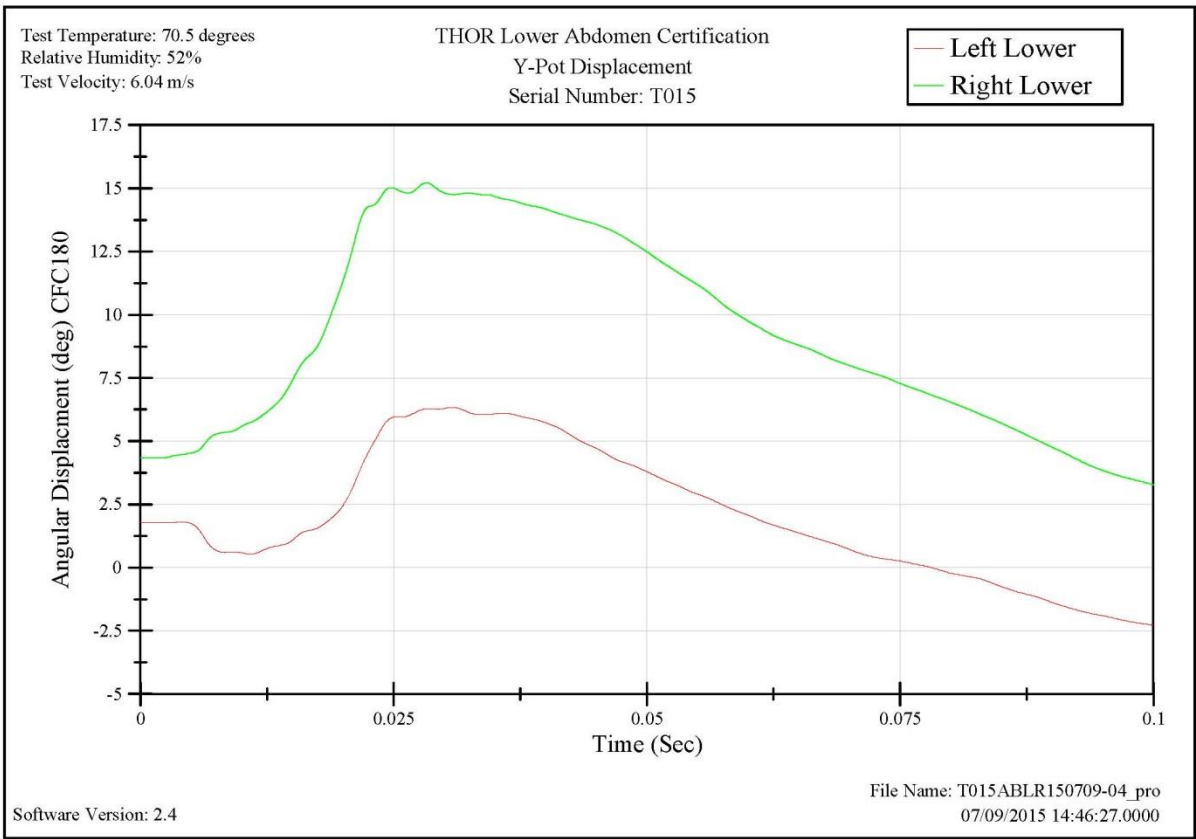
THOR Lower Abdomen Certification  
IRTRACC Displacement  
Serial Number: T015

Left Lower IR-TRACC  
Right Lower IR-TRACC



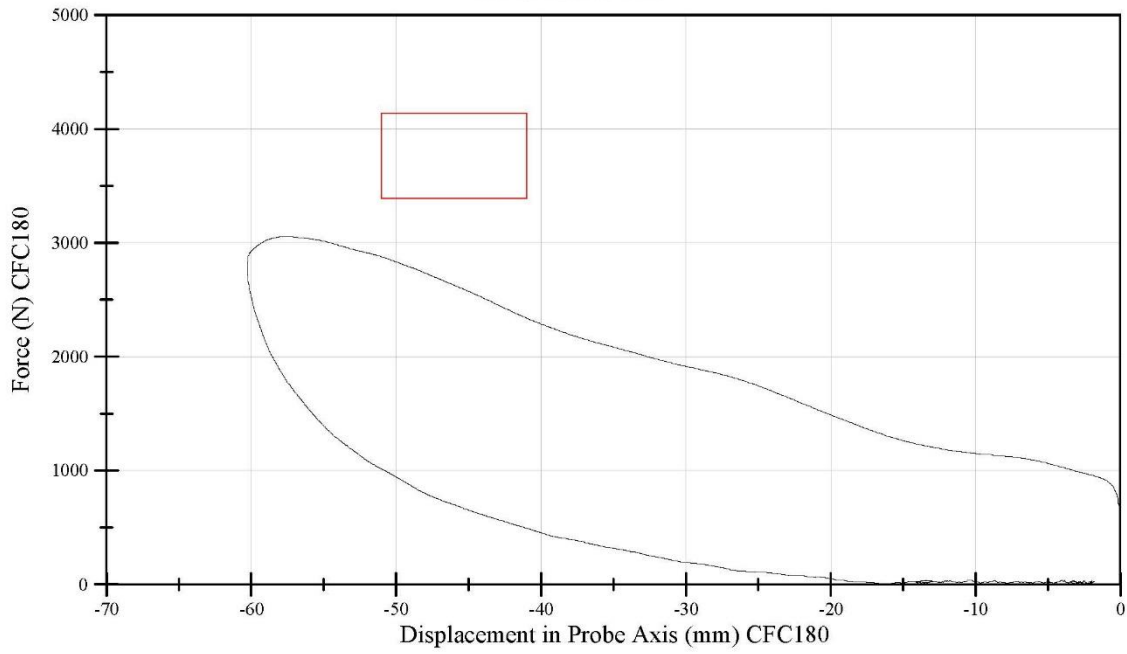
Software Version: 2.4

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

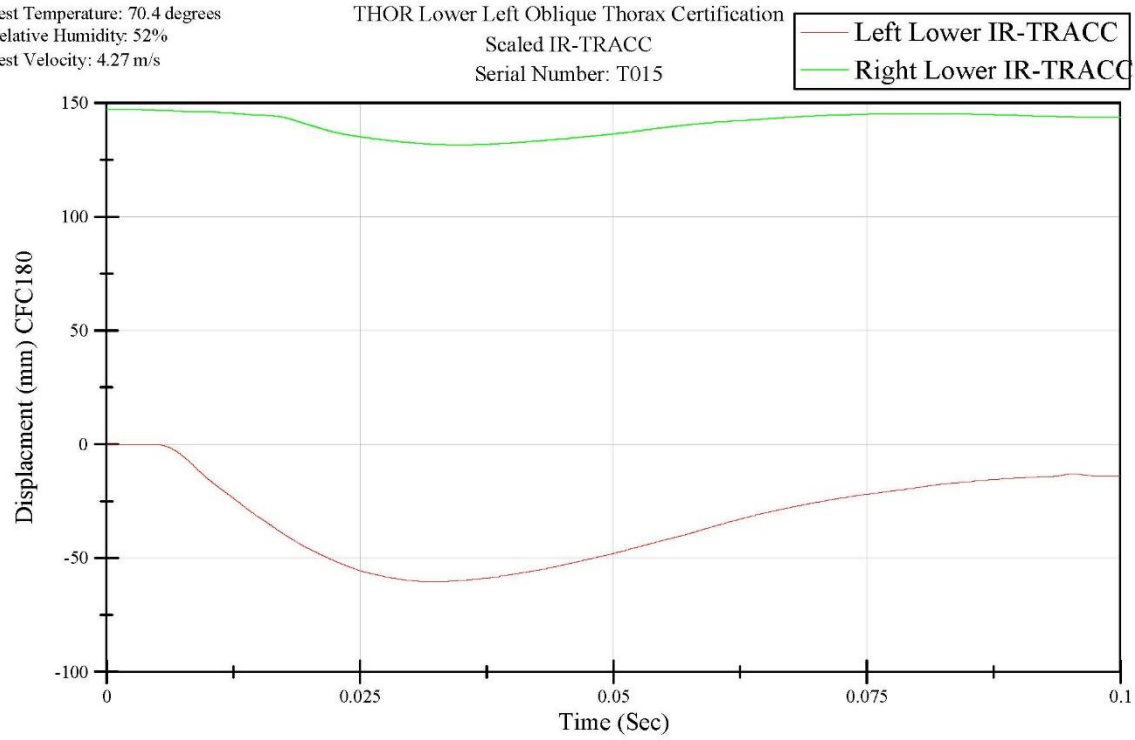


Software Version: 2.4

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



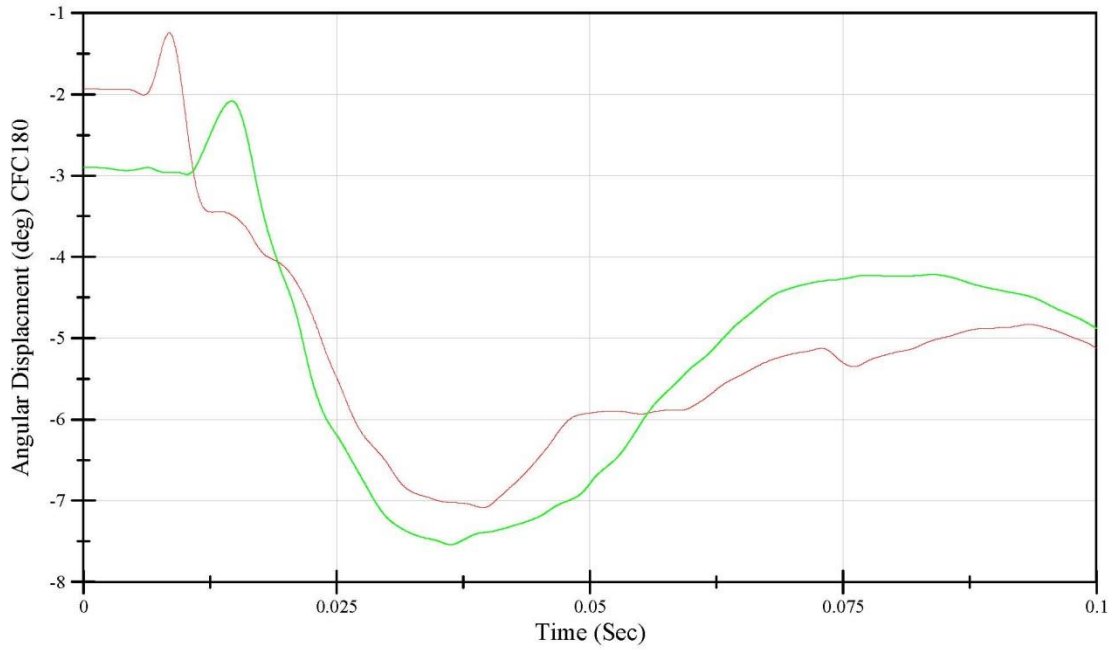
Software Version: 2.4

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



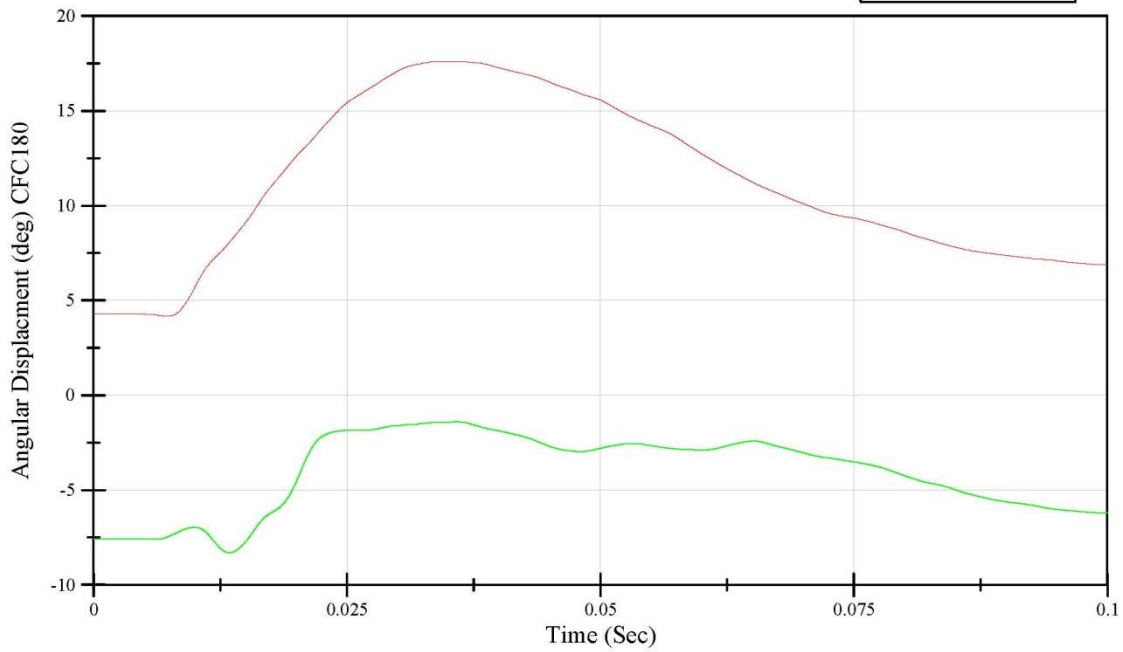
Software Version: 2.4

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

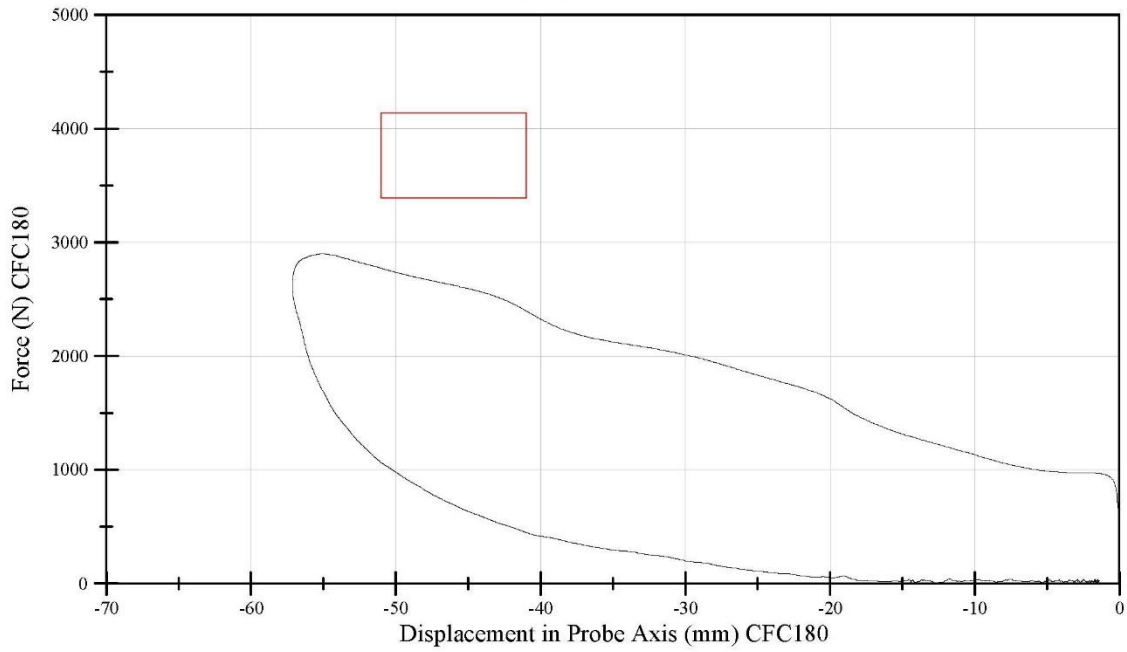


Software Version: 2.4

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

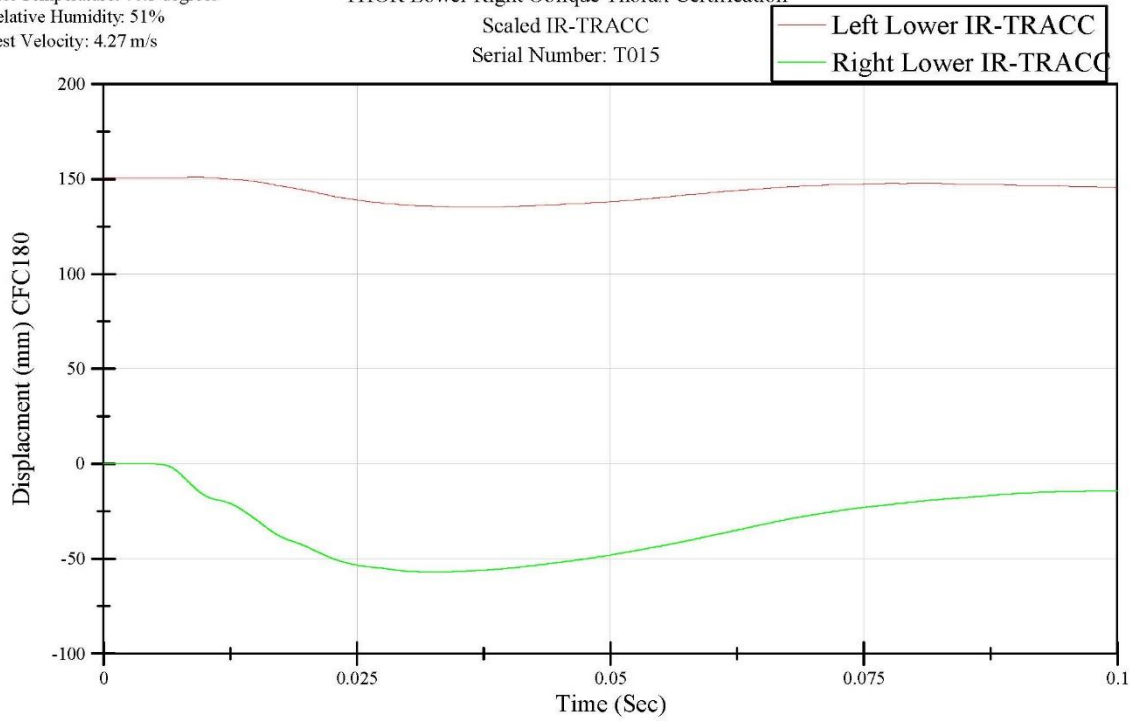


Software Version: 2.4

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

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



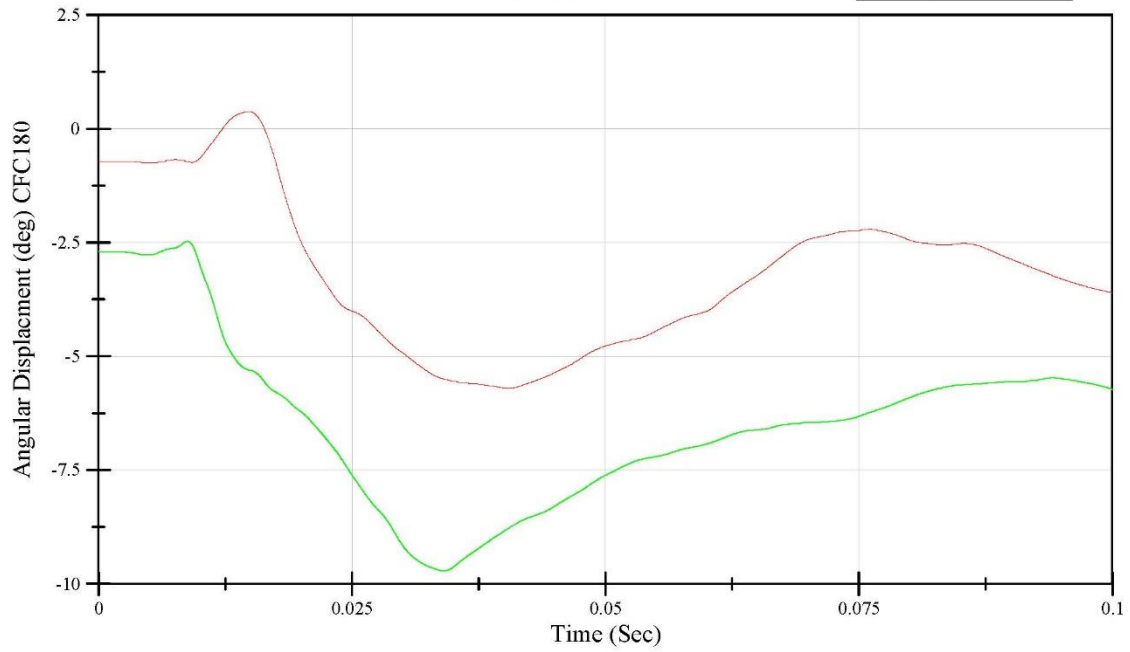
Software Version: 2.4

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

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

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

Left Lower  
Right Lower



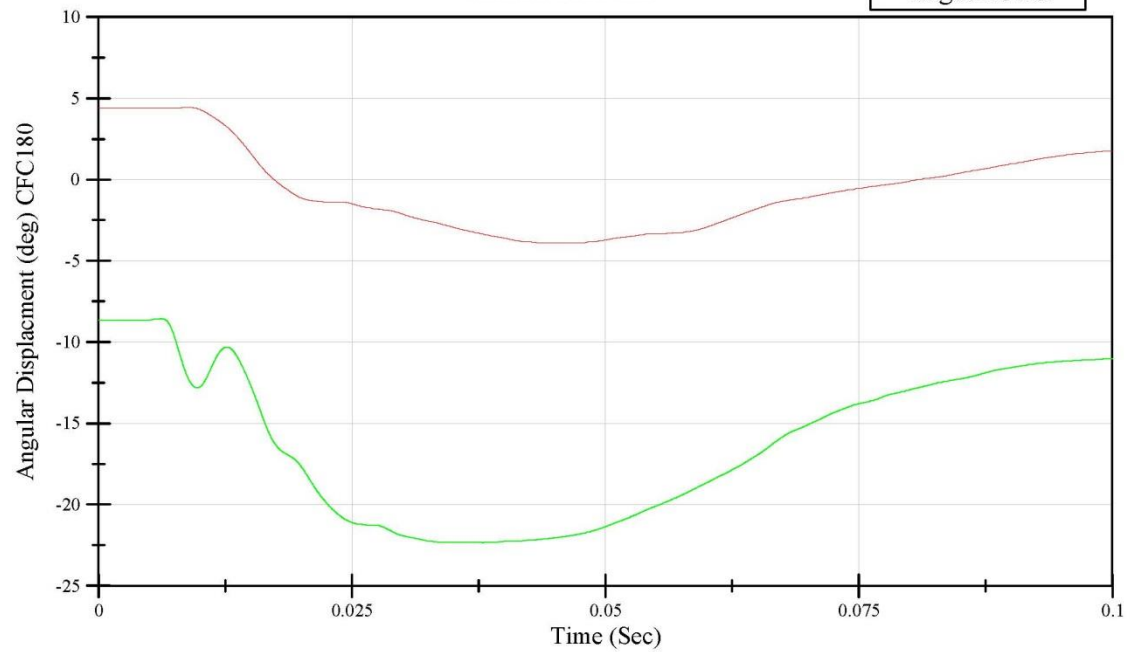
Software Version: 2.4

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

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

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

Left Lower  
Right Lower

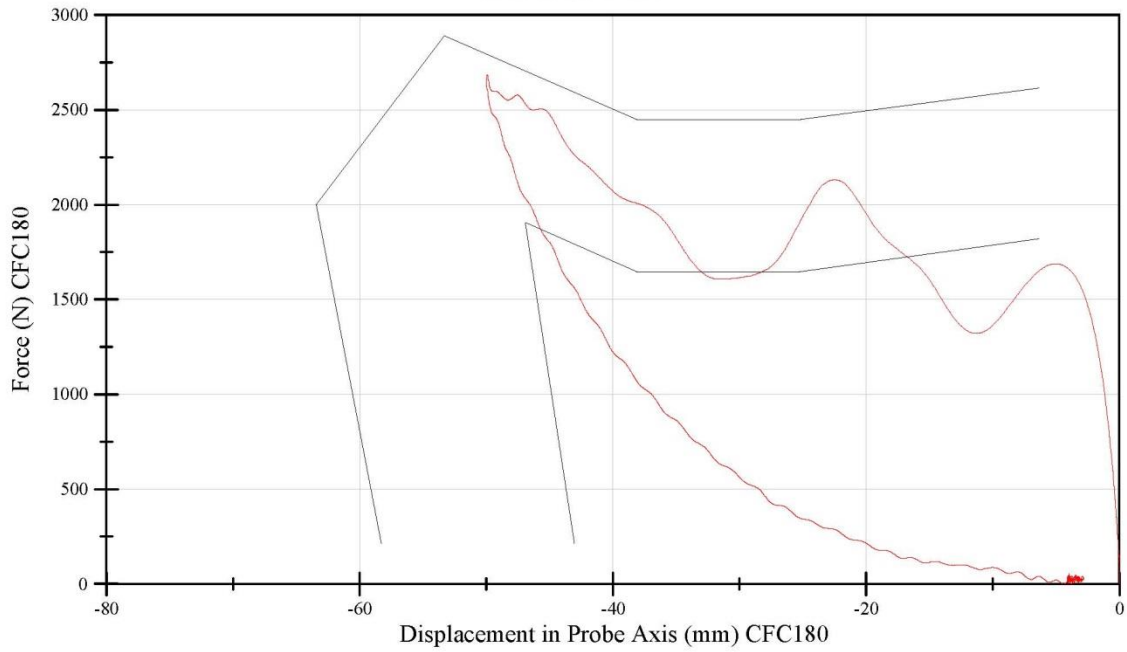


Software Version: 2.4

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



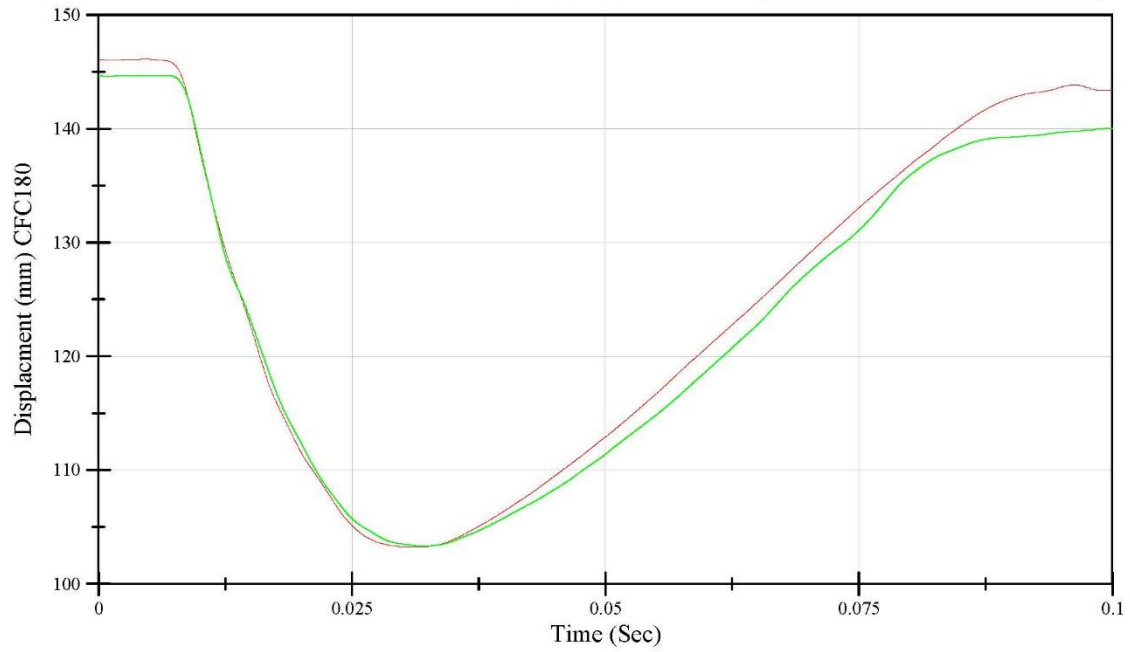
Software Version: 2.4

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

— Left Upper IR-TRACC  
— Right Upper IR-TRACC



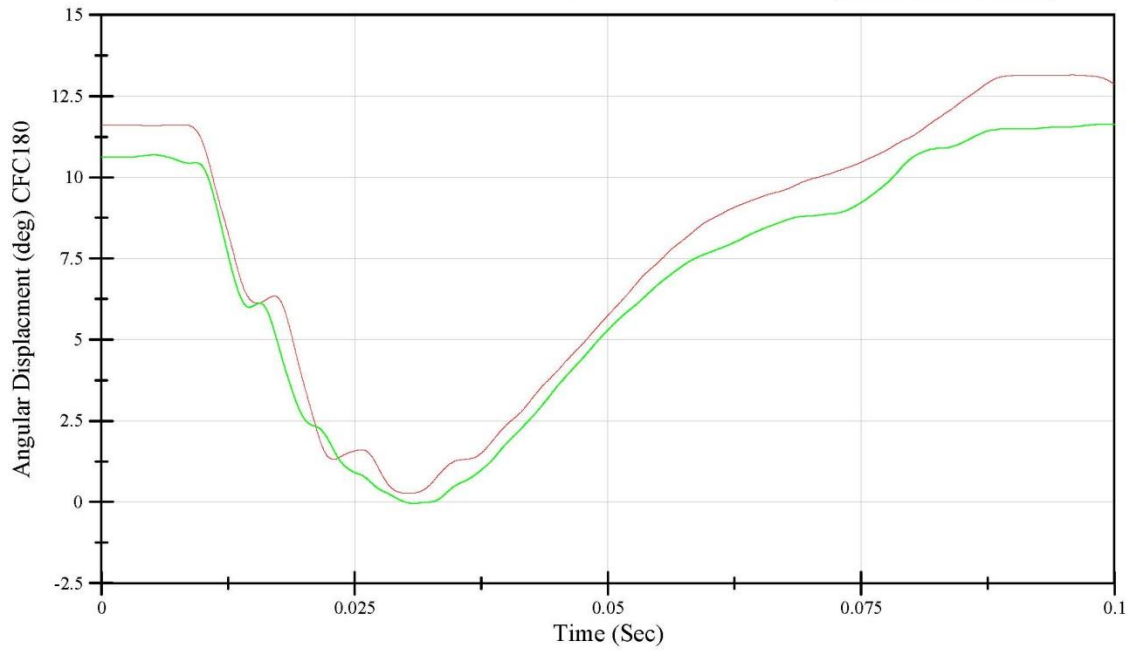
Software Version: 2.4

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  
Y-Potentiometer  
Serial Number: T015

— Left Upper  
— Right Upper



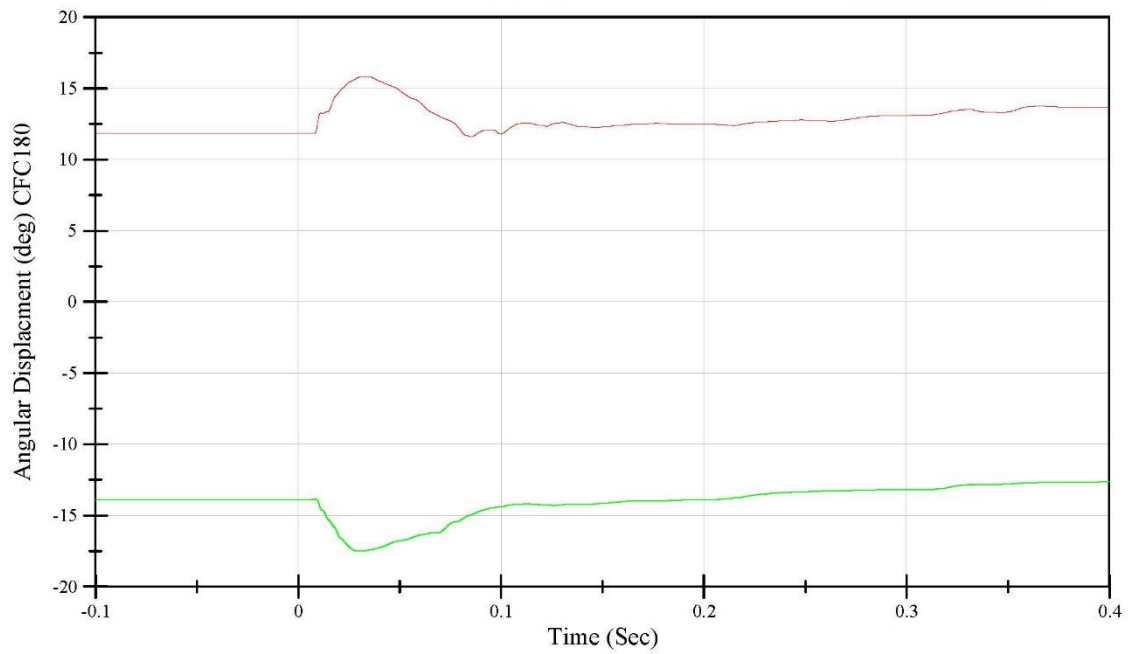
Software Version: 2.4

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  
Z-Potentiometer  
Serial Number: T015

— Left Upper  
— Right Upper

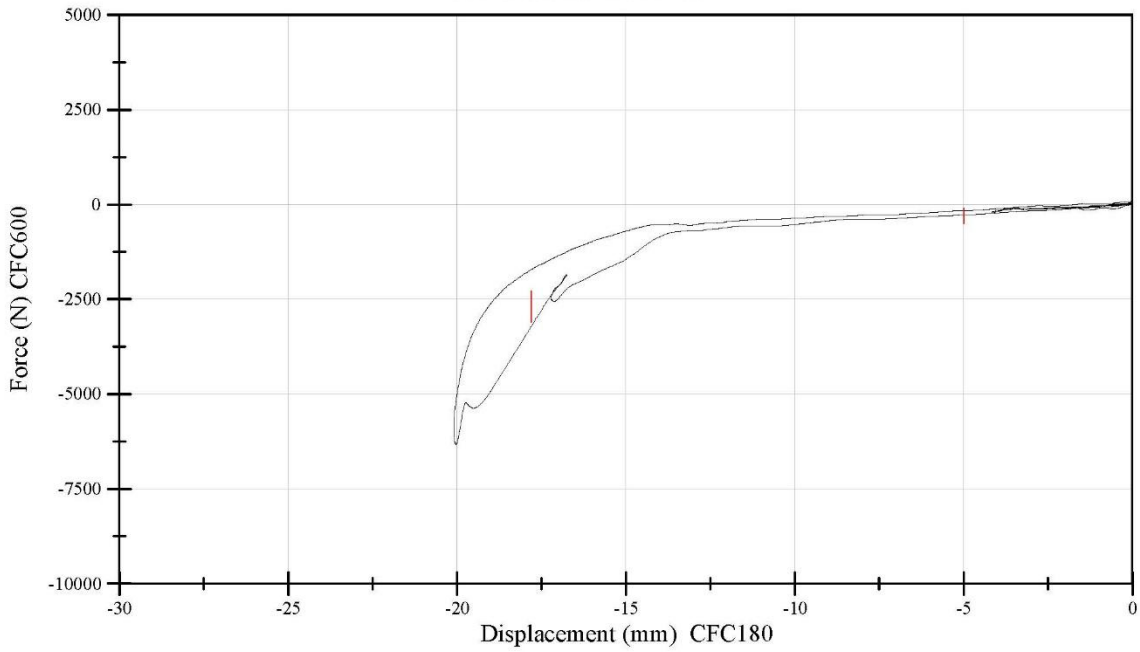


Software Version: 2.4

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

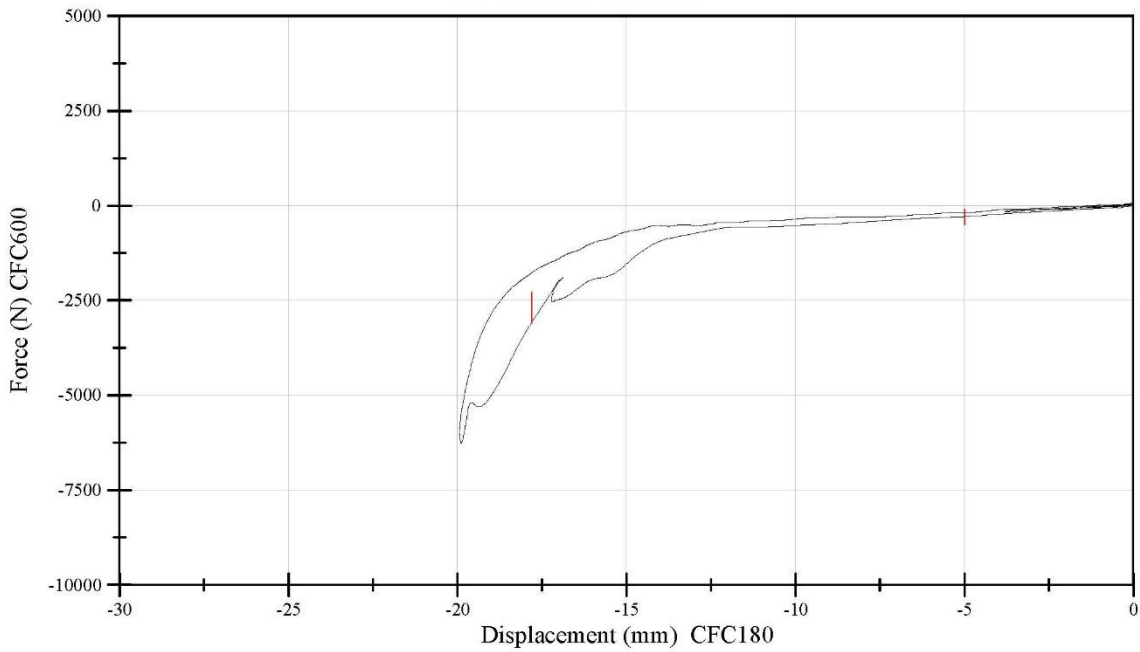


Software Version: 2.4

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

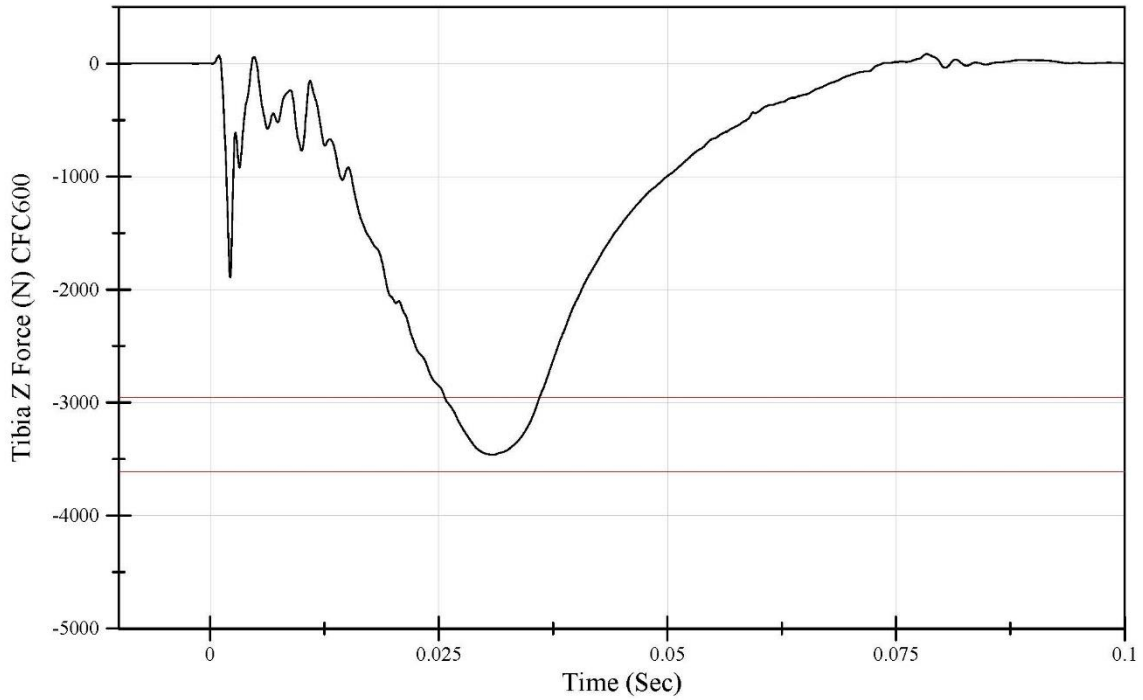


Software Version: 2.4

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

Test Temperature: 71.2 degrees  
Relative Humidity: 28.6%  
Test Velocity: 5.03 m/s

THOR Right Foot Dorsiflexion Certification  
Tibia Load  
Serial Number: LX0038

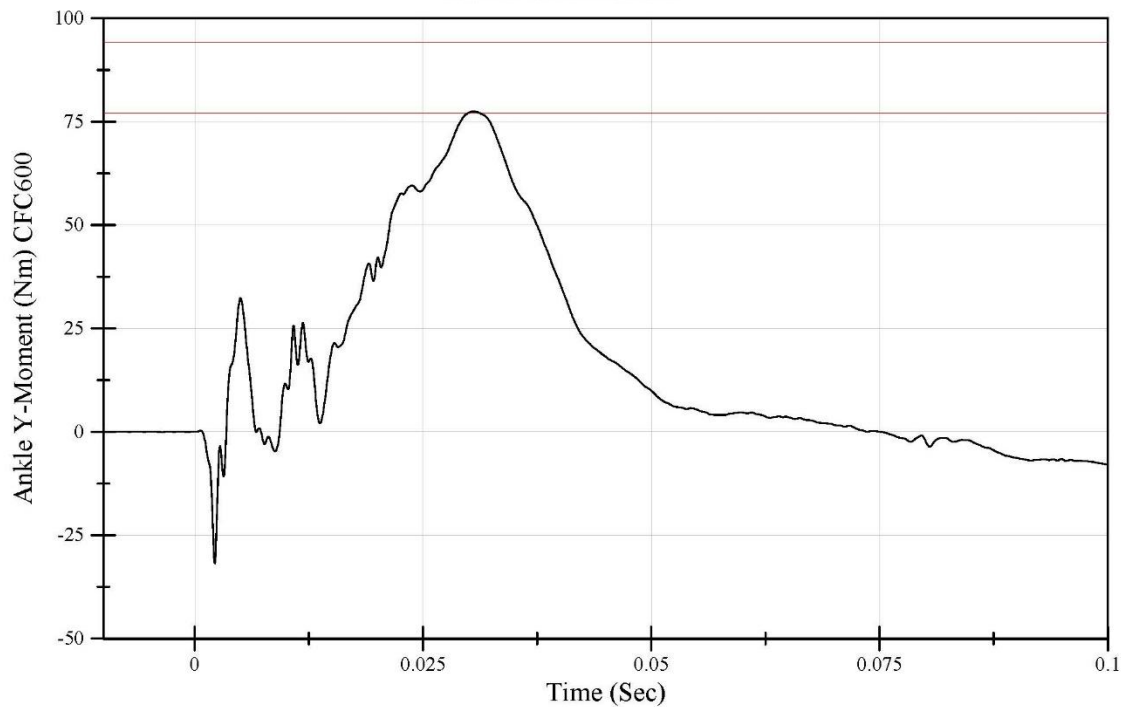


Software Version: 2.4

File Name: LX0038Ball150323\_06processed  
03/23/2015 09:51:34.0000

Test Temperature: 71.2 degrees  
Relative Humidity: 28.6%  
Test Velocity: 5.03 m/s

THOR Right Foot Dorsiflexion Certification  
Ankle Y-Moment  
Serial Number: LX0038

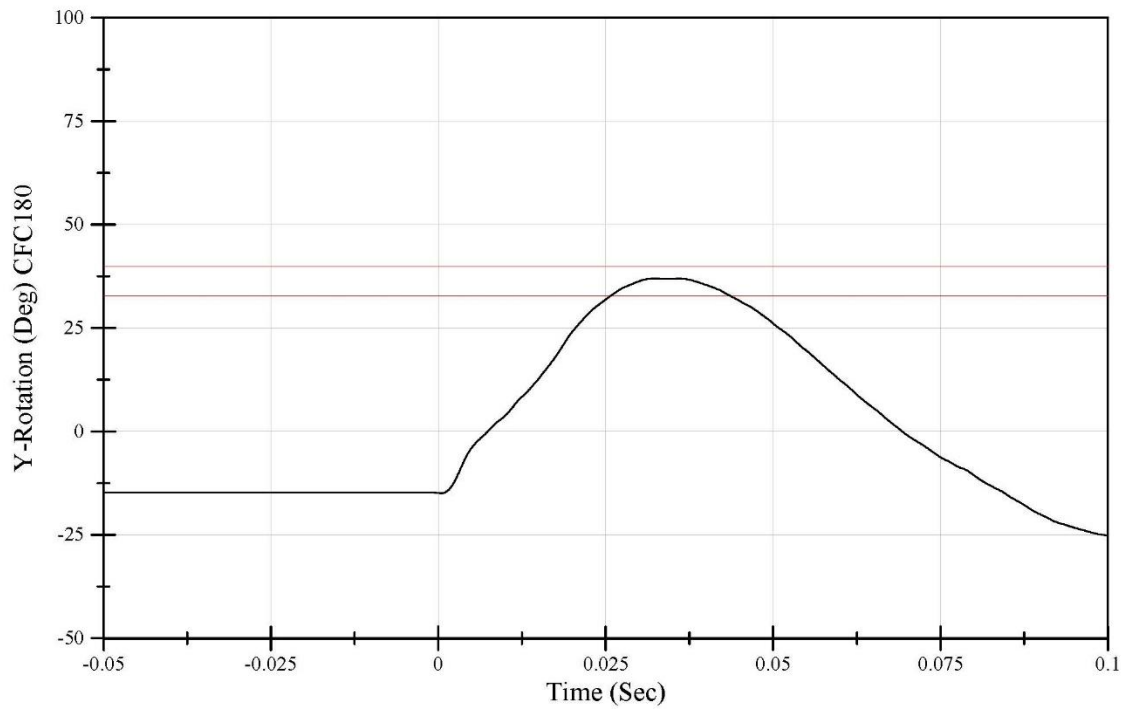


Software Version: 2.4

File Name: LX0038Ball150323\_06processed  
03/23/2015 09:51:34.0000

Test Temperature: 71.2 degrees  
Relative Humidity: 28.6%  
Test Velocity: 5.03 m/s

THOR Right Foot Dorsiflexion Certification  
Ankle Y-Rotation  
Serial Number: LX0038

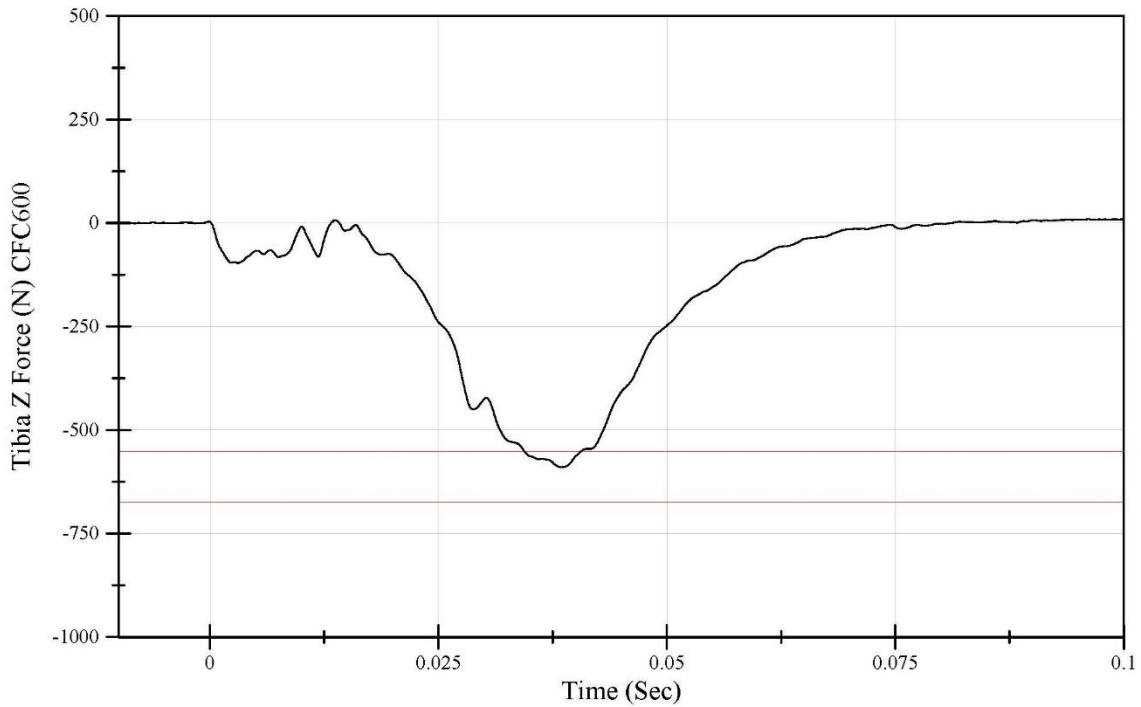


Software Version: 2.4

File Name: LX0038Ball150323\_06processed  
03/23/2015 09:51:34.0000

Test Temperature: 71 degrees  
Relative Humidity: 33.2%  
Test Velocity: 1.95 m/s

THOR Right Foot Eversion Certification  
Tibia Load  
Serial Number: LX0038

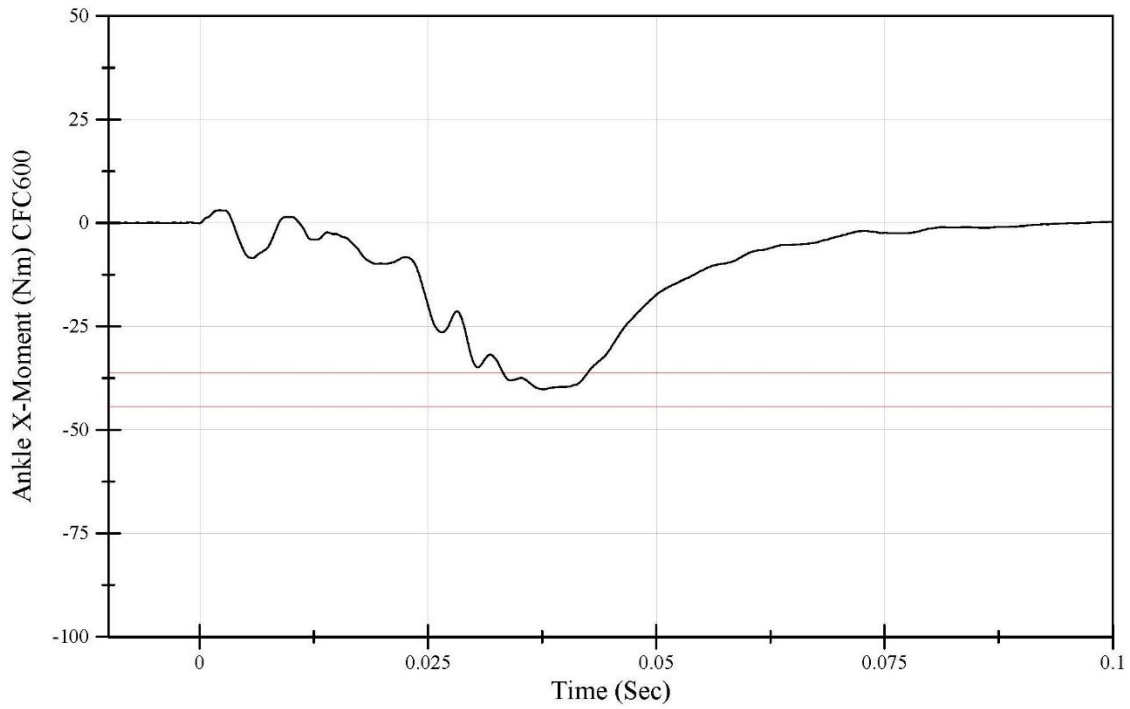


Software Version: 2.4

File Name: LX0038Eversion150319\_01processed  
03/19/2015 14:01:21.0000

Test Temperature: 71 degrees  
Relative Humidity: 33.2%  
Test Velocity: 1.95 m/s

THOR Right Foot Eversion Certification  
Ankle Moment  
Serial Number: LX0038

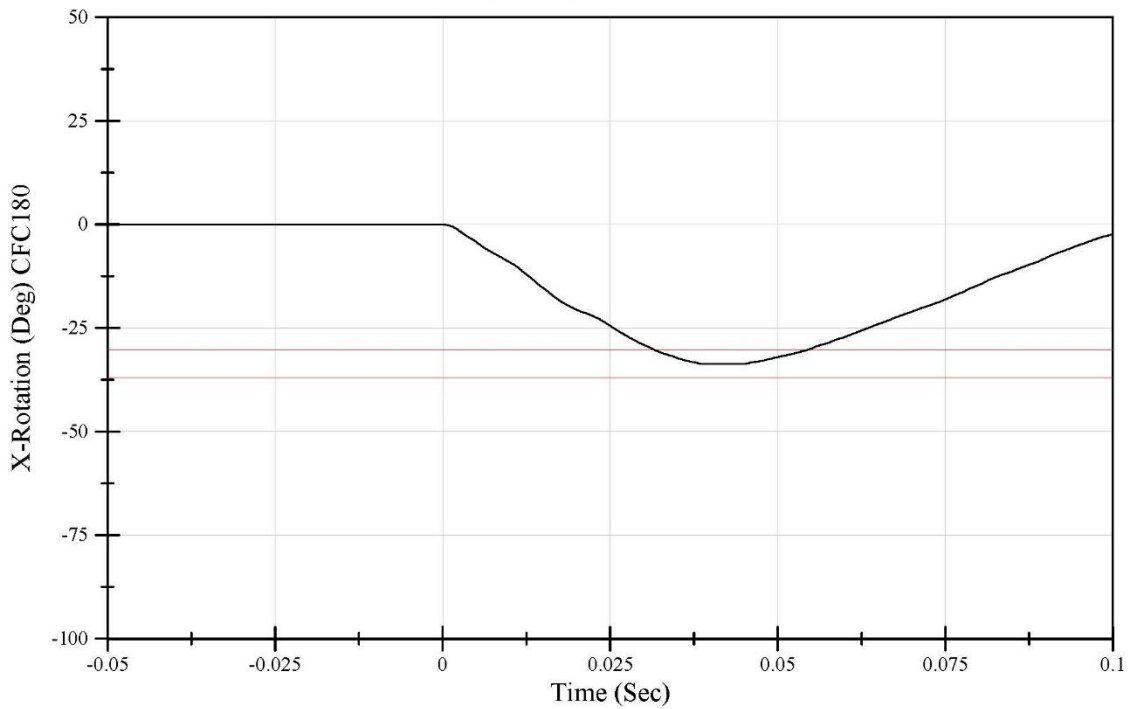


Software Version: 2.4

File Name: LX0038Eversion150319\_01processed  
03/19/2015 14:01:21.0000

Test Temperature: 71 degrees  
Relative Humidity: 33.2%  
Test Velocity: 1.95 m/s

THOR Right Foot Eversion Certification  
Ankle X-Rotation  
Serial Number: LX0038



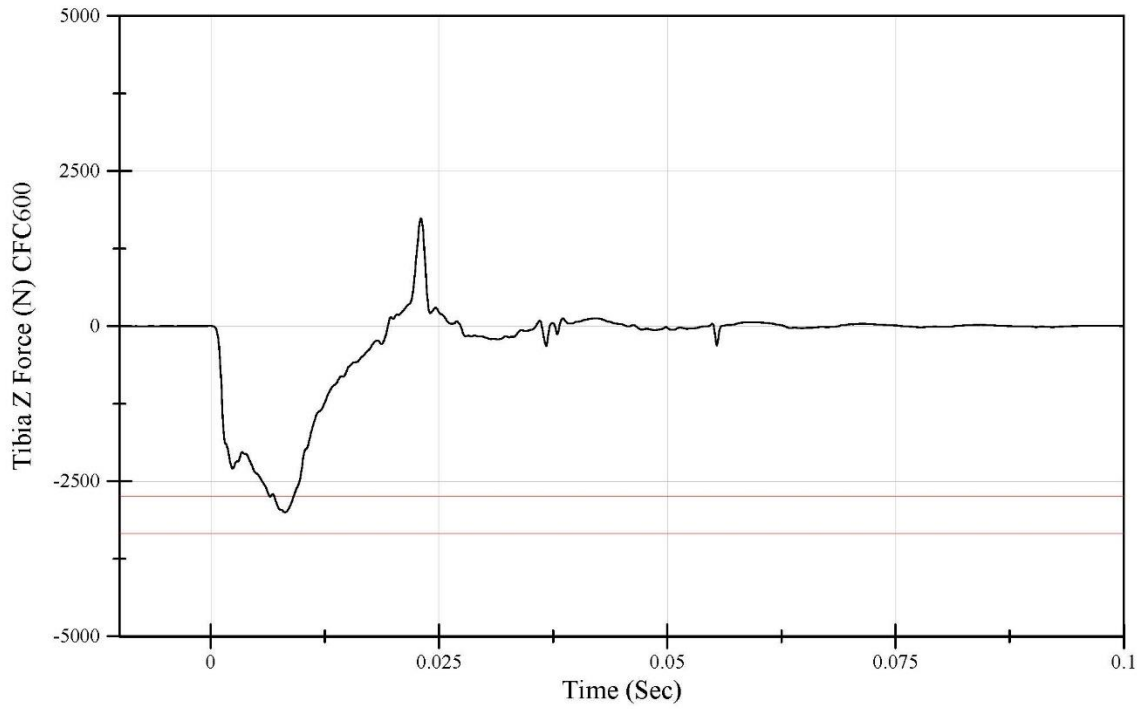
Software Version: 2.4

File Name: LX0038Eversion150319\_01processed  
03/19/2015 14:01:21.0000

Test Temperature: 71 degrees  
Relative Humidity: 28.4%  
Test Velocity: 3.91 m/s

### THOR Right Foot Heel Certification

Tibia Load  
Serial Number: LX0038



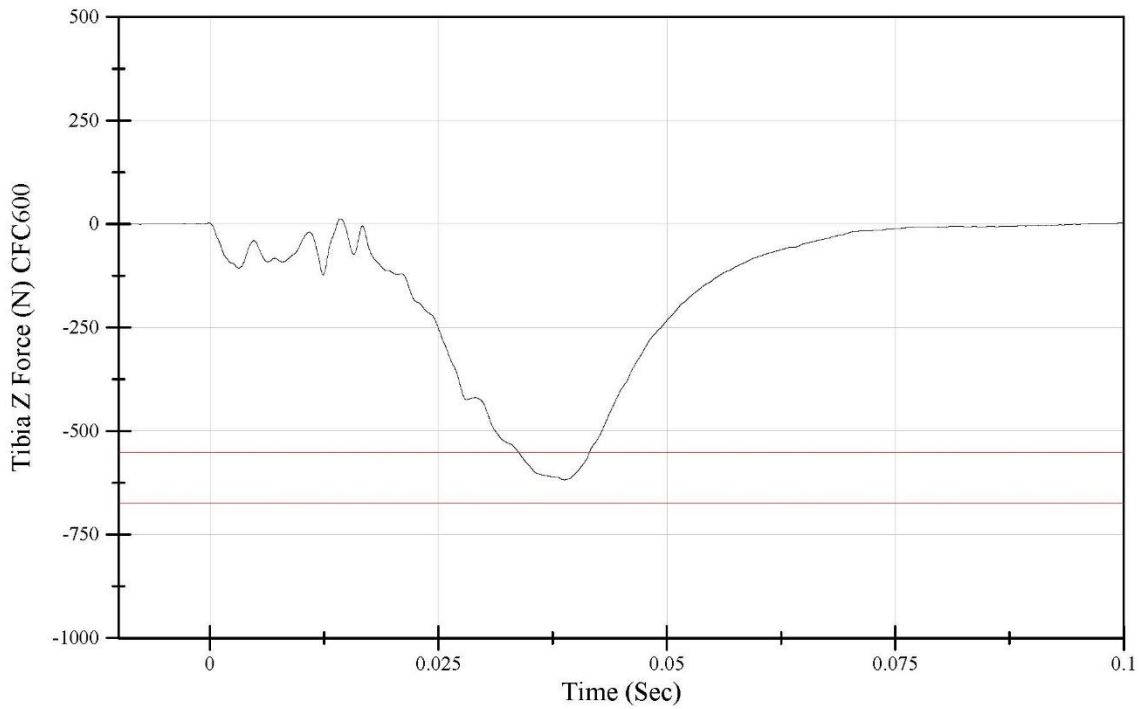
Software Version: 2.4

File Name: LX0038Heel150323\_02processed  
03/23/2015 13:53:13.0000

Test Temperature: 71.2 degrees  
Relative Humidity: 33.1%  
Test Velocity: 1.94 m/s

### THOR Right Foot Inversion Certification

Tibia Load  
Serial Number: LX0038

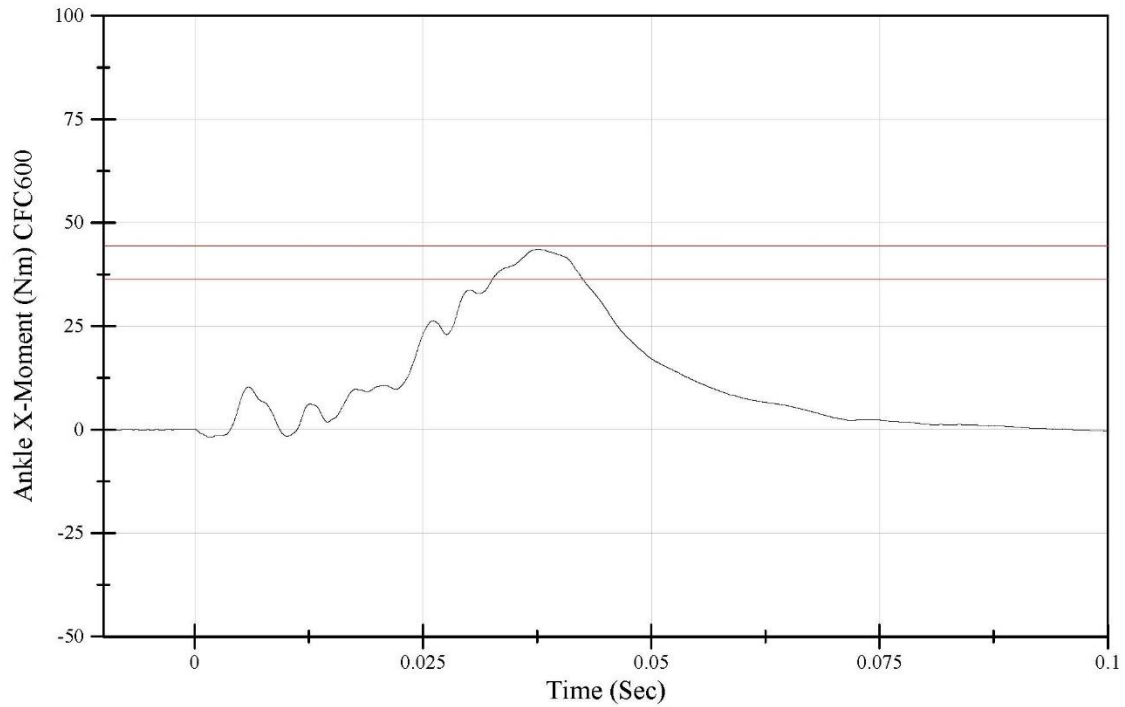


Software Version: 2.4

File Name: LX0038Inversion150319\_05processed  
03/19/2015 13:27:37.0000

Test Temperature: 71.2 degrees  
Relative Humidity: 33.1%  
Test Velocity: 1.94 m/s

THOR Right Foot Inversion Certification  
Ankle Moment  
Serial Number: LX0038

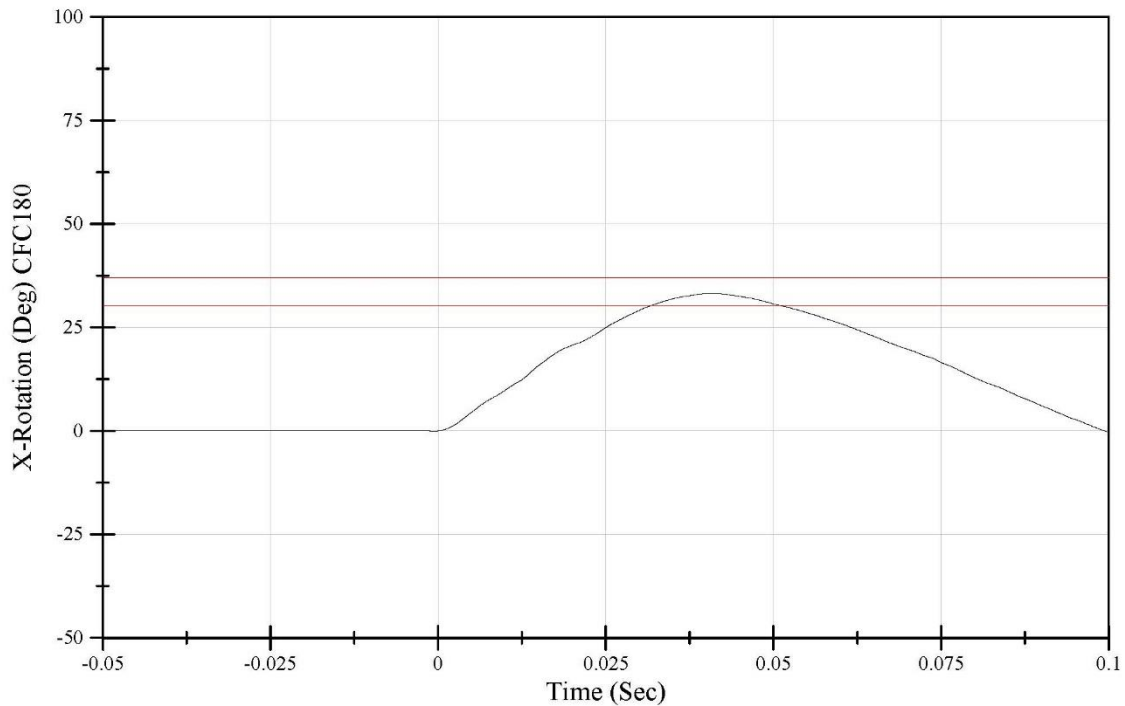


Software Version: 2.4

File Name: LX0038Inversion150319\_05processed  
03/19/2015 13:27:37.0000

Test Temperature: 71.2 degrees  
Relative Humidity: 33.1%  
Test Velocity: 1.94 m/s

THOR Right Foot Inversion Certification  
Ankle X-Rotation  
Serial Number: LX0038

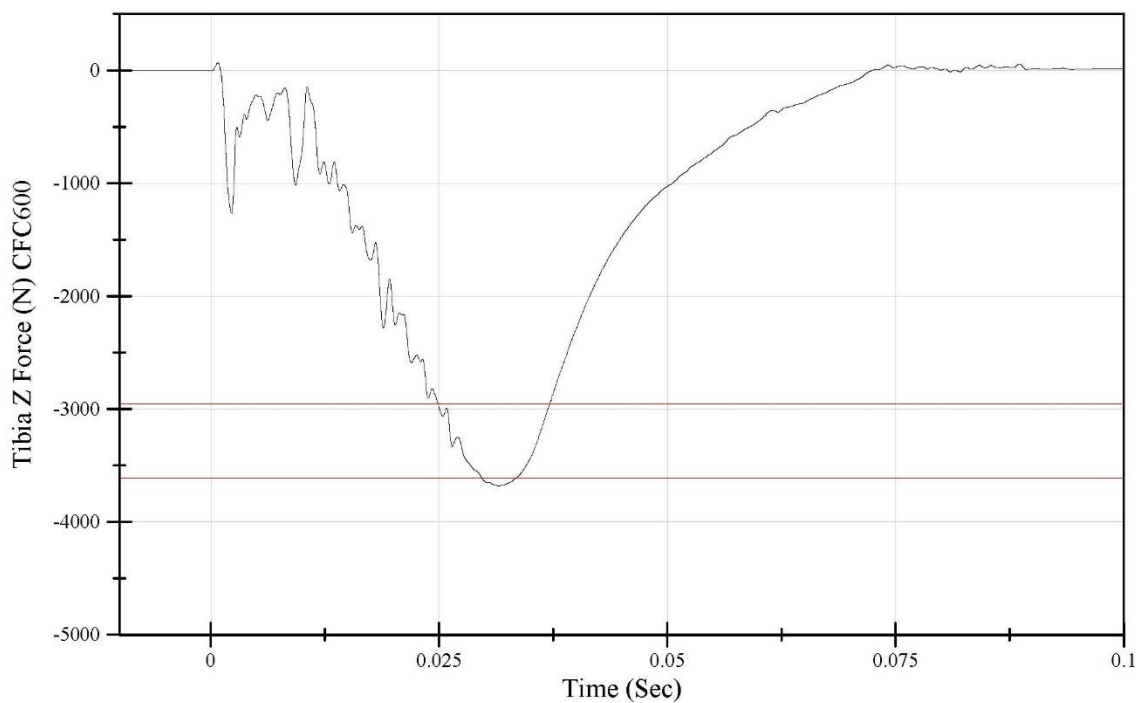


Software Version: 2.4

File Name: LX0038Inversion150319\_05processed  
03/19/2015 13:27:37.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.4%  
Test Velocity: 4.98 m/s

THOR Left Foot Dorsiflexion Certification  
Tibia Load  
Serial Number: LX0039

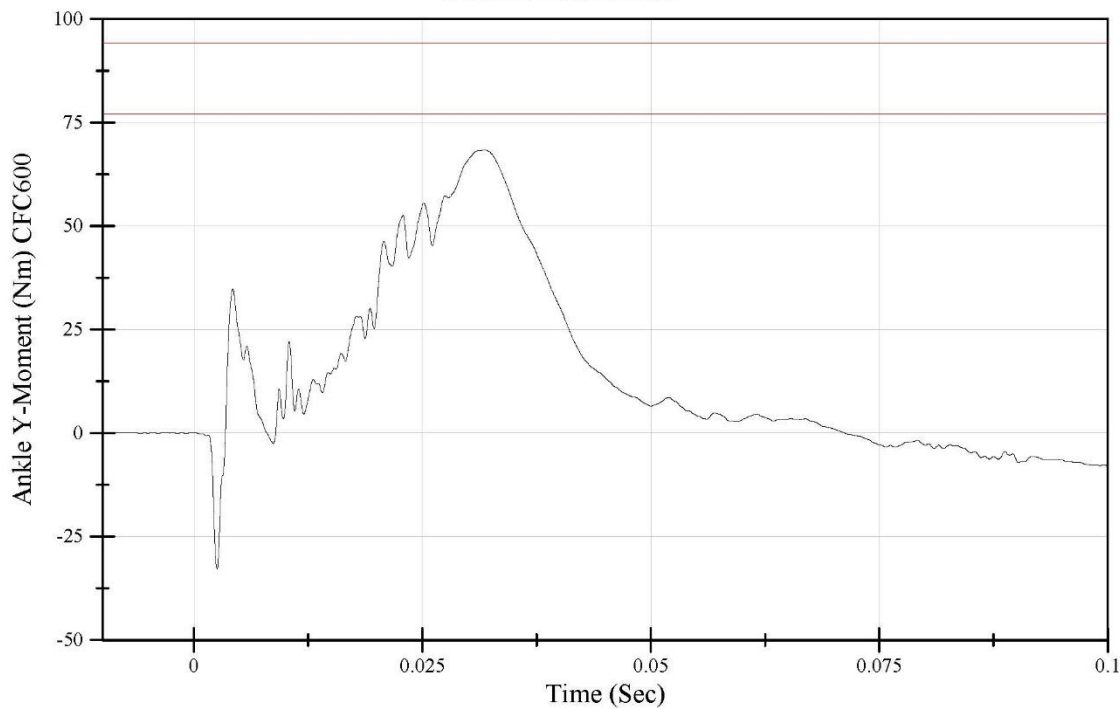


Software Version: 2.4

File Name: LX0039Ball1150324\_04processed  
03/24/2015 09:40:54.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.4%  
Test Velocity: 4.98 m/s

THOR Left Foot Dorsiflexion Certification  
Ankle Y-Moment  
Serial Number: LX0039

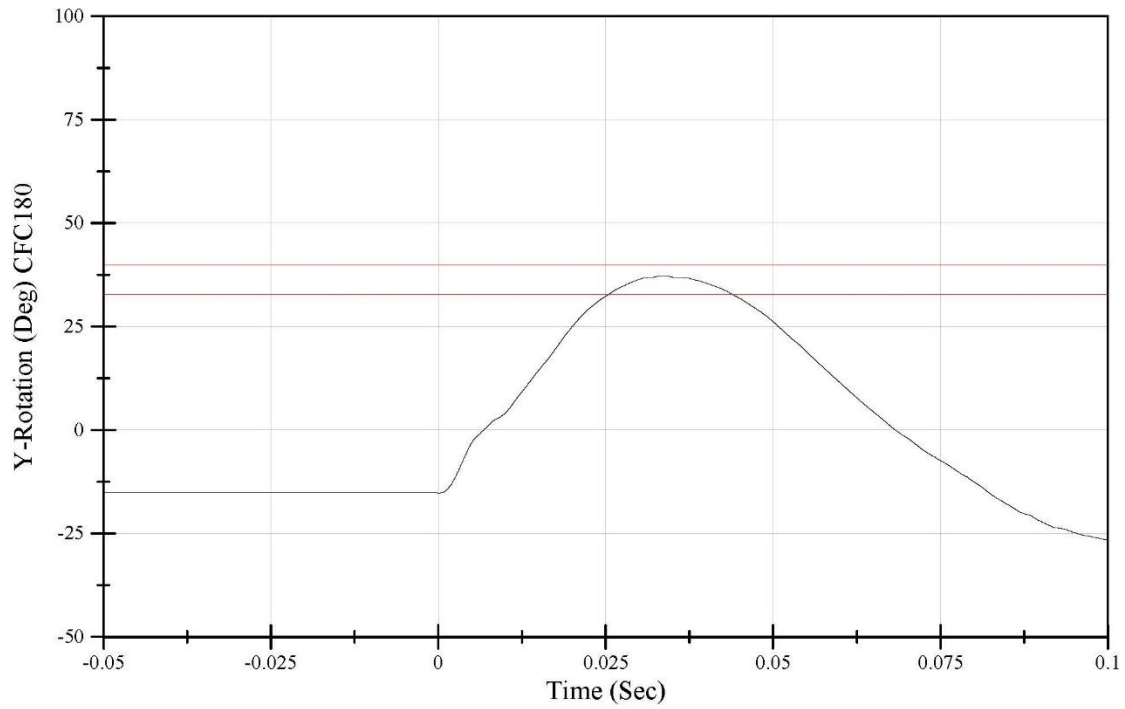


Software Version: 2.4

File Name: LX0039Ball1150324\_04processed  
03/24/2015 09:40:54.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.4%  
Test Velocity: 4.98 m/s

THOR Left Foot Dorsiflexion Certification  
Ankle Y-Rotation  
Serial Number: LX0039

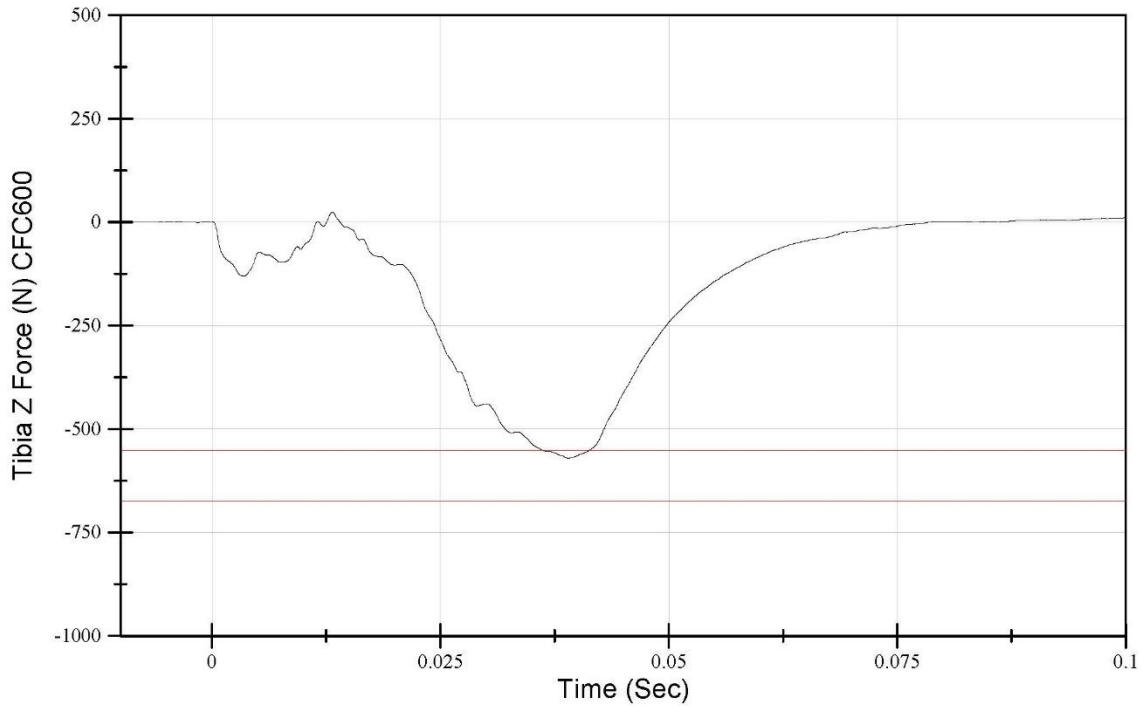


Software Version: 2.4

File Name: LX0039Ball150324\_04processed  
03/24/2015 09:40:54.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.8%  
Test Velocity: 2.04 m/s

THOR Left Foot Eversion Certification  
Tibia Load  
Serial Number: LX0039

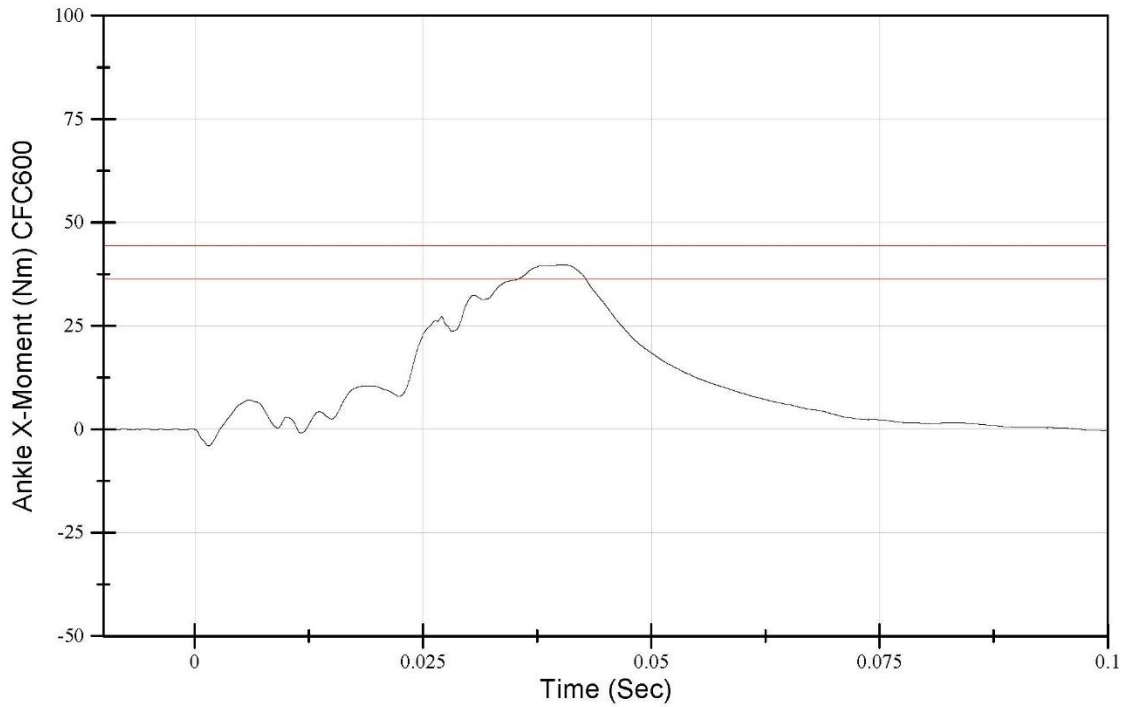


Software Version: 2.4

File Name: LX0039Eversion150324\_01processed  
03/24/2015 06:43:58.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.8%  
Test Velocity: 2.04 m/s

THOR Left Foot Eversion Certification  
Ankle Moment  
Serial Number: LX0039

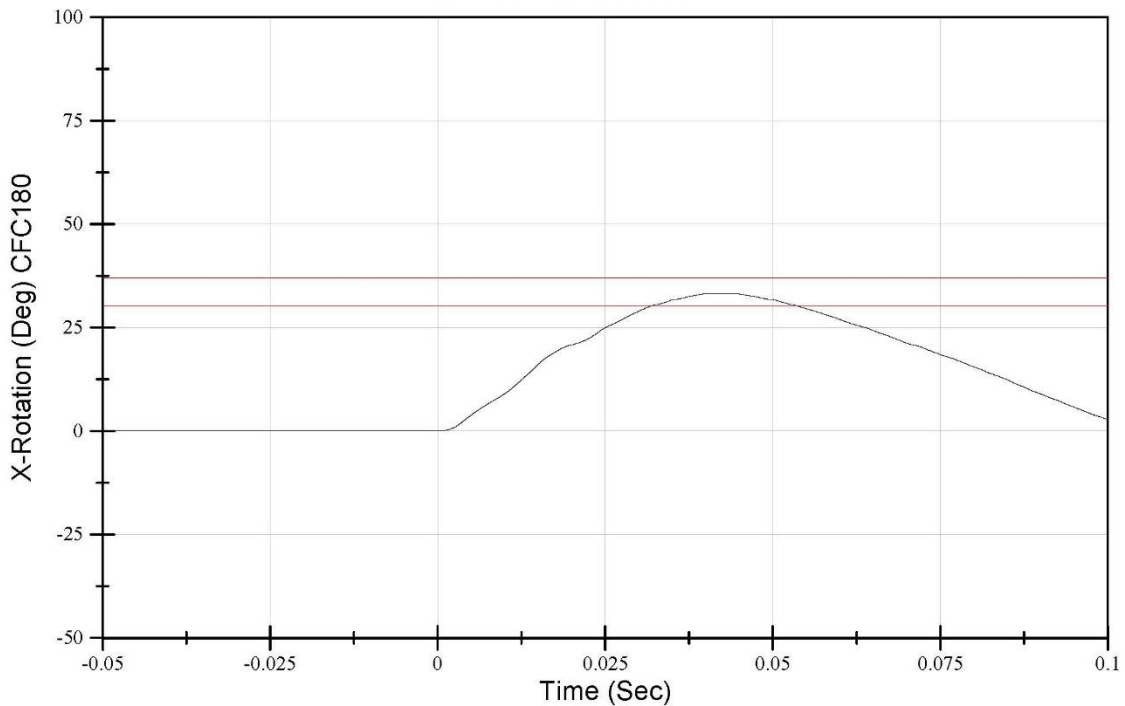


Software Version: 2.4

File Name: LX0039Eversion150324\_01processed  
03/24/2015 06:43:58.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.8%  
Test Velocity: 2.04 m/s

THOR Left Foot Eversion Certification  
Ankle X-Rotation  
Serial Number: LX0039

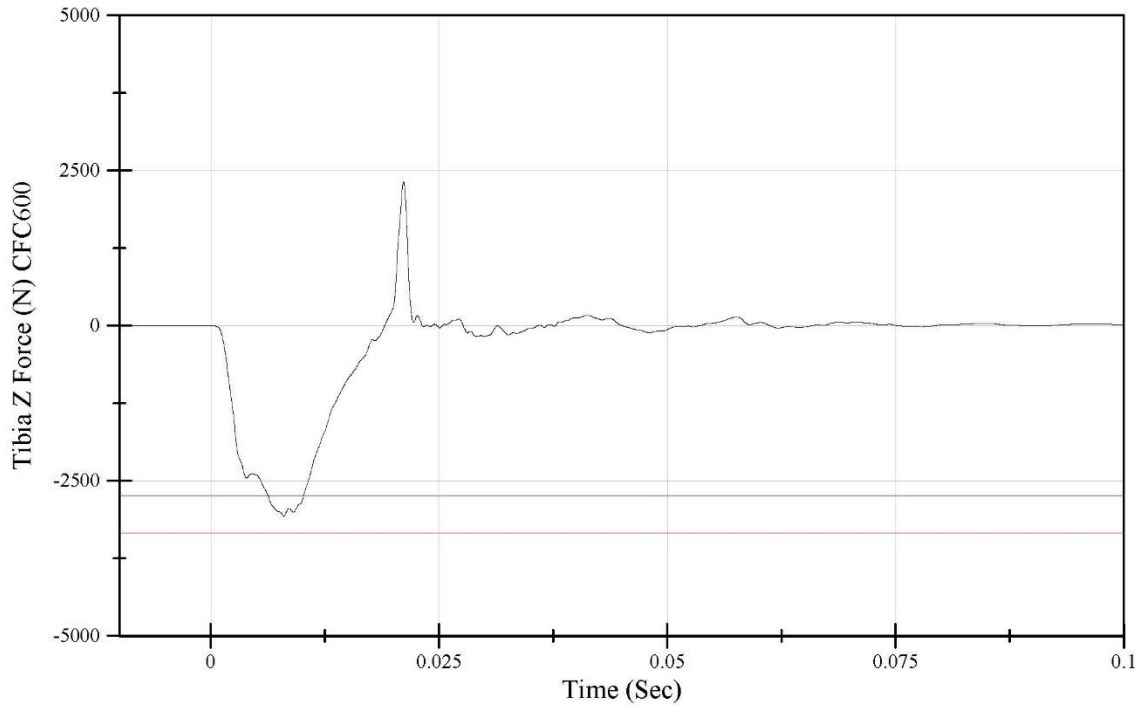


Software Version: 2.4

File Name: LX0039Eversion150324\_01processed  
03/24/2015 06:43:58.0000

Test Temperature: 71 degrees  
Relative Humidity: 26.4%  
Test Velocity: 3.96875 m/s

THOR Left Foot Heel Certification  
Tibia Load  
Serial Number: LX0039

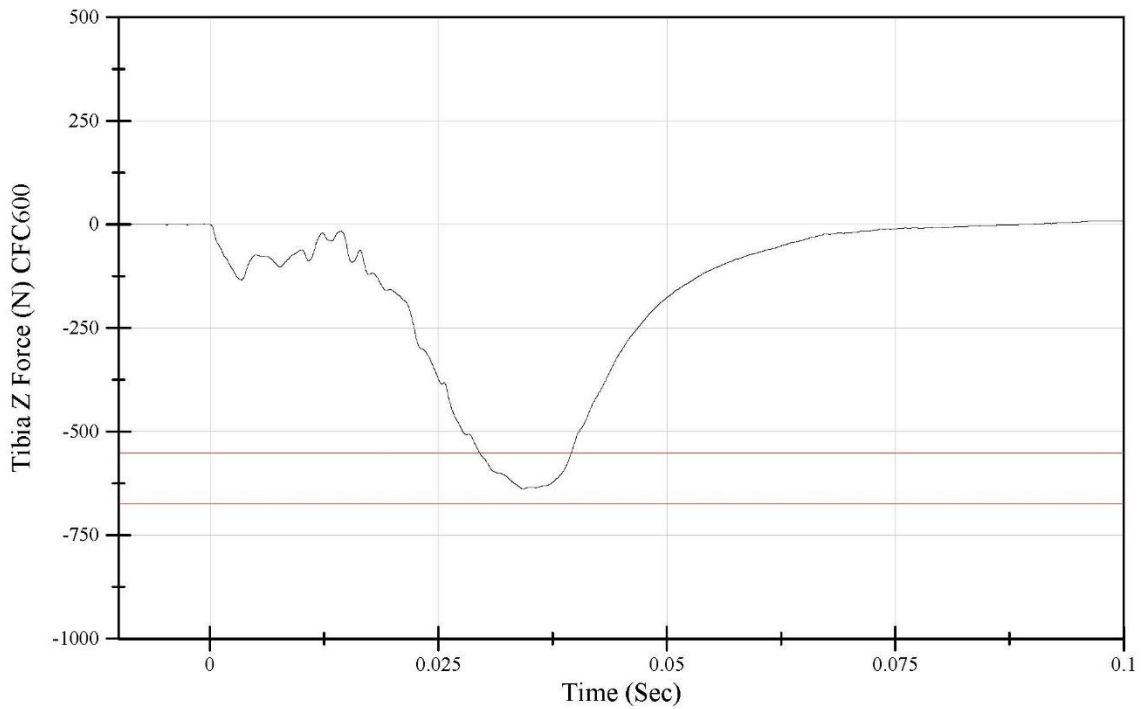


Software Version: 2.4

File Name: LX0039Heel150324\_01processed  
03/24/2015 10:54:09.0000

Test Temperature: 71 degrees  
Relative Humidity: 28.6%  
Test Velocity: 2 m/s

THOR Left Foot Inversion Certification  
Tibia Load  
Serial Number: LX0039

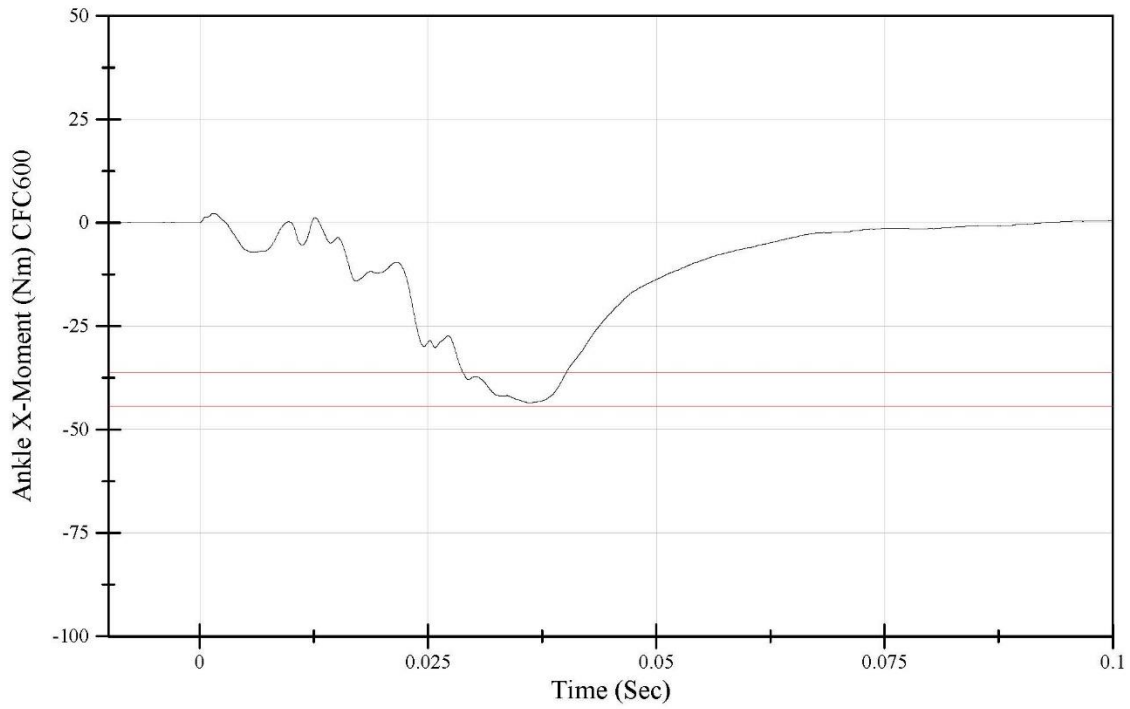


Software Version: 2.4

File Name: LX0039Inversion150323\_02processed  
03/23/2015 16:18:23.0000

Test Temperature: 71 degrees  
Relative Humidity: 28.6%  
Test Velocity: 2 m/s

THOR Left Foot Inversion Certification  
Ankle Moment  
Serial Number: LX0039

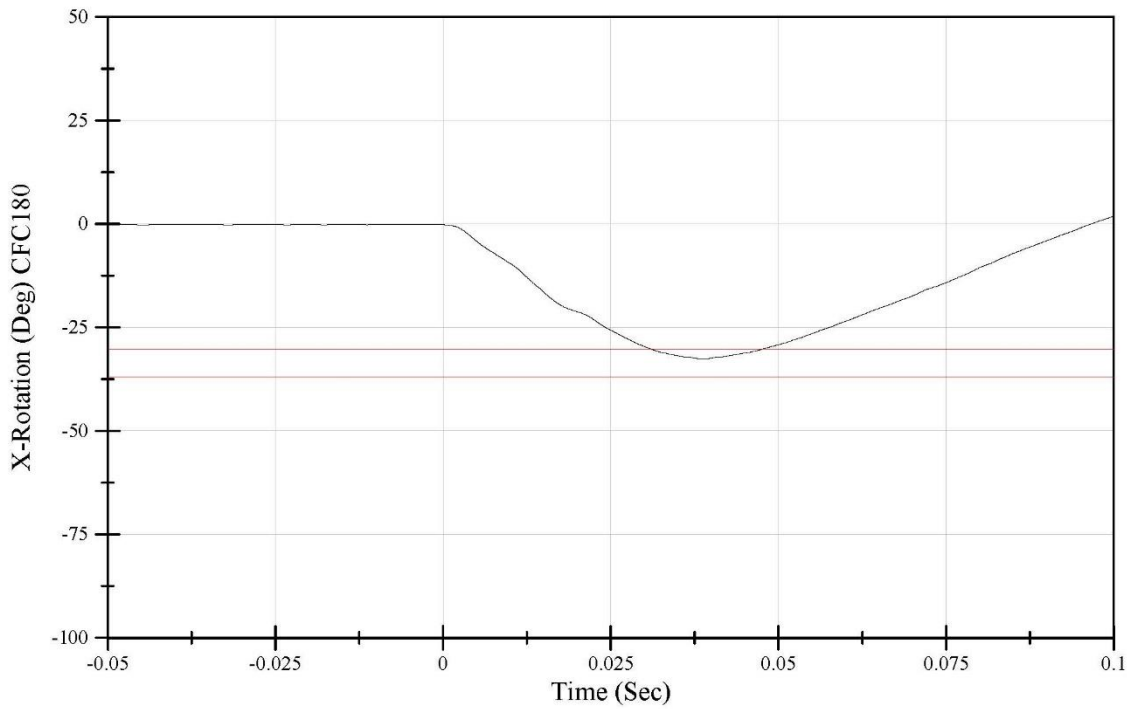


Software Version: 2.4

File Name: LX0039Inversion150323\_02processed  
03/23/2015 16:18:23.0000

Test Temperature: 71 degrees  
Relative Humidity: 28.6%  
Test Velocity: 2 m/s

THOR Left Foot Inversion Certification  
Ankle X-Rotation  
Serial Number: LX0039

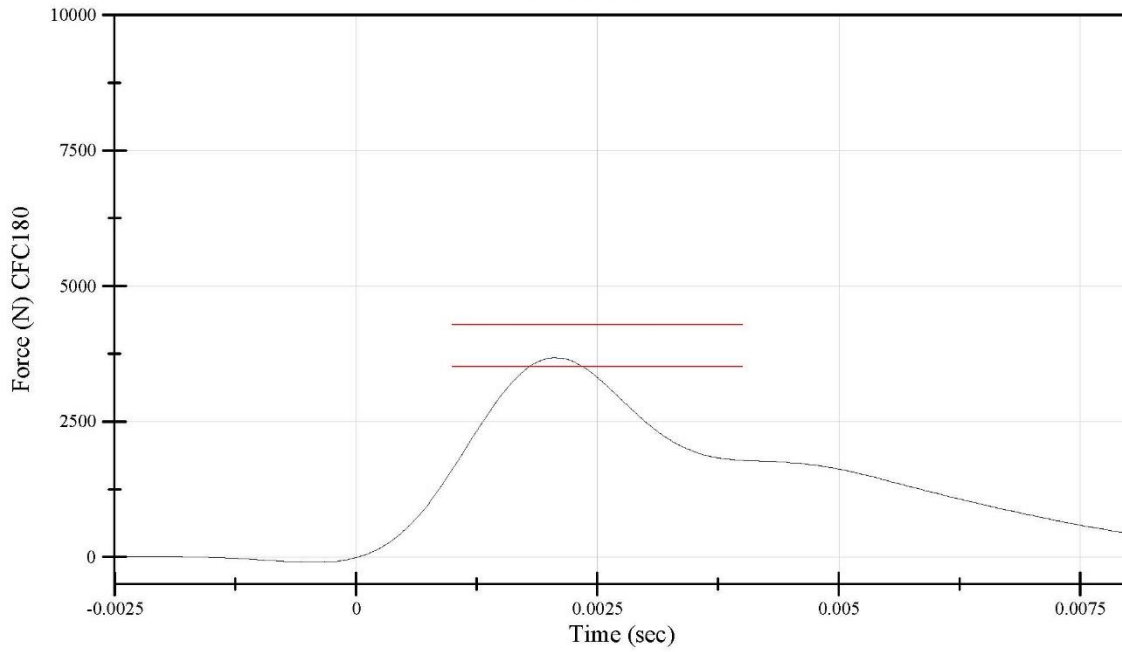


Software Version: 2.4

File Name: LX0039Inversion150323\_02processed  
03/23/2015 16:18:23.0000

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

THOR Left Femur Certification  
Probe Force  
Serial Number: T015

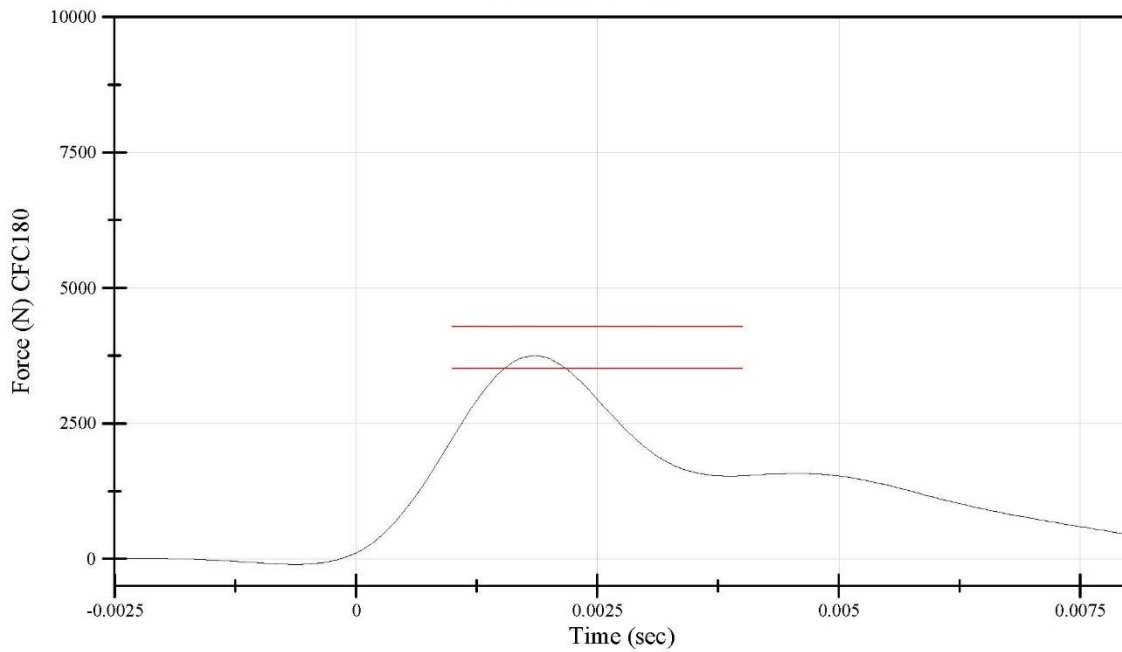


Software Version: 2.4

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

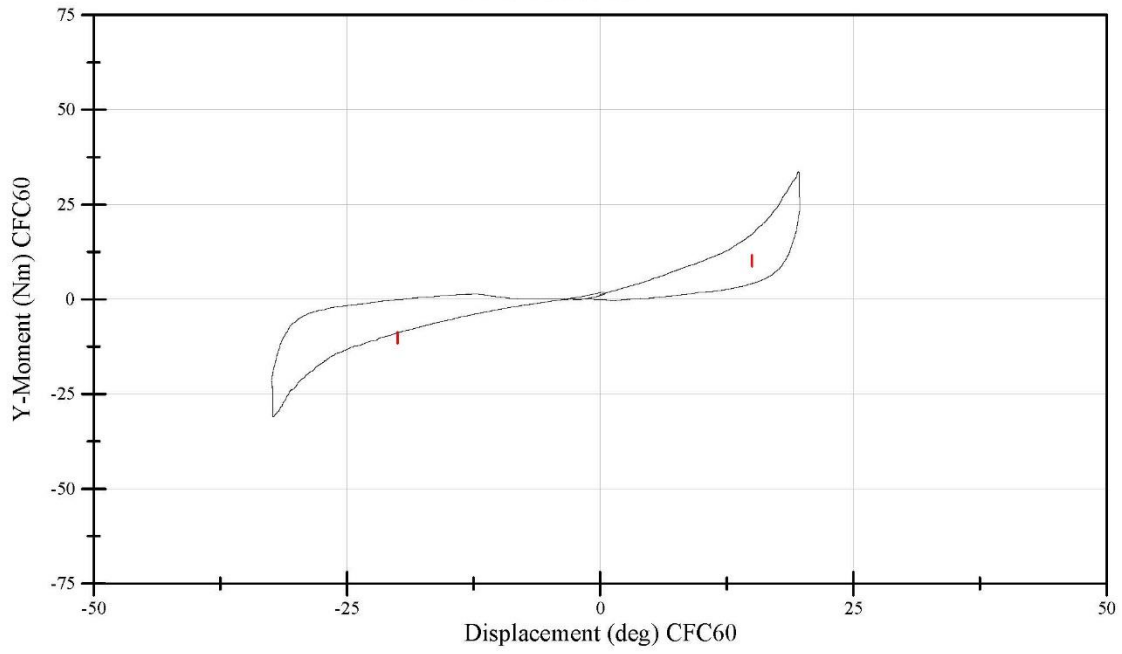


Software Version: 2.4

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



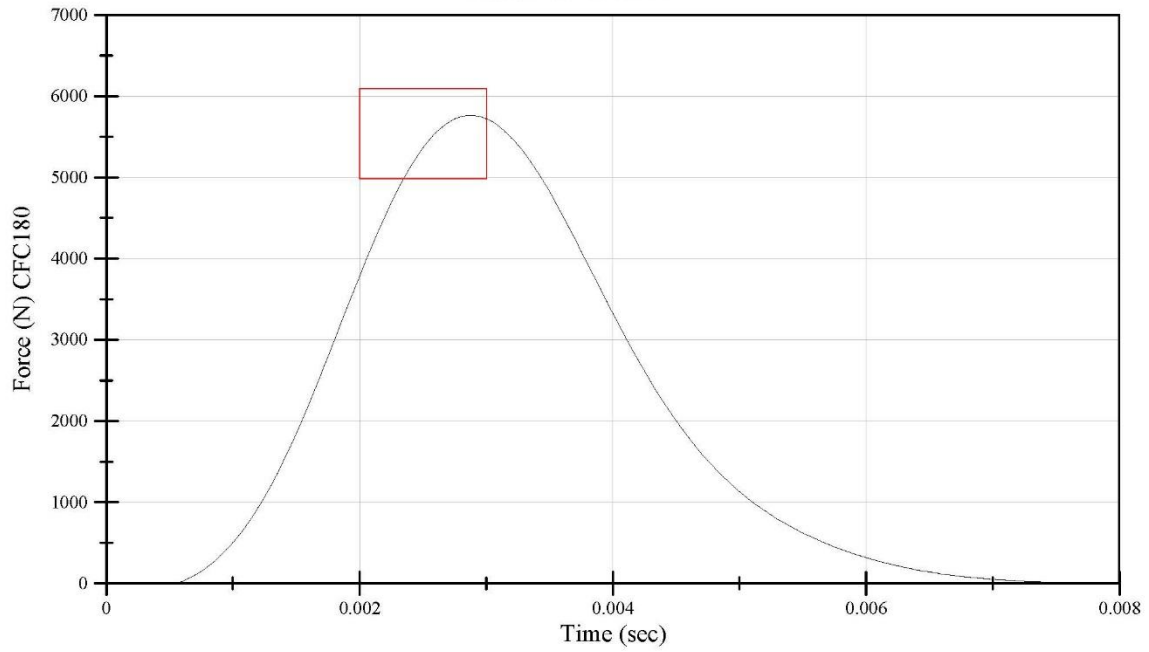
Software Version: 2.4

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

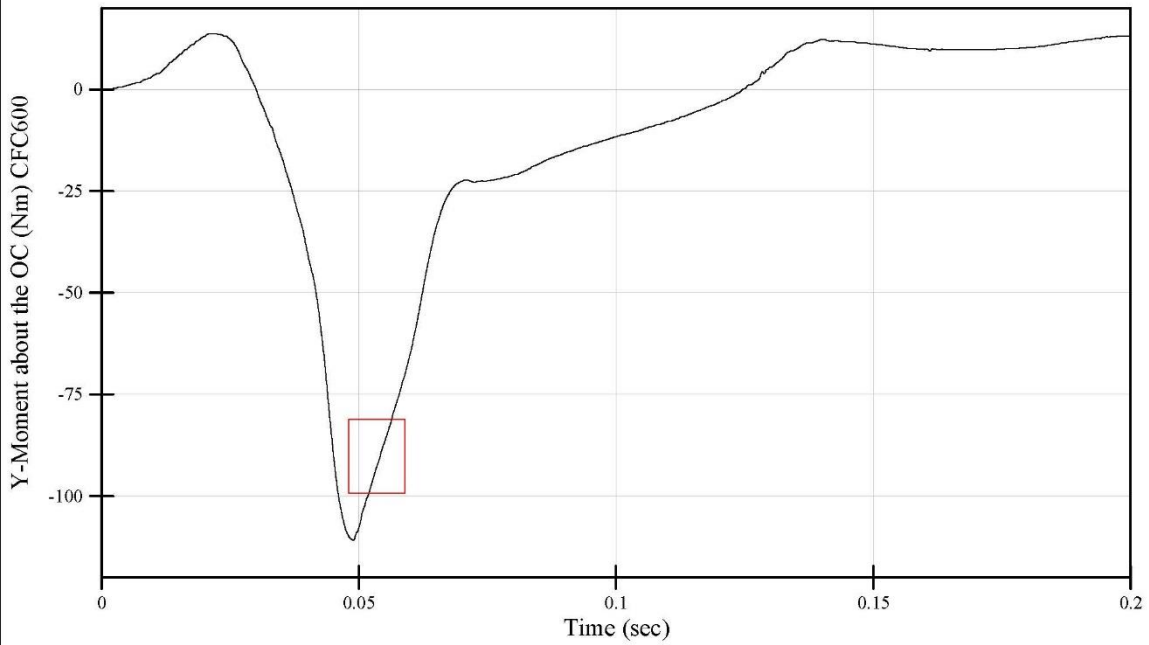


Software Version: 2.4

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

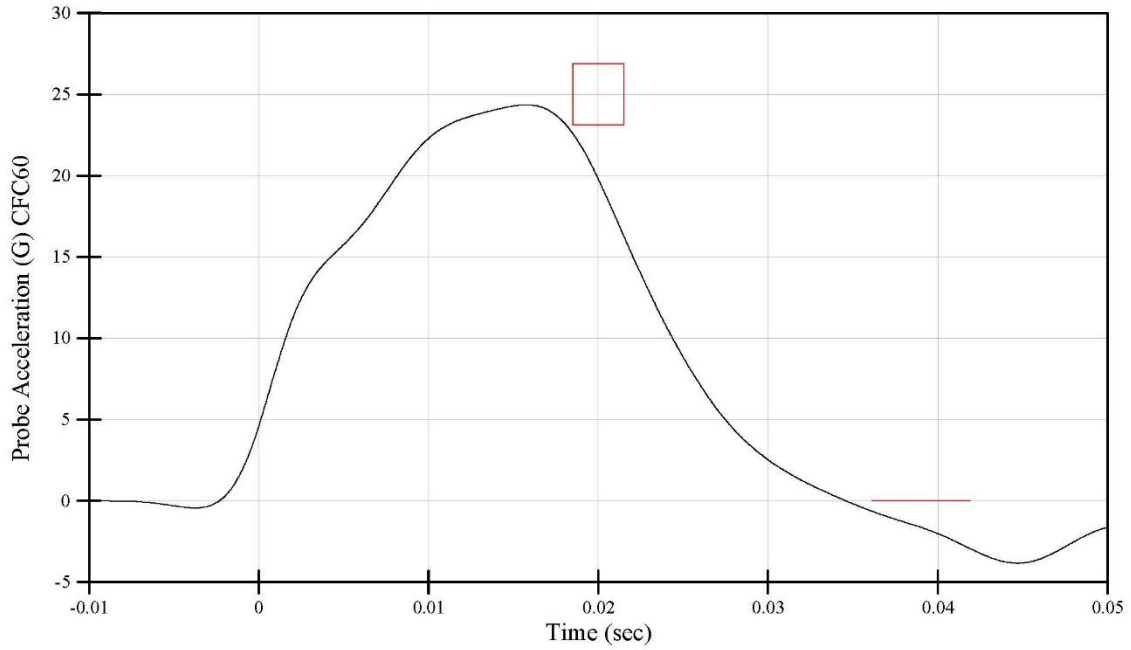


Software Version: 2.4

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

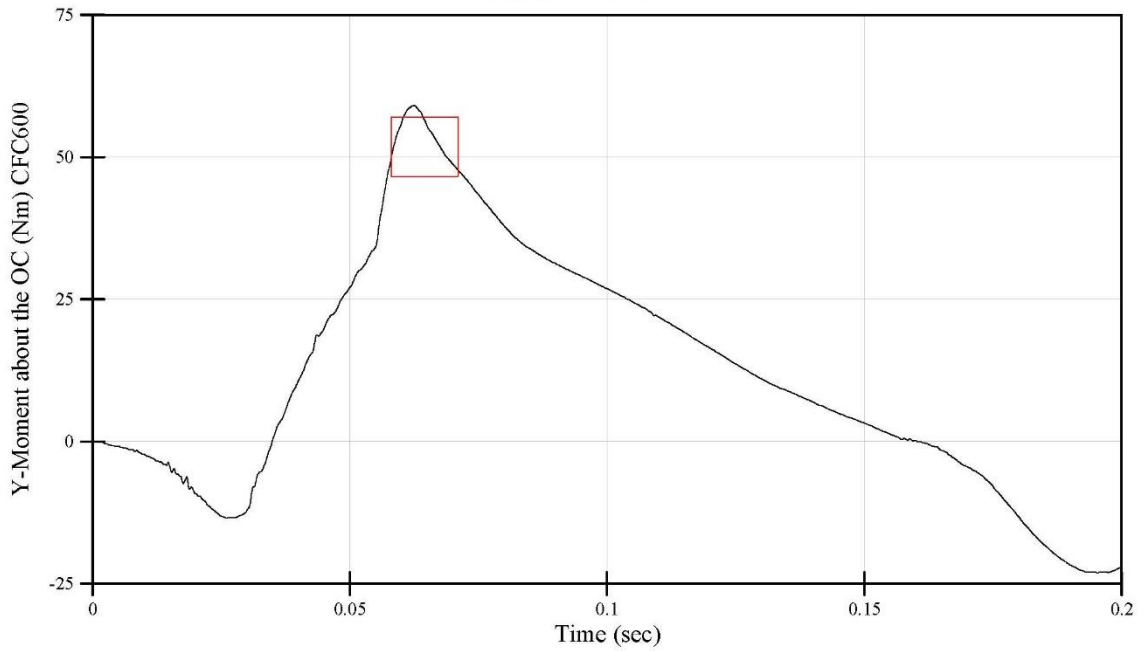


Software Version: 2.4

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

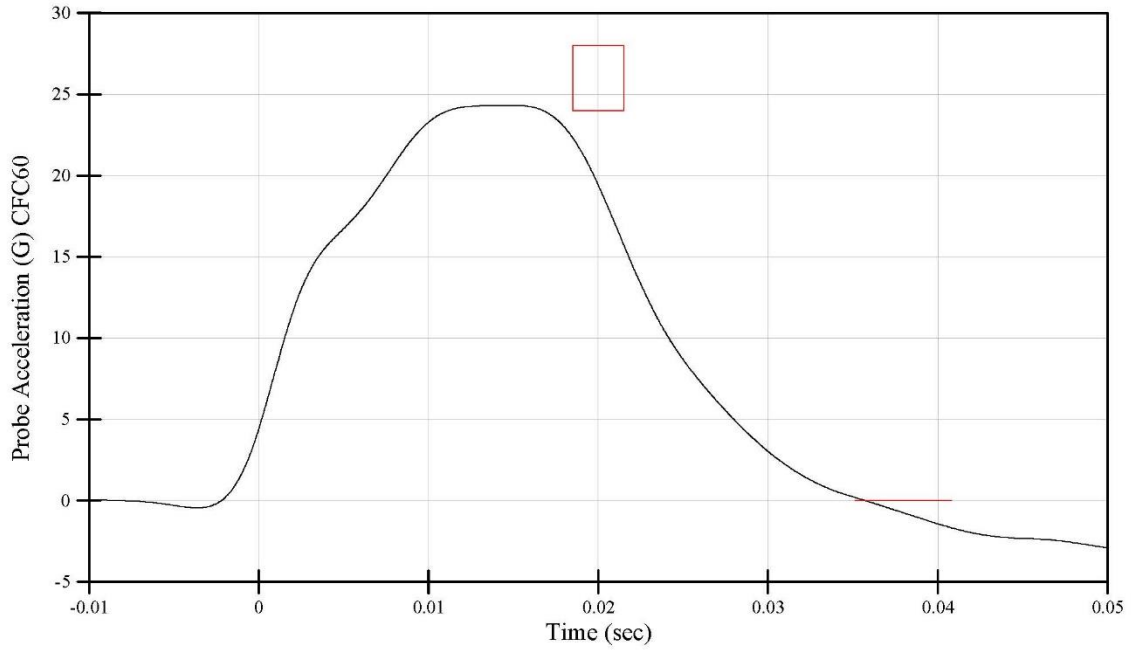


Software Version: 2.4

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

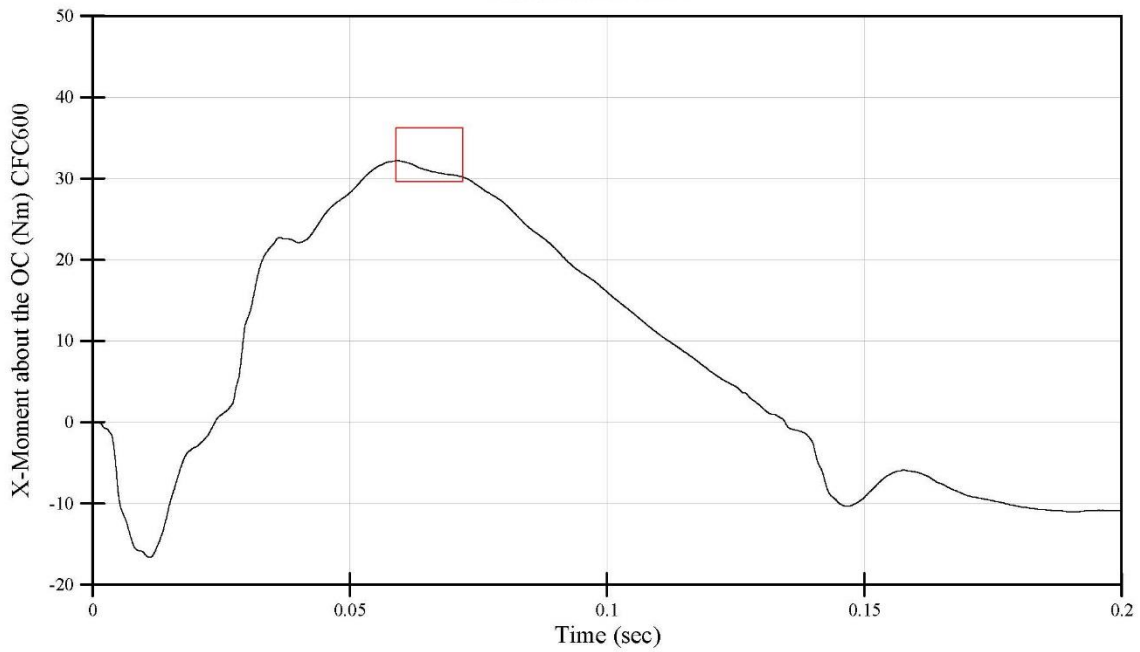


Software Version: 2.4

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

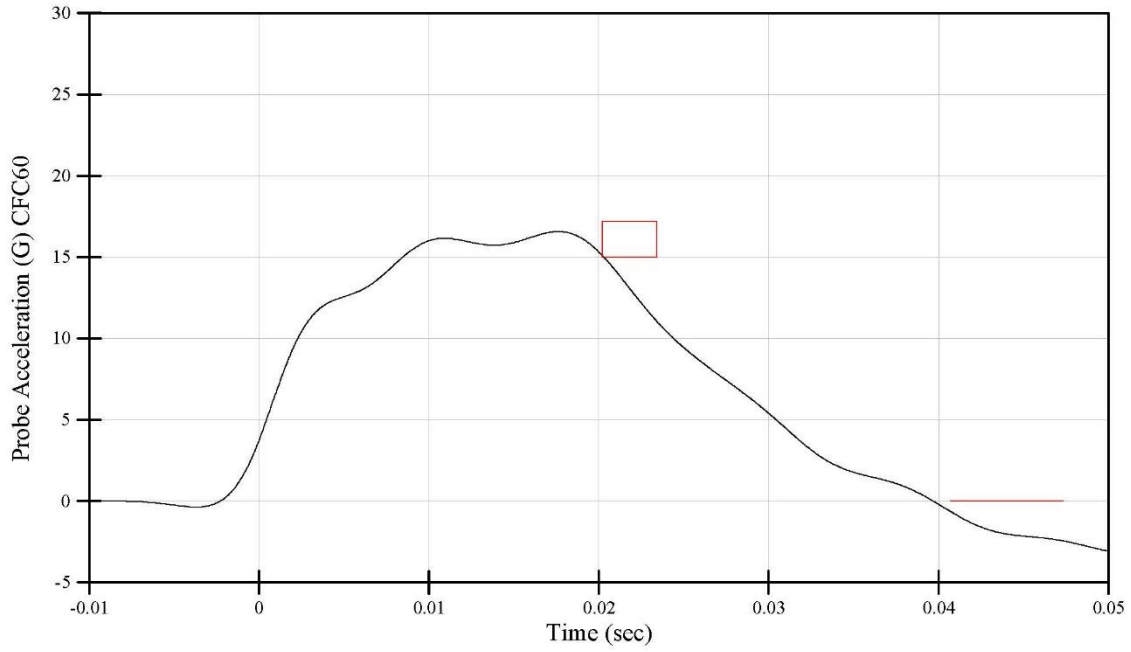


Software Version: 2.4

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

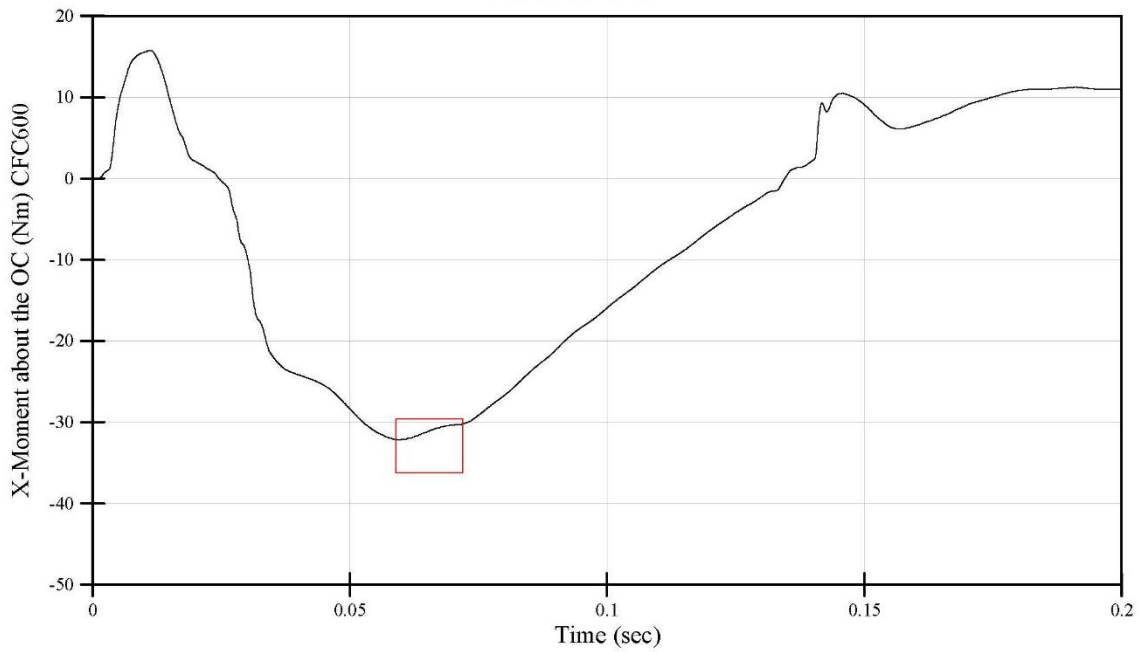


Software Version: 2.4

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

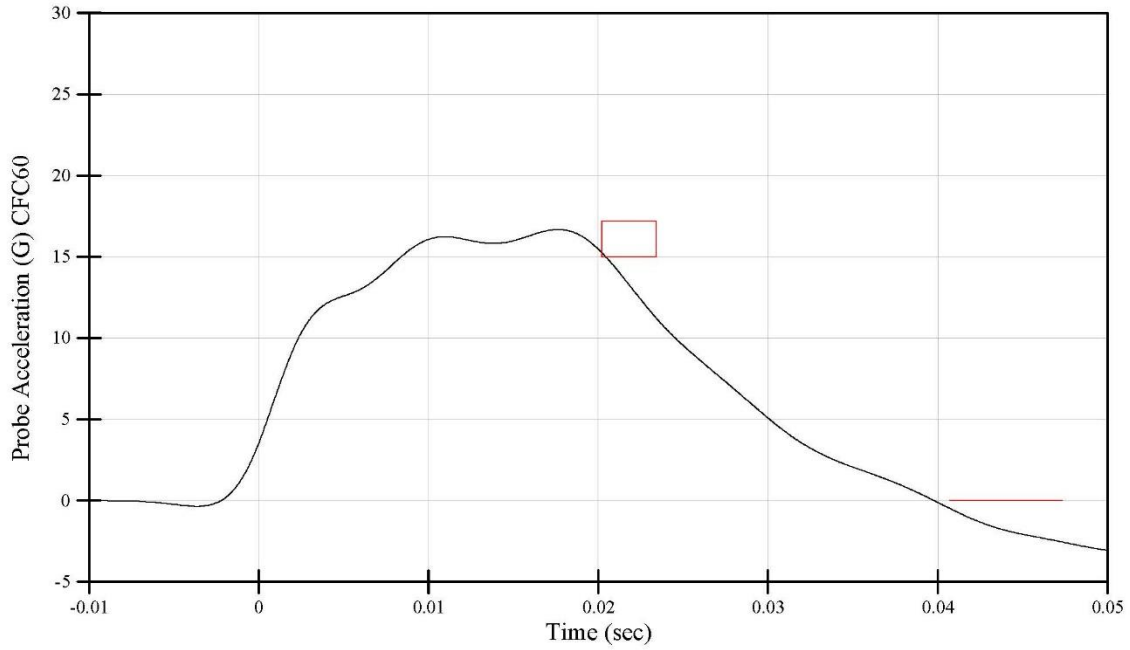


Software Version: 2.4

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

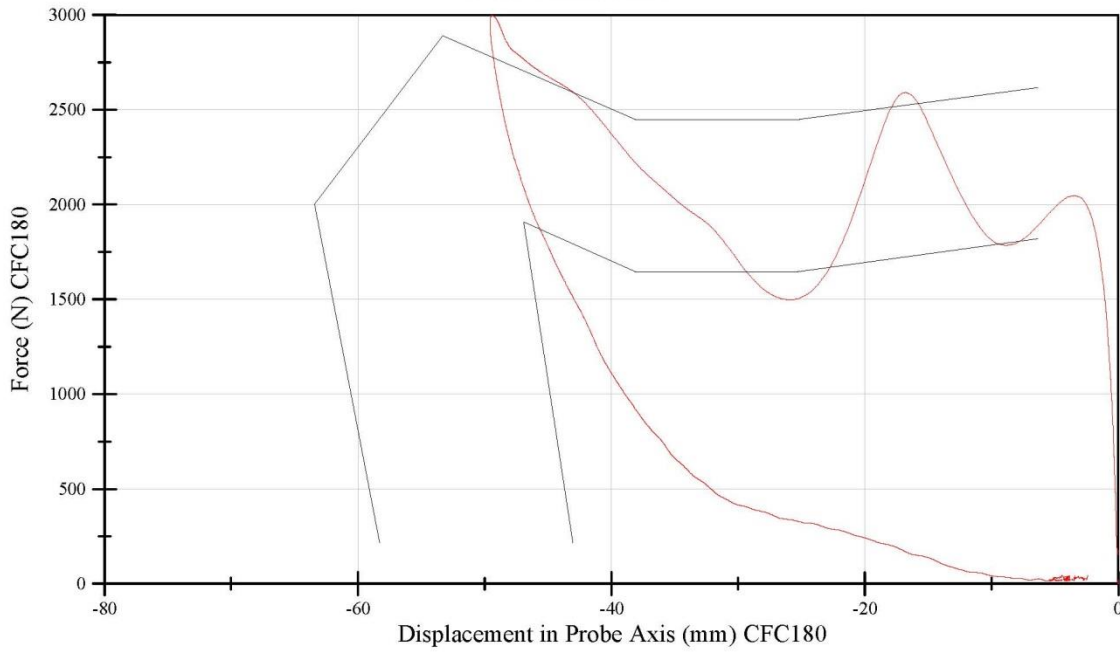


Software Version: 2.4

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

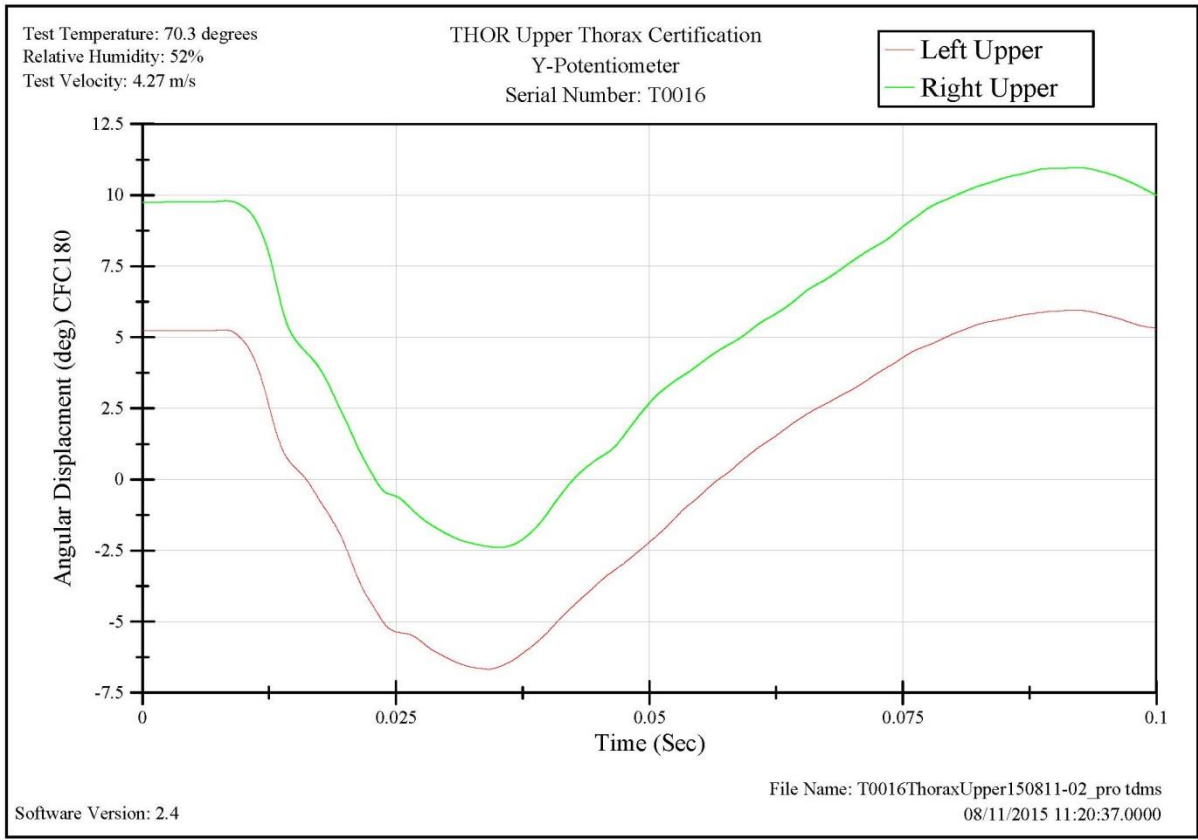
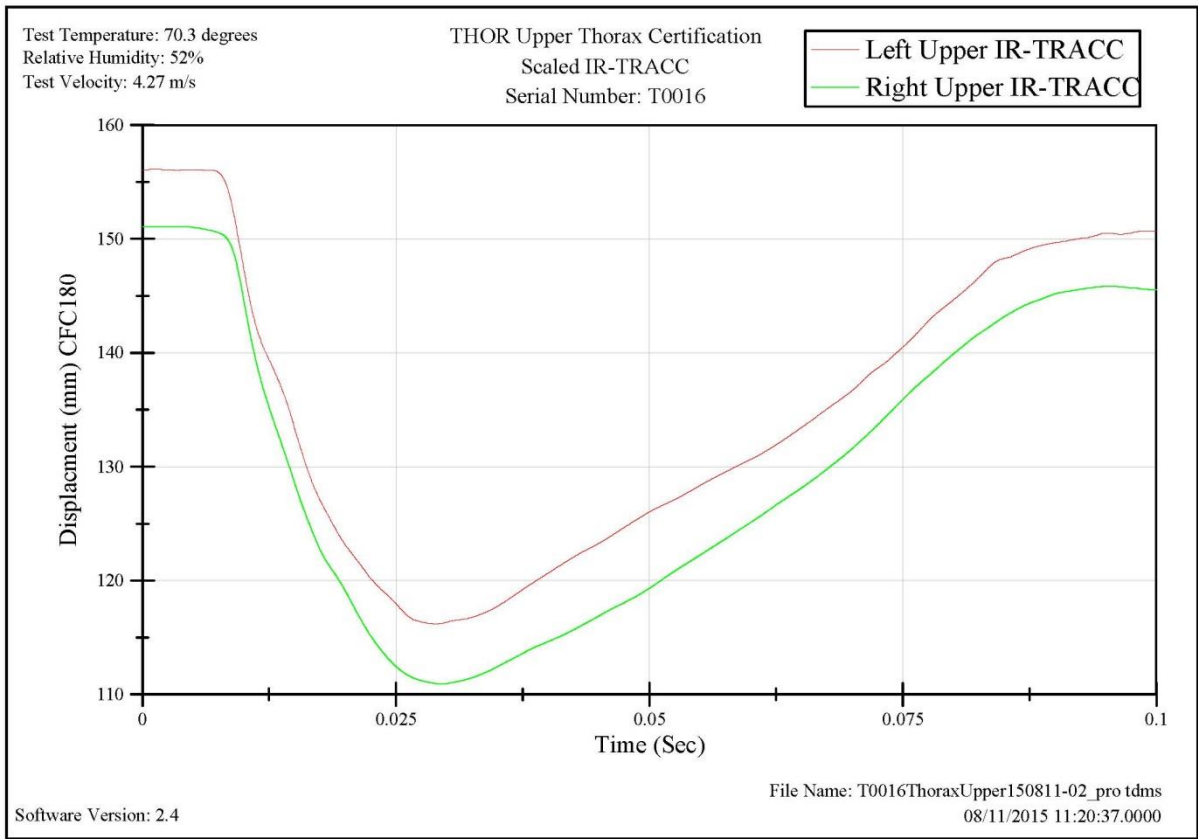
Test Temperature: 70.3 degrees  
Relative Humidity: 52%  
Test Velocity: 4.27 m/s

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



Software Version: 2.4

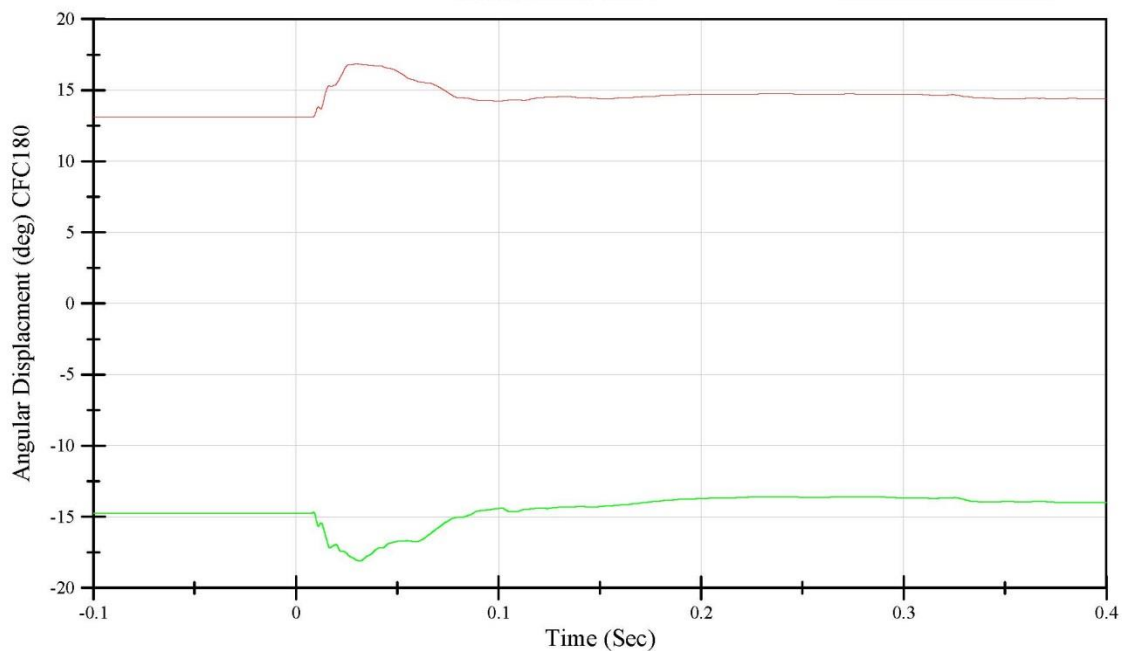
File Name: T0016ThoraxUpper150811-02\_pro.tdms  
08/11/2015 11:20:37.0000



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

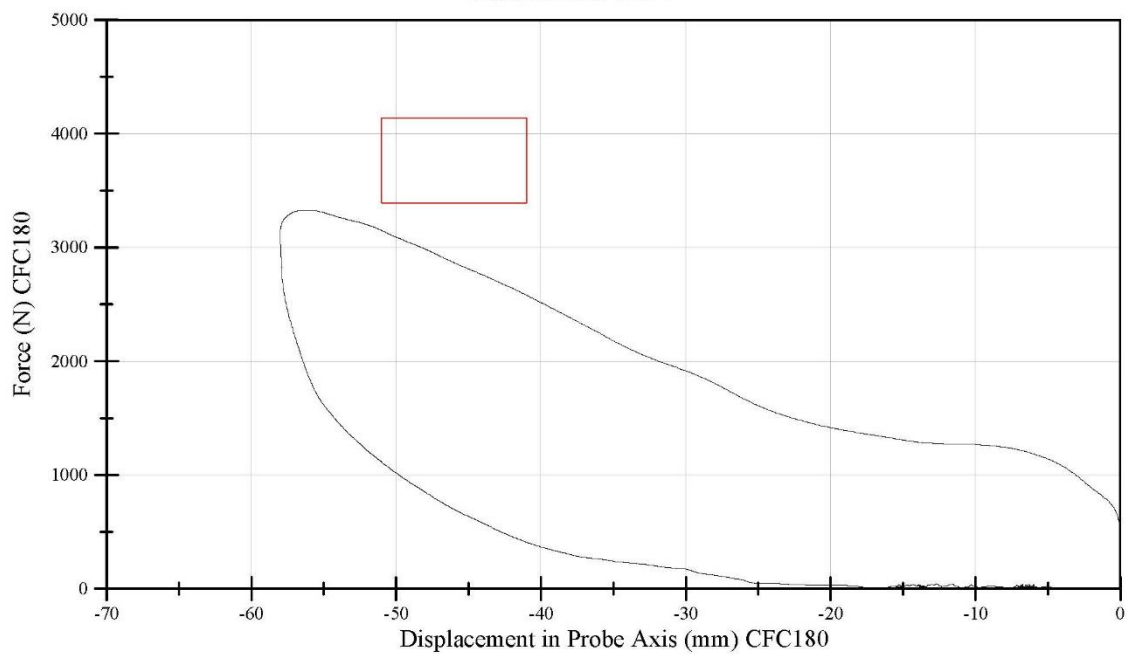


Software Version: 2.4

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

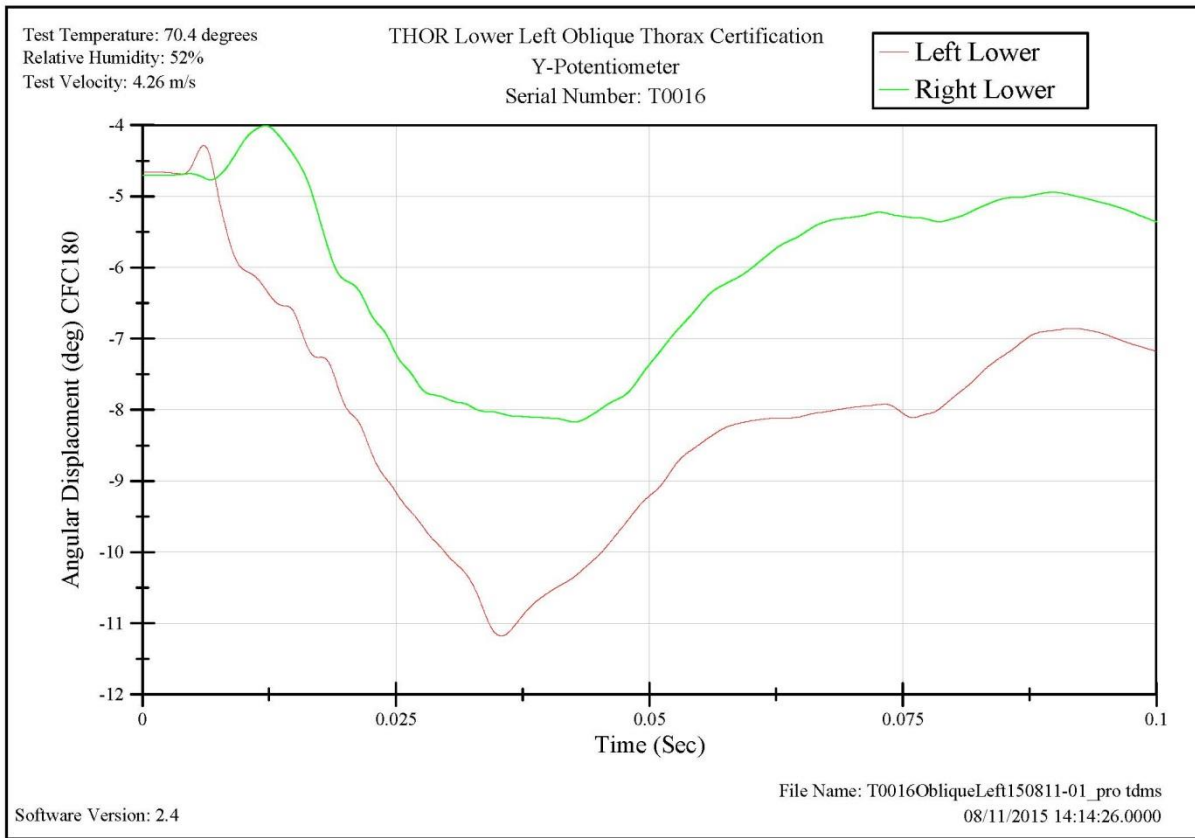
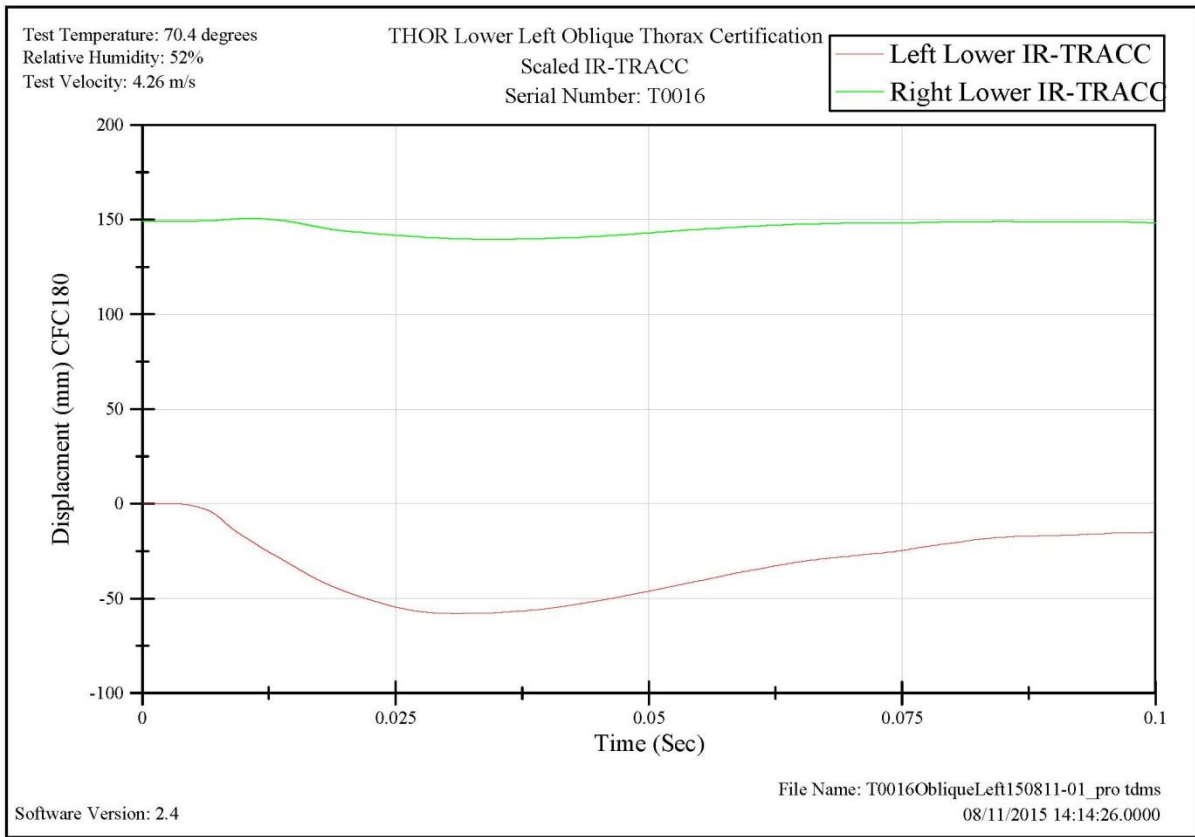
Test Temperature: 70.4 degrees  
Relative Humidity: 52%  
Test Velocity: 4.26 m/s

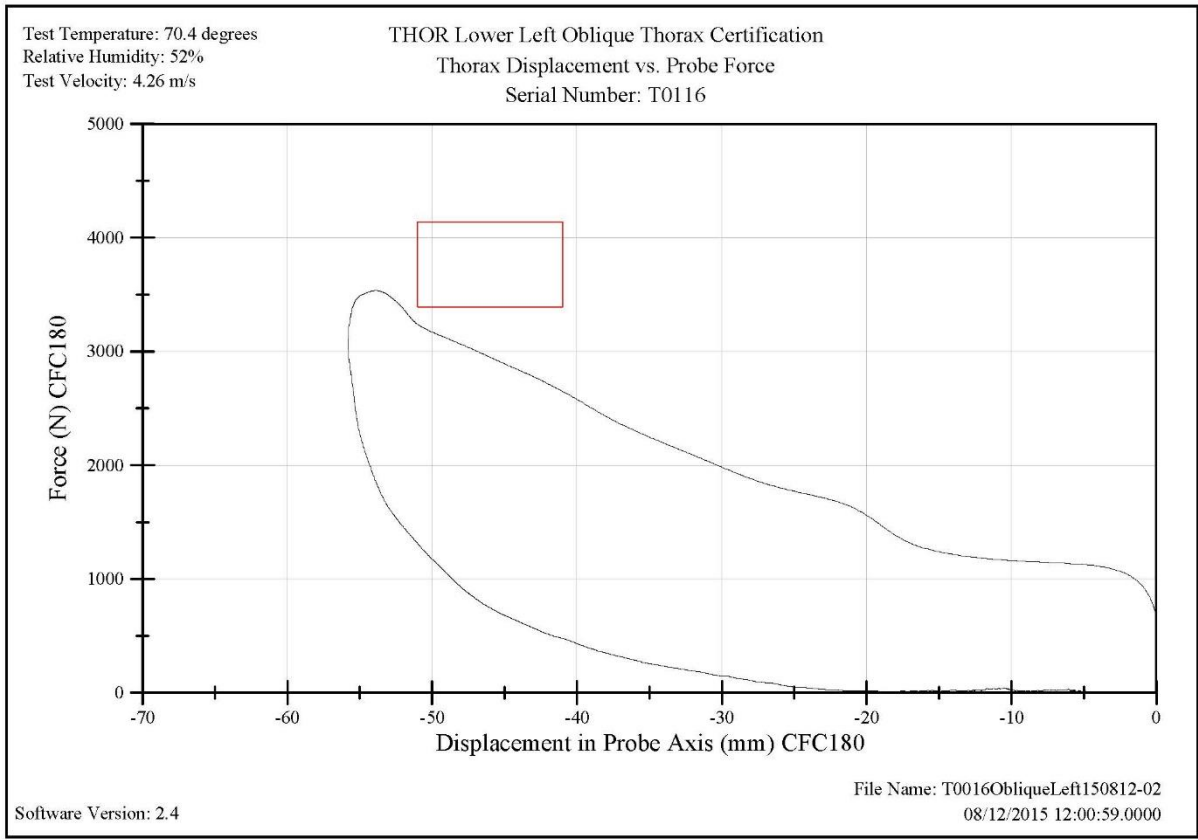
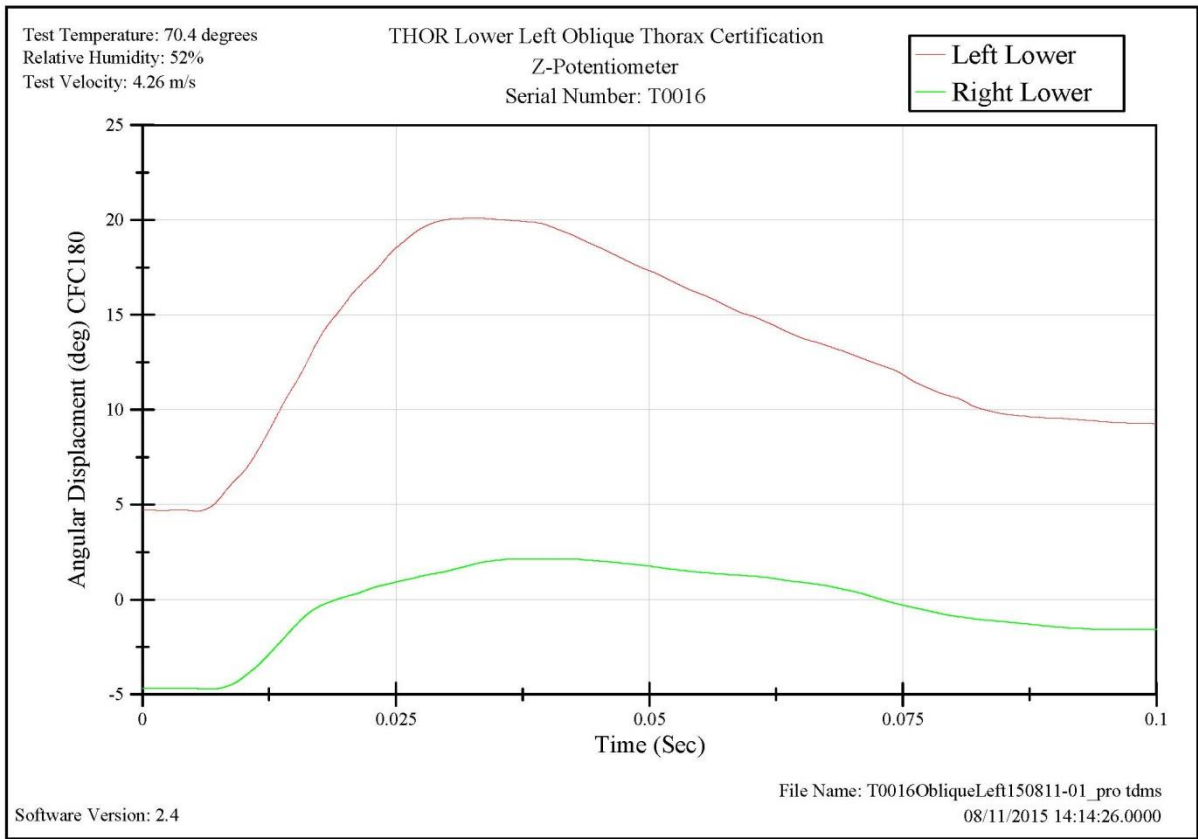
THOR Lower Left Oblique Thorax Certification  
Thorax Displacement vs. Probe Force  
Serial Number: T0016

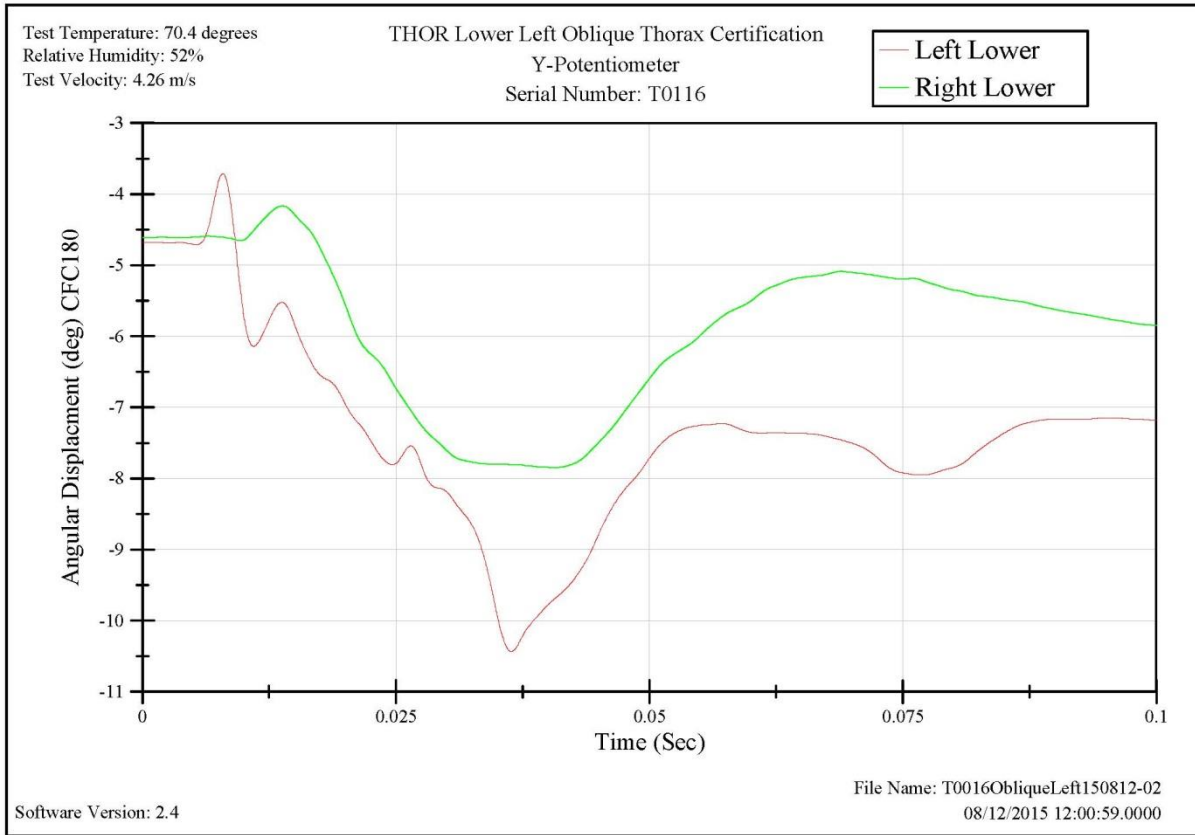
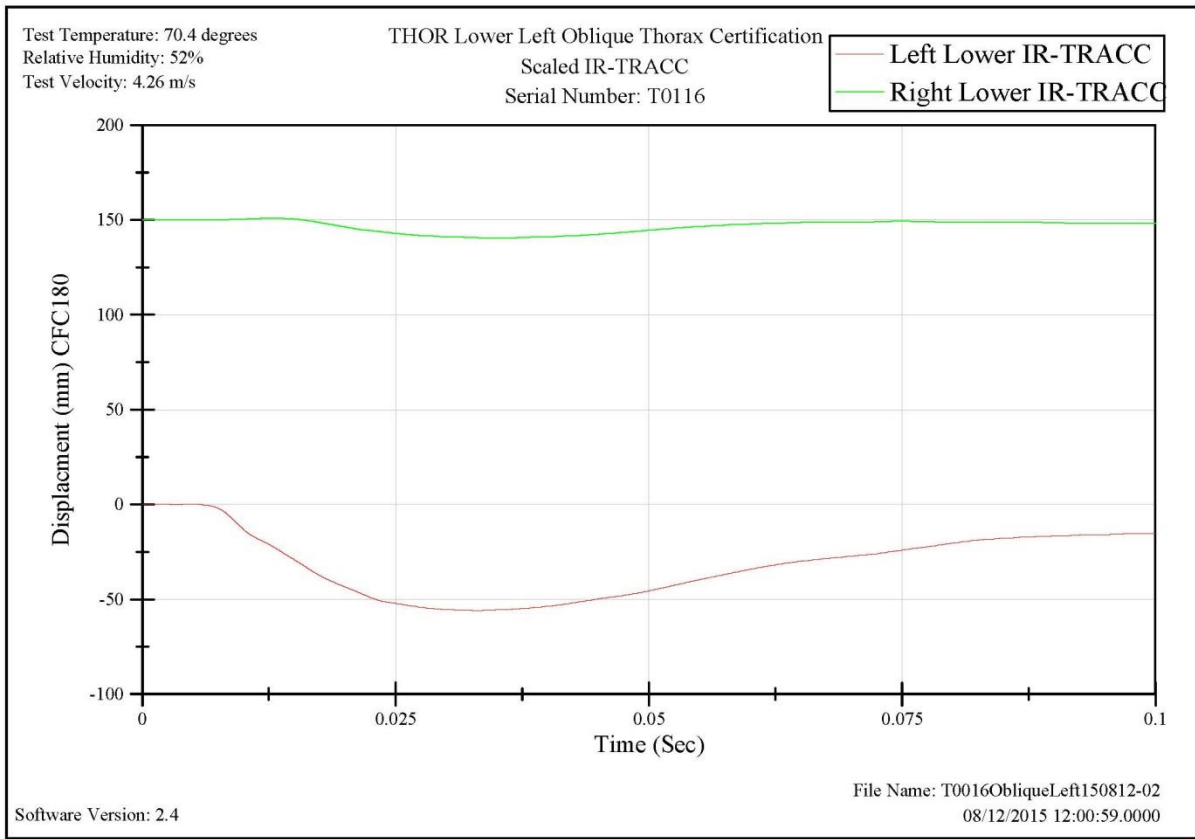


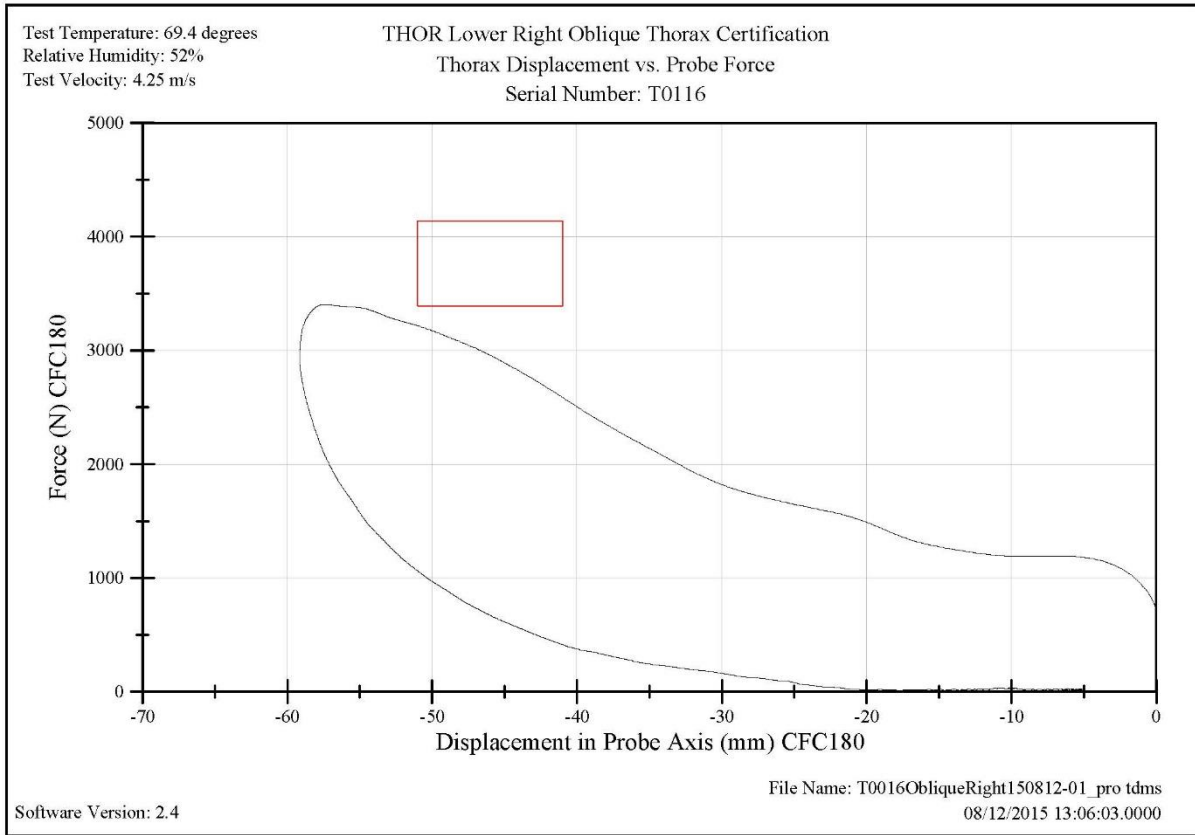
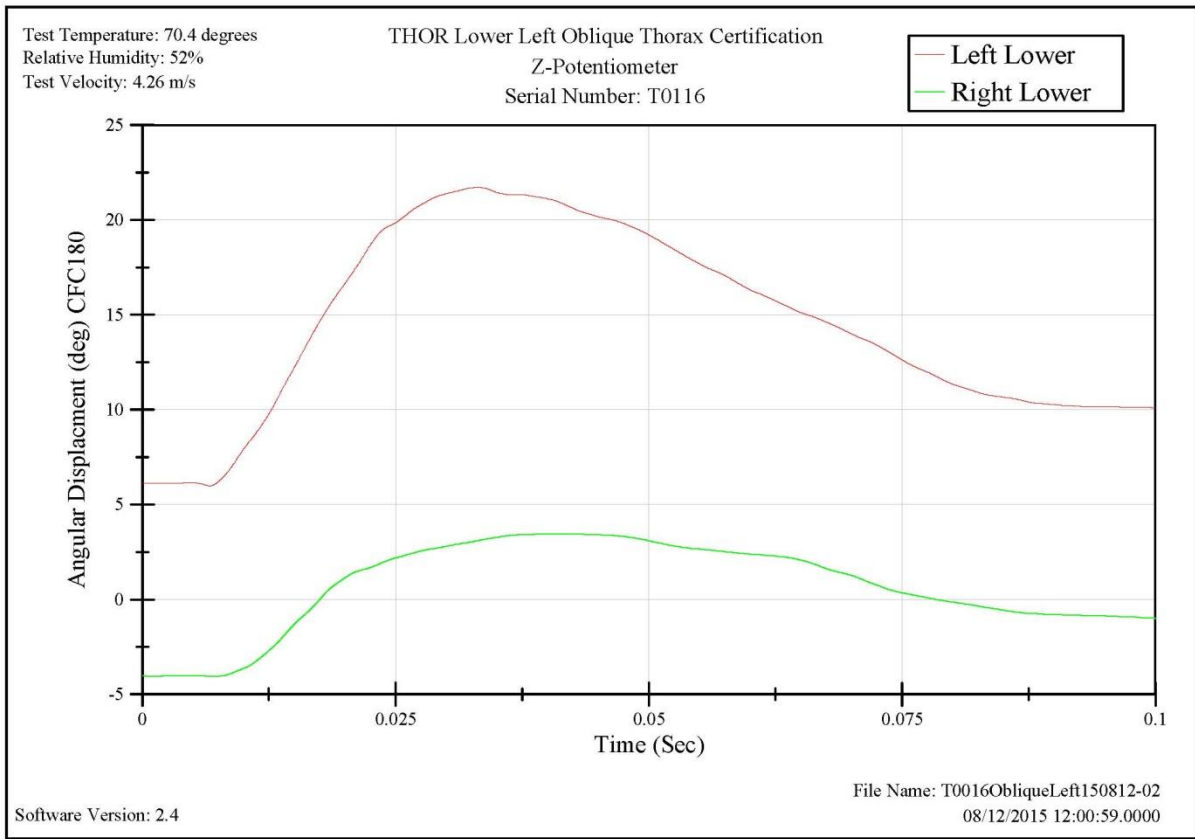
Software Version: 2.4

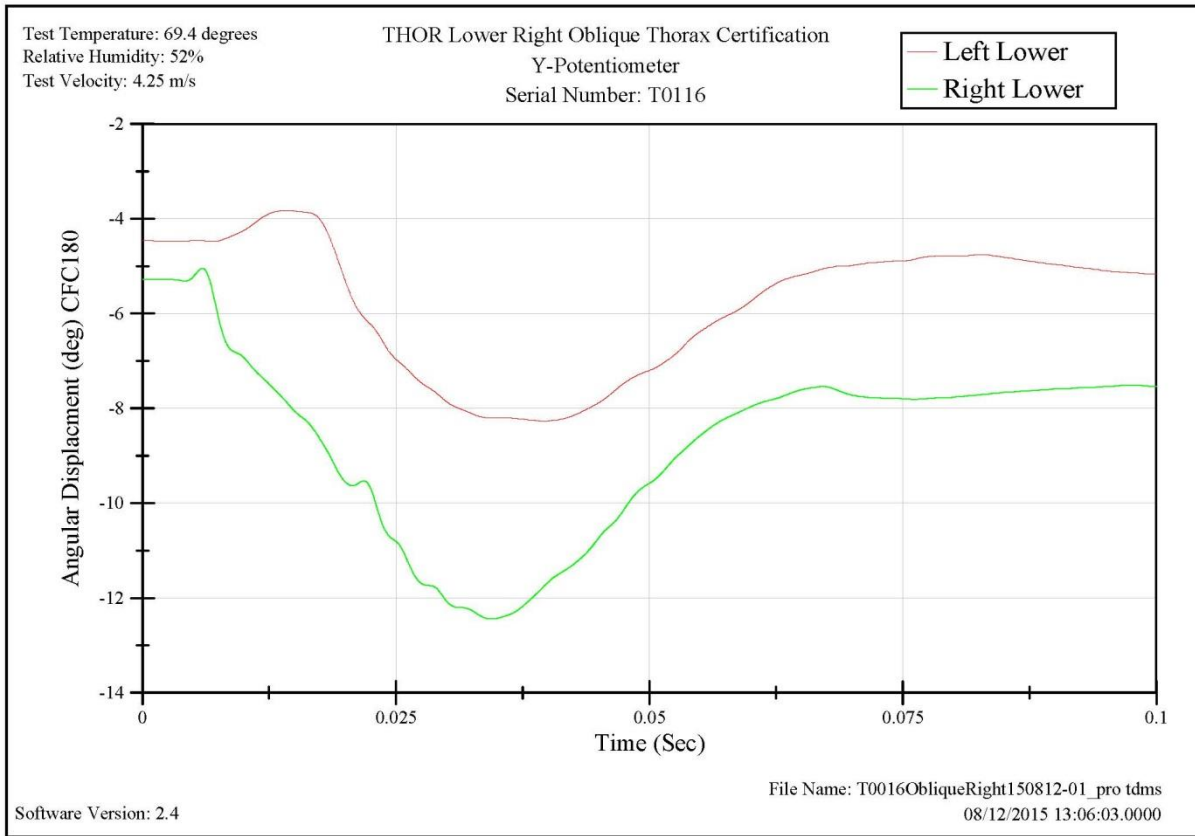
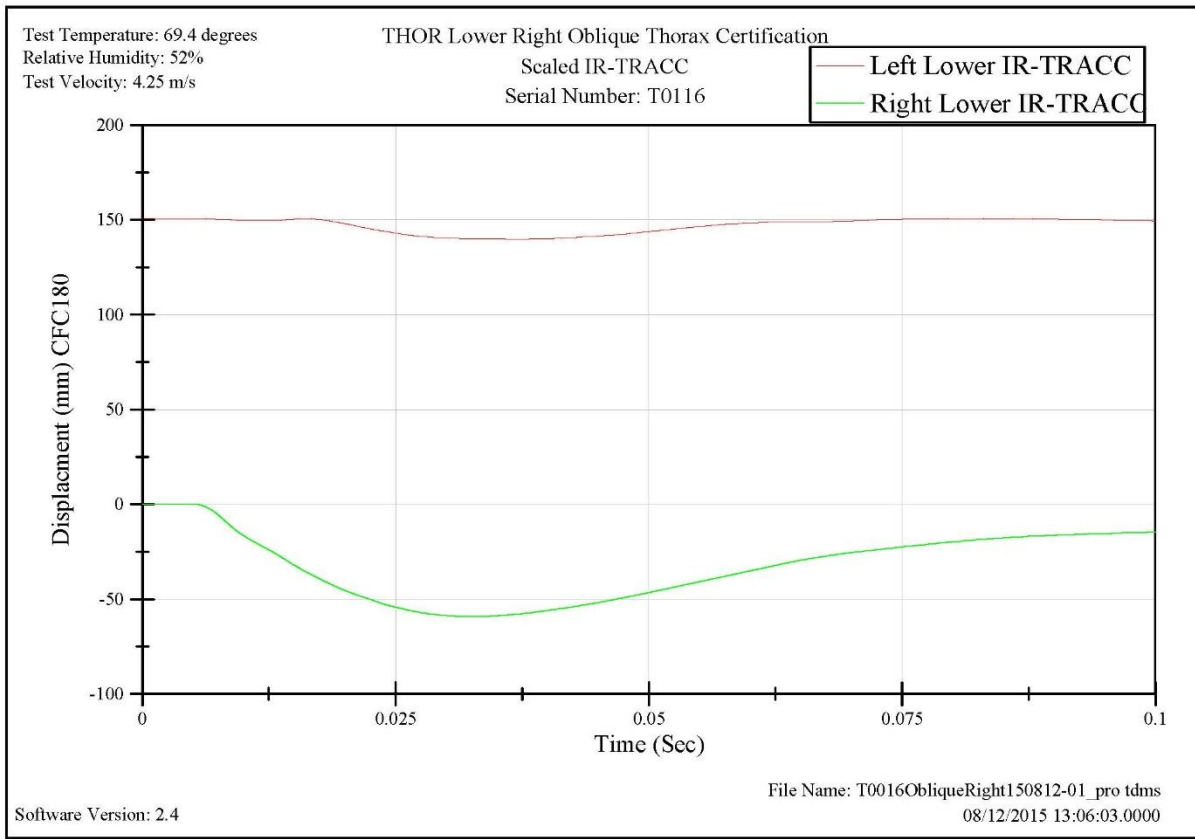
File Name: T0016ObliqueLeft150811-01\_pro tdms  
08/11/2015 14:14:26.0000







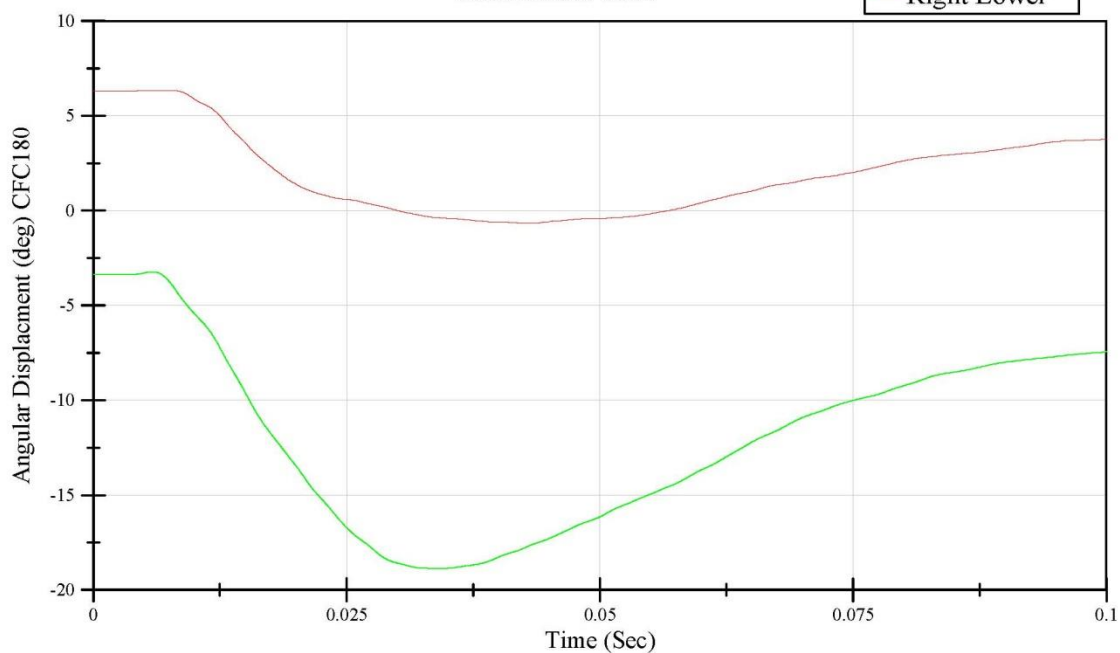




Test Temperature: 69.4 degrees  
Relative Humidity: 52%  
Test Velocity: 4.25 m/s

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

Left Lower  
Right Lower

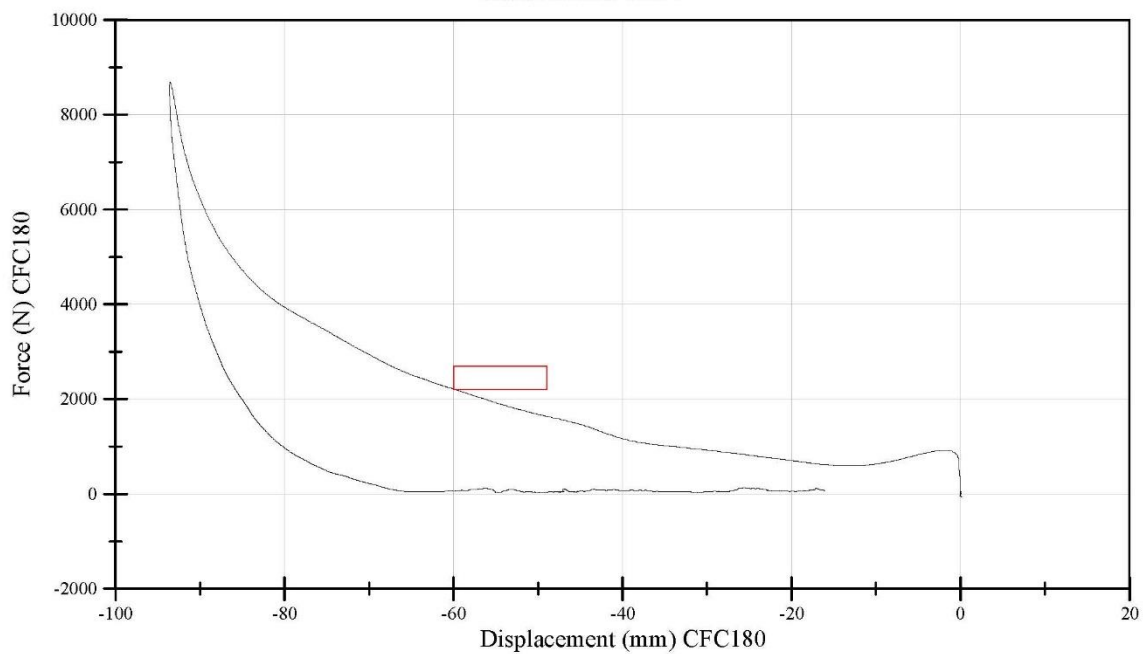


Software Version: 2.4

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

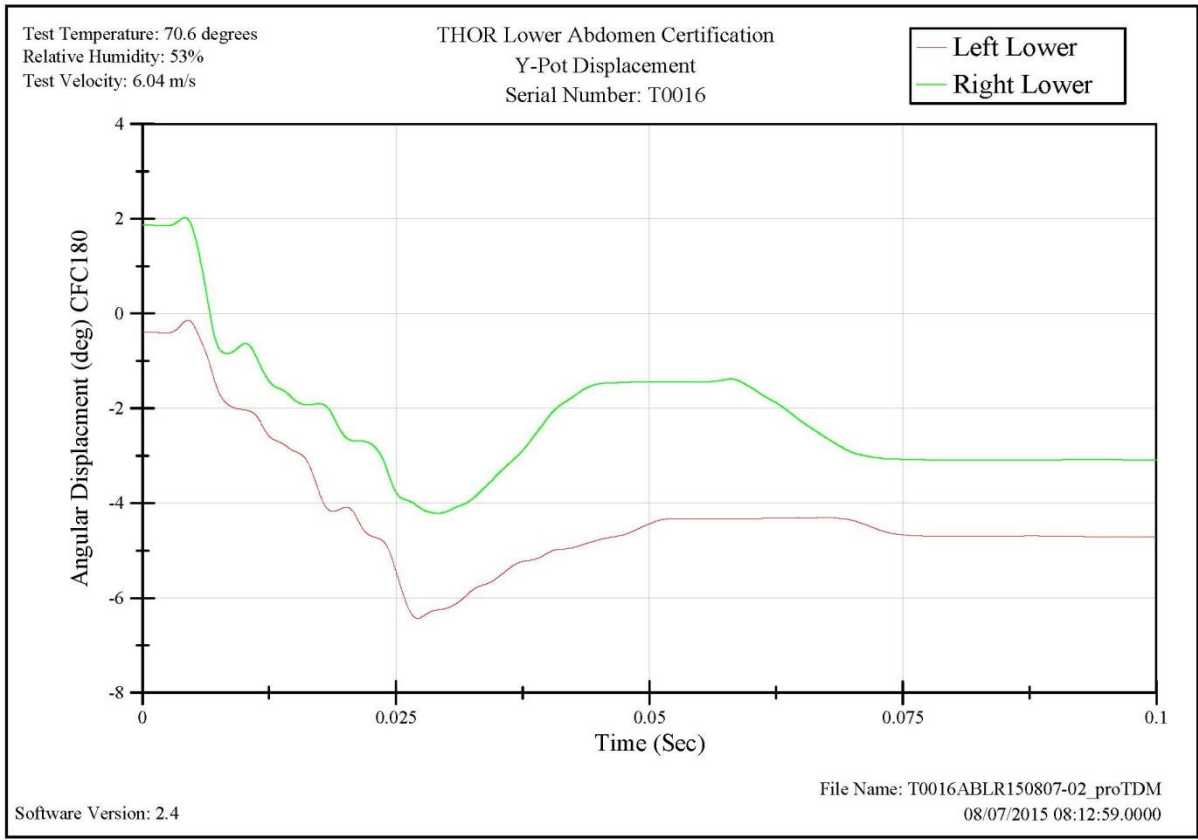
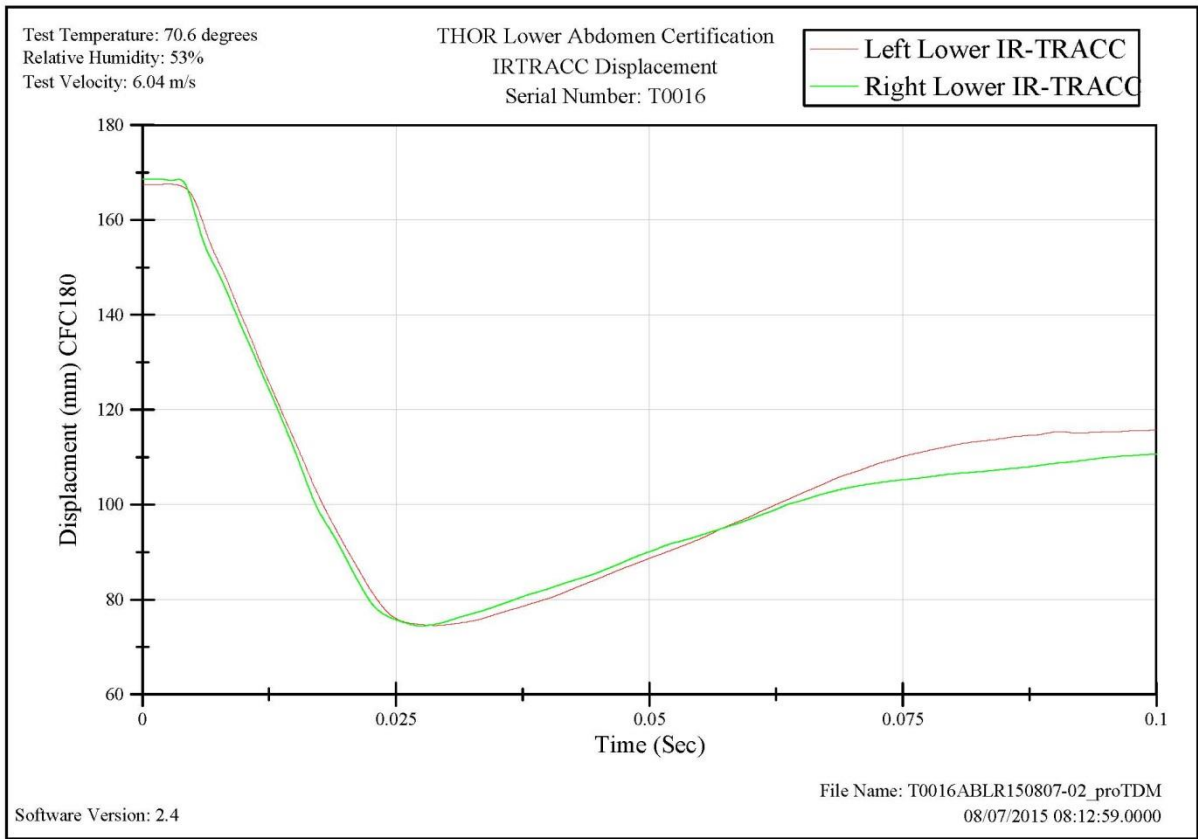
Test Temperature: 70.6 degrees  
Relative Humidity: 53%  
Test Velocity: 6.04 m/s

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



Software Version: 2.4

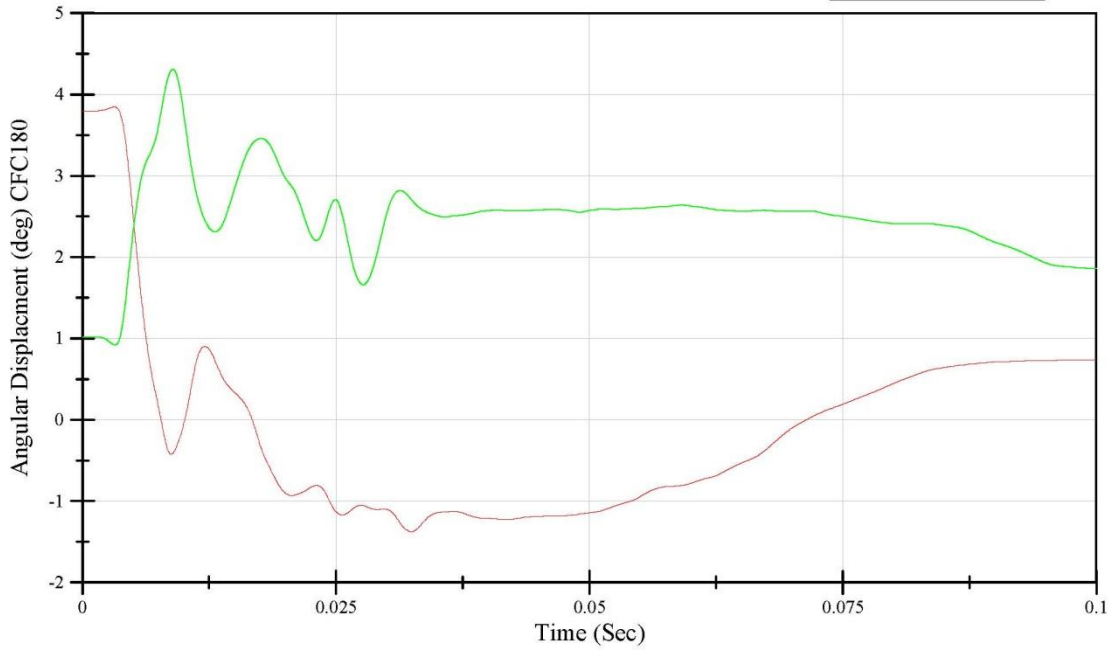
File Name: T0016ABLR150807-02\_proTDM  
08/07/2015 08:12:59.0000



Test Temperature: 70.6 degrees  
Relative Humidity: 53%  
Test Velocity: 6.04 m/s

THOR Lower Abdomen Certification  
Z-Potentiometer  
Serial Number: T0016

— Left Lower  
— Right Lower

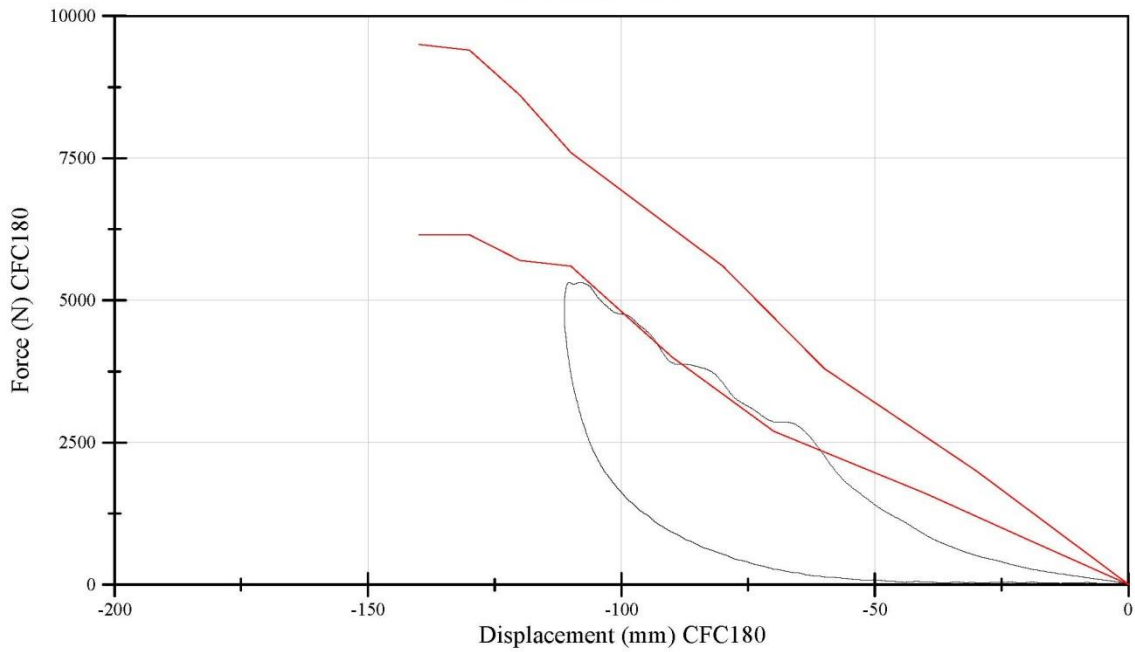


Software Version: 2.4

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

Test Temperature: 70.6 degrees  
Relative Humidity: 52%  
Test Velocity: 6.57 m/s

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

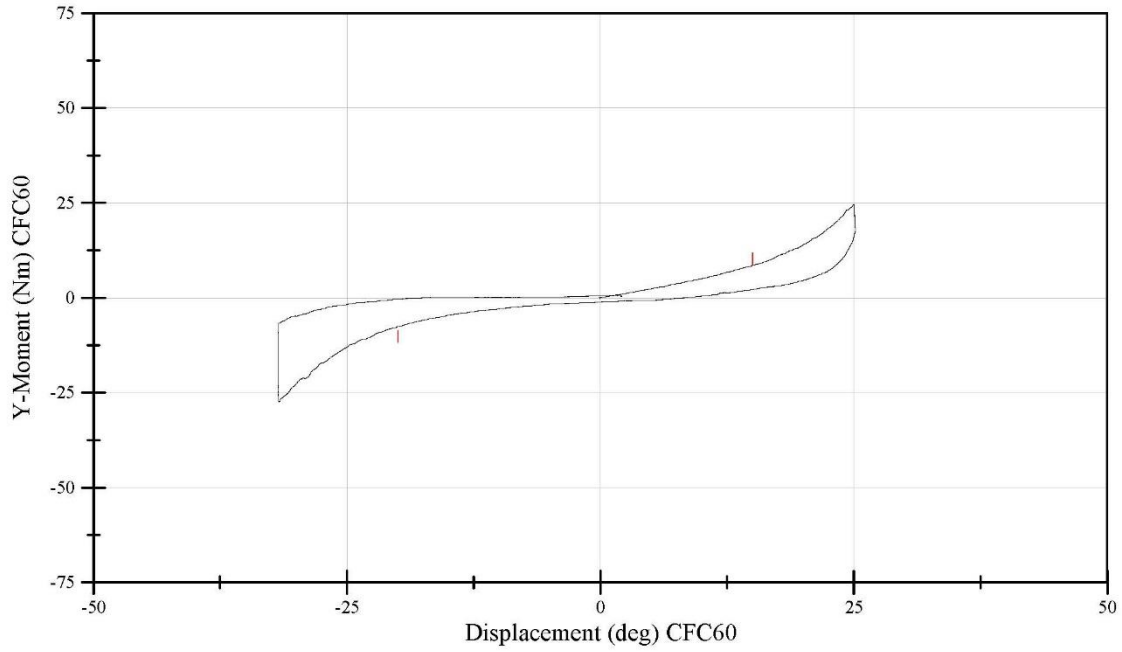


Software Version: 2.4

File Name: T0016ABUP150807-01\_proTDM  
08/07/2015 13:20:12.0000

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

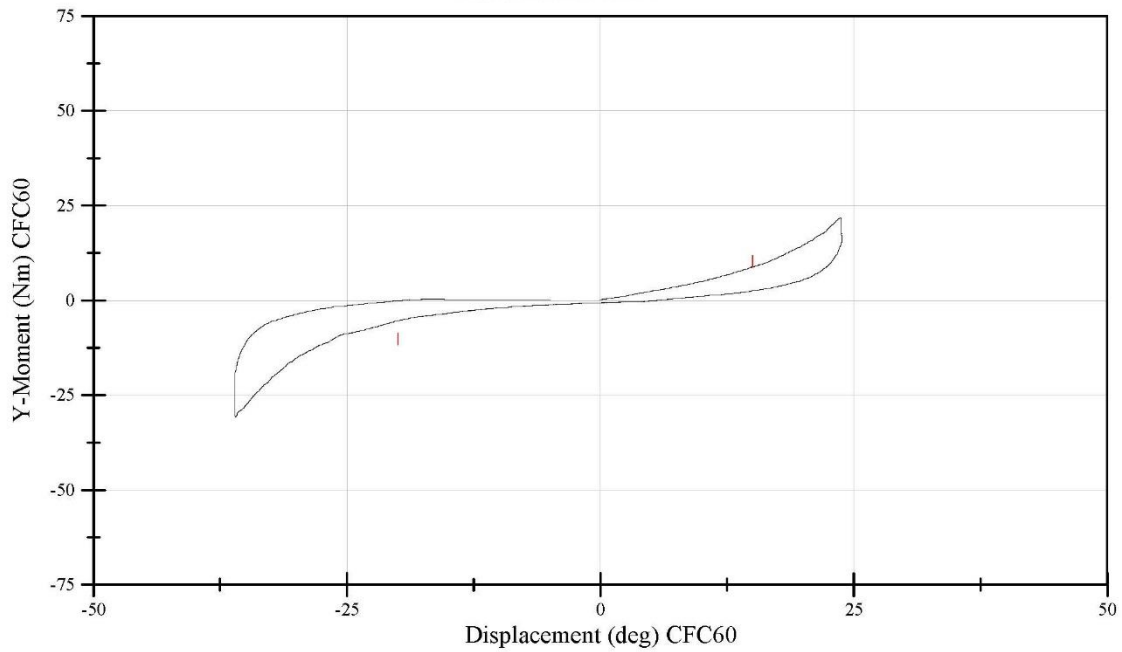


Software Version: 2.4

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

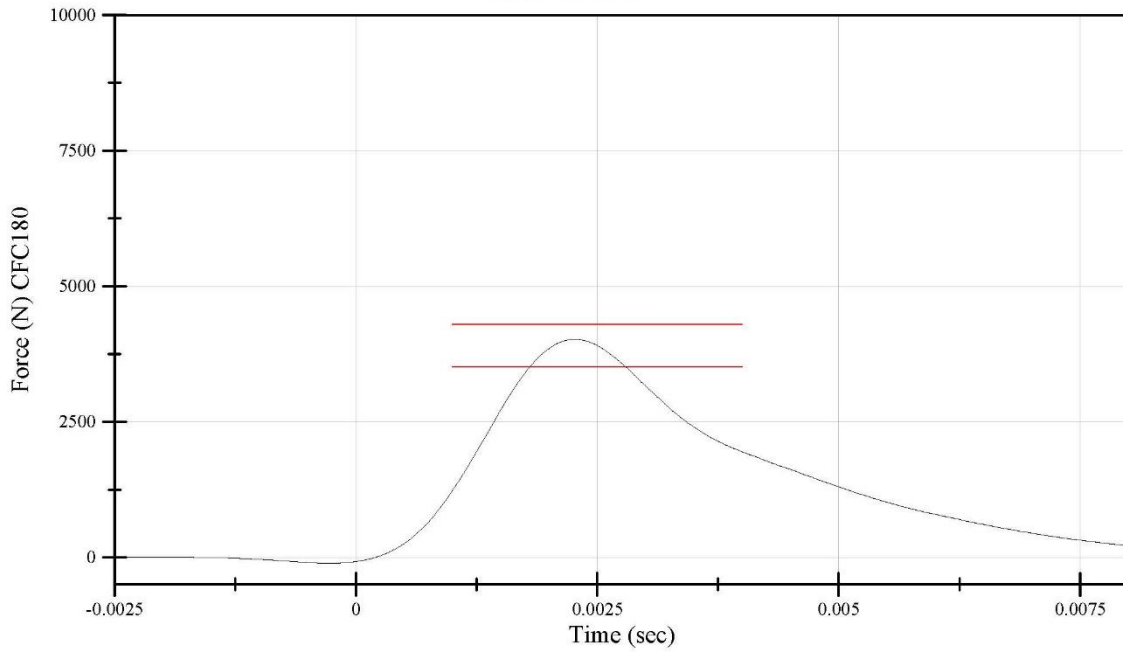


Software Version: 2.4

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

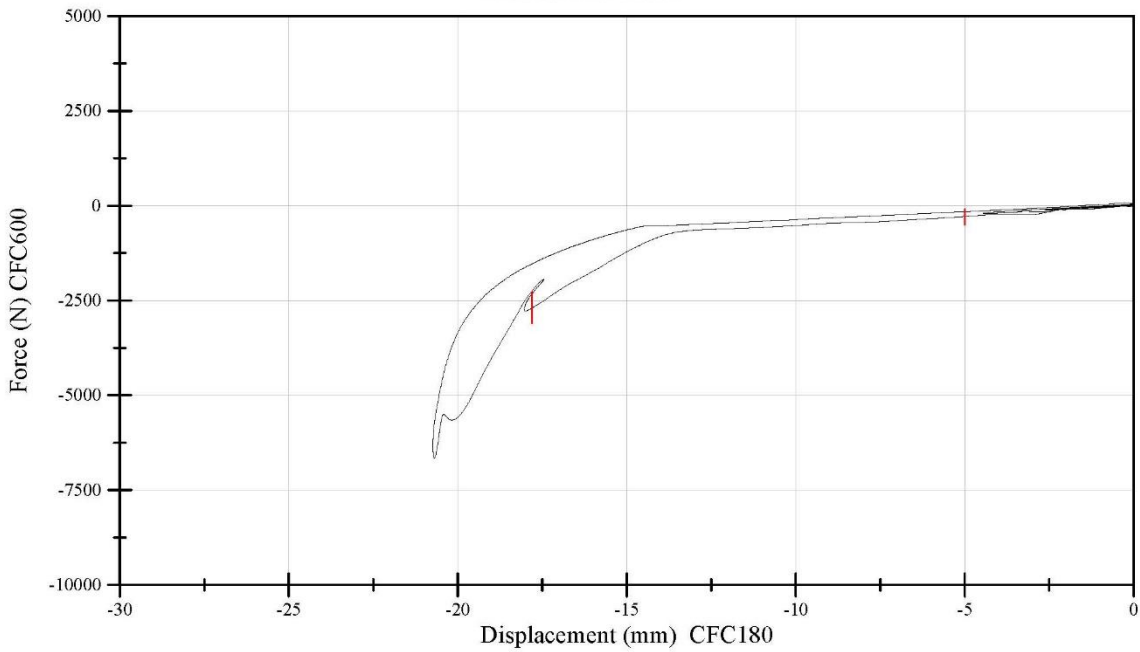


Software Version: 2.4

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

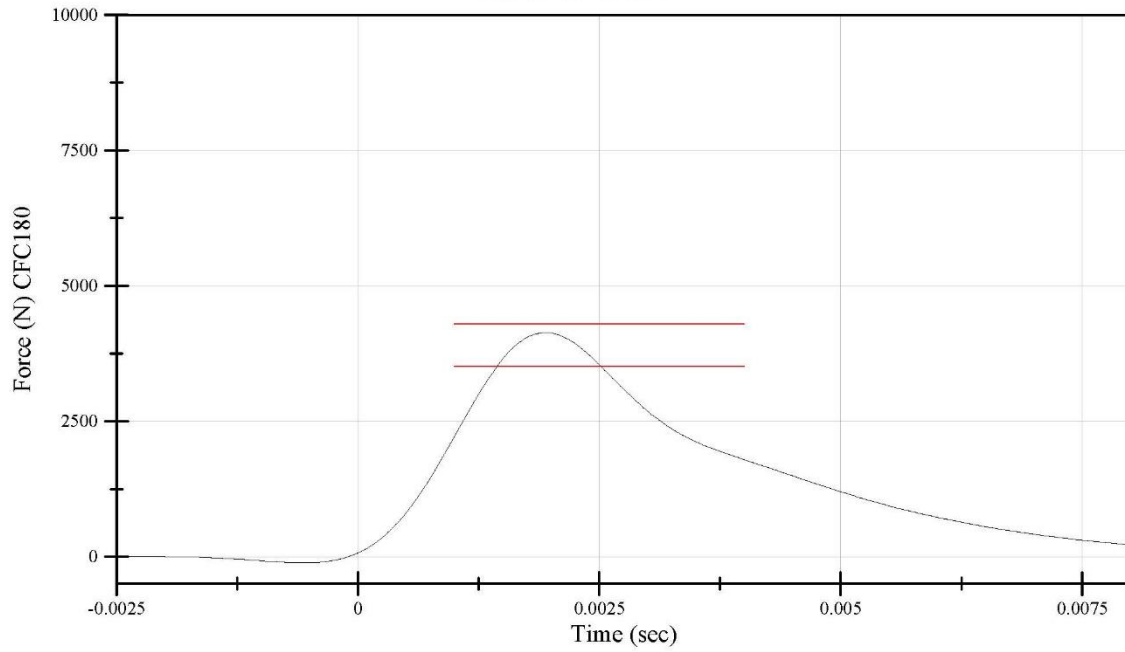


Software Version: 2.4

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

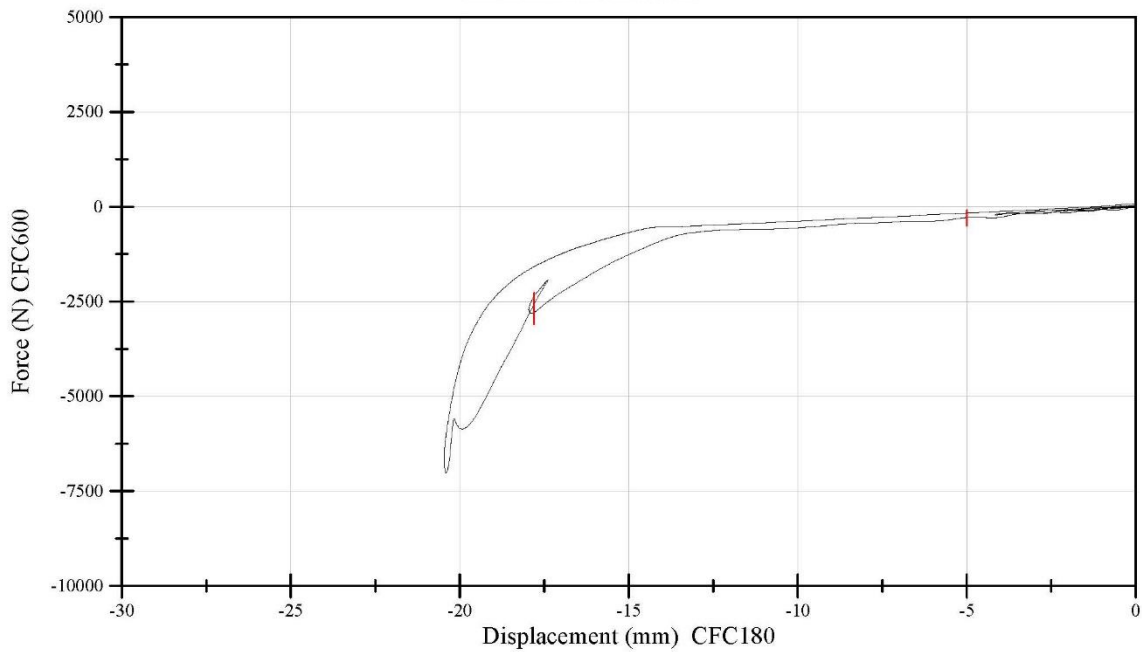


Software Version: 2.4

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

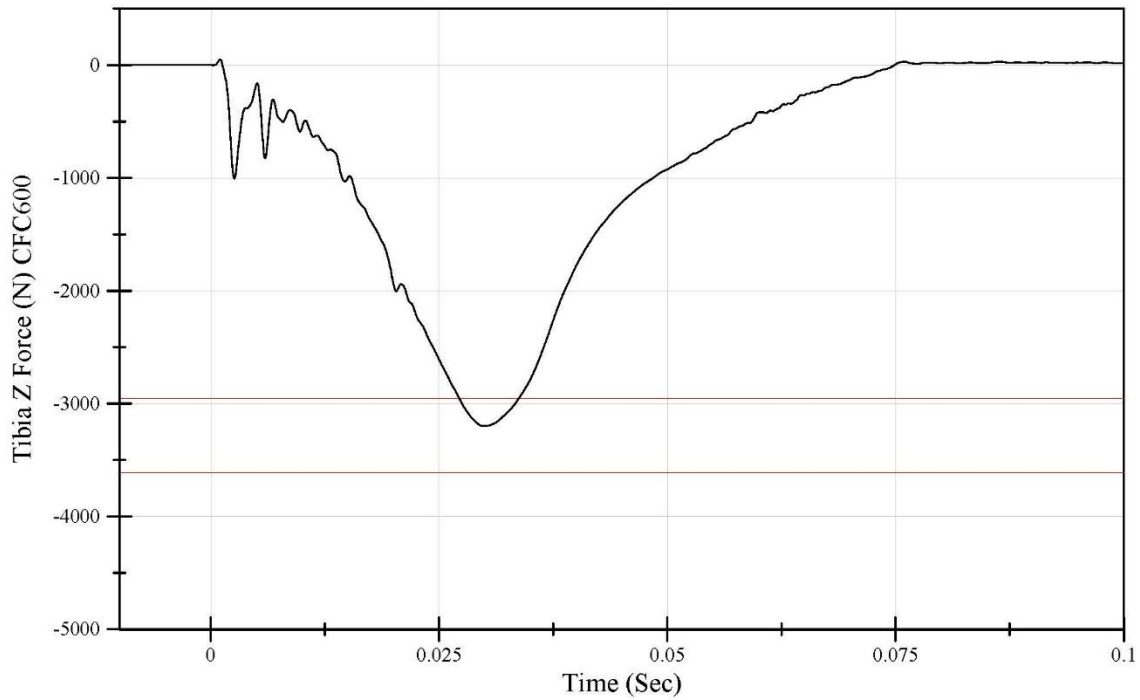


Software Version: 2.4

File Name: 12070382Knee150708\_01renamedprocessed  
07/09/2015 06:31:18.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 5.03 m/s

THOR Right Foot Dorsiflexion Certification  
Tibia Load  
Serial Number: LX 0018

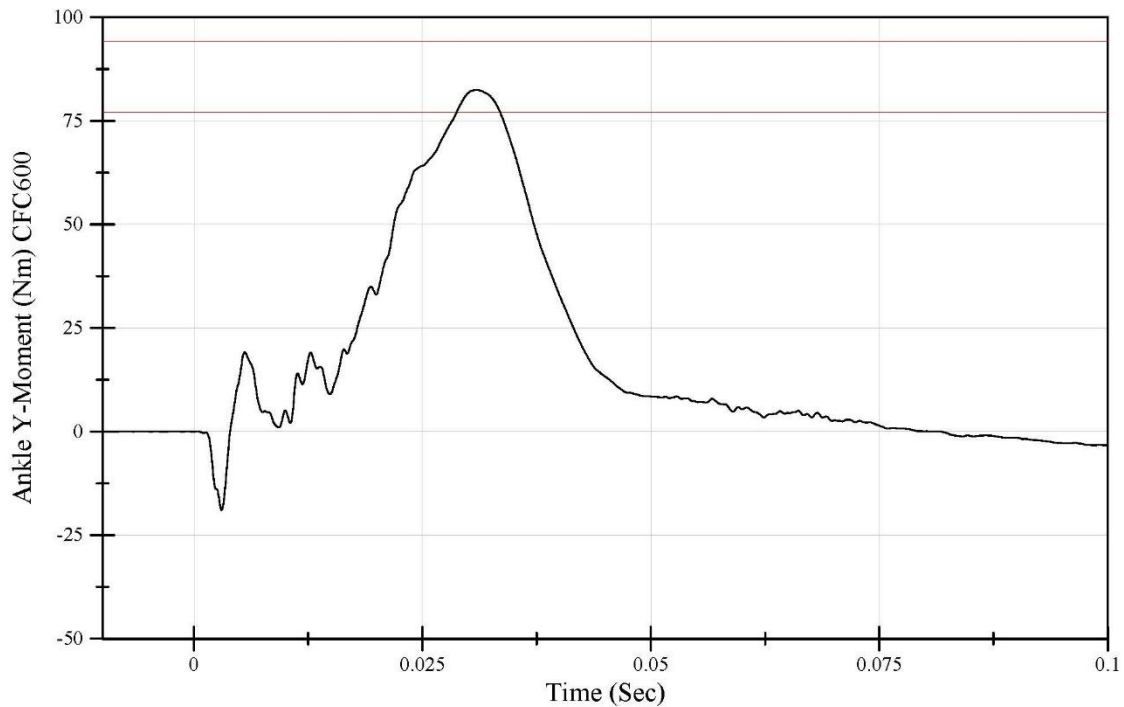


Software Version: 2.4

File Name: LX0018Ball1150707\_02processed  
07/07/2015 12:41:39.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 5.03 m/s

THOR Right Foot Dorsiflexion Certification  
Ankle Y-Moment  
Serial Number: LX 0018

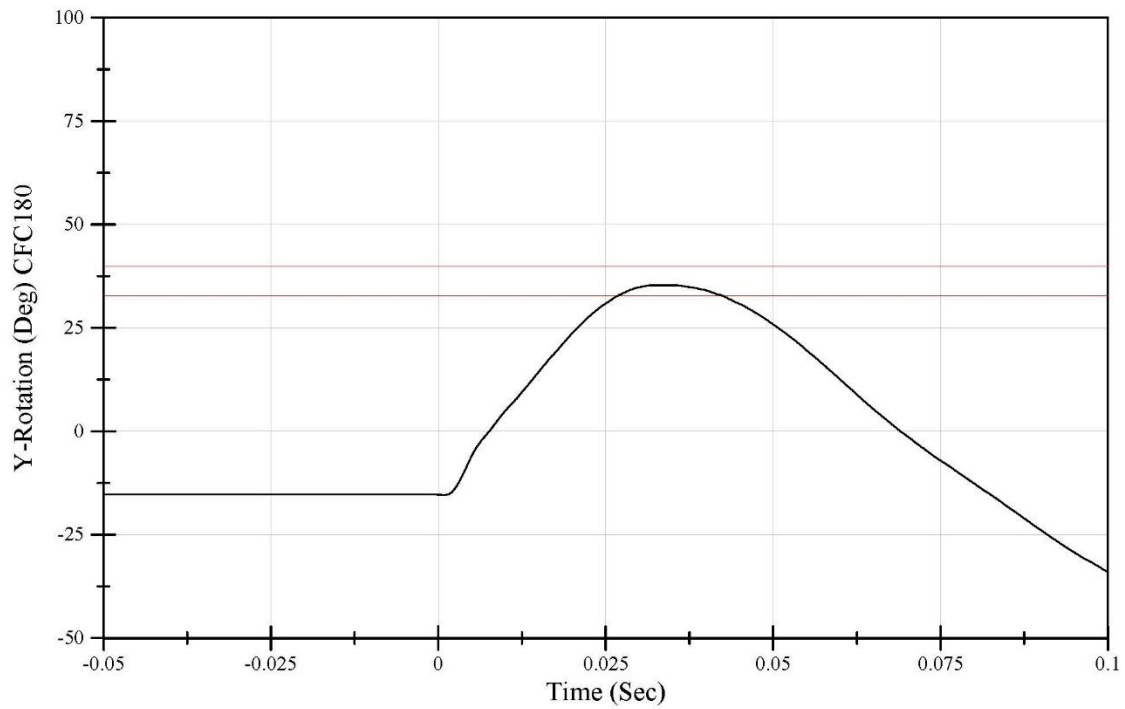


Software Version: 2.4

File Name: LX0018Ball1150707\_02processed  
07/07/2015 12:41:39.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 5.03 m/s

THOR Right Foot Dorsiflexion Certification  
Ankle Y-Rotation  
Serial Number: LX 0018

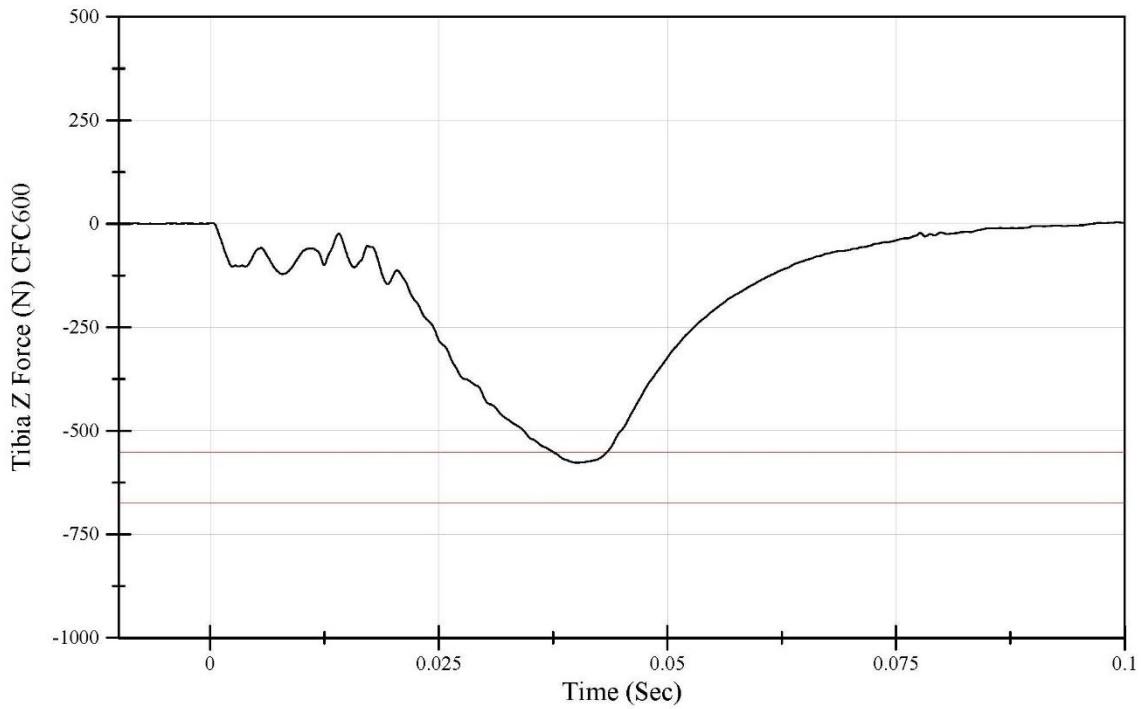


Software Version: 2.4

File Name: LX0018Ball150707\_02processed  
07/07/2015 12:41:39.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 2 m/s

THOR Right Foot Eversion Certification  
Tibia Load  
Serial Number: LX 0018

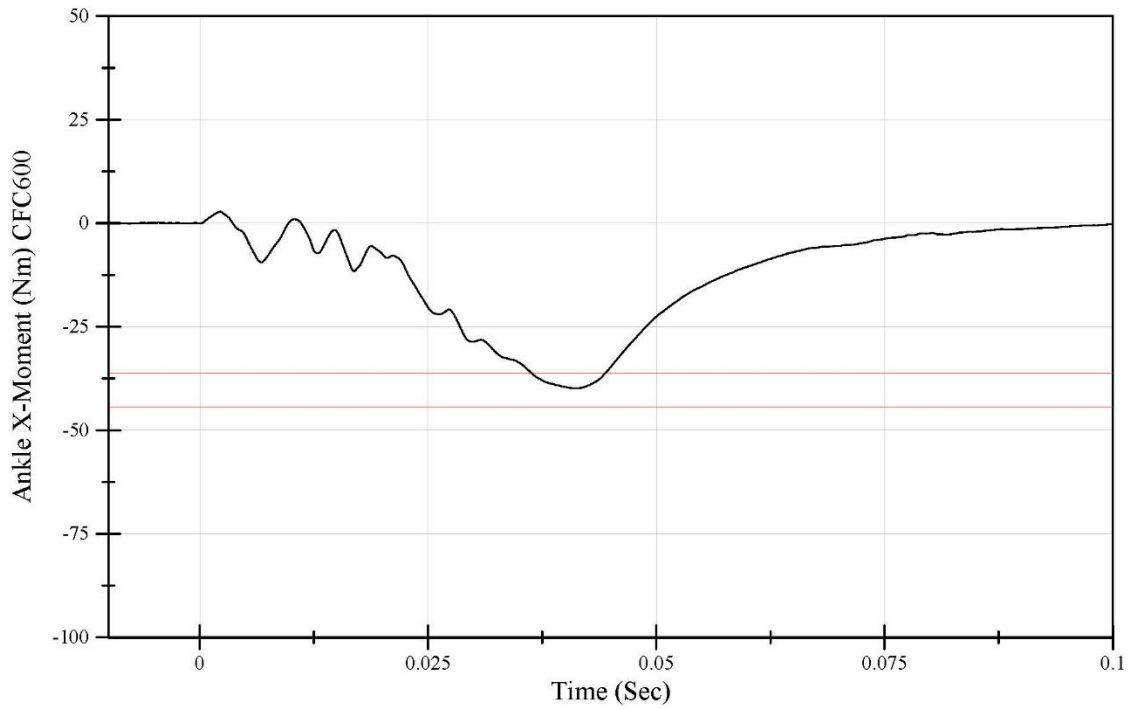


Software Version: 2.4

File Name: LX0018Eversion150707\_01processed  
07/07/2015 11:02:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 2 m/s

THOR Right Foot Eversion Certification  
Ankle Moment  
Serial Number: LX 0018

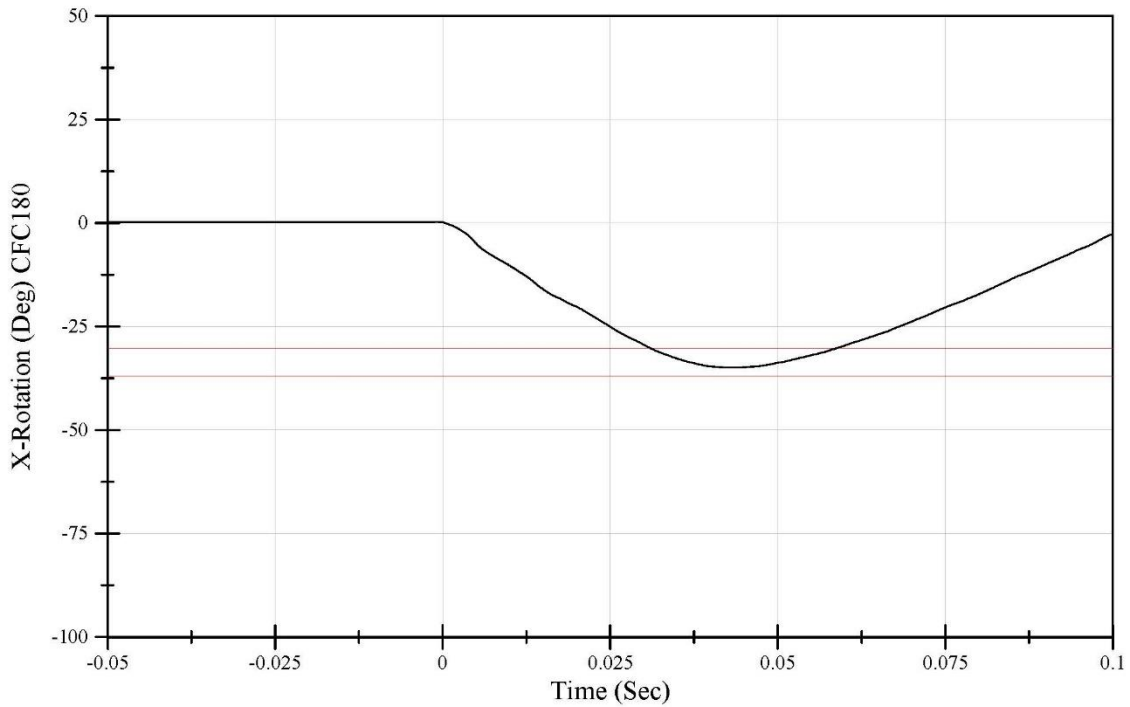


Software Version: 2.4

File Name: LX0018Eversion150707\_01processed  
07/07/2015 11:02:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 2 m/s

THOR Right Foot Eversion Certification  
Ankle X-Rotation  
Serial Number: LX 0018



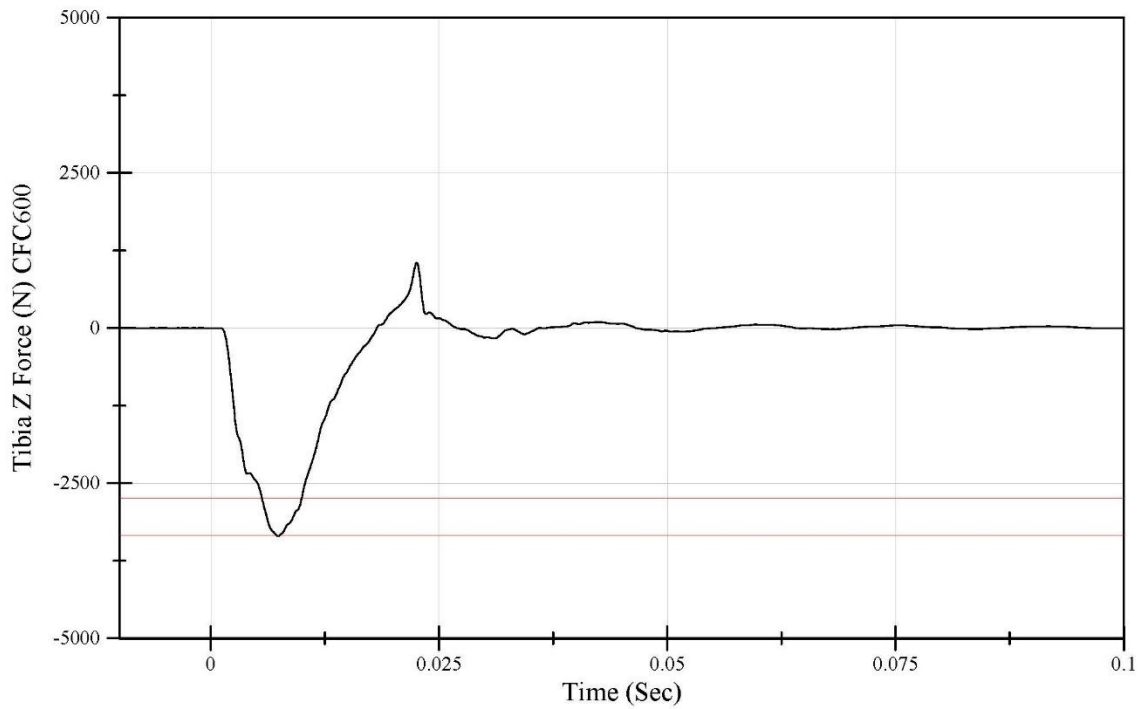
Software Version: 2.4

File Name: LX0018Eversion150707\_01processed  
07/07/2015 11:02:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 3.91 m/s

### THOR Right Foot Heel Certification

Tibia Load  
Serial Number: LX 0018



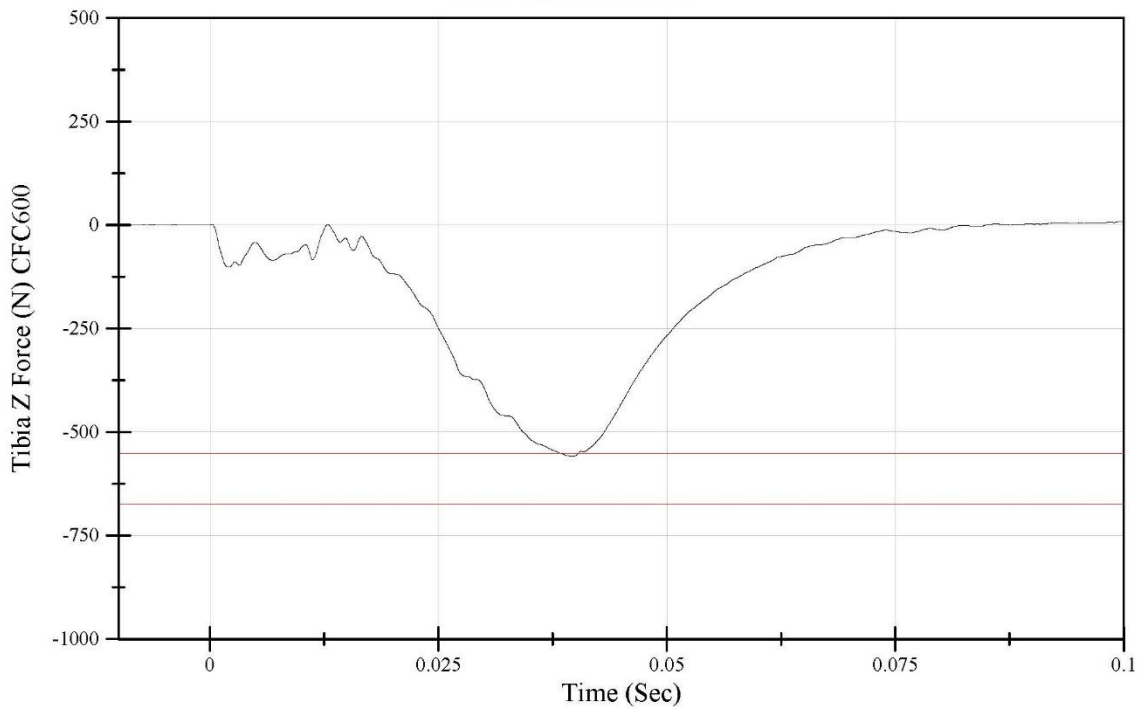
Software Version: 2.4

File Name: LX0018Heel150707\_01processed  
07/07/2015 13:34:11.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 1.99 m/s

### THOR Right Foot Inversion Certification

Tibia Load  
Serial Number: LX 0018

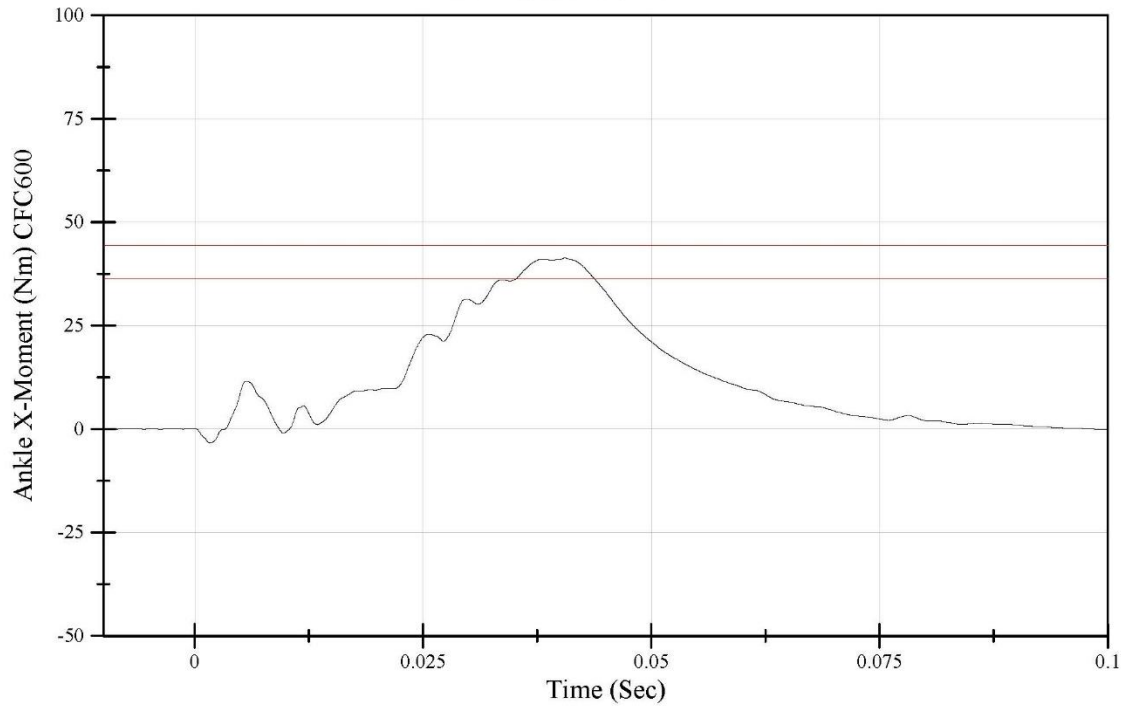


Software Version: 2.4

File Name: LX0018Inversion150707\_01renamedprocessed  
07/07/2015 10:04:43.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 1.99 m/s

THOR Right Foot Inversion Certification  
Ankle Moment  
Serial Number: LX 0018

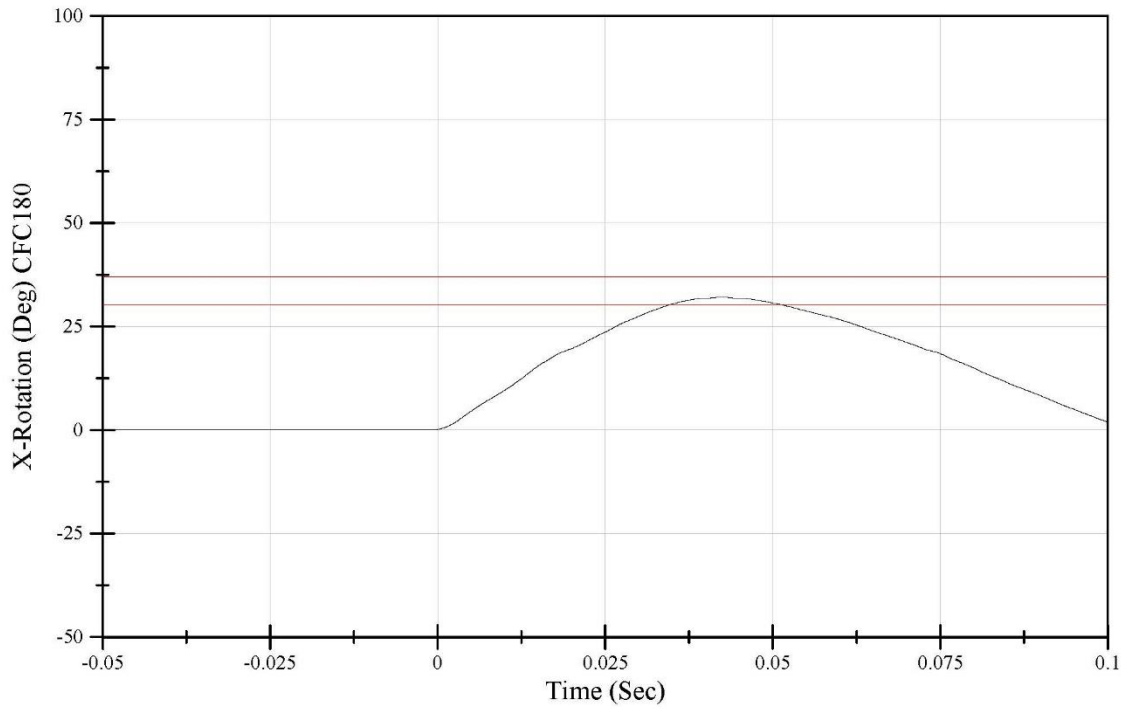


Software Version: 2.4

File Name: LX0018Inversion150707\_01renamedprocessed  
07/07/2015 10:04:43.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 1.99 m/s

THOR Right Foot Inversion Certification  
Ankle X-Rotation  
Serial Number: LX 0018

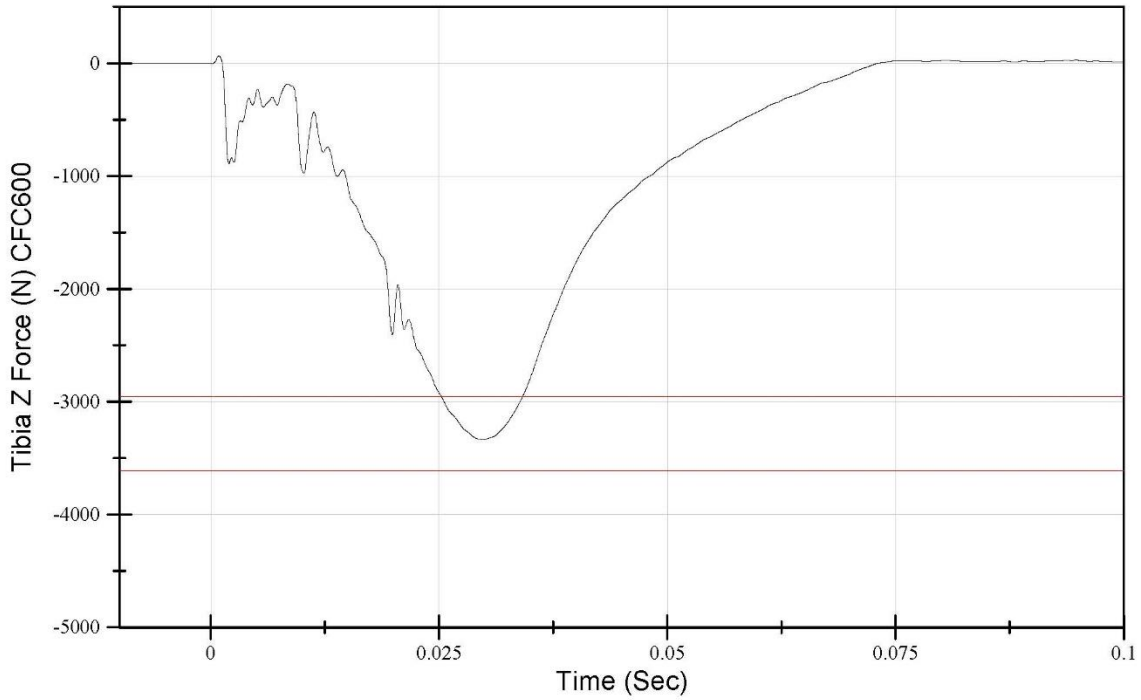


Software Version: 2.4

File Name: LX0018Inversion150707\_01renamedprocessed  
07/07/2015 10:04:43.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 4.98 m/s

THOR Left Foot Dorsiflexion Certification  
Tibia Load  
Serial Number: LX 0019

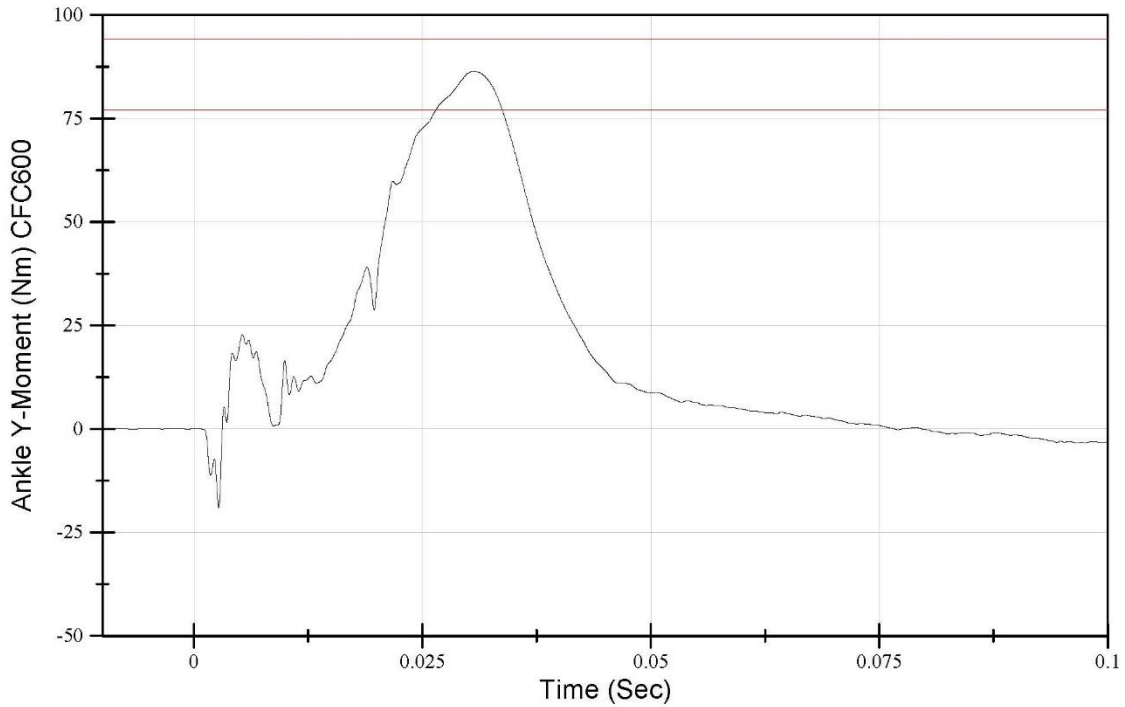


Software Version: 2.4

File Name: LX0019 Ball 150706\_01processed  
07/06/2015 07:34:13.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 4.98 m/s

THOR Left Foot Dorsiflexion Certification  
Ankle Y-Moment  
Serial Number: LX 0019

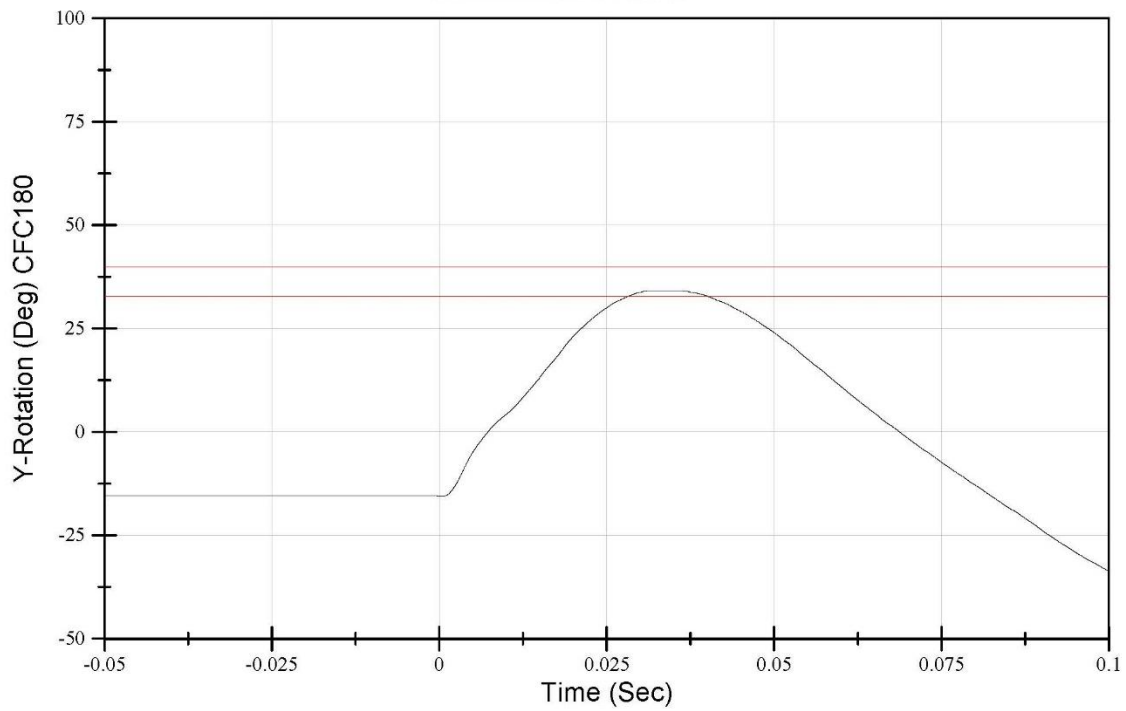


Software Version: 2.4

File Name: LX0019 Ball 150706\_01processed  
07/06/2015 07:34:13.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 4.98 m/s

THOR Left Foot Dorsiflexion Certification  
Ankle Y-Rotation  
Serial Number: LX 0019

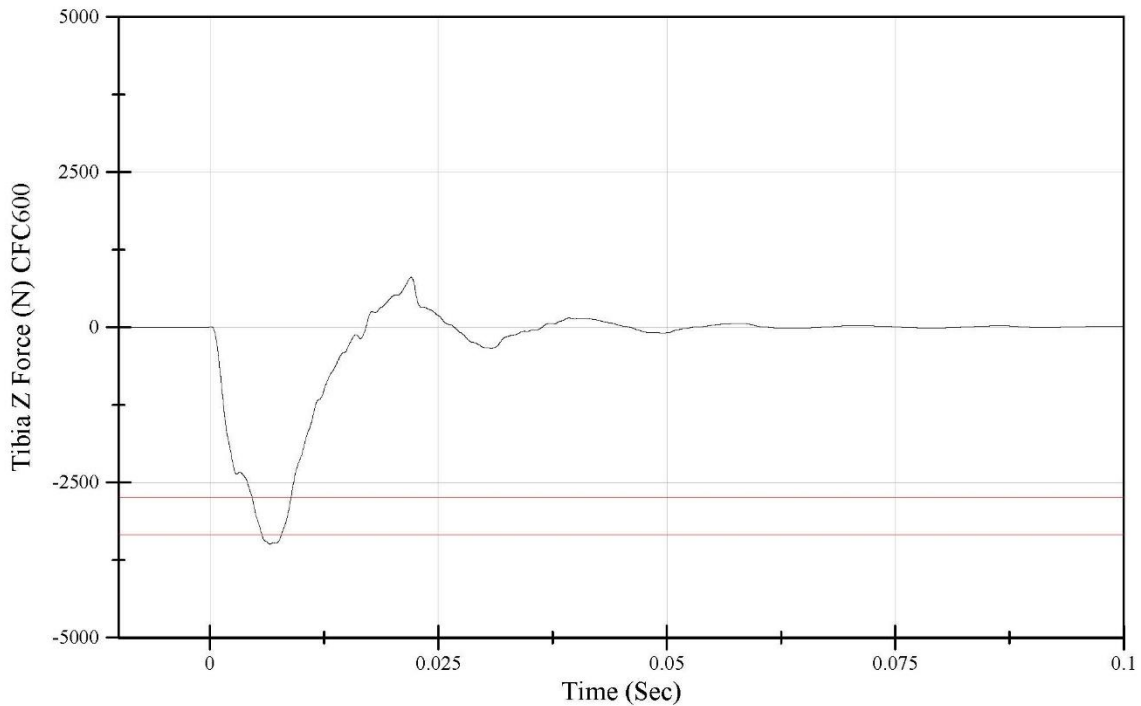


Software Version: 2.4

File Name: LX0019 Ball 150706\_01processed  
07/06/2015 07:34:13.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 3.91 m/s

THOR Left Foot Heel Certification  
Tibia Load  
Serial Number: LX 0019

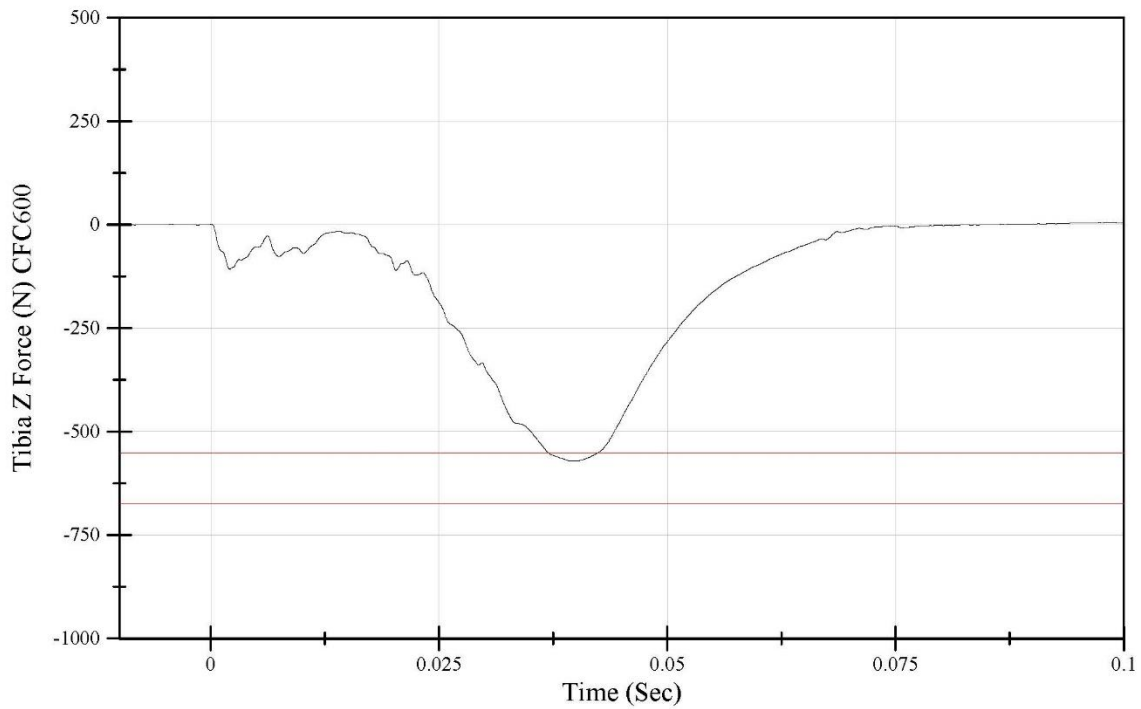


Software Version: 2.4

File Name: LX0019 Heel 150706\_01processed  
07/06/2015 11:35:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 2.06 m/s

THOR Left Foot Eversion Certification  
Tibia Load  
Serial Number: LX0019

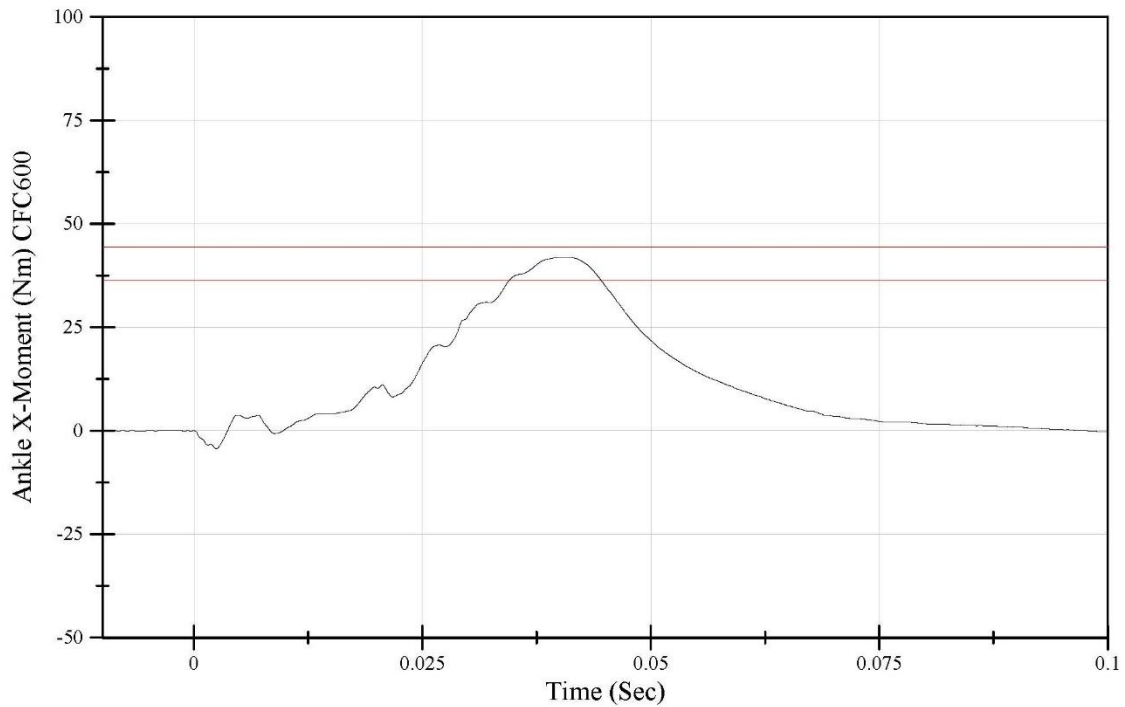


Software Version: 2.4

File Name: LX0019Eversion150702\_01processed  
07/02/2015 14:35:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 2.06 m/s

THOR Left Foot Eversion Certification  
Ankle Moment  
Serial Number: LX0019

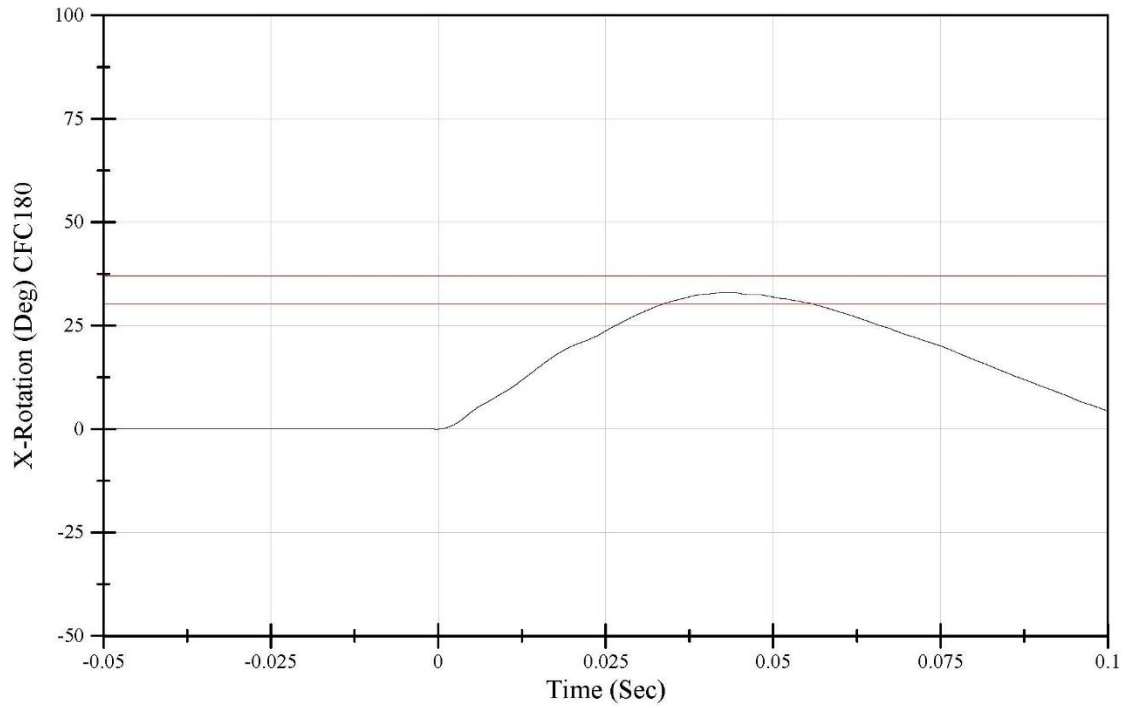


Software Version: 2.4

File Name: LX0019Eversion150702\_01processed  
07/02/2015 14:35:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 2.06 m/s

THOR Left Foot Eversion Certification  
Ankle X-Rotation  
Serial Number: LX0019

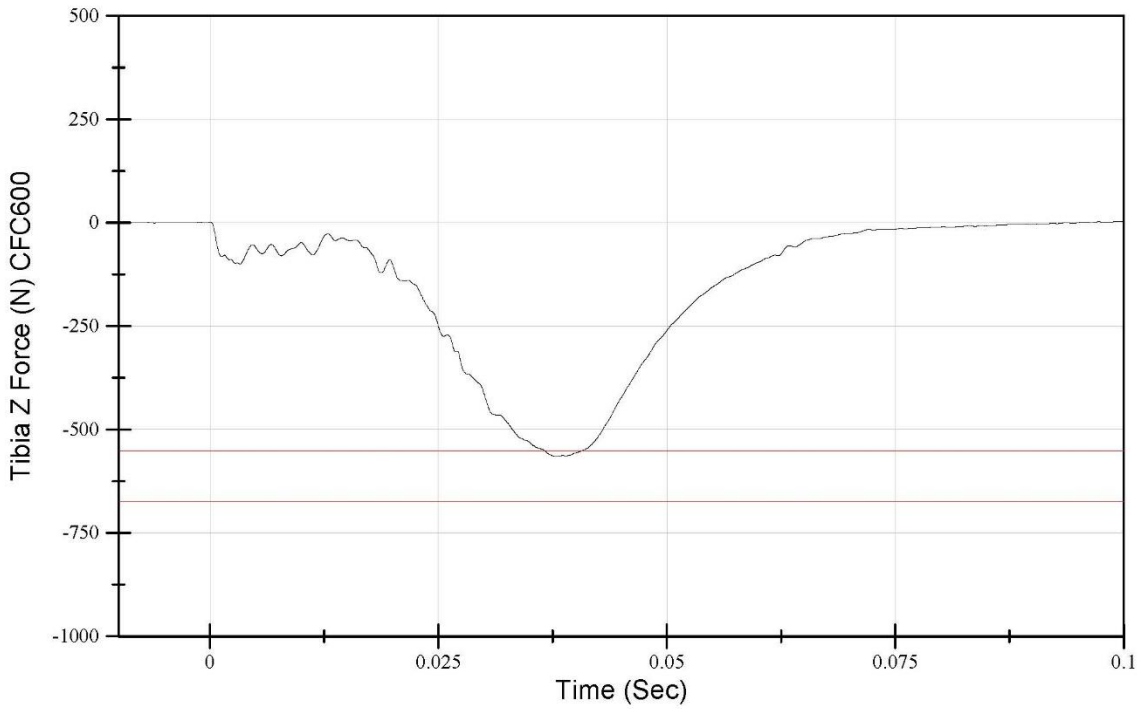


Software Version: 2.4

File Name: LX0019Eversion150702\_01processed  
07/02/2015 14:35:49.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 1.98 m/s

THOR Left Foot Inversion Certification  
Tibia Load  
Serial Number: LX0019

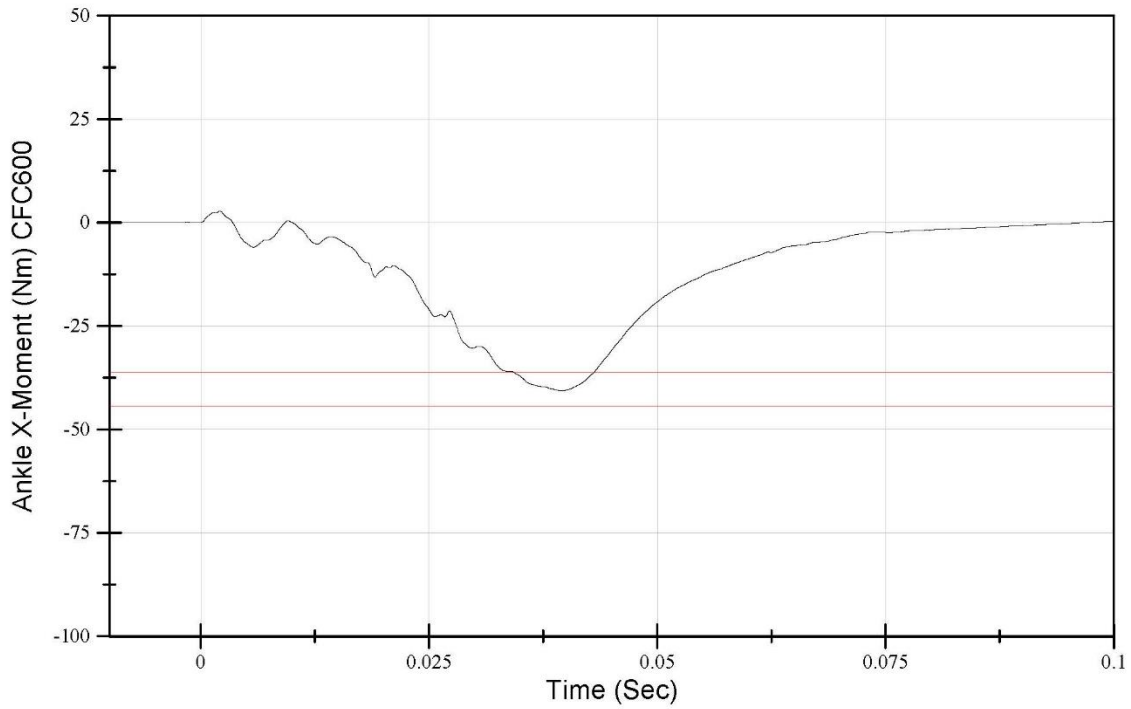


Software Version: 2.4

File Name: LX0019Inversion150702\_01processed  
07/02/2015 14:04:39.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 1.98 m/s

THOR Left Foot Inversion Certification  
Ankle Moment  
Serial Number: LX0019

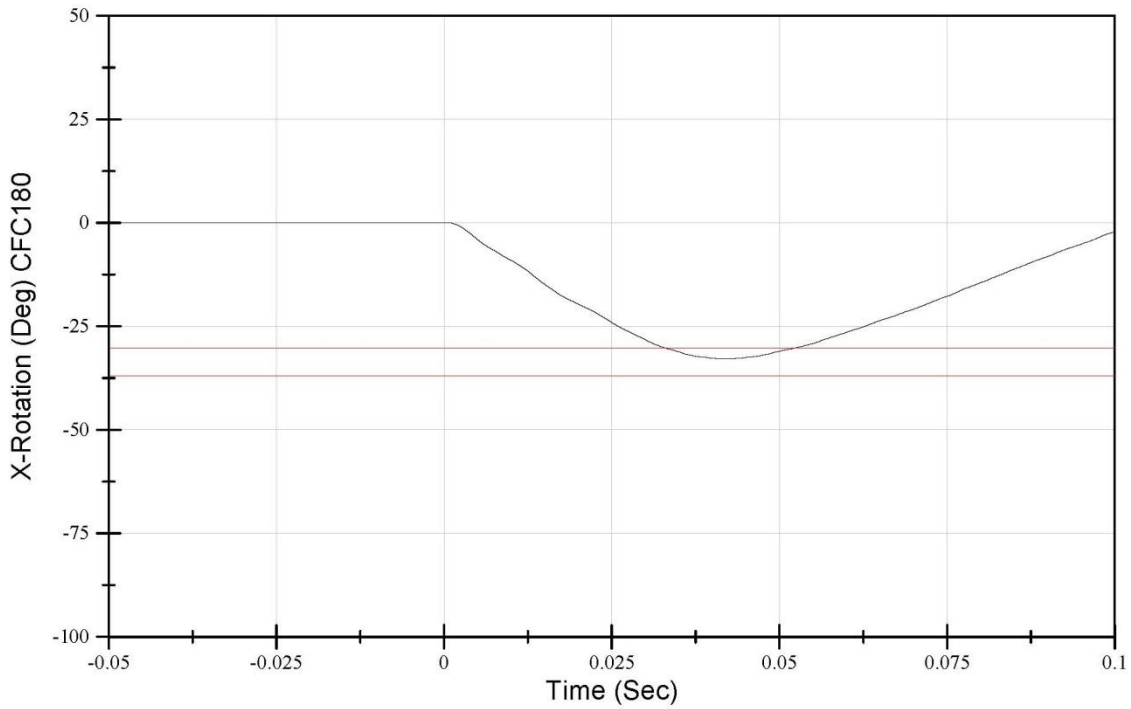


Software Version: 2.4

File Name: LX0019Inversion150702\_01processed  
07/02/2015 14:04:39.0000

Test Temperature: 71 degrees  
Relative Humidity: 51%  
Test Velocity: 1.98 m/s

THOR Left Foot Inversion Certification  
Ankle X-Rotation  
Serial Number: LX0019



Software Version: 2.4

File Name: LX0019Inversion150702\_01processed  
07/02/2015 14:04:39.0000