

# Introducing the Composites Manufacturing and Simulation Center at Purdue University

7/6/2022



Composites Manufacturing  
& Simulation Center™



# Composites Manufacturing and Simulation Center



We are experts in composites manufacturing, simulation, and characterization.



We advance composites manufacturing science and simulation technology  
To enrich simulation-based design and manufacturing decisions  
For industry and government partners  
Through research and engineering.



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# Facilities

## Manufacturing

- ⬠ Additive LSAM
- ⬠ TP Sheet Forming
- ⬠ Compression Molding
- ⬠ AFP
- ⬠ RTM, Autoclave, Machining



**CMFC**  
Composites Manufacturing  
& Simulation Center

## Characterization

- ⬠ Test frames, fixtures,  
Thermal chamber
- ⬠ DMA, DSC, TGA  
Rheometer
- ⬠ Microscopy, CT Scan



# Partnership: Dassault 3D Experience Edu Center of Excellence

## Integrated Composites Workflow Applications

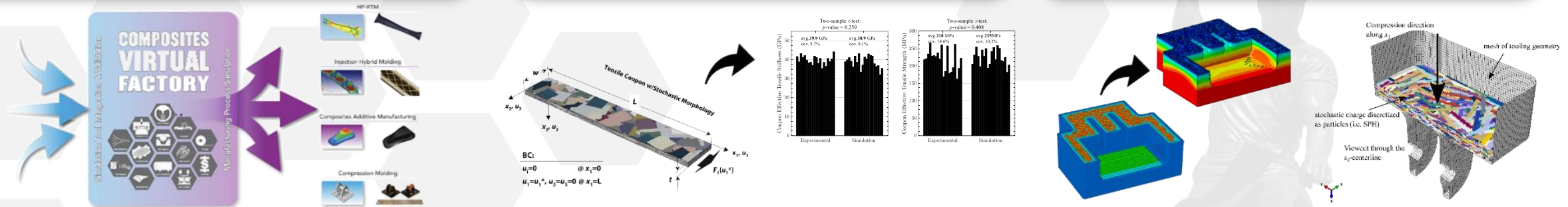
Combine multiple models and simulations to provide end-to-end virtual process twins

## Composites Simulation Validation

Connect virtual twins to reality through characterization, rapid prototyping, and validation

## New Composites Simulation Methods

Drive the development of robust and transformative predictive methods



Simulation for Manufacturing Informed Design

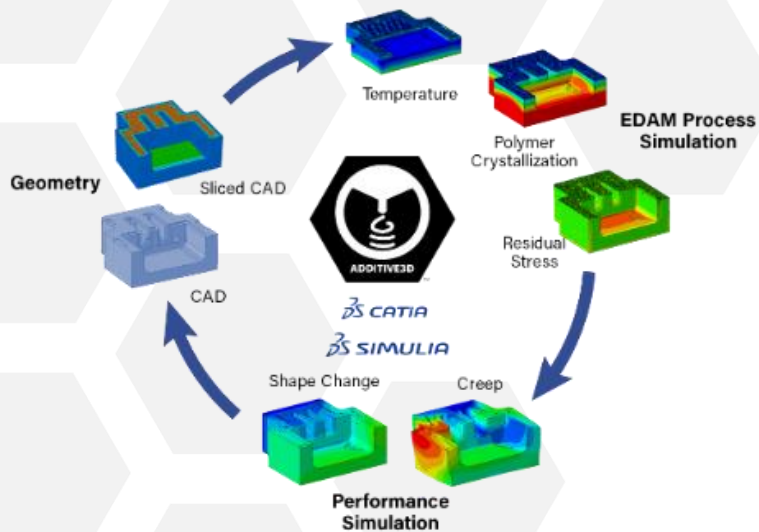
Simulation Driven Certification

Simulation as the Language of Innovation

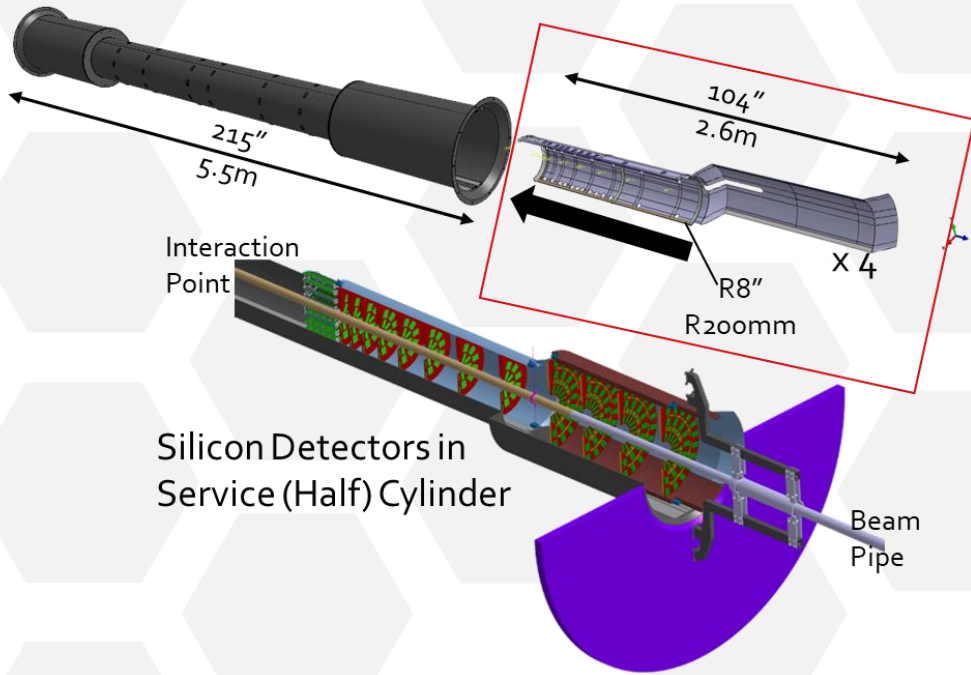
Empowering a manufacturing-informed design experience for composites connected across the supply chain

# Partnership: Thermwood LSAM Research Laboratory

- ⬠ Goal: Support Thermwood and large-scale additive manufacturing industry through applied research and physics-based process simulations
- ⬠ Thermwood LSAM 105 at Purdue
- ⬠ Access to LSAM 1020 at Thermwood



# Partnership: Support Structures for CERN

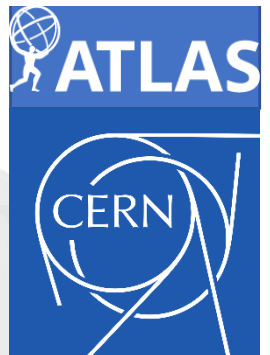
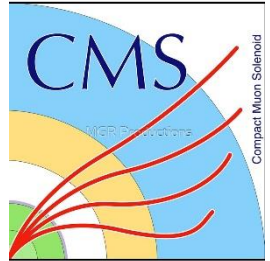
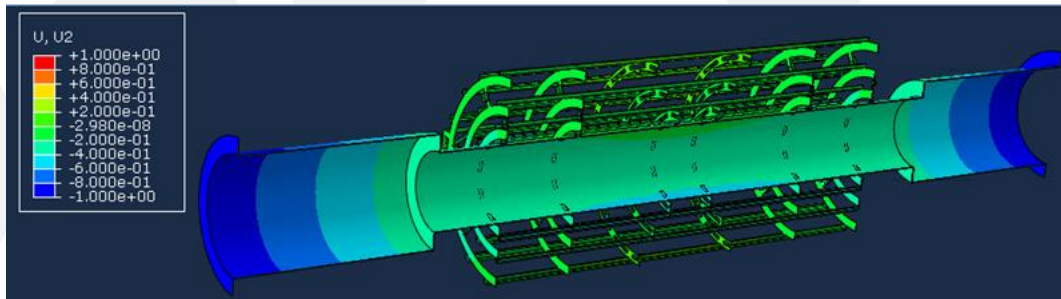
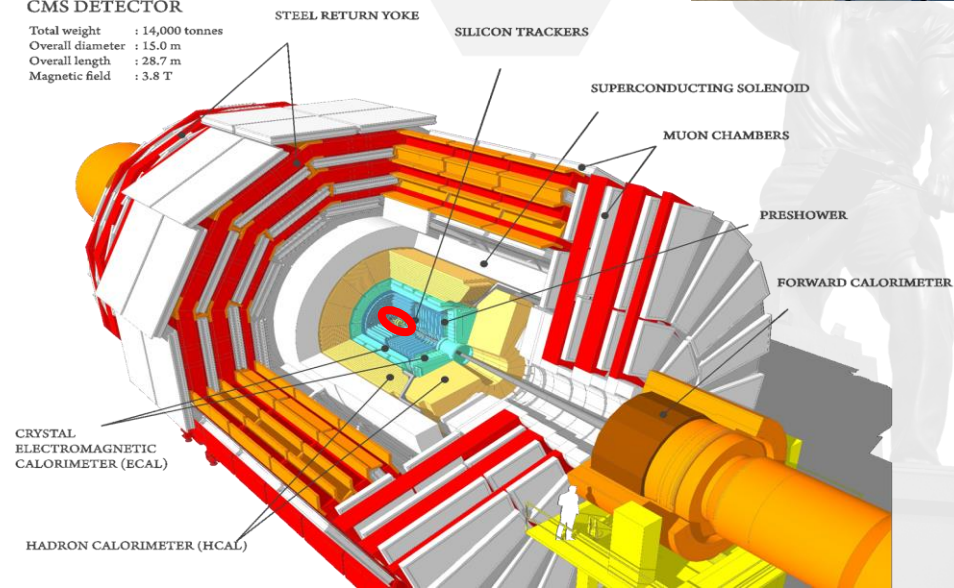


Silicon Detectors in Service (Half) Cylinder

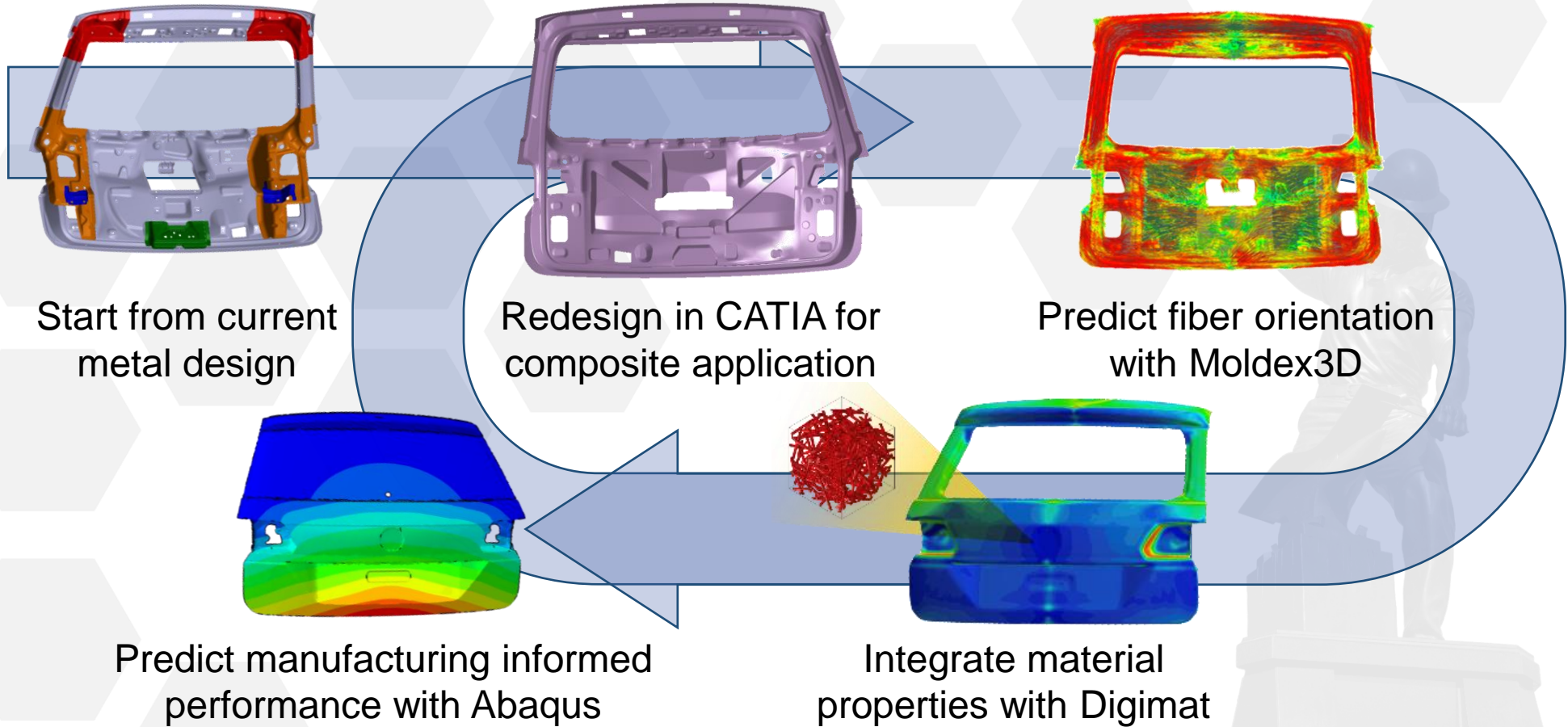


## CMS DETECTOR

Total weight : 14,000 tonnes  
Overall diameter : 15.0 m  
Overall length : 28.7 m  
Magnetic field : 3.8 T



# Manufacturing-Informed Design Process

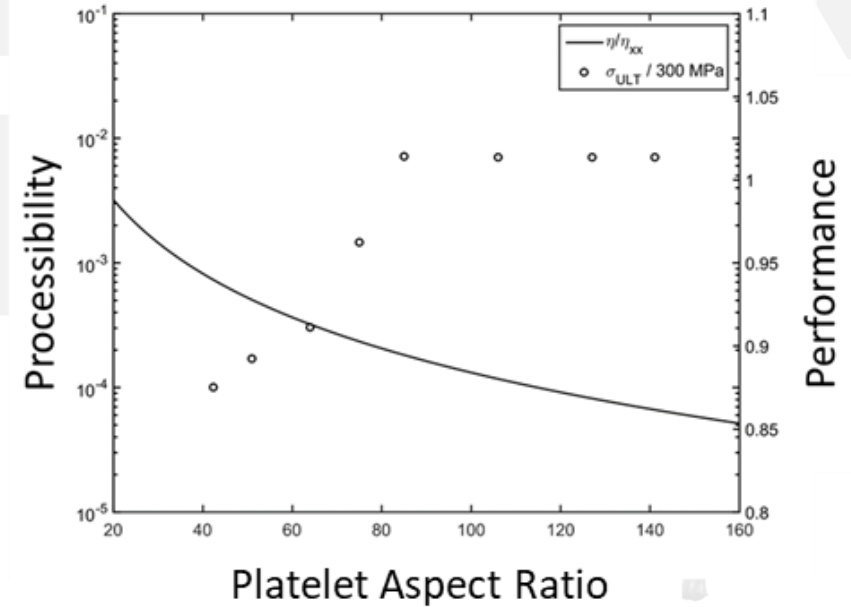


Volkswagen



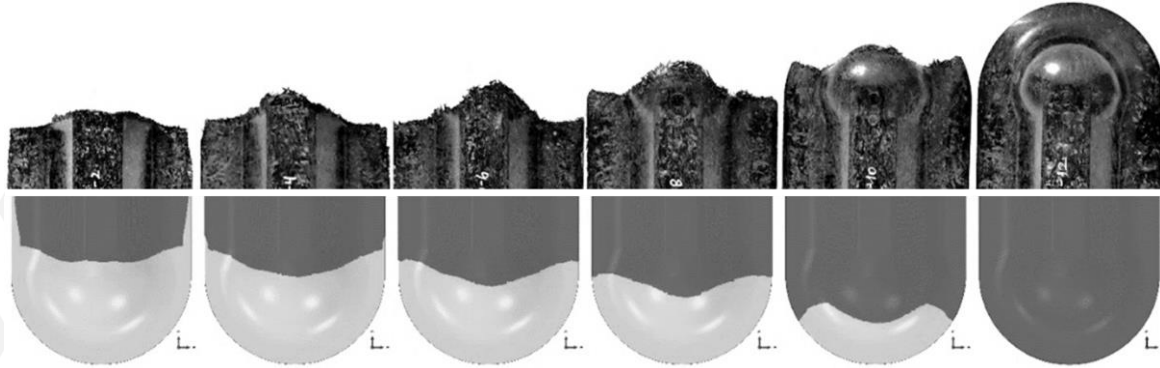


# Supporting Development and Application of Novel Material Systems

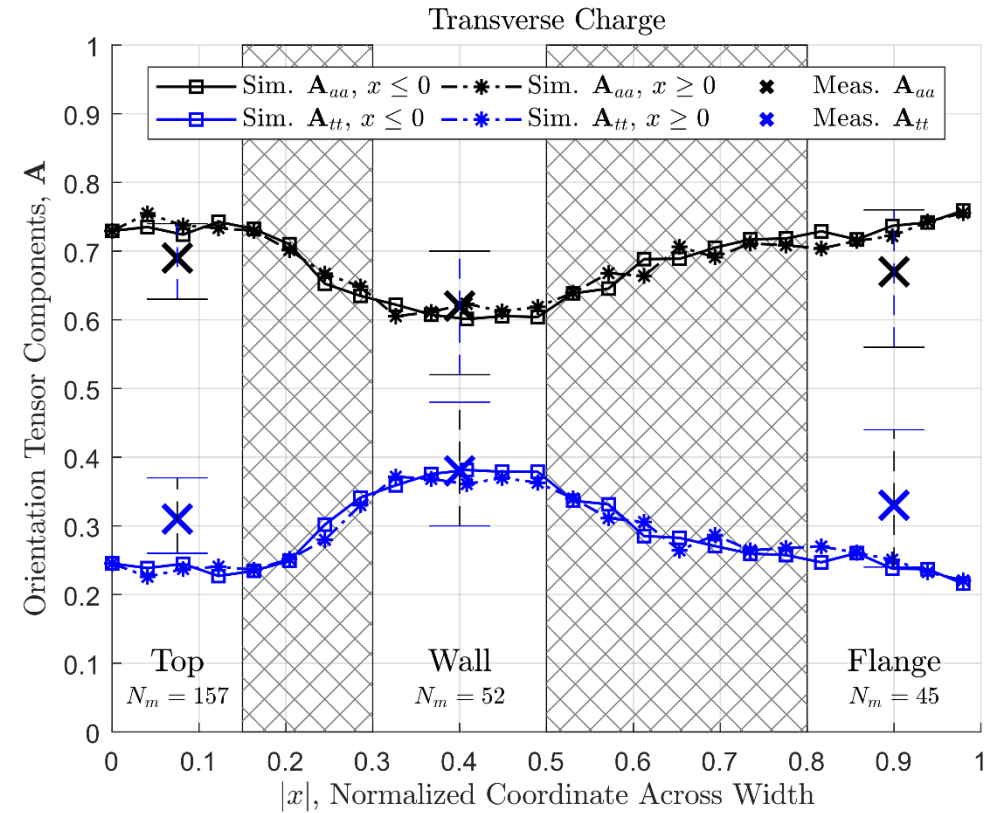


# Physics-based Predictions of Flow and Orientation

## Flow Validated by Short Shot Experiments



## Orientation Validated by New Microscopy Method



# Resulting Structural Filling and Performance



# Cross-Cutting Design, Modeling, and Simulation for Composites

- Partnerships for prosperity
- Manufacturing-informed performance
- High-rate & thermoplastic experience
- Modeling and simulation for economic prosperity and sustainability

