Autodesk Helius PFA: Advanced Material Simulation for Light-Weighting

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Autodesk

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Product Manager
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Class summary

Plastics, composites, and other advanced materials are replacing metal across multiple industries. The main benefit provided by replacing metallic designs with advanced material designs is the ability to make a product lighter. Advanced materials add challenges to the design process for parts, assemblies, and structures that use these materials. The material behavior is often non-linear, anisotropic, and influenced by how products are manufactured. Helius PFA software provides powerful capabilities for simulating these beneficial but complex materials within a mechanical design. The Helius PFA software suite includes Advanced Material Exchange software for mapping manufacturing data from Moldflow Insight to structural simulation. Join Autodesk, Inc., to learn about the newest features, use cases, best practices for using Helius PFA software, and on the future of advanced material simulation at Autodesk.

Key learning objectives

At the end of this class, you will be able to:

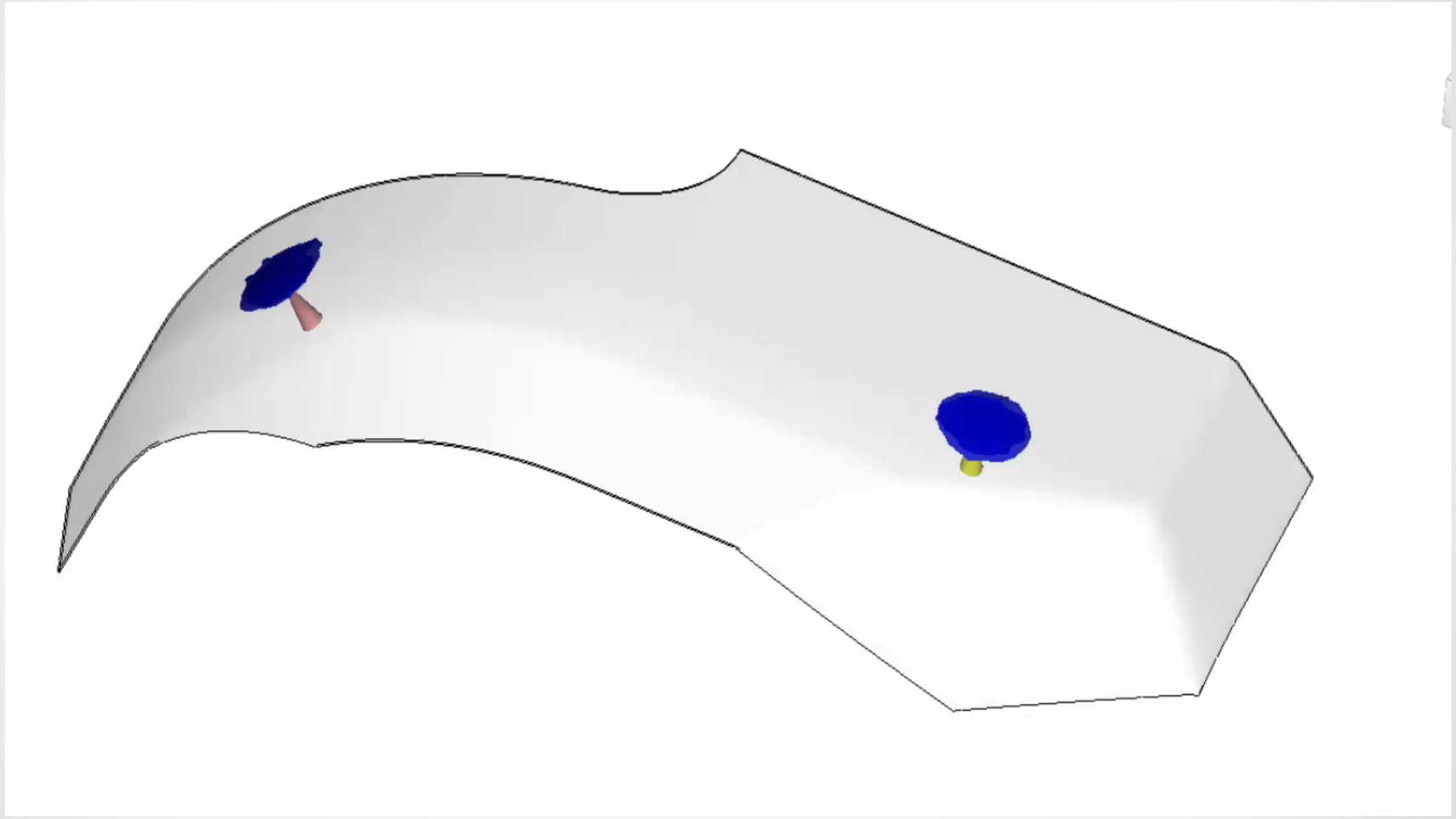
- Learn how to identify use cases and the benefits for using advanced material simulation tools
- Learn best practices for using Helius PFA
- Discover the newest features available in Helius PFA 2016
- Discover the future of advanced material simulation at Autodesk

Benefits of Using Advanced Material Simulation Tools

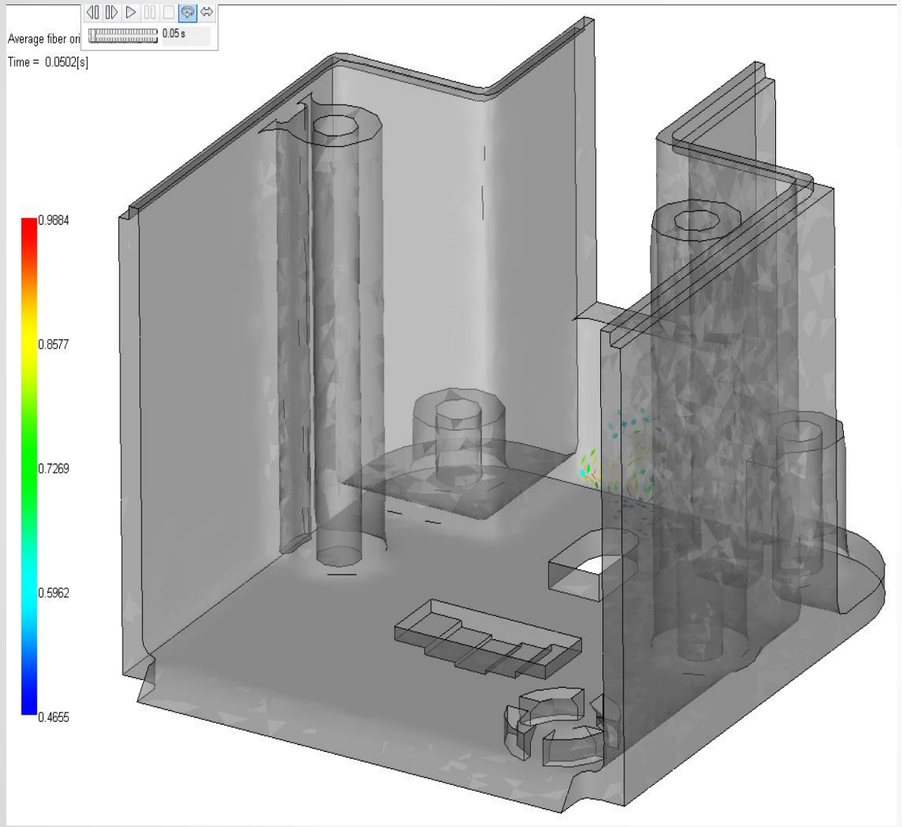
Innovative Design

Lightweight Performance

Manufacturing Process Influences Product Behavior



Use Autodesk Moldflow to Simulate Fiber Orientation



- Chopped Fiber Reinforced Plastics

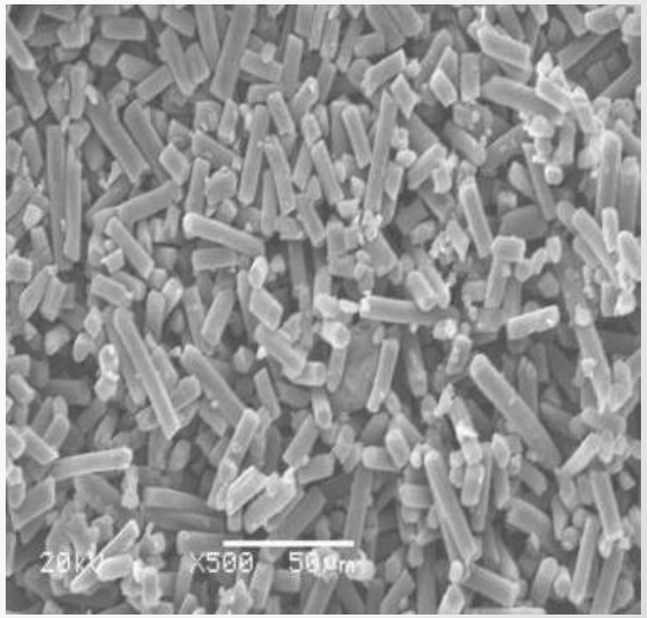
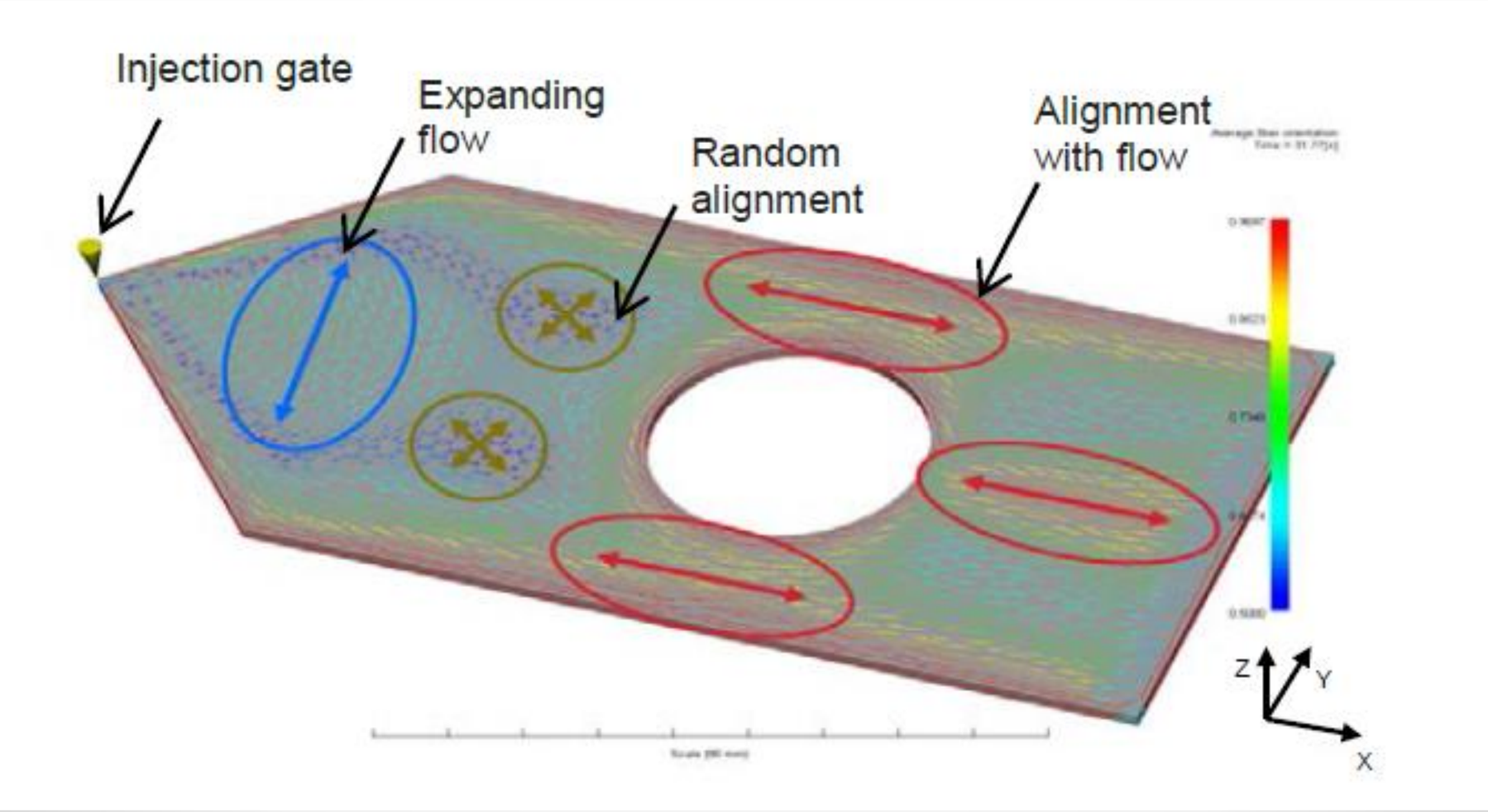


Image Credit: Google, Inc.

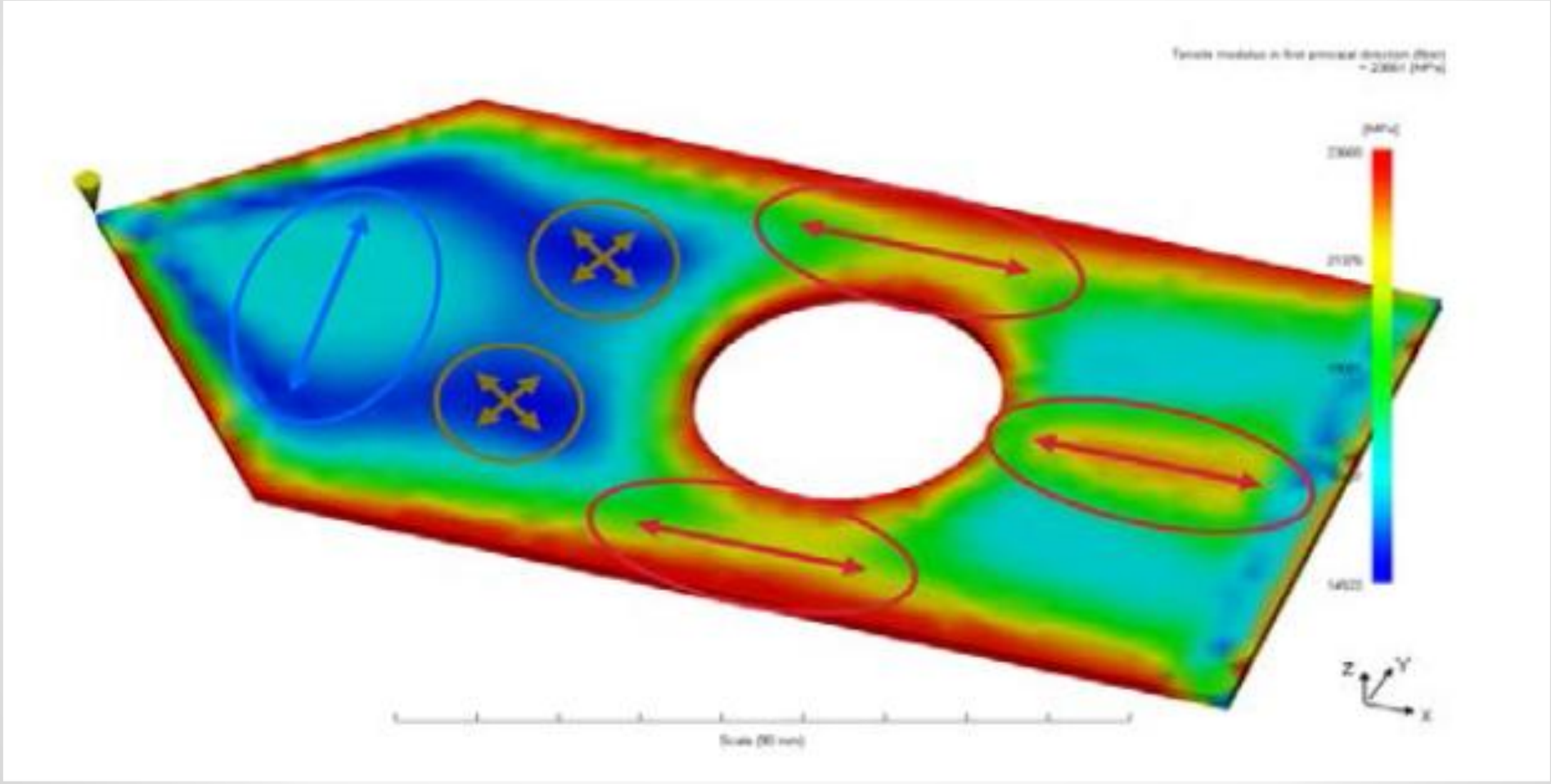
Use Autodesk Moldflow to Simulate Fiber Orientation



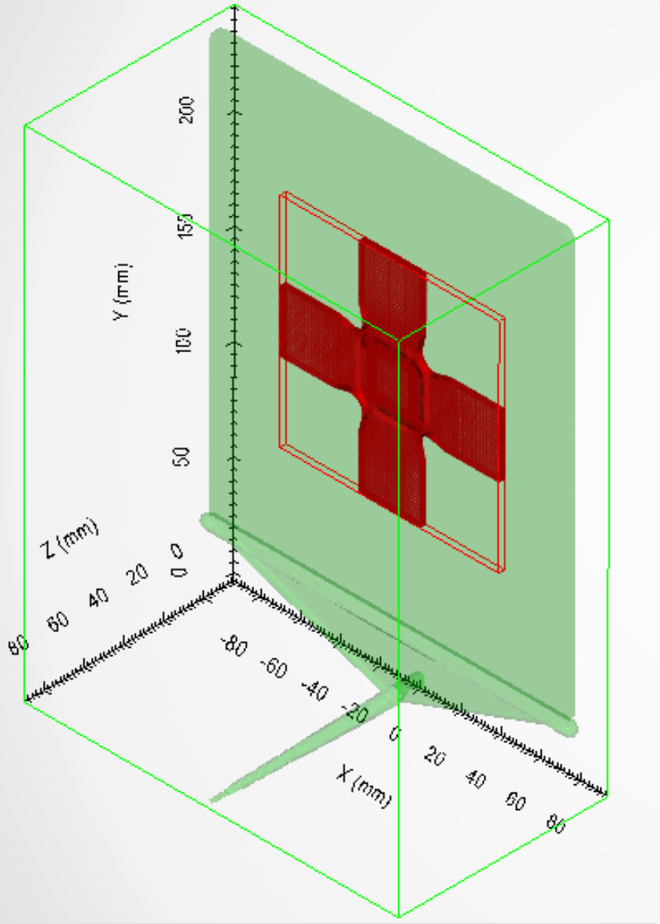
Why Are Fiber Orientations Important?

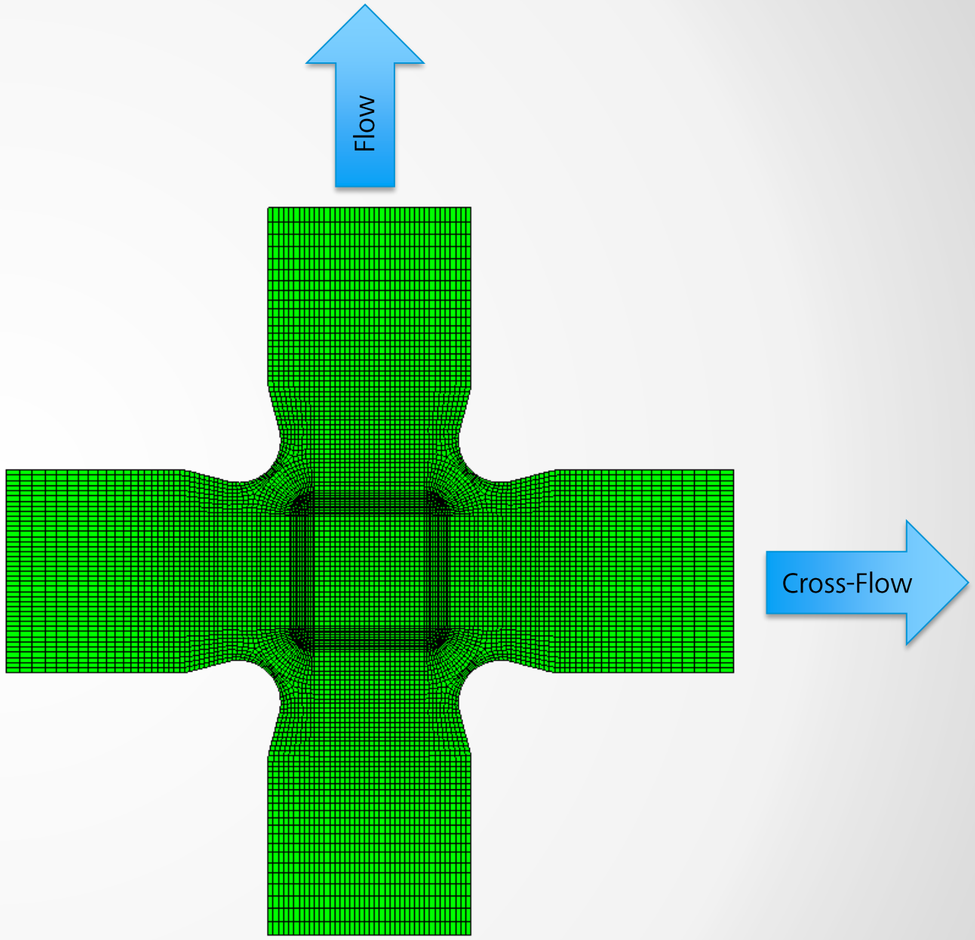
	Fibers in X direction	Random Alignment
Ex (MPa)	12000	5500
Ey (MPa)	4000	5500

Accouting for Orthotropic Material Behavior



Strength/Failure Predicitons





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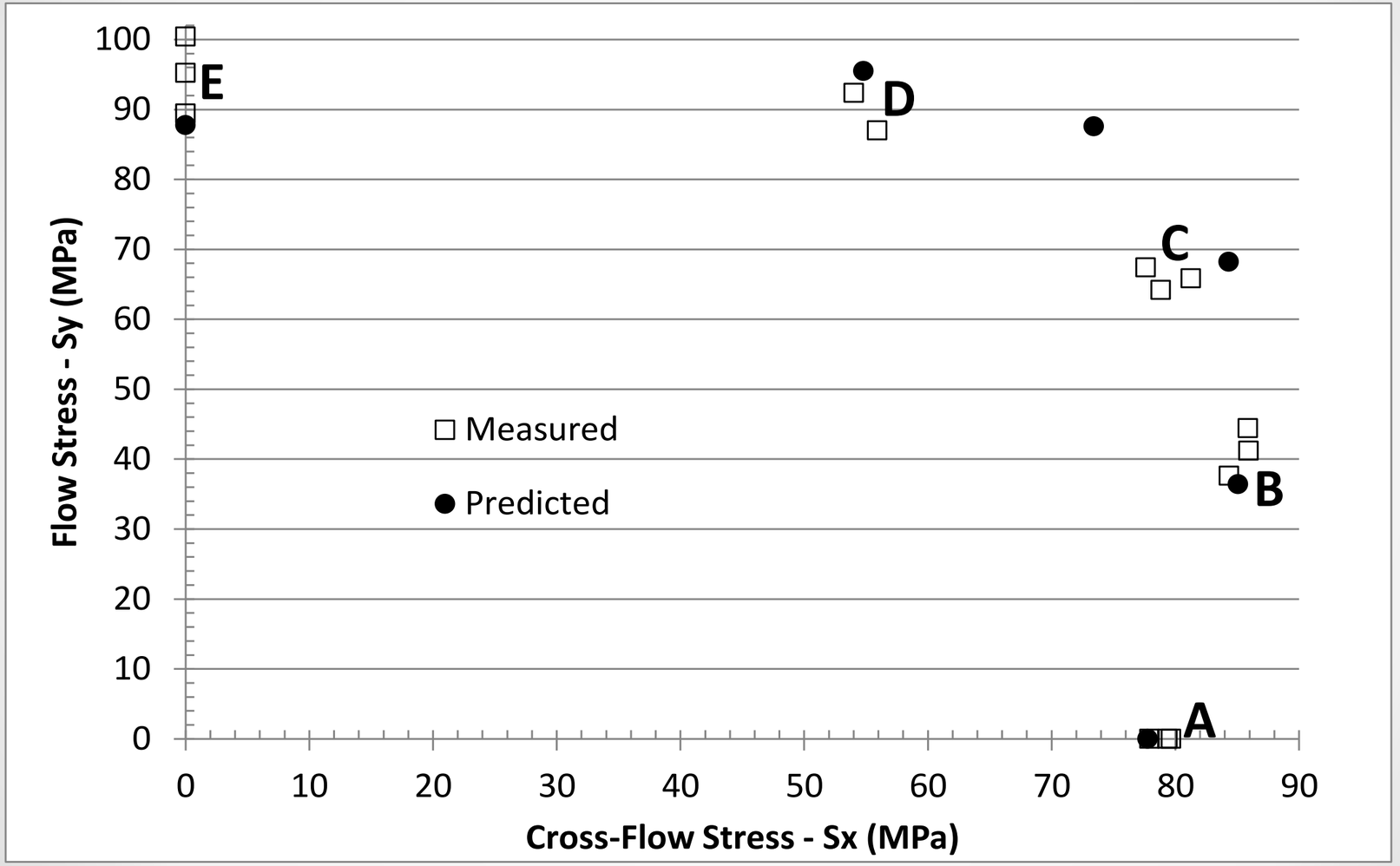
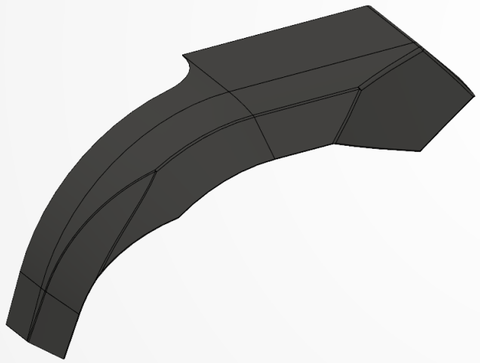


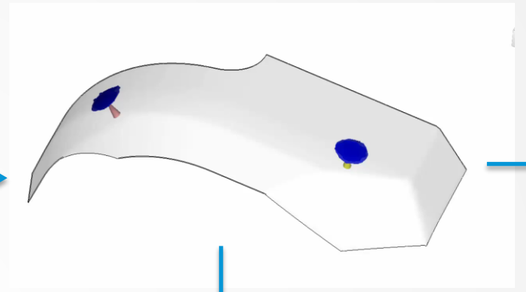
Advanced Material Simulation Best Practices

Account for Fiber Orientation

Manufacturing Simulation

Preprocessor



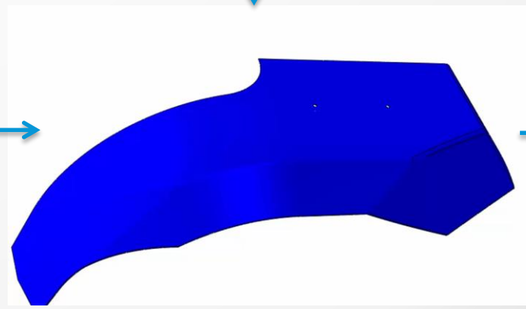


AUTODESK® MOLDFLOW®

AUTODESK® HELIUS PFA

Advanced Material Exchange

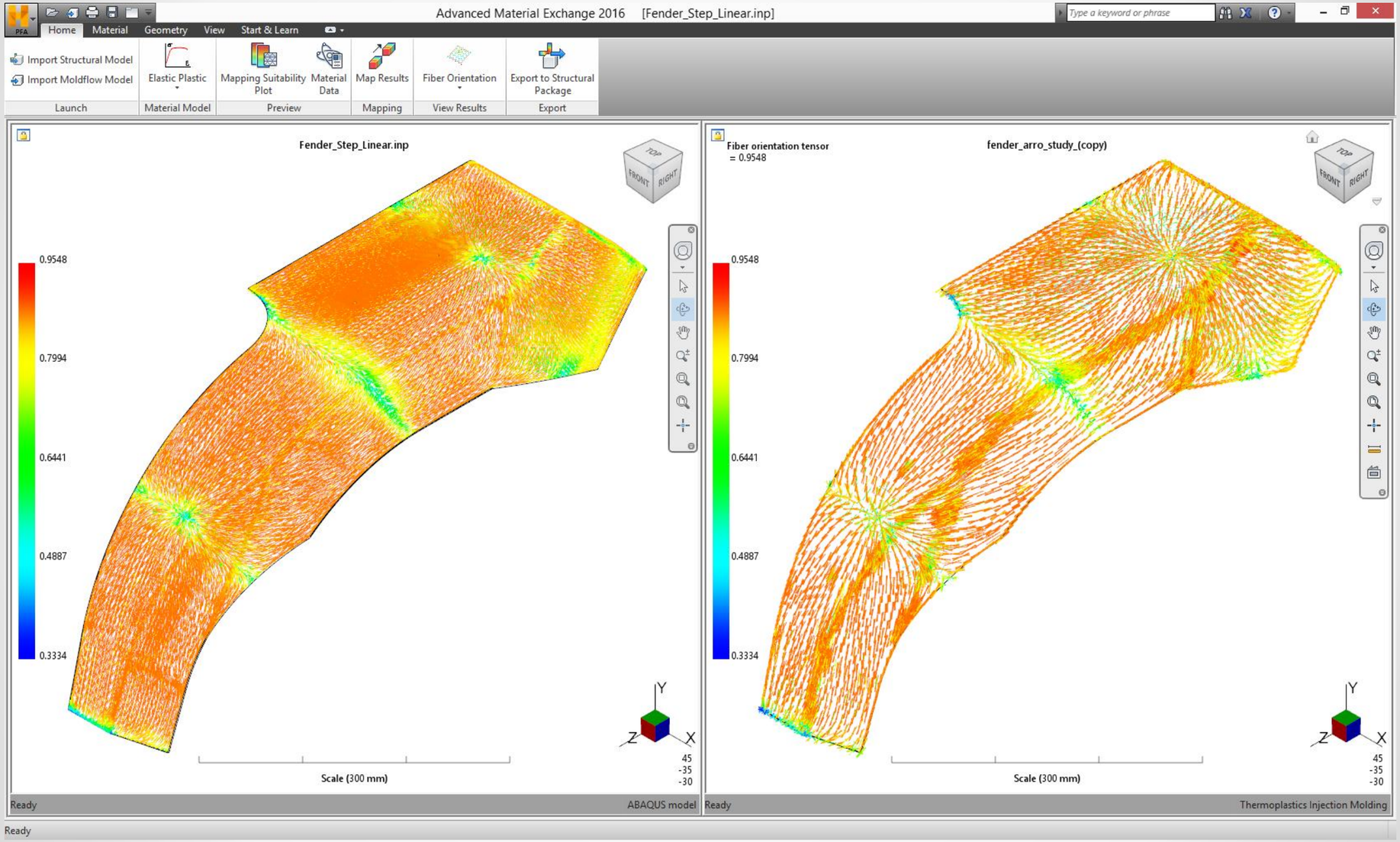
Preprocessor



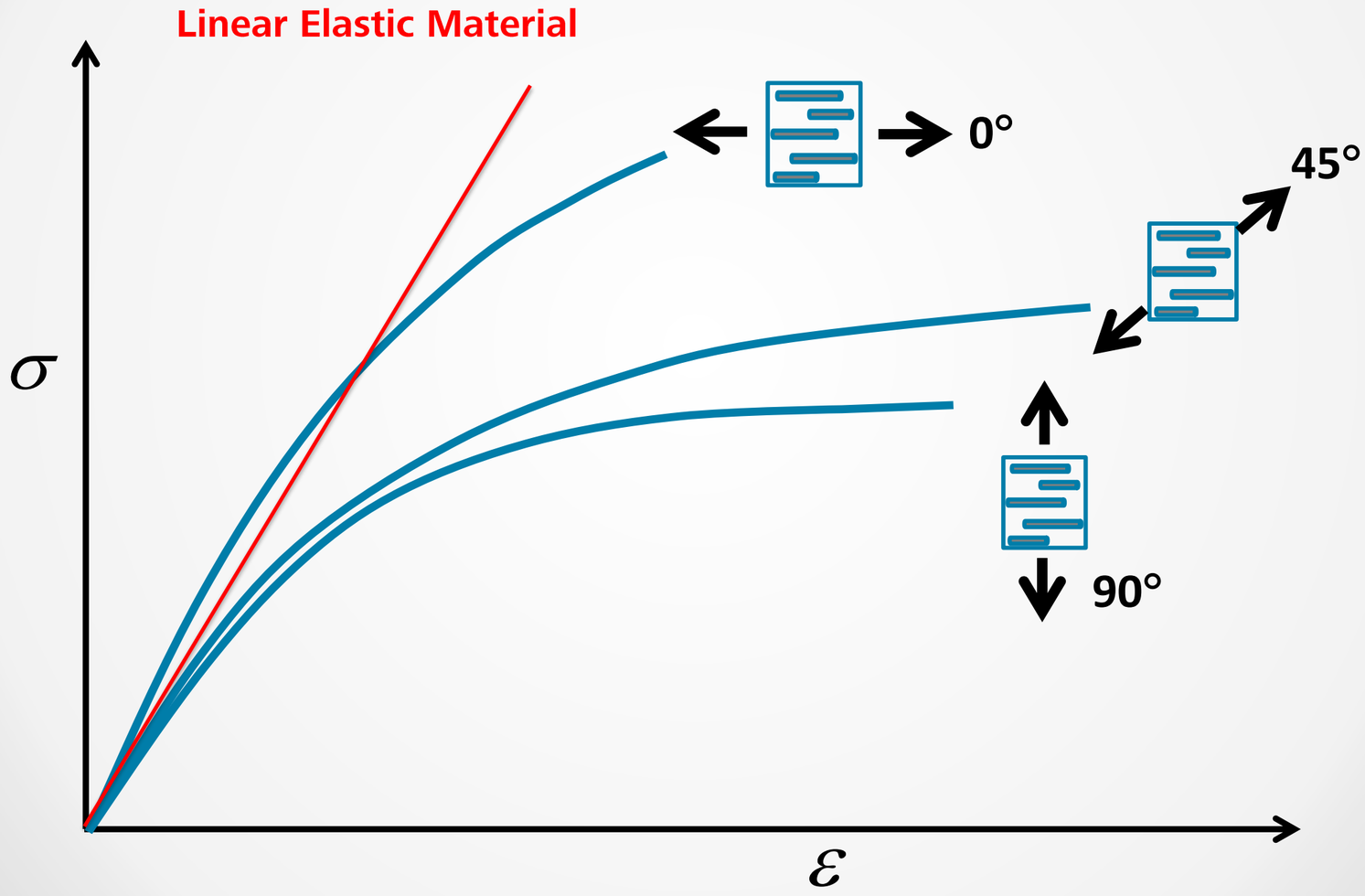
AUTODESK® HELIUS PFA

Structural Simulation

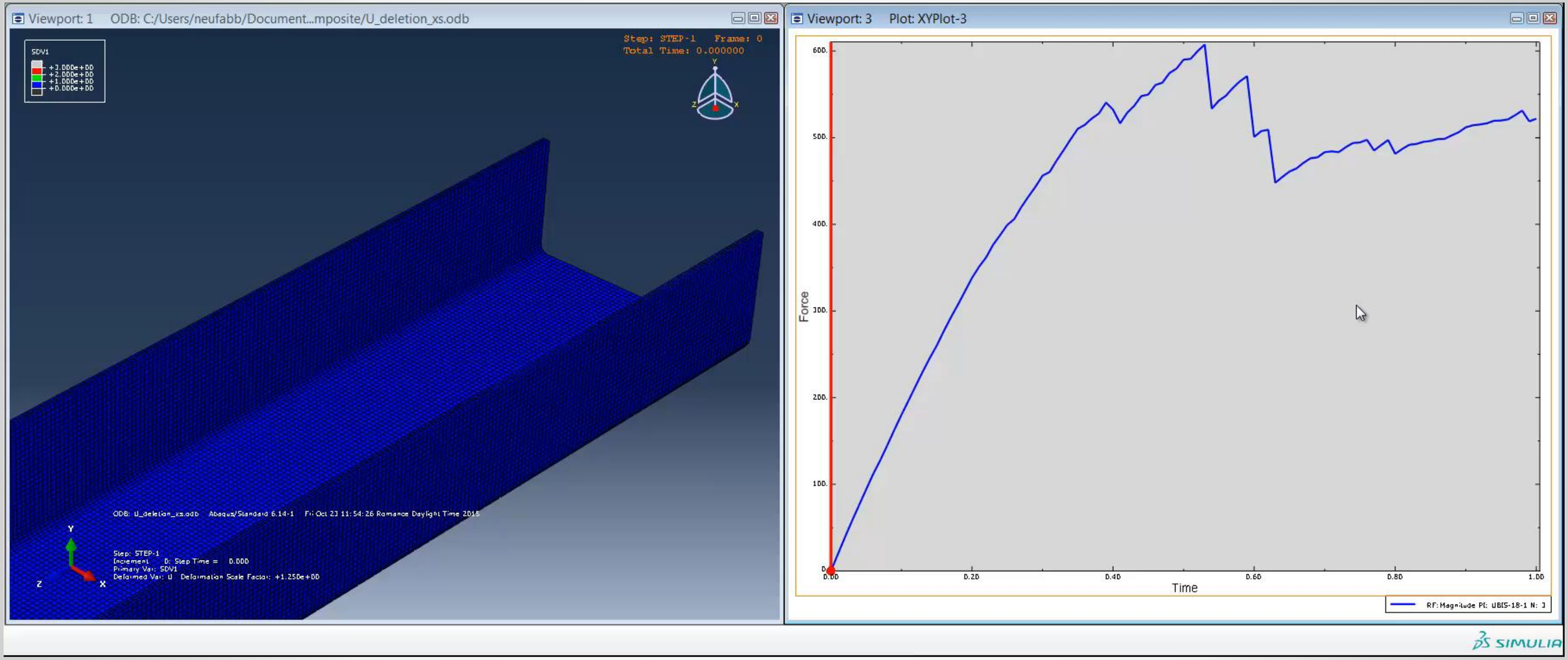
Account for Fiber Orientation



Use Non-Linear Test Data



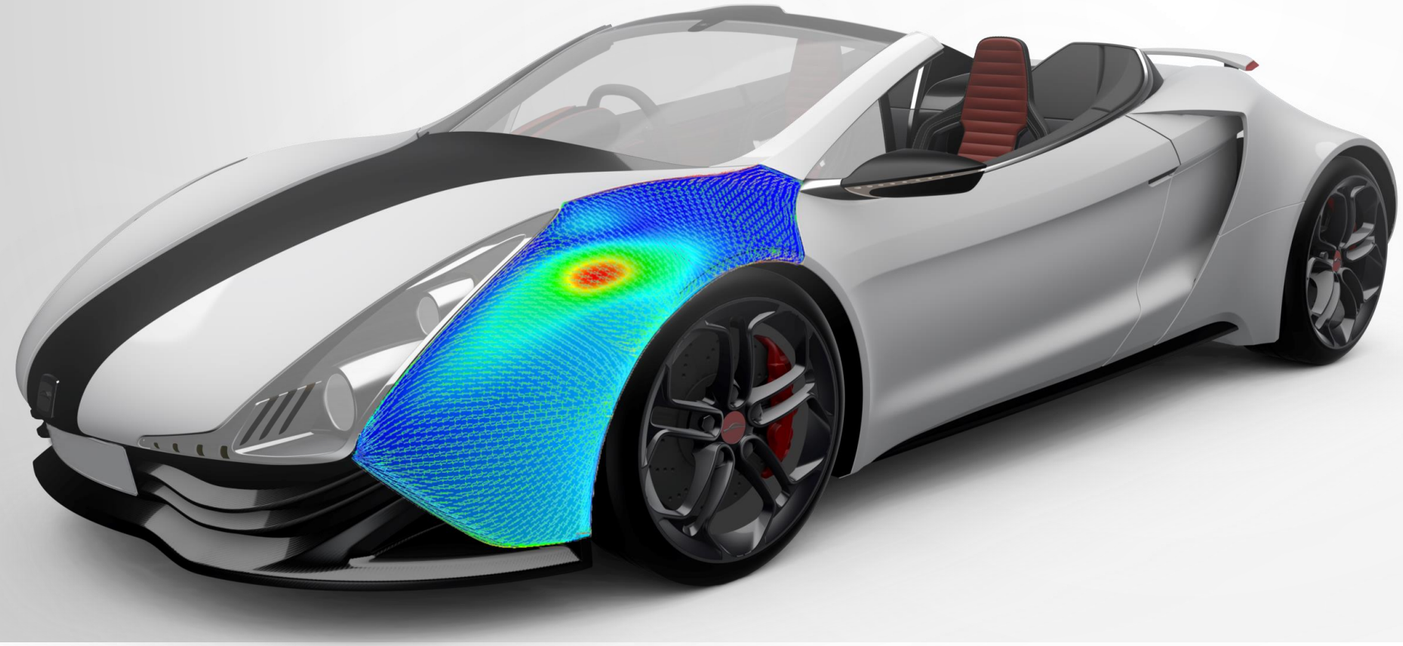
Improve Convergence Behavior

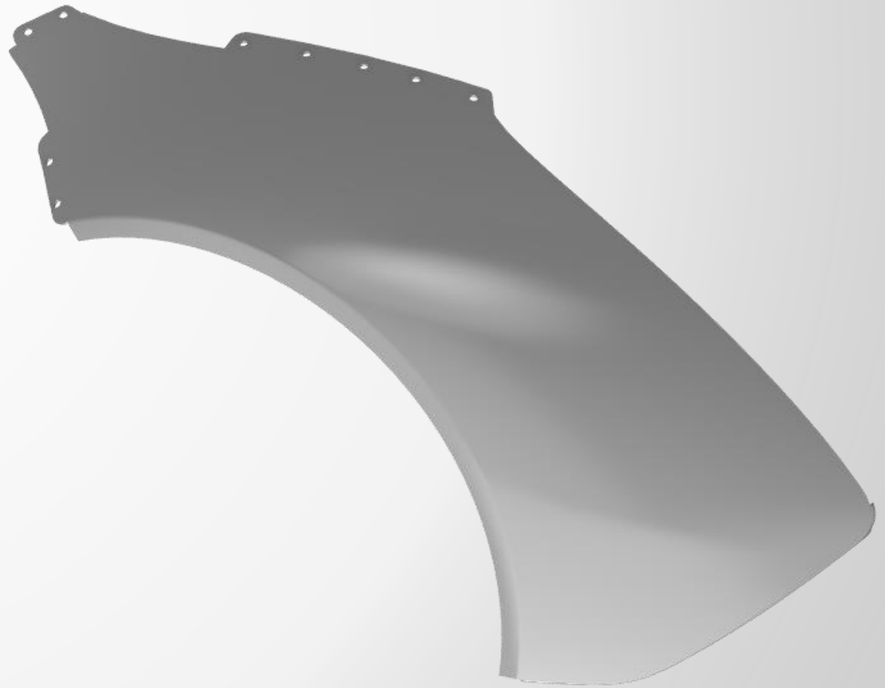


Fender Fit After Warp
Moldflow + Helius PFA

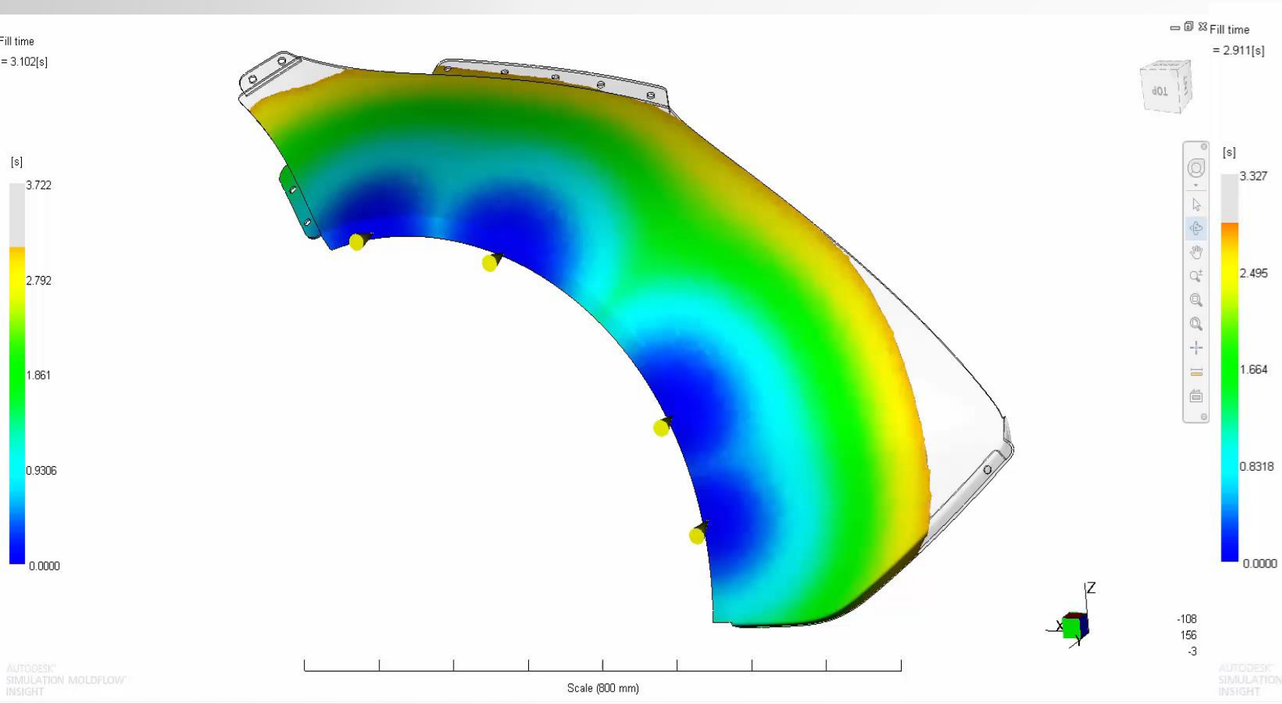
Overview

- Comparing gate locations for dimensional stability
  - How does the part deflect after assembly?
  - Can gate locations be modified to reduce deflection?

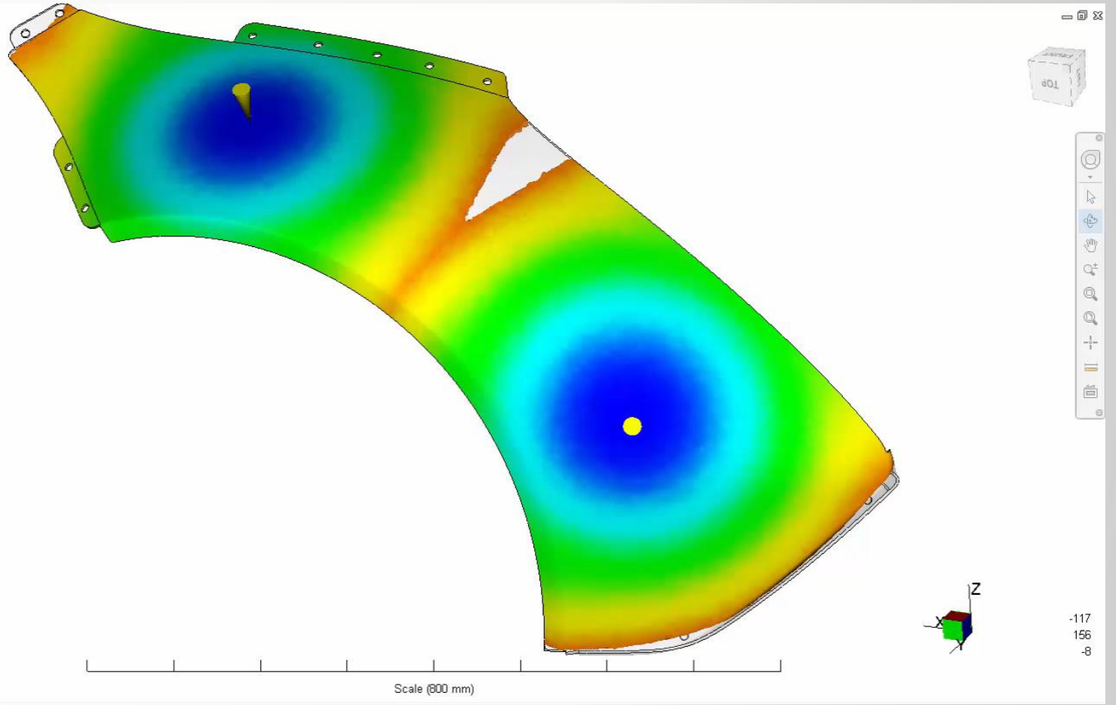




Moldflow Simulation

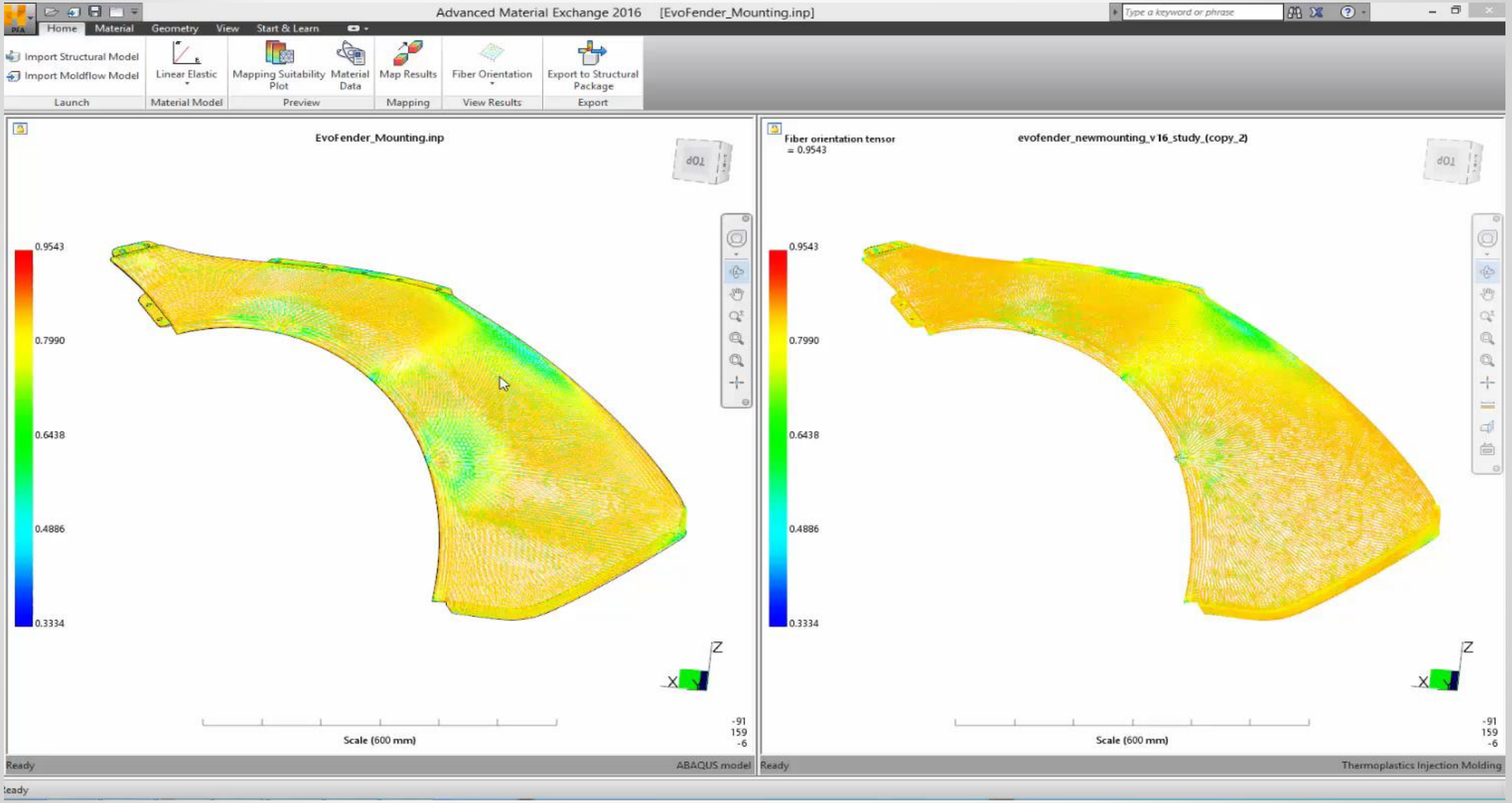


Edge Gates

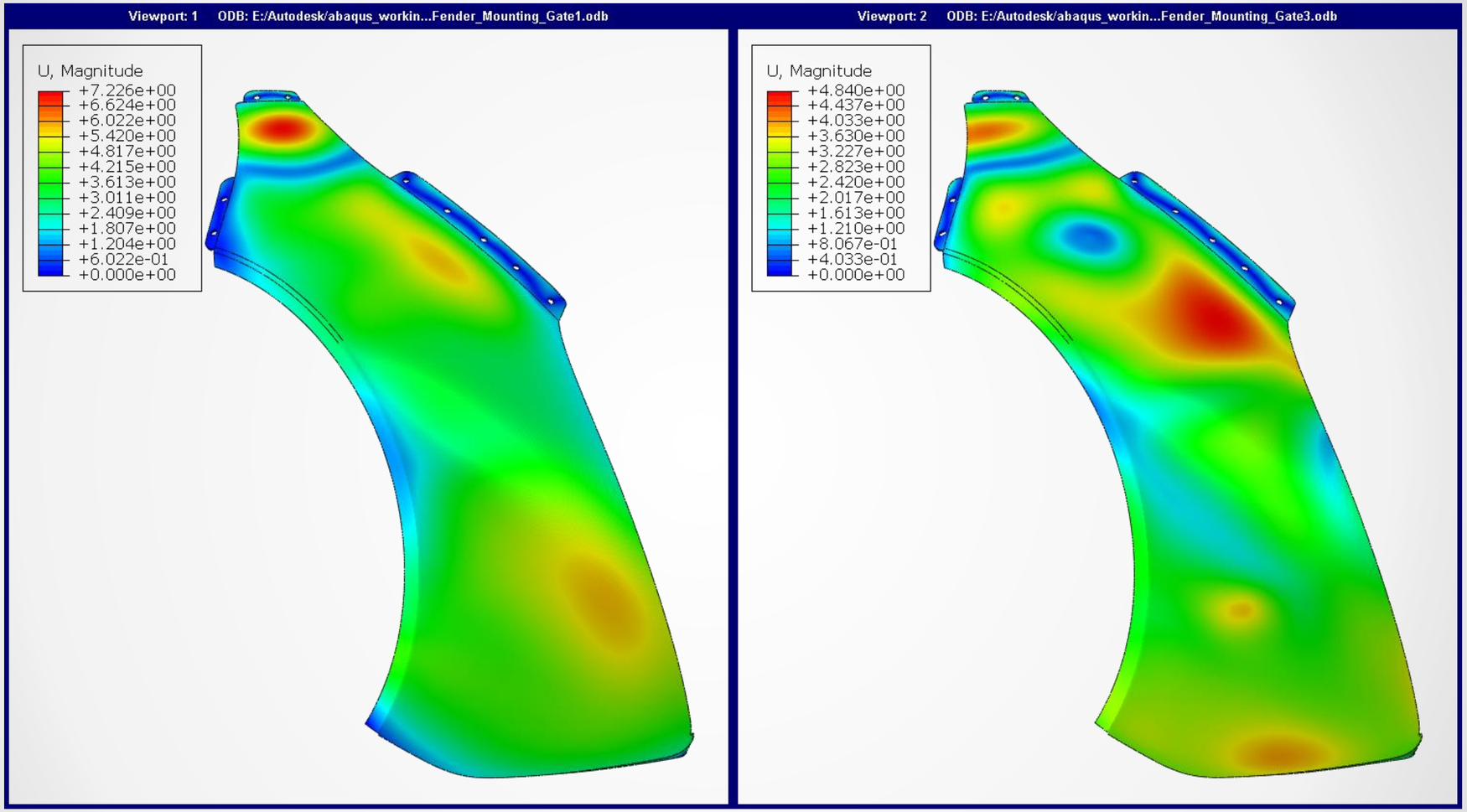


Center Gates

Advanced Material Exchange



Deflection Comparison



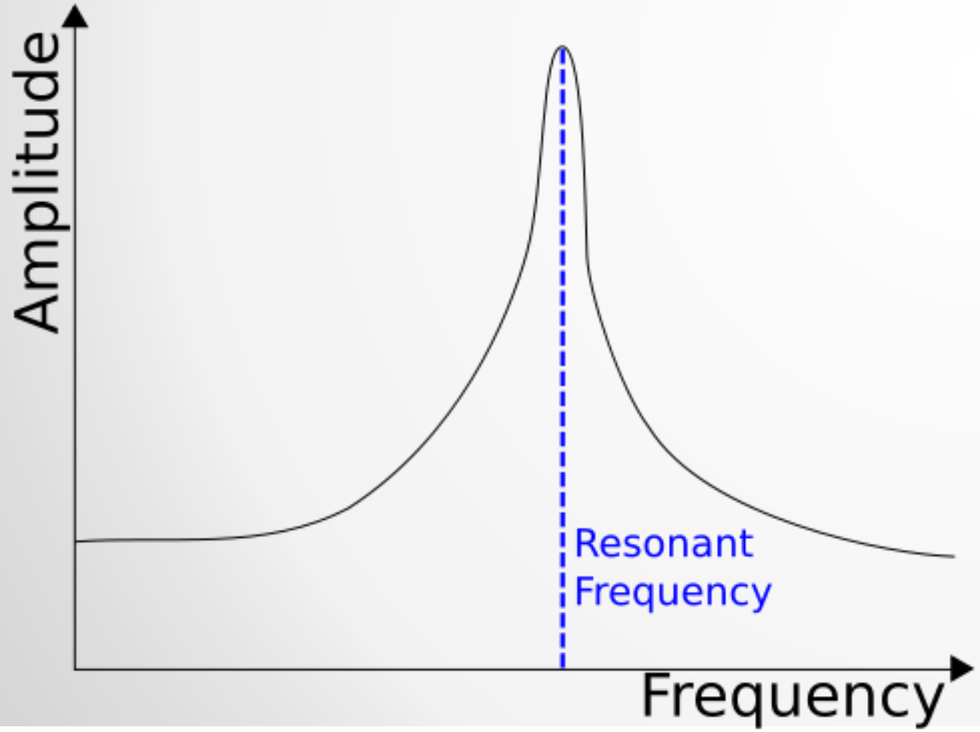
Edge Gates

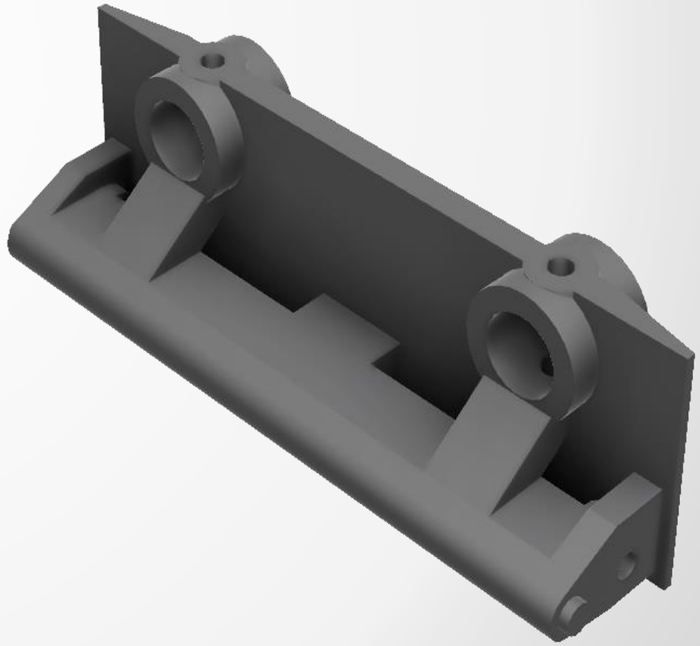
Center Gates

Designing a Plastic Bracket Moldflow + Helius PFA

Overview

- Redesigning a metal bracket for injection molding
- Concerned with natural frequencies and mode shapes
  - Need to keep the bracket away from the natural frequency of the car

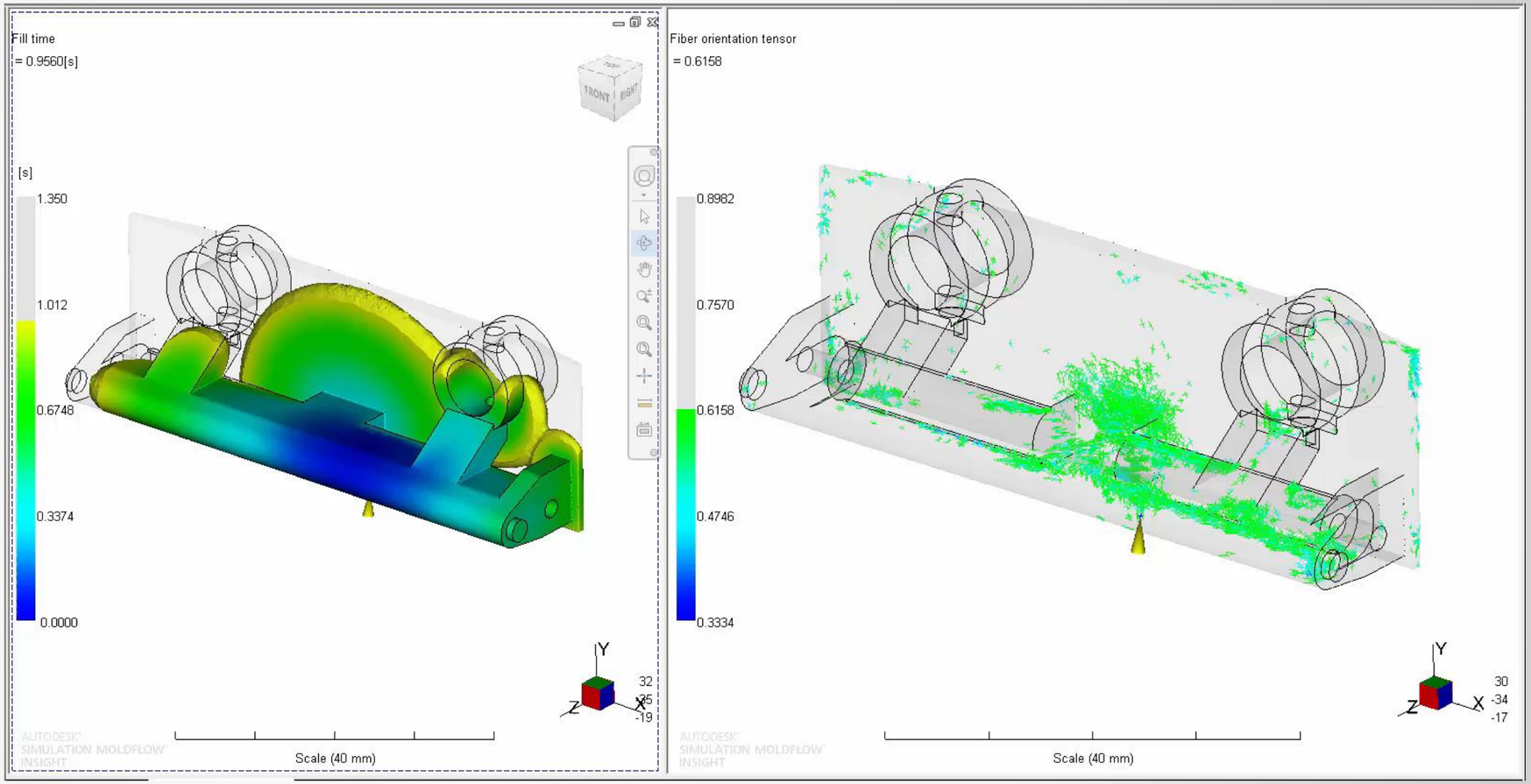




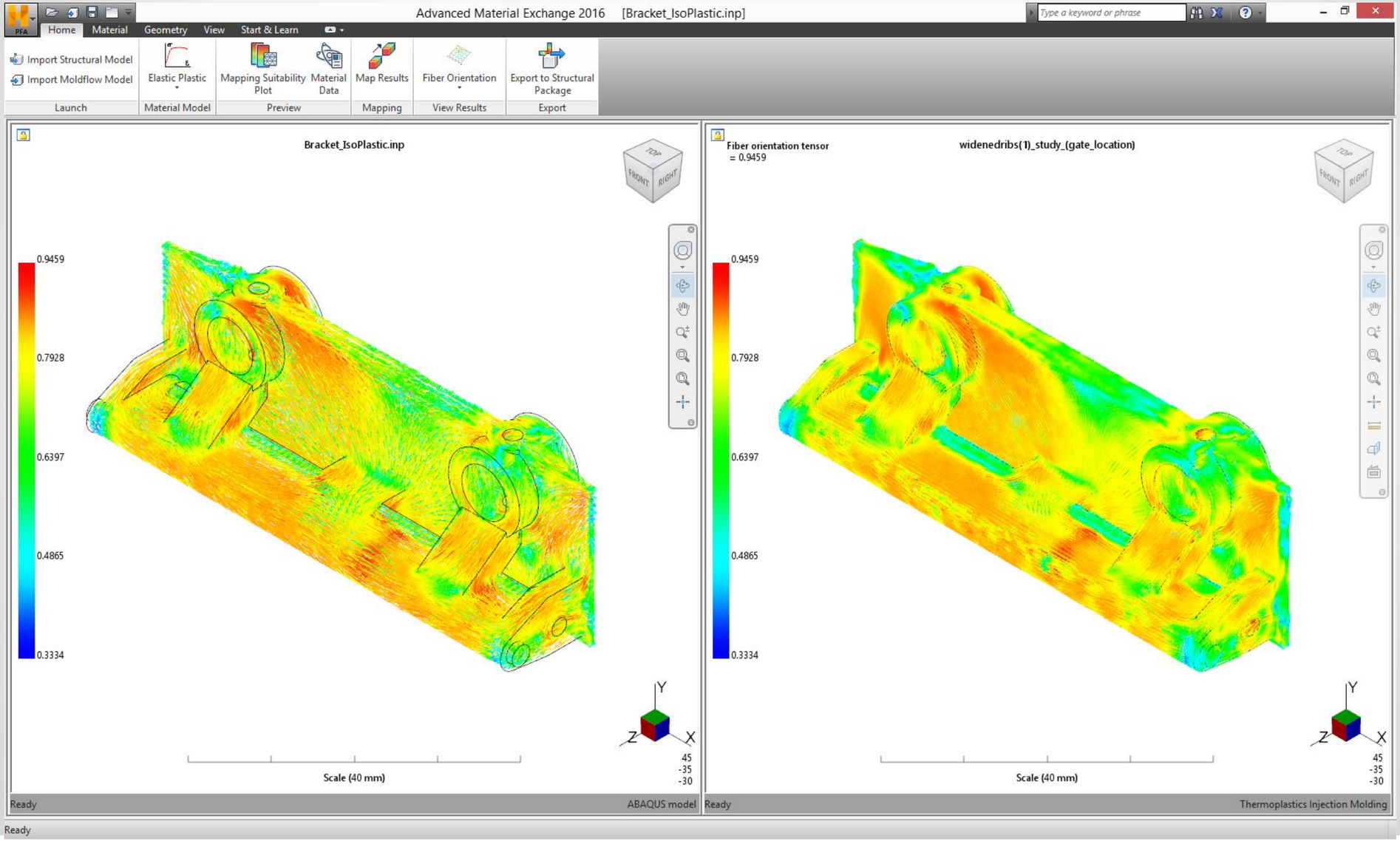
Moldflow Simulation

Metal = *75g*

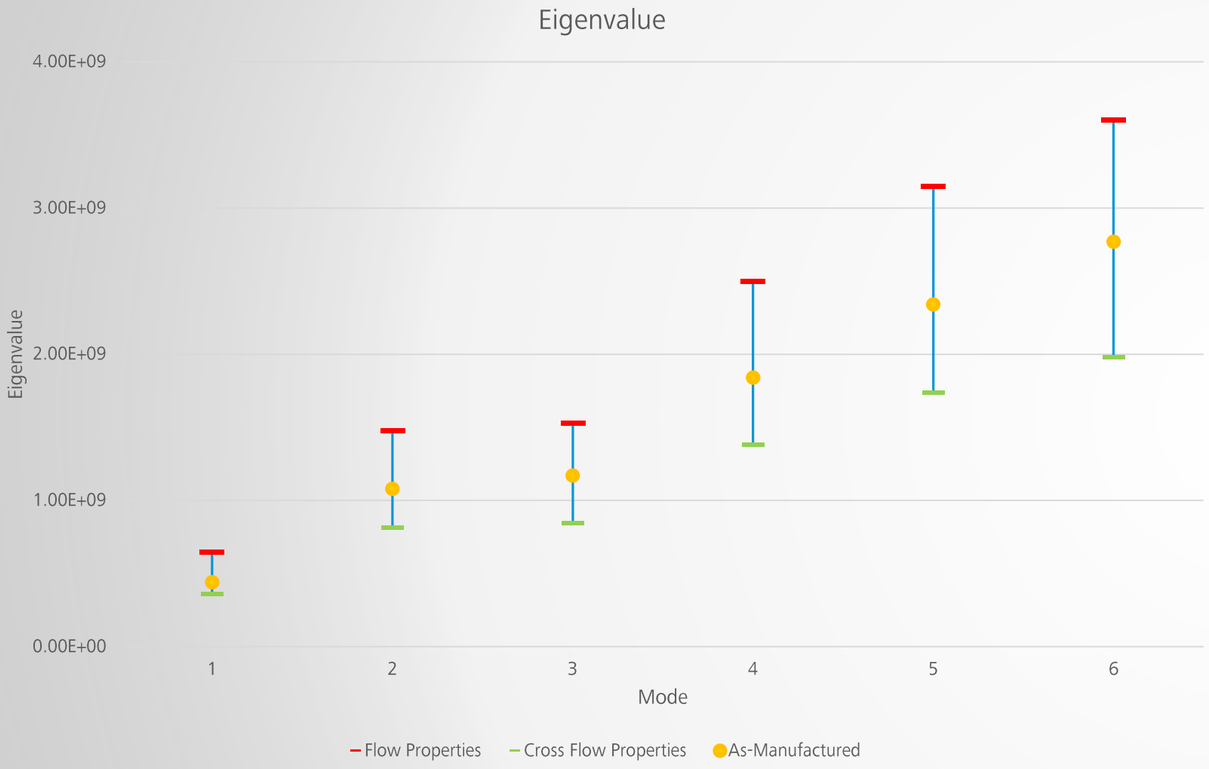
Plastic = *15g*



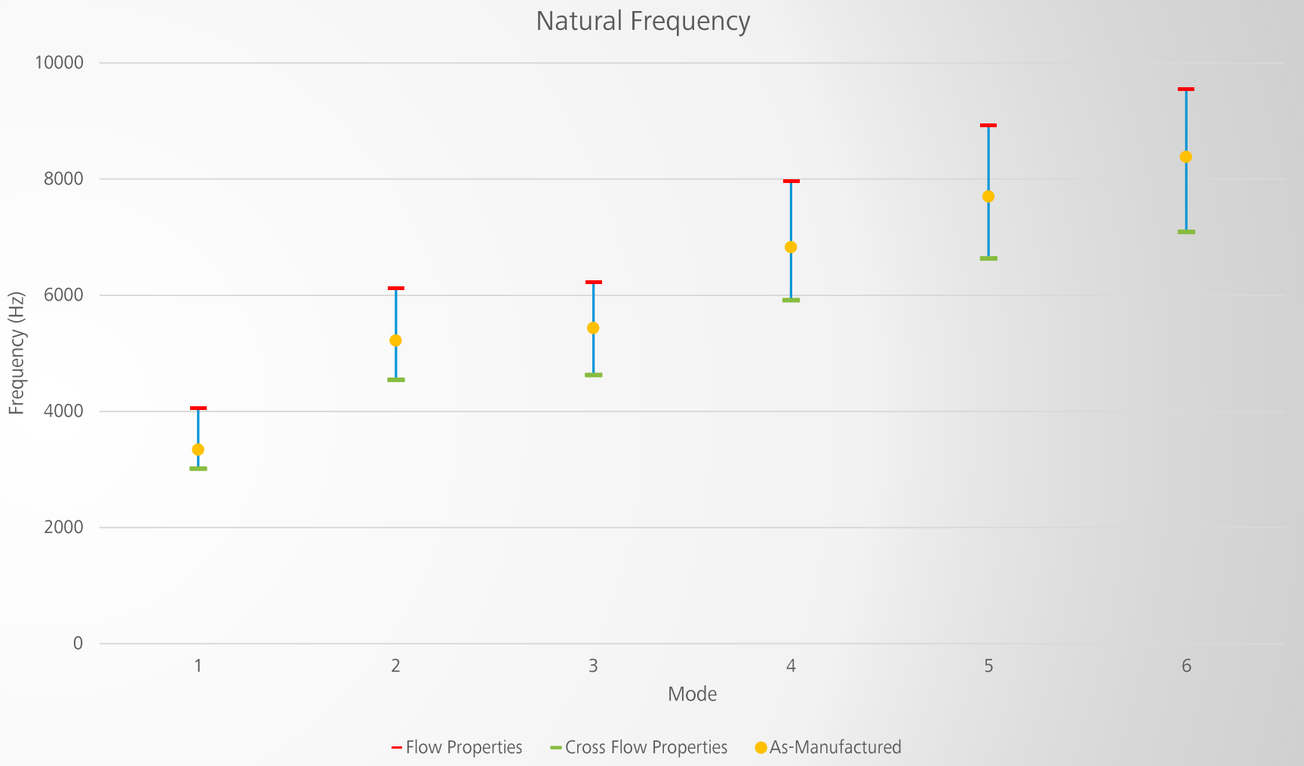
Advanced Material Exchange



Modal Analysis



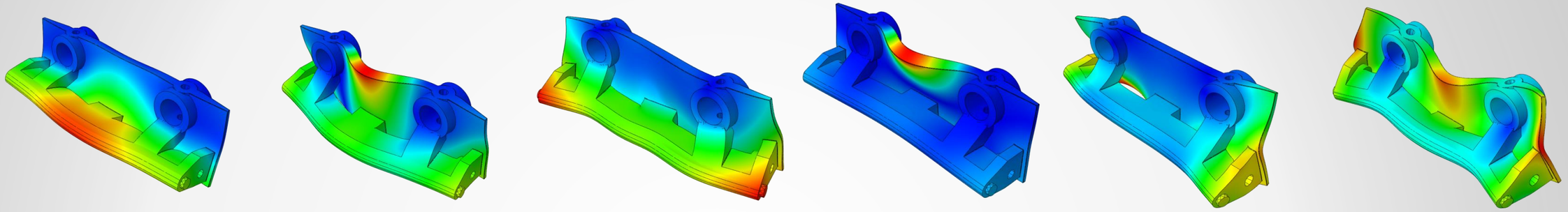
Max error of 48%



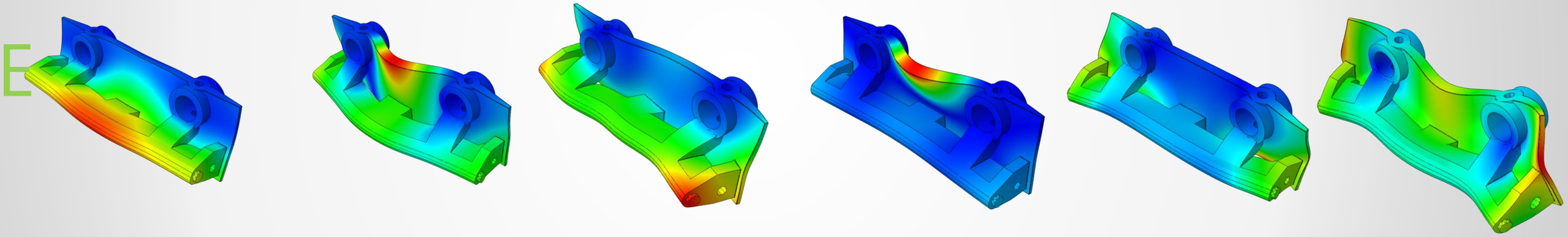
Max error of 21%

Mode Shapes

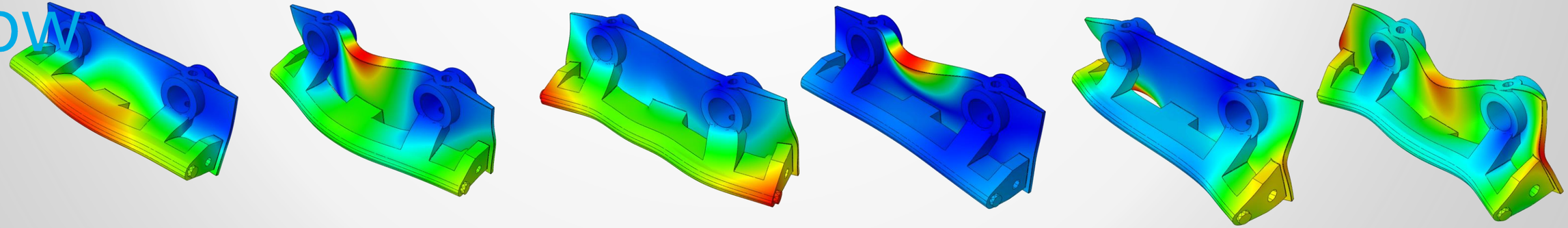
Flow



AME

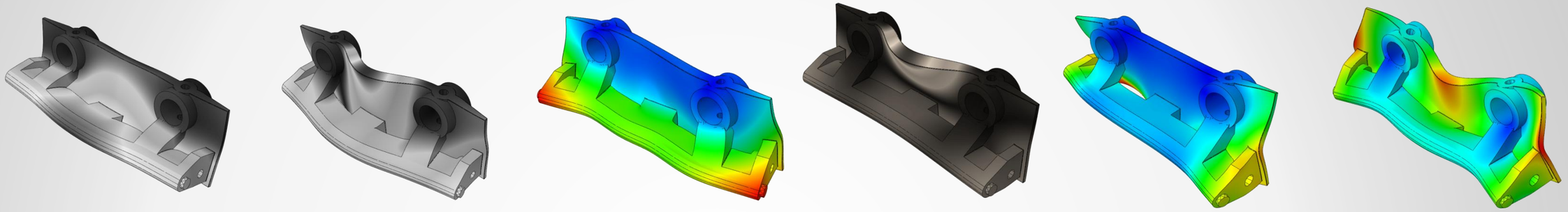


X Flow

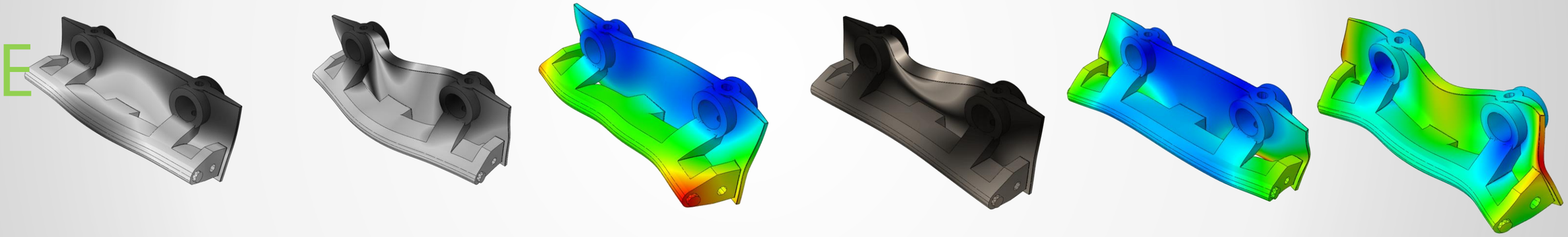


Mode Shapes

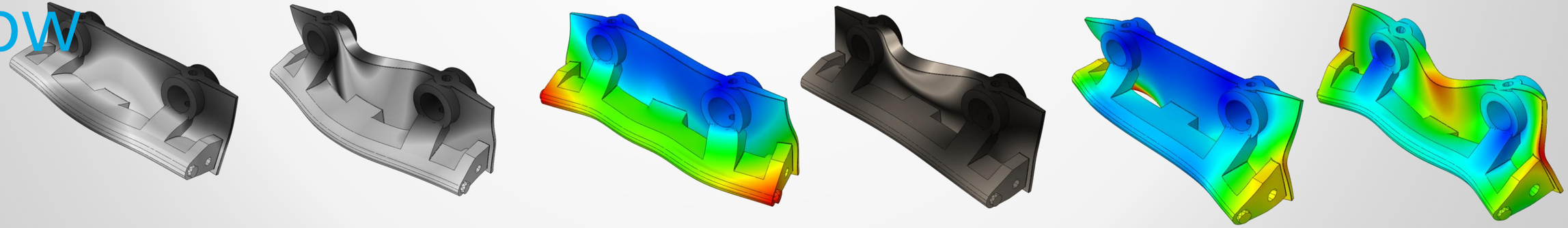
Flow



AME



X Flow



Discover the Newest Features Available in Helius PFA 2016

Disclaimer

We may make statements regarding planned or future development efforts for our existing or new products and services. These statements are not intended to be a promise or guarantee of future delivery of products, services or features but merely reflect our current plans, which may change. Purchasing decisions should not be made based upon reliance on these statements.

The Company assumes no obligation to update these forward-looking statements to reflect events that occur or circumstances that exist or change after the date on which they were made.

Helius PFA – Advanced Material Simulation

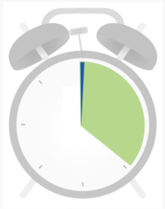
Open and Intuitive

ABAQUS

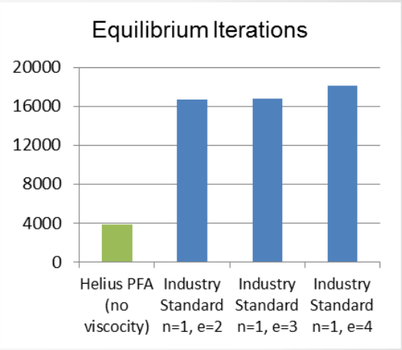
AUTODESK® MOLDFLOW® INSIGHT

ANSYS®

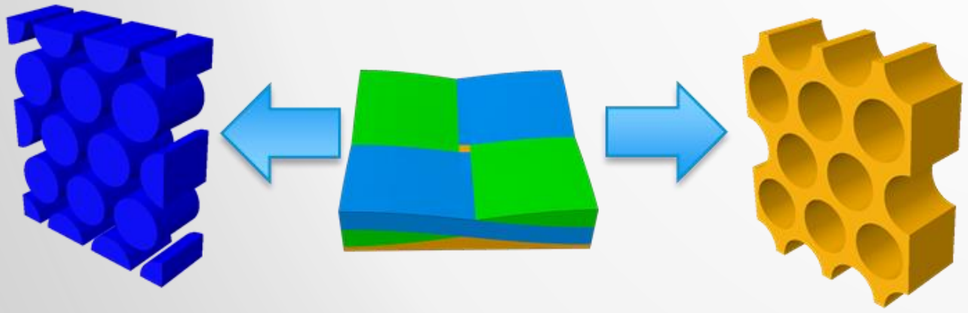
Robust and Efficient



Helius PFA = 0:02:30
Abaqus = 04:02:41



Cutting Edge

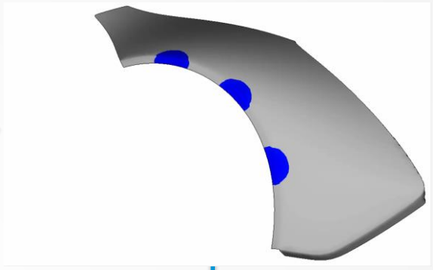


Trusted and Validated

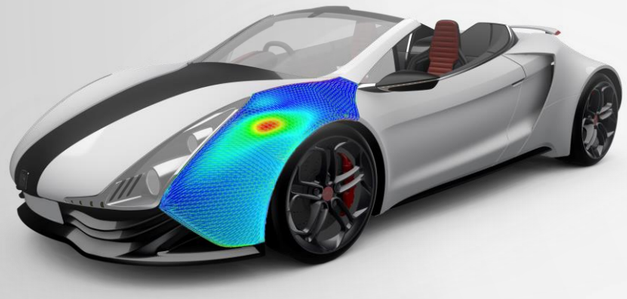
Advanced Material Exchange (AME)

Manufacturing simulation

Preprocessor



AUTODESK® MOLDFLOW®



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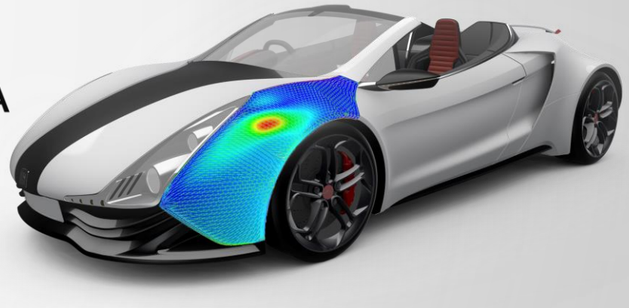
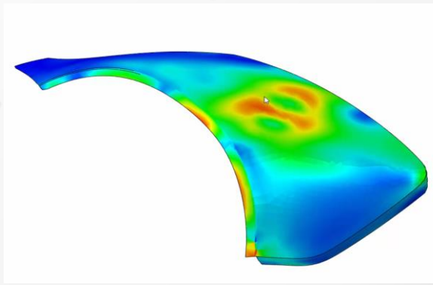
Advanced material exchange



CAE simulation

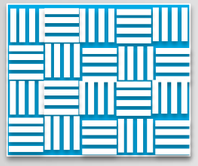
Preprocessor



AUTODESK® HELIUS PFA

Helius PFA 2016

Timeline To Date



Helius Launch

2013

Jan May Sep

2014

Jan May Sep

2015

Jan May Sep

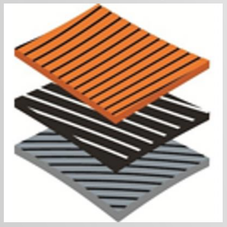
FY15 Launch

- ANSYS
- Unfilled
- Linear Elastic
- Midplane 2 shell

FY16 Launch

We are Here

Firehole Acquisition



Sundance Launch

AME Launch

- Abaqus
- Fiber-filled
- Elastic-plastic
- Single part

FY16 SAP Launch

- All elements
- Usability
- Material tests

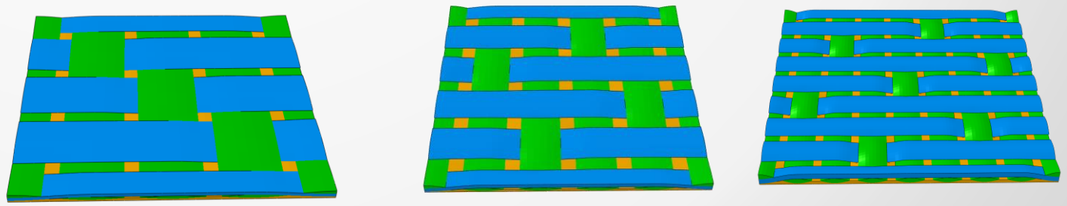
Helius PFA 2016 + 2016 SAP

AME

- ANSYS 16.2, 16.1, 16.0, 15
- Mapping Improvements
  - Injection-compression
  - Support for all elements
  - Midplane to shell mapping
  - Residual strains
- Expanded Material Support
  - Unfilled
  - Unlimited data
- New material tests

Continuous Fiber

- Weaves Beta

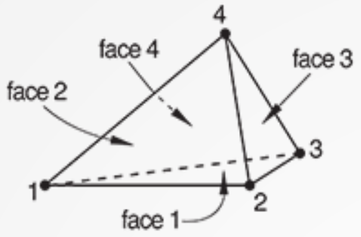


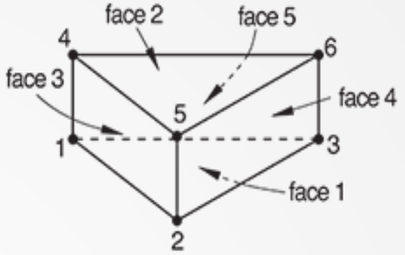
ALL Elements

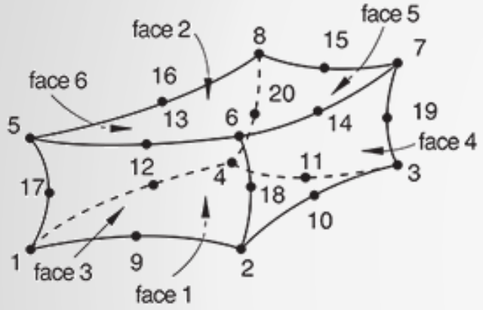
Supported el

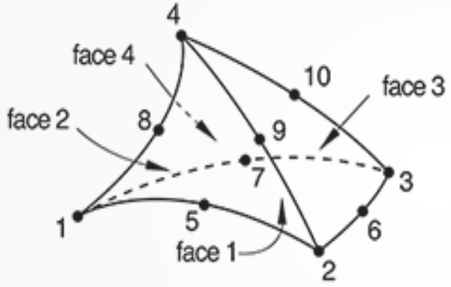
FEA Platform	4 Node			4 Node Shell
Abaqus	C3D4	C3	S3	S4, S4R
ANSYS	SOLID285	SOLID1	SHELL181	SHELL181

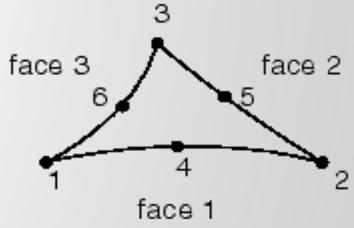
ALL Elements

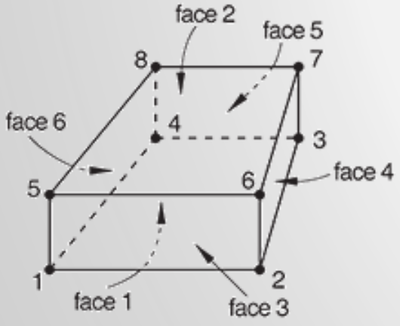


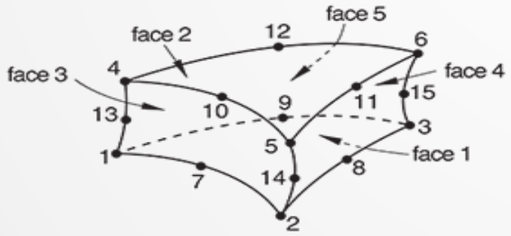


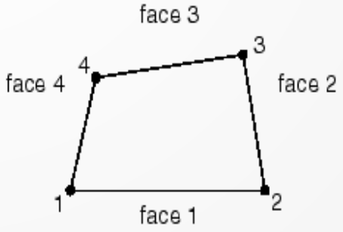


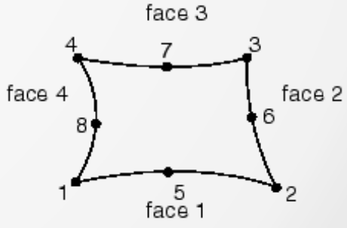






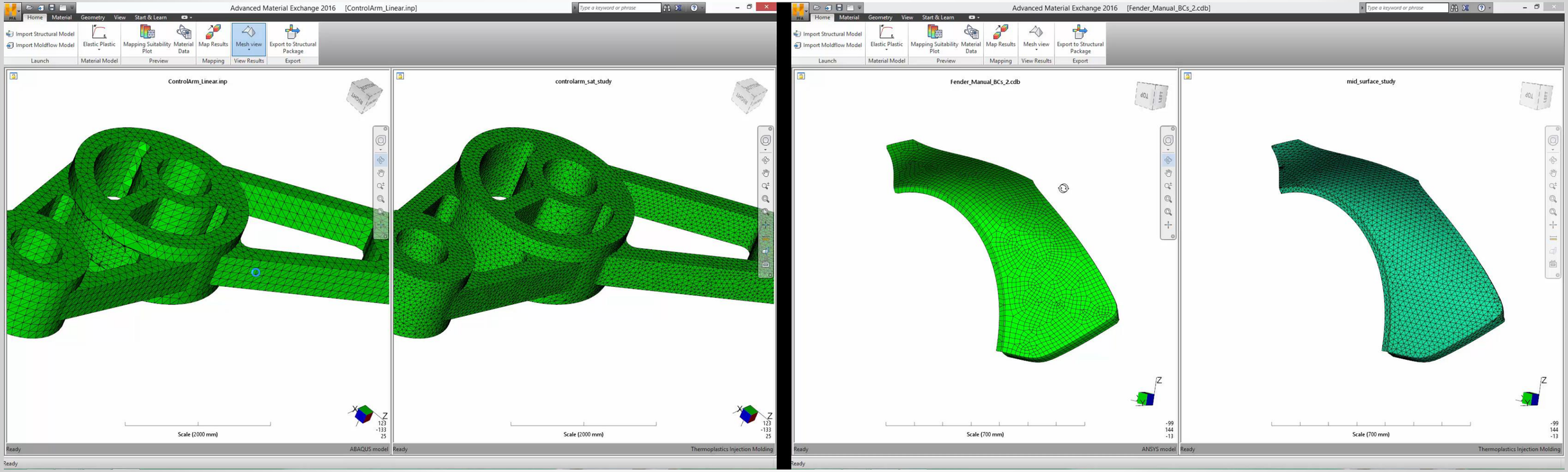






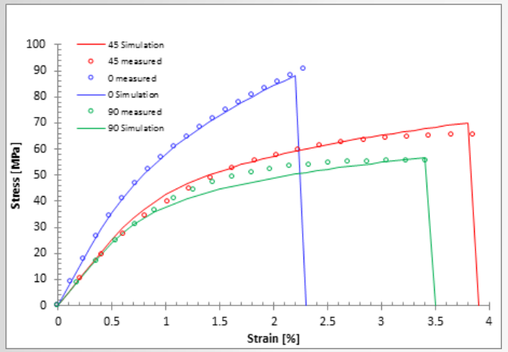
New Mappings

- Midplane to shell
- Cutting planes
- Residual Strain

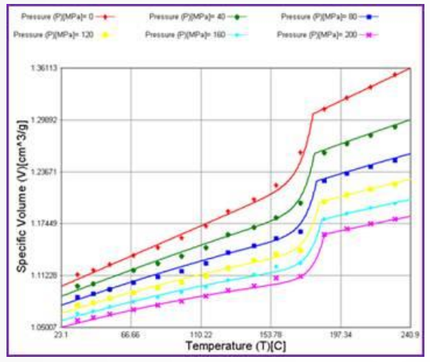


New Material Tests

- Bypass entering material data



Mechanical Test Data



Manufacturing Test Data

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AUTODESK® MOLDFLOW®

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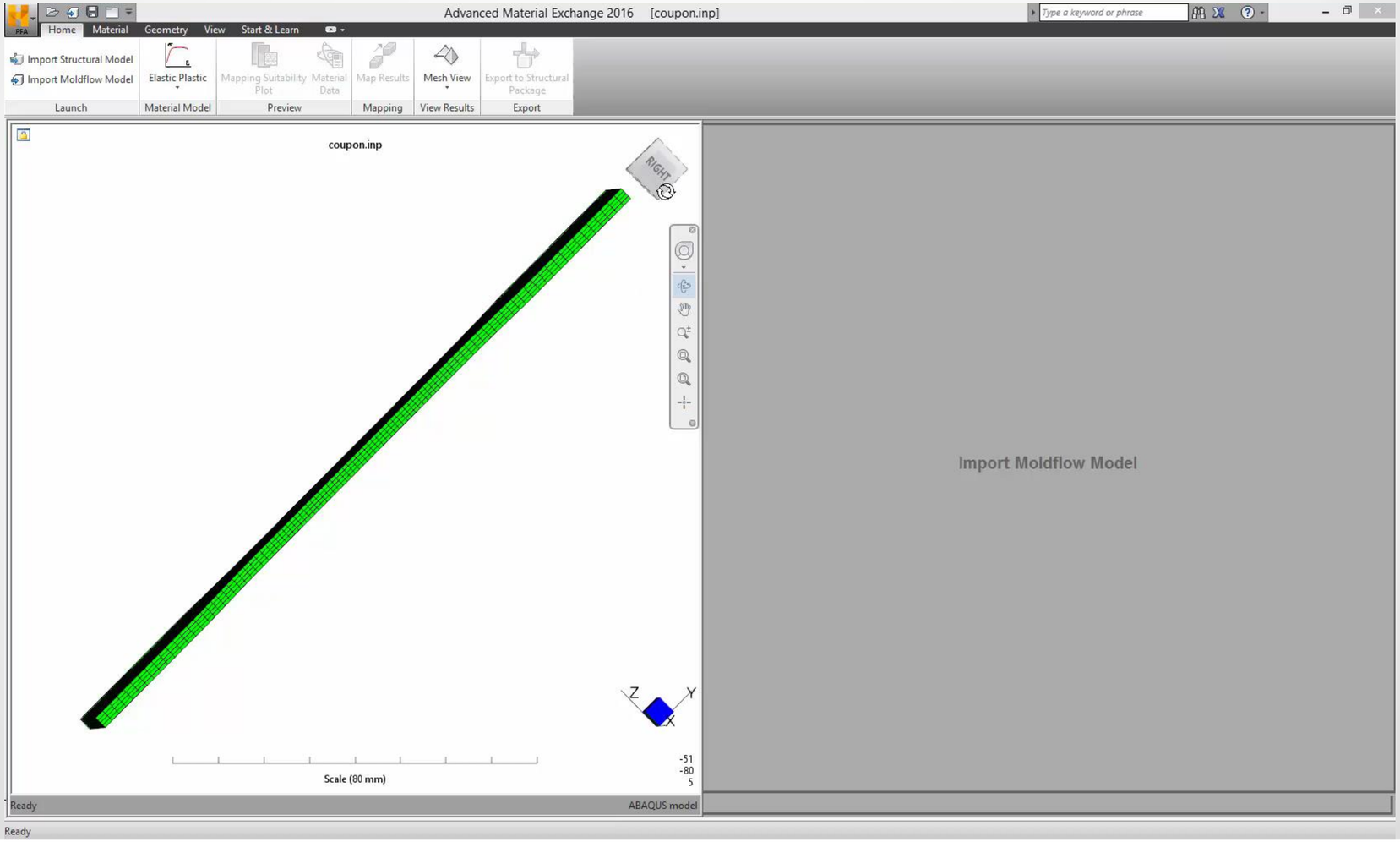
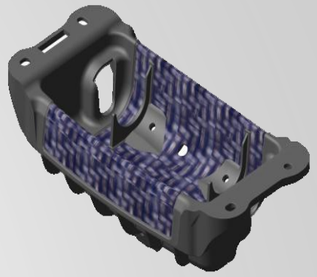
New Material Tests

- Bypass entering material data



Extrapolated Timeline



FY16 Launch

We are Here

FY17 Launch

FY17 SAP Launch

FY18 Launch

We are Going Here

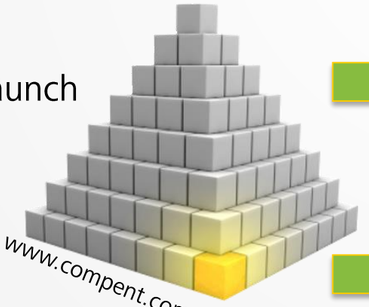
2015

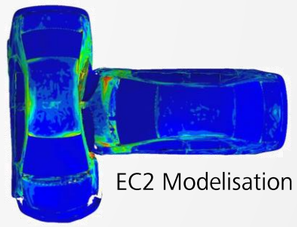
2016

2017

Jan May Sep Jan May Sep Jan May

FY16 SAP Launch



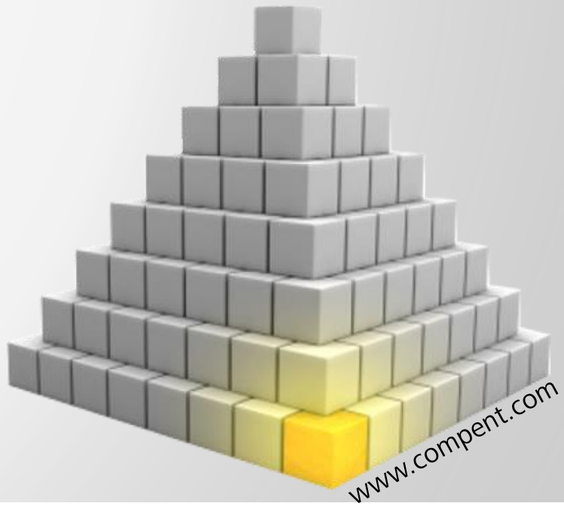


EC2 Modelisation

Future of Lightweighting

- Data-centric
- Generative design
- Mixed materials
- Advanced MFG

Helius PFA 2017



Helius PFA 2017 + 2017 SAP

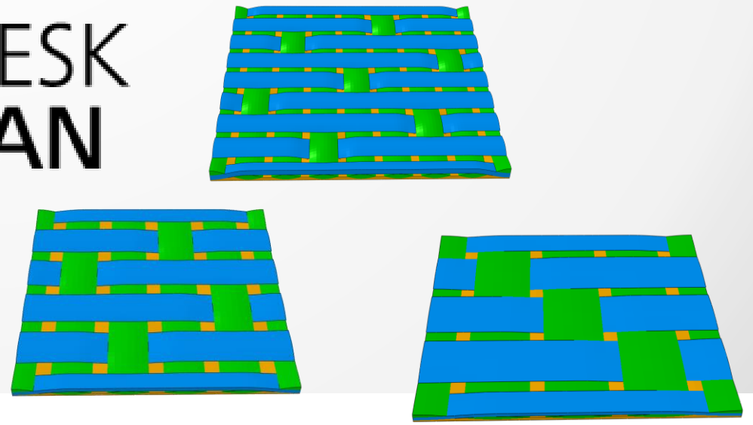
AME

- Material model improvements
  - New material characterization
  - Compression
  - Temperature dependence
- Assemblies
- Weld-line strength

Continuous Fiber

- Nastran
- Weaves
  - Efficiency
  - Nonlinear shear

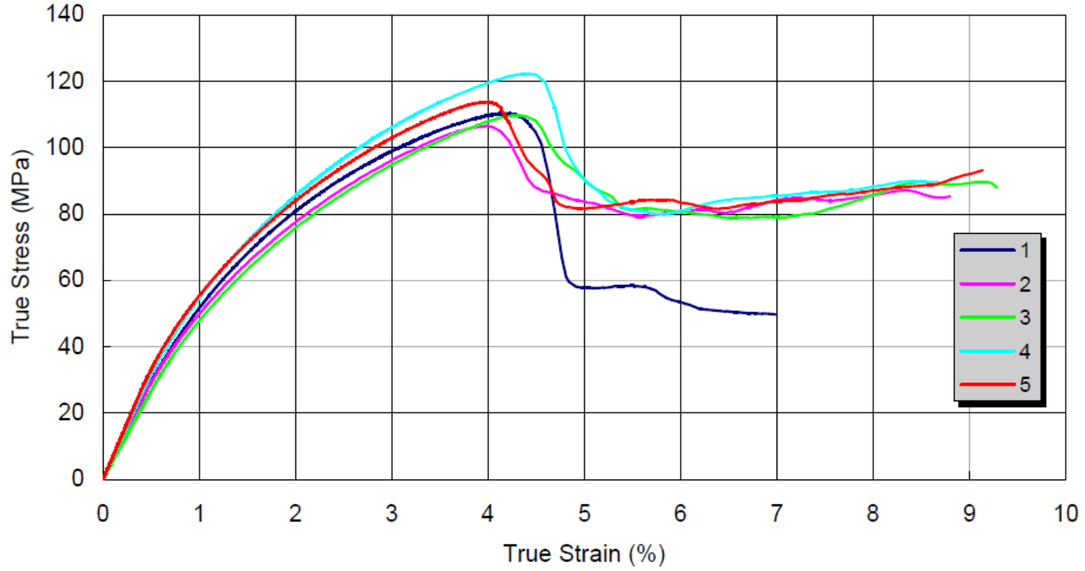
AUTODESK NASTRAN



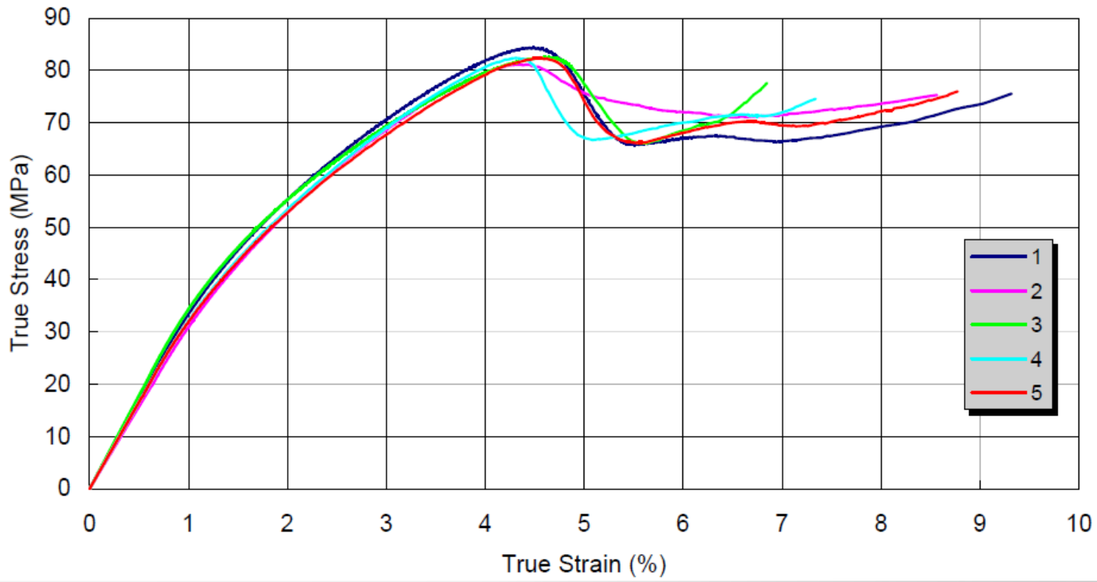
Compression

- Implement new compressive law
  - ‘Plateau’ of load stroke curve in compression (crushing)
  - Fundamentally different than tension!

Flow

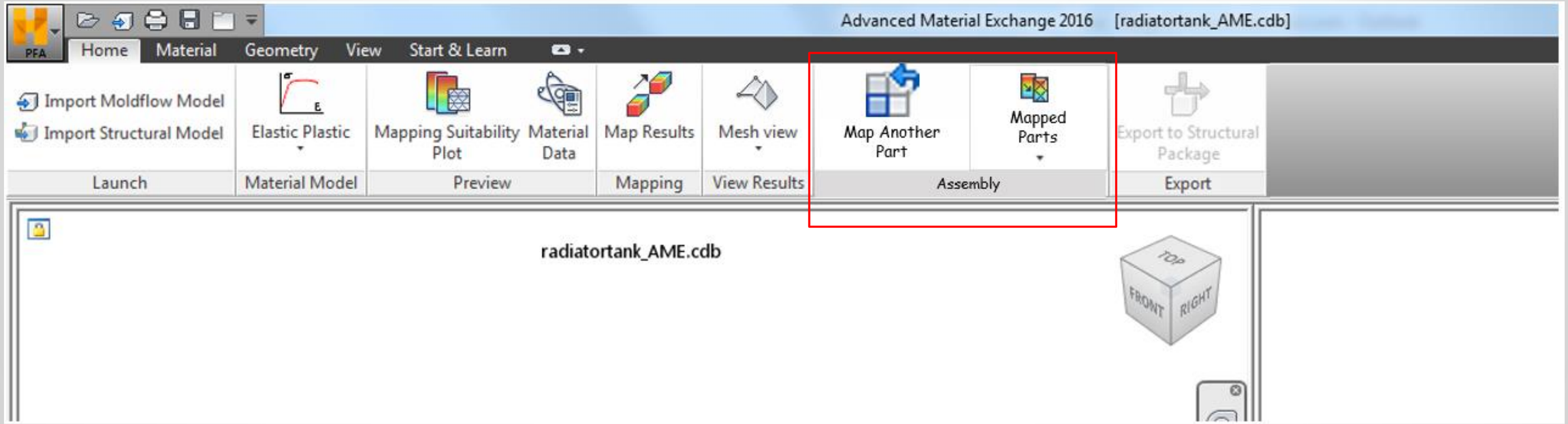


Cross-Flow



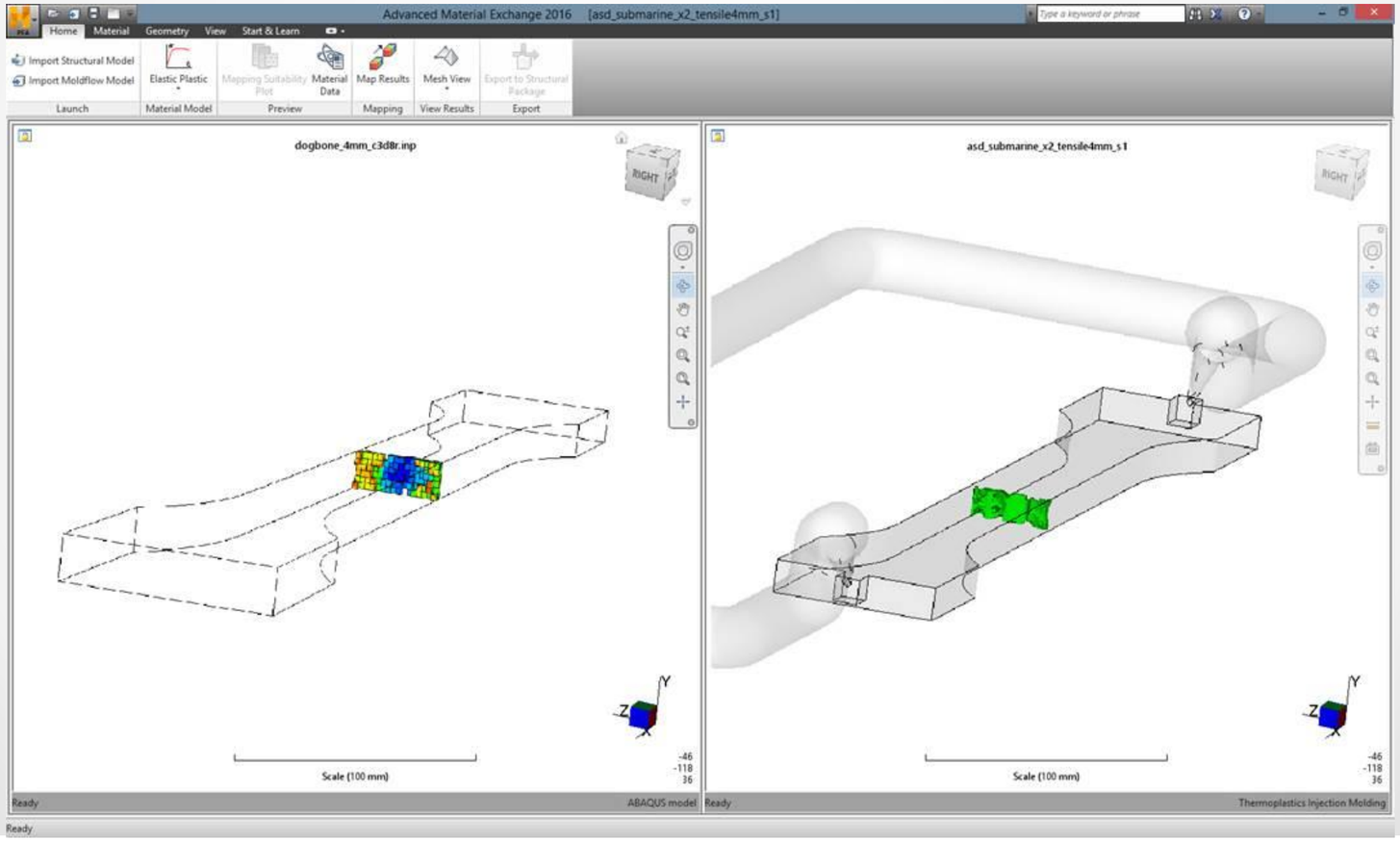
Assemblies

- Map multiple MF studies to structural model



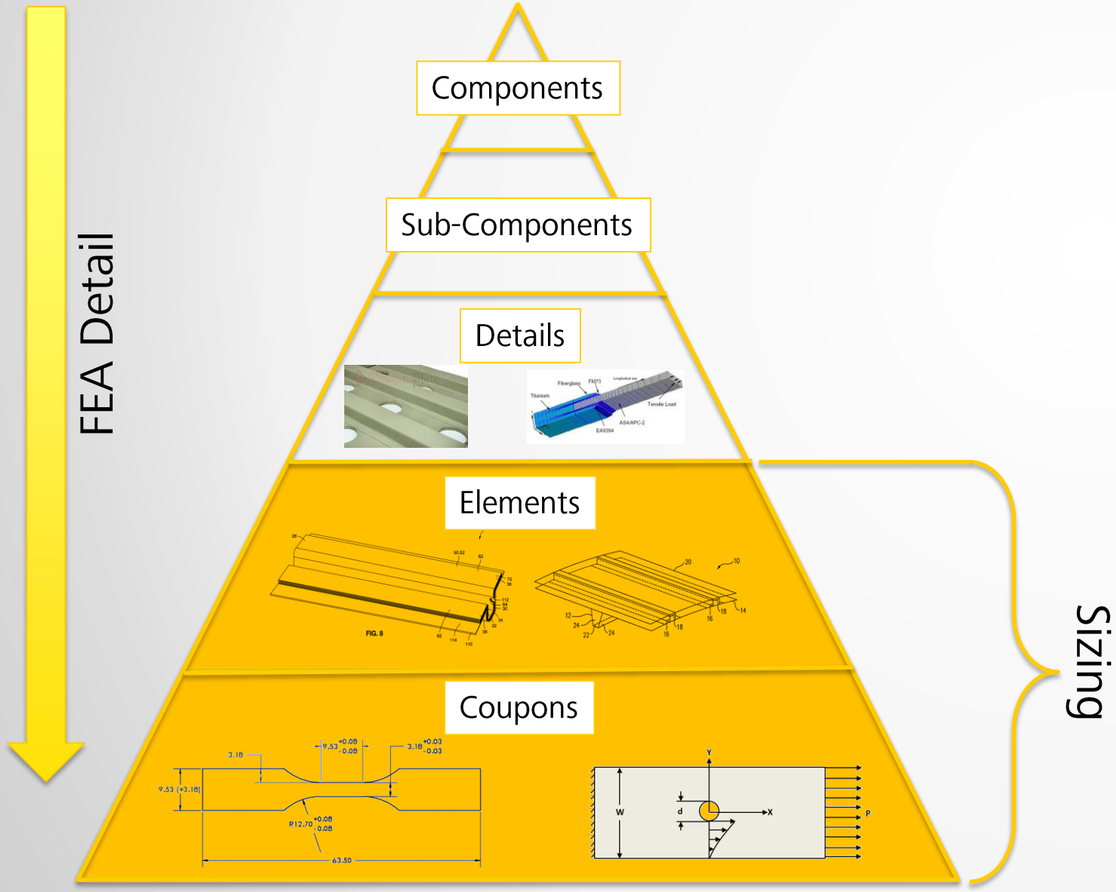
Weld-Line Strength

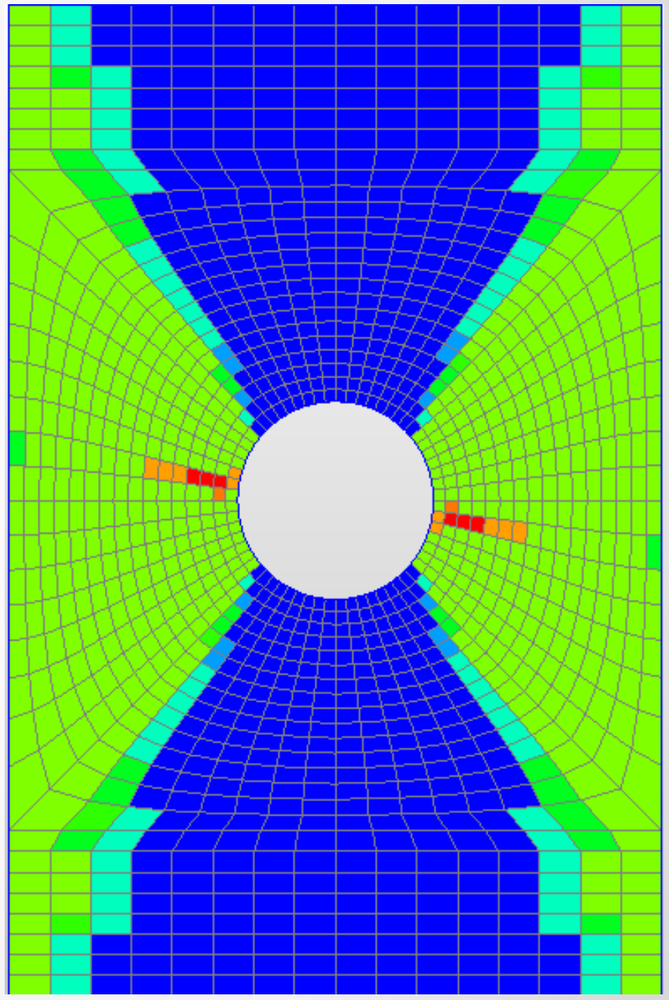
- Map weld-surface locations to structural
- Predict weld-surface strength reduction based on:
- Use strength reduction in structural sim



Autodesk Nastran

Continuous fiber progressive failure

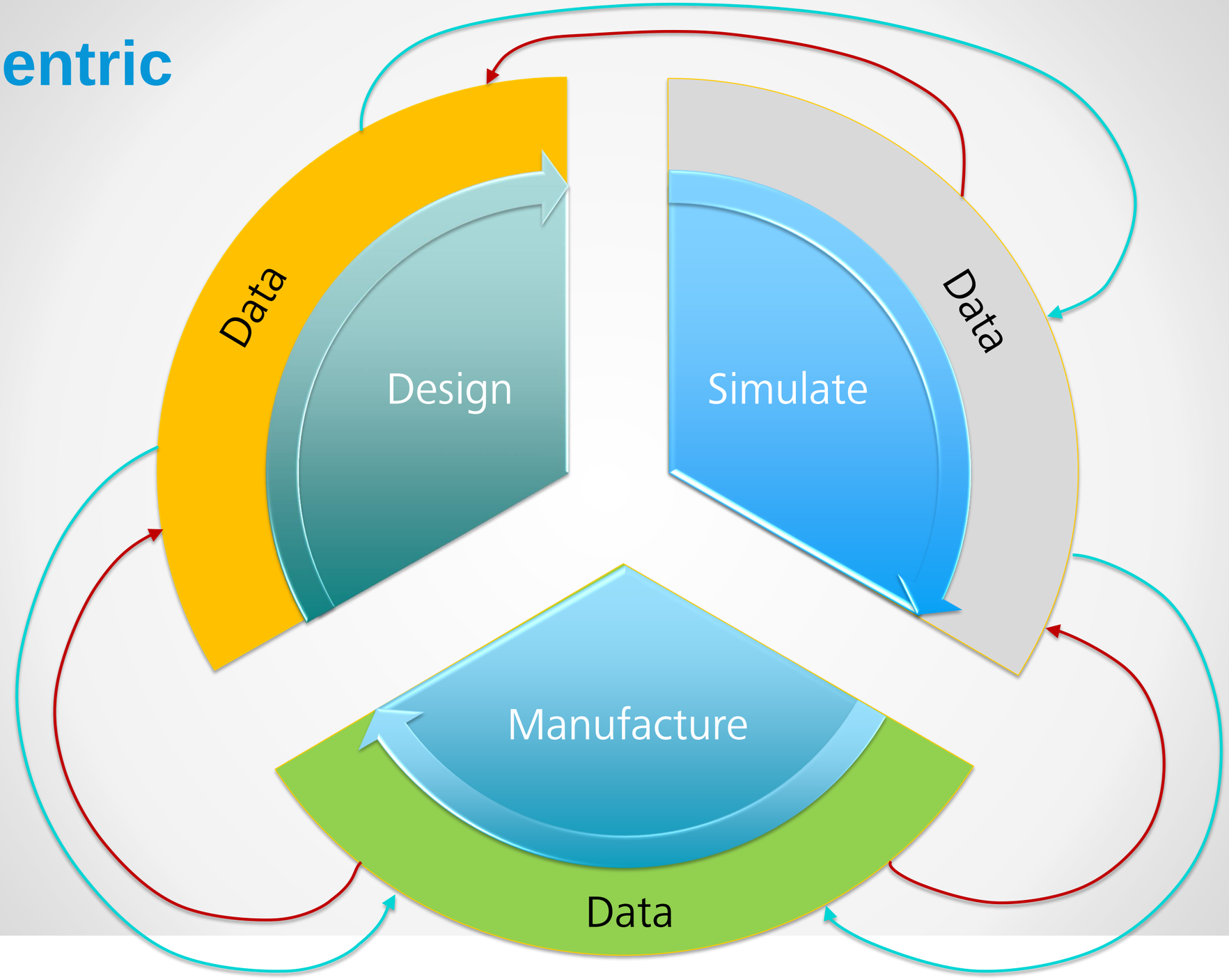




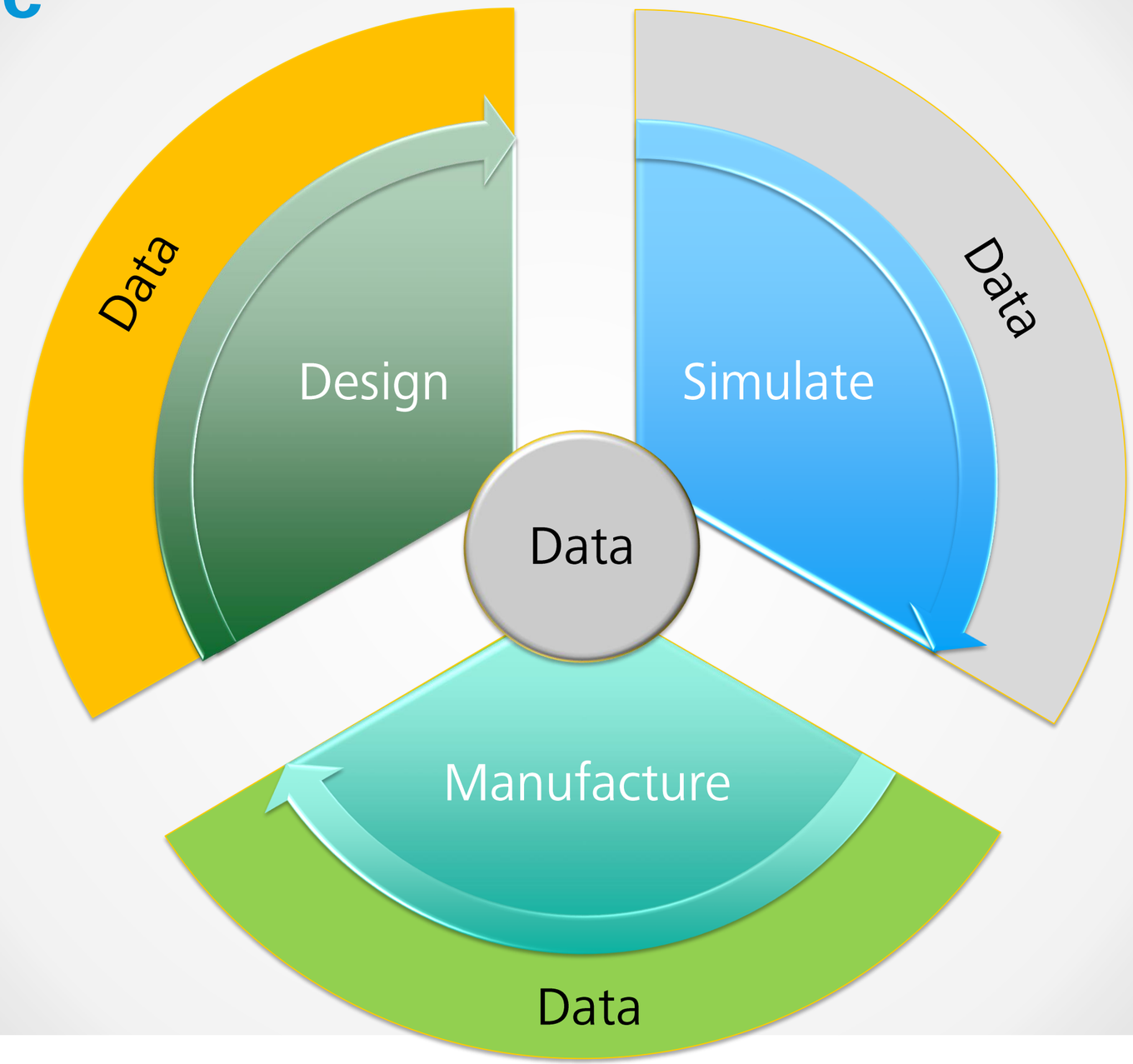
Damage Plot

Future of Lightweighting With Advanced Materials

Data-Centric

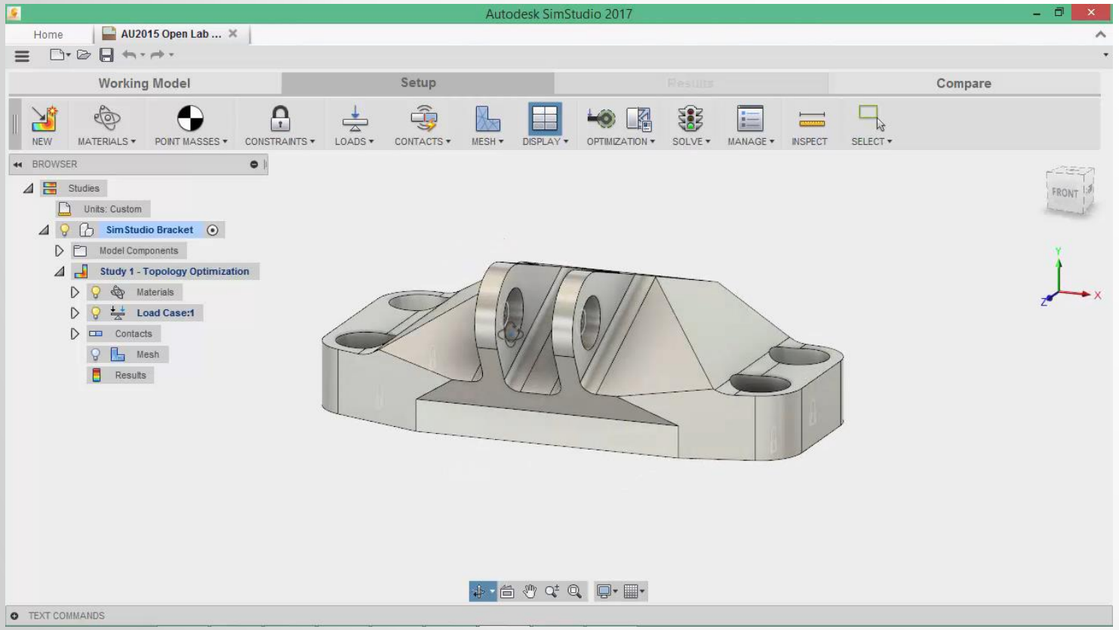


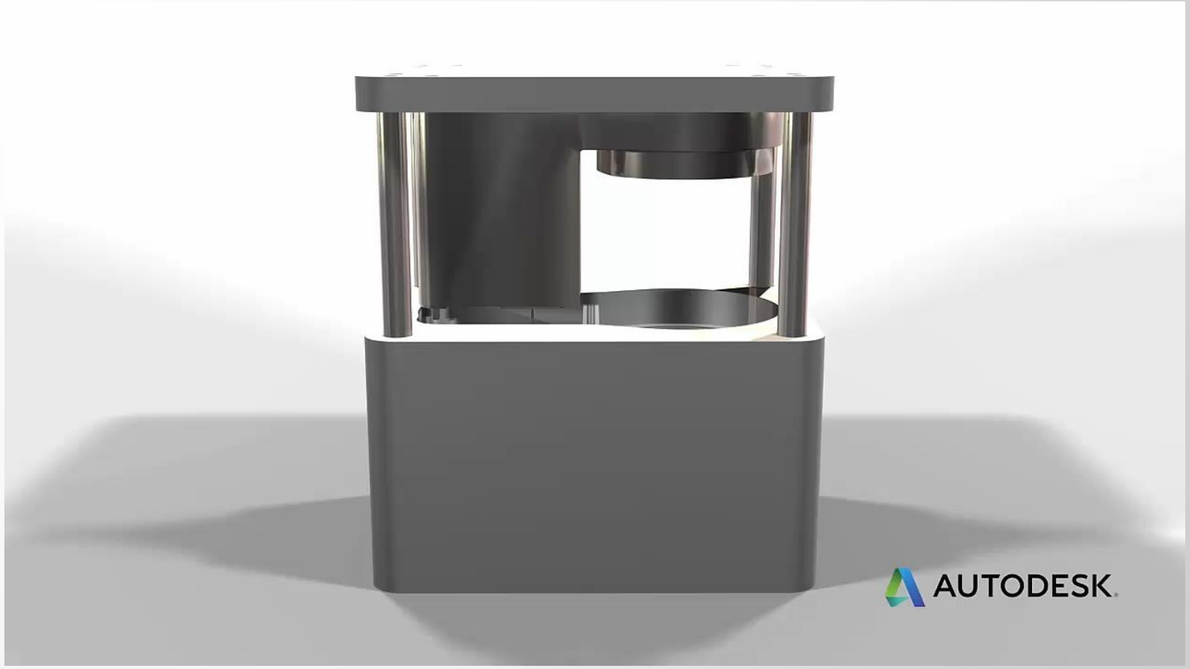
Data-Centric



Goal-Driven Design

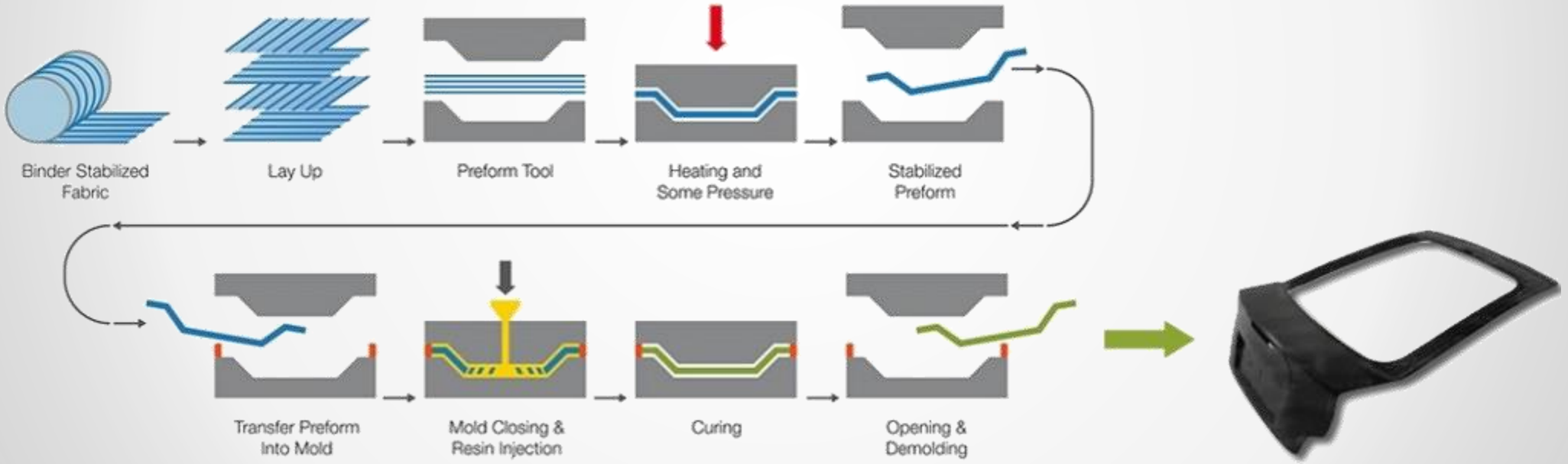
- Lightweight through automated geometry modification
  - Based on constrains
- Reduce costs/timelines of manufacturing





Advancing the State of the Art

- Manufacturing non-traditional geometries
  - HP-RTM



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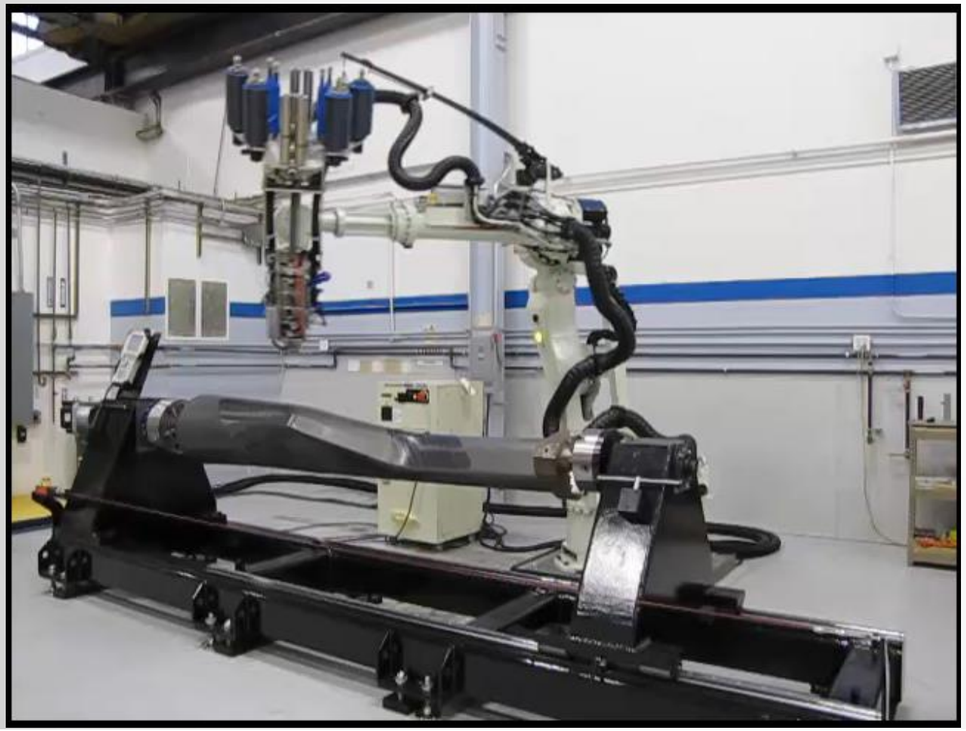
Advancing the State of the Art

- Manufacturing non-traditional geometries
  - HP-RTM
  - 3D Printing



Mixed Materials

- Strength and stiffness where required
- Ease of manufacturability

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Wrap-Up

- Simulation in the Future of Making Things
  - Murano 3301
  - Wed. Dec. 2nd, 4:30-5:30
- Simulation On Tap
  - Yardbird Living Room
  - Wed. Dec. 2nd, 5:30-8:30
  - Need a green wristband to get in – come get one from the presenters

Forget to take notes? No problem!

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All of your sessions will be there to enjoy again and again.