



Royalty-free THUMS

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VIRTUAL - OSCCAR workshop

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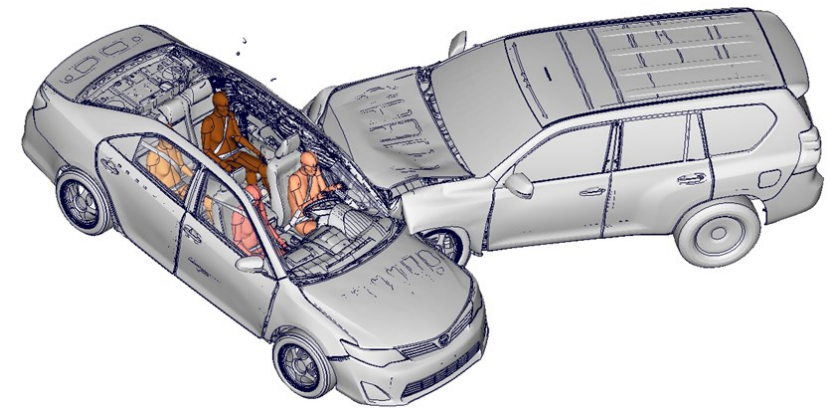
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1. About Royalty-free

Background:

- THUMS is now widely used for vehicle safety research.
- Future updates should be made based on user needs.
- Royalty-free license may bring further expansion and evolution of THUMS.



1. About Royalty-free

What models for free from January 2021?

- Version 4 Occupant AM50, AF05, AM95, 3YO, 6YO, 10YO
- Version 4 Pedestrian AM50, AF05, AM95, 3YO, 6YO, 10YO
- Version 5 Occupant AM50, AF05, AM95
- Version 6 Occupant AM50, AF05, AM95

What else?

- Validation Datasets for Each Model
- Other Variation Models for Research Collaboration

1. About Royalty-free

Terms and conditions: (under development)

- Original copyright permanently belongs to TOYOTA.
- User needs to register information such as name and affiliation.
- THUMS can be modified and shared with other registered users but free of charge. (Commercial support is OK.)
- Users are obliged to inform TMC what they share with whom.

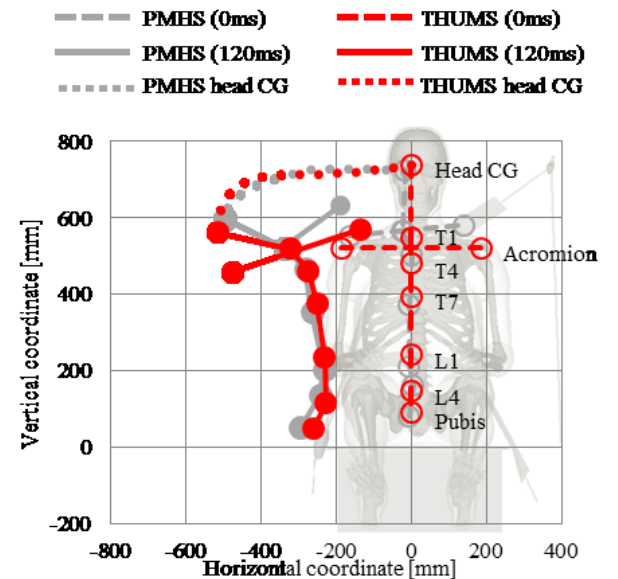
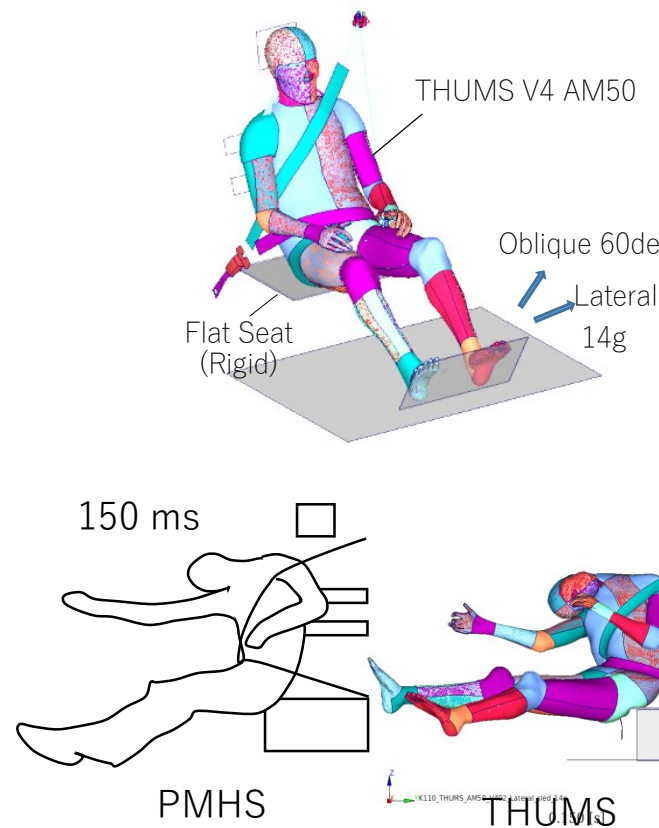
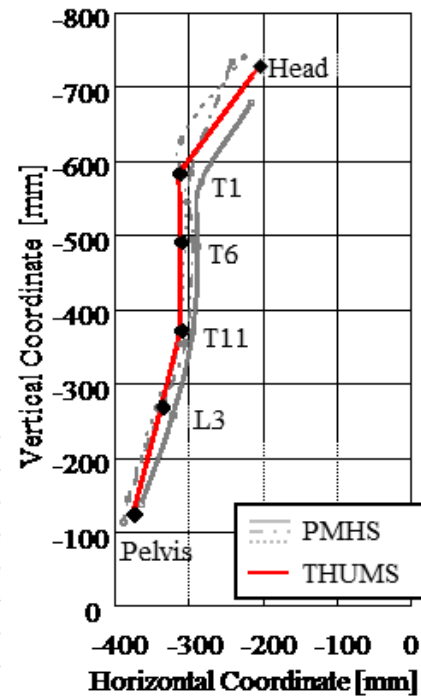
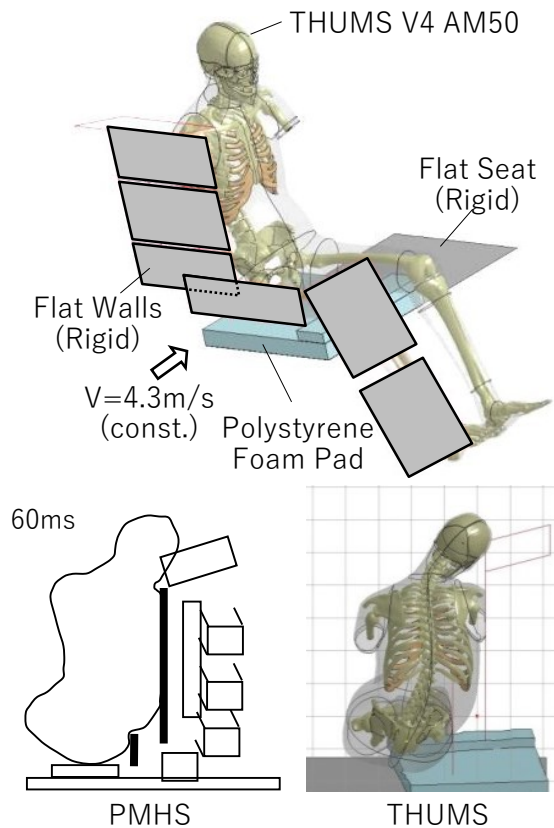
Note: Existing users are recommended to switch to new agreement.

2. Use for Virtual Testing

Load Cases	Available THUMS Models		Features
Far-side Impact	V4 OCC	AM50	(Original)
Rear Impact	V4 OCC	AM50, AF50	Cervical Joint Capsules
Frontal Impact	V4 OCC	AM50, AF05, 10YO, 6YO	Aging Effects on Ribs
Pedestrian Impact	V4 PED	AM50, AF05, AM95, 6YO	Walking Postures
Pre-collision	V6 OCC	AM50, AF05, AM95	Muscle Responses
<i>ADS Posture</i>	<i>V7 OCC</i>	<i>AM50, Obese, AF05</i>	<i>Abdominal Soft Tissues</i>

2. Use for Virtual Testing: Far-side Impact

- Previously validated to both near-side and far-side impact tests

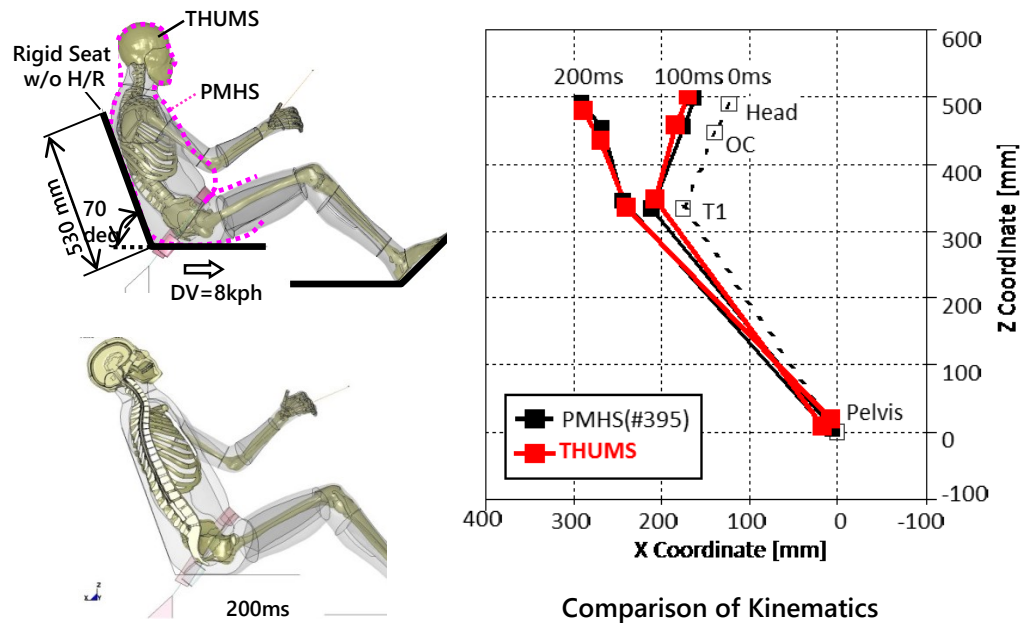


Near-side Impact (Lessley et al. 2010)

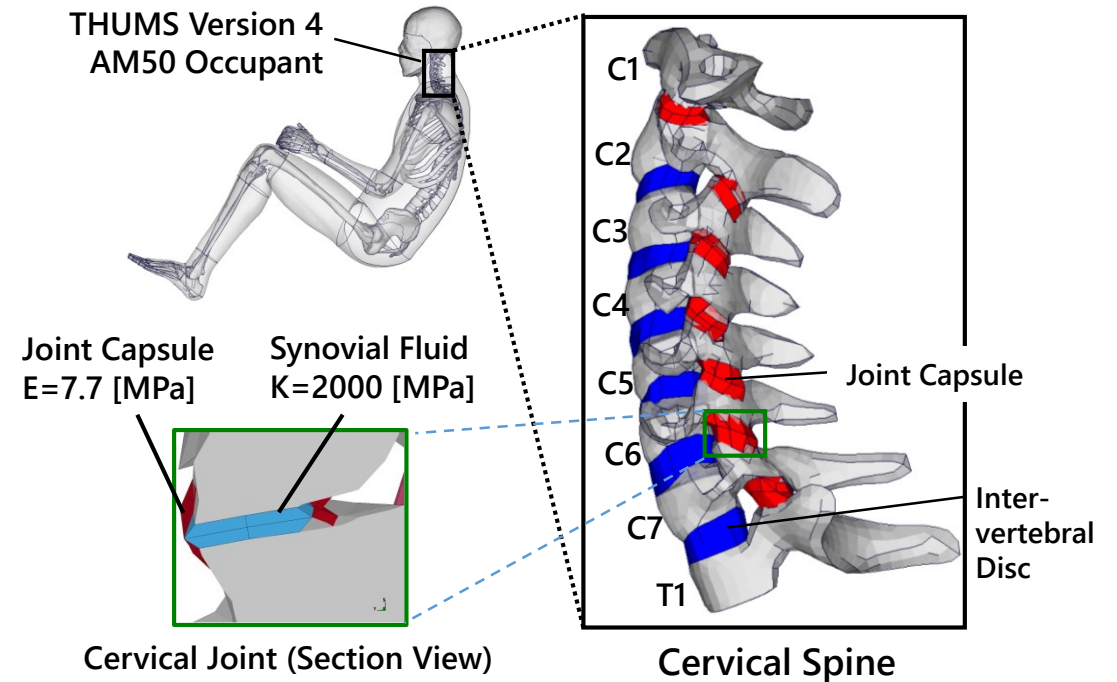
Far-side Impact (Forman et al. 2013)

2. Use for Virtual Testing: Rear Impact

- Previously validated to low-speed rear impact tests
- Modeling of cervical joint capsules for both AM50 and AF50



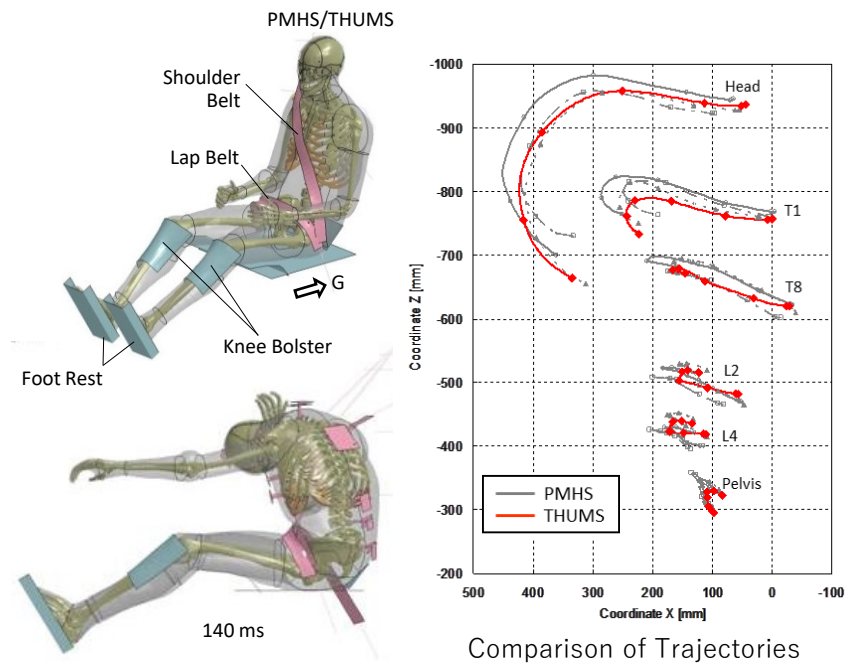
Validation to PMHS Rear Impact Tests
(White et al. 2009)



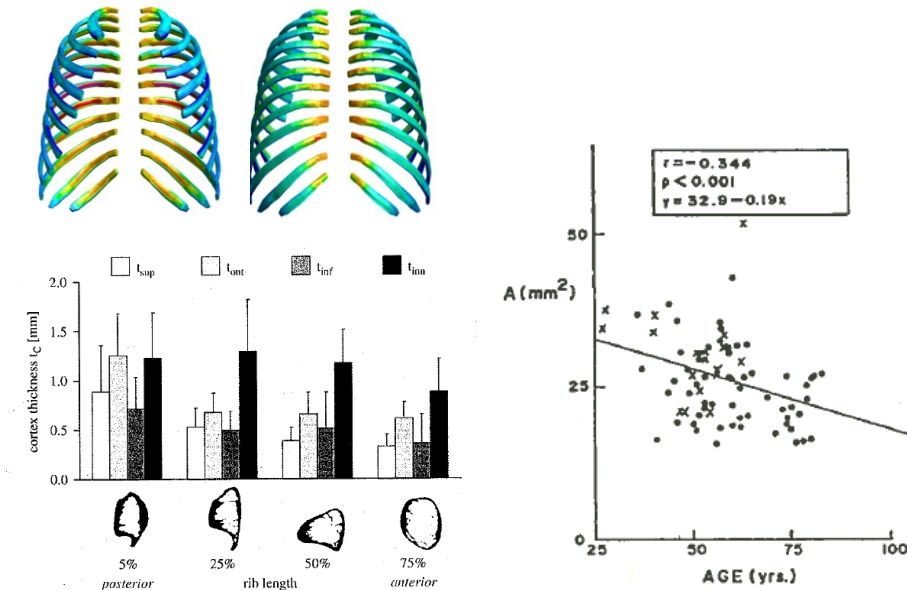
Modeling of Cervical Joint Capsules

2. Use for Virtual Testing: Frontal Impact

- Previously validated to frontal impact tests
- Realistic rib cortical bone to better predict rib fracture of elderly



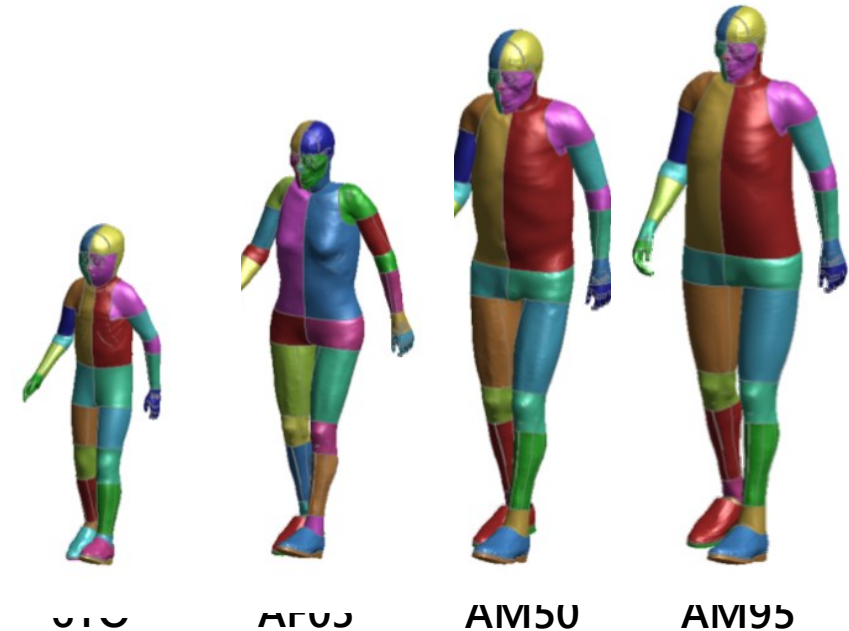
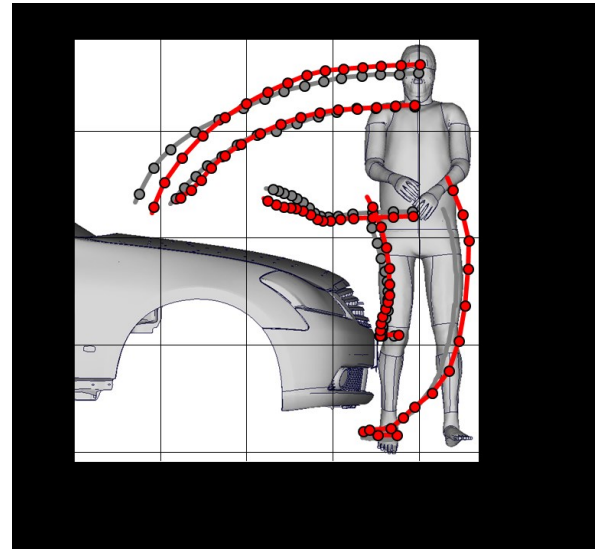
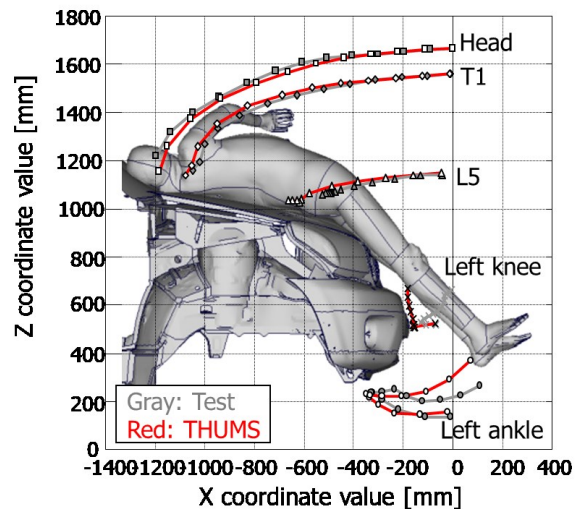
Validation to PMHS Frontal Impact Tests
(Shaw et al. 2009)



Aging Effect on Rib Cortical Bone
(Mohr et al. 2007, Stein et al. 1976)

2. Use for Virtual Testing: Pedestrian Impact

- Previously validated to pedestrian impact tests
- Different body size models in walking posture for TB024

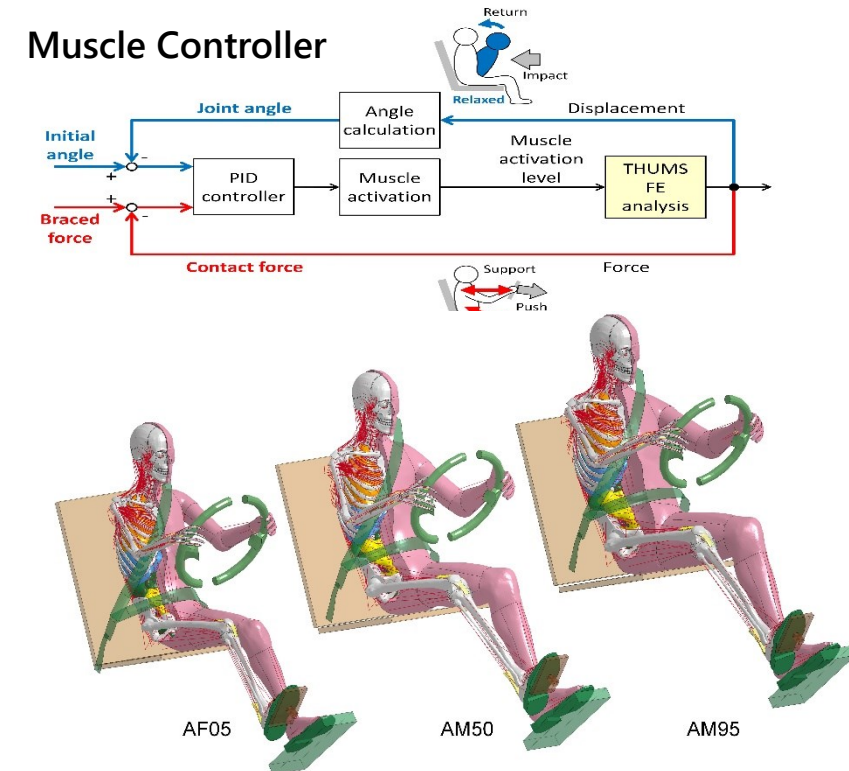
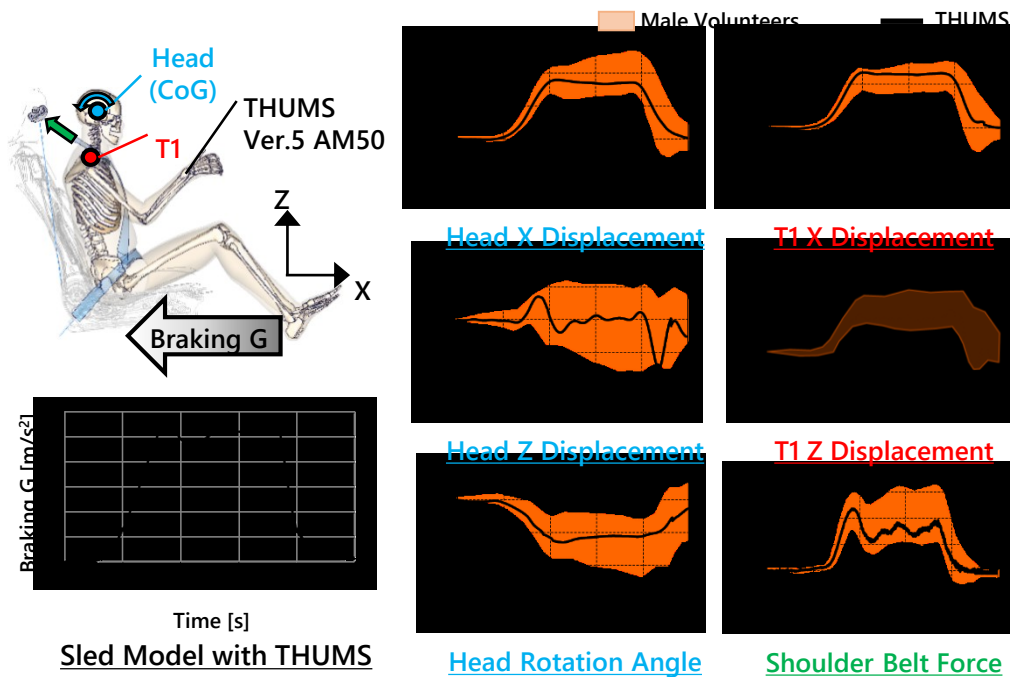


Validation to PMHS Pedestrian Impact Tests
(Schroeder et al. 2008, Subit et al. 2008)

Different Body Size Models
(Euro NCAP TB024)

2. Use for Virtual Testing: Pre-collision

- Previously validated to volunteer kinematics in braking tests
- Both pre-collision and in-collision simulations are executable



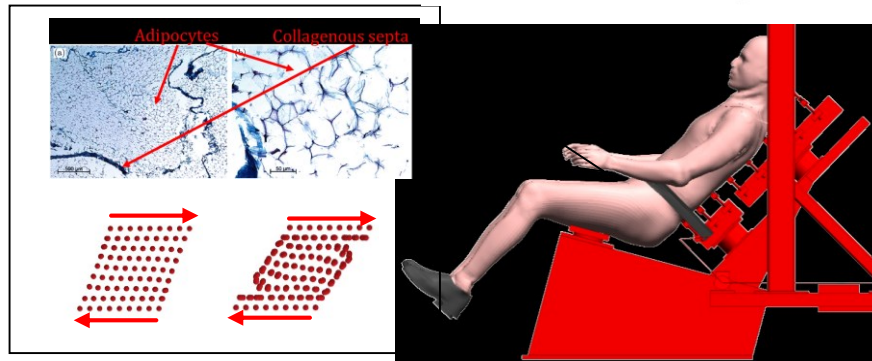
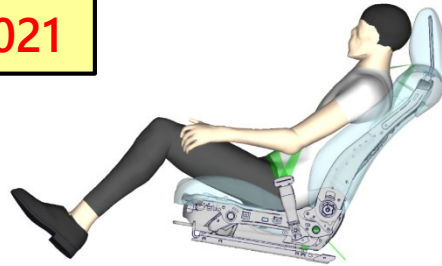
THUMS V6 AF05/AM50/AM95

Validation to Volunteer Braking Tests
(Ólafsdóttir J M, et al. (2013))

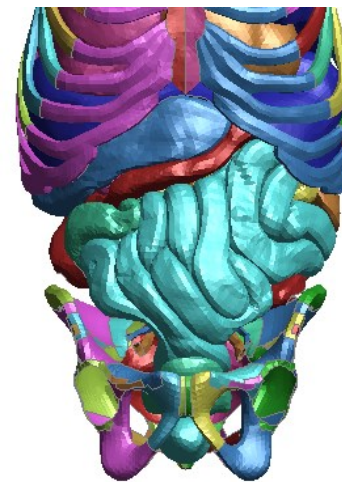
2. Use for Virtual Testing: ADS Posture

- V7 under development to represent occupant ADS posture
- Modeling of abdominal soft tissue to simulate seatbelt interaction

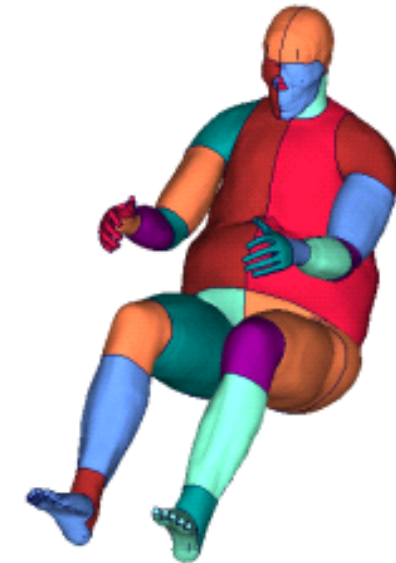
To be completed in 2021



Validation to PMHS Reclined Tests
(CSRC-UVA Research Project)



Small Intestine
and Mesentery



Obese Occupant

Modeling of Abdominal Soft Tissue

2. Use for Virtual Testing

- ✓ Availability of Base Models
 - ✓ Validation to Test Data
 - Certification - TBD
 - Encryption - Possible
 - Free Access - from 2021
- *Ready to Use*

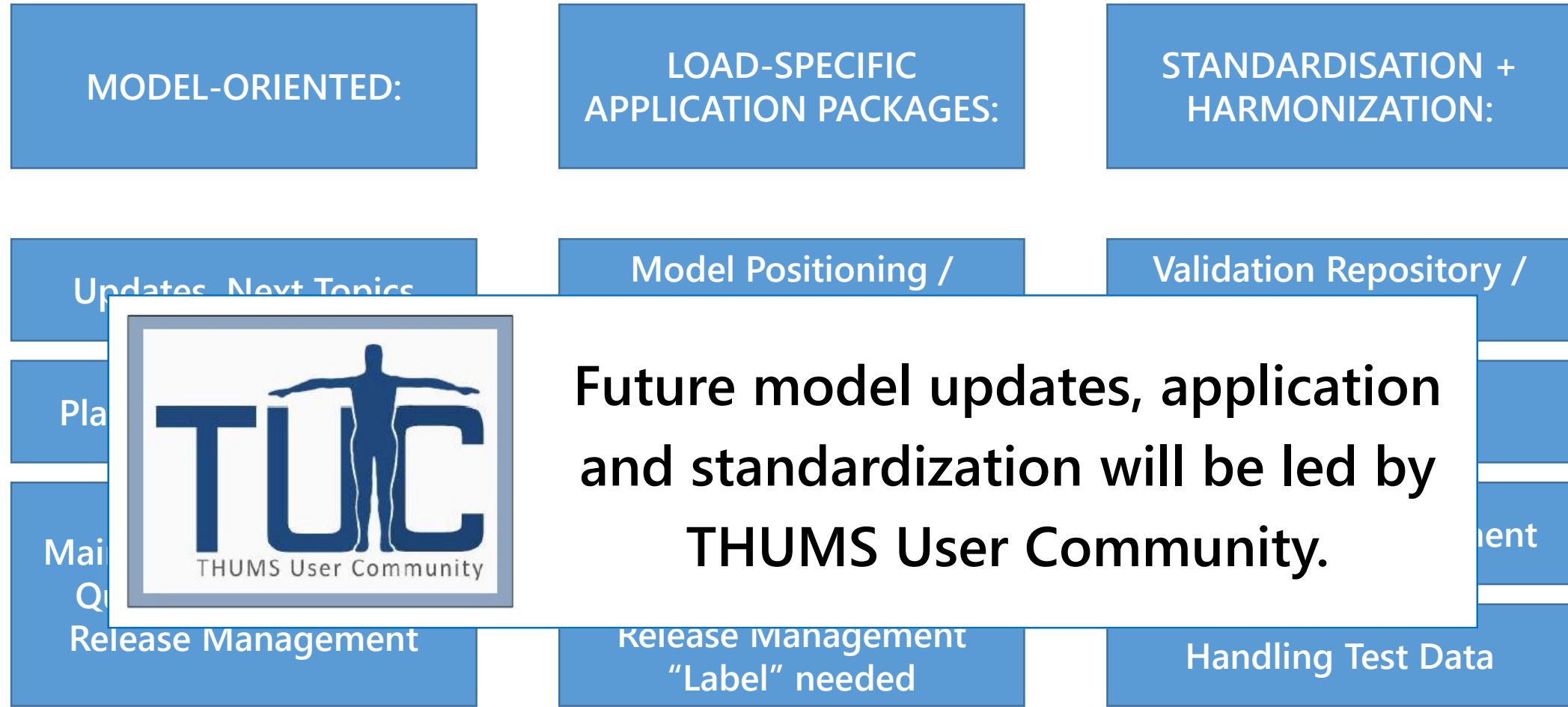
3. Future Updates

Versions	Features	Release
V4.1 OCC (AF05, AM95)	Pelvis-Lumbar-Rib Geometry	Jan 2021
V6.1 OCC (AF05, AM95)		
V7 OCC (AM50, AF05, AM95)	Abdominal Soft Tissue	End of 2021

Note:

- *No more updates by Toyota after V4.1, V6.1 and V7*
- *No more supports by Toyota like we did for TB024*

3. Future Updates



Questions?

Further information will be provided by January 2021.