

DEVELOPMENT AND  
ENGINEERING CENTER  
FOR ADVANCED  
FIBER PLACEMENT  
TECHNOLOGIES

# FPC FIBER PLACEMENT CENTER

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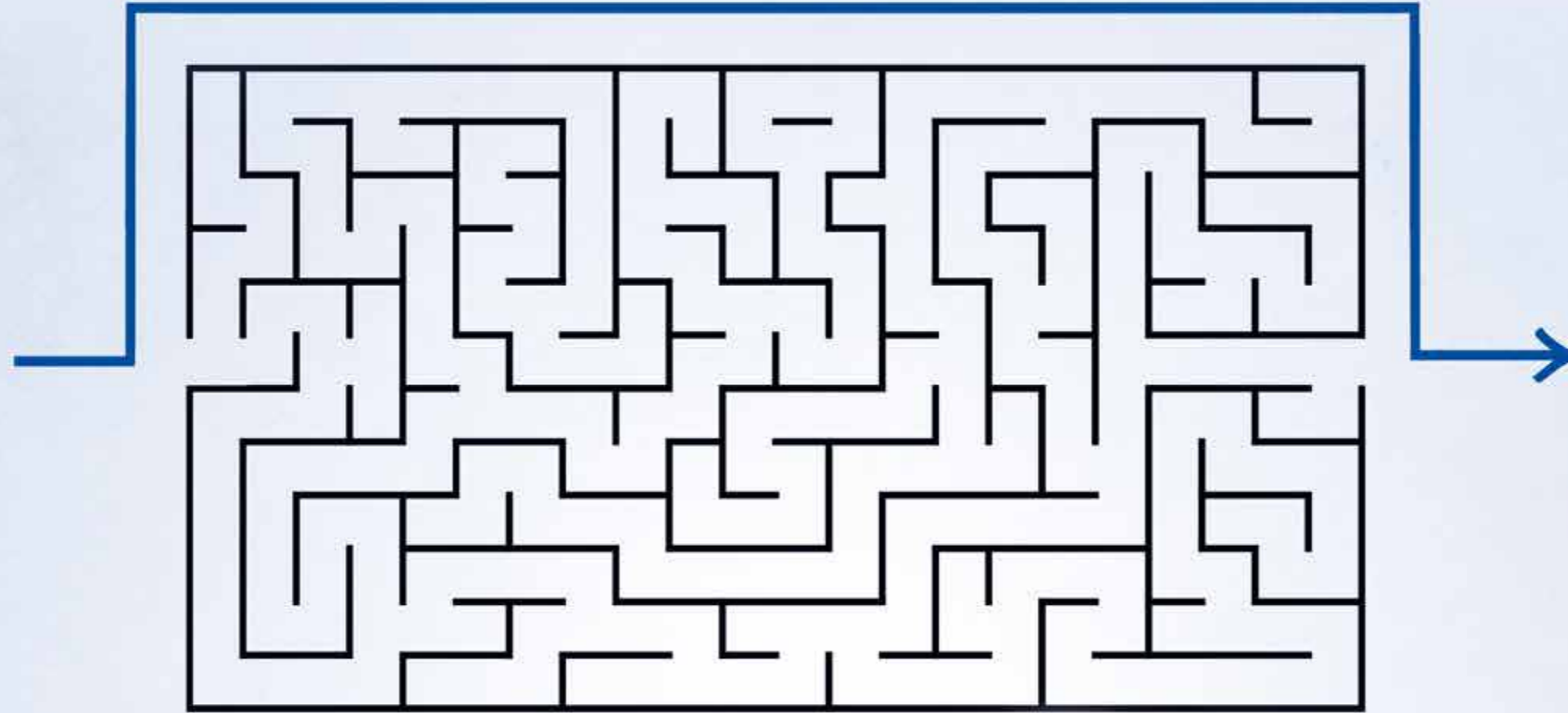
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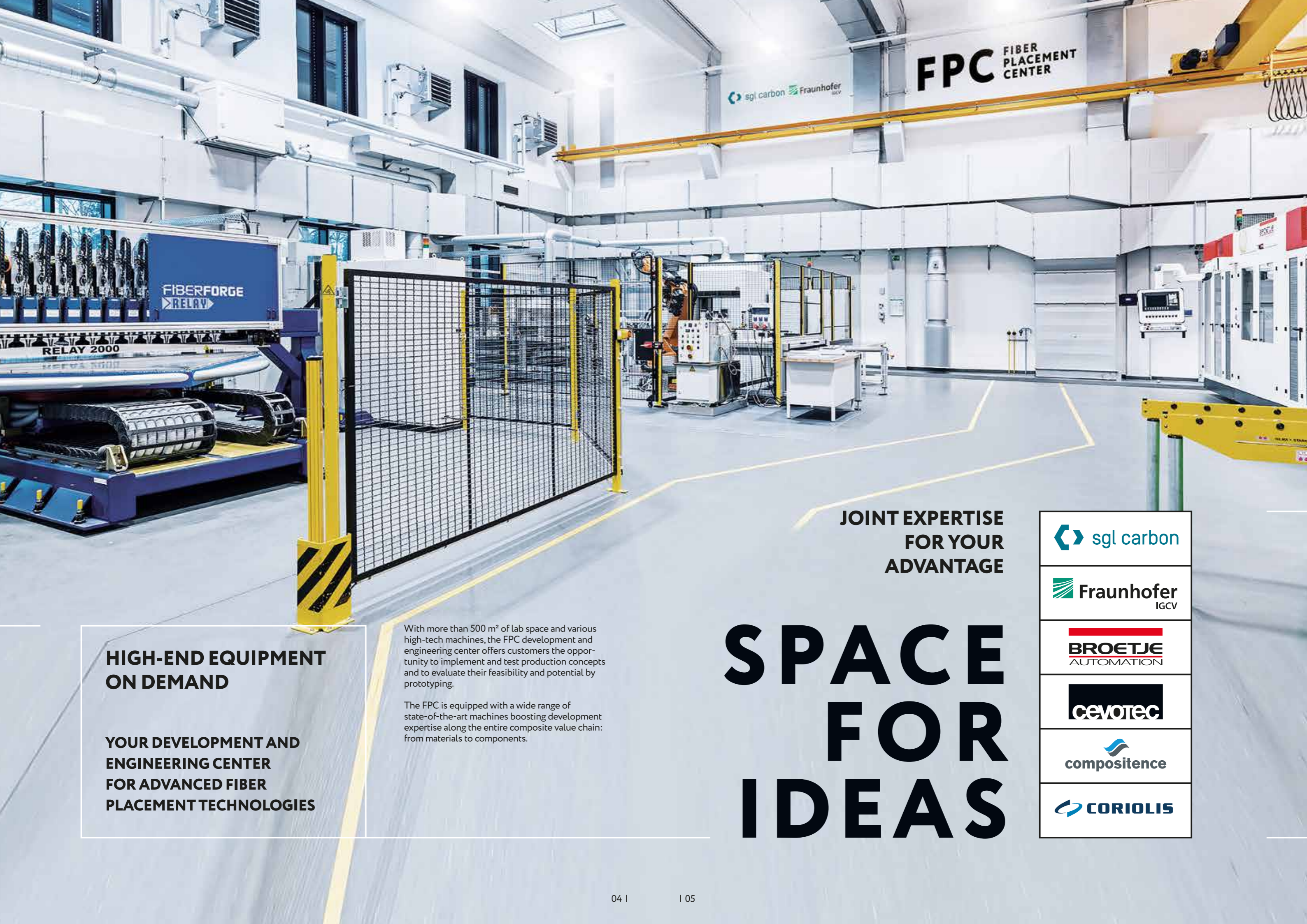
SIMPLIFY  
COMPOSITES



# SIMPLIFY COMPOSITES



Simplify composites is the new motto of today for industries like automotive, aerospace, sports and industrial applications: Make composites efficient and economical. Satisfy the needs of the market. The Fiber Placement Center with its partners offers space for your ideas, concentrated expertise and the high-end equipment to bring to life this ambition. On demand, at one place, simple and beneficial for you. So as to make market opportunities your market success. Let's start a conversation.



sgl carbon Fraunhofer IGCV

**FPC** FIBER PLACEMENT CENTER

FIBERFORGE  
RELAY

RELAY 2000

## HIGH-END EQUIPMENT ON DEMAND

**YOUR DEVELOPMENT AND ENGINEERING CENTER FOR ADVANCED FIBER PLACEMENT TECHNOLOGIES**

With more than 500 m<sup>2</sup> of lab space and various high-tech machines, the FPC development and engineering center offers customers the opportunity to implement and test production concepts and to evaluate their feasibility and potential by prototyping.

The FPC is equipped with a wide range of state-of-the-art machines boosting development expertise along the entire composite value chain: from materials to components.

**JOINT EXPERTISE FOR YOUR ADVANTAGE**

# SPACE FOR IDEAS

-  sgl carbon
-  Fraunhofer IGCV
-  BROETJE AUTOMATION
-  cevotec
-  compositence
-  CORIOLIS



SGL Carbon's TowPregs for processing with AFP and FPP systems

SGL Carbon's thermoplastic UD tapes for processing with AFP systems



### INNOVATIVE MATERIAL MIX AND ENGINEERING EXPERTISE

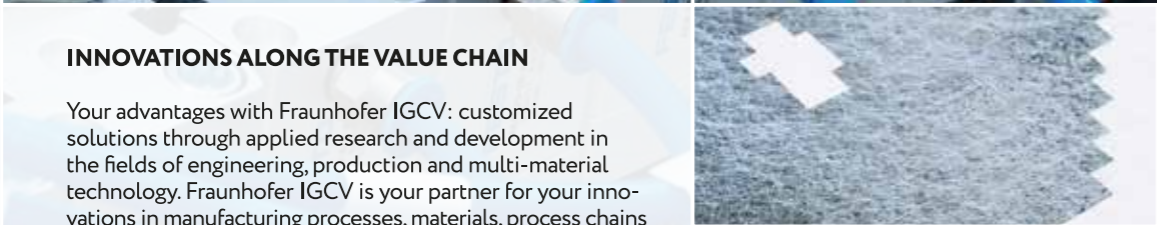
Your advantages with SGL Carbon: What matters to SGL Carbon is added value for you. Not only offering first-class products but also the opportunity to develop components and systems together. With a broad range of materials SGL Carbon supplies the perfect basis for efficient, cost-optimized serial production of fiber composites.

In partnership with the customers, SGL Carbon develops intelligent, trendsetting and sustainable solutions that deliver a clear benefit.

With the in-depth materials, engineering and application know-how, SGL Carbon makes a substantial contribution to major future topics like mobility, energy and digitization.

# SMART SOLUTIONS



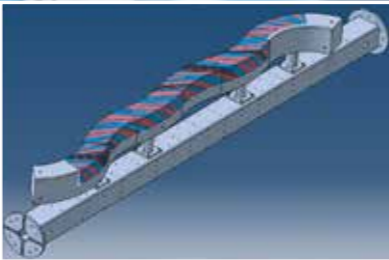


**INNOVATIONS ALONG THE VALUE CHAIN**

Your advantages with Fraunhofer IGCV: customized solutions through applied research and development in the fields of engineering, production and multi-material technology. Fraunhofer IGCV is your partner for your innovations in manufacturing processes, materials, process chains and production networks. You get cross-platform special solutions in composite and processing technologies.

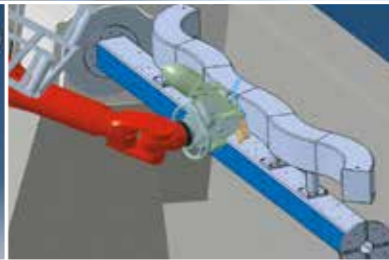
- New applications for fiber placement technologies
- Standardization
- Technology demonstration and transfer
- Manufacturing Engineering
- Fiber/Tape Placement Technologies
- Online Process Monitoring and NDT
- Cost and efficiency analysis
- Sustainability

**COMPREHENSIVE SOLUTIONS**



**DESIGN TO AFP**

Selection of a suitable technology to produce a specific part  
Tooling design  
Definition of layup strategies (staggering, gaps/overlaps etc.)



**DIGITAL PROCESS CHAIN**

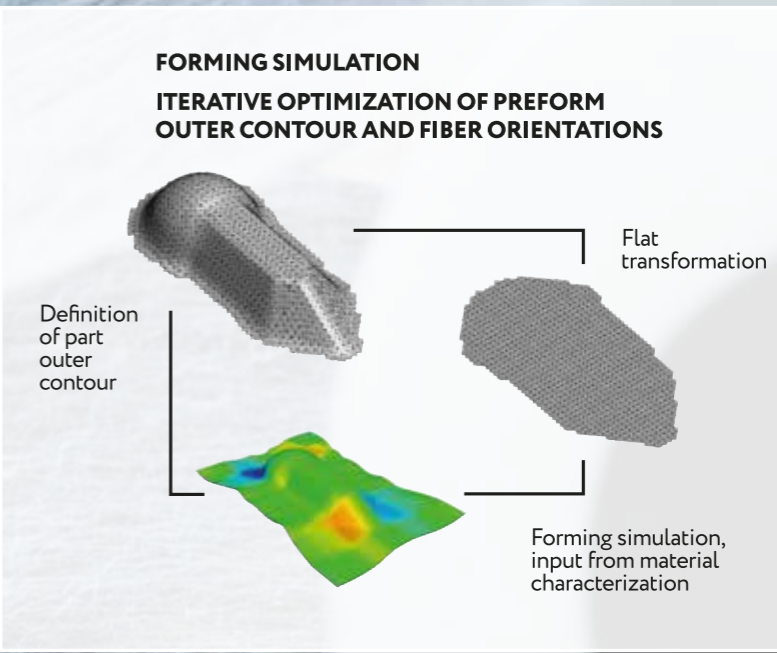
Development of cost-efficient production processes  
Automation of programming tasks  
Holistic process simulation of highly complex parts



**PROCESS VALIDATION**

Characterization of material layup quality on 2D/3D contours  
Determination of suitable processing parameters

- CONTINUOUS FIBER TAILORING (CFT) PROTOTYPE MACHINE**
- Efficient production of highly drapeable 2D stacks
  - Materials: 50k rovings, thermoplastic binder veil
  - Layer fixation: infrared activation of binder systems
  - Variable number of rovings: up to 30
  - Individual cut and feed
  - Max. layer width: 600 mm



Hot forming process: From obtained contour of the organosheet to final part



**BROETJE**  
AUTOMATION

**BROETJE**  
AUTOMATION

**BROETJE-AUTOMATION  
STAXX 1700**

Composite materials:  
thermoplastic and thermoset

Heating systems for material fixation:  
infrared or diode laser

Number of tows / tapes: 16

Width of the material:  
½" thermoplastic and thermoset

Max. part size: 1,4 x 1,1 m<sup>2</sup>

Part geometries: 2 - 2,5D

**FULLY FLEXIBLE  
SCALABLE HIGH PERFORMANCE  
FIBER PLACEMENT**

Your advantages with Broetje-Automation: More than 40 years of experience in specialized production facilities as well as a deep understanding of composite production processes enable Broetje-Automation to fully exploit the potential of composite automation.

At the Fiber Placement Center Broetje-Automation is presenting the STAXX Compact 1700 machining centre - the world's first CNC-controlled machine for automated fiber placement, which has been specially developed for industrial series production. This allows pre-impregnated carbon fiber bundles, so-called TowPregs, to be automatically and reproducibly routed away from the coil very close to the desired final contour. The process significantly reduces material losses and thus (unit) costs.

STAXX Compact 1700 is a robust, scalable and process-reliable solution that can easily be integrated into existing production environments. With the STAXX 3D, the system concept was extended by the ability to lay-up larger and more complex structures in 3D. The STAXX FLEX fiber placement head is the newest member of the STAXX family of products. The new STAXX FLEX is a compact and versatile end effector for 3D fiber stacking. Due to its low weight it easily can be mounted on any standard robot and therefore is a very competitive industrial solutions.

**COMPOSED  
TO COMPETE**

**BROETJE**  
AUTOMATION

**BROETJE**  
AUTOMATION

PRODUCTION

GUIDES

COMPONENT APPS

INFORMATION

NUMERIC CONTROL

OPERATOR

Program progress

NC-Block Nr. N000120

op-Mode

OFF

Cycle-Mode

JOB OK

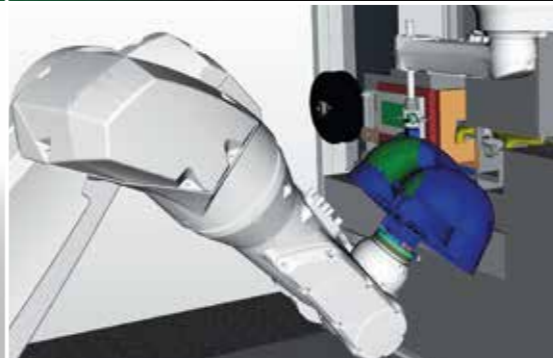
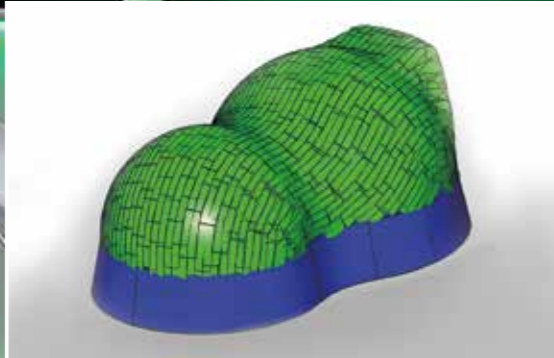
Signal

4649

Lowell



Cevotec Artist Studio Software:  
From laminate design to machine program



### SAVE COST AND TIME WITH CEVOTEC AUTOMATION

Your advantages with Cevotec: Automate the lay-up of your complex composites parts with Cevotec's SAMBA systems. Based on Fiber Patch Placement (FPP) technology, SAMBA enables you to save 20% - 60% in production cost and time.

Key applications are multi-material composites, complex-shaped parts, and tailored local reinforcements. SAMBA systems work with a broad range of materials, including carbon and glass fibers, adhesives, and other technical fibers. The compaction-controlled, additive placement process works with a form-flexible patch gripper that enables direct 3D fiber placement also on very complex surfaces.

You can explore FPP technology in detail through development projects with the Fiber Placement Center. Receive your feasibility assessment and unit-cost estimation for your application upfront at no cost. Let's team up to achieve milestones in composites – for a lighter, more sustainable future.

# SAMBA FOR COMPLEX COMPOSITES

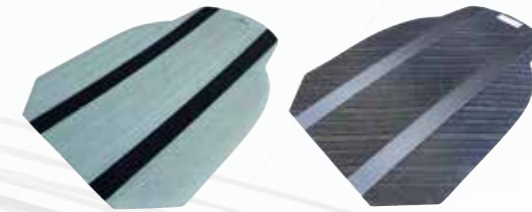
#### CEVOTEC SAMBA LAY-UP SYSTEMS

- Net-shape 3D fiber placement on highly complex shapes
- Wide range of thermoset prepreg and dryfiber material systems processible, incl. glass and adhesives
- Flexible robot configurations, up to 13 cooperating axes
- Cutting systems: ultrasonic knife, fiber laser
- Patch gripper: form-adaptive, customizable up to 300 mm x 400 mm
- Multiple sensors for advanced process control: quality, positioning, compaction
- All Systems integrated in ARTIST STUDIO platform, incl. FE-interface
- General part sizes up to 5 m x 2 m x 1 m
- Tape width up to 300 mm (~12")

#### CEVOTEC SAMBA PRO

- Available for projects at Fiber Placement Center
- Configuration with 10 cooperating robot axes and Scara fast picker
- Max. part size: length 1,2 m, diameter 1 m
- Tape width: 12,5 mm (½") – 50 mm (~2")
- Patch length: 50 mm – 200 mm
- Cutting system: fiber laser with ultra-high precision scanner
- Form-adaptive, customizable patch gripper in different sizes

Compositence Thermoplastic Tape Blanks



High Output 2D Fiber Placement System



### COSTS DOWN ADVANTAGES UP

Your advantages with Compositence: Passion for innovative composite production and orientation to offer you the best fitted solutions that support your business. Compositence intends to make the advantages of composite materials accessible for a wide range of applications.

Compositence automation systems are extremely material saving and in the same time allow to optimally allocate and align the material. Paired with high production rates and best reproducibility this leads to cost efficient lightweight constructions.

Since 2009 Compositence supplies technologies, services, software and systems for automated composite manufacturing. Several unique preforming technologies with corresponding design software have been developed and the associated systems designed and installed.

As partner of the Fiber Placement Center Compositence contributes to bring newest production technology to life in your applications.



Fiber Guiding Systems

### COMPOSITENCE FIBER PLACEMENT TECHNOLOGY

- Composite materials:  
thermoplastic, thermoset,  
dry fiber tapes
- Material fixation:  
edge fixation, infrared or laser
- Number of tows / tapes:  
16x12 mm / 4x46 mm
- Width of the material:  
12 mm - thermoplastic and thermoset  
46 mm - dry fiber tape
- Max. part size:  
2x2 m<sup>2</sup> - robot based system  
2,7x2 m<sup>2</sup> - linear axis system
- Part geometries:  
2 - 2,5D

# COMPOSITE MANUFACTURING SOLUTIONS FOR YOUR GOALS





# AGILITY FOR PRODUCTION

## REDUCE COMPLEXITY, WEIGHT, ENERGY FROM THE START UP TO SERIES PRODUCTION

Your advantages with Coriolis Composites: Passion for composite industry and innovation and encourage a culture of no limits. This offers you support from the beginning of your project with defining your needs and designing of the part itself, all the way to the implementation and optimization of AFP machines.

The Mission of Coriolis Composites is to develop and supply automated solutions for the production of composite parts. Together with you, Coriolis Composites analyzes new requirements and demonstrates feasibility, to deliver fully industrialized solutions for reliable, fast and cost-efficient manufacturing from the very start of series production.

For this Coriolis Composites has developed proprietary technology to guarantee the reliability and performance of our AFP solutions. The highly modular and standardized systems include compact, precise and agile AFP heads combined with standard, articulated robots. It offers the combination of versatility and productivity required for the series production of composite parts, from simple to highly complex parts, using multimaterial, such as thermoset, thermoplastic or dry fiber.



**CORIOLIS**

### CORIOLIS C1

- Part geometries: 2D - highly complex 3D
- Machine type: robot-based system
- CFRP material: thermoplastic, thermoset and dry fibers
- Heating systems for material fixation: IR or diode laser
- Head configuration: 8 tows / tapes
- Width of the material: ¼"
- Max. part size: length 7 m, diameter 3 m

### CORIOLIS Csolo

- Part geometries: 2D - 3D
- Machine type: robot-based system
- CFRP material: thermoplastic, thermoset and dry fibers
- Heating systems for material fixation: IR or diode laser
- Head configuration: single tow / tape
- Width of the material: ¼" - 1½"
- Max. part size: length 3 m, width 1,3 m

## GOALS

**DEVELOPMENT OF CUSTOMIZED MATERIALS AND FIBER PLACEMENT SOLUTIONS FOR EFFICIENT AND SUSTAINABLE LIGHTWEIGHT COMPOSITE COMPONENTS**

**APPLICATION OF COST-EFFECTIVE MATERIALS**

**SCRAP AND CYCLE TIME REDUCTION**

**COMBINATION OF TECHNOLOGIES TO IMPLEMENT AN EFFICIENT PROCESS ROUTE FOR A GIVEN COMPOSITE COMPONENT**

### FPC IS A COOPERATION AGREEMENT BETWEEN R&D AND INDUSTRY PARTNERS

Definition of general scope, goals, IP, confidentiality etc.  
Agreement for the utilization of the different machines  
No legal status e.g. as a joint venture

### JOINT INDUSTRY PROJECTS

Individual project definition  
Short to medium-term contract research  
Contract between customer and one or more FPC Partner/s

### PUBLICLY FUNDED PROJECTS

Cooperation of partners from research and industry in a consortial R&D project: EU, national etc.  
Involvement of one or more FPC partners

# REACH FOR YOUR GOALS

# FPC FIBER PLACEMENT CENTER

## FROM MATERIAL TO FINAL COMPONENT

### IMPROVING PRODUCTS AND PROCESSES

(Re-)design to AFP and FPP  
Product-process matching  
Improved performance and cost efficiency

### DEVELOPING PRODUCTS AND PROCESSES

Material development  
AFP and FPP digital process chain  
Optimization of processing parameters

### INTRODUCING NEW TECHNOLOGIES

Manufacturing process routes  
From TRL 1 to product qualification  
Prototypes and small batches

### CHARACTERIZATION AND TESTING

Analysis of layup quality  
High-quality testing facilities  
Test reports

### QUALIFYING FOR THE FUTURE

Technical training for engineers and/or operators  
Knowledge transfer to customer teams

### CONSULTING ON INNOVATIONS

Market, trend and profitability analyses  
Feasibility studies