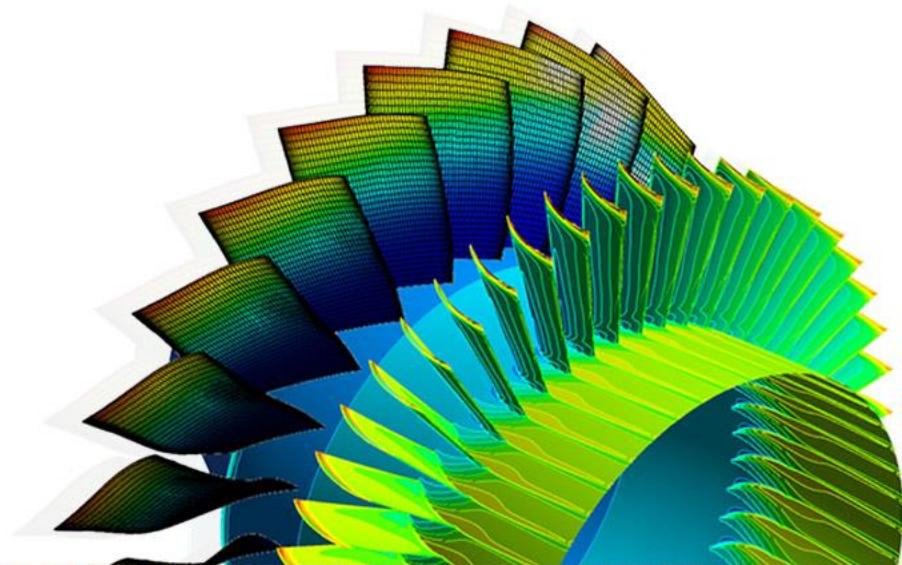




ANSYS Composite PrepPost 19.0

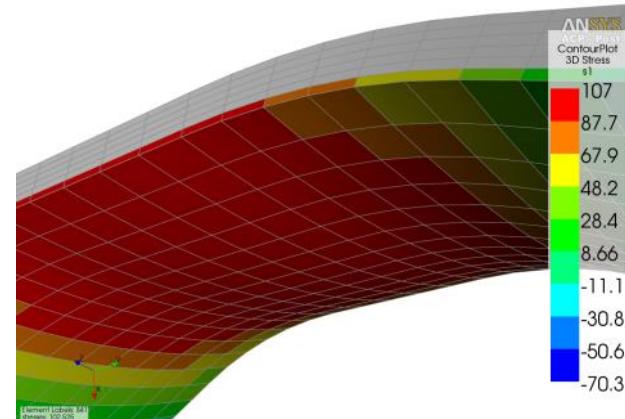
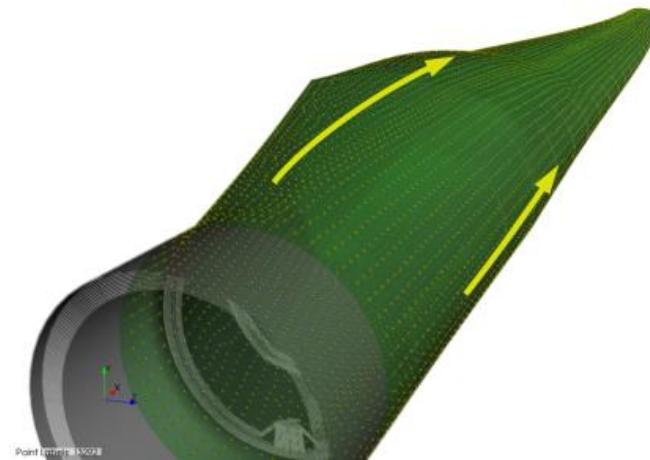
Module 3: ANSYS Composite PrepPost Introduction



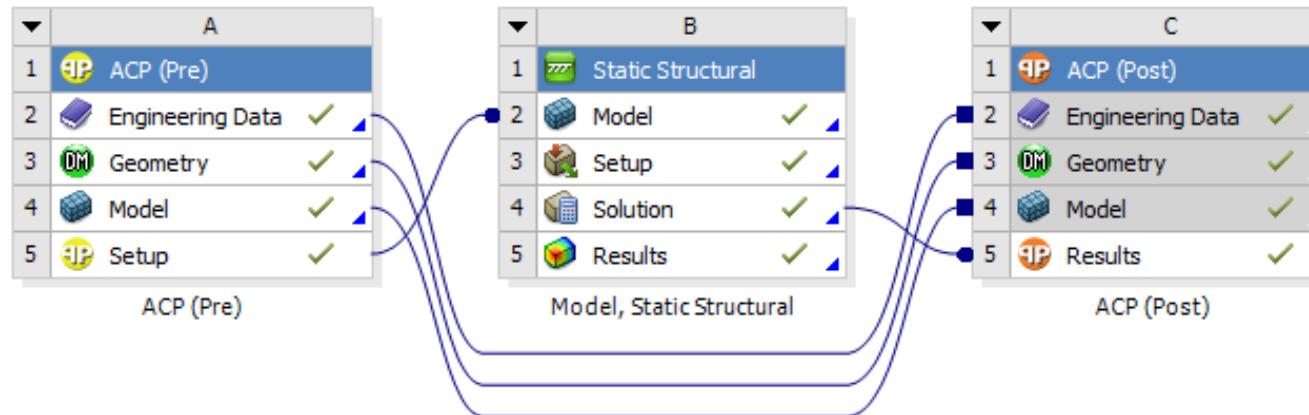
3 ANSYS Composite PrepPost Introduction

What can I do with ANSYS Composite PrepPost?

- Build up the Composite Design
 - Define complex Composite Layup
 - Define Fiber Directions and Orientations
 - Optimize composite design
- Evaluate the Composite Design
 - Evaluate Stresses in the Layer
 - Evaluate Failure Criteria
 - Evaluate complex failure mechanism like Delamination and Wrinkling
 - Get fast access to critical layer information
 - Detailed analysis of regions using Submodeling



3.1 The Integration in ANSYS Workbench



Preprocessing

- Material
- Geometry
- Mesh
- Composite Layup

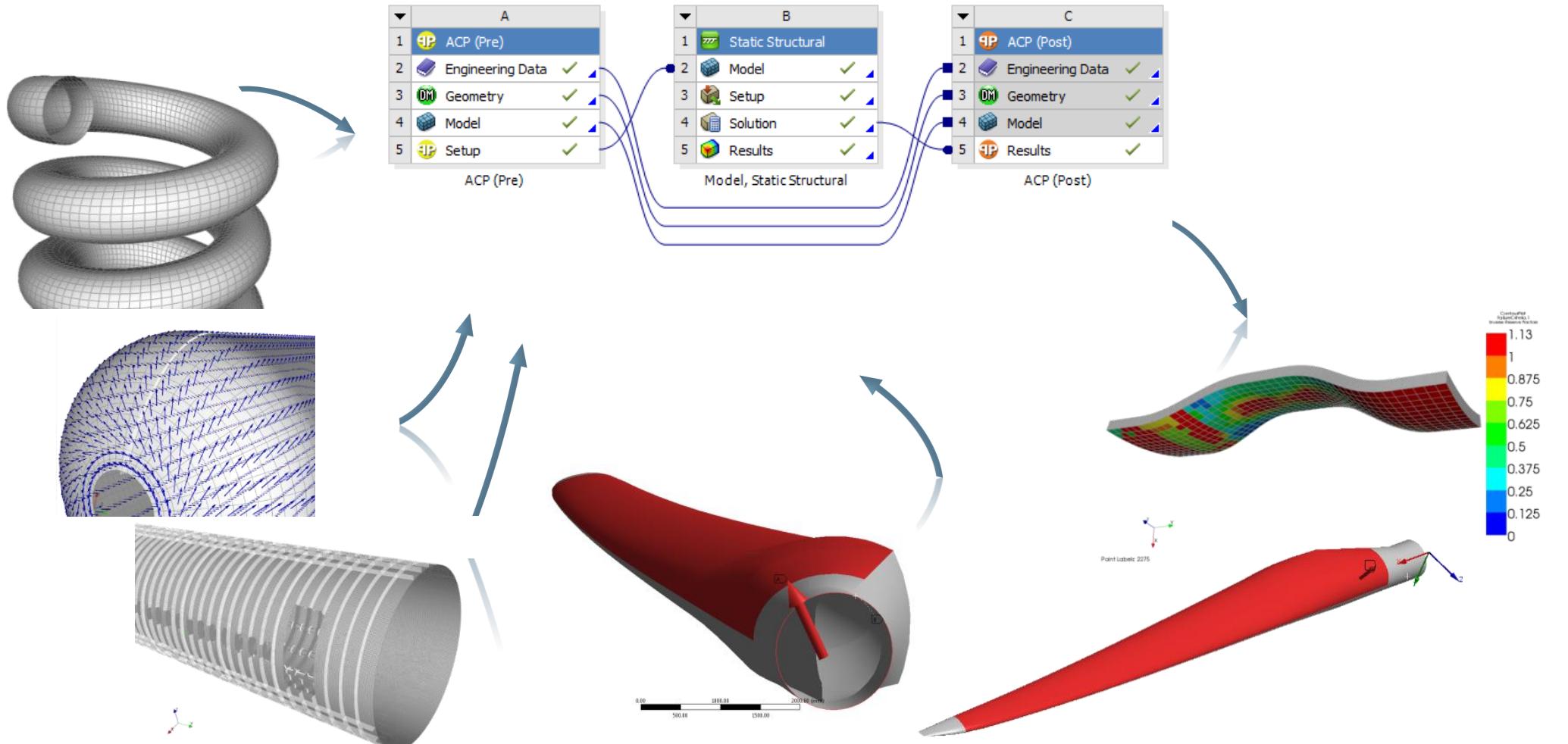
Simulation

- Loads
- Boundary Conditions
- Solution
- global Postprocessing

Postprocessing

- detailed analysis of composite results

3.1 The Integration in ANSYS Workbench



3.2 Defining Material Data

Demonstration_ACP_160 - Workbench

File View Tools Units Extensions Help

Import... Reconnect Refresh Project Update Project ACT Start Page

Project Schematic

D

1 ACP (Pre) ✓

2 Engineering Data ✓

3 Geometry ✓

4 Model ✓

5 Setup ✓

ACP (Pre)

Component Systems

- ACP (Post)
- ACP (Pre) **Selected**
- Autodyn
- BladeGen
- CFX
- Engineering Data
- Explicit Dynamics (LS-DYNA Export)
- External Data
- External Model
- Finite ElementModeler
- Fluent
- Fluent (with Fluent Meshing)
- Geometry
- ICEM CFD
- Icepak
- Mechanical APDL
- Mechanical Model
- Mesh
- Microsoft OfficeExcel
- Polyflow
- Polyflow - Blow Molding
- Polyflow - Extrusion
- Results
- System Coupling
- Turbo Setup
- TurboGrid
- Vista AFD
- Vista CCD
- Vista CCD (with CCM)
- Vista CPD
- Vista RTD
- Vista TF
- Custom Systems
- Design Exploration
- External ConnectionSystems

View All / Customize...

A350_Model - Workbench

File Edit View Tools Units Help

Import... Reconnect Refresh Project Update Project Return to Project Compact Mode

Outline of Schematic A2: Engineering Data

	A	B	C	D	E
1	Contents of Engineering Data			source	Description
2	Material				
3	Epoxy_Carbon_UD_395GPa_Prepreg				
4	Epoxy_Carbon_Woven_395GPa_Prepreg				

Properties of Outline Row 3: Epoxy_Carbon_UD_395GPa_Prepreg

	A	B	C	D	E
1	Property	Value	Unit		
2	Density	1.54E-09	mm^-3 t		
3	Orthotropic Elasticity				
9	Young's Modulus X direction	2.09E+05	MPa		
10	Young's Modulus Y direction	9450	MPa		
11	Young's Modulus Z direction	9450	MPa		
12	Poisson's Ratio XY	0.27			
13	Poisson's Ratio YZ	0.4			
14	Poisson's Ratio XZ	0.27			
15	Shear Modulus XY	5500	MPa		
16	Shear Modulus YZ	3900	MPa		
17	Shear Modulus XZ	5500	MPa		
18	Orthotropic Stress Limits				
20	Tensile X direction	1979	MPa		
21	Tensile Y direction	26	MPa		
22	Tensile Z direction	26	MPa		
23	Compressive X direction	-893	MPa		
24	Compressive Y direction	-139	MPa		
25	Compressive Z direction	-139	MPa		
26	Shear XY	100	MPa		
27	Shear YZ	50	MPa		
28	Shear XZ	100	MPa		
29	Orthotropic Strain Limits				
30	Tensile Y direction	n nnn			

Messages Progress

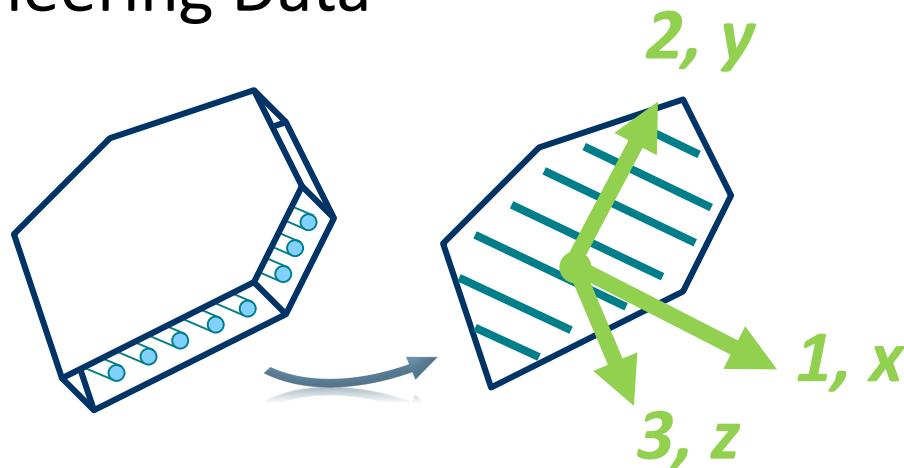
Ready

Show Progress Show 1 Messages

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3.2 Defining Material Data

- Material Data are defined in the ANSYS Workbench Engineering Data
- Material Data are defined for fabrics



- Mechanical Properties
 - Young's Modulus in x, y and z-direction
 - Shear Modulus in the xy, yz and xz-plane
 - Poisons Ratio in the xy, yz and xz-plane

3.2 Defining Material Data

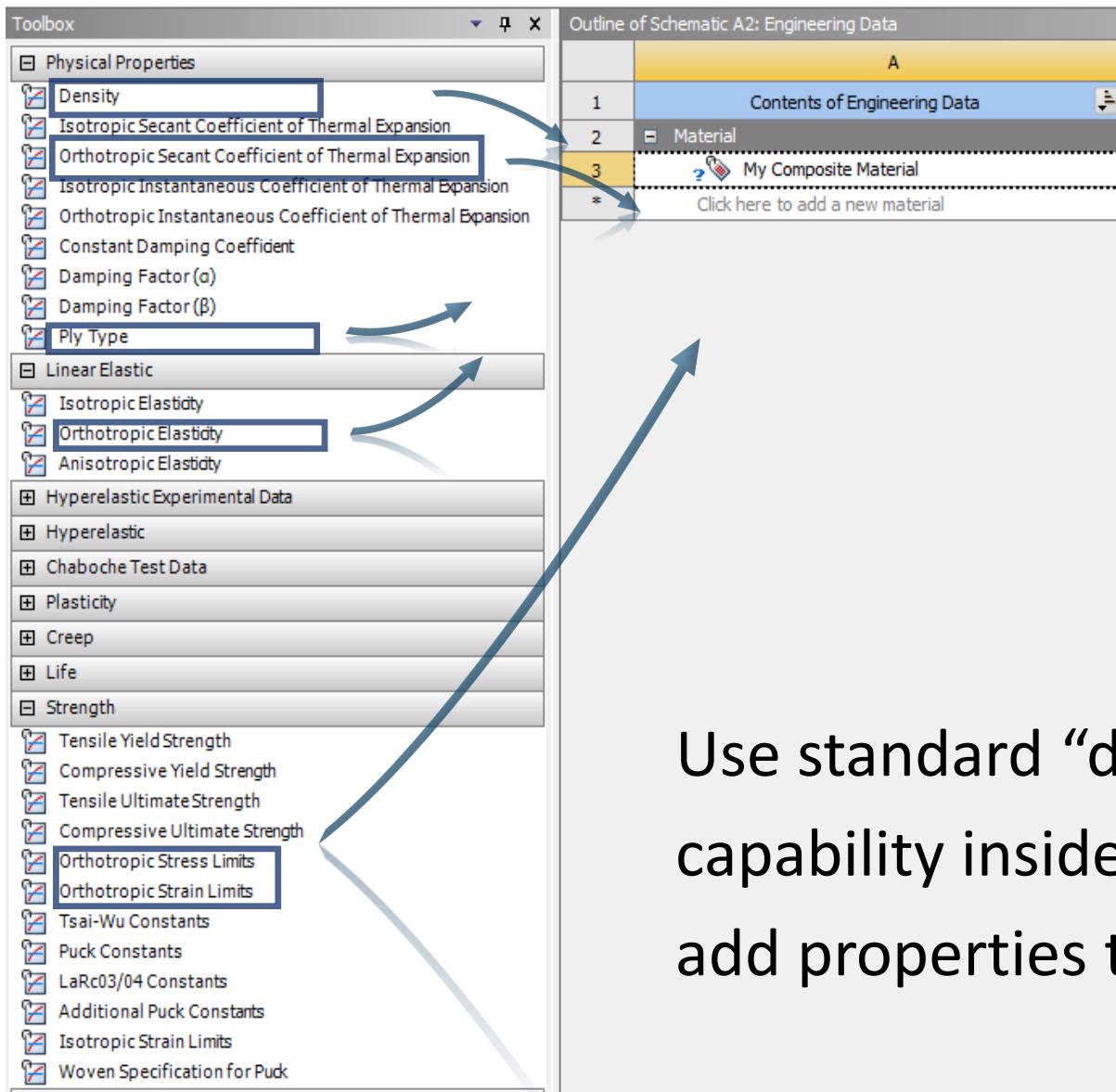
- Stress and Strain Limits are used to evaluate failure criteria values
- Stress and Strain limits are different for compression and tension

<i>Stress Limits</i>		<i>Strain Limits</i>	
Tension	X, Y and Z	Tension	X, Y and Z
Compression	X, Y and Z	Compression	X, Y and Z
Shear	XY, YZ and XZ	Shear	XY, YZ and XZ

3.2 Defining Material Data

- The ply type has to be defined so ANSYS Composite PrepPost applies the right failure criteria
 - Regular Ply
 - Woven Ply
 - Isotropic Ply
 - Isotropic Homogeneous Core
 - Orthotropic Homogeneous Core
 - Honeycomb Core
- Some Failure Criteria need additional constants
(see Failure Criteria in Postprocessing)

3.2 Defining Material Data

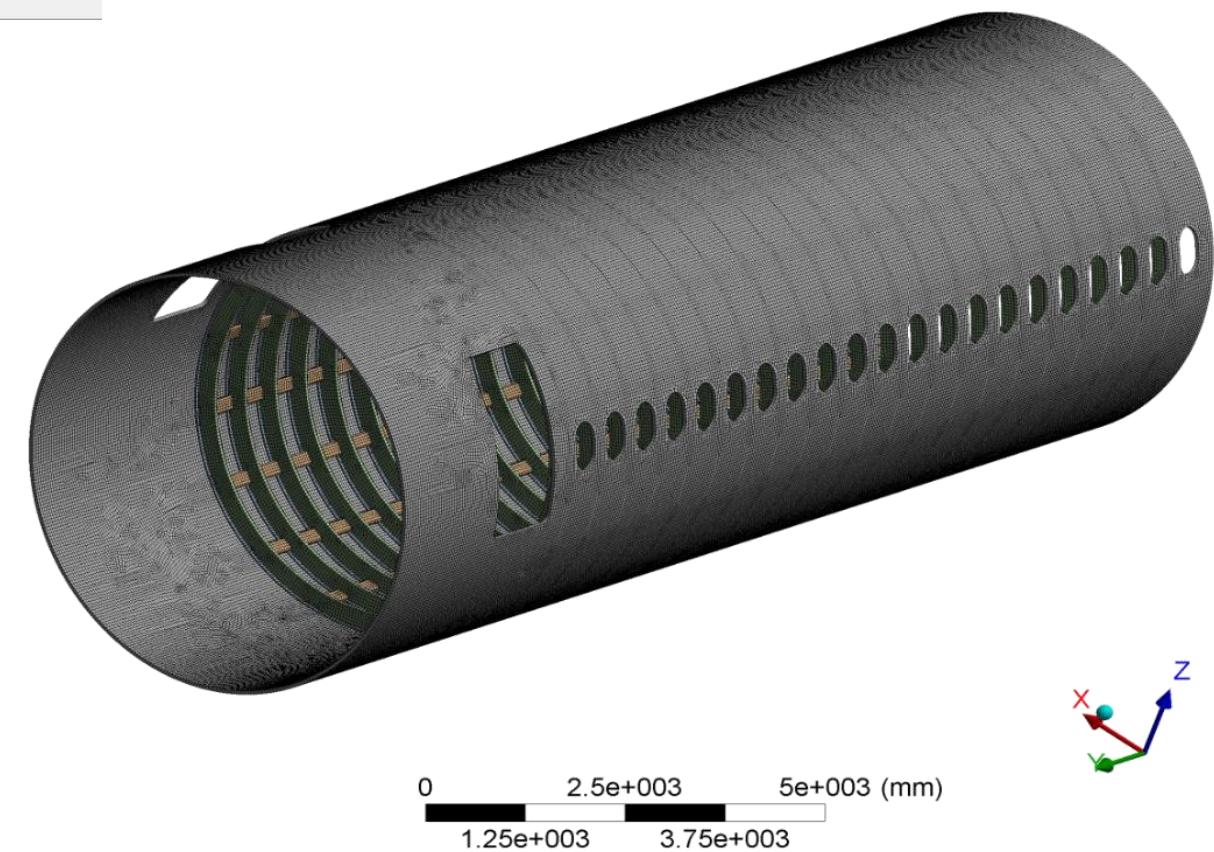
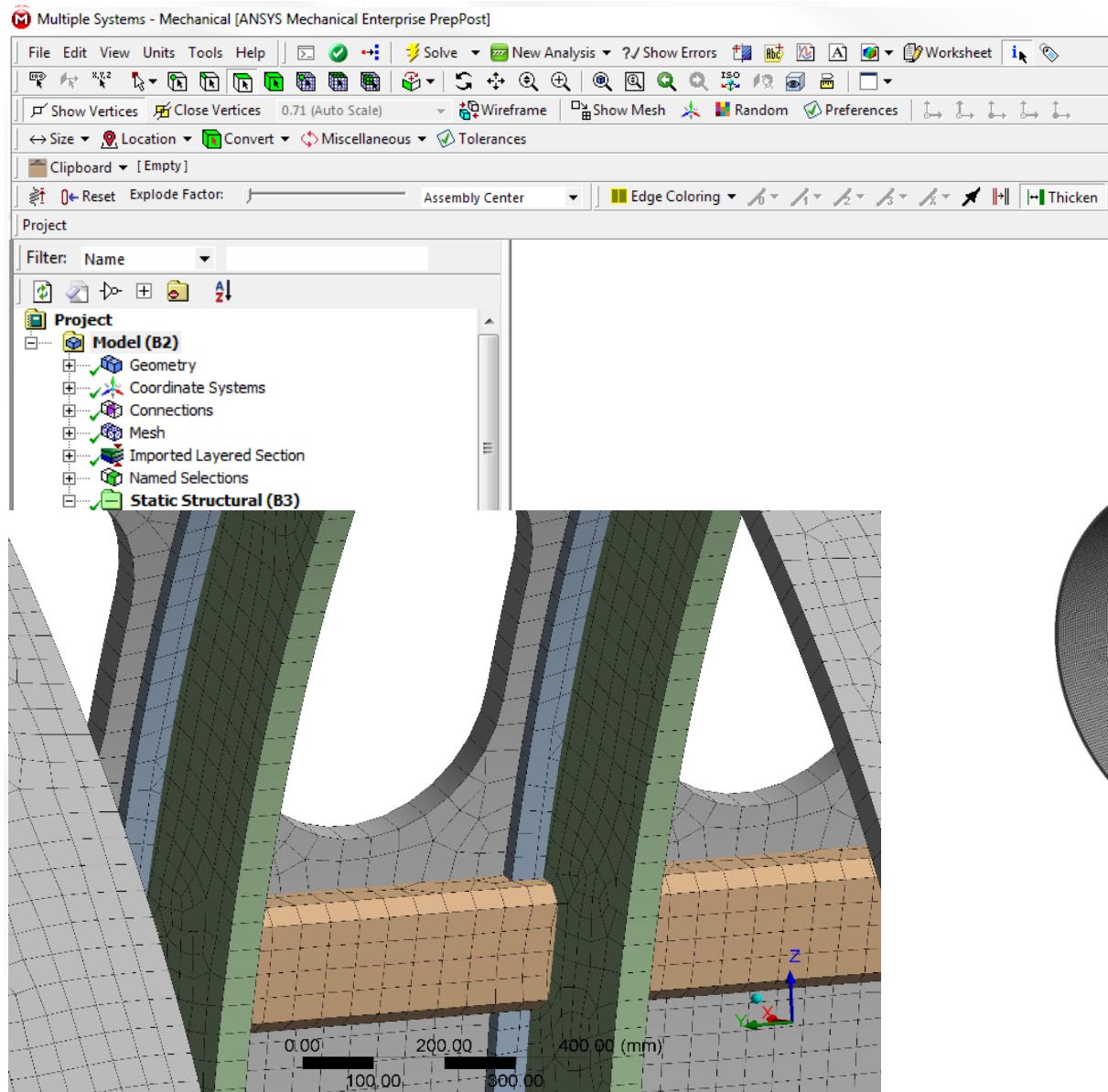


Use standard “drag and drop”
capability inside engineering data to
add properties to your material

3.3 Mesh Generation

- The mesh is generated within the ACP (Pre) component using Mechanical GUI
- All mesh sizing and options can be applied
- ANSYS Composite PrepPost **always starts with a shell mesh**
- In case solid models are used they will be generated within ANSYS Composite PrepPost

3.3 Mesh Generation



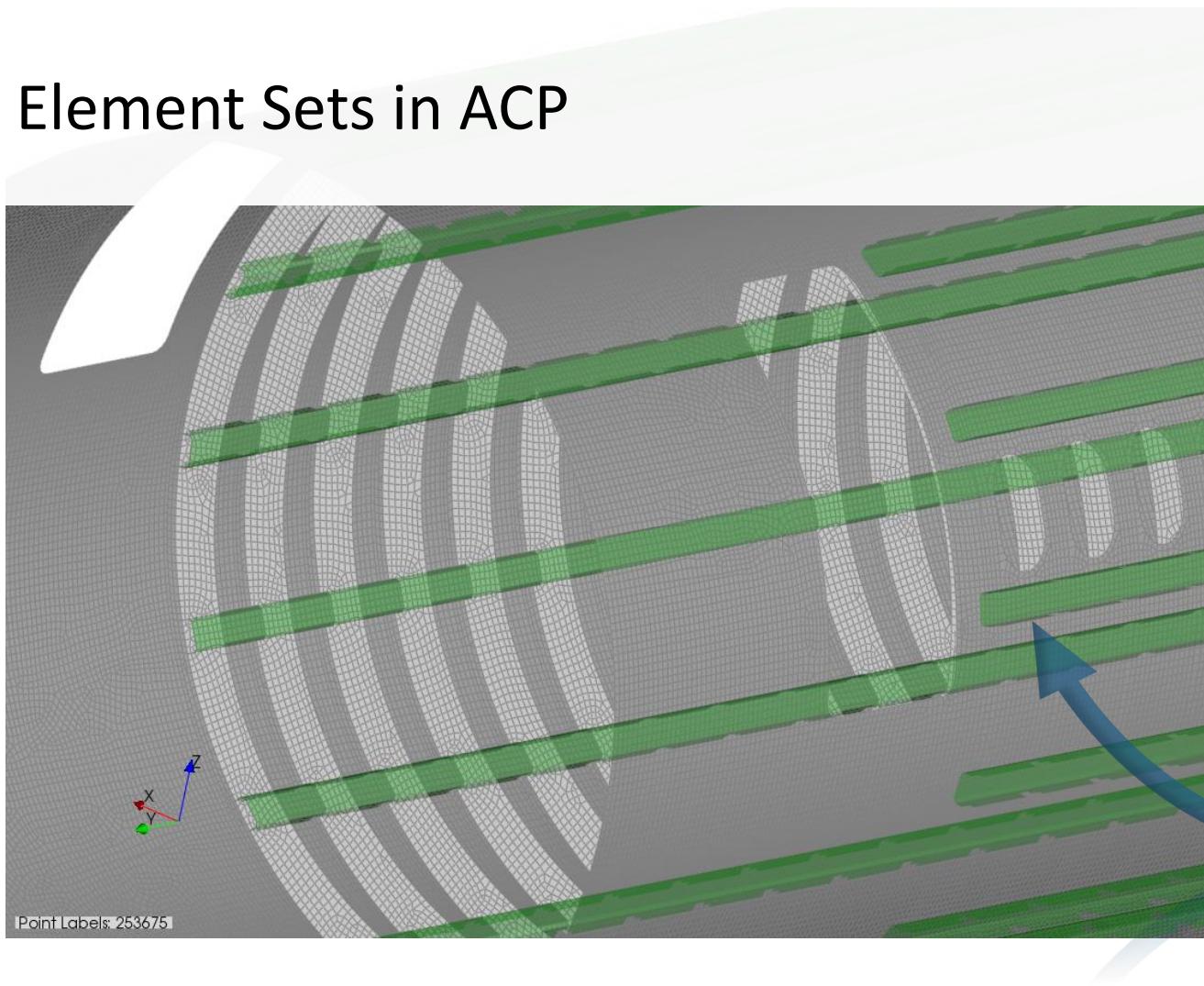
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3.4 Named Selections

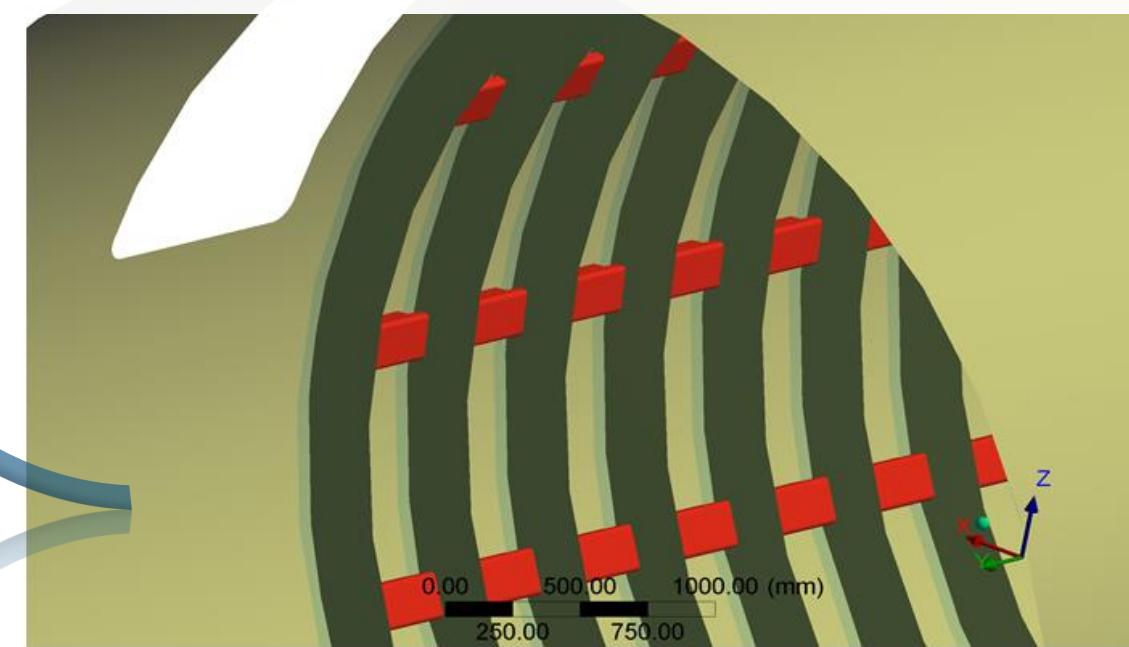
- Named Selections are used to transfer element selections to ANSYS Composite PrepPost
- The complete composite layup will be based on the Named Selections
- Named Selections should be checked if the designs geometry is modified
- Composite layups based on Named Selections allow one-click design updates

3.4 Named Selections

Element Sets in ACP

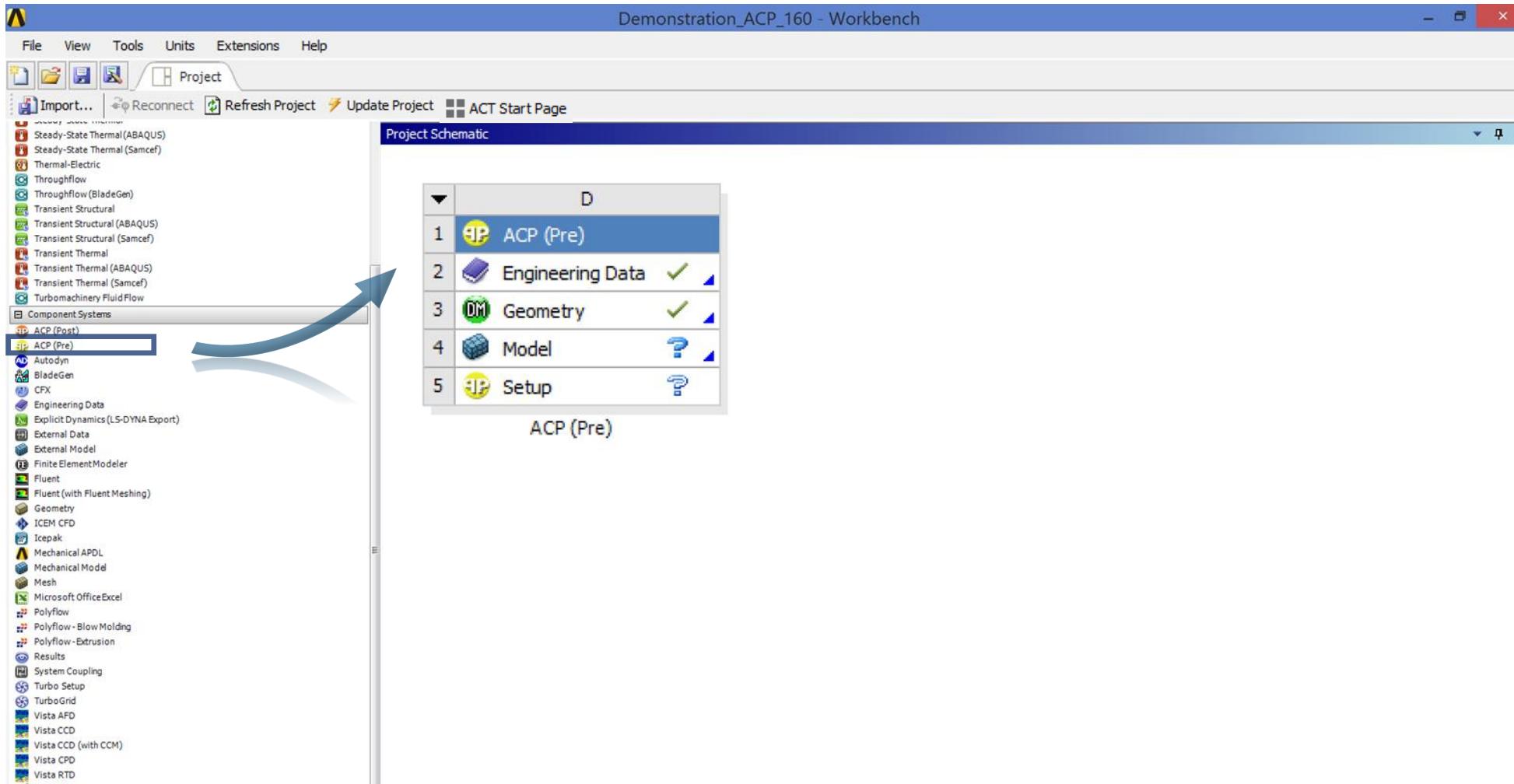


Named Selections in Mechanical

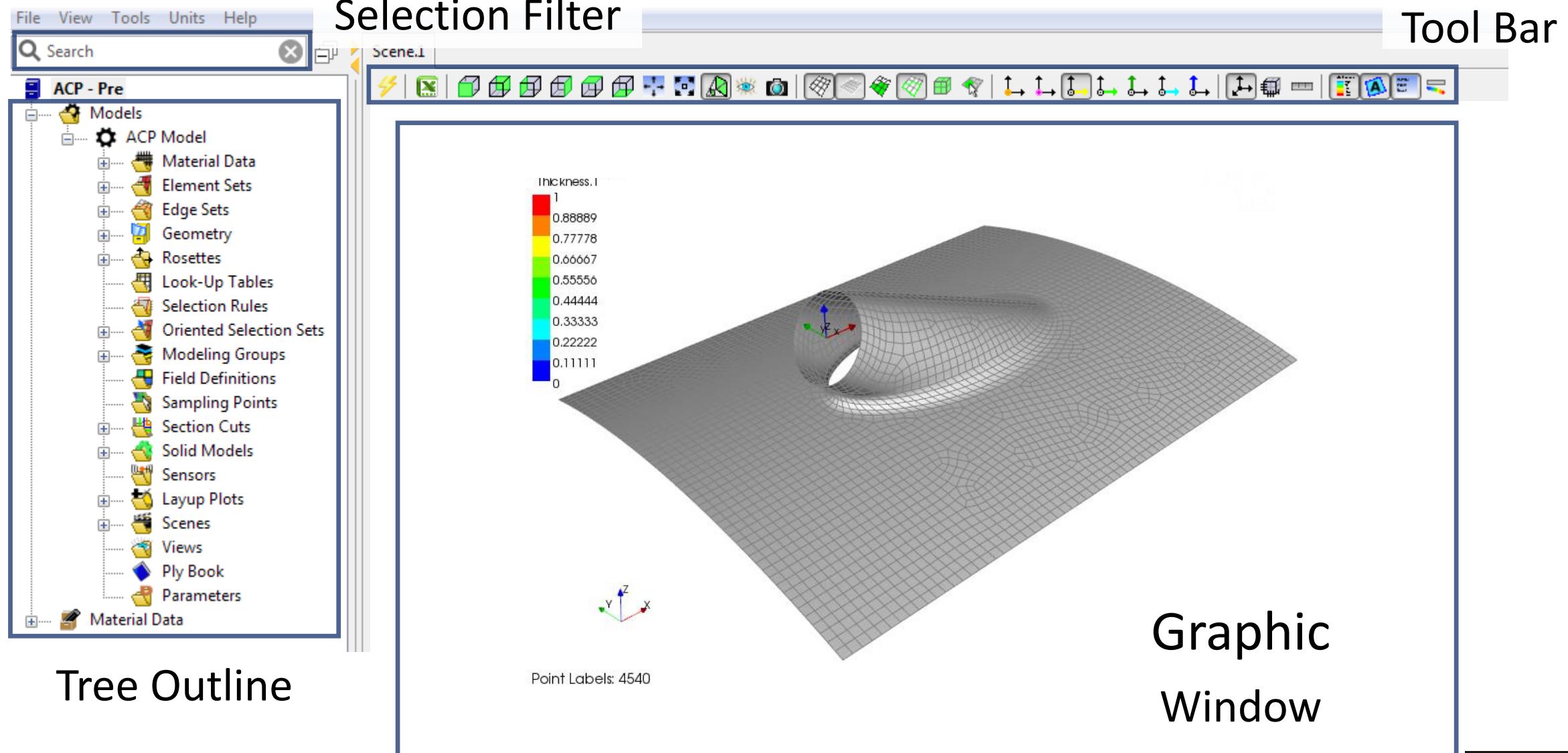


3.5 ANSYS Composite PrepPost Overview

- Start ANSYS Composite PrepPost

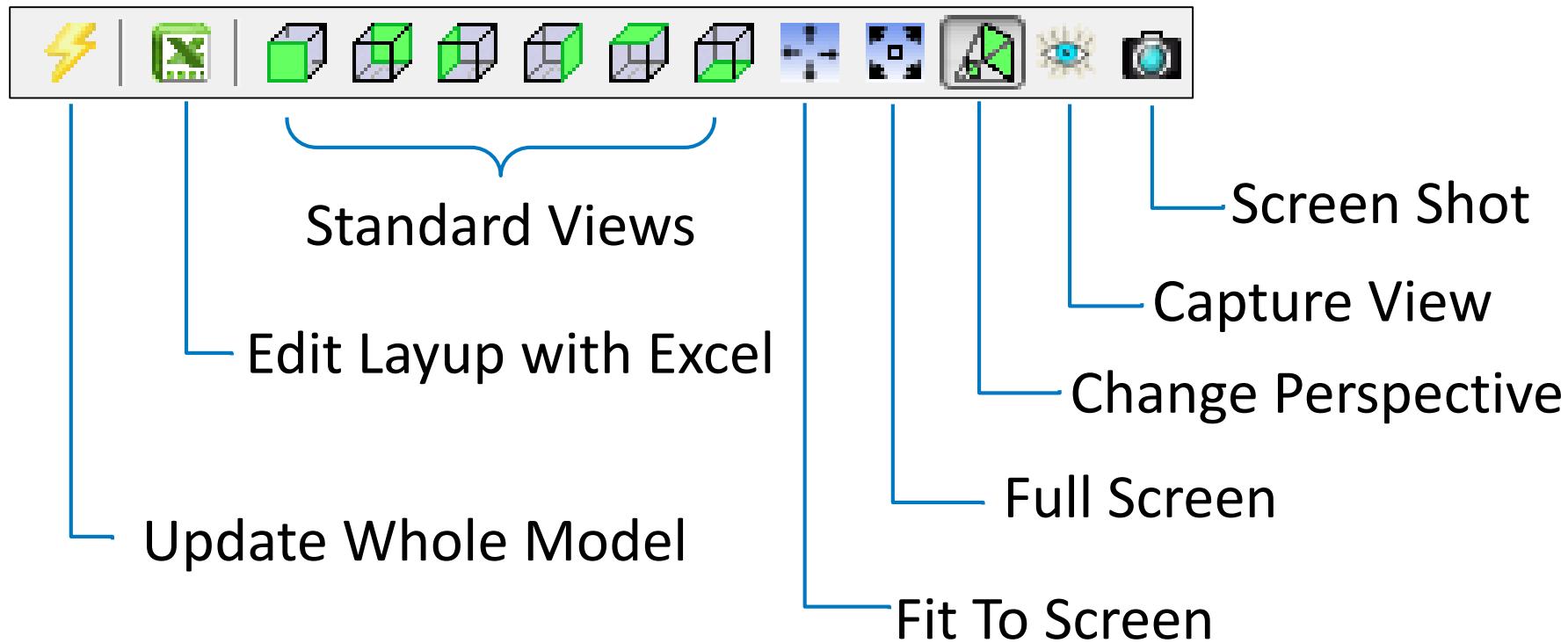


3.5 ANSYS Composite PrepPost Overview



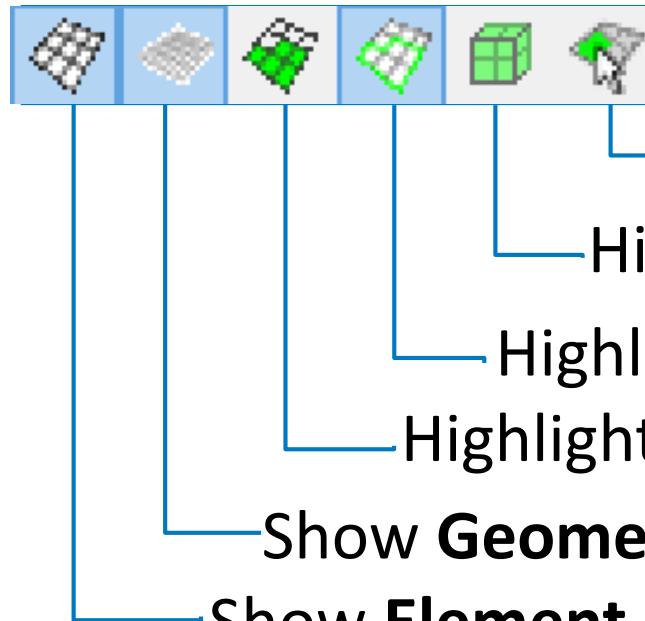
3.5 ANSYS Composite PrepPost Overview

- Tool Bar:



3.5 ANSYS Composite PrepPost Overview

- Tool Bar:



Probe **Values** on Hover

Highlight **Shell or Solid** Elements in Selections

Highlight **Silhouettes / Edges** of Elements in Selections

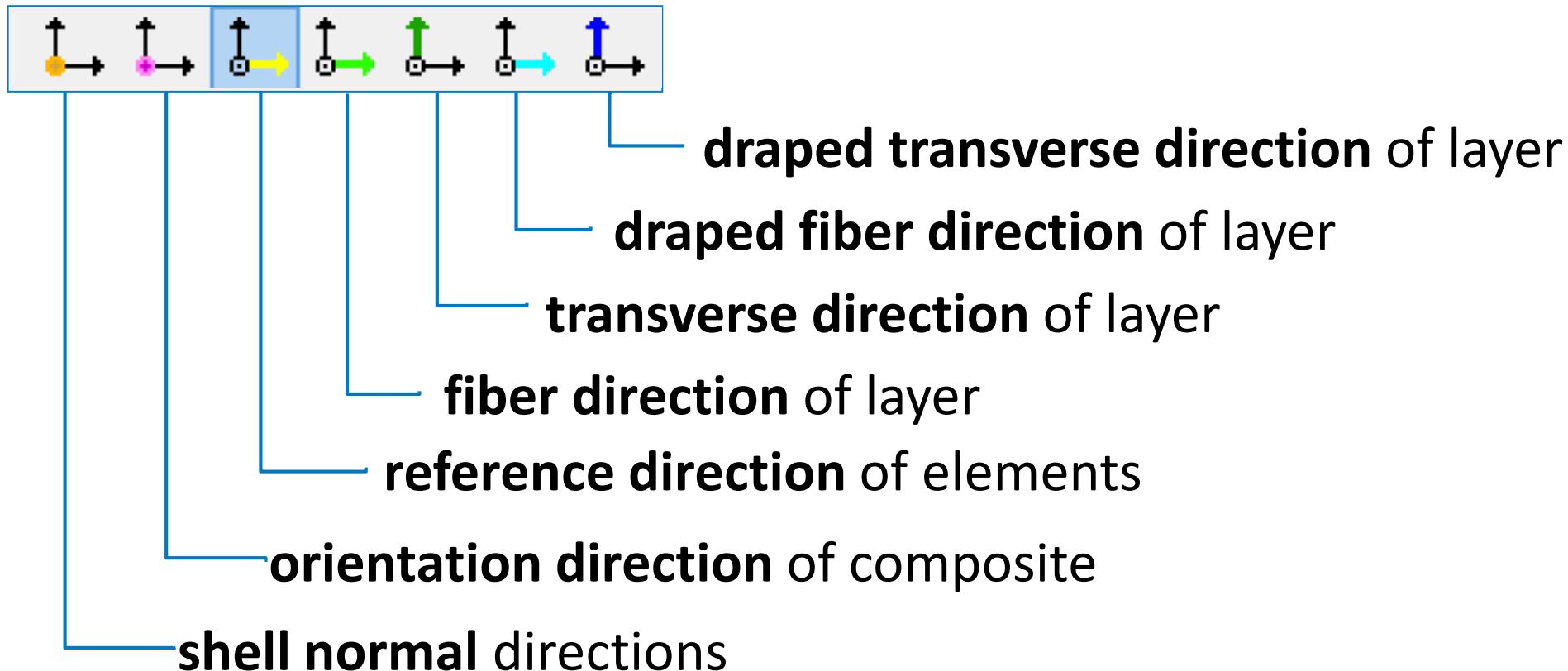
Highlight **Element faces** in Selections

Show **Geometry Face** (in grey when unselected)

Show **Element Edges** (in grey when unselected)

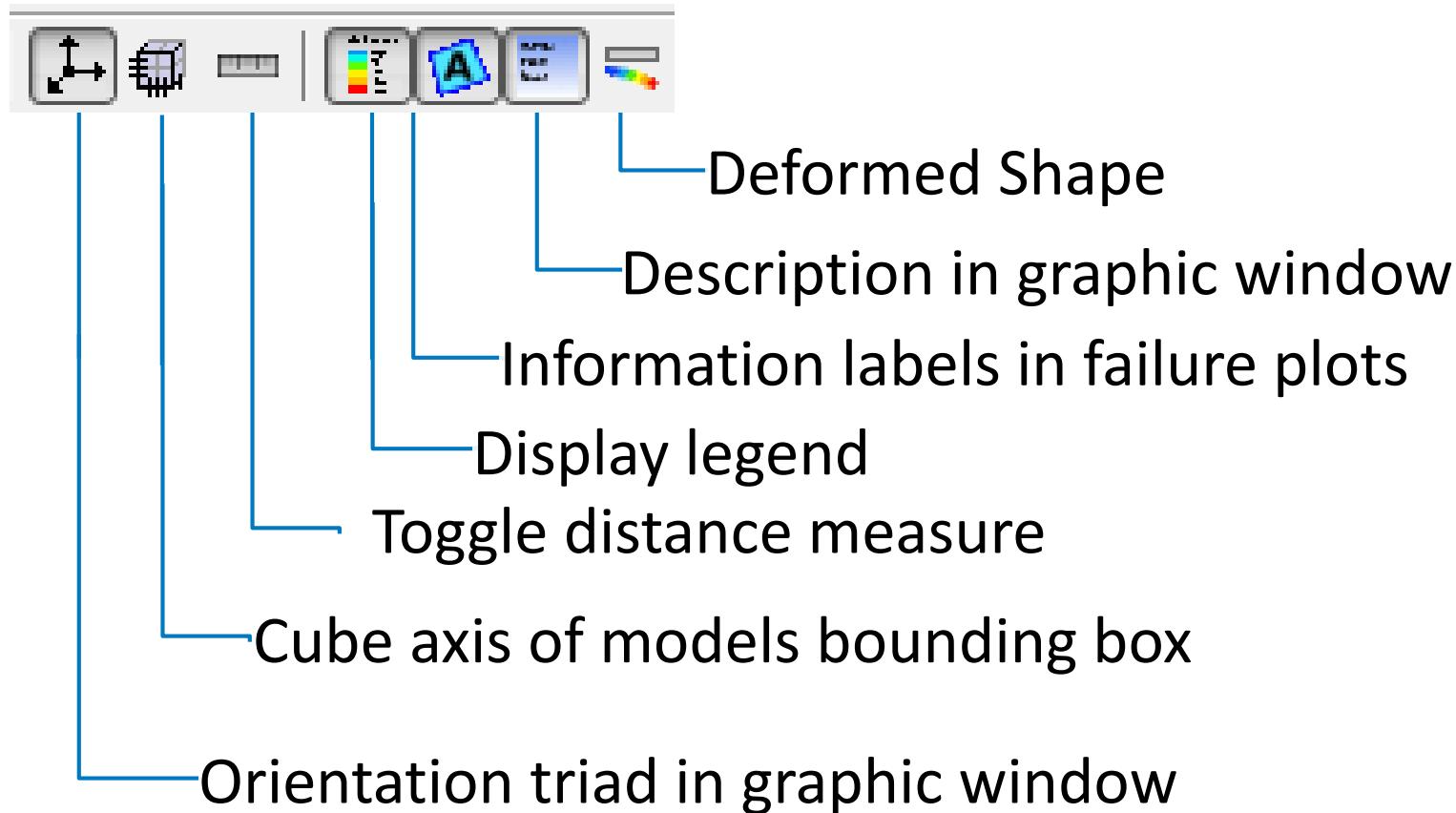
3.5 ANSYS Composite PrepPost Overview

- Tool Bar:



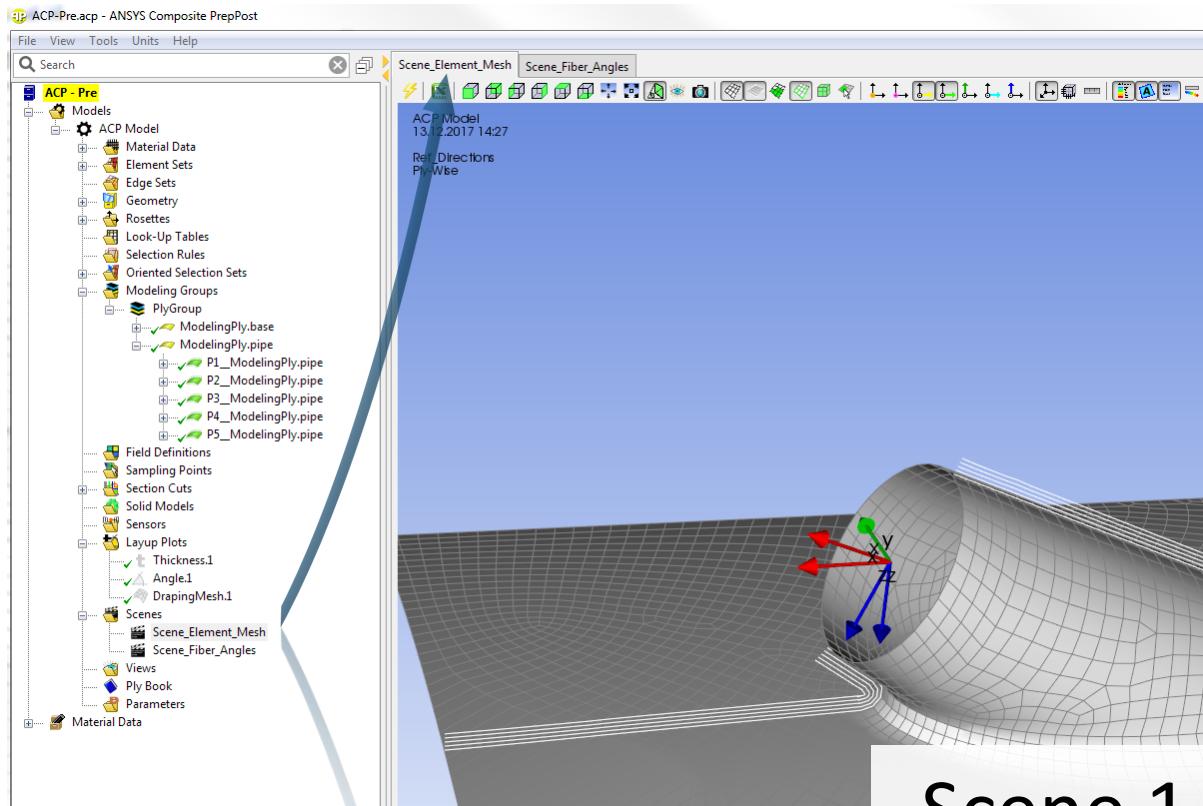
3.5 ANSYS Composite PrepPost Overview

- Tool Bar:

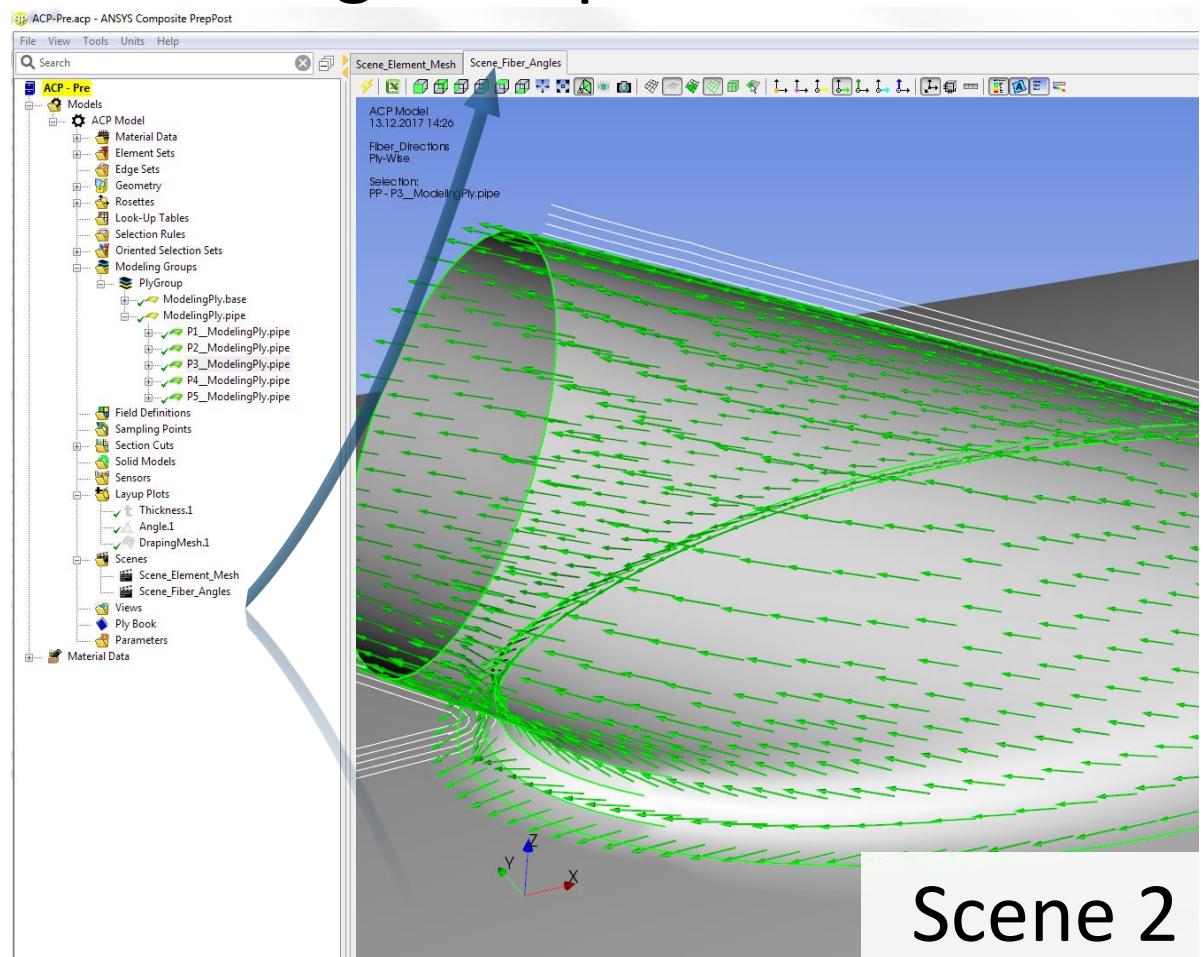


3.5 ANSYS Composite PrepPost Overview

- ANSYS Composites PrepPost allows using multiple Scenes with different view settings



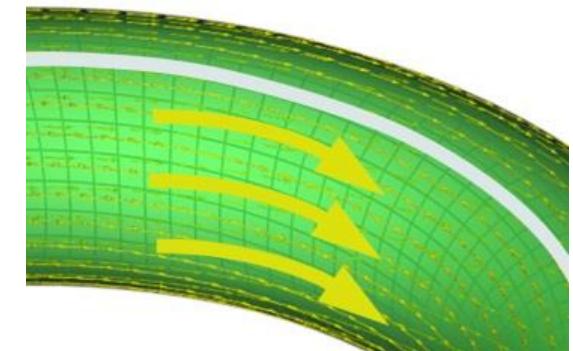
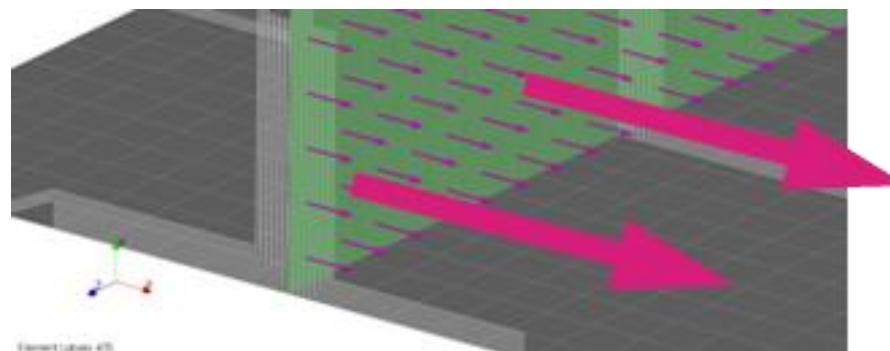
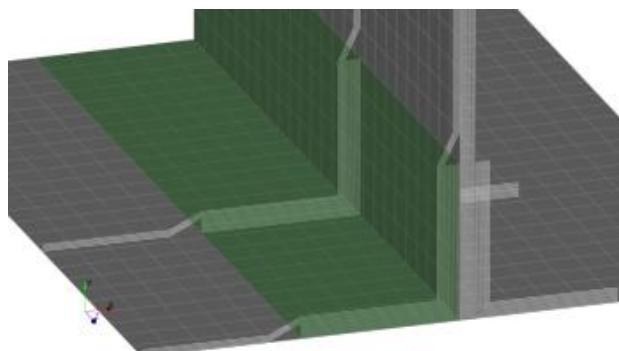
Scene 1



Scene 2

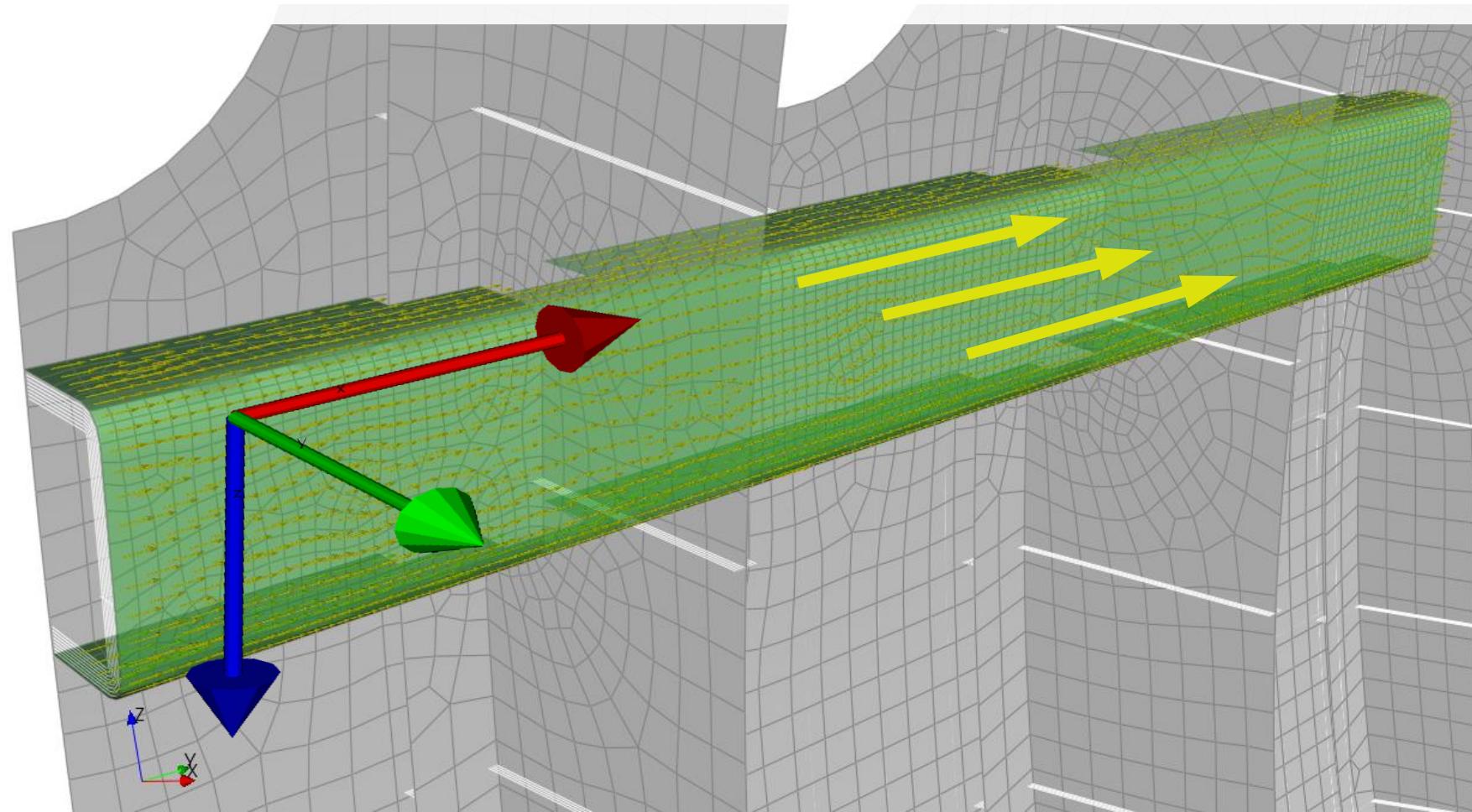
3.6 Composite Layup

- A composite layer is defined by selecting
 - the fabric to be used,
 - the area where this fabric should be placed,
 - the layup direction and
 - the fiber direction



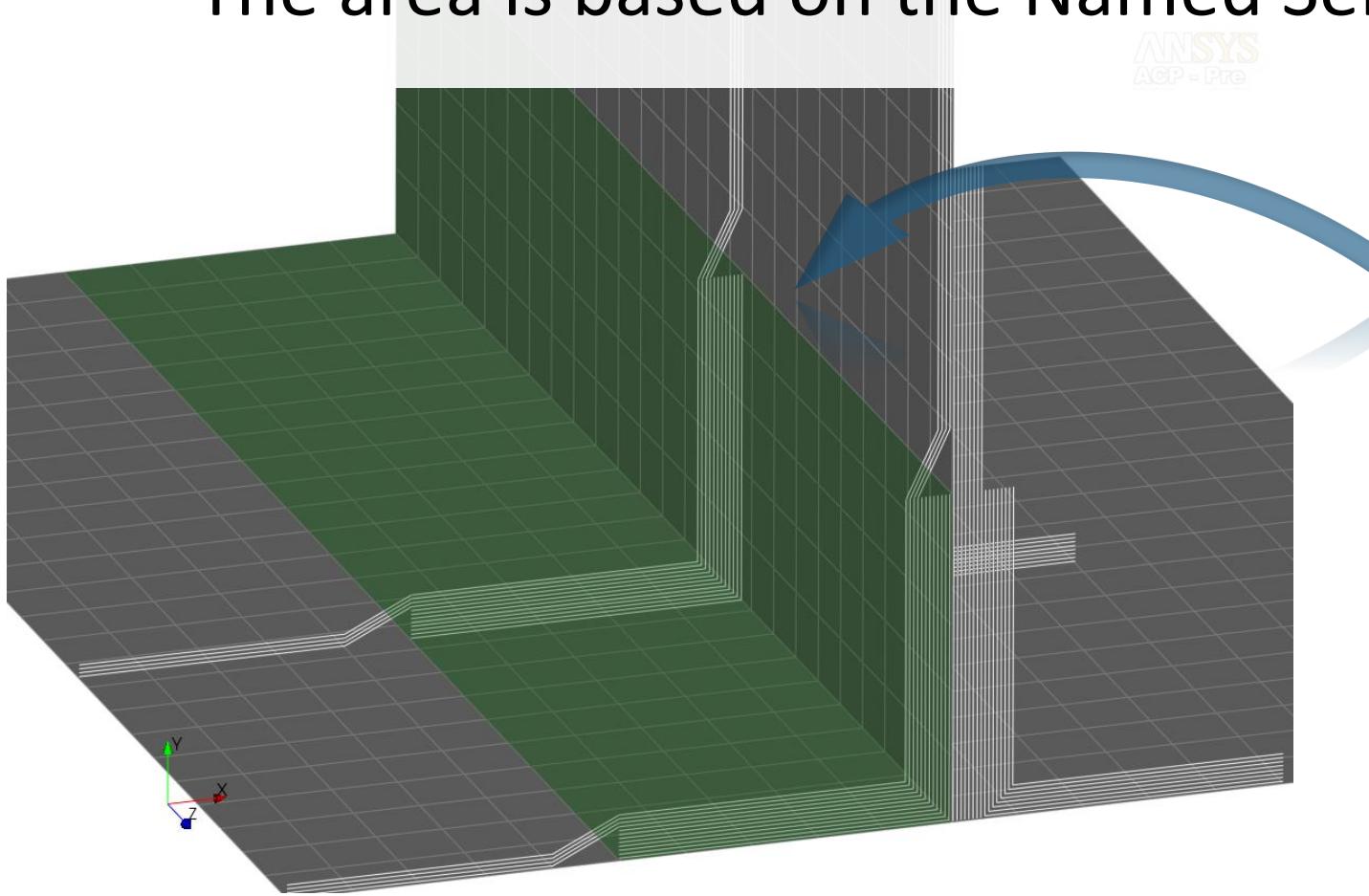
3.6 Composite Layup

- Fiber directions are defined by Rosettes



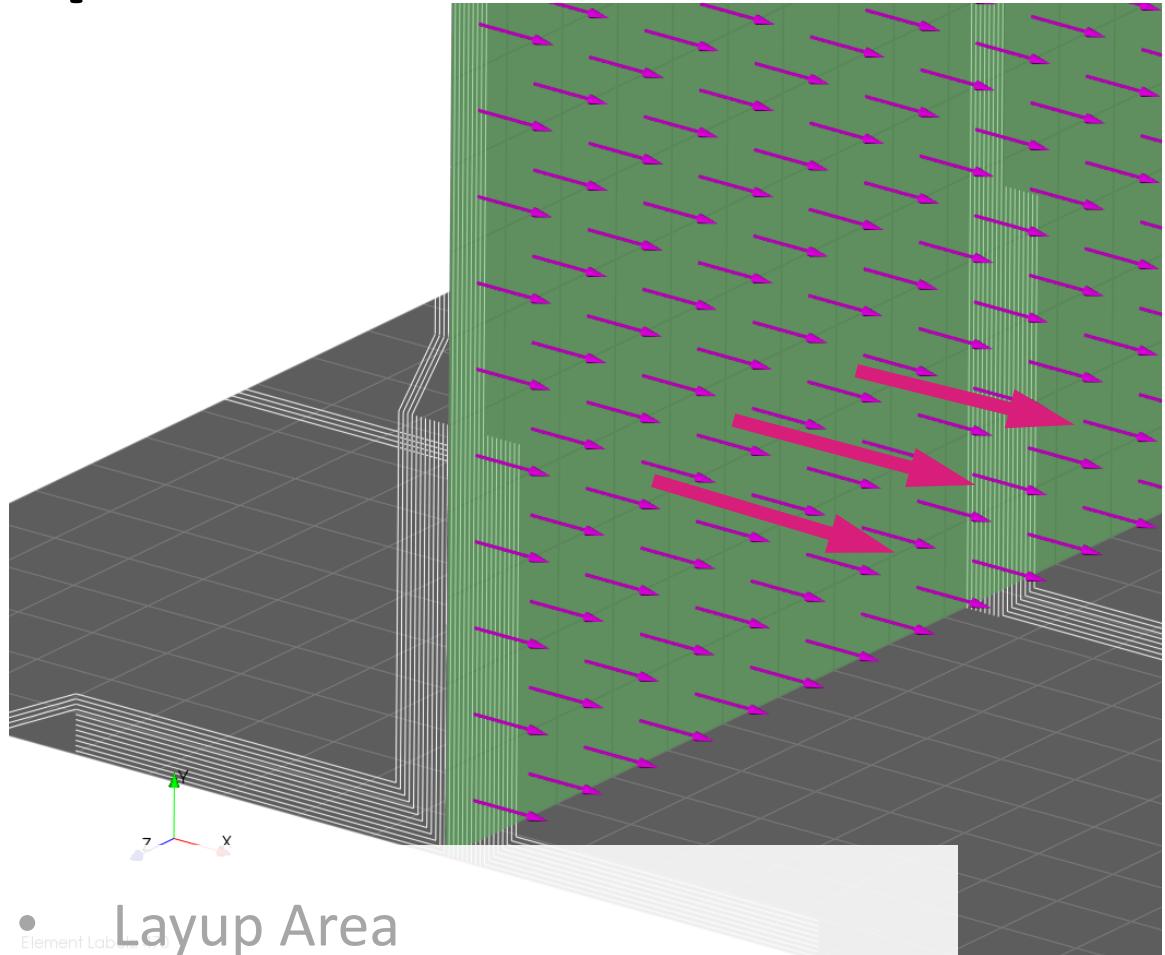
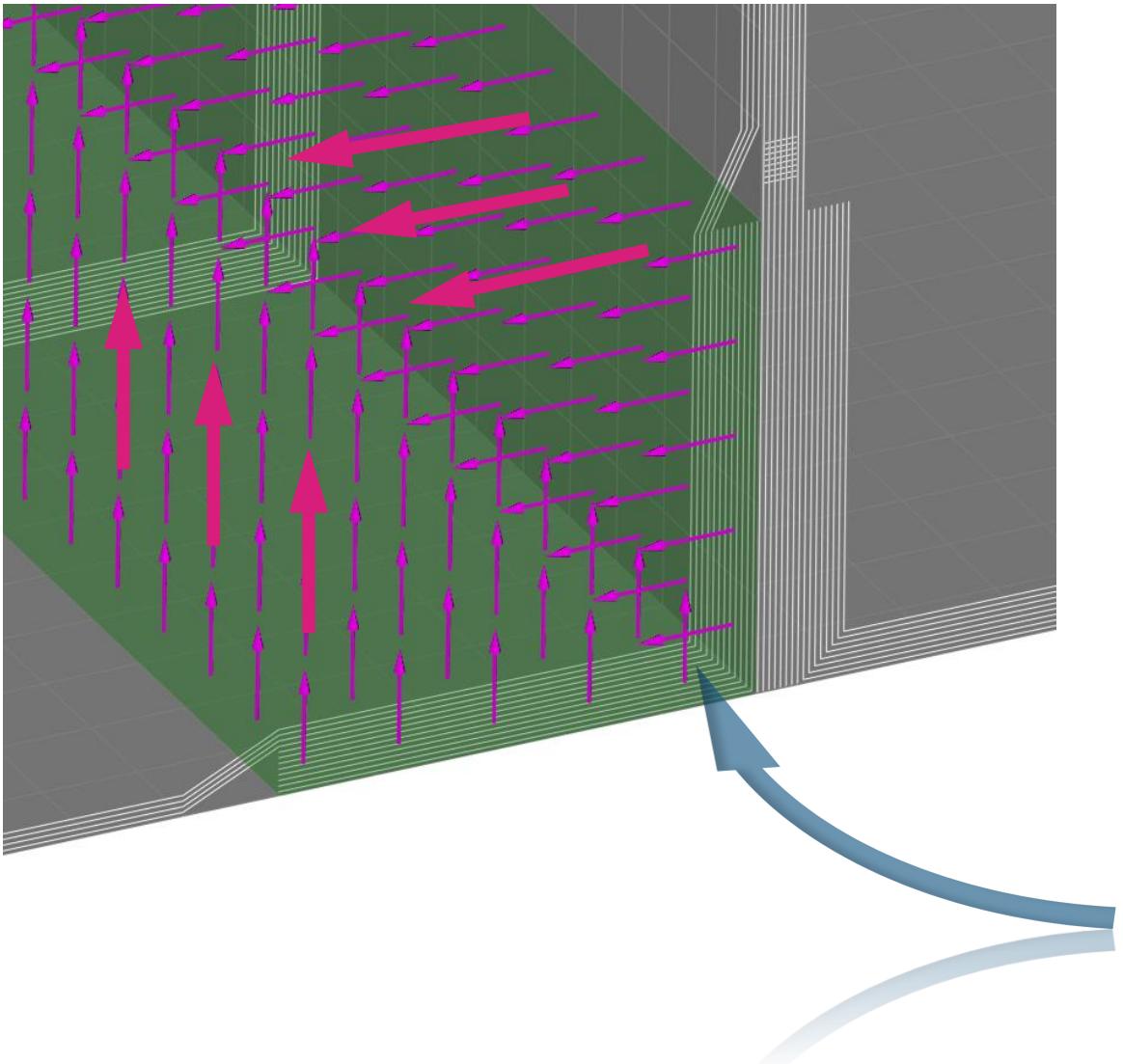
3.6 Composite Layup

- Oriented Selection Sets define the area the fabric will be placed on
- The area is based on the Named Selections



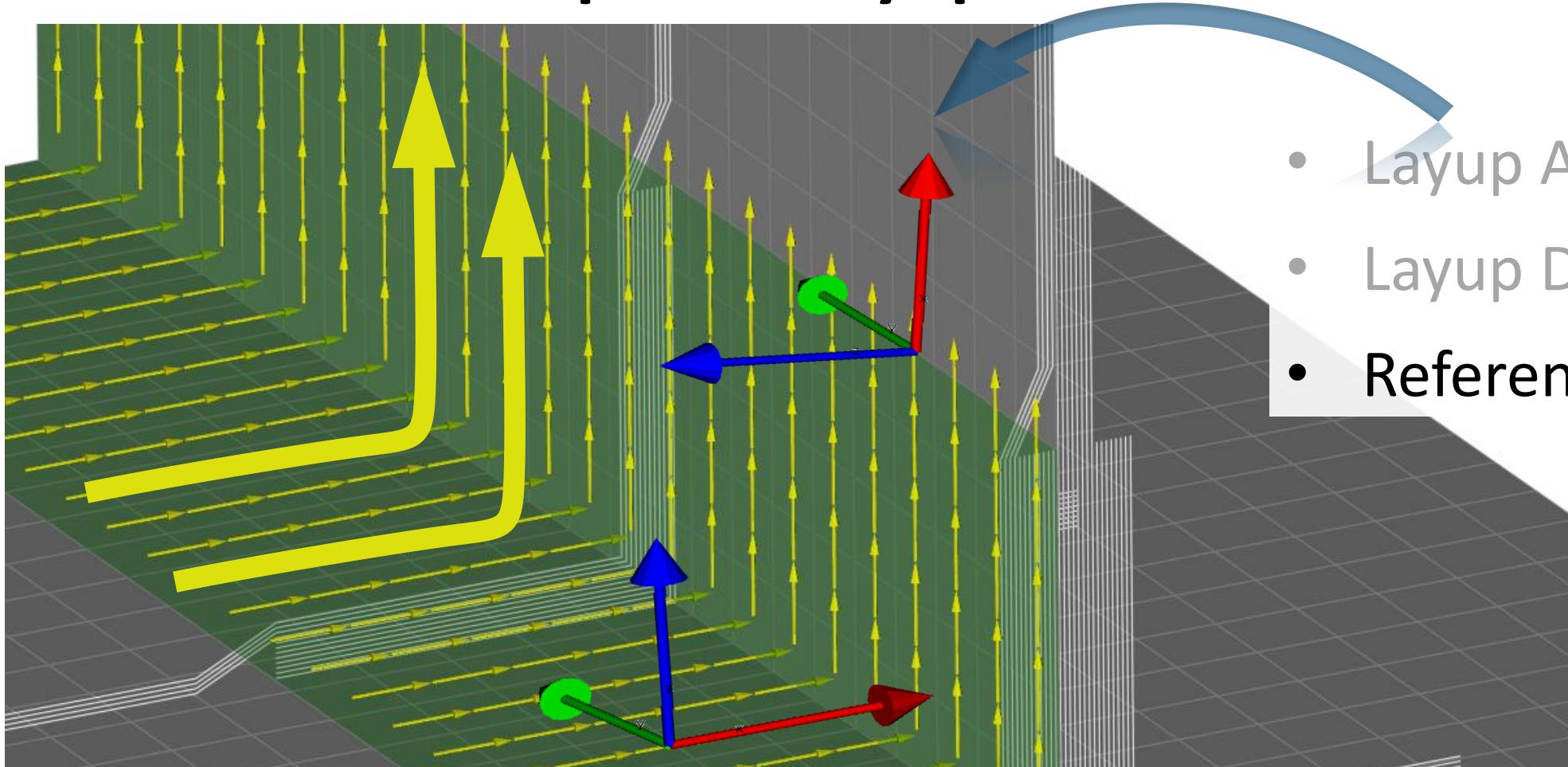
- Layup Area
- Layup Direction
- Reference Direction

3.6 Composite Layup



- Layup Area
- Layup Direction
- Reference Direction

3.6 Composite Layup



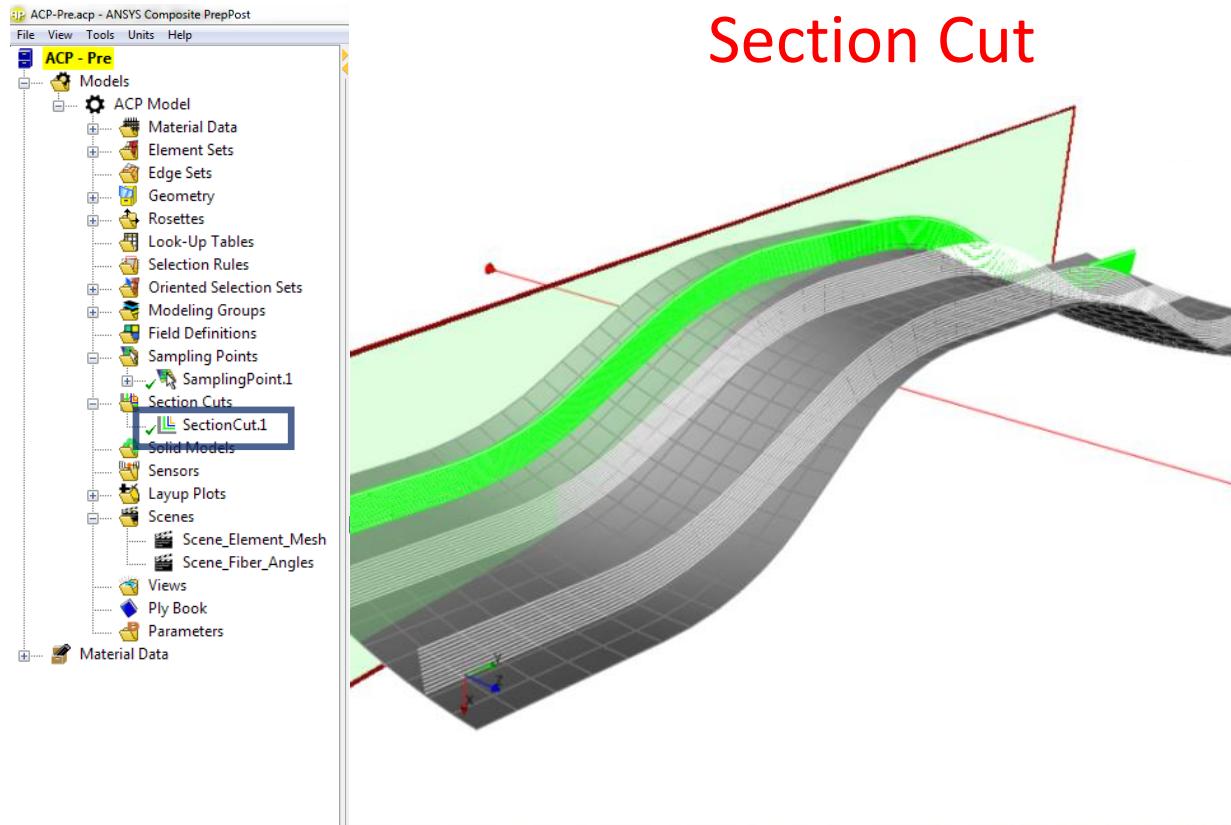
- Layup Area
- Layup Direction
- Reference Direction

- The Reference Direction (0° Layer) is defined by Rosettes

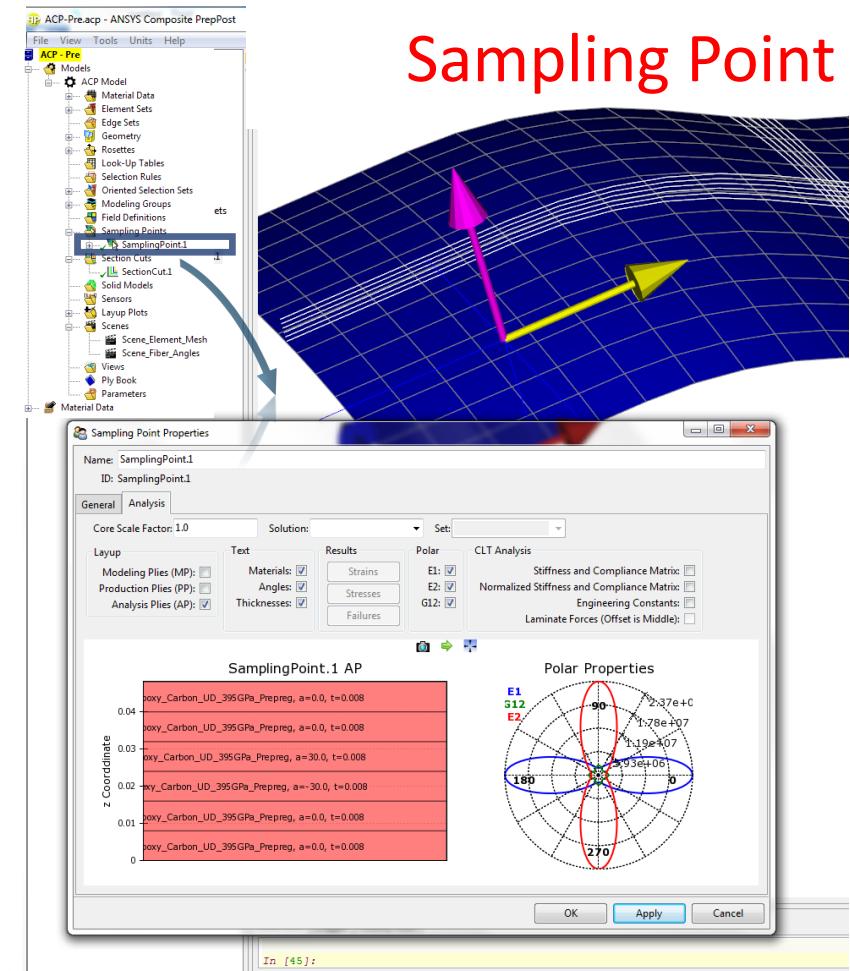
3.6 Composite Layup

- The composite layup can be checked by
 - Section Cuts and
 - Sampling Points

Section Cut



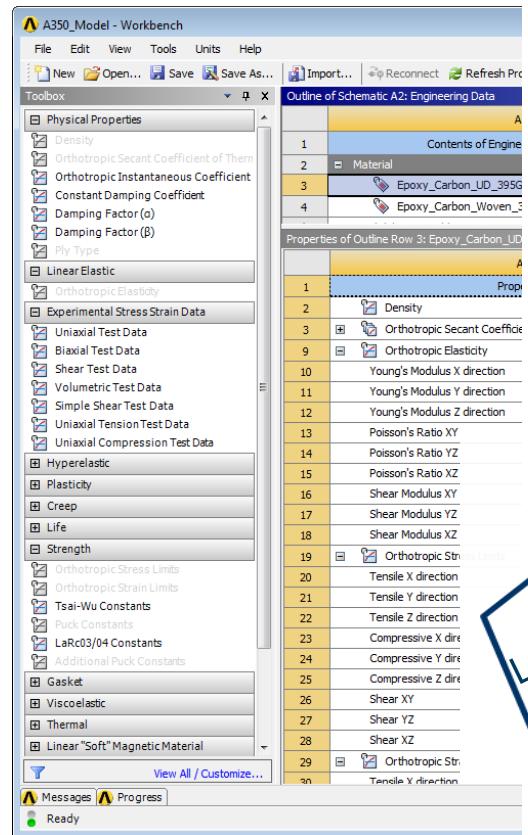
Sampling Point



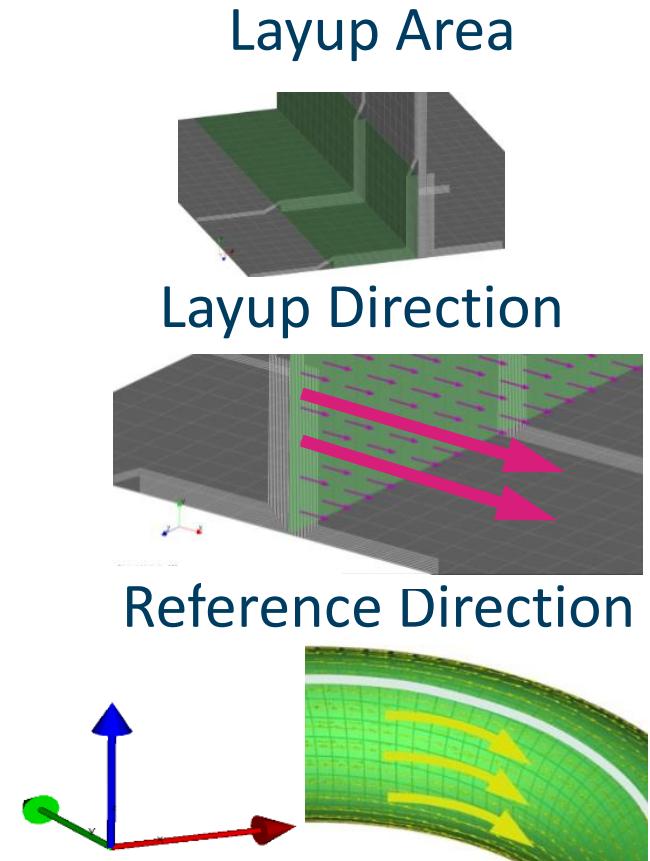
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3.6 Three Steps to a Composite Layup

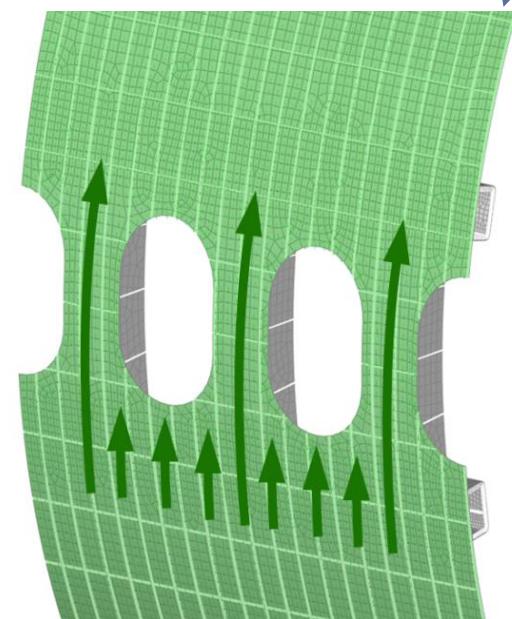
Material Data Fabrics/Stackups



Oriented Selection Sets



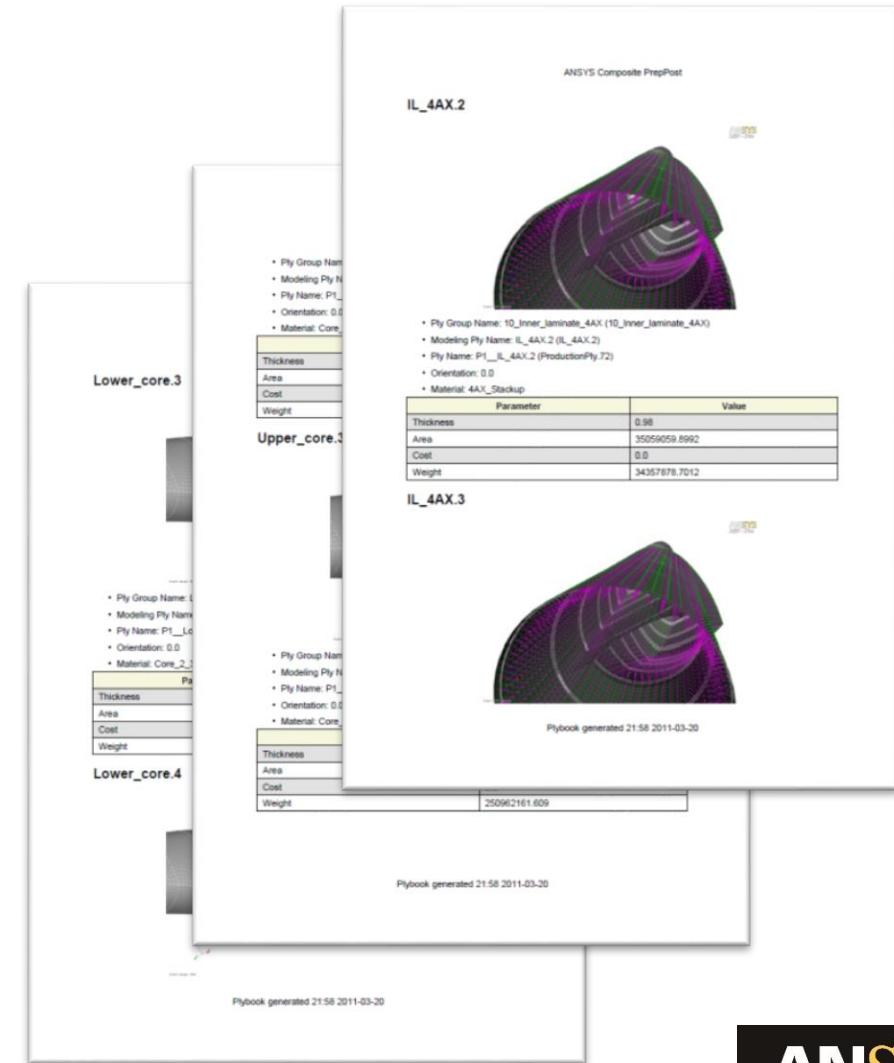
Layup



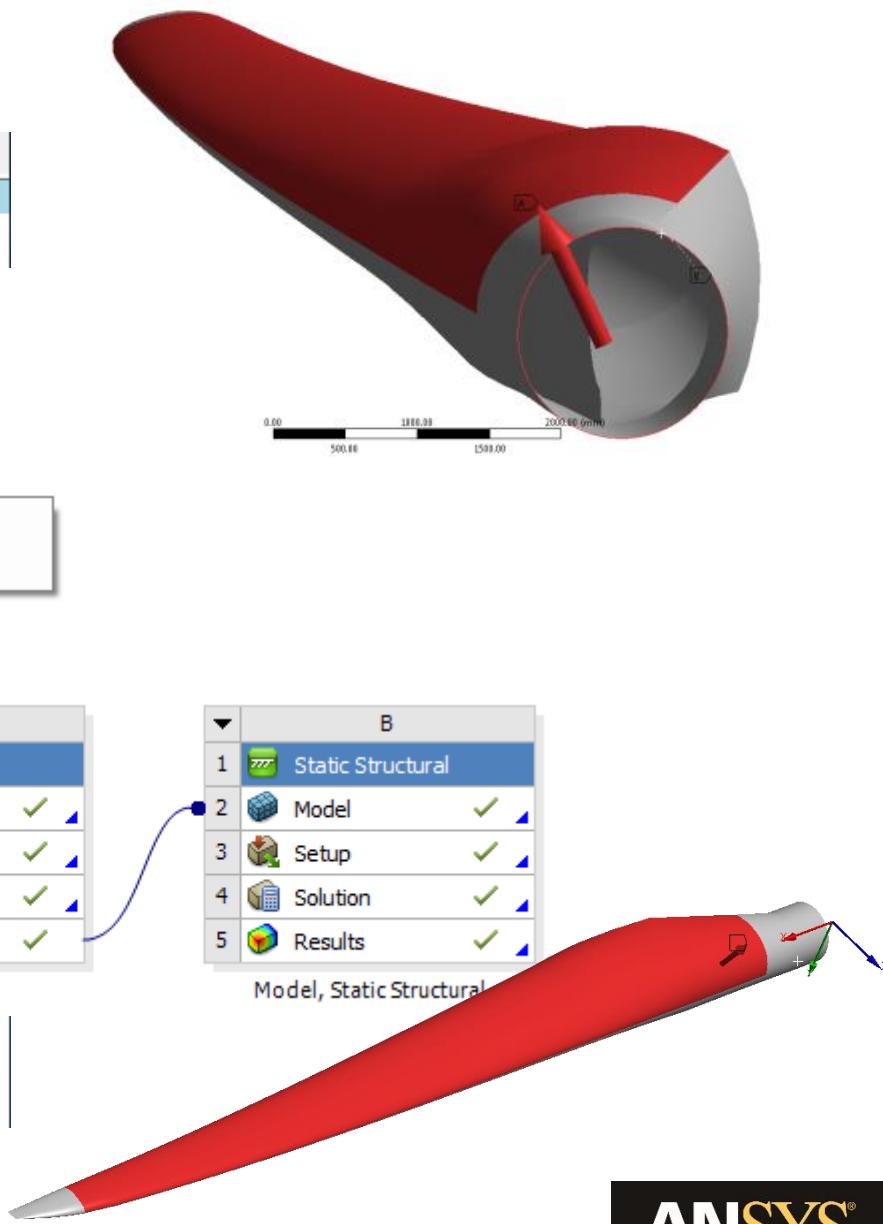
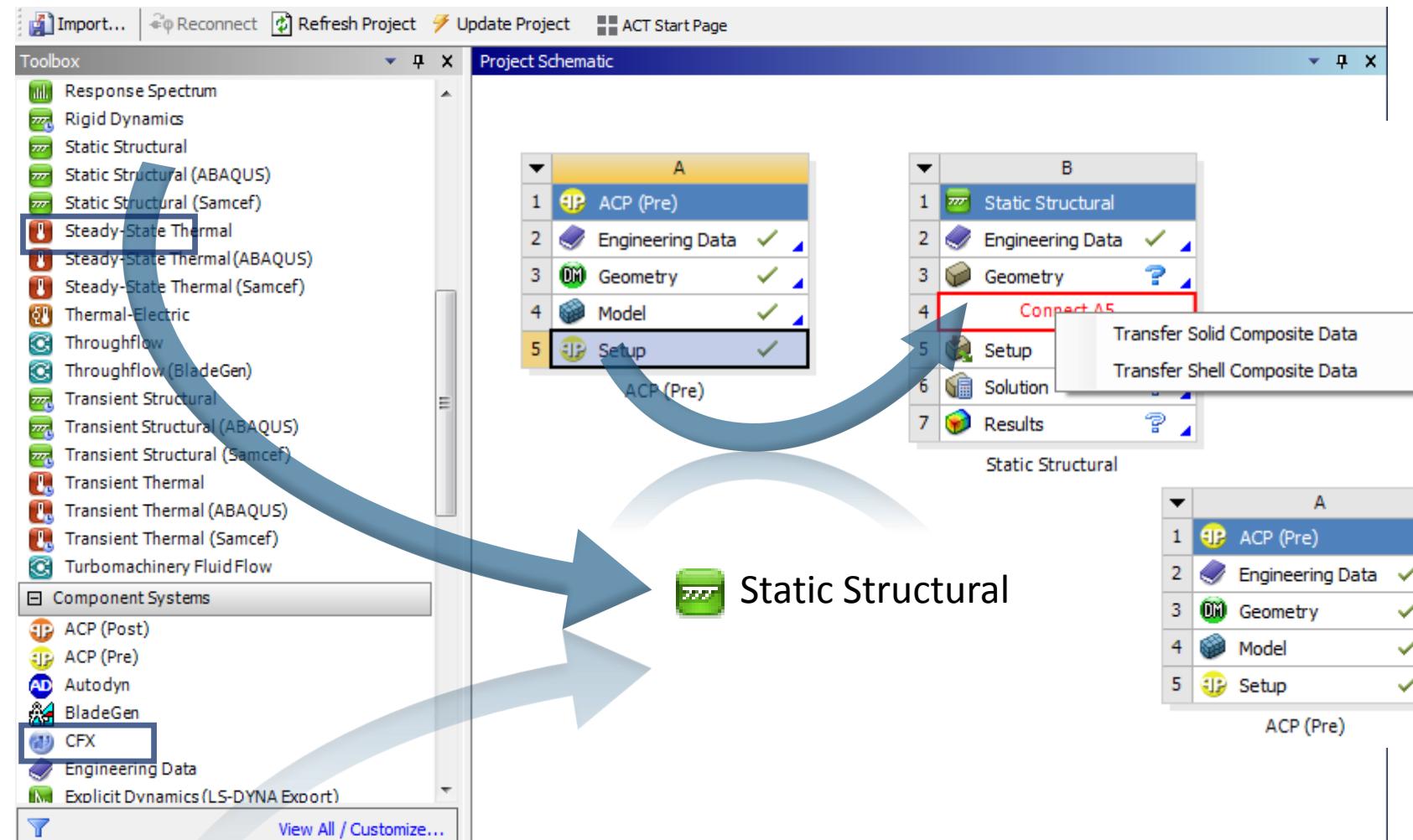
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3.6 Composite Layup

- ANSYS Composite PrepPost can create a ply book which can be used as a guideline for manufacturing
- The ply book lists all plies and materials used in the composite design as well as layup information and ply summaries

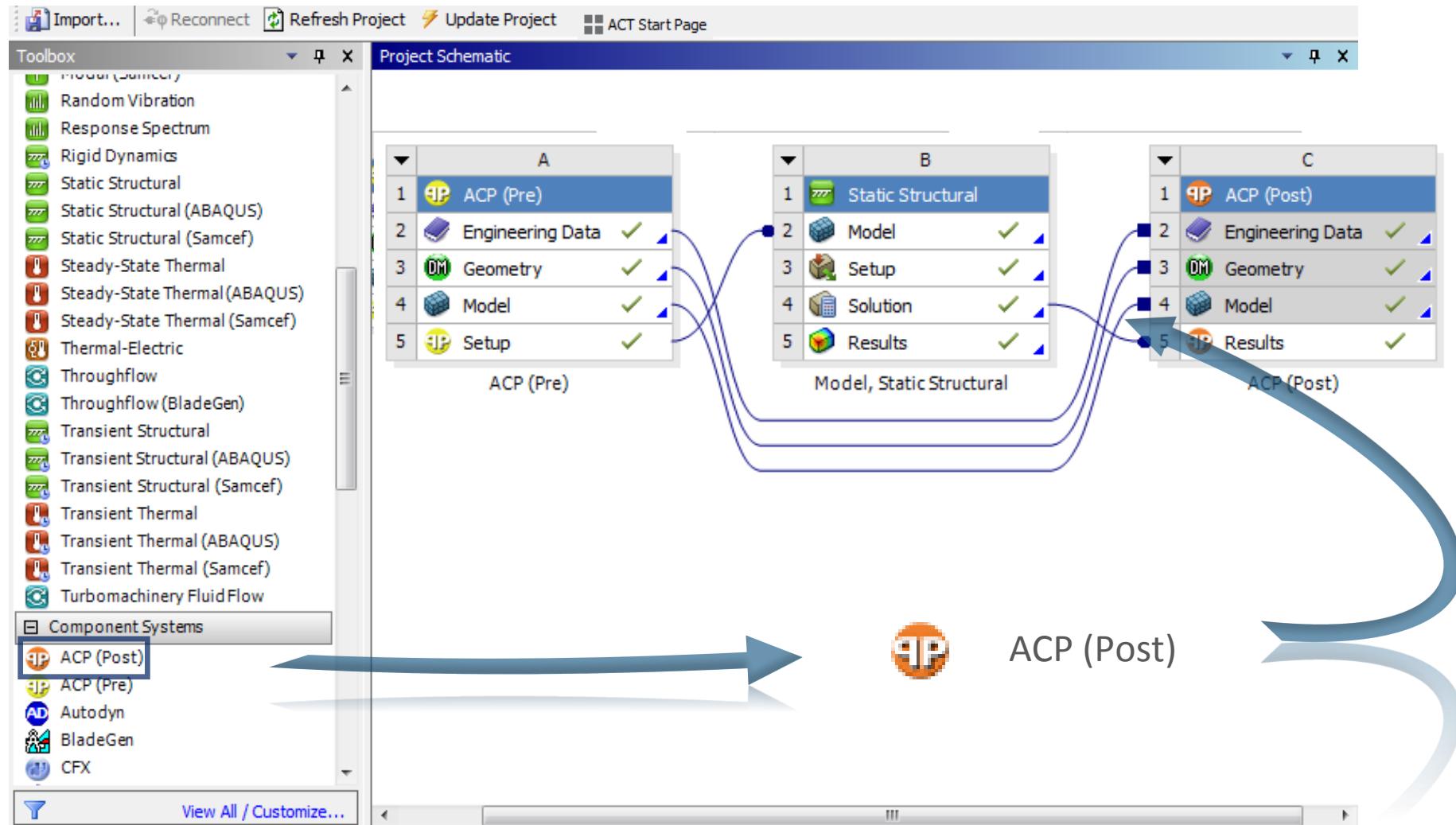


3.7 Analysis



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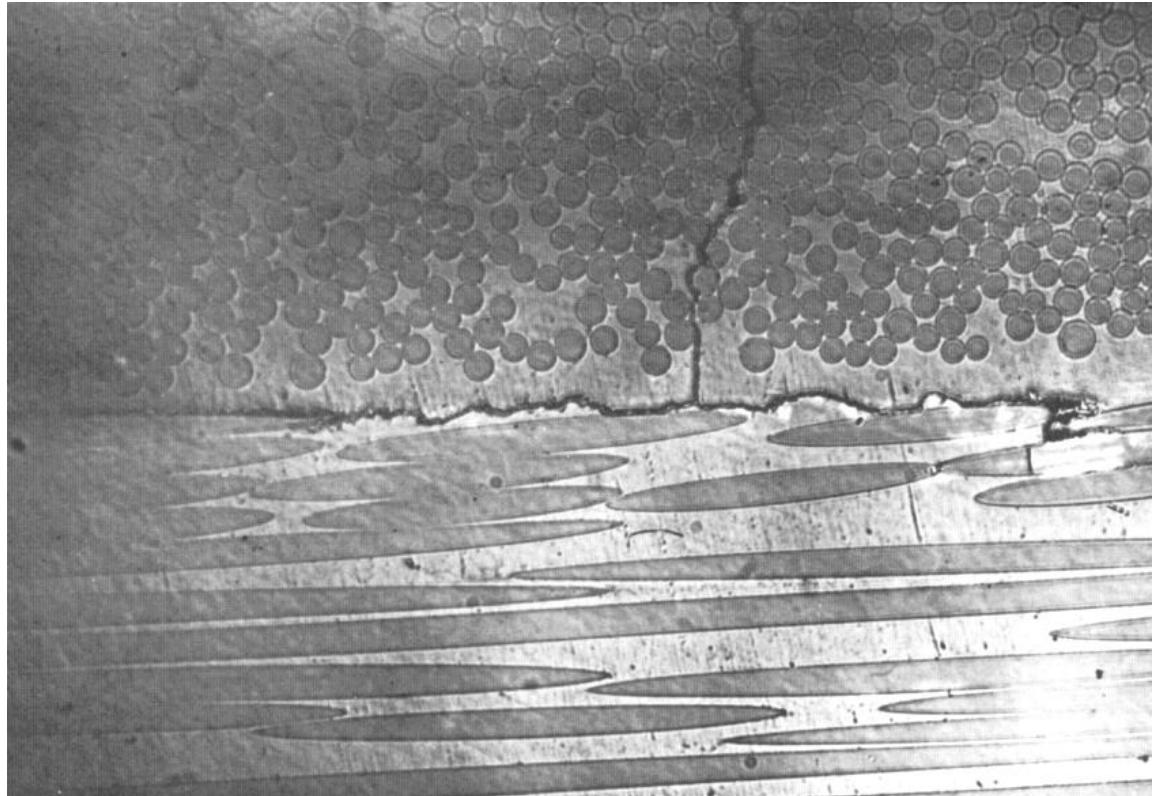
3.8 Postprocessing



3.8 Postprocessing

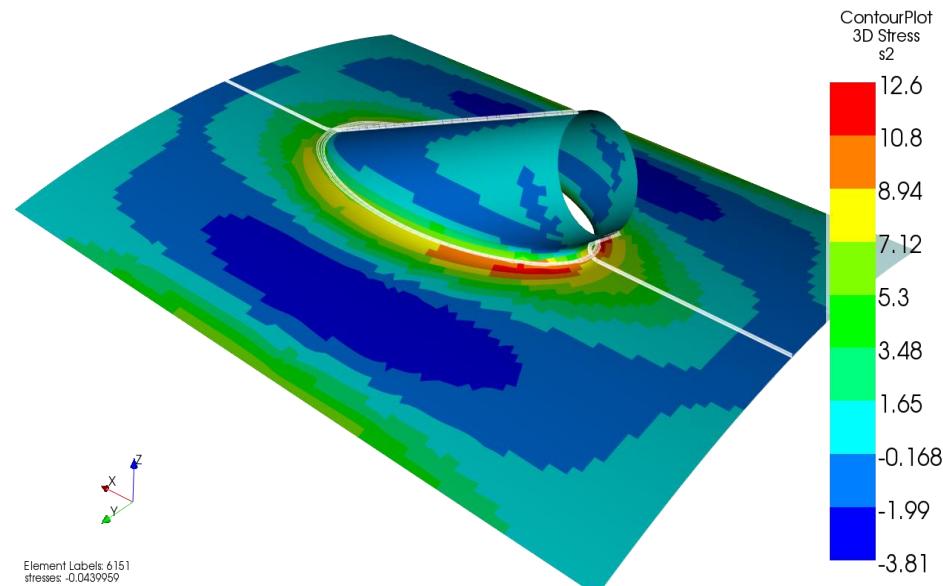
- Available Failure Criteria

- Max. Strain & Max. Stress
- Tsai-Wu
- Tsai-Hill
- Hoffman
- Hashin
- Puck
- LaRC
- Cuntze
- Face Sheet Wrinkling
- Core Failure



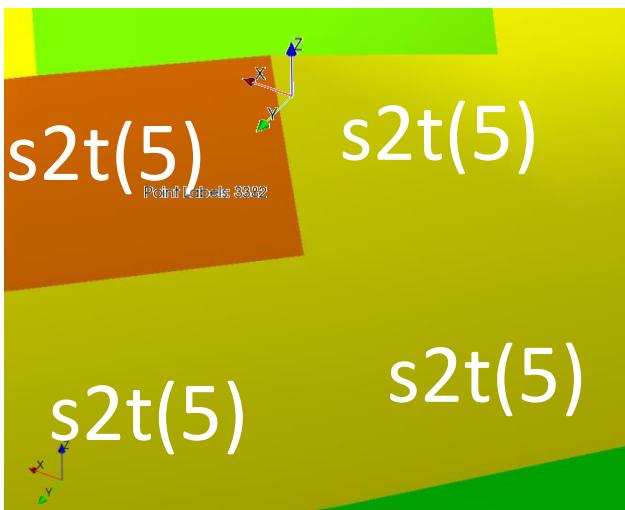
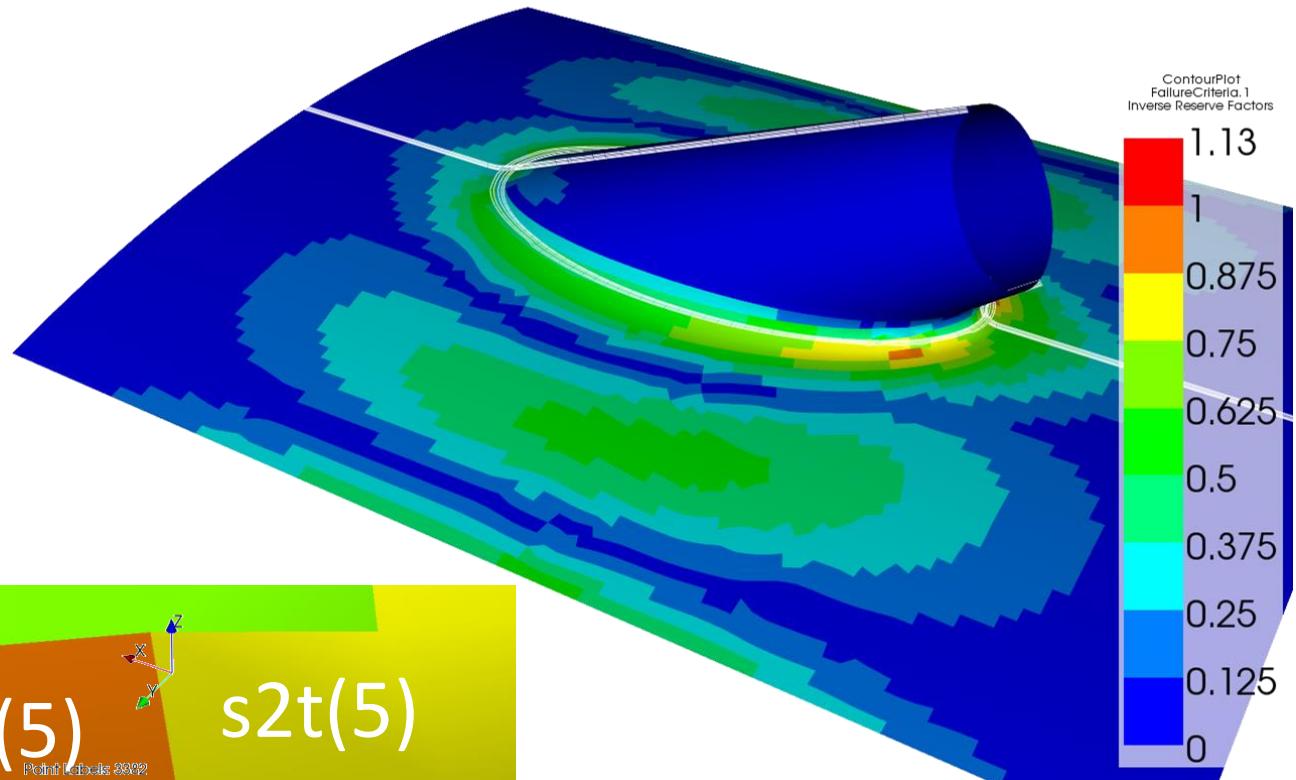
3.8 Postprocessing

- Evaluate stresses in
 - Fiber direction (S1)
 - In-plane transversal to fiber direction (S2)
 - Out of plane normal direction (s3)



3.8 Postprocessing

- View in one plot
 - Failure Criteria
 - Failure Mode
 - Critical Layer
 - Critical Loadstep



3. Summary ACP Introduction

- Integrated in ANSYS Workbench
- Intuitive modeling of composite layup
- Modeling process follows manufacturing
- Simple and fast modification of composite layup and composite designs possible
- State of the art failure criteria available
- Efficient postprocessing