

3DEXPERIENCE CATIA

MODSIM FOR COMPOSITES DESIGN

As-Is Process

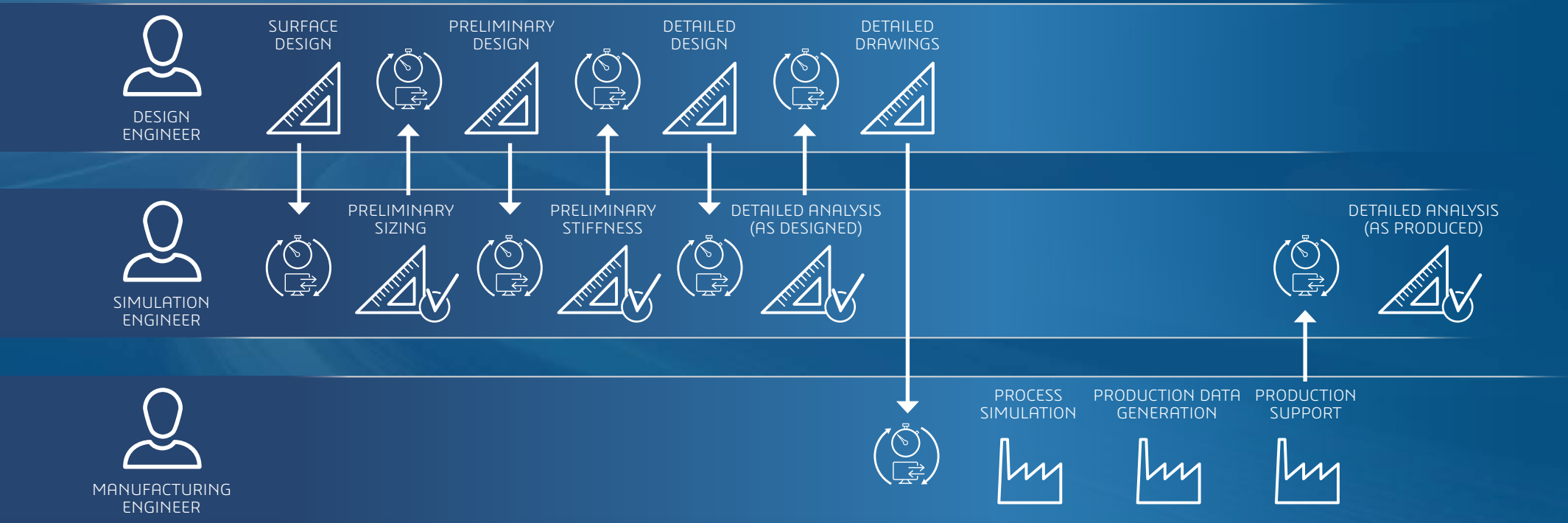
3DEXPERIENCE Composites

- Layup Definition
- Layup Optimization
- Detailed Layup Definition
- Detailed Layup Validation
- Manual Layup
Manufacturing
Preparation
- MBOM Preparation
- MBOM Creation, Process
Planning, and Work
Instructions
- Automated Fiber
Placement Simulation
and Programming

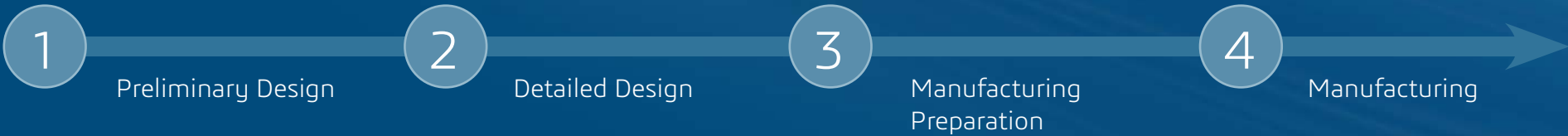
Conclusion

COMPOSITES ENGINEERING | AS-IS PROCESS

END-TO-END WITH DISCONNECTED DATA, PEOPLE, PROCESS, AND TOOLS

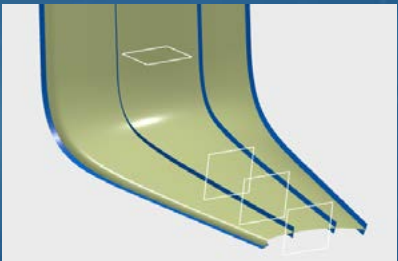


RESULTS IN INEFFICIENCY



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- 3DEXPERIENCE Composites
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 - Automated Fiber Placement Simulation and Programming
- Conclusion

CONNECTED DATA, PEOPLE, PROCESSES, AND TOOLS
RESULTS IN A UNIFIED DATA MODEL FOR SEAMLESS COLLABORATION



COMPOSITES WINGLET

ILLUSTRATION OF A COMPLETE COMPOSITES
PROCESS LEVERAGING 3DEXPERIENCE



DESIGN
ENGINEER



SIMULATION
ENGINEER



MANUFACTURING
ENGINEER

SIMULATION-
DRIVEN CONCEPT

- Layup Sizing
- Layup Optimization

SIMULATION-
DRIVEN DESIGN

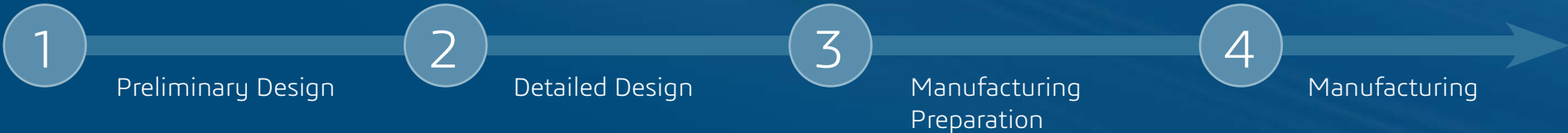
- Layup Detailed Design
- Structural validation

DESIGN FOR
MANUFACTURING

- Manufacturing
- Manual Layup
 - Automated Fiber Placement

MANUFACTURING
SUPPORT

- Production
- MBOM
 - Process Planning
 - Work Instruction
 - Machines Programming



As-Is Process
3DEXPERIENCE Composites
• Layup Definition • Layup Optimization • Detailed Layup Definition • Detailed Layup Validation • Manual Layup Manufacturing Preparation • MBOM Preparation • MBOM Creation, Process Planning, and Work Instructions • Automated Fiber Placement Simulation and Programming
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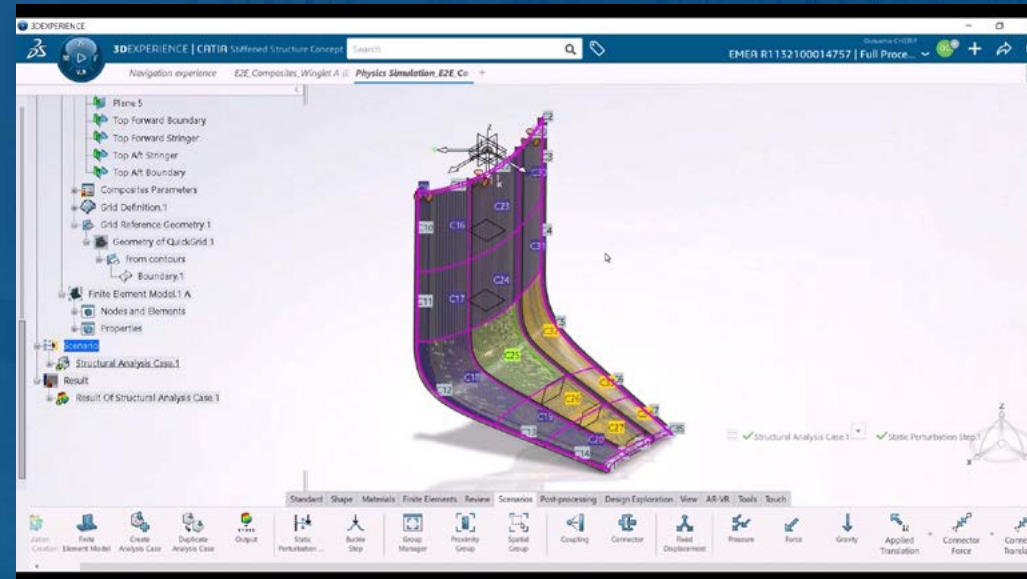
3DEXPERIENCE CATIA - MODSIM FOR COMPOSITES DESIGN

COMPOSITES WINGLET LAYUP SIZING

LAYUP DEFINITION WITH STIFFENED STRUCTURE CONCEPT

Key Values:

- Fast definition of stiffener positions on a panel and easy definition of iso-thickness zones of composite materials on a skin
- Finite Element model setup with Structural simulation and Design exploration capabilities
- Model reduction into beam elements for a faster convergence of the sizing process



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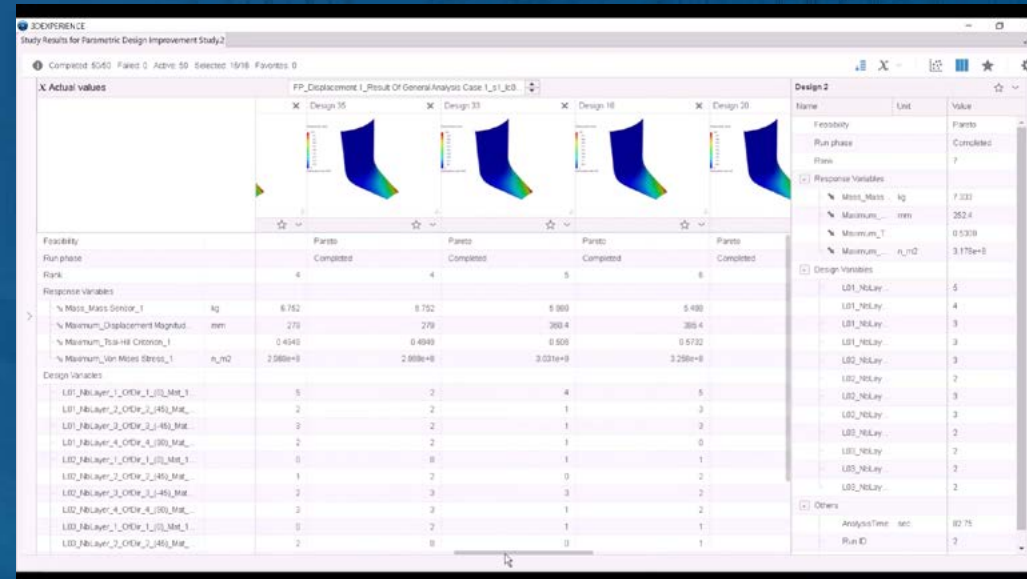


COMPOSITES WINGLET LAYUP OPTIMIZATION

LAYUP OPTIMIZATION WITH PARAMETRIC DESIGN STUDY

Design exploration study used to identify designs that satisfy requirements and improve performance while trading off across multiple objectives:

- Design exploration to a simulation for a single physics simulation
- Easily author, monitor and postprocess design exploration studies
- Automatically search for and discover better designs using a design improvement study



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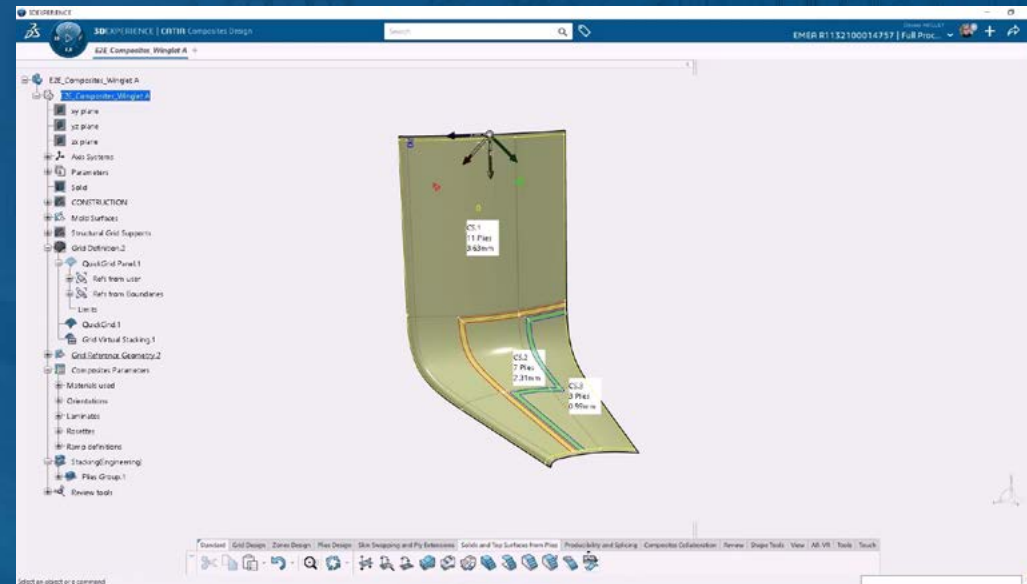
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COMPOSITES WINGLET DETAILED DESIGN

DETAILED LAYUP DEFINITION WITH COMPOSITES DESIGN

Key Values:

- Powerful and **associative review** and modification tools
- **Associative Solids and Surfaces from plies** for Mock-up, relational design and tooling
- Fast Generation of outputs such as 3D Sections, 2D documentation
- Integration with review tools of the platform



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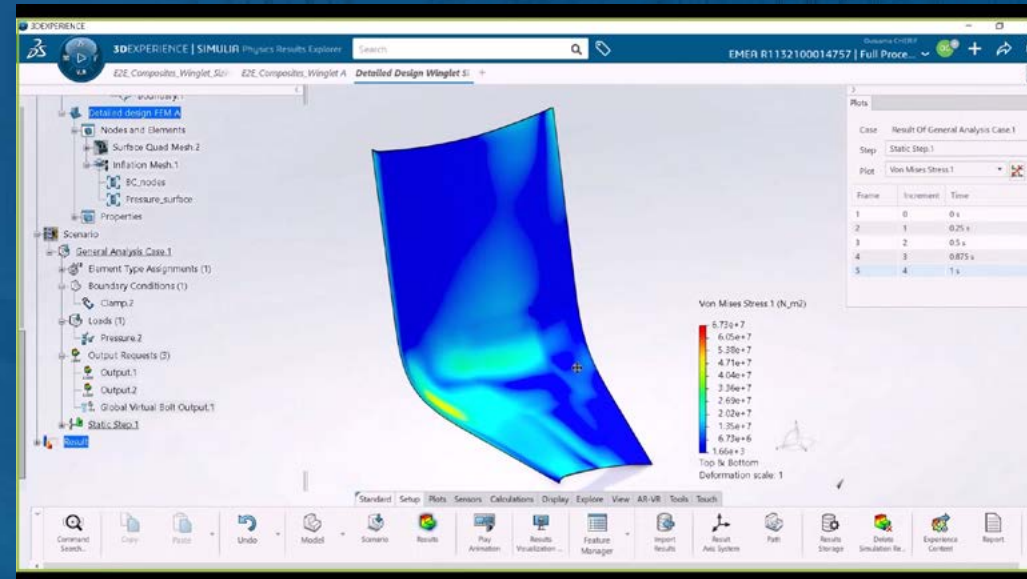
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COMPOSITES DETAILED DESIGN VALIDATION

DETAILED LAYOUT VALIDATION WITH COMPOSITE STRUCTURES ANALYSIS ENGINEER

Key Values:

- Mapping from Composite Plies, Zones or Grids on meshes
- Composite Shell Section or Continuum Shell Section
- Compute fiber orientations from Manufacturing parameters
- Associativity with design allows quick iterations on the composite layup during the Preliminary Design stage (grid-based design, virtual stacking)
- Dedicated tools allowing composite simulation experts to run complex non-linear simulations within the fully immersive, intuitive, **3DEXPERIENCE** Platform



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MANUFACTURING PREPARATION

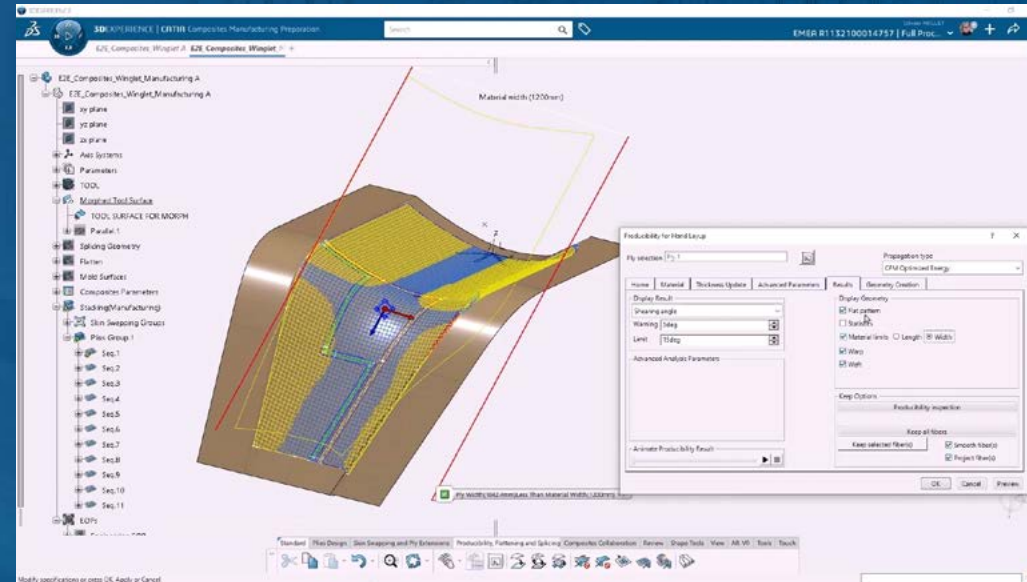
MANUAL LAYUP WITH COMPOSITES MANUFACTURING PREPARATION AND FIBER PLACEMENT WITH CATFIBER DFM

Manual Layup:

- Draping simulation to ensure manufacturability
- Material Excess accounting
- Visualize lay-up of plies on the mold to identify where part geometry will cause fabric distortion
- Generation of optimized flat patterns
- Shop floor documentation with associated operations and work instructions
- Fully integrated laser projection capability supporting most common formats

Automated Fiber Placement:

- Investigate multiple AFP configurations for each part
- Define manufacturing process requirements as early as possible
- Ease communication between engineering and manufacturing
- Validate mechanical properties with maximum precision



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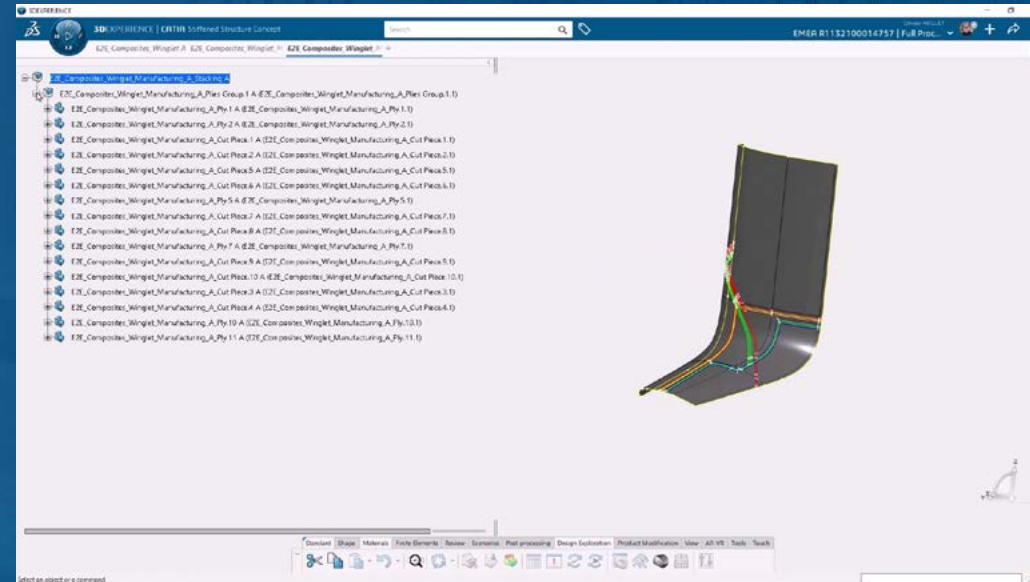


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COMPOSITES DESIGN MBOM PREPARATION

MBOM PREPARATION WITH COMPOSITES MANUFACTURING PREPARATION

Creation of an MBOM associative to the engineering definition allows a better traceability and quality in the manufacturing process



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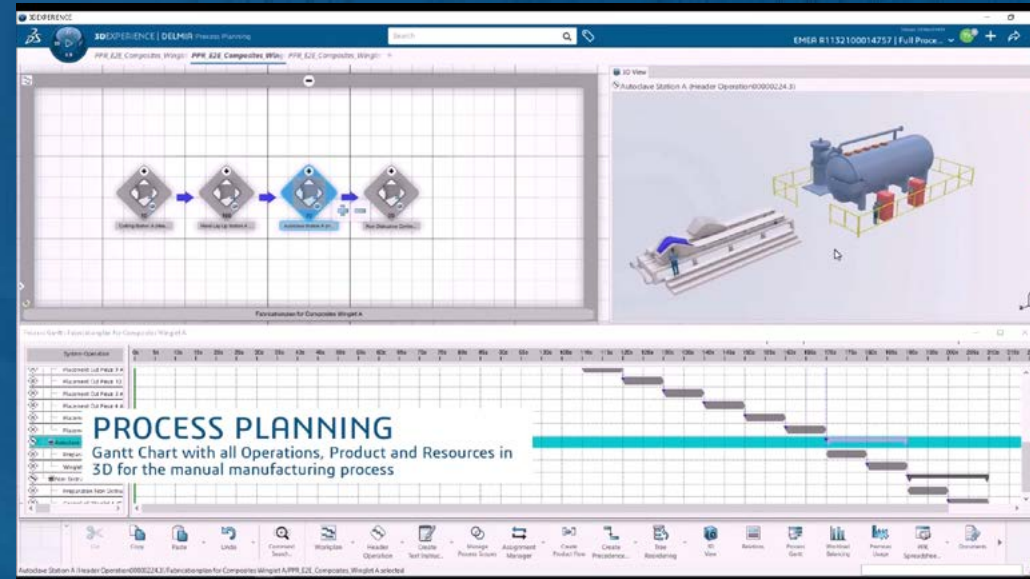
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COMPOSITES DESIGN MBOM CREATION

MBOM PREPARATION WITH COMPOSITES MANUFACTURING PREPARATION

Key Values:

- Define and validate manufacturing process plans of a composites part in 3D
- User is able to describe the necessary transformation steps
- Maximize resource utilization with line balancing
- Reduce cost, risk and time to market
- Easy-to-use features to detail & document simple assembly prototyping & complex manufacturing or maintenance processes.
- Add textual instructions and 3D annotations to describe a job
- Process engineers can publish process plans and related work instructions
- Can be executed as shop orders using DELMIA Apriso Execution



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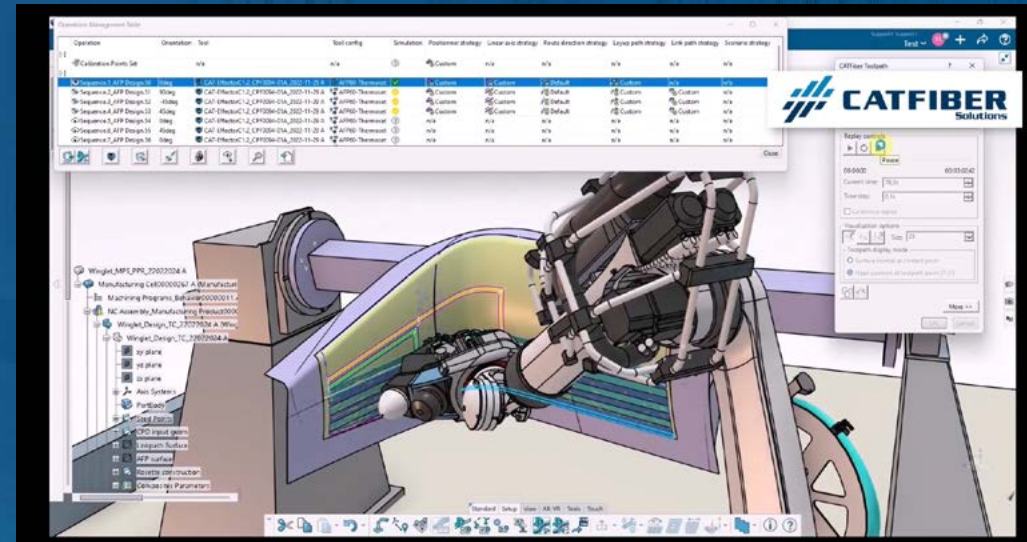
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FIBER PLACEMENT SIMULATION AND PROGRAMMING

AUTOMATED FIBER PLACEMENT SIMULATION AND PROGRAMMING WITH CATFIBER MPS

Key Values:

- Ease communication between engineering and manufacturing
- Robot trajectory programming and simulation in the **3DEXPERIENCE** environment
- Solution independent from the AFP machines



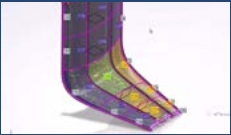
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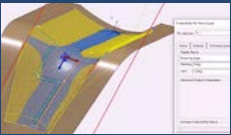
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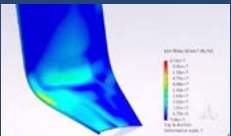
CONCLUSION



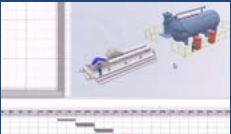
1 Comprehensive set of process-oriented applications
Design, validate, manage and optimize complex production-ready composites parts



2 Composite manufacturing constraints early in the conceptual stage
Reduce design time to market



3 Integrated composites structural analysis and finite element analysis
Optimize the performance and weight by designing in the context of analysis



4 Advanced manufacturing simulation tools integrated with structural analysis
Minimize development costs and prototyping, avoiding trial and error



5 Integrated production management applications
Full traceability thru the complete composites part life cycle

Our **3DEXPERIENCE®** platform powers our brand applications, serving 11 industries, and provides a rich portfolio of industry solution experiences.

Dassault Systèmes, the **3DEXPERIENCE** Company, is a catalyst for human progress. We provide business and people with collaborative virtual environments to imagine sustainable innovations. By creating 'virtual experience twins' of the real world with our **3DEXPERIENCE** platform and applications, our customers push the boundaries of innovation, learning and production.

Dassault Systèmes' 20,000 employees are bringing value to more than 270,000 customers of all sizes, in all industries, in more than 140 countries. For more information, visit www.3ds.com.



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