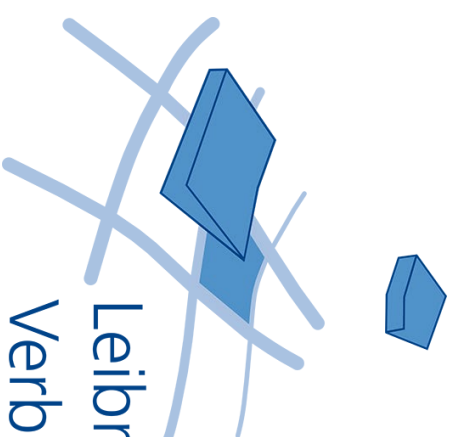


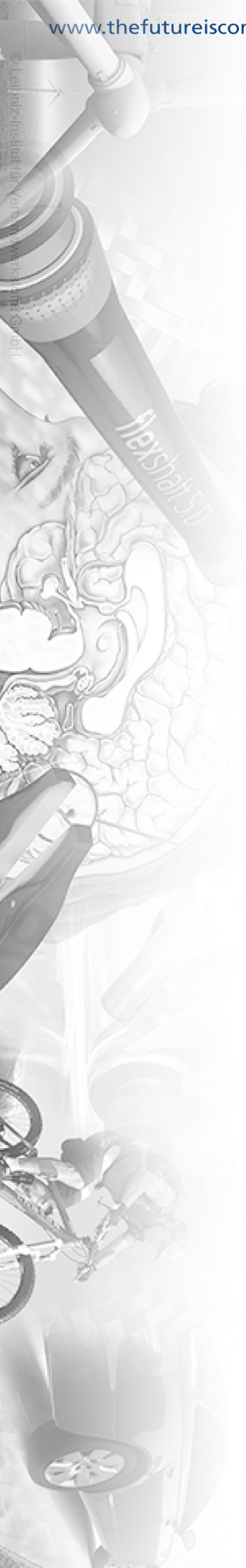
# „Mehr Effizienz durch Automation, digitale Zwillinge und machine learning?“

CU Jour Fix, 16.05.2022

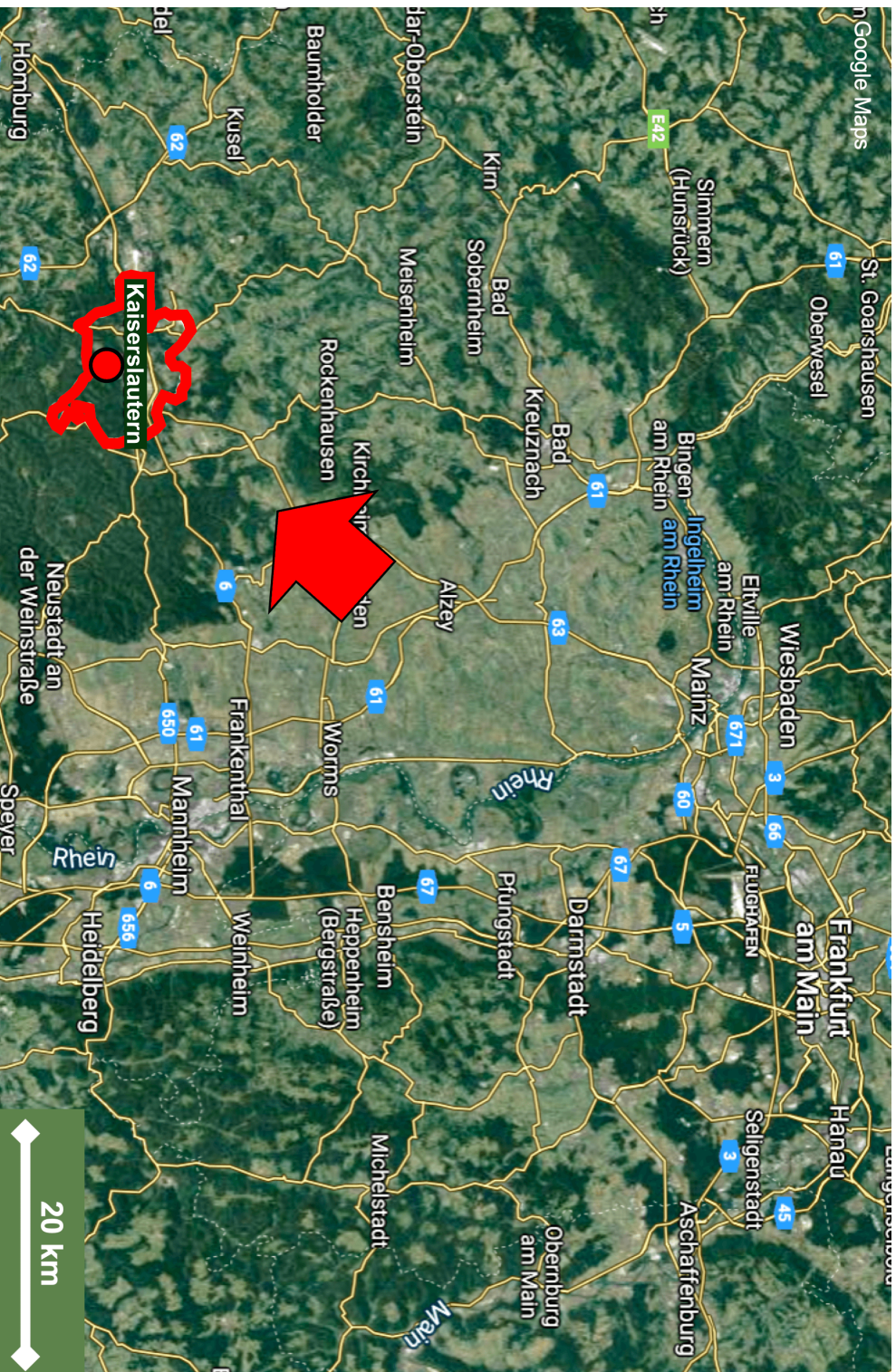
Miro Duhovic



Leibniz-Institut für  
Verbundwerkstoffe



# Location



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- ✓ Kaiserslautern City  
100,000 residents
  - ✓ Technical University  
15,000 students
  - ✓ University of Applied  
Science 6,000 students
  - ✓ Science & Innovation  
Alliance Kaiserslautern
  - ✓ Fraunhofer  
ITWM, IESE
  - ✓ MPI Max Planck  
Software Systems
  - ✓ German Research  
Center f. Artificial  
Intelligence DFKI
  - ✓ Institute for Surface  
and Thin Film Analysis
- Industry**
- ✓ BASF Ludwigshafen
  - ✓ John Deere
  - ✓ General Dynamics  
European Land Systems
  - ✓ Corning
  - ✓ Adient / Recaro
  - ✓ Opel / ACC
  - +...






# Leistungszentrum Simulations- und Software-basierte Innovation

## LEISTUNGSZENTRUM: NEUE STRUKTUR UND PARTNER

### Kooperationsvertrag aller Forschungspartner

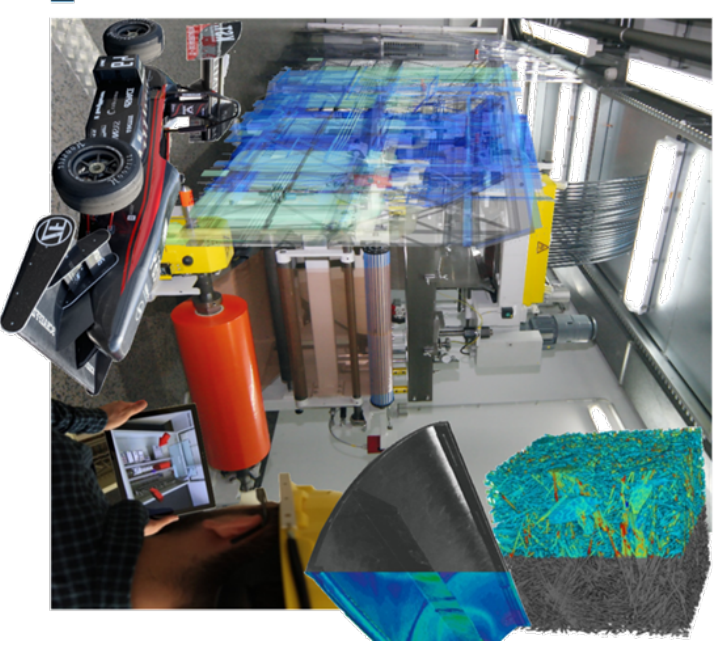
Forschungs-partner	Leitungsrat	Advisory Board	Industrie-partner	Kooperationen
 TU KAISERSLAUTERN  Hochschule Kaiserslautern  Fraunhofer ISE  Fraunhofer ITWM  Leibniz-Institut für Verbundwerkstoffe	<p>Sprecher: Prof. Dr. D. Pätzelt-Wolters</p> <p>Prof. Dr. W. Thiel</p>	<p><b>Executive Board</b> Geschäftsführung und Transfer K. Steiner, Stv: M. Jung</p> <p>Transferzentrum 1 Verfahrenstechnik/Chemie M. Bortz (ITWM), H. Hasse (TUK)</p> <p>Transferzentrum 2 Mobilität K. Dressler (ITWM), Oliver Blesinger (ISE)</p> <p>Transferzentrum 3 Produktionsprozesse S. Schmitt (ISE), D. Hietel (ITWM)</p> <p>Transferzentrum 4 Biotechnologie/Gesundheit K.-H. Küfer (ITWM), Rolf van Lengen (ISE)</p>	<p>BASF</p> <p>Daimler Trucks</p> <p>John Deere</p> <p>Math2Market</p> <p>Robert Bosch</p> <p>Intelligence</p> <p>BionTech</p> <p>bisher ca. 100 Firmen</p>	<p>SIAK</p> <p>IHK</p> <p>CVA</p> <p>KOMMS</p> <p>OD Pfalz</p> <p>Felix-Klein-Zentrum</p> <p>Gründungsbüro Kaiserslautern</p> <p>Karat</p>
<p><b>FuE-Lab 1</b> <b>Digitale Zwillinge</b> K. Steiner (ITWM), M. Duhovic (IW), A. Badhoeck (ISE), J. Rambach (DFK)</p>	<p><b>FuE-Lab 2</b> <b>Data Analysis und Künstliche Intelligenz</b> S. Schwaar (ITWM), N. Gauger (TUK), Julien Siebert (ISE), J. Hees (DFK),</p>	<p><b>FuE-Lab 3</b> <b>Next Generation Computing</b> M. Jung (ISE), J. Krüger (ITWM), N. Wehn (TUK)</p>	<p><b>Promoter:</b> <b>Ausgründungen</b> F.-J. Pfeundt</p>	

## FuE-Lab 1: Digitale Zwillinge



### Themen/Projekte/Kooperationen: Erstellung von digitalen Zwillingen

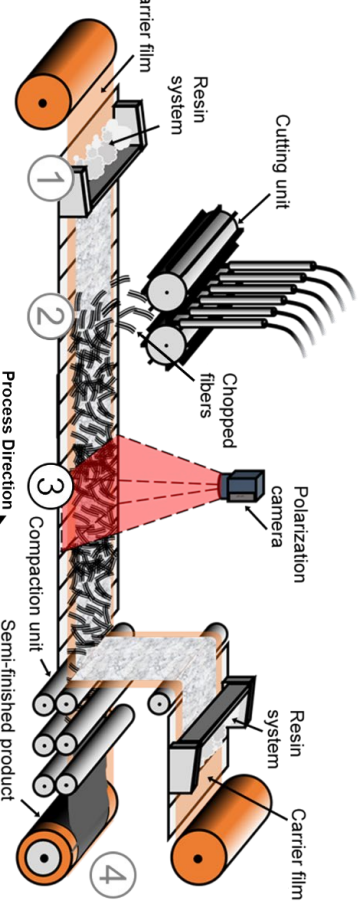
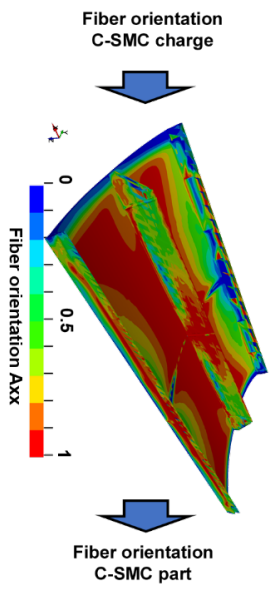
- Geometrie und Semantik:
    - Scan-to-Twin: Erstellung von dynamischen semantischen digitalen Zwillingen
    - Visualisierung digitaler Zwillinge in AR/VR/XR
  - Material und Prozess:
    - Digitaler Zwilling für faserverstärkter Kunststoffbauteile (FVK)
    - Bildanalyse und Simulation der Faserorientierung und –konzentration
    - Bewertung des Crash- und Ermüdungsverhaltens von FVK-Bauteilen
  - Systeme und Infrastrukturen: VCIP/FERAL
    - Kontinuierliche virtuelle Selbstvalidierung verlässlicher Systeme
    - Co-Simulation kognitiver digitaler Zwillinge
    - Virtuelle Hardware-Prototypen und XIL-basierte Komponenteoptimierung
- ### Maßnahmen/Aktivitäten
- Digitizing the Production of Carbon Fiber Sheet Molding Compounds
  - IWW-Leibniz Projekt: ML4ProcessSimulation mit Beteiligung von DFKI und ITWM



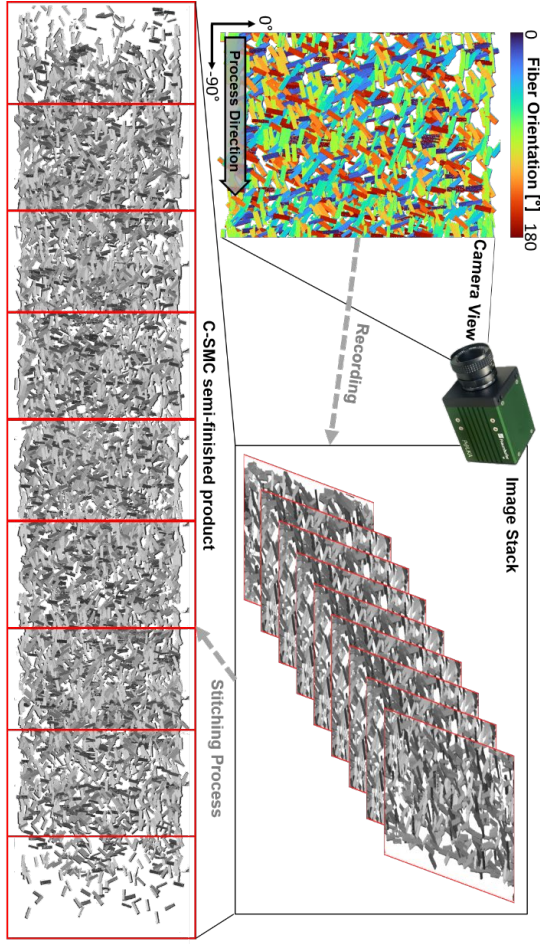


# Project "Digitizing the Production of Carbon Fiber Sheet Molding Compounds"

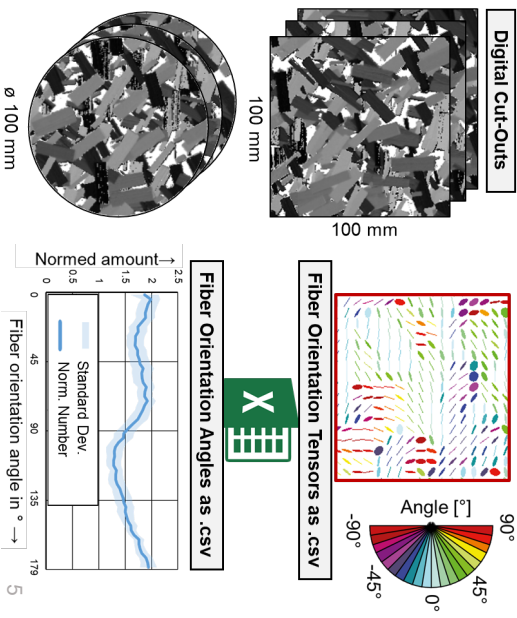
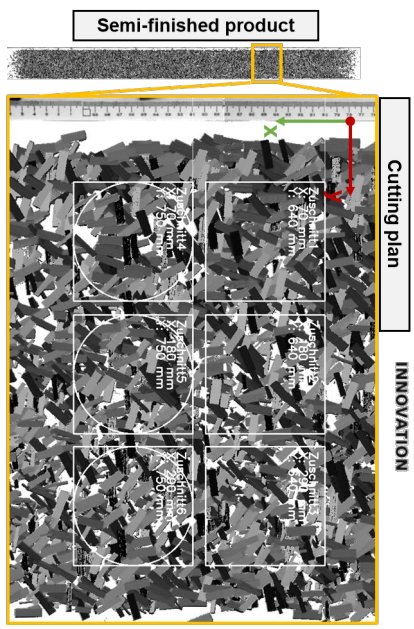
Input Process simulation Output



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## Real-Time & Off-Line Analysis



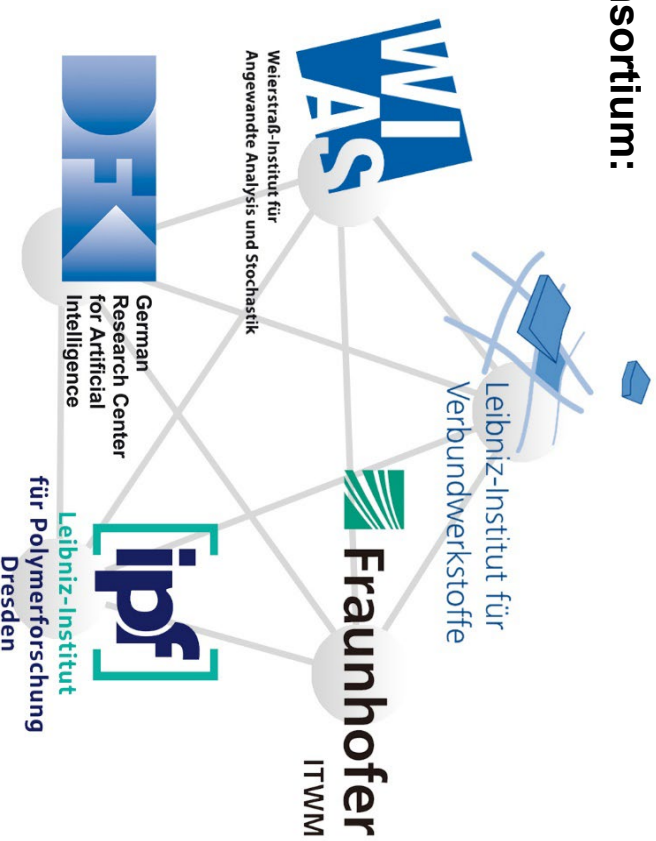
## “Machine Learning for Simulation Intelligence in Composite Process Design”

Funded by:





- Funding scheme:** *Cooperative Excellence*
- Duration:** *3 Years, 01/22 - 12/24*
- Budget:** *998 k€ (IVW: ca. 500 k€)*
- Target:** *Develop methodological competence in the application of machine learning for composite process simulation*

### Consortium:



### Associated:

- **UNIVERSITY OF DELAWARE**
- **UNIVERSITY of WASHINGTON**
- Prof. Suresh Advani**  
*Composite process simulation*  
(h-index of 81, 23,000 citations)
- Prof. J. Nathan Kutz**  
*Expert for machine learning*  
(h-index of 61, 14,000 citations)



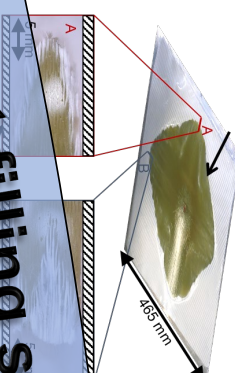
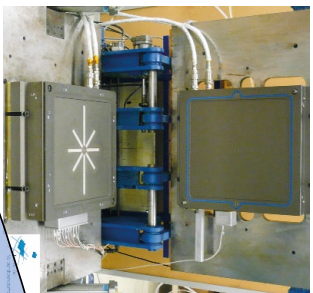
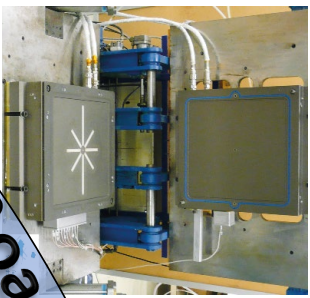
# Roadmap to Precise Component Filling Simulation

Unsaturated 2-directional-flow

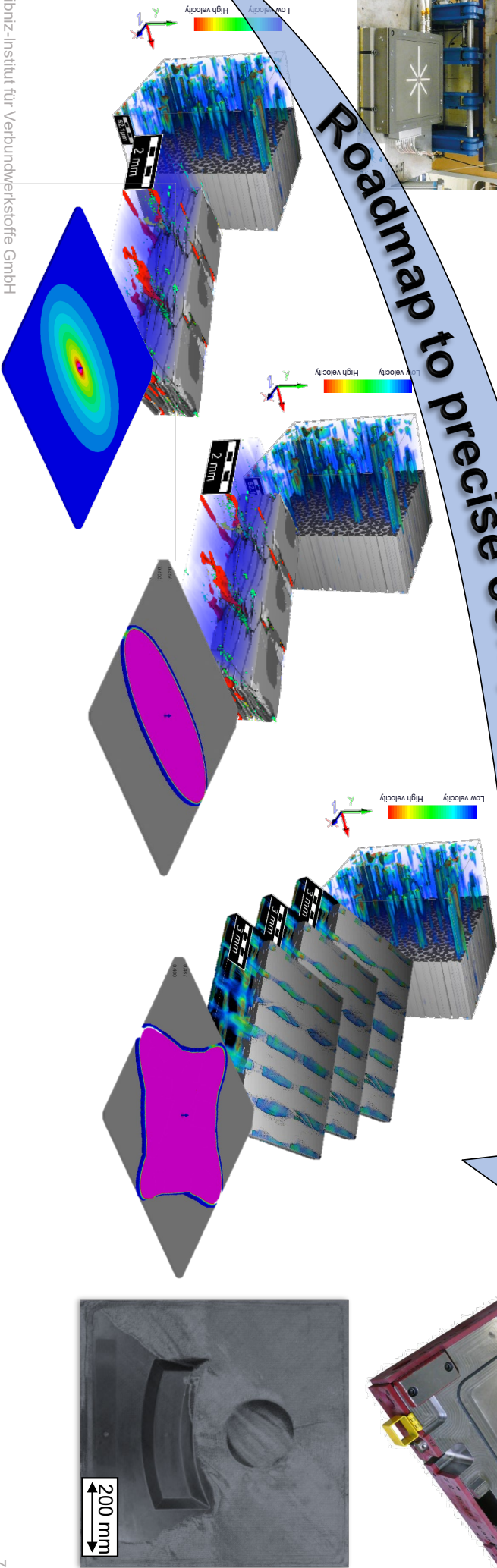
Unsaturated 3-directional flow

Saturated 2-  
directional-flow

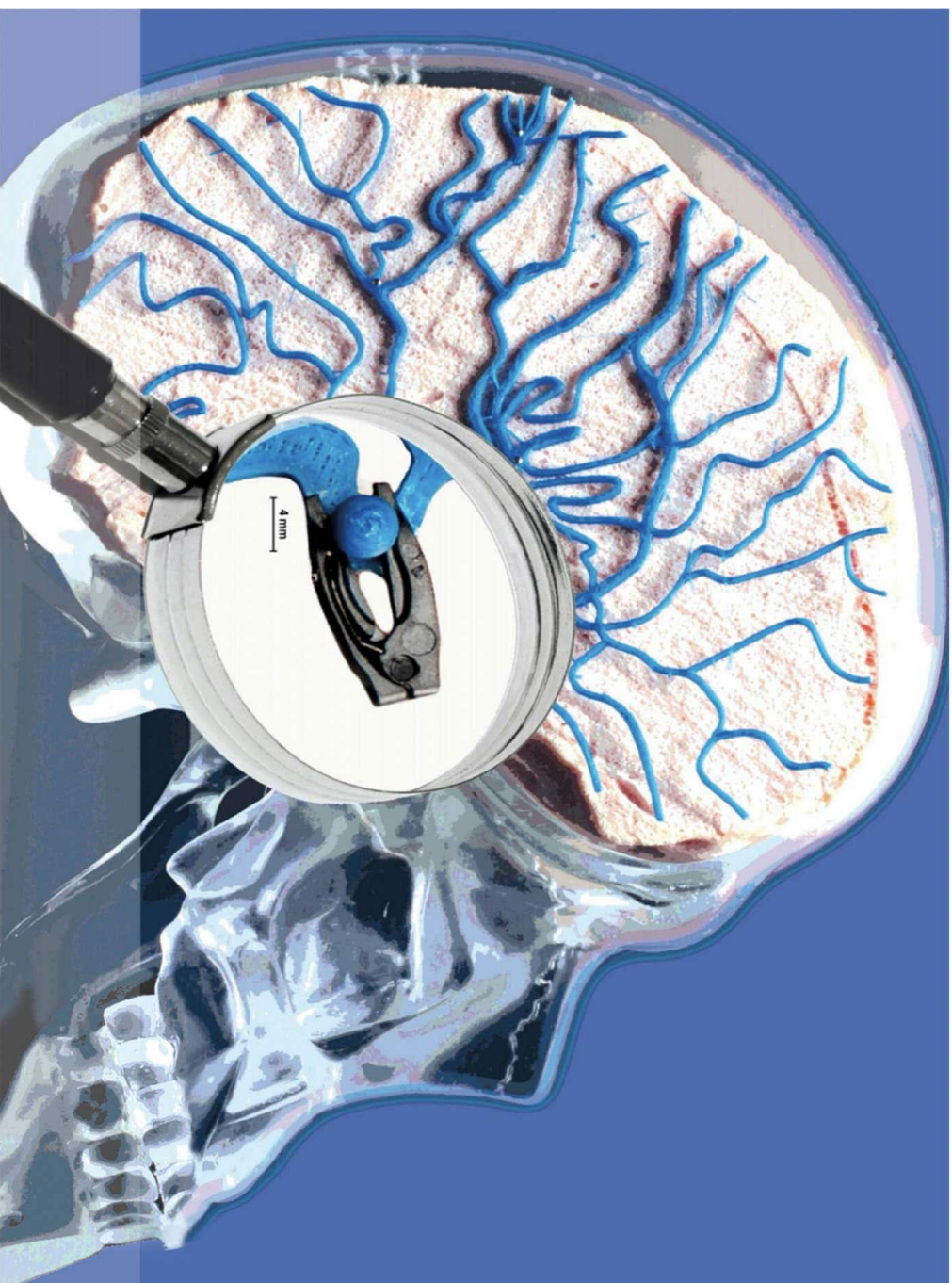
Unsaturated 3-  
directional-flow -  
complex component



Roadmap to precise component filling simulation



# Thank you for your attention!



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## Composite Aneurysm Clip