REPORT NUMBER: 214P-CAL-10-1

SAFETY COMPLIANCE TESTING FOR FMVSS 214
DYNAMIC SIDE IMPACT PROTECTION
RIGID POLE SIDE IMPACT

HYUNDAI MOTOR COMPANY
2010 HYUNDAI TUSCON GLS
4-DOOR MPV

NHTSA NUMBER: CA0503

PREPARED BY:
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Test Date: March 4, 2010

FINAL REPORT

PREPARED FOR:
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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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FINAL REPORT ACCEPTANCE BY OVSC:

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Technical Report Documentation Page

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16. Abstract

A 32 km/h (20 mph) 75° oblique impact compliance test was conducted on the subject 2010 Hyundai Tuscon GLS 4-Door MPV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP- 214P-01 for the determination of FMVSS 214 Side Impact Protection compliance. The test was conducted by the Calspan Corporation Transportation Research Group in Buffalo, New York, on March 4, 2010.

The impact velocity was 31.2 km/h, and the ambient temperature at the struck side (driver side) of the test vehicle was 21.7°C. The test vehicle's maximum post test static crush was 362 mm at level 3. The test vehicle's occupant performance is as follows:

	DRIVER
HIC	351.3
Max. Rib Deflection (mm)	33.5
Sum of Abdomen Forces (N)	1523
Pubic Symphysis (N)	2093

The 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.

17. Key Words Compliance Testing Side Impact Protection Pole Test ES-2re	*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Admin. Technical Information Services Room E12-100 East Bldg. 1200 New Jersey Avenue, SE Washington, DC 20590 Phone : (202) 366-2588

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SECTION 1
PURPOSE AND TEST PROCEDURE

PURPOSE

This side impact test is part of the FY 2010 FMVSS 214 Side Impact Protection Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-07-D-00064. The purpose of this test was to evaluate side impact protection in a 2010 Hyundai Tuscon GLS 4-Door MPV. The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-214P-01, dated July 2009).

SUMMARY

A rigid pole impact test was conducted on a 2010 Hyundai Tuscon GLS 4-Door MPV. The test was towed into a rigid pole at an angle of 75° and a velocity of 31.2 km/h. The test was conducted by the Calspan Corporation Transportation Sciences Group in Buffalo, New York on March 4, 2010. Pre-test and post-test photographs of the test vehicle and side impact dummy are included in Appendix A of this report.

One Part 572U dummy was placed in the left front outboard designated seating position according to instructions specified in TP-214P-01 dated January 2010. The side impact event was documented by 1 real-time and 9 high speed cameras.

The ES2-re male dummy was instrumented with a tri-axial accelerometer pack located in the head, 3 rib displacement transducers located in the chest, 3 load cells located in the abdomen and a load cell in the pubic symphysis.

The summary of the test results follows:

Driver ES-2re Male Dummy		
HIC	351.3	
UPPER RIB DEFLECTION	31.5	mm
MIDDLE RIB DEFLECTION	29.1	mm
LOWER RIB DEFLECTION	33.5	mm
ABDOMEN (FRONT)	450	N
ABDOMEN (MID)	468	N
ABDOMEN (REAR)	604	N
SUM OF ABDOMEN FORCES	1523	N
PUBIC SYMPHYSIS	2093	N

SECTION 2

DATA SHEET NO. 1
TEST VEHICLE INFORMATION AND OPTIONS

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214P Side Impact	Test Date:	March 4, 2010

Vehicle Information	
Make	Hyundai Motor Company
Model	Tuscon GLS
Body Style	4-Door MPV
VIN	KM8JU3ACXAU017395
Body Color	Red
Engine Disp (liters)	2.4 liters
# of Cylinders	4
Engine Placement	Lateral
Transmission Type	Automatic
Transmission Speeds	6 speed
Overdrive	Yes
Final Drive	Front
Odometer Reading	27 km

Options	
ESC	Yes
All-Wheel Drive	No
Power Steering	Yes
Tilt Steering Wheel	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	Yes
Driver Combo Bag	No
Driver Seat Belt Pretentioners	Yes
Driver Seat Belt Load Limiters	Yes
Driver Power Seats	No
Rear Pass. Curtain Airbag	Yes
Rear Pass. Side Torso Airbag	No
Rear Pass. Seat Belt Pretentioners	No
Rear Pass. Seat Belt Load Limiters	No
Rear Pass. Power Seats	No
Power Windows	Yes
Air Conditioning	Yes
AM/FM CD	Yes
Automatic Door Locks (ADL)	Yes
Does owner's manual provide instructions to disable ADLs?	No
Anti-Lock Brakes	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Hyundai Motor Company	GVWR (kg)	2040
		GAWR Front (kg)	1055
Date of Manufacture	9/09	GAWR Rear (kg)	1125

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number Of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				420.0
Cargo Wt. (RCLW) (kg)				79.8

DATA SHEET NO. 2
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214P Side Impact	Test Date:	March 4, 2010

TIRE PRESSURES

	Units	LF	RF	RR	LR
As Delivered	Kpa	228	228	228	228
As Tested	Kpa	228	228	228	228

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			Fully Loaded (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	438.0	303.5		465.0	370.0		467.0	355.0	
Right	kg	435.5	279.0		444.5	331.5		451.5	332.0	
Ratio	%	54.2	36.2		56.5	43.5		57.2	42.8	
Totals	kg	873.5	582.5	1456.0	909.5	701.5	1611.0	918.5	687.0	1605.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1456.0
Weight of 1 P572U ATD (78.0 kg each)	kg	78.0
Rated Cargo/Luggage Weight (RCLW)	kg	79.8
Calculated Vehicle Target Weight (TVTW)	kg	1613.8

* Actual As Tested Weight (ATW) will be TVTW -4.5/-9.1 kg

Weight of Ballast (including instrumentation package and cameras): 71.5 kg

WEIGHT of BALLAST and VEHICLE COMPONENTS REMOVED TO MEET TVTW

Description of Component	Weight (kg)
Ballast (if any)	34
No components were removed	

TEST VEHICLE ATTITUDES

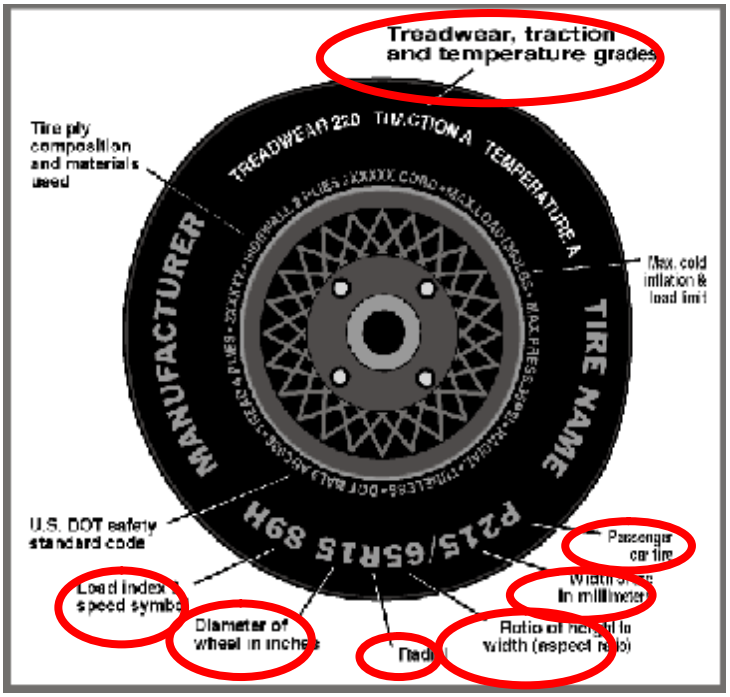
	Units	LF	RF	LR	RR
Fully Loaded	mm	748	753	749	756
As Tested	mm	747	754	758	766
DIFF Δ	mm	1	-1	-9	-10

CALCULATION OF THE VERTICAL IMPACT REFERENCE LINE

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2642
Vertical Impact Reference Line Aft of Front Axle	mm	1311

DATA SHEET NO. 3
VEHICLE TIRE INFORMATION

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010



DATA FROM TIRE PLACARD

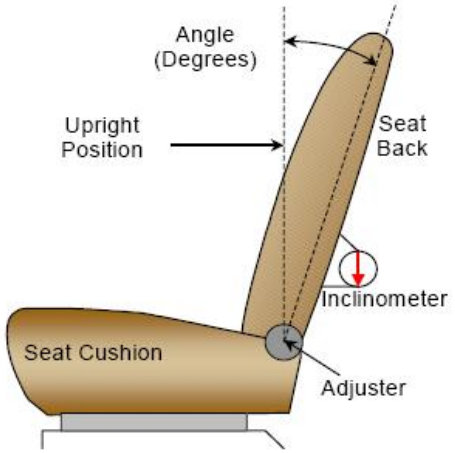
Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	303	303
Cold / Test Pressure (kPa)	228	228
Recommended Tire Size	225/60R17	225/60R17
Tire Size on Vehicle	225/60R17	225/60R17
Tire Manufacturer	Kumho	Kumho
Tire Name	Solus KL21	Solus KL21
Tire Type	Passenger	Passenger
Tire Width (mm)	225	225
Ratio of Height to Width (aspect ratio)	60	60
Radial	Yes	Yes
Wheel Diameter	17	17
Load Index & Speed Symbol	99H	99H
Treadwear	500	500
Traction Grade	A	A
Temperature Grade	A	A

DATA SHEET NO. 4
SEAT AND SEAT BELT ADJUSTMENT DATA

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

NORMAL DESIGN RIDING POSITION

An inclinometer was placed on the head restraint post and it measured a vertical angle of 9 degrees without the ATD in the seat.



FRONT SEAT ASSEMBLY

SEAT BACK ANGLES

	Degrees
Driver w/ Seated Dummy	9.2

SEAT FORE/AFT POSITIONS

The seat was placed in the mid travel position while maintaining the seat cushion mid-angle position.

SEAT FORE/AFT POSITIONING

	Driver Seat
Total Fore/Aft Travel (mm)	240
Test Position (mm)	120
Test Detent (forward-most detent defined as 0)	12
Total Number of Detents (including 0)	24

SEAT BELT UPPER ANCHORAGES

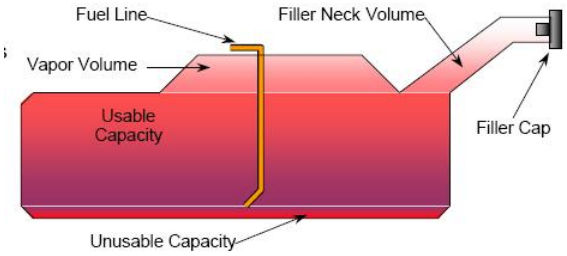
	Total # of Positions	Placed in Position #
Driver Seat	4	2

DATA SHEET NO. 5
FUEL SYSTEMS AND STEERING WHEEL POSITION DATA

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

FUEL SYSTEM INFORMATION

The test vehicle is equipped with an electric fuel pump



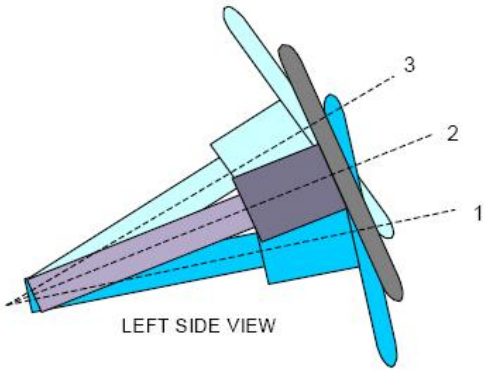
VEHICLE FUEL TANK ASSEMBLY

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard" Fuel Tank (Form 1)	54.9
Usable Capacity of "Standard" Fuel Tank (Owner's Manual)	54.9
92%-94% of Fuel Tank Usable Capacity	51.1
Actual Amount of Stoddard Used	51.1

STEERING COLUMN ADJUSTMENT

A flat plate was placed on the top and bottom of steering wheel. The inclinometer was placed on the flat plate to measure the angle.



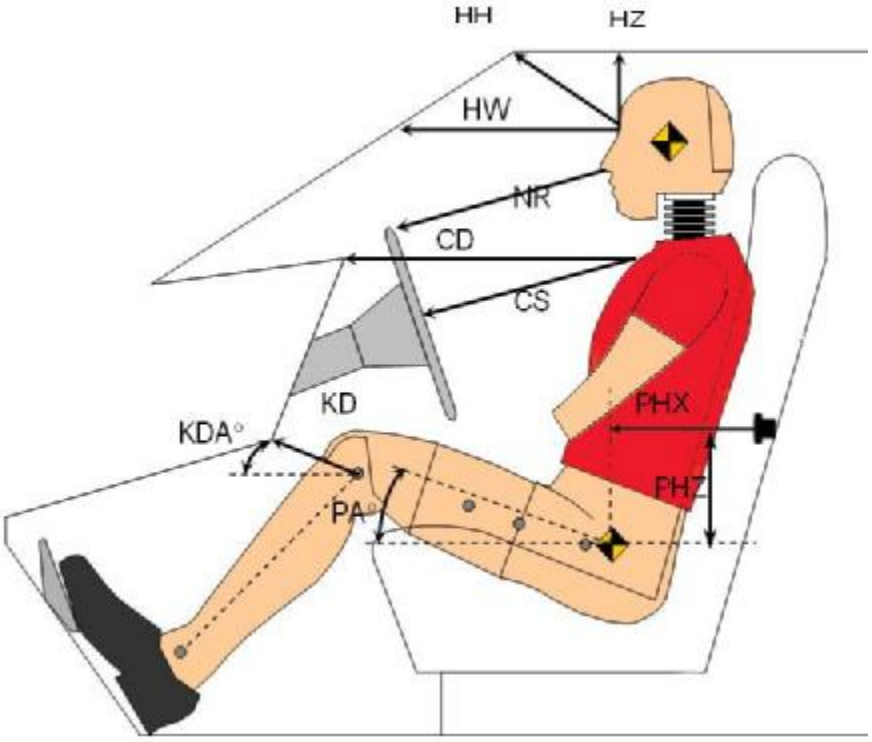
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONING

	Degrees	Fore/Aft Position (mm)
Lowermost - Position 1	27.0	0
Geometric Center – Position 2	29.5	0
Uppermost – Position 3	32.0	0
Telescoping Steering Wheel Travel	NA	40
Test Position	29.5	20

DATA SHEET NO. 6
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

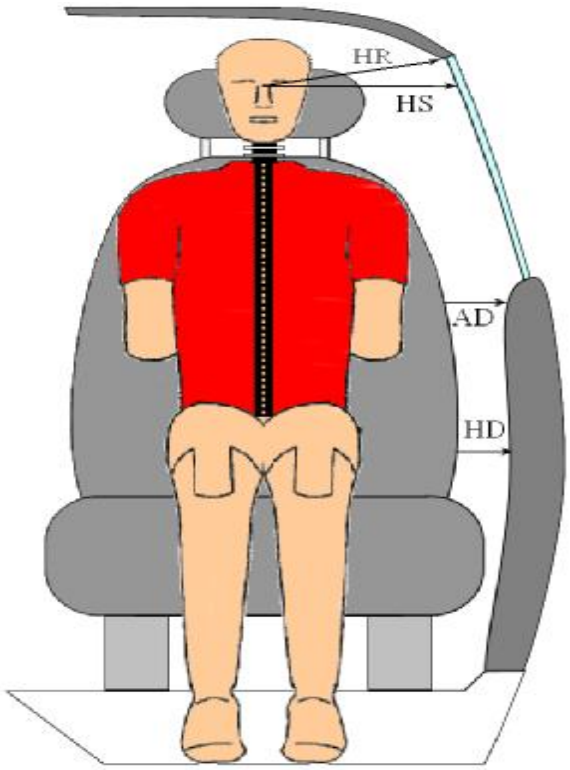
Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010



Frt. Occupant Code	Measurement Description	037 ES2-re	
		Length (mm)	Angle
HH	Header to Header	404	
HW	Header to Windshield	619	
HZ	Head to Roof	165	
NR	Nose to Rim/Seat Back	502	
CD	Chest to Dash/Seat Back	625	
CS	Chest to Steering Wheel	334	
KDL	Left Knee to Dash/Seat Back	168	27.9
KDR	Right Knee to Dash/Seat Back	115	25.0
PA	Pelvic Angle		22.5
PHX	H-Point to Striker (X-Axis)	206	
PHZ	H-Point to Striker (Z-Axis)	180	

DATA SHEET NO. 7
DUMMY LATERAL CLEARANCE DIMENSIONS

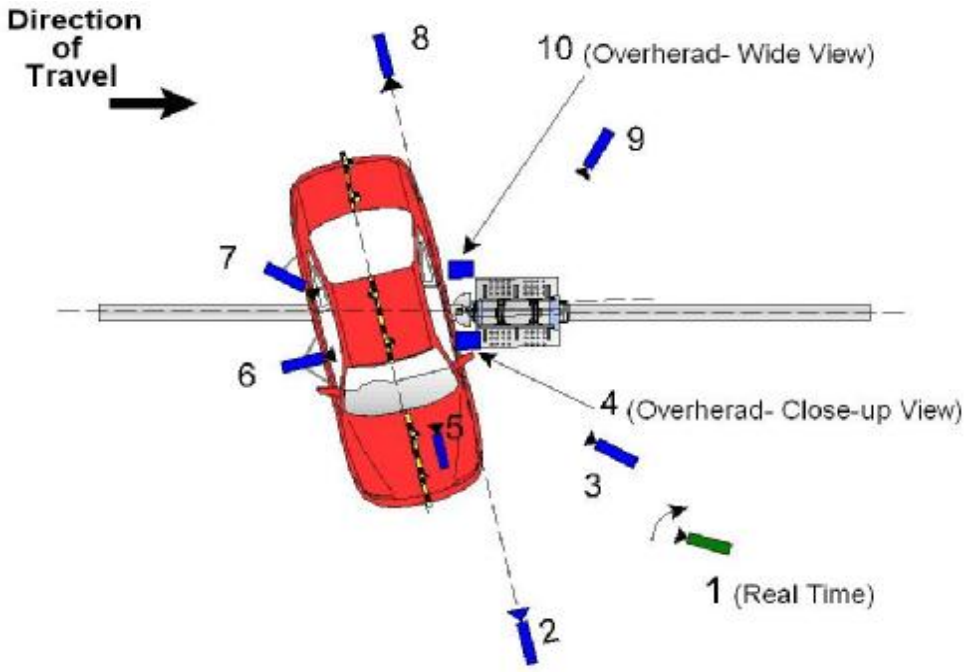
Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010



Code		Units	Front Occupant
HR	Head to Side Header	mm	192
HS	Head to Side Window	mm	310
AD	Arm to Door	mm	125
HD	H-point to Door	mm	169

DATA SHEET NO. 8
HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214P Side Impact	Test Date:	March 4, 2010

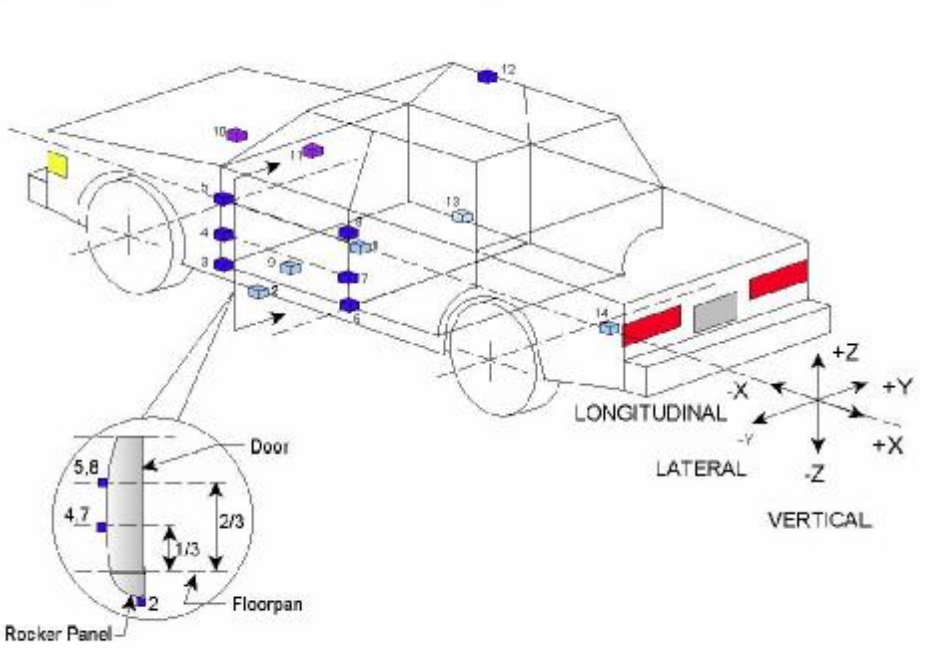


No.	CAMERA VIEW	Location			LENS (mm)	FILM SPEED (fps)
		X	Y	Z		
1	Real time (24 fps) film coverage	-	-	-	-	24
2	Front ground level - impact view	-1890	-4290	1035	28	1000
3	Impact side 45* - forward pole view	-1670	-1245	2270	24	1000
4	Overhead Close-up view of impact	-40	-210	4375	28	1000
5	Onboard – dummy front view				25	500
6	Onboard – dummy side view				12.5	500
7	Onboard – dummy rear view				12.5	500
8	Rear ground level – impact view	1560	6480	1020	24	1000
9	Impact side 45º - rearward pole view	-2950	2640	1510	24	1000
10	Overhead wide-view of impact	310	-160	4375	14	1000

Reference: Impact Point projected to Ground
+X = To Front, +Y = To Right, +Z = Down
*All measurements accurate to ± 6 mm.

DATA SHEET NO. 9
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010



Loc. No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle C.G.	2411	41	626
2	Left Floor Sill	2735	-659	397
3	Left A-Pillar Sill	3032	-659	458
4	Left A-Pillar Low	3076	-666	649
5	Left A-Pillar Mid	2991	-667	1172
6	Left B-Pillar Sill	1996	-666	472
7	Left B-Pillar Low	1993	-679	750
8	Left B-Pillar Mid	1965	-674	1109
9	Left Seat Track	2123	-572	463
10	Engine Top	3733	405	843
11	Firewall	3522	-5	1045
12	Right Roof	2090	621	1595
13	Right Floor Sill	2721	666	416
14	Rear Deck	1055	23	586

X – Test Vehicle Rear Bumper (+ forward)
Y – Test Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

DATA SHEET NO. 10
TEST VEHICLE ACCELEROMETER DATA SUMMARY

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

Loc. No	Description	Peak Values (g's)			
		Max	Time (ms)	Min	Time (ms)
1	Vehicle CG (X)	17.3	34.8	-32.0	46.4
	Vehicle CG (Y)	63.4	74.7	-35.7	83.2
	Vehicle CG (Z)	27.3	39.4	-18.7	84.4
	Vehicle CG Resultant	63.8	74.7	0.0	239.8
2	Left Floor Sill (Y)	49.1	18.7	-9.7	34.6
3	Left A-Pillar Sill (Y)	43.7	68.8	-39.4	63.8
4	Left A-Pillar Low (Y)	31.4	19.2	-9.4	22.9
5	Left A-Pillar Mid (Y)	59.0	20.0	-41.4	32.0
6	Left B-Pillar Sill (Y)	103.2	24.6	-106.1	27.9
7	Left B-Pillar Low (Y)	167.4	16.4	-136.8	20.5
8	Left B-Pillar Mid (Y)	60.0	10.6	-58.6	15.5
9	Seat Track (Y)	77.8	31.8	-6.0	74.9
10	Engine Top (X)	3.1	104.5	-10.1	36.1
	Engine Top (Y)	12.5	60.1	-4.7	203.6
11	Firewall (Y)	12.6	49.5	-1.6	3.7
12	Right Roof (Y)	23.5	37.2	-4.8	10.6
13	Right Floor Sill (Y)	21.2	68.9	-4.8	64.4
14	Rear Deck (X)	2.4	-100.0	-8.4	35.8
	Rear Deck (Y)	16.0	34.4	-0.8	166.9

DATA SHEET NO. 11
DUMMY INJURY RESPONSE DATA FOR ES-2re

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

DUMMY Serial # 037				
	Positive		**Negative**	
	MAX	**TIME (ms)**	**MAX**	**TIME (ms)**
HEAD ACCELERATION (g)				
Longitudinal (X)	5.3	127.4	-27.9	62.0
Lateral (Y)	51.8	59.5	-13.0	129.9
Vertical (Z)	15.5	36.9	-5.3	13.4
Resultant (R)	58.1	59.5	0.0	-51.5
HIC36 (t1, t2)	351.3		**t1 =** 44.5	**t2 =** 70.2
THORAX DEFLECTION (mm)				
Upper Rib	31.5	46.8	-5.6	19.9
Middle Rib	29.1	54.1	-4.3	89.2
Lower Rib	33.5	51.5	-1.2	178.4
ABDOMINAL FORCES (N)				
Front	449.7	44.4	-31.8	17.0
Middle	467.9	44.9	-12.7	205.7
Rear	604.0	44.0	-20.9	184.6
SUM	1522.9	44.5	-39.5	178.0
PELVIS FORCE (N)				
Pubic Symphysis (Y)	203.9	154.4	-2093.2	60.8

Reference:

Positive direction:

Longitudinal	(x) = forward
Lateral	(y) = to right
Vertical	(z) = down

DATA SHEET NO. 12
POST TEST OBSERVATIONS

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

TEST DUMMY INFORMATION AND CONTACT

Description	Front Occupant
Head Contact	Side of Head – Side curtain airbag
Upper Torso Contact	Side Torso airbag
Lower Torso Contact	Side Torso airbag
Left Knee Contact	Door
Right Knee Contact	No contact

POST TEST DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Left Side Doors	Jammed Shut	Jammed Shut
Right Side Doors	Closed and operational	Closed and operational
Hatch and Other Doors	NA	Closed and operational
Seat Movement	None	None
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	B-Pillar Intrusion caused by pole impact
Sill Separation	No separation
Windshield Damage	Severe cracking on left side of windshield
Window Damage	Left front window shattered
Other Notable Effects	None

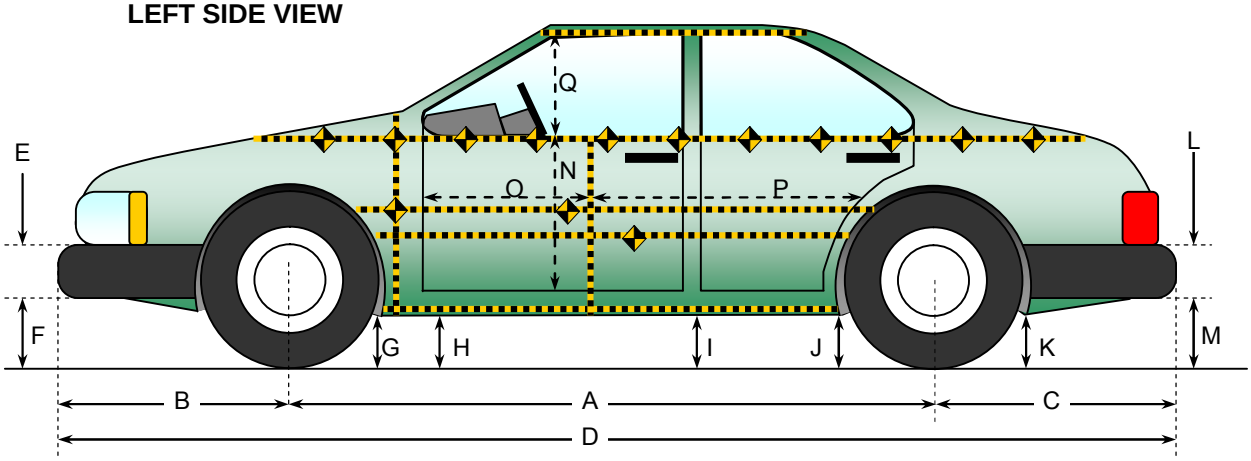
SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Front Occupant	
	Installed	Operated
Front Airbag	Yes	No
Side Torso Airbag	Yes	Yes
Head Airbag	No	NA
Curtain Airbag	Yes	Yes
Seat Belt Pretensioner	Yes	Yes
Seat Belt Load Limiter	Yes	Yes

DATA SHEET NO. 13
VEHICLE PRE-TEST AND POST-TEST MEASUREMENTS

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

LEFT SIDE VIEW

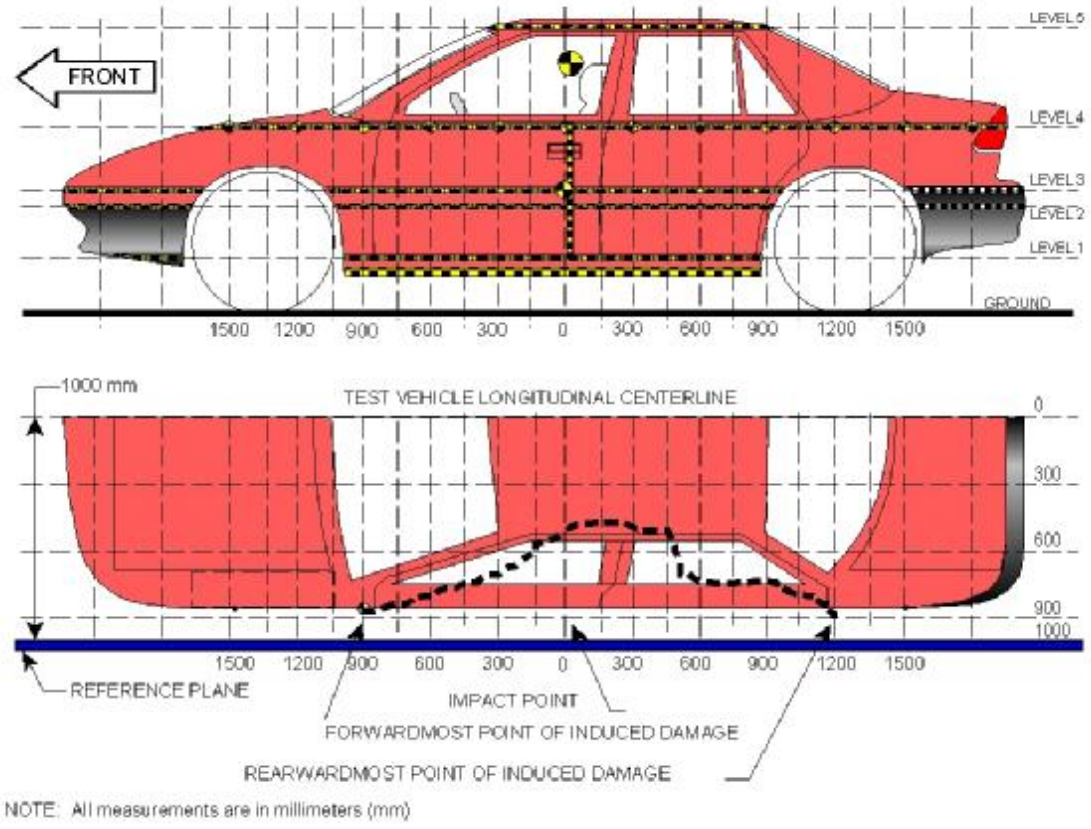


Code	Description	Pre-Test	Post-Test	Diff Δ
A	Wheelbase	2641	2582	59
B	Front Axle to FSOV	871	901	-30
C	Rear Axle to RSOV	886	886	0
D	Total Length at Centerline	4398	4369	29
E	Front Bumper Thickness	80	80	0
F	Front Bumper Bottom to Ground	448	487	-39
G	Sill Height at Front Wheel Well	270	284	-14
H	Sill Height at Front Door Leading Edge	268	277	-9
I	Sill Height at B Pillar	273	268	5
J1	Sill Height at Rear Wheel Well	280	319	-39
J2	Pinch Weld Height at Rear Wheel Well	255	284	-29
K	Sill Height Aft of Rear Wheel Well	287	313	-26
L	Rear Bumper Thickness	75	75	0
M	Rear Bumper Bottom to Ground	435	445	-10
N	Sill Height to Window Bottom Sill	774	776	-2
O	Front Door Leading Edge to Impact CL	827	825	2
P	Rear Door Trailing Edge to Impact CL	1079	1054	24
Q	Front Window Opening	452	430	23
R*	Right Side Length	4288	4283	5
S*	Left Side Length	4287	4227	60
T*	Vehicle Width at B Post	1829	1617	212

* - not shown in schematic above

DATA SHEET NO. 14
EXTERIOR CRUSH MEASUREMENTS

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010



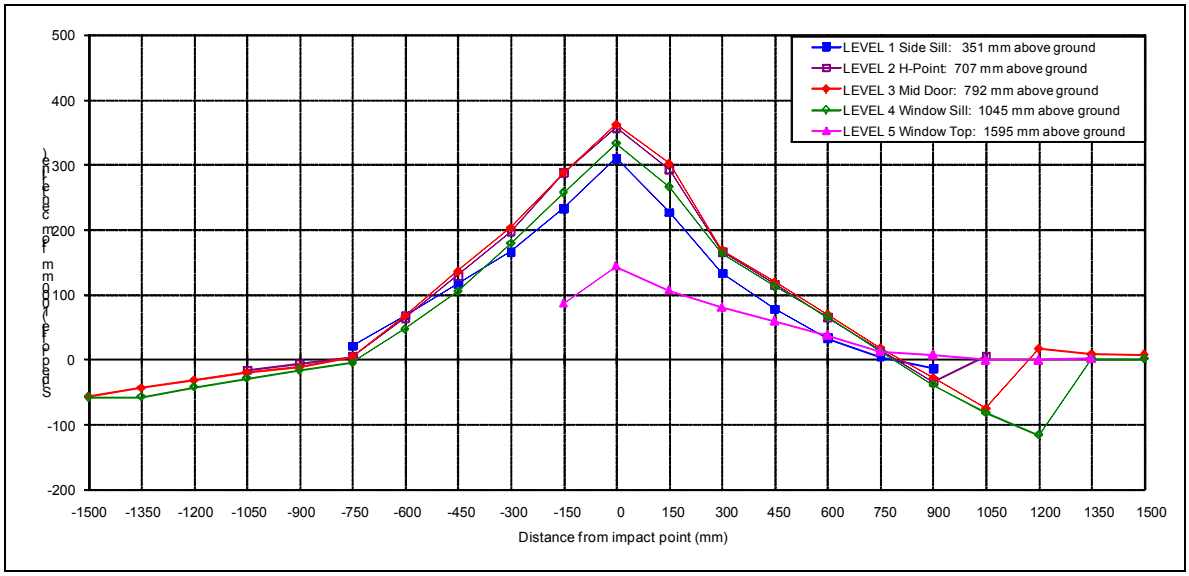
NOTE: All measurements are in millimeters (mm)

Maximum Exterior Crush Measurements

Level	Measurement Description	Maximum Exterior Static Crush	Distance from Impact	Height Above Ground
1	Sill Top	310	0	351
2	Occupant H-Point	357	0	707
3	Mid-Door	362	0	792
4	Window Sill	333	0	1045
5	Window Top	144	0	1595

DATA SHEET NO. 15
VEHICLE EXTERIOR CRUSH PROFILES

Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010



	Pre-Test					Post-Test					Diff Δ				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-1500	--	--	907	753	--	--	--	963	811	--	--	--	-56	-58	--
-1350	--	--	914	802	--	--	--	957	859	--	--	--	-43	-57	--
-1200	--	--	916	826	--	--	--	947	868	--	--	--	-31	-42	--
-1050	--	915	913	838	--	--	931	933	867	--	--	-16	-20	-29	--
-900	--	909	905	842	--	--	915	916	858	--	--	-6	-11	-16	--
-750	880	900	901	843	--	859	895	896	848	--	21	5	5	-5	--
-600	877	898	901	842	--	809	834	833	795	--	68	64	68	47	--
-450	875	898	901	847	--	758	769	765	742	--	117	129	136	105	--
-300	872	898	901	852	--	706	701	698	673	--	166	197	203	179	--
-150	871	898	901	856	607	638	610	613	599	520	233	288	288	257	87
0	870	898	901	860	616	560	541	539	527	472	310	357	362	333	144
150	869	897	901	862	618	642	604	599	596	511	227	293	302	266	107
300	868	895	899	863	616	735	729	730	699	535	133	166	169	164	81
450	868	894	897	864	614	790	778	778	751	554	78	116	119	113	60
600	868	891	895	865	610	835	826	825	799	572	33	65	70	66	38
750	869	890	892	866	604	865	876	874	853	591	4	14	18	13	13
900	870	898	895	867	596	883	932	923	906	588	-13	-34	-28	-39	8
1050	--	910	907	856	584	--	904	982	938	584	--	6	-75	-82	0
1200	--	--	915	870	566	--	--	898	986	566	--	--	17	-116	0
1350	--	--	916	868	515	--	--	907	867	513	--	--	9	1	2
1500	--	--	915	862	--	--	--	907	861	--	--	--	8	1	--

DATA SHEET NO. 16
SUMMARY OF FMVSS 301 FUEL SYSTEM DATA

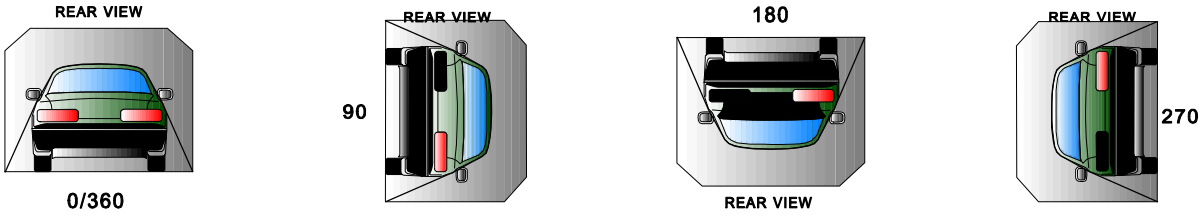
Test Vehicle:	2010 Hyundai Tuscon GLS	NHTSA No.	CA0503
Test Program:	FMVSS 214 Indicant Side Impact	Test Date:	March 4, 2010

FUEL SYSTEM INTEGRITY POST IMPACT DATA

Time Interval	FMVSS 301 Maximum Allowable Spillage	Spillage (g)
Impact Until Motion Ceases	28 g	0
First Five Minutes Following Impact	142 g	0
Next 25 Minutes	28 g / 1 minute	0

Spillage Location(s)	None

STATIC ROLLOVER DATA

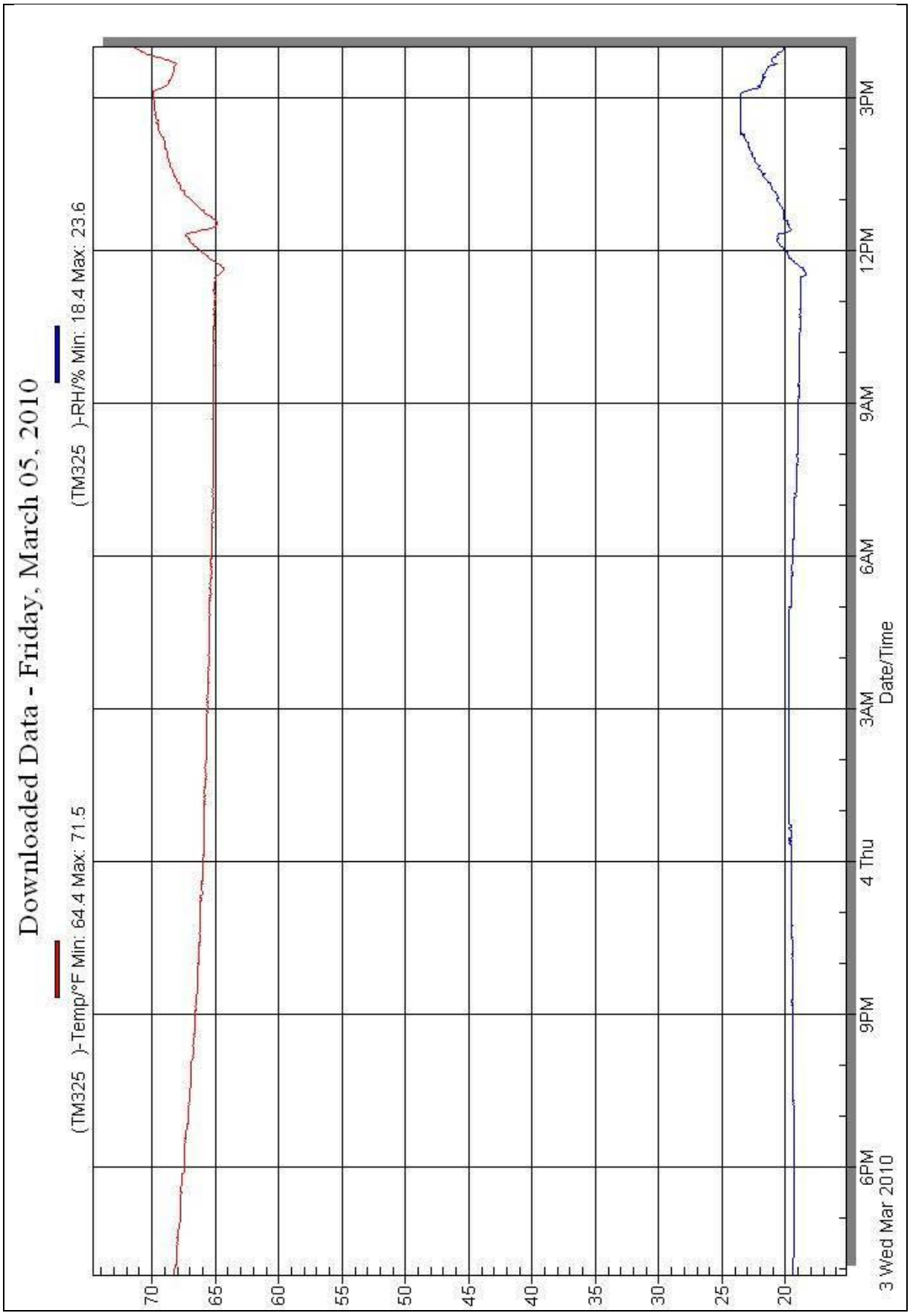


Rollover Stage	Rotation Time (spec. 1 -3 min)				FMVSS 301 Hold Time		Total Time				Next Whole Minute Interval	
0º - 90º	1	minutes	04	seconds	5	minutes	6	minutes	4	seconds	7	minutes
90º - 180º	1	minutes	10	seconds	5	minutes	6	minutes	10	seconds	7	minutes
180º-270º	1	minutes	01	seconds	5	minutes	6	minutes	1	seconds	7	minutes
270º-360º	1	minutes	09	seconds	5	minutes	6	minutes	9	seconds	7	minutes

Rollover Stage	Spillage (g)			
	First 5 min. from onset of rotation	6th min.	7th min.	8th min. (if required)
0º - 90º	0	0	0	0
90º - 180º	0	0	0	0
180º-270º	0	0	0	0
270º-360º	0	0	0	0
FMVSS 301 Maximum Allowable (for each 90º stage)	142	28	28	28

Rollover Stage	Spillage Location(s)
0º - 90º	None
90º - 180º	None
180º-270º	None
270º-360º	None

DATA SHEET NO. 17
TEMPERATURE AND HUMIDITY TRACE



APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

FIGURE A-1 : Pre-Test Front View of Test Vehicle

FIGURE A-2 : Post-Test Front View of Test Vehicle

FIGURE A-3 : Pre-Test Rear View of Test Vehicle

FIGURE A-4 : Post-Test Rear View of Test Vehicle

FIGURE A-5 : Pre-Test Impacted Side View of Test Vehicle

FIGURE A-6 : Post-Test Impacted Side View of Test Vehicle

FIGURE A-7 : Pre-Test Left ¾ Front View of Vehicle and Pole

FIGURE A-8 : Pre-Test Left ¾ Rear View of Vehicle and Pole

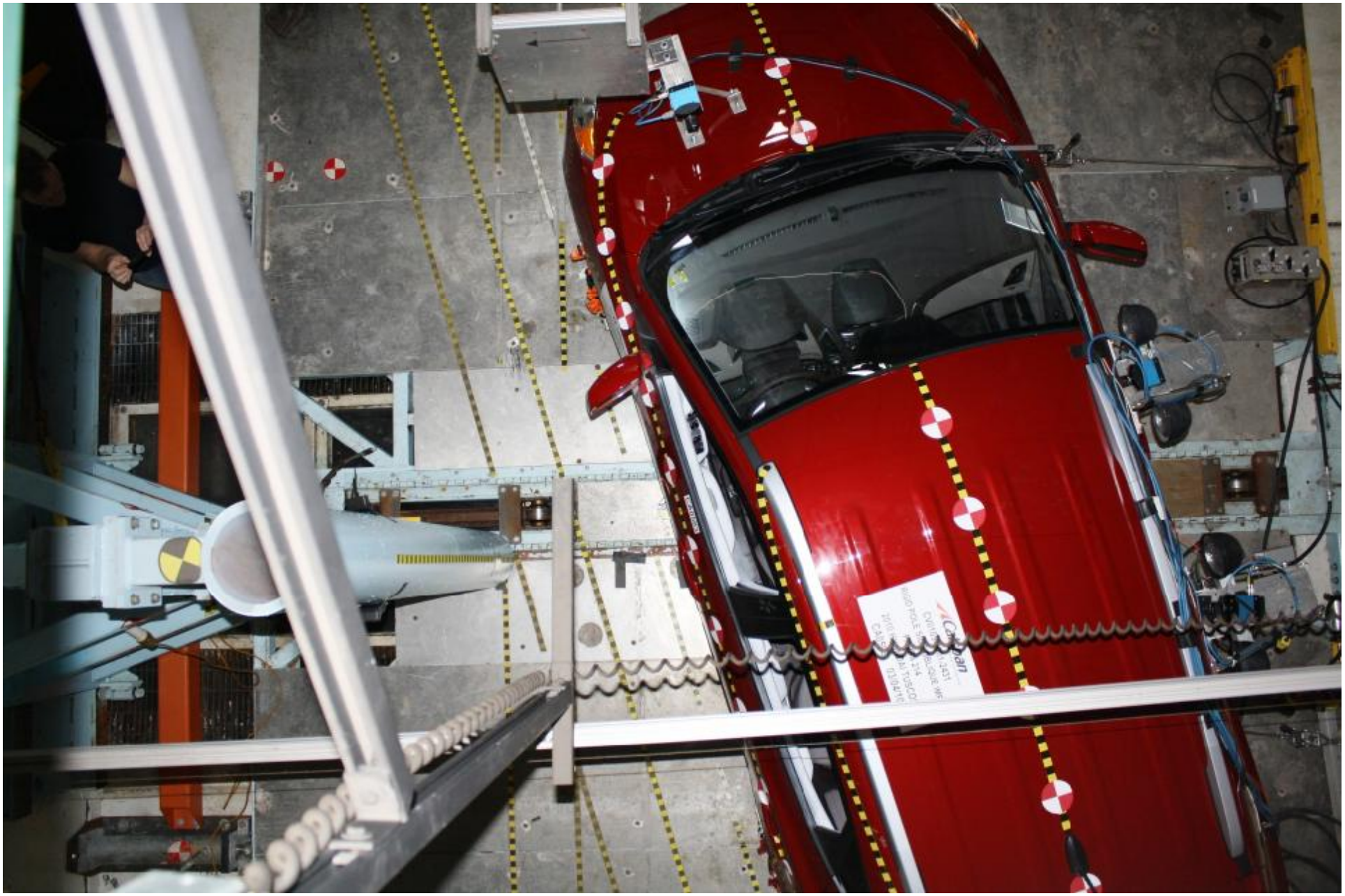


FIGURE A-9 : Pre-Test Overhead View of Aligned Vehicle and Pole

FIGURE A-10 : Post-Test Overhead View of Aligned Vehicle and Pole

FIGURE A-11 : Pre-Test Dummy Thru Opposite Wndow

FIGURE A-12 : Post-Test Dummy Thru Opposite Wndow

FIGURE A-13 : Pre-Test Close-up of Dummy w/Door Closed (Impact Side)

FIGURE A-14 : Post-Test Dummy w/Door Closed (Impact Side)

FIGURE A-15 : Pre-Test Dummy Door Open

FIGURE A-16 : Pre-Test Dummy Shoulder and Door Top View

FIGURE A-17 : Post-Test Dummy Shoulder and Door Top View

FIGURE A-18 : Pre-Test Interior of Front Door Closed (thru opposite door)

FIGURE A-19 : Post-Test Interior of Front Door Showing Dummy Impact Locations

FIGURE A-20 : Impact Event

Photograph Not Available

FIGURE A-21 : Post-Test Impact Zone Close-up View

FIGURE A-22 : Post-Test ¾ Front View of Impact Zone

FIGURE A-23 : Post-Test ¾ Rear View of Impact Zone

FIGURE A-24 : Post-Test Close-Up View of Impact Point Target

FIGURE A-25 : Close-up View of Vehicle's Certification Label

FIGURE A-26 : Close-up View of Vehicle's Tire Placard Label

FIGURE A-27 : Rollover 90 Degrees

FIGURE A-28 : Rollover 180 Degrees

FIGURE A-29 : Rollover 270 Degrees

FIGURE A-30 : Rollover 360 Degrees

APPENDIX B

ES-2re DUMMY RESPONSE DATA

(SAE sign convention)

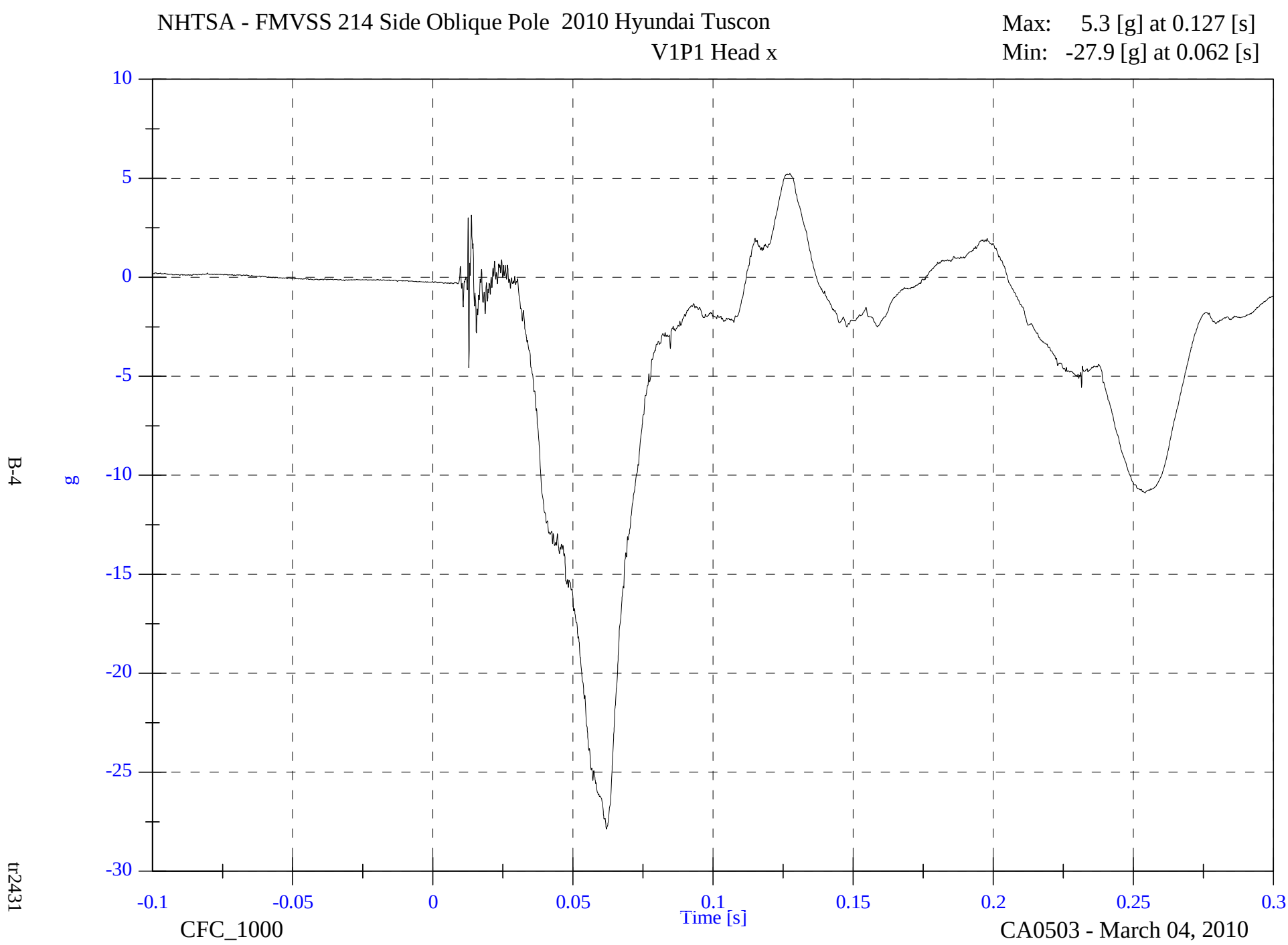
ES-2re DATA CHANNEL FILTER CLASS SUMMARY

Data Type	SAE Filter Class	Cut-off Frequency
Dummy Head Acceleration	1000	1650
Chest Deflection	180	300
Spine Acceleration	60	100
Abdomen Force	600	1000
Pubic Force	600	1000

DATA CHANNEL TITLE KEY

Prefix	Suffix
V1 = Vehicle 1 (Test Vehicle)	Ax = Acceleration, X-direction
	Ay = Acceleration, Y-direction
P1 = Left Front Seating Position (Driver)	Az = Acceleration, Z-direction
	Fx = Force, X-direction
A1-A18 = Accelerometer Location Number	Fy = Force, Y-direction
	Fz = Force, Z-direction
	Dx = Deflection, X-direction
	Dy = Deflection, Y-direction
	Dz = Deflection, Z-direction

TABLE OF DATA PLOTS for ES-2RE


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Head x
Max: 5.3 [g] at 0.127 [s]
Min: -27.9 [g] at 0.062 [s]
10
5
0
-5
-10
-15
-20
-25
-30
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_1000
CA0503 - March 04, 2010
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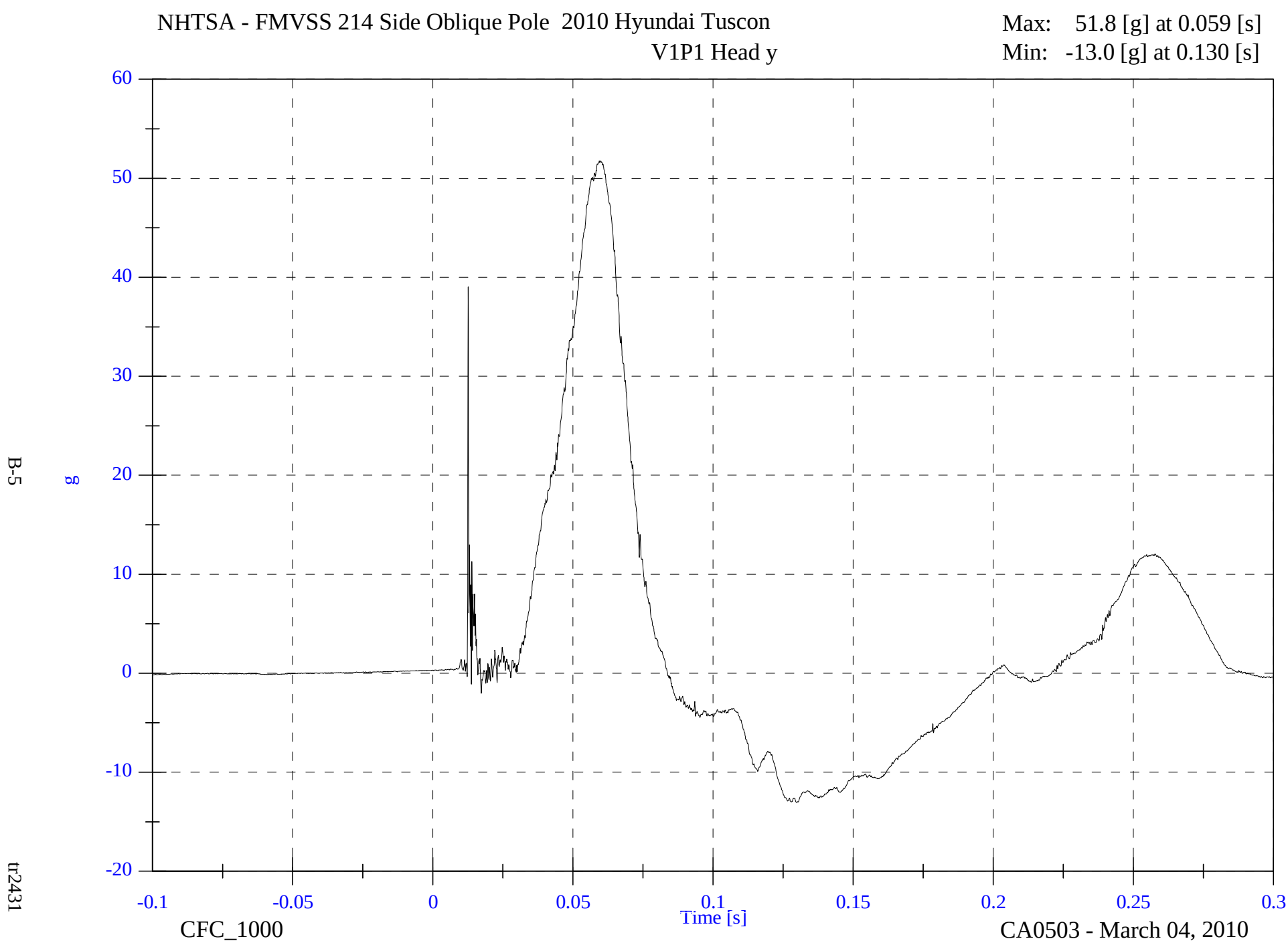
tr2431


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Head y
Max: 51.8 [g] at 0.059 [s]
Min: -13.0 [g] at 0.130 [s]
60
50
40
30
20
10
0
-10
-20
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_1000
CA0503 - March 04, 2010
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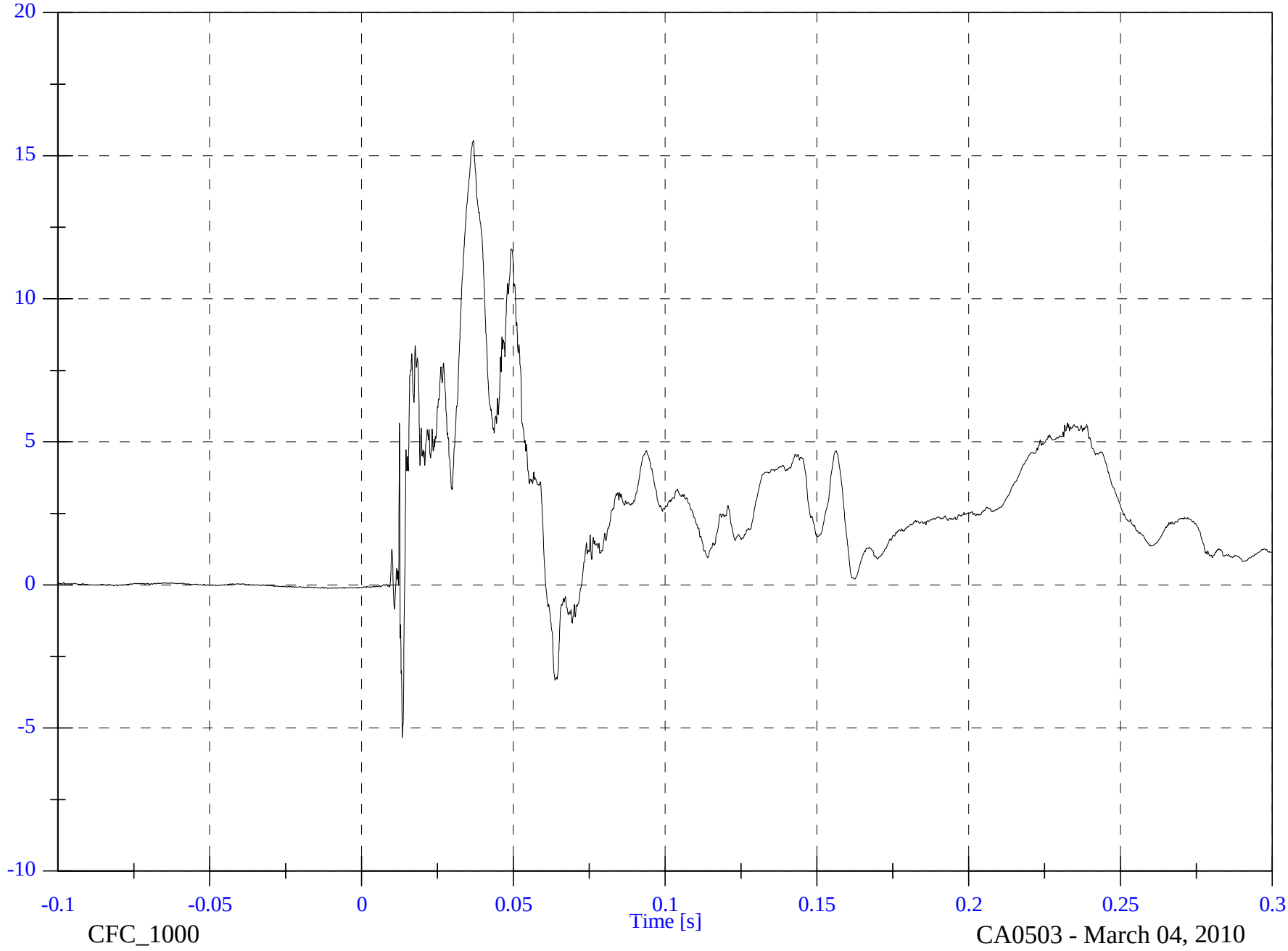
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Head z

Max: 15.5 [g] at 0.037 [s]

Min: -5.3 [g] at 0.013 [s]



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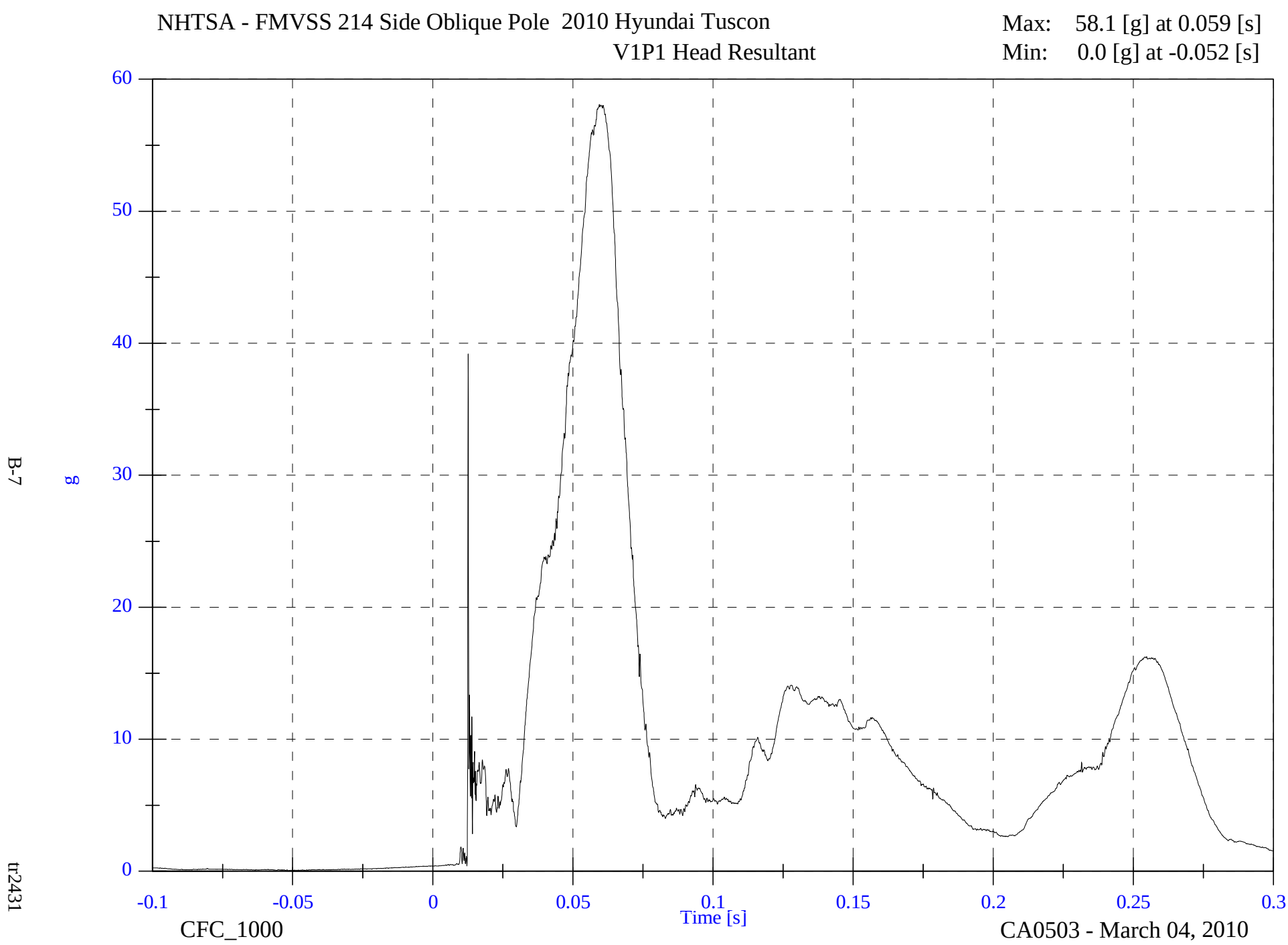
NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Head Resultant
Max: 58.1 [g] at 0.059 [s]
Min: 0.0 [g] at -0.052 [s]
60
50
40
30
20
10
0
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_1000
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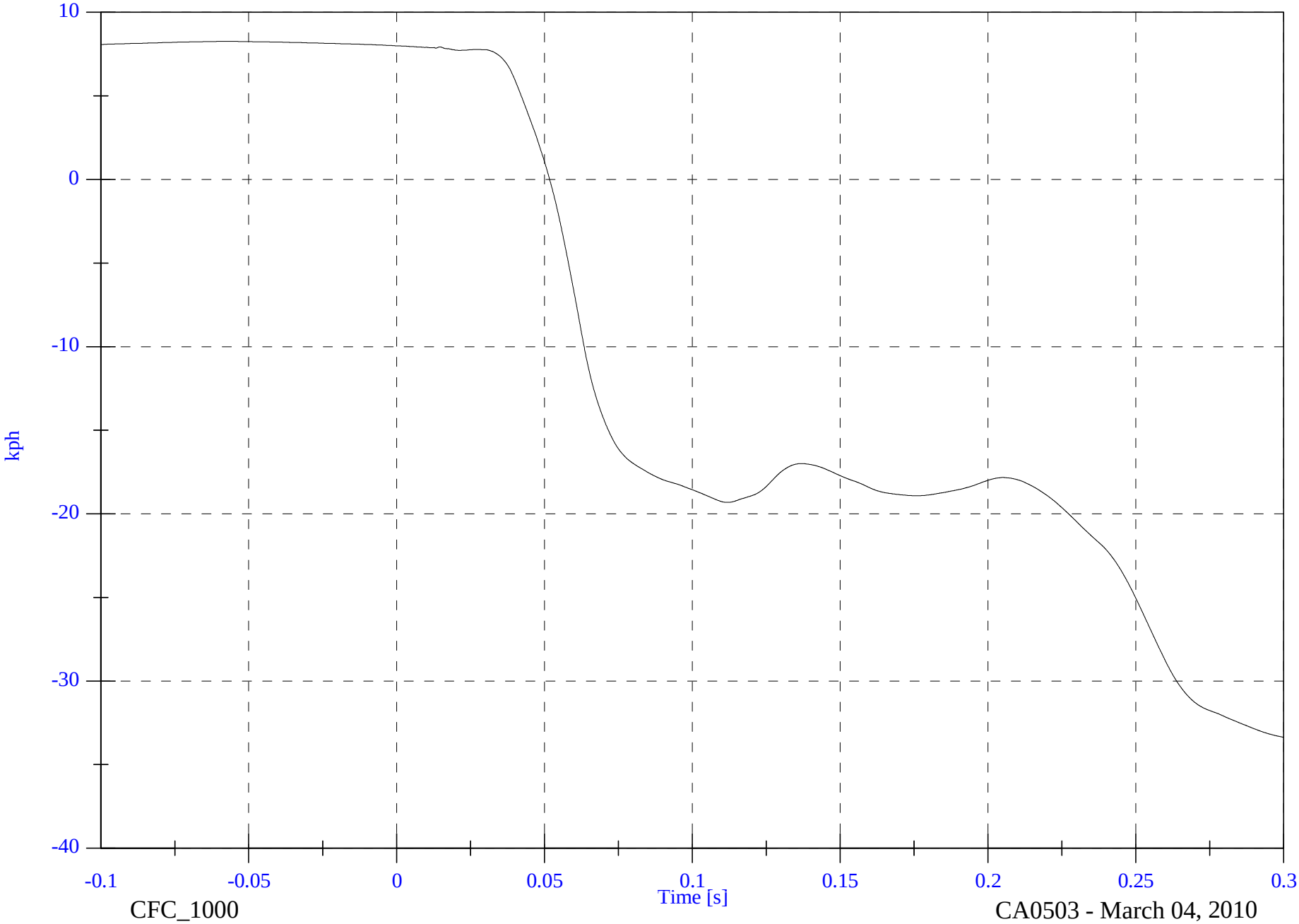
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Head x Velocity

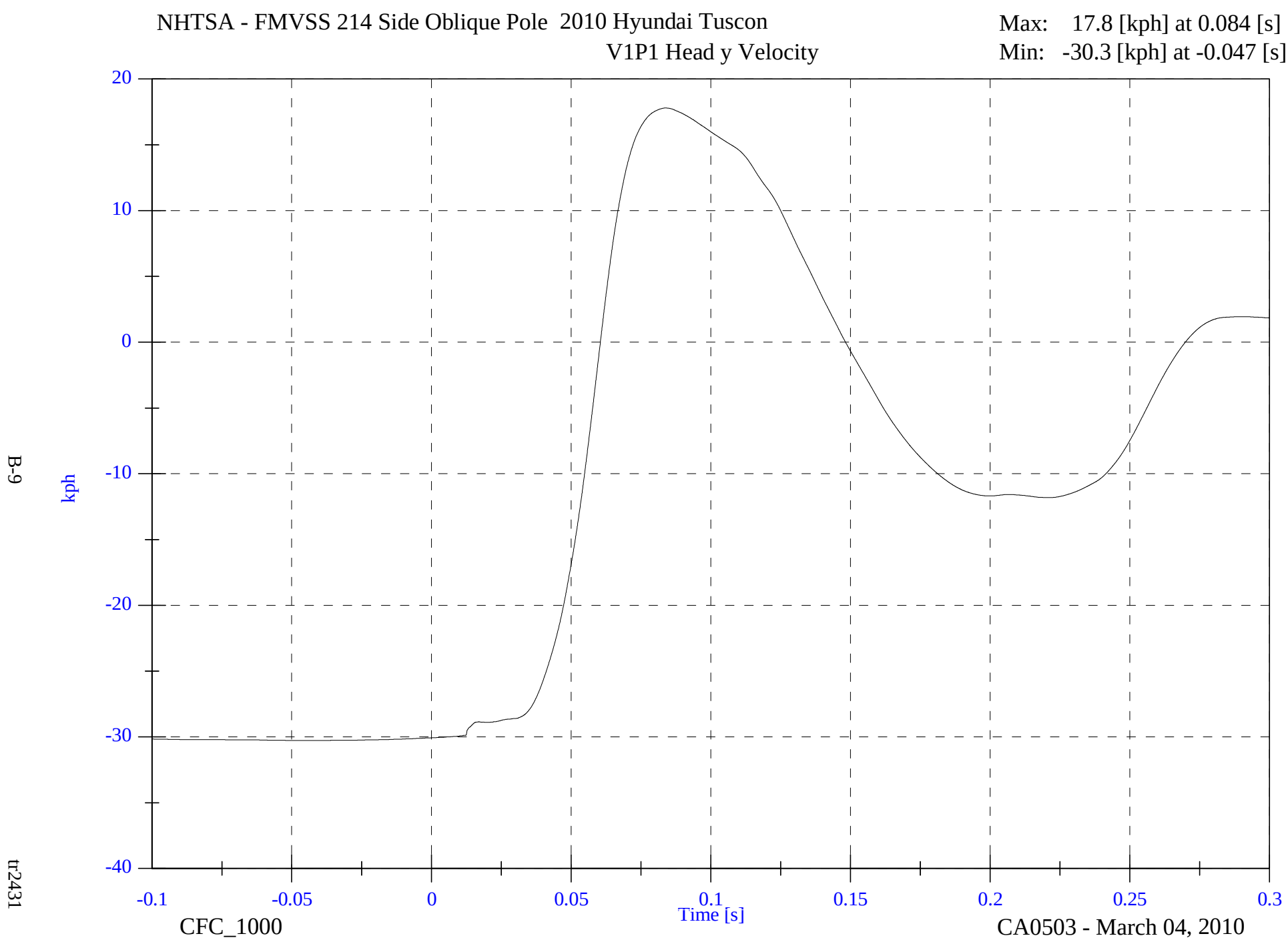
Max: 8.3 [kph] at -0.058 [s]

Min: -33.4 [kph] at 0.300 [s]



CFC_1000

CA0503 - March 04, 2010


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Head y Velocity
Max: 17.8 [kph] at 0.084 [s]
Min: -30.3 [kph] at -0.047 [s]
20
10
0
-10
-20
-30
-40
kph
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_1000
CA0503 - March 04, 2010

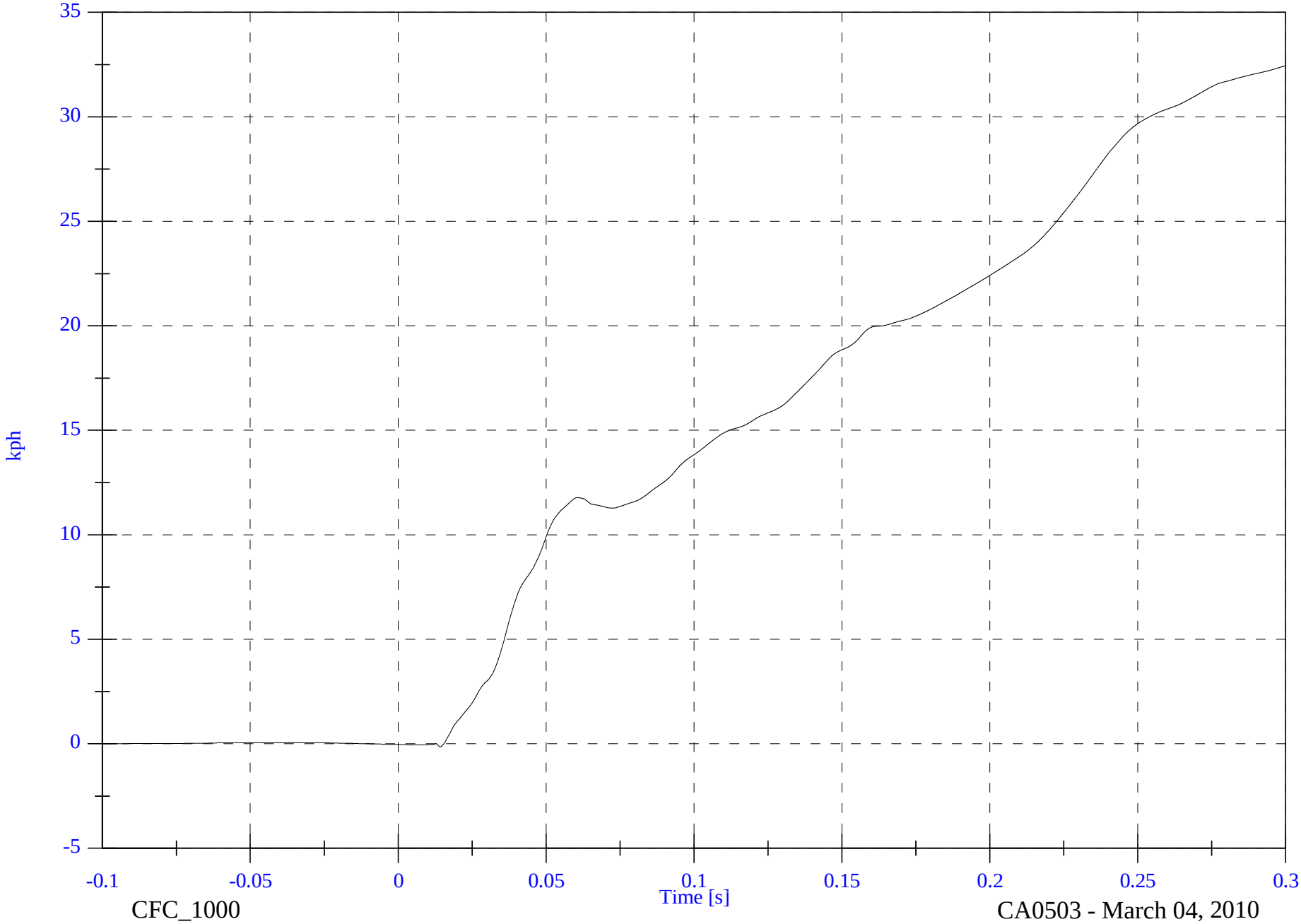
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Head z Velocity

Max: 32.4 [kph] at 0.300 [s]

Min: -0.2 [kph] at 0.014 [s]



CFC_1000

CA0503 - March 04, 2010

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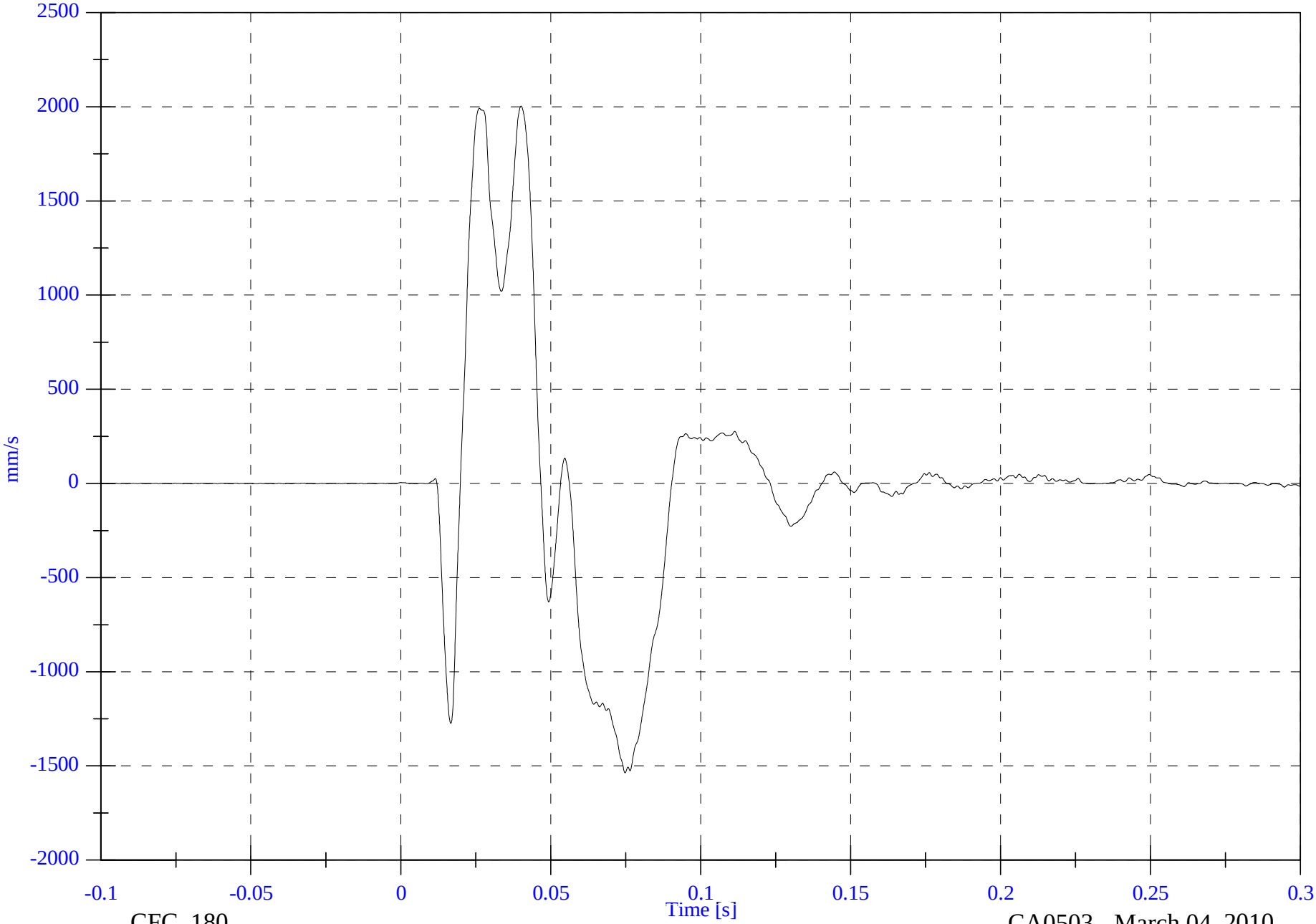
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Upper Thorax Rib Deflection Rate

Max: 2003.2 [mm/s] at 0.040 [s]

Min: -1536.6 [mm/s] at 0.075 [s]



CFC_180

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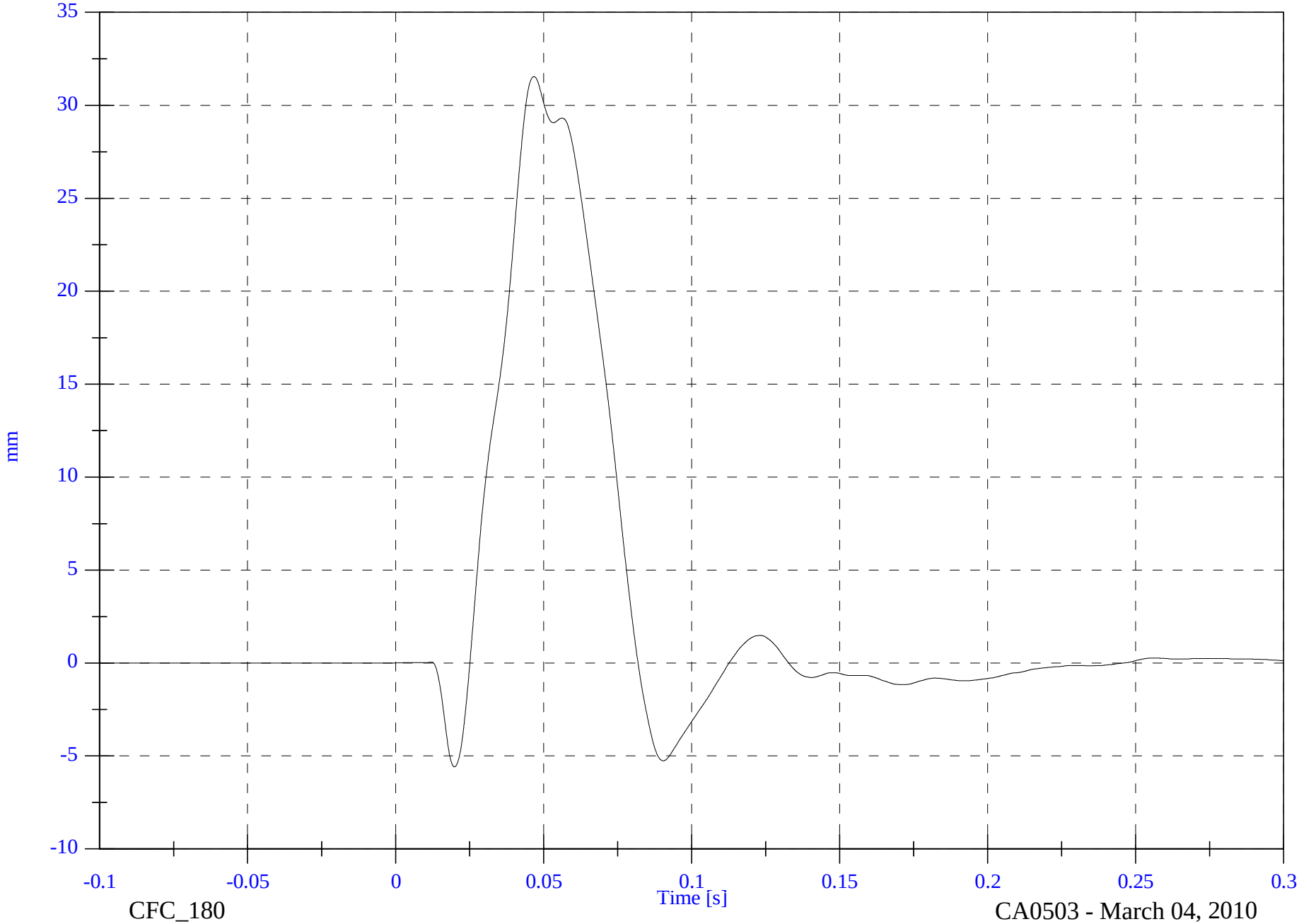
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Upper Thorax Rib Dy

Max: 31.5 [mm] at 0.047 [s]

Min: -5.6 [mm] at 0.020 [s]



CFC_180

CA0503 - March 04, 2010

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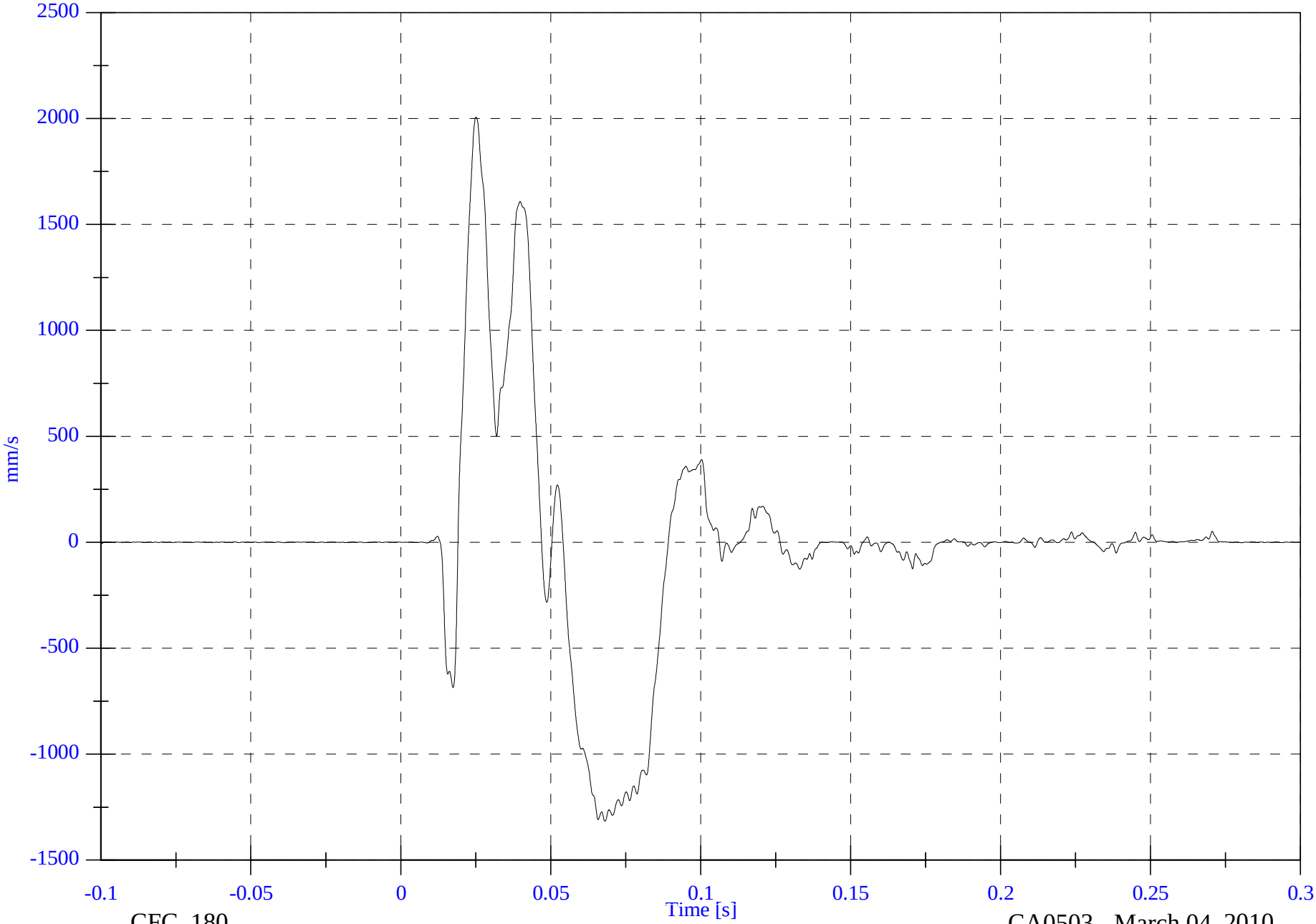
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Middle Thorax Rib Deflection Rate

Max: 2006.7 [mm/s] at 0.025 [s]

Min: -1316.5 [mm/s] at 0.068 [s]



CFC_180

CA0503 - March 04, 2010

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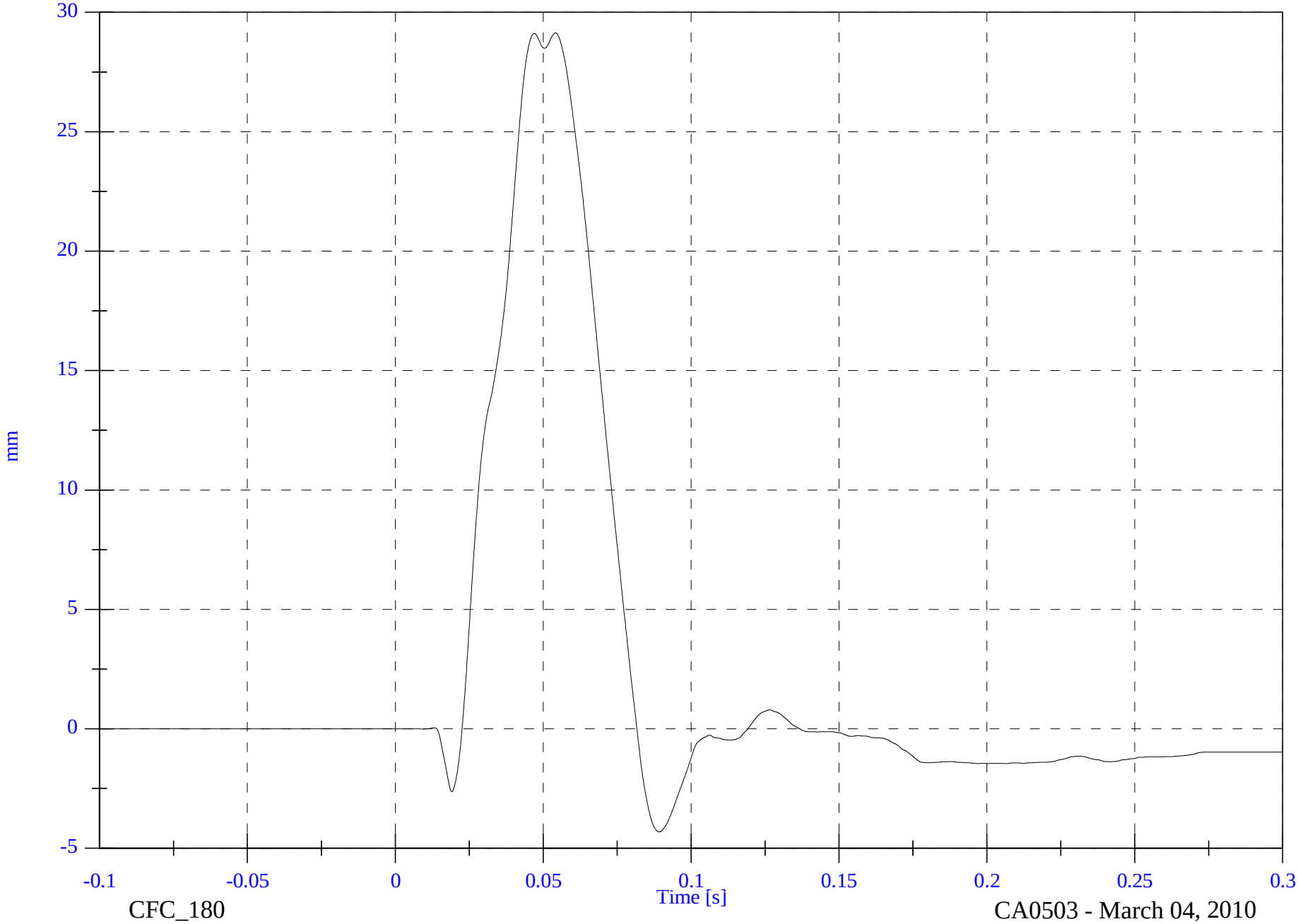
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Middle Thorax Rib Dy

Max: 29.1 [mm] at 0.054 [s]

Min: -4.3 [mm] at 0.089 [s]



CFC_180

CA0503 - March 04, 2010

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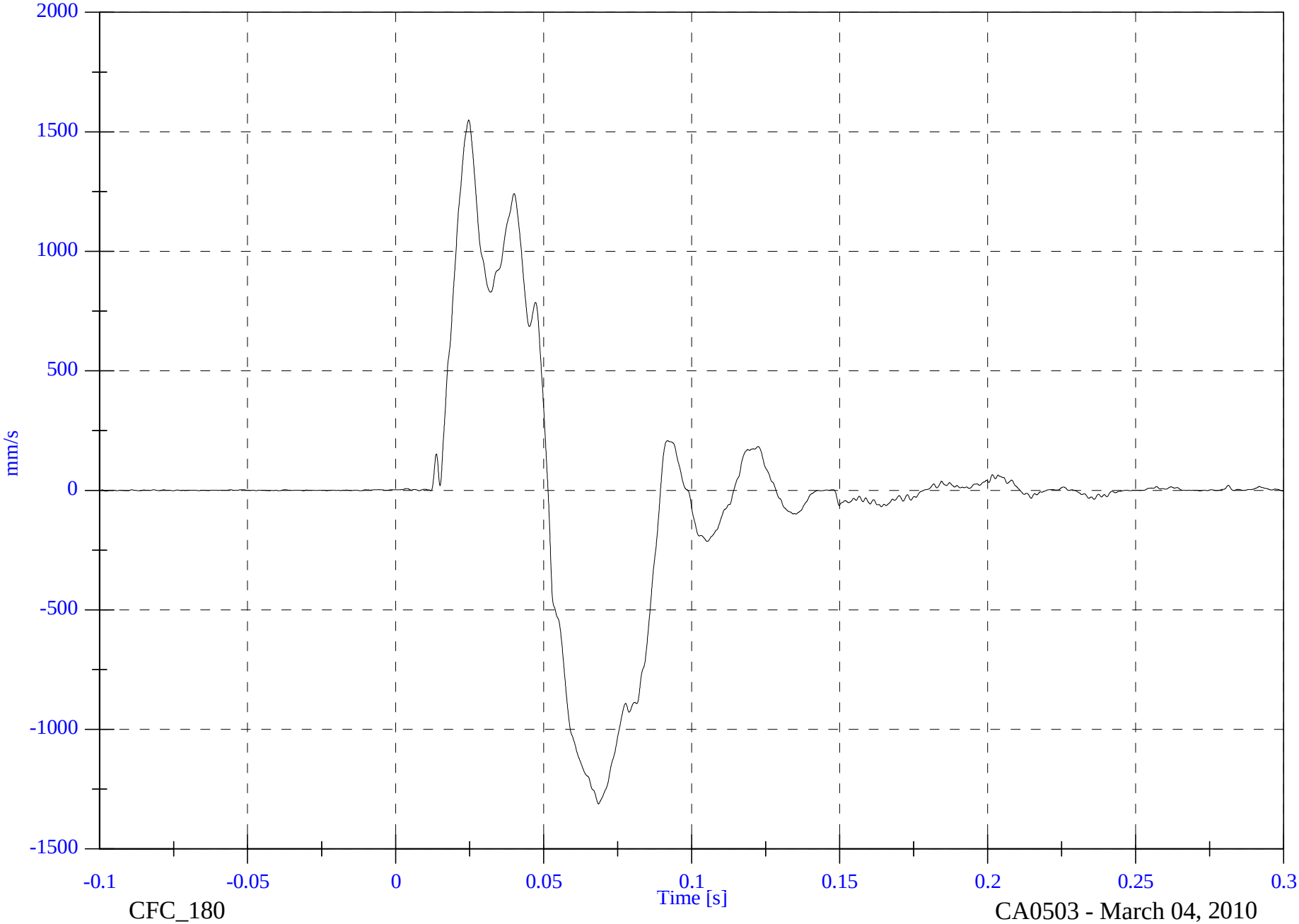
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Lower Thorax Rib Deflection Rate

Max: 1550.0 [mm/s] at 0.025 [s]

Min: -1311.8 [mm/s] at 0.069 [s]



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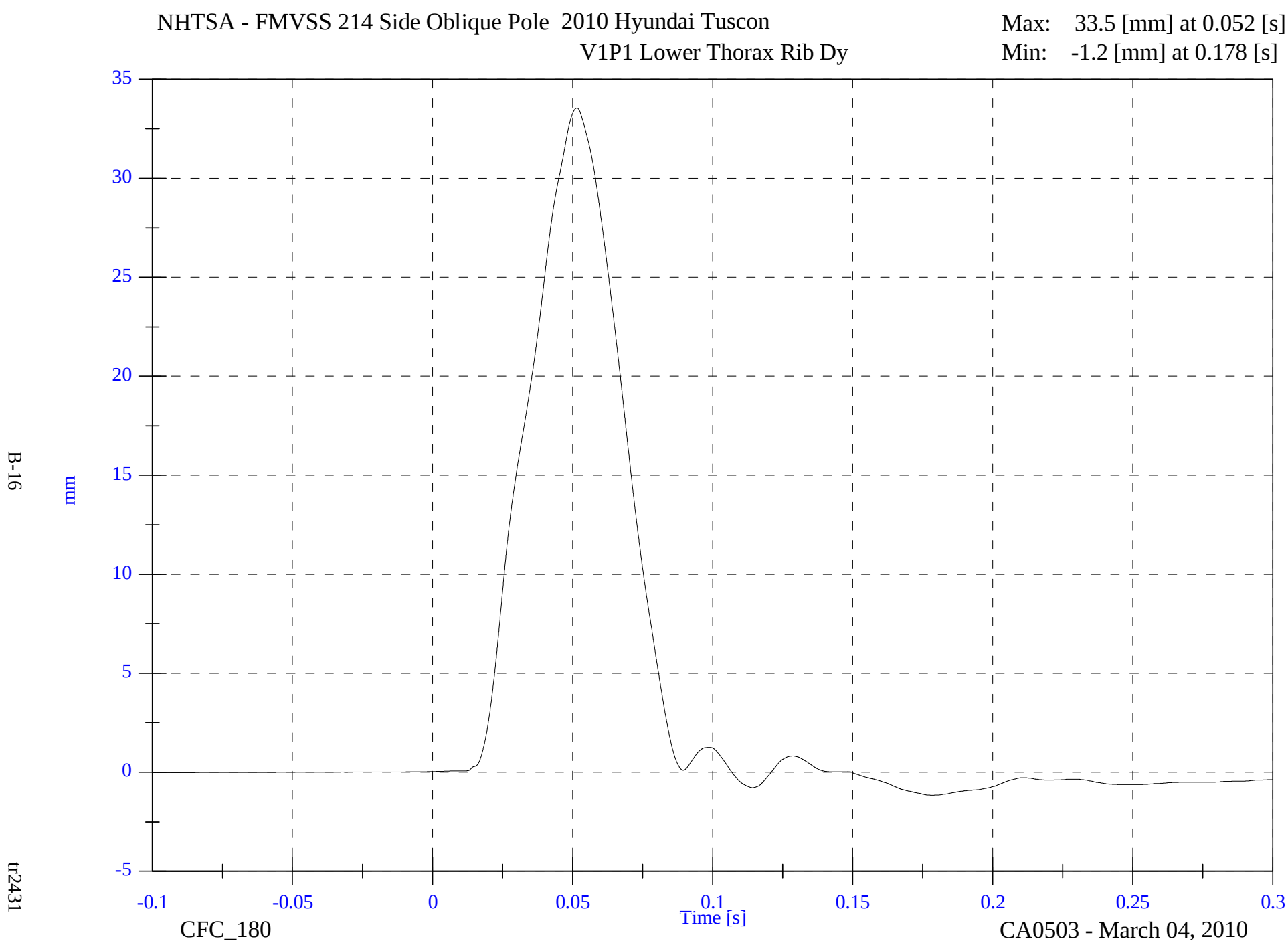
tr2431

CFC_180

CA0503 - March 04, 2010


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Lower Thorax Rib Dy
Max: 33.5 [mm] at 0.052 [s]
Min: -1.2 [mm] at 0.178 [s]
mm
35
30
25
20
15
10
5
0
-5
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_180
CA0503 - March 04, 2010

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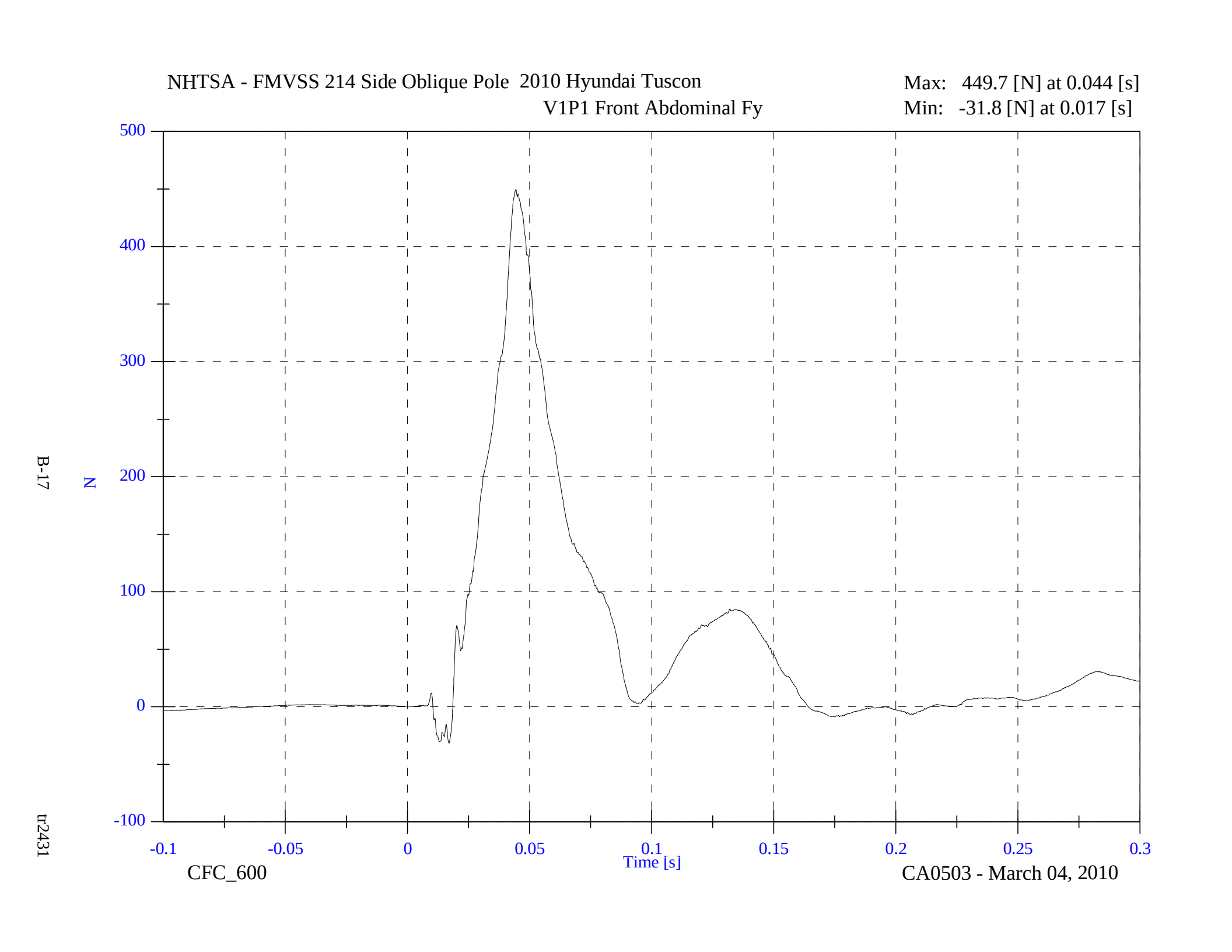
NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Front Abdominal Fy
Max: 449.7 [N] at 0.044 [s]
Min: -31.8 [N] at 0.017 [s]
500
400
300
200
100
0
-100
N
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_600
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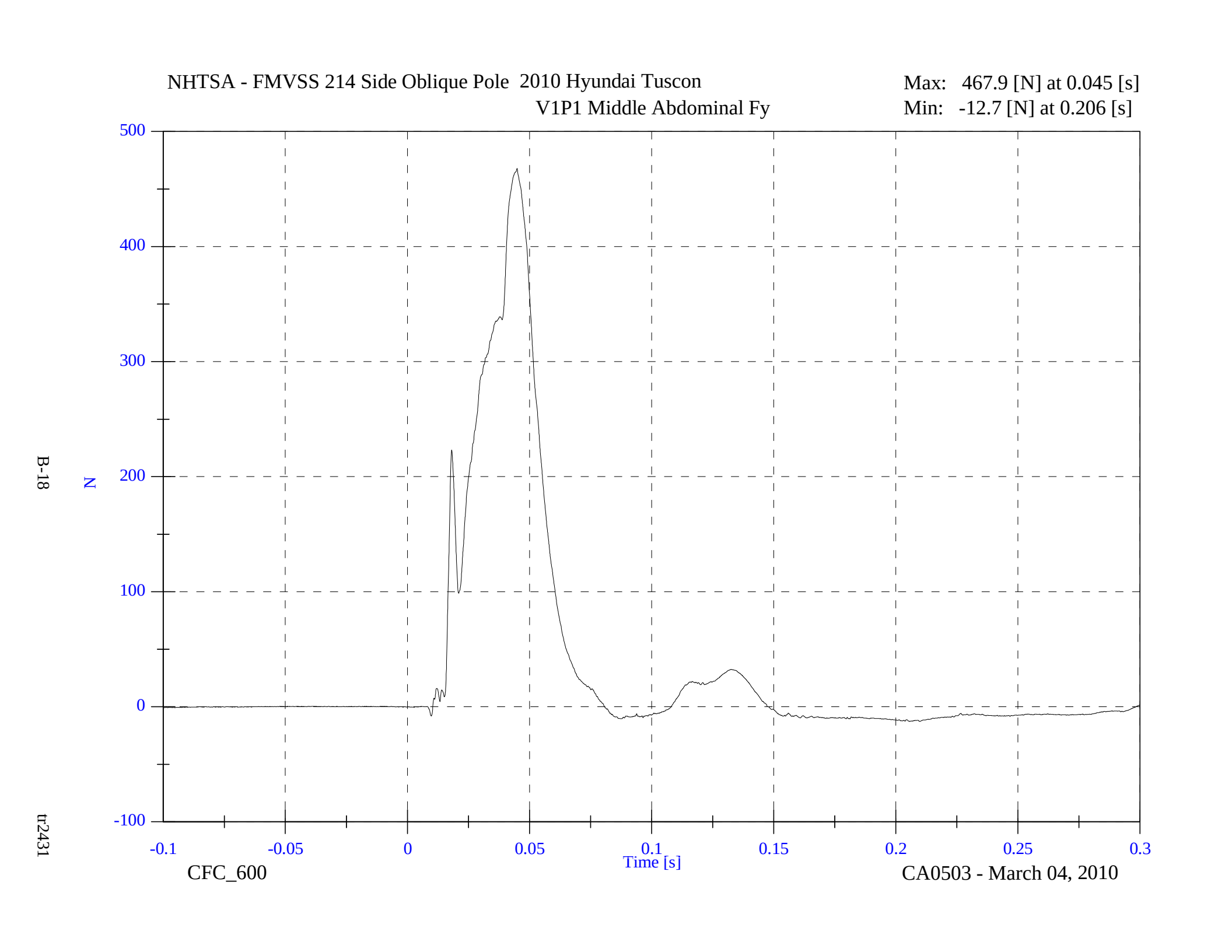
tr2431


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Middle Abdominal Fy
Max: 467.9 [N] at 0.045 [s]
Min: -12.7 [N] at 0.206 [s]
500
400
300
200
100
0
-100
N
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_600
CA0503 - March 04, 2010
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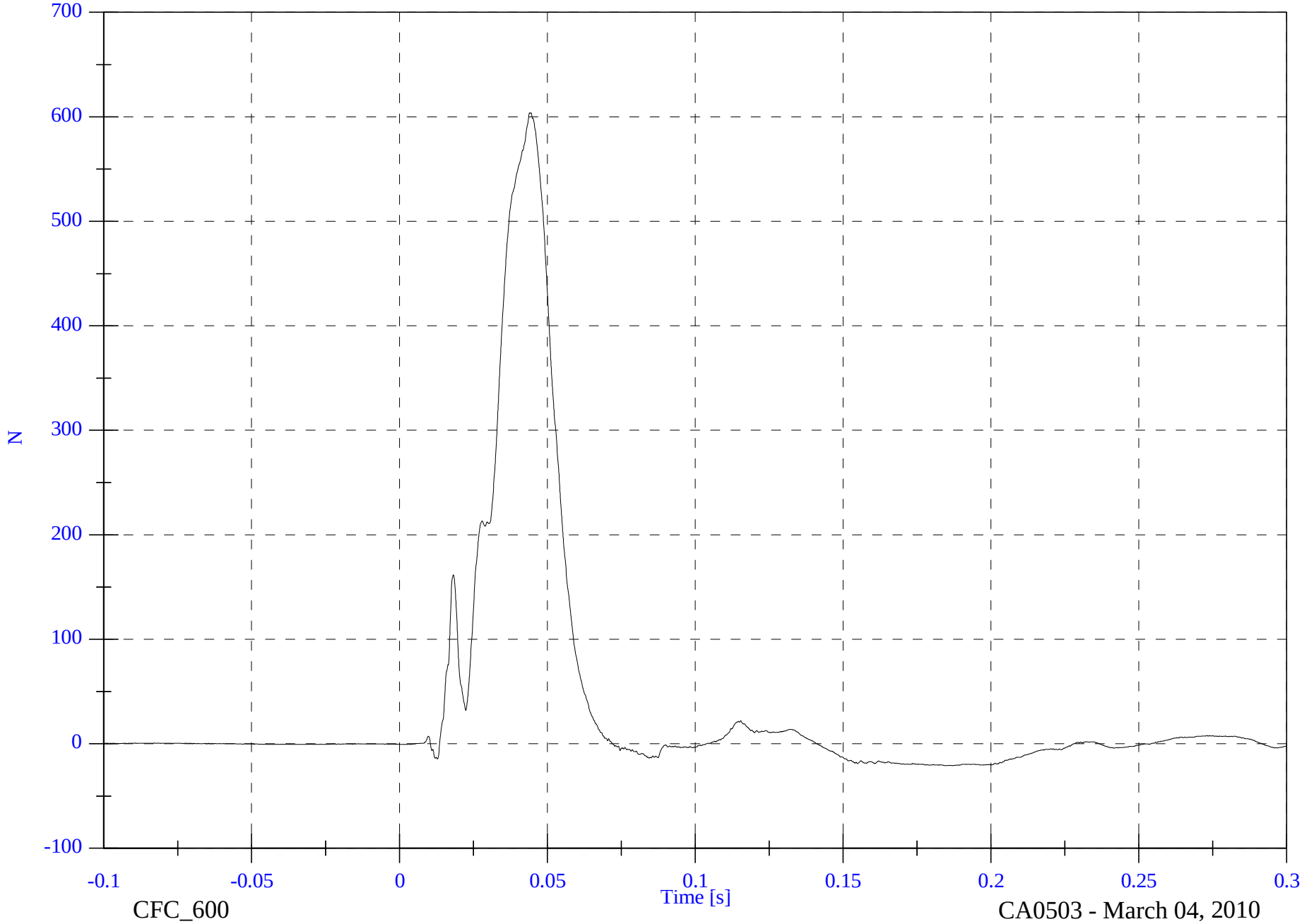
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Rear Abdominal Fy

Max: 604.0 [N] at 0.044 [s]

Min: -20.9 [N] at 0.185 [s]



CFC_600

CA0503 - March 04, 2010

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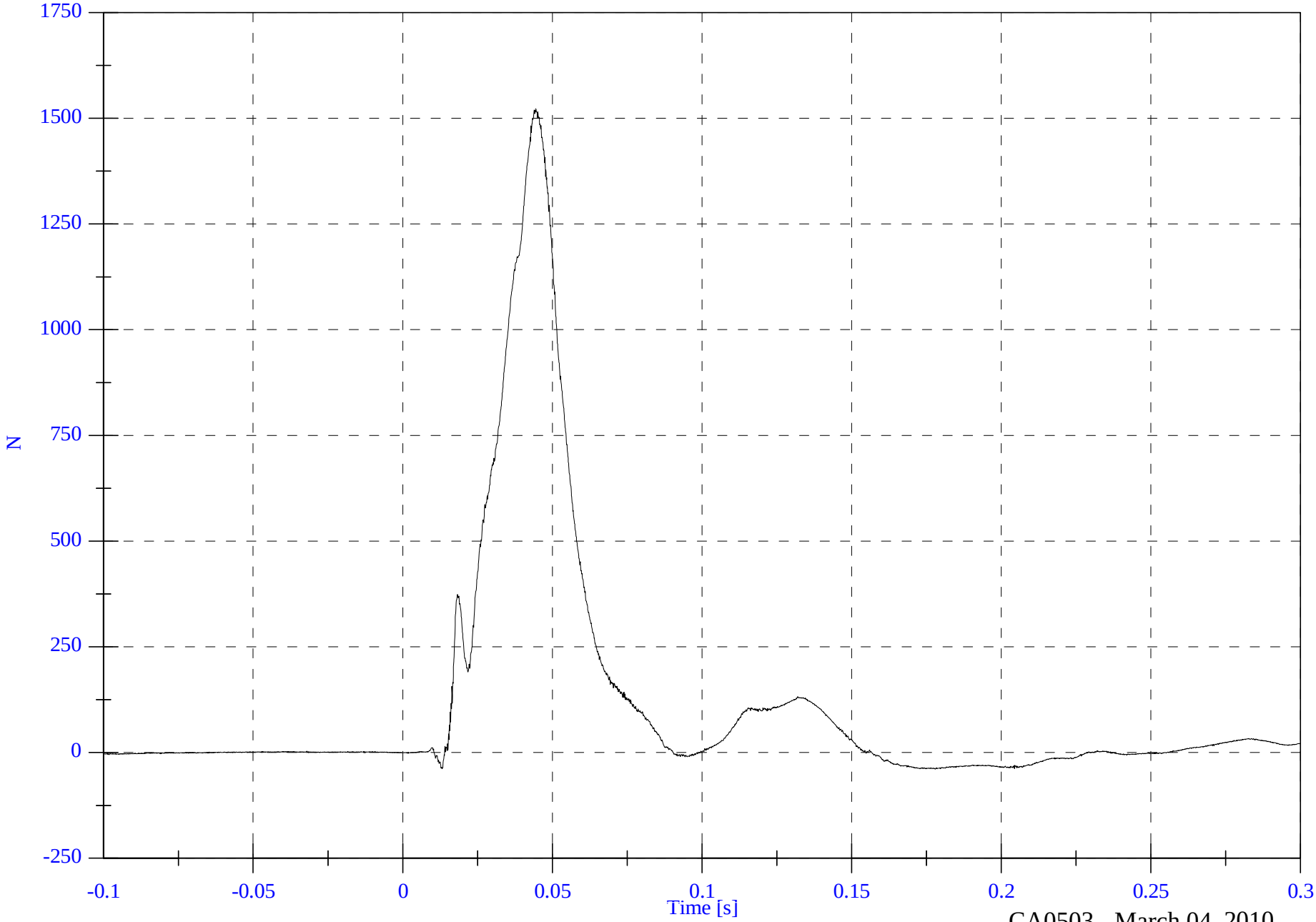
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1P1 Abdominal Summation Fy

Max: 1522.9 [N] at 0.044 [s]

Min: -39.5 [N] at 0.178 [s]



CA0503 - March 04, 2010

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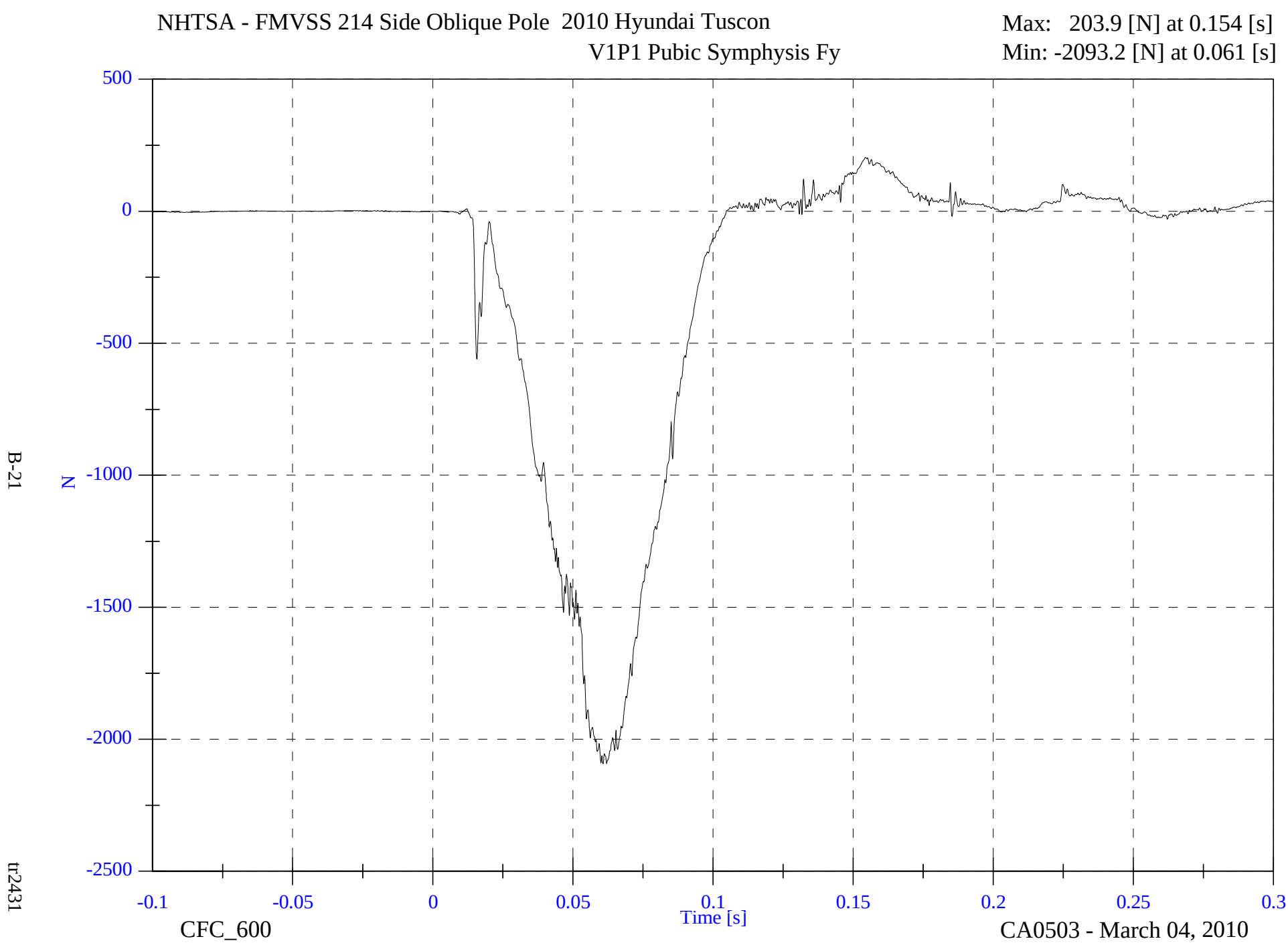
tr2431


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1P1 Pubic Symphysis Fy
Max: 203.9 [N] at 0.154 [s]
Min: -2093.2 [N] at 0.061 [s]
500
0
-500
-1000
-1500
-2000
-2500
N
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_600
CA0503 - March 04, 2010

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tr2431

APPENDIX C

VEHICLE ACCELEROMETER RESPONSE DATA

(SAE sign convention)

DATA CHANNEL TITLE KEY

Prefix	Suffix
V1 = Vehicle 1 (Test Vehicle)	Ax = Acceleration, X-direction
	Ay = Acceleration, Y-direction
P1 = Left Front Seating Position (Driver)	Az = Acceleration, Z-direction
	Fx = Force, X-direction
A1-A18 = Accelerometer Location Number	Fy = Force, Y-direction
	Fz = Force, Z-direction
	Dx = Deflection, X-direction
	Dy = Deflection, Y-direction
	Dz = Deflection, Z-direction

TABLE OF DATA PLOTS for VEHICLE

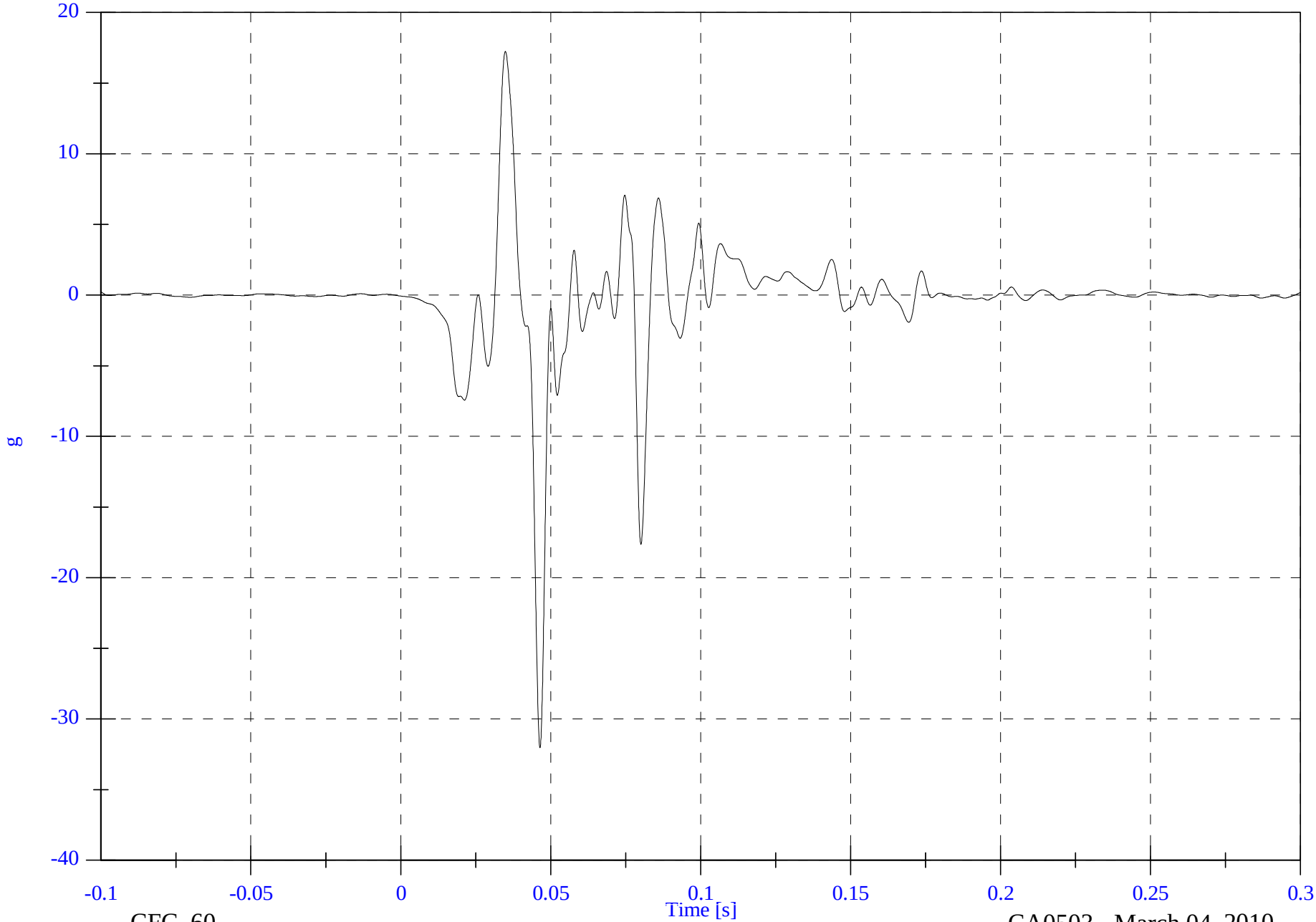
TABLE OF DATA PLOTS for VEHICLE

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG x

Max: 17.3 [g] at 0.035 [s]

Min: -32.0 [g] at 0.046 [s]



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tr2431

CFC_60

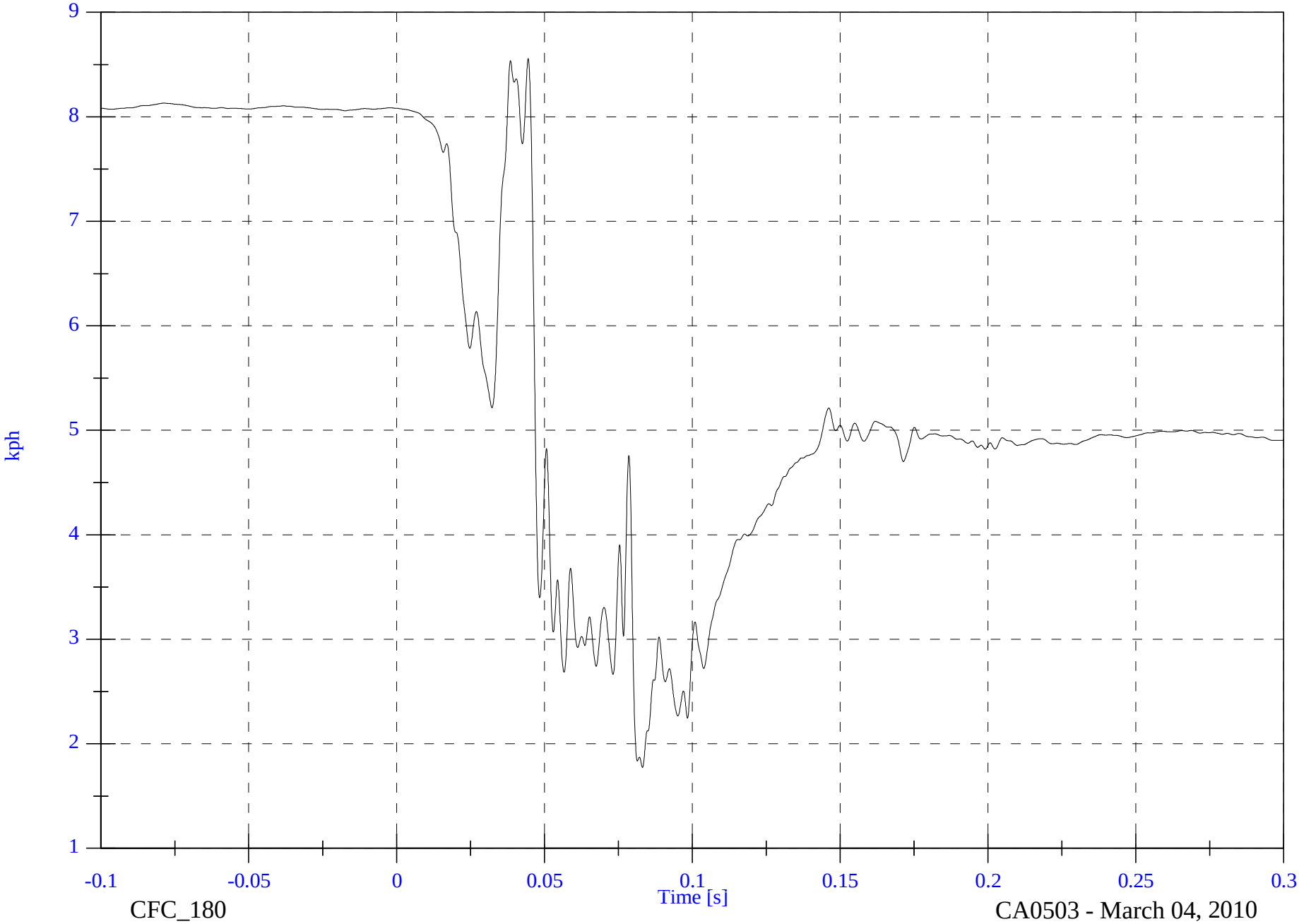
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG x Velocity

Max: 8.6 [kph] at 0.044 [s]

Min: 1.8 [kph] at 0.083 [s]



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tr2431

CFC_180

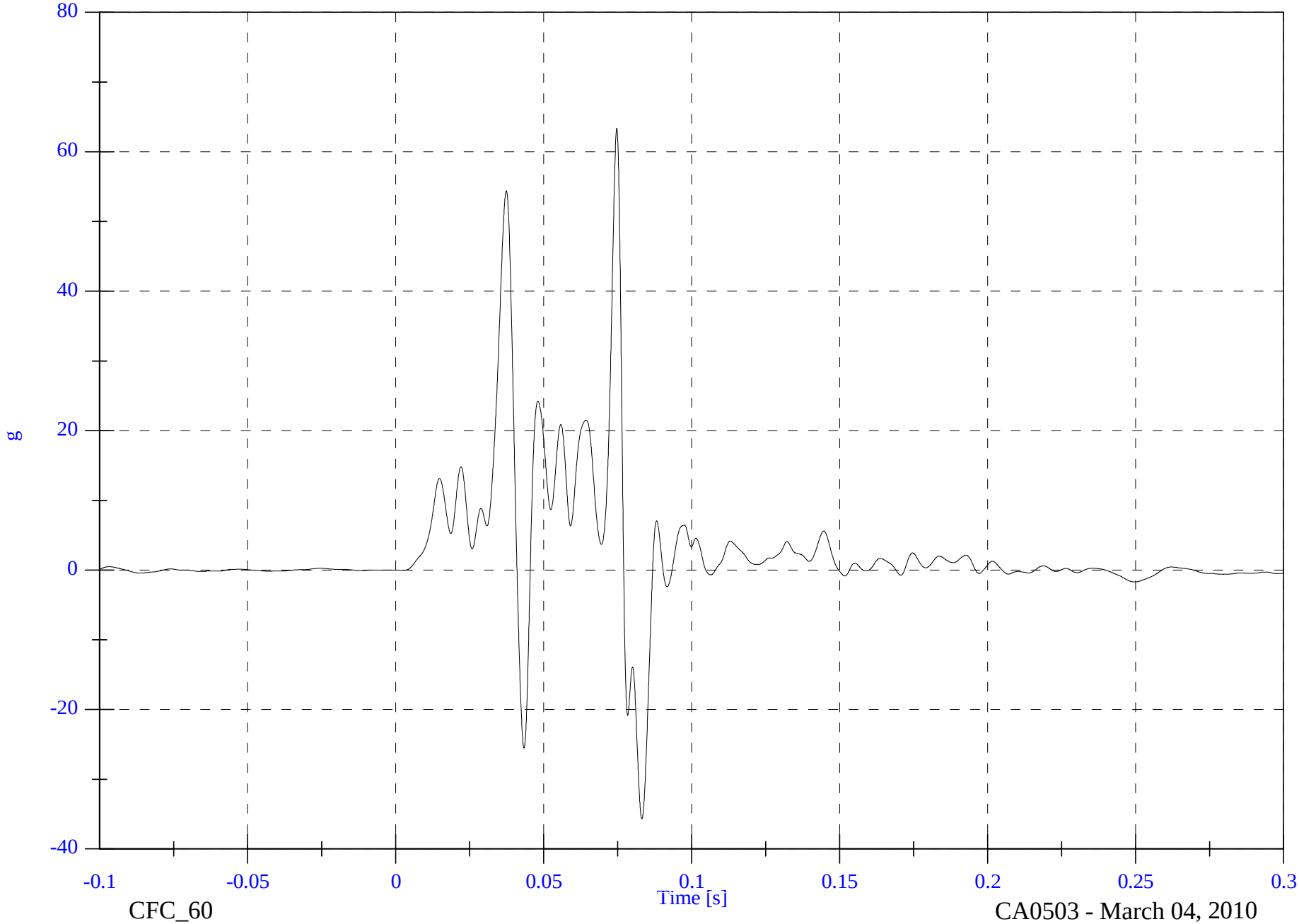
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG y

Max: 63.4 [g] at 0.075 [s]

Min: -35.7 [g] at 0.083 [s]



C-7

tr2431

CFC_60

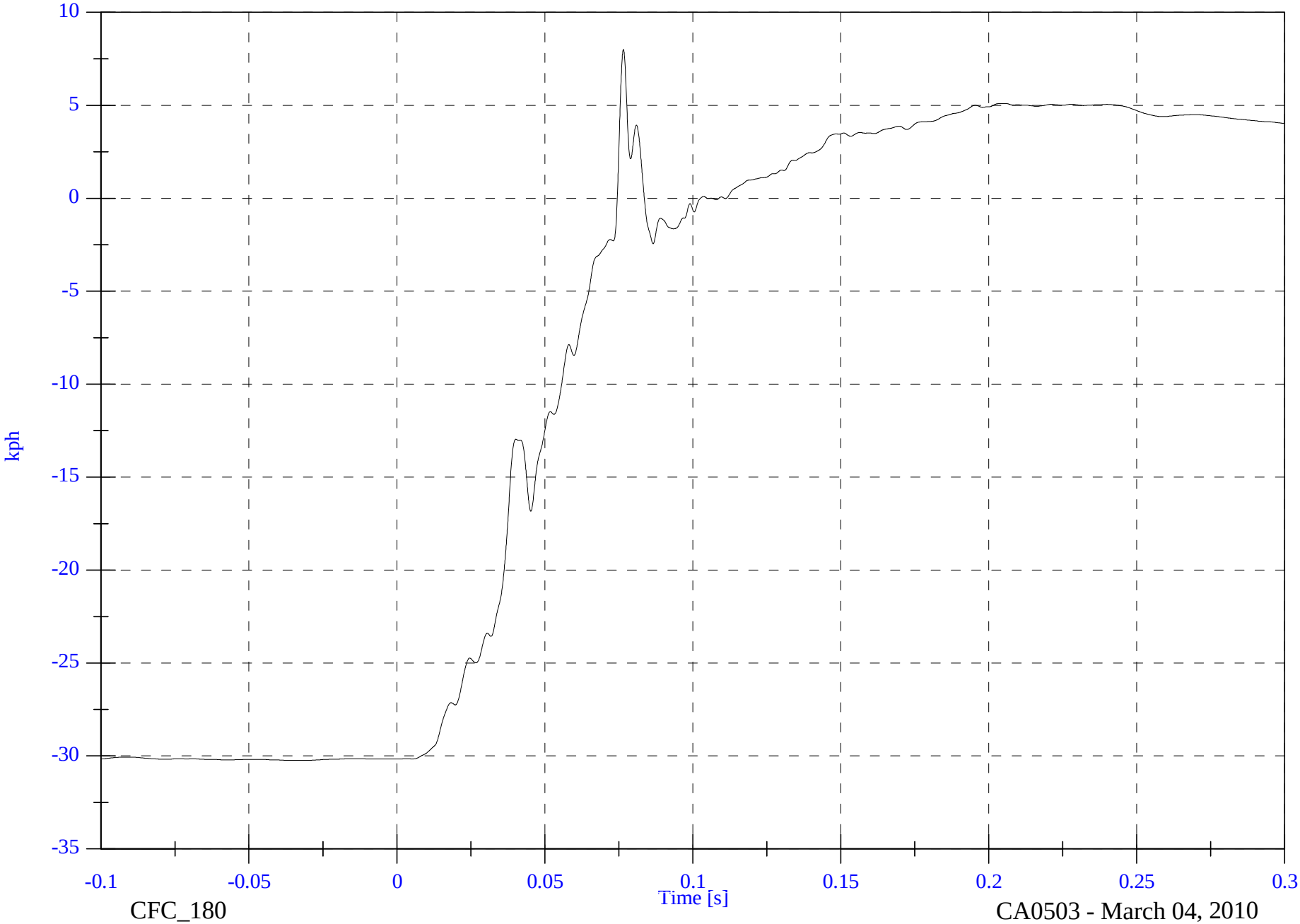
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG y Velocity

Max: 8.0 [kph] at 0.077 [s]

Min: -30.2 [kph] at -0.035 [s]



CFC_180

CA0503 - March 04, 2010

C-8

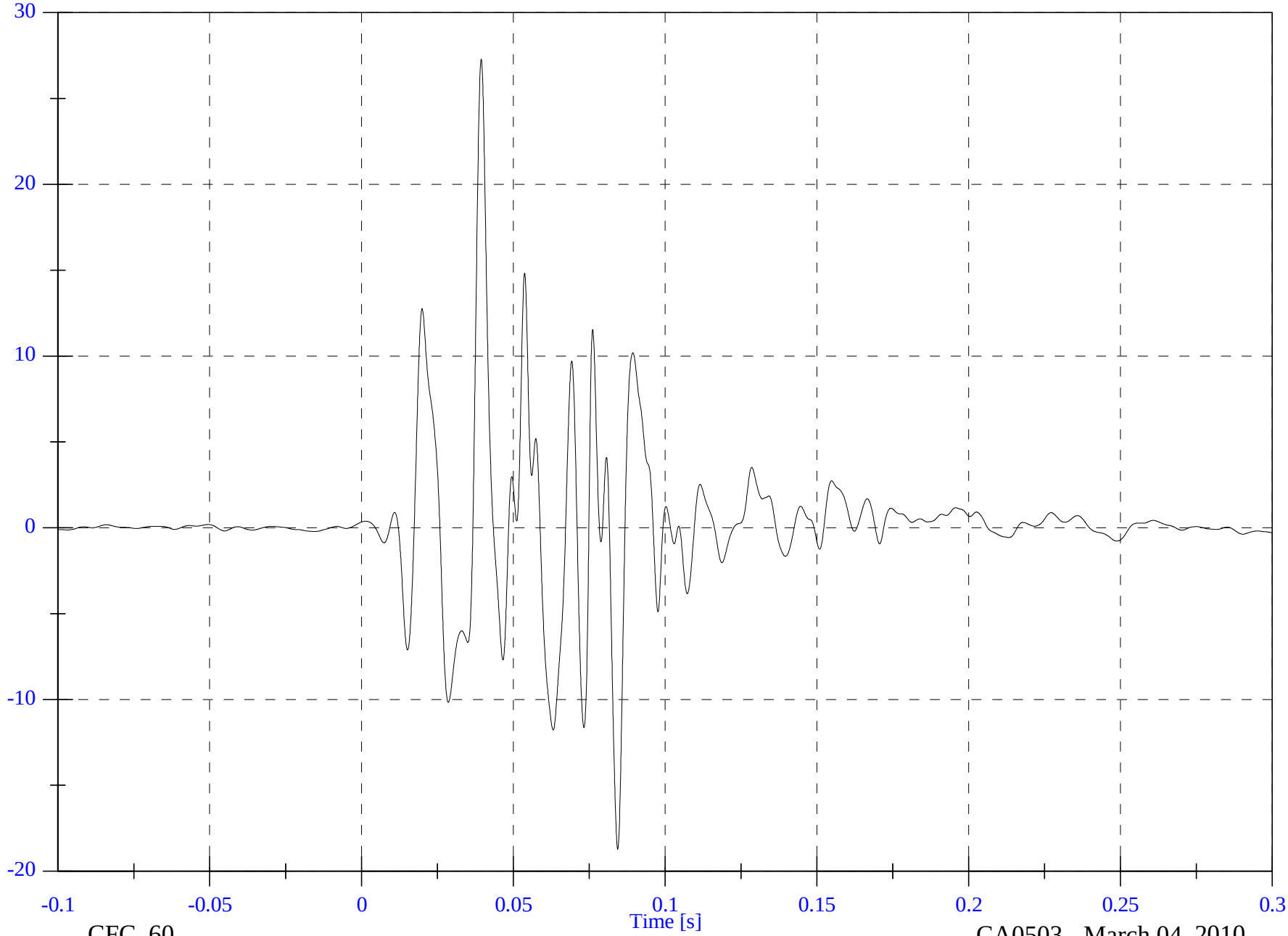
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG z

Max: 27.3 [g] at 0.039 [s]

Min: -18.7 [g] at 0.084 [s]



C-9

tr2431

CFC_60

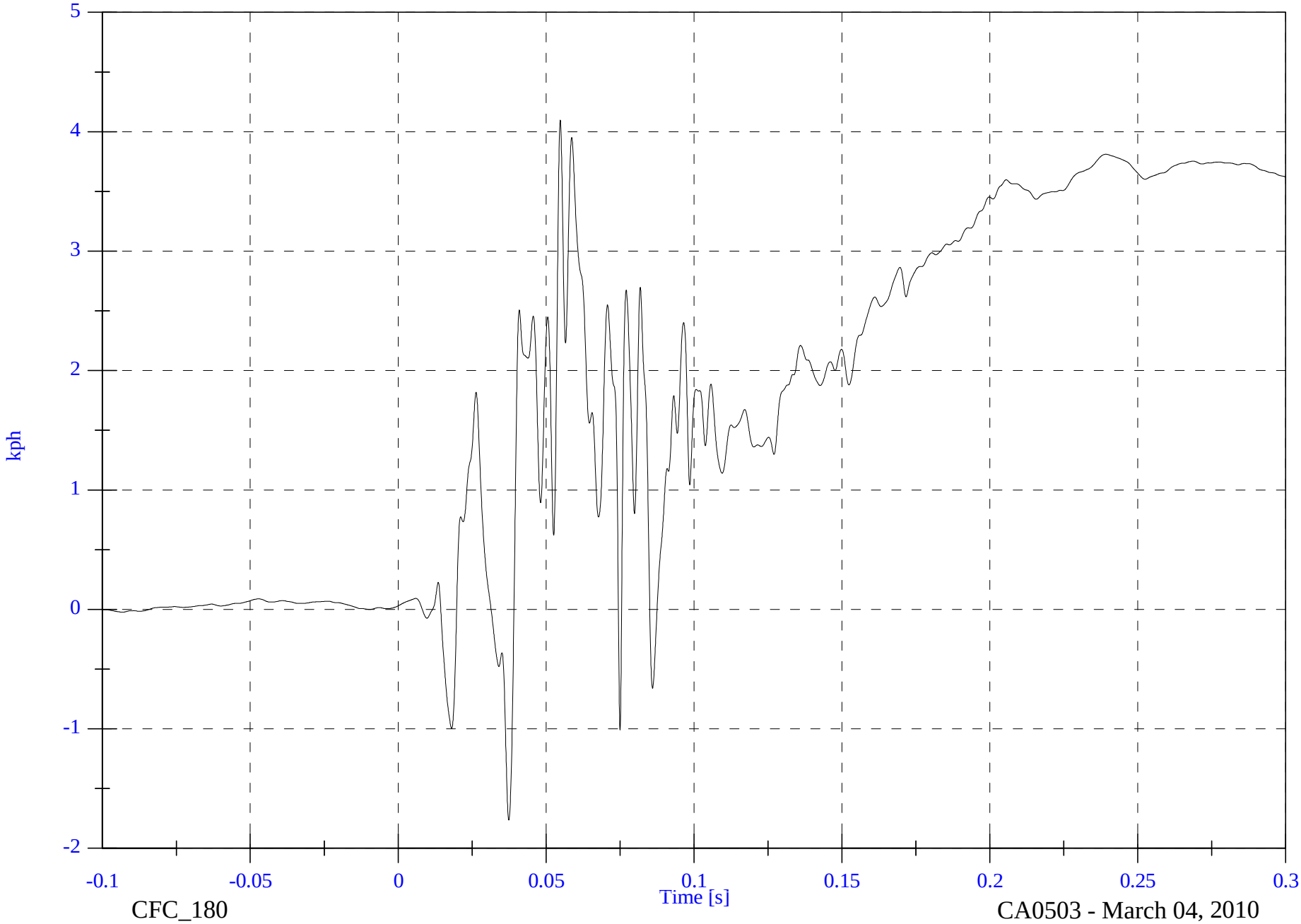
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG z Velocity

Max: 4.1 [kph] at 0.055 [s]

Min: -1.8 [kph] at 0.037 [s]



C-10

tr2431

CFC_180

CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Vehicle CG Resultant

Max: 63.8 [g] at 0.075 [s]

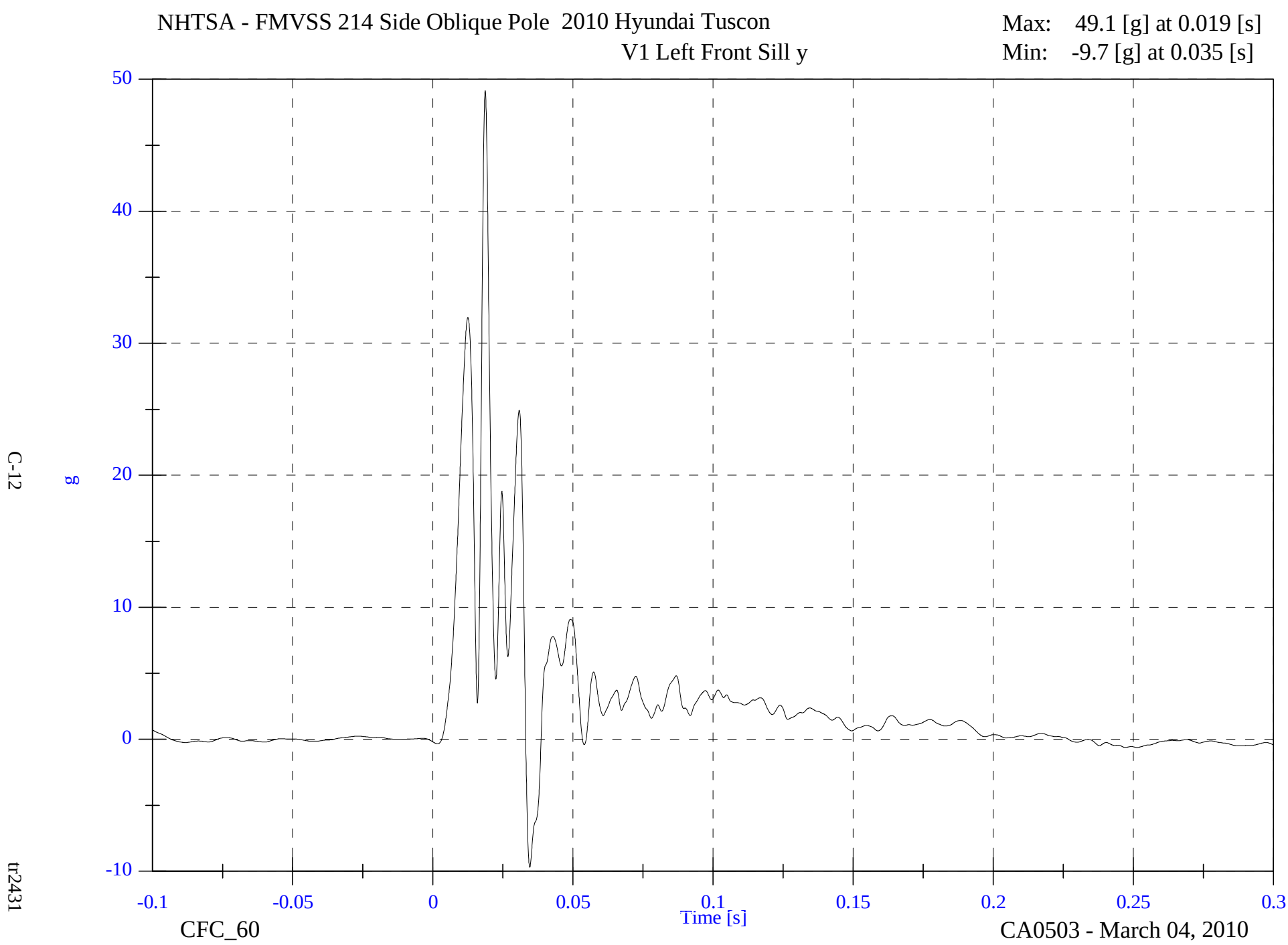
Min: 0.0 [g] at 0.240 [s]

C-11

tr2431

CFC_60

CA0503 - March 04, 2010

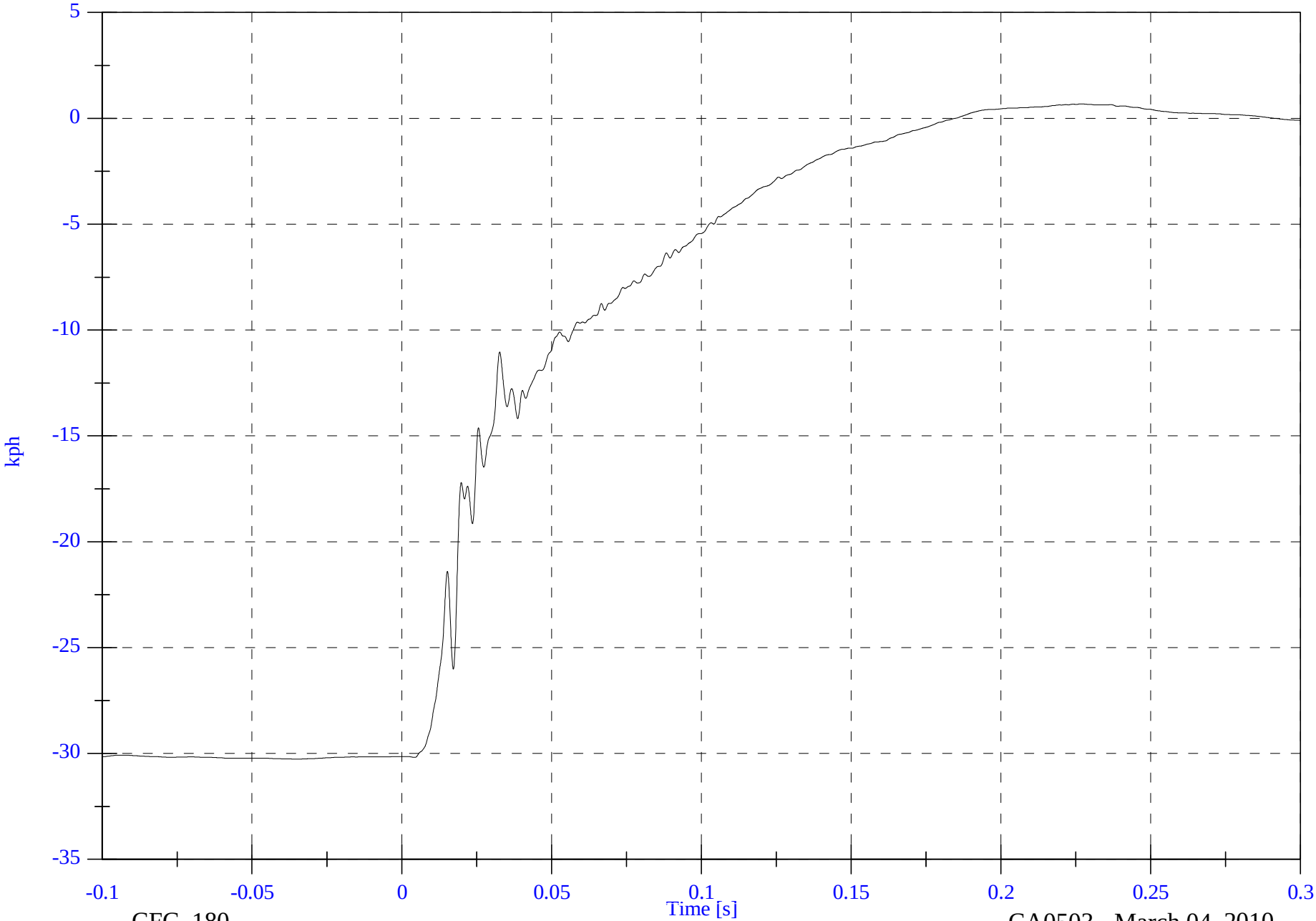

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Left Front Sill y
Max: 49.1 [g] at 0.019 [s]
Min: -9.7 [g] at 0.035 [s]
50
40
30
20
10
0
-10
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_60
CA0503 - March 04, 2010
C-12
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left Front Sill y Velocity

Max: 0.7 [kph] at 0.227 [s]

Min: -30.3 [kph] at -0.035 [s]



C-13

tr2431

CFC_180

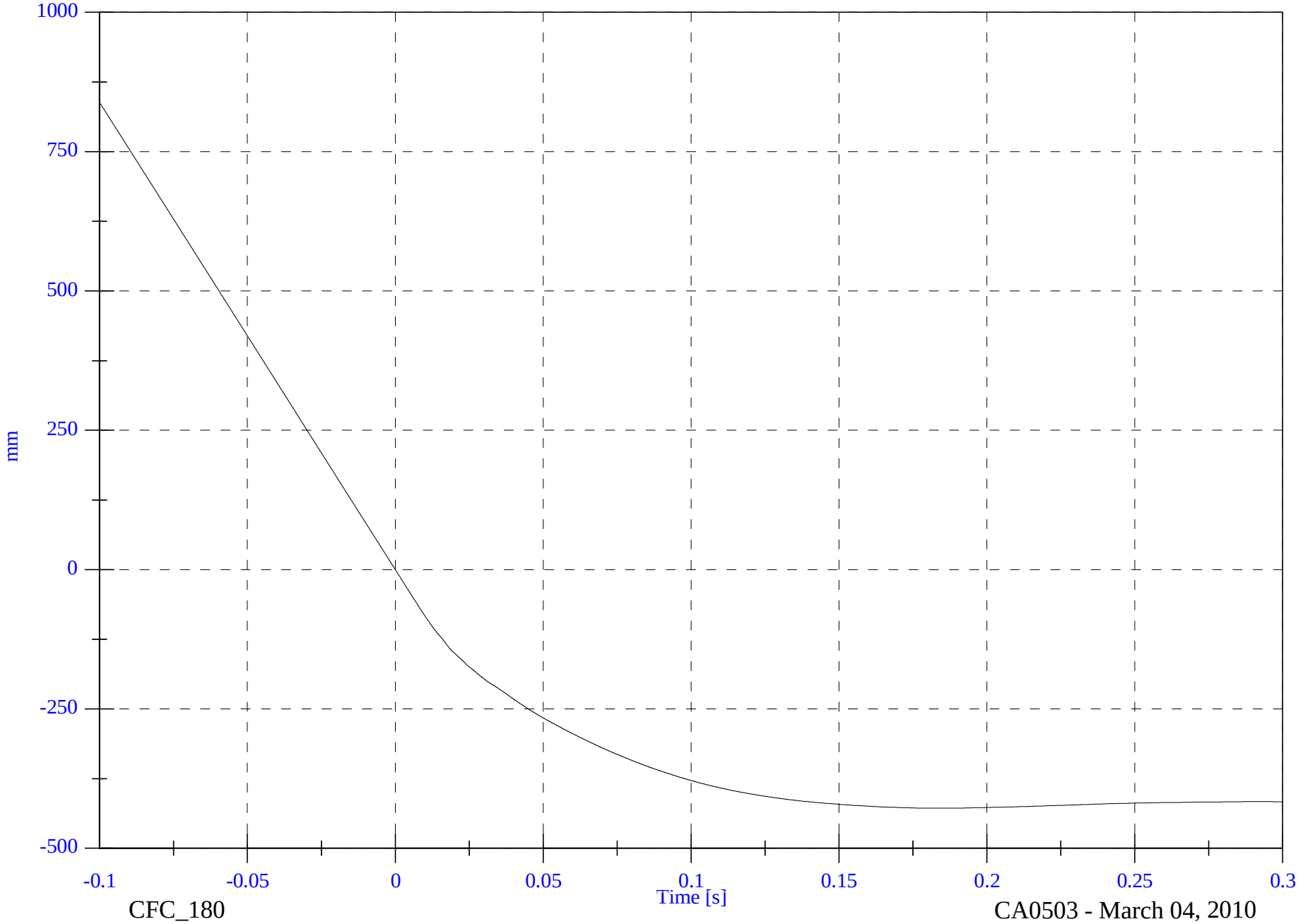
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left Front Sill y Displacement

Max: 838.0 [mm] at -0.100 [s]

Min: -428.1 [mm] at 0.185 [s]



CFC_180

CA0503 - March 04, 2010

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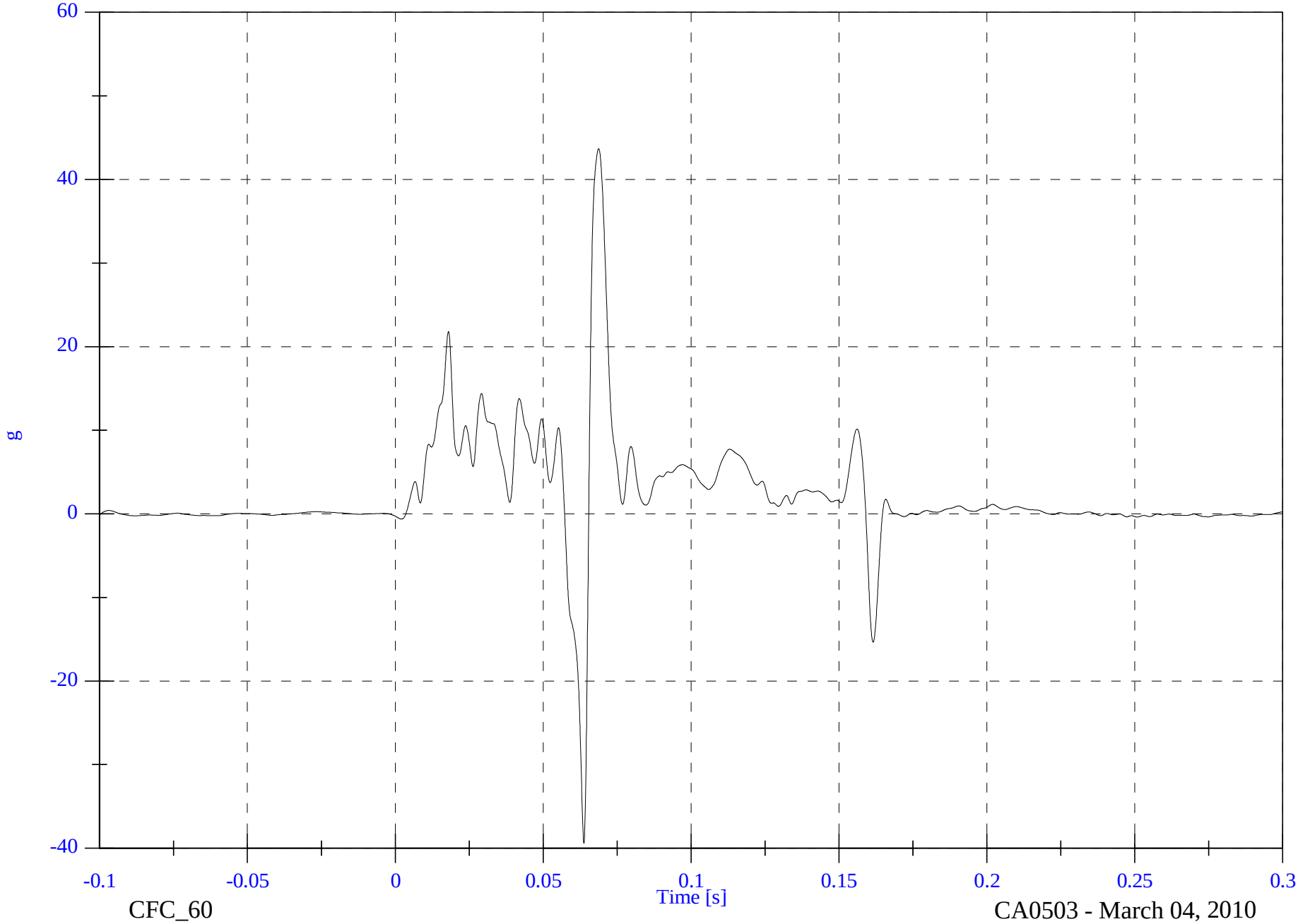
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left Lower A-Pillar Sill

Max: 43.7 [g] at 0.069 [s]

Min: -39.4 [g] at 0.064 [s]



C-15

tr2431

CFC_60

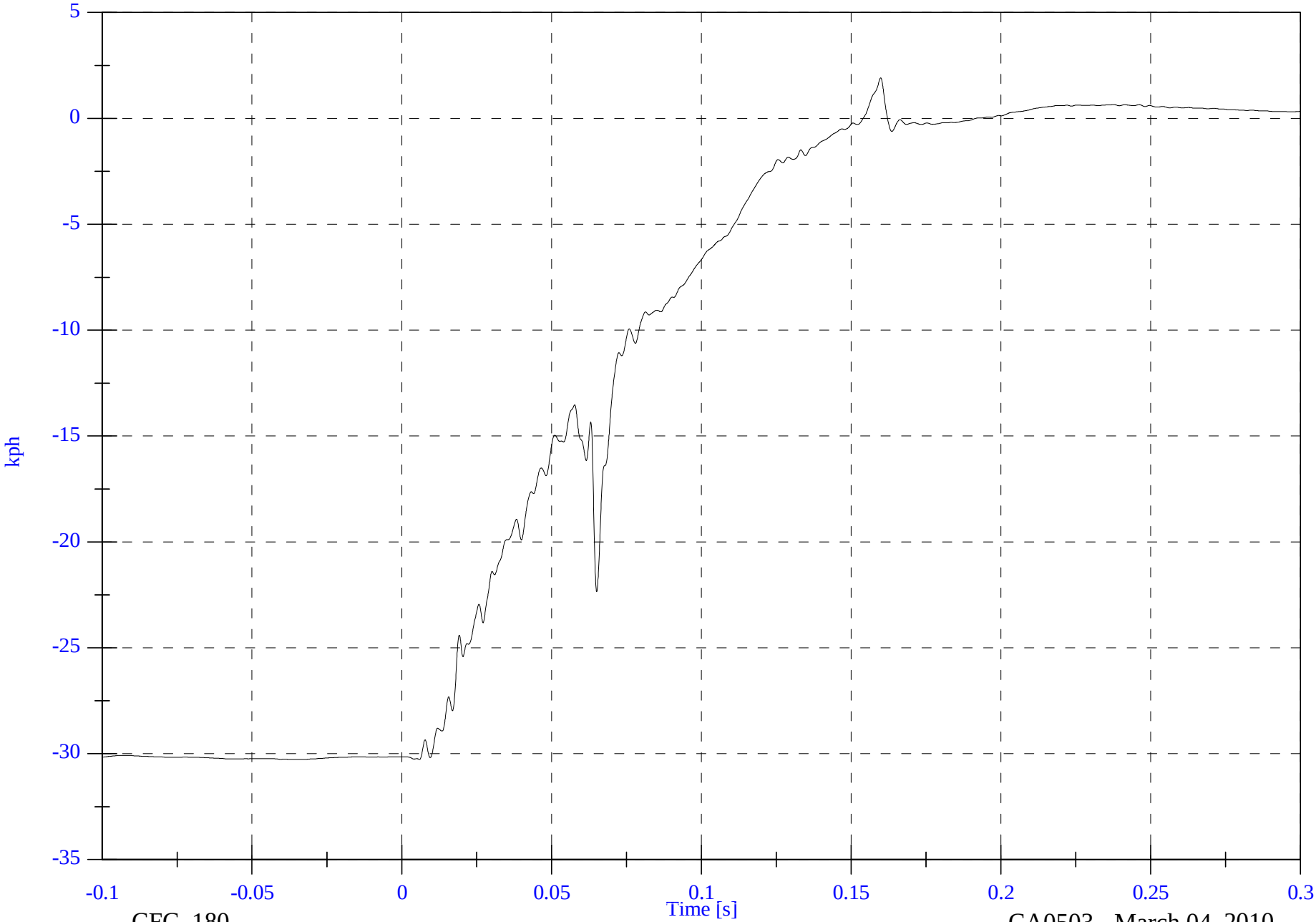
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left Lower A-Pillar Sill Velocity

Max: 1.9 [kph] at 0.160 [s]

Min: -30.3 [kph] at 0.006 [s]



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tr2431

CFC_180

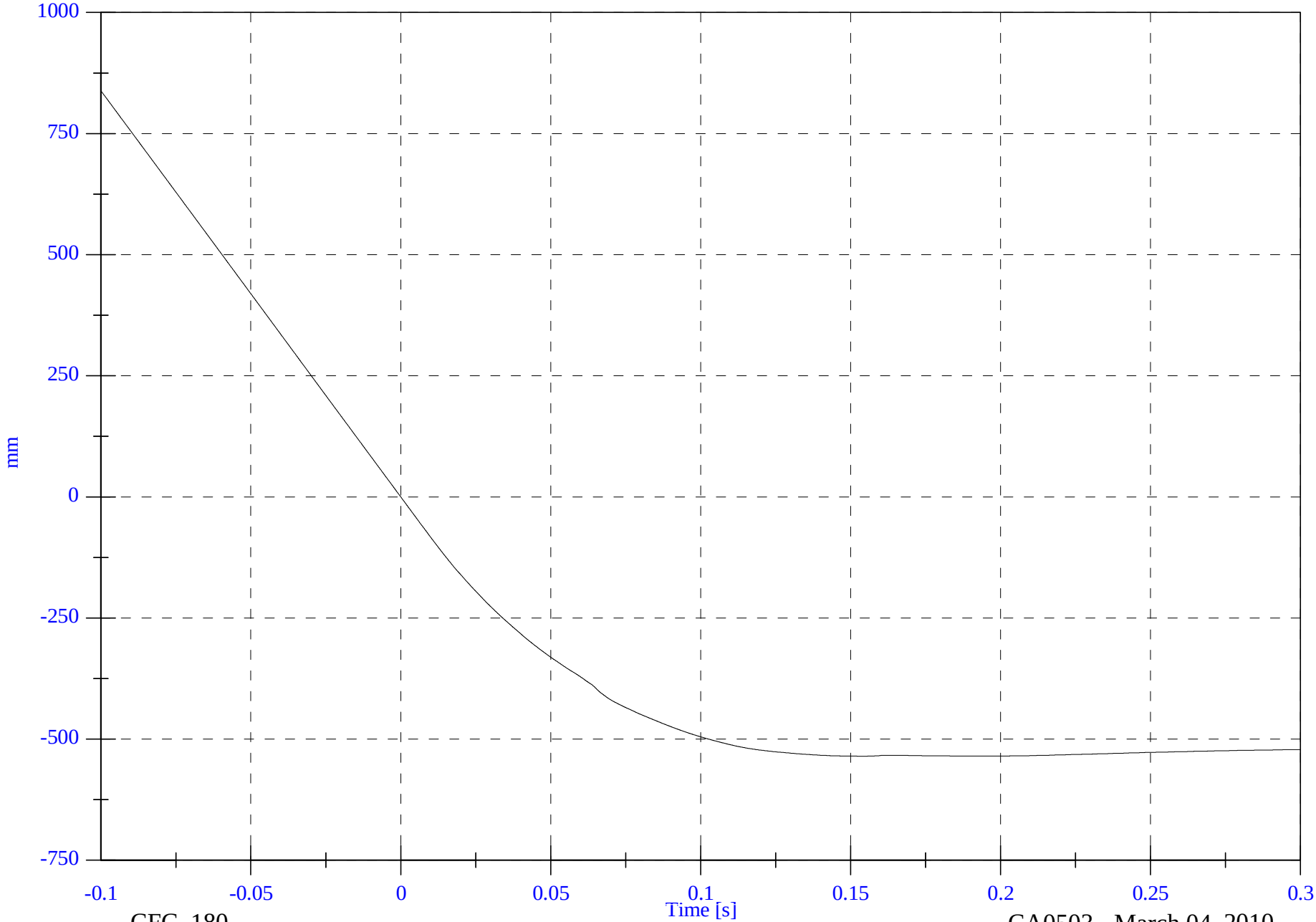
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left Lower A-Pillar Sill Displacement

Max: 838.1 [mm] at -0.100 [s]

Min: -535.4 [mm] at 0.154 [s]



C-17

tr2431

CFC_180

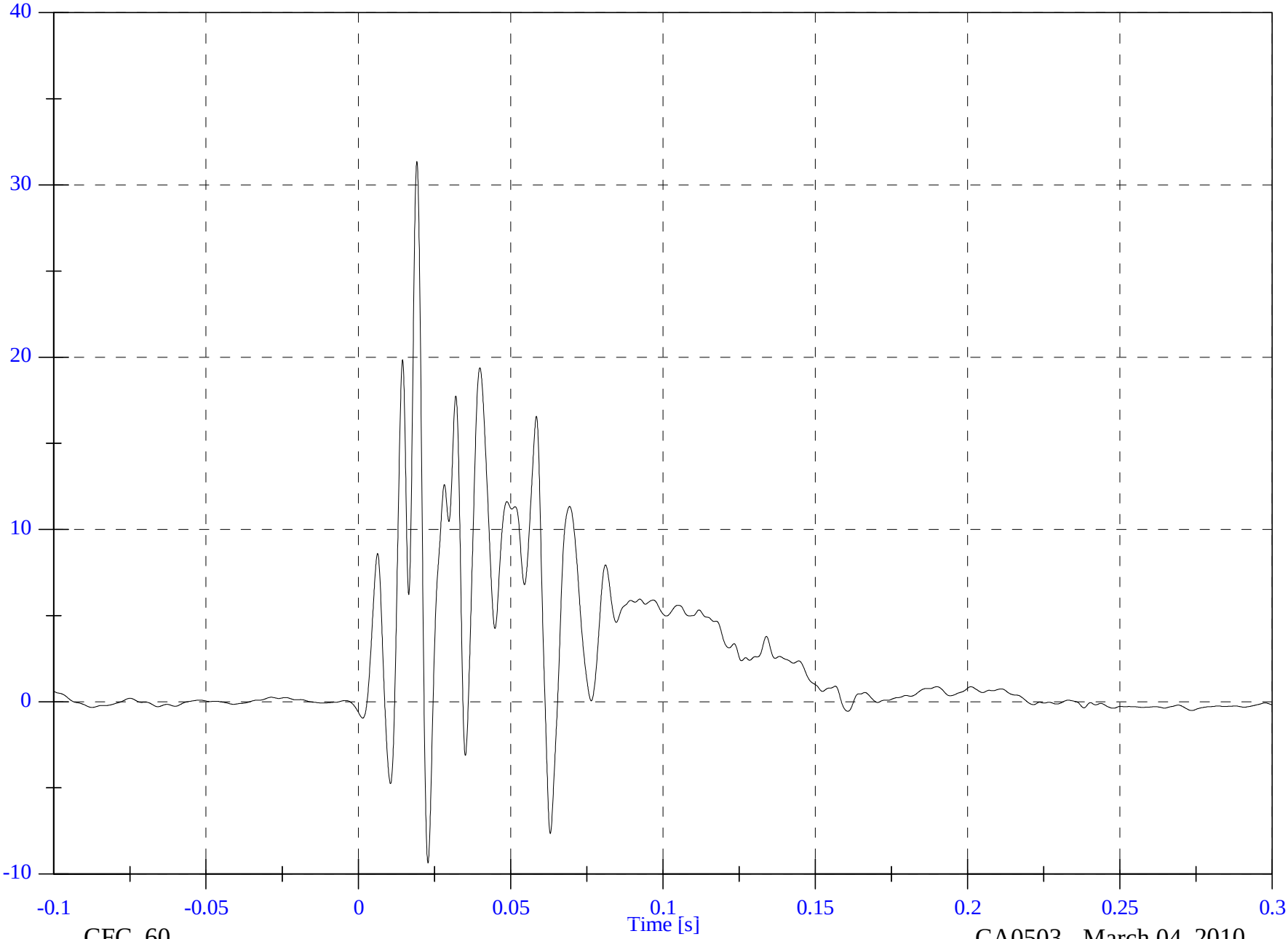
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left A-Pillar Mid y

Max: 31.4 [g] at 0.019 [s]

Min: -9.4 [g] at 0.023 [s]



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tr2431

CFC_60

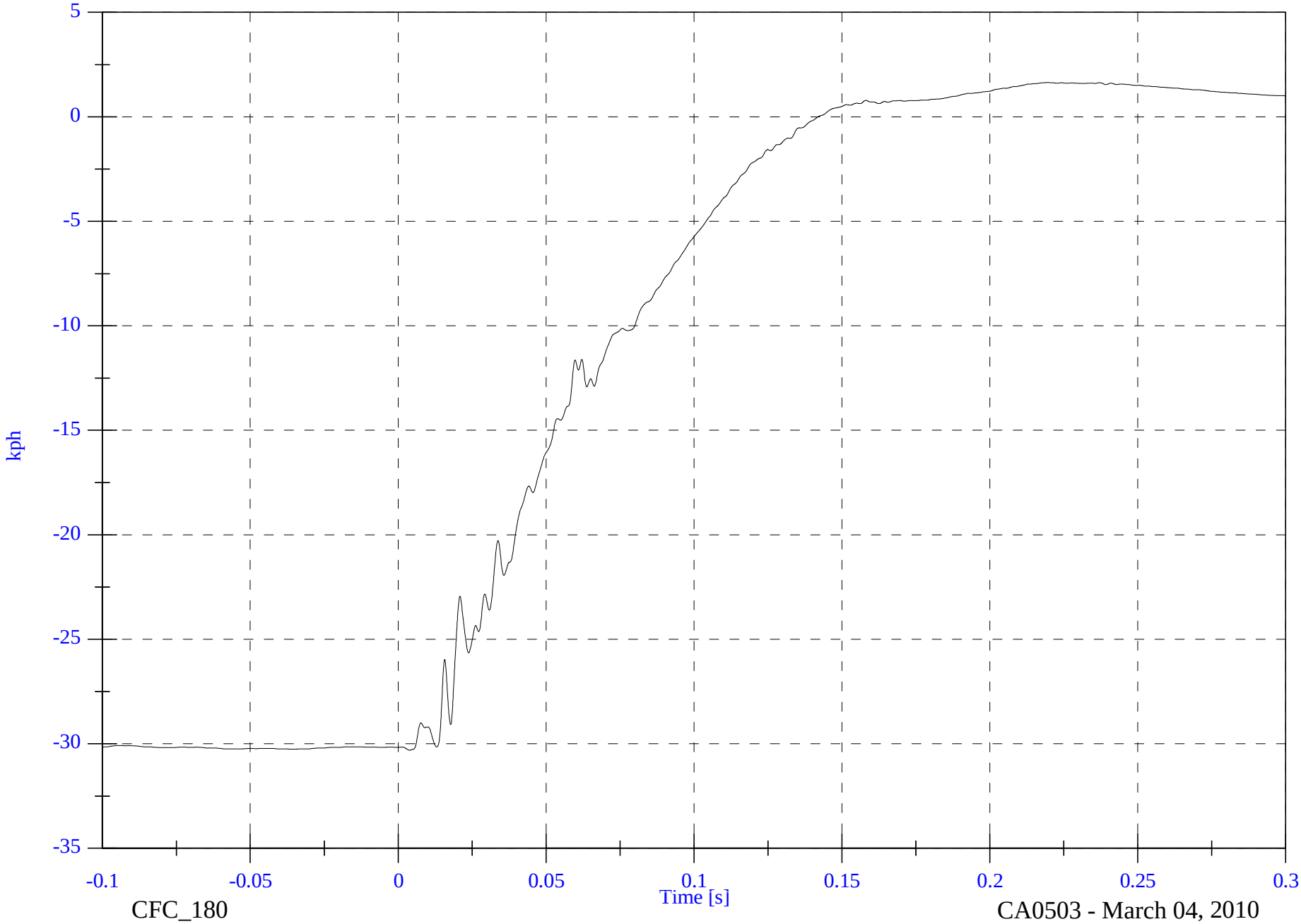
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left A-Pillar Mid y Velocity

Max: 1.6 [kph] at 0.220 [s]

Min: -30.3 [kph] at 0.004 [s]



C-19

tr2431

CFC_180

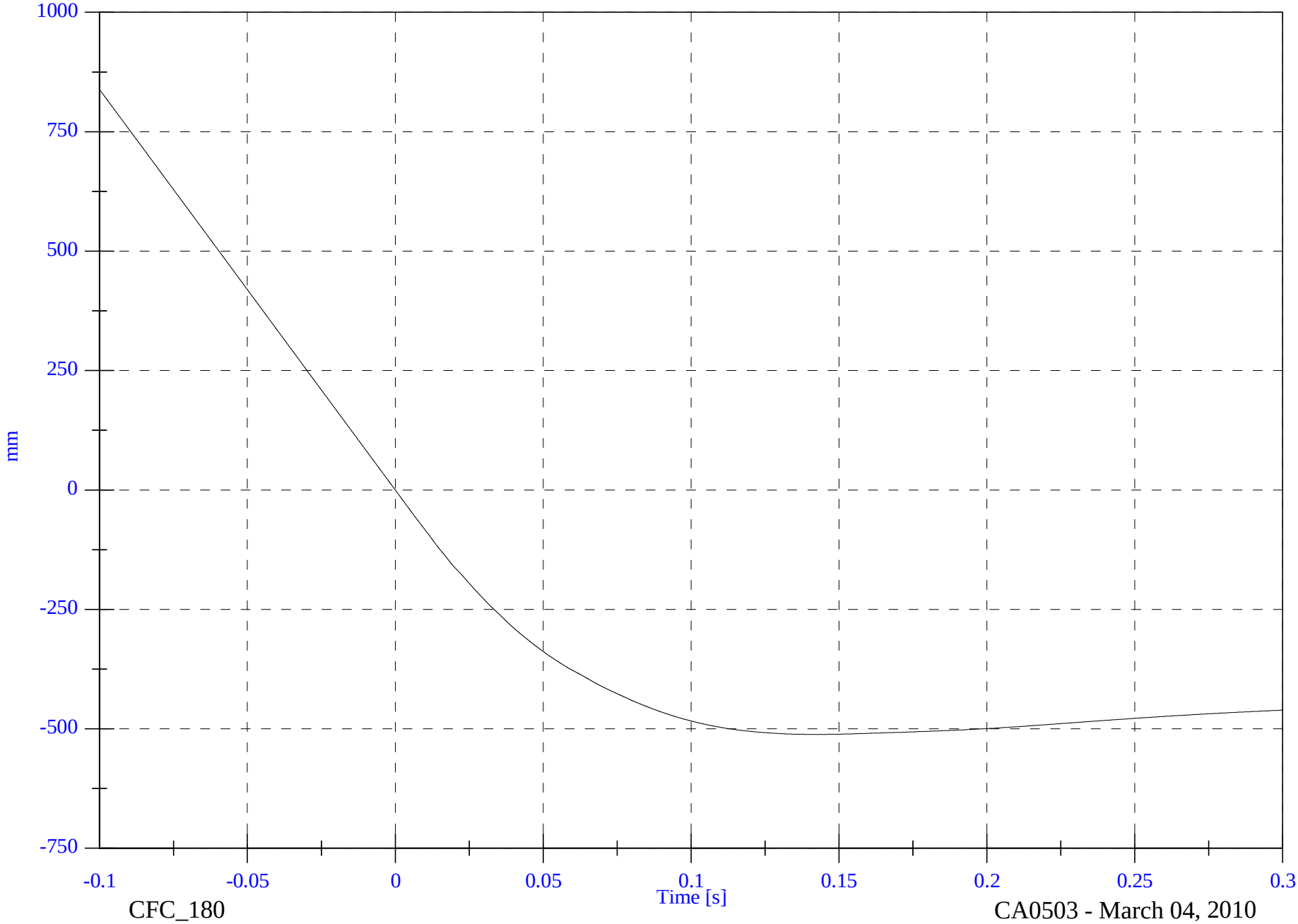
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left A-Pillar Mid y Displacement

Max: 838.0 [mm] at -0.100 [s]

Min: -511.8 [mm] at 0.142 [s]



C-20

tr2431

CFC_180

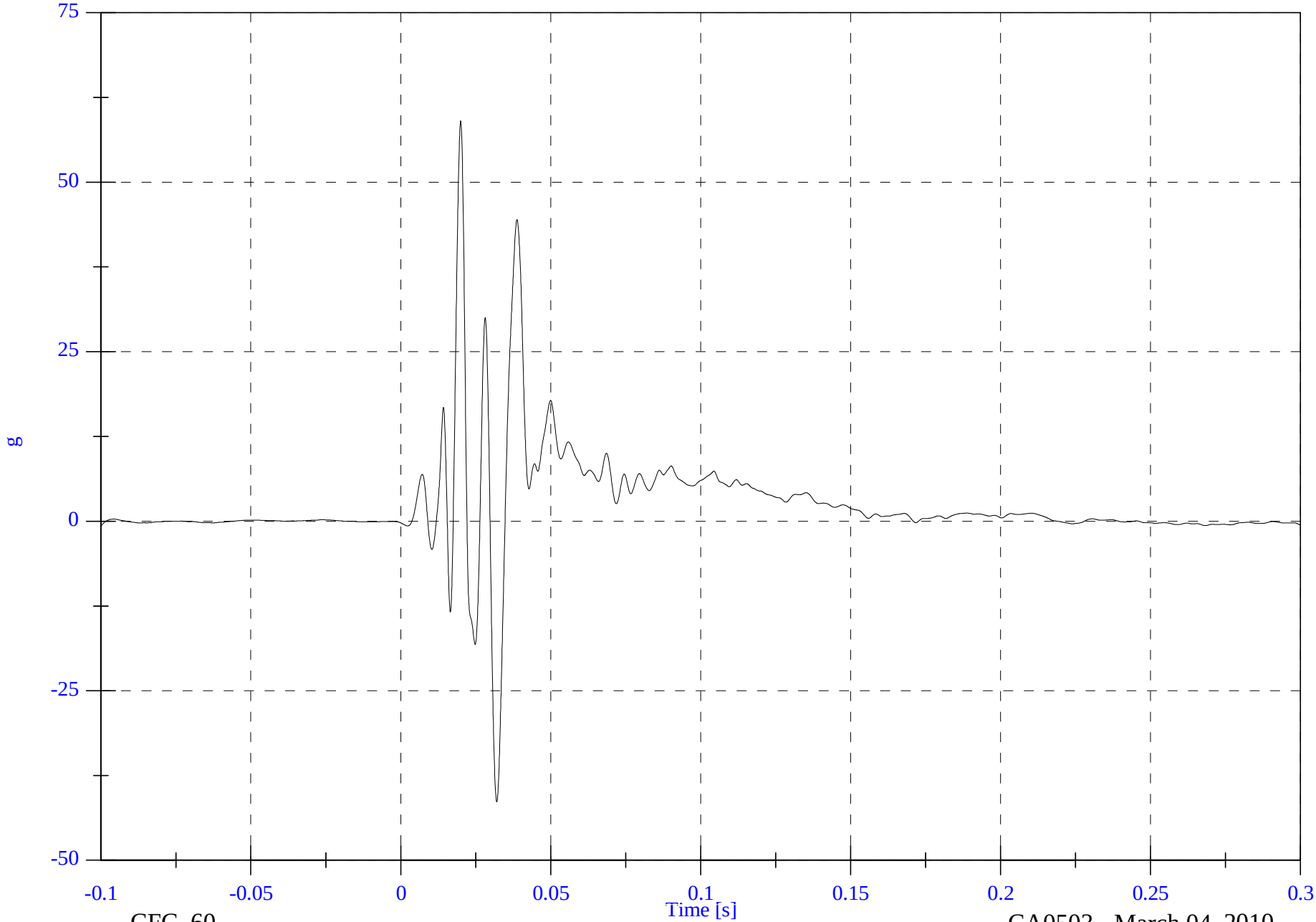
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left A-Pillar Top y

Max: 59.0 [g] at 0.020 [s]

Min: -41.4 [g] at 0.032 [s]



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tr2431

CFC_60

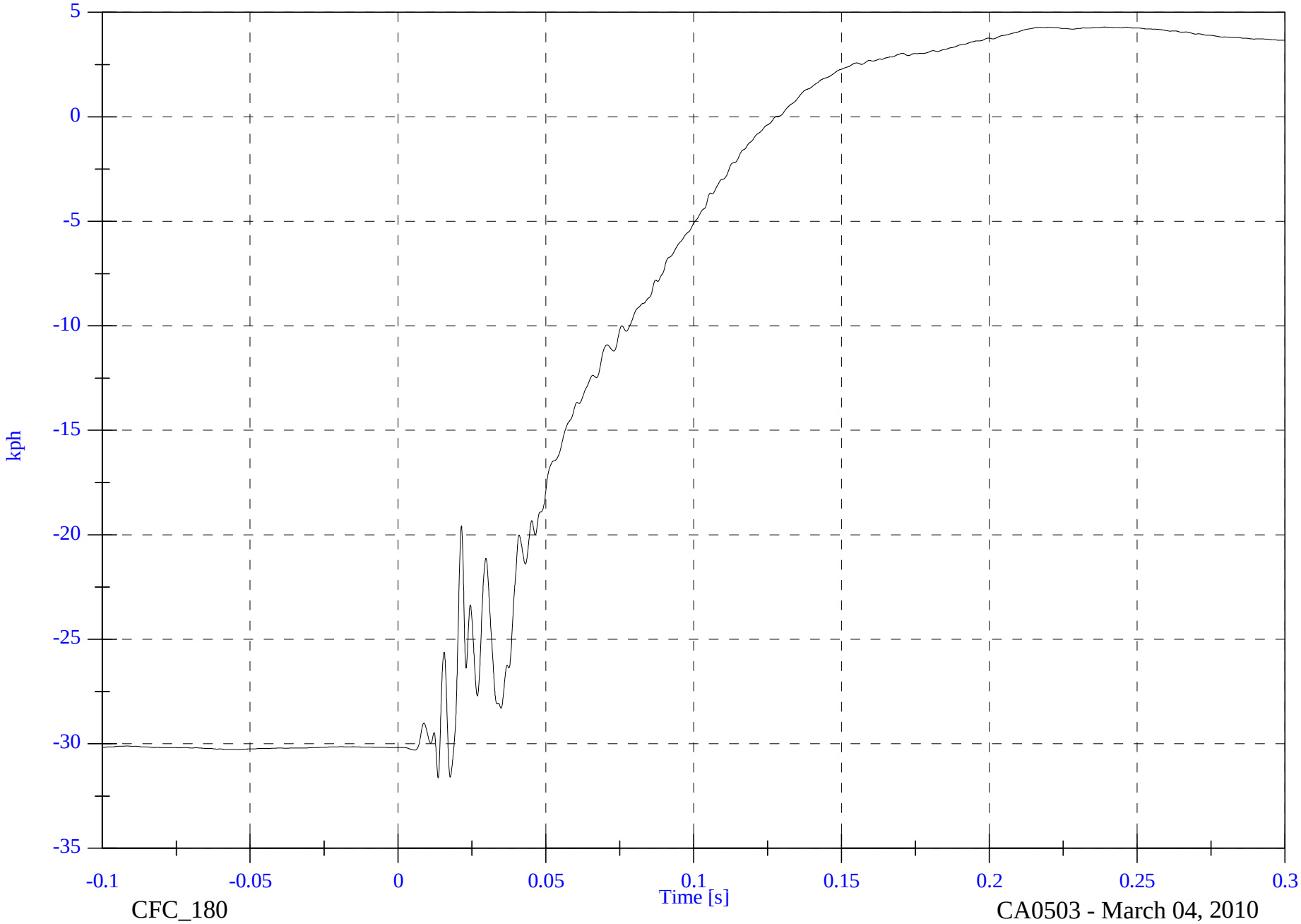
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left A-Pillar Top y Velocity

Max: 4.3 [kph] at 0.239 [s]

Min: -31.6 [kph] at 0.014 [s]



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tr2431

CFC_180

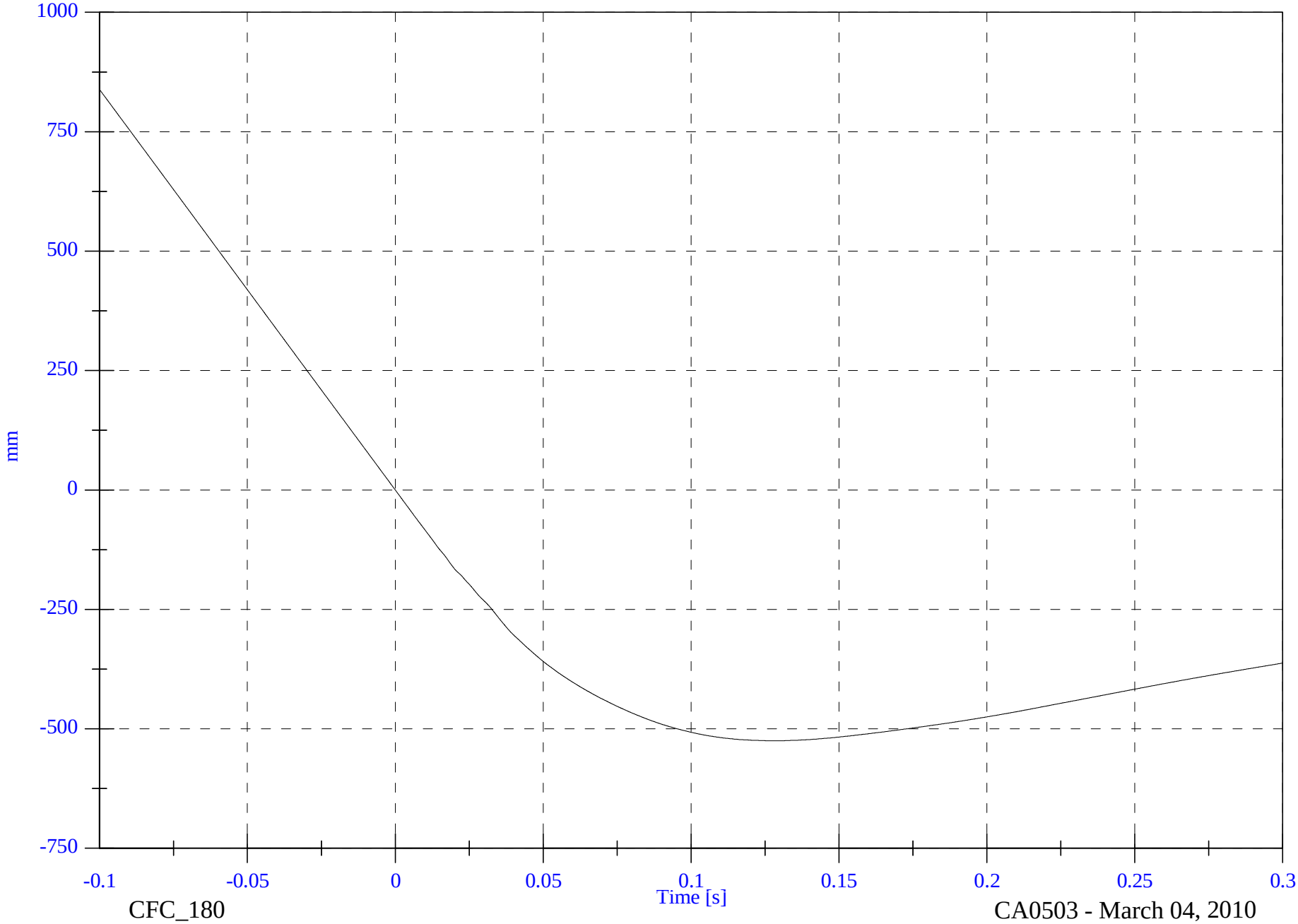
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left A-Pillar Top y Displacement

Max: 838.1 [mm] at -0.100 [s]

Min: -524.8 [mm] at 0.128 [s]



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tr2431

CFC_180

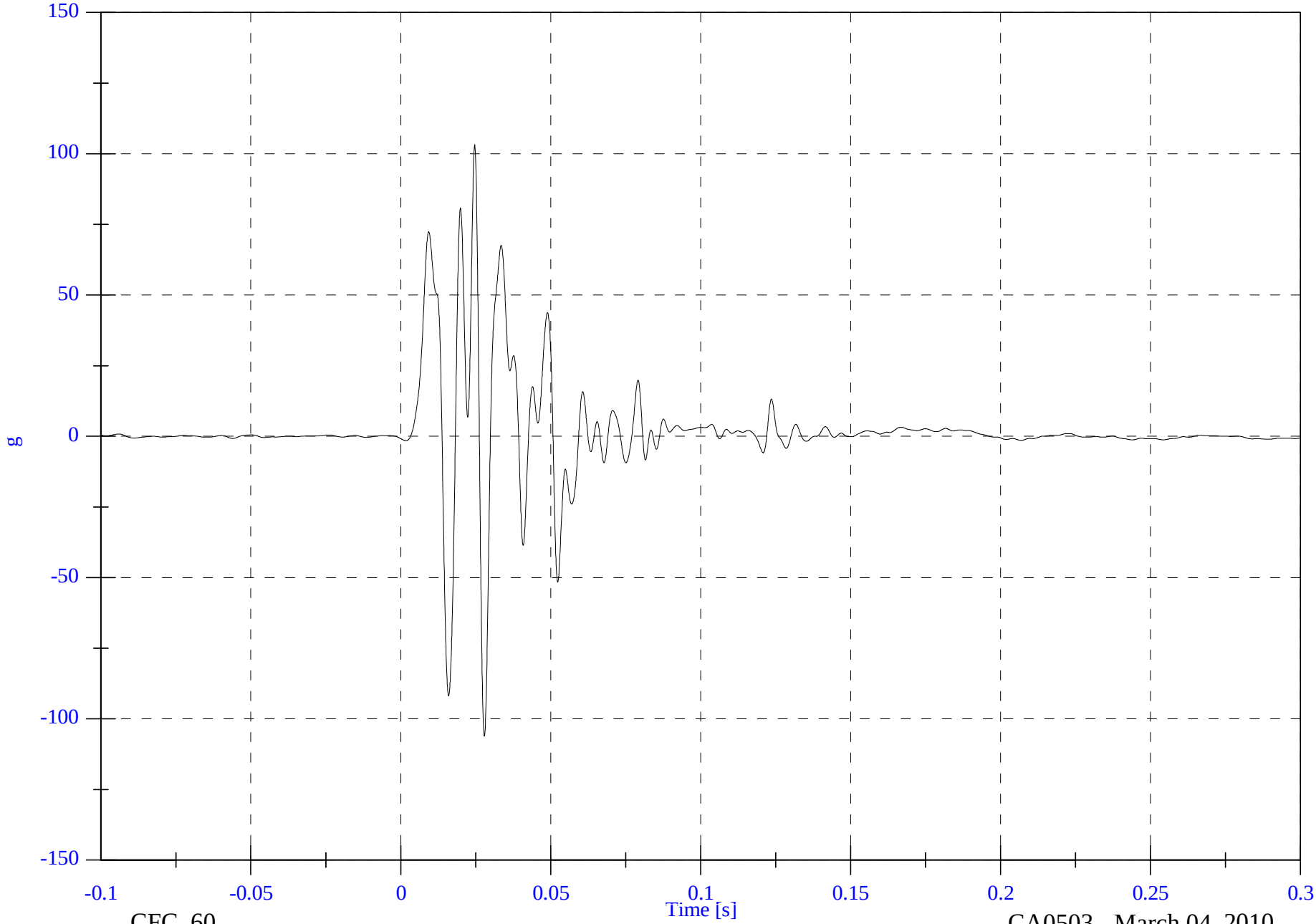
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Sill y

Max: 103.2 [g] at 0.025 [s]

Min: -106.1 [g] at 0.028 [s]



C-24

tr2431

CFC_60

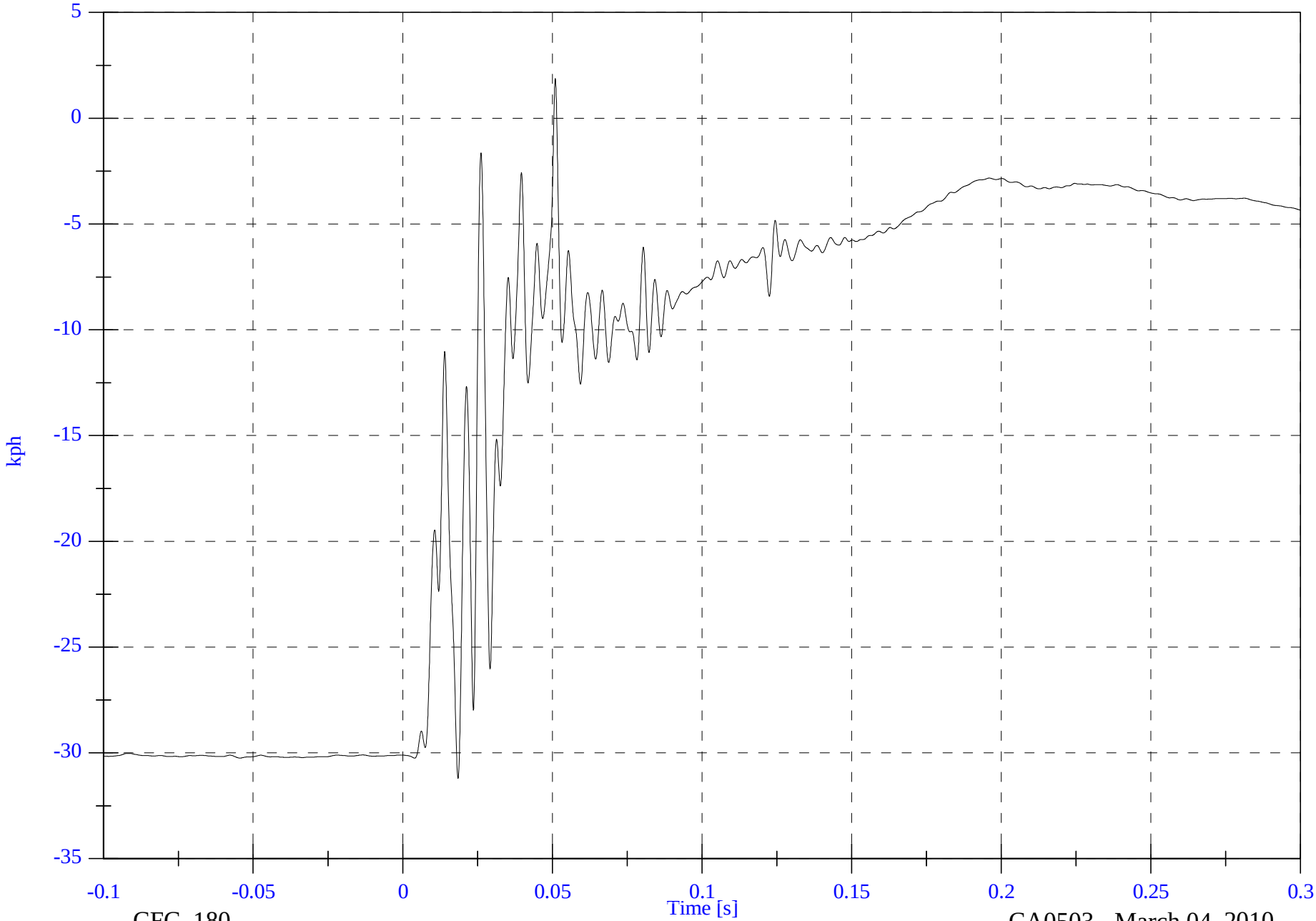
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Sill y Velocity

Max: 1.9 [kph] at 0.051 [s]

Min: -31.2 [kph] at 0.018 [s]



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tr2431

CFC_180

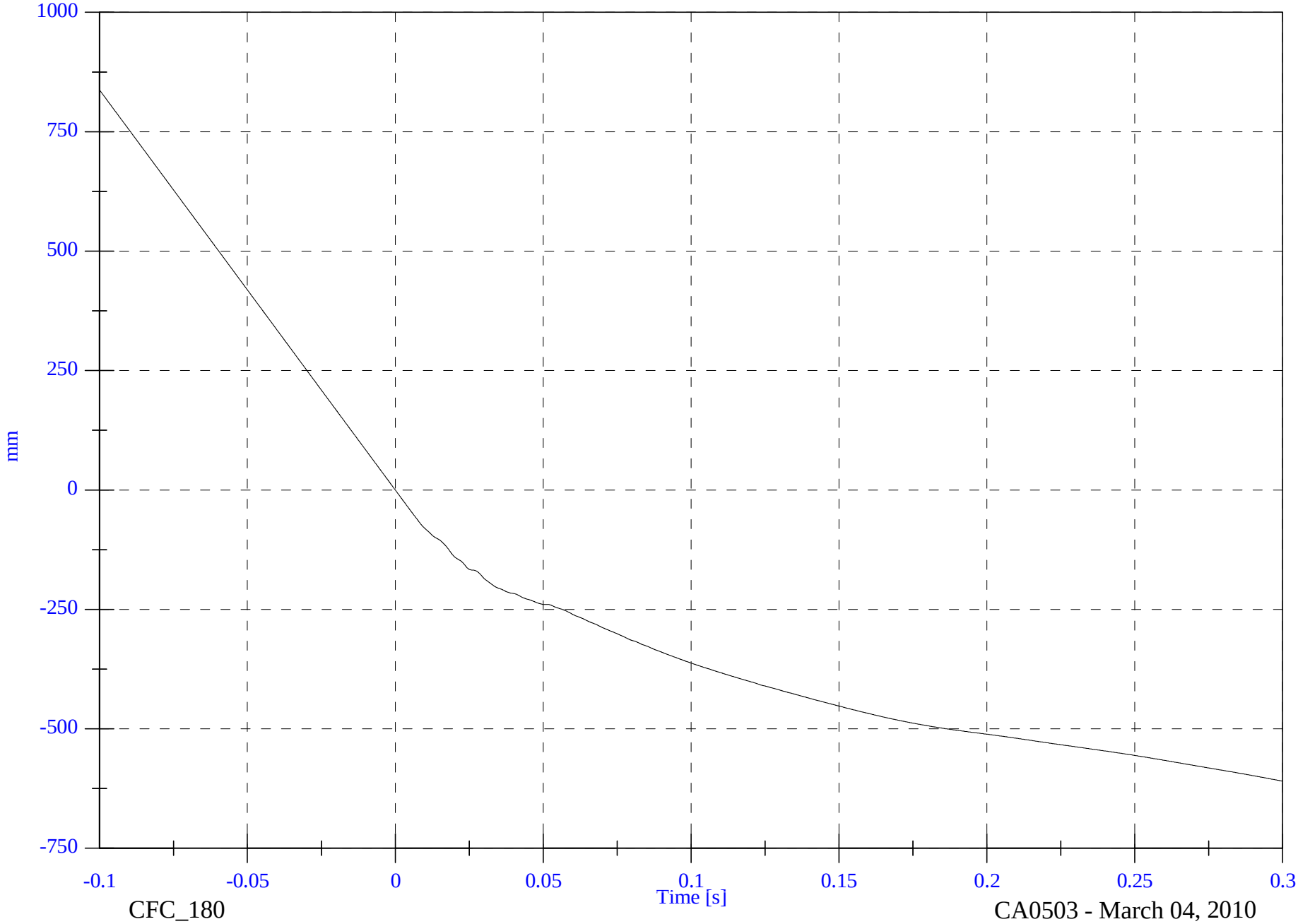
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Sill y Displacement

Max: 837.1 [mm] at -0.100 [s]

Min: -609.5 [mm] at 0.300 [s]



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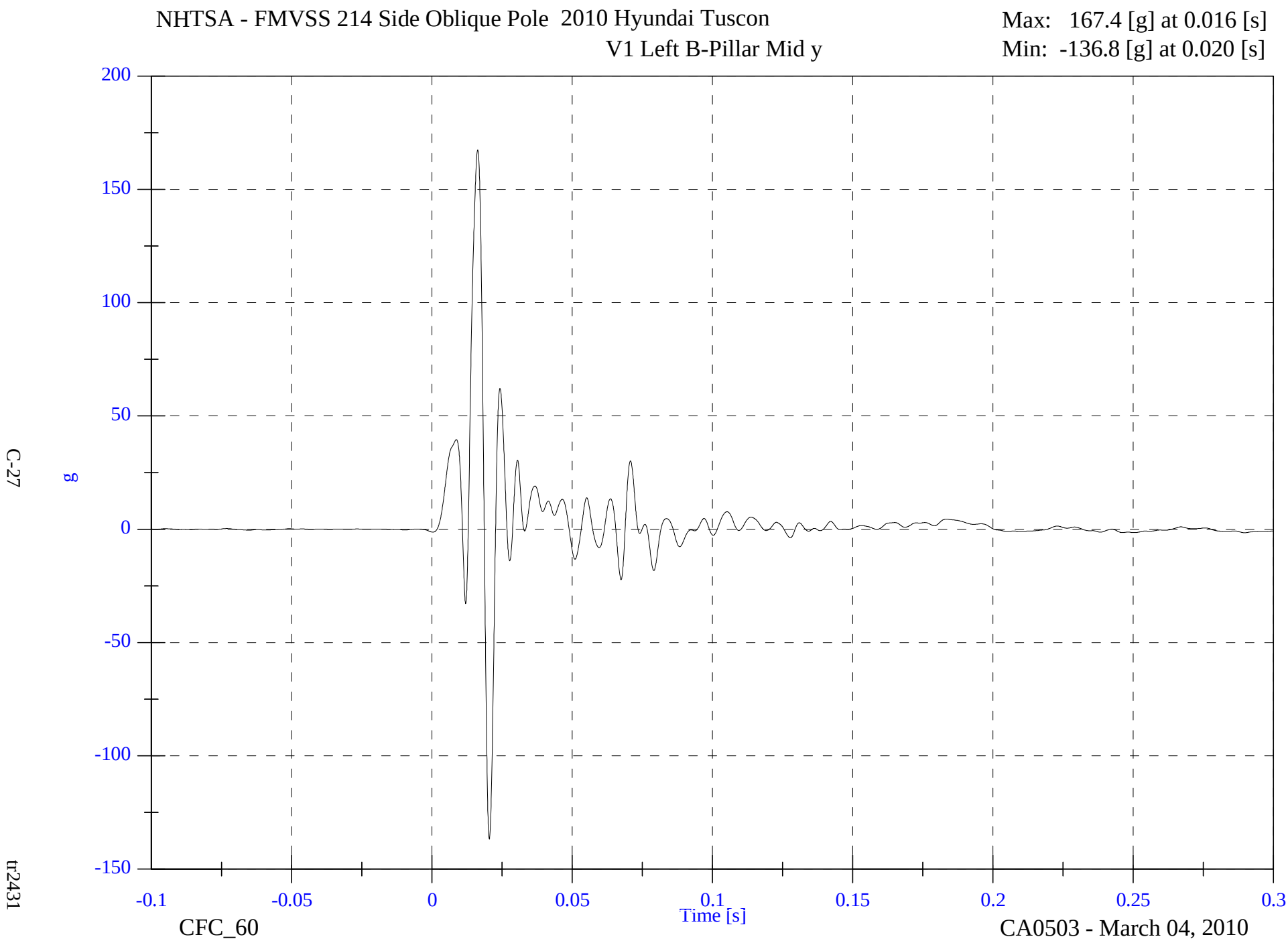
tr2431

CFC_180

CA0503 - March 04, 2010

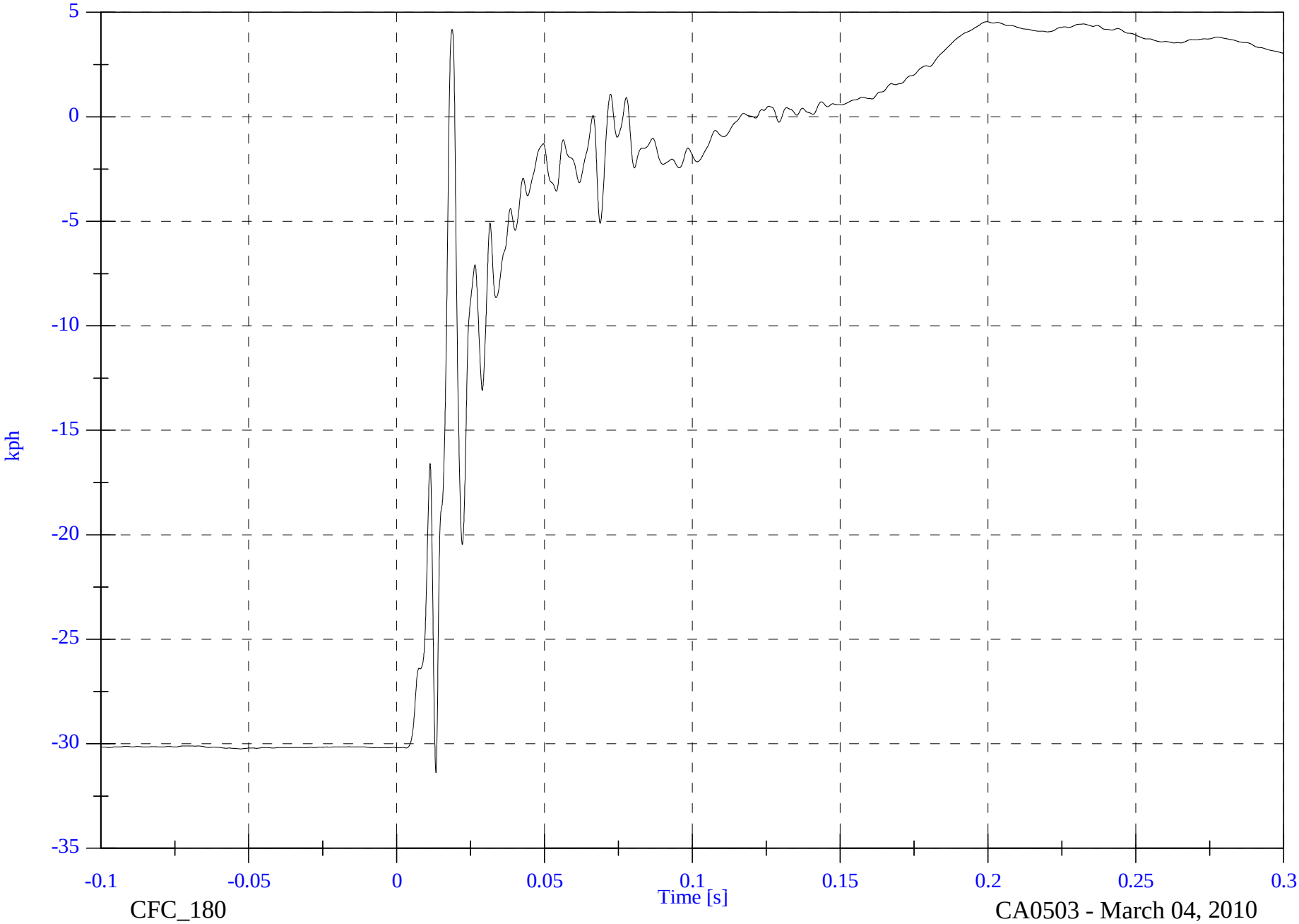

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Left B-Pillar Mid y
Max: 167.4 [g] at 0.016 [s]
Min: -136.8 [g] at 0.020 [s]
200
150
100
50
0
-50
-100
-150
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
C-27
tr2431
CFC_60
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Mid y Velocity

Max: 4.6 [kph] at 0.200 [s]

Min: -31.4 [kph] at 0.013 [s]



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tr2431

CFC_180

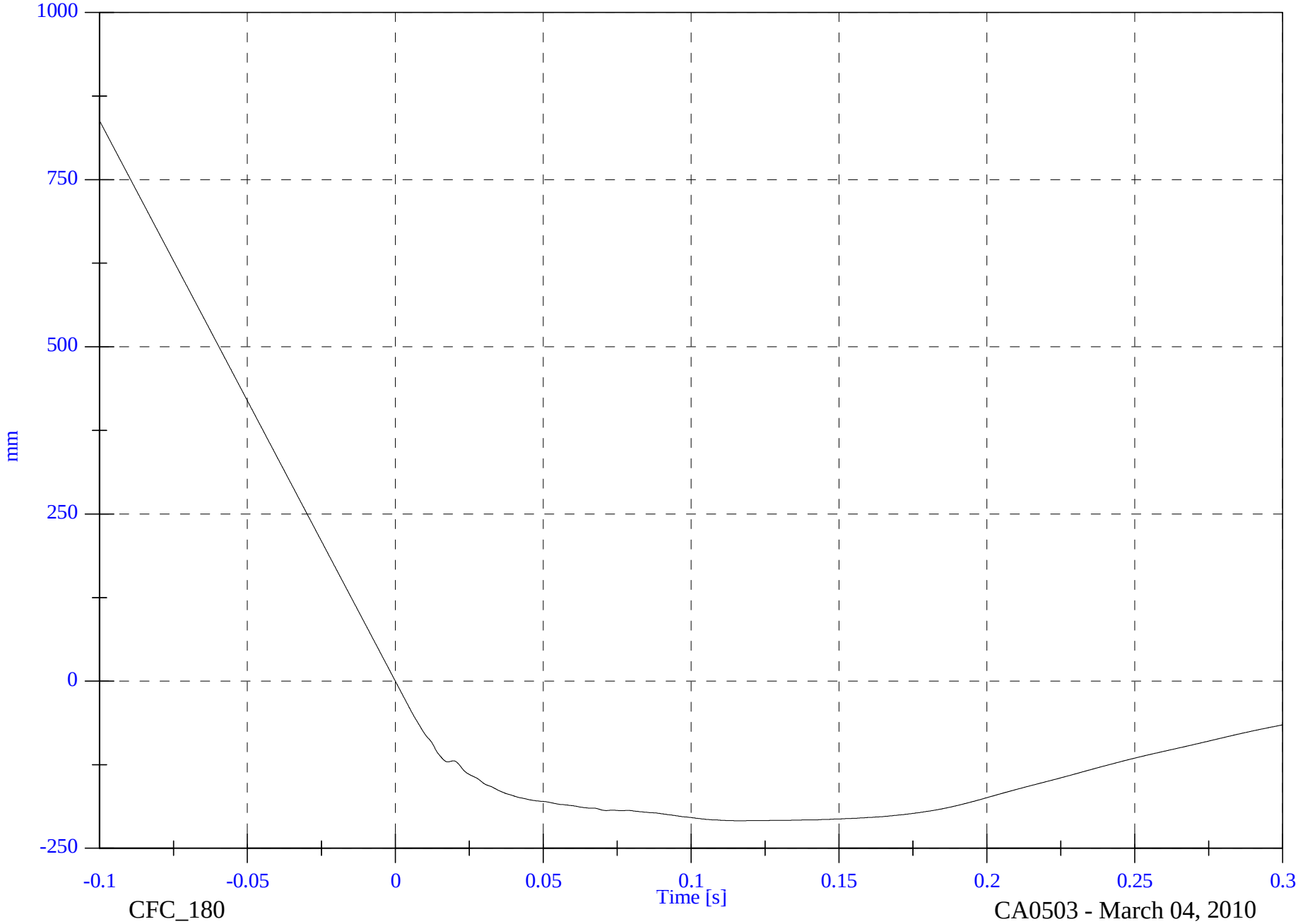
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Mid y Displacement

Max: 837.5 [mm] at -0.100 [s]

Min: -208.9 [mm] at 0.116 [s]

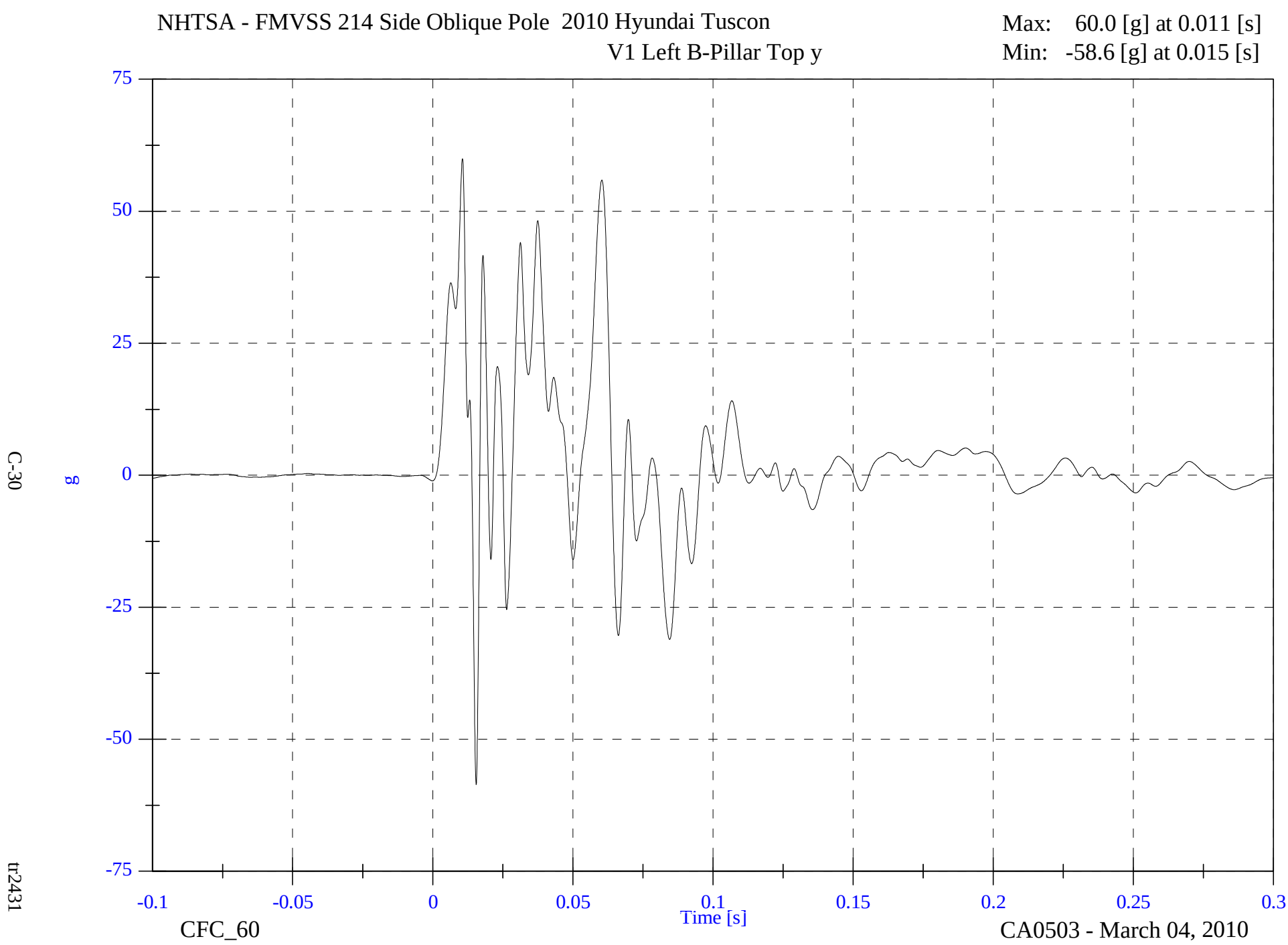


C-29

tr2431

CFC_180

CA0503 - March 04, 2010


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Left B-Pillar Top y
Max: 60.0 [g] at 0.011 [s]
Min: -58.6 [g] at 0.015 [s]
75
50
25
0
-25
-50
-75
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
C-30
tr2431
CFC_60
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Top y Velocity

Max: 6.7 [kph] at 0.064 [s]

Min: -31.4 [kph] at 0.017 [s]

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tr2431

CFC_180

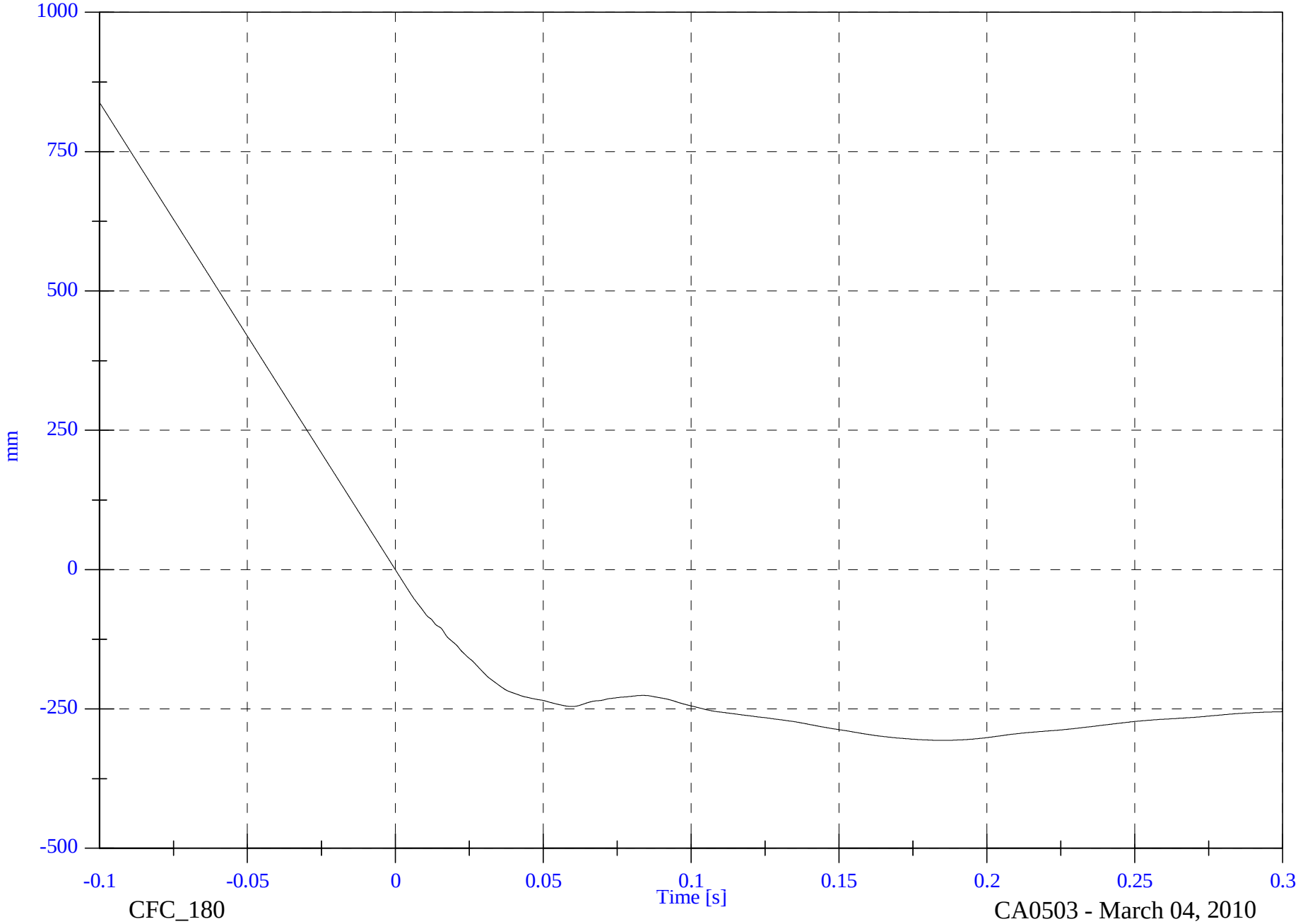
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Left B-Pillar Top y Displacement

Max: 837.8 [mm] at -0.100 [s]

Min: -306.3 [mm] at 0.185 [s]



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tr2431

CFC_180

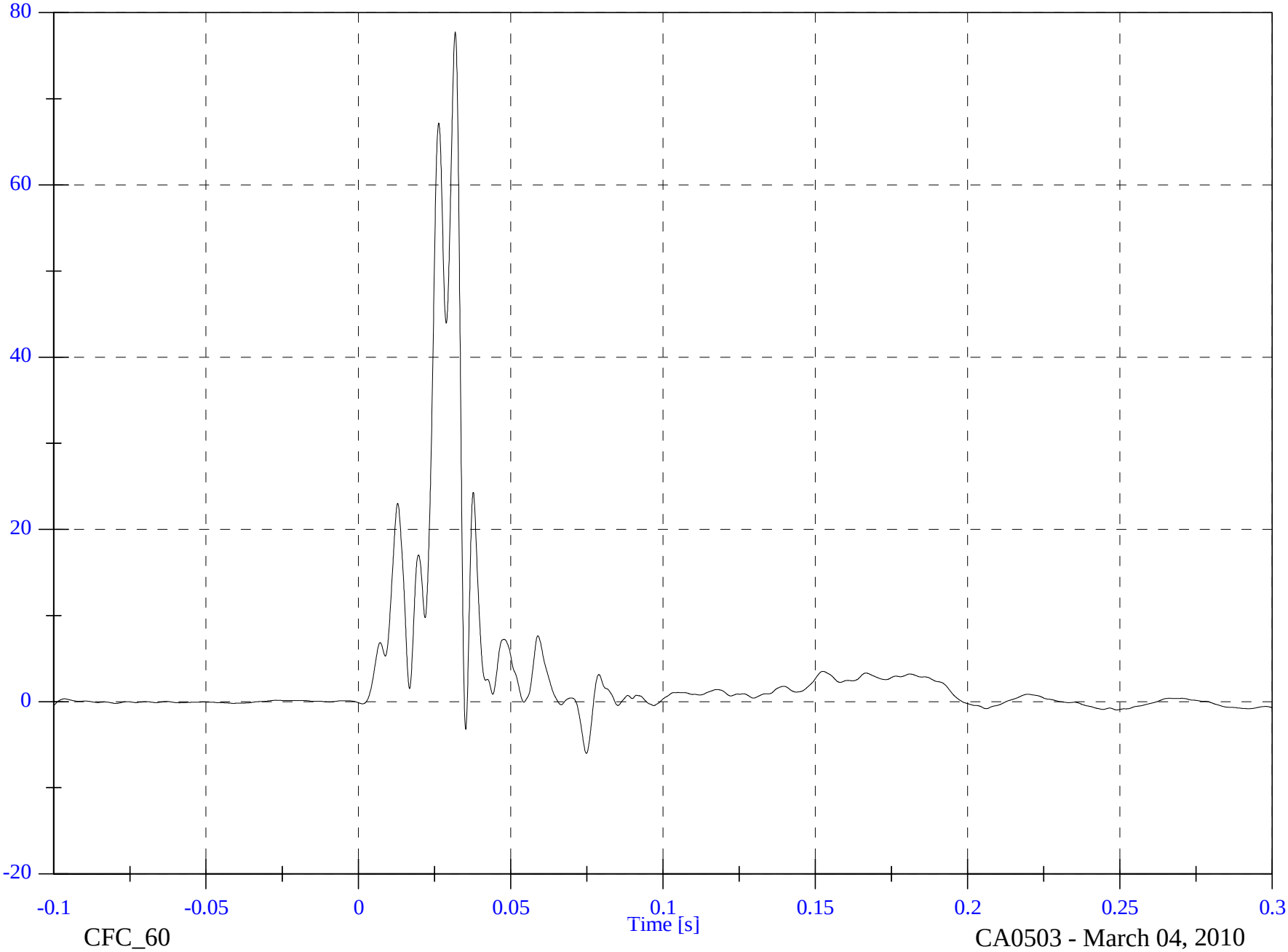
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Seat Track y

Max: 77.8 [g] at 0.032 [s]

Min: -6.0 [g] at 0.075 [s]



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tr2431

CFC_60

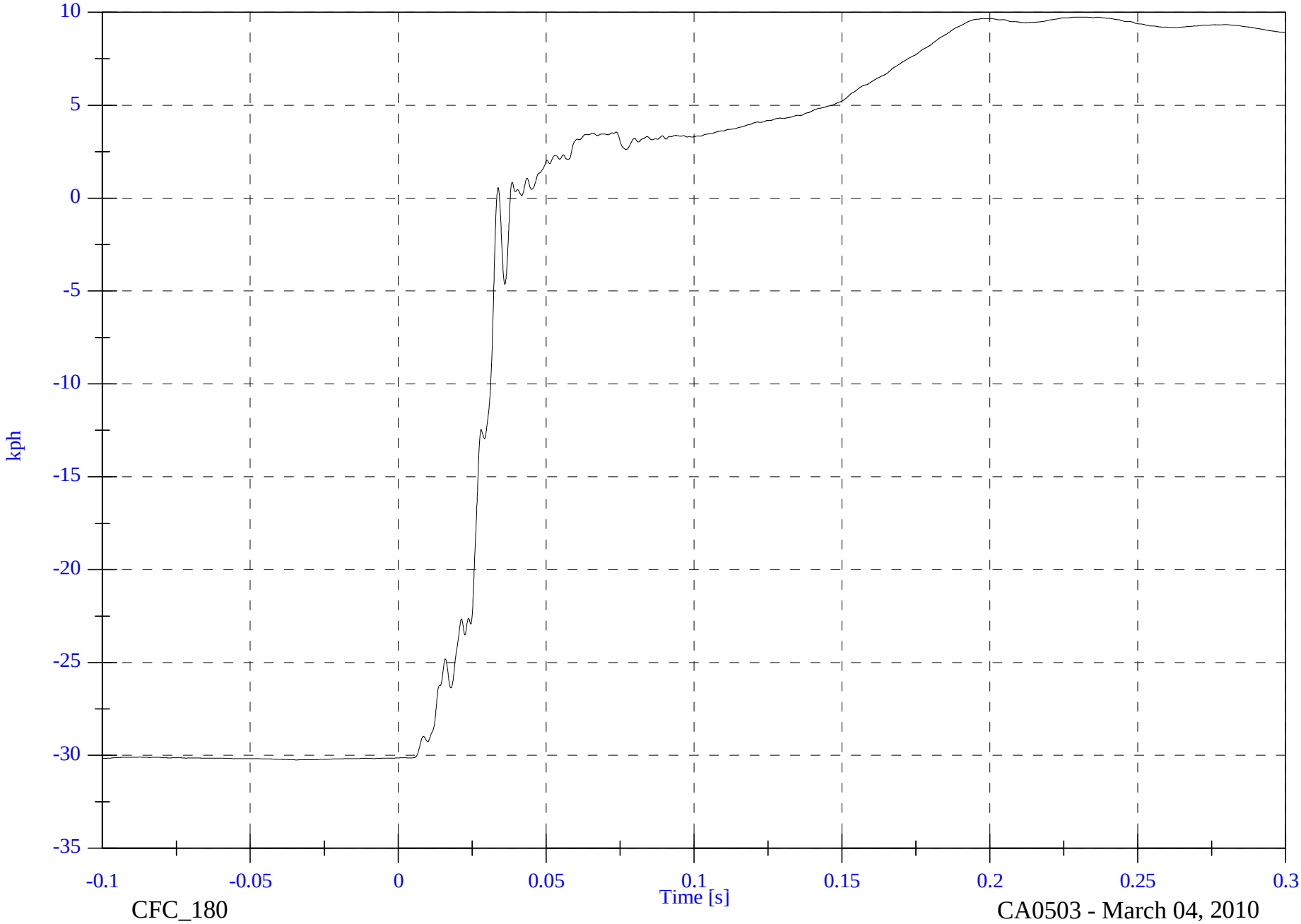
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Seat Track y Velocity

Max: 9.7 [kph] at 0.229 [s]

Min: -30.2 [kph] at -0.034 [s]



CFC_180

CA0503 - March 04, 2010

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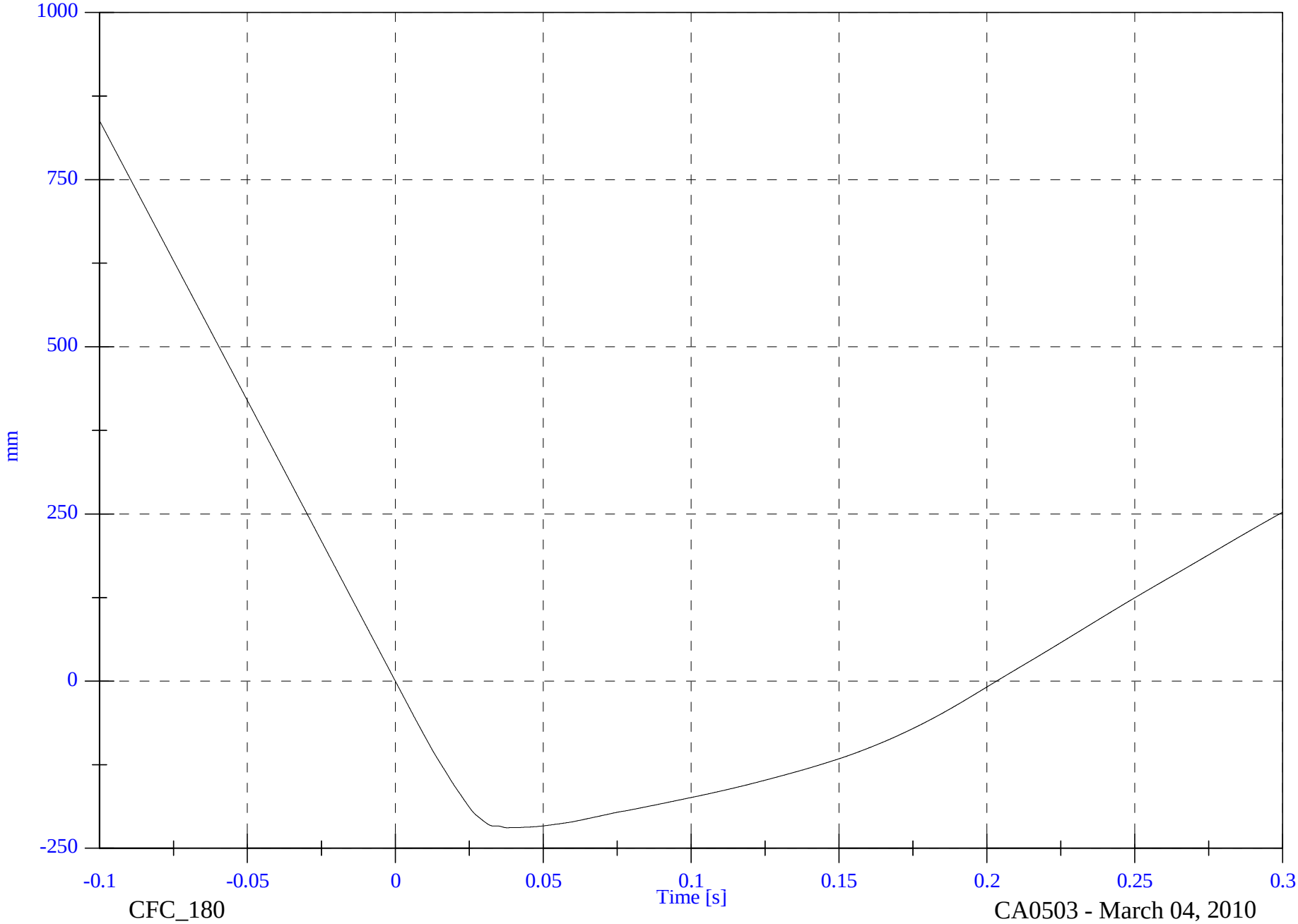
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Seat Track y Displacement

Max: 837.5 [mm] at -0.100 [s]

Min: -219.3 [mm] at 0.038 [s]



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tr2431

CFC_180

CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Engine Top x

Max: 3.1 [g] at 0.104 [s]

Min: -10.1 [g] at 0.036 [s]

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tr2431

CFC_60

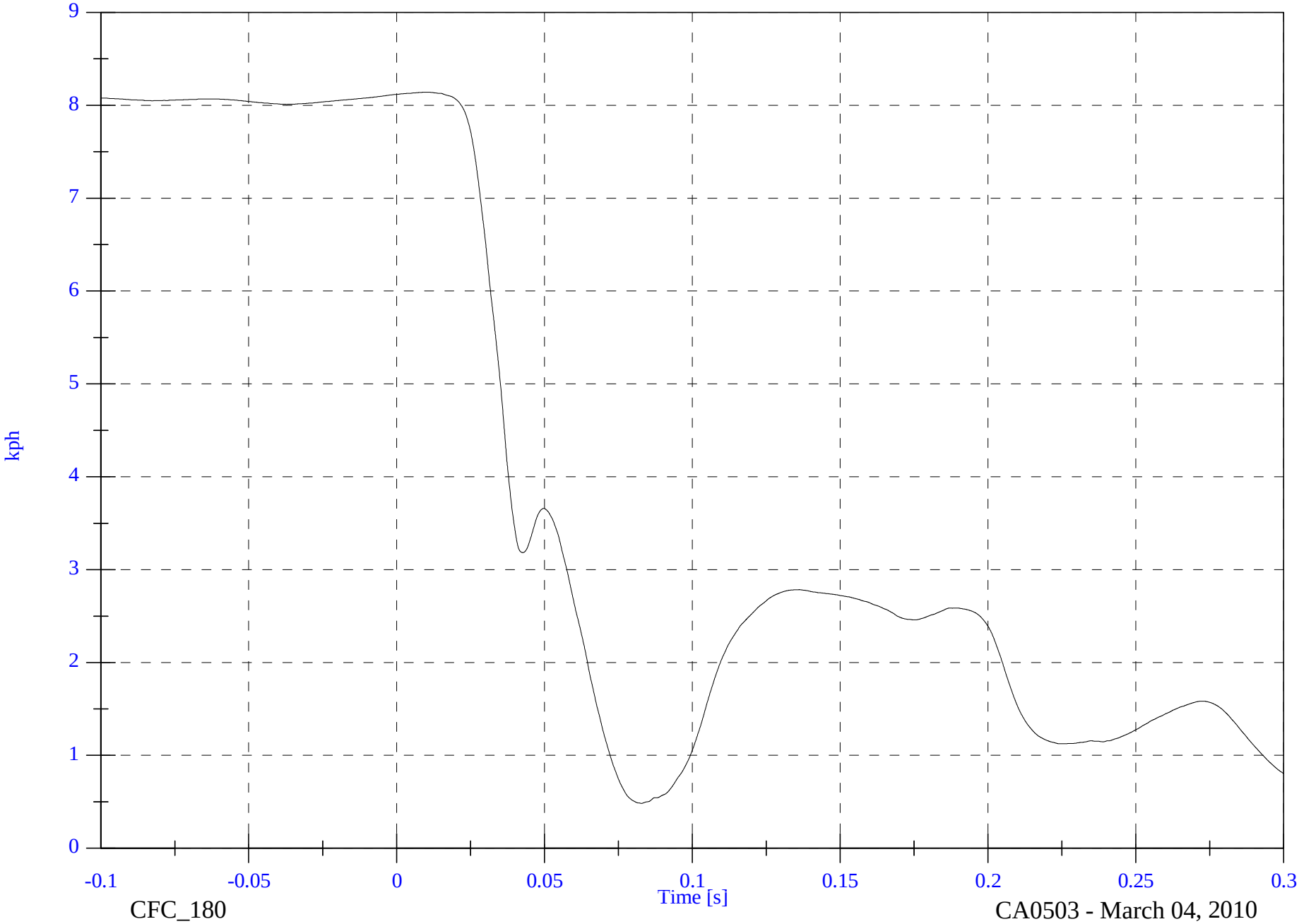
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Engine Top x Velocity

Max: 8.1 [kph] at 0.011 [s]

Min: 0.5 [kph] at 0.083 [s]



CFC_180

CA0503 - March 04, 2010

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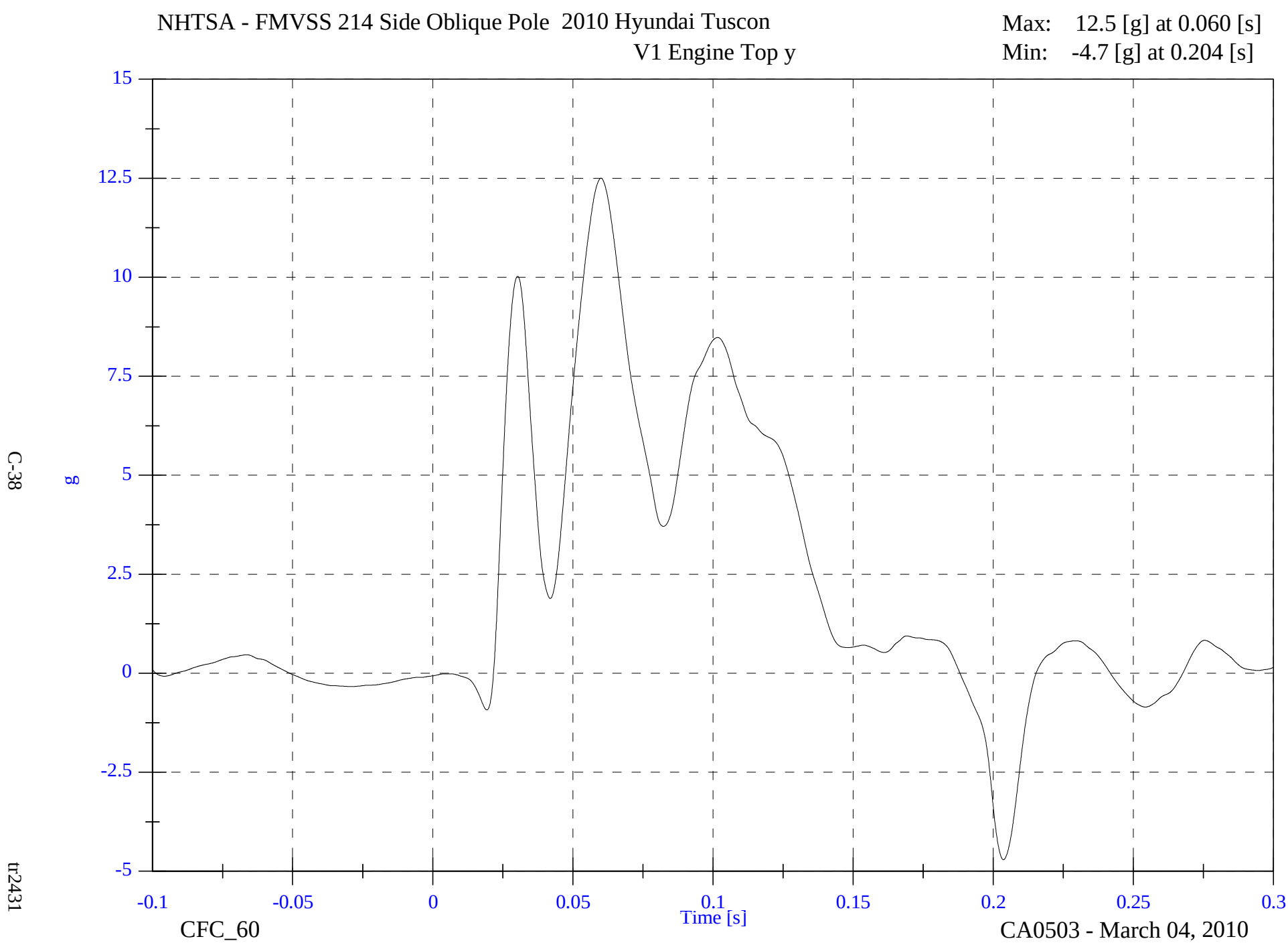
tr2431


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Engine Top y
Max: 12.5 [g] at 0.060 [s]
Min: -4.7 [g] at 0.204 [s]
15
12.5
10
7.5
5
2.5
0
-2.5
-5
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_60
CA0503 - March 04, 2010

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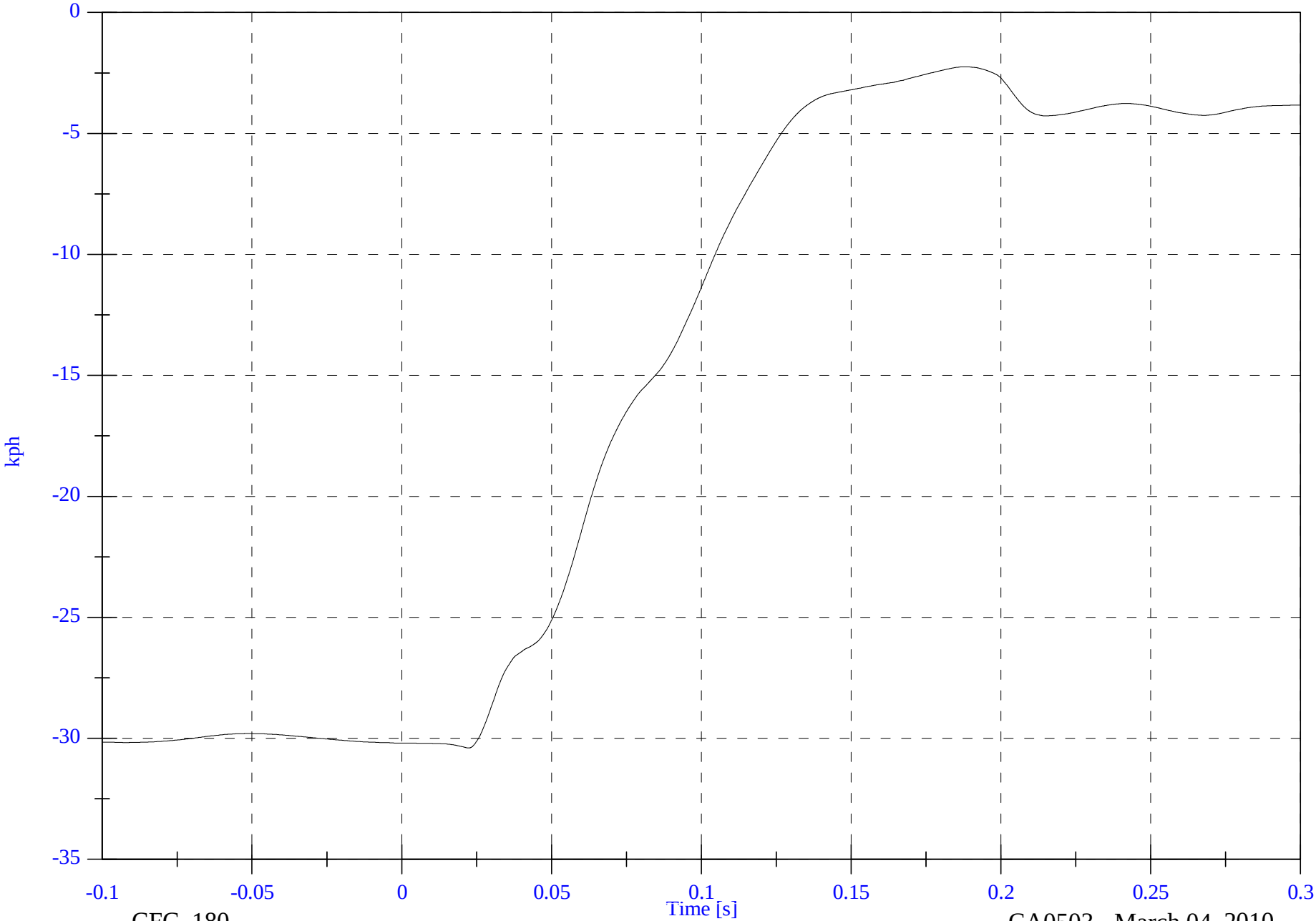
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Engine Top y Velocity

Max: -2.2 [kph] at 0.188 [s]

Min: -30.4 [kph] at 0.022 [s]



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tr2431

CFC_180

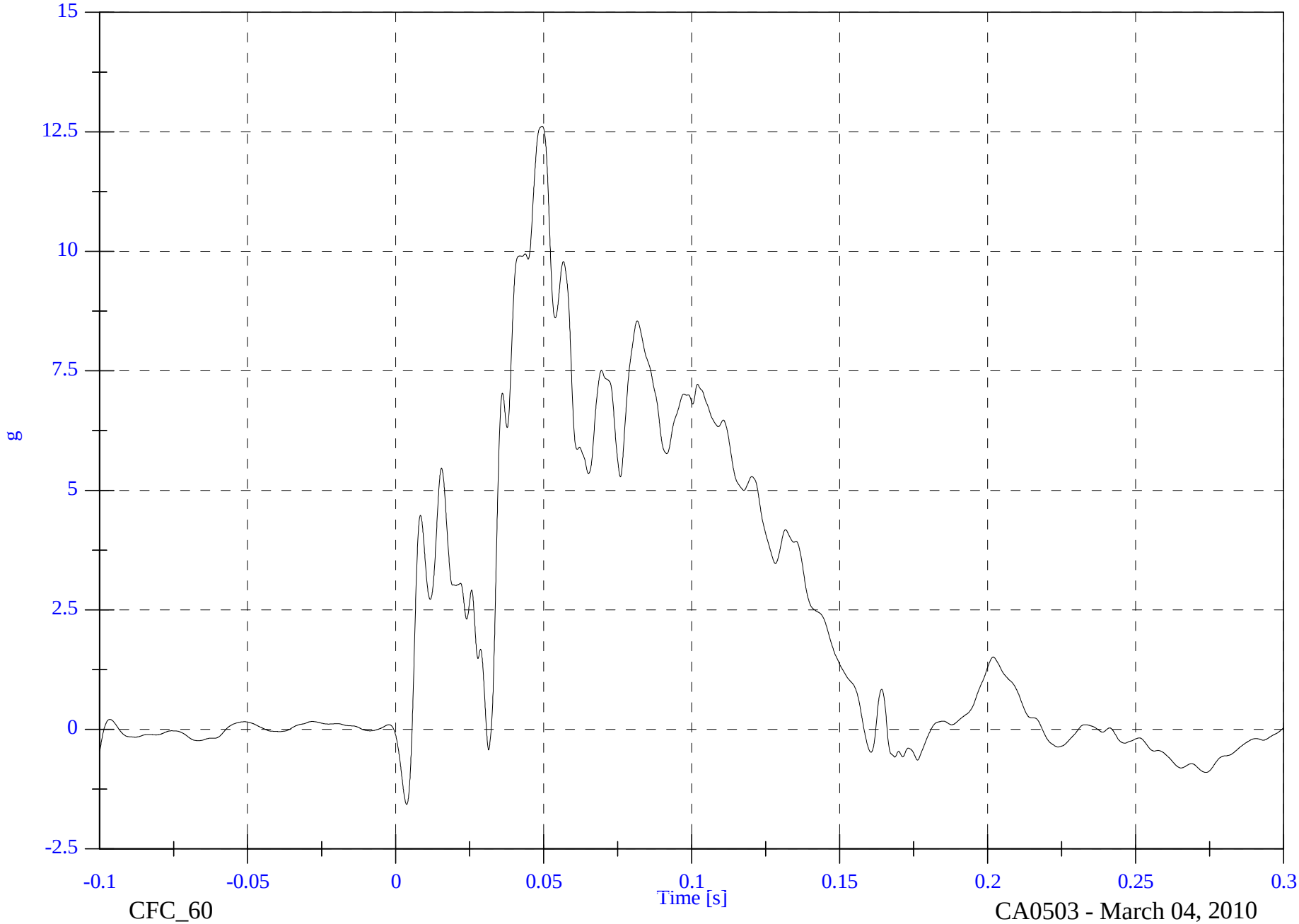
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Firewall y

Max: 12.6 [g] at 0.050 [s]

Min: -1.6 [g] at 0.004 [s]



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tr2431

CFC_60

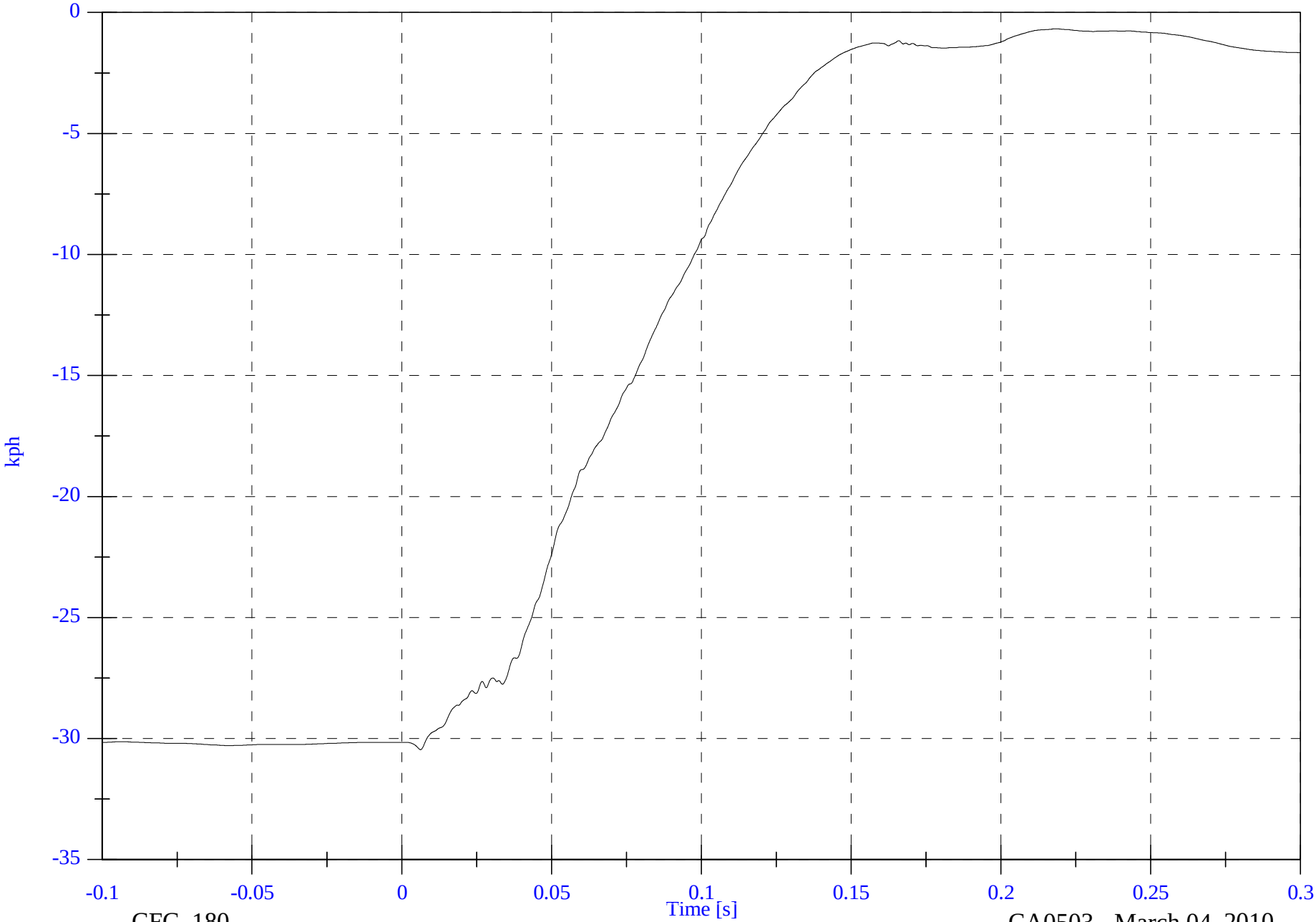
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Firewall y Velocity

Max: -0.7 [kph] at 0.218 [s]

Min: -30.5 [kph] at 0.006 [s]



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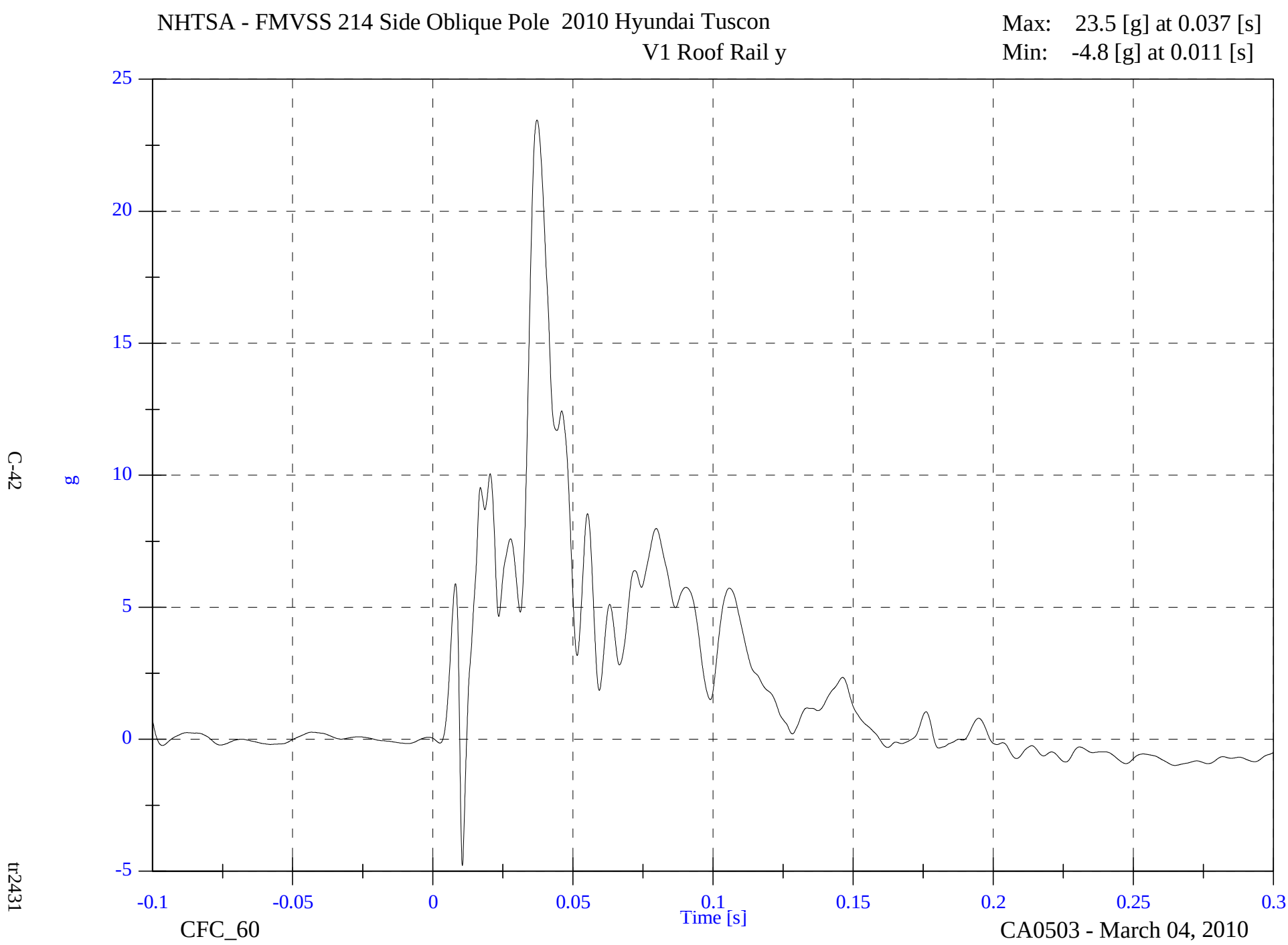
tr2431

CFC_180

CA0503 - March 04, 2010


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Roof Rail y
Max: 23.5 [g] at 0.037 [s]
Min: -4.8 [g] at 0.011 [s]
25
20
15
10
5
0
-5
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_60
CA0503 - March 04, 2010

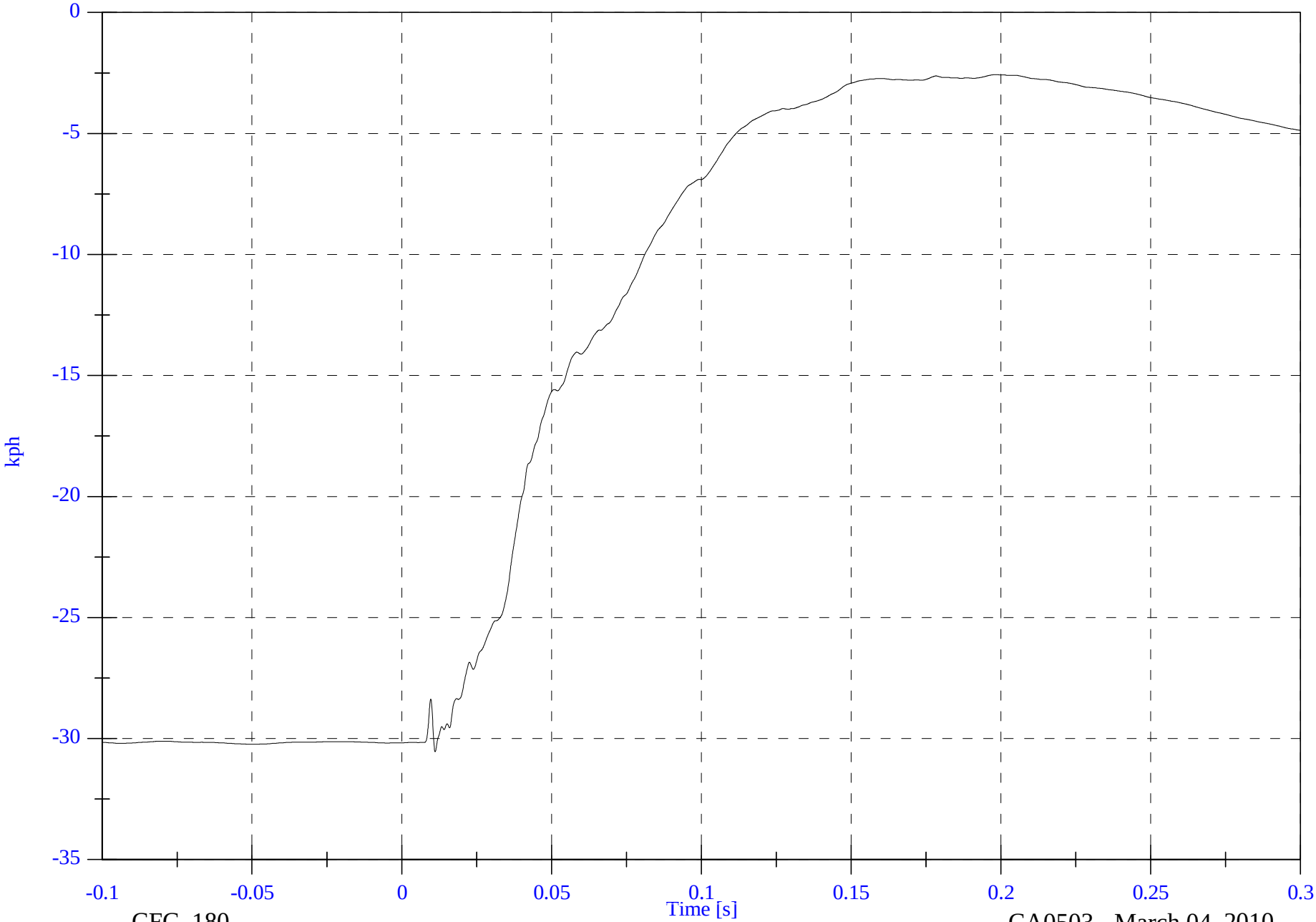
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Roof Rail y Velocity

Max: -2.6 [kph] at 0.198 [s]

Min: -30.5 [kph] at 0.011 [s]

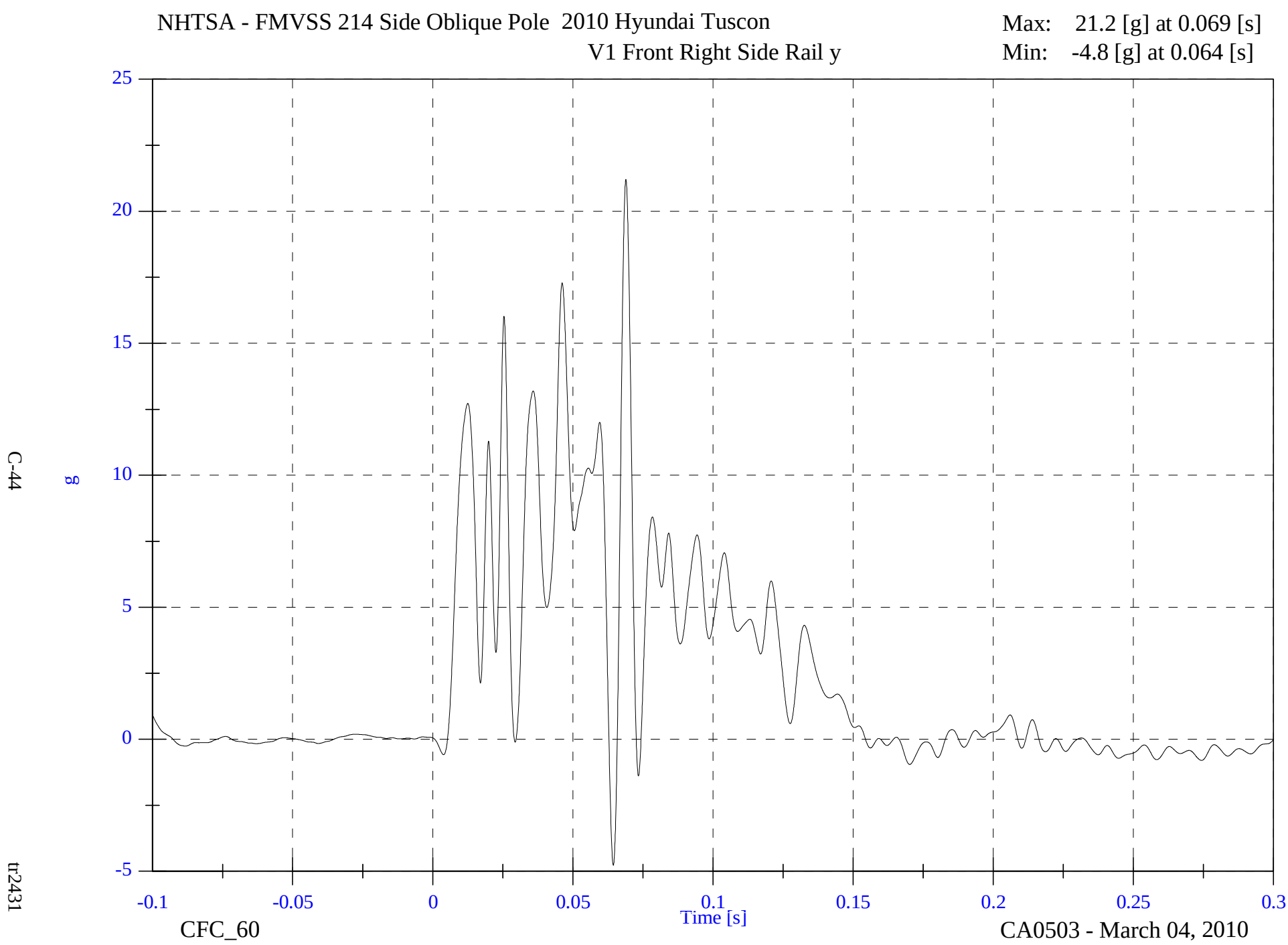


C-43

tr2431

CFC_180

CA0503 - March 04, 2010


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Front Right Side Rail y
Max: 21.2 [g] at 0.069 [s]
Min: -4.8 [g] at 0.064 [s]
25
20
15
10
5
0
-5
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_60
CA0503 - March 04, 2010

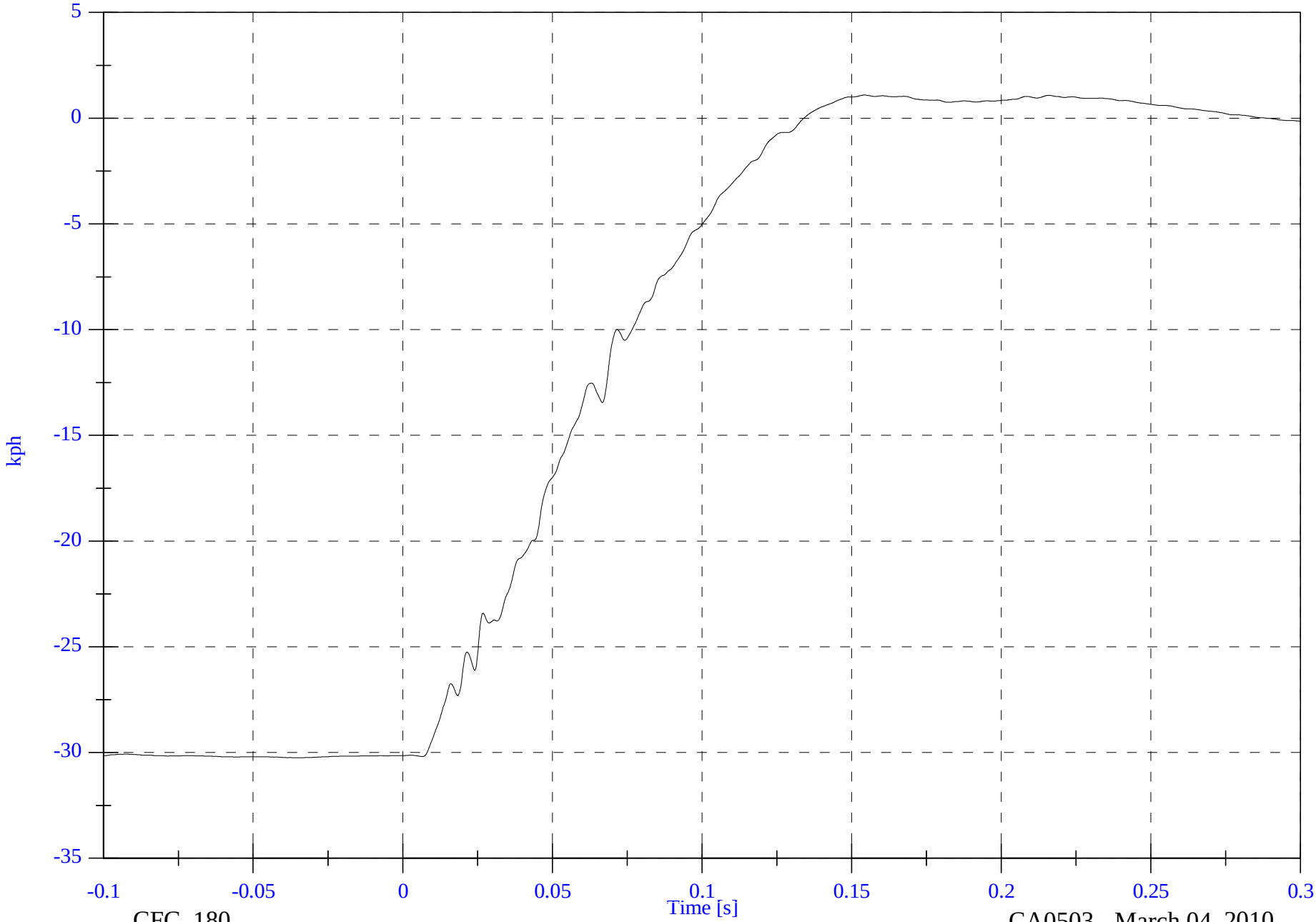
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Front Right Side Rail y Velocity

Max: 1.1 [kph] at 0.154 [s]

Min: -30.2 [kph] at -0.036 [s]



C-45

tr2431

CFC_180

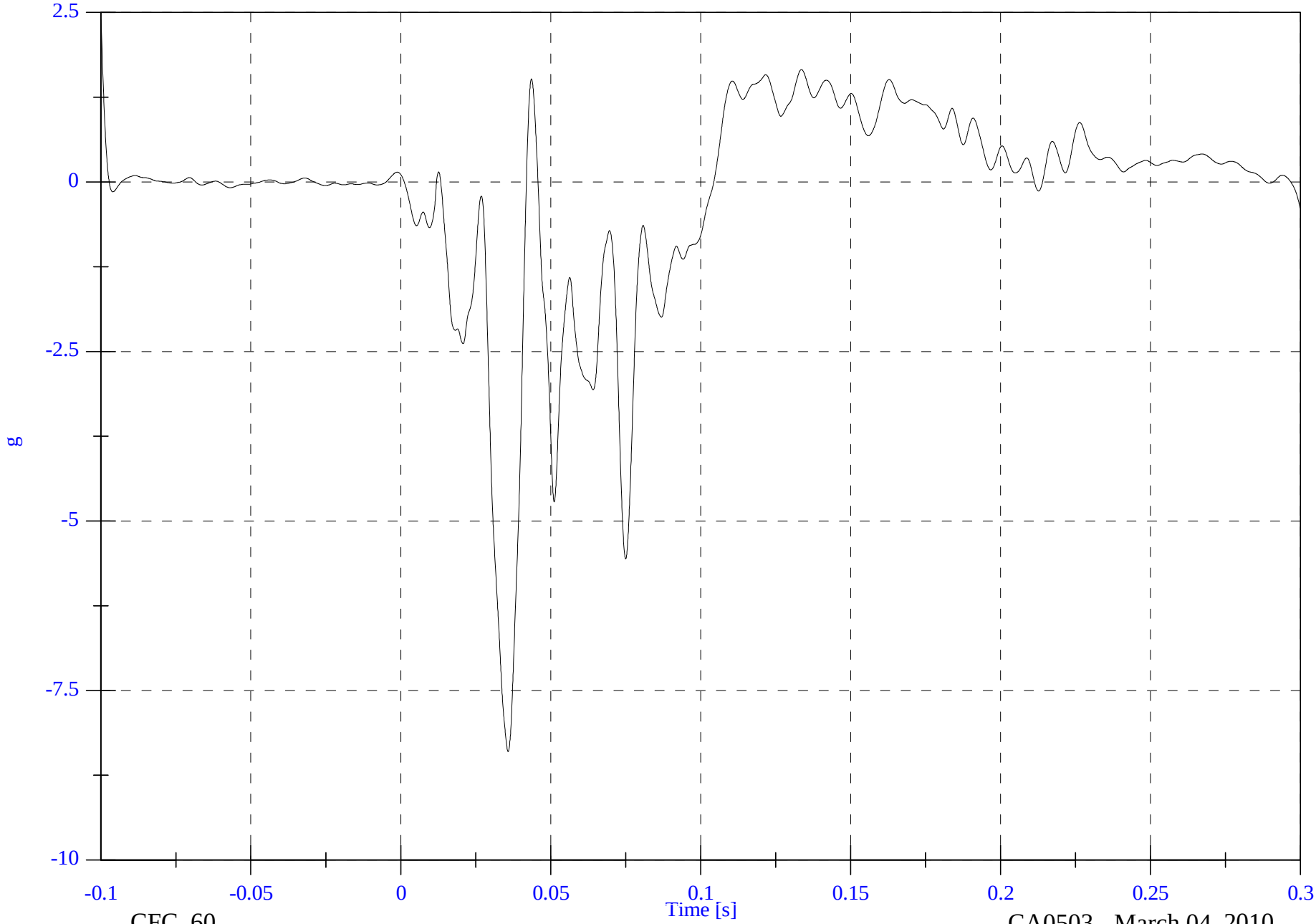
CA0503 - March 04, 2010

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Rear Floorpan x

Max: 2.4 [g] at -0.100 [s]

Min: -8.4 [g] at 0.036 [s]

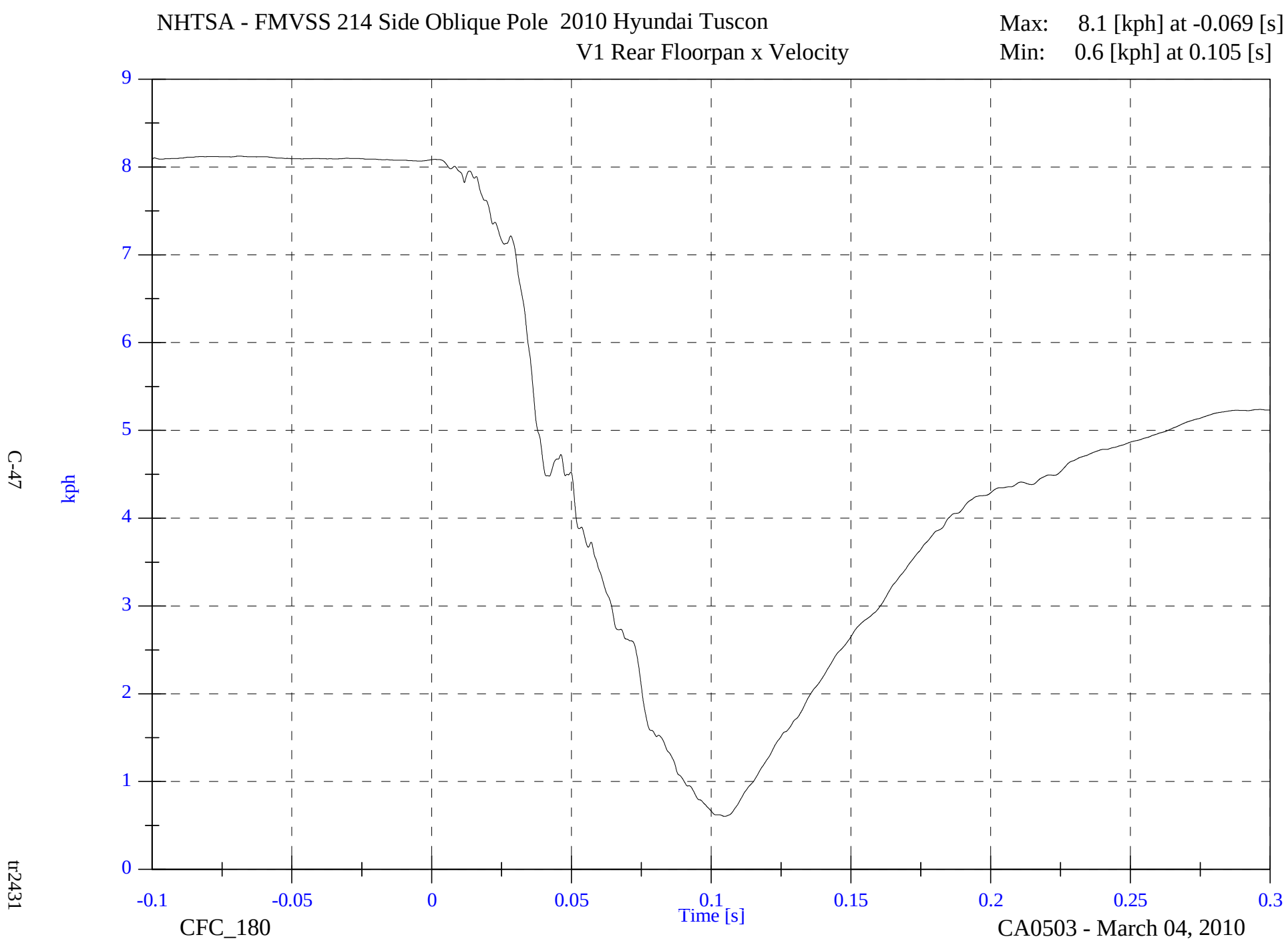


C-46

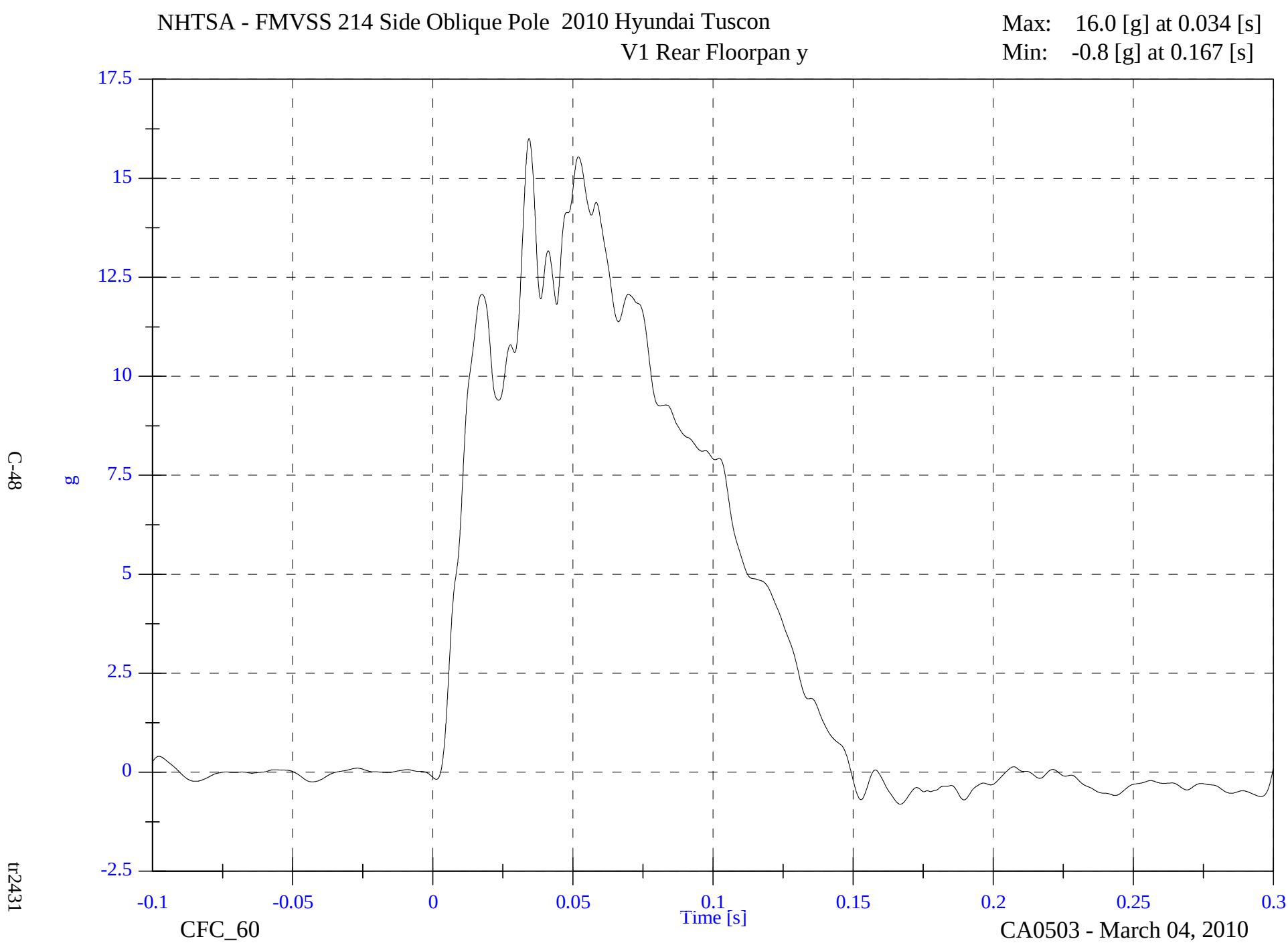
tr2431

CFC_60

CA0503 - March 04, 2010


NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Rear Floorpan x Velocity
Max: 8.1 [kph] at -0.069 [s]
Min: 0.6 [kph] at 0.105 [s]
kph
Time [s]
CFC_180
CA0503 - March 04, 2010

tr2431

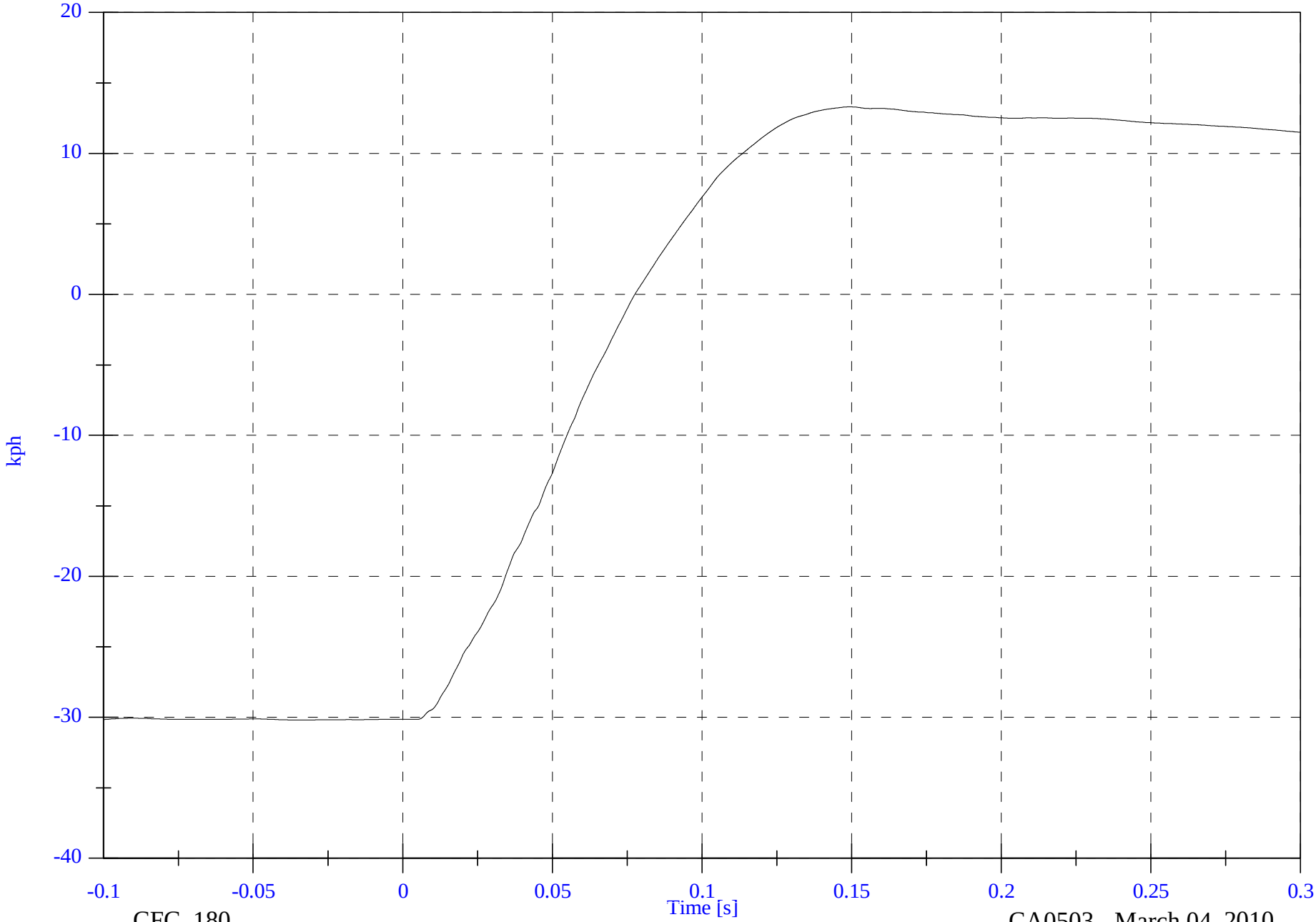

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon
V1 Rear Floorpan y
Max: 16.0 [g] at 0.034 [s]
Min: -0.8 [g] at 0.167 [s]
17.5
15
12.5
10
7.5
5
2.5
0
-2.5
g
-0.1
-0.05
0
0.05
0.1
0.15
0.2
0.25
0.3
Time [s]
CFC_60
CA0503 - March 04, 2010
C-48
tr2431

NHTSA - FMVSS 214 Side Oblique Pole 2010 Hyundai Tuscon

V1 Rear Floorpan y Velocity

Max: 13.3 [kph] at 0.149 [s]

Min: -30.2 [kph] at -0.036 [s]



C-49

tr2431

CFC_180

CA0503 - March 04, 2010

APPENDIX D

DUMMY ES2-re PERFORMANCE CALIBRATION TEST DATA

Calspan

VERIFICATION REPORT

Name of Test:	**Head Drop**	REVISION:	**12/14/2006**
Name of Sub Test:		Type of Spec:	**NHTSA**
Type of ATD:	**ES-2re**		
ATD Serial Number:	**SID D037**		
ID of Test:	**Head Drop**	Date:	**2/5/2010**
Number of Test:	**1**	Time of Test:	**8:38:37 AM**

Part Number of Component	Serial Number of Component
455-1007	

COMMENTS:

Parameters of Test	Specifications of Test			Results of Test		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10	--	70	**24**	%RH	P
Resultant Acceleration	125	--	155	**151**	g	P
Oscillation	0.0	--	15.0	**3.2**	%	P
Fore-Aft Acceleration	-15.00	--	15.00	**7.03**	g	P

All test parameters are within specifications

Name of Tech.: **A. Rudniski** SIGNATURE: _____

Name of Super.: **D. Travale** SIGNATURE: _____

Calspan

ID of Test: **Head Drop** Time of Test: **8:38:37 AM** Date of Test: **2/5/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Endevco	**7264-2000**	**AC-P18639**	**1/25/2010**
Endevco	**7264-2000**	**AC-P23128**	**1/25/2010**
Endevco	**7264-2000**	**AC-P16591**	**1/25/2010**

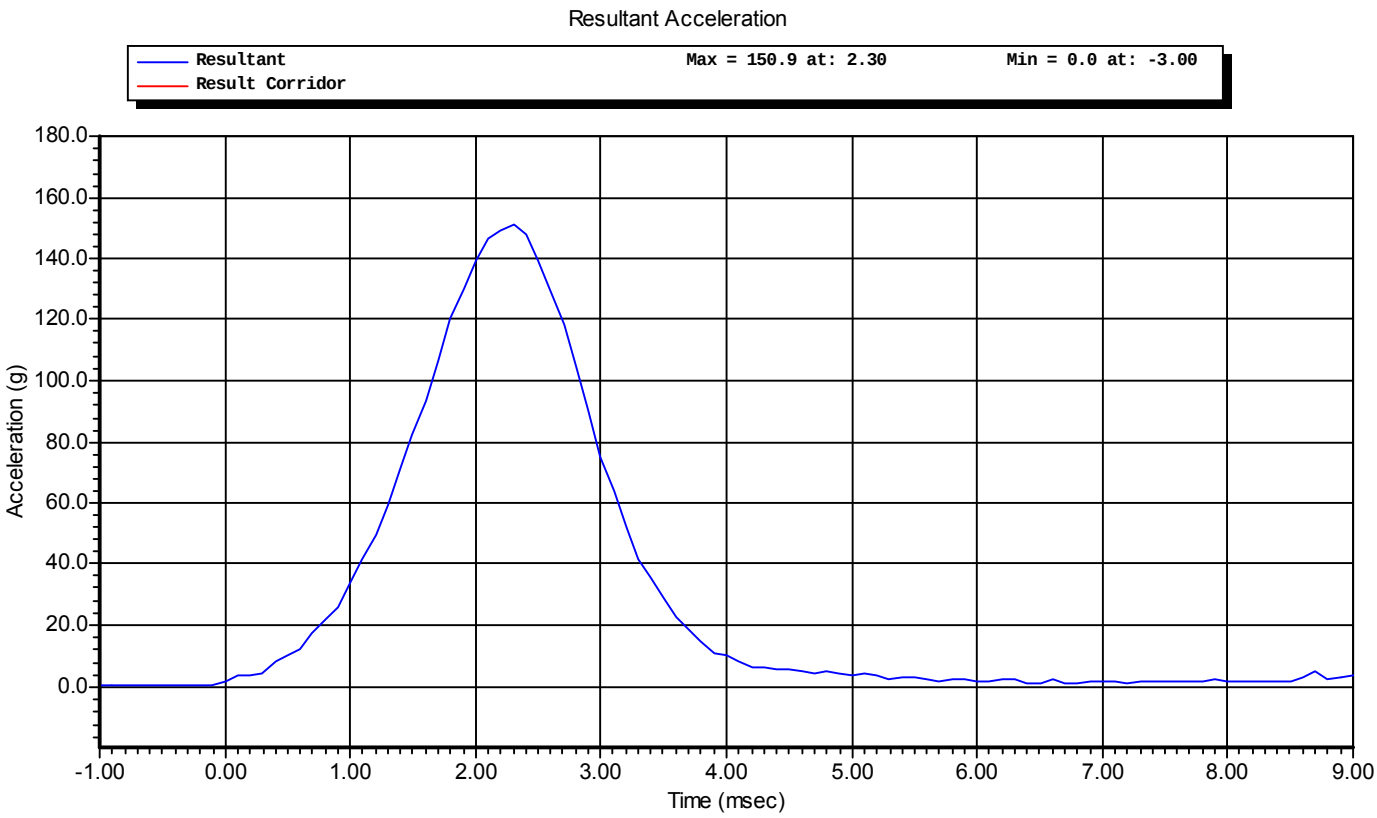
Calspan

ID of Test: **Head Drop** Time of Test: **8:38:37 AM** Date of Test: **2/5/2010**

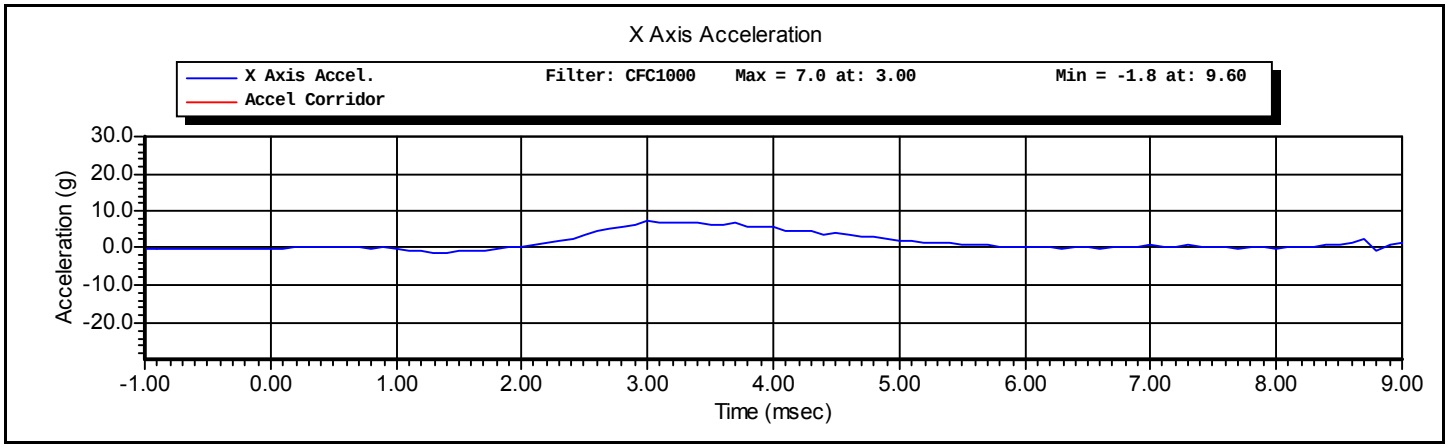
Calspan

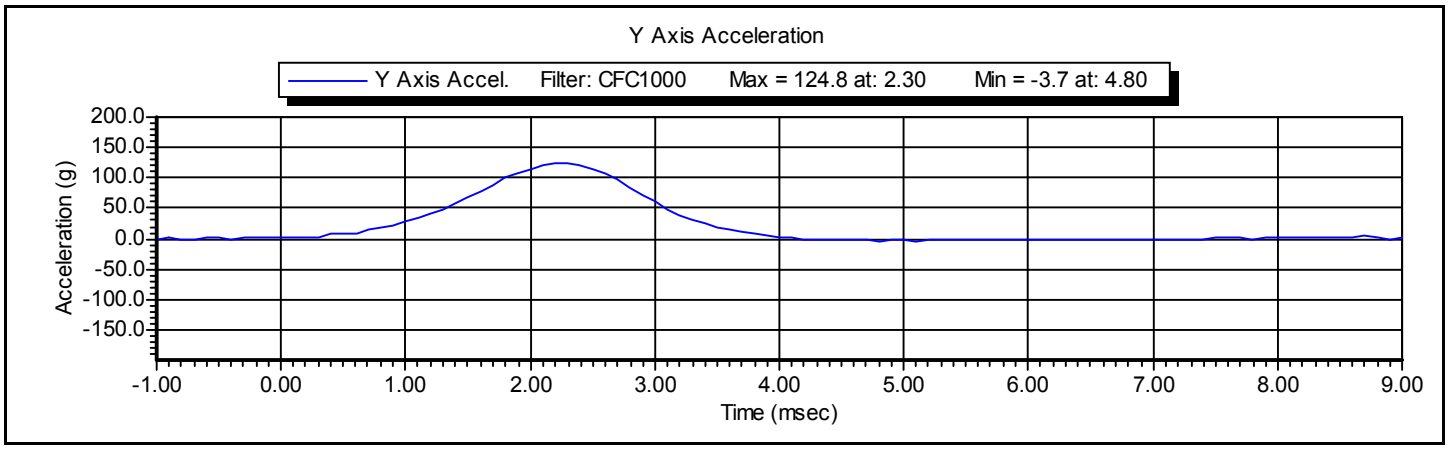
Test Name:	**Head Drop**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**SID D037**		
		Test Date:	**2/5/2010**
Test Number:	**1**	Test Time:	**8:38:37 AM**

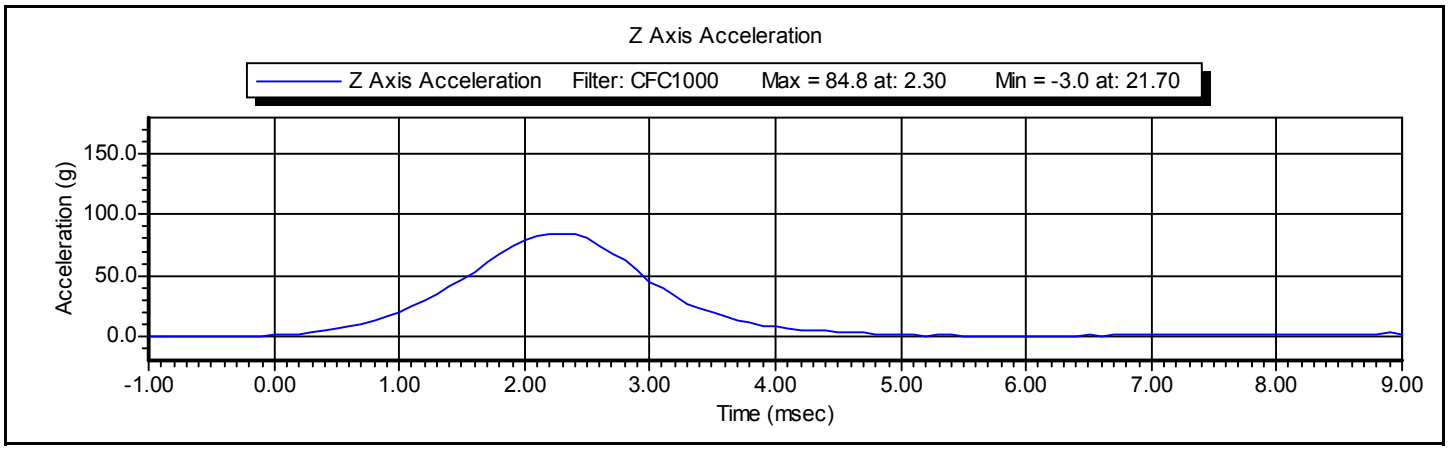
Component Part Number	Component Serial Number
455-1007	



Calspan







Calspan

VERIFICATION REPORT

Test Name:	**Neck Flexion**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Neck Flexion Test**	Test Date:	**2/12/2010**
Test Number:	**1**	Test Time:	**9:16:03 AM**

Component Part Number	Component Serial Number
455-2002	**19-020118**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10	--	70	**24**	%RH	P
Velocity	3.30	--	3.50	**3.34**	m/s	P
Maximum Neck Flexion Angle	49.0	--	59.0	**52.8**	degrees	P
Time At Maximum Neck Flexion	54.0	--	66.0	**61.5**	ms	P
Decay to Zero Degrees	53.0	--	88.0	**58.3**	ms	P
Velocity Corridor		--				P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Neck Flexion Test** Test Time: **9:16:03 AM** Test Date: **2/12/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7231CT**	**AE8K0**	**12/14/2009**
DentonATD	**7000428**	**094**	**10/23/2009**
DentonATD	**7000428**	**095**	**10/23/2009**
DentonATD	**7000428**	**093**	**10/23/2009**

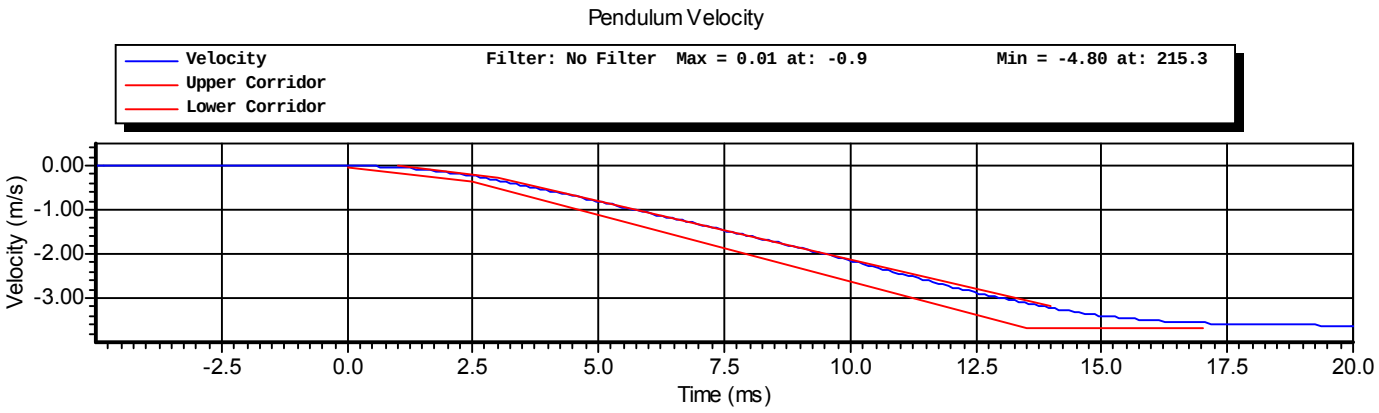
Calspan

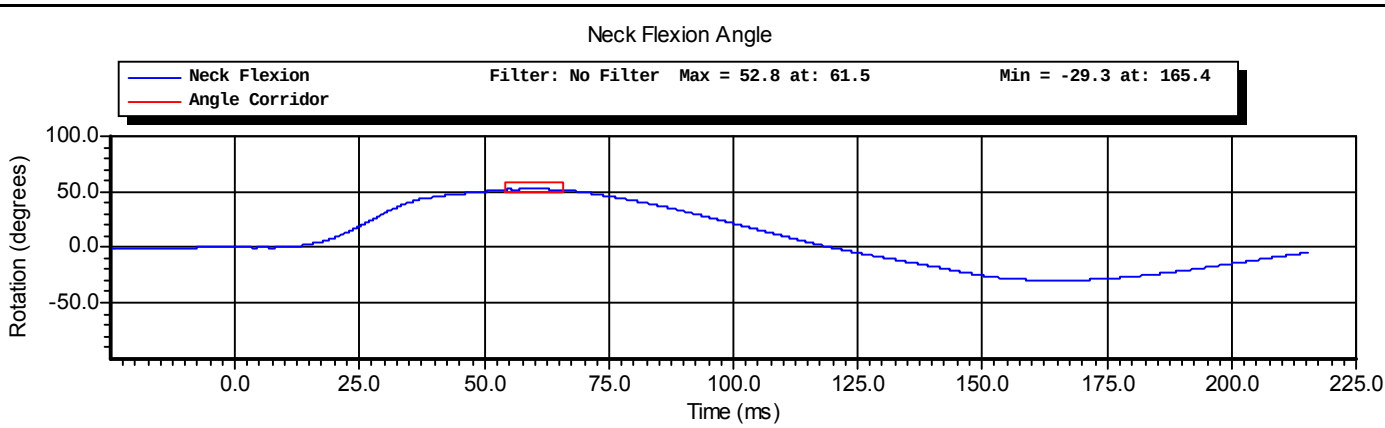
Test ID: **Neck Flexion Test** Test Time: **9:16:03 AM** Test Date: **2/12/2010**

Calspan

Test Name:	**Neck Flexion**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/12/2010**
Test Number:	**1**	Test Time:	**9:16:03 AM**

Component Part Number	Component Serial Number
455-2002	**19-020118**





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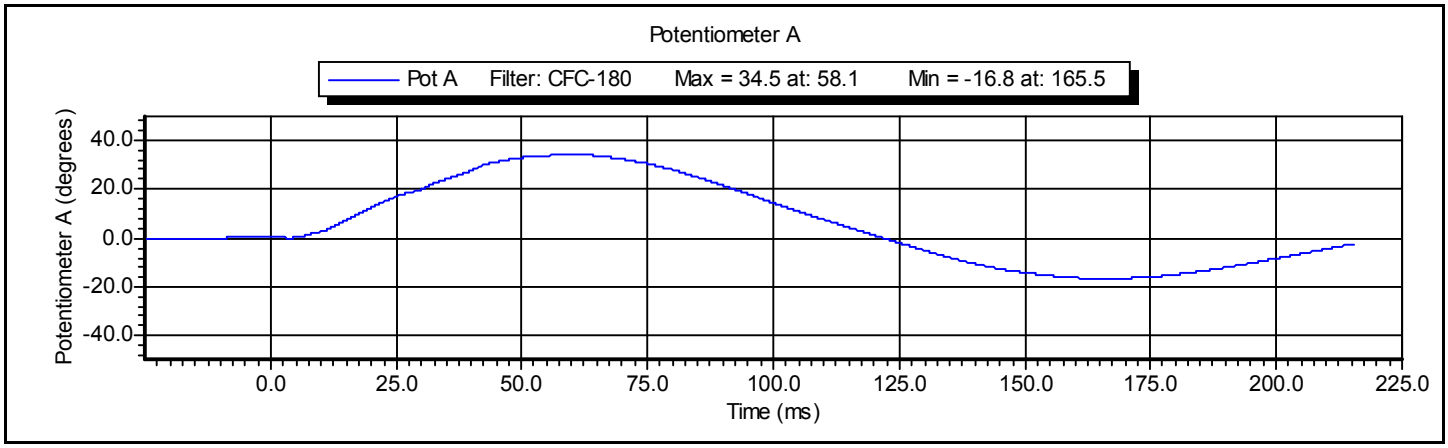
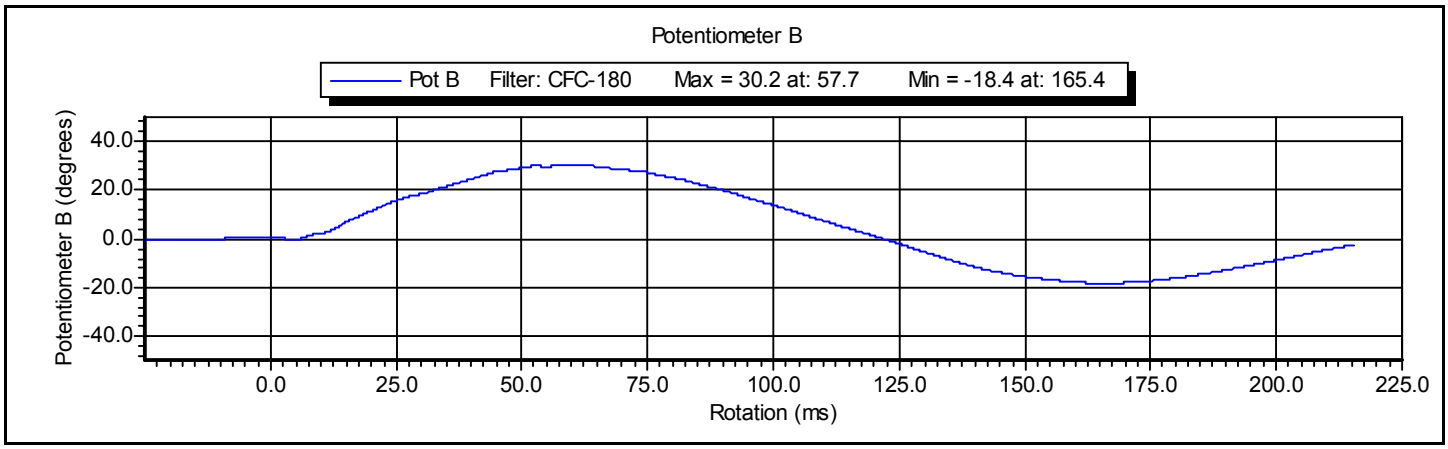
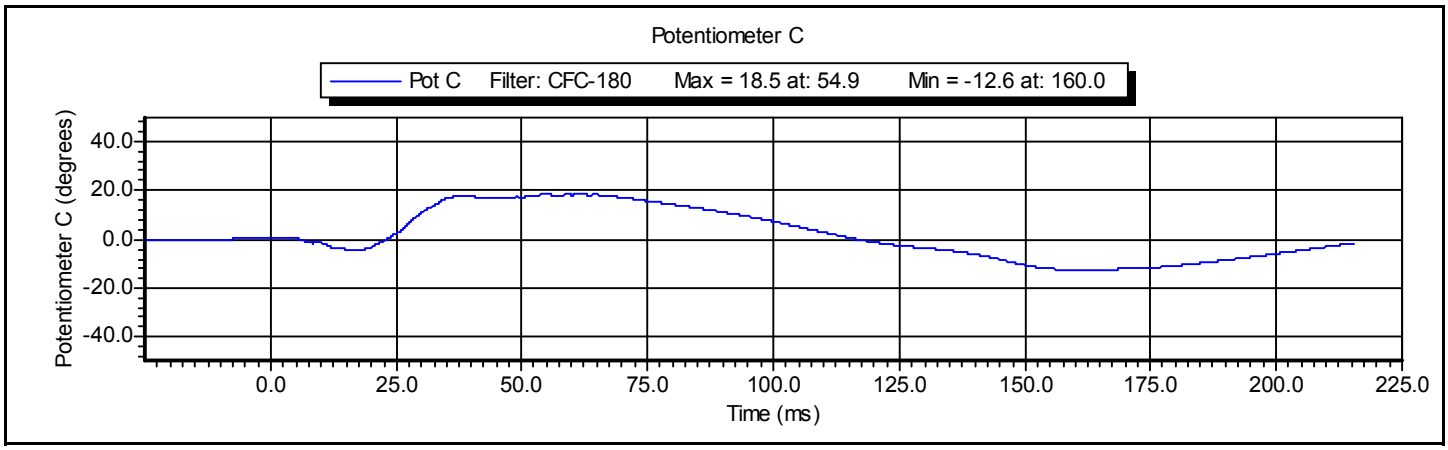






Calspan

VERIFICATION REPORT

Test Name:	**Shoulder Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Shoulder Impact**	Test Date:	**2/16/2010**
Test Number:	**1**	Test Time:	**8:24:57 AM**

Component Part Number	Component Serial Number
960715-313	

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**22.2**	deg C	P
Humidity	10.0	--	70.0	**15.0**	%RH	P
Velocity	4.20	--	4.40	**4.32**	m/s	P
Pendulum Acceleration	-10.50	--	-7.50	**-8.89**	g	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Shoulder Impact** Test Time: **8:24:57 AM** Test Date: **2/16/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16761**	**1/22/2010**

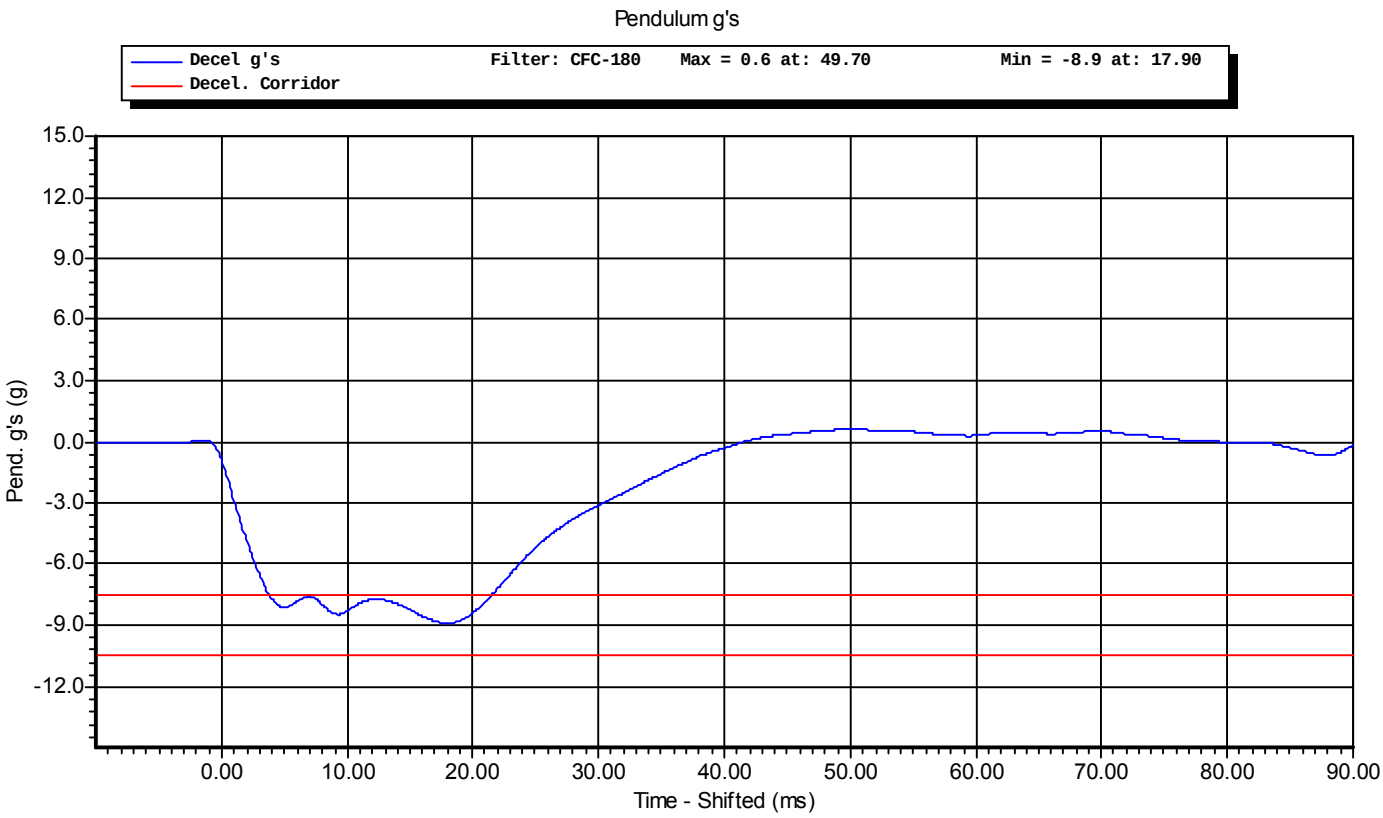
Calspan

Test ID: **Shoulder Impact** Test Time: **8:24:57 AM** Test Date: **2/16/2010**

Calspan

Test Name:	**Shoulder Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/16/2010**
Test Number:	**1**	Test Time:	**8:24:57 AM**

Component Part Number	Component Serial Number
960715-313	



Calspan

Test Time: **8:24:57 AM** Test Date: **2/16/2010**

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Lower Rib 3 m/s**	Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**1:40:15 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**20.6**	deg C	P
Humidity	10.0	--	70.0	**28.0**	%RH	P
Velocity	2.90	--	3.10	**2.98**	m/s	P
Rib Displacement	-40.00	--	-36.00	**-37.11**	mm	P
Drop Height	454	--	464	**459**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Lower Rib 3 m/s** Test Time: **1:40:15 PM** Test Date: **2/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-3**	**1/11/2010**
DentonATD	**Velocity Vane**	**1**	**1/22/2010**
Endevco	**(CALSPAN) 7264-2000**	**P23137**	**1/22/2010**

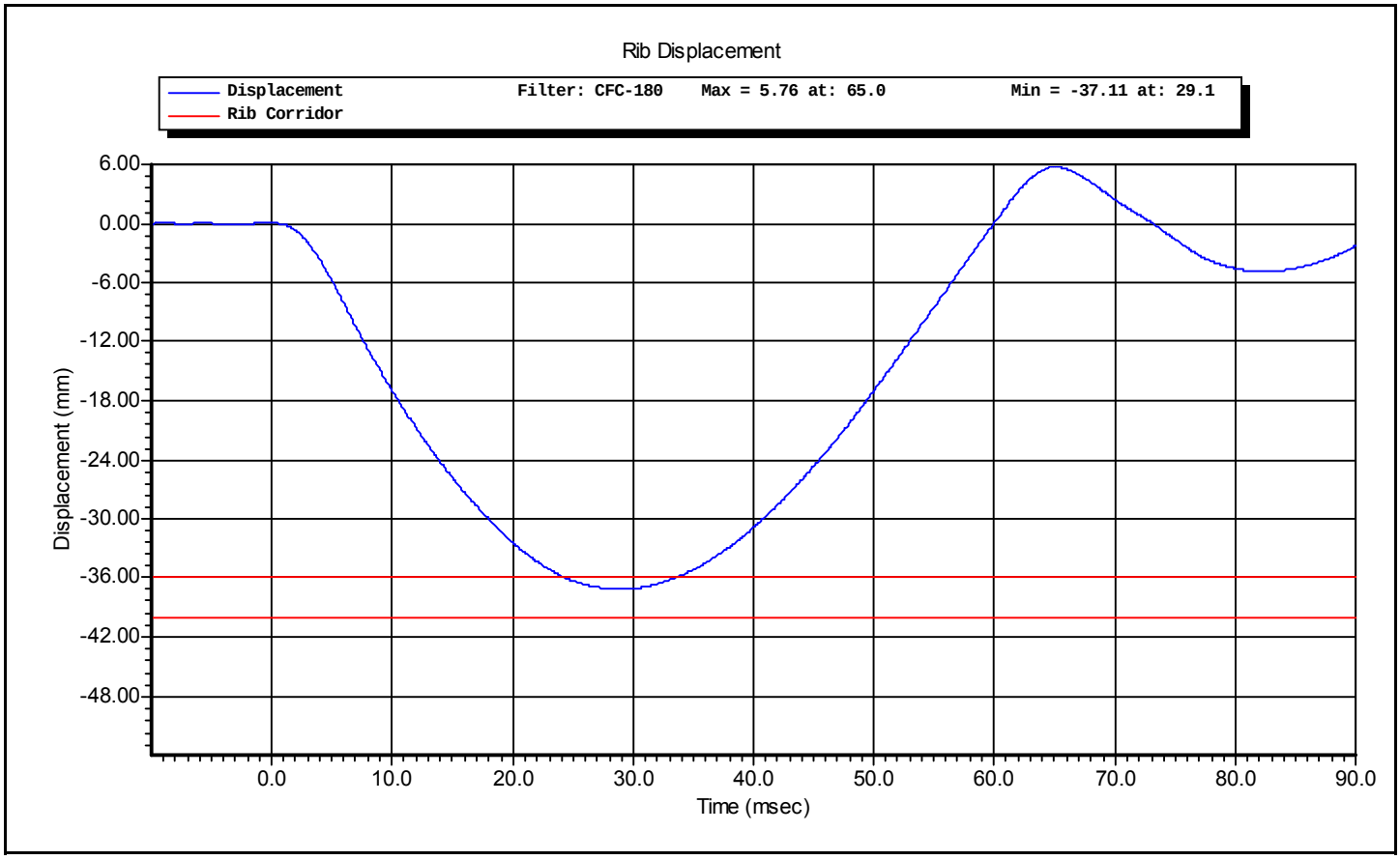
Calspan

Test ID: **Lower Rib 3 m/s** Test Time: **1:40:15 PM** Test Date: **2/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**1:40:15 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**



Calspan

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Lower Rib 4 m/s**	Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**2:00:38 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**20.6**	deg C	P
Humidity	10.0	--	70.0	**28.0**	%RH	P
Velocity	3.90	--	4.10	**4.00**	m/s	P
Rib Displacement	-51.00	--	-46.00	**-47.16**	mm	P
Drop Height	807.0	--	823.0	**815.0**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Lower Rib 4 m/s** Test Time: **2:00:38 PM** Test Date: **2/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-3**	**1/11/2010**
DentonATD	**Velocity Vane**	**1**	**1/22/2010**
Endevco	**(CALSPAN) 7264-2000**	**P23137**	**1/22/2010**

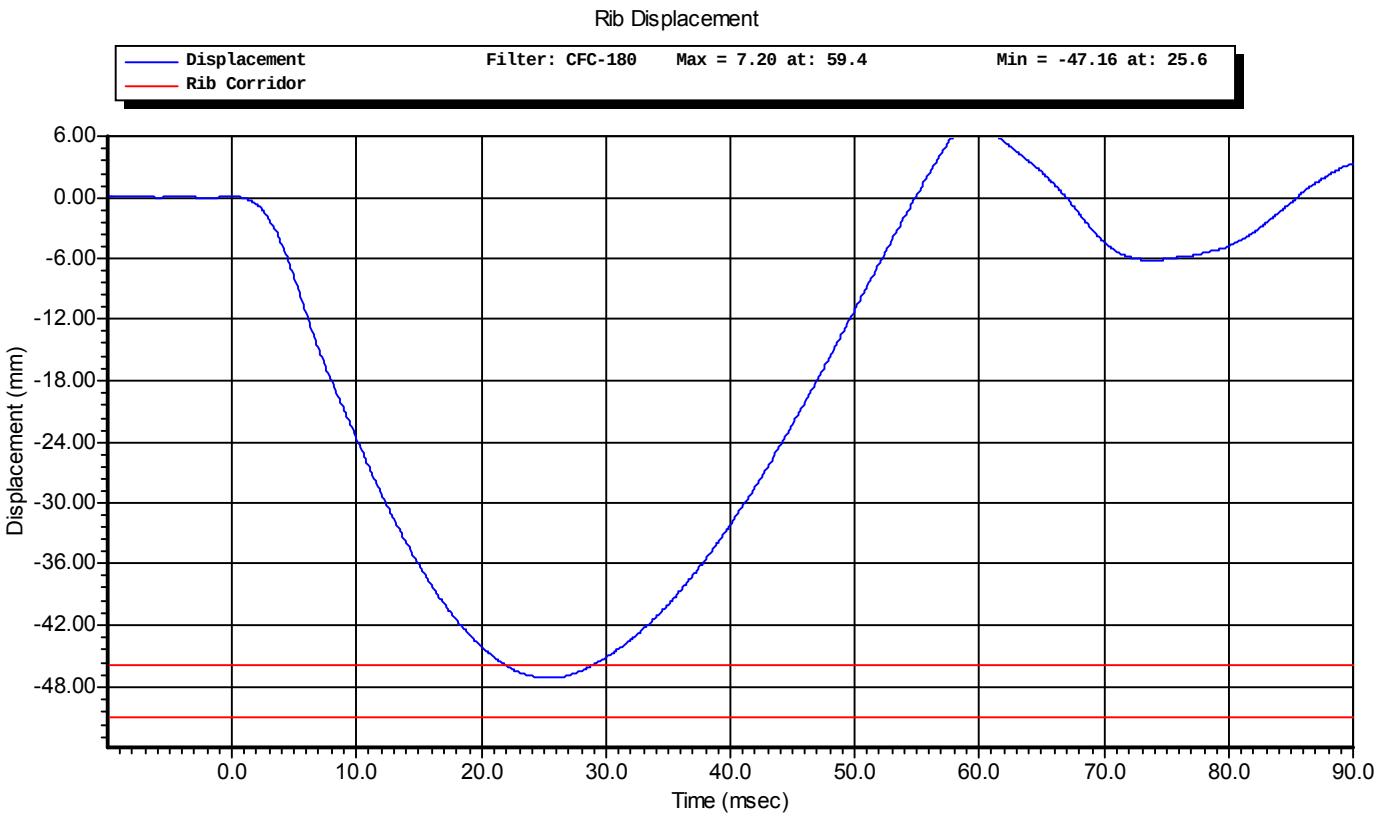
Calspan

Test ID: **Lower Rib 4 m/s** Test Time: **2:00:38 PM** Test Date: **2/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**2:00:38 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**



Calspan

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Middle Rib 3 m/s**	Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**3:49:51 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**20.6**	deg C	P
Humidity	10.0	--	70.0	**28.0**	%RH	P
Velocity	2.90	--	3.10	**2.98**	m/s	P
Rib Displacement	-40.00	--	-36.00	**-36.98**	mm	P
Drop Height	454	--	464	**459**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Middle Rib 3 m/s** Test Time: **3:49:51 PM** Test Date: **2/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0807**	**1/11/2010**
DentonATD	**Velocity Vane**	**1**	**1/22/2010**
Endevco	**(CALSPAN) 7264-2000**	**P23137**	**1/22/2010**

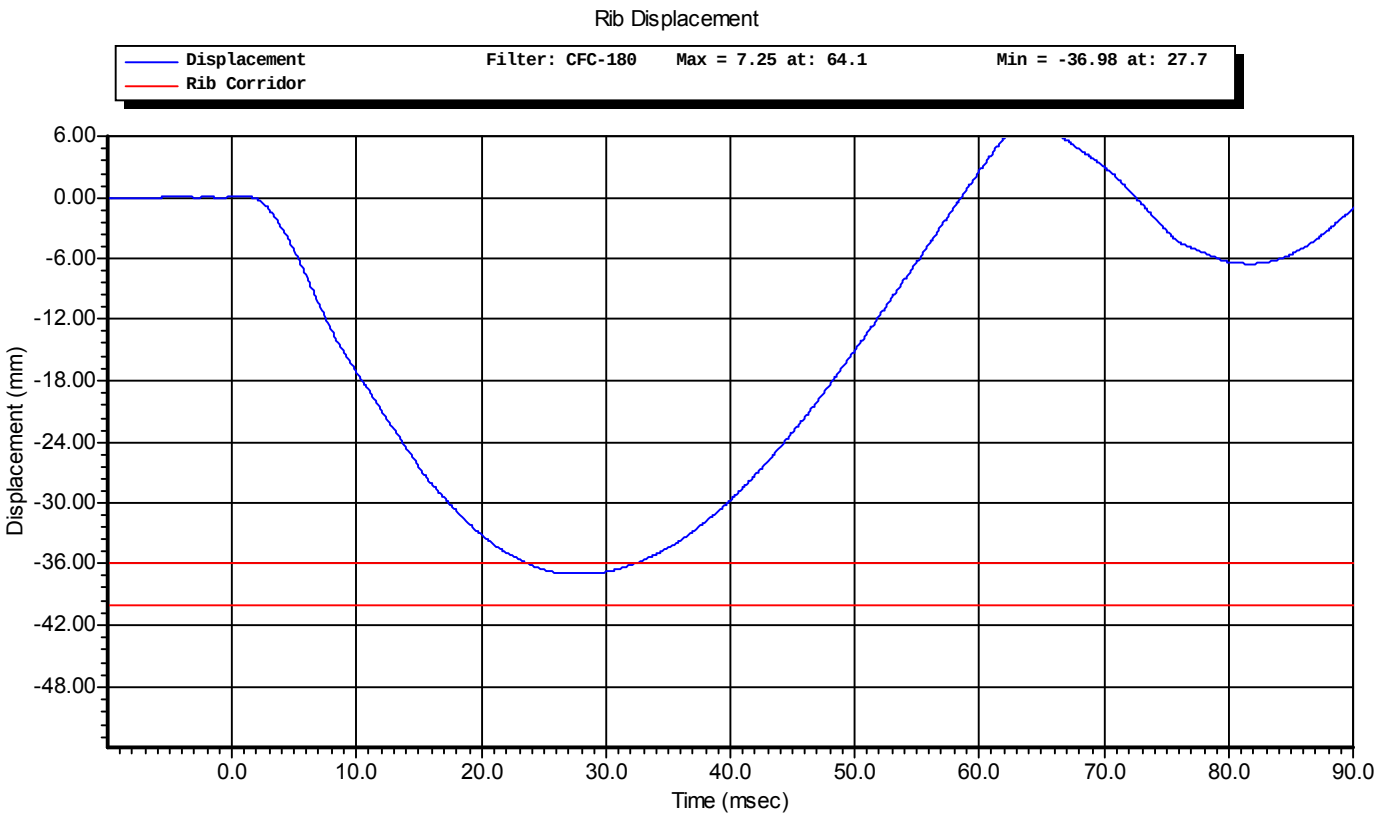
Calspan

Test ID: **Middle Rib 3 m/s** Test Time: **3:49:51 PM** Test Date: **2/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**3:49:51 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**



Calspan

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Middle Rib 4 m/s**	Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**4:18:22 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**20.6**	deg C	P
Humidity	10.0	--	70.0	**28.0**	%RH	P
Velocity	3.90	--	4.10	**4.01**	m/s	P
Rib Displacement	-51.00	--	-46.00	**-47.03**	mm	P
Drop Height	807.0	--	823.0	**815.0**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Middle Rib 4 m/s** Test Time: **4:18:22 PM** Test Date: **2/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0807**	**1/11/2010**
DentonATD	**Velocity Vane**	**1**	**1/22/2010**
Endevco	**(CALSPAN) 7264-2000**	**P23137**	**1/22/2010**

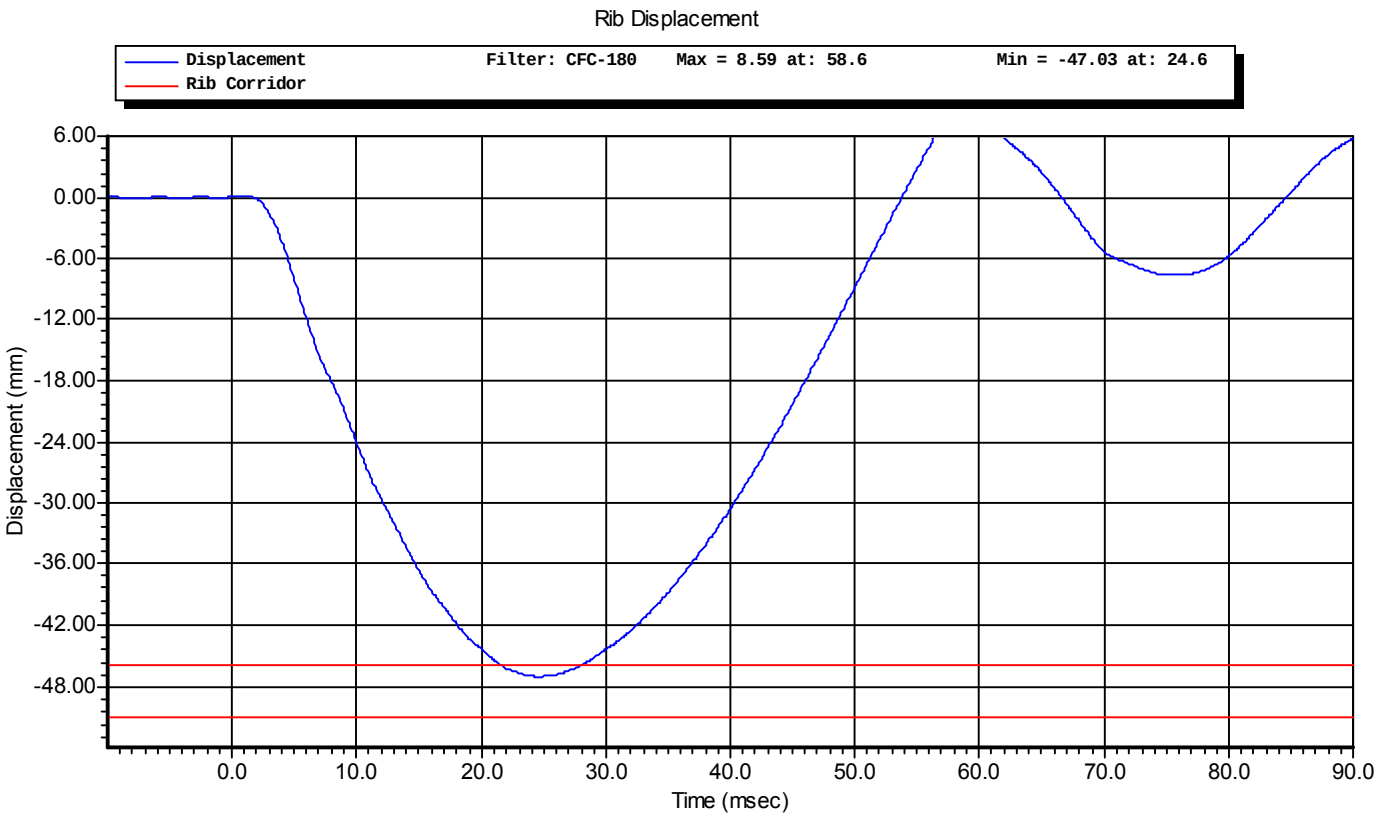
Calspan

Test ID: **Middle Rib 4 m/s** Test Time: **4:18:22 PM** Test Date: **2/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**4:18:22 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**



Calspan

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Upper Rib 3 m/s**	Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**11:44:47 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**20.6**	deg C	P
Humidity	10.0	--	70.0	**28.0**	%RH	P
Velocity	2.90	--	3.10	**2.95**	m/s	P
Rib Displacement	-40.00	--	-36.00	**-37.38**	mm	P
Drop Height	454	--	464	**459**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Upper Rib 3 m/s** Test Time: **11:44:47 AM** Test Date: **2/8/2010**

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VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-01**	**1/11/2010**
DentonATD	**Velocity Vane**	**1**	**1/22/2010**
Endevco	**(CALSPAN) 7264-2000**	**P23137**	**1/22/2010**

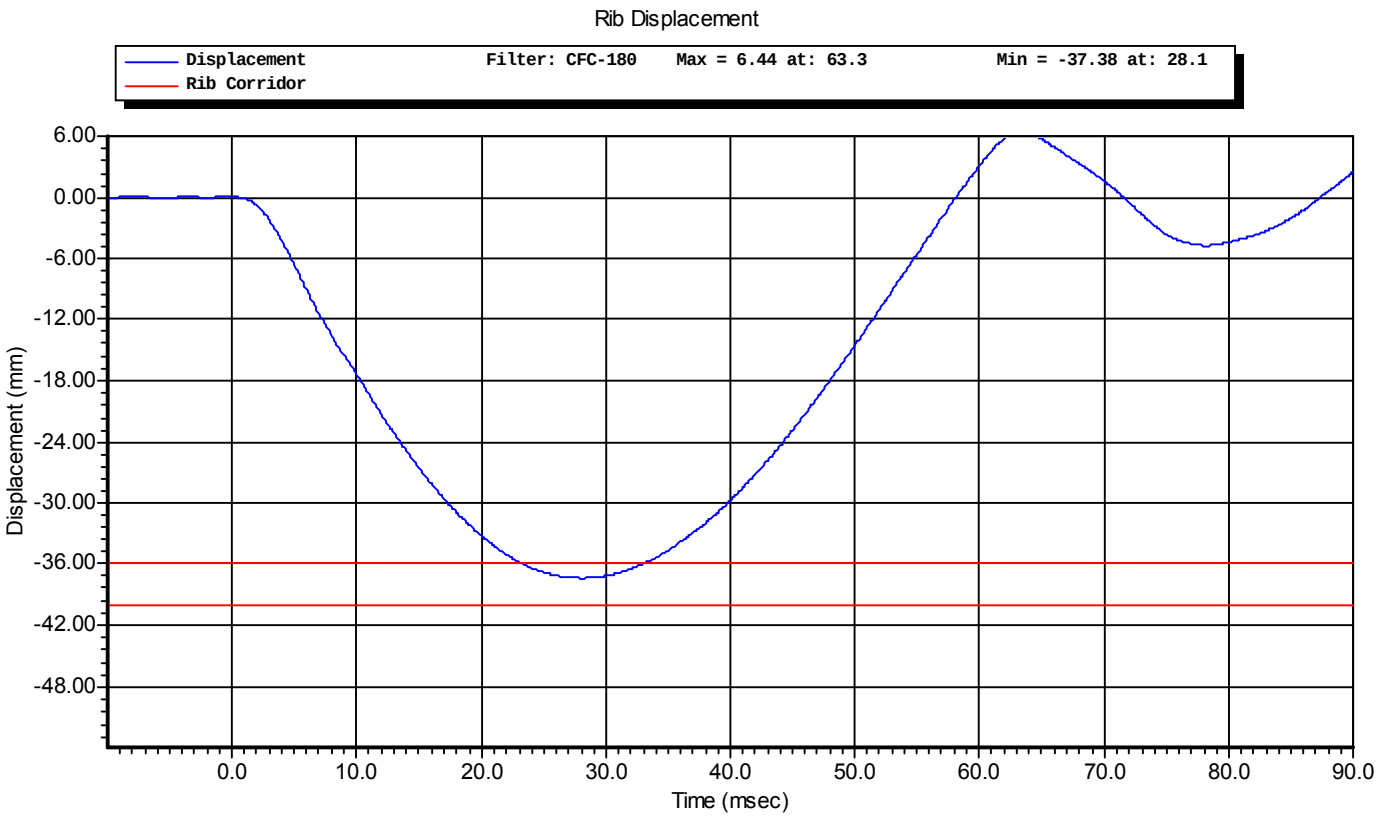
Calspan

Test ID: **Upper Rib 3 m/s** Test Time: **11:44:47 AM** Test Date: **2/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**11:44:47 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**



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VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Upper Rib 4 m/s**	Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**12:10:35 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**20.6**	deg C	P
Humidity	10.0	--	70.0	**28.0**	%RH	P
Velocity	3.90	--	4.10	**3.99**	m/s	P
Rib Displacement	-51.00	--	-46.00	**-48.65**	mm	P
Drop Height	807.0	--	823.0	**815.0**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

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Test ID: **Upper Rib 4 m/s** Test Time: **12:10:35 PM** Test Date: **2/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-01**	**1/11/2010**
DentonATD	**Velocity Vane**	**1**	**1/22/2010**
Endevco	**(CALSPAN) 7264-2000**	**P23137**	**1/22/2010**

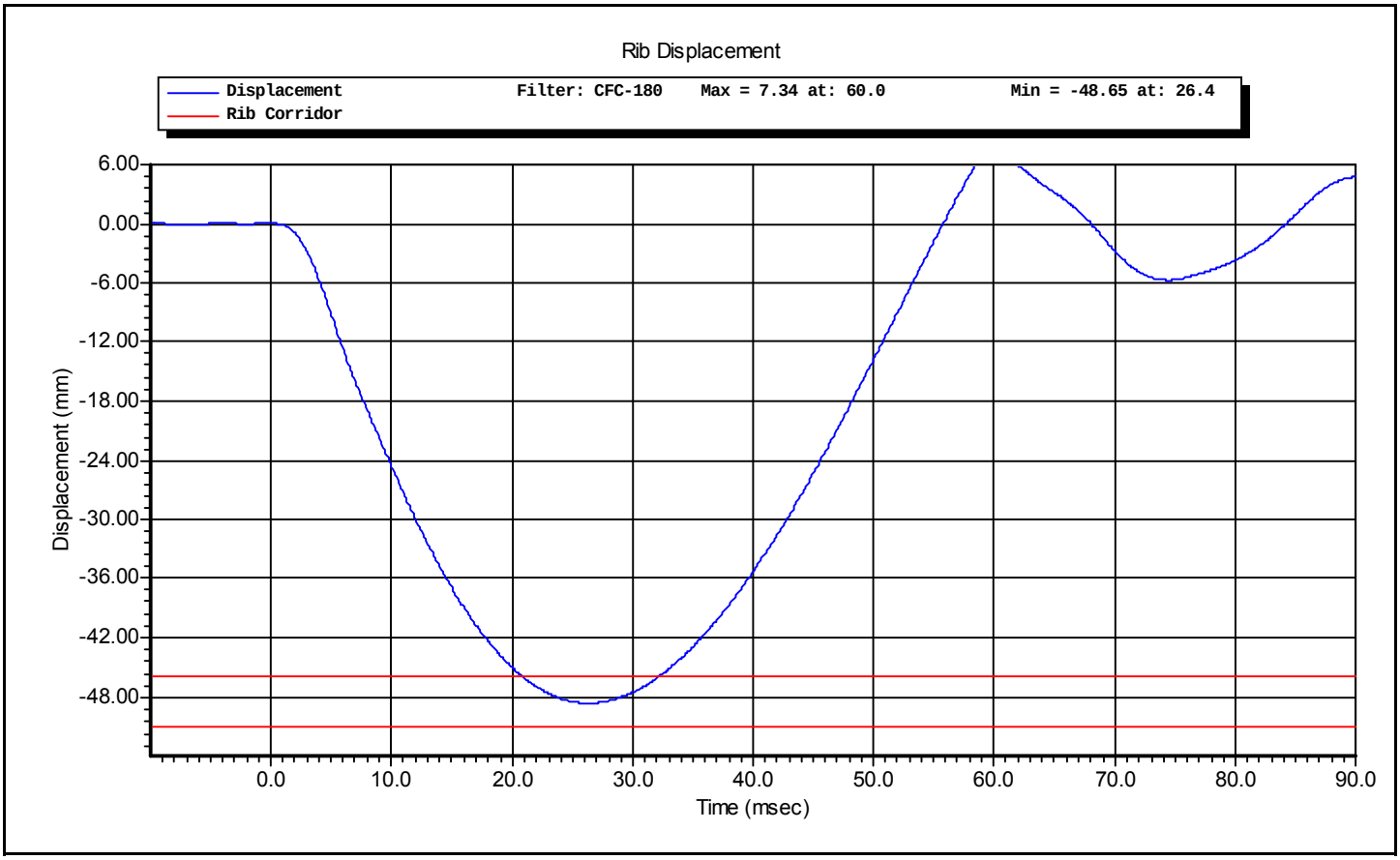
Calspan

Test ID: **Upper Rib 4 m/s** Test Time: **12:10:35 PM** Test Date: **2/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/8/2010**
Test Number:	**1**	Test Time:	**12:10:35 PM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**



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VERIFICATION REPORT

Test Name:	**Thorax Impact**	Revision:	**8/15/2008**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Thorax Impact**	Test Date:	**2/18/2010**
Test Number:	**1**	Test Time:	**9:02:14 AM**

Component Part Number	Component Serial Number
Upper Rib - 175-4002	**1954-0124A**
Middle Rib - 175-4002	**1954-0125A**
Lower Rib - 175-4002	**1954-0126A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**22.2**	deg C	P
Humidity	10.0	--	70.0	**31.0**	%RH	P
Velocity	5.40	--	5.60	**5.50**	m/s	P
Upper Rib Displacement	34.0	--	41.0	**37.2**	mm	P
Middle Rib Displacement	37.0	--	45.0	**40.8**	mm	P
Lower Rib Displacement	37.0	--	44.0	**41.1**	mm	P
Impactor Force	5100	--	6200	**5572**	N	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Thorax Impact** Test Time: **9:02:14 AM** Test Date: **2/18/2010**

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VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16761**	**1/22/2010**
Honeywell	**MLT-38000**	**DS-0552-01**	**1/11/2010**
Honeywell	**MLT-38000**	**DS-0807**	**1/11/2010**
Honeywell	**MLT-38000**	**DS-0552-3**	**1/11/2010**

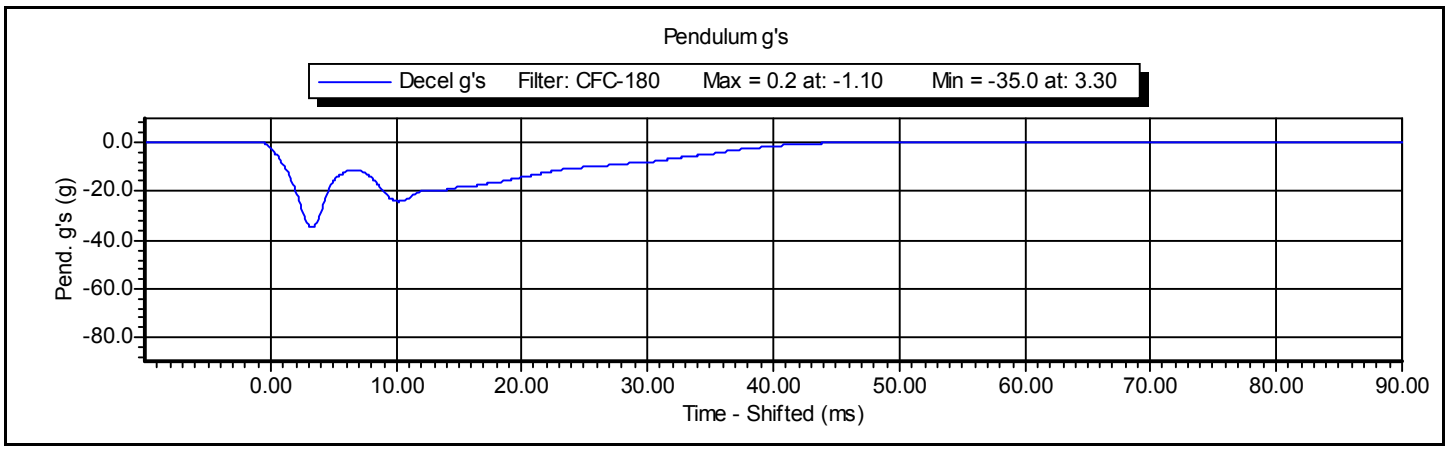
Calspan

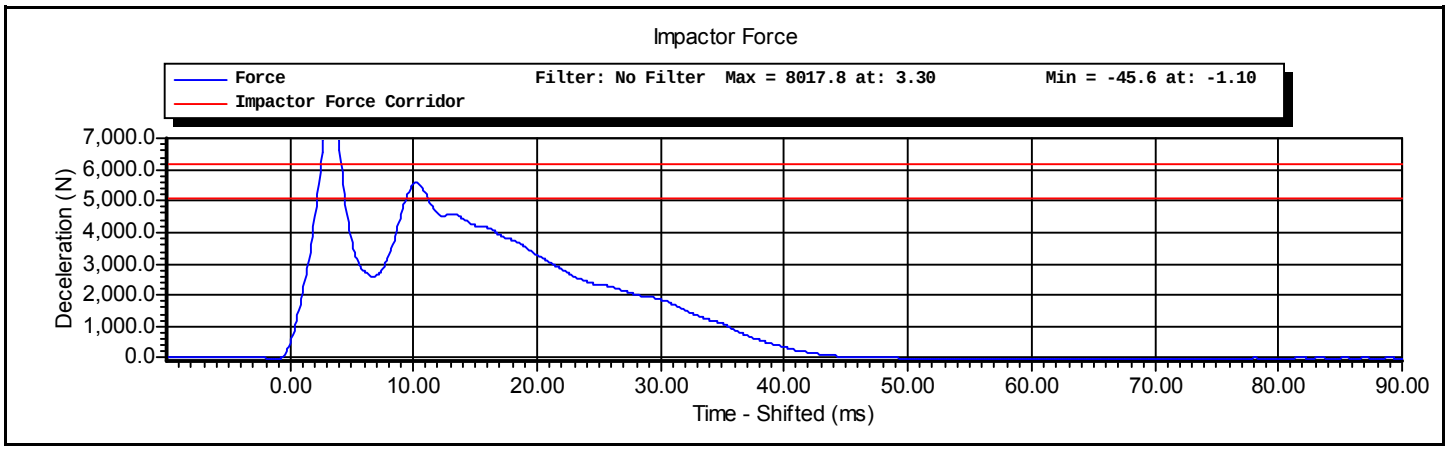
Test ID: **Thorax Impact** Test Time: **9:02:14 AM** Test Date: **2/18/2010**

Calspan

Test Name:	**Thorax Impact**	Revision:	**8/15/2008**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/18/2010**
Test Number:	**1**	Test Time:	**9:02:14 AM**

Component Part Number	Component Serial Number
Upper Rib - 175-4002	**1954-0124A**





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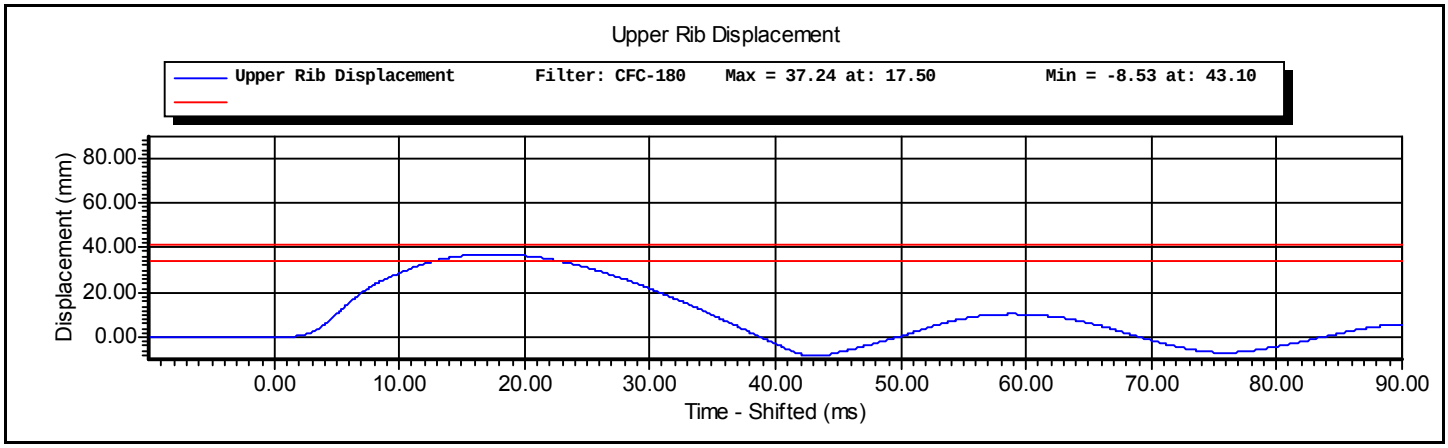

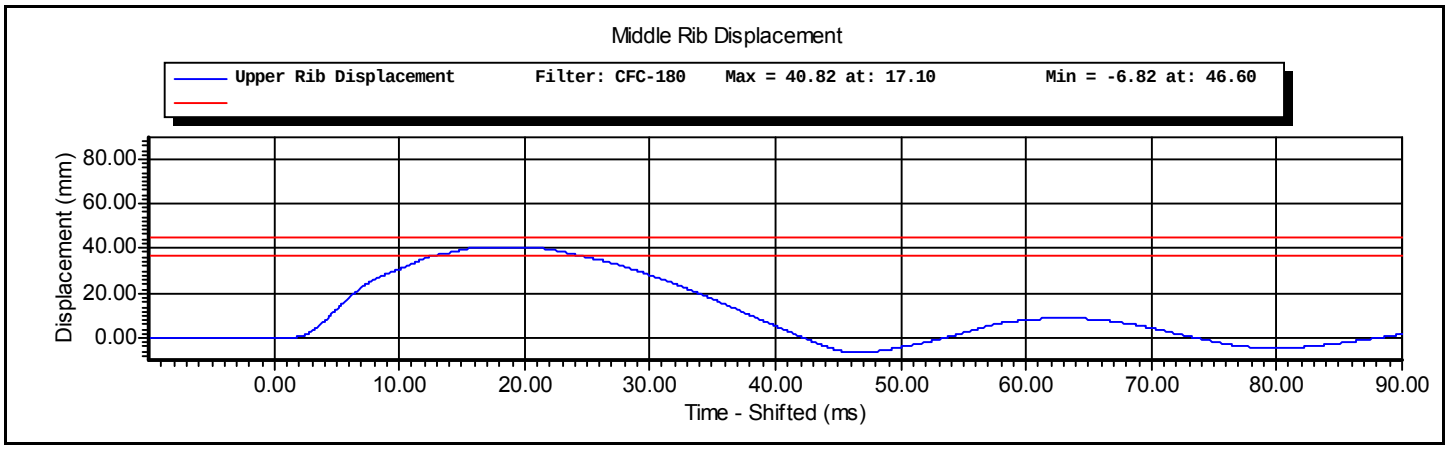

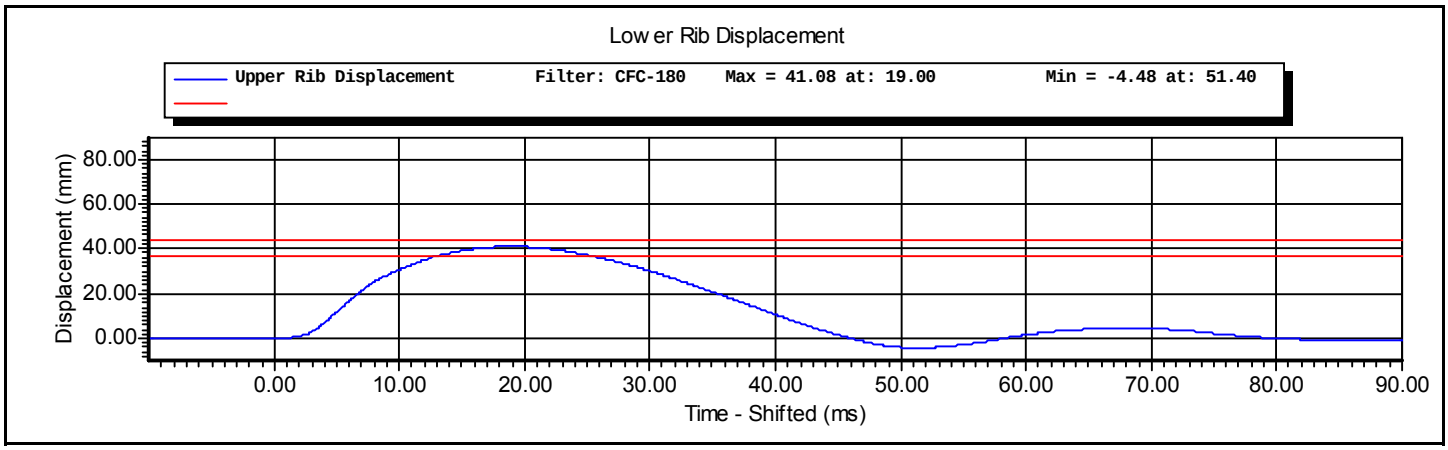

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VERIFICATION REPORT

Test Name:	**Abdominal Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Abdomen Test**	Test Date:	**2/25/2010**
Test Number:	**4**	Test Time:	**3:45:09 PM**

Component Part Number	Component Serial Number
455-4001	**19-179**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.7**	deg C	P
Humidity	10	--	70	**25**	%RH	P
Velocity	3.90	--	4.10	**4.02**	m/s	P
Peak Abdominal Force	-2.70	--	-2.20	**-2.56**	kN	P
Time At Peak Abdominal Force	10.0	--	12.3	**11.2**	ms	P
Maximum Pendulum Force	-4.80	--	-4.00	**-4.75**	kN	P
Time at Peak Pendumlum Force	10.6	--	13.0	**10.6**	ms	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

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Test ID: **Abdomen Test** Test Time: **3:45:09 PM** Test Date: **2/25/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16576**	**11/4/2009**
Denton	**2631**	**LC-1507Fy**	**1/7/2010**
Denton	**2631**	**LC-1508Fy**	**1/7/2010**
Denton	**2631**	**LC-1509Fy**	**1/7/2010**

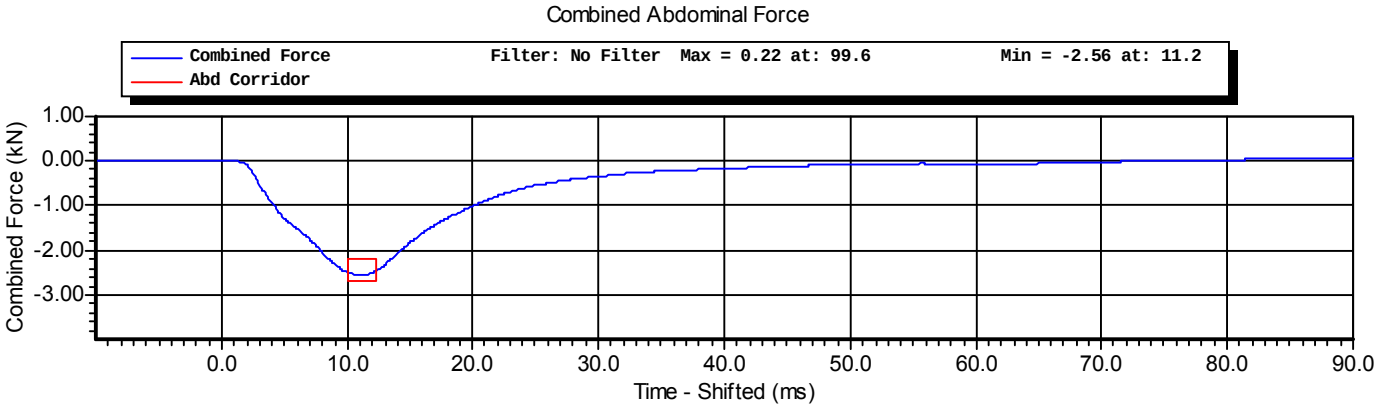
Calspan

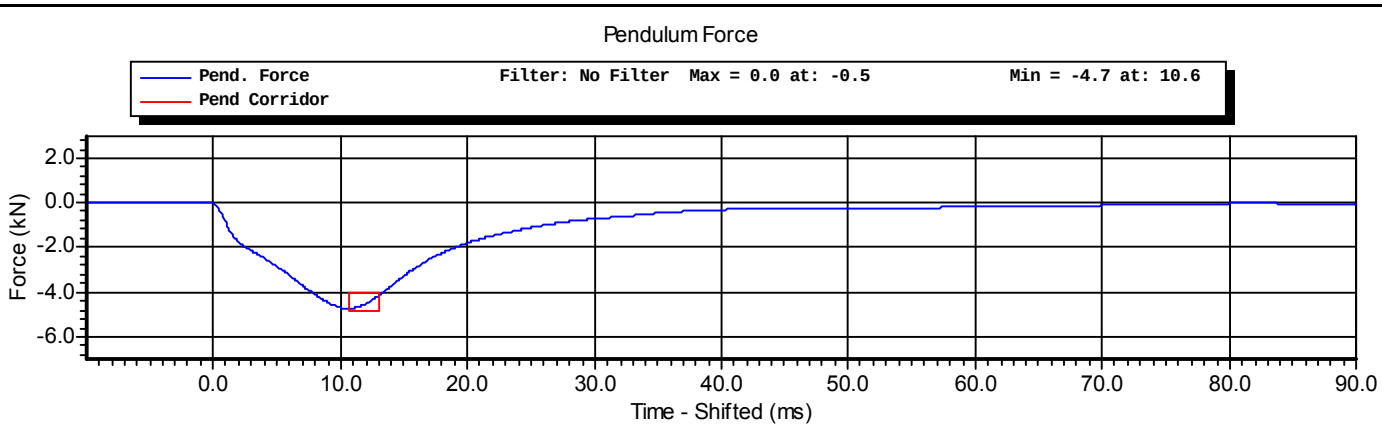
Test ID: **Abdomen Test** Test Time: **3:45:09 PM** Test Date: **2/25/2010**

Calspan

Test Name:	**Abdominal Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/25/2010**
Test Number:	**4**	Test Time:	**3:45:09 PM**

Component Part Number	Component Serial Number
455-4001	**19-179**





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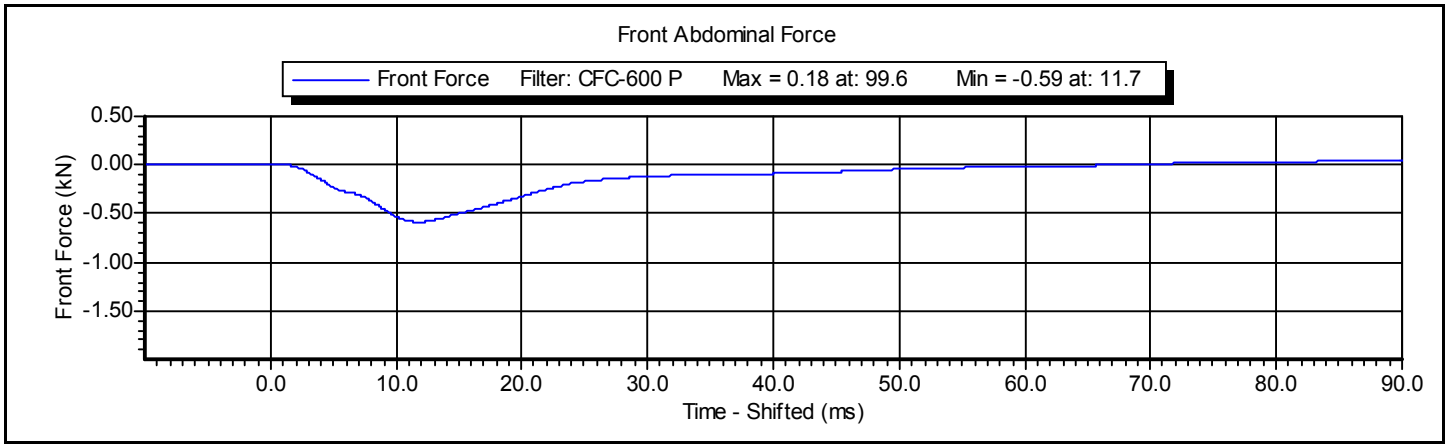

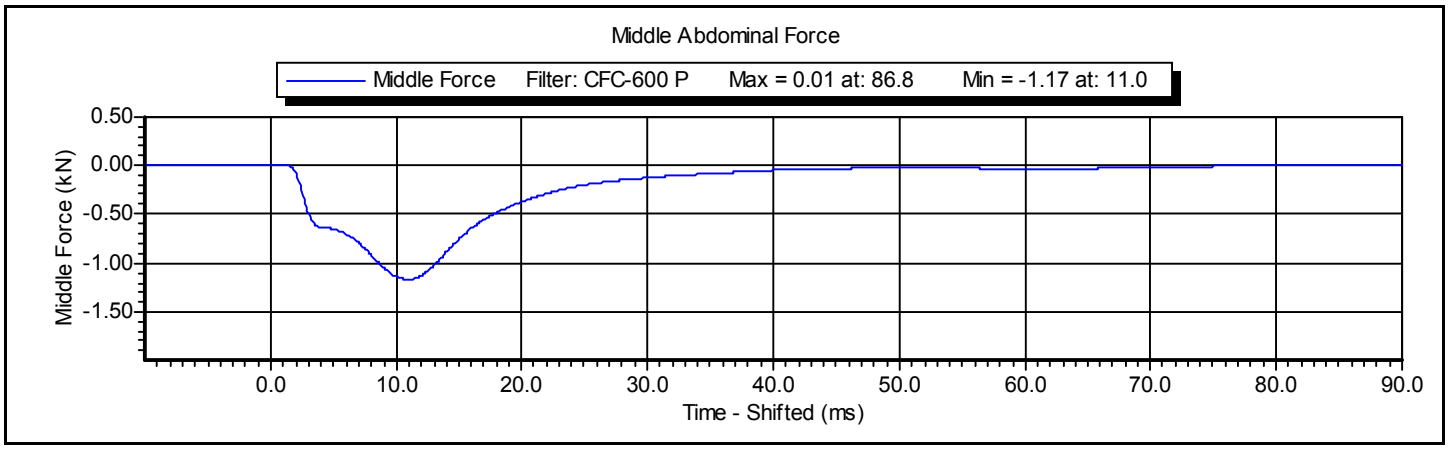

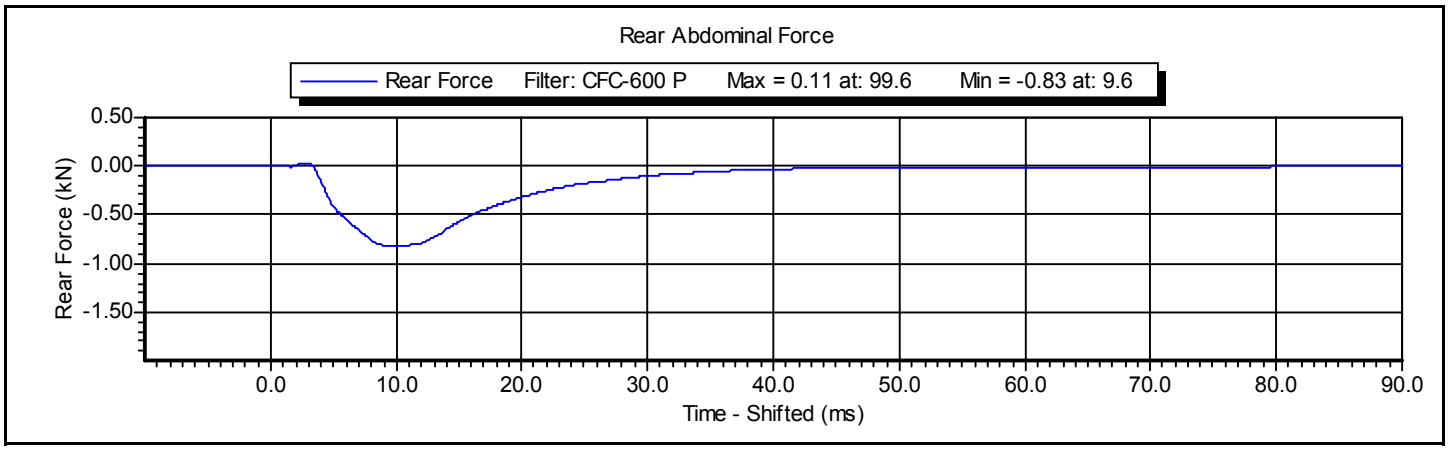

Test Time: **3:45:09 PM** Test Date: **2/25/2010**

Calspan

VERIFICATION REPORT

Test Name:	**Lumbar Spine**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Lumbar Spine**	Test Date:	**2/12/2010**
Test Number:	**1**	Test Time:	**2:00:04 PM**

Component Part Number	Component Serial Number
175-5501	**15-0376**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10	--	70	**23**	%RH	P
Velocity	5.95	--	6.15	**6.08**	m/s	P
Maximum Headform Flexion Angle	45.0	--	55.0	**49.6**	degrees	P
Time at Maximum Headform Flexion Angle	39.0	--	53.0	**43.0**	ms	P
Decay to Zero Degrees	37.0	--	57.0	**38.6**	ms	P
Velocity Corridor		--				P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Lumbar Spine** Test Time: **2:00:04 PM** Test Date: **2/12/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7231CT**	**AE8K0**	**12/14/2009**
DentonATD	**7000428**	**094**	**10/23/2009**
DentonATD	**7000428**	**095**	**10/23/2009**
DentonATD	**7000428**	**093**	**10/23/2009**

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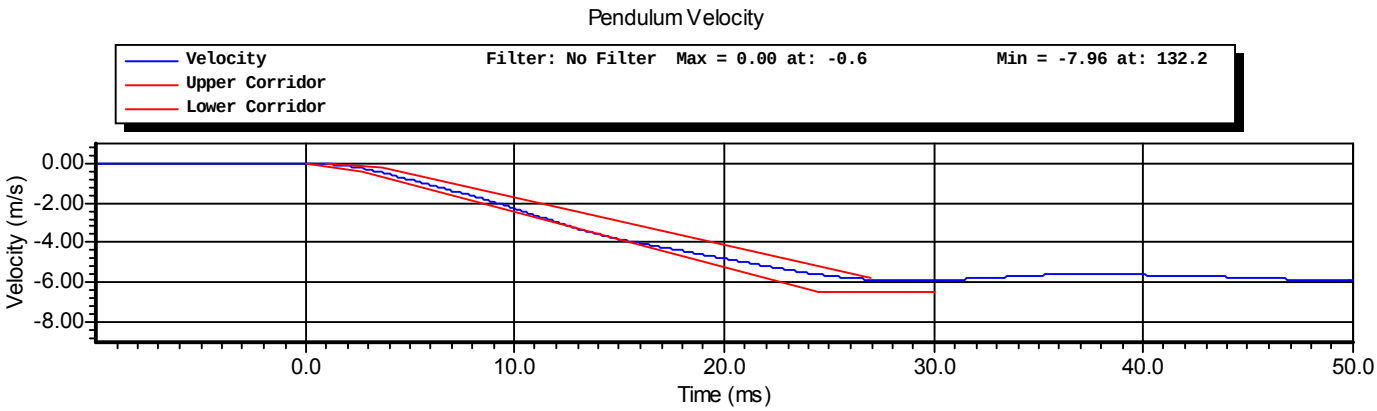
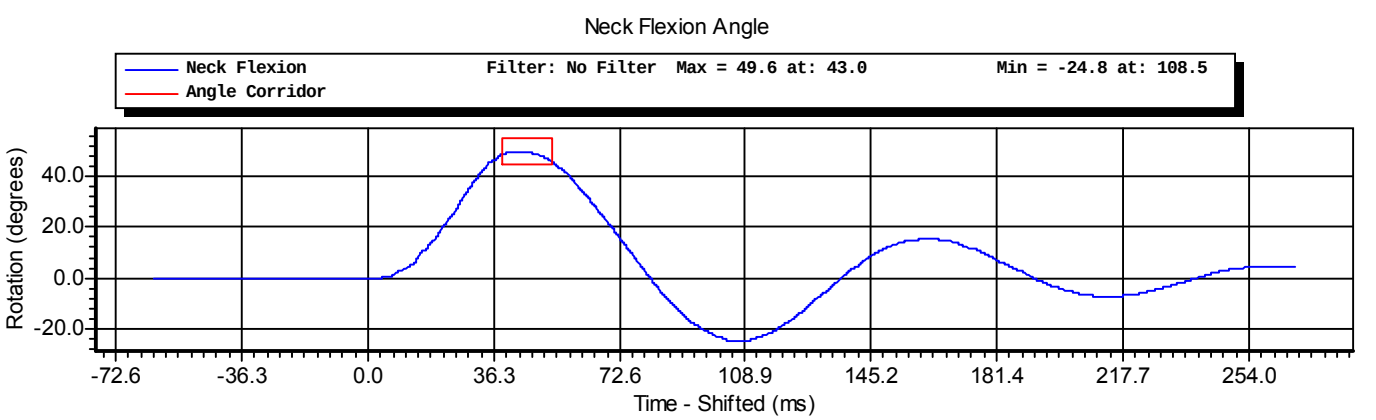
Test ID: **Lumbar Spine** Test Time: **2:00:04 PM** Test Date: **2/12/2010**

Calspan

Test Name:	**Lumbar Spine**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/12/2010**
Test Number:	**1**	Test Time:	**2:00:04 PM**

Component Part Number	Component Serial Number
175-5501	**15-0376**





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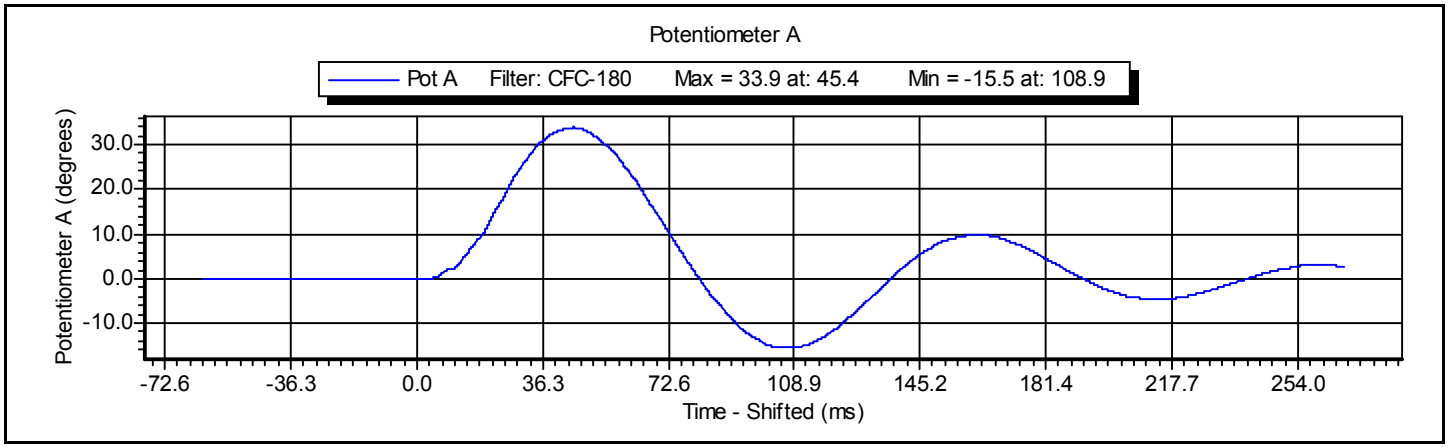

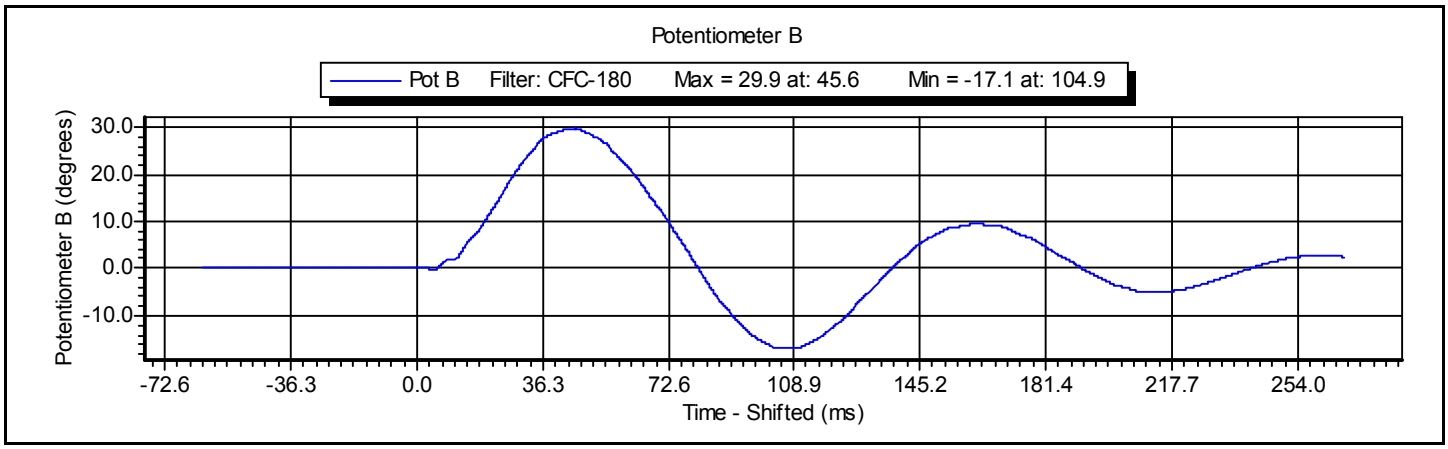

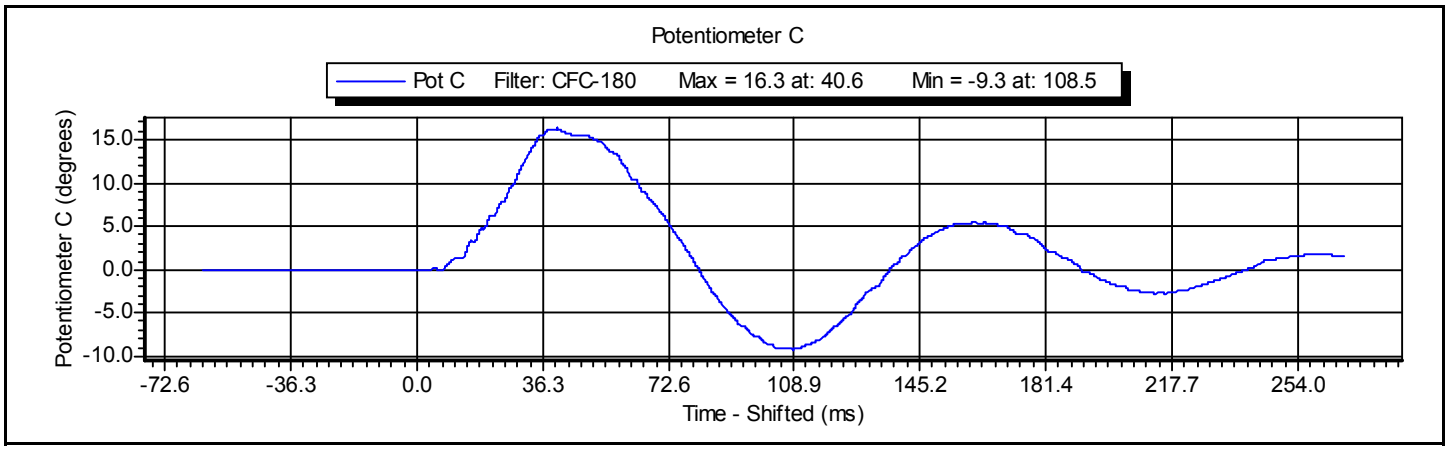

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VERIFICATION REPORT

Test Name:	**Pelvis Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Pelvis Impact Test**	Test Date:	**2/17/2010**
Test Number:	**2**	Test Time:	**1:20:49 PM**

Component Part Number	Component Serial Number
455-4003	

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**22.2**	deg C	P
Humidity	10	--	70	**20**	%RH	P
Velocity	4.20	--	4.40	**4.31**	m/s	P
Peak Pendulum Force	-5.40	--	-4.70	**-4.88**	kN	P
Time at Peak Pendulum Force	11.80	--	16.10	**14.25**	ms	P
Peak Pubic Symphysis Force	-1.59	--	-1.23	**-1.33**	kN	P
Time at Peak Pubic Symphysis Force	12.20	--	17.00	**13.55**	ms	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

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Test ID: **Pelvis Impact Test** Test Time: **1:20:49 PM** Test Date: **2/17/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16761**	**1/22/2010**
Denton	**3096**	**LC-458Fy**	**1/7/2010**

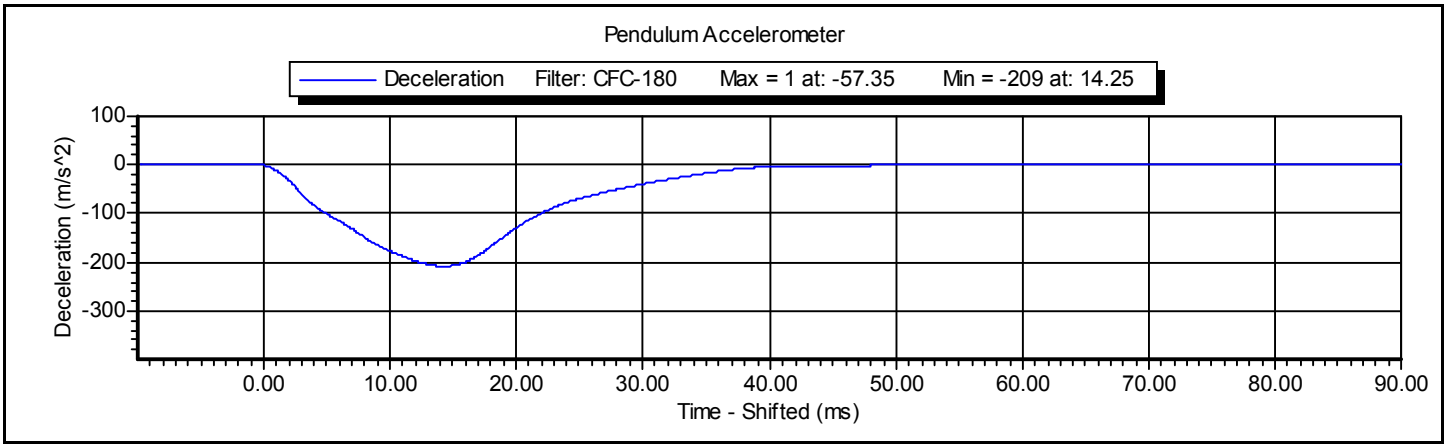
Calspan

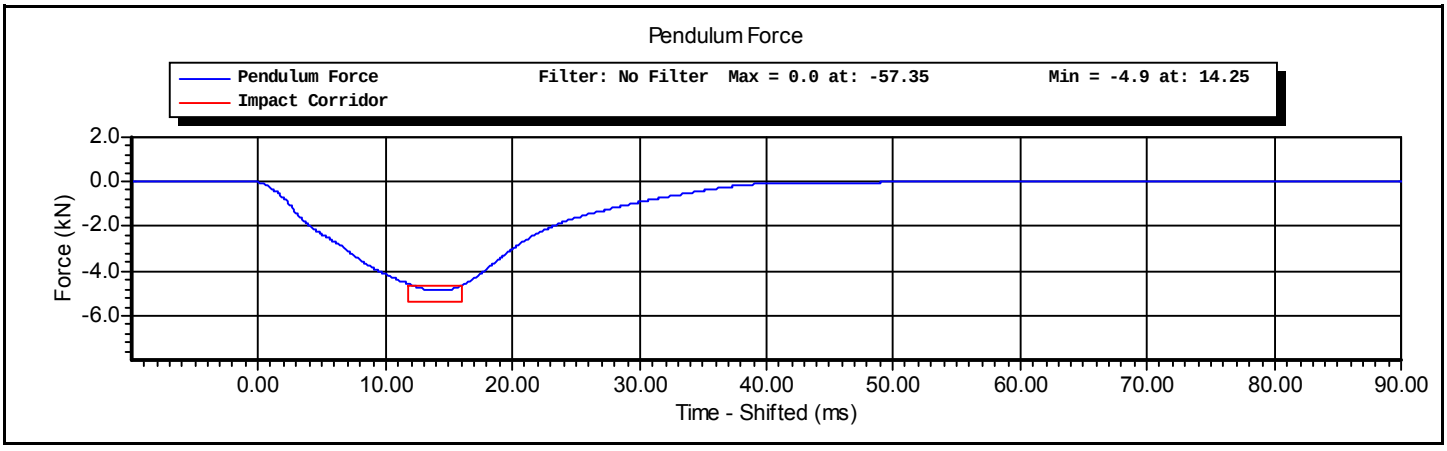
Test ID: **Pelvis Impact Test** Test Time: **1:20:49 PM** Test Date: **2/17/2010**

Calspan

Test Name:	**Pelvis Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**2/17/2010**
Test Number:	**2**	Test Time:	**1:20:49 PM**

Component Part Number	Component Serial Number
455-4003	





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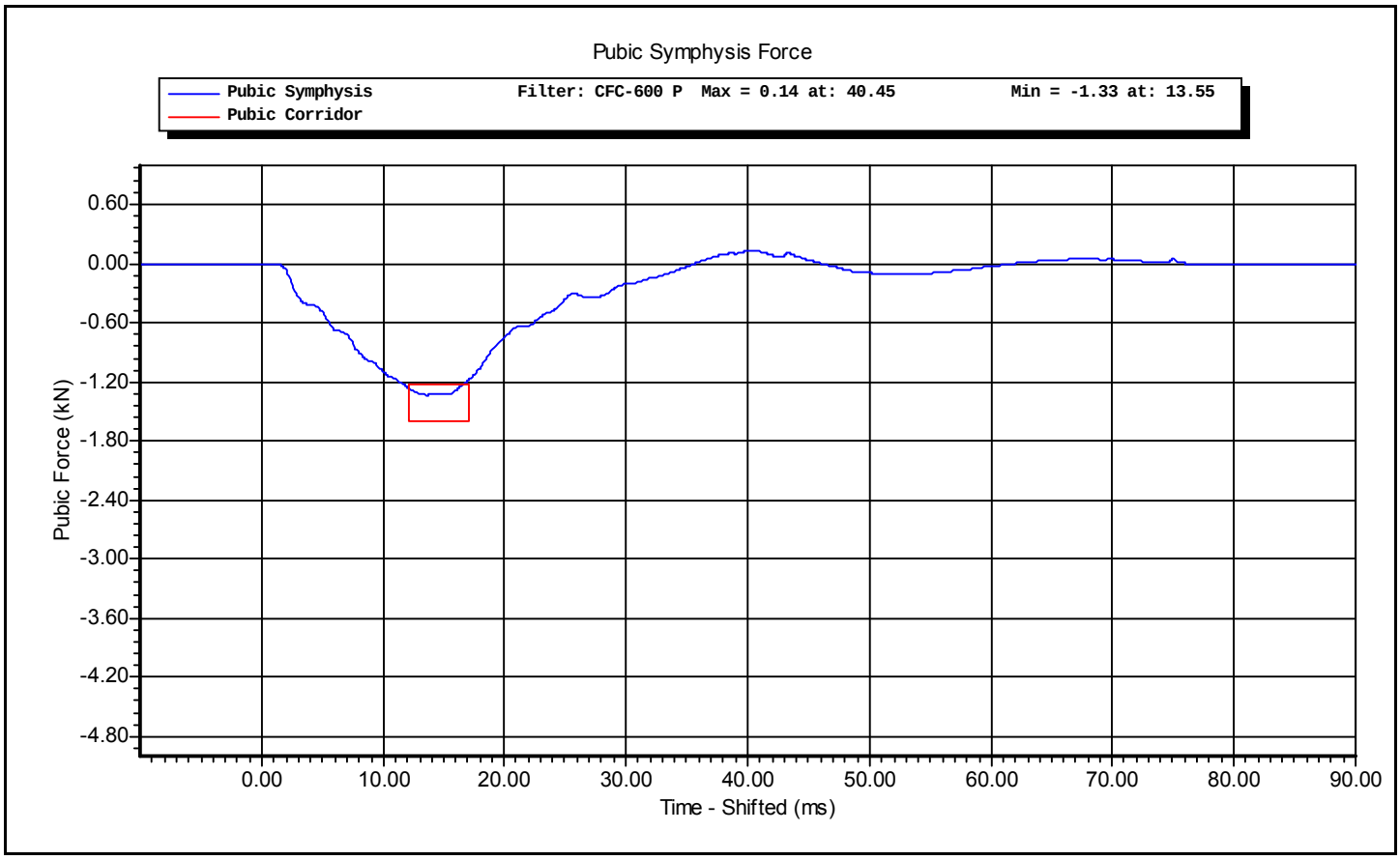

Test Time: **1:20:49 PM** Test Date: **2/17/2010**

Calspan

VERIFICATION REPORT

Name of Test:	**Head Drop**	REVISION:	**12/14/2006**
Name of Sub Test:		Type of Spec:	**NHTSA**
Type of ATD:	**ES-2re**		
ATD Serial Number:	**D037**		
ID of Test:	**Head Drop**	Date:	**3/8/2010**
Number of Test:	**1**	Time of Test:	**1:55:42 PM**

Part Number of Component	Serial Number of Component
455-1007	

COMMENTS:

Parameters of Test	Specifications of Test			Results of Test		
Temperature	20.6	--	22.2	**21.7**	deg C	P
Humidity	10	--	70	**35**	%RH	P
Resultant Acceleration	125	--	155	**133**	g	P
Oscillation	0.0	--	15.0	**12.2**	%	P
Fore-Aft Acceleration	-15.00	--	15.00	**-7.86**	g	P

All test parameters are within specifications

Name of Tech.: **A. Rudniski** SIGNATURE: _____

Name of Super.: **D. Travale** SIGNATURE: _____

Calspan

ID of Test: **Head Drop** Time of Test: **1:55:42 PM** Date of Test: **3/8/2010**

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VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Endevco	**7264-2000**	**AC-P18639**	**1/25/2010**
Endevco	**7264-2000**	**AC-P23128**	**1/25/2010**
Endevco	**7264-2000**	**AC-P16591**	**1/25/2010**

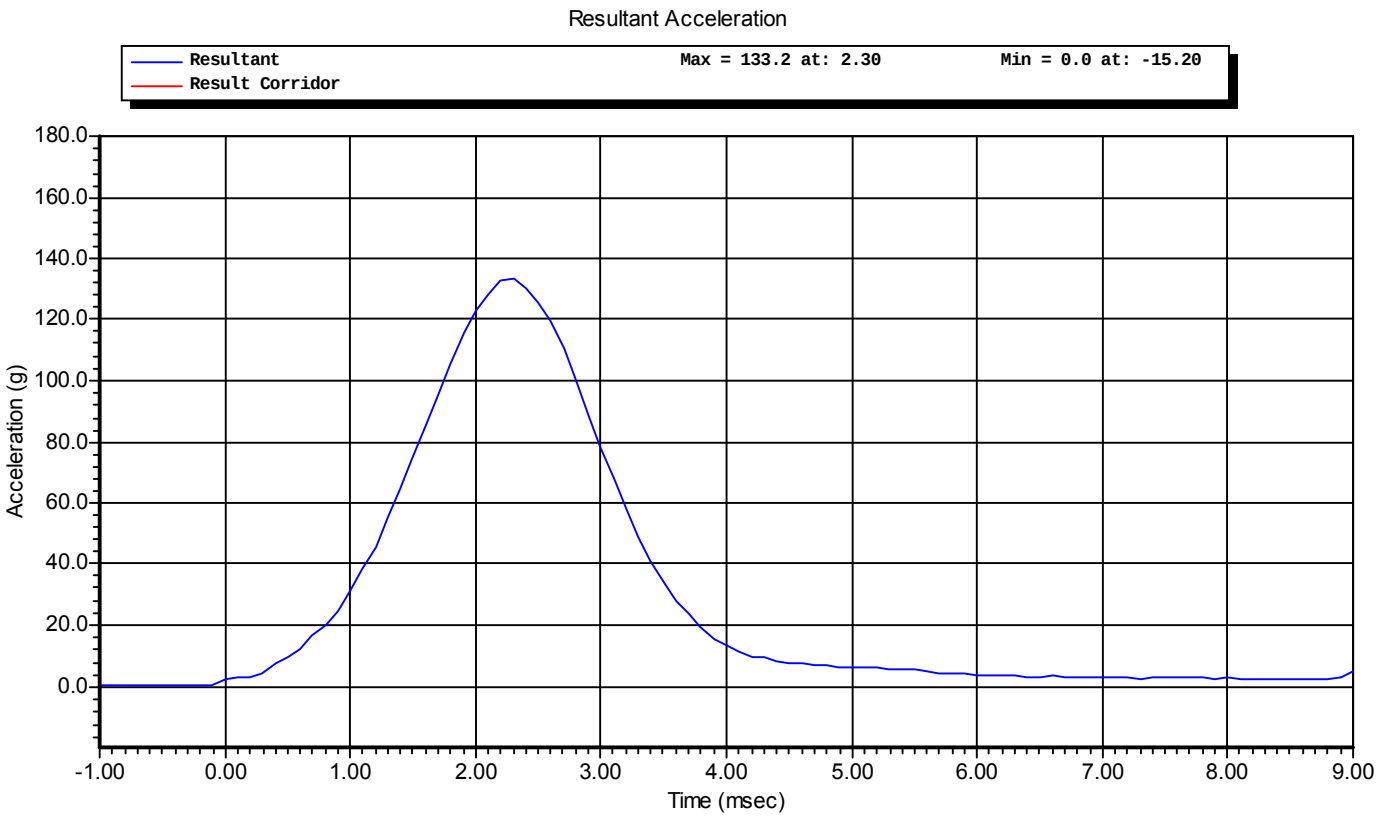
Calspan

ID of Test: **Head Drop** Time of Test: **1:55:42 PM** Date of Test: **3/8/2010**

Calspan

Test Name:	**Head Drop**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**1:55:42 PM**

Component Part Number	Component Serial Number
455-1007	



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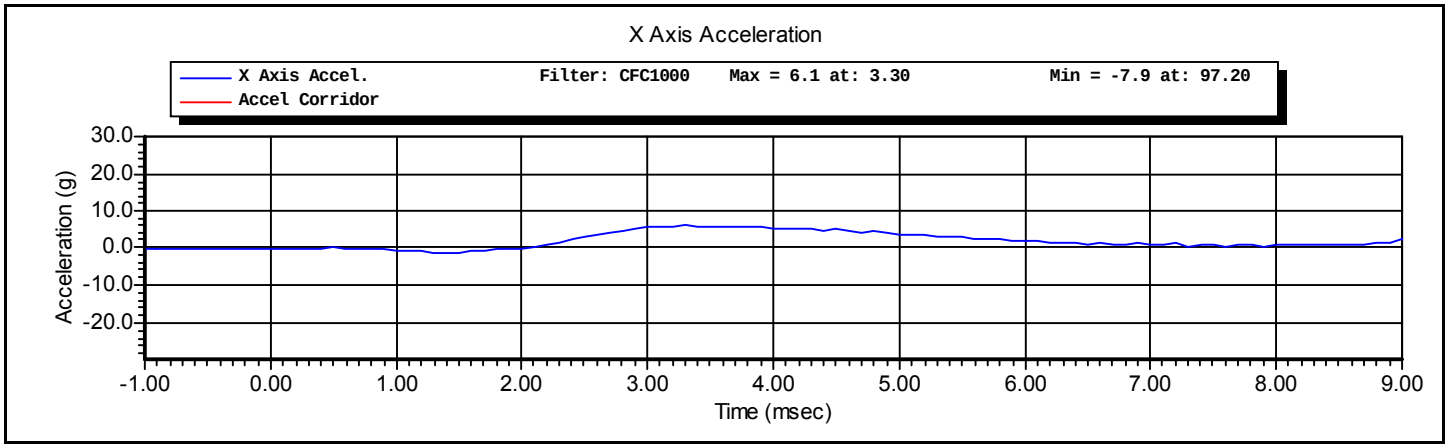
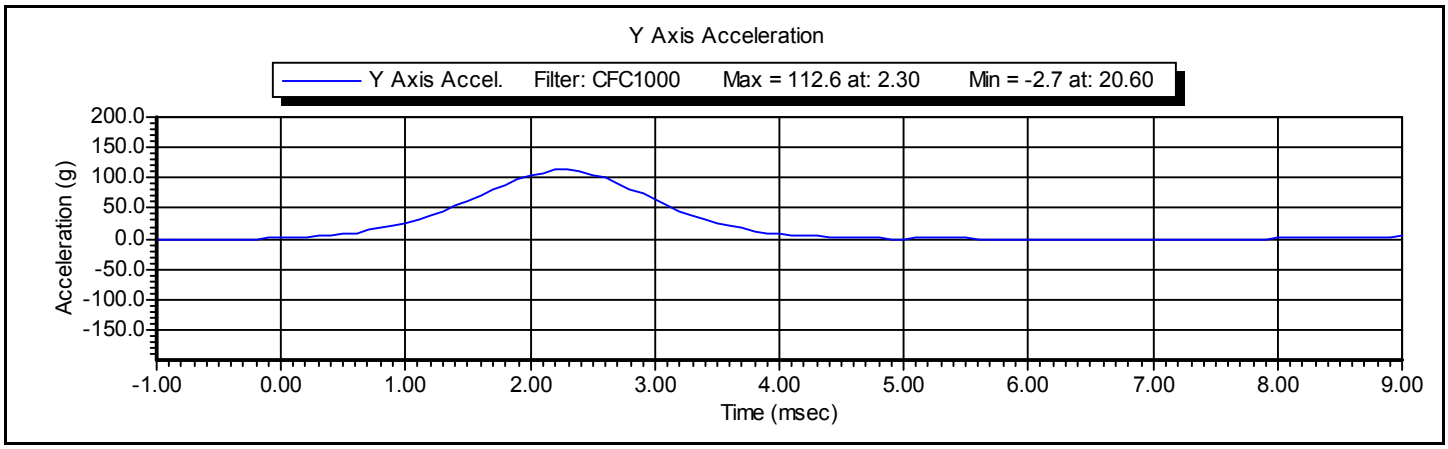
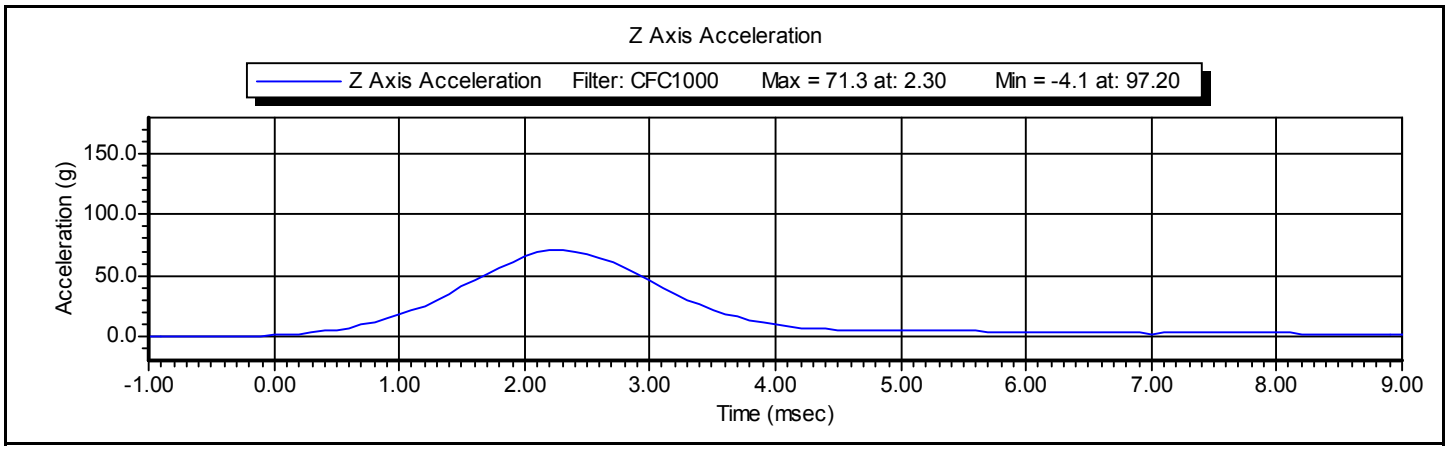






Calspan

VERIFICATION REPORT

Test Name:	**Neck Flexion**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Neck Flexion**	Test Date:	**3/9/2010**
Test Number:	**3**	Test Time:	**10:48:52 AM**

Component Part Number	Component Serial Number
455-2002	**19-020118**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.7**	deg C	P
Humidity	10	--	70	**35**	%RH	P
Velocity	3.30	--	3.50	**3.35**	m/s	P
Maximum Neck Flexion Angle	49.0	--	59.0	**53.2**	degrees	P
Time At Maximum Neck Flexion	54.0	--	66.0	**58.6**	ms	P
Decay to Zero Degrees	53.0	--	88.0	**60.6**	ms	P
Velocity Corridor		--				P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Neck Flexion** Test Time: **10:48:52 AM** Test Date: **3/9/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7231CT**	**AF5B3**	**2/24/2010**
DentonATD	**7000428**	**094**	**10/23/2009**
DentonATD	**7000428**	**095**	**10/23/2009**
DentonATD	**7000428**	**093**	**10/23/2009**

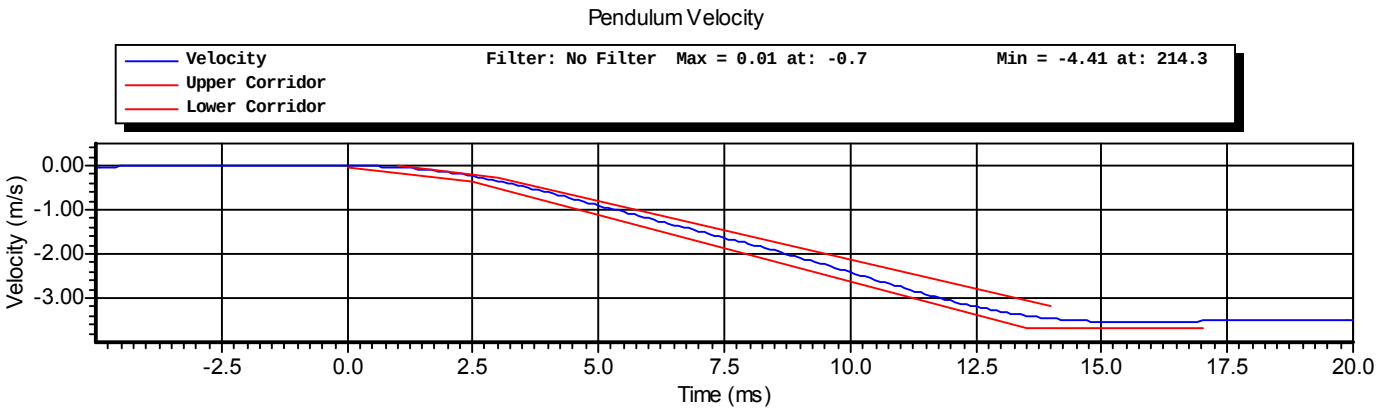
Calspan

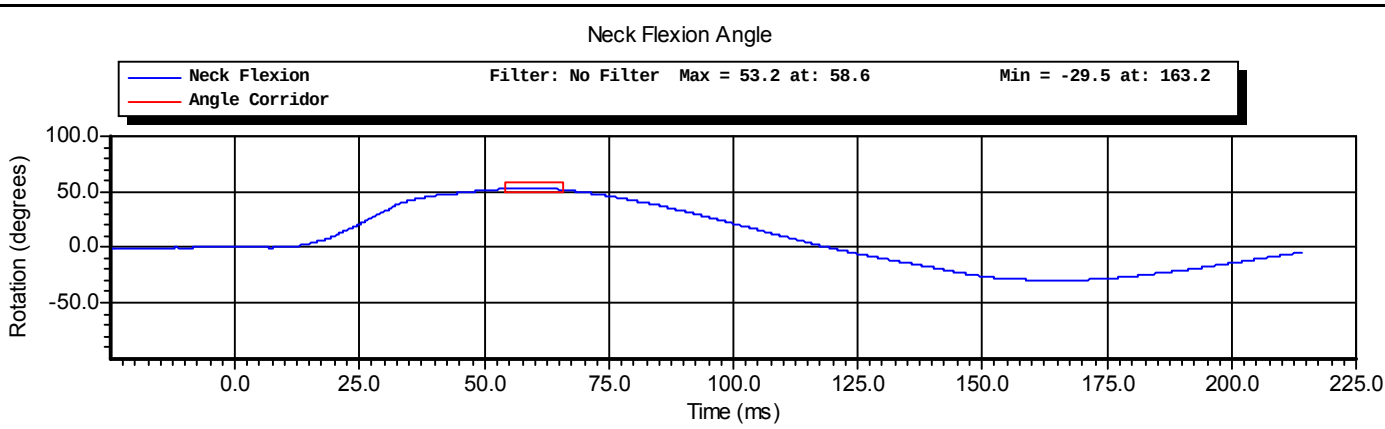
Test ID: **Neck Flexion** Test Time: **10:48:52 AM** Test Date: **3/9/2010**

Calspan

Test Name:	**Neck Flexion**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/9/2010**
Test Number:	**3**	Test Time:	**10:48:52 AM**

Component Part Number	Component Serial Number
455-2002	**19-020118**





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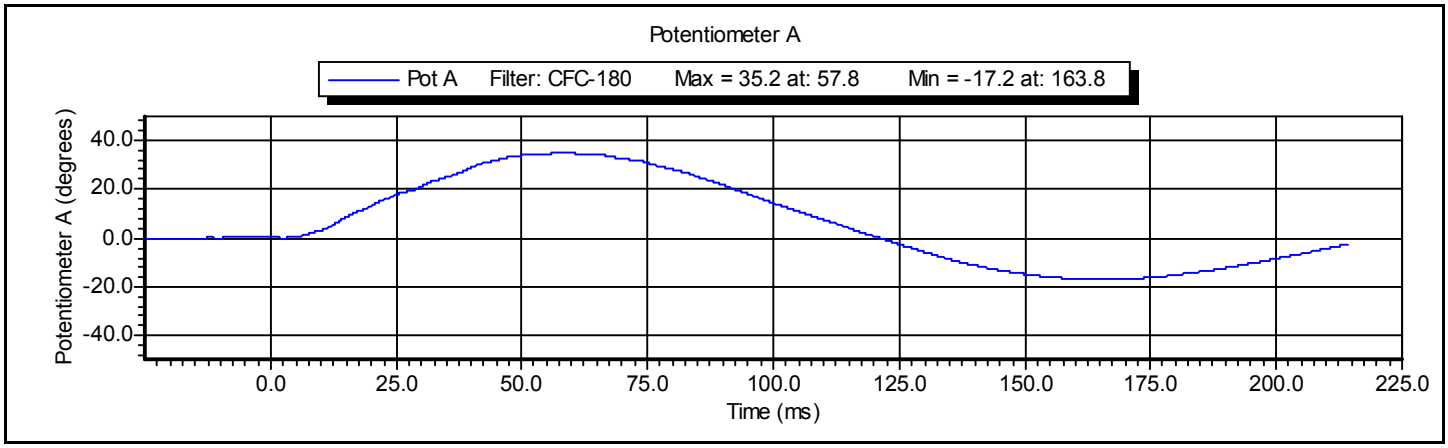
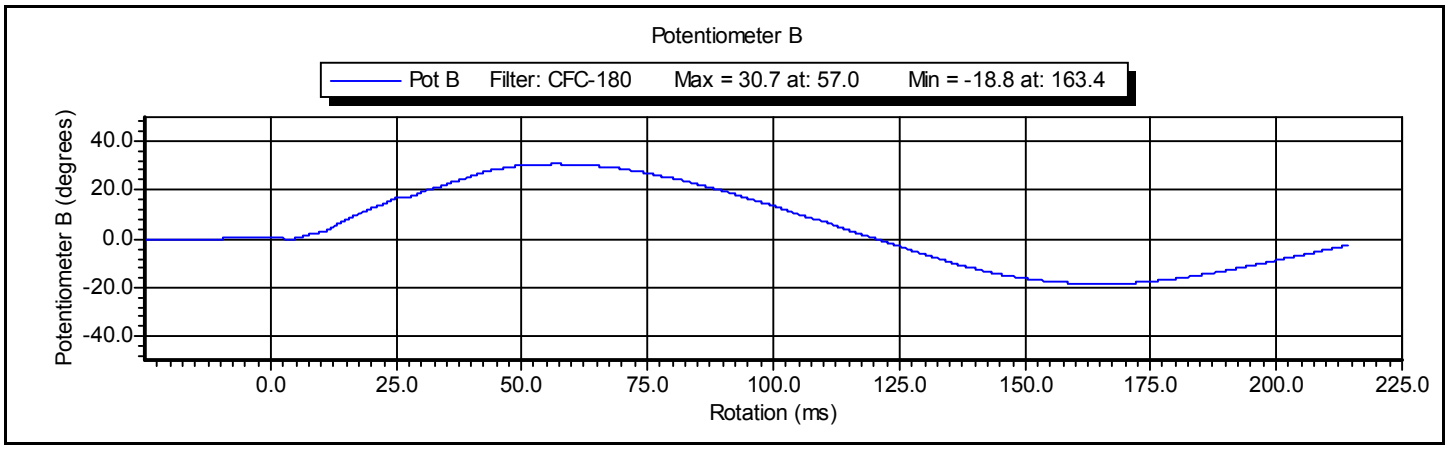
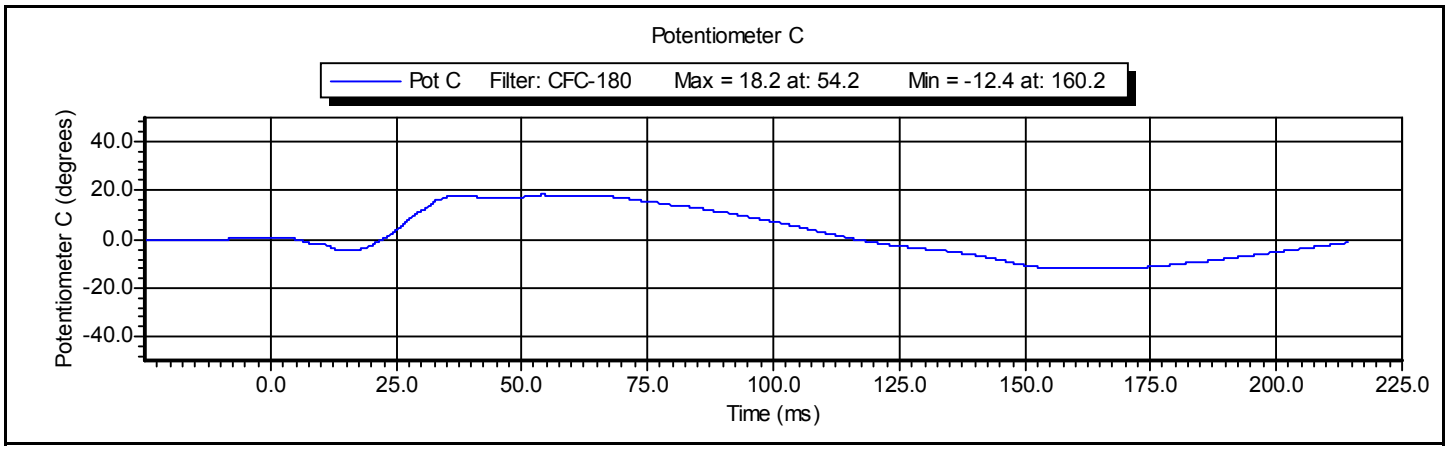
Test Time: **10:48:52 AM** Test Date: **3/9/2010**







Calspan

VERIFICATION REPORT

Test Name:	**Shoulder Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Shoulder Test**	Test Date:	**3/5/2010**
Test Number:	**1**	Test Time:	**3:41:47 PM**

Component Part Number	Component Serial Number
960715-313	

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**22.2**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	4.20	--	4.40	**4.31**	m/s	P
Pendulum Acceleration	-10.50	--	-7.50	**-7.86**	g	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Shoulder Test** Test Time: **3:41:47 PM** Test Date: **3/5/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16576**	**11/4/2009**

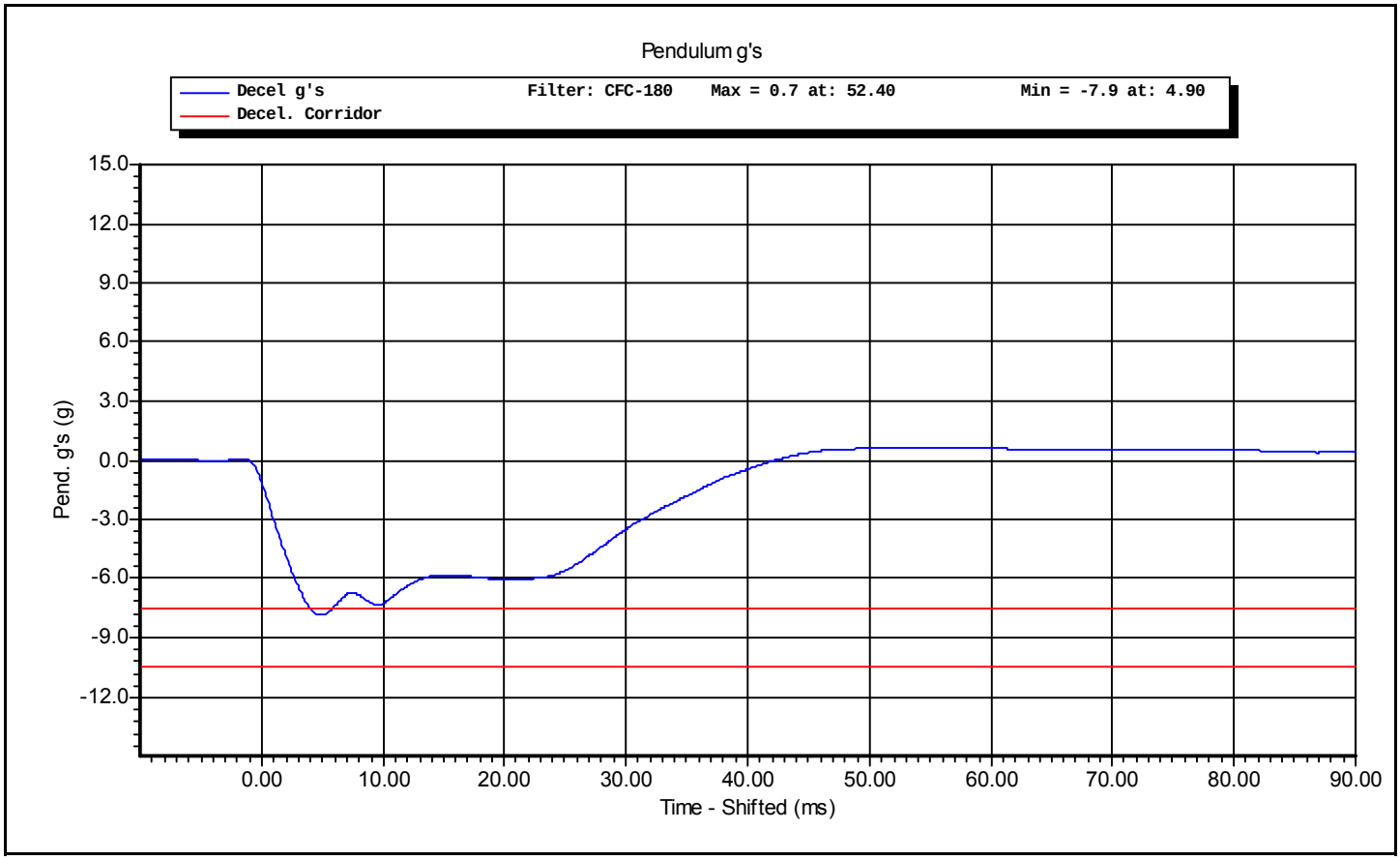
Calspan

Test ID: **Shoulder Test** Test Time: **3:41:47 PM** Test Date: **3/5/2010**

Calspan

Test Name:	**Shoulder Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/5/2010**
Test Number:	**1**	Test Time:	**3:41:47 PM**

Component Part Number	Component Serial Number
960715-313	



Calspan

Test Time: **3:41:47 PM** Test Date: **3/5/2010**

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Lower Rib 3 m/s**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**10:07:18 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	2.90	--	3.10	**2.99**	m/s	P
Rib Displacement	-40.00	--	-36.00	**-37.88**	mm	P
Drop Height	454	--	464	**459**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Lower Rib 3 m/s** Test Time: **10:07:18 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-3**	**1/11/2010**
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P23137**	**1/22/2010**

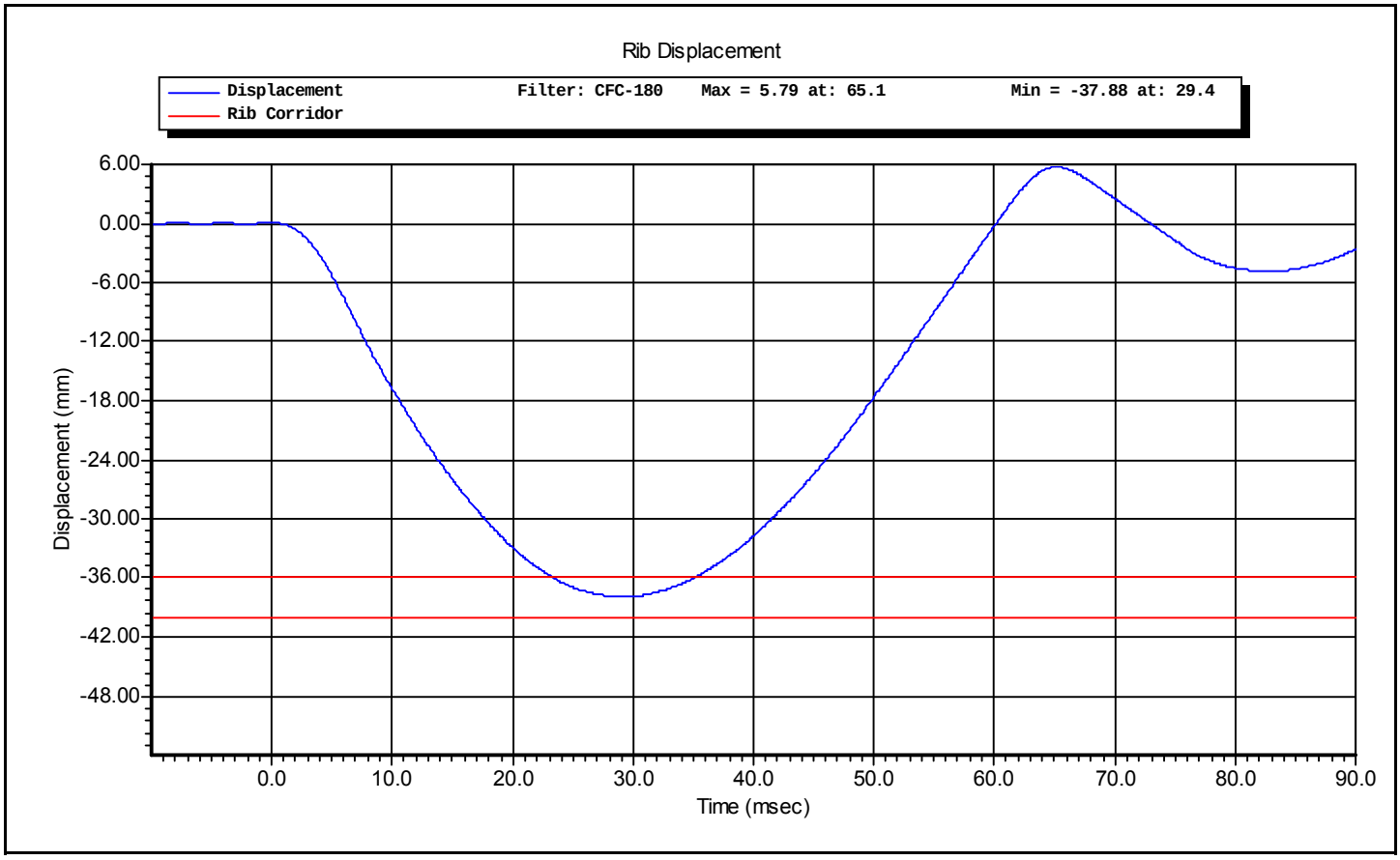
Calspan

Test ID: **Lower Rib 3 m/s** Test Time: **10:07:18 AM** Test Date: **3/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**10:07:18 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**



Calspan

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Lower Rib 4 m/s**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**10:17:58 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	3.90	--	4.10	**3.96**	m/s	P
Rib Displacement	-51.00	--	-46.00	**-47.25**	mm	P
Drop Height	807.0	--	823.0	**815.0**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Lower Rib 4 m/s** Test Time: **10:17:58 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-3**	**1/11/2010**
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P23137**	**1/22/2010**

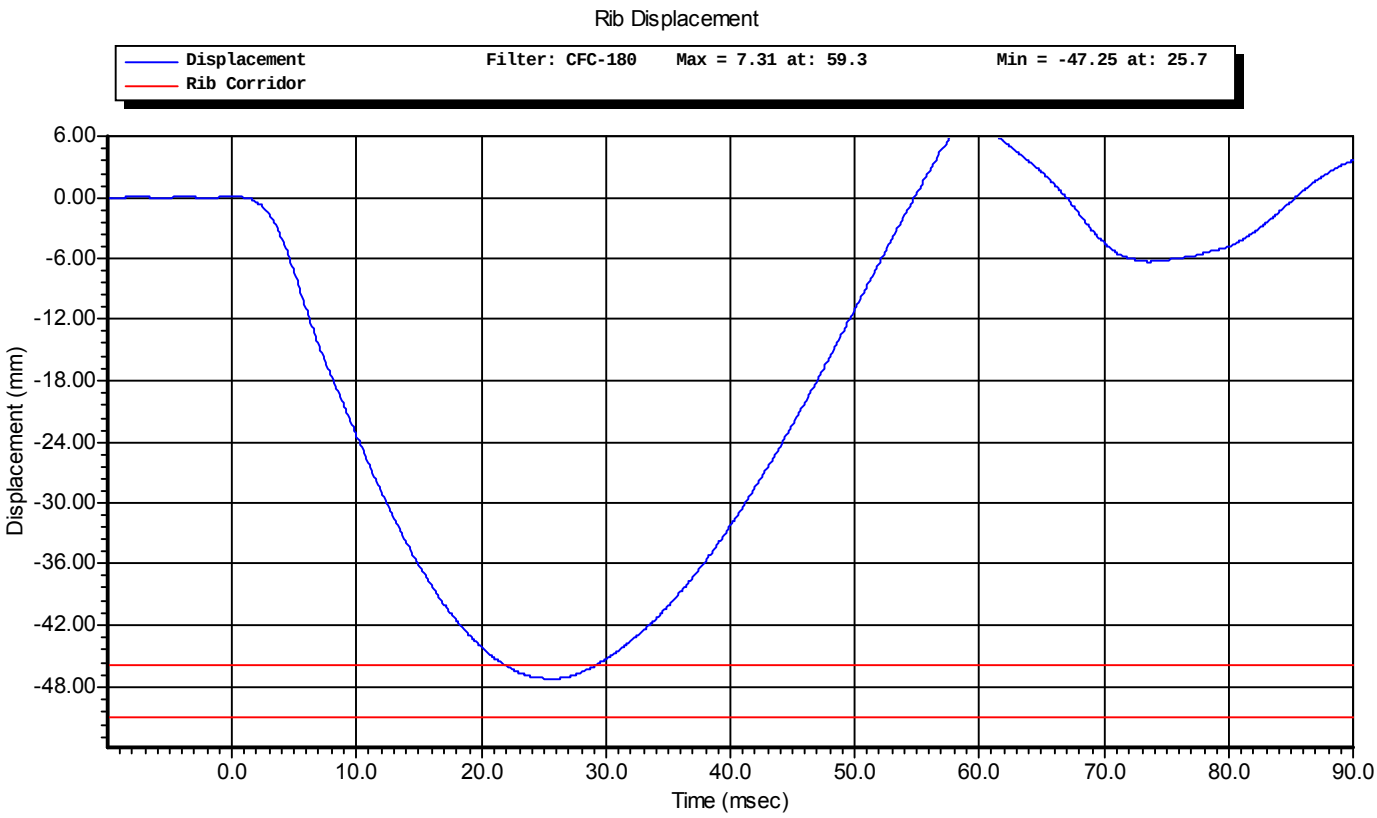
Calspan

Test ID: **Lower Rib 4 m/s** Test Time: **10:17:58 AM** Test Date: **3/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**10:17:58 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0126A**



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VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Middle Rib 3 m/s**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**9:37:57 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	2.90	--	3.10	**2.99**	m/s	P
Rib Displacement	-40.00	--	-36.00	**-36.96**	mm	P
Drop Height	454	--	464	**459**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Middle Rib 3 m/s** Test Time: **9:37:57 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0807**	**1/11/2010**
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P23137**	**1/22/2010**

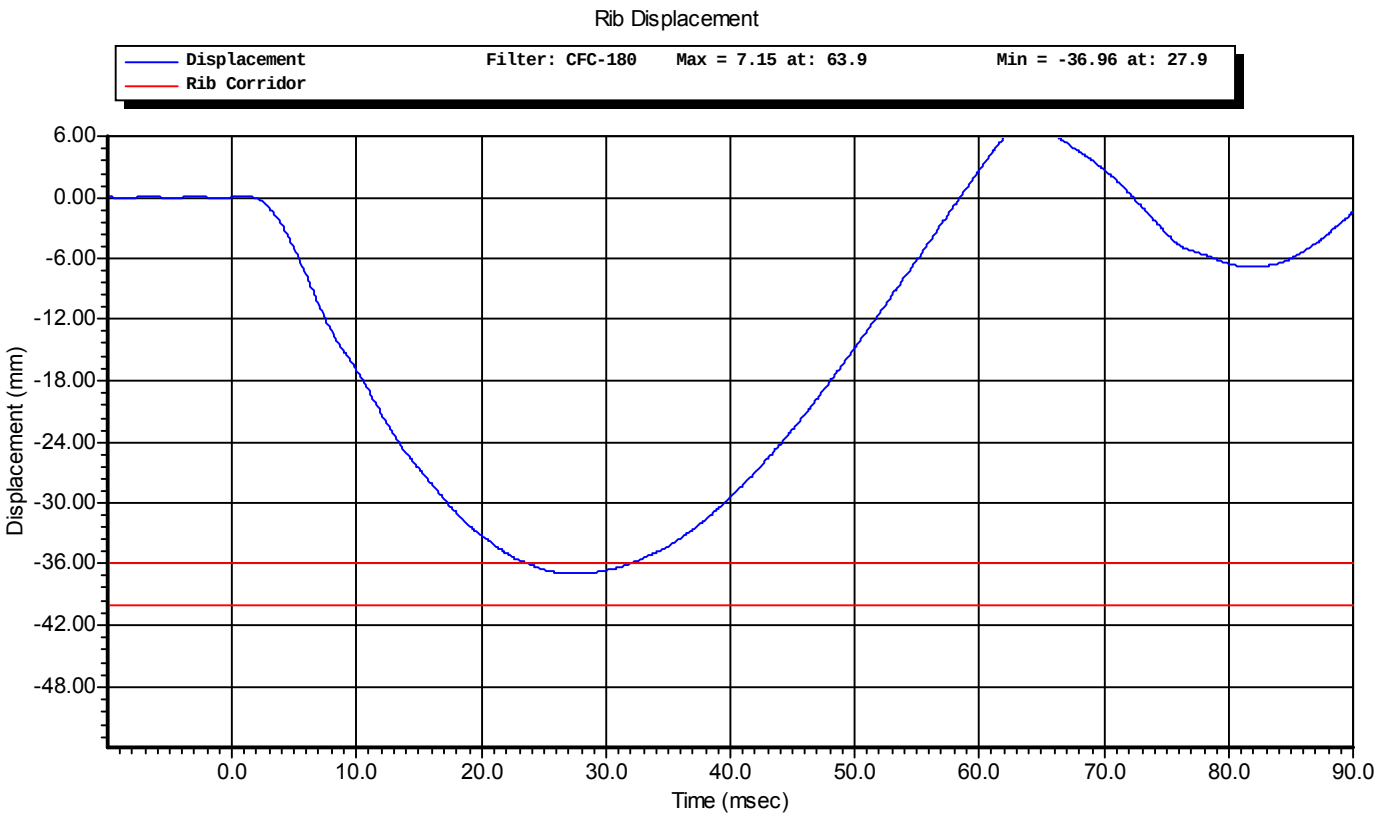
Calspan

Test ID: **Middle Rib 3 m/s** Test Time: **9:37:57 AM** Test Date: **3/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**9:37:57 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**



Calspan

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Middle Rib 4 m/s**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**9:51:32 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	3.90	--	4.10	**3.97**	m/s	P
Rib Displacement	-51.00	--	-46.00	**-47.50**	mm	P
Drop Height	807.0	--	823.0	**815.0**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Middle Rib 4 m/s** Test Time: **9:51:32 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0807**	**1/11/2010**
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P23137**	**1/22/2010**

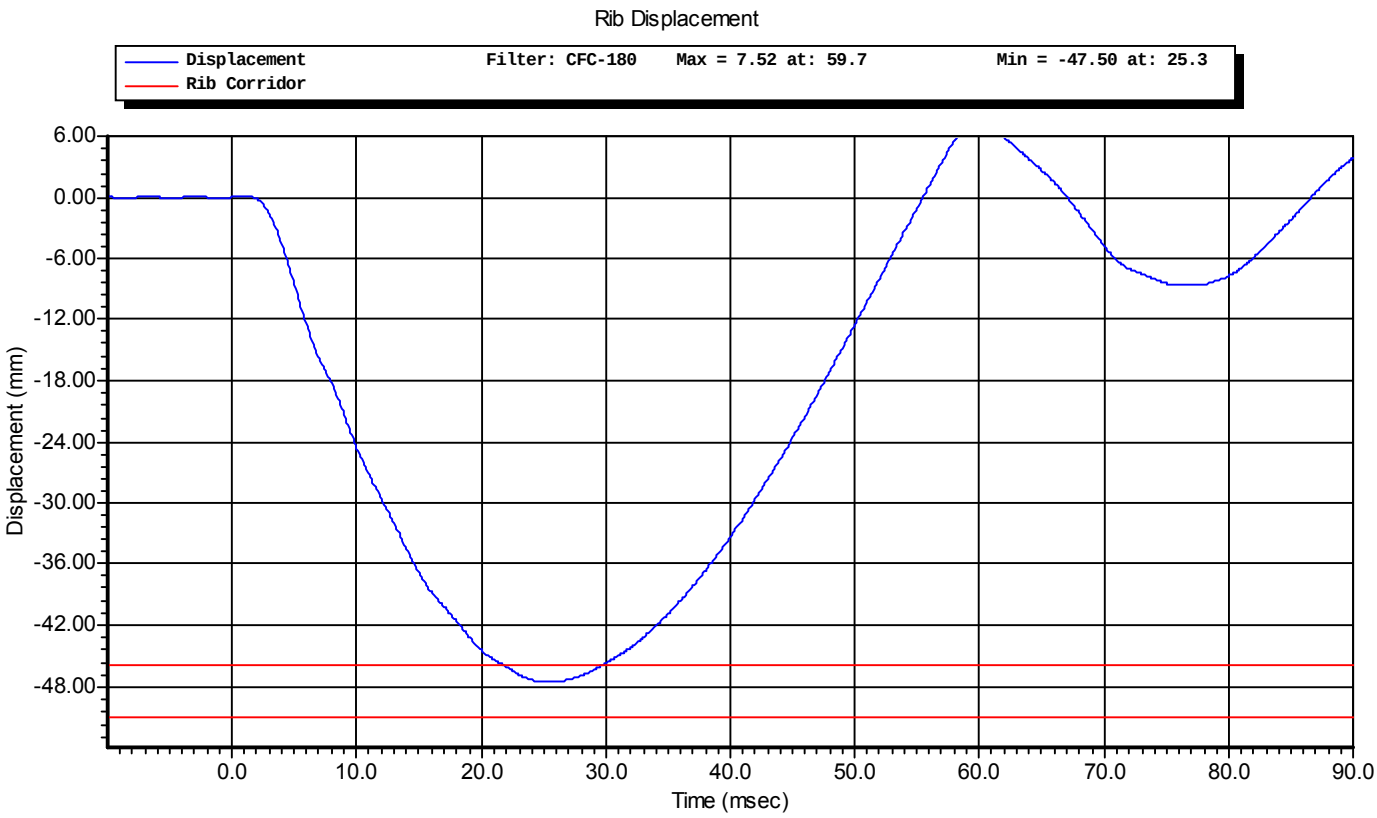
Calspan

Test ID: **Middle Rib 4 m/s** Test Time: **9:51:32 AM** Test Date: **3/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**9:51:32 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0125A**



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Test Time: **9:51:32 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Upper Rib 3 m/s**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**8:35:48 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**31.0**	%RH	P
Velocity	2.90	--	3.10	**2.98**	m/s	P
Rib Displacement	-40.00	--	-36.00	**-37.17**	mm	P
Drop Height	454	--	464	**459**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Upper Rib 3 m/s** Test Time: **8:35:48 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-01**	**1/11/2010**
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P23137**	**1/22/2010**

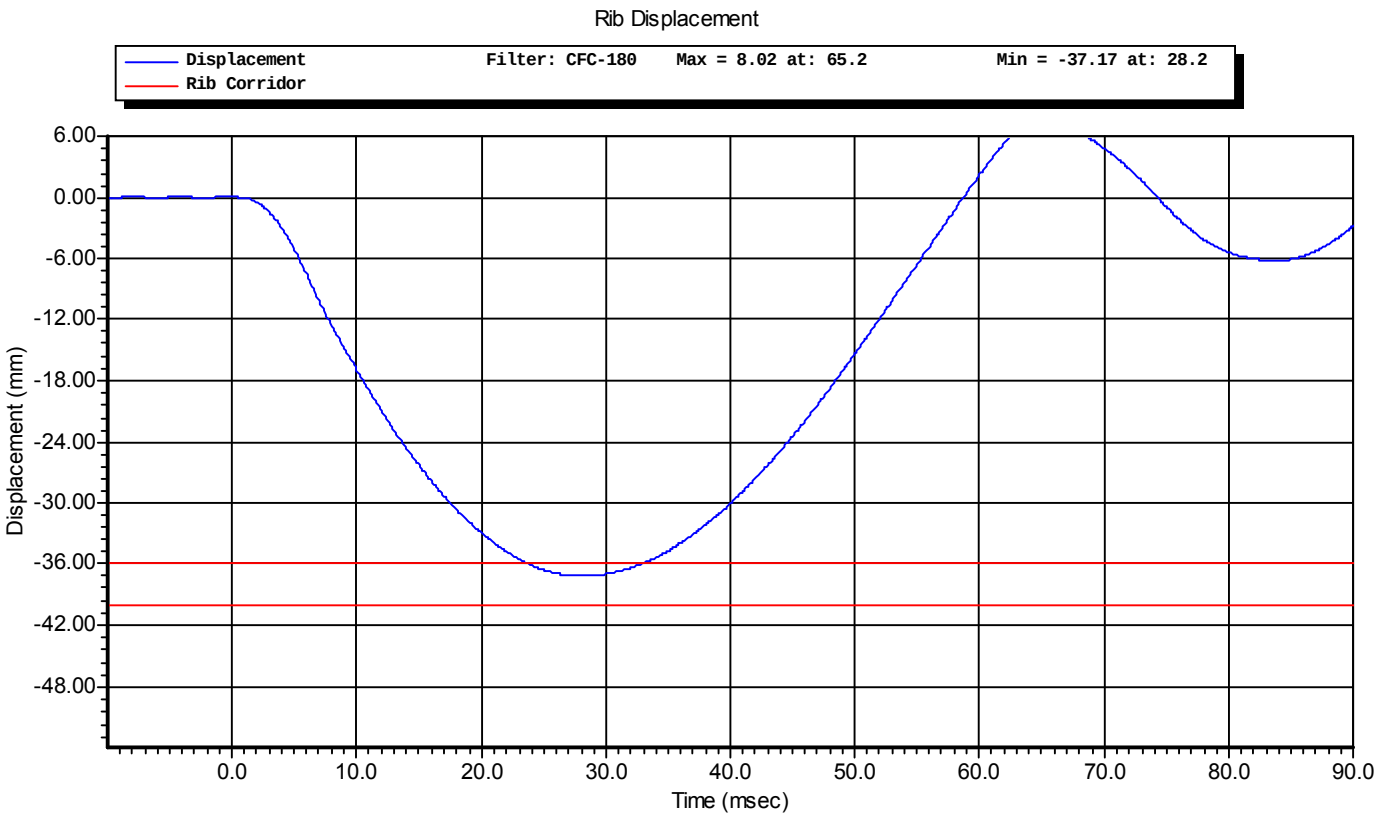
Calspan

Test ID: **Upper Rib 3 m/s** Test Time: **8:35:48 AM** Test Date: **3/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**3.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**8:35:48 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**



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Calspan

VERIFICATION REPORT

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Upper Rib 4 m/s**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**8:55:57 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	3.90	--	4.10	**3.98**	m/s	P
Rib Displacement	-51.00	--	-46.00	**-48.49**	mm	P
Drop Height	807.0	--	823.0	**815.0**	mm	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Upper Rib 4 m/s** Test Time: **8:55:57 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
Honeywell	**MLT-38000**	**DS-0552-01**	**1/11/2010**
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P23137**	**1/22/2010**

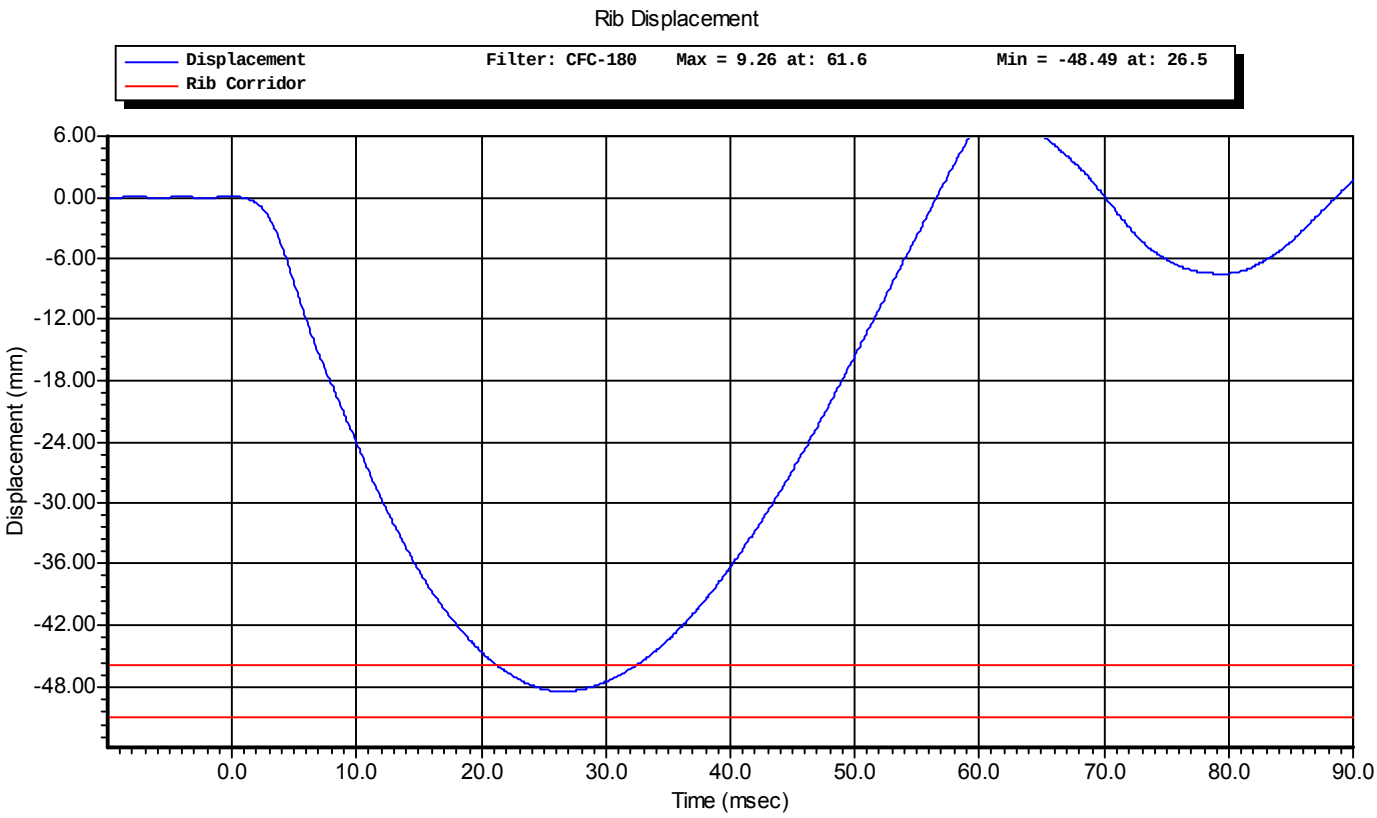
Calspan

Test ID: **Upper Rib 4 m/s** Test Time: **8:55:57 AM** Test Date: **3/8/2010**

Calspan

Test Name:	**Full Rib Module Impact**	Revision:	**12/14/2006**
Sub Test Name:	**4.0 Meters/Second**	Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**8:55:57 AM**

Component Part Number	Component Serial Number
455-3100	**1954-0124A**



Calspan

Test Time: **8:55:57 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

Test Name:	**Thorax Impact**	Revision:	**8/15/2008**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Thorax Impact**	Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**10:52:13 AM**

Component Part Number	Component Serial Number
Upper Rib - 175-4002	**1954-0124A**
Middle Rib - 175-4002	**1954-0125A**
Lower Rib - 175-4002	**1954-0126A**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.1**	deg C	P
Humidity	10.0	--	70.0	**30.0**	%RH	P
Velocity	5.40	--	5.60	**5.50**	m/s	P
Upper Rib Displacement	34.0	--	41.0	**37.1**	mm	P
Middle Rib Displacement	37.0	--	45.0	**40.3**	mm	P
Lower Rib Displacement	37.0	--	44.0	**40.3**	mm	P
Impactor Force	5100	--	6200	**5712**	N	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Thorax Impact** Test Time: **10:52:13 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16576**	**11/4/2009**
Honeywell	**MLT-38000**	**DS-0552-01**	**1/11/2010**
Honeywell	**MLT-38000**	**DS-0807**	**1/11/2010**
Honeywell	**MLT-38000**	**DS-0552-3**	**1/11/2010**

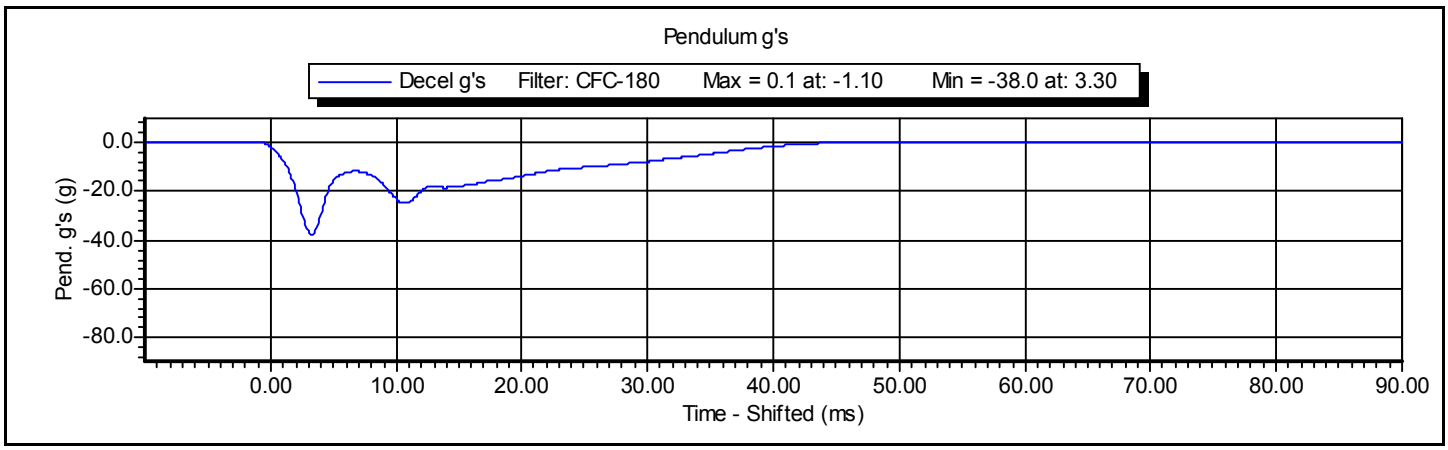
Calspan

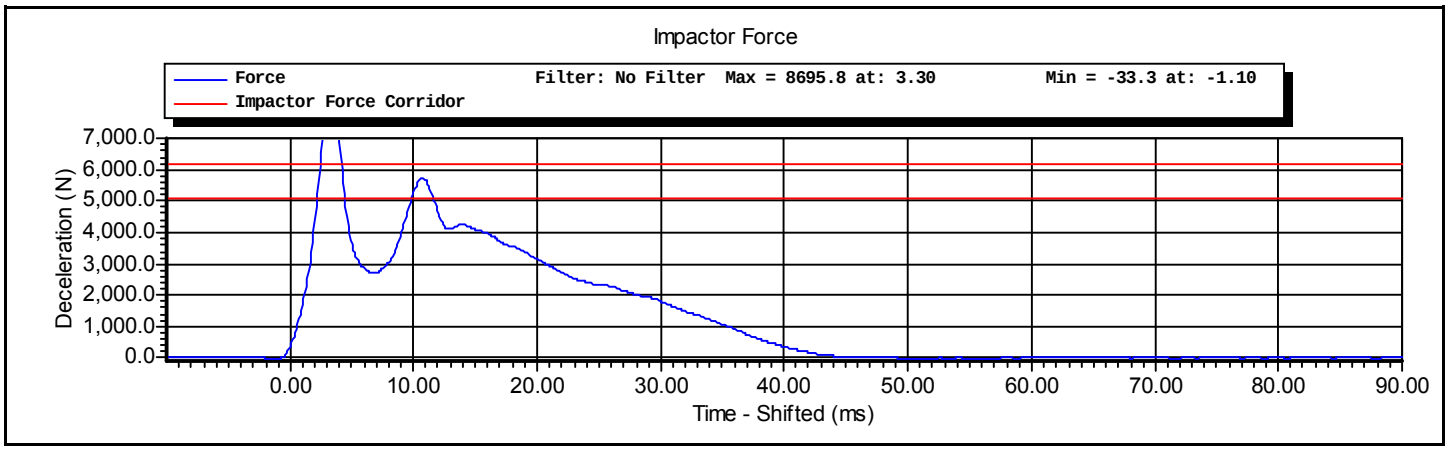
Test ID: **Thorax Impact** Test Time: **10:52:13 AM** Test Date: **3/8/2010**

Calspan

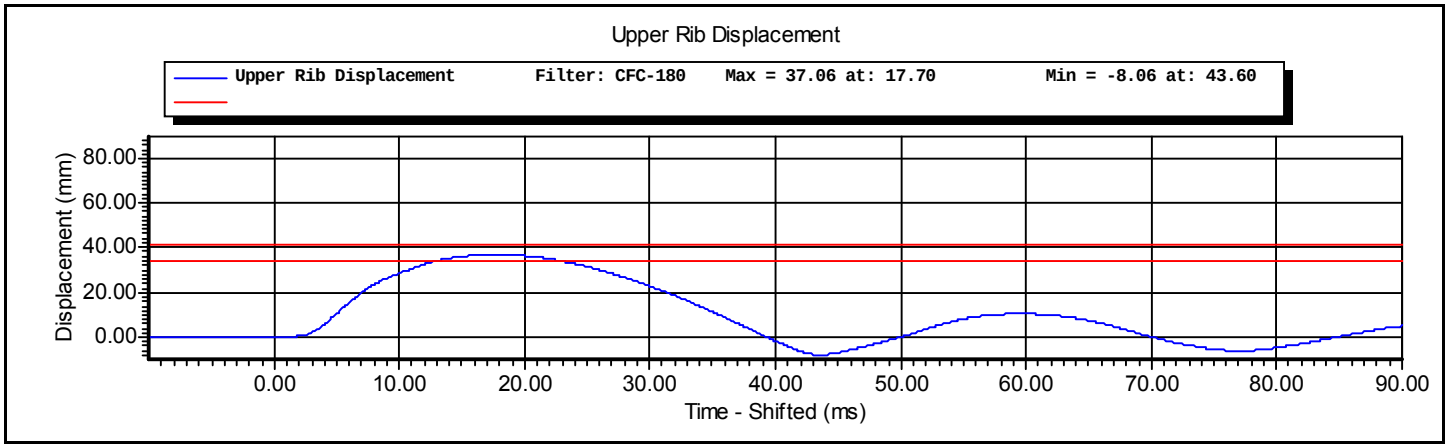
Test Name:	**Thorax Impact**	Revision:	**8/15/2008**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/8/2010**
Test Number:	**1**	Test Time:	**10:52:13 AM**

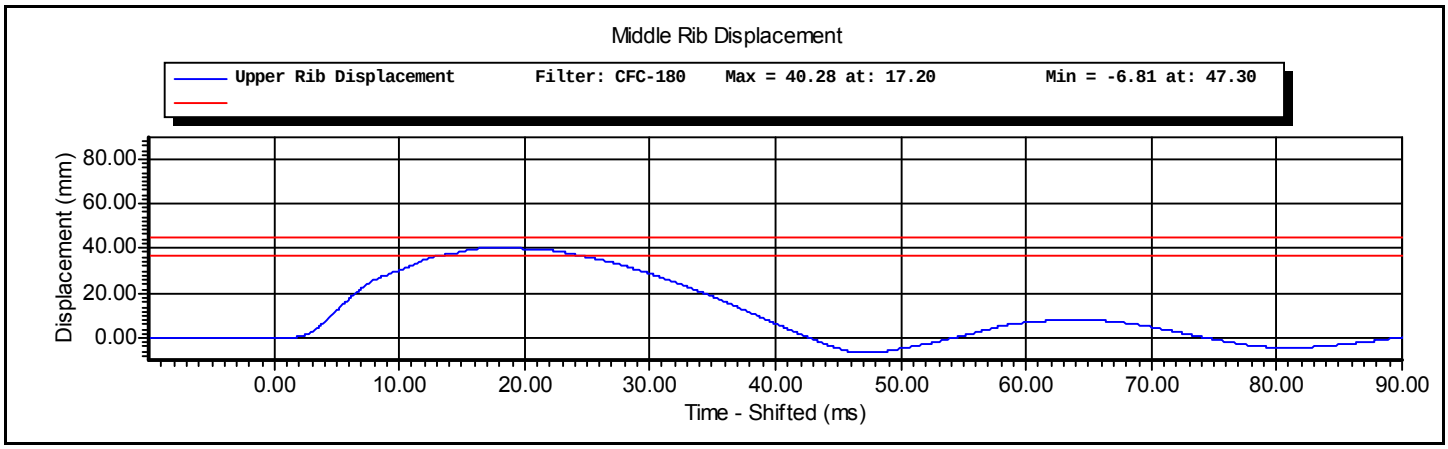
Component Part Number	Component Serial Number
Upper Rib - 175-4002	**1954-0124A**

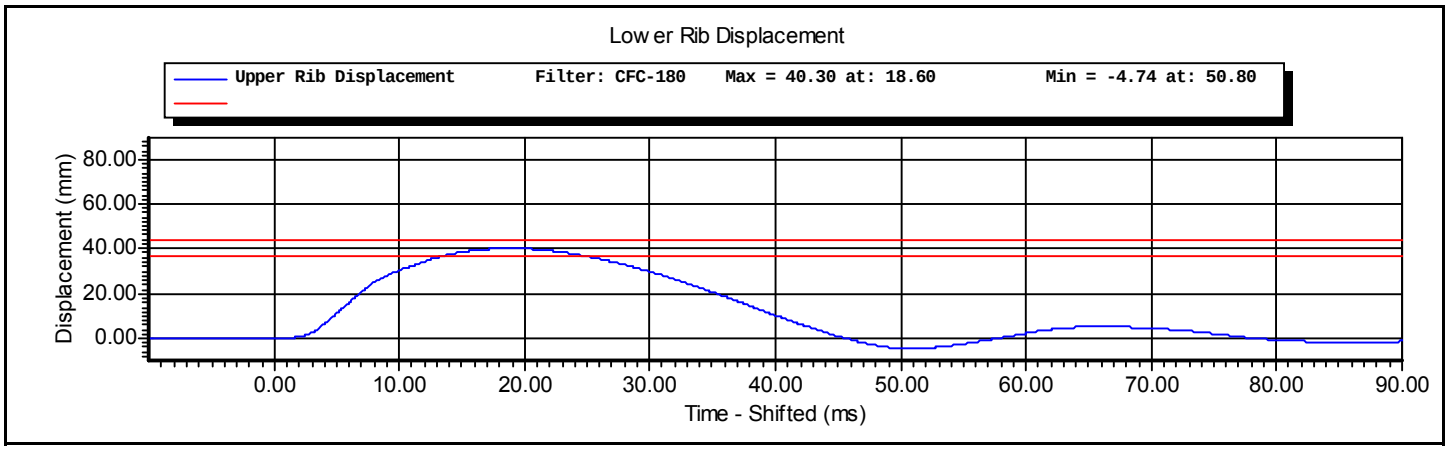




Calspan







Test Time: **10:52:13 AM** Test Date: **3/8/2010**

Calspan

VERIFICATION REPORT

Test Name:	**Abdominal Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Abdomen Test**	Test Date:	**3/5/2010**
Test Number:	**3**	Test Time:	**1:47:17 PM**

Component Part Number	Component Serial Number
455-4001	**19-179**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**22.2**	deg C	P
Humidity	10	--	70	**27**	%RH	P
Velocity	3.90	--	4.10	**3.99**	m/s	P
Peak Abdominal Force	-2.70	--	-2.20	**-2.64**	kN	P
Time At Peak Abdominal Force	10.0	--	12.3	**11.1**	ms	P
Maximum Pendulum Force	-4.80	--	-4.00	**-4.78**	kN	P
Time at Peak Pendumlum Force	10.6	--	13.0	**10.6**	ms	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Abdomen Test** Test Time: **1:47:17 PM** Test Date: **3/5/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16576**	**11/4/2009**
Denton	**2631**	**LC-1507Fy**	**1/7/2010**
Denton	**2631**	**LC-1508Fy**	**1/7/2010**
Denton	**2631**	**LC-1509Fy**	**1/7/2010**

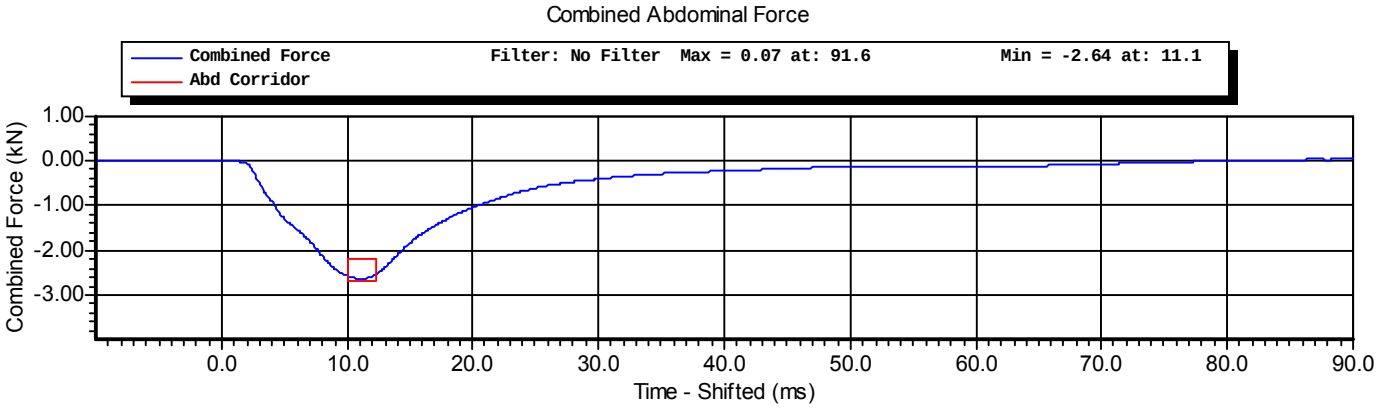
Calspan

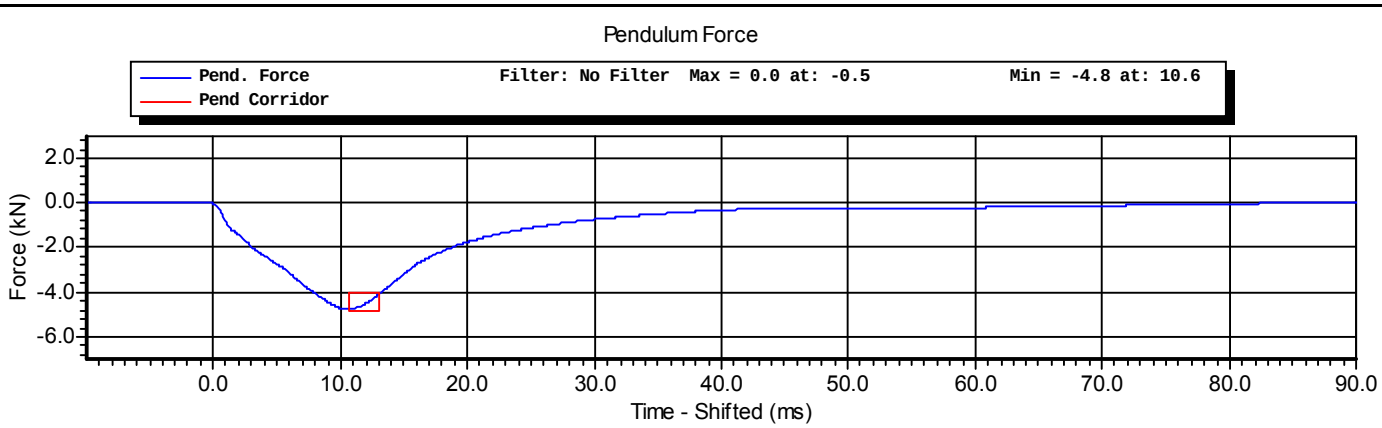
Test ID: **Abdomen Test** Test Time: **1:47:17 PM** Test Date: **3/5/2010**

Calspan

Test Name:	**Abdominal Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/5/2010**
Test Number:	**3**	Test Time:	**1:47:17 PM**

Component Part Number	Component Serial Number
455-4001	**19-179**





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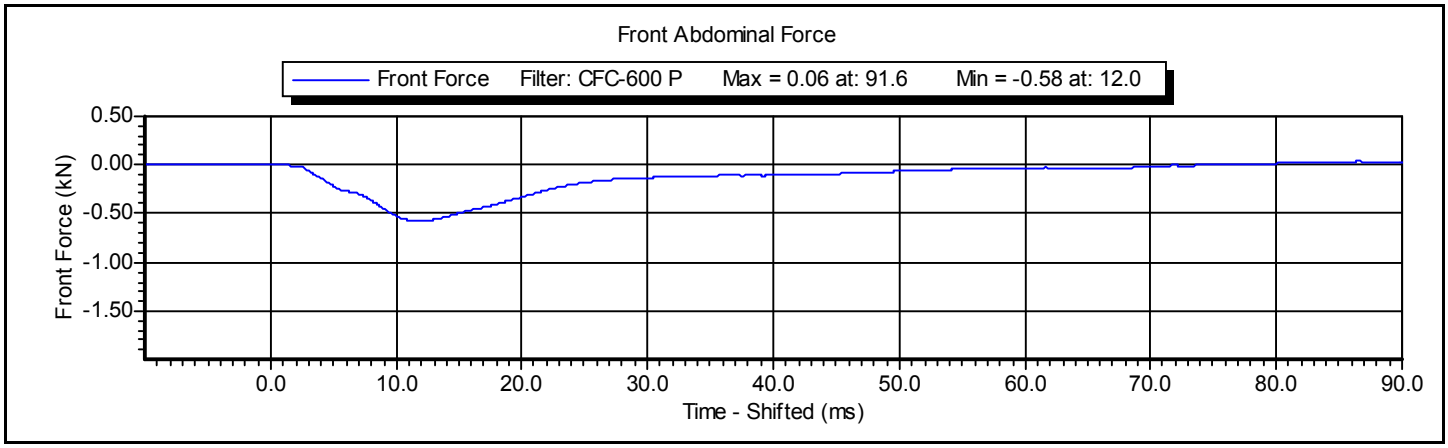
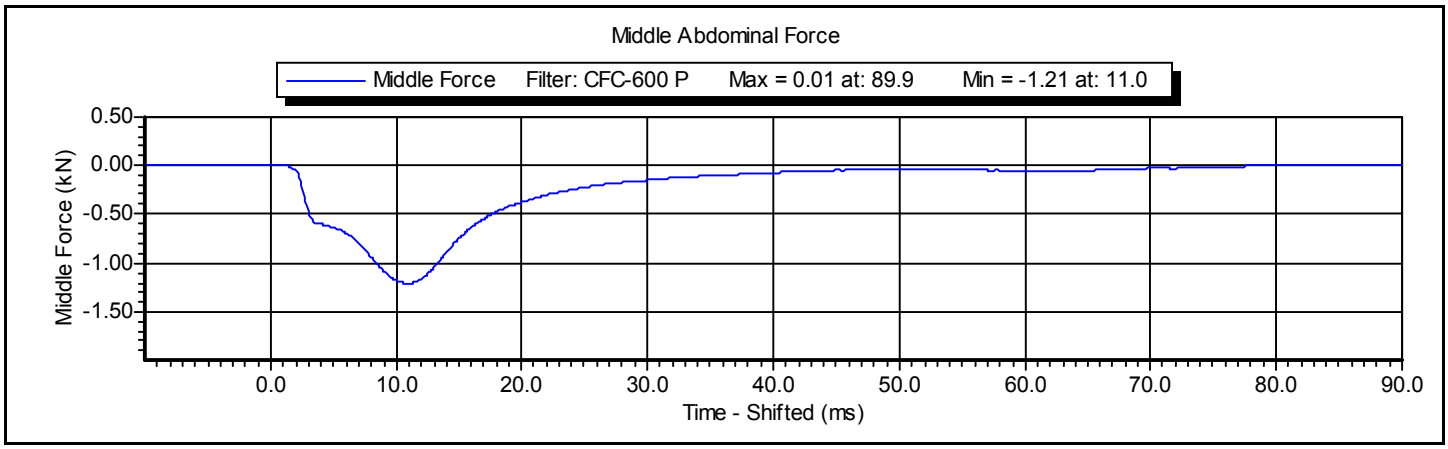
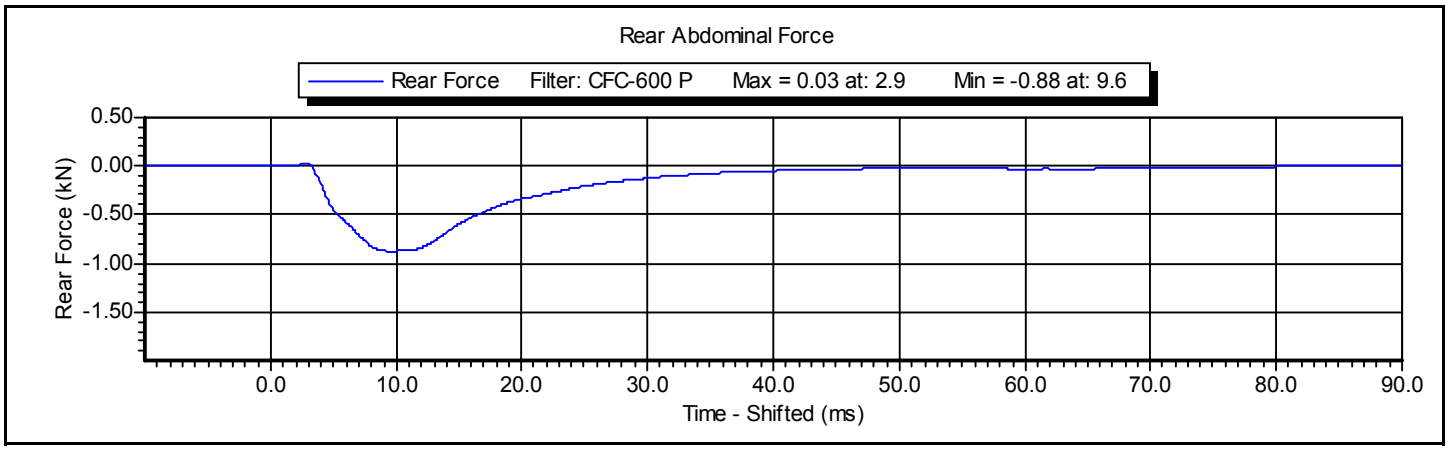






Calspan

VERIFICATION REPORT

Test Name:	**Lumbar Spine**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Lumbar Spine**	Test Date:	**3/9/2010**
Test Number:	**2**	Test Time:	**1:41:38 PM**

Component Part Number	Component Serial Number
175-5501	**15-0376**

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**21.7**	deg C	P
Humidity	10	--	70	**33**	%RH	P
Velocity	5.95	--	6.15	**6.08**	m/s	P
Maximum Headform Flexion Angle	45.0	--	55.0	**48.4**	degrees	P
Time at Maximum Headform Flexion Angle	39.0	--	53.0	**41.8**	ms	P
Decay to Zero Degrees	37.0	--	57.0	**38.6**	ms	P
Velocity Corridor		--				P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Lumbar Spine** Test Time: **1:41:38 PM** Test Date: **3/9/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7231CT**	**AF5B3**	**2/24/2010**
DentonATD	**7000428**	**094**	**10/23/2009**
DentonATD	**7000428**	**095**	**10/23/2009**
DentonATD	**7000428**	**093**	**10/23/2009**

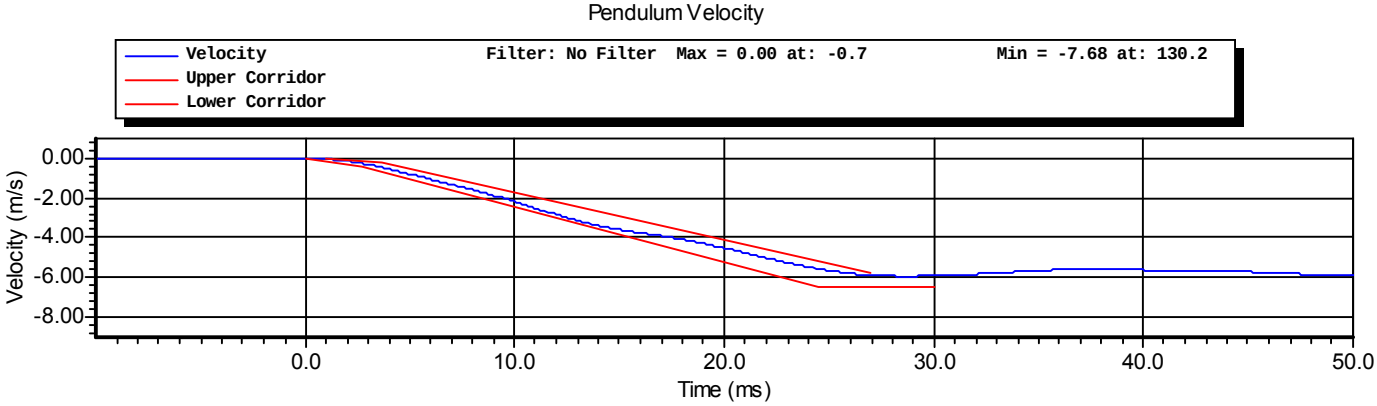
Calspan

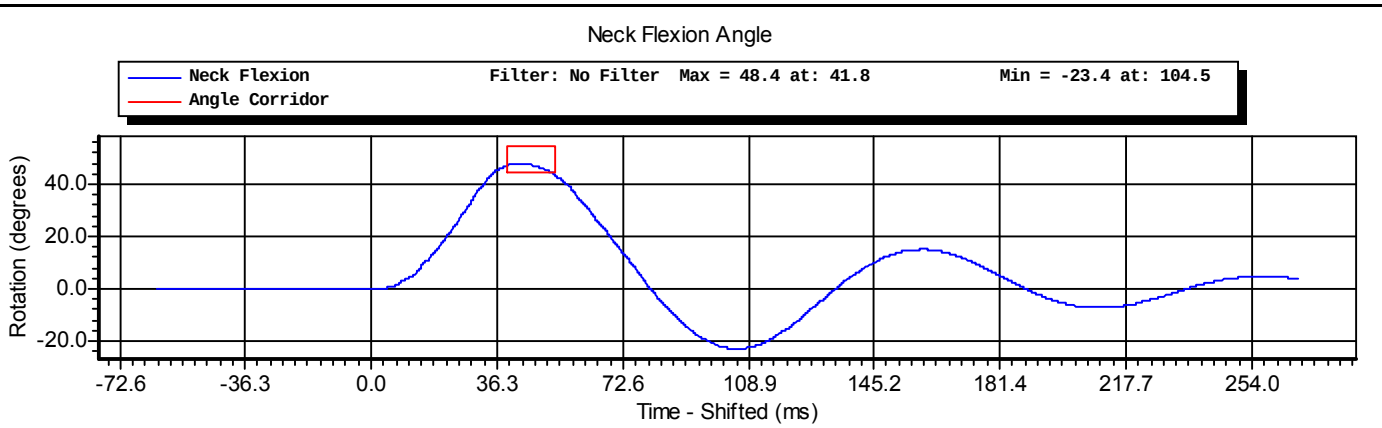
Test ID: **Lumbar Spine** Test Time: **1:41:38 PM** Test Date: **3/9/2010**

Calspan

Test Name:	**Lumbar Spine**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/9/2010**
Test Number:	**2**	Test Time:	**1:41:38 PM**

Component Part Number	Component Serial Number
175-5501	**15-0376**





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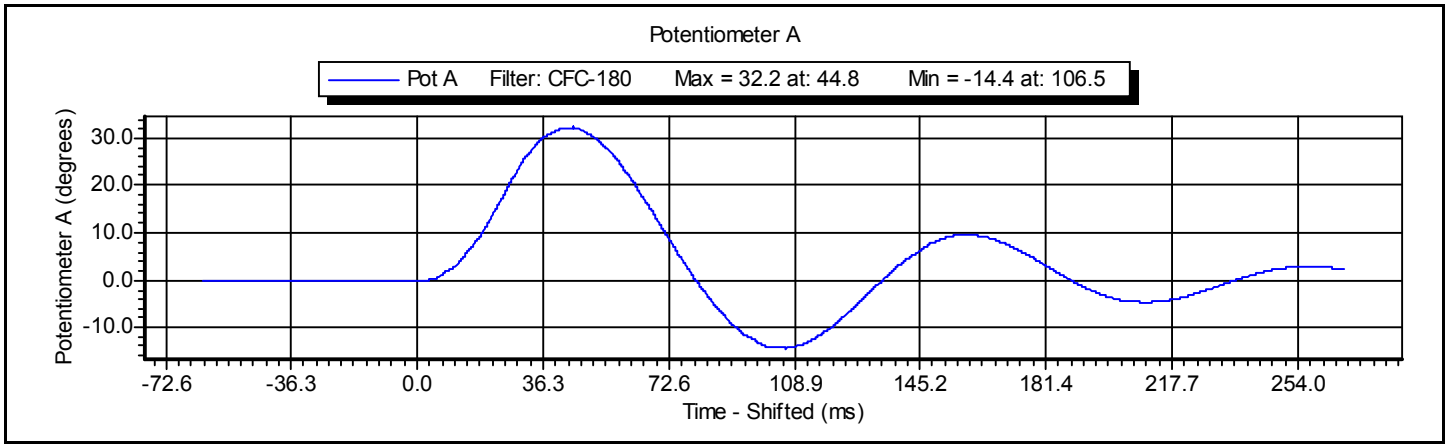
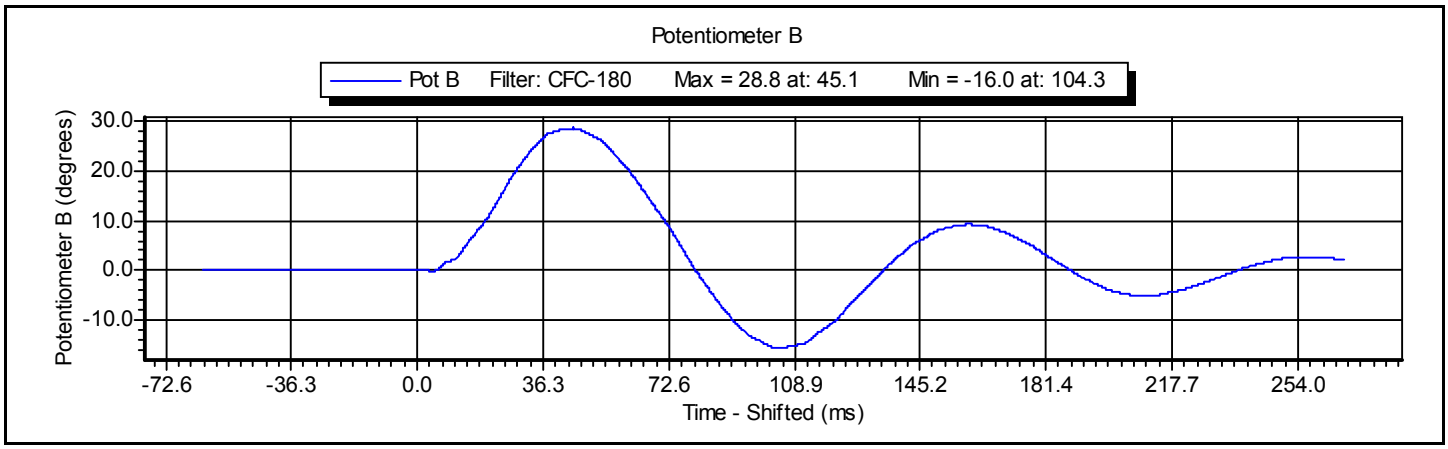
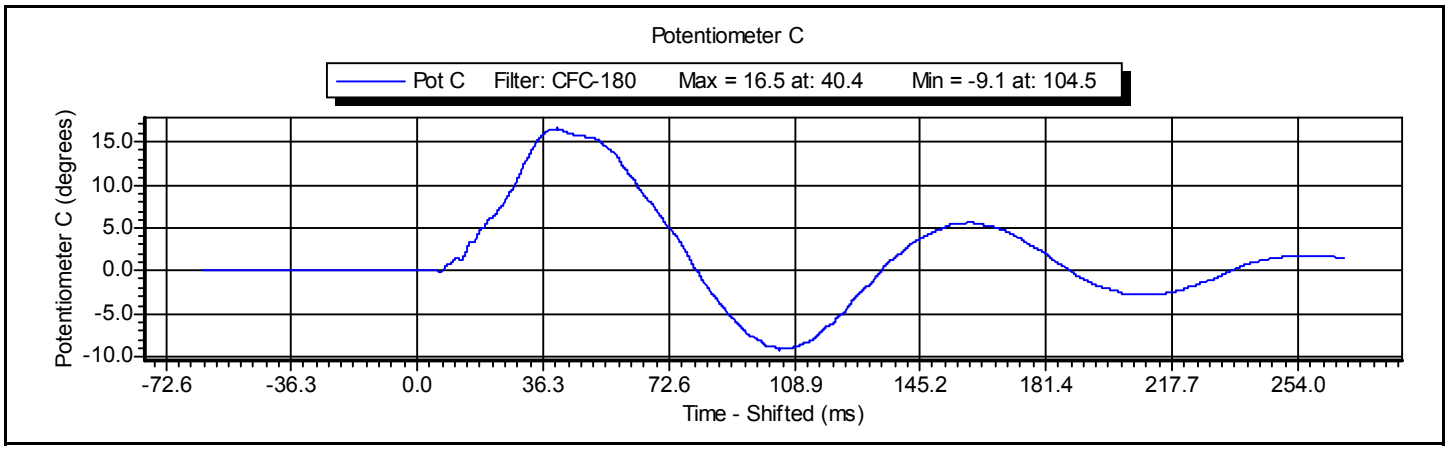
Test Time: **1:41:38 PM** Test Date: **3/9/2010**







Calspan

VERIFICATION REPORT

Test Name:	**Pelvis Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
Test ID:	**Pelvis Impact**	Test Date:	**3/5/2010**
Test Number:	**1**	Test Time:	**3:04:03 PM**

Component Part Number	Component Serial Number
455-4003	

Comments:

Test Parameters	Test Specifications			Test Results		
Temperature	20.6	--	22.2	**22.2**	deg C	P
Humidity	10	--	70	**30**	%RH	P
Velocity	4.20	--	4.40	**4.31**	m/s	P
Peak Pendulum Force	-5.40	--	-4.70	**-5.12**	kN	P
Time at Peak Pendulum Force	11.80	--	16.10	**13.90**	ms	P
Peak Pubic Symphysis Force	-1.59	--	-1.23	**-1.55**	kN	P
Time at Peak Pubic Symphysis Force	12.20	--	17.00	**14.60**	ms	P

All test parameters are within specifications

Technician: **A. Rudniski** Signature: _____

Supervisor: **D. Travale** Signature: _____

Calspan

Test ID: **Pelvis Impact** Test Time: **3:04:03 PM** Test Date: **3/5/2010**

Calspan

VERIFICATION REPORT

REFERENCE EQUIPMENT

Manufacturer	Model	Serial Number	Calibration Date
DentonATD	**Velocity Trap**	**1**	**1/11/2010**
Endevco	**7264-2000**	**P16761**	**1/22/2010**
Denton	**3096**	**LC-458Fy**	**1/7/2010**

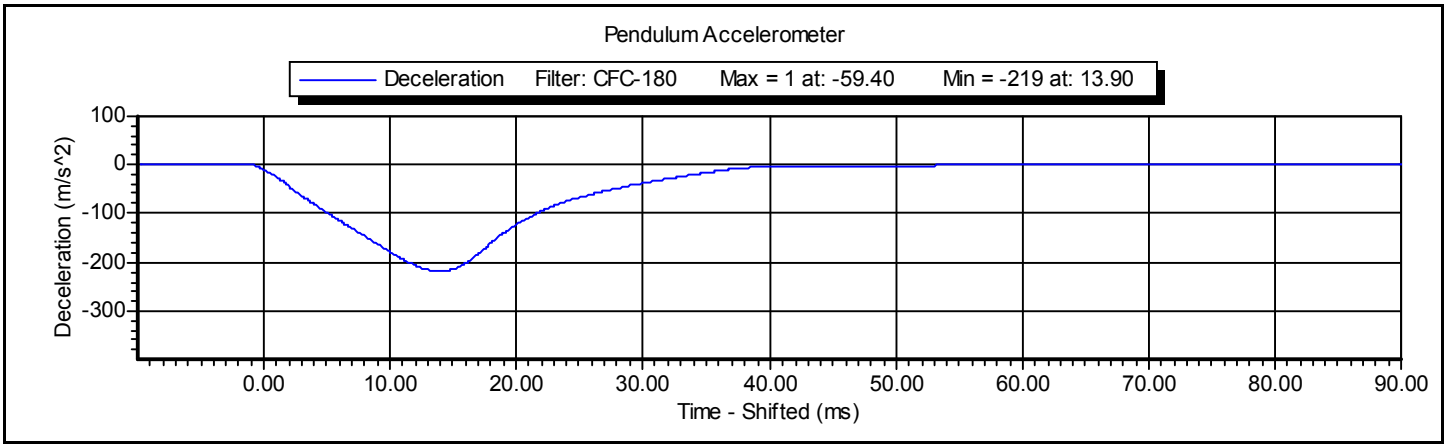
Calspan

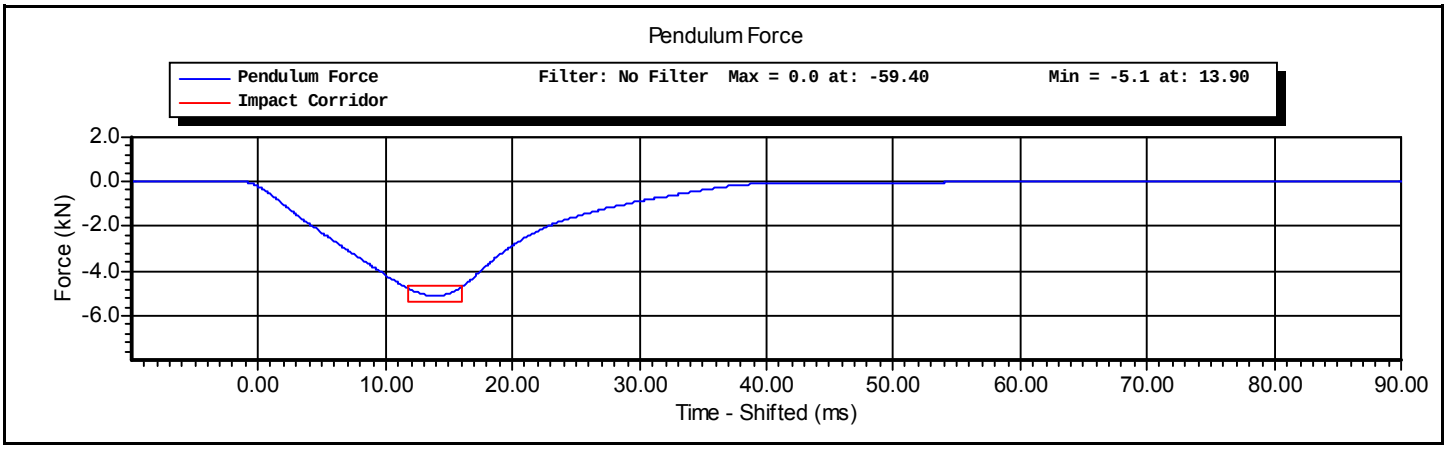
Test ID: **Pelvis Impact** Test Time: **3:04:03 PM** Test Date: **3/5/2010**

Calspan

Test Name:	**Pelvis Impact**	Revision:	**12/14/2006**
Sub Test Name:		Spec Type:	**NHTSA**
ATD Type:	**ES-2re**		
ATD Serial Number:	**D037**		
		Test Date:	**3/5/2010**
Test Number:	**1**	Test Time:	**3:04:03 PM**

Component Part Number	Component Serial Number
455-4003	





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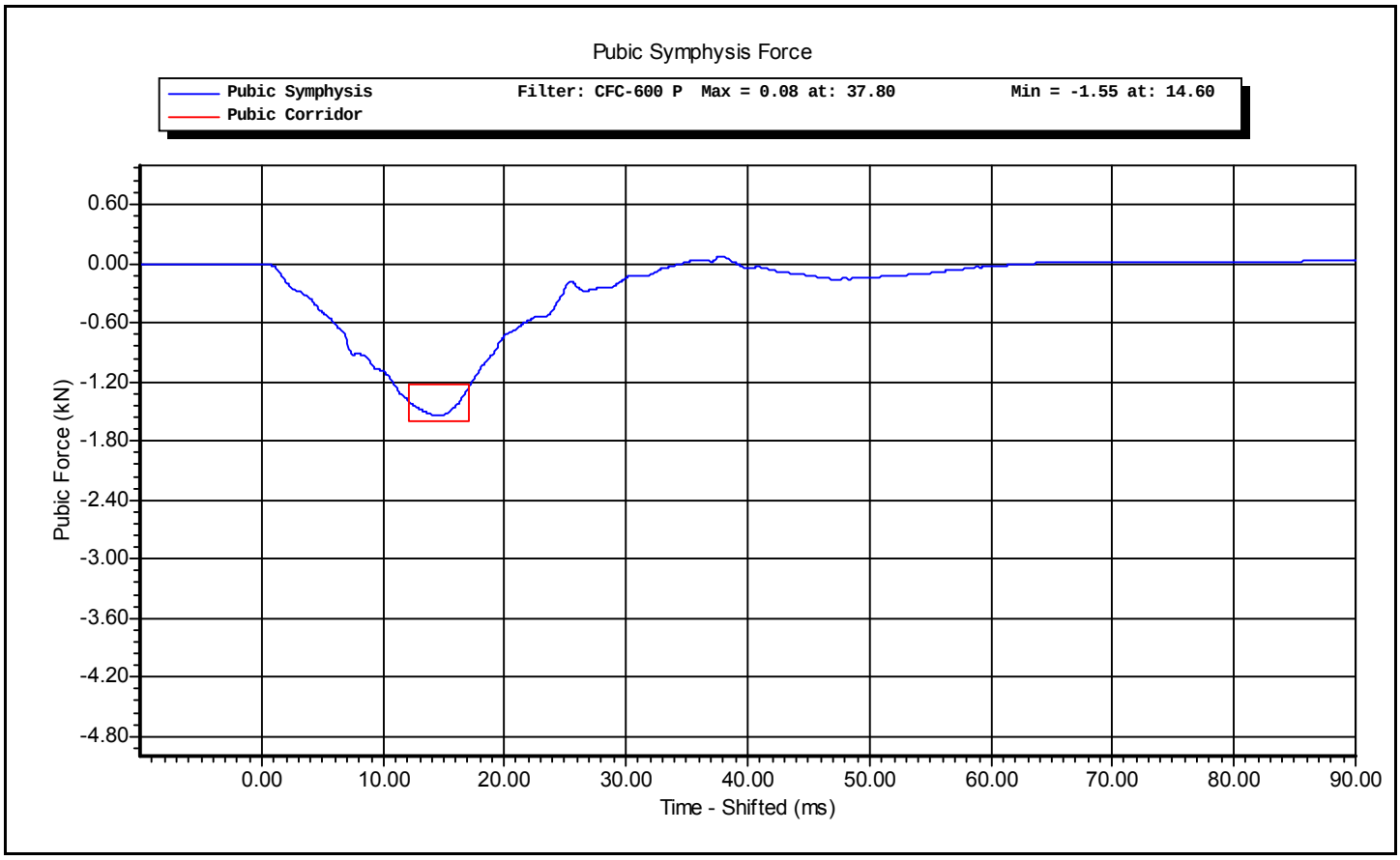

APPENDIX E

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

DUMMY INSTRUMENTATION

		FRONT ES2-re NO.: 037		
		SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
Head Accelerometers	X	AC-P18639	ENDEVCO	25-Jan-10
	Y	AC-P23128	ENDEVCO	25-Jan-10
	Z	AC-P16591	ENDEVCO	25-Jan-10
Head Accelerometers (Redundant)	X	AC-J45479	ENDEVCO	22-Jan-10
	Y	AC-P32453	ENDEVCO	25-Jan-10
	Z	AC-P22639	ENDEVCO	25-Jan-10
Thorax Potentiometers	Upper Rib (Y)	DS-0552-01	Honeywell	11-Jan-10
	Middle Rib (Y)	DS-0807	Honeywell	11-Jan-10
	Lower Rib (Y)	DS-0552-3	Honeywell	11-Jan-10
Abdomen Load Cells	Forward (Y)	LC-1507Fy	DENTON	07-Jan-10
	Middle (Y)	LC-1508Fy	DENTON	07-Jan-10
	Rear (Y)	LC-1509Fy	DENTON	07-Jan-10
Pubic Symphysis Load Cell (Y)		LC-458Fy	DENTON	07-Jan-10

REMARKS: None

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

VEHICLE AND MDB INSTRUMENTATION

VEHICLE INSTRUMENTATION	VEHICLE AND MDB INSTRUMENTS		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
VEHICLE CG (X)	AC-P26263	ENDEVCO	02-Feb-10
VEHICLE CG (Y)	AC-P47300	ENDEVCO	02-Feb-10
VEHICLE CG (Z)	AC-P32146	ENDEVCO	02-Feb-10
LEFT FLOOR SILL (Y)	AC-P18728	ENDEVCO	04-Nov-09
A-PILLAR LEFT SILL (Y)	AC-P23288	ENDEVCO	04-Nov-09
LOWER LEFT A-PILLAR (Y)	AC-APF89	ENDEVCO	04-Nov-09
MIDDLE LEFT A-PILLAR (Y)	AC-J38127	ENDEVCO	04-Nov-09
B-PILLAR LEFT SILL (Y)	AC-P19217	ENDEVCO	22-Jan-10
LOWER LEFT B- PILLAR (Y)	AC-P32227	ENDEVCO	04-Nov-09
MIDDLE LEFT B-PILLAR (Y)	AC-P16841	ENDEVCO	24-Feb-10
DRIVER SEAT TRACK (Y)	AC-P23788	ENDEVCO	22-Jan-10
ENGINE TOP (X)	AC-P16671	ENDEVCO	25-Sep-09
ENGINE TOP (Y)	AC-P23885	ENDEVCO	04-Nov-09
FIREWAELL CENTER (Y)	AC-P23926	ENDEVCO	25-Sep-09
RIGHT ROOF at VERTICAL IMPACT REFERENCE (Y)	AC-A13829	ENDEVCO	24-Feb-10
RIGHT SILL at VERTICAL IMPACT REFERENCE (Y)	AC-P35793	ENDEVCO	24-Feb-10
REAR FLOORPAN BEHIND REAR AXLE at C/L (X)	AC-P32225	ENDEVCO	25-Jan-10
REAR FLOORPAN BEHIND REAR AXLE at C/L (Y)	AC-P32276	ENDEVCO	25-Jan-10

REMARKS: None