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# PANEL
# Simulation and Validation Challenges in Industrial Systems

**MODERATOR:**
**Jos van Rooyen, principal consultant Bartosz ICT**

# Panelists

**Moderator**

**Jos van Rooyen, Bartosz ICT, The Netherlands**

**Panelists**

- **Xinli Gu, Huawei Technologies, USA**
- **Arash Ramezani, University of the Federal Armed Forces, Germany**
- **Marek Bauer, Cracow University of Technology, Poland**

# Topics to be discussed

- **Xinli Gu:**

  **“Validation of network devices connected running with various test tools for validation and debug methodology).“**

- **Arash Ramezani:**

  **Numerical Investigation of Modern Armor Structures for Defense and Security**

- **Marek Bauer:**

  **Simulation and Validation Challenges in transportation systems in big cities**

# Agenda

- **Per panellist 5 minutes introduction**
- **Open discussion**

# Open discussion


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# Simulation and Validation Challenges in transportation systems in big cities

**Dr Marek Bauer, assistant professor**

**Cracow University of Technology**

**Faculty of Civil of Engineering**

**Institute of Road and Railway Engineering**

**Department of Transportation Systems**

***mbauer@pk.edu.pl***

# Simulation and Validation Challenges in transportation systems in big cities

## ❑Why do we use the simulation methods in planning and operating of transportation systems?

- ➢We want get to know the consequences of our activities (new road, new tramway line, changes in public transport routes, differentiated strategies of traffic control, etc.)
- ➢We could test every concept of transportation network development (even futuristic)
- ➢We want to know which solution is the best in this moment and in the future
- ➢We want to know the costs and the benefits of our activities
- ➢We use very sophisticated numeric models of big cities

# Simulation and Validation Challenges in transportation systems in big cities

**EXISTING NETWORK**

**VISUALIZATION OF THE NETWORK**
**EVALUATION OF EXISTING NETWORK**
**DECISION: „*TO CHANGE OR NOT TO CHANGE*”**

**IF „YES”: CONCEPTS (VARIANTS)**

**EVALUATION**

**SOLUTION: THE BEST VARIANT**

| |
|---|
| **RESIDENTS - QUALITY** |
| **EXECUTIVE - COSTS** |
| **ENVIROMENT - LOADS** |

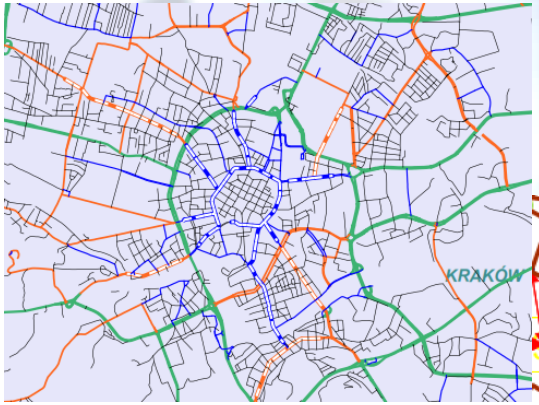
# Simulation and Validation Challenges in transportation systems in big cities

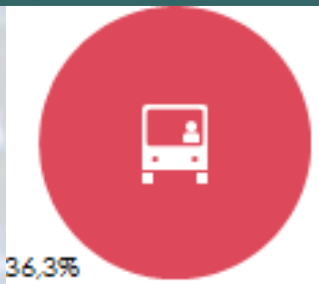
DEMAND

TRIP DISTRIBUTION

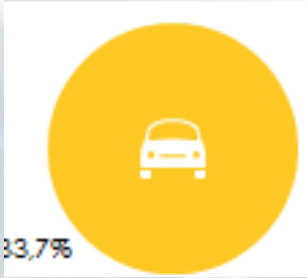
MODAL SPLIT

ASSIGNMENT



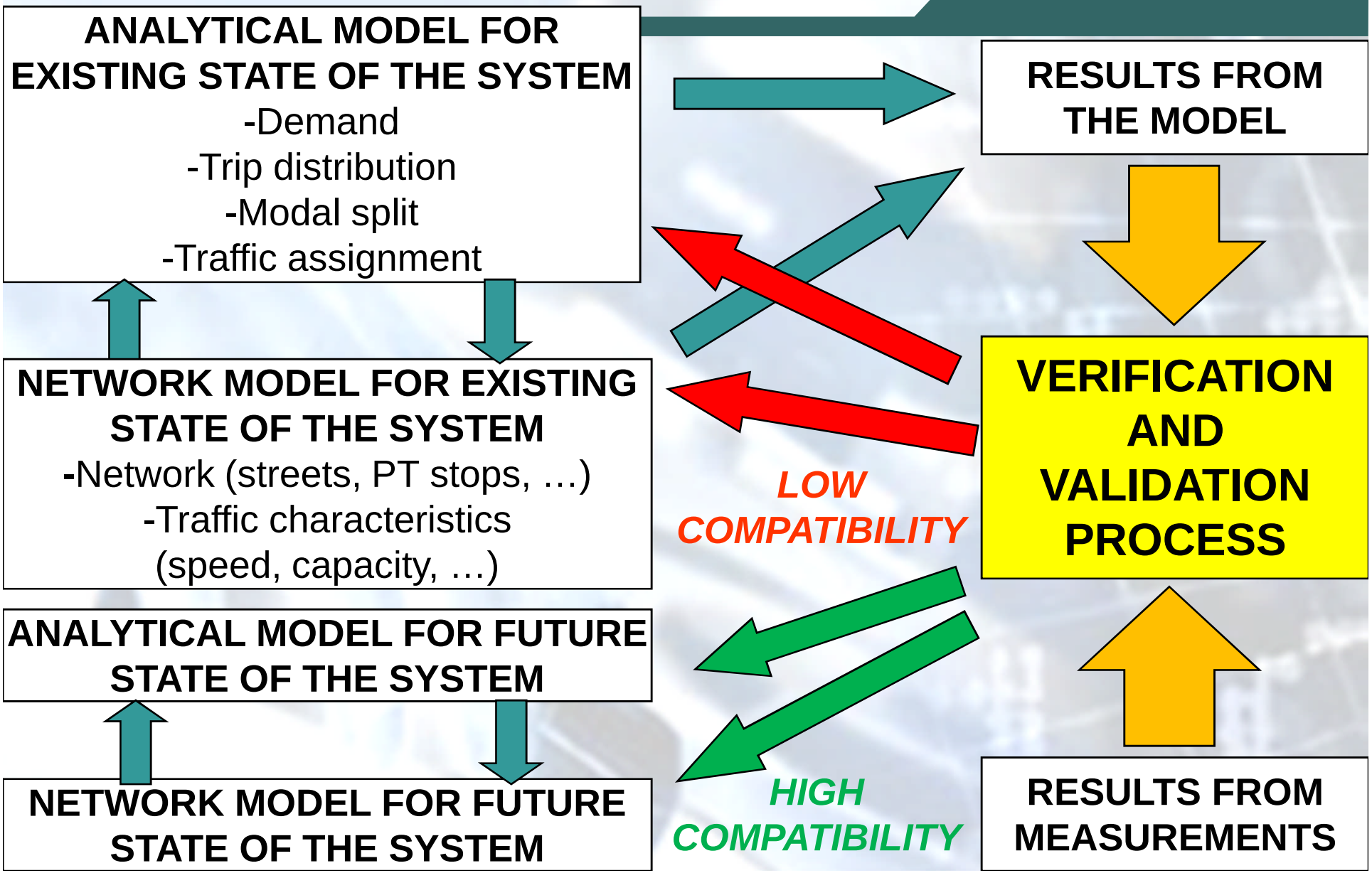








NETWORK

# Simulation and Validation Challenges in transportation systems in big cities



# Simulation and Validation Challenges in transportation systems in big cities

| Analytical model | Verification | Validation |
|---|---|---|
| Demand modelling | ++ | + |
| Trip distribution | ++ | + |
| Modal split | ++ | + |
| Assignment | ++ | ++ |

| Network model | Verification | Validation |
|---|---|---|
| Traffic zones defining | + | ++ |
| Network building | ++ | ++ |
| Traffic connecting | + | - |

# Simulation and Validation Challenges in transportation systems in big cities

**Before verification and validation**

**After verification:**

Difference: MORE PT USERS

Consequence: STRONGER BASIS FOR ANALYSIS

**After validation:**

EASIER USAGE OF THE MODEL

The Eighth International Conference
on Advances in System Simulation

# PANEL on SIMUL/VALID

## Topic: Simulation/Validation Methods in Data Analytics

August 22, 2016

Dr.-Ing. Dipl.-Math. Arash Ramezani
Helmut-Schmidt-University
University of the Federal Armed Forces Hamburg
Holstenhofweg 85, D-22043 Hamburg

# Biography



- Arash Ramezani currently works for the Federal Ministry of Defence.
- He has studied Applied Mathematics at the University of Bremen and the University of Queensland in Australia and received his Diploma degree in 2010.
- In 2015 he received his doctor's degree in engineering science with his studies on
  - "Numerical Simulation of Terminal Ballistic Processes for the Analysis of Selected Armor Structures and the Optimization of Modern Security Vehicles".
- His research interests include modeling, simulation and visualization of ballistic problems.

# Numerical Investigation of Modern Armor Structures for Defense and Security

- The threat imposed by terrorist attacks is a major hazard for military installations, vehicles and other items
- An important endeavor of international research and development is to avert danger to life and limb
- Ballistic testing is limited due to costs and permissions for experimental results
- This is why numerical simulations are more frequently applied than experimental tests which are thus being replaced gradually

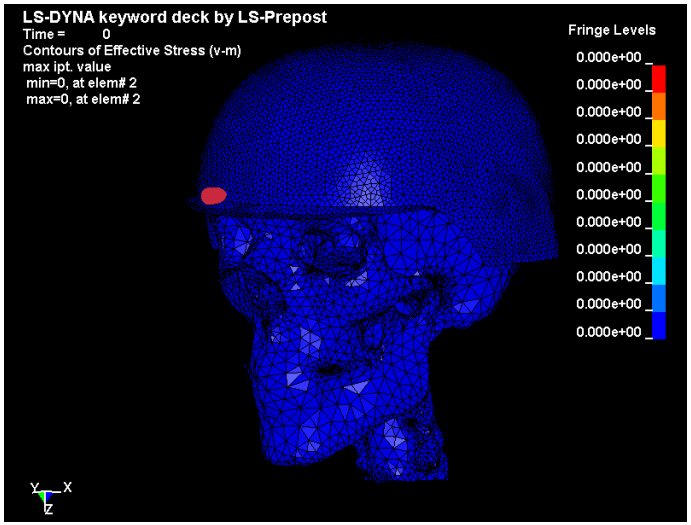
# Numerical Investigation of Modern Armor Structures for Defense and Security

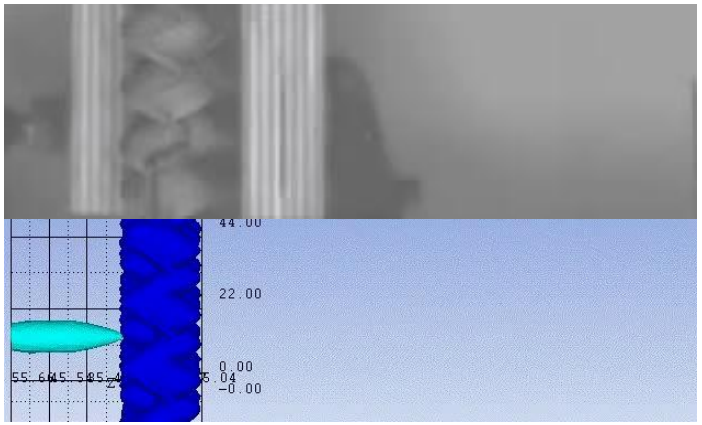


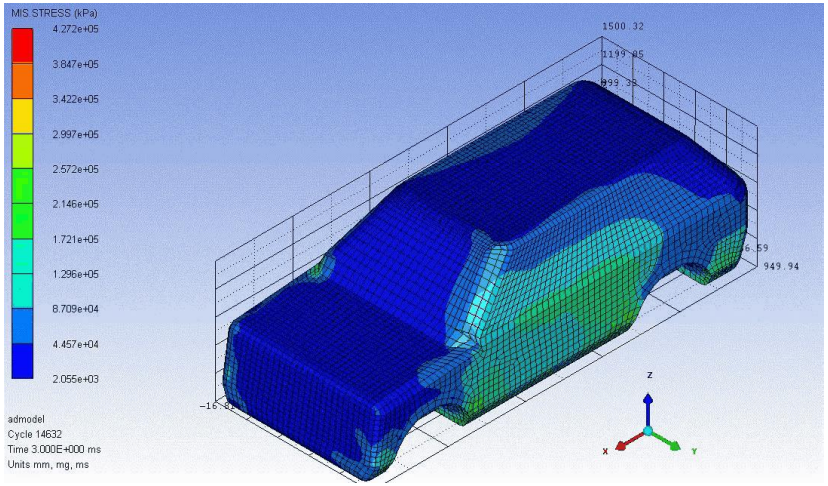
# Numerical Investigation of Modern Armor Structures for Defense and Security

Fields of application:

- Simulation of impacts
- Ballistic protection
- Energetic systems
- Wave propagation
- Force of detonation
- Testing of materials

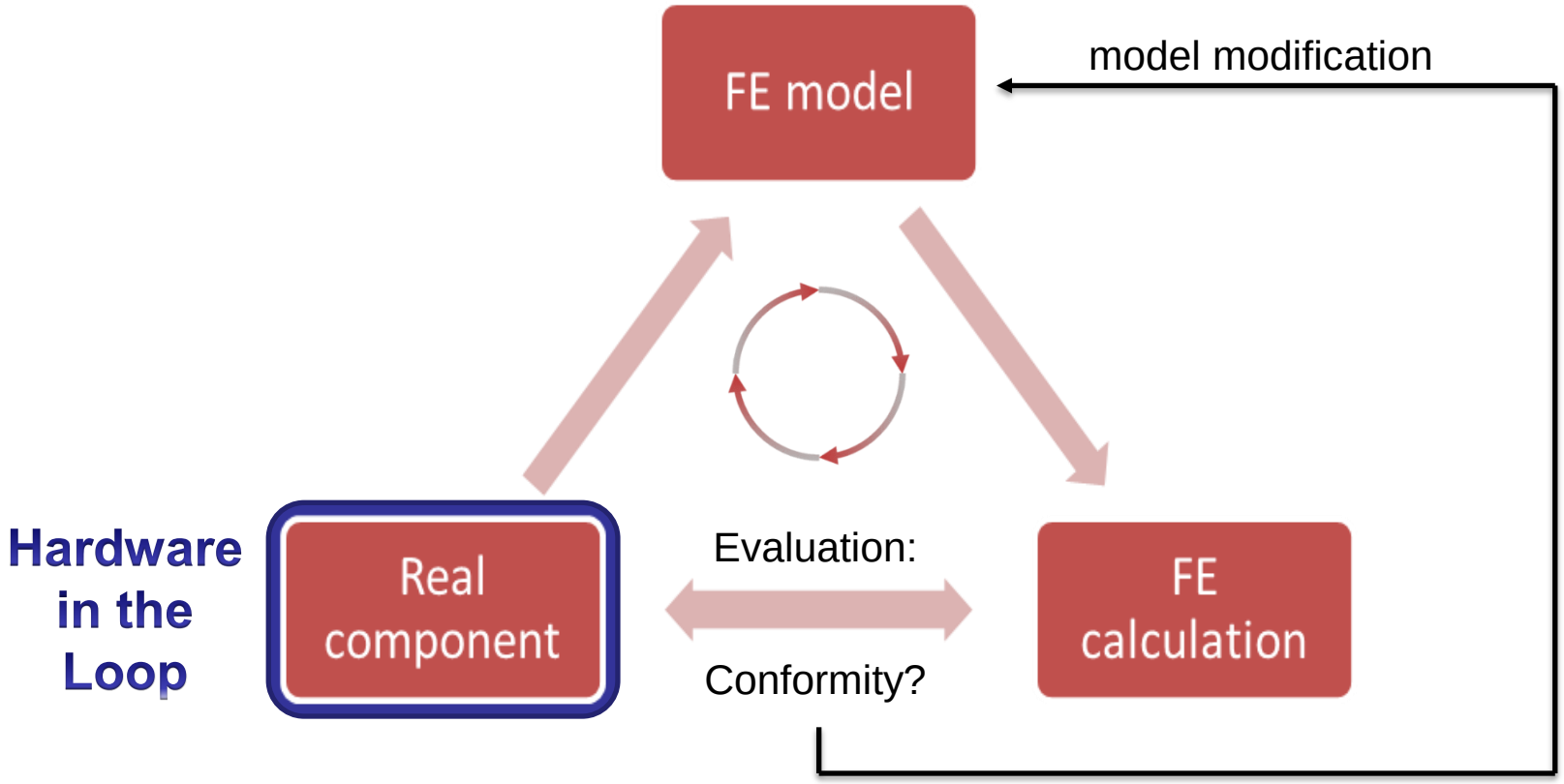


# Numerical Investigation of Modern Armor Structures for Defense and Security



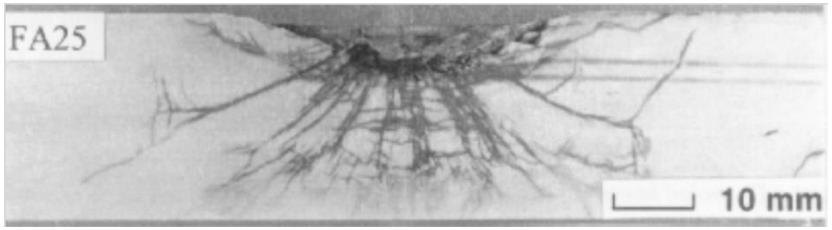


# Numerical Investigation of Modern Armor Structures for Defense and Security

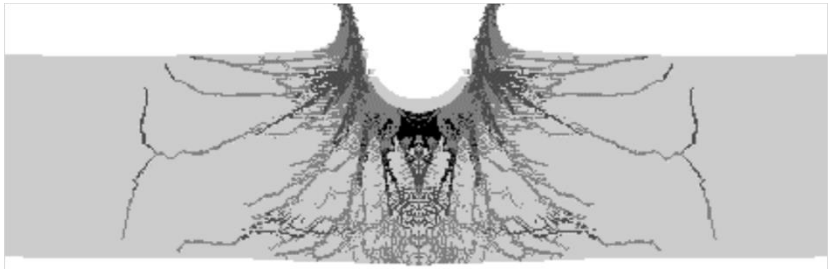


Challenge:

- The materials of the test objects are normally unknown – they have to be created and optimized for the calculation, so that the material behavior in the simulation can be conveyed in an exact manner
  - ➢ Data analysis for a statistical certainty
    - ➢ High susceptibility to errors
      - ➢ High safety hazard




Experiment



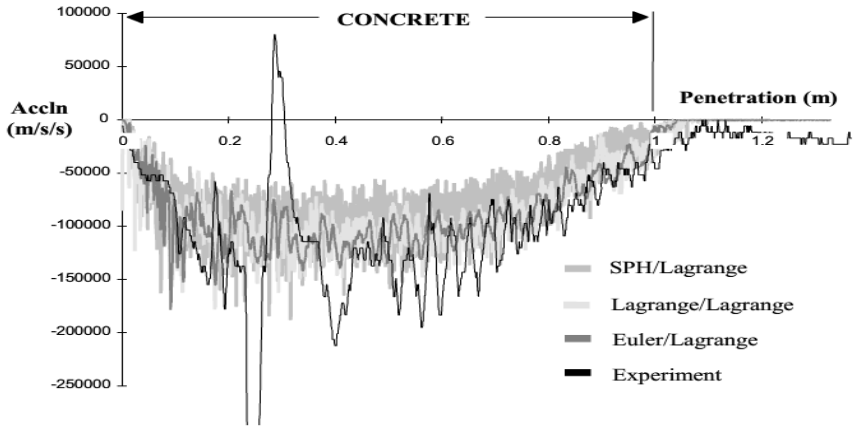
Simulation

# Numerical Investigation of Modern Armor Structures for Defense and Security



Numerical solvers:

- For problems of large dynamic fluid-structure interaction and impact, there typically is no single “best” numerical method
- Techniques to couple different types of solvers in a single simulation are required
- The numerical solvers utilized in hydrocodes (numerical wavecodes) generally fall into the following classes:
  - Lagrange
  - Euler
  - Smoothed-particle hydrodynamics (SPH)

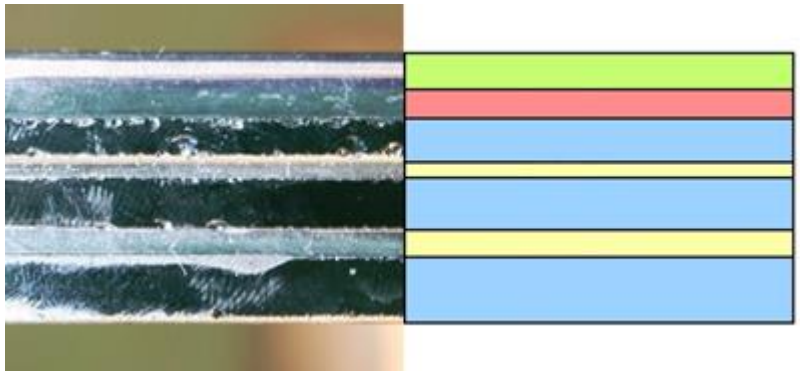


# Numerical Investigation of Modern Armor Structures for Defense and Security



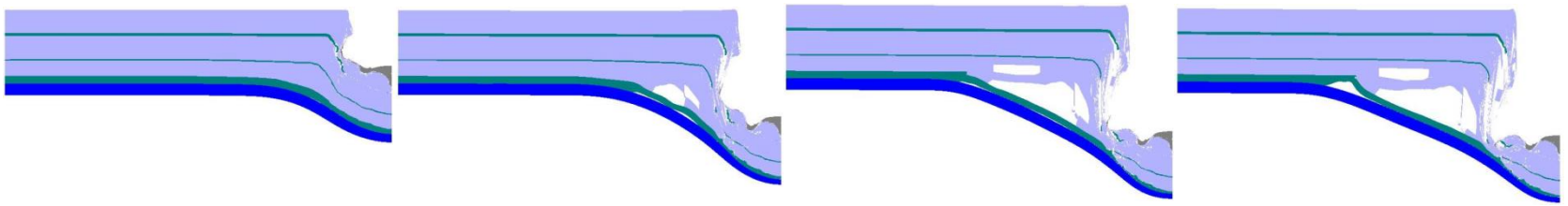
Target: safety glass (BR4)

- Soda lime glass
- Polycarbonate laminate
- Polyurethane layer
- Thickness: 23 mm

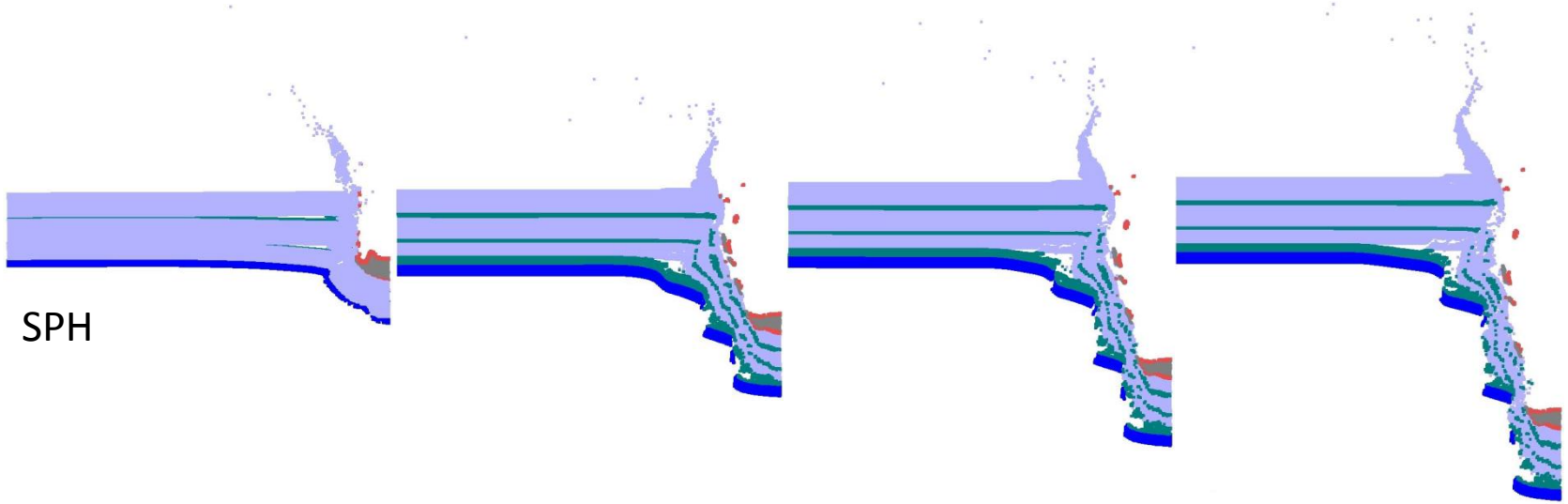


# Numerical Investigation of Modern Armor Structures for Defense and Security

Lagrange



*t = 10 ms* *t = 20 ms* *t = 30 ms* *t = 36 ms*



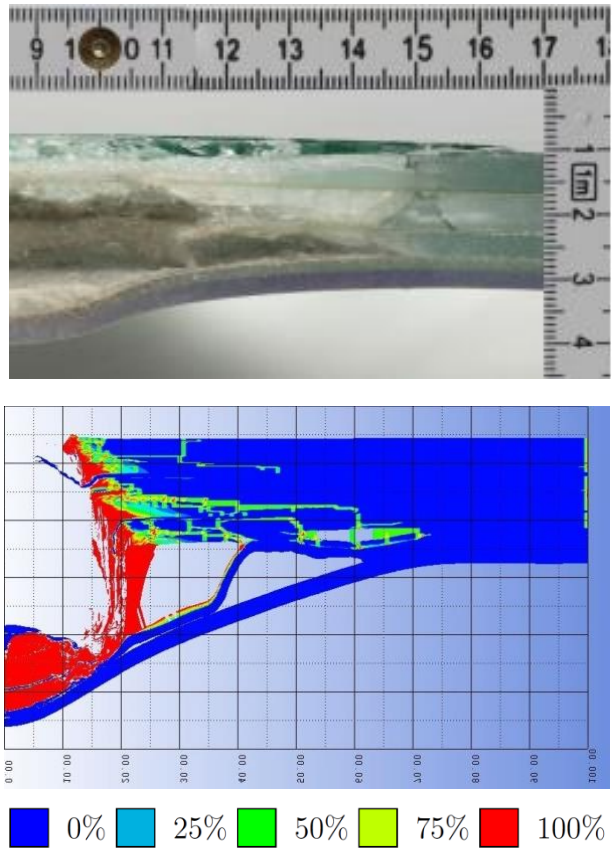
SPH

# Numerical Investigation of Modern Armor Structures for Defense and Security



Best solution:

- SPH-Lagrange Coupling
- Explicit time integration
- Rotational symmetry
- Computation time: 35 h
  - HP ProLiant DL580
  - Processor: Intel® Xeon® E7-4800
  - RAM: 512 GB

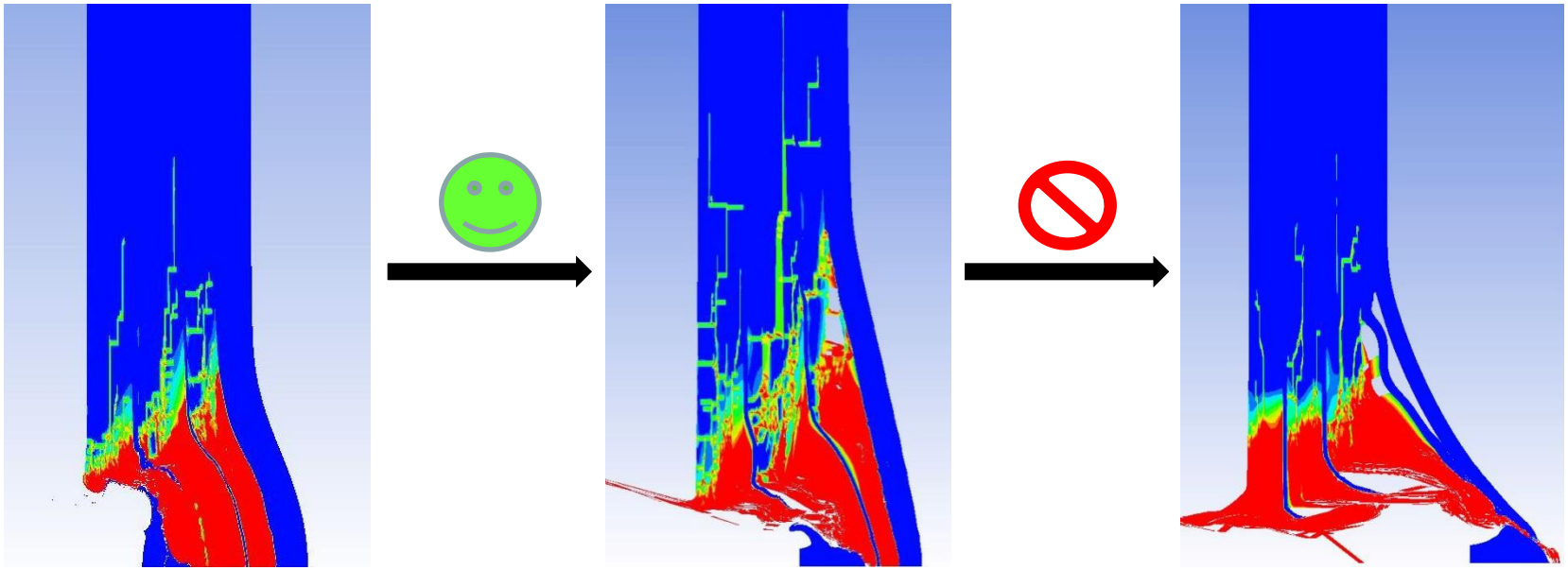


# Numerical Investigation of Modern Armor Structures for Defense and Security



Conclusion:

Appropriate solver technologies can be used for the **optimization** of brittle materials such as glass or ceramic



*23 mm* *20 mm* *18 mm*

# Numerical Investigation of Modern Armor Structures for Defense and Security



# Numerical Investigation of Modern Armor Structures for Defense and Security



Traditional ballistic testing: