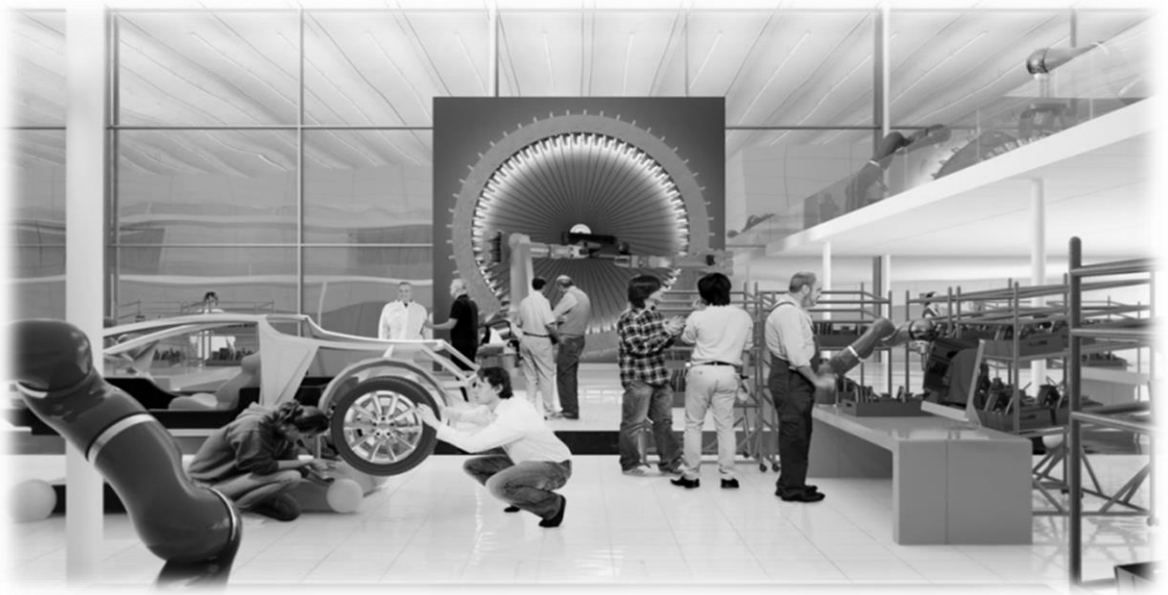
GEFÖRDERT VOM
Bundesministerium für Bildung und Forschung
BETREUT VOM
PTKA Projektträger Karlsruhe
Karlsruher Institut für Technologie
FORSCHUNGS CAMPUS
öffentlich-private Partnerschaft für Innovationen

ARENA2036 DigitPro

Christian Liebold
DYNAmore GmbH



Strategic partnership for new innovations and research on a new level

DigitPro – **Digit**aler **Pro**totyp

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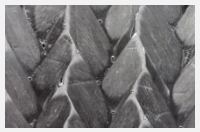
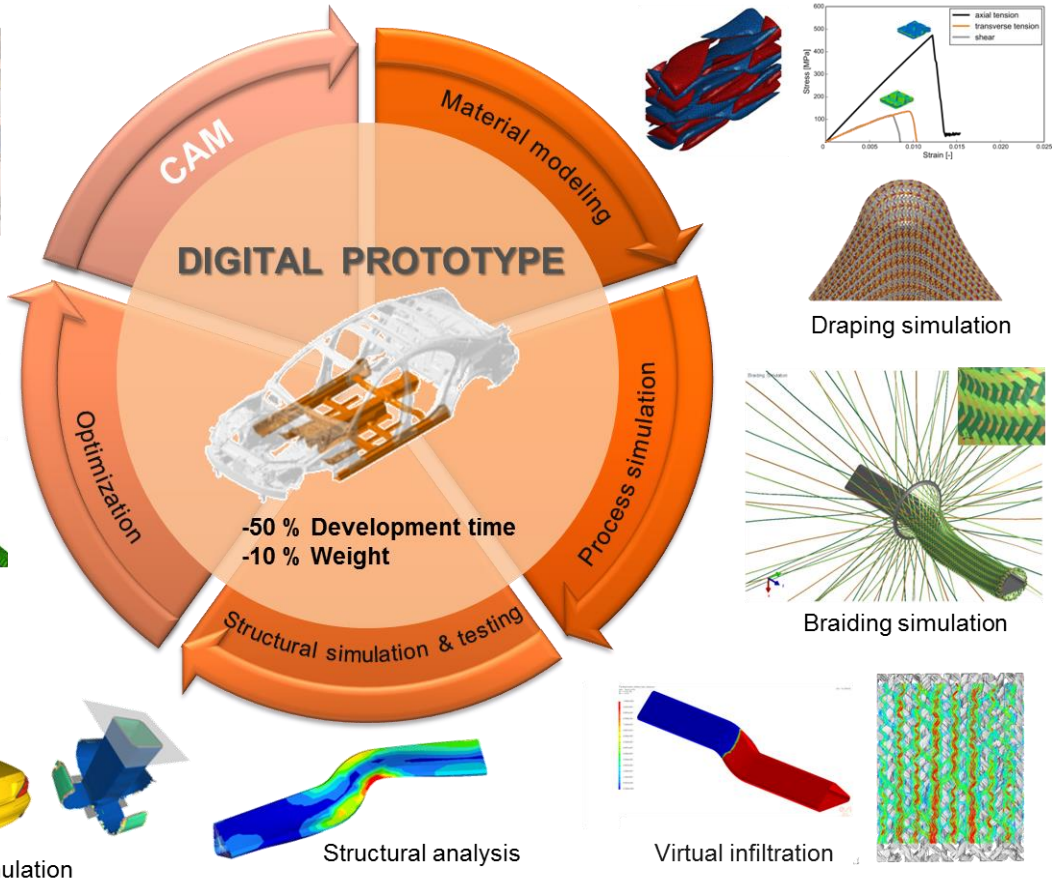
- closed simulation process chain
- from preliminary design to the final component
- micro, meso and macro modeling
- different simulation software tools
- HDF5 Format
- digital fingerprint

– braided components
– **O**pen-**R**eed-**W**eaving components

-50% development time
mind. -10% weight




Robot control system



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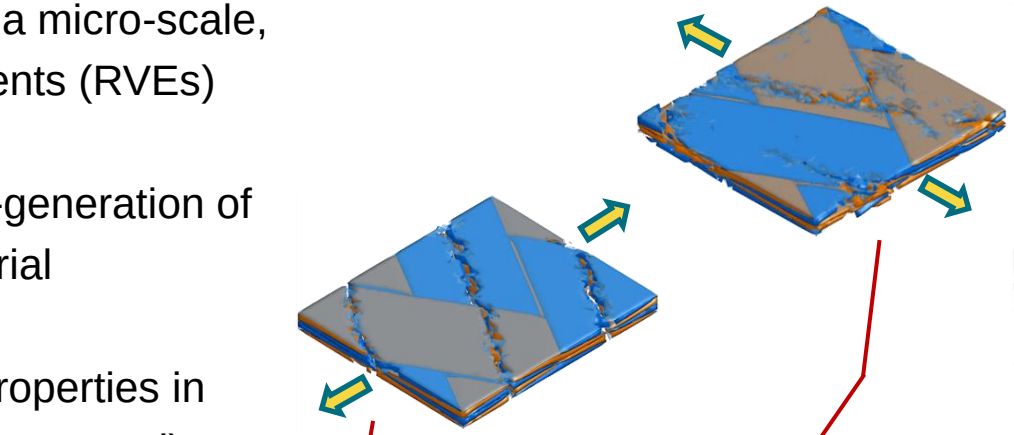
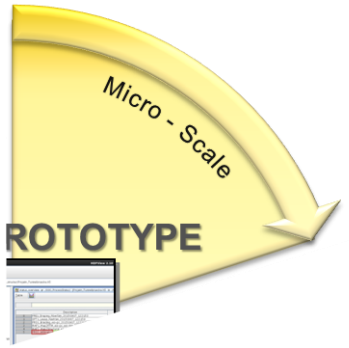
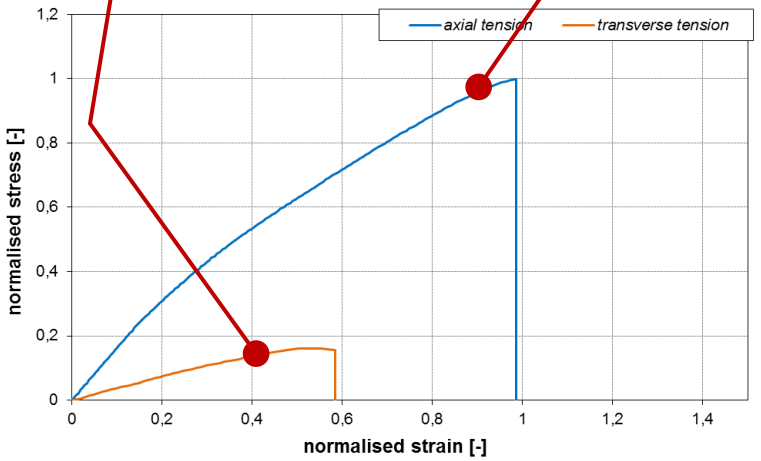
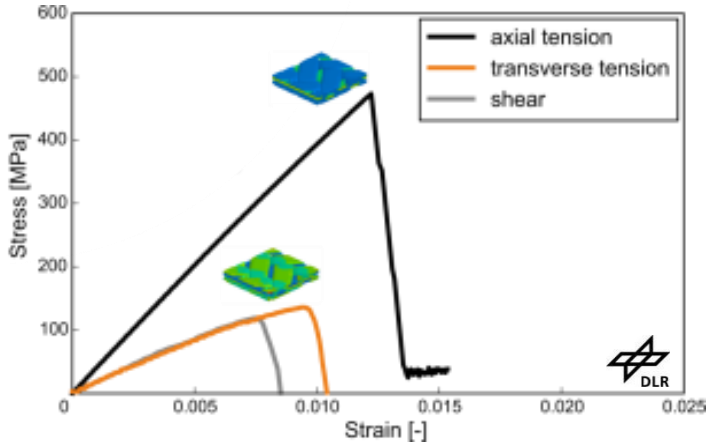
- determine material parameters on a micro-scale, using representative volume elements (RVEs)
- scripted TexGen program for RVE-generation of braided structures and ORW material
- Numerical estimation of material properties in tension, compression (axial and transversal) and shear

make detemined material data accessible for various material models









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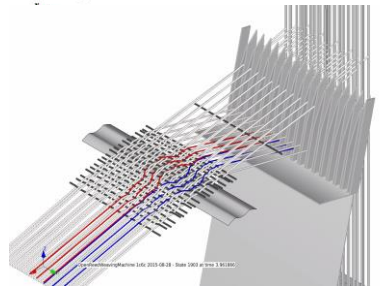
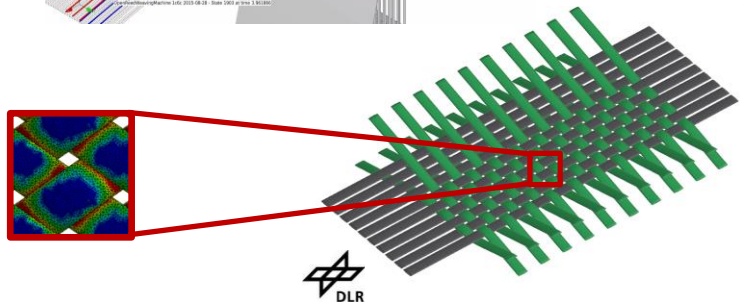
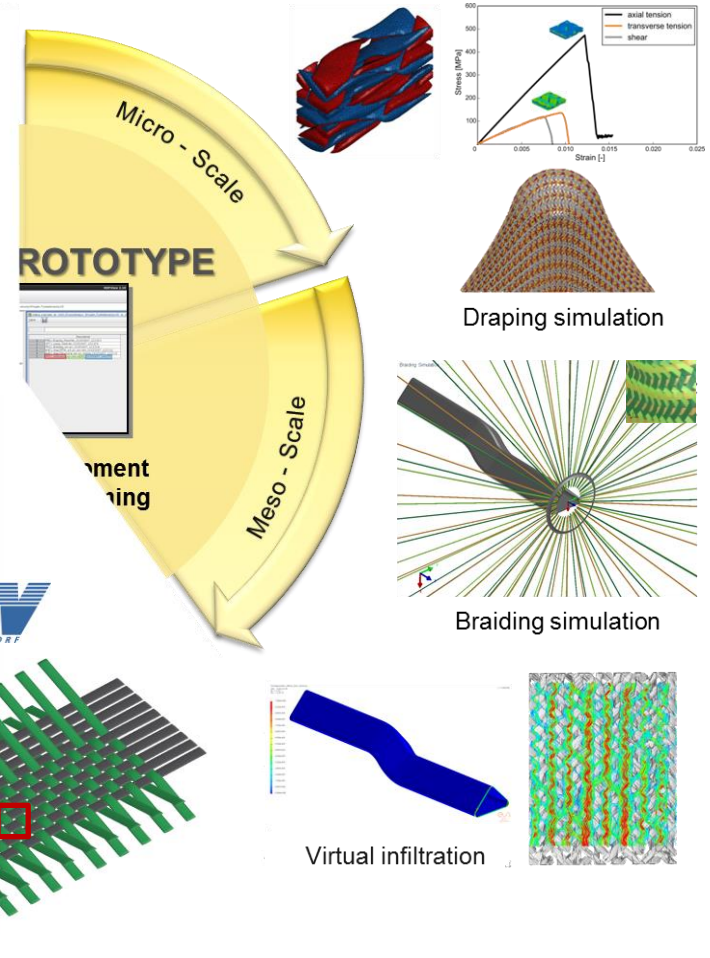
- several process simulations will be investigated and improved
- various modeling techniques conceivable:
- braiding simulations with beam- and shell approach
- draping simulations with beam- and shell approach
- weaving simulations with beam-, shell or even solid elements

consider results from process simulations in stuctural analysis







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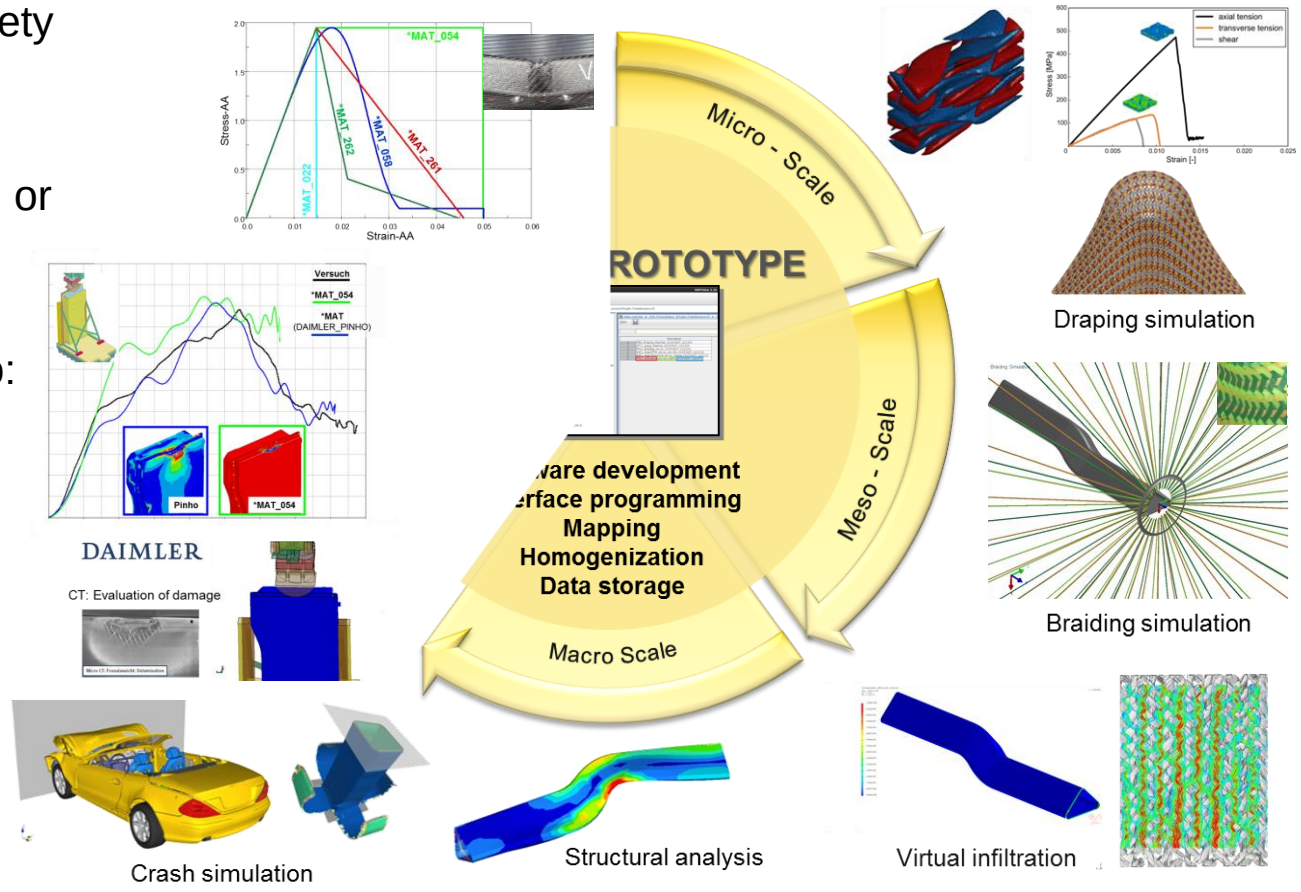
- Structural analysis can be performed with a large variety of material models available in LS-DYNA
- element sizes are much larger compared to the micro- or macro modeling approaches
- mapping and data storage is very important in order to:
  - Properly consider process simulation in structural analysis
  - Guarantee an easy data exchange btw. collaborating partners
- Homogenization methods are needed

properly transform results from process simulations onto structural meshes



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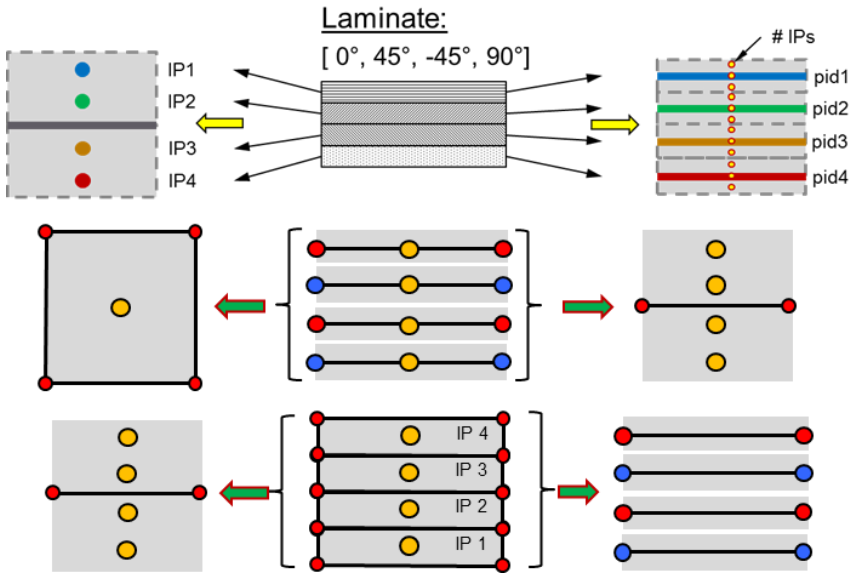
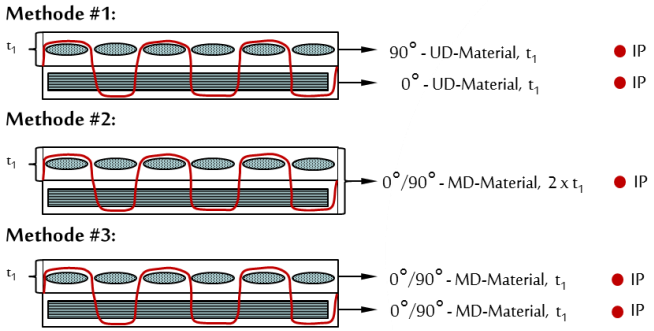
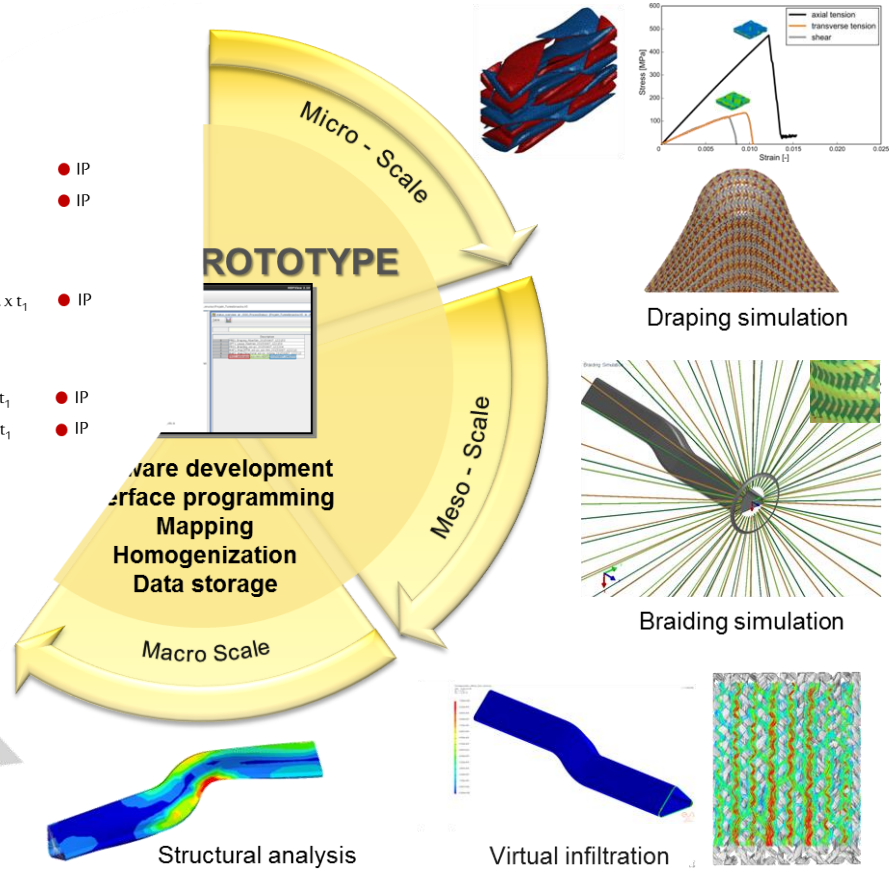
- for composites, there exists a large variety of modeling approaches







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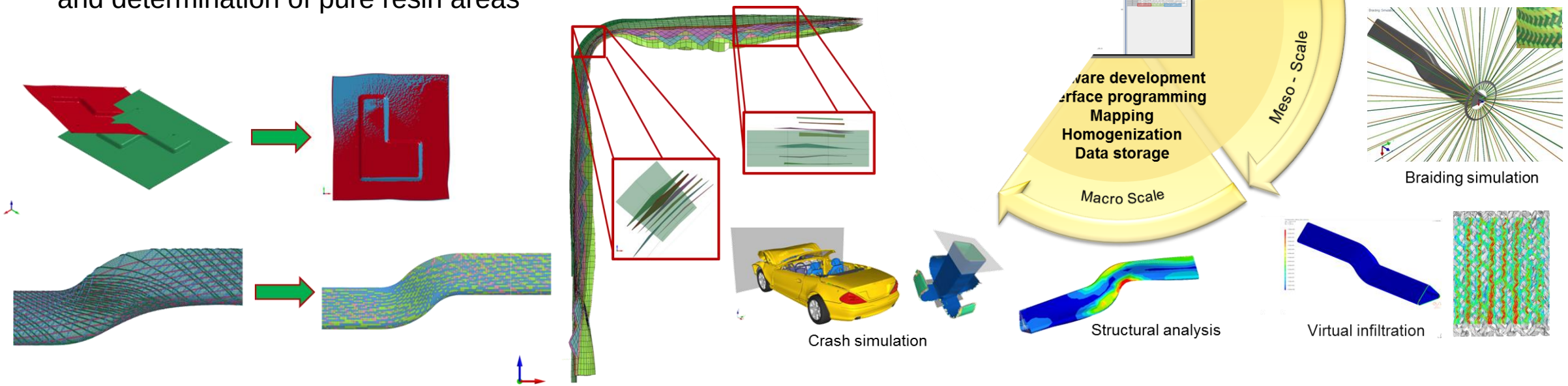
- Automatic geometry matching implemented
- Considering roving width
- Thickness considerations from shell-stacking sequence and determination of pure resin areas



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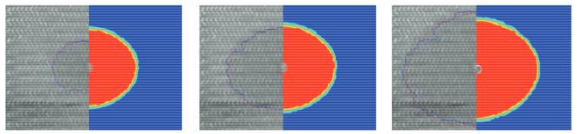
- different results with different approaches

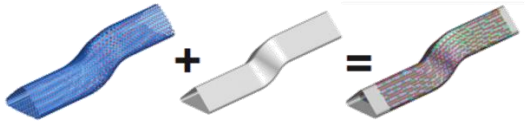
Infiltration Simulation



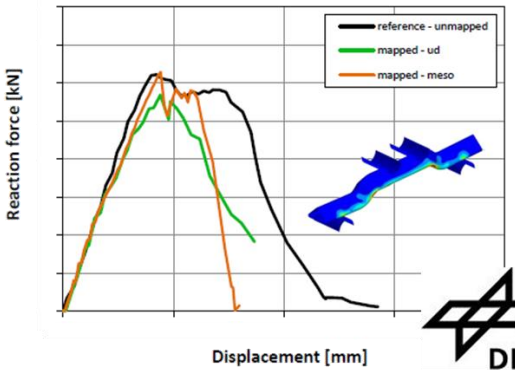
IFB
Universität Stuttgart

Structural Simulation

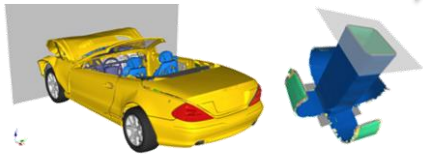
- Mapping of the orientations from the braiding process simulation on the virtual structure



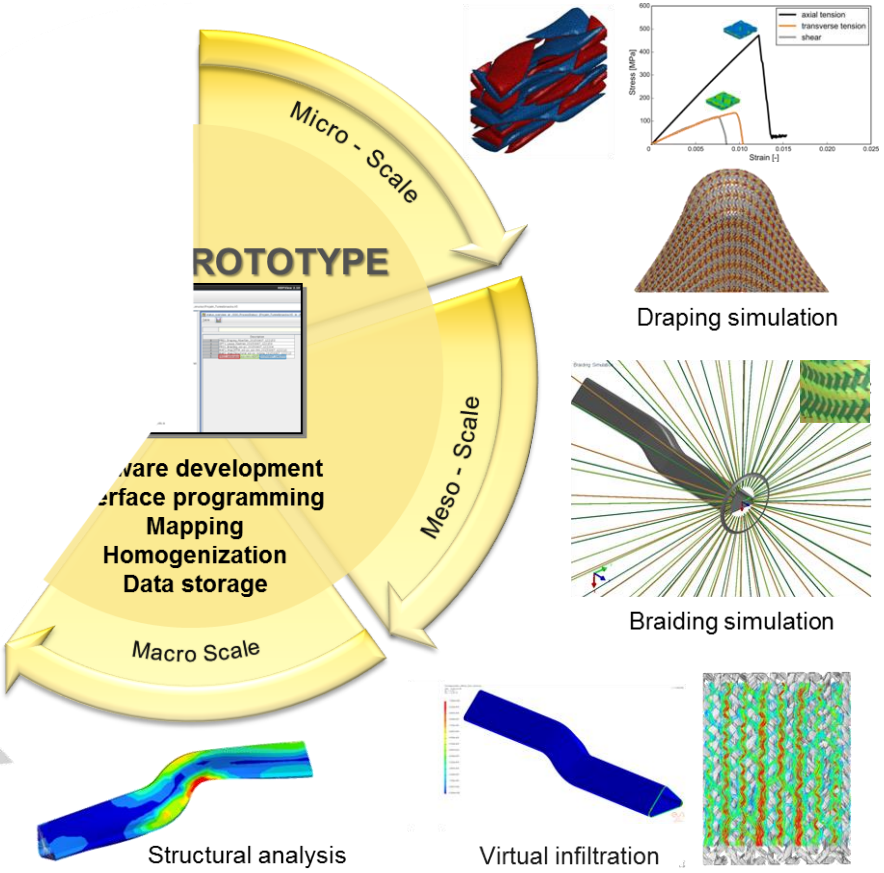
- Investigation of numerical approaches for the simulation of braided structures (CRFP)



DLR



Crash simulation



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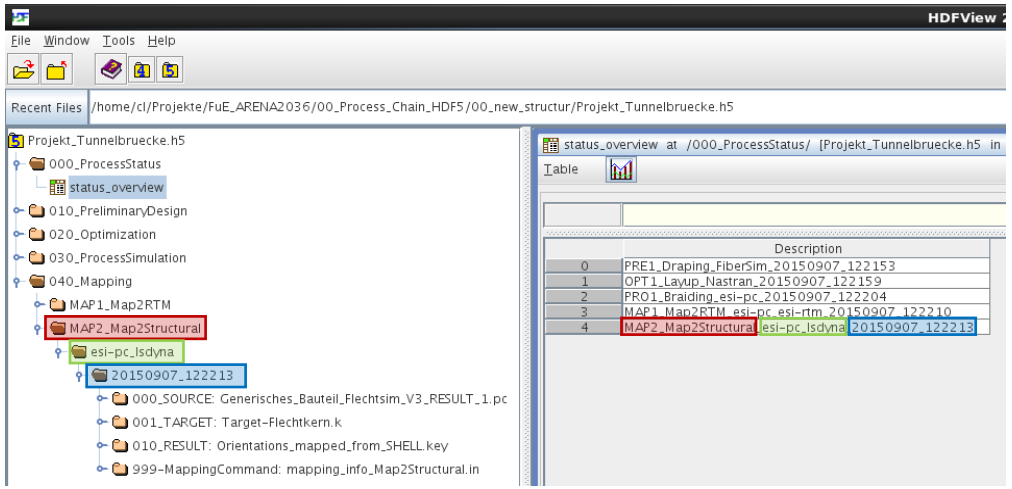
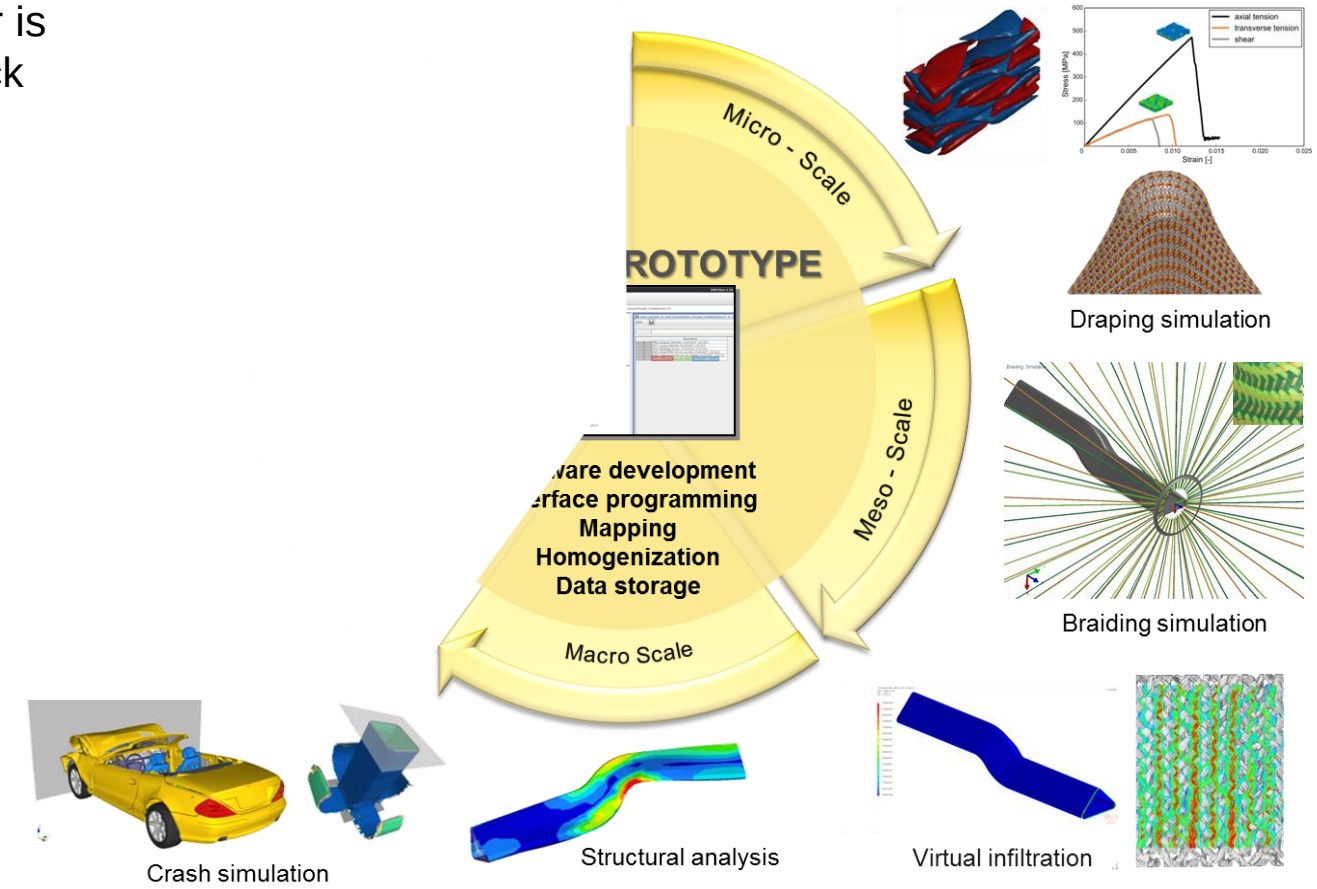
- a platform independent, HDF5 data storage container is defined within the project, allowing to access and track simulation results



development of a readable data exchange platform



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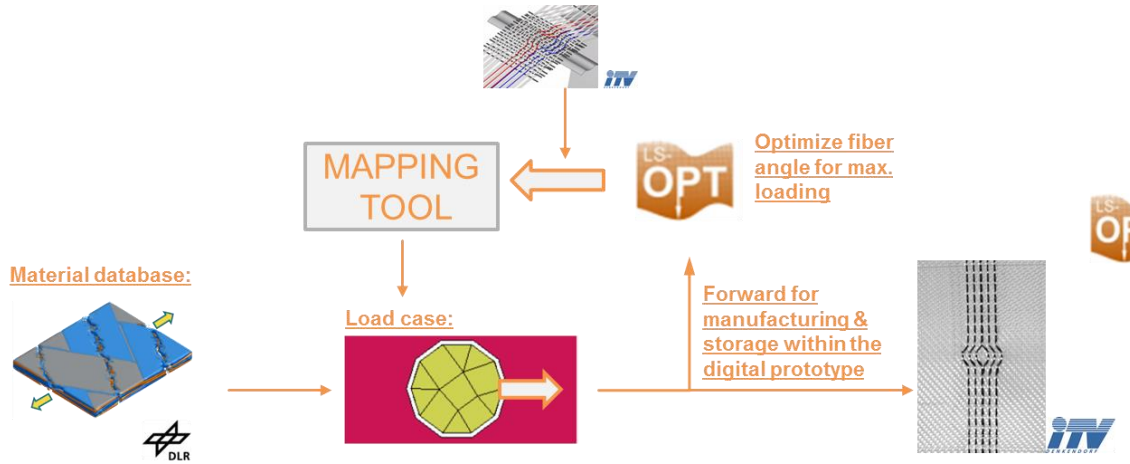
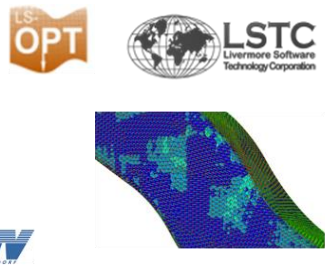
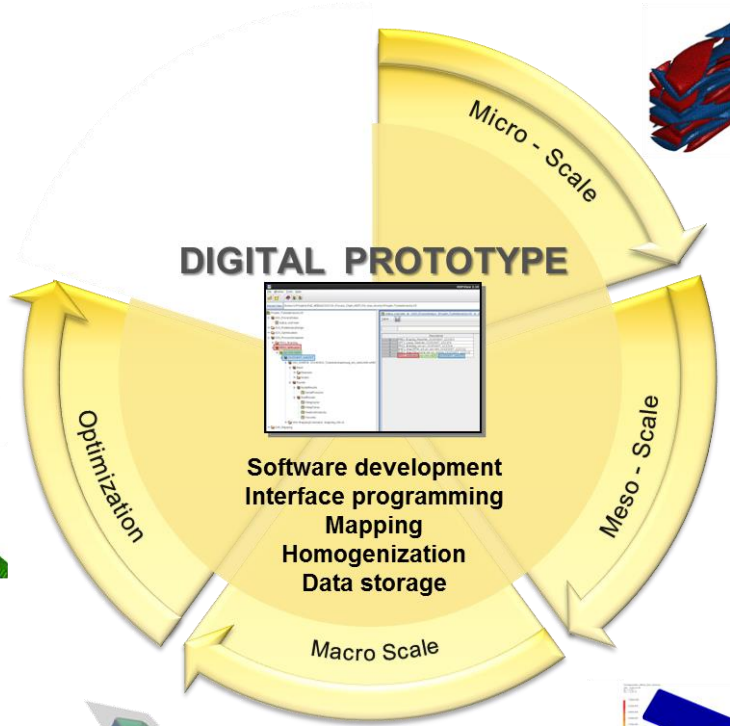
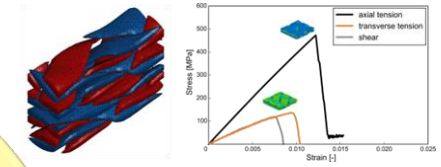
- Strategy development for the consideration of processing parameters within component optimizations



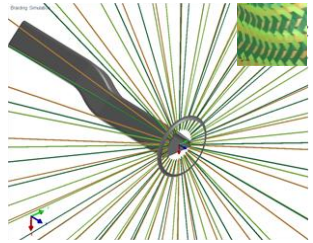


Optimizing load paths & structure evaluation

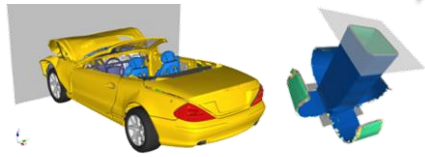




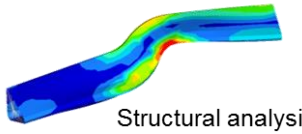
Draping simulation



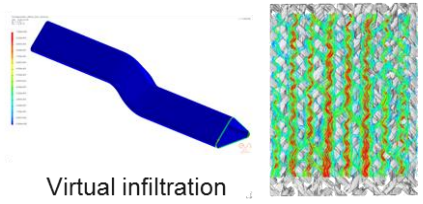
Braiding simulation



Crash simulation

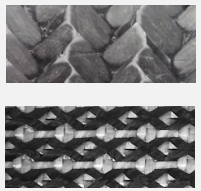


Structural analysis



Virtual infiltration

make these data available for optimization of the process parameters



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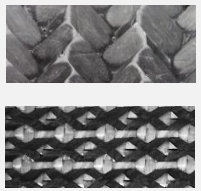
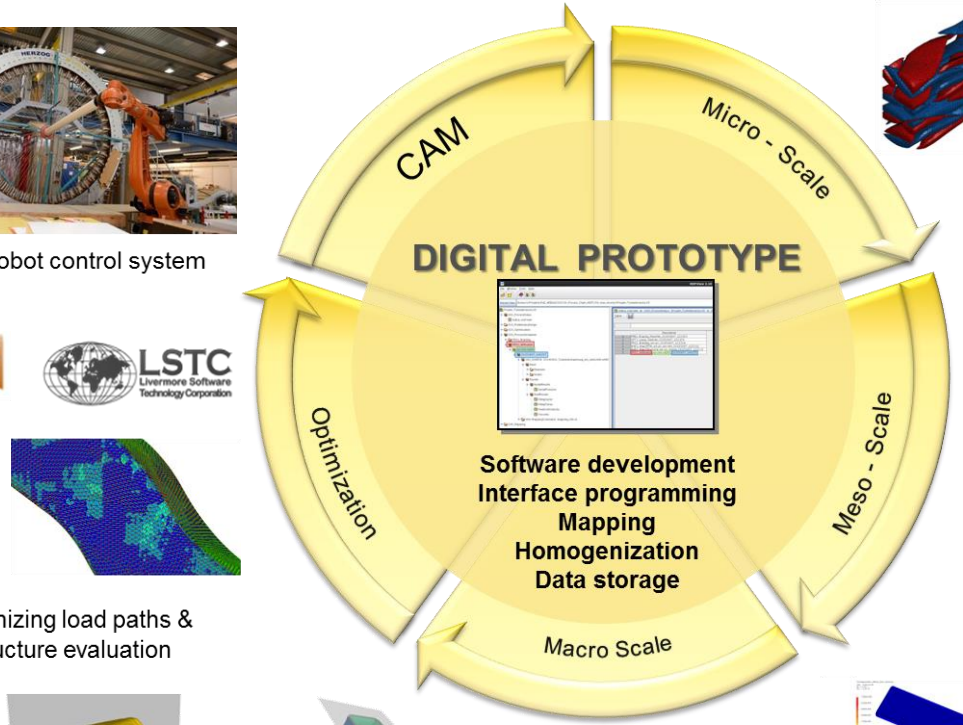
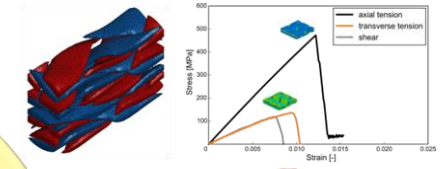
- Within the ARENA2036 research campus, a multi-scale, integrative simulation environment is being established, allowing to consider multiple manufacturing processes
- The developed mapping, homogenization and data exchange platform is solver independent
- Optimization and CAM interfaces are under investigation

DigitPro – the Digital Prototype: closing the simulatoin process chain

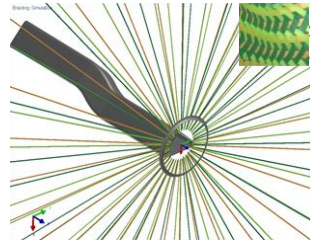


Robot control system



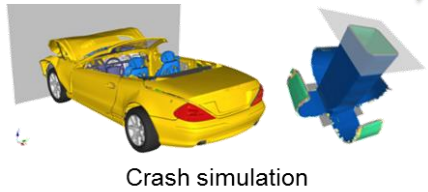


Draping simulation

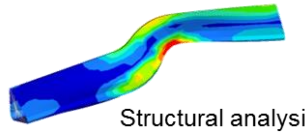


Braiding simulation

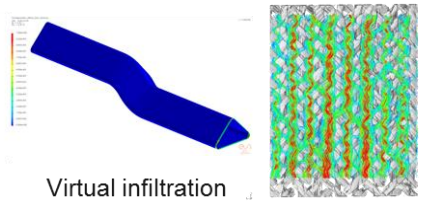
Optimizing load paths & structure evaluation



Crash simulation



Structural analysis



Virtual infiltration

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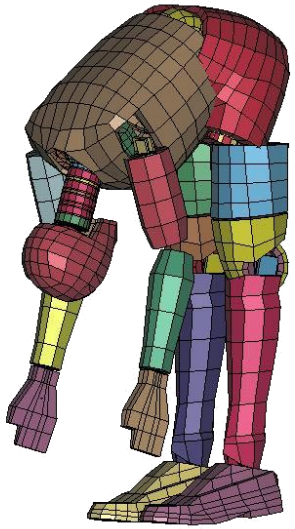

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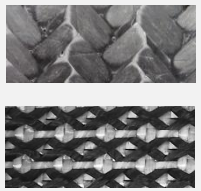
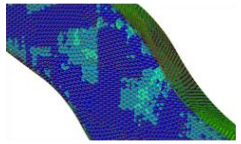
Dieses Forschungs- und Entwicklungsvorhaben wird mit Mitteln des Bundesministeriums für Bildung und Forschung (BMBF) gefördert und vom Projektträger Karlsruhe (PTKA) betreut.
Die Verantwortung für den Inhalt dieser Veröffentlichung liegt beim Autor.

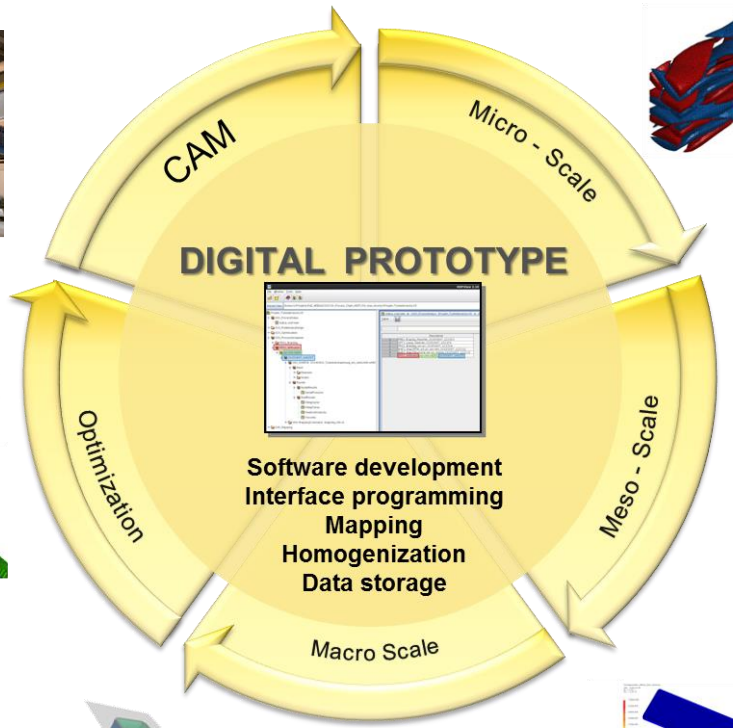
DigitPro – the Digital Prototype: closing the simulatoin process chain

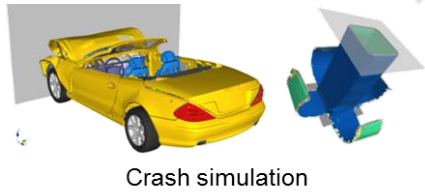


Robot control system

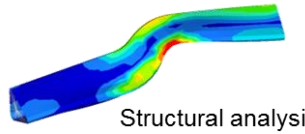


Optimizing load paths & structure evaluation



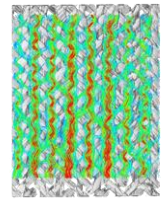


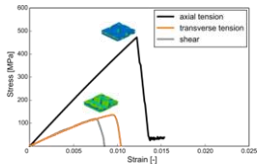
Crash simulation



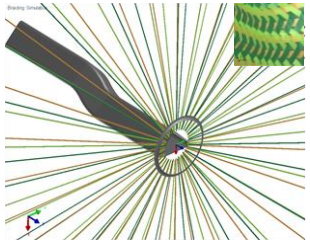
Structural analysis

Virtual infiltration





Draping simulation



Braiding simulation

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