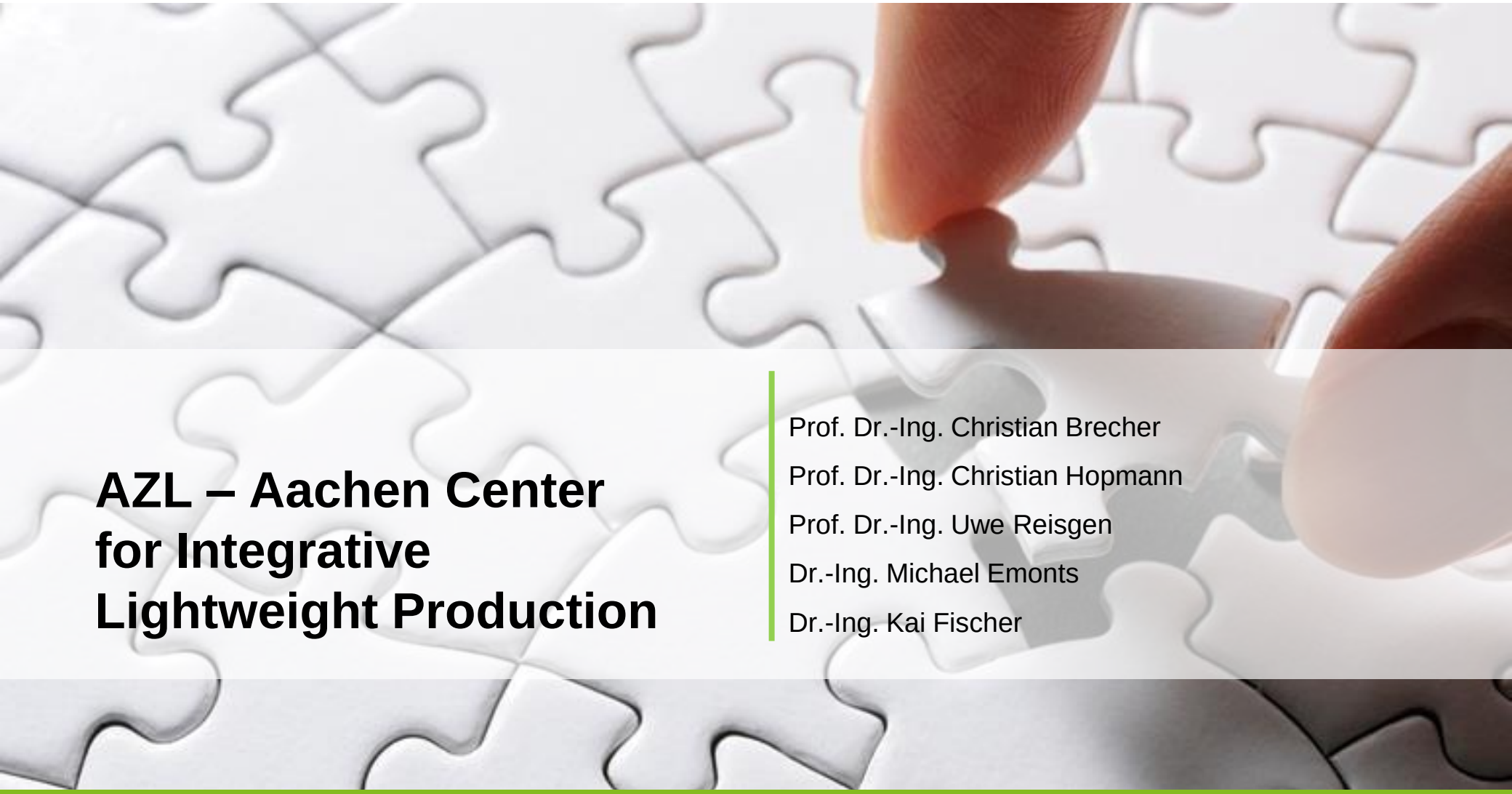
Aachener Zentrum für integrativen Leichtbau

RWTH AACHEN UNIVERSITY



AZL – Aachen Center for Integrative Lightweight Production

Prof. Dr.-Ing. Christian Brecher

Prof. Dr.-Ing. Christian Hopmann

Prof. Dr.-Ing. Uwe Reisgen

Dr.-Ing. Michael Emonts

Dr.-Ing. Kai Fischer

Content

- **RWTH Aachen University, AZL and Partner Institutes**
- Growing AZL Partner Network
- Events and Meetings
- Projects and Cooperations
- Marketing News
- AZL Infrastructure News

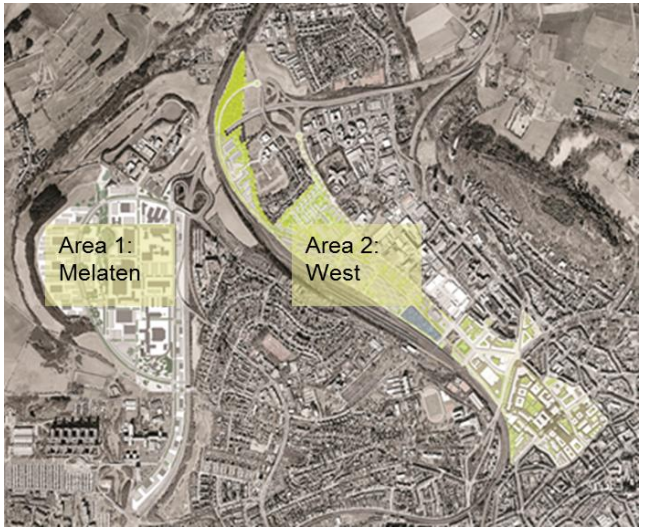
RWTH Aachen is the European Center for Production Technology

RWTH Aachen

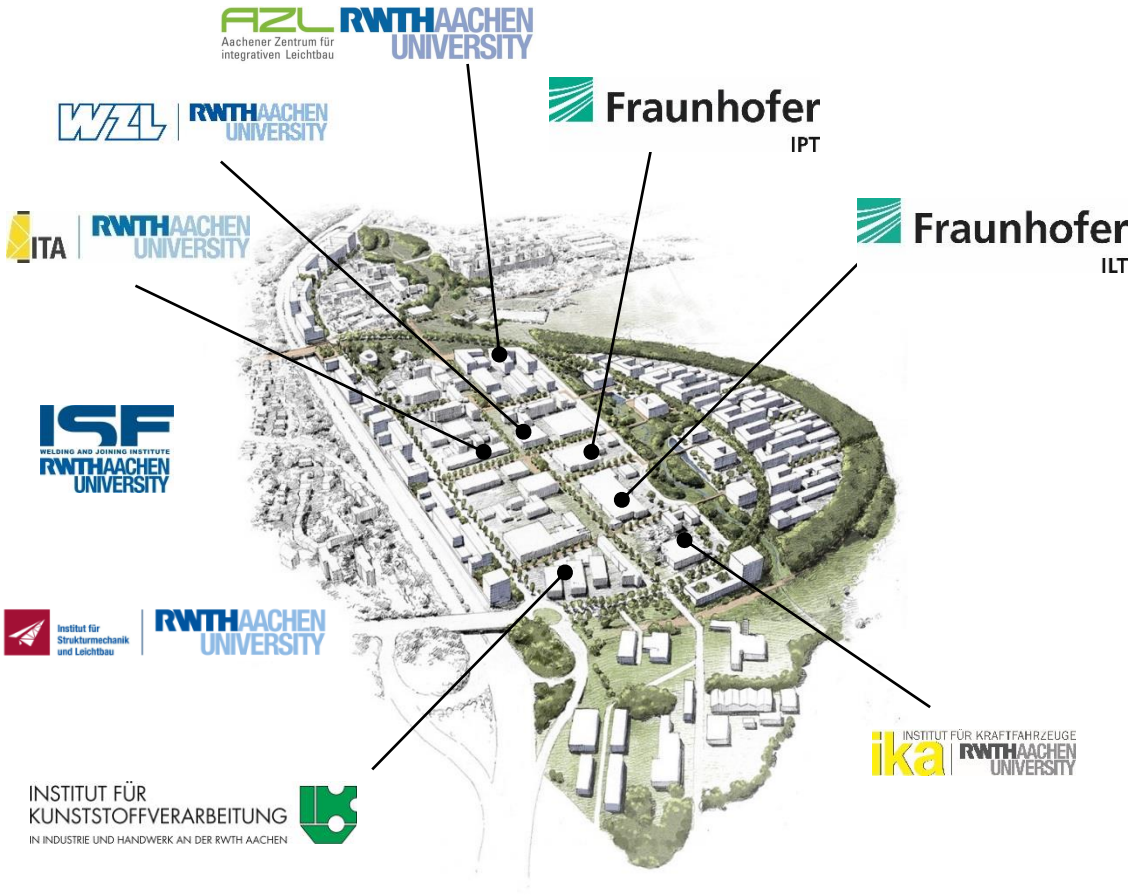
- Founded in 1870
- 260 research institutes
- 538 professorships
- 4.750 scientists
- 42.298 students
- 2 clusters of excellence:
  - “Integrative Production Technology for High-Wage Countries”
  - “Tailor-Made Fuels from Biomass”

New RWTH Aachen Campus

- 2 areas with 800.000 m²
- Emphasis on production technology:
  - 62 professorships
  - 12.050 students, 2.600 employees
- Already signed industrial collaborations:
  - 120 international and national companies
  - 30 research institutions



Composite Competences along the Value Chain are present at the new RWTH Campus



Composite competences and cooperation since more than 25 years

- Textiles (ITA)
- Plastics and Composites (IKV)
- Production Technology (AZL, WZL, IPT, ILT, ISF)
- Quality Assurance (WZL)
- Lightweight Design (IKV, SLA)
- Automotive (ika)

- 9 Institutes
- More than 750 scientists
- More than 1.100 student workers

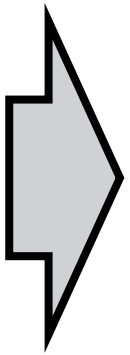
1987 — Composite Design Processes Application RWTH AACHEN — 2015

Lightweight Materials have a Great Business Potential for High Wage Countries

AZL Aachener Zentrum für integrativen Leichtbau
RWTH AACHEN UNIVERSITY

State of the Art

- Large aircraft structures
- Large complex structures in wind energy
- Automotive structures for small and medium-sized series
- Cycle times still too long
- Limited process capability and quality assurance
- Limited reproducibility
- High costs



Goals & Challenges

- Mass production
- Short cycle times
- High quality
- Reproducibility
- Cost efficiency
- Multi material manufacturing

Composites have a tremendous potential but they require an integrative and interdisciplinary approach along the value chain

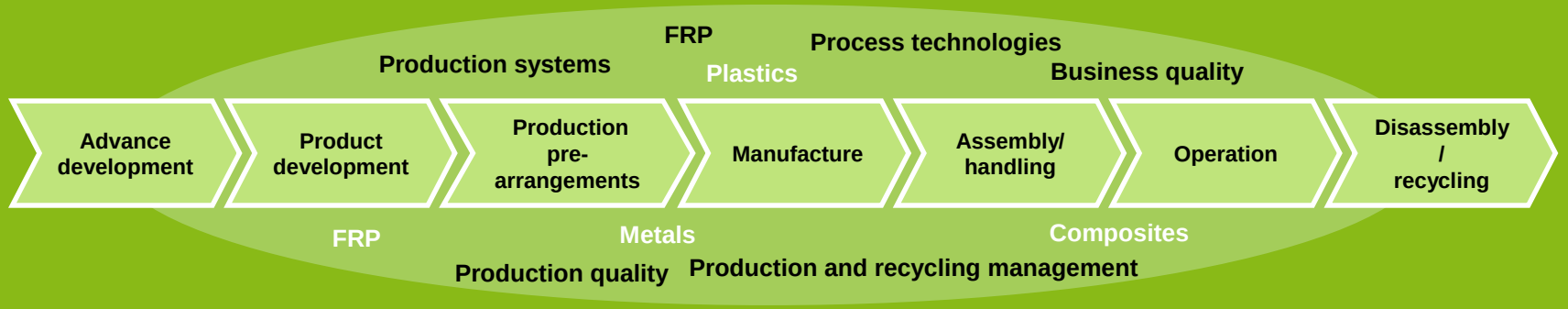
Integrative Production Technology and Material Science

Growing Industrial Demand

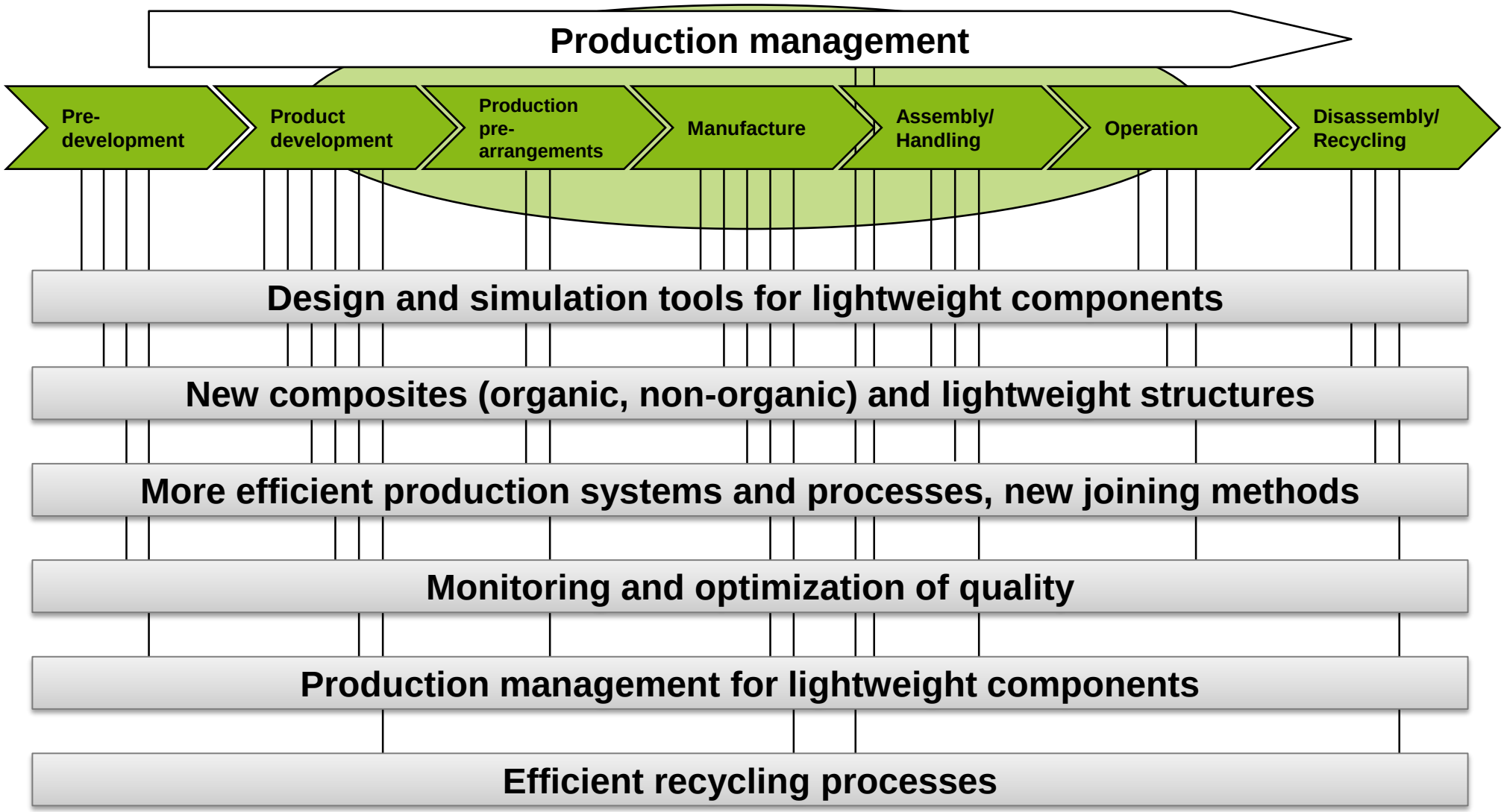
- Multi-Material-Systems
- Automation of Lightweight Production
- Lightweight and recycling suited product development, manufacture, assembly, planning and quality assurance
- More efficient methods for processing, machining, assembly and recycling

Integrative Approach

- Holistic consideration of lightweight design operations
- Services across branches, products and materials

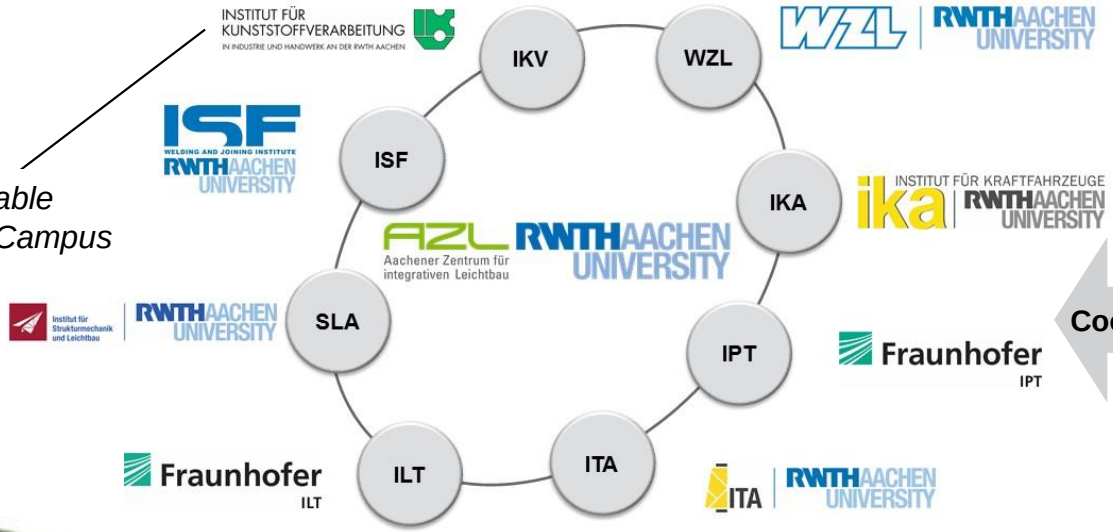


Integrative Strategic Research Topics



The AZL is designed as the Integrative Solution Provider

All competences available at the RWTH Aachen Campus



Industrial Partners

- Materials
- Molder
- Manuf. Equipm. Supplier
- Tier 1 / 2
- OEM

- Material supplier
- Manufacturing equipment supplier
- Molder
- Tier 1/2
- OEM

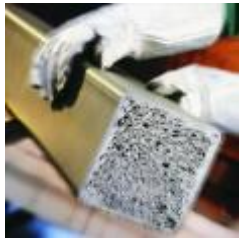
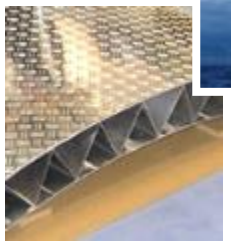
∑ 750 scientists working on production technologies, lightweight materials and lightweight applications

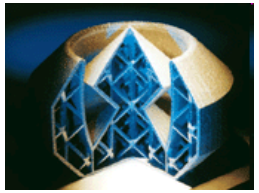
- **All required competences along the value chain are present at the new campus**
- **Integrative and interdisciplinary approach along the value chain**

AZL – Addressed Branches and Products








Lightweight design for

- Aerospace
  - Structural parts
- Wind energy
  - Blades
  - Power train (gear housing, gear wheels , hollow shafts)
  - Nacelle and tower
- Automotive industry
  - Bodywork
  - Structural parts
  - Power train (gear housing, shafts and gear wheels)
- Transportation (Trucks, ships, trains, busses)
  - Gear housing (lightweight design, reduction of noise emissions)
  - Structural parts
- Sport and leisure industry
  - Sports equipment
- Machine tools
  - Structural parts (lightweight design, stiffness, corrosion resistance)
- Plant construction
  - Composite vessels and tubes
- Chemical and food industry
  - Composite vessels and tubes

Content

- RWTH Aachen University, AZL and Partner Institutes
- **Growing AZL Partner Network**
- Events and Meetings
- Projects and Cooperations
- Marketing News
- AZL Infrastructure News

AZL Partnership

Currently 62 AZL Partner Companies

AZL Aachener Zentrum für integrativen Leichtbau – RWTH AACHEN UNIVERSITY

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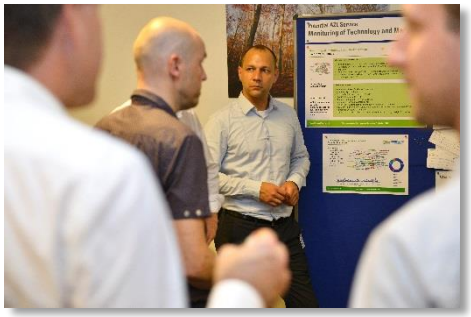
Events and Meetings
AZL Annual Partner Meeting 2015



- Presentation of last Year's AZL Activities!
- **Innovations** of AZL Partner Institutes and Companies!
- **Definition** of Workshop Topics, Joint Projects and Strategic Research Topics!
- Networking with **more than 100 Representatives** from AZL Partner Companies!

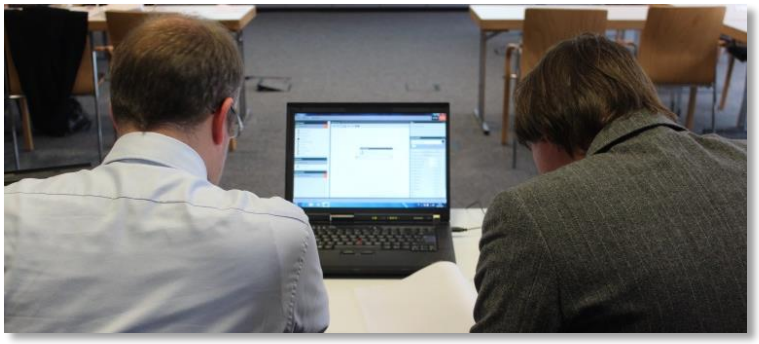
Events and Meetings
Workshops and Workgroups for AZL Partners

AZL Workshops

- Low-Cost and Energy-Efficient Double-Belt Presses
- Thermoplastic Tapes
- Research Landscape for Composites – Germany and EU
- Process Costing Tool
- Quality Assurance in Composite Value Chains
- Printed Lightweight Structures
- Design and Process Systematics
- End-machining of Fiber-Reinforced Plastics

AZL Workgroups

- High-Speed RTM-Matrices
- Hybrid Thermoplastic Composites
- Joining
- Pipes and Vessels



Events and Meetings

Upcoming Workshops, Workgroups, Conferences

February 03, 2016
Workshop: High-Performance SMC

February 17, 2016
Workgroup Meeting: High-Speed RTM

February 18, 2016
Workgroup Meeting: Hybrid Thermoplastic Composites

March 01, 2016
Joint Partner Project: Final Report Meeting - Thermoplastic Tapes

May 10, 2016
Workgroup Meeting: Pipes and Vessels

June 09, 2016
AZL Annual Partner Meeting 2016

Cooperation between AZL and JEC Group

Cooperation with the JEC Group

- 200 m² innovation area for AZL
- Presentation of AZL and its 8 Partner Institutes
- AZL Session “Innovations in Lightweight Production”
- Guided Tour to 5 AZL Partner Companies

Regular Open Days – Lightweight in Aachen

- Invitation to industry representatives
- Overview on lightweight research in Aachen
- Guided tours to 8 research institutes and their facilities
- Networking with Aachen research engineers and industry representatives

Content

- RWTH Aachen University, AZL and Partner Institutes
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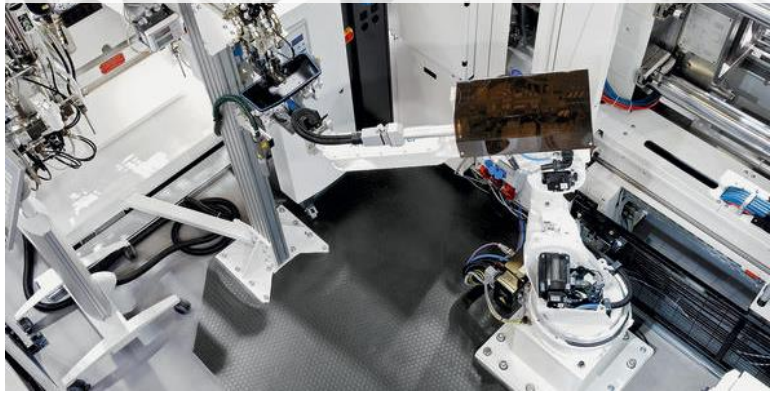
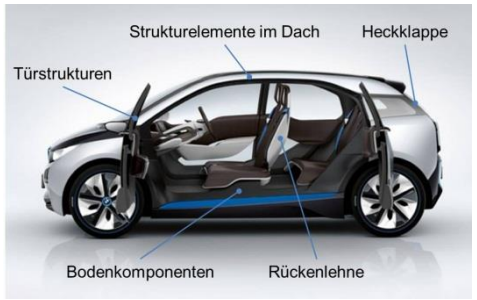
Project Example
BMBF-Project „OptoLIGHT“

Aachener Zentrum für integrativen Leichtbau
RWTH AACHEN UNIVERSITY

Combination:
Thermoforming – Injection Molding– Laser Processing





„OptoLIGHT“

- Time Frame:
  - Start: February 2014
  - Duration: 3 years
- Project Objectives:
  - Laser sublimation for local exposing of fibers
  - Integrated laser structuring (preparation for joining)
  - Laser cutting and laser trimming
  - Optical process control
  - Optical control of part quality
- Project Partner:
  - AZL
  - BMW
  - KraussMaffei
  - Arges
  - Precitec
  - Steinbichler
  - Sensortherm

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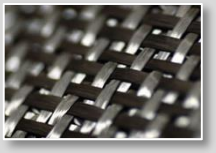
Federal Ministry of Education and Research

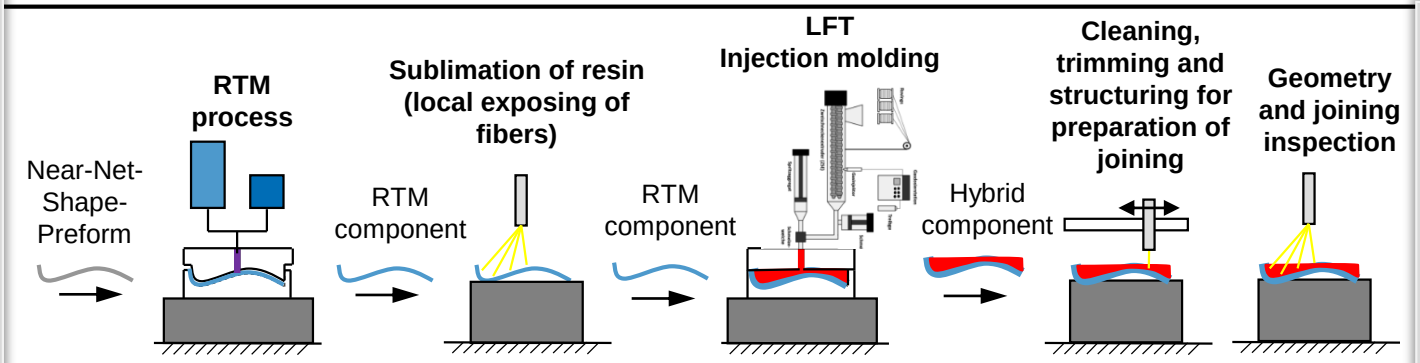
Project Example
BMBF-Project „OptoLIGHT“

Use of material



Continuous fiber reinforced **thermoset composites**

Long fiber reinforced **thermoplastic composites**



Structural component (BMW i3)

Quality characteristics: Strength, stiffness, ease of installation, design, sustainability

Integration of composite and laser system technology in one manufacturing cell

Partners:

BMW, ARGES, PRECITEC, KraussMaffei, SensorTherm, steinbichler Optotechnik GmbH

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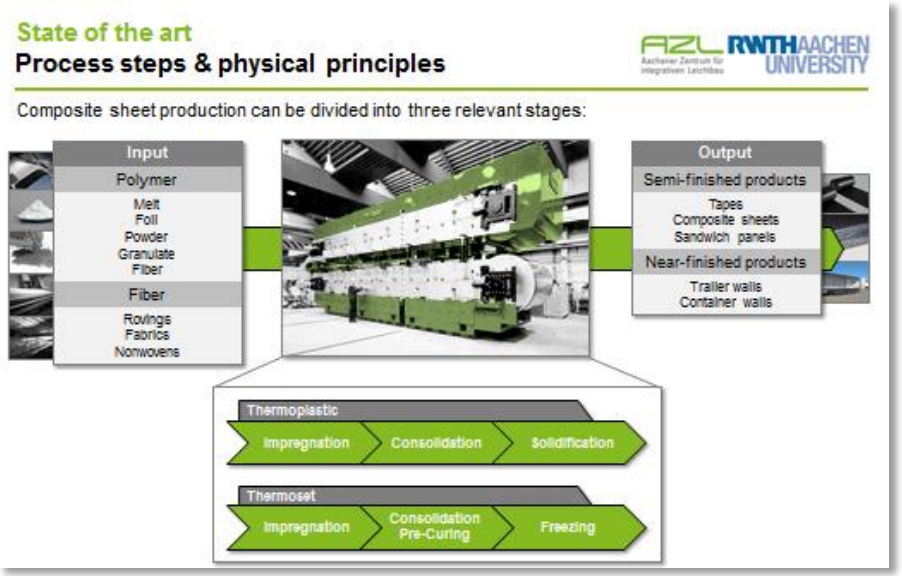
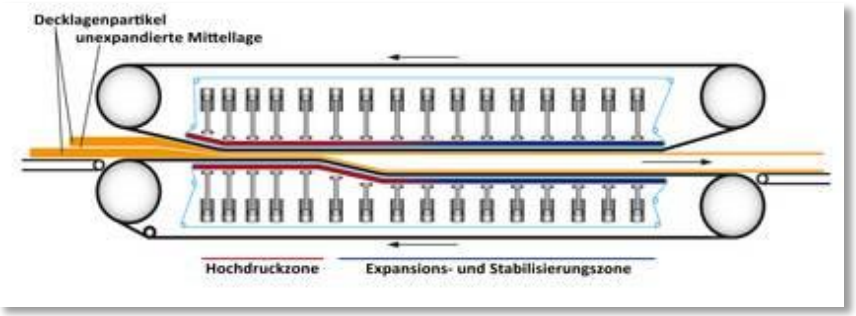
Projects and Cooperation's
Joint Partner Projects derived from Workshops

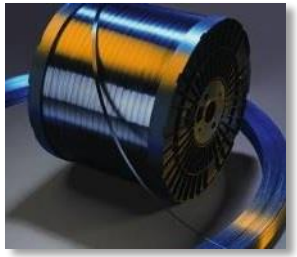


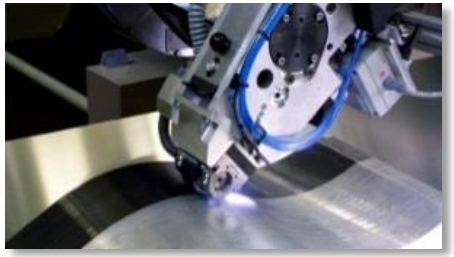


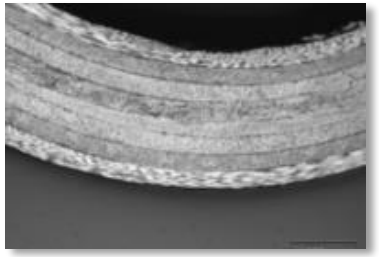
New Designs for Low-Cost and Energy-Efficient Double-Belt Presses for Continuous Composite Manufacturing

- 6 AZL partner companies involved
- Start: November 2014
- Duration: 1 year
- Pre-competetive research project

Joint Partner Projects derived from Workshops







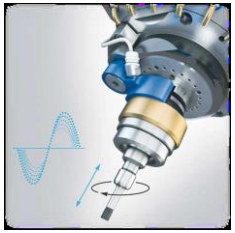
Thermoplastic Tapes – Material and Processing Benchmark

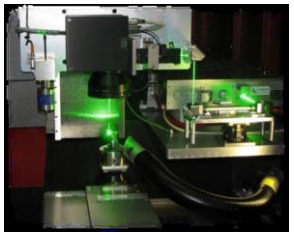
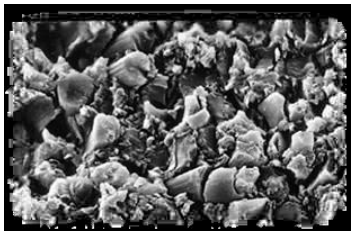
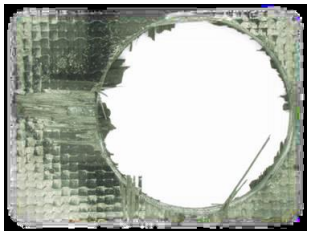
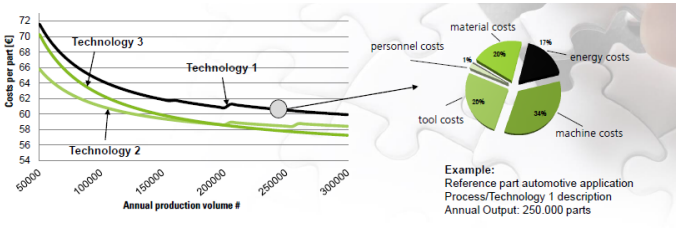
- 7 AZL partner companies involved
- Start: November 2014
- Duration: 1 year
- Pre-competetive research project

Projects and Cooperation's
Joint Partner Projects derived from Workshops

Machining task	Integration of bore holes	Trimming			
Work piece material	CFRP-EP	GFRP-EP	CFRP-EP-Aluminum	GFRP-PA	GFRP-PP
Work piece thickness	1.0 – 2.0 mm	3.0 – 6.0 mm	8.0 – 10.0 mm	8.0/ 8.0 mm	
Tool diameter	6.0 – 7.9 mm	8.0 – 15.0 mm			
Machining technologies	DM	WJC	LC	S	

Benchmark scenarios are deduced from illustrated categories.



End-machining of FRP

15 AZL partner companies planned

- Start: Beginning 2016
- Duration: 1 year
- Pre-competetive research project

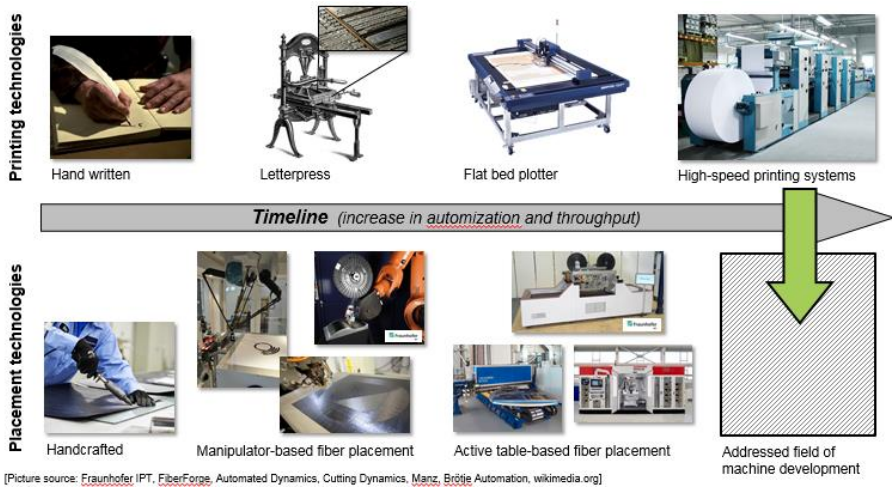
Project consist of 3 Work Packages

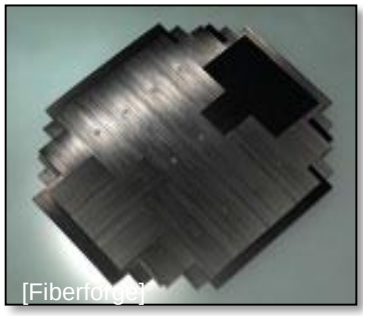
WP1 Technology Study

WP2 Benchmark and Technology Investigations

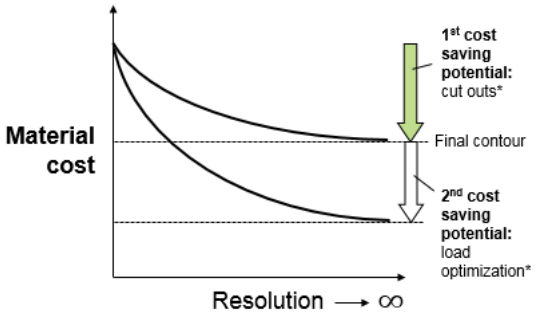
WP3 Profitability Analysis

Joint Partner Projects derived from Workshops





Tailored blank



Concept, Design and Buildup of a Prototype for the Ultra-Fast Manufacturing of Tailored Composite Blanks

12 AZL partner companies planned

- Start: Beginning 2016
- Duration: 18 month
- Pre-competetive research project

Project consist of 4 Phases

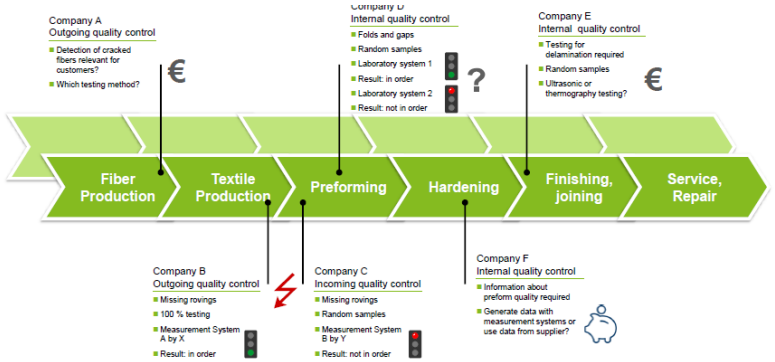
Phase 1 State of the Art

Phase 2 Concept Phase

Phase 3 Proof-of-Concept

Phase 4 Process and Feasibility

Joint Partner Projects derived from Workshops



Quality Assurance in Composite Value Chains

15 AZL partner companies planned

- Start: Beginning 2016
- Duration: 1 year
- Pre-competetive research proect

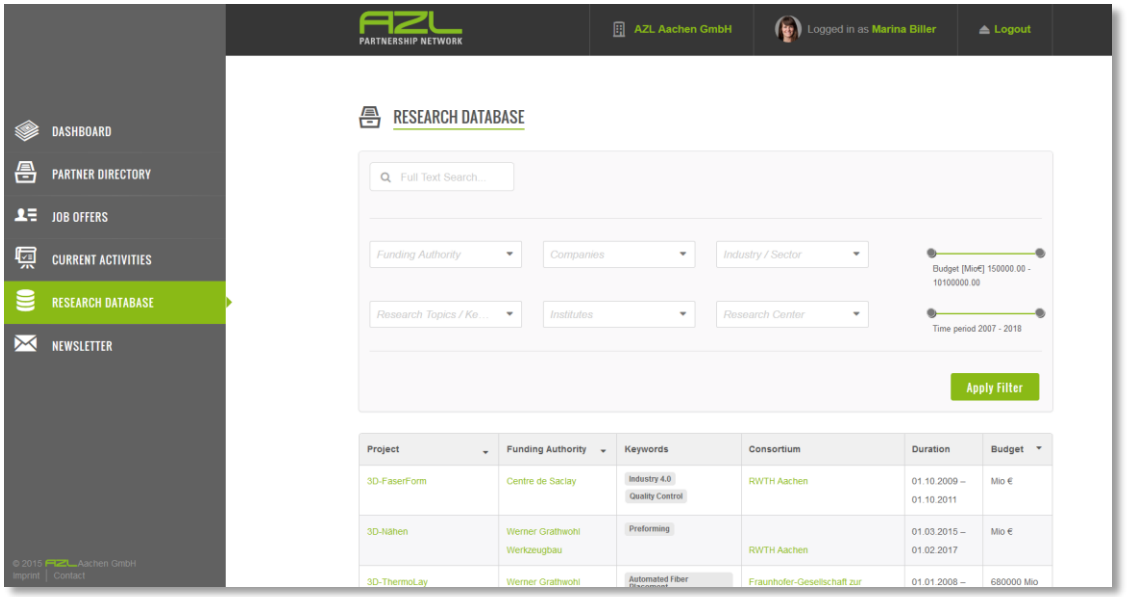
Project consist of 4 Phases

Phase 1 Analysis of interfaces and customer relevant quality characteristics along the FRP value chain

Phase 2 Development of guidelines for the measurement systems selection for the inspection of lightweight products

Projects and Cooperation's
Research Database

- Database with lightweight related research projects of institutes in Aachen
- Comprising information:
  main topics, keywords, partners, funding authority, budget
- Initiated by workshop participants “Research Landscape for Composites” (Sept. 23rd 2014)
- Further expansion of data:
  – Projects from Germany
  – EU projects



About 100 Research Projects available in the new AZL Partner Section!

AZL-Partnership-included Service by AZL

Various Individual Projects and Cooperation's

Several individual Partner Projects, e.g.:

- Composite tailgate
- Technical and economic material benchmarks
- Recycling of carbon fiber cut-off

Cooperation between M.TEC and KATCON

M.TEC
www.mtec-engineering.com

KATCON
GLOBAL

April 28, 2015, Aachen, Germany

Press release for immediate distribution

Two AZL partners are joining forces with AMAC´s support: Composites market newcomer, Mexico-headquartered Katcon Advanced Materials and German engineering specialist M.TEC

As of April 2015, through the excellence network in composites production technology of the Aachen Center for integrative Lightweight Production (AZL), the two partnering companies Katcon and M.TEC announce their strategic cooperation in order to establish a high-class product portfolio to serve Automotive and aircraft interior customers.

As a long-term reliable and established global Automotive supplier, family-owned Mexico-headquartered company Katcon has been serving directly and with great satisfaction over 60 OEM´s in the worldwide Automotive industry. Financially strong and with significant investment potential, Katcon decided to expand and strategically divert its profitable activities in entering the composite market.

Dr. Michael Effing, Founder of AMAC GmbH, Senior Advisor to AZL and as of now, also European Representative of Katcon Advanced Materials is happy: "We started advising and introducing Katcon, the worldwide renowned manufacturer for Automotive exhaust systems, to the composite industry only in 2014. To see this project alive and operational already now shows efficient project management."

Fernando Turner, President of Katcon Advanced Materials explains: "Katcon is proud to invest in the fascinating and innovative composites industry with machines, people and business development: The AZL and the excellence in business development of AMAC helped us significantly to establish collaborations with international top players of the composite industry. In record time, we have chosen the latest Advanced material´s manufacturing technology and equipment and bought state-of-the-art machines for processes like RTM for thermoset and for thermoplastic, thermoforming and hybrid moulding, as well as related post-processing technologies."

With these techniques, Katcon focusses on Automotive and aircraft interior applications like external & internal body panels, underbody and structural components, doors, tailgates, floor pans or seats. While

Project Example
AZL Market and Technology Study

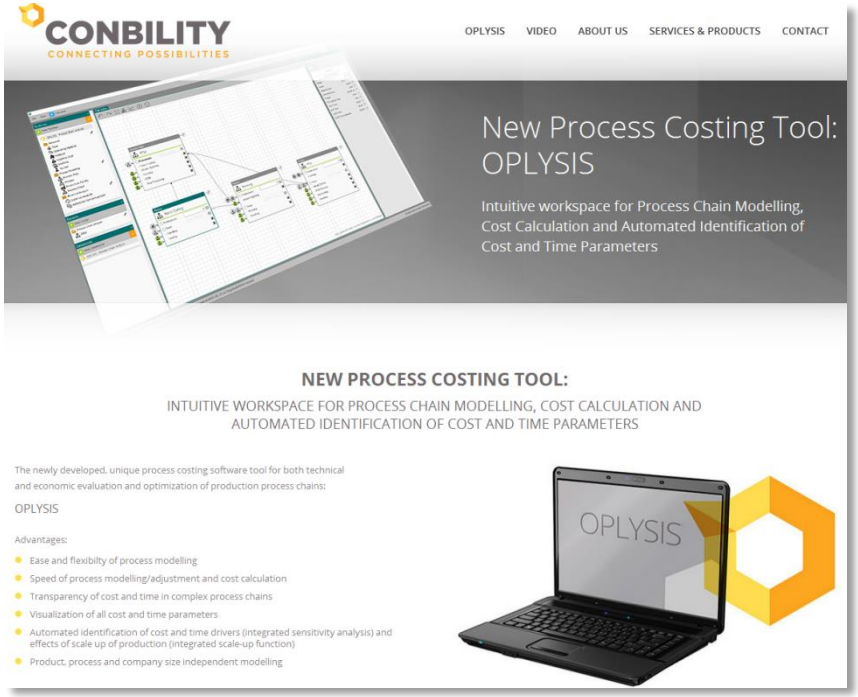
Kick-Off Meeting: Feb. 06th 2013 in Aachen:

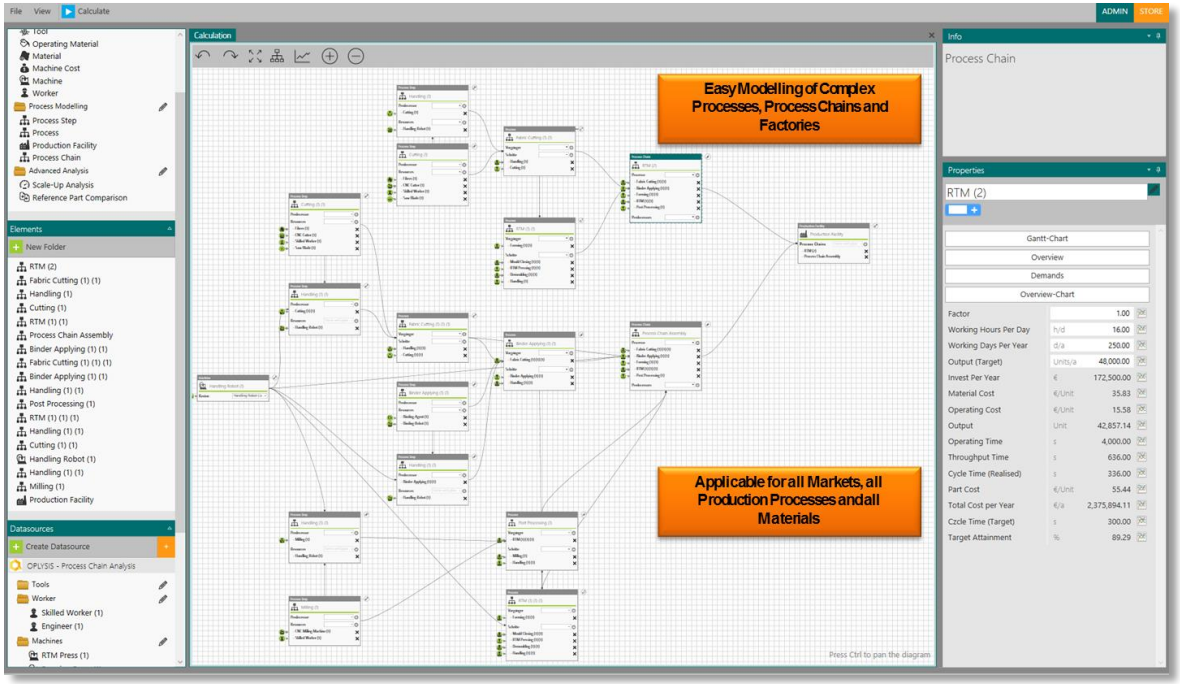
- Start of project: March 2013, duration: 12 months
- International industrial consortium with 34 companies
  - 15 Material Suppliers
  - 6 OEM
  - 7 Tier 1/ Tier 2
  - 6 Equipment Provider

Projects and Cooperation's
»OPLYSIS« – Process Chain Costing Tool

- New Process Chain Costing Tool
- Contribution by Conbility GmbH

www.conbility.com

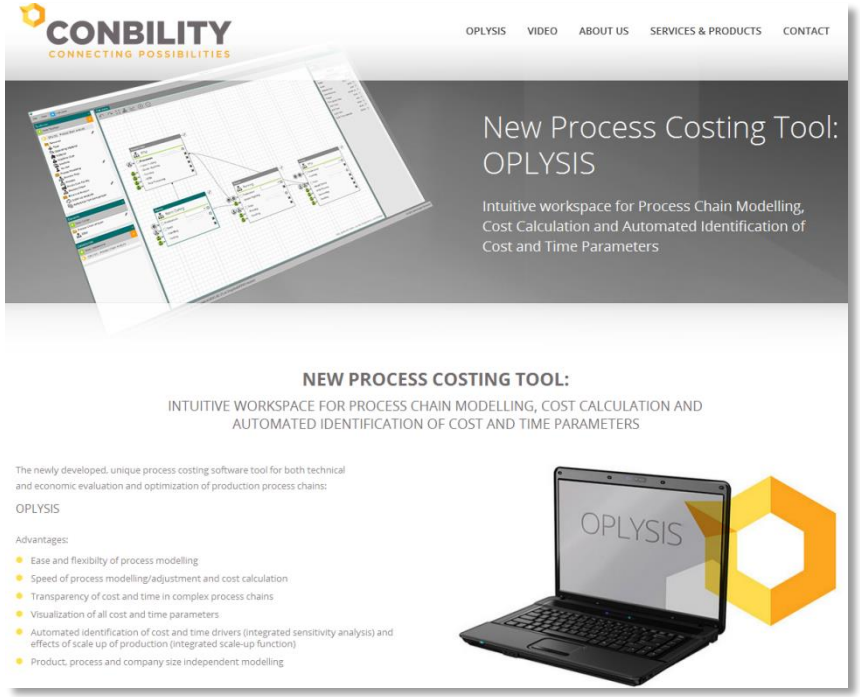




Projects and Cooperation's
»OPLYSIS« – Process Chain Costing Tool

- New Process Chain Costing Tool
- Contribution by Conbility GmbH

www.conbility.com



Regular Software costs:

4.900,- € annual license cost per user (floating license)

Discount for AZL Partner Companies:

- 200 € discount for 1 to 4 licenses per year
- 400 € discount for 5 to 10 licenses per year

(Discount limited to maximum of 10 licenses)

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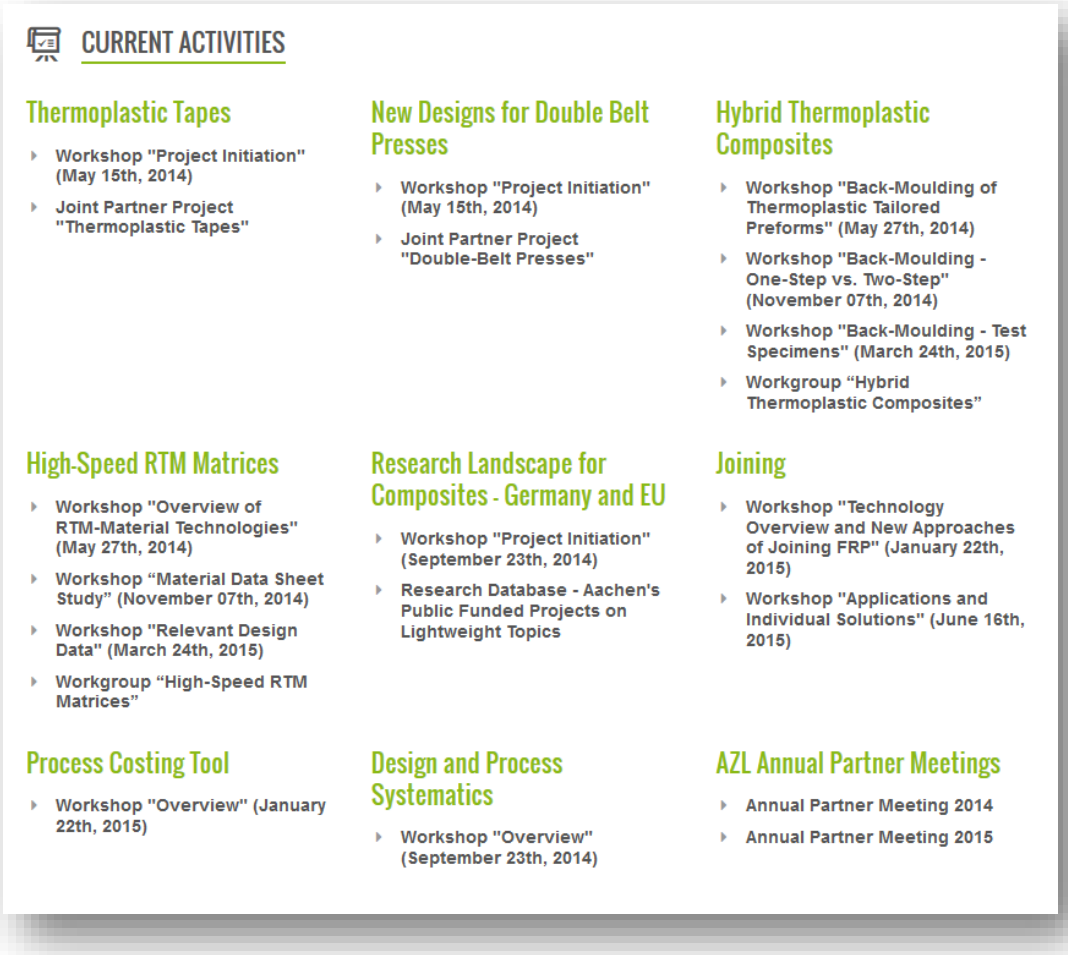
- **Marketing News**
- AZL Infrastructure News

Exclusive Information and Communication Platform

- More than **300 personal contacts** of the AZL Partner Network
- **Information and documents** for all AZL workshops, workgroups and projects
- **Research Database** with details on research projects of lightweight institutes in Aachen
- Dashboard for your **individual requests** to the AZL Network



Marketing News

Benefits from our Marketing and HR Support!

- **Publications and press releases to your innovative products**
- Company news within the AZL Newsletter
- Usage of AZL as business show case
- Publication of offers at the AZL Job Board
- Identification of new potential employees within our student network according to your individual demands

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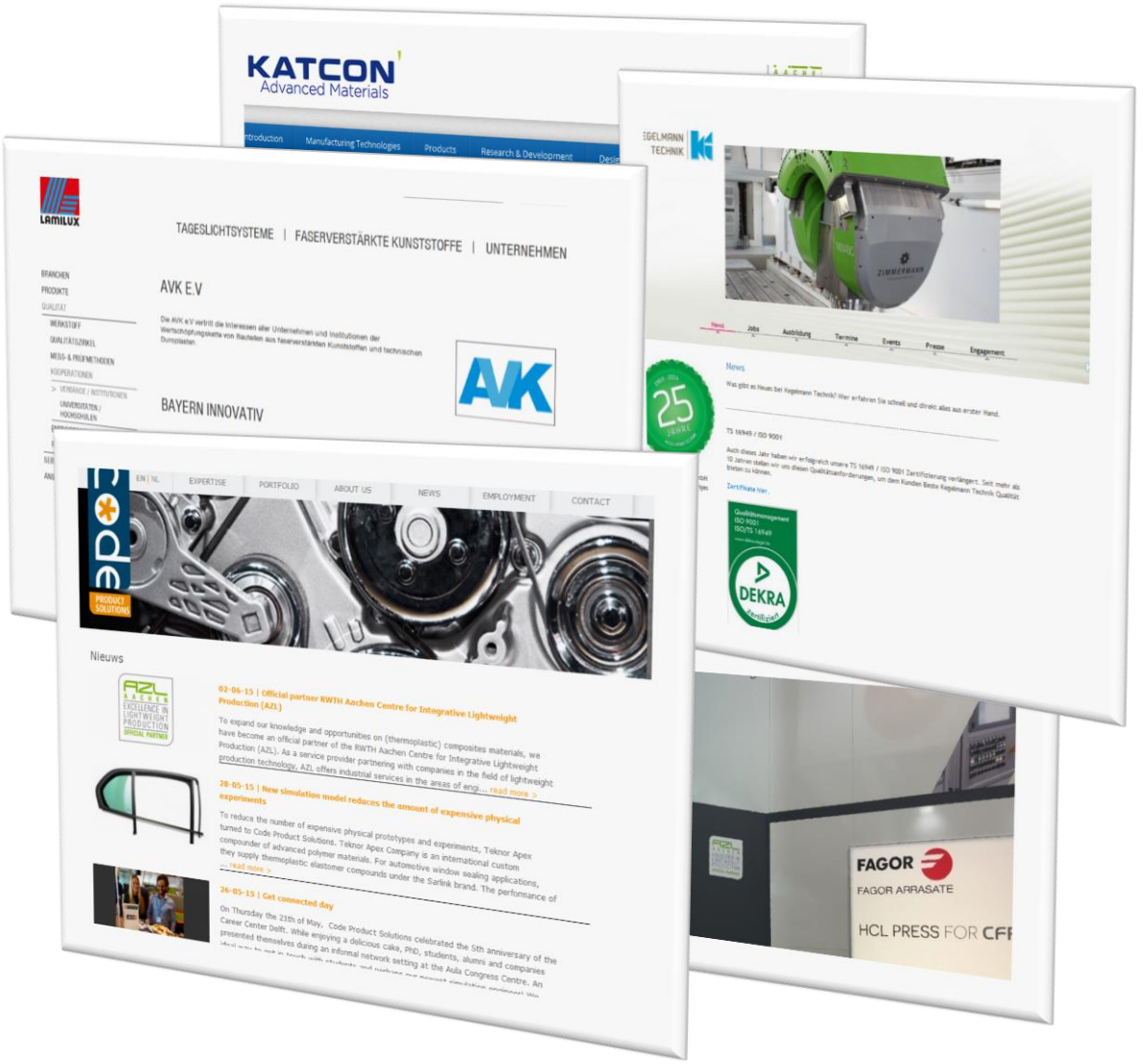

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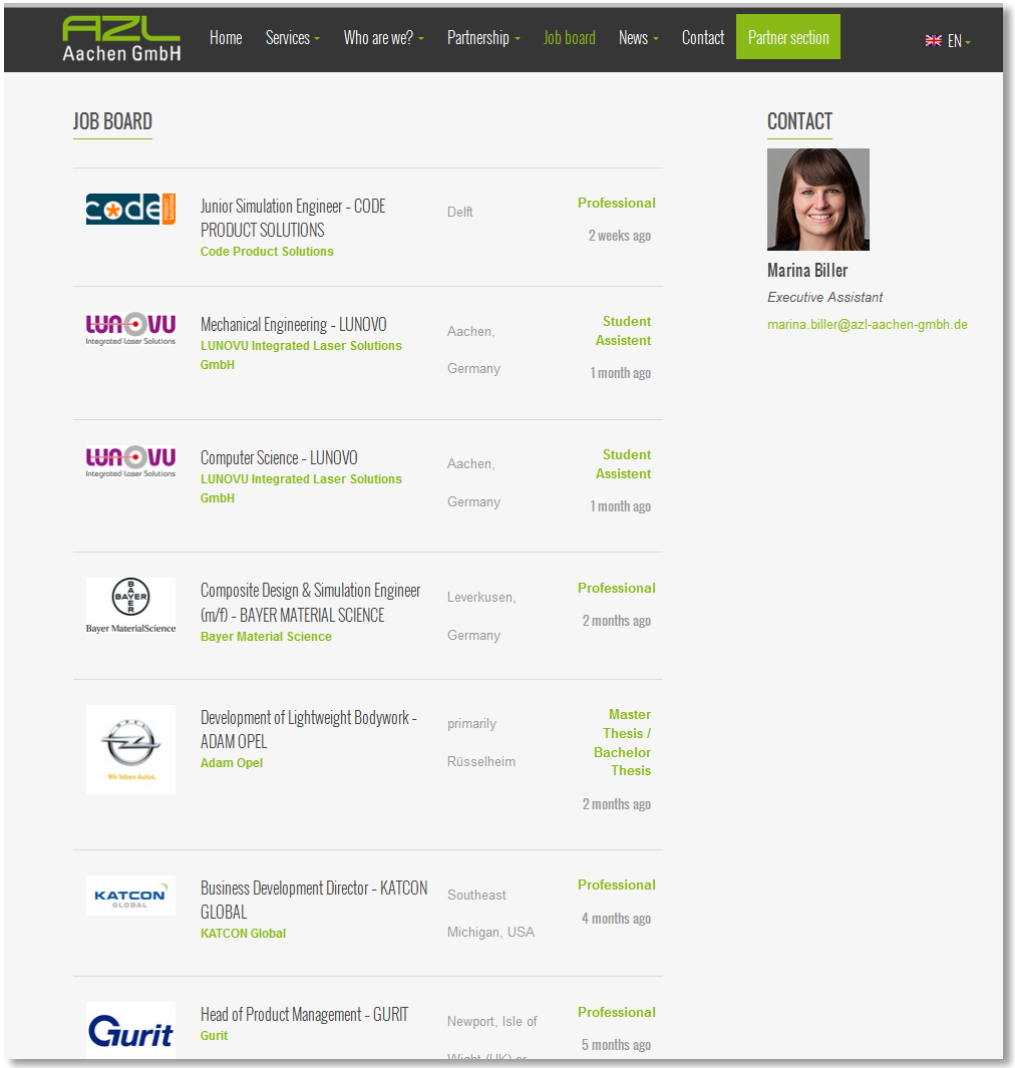

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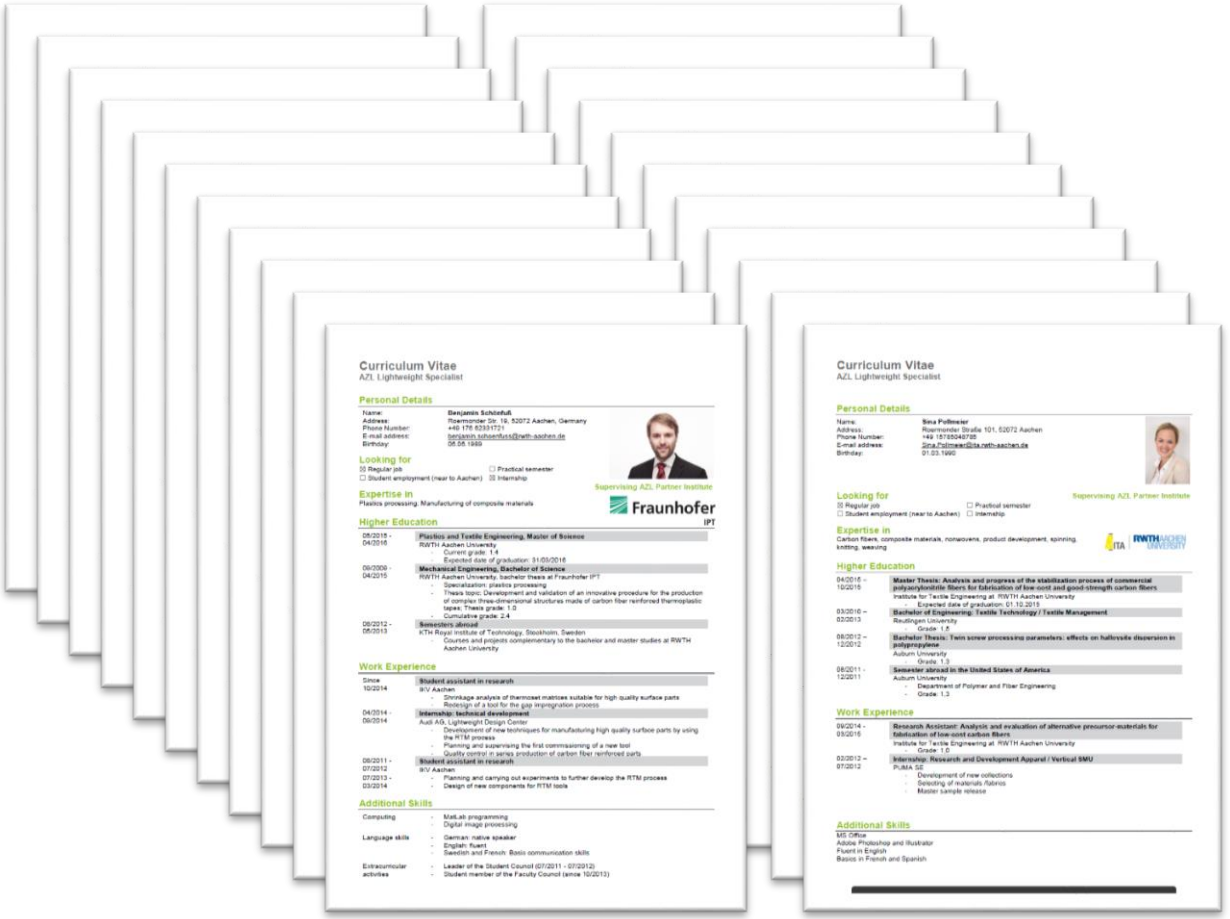


Content

- RWTH Aachen University, AZL and Partner Institutes
- Growing AZL Partner Network
- Events and Meetings
- Projects and Cooperations
- Marketing News
- **AZL Infrastructure News**

Cluster-Building “Integrative Production Technology”

Pictures: Capricorn Development, Henn Architekten

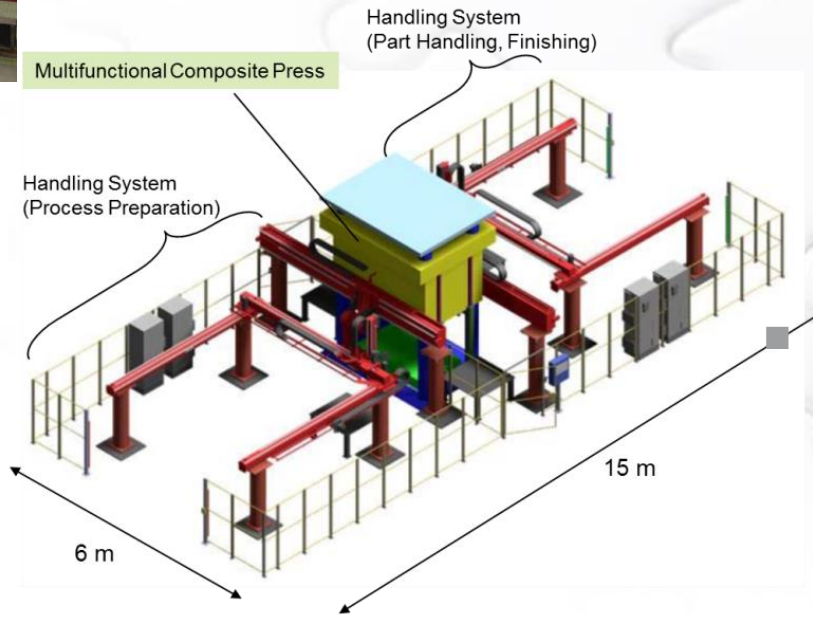
New Building complex of the new Cluster “Integrative Production Technology” at RWTH Aachen University:

- 25.000 m² machinery hall and office buildings for AZL, WBA and E-Lab
- Infrastructure for additional 800 scientists
- 3.000 m² for shops, gastronomy, service

Installation of Composite Press in 2016

SCHULER
Member of the ANDRITZ GROUP

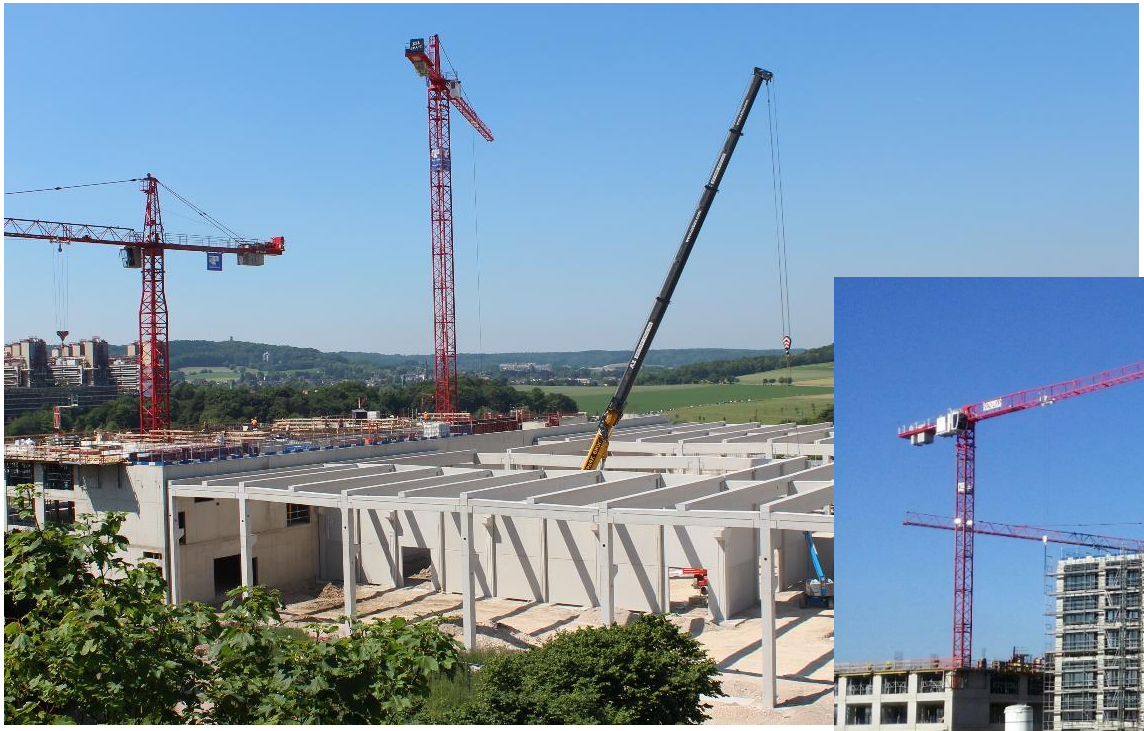
AZL AACHEN EXCELLENCE IN LIGHTWEIGHT PRODUCTION PREMIUM PARTNER



- Schuler Composite Press System
  - Table Size: 1,8 m x 2,8 m
  - Tonnage: 1.800 to
- Handling Systems
  - Loading of press system
  - Handling of semi-finished products
  - Handling and processing of parts
  - Integrated quality assurance systems
- Large-Scale Production Systems for
  - Injection molding
  - Compression molding
  - Thermoforming
  - Combined processing

Cluster „Integrative Production Technology“ (New home of AZL)

July 2015



December 2015

Contact for further Information

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