

REPORT NUMBER: 214P-CAL-23-003

RESEARCH SIDE IMPACT POLE TEST

**KIA Motors Mexico S.A DE C.V.
2019 Hyundai Accent
4 Door Sedan**

NHTSA No: R20194204

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



March 8, 2024

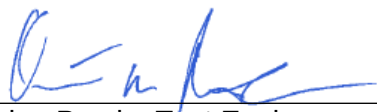
FINAL REPORT

**PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
STRUCTURE & RESTRAINT RESEARCH DIVISION
MAIL CODE: NSR-210
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WASHINGTON, D.C. 20590**

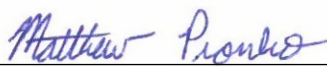
This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number 693JJ922D000001.

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Date: March 8, 2024

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Date: March 8, 2024

FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Structure & Restraint Research Division

Date: _____

COTR, New Car Assessment Program
NHTSA, Office of Structure & Restraint Research Division

Date: _____

TECHNICAL REPORT DOCUMENTATION PAGE

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16. Abstract A 32.20 km/h (20 mph), 75° oblique compliance test was conducted on the subject 2019 Hyundai Accent 4 Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance FMVSS No. 214, Dynamic Side Impact Protection Laboratory Test Procedure TP-214P-01, dated September, 2012 for the generation of consumer information on vehicle side pole crash protection. This test was conducted at Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on June 5, 2023. The impact velocity of the vehicle was 30.99 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle was 21°C. The target vehicle's maximum post-test static crush was 280 mm located at level 3. The test vehicle's occupant performance data is as follows: <table border="1"> <thead> <tr> <th rowspan="2">Measurement Description</th> <th colspan="3">Driver ATD (ES-2re) (Serial No.F034)</th> </tr> <tr> <th>Units</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC36)</td> <td></td> <td>1000</td> <td>250.38</td> </tr> <tr> <td>Brain Injury Criterion (BrIC)</td> <td></td> <td></td> <td>0.68</td> </tr> <tr> <td>Maximum Thoracic Rib Deflection</td> <td>mm</td> <td>44</td> <td>28.66</td> </tr> <tr> <td>Pubic Symphysis Force</td> <td>N</td> <td>6000</td> <td>1723.80</td> </tr> <tr> <td>Maximum Shoulder Force</td> <td>N</td> <td></td> <td>1790.79</td> </tr> <tr> <td>Combined Abdominal Force</td> <td>N</td> <td>2500</td> <td>923.91</td> </tr> </tbody> </table> The two doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.						Measurement Description	Driver ATD (ES-2re) (Serial No.F034)			Units	Threshold	Result	Head Injury Criteria (HIC36)		1000	250.38	Brain Injury Criterion (BrIC)			0.68	Maximum Thoracic Rib Deflection	mm	44	28.66	Pubic Symphysis Force	N	6000	1723.80	Maximum Shoulder Force	N		1790.79	Combined Abdominal Force	N	2500	923.91
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SECTION 1

TEST PURPOSE AND PROCEDURE

This side impact test was conducted as part of the Federal Motor Vehicle Safety Standard 214 Side Impact Protection Program. It was conducted for the National Highway Traffic Safety Administration (NHTSA), under Contract No. 693JJ922D000001. The purpose of this test was to evaluate side impact protection in a 2019 Hyundai Accent 4 Door Sedan. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure, TP-214P-01 dated September 2012.

SECTION 2

SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2019 Hyundai Accent 4 Door Sedan. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 30.99 km/h. The test was conducted by Calspan Corporation's Transportation Test Operations facility in Buffalo, New York on June 5, 2023. Pre-test and post-test photographs of the test vehicle and side impact dummy (ES-2re) are included in Appendix A of this report.

One Part 572U (ES-2re) dummy was placed in the driver designated seating position according to instructions specified in the OCWS FMVSS No. 214, Dynamic Side Impact Protection Laboratory Test Procedure, TP-214P-01, dated September, 2012. Camera locations and other pertinent camera information are included on page 3-11 in this report.

The Part 572U (ES-2re) dummy was instrumented accordingly:

- DRIVER ATD (ES-2re)
- Head CG tri-axial accelerometer
- Head angular rate sensor
- Upper neck load cells
- Shoulder load cell
- Upper (T1) and lower spine (T12) tri-axial accelerometers
- Lower Spine (T12) load cell
- Lumbar load cell
- Pelvic tri-axial accelerometers
- Pubic load cell
- Abdomen forward, middle, and rear y-axis load cells

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D identifies all serial numbers, manufacturers, and calibration dates for test equipment, dummy sensors, potentiometers, and load cells used to collect data during the test. Appendix E contains the seating procedure worksheets and plots.

Injury readings for the ES-2re dummy were recorded as follows:

INJURY READINGS

Measurement Description	Driver ATD (ES-2re)		
	Units	IARV	Result
Head Injury Criteria (HIC36)		1000	250.38
Brain Injury Criterion (BrIC)			0.68
Maximum Thoracic Rib Deflection	mm	44	28.66
Pubic Symphysis Force	N	6000	1723.80
Maximum Shoulder Force	N		1790.79
Combined Abdominal Force	N	2500	923.91

*Proposed IARV

Supplemental restraint information was recorded as follows:

SUPPLEMENTAL RESTRAINT INFORMATION

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Front Airbag	Yes	No		
Knee Airbag	No	N/A		
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other	N/A	N/A	N/A	N/A

GENERAL COMMENTS:

1. P1 serial number - F034

Data Anomalies:

- Left Sill B-Pillar Y Acceleration, Exceeded calibration range at 19.2 ms
- LFT. FRT. Door Mid Rear Y Acceleration, Exceeded calibration range at 23.3 ms
- Load Cell Pole Barrier #1 Fy, Questionable data throughout
- Load Cell Pole Barrier #6 Fy, Failed to return to zero

SECTION 3

OCCUPANT AND VEHICLE INFORMATION

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 - General Test and Vehicle Parameter Data

Data Sheet No. 2 - Seat, Seat Belt, Steering Wheel Adjustment and Fuel Systems Data

Data Sheet No. 3 - Dummy Longitudinal Clearance Dimensions

Data Sheet No. 4 - Dummy Lateral Clearance Dimensions

Data Sheet No. 5 - Camera and instrumentation Data

Data Sheet No. 6 - Vehicle Accelerometer Data

Data Sheet No. 7- Rigid Pole Load Cell Data

Data Sheet No. 8 - Post-Test Observations

Data Sheet No. 9 - Test Vehicle Profile Measurements

Data Sheet No. 10 - Test Vehicle Exterior Crush Measurements

Data Sheet No. 11 - Vehicle Damage Profile Distances

Data Sheet No. 12 - FMVSS No. 301 Static Rollover Results

Data Sheet No. 13 - Dummy / Vehicle Temperature and Humidity Stabilization Data

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

Test Date: 06/05/2023

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	R20194204	Traction Control System (TCS)	Yes
Model Year	2019	Auto-Leveling System	No
Make	Hyundai	Automatic Door Locks (ADL)	Yes
Model	Accent	Power Window Auto-Reverse	No
Body Style	Four Door Sedan	Other Optional Feature	N/A
VIN	3KPC24A32KE071637	Driver Front Airbag	Yes
Body Color	White	Driver Curtain Airbag	Yes
Odometer Reading (km/mi)	48,345 miles	Driver Head/Torso Airbag	No
Engine Displacement (L)	1.6	Driver Torso Airbag	No
Type / No. Cylinders	I4	Driver Torso / Pelvis Airbag	Yes
Engine Placement	Transverse	Driver Pelvis Airbag	No
Transmission Type	Automatic	Driver Knee Airbag	No
Transmission Speeds	6-Speed	Rear Pass. Curtain Airbag	Yes
Overdrive	Yes	Rear Pass. Head / Torso Airbag	No
Final Drive	Front Wheel Drive	Rear Pass. Torso Airbag	No
Roof Rack	No	Rear Pass. Torso / Pelvis Airbag	Yes
Sunroof / T-Top	No	Rear Pass. Pelvis Airbag	No
Running Boards	No	Driver Seat Belt Pretensioner	Yes
Tilt Steering Wheel	Yes	Rear Pass. Seat Belt Pretensioner	No
Power Seats	No	Driver Load Limiter	Yes
Anti-Lock Brakes (ABS)	Yes	Rear Pass. Load Limiter	No
		Other Safety Restraint	N/A

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

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	KIA Motors Mexico S.A DE C.V.	GVWR	1600
Date of Manufacture	12/18	GVWR Front	880
Vehicle Type	Passenger Car	GVWR Rear	840

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	N/A	5	
Vehicle Capacity Weight (VCW) (kg)				385	(A)
DSC x 68.04 kg				340.2	(B)
Cargo Weight (RCLW) (kg)				44.8	(A-B)

VEHICLE SEAT TYPE

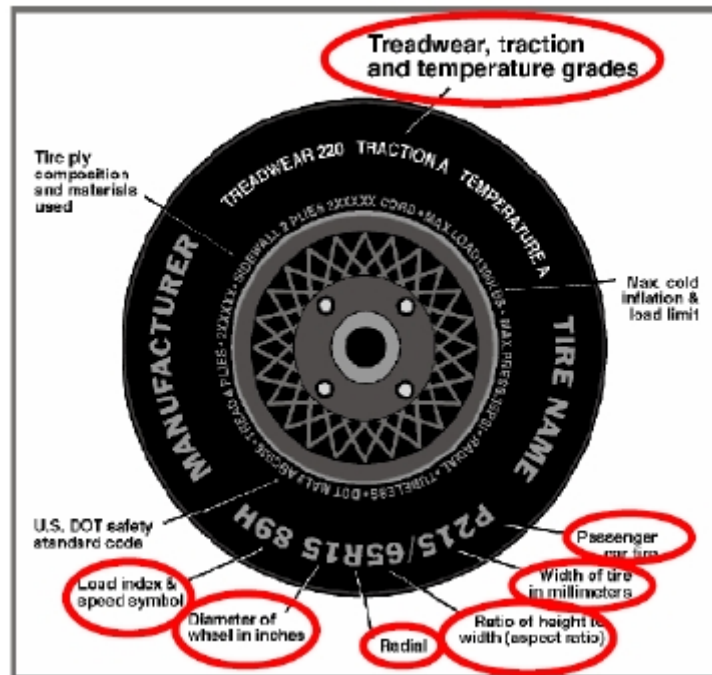
Seating Location	Type Of Seat Pan				Type Of Seat Back		
	Bucket	Bench	Split Bench	Contour	Fixed	Adjustable	
						W/ Lever	W/ Knob
Front	X					X	
Rear or Second Row Seat			X		X		
Third Row seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

Collected for year, make, model, & VIN, all items circled in red, tire manufacturer and tire name



VEHICLE TIRE INFORMATION

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	230	230
Recommended Tire Size	185/65R15	185/65R15
Tire Size on Vehicle	185/65R15	185/65R15
Tire Manufacturer	Master Craft	Master Craft
Tire Model	Courser Quest	Courser Quest
Treadwear	700	700
Traction	A	A
Temperature Grades	A	A
Load Index / Speed Symbol	88H	88H
Tire Material	Rubber	Rubber

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

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	212	228	206	220
Tire Placard	kPa	230	230	230	230
Owner's Manual	kPa	230	230	230	230
As Tested	kPa	230	230	230	230

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Rear	Total	Total	Front	Rear	Total
Left	kg	369	233		399	275		400	282	
Right	kg	355	223		370	255		364	257	
Ratio	%	61.4	38.6		59.2	40.8		58.6	41.4	
Totals	kg	724	456	1180	769	530	1299	764	539	1303

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1180	(A)
Actual Weight of 1 P572U (ES-2re) ATD Used	kg	82	(B)
Rated Cargo / Luggage Weight (RCLW)	kg	44.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1306.8	(A+B+C)

Does the measured As Test Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to – 9 kg)?

☒ Yes

☐ No

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	As Delivered	As Tested	Fully Loaded	Meets Rqmt***
Driver Door Sill Angle (front-to-rear)*	Deg	+ 1.25	+ 0.95	+ 0.90	Yes
Front Passenger Sill Angle (front-to-rear)*	Deg	- 0.40	- 0.40	- 0.30	Yes
Front Bumper-Line Angle (left-to-right)**	Deg	- 0.40	- 0.40	- 0.45	Yes
Rear Bumper-Line Angle (left-to-right)**	Deg	+ 0.10	+ 0.20	+ 0.65	Yes
Vehicle CG (Aft of Front Axle)	mm	997	1053	1068	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	-16	-29	-36	

* ND = Nose Down (-), NU = Nose Up (+)

** LD = Left Down (-), LU = Left Up (+)

*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements. Indicate "Yes" or "No" for Meets Requirement

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

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

Test Date: 06/05/2023

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Trunk Carpeting	3
Spare Tire	10
Jack	3
Tail Lights	3
Rubber Floor Mats	3
Ballast / Equipment Added	0

Test Height – Adjustable Suspension Setting, if Applicable	N/A
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DATA SHEET NO. 2
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

Test Date: 06/05/2023

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the forward-most, mid-height, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL(°)		
	Max	Min	Mid
Driver Seat	15.7	13.2	14.5
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rearmost	Mid-Fore / Aft	Forward-Most
Driver Seat	14.5	28	Max	-	-	-
			Mid	-	-	-
			Min	10	28	40
Front Passenger Seat	Fixed	Fixed	Max			
			Mid			
			Min			
Front Center Seat*			Max			
			Mid			
			Min			

**If applicable*

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

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

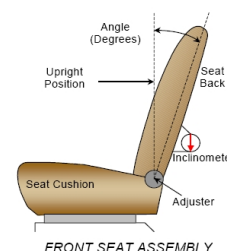
Test Date: 06/05/2023

SEAT FORE / AFT POSITION

Seat	Total Fore / Aft Travel		Test Position from Forward most Position	
	mm	Detents*	mm	Detents*
Driver Seat	248	39 (0-38)	124.5	19
Front Passenger Seat	242	39 (0-38)	122.5	19
Front Center Seat				

SEAT BACK ANGLE ADJUSTMENT

The driver and passenger seat back are positioned to the manufacturer's designated angle provided in the Form1.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents*	Degrees	Detents*
Driver Seat w/Seated Dummy	57.1	28	1.15	7
Front Passenger Seat	58.0	28	0.1	6
Front Center Seat				

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1. Zero is defined as the uppermost detent

Seat	Total # of Positions	Placed in Position #
Driver Seat	3 (0-2)	0

HEAD RESTRAINT ADJUSTMENT

The driver's head restraint is adjusted to the lowest and most full forward in-use position.

Seat	Total # of Positions	Placed in Position #
Driver Seat	6 (0-5)	Uppermost

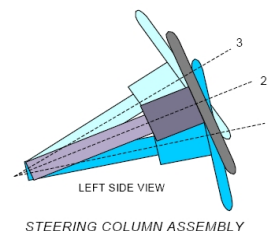
DATA SHEET NO. 2 ... (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

STEERING COLUMN POSITIONS

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

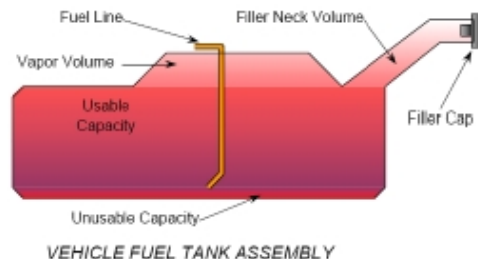


	Degrees	Fore / Aft Position (mm)
Lowermost - Position No. 1	21.6	
Geometric center - Position No. 2	24.2	
Uppermost - Position No. 3	26.7	
Telescoping Steering Wheel Travel		N/A
Test Position	24.1	N/A

FUEL PUMP

Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck

The vehicle is equipped with an electric fuel pump. The fuel filler neck is on the left side of the vehicle. The pump creates positive pressure in the fuel lines, pushing the gasoline to the engine. See form 1 for more information.



FUEL TANK CAPACITY

Description	Liters
Usable Capacity of "Standard Tank" - see Form No. 1	45
Usable Capacity of "Optional Tank" - see Form No. 1	N/A
Usable Capacity of "Standard Tank" - see Owner's Manual	45
Usable Capacity of "Optional Tank" - see Owner's Manual	N/A
93% of Usable Capacity	41.85
Actual Amount of Solvent Used in Test	41.85
1/3 of Usable Capacity	14.85

Is the Actual Amount of Solvent Used in the test equal to 93% $\pm$ 1% of the Usable

Capacity stated in Form No. 1?



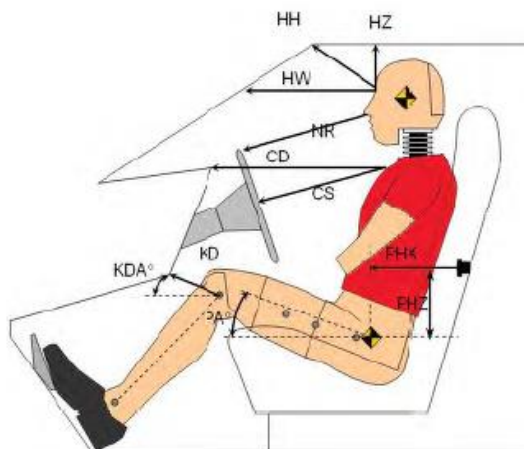
Yes



No

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle:	2019 Hyundai Accent 4 Door Sedan	NHTSA No:	R20194204
Test Program:	Research Side Pole Impact Test	Test Date:	06/05/2023



Note: All measurements are in millimeters. 2-door vehicle shown. Rear dummy HX, HZ, PHX and PHZ measurements for 4-door vehicle would use the C-post striker as a reference point.

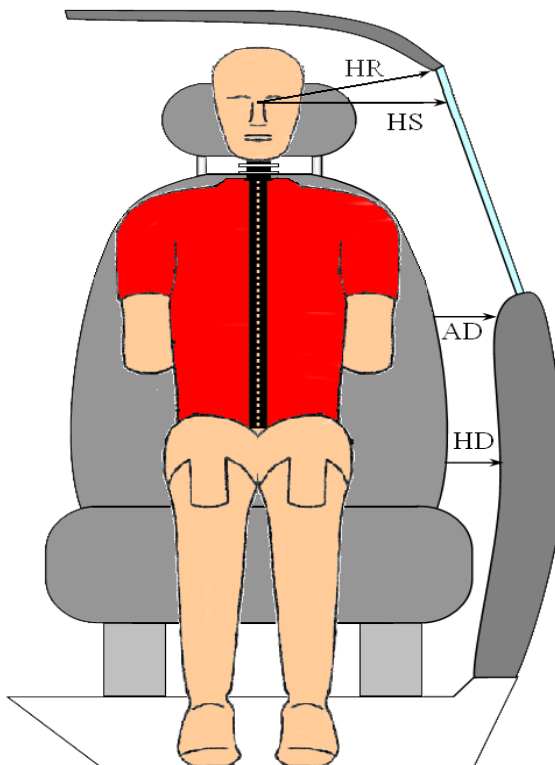
Code	Measurement Description	Driver SN # F034	
		Length (mm)	Angle
HH	Header to Header	417	
HW	Header to Windshield	680	
HZ	Head to Roof Liner	185	
NR	Nose to Rim/Seat Back	451	
CD	Chest to Dash/Seat Back	941	
CS	Chest to Steering Wheel	335	
KD(L)/KDA(L)°	Left Knee to Dash/Seat Back	227	43
KD(R)/KDA(R)°	Right Knee to Dash/Seat Back	191	16
PAX°	Pelvic Tilt Angle X		-19.2
PAY°	Pelvic Tilt Angle Y		0.2
PHX	Hip Point to Striker (X-Axis)	150	
PHZ	Hip Point to Striker (Z-Axis)	228	
HAX°	Head Tilt Angle X		
HAY1°	Head Tilt Angle Y		
TAX°	Thorax Tilt Angle X		
TAY°	Thorax Tilt Angle Y		
	Head Rest Angle		1.15
	H-Point Tool Angle		12.8
	Torso Angle		10.6
	Windshield Angle		61.4

See Appendix E

DATA SHEET NO. 4 **DUMMY LATERAL CLEARANCE DIMENSIONS**

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023



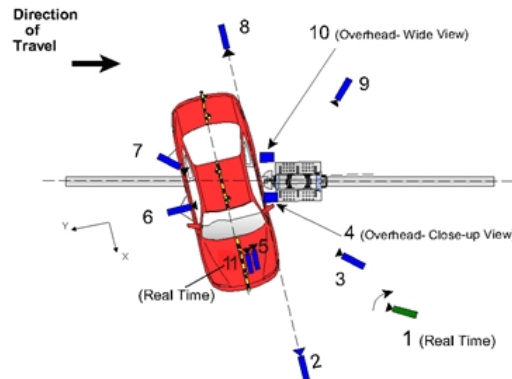
Code	Description	Units	Driver – Length (Serial No. F034)
HR	Head to Side Header	mm	201
HS	Head to Side Window	mm	326
AD	Arm to Door	mm	89
HD	H-point to Door	mm	208

See Appendix E

DATA SHEET NO. 5 CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
Test Date: 06/05/2023



CAMERA LOCATIONS AND DATA

No.	Camera View	Location (mm)			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Real-time (24 - 30 fps) pan view of impact				Zoom	60
2	Front ground level - impact view	7285	0	-1487	28	1000
3	Impact side 45° - forward pole view	4621	1194	-1490	24	1000
4	Overhead Close-up view of impact	0	0	-8992	28	1000
5	Onboard - dummy front view				25	1000
6	Onboard - dummy side view				12.5	1000
7	Onboard - dummy rear oblique view				12.5	1000
8	Rear ground level - impact view	-8762	0	-1484	28	1000
9	Impact side 45° - rearward pole view	-4774	3947	-1479	24	1000
10	Overhead wide - view of impact	0	-294	-8992	16	1000
11	Real-time (24 - 30 fps) - dummy front view				Zoom	60

Notes: *Reference - From Point of Impact for X and Y; from Ground for Z*

+X = Forward of vehicle, +Y = Right of vehicle, +Z = Down

** All measurements accurate to ± 6 mm. Vehicle is at a 75° angle to the rigid pole.*

If applicable, explain why camera(s) did not operate as intended: All cameras operated as intended.

INSTRUMENTATION

Description	Number of Channels
Driver Dummy Channels	16
Vehicle Structure Accelerometers	18
Pole Load Cells	8
Total	42

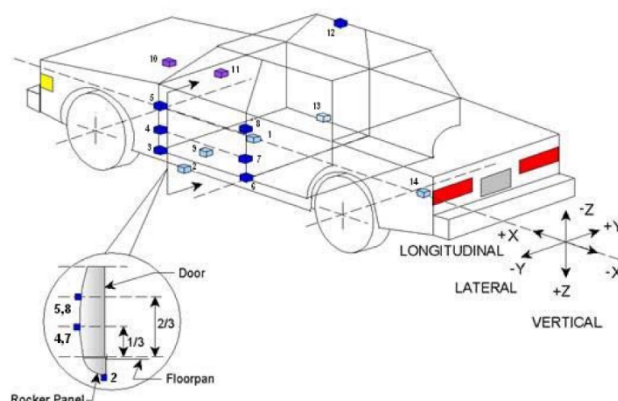
DATA SHEET NO. 6 TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

Test Date: 06/05/2023



TEST VEHICLE ACCELEROMETER LOCATIONS

No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2651	118	279
2	Left Floor Sill	2744	-638	317
3	A-Pillar Sill	3025	-686	193
4	A-Pillar Low	3161	-680	2
5	A-Pillar Mid	3029	-663	-402
6	B-Pillar Sill	1881	-646	289
7	B-Pillar Low	1999	-689	-12
8	B-Pillar Mid	1987	-694	-341
9	Driver Seat Track	2256	-546	299
10	Engine Top	3689	18	-247
11	Firewall	3511	-2	-272
12	Right Roof	2318	536	-818
13	Right Floor Sill	2704	676	223
14	Rear Floor Pan	1126	1	-60
15	Left Front Door – Mid Centerline	2547	-733	-51
16	Left Front Door – Mid Rear	2162	-719	-44
17	Left Front Door – Upper Centerline	2569	-722	-322
18	Left Rear Door – Mid Rear	1368	-706	-76
19	Left Rear Door – Upper Centerline	1517	-702	-421
20	Rear Deck	204	27	-57
21	Rear Deck ARS	200	25	-40

Reference: X – Rear surface of vehicle (+ forward)
Y – Vehicle centerline (+ to right)
Z – Ground plane (+ down)

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA AND ES-2re INJURY SUMMARY

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

RIGID POLE BARRIER AND LOAD CELL LOCATION



ID	Units	Height From Ground
1	mm	200
2	mm	590
3	mm	750
4	mm	1075
5	mm	1260
6	mm	1740
7	mm	1920
8	mm	2300

Loc. No	Description	Axes	Units	Peak Values (g's)			
				Max	Time (ms)	Min	Time (ms)
N/A	Pole Load Cell 1	Y	g	0.00	0.50	0.00	0.50
N/A	Pole Load Cell 2	Y	g	356.42	0.13	-51903.21	0.05
N/A	Pole Load Cell 3	Y	g	1501.17	0.13	-26269.85	0.04
N/A	Pole Load Cell 4	Y	g	1384.97	0.13	-11989.18	0.04
N/A	Pole Load Cell 5	Y	g	1033.12	0.13	-19623.62	0.04
N/A	Pole Load Cell 6	Y	g	1620.11	0.15	-6391.99	0.04
N/A	Pole Load Cell 7	Y	g	1100.52	0.13	-1747.29	0.14
N/A	Pole Load Cell 8	Y	g	2589.79	0.14	-2307.15	0.12

DATA SHEET NO. 7... (CONTINUED)
RIGID POLE LOAD CELL DATA AND ES-2re INJURY SUMMARY

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

Driver: ES-2re Serial No. F034 Injury Summary

	Nomenclature	Units	Source	Max	Max Time	Min	Min Time
Head	Head CG X Acceleration	g	CFC1000	13.29	124.30	-16.56	57.80
	Head CG Y Acceleration	g	CFC1000	52.57	41.00	-7.61	78.10
	Head CG Z Acceleration	g	CFC1000	10.41	43.40	-15.07	62.25
	Head Resultant Acceleration	g	Compute	53.45	41.30		
	36 ms HIC		Compute	250.38			
	15 ms HIC		Compute	194.44			
	Head Resultant Acceleration, 3 ms Clip	g	CFC1000	52.16			
	Head CG X Angular Rate	deg/s	CFC60	1501.76	43.95	-816.00	85.95
	Head CG Y Angular Rate	deg/s	CFC60	872.22	97.00	-471.27	147.60
	Head CG Z Angular Rate	deg/s	CFC60	515.24	282.00	-1190.45	186.05
	Head CG Resultant Angular Rate	deg/s	CFC60	1525.02			
	Brain Injury Criteria (BrIC)		Compute	0.68			
Neck	Upper Neck Tension	N	CFC1000	1312.88	42.60		
	Upper Neck Compression	N	CFC1000			-164.90	161.15
	Upper Neck Resultant Force	N	CFC1000	1326.10	42.60		
	Upper Neck Resultant Moment	Nm	CFC600	60.49	47.55		
Shoulder	Shoulder Y Force	N	CFC600	1790.79	43.45	-155.75	87.90
	Shoulder Resultant Force	N	CFC600	1810.68			
Chest	Thorax Rib Upper Y Deflection	mm	CFC180	27.15	58.45	-2.46	79.10
	Thorax Rib Middle Y Deflection	mm	CFC180	23.25	40.40	-1.64	76.55
	Thorax Rib Lower Y Deflection	mm	CFC180	28.66	58.50	-0.73	300.00
	Thorax Rib Max. Deflection	mm	CFC180	28.66			
	Thorax Rib Avg. Deflection	mm	CFC180	26.35			
Abdomen	Abdomen Front Y Force	N	CFC600	183.93	55.75	-27.71	85.85
	Abdomen Middle Y Force	N	CFC600	309.16	44.85	-5.62	19.75
	Abdomen Rear Y Force	N	CFC600	459.00	45.10	-9.45	293.85
	Combined Abdominal Force	N	Compute	923.91			
Spine	Lower Spine T12 Y Force	N	CFC600	1323.59	52.35	-136.93	19.10
	Lower Spine T12 X Moment	Nm	CFC600	44.43	68.95	-82.38	185.60
	Lower Spine T12 Resultant Acceleration	g	CFC180	40.03	39.30		
Pelvis	Lumbar Y Force	N	CFC600	1268.12	43.00	-76.02	89.00
	Lumbar Z Force	N	CFC600	1989.50	54.20	-100.61	84.60
	Lumbar X Moment	Nm	CFC600	75.99	53.65	-26.63	124.65
	Pubic Symphysis Y Force	N	CFC600	125.24	226.70	-1723.80	50.40
	Pelvis Resultant Acceleration	g	CFC1000	49.08			

**DATA SHEET NO. 8
POST-TEST OBSERVATIONS**

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
Test Date: 06/05/2023

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Driver Seat Dummy (ES-2re)
Face	Curtain Airbag
Top of Head	Side Header & Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Head Restraint & Side Header
Left Shoulder	Door Trim & Torso/Pelvic Airbag
Upper Torso	Seat Back & Torso/Pelvic Airbag
Lower Torso	Seat Back & Torso/Pelvic Airbag
Left Hip	Seat pan, Door Trim & Torso/Pelvic Airbag
Left Knee	Driver Door Trim

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/Other
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	No	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Width of Opening at Striker (mm)	N/A	N/A	N/A	N/A	N/A

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	No	No	No
Seat Disengagement from Floor Pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

DATA SHEET NO. 8 ... (CONTINUED)
POST-TEST OBSERVATIONS

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
Test Date: 06/05/2023

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar & C-Pillar Buckled
Sill Separation	115 mm Along struck side pinch weld
Windshield Damage	Cracked Throughout
Side Window Damage	Driver window shattered during impact event
Other Notable Effects	None

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Front Airbag	Yes	No		
Knee Airbag	No	N/A		
Side Airbag 1 - Curtain	Yes	Yes	Yes	Yes
Side Airbag 2 - Torso/Pelvis Airbag	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Yes	No	N/A
Other	N/A	N/A	N/A	N/A

VEHICLE SPEED, VEHICLE ANGLE AT IMPACT AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Ref Line - Aft of Front Axle, Intended Impact Pt	mm		1300
Actual Impact Point - Aft of Front Axle	mm		1305
Horizontal Offset (+ forward / - rearward)	mm	+/- 38*	-5
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	deg	75 +/- 3	75
Trap No. 1 Velocity - Primary	kph	31.4 to 33.0	30.99
Trap No. 2 Velocity - Redundant	kph	31.4 to 33.0	31.01

*Of Intended Impact Point

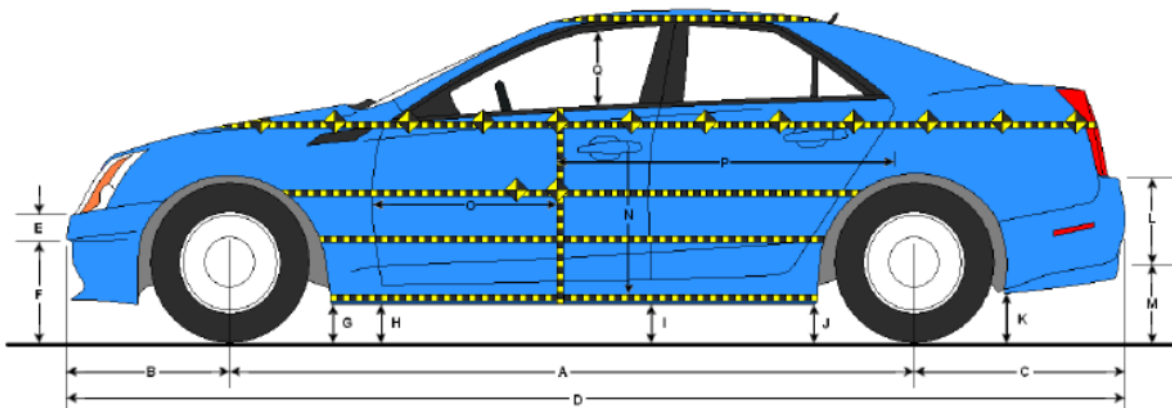
DATA SHEET NO. 9
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

Test Date: 06/05/2023



LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

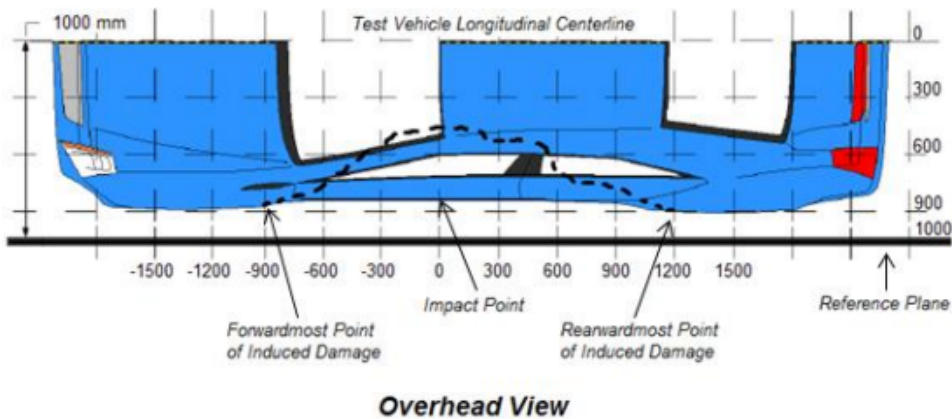
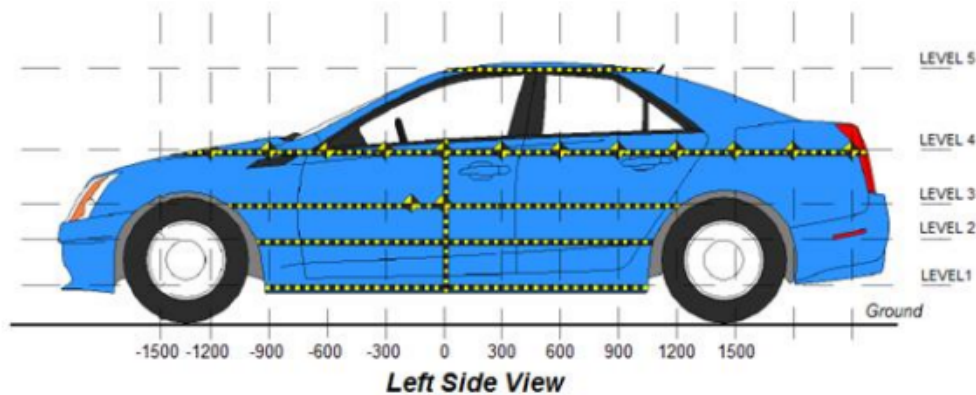
No.	Measurement Description	Pre-Test	Post-Test	Difference
A	Vehicle Wheelbase	2581	2548	-33
B	Front Axle to FSOV	830	851	21
C	Rear Axle to RSOV	972	965	-7
D	Total Length at Centerline	4383	4364	-19
E	Front Bumper Thickness	106	106	0
F	Front Bumper Bottom to Ground	399	406	7
G	Sill Height at Front Wheel Well	168	163	-5
H	Sill Height at Front Door Leading Edge	170	172	2
I	Sill Height at B Pillar	173	171	-2
J1	Sill Height at Rear Wheel Well	169	183	14
J2	Pinch Weld Height at Rear Wheel Well	149	162	13
K	Sill Height Aft of Rear Wheel Well	215	214	-1
L	Rear Bumper Thickness	229	229	0
M	Rear Bumper Bottom to Ground	402	401	-1
N	Sill Height to Bottom of Front Window Sill	720	722	2
O	Front Door Leading Edge to Impact CL	864	817	-47
P	Rear Door Trailing Edge to Impact CL	1162	1102	-60
Q	Front Window Opening	372	364	-8
R	Right Side Length	4269	4267	-2
S	Left Side Length	4268	4234	-34
T	Vehicle Width at B-Pillars	1709	1592	-117

* All measurements in mm with tolerance of $\pm 3\text{mm}$

DATA SHEET NO.10 **TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023



MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Units	Height Above Ground	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	mm	332	252	0
2	Driver H-Point	mm	515	262	0
3	Mid-Door	mm	643	280	0
4	Window Sill	mm	882	263	0
5	Window Top	mm	1377	79	0

NOTE: The above measurements should be taken along the vertical impact reference line. Vehicle measurements forward of the vertical impact reference line are negative.

DATA SHEET NO.10 ... (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

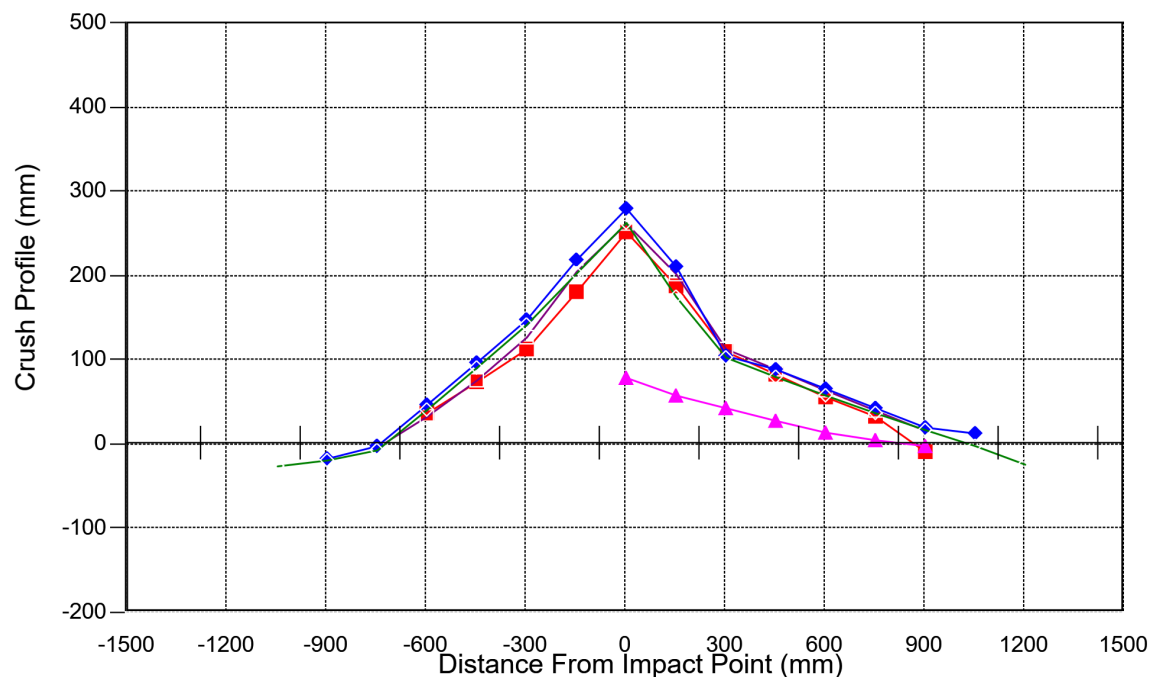
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500															
-1350															
-1200															
-1050				773					799					-26	
-900			857	782				874	801				-17	-19	
-750		847	853	791			851	855	798			-4	-2	-7	
-600	836	845	853	802		799	812	806	761		37	33	47	41	
-450	839	845	854	811		765	769	757	720		74	76	97	91	
-300	841	845	855	818		728	718	707	676		113	127	148	142	
-150	843	845	856	823		662	640	637	620		181	205	219	203	
0	843	846	856	824	592	591	584	576	561	513	252	262	280	263	79
150	841	845	855	822	593	653	643	644	647	535	188	202	211	175	58
300	837	842	853	821	593	727	729	748	718	550	110	113	105	103	43
450	834	841	852	820	590	751	752	763	740	562	83	89	89	80	28
600	831	842	850	819	584	775	778	784	761	570	56	64	66	58	14
750	832	846	851	818	569	799	806	808	781	564	33	40	43	37	5
900	839	857	855	819	537	848	841	835	802	539	-9	16	20	17	-2
1050			861	849				848	851				13	-2	
1200				822					846					-24	
1350															
1500															

NOTE: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy's head.

DATA SHEET NO.10 ... (CONTINUED) **TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS**

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023



LEVEL 1 Side Sill: 332 mm above ground	LEVEL 2 H-Point: 515 mm above ground	LEVEL 3 Mid Door: 643 mm above ground
LEVEL 4 Window Sill: 882 mm above ground	LEVEL 5 Window Top: 1277 mm above ground	

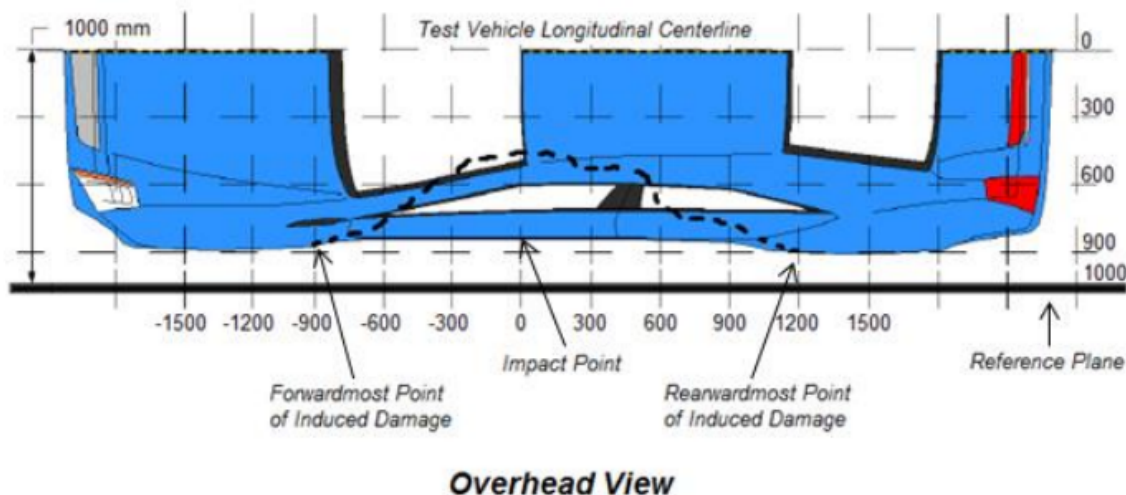
Vehicle Exterior Crush Measurements - Visual Representation

DATA SHEET NO.11 **VEHICLE DAMAGE PROFILE DISTANCE**

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
 Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
 Test Date: 06/05/2023

For guidance regarding damage profile distance measurements, please refer to the latest version of the *NHTSA Test Reference Guide, Volume 1: Vehicle Tests*.



VEHICLE DAMAGE PROFILE DISTANCES

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	-900	3	126	143	-17
2	-510	3	223	146	77
3	-120	3	375	144	231
4	270	3	273	147	126
5	660	3	206	150	56
6	1050	3	152	139	13

DATA SHEET NO.12
FMVSS NO.301 STATIC ROLLOVER RESULTS

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan

NHTSA No.: R20194204

Test Program: Research Side Pole Impact Test

Test Date: 06/05/2023

Test Time: 10:25 AM

Temperature: 21 °C

A. From impact until vehicle motion ceases:
(Maximum allowable is 1 oz.)

0 oz

B. For the 5-minute period after motion ceases:
(Maximum allowable is 5 oz.)

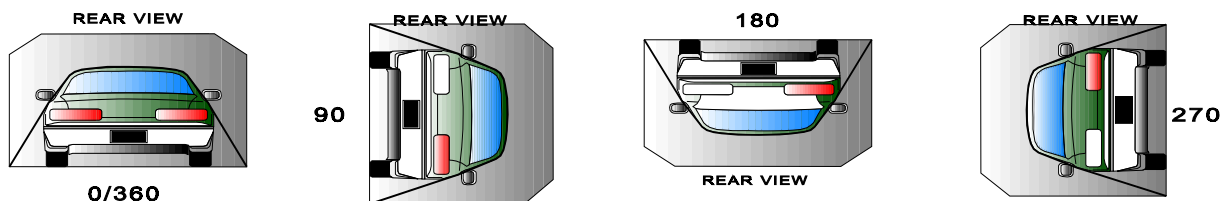
0 oz

C. For the following 25 minutes:
(Maximum allowable is 1 oz.)

0 oz

D. Spillage Detail:

No Spillage Occured



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°			
90° to 180°			
180° to 270°			
270° to 360°			

FMVSS 301 SPILLAGE TABLE

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

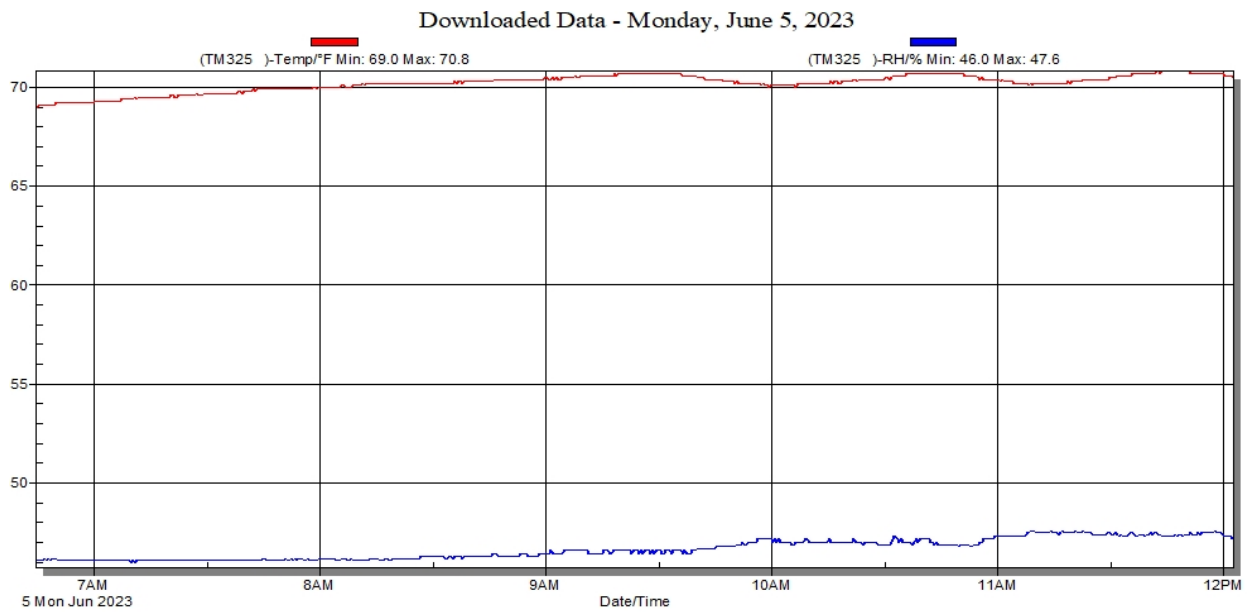
SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

DATA SHEET NO. 13
DUMMY / VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2019 Hyundai Accent 4 Door Sedan
Test Program: Research Side Pole Impact Test

NHTSA No.: R20194204
Test Date: 06/05/2023



Temperature and Humidity Stabilization Chart/Data for Dummies and Test Vehicle

APPENDIX A
PHOTOGRAPHS

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Fig.	Description	Page
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R20194204

Figure A-1: As Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



R20194204

Figure A-2: As Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle

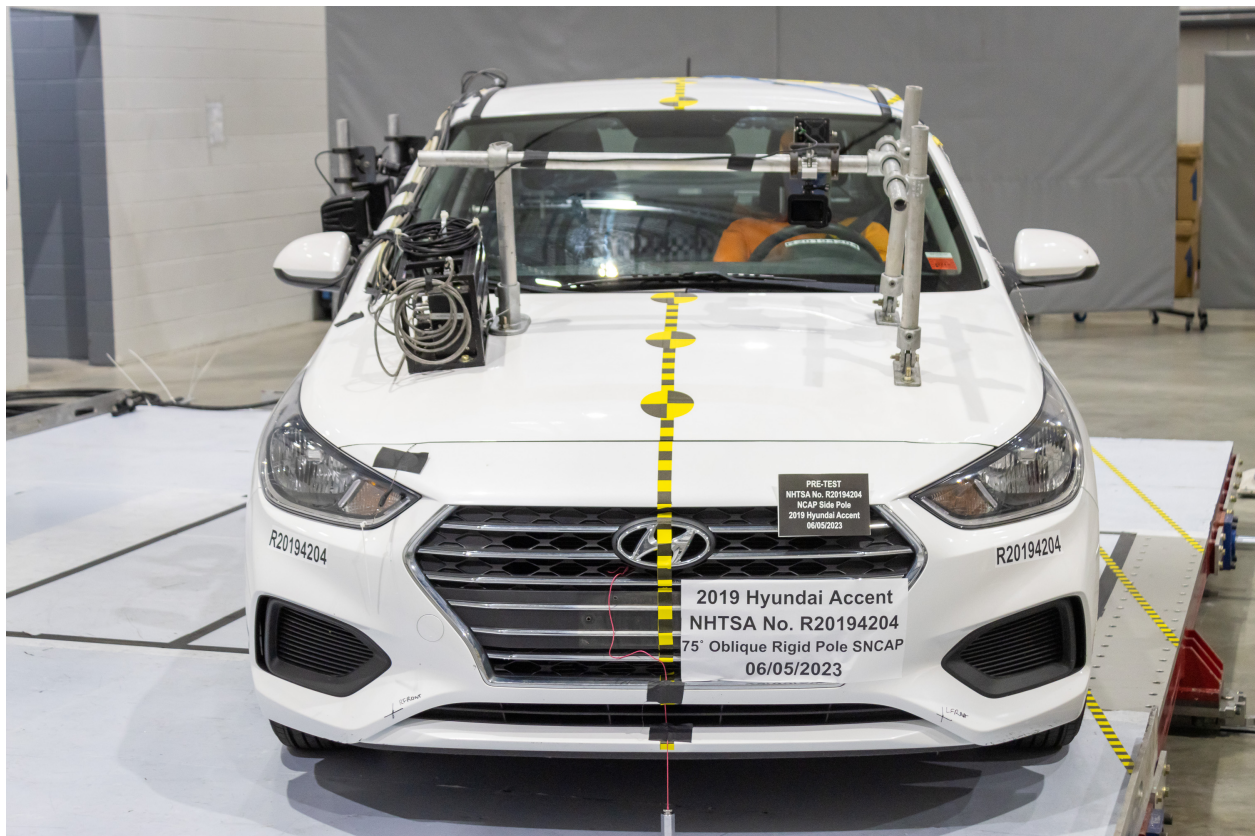


Figure A-3: Pre-Test Frontal View of Test Vehicle

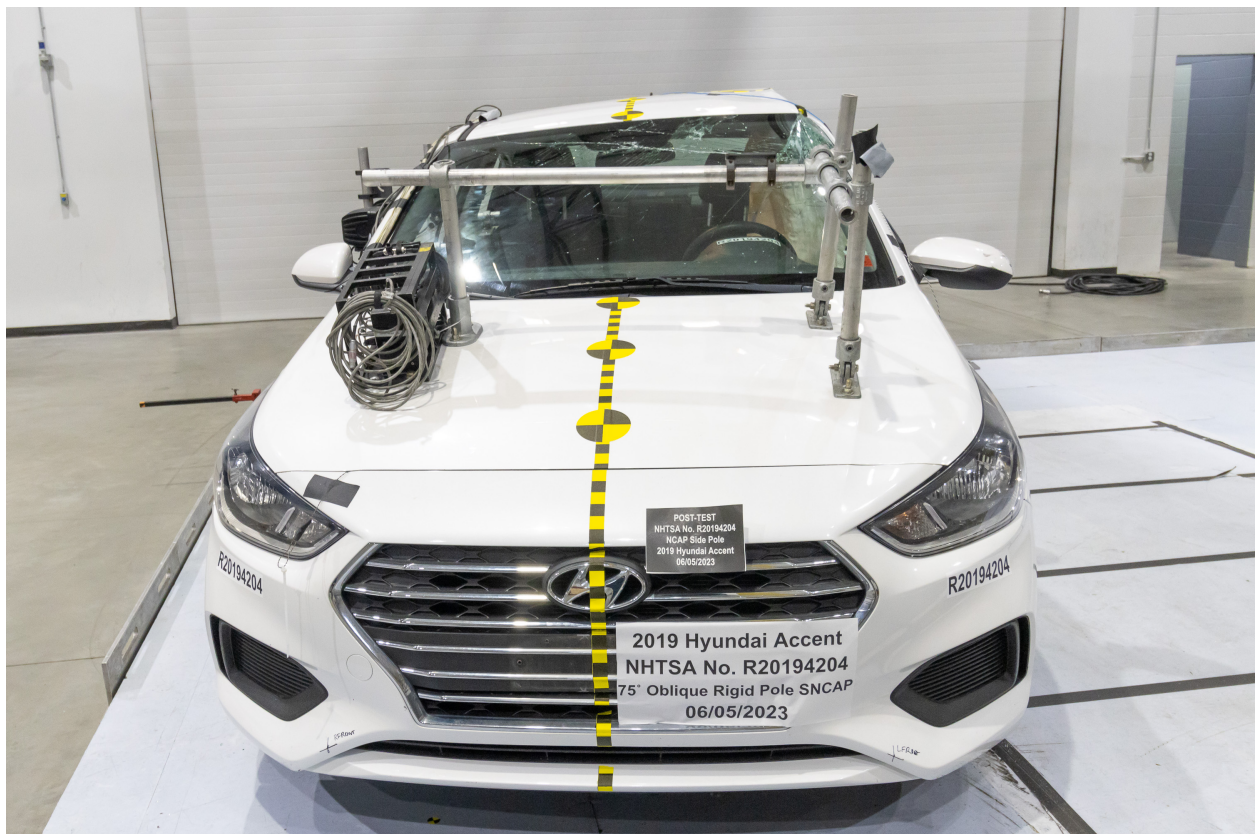


Figure A-4: Post-Test Frontal View of Test Vehicle



Figure A-5: Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-6: Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



Figure A-7: Pre-Test Left Side View of Test Vehicle



Figure A-8: Post-Test Left Side View of Test Vehicle



Figure A-9: Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle

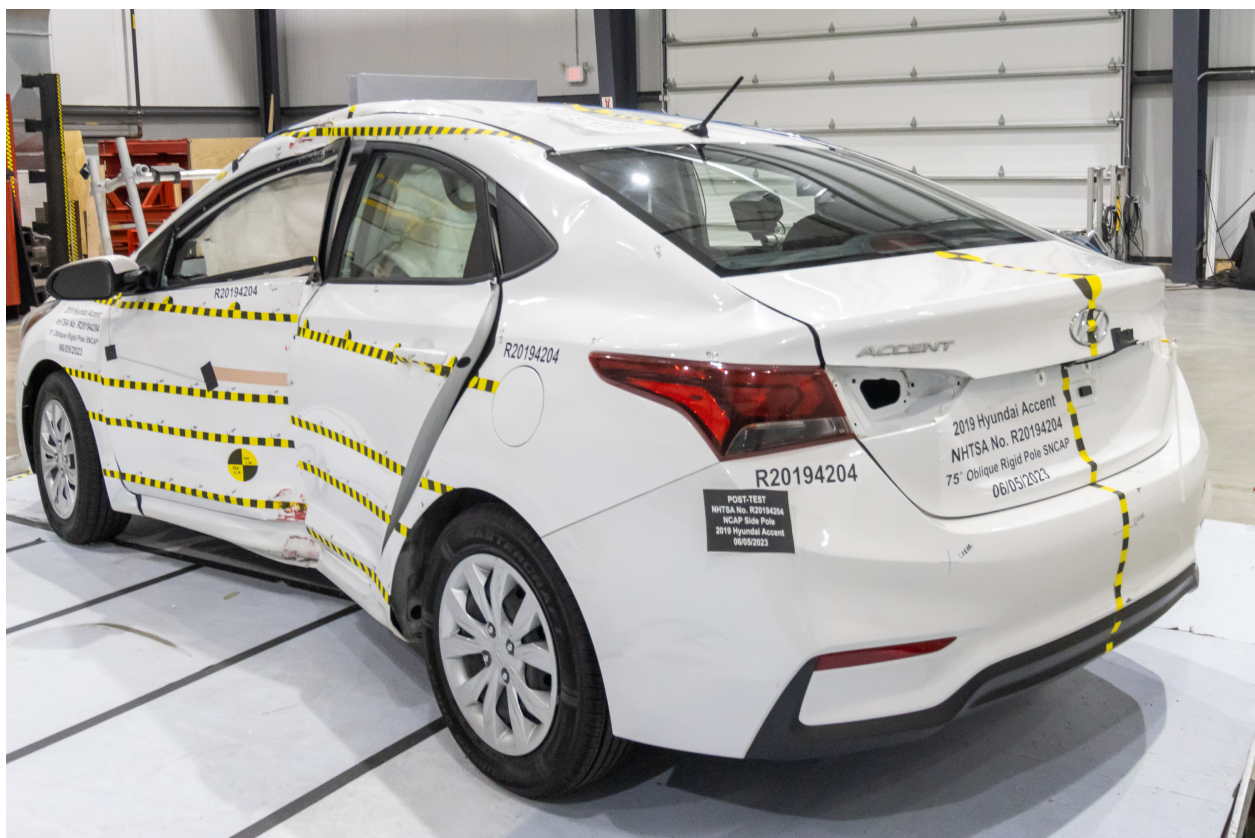


Figure A-10: Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



Figure A-11: Pre-Test Rear View of Test Vehicle



Figure A-12: Post-Test Rear View of Test Vehicle

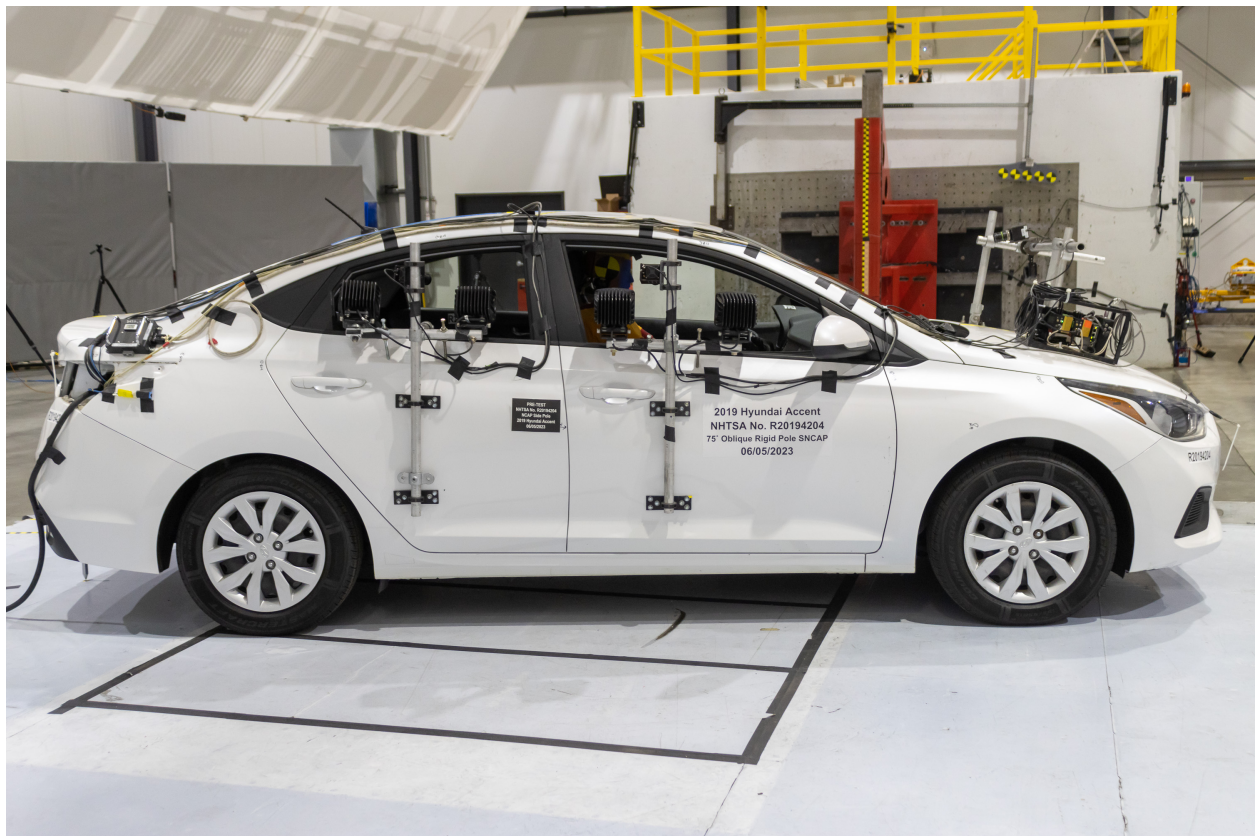


Figure A-13: Pre-Test Right Side View of Test Vehicle

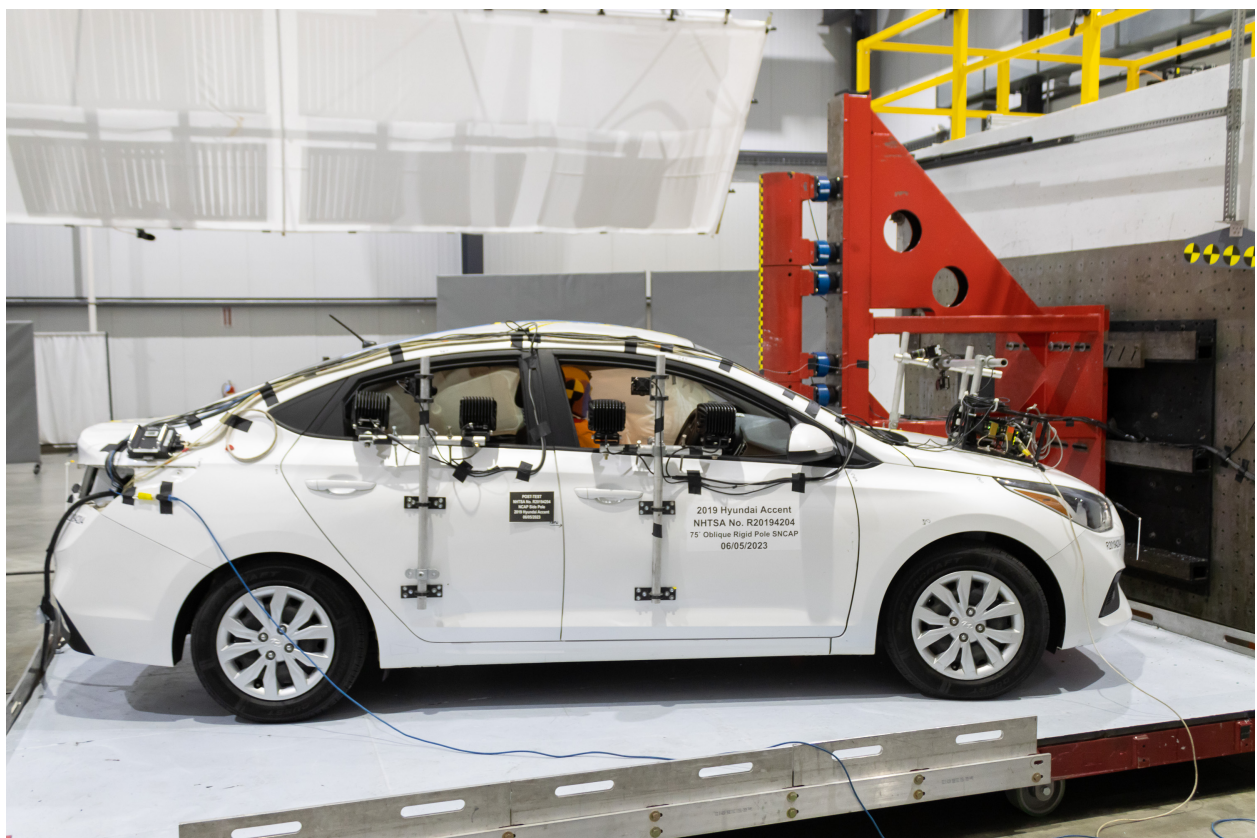


Figure A-14: Post-Test Right Side View of Test Vehicle



Figure A-15: Pre-Test Overhead View of Test Area

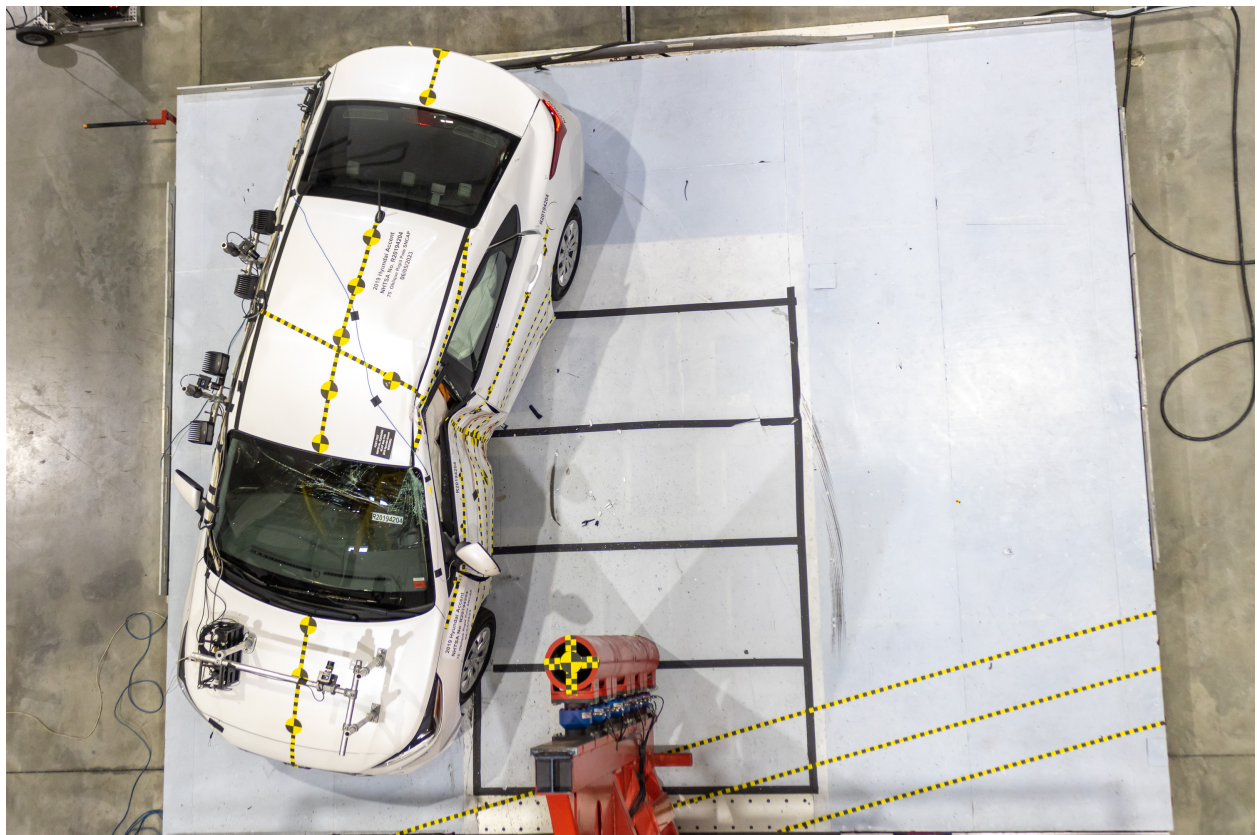


Figure A-16: Post-Test Overhead View of Test Area



Figure A-17: Pre-Test Left Side View of Pole Positioned Against Side of Vehicle

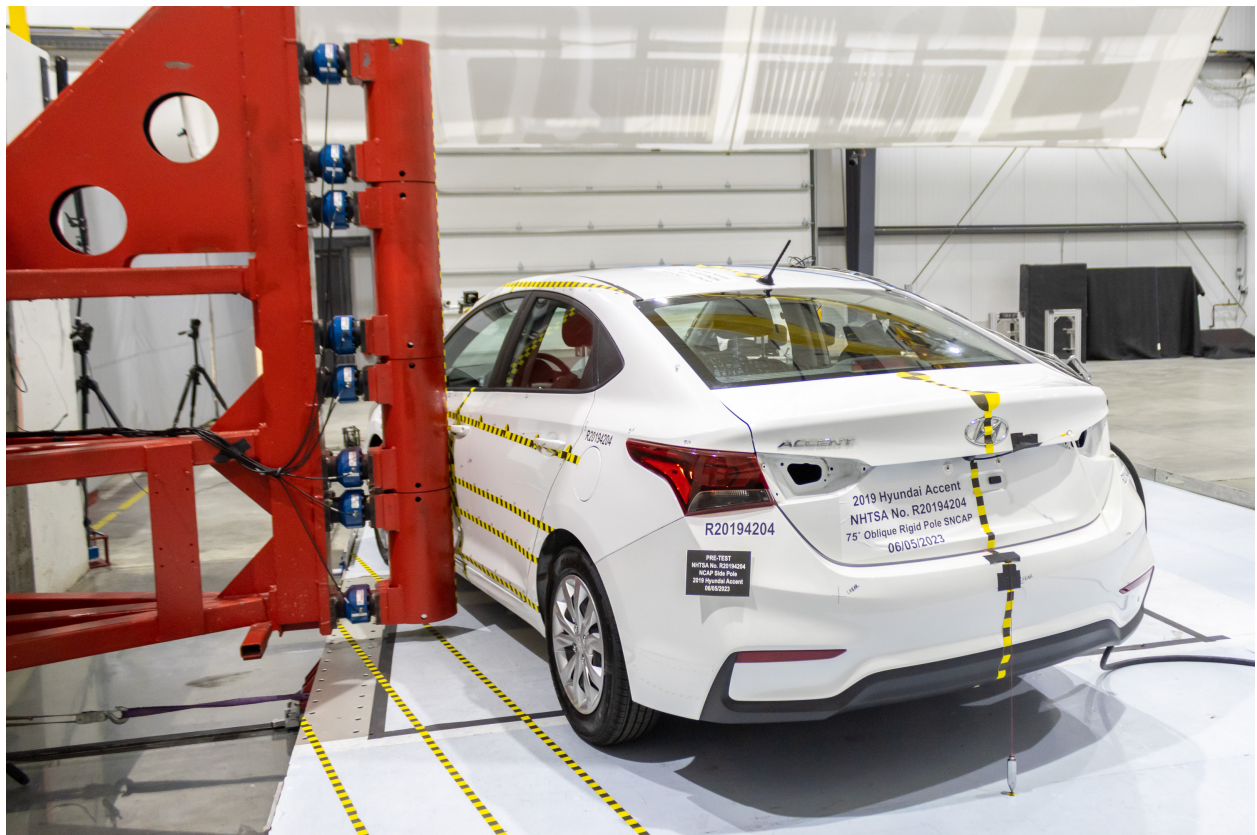


Figure A-18: Pre-Test Right Side View of Pole Positioned Against Side of Vehicle

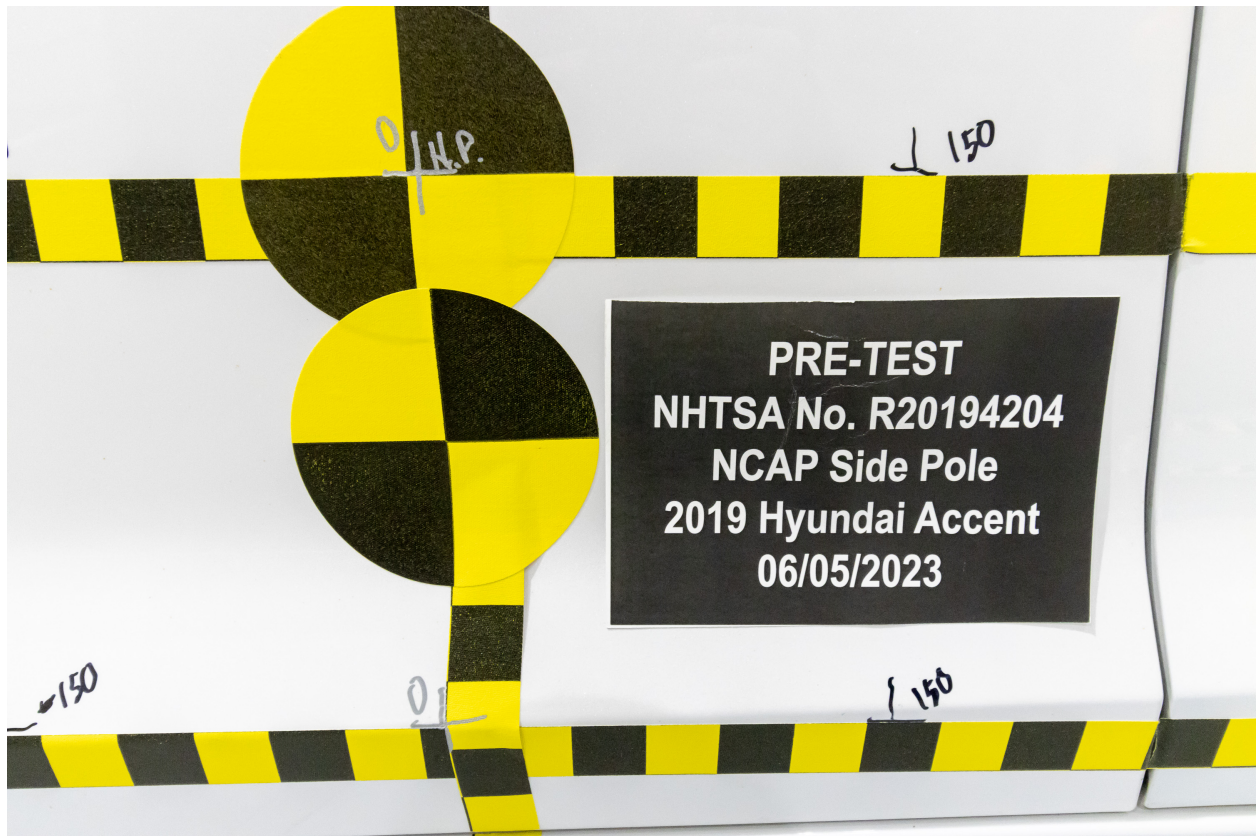


Figure A-19: Pre-Test Close-Up View of Impact Point Target



Figure A-20: Post-Test Close-Up View of Impact Point Target Showing Impact Location



Figure A-21: Pre-Test Front Close-Up View of Dummy Head and Chest



Figure A-22: Post-Test Front Close-Up View of Dummy



Figure A-23: Pre-Test Left Side View of Dummy Showing Belt and Chalking



Figure A-24: Pre-Test Left Side View of Dummy Shoulder and Door Top View



Figure A-25: Post-Test Left Side View of Dummy Shoulder and Door Top View



Figure A-26: Pre-Test Frontal View of Seat Back Prior to Dummy Positioning



Figure A-27: Pre-Test Frontal Close-Up View of Dummy Head / Shoulders in Relation to Head Restraint



Figure A-28: Pre-Test Frontal View of Seat Pan Prior to Dummy Positioning



Figure A-29: Pre-Test Overhead View of Dummy Thighs on Seat Pan

Photo Not Applicable

Figure A-30: Pre-Test Left Side View of Dummy's Neck Showing Position of Adjustable Neck Bracket

Photo Not Applicable

Figure A-31: Pre-Test Left Side View of Dummy's Head Showing Dummy's Head is Level



Figure A-32: Pre-Test Placement of Dummy's Feet



Figure A-33: Pre-Test View of Belt Anchorage for Dummy



Figure A-34: Pre-Test Left Side View of Steering Wheel



Figure A-35: Pre-Test View of Disengaged Parking Brake



Figure A-36: Pre-Test View of Parking Brake

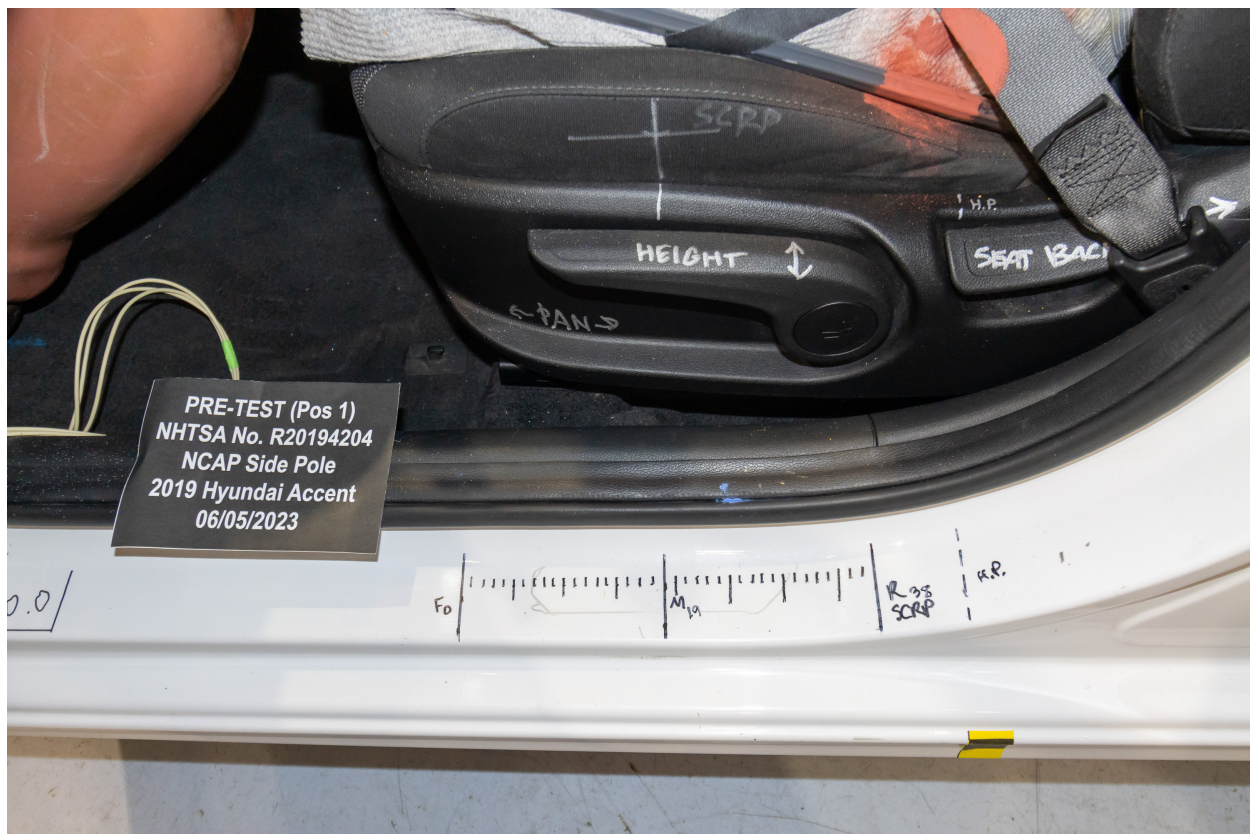


Figure A-37: Pre-Test Close-Up Left Side View of Driver Seat Track



Figure A-38: Pre-Test Close-Up Left Side View of Driver Seat Back



Figure A-39: Pre-Test Close-Up View of Driver Seat Back or Head Restraint



Figure A-40: Pre-Test Dummy and Door Clearance View



Figure A-41: Post-Test Dummy and Door Clearance View



Figure A-42: Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment



Figure A-43: Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment



Figure A-44: Pre-Test Inner Door Panel View



Figure A-45: Post-Test Inner Door Panel View Showing Dummy Contact Location

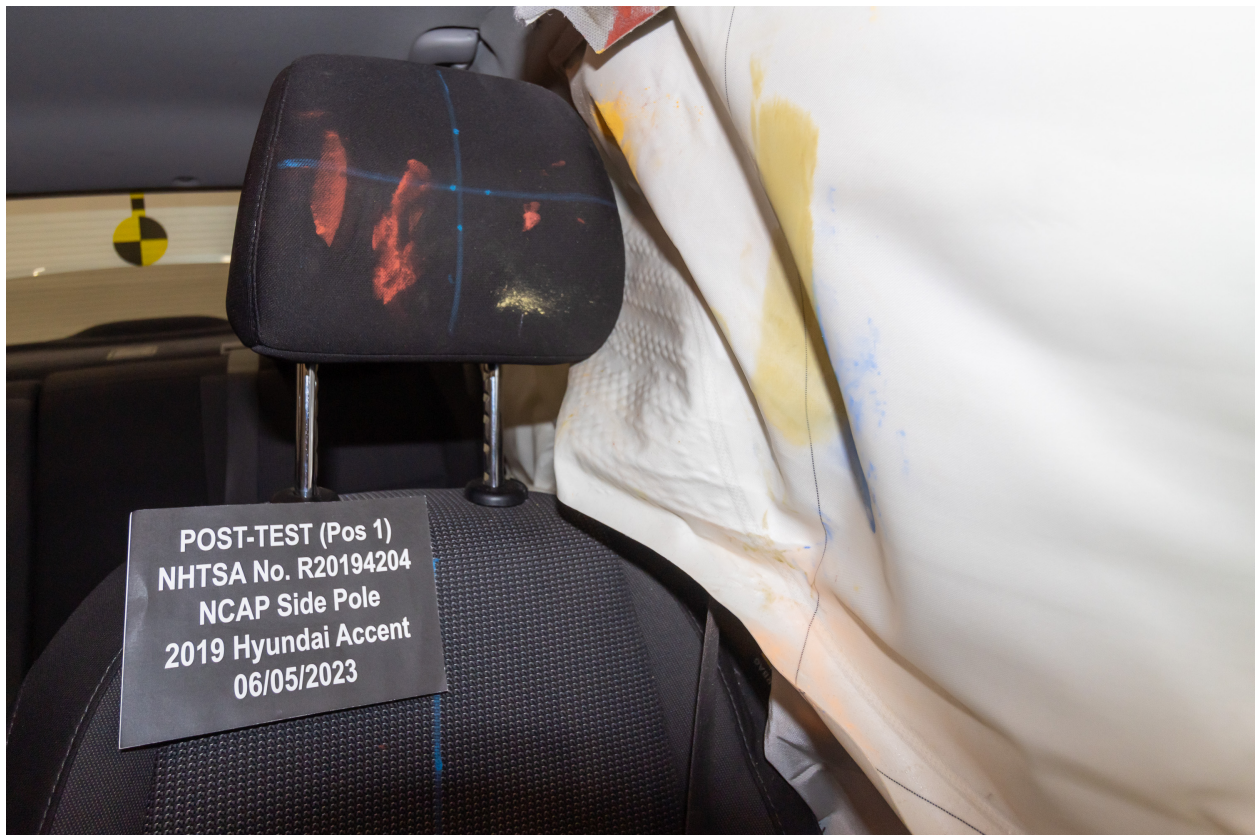


Figure A-46: Post-Test Dummy Close-Up Head Contact with Vehicle Interior View

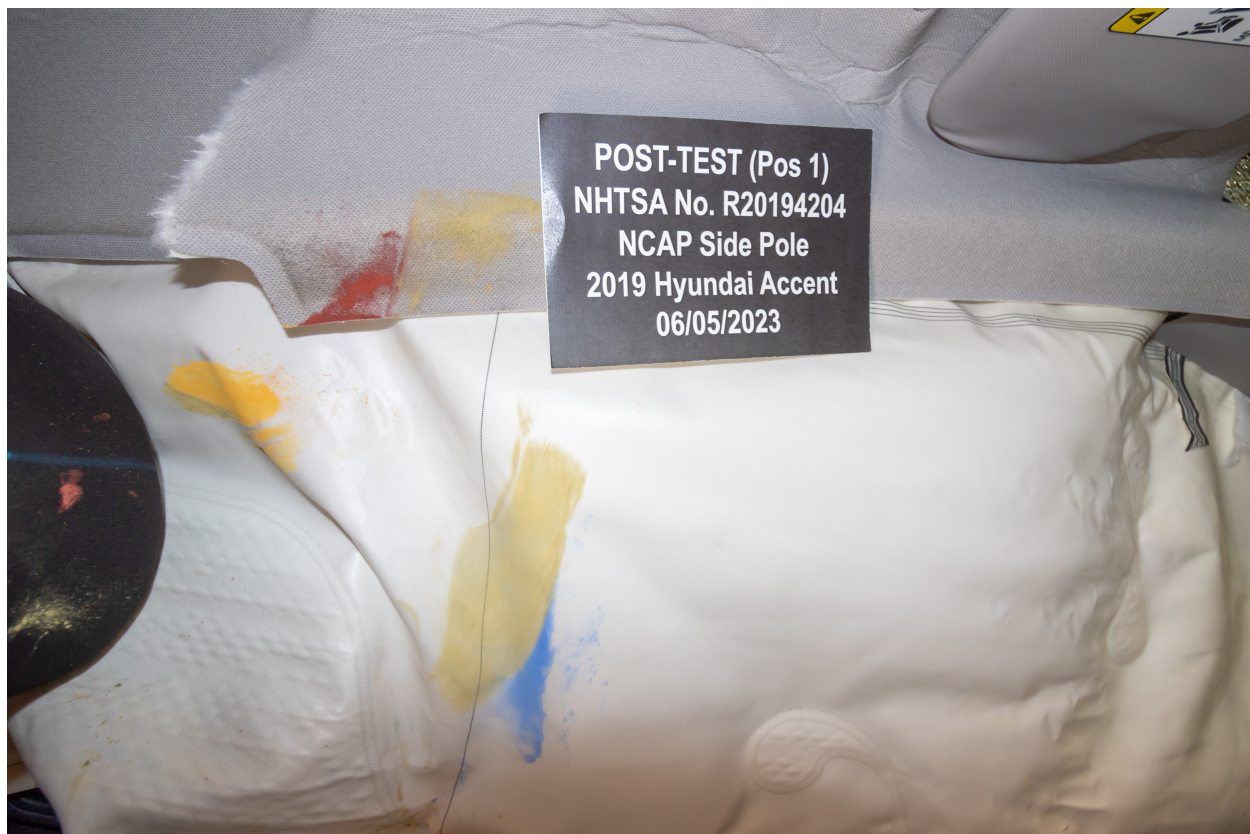


Figure A-47: Post-Test Dummy Close-Up Head Contact with Side Airbag View



Figure A-48: Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View



Figure A-49: Post-Test Dummy Close-Up Torso Contact with Side Airbag View



Figure A-50: Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View



Figure A-51: Post-Test Dummy Close-Up Pelvis Contact with Side Airbag View



Figure A-52: Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View



Figure A-53: Pre-Test Right Side View of Dummy and Rear Seat of Occupant Compartment



Figure A-54: Post-Test Inner Rear Passenger Torso Air Bag Deployment View



Figure A-55: Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



Figure A-56: Post-Test View of Fuel Filler Cap or Fuel Filler Neck

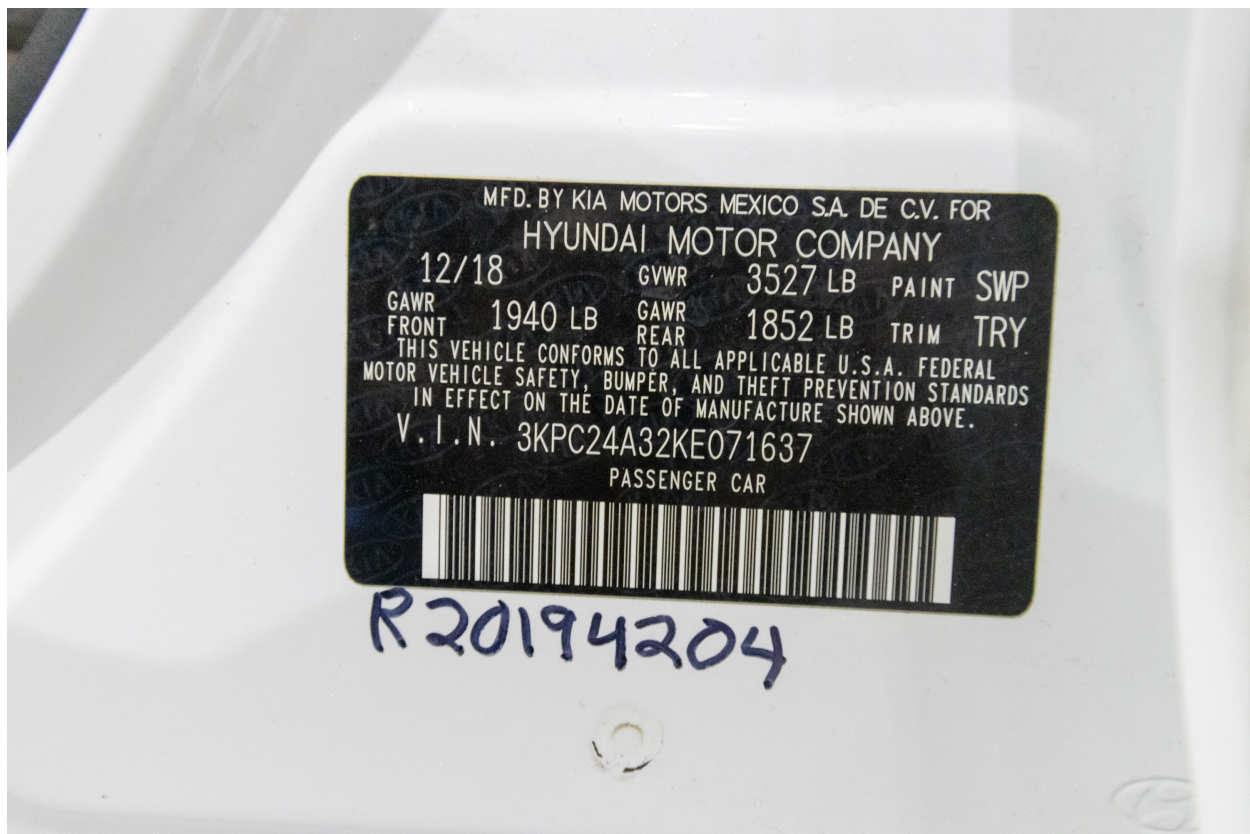


Figure A-57: Close-Up View of Vehicle's Certification Label



Figure A-58: Close-Up View of Vehicle's Tire Information Placard or Label



Figure A-59: Pre-Test Pole Barrier Front View



Figure A-60: Post-Test Pole Barrier Front View

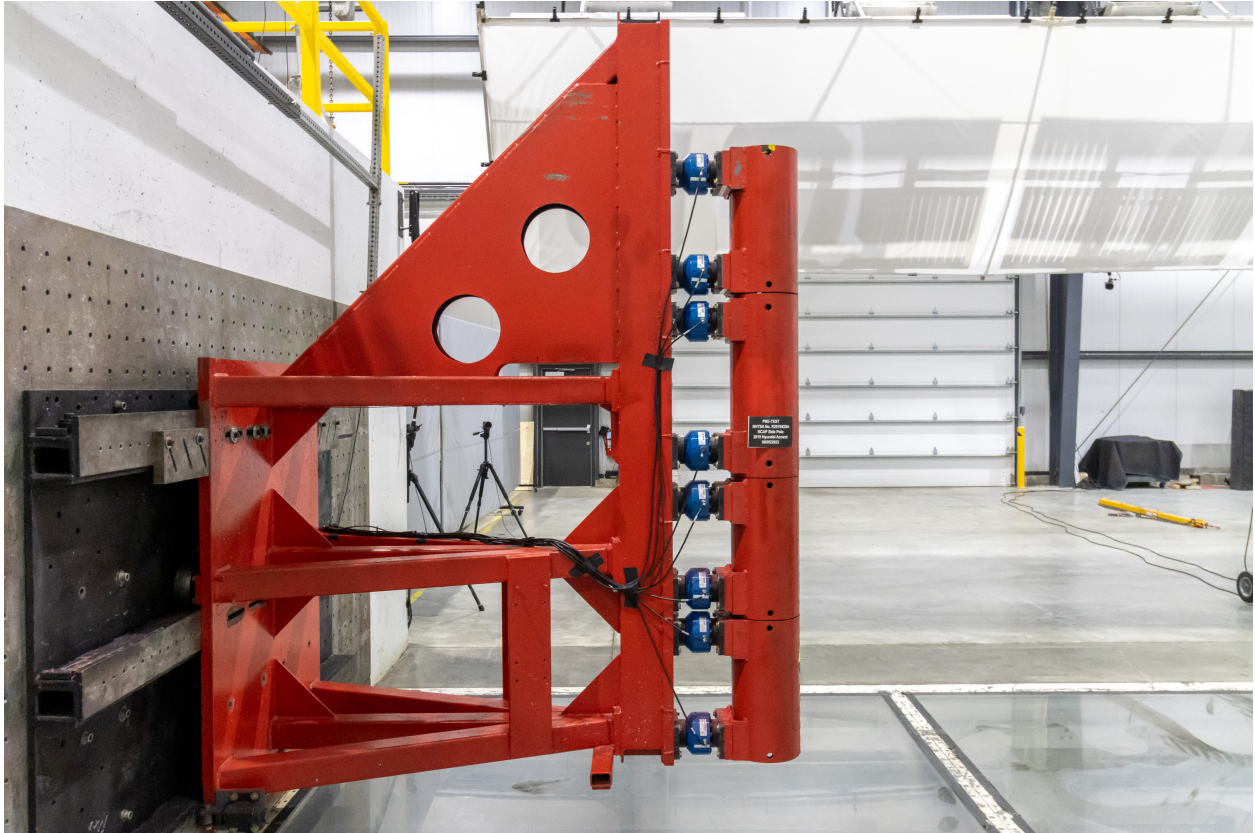


Figure A-61: Pre-Test Pole Barrier Side View

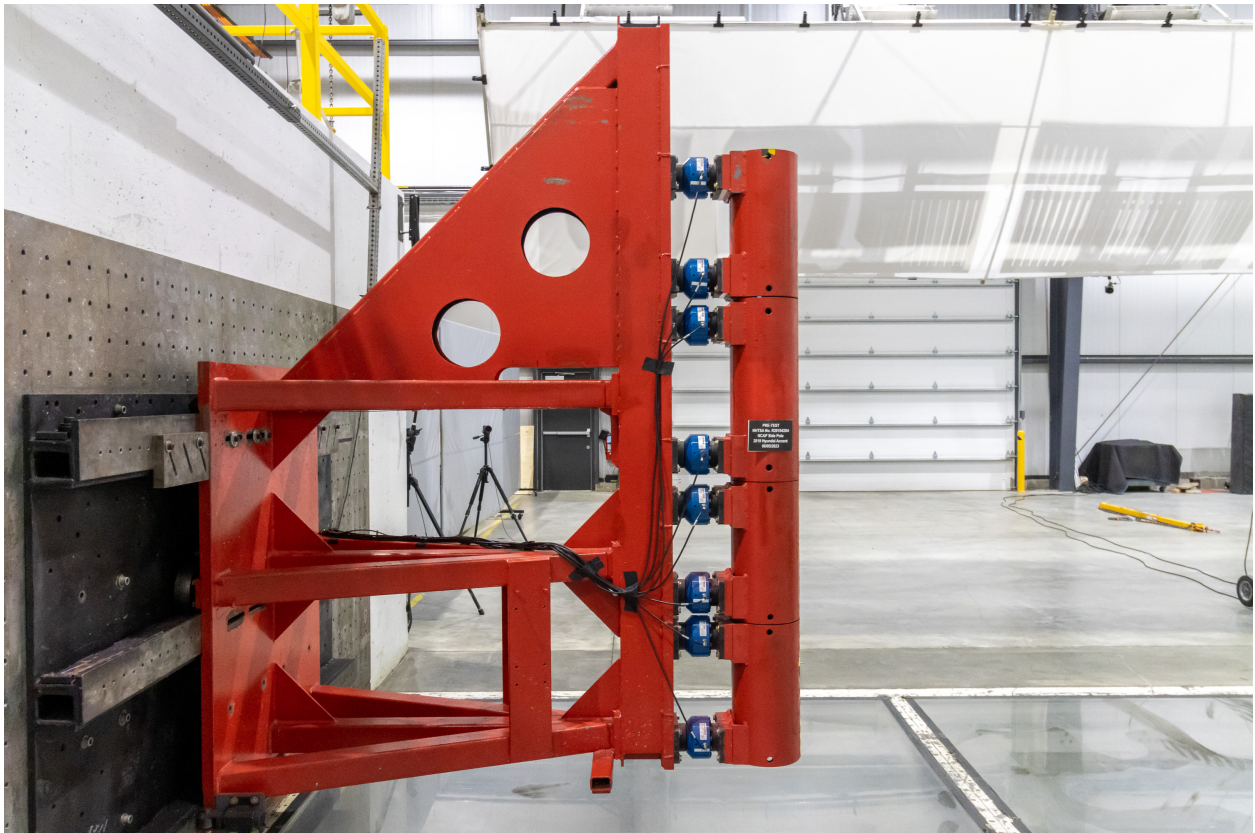


Figure A-62: Post-Test Pole Barrier Side View

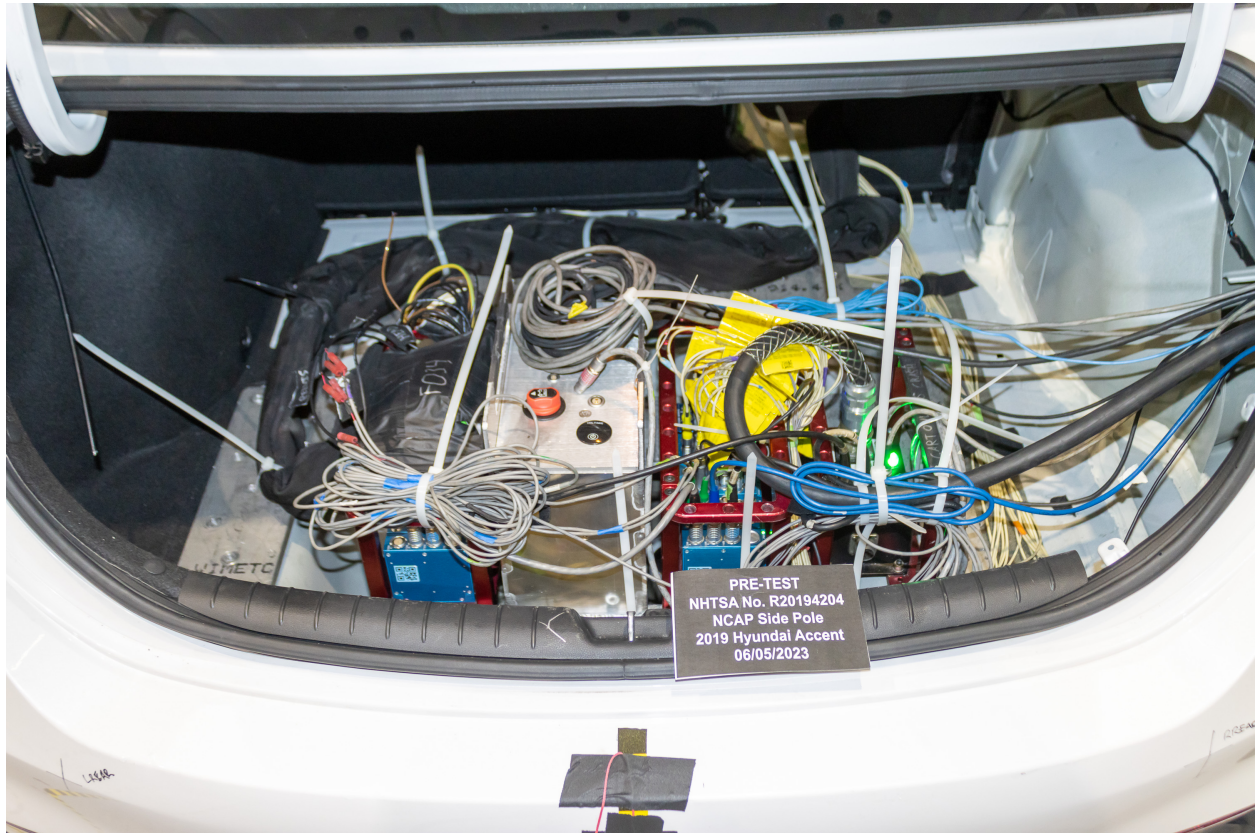


Figure A-63: Pre-Test Ballast View



Figure A-64: Post-Test Primary and Redundant Speed Trap Read-Out

Photo Not Applicable

Figure A-65: FMVSS No. 301 Static Rollover 0 Degrees

Photo Not Applicable

Figure A-66: FMVSS No. 301 Static Rollover 90 Degrees

Photo Not Applicable

Figure A-67: FMVSS No. 301 Static Rollover 180 Degrees

Photo Not Applicable

Figure A-68: FMVSS No. 301 Static Rollover 270 Degrees

Photo Not Applicable

Figure A-69: FMVSS No. 301 Static Rollover 360 Degrees

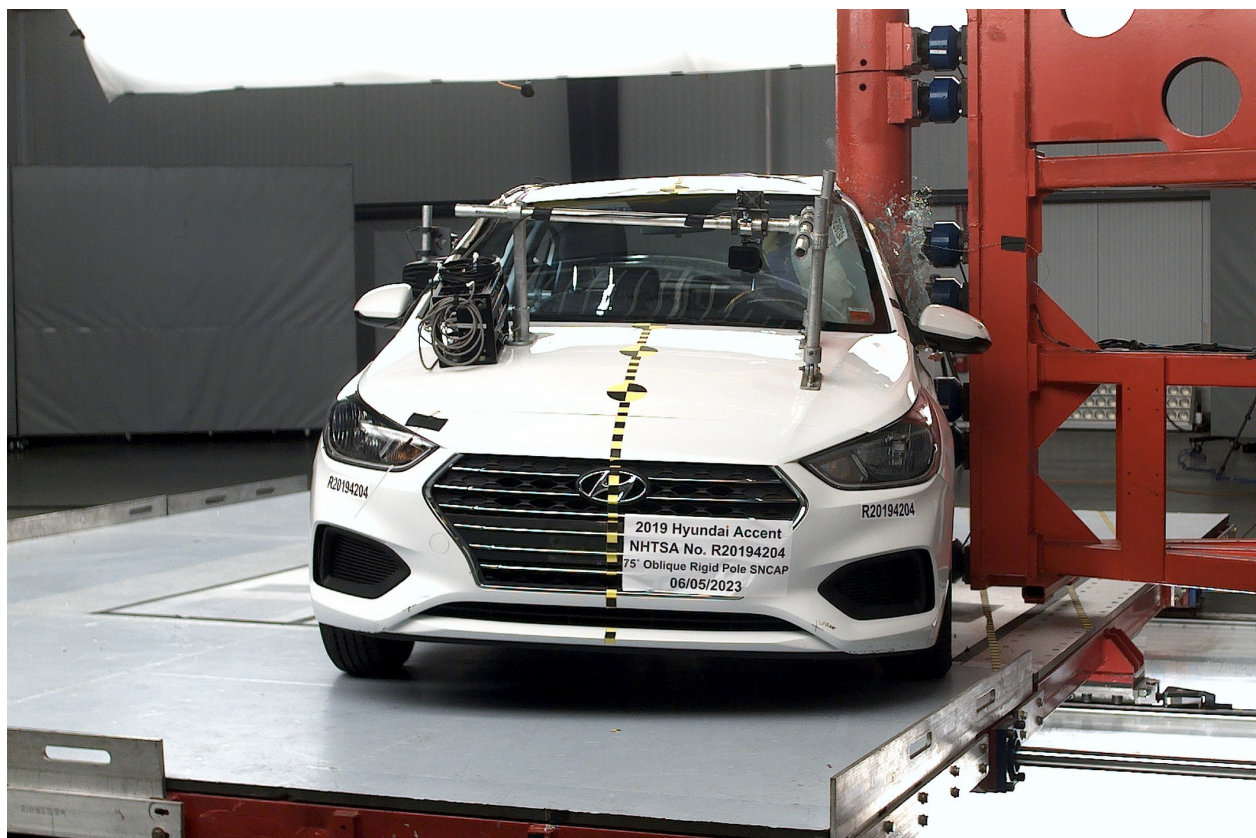


Figure A-70: Impact Event

Photo Not Applicable

Figure A-71: Monroney Label

Photo Not Applicable

Figure A-72: Head Restraint Use and Adjustment Information from Vehicle Owner's Manual



Figure A-73: Post-Test View of Shattered Vehicle Inner Door Panel

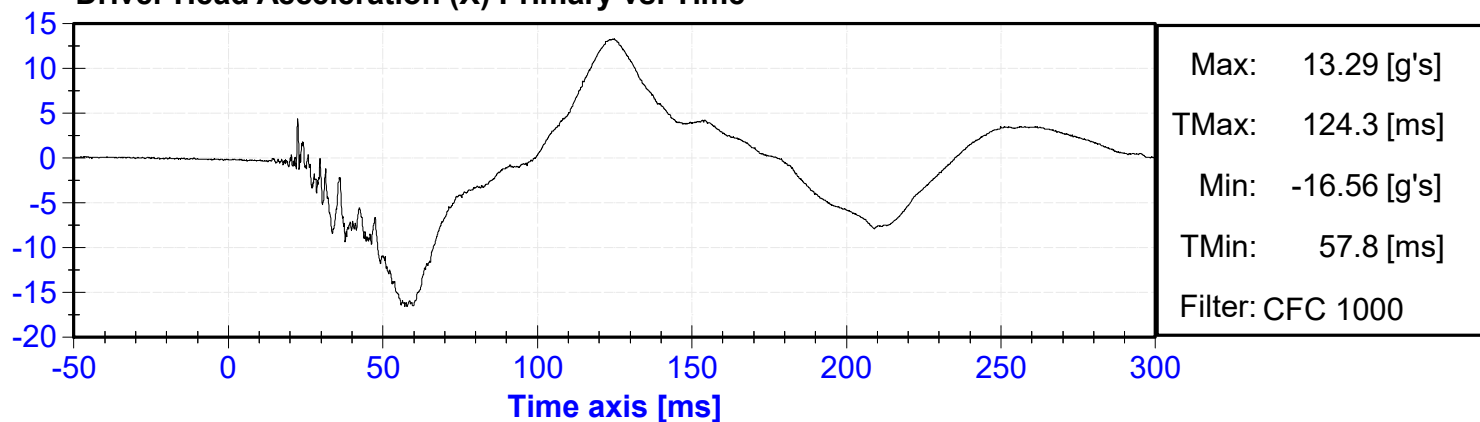
Data Traces
VEHICLE & DUMMY RESPONSE DATA TRACES

Table of Data Plots

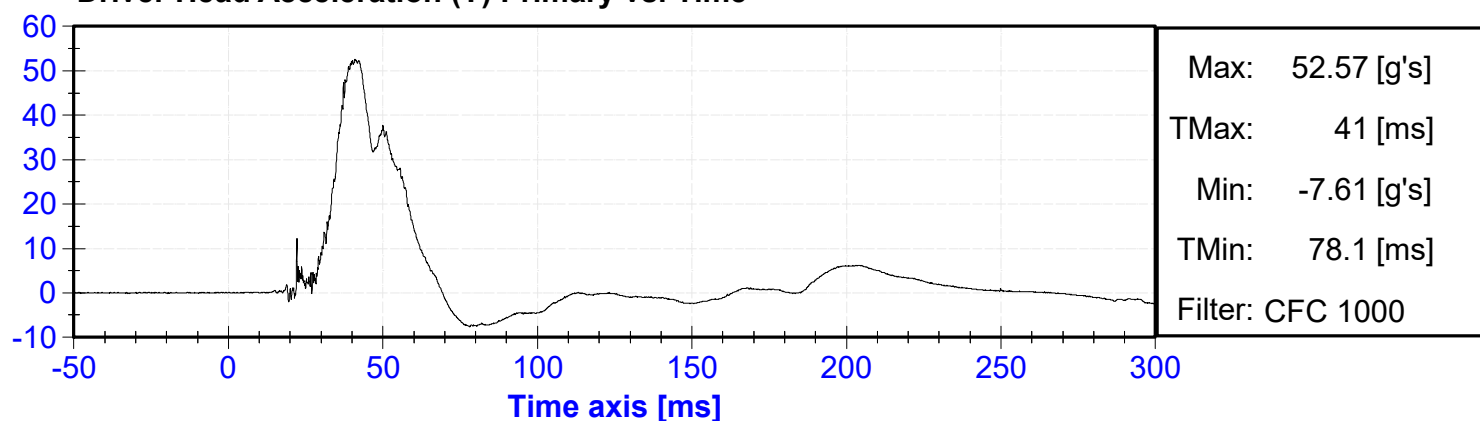
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2	Driver Head Acceleration (Y) Primary vs. Time	B-4
3	Driver Head Acceleration (Z) Primary vs. Time	B-4
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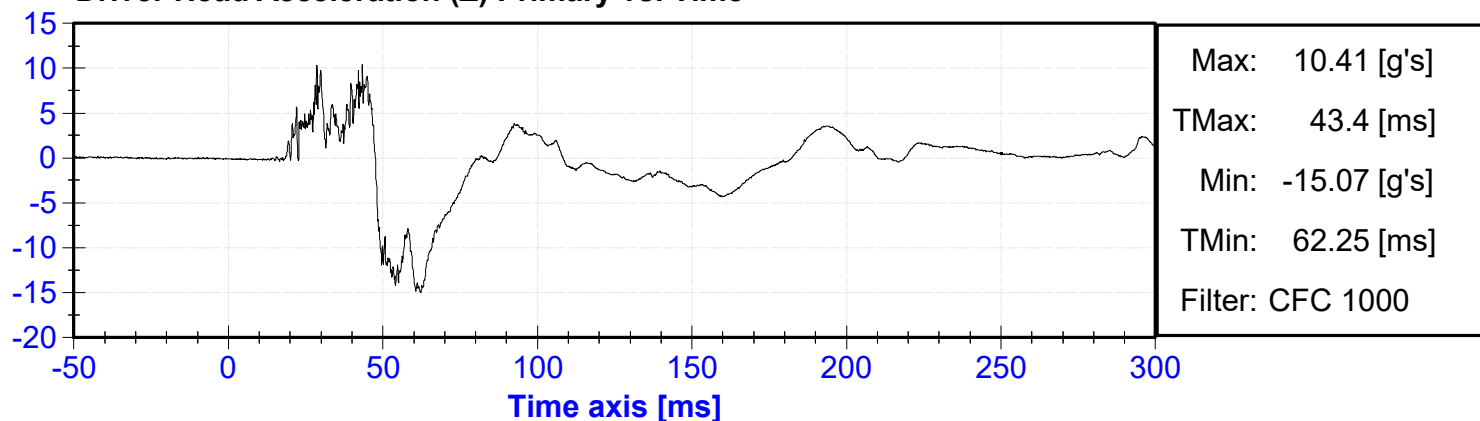
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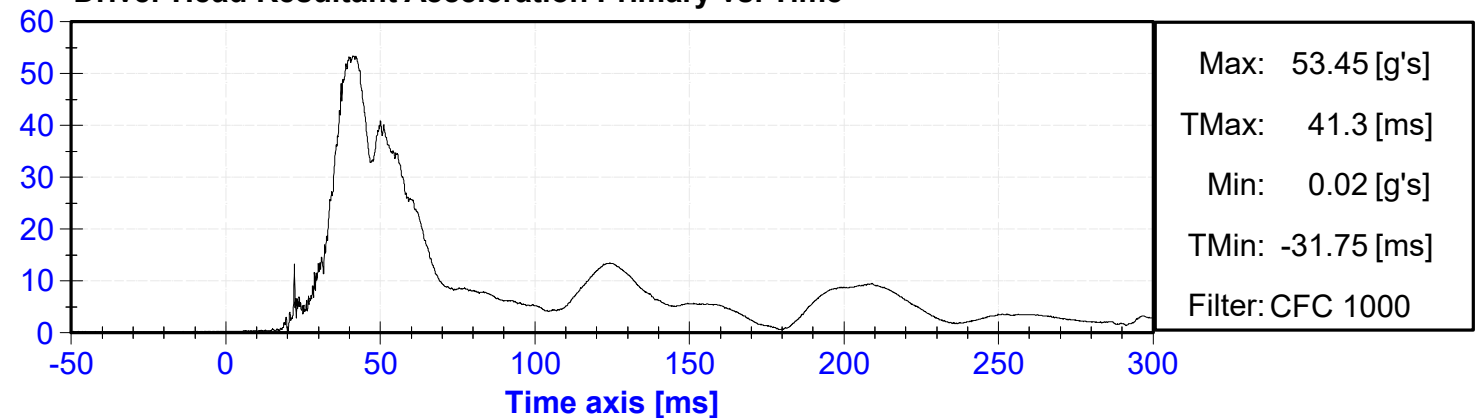
Driver Head Acceleration (Y) Primary vs. Time



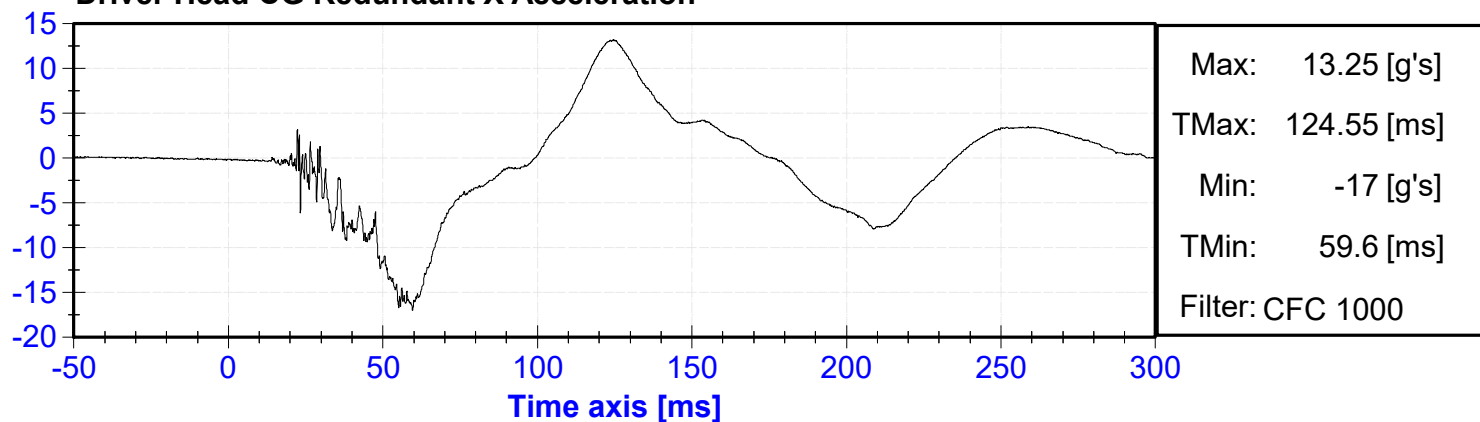
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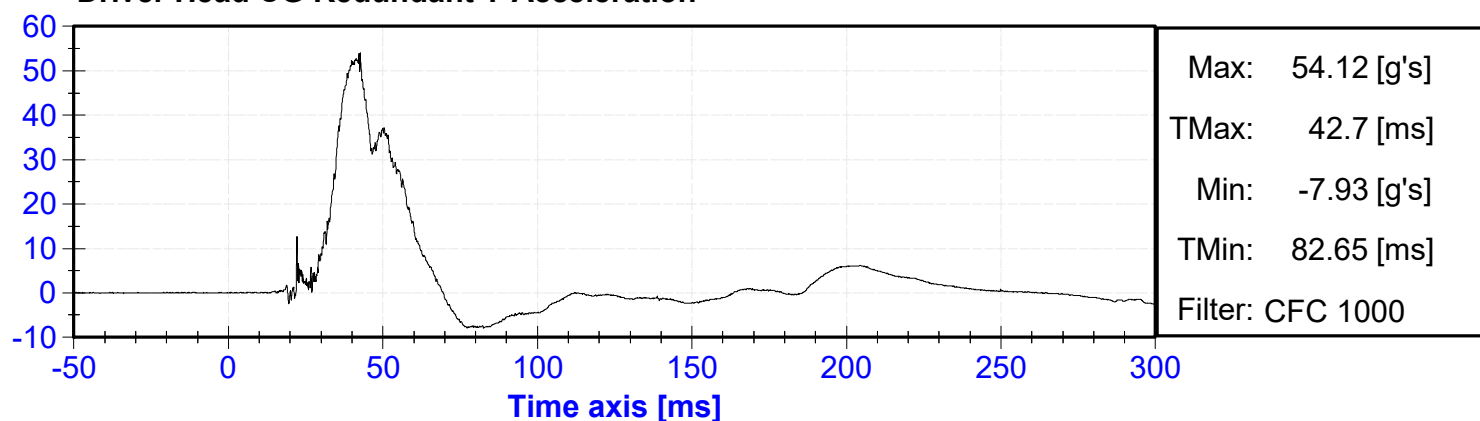
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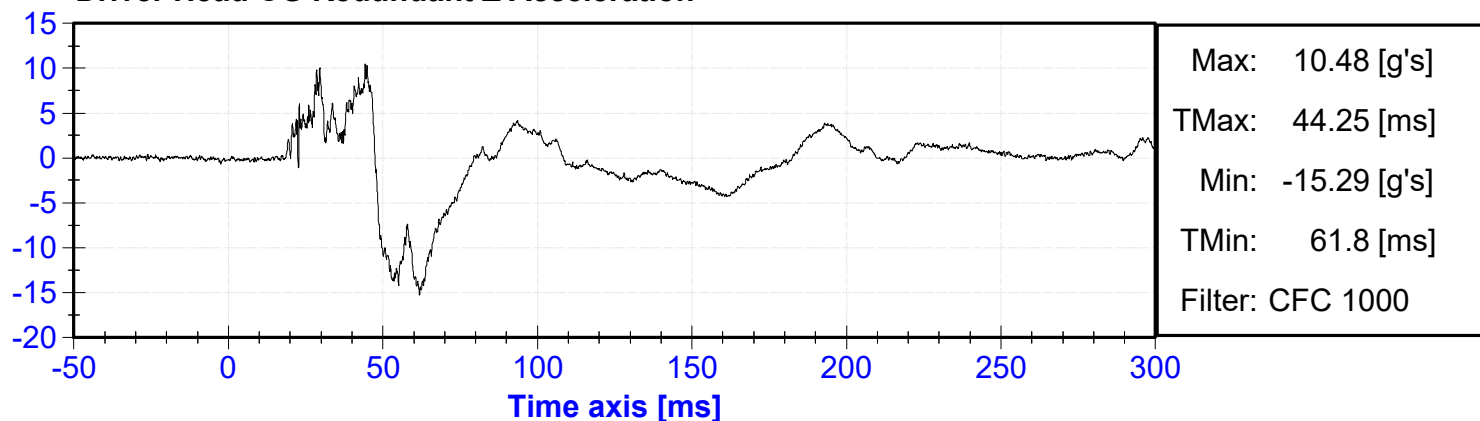
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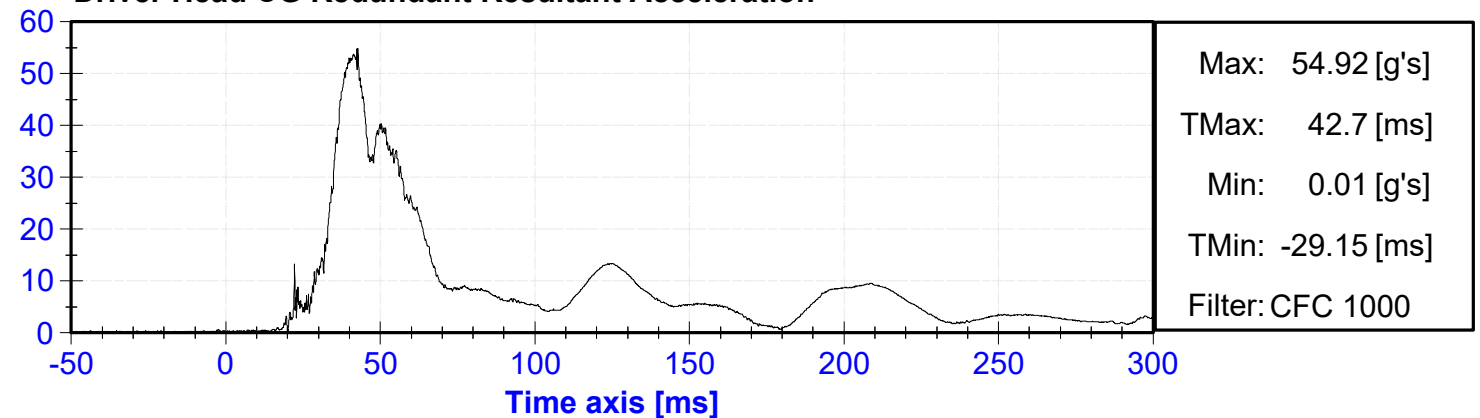
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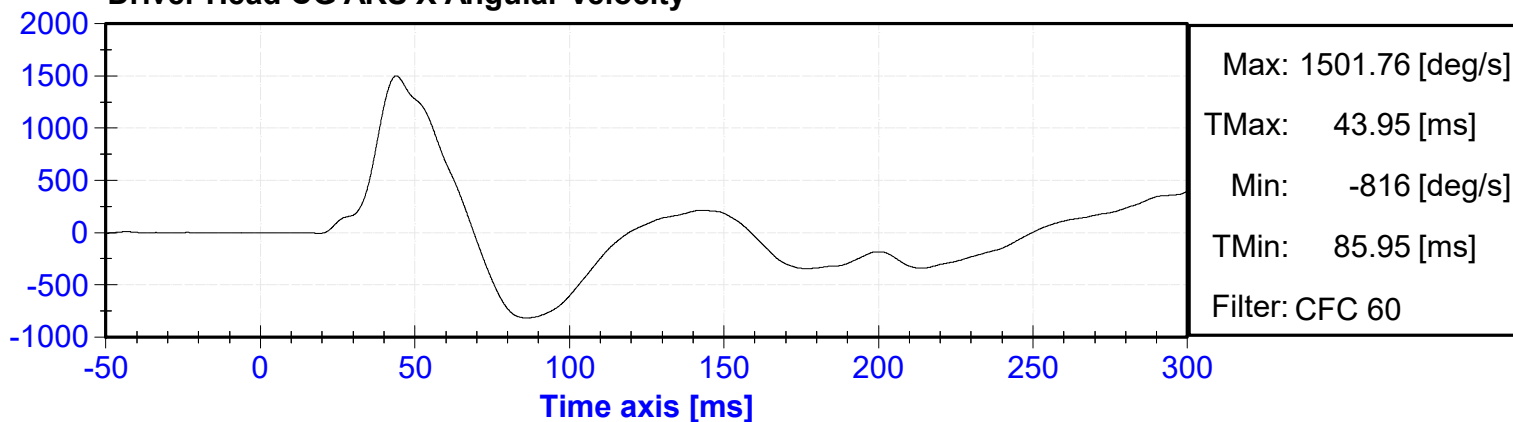
Driver Head CG Redundant Z Acceleration



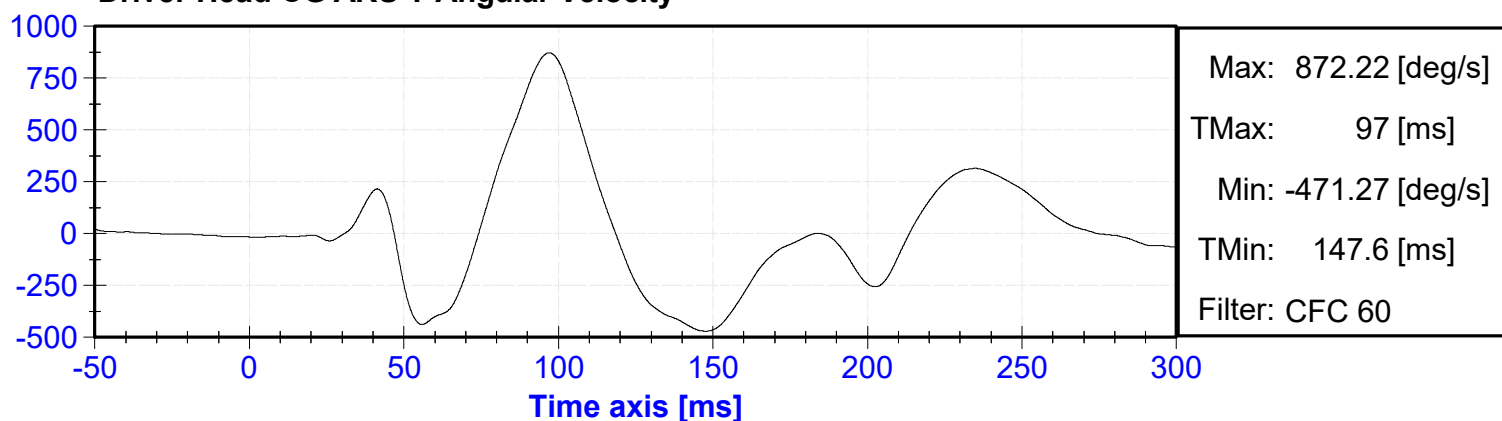
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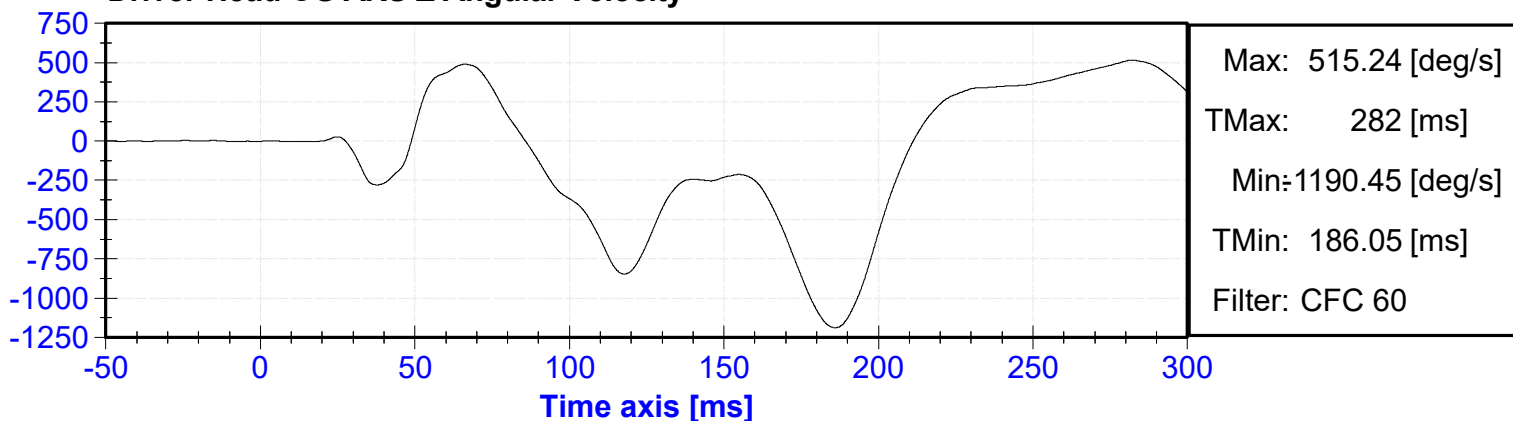
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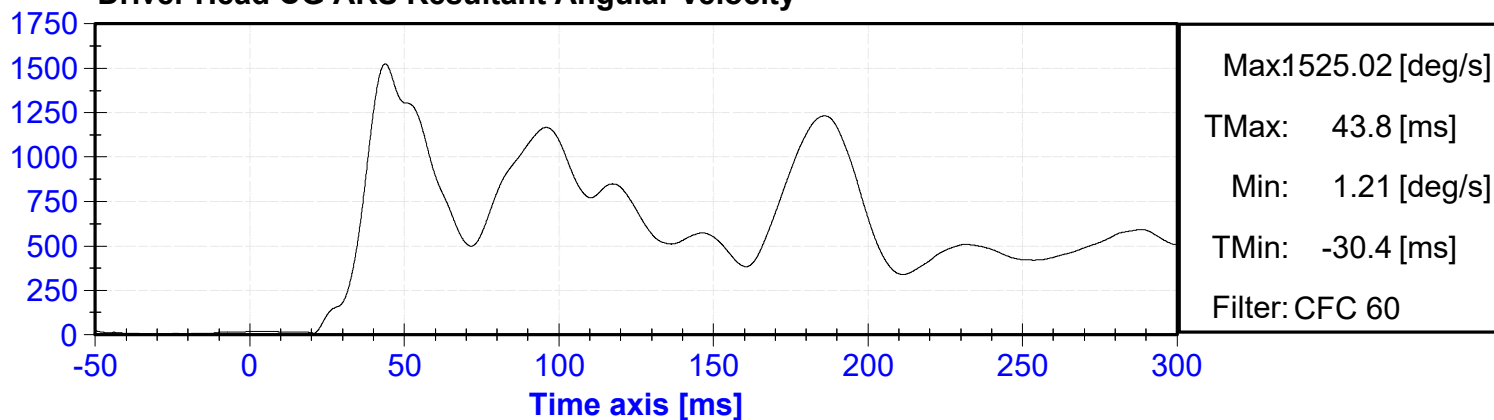
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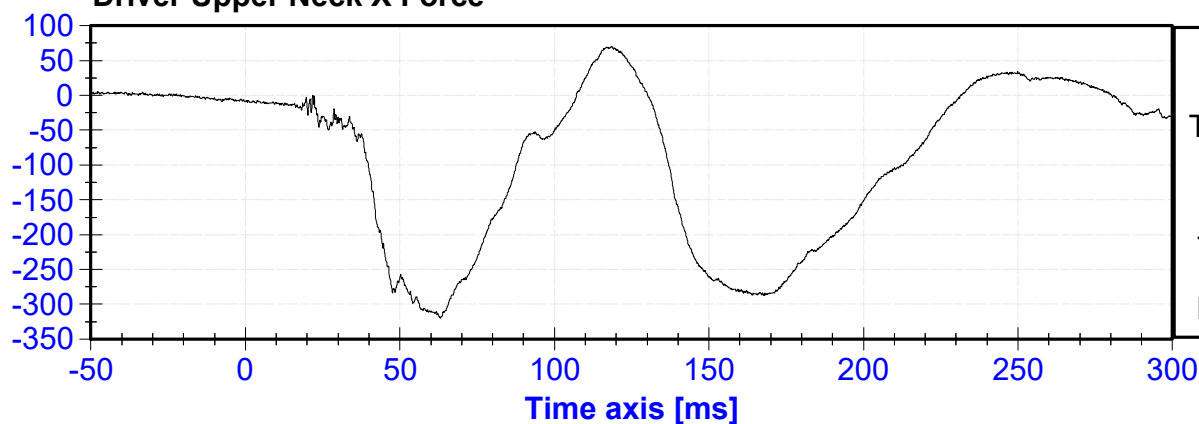
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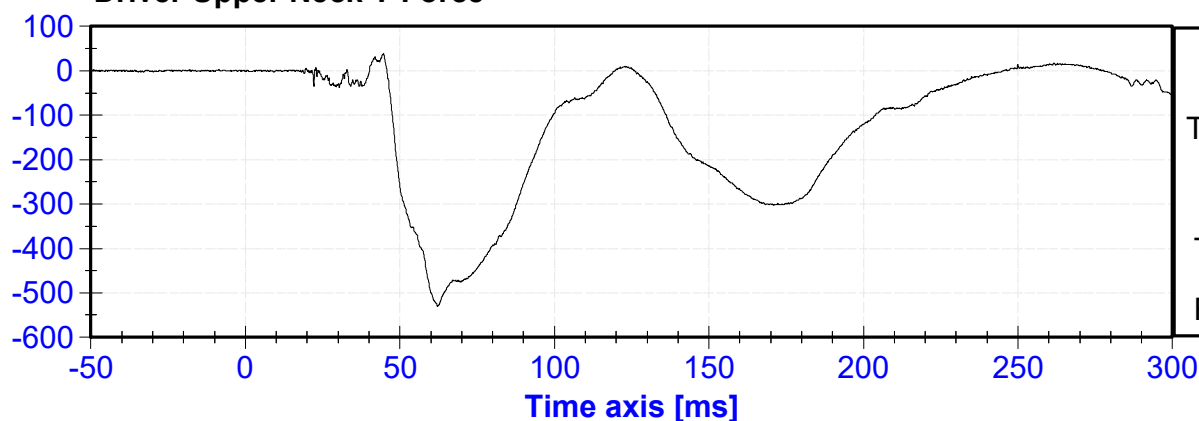
Driver Head CG ARS Resultant Angular Velocity



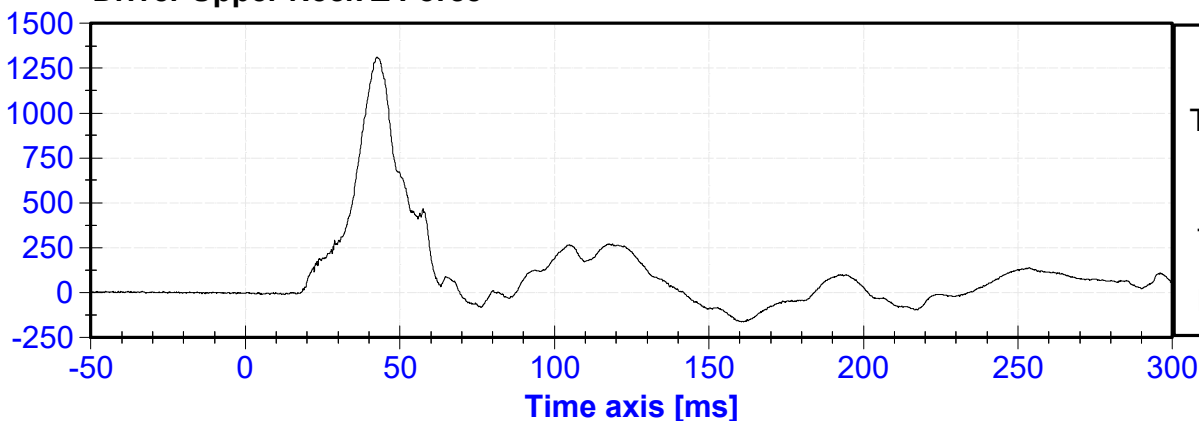
Driver Upper Neck X Force



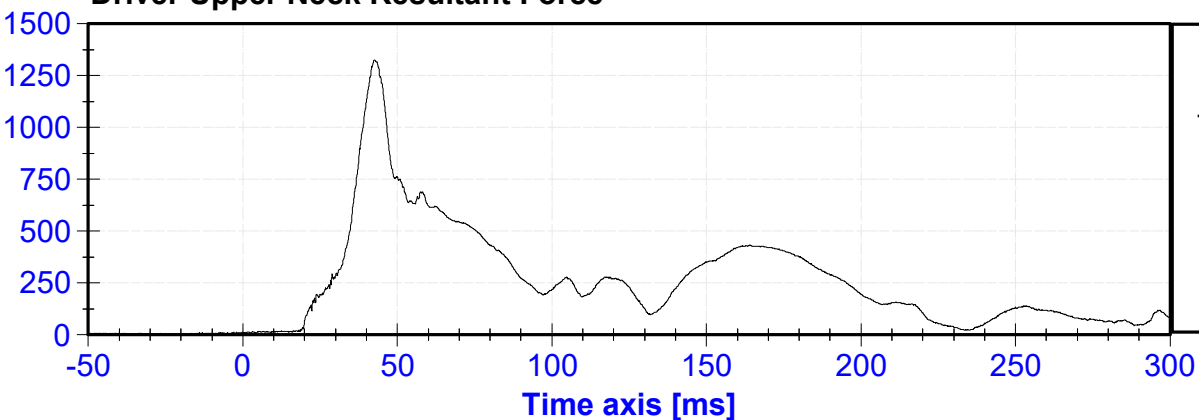
Driver Upper Neck Y Force



Driver Upper Neck Z Force

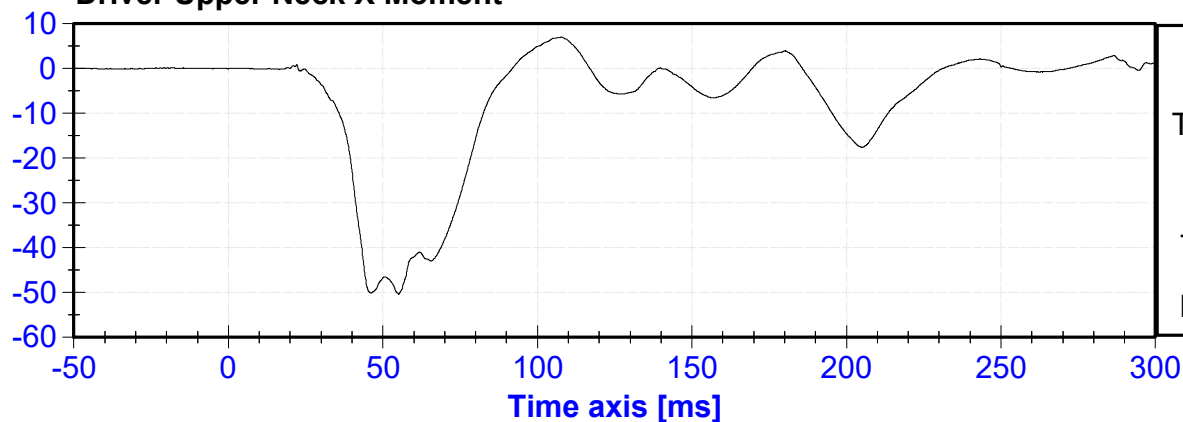


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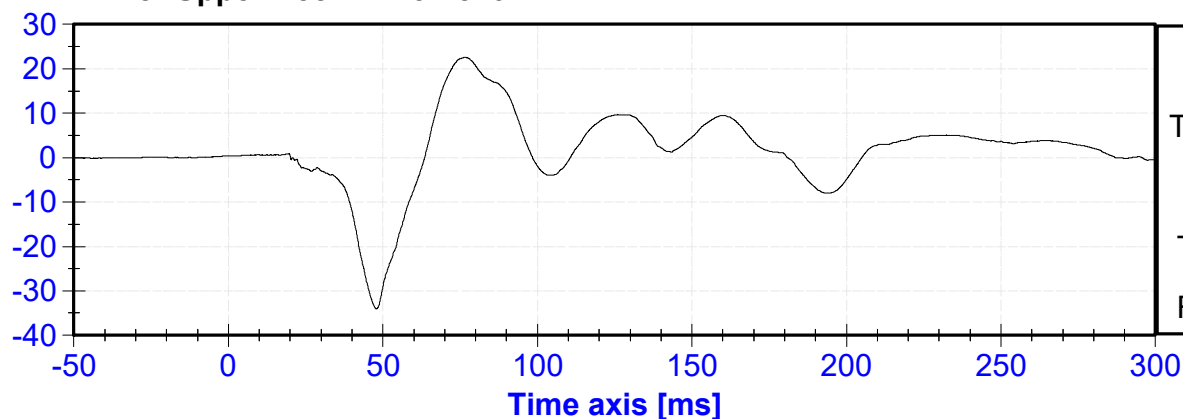
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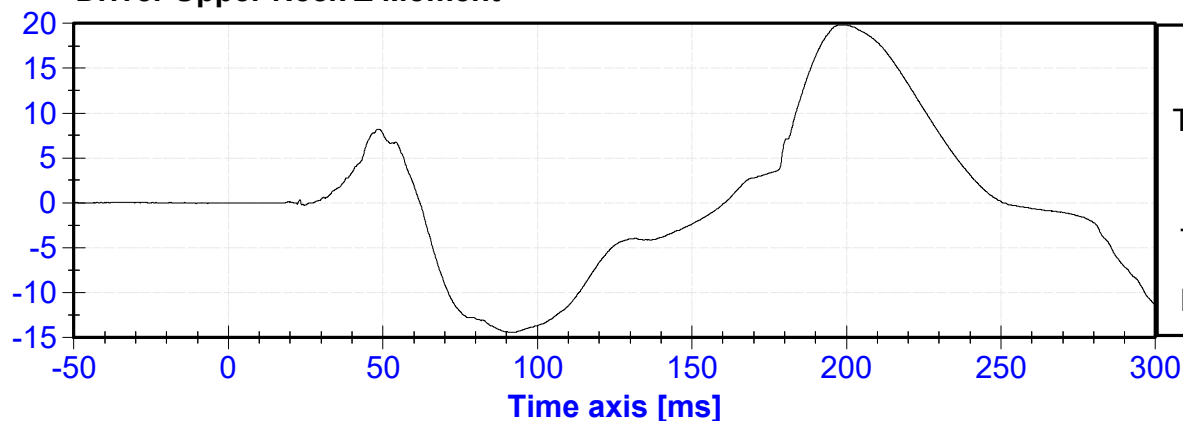
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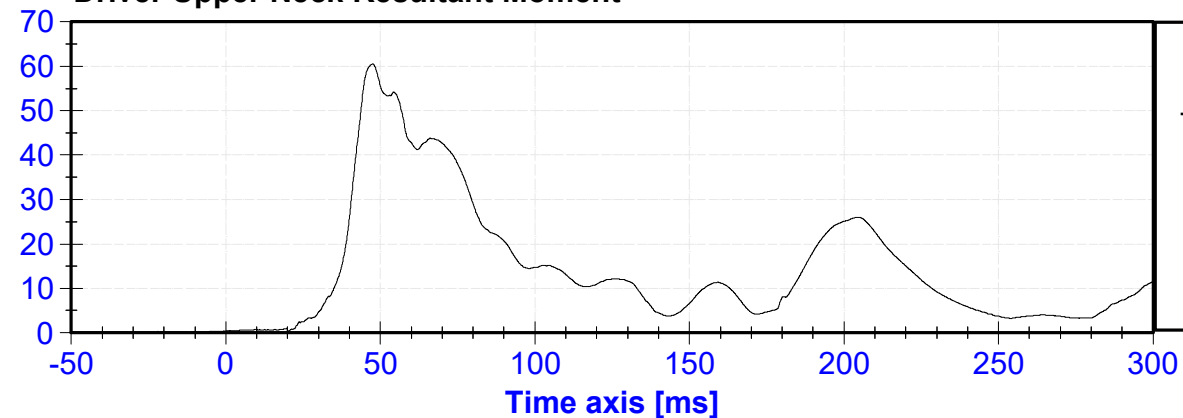
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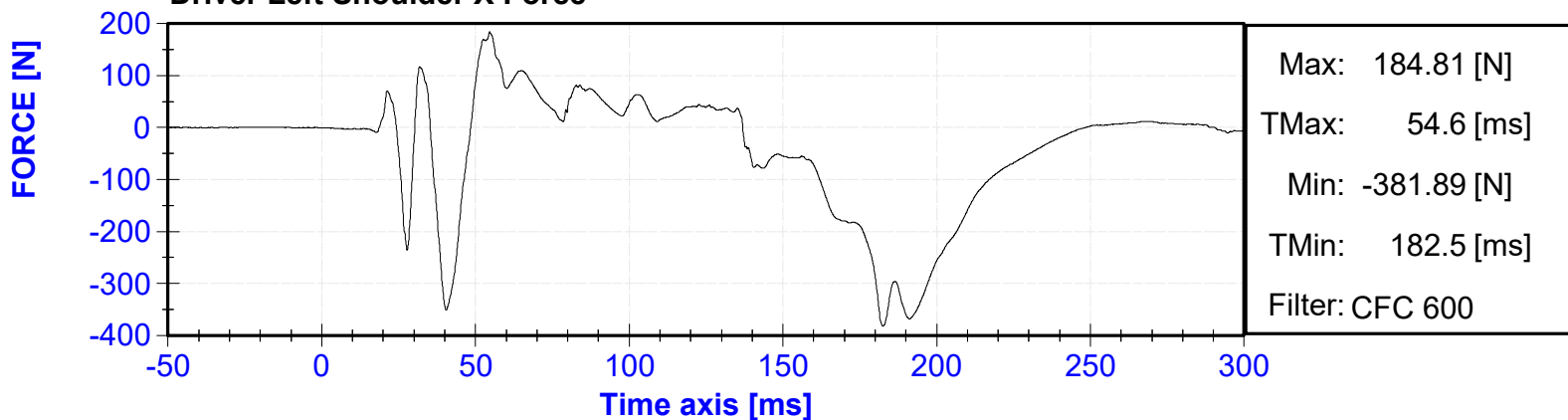


Driver Upper Neck Resultant Moment

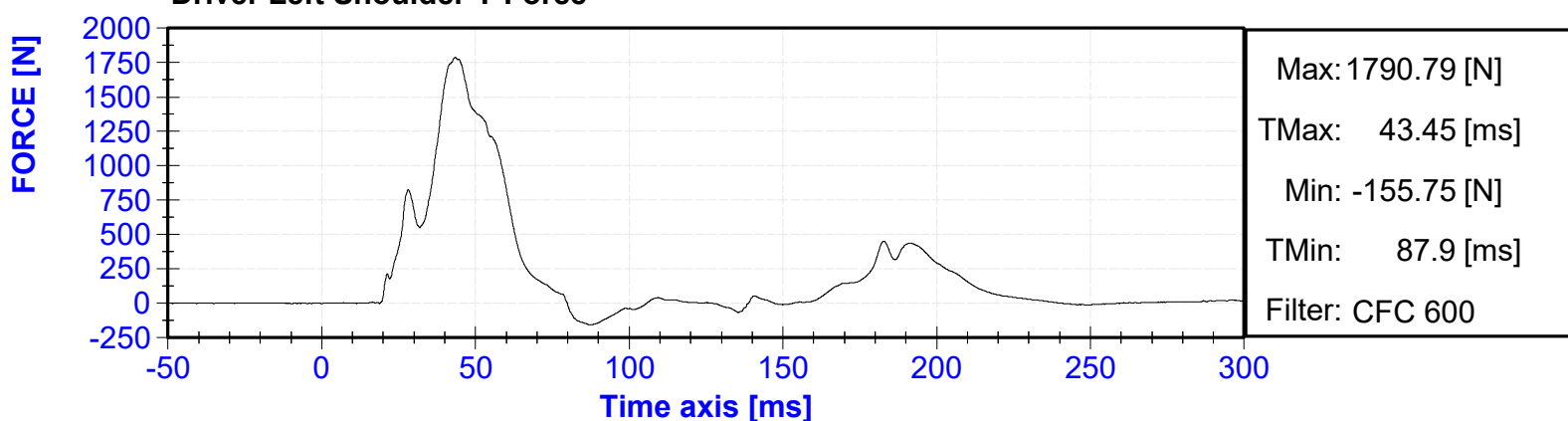
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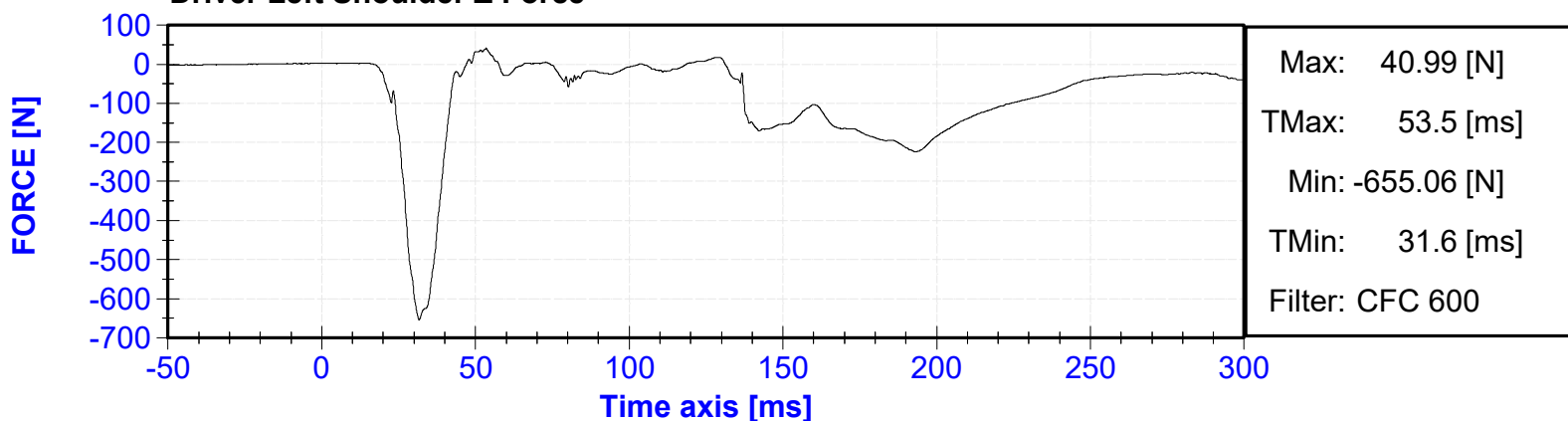
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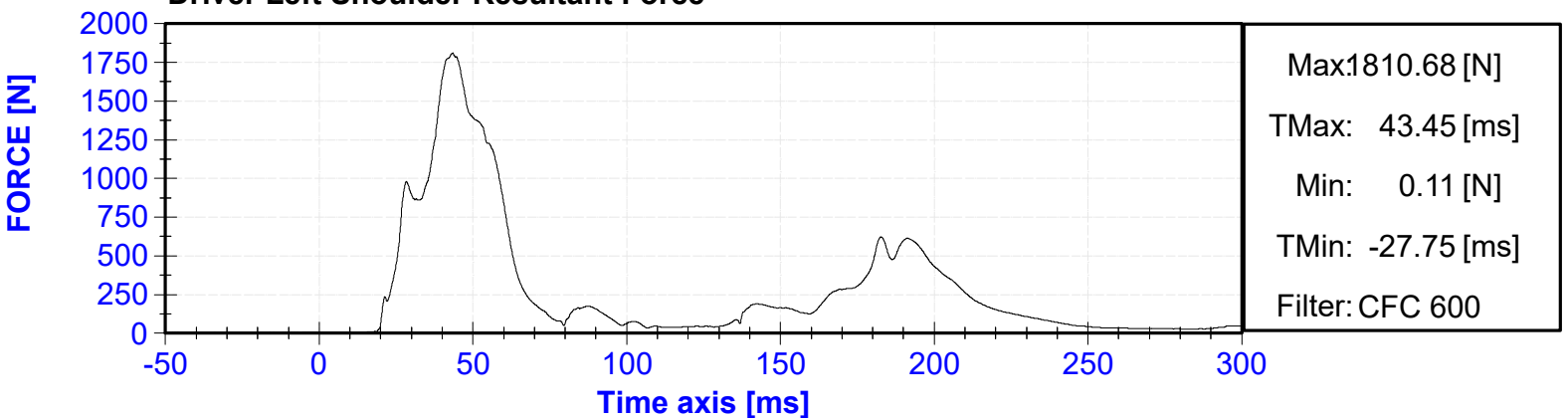
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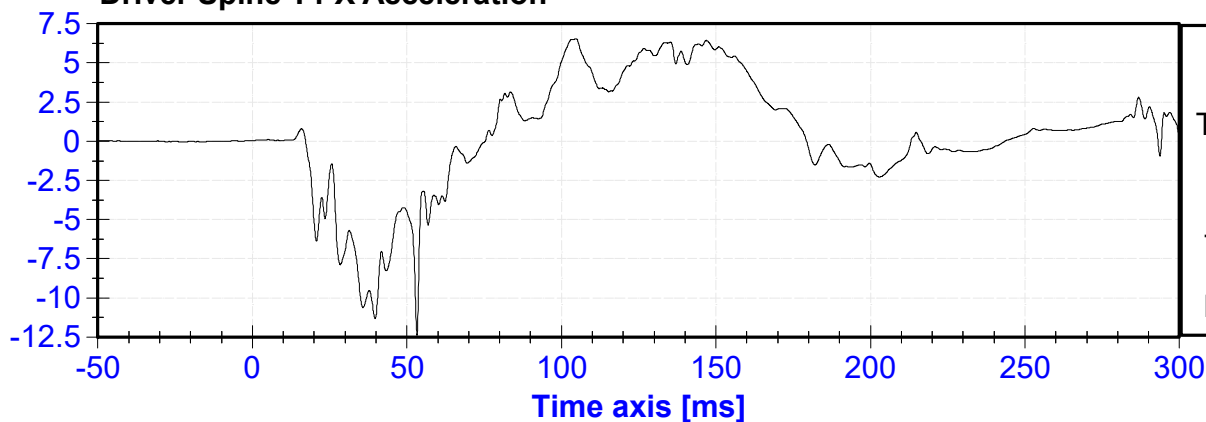
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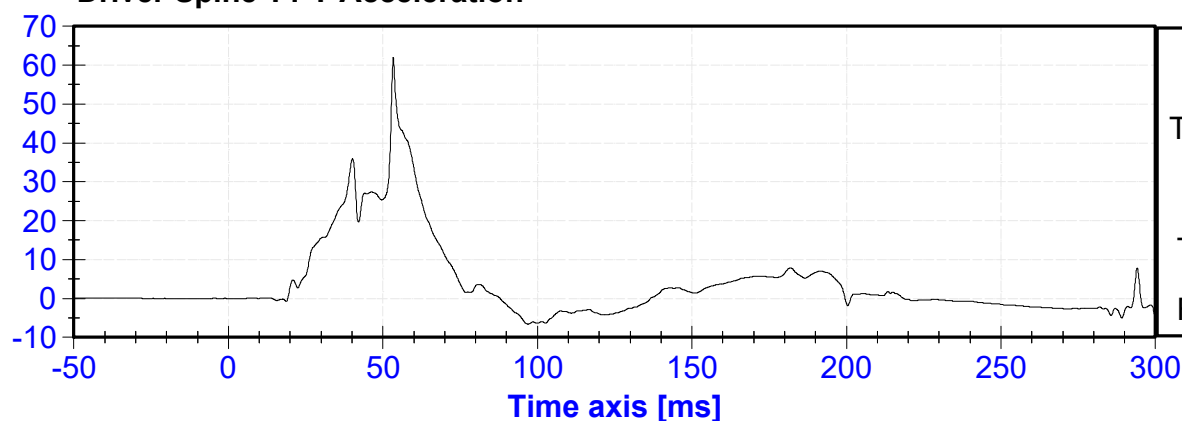
Driver Left Shoulder Resultant Force



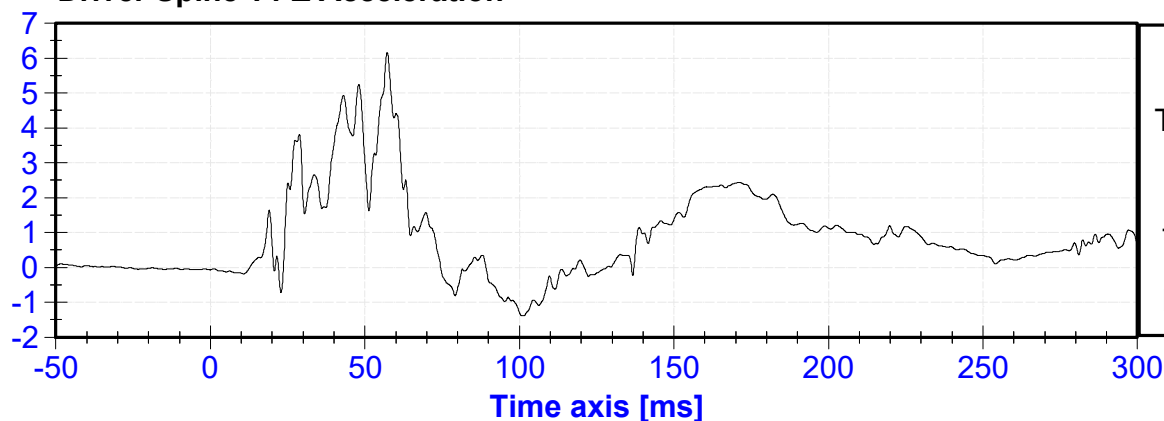
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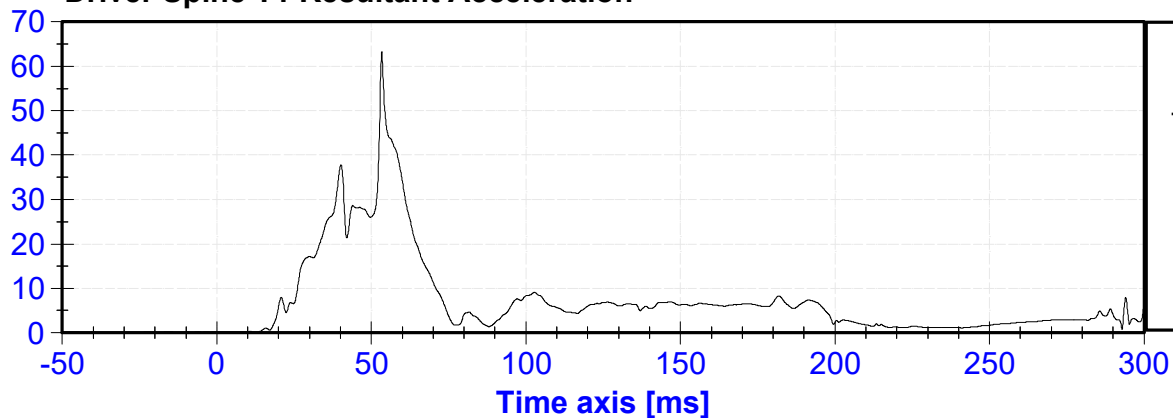
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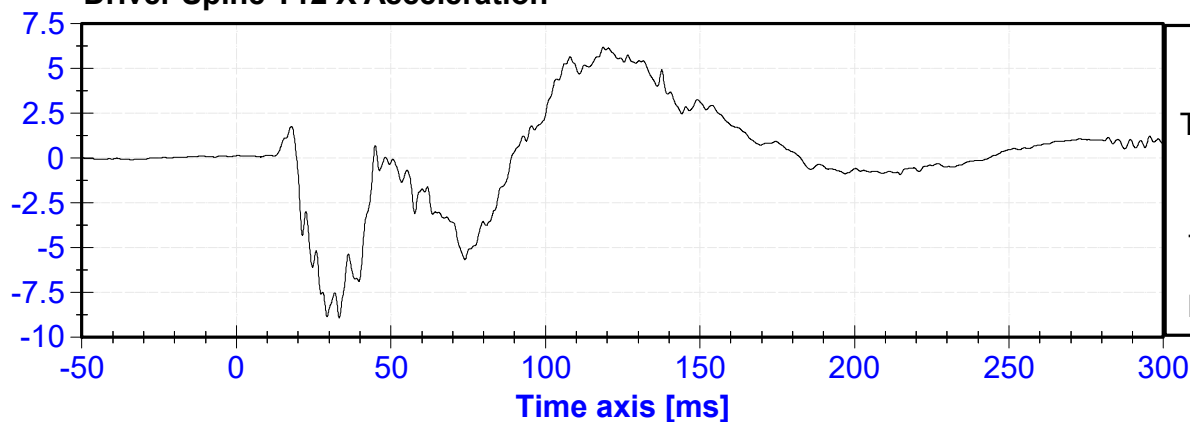
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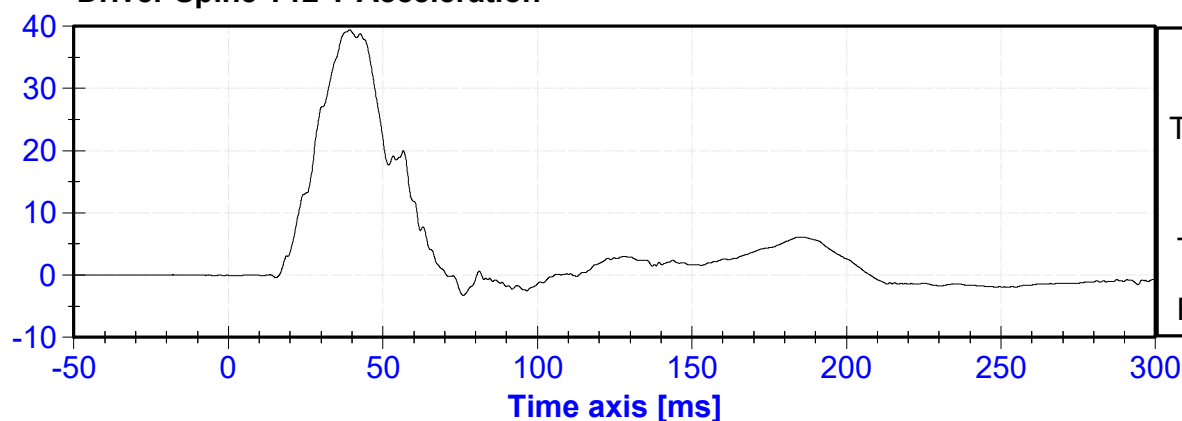
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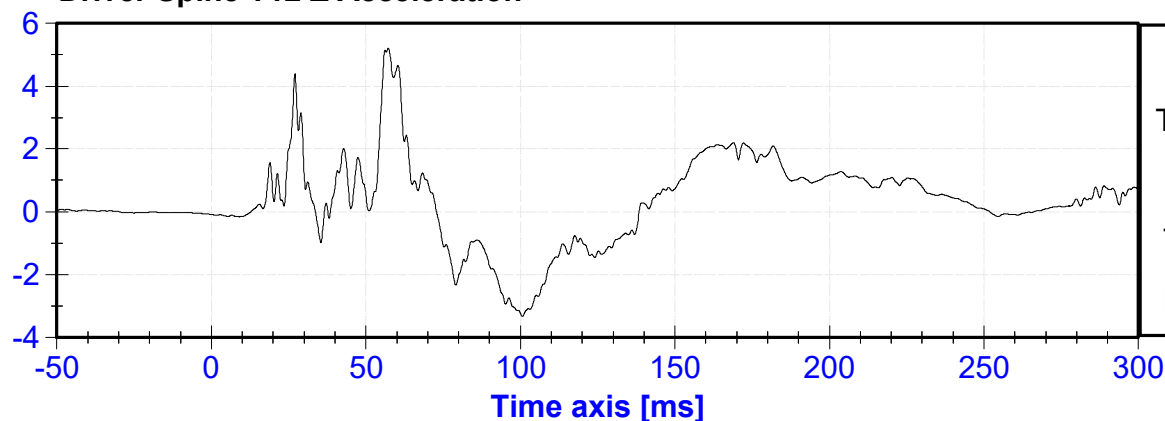
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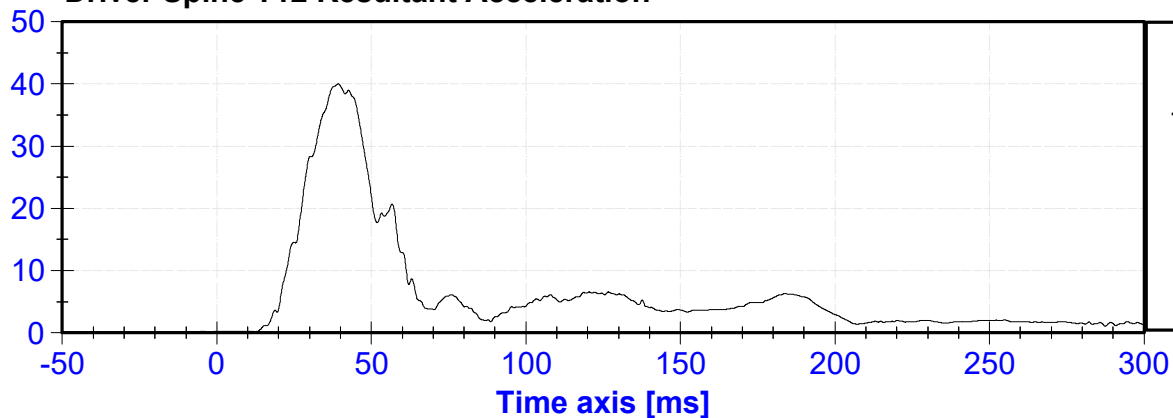
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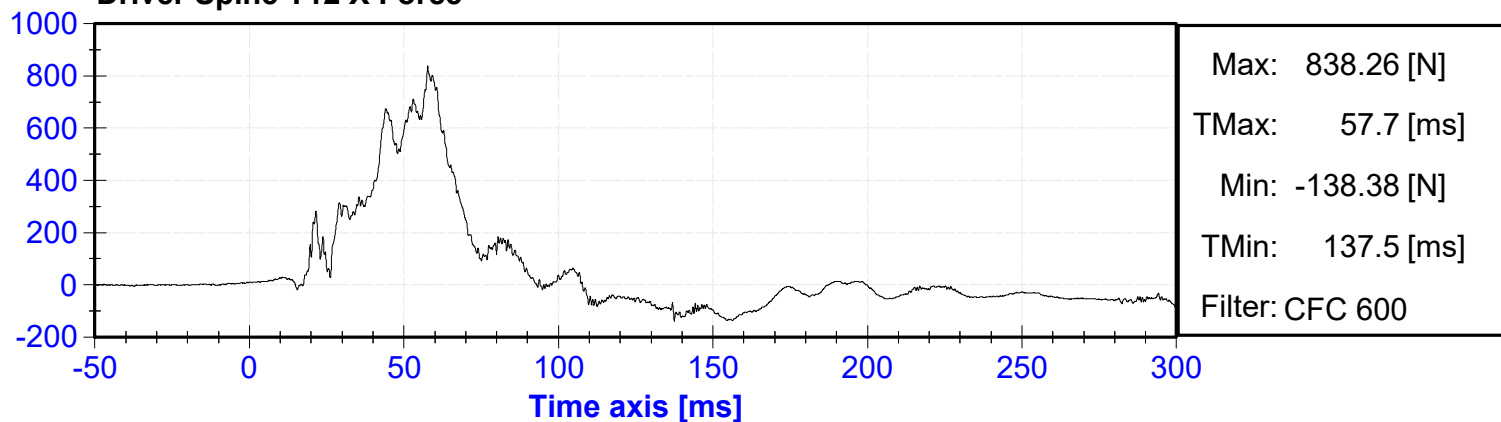
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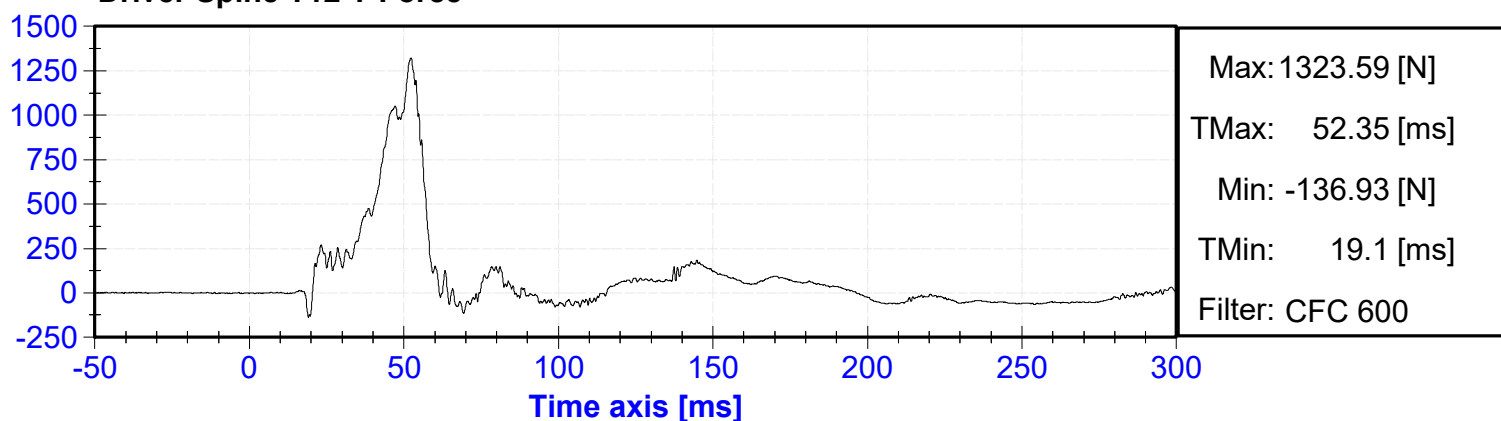
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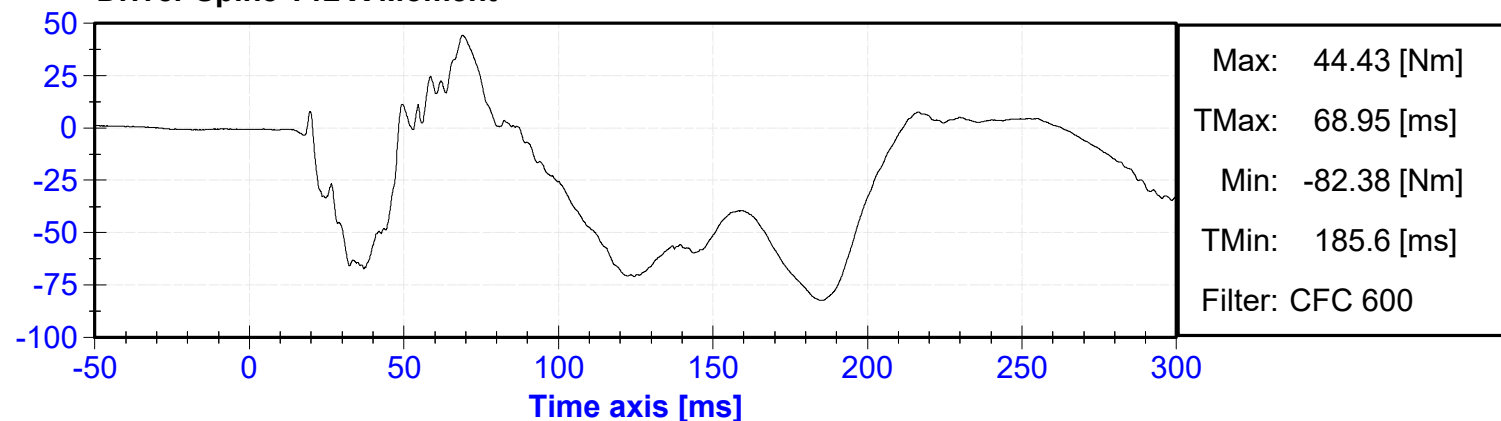
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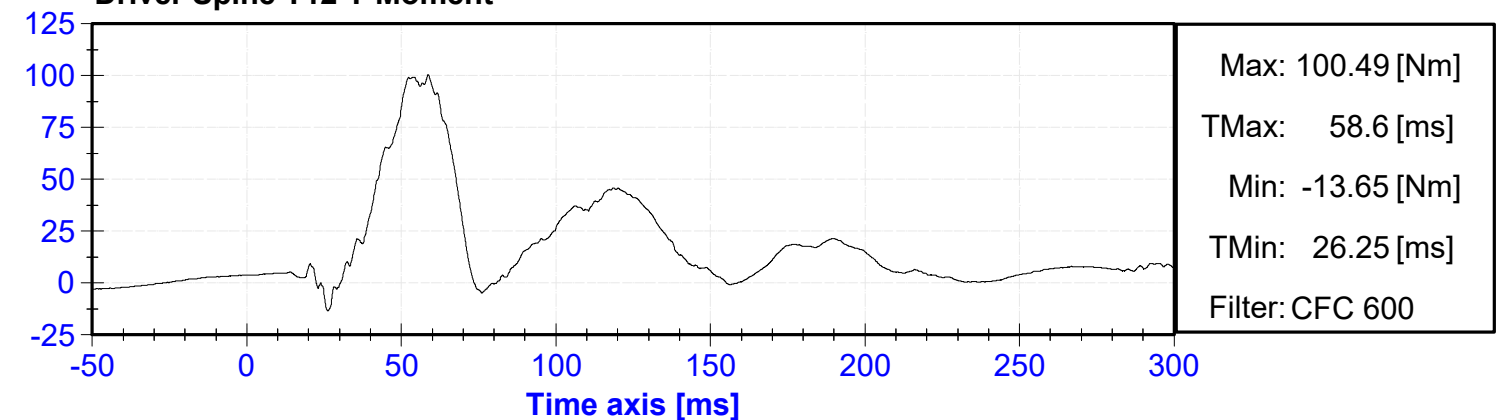
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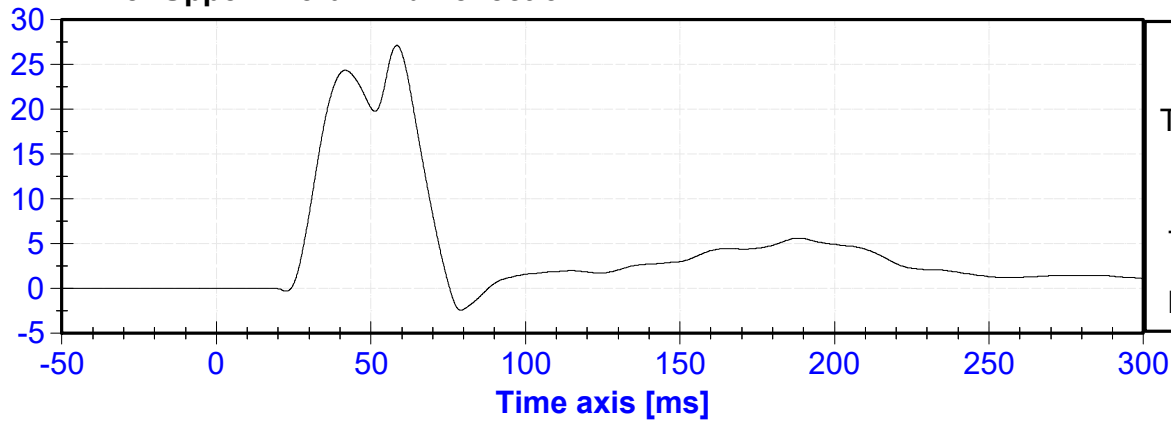
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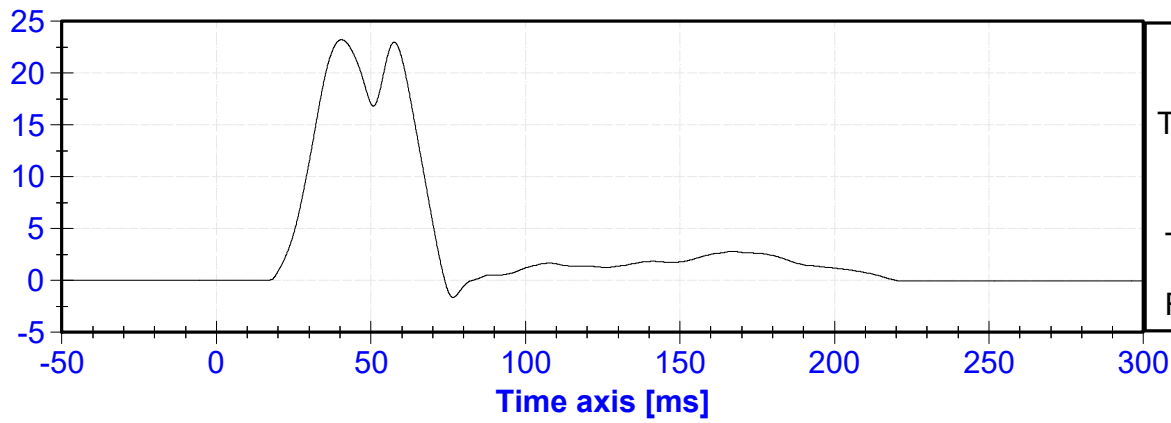
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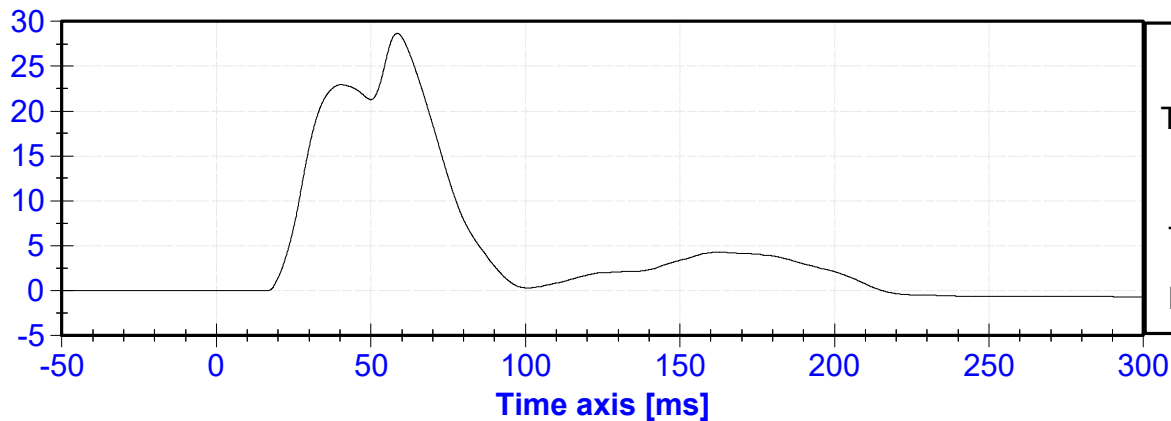
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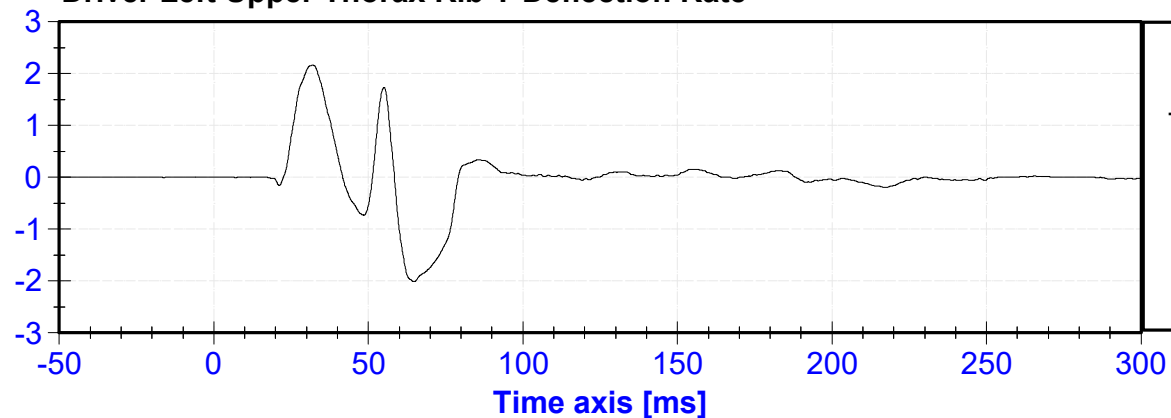
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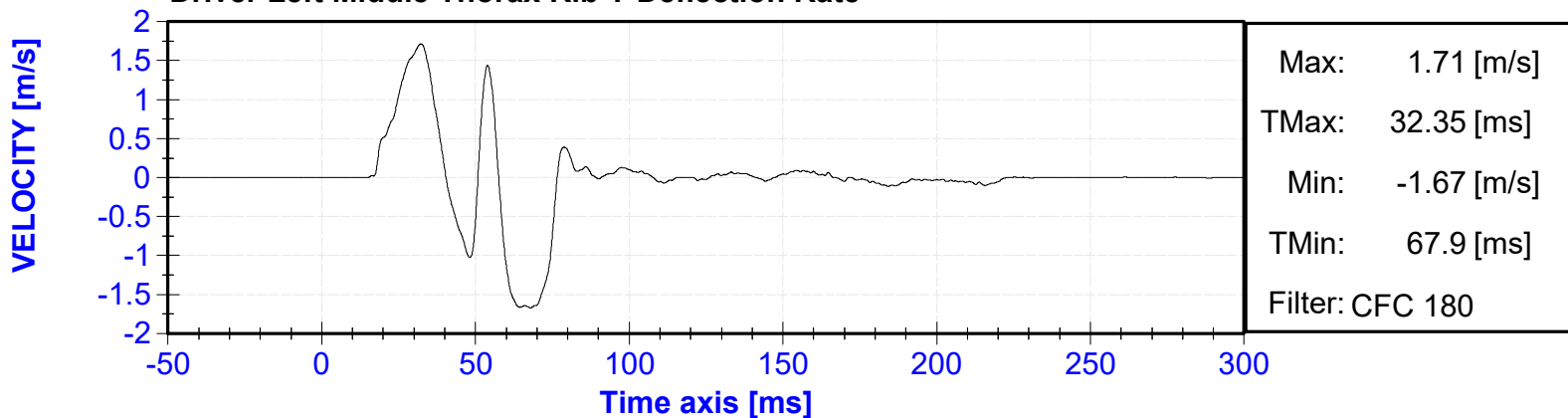
Driver Lower Thorax Rib Deflection



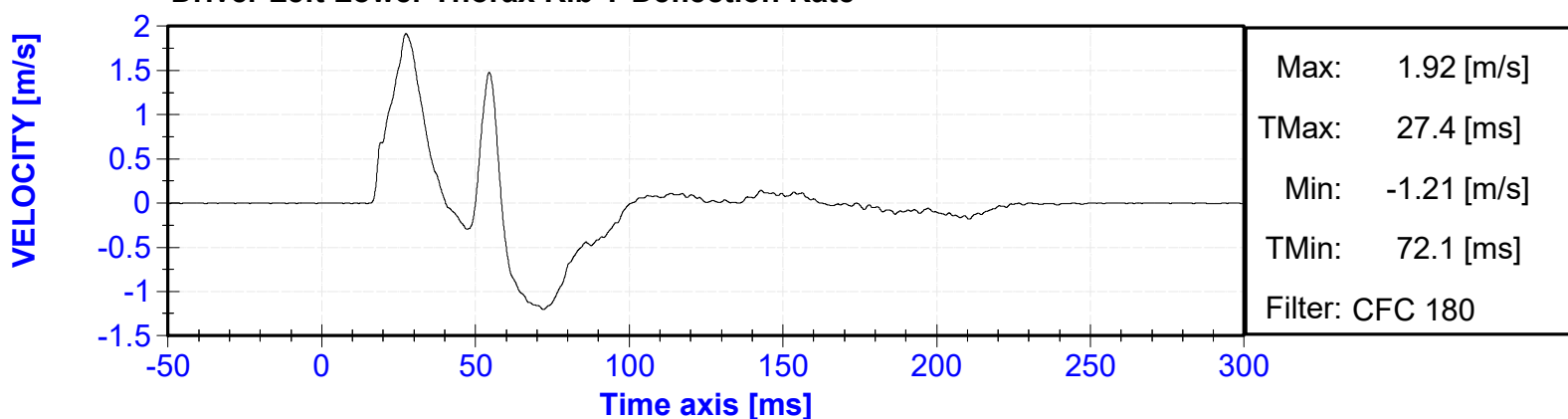
Driver Left Upper Thorax Rib Y Deflection Rate



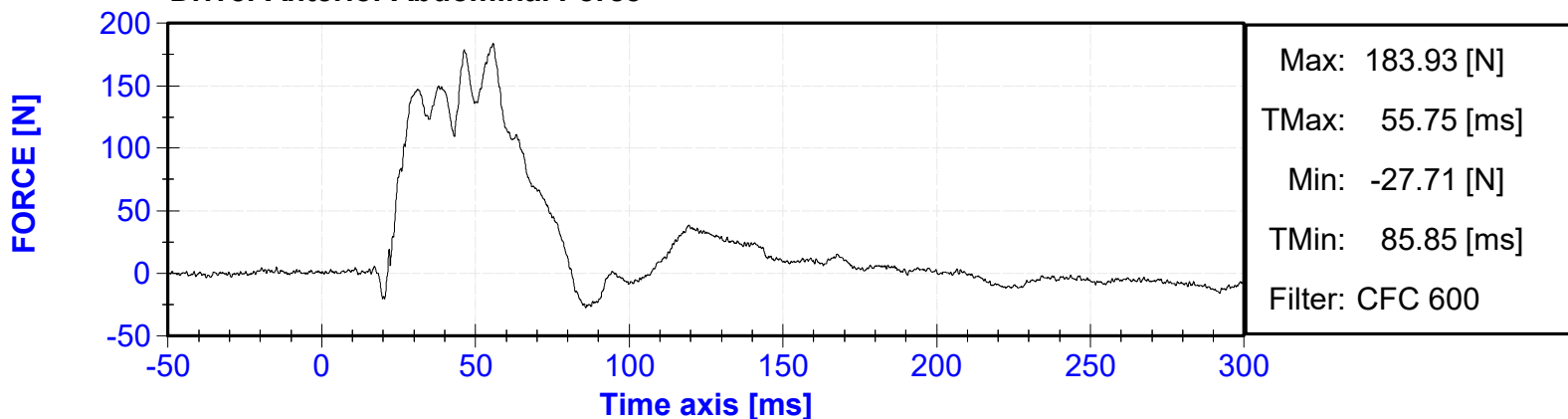
Driver Left Middle Thorax Rib Y Deflection Rate



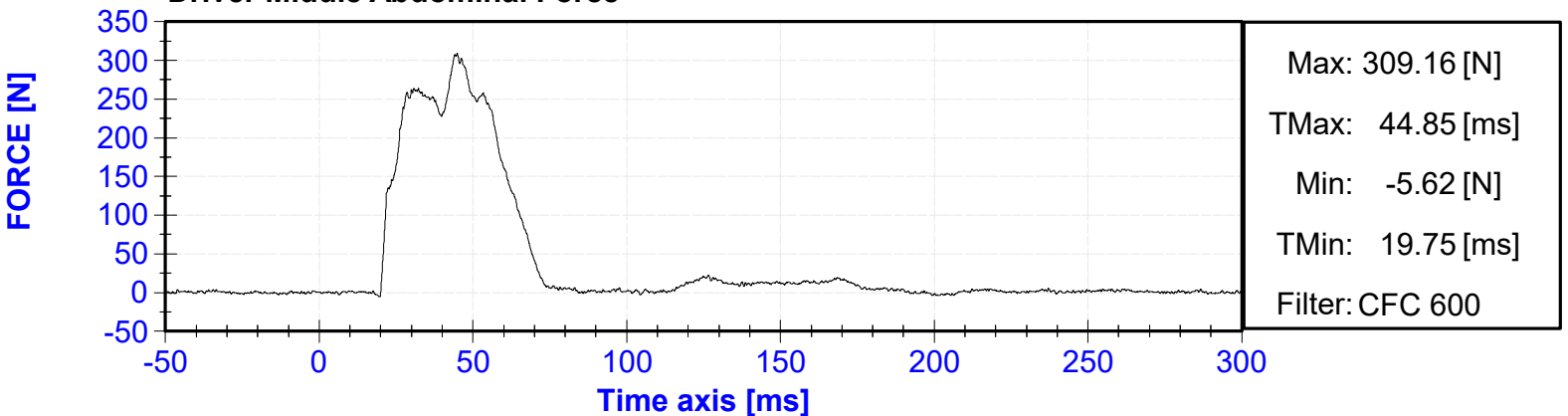
Driver Left Lower Thorax Rib Y Deflection Rate



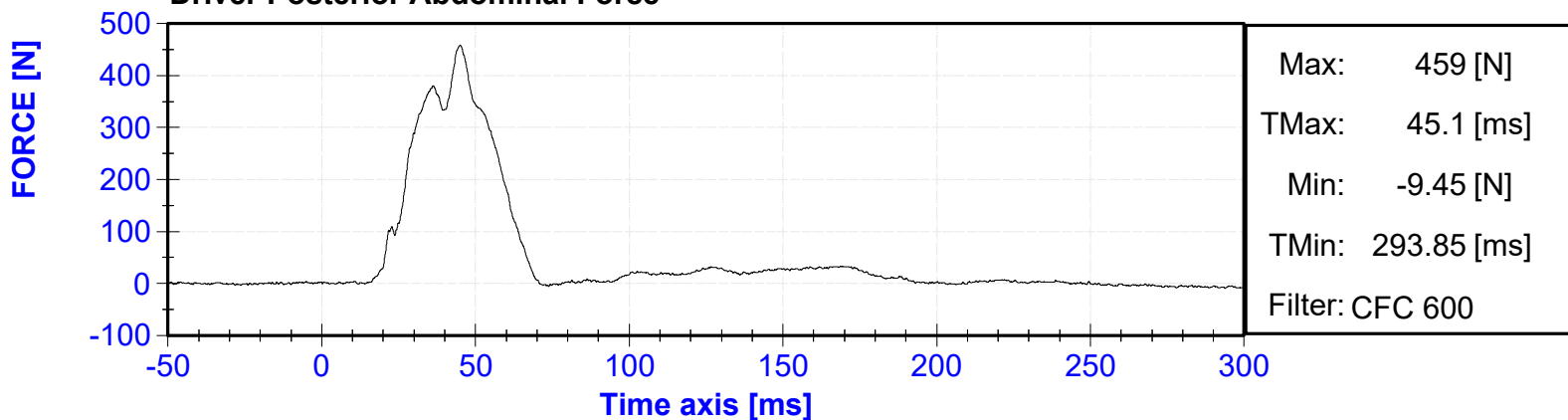
Driver Anterior Abdominal Force



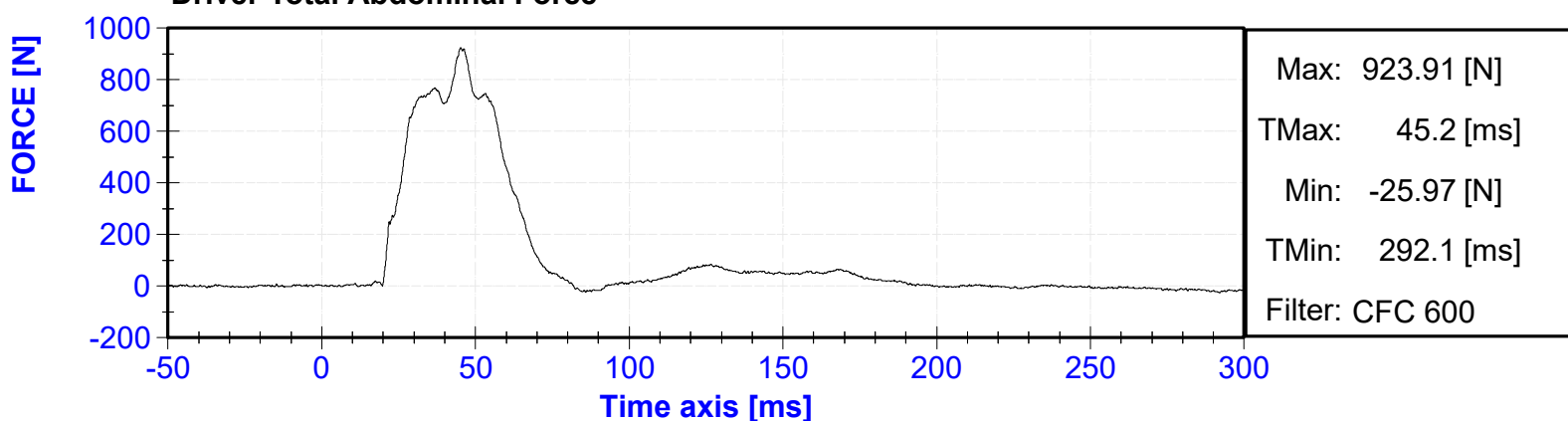
Driver Middle Abdominal Force



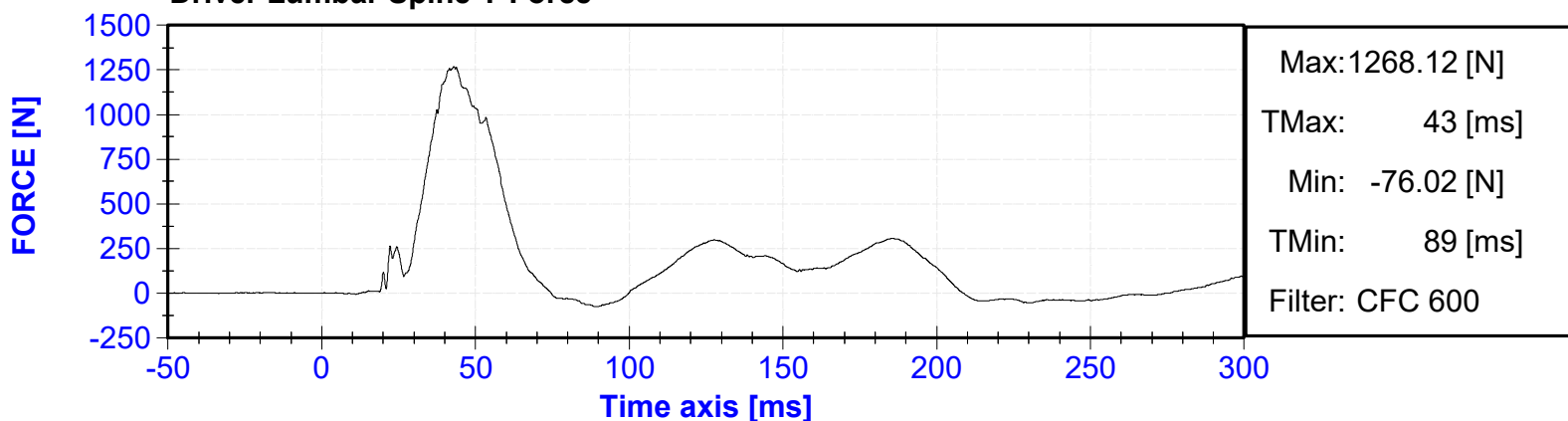
Driver Posterior Abdominal Force



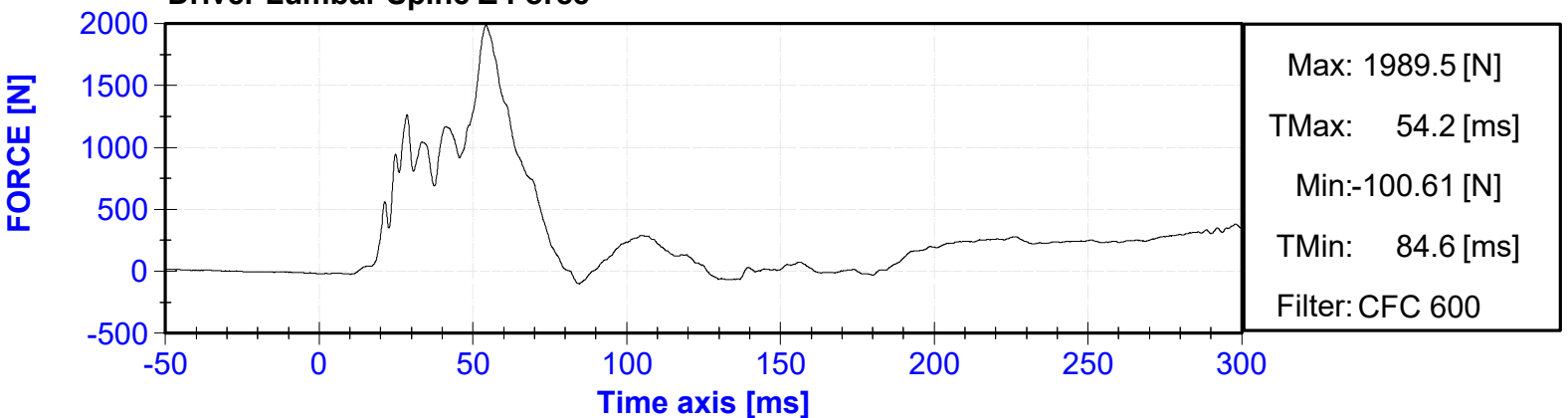
Driver Total Abdominal Force



Driver Lumbar Spine Y Force

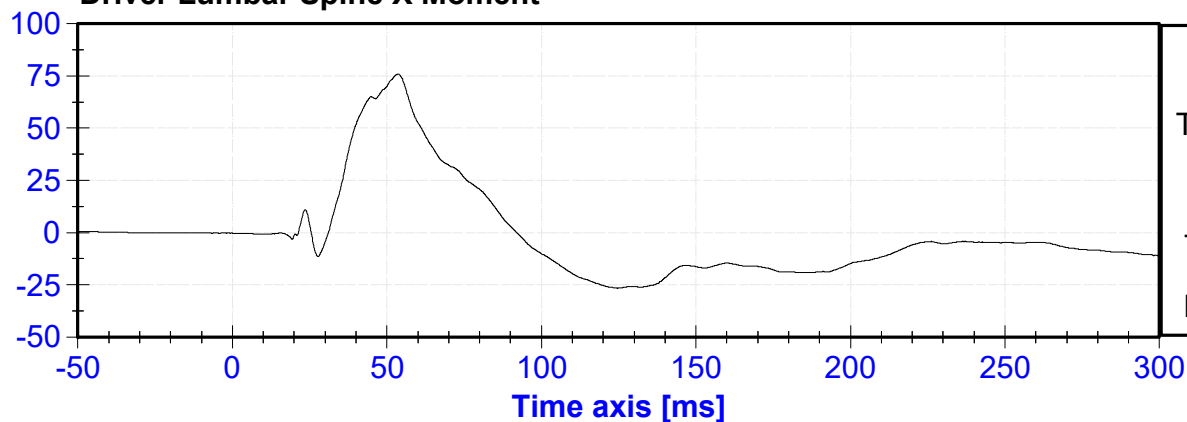


Driver Lumbar Spine Z Force



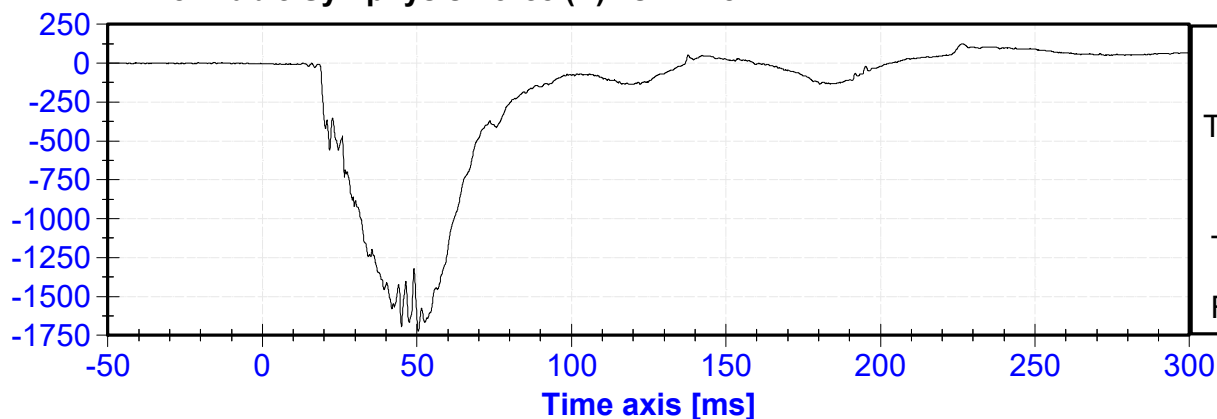
Driver Lumbar Spine X Moment

MOMENT [Nm]



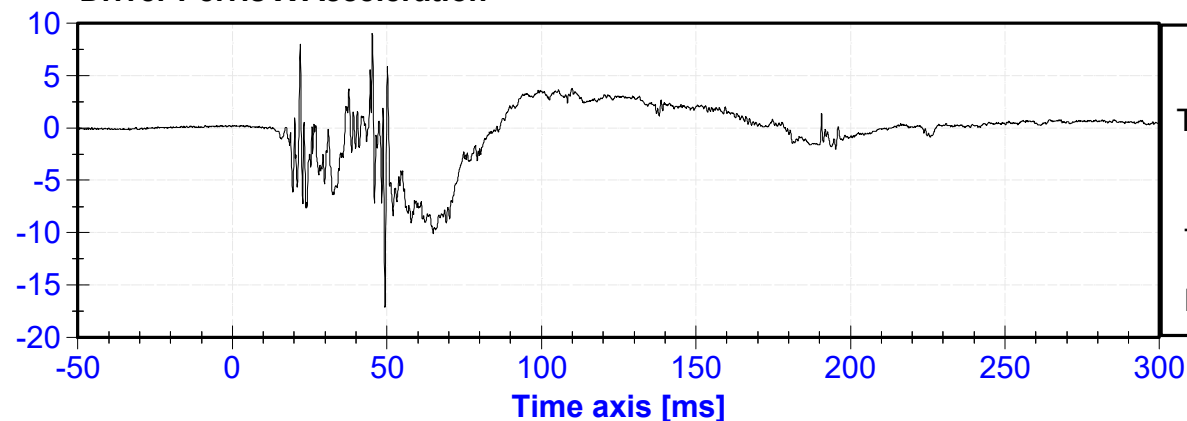
Driver Pubic Symphysis Force (Y) vs. Time

FORCE [N]



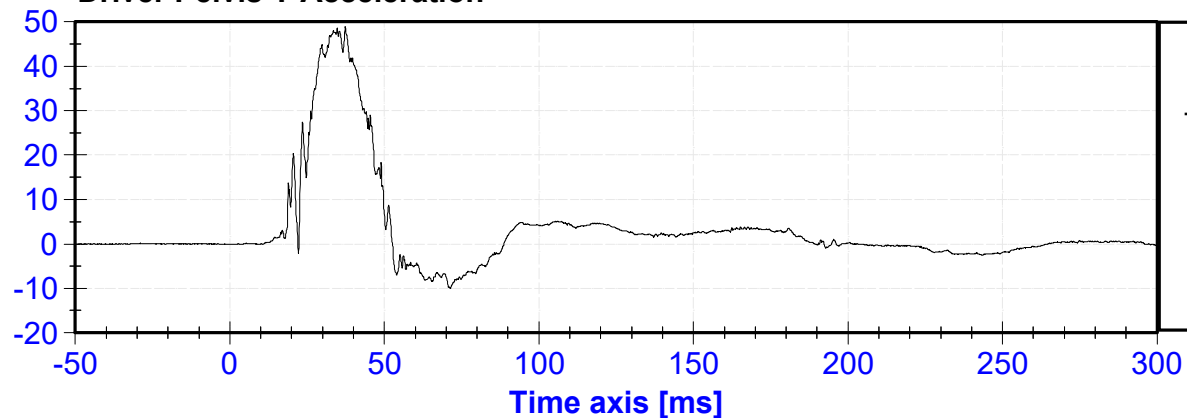
Driver Pelvis X Acceleration

ACCELERATION [g's]

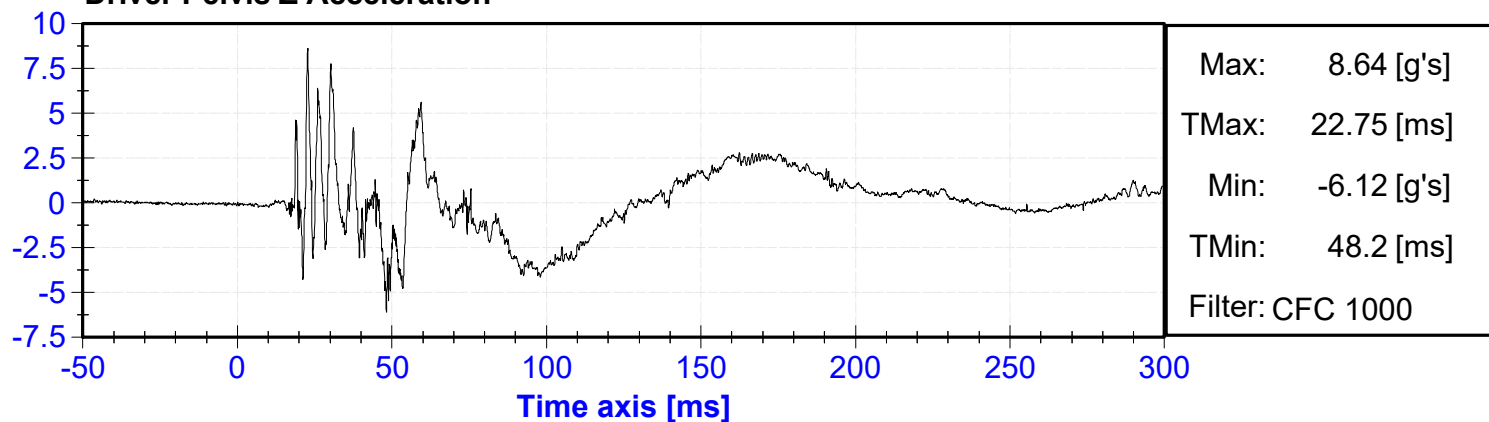


Driver Pelvis Y Acceleration

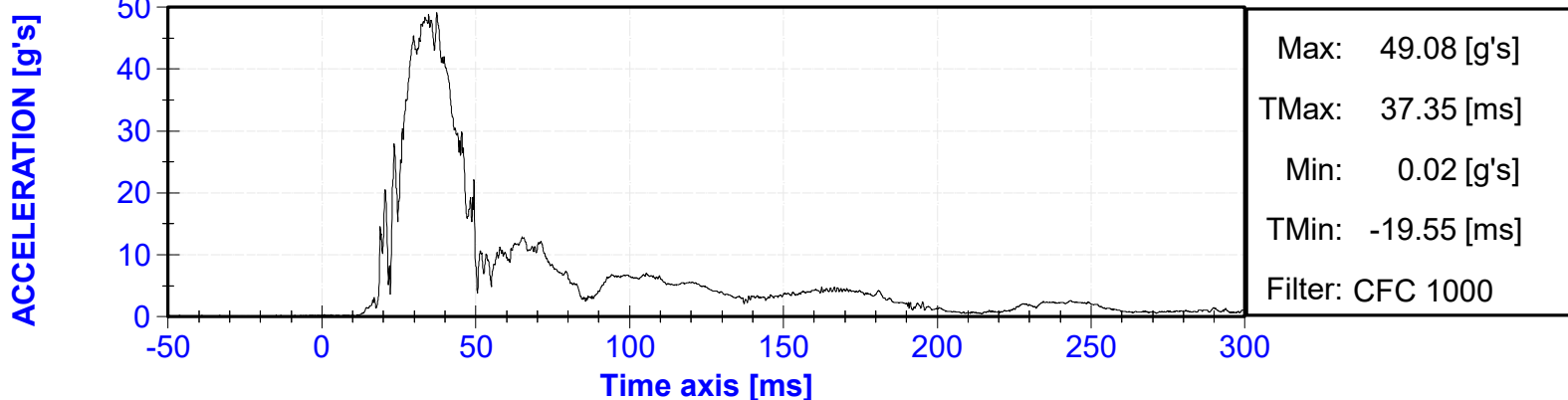
ACCELERATION [g's]



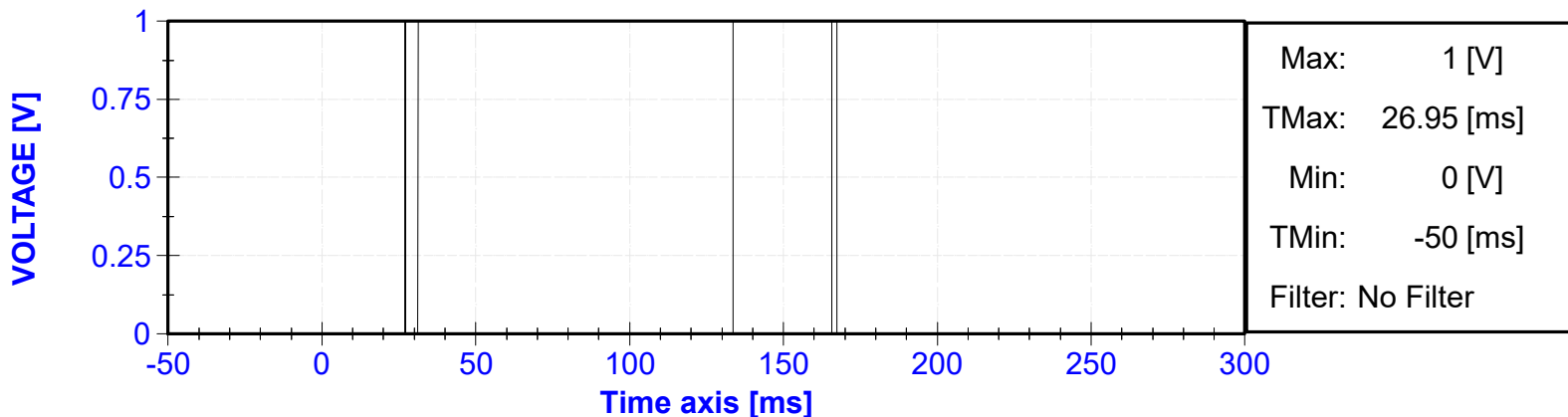
Driver Pelvis Z Acceleration



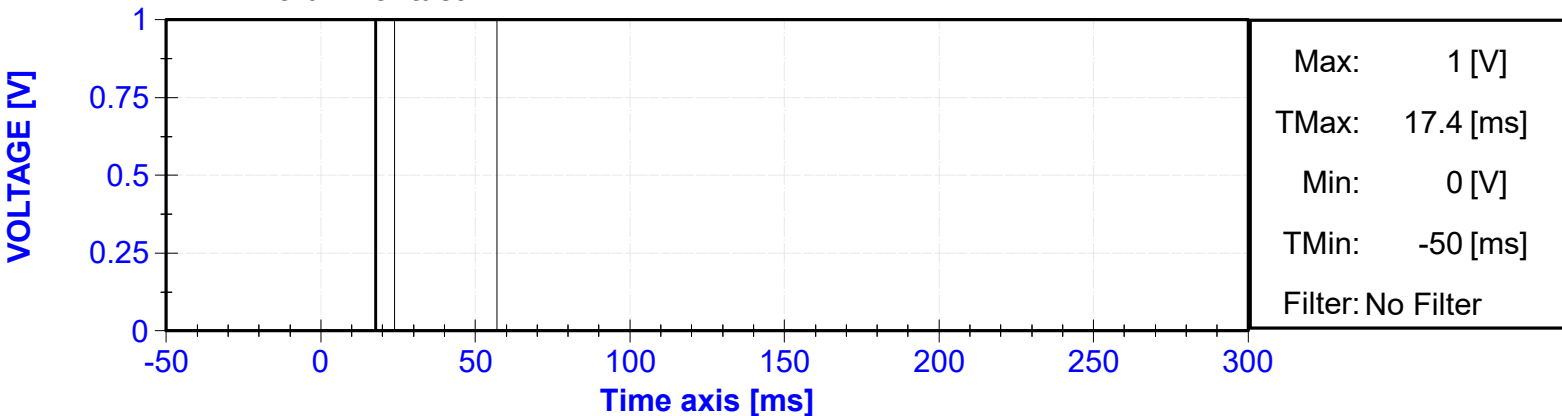
Driver Pelvis Resultant Acceleration

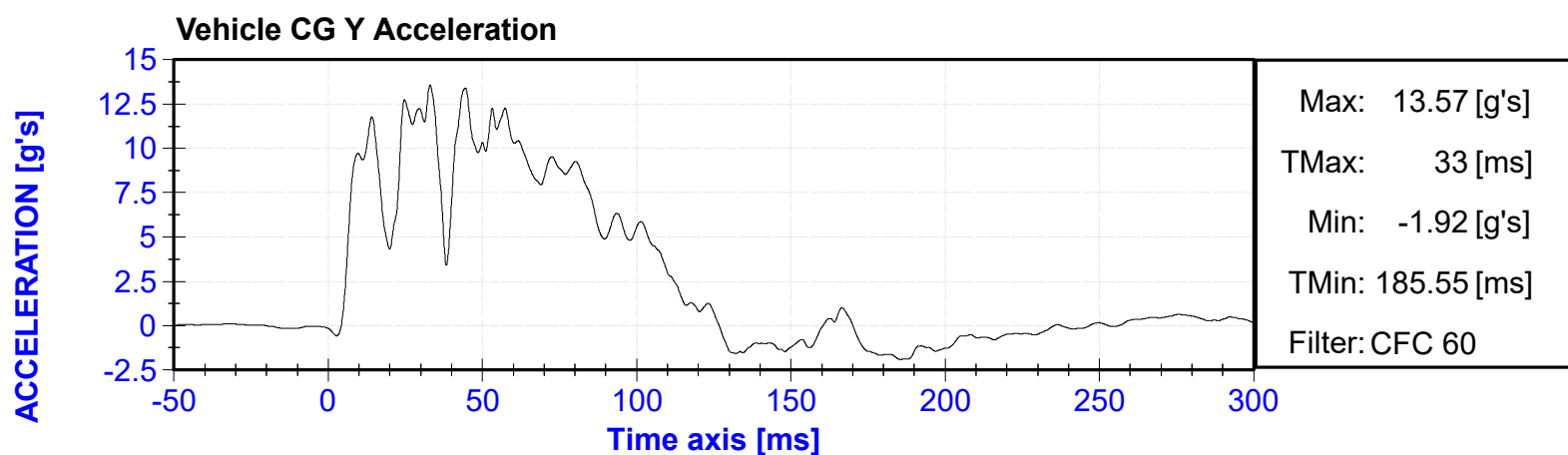
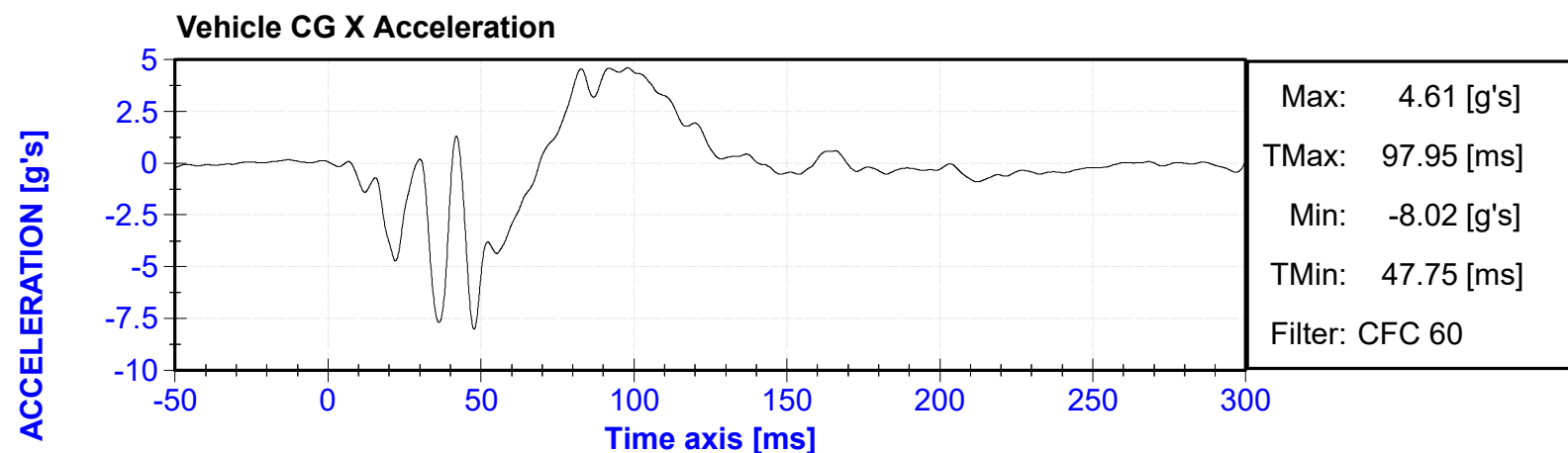
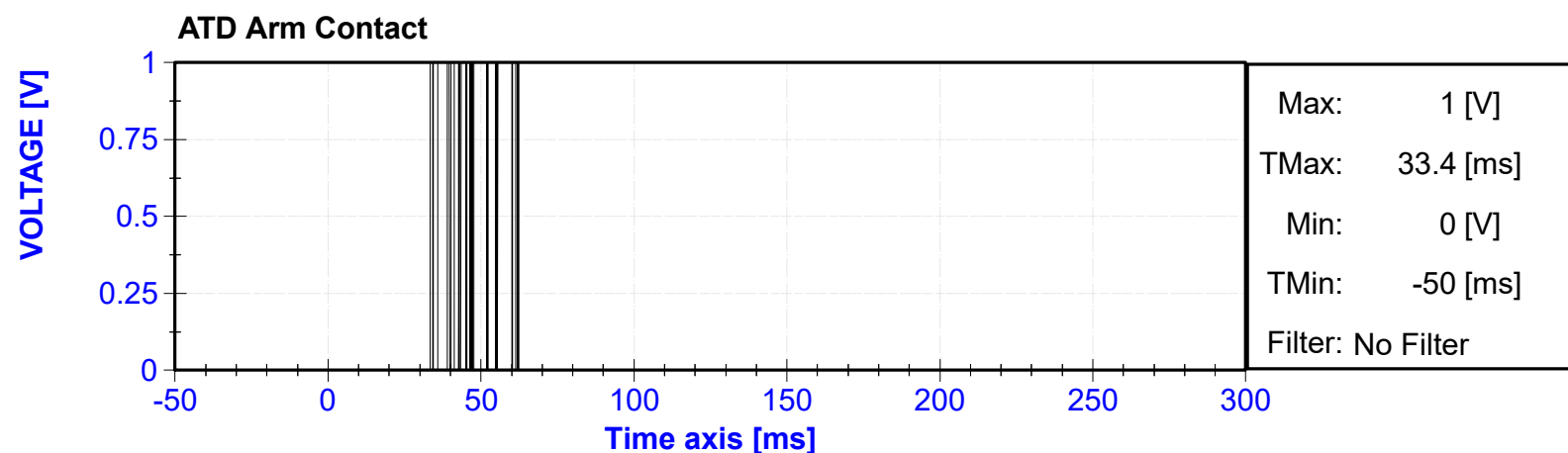
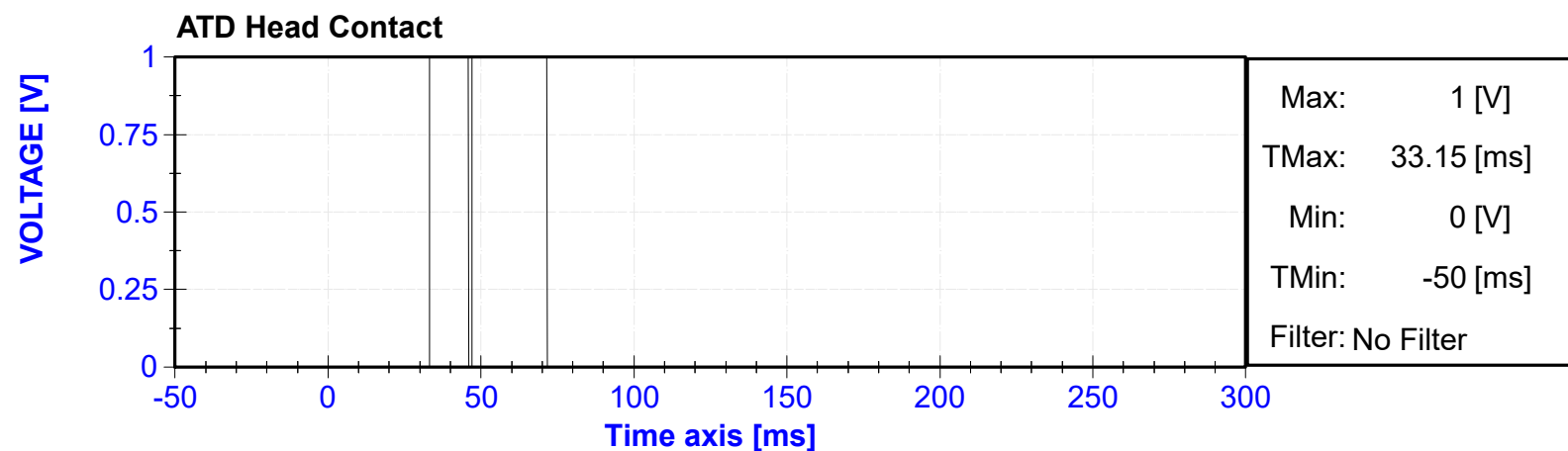


ATD Pelvis Contact

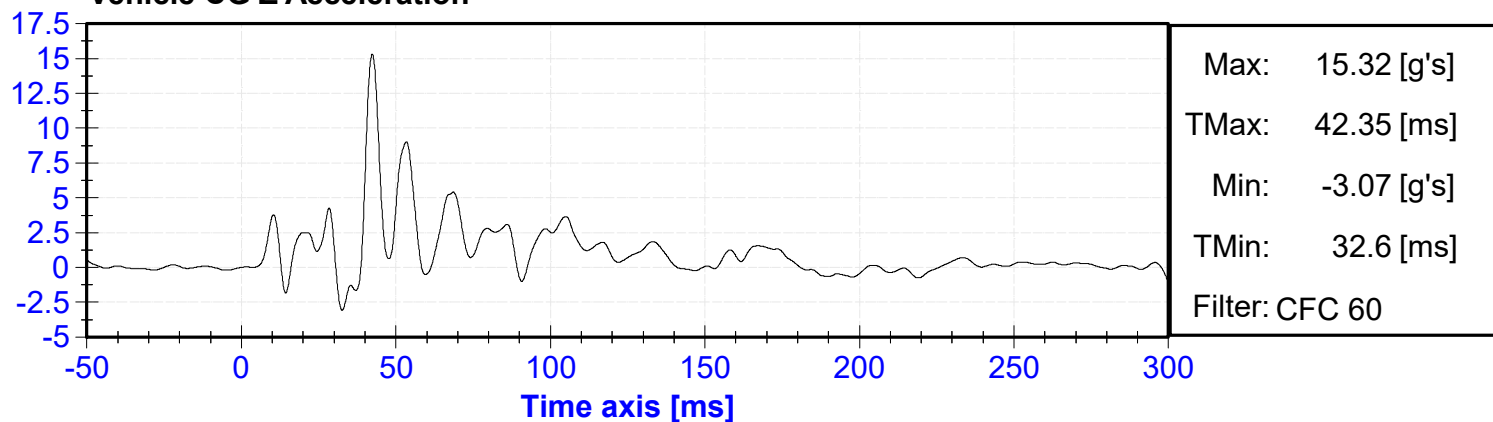


ATD Thorax Contact

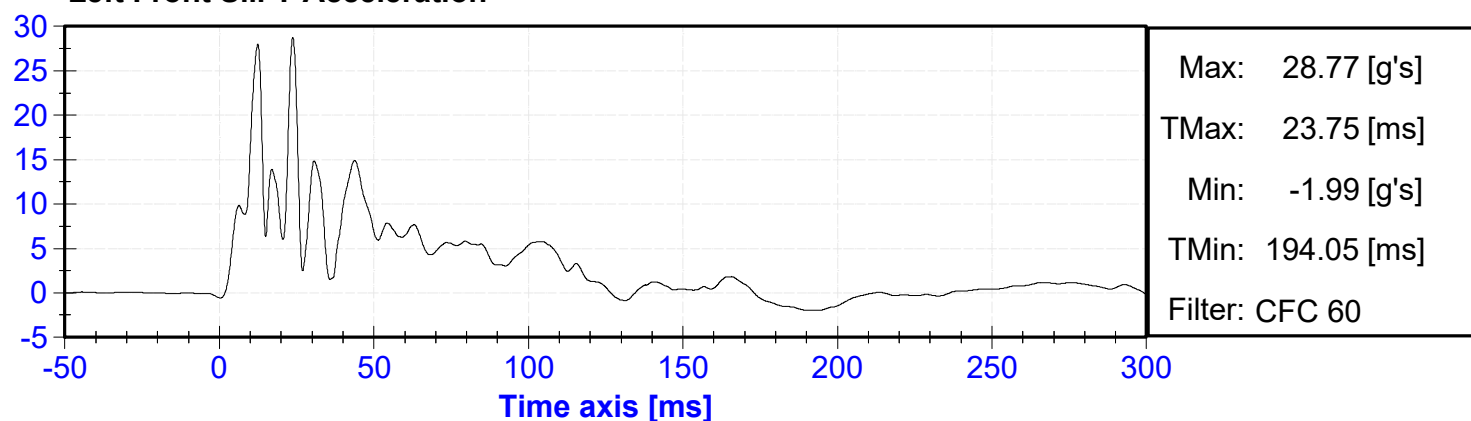




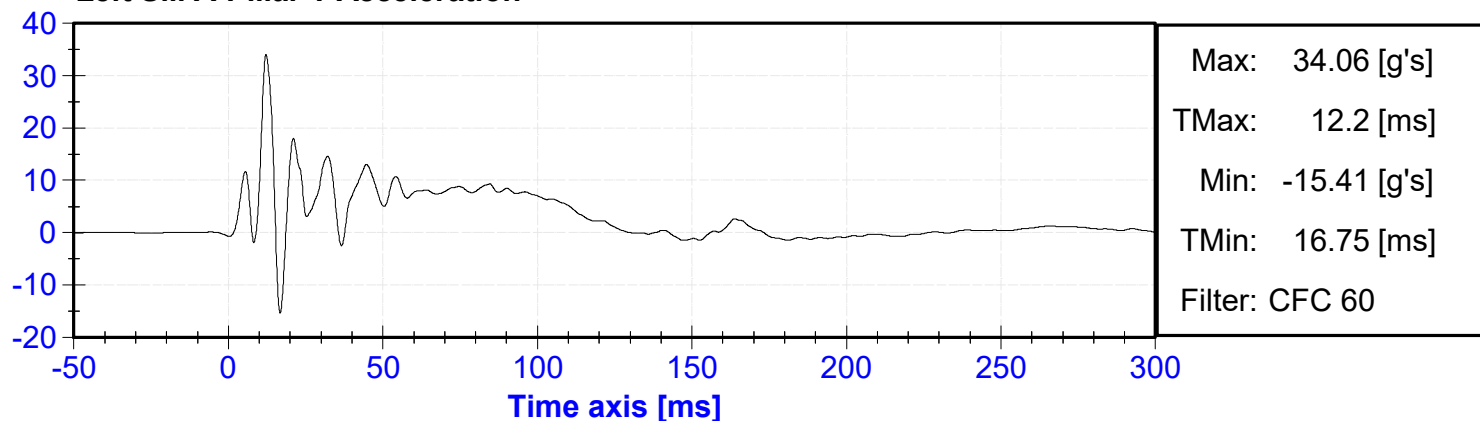
Vehicle CG Z Acceleration



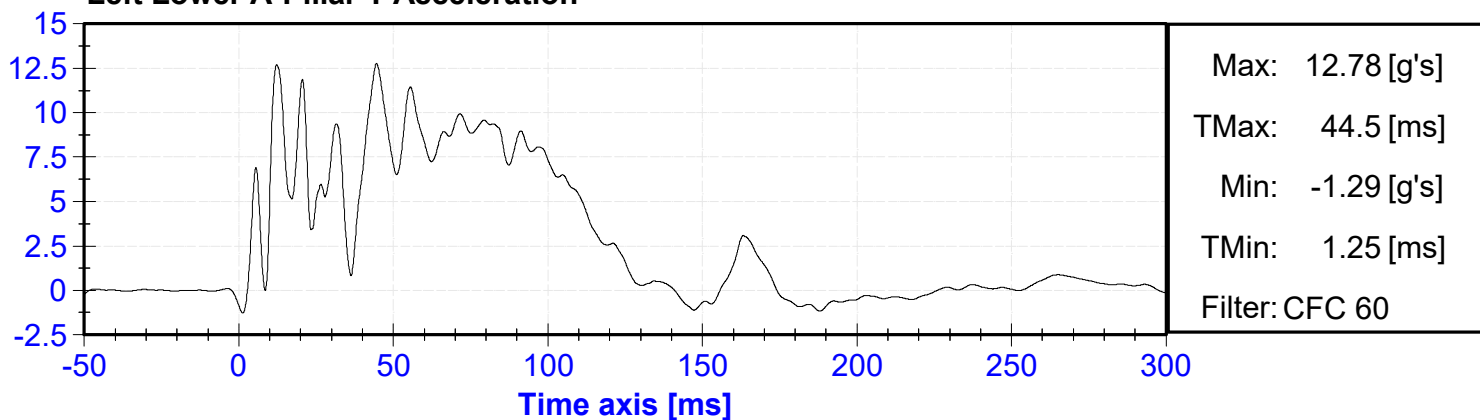
Left Front Sill Y Acceleration



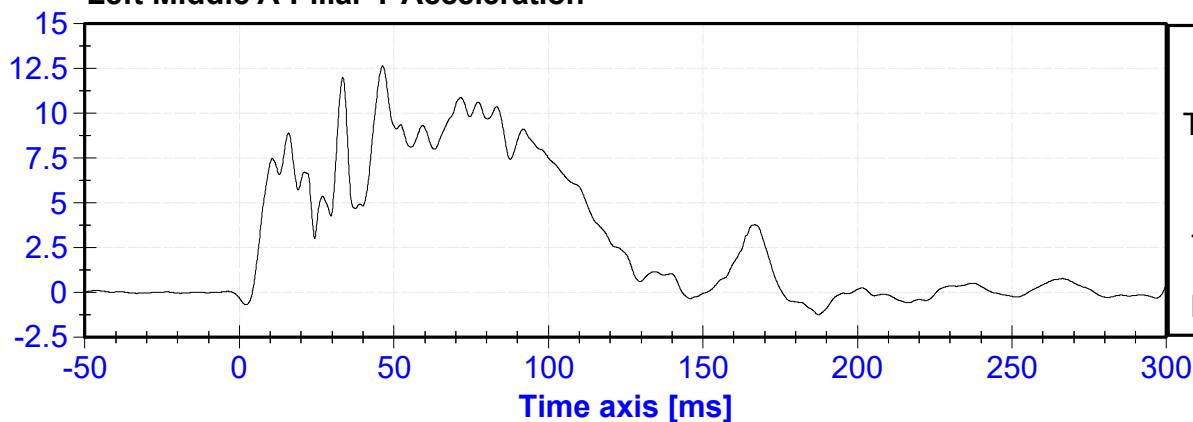
Left Sill A-Pillar Y Acceleration



Left Lower A-Pillar Y Acceleration

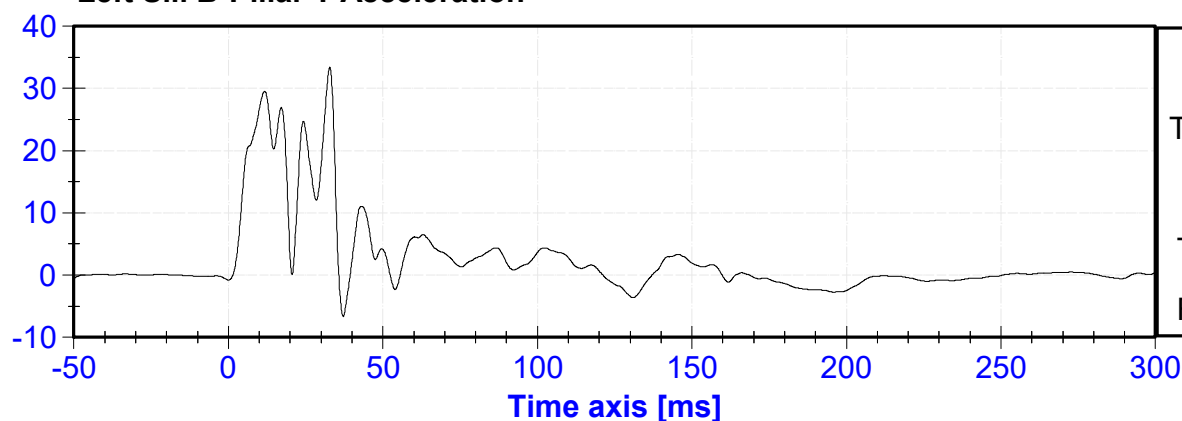


Left Middle A-Pillar Y Acceleration

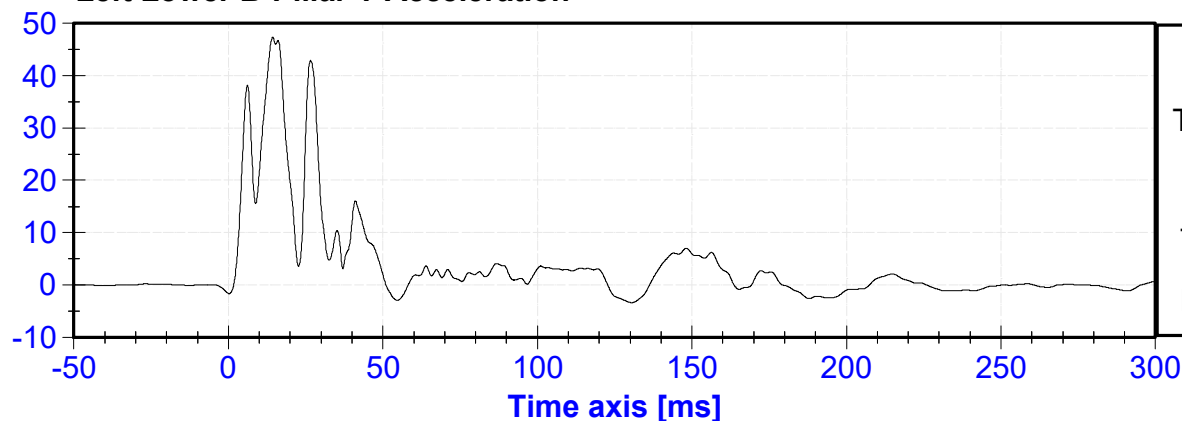


Left Sill B-Pillar Y Acceleration

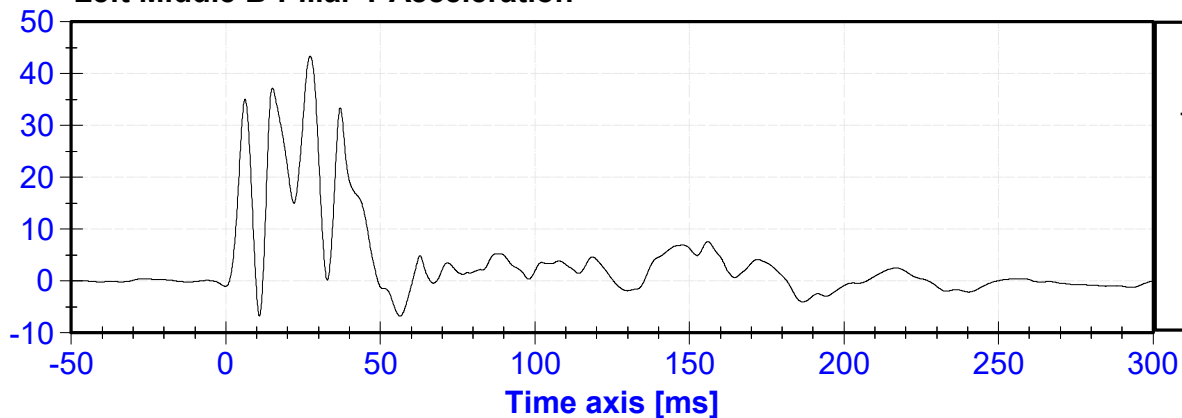
Exceeded calibration range at 19.2 ms



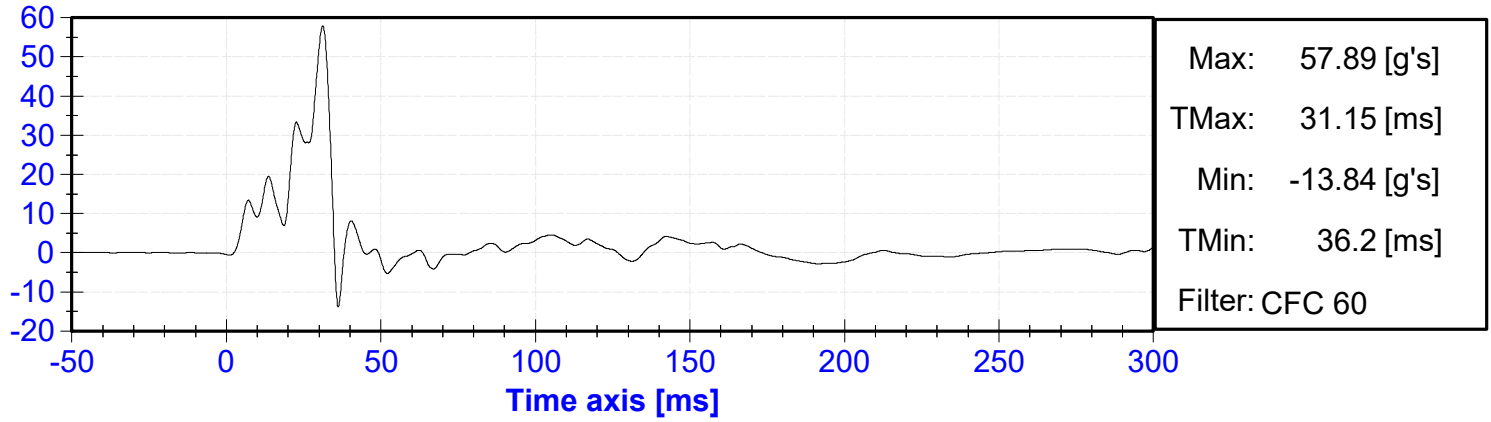
Left Lower B-Pillar Y Acceleration



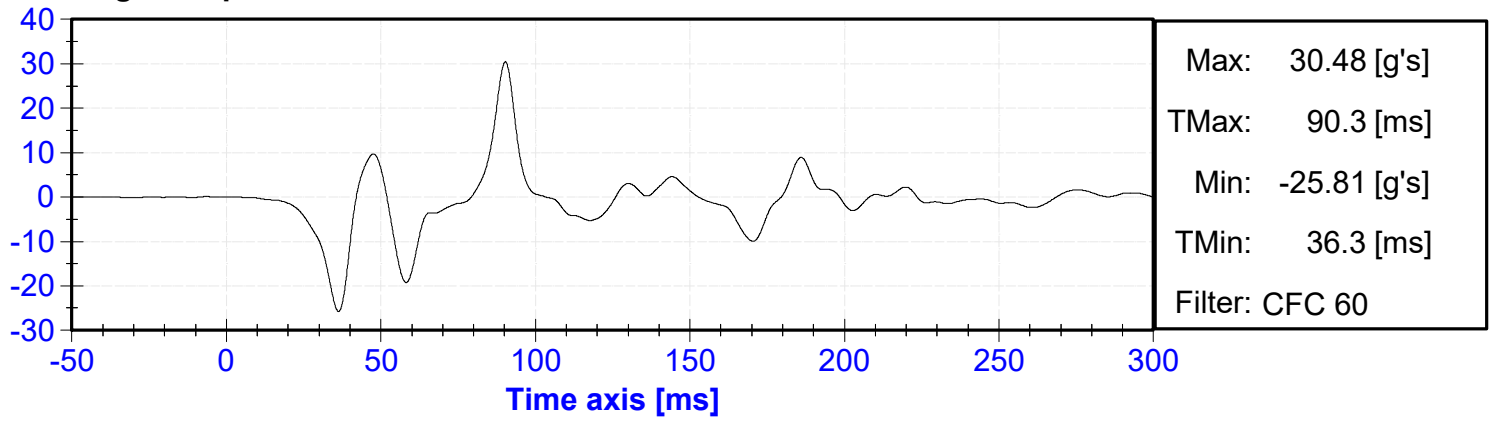
Left Middle B-Pillar Y Acceleration



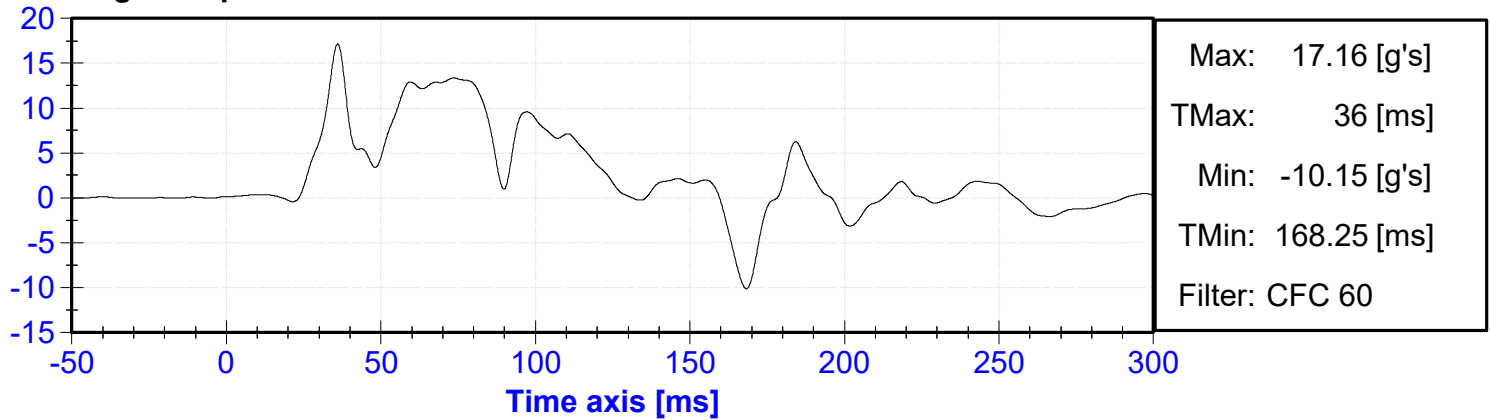
Front Seat Track Y Acceleration



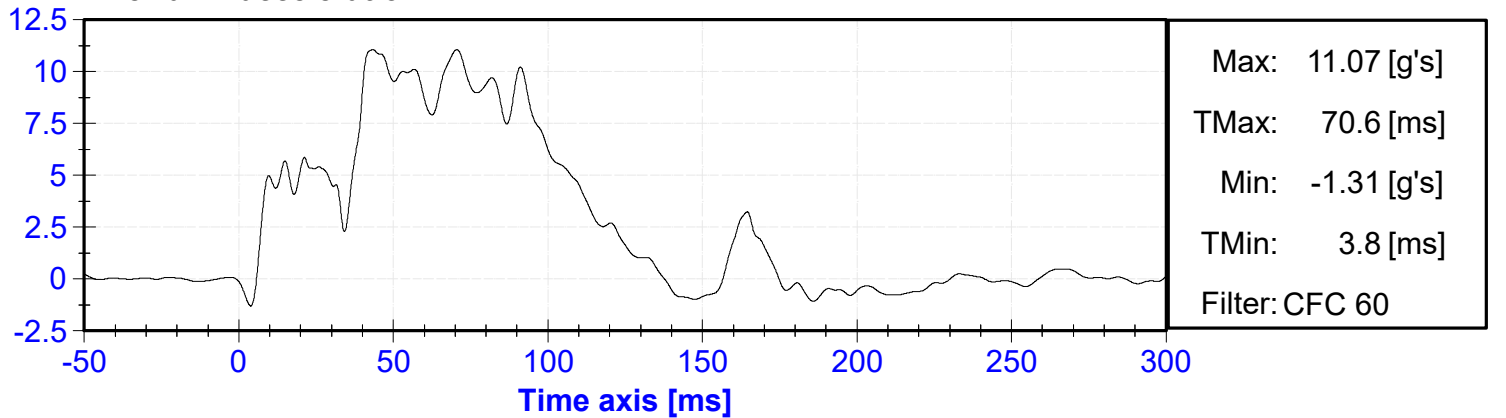
Engine Top X Acceleration



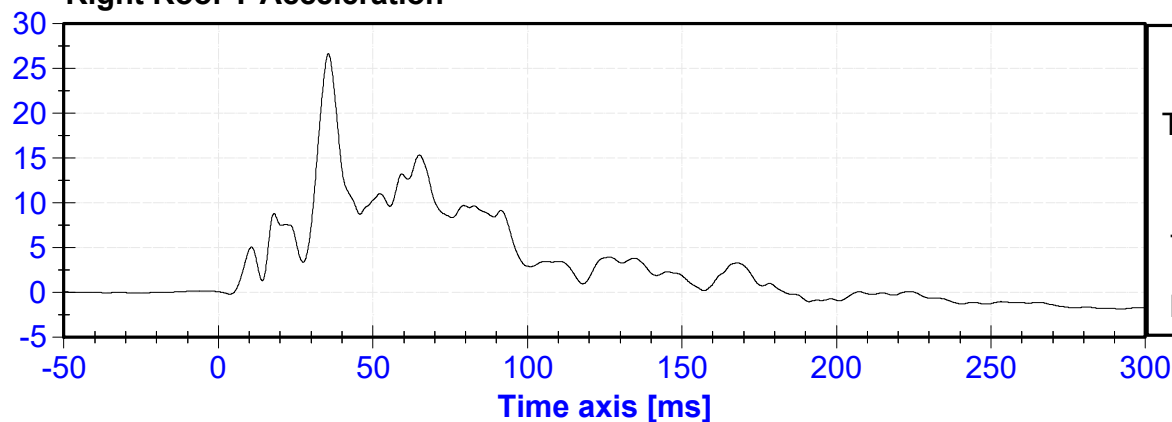
Engine Top Y Acceleration



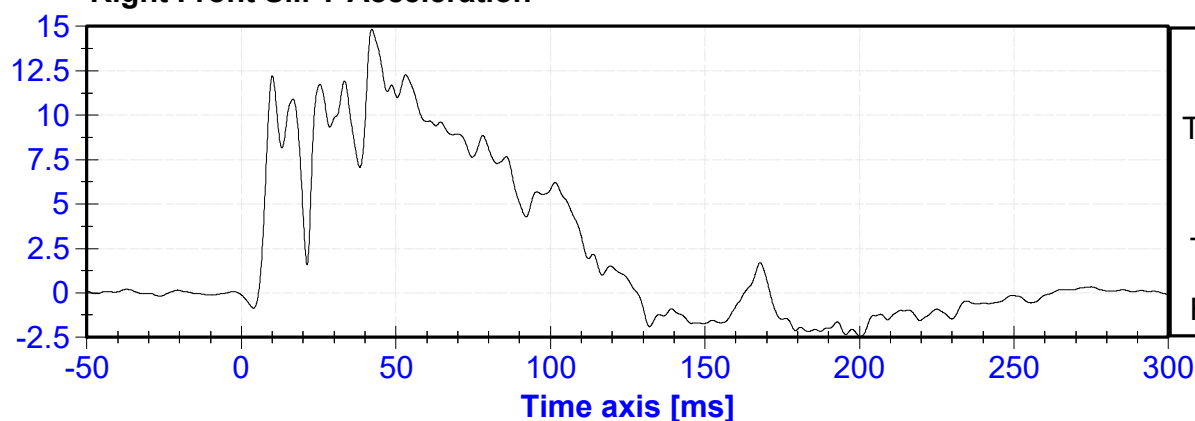
Firewall Y acceleration



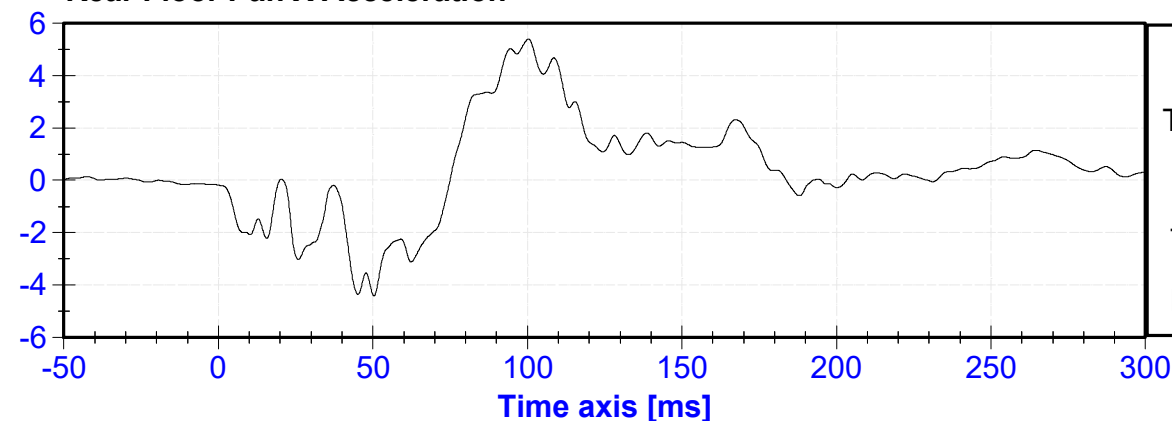
Right Roof Y Acceleration



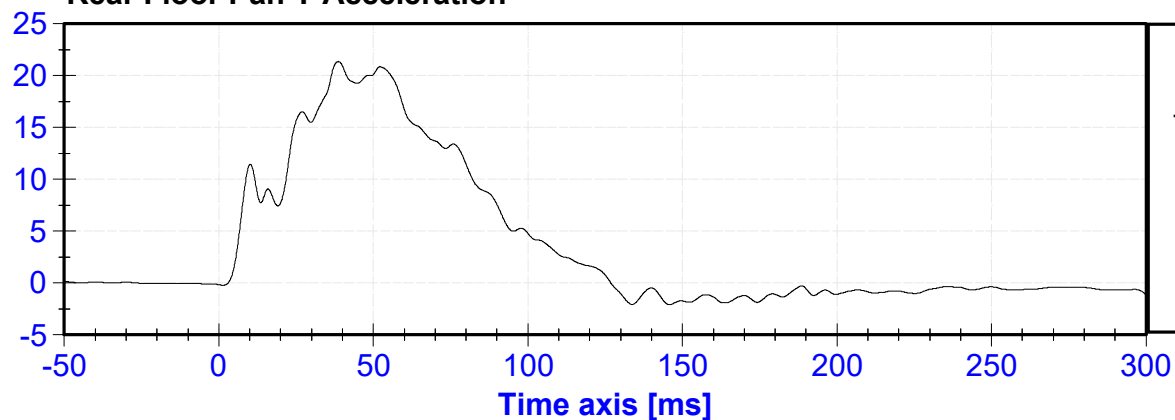
Right Front Sill Y Acceleration



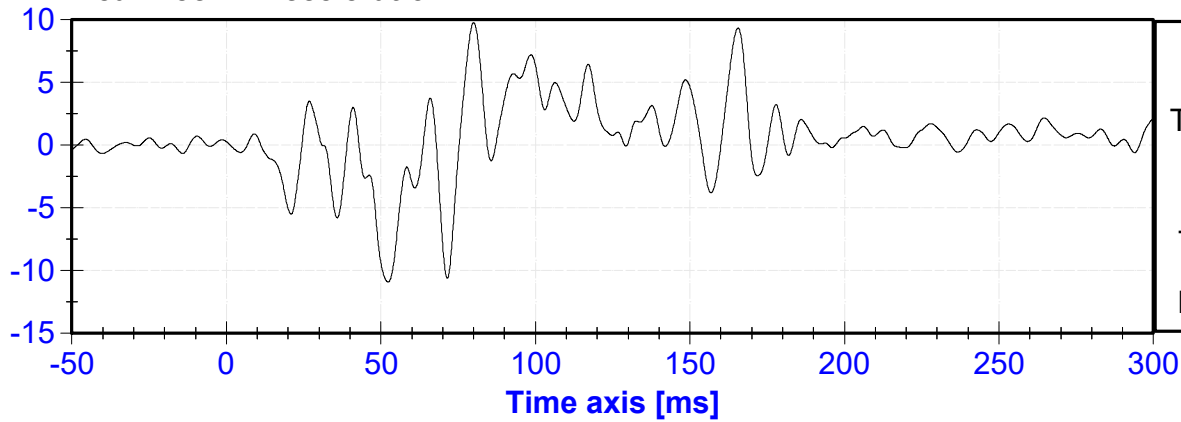
Rear Floor Pan X Acceleration



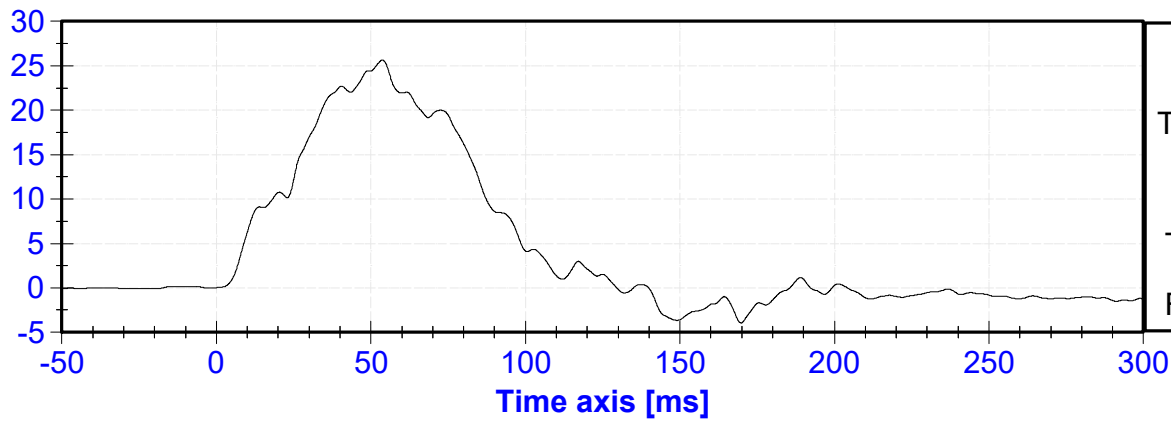
Rear Floor Pan Y Acceleration



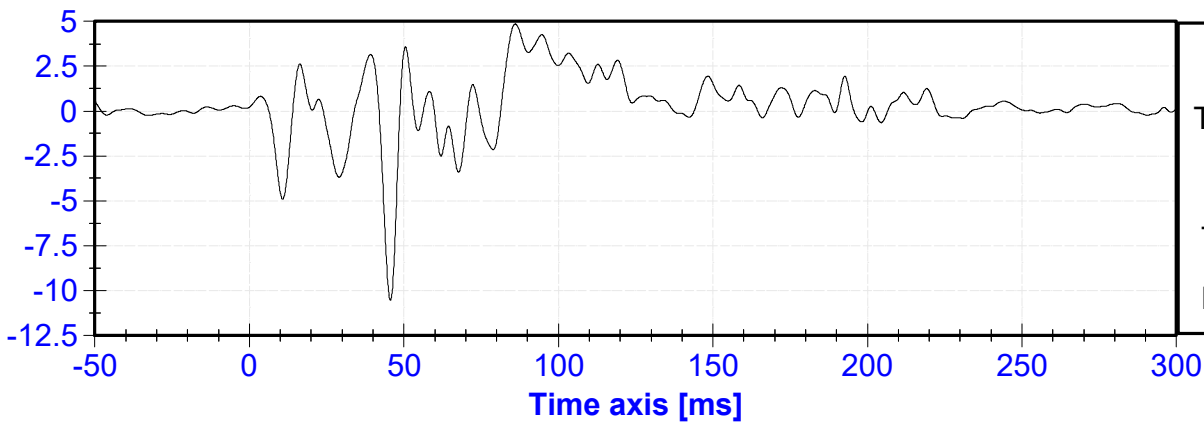
Rear Deck X Acceleration



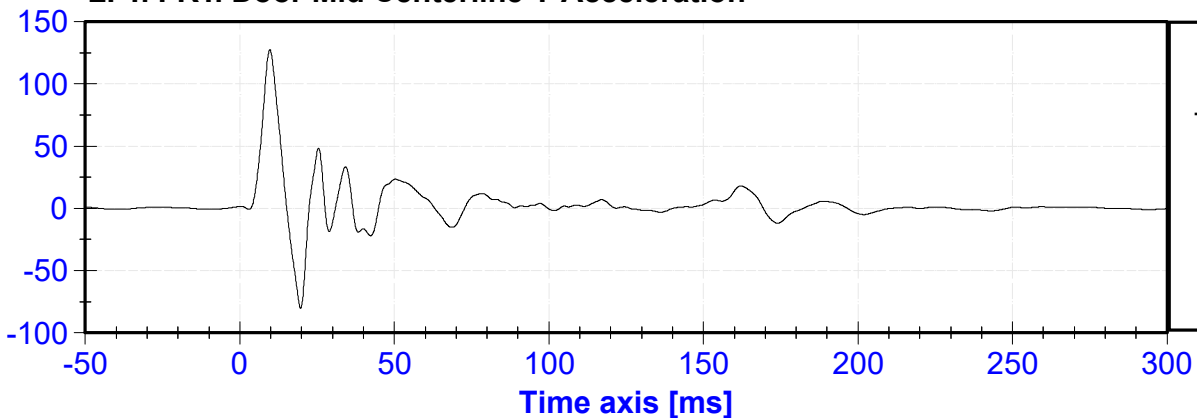
Rear Deck Y Acceleration



Rear Deck Z Acceleration

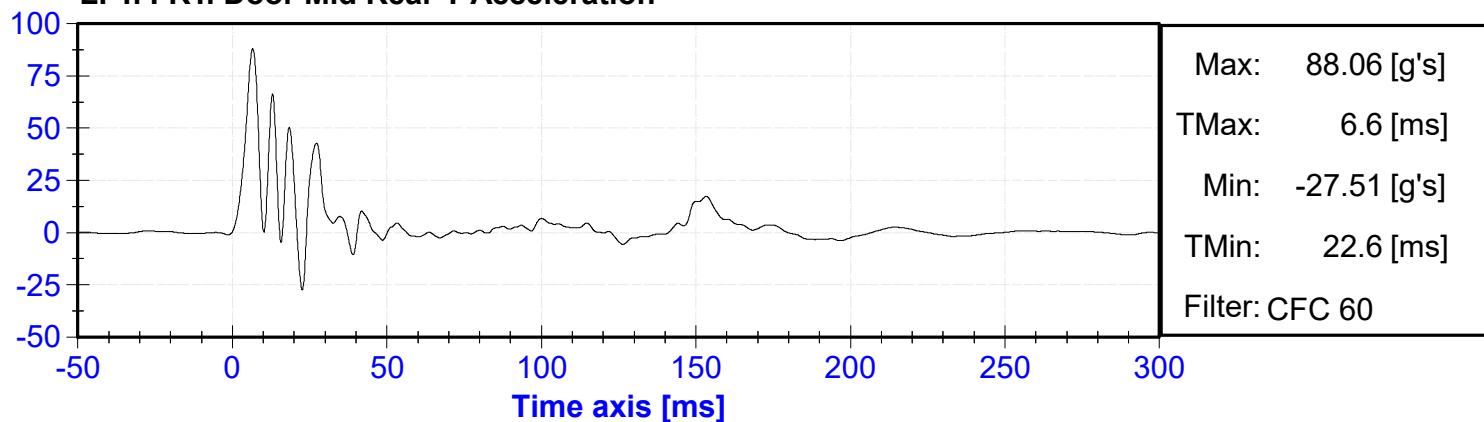


LFT. FRT. Door Mid Centerline Y Acceleration

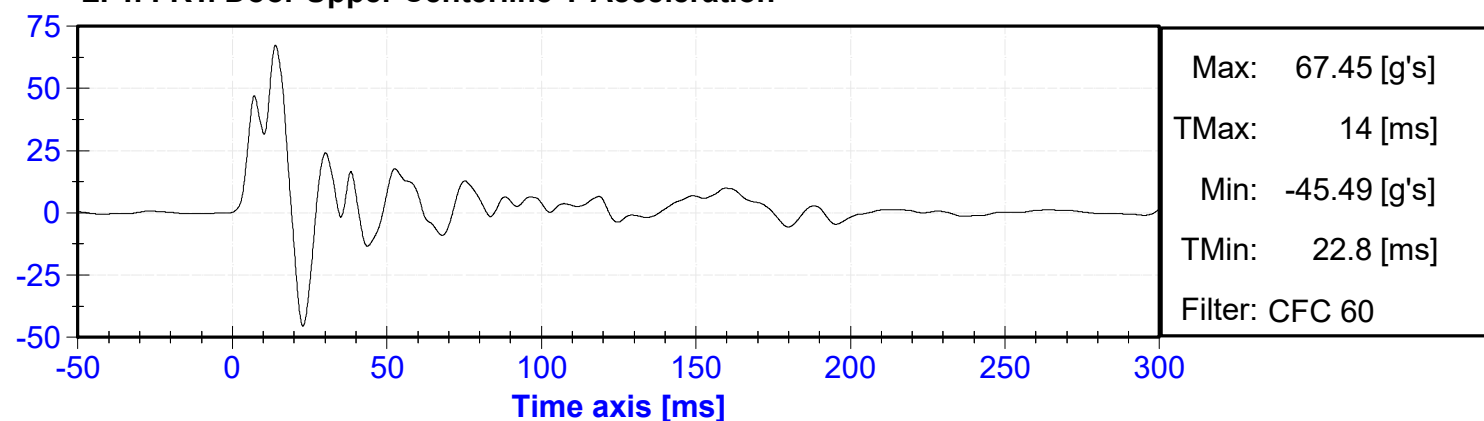


Exceeded calibration range at 23.3 ms

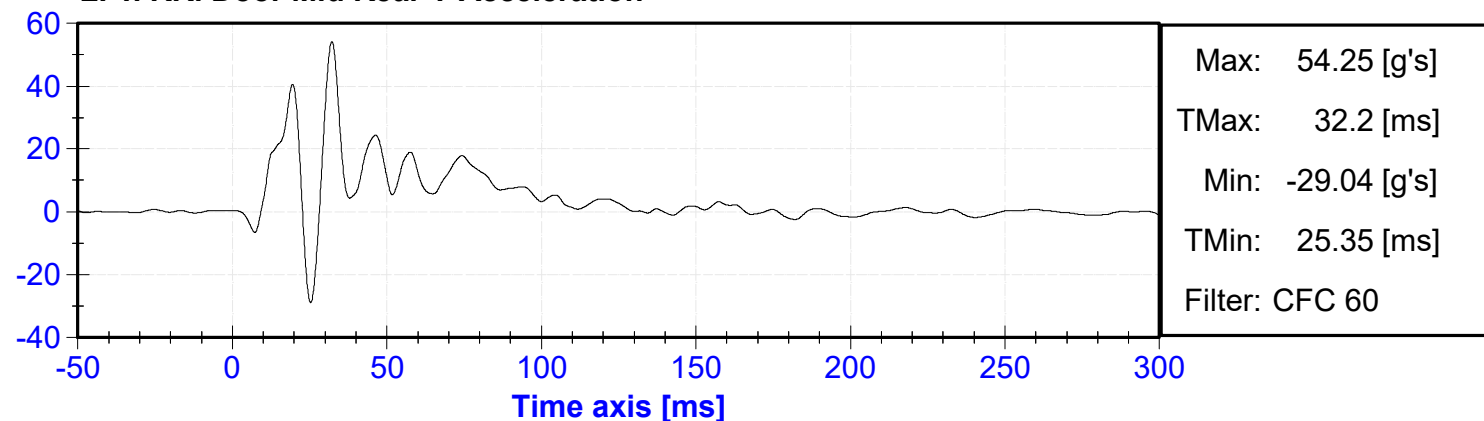
LFT. FRT. Door Mid Rear Y Acceleration



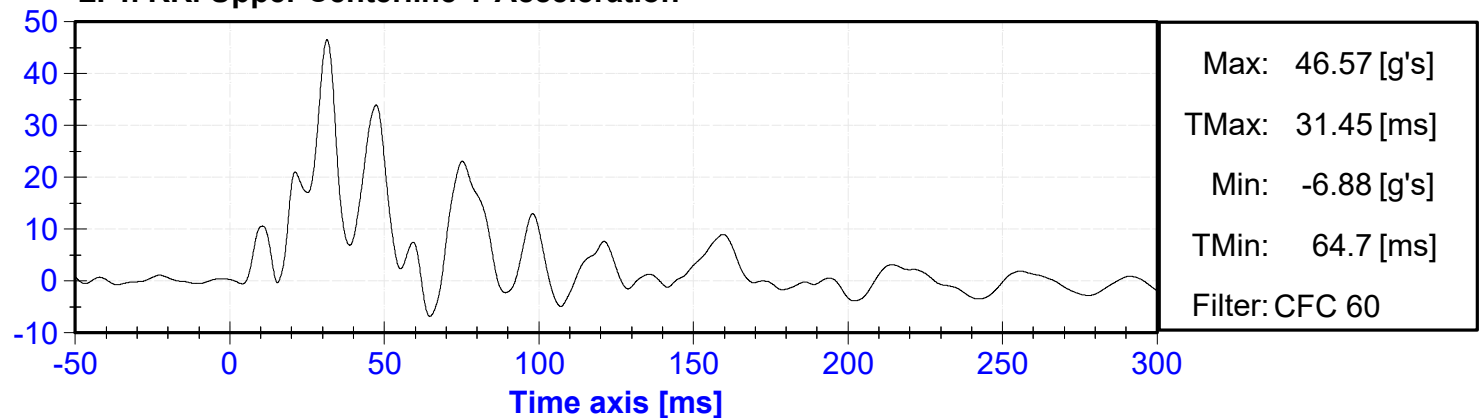
LFT. FRT. Door Upper Centerline Y Acceleration



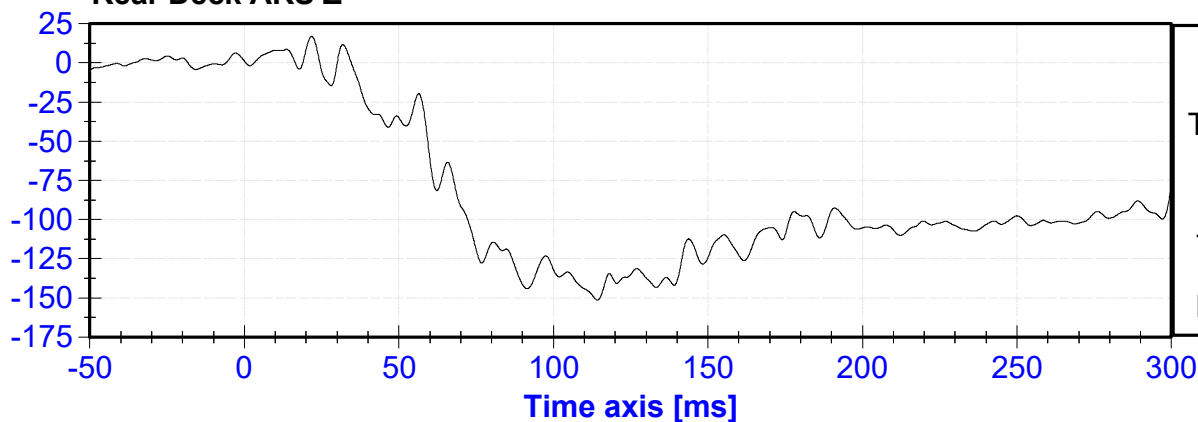
LFT. RR. Door Mid Rear Y Acceleration



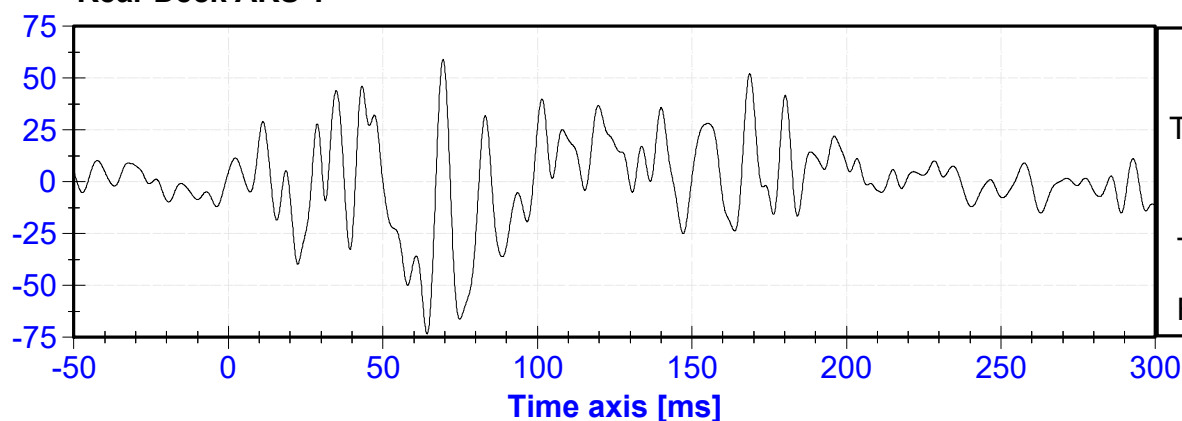
LFT. RR. Upper Centerline Y Acceleration



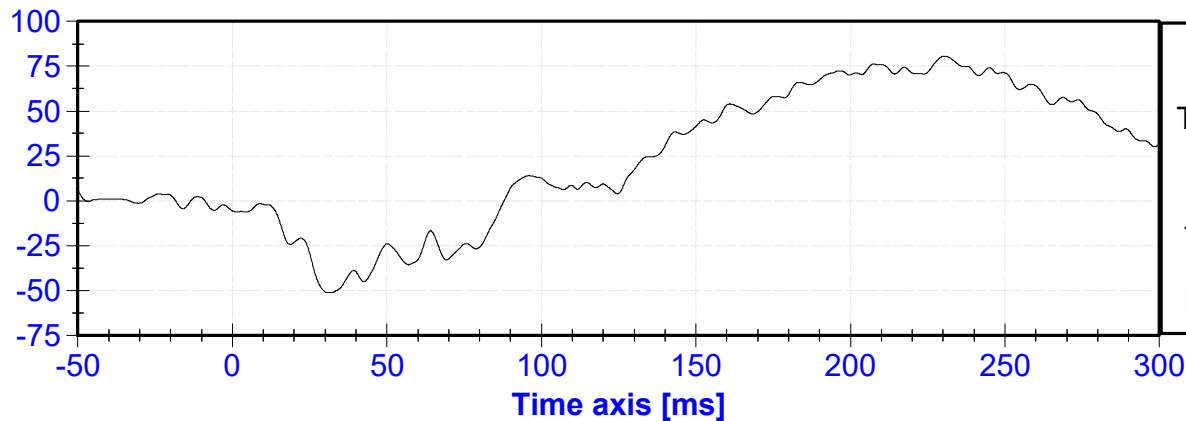
Rear Deck ARS Z



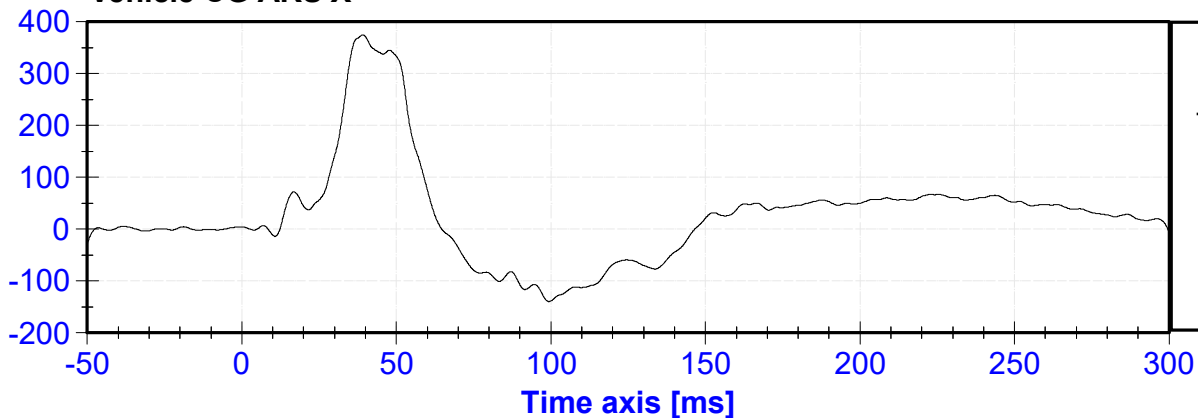
Rear Deck ARS Y



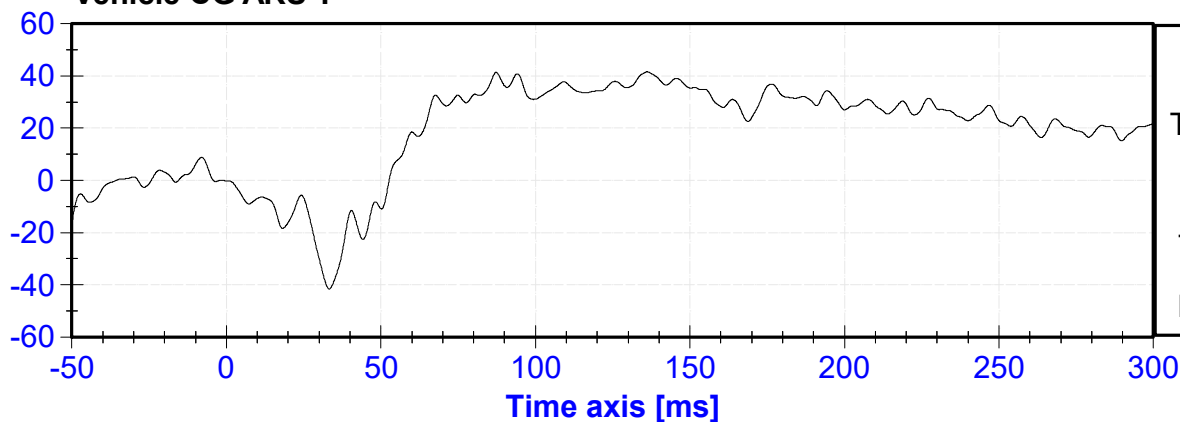
Rear Deck ARS X



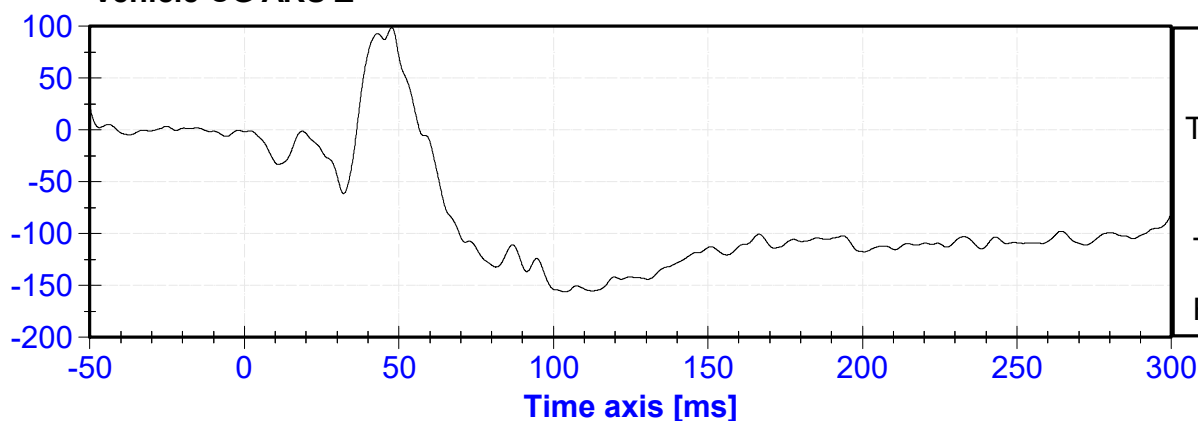
Vehicle CG ARS X



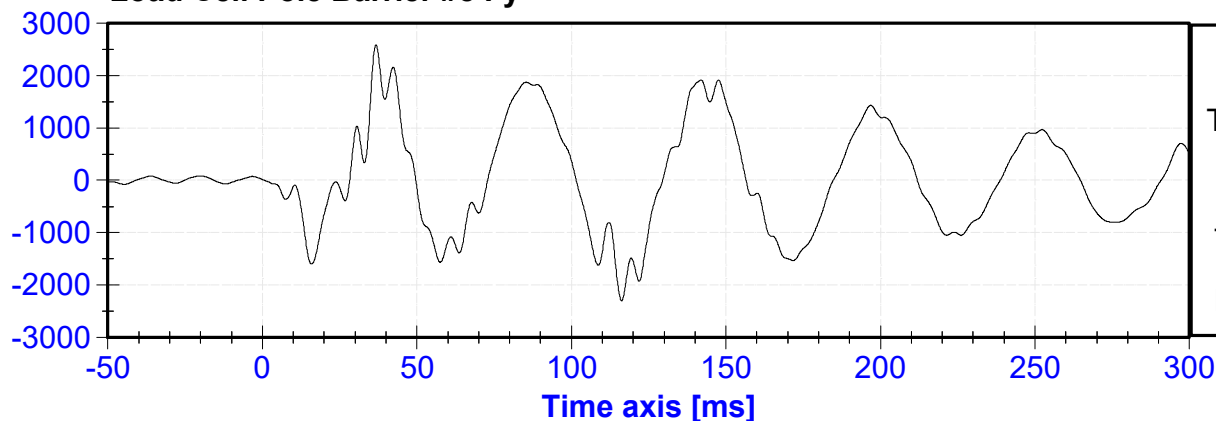
Vehicle CG ARS Y



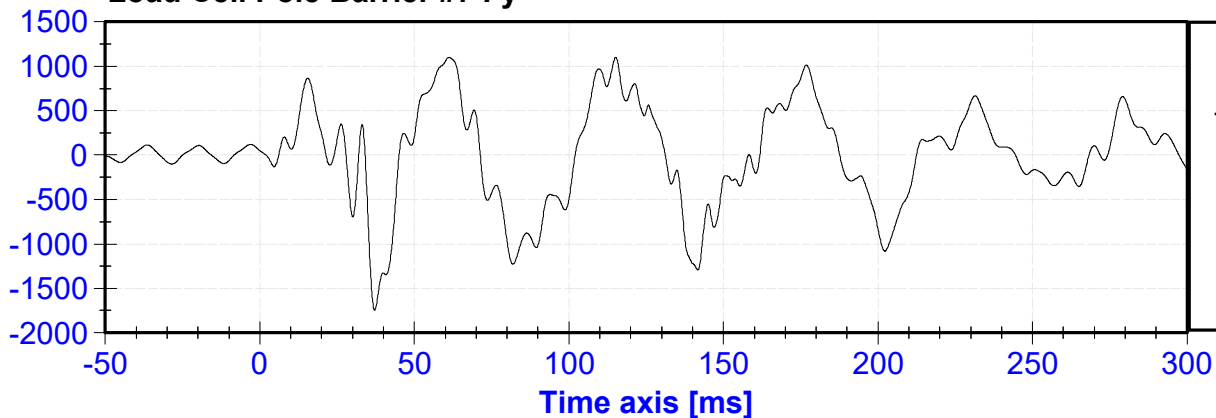
Vehicle CG ARS Z



Load Cell Pole Barrier #8 Fy

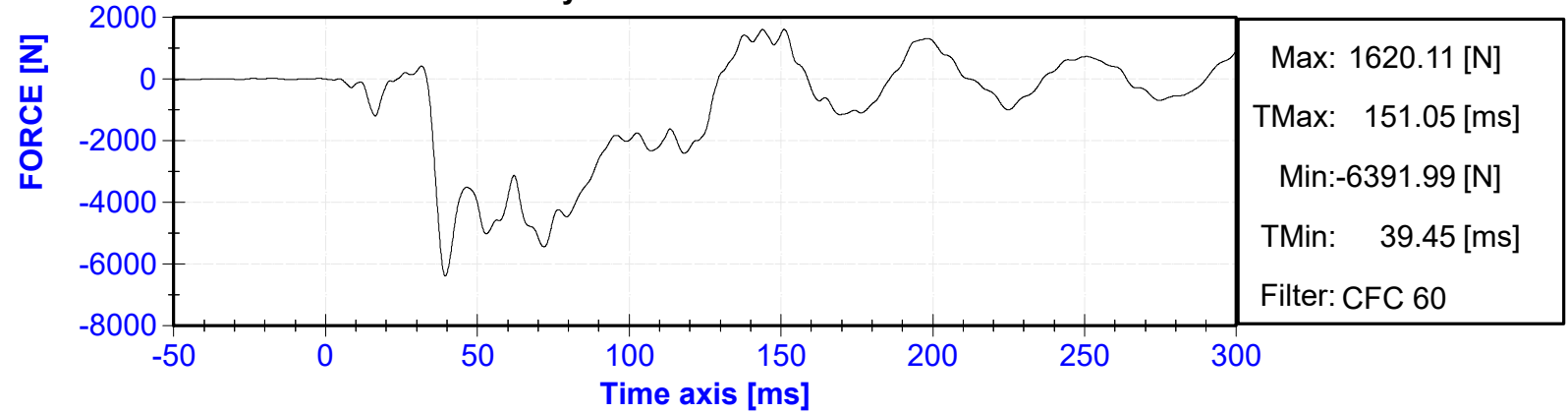


Load Cell Pole Barrier #7 Fy

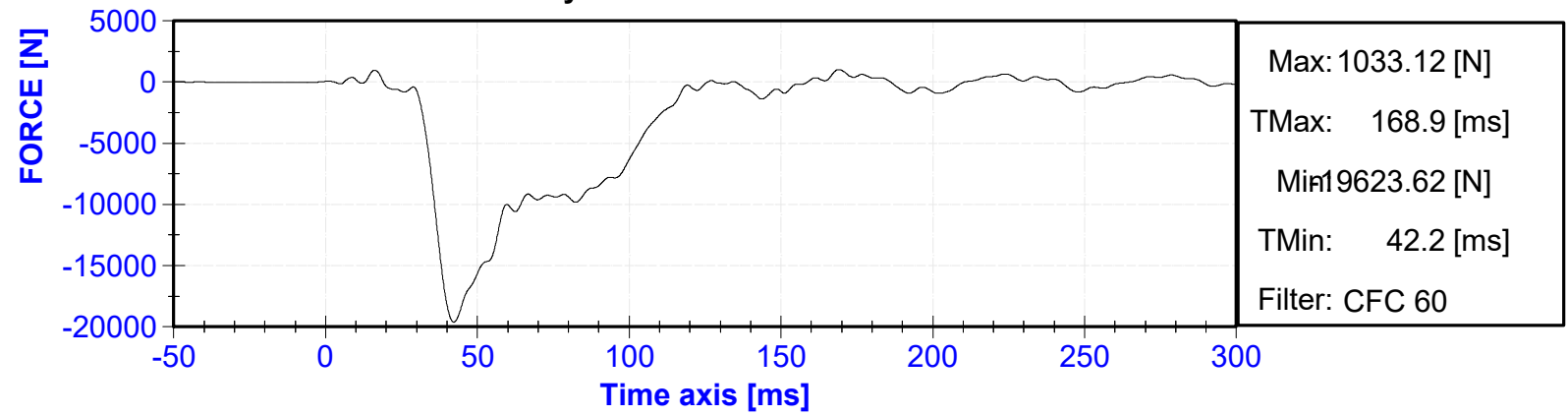


Failed to return to zero

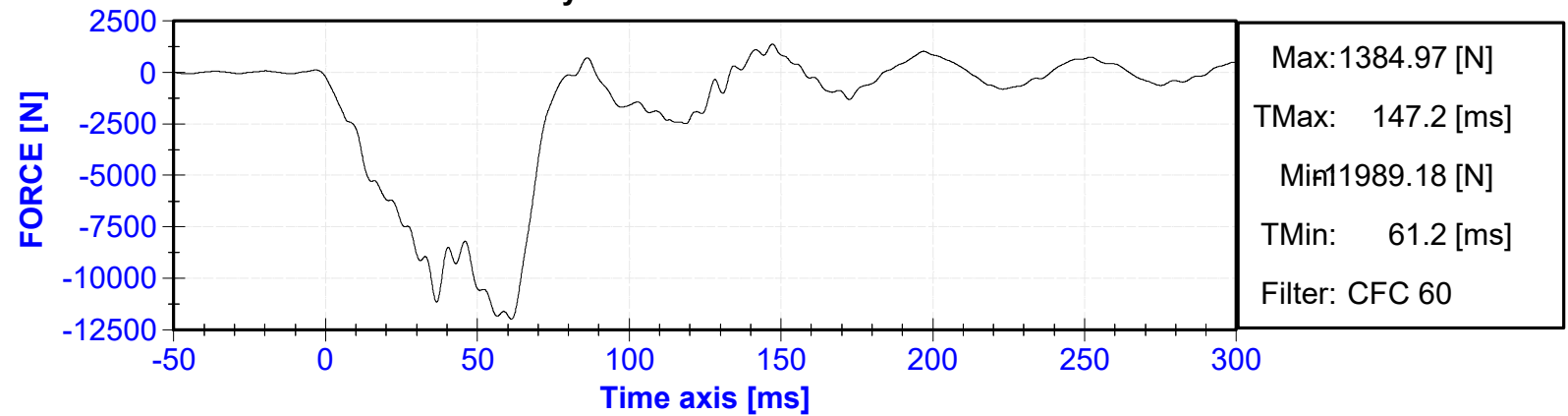
Load Cell Pole Barrier #6 Fy



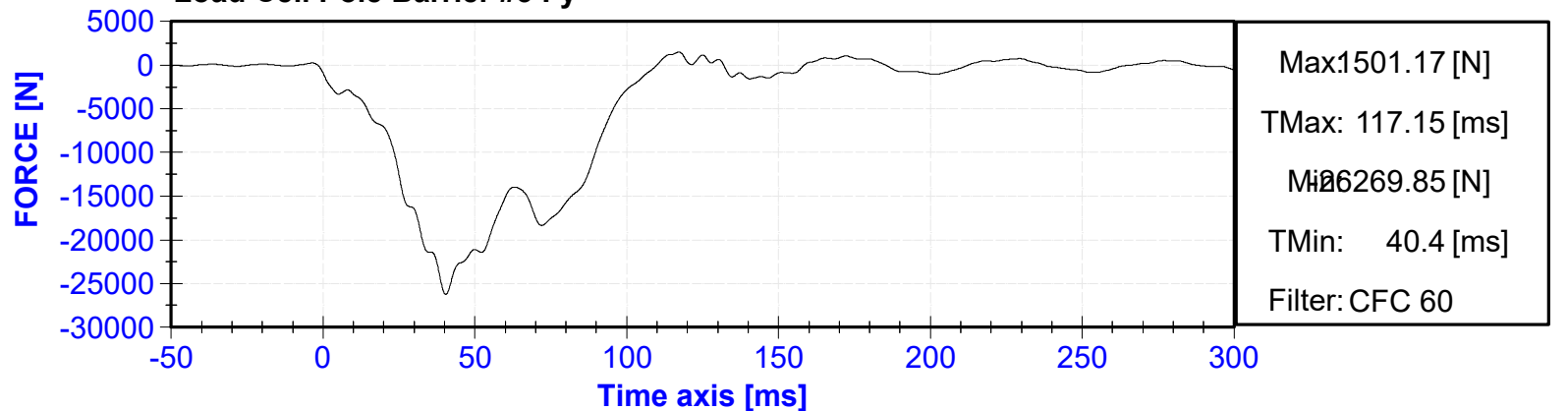
Load Cell Pole Barrier #5 Fy

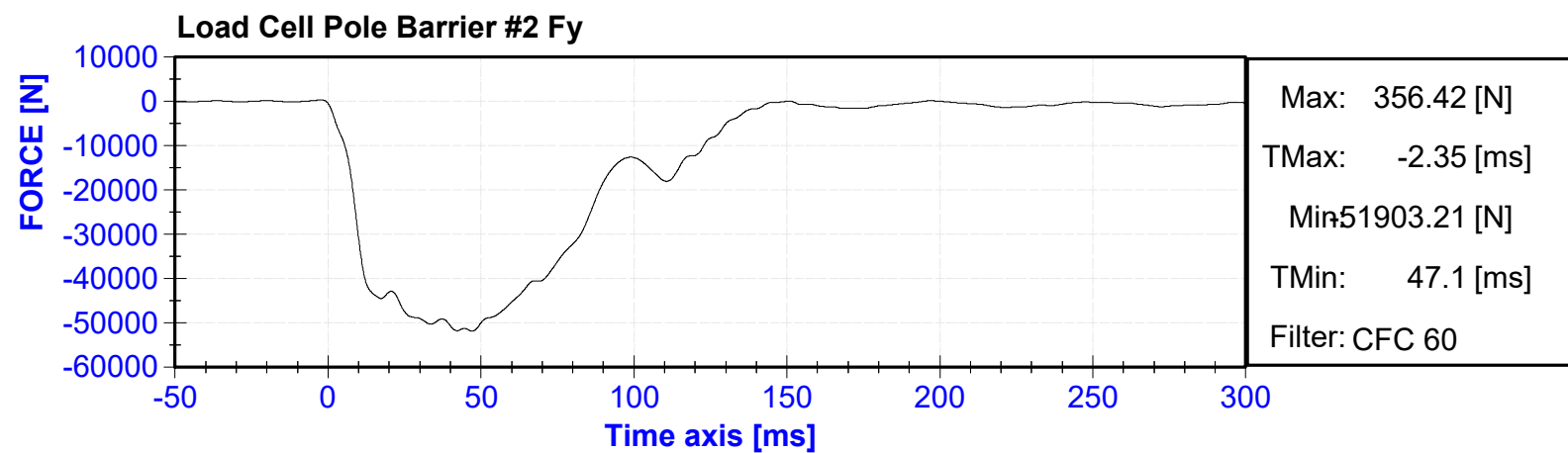


Load Cell Pole Barrier #4 Fy

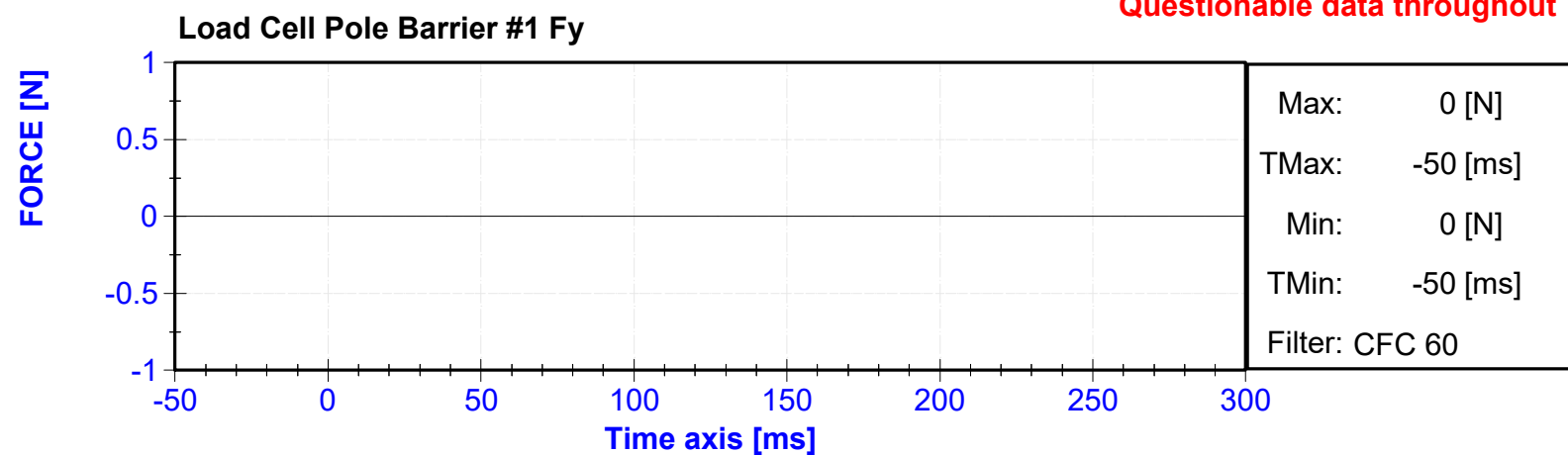


Load Cell Pole Barrier #3 Fy





Questionable data throughout



APPENDIX C

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

ES-2RE 5TH PERCENTILE MALE - DRIVER ATD

SERIAL NO:F034

(CONFIGURED FOR LEFT SIDE IMPACT)

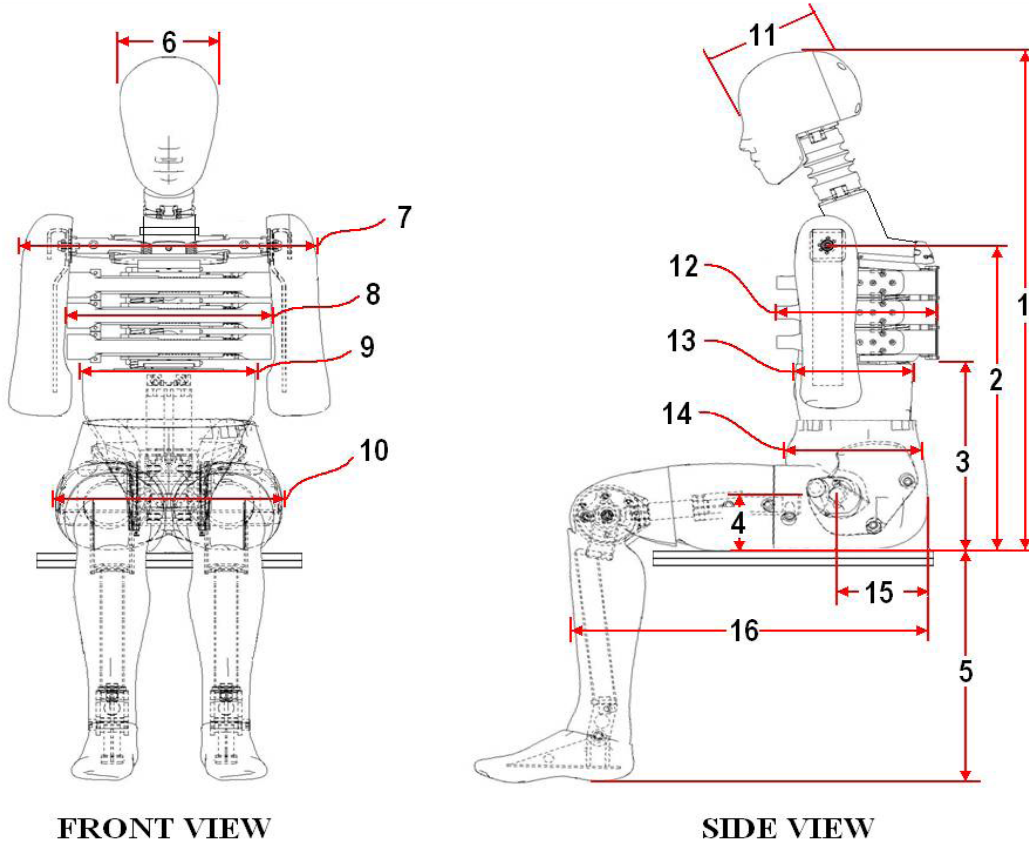


External Measurements - EuroSID-2re

Technician: K. Brogan

Date: 05/02/2023

Dummy Serial Number: F034



FRONT VIEW

SIDE VIEW

Dim. No.	Description	Specification (mm)		Result (mm)	Pass/Fail
1	Sitting Height	900	918	914	Pass
2	Seat to Shoulder Joint	558	572	569	Pass
3	Seat to Lower Face of Thoracic Spine Box	346	356	352	Pass
4	Seat to Hip Joint (center of bolt)	97	103	101	Pass
5	Sole to Seat, Sitting	333	451	425	Pass
6	Head Width	152	158	154	Pass
7	Shoulder/Arm Width	461	479	472	Pass
8	Thorax Width	322	332	329	Pass
9	Abdomen Width	273	287	284	Pass
10	Pelvis Lap Width	359	373	367	Pass
11	Head Depth	196	206	202	Pass
12	Thorax Depth	262	272	269	Pass
13	Abdomen Depth	194	204	202	Pass
14	Pelvis Depth	235	245	240	Pass
15	Back of Buttocks to Hip Joint (center of bolt)	150	160	156	Pass
16	Back of Buttocks to Front Knee	597	615	609	Pass

ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

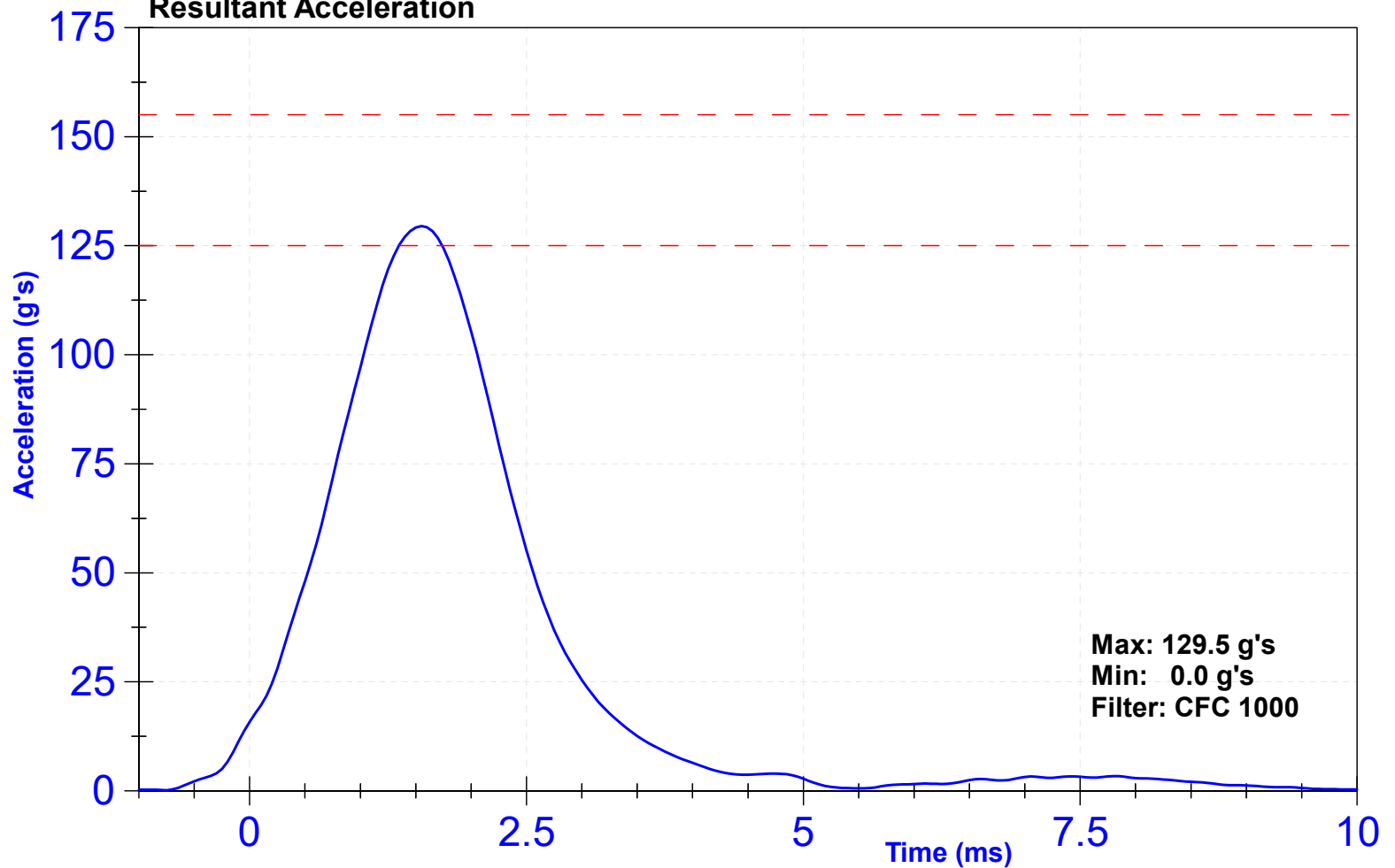
Results

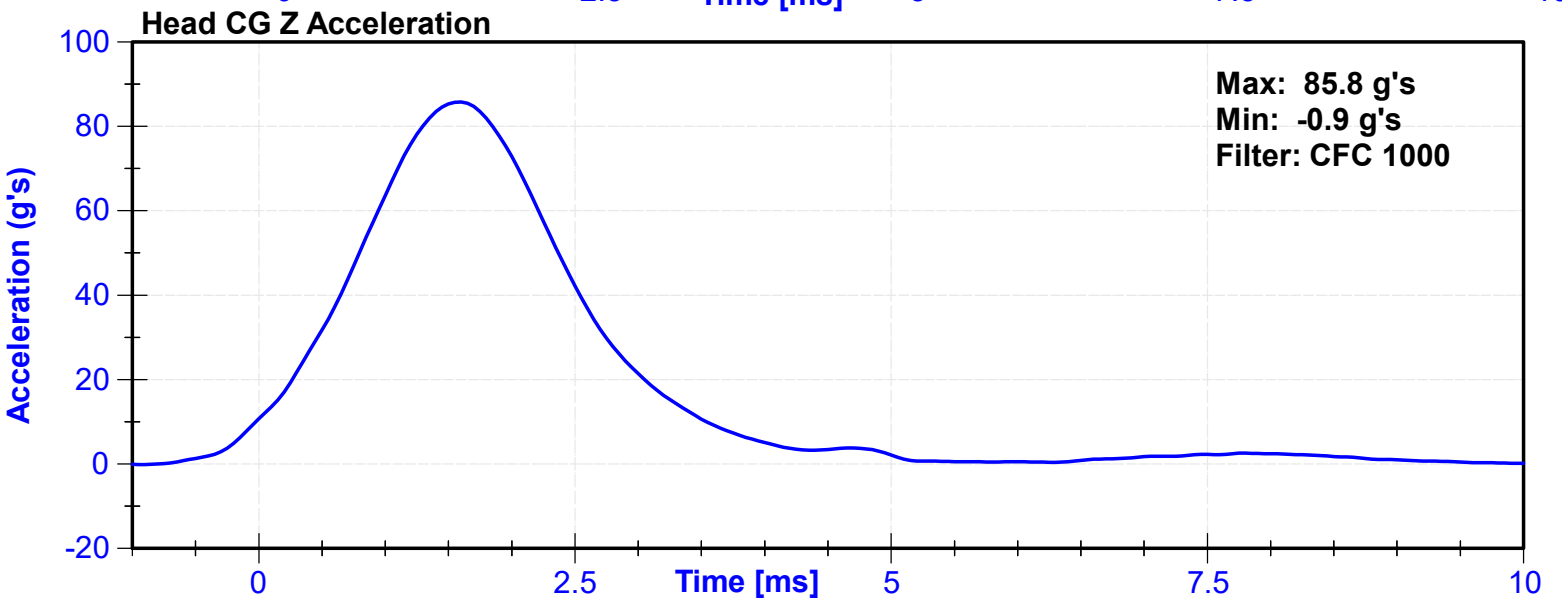
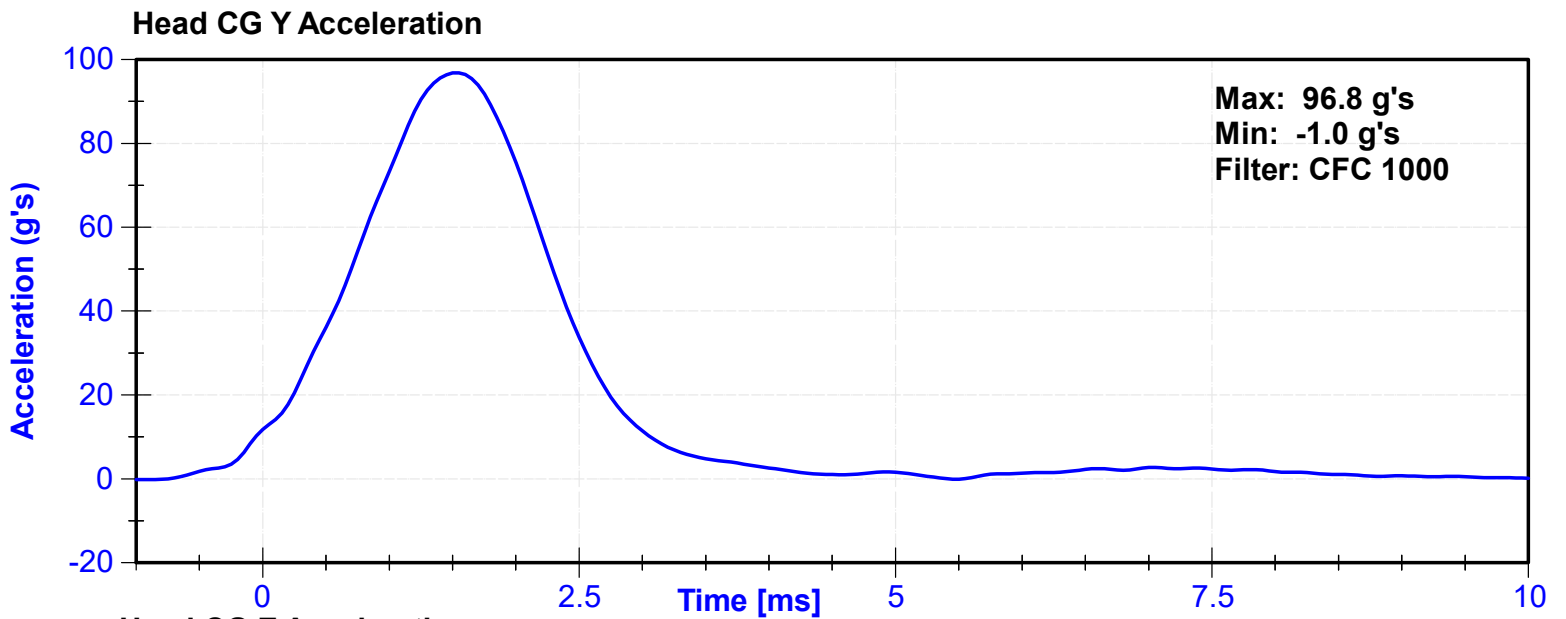
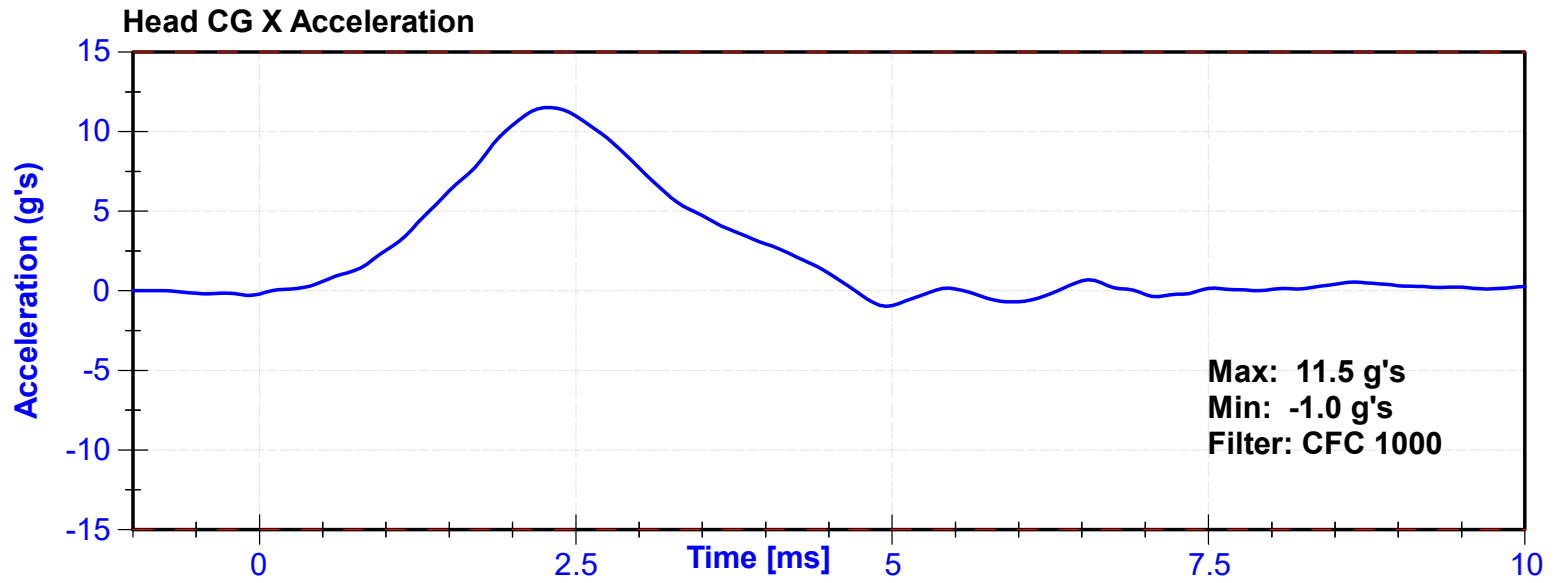
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Resultant Acceleration	125	155	g's	129.5	Pass
Oscillation	0	15	%	3.03	Pass
Fore-Aft Acceleration	-15	15	g's	11.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
X Accelerometer	Endevco	P51945	4/26/2023	10/23/2023
Y Accelerometer	Endevco	P51974	4/26/2023	10/23/2023
Z Accelerometer	Endevco	P51946	4/26/2023	10/23/2023

Resultant Acceleration





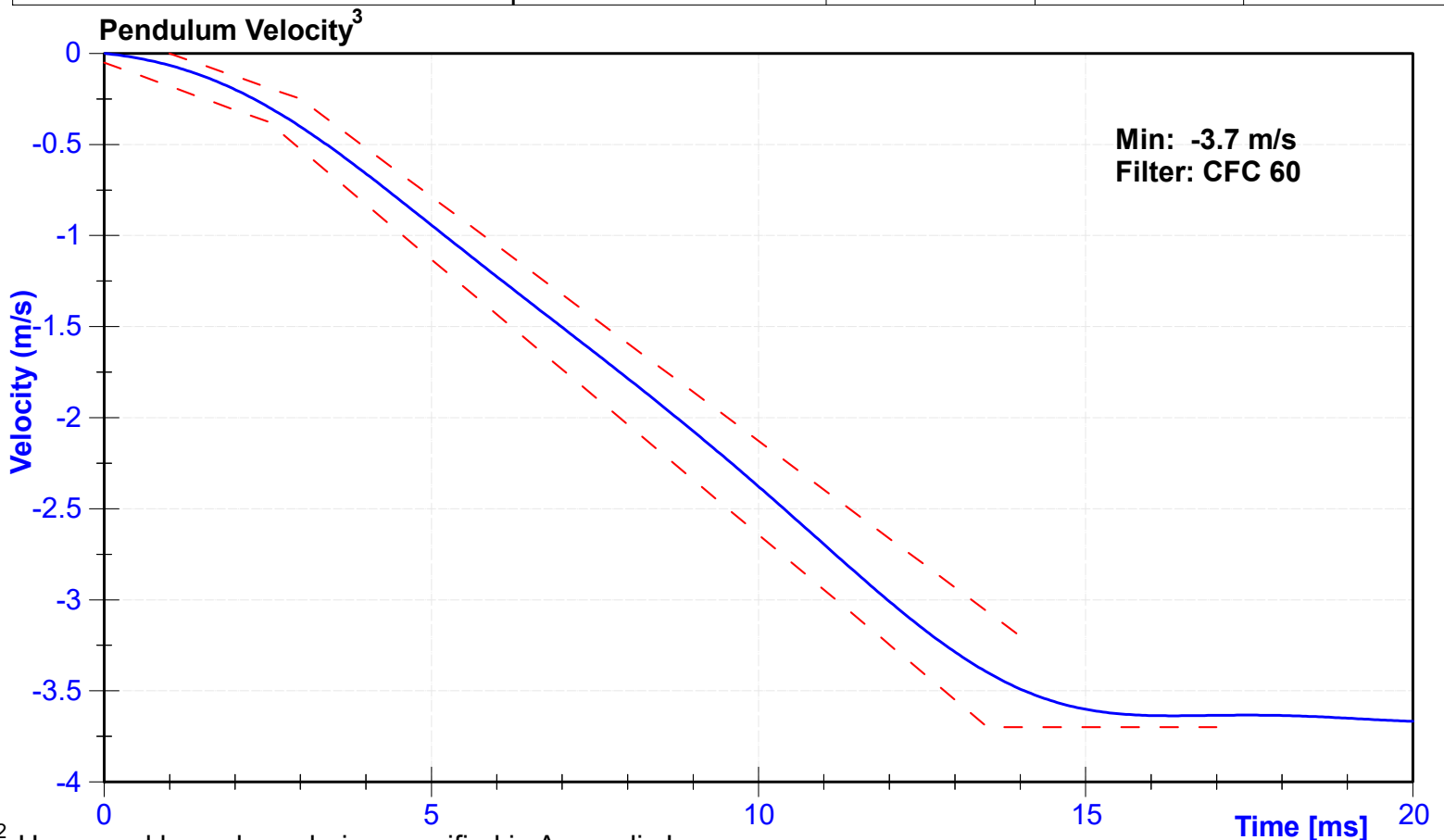
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	31.5	Pass
Velocity	3.3	3.5	m/s	3.44	Pass
Lateral Neck Rotation	49	59	deg	52.7	Pass
Time at Maximum Rotation	54	66	ms	56.6	Pass
Time of Rotation Decay from Maximum	53	88	ms	56.4	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

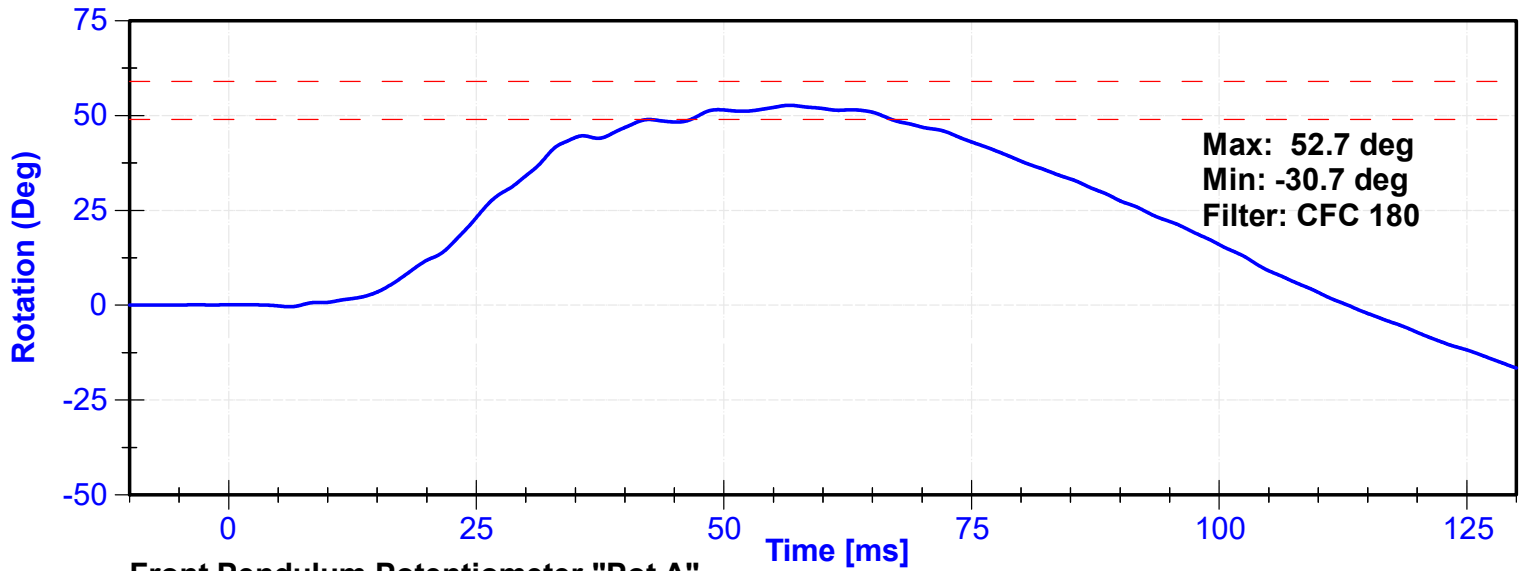
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Front Pendulum Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Headform Potentiometer	Sfernice	095	10/5/2022	10/5/2023

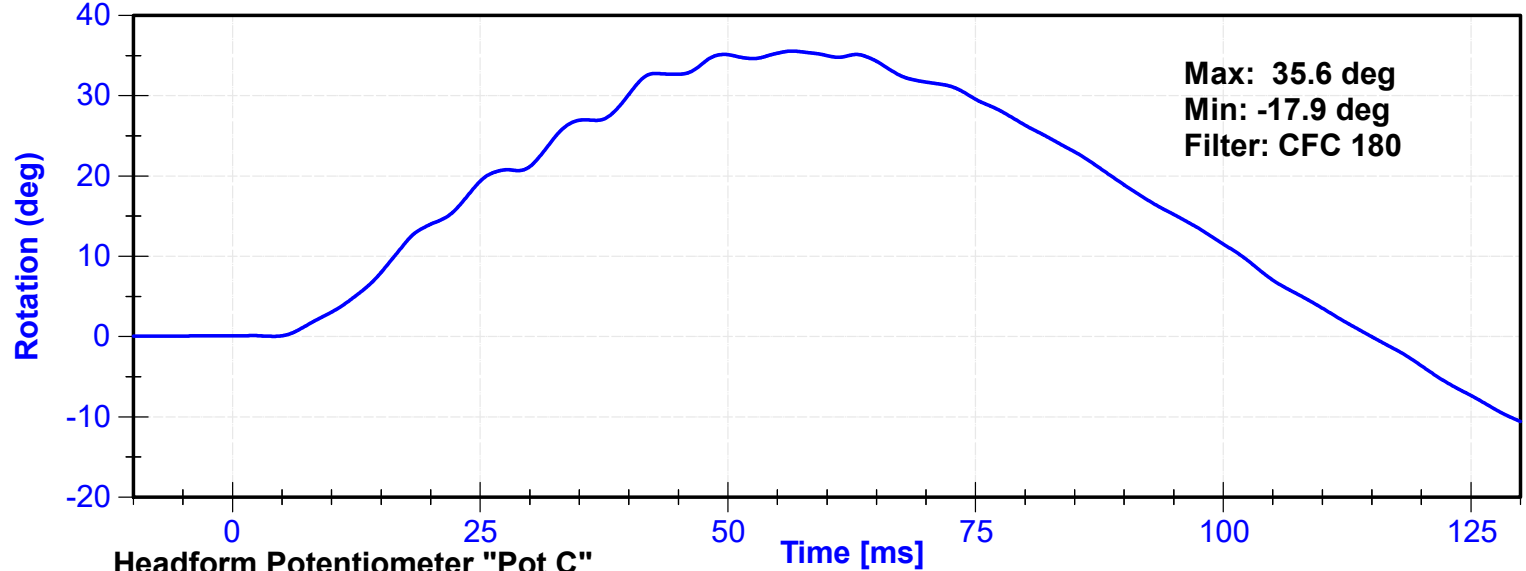


^{1,2} Upper and lower boundaries specified in Appendix I

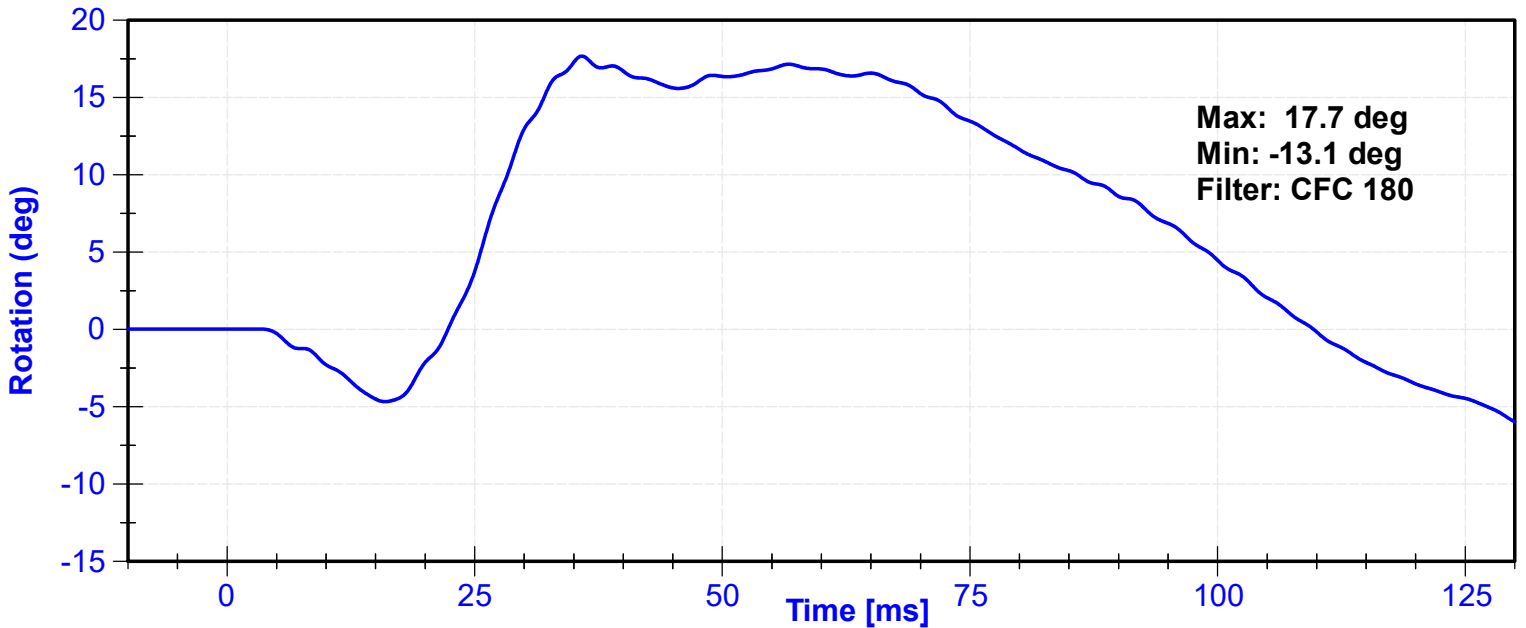
Neck Rotation



Front Pendulum Potentiometer "Pot A"



Headform Potentiometer "Pot C"



Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.0	-0.25	2.5	-0.375
14.0	-3.20	13.5	-3.7
		17.0	-3.7

ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

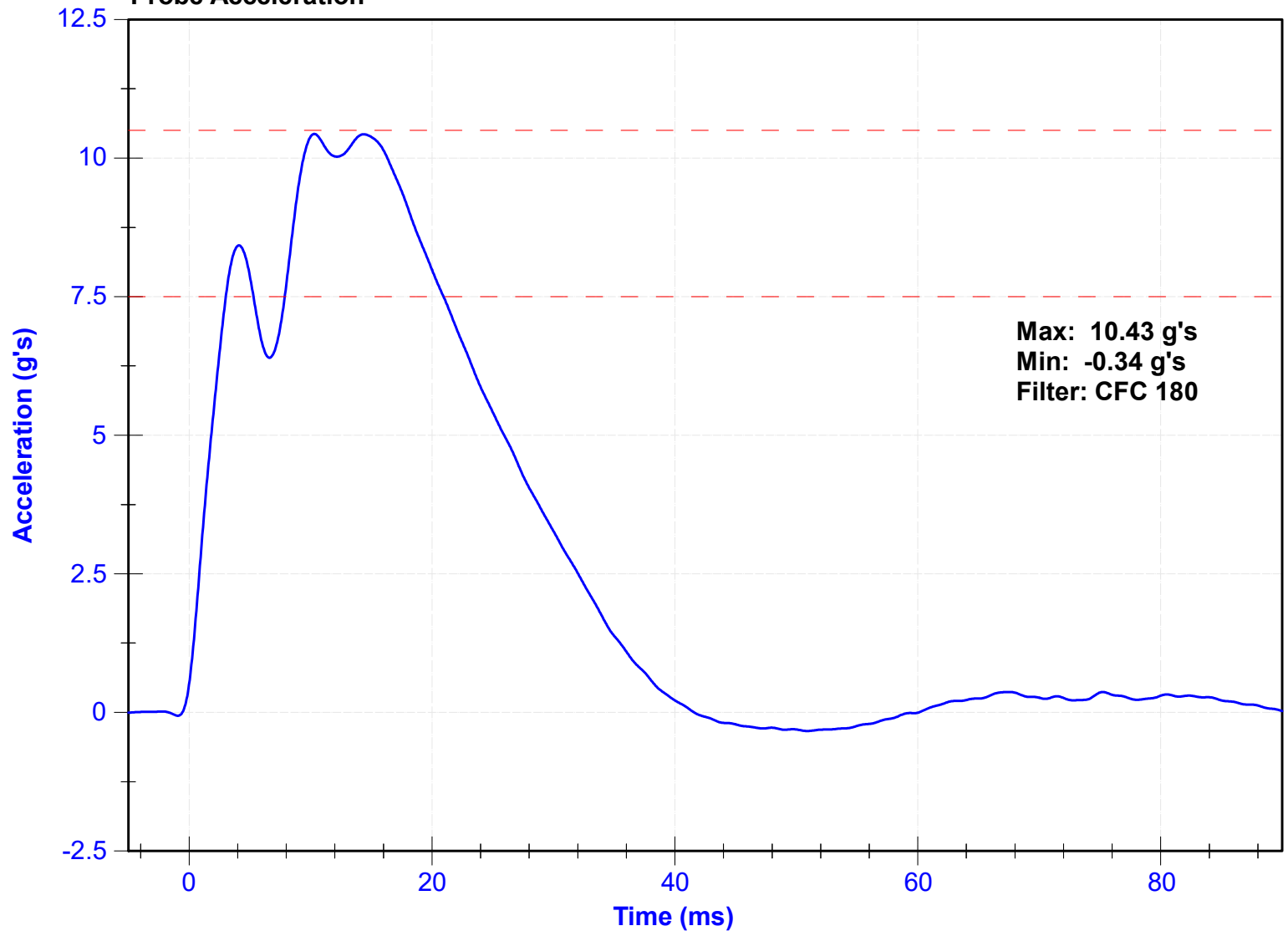
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	36.6	Pass
Velocity	4.2	4.4	m/s	4.35	Pass
Probe Acceleration	7.5	10.5	g's	10.43	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023

Probe Acceleration



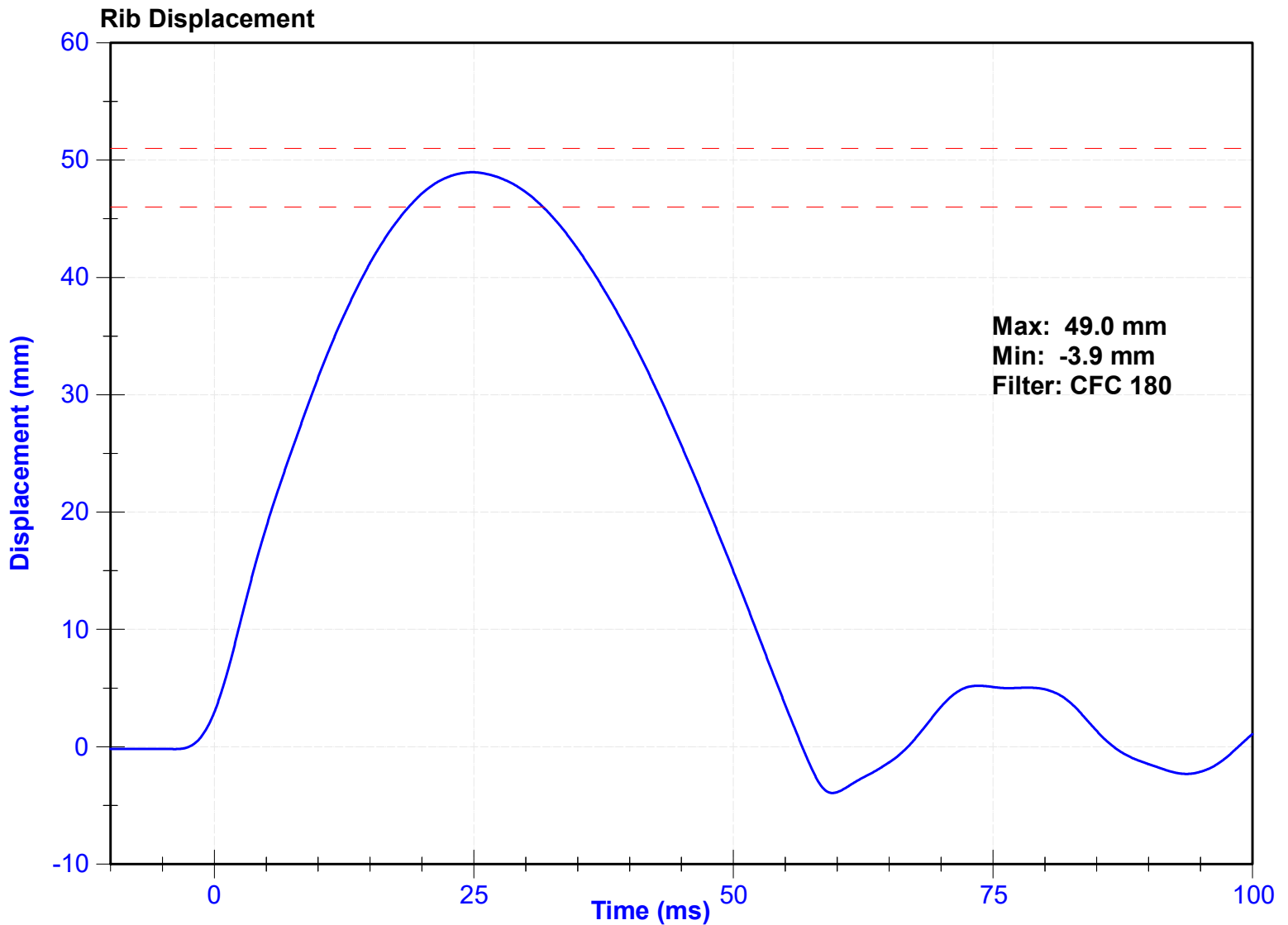
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Rib Displacement	46	51	mm	49.0	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	182GFE	4/27/2023	10/26/2023



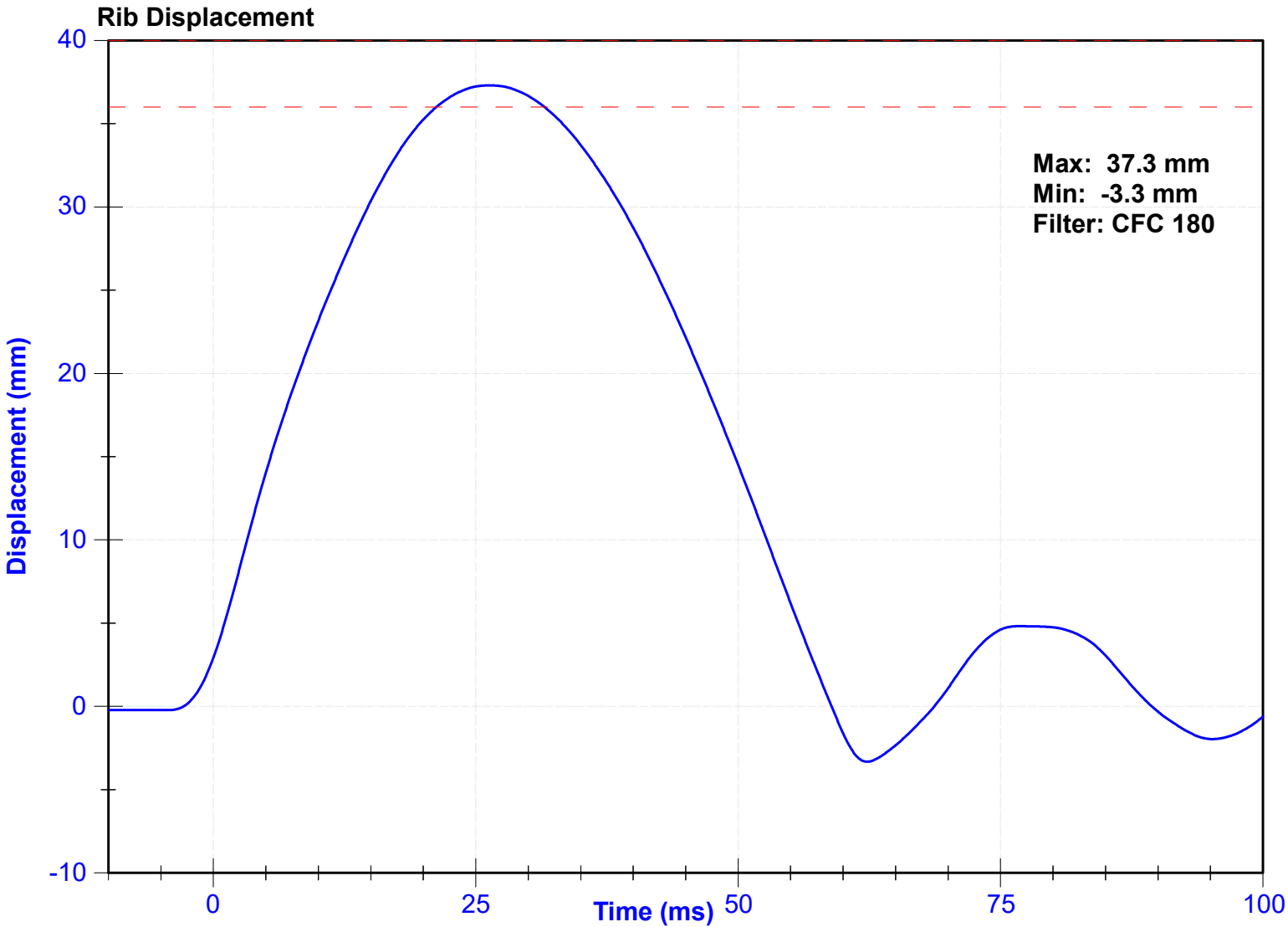
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Rib Displacement	36	40	mm	37.3	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	182GFE	4/27/2023	10/26/2023



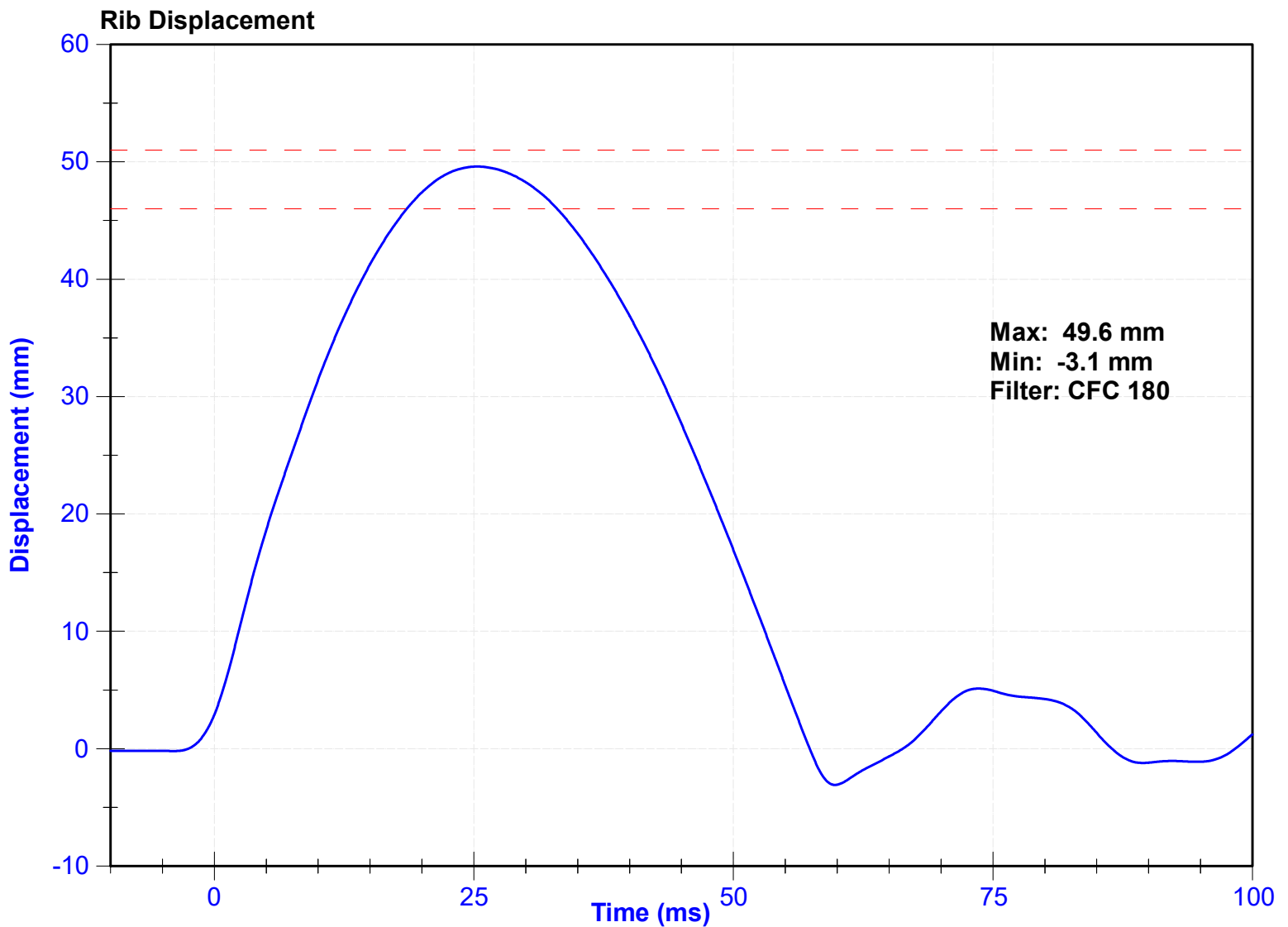
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Rib Displacement	46	51	mm	49.6	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	183GFE	4/27/2023	10/26/2023



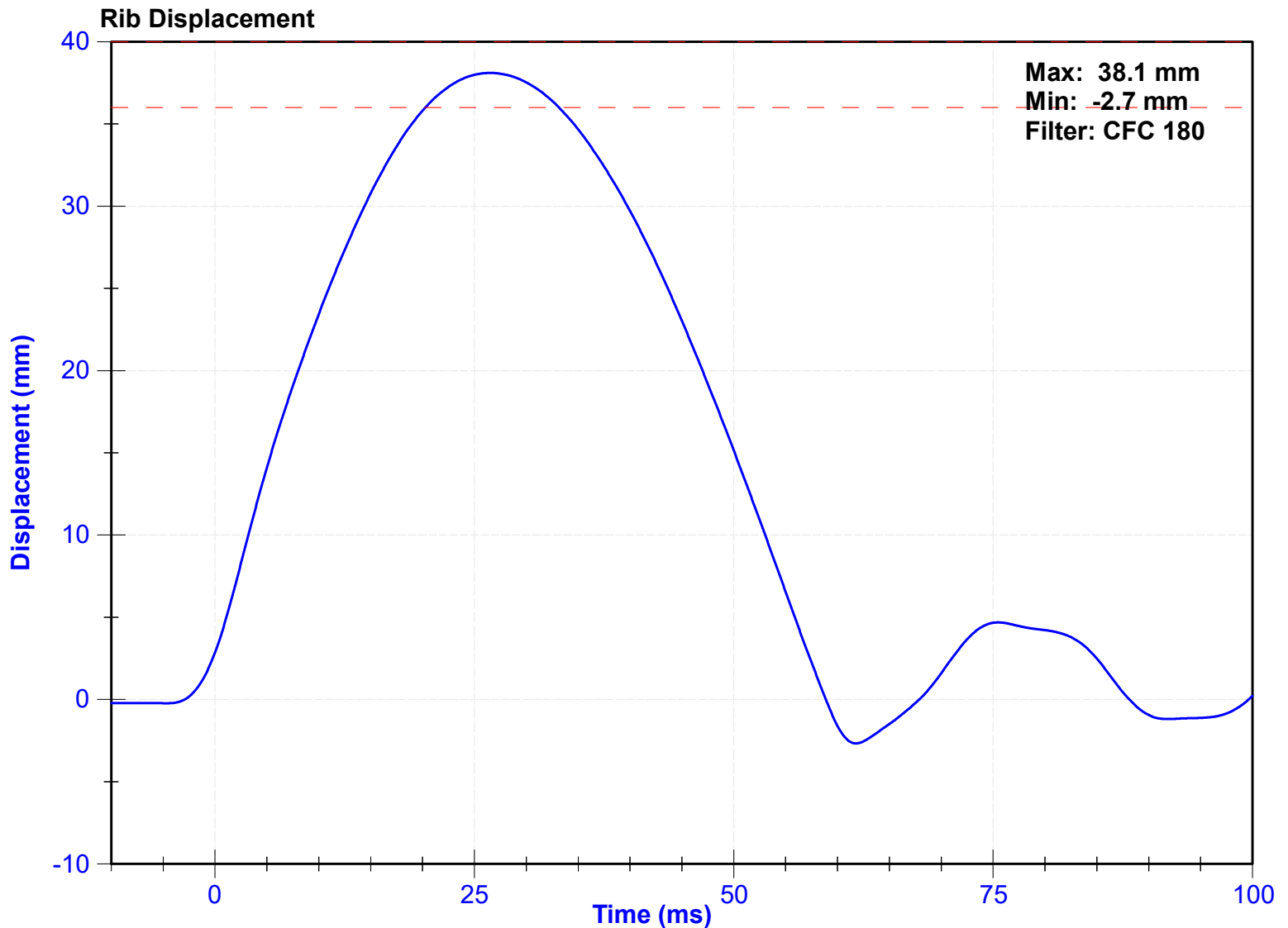
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Rib Displacement	36	40	mm	38.1	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	183GFE	4/27/2023	10/26/2023



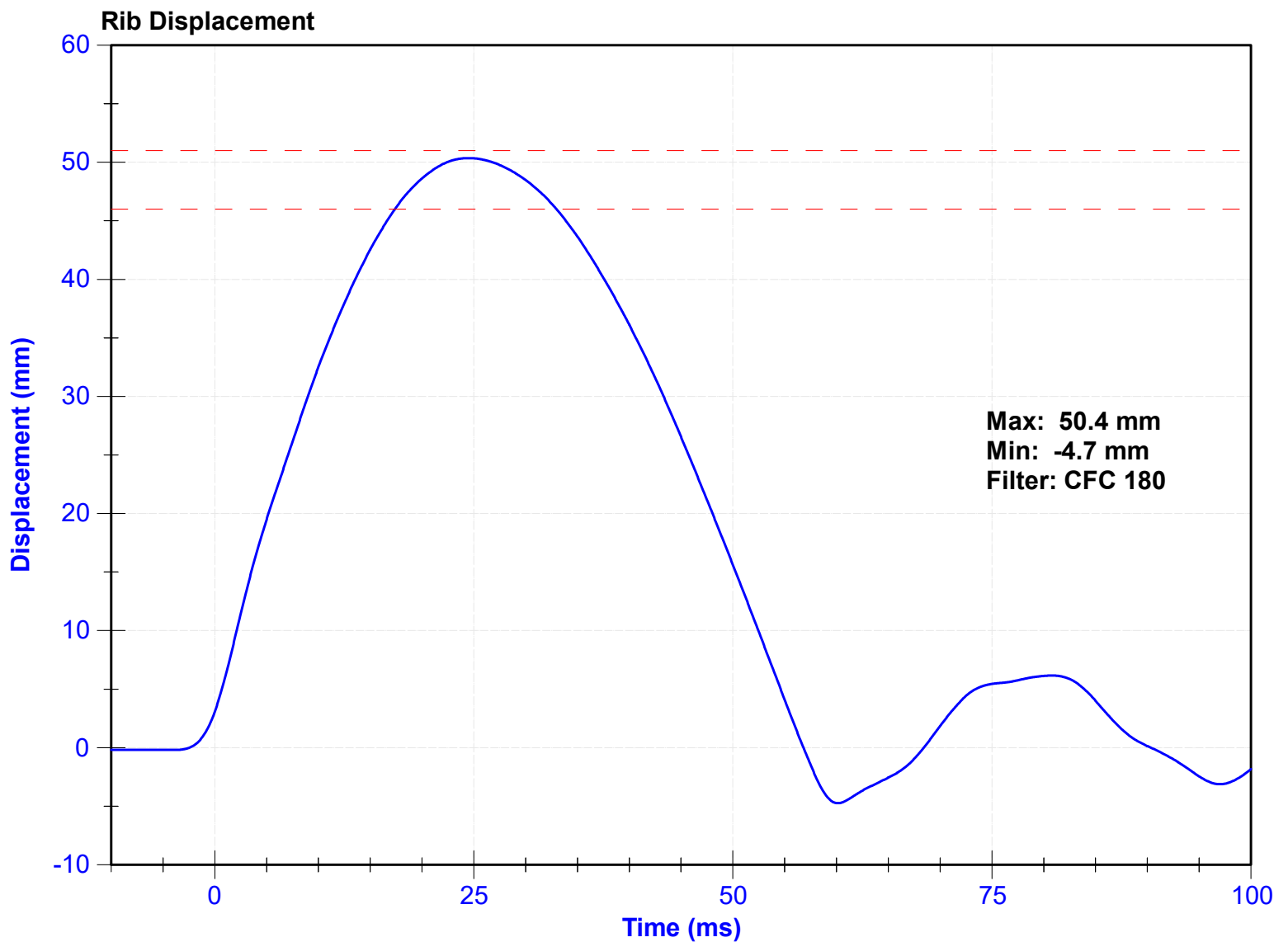
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Rib Displacement	46	51	mm	50.4	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	184GFE	4/27/2023	10/26/2023



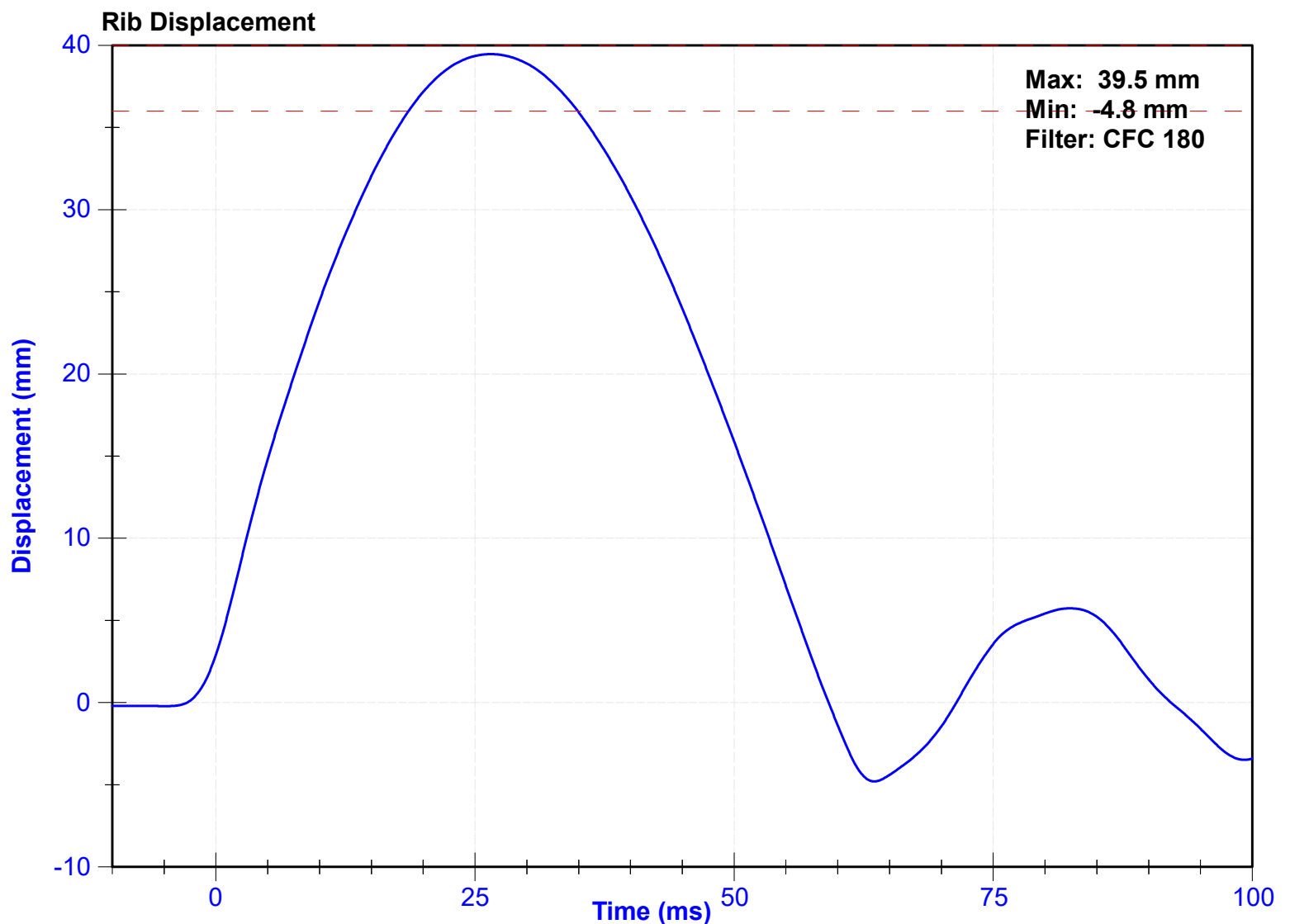
ATD Manufacturer	FTSS	Test Technician	D. Sakona
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	27.5	Pass
Rib Displacement	36	40	mm	39.5	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Rib Potentiometer	Honeywell	184GFE	4/27/2023	10/26/2023



ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

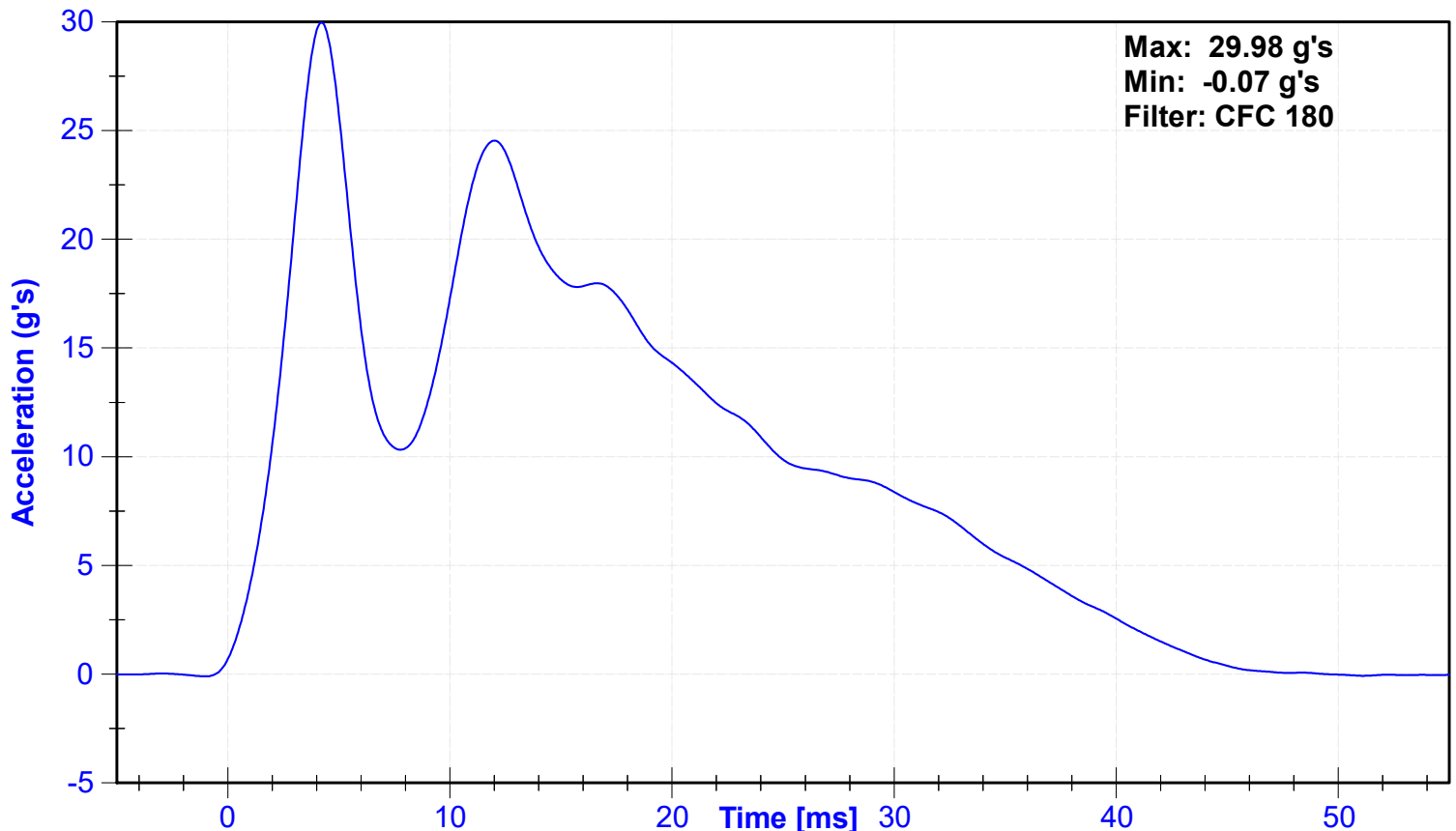
Results

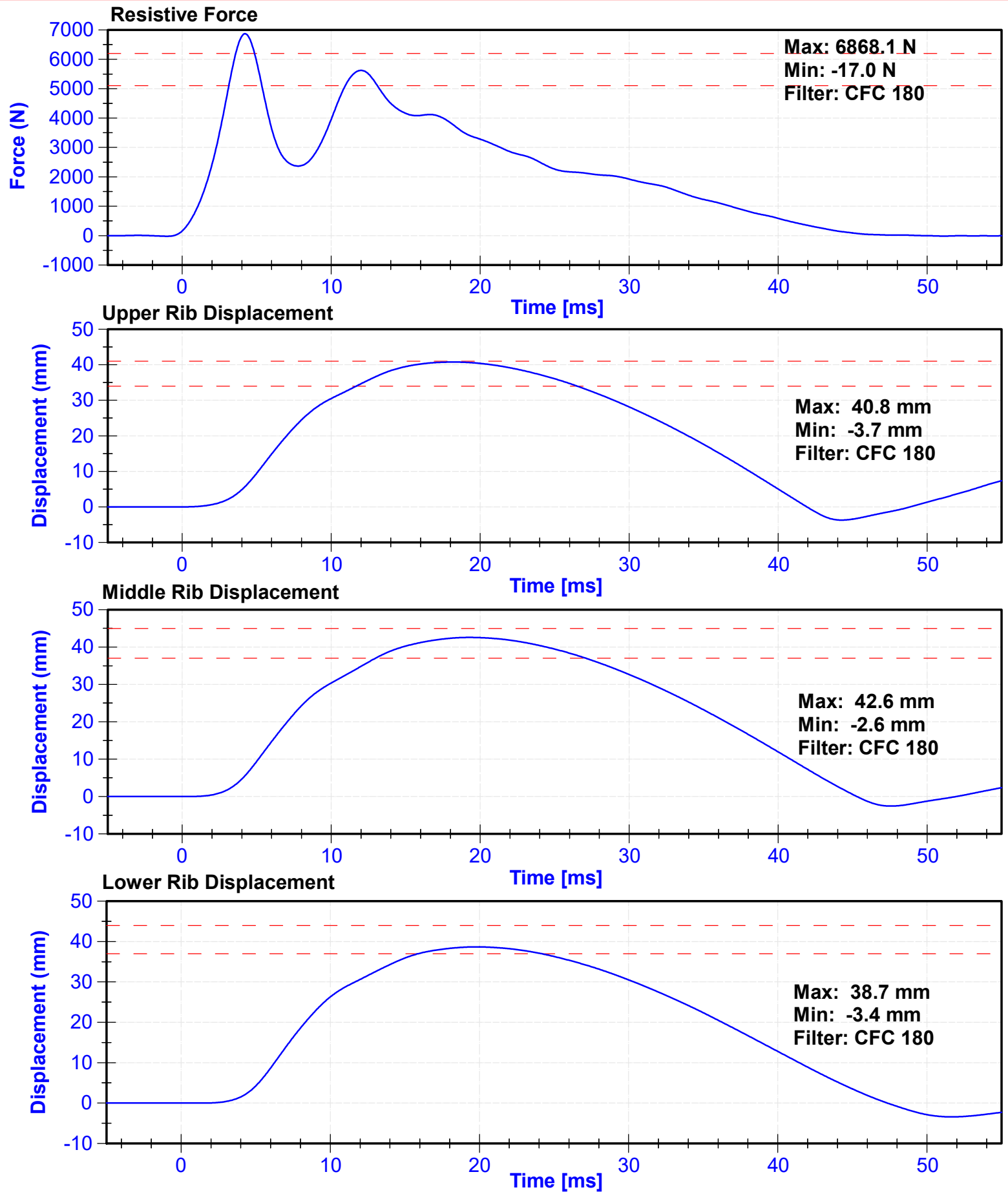
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	36.6	Pass
Velocity	5.4	5.6	m/s	5.53	Pass
Resistive Force after 6ms	5100	6200	N	5621.8	Pass
Upper Thorax Rib Deflection	34	41	mm	40.8	Pass
Mid Thorax Rib Deflection	37	45	mm	42.6	Pass
Lower Thorax Rib Deflection	37	44	mm	38.7	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Probe Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Upper Thorax Rib Potentiometer	Honeywell	182GFE	4/27/2023	10/26/2023
Middle Thorax Rib Potentiometer	Honeywell	183GFE	4/27/2023	10/26/2023
Lower Thorax Rib Potentiometer	Honeywell	184GFE	4/27/2023	10/26/2023

Probe Acceleration





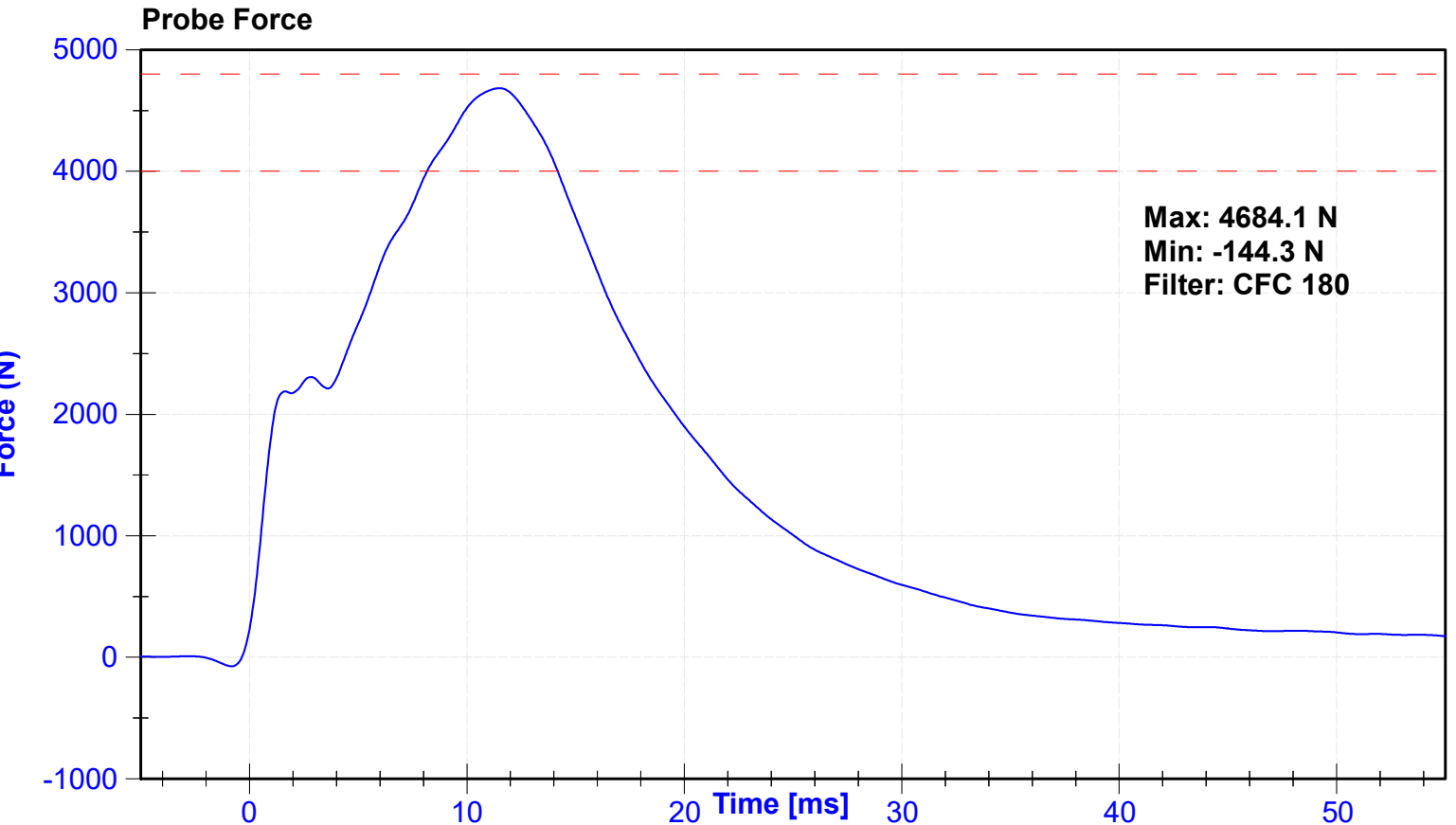
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

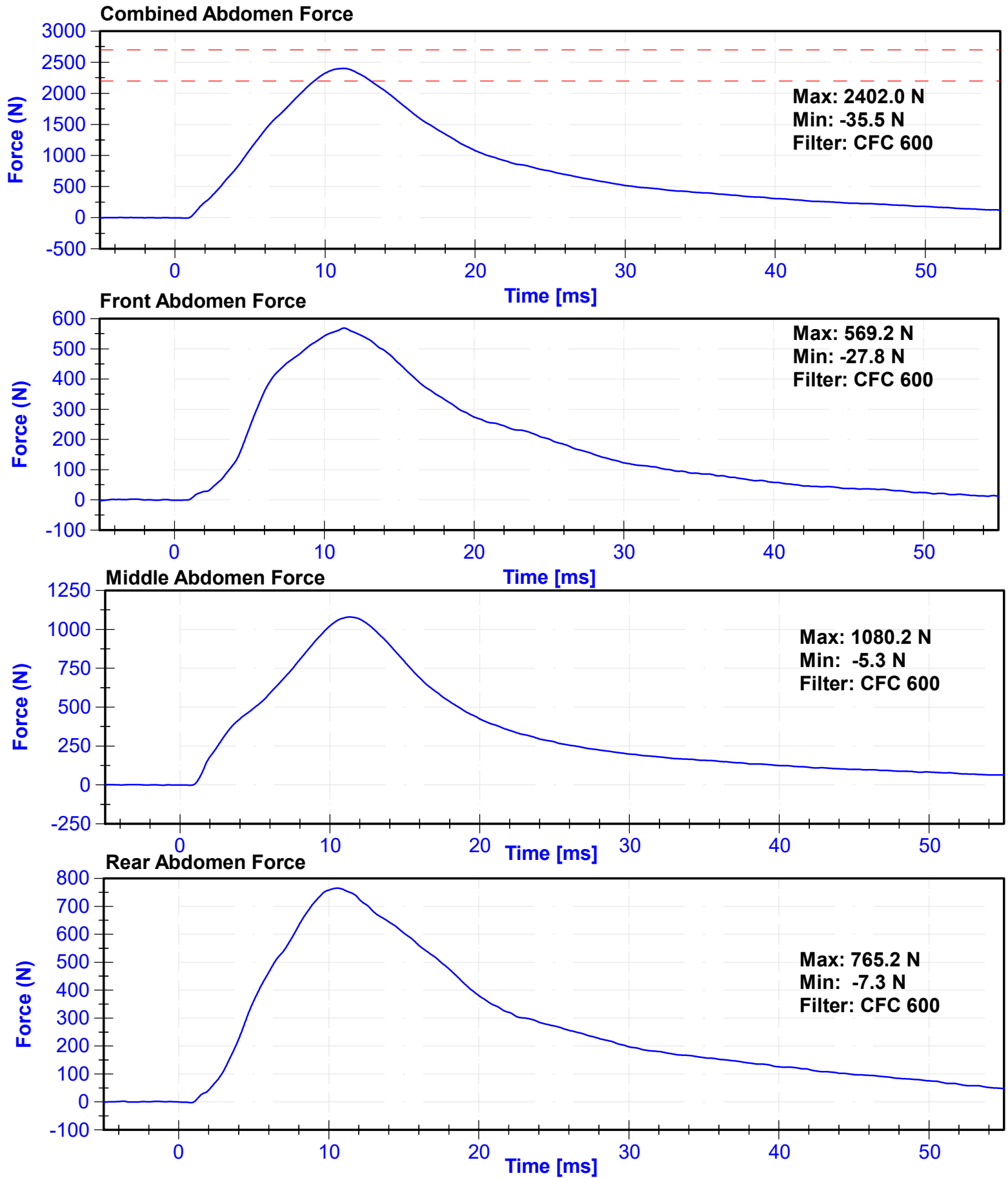
Results

Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	36.6	Pass
Velocity	3.9	4.1	m/s	4.03	Pass
Combined Abdomen Force	2200	2700	N	2402.0	Pass
Time at Peak Abdomen Force	10.0	12.3	ms	11.25	Pass
Resistive Probe Force	4000	4800	N	4684.1	Pass
Time at Peak Resistive Force	10.6	13.0	ms	11.50	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Front Abdomen Load Cell	Denton	1523	8/12/2022	8/12/2023
Middle Abdomen Load Cell	Denton	1524	8/12/2022	8/12/2023
Rear Abdomen Load Cell	Denton	1530	8/12/2022	8/12/2023





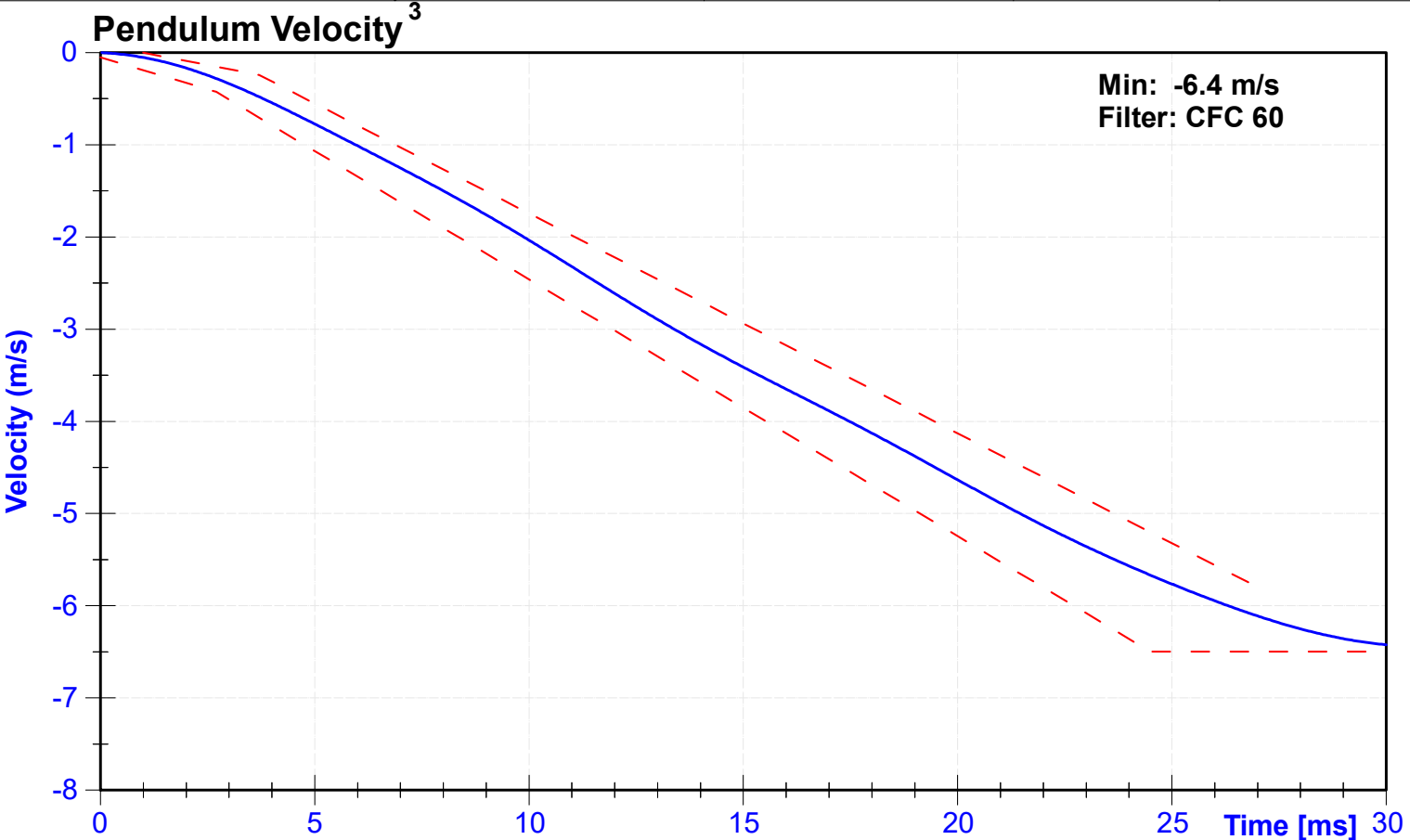
ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

Results

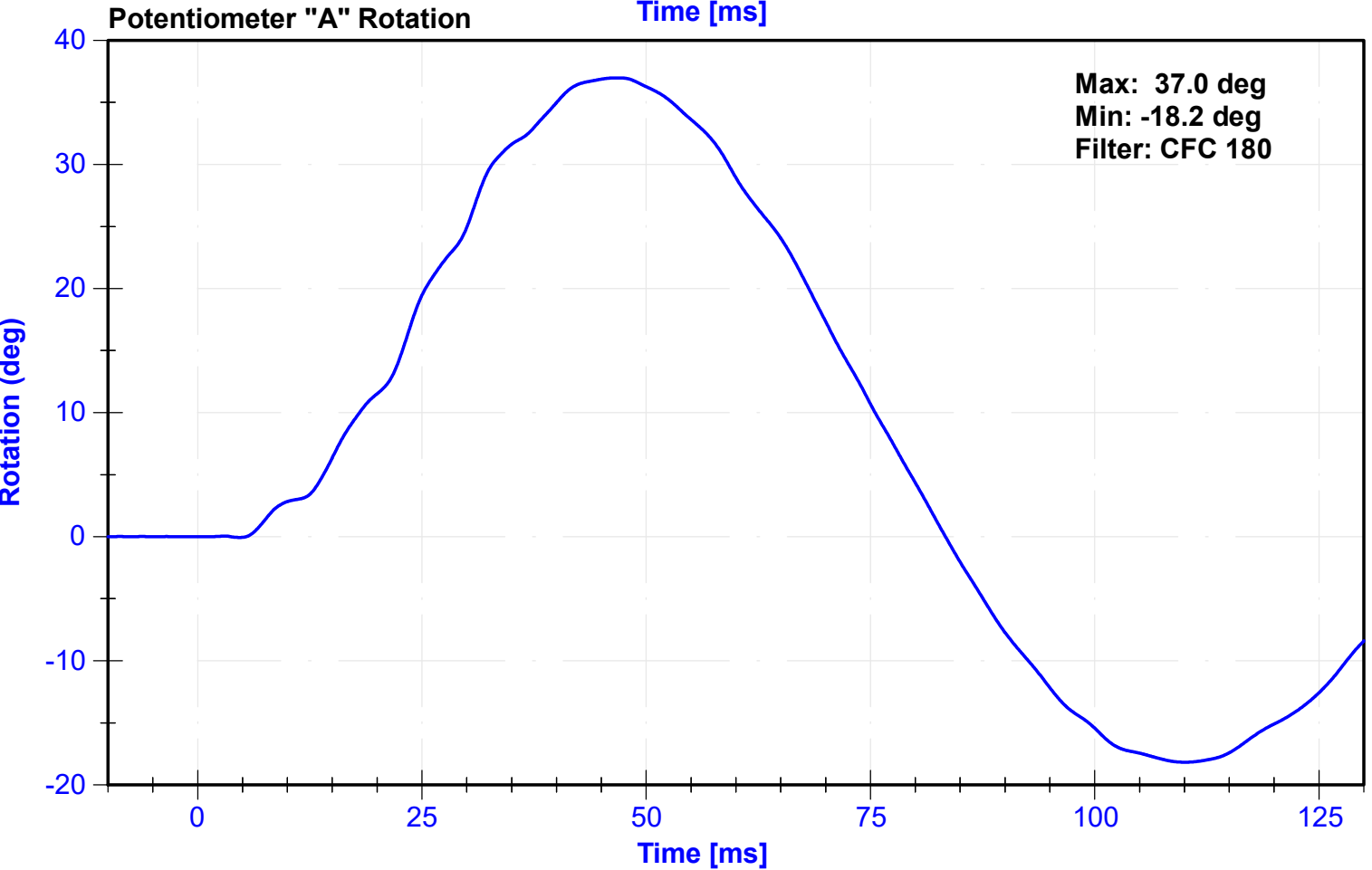
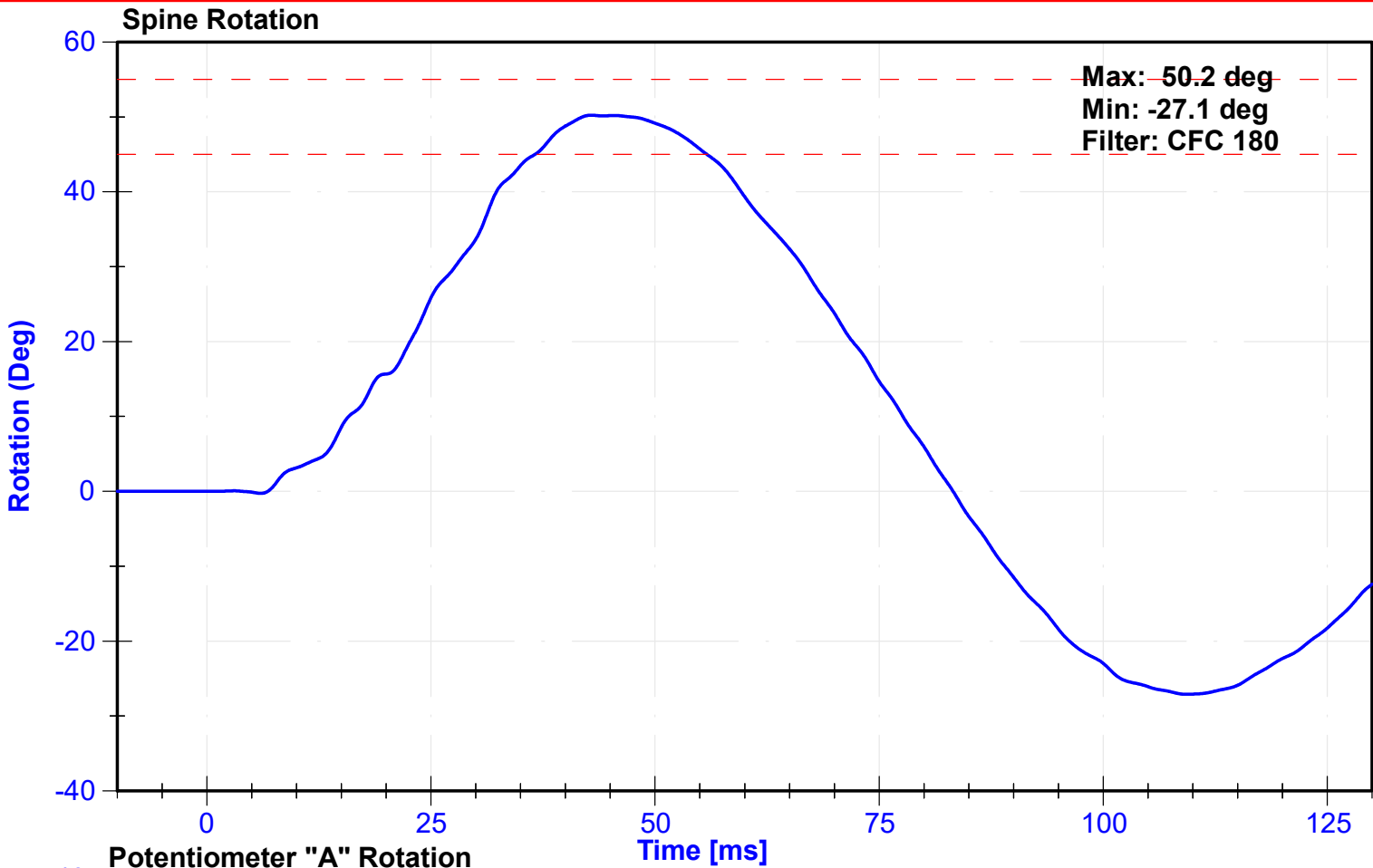
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.1	Pass
Humidity	10	70	%	31.5	Pass
Velocity	5.95	6.15	m/s	6.080	Pass
Lateral Spine Rotation	45	55	deg	50.2	Pass
Time at Maximum Rotation	39	53	ms	42.9	Pass
Time of Decay to Zero Degrees	37	57	ms	40.4	Pass
Pendulum Velocity Overall Corridor	Lower Boundary ¹	Upper Boundary ²	m/s	See Plot ³	Pass

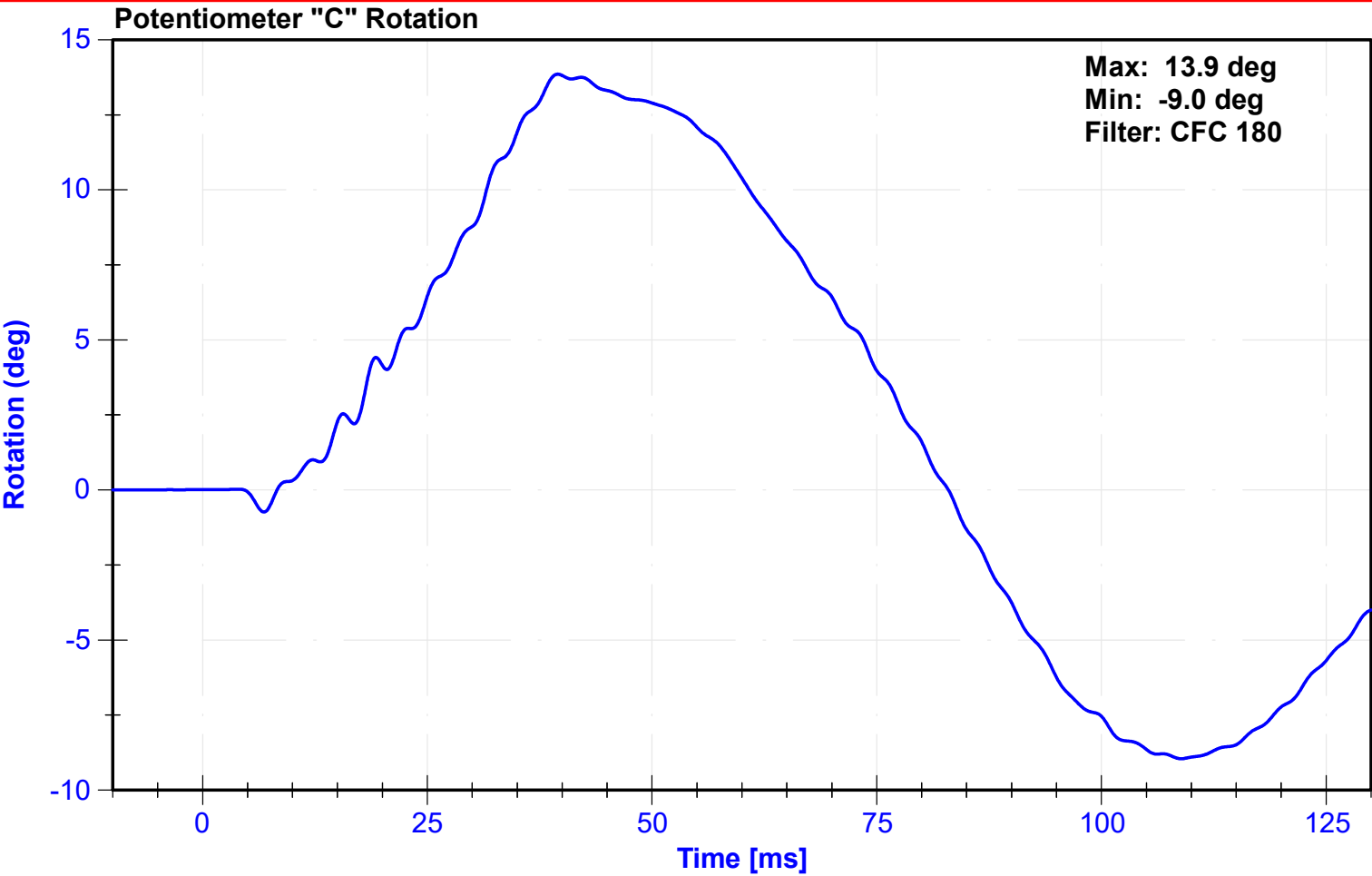
Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	C16503	10/26/2022	10/26/2023
Pendulum "A" Potentiometer	Sfernice	094	10/5/2022	10/5/2023
Condyle "B" Potentiometer	Sfernice	095	10/5/2022	10/5/2023



^{1,2} Upper and lower boundaries specified in Appendix I C-19





Appendix I

² Upper Boundary Corridor		¹ Lower Boundary Corridor	
Time (ms)	Velocity (m/s)	Time (ms)	Velocity (m/s)
1.0	0.00	0.0	-0.05
3.7	-0.24	2.7	-0.425
27.0	-5.80	24.5	-6.5
		30.0	-6.5

ATD Manufacturer	FTSS	Test Technician	C. Mantell
ATD Serial Number	F034	Laboratory Supervisor	C. Mantell

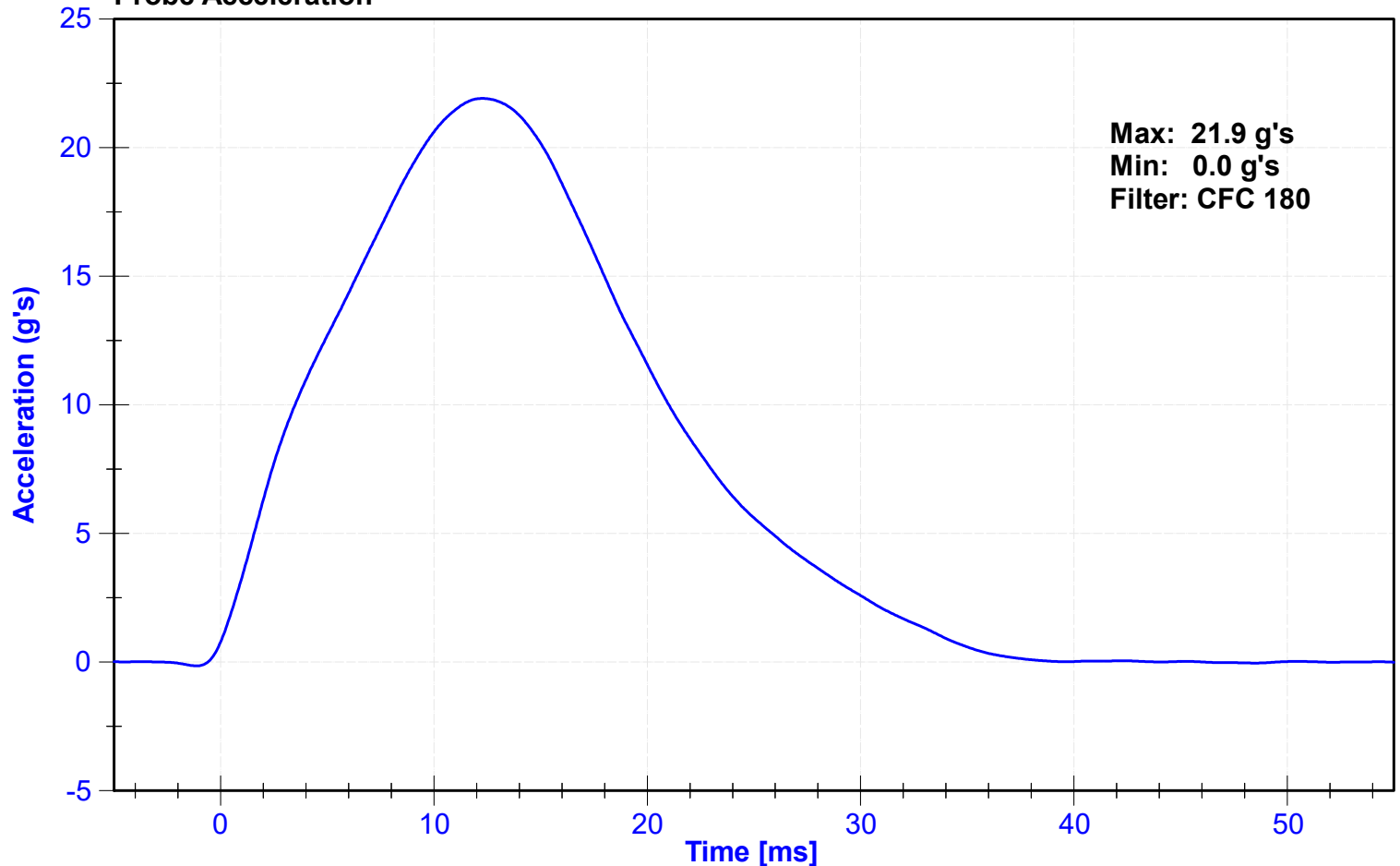
Results

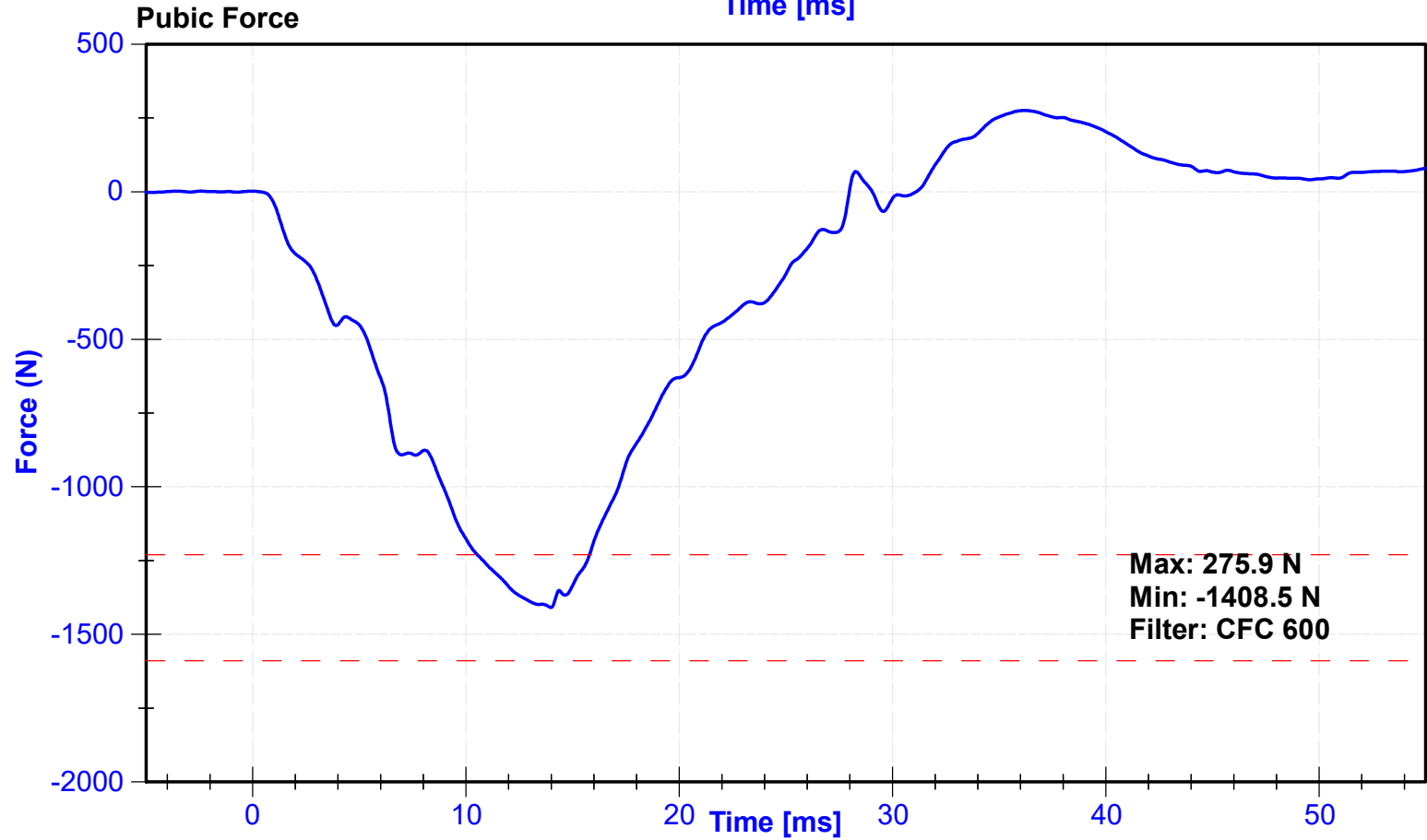
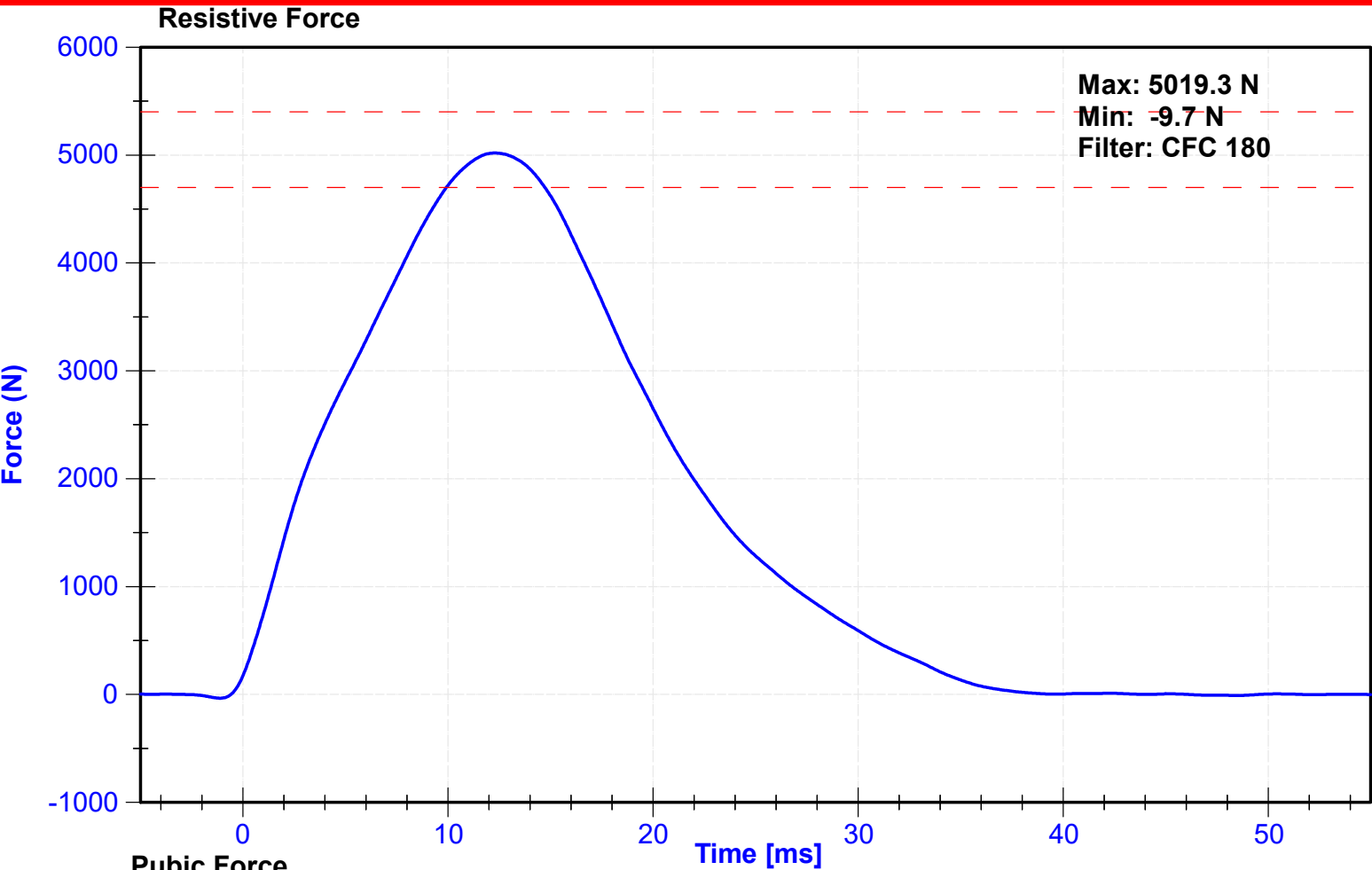
Test Parameter	Minimum Specification	Maximum Specification	Unit	Result	Pass/Fail
Temperature	20.6	22.2	°C	21.2	Pass
Humidity	10	70	%	36.6	Pass
Velocity	4.2	4.4	m/s	4.37	Pass
Resistive Force	4700	5400	N	5019.3	Pass
Time at Peak Resistive Force	11.8	16.1	ms	12.25	Pass
Pubic Force	-1590	-1230	N	-1408.5	Pass
Time at Peak Pubic Force	12.2	17.0	ms	13.95	Pass

Transducer Calibrations

Channel	Manufacturer	Serial Number	Calibration Date	Calibration Due Date
Pendulum Accelerometer	Endevco	P51736	10/25/2022	10/25/2023
Pubic Load Cell	Denton	458-FY	8/12/2022	8/12/2023

Probe Acceleration





APPENDIX D

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N F034		
			Serial Number	Manufacturer	Calibration Date
Head	Primary Accelerometers	X	P51945	Endevco	4/26/2023
		Y	P51974	Endevco	4/26/2023
		Z	P51946	Endevco	4/26/2023
	Redundant Accelerometers	X	P51950	Endevco	4/26/2023
		Y	P49440	Endevco	4/26/2023
		Z	P49211	Endevco	4/26/2023
	Angular Rate Sensors	X	21126	DTS ARS	8/3/2022
		Y	21115	DTS	8/22/2022
		Z	20842	DTS ARS	9/16/2022
Upper Neck Load Cell	Forces	X	131-FX	FTSS	3/29/2023
		Y	131-FY	FTSS	3/29/2023
		Z	131-FZ	FTSS	3/29/2023
	Moments	X	131-MX	FTSS	3/29/2023
		Y	131-MY	FTSS	3/29/2023
		Z	131-MZ	FTSS	3/29/2023
Shoulder Load Cell	Forces	X	119-FX	FTSS	3/30/2023
		Y	119-FY	FTSS	3/30/2023
		Z	119-FZ	FTSS	3/30/2023
Thorax Rib Displacement Potentiometers	Upper	Y	182GFE	Honeywell	4/27/2023
	Middle	Y	183GFE	Honeywell	4/27/2023
	Lower	Y	184GFE	Honeywell	4/27/2023
Abdomen Load Cells	Forward	Y	1523	Denton	8/12/2022
	Middle	Y	1524	Denton	8/12/2022
	Rear	Y	1530	Denton	8/12/2022
Spine	Upper (T1) Accelerometers	X	T34792	Endevco	4/26/2023
		Y	T28864	Endevco	4/27/2023
		Z	T34366	Endevco	4/26/2023
	Lower (T12) Accelerometers	X	P51962	Endevco	4/26/2023
		Y	P64007	Endevco	4/26/2023
		Z	P71281	Endevco	4/26/2023
	Forces	X	103-FX	FTSS	2/20/2008
		Y	103-FY	FTSS	2/20/2008
	Moments	X	103-MX	FTSS	2/20/2008
		Y	103-MY	FTSS	2/20/2008
Lumbar Spine	Forces	Y	105-FY	FTSS	7/14/2020
		Z	105-FZ	FTSS	7/14/2020
	Moment	X	105-MX	FTSS	7/14/2020
Pelvis	Pubic Symphysis Load Cell	Y	458-FY	Denton	8/12/2022
	Accelerometers	X	P58871	Endevco	4/26/2023
		Y	P58776	Endevco	4/26/2023
		Z	P51734	Endevco	4/26/2023

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	A352419	Measurement Specialties	4/7/2023
		Y	A352424	Measurement Specialties	4/7/2023
		Z	A352425	Measurement Specialties	4/7/2023
2	Vehicle Center of Gravity Angular Rate	X	9083	DTS ARS	11/14/2022
		Y	17930	DTS ARS	11/14/2022
		Z	18467	DTS ARS	3/31/2023
3	Right Sill at Vertical Impact Reference Line	Y	G22899	Endevco	2/25/2023
4	Left Floor Sill	Y	G22736	Endevco	1/5/2023
5	Left Front Door Mid Centerline	Y	G22836	Endevco	2/4/2023
6	Left Front Door Mid Rear	Y	G22900	Endevco	2/25/2023
7	Left Front Door Upper Centerline	Y	G22834	Endevco	2/4/2023
8	Left Rear Door Mid Rear	Y	G22918	Endevco	2/25/2023
9	Left Rear Door Upper Centerline	Y	G22639	Endevco	1/24/2023
10	Left Lower A-Pillar	Y	G22768	Endevco	1/11/2023
11	Left Mid A-Pillar	Y	G22833	Endevco	2/4/2023
12	Left A-Pillar Sill	Y	A428011	Measurement Specialties	2/28/2023
13	Left Lower B-Pillar	Y	A280186	Measurement Specialties	3/6/2023
14	Left Mid B-Pillar	Y	A400016	Measurement Specialties	3/6/2023
15	Left B-Pillar Sill	Y	A350932	Measurement Specialties	3/6/2023
16	Driver Seat Track at Dummy H-Point	Y	G22810	Endevco	2/6/2023
17	Engine Block Top	X	A315198	Measurement Specialties	5/3/2023
		Y	A352354	Measurement Specialties	5/3/2023
18	Firewall Center	Y	G22200	Endevco	1/6/2023
19	Right Roof at Vertical Impact Reference Line	Y	G22919	Endevco	2/25/2023
20	Rear Floorpan Behind Rear Axle at Centerline	X	A414758	Measurement Specialties	5/25/2023
		Y	A414760	Measurement Specialties	5/25/2023
21	Rear Deck	X	A283601	Measurement Specialties	2/17/2023
		Y	A315197	Measurement Specialties	2/17/2023
		Z	A352338	Measurement Specialties	2/17/2023
22	Rear Deck Angular Velocity	X	18627	DTS ARS	1/20/2023
		Y	20279	DTS ARS	1/20/2023
		Z	20292	DTS ARS	1/20/2023

Table 4 – Pole Instrumentation

Pole Instrumentation	Serial Number	Manufacturer	Calibration Date
Load Cell 1	1220AF-1117006-F0	Interface	7/19/2022
Load Cell 2	1220AF-18870-F0	Interface	7/19/2022
Load Cell 3	1220AF-1117025-F0	Interface	7/19/2022
Load Cell 4	1220AF-1130989-F0	Interface	7/19/2022
Load Cell 5	1220AF-1281288-F0	Interface	3/17/2023
Load Cell 6	1220AF-1281285-F0	Interface	3/17/2023
Load Cell 7	1220AF-1117035-F0	Interface	7/19/2022
Load Cell 8	1220AF-1117011-F0	Interface	7/19/2022

APPENDIX E

SEATING PROCEDURE WORKSHEETS AND PLOTS

Driver ES2re Seating Worksheet									
Vehicle	2019 Hyundai Accent				Technician	Matthew Pronko			
VIN #	3KPC24A32KE071637				Position	Senior Test Engineer			
ATD	ES2re (Left Side Hit)				Date	6/5/2023			
Test #	R20194204								
SCRL Angle	Max	15.7			ES2re Tilt Sensors	X	Y		
	Min -	13.2			Head	0°±2			
	Difference	2.5			T6	0°±2	N/A	N/A	
	/2	1.25			Pelvis	0°±2	-19.2	-0.2	ES2re
	Min +	1.25							
	Mid Angle	14.45							
Seat Back Angle	W/Level *	14.5					REST POST ANGLE		
Seat Pan Angle	W/Level *		HEAD REST POST ANGLE		1.15			1.15	
Pelvis Angle	ES2re 0° +/- 2.5°		Manual Inclinator		Tilt Sensor				
FARO Measurements On Vehicle Before Seating and Instrumentation									
TAKE WITH ES2 RE TESTS									
Measurements From Striker									
Name	Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg	
SBU -	X	2066.226	-747.978	-175.299					
SBL -	X	2068.627	-749.254	-144.315					
STRIKER (Center) -	X	2099.913	-750.258	-162.187					
FOSB	X	2520.834	-570.421	268.322					
FISB	X	2521.404	-141.191	268.934					
ROSB	X	2107.260	-571.943	303.213					
RISB	X	2105.751	-144.298	300.941					
SO	X	2589.209	-341.700	-310.255					
TS -	X	2671.023	-340.089	-490.111					
BS -	X	2528.791	-342.289	-172.722					
SC1-	X	2684.997	-340.057	-291.038					
CLAP (Bottom center of accel pedal)	X	3095.867	-170.280	206.201					
Floor Pan Point	X	3095.465	-170.328	301.009					
PEDAL REFERENCE POINT (PRP)	X	3123.926	-169.734	163.115					
RHP - (Right Heel Point)	X	3002.439	-170.787	322.889					
LHP - (Left Heel Point)	X	3000.340	-495.216	330.818					
Gas Pedal Right Upper	X	3155.375	-152.203	126.898					
Gas Pedal Right Lower	X	3096.411	-153.209	205.308					
Gas Pedal Left Upper	X	3154.775	-189.300	126.936					
Gas Pedal Left Lower	X	3096.682	-189.745	203.416					
Brake Pedal Right Upper	X	3110.199	-264.332	133.043					
Brake Pedal Right Lower	X	3077.988	-272.711	177.187					
Brake Pedal Left Upper	X	3110.518	-362.939	134.966					
Brake Pedal Left Lower	X	3077.916	-356.741	177.143					
Seat Centerline Point	X	2539.559	-332.679	54.718					
SCR-P- Full Forward (Per Seating Procedure)	X	2551.364	-582.013	55.378					
SCR-P- Full Rearward (Per Seating Procedure)	X	2303.584	-582.793	84.962					
SCR-P- Mid Track (Per Seating Procedure)	X	2427.052	-581.886	66.978					
SAE J826 Manikin H-POINT - (Seating Procedure)	X	2257.726	-533.818	71.805					
DR PROJECTED WSID H-POINT AT MID-POSITION - (Seating Procedure)									
DRIVER STP 15.27 MID-POSITION - (Seating Procedure)									
NOTES:									

		FARO Measurements Taken Once Seating is Complete							
Name		Measurements From Striker							
		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
DRIVER STP STEP 18.6 TRIAL 1 -									
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 1 -									
DRIVER STP STEP 18.6 TRIAL 2 -									
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 2 -									
DRIVER STP STEP 18.6 TRIAL 3 -									
DR PROJECTED THOR H-POINT STEP 18.6.2 TRIAL 3 -									
RHDCG	x	2,121,946	-266,244	-631,480					
3DLHDCG		2,121,916	-266,284	-631,665					
LHDCG	x	2,119,318	-420,383	-631,380					
BON	x	2,215,575	-343,431	-617,976					
TN	x	2,228,237	-341,556	-576,240					
TC -	x	2,193,497	-343,500	-502,914					
SHLD R1 -	c/l of AT	2,236,575	-343,820	-357,067					
THX R1 -	c/l of AT	2,246,436	-344,096	-311,484					
THX R2 -	c/l of AT	2,271,597	-344,716	-256,597					
THX R3 -	c/l of AT								
ABD R1 -	top center	2,268,770	-344,318	-201,935					
ABD R2 -	bottom center								
TPS	x	2,326,303	-344,420	-61,091					
C1 -	x	2,193,742	-345,662	-376,158					
C2 -	x	2,254,619	-341,754	-309,855					
C3 -	x	2,288,098	-341,565	-171,910					
SHI -	x	2,127,852	-569,290	-378,693					
E1 -	x	2,329,720	-612,129	-243,188					
P1 -	x	2,270,425	-461,226	61,109					
H-POINT -	x	2,250,174	-461,124	65,714					
H-POINT 2 -	x	2,251,013	-511,313	65,782					
OK -	x	2,640,035	-517,666	-36,683					
K -	x	2,653,860	-261,053	-35,093					
OA -	x	2,961,010	-533,416	223,855					
IA -	x	2,962,645	-227,012	204,274					
OH -	x	3,005,124	-502,729	331,273					
IH -	x	3,016,094	-189,891	319,448					
OUTBOARD TOE	x	3,129,205	-479,802	46,565					
INBOARD TOE	x	3,130,863	-481,609	46,344					
OP -	x	1,915,496	-412,955	-476,538					
TOP CENTER SHOULDER BELT	x	2,249,508	-344,478	-344,500					
BOTTOM CENTER SHOULDER BELT	x	2,278,604	-348,809	-278,709					
TOP CENTER LAP BELT	x	2,323,160	-344,499	-79,939					
BOTTOM CENTER LAP BELT	x	2,353,110	-342,109	-45,094					
CENTER OF BELT AT D-RING	x	1,983,285	-595,734	-552,568					
DRIVER SCRIP - FINAL TEST POSITION	x	2,425,476	-575,277	65,550					
Measurements to be taken once Dummy is seated and measured									
Name		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
R	x	2,214,156	-344,497	-803,460					
H	x	2,612,191	-343,619	-747,143					
W1	x	2,895,957	-343,508	-618,950					
W1 OUTSIDE	x	2,913,854	-343,573	-618,297					
W2 OUTSIDE	x	3,189,377	-344,379	-468,103					
D1	x	2,793,950	-345,539	-456,531					
D2	x	2,813,730	-518,507	-198,106					
D3	x	2,837,951	-261,426	-87,775					
HRP	x	2,216,499	-521,434	-710,822					
HSP	x	2,216,379	-669,461	-619,065					
ADP	x	2,329,894	-701,290	-242,647					
HDP	x	2,251,919	-668,678	67,528					
Measurements calculated using points collected from the FARO arm									
Name		Meas X	Meas Y	Meas Z	X-DISTANCE	Y-DISTANCE	Z-DISTANCE	3D Distance	Deg
HZ	x						185		
HH	x							417	
HW	x				680				
NR	x							451	
CD	x							941	
CS	x				335				
CBS	x				241				
IKD	x							191	
OKD	x							227	
HR	x							201	
HS	x					326			
AD	x					89			
HD	x					208			
HLHL	x							313	
KK	x							257	
SH	x							398	
HRA - (Inclinometer measurement deg)	x								1.15
H-POINT TOOL ANGLE	x								12.8
TORSO ANGLE	x								10.6
WINDSHIELD ANGLE	x								61.4
NOTES:									