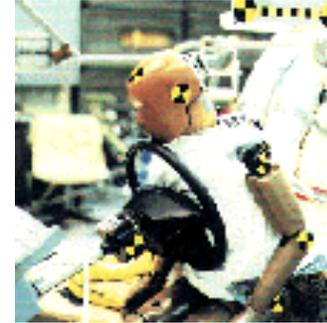


COMMON

SIMon

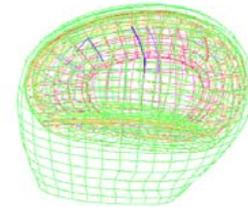


Simulated Injury Monitor

**A next generation (G2) human injury
assessment tool**



SIMon

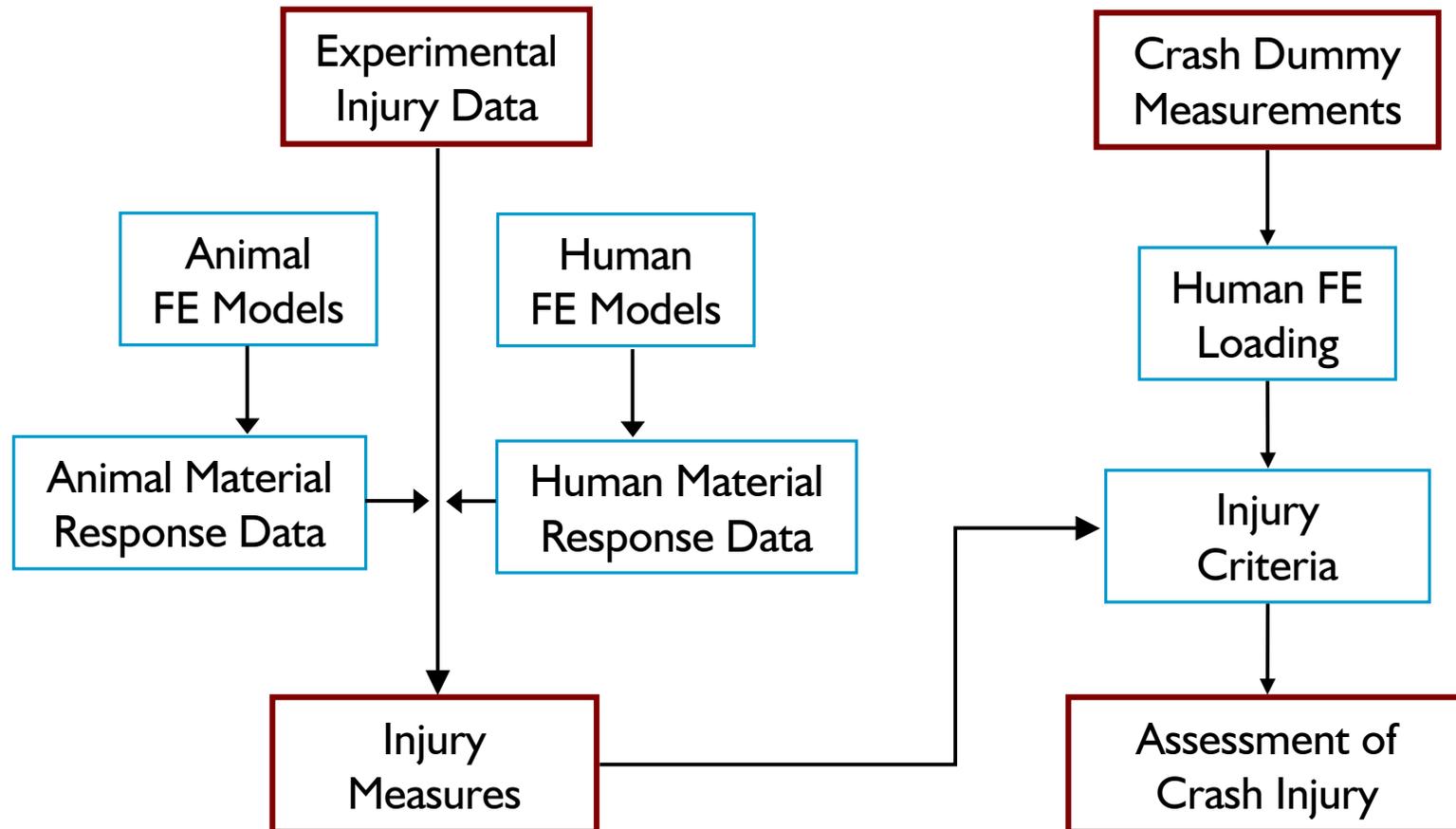


Evaluates injury potential by:

**Directly imposing crash dummy responses on
body-region-specific finite element (FE) models**

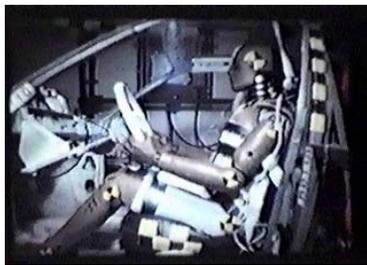
Utilizing biomechanically-based injury measures

Development of SIMon Concept

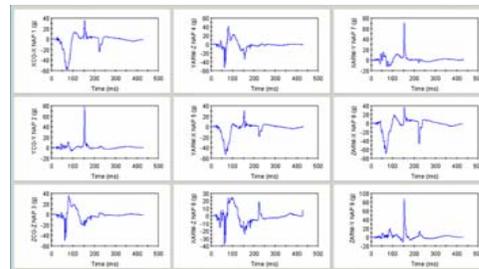


SIMon Head Injury Assessment

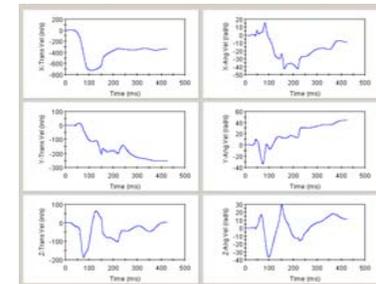
SIMon uses biomechanical measures and dynamic head responses from crash tests to assess head injury



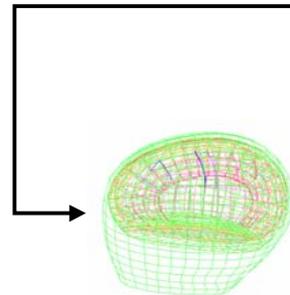
Crash Test



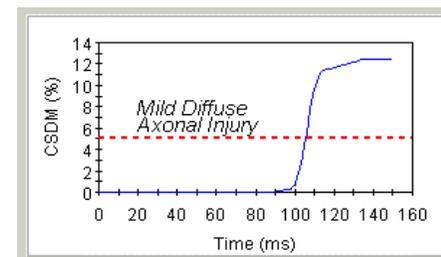
NAP Data



Load Curves



FE Head Model

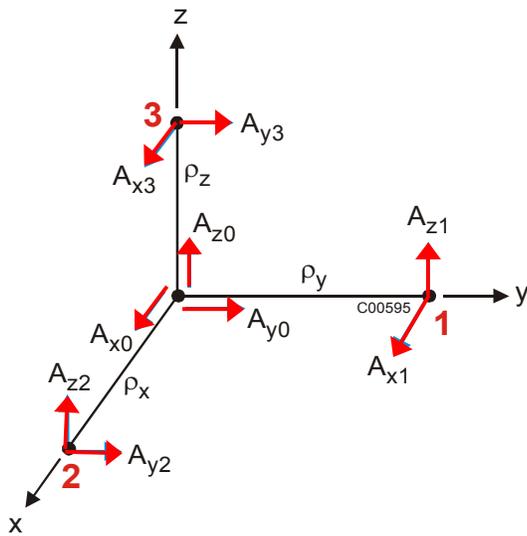


Injury Assessment

Instrumentation

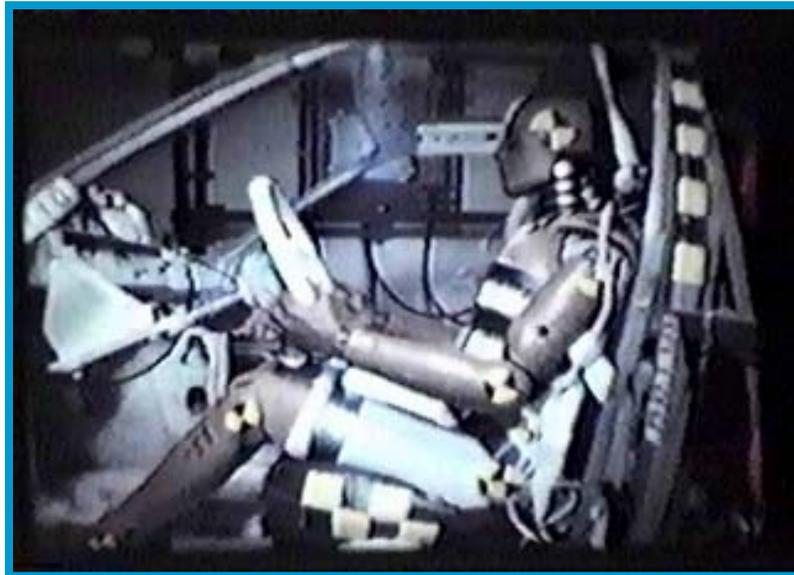
Standard Nine-Accelerometer Package (NAP)
provides full 3-D kinematic dummy head response

NAP device integrated in the HYBRID III head



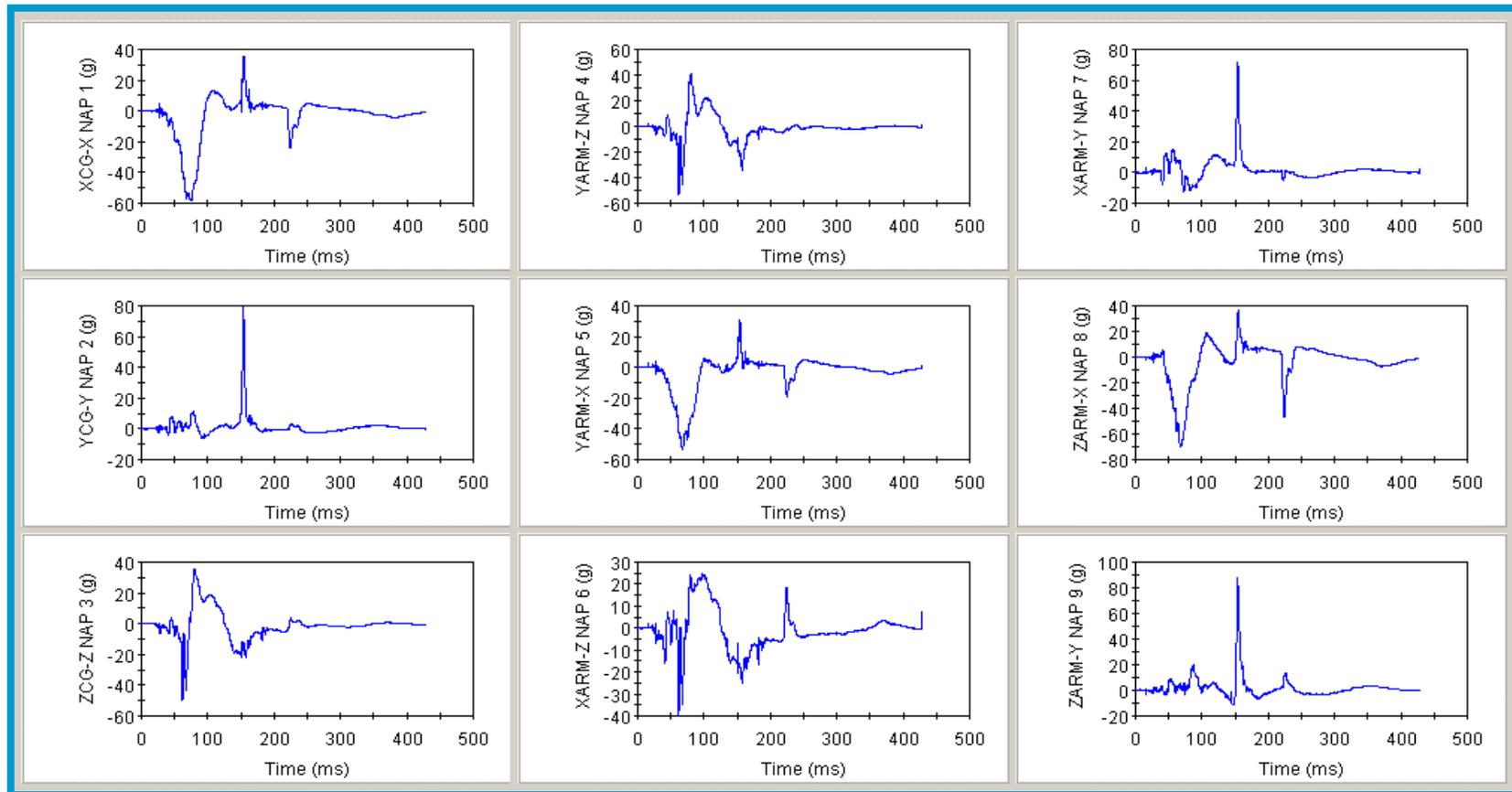
Instrumented Crash-Test Dummies

**Provide raw NAP data for SIMon Head
Injury Assessment**



Raw NAP Data

Nine acceleration-time histories are input to SIMon



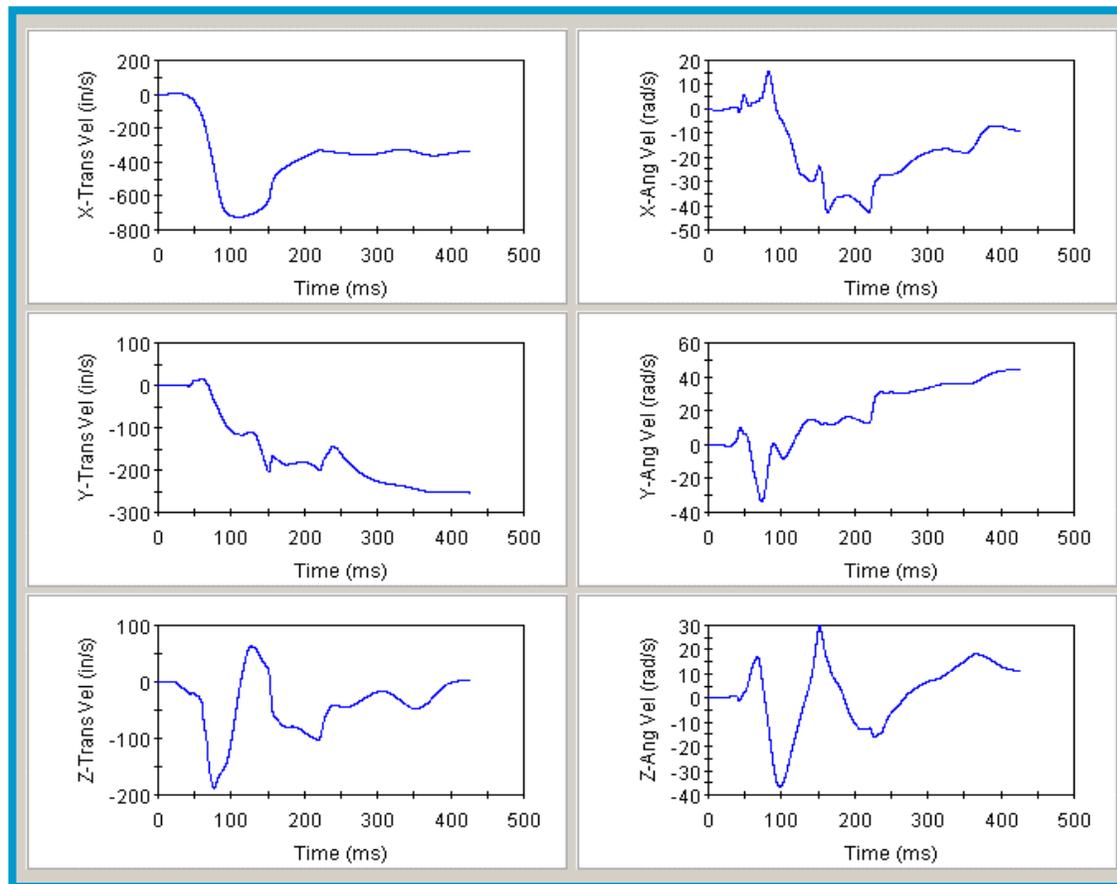
SIMon Processes NAP Data

To drive head model



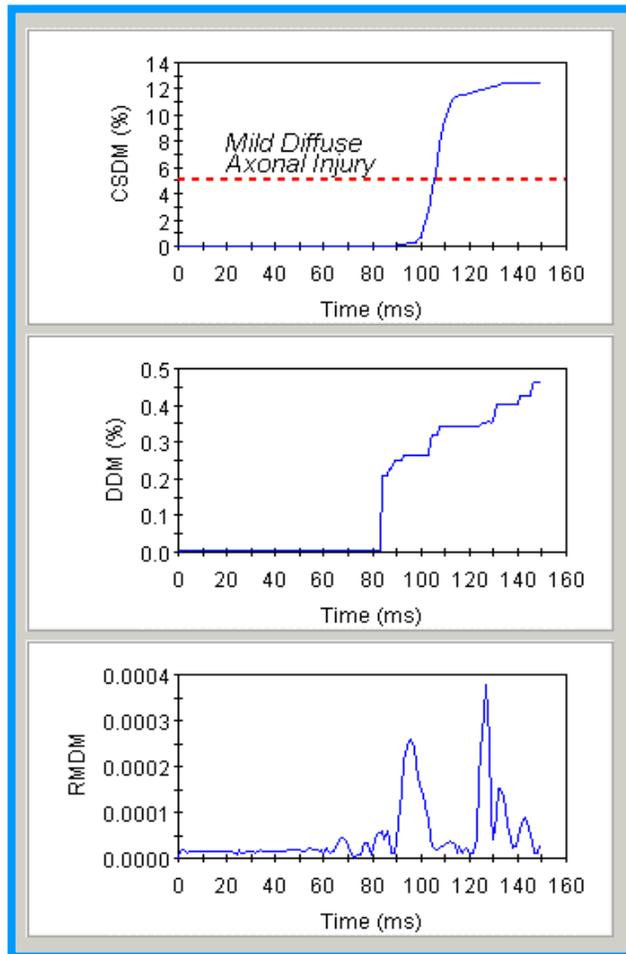
SIMon Generates Loading

Applied to FE model of the head to calculate biomechanical injury measures



SIMon Produces an Injury Summary

Based on three types of head injury mechanisms:



Diffuse axonal and microvascular injuries, tracked using a

Cumulative Strain Damage Measure (CSDM)

Focal lesions occurring in regions of extreme low pressure, tracked by the

Dilatation Damage Measure (DDM)

Acute subdural hematoma reflecting relative tissue displacement, given by

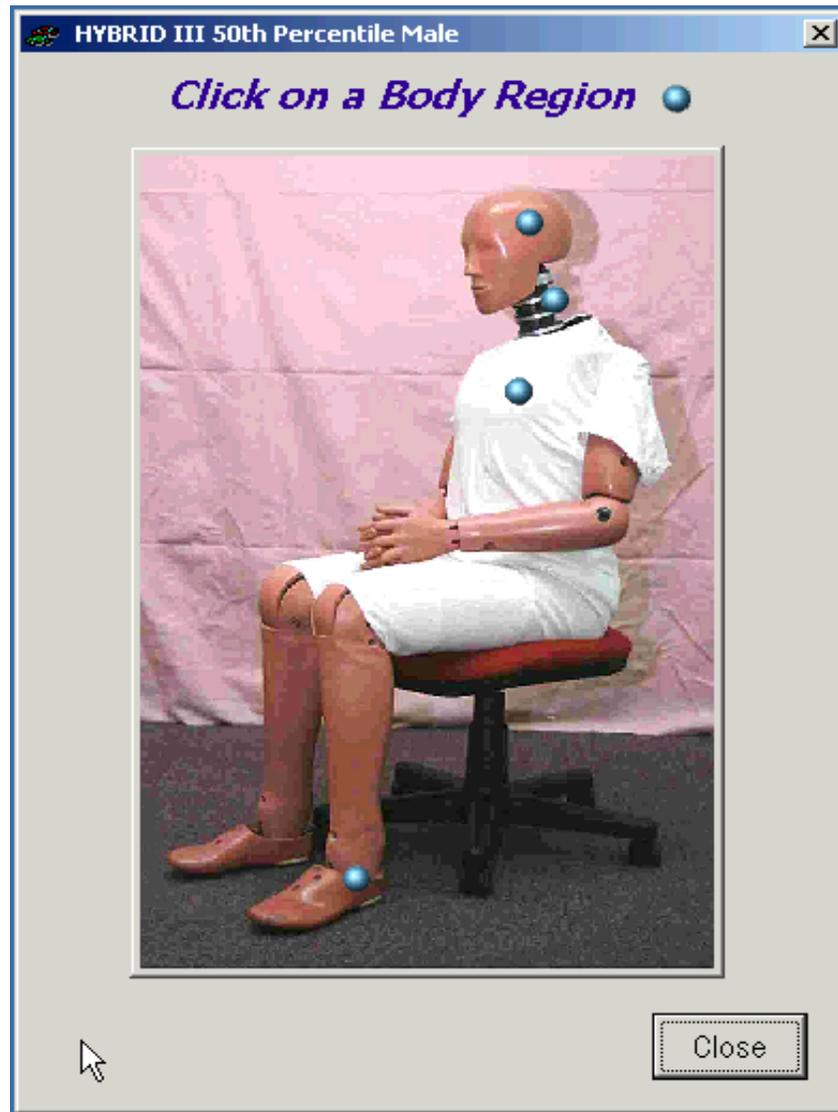
Relative Motion Damage Measure (RMDM)

Sample SIMon Procedure

Step One: Select the Dummy Used



Step Two: Select Body Region



Step Three: Add or select test

HEAD INJURY - TEST DATA SELECTION

User Test Number

1004
1502
1758
1789
2075
2076
2143
2146

Use NHTSA database?

New Test Delete Test

Head Acceleration View Database Help Close

Test Query DataBase Settings Exit All

Test Title

Test Configuration

Test Objective

Test Date Test Reference Test Performer

Contract Number Contract Monitor Closing Speed (km/hr)

Test Comments Impact Angle (deg)

Status

BEGIN BY SELECTING A NHTSA TEST NUMBER

Step Four: Calculate Dummy Head Response

HEAD INJURY - TEST DATA SELECTION

User Test Number

2076
2143
2146
2321
2387
2446
2447
2448

Use NHTSA database?

New Test Delete Test

Head Acceleration View Database Help Close

Test 2448 Query DataBase Settings Exit All

Test Title

Test Configuration

Test Objective

Test Date Test Reference Test Performer

Contract Number Contract Monitor Closing Speed (km/hr)
400

Test Comments Impact Angle (deg)

Status
Selected Head Acceleration for NAP data and Head Injury Estimates ...

Step Five: Assess Brain Injury

HEAD INJURY

TEST: 2448 [Recalculate] [Help] [Close]

NAP Rotation (deg): PHI: 0, THETA: 0, PSI: 0

Initial Velocity (in/sec): X-VEL: 400, Y-VEL: 0, Z-VEL: 0

NAP Arm Lengths (inches): X: 2.2, Y: 1.9, Z: 3.2

Plot Selection:

- NAP translational accelerations (nine gauges)
- Resultant head acceleration
- Angular displacement
- Angular velocity
- Angular acceleration

[Trace Polarity Editor] [HIC] [BIC] [Calculate Brain Injury Criteria]

[Maxima] Tmin: 0 Tmax: 0 [Plot]

Status: Angular acceleration plotted in body coordinates

X-Ang Acc (rad/s/s) vs Time (ms)

Y-Ang Acc (rad/s/s) vs Time (ms)

Z-Ang Acc (rad/s/s) vs Time (ms)

Potential Applications

SIMon can be used for injury assessment of other body regions, and can be applied to tests utilizing crash dummies of any size



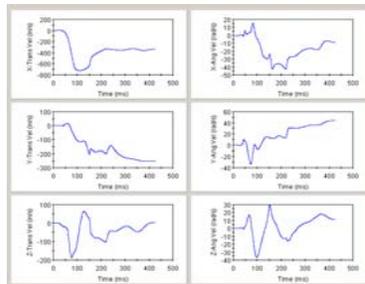
Crash Dummy Family



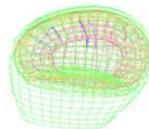
Test Subject



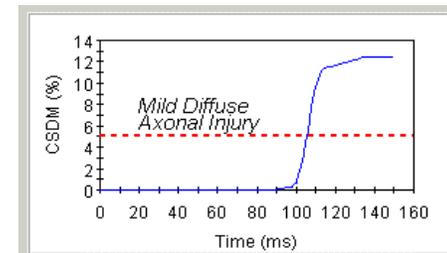
Crash Test



Realistic Loading



Detailed FE Model



Injury Assessment



Start Over