

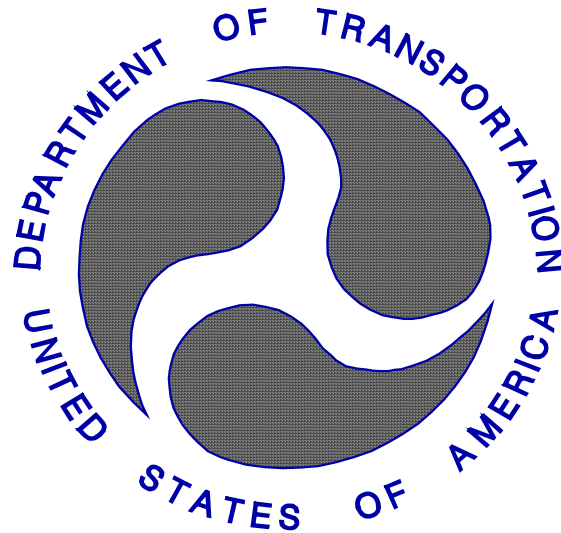
REPORT NO. MCW-DOT-NOSAD-102

**TWG TEST 3.3.3.1**

HONDA MOTOR CORPORATION  
2004 ACURA 3.5RL 4-DOOR SEDAN  
STATIC SIDE AIRBAG DEPLOYMENT

NHTSA NUMBER: M45302TWG2

MEDICAL COLLEGE OF WISCONSIN  
5000 WEST NATIONAL AVENUE  
MILWAUKEE, WI 53295



15 JUNE 2004

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
RULEMAKING  
OFFICE OF CRASHWORTHINESS STANDARDS  
ROOM 5307, NVS-111  
400 SEVENTH STREET, SW  
WASHINGTON, DC 20590

This Final Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-01-D-02003. This document is disseminated under the sponsorship of the U. S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof.

Prepared By:

\_\_\_\_\_  
John R. Humm, Project Engineer

Approved By:

\_\_\_\_\_  
Frank A. Pintar, Facility Director

Approval Date:

\_\_\_\_\_

FINAL REPORT ACCEPTANCE BY:

Accepted By:

\_\_\_\_\_

Acceptance Date:

\_\_\_\_\_

**TECHNICAL REPORT STANDARD TITLE PAGE**

<b>1. Report No.</b> Final Copy	<b>2. Government Accession No.</b>	<b>3. Recipient's Catalog No.</b> NOSAD-102															
<b>4. Title and Subtitle</b> Final Report of a side airbag out of position test of a Hybrid III 3-year-old child dummy in a 2004 Acura 3.5RL 4-Door Sedan NHTSA No. M45302TWG2		<b>5. Report Date</b> 15 June 2004															
		<b>6. Performing Organization Code</b> MCW															
<b>7. Author(s)</b> John Humm, Mark Meyer		<b>8. Performing Organization Report No.</b> NOSAD-102															
<b>9. Performing Organization Name and Address</b> Medical College of Wisconsin 5000 W. National Avenue Milwaukee, WI 53295		<b>10. Work Unit No.</b>															
		<b>11. Contract or Grant No.</b> DTNH22-01-D-02003															
<b>12. Sponsoring Agency Name and Address</b> U.S. Department of Transportation National Highway Traffic Safety Administration Rulemaking Office of Crashworthiness Standards Room 5307, NVS-111 400 Seventh Street, SW Washington, DC 20590		<b>13. Type of Report and Period Covered</b>															
		<b>13. Sponsoring Agency Code</b> NVS-111															
<b>15. Supplementary Notes</b>																	
<b>16. Abstract</b> A side airbag out of position test was done on a forward facing Hybrid III 3-year-old child dummy seated on a booster block in a 2004 Acura 3.5RL 4-Door Sedan in accordance with instructions specified in the TWG Recommended Procedures For Evaluating Occupant Injury Risk From Deploying Side Airbags, dated July 2003. This test was conducted at the Medical College of Wisconsin's Vehicle Crashworthiness Lab in Milwaukee, Wisconsin, on 15 June 2004. The ambient temperature at the passenger side (by the positioned dummy) of the vehicle at the time of deployment was 21.5° C. The test dummy's performance follows:  <table border="0" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>Injury Value</u></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>Head Injury Criterion (HIC)</b></td> <td style="text-align: center;">57</td> </tr> <tr> <td style="text-align: center;"><b>Ntf</b></td> <td style="text-align: center;">0.78</td> </tr> <tr> <td style="text-align: center;"><b>Nte</b></td> <td style="text-align: center;">1.71 †</td> </tr> <tr> <td style="text-align: center;"><b>Ncf</b></td> <td style="text-align: center;">0.39</td> </tr> <tr> <td style="text-align: center;"><b>Nce</b></td> <td style="text-align: center;">0.00</td> </tr> <tr> <td style="text-align: center;">† Failure</td> <td></td> </tr> </tbody> </table>					<u>Injury Value</u>	<b>Head Injury Criterion (HIC)</b>	57	<b>Ntf</b>	0.78	<b>Nte</b>	1.71 †	<b>Ncf</b>	0.39	<b>Nce</b>	0.00	† Failure	
	<u>Injury Value</u>																
<b>Head Injury Criterion (HIC)</b>	57																
<b>Ntf</b>	0.78																
<b>Nte</b>	1.71 †																
<b>Ncf</b>	0.39																
<b>Nce</b>	0.00																
† Failure																	
<b>17. Key Words</b> HIII 3-Year-Old New Car Assessment Program (NCAP) NHTSA No. M45302TWG2 Side Airbag Out-of-Position TWG		<b>18. Distribution Statement</b> <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Rulemaking Office of Crashworthiness Standards Room 5307, NVS-111 400 Seventh Street, SW Washington, DC 20590															
<b>19. Security Classif.(of this report)</b> Unclassified	<b>20. Security Classif.(of this page)</b> Unclassified	<b>21. No. of Pages</b> 65	<b>22. Price</b>														

## TABLE OF CONTENTS

Section		Page No.
1	PURPOSE AND TEST PROCEDURE	1-1
2	SUMMARY OF SIDE IMPACT TEST	2-1
3	SUMMARY OF TEST RESULTS	3-1
	Data Sheet 1 – General Vehicle Test Parameter Data	3-2
	Data Sheet 2 – Test Vehicle Summary	3-5
	Data Sheet 3 – Post-Test Observations	3-6
4	OCCUPANT AND VEHICLE INFORMATION	4-1
	Data Sheet 4 – HIII 3-Year-Old Instrumentation Data	4-2
	Data Sheet 5 – Vehicle Pre- and Post-Measurements	4-4
	Data Sheet 6 – HIII 3-Year-Old Longitudinal Clearance Dimensions	4-5
	Data Sheet 7 – High-Speed Camera Locations and Data	4-6
	APPENDIX A PHOTOGRAPHS	A-1
	APPENDIX B VEHICLE AND HIII 3-YEAR-OLD RESPONSE DATA	B-1
	APPENDIX C HIII 3-YEAR-OLD CONFIGURATION AND VERIFICATION RESULTS	C-1
	APPENDIX D TEST EQUIPMENT LIST AND CALIBRATION INFORMATION	D-1

**SECTION 1****PURPOSE AND TEST PROCEDURE**

This out of position airbag test was sponsored by the National Highway Traffic Safety Administrations (NHTSA), under Contract No. DTNH22-01-D-02003. The purpose of this test was to maximize the head/neck interaction by aligning the neck with the top of the seat side airbag module. This test was conducted in accordance with the instructions specified in the TWG Recommended Procedures For Evaluating Occupant Injury Risk From Deploying Side Airbags, dated July 2003.

The Medical College of Wisconsin does not endorse or certify products. The manufacturer's name appears solely for identification purposes only.

## SECTION 2

### SUMMARY OF SIDE IMPACT TEST

A front passenger seat-mounted side airbag was deployed in a 2004 Acura 3.5RL 4-Door Sedan on 15 June 2004. Previously, in January of 2004, the Acura was involved in a NCAP side impact. Both tests were conducted by the Medical College of Wisconsin.

One Hybrid III 3-Year-Old dummy was placed in the front passenger seat on the outboard edge of a foam booster block and orientated in the forward facing direction. The seat was placed in its lowest height position and the seatback at the manufacturer's design for a 50<sup>th</sup> percentile male. As a result of the vehicle previously being tested in a NCAP side impact, the side window was unable to be closed. The dummy's upper spine was aligned with the leading edge of the seat bolster. The head was placed between, but not contacting the seat bolster and the B-Pillar, keeping it in its neutral orientation. The heels were located at placement points 20 to 50 mm forward of the booster block and 75 mm to either side of the centerline. The dummy's pelvis was positioned so that the head/neck junction was aligned vertically with the top edge of the airbag module. Also, the pelvis and upper torso were positioned so that the pelvis or torso was in contact with the vehicle door. The outboard arm was placed on the armrest, and in the inboard arm was flexed so that the upper arm was in contact with the seatback, and the fingertips were in contact with the booster block. This orientation complies with section 3.3.3.1 of the TWG Recommended Procedures For Evaluating Occupant Injury Risk From Deploying Side Airbags as defined by Lund, et al. and the Technical Working Group dated July 2003. This event was documented by four high-speed video cameras. Camera locations and other pertinent camera information can be found in this report.

Hybrid III 3-Year-Old was instrumented with the following accelerometers.

1. Head Center of Gravity triaxial accelerometer (X-, Y-, and Z-direction)
2. Upper Neck (NKU) six axis load cell (Fx, Fy, Fz, Mx, My, Mz)

Pre- and post-test photographs of the test vehicle and the Hybrid III 3-Year-Old are included in Appendix A. Appendix B contains the dummy response data traces. A summary of the Hybrid III 3-Year-Old configuration and performance verification test data is shown in Appendix C. Dummy instrumentation calibration data can be found in Appendix D of this report.

The following table summarizes the results of this test.

Injury Criteria	Hybrid III 3-Year-Old
HIC36	57
Ntf	0.78
Nte	1.71 †
Ncf	0.39
Nce	0.00

† Failure

The vehicle's airbag information is summarized in the following table

	Frontal	Side-Torso	Side-Torso/Head	Side-Head
Driver	Yes-Steering wheel	Yes- Seat	None	None
Front Passenger	Yes- Dashboard	Yes- Seat	None	None
Left Rear Passenger	None	None	None	None
Right Rear Passenger	None	None	None	None

**SECTION 3**  
**SUMMARY OF TEST RESULTS**

**DATA SHEET NO. 1****GENERAL VEHICLE TEST PARAMETER DATA**TEST VEHICLE INFORMATION

Year/ Make/ Model/ Body Style		2004 Acura 3.5RL 4-Door Sedan			
Vehicle NHTSA NO.		<u>M45302TWG2</u>	VIN	<u>JH4KA966X4C004162</u>	
Vehicle Body Color		<u>Silver</u>	Build Date	<u>June 2003</u>	
Engine Data	<u>6</u> Cylinders	<u>CID</u>	<u>3.5</u> Liter	<u>cc</u>	
Placement	<u>Longitudinal</u>	<u>X</u> Lateral			
Transmission	<u>4</u> Speed	<u>Manual</u>	<u>X</u> Automatic	<u>X</u> Overdrive	
Final Drive	<u>Rear Wheel Drive</u>	<u>X</u> Front Wheel Drive	<u>Four Wheel Drive</u>		
Odometer Reading	<u>109 miles</u>	Date	<u>31 December 03</u>		
Options	<u>X</u> A/C	<u>X</u> Power Steering	<u>X</u> Power Brakes	<u>X</u> Power Windows	
	<u>X</u> Cruise Control	<u>X</u> Tilt Wheel	<u>X</u> Power Locks	<u>ADLs</u>	

DATA FROM TIRE PLACARD:

Tire Pressure (at Capacity)	<u>30</u> PSI Front	
	<u>30</u> PSI Rear	
Recommended Tire Size	<u>P225 55 R16</u>	
Tires on Test Vehicle	<u>P225 55 R16</u>	Manufacturer <u>Michelin</u>

TEST VEHICLE AIRBAG INFORMATION:

	<u>Frontal</u>	<u>Side-Torso</u>	<u>Side-Torso/Head</u>	<u>Side-Head</u>
Driver	Yes- Steering Wheel	Yes- Seat	None	None
Front Passenger	Yes- Dashboard	Yes- Seat	None	None
Left Rear Passenger	None	None	None	None

VEHICLE CAPACITY DATA:

Number of Occupants:	<u>2</u> Front	<u>3</u> Rear	<u>3<sup>rd</sup></u> Seat	<u>5</u> Total
Type of Front Seats	<u>X</u> Bucket	<u>Bench</u>	<u>Split Bench</u>	
Type of Front Seat Back	<u>Fixed</u>	<u>X</u> Adjustable w/	<u>X</u> Lever	<u>Knob</u>
Vehicle Max Capacity Loading		<u>385.6</u>	kg (A)	
No. of Occupants X 68.04 kg		<u>340.2</u>	kg (B)	
Cargo Capacity (A) – (B)		<u>45.4</u>	kg	

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Left Front	=	<u>530.7</u>	kg	Left Rear	=	<u>357</u>	kg
Right Front	=	<u>509.3</u>	kg	Right Rear	=	<u>357.9</u>	kg
TOTAL FRONT	=	<u>1040</u>	kg	TOTAL REAR	=	<u>714.9</u>	kg
% Total Weight	=	<u>59.3</u>	%	%Total Weight	=	<u>40.7</u>	%
TOTAL WEIGHT	=	<u>1754.9</u>	kg				



**DATA SHEET 1 (continued)****GENERAL VEHICLE TEST PARAMETER DATA**Vehicle: 2004 Acura 3.5RLNHTSA No. M45302TWG2CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Test Vehicle Delivered Weight with Max Fluids	=	<u>1754.9</u>	kg	(A)
Maximum Cargo Carrying Capacity of Test Vehicle	=	<u>45.4</u>	kg	(B)
Weight of (2) instrumented Side Impact Dummies	=	<u>161.0</u>	kg	(C)
TEST VEHICLE TARGET WEIGHT	=	<u>1961.3</u>	kg	(A+B+C)

FULLY LOADED TEST VEHICLE (UDVW + 1 OR 2 SID H3(s) + CARGO)

Left Front	=	<u>585.1</u>	kg	Left Rear	=	<u>444.5</u>	kg
Right Front	=	<u>511.2</u>	kg	Right Rear	=	<u>420.5</u>	kg
TOTAL FRONT	=	<u>1096.3</u>	kg	TOTAL REAR	=	<u>865</u>	kg
% Total Weight	=	<u>55.9</u>	%	%Total Weight	=	<u>44.1</u>	%
TOTAL WEIGHT	=	<u>1961.3</u>	kg				

AS TESTED WEIGHT OF TEST VEHICLE (UDVW+ SID H3(s)+CARGO+EQUIPMENT & INSTRUMENTATION) \*

Left Front	=	<u>583.3</u>	kg	Left Rear	=	<u>440.9</u>	kg
Right Front	=	<u>511.2</u>	kg	Right Rear	=	<u>419.1</u>	kg
TOTAL FRONT	=	<u>1094.5</u>	kg	TOTAL REAR	=	<u>860</u>	kg
% Total Weight	=	<u>56.0</u>	%	%Total Weight	=	<u>44.0</u>	%
TOTAL WEIGHT	=	<u>1954.5</u>	kg				

TEST VEHICLE ATTITUDE (all dimensions in millimeters):

## AS DELIVERED

Left Front	<u>734</u>	Right Front	<u>737</u>	Left Rear	<u>735</u>	Right Rear	<u>737</u>
------------	------------	-------------	------------	-----------	------------	------------	------------

## FULLY LOADED

Left Front	<u>715</u>	Right Front	<u>722</u>	Left Rear	<u>698</u>	Right Rear	<u>711</u>
------------	------------	-------------	------------	-----------	------------	------------	------------

## AS TESTED \*

Left Front	<u>720</u>	Right Front	<u>725</u>	Left Rear	<u>699</u>	Right Rear	<u>712</u>
------------	------------	-------------	------------	-----------	------------	------------	------------

Test Vehicle Wheelbase	<u>2914</u>	mm
------------------------	-------------	----

As Tested CG	=	<u>1282</u>	mm rearward of front wheel centerline
--------------	---	-------------	---------------------------------------

TOTAL VEHICLE LENGTH:

Right Side	=	<u>4597</u>	mm
Left Side	=	<u>4597</u>	mm
Centerline	=	<u>4985</u>	mm

\* Side NCAP Test

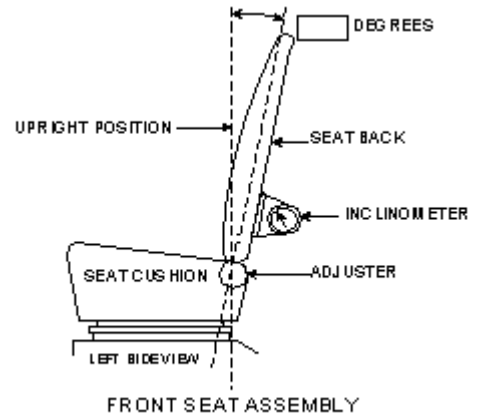
**DATA SHEET 1 (continued)**

**GENERAL TEST VEHICLE PARAMETER DATA**

Vehicle: 2004 Acura 3.5RL

NHTSA No.: M45302TWG2

Nominal Design Riding Position for adjustable driver and passenger seats. Please describe how to position the inclinometer to measure the seat back angle. Include a description of the adjustment latch detent if applicable



FRONT SEAT CUSHION PLACEMENT:

Total Length of Adjustment Travel		<u>232 mm</u>
Total Number of Detents	<u>N/A</u>	Test Position <u>116 mm rearward of full forward position (mid-position)</u>

FRONT SEAT BACK ADJUSTMENT:

Seat Back Angle	<u>10.4° measured at head rest post (w/o SID H3)- 677 mm from outer visor bolt to center of head rest hole</u>
-----------------	--

REAR SEAT POSITION:

Total Length Fore/Aft Adjustment	<u>N/A</u>
Seat Back Adjustment Position	<u>N/A</u>

ADJUSTABLE STEERING COLUMN POSITION:

<u>Mid-Position</u>
---------------------

WINDOW POSITIONS:

Left Front	<u>N/A</u>	Right Front	<u>Removed</u>
Left Rear	<u>N/A</u>	Right Rear	<u>N/A</u>

AMOUNT OF STODDARD SOLVENT IN FUEL TANK:

Fuel System usable Capacity	<u>N/A</u>
Test Volume	<u>N/A</u>

**DATA SHEET 2**  
**TEST VEHICLE SUMMARY**

VEHICLE IDENTIFICATION:

Year/Make/Model/Body Style	2004 Acura 3.5RL 4-Door Sedan		
Body Color	Silver	VIN	JH4KA966X4C004162
NHTSA No.	M45302TWG2	Test Date	15 June 2004
Overall Length	4985 mm	Overall Width	1825 mm

VEHICLE TEST WEIGHT (Pre-Test):

Left Front	=	583.3	kg	Left Rear	=	440.9	kg
Right Front	=	511.2	kg	Right Rear	=	419.1	kg
TOTAL FRONT	=	1094.5	kg	TOTAL REAR	=	860	kg
% Total Weight	=	56.0	%	%Total Weight	=	44.0	%
TOTAL WEIGHT	=	1954.5	kg				
Wheelbase	=				=	2914	mm
Longitudinal CG from Center of Front Axle	=				=	1282	mm *

ACTUAL IMPACT POINT

Impact is 4 mm Forward and 9 mm Below impact point \*

MAXIMUM EXTERIOR STATIC CRUSH: \*

1. LEVEL 1	(238 mm above ground)	=	177	mm
2. LEVEL 2	(471 mm above ground)	=	395	mm
3. LEVEL 3	(577 mm above ground)	=	351	mm
4. LEVEL 4	(893 mm above ground)	=	297	mm
5. LEVEL 5	(1306 mm above ground)	=	113	mm

Maximum Post-Test intrusion at Level 2 is 395 mm

<u>OCCUPANTS</u>	<u>Right Front Passenger</u>
Dummy Identification	HIII 3-Year-Old/040
Restraints Used	Torso Side Airbag

INSTRUMENTATION:

Number of Cameras	Offboard	4 †
	TOTAL	4

† Offboard cameras did not trigger

\* Side NCAP Test

**DATA SHEET NO. 3**

**POST-TEST OBSERVATIONS**

Vehicle: 2004 Acura 3.5RL

NHTSA No.: M45302TWG2

VISIBLE DUMMY CONTACT POINTS:

	<u>RIGHT FRONT SID H3</u>
Head	Not measured
Upper Torso	To seat mounted side airbag
Lower Torso	To seat mounted side airbag
Left Knee	Not measured
Left Leg	Not measured

DOOR OPENING:

	<u>LEFT DOOR</u>	<u>RIGHT DOOR</u>
Front	N/A	N/A
Rear	N/A	N/A

MDB DISTANCE FROM TARGET IMPACT POINT:

Horizontal	N/A	Vertical	N/A
------------	-----	----------	-----

ARM REST LOCATIONS:

Front	240 mm below window sill
Rear	N/A

SEAT MOVEMENT:

Front	N/A
Rear	N/A

GLAZING DAMAGE

Windshield	N/A
Window	N/A

PILLAR PERFORMANCE:

N/A

SILL SEPARATION

N/A

AIRBAG DEPLOYMENT STATUS:

	<u>DRIVER</u>	<u>FRONT PASSENGER</u>	<u>REAR PASSENGER</u>
<u>FRONT</u>	Did Not Deploy	Did Not Deploy	N/A
<u>SIDE</u>	Deployed Previously in Side NCAP Test	Deployed	N/A

OTHER NOTABLE IMPACT EFFECTS:

None

**SECTION 4**  
**OCCUPANT AND VEHICLE INFORMATION**

**DATA SHEET 4**

**IIII 3-YEAR-OLD INSTRUMENTATION DATA**

Vehicle: 2003 Acura 3.5RL

NHTSA No.: M45302TWG2

Dummy ID 040 Accelerations				
Max		Min		
G's	msec	G's	Msec	
HEAD ACCELERATION:				
Longitudinal (X)	35.0	37.5	-23.2	113.3
Lateral (Y)	5.6	116.2	-63.6	113.3
Vertical (Z)	25.6	14.1	-12.4	7.9
Resultant (R)	67.7	113.3		
HIC36	57			

REFERENCE:

Positive Direction -	Anterior/Posterior	+(X) = anterior
	Lateral	+(Y)= right
	Superior/Inferior	+(Z)= inferior
Negative Direction	Anterior/Posterior	-(X) = posterior
	Lateral	-(Y)= left
	Superior/Inferior	-(Z)= superior

Head Accelerations have been filtered at SAE Class 1000

**DATA SHEET 4 (continued)**

**IIII 3-YEAR-OLD INSTRUMENTATION DATA**

Vehicle: 2003 Acura 3.5RL

NHTSA No. M45302TWG2

Dummy ID 040					
		Max		Min	
		N	msec	N	msec
NECK FORCE:					
Longitudinal (X)	625.0	14.8	-300.5	39.2	
Lateral (Y)	12.5	5.3	-1.2	181.1	
Vertical (Z)	721.1	14.2	-332.0	8.0	
	Nm	msec	Nm	msec	
NECK MOMENT:					
Lateral Bending (X)	6.2	10.4	-9.8	79.7	
Flexion/Extension (Y)	30.2	14.5	-37.6	38.5	
Rotation (Z)	4.9	36.2	-10.9	19.0	

REFERENCE:

*Upper neck load cell polarity follows the dummy manipulation table A-1 in the NHTSA Test Reference Guide version 5*

Force

- Fx positive response: Head rearward, chest forward
- Fy positive response: Head leftward, chest rightward
- Fz positive response: Head upward, chest downward

Moment

- Mx positive response: Left ear to left shoulder
- My positive response: Chin to sternum
- Mz positive response: Chin to left shoulder

Neck forces have been filtered at SAE Class 1000

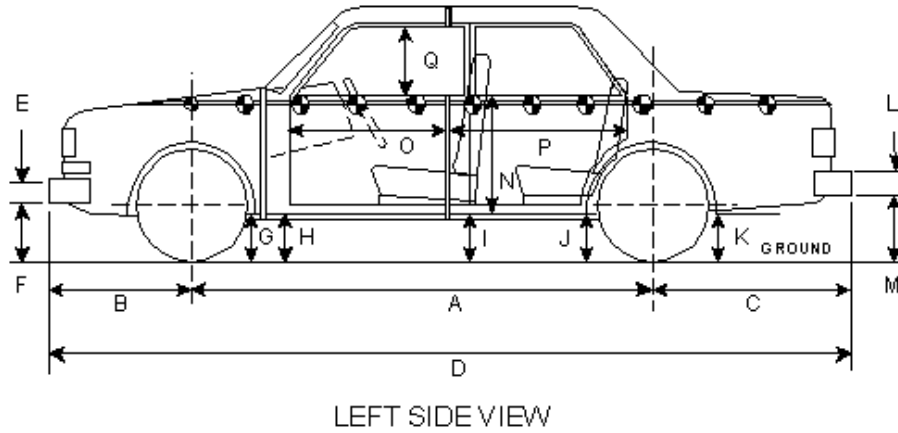
Neck moments have been filtered at SAE Class 600

**DATA SHEET 5**

**VEHICLE PRE- AND POST- MEASUREMENTS**

Vehicle: 2003 Acura 3.5RL

NHTSA No.: M45302TWG2



	PRE-TEST As delivered (mm)	PRE-TEST As Tested (mm)	POST-TEST (mm)	Δ CHANGE (mm)
A	2914	-	2861	-53
B	673	-	674	1
C	1010	-	1003	-7
D	4985	-	4958	-27
E	203	-	203	0
F	265	265	281	16
G	248	230	244	14
H	248	229	267	38
I	250	227	293	66
J1	189	160	121	-39
J2	261	228	256	28
K	295	254	263	9
L	265	-	265	0
M	329	289	295	6
N	705	-	617	-88
O	1085	-	1078	-7
P	900	-	843	-57
Q	453	-	425	-28
R	4597	-	4607	10
S	4597	-	4538	-59
T	1825	-	1456	-369

\* Side NCAP Test



**DATA SHEET 6**

**HIII 3-YEAR-OLD LONGITUDINAL CLEARANCE DIMENSIONS**

Vehicle: 2003 Acura 3.5RL

NHTSA No.: M45302TWG2



NOTE: All dimensions are in millimeters with tolerance of  $\pm 3$  mm and taken from tip of dummy nose

	Dummy ID/ HIII 3-Year-Old/040
ND	700
NS	201
NR	318

\* Reference: (ND) Nose to dashboard  
 (NS) Nose to side  
 (NR) Nose to header

## DATA SHEET 7

## HIGH-SPEED CAMERA LOCATIONS AND DATA SUMMARY

Vehicle: 2003 Acura 3.5RLNHTSA No. M45302TWG2

Camera No.	View	Coordinates (mm)*	Lens (mm)	Film Speed (fps)
101	Left overall of HIII 3-Year-Old	2115	25	5000
102	Front overall of HIII 3-Year-Old	2866	50	5000
104	Front-right oblique of HIII 3-Year-Old	1040	12.5	5000
105	Front close-up of HIII 3-Year-Old	2605	50	5000

† Offboard cameras did not trigger

\* Reference: From camera lens to tip of dummy nose

**APPENDIX A**  
**PHOTOGRAPHS**

**TABLE OF PHOTOGRAPHS**

<u>Figure</u>	<u>Photograph Title</u>	<u>Page</u>
A-1	PRE- SIDE NCAP (JAN 2004) LEFT SIDE VIEW OF TEST VEHICLE	A-3
A-2	POST- SIDE NCAP (JAN 2004) LEFT SIDE VIEW OF TEST VEHICLE	A-4
A-3	PRE-TEST RIGHT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD	A-5
A-4	POST-TEST RIGHT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD	A-6
A-5	PRE-TEST LEFT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD	A-7
A-6	POST-TEST LEFT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD	A-8
A-7	PRE-TEST FRONTAL VIEW OF HYBRID III 3-YEAR-OLD	A-9
A-8	POST-TEST REAR VIEW OF HYBRID III 3-YEAR-OLD	A-10
A-9	PRE-TEST VIEW OF HYBRID III 3-YEAR-OLD FEET PLACEMENT	A-11
A-10	POST-TEST LEFT OVERALL VIEW OF AIRBAG AND BOOSTER BLOCK	A-12
A-11	POST-TEST LEFT VIEW OF AIRBAG	A-13
A-12	VEHICLE IDENTIFICATION NUMBER	A-14



Figure A-1: PRE-SIDE NCAP (JAN 2004) LEFT SIDE VIEW OF TEST VEHICLE



Figure A-2: POST-SIDE NCAP (JAN 2004) LEFT SIDE VIEW OF TEST VEHICLE



Figure A-3: PRE-TEST (15 JUNE 2004) RIGHT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD



Figure A-4: POST-TEST (15 JUNE 2004) RIGHT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD





Figure A-5: PRE-TEST (15 JUNE 2004) LEFT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD



Figure A-6: POST-TEST (15 JUNE 2004) LEFT OCCUPANT COMPARTMENT VIEW OF HYBRID III 3-YEAR-OLD



Figure A-7: PRE-TEST (15 JUNE 2004) FRONTAL VIEW OF HYBRID III 3-YEAR-OLD



Figure A-8: POST-TEST (15 JUNE 2004) REAR VIEW OF HYBRID III 3-YEAR-OLD



Figure A-9: PRE-TEST (15 JUNE 2004) VIEW OF HYBRID III 3-YEAR-OLD FEET PLACEMENT

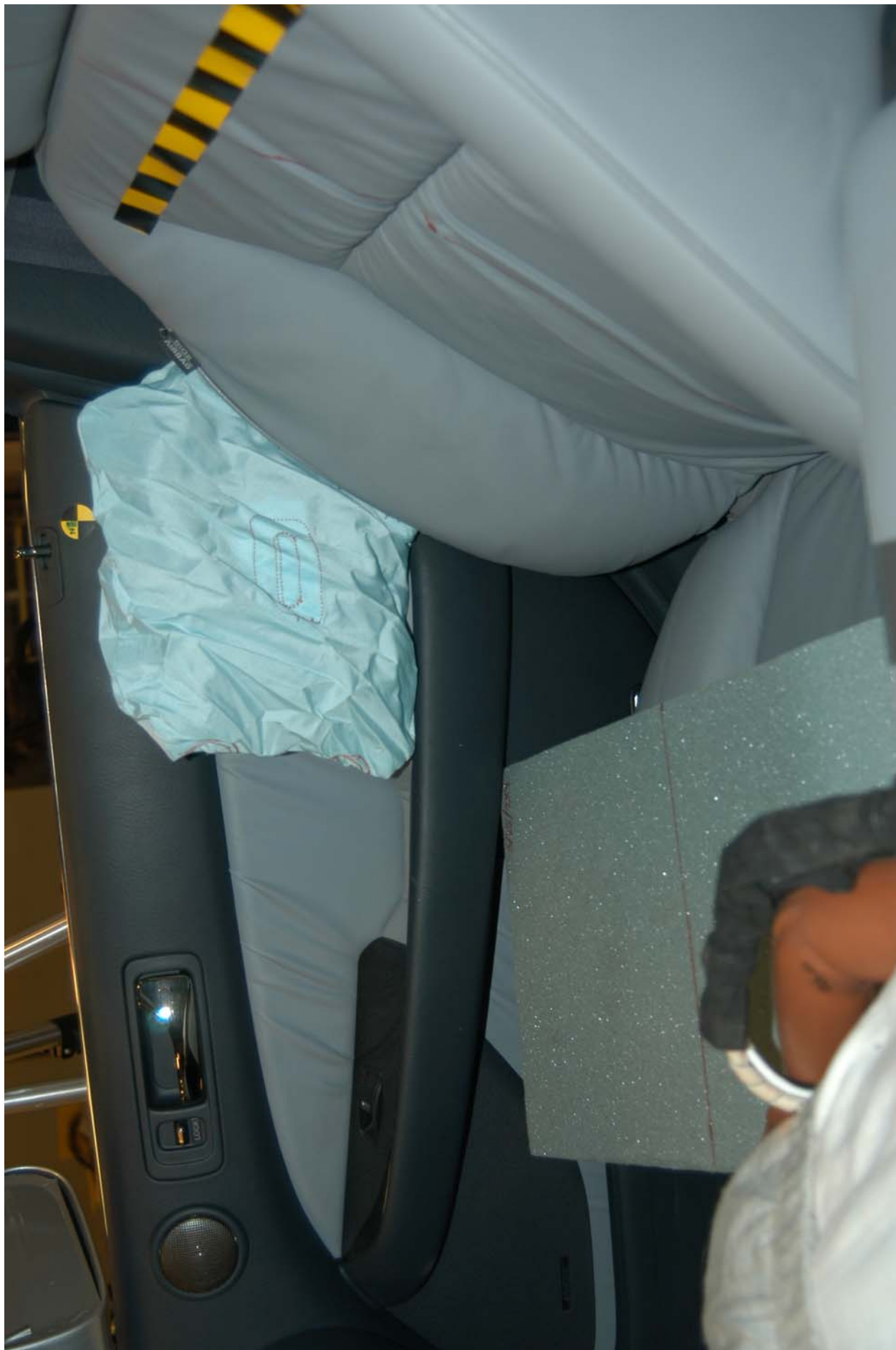


Figure A-10: POST-TEST (15 JUNE 2004) LEFT OVERALL VIEW OF AIRBAG AND BOOSTER BLOCK



Figure A-11: POST-TEST (15 JUNE 2004) LEFT VIEW OF AIRBAG



Figure A-12: VEHICLE IDENTIFICATION NUMBER



**APPENDIX B**

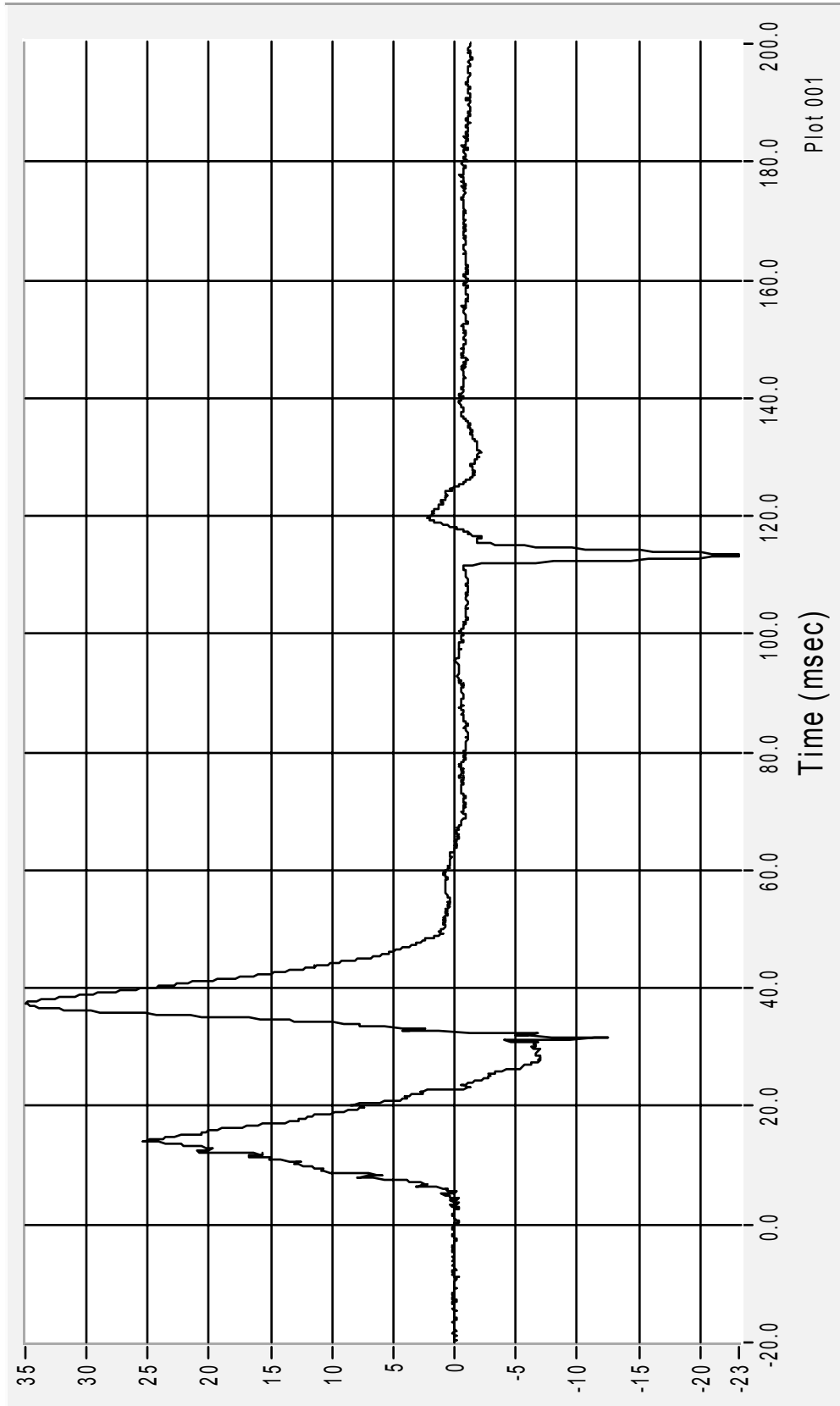
**HII 3 YR OLD RESPONSE DATA**

## TABLE OF CONTENTS

### DUMMY INSTRUMENTATION PLOTS ACCELERATION DATA – FILTER CLASS 1000, UPPER NECK FORCES – FILTER CLASS 1000; UPPER NECK MOMENTS FILTER CLASS 600

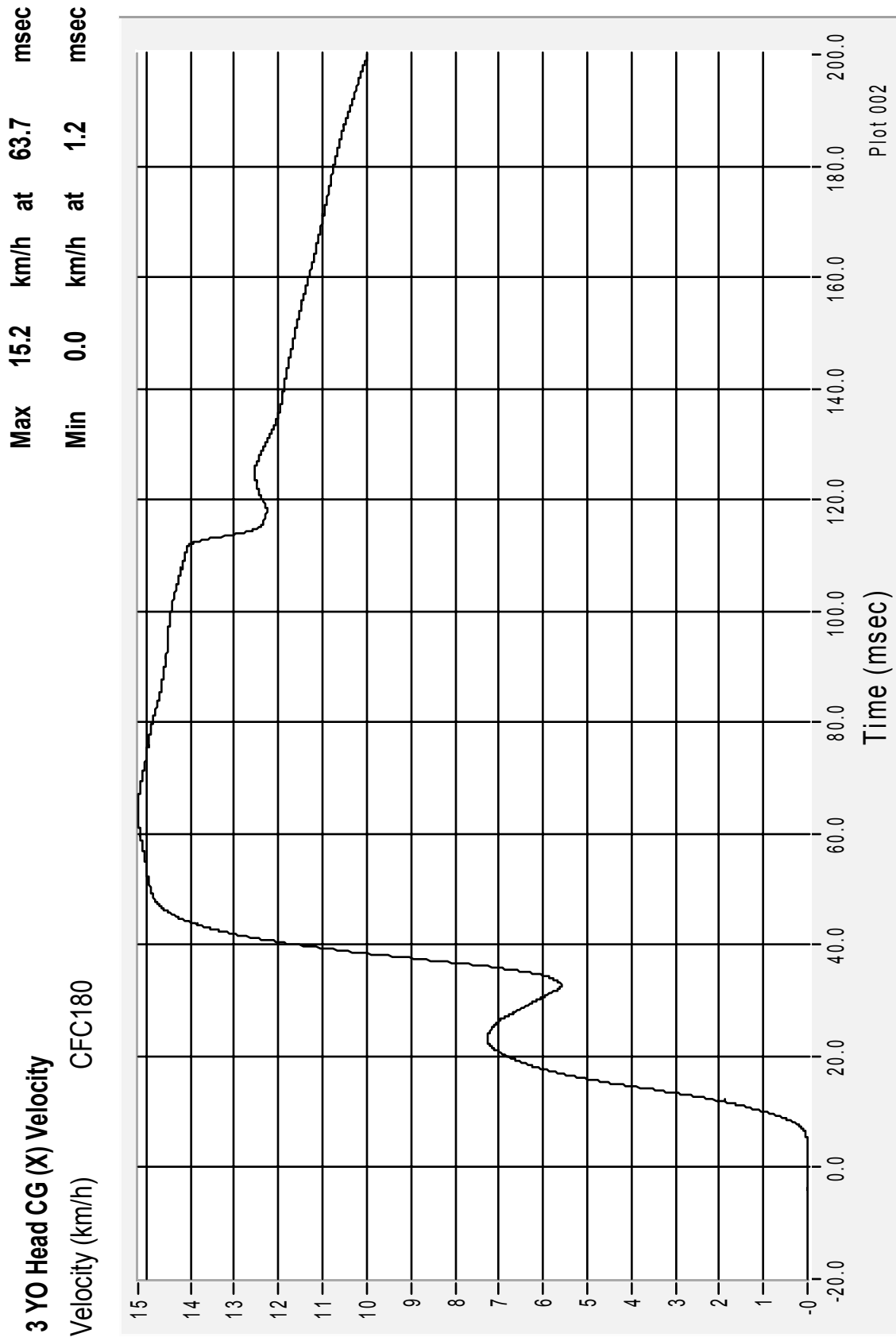
<u>Plot No.</u>	<u>Data Plot Title</u>	<u>Page</u>
1	NOSAD-102 3 YO HEAD CG (X) ACCELERATION	B-3
2	NOSAD-102 3 YO HEAD CG (X) VELOCITY	B-4
3	NOSAD-102 3 YO HEAD CG (Y) ACCELERATION	B-5
4	NOSAD-102 3 YO HEAD CG (Y) VELOCITY	B-6
5	NOSAD-102 3 YO HEAD CG (Z) ACCELERATION	B-7
6	NOSAD-102 3 YO HEAD CG (Z) VELOCITY	B-8
7	NOSAD-102 3 YO HEAD RESULTANT ACCELERATION	B-9
8	NOSAD-102 3 YO UPPER NECK (X) FORCE	B-10
9	NOSAD-102 3 YO UPPER NECK (Y) FORCE	B-11
10	NOSAD-102 3 YO UPPER NECK (Z) FORCE	B-12
11	NOSAD-102 3 YO UPPER NECK (X) MOMENT	B-13
12	NOSAD-102 3 YO UPPER NECK (Y) MOMENT	B-14
13	NOSAD-102 3 YO UPPER NECK (Z) MOMENT	B-15
14	NOSAD-102 3 YO UPPER NECK FORCES	B-16
15	NOSAD-102 3 YO UPPER NECK MOMENTS	B-17
16	NOSAD-102 3 YO N <sub>ij</sub> CRITERIA	B-18
17	NOSAD-102 3 YO AXIAL LOAD VS OCCIPITAL CONDYL MOMENT	B-19
18	NOSAD-102 3 YO 36 ms HIC	B-20

**3 YO Head CG (X) Acceleration**  
Acceleration (G) CFC1000  
Max 35.0 G at 37.5 msec  
Min -23.2 G at 113.3 msec



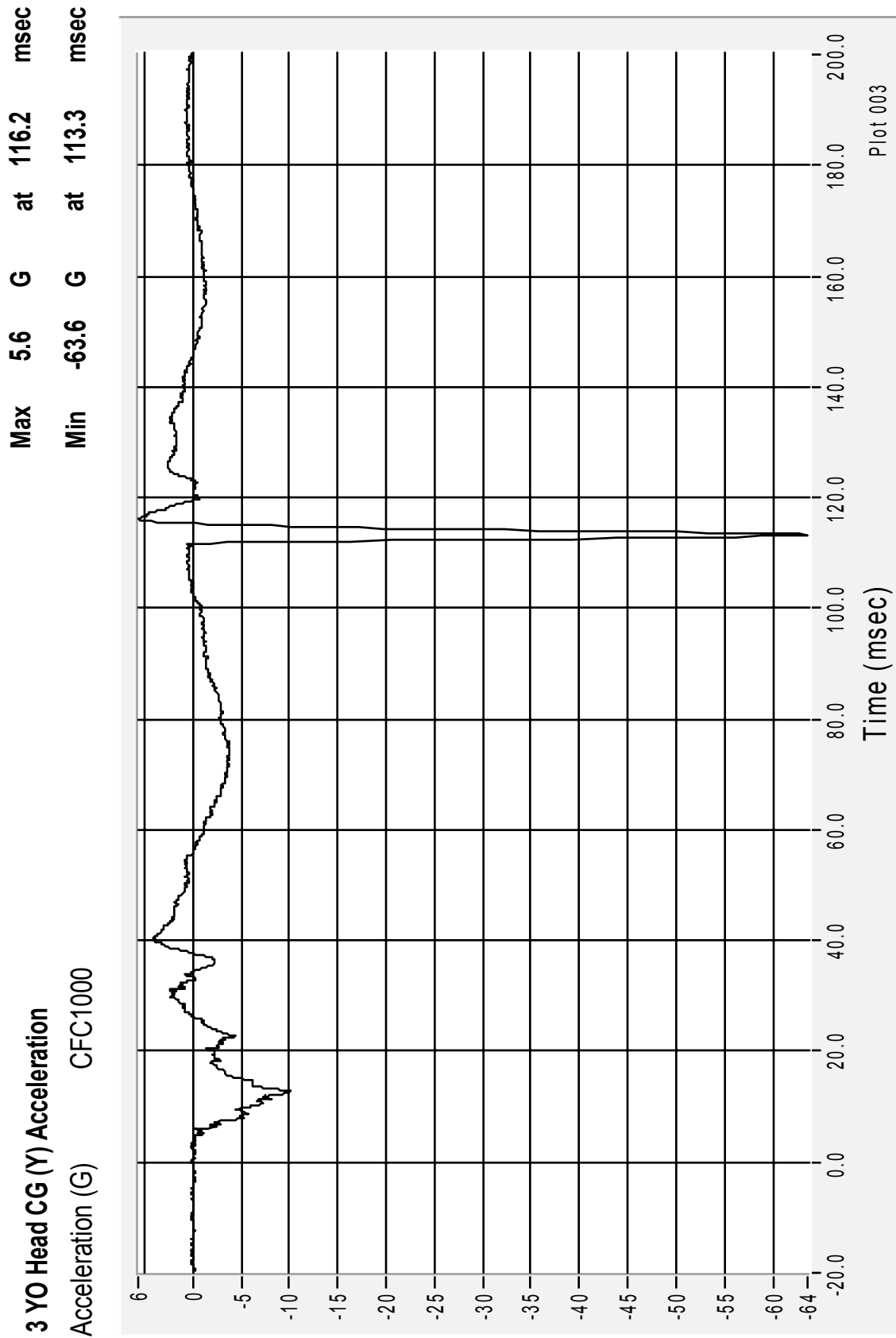
Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004



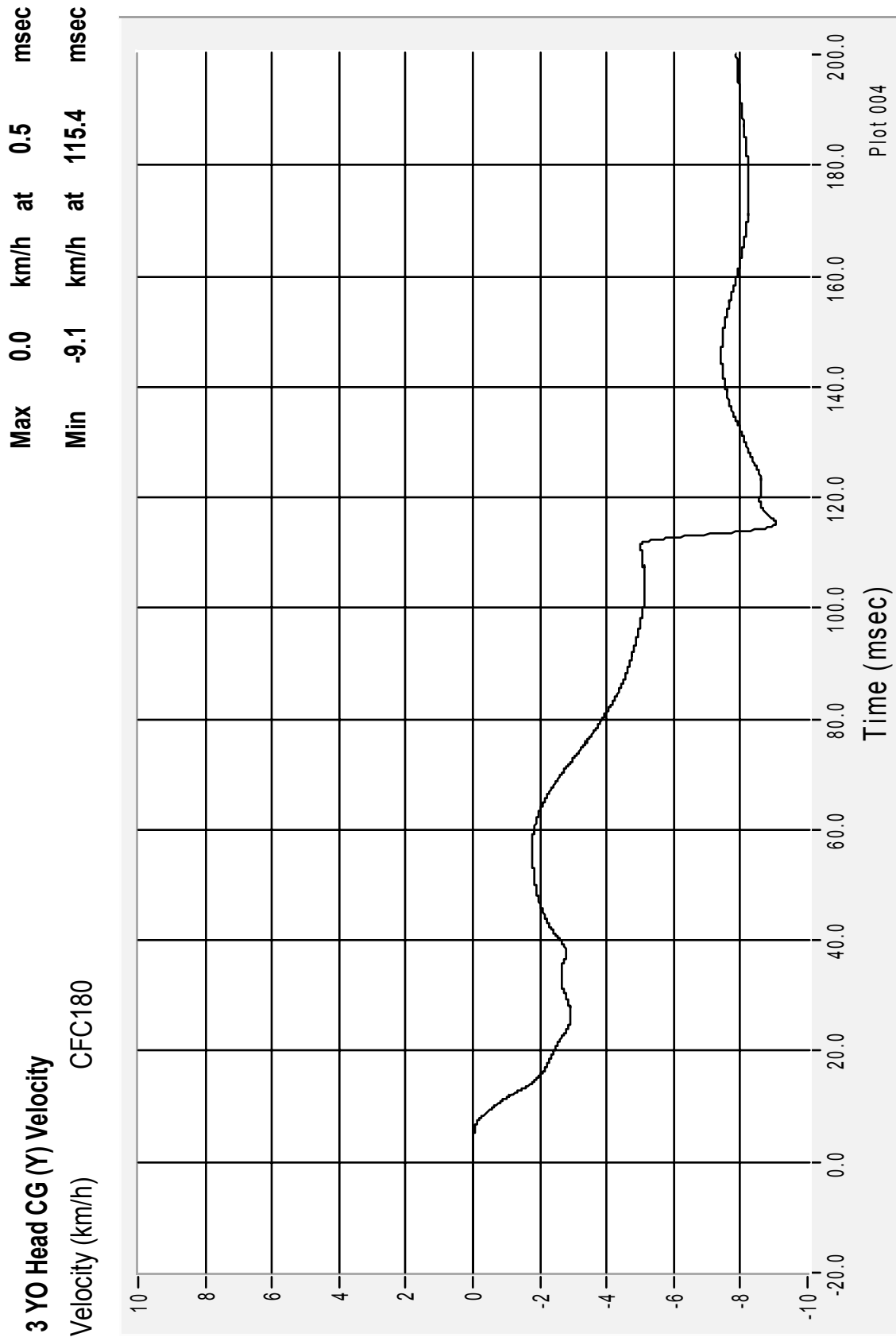
Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004



Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

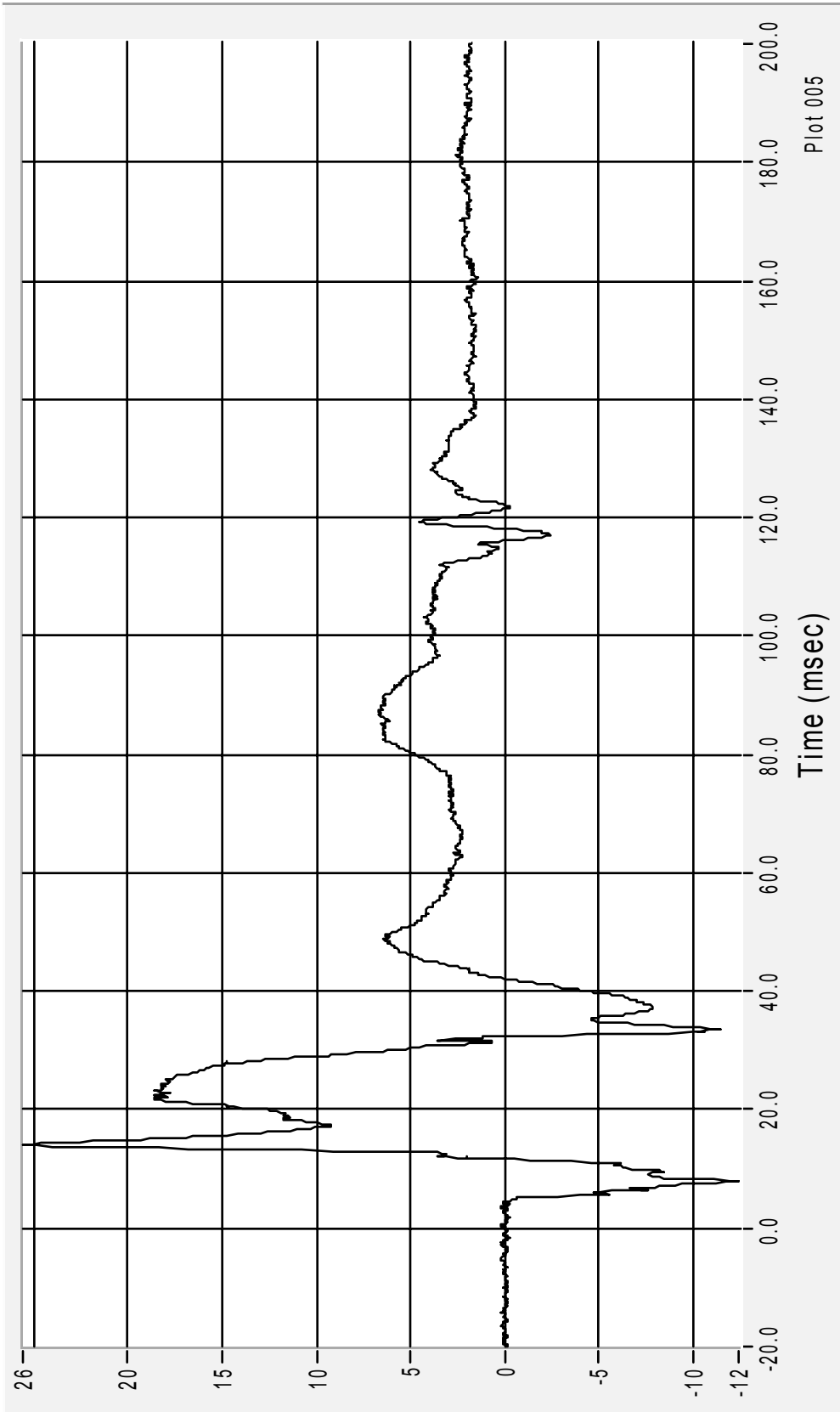


Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

**3 YO Head CG (Z) Acceleration**  
Acceleration (G) CFC1000

Max	25.6	G	at	14.1	msec
Min	-12.4	G	at	7.9	msec



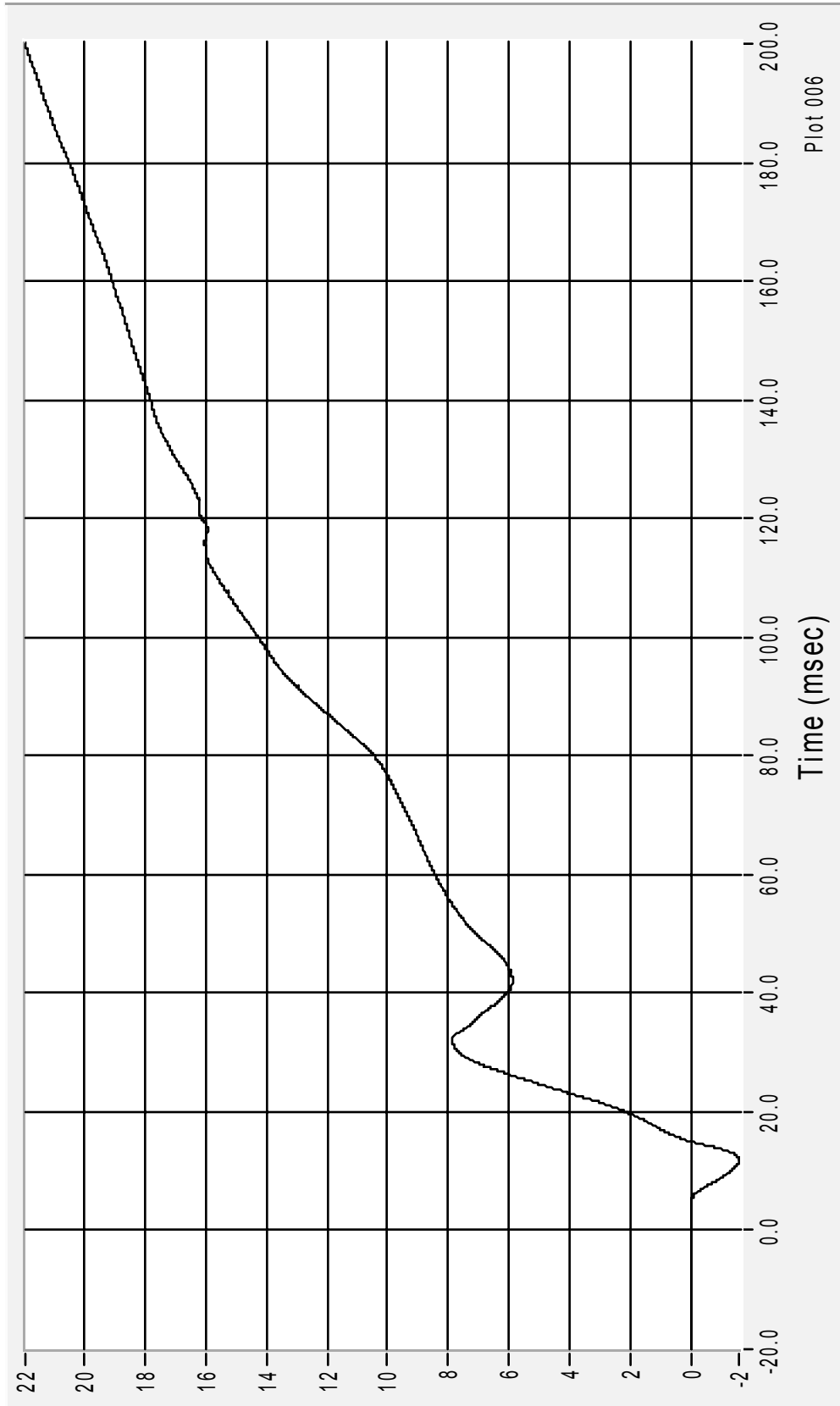
Plot 005

Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

**3 YO Head CG (Z) Velocity**  
Velocity (km/h) CFC180

Max	21.9	km/h	at	199.9	msec
Min	-1.6	km/h	at	11.8	msec



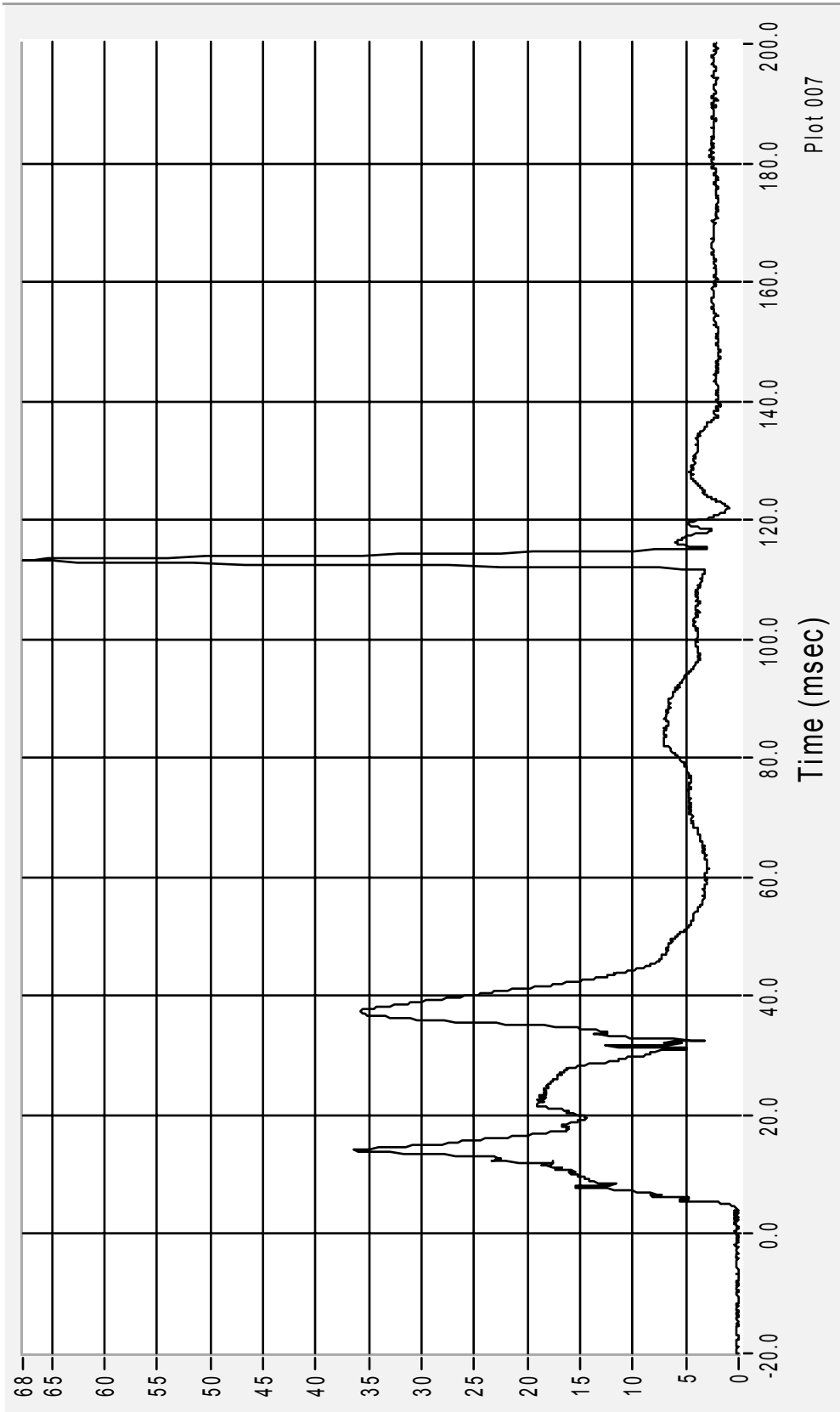
Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004



**3 YO Head Resultant Acceleration**  
Acceleration (G) CFC1000

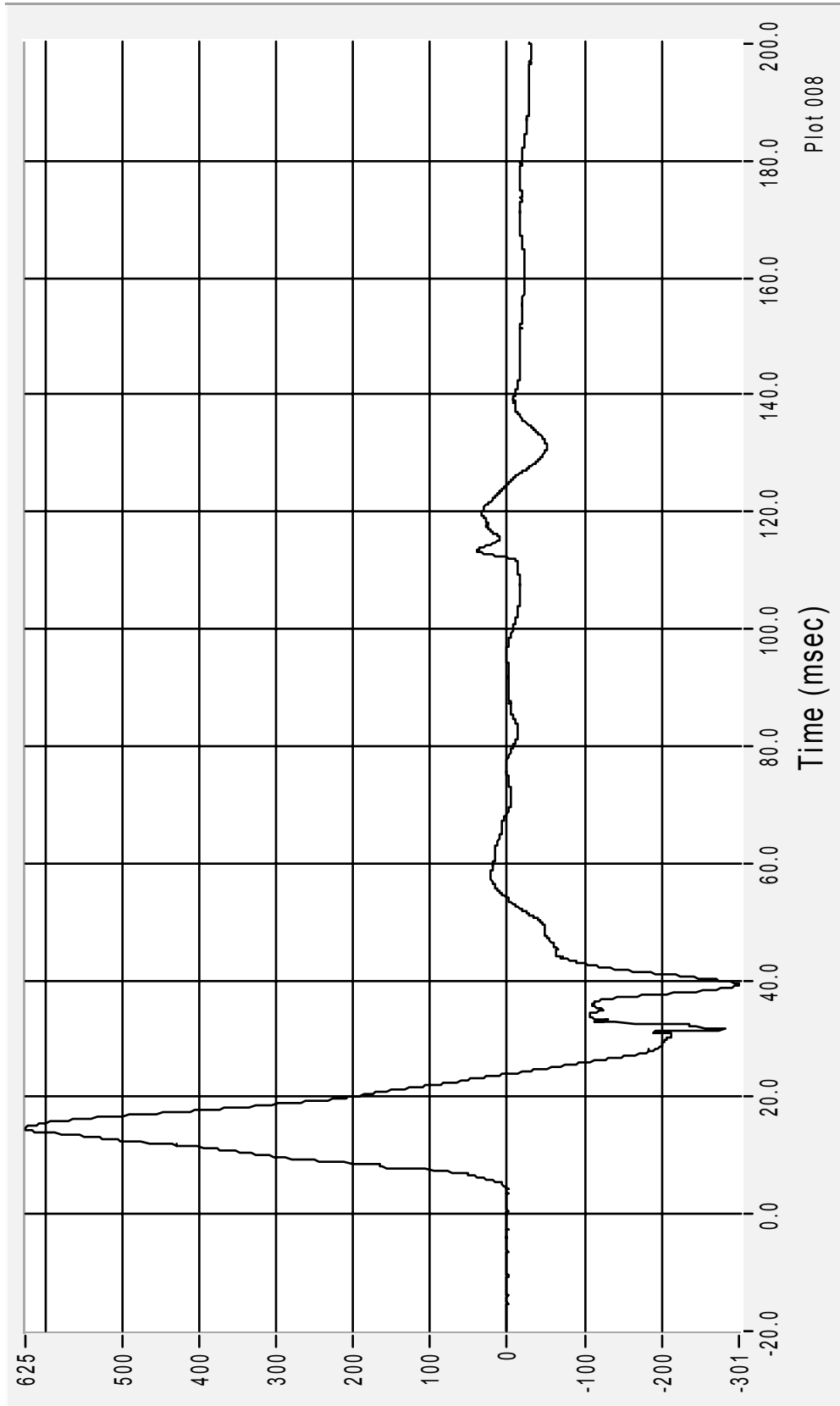
Max	67.7	G	at	113.3	msec
Min	0.0	G	at	3.0	msec



Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

**3 YO Upper Neck (X) Force**  
CFC1000  
Max 625.0 N at 14.8 msec  
Min -300.5 N at 39.2 msec

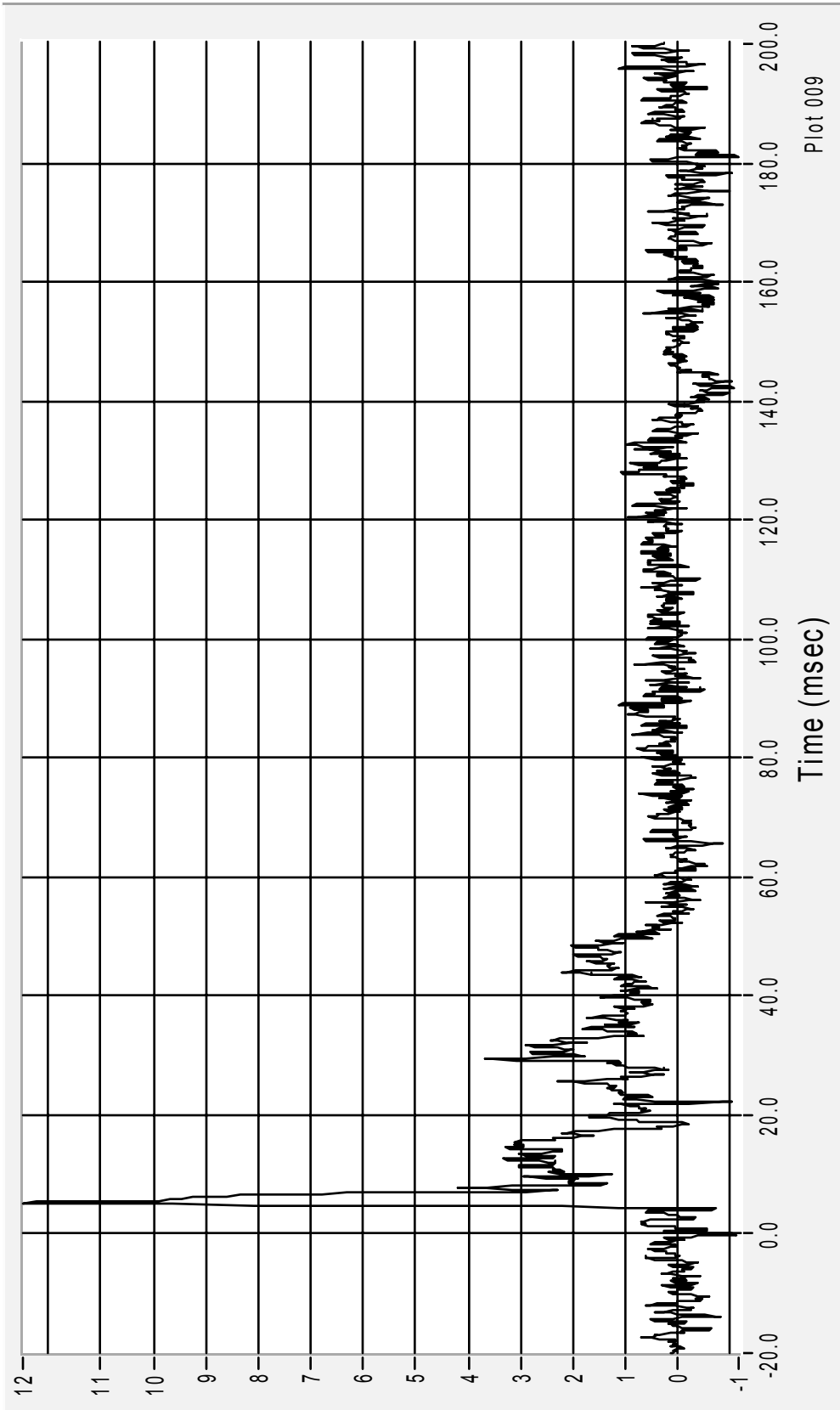


Plot 008

Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

**3 YO Upper Neck (Y) Force**  
CFC1000  
Max 12.5 N at 5.3 msec  
Min -1.2 N at 181.1 msec



Plot 009

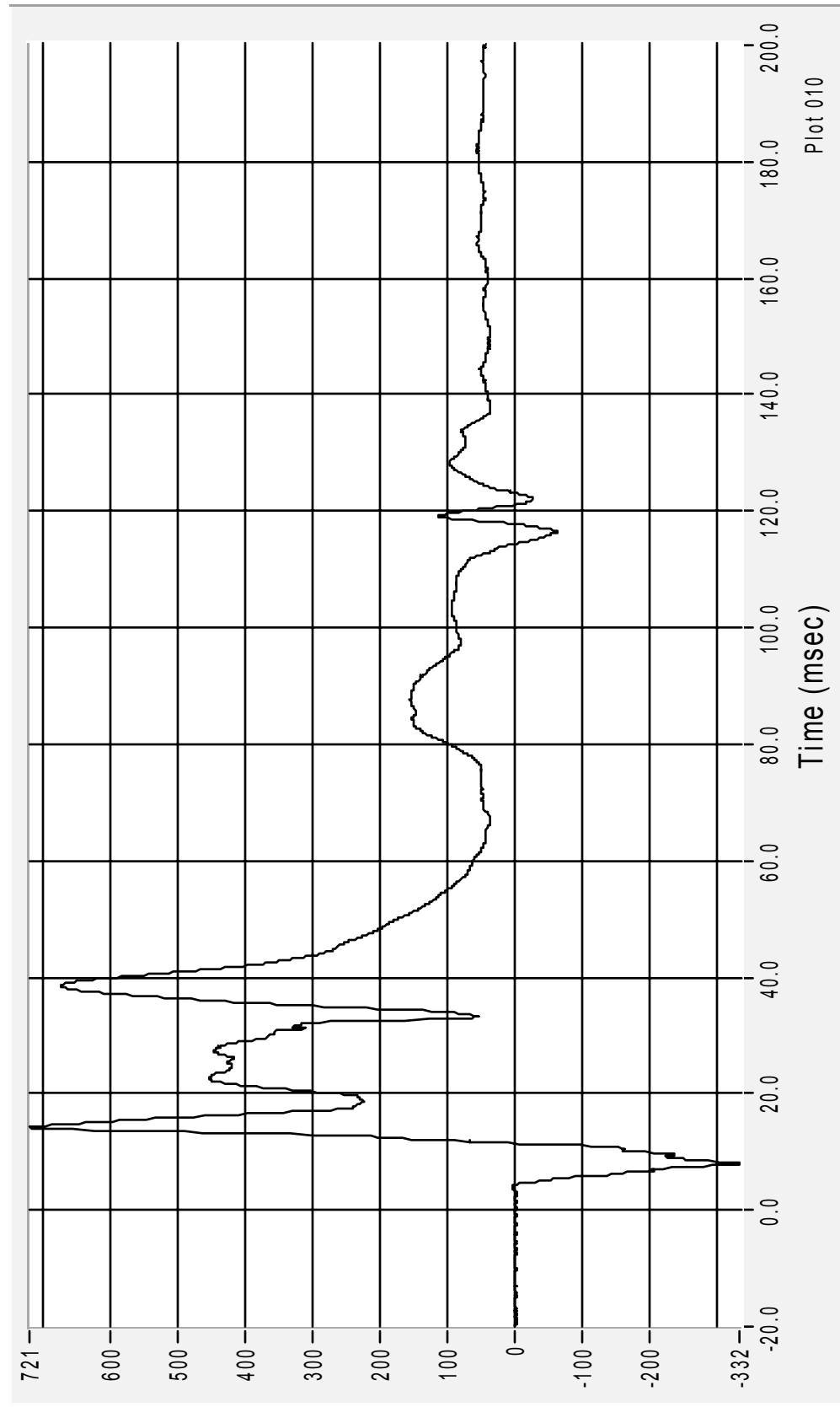
Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

Max 721.1 N at 14.2 msec  
Min -332.0 N at 8.0 msec

3 YO Upper Neck (Z) Force

Force (N) CFC1000

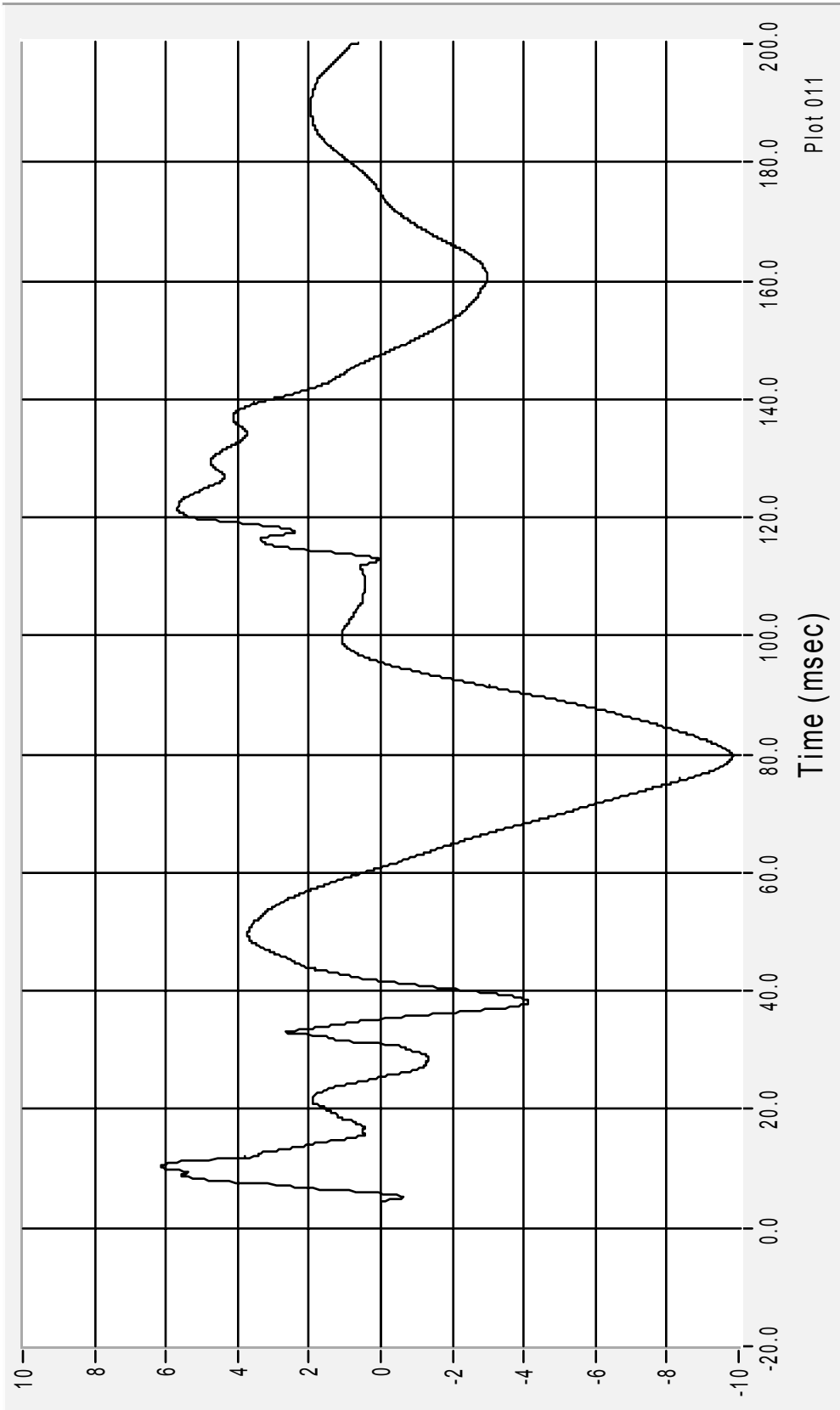


Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

**3 YO Upper Neck (X) Moment**  
Moment (Nm) CFC600

Max	6.2	Nm	at	10.4	msec
Min	-9.8	Nm	at	79.7	msec



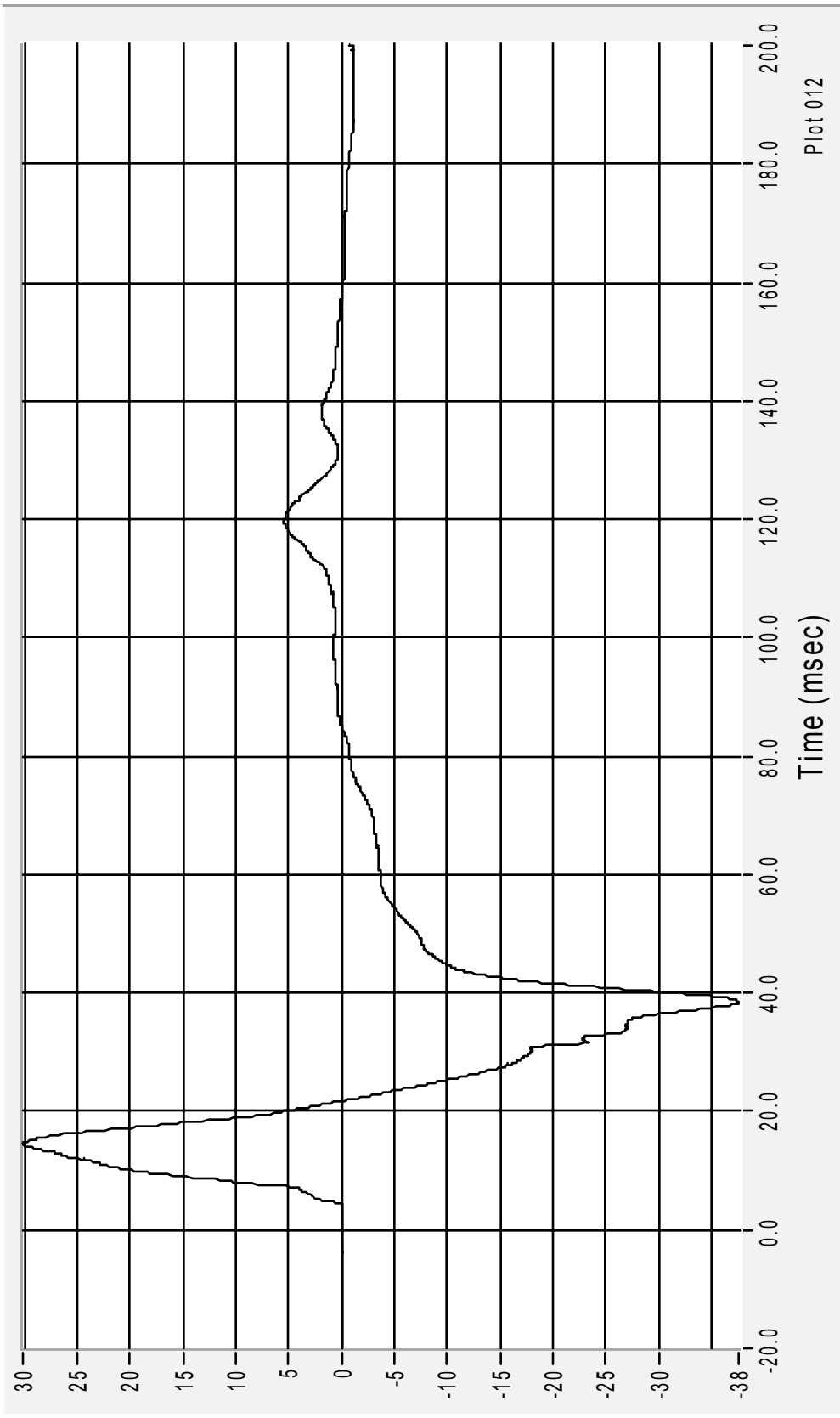
Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

Max 30.2 Nm at 14.5 msec  
Min -37.6 Nm at 38.5 msec

3 YO Upper Neck (Y) Moment

Moment (Nm) CFC600



Plot 012

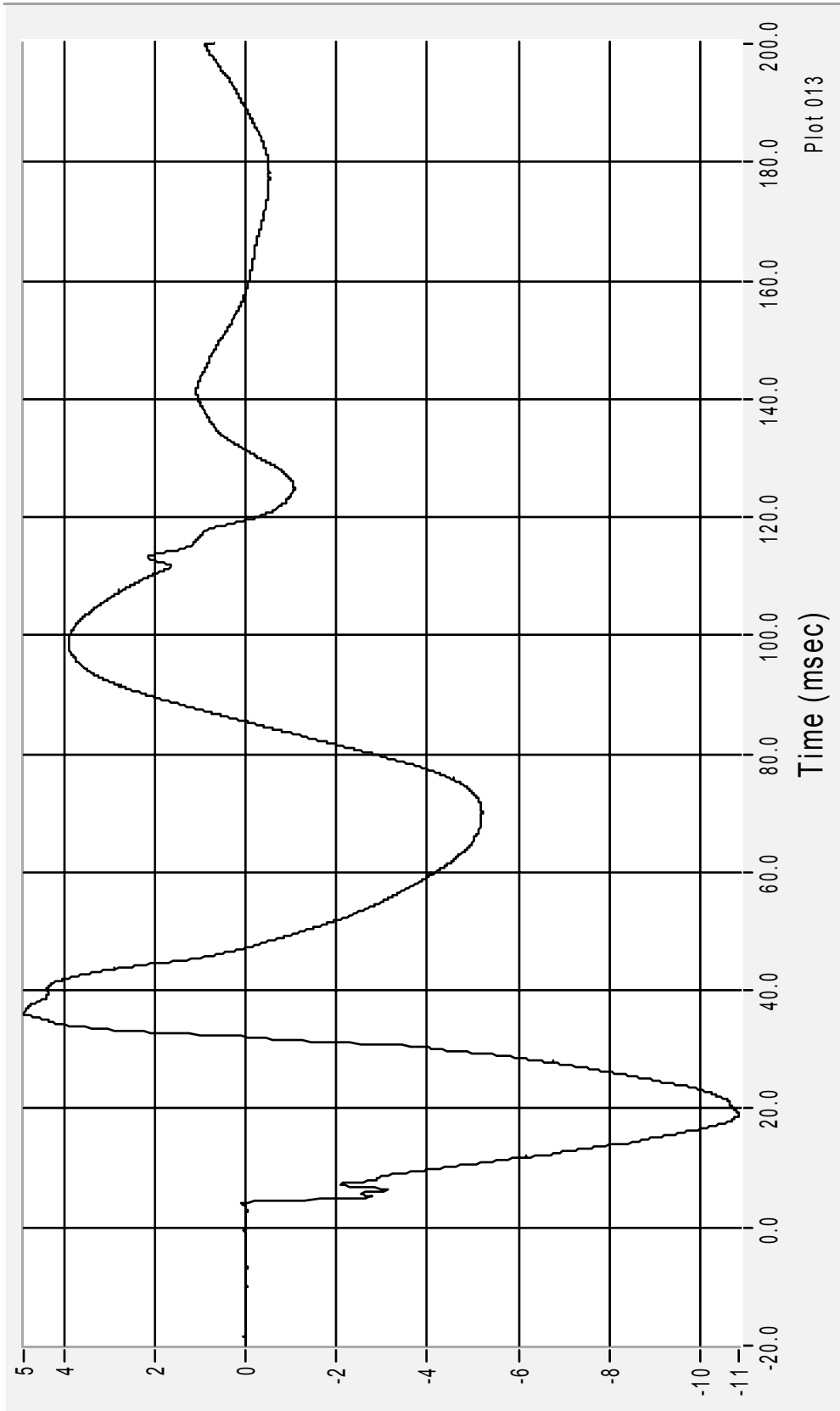
Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

Max 4.9 Nm at 36.2 msec  
Min -10.9 Nm at 19.0 msec

3 YO Upper Neck (Z) Moment

Moment (Nm) CFC600



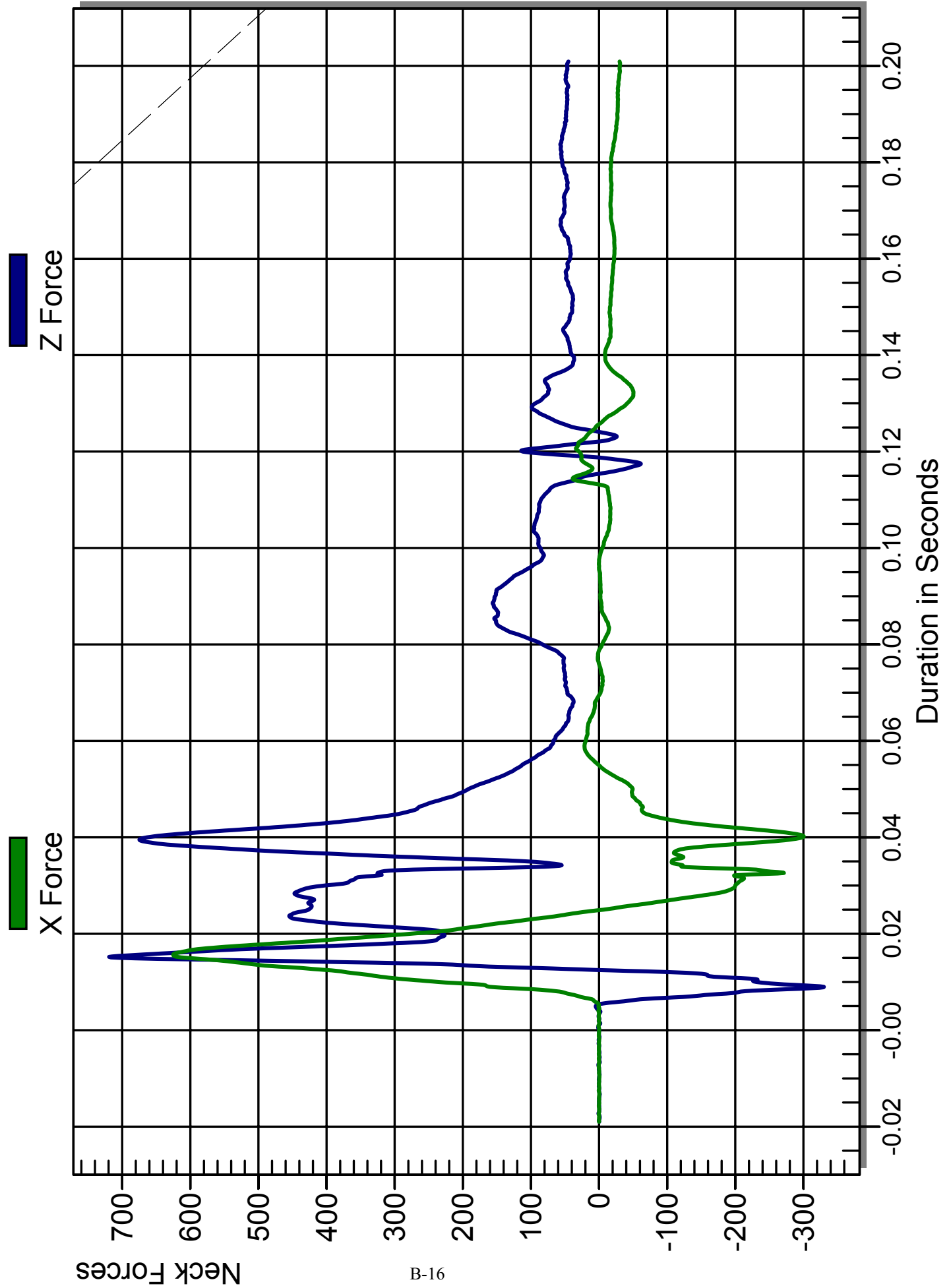
Plot 013

Medical College of Wisconsin  
Neurosurgery Research

NOSAD102 TWG 3.3.3.1  
15 June 2004

# Nij Version 10

Ntff= 0.78, Nte= 1.71, Ncf= 0.39, Nce= 0.00

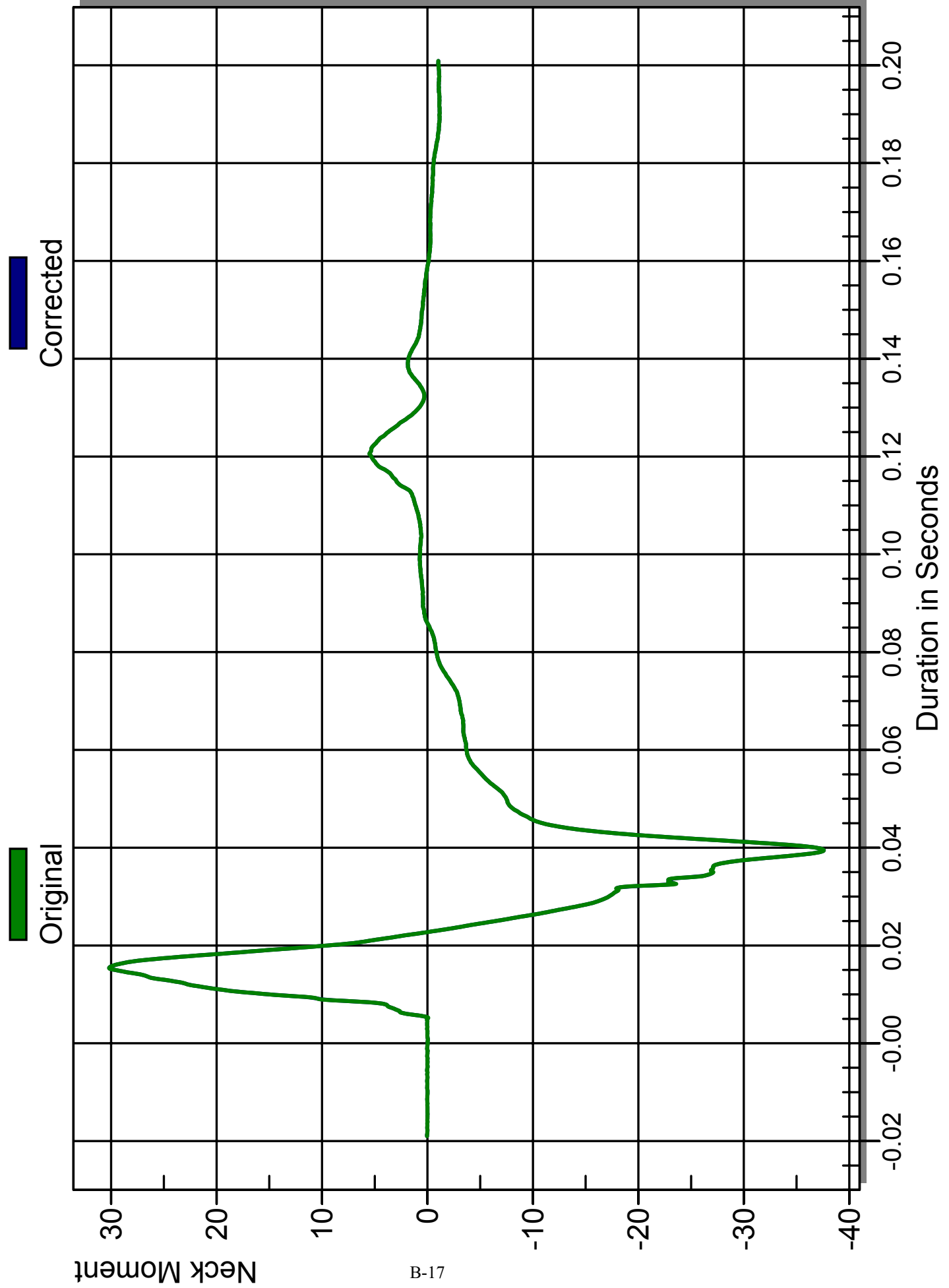


Neck Forces



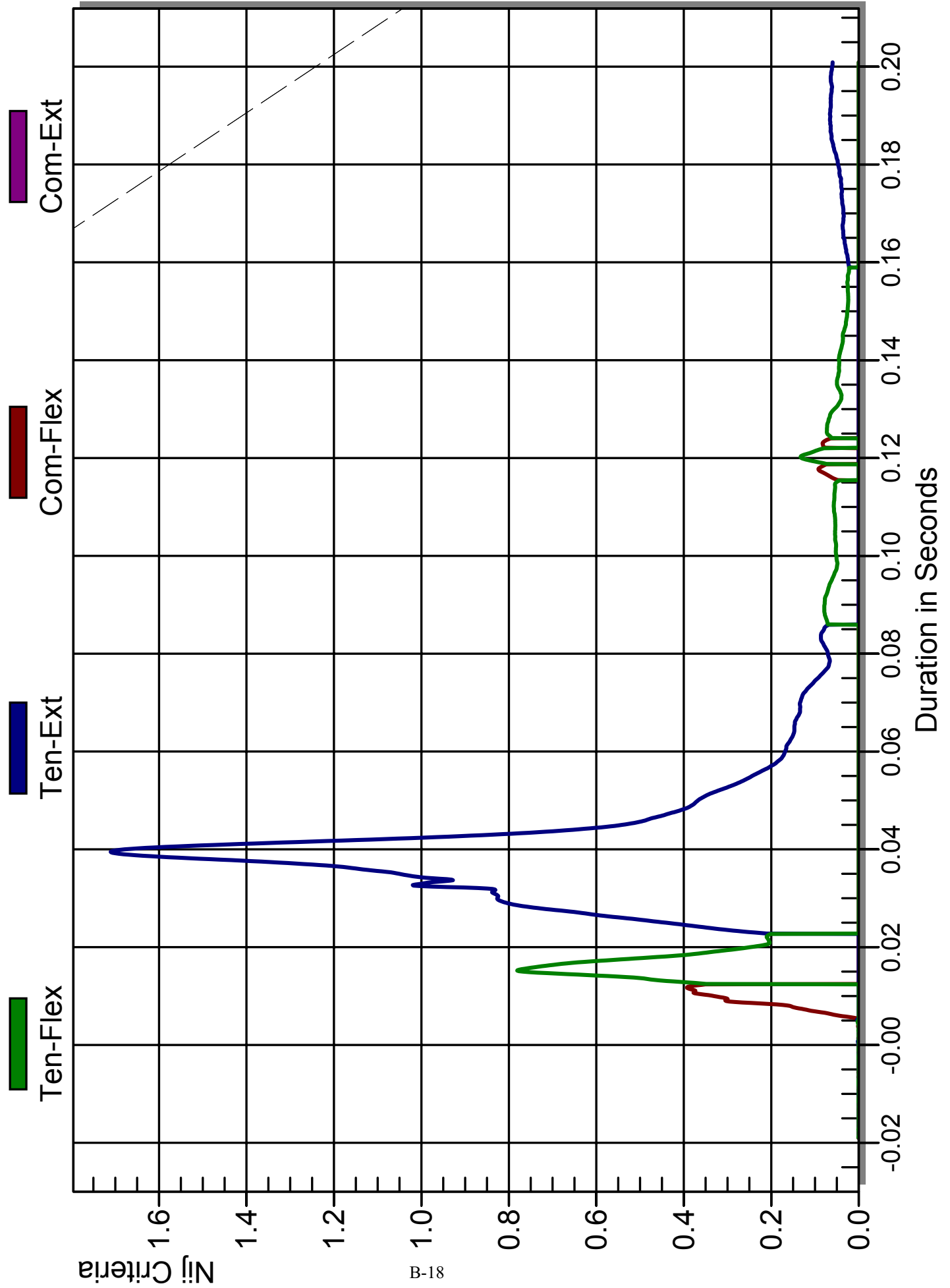
# Nij Version 10

Ntf= 0.78, Nte= 1.71, Ncf= 0.39, Nce= 0.00



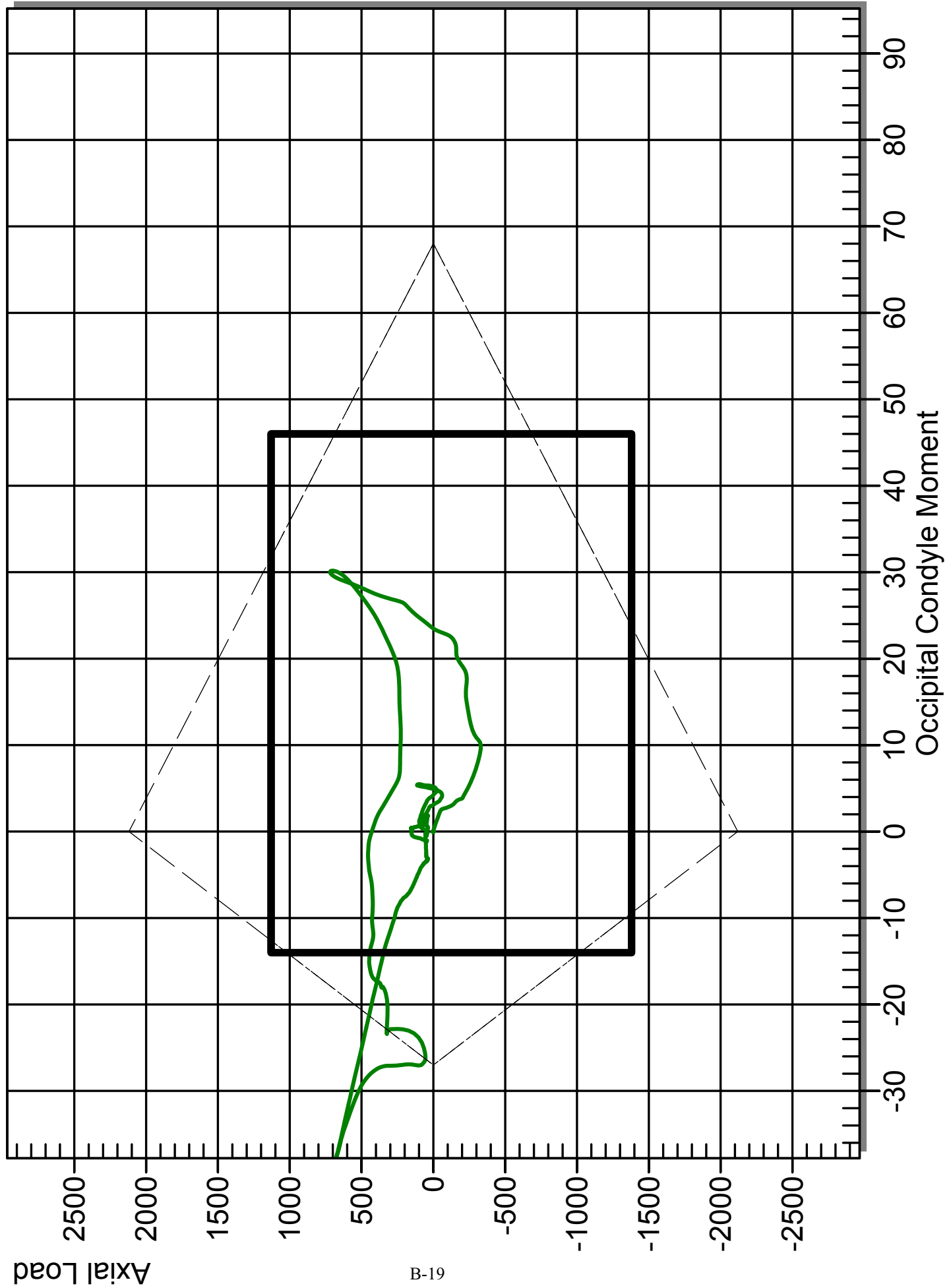
# Nij Version 10

Ntff= 0.78, Nte= 1.71, Ncf= 0.39, Nce= 0.00



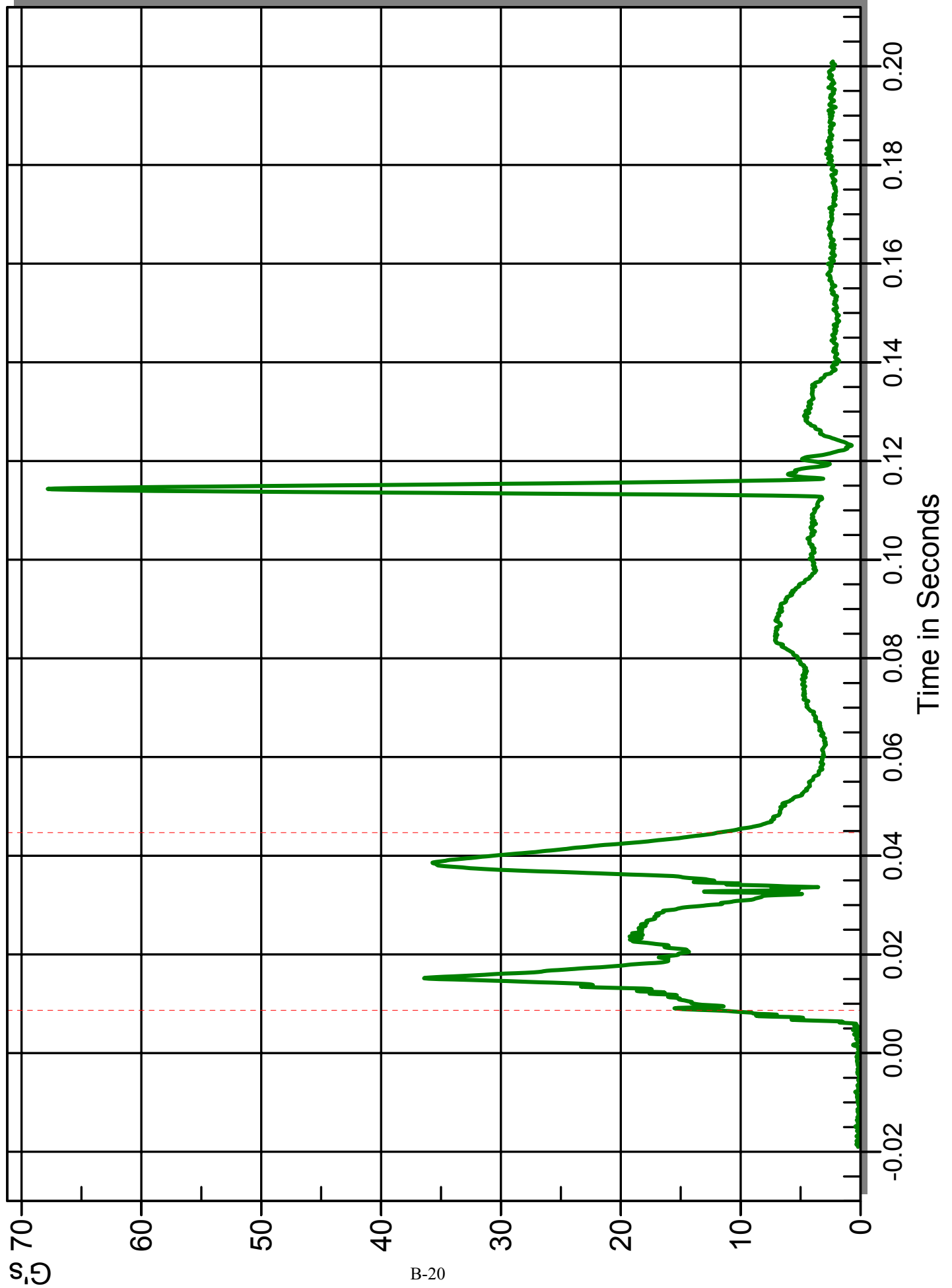
# Nij Version 10

Ntff= 0.78, Nte= 1.71, Ncf= 0.39, Nce= 0.00



# NOSAD102\_3YFH1X

36.0 ms HIC = 56.1 from 7.7 ms to 43.7 ms (36.0 ms)



**Appendix C**

**IIII 3 YR OLD CONFIGURATION AND VERIFICATION RESULTS**

**TABLE OF CONTENTS**

	Page No.
VERIFICATION TEST RESULTS SUMMARY PRE TEST	C-3
SUMMARY HIII 3 YR OLD VERIFICATION	C-4
DUMMY INSPECTION LIST TEST	C-9

**VERIFICATION TEST RESULTS SUMMARY  
PRE TEST**

HIII 3 YR OLD DUMMY Serial Number      HIII 3 YR OLD 040      Test Sequences      03

TEST	PRE	
	COMMENTS	BY
EXTERNAL DIMENSIONS	Pass all requirements	Technician at TRC
HEAD DROP	Pass all requirements	Technician at TRC
NECK FLEXION TEST	Pass all requirements	Technician at TRC
NECK EXTENSION TEST	Pass all requirements	Technician at TRC
THORAX IMPACT TEST	Pass all requirements	Technician at TRC
TORSO FLEXION TEST	Pass all requirements	Technician at TRC

**POST TEST**

HIII 3 YR OLD DUMMY Serial Number      HIII 3 YR OLD 040      Test Sequences      03

TEST	PRE	
	COMMENTS	BY
NECK FLEXION TEST	Pass all requirements	Technician at MGA
NECK EXTENSION TEST	Pass all requirements	Technician at MGA

**SUMMARY**  
**HIII 3 YR OLD DUMMY VERIFICATION**

Dummy Serial Number

HIII 3 YR OLD 040

Calibration Number

03

**MEASUREMENTS**

TEST PARAMETER	SPECIFICATION	HIII 3 YR OLD 040
		TEST RESULTS
A - Total Sitting Height (mm)	538.5 - 553.7	545
B - Shoulder Pivot Height (mm)	307.3 - 322.6	315
C - Hip Pivot Height (mm)	33.0 - 43.2	40
D - Hip Pivot From Backline (mm)	56.9 - 67.1	66
E - Shoulder Pivot from Backline (mm)	58.4 - 68.6	64
F - Thigh Clearance (mm)	81.0 - 91.2	86
G - Back of Elbow to Wrist Pivot (mm)	247.4 - 262.6	251
H - Head Back to Backline (mm)	48.3 - 58.4	53
I - Shoulder to Elbow Length (mm)	185.0 - 200.7	196
J - Elbow Rest Height (mm)	133.6 - 148.8	139
K - Buttock to Knee Length (mm)	287.3 - 302.5	297
L - Popliteal Height (mm)	221.0 - 236.2	229
M - Knee to Floor Height (mm)	241.6 - 256.8	254
N - Buttock Popliteal Height (mm)	217.9 - 233.2	225
O - Chest Depth without Jacket (mm)	134.6 - 149.9	145
P - Foot Length (mm)	137.7 - 147.8	140
Q - Stature (mm)	932.2 - 957.6	945
R - Buttock to Knee Pivot Length (mm)	251.5 - 261.6	254
S - Head Breadth (mm)	128.3 - 143.5	138
T - Head Depth (mm)	167.4 - 182.6	178
U - Hip Breadth (mm)	200.7 - 215.9	204
V - Shoulder Breadth (mm)	236.5 - 251.7	239
W - Foot Breadth (mm)	53.6 - 63.8	57
X - Head Circumference (mm)	500.4 - 515.6	503
Y - Chest Circumference with Jacket (mm)	527.1 - 552.5	548
Z - Waist Circumference (mm)	527.1 - 552.5	540
AA - Reference Location for Chest Circumference (mm)	248.9 - 259.1	255
BB - Reference Location for Waist Circumference (mm)	160.0 - 170.2	165



**SUMMARY**  
**HIII 3 YR OLD DUMMY PRE VERIFICATION**

Dummy Serial Number	<u>HIII 3 YR OLD 040</u>	Calibration Number	<u>03 - 1</u>
		Test Date	<u>18 May 2004</u>

**572P Head Drop Test**

TEST PARAMETER	SPECIFICATION	HIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	18.9 - 25.6	20.6
Relative Humidity (%)	10 - 70	51
Peak Resultant Acceleration (G's)	250 - 280	264.8
Peak Lateral Acceleration (G's)	15 G Max	8.0
Is Acceleration Curve Unimodal?	Yes	Yes

**SUMMARY**  
**HIII 3 YR OLD DUMMY VERIFICATION**

Dummy Serial Number      HIII 3 YR OLD 040      Calibration Number      03 - 3  
 Test Date      18 May 2004

**572P Neck Flexion Test - 6 Channel Transducer - Pre Test**

TEST PARAMETER	SPECIFICATION	HIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	20.6 - 22.2	20.7
Relative Humidity (%)	10 - 70	52
Impact Velocity (m/s)	5.40 - 5.60	5.58
Integrated Pendulum Velocity (m/s)		
10 ms	2.00 - 2.70	2.60
15 ms	3.00 - 4.00	3.76
20 ms	4.00 - 5.10	5.07
Peak D Plane Rotation (degrees)	70 - 82	71.0
Peak Moment About Occipital Condyles (Nm)	42.0 - 53.0	45.49
Positive Moment Decay Time To 10 Nm (ms)	60 - 80	71.60

Dummy Serial Number      HIII 3 YR OLD 040      Calibration Number      D04BF2  
 Test Date      22 June 2004

**572P Neck Flexion Test - 6 Channel Transducer - Post Test**

TEST PARAMETER	SPECIFICATION	HIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	20.6 - 22.2	21.4
Relative Humidity (%)	10 - 70	52
Impact Velocity (m/s)	5.40 - 5.60	5.50
Integrated Pendulum Velocity (m/s)		
10 ms	2.00 - 2.70	2.20
15 ms	3.00 - 4.00	3.20
20 ms	4.00 - 5.10	4.40
Peak D Plane Rotation (degrees)	70 - 82	80.1
Peak Moment About Occipital Condyles (Nm)	42.0 - 53.0	43.5
Positive Moment Decay Time To 10 Nm (ms)	60 - 80	73

**Summary**  
**HIII 3 YR OLD DUMMY VERIFICATION**

Dummy Serial Number      HIII 3 YR OLD 040      Calibration Number      03 - 2  
 Test Date      18 May 2004

**572P Neck Extension Test - 6 Channel Transducer - Pre Test**

TEST PARAMETER	SPECIFICATION	HIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	20.6 - 22.2	20.7
Relative Humidity (%)	10 - 70	52
Impact Velocity (m/s)	3.55 - 3.75	3.71
Integrated Pendulum Velocity (m/s)		
10 ms	1.00 - 1.40	1.25
15 ms	1.90 - 2.50	2.18
20 ms	2.80 - 3.50	2.96
Peak D Plane Rotation (degrees)	83 - 93	86.7
Peak Moment About Occipital Condyles (Nm)	-53.3 - (-43.7)	-45.06
Positive Moment Decay Time To 10 Nm (ms)	60 - 80	70.56

Dummy Serial Number      HIII 3 YR OLD 040      Calibration Number      D04BH3  
 Test Date      22 June 2004

**572P Neck Extension Test - 6 Channel Transducer - Post Test**

TEST PARAMETER	SPECIFICATION	HIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	20.6 - 22.2	21.4
Relative Humidity (%)	10 - 70	52
Impact Velocity (m/s)	3.55 - 3.75	3.72
Integrated Pendulum Velocity (m/s)		
10 ms	1.00 - 1.40	1.30
15 ms	1.90 - 2.50	2.20
20 ms	2.80 - 3.50	3.00
Peak D Plane Rotation (degrees)	83 - 93	84.0
Peak Moment About Occipital Condyles (Nm)	-53.3 - (-43.7)	-47.1
Positive Moment Decay Time To 10 Nm (ms)	60 - 80	67.7

**Summary**  
**IIII 3 YR OLD DUMMY PRE VERIFICATION**

Dummy Serial Number      IIII 3 YR OLD 040      Calibration Number      040C03TF1  
 Test Date      18 May 2004

**572P Torso Flexion Test**

TEST PARAMETER	SPECIFICATION	IIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	18.9 - 25.6	20.7
Relative Humidity (%)	10 - 70	55
Initial Angle of Unsupported Dummy (degrees)	<=15 Reference to Vertical	5.1
Maximum Force at 45 Degrees During 10 Second Period (N)	130 - 180	170.7
Return Angle (degrees)		1.3
Difference Between Return Angle & Initial Angle (degrees)	+/- 10 Degrees of Initial Angle	3.8
Rate (degrees/sec)	0.5 - 1.5	1.05

Dummy Serial Number      IIII 3 YR OLD 040      Calibration Number      03 - 1  
 Test Date      19 May 2004

**572P Thorax Test**

TEST PARAMETER	SPECIFICATION	IIII 3 YR OLD 040
		TEST RESULTS
Temperature (degrees C)	20.6 - 22.2	20.6
Relative Humidity (%)	10 - 70	51
Pedulum Velocity (m/s)	5.90 - 6.10	5.95
Maximum Chest Deflection (mm)	-38.0 - (-32.0)	-32.4
Peak Impact Probe Force Within Compression Corridor (N)	680 - 810	730
Internal Hysteresis (%)	65 - 85	70
Maximum Force Between 12.5 mm & 32 mm of Deflection	<=910	811

**Summary**  
**HIII 3 YR OLD DUMMY VERIFICATION**

**DUMMY INSPECTION LIST**  
**PRE TEST**

HIII 3 YR OLD Serial Number 040

		HIII 3 YR OLD
		PRE
	DATE	14 June 2004
	PERFORMED BY	Mark Meyer
PART	INSPECTION	Pass
Skin	Visual	Pass
Head	Visual, Accelerometer Mount	Pass
Neck	Visual	Pass
Spine Box	Visual	Pass
Rib Cage	Visual	Pass
Sternum	Visual	Pass
Lumbar Spine	Visual	Pass
Abdomen	Visual	Pass
Pelvis	Visual	Pass
Upper Legs	Visual	Pass
Knees	Visual, Stops, Inserts	Pass
Lower Legs	Visual, Range of Motion	Pass
Ankles	Visual, Range of Motion	Pass
Feet	Visual, Range of Motion	Pass
Joints	1 to 2 G Range	Pass
Other		None

**Summary**  
**HIII 3 YR OLD DUMMY VERIFICATION**

**DUMMY INSPECTION LIST**  
**POST TEST**

HIII 3 YR OLD Serial Number 040

		HIII 3 YR OLD
		POST
		16 June 2004
		Mark Meyer
PART	INSPECTION	Pass
Skin	Visual	Pass
Head	Visual, Accelerometer Mount	Pass
Neck	Visual	Pass
Spine Box	Visual	Pass
Rib Cage	Visual	Pass
Sternum	Visual	Pass
Lumbar Spine	Visual	Pass
Abdomen	Visual	Pass
Pelvis	Visual	Pass
Upper Legs	Visual	Pass
Knees	Visual, Stops, Inserts	Pass
Lower Legs	Visual, Range of Motion	Pass
Ankles	Visual, Range of Motion	Pass
Feet	Visual, Range of Motion	Pass
Joints	1 to 2 G Range	Pass
Other		None

**APPENDIX D**

**TEST EQUIPMENT LIST AND CALIBRATION INFORMATION**

**TABLE OF CONTENTS**

Section	Page No.
DUMMY INSTRUMENTATION	D-3



**DUMMY INSTRUMENTATION****HYBRID III 3-Year-Old NO. 040**

	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
HEAD X ACCELERATION	J43708	ENDEVCO	08June04
HEAD Y ACCELERATION	J44017	ENDEVCO	08June04
HEAD Z ACCELERATION	J43798	ENDEVCO	08June04
SIX AXIS UPPER NECK LOAD CELL (FX, FY, FZ, MX, MY, MZ)	121	DENTON ATD	26Aug03