

**REPORT NUMBER: 8708-SLEDNCAP-21**

**CHILD RESTRAINT SYSTEM IN  
DYNAMIC SLED TEST  
GRACO ULTRA CARGO WITH A HYIII THREE YEAR OLD  
COSCO EDDIE BAUER HIGH BACK WITH A HYIII THREE YEAR OLD**

**TEST NUMBER: 08-3-21**

**PREPARED BY:  
VERIDIAN ENGINEERING  
4455 GENESEE STREET  
BUFFALO, NEW YORK 14225**



**AUGUST 7<sup>TH</sup>, 2003**

**FINAL REPORT**

**PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
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Date of Acceptance

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COTR, NCAP Dynamic Sled Test Program

\_\_\_\_\_  
Date of Acceptance

## TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract This report contains the results of tests performed in accordance with FMVSS 213 Final Rule Published June 24th, 2003 for FMVSS 213 Child Restraint Systems.  Two (2) seats were tested during this run. Position 3 was a Graco Ultra Cargo Child Restraint System. This seat was tested with a HYIII 3 year old ATD.  Position 4 was a Cosco Eddie Bauer High Back Child Restraint System. This seat was tested with a HYIII 3 year old ATD.			
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## SECTION 1

### PURPOSE AND TEST PROCEDURE

#### 1.1 PURPOSE

This dynamic sled testing is part of the FY' 03 New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract Number DTNH22-01-D-32005. The purpose of this test is to obtain child seat research data for frontal dynamic testing.

#### 1.2 TEST PROCEDURE

This frontal dynamic sled test was conducted in accordance with the child restraint test procedure provided by the FMVSS No. 213 Final Rule published June 24<sup>th</sup>, 2003. Any reference to FMVSS No. 213 in this document refers to the Final Rule published June 24<sup>th</sup>, 2003, for FMVSS No. 213 Child Restraint Systems.

The test was conducted at Veridian Engineering on August 7<sup>th</sup>, 2003 at a speed of 46.3 kph ( 28.8 mph). The FMVSS No. 213 sled pulse was used as a crash pulse. The requirements specified in the FMVSS No. 213 were also followed.

The bench seat contained one anthropomorphic test device (ATD). One (1) Hybrid III 3 Year Old ATD, Serial Number 142, was instrumented with head, chest, and pelvic tri-axial accelerometers. This ATD was also instrumented with upper and lower neck load cells. This dummy was placed in a Graco Ultra Cargo child seat and the seat was located in Position 3 – Right Rear Passenger

One (1) Hybrid III 3 Year Old ATD, Serial Number 044, was instrumented with head, chest, and pelvic tri-axial accelerometers. This ATD was also instrumented with upper and lower neck load cells. This dummy was placed in a Cosco Eddie Bauer High Back child seat and the seat was located in Position 4 – Left Rear Passenger.

The child ATD was positioned according to the child seat manufacturer's instructions. The data was digitally sampled at 20,000 samples per second and processed per Section IP11 of the Laboratory Test Procedure.

Position 4 – Upper Neck Mx did not record.

## SECTION 2

### CHILD RESTRAINT INFORMATION

Test No.: 08-3-21

Test Date: August 7th, 2003

#### **POSITION 3**

Child Restraint Type (forward-facing, rearward facing, booster)	FORWARD FACING
LATCH or NON-LATCH	LATCH WITH TETHER
Harness Type	5 POINT
Child Restraint Manufacturer	GRACO
Child Restraint Model	ULTRA CARGO
Model Number	8487HEN
Date of Manufacture	1/14/2003
Child Restraint Height Limits (mm)	686 - 1372
Child Restraint Weight Limits (kg)	9.1 – 36.3
Weight of Child Restraint (kg)	4.9

#### **POSITION 4**

Child Restraint Type (forward-facing, rearward facing, booster)	FORWARD FACING
LATCH or NON-LATCH	LATCH WITH TETHER
Harness Type	5 POINT
Child Restraint Manufacturer	COSCO
Child Restraint Model	EDDIE BAUER HIGH BACK
Model Number	22-859-ARD
Date of Manufacture	6/19/2003
Child Restraint Height Limits (mm)	737 - 1321
Child Restraint Weight Limits (kg)	10.0 – 36.3
Weight of Child Restraint (kg)	4.3

**SECTION 3**  
**POST-TEST OBSERVATIONS**

Test No.: 08-3-21

Test Date: August 7th, 2003

**POSITION 3**

Child Seat	GRACO ULTRA CARGO
Belt Fraying	NONE
Stress Marks	NONE
Cracks	NONE
Buckle Stress	NONE
Latch Hooks	NONE
Max. Head Excursion (mm)	594
Max. Knee Excursion (mm)	645
Velocity (kph)	46.3
Acceleration (G's)	23.2

**POSITION 4**

Child Seat	COSCO EDDIE BAUER HIGH BACK
Belt Fraying	NONE
Stress Marks	NONE
Cracks	NONE
Buckle Stress	NONE
Latch Hooks	NONE
Max. Head Excursion (mm)	589
Max. Knee Excursion (mm)	643
Velocity (kph)	46.3
Acceleration (G's)	23.2

## SECTION 4

### POSITION 3 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA

Test No.: 08-3-21

Test Date: August 7th, 2003

#### HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Head CG	X	G's	51.7	187.4	-61.0	92.2
Head CG	Y	G's	4.6	92.6	-6.5	91.1
Head CG	Z	G's	57.1	76.7	-0.0	4.2
Head CG Resultant	N/A	G's	65.7	92.2		

#### CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	G's	14.1	170.3	-33.6	55.0
Chest CG	Y	G's	3.0	64.7	-1.5	192.0
Chest CG	Z	G's	11.5	83.0	-28.3	55.8
Chest CG Resultant	N/A	G's	44.0	55.3		

#### SEAT BELT SENSOR PEAK VALUES

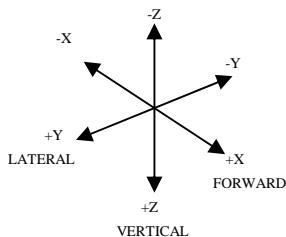
Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Tether Belt	N/A	Newtons	NA	NA		

#### HEAD INJURY CRITERIA (HIC)

Location	P3 (Right) Rear Passenger			
	HIC	Avg. G's	T <sup>1</sup>	T <sup>2</sup>
Head CG Primary (36 msec)	502.5	45.9	60.3	95.6
Head CG Primary (15 msec)	323.5	54.1	68.0	83.0

#### CHEST CLIP (3 MSEC)

Location	P3 (Right) Rear Passenger		
	Clip	T <sup>1</sup>	T <sup>2</sup>
Chest CG Primary	43.3	53.8	56.8



**POSITION 3 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA...(continued)**

Test No.: 08-3-21

Test Date: August 7th, 2003

**PELVIC PEAK ACCELERATIONS**

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Pelvis	X	G's	28.3	107.3	-48.8	61.0
Pelvis	Y	G's	3.9	70.6	-3.7	209.9
Pelvis	Z	G's	10.9	108.4	-40.3	60.5

**UPPER NECK PEAK FORCES AND MOMENTS**

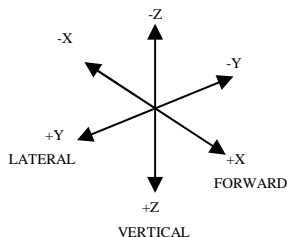
Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	153.2	174.9	-596.5	90.3
Neck Force	Y	Newtons	53.5	65.9	-17.2	169.9
Neck Force	Z	Newtons	1489.7	76.1	-113.0	213.4
Neck Moment	X	Nm	3.0	71.2	-1.9	103.1
Neck Moment	Y	Nm	8.3	93.6	-14.1	206.4
Neck Moment	Z	Nm	2.6	247.2	-1.3	130.5

**LOWER NECK PEAK FORCES AND MOMENTS**

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	239.3	187.8	-1346.9	77.5
Neck Force	Y	Newtons	47.7	66.8	-40.6	99.6
Neck Force	Z	Newtons	972.7	74.3	-113.9	127.7
Neck Moment	X	Nm	8.3	67.6	-2.4	105.9
Neck Moment	Y	Nm	105.0	90.2	-16.7	187.8
Neck Moment	Z	Nm	2.5	65.2	-1.9	106.0

**CHEST PEAK DISPLACEMENTS**

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	mm	0.0	-17.5	-21.4	93.0



## SECTION 4

### POSITION 4 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA

Test No.: 08-3-21

Test Date: August 7th, 2003

#### HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Head CG	X	G's	53.3	188.1	-32.8	97.7
Head CG	Y	G's	4.9	98.2	-2.6	75.7
Head CG	Z	G's	51.4	74.4	-0.4	216.6
Head CG Resultant	N/A	G's	60.0	187.8		

#### CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	G's	19.6	173.7	-32.9	53.2
Chest CG	Y	G's	2.7	39.2	-2.2	87.7
Chest CG	Z	G's	12.4	196.3	-34.1	56.1
Chest CG Resultant	N/A	G's	45.2	54.3		

#### SEAT BELT SENSOR PEAK VALUES

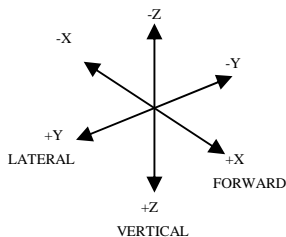
Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Tether Belt	N/A	Newtons	NA	NA		

#### HEAD INJURY CRITERIA (HIC)

Location	P4 (Left) Rear Passenger			
	HIC	Avg. G's	T <sup>1</sup>	T <sup>2</sup>
Head CG Primary (36 msec)	516.7	46.0	63.5	99.5
Head CG Primary (15 msec)	305.3	52.9	69.7	84.7

#### CHEST CLIP (3 MSEC)

Location	P4 (Left) Rear Passenger		
	Clip	T <sup>1</sup>	T <sup>2</sup>
Chest CG Primary	44.1	53.0	56.0



**POSITION 4 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA...(continued)**

Test No.: 08-3-21

Test Date: August 7th, 2003

**PELVIC PEAK ACCELERATIONS**

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Pelvis	X	G's	37.1	110.1	-39.7	54.8
Pelvis	Y	G's	3.4	123.8	-5.0	62.3
Pelvis	Z	G's	99.3	24.7	-62.3	116.2

**UPPER NECK PEAK FORCES AND MOMENTS**

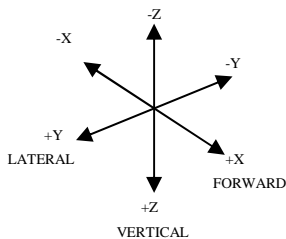
Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	152.0	178.0	-752.6	93.6
Neck Force	Y	Newtons	14.2	186.8	-54.2	103.2
Neck Force	Z	Newtons	1616.7	82.7	-46.0	212.0
Neck Moment	X	Nm	N/A	N/A	N/A	N/A
Neck Moment	Y	Nm	7.6	142.2	-13.0	204.3
Neck Moment	Z	Nm	2.7	102.3	-1.2	248.2

**LOWER NECK PEAK FORCES AND MOMENTS**

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	229.9	187.6	-1284.8	82.9
Neck Force	Y	Newtons	69.2	86.5	-44.9	199.8
Neck Force	Z	Newtons	952.1	77.1	-114.3	57.1
Neck Moment	X	Nm	2.4	187.8	-6.3	103.2
Neck Moment	Y	Nm	117.2	91.7	-14.8	187.8
Neck Moment	Z	Nm	0.5	28.5	-3.1	119.0

**CHEST PEAK DISPLACEMENTS**

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	mm	0.0	-17.0	-31.8	100.7



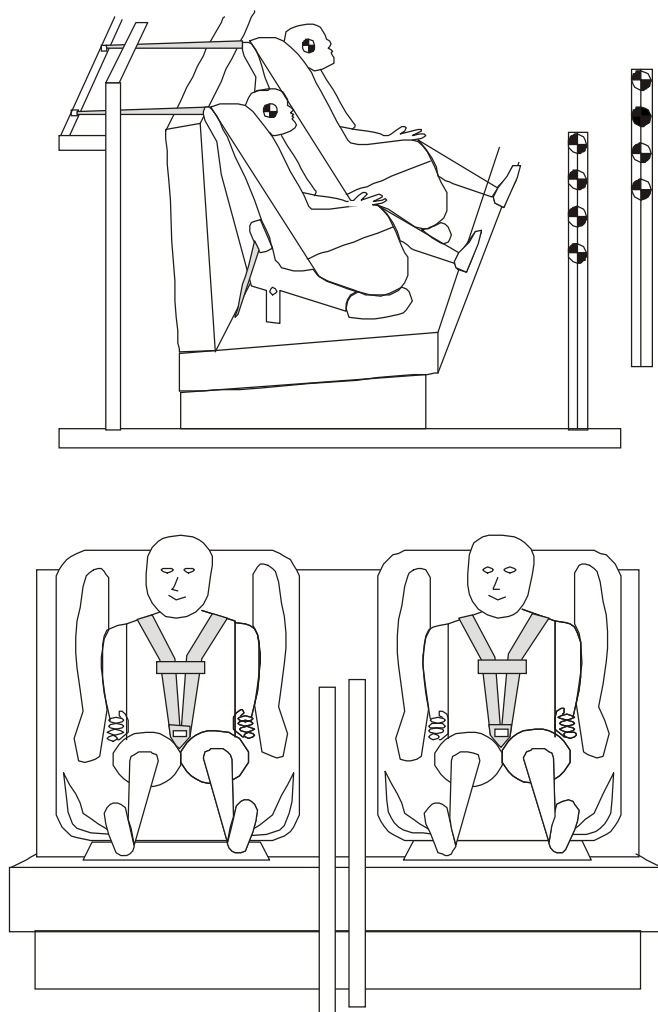
**SECTION 5**  
**SLED TEST SET-UP**

Test No.: 08-3-21

Test Date: August 7th, 2003

An FMVSS 213 test bench was fastened on the sled in order to simulate a frontal impact. Two child seats were placed on the bench and fastened in a manner suggested in the owner's manual of the child seat. Stadia poles were set up to measure dummy head and knee excursions.

Pre-test Infant and Car Seat Positions

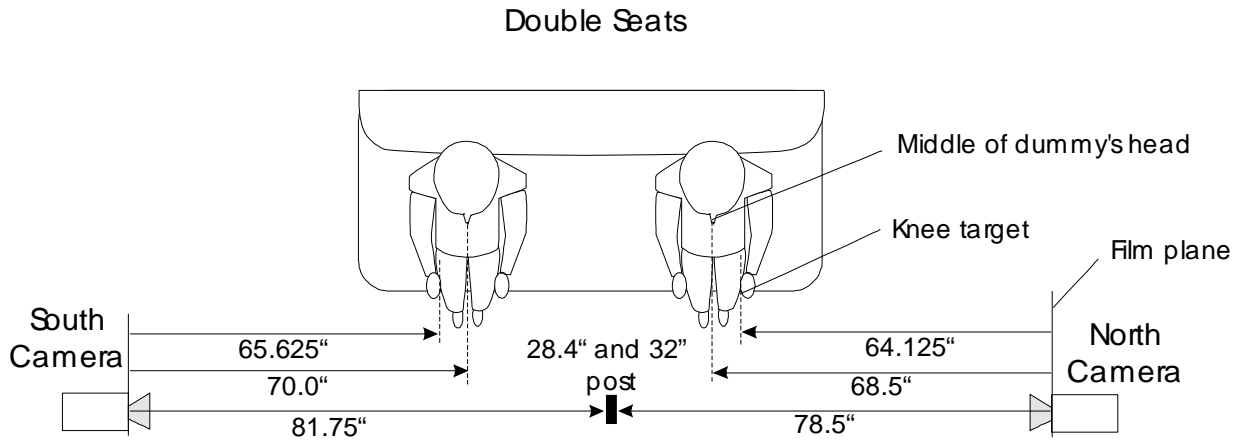


**SECTION 6**  
**CAMERA LOCATION**

Test No.: 08-3-21

Test Date: August 7th, 2003

There were two cameras mounted onto the sled carriage for views of the left and right side of the child seat.



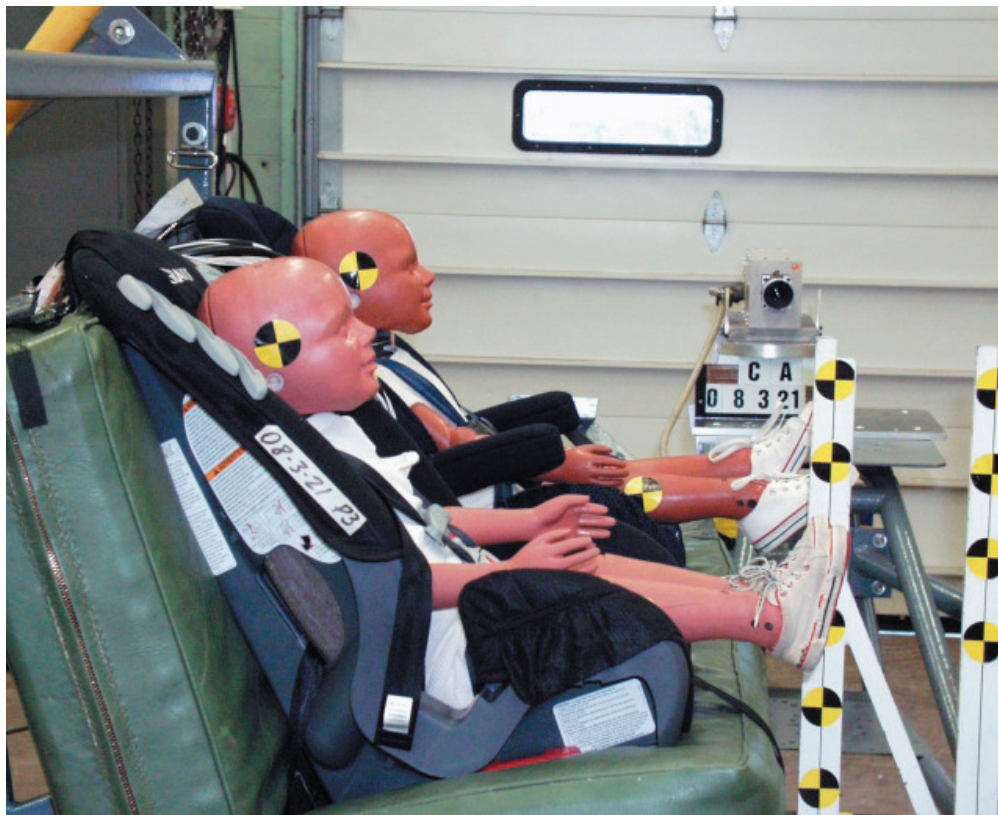
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**PHOTOGRAPHS**

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Photo 3 – Pre-Test and Post Test Left Side View	14



Pre Test Right Side View



Post Test Right Side View



Pre Test Right Front View



Post Test Right Front View



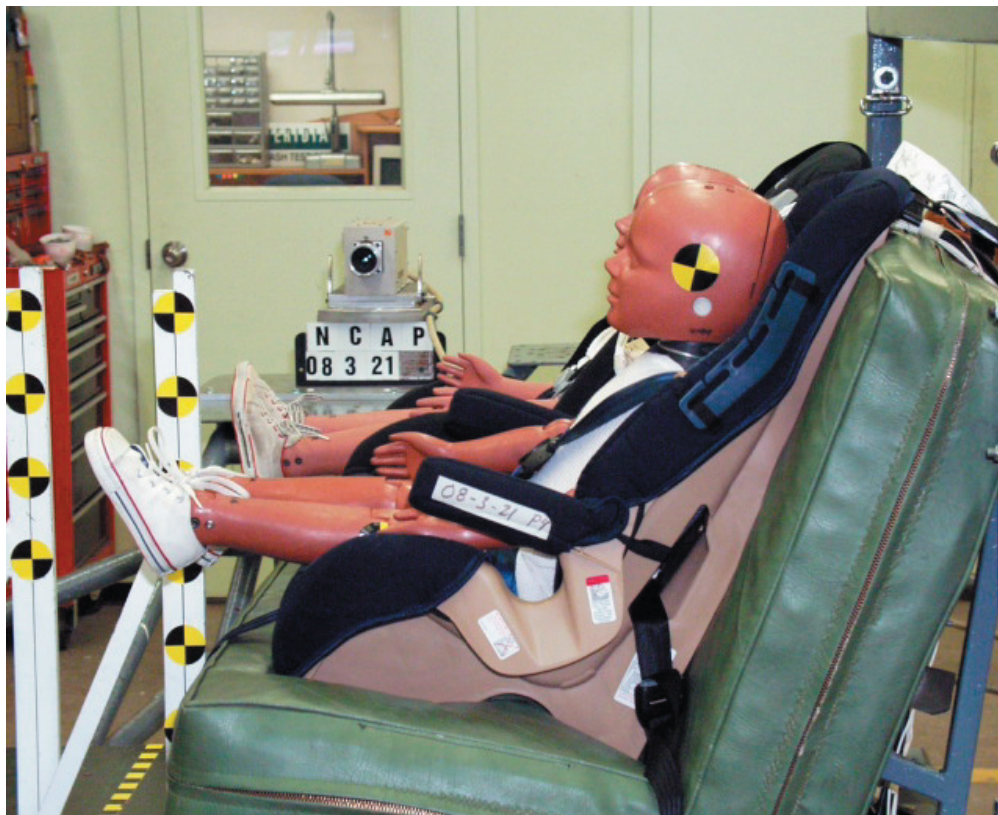
Pre Test Left Front View



Post Test Left Front View



Pre Test Left Side View



Post Test Left Side View

## **SECTION 8**

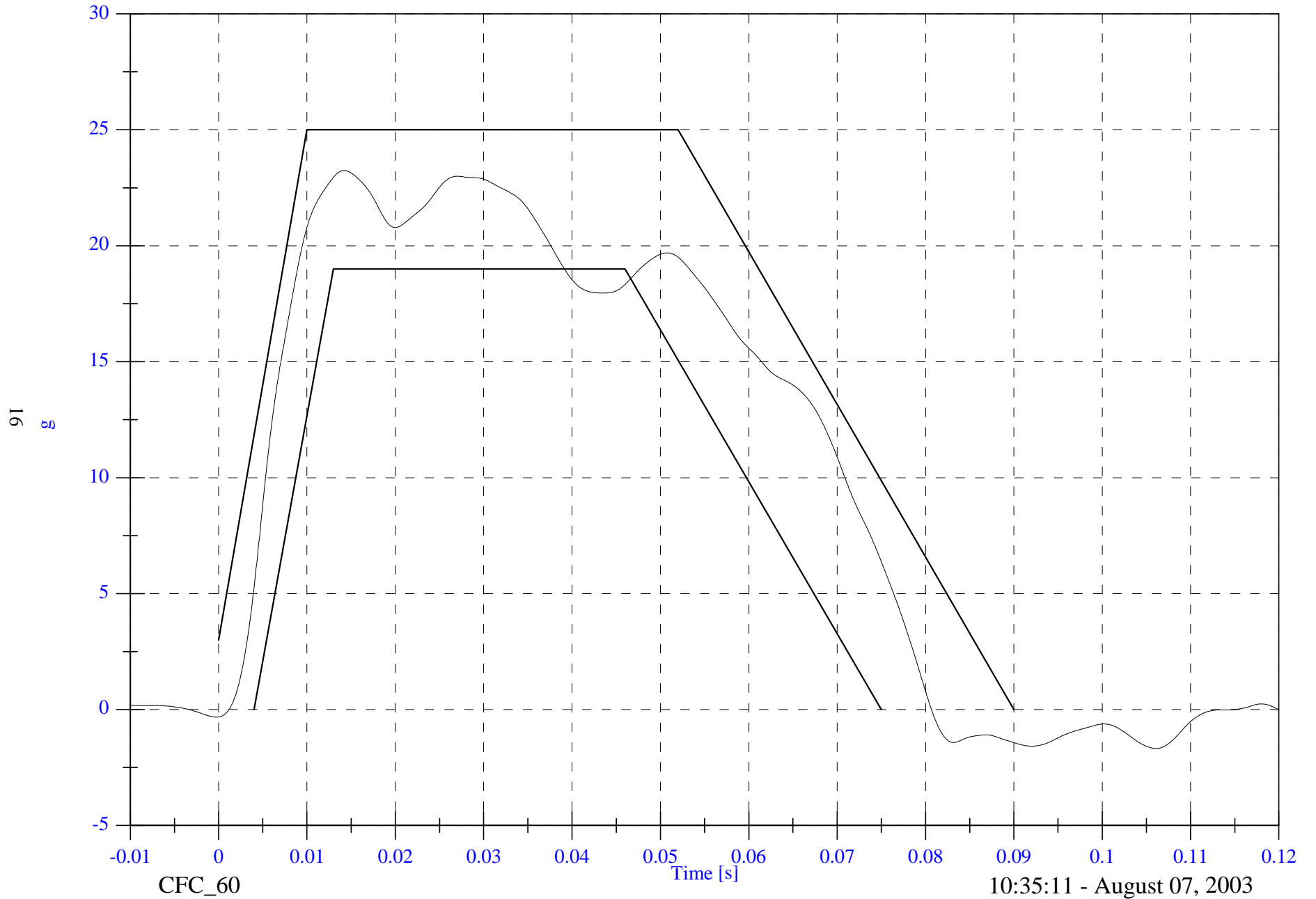
### **Data Plots**

Sled Test NCAP SLED 08-3-21

Sled Pulse Corridor

Max: 23.2 [g] at 0.014 [s]

Min: -1.8 [g] at 0.147 [s]



FACILITY: HYGE SLED  
 TEST#: 08-3-21  
 TITLE: Sled Test NCAP SLED 08-3-21

DATE: August 07, 2003

CHN NAME	Unit	Max	msec	Min	msec	Filt	Comment
49 Sled Acceleration	g	23.2	14.2	-1.8	147.4	CFC_60	
50 Sled Acceleration Velocity	kph	46.3	80.6	-0.1	-12.0	CFC_180	
51 Sled Acceleration Displacement	mm	2629.5	250.0	-0.0	0.9	CFC_180	
52 P3 Head x	g	51.7	187.4	-61.0	92.2	CFC_1000	
53 P3 Head y	g	4.6	92.6	-6.5	91.1	CFC_1000	
54 P3 Head z	g	57.1	76.7	-0.0	4.2	CFC_1000	
55 P3 Head Resultant	g	65.7	92.2	0.0	-11.8	CFC_1000	
56 P3 Upper Neck Fx	N	153.2	174.9	-596.5	90.3	CFC_1000	
57 P3 Upper Neck Fy	N	53.5	65.9	-17.2	169.9	CFC_1000	
58 P3 Upper Neck Fz	N	1489.7	76.1	-113.0	213.4	CFC_1000	
59 P3 Upper Neck F Resultant	N	1550.5	76.1	0.1	-9.4	CFC_1000	
60 P3 Upper Neck Mx	N-m	3.0	71.2	-1.9	103.1	CFC_600	
61 P3 Upper Neck My	N-m	8.3	93.6	-14.1	206.4	CFC_600	
62 P3 Upper Neck Mz	N-m	2.6	247.2	-1.3	130.5	CFC_600	
63 P3 Upper Neck M Resultant	N-m	14.1	206.4	0.0	-9.3	CFC_600	
64 P3 Lower Neck Fx	N	239.3	187.8	-1346.9	77.5	CFC_1000	
65 P3 Lower Neck Fy	N	47.7	66.8	-40.6	99.6	CFC_1000	
66 P3 Lower Neck Fz	N	972.7	74.3	-113.9	127.7	CFC_1000	
67 P3 Lower Neck F Resultant	N	1639.9	76.5	0.1	-14.9	CFC_1000	
68 P3 Lower Neck Mx	N-m	8.3	67.6	-2.4	105.9	CFC_600	
69 P3 Lower Neck My	N-m	105.0	90.2	-16.7	187.8	CFC_600	
70 P3 Lower Neck Mz	N-m	2.5	65.2	-1.9	106.0	CFC_600	
71 P3 Lower Neck M Resultant	N-m	105.1	90.2	0.0	-8.2	CFC_600	
72 P3 Chest x	g	14.1	170.3	-33.6	55.0	CFC_180	
73 P3 Chest y	g	3.0	64.7	-1.5	192.0	CFC_180	
74 P3 Chest z	g	11.5	83.0	-28.3	55.8	CFC_180	
75 P3 Chest Resultant	g	44.0	55.3	0.0	-10.7	CFC_180	
76 P3 Pelvic x	g	28.3	107.3	-48.8	61.0	CFC_1000	
77 P3 Pelvic y	g	3.9	70.6	-3.7	209.9	CFC_1000	
78 P3 Pelvic z	g	10.9	108.4	-40.3	60.5	CFC_1000	
79 P3 Pelvic Resultant	g	63.3	60.5	0.0	-11.3	CFC_1000	

FACILITY: HYGE SLED  
 TEST#: 08-3-21  
 TITLE: Sled Test NCAP SLED 08-3-21

DATE: August 07, 2003

CHN	NAME	Unit	Max	msec	Min	msec	Filt	Comment
80	P3 Head Red z	g	66.3	92.1	-25.2	187.2	CFC_1000	
81	P3 Chest Compression	mm	0.0	-17.5	-21.4	93.0	CFC_600	
82	P3 Upper Neck Mocy	N-m	8.3	93.6	-14.1	206.4	CFC_600	
83	P4 Head x	g	53.3	188.1	-32.8	97.7	CFC_1000	
84	P4 Head y	g	4.9	98.2	-2.6	75.7	CFC_1000	
85	P4 Head z	g	51.4	74.4	-0.4	216.6	CFC_1000	
86	P4 Head Resultant	g	60.0	187.8	0.0	-9.4	CFC_1000	
87	P4 Upper Neck Fx	N	152.0	178.0	-752.6	93.6	CFC_1000	
88	P4 Upper Neck Fy	N	14.2	186.8	-54.2	103.2	CFC_1000	
89	P4 Upper Neck Fz	N	1616.7	82.7	-46.0	212.0	CFC_1000	
90	P4 Upper Neck F Resultant	N	1698.3	82.7	0.1	-14.4	CFC_1000	
91	P4 Upper Neck Mx	N-m	0.5	234.8	-1.6	160.6	CFC_600	
92	P4 Upper Neck My	N-m	7.6	142.2	-13.0	204.3	CFC_600	
93	P4 Upper Neck Mz	N-m	2.7	102.3	-1.2	248.2	CFC_600	
94	P4 Upper Neck M Resultant	N-m	13.0	204.3	0.0	-10.7	CFC_600	
95	P4 Lower Neck Fx	N	229.9	187.6	-1284.8	82.9	CFC_1000	
96	P4 Lower Neck Fy	N	69.2	86.5	-44.9	199.8	CFC_1000	
97	P4 Lower Neck Fz	N	952.1	77.1	-114.3	57.1	CFC_1000	
98	P4 Lower Neck F Resultant	N	1520.9	82.6	0.1	-9.3	CFC_1000	
99	P4 Lower Neck Mx	N-m	2.4	187.8	-6.3	103.2	CFC_600	
100	P4 Lower Neck My	N-m	117.2	91.7	-14.8	187.8	CFC_600	
101	P4 Lower Neck Mz	N-m	0.5	28.5	-3.1	119.0	CFC_600	
102	P4 Lower Neck M Resultant	N-m	117.2	91.7	0.0	-10.0	CFC_600	
103	P4 Chest x	g	19.6	173.7	-32.9	53.2	CFC_180	
104	P4 Chest y	g	2.7	39.2	-2.2	87.7	CFC_180	
105	P4 Chest z	g	12.4	196.3	-34.1	56.1	CFC_180	
106	P4 Chest Resultant	g	45.2	54.3	0.0	-14.0	CFC_180	
107	P4 Pelvic x	g	37.1	110.1	-39.7	54.8	CFC_1000	
108	P4 Pelvic y	g	3.4	123.8	-5.0	62.3	CFC_1000	
109	P4 Pelvic z	g	99.3	24.7	-62.3	116.2	CFC_1000	
110	P4 Pelvic Resultant	g	99.3	24.7	0.0	-13.5	CFC_1000	

FACILITY: HYGE SLED  
TEST#: 08-3-21  
TITLE: Sled Test NCAP SLED 08-3-21

DATE: August 07, 2003

CHN NAME	Unit	Max	msec	Min	msec	Filt	Comment
111 P4 Head Red z	g	65.3	77.4	-21.0	192.8	CFC_1000	
112 P4 Chest Compression	mm	0.0	-17.0	-31.8	100.7	CFC_600	
113 P4 Upper Neck Mocy	N-m	7.6	142.2	-13.0	204.3	CFC_600	

FACILITY: HYGE SLED  
TEST#: 08-3-21  
TITLE: Sled Test NCAP SLED 08-3-21  
Version 5.00

DATE: August 07, 2003

=====

P3 HIC(36 ms): 502.5  
t1: 60.3 msec  
t2: 95.6 msec  
Duration: 35.3 msec  
Average Acceleration: 45.9 g  
Input channels: P3 Head x (2) CFC\_1000  
P3 Head y (3) CFC\_1000  
P3 Head z (4) CFC\_1000

P3 UP NECK Fx: Max: 153.2 N 174.9 msec  
Min: -596.5 N 90.3 msec  
Input channel: P3 Upper Neck Fx (6) CFC\_1000

P3 UP NECK Fz: Max: 1489.7 N 76.1 msec  
Min: -113.0 N 213.4 msec  
Input channel: P3 Upper Neck Fz (8) CFC\_1000

P3 UP NECK Mocy (3YO Child OOP)  
Max: 8.3 N-m 93.6 msec  
Min: -14.1 N-m 206.4 msec  
Input channels: P3 Upper Neck Fx (6) CFC\_600  
P3 Upper Neck My (10) CFC\_600  
Docy: 0

P3 UP NECK Nij (3YO Child OOP)  
Ntf: 0.75 Nij 78.9 msec CVt: 2120 CVf: 68  
Nte: 0.63 Nij 187.8 msec CVt: 2120 CVe: 27  
Ncf: 0.00 Nij -12.4 msec CVc: 2120 CVf: 68  
Nce: 0.57 Nij 207.1 msec CVc: 2120 CVe: 27  
Input channels: P3 Upper Neck Fz (8) CFC\_600  
P3 Upper Neck Mocy [N-m, CFC\_600] (101)

FACILITY: HYGE SLED  
TEST#: 08-3-21  
TITLE: Sled Test NCAP SLED 08-3-21  
Version 5.00

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=====

P3 CLIP(3 ms): 43.3 g  
t1: 53.8 msec  
t2: 56.8 msec  
Duration: 3.0 msec

P3 CSI: 314.1  
Input channels: P3 Chest x (18) CFC\_180  
P3 Chest y (19) CFC\_180  
P3 Chest z (20) CFC\_180

P3 CHEST DISP: Max: 0.0 mm -17.5 msec  
Min: -21.4 mm 93.0 msec  
Input channel: P3 Chest Compression (21) CFC\_600

=====

P3 HIC(15 ms): 323.5  
t1: 68.0 msec  
t2: 83.0 msec  
Duration: 15.0 msec  
Average Acceleration: 54.1 g  
Input channels: P3 Head x (2) CFC\_1000  
P3 Head y (3) CFC\_1000  
P3 Head z (4) CFC\_1000

=====

FACILITY: HYGE SLED  
TEST#: 08-3-21  
TITLE: Sled Test NCAP SLED 08-3-21  
Version 5.00

DATE: August 07, 2003

=====

P4 HIC(36 ms): 516.7  
t1: 63.5 msec  
t2: 99.5 msec  
Duration: 36.0 msec  
Average Acceleration: 46.0 g  
Input channels: P4 Head x (25) CFC\_1000  
P4 Head y (26) CFC\_1000  
P4 Head z (27) CFC\_1000

P4 UP NECK Fx: Max: 152.0 N 178.0 msec  
Min: -752.6 N 93.6 msec  
Input channel: P4 Upper Neck Fx (29) CFC\_1000

P4 UP NECK Fz: Max: 1616.7 N 82.7 msec  
Min: -46.0 N 212.0 msec  
Input channel: P4 Upper Neck Fz (31) CFC\_1000

P4 UP NECK Mocy (3YO Child OOP)  
Max: 7.6 N-m 142.2 msec  
Min: -13.0 N-m 204.3 msec  
Input channels: P4 Upper Neck Fx (29) CFC\_600  
P4 Upper Neck My (33) CFC\_600  
Docy: 0

P4 UP NECK Nij (3YO Child OOP)  
Ntf: 0.72 Nij 77.4 msec CVt: 2120 CVf: 68  
Nte: 1.02 Nij 88.9 msec CVt: 2120 CVe: 27  
Ncf: 0.00 Nij 0.6 msec CVc: 2120 CVf: 68  
Nce: 0.41 Nij 207.9 msec CVc: 2120 CVe: 27  
Input channels: P4 Upper Neck Fz (31) CFC\_600  
P4 Upper Neck Mocy [N-m, CFC\_600] (107)

FACILITY: HYG SLED  
TEST#: 08-3-21  
TITLE: Sled Test NCAP SLED 08-3-21  
Version 5.00

DATE: August 07, 2003

=====

P4 CLIP(3 ms): 44.1 g  
t1: 53.0 msec  
t2: 56.0 msec  
Duration: 3.0 msec

P4 CSI: 300.9  
Input channels: P4 Chest x (41) CFC\_180  
P4 Chest y (42) CFC\_180  
P4 Chest z (43) CFC\_180

P4 CHEST DISP: Max: 0.0 mm -17.0 msec  
Min: -31.8 mm 100.7 msec  
Input channel: P4 Chest Compression (44) CFC\_600

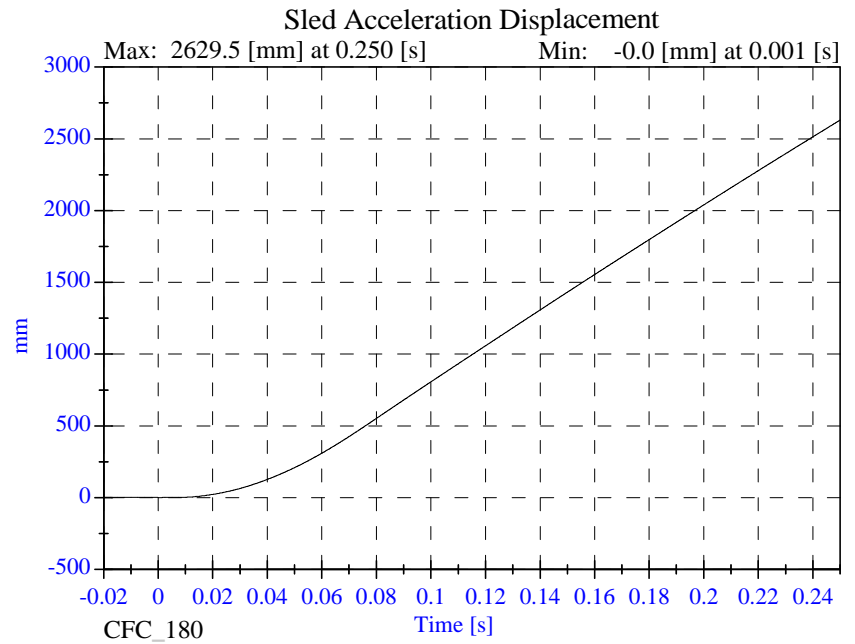
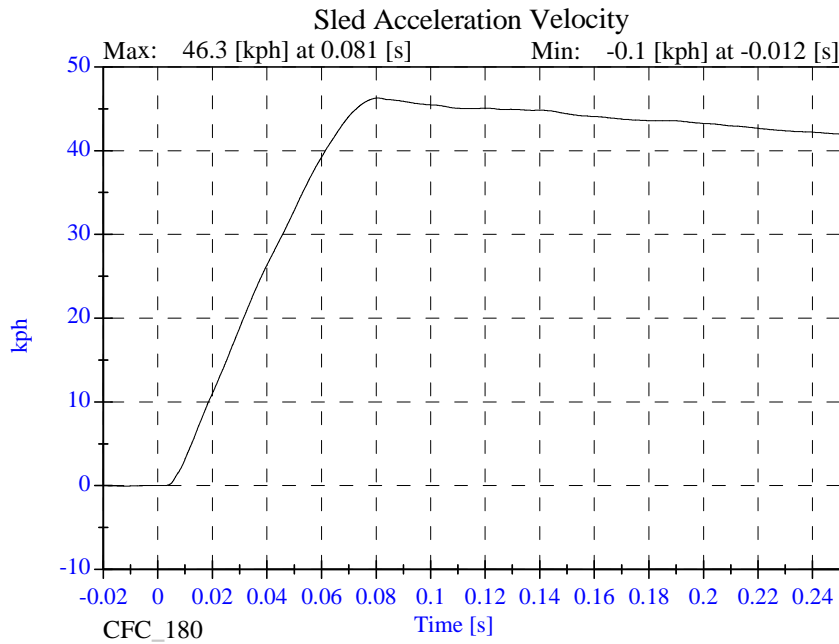
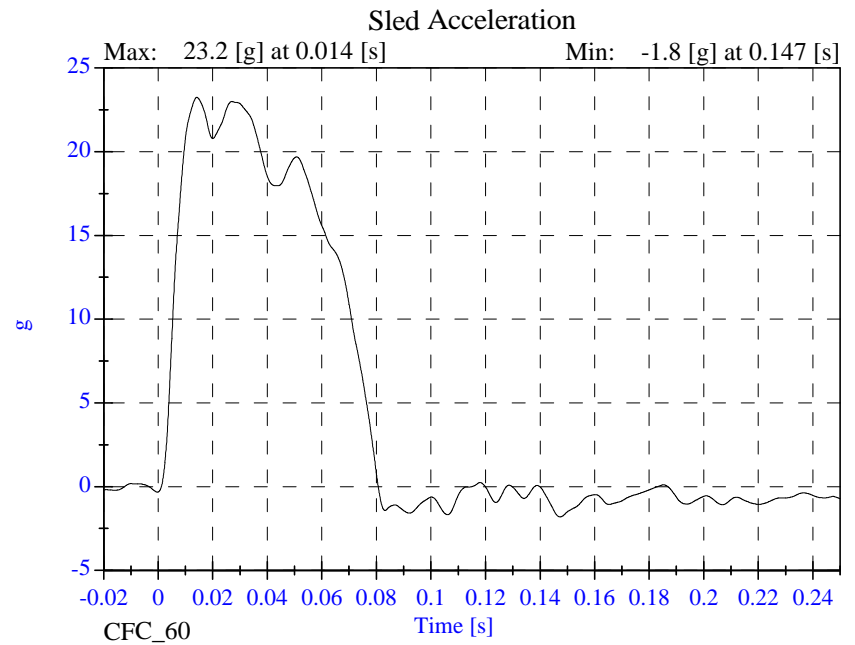
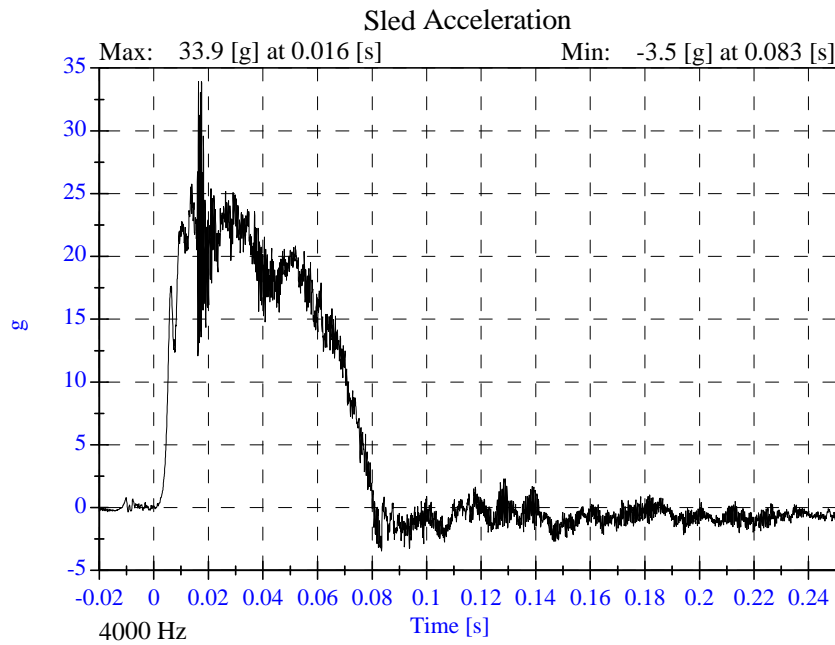
=====

P4 HIC(15 ms): 305.3  
t1: 69.7 msec  
t2: 84.7 msec  
Duration: 15.0 msec  
Average Acceleration: 52.9 g  
Input channels: P4 Head x (25) CFC\_1000  
P4 Head y (26) CFC\_1000  
P4 Head z (27) CFC\_1000

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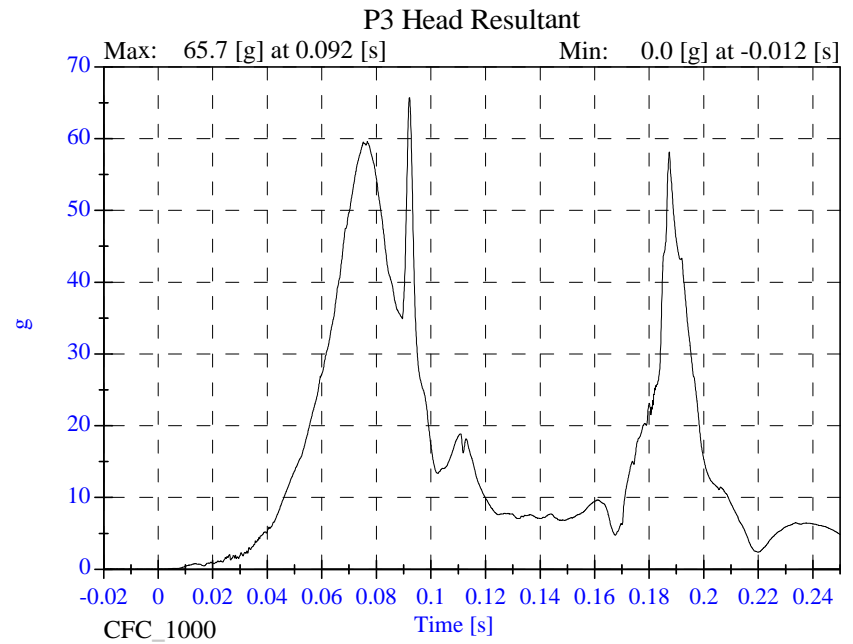
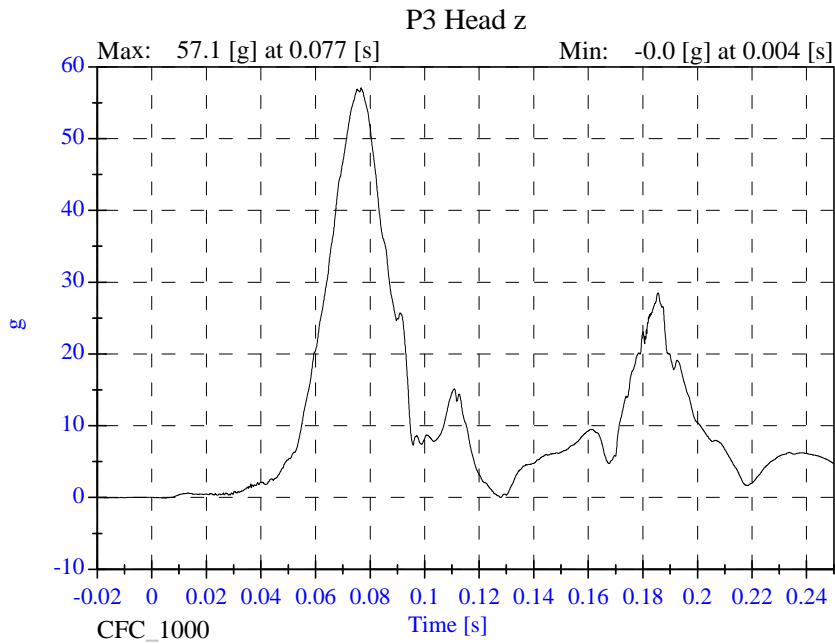
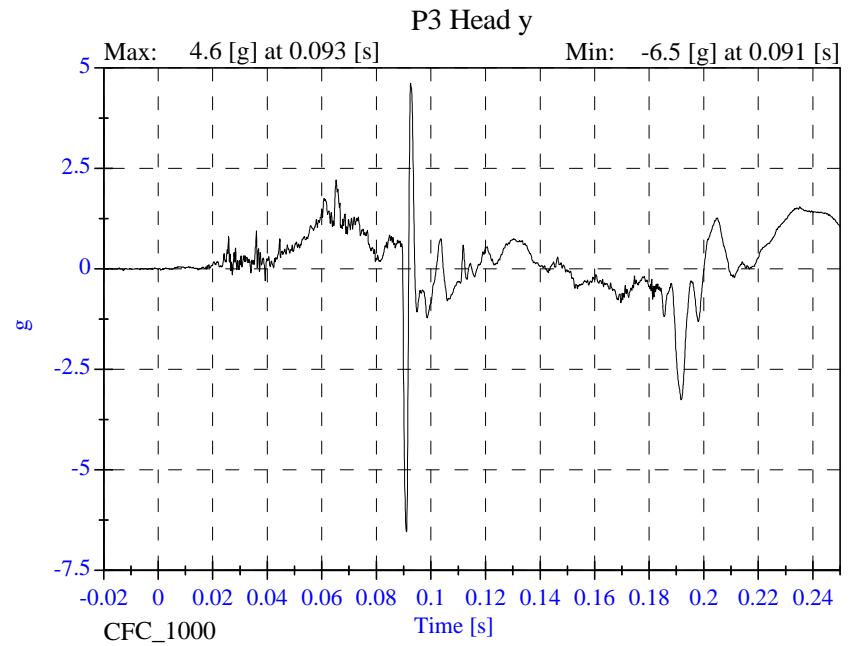
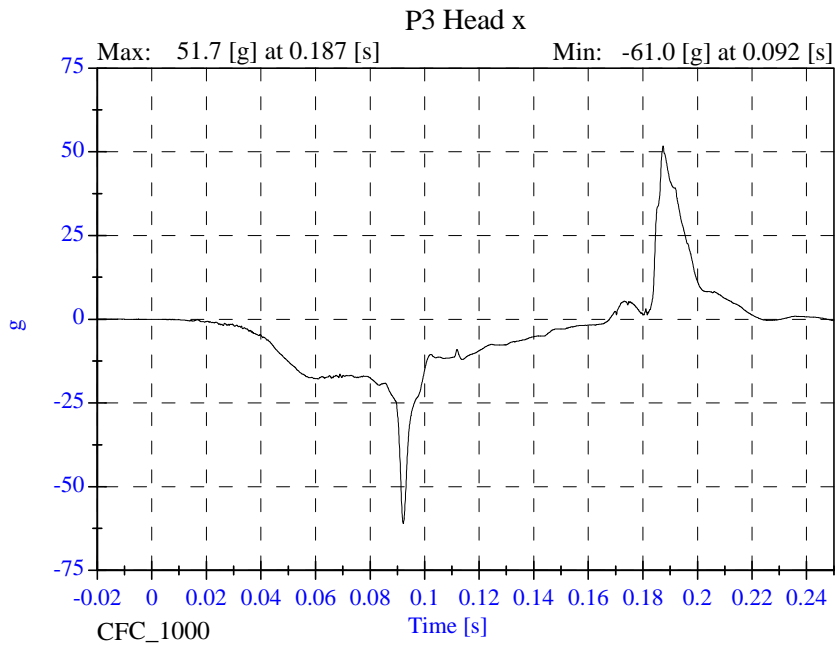
# Sled Test NCAP SLED 08-3-21

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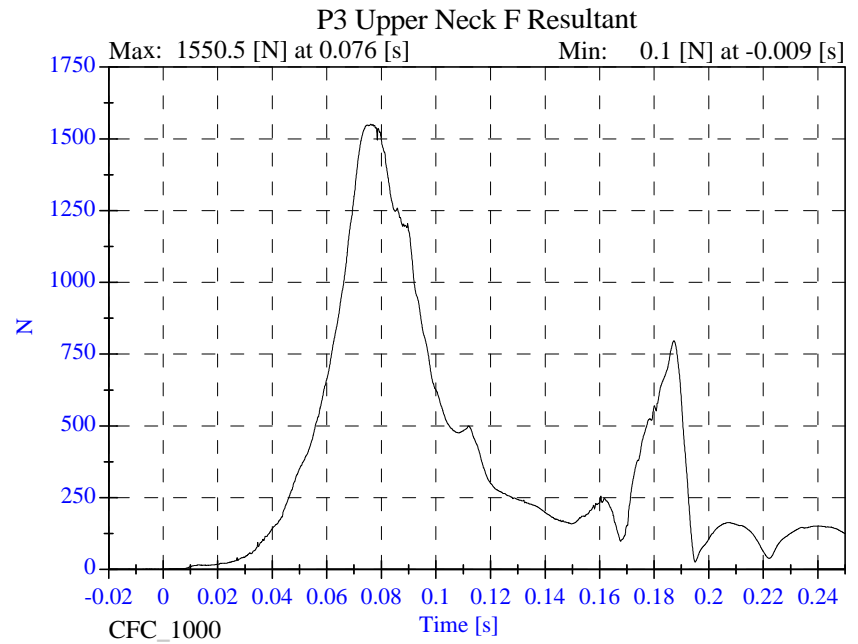
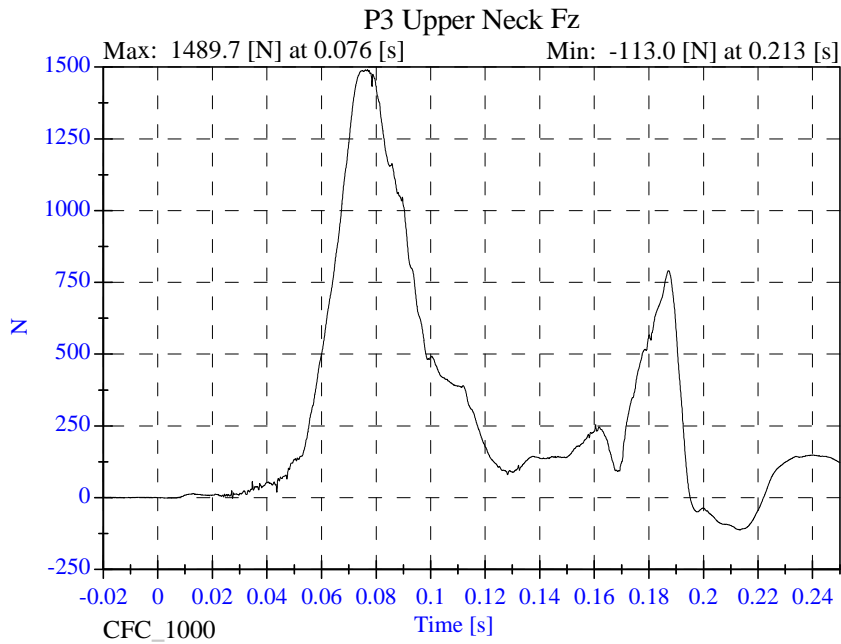
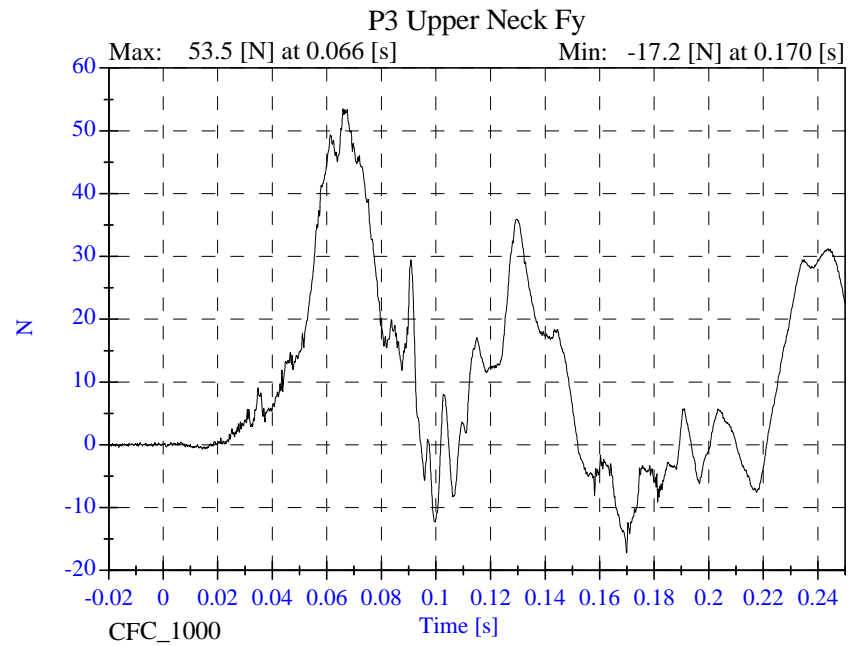
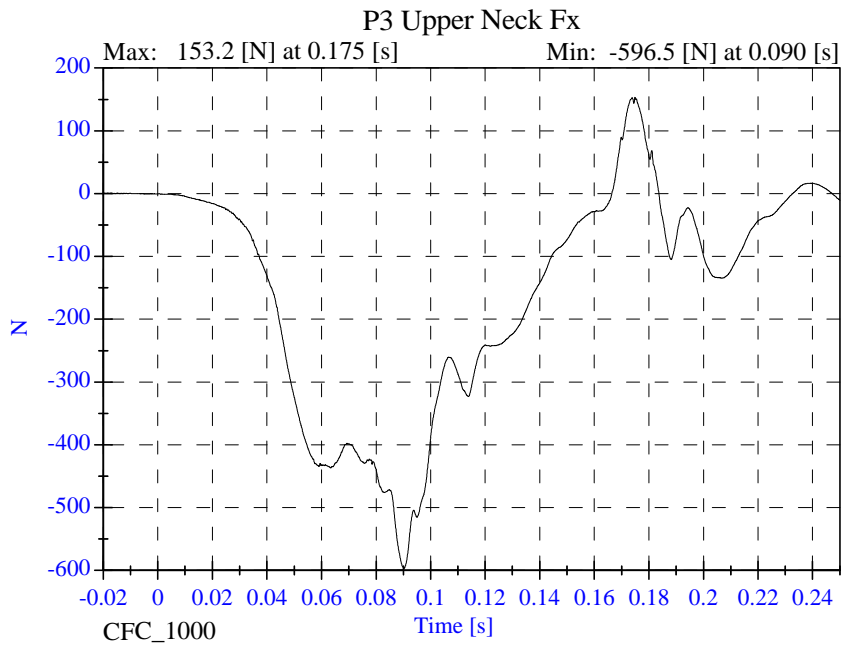
# Sled Test NCAP SLED 08-3-21

- August 07, 2003



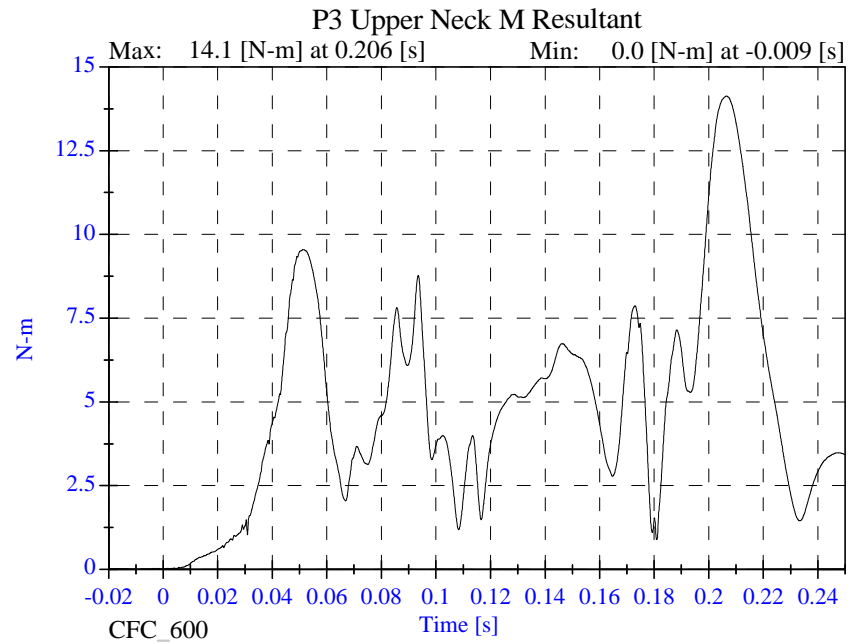
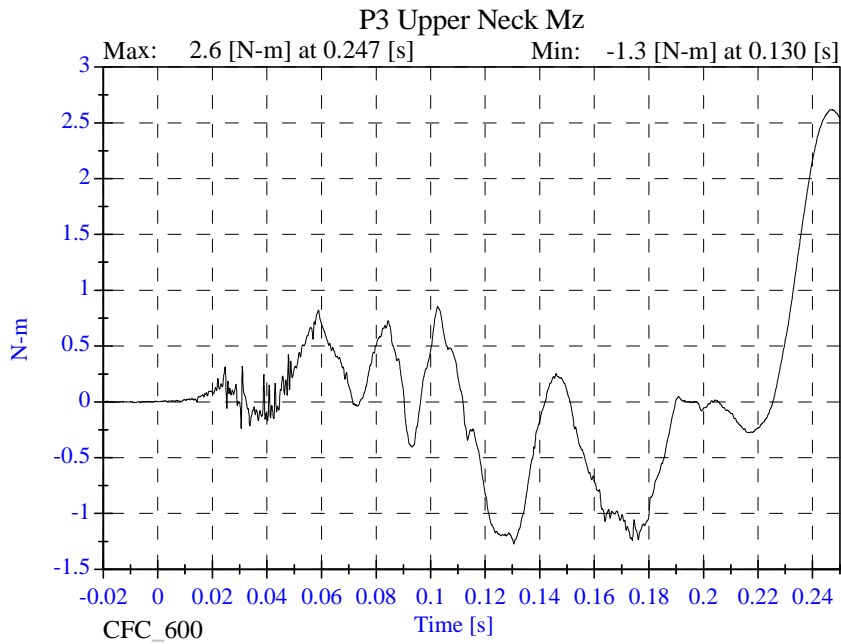
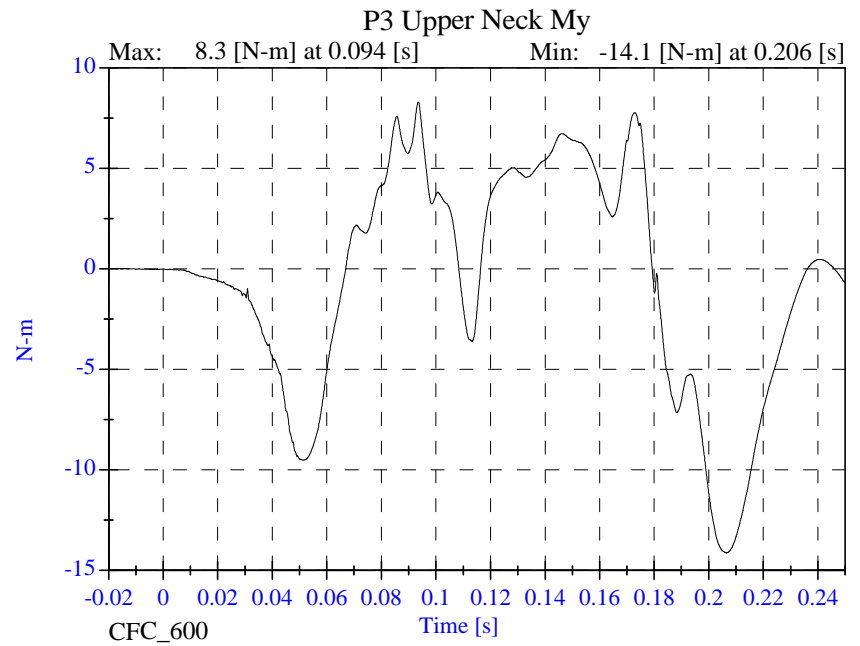
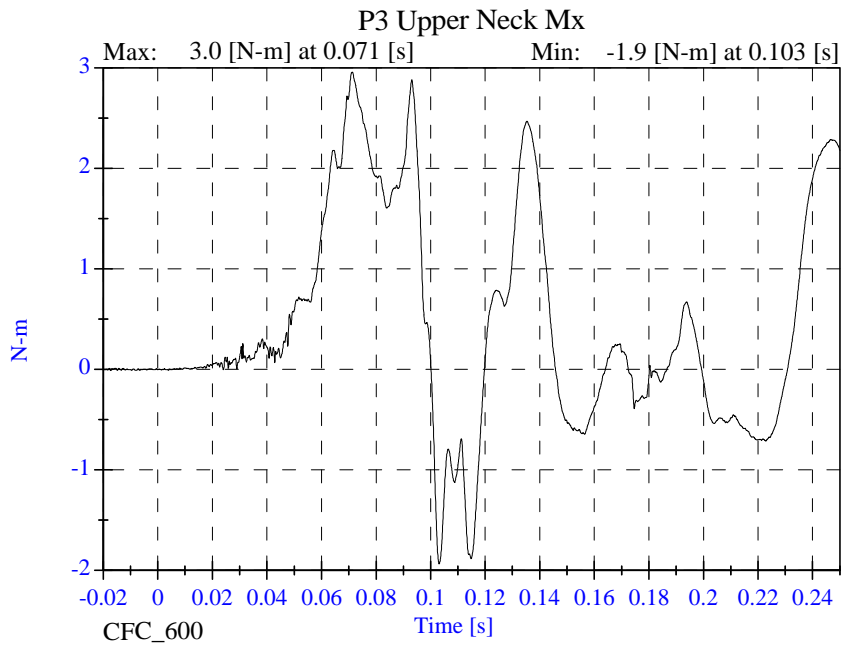
# Sled Test NCAP SLED 08-3-21

- August 07, 2003



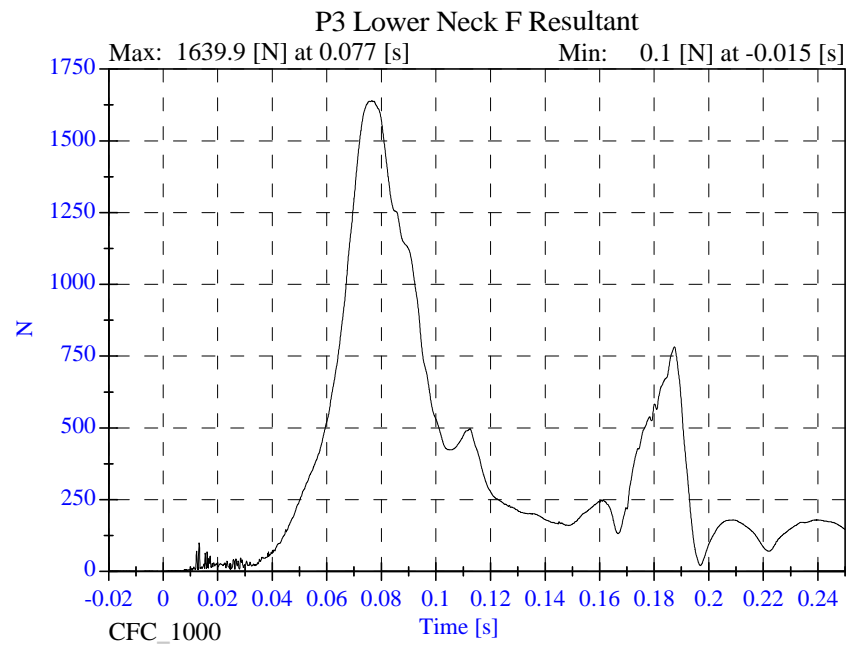
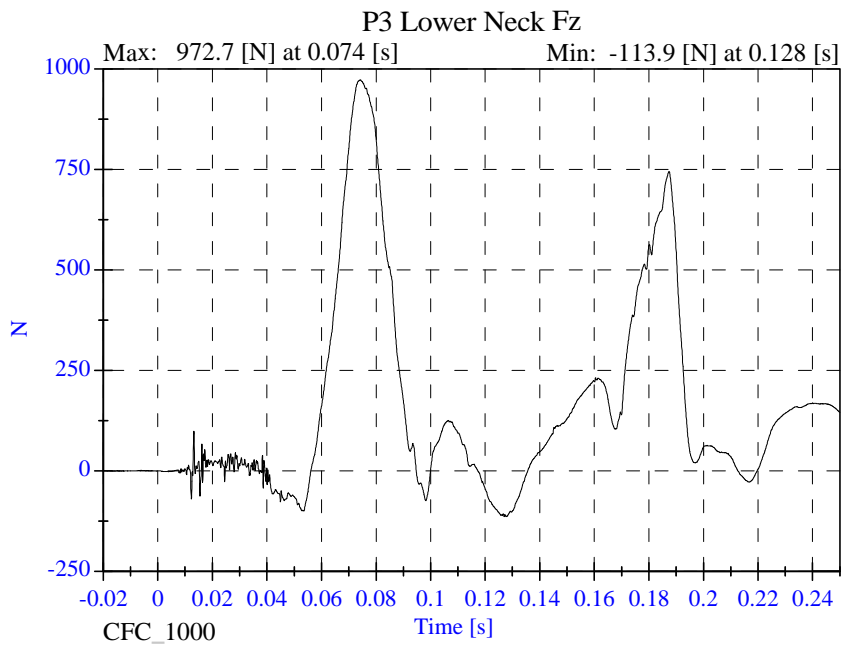
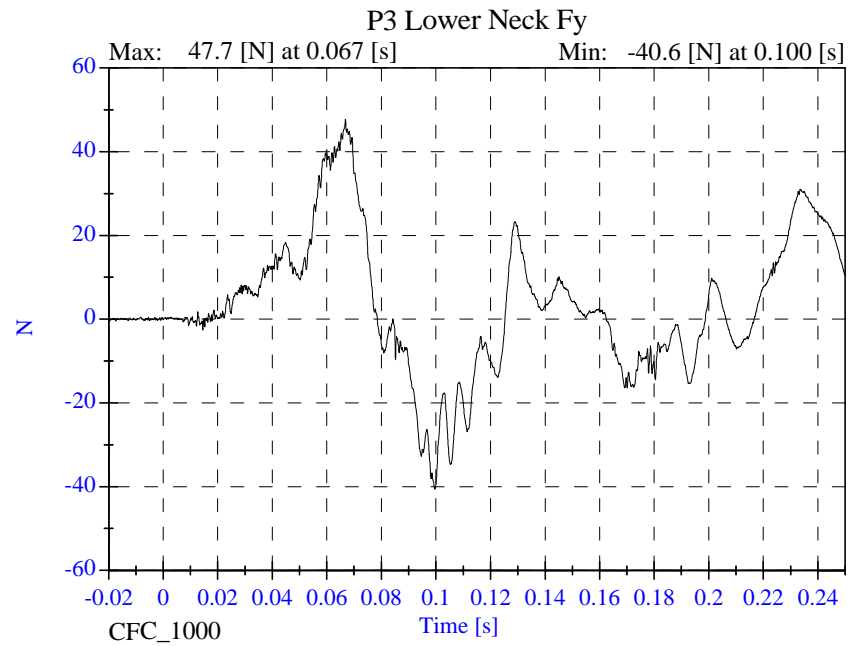
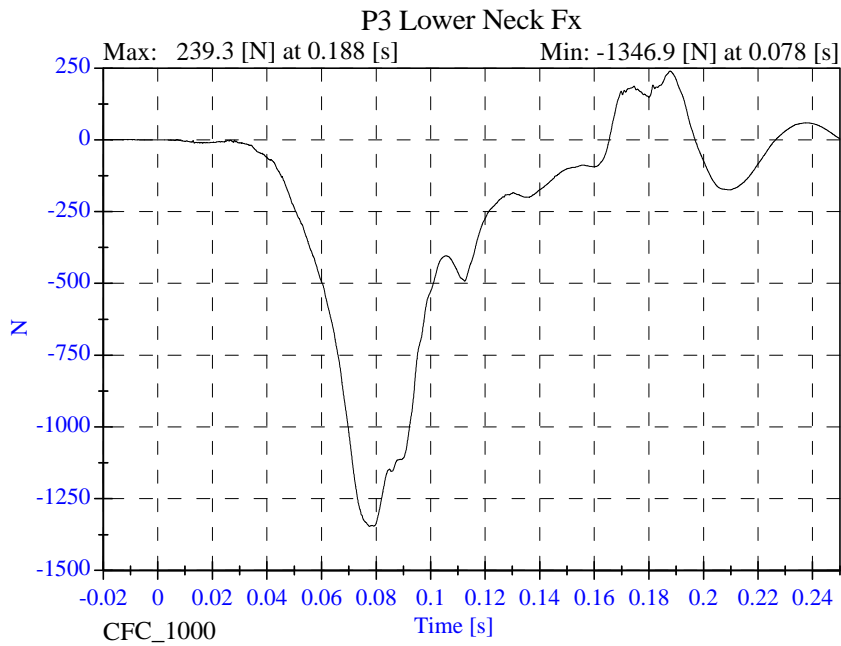
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- August 07, 2003



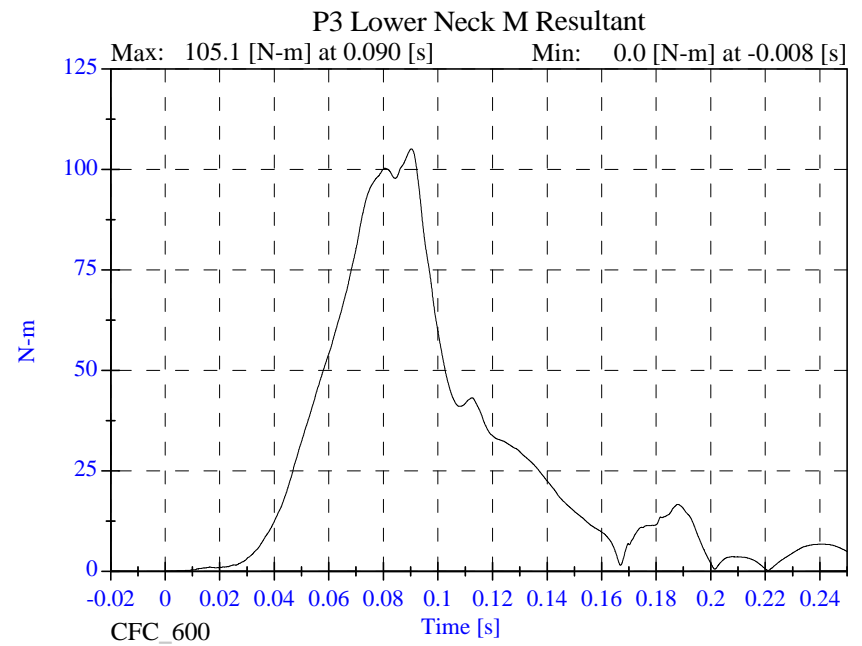
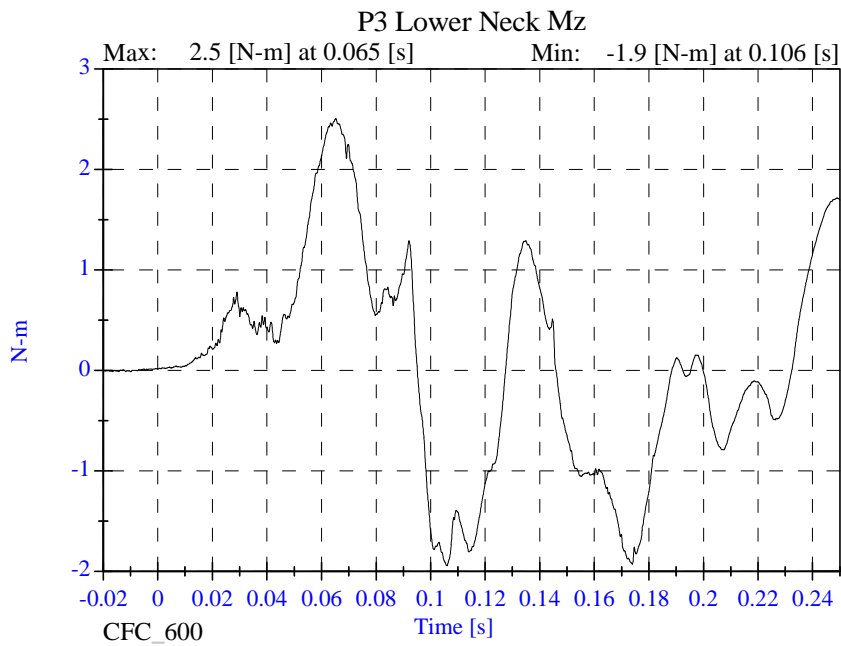
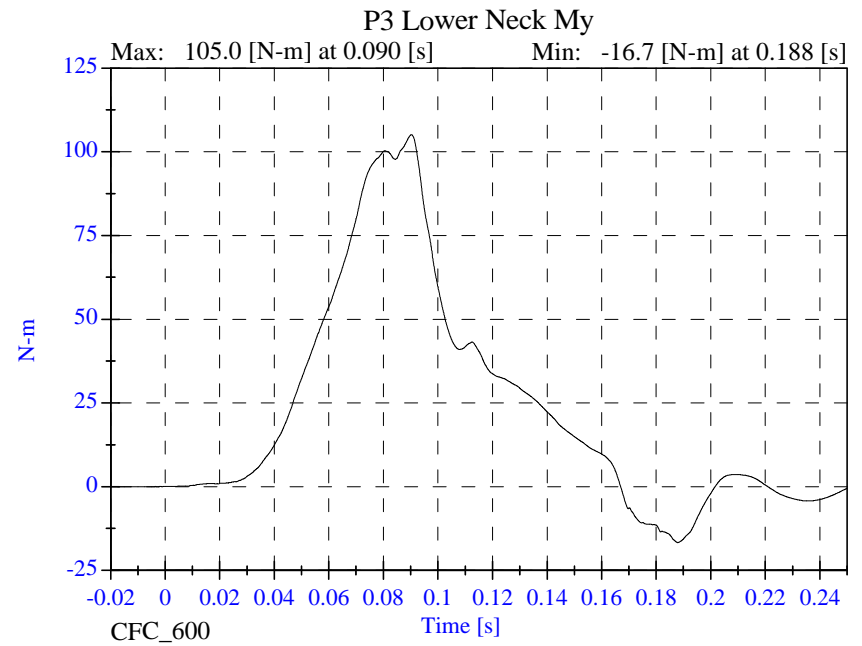
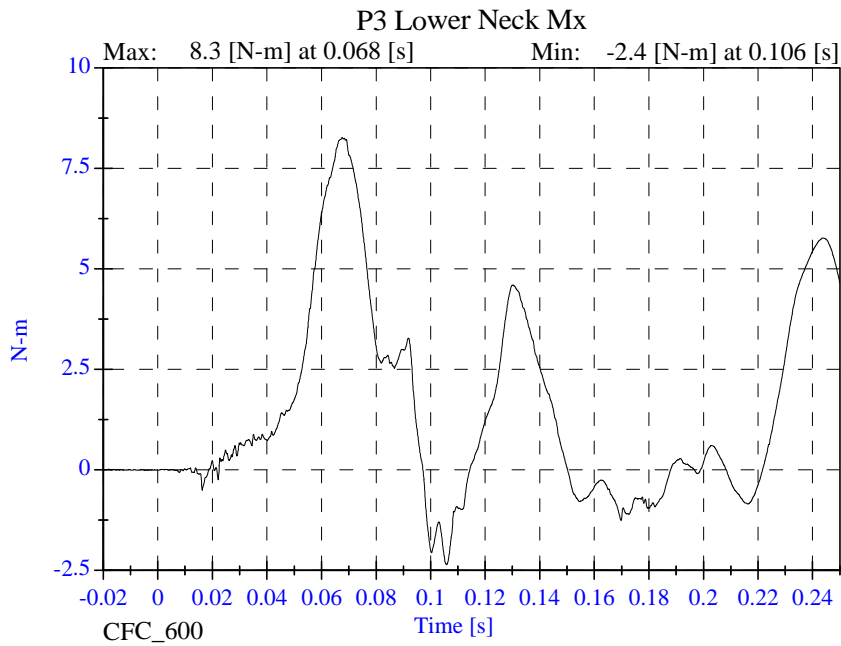
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- August 07, 2003



# Sled Test NCAP SLED 08-3-21

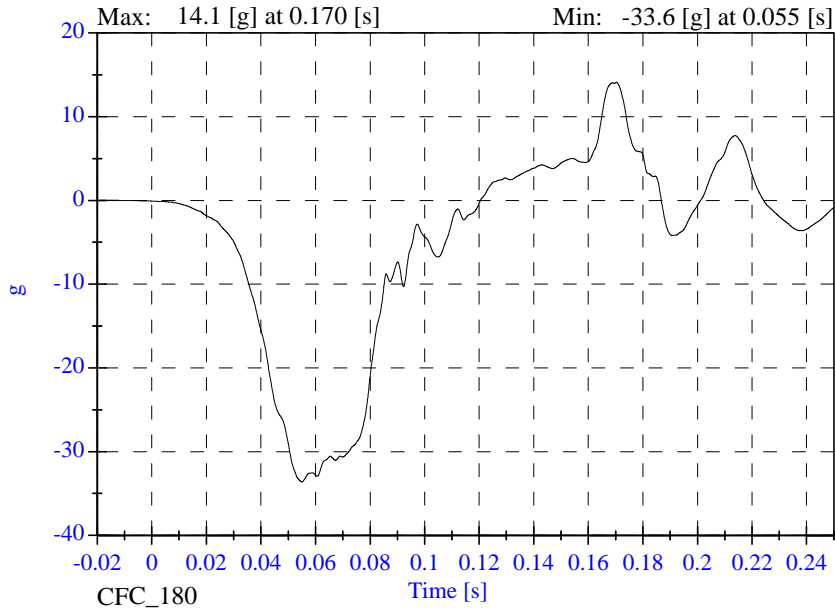
- August 07, 2003



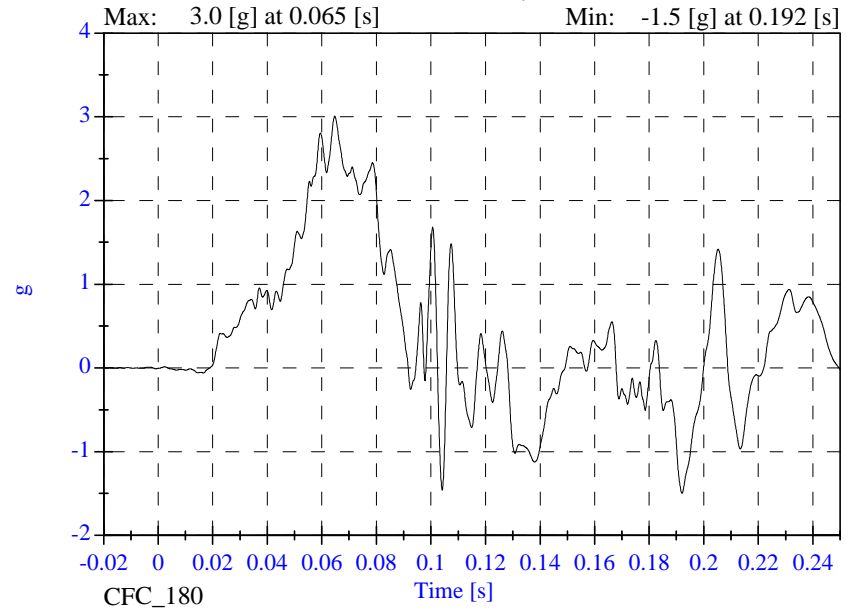
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- August 07, 2003

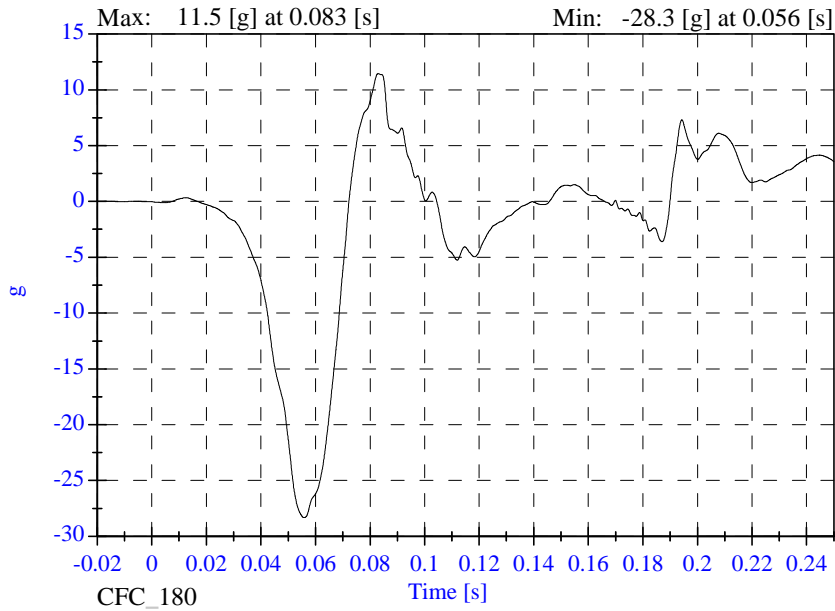
### P3 Chest x



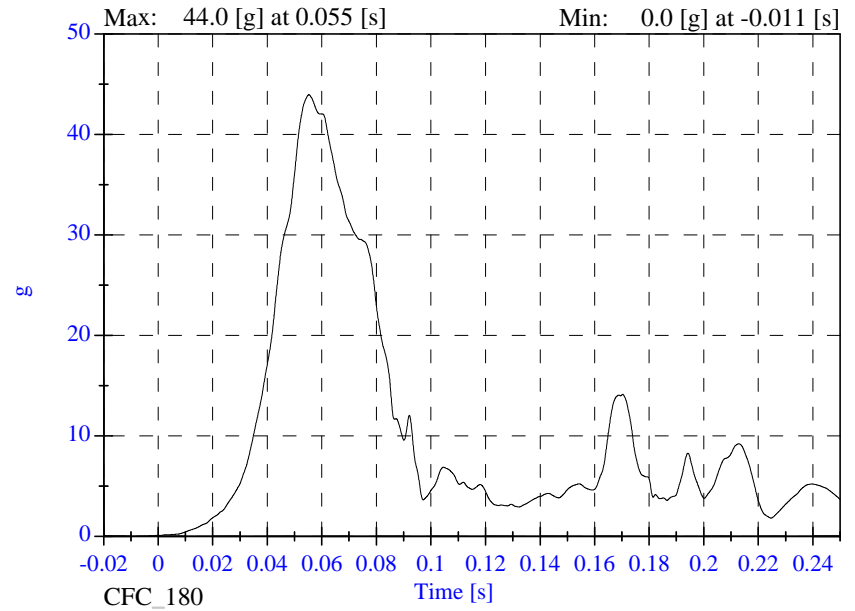
### P3 Chest y



### P3 Chest z

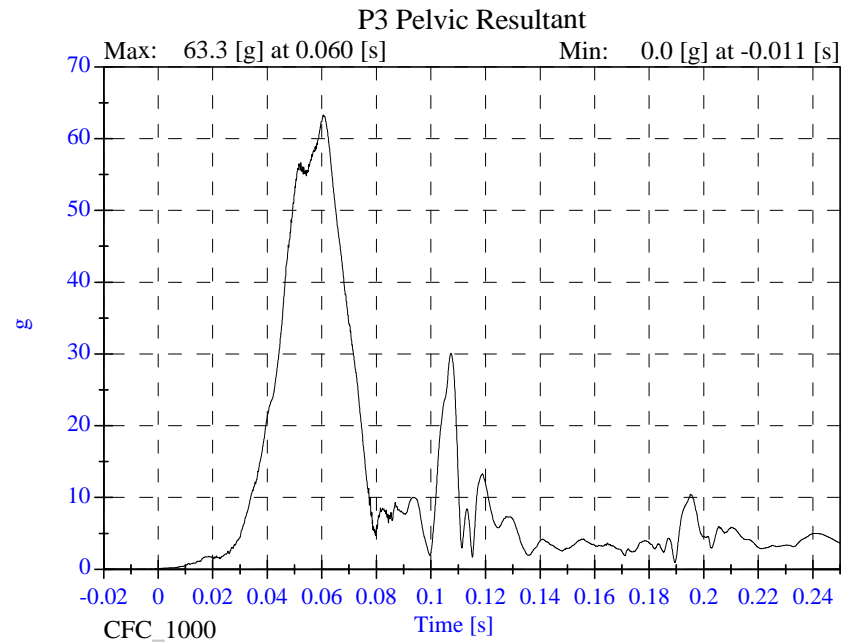
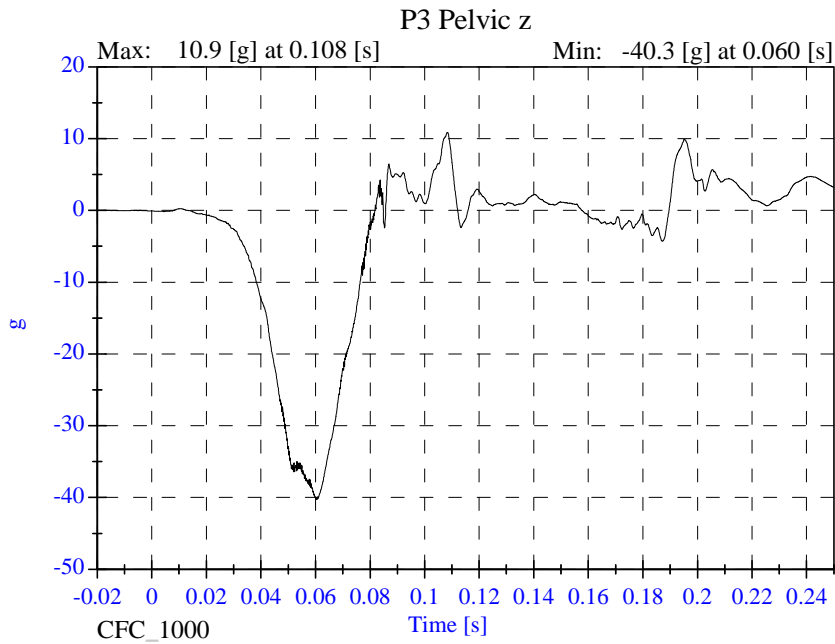
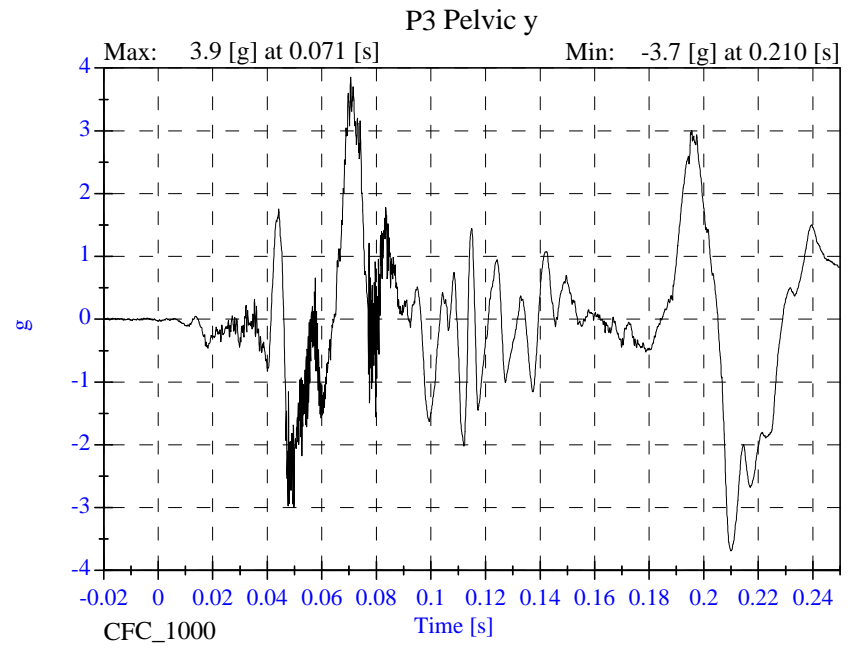
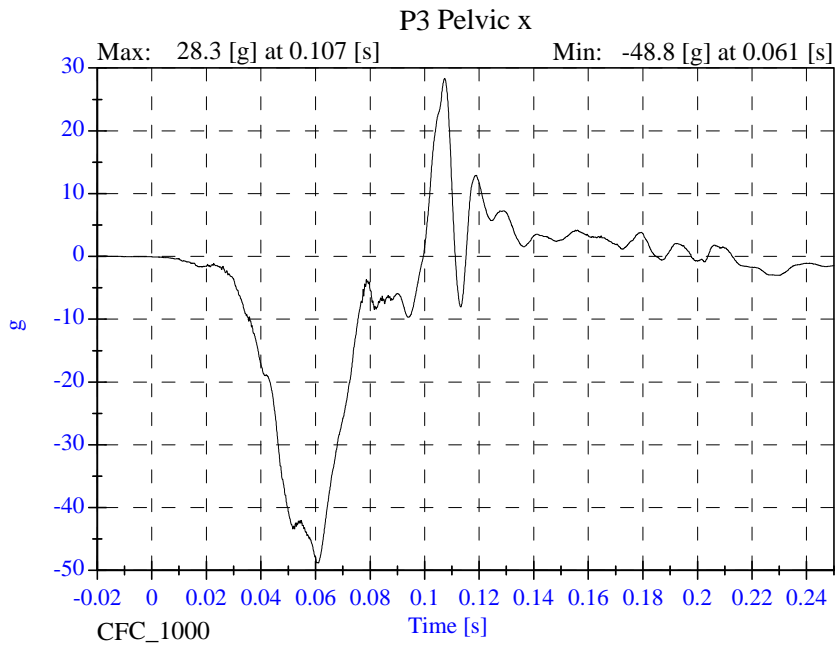


### P3 Chest Resultant



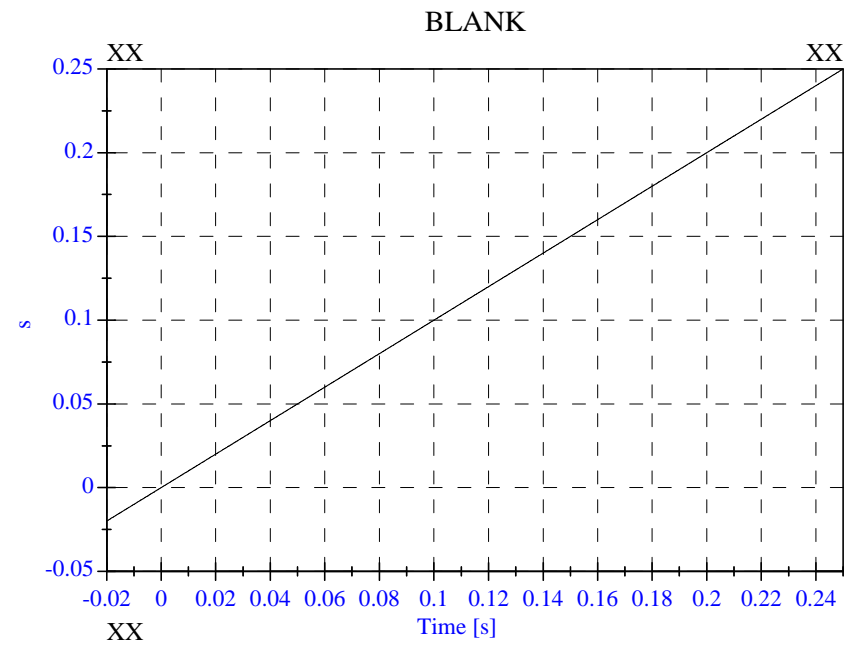
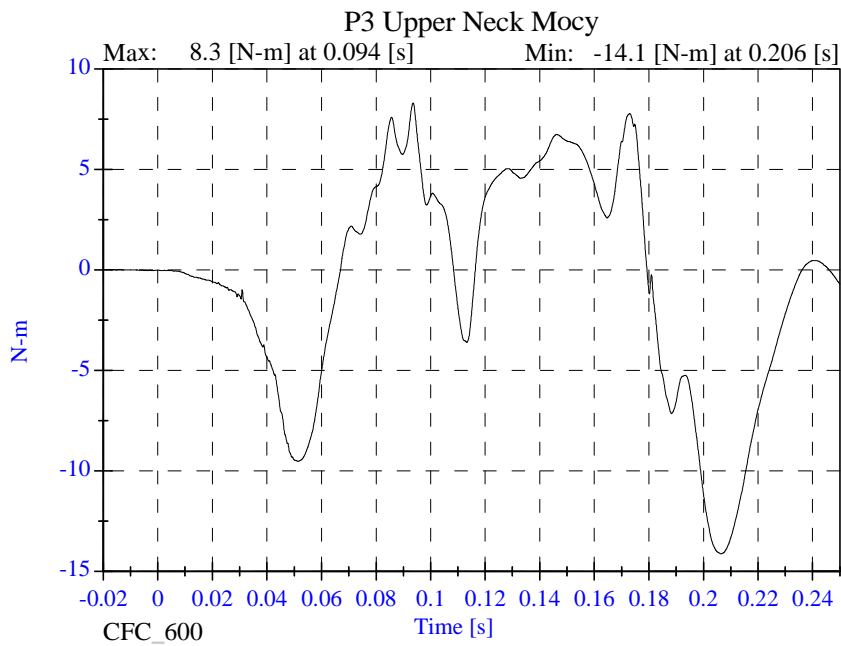
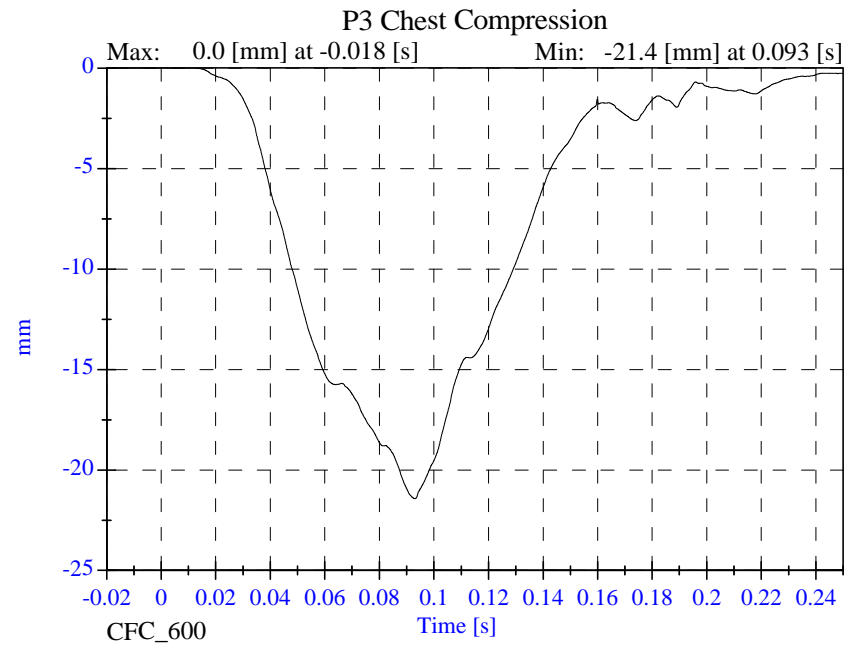
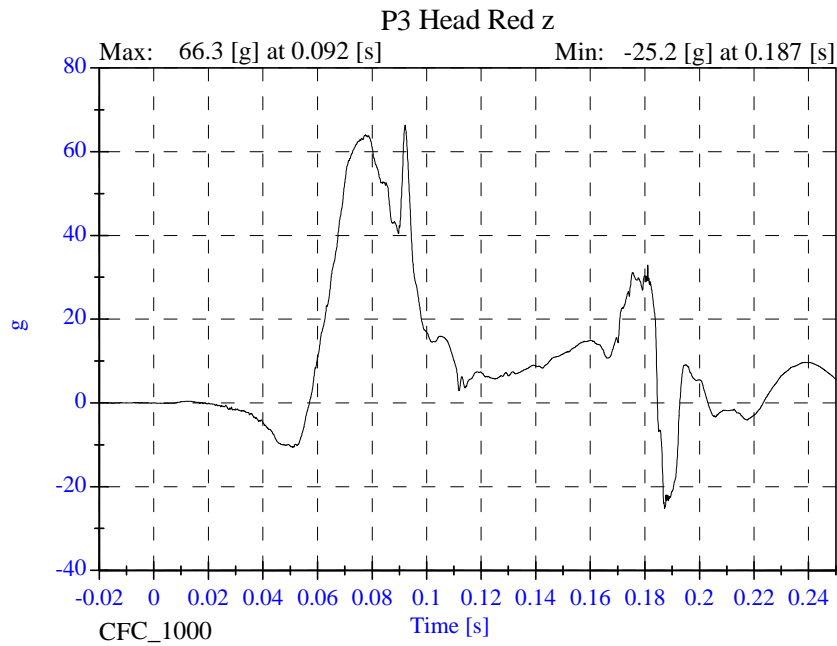
# Sled Test NCAP SLED 08-3-21

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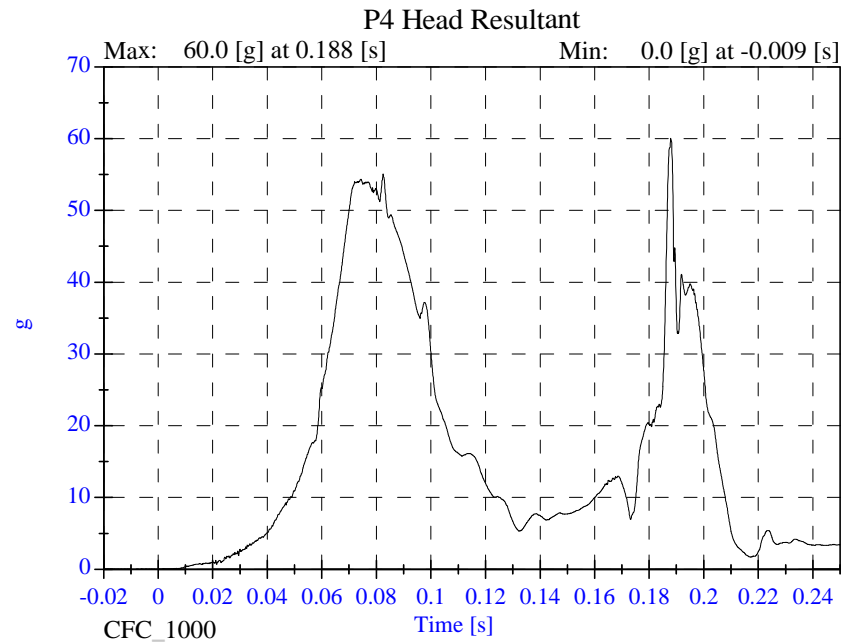
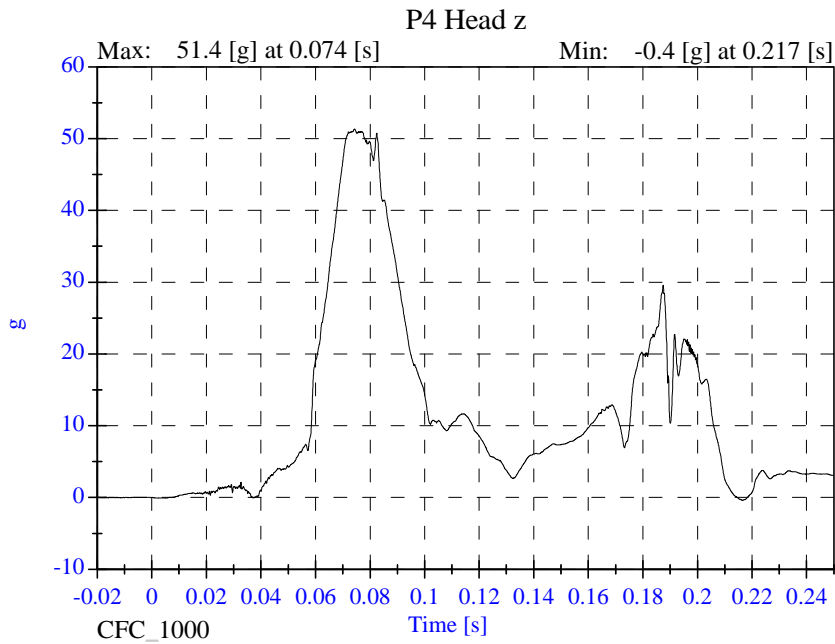
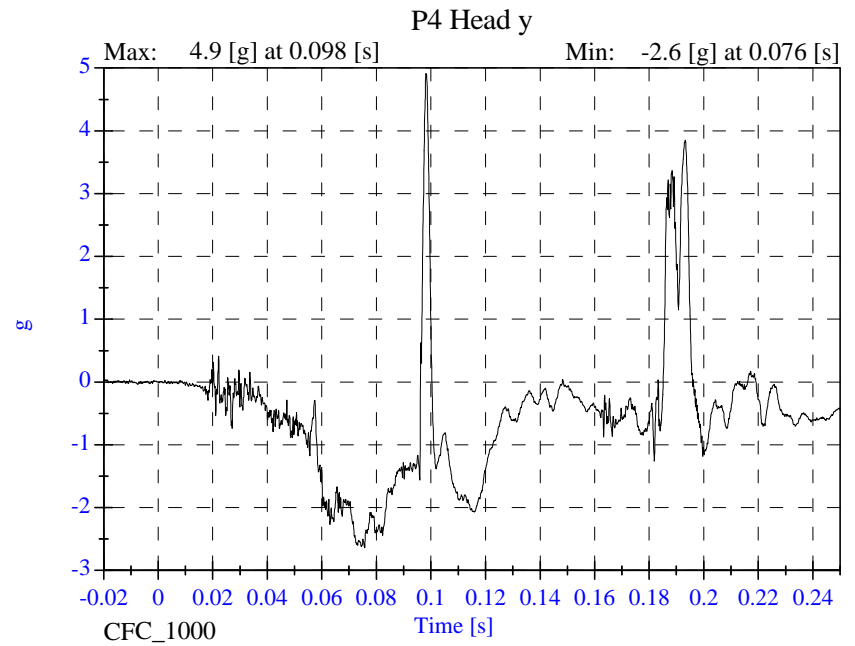
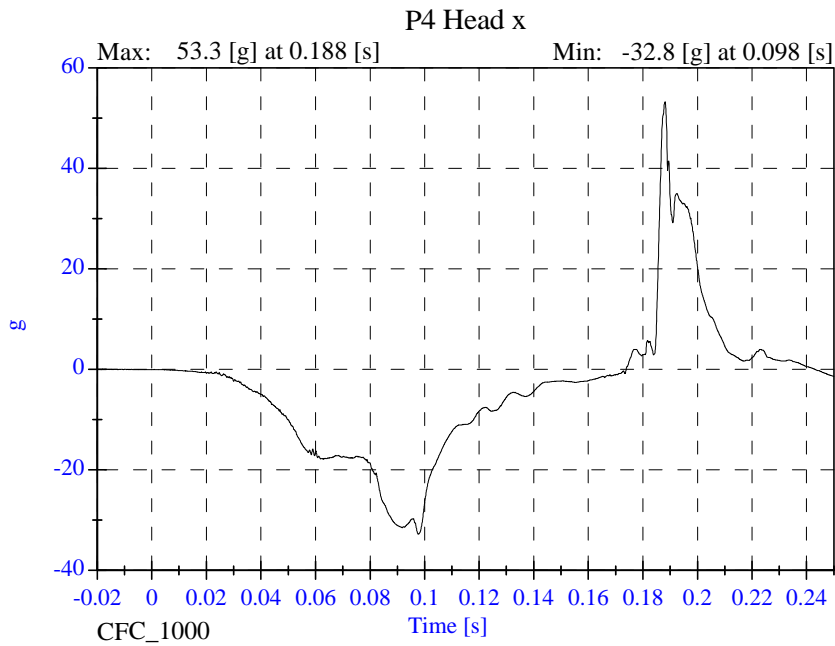
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- August 07, 2003



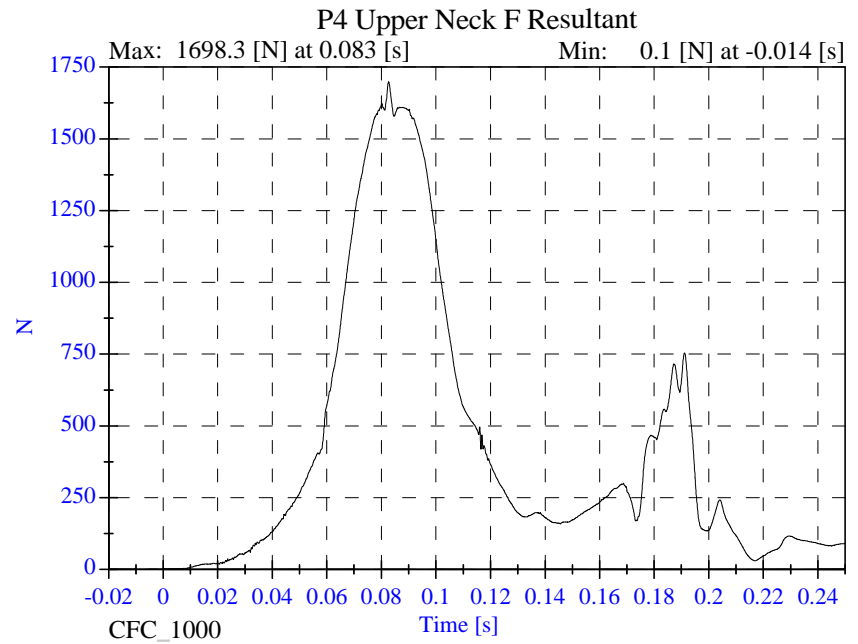
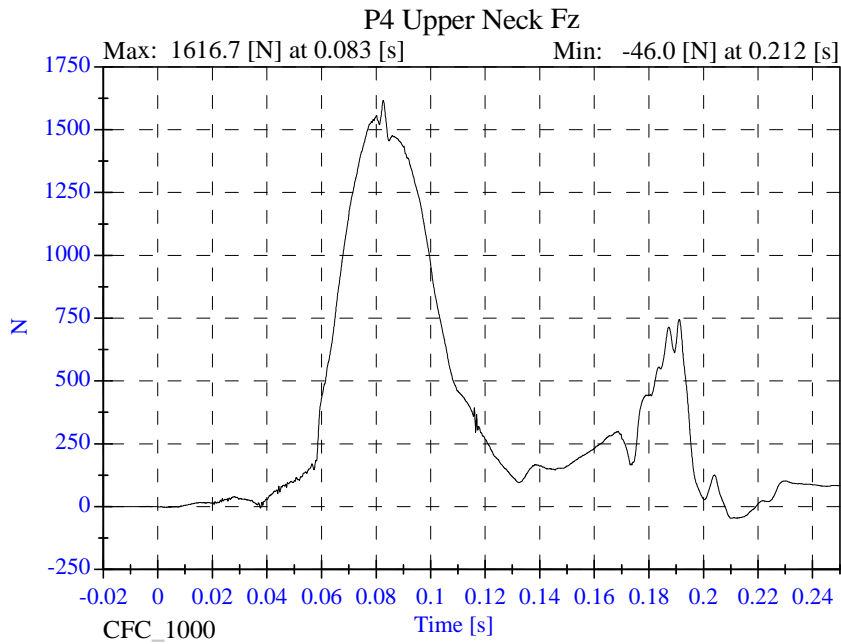
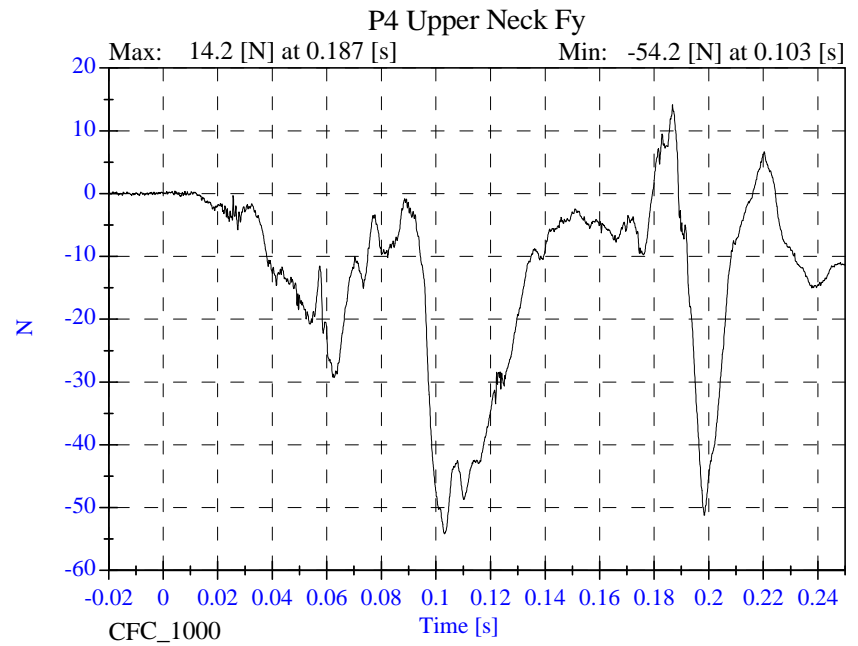
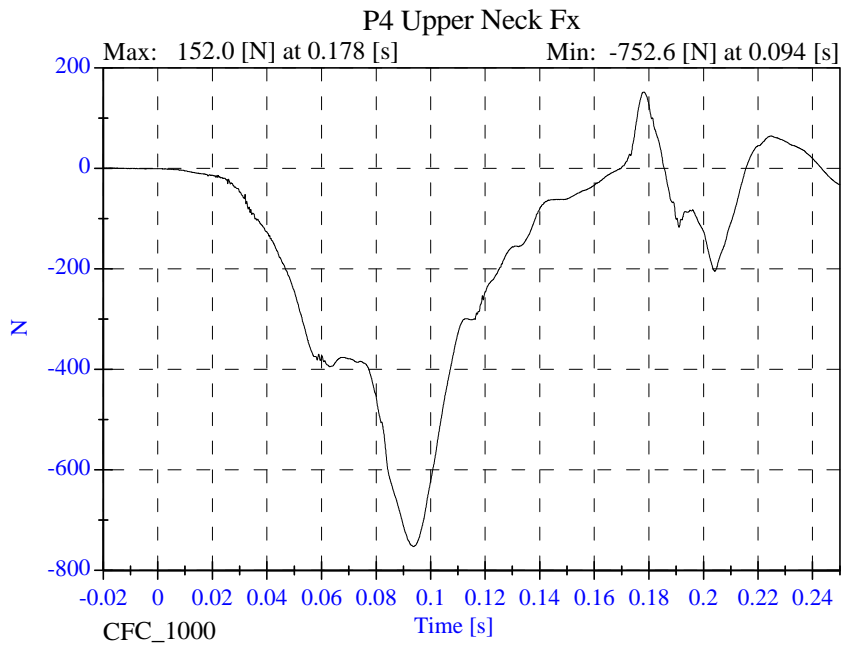
# Sled Test NCAP SLED 08-3-21

- August 07, 2003



# Sled Test NCAP SLED 08-3-21

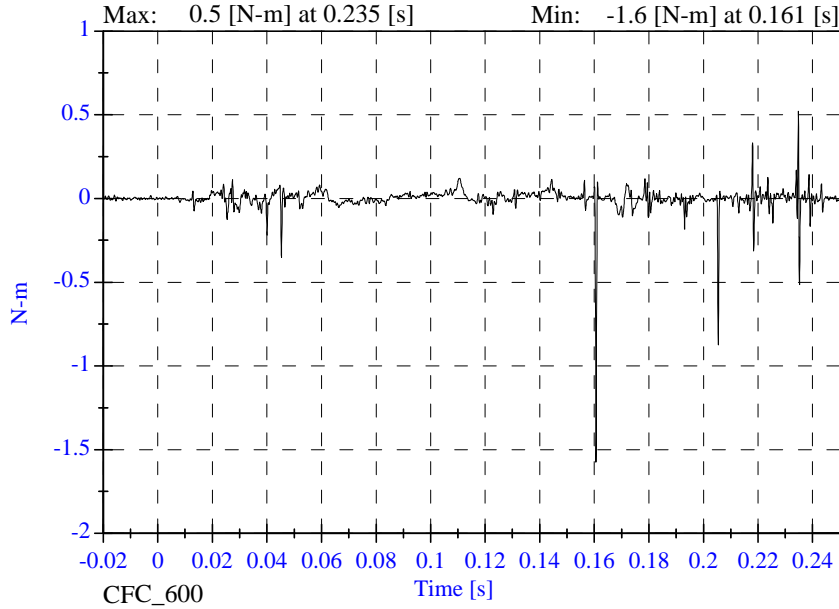
- August 07, 2003



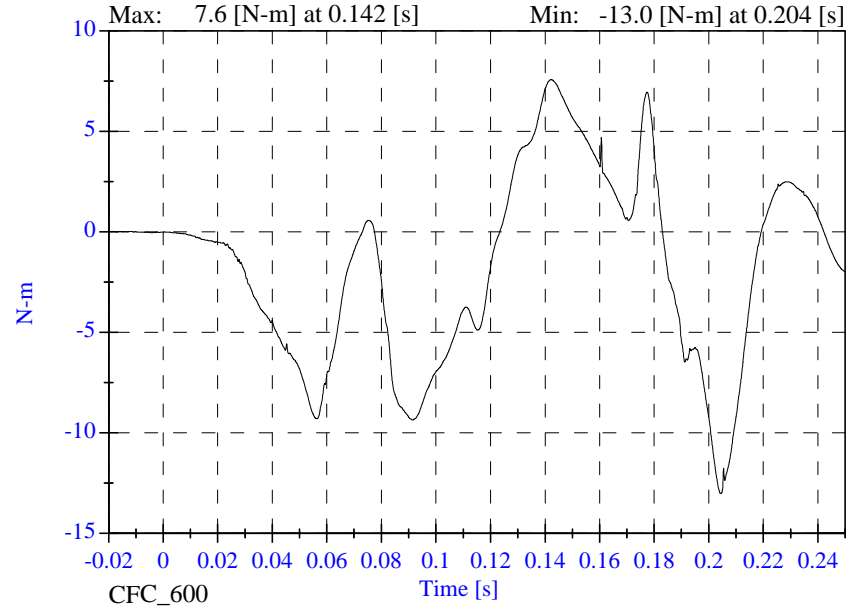
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- August 07, 2003

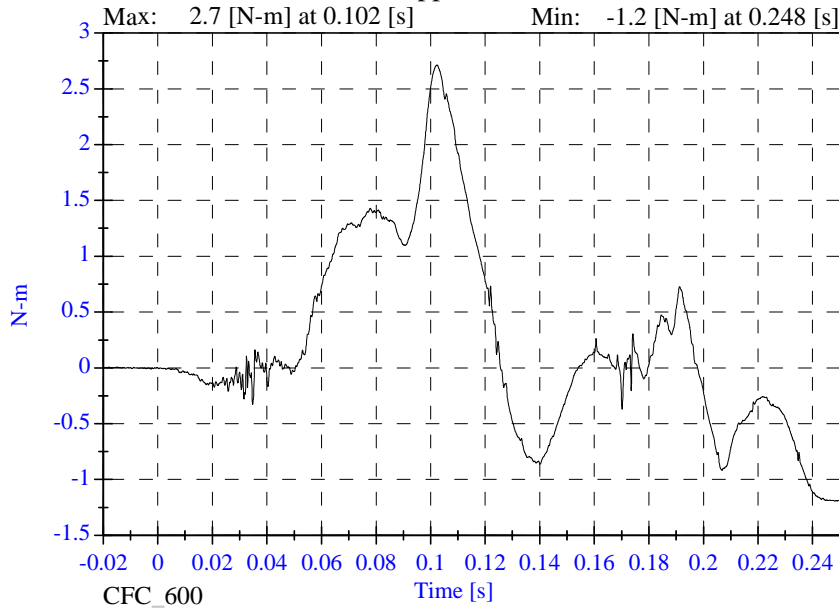
### P4 Upper Neck Mx



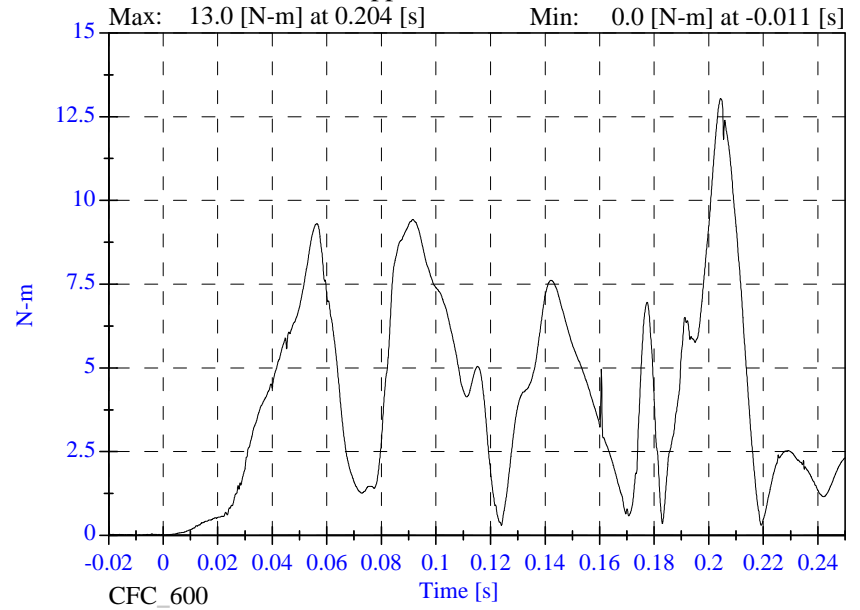
### P4 Upper Neck My



### P4 Upper Neck Mz

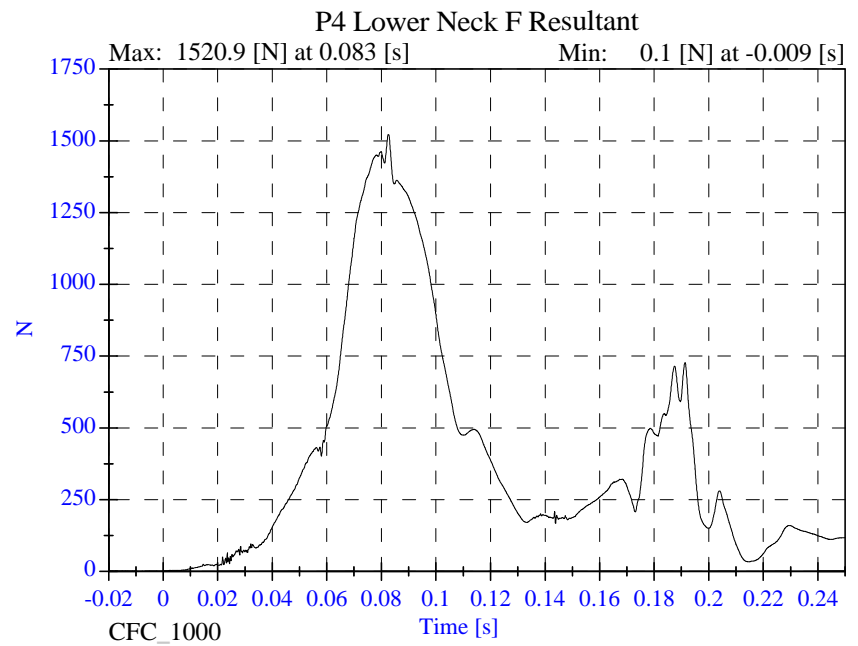
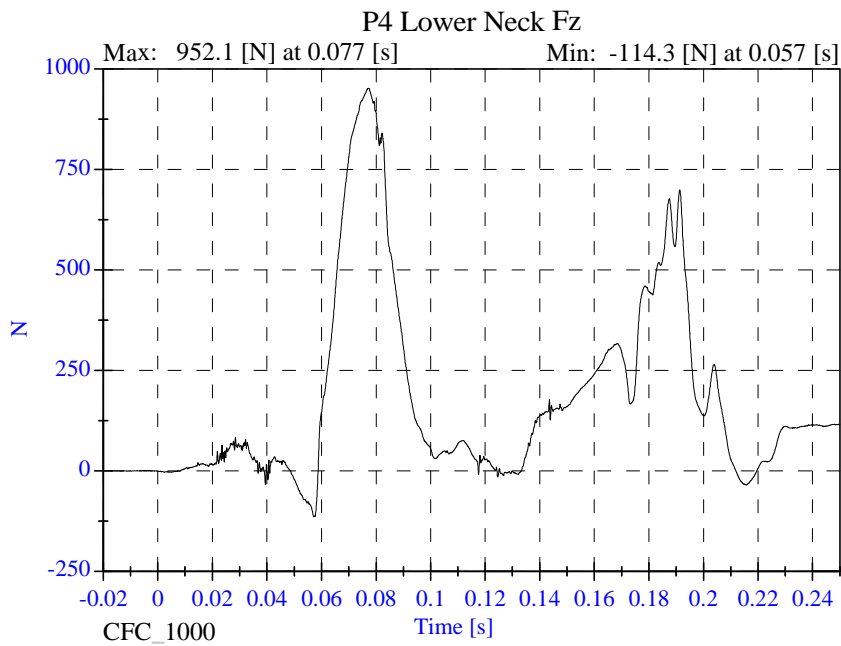
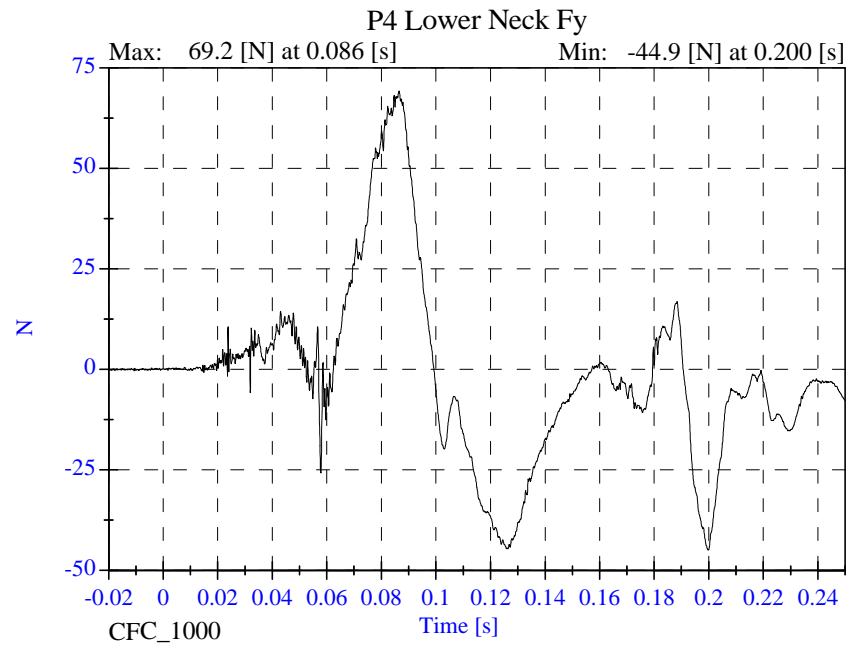
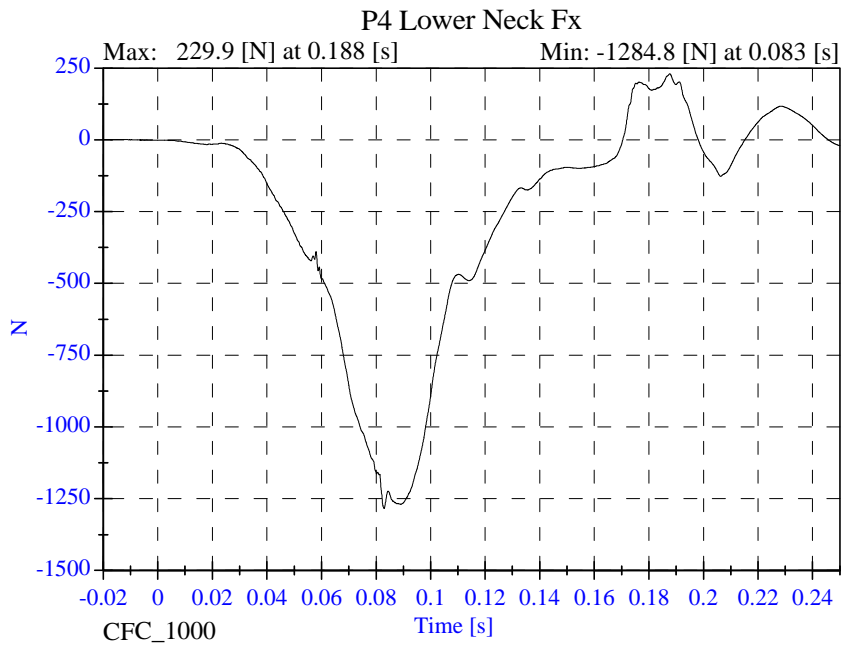


### P4 Upper Neck M Resultant



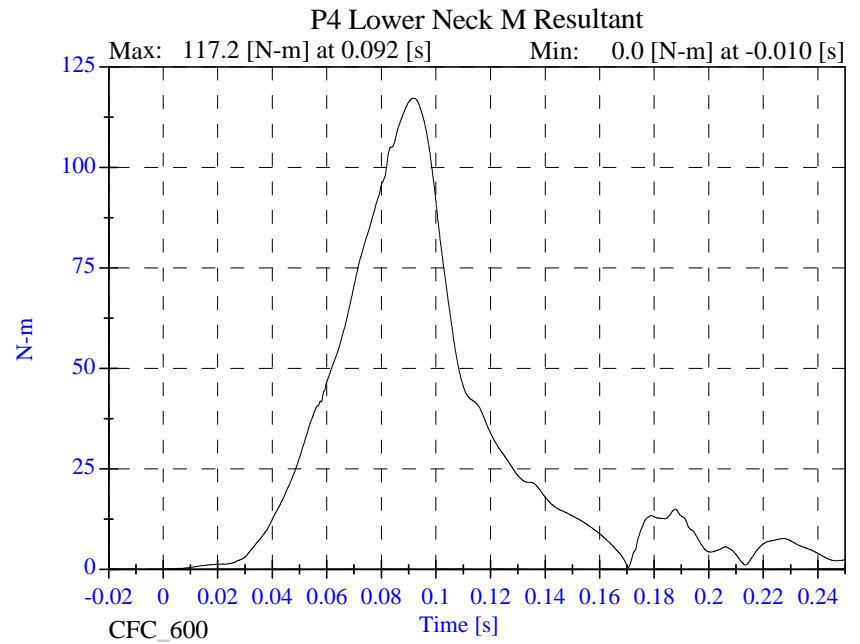
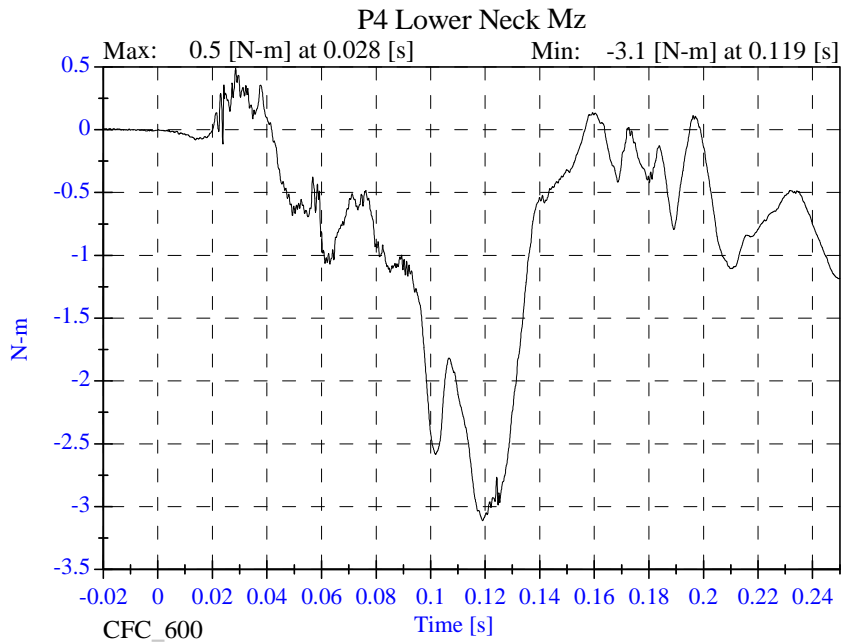
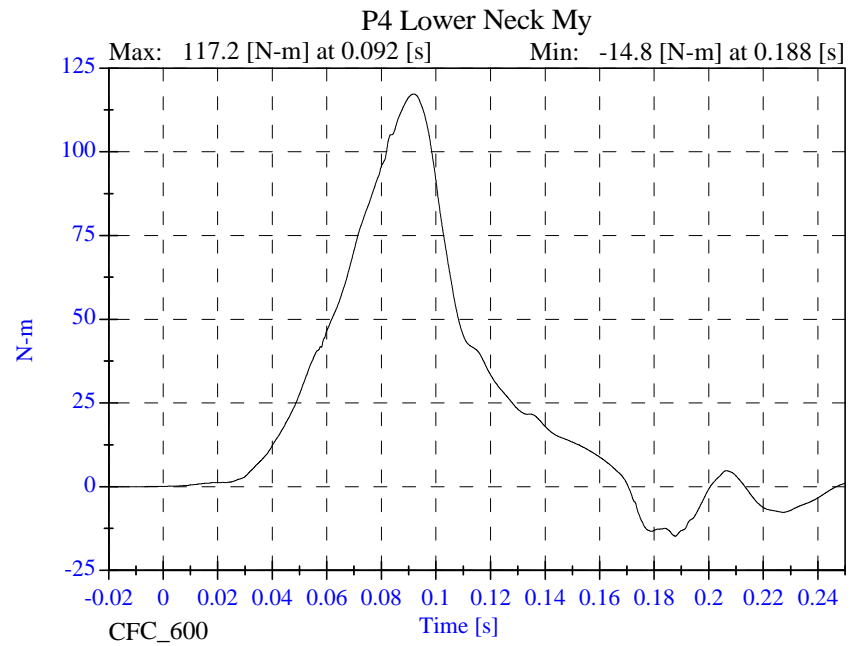
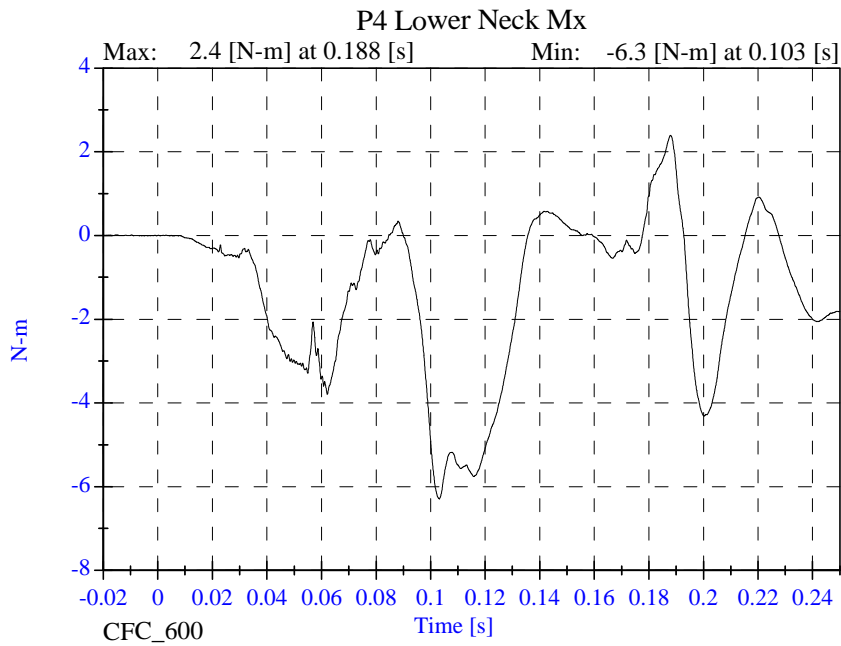
# Sled Test NCAP SLED 08-3-21

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# Sled Test NCAP SLED 08-3-21

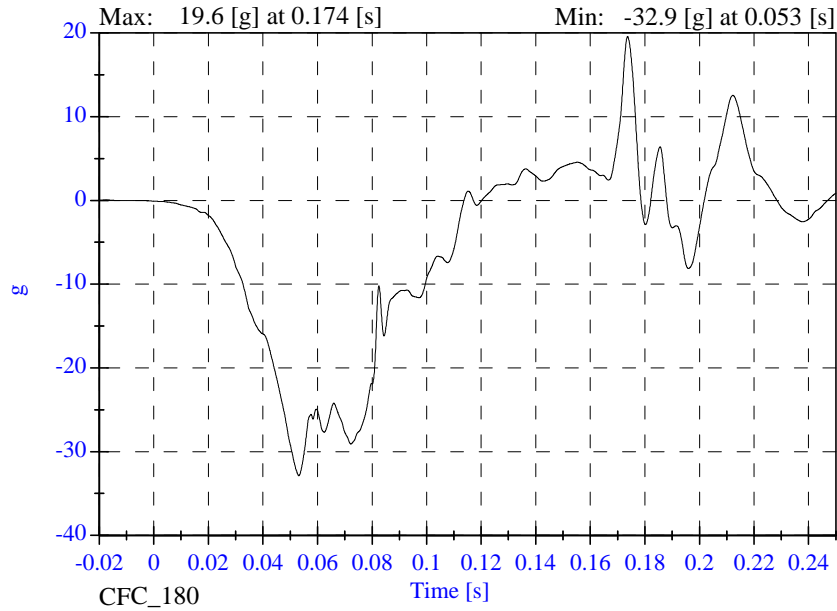
- August 07, 2003



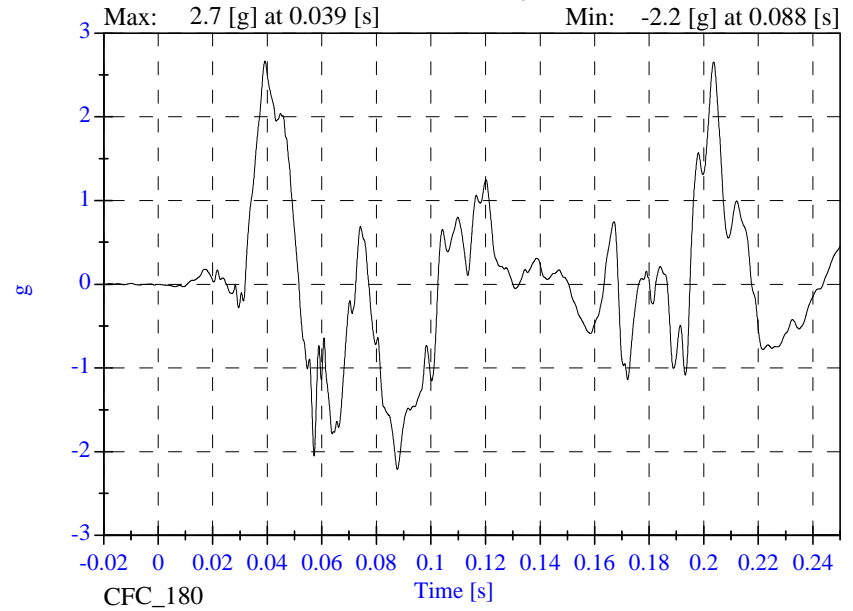
# Sled Test NCAP SLED 08-3-21

- August 07, 2003

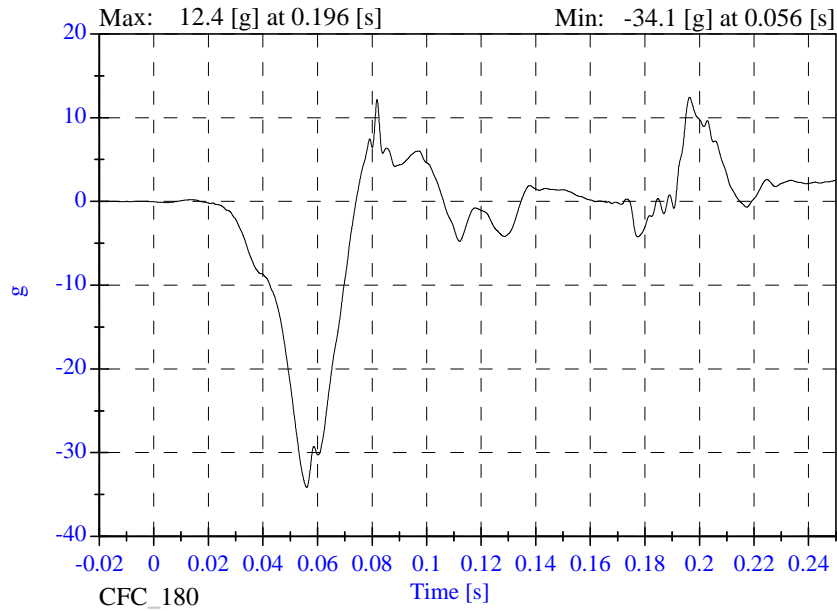
### P4 Chest x



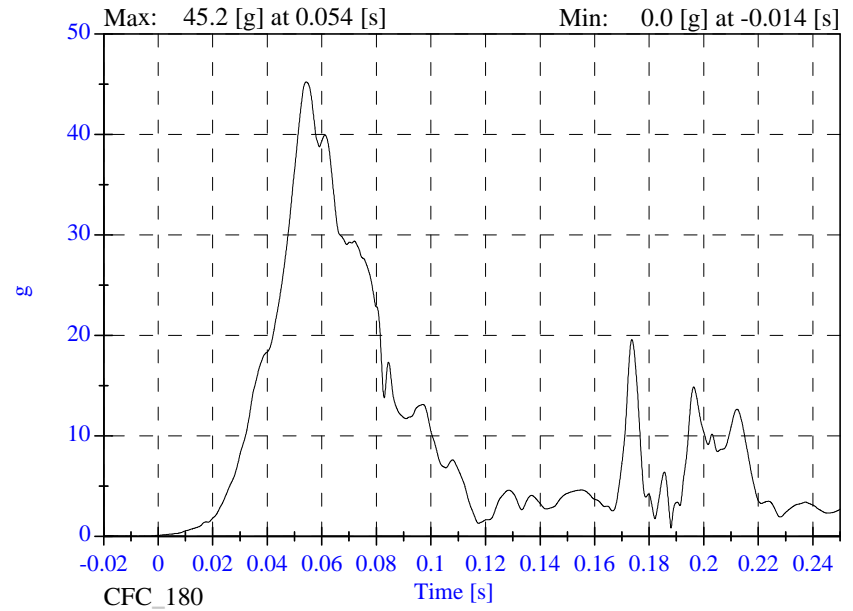
### P4 Chest y



### P4 Chest z

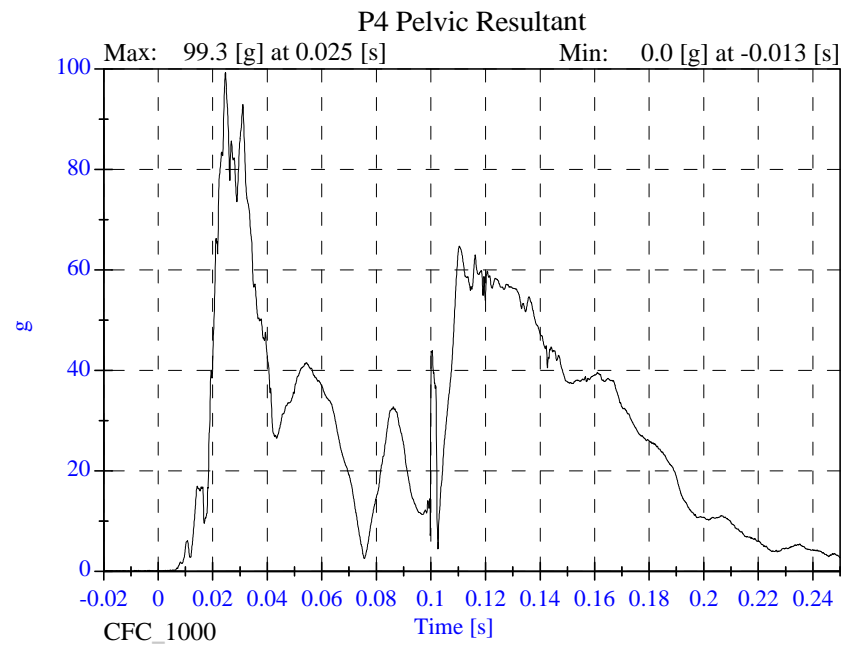
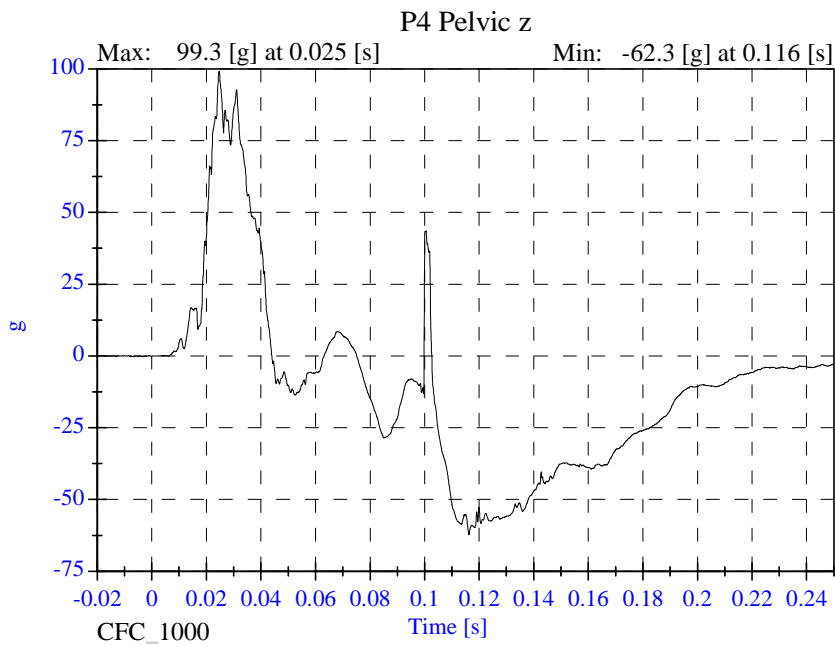
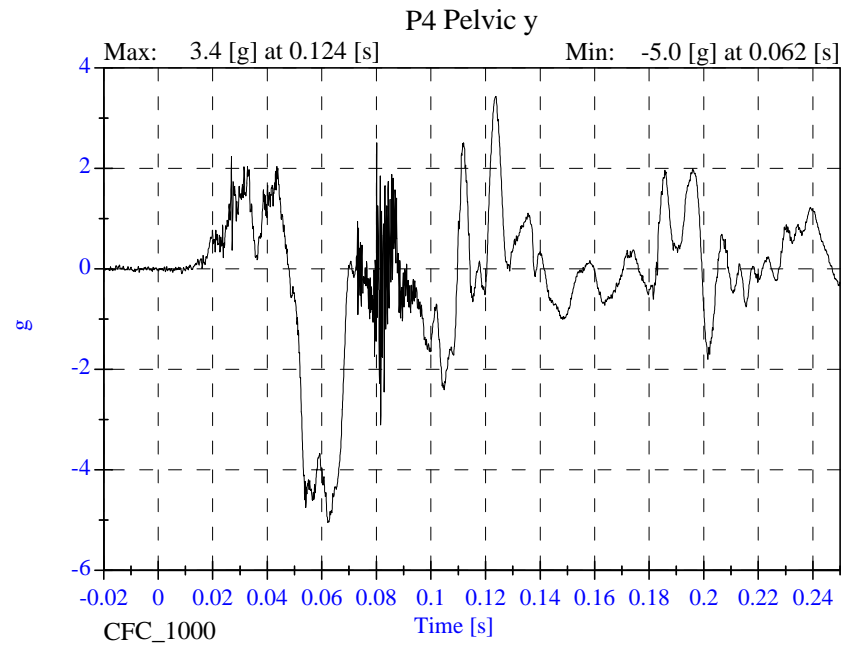
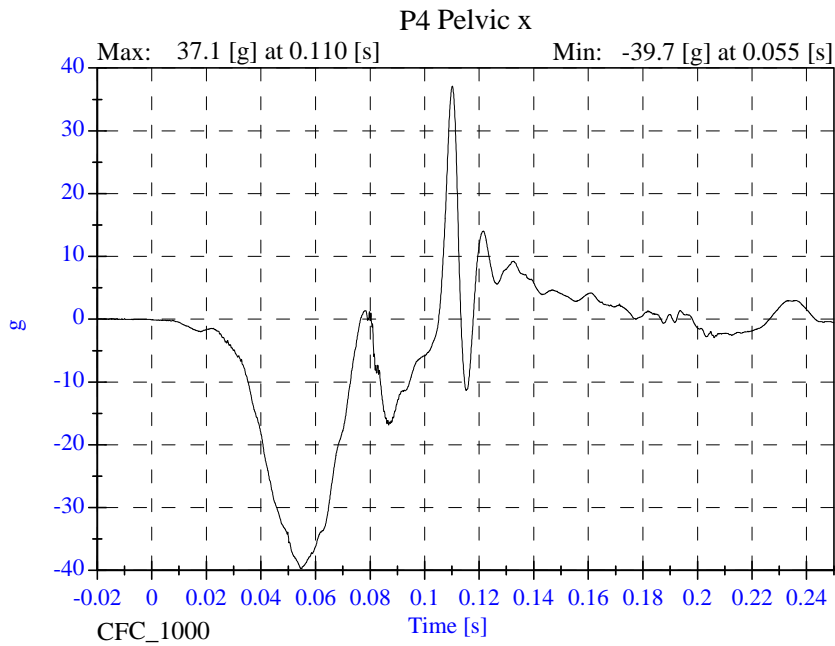


### P4 Chest Resultant



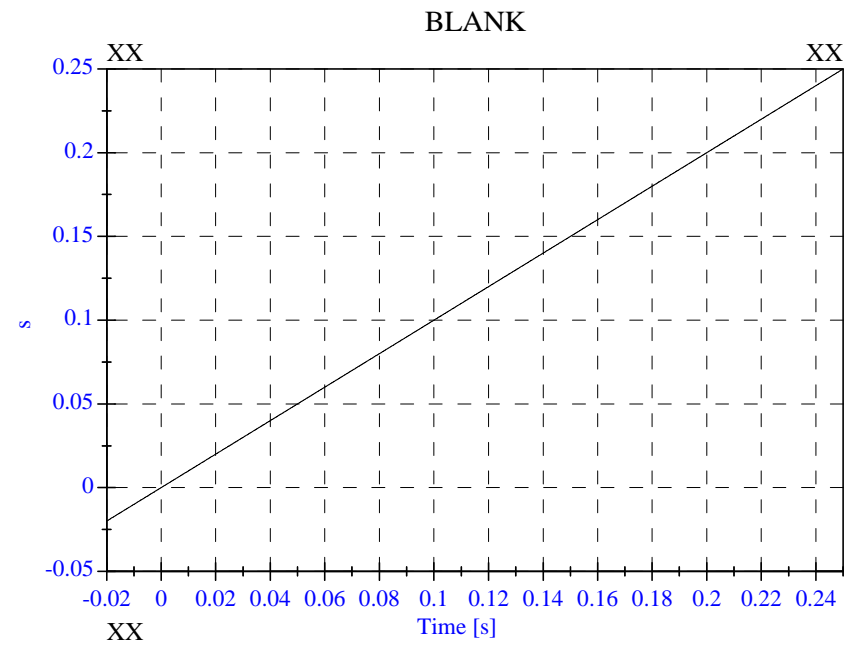
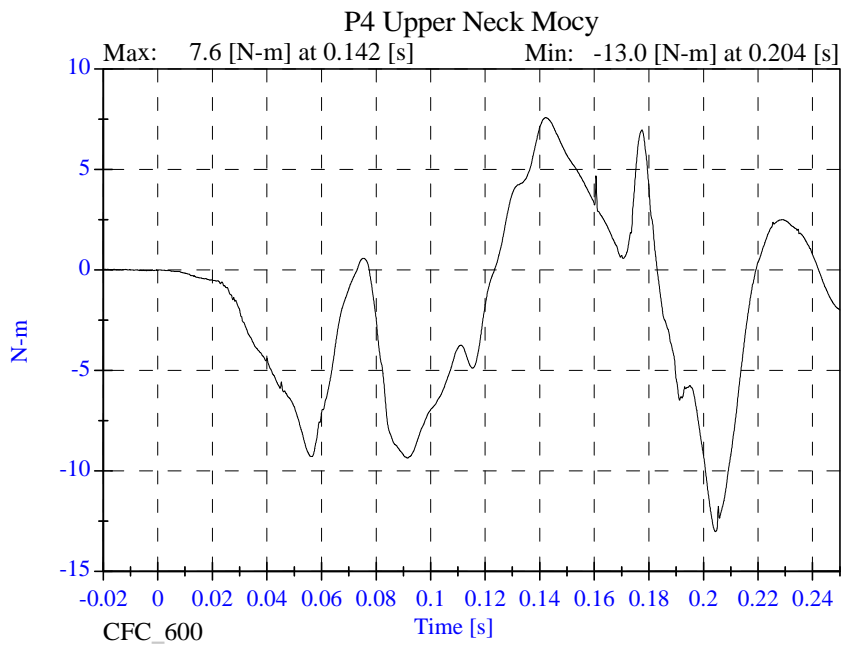
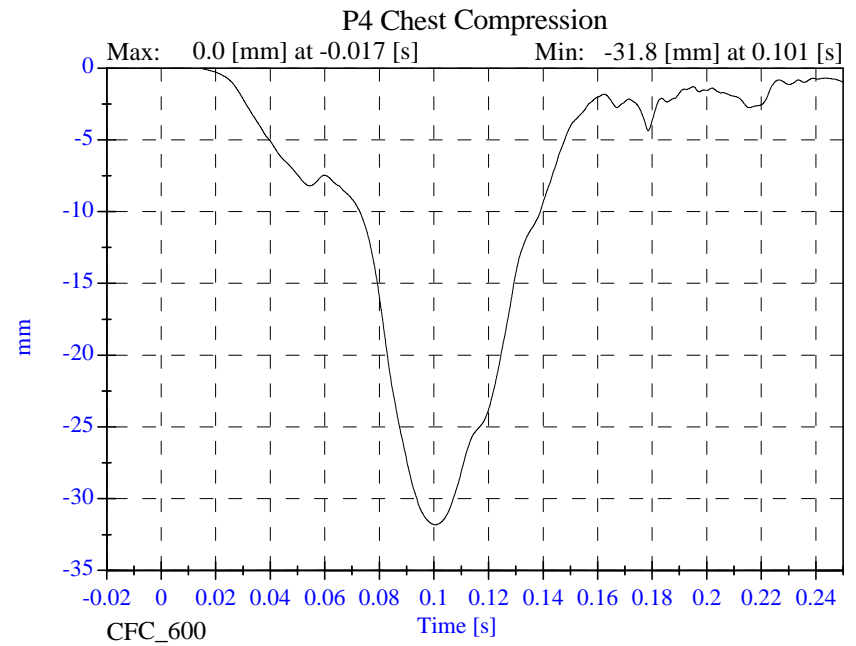
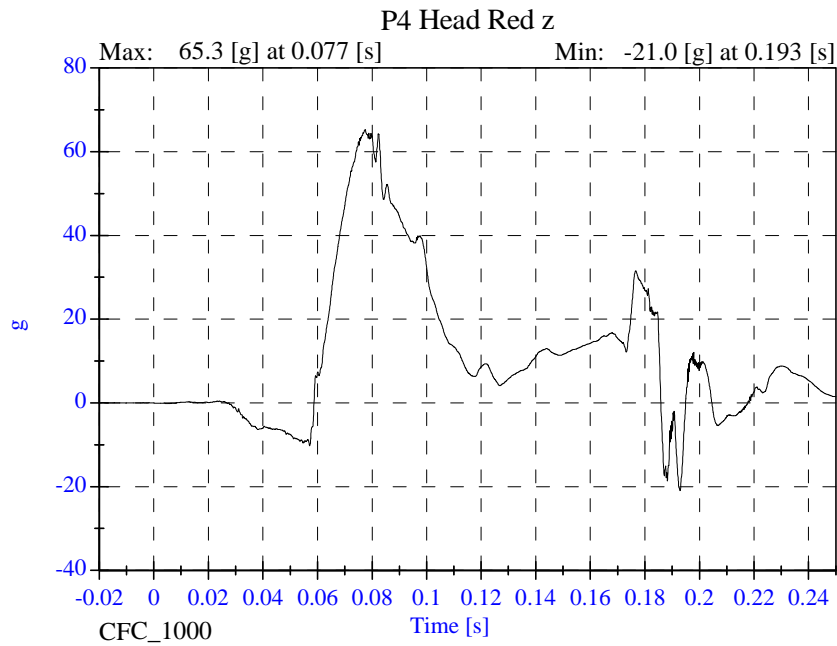
# Sled Test NCAP SLED 08-3-21

- August 07, 2003



# Sled Test NCAP SLED 08-3-21

- August 07, 2003

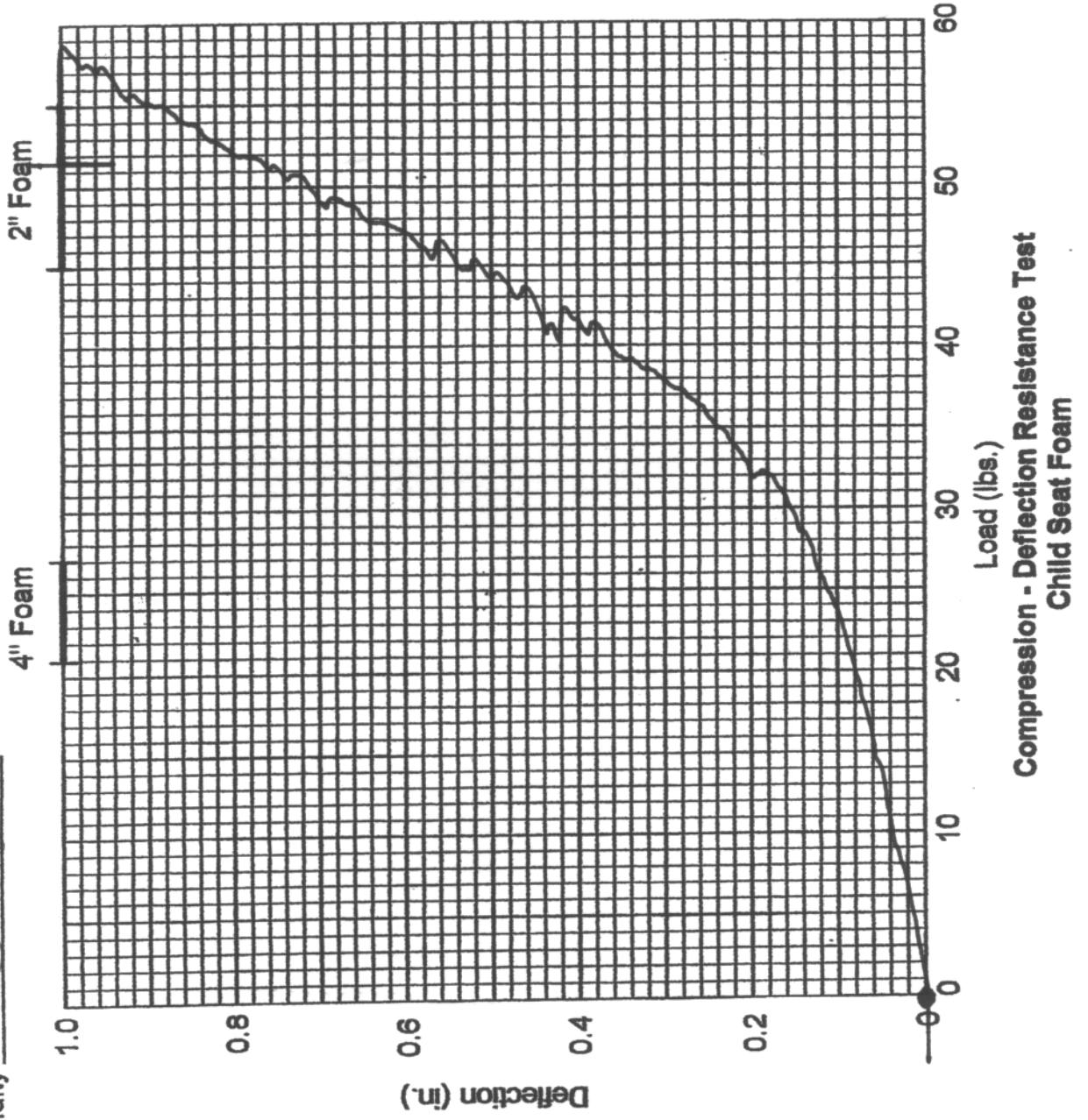


**SECTION 9**

**Compression – Deflection Resistance Test**

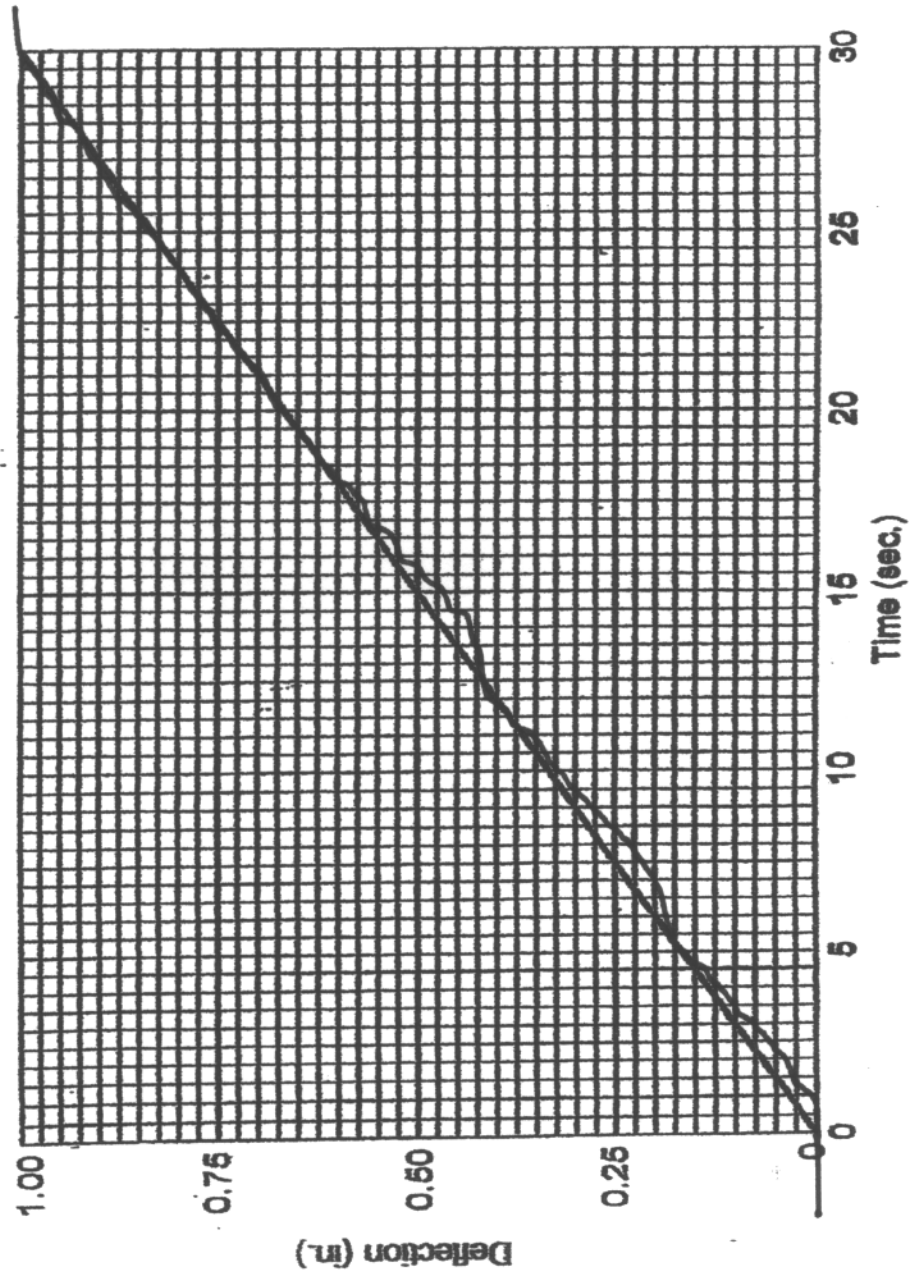
( 8/6/03 )  
Foam No. 2" x 8" 2" x 29" I 6

Date 8/6/03  
Performed By [Signature]  
Temp. 50°  
Humidity 50%



Compression - Deflection Resistance Test  
Child Seat Foam

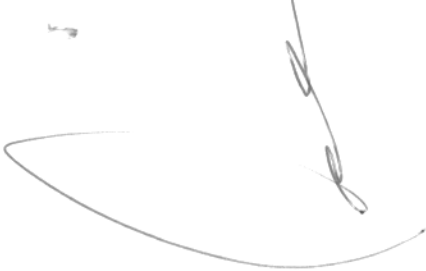
Date 8/6/03  
 Temp 70°  
 Humidity 50%  
 Foam No. 2" X 20" 2" X 24" IG



Compression - Deflection Resistance Test Child Seat Foam

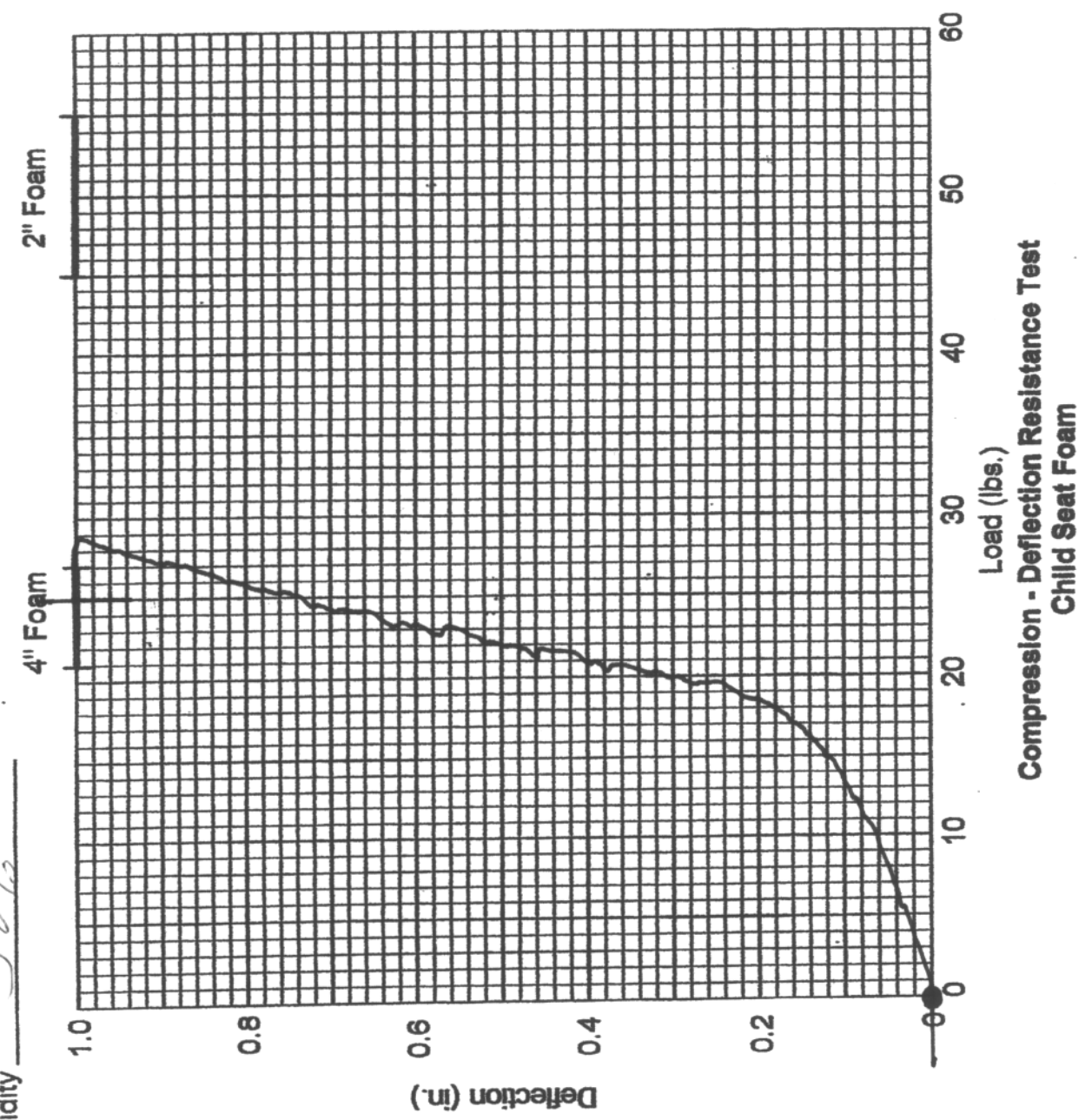
SEAT FOAM USAGE LOG

Foam I.D. Number 2" x 20" x 24" IG

Pass/Fail	Peak Load	Date
	51.5 LBS	8/6/03

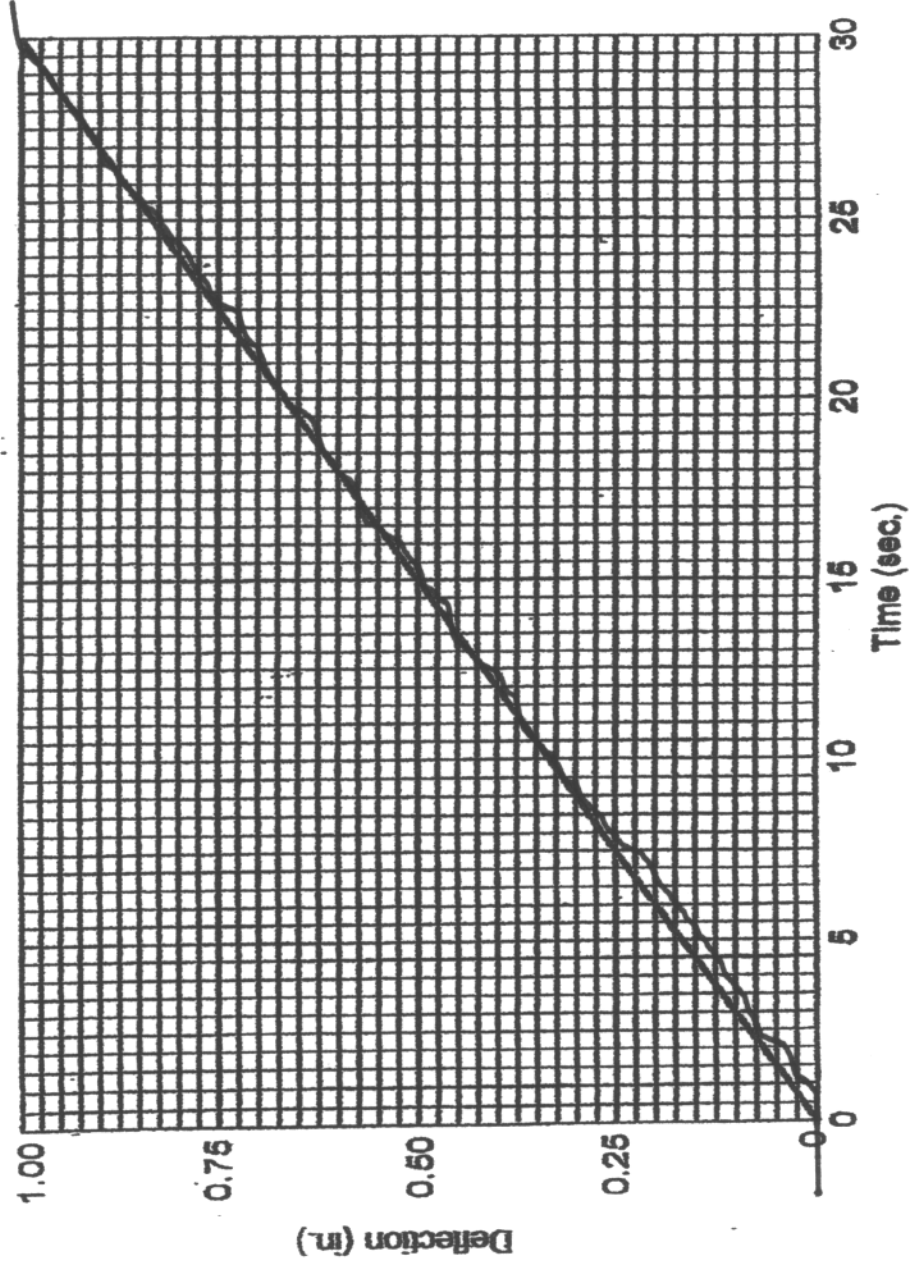
Date 8/6/03  
 Performed By [Signature]  
 Temp. 70°  
 Humidity 50%

Foam No. 4" X 20" I 6



Compression - Deflection Resistance Test  
 Child Seat Foam

Date 8/6/03  
 Temp 70°  
 Humidity 50%  
 Foam No. 1" X 20" FL



Compression - Deflection Resistance Test Child Seat Foam

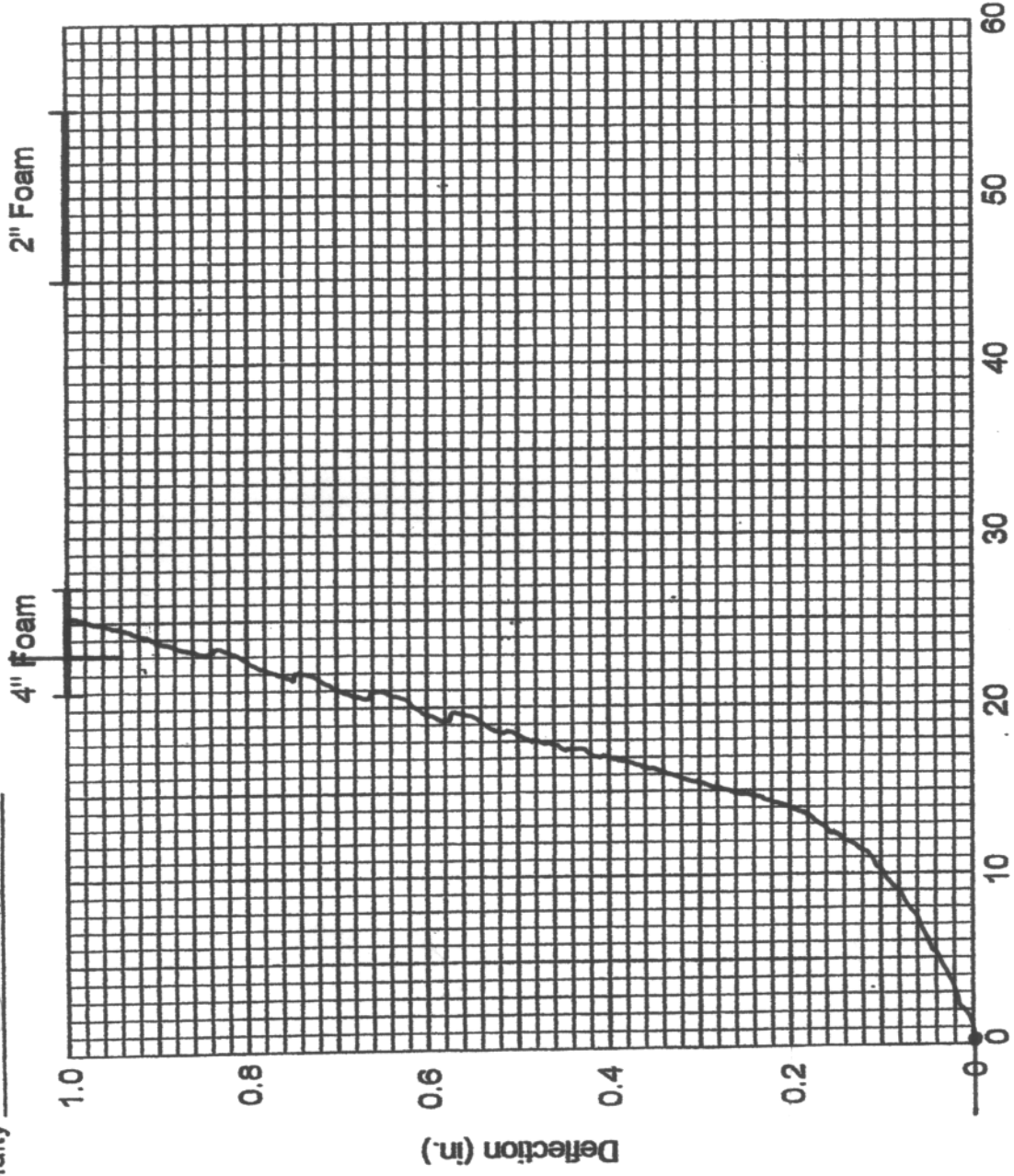
SEAT FOAM USAGE LOG

Foam I.D. Number 4" x 20" I6

Date	Peak Load	Pass/Fail
8/6/03	25 LBS	PASS

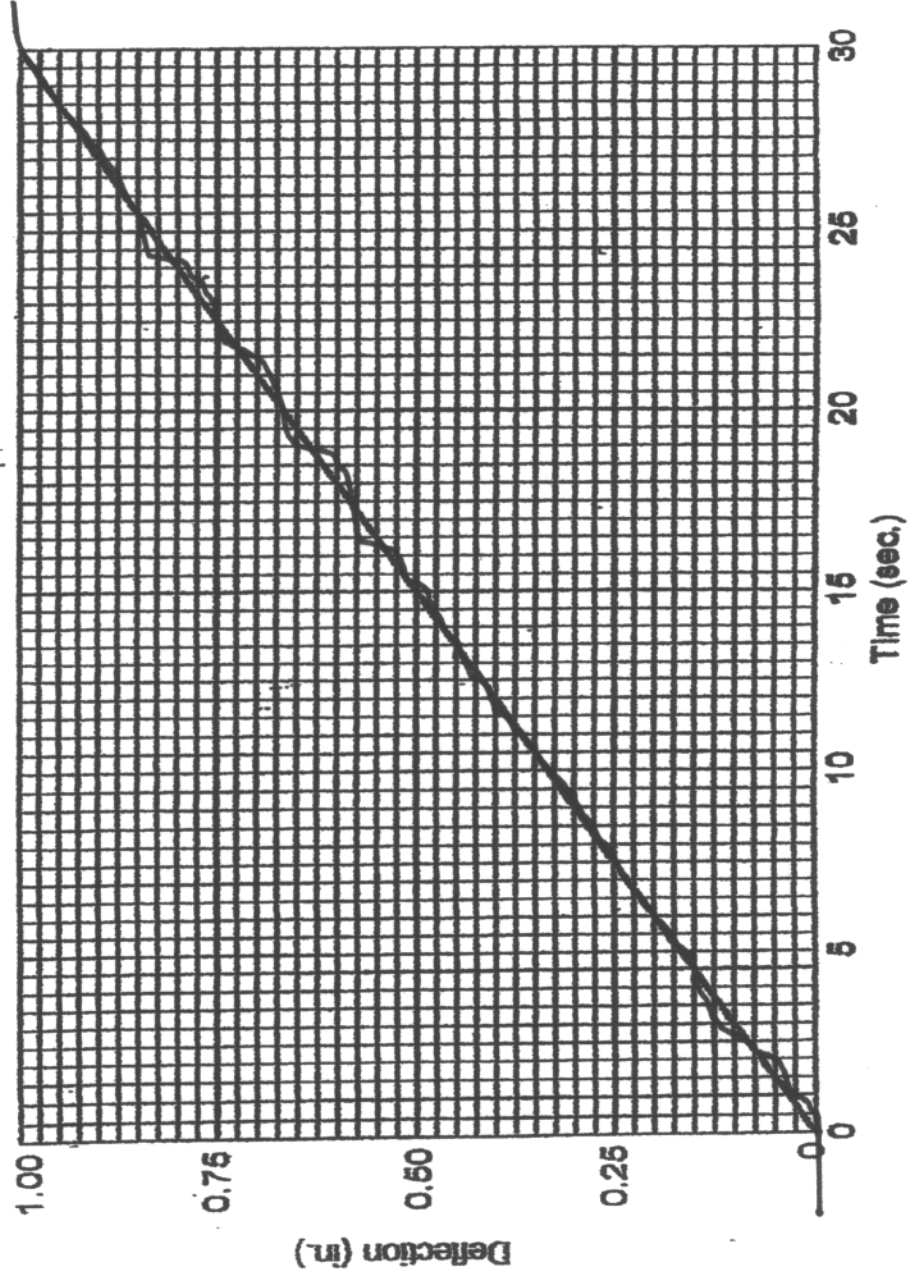
Date 8/6/03  
 Performed By [Signature]  
 Temp. 70°  
 Humidity 50%

Foam No. 4" X EA" ICG



Compression - Deflection Resistance Test  
 Child Seat Foam

Date 8/6/03  
 Temp 70°  
 Humidity 50%  
 Foam No. A"X24" I6



Compression - Deflection Resistance Test Child Seat Foam

SEAT FOAM USAGE LOG

Foam I.D. Number 4" X 24" I6

Date	Peak Load	Pass/Fail
8/6/03	23 LBS	PASS

**SECTION 10**

**Child Dummy Calibration Data Traces and Tables**

# HYIII 3 Year Old Head Drop Test S/N:142

Part 572P Head Drop

Calibration Date: July 21, 2003

Serial No: 142

Work File: 4001

## -----TEST RESULTS-----

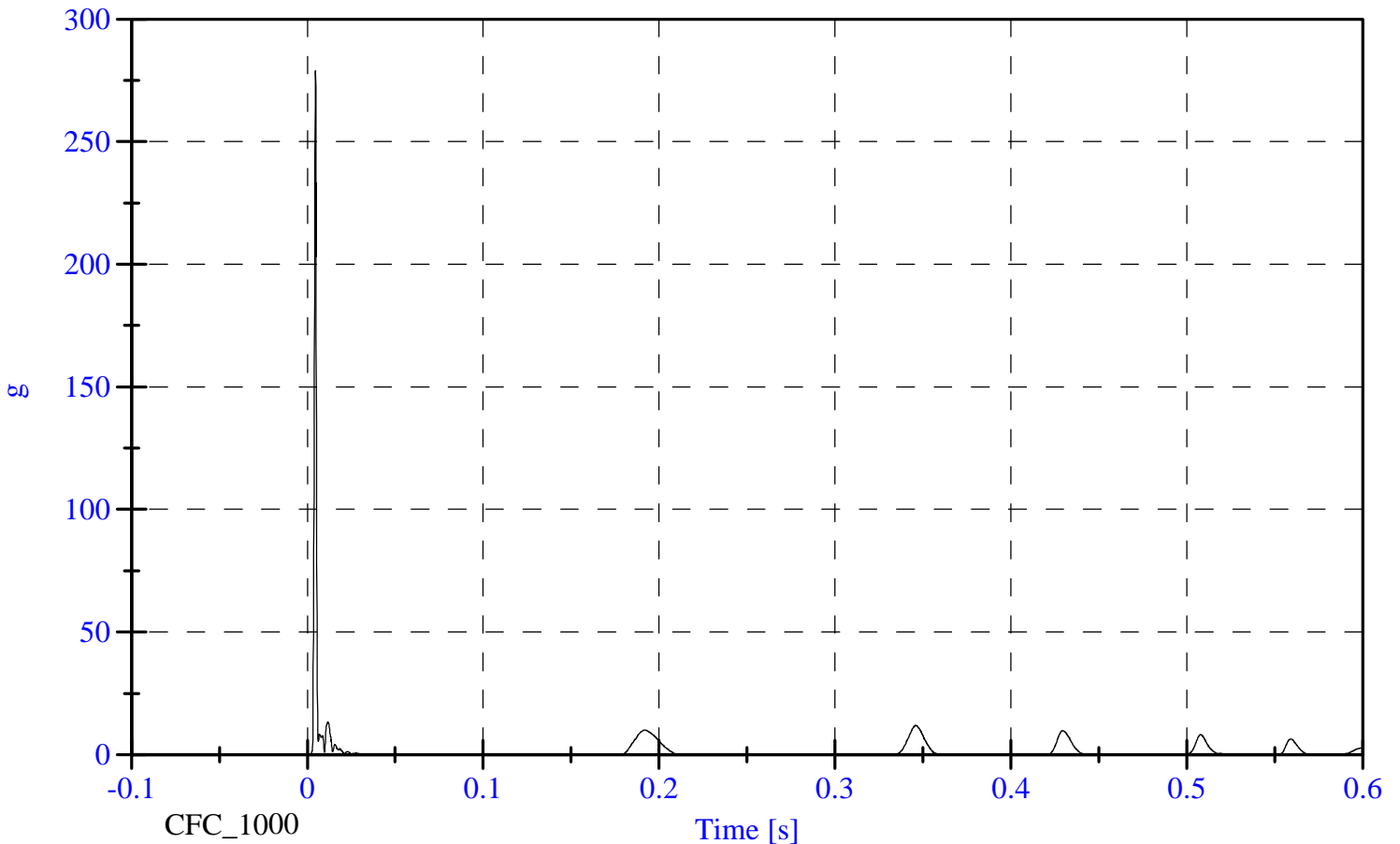
<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	66.0-78.0 F	70.0 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Peak Resultant Accel.:	250-280 Gs	279.06 Gs	Passed
Peak Lateral Accel.:	15 Gs Max	14.76 Gs	Passed
Curve PerCent NonModal:	< 10%	4.82 %	Passed

HYIII 3 Year Old Head Drop Test S/N:142

Head Resultant

Max: 279.1 [g] at 0.005 [s]

Min: 0.0 [g] at 0.398 [s]



# Hybrid III Head Neck Extention Test S/N:142

Part 572P Neck Extension Test Calibration Date: July 16, 2003  
Serial No: 142 Work File: 4001

## -----TEST RESULTS-----

<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	69.0-72.0 F	70.00 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Test Pendulum Speed:	11.58-12.38 ft/s	12.30 ft/s	Passed

## -----PENDULUM PULSE-----

Pulse at 6 ms:	3.30- 4.60 ft/s	3.88 ft/s	Passed
Pulse at 10 ms:	6.20- 8.20 ft/s	6.82 ft/s	Passed
Pulse at 14 ms:	9.20-11.50 ft/s	9.36 ft/s	Passed

## -----D PLANE ROTATION-----

Maximum Rotation:	83.0-93.0 Deg	84.20 Deg	Passed
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## -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

Max Occipital Moment:	-53.30--43.70 N-m	-44.75 N-m	Passed
Occipital Moment Decay:	60.0-80.0 ms	65.30 ms	Passed

# Hybrid III 3 Year Old Head Neck Flexion Test S/N:142

Part 572P                      Neck Flexion Test                      Calibration Date:                      July 16, 2003  
Serial No:                      142                      Work File:                      4001

## -----TEST RESULTS-----

<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	69.0-72.0 F	70.00 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Test Pendulum Speed:	17.65-18.45 ft/s	18.34 ft/s	Passed

## -----PENDULUM PULSE-----

Pulse at 10 ms:	6.60- 8.90 ft/s	7.19 ft/s	Passed
Pulse at 15 ms:	9.80-13.10 ft/s	10.46 ft/s	Passed
Pulse at 20 ms:	13.10-16.70 ft/s	14.31 ft/s	Passed

## -----D PLANE ROTATION-----

Maximum Rotation:	70.0-82.0 Deg	77.80 Deg	Passed
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## -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

Max Occipital Moment:	42.00- 53.00 N-m	50.03 N-m	Passed
Occipital Moment Decay:	60.0-80.0 ms	73.8 ms	Passed

# Hybrid III 3 Year Old Thorax Test S/N:142

Part 572P Thorax Impact

Calibration Date:

July 21, 2003

Serial No: 142

Work File:

4001

## -----TEST RESULTS-----

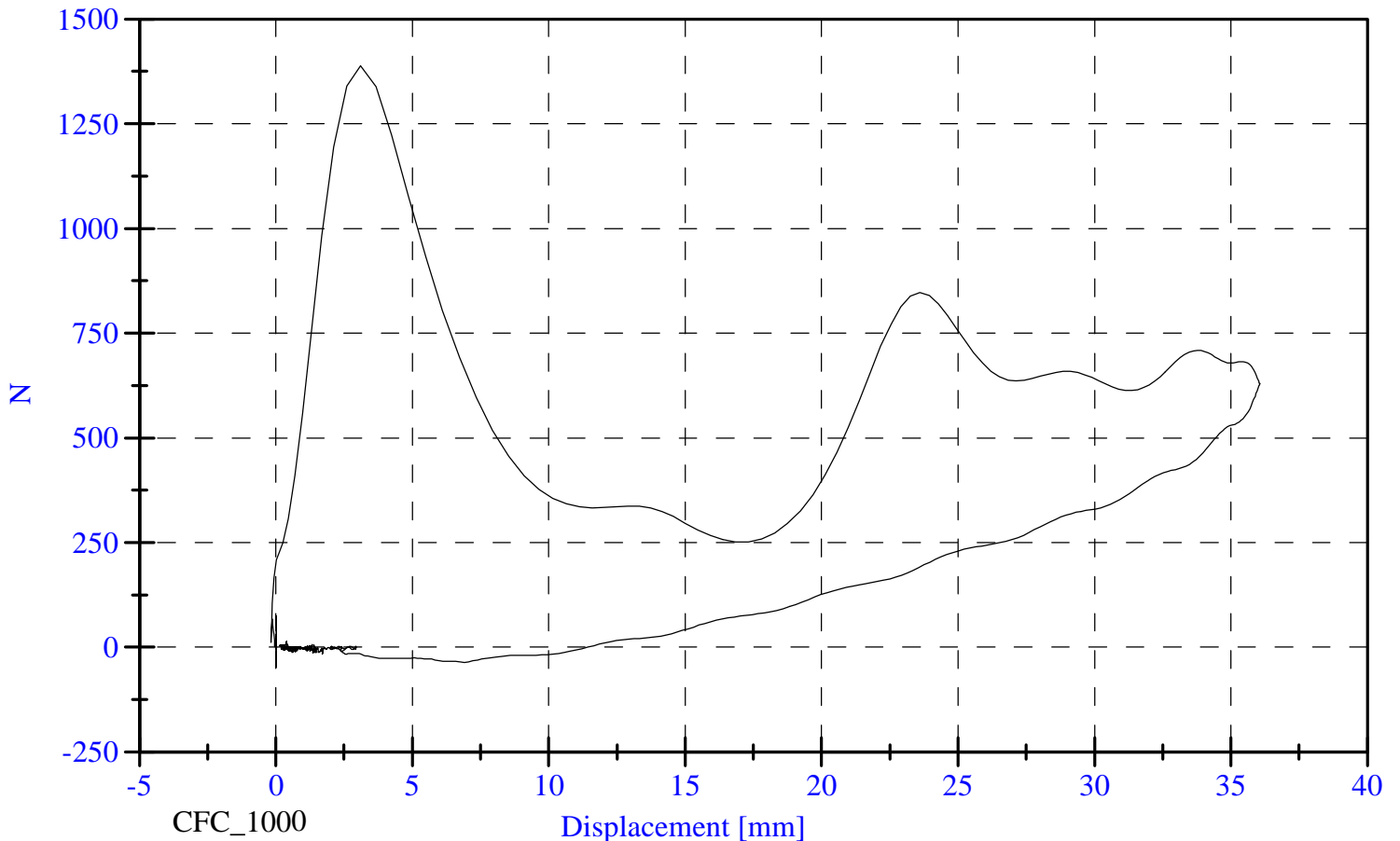
<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	20.6-22.2 C	21.1 C	Passed
Lab Humidity:	10-70 %	34.00 %	Passed
Pendulum Velocity:	5.90- 6.10 m/s	6.07 m/s	Passed
Maximum Deflection:	32.00-38.00 mm	36.06 mm	Passed
Maximum Res. Force:	680.00- 810.00 N	709.45 N	Passed
Internal Hysteresis:	65-85 %	75.47 %	Passed
Pass Sternum Force Criteria?:	860.00 N	846.79	Passed

Hybrid III 3 Year Old Thorax Test S/N:142

Probe Force vs. Displacement

Max: 1388.0 [N] at 3.104 [mm]

Min: -48.5 [N] at 0.011 [mm]



# HYIII 3 Year Old Head Drop Test S/N:044

Part 572P Head Drop

Calibration Date:

July 22, 2003

Serial No: 044

Work File:

4001

## -----TEST RESULTS-----

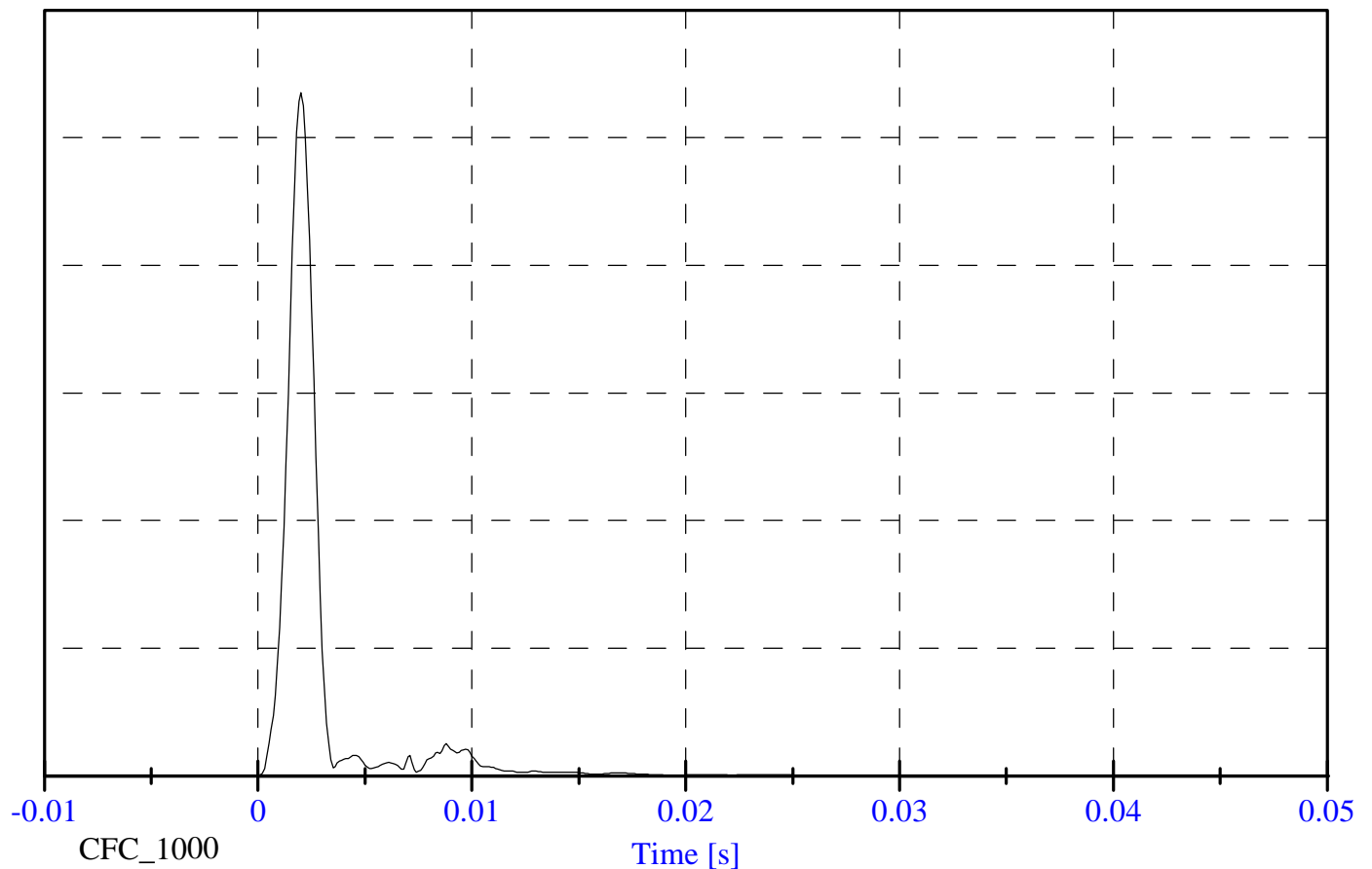
<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	66.0-78.0 F	70.0 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Peak Resultant Accel.:	250-280 Gs	267.66 Gs	Passed
Peak Lateral Accel.:	15 Gs Max	5.53 Gs	Passed
Curve PerCent NonModal:	< 10%	6.05 %	Passed

HYIII 3 Year Old Head Drop Test S/N:044

Head Resultant

Max: 267.7 [g] at 0.002 [s]

Min: 0.0 [g] at -0.080 [s]



## Hybrid III Head Neck Extention Test S/N:044

Part 572P                      Neck Extension Test                      Calibration Date:                      July 22, 2003  
Serial No:                      144                      Work File:                      4001

### -----TEST RESULTS-----

<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	69.0-72.0 F	70.00 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Test Pendulum Speed:	11.58-12.38 ft/s	12.30 ft/s	Passed

### -----PENDULUM PULSE-----

Pulse at 6 ms:	3.30- 4.60 ft/s	3.89 ft/s	Passed
Pulse at 10 ms:	6.20- 8.20 ft/s	6.94 ft/s	Passed
Pulse at 14 ms:	9.20-11.50 ft/s	9.47 ft/s	Passed

### -----D PLANE ROTATION-----

Maximum Rotation:	83.0-93.0 Deg	86.18 Deg	Passed
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### -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

Max Occipital Moment:	-53.30--43.70 N-m	-45.61 N-m	Passed
Occipital Moment Decay:	60.0-80.0 ms	71.60 ms	Passed

# Hybrid III 3 Year Old Head Neck Flexion Test S/N:044

Part 572P                      Neck Flexion Test                      Calibration Date:                      July 22, 2003  
Serial No:                      044                      Work File:                      4001

## -----TEST RESULTS-----

<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	20.6-22.2 C	21.11 C	Passed
Lab Humidity:	10-70 %	36.00 %	Passed
Test Pendulum Speed:	5.40- 5.60 m/s	5.60 m/s	Passed

## -----PENDULUM PULSE-----

Pulse at 10 ms:	2.00- 2.70 m/s	2.13 m/s	Passed
Pulse at 15 ms:	3.00- 4.00 m/s	3.10 m/s	Passed
Pulse at 20 ms:	4.00- 5.10 m/s	4.20 m/s	Passed

## -----D PLANE ROTATION-----

Maximum Rotation:	70.0-82.0 Deg	81.53 Deg	Passed
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## -----MOMENT ABOUT THE OCCIPITAL CONDYLE-----

Max Occipital Moment:	42.00- 53.00 N-m	47.85 N-m	Passed
Occipital Moment Decay:	60.0-80.0 ms	74.00 ms	Passed

# Hybrid III 3 Year Old Thorax Test S/N:044

Part 572P Thorax Impact

Calibration Date: July 22, 2003

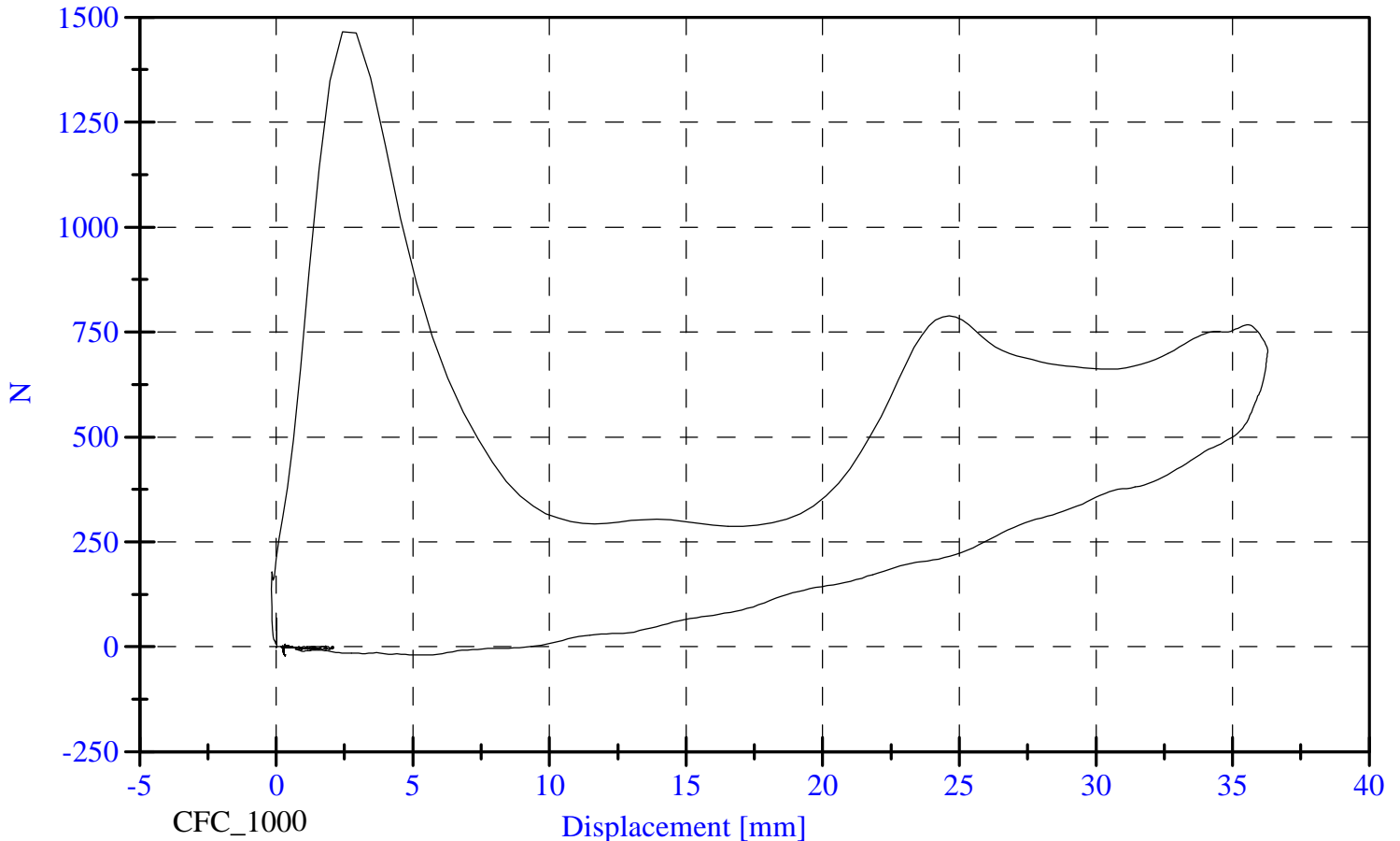
Serial No: 044

Work File: 4001

## -----TEST RESULTS-----

<u>TEST CONDITION</u>	<u>PARAMETERS</u>	<u>RESULTS</u>	<u>STATUS</u>
Lab Temperature:	20.6-22.2 C	21.1 C	Passed
Lab Humidity:	10-70 %	36.00 %	Passed
Pendulum Velocity:	5.90- 6.10 m/s	6.08 m/s	Passed
Maximum Deflection:	32.00-38.00 mm	36.28 mm	Passed
Maximum Res. Force:	680.00- 810.00 N	767.48 N	Passed
Internal Hysteresis:	65-85 %	73.20 %	Passed
Pass Sternum Force Criteria?:	860.00 N	788.71	Passed

Hybrid III 3 Year Old Thorax Test S/N:044 Probe Force vs. Displacement  
 Max: 1465.5 [N] at 2.421 [mm]  
 Min: -21.7 [N] at 0.325 [mm]



**SECTION 11**

**Test Equipment and Instrumentation Calibration**

## Calibrations for Test 08-3-21

SHORTNAME	SENSCOM	CALDATE
P3 HDCG Ax	MFG: ENTRAN S/N: 99108-F29	7/15/2003
P3 HDCG Ay	MFG: ENTRAN S/N: 99102-F12	7/15/2003
P3 HDCG Az	MFG: ENTRAN S/N: 00L13-F03	7/15/2003
P3 HDCG RAz	MFG: ENTRAN S/N: 98G18-F18	7/15/2003
P3 CHST Ax	MFG: ENTRAN S/N: 99108-F30	7/15/2003
P3 CHST Ay	MFG: ENTRAN S/N: 99108-F28	7/15/2003
P3 CHST Az	MFG: ENTRAN S/N: 99H30-Z04	7/15/2003
P3 CHST Dx	MFG: SERVO S/N: 142	7/22/2003
P3 PVCN Ax	MFG: ENTRAN S/N: 99102-F06	7/15/2003
P3 PVCN Ay	MFG: ENTRAN S/N: 99102-F15	7/15/2003
P3 PVCN Az	MFG: ENTRAN S/N: 99G29-Q13	7/15/2003
P3 NEKU Fx	MFG: Denton S/N: 213-FX	7/21/2003
P3 NEKU Fy	MFG: Denton S/N: 213-Fy	7/21/2003
P3 NEKU Fz	MFG: Denton S/N: 213-Fz	7/21/2003
P3 NEKU Mx	MFG: Denton S/N: 213-Mx	7/21/2003
P3 NEKU My	MFG: Denton S/N: 213-My	7/21/2003
P3 NEKU Mz	MFG: Denton S/N: 213-Mz	7/21/2003
P3 NEKL Fx	MFG: Denton S/N: 214Fx	7/21/2003
P3 NEKL Fy	MFG: Denton S/N: 214-Fy	7/21/2003
P3 NEKL Fz	MFG: Denton S/N: 214-Fz	7/21/2003
P3 NEKL Mx	MFG: Denton S/N: 214-Mx	7/21/2003
P3 NEKL My	MFG: Denton S/N: 214-My	7/21/2003
P3 NEKL Mz	MFG: Denton S/N: 214-Mz	7/21/2003
P4 HDCG Ax	MFG: ENDEVCO S/N: P17912	7/17/2003
P4 HDCG Ay	MFG: ENDEVCO S/N: P17743	7/17/2003
P4 HDCG Az	MFG: ENDEVCO S/N: P15319	6/26/2003
P4 HDCG RAz	MFG: ENDEVCO S/N: P16279	6/25/2003
P4 CHST Ax	MFG: ENDEVCO S/N: P15334	7/17/2003
P4 CHST Ay	MFG: ENDEVCO S/N: P15321	7/17/2003
P4 CHST Az	MFG: ENDEVCO S/N: P17758	7/17/2003
P4 CHST Dx	MFG: SERVO S/N: 044	7/22/2003
P4 PVCN Ax	MFG: ENDEVCO S/N: P16755	7/17/2003
P4 PVCN Ay	MFG: ENDEVCO S/N: P15591	7/17/2003
P4 PVCN Az	MFG: ENDEVCO S/N: P16155	7/17/2003
P4 NEKU Fx	MFG: Denton S/N: 248-FX	7/18/2003
P4 NEKU Fy	MFG: Denton S/N: 248-FY	7/18/2003
P4 NEKU Fz	MFG: Denton S/N: 248-FZ	7/18/2003
P4 NEKU Mx	MFG: Denton S/N: 248-MX	7/18/2003
P4 NEKU My	MFG: Denton S/N: 248-MY	7/18/2003
P4 NEKU Mz	MFG: Denton S/N: 248-MZ	7/18/2003
P4 NEKL Fx	MFG: Denton S/N: 249Fx	7/18/2003
P4 NEKL Fy	MFG: Denton S/N: 249Fy	7/18/2003
P4 NEKL Fz	MFG: Denton S/N: 249Fz	7/18/2003
P4 NEKL Mx	MFG: Denton S/N: 249Mx	7/18/2003
P4 NEKL My	MFG: Denton S/N: 249My	7/18/2003
P4 NEKL Mz	MFG: Denton S/N: 249Mz	7/18/2003
Sled Ax	MFG: ENDEVCO S/N: 24144	7/24/2003

**SECTION 12**

**Link to High Speed Movies**

Test 08-3-21 North View

Test 08-3-21 South View