

**Denton ATD, Inc.**

**Denton ATD Update  
to BioRID II TEG**

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**April 28, 2010**

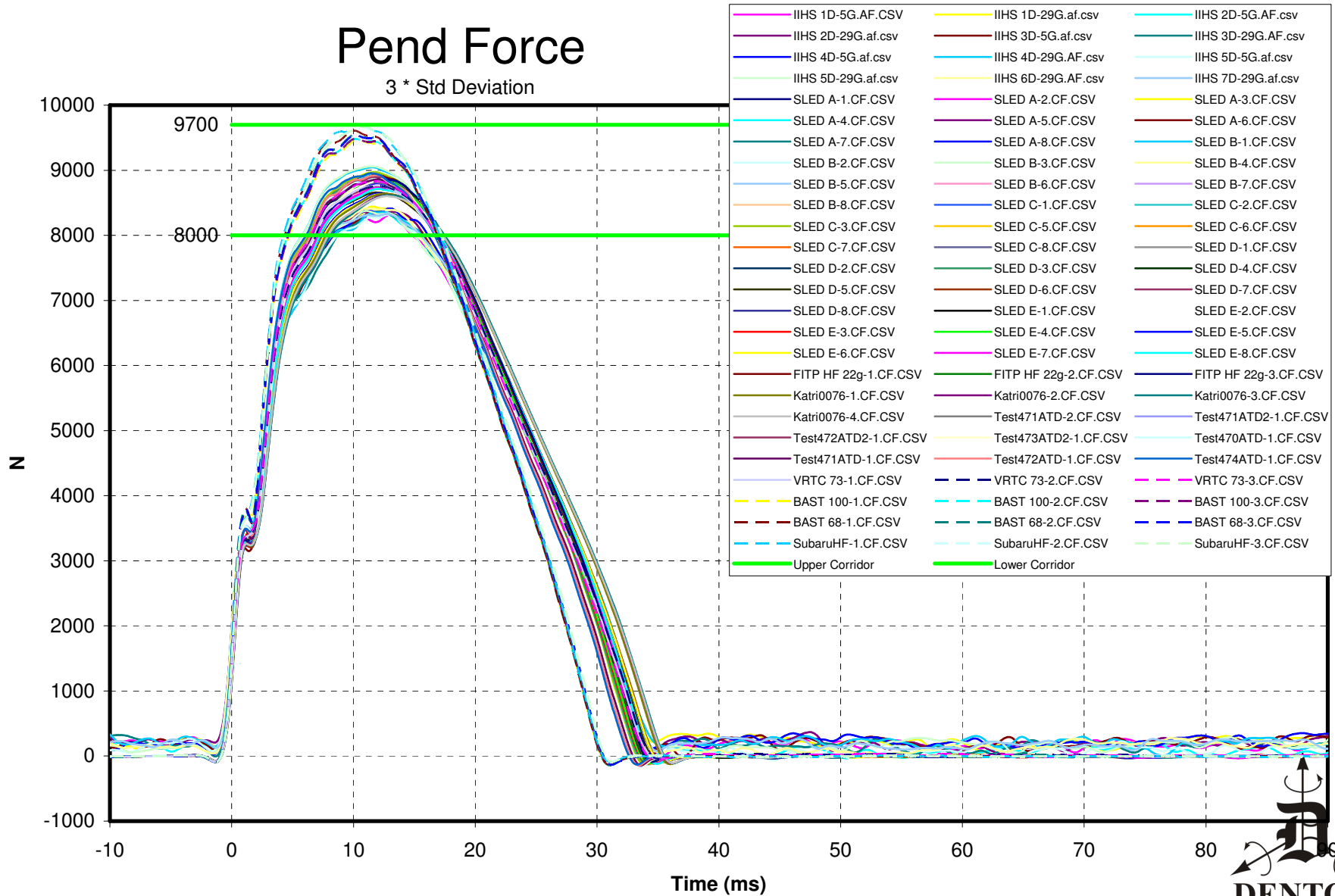


# Agenda

- GM Dummy Problem
- Certification Progress
  - Corridors
    - New proposed corridors
    - Ford data
      - Working on overlaying Ford data with corridors
      - Show weight package Ford data
    - New Adjustable Headrest test
    - Variability investigation plans
    - Possible additional inspection tests
- Skull cap switch
- Drawing review



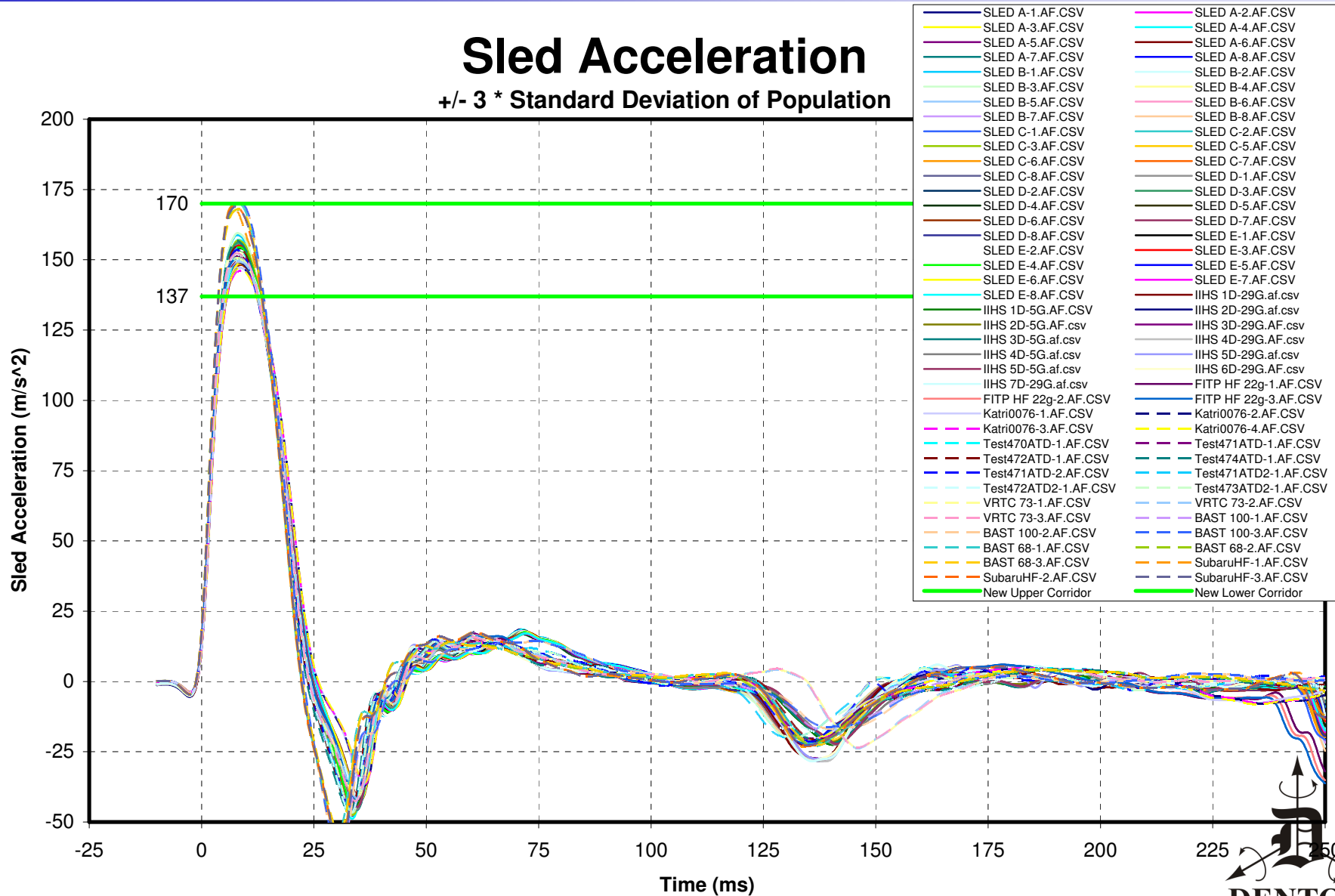
# Dummy Test with Corridors



# Dummy Test with Corridors

## Sled Acceleration

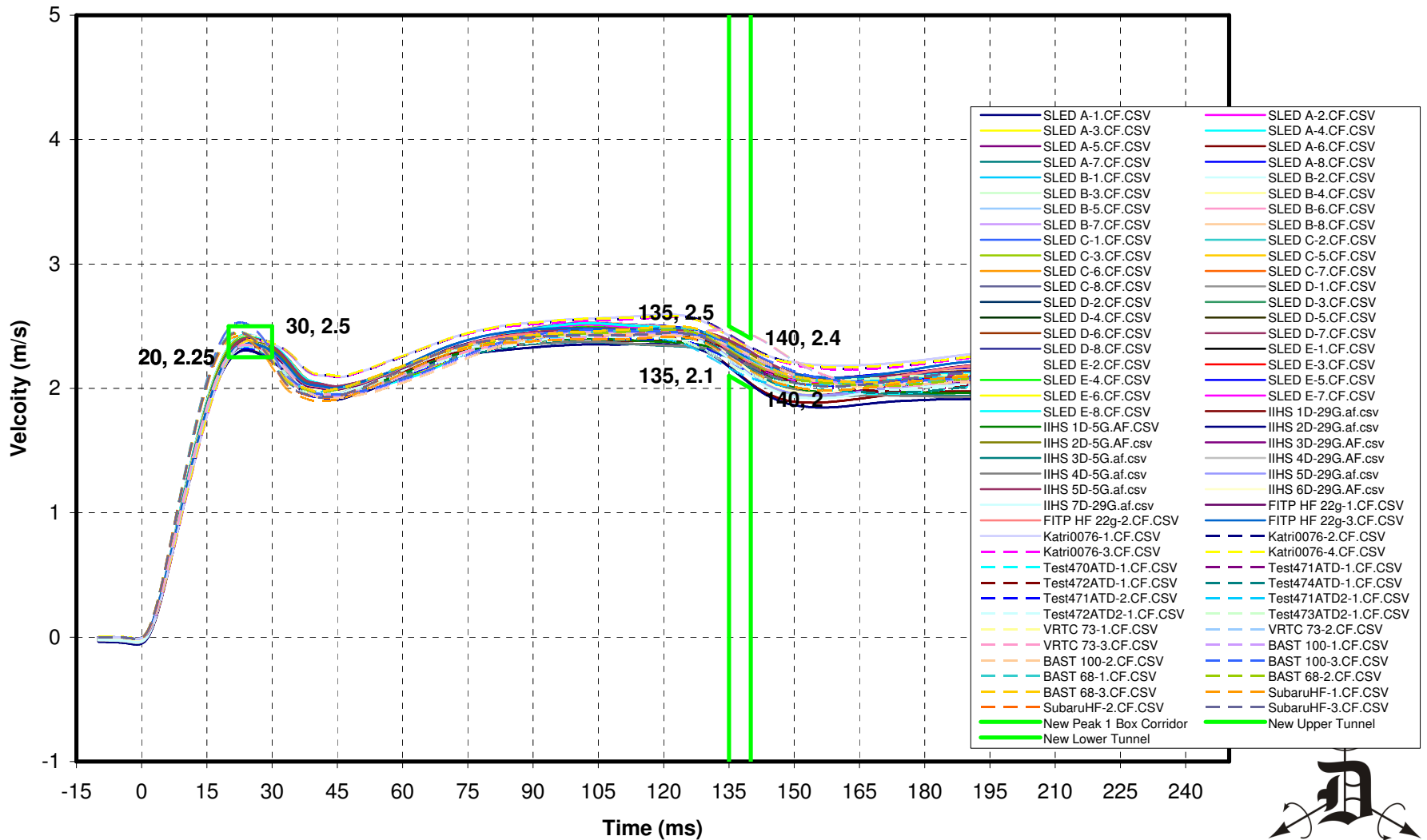
$\pm 3 * \text{Standard Deviation of Population}$





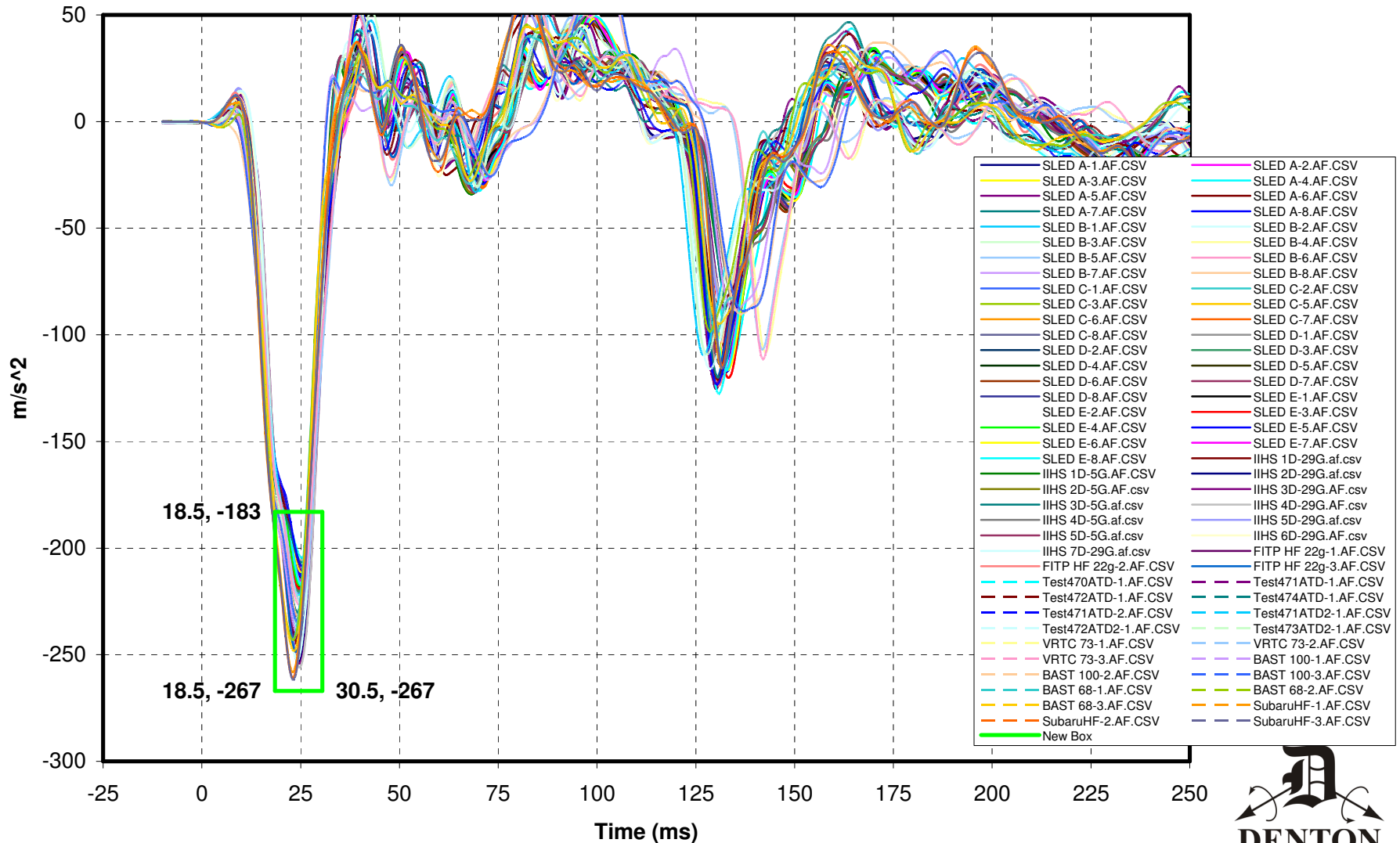
# Dummy Test with Corridors

Sled Velocity  
3 \* Std Deviation of Population



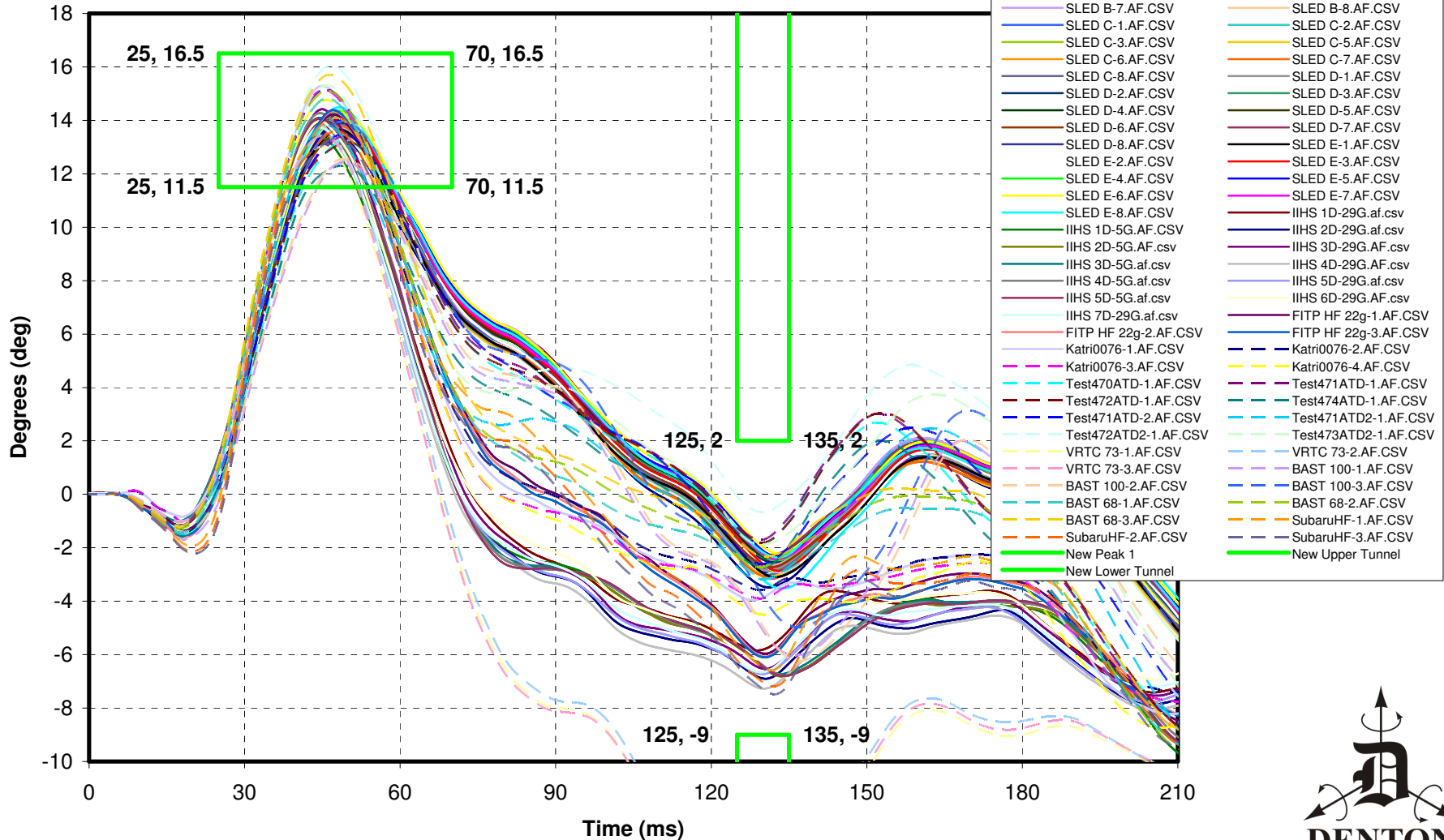
# Dummy Test with Corridors

T1 Acceleration  
+/- 3 \* Std Deviation



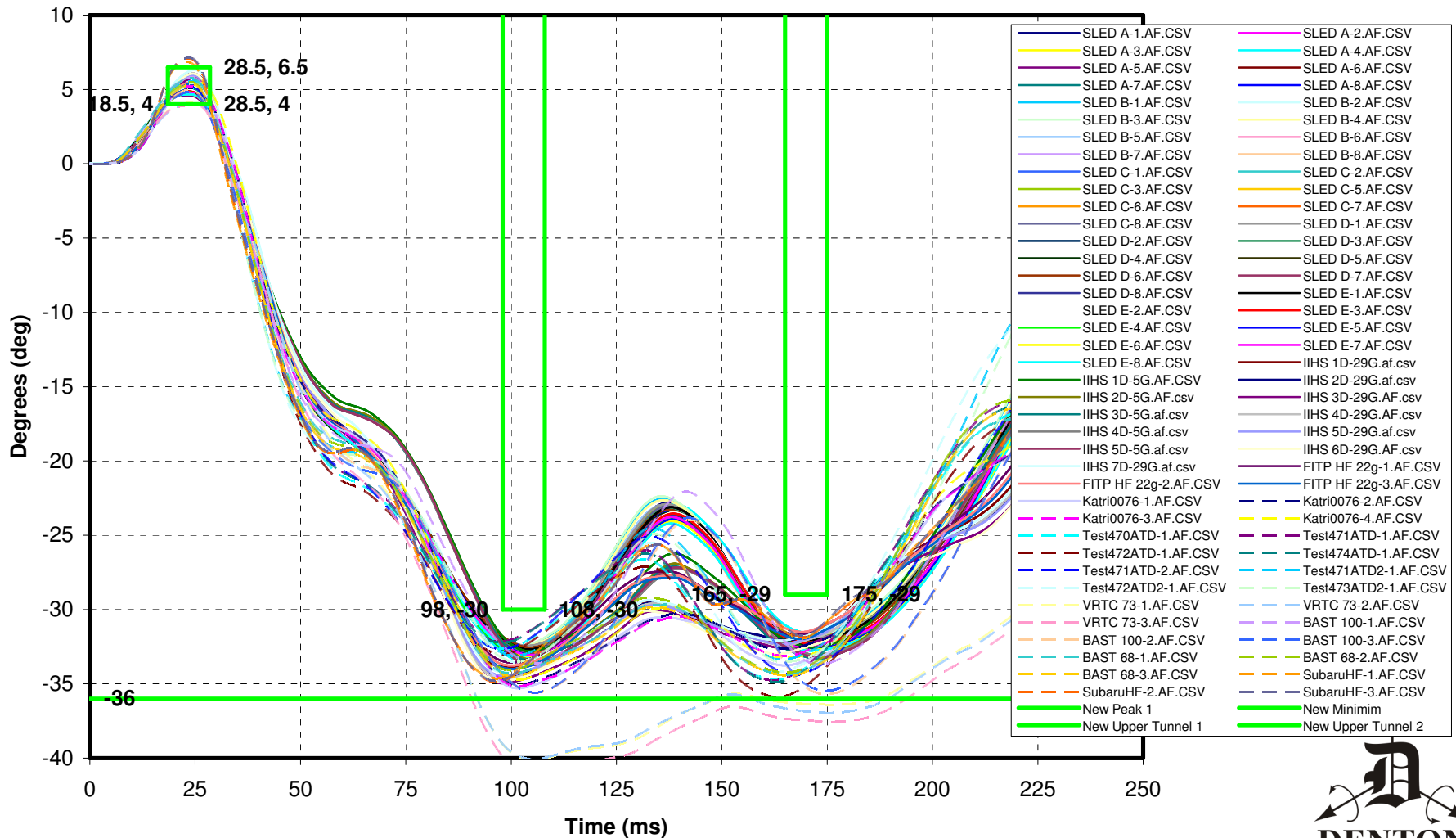
# Dummy Test with Corridors

Head Rotation about OC Corridor Check (Pot A)  
Peak 1 = Same as original except shifted  
Tunnel = +/-3 \* Std Dev



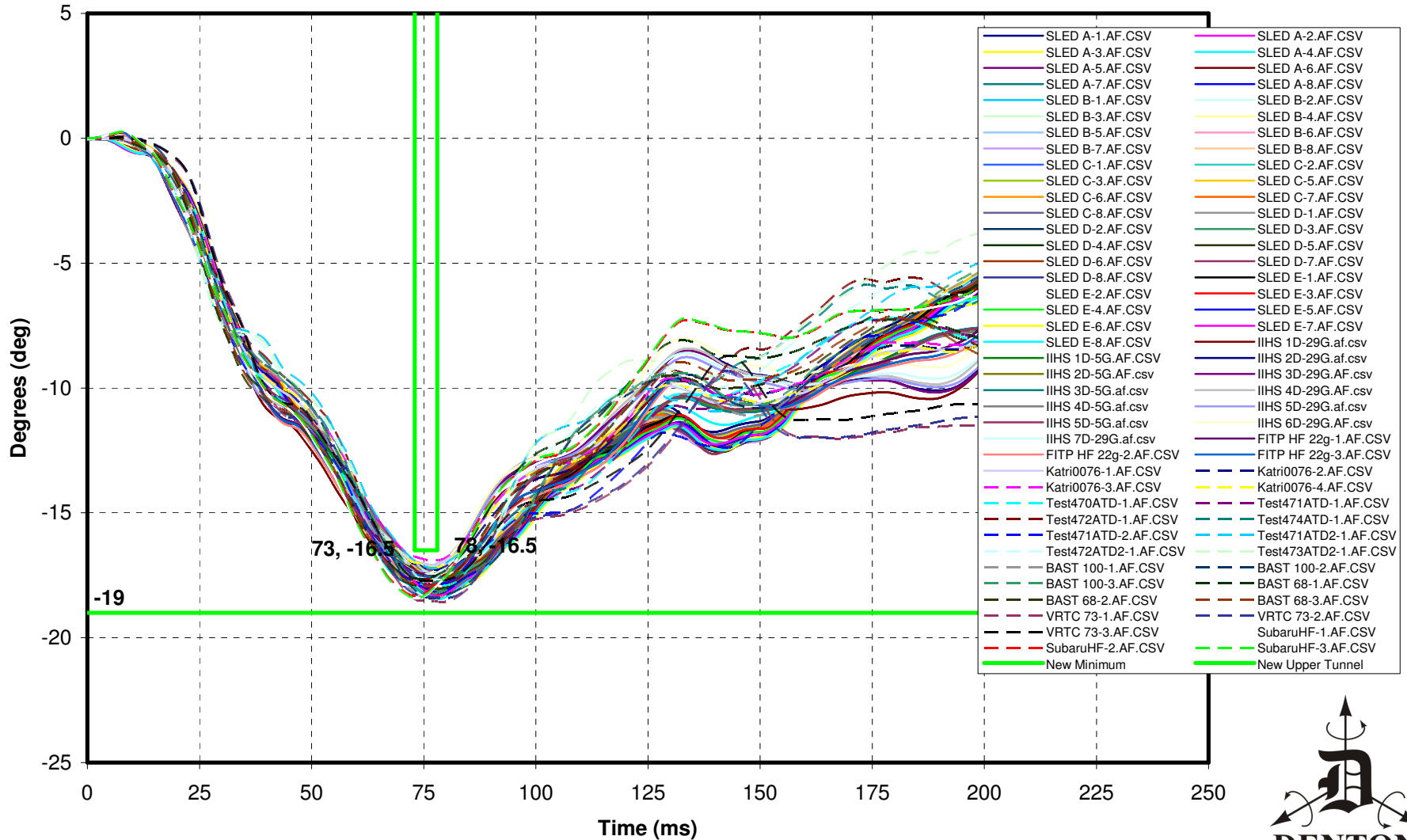
# Dummy Test with Corridors

Neck Link Rotation About T1 Corridor Check (Pot B)  
 3 \* Std Dev (same size as original)  
 Tunnels < than original



# Dummy Test with Corridors

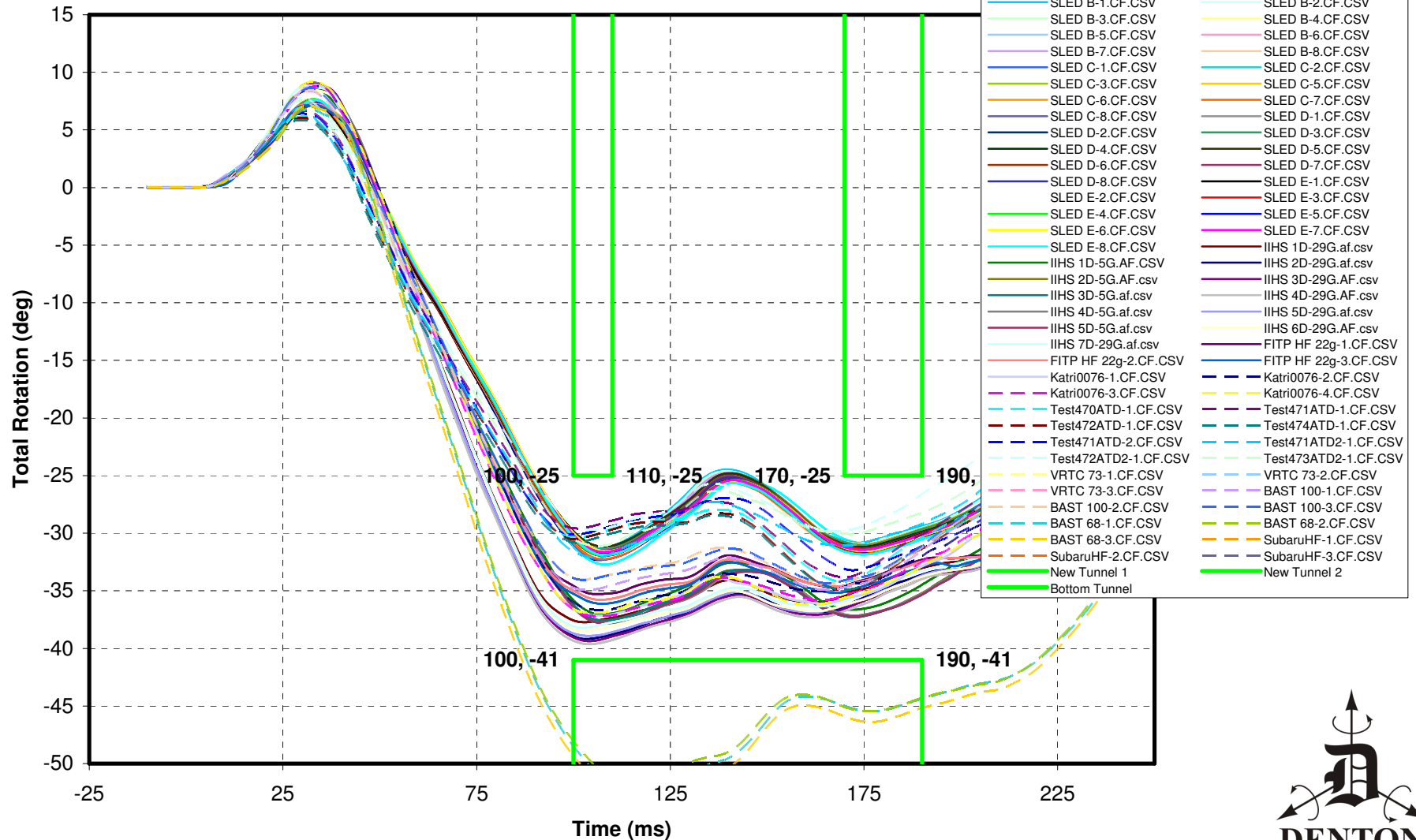
T1 Rotation Corridor Check (Pot C)  
3 \* Std Deviation



# Dummy Test with Corridors

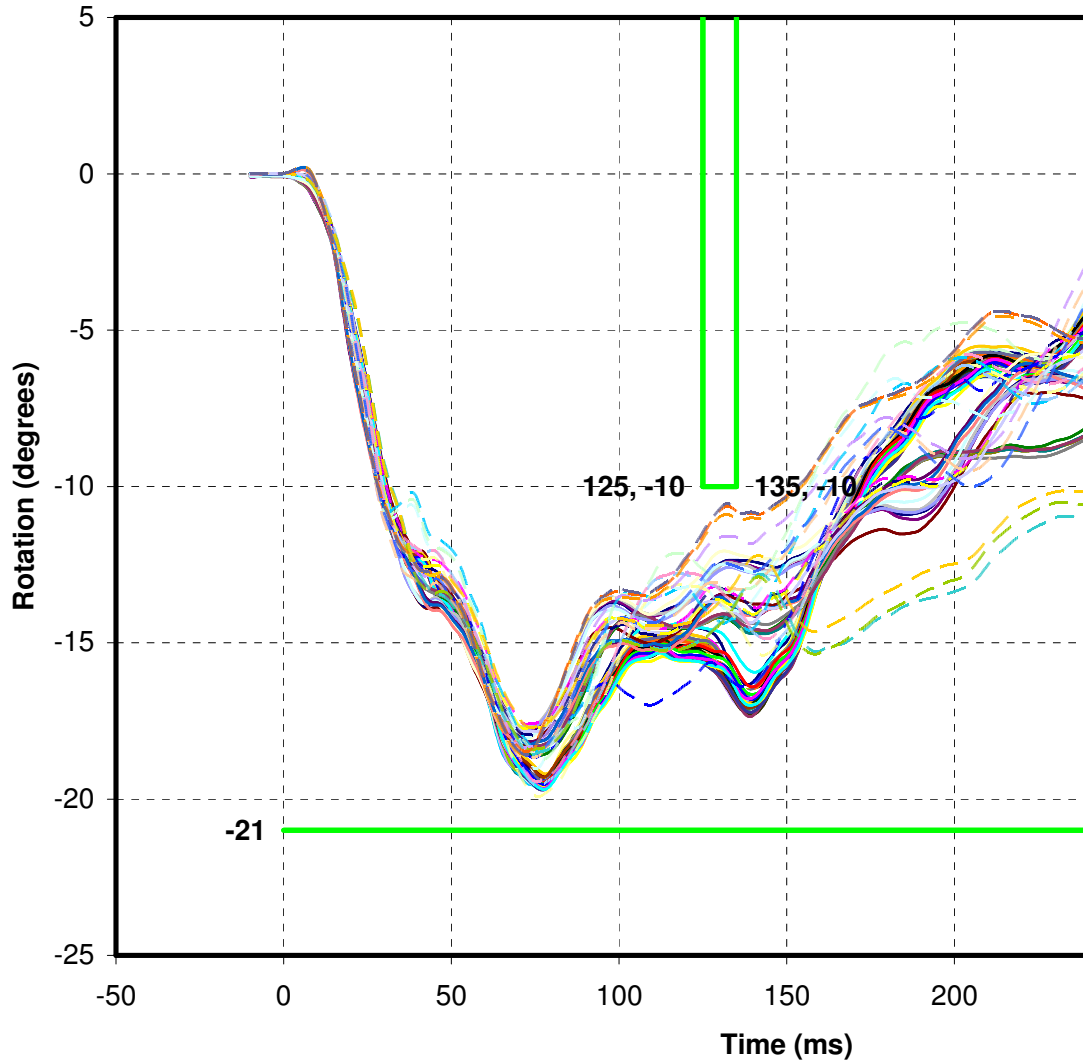
## Total Head Rotation ab T1 Corridor Check

+/- 3 \* Std Dev of Population



# Dummy Test with Corridors

**Total Thoracic Rotation**  
 $\pm 2 * \text{Std Dev of Population}$

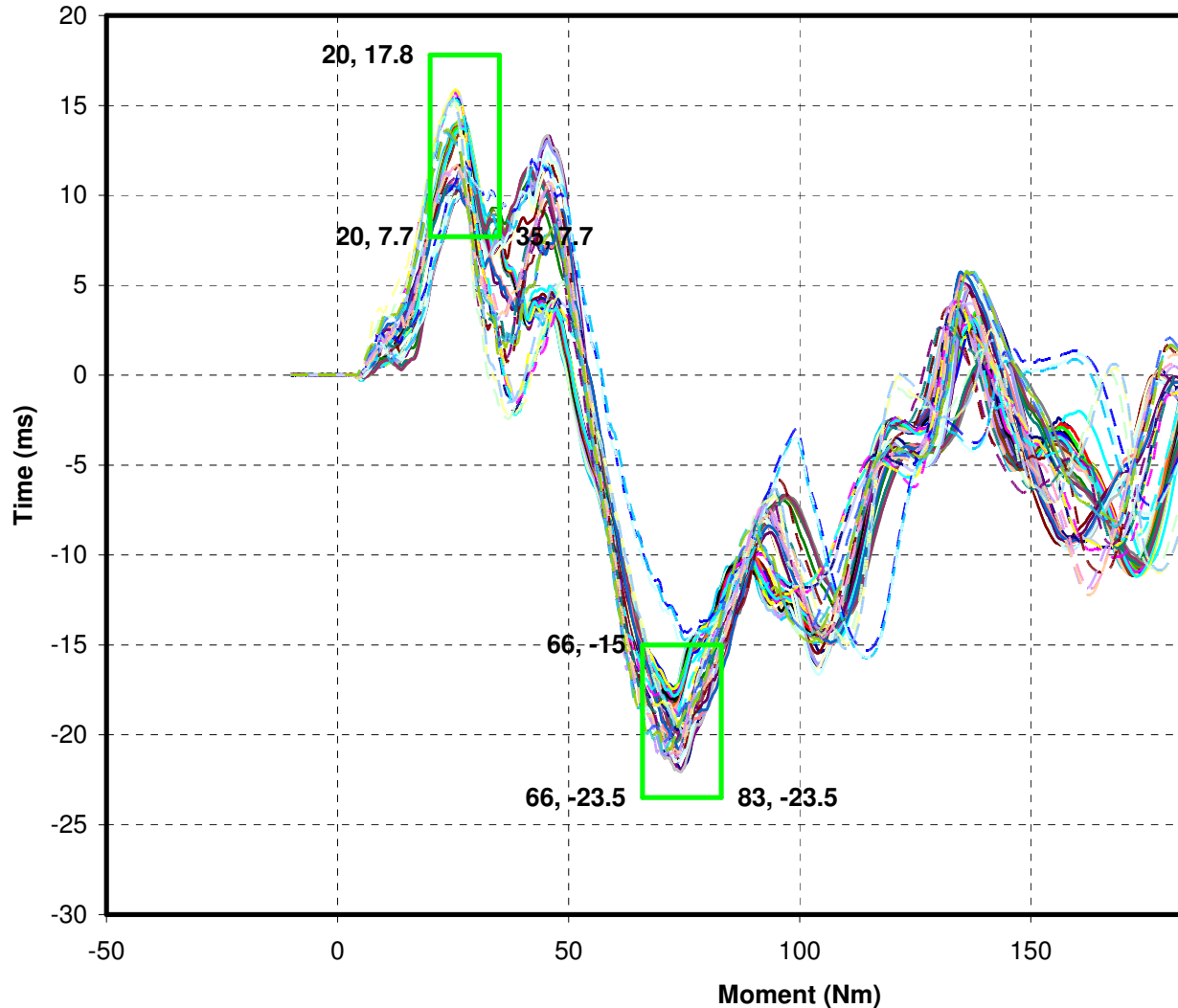


- SLED A-1.AF.CSV
- SLED A-2.AF.CSV
- SLED A-3.AF.CSV
- SLED A-4.AF.CSV
- SLED A-5.AF.CSV
- SLED A-6.AF.CSV
- SLED A-7.AF.CSV
- SLED A-8.AF.CSV
- SLED B-1.AF.CSV
- SLED B-2.AF.CSV
- SLED B-3.AF.CSV
- SLED B-4.AF.CSV
- SLED B-5.AF.CSV
- SLED B-6.AF.CSV
- SLED B-7.AF.CSV
- SLED B-8.AF.CSV
- SLED C-1.AF.CSV
- SLED C-2.AF.CSV
- SLED C-3.AF.CSV
- SLED C-4.AF.CSV
- SLED C-5.AF.CSV
- SLED C-6.AF.CSV
- SLED C-7.AF.CSV
- SLED C-8.AF.CSV
- SLED D-1.AF.CSV
- SLED D-2.AF.CSV
- SLED D-3.AF.CSV
- SLED D-4.AF.CSV
- SLED D-5.AF.CSV
- SLED D-6.AF.CSV
- SLED D-7.AF.CSV
- SLED D-8.AF.CSV
- SLED E-1.AF.CSV
- SLED E-2.AF.CSV
- SLED E-3.AF.CSV
- SLED E-4.AF.CSV
- SLED E-5.AF.CSV
- SLED E-6.AF.CSV
- SLED E-7.AF.CSV
- SLED E-8.AF.CSV
- IIHS 1D-29G.af.csv
- IIHS 1D-5G.AF.CSV
- IIHS 2D-29G.af.csv
- IIHS 2D-5G.AF.CSV
- IIHS 3D-29G.af.csv
- IIHS 3D-5G.af.csv
- IIHS 4D-29G.AF.CSV
- IIHS 4D-5G.af.csv
- IIHS 5D-29G.af.csv
- IIHS 5D-5G.af.csv
- IIHS 6D-29G.AF.CSV
- IIHS 7D-29G.af.csv
- FITP HF 22g-1.AF.CSV
- FITP HF 22g-2.AF.CSV
- FITP HF 22g-3.AF.CSV
- Katri0076-1.AF.CSV
- Katri0076-2.AF.CSV
- Katri0076-3.AF.CSV
- Katri0076-4.AF.CSV
- Test471ATD-2.AF.CSV
- Test471ATD2-1.AF.CSV
- Test472ATD2-1.AF.CSV
- Test473ATD2-1.AF.CSV
- BAST 100-1.AF.CSV
- BAST 100-2.AF.CSV
- BAST 100-3.AF.CSV
- BAST 68-1.AF.CSV
- BAST 68-2.AF.CSV
- BAST 68-3.AF.CSV
- VRTC 73-1.AF.CSV
- VRTC 73-2.AF.CSV
- VRTC 73-3.AF.CSV
- SubaruHF-1.AF.CSV
- SubaruHF-2.AF.CSV
- SubaruHF-3.AF.CSV
- Upper Tunnel
- Minimum
- Upper Tunnel
- Minimum
- Series79



# Dummy Test with Corridors

Upper Neck Moment My  
 $\pm 3 \cdot \text{Std Deviation}$



- |                      |                      |
|----------------------|----------------------|
| SLED A-1.AF.CSV      | SLED A-2.AF.CSV      |
| SLED A-3.AF.CSV      | SLED A-4.AF.CSV      |
| SLED A-5.AF.CSV      | SLED A-6.AF.CSV      |
| SLED A-7.AF.CSV      | SLED A-8.AF.CSV      |
| SLED B-1.AF.CSV      | SLED B-2.AF.CSV      |
| SLED B-3.AF.CSV      | SLED B-4.AF.CSV      |
| SLED B-5.AF.CSV      | SLED B-6.AF.CSV      |
| SLED B-7.AF.CSV      | SLED B-8.AF.CSV      |
| SLED C-1.AF.CSV      | SLED C-2.AF.CSV      |
| SLED C-3.AF.CSV      | SLED C-5.AF.CSV      |
| SLED C-6.AF.CSV      | SLED C-7.AF.CSV      |
| SLED C-8.AF.CSV      | SLED D-1.AF.CSV      |
| SLED D-2.AF.CSV      | SLED D-3.AF.CSV      |
| SLED D-4.AF.CSV      | SLED D-5.AF.CSV      |
| SLED D-6.AF.CSV      | SLED D-7.AF.CSV      |
| SLED D-8.AF.CSV      | SLED E-1.AF.CSV      |
| SLED E-2.AF.CSV      | SLED E-3.AF.CSV      |
| SLED E-4.AF.CSV      | SLED E-5.AF.CSV      |
| SLED E-6.AF.CSV      | SLED E-7.AF.CSV      |
| SLED E-8.AF.CSV      | IIHS 1D-29G.af.csv   |
| IIHS 1D-5G.AF.CSV    | IIHS 2D-29G.af.csv   |
| IIHS 2D-5G.AF.csv    | IIHS 3D-29G.AF.csv   |
| IIHS 3D-5G.af.csv    | IIHS 4D-29G.AF.csv   |
| IIHS 4D-5G.af.csv    | IIHS 5D-29G.af.csv   |
| IIHS 5D-5G.af.csv    | IIHS 6D-29G.AF.csv   |
| IIHS 7D-29G.af.csv   | FITP HF 22g-1.AF.CSV |
| FITP HF 22g-2.AF.CSV | FITP HF 22g-3.AF.CSV |
| Test470ATD-1.AF.CSV  | Test471ATD-1.AF.CSV  |
| Test472ATD-1.AF.CSV  | Test474ATD-1.AF.CSV  |
| Test471ATD-2.AF.CSV  | Test471ATD2-1.AF.CSV |
| Test472ATD2-1.AF.CSV | Test473ATD2-1.AF.CSV |
| VRTC 73-1.AF.CSV     | VRTC 73-2.AF.CSV     |
| VRTC 73-3.AF.CSV     | BAST 100-1.AF.CSV    |
| BAST 100-2.AF.CSV    | BAST 100-3.AF.CSV    |
| BAST 68-1.AF.CSV     | BAST 68-2.AF.CSV     |
| BAST 68-3.AF.CSV     | SubaruHF-1.AF.CSV    |
| SubaruHF-2.AF.CSV    | SubaruHF-3.AF.CSV    |
| Box 1                | Box 2                |



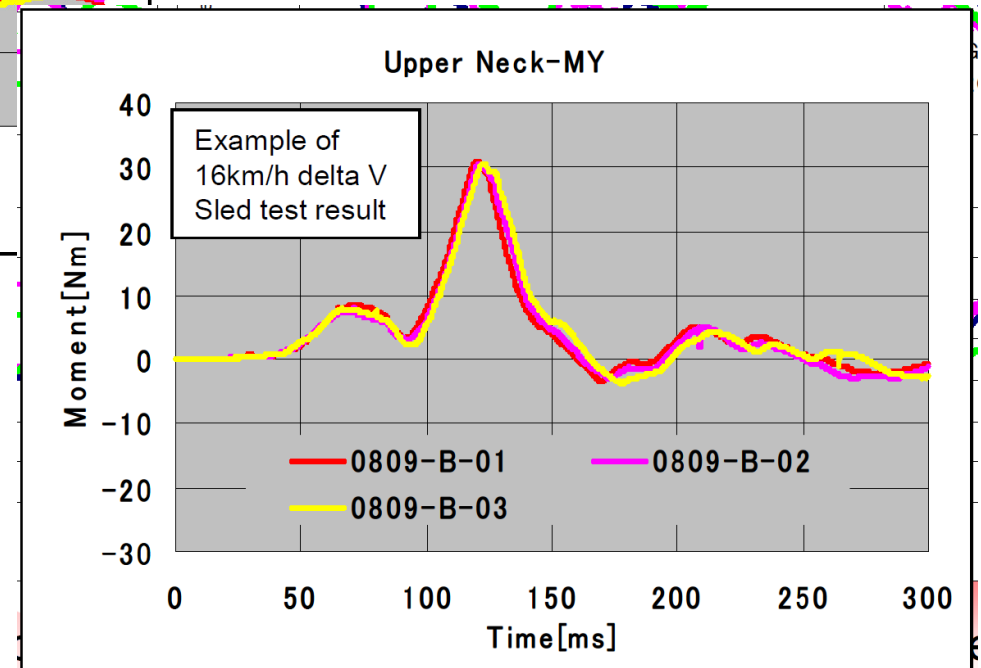
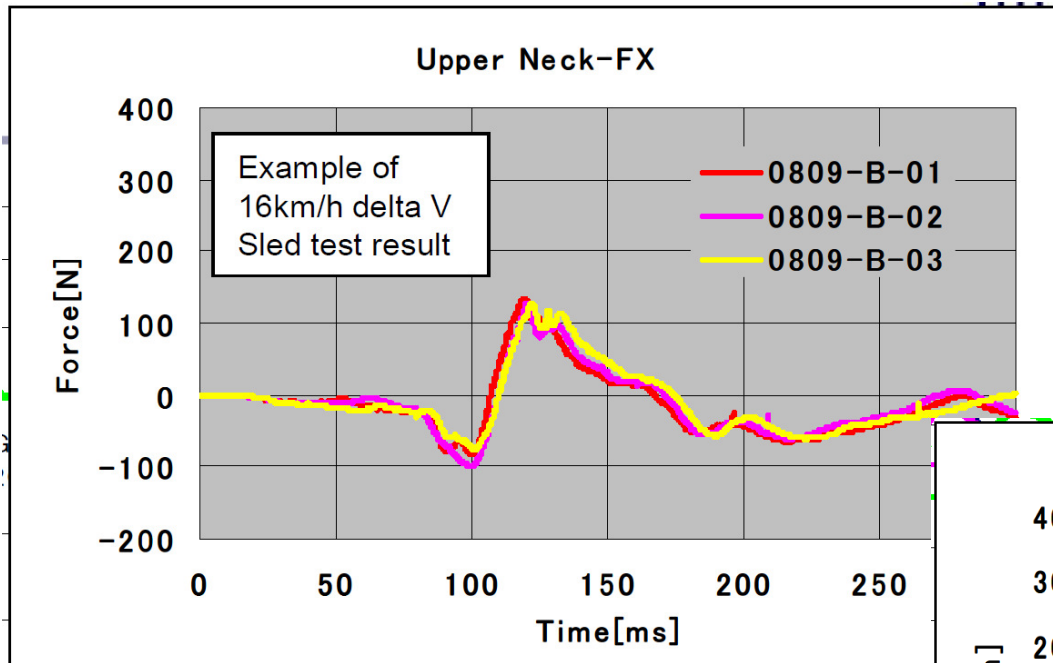
# New Adjustable Headrest Test

- Fixed rigid headrest test was unacceptable
- New design
  - Adjustable for 50 to 100 mm backset
  - Foam pad to simulate headrest
  - Trying to match **JASIC/Japan** seat test Fx & My peaks and curve shapes from their Feb. 2010 presentation

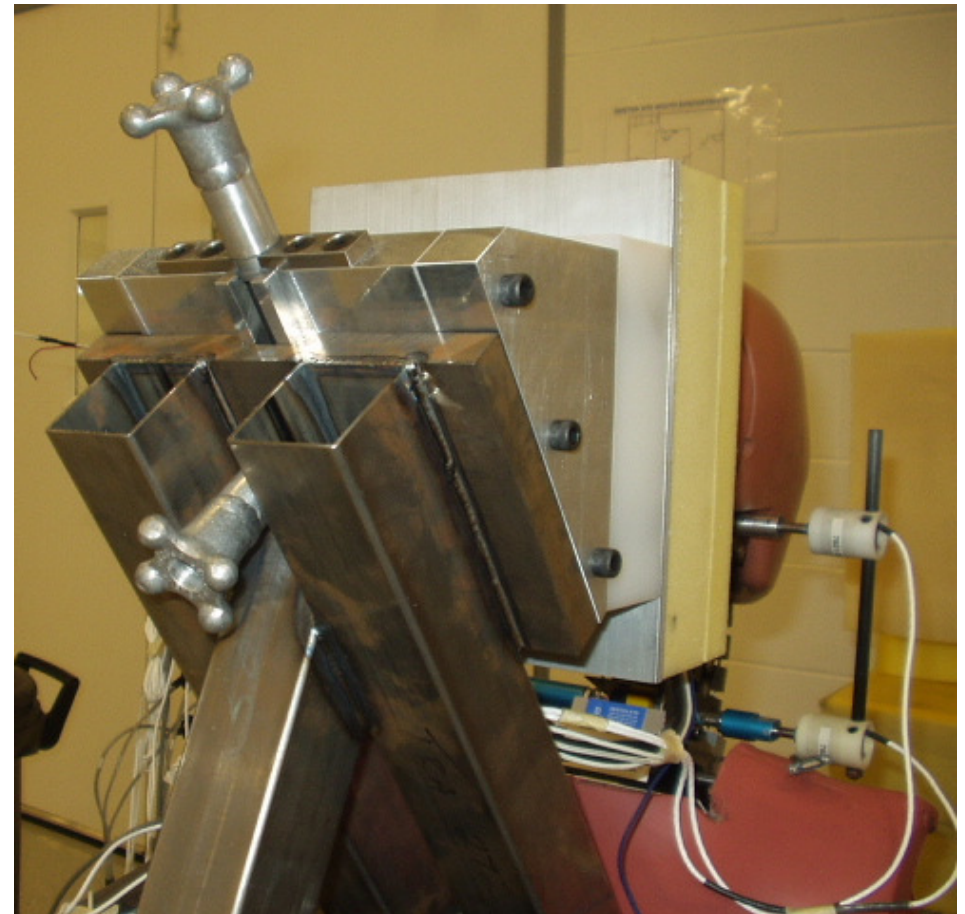


# New Adjustable Headrest Test

- Target curves from **JASIC/Japan**



# New Adjustable Headrest Test



# New Adjustable Headrest Test

- Have done preliminary testing
- Working on
  - Targeting 10 g peak 16 kph pulse
  - Adjusting foam headrest pad
    - Thickness
    - Stiffness
  - Will require dynamic foam headrest pad certification test
    - Probably drop tower test at 2 velocities



# Variability Investigation Plans

- Planning studies of the effects of the following factors on mini-sled tests
  - loss of oil in damper (started)
  - humidity on ETD
  - spine setup variation
  - lateral OC plate adjustment
  - Jacket stiffness
  - with & without water in abdomen
  - Pin fit tolerances
  - Bumper stiffness and height variations
  - Vertebrae fit tolerances
  - MMI variation in head
  - Muscle substitute spring stiffness variation
  - Other?
- Schedule: May through September



# Variability Investigation Plans

- Most will run on tests with and without headrest
  - Primary focus will be foam headrest test
- For parameters that seem most important on mini-sled
  - We have a partner where we will try to run in a car seat
- Will report out on results at each meeting
  - Planning to finish all testing before September meeting



# Additional Certification Tests

- Possible need for additional inspection tests
  - Pelvis impact (bottom or back)
  - Jacket (dynamic impact)
  - Head drop
  - Static spring/spine setup and measurements
    - Use existing, improve, or new
  - Dynamic damper test



# Pelvis & Jacket Tests

- Check at manufacturing to control process
- Occasional check at customer to look for material change over time
- Impact test to back or bottom of pelvis
- Possible fixtures:
  - Quasi-static compression
  - Dynamic on knee impact fixture
  - Dynamic on front of mini-sled
- Currently building fixtures to try out pelvis and jacket tests
  - Start testing next week





# Skull Cap Switch

- Found way to adhere to vinyl
  - Will have flexible conductive cloth to drape over headrest
- Provide consistent friction between cap skin and headrest
- Same cap material as existing caps



# Drawing Review

- Denton and FTSS are continuing drawing review process
  - Have compared most vertabrae, damper, skull drawings
- Working together to develop drawing package for submission



THANK YOU  
for your attention

Questions?

