S VERTICAL
Integrated Simulation Intelligence

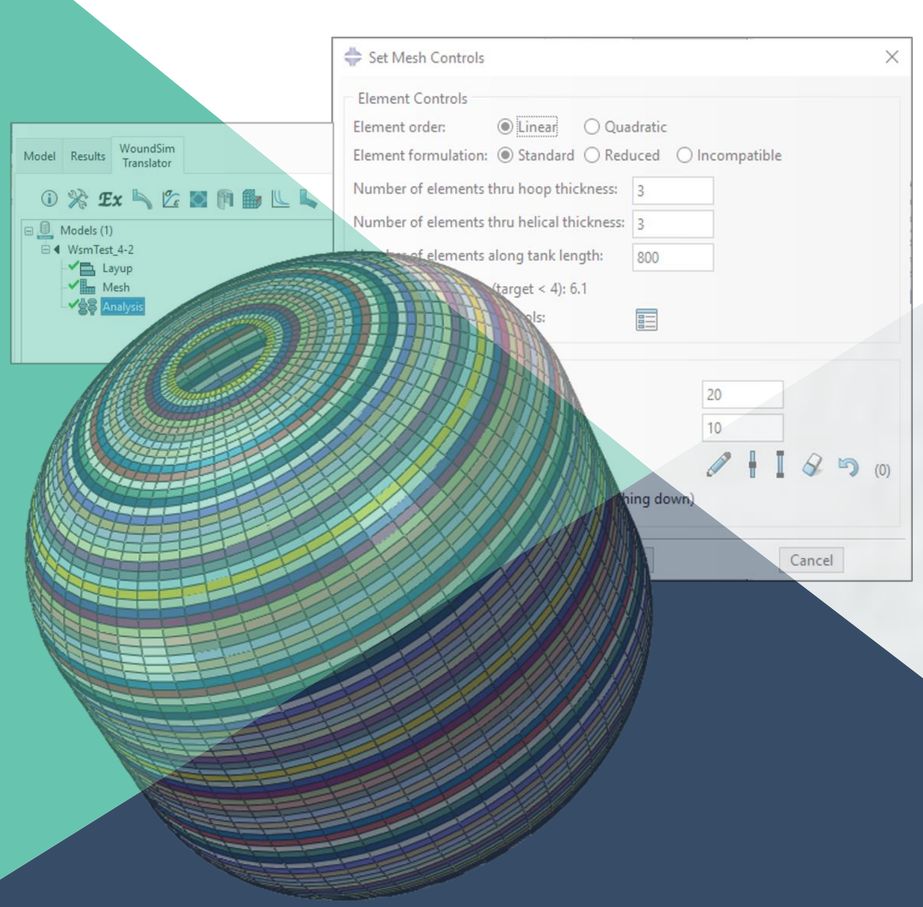
QUSTOMAPPS

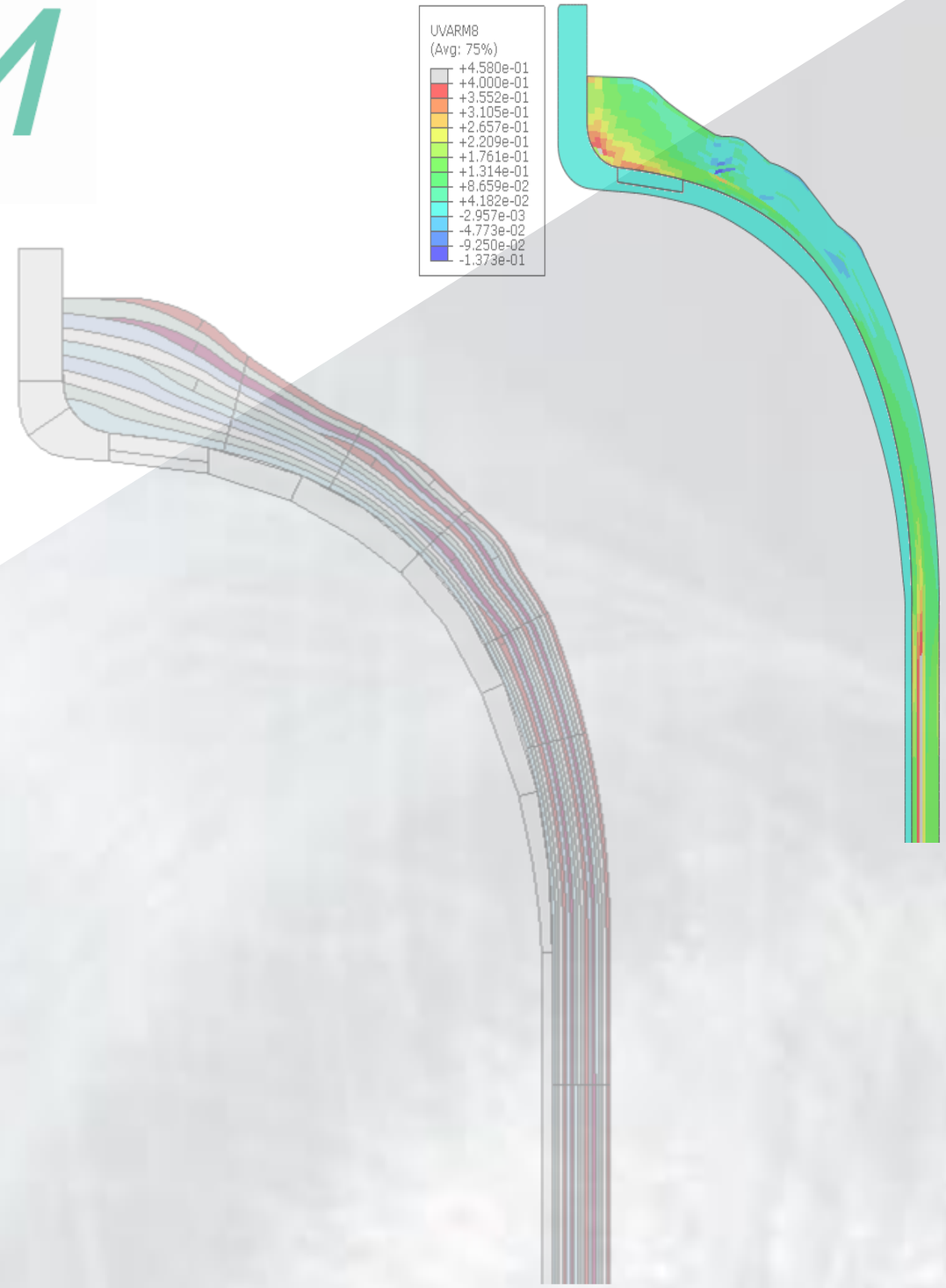
WoundSIM

THE integrated intelligence for composite pressure vessels design and simulation

Major Release: WoundSim 2023

Release Notes





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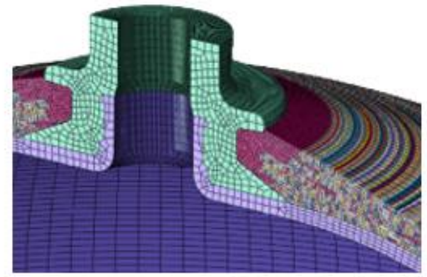
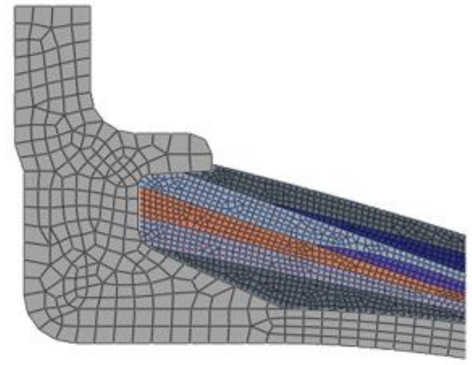
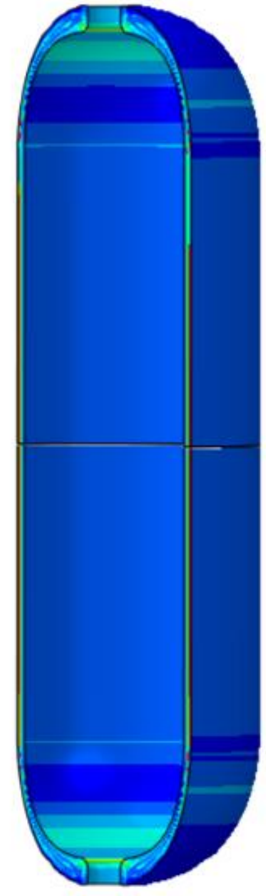
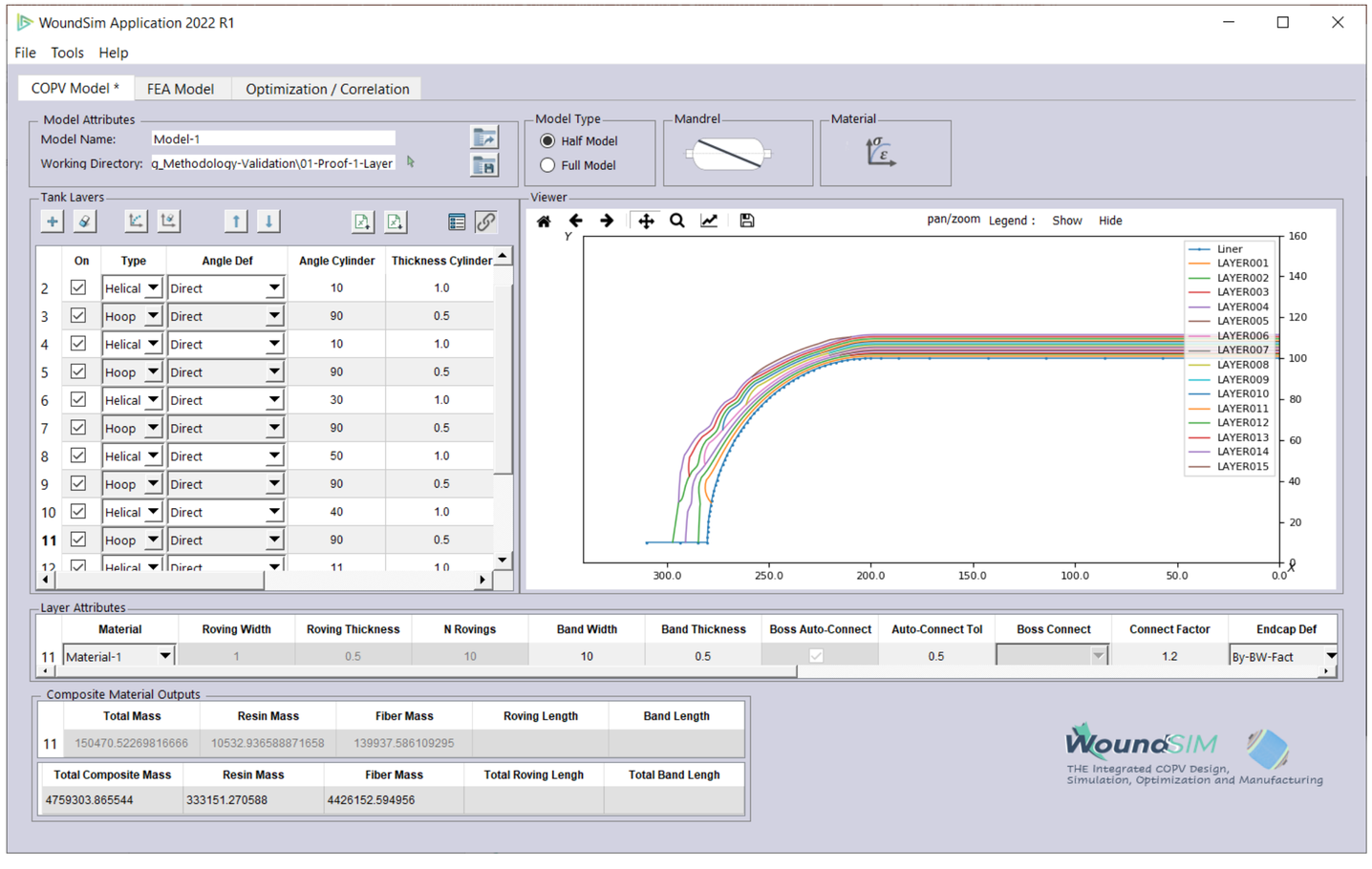
WoundSim-2022 Major Release Main New Features

- ✓ New user-friendly **GUI**,
- ✓ Flexible layup construction with advanced **LAYER-BY-LAYER** controls,
- ✓ Support for **DOILIES**,
- ✓ Geometry **SMOOTHING** parameters and tapered layer endcaps,
- ✓ Enhancements to **WIND ANGLES** computation near layer turn-around positions,
- ✓ Abaqus/**EXPLICIT** solver support to model drop tests and high-speed impacts,
- ✓ Enhanced **MESHING** parameters including automatic mesh possibility,

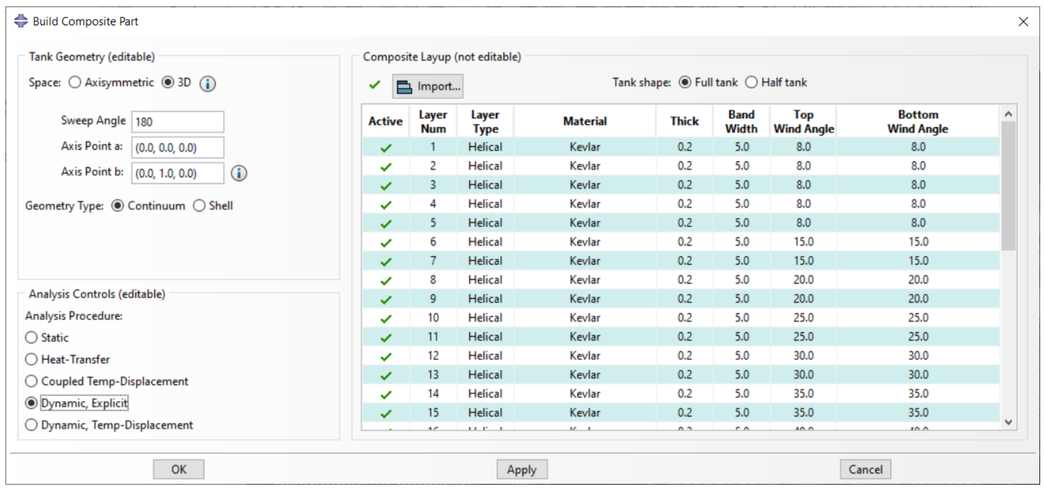






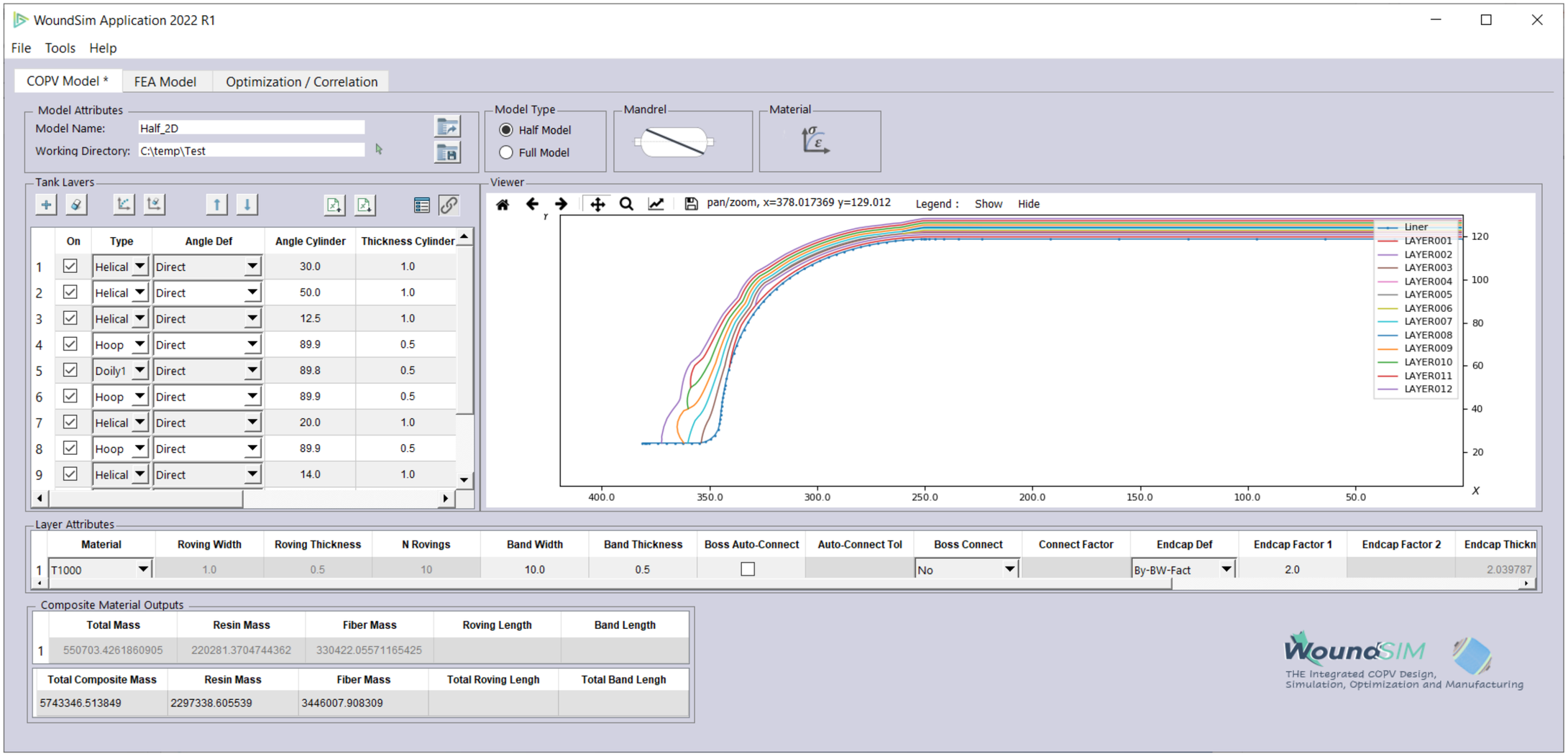


Explicit Solver Support



What's New In WoundSim 2022

- ✓ New user-friendly **USER INTERFACE**

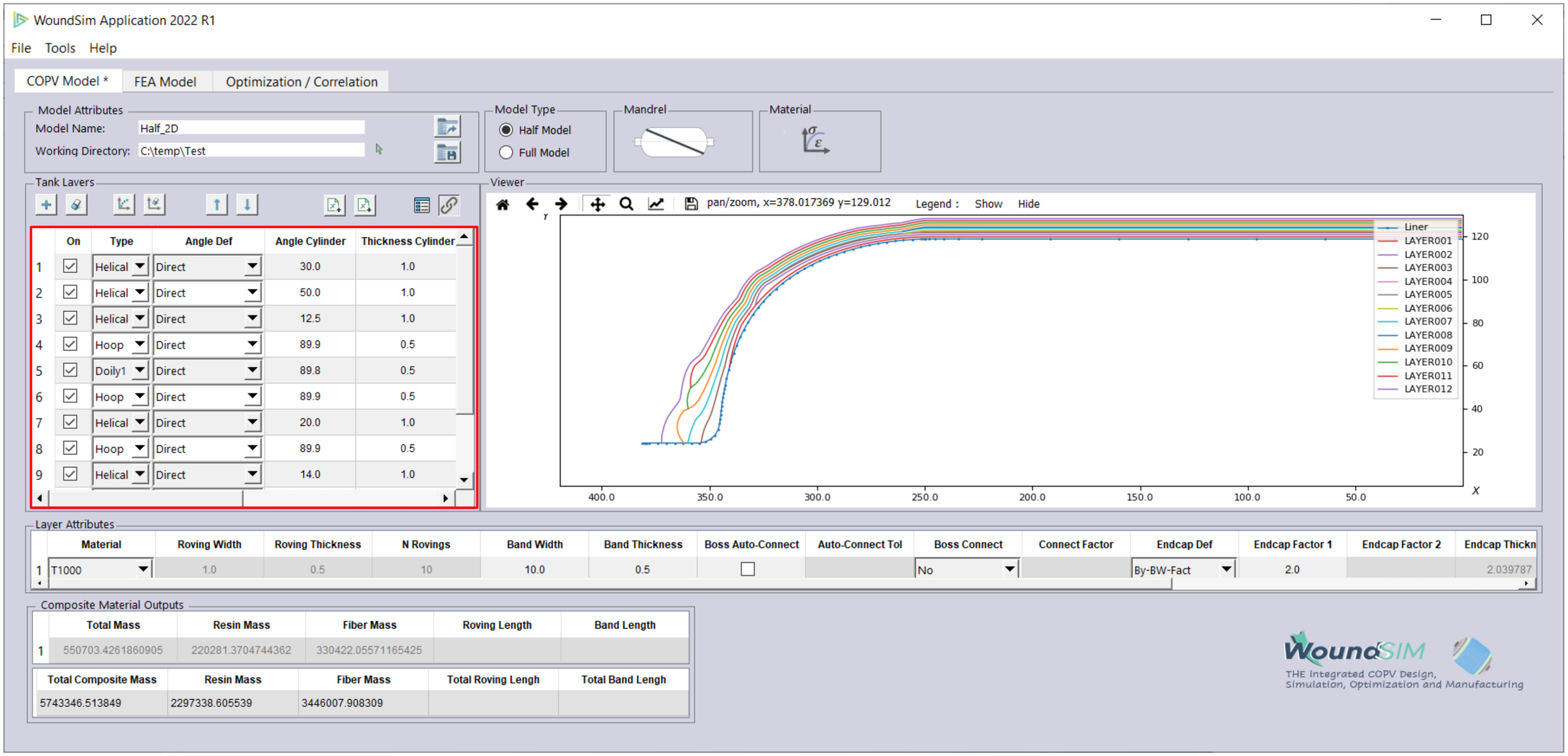


	On	Type	Angle Def	Angle Cylinder	Thickness Cylinder
1	☑	Helical	Direct	30.0	1.0
2	☑	Helical	Direct	50.0	1.0
3	☑	Helical	Direct	12.5	1.0
4	☑	Hoop	Direct	89.9	0.5
5	☑	Doily1	Direct	89.8	0.5
6	☑	Hoop	Direct	89.9	0.5
7	☑	Helical	Direct	20.0	1.0
8	☑	Hoop	Direct	89.9	0.5
9	☑	Helical	Direct	14.0	1.0

	Material	Roving Width	Roving Thickness	N Rovings	Band Width	Band Thickness	Boss Auto-Connect	Auto-Connect Tol	Boss Connect	Connect Factor	Endcap Def	Endcap Factor 1	Endcap Factor 2	Endcap Thickn
1	T1000	1.0	0.5	10	10.0	0.5	☐		No		By-BW-Fact	2.0		2.039787

What's New In WoundSim 2022

- ✓ New **LAYOUT-TABLE** with additional features



	On	Type	Angle Def	Angle Cylinder	Thickness Cylinder
1	☑	Helical	Direct	30.0	1.0
2	☑	Helical	Direct	50.0	1.0
3	☑	Helical	Direct	12.5	1.0
4	☑	Hoop	Direct	89.9	0.5
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8	☑	Hoop	Direct	89.9	0.5
9	☑	Helical	Direct	14.0	1.0

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1	T1000	1.0	0.5	10	10.0	0.5	☐		No		By-BW-Fact	2.0		2.039787

What's New In WoundSim 2022

- ✓ New **LAYERS CONTROLS**

WoundSim Application 2022 R1

File Tools Help

COPV Model * | FEA Model | Optimization / Correlation

Model Attributes

Model Name: Half_2D

Working Directory: C:\temp\Test

Model Type

(•) Half Model

( ) Full Model

Mandrel

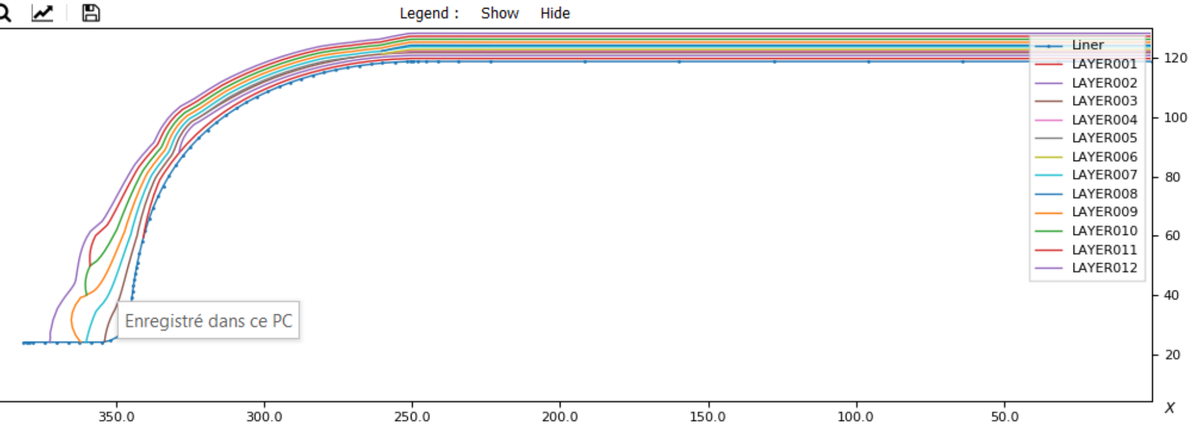
Material

Tank Layers

	On	Type	Angle Def	Angle Cylinder	Thickness Cylinder
1	☑	Helical	Direct	30.0	1.0
2	☑	Helical	Direct	50.0	1.0
3	☑	Helical	Direct	12.5	1.0
4	☑	Hoop	Direct	89.9	0.5
5	☑	Doily1	Direct	89.8	0.5
6	☑	Hoop	Direct	89.9	0.5
7	☑	Helical	Direct	20.0	1.0
8	☑	Hoop	Direct	89.9	0.5
9	☑	Helical	Direct	14.0	1.0

Viewer

Legend : Show Hide



Layer Attributes

	Material	Roving Width	Roving Thickness	N Rovings	Band Width	Band Thickness	Boss Auto-Connect	Auto-Connect Tol	Boss Connect	Connect Factor	Endcap Def	Endcap Factor 1	Endcap Factor 2	Endcap Thickn
1	T1000	1.0	0.5	10	10.0	0.5	☐		No		By-BW-Fact	2.0		2.039787

Composite Material Outputs

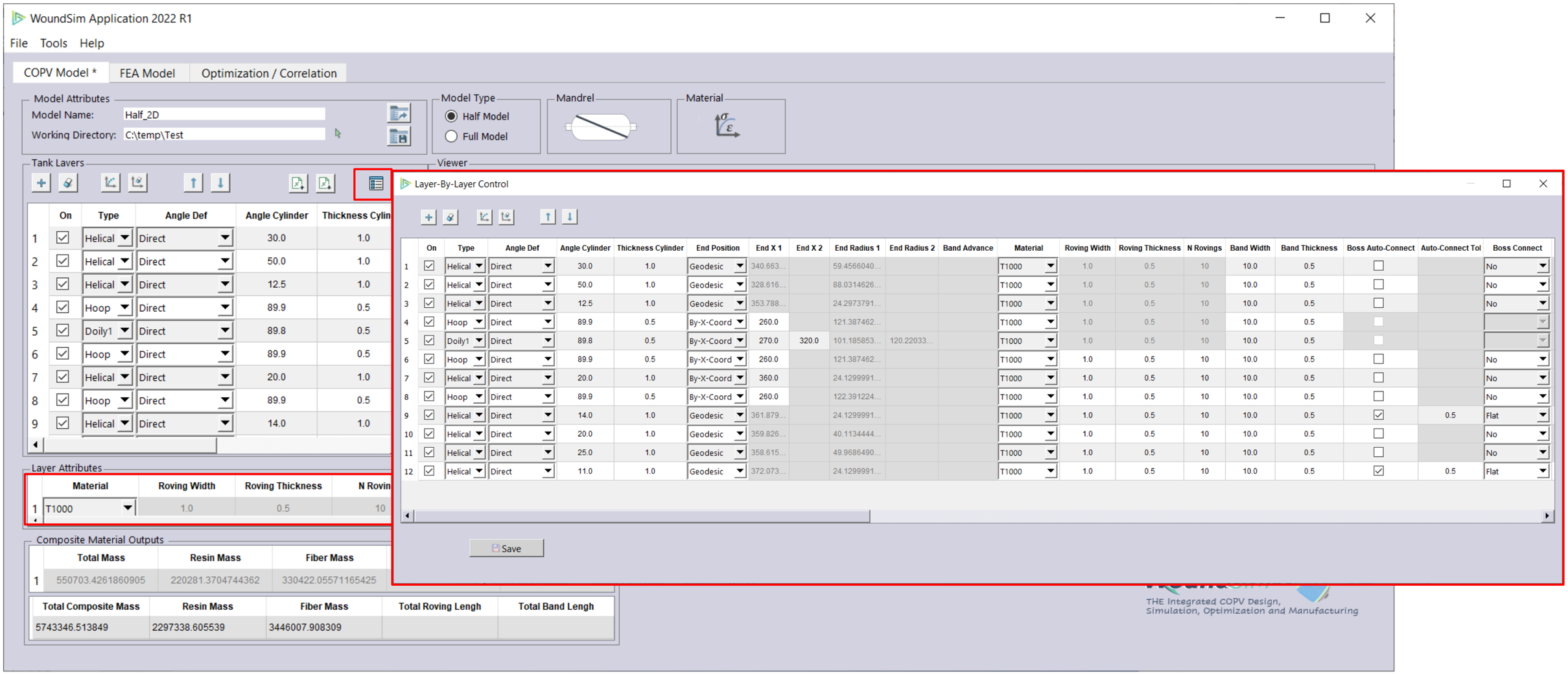
	Total Mass	Resin Mass	Fiber Mass	Roving Length	Band Length
1	550703.4261860905	220281.3704744362	330422.05571165425		

Total Composite Mass	Resin Mass	Fiber Mass	Total Roving Lengh	Total Band Lengh
5743346.513849	2297338.605539	3446007.908309		

WoundSIM
THE Integrated COPV Design, Simulation, Optimization and Manufacturing

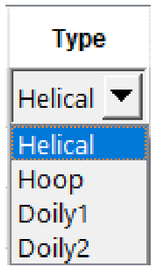
What's New In WoundSim 2022

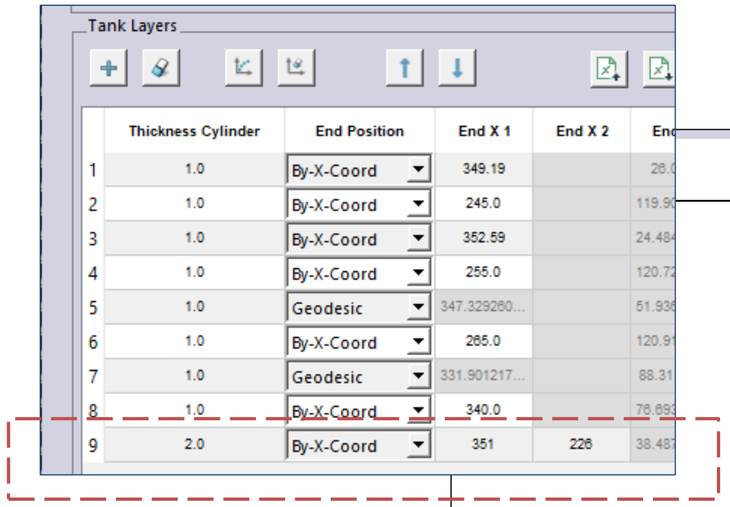
- ✓ Flexible layup construction with advanced **LAYER-BY-LAYER** controls

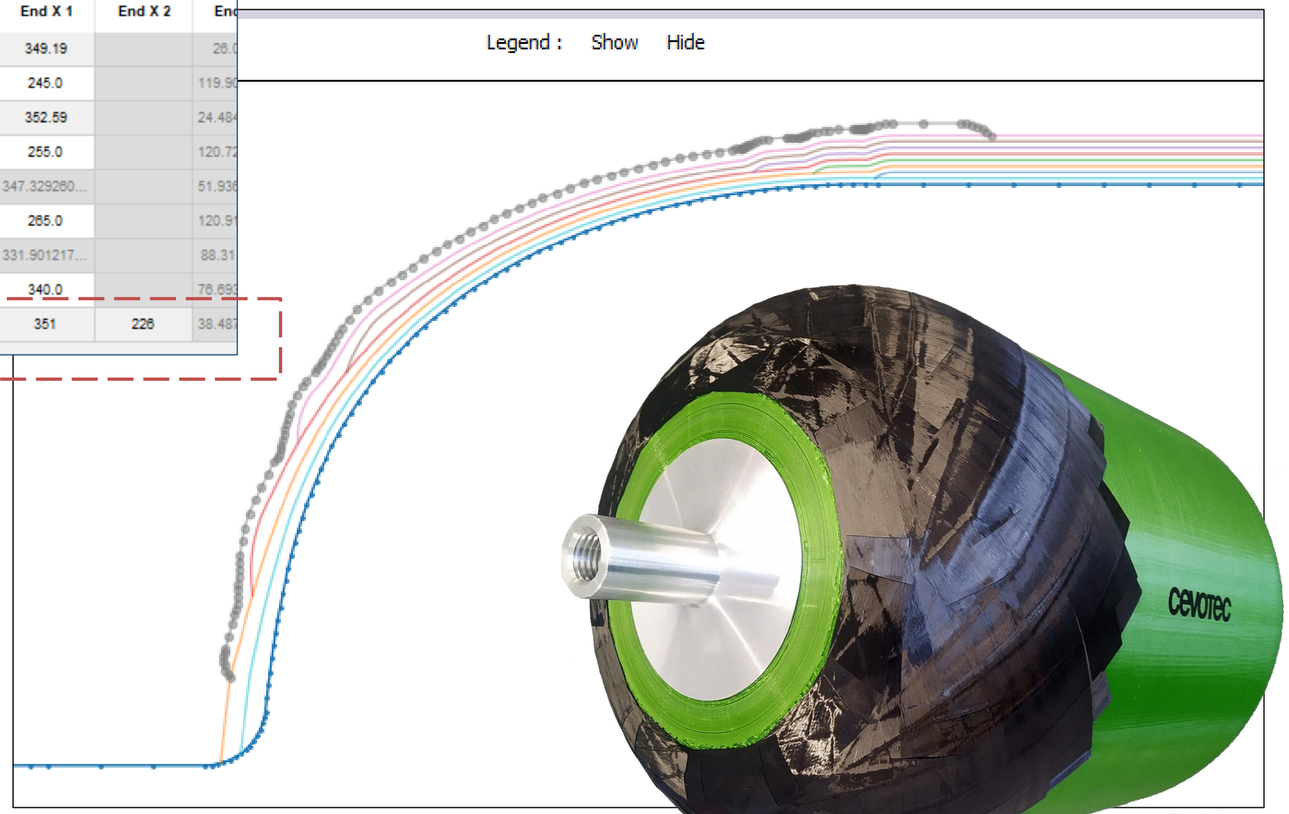


What's New In WoundSim 2022

- ✓ Support for **DOILY layers**
  - ➢ Rubber shear-plies
  - ➢ Reinforcement layers



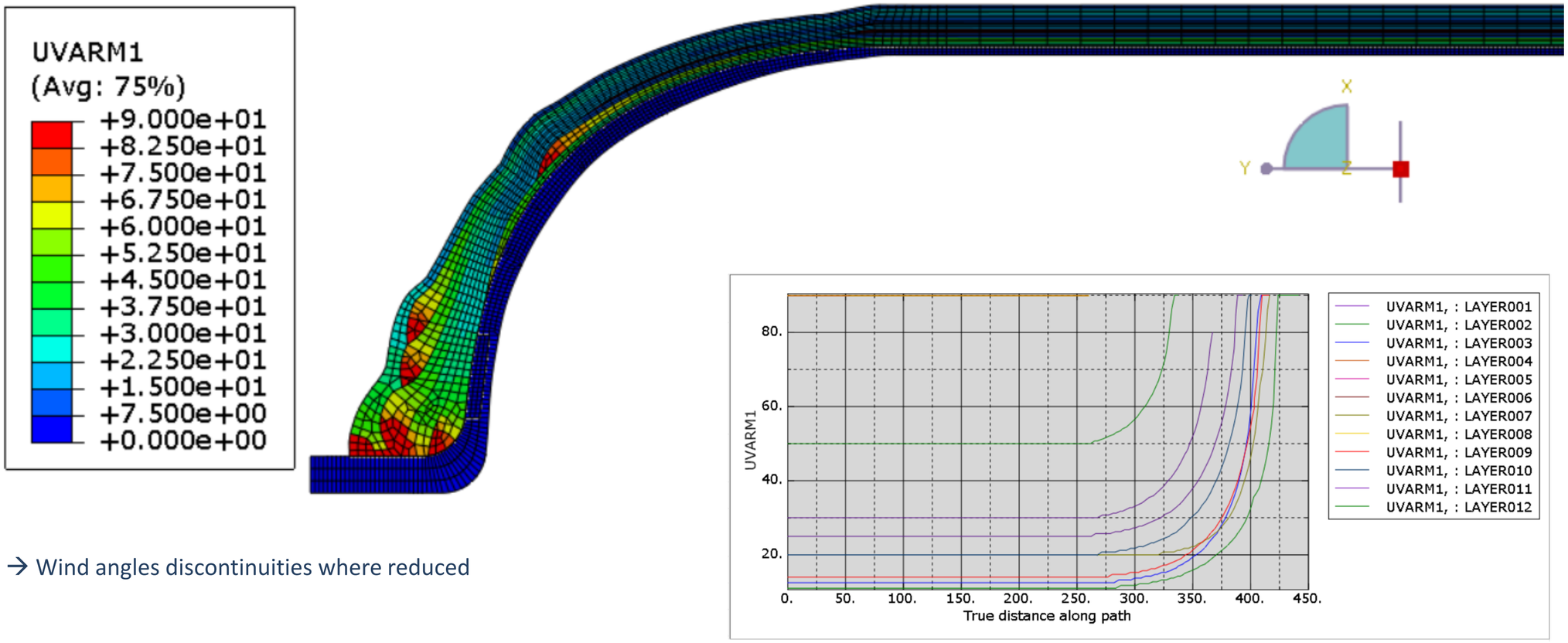




Courtesy Cevotec

What's New In WoundSim 2022

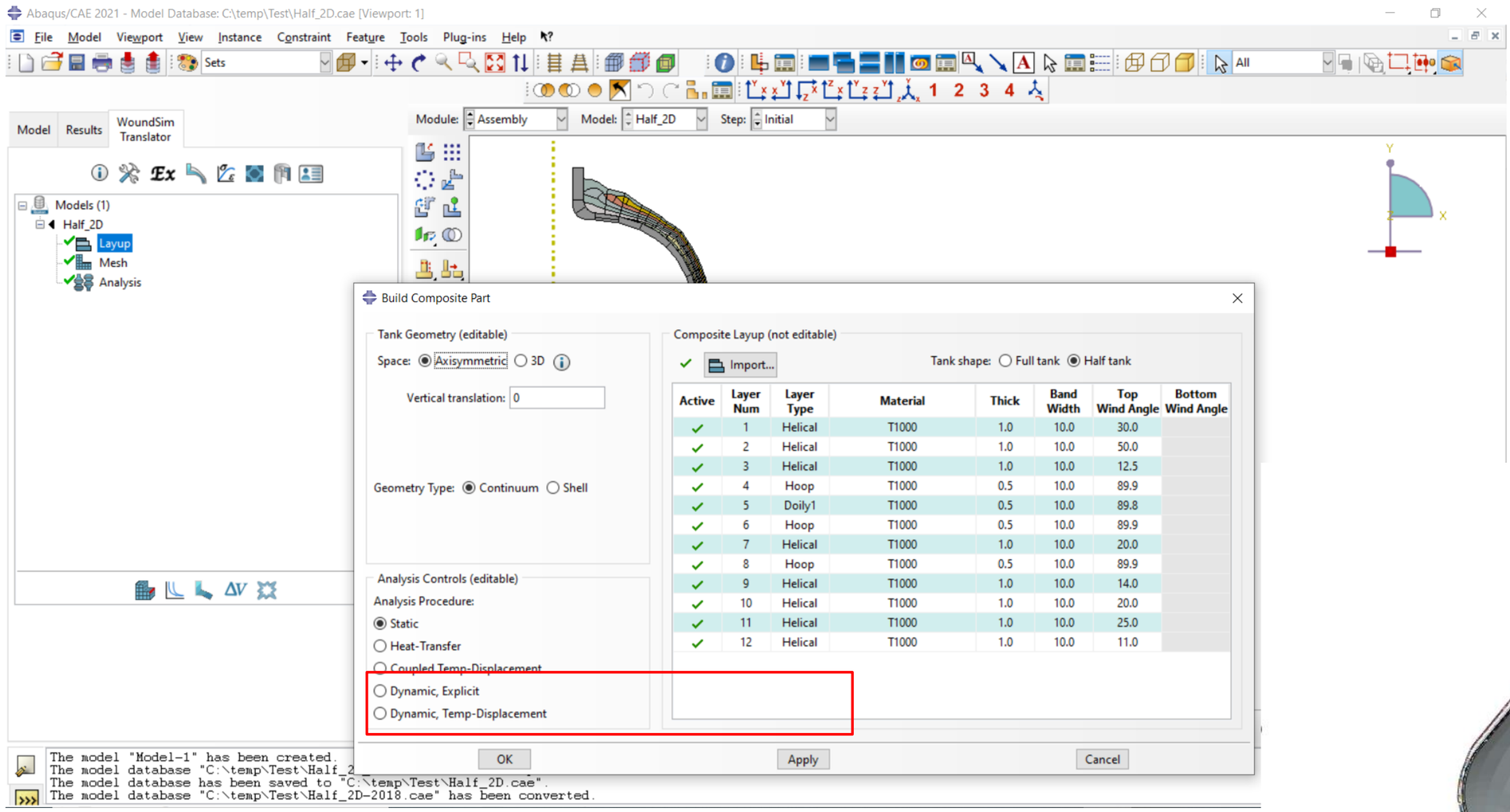
- ✓ Enhancements to **WIND ANGLES** computation near layer turn-around positions

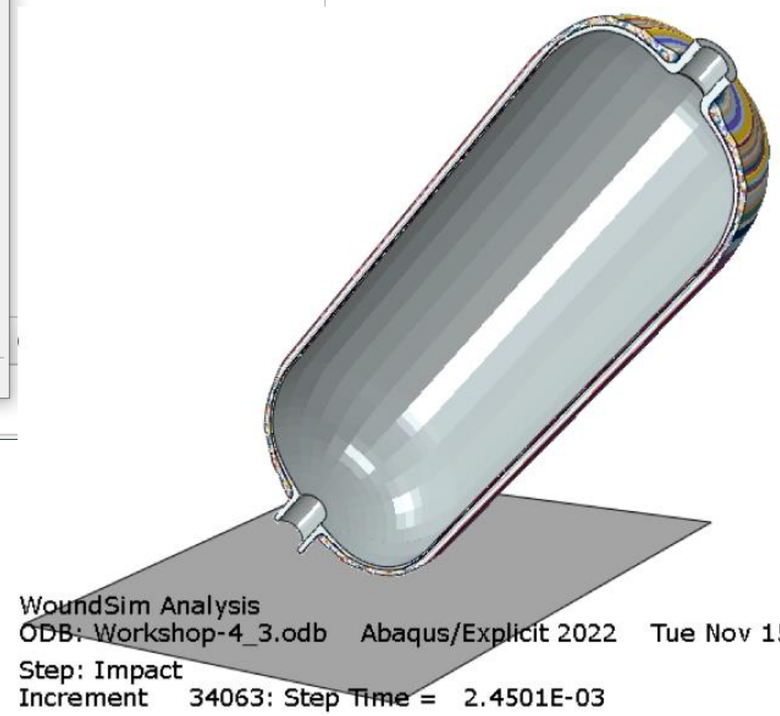


→ Wind angles discontinuities where reduced

What's New In WoundSim 2022

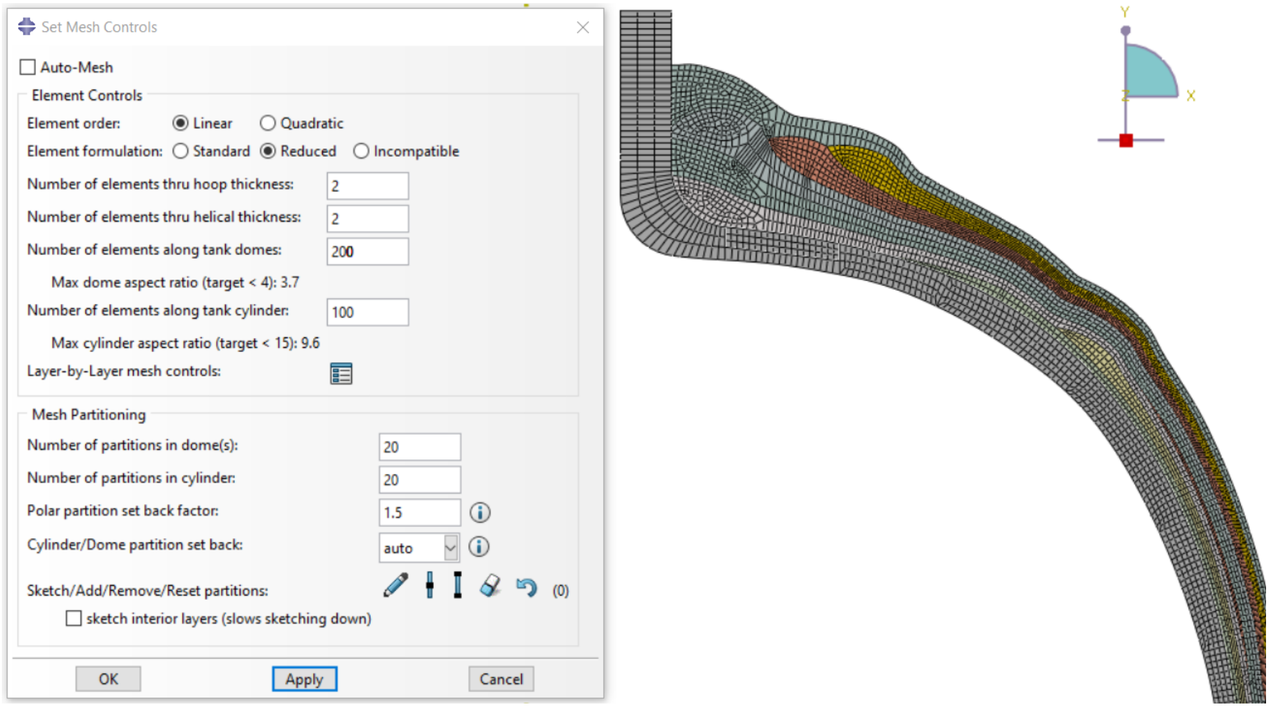
- ✓ **Abaqus/EXPLICIT** solver support to model drop tests and high-speed impacts

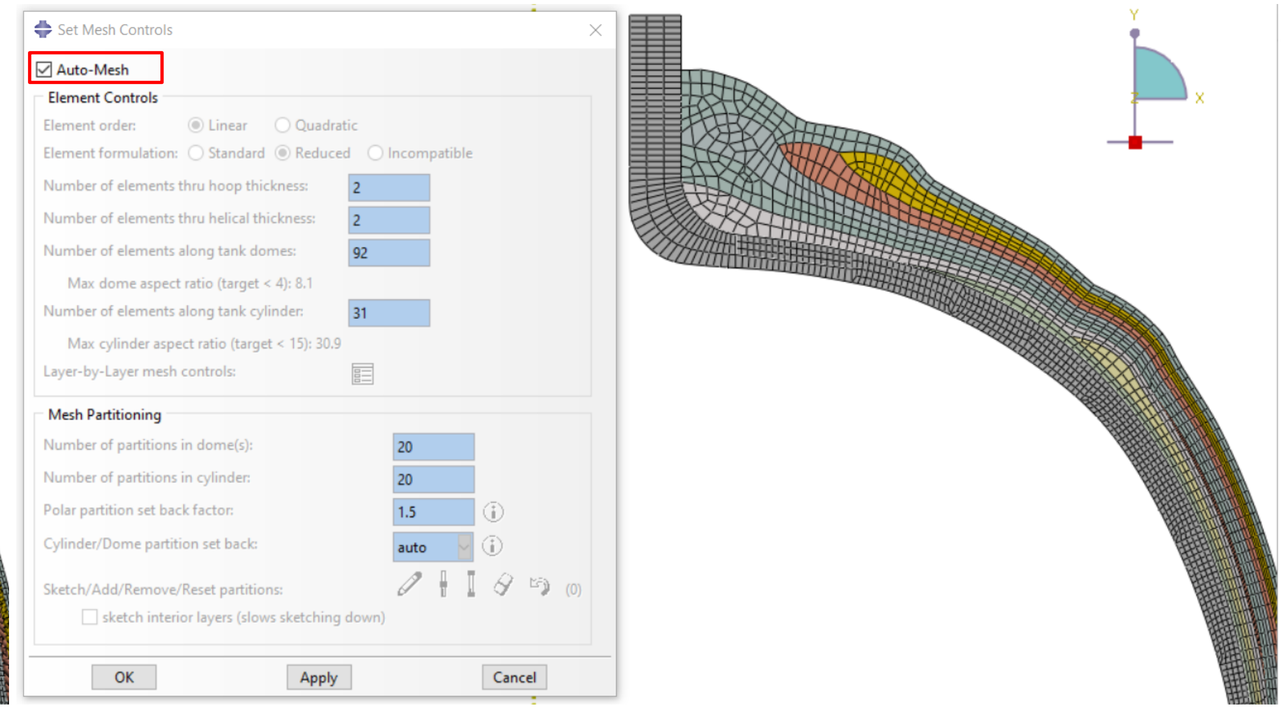




What's New In WoundSim 2022

- ✓ Enhanced **MESHING** parameters including automatic mesh possibility

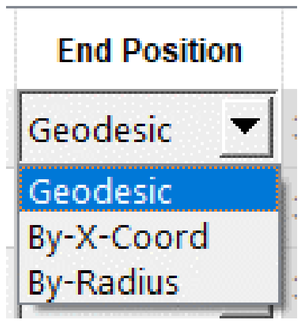




What's New In WoundSim 2022

- ✓ Few **ADDITIONAL** Features

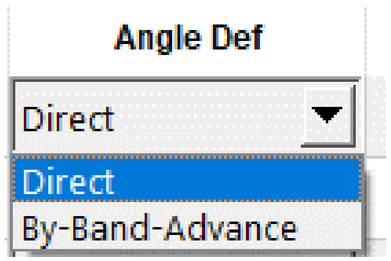
New Helical Layers **END-POSITION** possibilities



NON-SYMMETRIC Wing Angles

Angle Cylinder 1	Angle Cylinder 2
30.0	40

New Hoop Layers **ANGLE-DEFINITION** possibilities



Composite Material **OUTPUTS**

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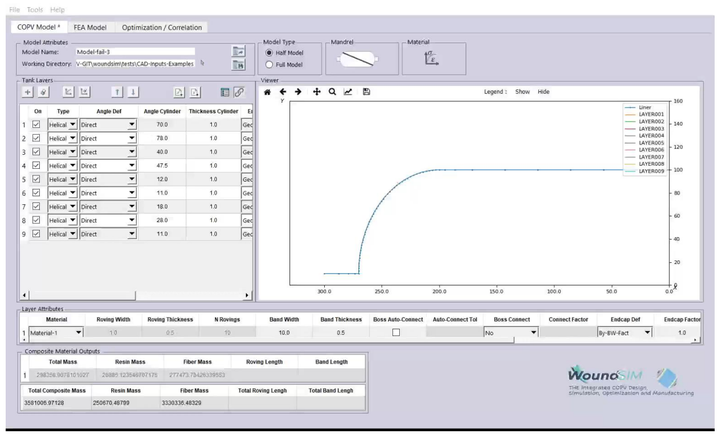
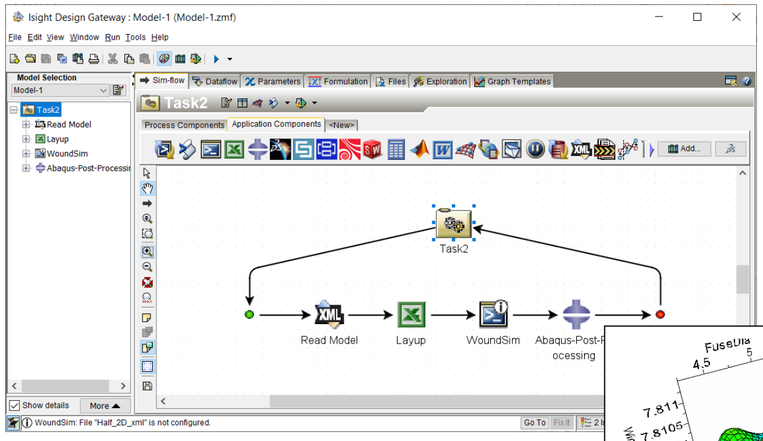
What's New In WoundSim 2022

- Additional to the embedded Optimization based on the DOF technique, the **COMMAND LINE** interface allows now be run WoundSim in a fully automated way with a simple command line and input parameters,
  - WoundSim models are now compatible with optimization software (e.g., SIMULIA Isight)
  - Meta-Models (Response Surface) of the tank can then be generated and used for advanced design/optimization/correlation procedures

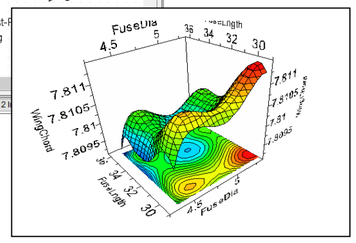




Command Line Interface:

buildWsModelFromInputFiles

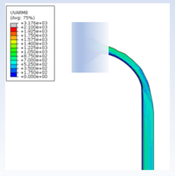
buildAbaqusModelFromInputFiles



Initial Design (Manually Optimized):

Weight : **35.58 KG**

Max Stress Failure: **1.055**



10% Weight reduction

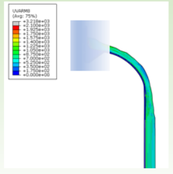
Optimization

Performance **Increase**

Optimized Design:

Weight : **32.43 KG**

Max Stress Failure: **1.048**



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