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Standardized Crash Computation

Automatisierte Crashberechnung

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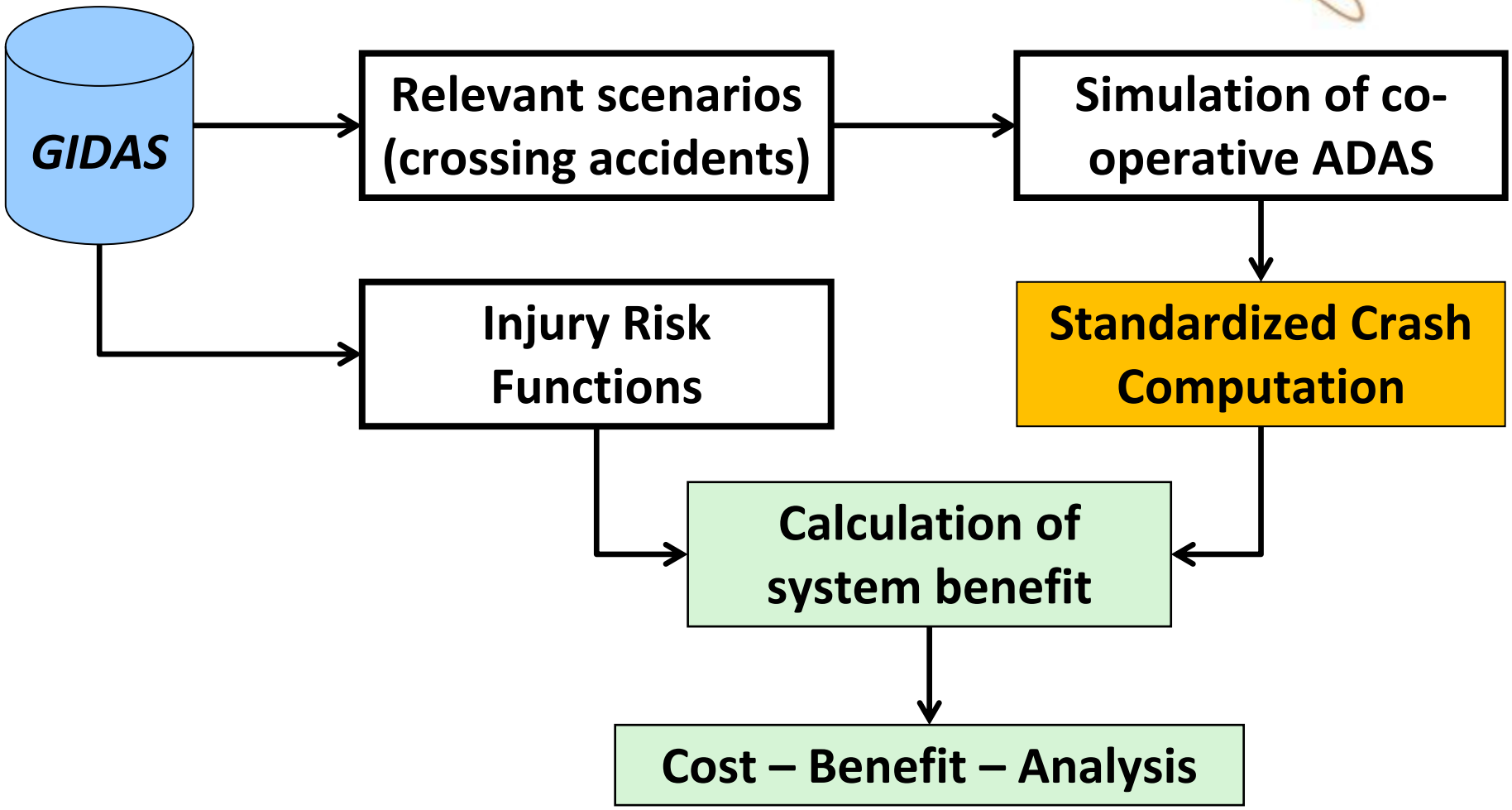
Federal Ministry of Economics and Technology
on the basis of a decision by the German Bundestag

Agenda

1. Context and Motivation
2. Standardized Crash Computation Process
3. Example
4. Benefit estimation using Injury Risk Functions
5. Summary

1. Context and Motivation



1. Context and Motivation

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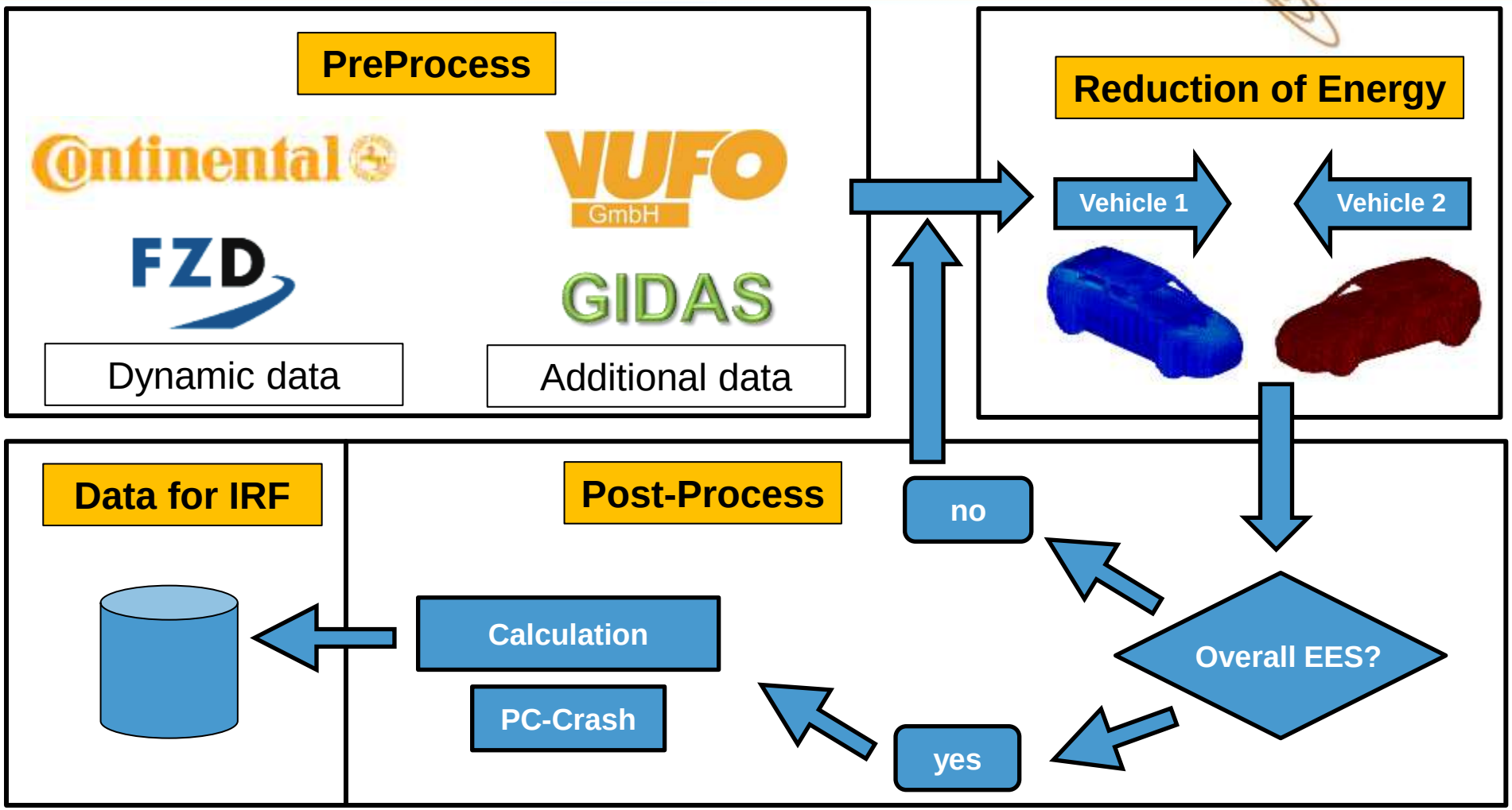
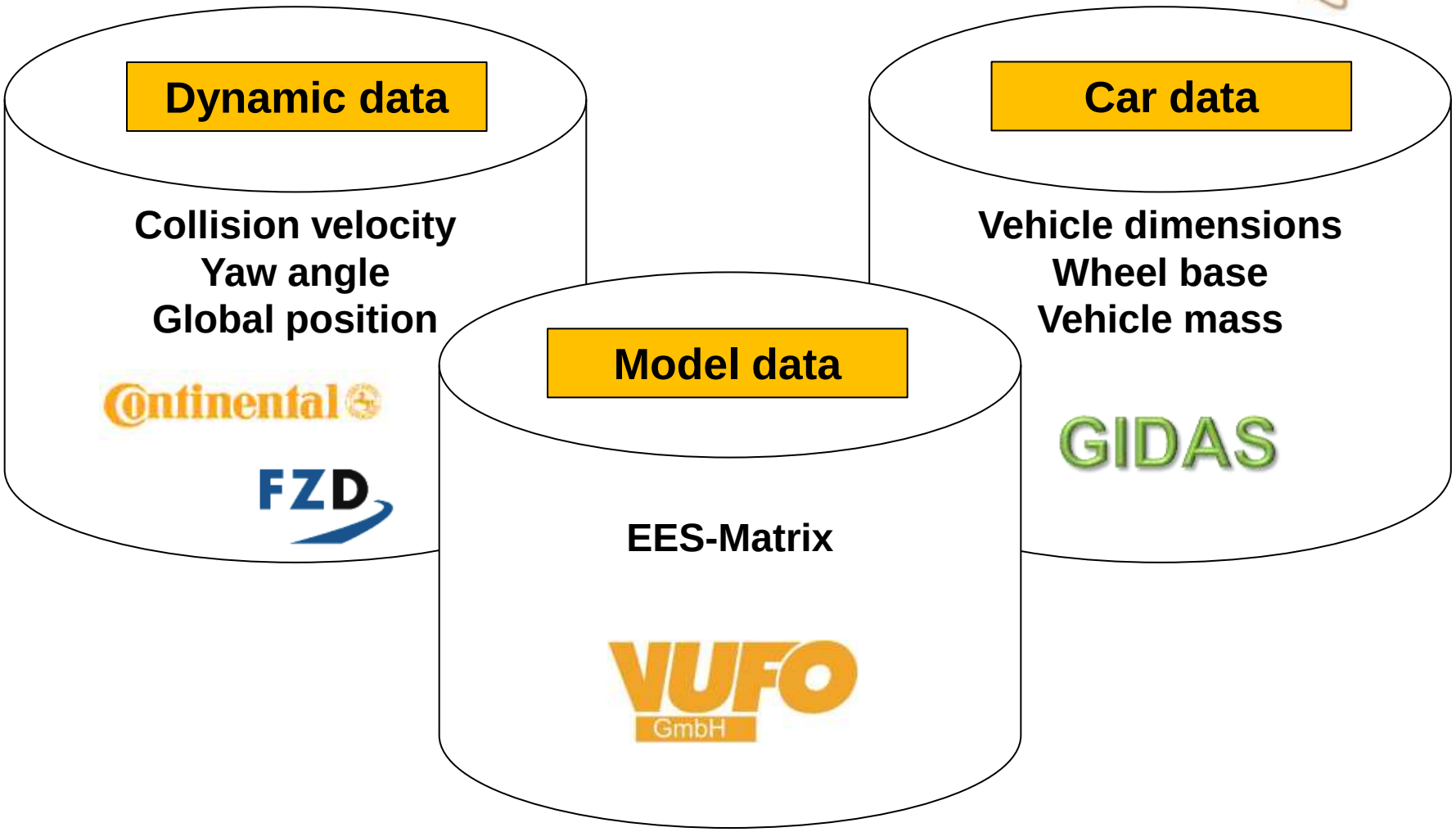
Motivation

Crash computation for new crash constellations resulting from the simulation with Driver Assistance Systems (ADAS)

2. SCC Process



2.1 Pre-Process



2.1 Pre-Process

Model data

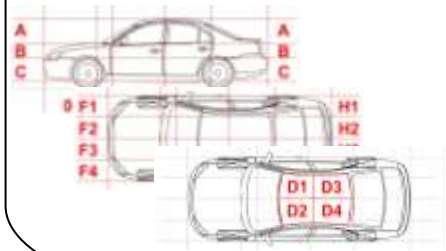
EES-Matrix

VUFO GmbH

Voxel-Matrix
[120 x 40 x 40]

GIDAS

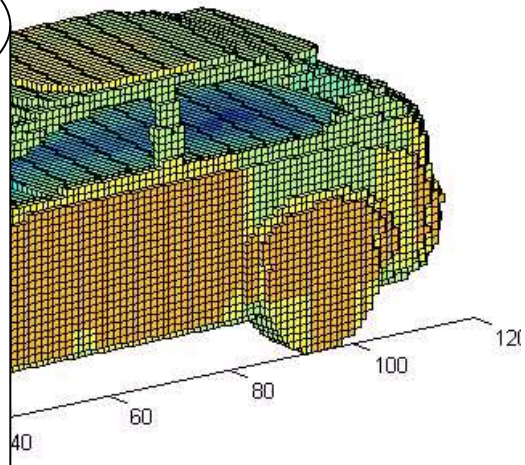
Deformations



Model data

EES-Matrix

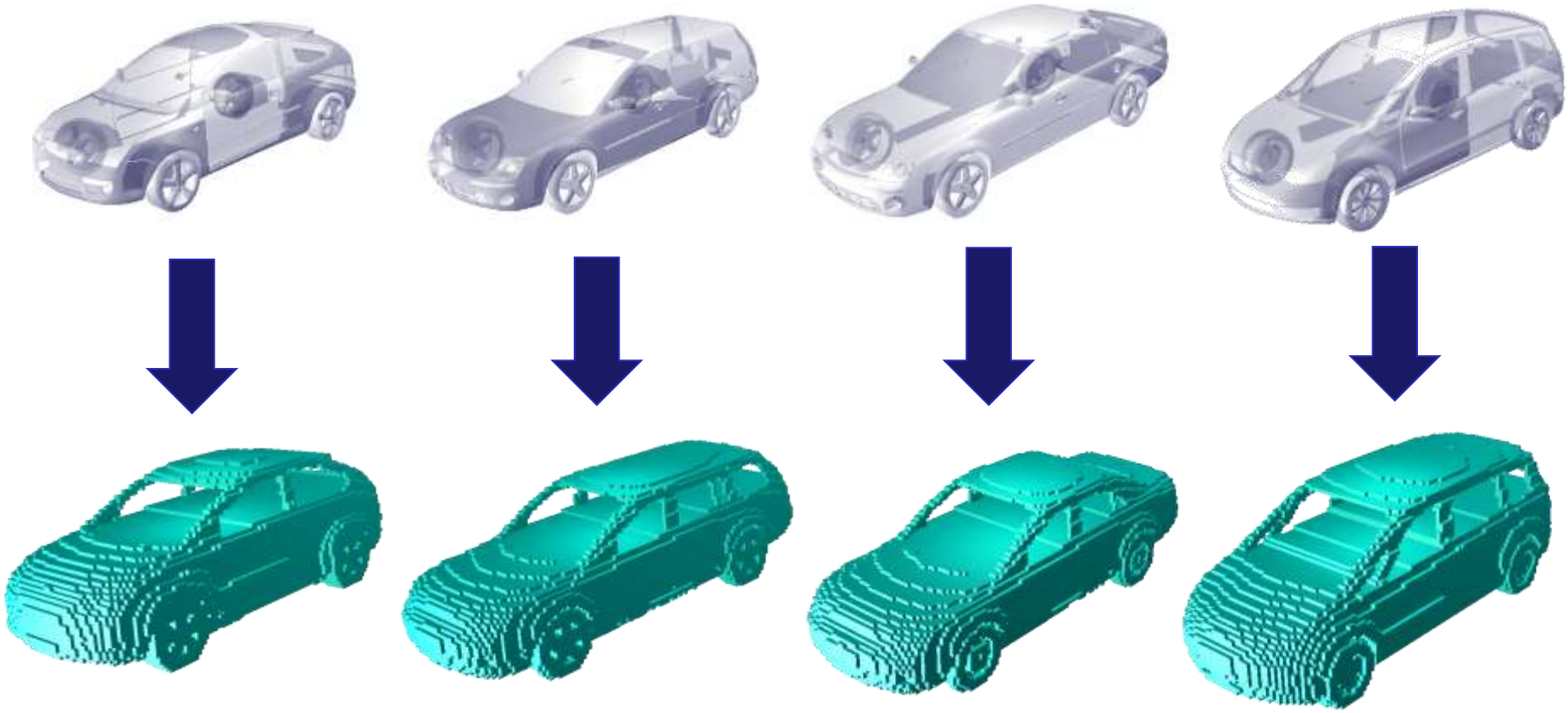
VUFO GmbH



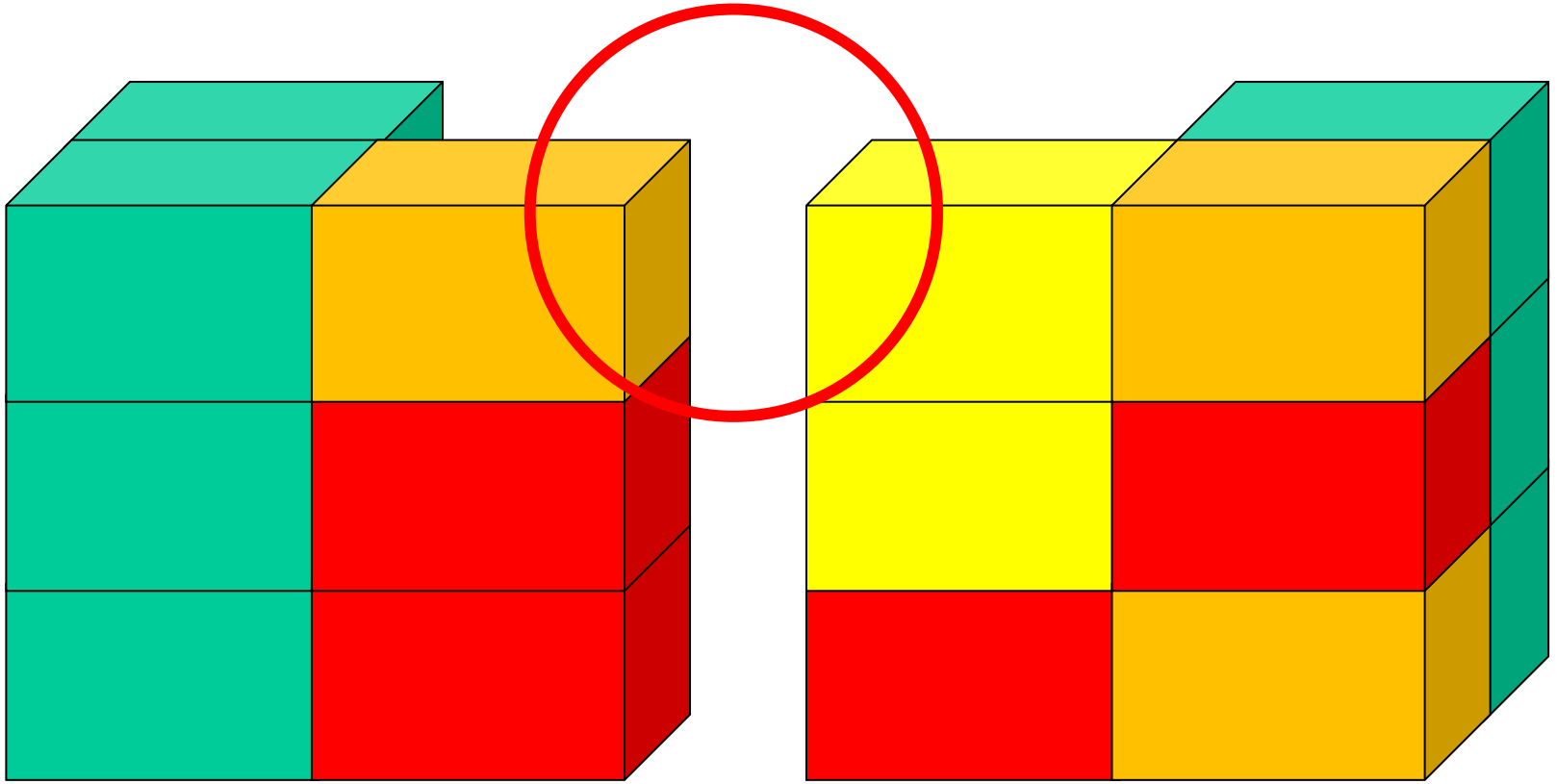
Specific EES per Voxel

2.1 Pre-Process

Creation of “EES per Voxel” distributions for four several vehicle shapes:
hatchback – estate – sedan – van



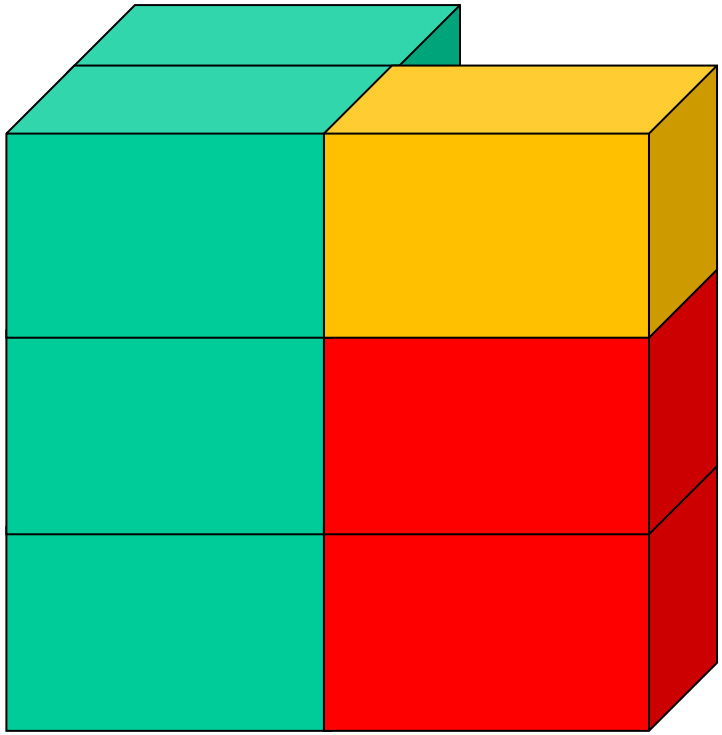
2.2 Reduction of Energy (Crash)

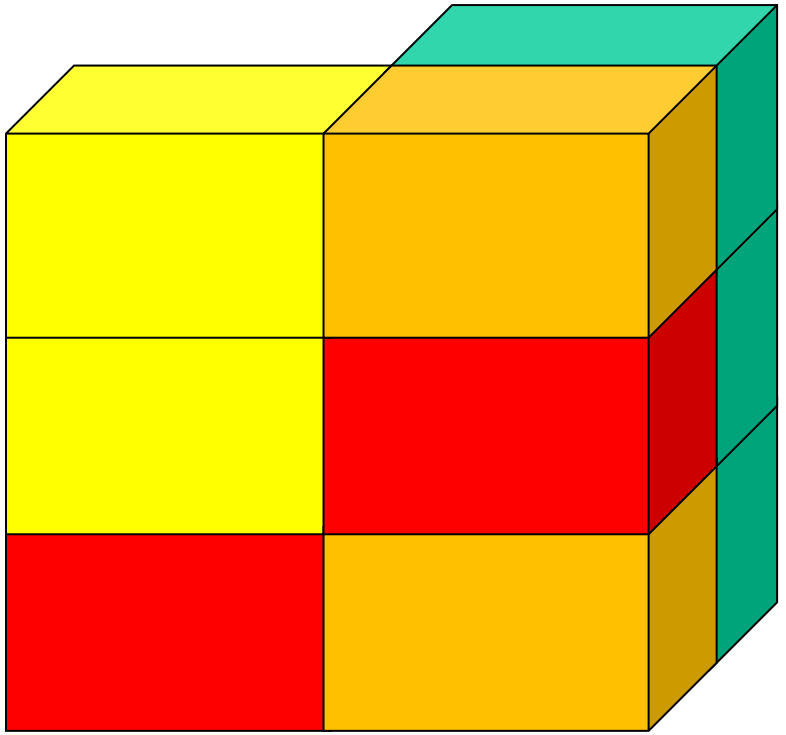


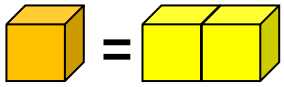
2.2 Reduction of Energy (Crash)

Calculation of EES for participants

TTC = 0.01 s



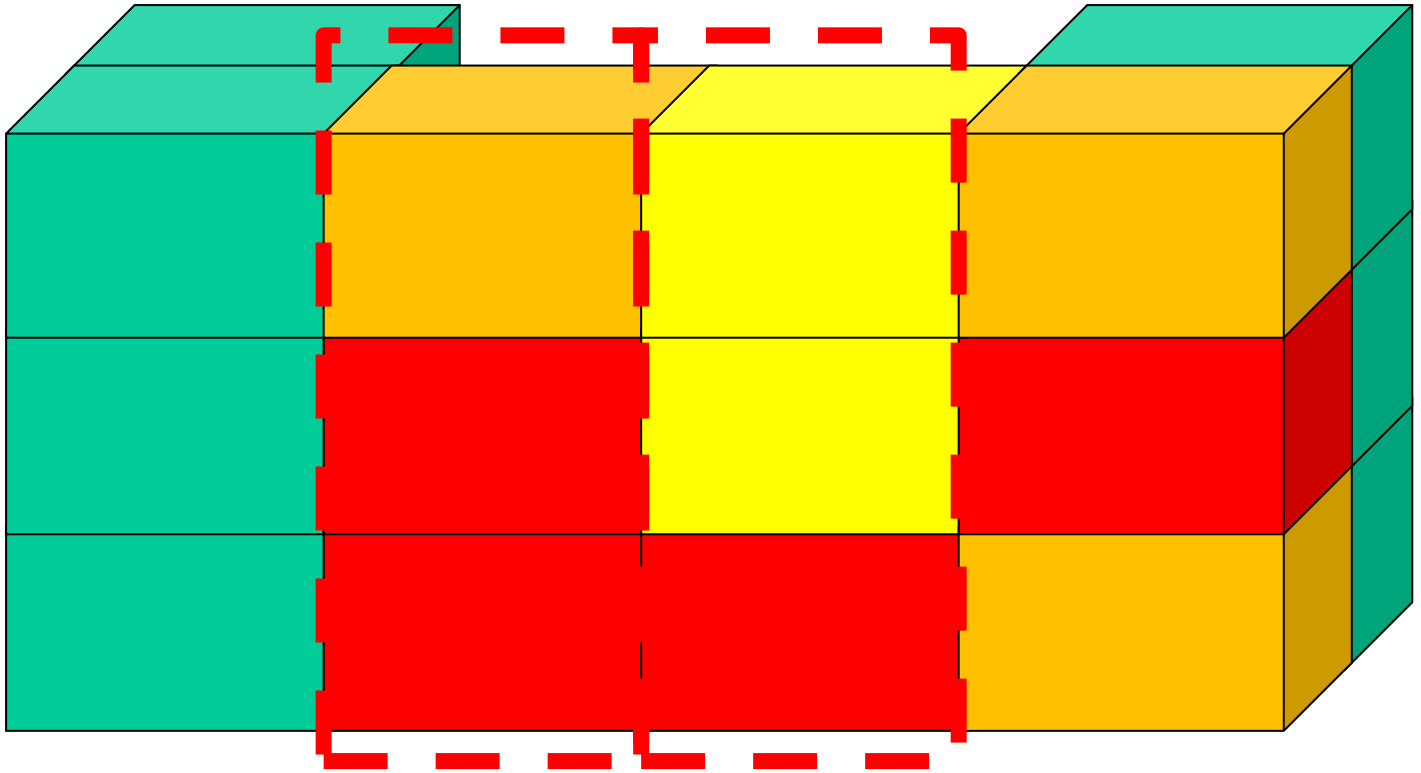


EES-Value:  **EES ≤ 0 ➔ DEFO**

2.2 Reduction of Energy (Crash)

Overall EES BET 1 > Overall EES BET 2

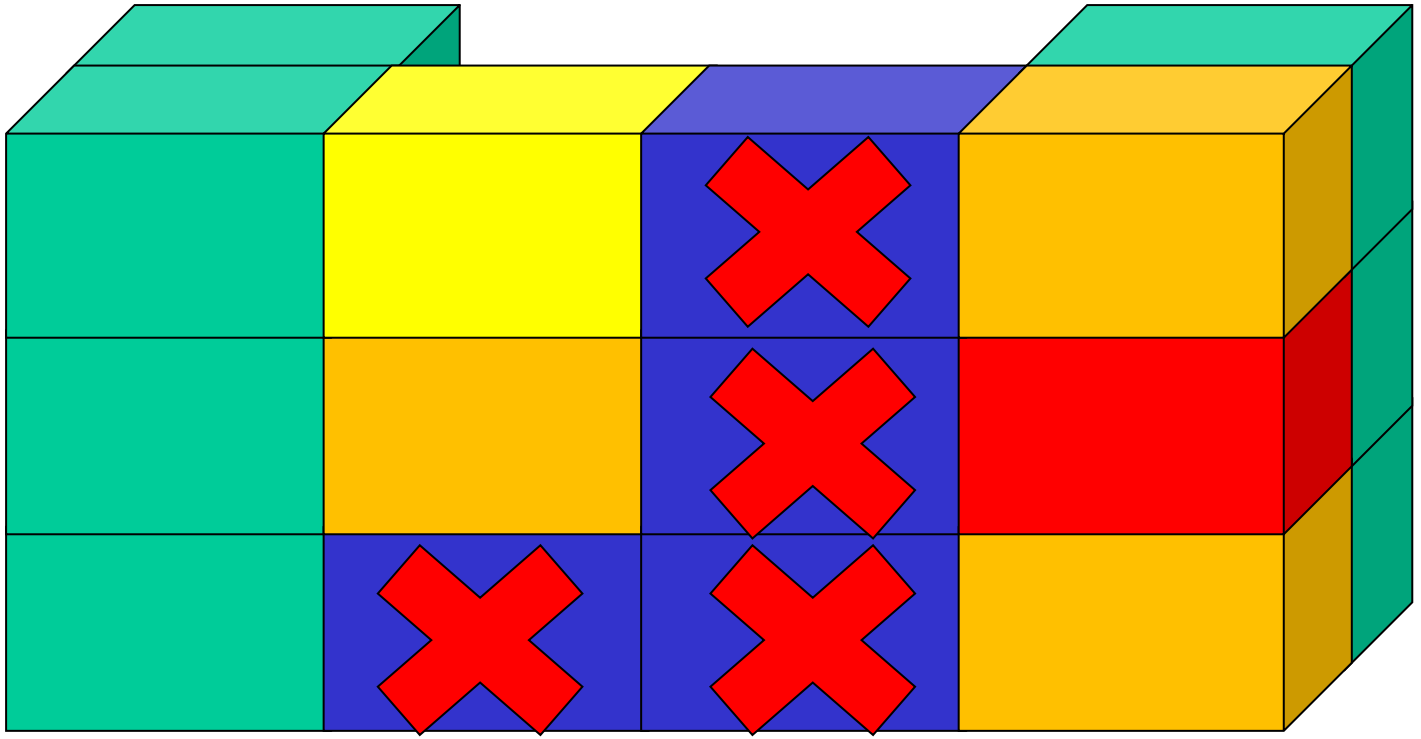
TTC = 0 s

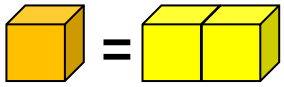
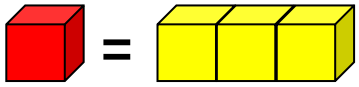


EES-Value: = = **EES ≤ 0 ➔ DEFO**

2.2 Reduction of Energy (Crash)

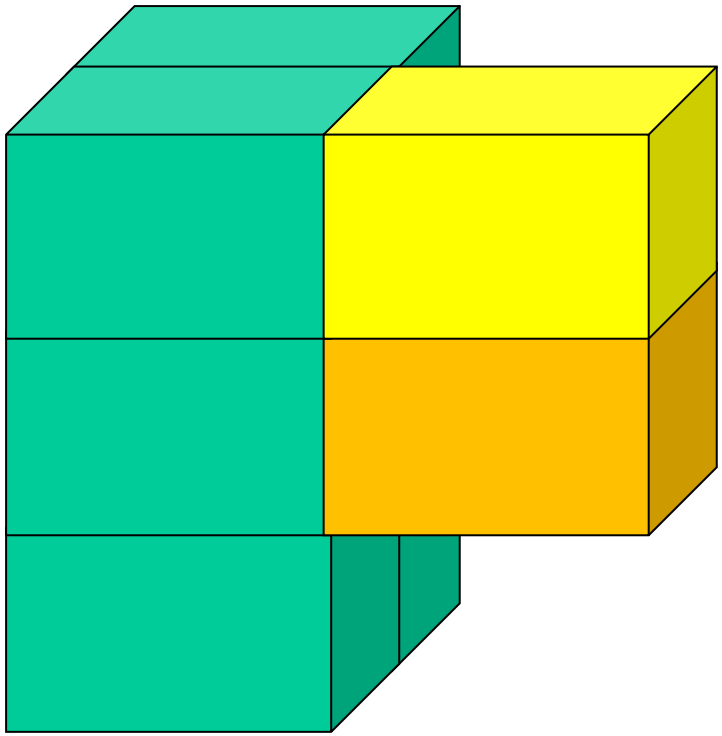
TTC = -0.01 s

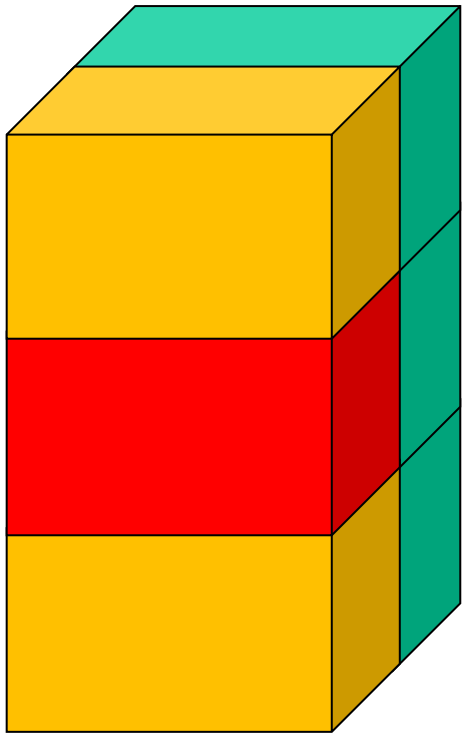


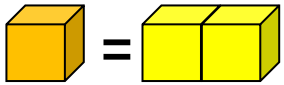
EES-Value:    **EES ≤ 0 ➔ DEFO**

2.2 Reduction of Energy (Crash)

TTC = -0.01 s





EES-Value:  **EES ≤ 0 ➔ DEFO**

2.2 Reduction of Energy (Crash)

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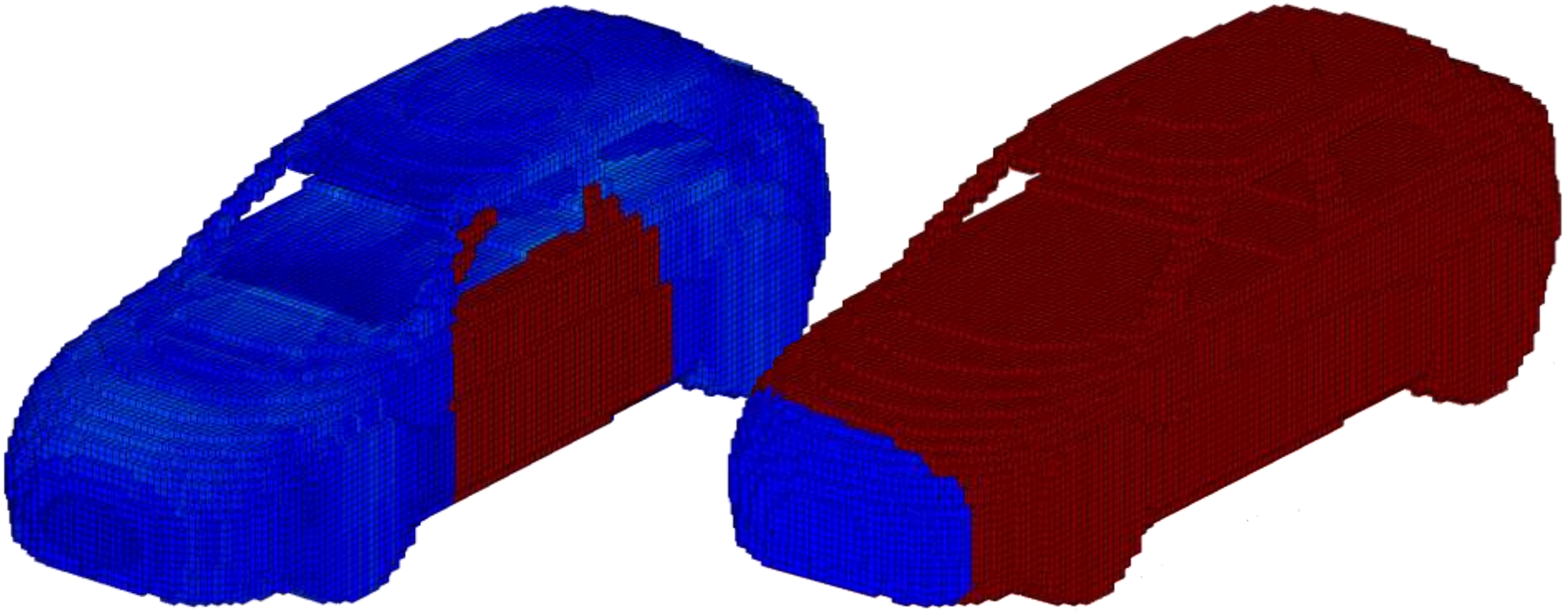
Resulting deformations and EES



2.2 Reduction of Energy (Crash)

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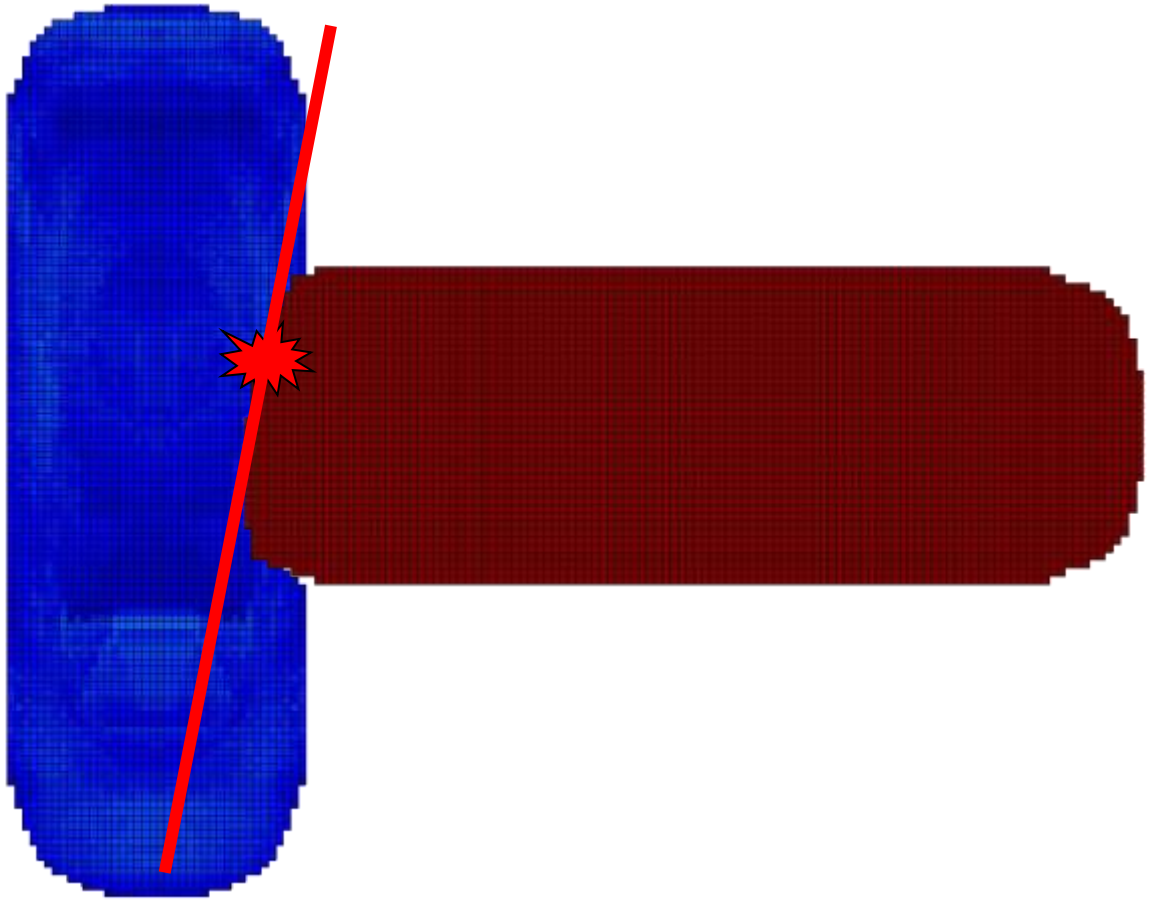
Resulting deformations and EES

Point of Impact

Impact plane



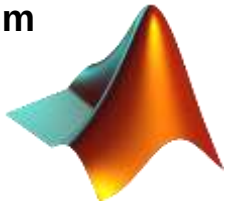
2.3 Post-Process and data for IRF

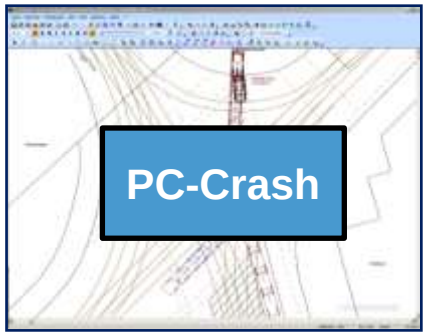
Resulting deformations and EES

Point of Impact

Impact plane

Algorithm





IRF Data

EES
Average acceleration
Duration of Impact
Deformation depth

+ delta-v
+ Impact impulse
+ Impulse angle
+ Angular velocity

3. Example

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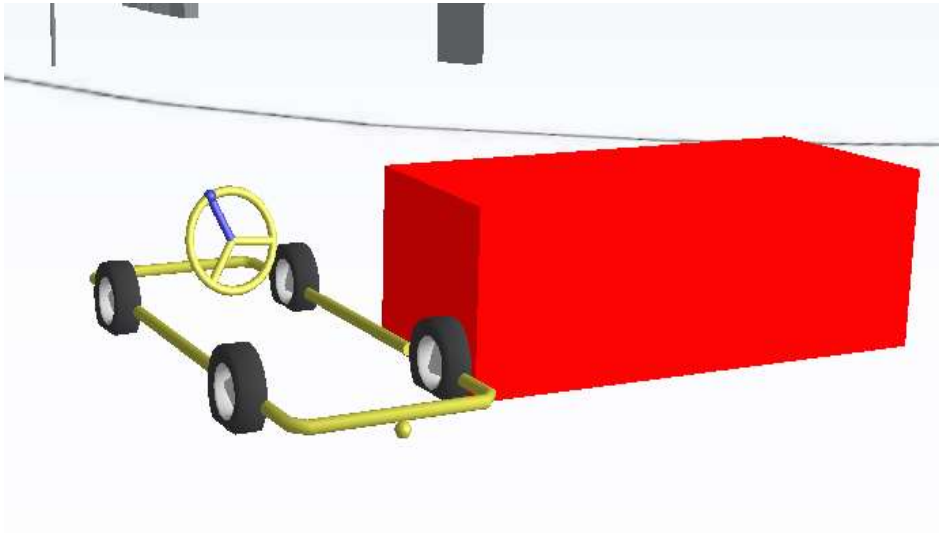
Simulation without ADAS

Simulation with ADAS

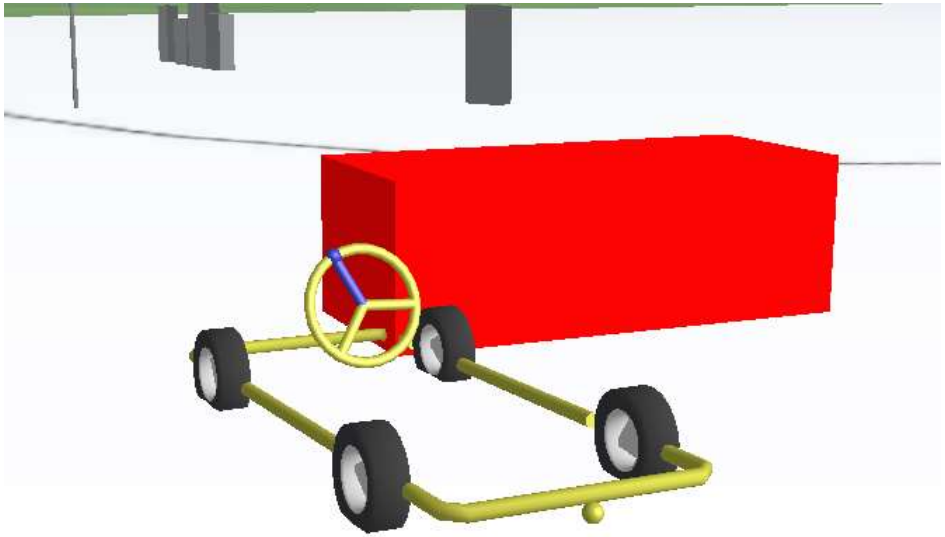
3. Example

Simulation without ADAS



Front to Side Collision

Simulation with ADAS



Front to Side Collision

3. Example

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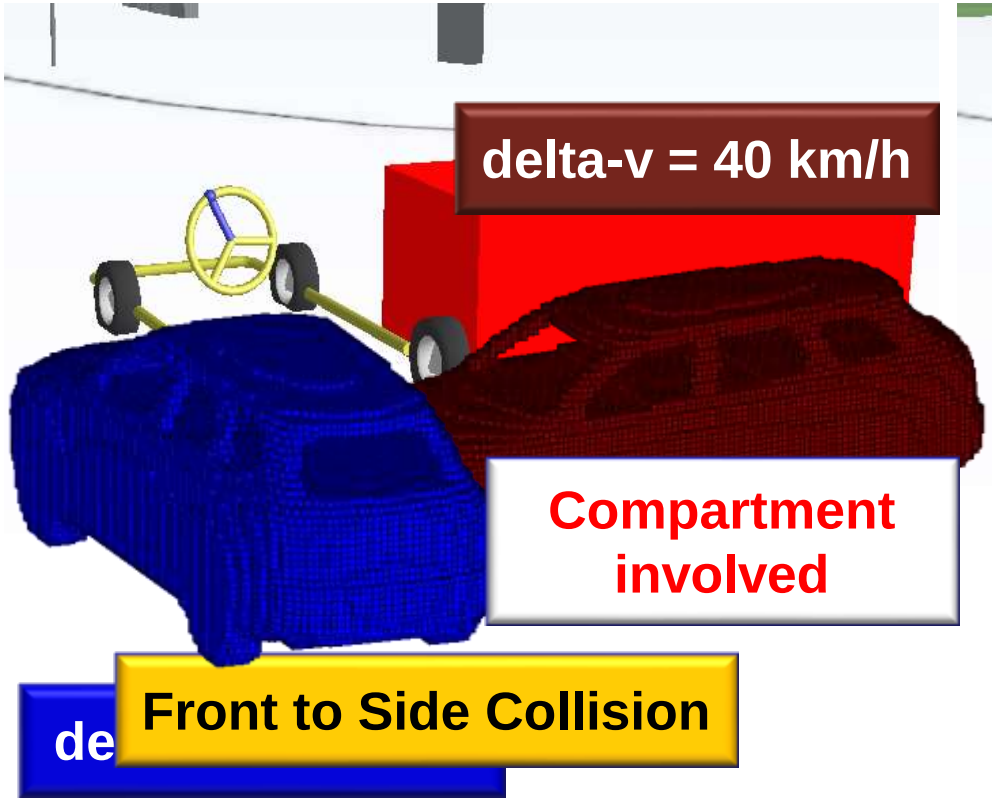
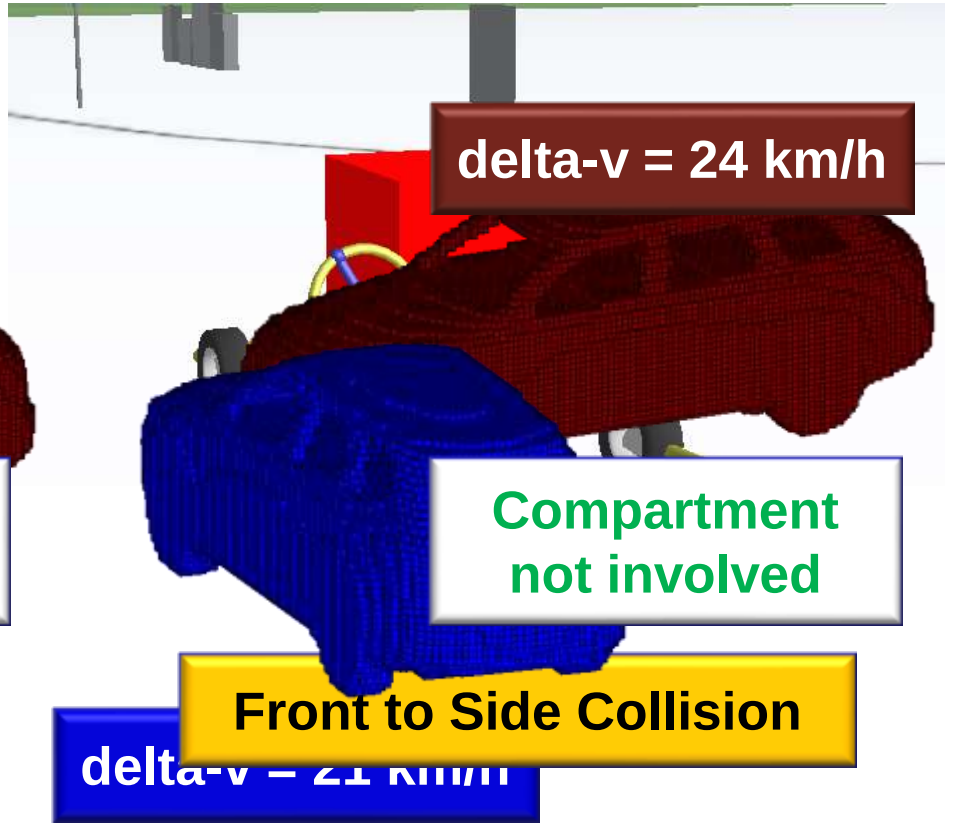
Simulation without ADAS



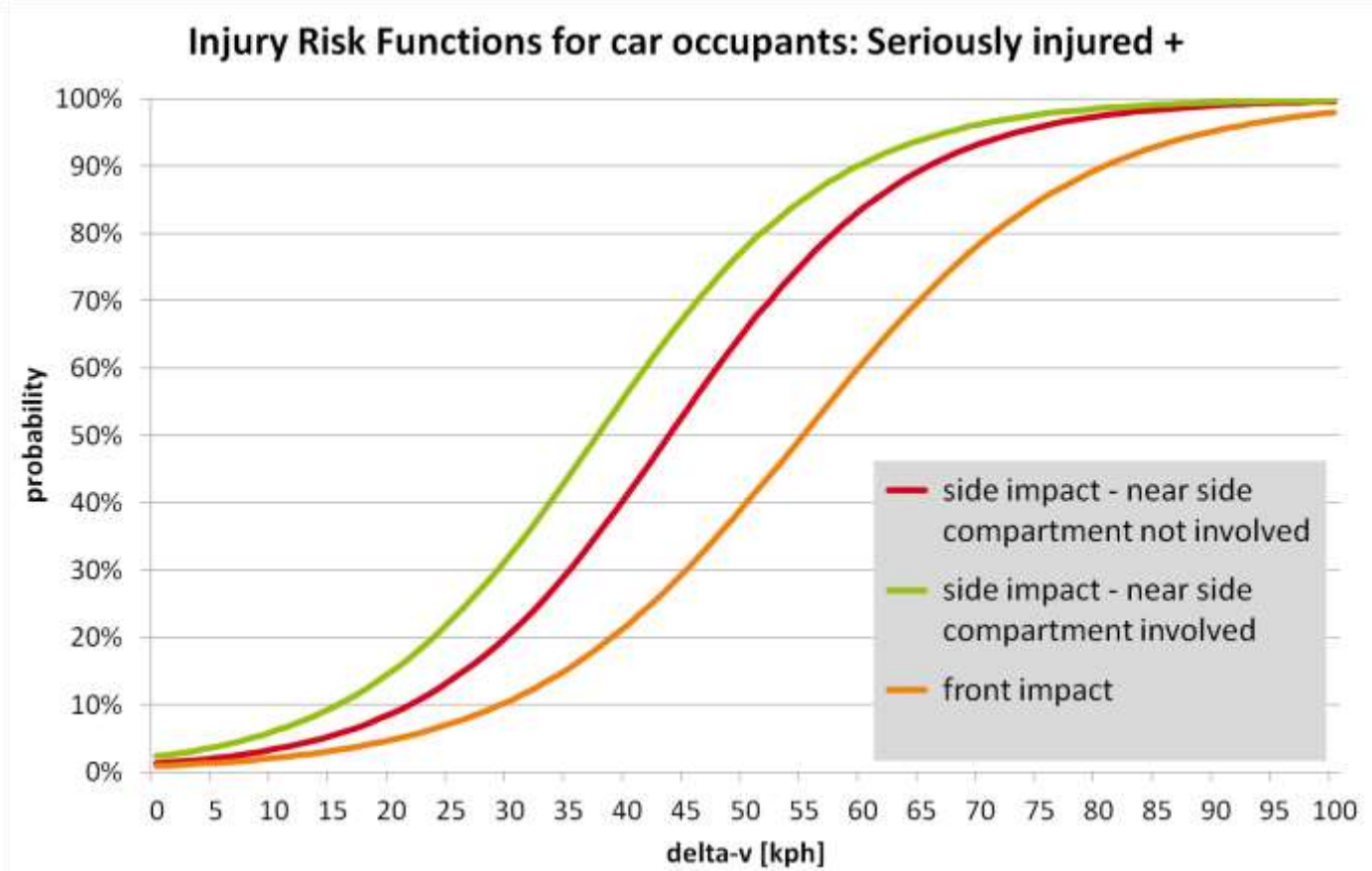
Simulation with ADAS



4. Further step: Benefit estimation with Injury Risk Function

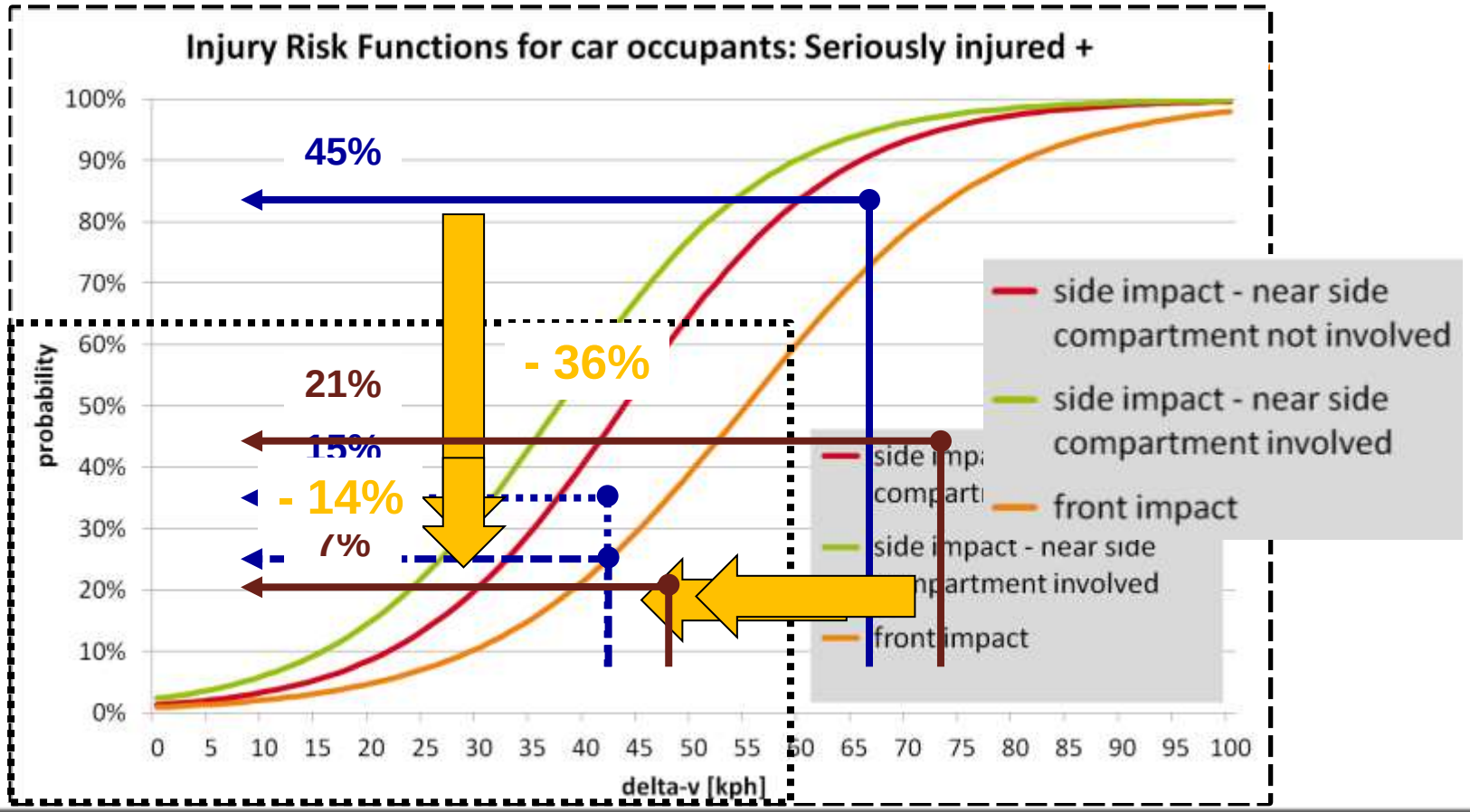
Which effect on the occupant's injury severity can be expected?

➔ Calculation and use of **Injury Risk Functions** for car occupants



4. Further step: Benefit estimation with Injury Risk Function

Application of the Injury Risk Function for every simulated scenario
→ Example case



5. Summary

- Simulation is a very effective tool for both the development and evaluation of active safety systems
- To evaluate active safety systems that are able to mitigate accidents concerning their benefit in real-world accidents a crash computation has to be conducted
- A standardized and automatic crash computation is necessary to enable benefit calculations on the basis of a representative set of accidents
- GIDAS allows the creation of deformation based EES and stiffness models as well as Injury Risk Functions which are substantial for a qualified benefit estimation of active safety systems

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Thank you for your attention.

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