

Background of GBUM Certification Test

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**Informal Working Group Meeting for GTR7
In Tokyo
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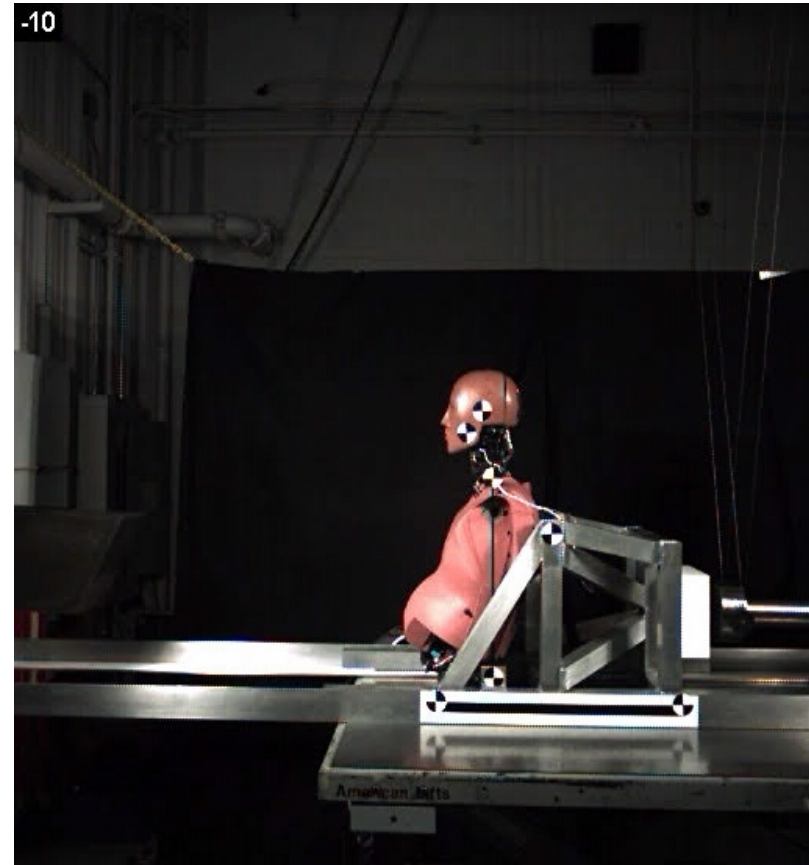
Agenda

- Problems with Original Certification Test
- Goals for GBUM test revision
- Changes to original test for GBUM test
- Rationale for Each Change
- Track system handling
- Open issues with GBUM test



Problems with Original Certification Test

- Original test used
 - Welded aluminum sled sliding on Teflon
 - Disposable Styrofoam energy transfer device



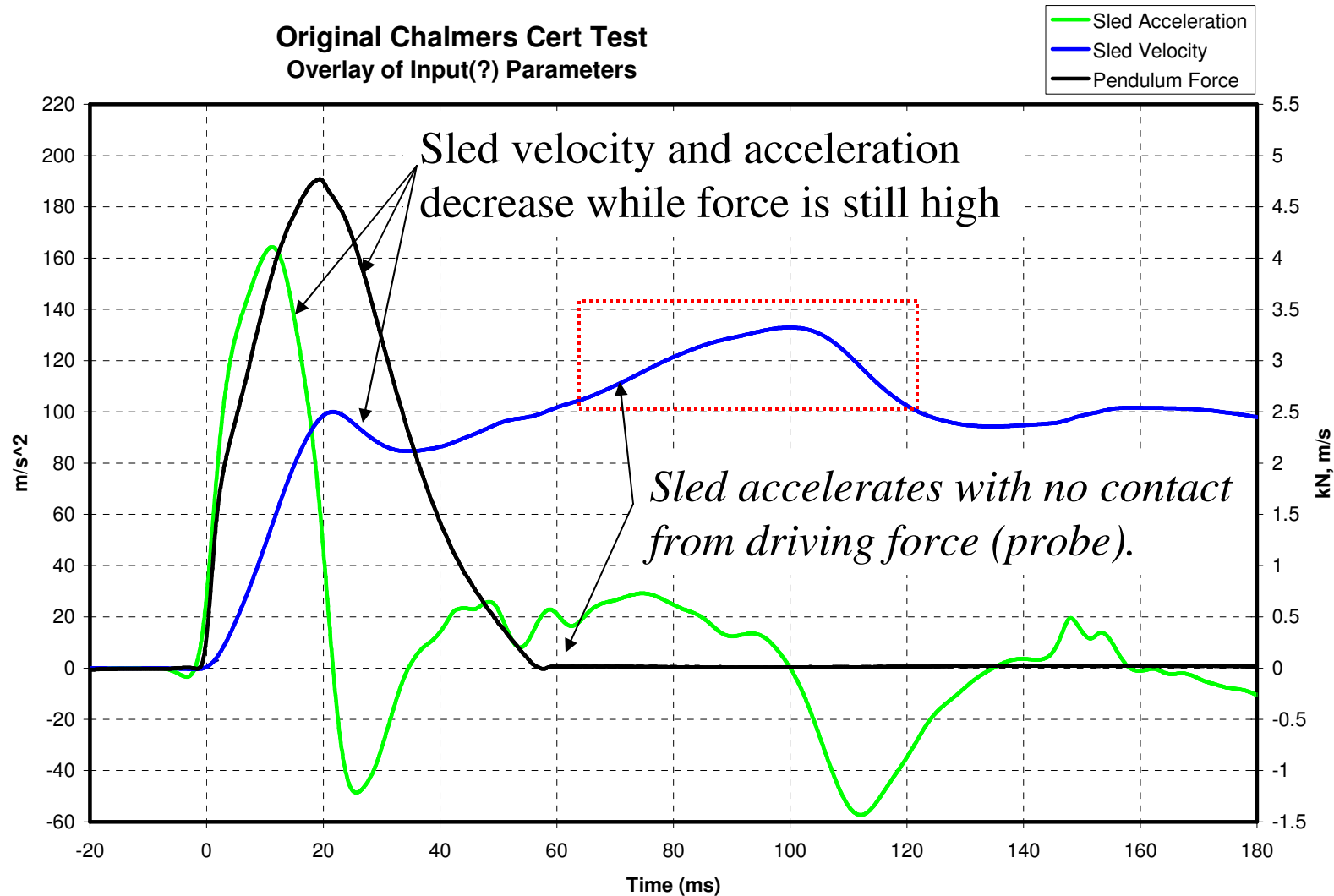
Problems with Original Certification Test

- Disposable Styrofoam has high variability
- Sled bounces during test
- Poor test repeatability and reproducibility
- Interaction of dummy with input pulse (sled velocity corridors)



Problems with Original Certification Test

- Heavy interaction of dummy with test inputs



Problems with Original Certification Test

- Impossible to separate whether failing sled velocity is due to dummy or Styrofoam
 - Labs adjust foam to get sled velocity to pass
 - This gets dummies to “pass” but increases test variability



Goals of GBUM Test Revision

- Late 2007 started discussing with BUM group changing certification test
- GOALS for test revision:
 - Good test repeatability and reproducibility
 - Discern differences between dummies
 - Eliminate sled bounce
 - Reusable energy transfer device to replace Styrofoam
 - Reasonable to adapt to existing certification labs
 - Add headrest? (open question)
 - Mid 2009 GBUM recommended adding headrest test



Changes to original test for GBUM test

- Reusable Energy Transfer Device (ETD)
- Ball bearing guide rail system
- Headform
- Stiffer bars for pot measurement system
- Added separate headrest test
- Added test to certify ETD and total sled system
- Steel sled



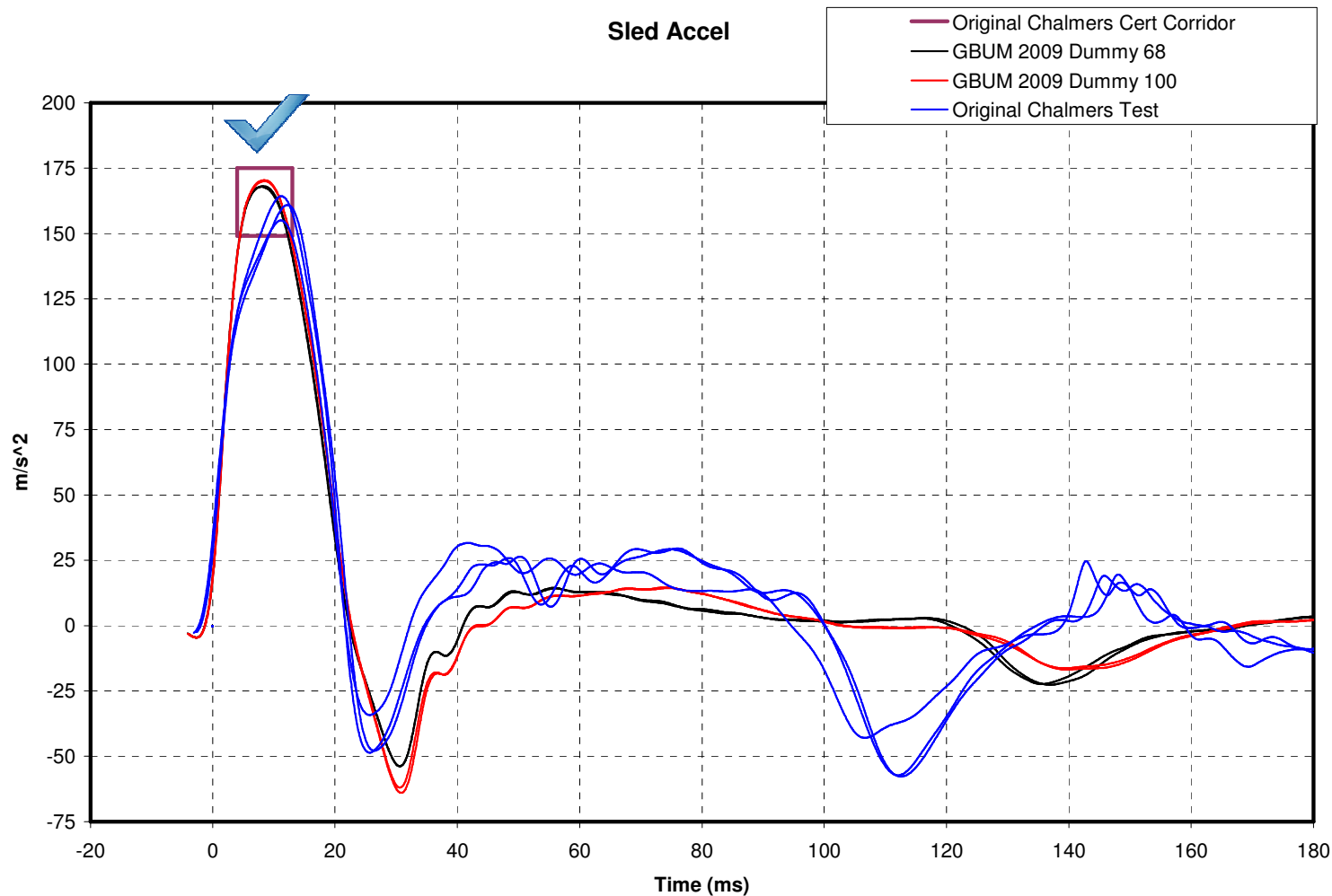
Rationale for Each Change

- Reusable energy transfer device
 - Keep close to existing sled pulse
 - Sled acceleration
 - Sled velocity first peak and tunnel
 - Keep similar dummy acceleration (T1)
 - Test to discern if ETD is no longer acceptable
 - Weight package sled certification test
 - Run several hundred tests without change
 - Best possible repeatability and reproducibility



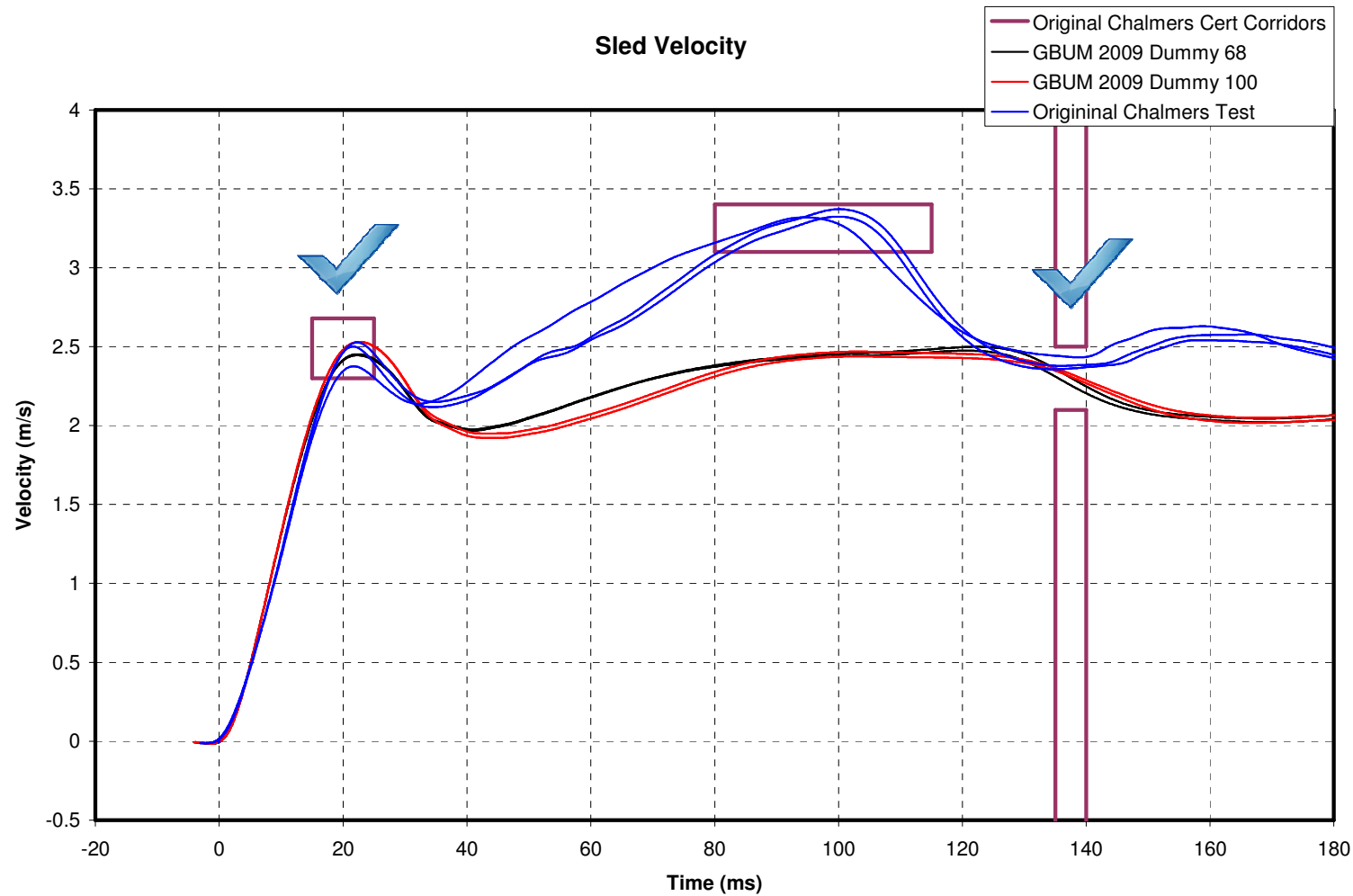
ETD: Similar Inputs

- Met original peak sled acceleration



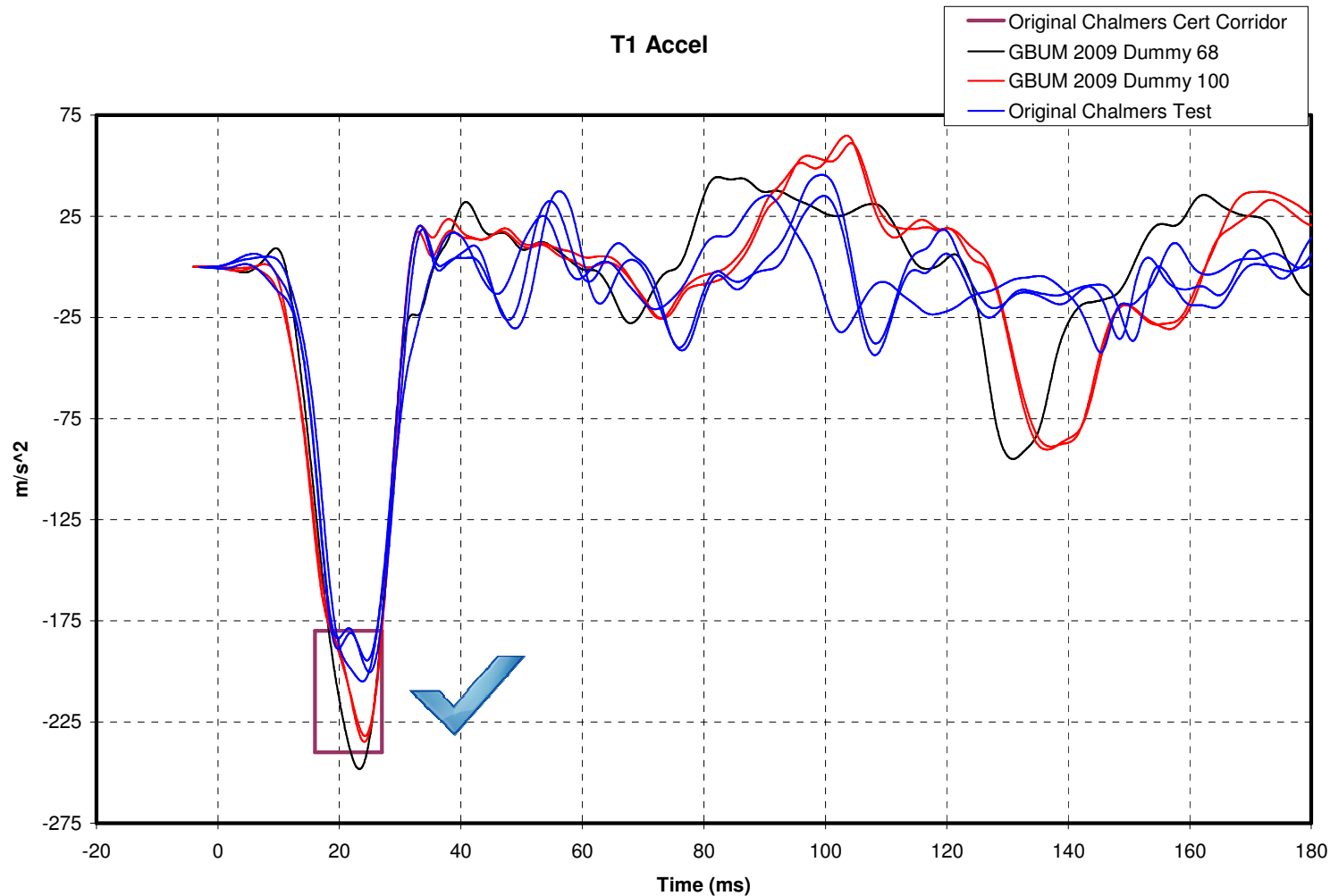
ETD: Similar Inputs

- Sled velocity first peak and tunnel



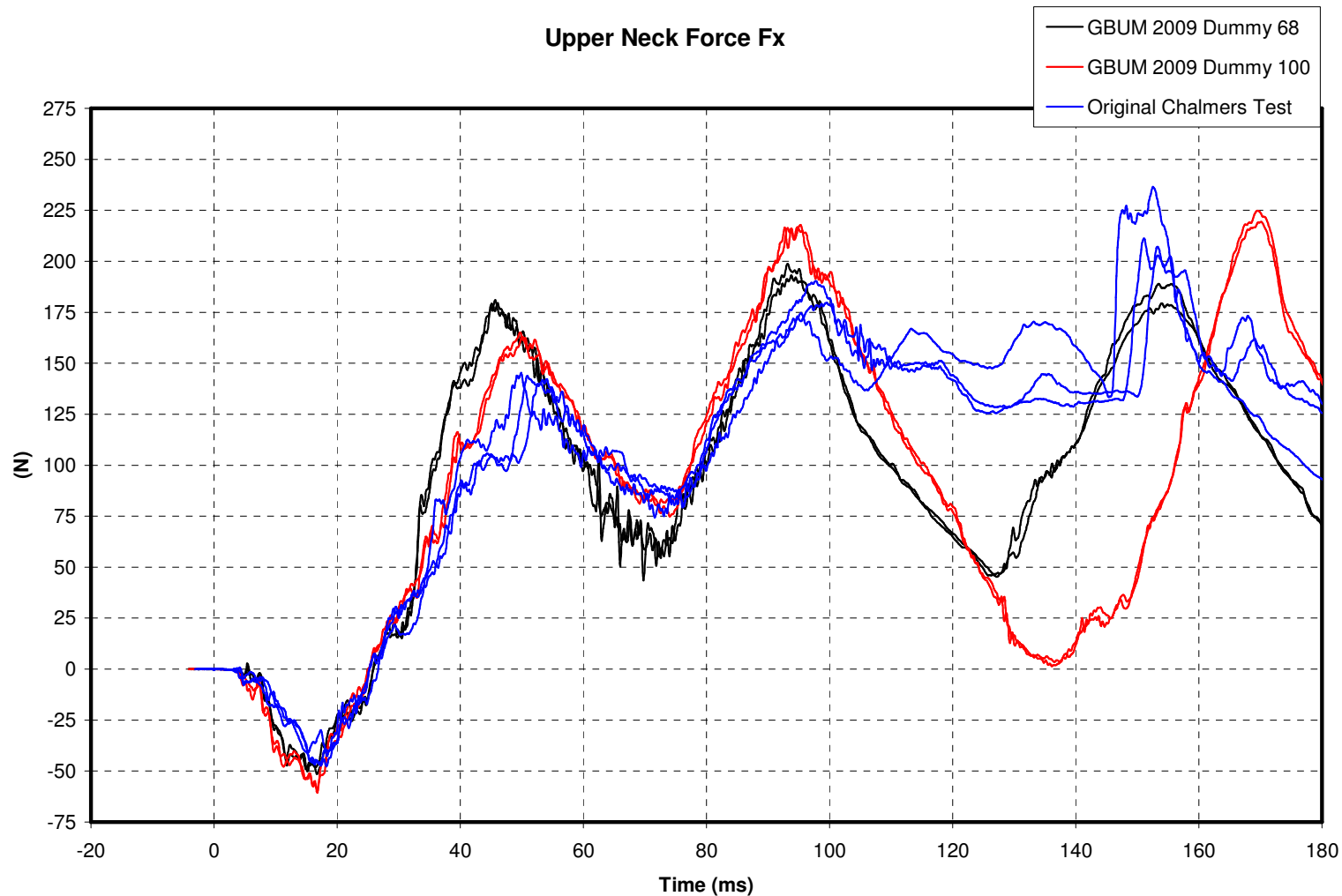
ETD: Similar Inputs

- Keep similar dummy acceleration (T1)



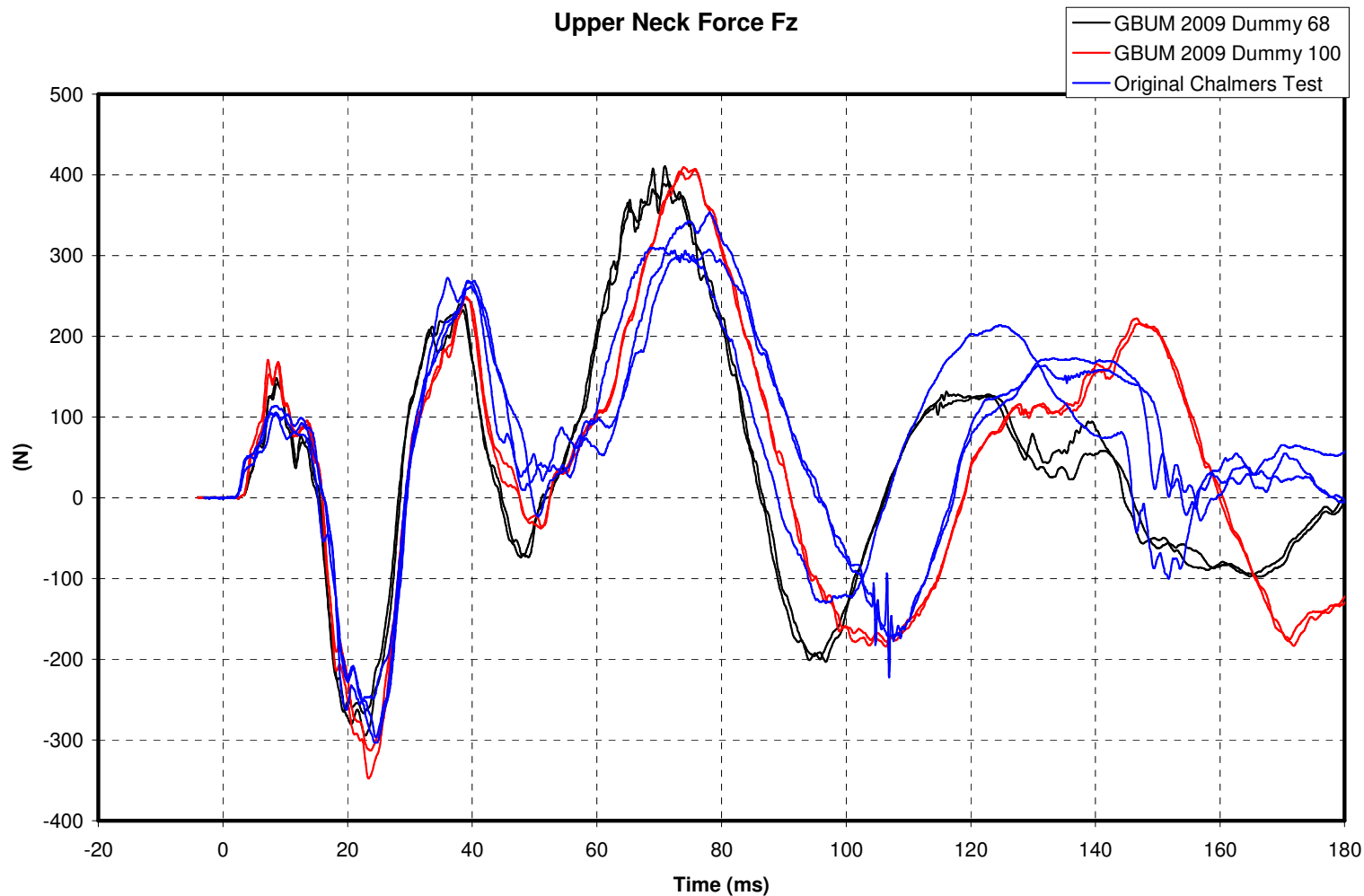
ETD: GBUM 2009 More Aggressive?

- Forces on Head Similar Magnitude & Onset



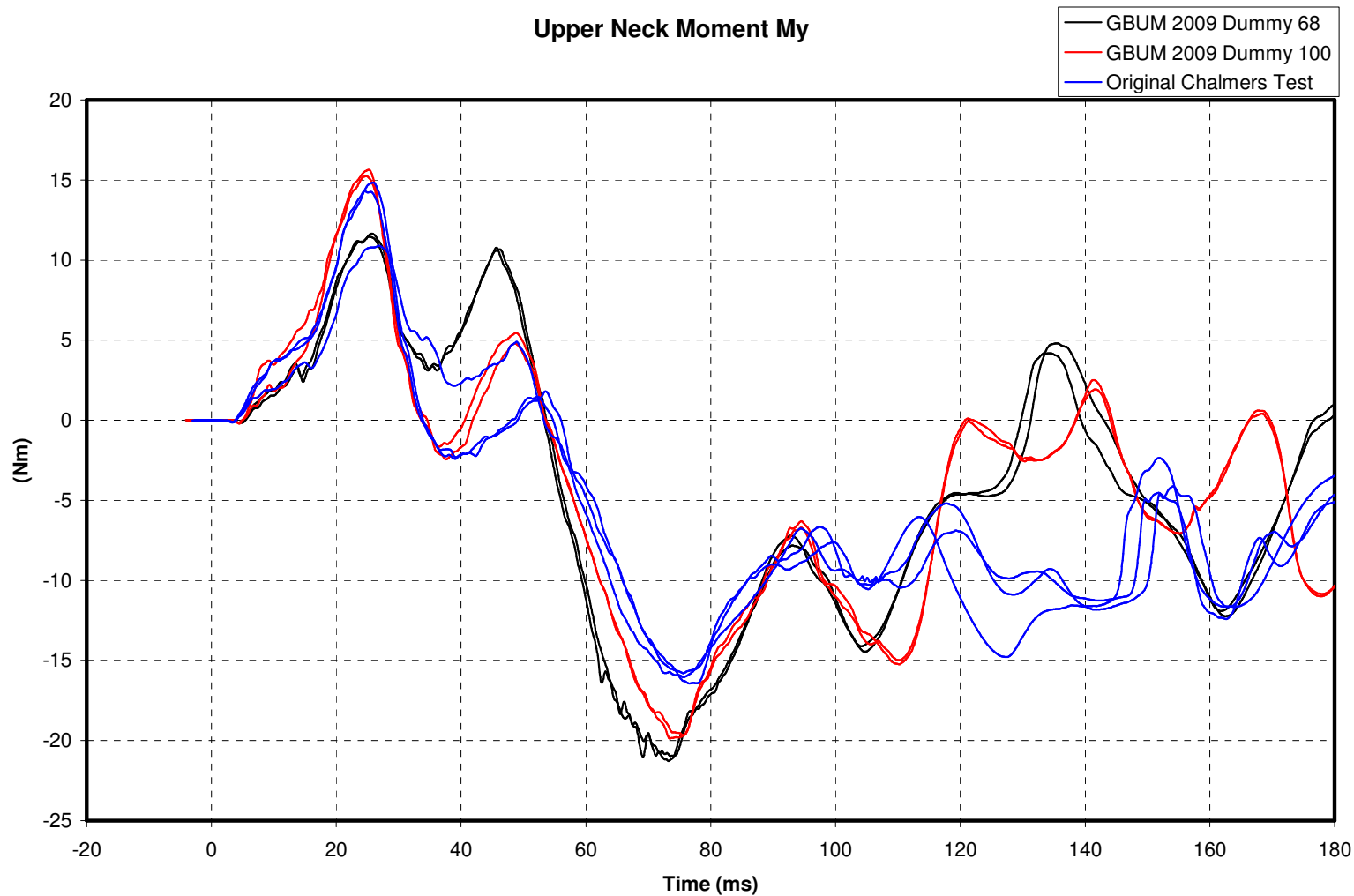
ETD: GBUM 2009 More Aggressive?

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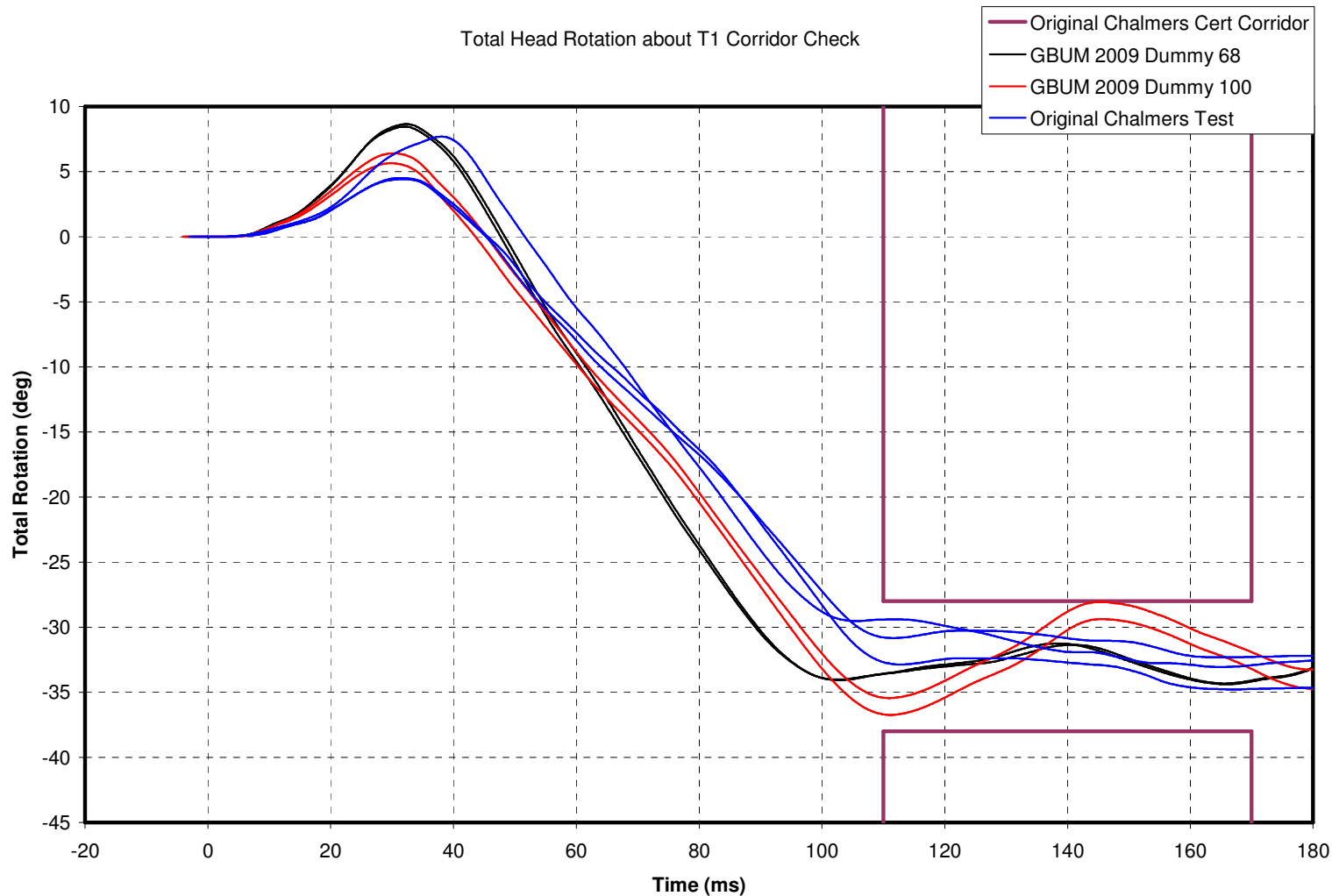
ETD: GBUM 2009 More Aggressive?

- Forces on Head Similar Magnitude & Onset



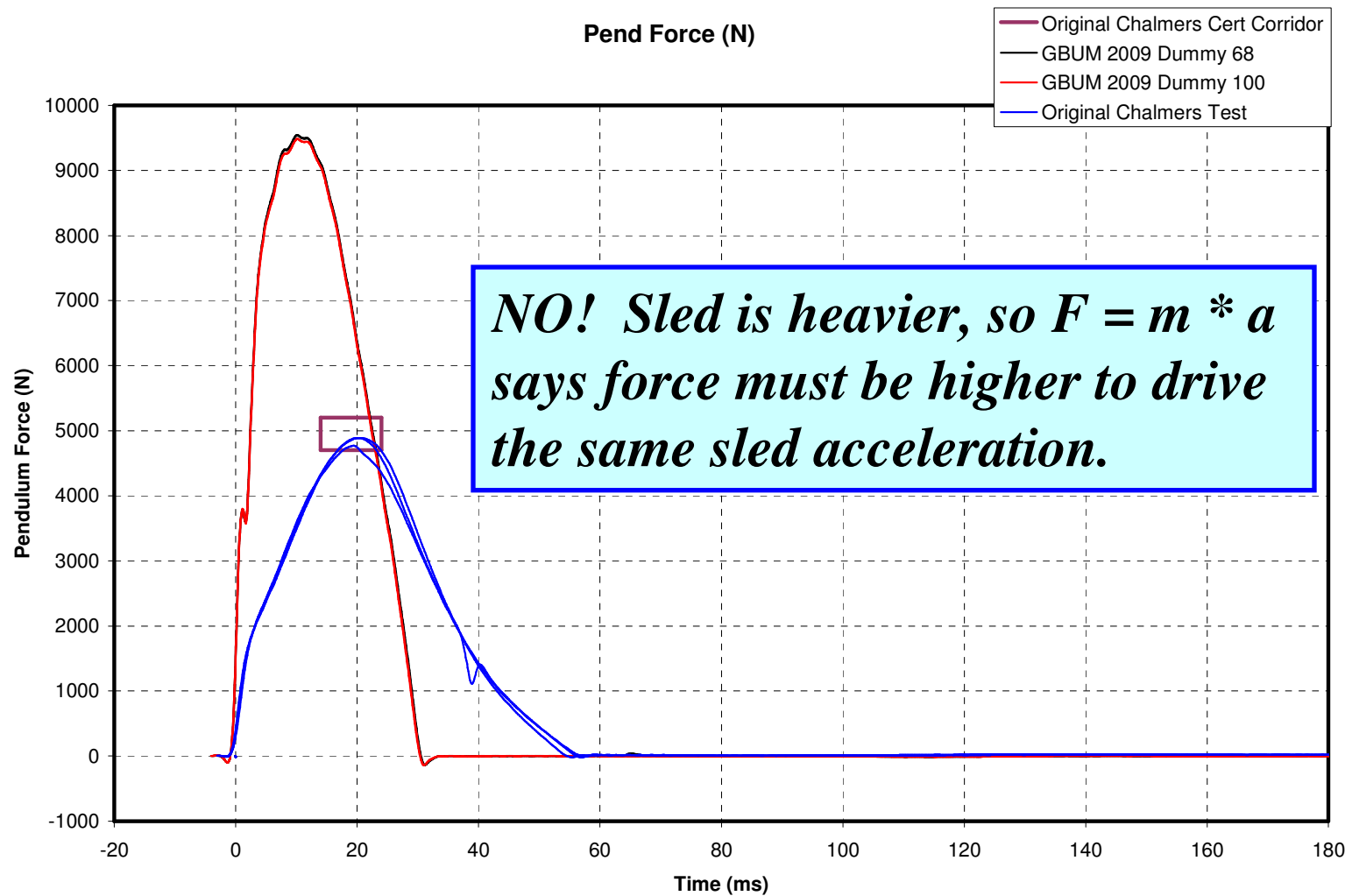
ETD: GBUM 2009 More Aggressive?

- Total Neck Rotation Similar Magnitude & Onset



ETD: GBUM 2009 More Aggressive?

- Does a higher probe force make it more aggressive?



Rationale for ETD

- Goal was repeatability, reproducibility, reusability, durability
- Denton evaluated many possible ETD before settling on this foam
 - Springs
 - Spring/damper system
 - Silicones
 - Foams
- Current foam ETD provided best overall performance



Rationale for Each Change

- Ball bearing guide rail system
 - Sled bouncing down track (see video) is probably not repeatable & reproducible
- Headform
 - Better reproducibility of Mass Moment of Inertia than heads
 - This has been done for many dummies
 - Easier access to adjusters during testing
- Stiffer bars for pot measurement system
 - Decrease oscillations sometimes seen in pot data



Rationale for Each Change

- Added separate headrest test
 - PDB paper at ESV 2009 indicated that biggest dummy to dummy reproducibility issues existed during head contact with headrest
- Added test to certify ETD and total sled system
 - Assures nothing has changed with ETD or sled
 - Assures correct sled & probe setup
 - Assures total system is reproducible



Rationale for Each Change

- Steel sled
 - Driven by head rest test
 - Allows rigid and durable mount for removable headrest
 - It undesirable for headrest to deflect or vibrate during contact
 - Reduce effect of dummy variation on test inputs (i.e. sled acceleration & velocity)
 - Don't want to tune inputs because of dummy
 - Want reproducibility of test
 - Want dummy differences to drive test output differences not input differences
 - See example on next pages

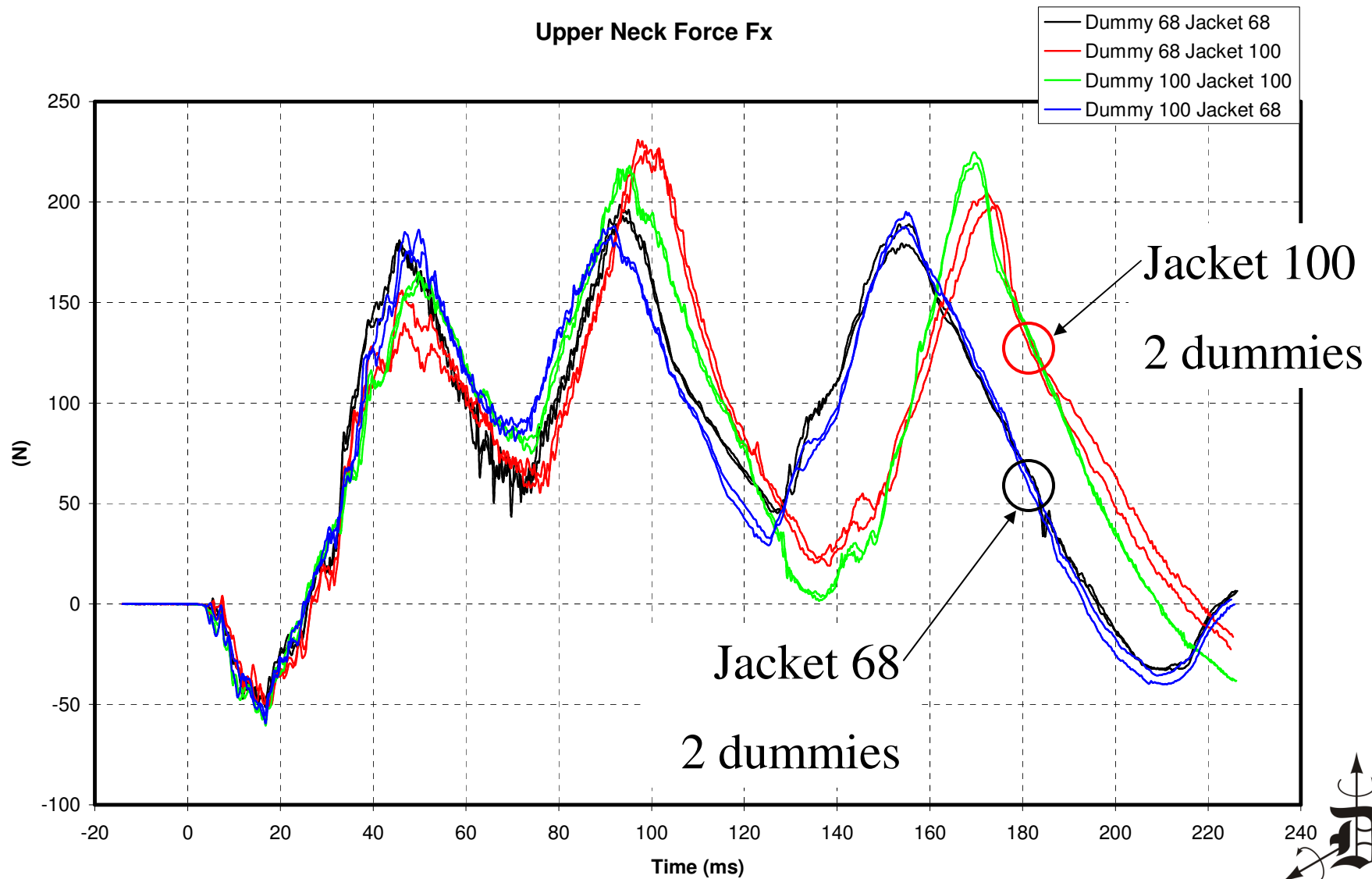


Rationale for Steel Sled: Example

- GBUM 2009 test helped identify differences between dummies caused by jackets
 - Both dummies passed Original Chalmers certification test
 - Dummies immediately appeared different on multiple data channels with GBUM 2009 test
 - Swapping jackets showed clear difference that tracked jacket
 - NOTE: we suspected jackets were a source of variation but could never prove it with original test



Rationale for Steel Sled: Example



Rationale for Heavy Rail Support

- Concern expressed that 6” aluminum beams under bearing rails are excessively heavy “over designed”
- Reason:
 - Massive forces are exerted on system throughout event
 - Small deflections of a parallel bearing rail system can cause random binding
 - Very rigid system minimizes deflections and therefore possible binding on rails
 - Also provides support for forces from stopping the dummy at end of test

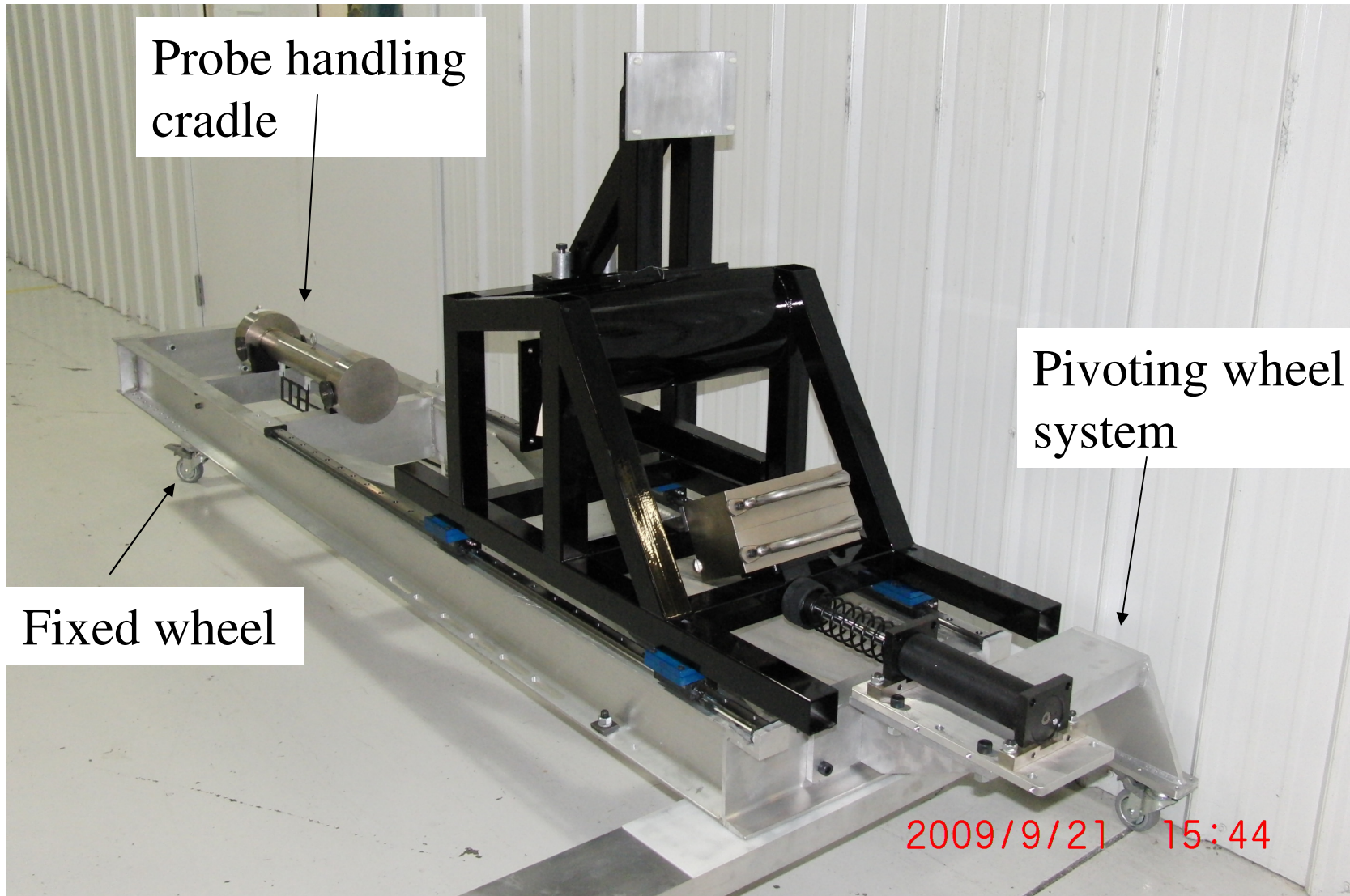


Track system handling

- There have been concerns about heavy sled/rail system for handling
 - i.e. too heavy to lift
- Systems were built with wheel system to allow easy one person installation/removal
 - i.e. just roll into place or away when done



Track system handling



Probe handling
cradle

Pivoting wheel
system

Fixed wheel

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Open issues with GBUM test

- Headrest test
 - How to set it up
 - Need for adjustable headrest?
 - What does it mean?
 - Is it needed?
- Should pulse change to better match seat testing?
- Finalizing corridors for standard and head rest tests



THANK YOU
for your attention

