Strategic partnership for new innovations and research on a new level
Active Research Environment for the Next generation of Automobiles

- Development of Industry 4.0 with higher flexibility and reduction of energy consumption
- 3 technical projects + 1 cross sectional project

**DigitPro**
Digital Prototype
- Process simulation
- Virtual testing

**ForschFab**
Research factory
- Versatile production of the future

**LeiFu**
Materials und construction
- Light weight materials
- Integration of functions

**Khoch3**
Creativity – Cooperation – Competence

19 partner out of science and economy areas
Active Research Environment for the Next generation of Automobiles

Scientific partner

DAIMLER
BOSCH
Fraunhofer
FKFS
Universität Stuttgart
DLR

Commercial partner

FARO
KUKA
PILZ
SIEMENS

Founders

Bär
BASF
IT'S OWL
OHLF
E3

Partner

In discussion

ARENA2036 Scientific Campus in Vaihingen

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Active Research Environment for the Next generation of Automobiles

- It’s more than an accelerator from Silicon Valley. PnP supports startups and companies which are already established and brings them together.
- PnP is also an investor and supports more than 100 companies each year.
- PnP is a global innovation platform with 22 locations around the world.

- International Start-Up Scouting with a focus on item topics like mobility and Industry 4.0 (especially hardware with software used)
- accelerator-programm includes mentoring, coworking-space and hardware lab
- Open for all industry partners
Active Research Environment for the Next generation of Automobiles

Future of Mobility, Vehicle & Transportation
- Biometrics for identification
- Wearables - Potential use cases inside the vehicle
- How the vehicle integrates with connected home (nest)
- Tracking Movement/User Interaction
- Sensor Fusion inside the vehicle for user interaction
- Improving visual attractiveness
- Luxury/Premium mobility of the future
- New vehicle exterior/interior, adaptive/functional exterior/interior
- Predictive Analytics in terms of UI
- ...

Future of Production / Industry 4.0
- Manufacturing / Manufacturing Equipment
- Site logistics / Autonomous logistics / Unmanned ground logistics
- IoT - Whole automation network / Industrial Internet
- Machine-Machine Communication
- New materials for automotive applications
- Machine learning
- UI/UX/Data Analytics
- Worker management
- Cyber security
- ...

13 NEW Start-Ups
Teams from:
- Israel
- Germany
- Finland
- Brasilia

APPLY & JOIN !!!
DigitPro – Digital Prototype

- Closed process chain
- From CAD design to final product
- Micro-, meso- and macroscopic modelling
- Different simulation tools
- HDF5 data Format

- Braided structures
- Open-Reed-Weaving-structures

- 50 % Development time
- 10 % Weight

Numerical closed process chain for support of product design processes of FRP structures
A constantly updated, automatically generated image of the reality, which allows planning, control and optimization of all factory processes.
In LeiFu different approaches of functional integration are developed, implemented and evaluated on the basis of a FRP demonstrator module.
Virtual Permeability Determination

Jörg Dittmann
Institute of Aircraft Design (IFB)
Permeability determination for 3D near-net-shape geometries in experiment not economical but essential

Transfer of in-plane permeability measurements to 3D architecture not adequate

How to simulate a complex 3D structure with varying fibre architecture?
DigitPro – Status Virtual Infiltration

Scientific content

Textile preform  FEM textile architecture  Permeability prediction  FEM filling simulation
Mesoscopic braiding simulation

- Braiding simulation with PAM-CRASH

  Bar simulation: ~ Days, with 24 Procs
  Shell simulation: ~ Weeks, with 24 Procs


Braiding architecture

Permeability prediction

Software:
- OpenFOAM

Utilities:
- 3dcalcPermeFoam (in-house post-processing)

Solver:
- Semi implicit pressure linked equation (SIMPLE)
- Boundaries:
  - Pressure gradient: $p = 2$ bar
  - Fluid dynamic viscosity: $\eta = 109$ mPas


Large near-net-shape 3D permeability tensor field !!!
## Results overview

<table>
<thead>
<tr>
<th>Textile</th>
<th>Layer [-]</th>
<th>VFC [%]</th>
<th>Permeability $K_{xx}$ [m$^2$]</th>
<th>Meshing time [min]</th>
<th>Computation time [min]</th>
<th>Cell count [-]</th>
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</thead>
<tbody>
<tr>
<td>Triax braid RVE (sHM/OF)</td>
<td>1</td>
<td>35</td>
<td>7.32e-09</td>
<td>14</td>
<td>60</td>
<td>3.4e+06</td>
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<tr>
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<td>6.62e-09</td>
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<td>Triax braid - radial in-plane experiment</td>
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<td>49.2</td>
<td>7.67e-11*</td>
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<td>Triax braid voxel RVE (Ansys CFX)</td>
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<td>2.14e-09**</td>
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