

# Review and Approval of Recommended Certification Tests for Biorid II



# BioRID II Certification Tests

- ▶ Dummy Certification without Head Rest
  - Weight package check of system & Energy Transfer Device (ETD)
- ▶ Dummy Certification with Head Rest
  - Weight package check of system & ETD
  - Headrest foam verification test
- ▶ Component tests
  - Jacket impact on mini-sled
  - Pelvis bottom impact on mini-sled
  - Pelvis back impact on mini-sled

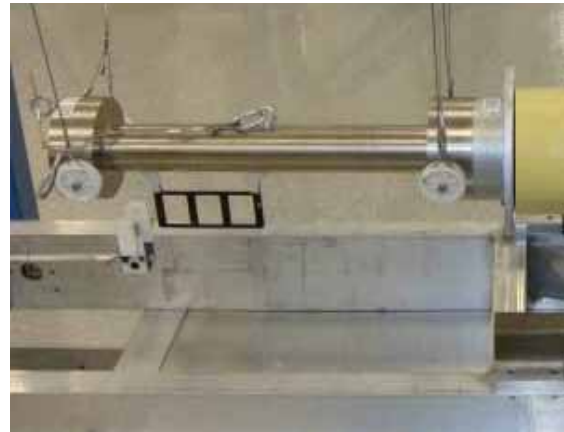
# Proposed BioRID Certification Process

1. Run component tests ANNUALLY
  - Jacket impact
  - Pelvis bottom
  - Pelvis back
2. Certify dummy WITHOUT headrest
  - Run weight package test to verify rail, sled, and ETD
  - Run dummy without headrest
3. Certify dummy WITH headrest
  - Run headrest foam verification test
  - Run weight package test to verify rail, sled, and ETD
  - Run dummy with headrest

# BioRID Dummy Certification

## ► Without Head Rest Certification Test

- Rail guided, heavier sled for better repeatability
- Sled mass without headrest: 44.25 kg +/- .05 kg
- Standard BioRID II probe with large face added
- Probe mass: 37.61kg +/- .1 kg
- Probe velocity: 4.70 – 4.80 m/s
- Reusable ETD for consistent input pulse



# Without Headrest Channel listing

## ▶ Required channels

- Pendulum velocity
- Pendulum acceleration
- Sled acceleration
- T1 acceleration
- Pot A (neck link at OC)
- Pot B (neck link at T1)
- Pot C (lumbar/thorax link at T1)
- Pot D (lumbar/thorax link at sled)
- Upper neck My

## ▶ Suggested channels

- Upper neck Fx
- Upper neck Fz
- Upper neck Mz
- Lower neck Fx
- Lower neck Fz
- Lower neck My

# BioRID Certification Requirements

Parameter	Upper Corridor	Lower Corridor	Lower Time (ms)	Upper Time (ms)
Pendulum Force (N)	9700	8000	n/a	n/a
Pot A (Deg)	11.5	16.5	25	70
Pot A Tunnel (Deg)	2	-9	125	135
Pot B (Deg)	6.5	4	18.5	28.5
Pot B Tunnel 1 Upper (Deg)	-30	n/a	98	108
Pot B Tunnel 2 Upper (Deg)	-29	n/a	165	175
Pot B Min (Deg)	n/a	-36	n/a	n/a
Pot C (Deg)	-16.5	n/a	73	78
Pot C Min (Deg)	n/a	-19	n/a	n/a
Sled Acceleration (m/s <sup>2</sup> )	170	137	n/a	n/a

# BioRID Certification Requirements

Parameter	Upper Corridor	Lower Corridor	Lower Time (ms)	Upper Time (ms)
Sled Velocity (m/s)	2.5	2.25	20	30
Sled Velocity Tunnel Upper (m/s)	2.5	2.4	135	140
Sled Velocity Tunnel Lower (m/s)	2.1	2	135	140
T1 Acceleration (m/s <sup>2</sup> )	-183	-267	18.5	30.5
Total Rotation (A+B) Upper Tunnel 1 (Deg)	-25	n/a	100	110
Total Rotation (A+B) Upper Tunnel 2 (Deg)	-25	n/a	170	190
Total Rotation (A+B) Lower Tunnel (Deg)	n/a	-41	100	190
Total Thoracic Rotation (C+D) Upper Tunnel (Deg)	-10	n/a	125	135
Total Thoracic Rotation Min (Deg)	n/a	-21	n/a	n/a
Upper Neck Moment My Max (Nm)	17.8	7.7	20	35
Upper Neck Moment My Min (Nm)	-15	-23.5	66	83

# Weight Package Verification

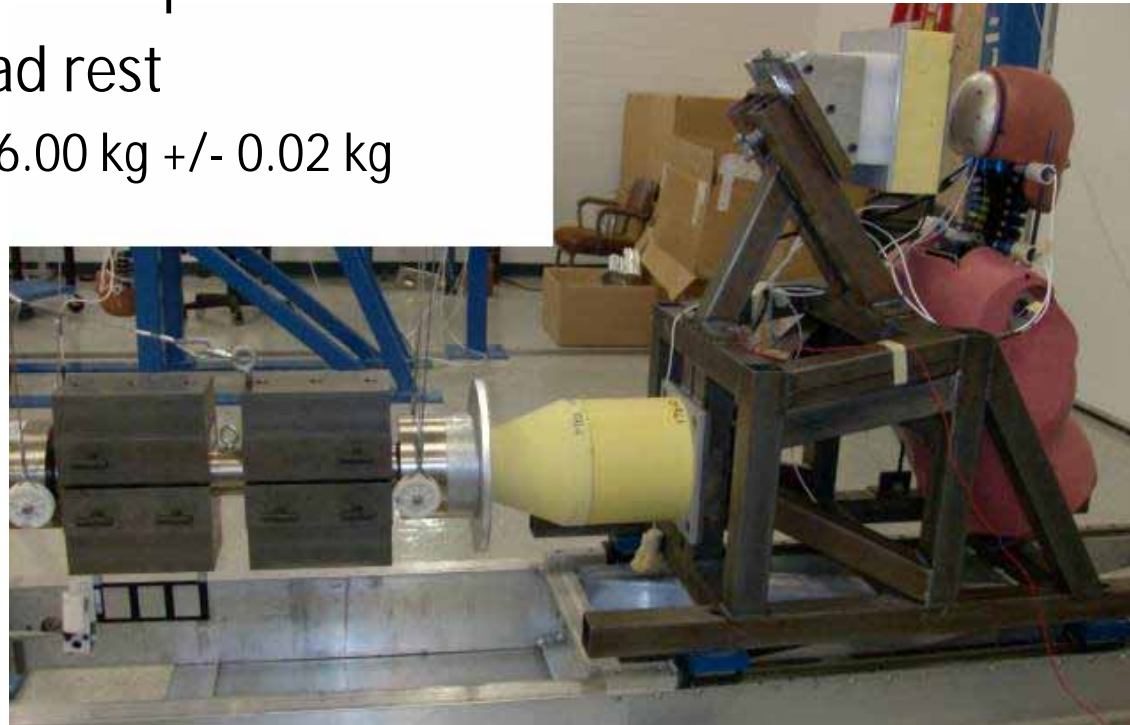
- ▶ Insures proper rail, sled, ETD installation and function
- ▶ Inputs
  - Fixed mass of 25.50 kg +/- 0.02 kg added to sled in place of dummy
  - Probe velocity 4.70 – 4.80 m/s
- ▶ Data channels: velocity, pendulum accel., sled accel.
- ▶ Response corridors
  - Pendulum Force: 9200N +/- 600
  - Peak sled acceleration: 127 M/s<sup>2</sup> +/- 9 M/s<sup>2</sup>
  - Peak Sled Velocity: 2.8 +/- 15 m/s
  - Sled velocity slope from 50 to 150 ms: 0 to -1.5 (m/s)/s



# BioRID Certification with Head Rest

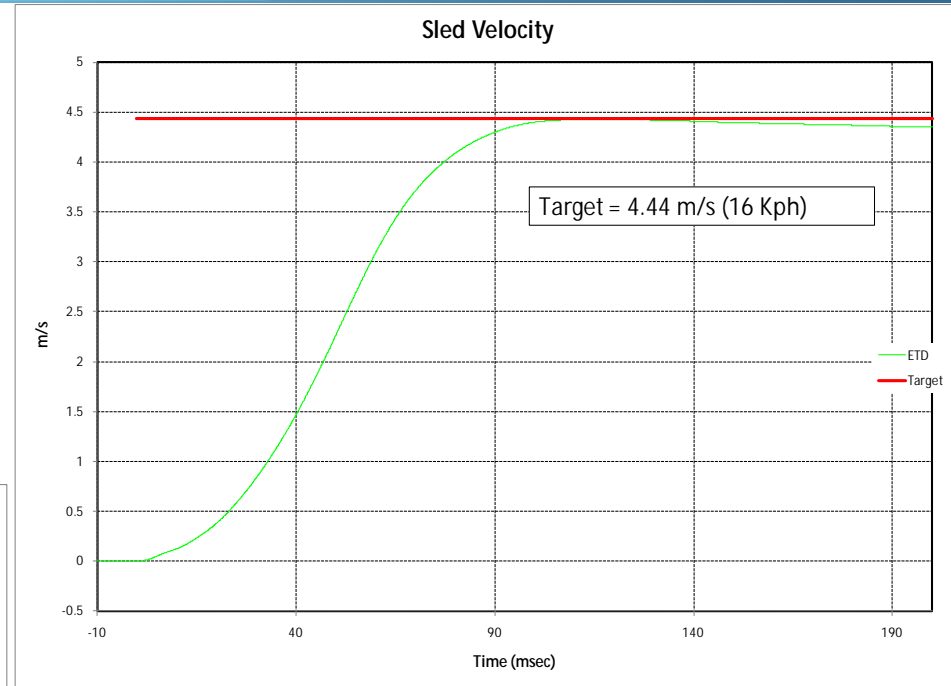
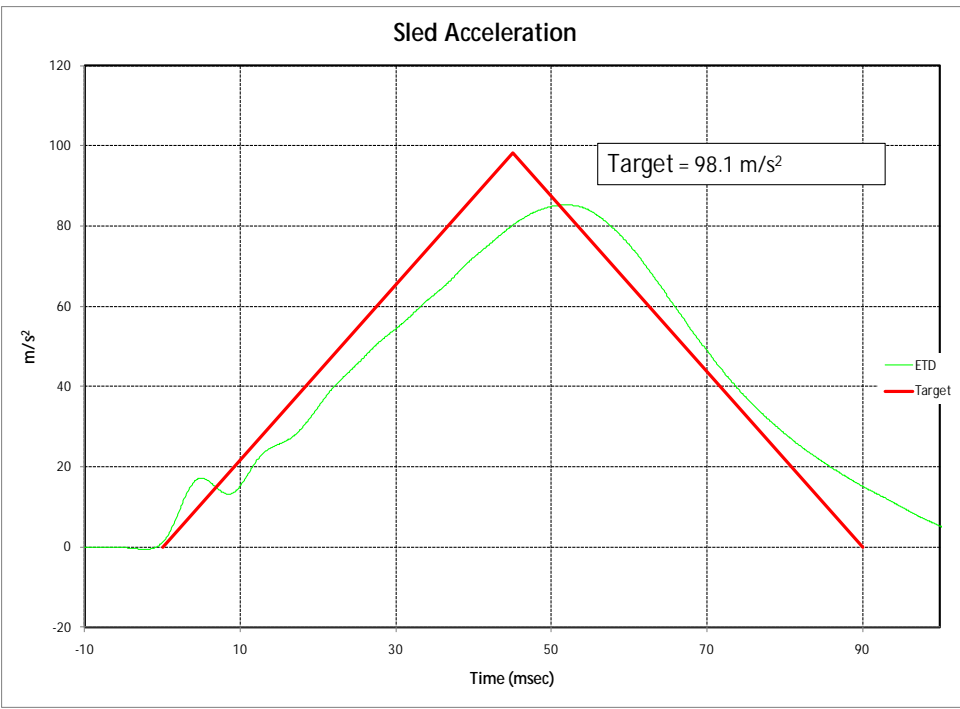
## ► Head Rest Certification Test

- Standard BioRID impact probe with large face and additional mass
  - „ Total probe mass = 118.5 kg +/- 0.1 kg (261.2lb)
- Custom ETD for advanced pulse
- Adjustable foam head rest
  - „ Mass added to sled 6.00 kg +/- 0.02 kg
- Cap contact switch



# BioRID Certification with Head Rest

- ▶ Impact pulse of 16kph to match seat testing



# WITH Headrest Channel listing

## ► Required channels

- Pendulum velocity
- Pendulum acceleration
- Sled acceleration
- T1 acceleration
- Head contact switch
- Upper neck Fx
- Upper neck Fz
- Upper neck My
- Lower neck Fx
- Lower neck Fz
- Lower neck My

## ► Suggested channels

- Upper neck Mz
- Pot A (neck link at OC)
- Pot B (neck link at T1)
- Pot C (lumbar/thorax link at T1)
- Pot D (lumbar/thorax link at sled)

# BioRID Certification Requirements

- ▶ Need to collect data
  - Multiple dummies which pass without headrest test
  - Multiple labs
  - Establish corridors on population of dummies that meets all other requirements
  - Find areas of curves that will exclude outlier dummies

# Headrest Foam Verification Test

- ▶ Mount headrest foam block to front of mini-sled
- ▶ Test Procedure
  - Mini Sled without weight package
  - H-III5F style thorax impact probe (mass 13.97 +/- 0.023 kg)
  - Impact Velocity (2.07 m/s – 2.12 m/s)
- ▶ Responses
  - Peak Pendulum Force
  - Peak Sled Acceleration



# Headrest Weight Package Verification

- ▶ Insures proper rail, sled, ETD installation and function
- ▶ Inputs
  - Fixed mass of 25.50 kg +/- 0.02 kg added to sled in place of dummy
  - Probe velocity 4.70 – 4.75 m/s
- ▶ Data channels: velocity, pendulum accel., sled accel.
- ▶ ***DRAFT*** Response corridors
  - Pendulum Force: 11340 – 9180 N
  - Peak sled acceleration: 90 - 70 m/s<sup>2</sup>
  - Peak Sled Velocity: 4.8 – 4.2 m/s
  - NEED MORE DATA

# BioRID Jacket Impact Test

## ▶ Test Procedure

- Mini Sled without weight package
- Jacket mounting adapter (Part # TRA-340)
- H-III5F style thorax impact probe (mass 13.97 +/- 0.023 kg)
- Impact Velocity (1.50 m/s – 1.55 m/s)

## ▶ Draft response corridors

- Peak Pendulum Force (1308N - 1151N)
- Peak Sled Acceleration (17.3m/s<sup>2</sup> – 15.3m/s<sup>2</sup>)



**PURPOSE:** insure consistent material stiffness amongst jackets.

# BioRID Pelvis Bottom Impact Test

## ▶ Test Procedure

- Mini Sled with weight package
- Pelvis mounting adapter (Part # TRA-330)
- H-III5F style thorax impact probe (mass 13.97 +/- 0.023 kg)
- Impact Velocity (1.50 m/s – 1.55 m/s)

## ▶ Draft response corridors??

- Peak Pendulum Force (3921N - 2944N)
- Peak Sled Acceleration ( $43.5\text{m/s}^2$  –  $31.8\text{m/s}^2$ )

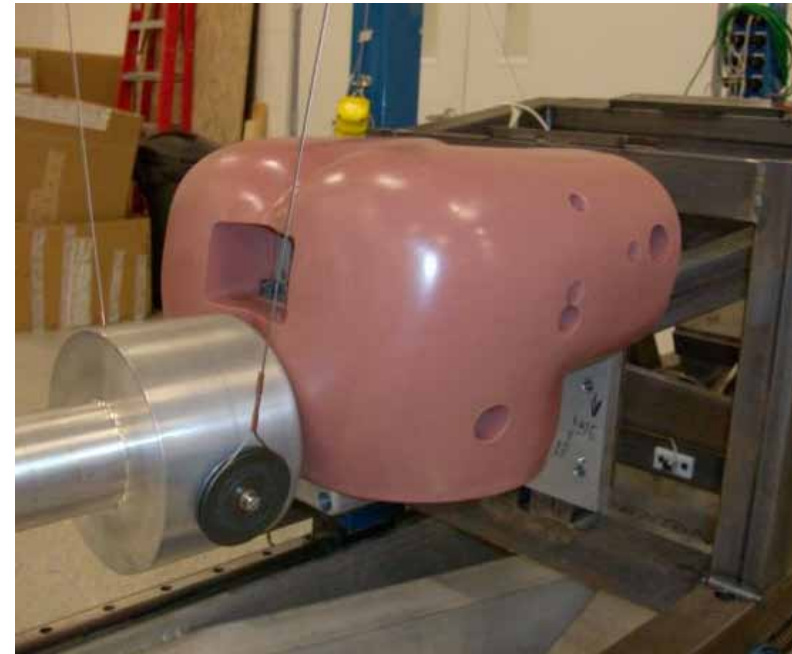


**PURPOSE:** insure consistent stiffness of the bottom of the pelvis for setup and seat interaction.



# BioRID Pelvis Back Impact Test

- ▶ Test Procedure
  - Mini Sled with weight package
  - Pelvis mounting adapter (Part # TRA-320)
  - H-III5F style thorax impact probe (mass 13.97 +/- 0.023 kg)
  - Impact Velocity (1.50 m/s – 1.55 m/s)
- ▶ Draft response corridors??
  - Peak Pendulum Force (2472N - 1809N)
  - Peak Sled Acceleration (26.7m/s<sup>2</sup> – 19.4m/s<sup>2</sup>)



**PURPOSE:** insure consistent stiffness of the bottom of the pelvis for setup and seat interaction.

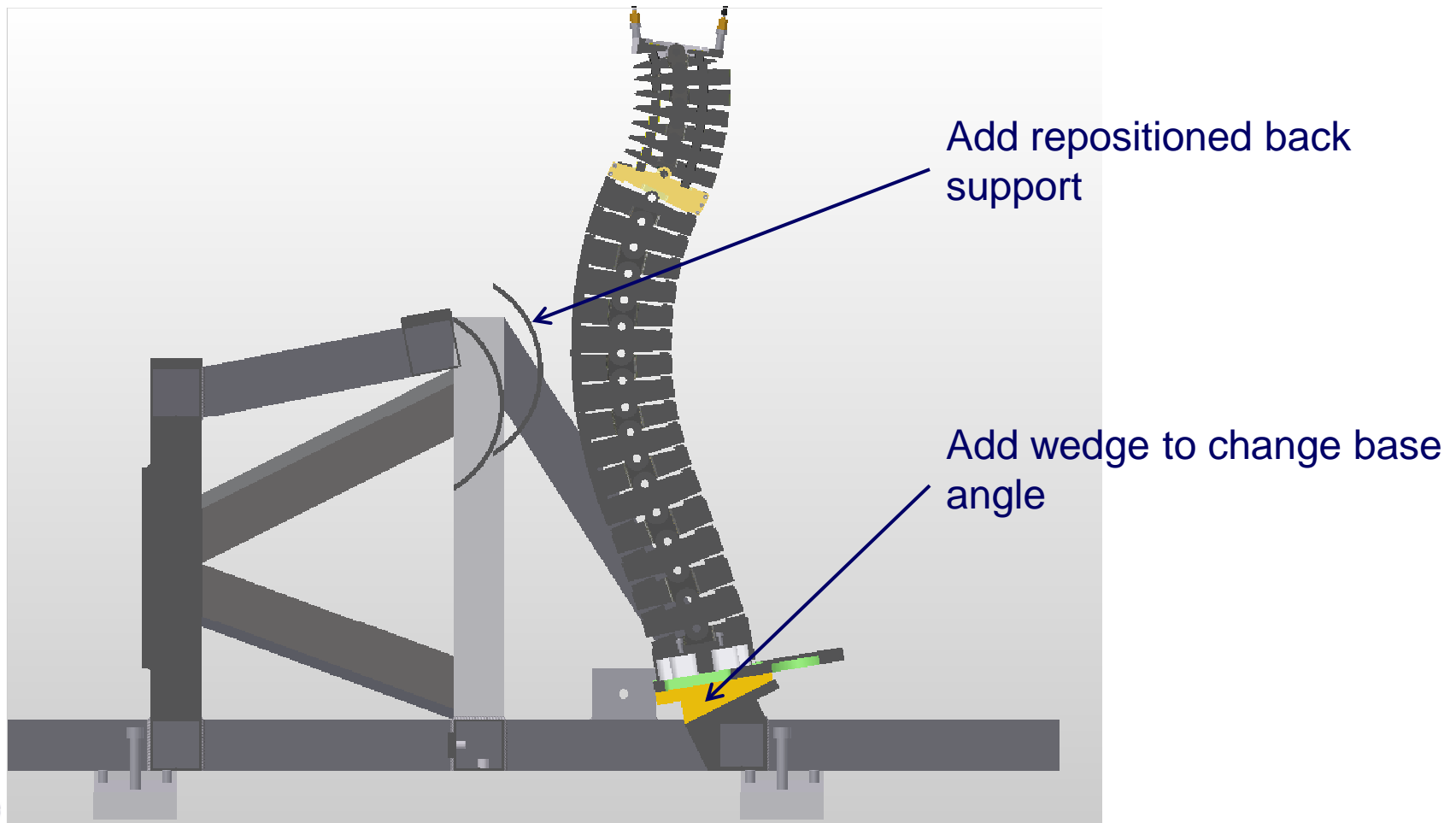
# Skull Cap Switch Option

- ▶ Conductive Cap
  - Flexible conductive cloth to drape over headrest
- ▶ Provide consistent friction between cap skin and headrest
- ▶ Same cap material as existing caps
- ▶ Need a skull cap switch for headrest test



# Upright spine certification

- ▶ It is possible to adapt the current mini-sled to do certification of upright spine setup with the correct geometry



# Approvals

- q Dummy Certification without Head Rest
  - q Accept corridors
  - q Weight package check of system & ETD
    - q Accept corridors
- q Dummy Certification with Head Rest
  - q Collect data to develop corridors
  - q Weight package check of system & ETD
    - q Collect more data to develop corridors
  - q Headrest foam verification test
    - q Collect data to develop corridors
- q OBSOLETE old test with disposable styrofoam blocks
  - q Optional use of new tests effective September 22, 2010
  - q Required use of new tests effective December 31, 2010

# Approvals

## q Component Tests

### q Jacket impact on mini-sled

- q Start using draft corridors, collect data to finalize

### q Pelvis bottom impact on mini-sled

- q Start using draft corridors, collect data to finalize

### q Pelvis back impact on mini-sled

- q Start using draft corridors, collect data to finalize

## q Skull cap contact switch

- q Add to drawings as optional

## q Develop upright spine certification test?