Denton ATD, Inc.

Global BioRID-II User's Meeting

Mike Beebe
Alex Schmitt

Friday January 22, 2010

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Agenda

- *Introductions and approval of agenda*
- *GBUM Deliverables to GTR/TEG*
  - *Dummy*
    - *Current Version*
    - *Recommended next steps*
  - *Certification Test*
    - *Current Specifications*
    - *Current Results*
    - *Recommended next steps*
    - *Chalmers Proposal*
  - *Users Manual*
    - *Current manual*
    - *Recommended next steps*
  - *Seating Procedure for Commercial Seats*
    - *Current tool*
    - *Recommended next steps*
- *Change of GBUM status to GTR/TEG*
  - *Introduction of Chairman*
    - **Bernd Lorenz**
  - *GTR Meeting Schedule*

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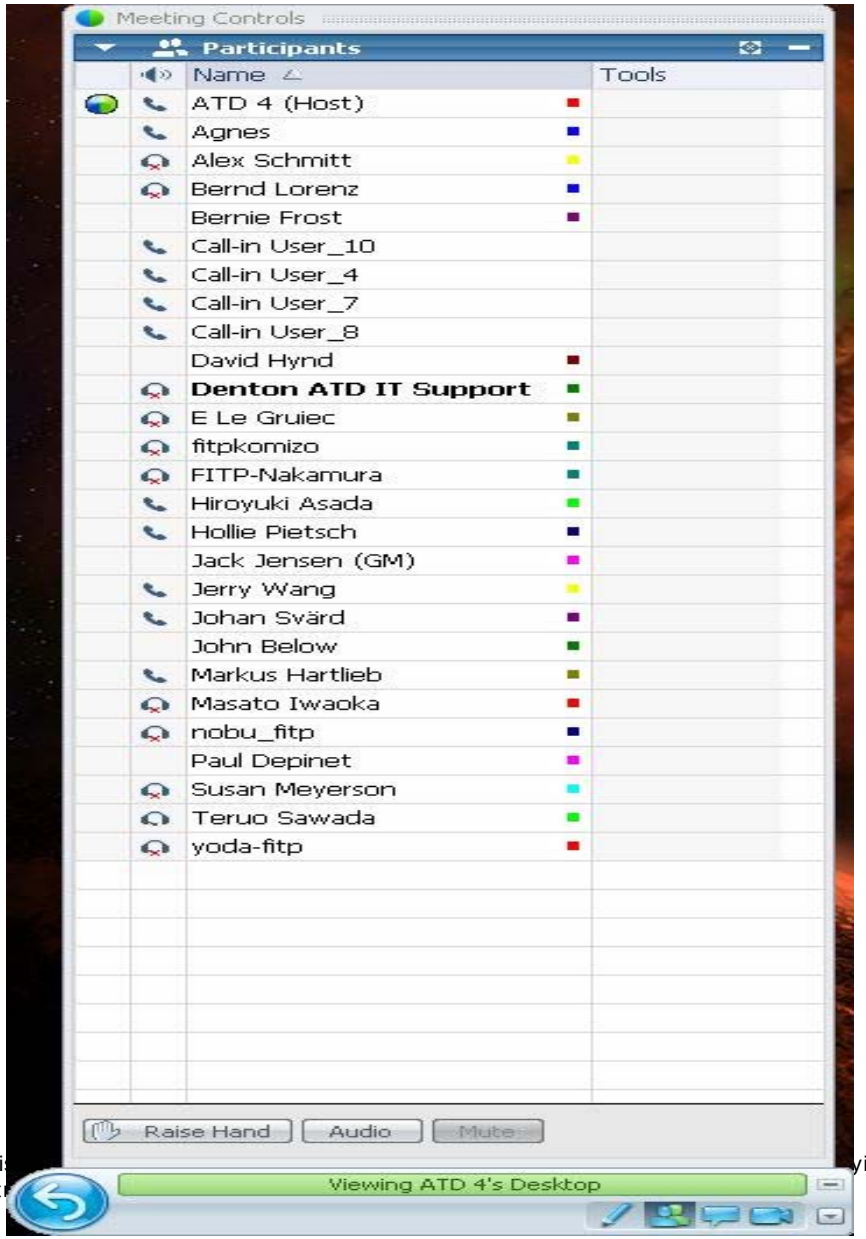
Attendee List



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Dummy Status

Goal: To make the BioRID easier to use, more durable, and reproducible without changing the biofidelity

- Need to prepare Drawings for ***UNECE.***

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Current Drawings Contain:

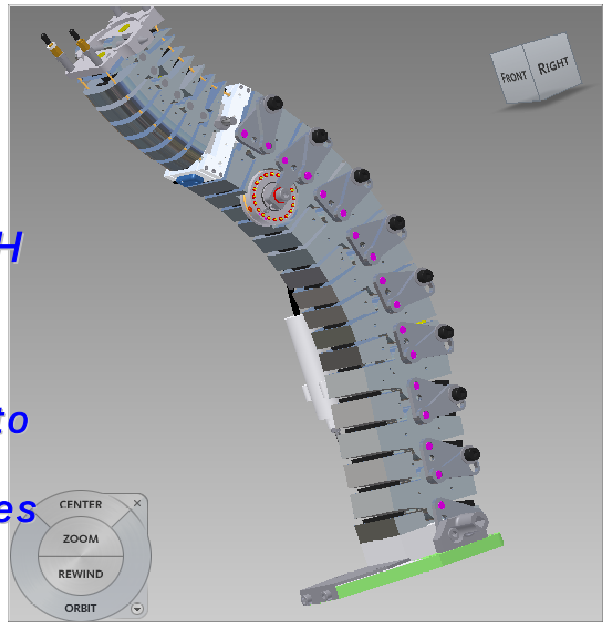
Revised Damper

Revised S1

One piece H Pt. Tool Mount

Updated T1 to be able to remove cables w/o cutting

Changed to SHCS w/ Washers



skull cap switch

Revised Clothing & Shoe specifications and updated manual

Head with cable exit through side with increased clearance in the chin

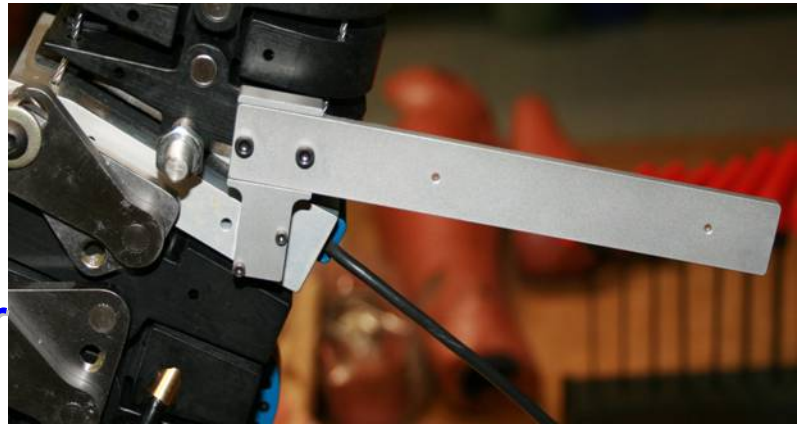
Thorax Flesh

Current Drawings Contain:

Updated Pelvis indicator tool

Added notch for tension cable routing

T1 Indicator



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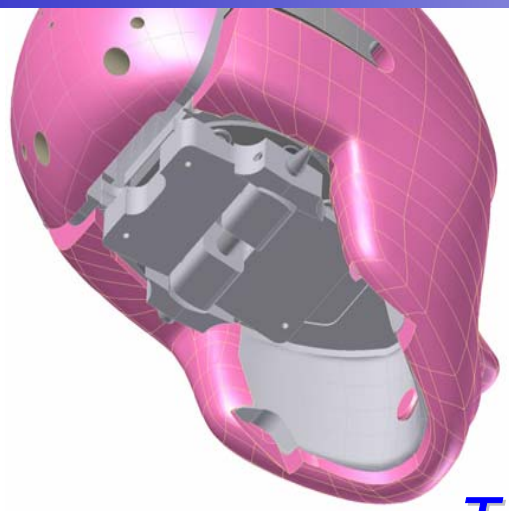
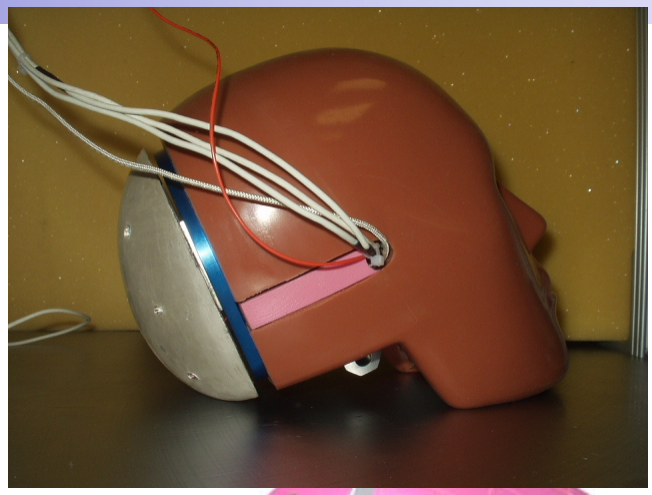
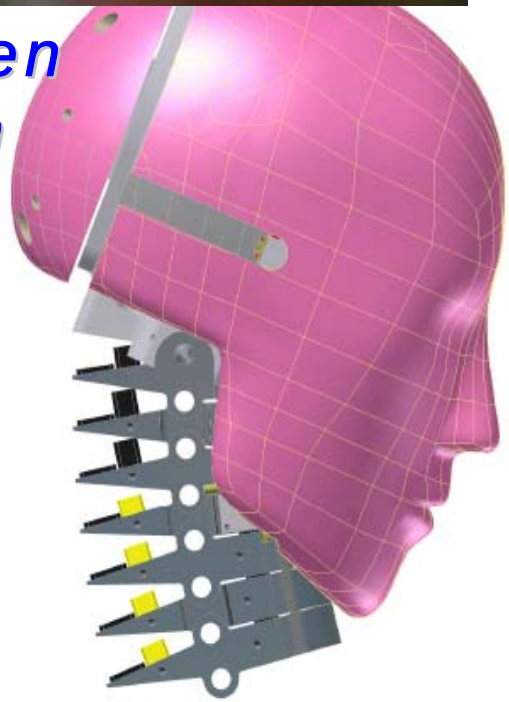
Current Drawings contain:





Testing has been completed with head and no issue was raised.



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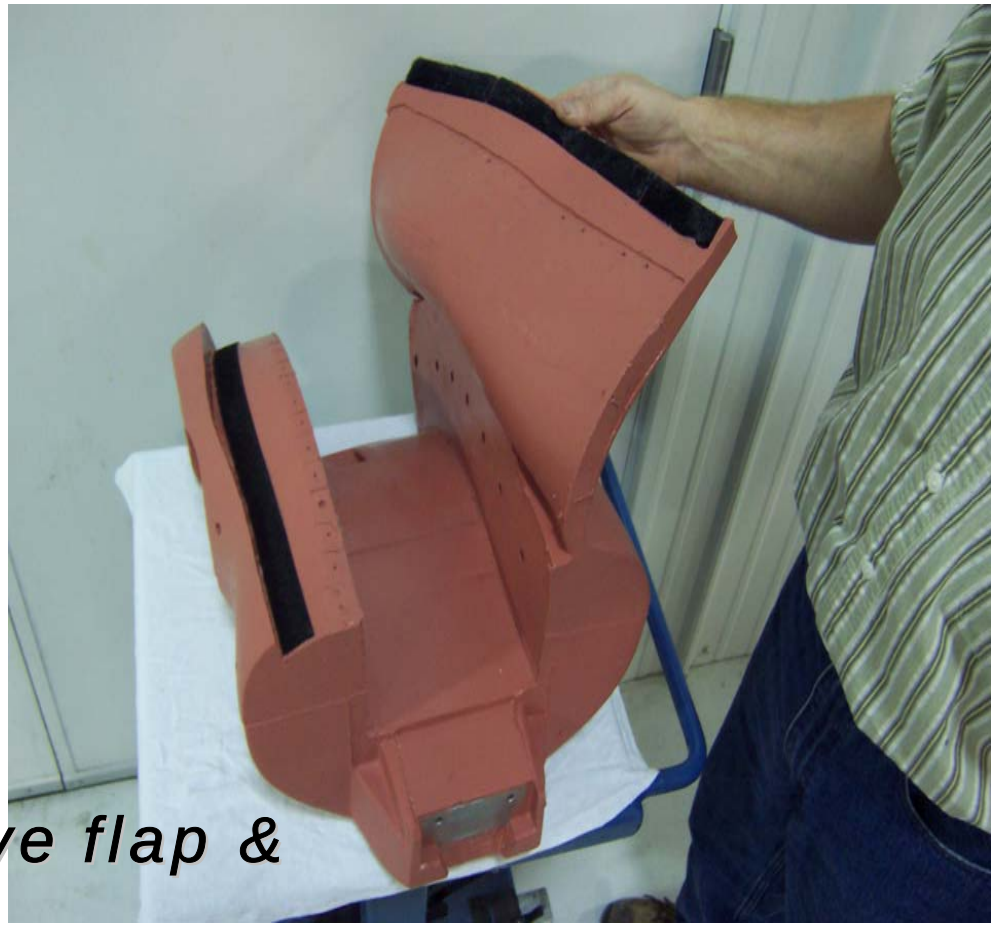
Current Drawings contain:



Jackets will have flap &

Symmetry of right and left side

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Dummy Next Steps

- Denton and FTSS will review drawing package and prepare a list of discussion items as necessary.
  - The first drawing review meeting occurred January 15, 2010
  - The second drawing review meeting is scheduled for January 25, 2010
  - A summary list will be presented at the GTR meeting in Japan
  - Add new head and torso flesh to package
  - Add new skull cap switch to package

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Certification Tests

- ***Improve the test to have better repeatability and discern differences between dummies, so that dummy can be fully analyzed for better reproducibility in sled testing.***
  - Created sled certification test
  - Replaced crushable foam with a reusable energy transfer device
  - Replaced dummy head with a head form for better test repeatability
  - Revised sled design to eliminate sled bounce
  - Revised sled to eliminate Jacket motion affect on Velocity Corridor and sled acceleration by the use of a higher mass sled.
  - Sled has greater rigidity
  - Created head rest certification test

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Rail and Sled Certification

- Rail certification with weight package fixed to the sled Prior to running any dummy test, ensure the sled is set up properly.
- Velocity and weight of probe and sled were adjusted to achieve similar energy input levels of current tests.

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Sled Test Requirements

- Probe Velocity: 4.70 – 4.80 m/s
- Probe Weight: 37.61kg +/- .1 kg
- Weight Package: 25.50 +/-.02 kg
- Sled Weight w/o headrest: 44.25 kg +/- .05 kg
- Sled Weight headrest: 6 kg +/- .02 kg
- Sled weight w/headrest: 50.25 kg +/.07 kg
- Sled equipment
  - Procedure for level and install
  - Set up procedures
- *Pendulum Force: 9200N +/- 600*
- Peak sled acceleration: 127 M/s2 +/- 9 M/s^2
- *Peak Sled Velocity: 2.8 +/- 15 m/s*
- Velocity slope from 50 to 150 ms: 0 to -1.5 (m/s)/s
- *BASED ON 5 SLEDS TESTED AT 5 Labs*

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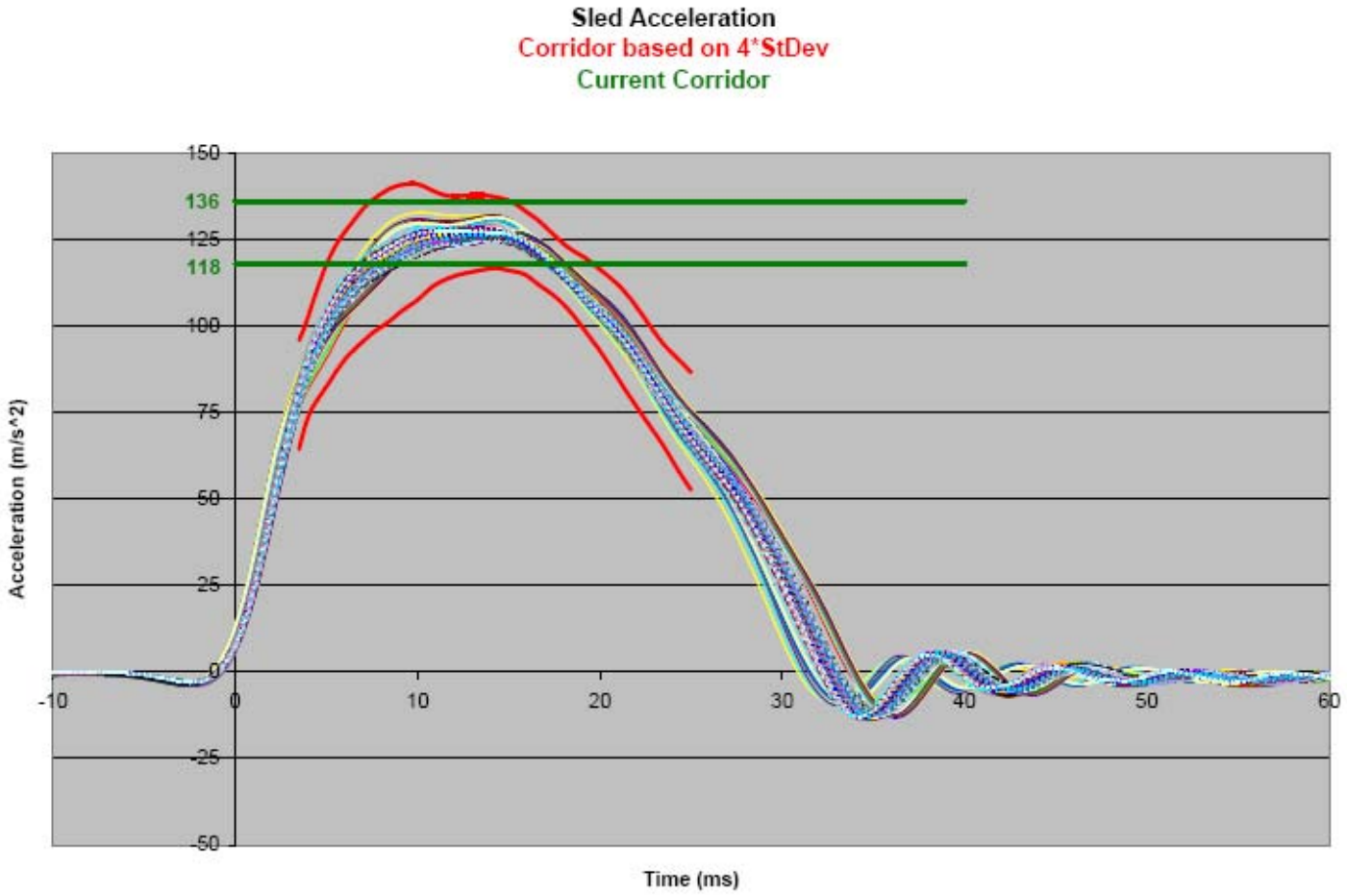
FTSS and Denton discussed reducing the sled with weight specifications to a sled peak acceleration, need further discussion.



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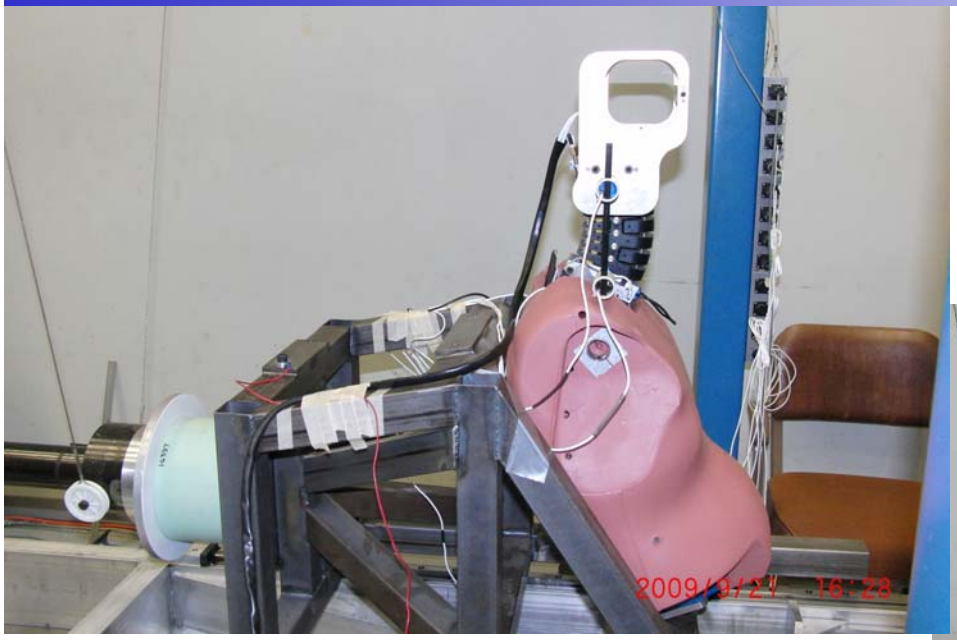
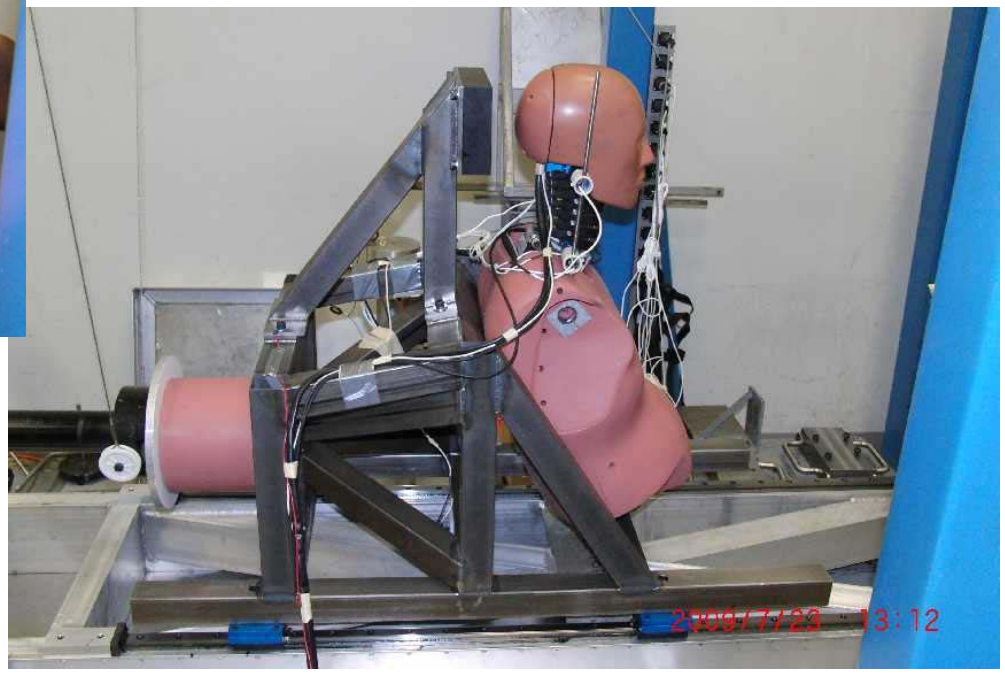
Results of testing with new sled





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Results to date

- *KATRI, IIHS, ATD, COE, & FITP*

  test results shows that the new sled tests are able to show differences between dummies as compared to old sled design.

  Require more BioRID's tested to create revised corridors

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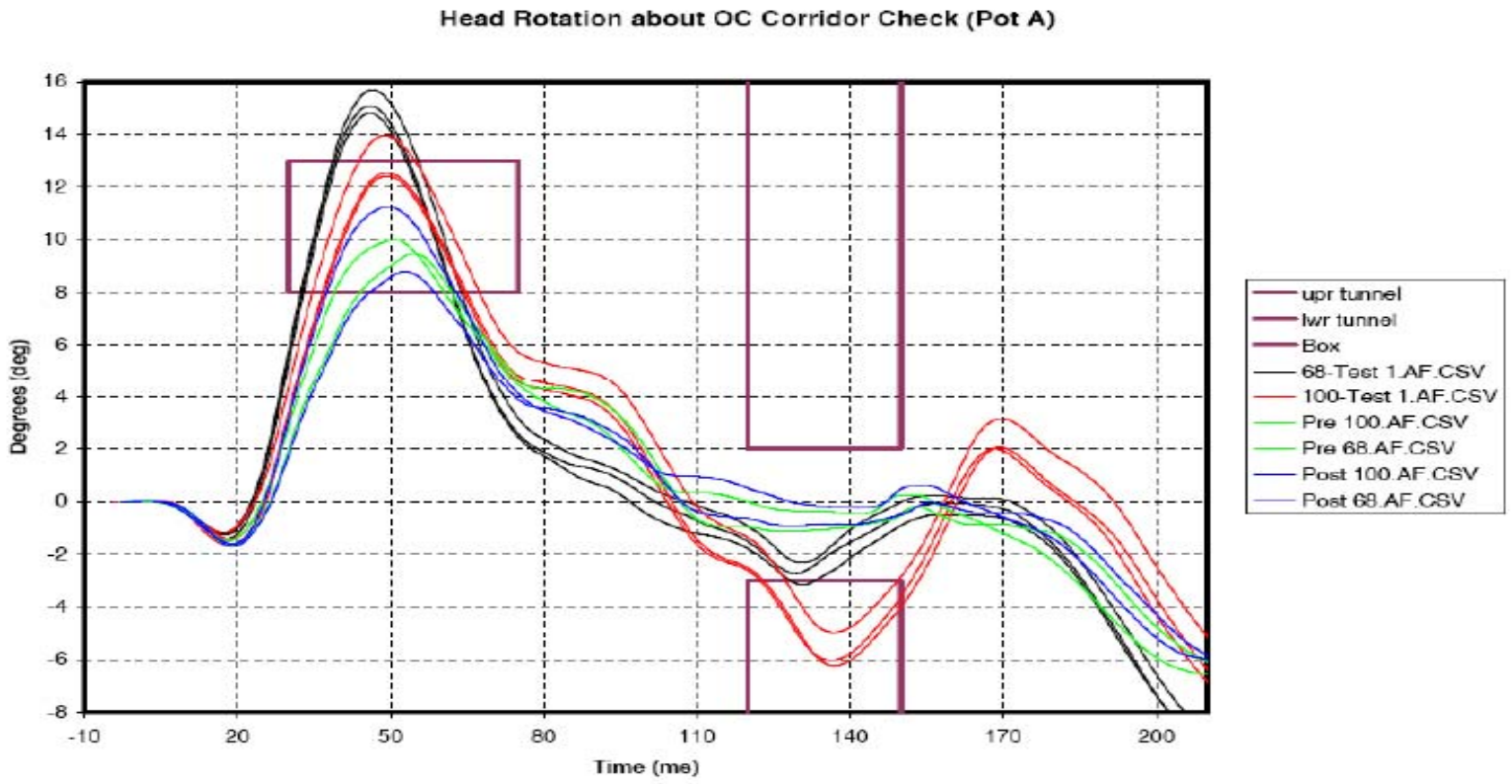
EXAMPLES: Difference between BAST dummies found on new sled

Green and Blue lines on original sled,

Black and Red lines on new sled



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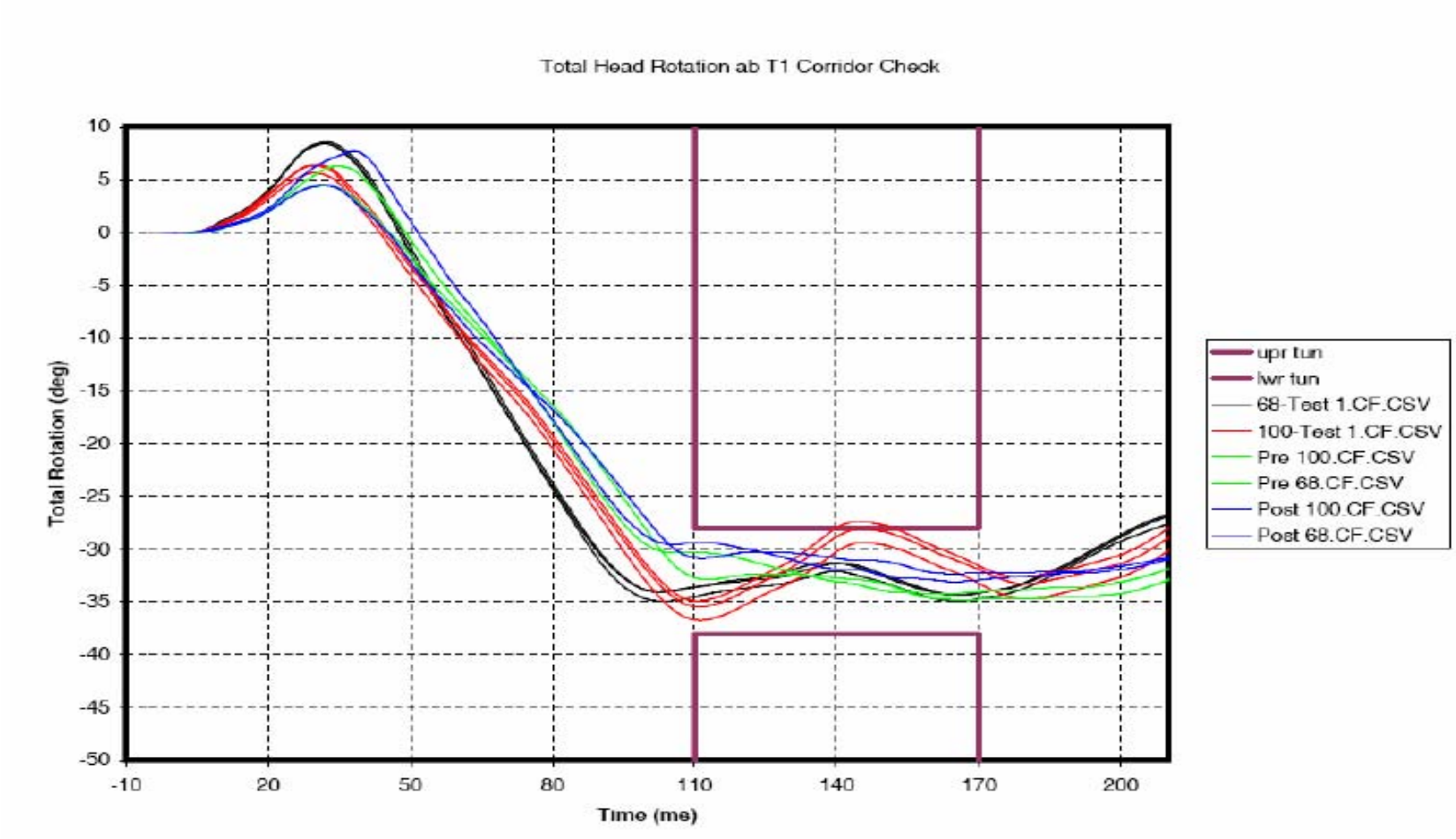

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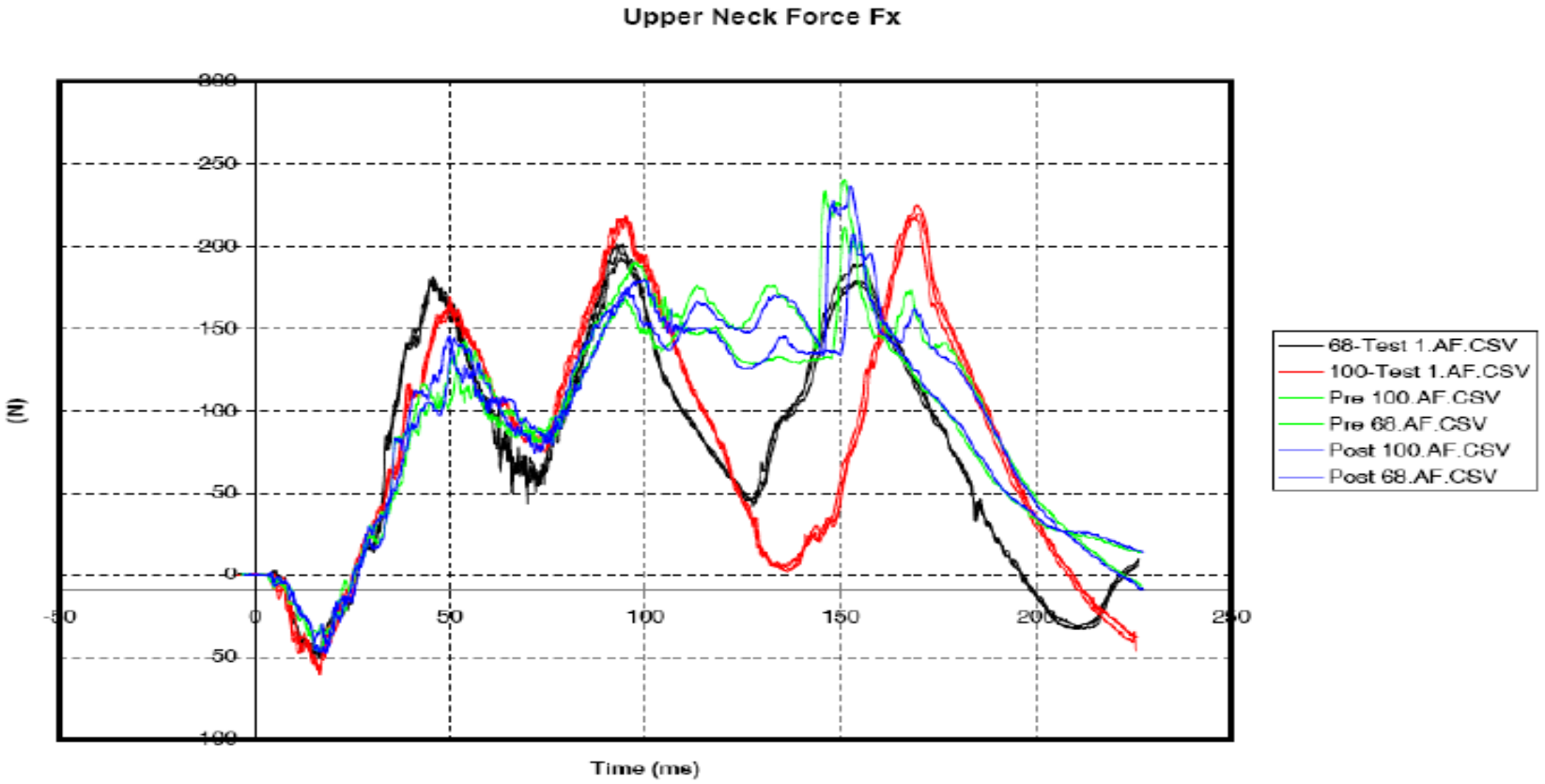

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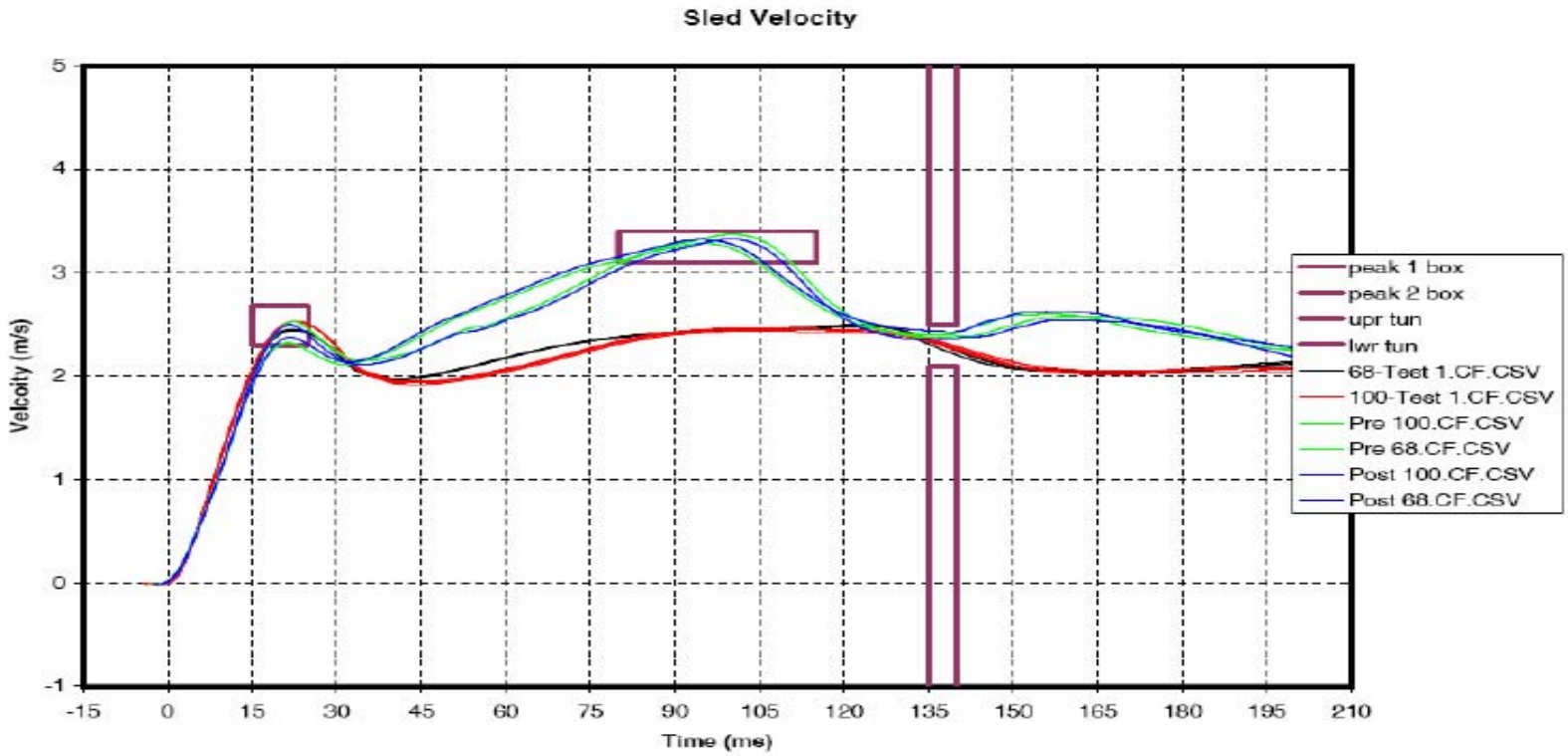

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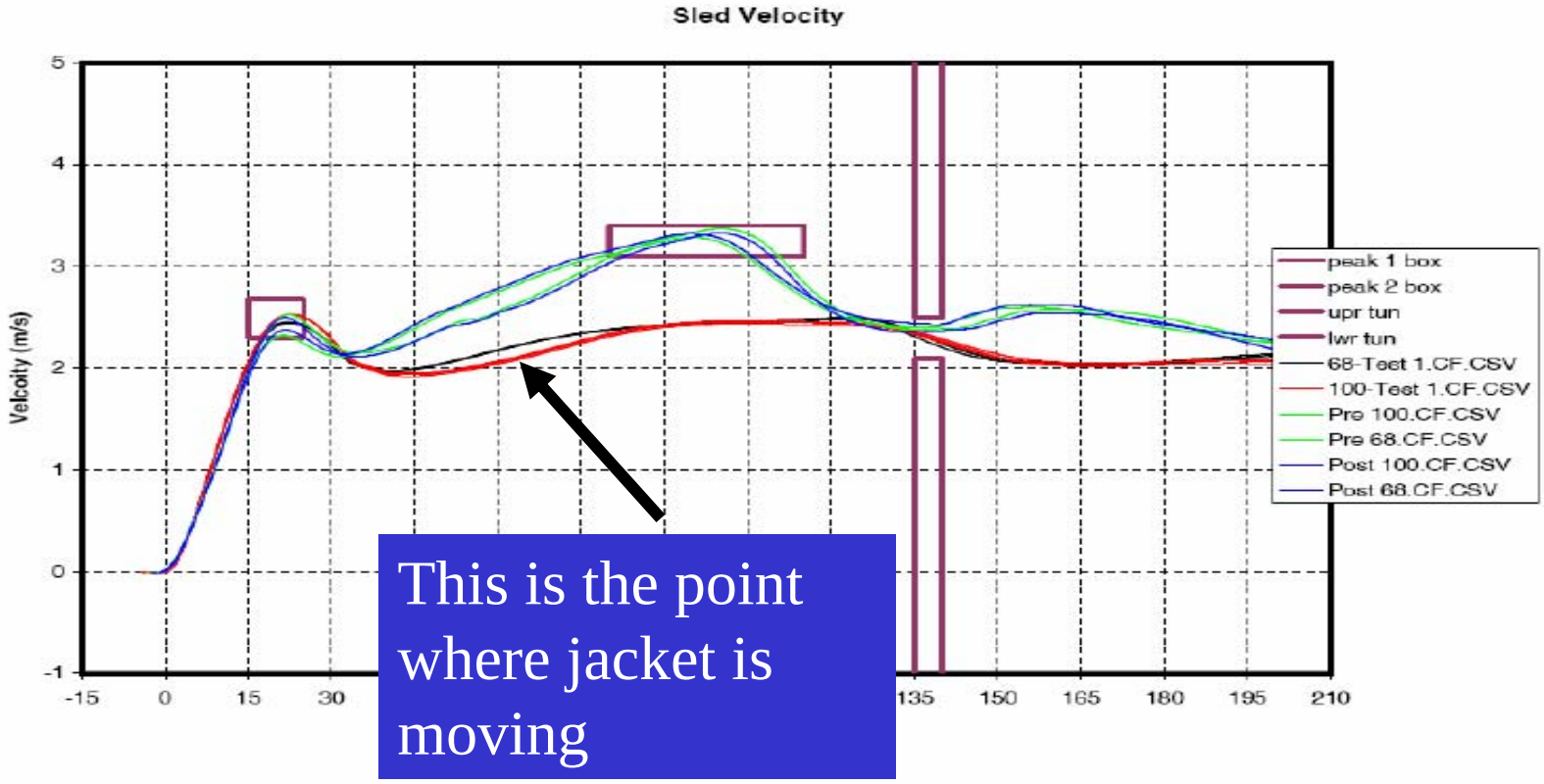
A Closer look at this plot led us to perform an experiment to determine what influence the jacket has on the dummy repeatability



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Jacket Influence Experiment Results

- The same dummies s/n 68 and s/n 100 was tested again by swapping jackets between both dummies.
- The new sled was used.
- Tests were performed at COE in Germany

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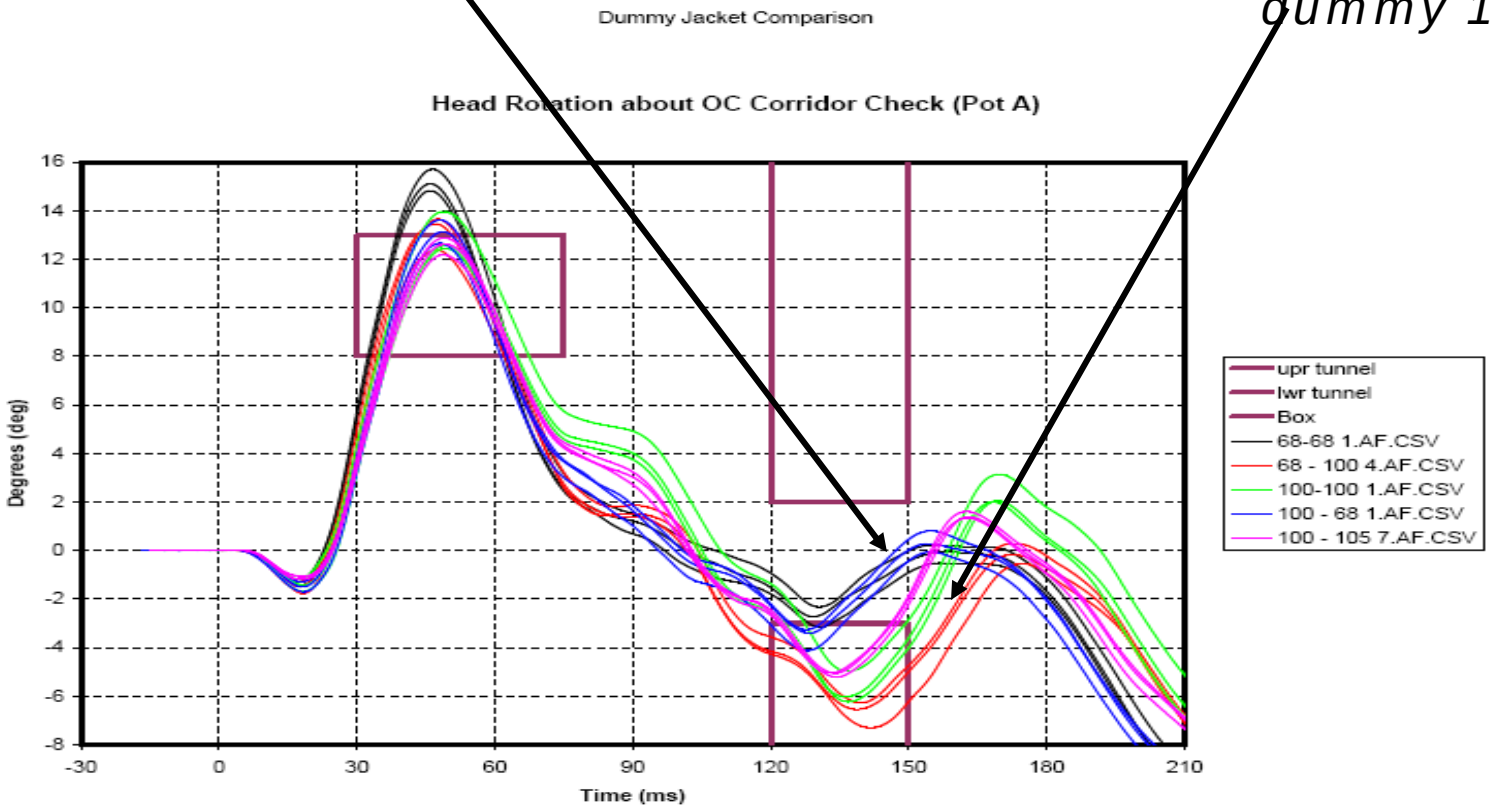
Examples of Jacket Influence on Certification Results

Jacket from Dummy 68

Jacket from dummy 100



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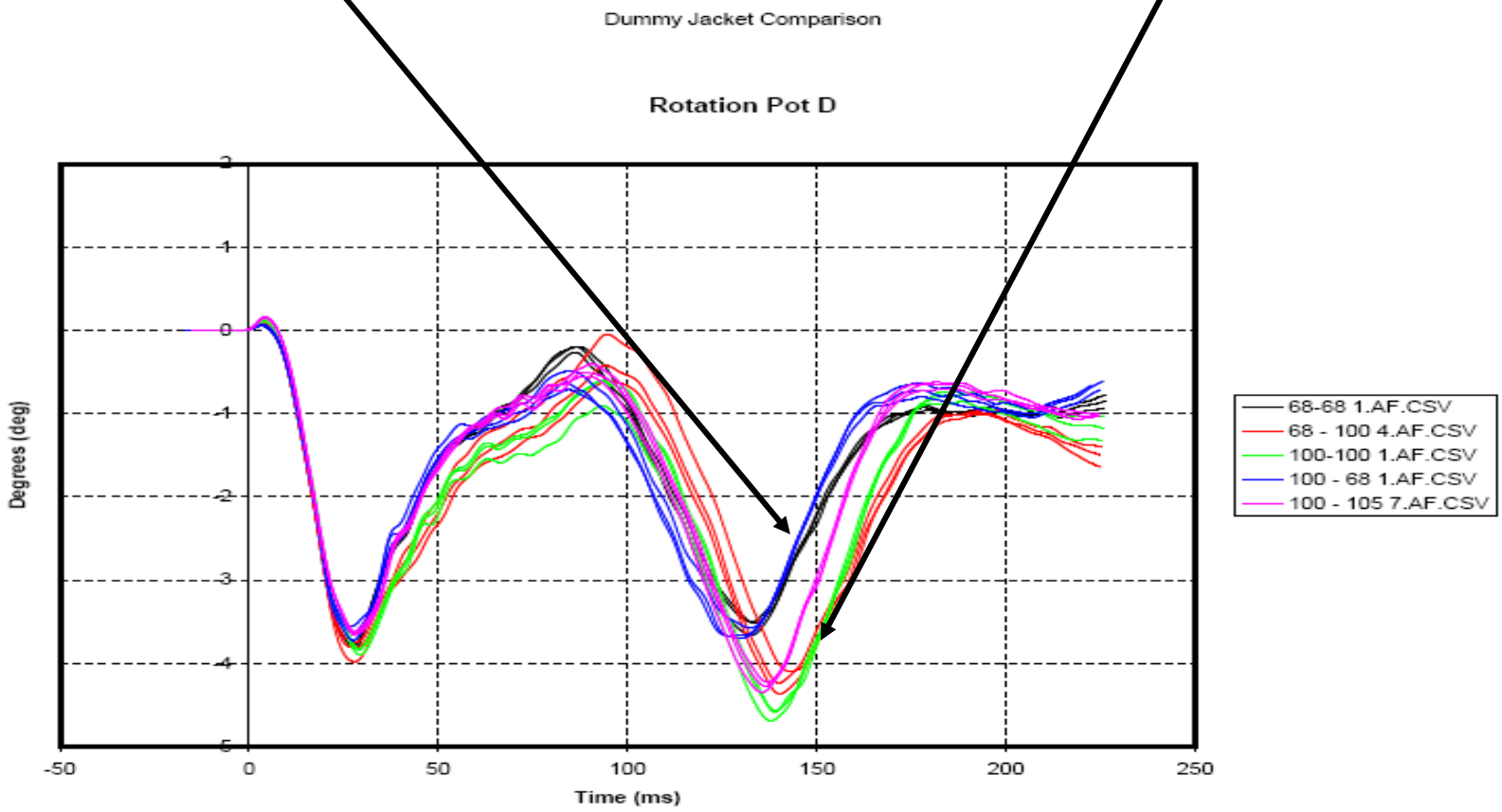
Examples of Jacket Influence on Certification Results

Jacket from Dummy 68

Jacket from dummy 100



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Examples of Jacket Influence on Certification Results

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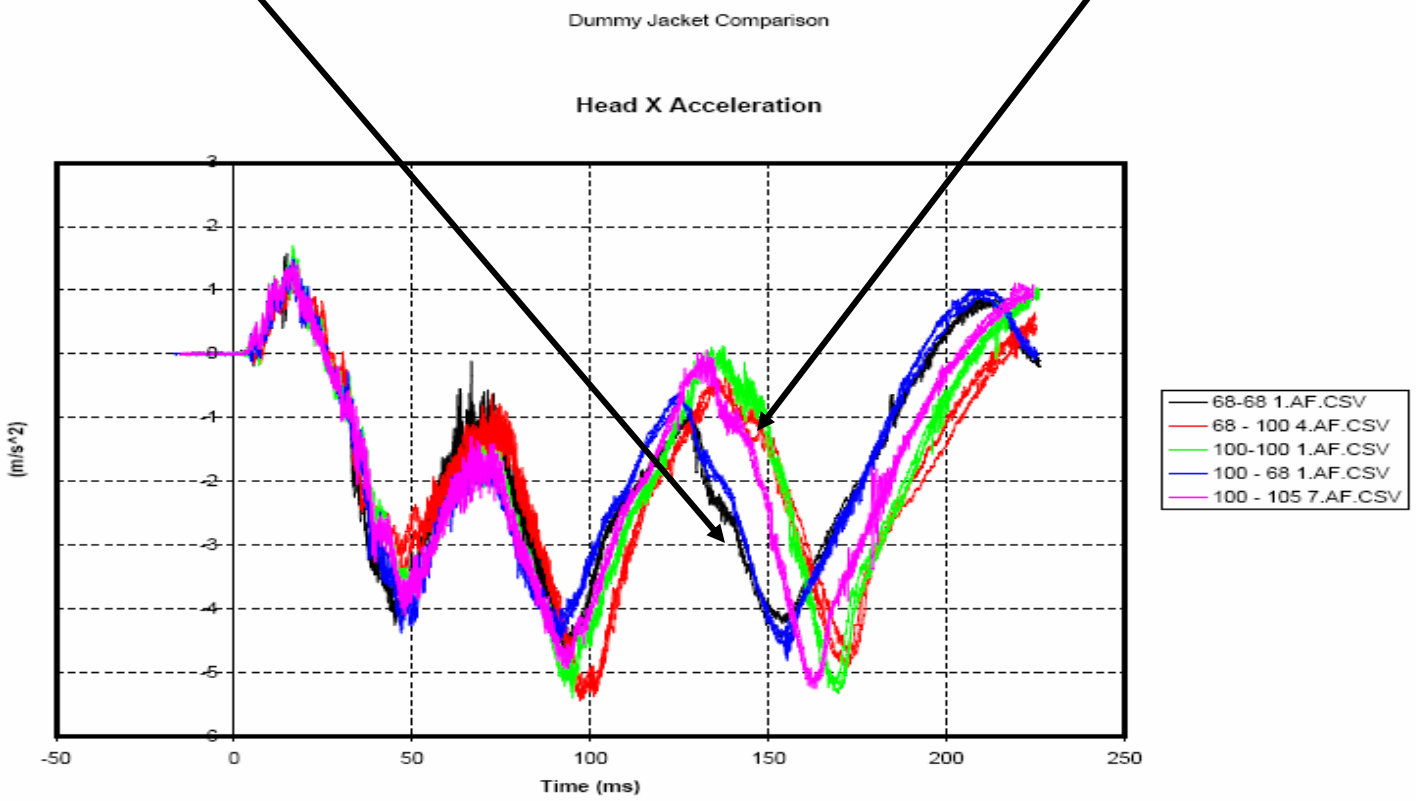

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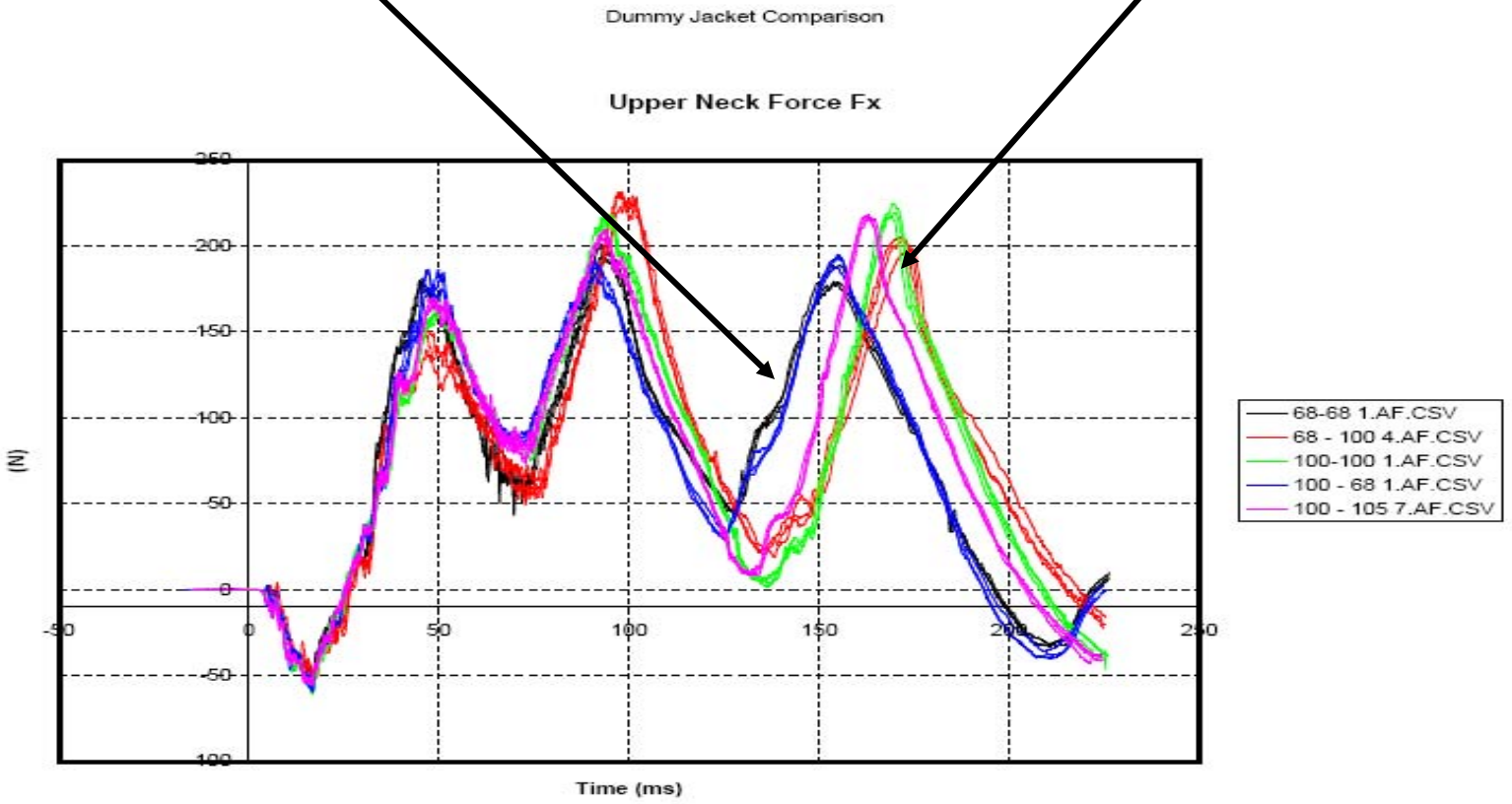

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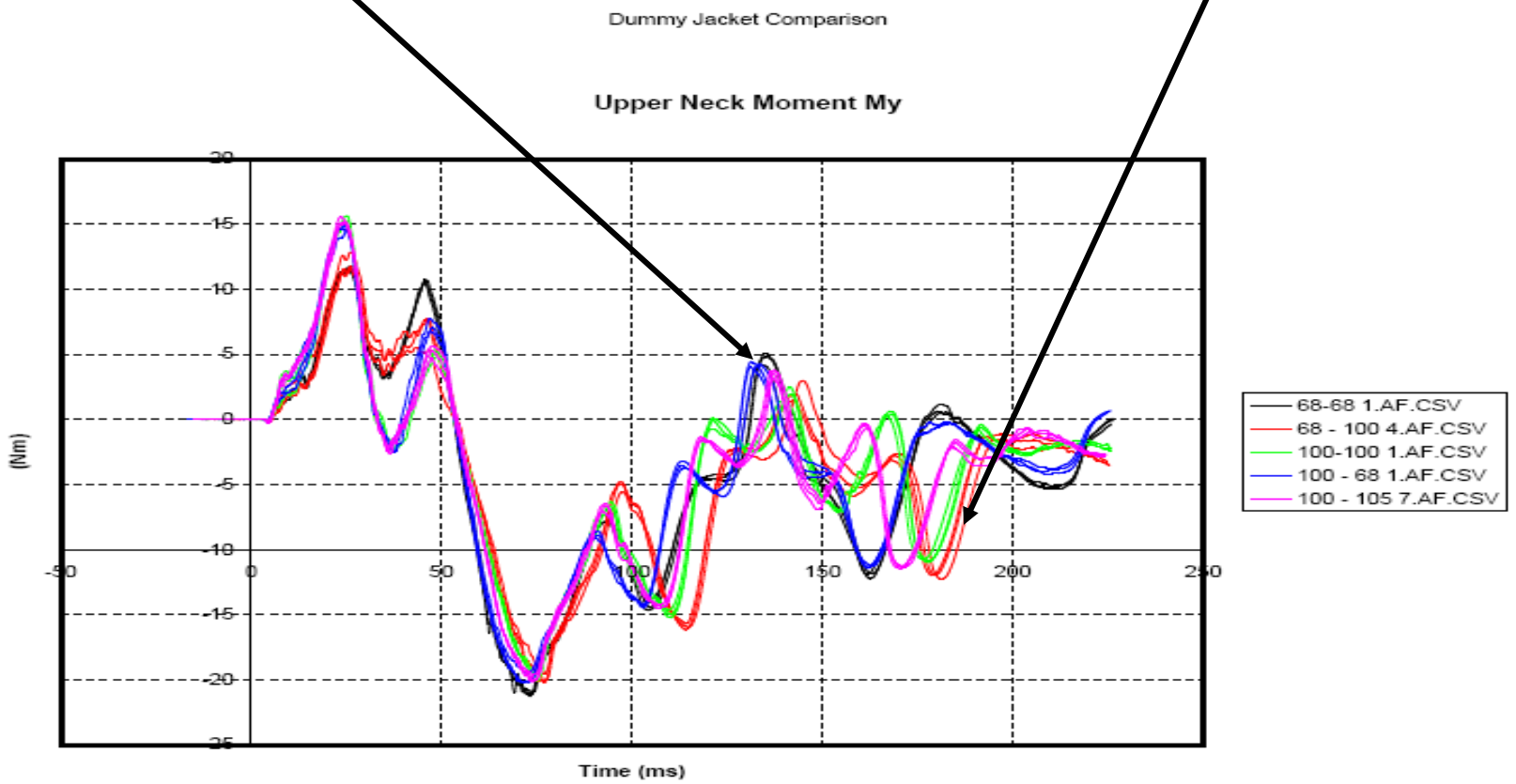

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Initial Proposal due to findings

- Can we control jacket stiffness better?
  - Current specification has always controlled stiffness with a durometer specification only.
  - We would recommend a dynamic stiffness test to replace durometer which can be used as a in house dummy manufacturer tests to check new jackets. Test could be used to tests jackets in the field as necessary as well.

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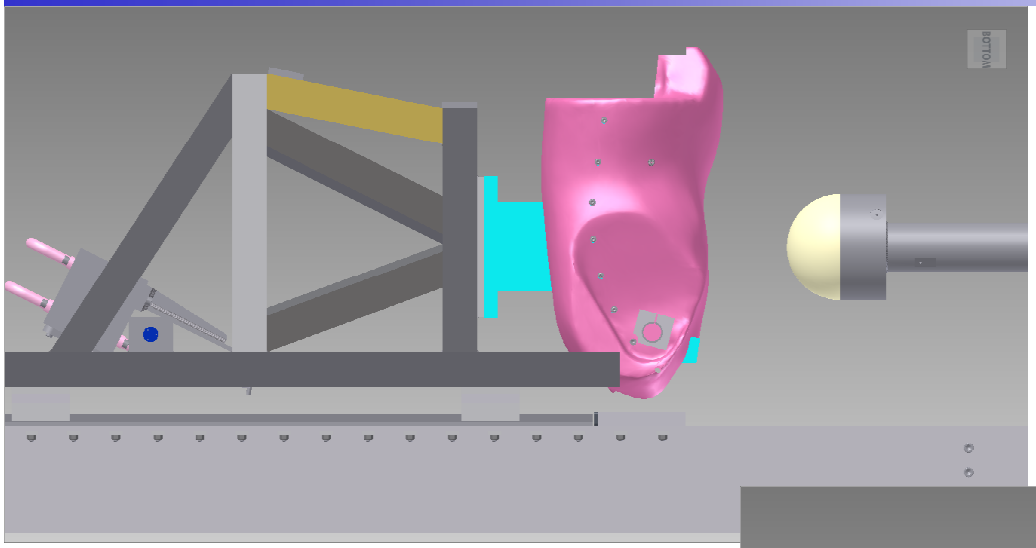
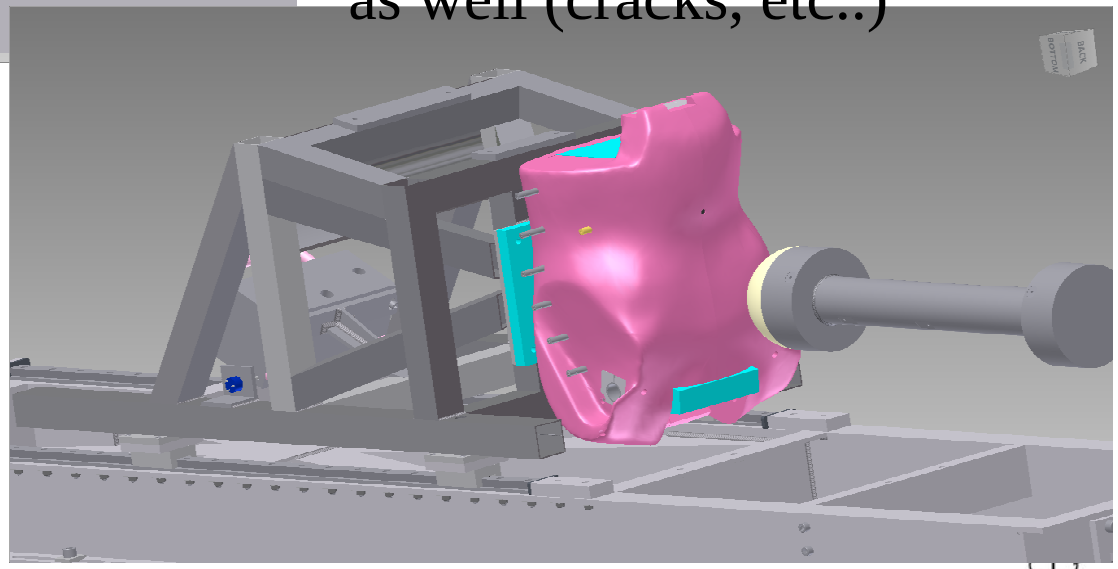
Jacket material Stiffness Test Proposal



This is a material stiffness test only, not a jacket bend tests.

Need to review jackets for internal possible wear as well (cracks, etc..)



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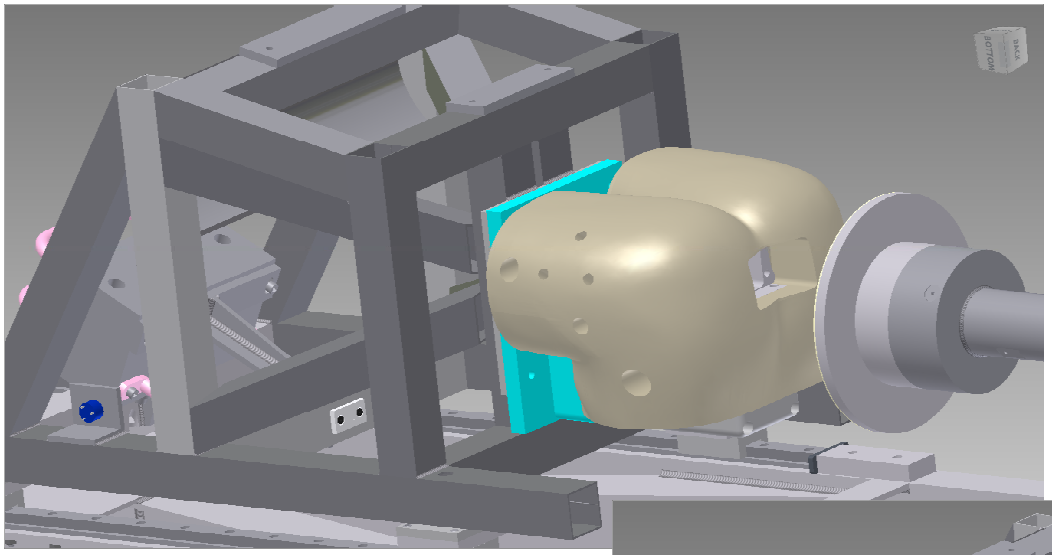
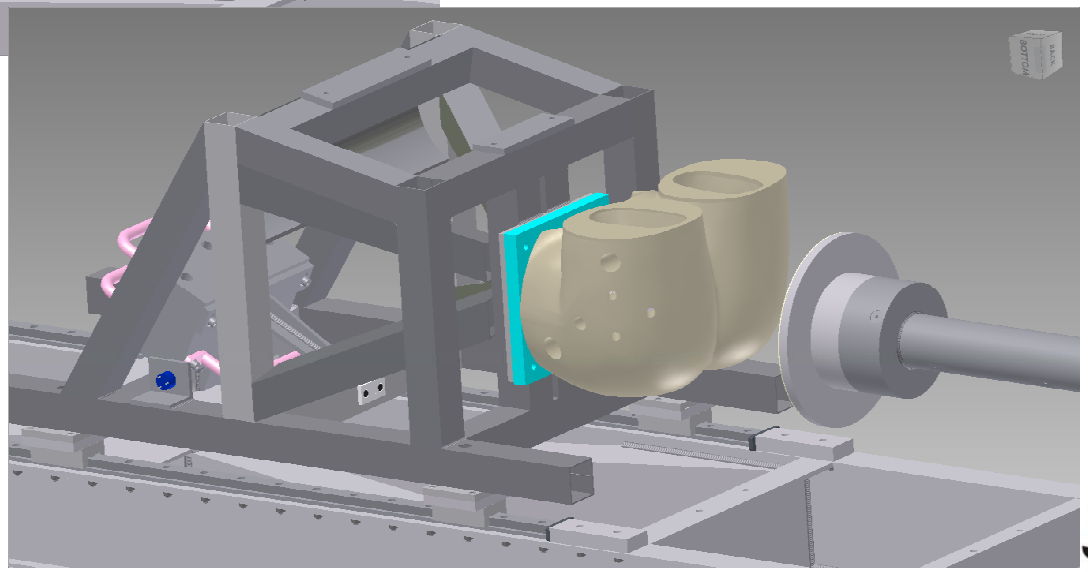
Another Proposal for a dynamic stiffness test if for the pelvis





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Suggested BioRID calibration specification 091204

By Johan Davidsson, Chalmers

Proposal from Johan

Table 1. BioRID II T8, L1 and Pelvis peak and average x-accelerations (m/s2) and durations (ms) for four different combinations of seat stiffness and sled pulses (kph).

Pulse	Seat	Peak acc. (g)			Duration (ms)	Suggested calibration sled characteritics	
		T8	L1	Pelvis	Pelvis	Peak acc. (g)	Duration (ms)
16 high	Soft	11.7	12.4	11.8	85	9.6	95
16 high	Soft	8.4	7.4	7.9	125		
16 high	Soft	7.9	6.9	11.8	75		
16 high	Stiff	10.6	11.9	14.6	75	12.2	87
16 high	Stiff	13.5	14.9	11.2	100		
16 high	Stiff	10.3	9.8	13.3	85		
24	Stiff	13.8	15.1	15.7	90	15.1	95
24	Stiff	16.4	16.1	13.5	100		
24	Soft	14.7	9.5	15.0	110	14.7	110

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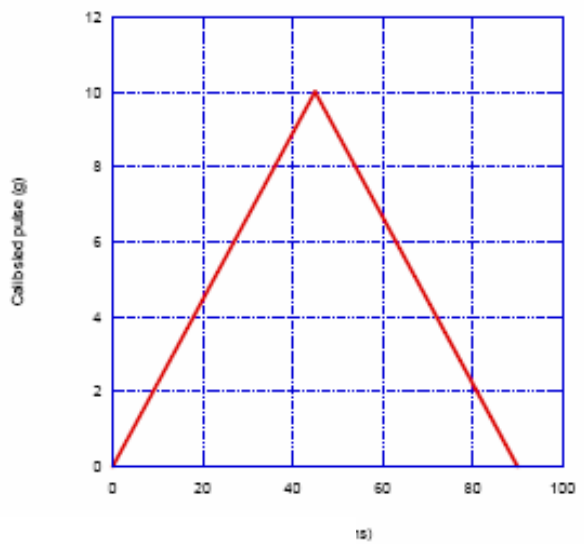
Suggested BioRID calibration specification 091204

By Johan Davidsson, Chalmers

Delta-V 16 kph
Sled acceleration duration 90 ms
Peak acceleration 10 g



Proposal from Johan

The proposed calibration sled pulse is rather different from that of the current pulse which approximately has the following characteristics (based on the current calibration corridors, Table 2):

Delta-V 9 kph
Sled acceleration duration 30 ms
Peak acceleration 17.5 g

Table 2. Current pendulum (g, km/h)

Parameter	Time	LL	UL	Method
Sled acc	5-13	14.9	20.1	box
Sled velocity	15-25	8.3	9.5	box
	80-115	11.2	11.7	box
	135-160	7.9	8.6	box or tube

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Seat/Head Restraint Test Sled Pulse Summary

Z. Jerry Wang, Ph.D.

First Technology Safety Systems, Inc.

Global BioRID Users Meeting
Jan 22, 2010

Background

Email from Johan Davisson, Chalmers University of Technology

Dear Mike and Jerry,

Earlier we discussed briefly that there is a need for a new BioRID calibration pulse. I foresee that calibration at a higher velocity change and longer duration, i.e. impact conditions usually occurring in real seat tests, will address some of the issues on reproducibility. Please comment on the attached document. Is this something for next GBUM meeting to address?

Regards,
Johan

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Davisson Proposed Sled Pulse

EuroNCAP Test

Table 1. BioRID II T8, L1 and Pelvis peak and average x-accelerations (m/s2) and durations (ms) for four different combinations of seat stiffness and sled pulses (kph).

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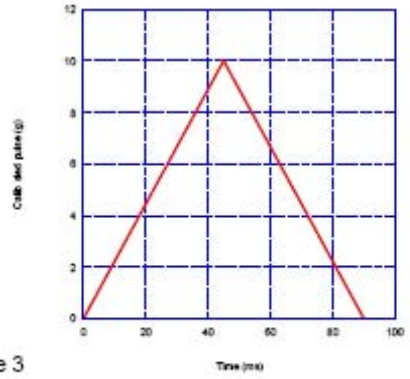
16 high	Stiff	13.5	14.9	11.2	100		
16 high	Stiff	10.3	9.8	13.3	85		
24	Stiff	13.8	15.1	15.7	90	15.1	95
24	Stiff	16.4	16.1	13.5	100		
24	Soft	14.7	9.5	15.0	110	14.7	110

Proposed Mini-Sled Pulse

- Delta velocity 16 KPH
- Peak acceleration: 10g
- Sled duration: 90 ms



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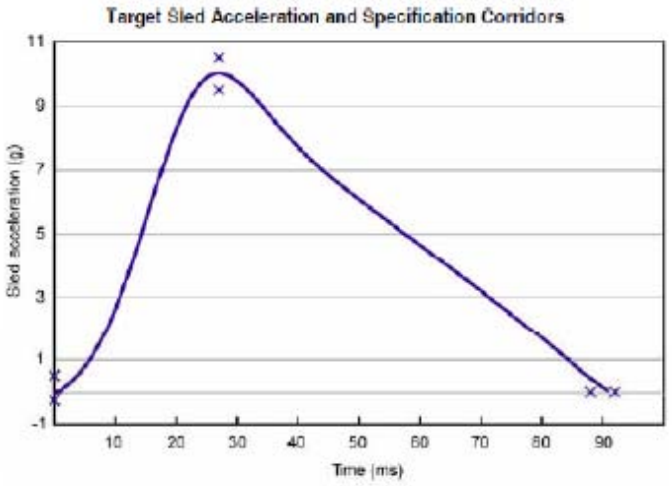
IIHS Sled Test Pulse

- Delta Velocity 16 KMH
- Major peak sled deceleration ~10g
- Total duration ~90 ms



http://www.iihs.org/ratings/head_restraints/head_restraint_info.html

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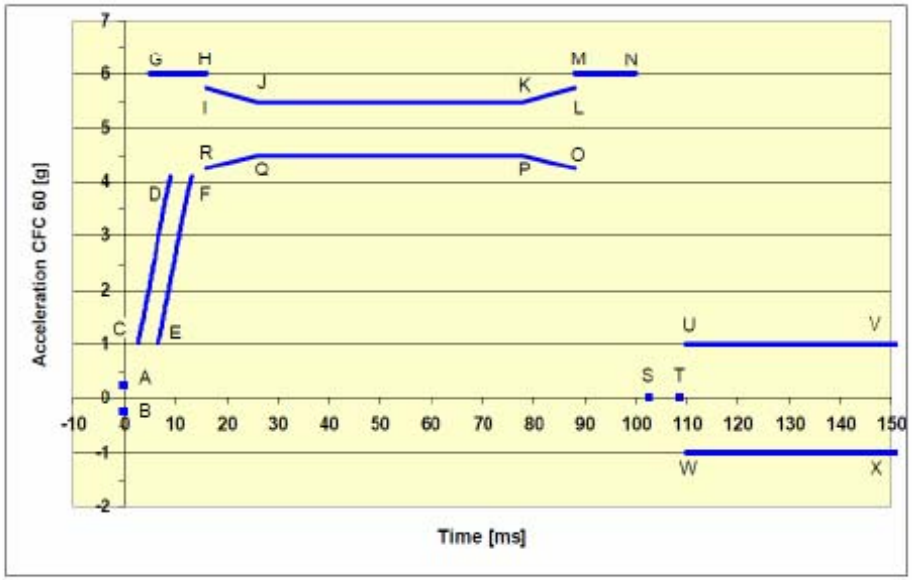
EuroNCAP Low Severity

- Delta velocity: 16.1 KMH
- Major peak sled acceleration: 5g
- Sled duration: ~105 ms



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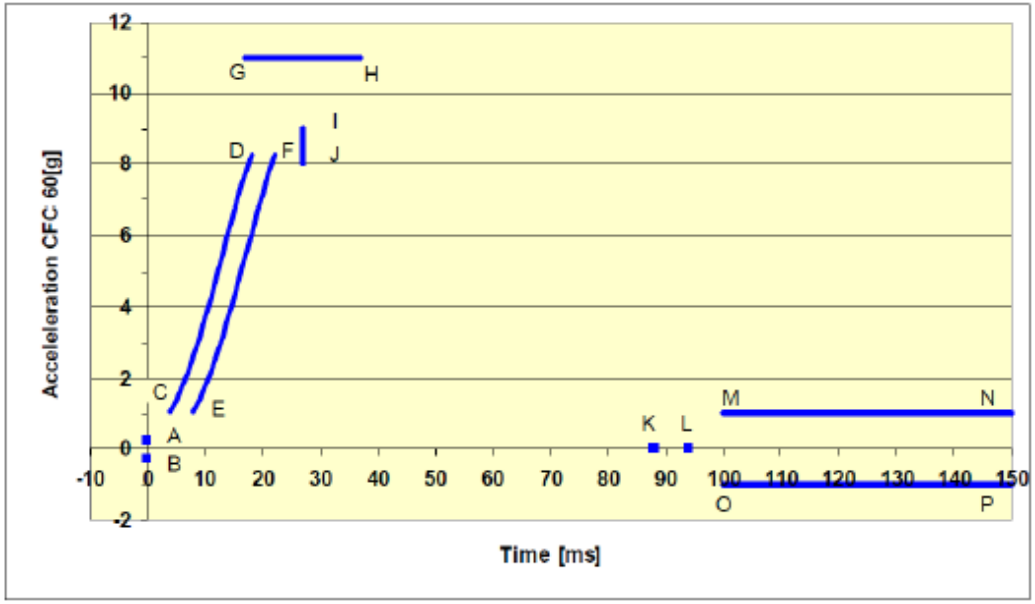
EuroNCAP Medium Severity

- Delta velocity: 15.65 KMH
- Major peak sled acceleration: 9.5g
- Sled duration: ~90 ms



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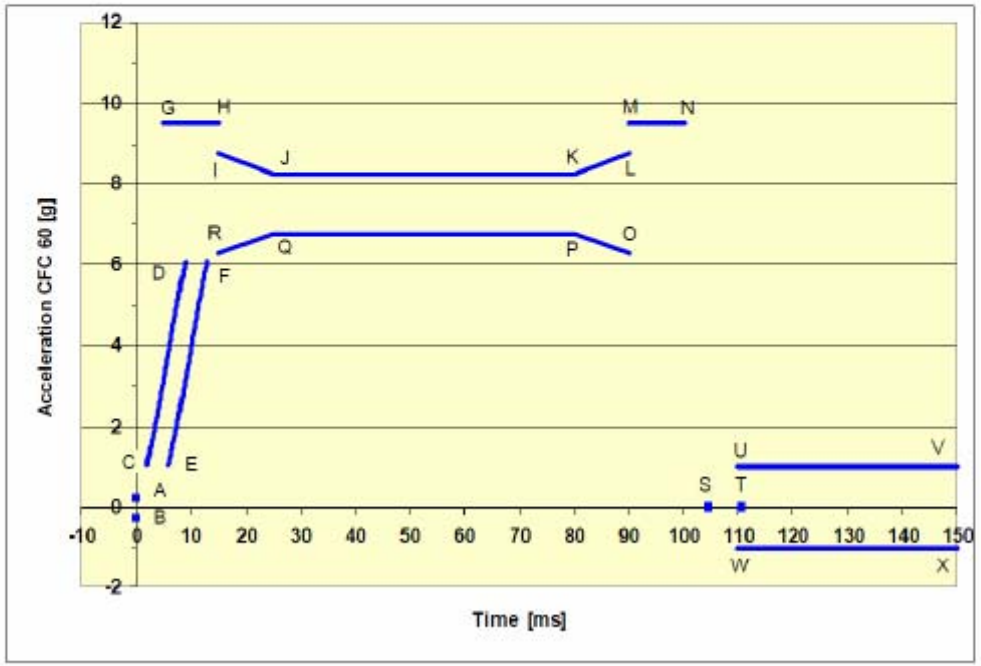
EuroNCAP High Severity

- Delta velocity: 24.45 KMH
- Major peak sled acceleration: 7.5 g
- Sled duration: ~108 ms



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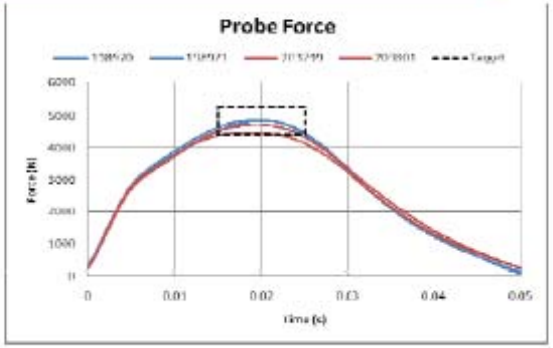
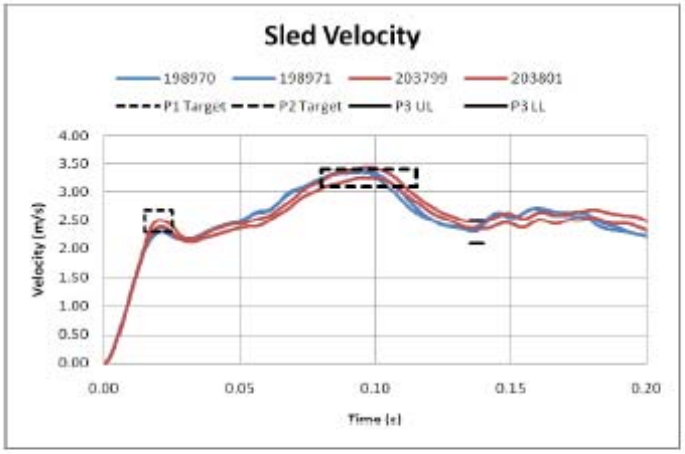
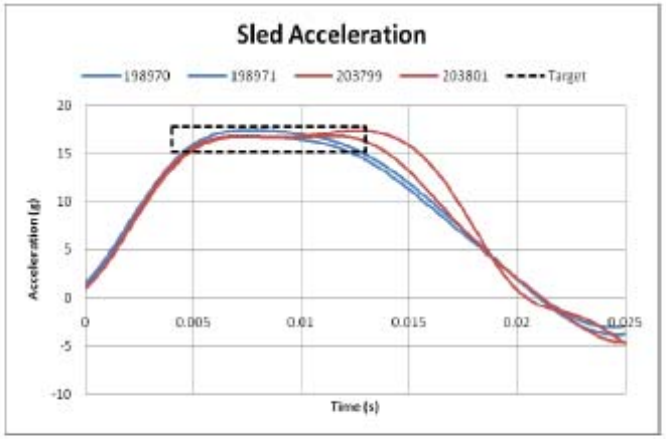
Chalmers Mini-Sled Pulse

- Delta Velocity: 3.25 m/s (11.7 KMH)
- Major peak sled acceleration: ~17 g
- Sled duration: ~50 ms







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Newly Proposed Denton Sled Pulse

- Delta Velocity: ~2.7 m/s (9.7 KMH)
- Major peak acceleration: ~13 g
- Sled duration: 35 m/s

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Newly Proposed FTSS Sled Pulse

- Close to Chalmers mini-sled values
  - Delta Velocity: 3.3 m/s (11.9 KMH)
  - Mean peak sled acceleration: ~17 g
  - Sled duration: ~50 ms

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Sled Pulse Summary

	Delta Velocity (KM/H)	Major Peak Acceleration (g)	Sled Duration (ms)
IIHS	16	10	90
EuroNCAP Low	16.1	5	105
EuroNCAP Medium	15.65	9.5	90
EuroNCAP High	24.5	7.5	108
Chalmers Mini-Sled	11.7	17	50
Denton Proposed Mini-Sled	9.7	13	35
FTSS Proposed Mini-Sled	11.9	17	50
Discussion and Recommendation?			

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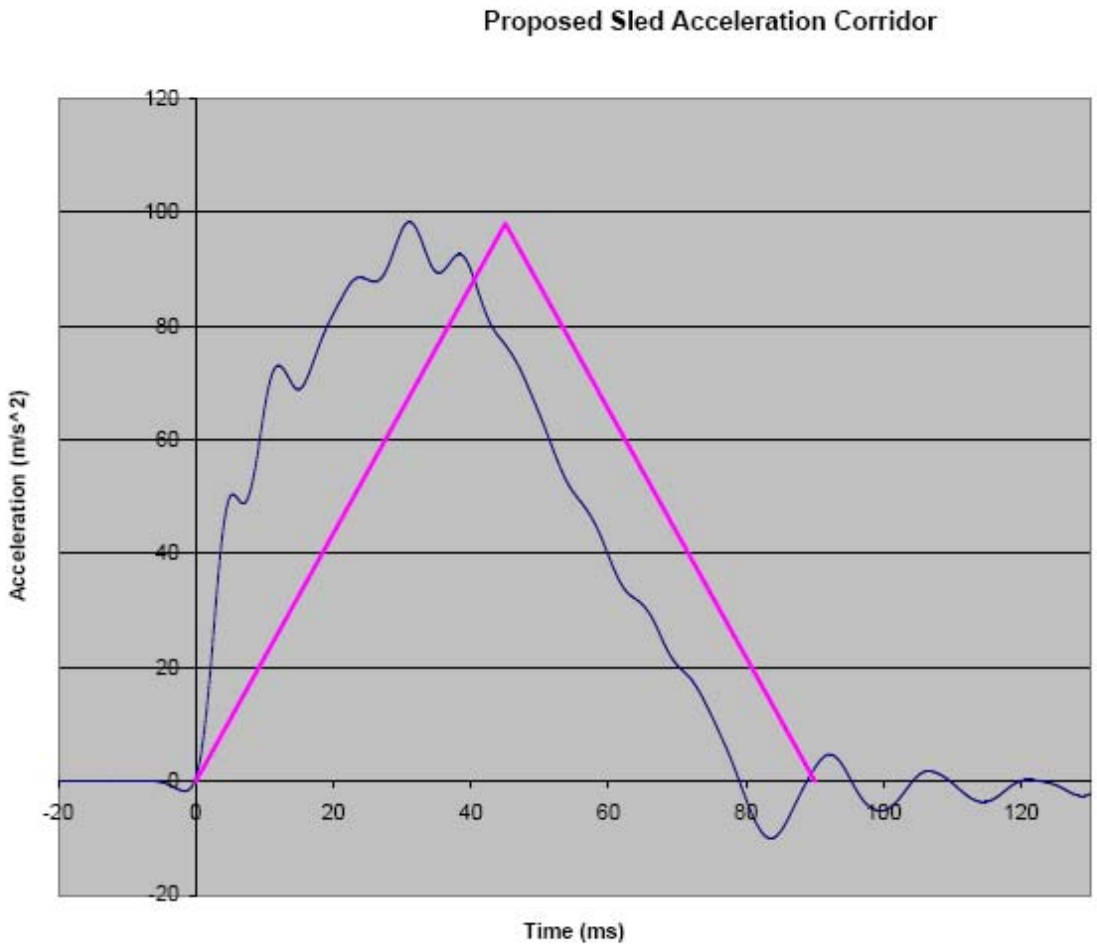
Initial Feasibility investigation by Denton to meet Chalmers proposed pulse shape with proposed sled and energy transfer device



~ 99 m/s2

80 msec duration

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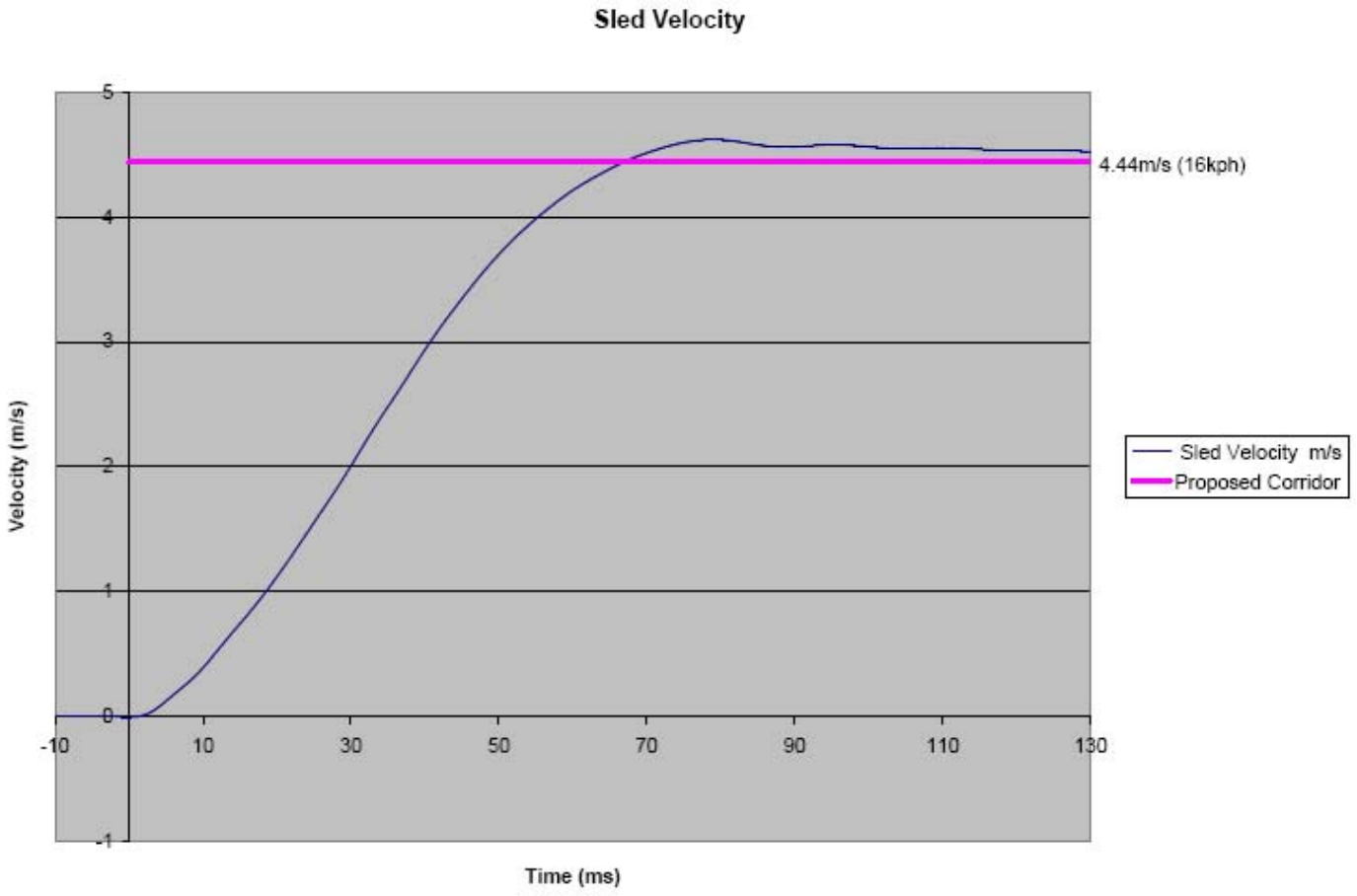
Initial Feasibility investigation by Denton



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FORD testing update

Presentation by Hollie Pietsch

of Ford Motor Company

January 22, 2010

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FORD testing update

- *BioRIDII New Sled Round Robin*
- *Preliminary Notes – Ford 1-21-10*
- *Sled Assembly*
  - *Sled and Rails seem bulky – 6 inch tall I-beams seem a little over designed, and much longer than needed for our lab.*
  - *Rails are smooth and make setup more exact and repeatable.*
  - *Foam appears to give very repeatable results – definitely preferred over single use foam.*
  - *We like the mass only test for verification of the foam.*
  - *Potentiometer rods are an improvement and seem to remove the oscillation typical of the T1 rotation (pot C)*
    - *Lumbar Concern*
  - *The new test does not have a chest stop to decelerate the test – only at the sled. This causes larger forward torso rotation upon stopping than the old sled.*
  - *We are concerned that the lumbar vertebrae pin holes may become damaged.*
  - *Data was collected to 1000 ms based on video showing rebound timing*
  - *Lumbar Forces at the stop are still 3 times higher than what we see in vehicle.*
  - *Could this force cause the vertebral pin holes to oval over time, causing damage and failing dummy responses over time?*
  - *Oval pin holes has been linked to failures in the past.*
- *New Head*
  - *The new head is difficult to work with. The bolts for the side pieces are hard to access and changing from right to left sides will be very difficult in the vehicle sled environment.*
  - *The new head has different skin – does this affect the head cap forces or head acceleration? There is no cert for the head cap skin, but there should be some test to tell if it is still usable or if a new material matches the old material.*
  - *Side exit of the cables could induce rotational forces.*
  - *Bolts on the head cap (& load cell) were very difficult to align and install properly compared to standard non-load-cell cap. Some bolts would bind up depending on the order of tightening.*
- *Head Form*
  - *The head form will be nice for times when the lab is setting the spine and spring tension.*
  - *However, changing from the head form to the head between tests seems unnecessarily cumbersome.*
  - *Can we just have a head form with a head cap attached to be used for both tests?*
    - *It could also be used in vehicle tests, the cables could come out the front – this dummy does not use its face for airbag or other interactions.*

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FORD testing update

- *New Jacket*
  - *The new jacket should have tear resistant webbing at the bend like the old jacket.*
  - *There is no ridge in the new jacket to hold the Teflon pad, which we thought was planned.*
  - *The single flap in the new jacket gives easier access to view and manage dummy wiring, etc.*
- *Head Restraint Test*
  - *Backset gap and head level were not achievable at the same time in some tests without torquing the chin of the dummy - a maneuver that is specifically discouraged when positioning vehicle tests by IIHS.*
    - *Is it acceptable in the cert if it is not acceptable in vehicle to manipulate the spine shape?*
  - *Painted switch is preferred over the copper/aluminum tape.*
    - *It does not work with our DAS, could an option be available for standard digital switch also?*
- *Questions:*
  - *Why are the pots not used during the head restraint test?*
  - *Why was the probe mass increased only at the front end instead of balanced?*
  - *What is the reasoning for the new head skin?*

- BioRIDII Lumbar Forces at Sled Stop
- *Old Sled vs. New Sled*
- *Dummy SN70 for both tests*
- *T3H1488 – Red – New Sled*
- *T3H1506 – Blue – Old Sled*
- *Key Channels with high forces at stop – page # for .pdf plots document*
  - *Lumbar MY – pg 27*
  - *Upper Neck FX – pg 4*
  - *Upper Neck MY – pg 8*
  - *T1 FZ – pg 17*
  - *T1 MY – pg 18*
  - *Lumbar FX – pg 23*
  - *Lumbar MX – pg 26 – oscillation on new sled?*

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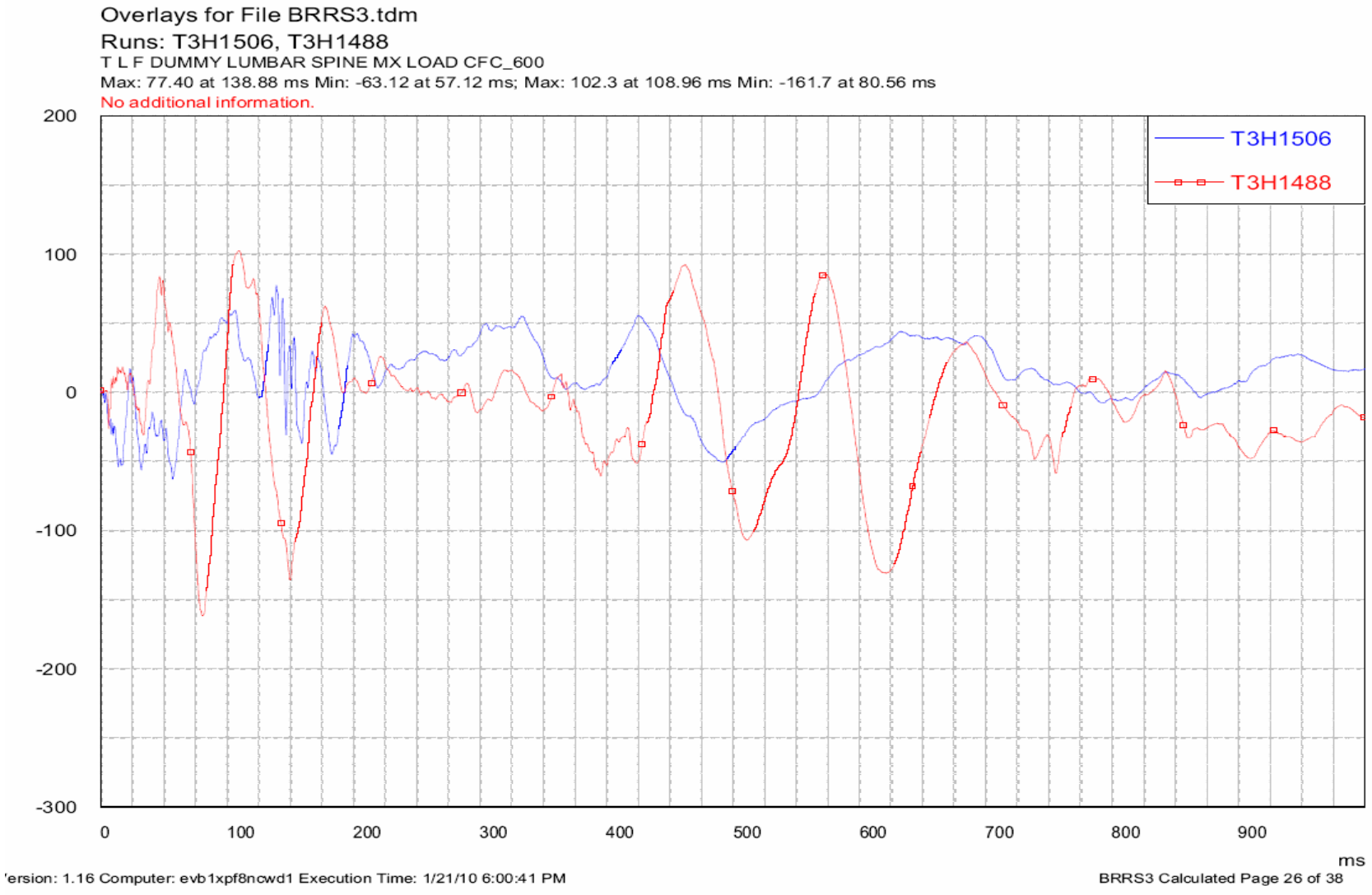
FORD testing update



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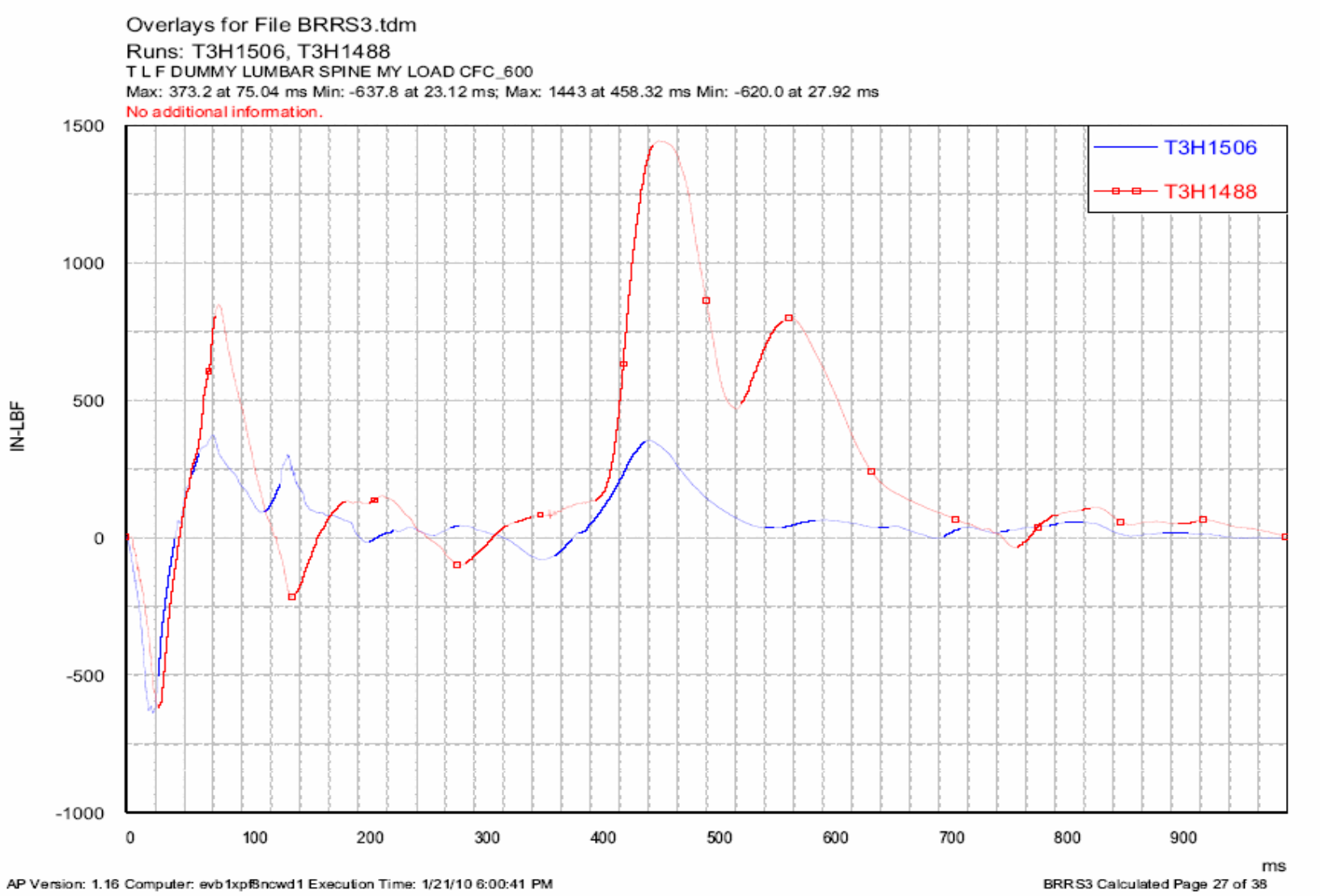

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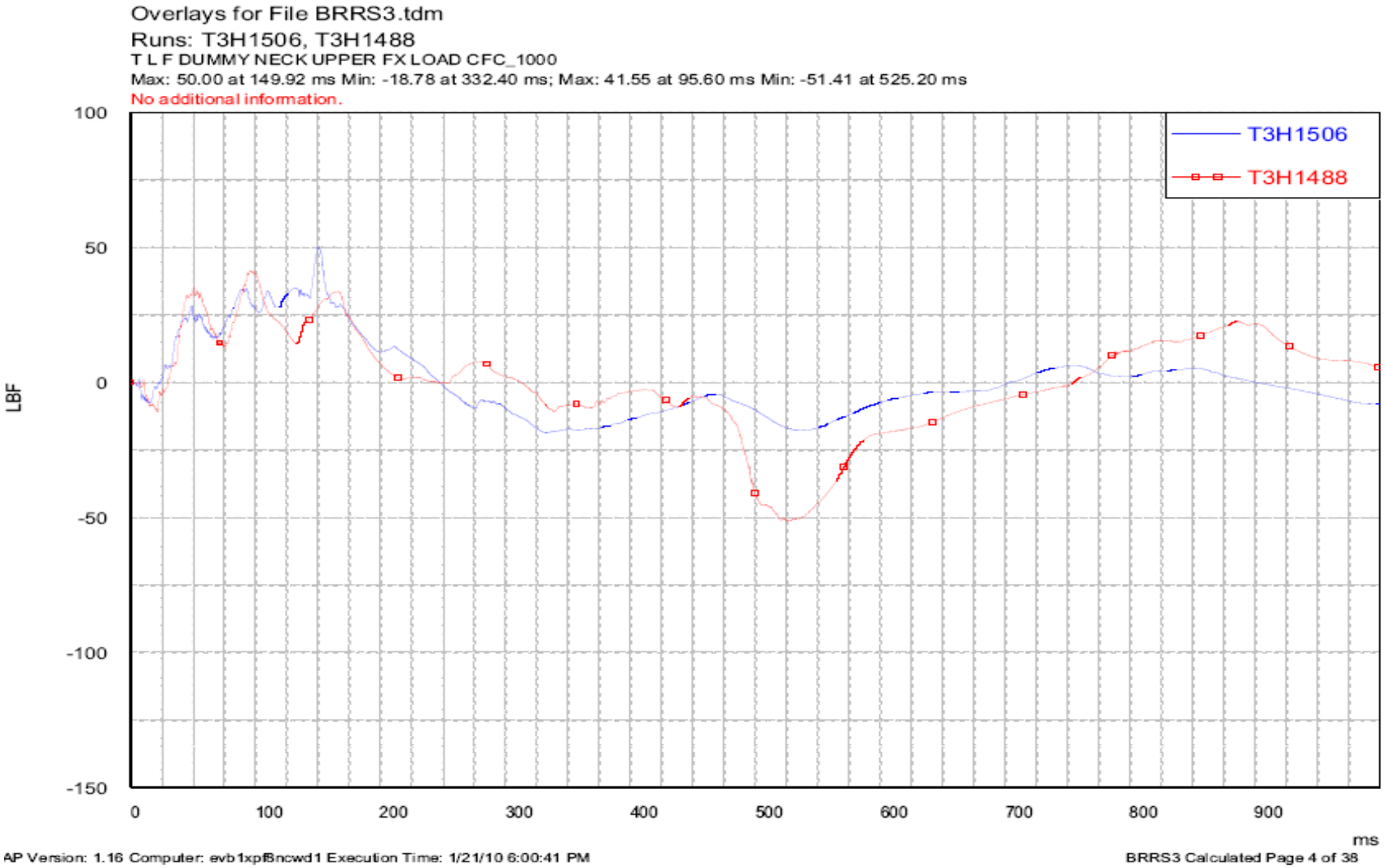

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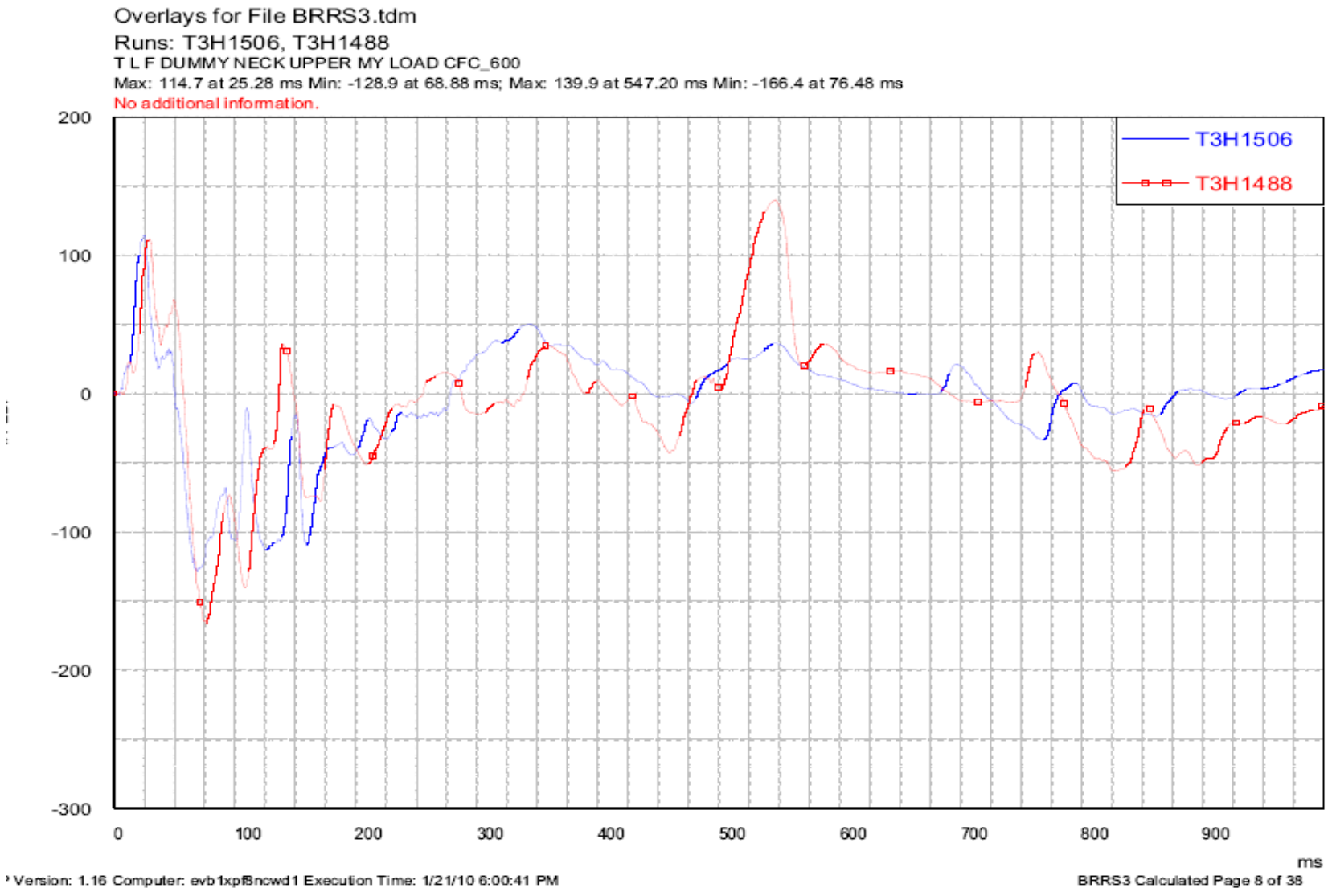

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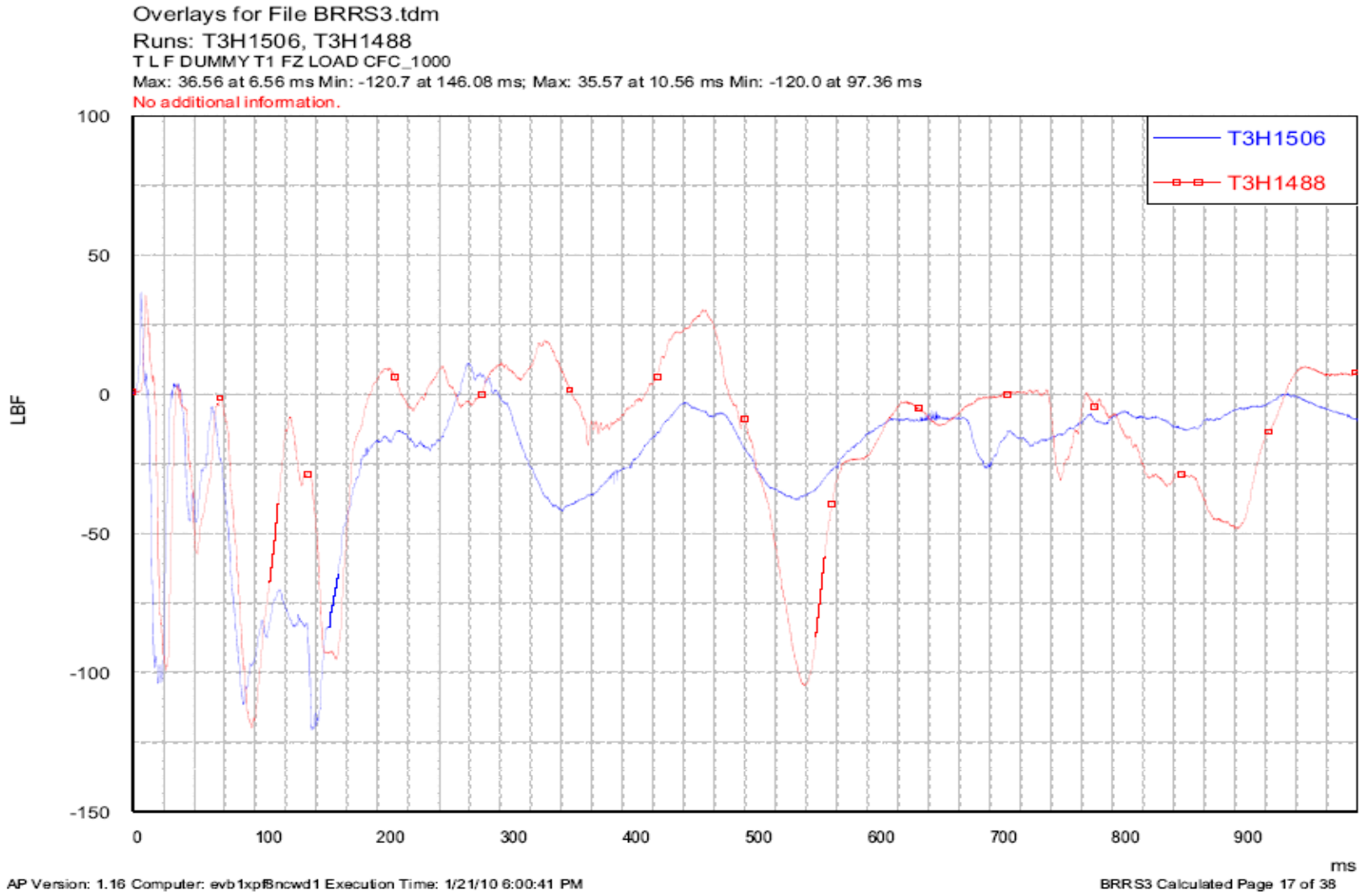

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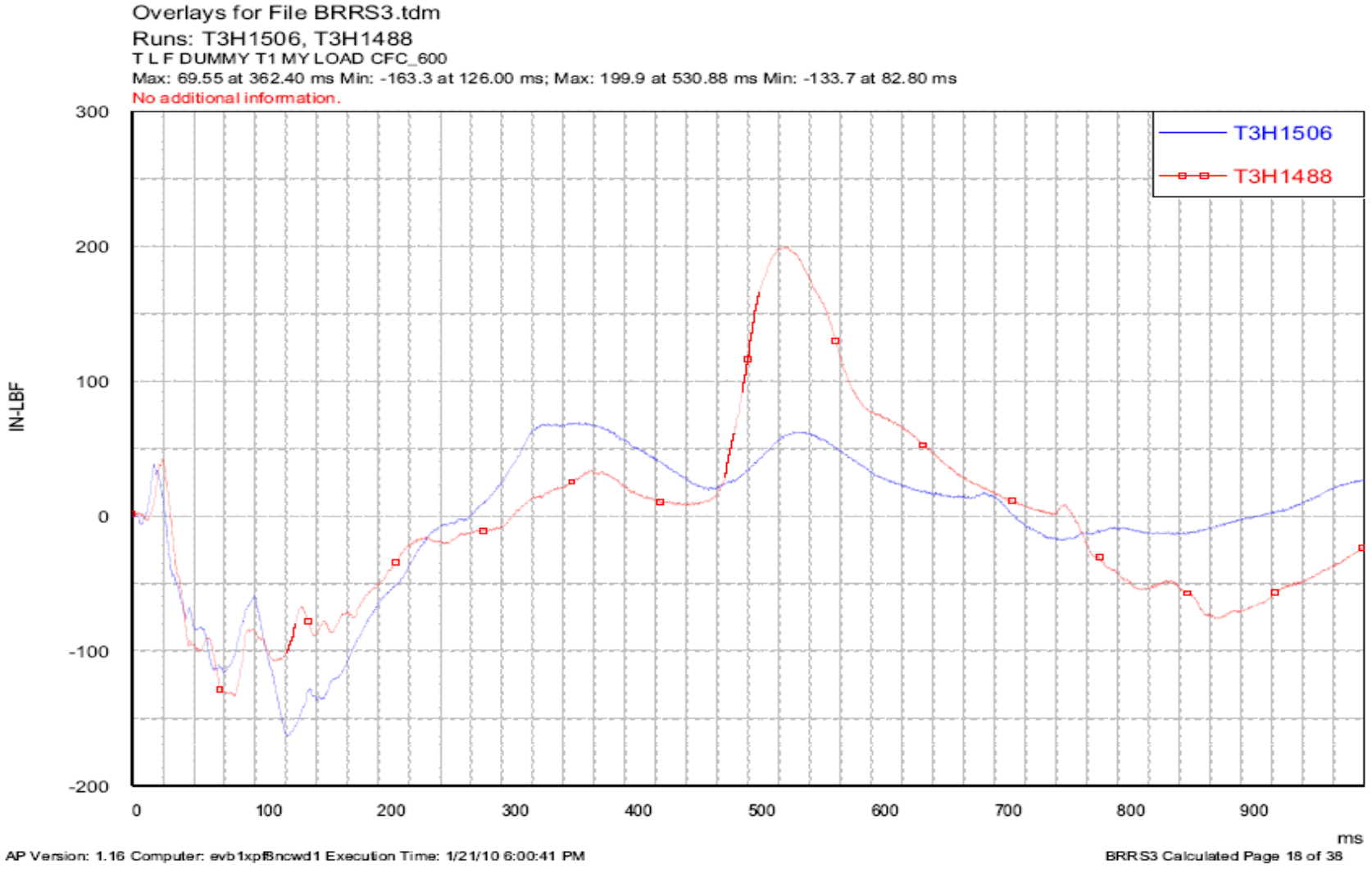

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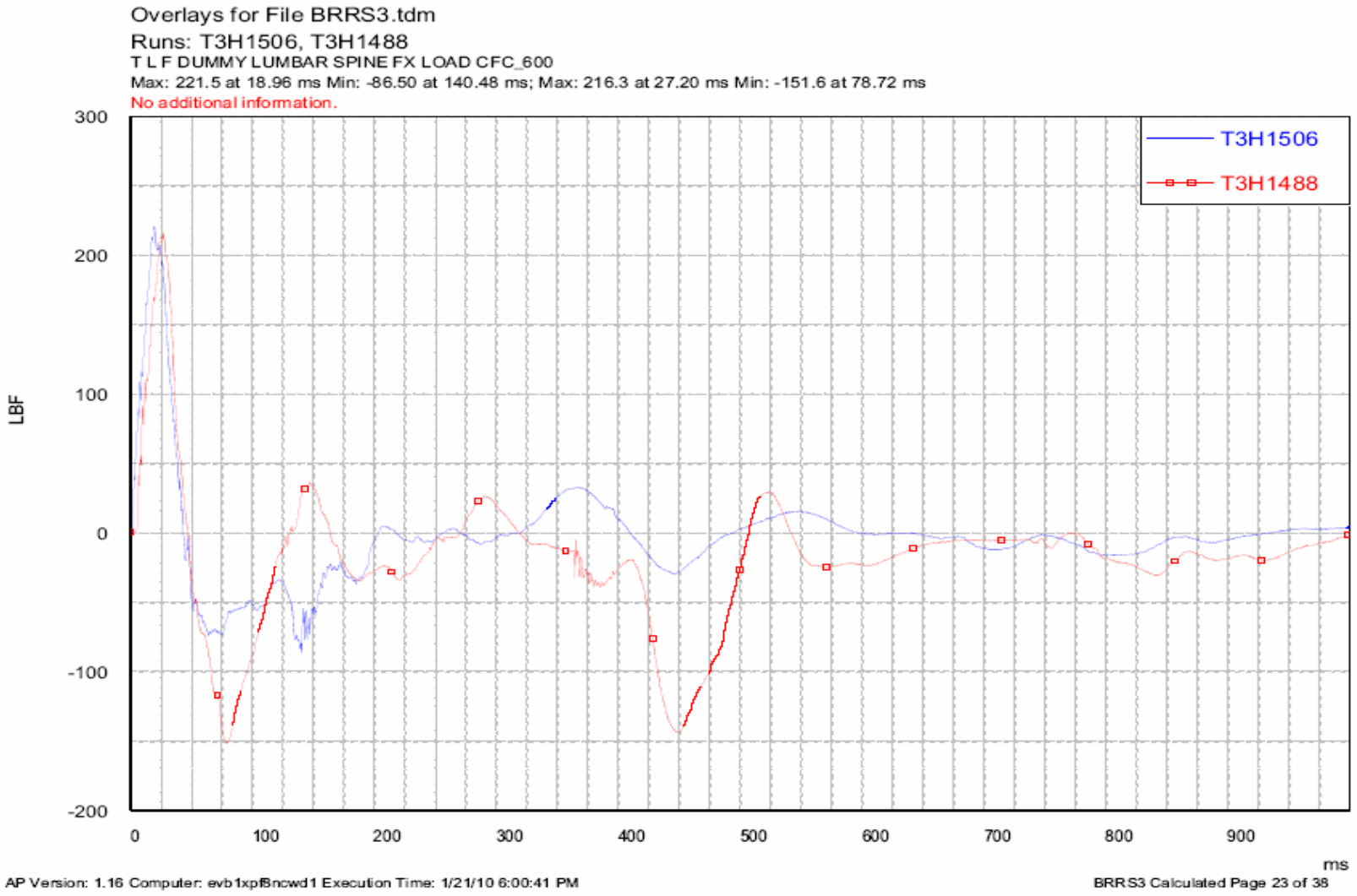

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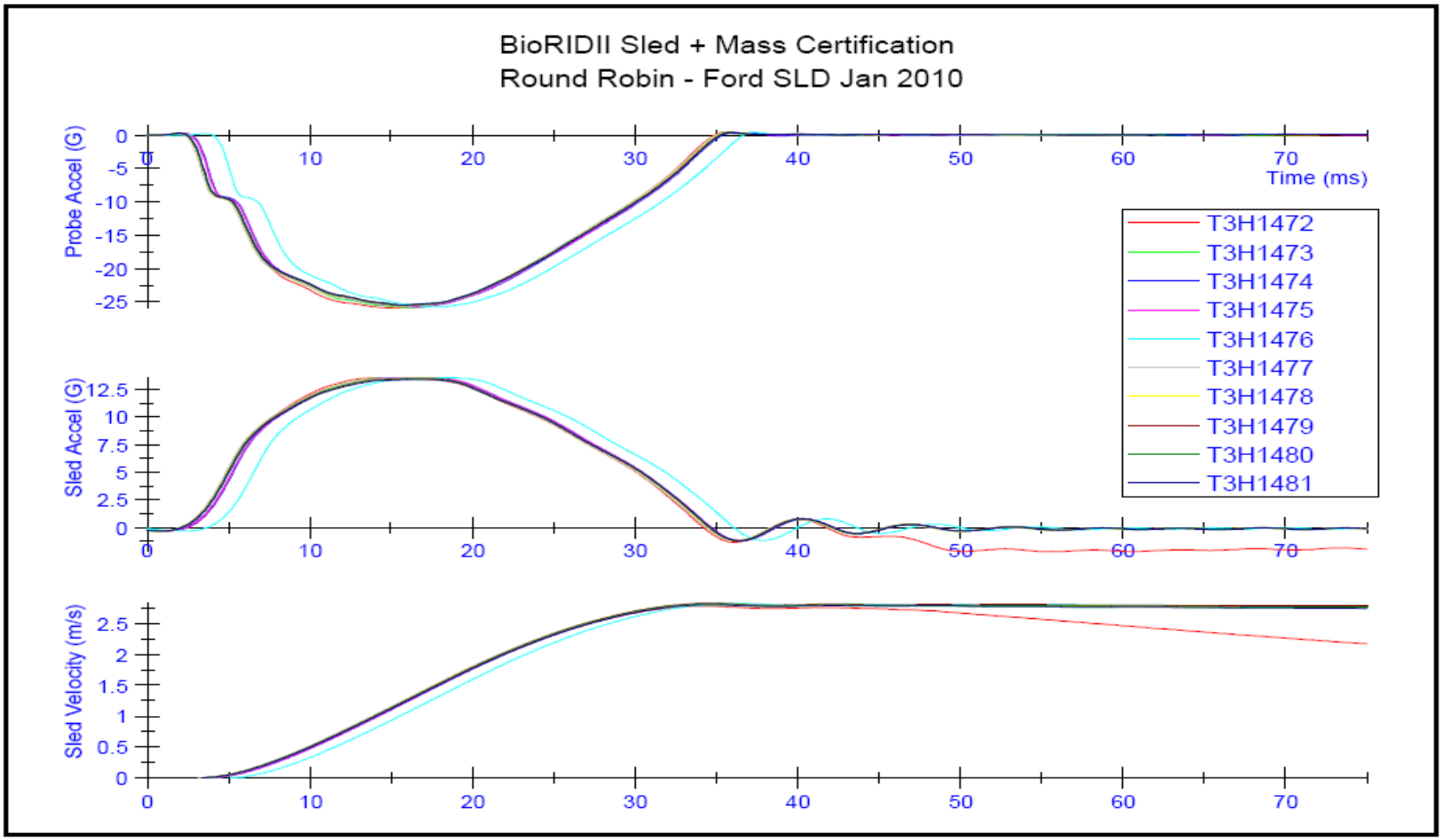

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Recommended Next Steps

- Using revised sled to test more BioRID's to create corridor with and without head rest.
- Perform testing reviewing different dummy variables (example: jacket stiffness, bumper stiffness, static spine set up procedure, muscle springs, etc…) to determine items which affect dummy repeatability and revise specifications on those items as necessary.

DENTON

Agenda

- Introductions and approval of agenda
- GBUM Deliverables to GTR/TEG
  - Dummy
    - Current Version
    - Recommended next steps
  - Certification Test
    - Current Specifications
    - Current Results
    - Recommended next steps
  - Users Manual
    - Current manual
    - Recommended next steps
  - Seating Procedure for Commercial Seats
    - Current tool
    - Recommended next steps
- Change of GBUM status to GTR/TEG
  - Introduction of Chairman
    - Bernd Lorenz
  - GTR Meeting Schedule

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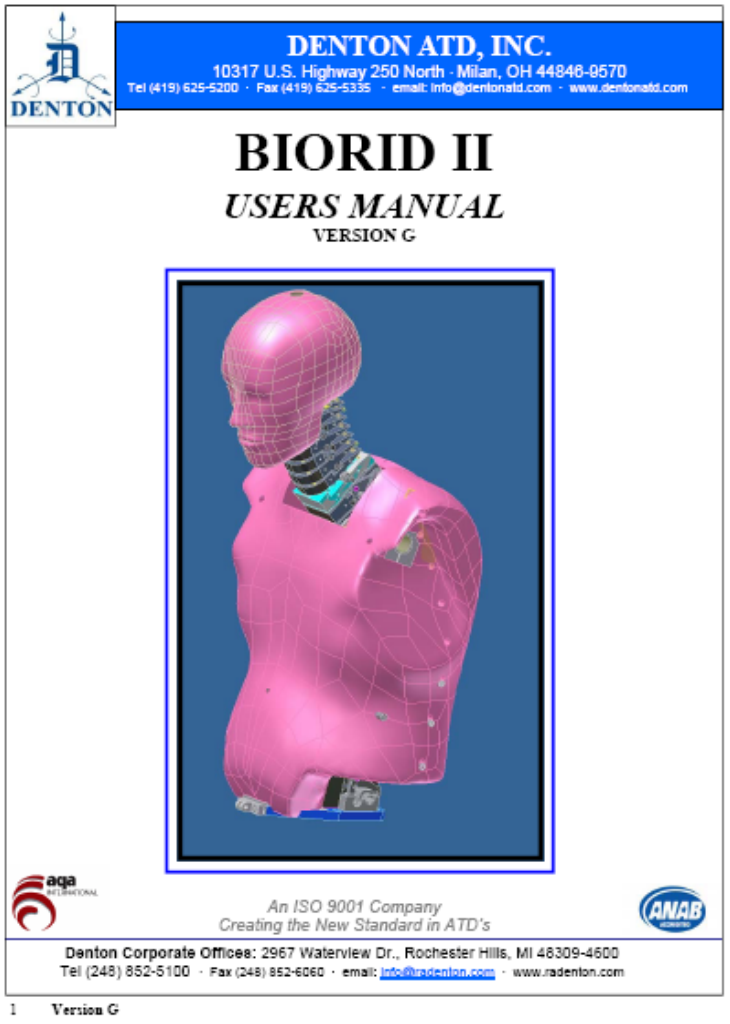
Users Manual



DENTON ATD, INC.
10317 U.S. Highway 250 North · Milan, OH 44846-9570
Tel (419) 625-5200 · Fax (419) 625-5335 · email: info@dentonatd.com · www.dentonatd.com

BIORID II

USERS MANUAL

VERSION G

An ISO 9001 Company
Creating the New Standard in ATD's

Denton Corporate Offices: 2967 Waterview Dr., Rochester Hills, MI 48309-4600
Tel (248) 852-5100 · Fax (248) 852-6060 · email: info@radenton.com · www.radenton.com

1 Version G

Users Manual Next Step

- Revise Certification test section
- Revise any areas that my need to my updated during the next year.

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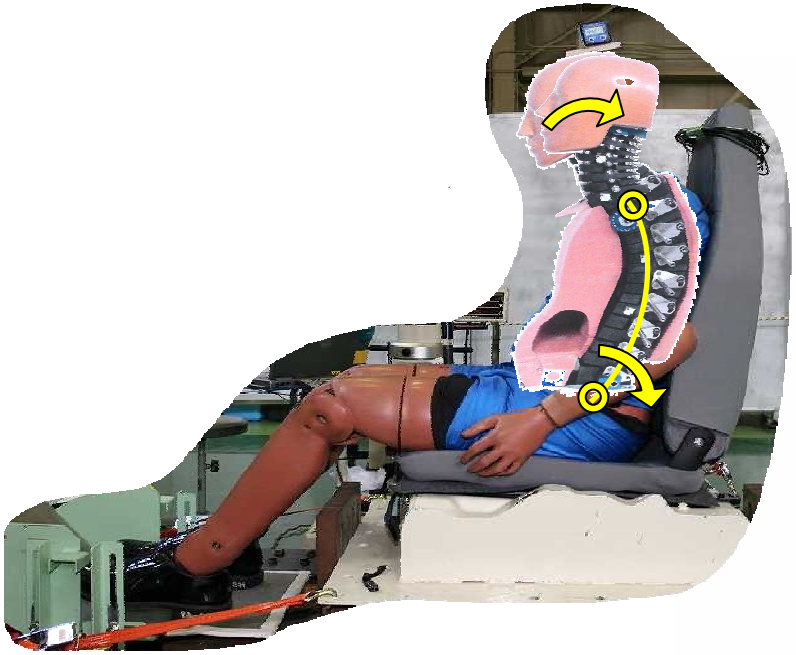
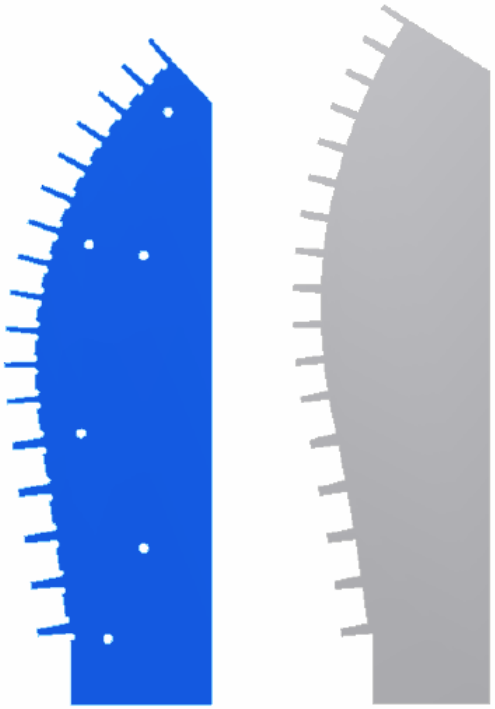
New comb is available to try



Current Tool



New Tool

Next Step will be to have someone try the new tool and report back to group

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THANK YOU to all!

- Thank You to all the worldwide GBUM members and participates, which have labored for the past 10 years to make the BioRID a better test device. Participates have included people from tests labs, car companies, insurance groups, government agencies, universities, and dummy manufacturers.

  Mike Beebe & Alex Schmitt

DENTON

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THANK YOU

for your attention

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