LS-DYNA Model Development of the Harmonized Hybrid III 05F Crash Test Dummy

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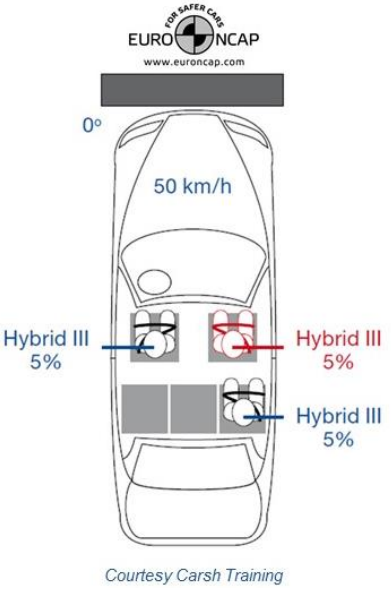
1 Introduction

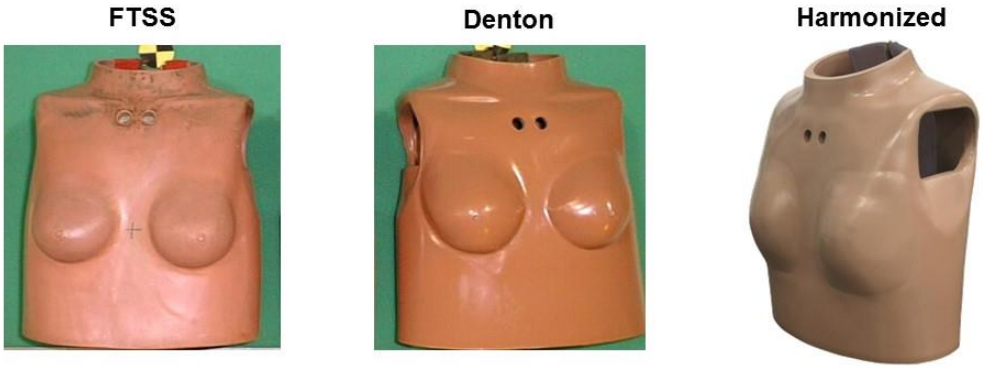
- Euro NCAP 2015 Protocols



- From January 2015 on the HIII 5th is used in full width tests
- Dummy configuration
  - Humanetics harmonized design
  - SAE Harmonized jacket
  - Neck shield ABA-211-DN
  - ASIS Loadcell for dummy on rear seat (criteria / modifier for submarining)
- Euro NCAP dummy definition is now also being proposed for future updates to R94
  - Decision during May 2015 GRSP meetings

Fig.1: Introduction

2 H305 Jacket comparison



- Different structure, geometry and materials -> different response

Fig.2: H305 Jacket hardware design comparison

3 Harmonized rib model validation

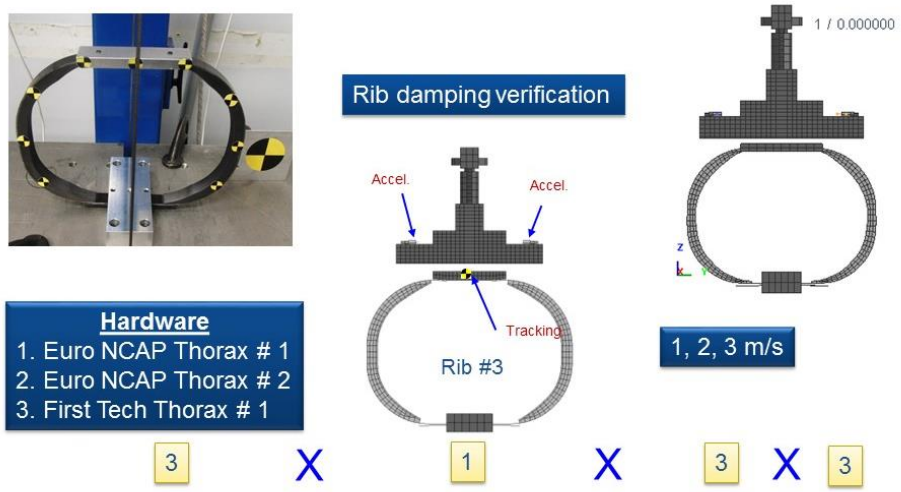


Fig.3: Single rib drop test

4 Thorax Enhancements

4.1 New harmonized SAE jacket from CT scan data

New Harmonized SAE jacket update from CT scan data

- Thicknesss details for each layer
- Jacket fitting is simulated and verified against final state scan

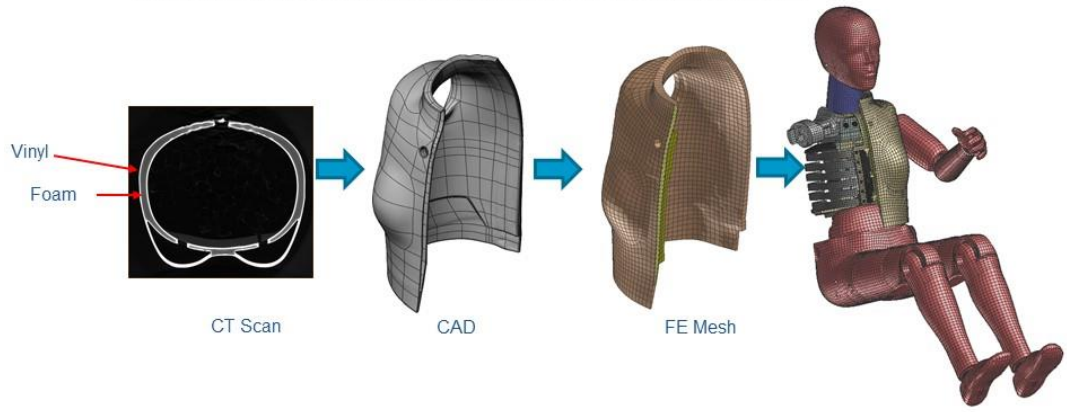


Fig.4: Harmonized SAE jacket

4.2 New material testing and materials modeling

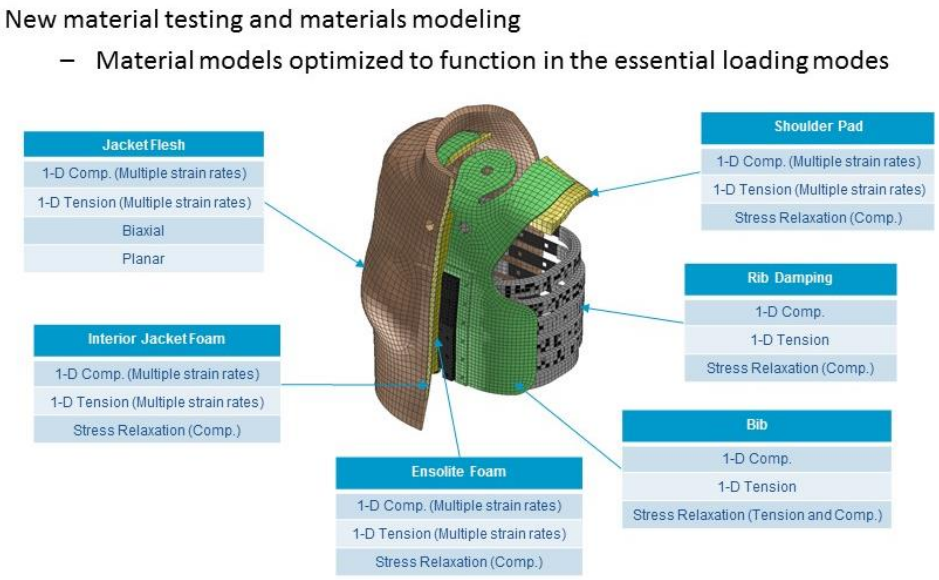


Fig.5: Material test matrix for thorax model

4.3 Material enhancement and verification

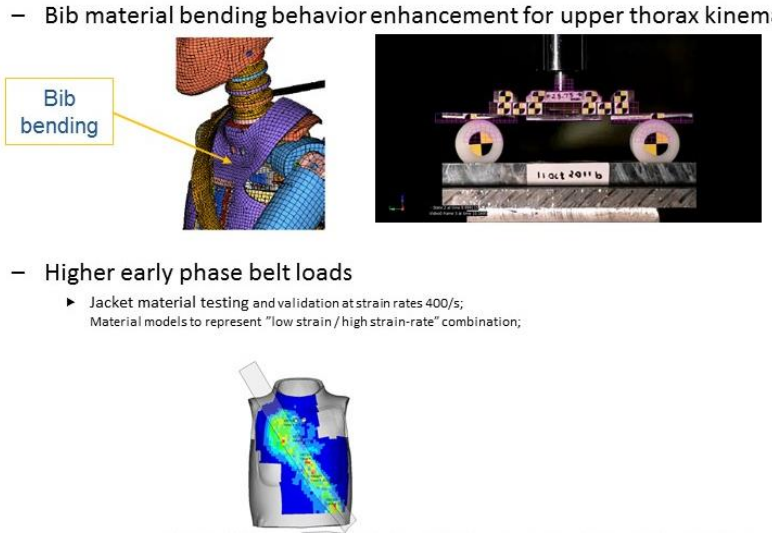


Fig.6: Bib material validation and thorax stress distribution

4.4 Thorax stamp testing

- Stamp tests with a controlled displacement over time on the thorax
- Stress and deformation mode similar to vehicle simulations

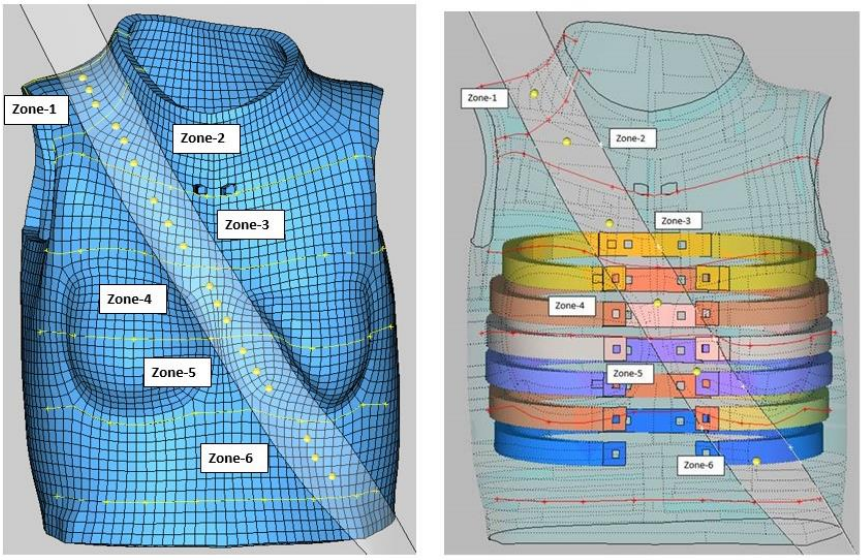


Fig.7: Stamp test impact locations

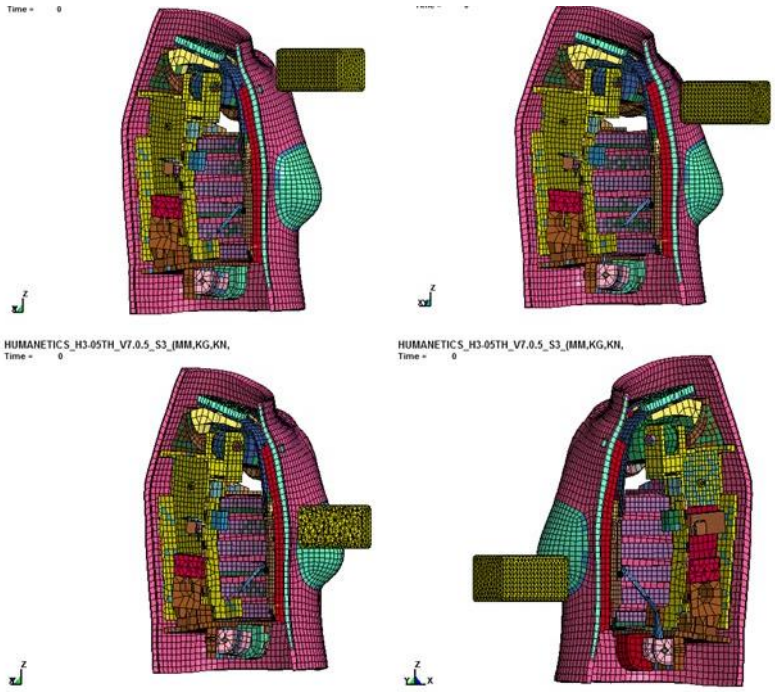


Fig.8: Stamp test pre-simulations to verify load levels

5 Harmonized thorax model validation

- Confirm thorax model against current hardware

2nd row belted

Full dummy	
# load cases	3 pulses 3 belt load levels

Dummy	Pulse	Load Limiter	n
Humanetics Harmonized	Pulse 1	4 kN CFR	3
	Pulse 2	3.5 kN CRF	3
	Pulse 3	4 kN CFR	3
	Static Pretensioner	-	2
First Tech	Pulse 1	4 kN CFR	2
	Pulse 2	3.5 kN CRF	2
	Pulse 3	4 kN CFR	2
Denton	Pulse 1	4 kN CFR	2
Dummy component "Mixture"	Pulse 1	4 kN CFR	2
	Pulse 2	3.5 kN CFR	2
			Total = 23

Fig.9: Sled tests rear occupant; analyze hardware variability

6 Borderline chest model

- 3m/s certification test allows 4,5mm spread
- Euro NCAP chest model prepared for borderline model development

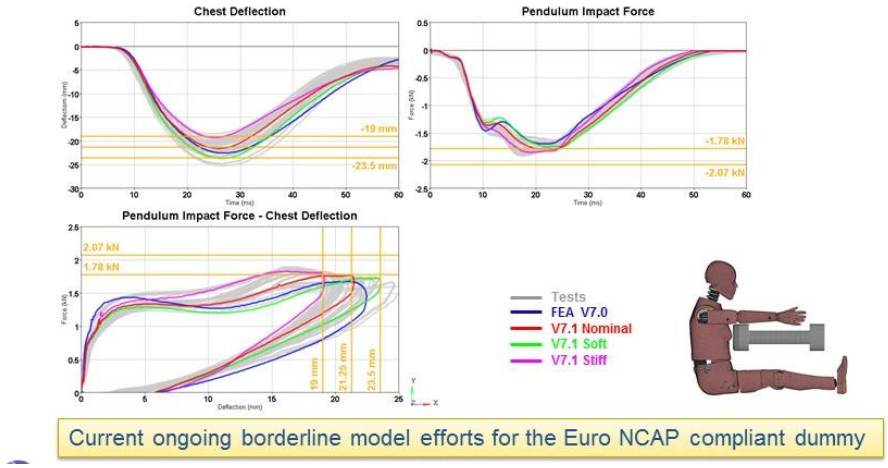


Fig.10: Thorax low speed certification test and model prediction

7 Additional Euro NCAP enhancements

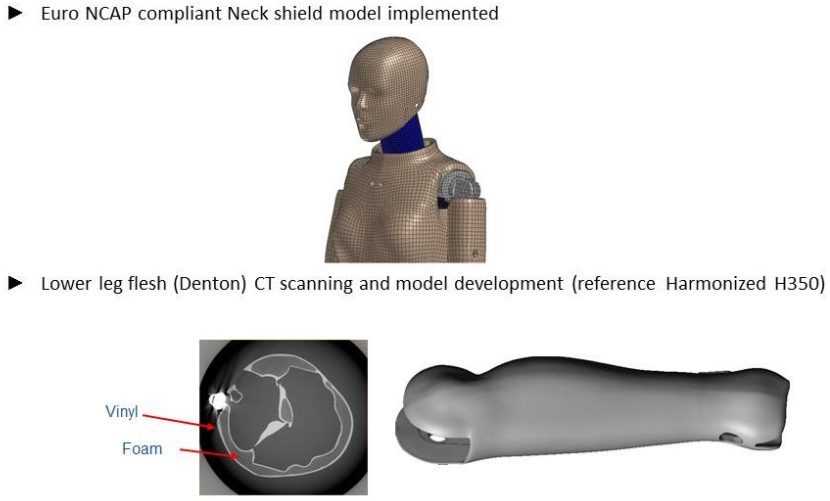


Fig.11: Euro NCAP specific adjustments

8 Neck model development

8.1 Neck material validation

- neck material tests based on harmonized hardware

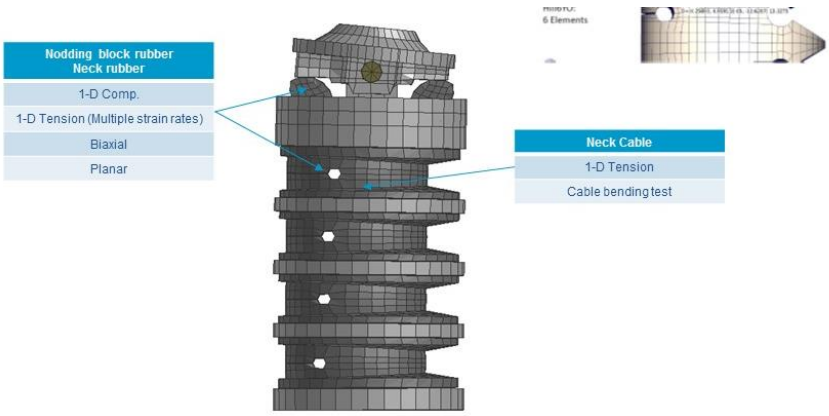


Fig.12: Neck material test matrix

8.2 Neck torsion validation

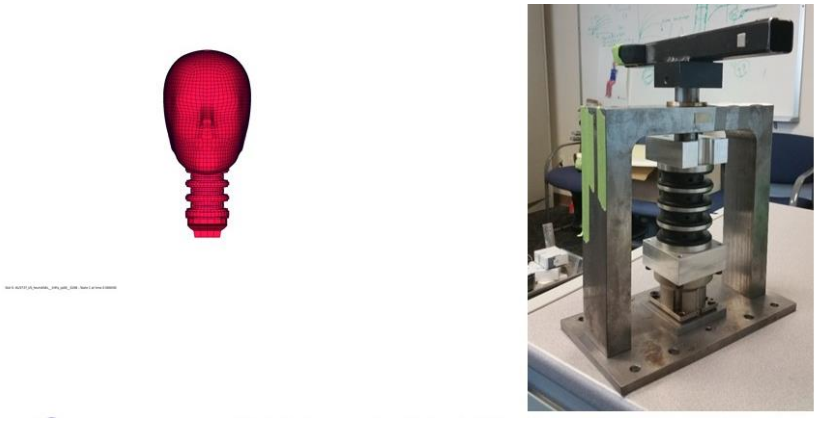


Fig.13: Test setup for neck torsion test

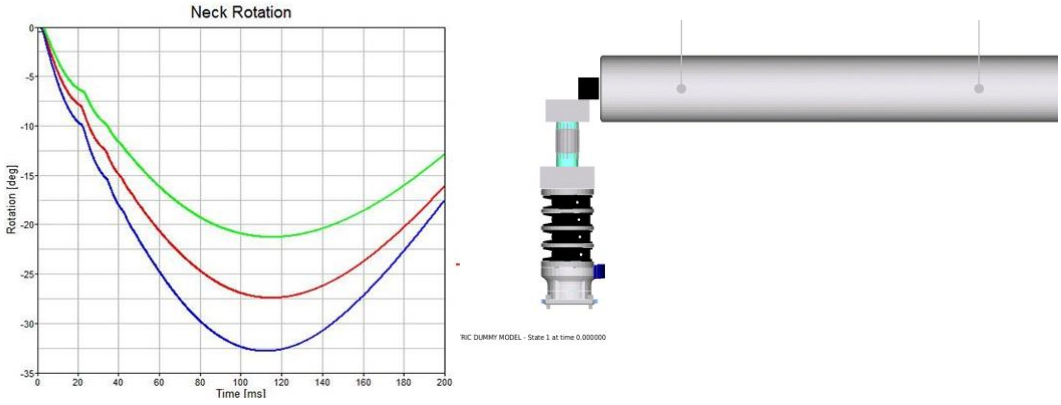


Fig.14: Pre-simulations to address load levels

9 Summary

- Euro NCAP requires use of the HII-5th percentile for its full width frontal barrier test procedures
  - Dummy should be according to the latest agreed harmonization
- An LS-DYNA model for this dummy is being developed
  - The model is being optimized to predict the nominal response
- Chest hardware variability can cause significant variation in the final Euro NCAP tests
  - The model allows to explore the influence of chest hardware variability