

# **Unique occupant protection research at SAFER**

**Lotta Jakobsson**

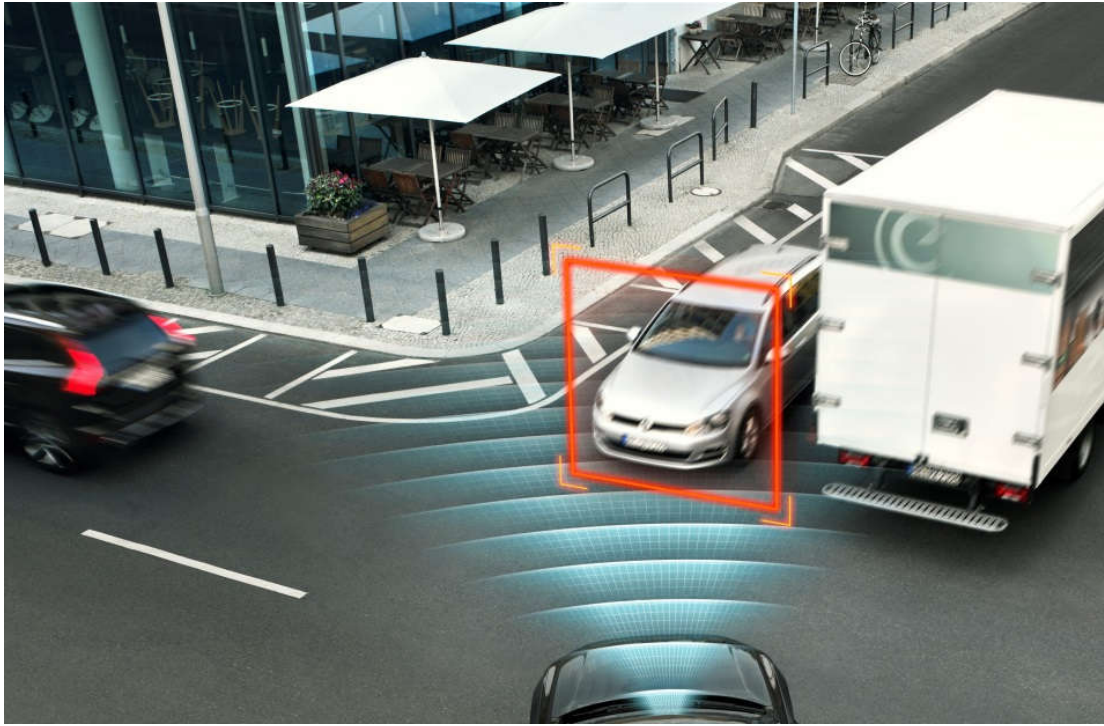
Senior Technical Leader, Injury Prevention, Volvo Cars

Adjunct Professor, Vehicle Safety, Chalmers

**Research Area Director, Human Body Protection, SAFER**



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VEHICLE AND TRAFFIC SAFETY CENTRE AT CHALMERS



# Occupant protection challenges, today and tomorrow

- How to model and measure injury consequences for humans in a crash, including preceding events?
- How do pre-crash factors and individual differences influence injury outcome?
- Understanding detailed injury biomechanics.
- Shared mobility and increased variations of sitting postures and activities in passenger cars.

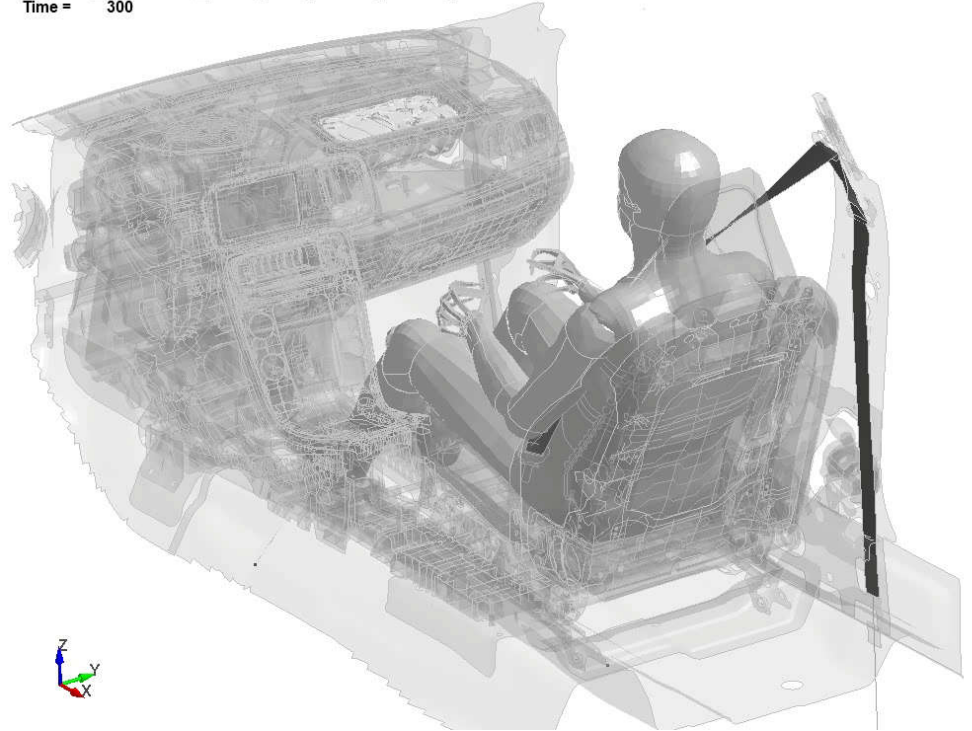


# SAFER Human Body Model v 9.0

- Released in January 2018

First of its kind to seamlessly simulate the occupant movement during a turn or brake maneuver AND injury prediction in a subsequent crash

12\_0.5s\_avoidance\_300N\_PPT\_frontal\_56kmh\_crash  
Time = 300





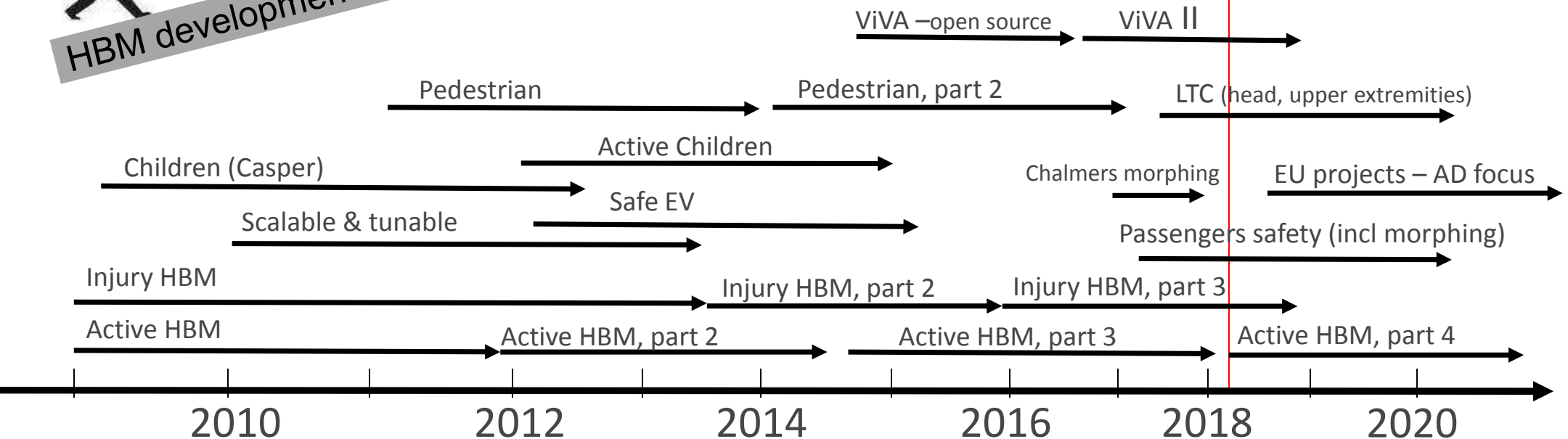
# HBM development @ SAFER

Tunable, scalable,  
injury prediction,  
whole sequence

PhD students

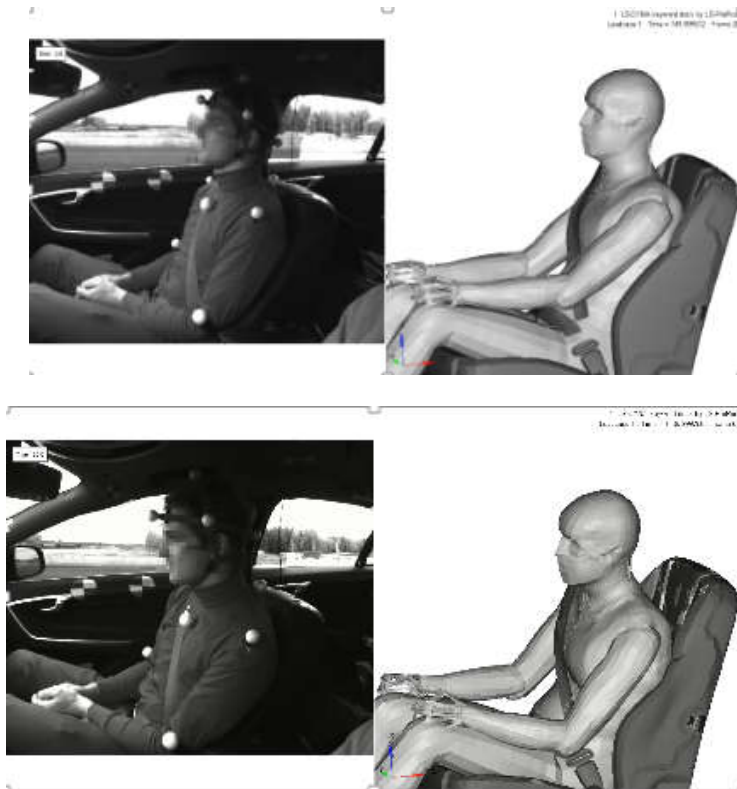


HBM development @ SAFER



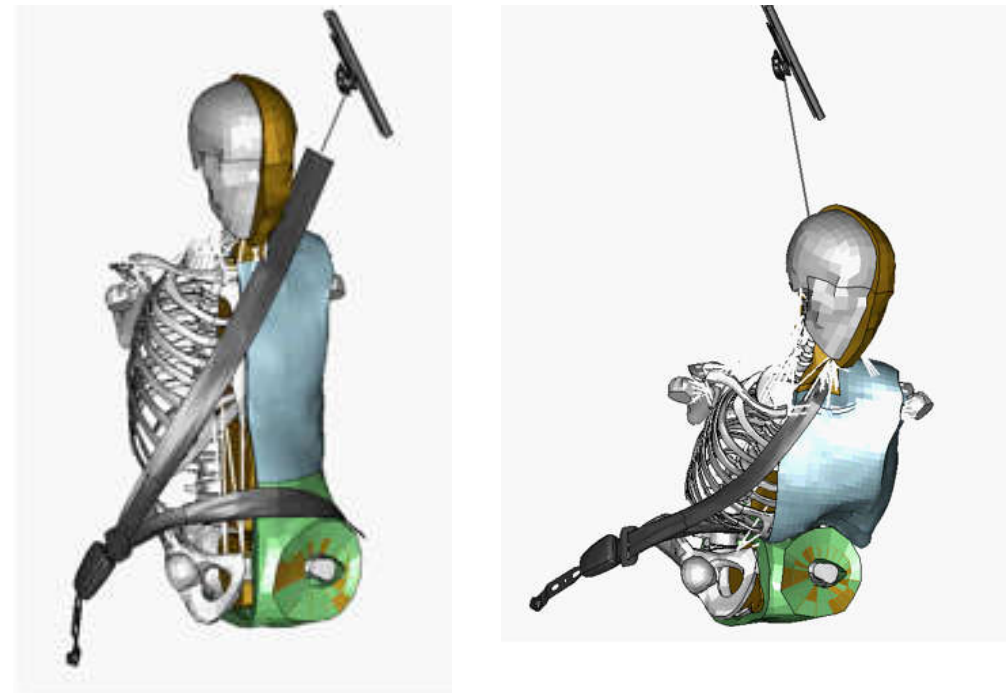
# Active muscles

- Lane change with braking



# Injury prediction

- Reconstructing a real-world crash



## What's next?

- Further develop active muscles activation and control
- Improve injury prediction, all body regions
- Address human diversity (including sitting postures)
- Open source HBM models

# Model Morphing using SAFER HBM v9.0

Female, 150cm,  
BMI=20

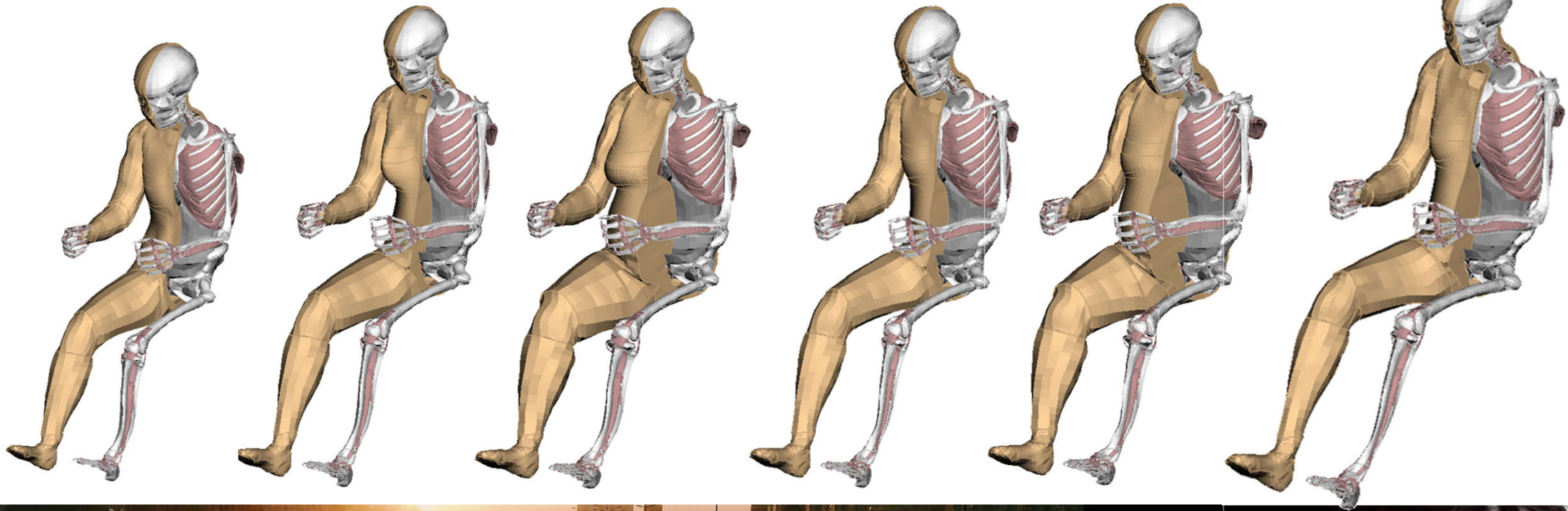
Female, 175cm,  
BMI=25

Female, 175cm,  
BMI=40

Male, 175cm,  
BMI=25

Male, 175cm,  
BMI=40

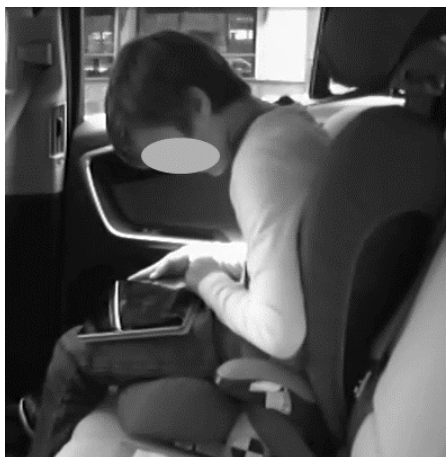
Male, 195cm,  
BMI=26



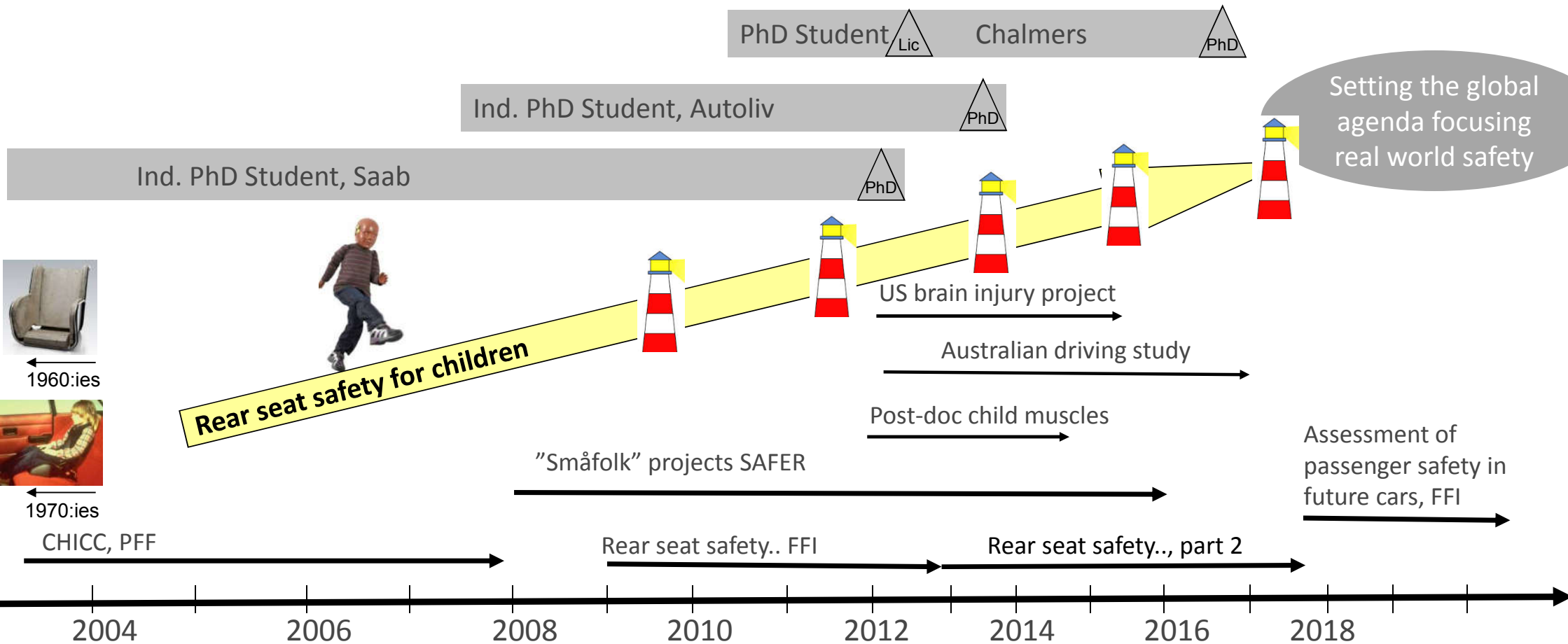




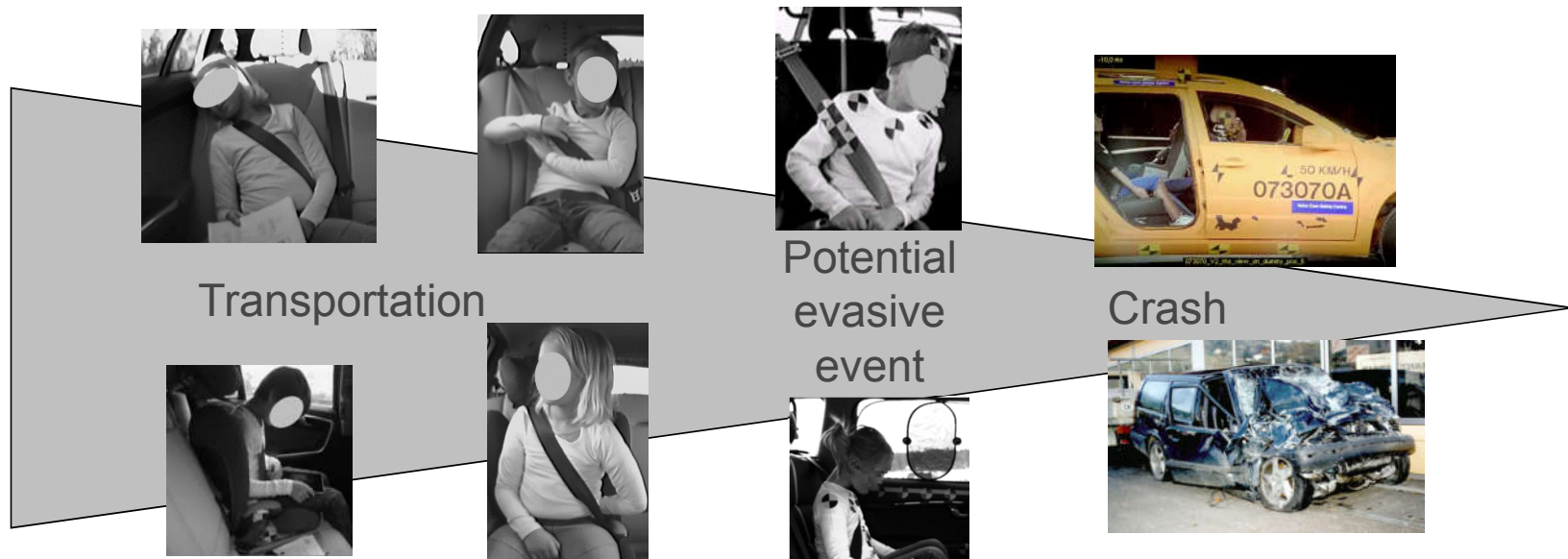
## Children do not sit like crash test dummies



# Road map for child safety research @SAFER



# Research scope – Real world safety



Evaluation of protection beyond standardized crash testing scenarios, including child kinematics and behavior during transportation and in potential evasive braking or steering before crash.

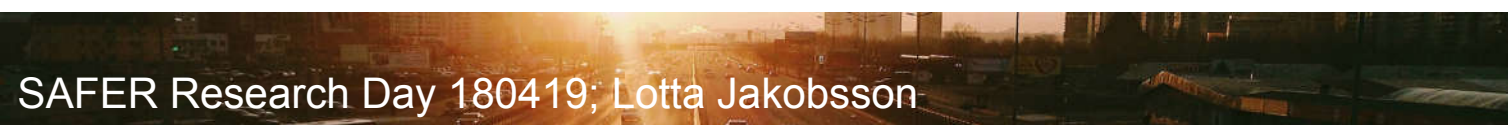




# Child occupant protection workshops; an example of successful project dissemination and international interaction



2009 Björholmen



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# Child occupant protection workshops

## Careful mix of experts

USA

Sweden

Europe

Vehicle manufacturers  
Child restraint manufacturers  
Biomechanists  
Epidemiologists  
Pediatric clinicians  
Government researchers  
System suppliers  
Safety researchers

Canada

Australia

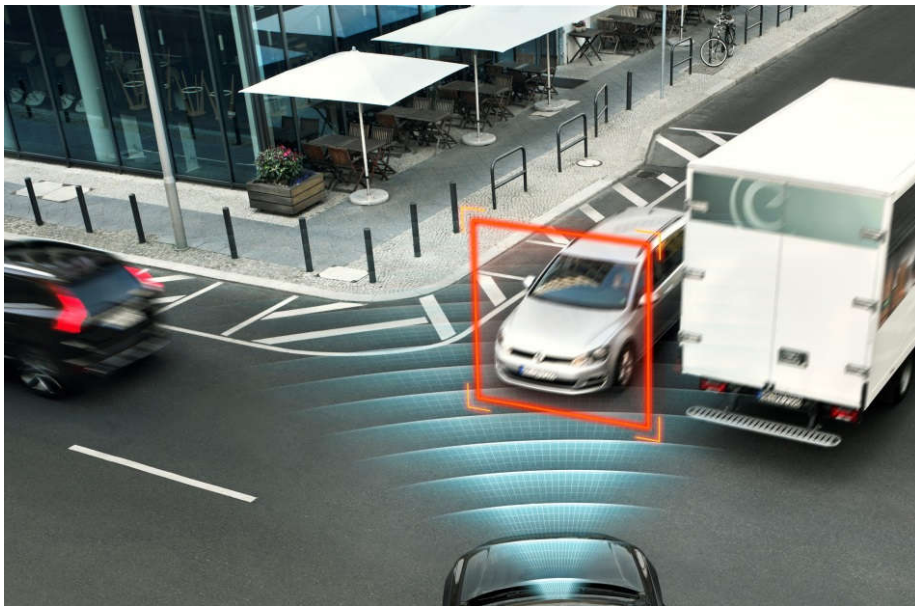
2017 expansion

+

Behavioral scientists  
Driver behavior experts  
Human Factors  
.....



SAFER occupant protection research is working in line with future needs and connects international multidisciplinary researchers.



# ACKNOWLEDGEMENTS

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Main project partners:



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Project descriptions at: <https://www.saferresearch.com/research/human-body-protection>