An innovative active light weight design chassis concept

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16.02.2022

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Contents

- DLR & Institute for vehicle concepts – what we do…
- Reasons for the need of a new chassis systems for full electric vehicles
- The chassis system of the Next Generation Car – Urban Modular Vehicle (NGC-UMV)
  - The orbital wheel concept
  - The two-axis independent steering system
  - Virtual dimensioning process for the GFRP transverse leaf spring
  - The wheel as deflection shield is enough for an improvement in passive safety
- Conclusion and outlook

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DLR & Institute for vehicle concepts – what we do…

Locations

Approx. 9.000 employees across 55 institutes and facilities at 26 sites.

Offices in Brussels, Paris, Tokyo and Washington.

Research Areas

- Aeronautics
- Space Research and Technology
- **Energy and Transport**
- Defence and Security
- Space Administration
- Project Management Agency

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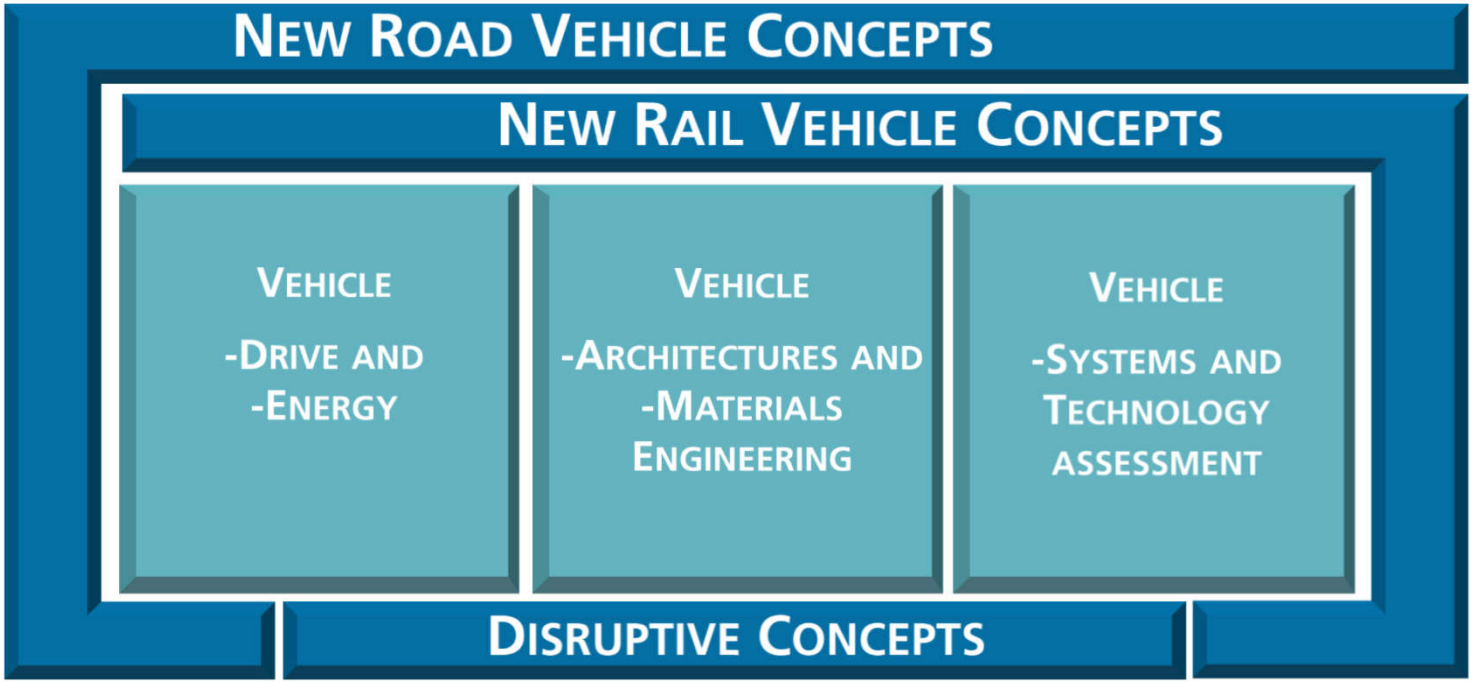
DLR & Institute for vehicle concepts – what we do…

Our solutions for concepts, technologies and methods are:

1. **SUSTAINABLE**
   (resource efficient & climate neutral)
2. **ECONOMICAL**
   (cost efficient & financeable)
3. **SAFE, SECURE AND NETWORKED**
4. **USER-ORIENTED**
   (visionary, unconventional, needs-oriented and inspiring)

We provide research services in 6 research / innovation transfer fields:



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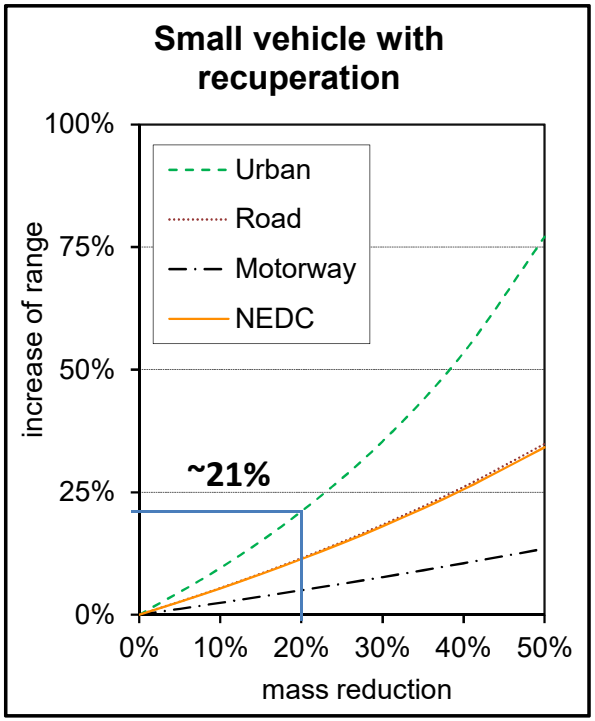
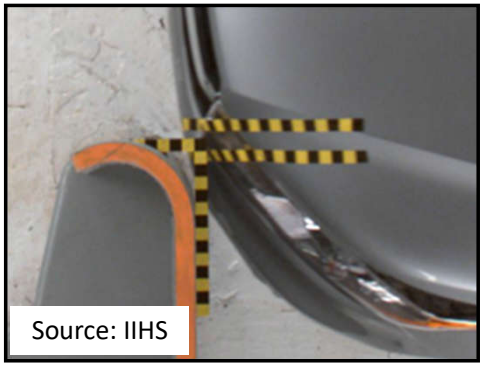
Reasons for the need of a new chassis systems for full electric vehicles

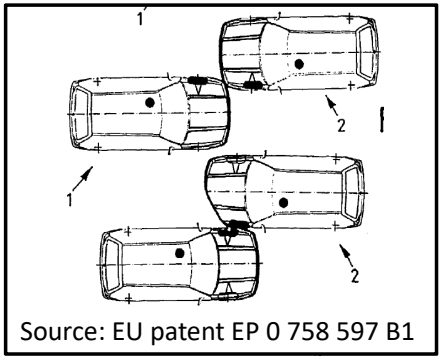
- Lightweight Design is still important for electrified vehicles

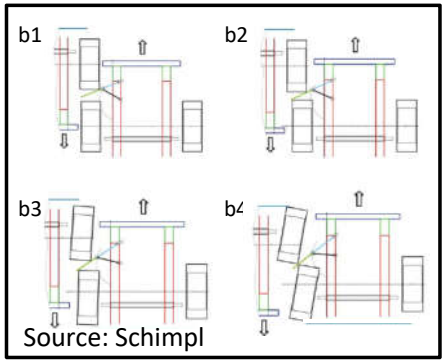


- Current regulations and a lack of crash compatibility in reality



- Deflection: a possible solution





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The orbital wheel concept – Basic Idea

Orbital wheel (F. Sbarro: EP000000414814A1, 1989)

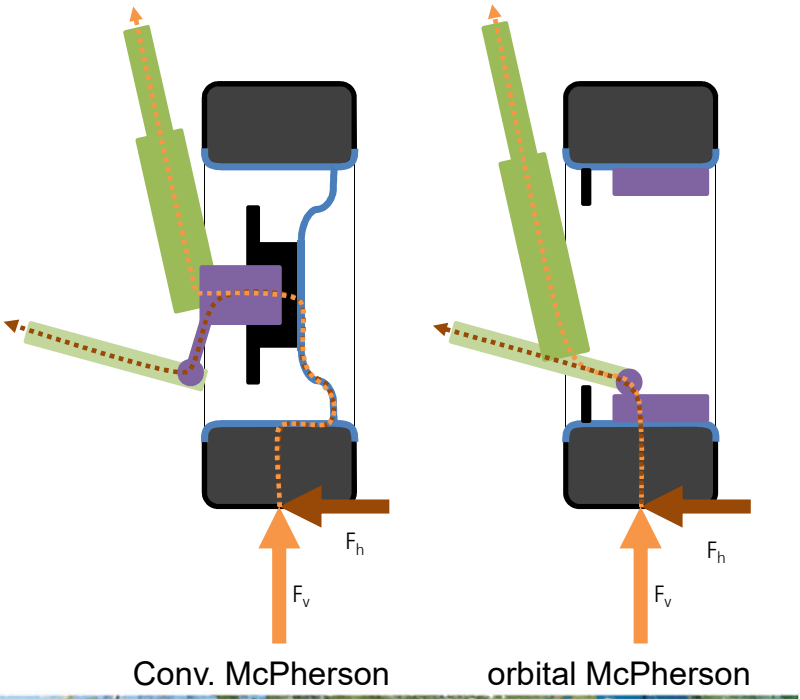
Idea:

- Point of force application close to the contact point
- Reduced (rotating) mass
- Reduced friction

In addition:

- Possibility of adjustment of camber angle

source: www.timsomerset.artfolio.com



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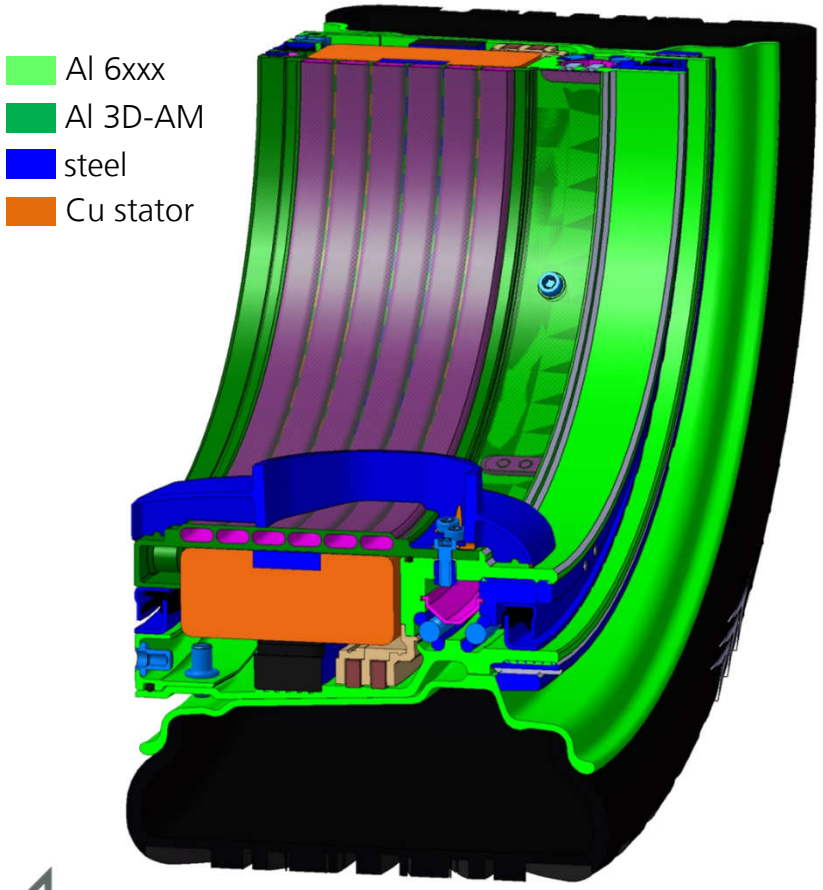
The orbital wheel concept – detailed design



Key facts:

- Dimensions:
  - 7x20 rim
  - 215/30 R20 tire
- Estimated weights from CAD:
  - 4.5kg rim & central lock
  - 15.8kg housings (wo tire/brake)
  - 9.1kg bearings and sealings
  - 46.7kg motor (wo cables)
  - 0.6kg link to wheel guidance components
- Relevant masses:
  - 17.6kg rotating mass (wo tire/brake disk)
  - 76.7kg unsprung mass (wo tire/brake)
- Motor.
  - 400V (17/25KW)
  - 240/330Nm
  - 500/1000U/min

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The orbital wheel concept – first impressions

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PARARE

ADDITIVE TECHNOLOGIES + CNC

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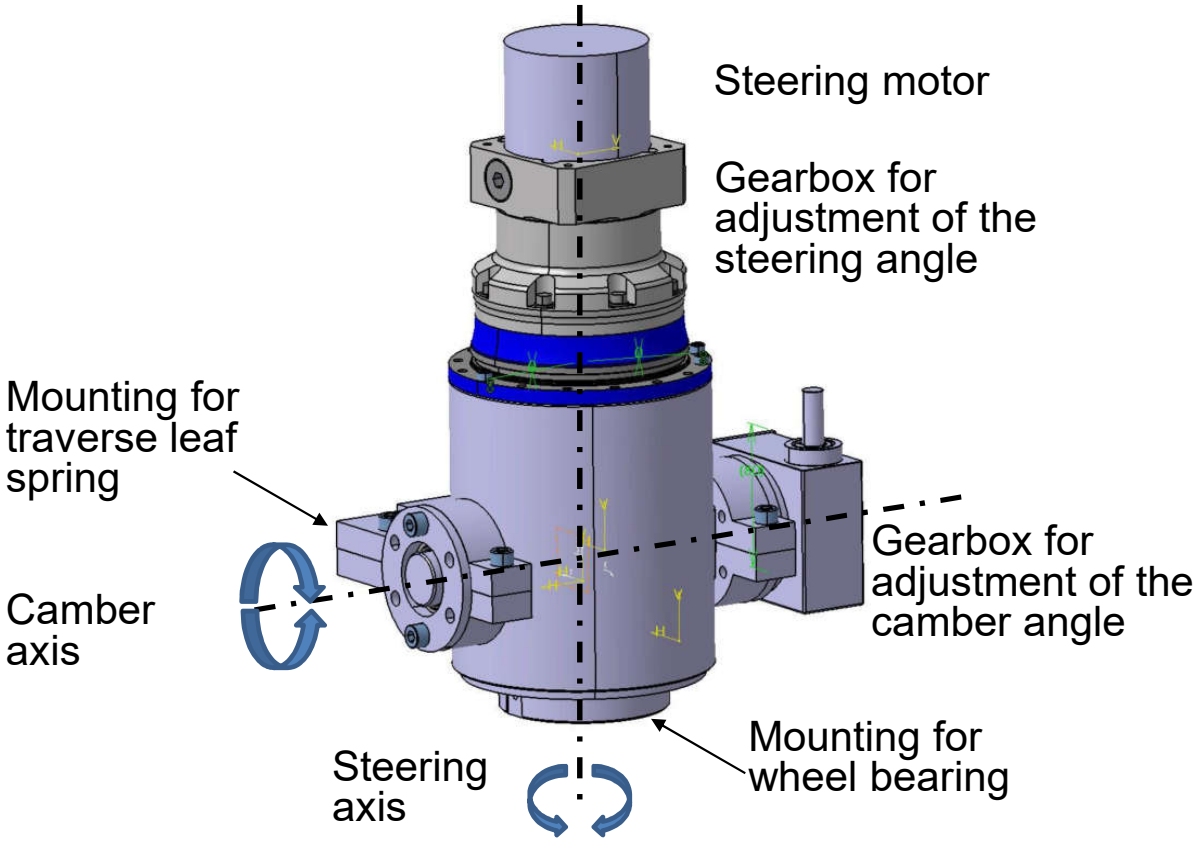
The two-axis independent steering system



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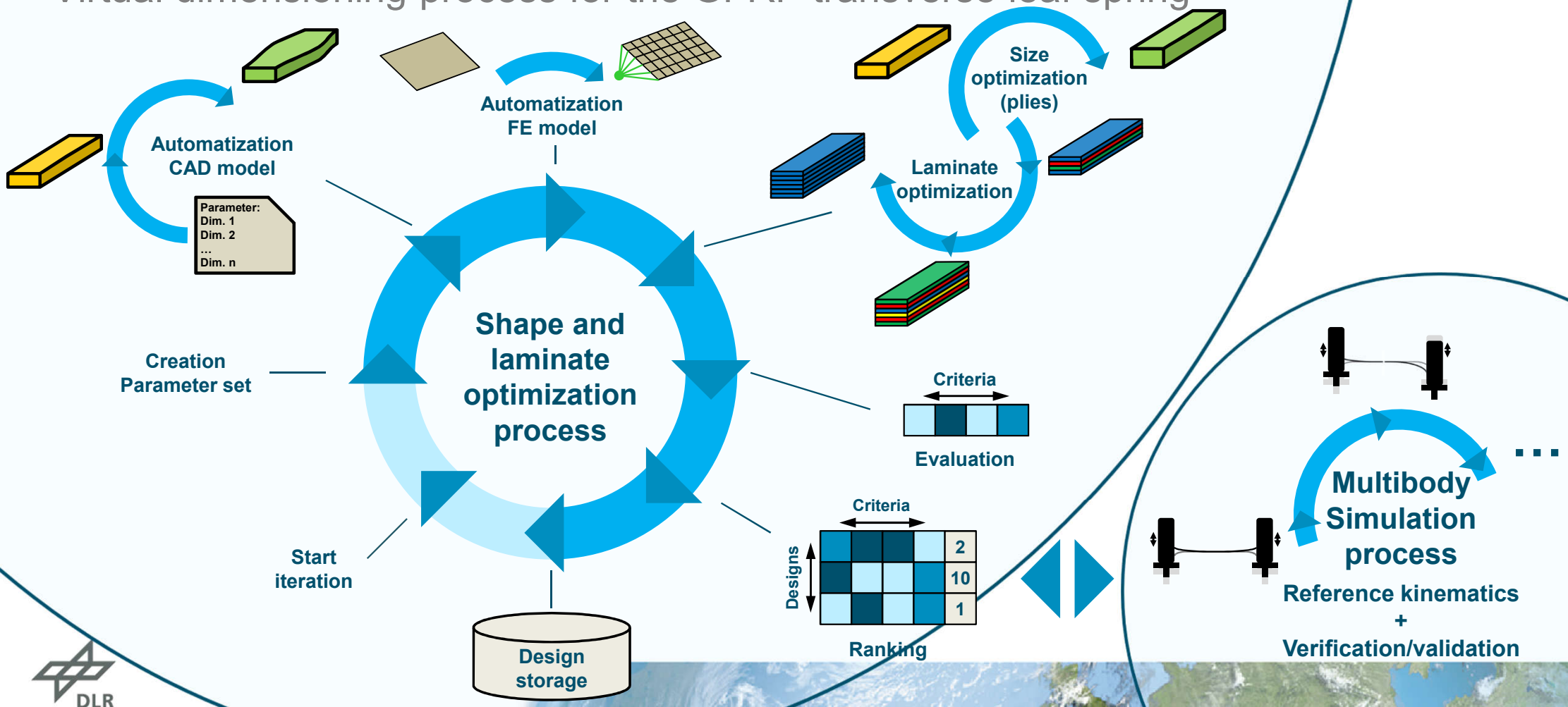
Virtual dimensioning process for the GFRP transverse leaf spring



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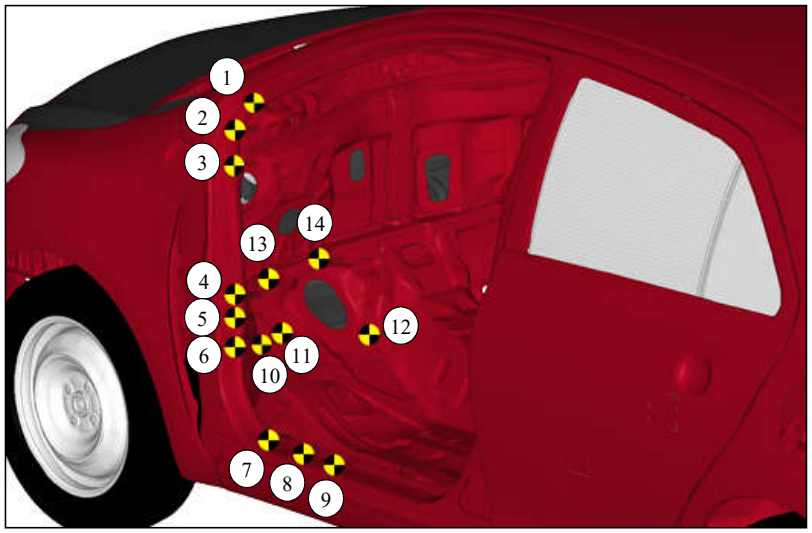
The wheel as deflection shield is enough for an improvement in passive safety

Assumptions:

- Turning speed of wheel 700°/s
- Use of parking sensors etc. for pre-crash detection
- Activation 0.5m before impact



Results

- Toe in angle of the wheel by 30°
- Wheel no longer hits the rocker panel
- Up to 32% less intrusion at rocker panel and hinge pillar
- No jammed door after crash
- Enhanced crash performance

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Conclusion and Outlook

- New crash test scenarios and new all electric vehicle concepts demand new safety solutions
- New chassis concepts with active systems can even enhance crash performance without additional mass
- The DLR proved the feasibility by static and dynamic simulations
- A methodical design and dimensioning of the transverse leaf spring is actually a work in progress
- Next steps are the build-up of a prototype of the wheel concept and the detailed design of the two-axis steering system

Space for questions…