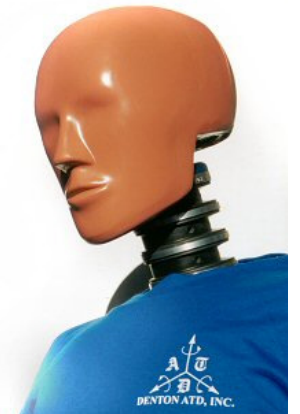


# GM Biorid Fx Data Issue Final Results

Report to GTR/TEG

April 28, 2010



# Overview

- GM data
- Initial Repairs
- Certification test results after repairs
- Current skull cap finding
- Head rest test results
- GM seat test confirming results
- Recommendations





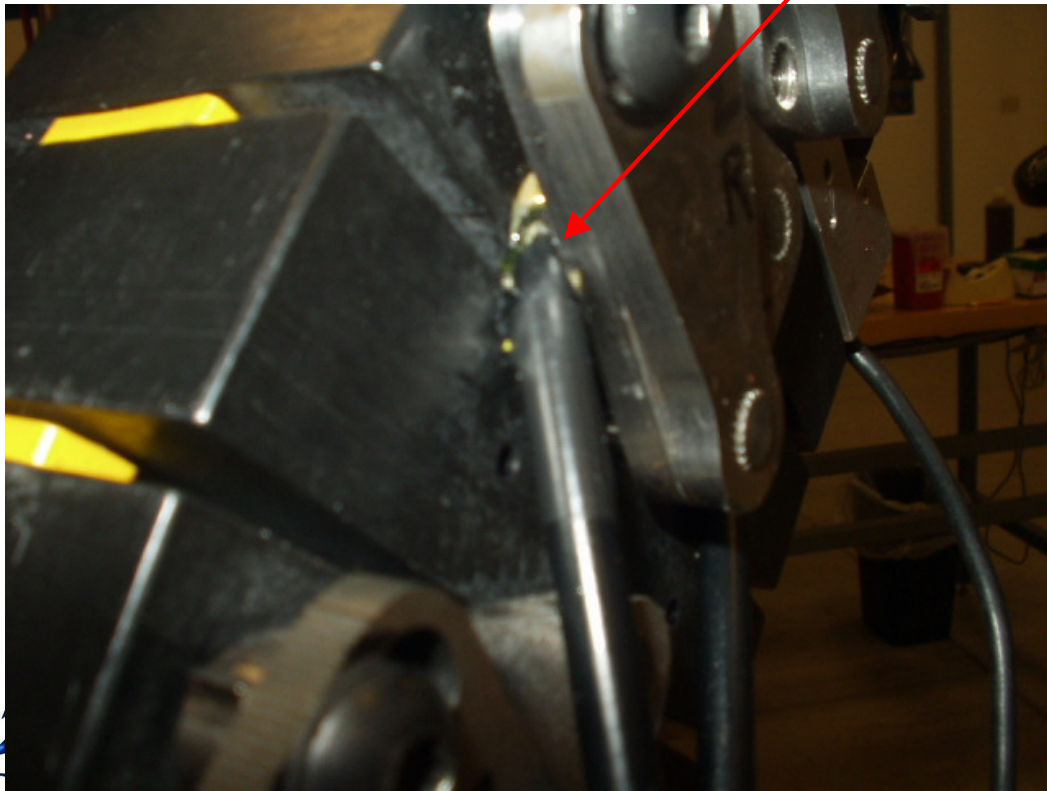
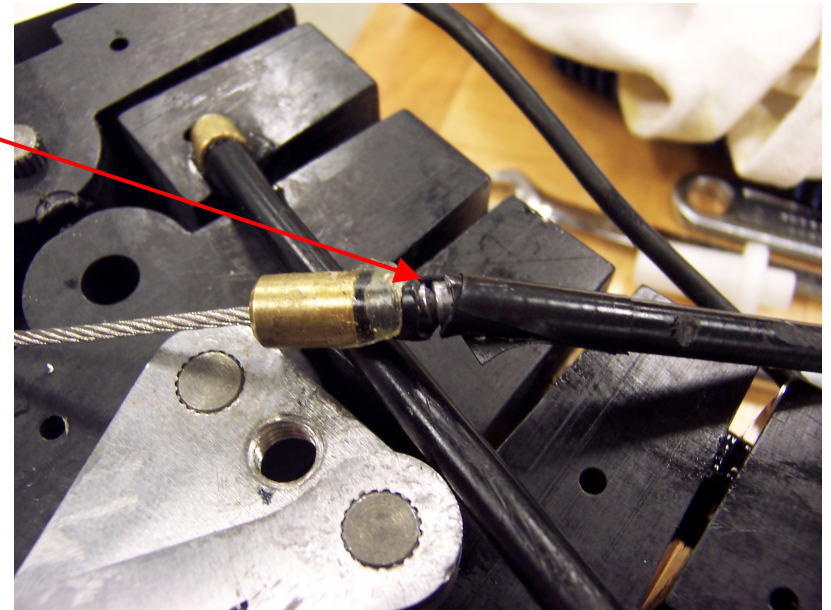
# Initial Repairs

- Loose damper & washer out of place (at GM)
- Damper missing oil (refilled & checked)
- Rear muscle tension cable sheath damaged
  - Replaced cable/sheath & added notch to washer plate



# Initial Repairs

**Muscle substitute cable sheath damage.**





# Effect of Initial Repairs

- Did NOT fix positive Fx problem
- Removed double peak in certification test My



# Certification Test Results

## mini-sled w/o headrest test

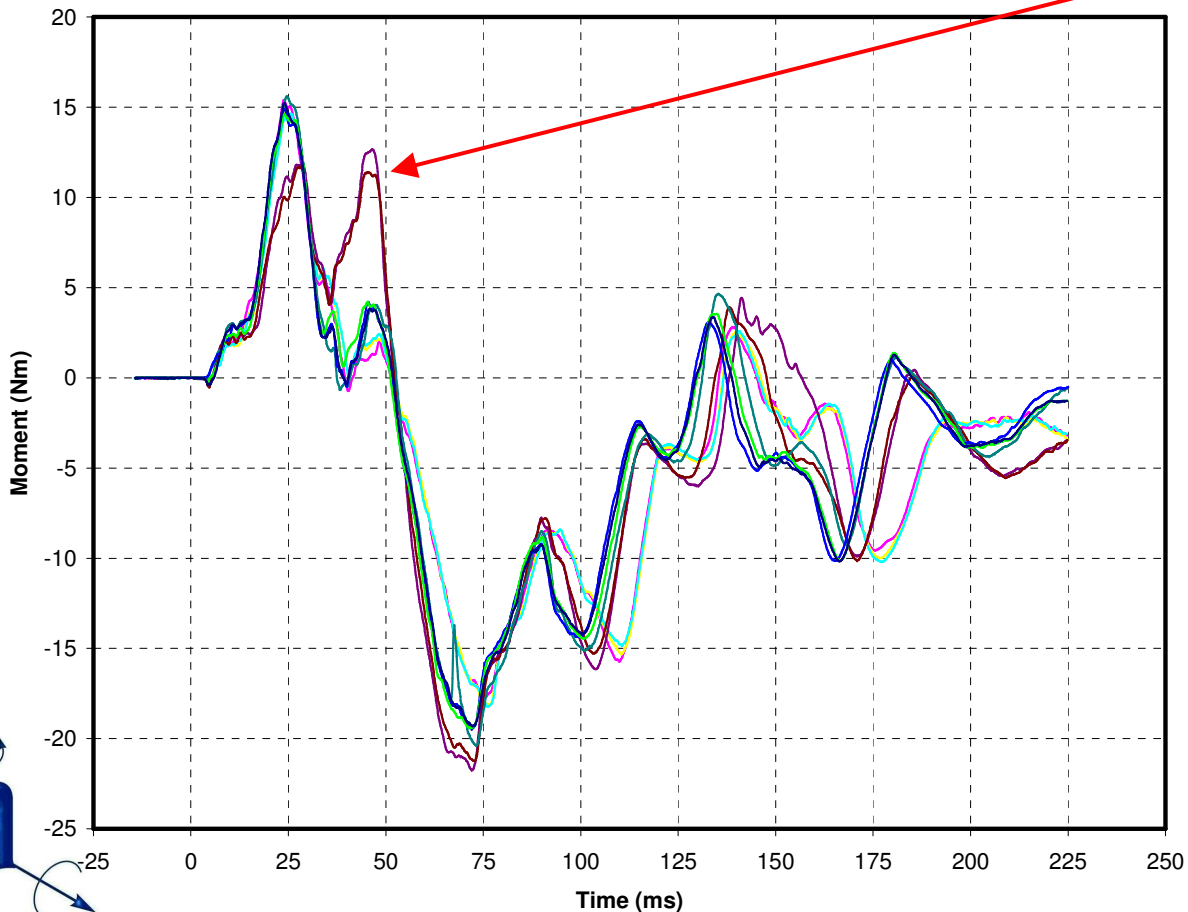
- Mini-sled w/o headrest test did not show problem
  - GM dummy compared well before and after initial repairs
  - GM dummy compared favorably to a new dummy
- One interesting change occurred in GM dummy from initial repairs



# Certification Test Results

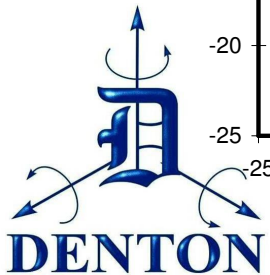
## mini-sled w/o headrest test

Upper Neck Moment MY



Something repaired changed performance. We will be investigating this further.

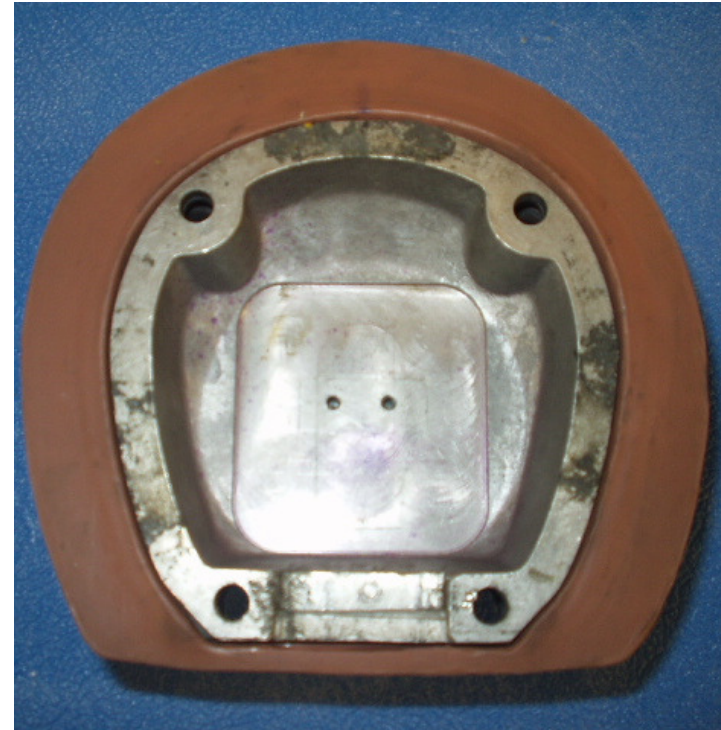
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
- Reset -1 GMLC.AF.CSV
- Reset -2 GMLC.AF.CSV
- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV





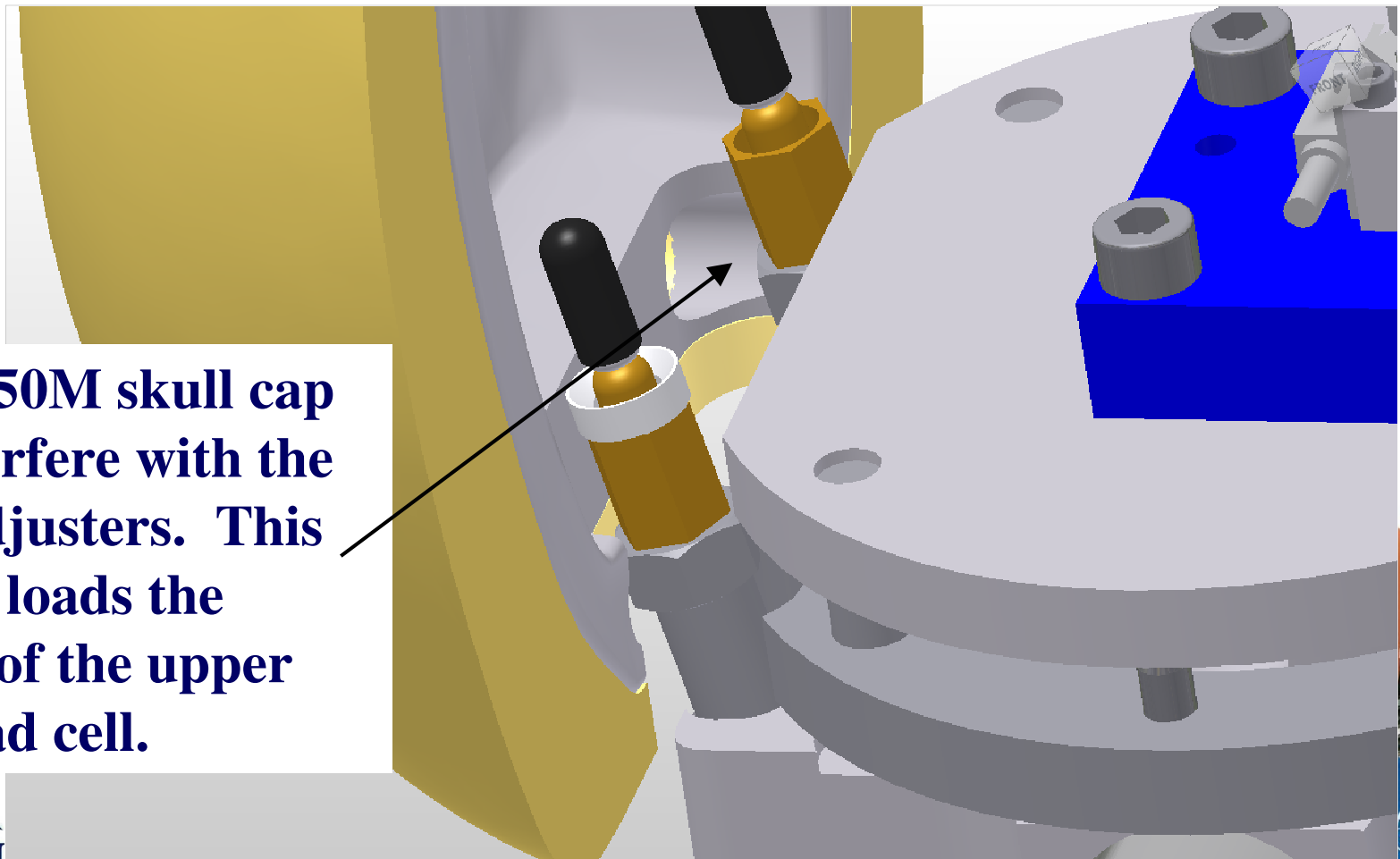
# Skull cap finding

- A close examination of dummy after last return found incorrect skull cap on dummy
  - This cap is a special FTSS Hybrid III 50<sup>th</sup> cap



# BioRID Skull Cap Design

- Biorid cap has clearance for cable adjustors



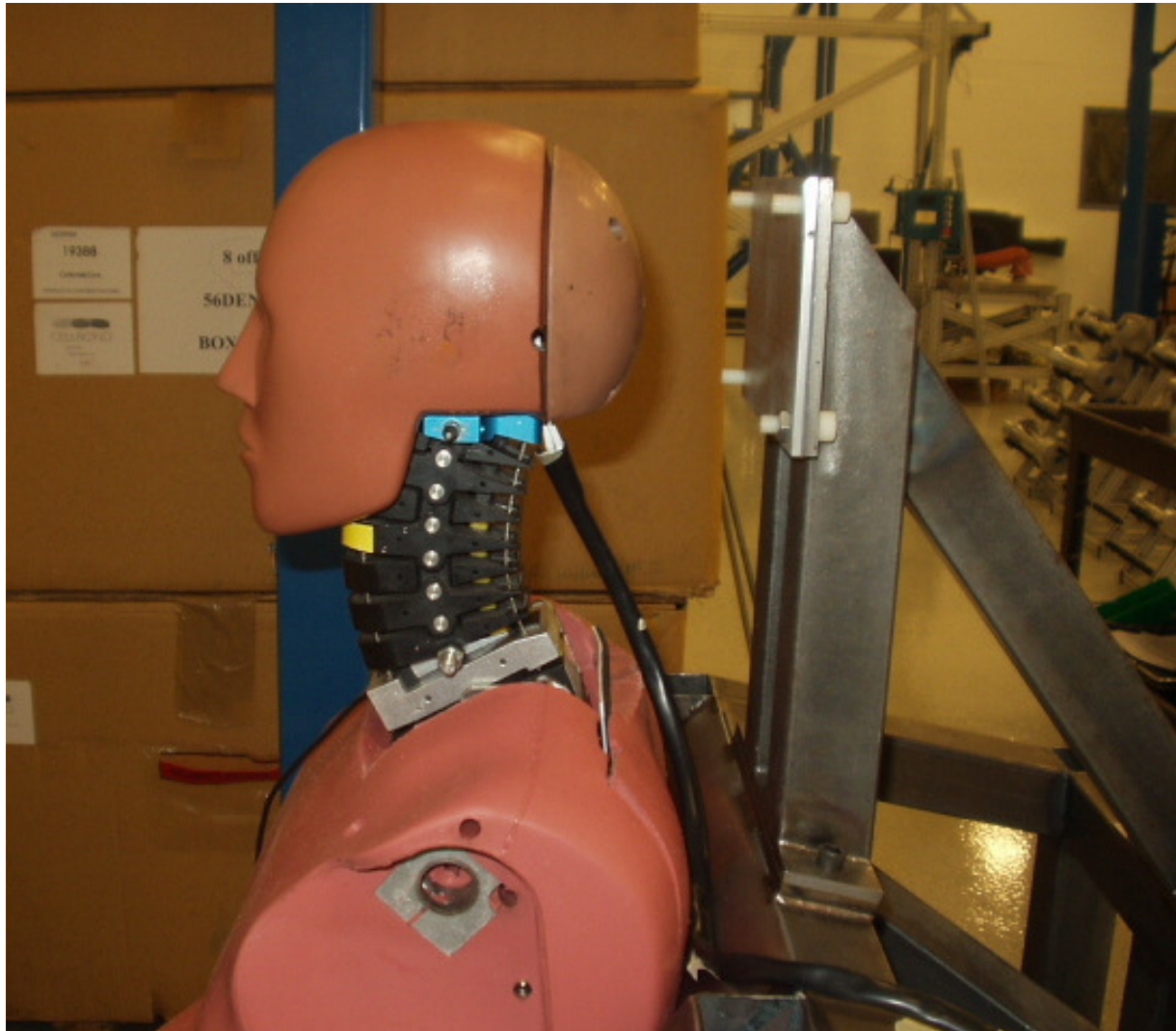
**A H-III50M skull cap will interfere with the cable adjustors. This directly loads the bottom of the upper neck load cell.**

# Head rest test results

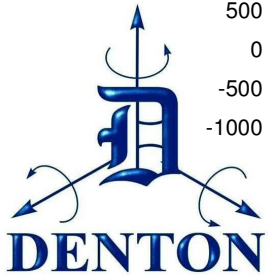
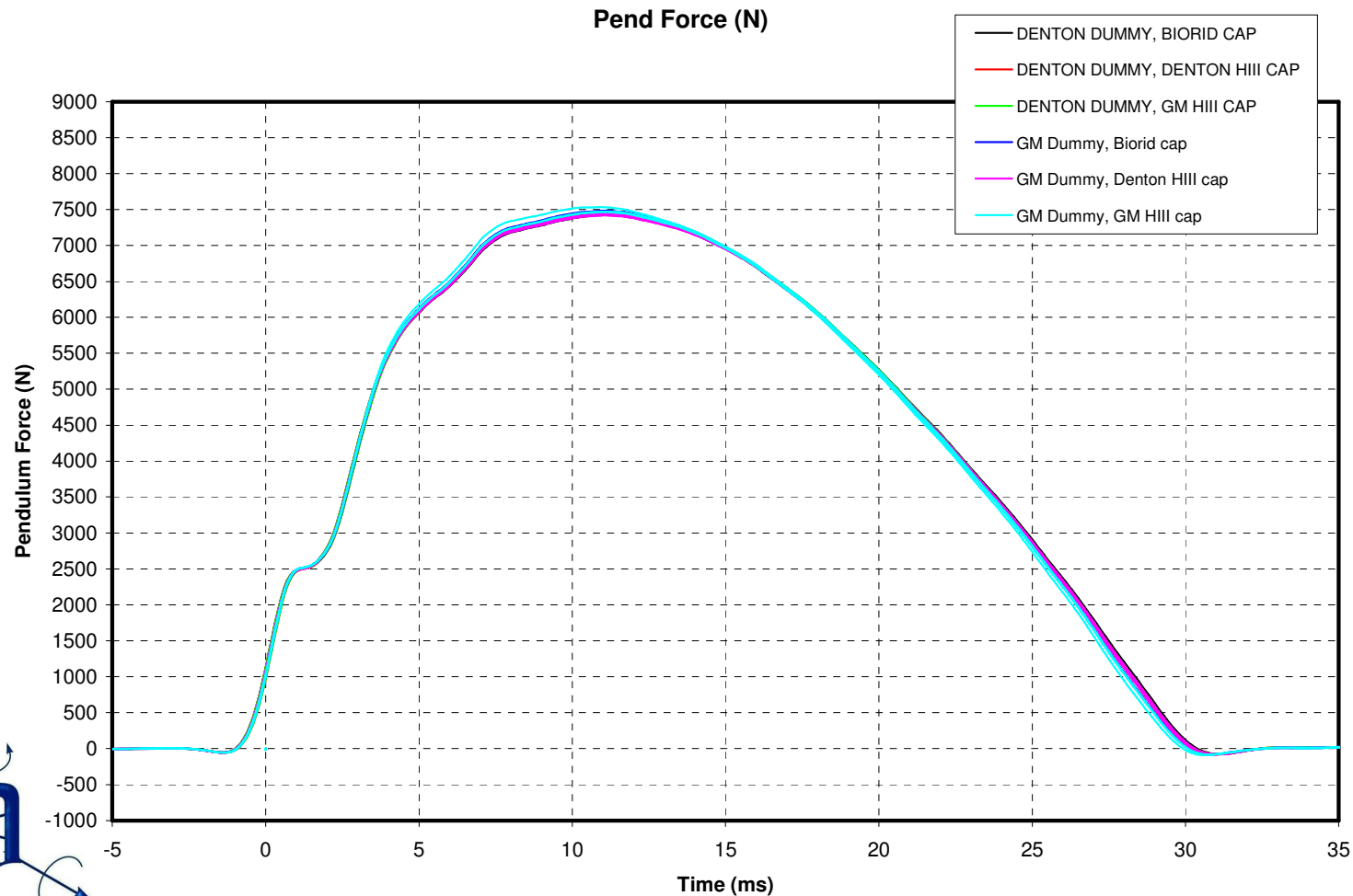
- Two separate tests run
  - Rigid head rest (70 mm backset)
  - 1" thick ensolite pad added to head rest (45 mm backset)
- Two dummies
  - GM dummy
  - Denton Engineering dummy
- Three skull caps
  - H-III50M (FTSS special) off of GM biorid
  - Standard BioRID cap
  - Denton H-III50M cap



# Head rest test results - Rigid

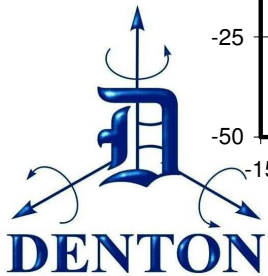
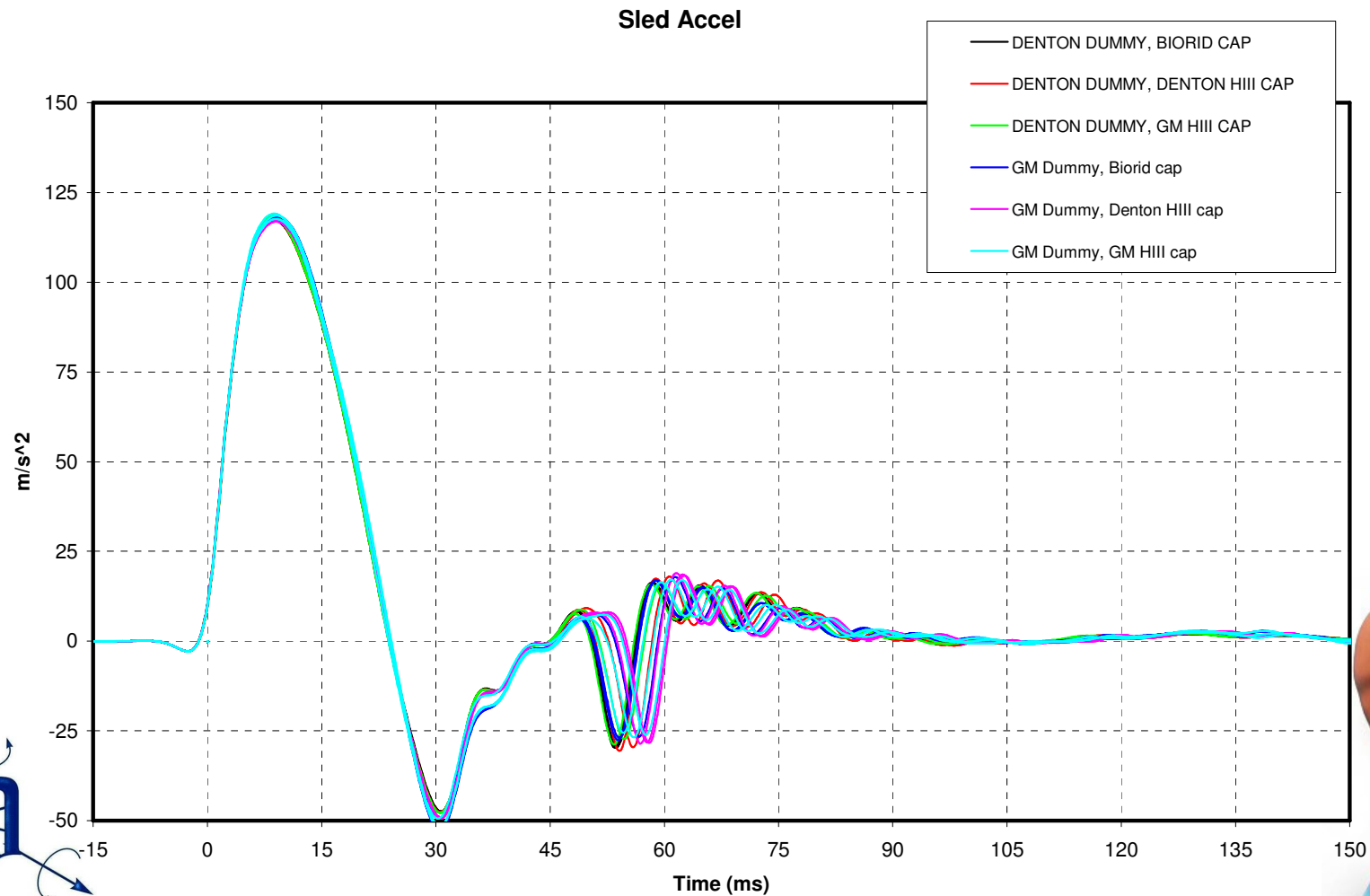


# Head rest test results - Rigid



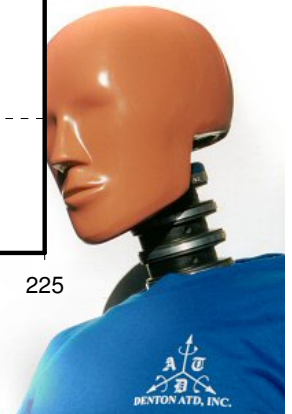
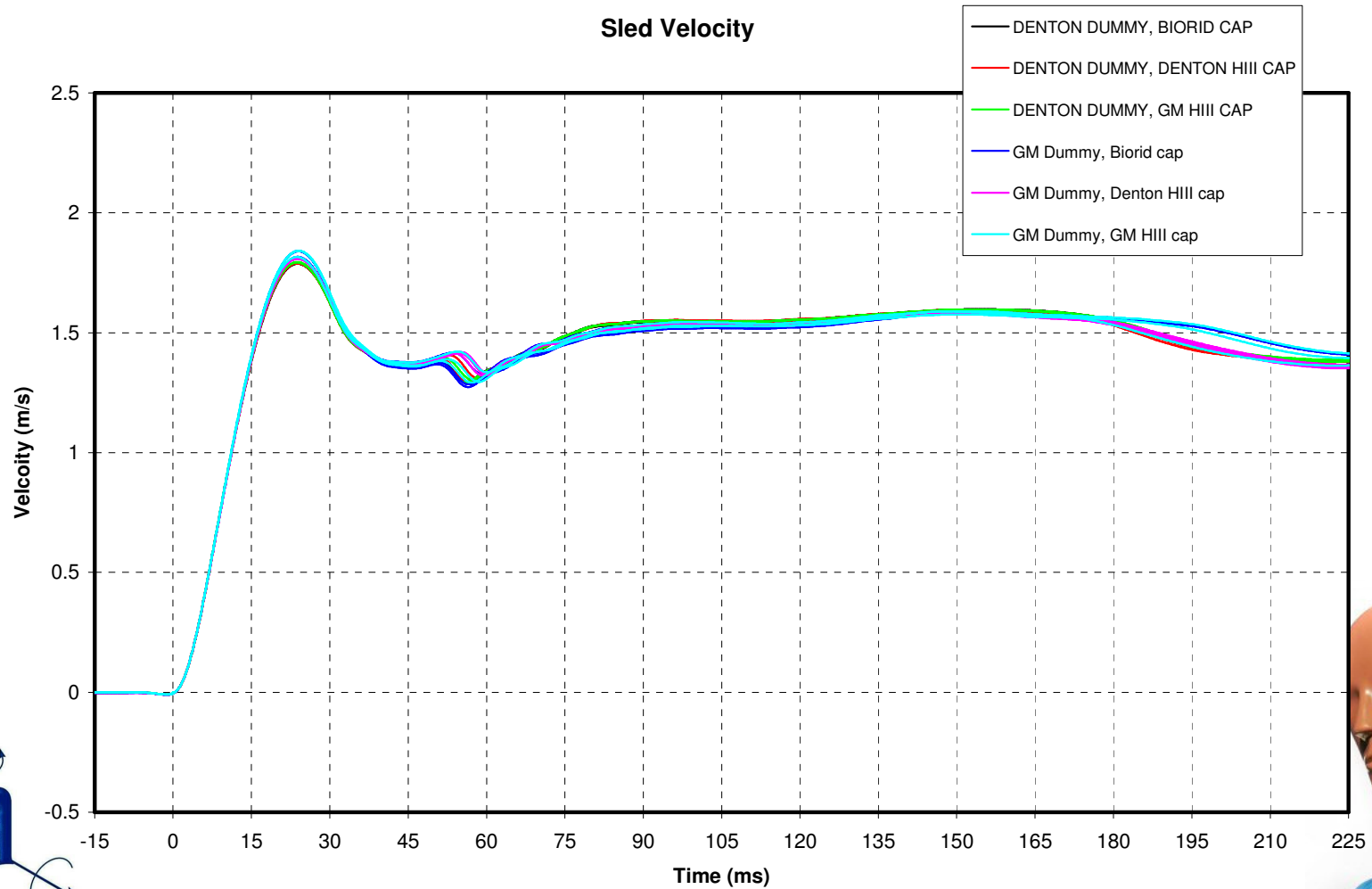


# Head rest test results - Rigid

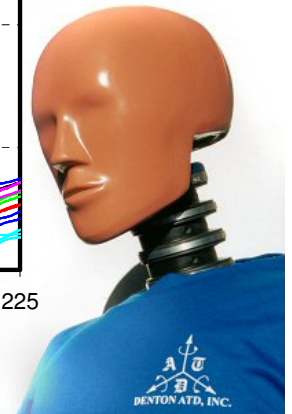
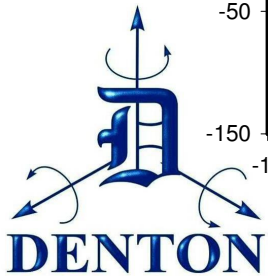
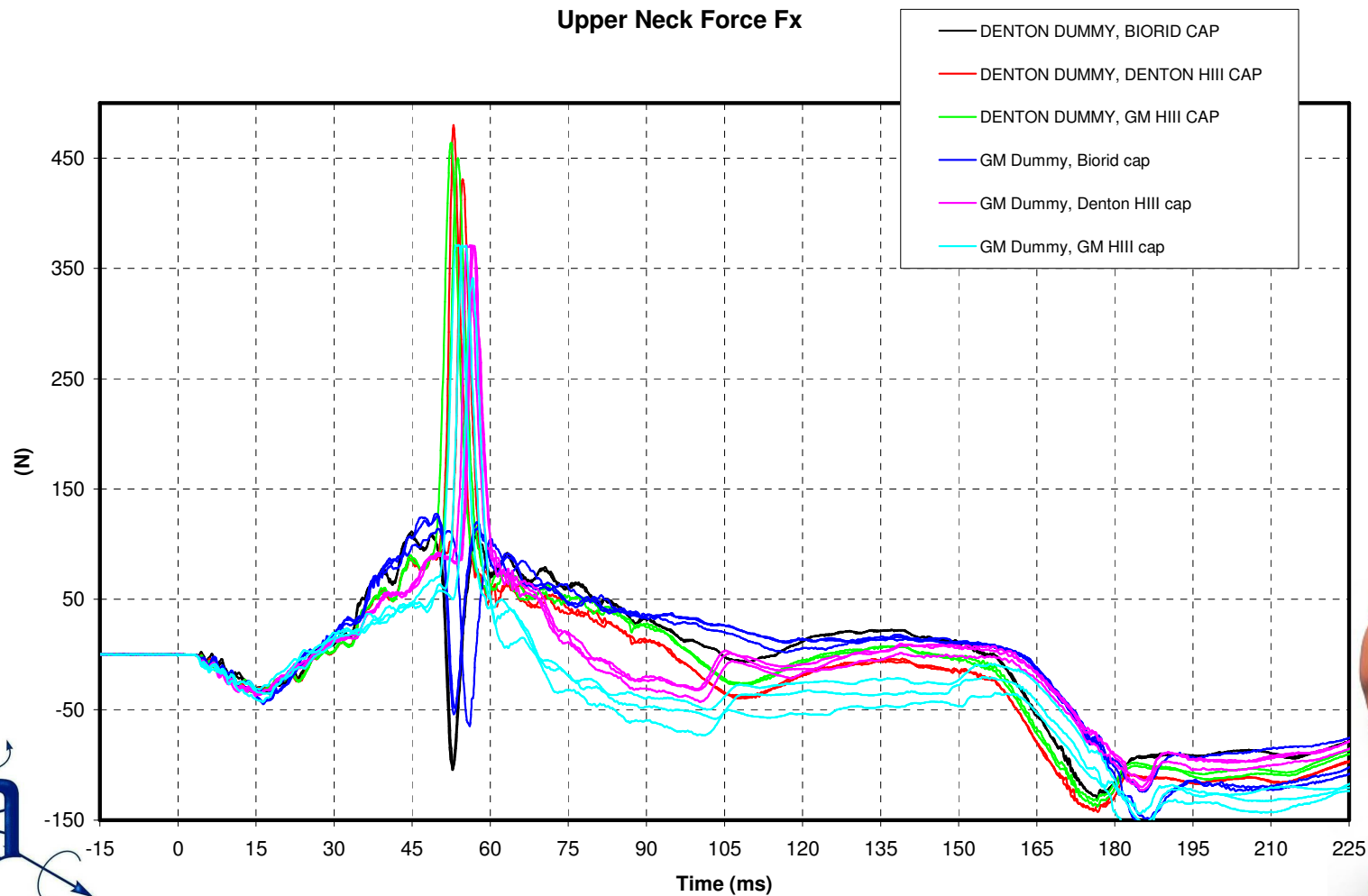




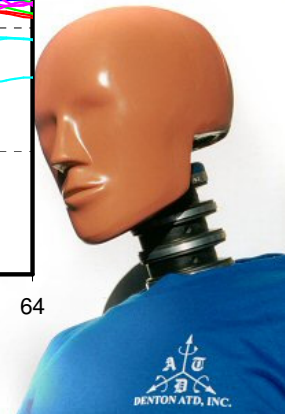
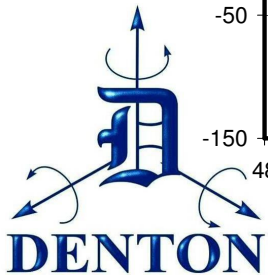
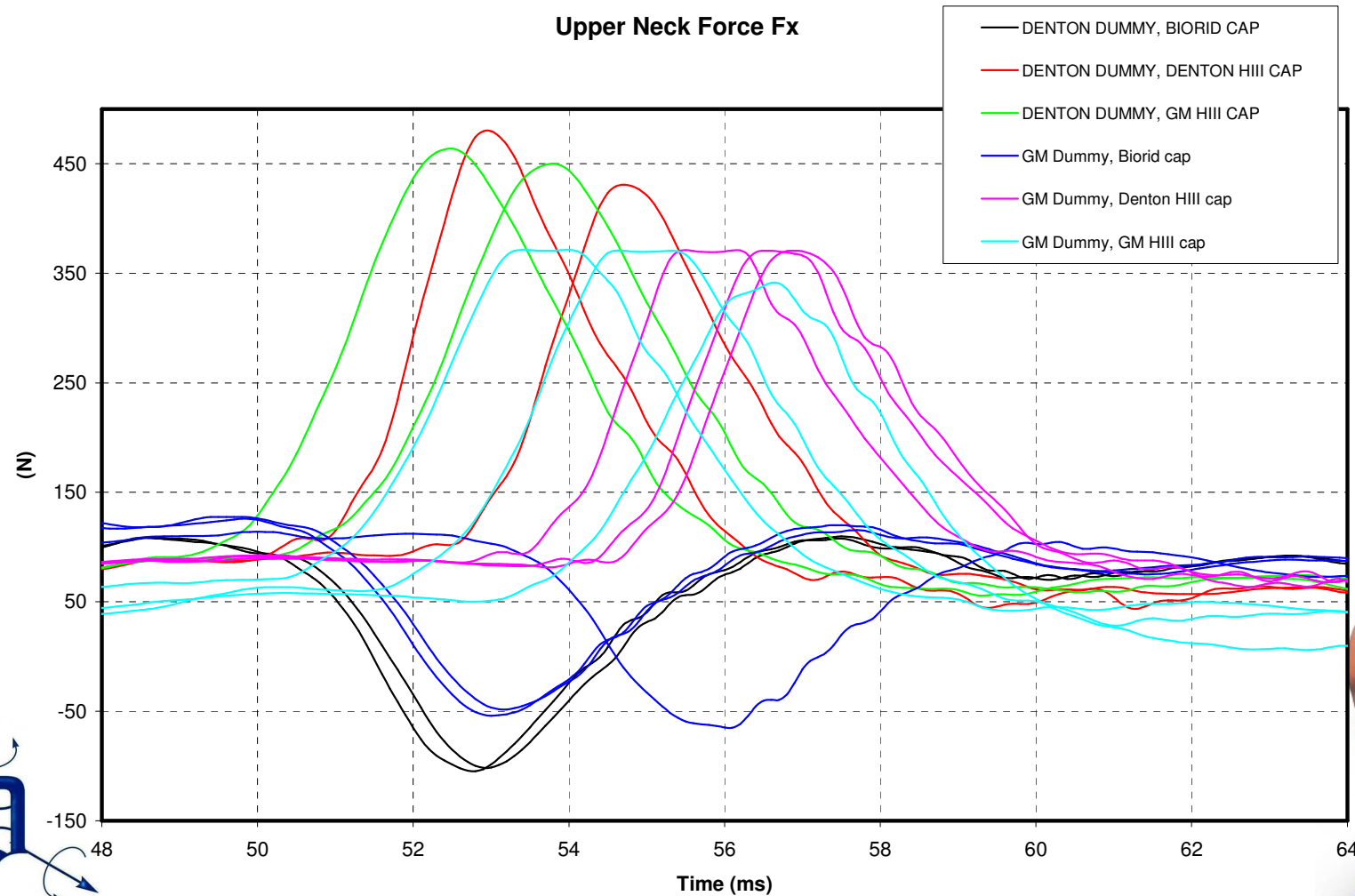
# Head rest test results - Rigid



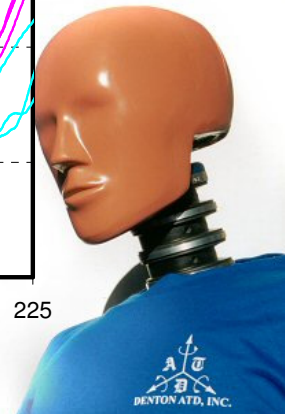
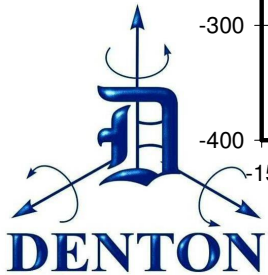
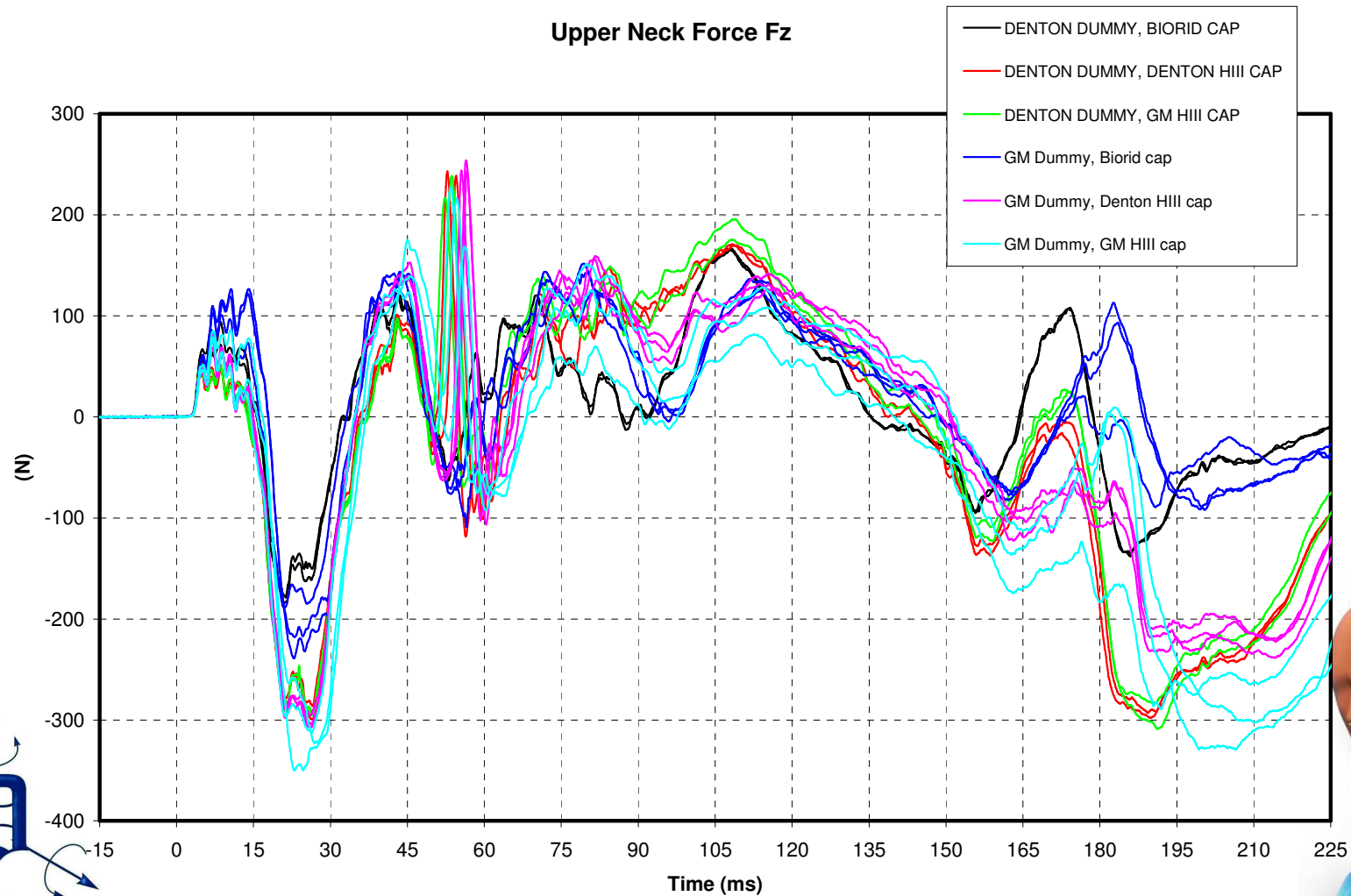
# Head rest test results - Rigid



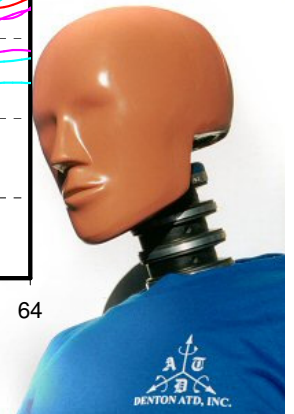
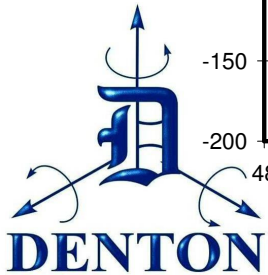
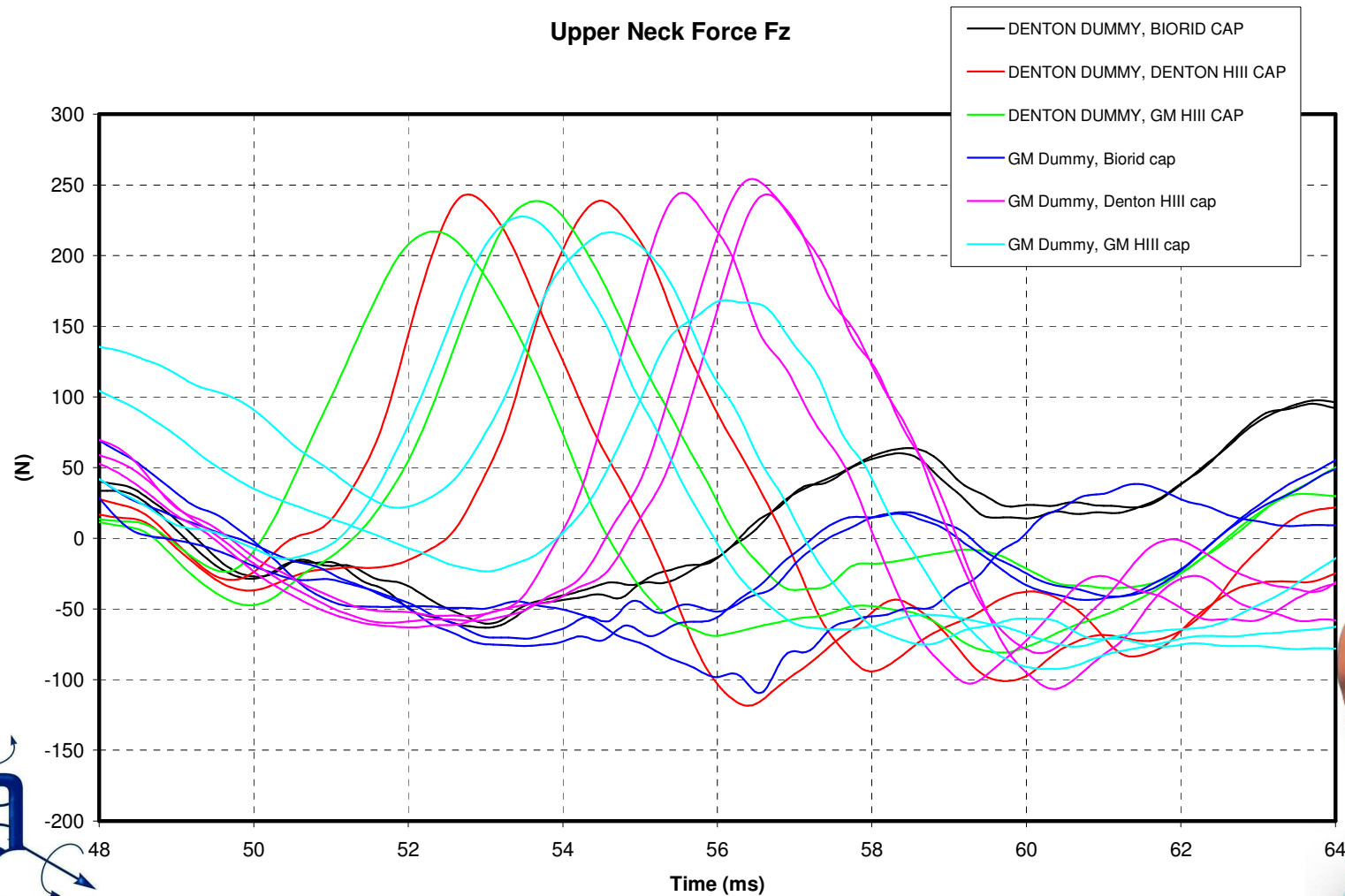
# Head rest test results - Rigid



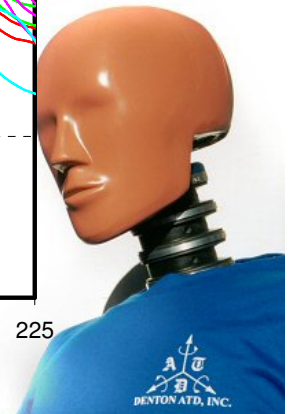
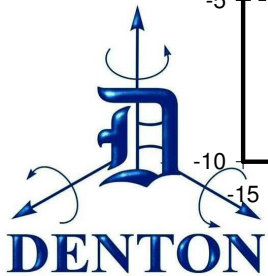
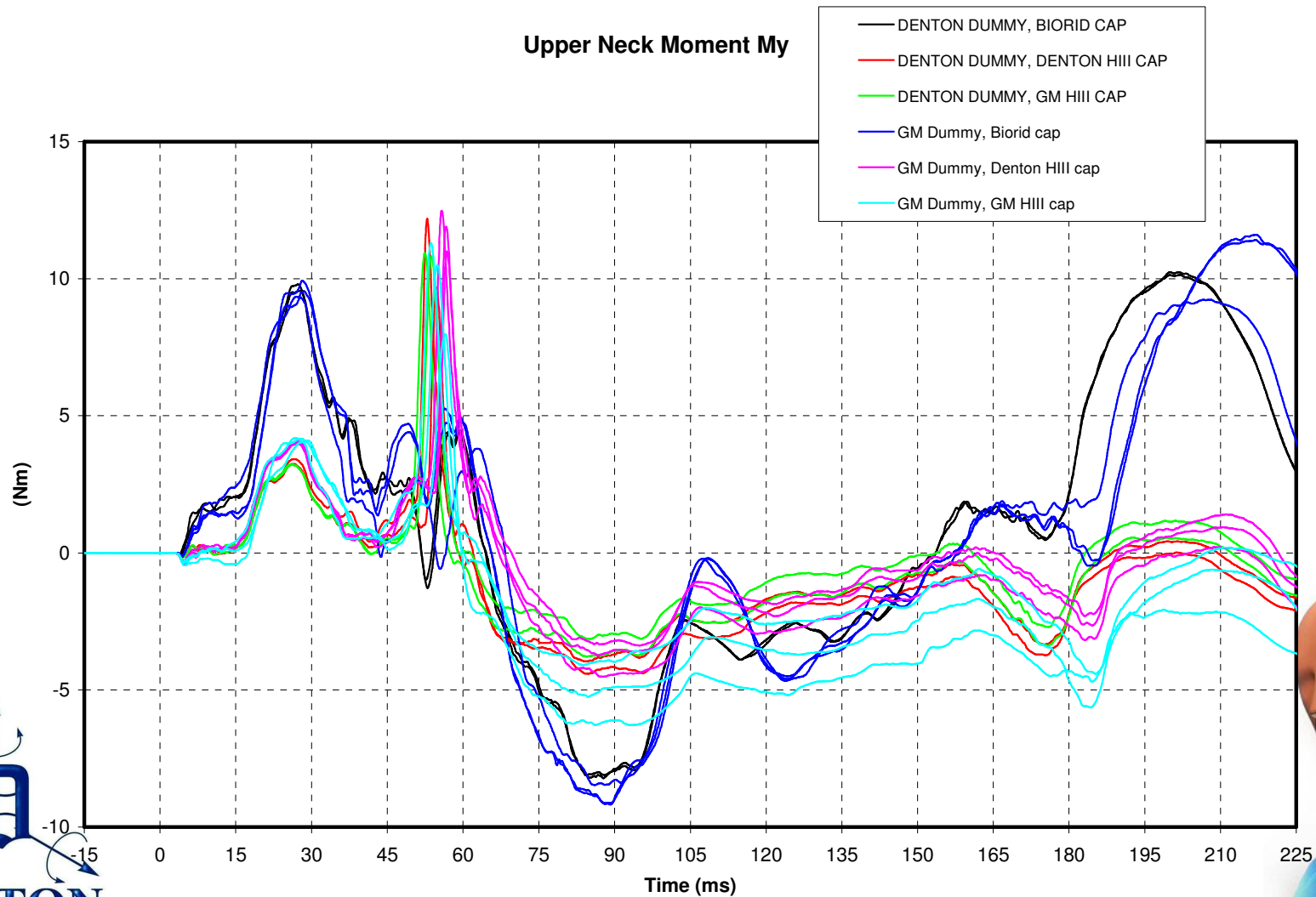
# Head rest test results - Rigid



# Head rest test results - Rigid

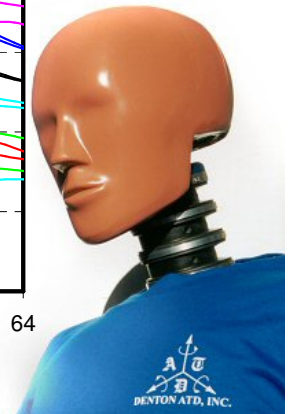
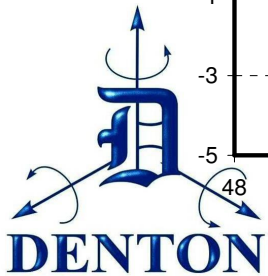
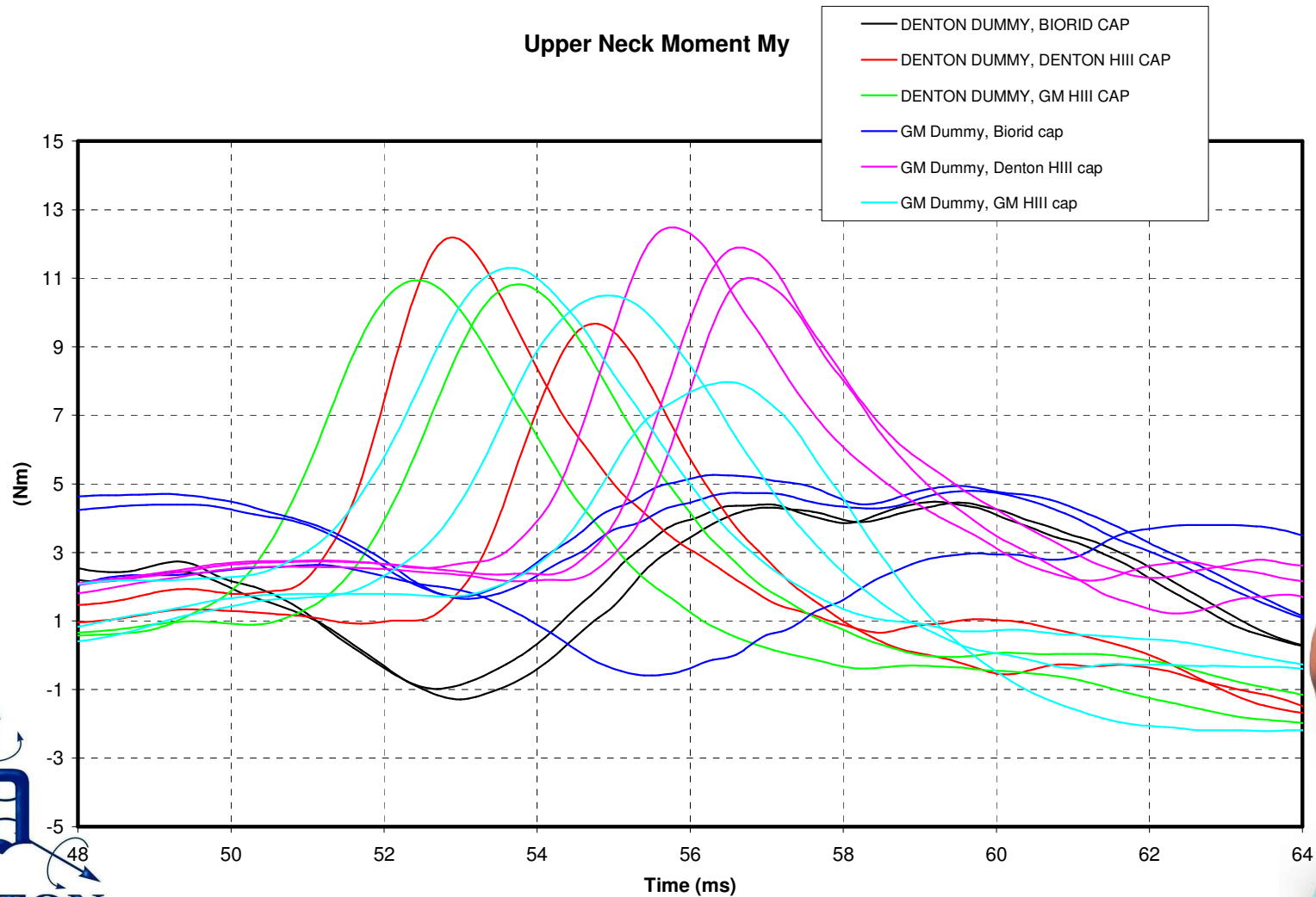


# Head rest test results - Rigid

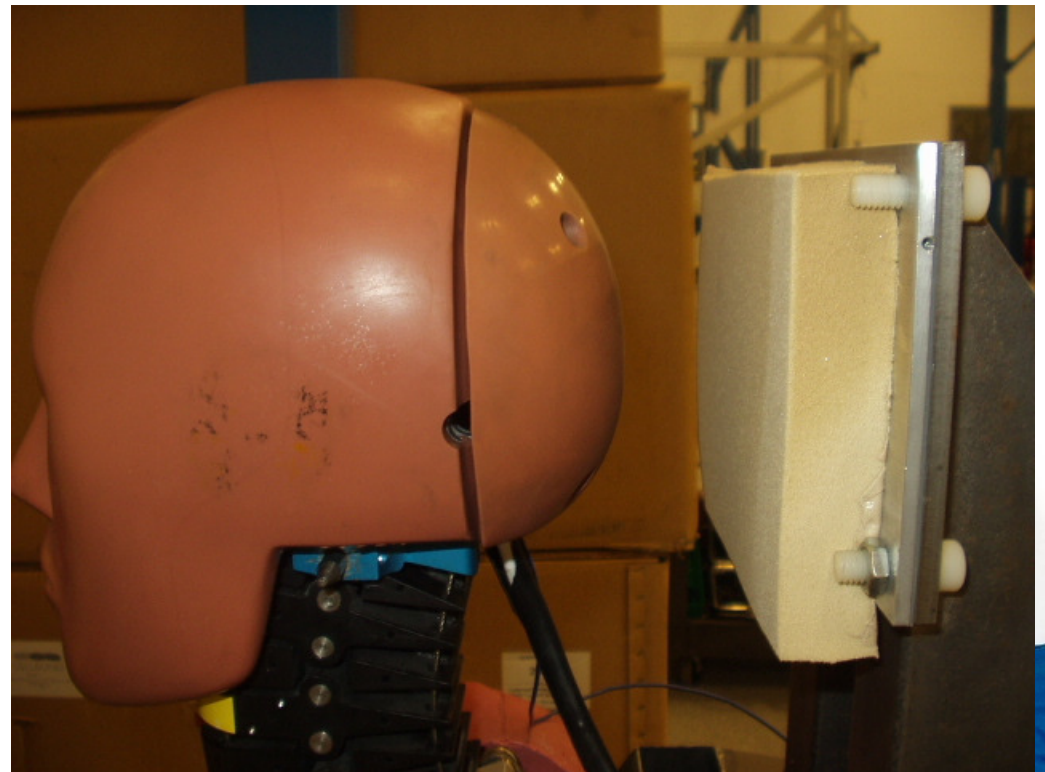
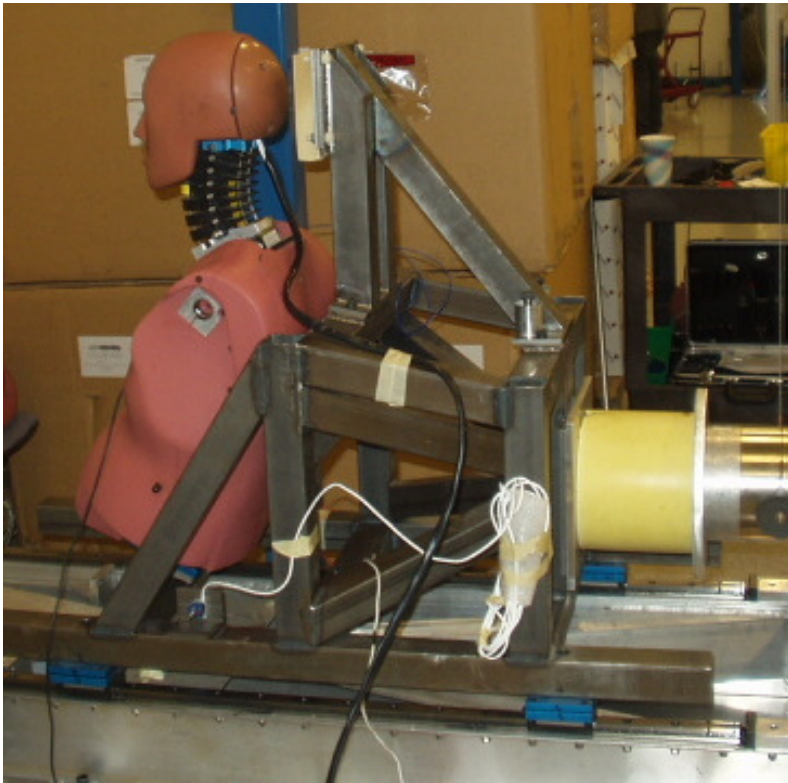




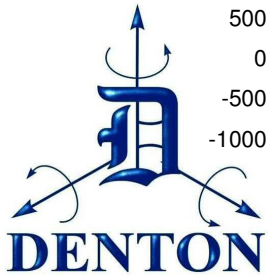
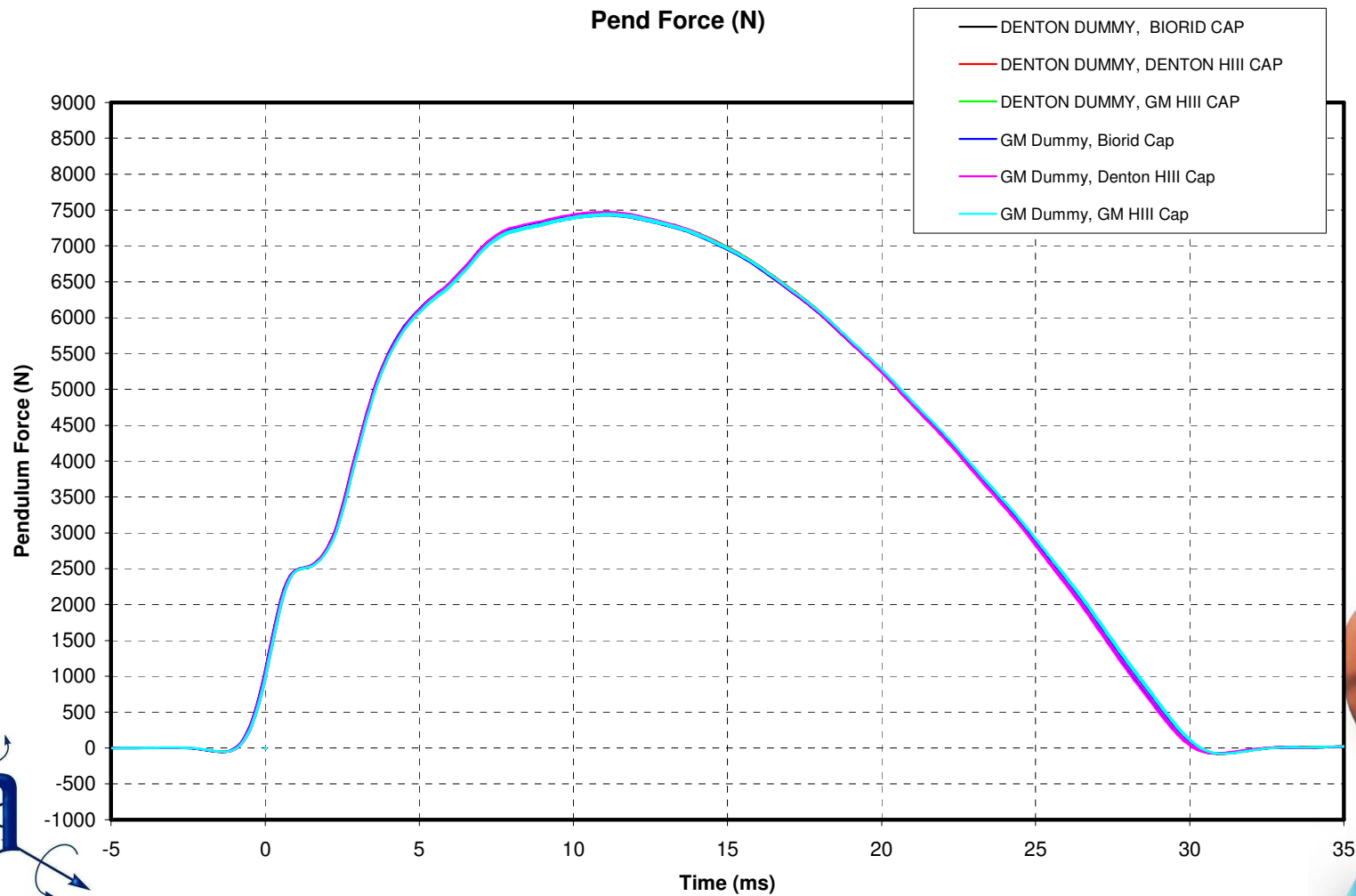
# Head rest test results - Rigid



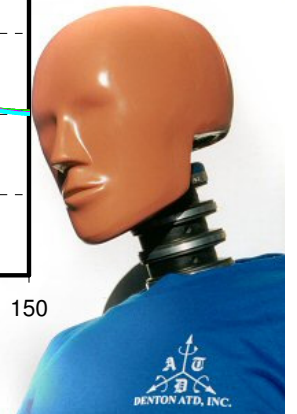
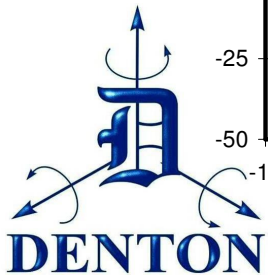
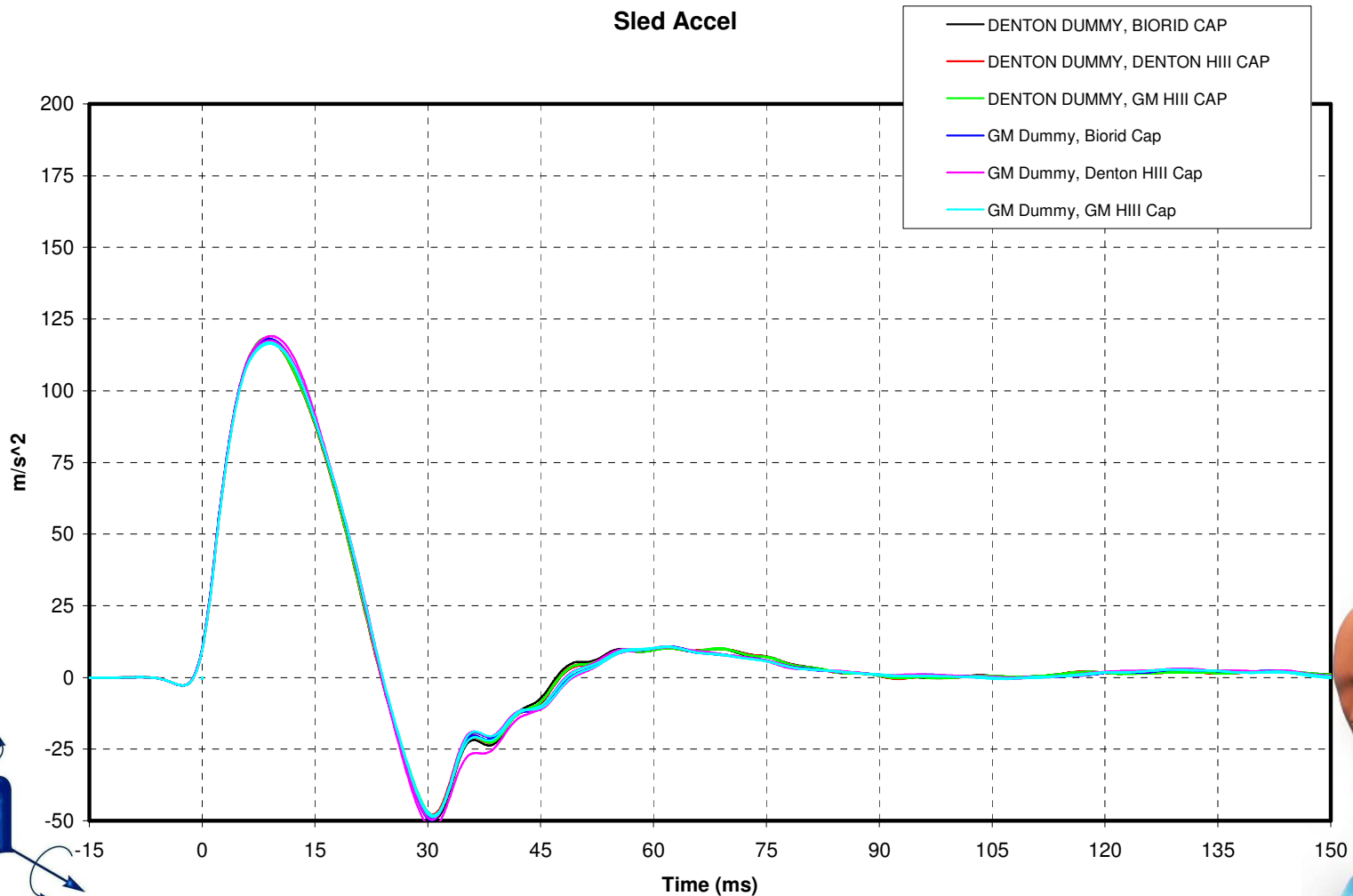
# Head rest test results - Ensolite



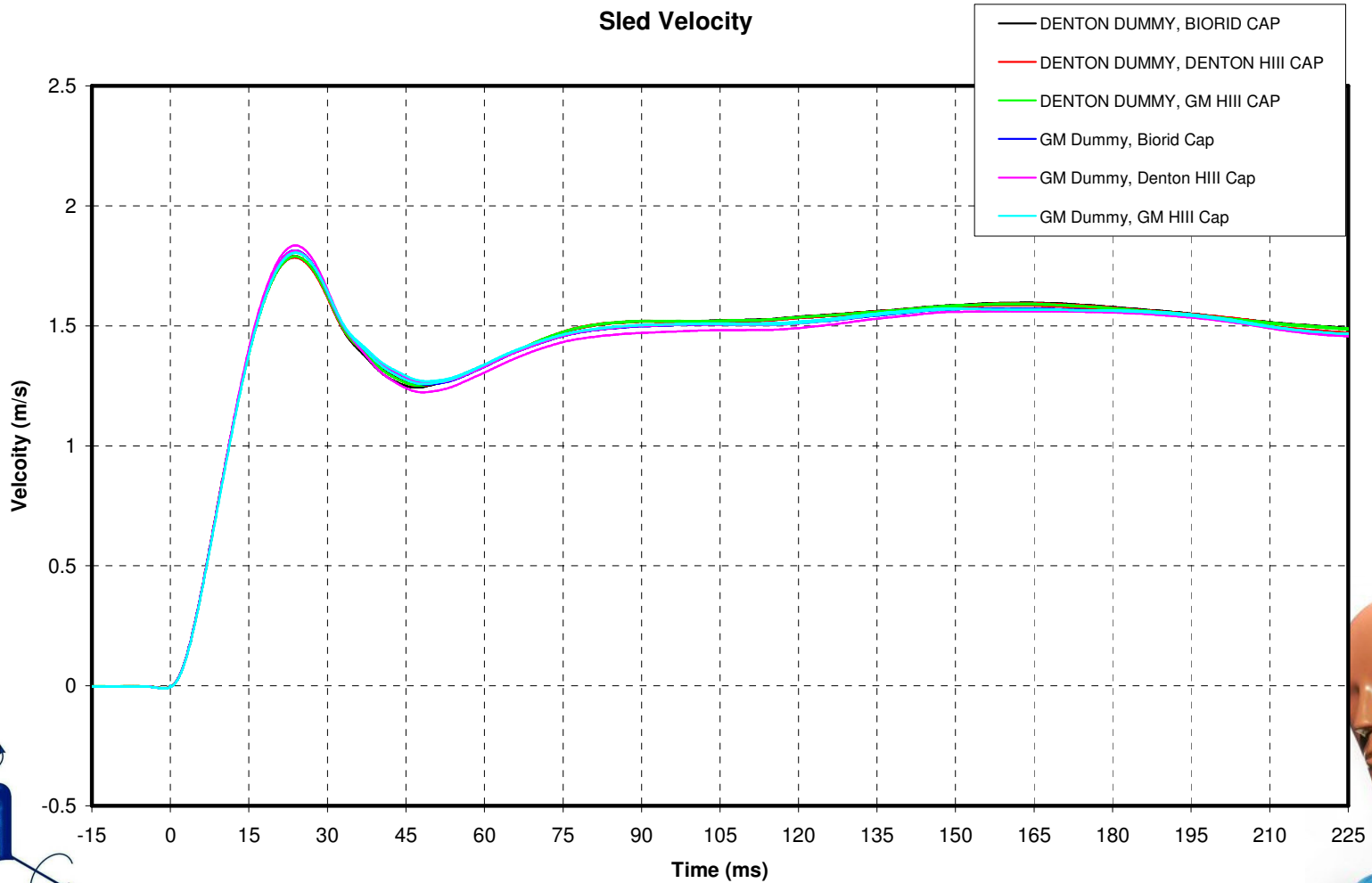
# Head rest test results - Ensolite



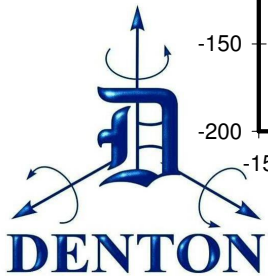
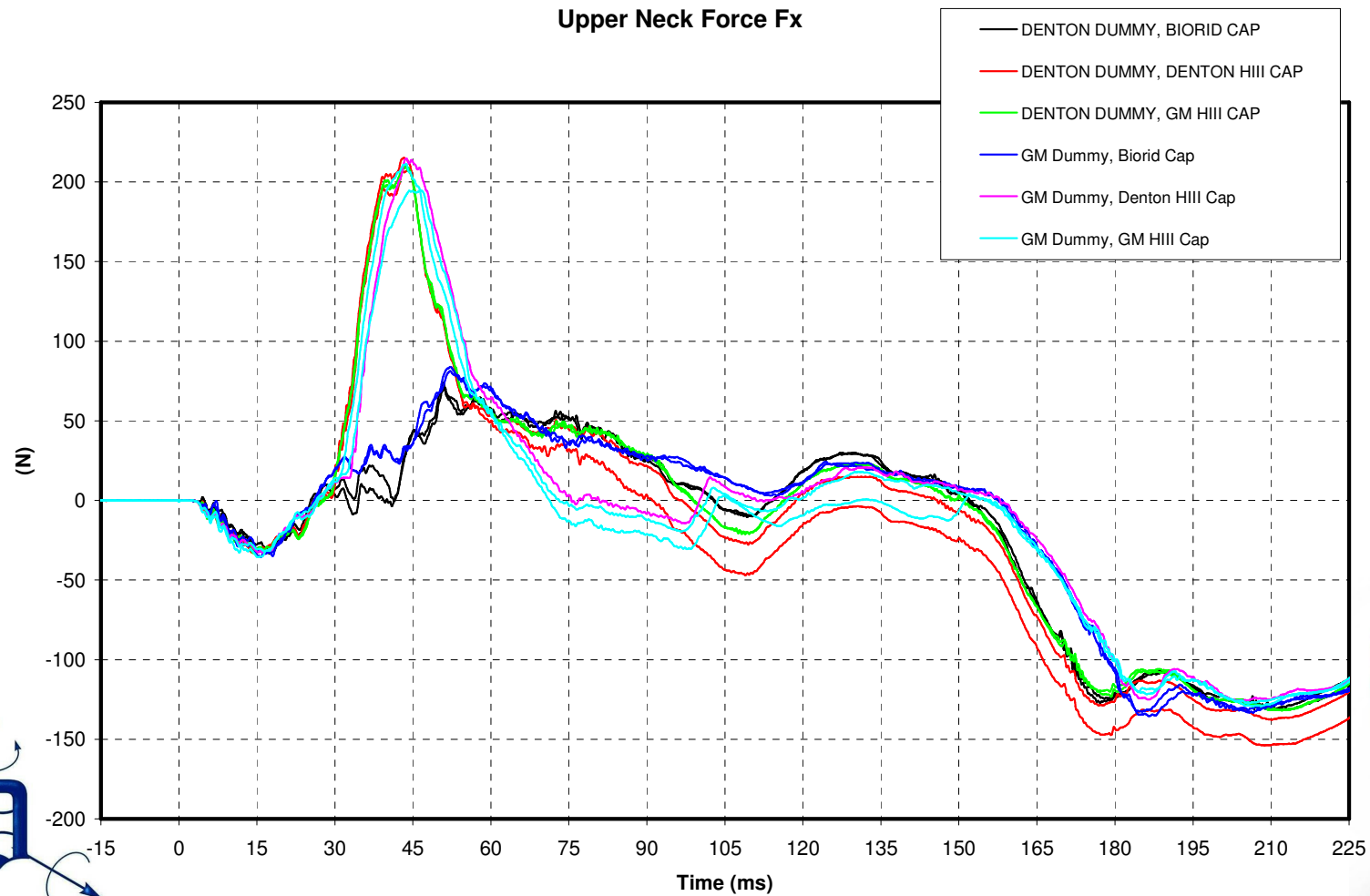
# Head rest test results - Ensolite



# Head rest test results - Ensolite

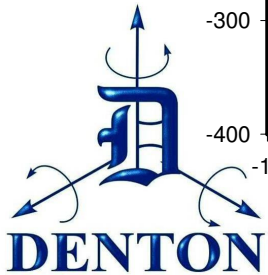
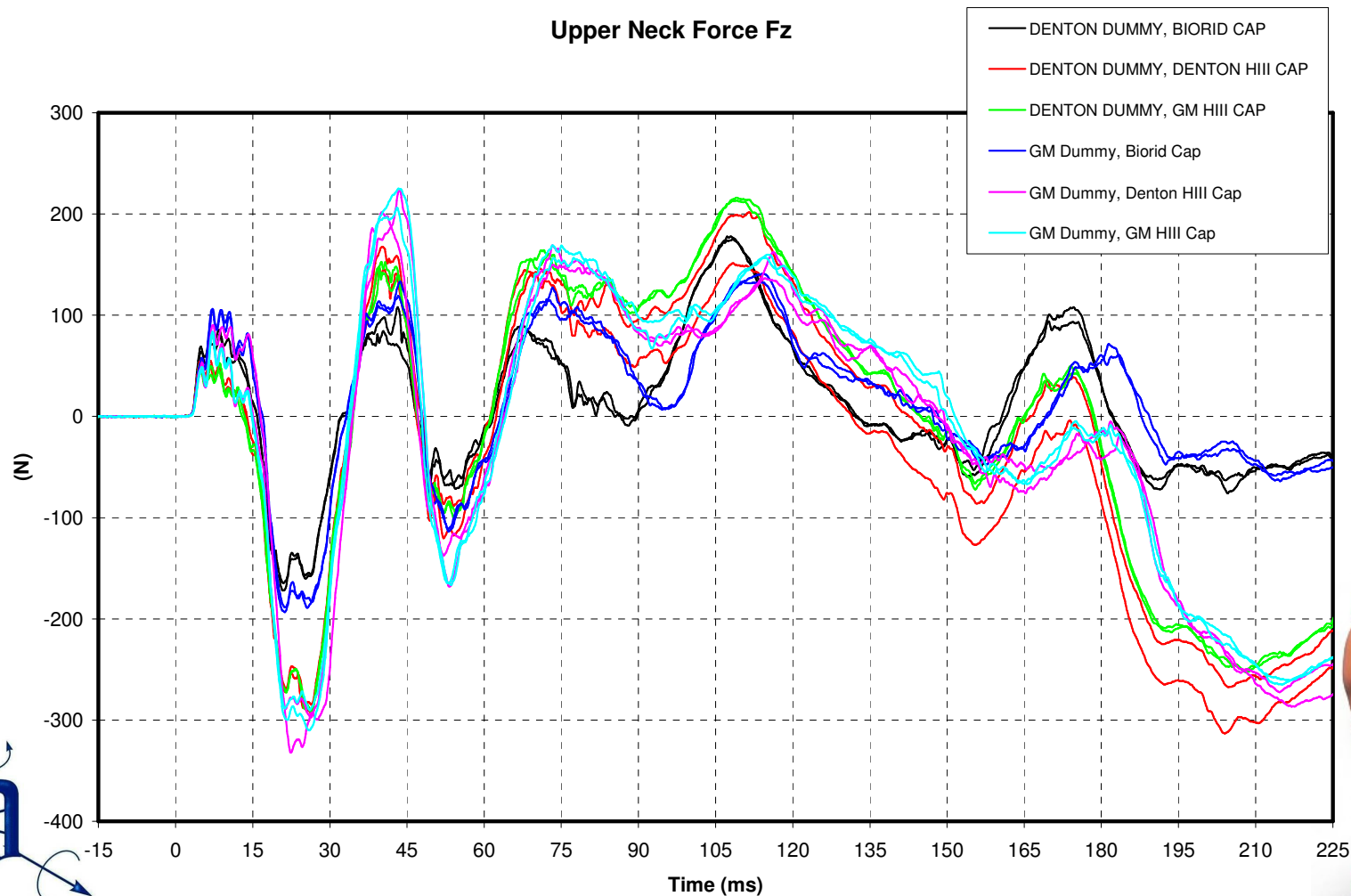


# Head rest test results - Ensolite

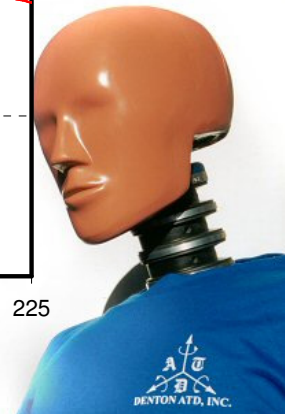
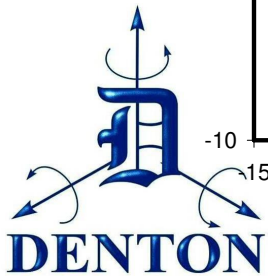
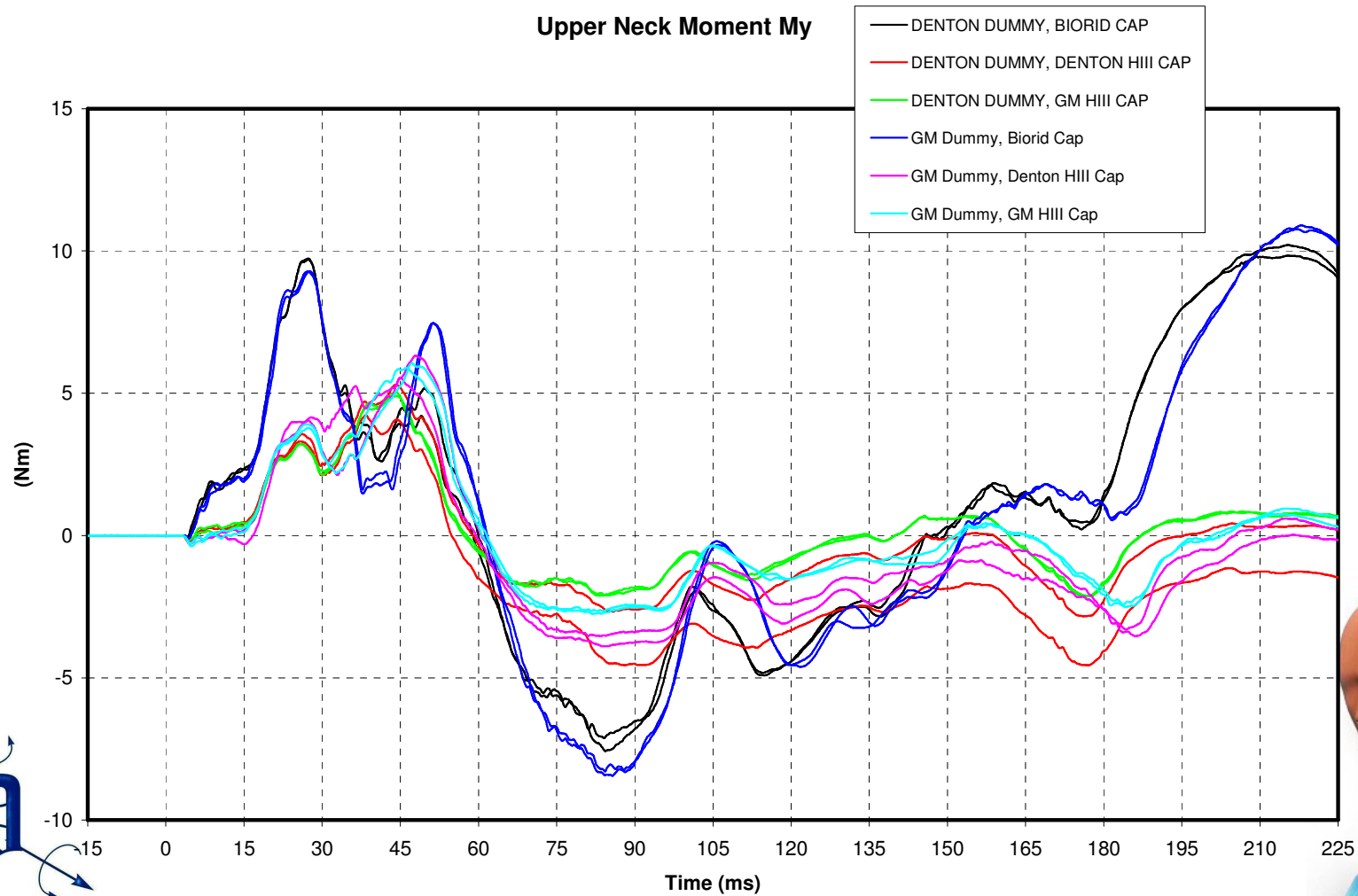




# Head rest test results - Ensolite



# Head rest test results - Ensolite

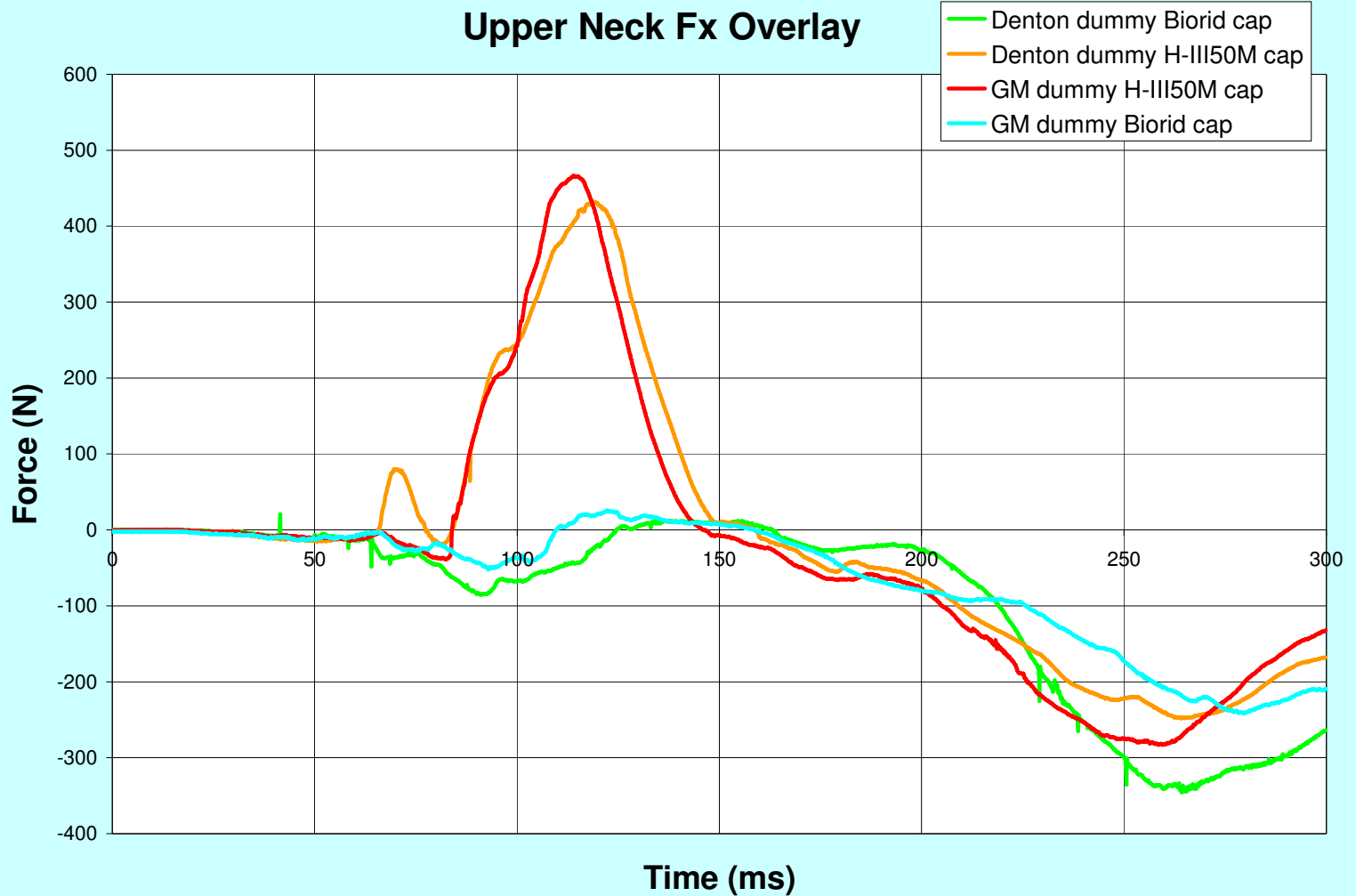


# Results GM Seat Testing

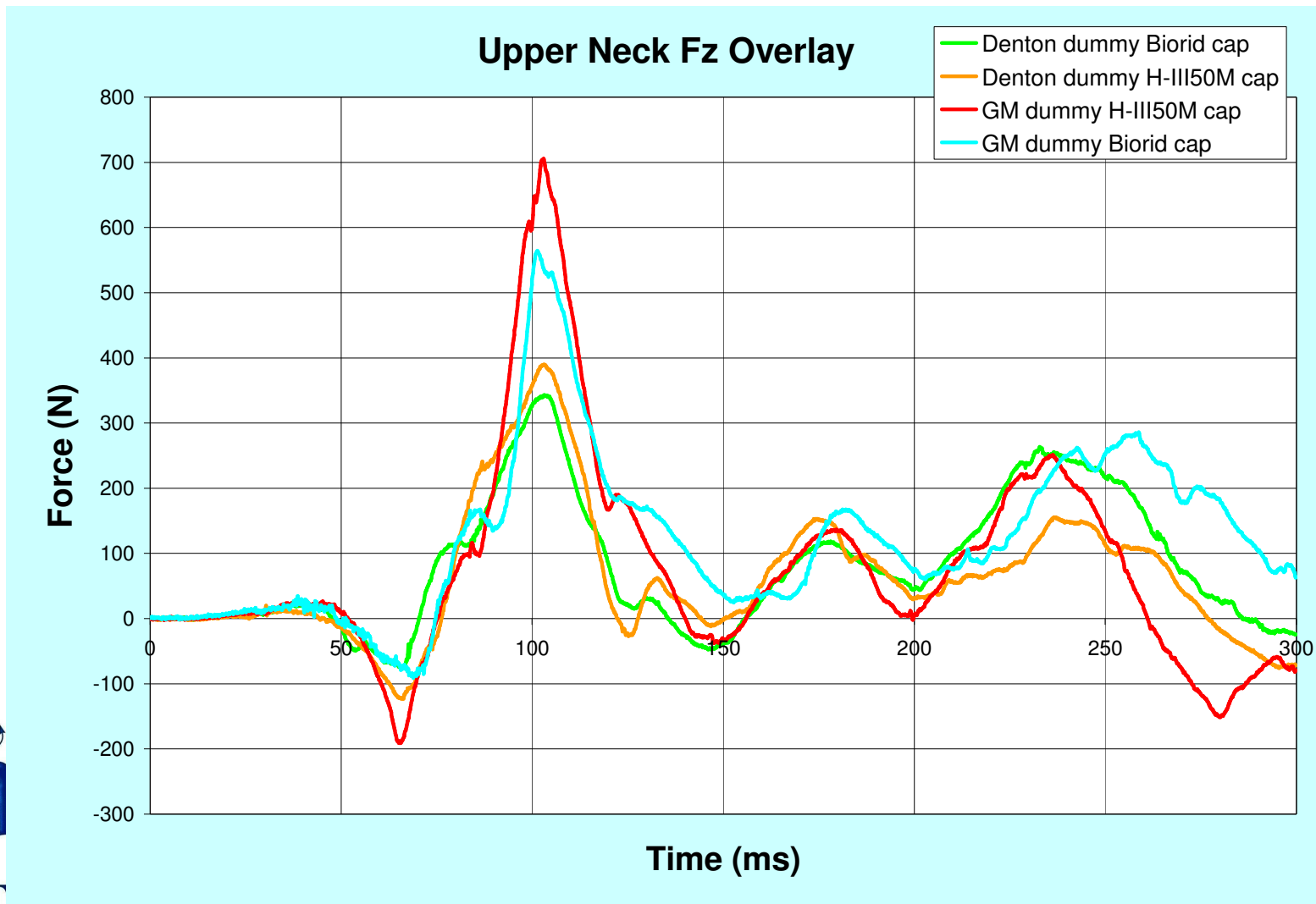
- GM ran sled tests to confirm skull cap as the issue
- Two dummies & two skull caps
  - GM dummy
    - H-III50M skull cap (found on GM dummy)
    - Biorid skull cap
      - NOTE: run in a different car seat from other tests
  - Denton lease dummy
    - H-III50M skull cap (found on GM dummy)
    - Biorid skull cap



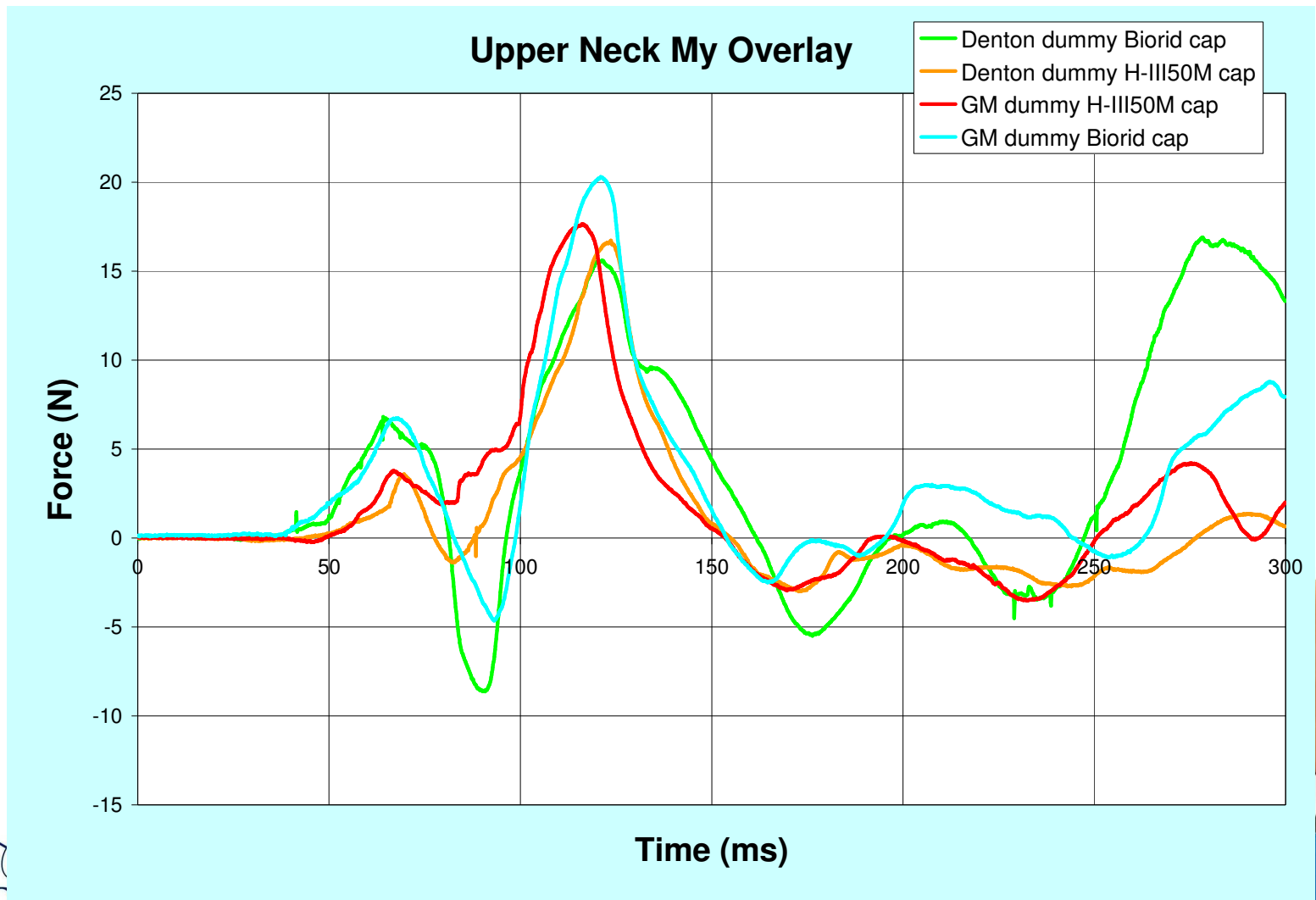
# Results GM Seat Testing



# Results GM Seat Testing



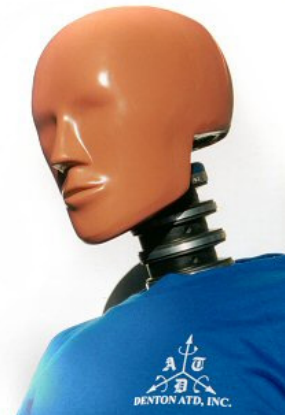
# Results GM Seat Testing





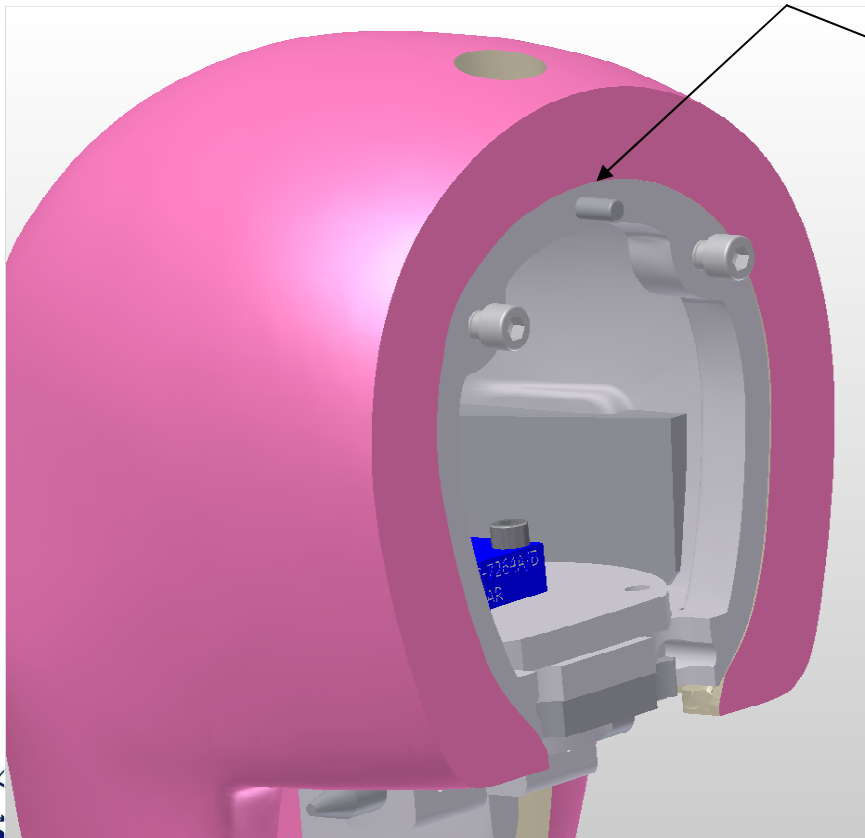
# Recommendations

- Error proof head
  - Add pin to skull and hole in cap
    - Could easily retrofit existing heads & caps
  - Use new head design for cable exit
    - Possible longer term solution
- Technical bulletin to users about problem
  - Which solution?



# Recommendations

- Pin in skull & hole in cap to error proof
  - Can easily modify existing parts



THANK YOU  
for your attention

Questions?



# Supplemental Data

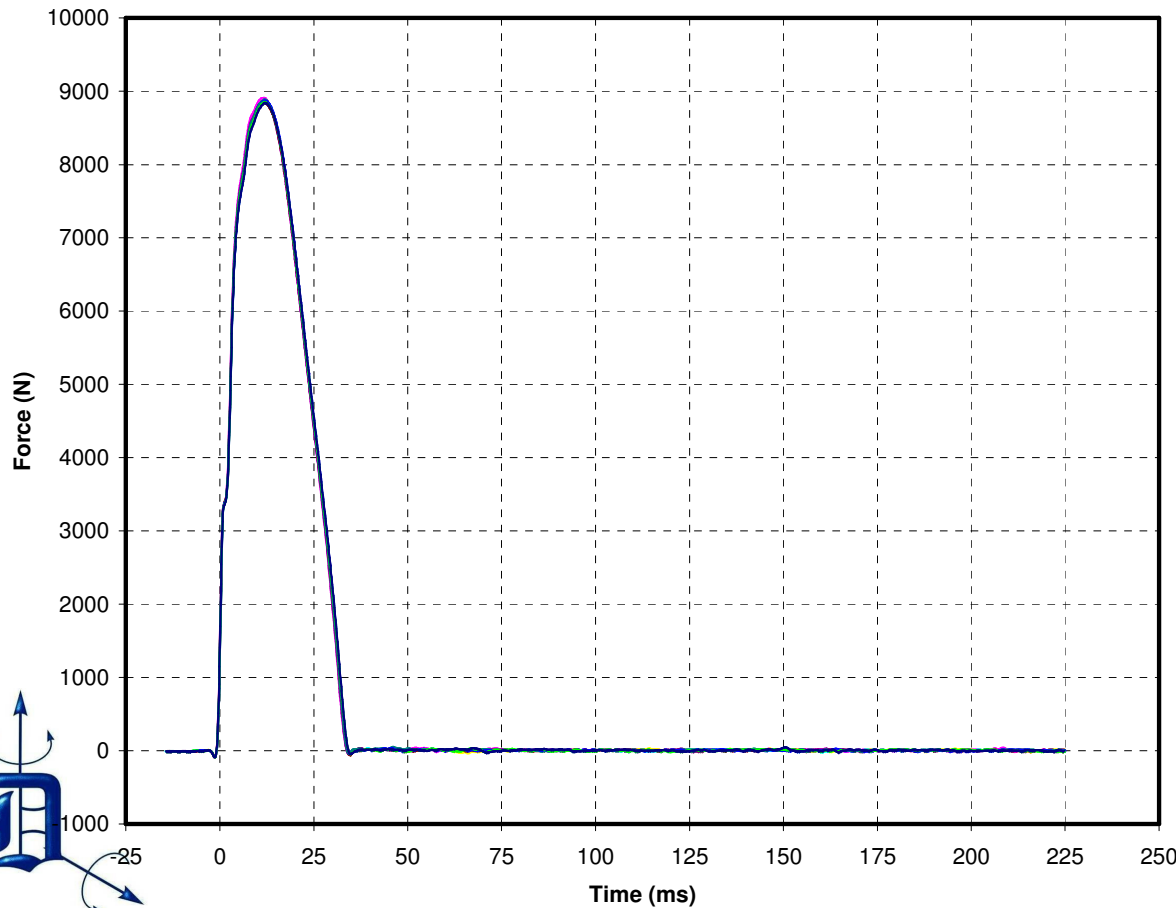
- Complete mini-sled w/o headrest results after repair



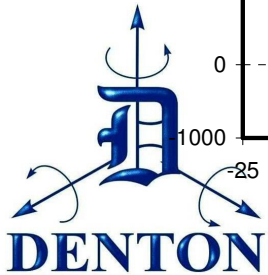
# Certification Test Results

## mini-sled w/o headrest test

Pendulum Force



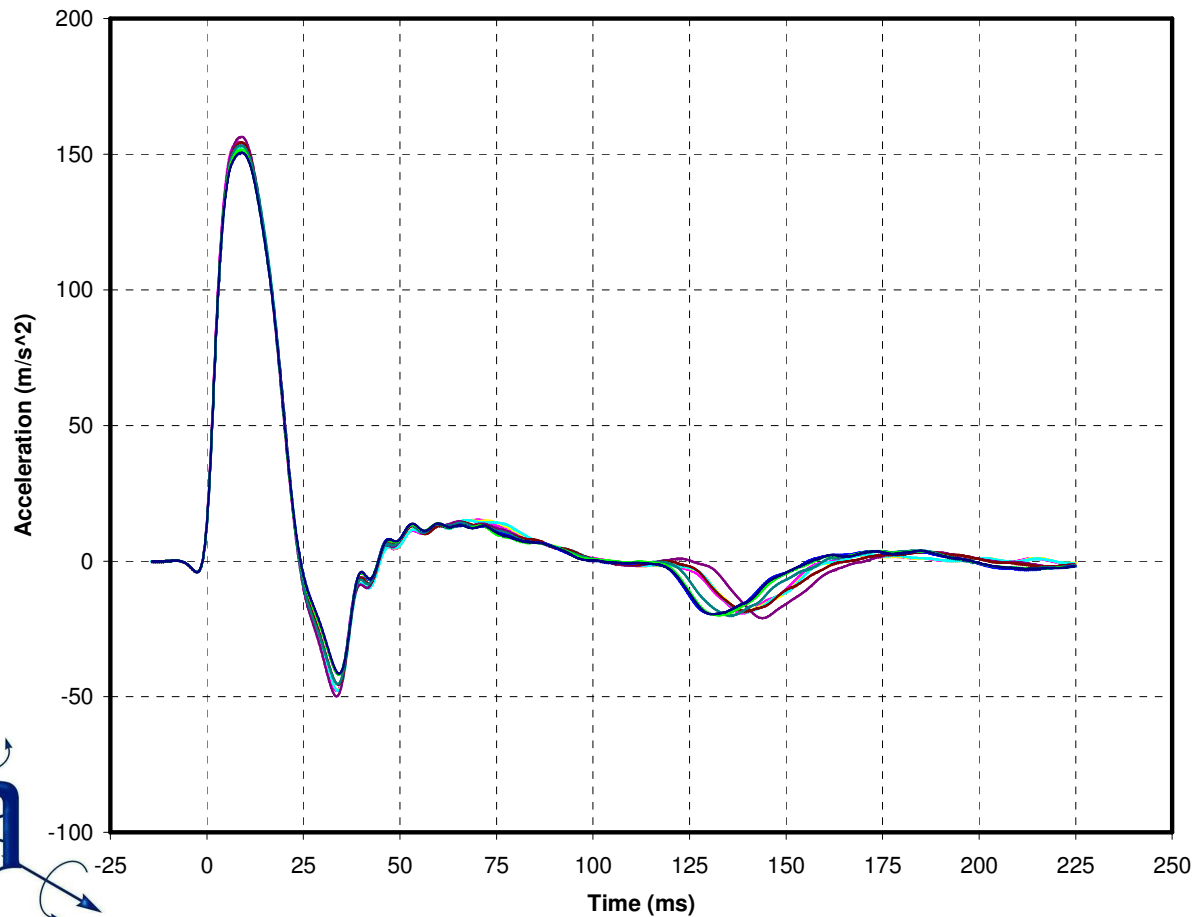
- 0106 -1.CF.CSV
- 0106 -2.CF.CSV
- 0106 -3.CF.CSV
- As Rec -1.CF.CSV
- As Rec -2.CF.CSV
- Reset -1 GMLC.CF.CSV
- Reset -2 GMLC.CF.CSV
- Reset -3 DLC.CF.CSV
- Reset -4 DLC.CF.CSV



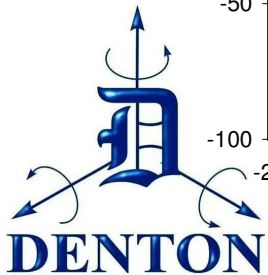
# Certification Test Results

## mini-sled w/o headrest test

Sled Acceleration



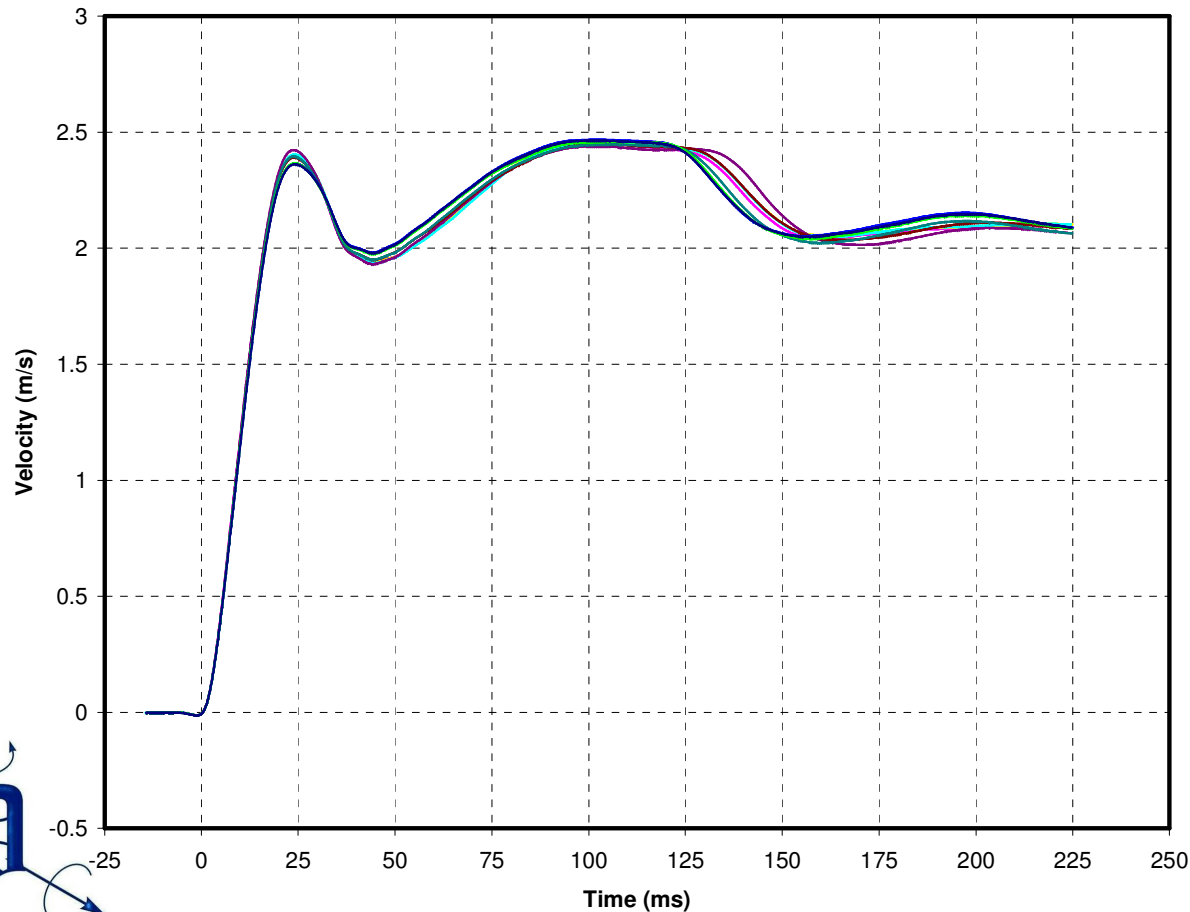
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
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- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



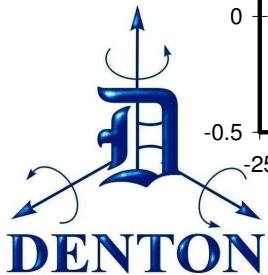
# Certification Test Results

## mini-sled w/o headrest test

Sled Velocity



- 0106 -1.CF.CSV
- 0106 -2.CF.CSV
- 0106 -3.CF.CSV
- As Rec -1.CF.CSV
- As Rec -2.CF.CSV
- Reset -1 GMLC.CF.CSV
- Reset -2 GMLC.CF.CSV
- Reset -3 DLC.CF.CSV
- Reset -4 DLC.CF.CSV

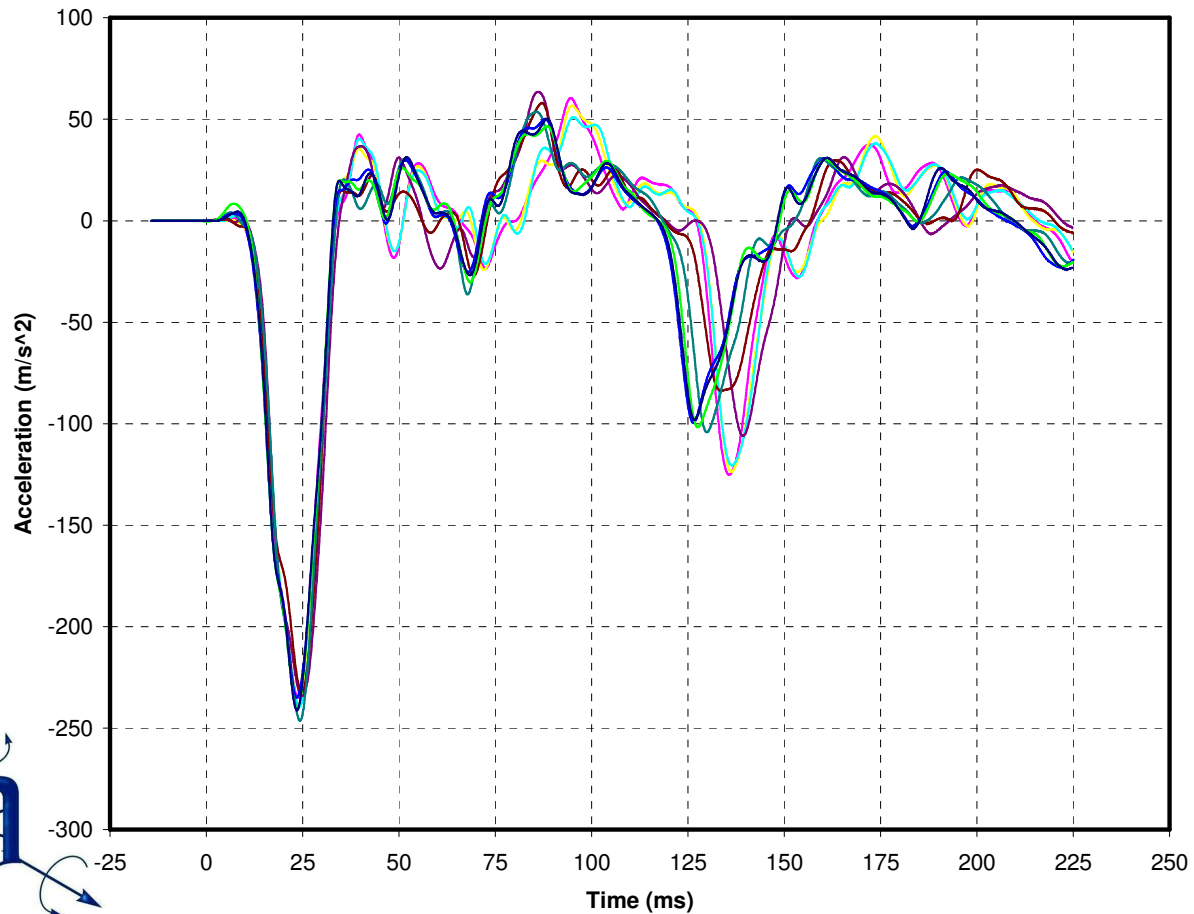




# Certification Test Results

## mini-sled w/o headrest test

T1 X Acceleration



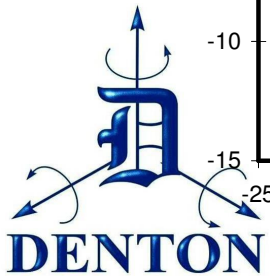
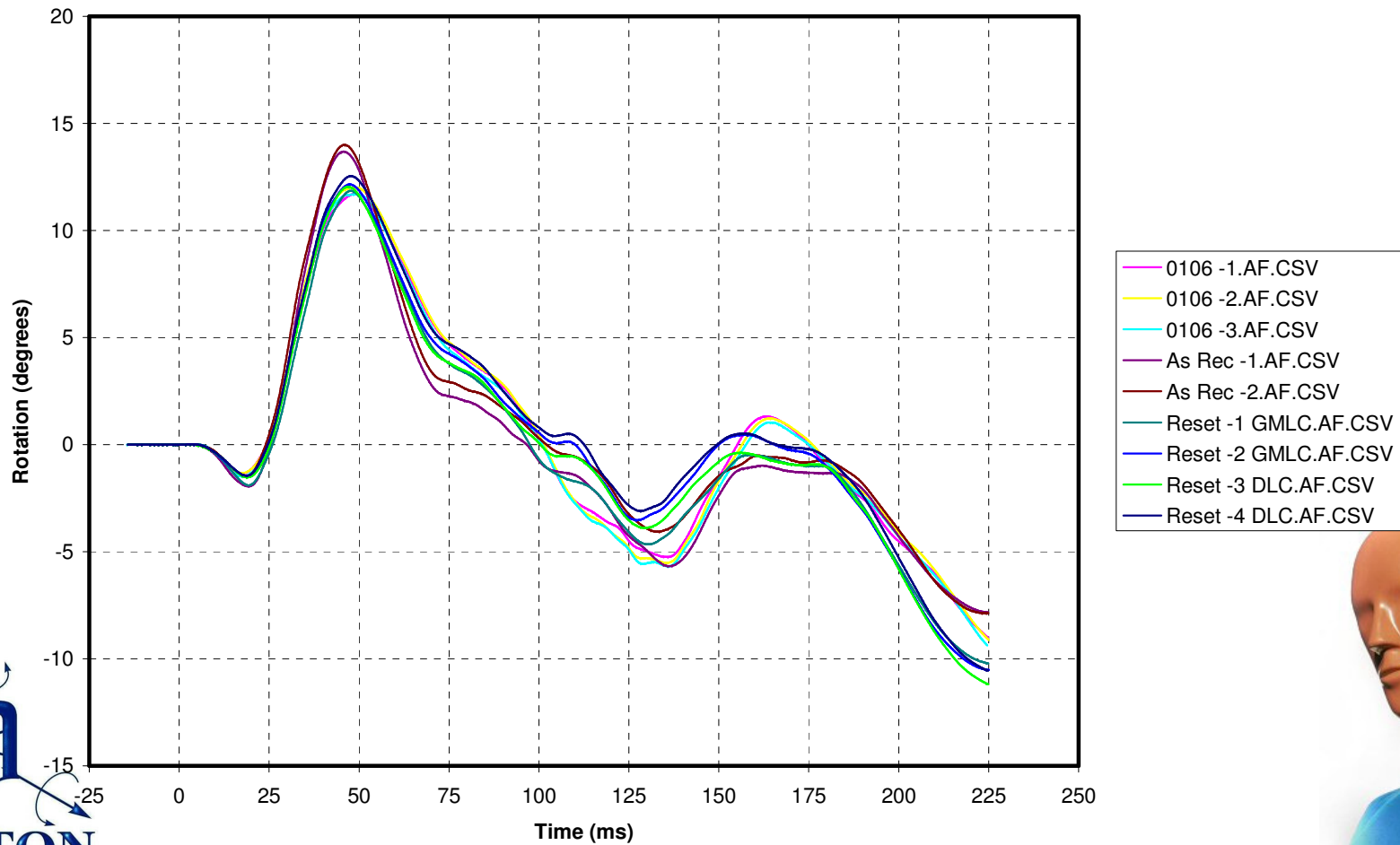
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
- Reset -1 GMLC.AF.CSV
- Reset -2 GMLC.AF.CSV
- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



# Certification Test Results

## mini-sled w/o headrest test

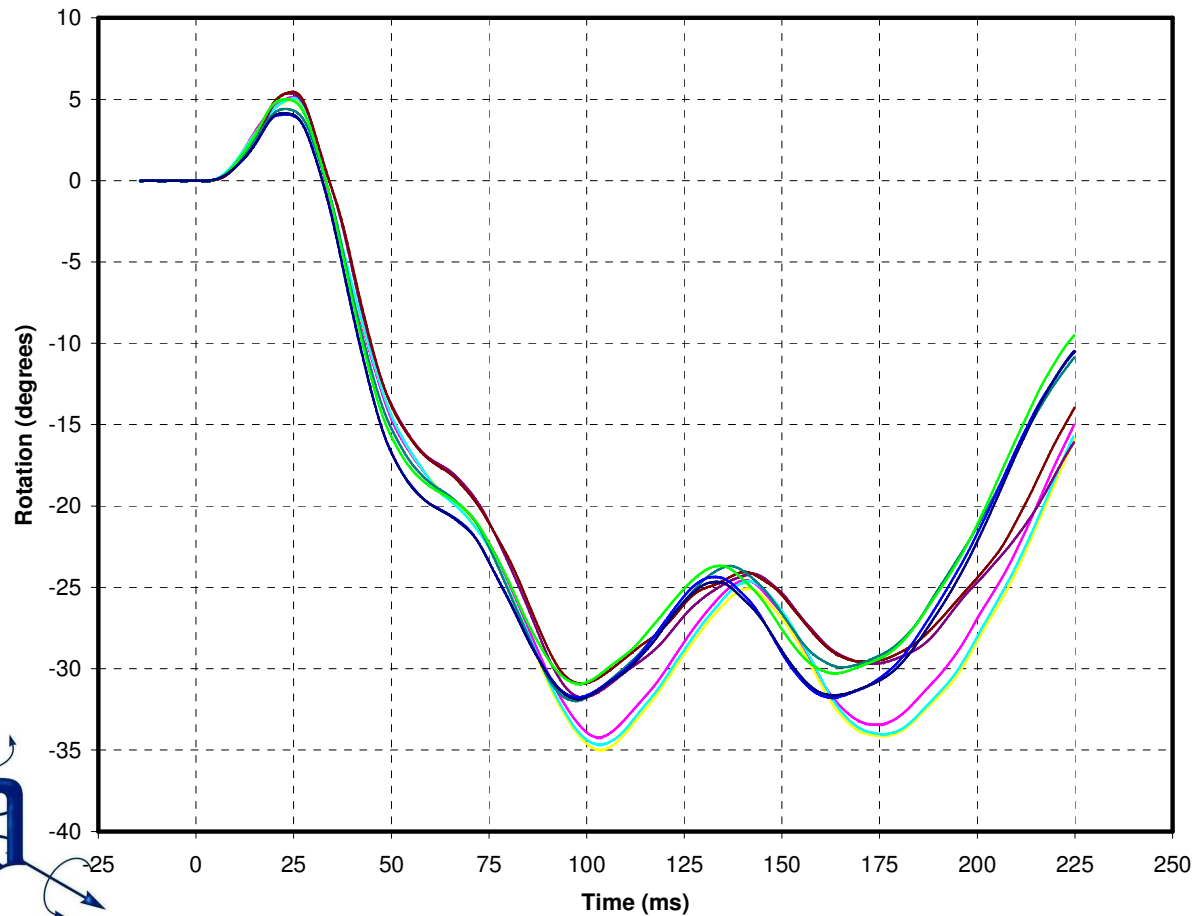
Pot A - Head Rotation



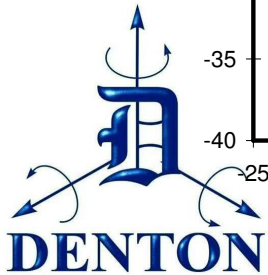
# Certification Test Results

## mini-sled w/o headrest test

Pot B - Neck Link Rotation



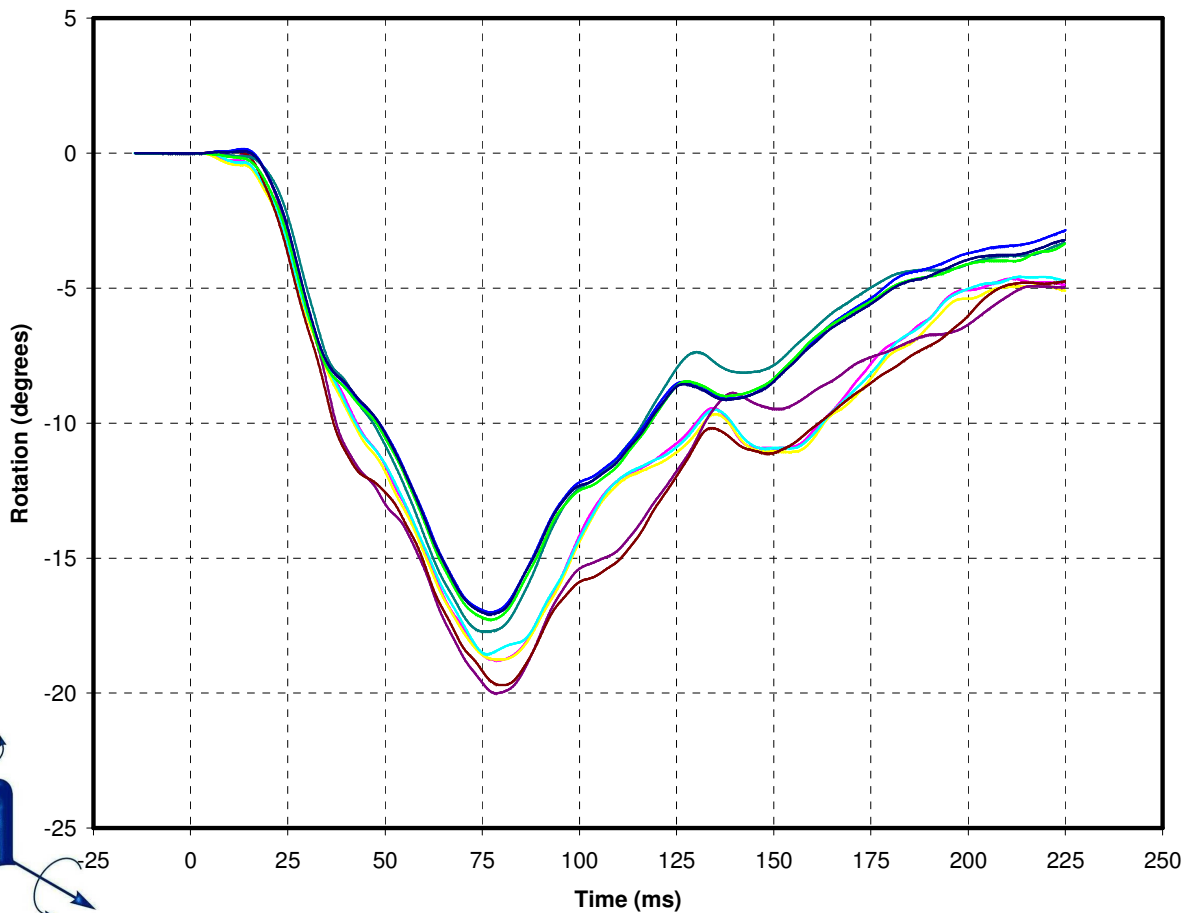
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
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- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



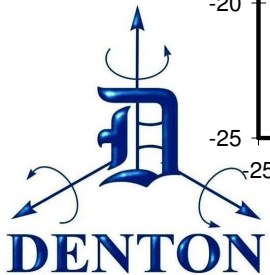
# Certification Test Results

## mini-sled w/o headrest test

Pot C - Lower Thorax



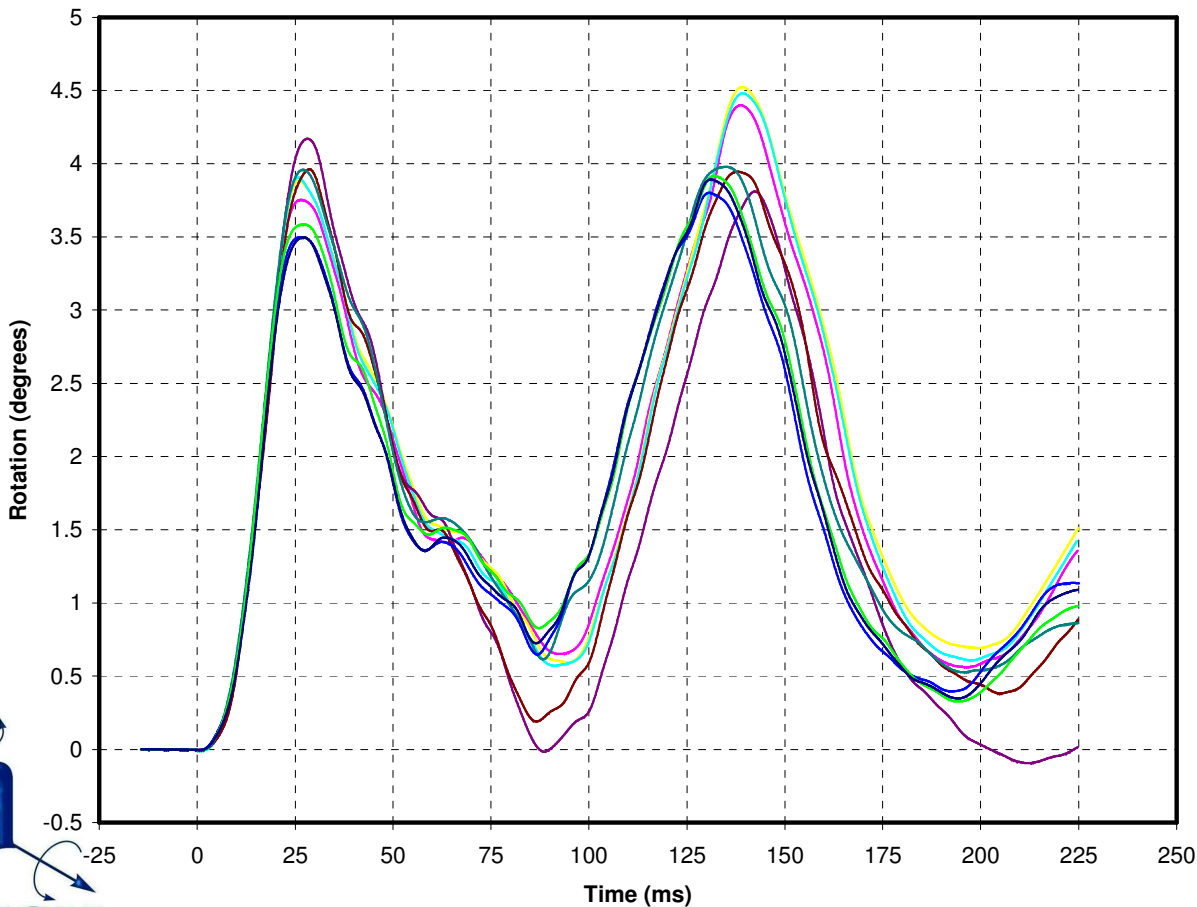
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- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
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- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



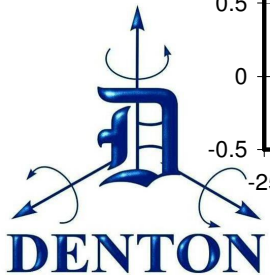
# Certification Test Results

## mini-sled w/o headrest test

Pot D - Lower Thorax



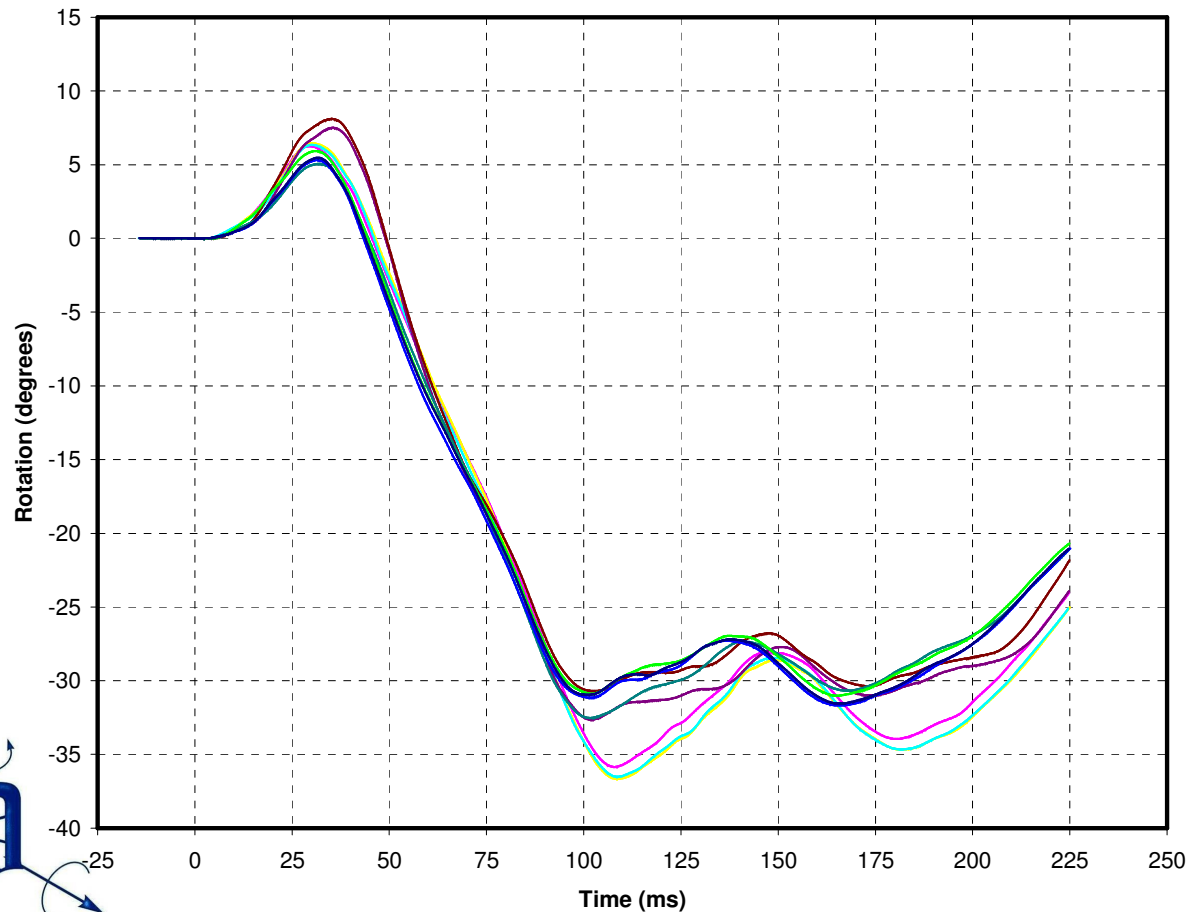
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
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- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



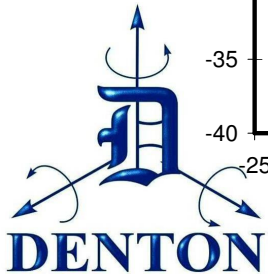
# Certification Test Results

## mini-sled w/o headrest test

Total Head Rotation



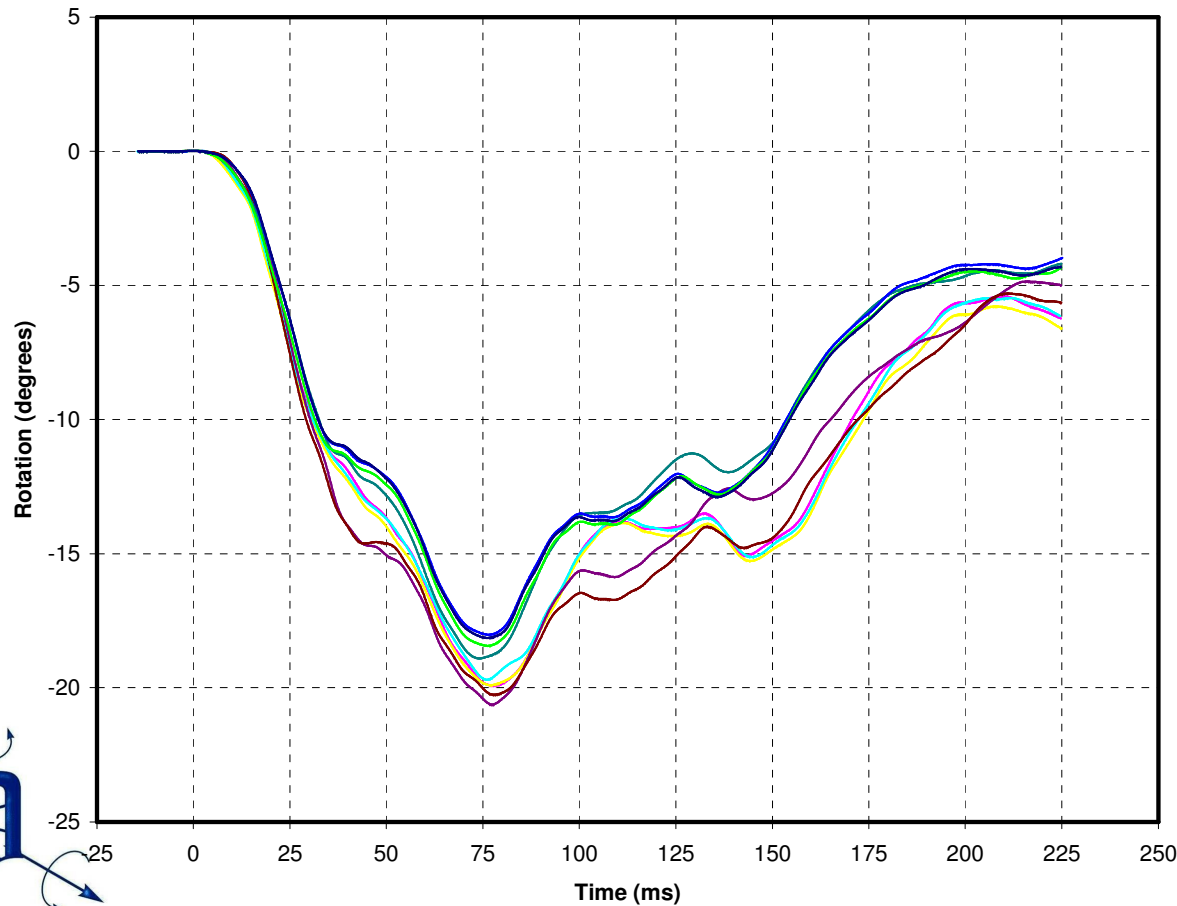
- 0106 -1.CF.CSV
- 0106 -2.CF.CSV
- 0106 -3.CF.CSV
- As Rec -1.CF.CSV
- As Rec -2.CF.CSV
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- Reset -3 DLC.CF.CSV
- Reset -4 DLC.CF.CSV



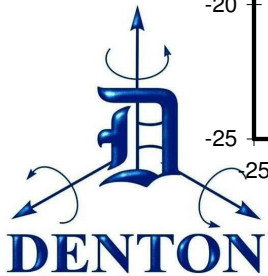
# Certification Test Results

## mini-sled w/o headrest test

Total Thoracic Rotation



- 0106 -1.CF.CSV
- 0106 -2.CF.CSV
- 0106 -3.CF.CSV
- As Rec -1.CF.CSV
- As Rec -2.CF.CSV
- Reset -1 GMLC.CF.CSV
- Reset -2 GMLC.CF.CSV
- Reset -3 DLC.CF.CSV
- Reset -4 DLC.CF.CSV

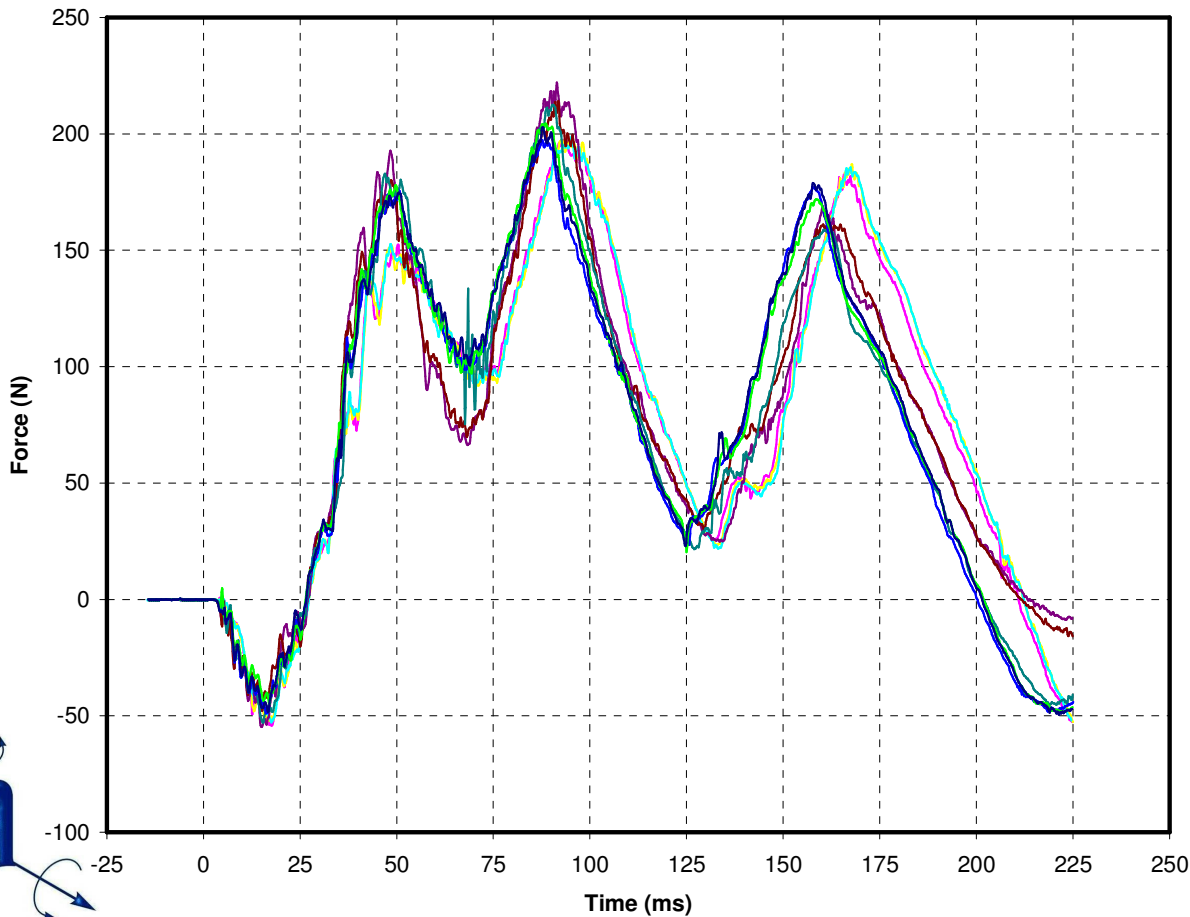




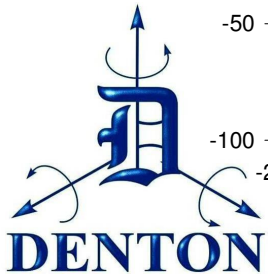
# Certification Test Results

## mini-sled w/o headrest test

Upper Neck Force FX



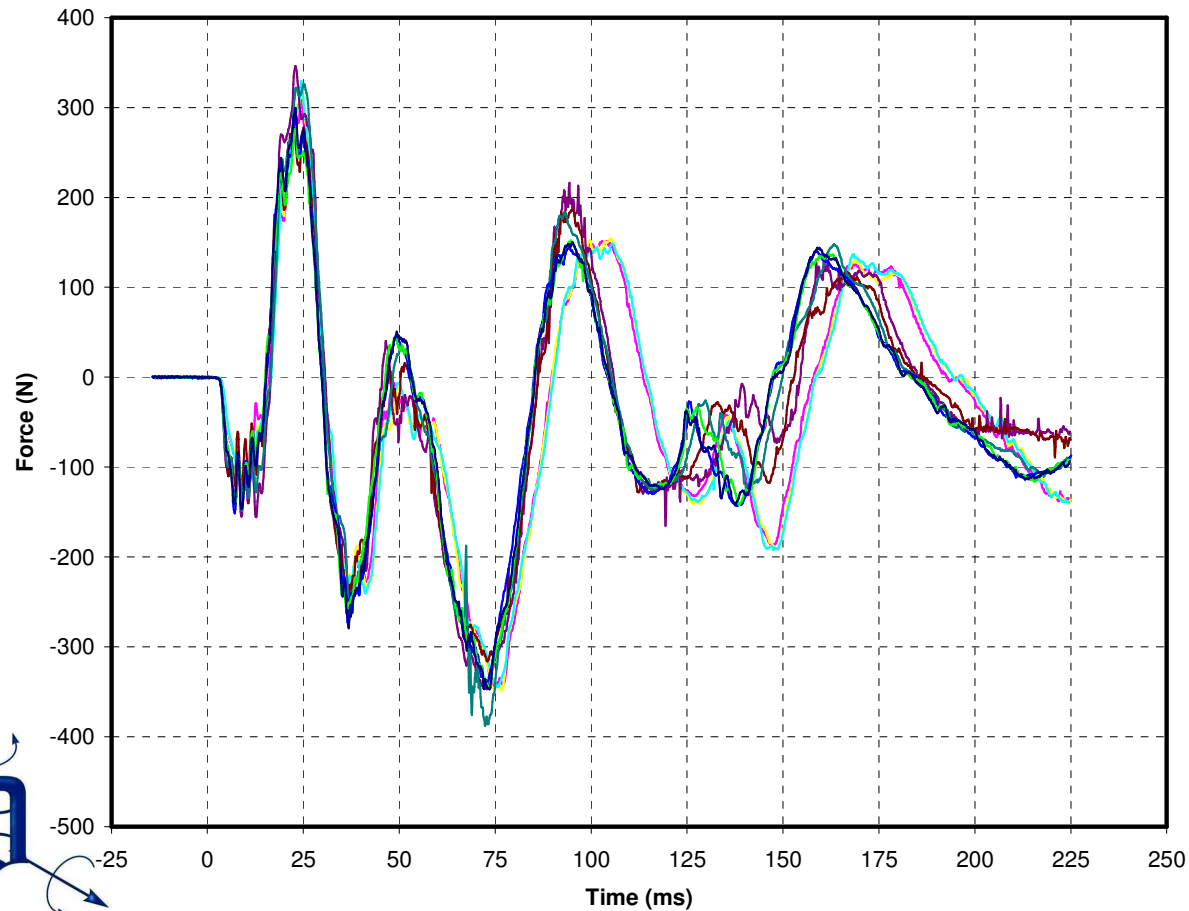
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
- Reset -1 GMLC.AF.CSV
- Reset -2 GMLC.AF.CSV
- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



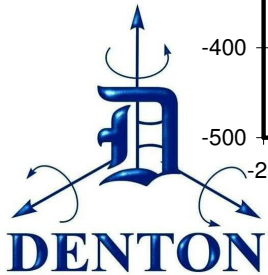
# Certification Test Results

## mini-sled w/o headrest test

Upper Neck Force FZ



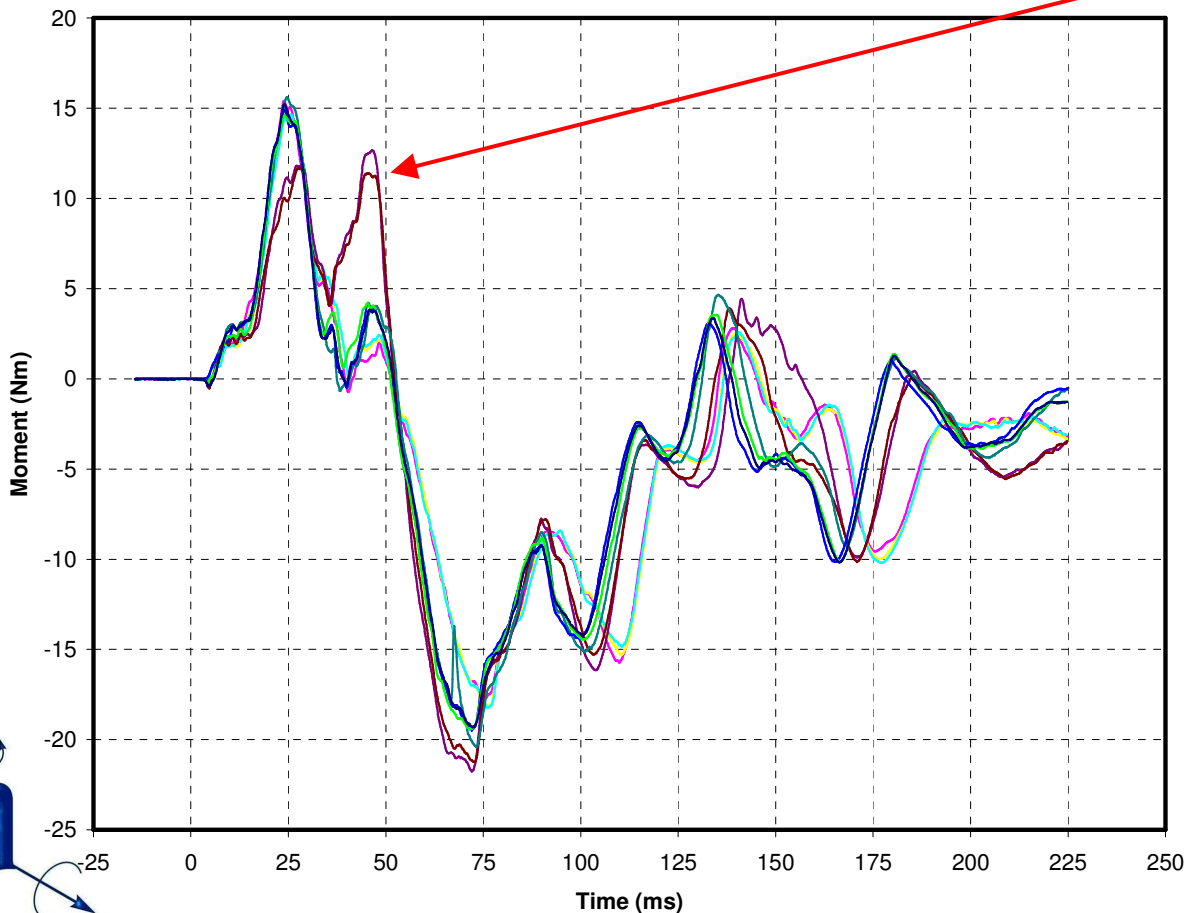
- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
- Reset -1 GMLC.AF.CSV
- Reset -2 GMLC.AF.CSV
- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV



# Certification Test Results

## mini-sled w/o headrest test

Upper Neck Moment MY



Something repaired changed performance. We will be investigating this further.

- 0106 -1.AF.CSV
- 0106 -2.AF.CSV
- 0106 -3.AF.CSV
- As Rec -1.AF.CSV
- As Rec -2.AF.CSV
- Reset -1 GMLC.AF.CSV
- Reset -2 GMLC.AF.CSV
- Reset -3 DLC.AF.CSV
- Reset -4 DLC.AF.CSV

