LASER SCANNING OF TEST SETUP

BOOST THE VALUE OF VEHICLE SAFETY SIMULATION

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Introduction

- Out of Position Load Case and Road Statistics
- Injuries
- Test and simulation setup
- First test and simulation
- Sensitivity study on dummy position
- 3 Dimensional Scanning of dummy
- Correlation of simulation and test
- Simulation vs. test
- Conclusion

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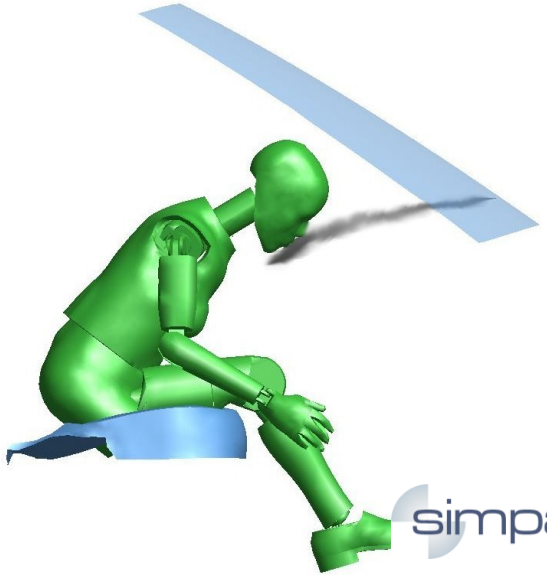
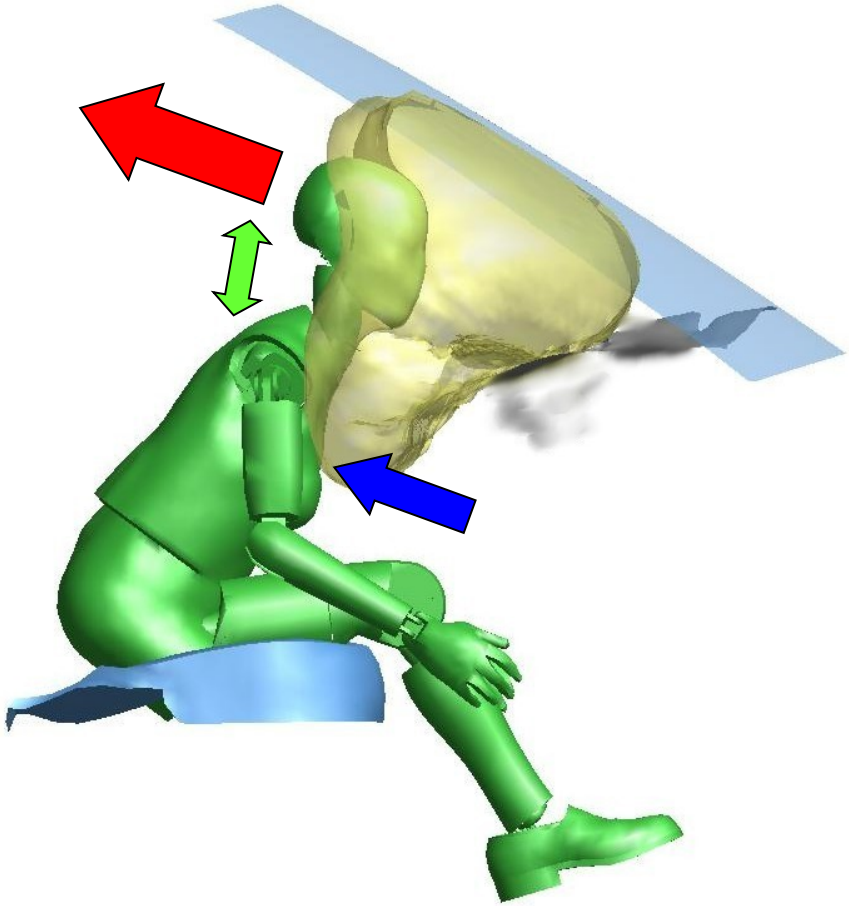
Out of Position

- What is Out of Position?
  - Adult/Child seated out of position
  - Airbag deployment in a low severity crash
  - Currently no legal requirements
  - In-house acceptance criteria
- Road Statistics
  - Airbags saves 1000's of lives … but
  - In USA alone 168 deaths due to OOP
- Aim of simulation and testing
  - Simulate/test several types of OOP
  - Extract and analyze dummy loads
  - Test new airbag designs, fold patterns etc.
  - Improve safety of Airbags



Injuries

- Head Injuries
  - **HIC** (Head Impact Criteria)
  - Acceleration of head
- Neck Injuries
  - **NIJ** (Neck Injuries)
  - Forces exerted to neck
- Chest Injuries
  - **Chest** acceleration
  - **Chest** compression



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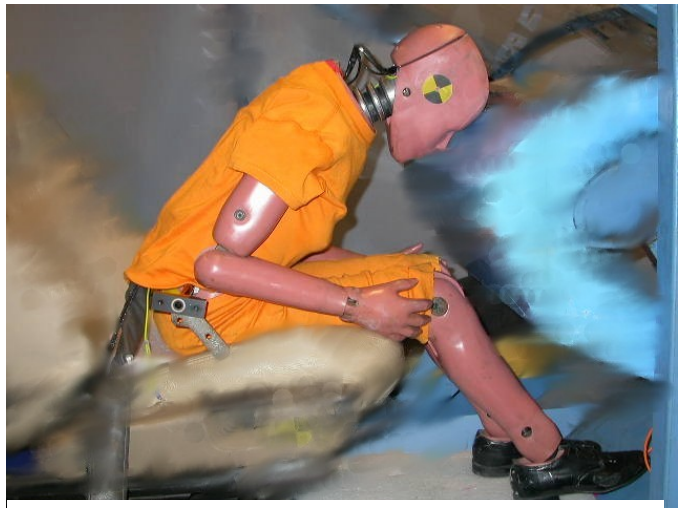
Test and Simulation Setup

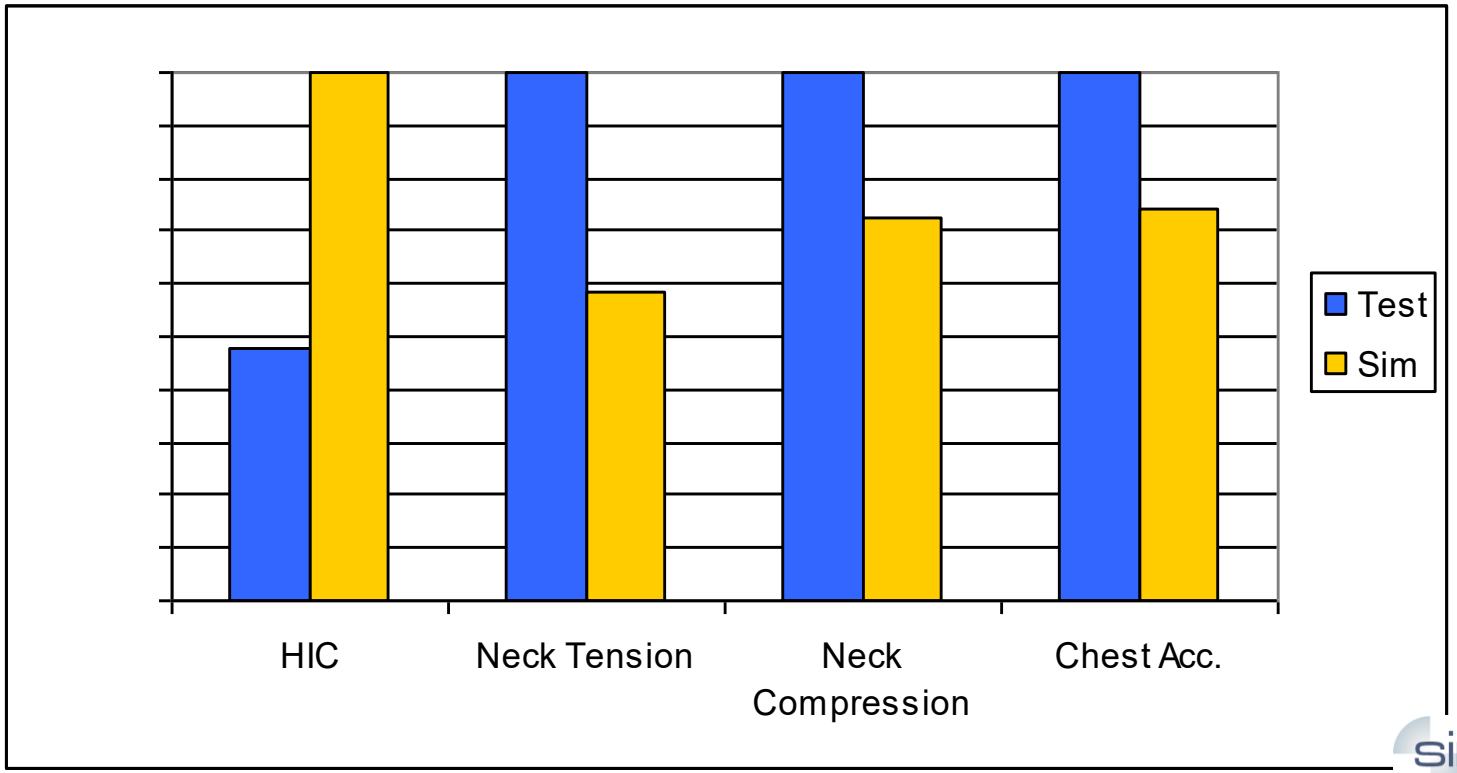
- Test Setup
  - Passenger Airbag Module
  - Generic rig (no BIW available)
  - Generic IP and seat
  - Hybrid III 5%'ile Female Dummy
  - Dummy positioned to CAD using an SAE 2D dummy



- Simulation Setup LS-DYNA
  - Correlated Passenger Airbag
  - Latest Design Level BIW, IP and seat
  - Hybrid III 5%'ile Female CAE Dummy
  - Dummy positioned to In house guidelines and within dummy limits

First Test and Simulation

- Less than good results
- Poor correlation although similar trends
- Possible explanation → differences in dummy position



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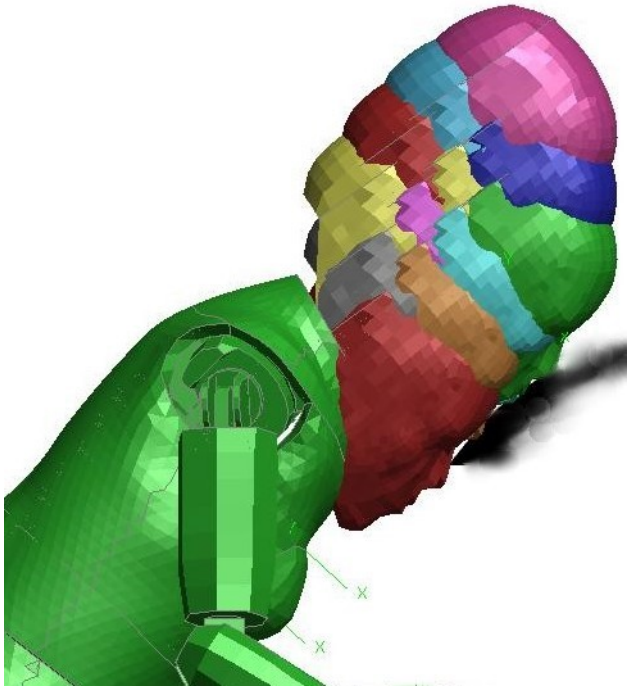
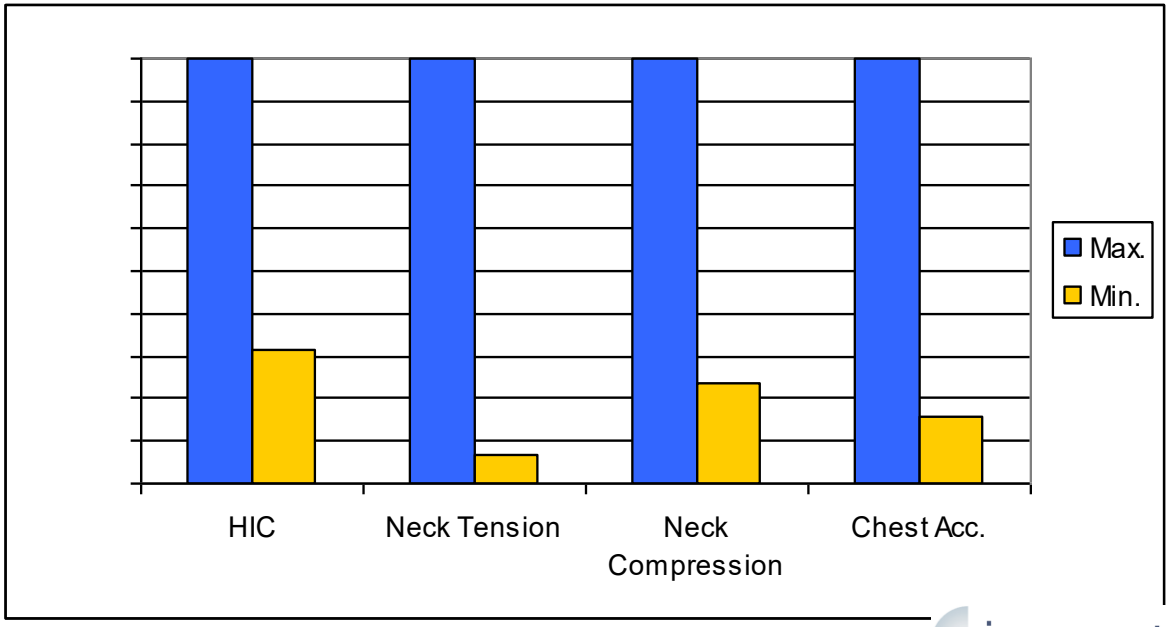
Sensitivity Study on Dummy Position

- Sensitivity study through simulation
- 12 Different dummy positions simulated
- Substantial differences in injuries
- Synchronisation of FEA and test dummies necessary





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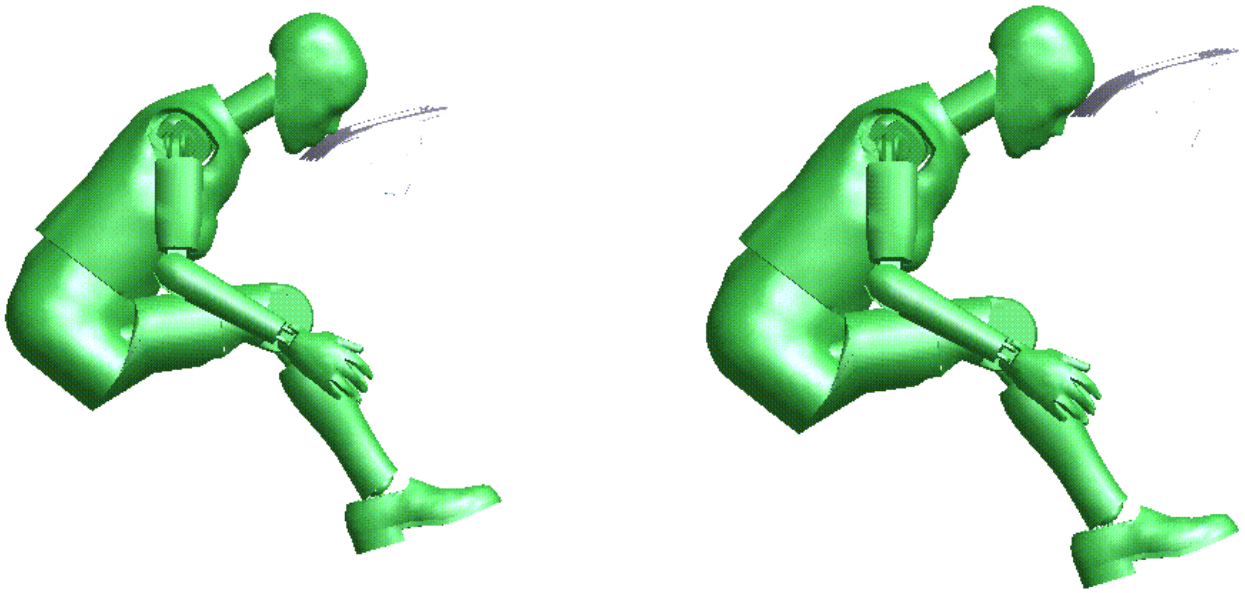
Sensitivity Study on Dummy Position



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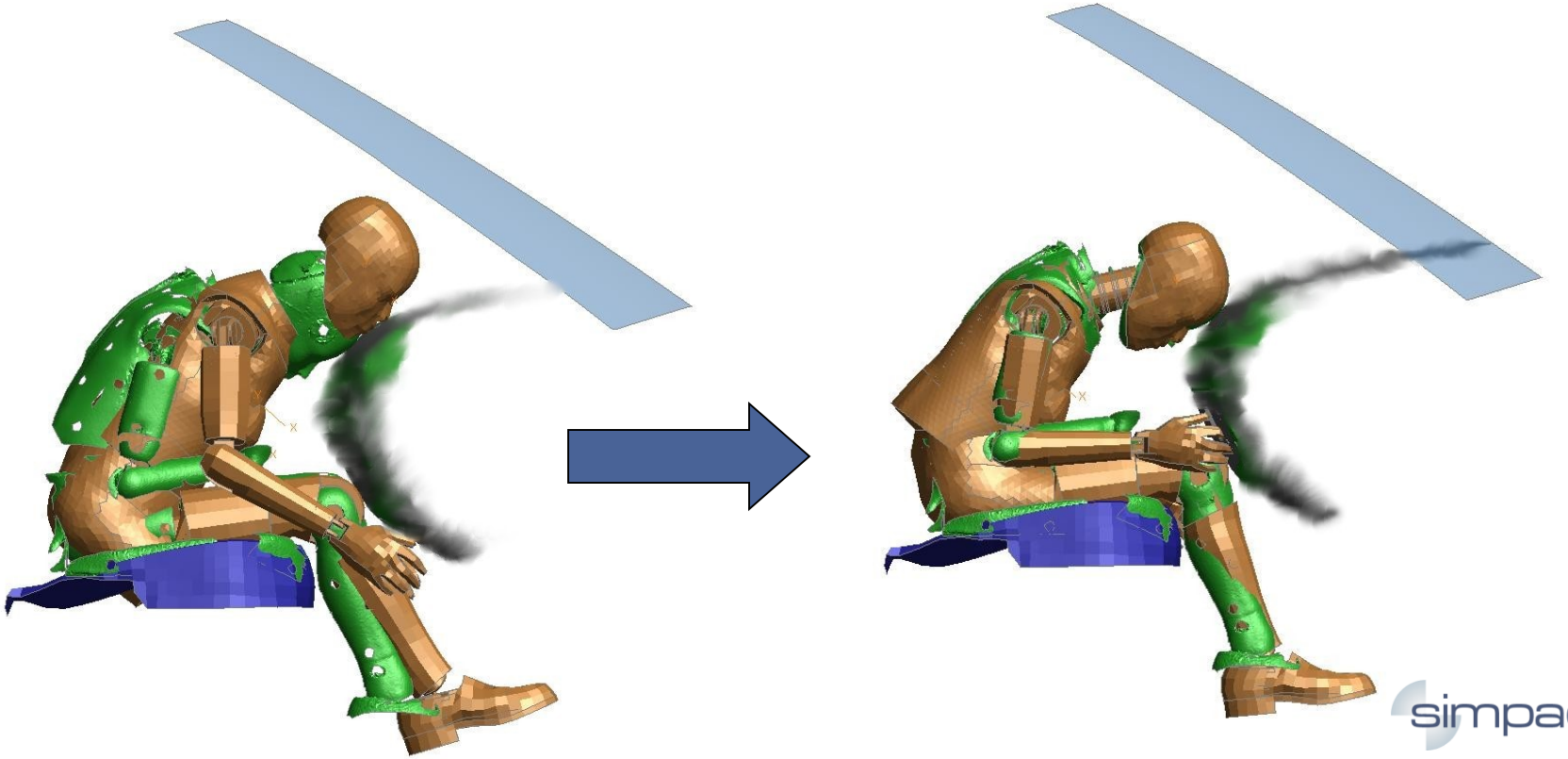
3D Scanning

- Scanning Setup
  - Latest design buck including IP and seat
  - Dummy positioned using correct guidelines
  - Setup and scanning time about 2 hours
  - Scanned surfaces used as master for both test and simulation

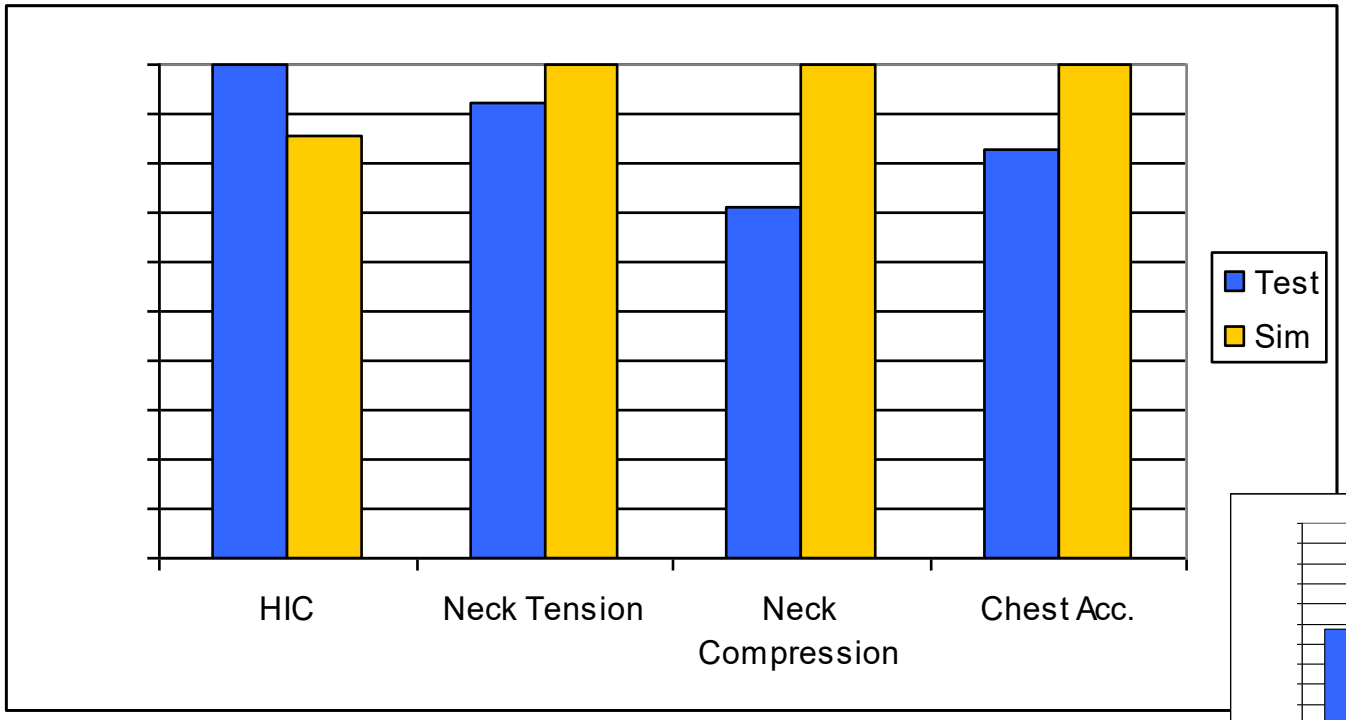
Synchronisation of FEA and Test Dummies

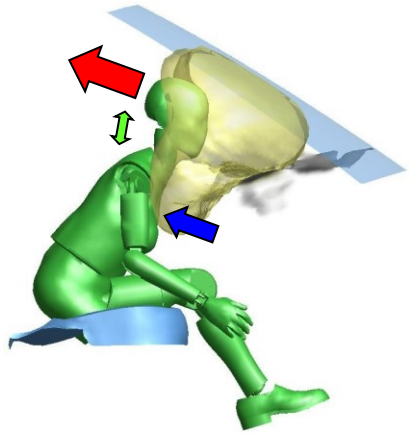
- Scanned master surfaces overlaid with simulation model
- FEA dummy repositioned
- Test dummy repositioned with input from FEA dummy

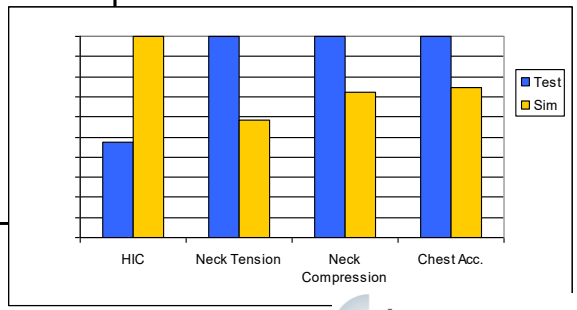


Correlating Simulation and Test

- Improved results
- Better correlation … (with room for further improvement)







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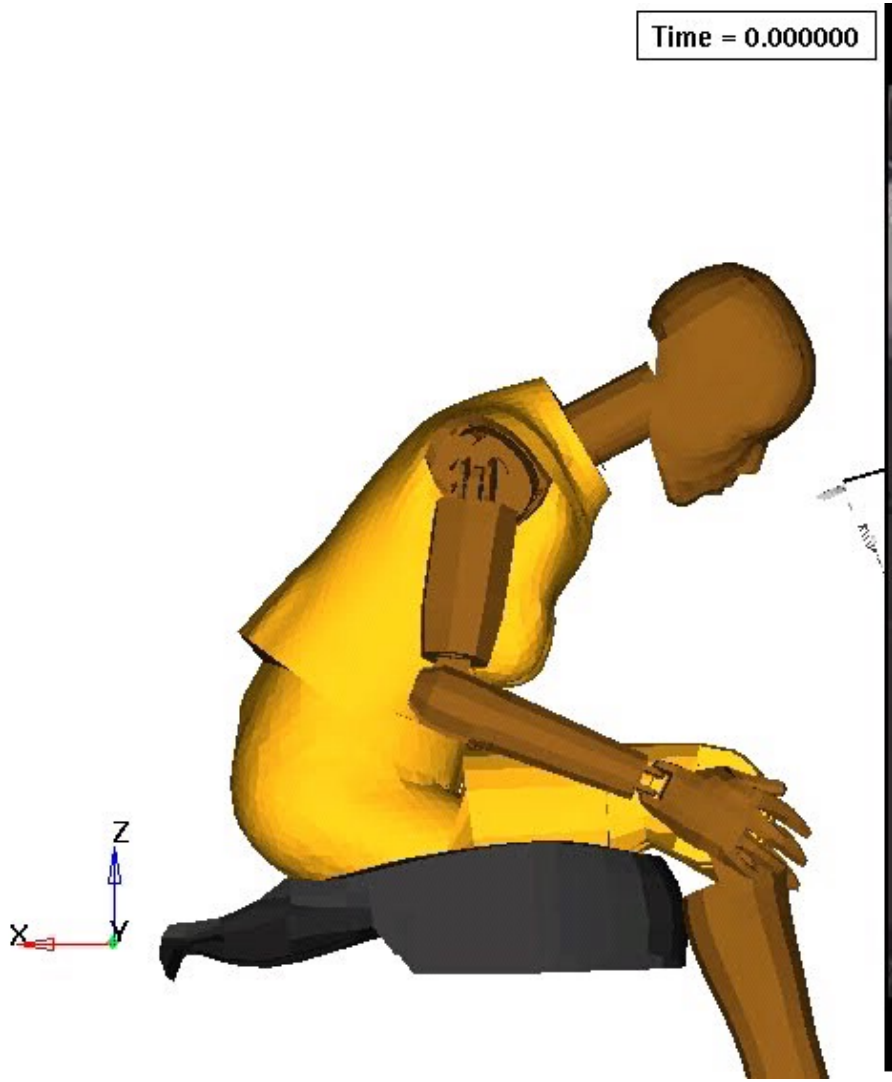
Correlating Simulation and Test



Simulation vs. Test

Simulation	vs.	Test
+ DOE		Reality Check +
+ Robustness		Airbag changes +
+ Sensitivity		Proof of airbag module +
+ Latest design level		Expensive -
+ Speed of change		Non-representative rig parts -
+ Repeatability		Test to test variation -
- Uniform Pressure PAB		Slow speed of change -
- CFD still too time consuming		

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Conclusion

- A sound correlation between simulation and testing → springboard has been created for parallel development

- The synergy between test and simulation and with the aid of 3D scanning → significant reduction in both development time and risk

- Ultimately → A safer airbag design

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