

Research Directions in Simulation Moldflow

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Class summary

This class will review new functionality in Simulation Moldflow Insight software and discuss current research directions in the development of Simulation Moldflow software.

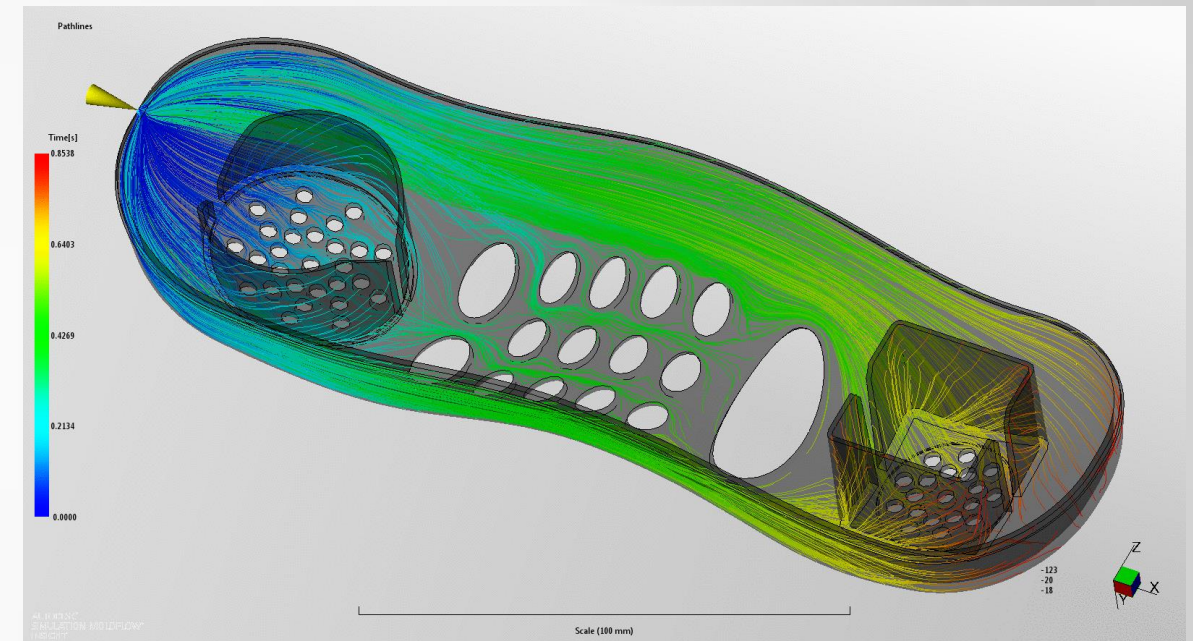
Key learning objectives

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

- Examining the polymer particle history during injection
- Understand how to model non-standard viscosity behavior
- Anticipate the new functionality in the Moldflow Insight Beta
- Choose the right technology for performing microcellular foaming simulation

Agenda

- 2015 Scandium Technology Preview
- Moldflow Insight 2016 Beta
- Some API Tools
- Long Term Research Collaborations



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.

Rapid Temperature Cycling

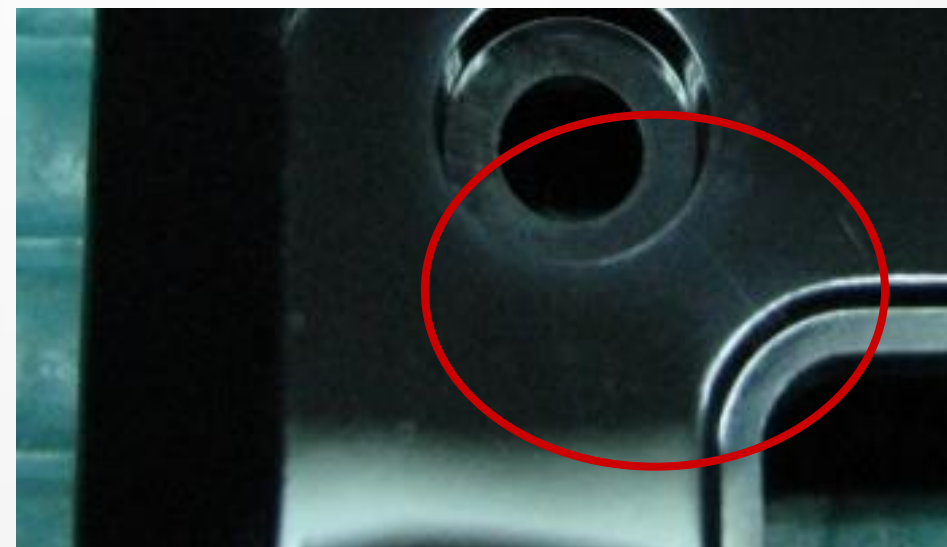
(RTC[®]) / RHCM[®] / Variotherm[®]

- **Heat Mold for Filling**
 - Eliminate visible weld-lines
 - Increase flow length
 - High (uniform) gloss finish
 - Eliminate Gate Marks (Cold slugs)
 - Typically only the cavity side is heated
- **Heat by:** Steam, Water, Electrical or Induction
- **Cool Mold during Packing**
 - Reduce cycle time

Conventional Molding



With RTC

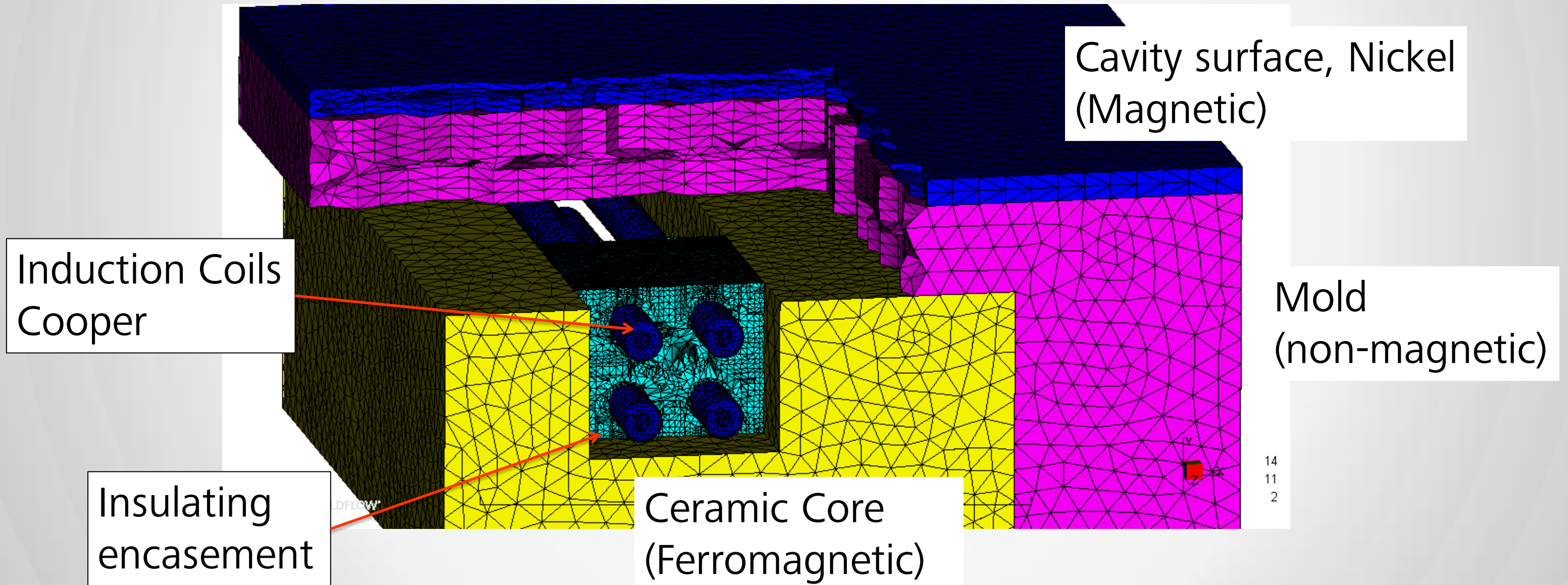


Images courtesy of GasInjection World Wide

Induction Heating for Cool (FEM)

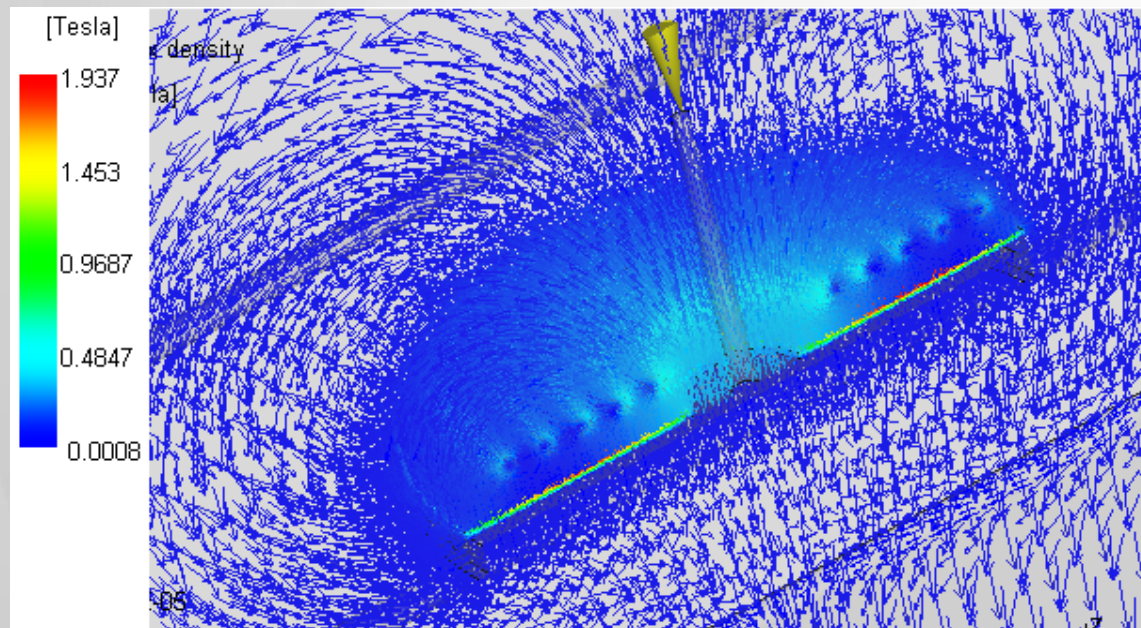
- Modeling mold components

Mold material		
Description	Thermal	Mechanical
Electrical resistivity of material	0.01	ohm-m [0:1e+020]
Relative magnetic permeability of material	600	[0:1e+020]



Induction Heating for Cool (FEM)

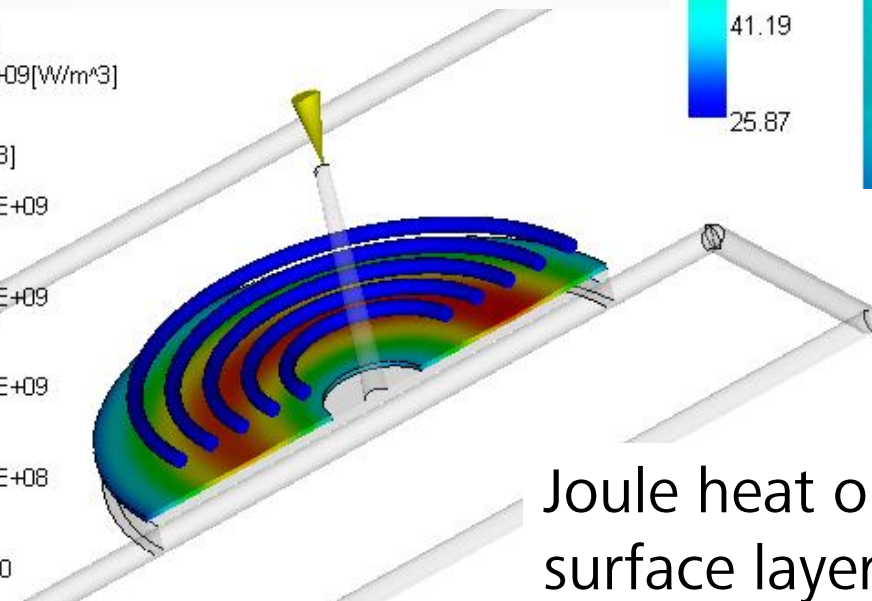
- Specify electric current and timing
 - Calculate current density
- Calculate Magnetic field and flux
- Calculate Joule Heating



Magnetic Flux

Joule heat
= $3.925\text{E}+09 [\text{W}/\text{m}^3]$

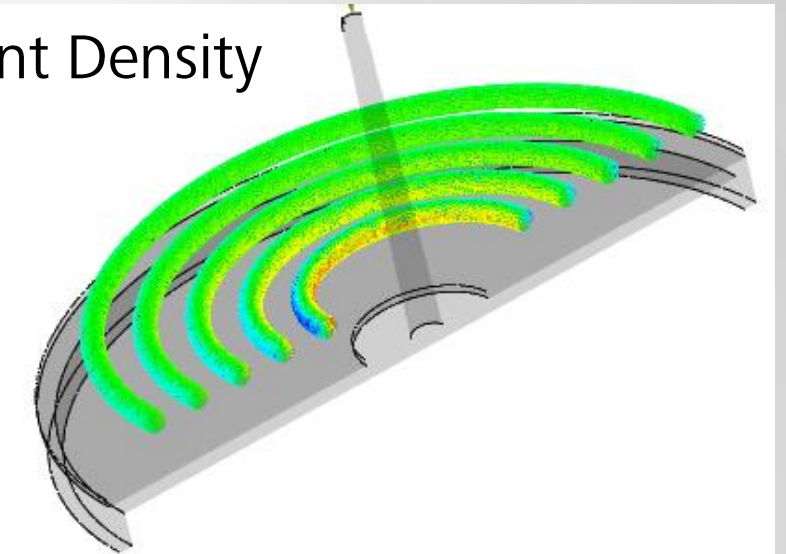
[W/m³]
3.925E+09
2.944E+09
1.963E+09
9.813E+08
0.0000



Joule heat on
surface layer

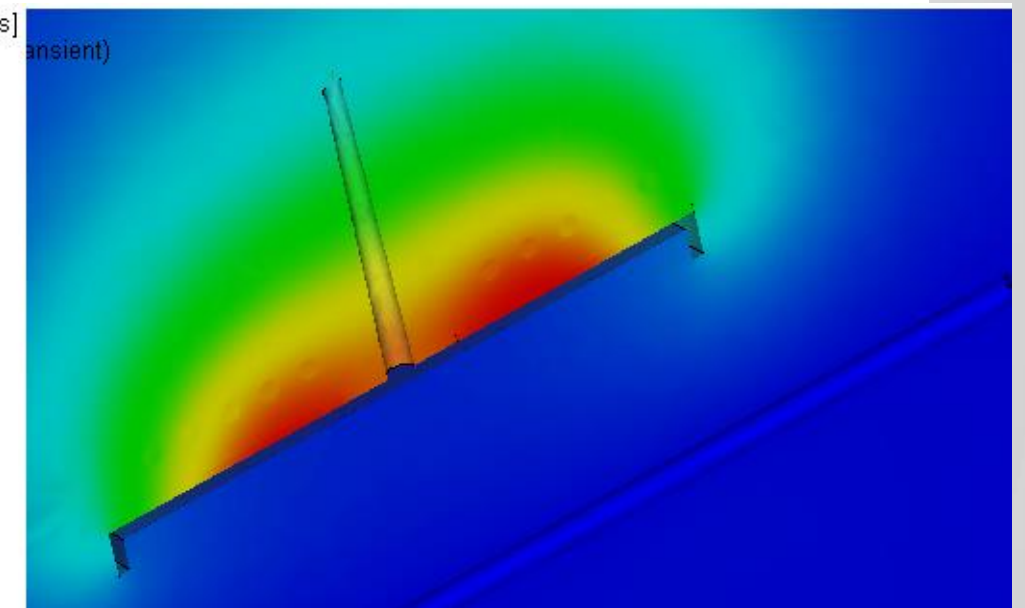
Current Density

[A/cm²]
3.227E+05
3.062E+05
2.897E+05
2.732E+05
2.566E+05



Time = 35.00[s]

[C]
87.16
71.84
56.51
41.19
25.87



Mold Temperature

Microcellular Foaming - Current (ASMI2015)

- Viscosity is modified by:

- Gas in solution, c
- Bubble volume, ϕ

$$\eta = \eta_r (1 - \phi)^{V_1} \exp(V_2 c + V_3 c^2)$$

- Bubble growth:

- Completes filling
- Maintains packing pressure

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \rho \vec{v} = 0$$

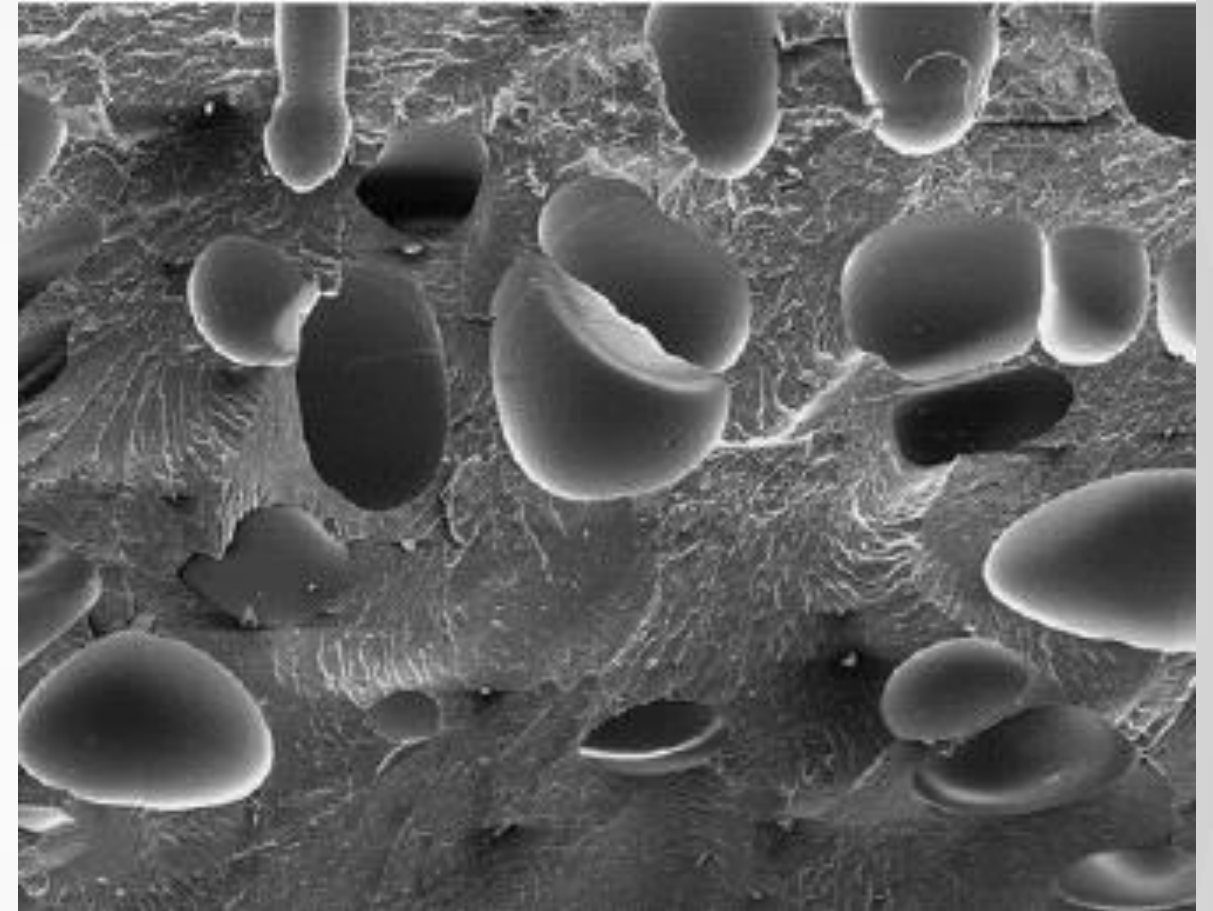
$$\rho = \rho_r (1 - \phi)$$

- Other material properties also modified by ϕ
- Available in Midplane and Dual-domain
- Cell density is a user input
 - Modify according to process and material parameters based on previous molding trials

Microcellular Foaming - New Developments

- Nucleation model depends on:
 - Gas properties
 - Polymer properties
 - Local temperature and pressure

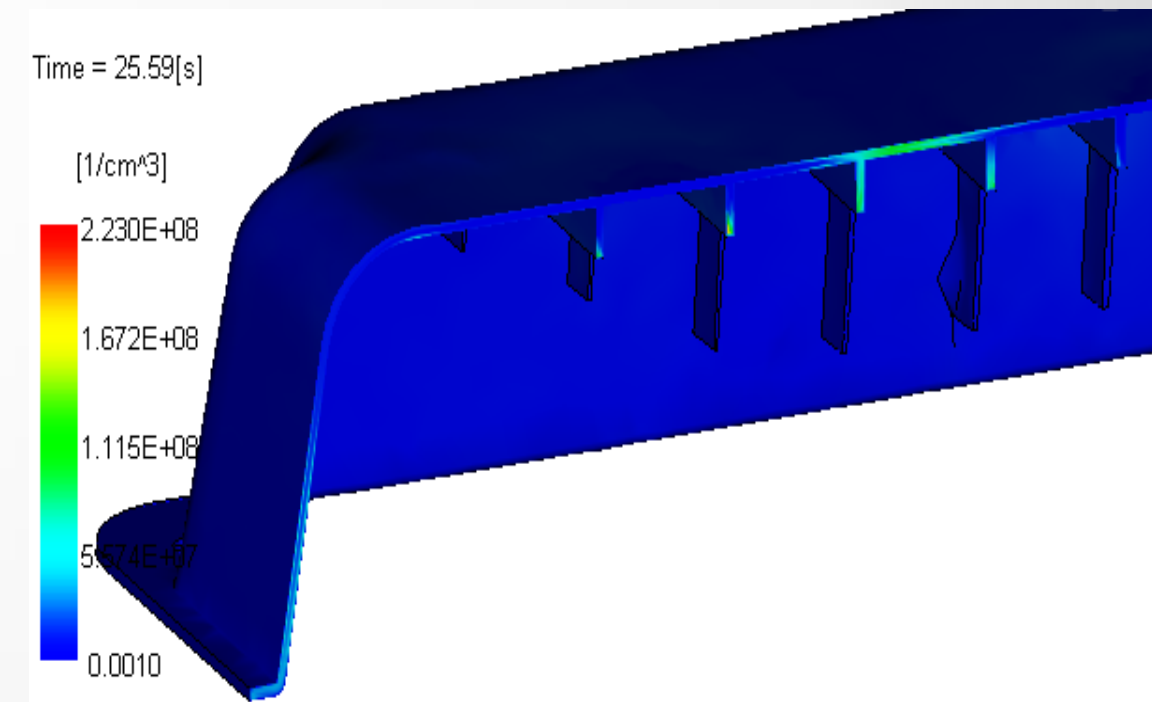
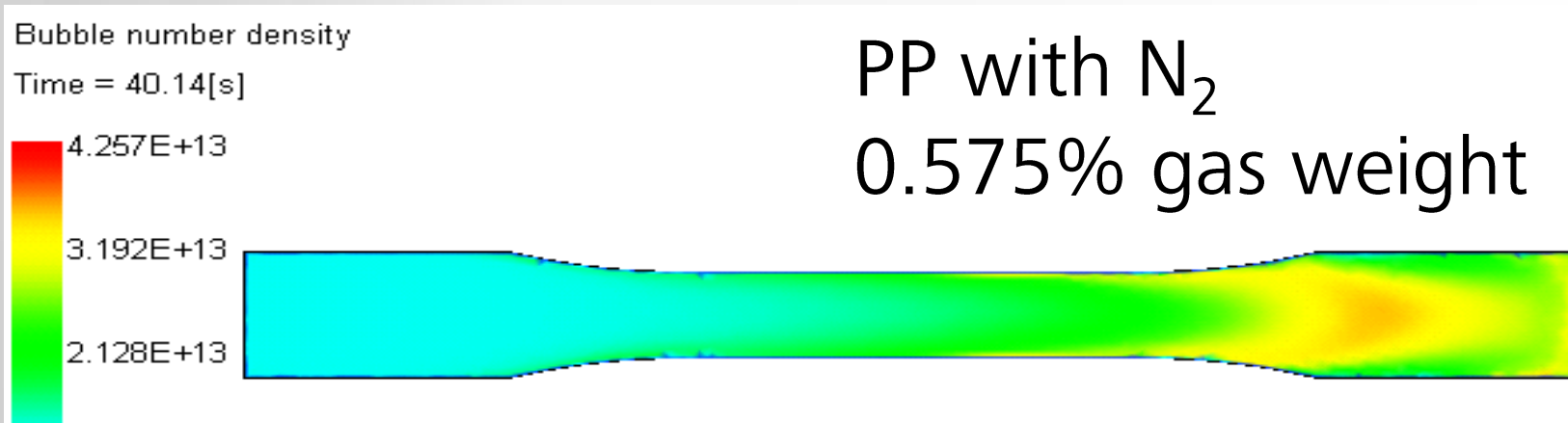
$$J = F_1 N \left[\frac{2\sigma}{\pi m} \right]^{\frac{1}{2}} \exp \left[\frac{-16 F_2 \pi \sigma^3}{3 k T [P_v - P_l]^2} \right]$$



K. Taki, Chemical Eng. Sci. 63 (2008) 3643-3653
K. Taki, J. of Cellular Plastics 39 (2003) 155-169

Microcellular Foaming - New Developments

- Nucleation model results is non-uniform nucleation prediction
 - Depends on local pressure and temperature history



Microcellular Foaming - New Developments

- Extend Microcellular foaming simulation to 3D
- %weight reduction target in process setup

Fill Settings - Page 1 of 2

Mold surface temperature 40 C

Melt temperature 240 C

Filling control

Automatic

Velocity/pressure switch-over (Microcellular)

By %weight reduction at 10 % (0:50)

Pack/holding control

%Filling pressure vs time Edit profile...

Advanced options

- Usability: Gas selection & concentration in process settings

Microcellular foaming gas

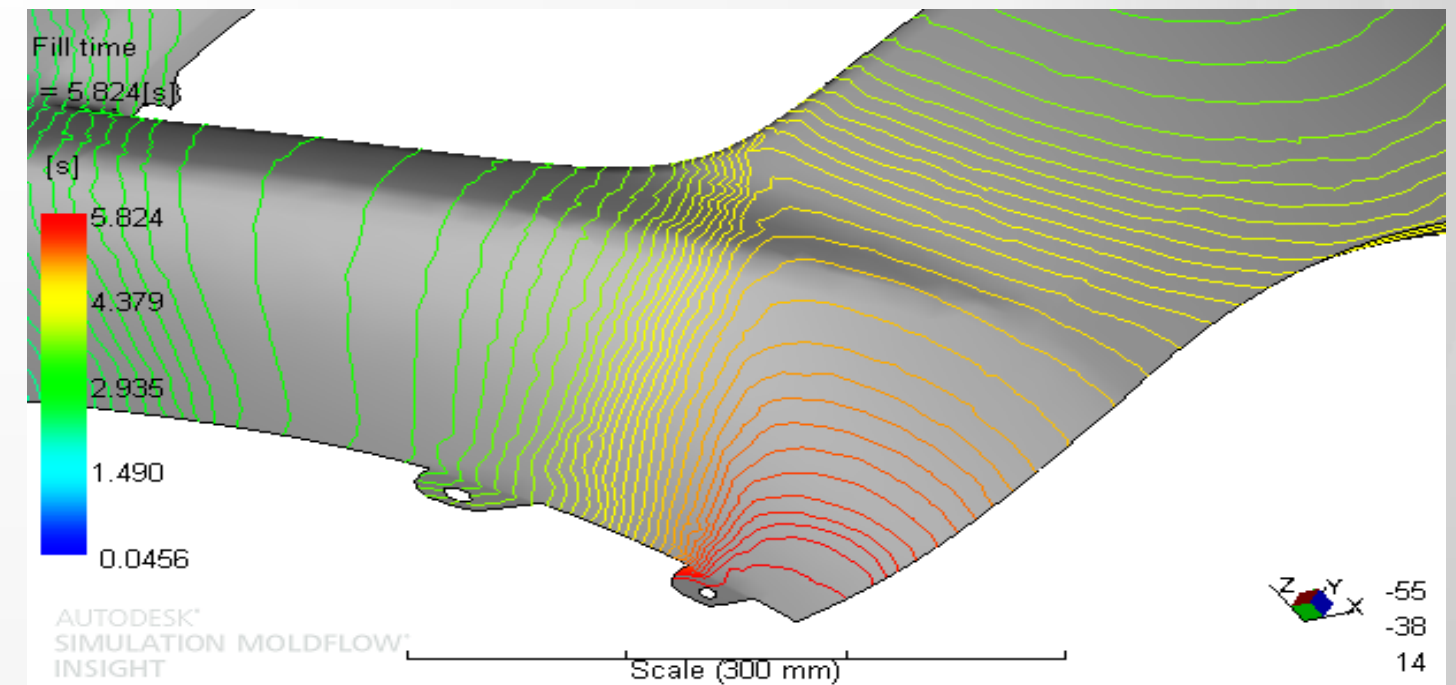
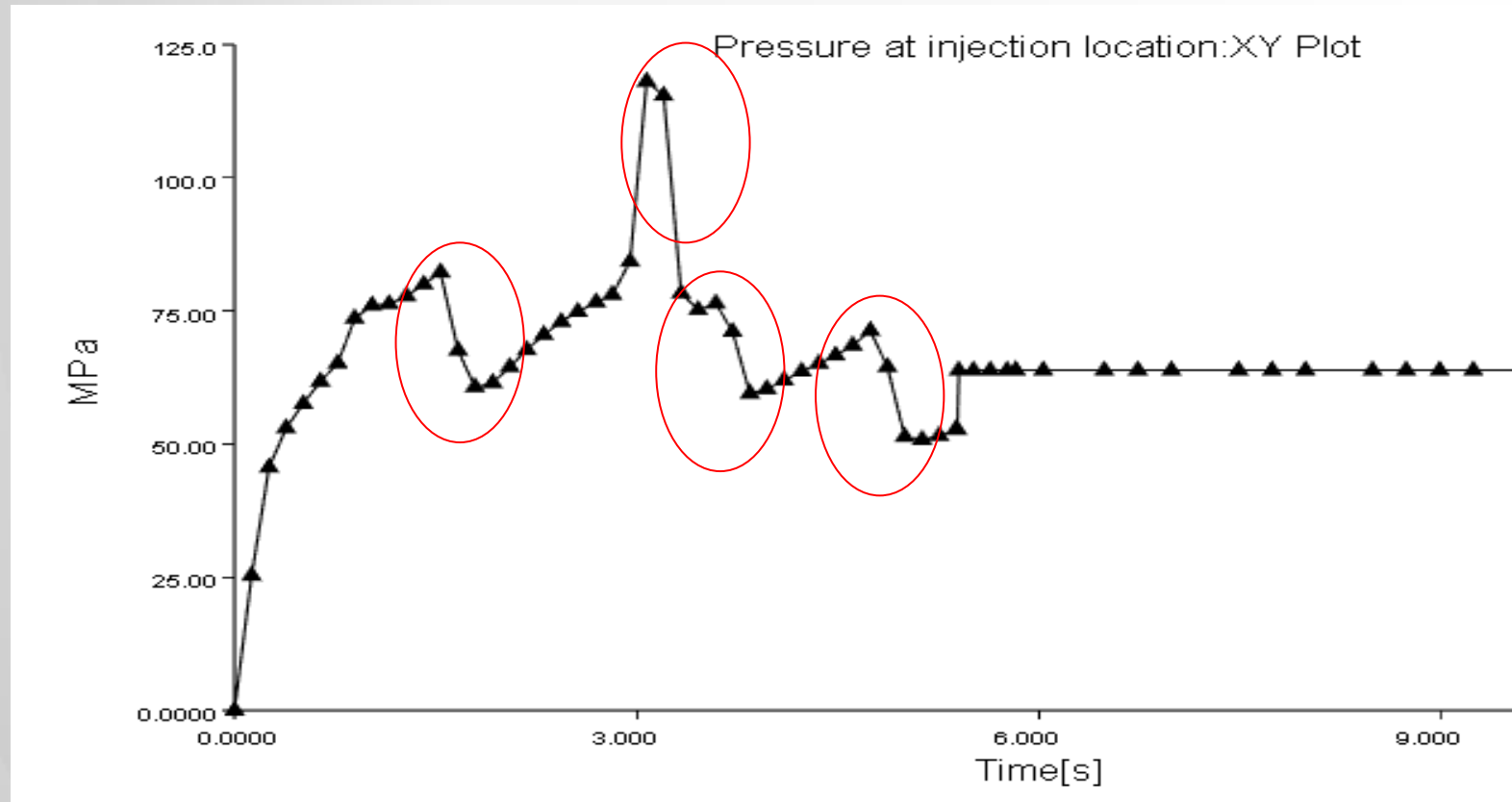
N2 Edit properties...

Initial gas amount

Initial gas concentration by weight % Initial gas concentration 0.5 % (0.1:3)

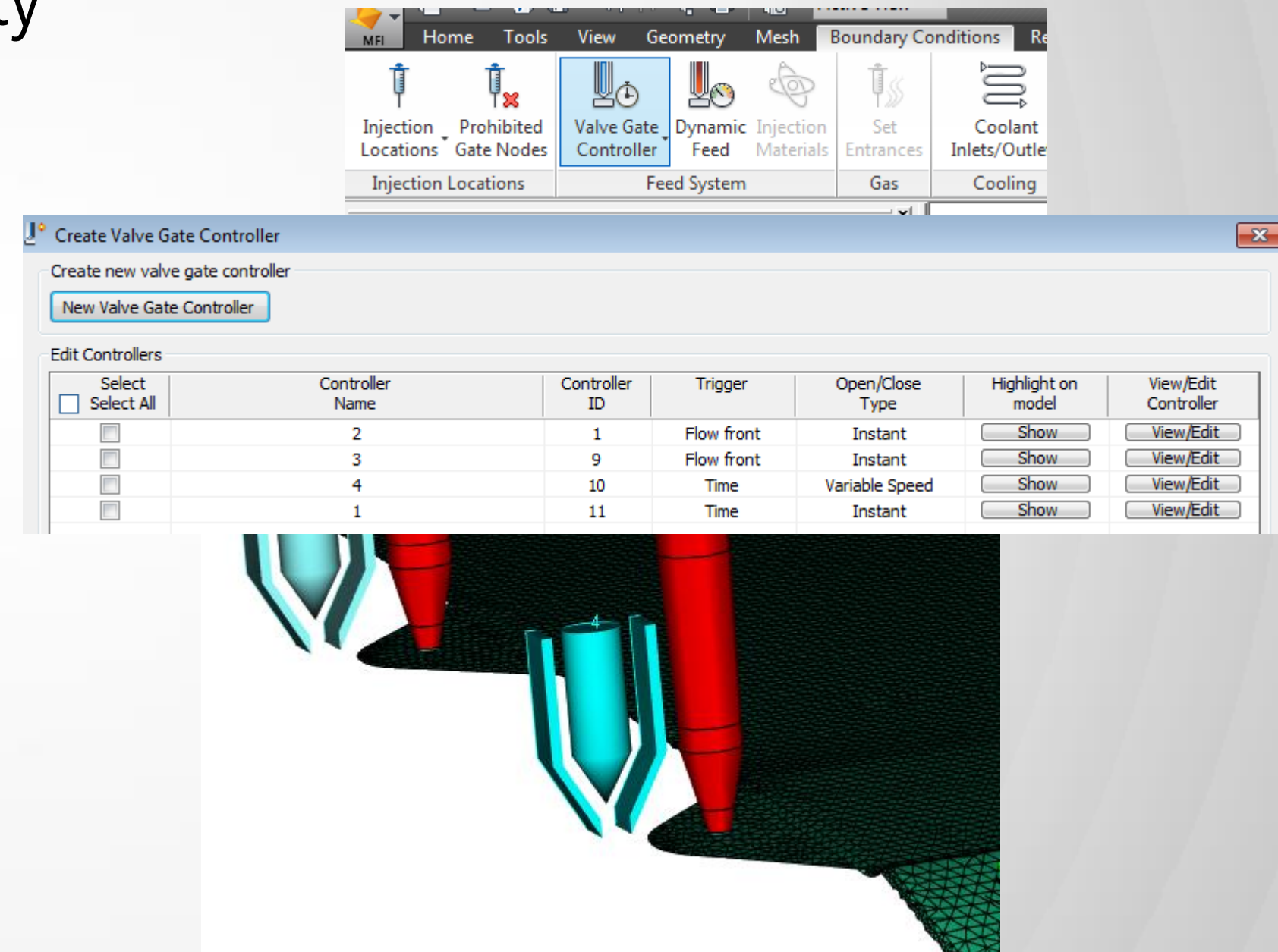
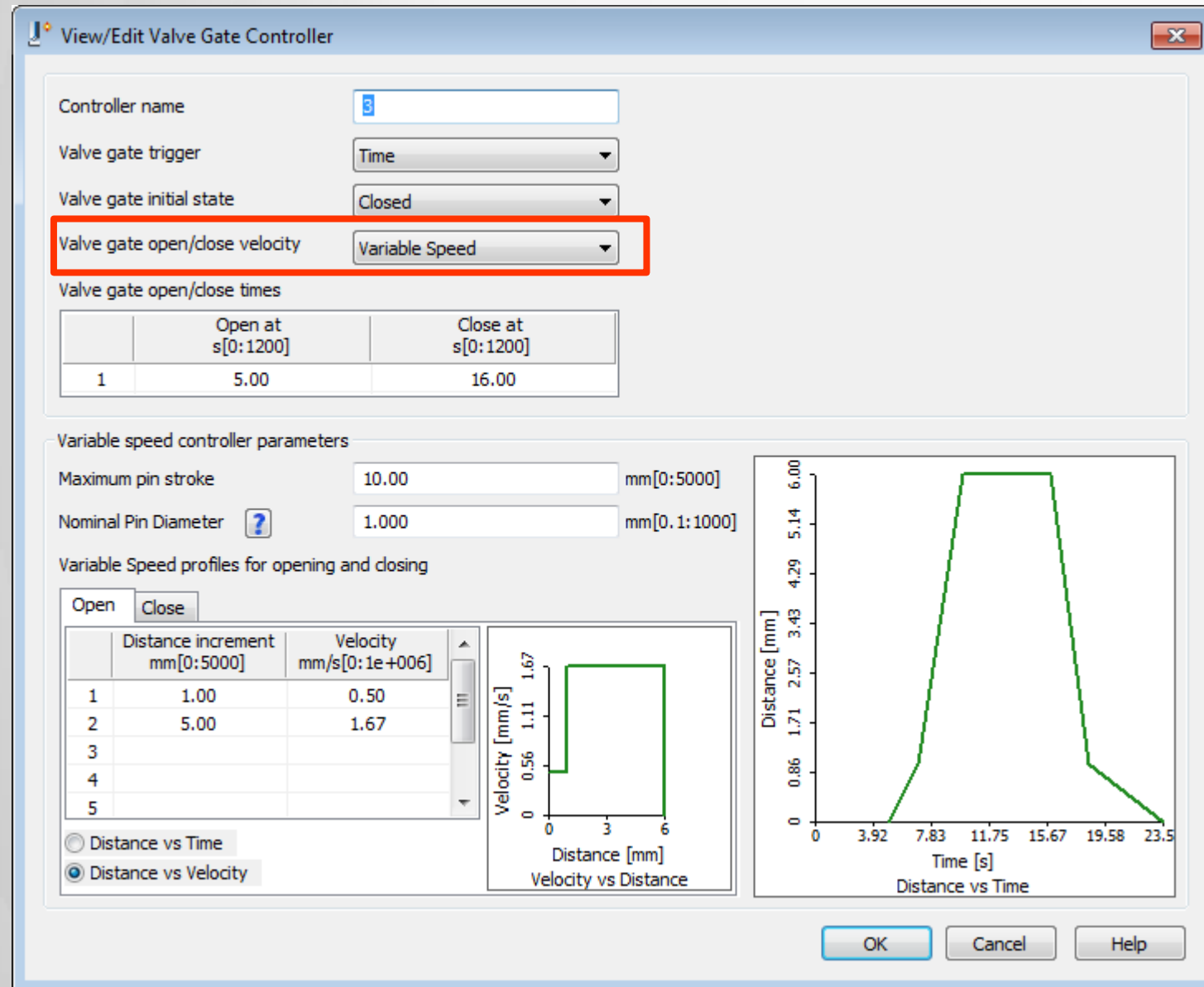
Cascading valve gates

- Injection pressure dips abruptly
- Flow front has periods of sharp acceleration
 - Visible flow marks
- Solution is to open valve gates gradually



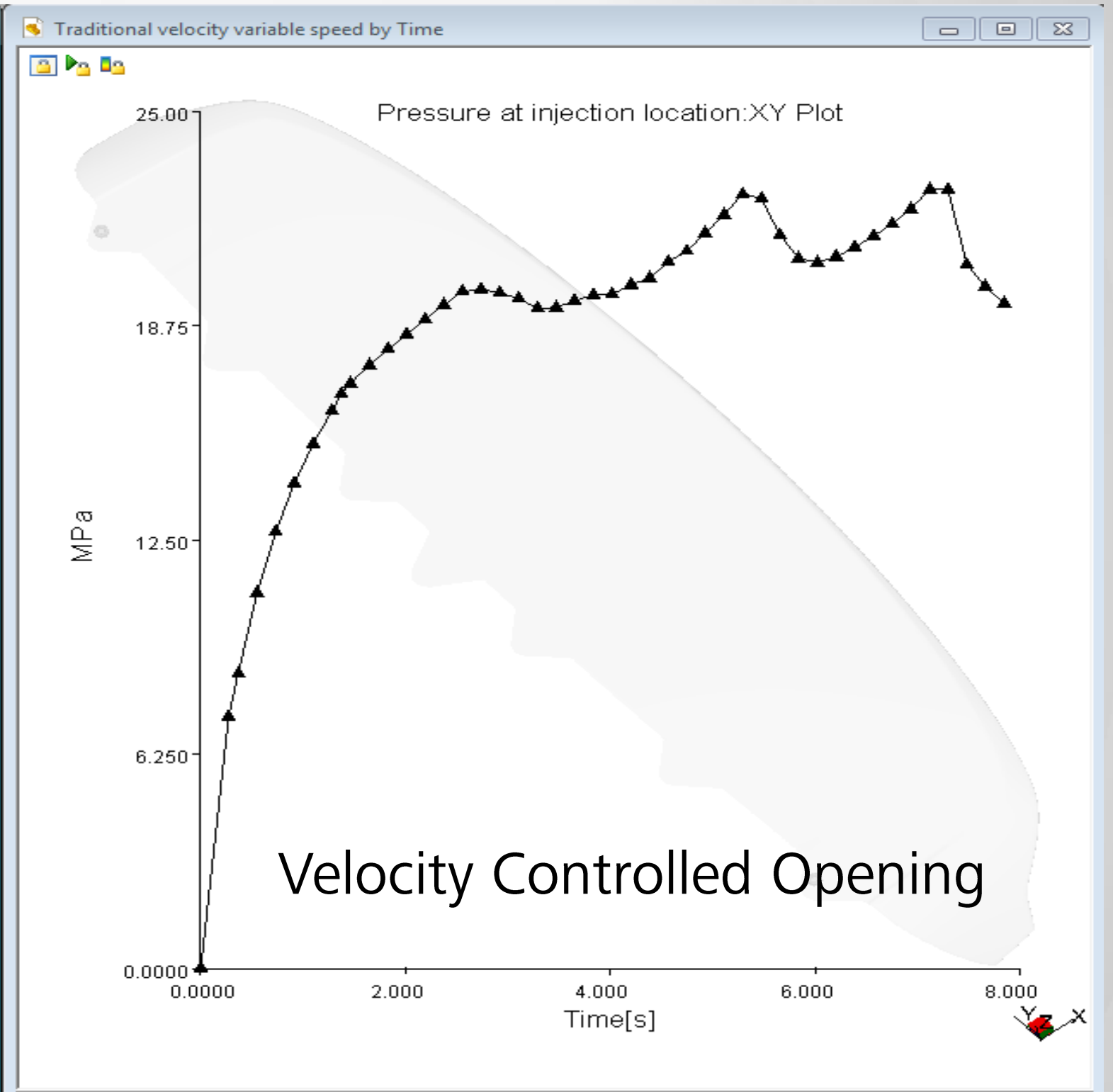
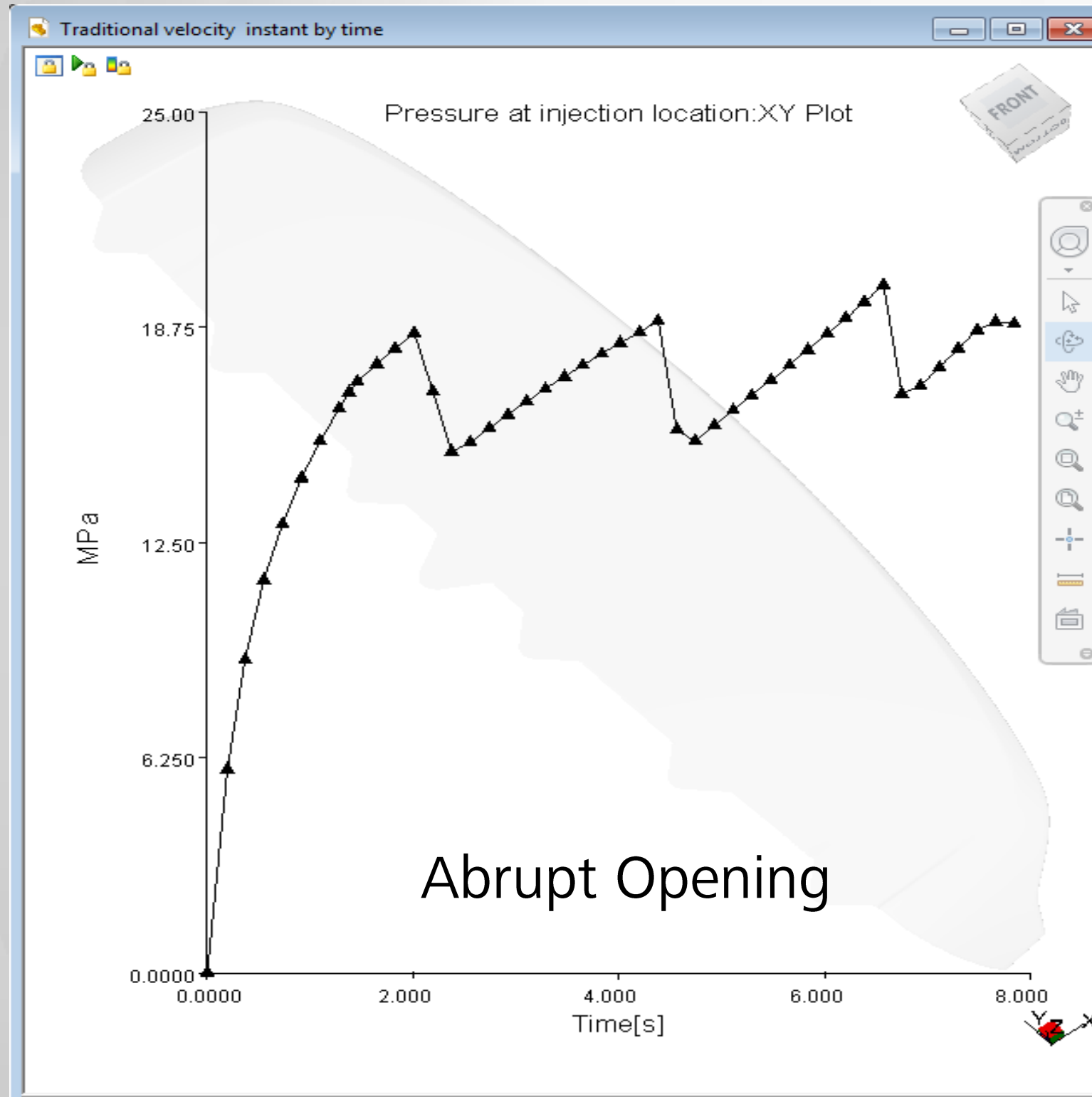
Velocity controlled valve gate settings

- Select whether a valve gate has abrupt or variable speed
 - Specify by either time or velocity

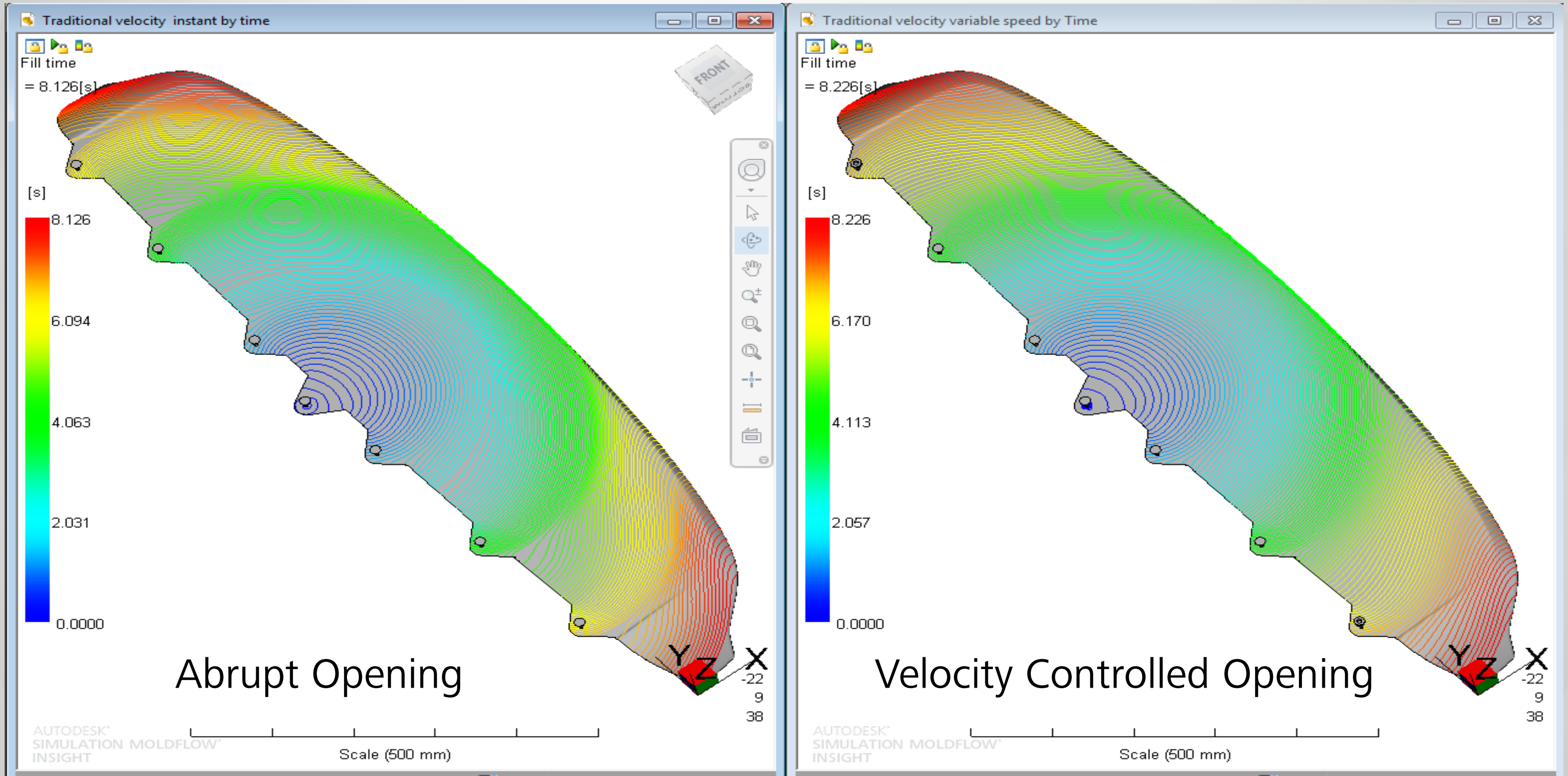


(Midplane and Dual-Domain only)

Velocity Controlled Valve gate - Pressure

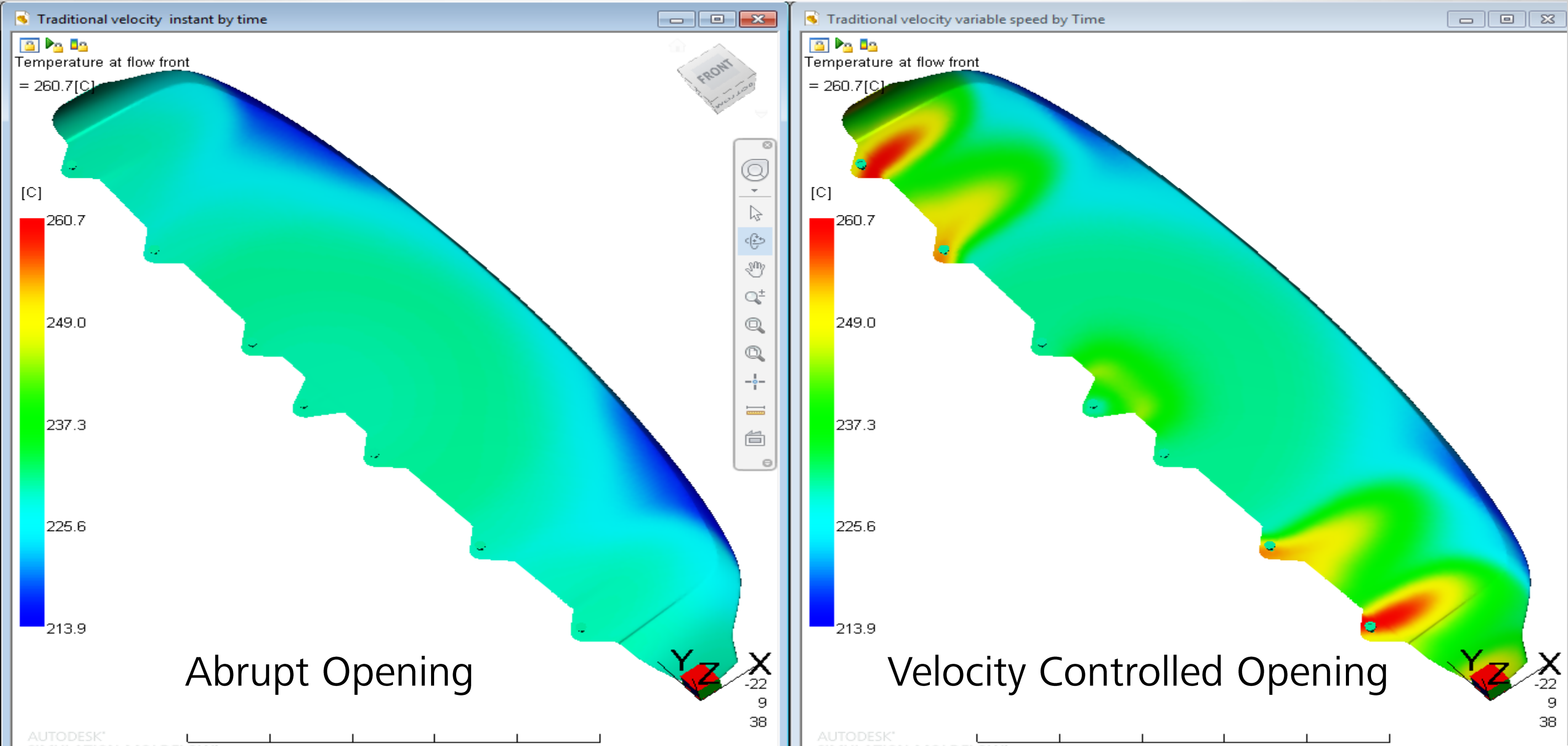


Velocity Controlled Valve gate – Fill Pattern



Model courtesy of HRS – Inglass S.p.A

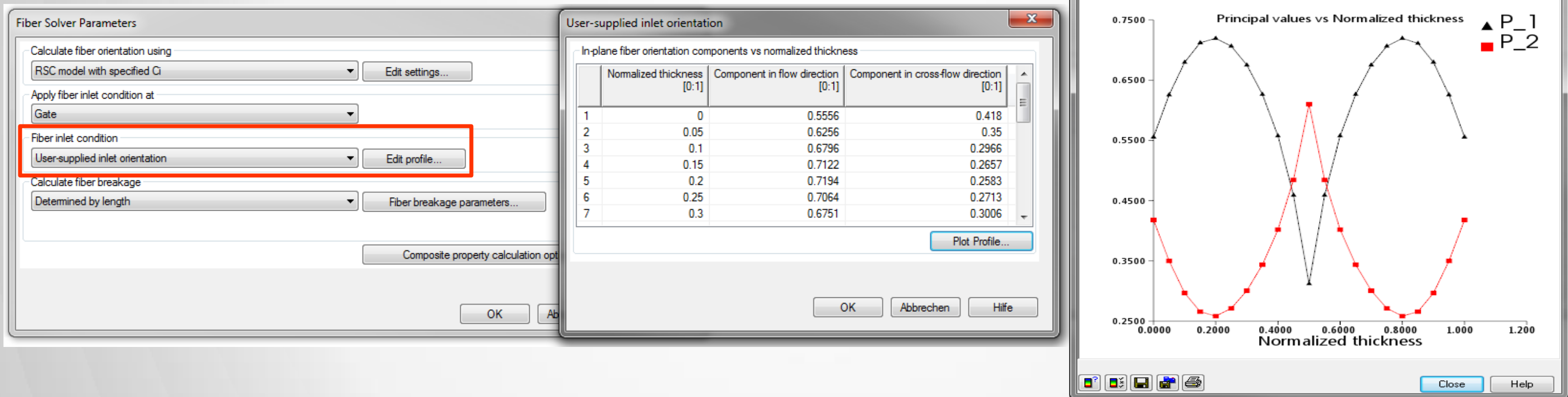
Velocity Controlled Valve gate – Flow Front Temperature



Model courtesy of HRS – Inglass S.p.A

3D Fiber – New Inlet Option

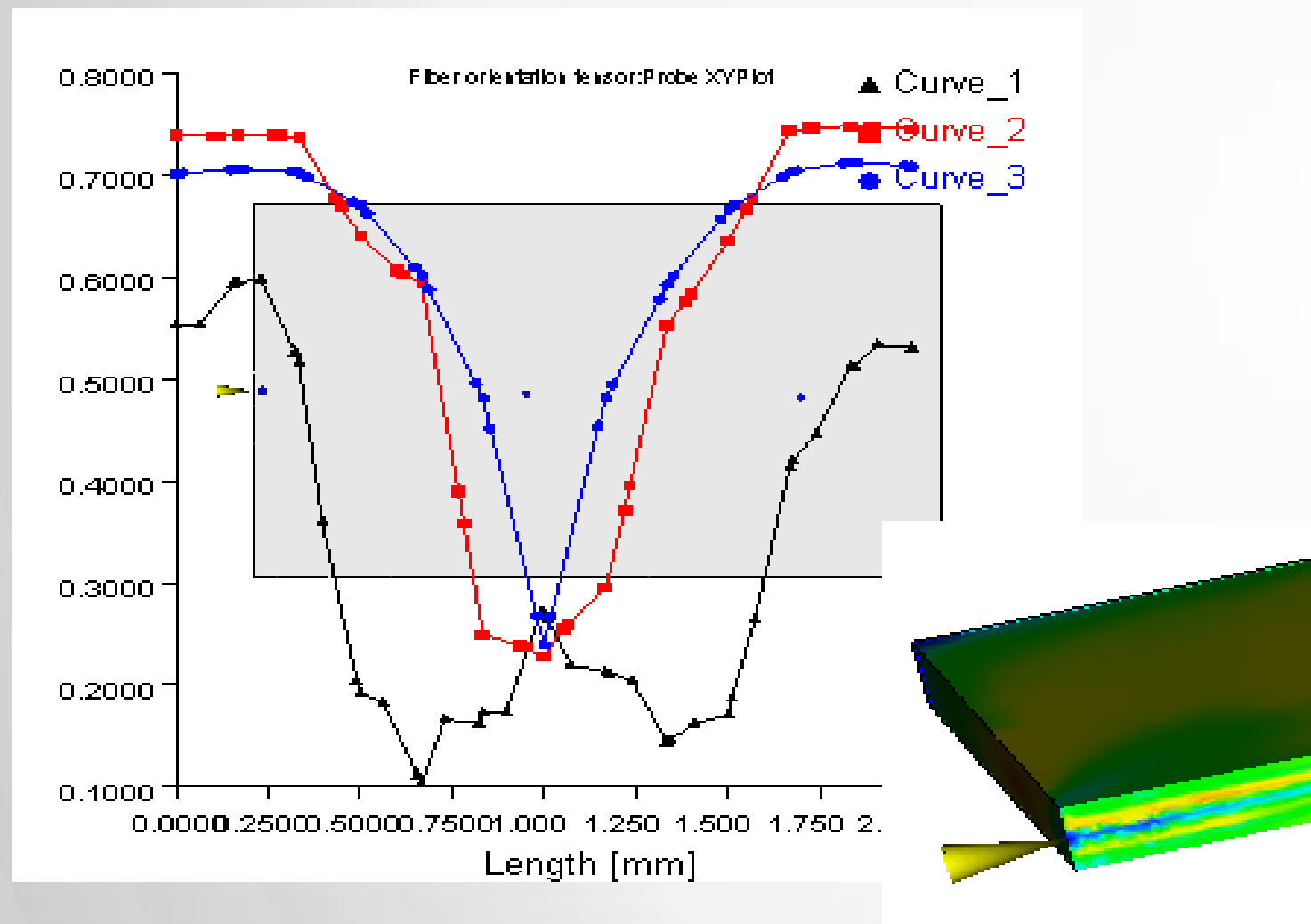
- Add specified inlet orientation
 - Already previously available for Midplane/DD



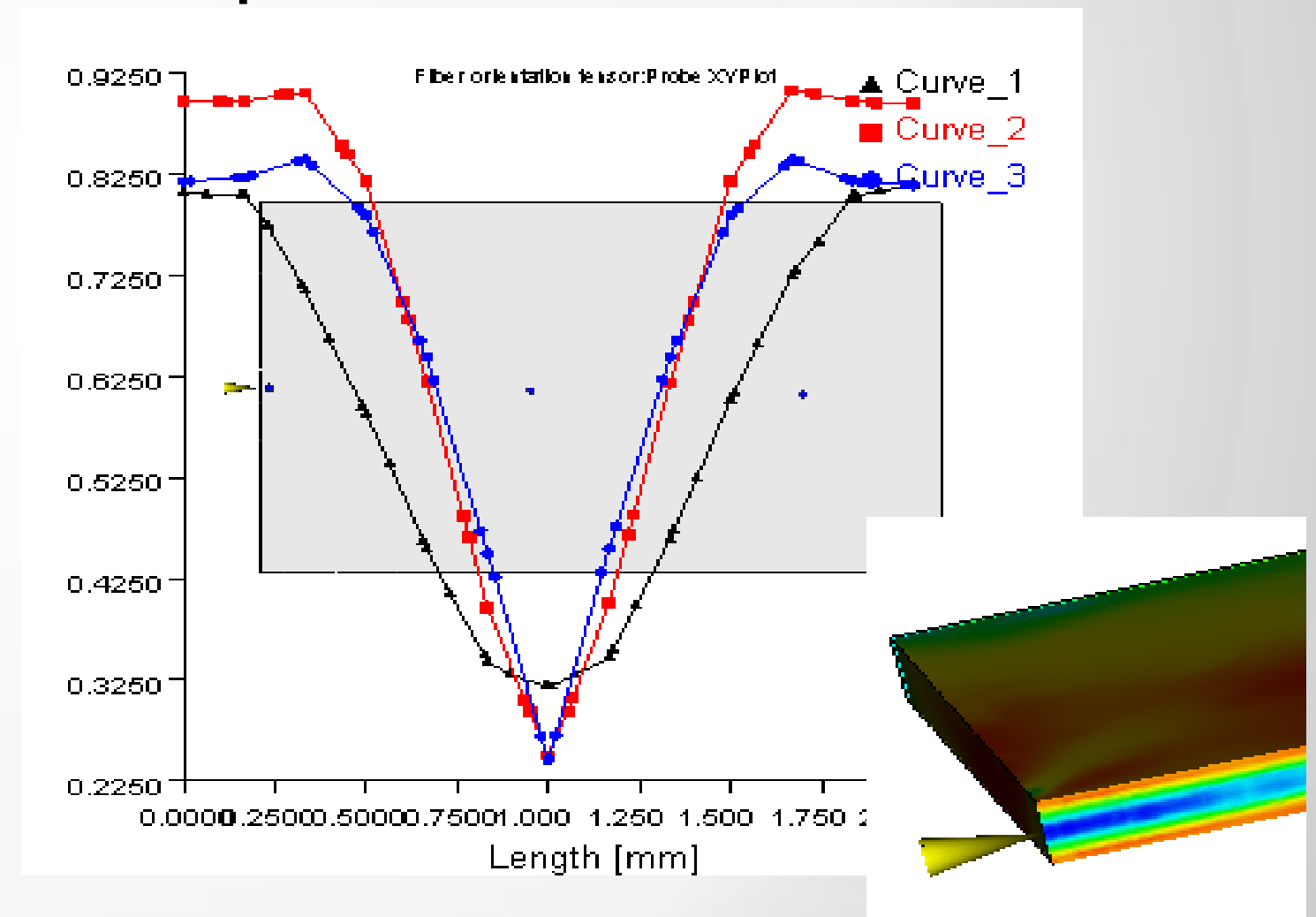
3D Fiber Improvements

- Preserving the inlet fiber orientation profile
 - Black line ("Curve_1") is immediately inside inlet

ASMI 2015



Development version

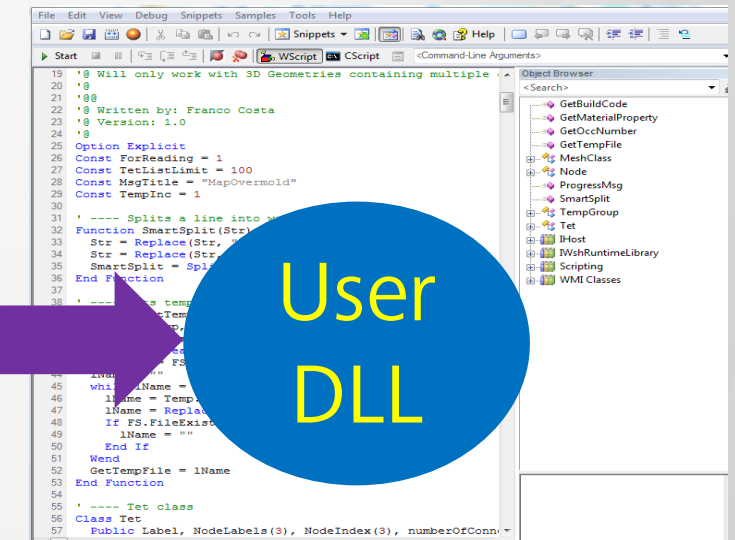


Using a finer mesh around gate

3D Flow Solver API

- Allow user routines for selected properties and calculations
 - Easier research collaborations
 - User-coded routines in a DLL (VS2012 recommended)
 - Example Template provided
 - First implementation is for a user viscosity routine
 - Others to follow:
 - Fiber Orientation ?
 - PVT ?
 - Curing ?
 - ?

3D
Flow



Selecting the User Viscosity Function

Process Settings Wizard - Fill Settings

Mold surface temperature: 80 C
Melt temperature: 290 C

Filling control: Absolute ram speed profile by Ram speed vs ram position Edit profile...

Velocity/pressure switch-over: Automatic

Pack/holding control: %Filling pressure vs time Edit profile...

☒ Fiber orientation analysis if fiber material
☐ Birefringence analysis if material data includes optical properties

Advanced options... 1

Fiber parameters...

OK Cancel Help

Fill + Pack Analysis Advanced Options

Molding material: Zytel PLS95G50DH2 BK261 : DuPont Pe Edit... Select...

Process controller: Process controller defaults Edit... Select...

Injection molding machine: Default injection molding machine Edit... Select...

Mold material: Tool steel P-20 Edit... Select...

Solver parameters: Thermoplastics injection molding solver parameters Edit... 2 Select...

OK Cancel Help

Thermoplastics injection molding solver parameters (3D)

Fill + Pack Analysis Cool Analysis Cool(FEM) Analysis Fiber Analysis Warp Analysis Mesh Core Shift Venting Analysis Interface Solver API 3

Viscosity model: User viscosity model (from MoldflowUserFunctions) Standard viscosity model (from material data) User viscosity model (from MoldflowUserFunctions) 4

Parameter text: 0.2573 441510.0 9.37276e+15 383.15 0.0 40.821 51.6 5

OK Cancel Help

Cross-WLF Viscosity with Pressure Dependence

$$\eta = \frac{\eta_0}{1 + \left(\frac{\eta_0 \dot{\gamma}}{\tau^*} \right)^{1-n}}$$

$$\eta_0 = D_1 \exp \left[\frac{-A_1 (T - T^*)}{A_2 + (T - T^*)} \right]$$

η : Viscosity (Pa.s)

$\dot{\gamma}$: shear rate (1/s)

T: Temperature

$T^* = D_2 + D_3 * P$

P: Pressure (Pa)

$A_2 = \tilde{A}_2 + D_3 * P$

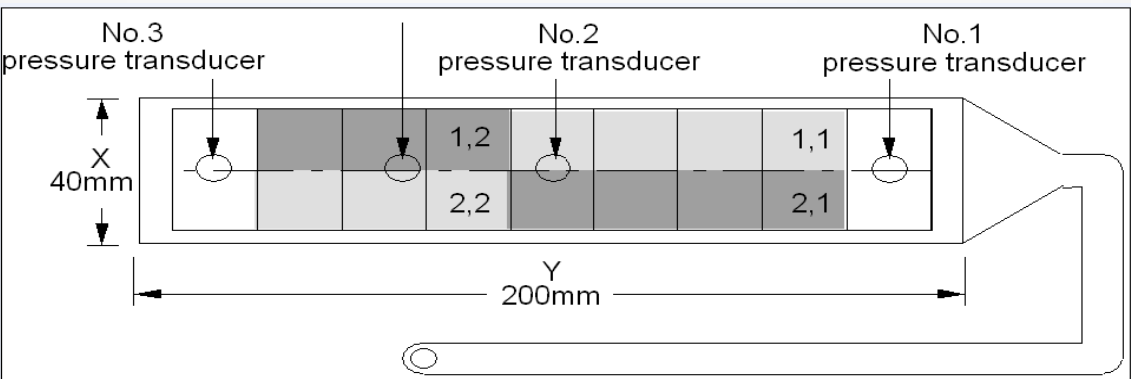
D_3 is the pressure dependence term

Barus Model: $\eta_0(T, P) = \eta_0(T) e^{\beta P}$

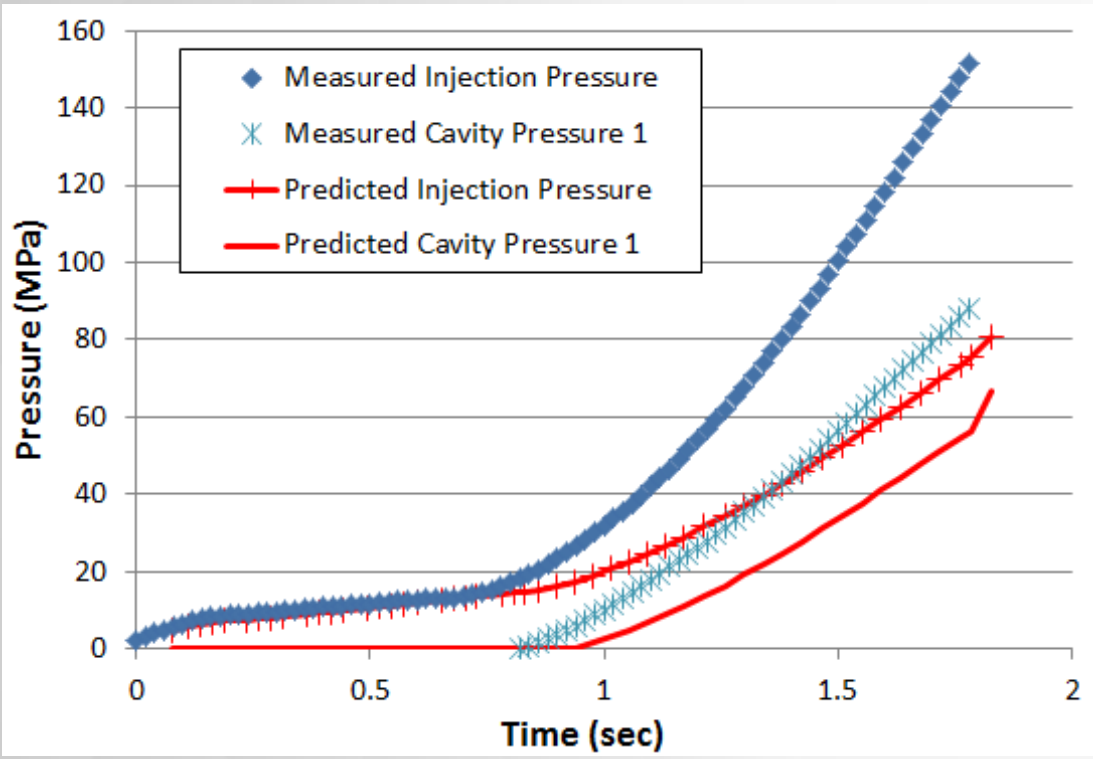
Quadratic Exponent Model: $\eta_0(T, P) = \eta_0(T) e^{\beta P + \kappa P^2}$

Evaluate Pressure Dependent Visc using Solver API

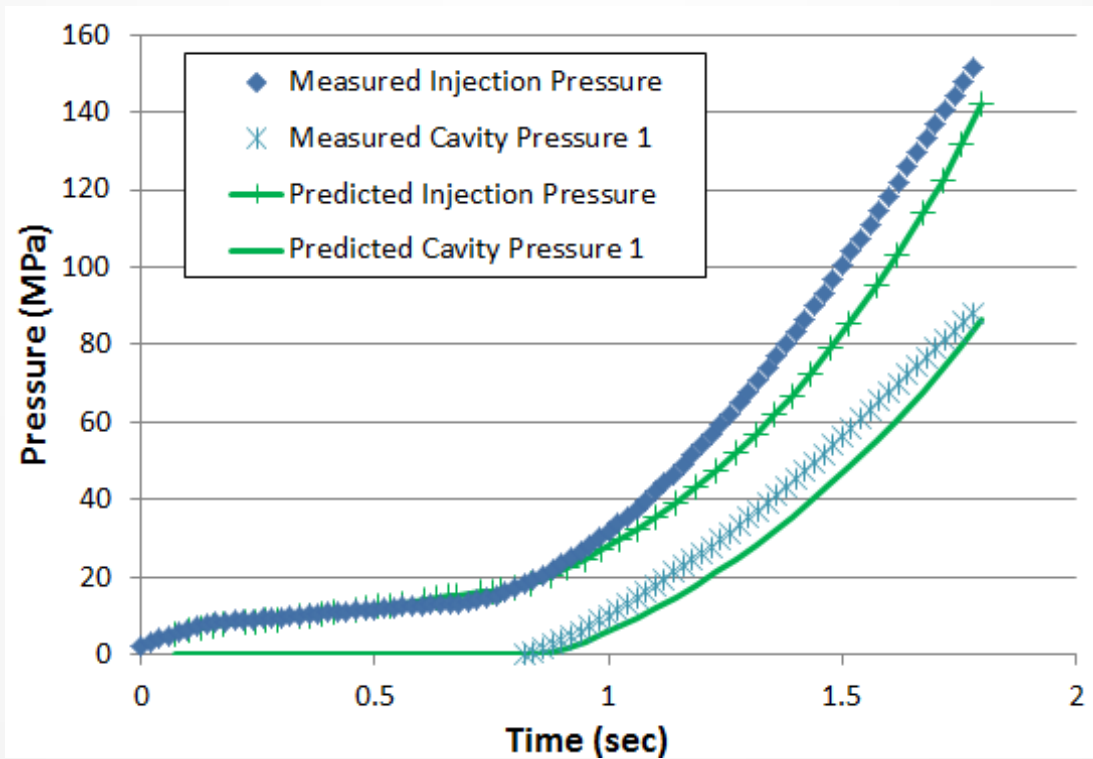
Unfilled PC Material



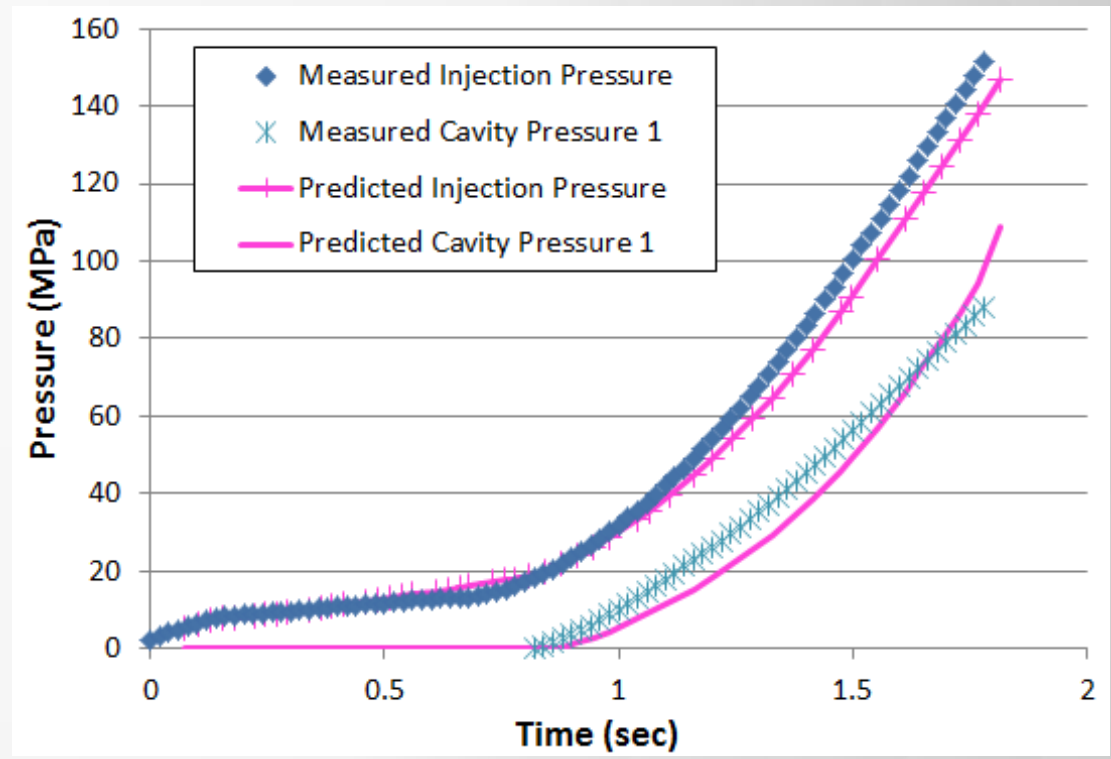
$$\eta_0(T, P) = \eta_0(T) e^{\beta P + \kappa P^2}$$



No Pressure Dependence



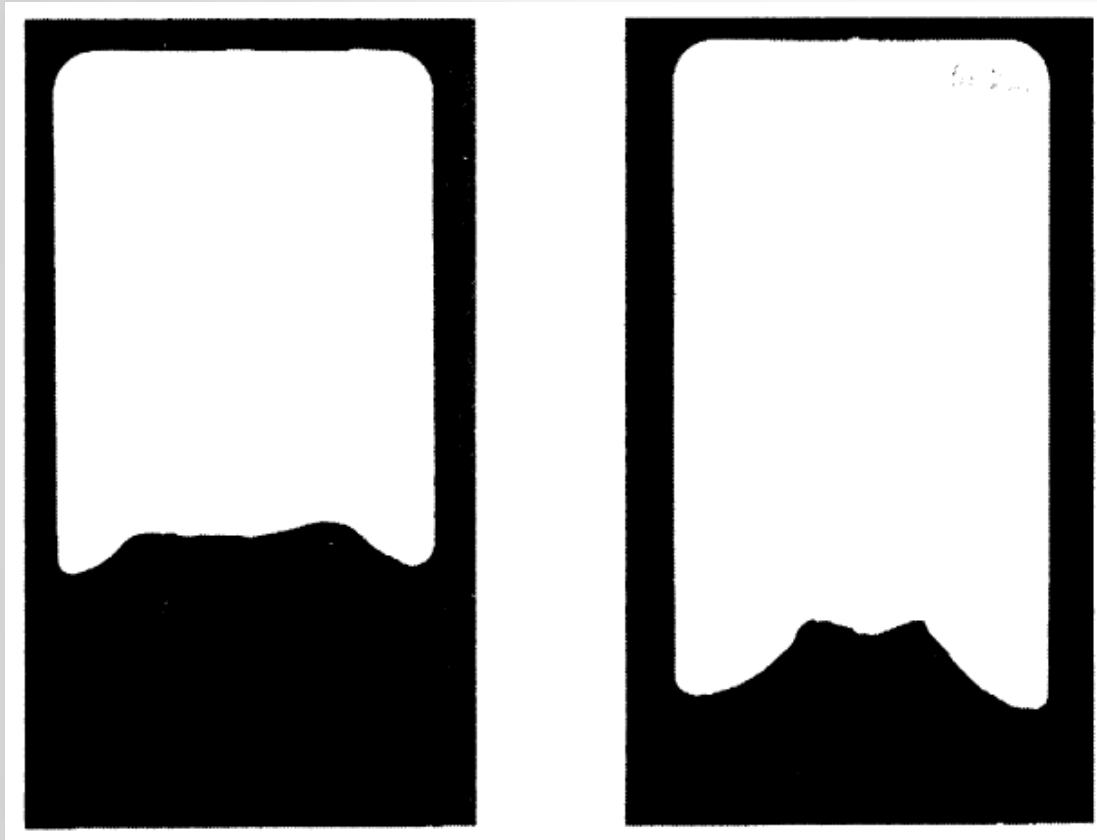
Barus (Standard)



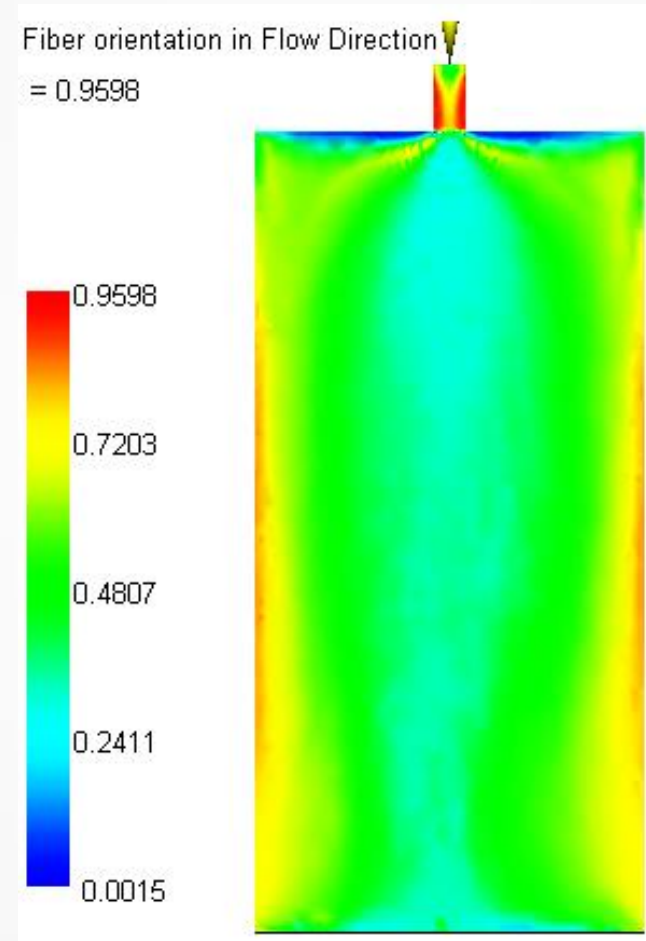
Quadratic Exponent

Dependence of Viscosity on Fiber Orientation

50%wt fiber filled PA



FOD on mid-surface



$$\begin{aligned} \eta(A_{ff}) &= \Psi \eta & \text{when } A_{ff} < A_{crit} \\ \eta(A_{ff}) &= \eta & \text{when } A_{ff} \geq A_{crit} \end{aligned}$$

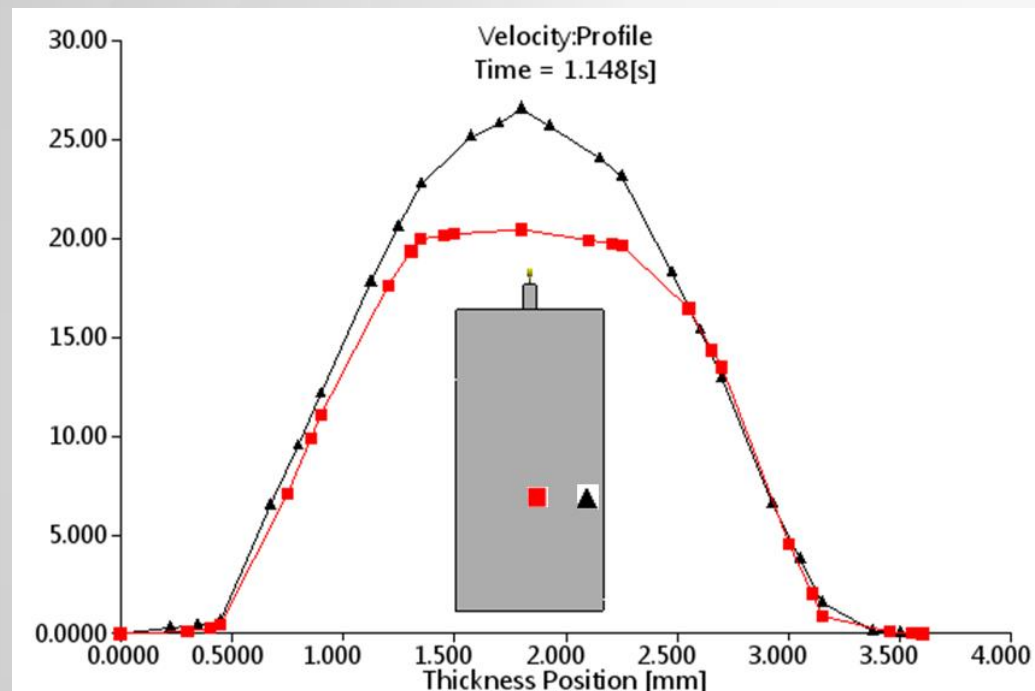
$$A_{crit} = 0.6$$

$$\Psi = 5$$

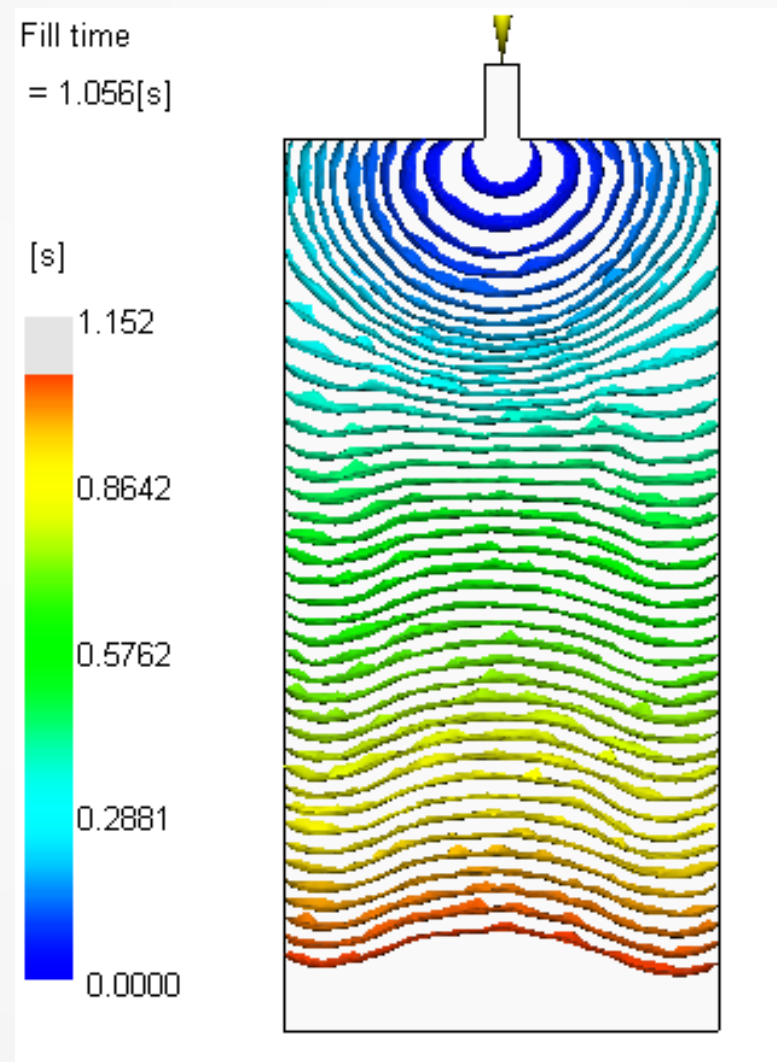
M. Akay and D. Barkley, *Plastics, Rubber & Composites Processing and Applications*, **20**, 137 (1993)

Dependence of Viscosity on Fiber Orientation

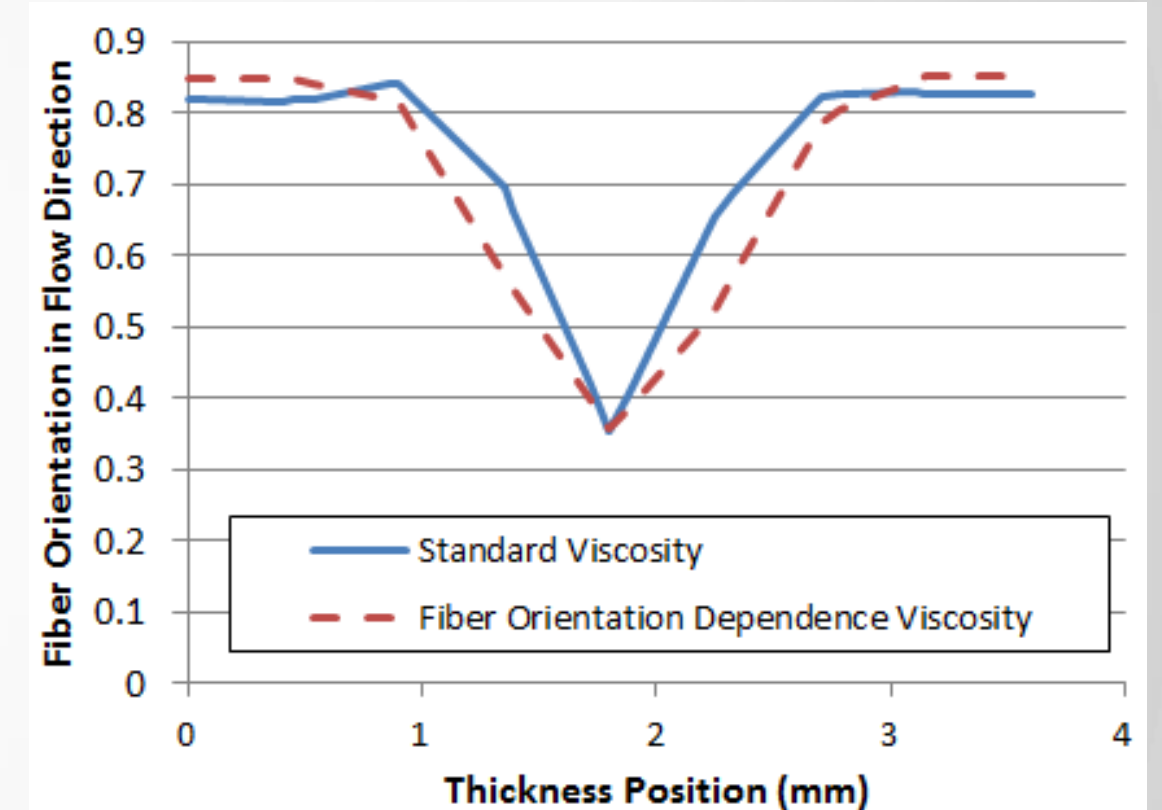
Velocity Profile



Fill Contours



Fiber Orientation Profile



Retractable Core pins

Tech Preview Only

- Supports part insert until pin is retracted

Nodal constraint

Nodal translation

Along X axis
Fixed

Along Y axis
Fixed

Along Z axis
Fixed

Nodal rotation

About X axis
Fixed

About Y axis
Fixed

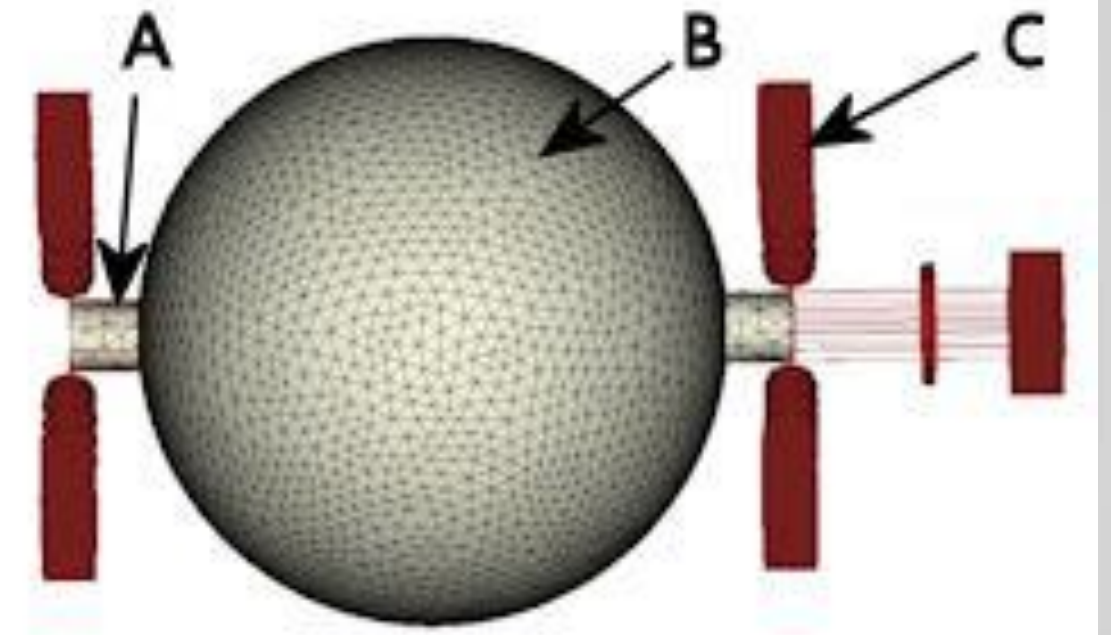
About Z axis
Fixed

Use constraint in
Core shift analysis ☒ Retractable Retraction time 1.5 s [0:100000]

Name Fixed nodal constraint

☒ Apply to all entities that share this property

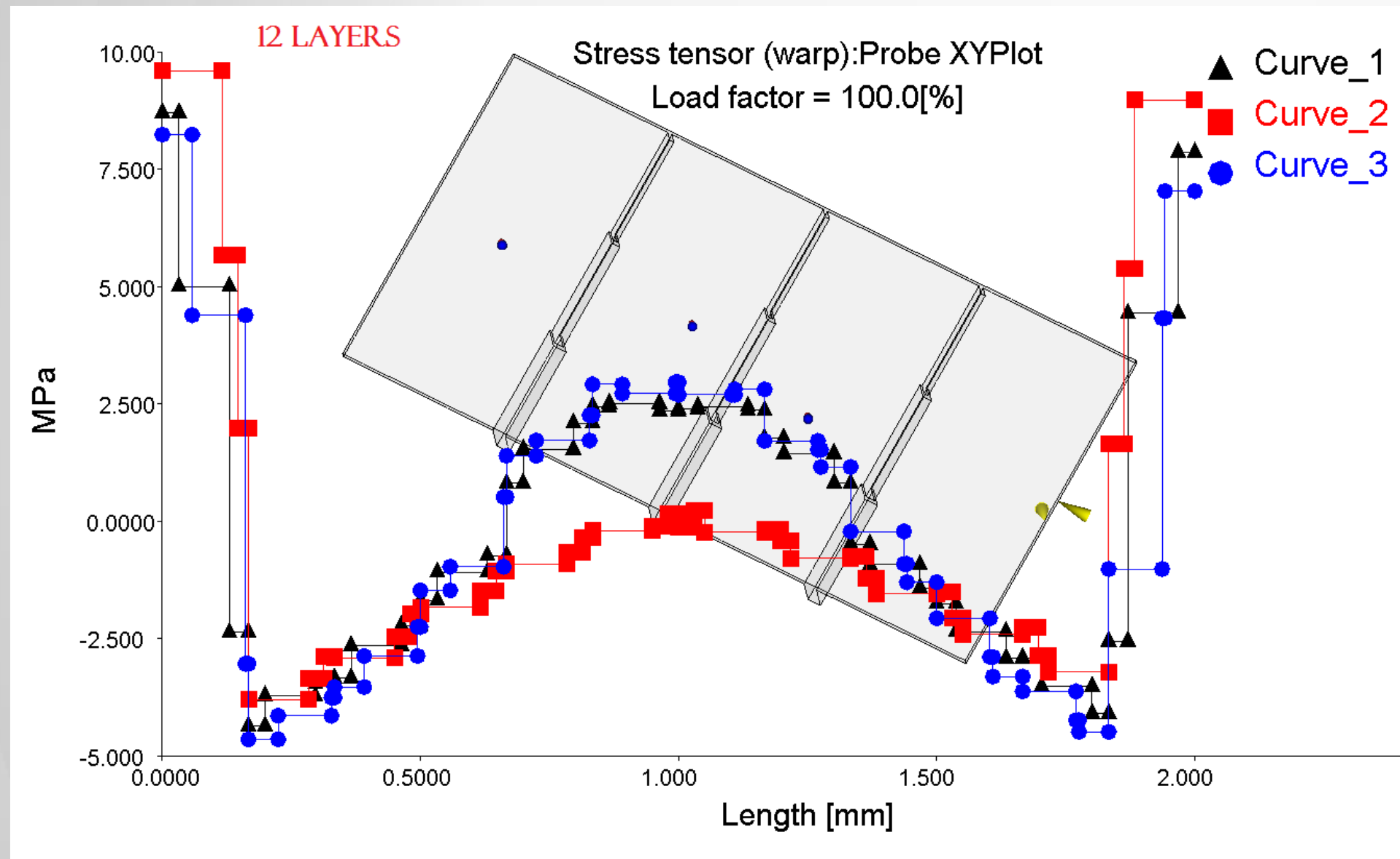
OK Cancel Help



3D Residual Stress: Post-warp

Tech Preview Only

Phase 1: Assume full mold constraint



Next Phases: Stress evolution

- Detachment from mold (before ejection)
- Consider viscoelastic stress relaxation

Ejection Force Calculation with Autodesk Mechanical Simulation

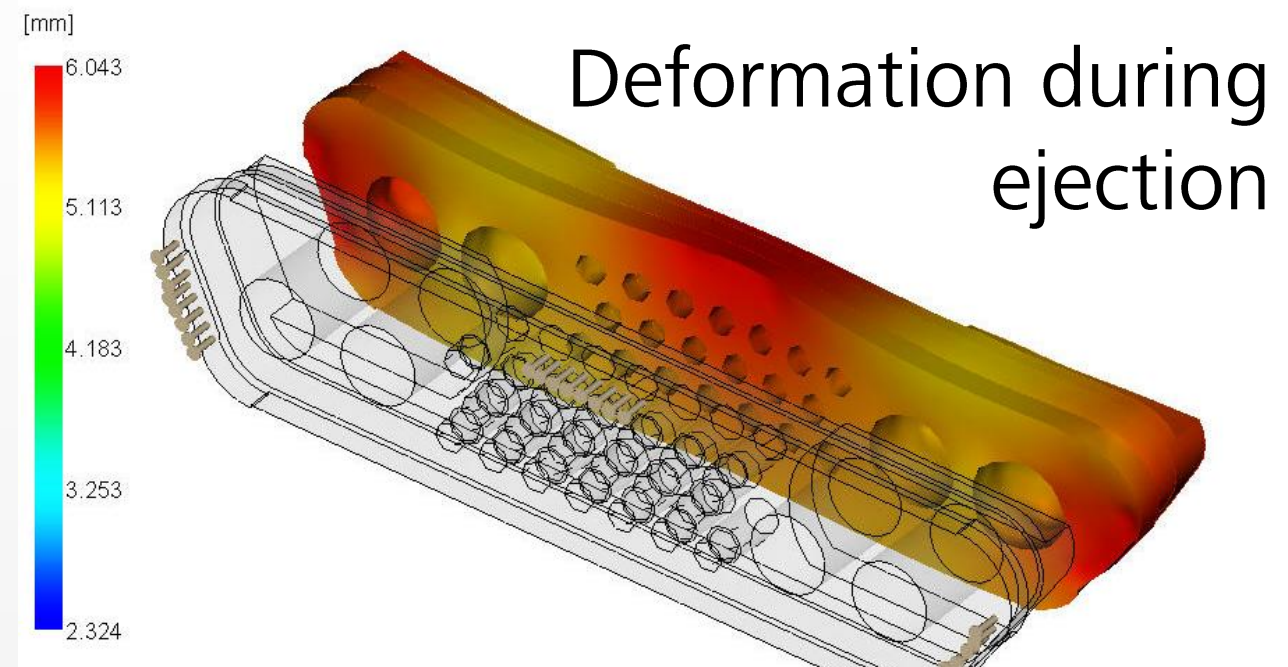
Tech Preview Only

■ Consider:

- Friction of part sliding on core
- Residual stress / pressure in the part
- Temperatures of the part
- Ejector position and direction
- Ejector speed profile

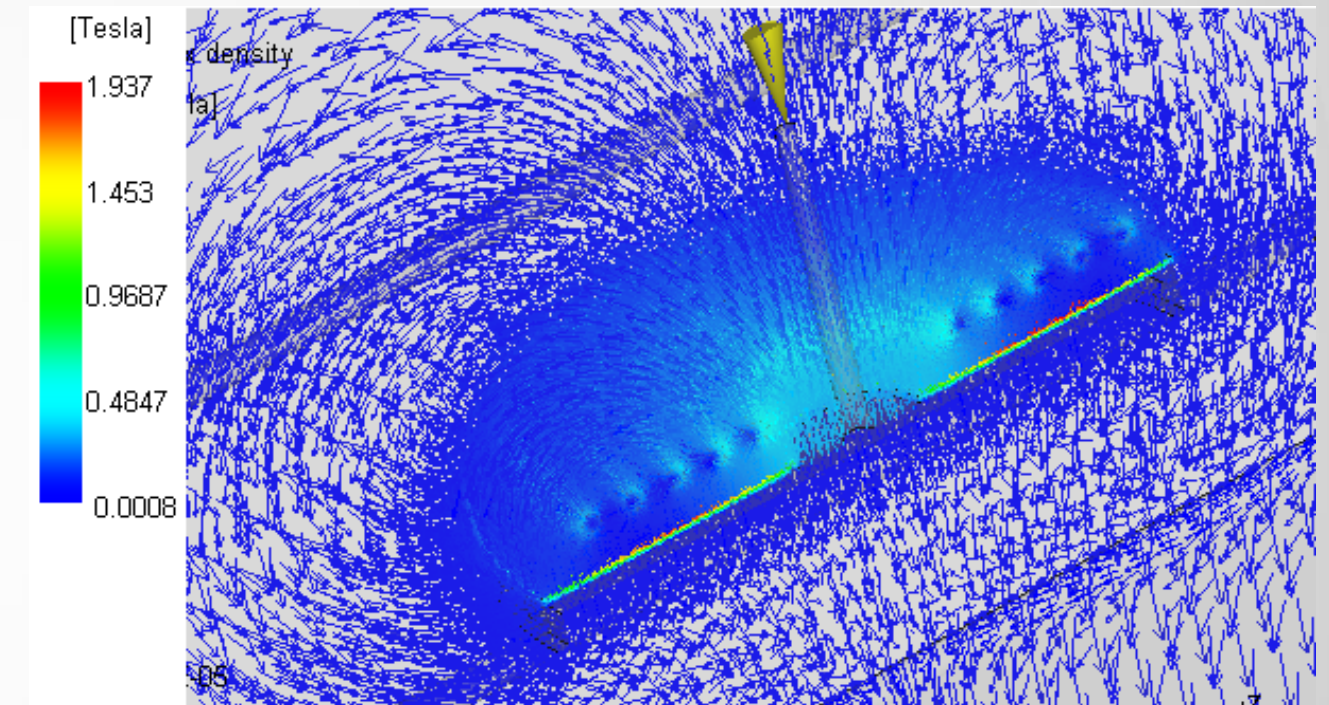
■ Predict:

- Deformation of plastic part during ejection
- Force required to eject



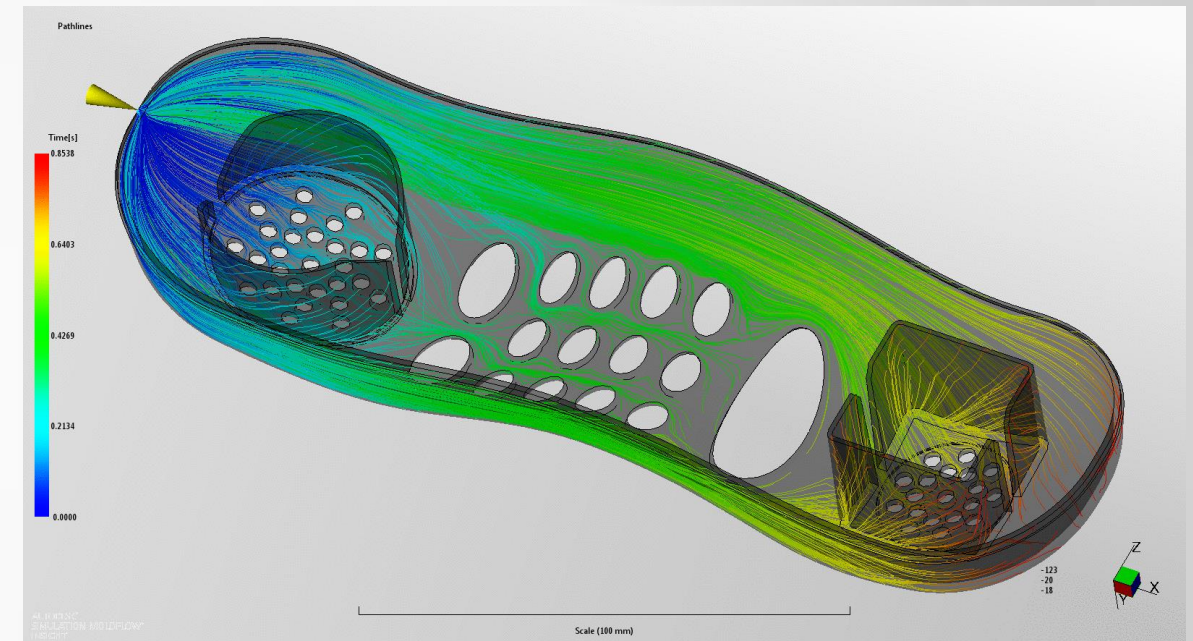
Summary

- 2015 Scandium Technology Preview
 - Induction Heating
 - Microcellular Foaming
 - Controlled Valve Gate Opening
 - 3D Fiber Inlet
 - Solver API (Viscosity)
 - Retractable Core Pins
 - 3D Residual Stress
 - Ejection Force



Agenda

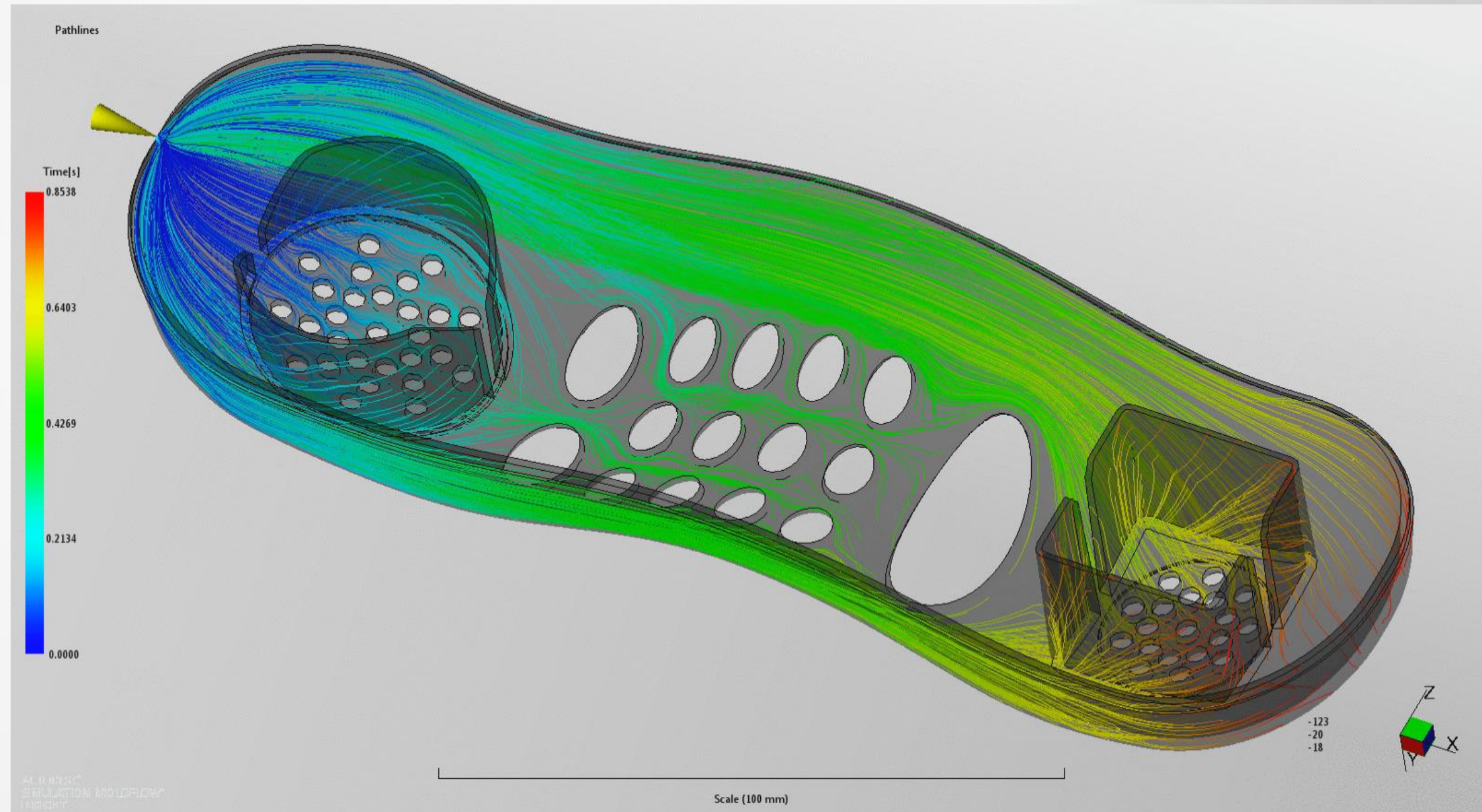
- 2015 Scandium Technology Preview
- Moldflow Insight 2016 Beta
- Some API Tools
- Long Term Research Collaborations



Pathlines

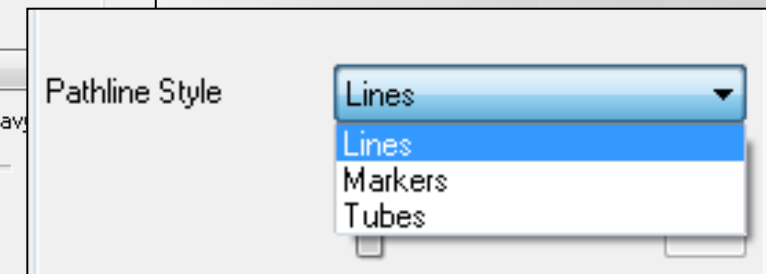
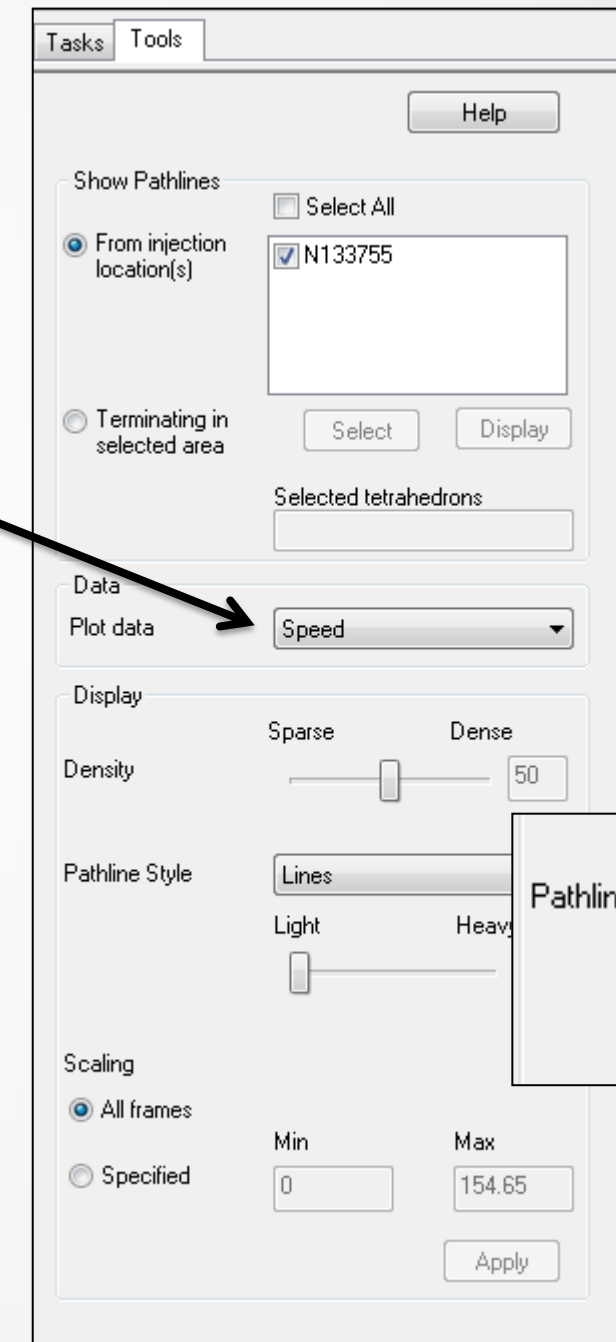
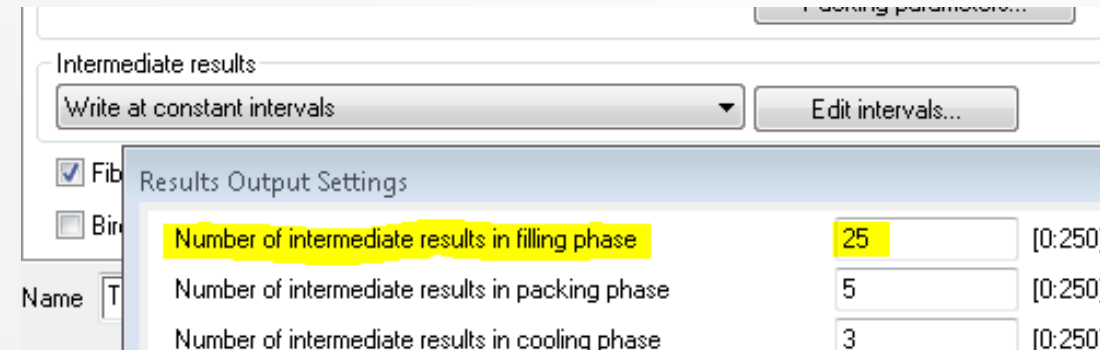
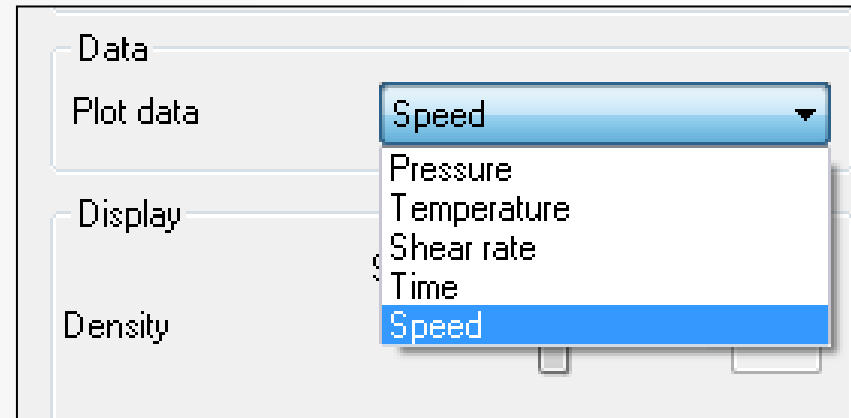
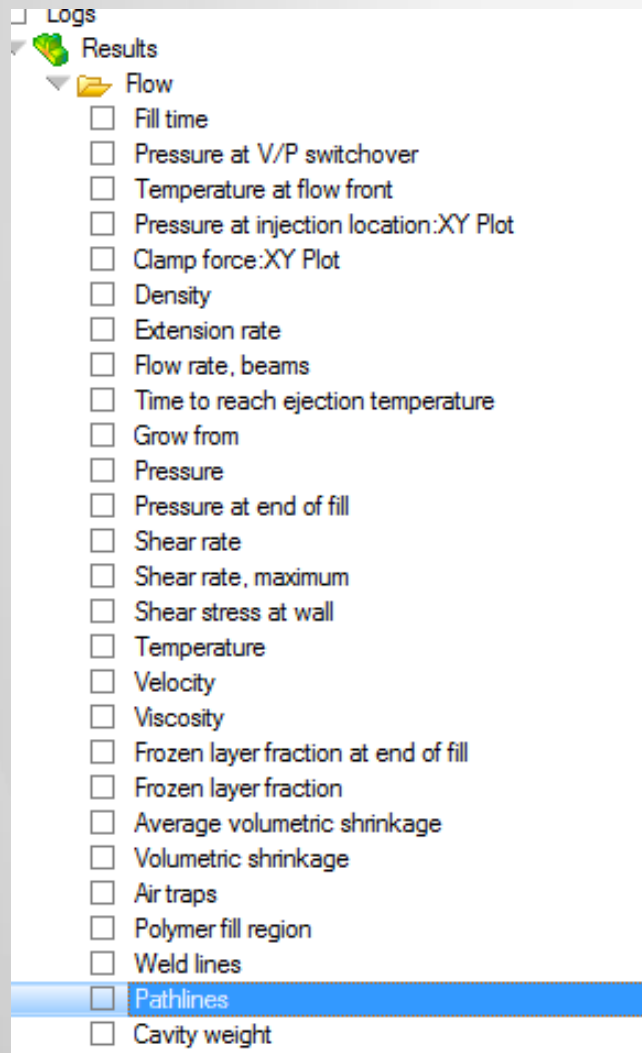
Track the flow path of polymer

- Overlay with
 - Time
 - Temperature
 - Pressure
 - Speed
 - Shear Rate



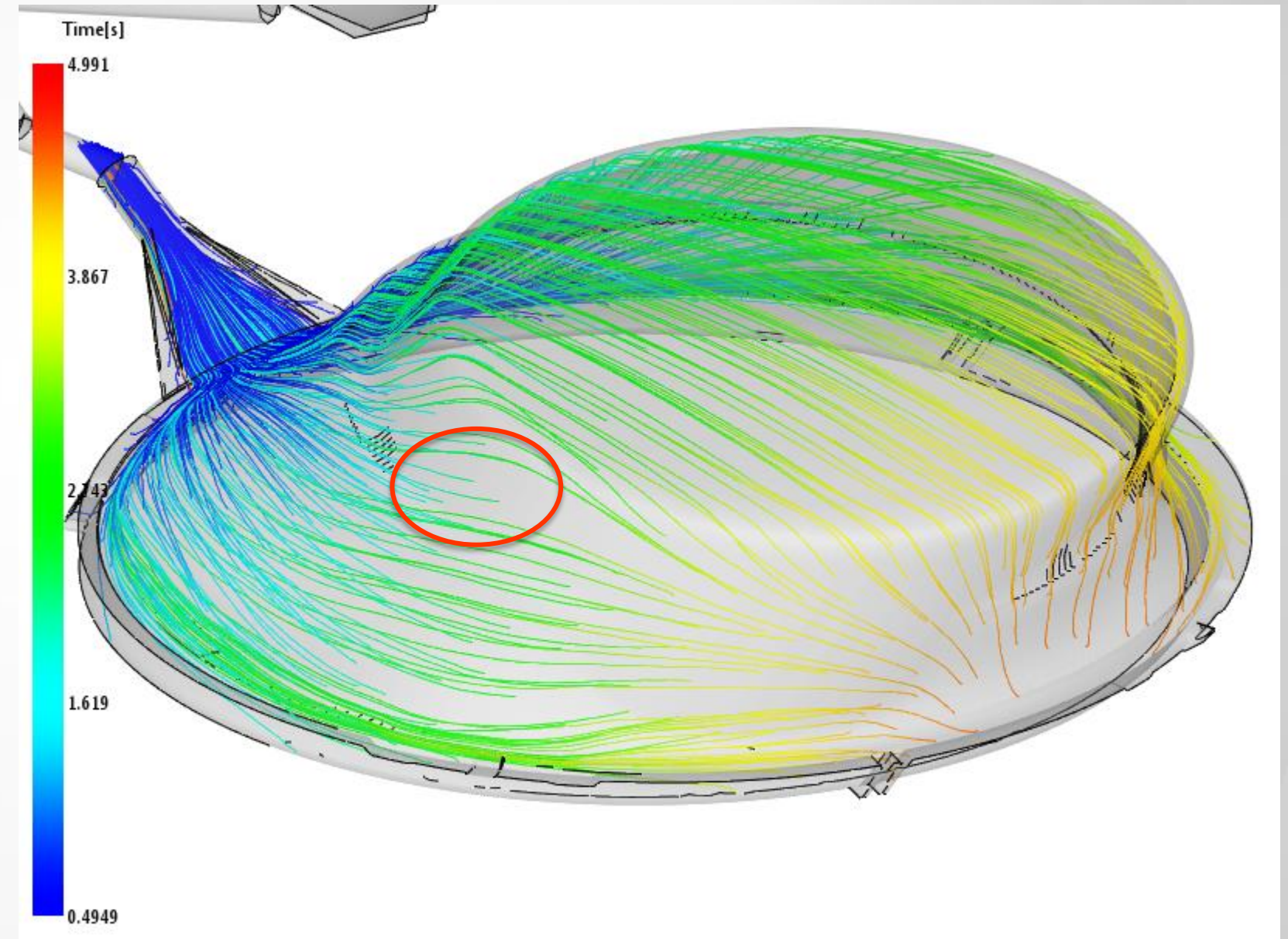
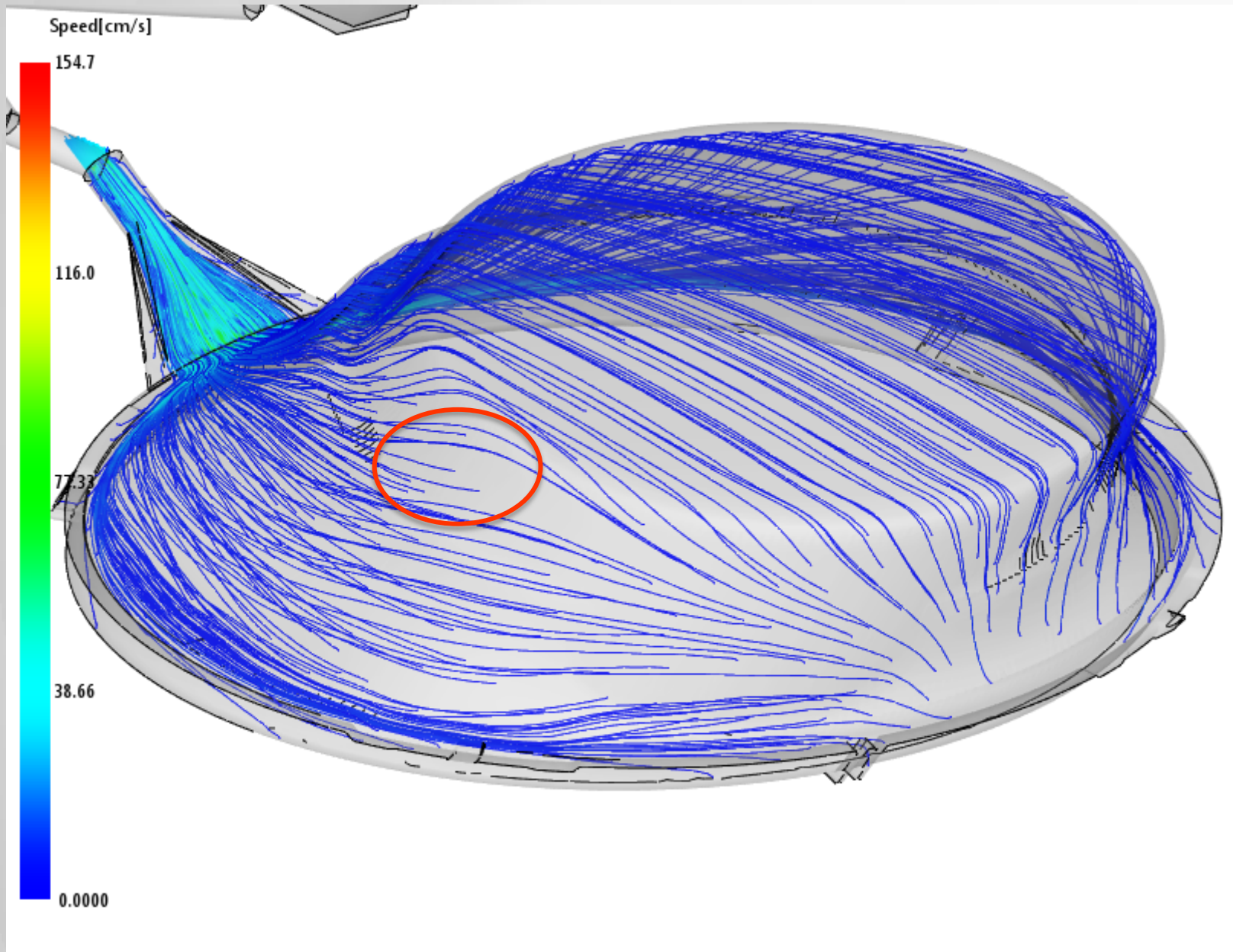
Pathlines: Where to find them

- Already in the default result list
- Old Studies: Rerun in 2016



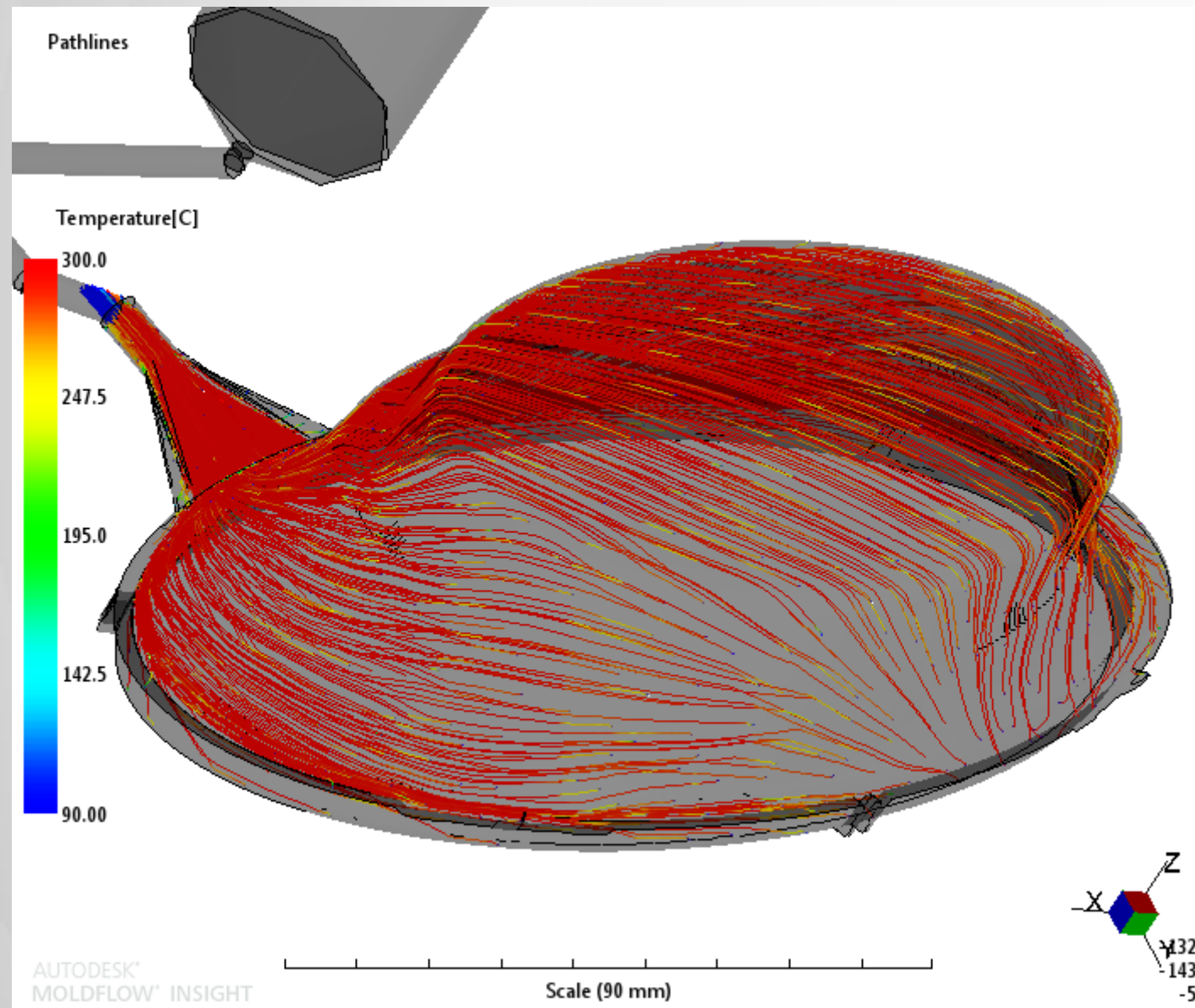
Pathlines: Speed & Time Results

Notice: Not all paths reach the end of flow!

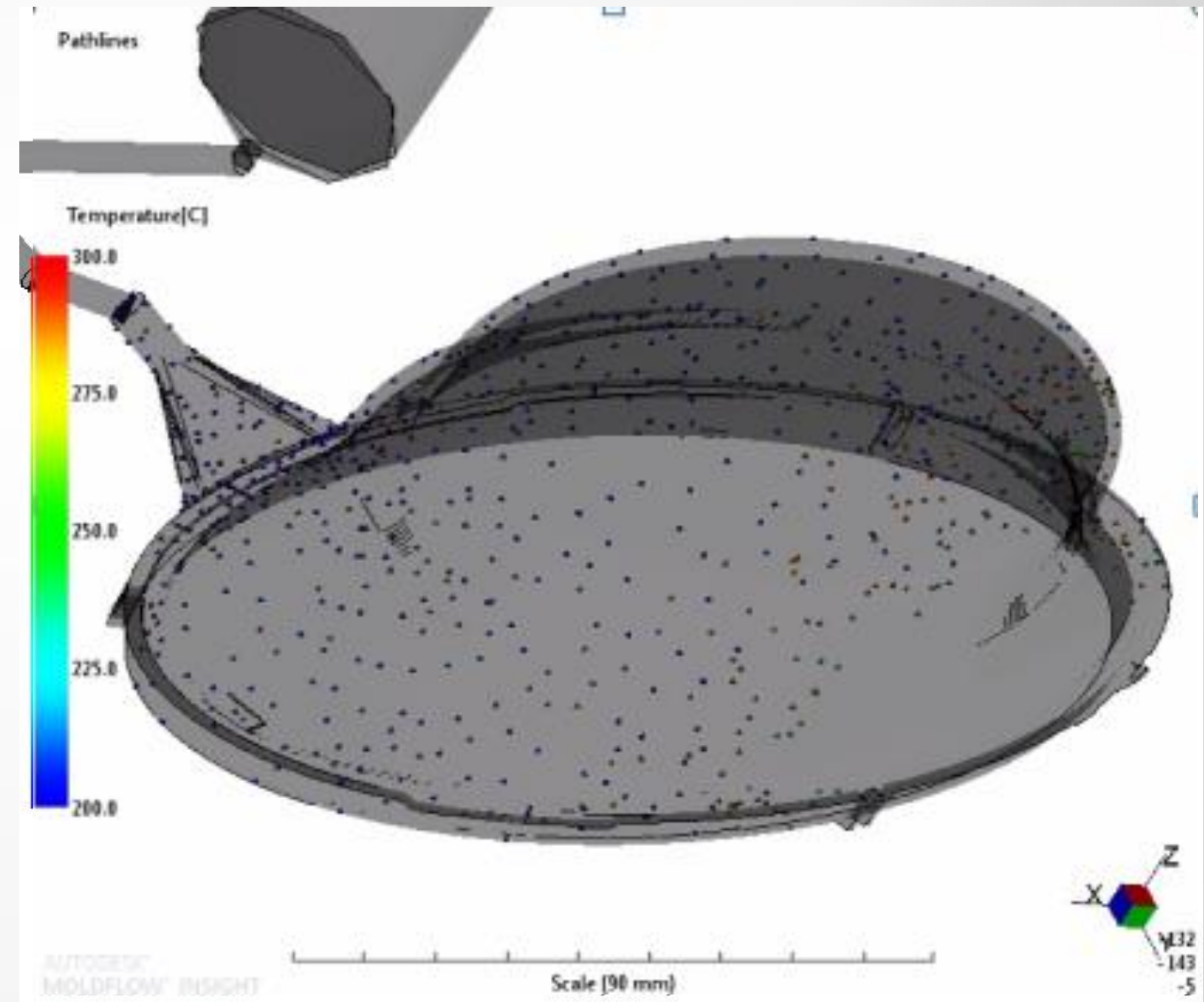


Pathlines: Temperature Result

Lines

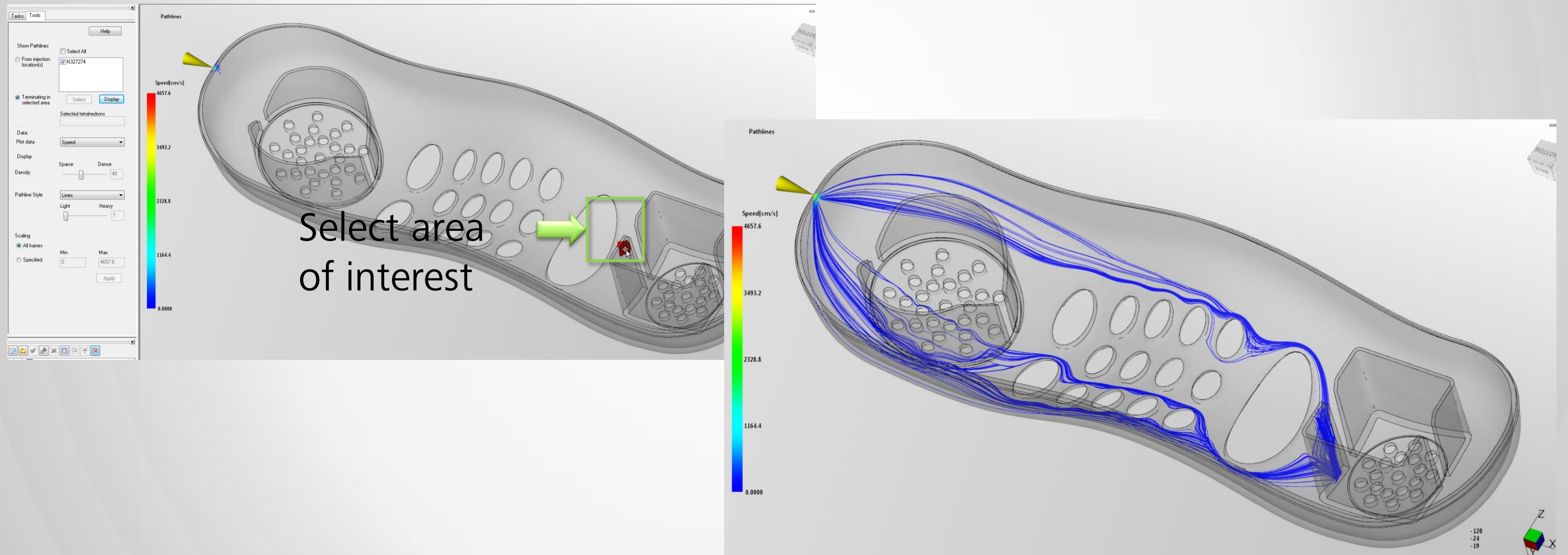


Markers

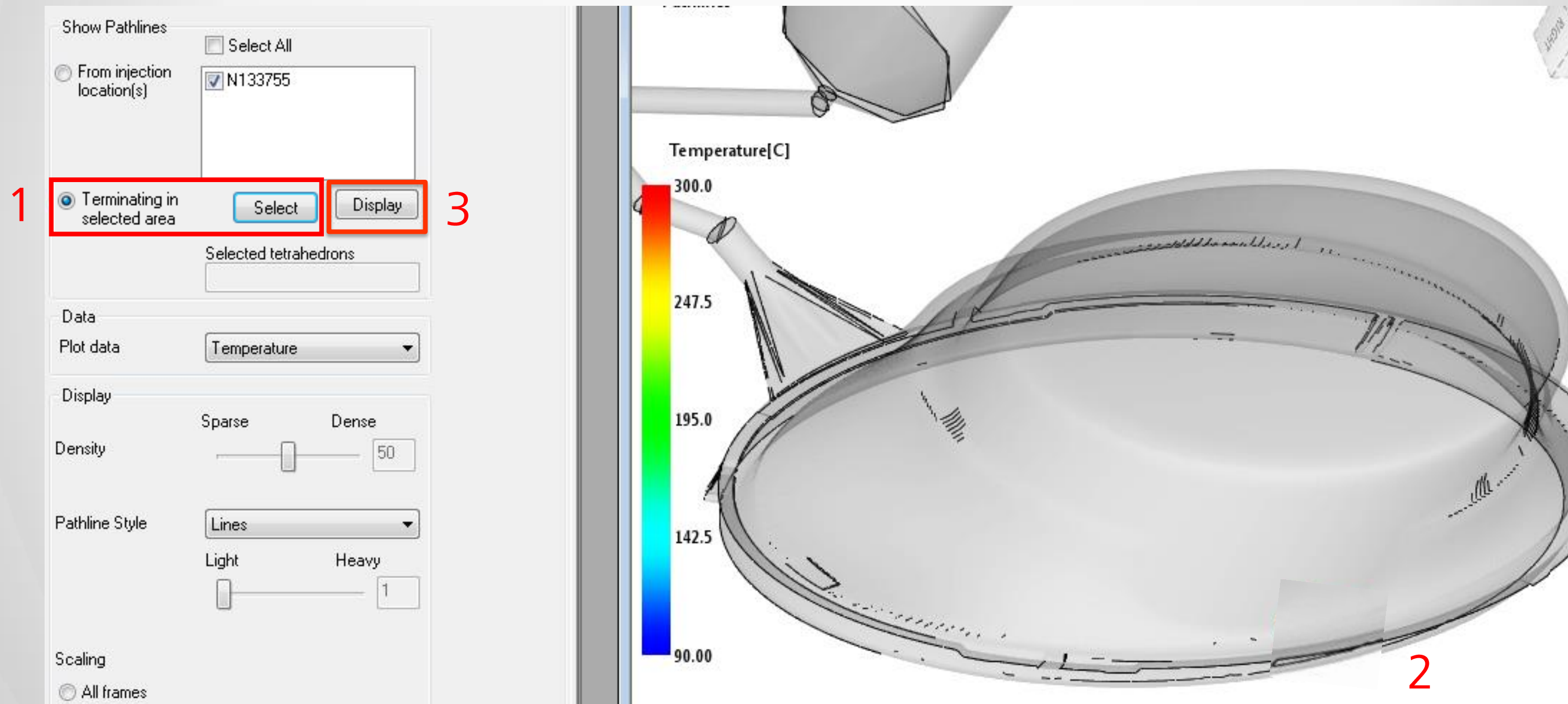


Pathlines: Examine paths terminating in a selected area

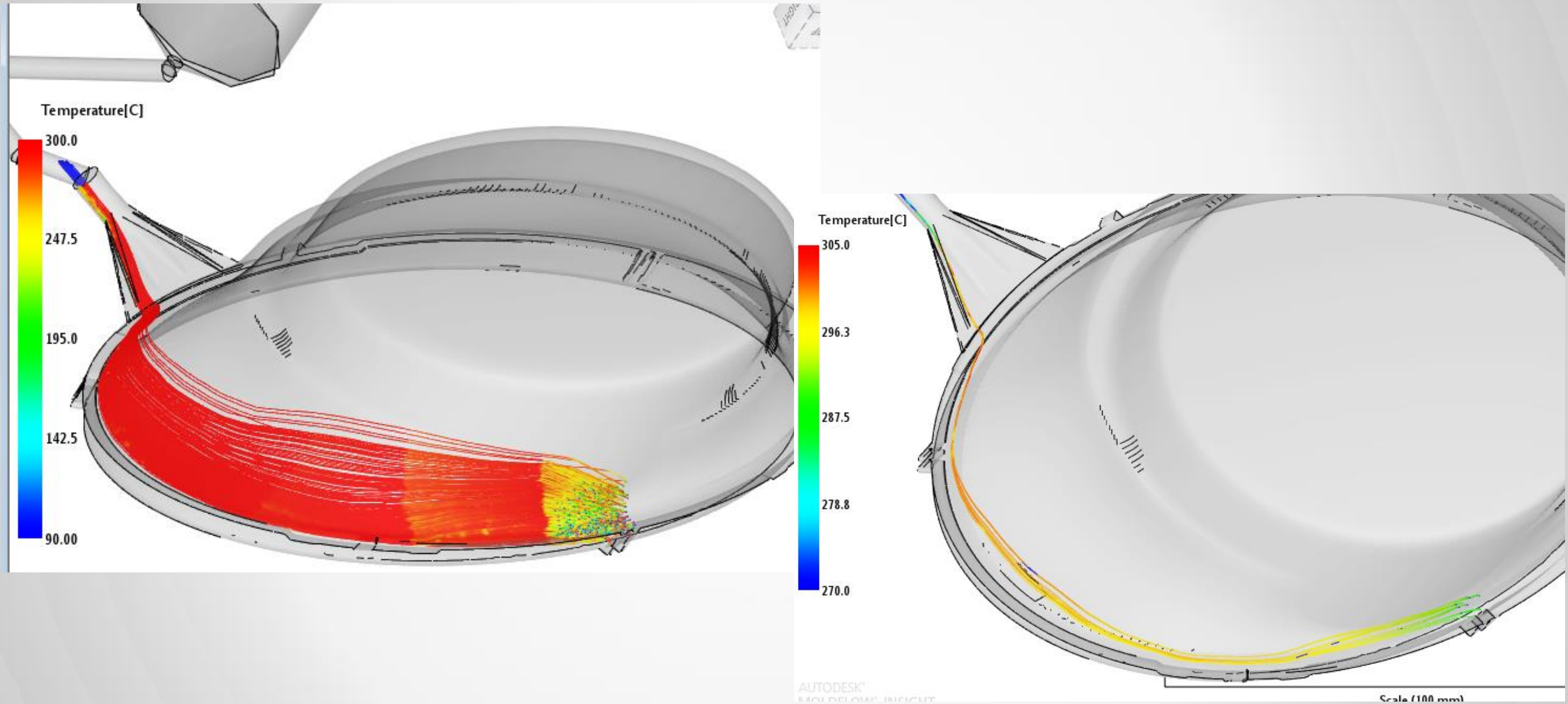
Choose to show only the path lines which terminate at a specified location



Pathlines: Examine paths terminating in a selected area

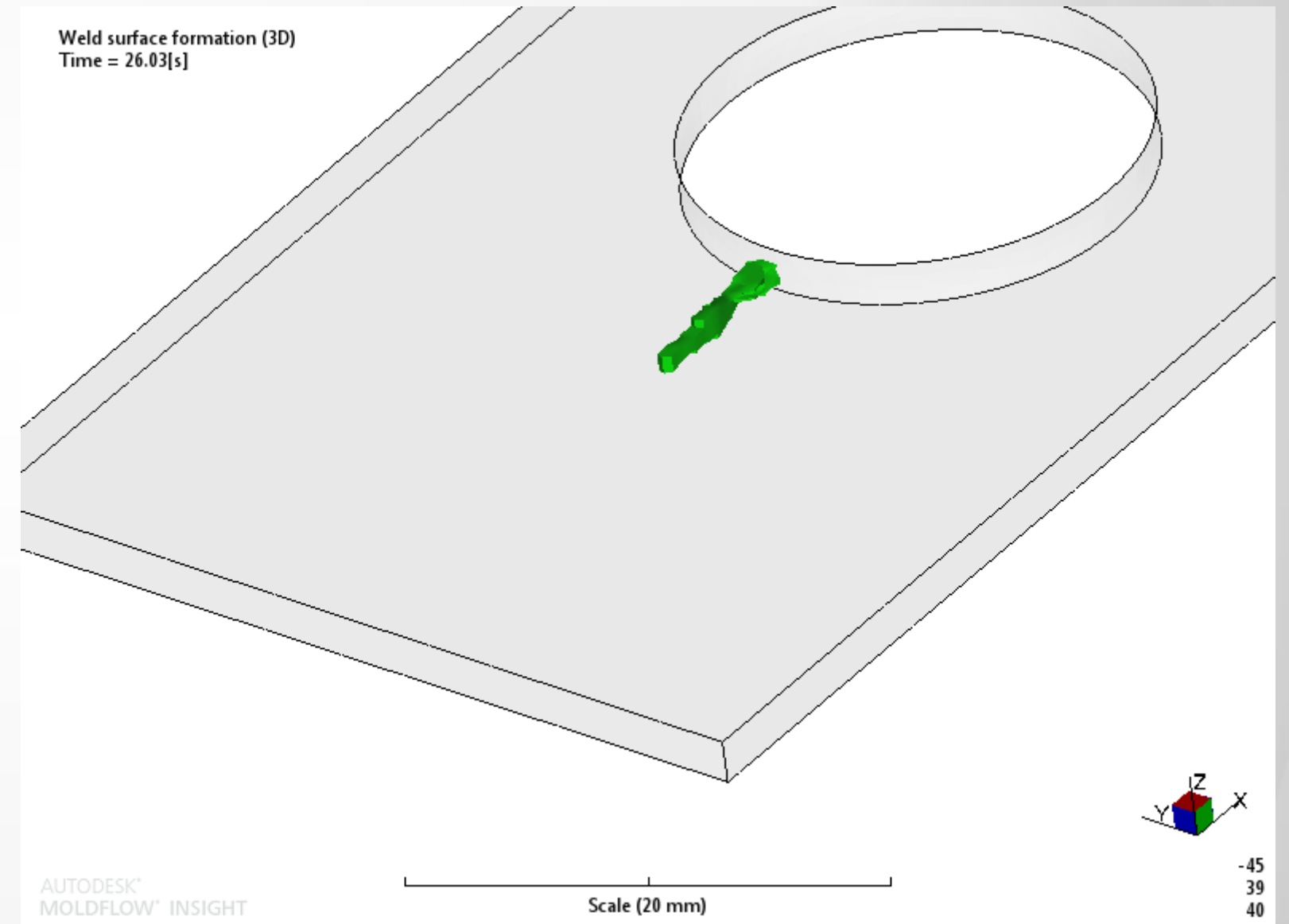
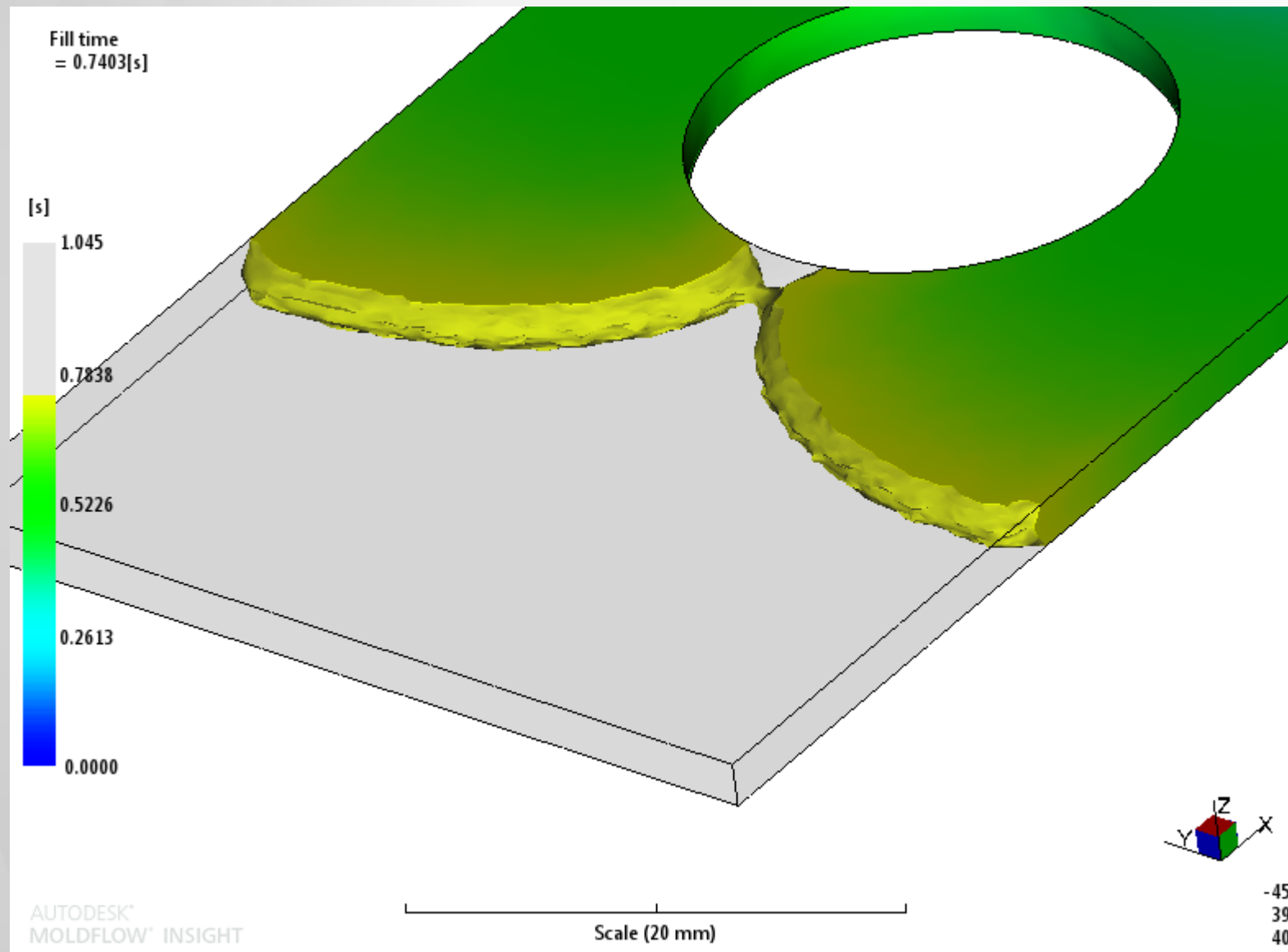


Pathlines: Examine paths terminating in a selected area

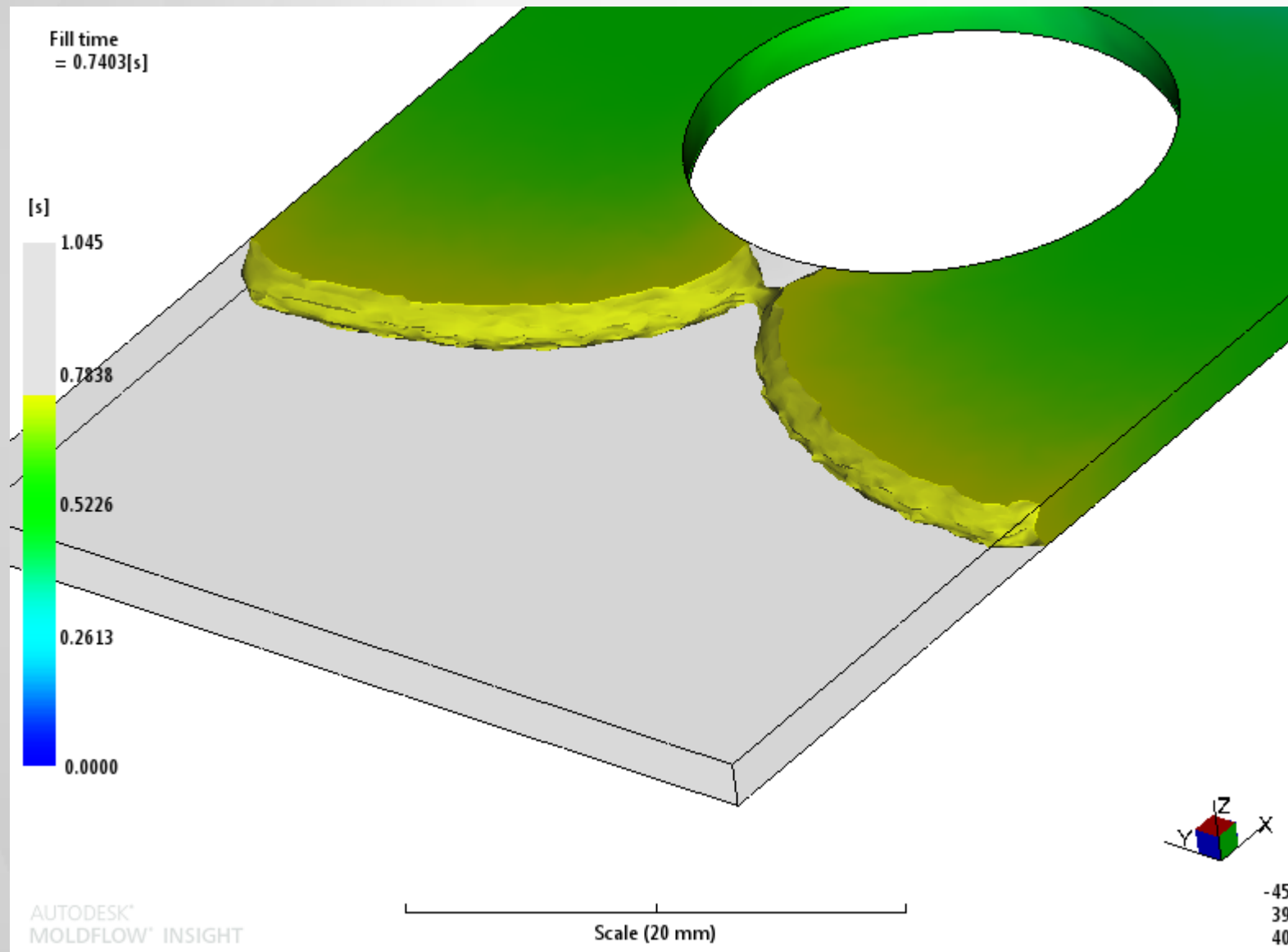


Visualize 3D Weld-Surfaces

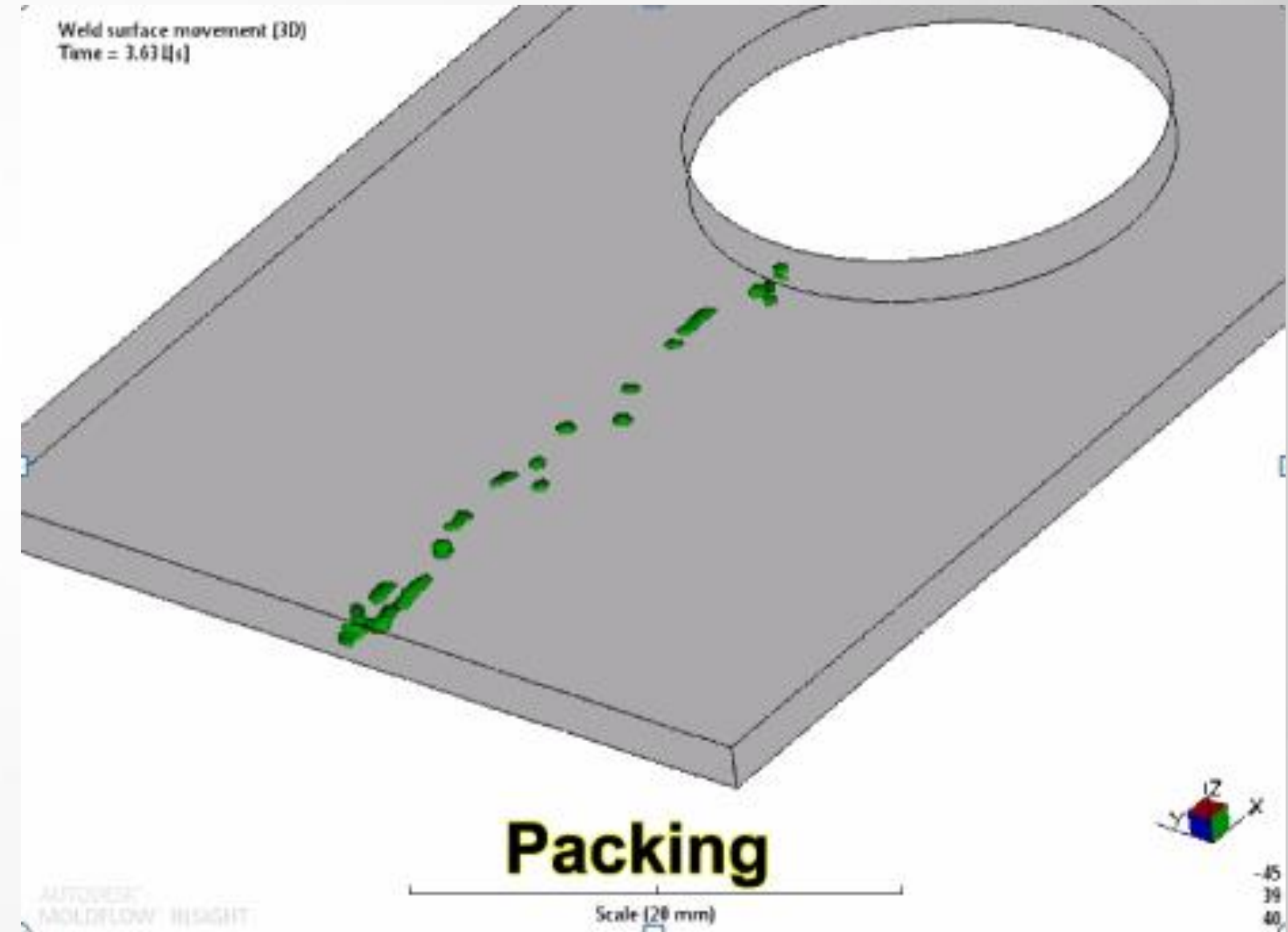
Initial Weld Surface Position



Visualize 3D Weld-Surfaces

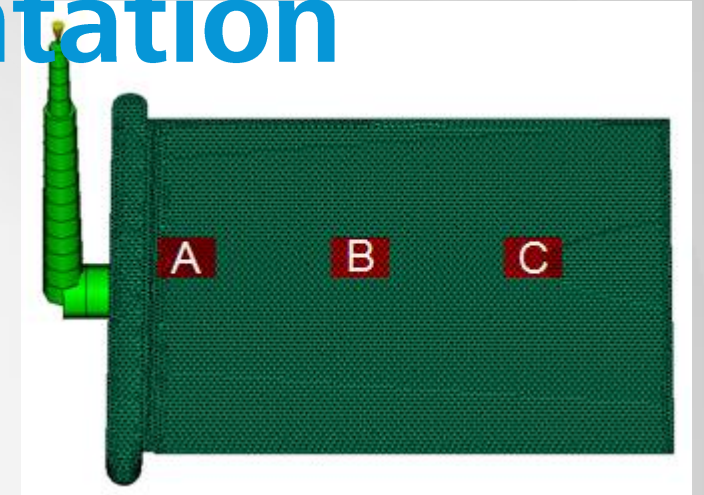


Animate Weld Surface

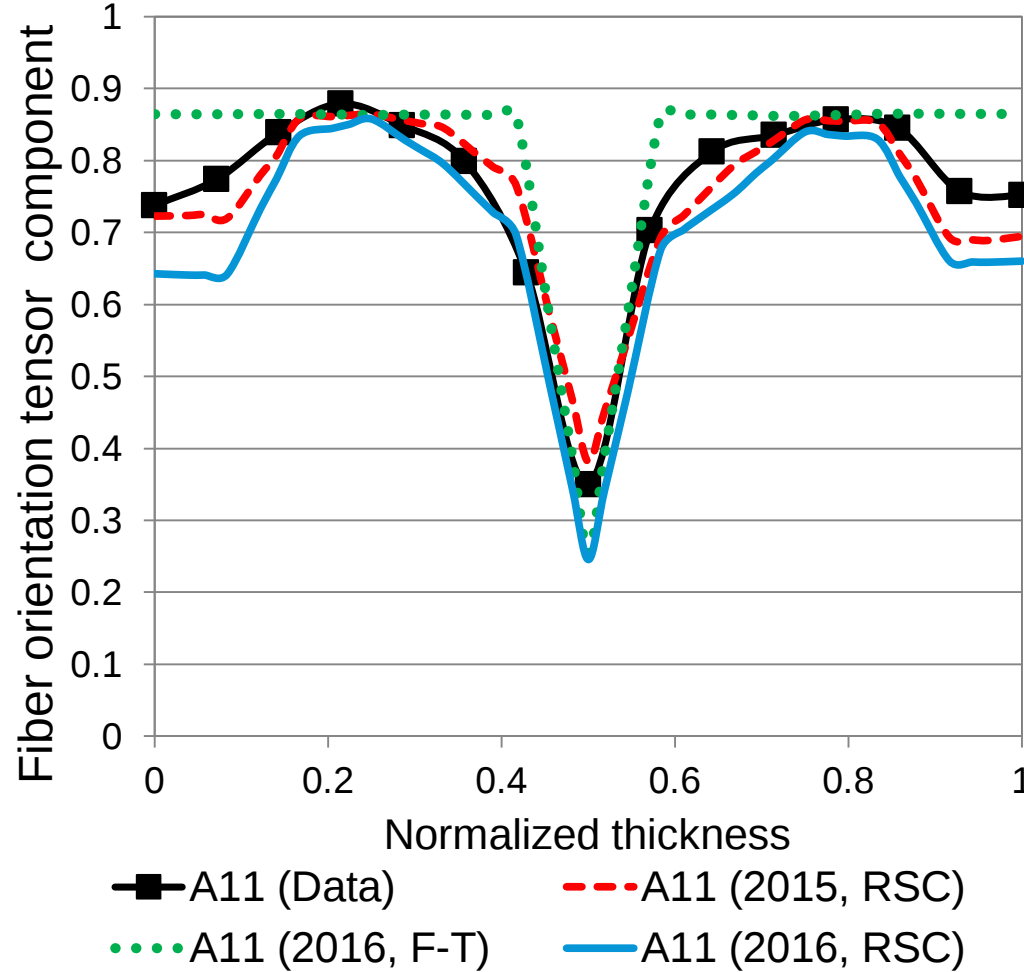


Improved RSC predictions for 3D Fiber Orientation

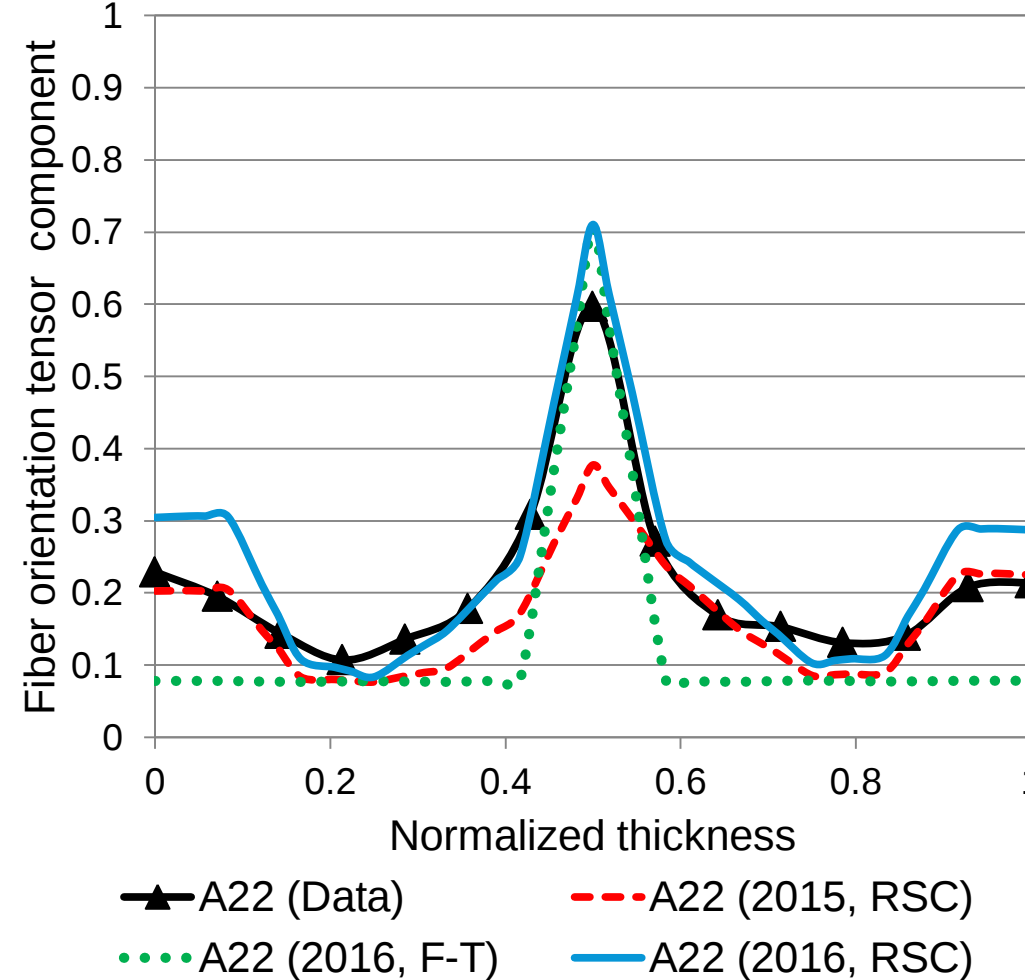
Delphi Iso-plaque: 2mm thick. 30wt%GF/PBT,
Slow fill, Location B



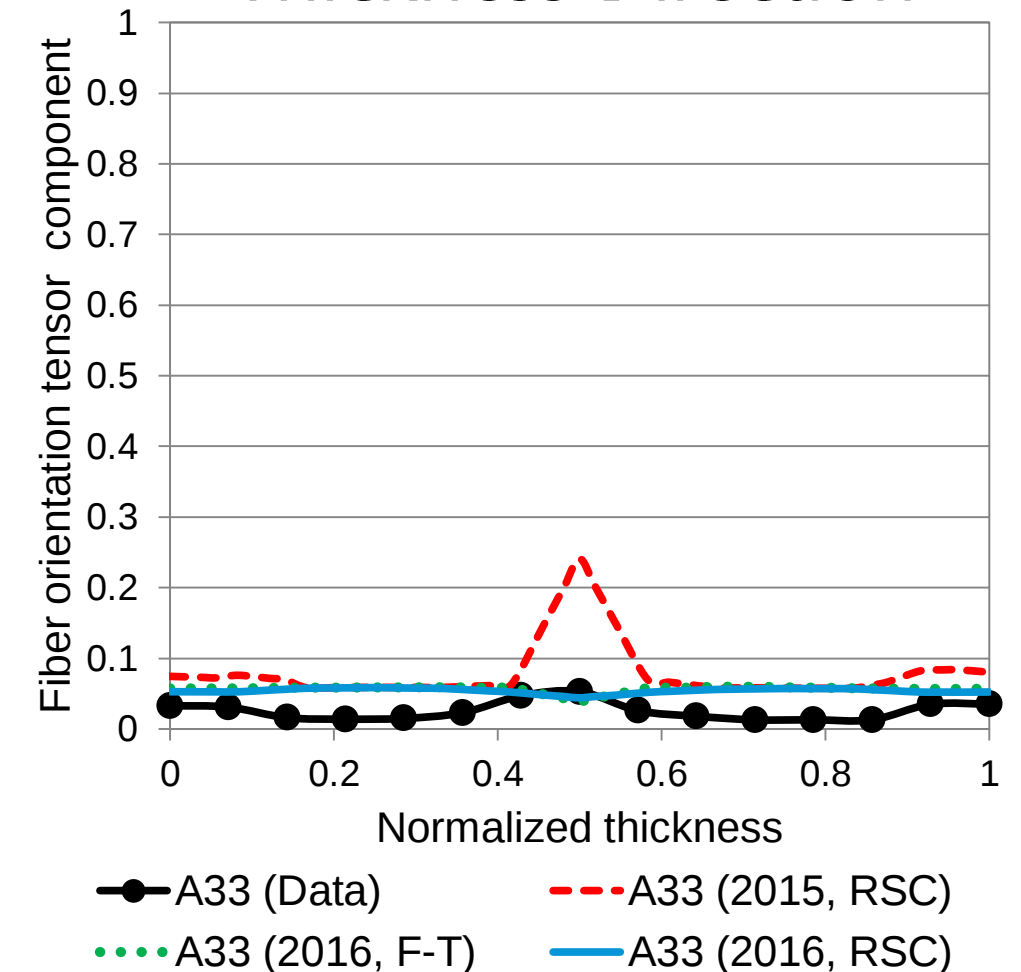
Flow Direction



Cross-Flow Direction

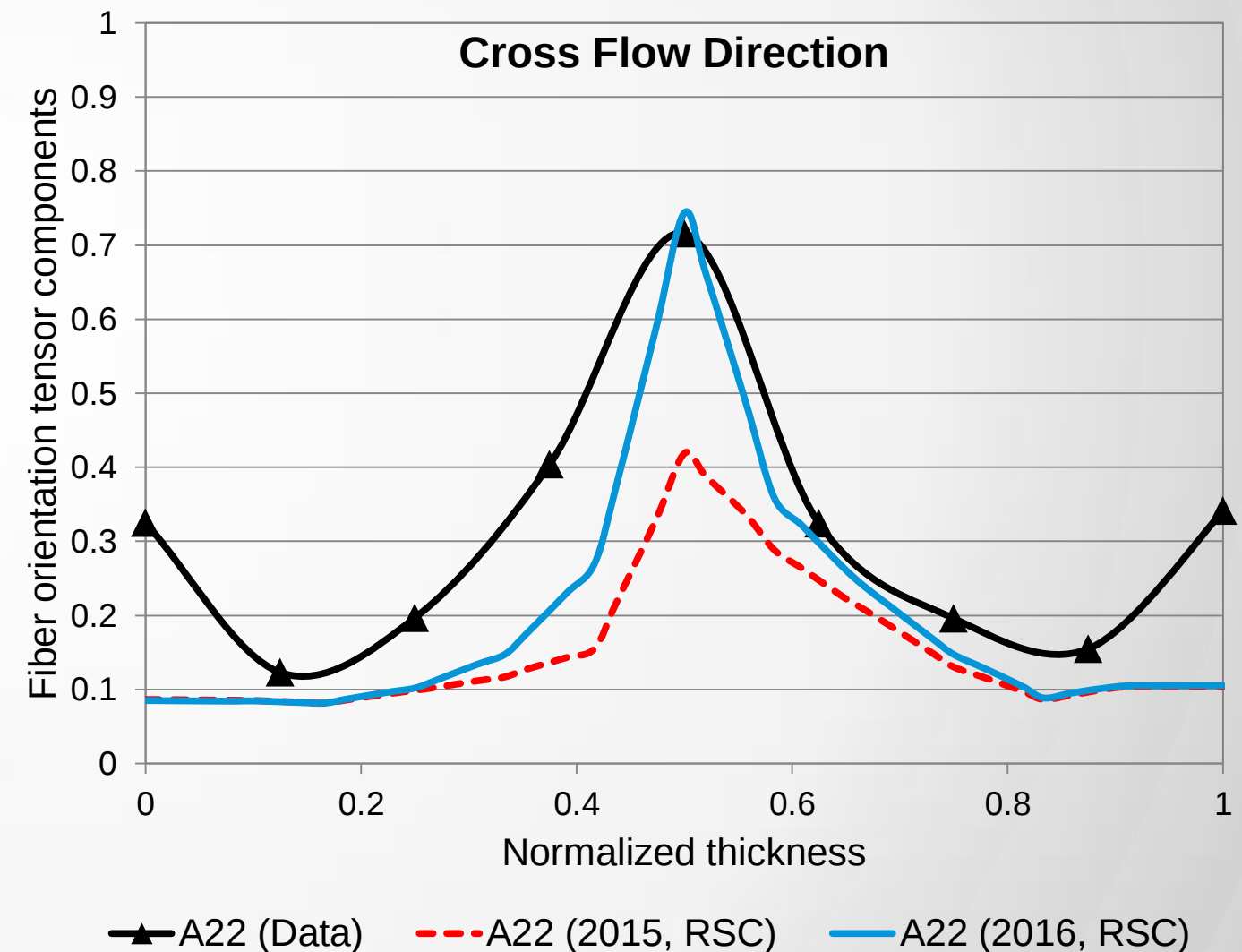
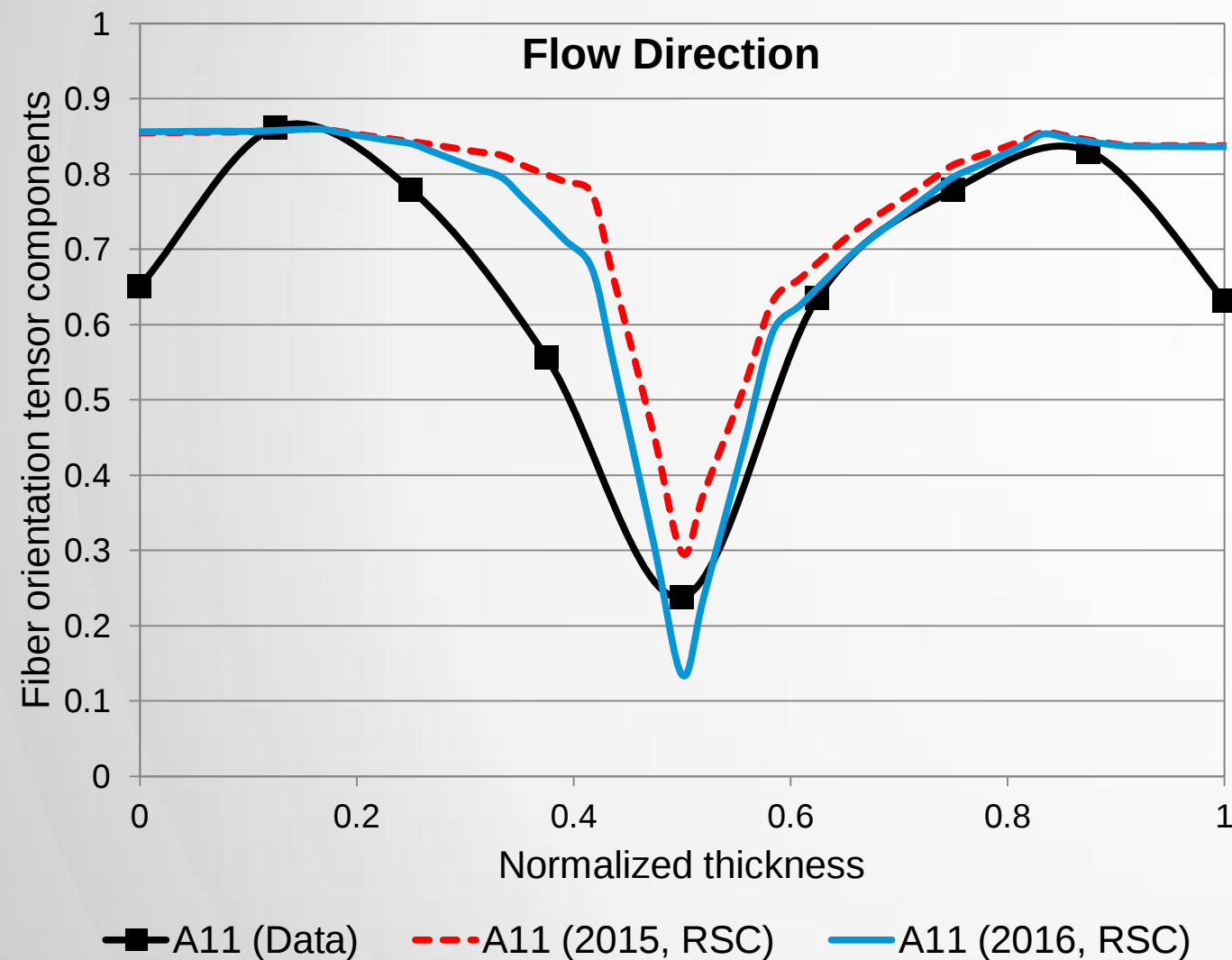
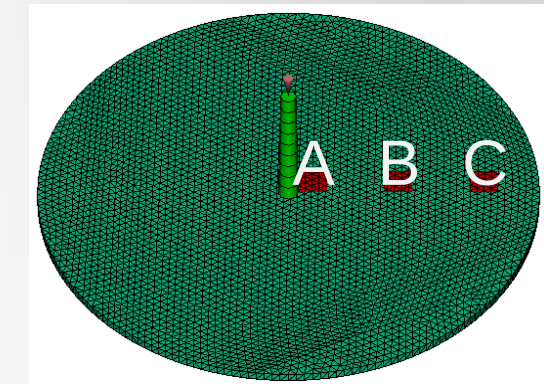


Thickness Direction



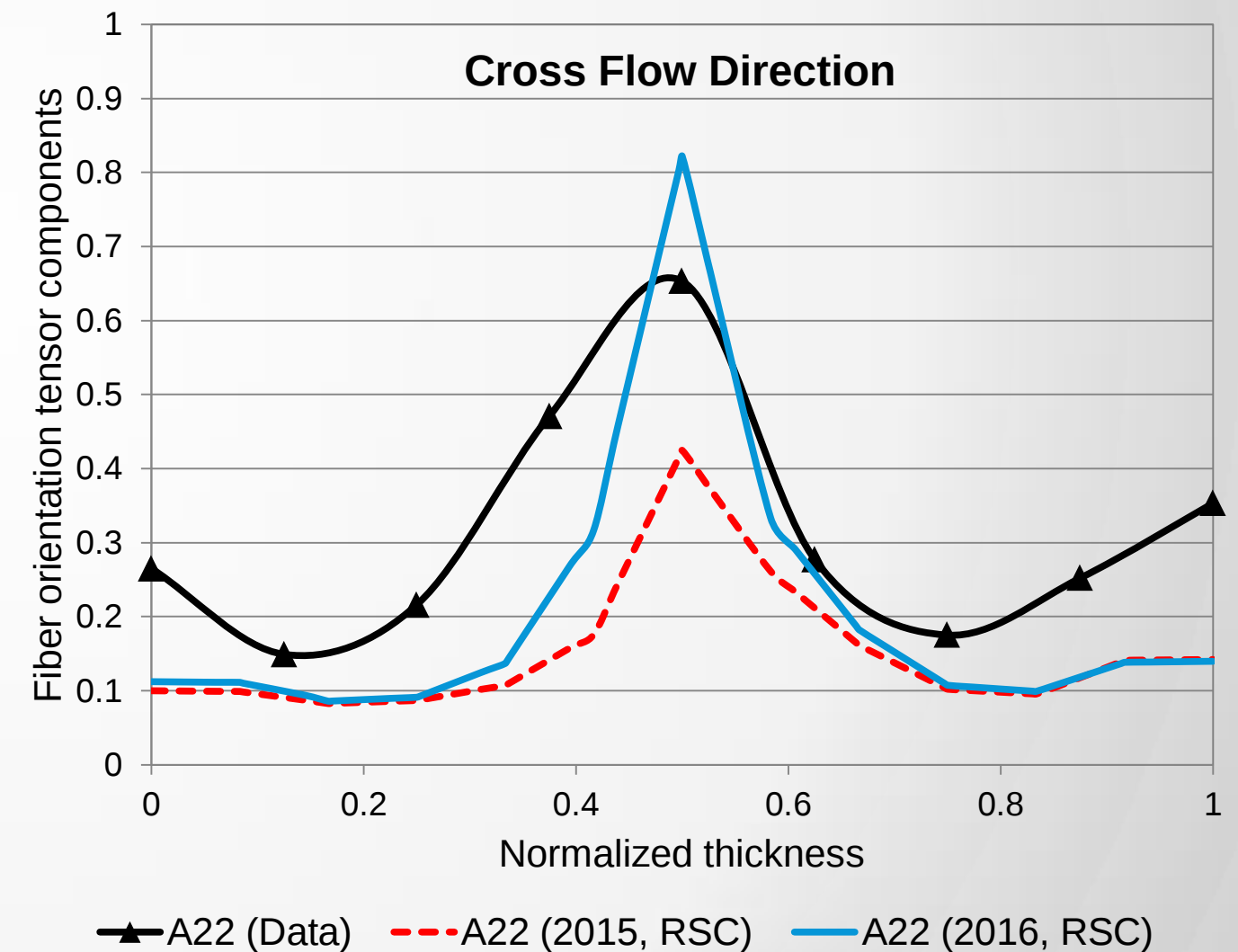
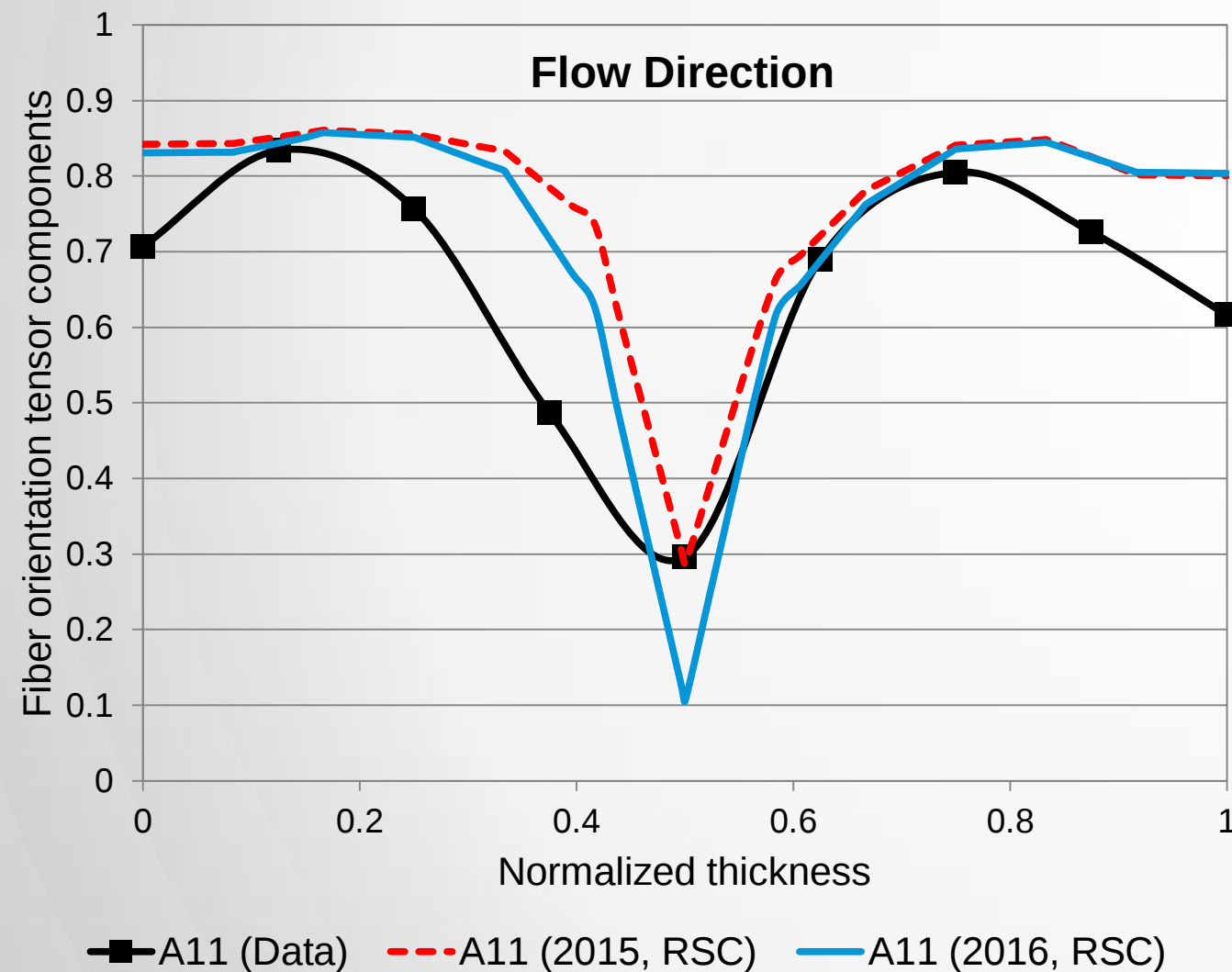
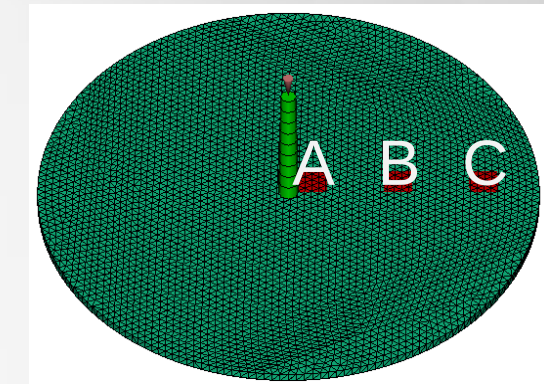
Improved RSC predictions for 3D Fiber Orientation

Delphi **Disk**: 1.5mm thick. 30wt%GF/PBT,
Slow fill, Location B



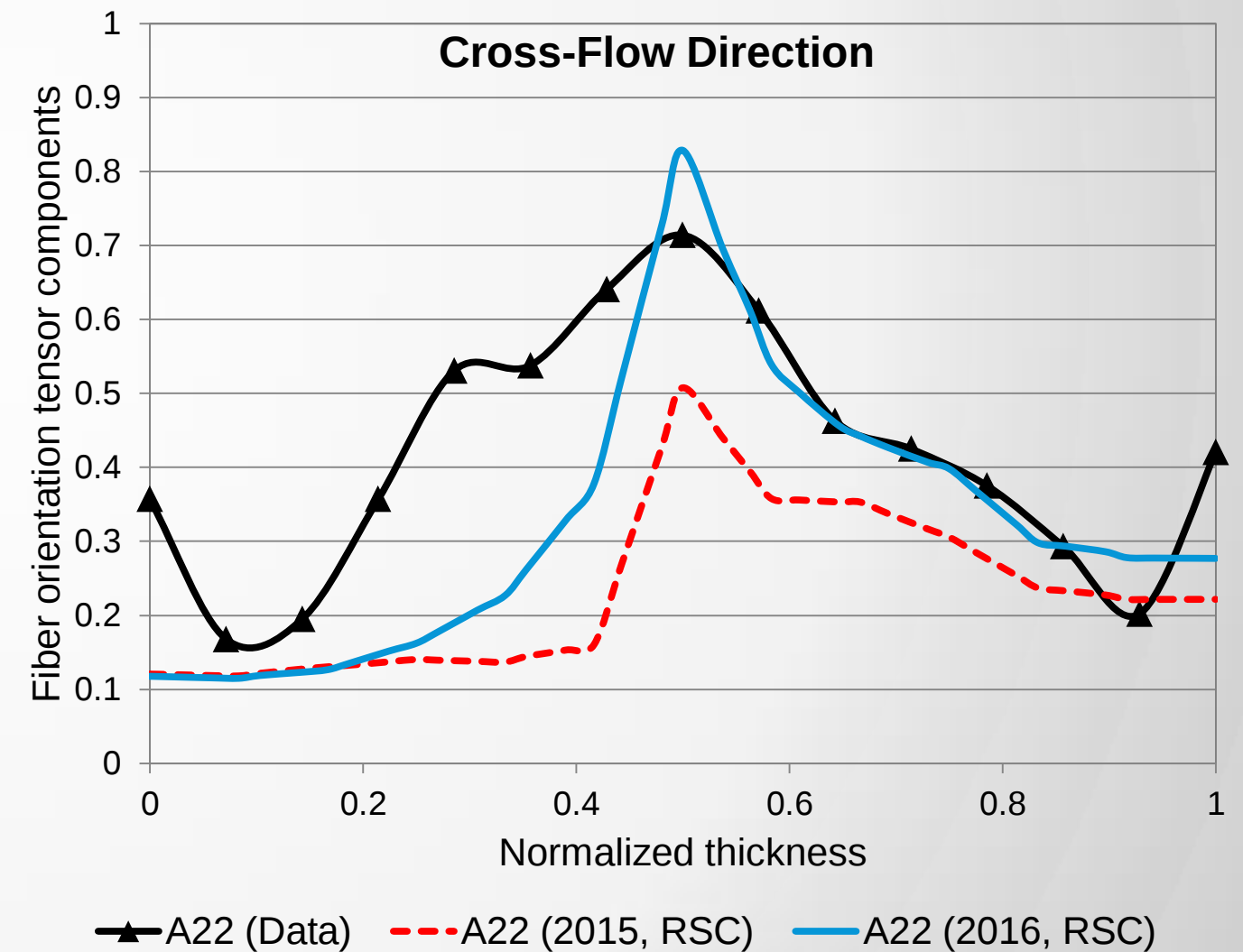
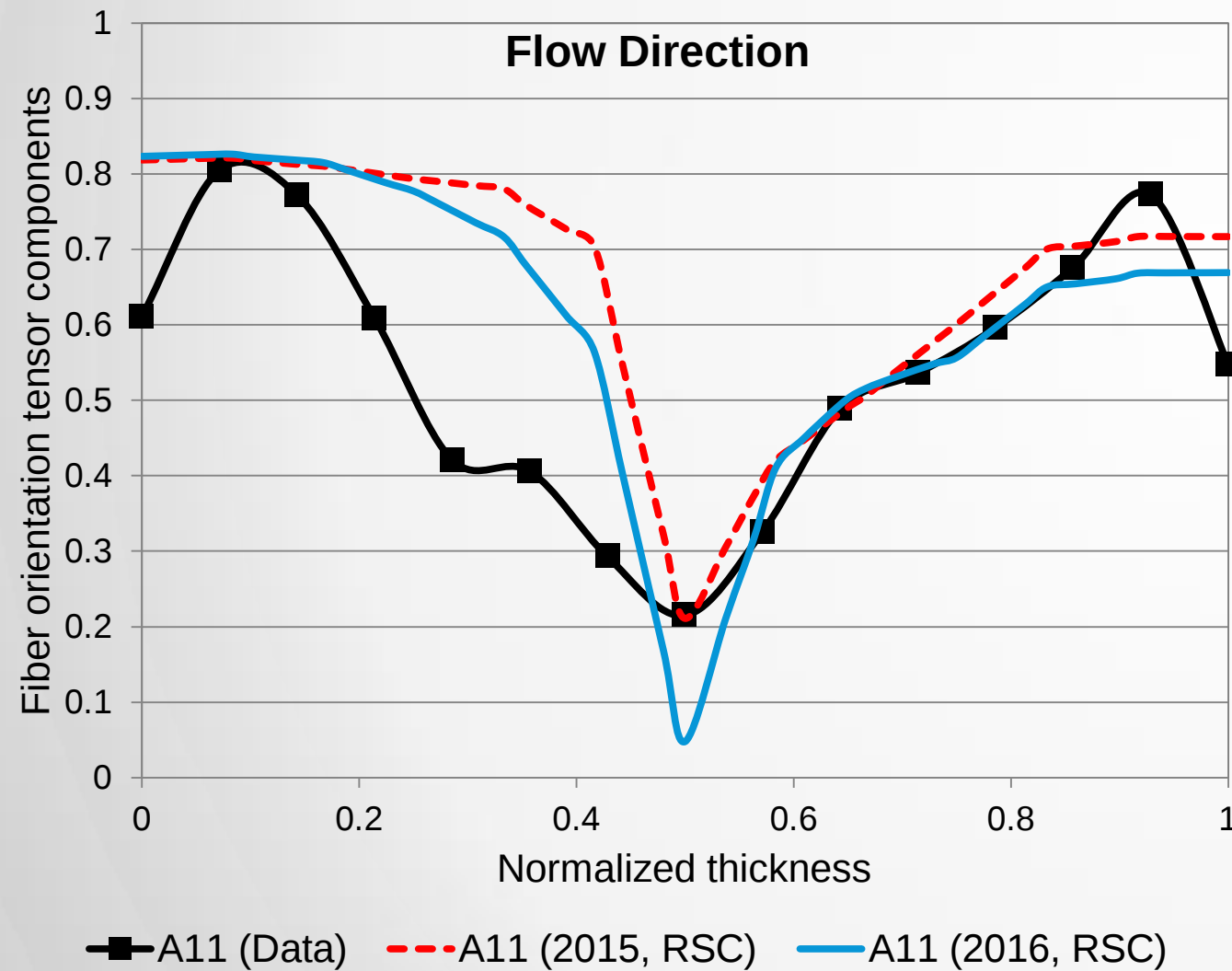
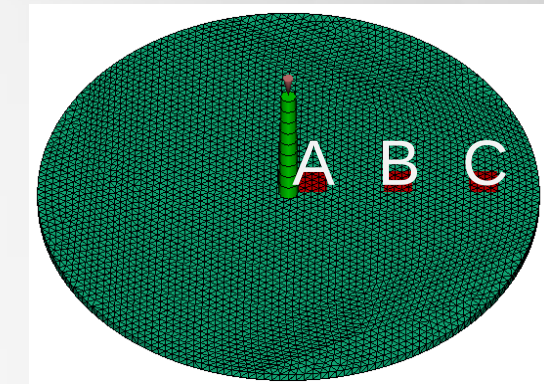
Improved RSC predictions for 3D Fiber Orientation

Delphi Disk: 1.5mm thick. 30wt%GF/PBT,
Slow fill, **Location C**



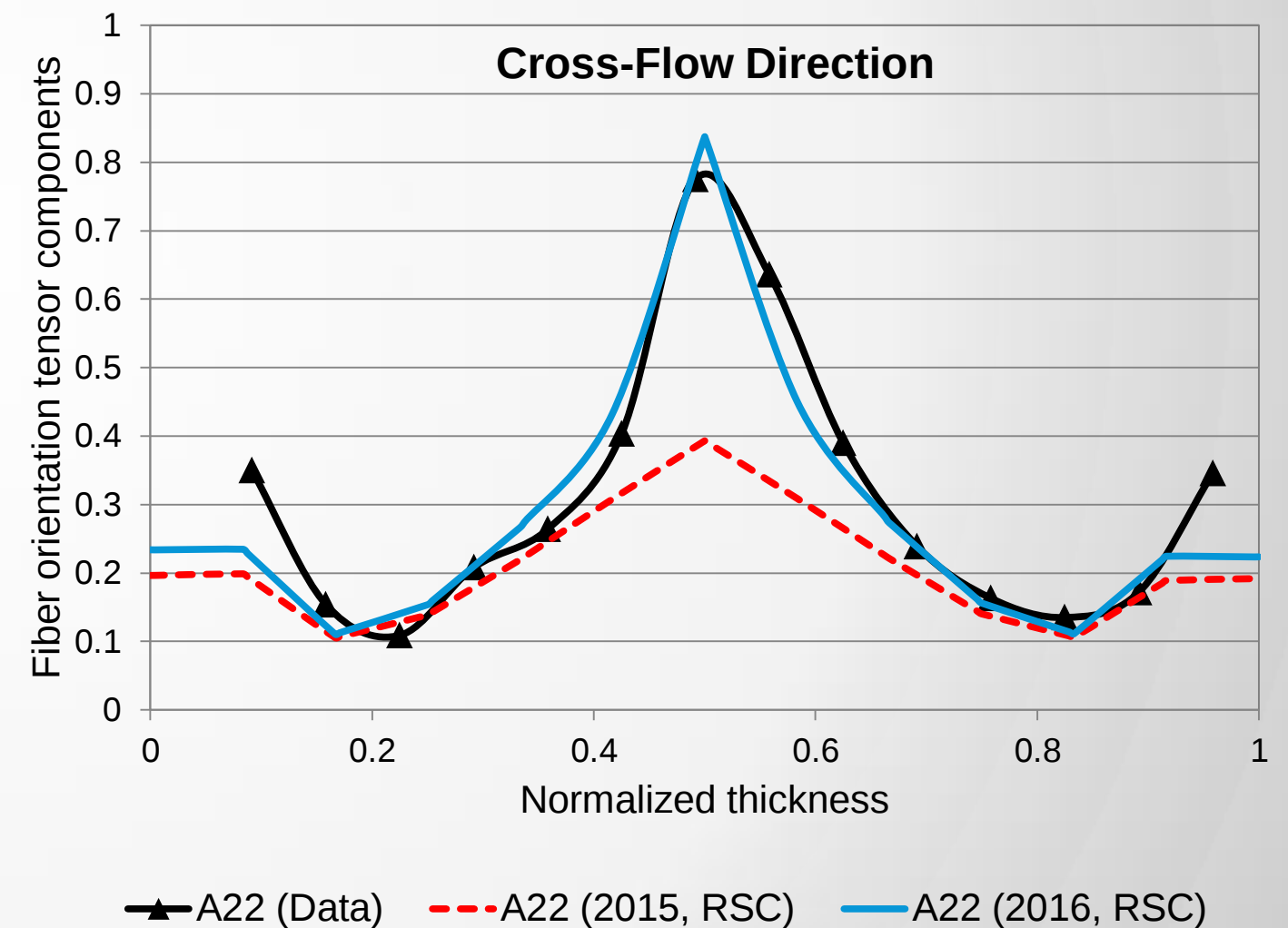
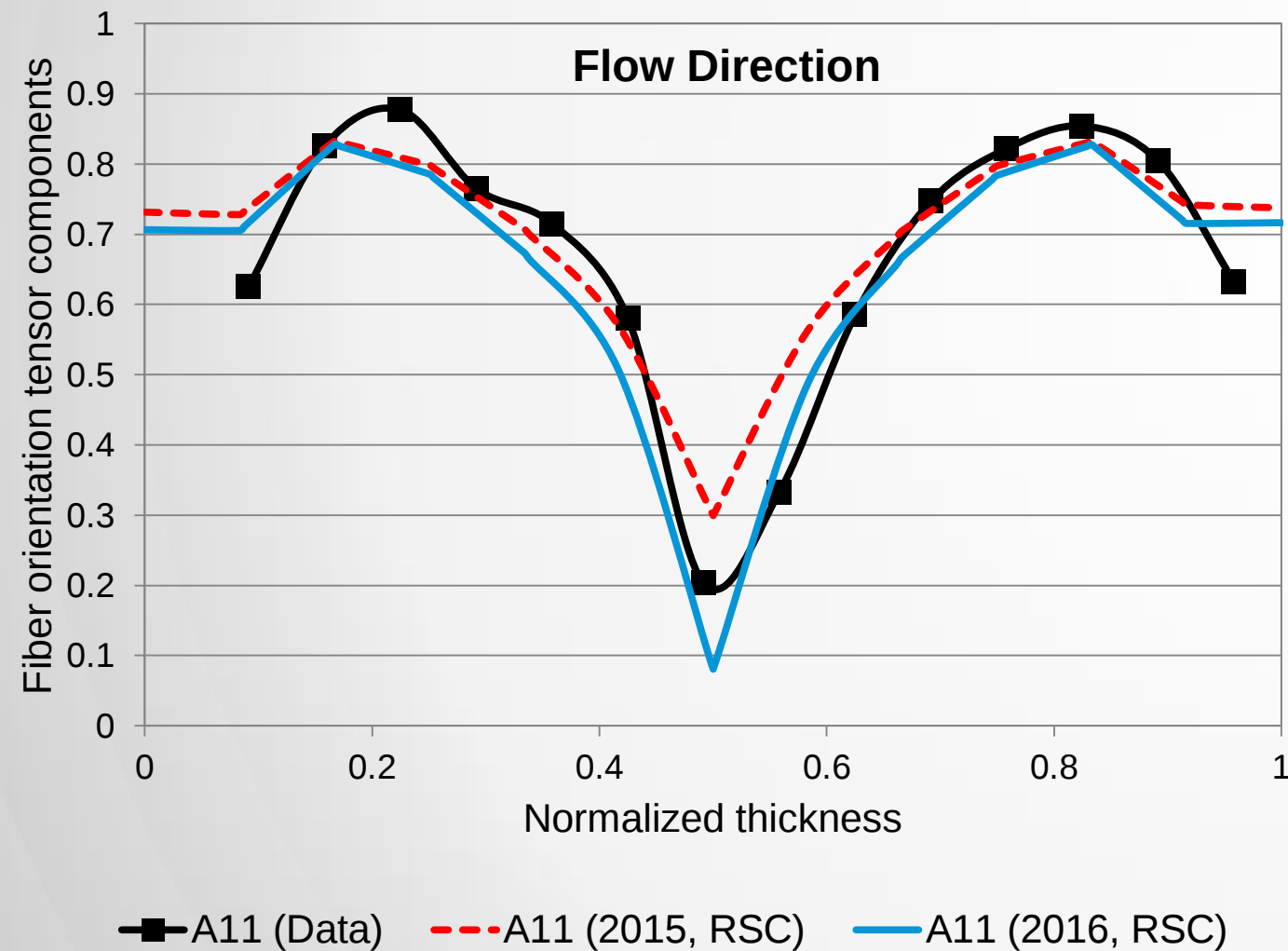
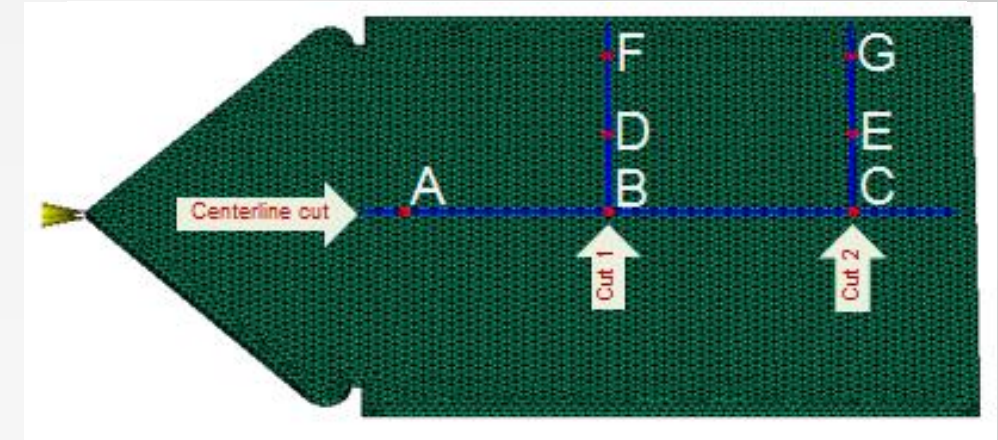
Improved RSC predictions for 3D Fiber Orientation

Delphi Disk: **6mm thick**. 30wt%GF/PBT,
Medium Flow Rate, Location B



Improved RSC predictions for 3D Fiber Orientation

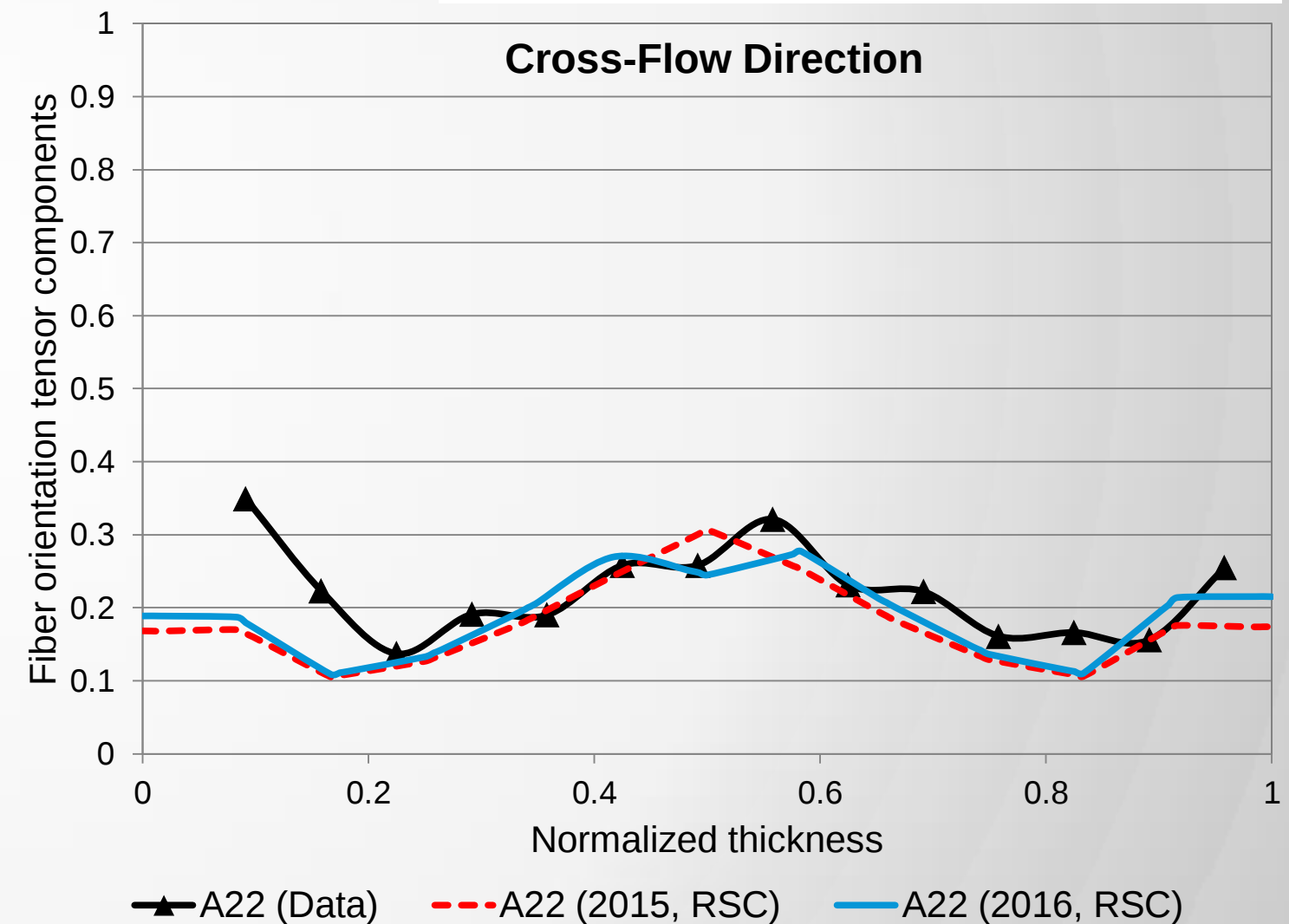
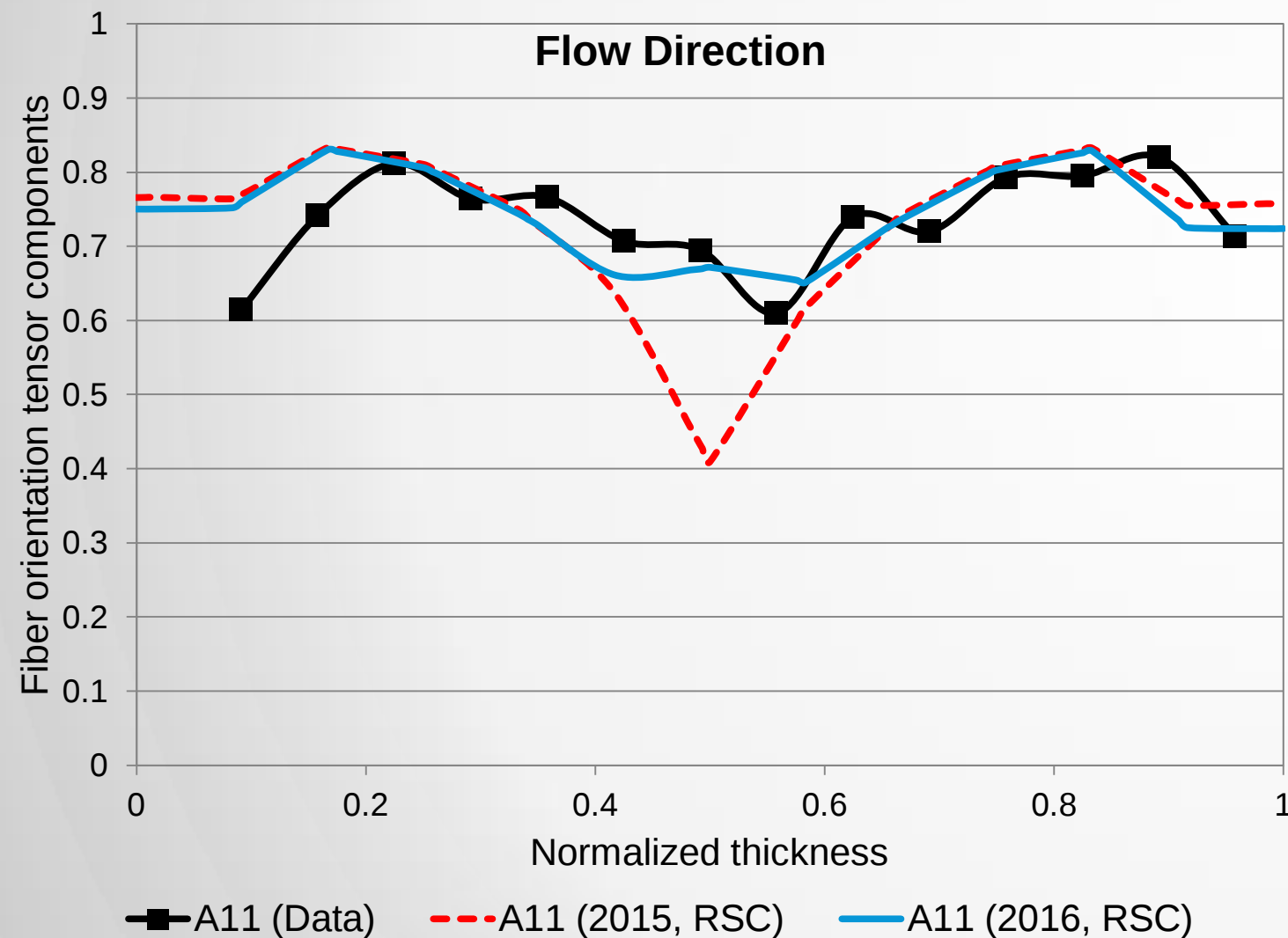
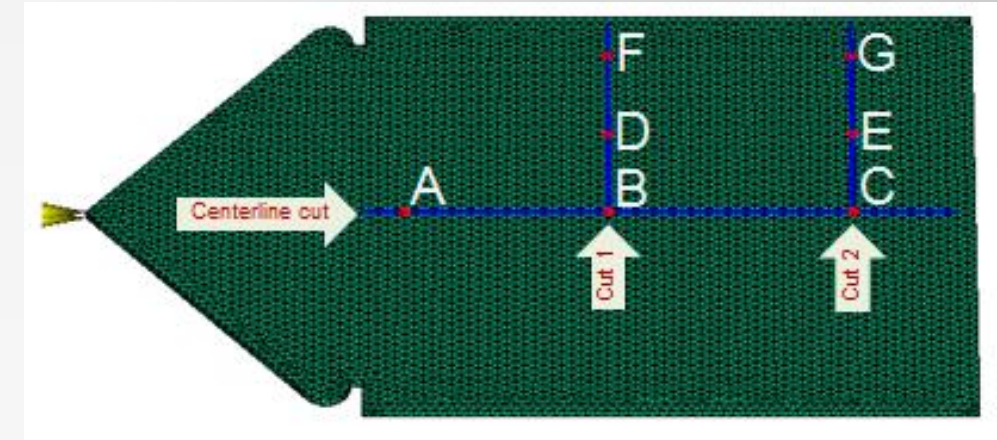
BASF Plaque: 4mm thick. 30wt%GF PA66,
Location B



Molding data courtesy of BASF

Improved RSC predictions for 3D Fiber Orientation

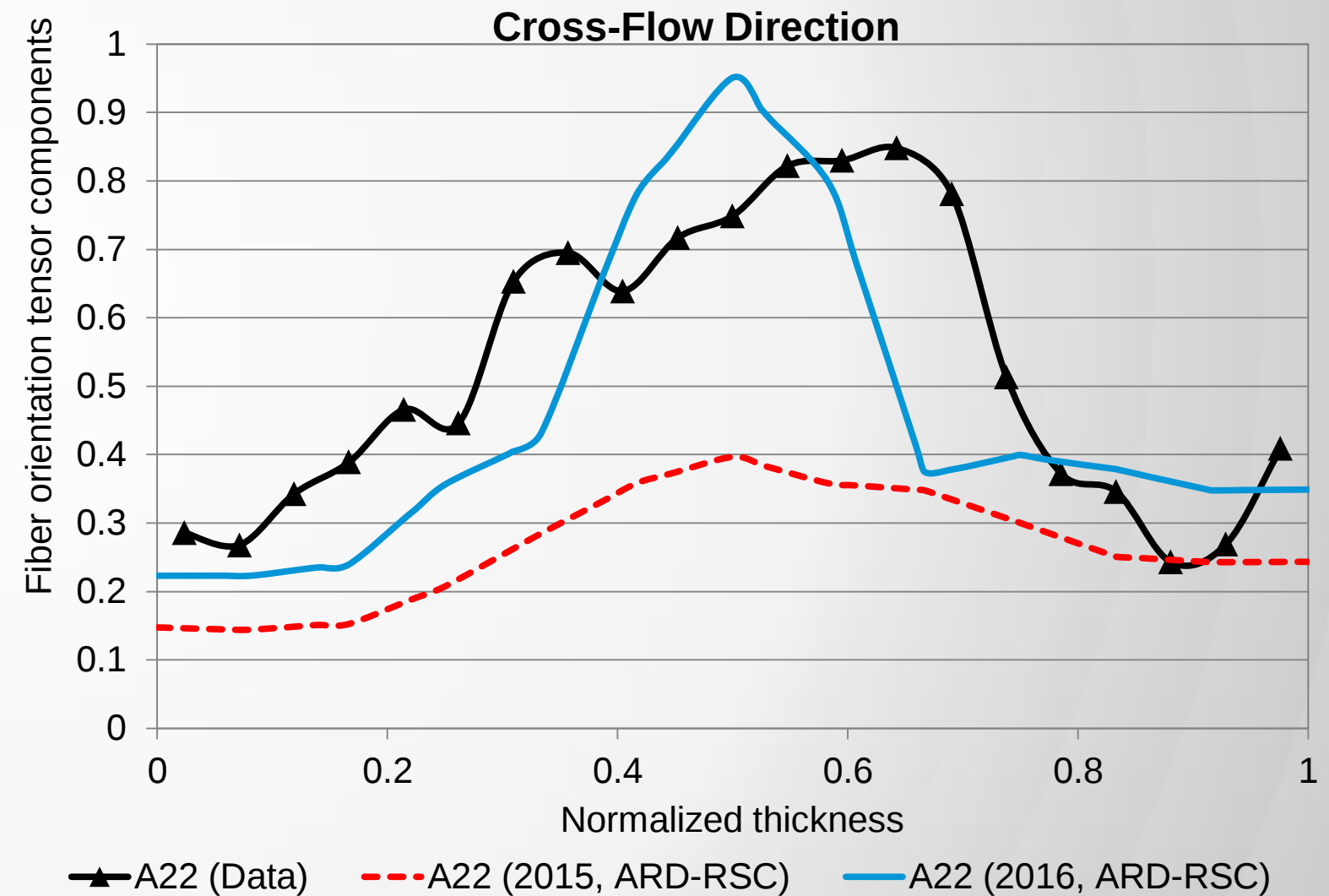
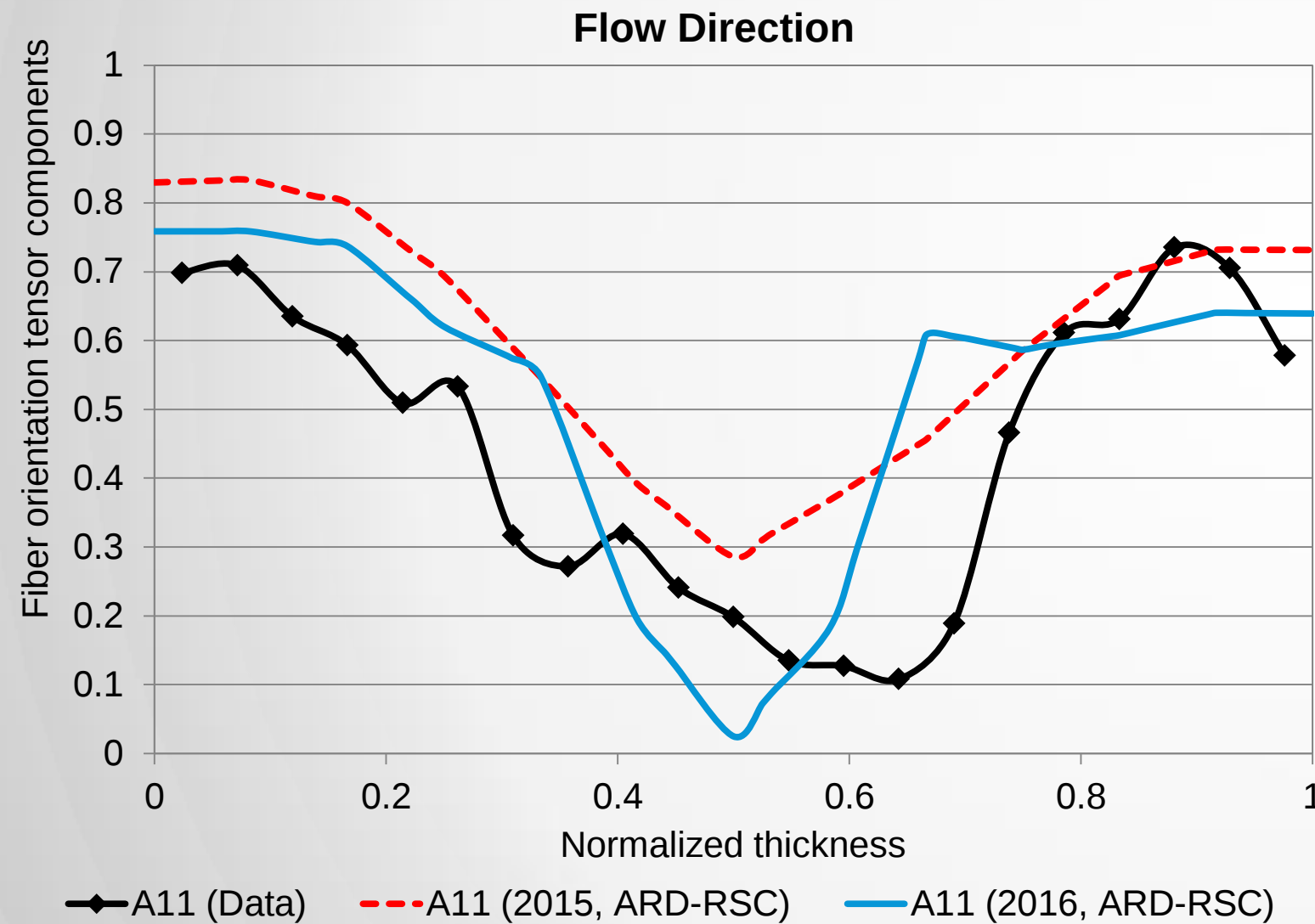
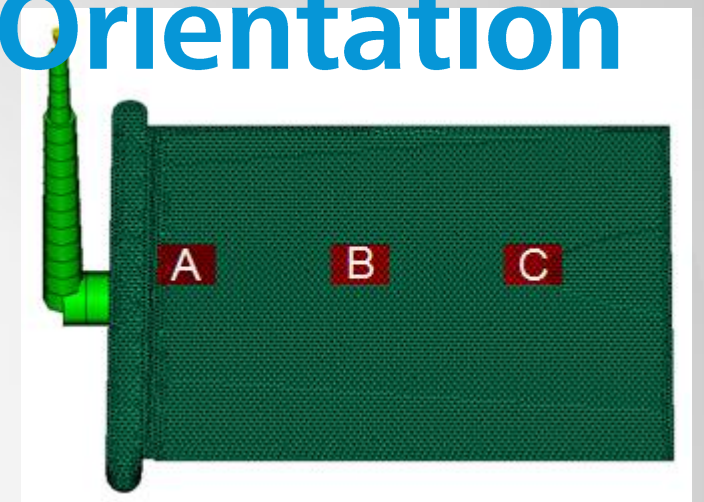
BASF Plaque: 4mm thick. 30wt%GF PA66,
Location F



Molding data courtesy of BASF

Improved ARD-RSC predictions for 3D Fiber Orientation

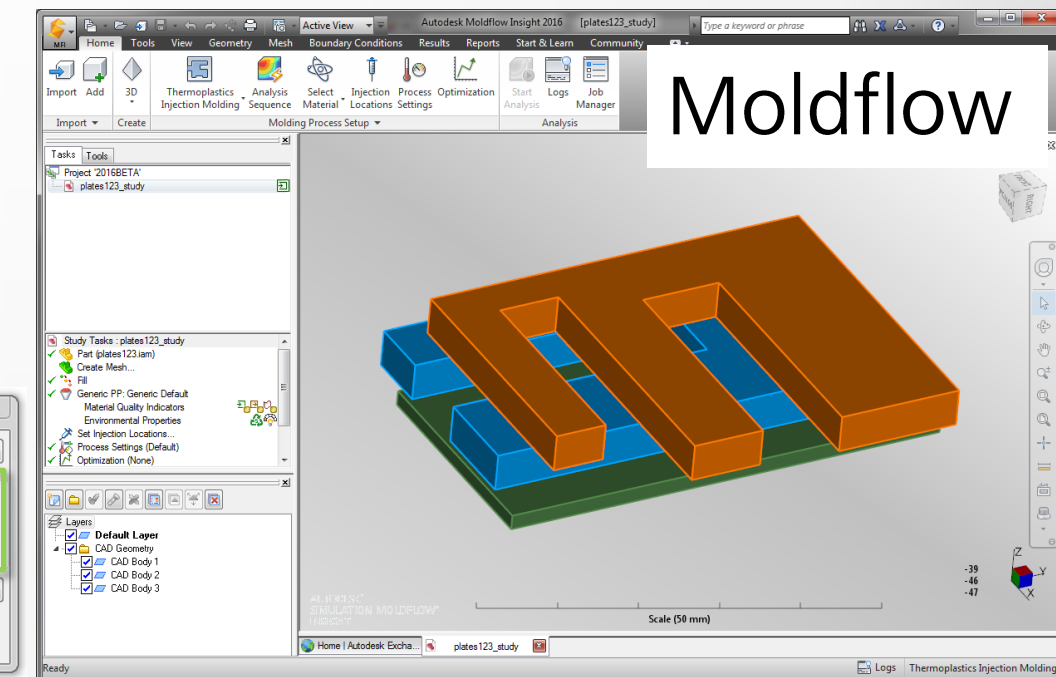
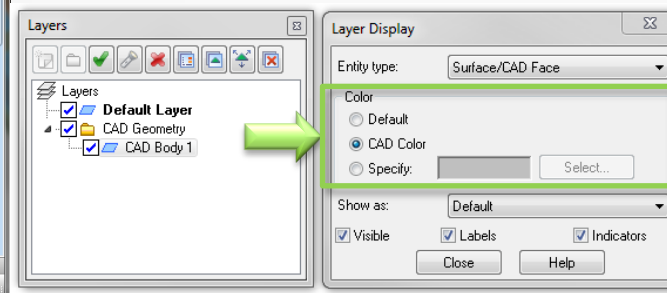
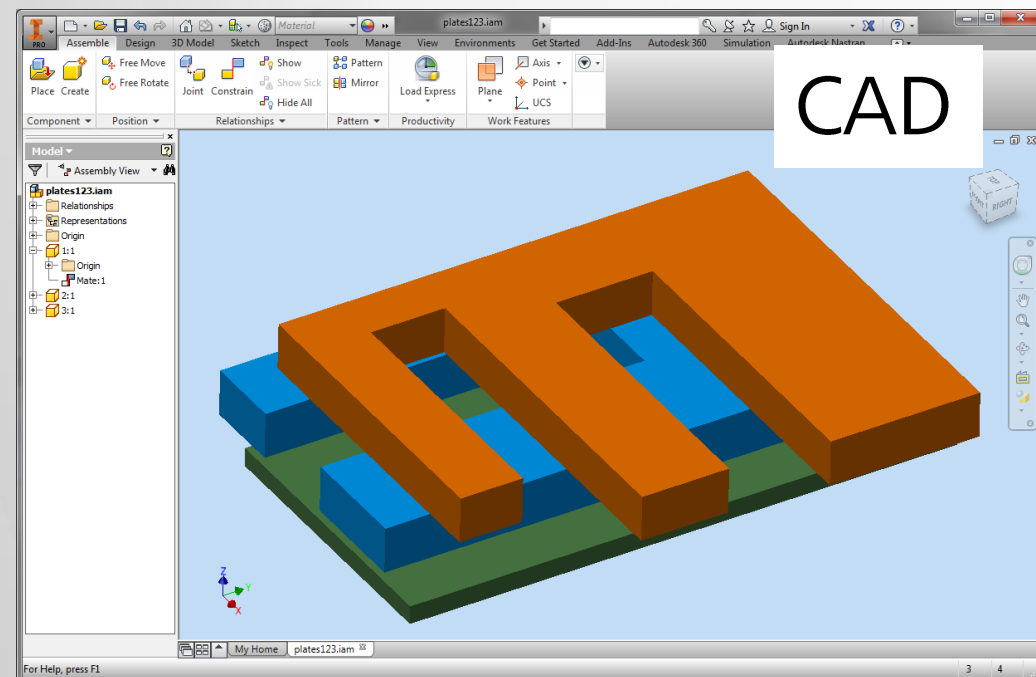
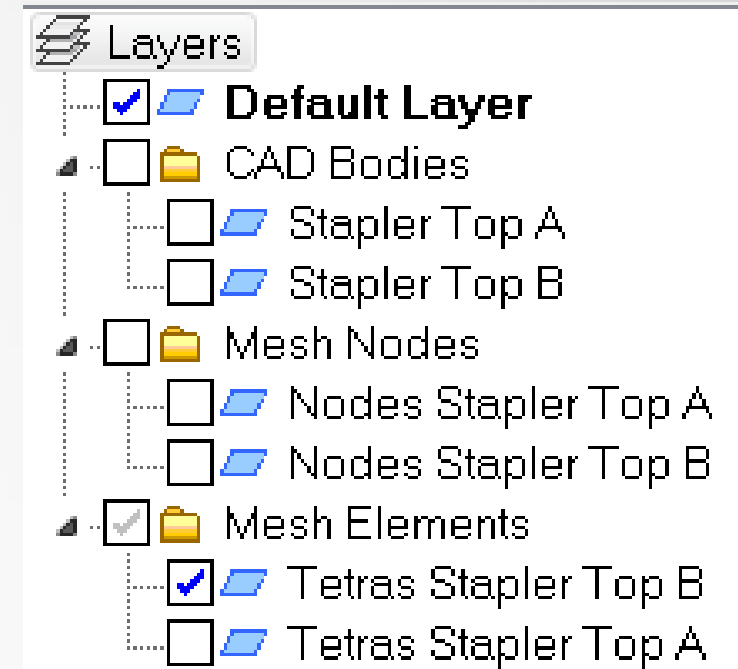
PNNL Plaque: 3mm thick. 40wt% LGF PP,
Location B



Molding data from PNNL/ORNL

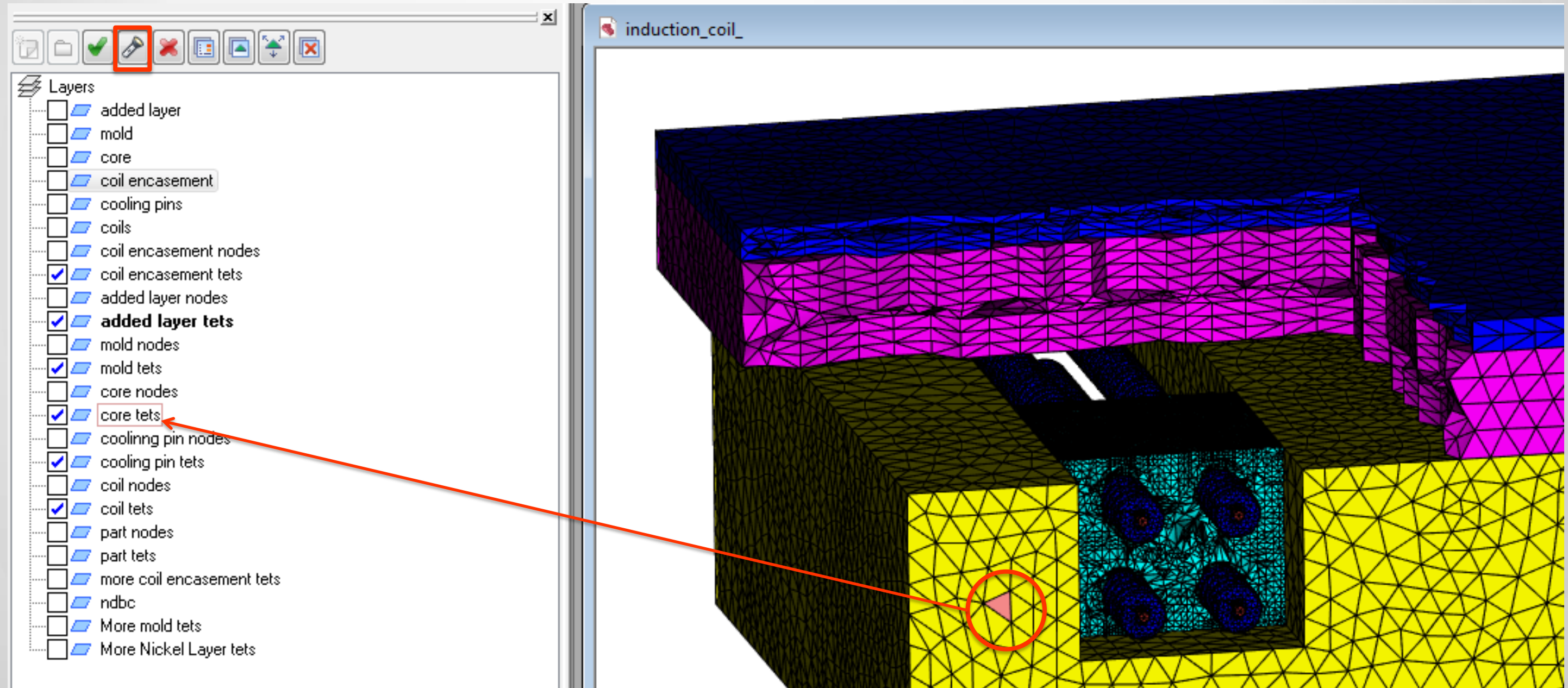
Improved Layer Management

- Turn on/off multiple layers
- Allow layer hierarchy
- Use CAD Body names and colors when importing



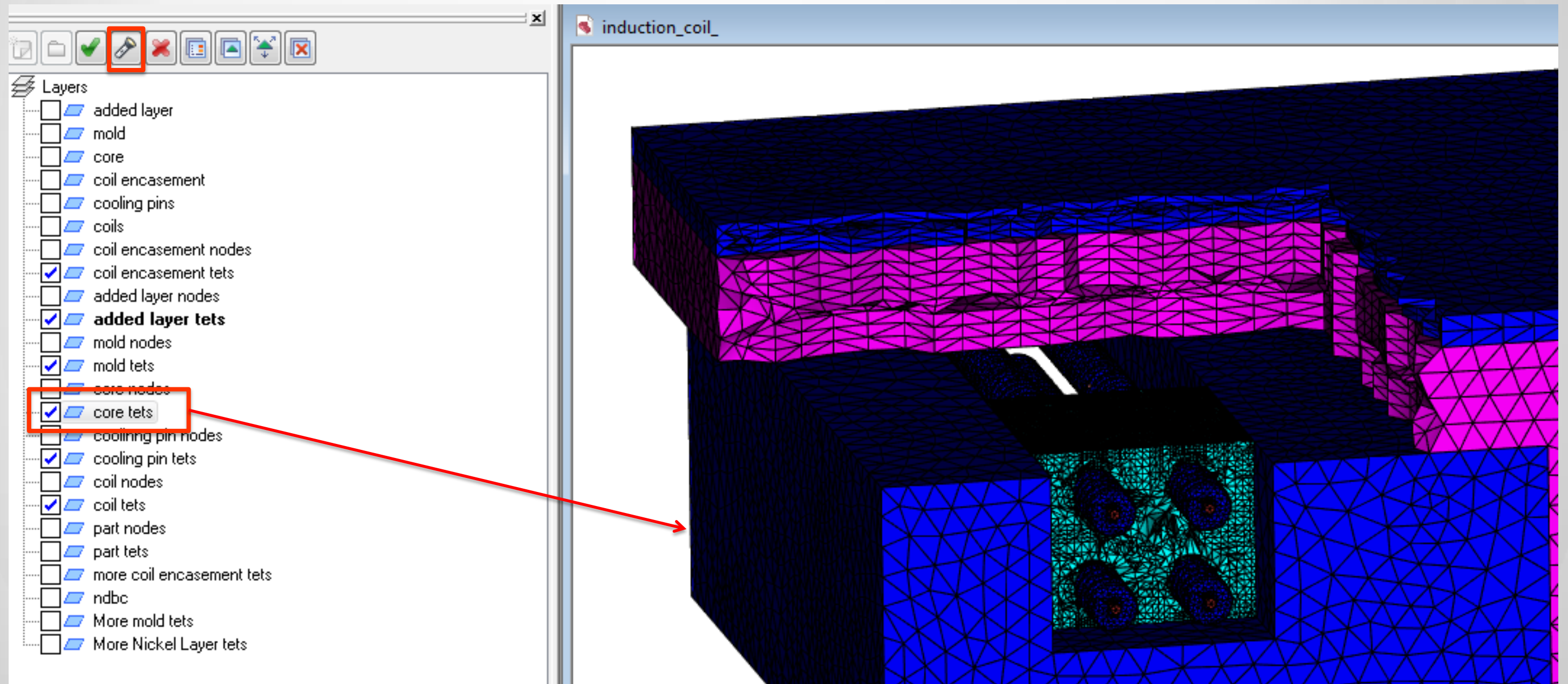
Layer Highlights

1. Select an entity – Layer is highlighted



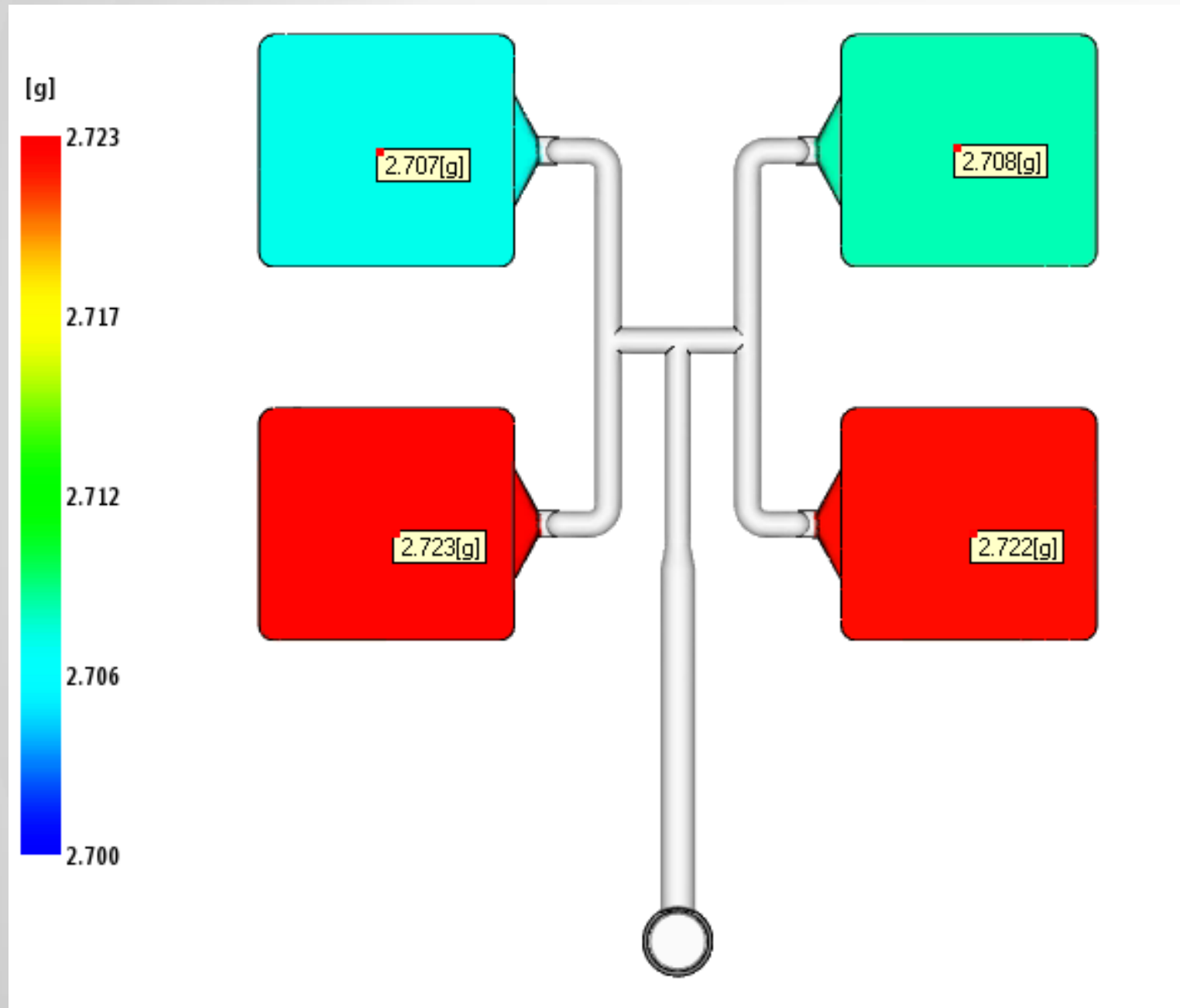
Layer Highlights

1. Select an entity – Layer is highlighted
2. Select a Layer – Entities are highlighted

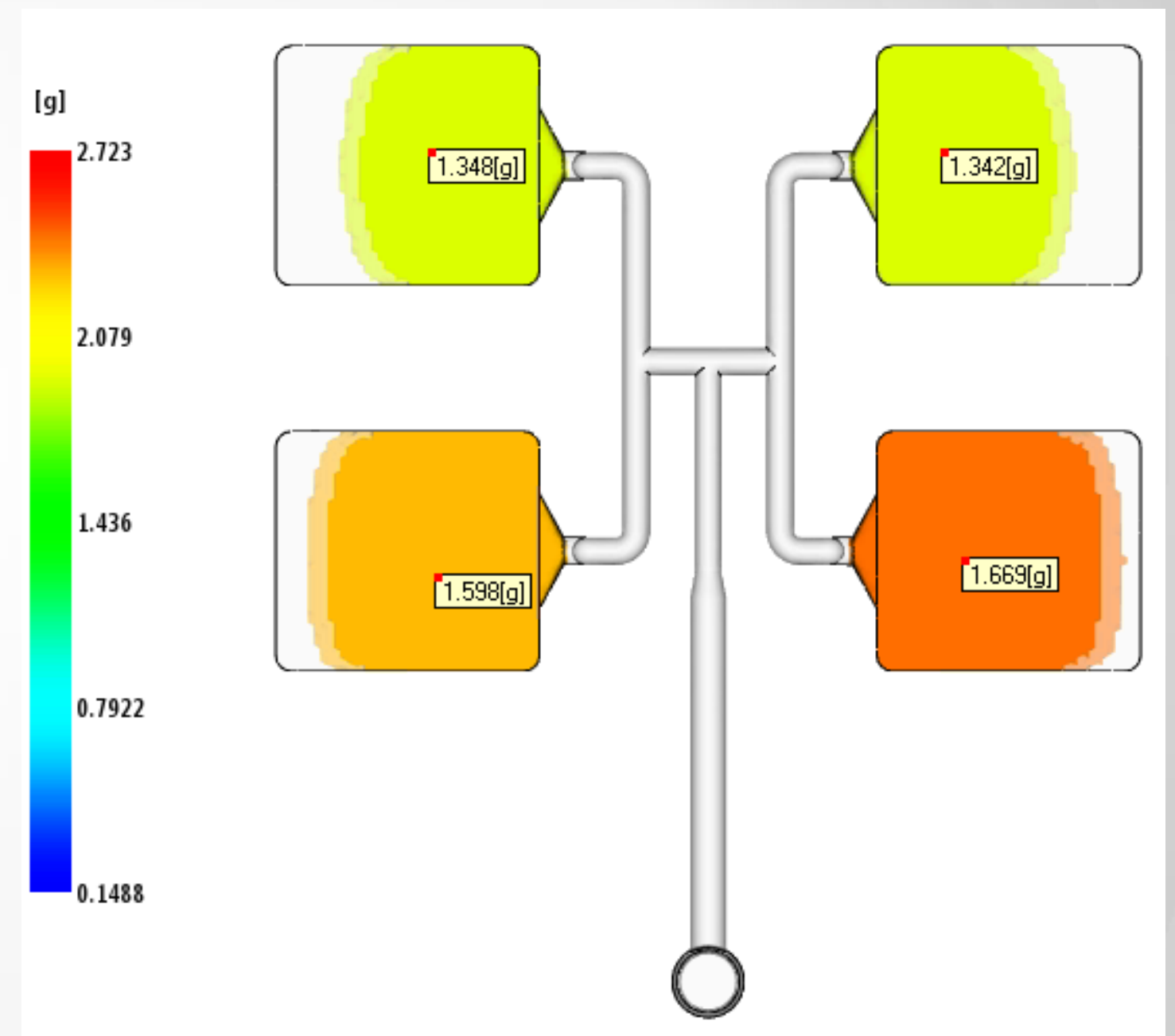


New Cavity Weight Result

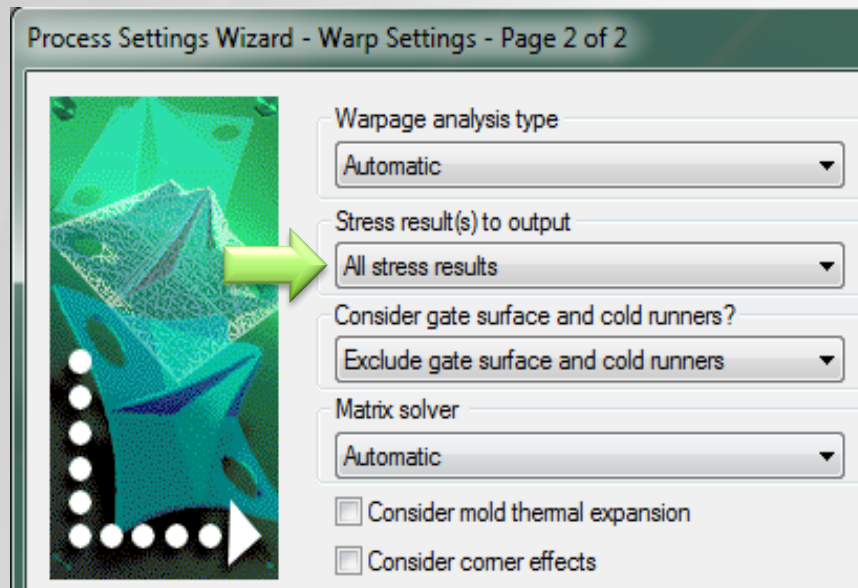
Final Weights



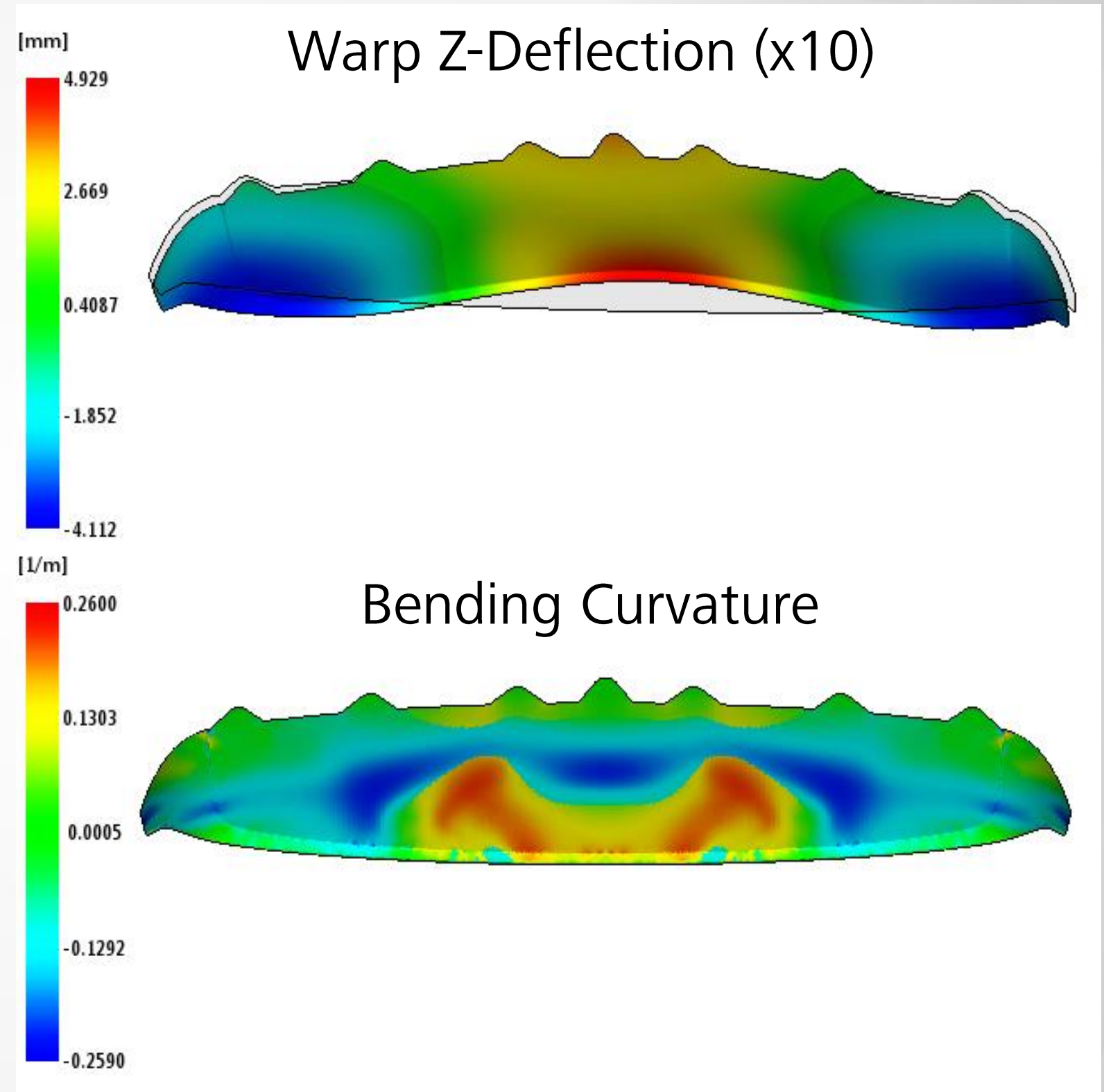
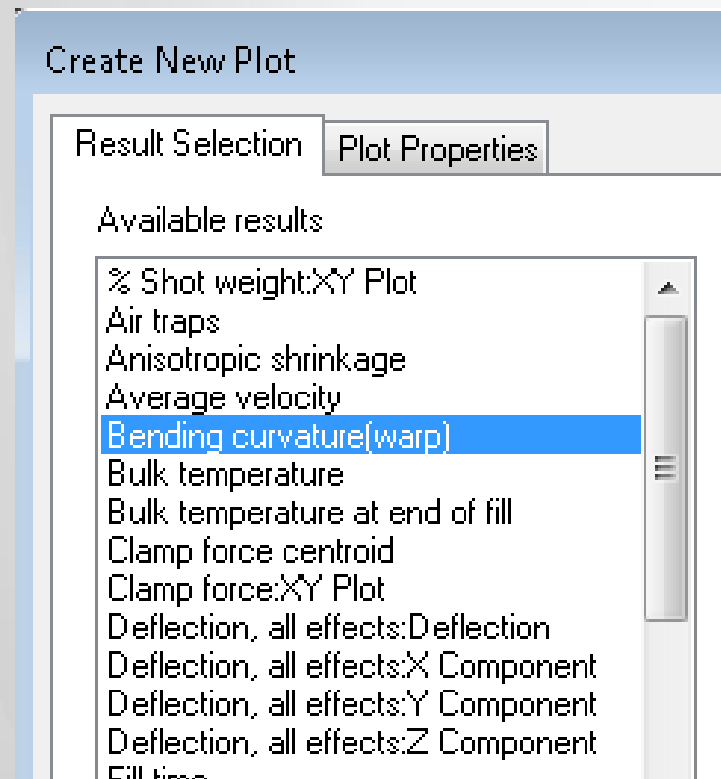
Intermediate Weights



Bending Curvature



Midplane
Only

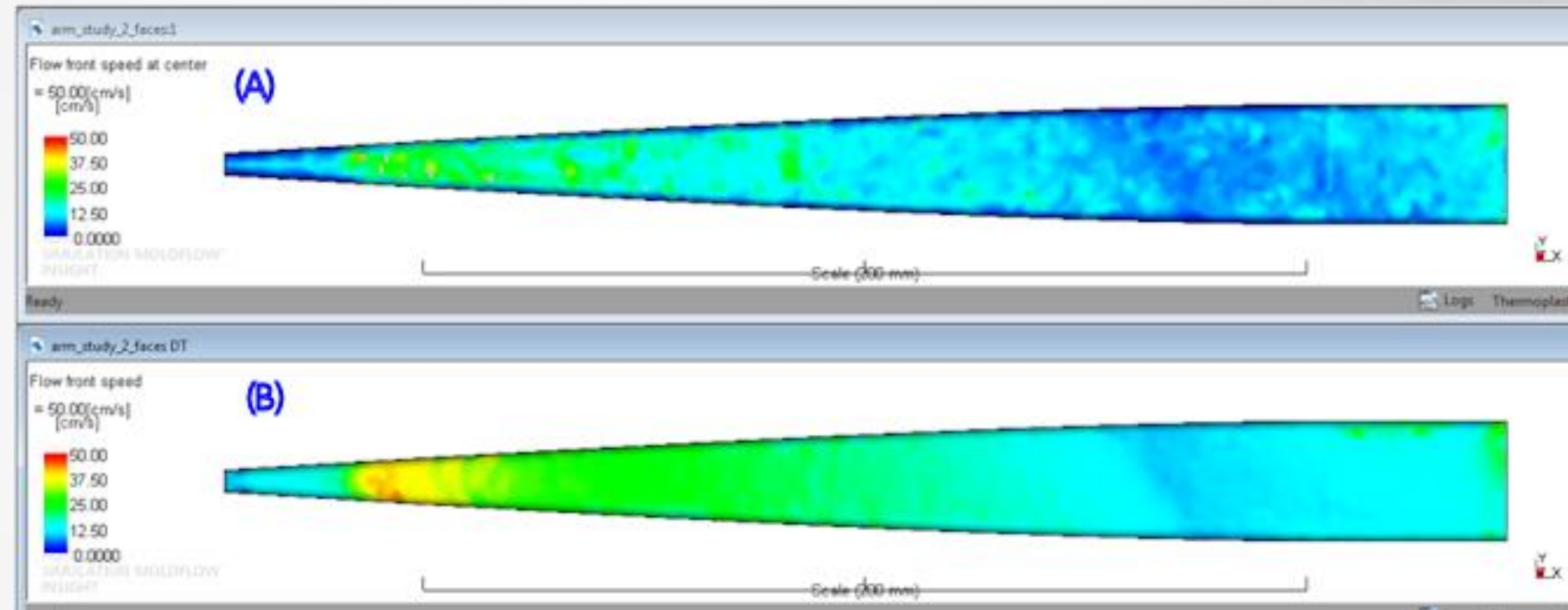


Model courtesy of HRS – Inglass S.p.A

Revised Flow Front Speed Result

Old Result:

- Velocity at Center laminate while filling



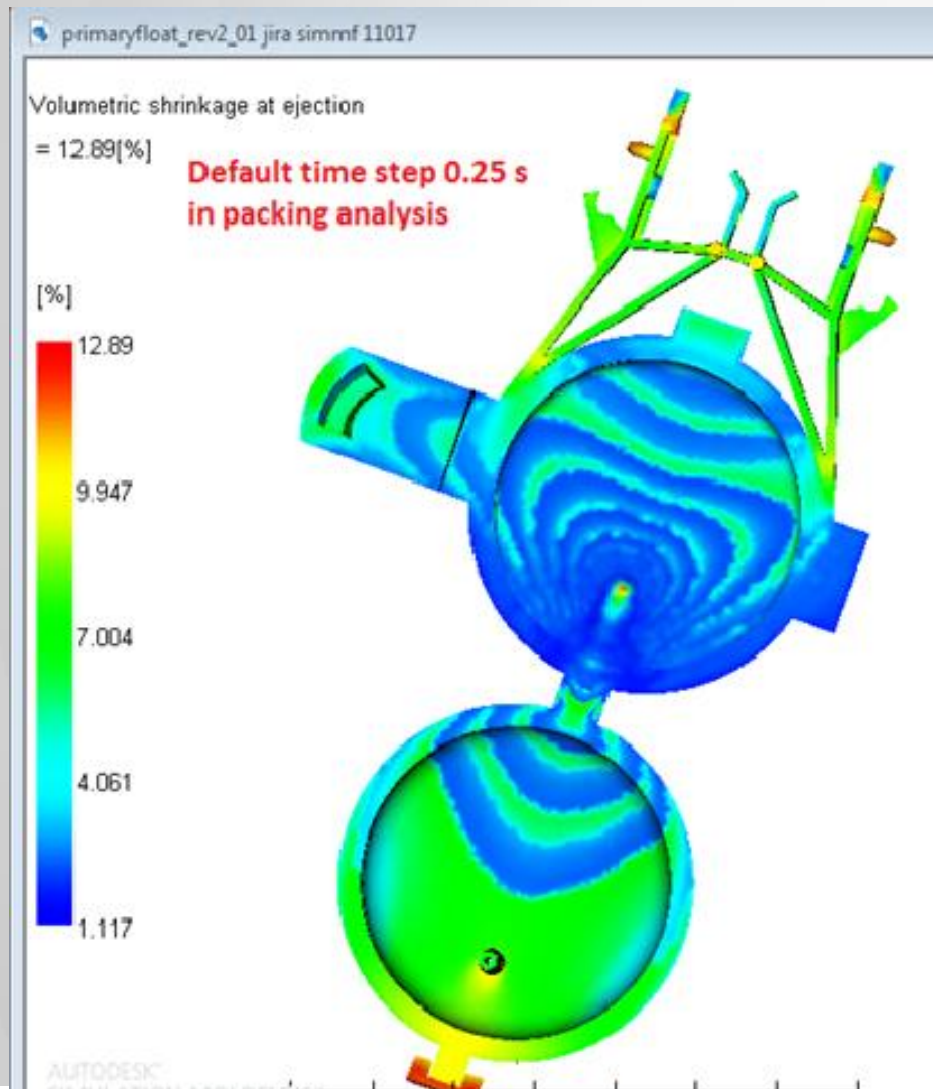
Replace with:

- Bulk Flow Front Speed

Midplane & Dual-domain Only

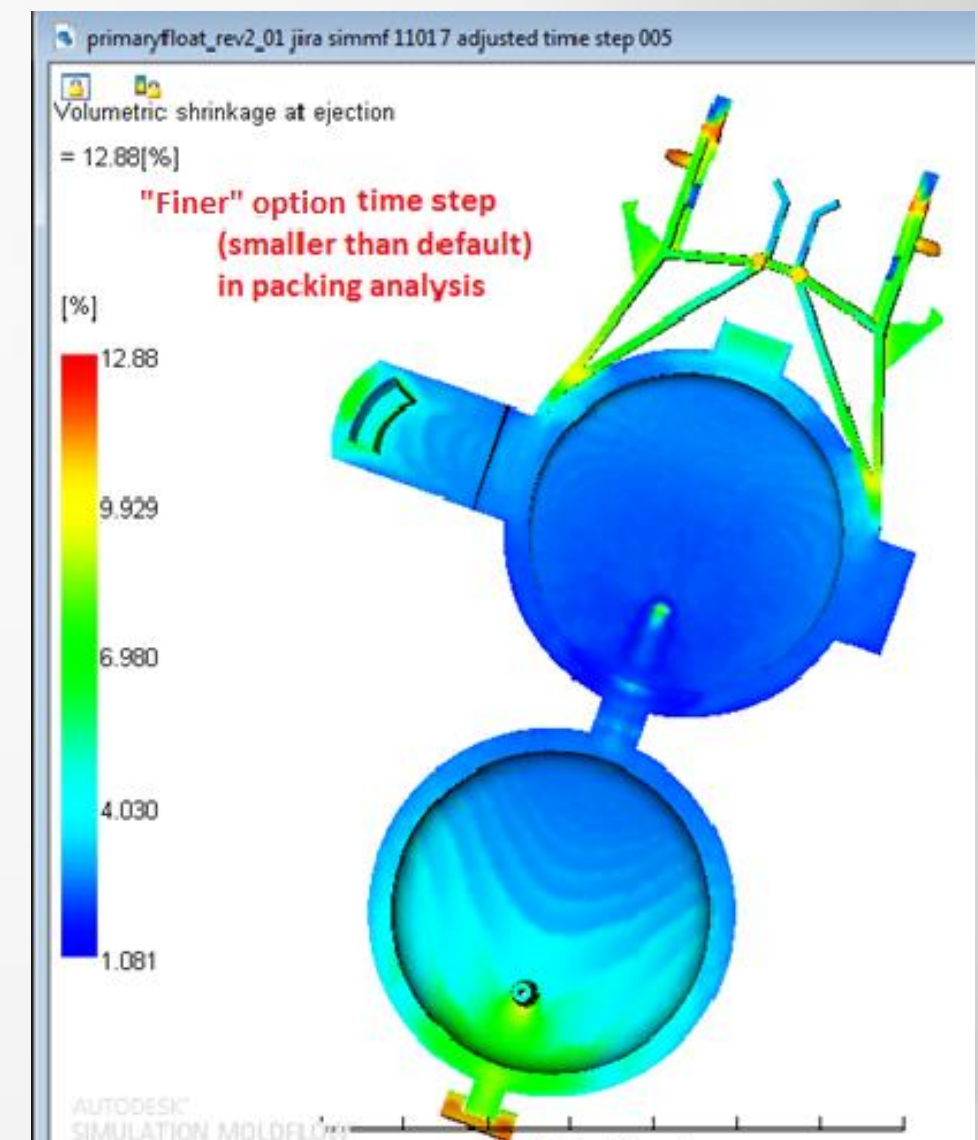
Packing Time Step Control

- Midplane & Dual-Domain flow using fixed packing time-step size
 - Can lead to banded results

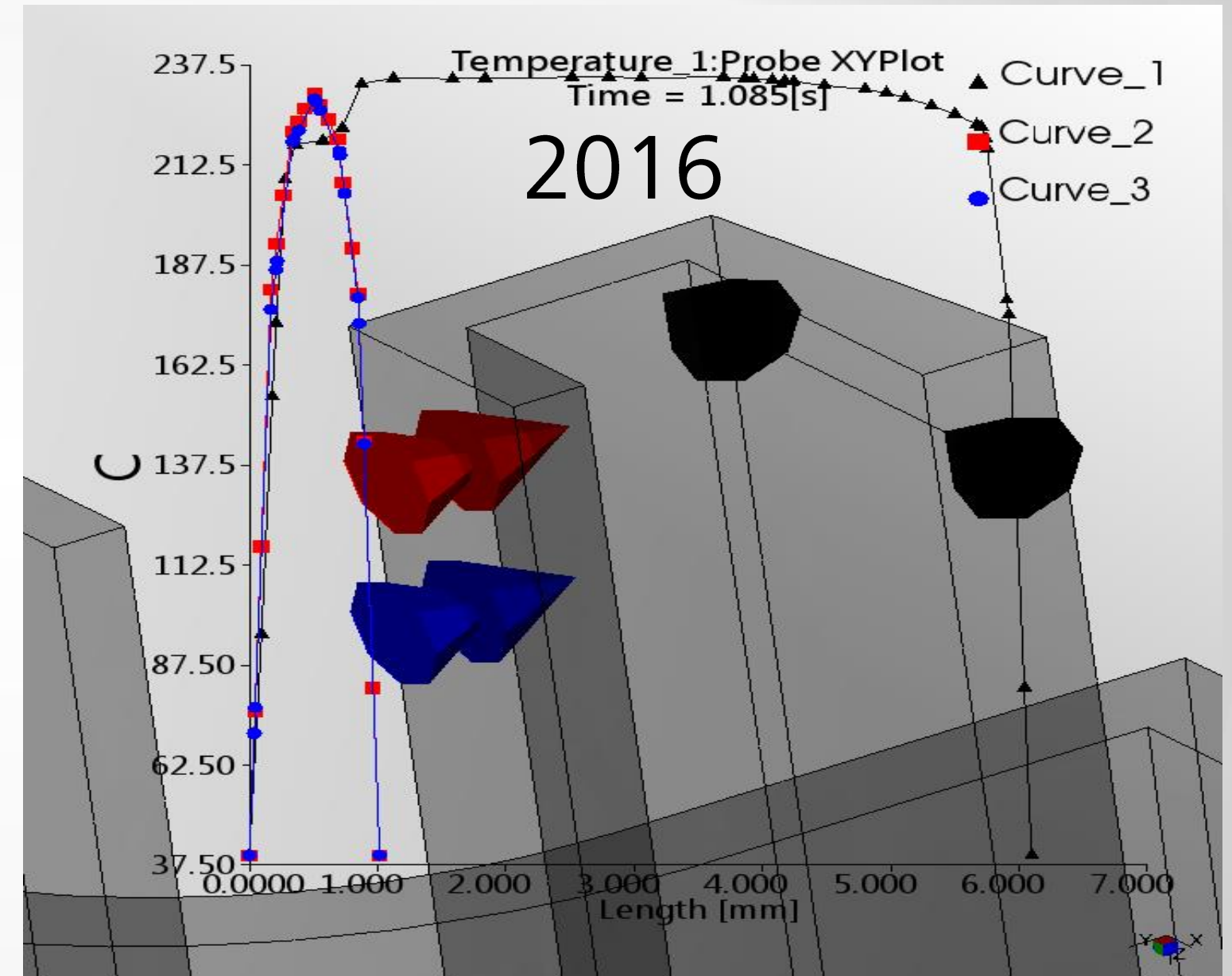
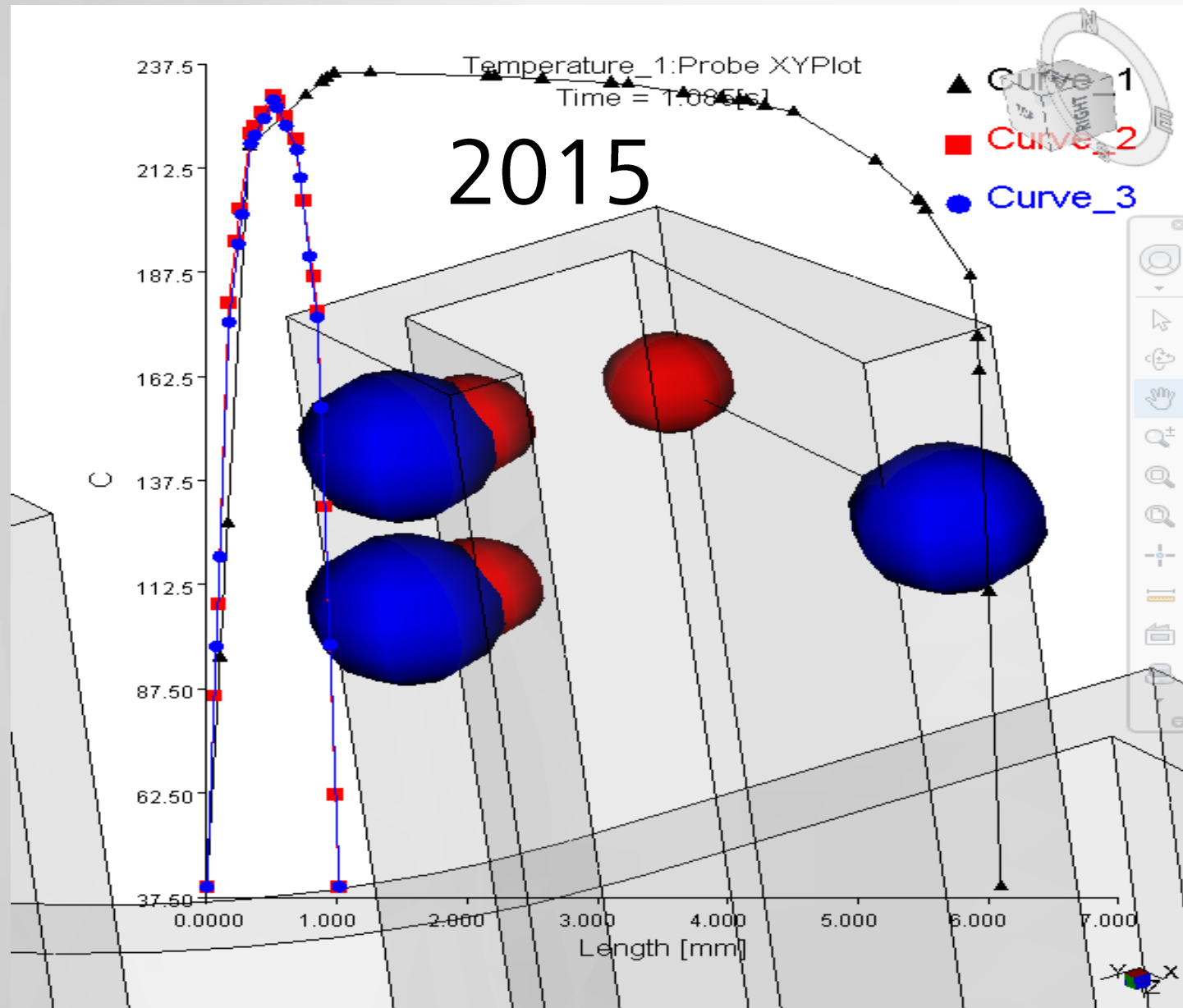


Thermoplastics injection molding solver parameters (Dual Domain)				
Warp Analysis		Core Shift	Shrinkage	
Mesh/Boundary	Intermediate Output	Convergence	Parallelization	Fiber Analysis
Flow rate convergence tolerance		Default (0.5)		
Maximum number of flow rate iterations		125		
Melt temperature convergence tolerance		Default (0.02)		
Maximum number of melt temperature iterations		200		
Nodal growth mechanism		Multiple		
Viscosity treatment at high shear rates		Apply above auto-determined shear rate		
Time step size for packing analysis		Default (0.25)		
		Default (0.25)		
		Finer		

Optional control based on stability criteria
Small time-steps -> longer analysis time

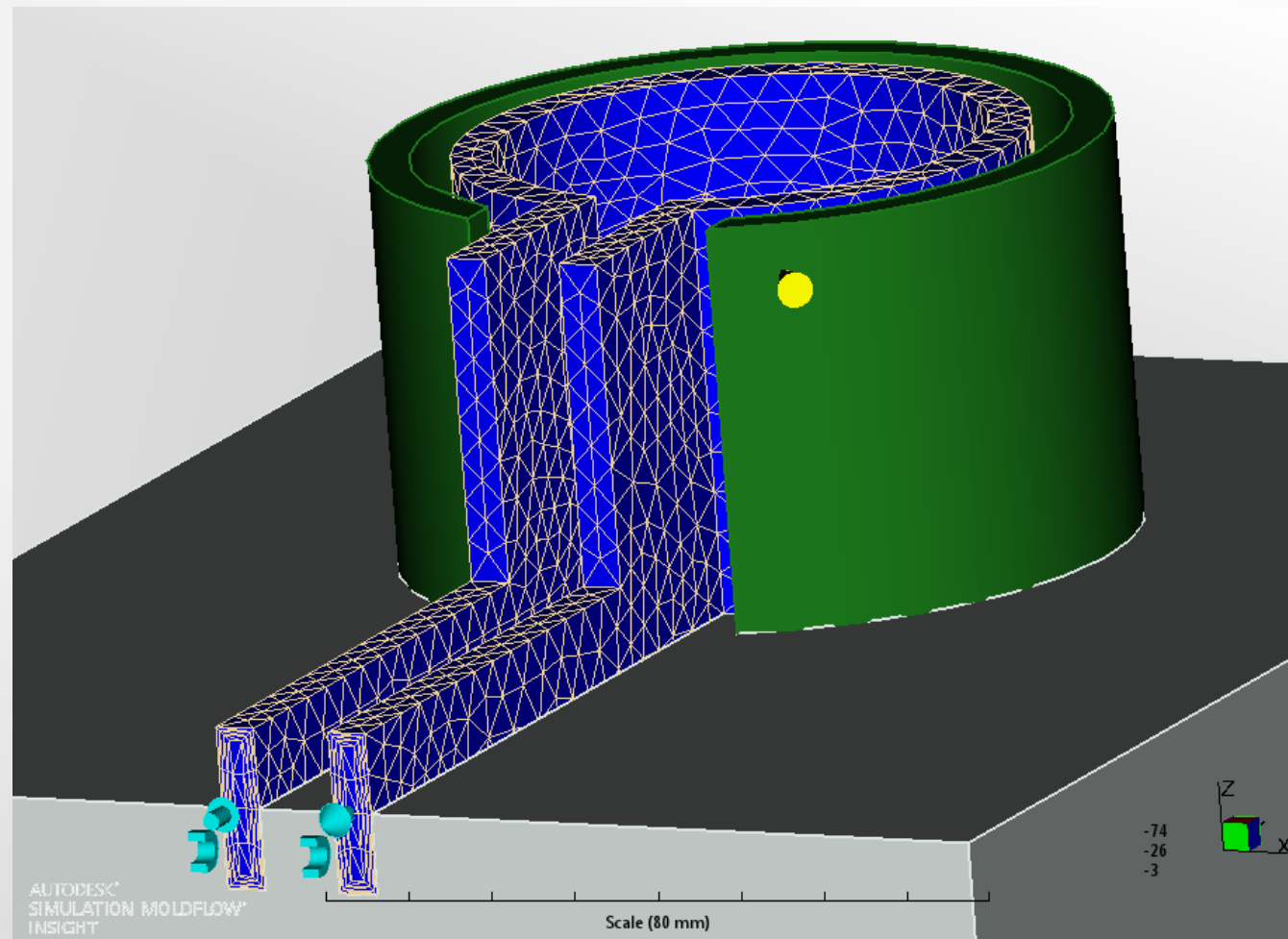


Improved markers for XY Plots



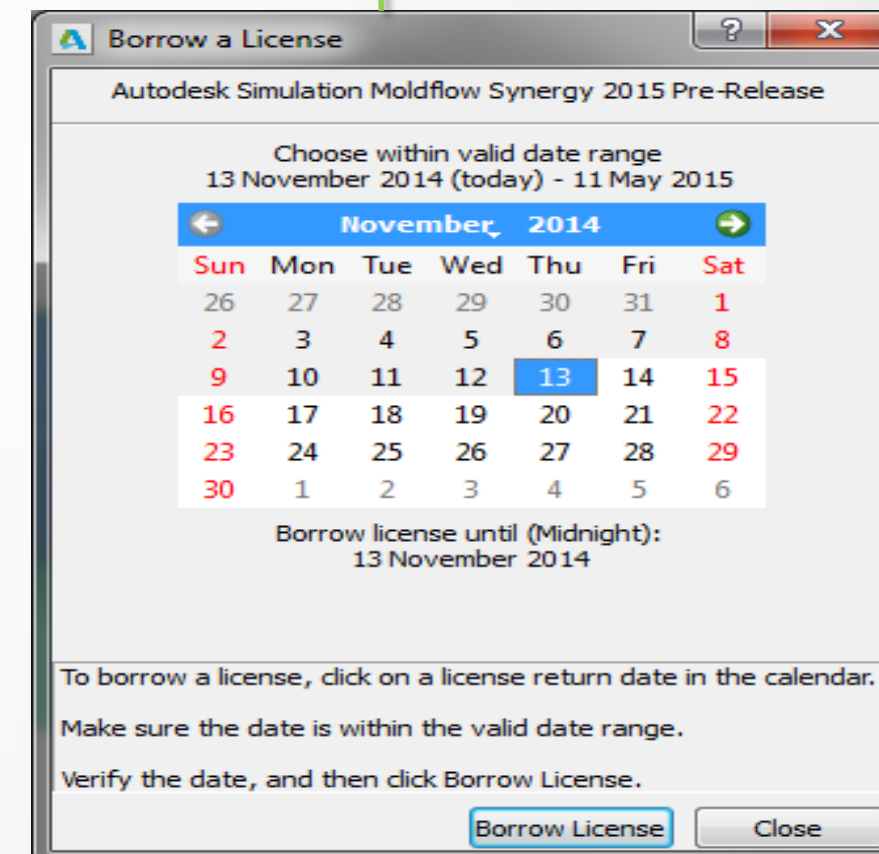
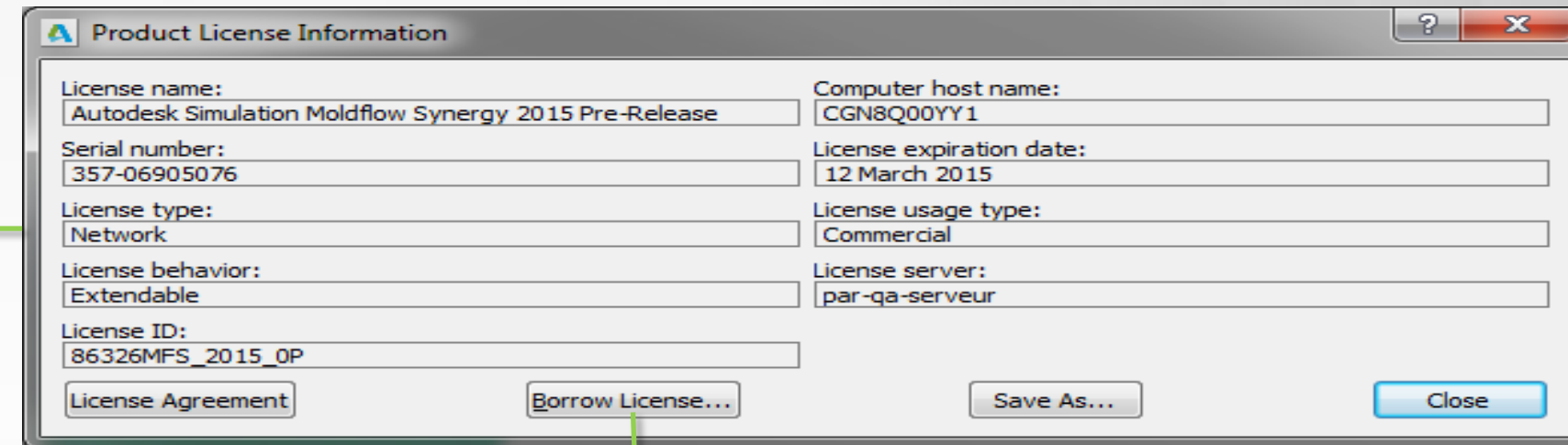
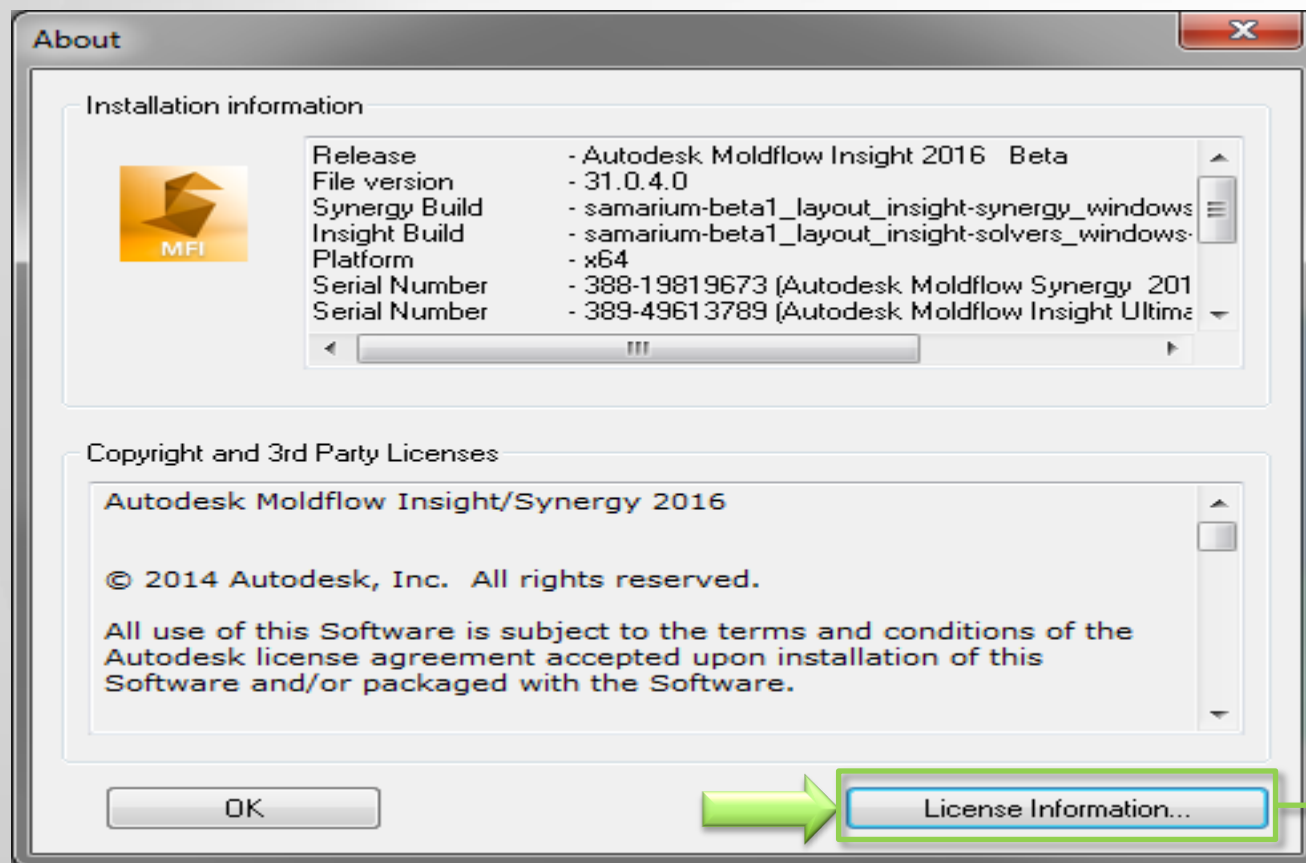
Integrate CFD Mesher for Conformal Cooling

- CFD Software installation & license no longer needed
- Channel meshing is faster



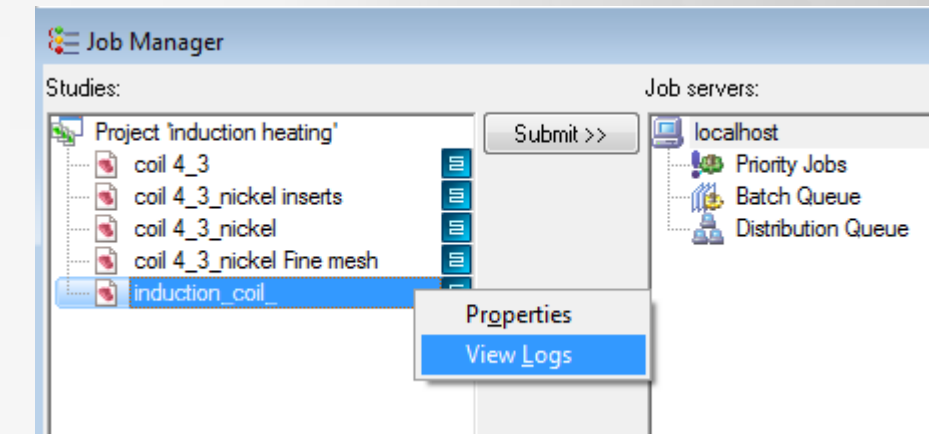
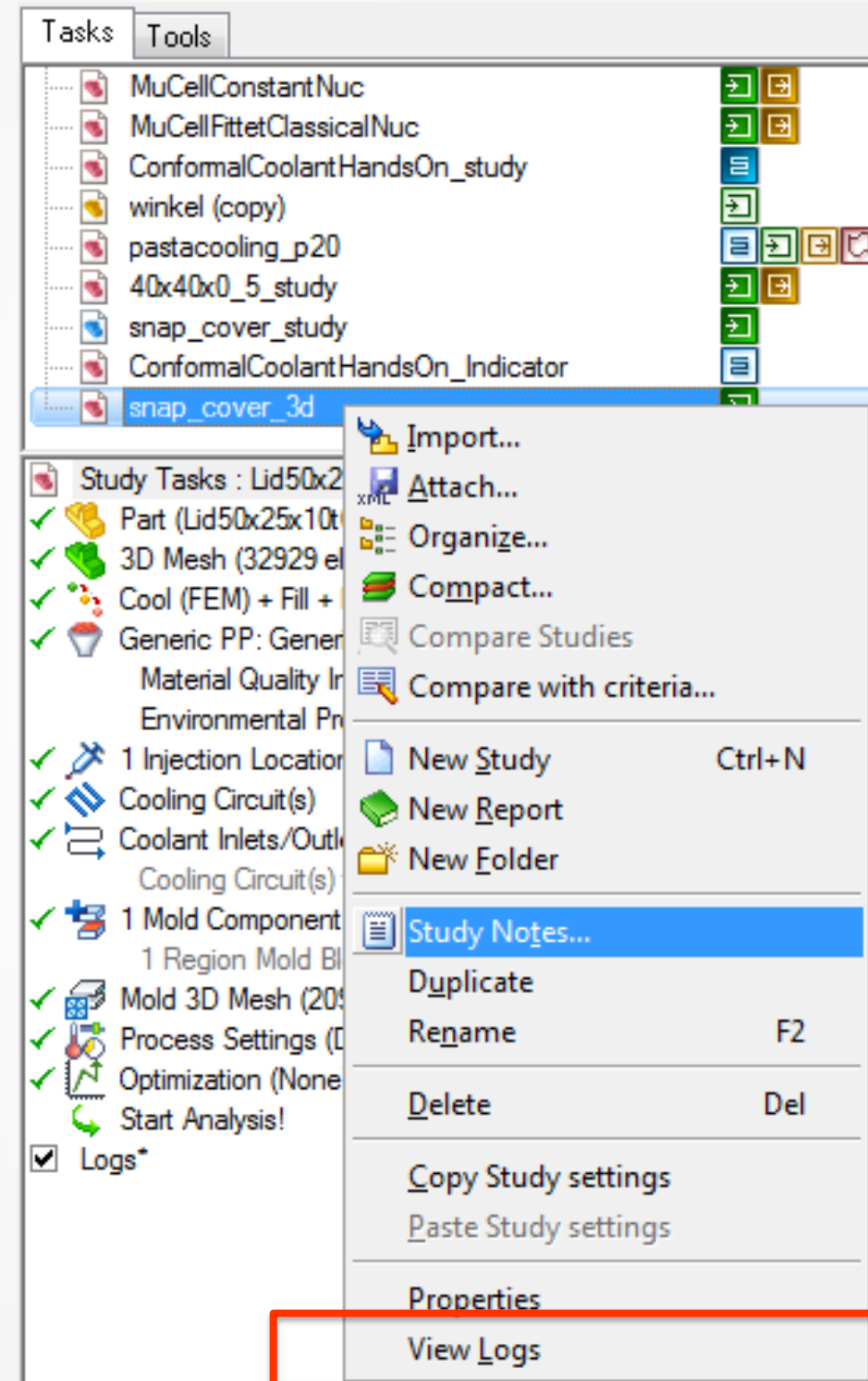
Borrow a License

- Borrow a Synergy License
- Set a return date



Access analysis information without opening study

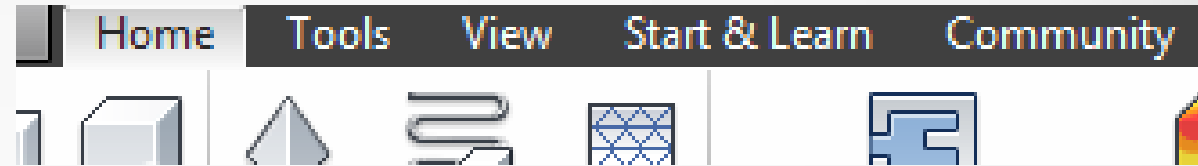
- View Study Notes from Project Tree
 - Hover or RMB
- View Analysis Log
 - From Study Tree
 - From Job Manager



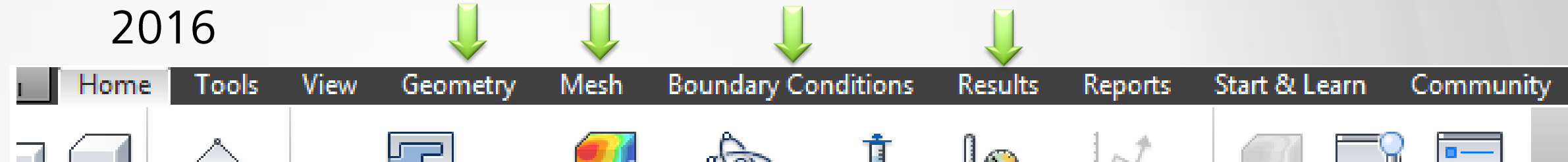
Enhancements to Ribbon Menu

- Permanently Available

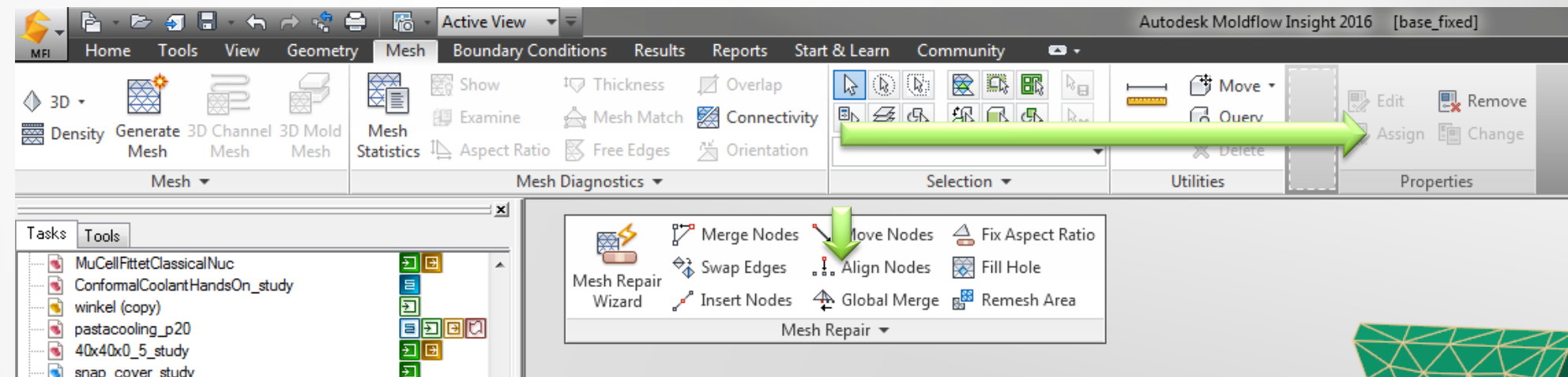
2015



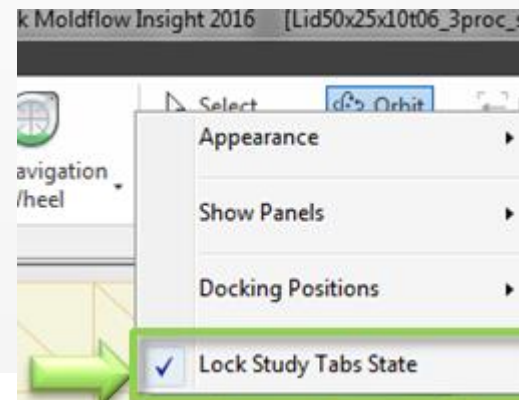
2016



- Customizable



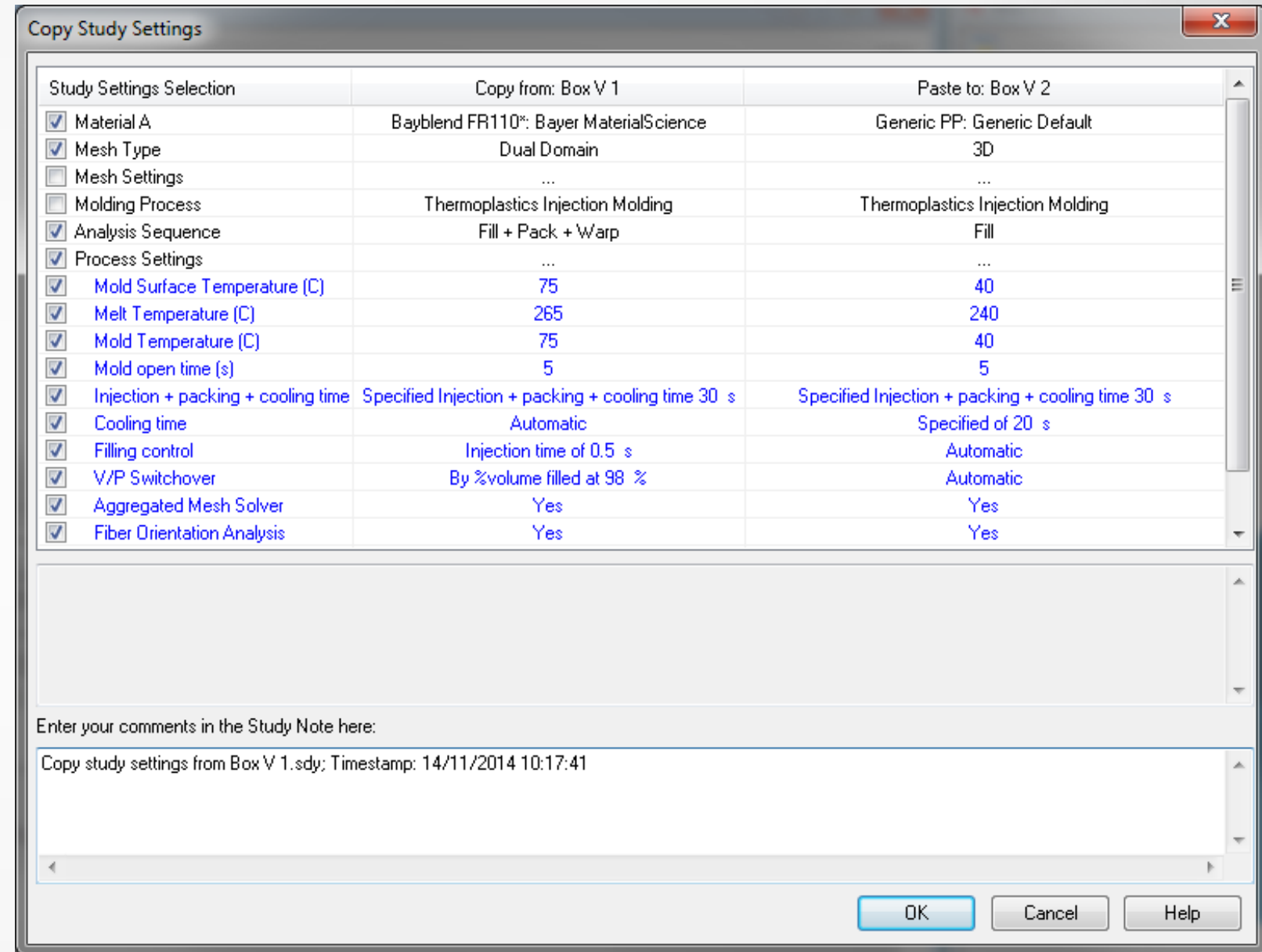
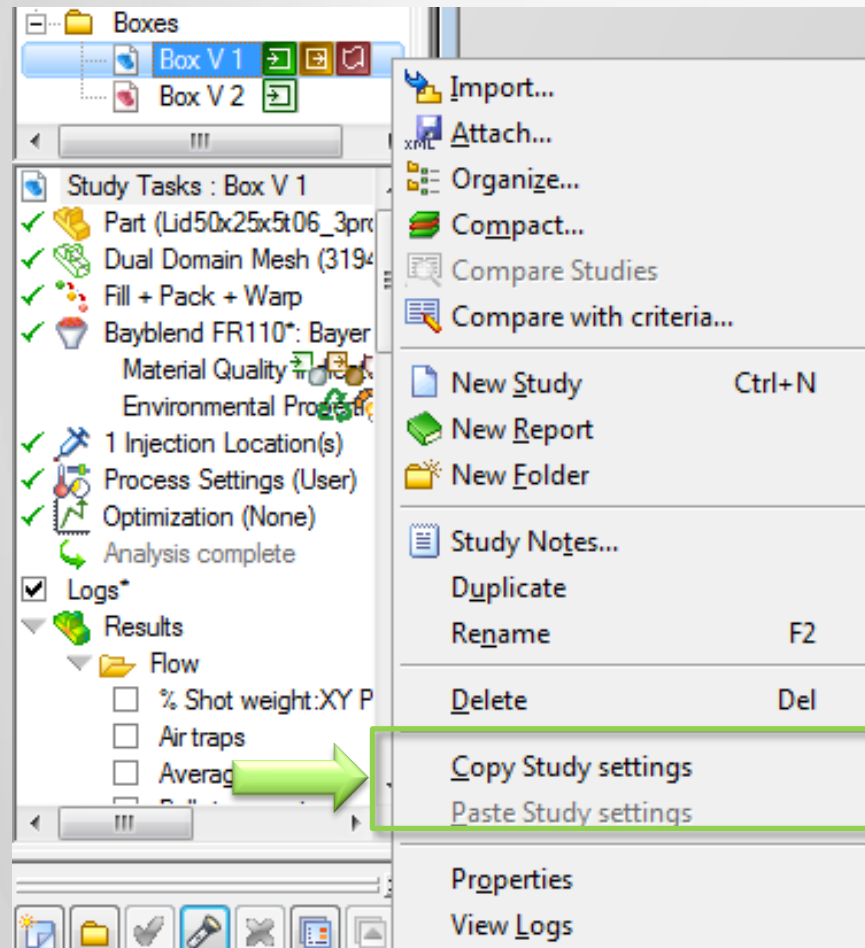
- Synchronize for all studies



Copy and Paste Study Settings to Another Study

Copy Study settings

Paste Study settings



Import Profile from file (*.csv)

RegularProfileProject008.csv - Editor

Datei	Bearbeiten	Format	Ansicht	?
.02	68			
4	68			
.02	56			
2	56			
.02	43			
1	43			
.02	35			
1	35			
.02	24			
1	24			
.02	12			
1	12			
.02	0			

Zeile 1, Sp

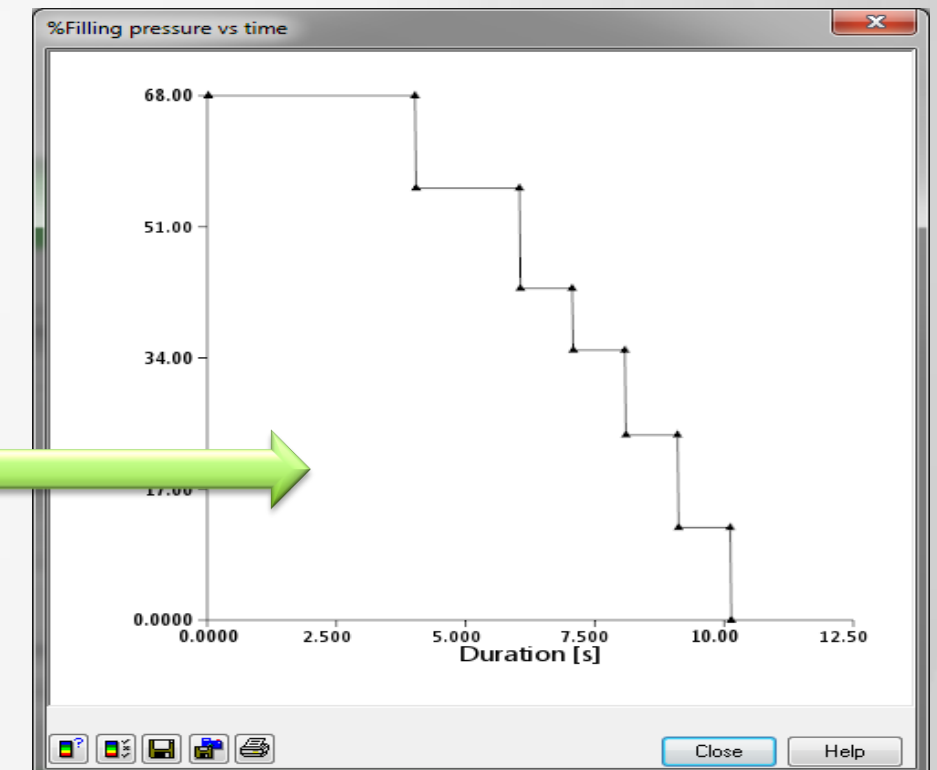
Pack/Holding Control Profile Settings

%Filling pressure vs time

	Duration s [0:300]	%Filling pressure % [0:200]
1	0.02	68
2	4	68
3	0.02	56
4	2	56
5	0.02	43
6	1	43
7	0.02	35
8	1	35
9	0.02	24
10	1	24
11	0.02	12
12	1	12
13	0.02	0

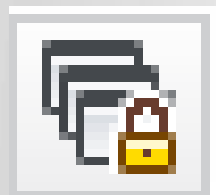
Import Profile... Plot Profile...

OK Abbrechen Hilfe

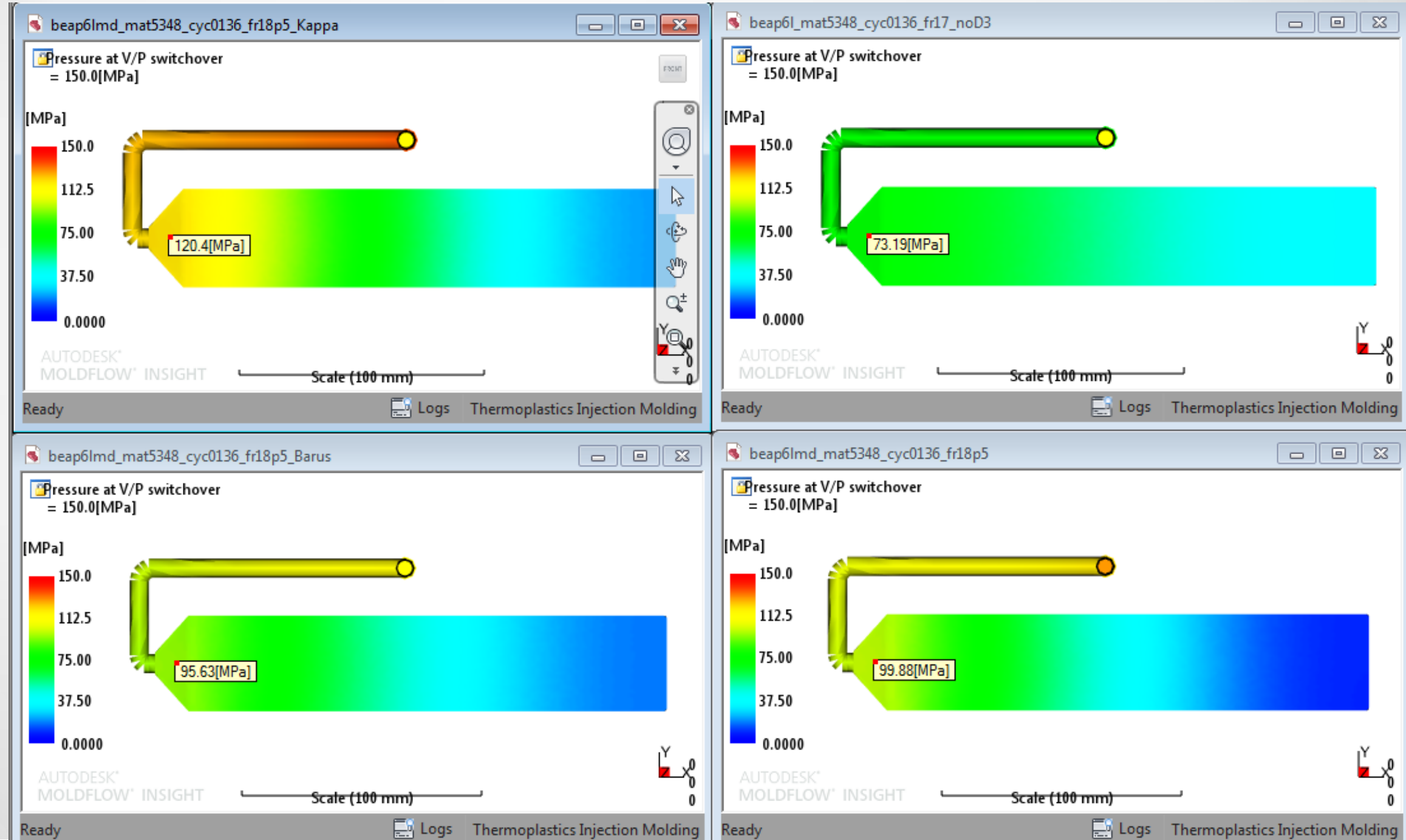
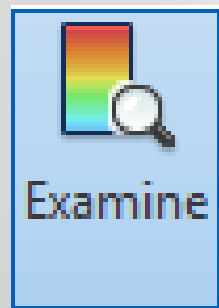


Synchronized Results Examine

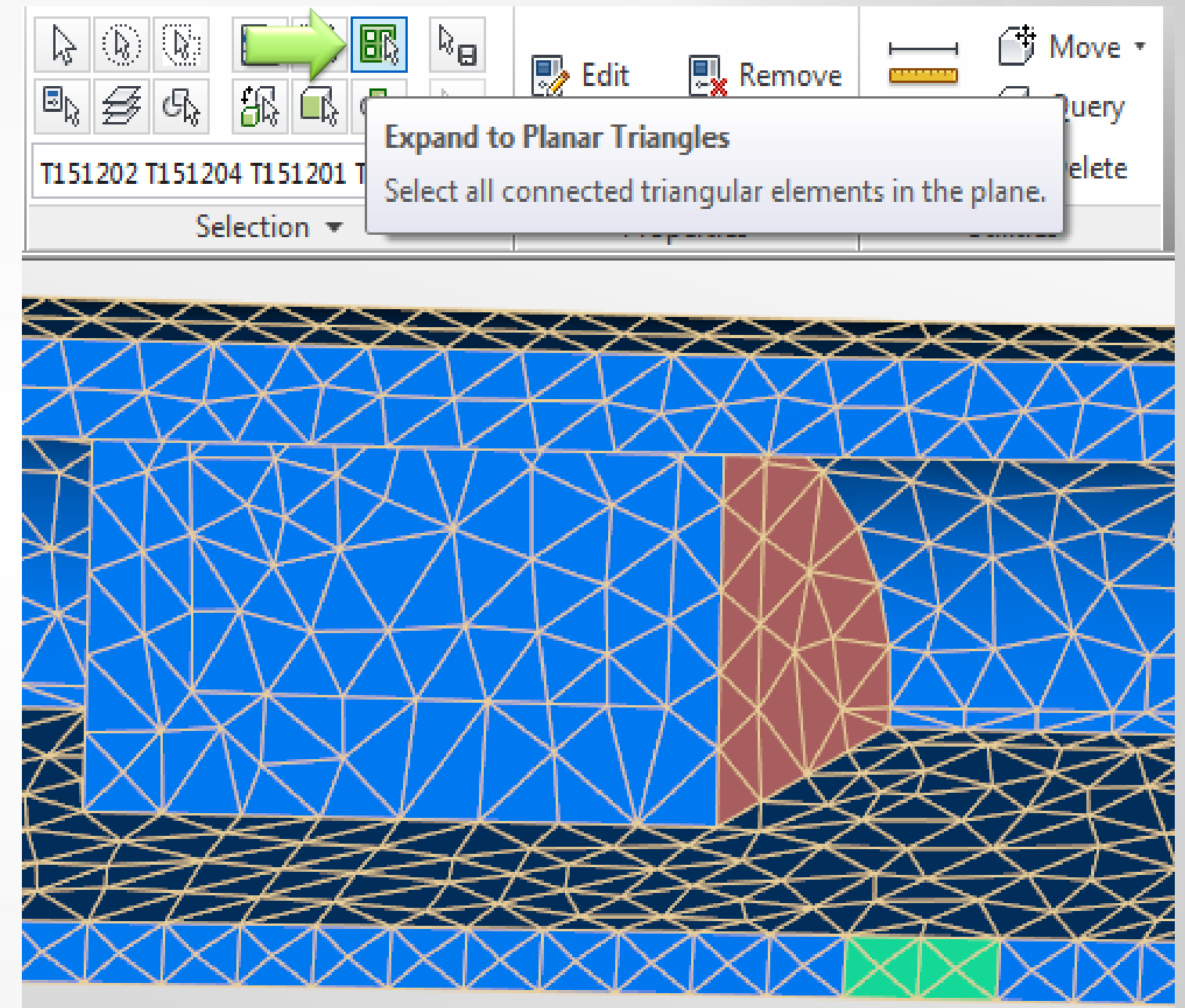
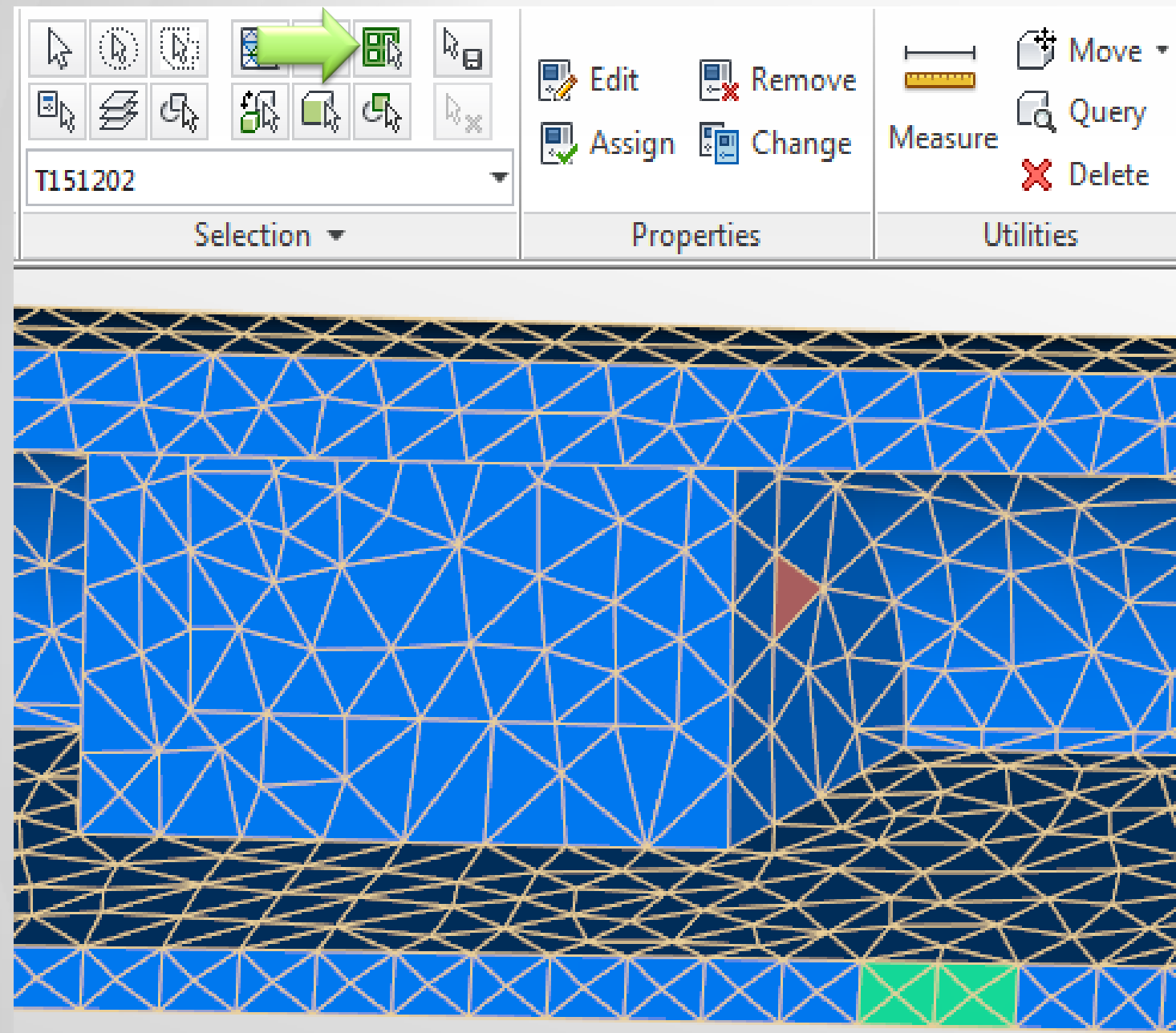
Result examine simultaneously on all locked the displays



+



Face Selection (Surface Mesh)

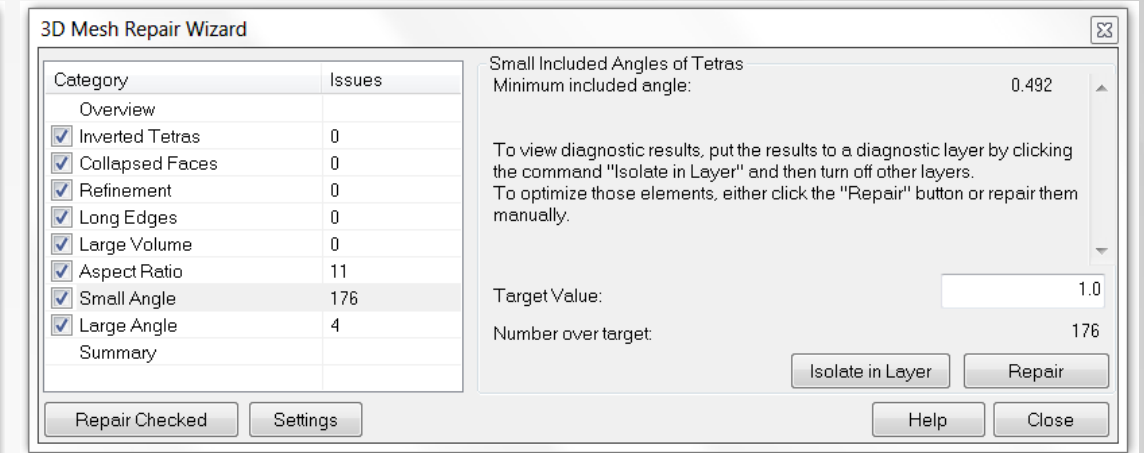
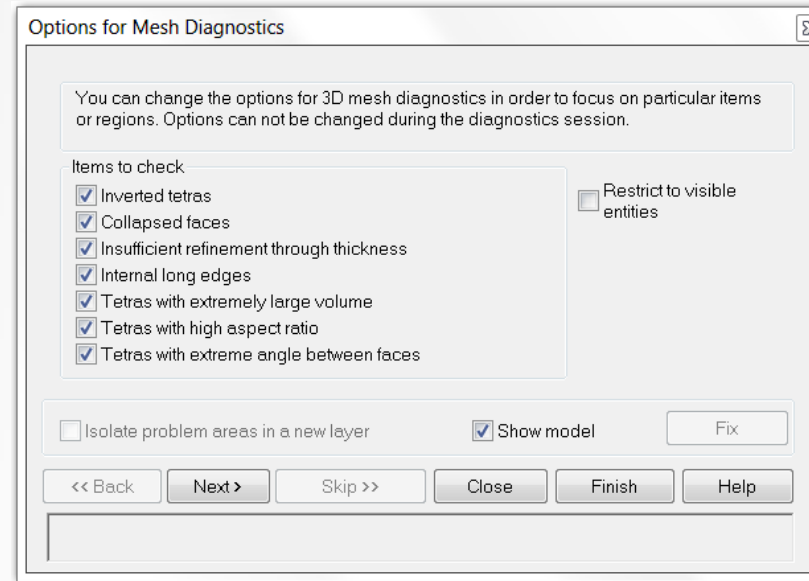


3D Mesh Repair Wizard

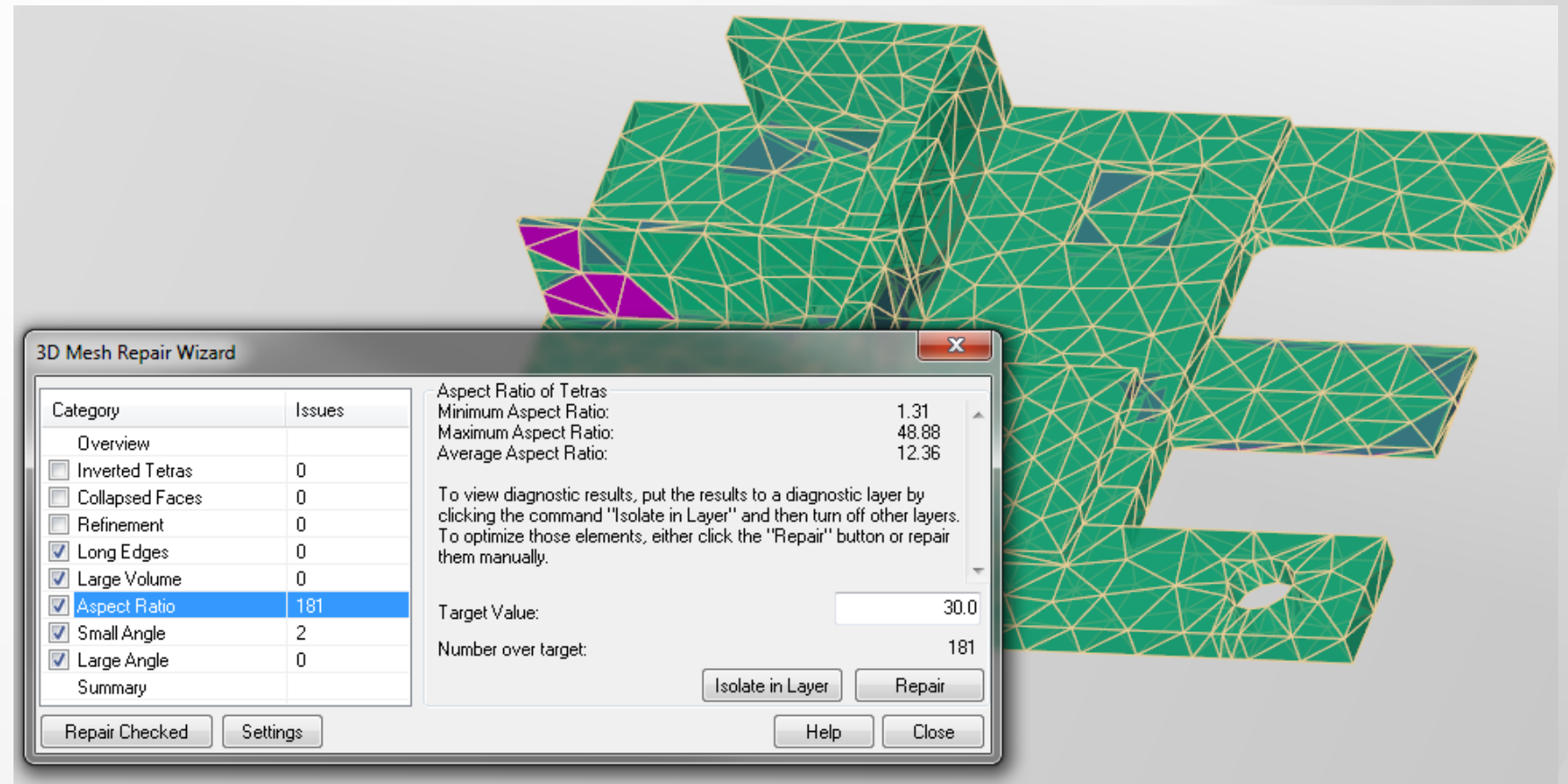
2015

2016

- New Layout

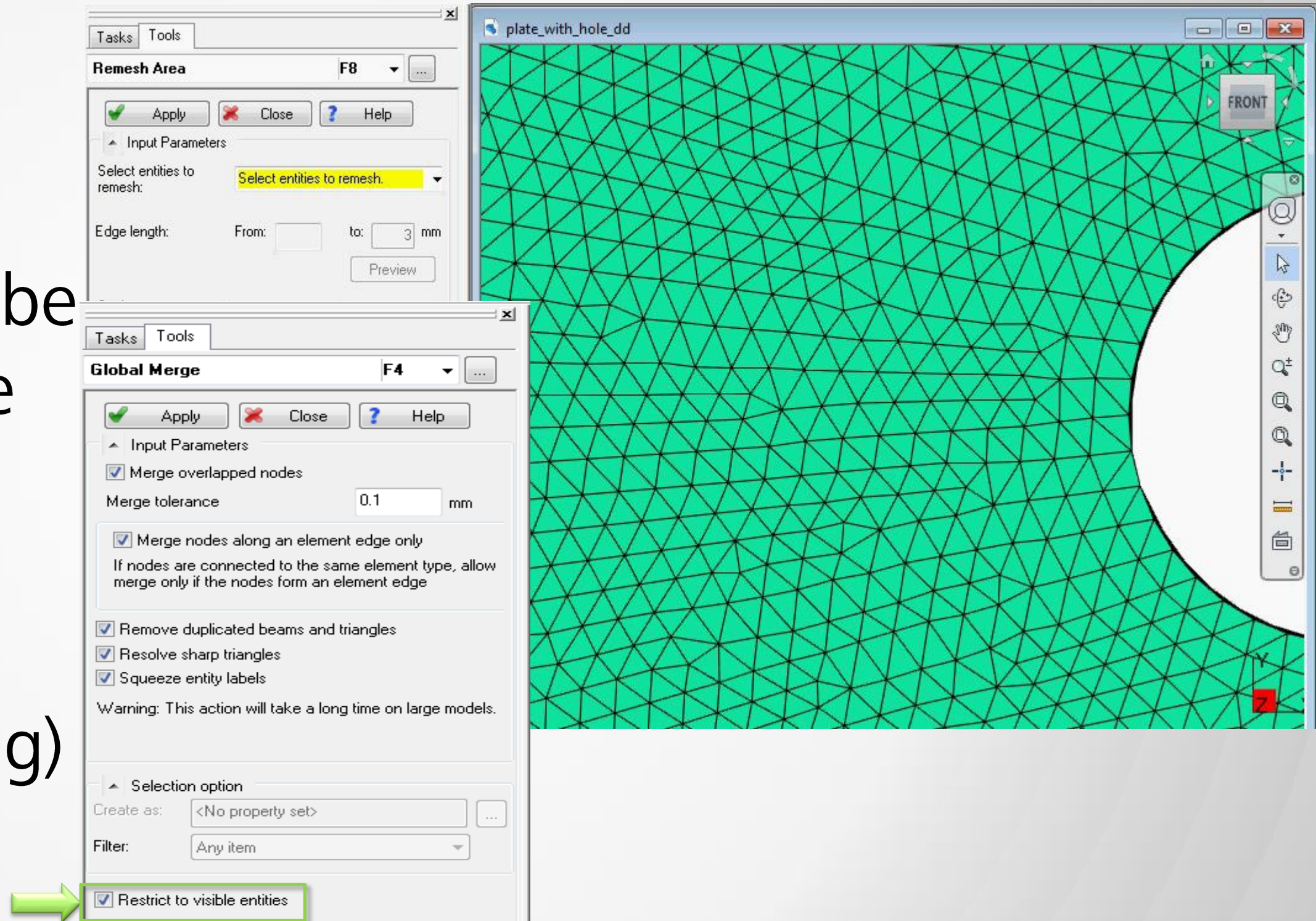


- Highlight defects on model



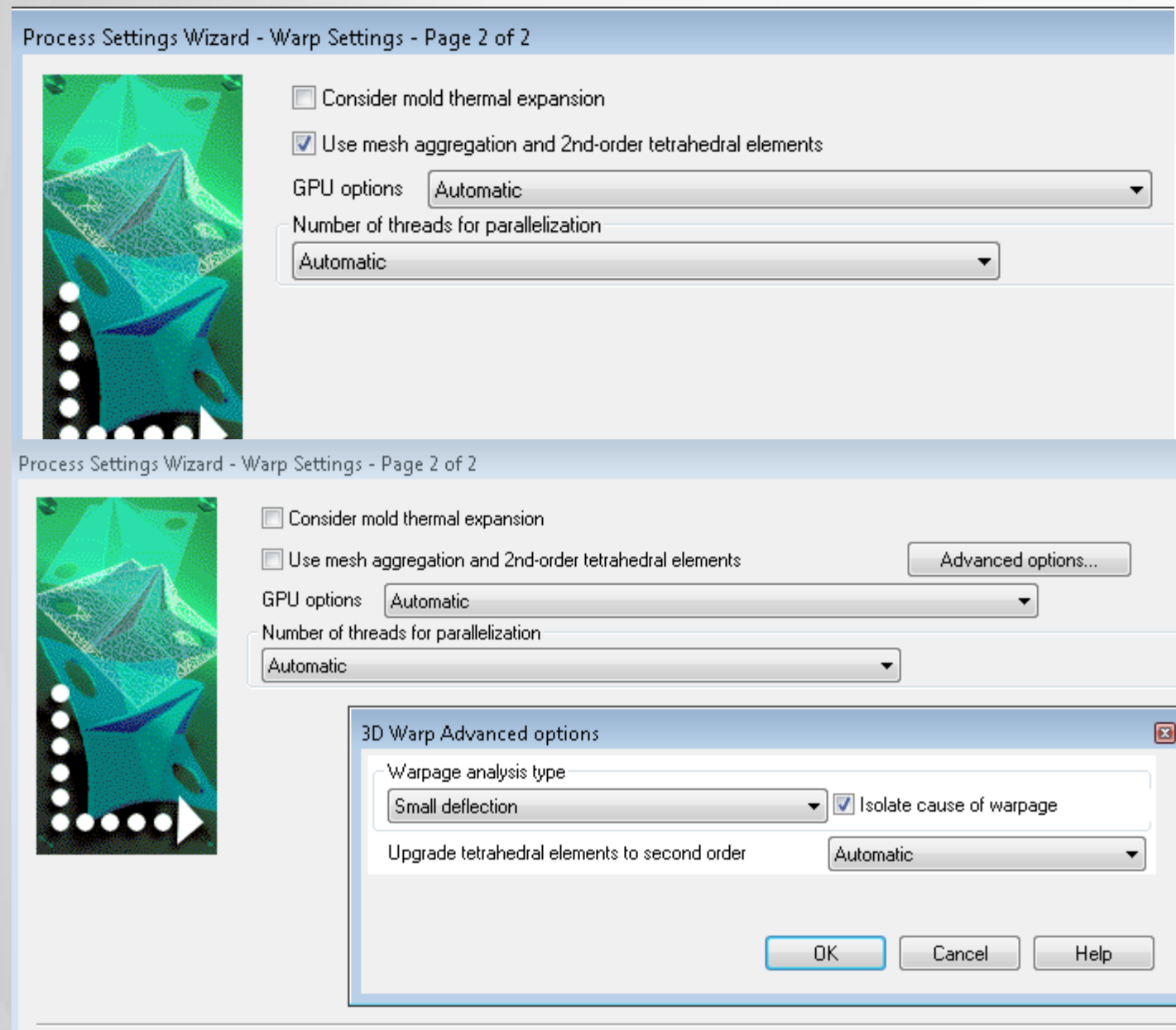
Mesh Usability Enhancements

- Remesh Area Preview
- Global merge can be restricted to visible nodes
- New mesh size controls for 1D (runner and cooling)
- Improved Overlap diagnostic

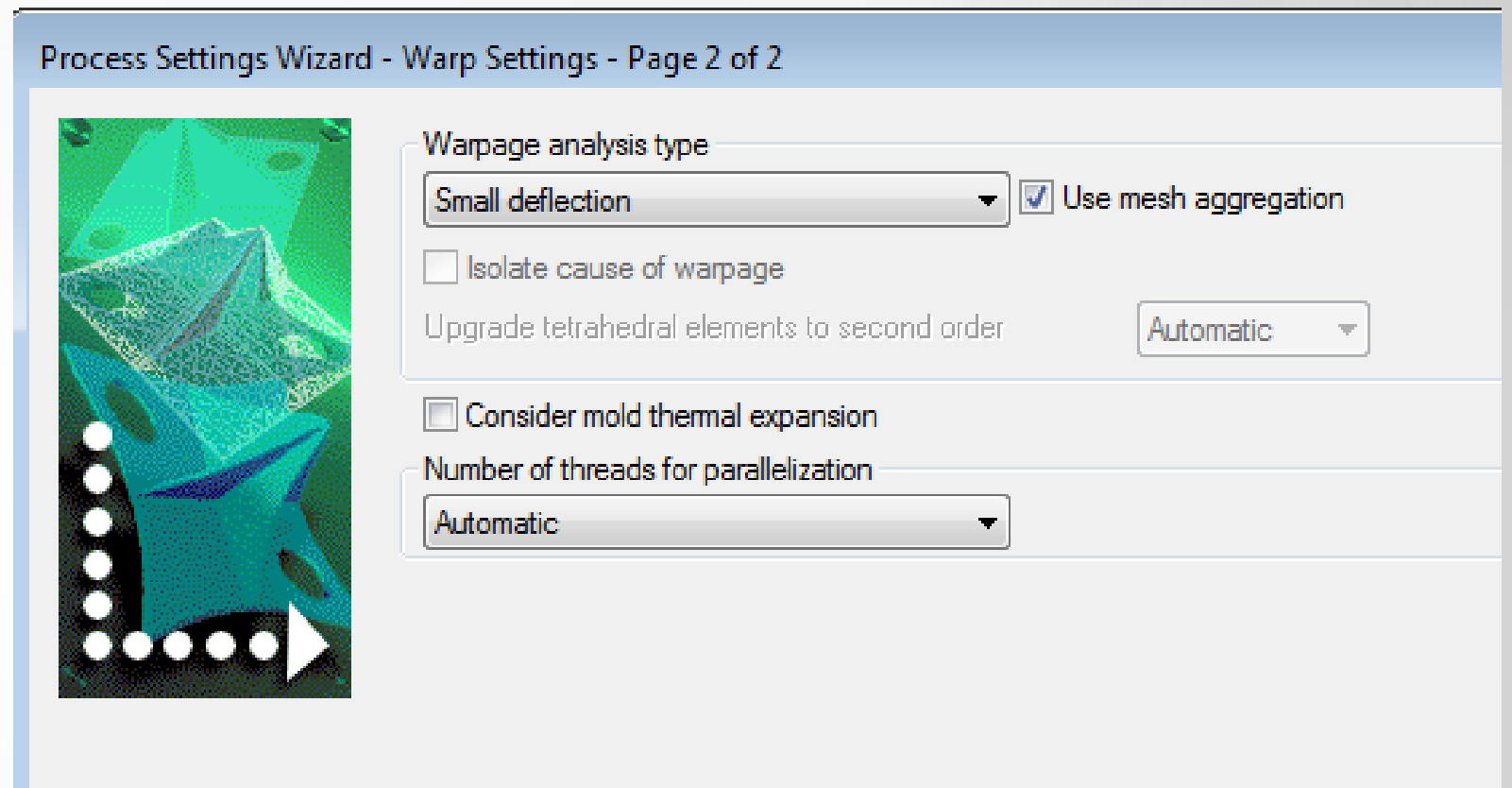


Simplified 3D Warp Process Settings

2015

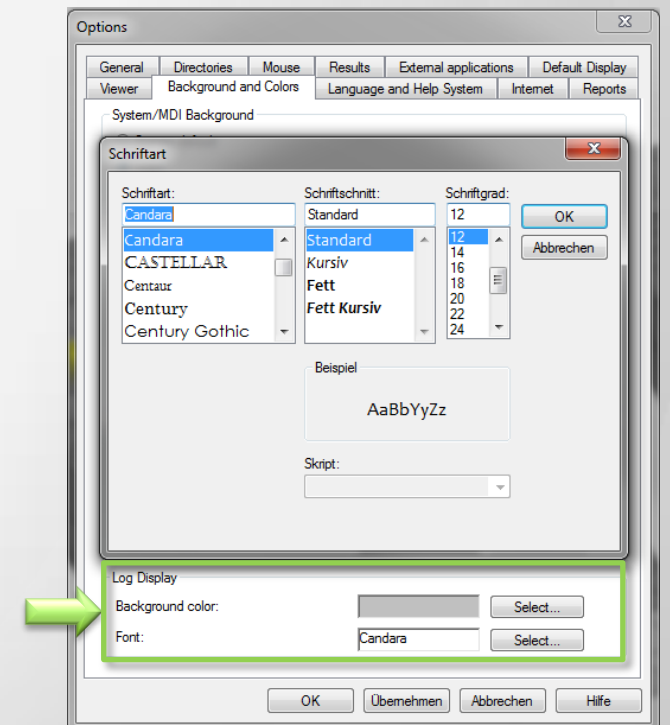
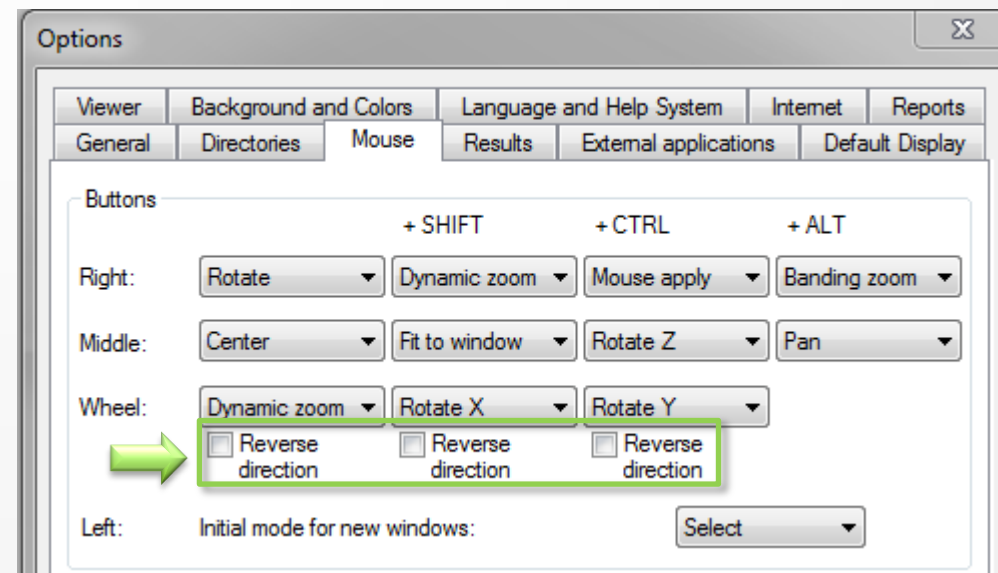


2016



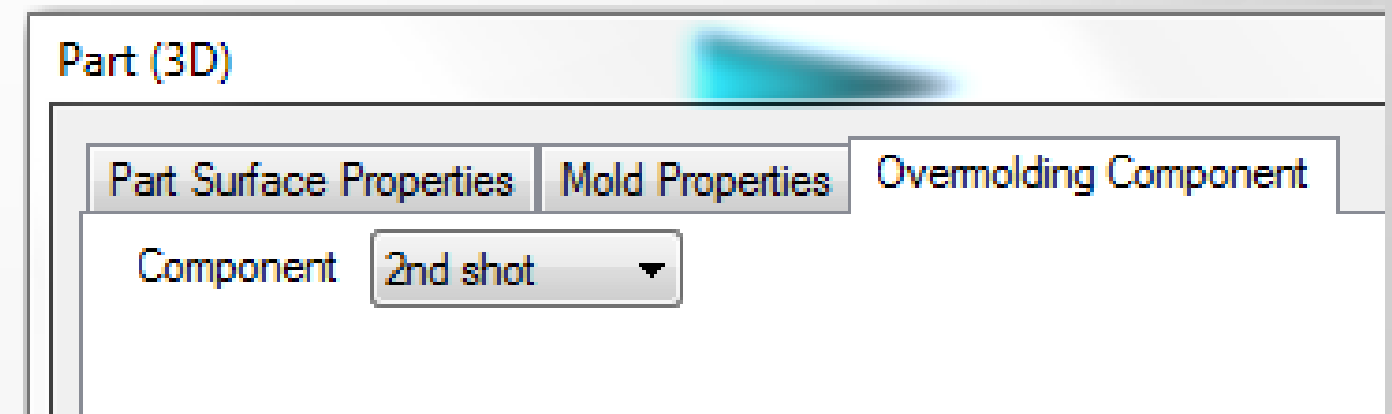
Other Usability Enhancements

- Speed-up large model handling (up to x2 faster)
 - Faster model display
 - Faster result display
- Enable Synergy-API for multiple instances of Synergy
- Studymod can select material
- Mouse wheel direction choice
- Log file color & font
- Synchronized XY Plot animations



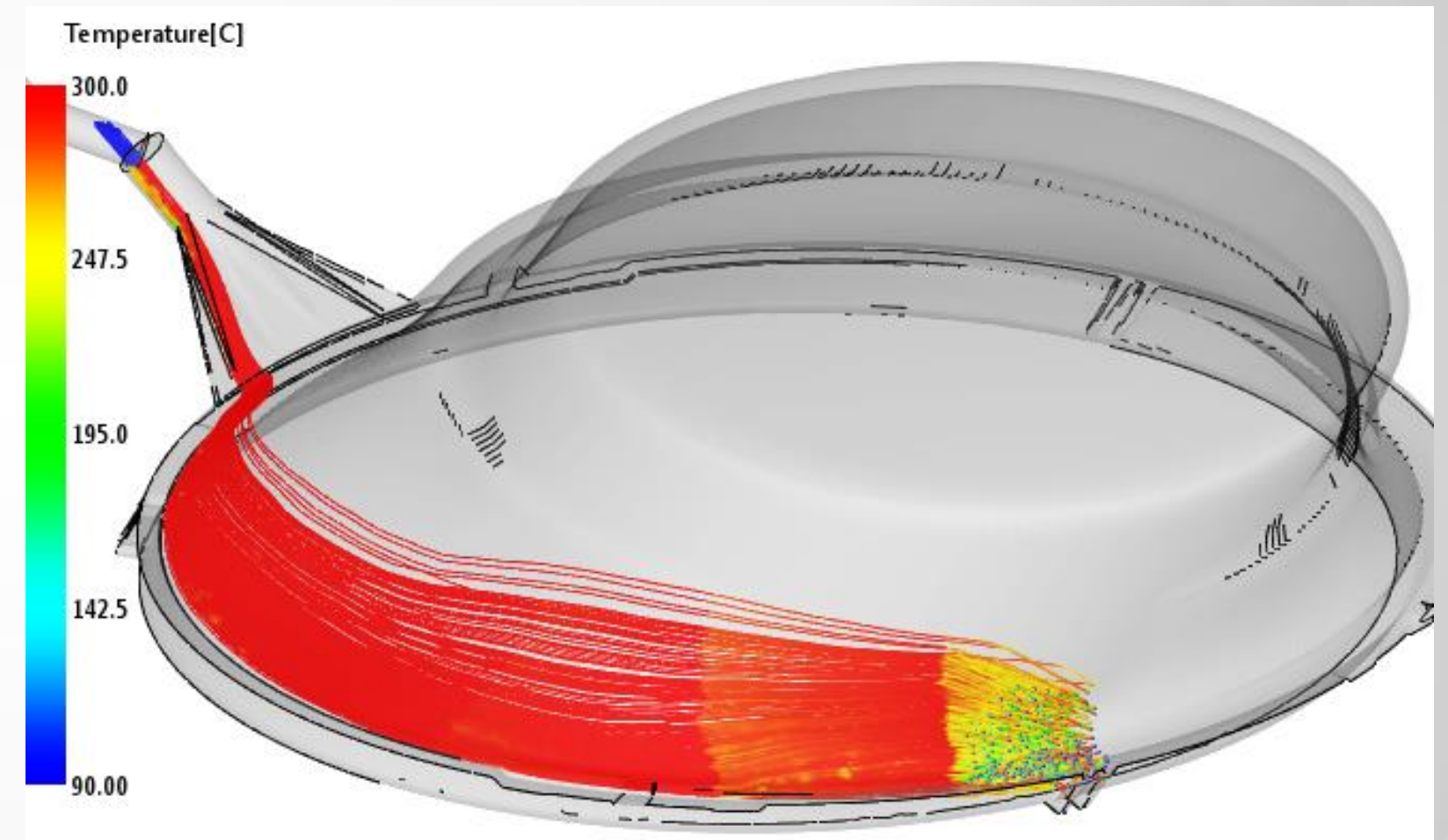
Other Solver Enhancements

- Fiber Breakage enabled for thermoset processes
- Improved 3D Automatic injection time
- Maximum Clamp Force Limit extended to 3D Flow
- Valve gate control by ram positions extended to 3D Flow
- Remove the “Legacy Overmolding Second Component” element types
 - Instead use regular part elements



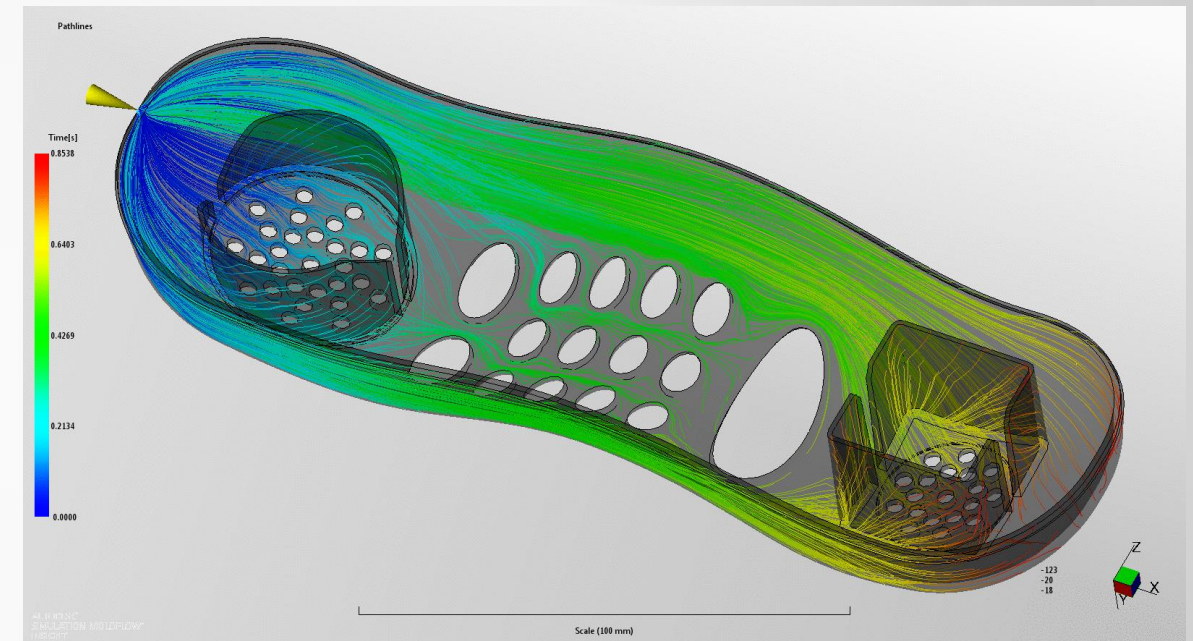
Summary

- Moldflow Insight 2016 Beta
 - Pathlines
 - 3D Weld-surface
 - 3D RSC Fiber Orientation
 - New Results
 - Cavity Weights
 - Bending Curvature,
 - Usability Improvements
 - Layer Management
 - License Borrowing
 - Face Selection,



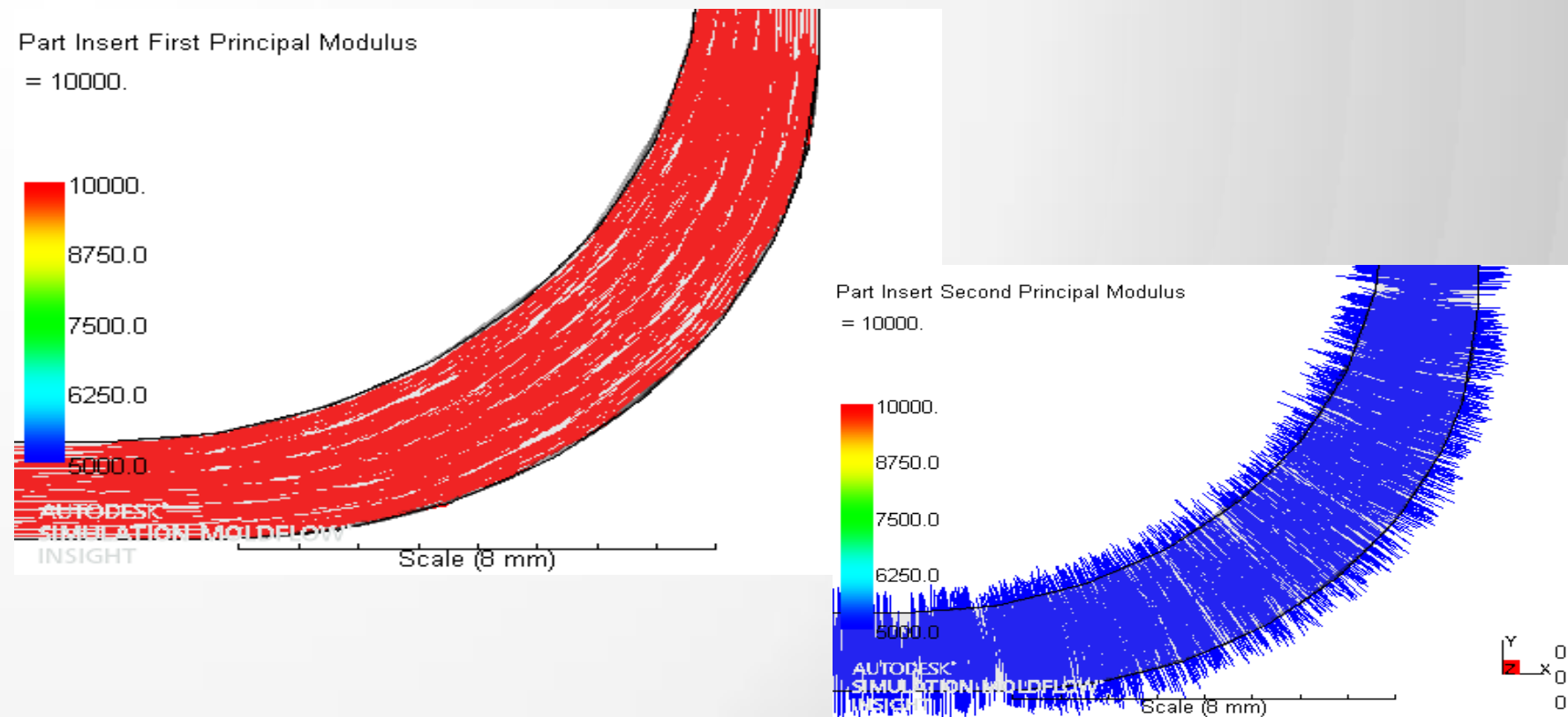
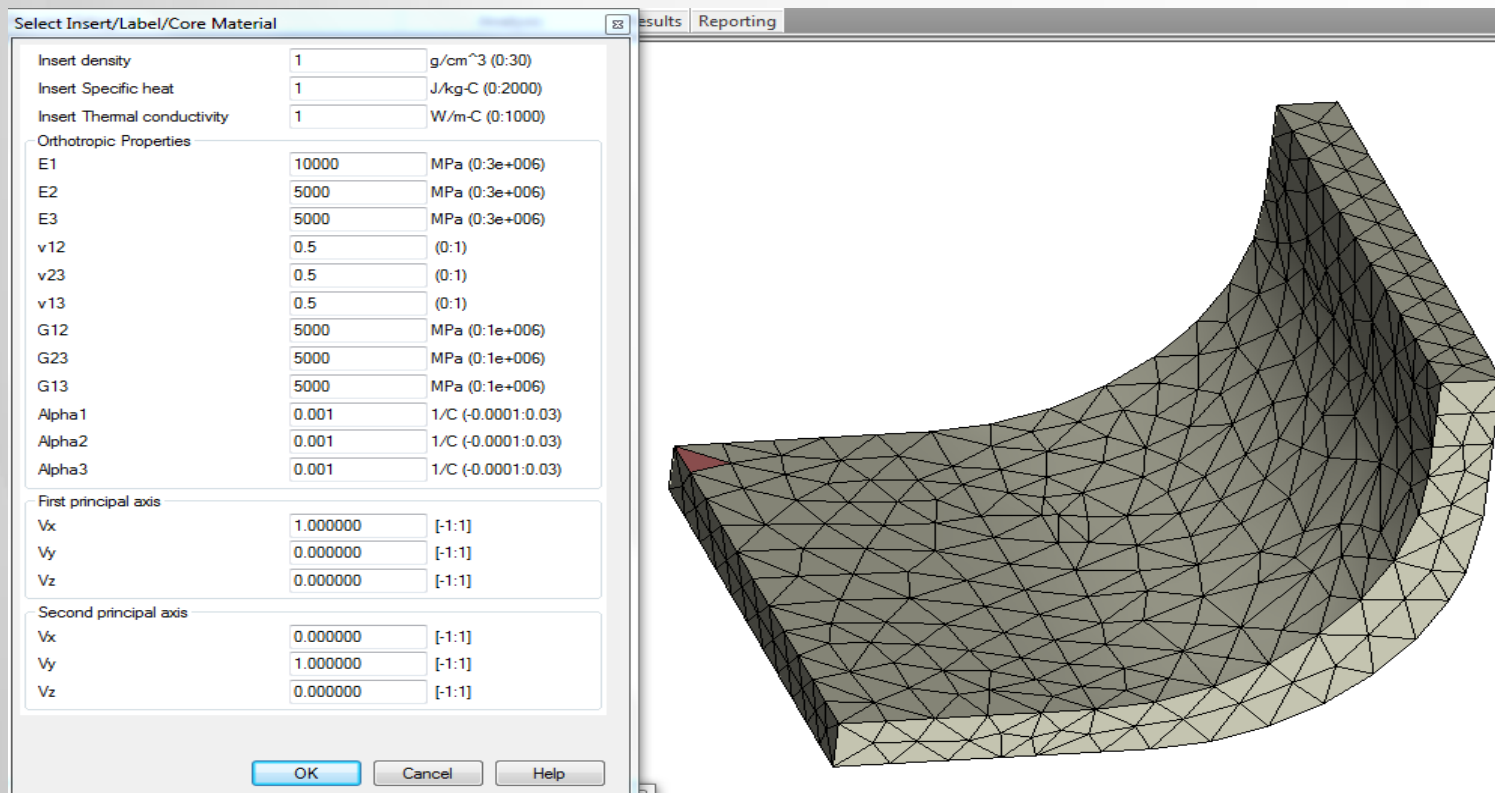
Agenda

- 2015 Scandium Technology Preview
- Moldflow Insight 2016 Beta
- Some API Tools
- Long Term Research Collaborations



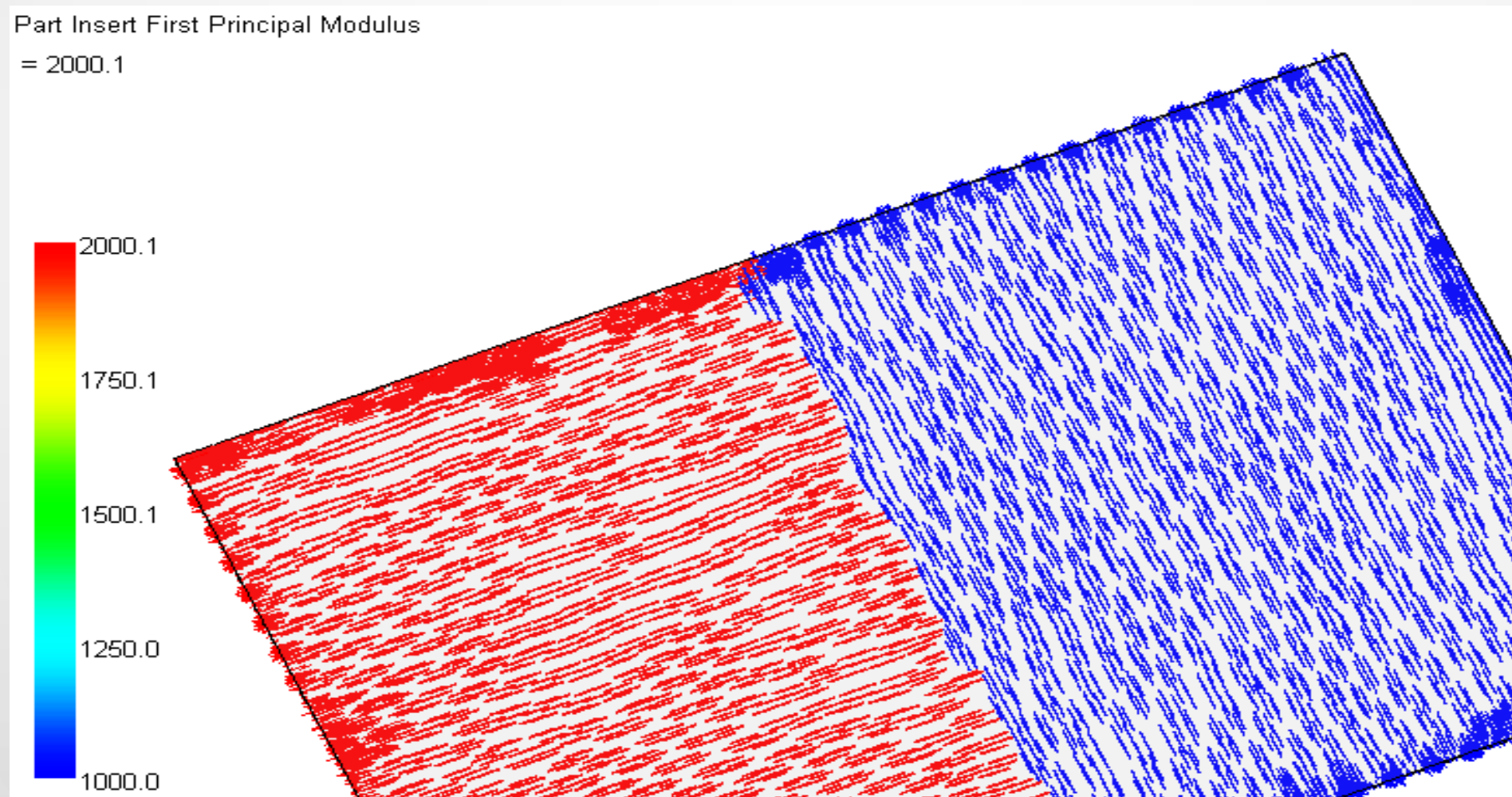
Draping Orthotropic properties over a curved insert

- First set the properties correctly on one element
- Run: SetOrthotropicProperties.vbs
 - Copies and rotates those properties to all connect elements
- Currently posted on Beyond Moldflow Insight blog:
 - <http://autodesk.typepad.com/beyondmoldflowinsight/>



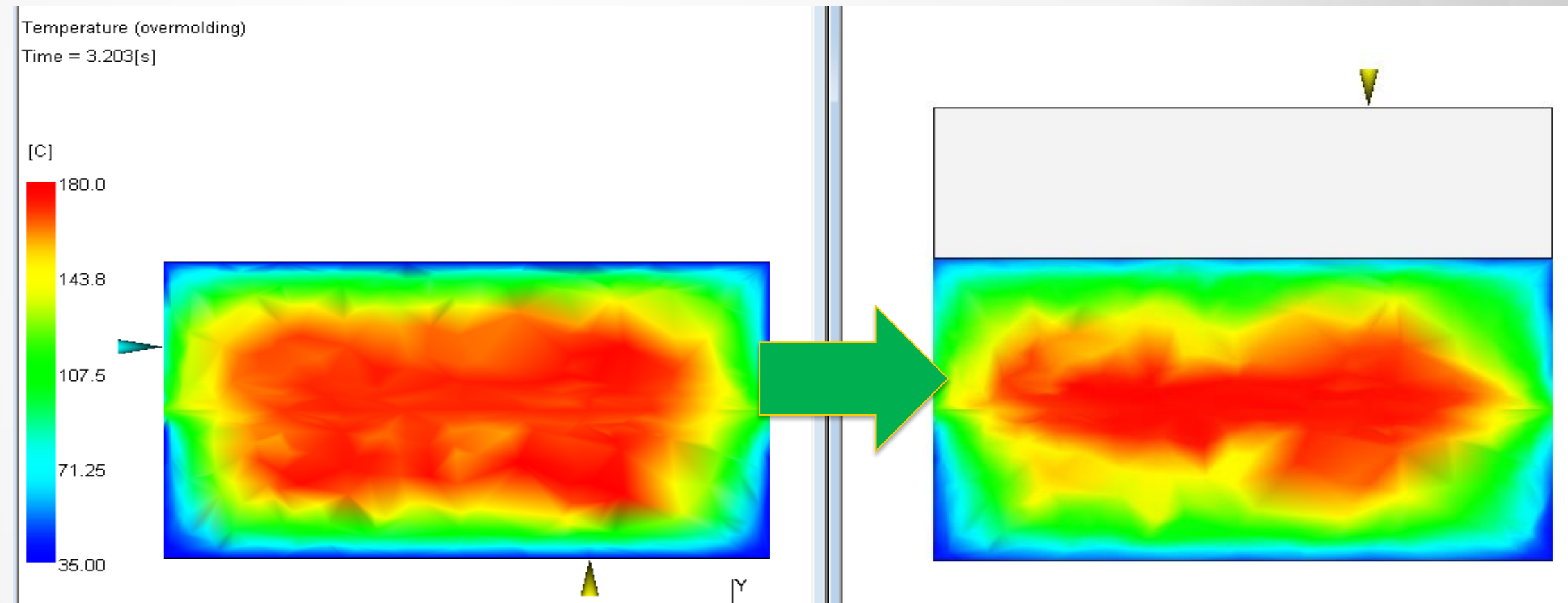
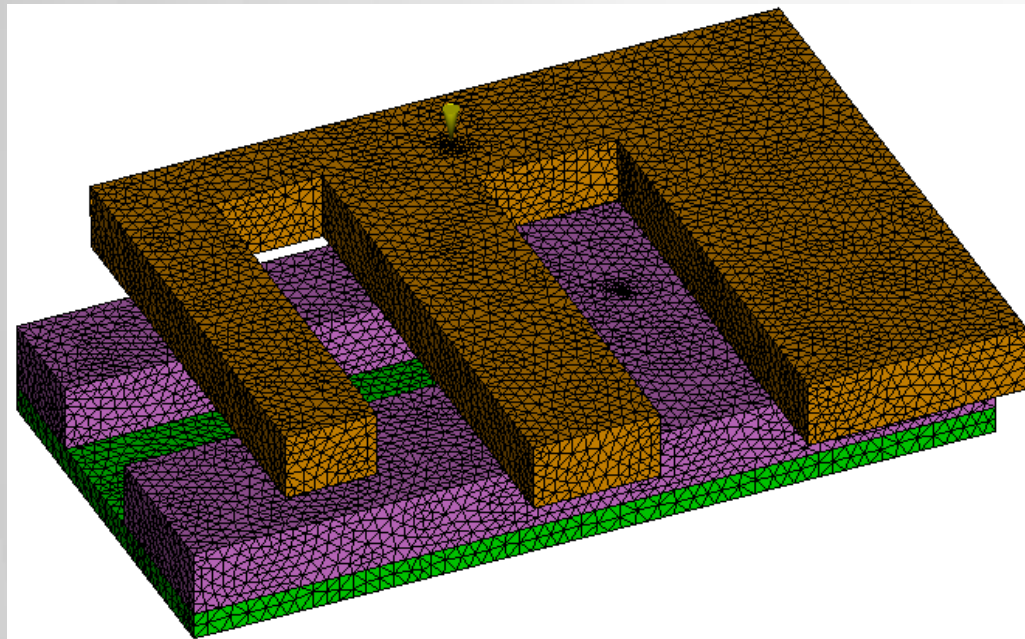
Displaying Orthotropic Properties after setup

- Run: DisplayOrthotropicProperties.vbs
- Included in the "commands" folder during install



Multi-shot over molding: API Macro

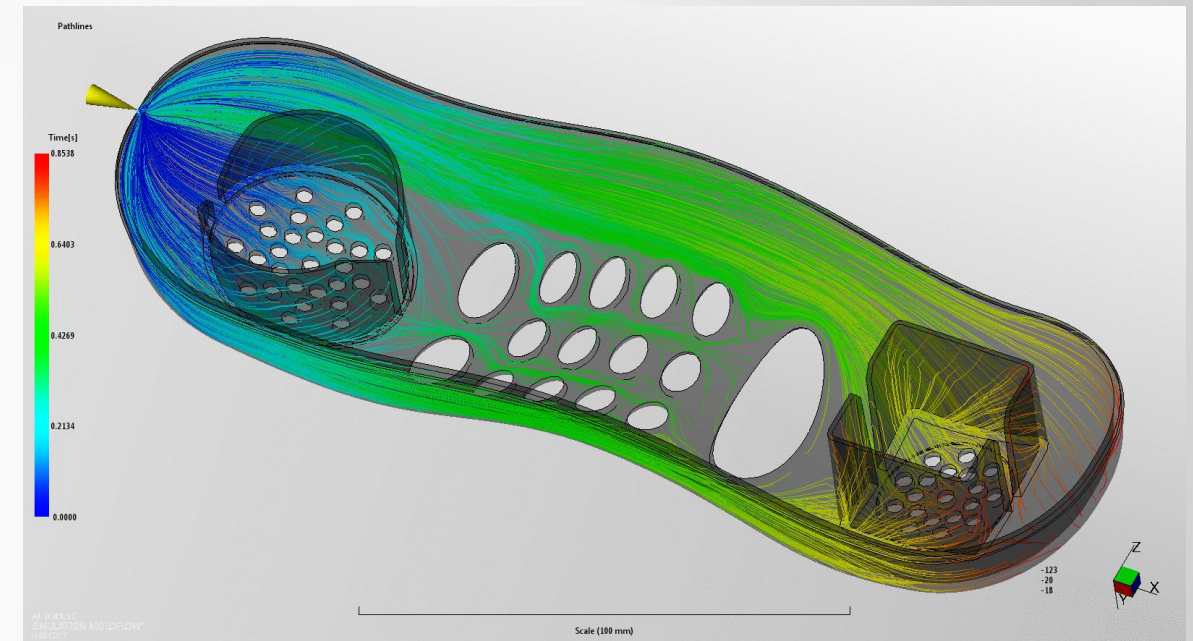
- Copy temperature results to a new study as initial insert temperatures for the subsequent shots



<http://autodesk.typepad.com/beyondmoldflowinsight/2014/11/script-for-multi-shot-overmoldings.html>

Agenda

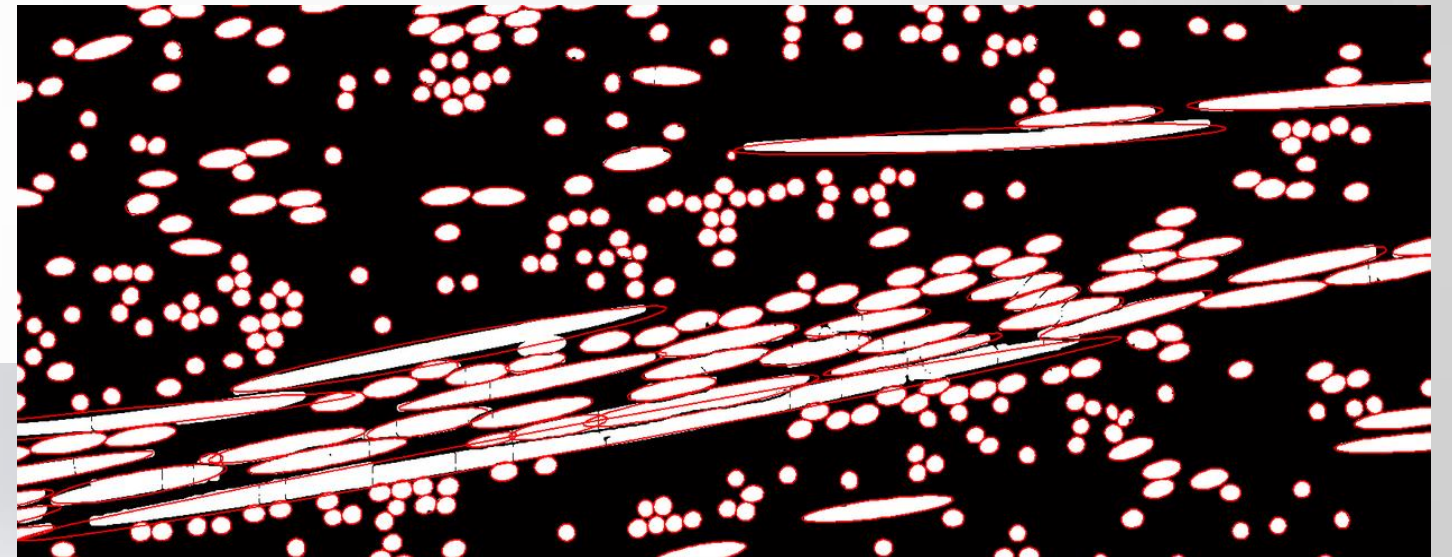
- 2015 Scandium Technology Preview
- Moldflow Insight 2016 Beta
- Some API Tools
- Long Term Research Collaborations



Long Carbon Fiber Injection Molded: PNNL, Toyota, UIUC, Plasticomp, Magna, Purdue Univ

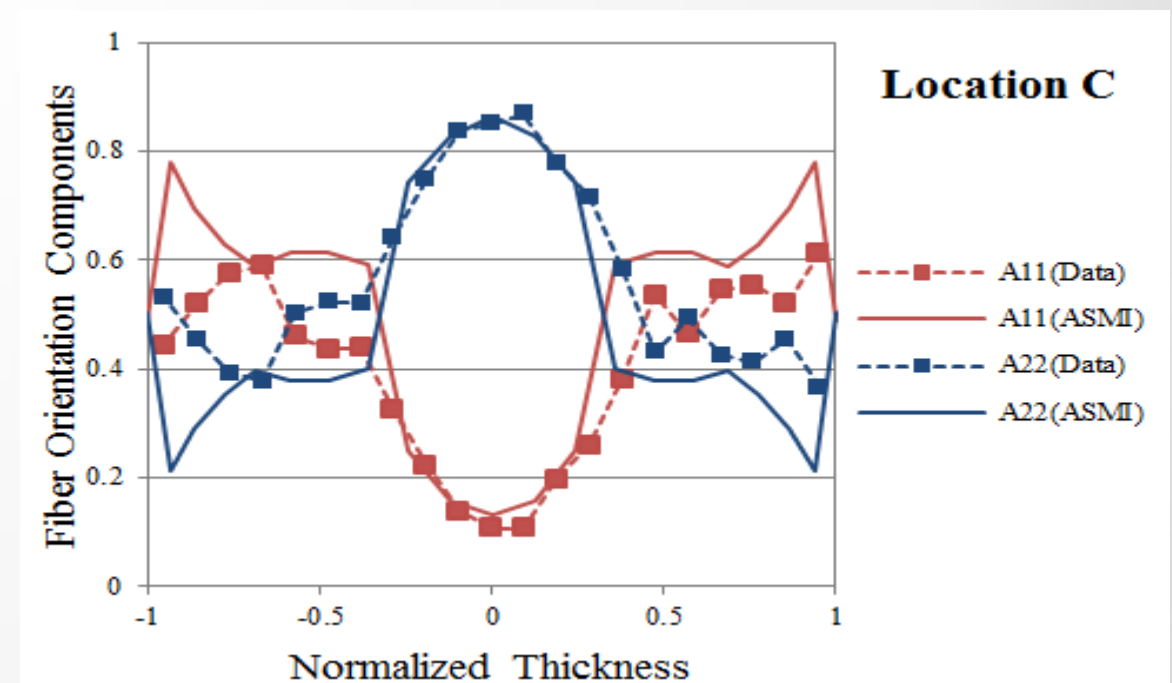
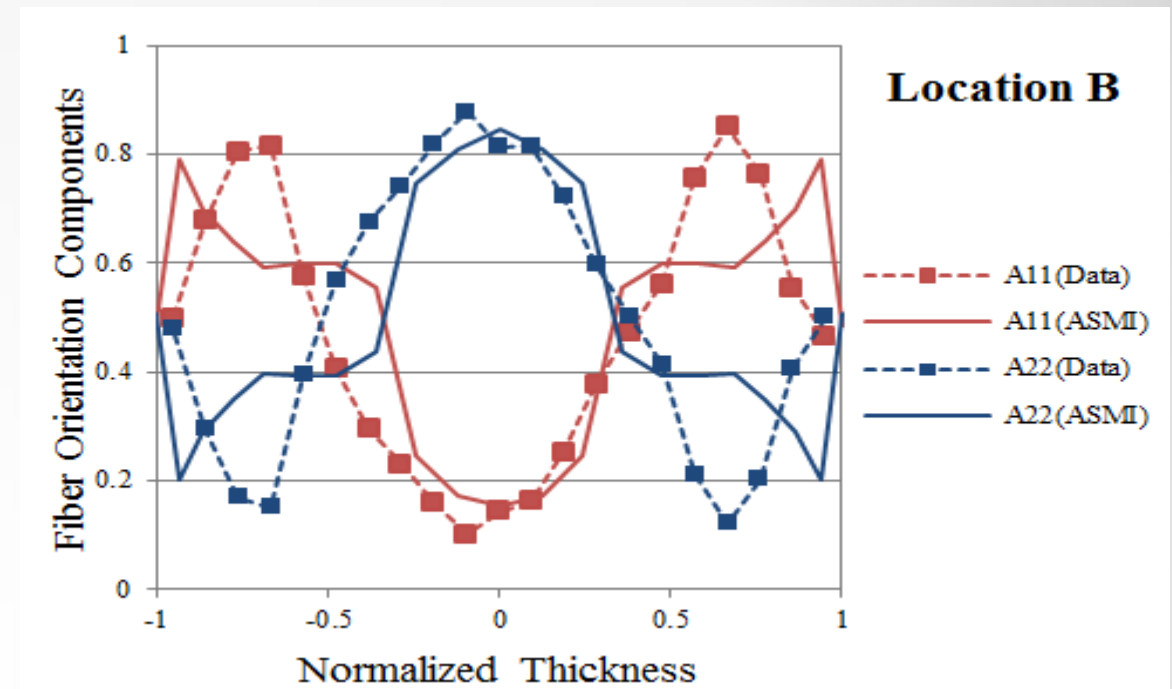
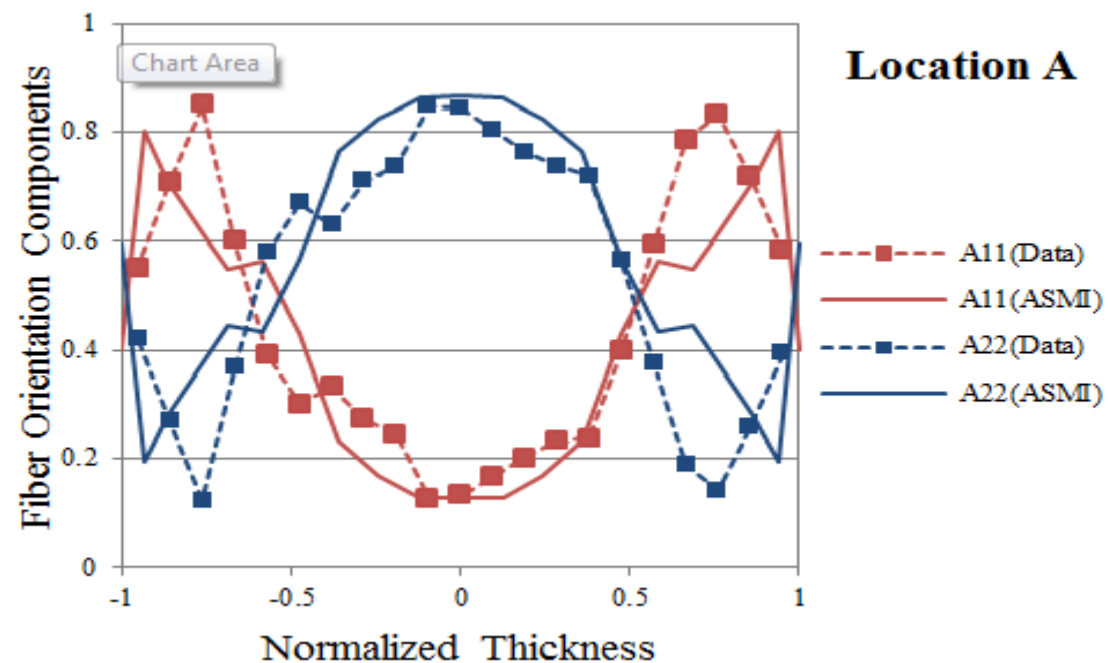
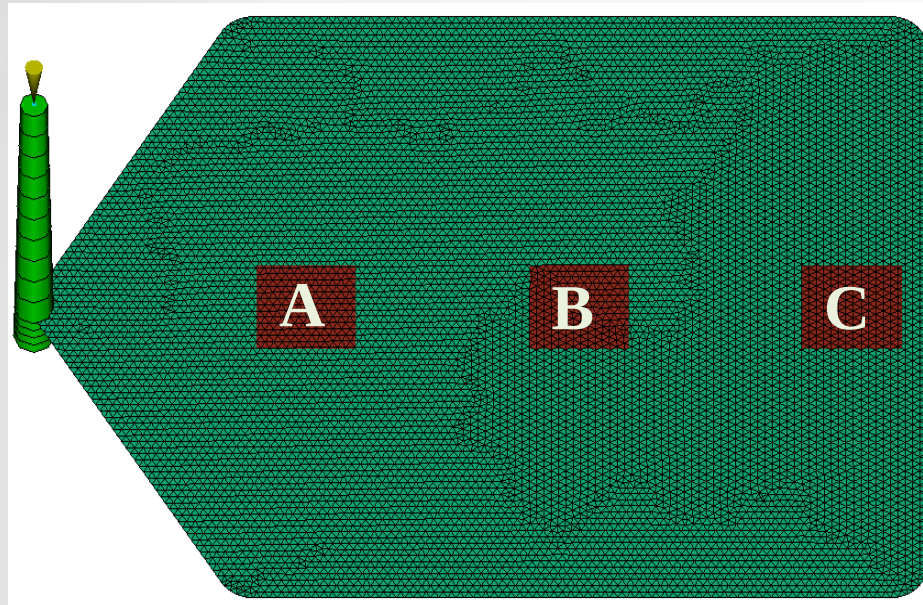
Prediction of fiber orientation and breakage during injection molding of “long” carbon fiber thermoplastics

2mm to 12mm



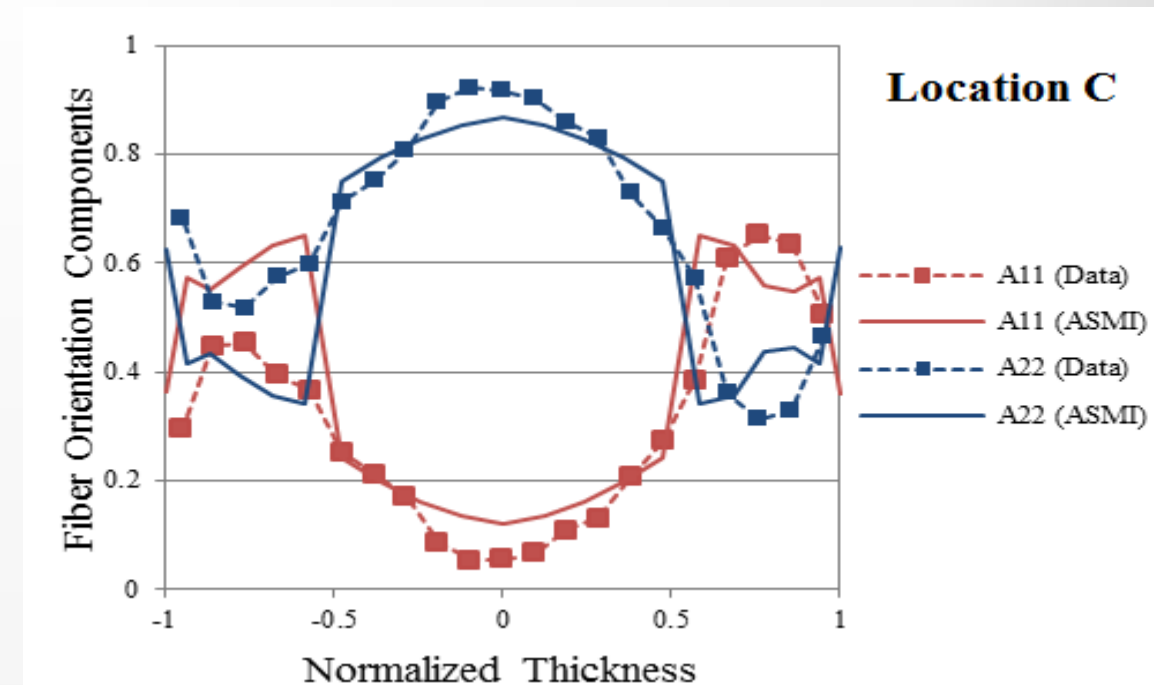
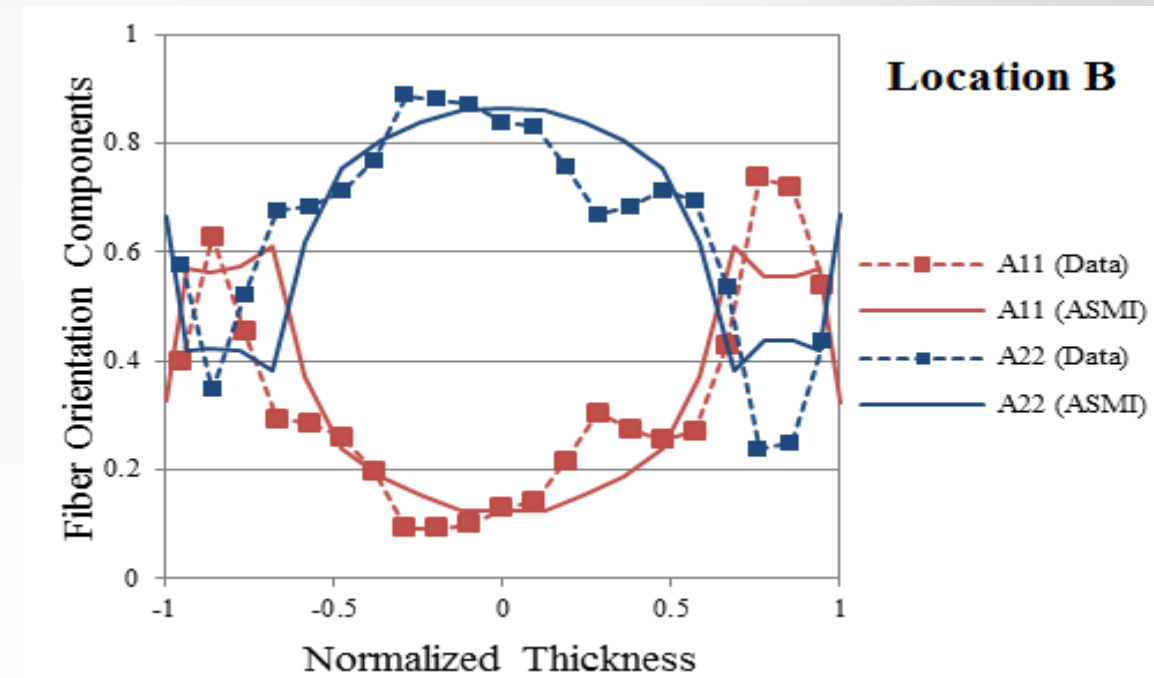
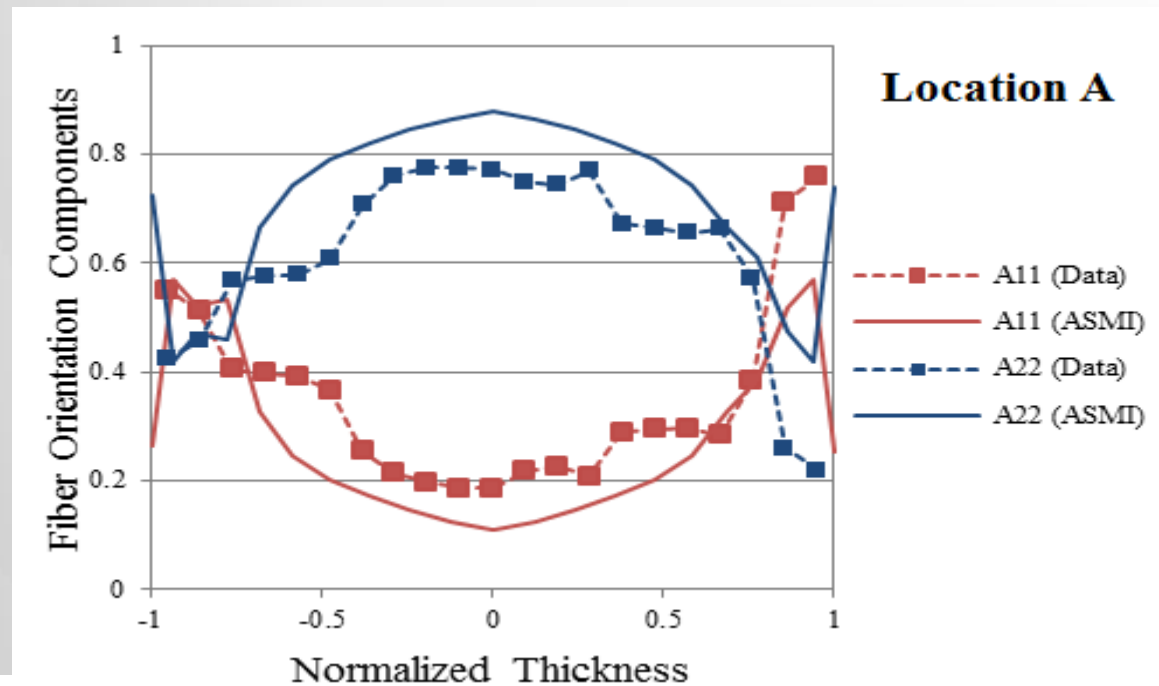
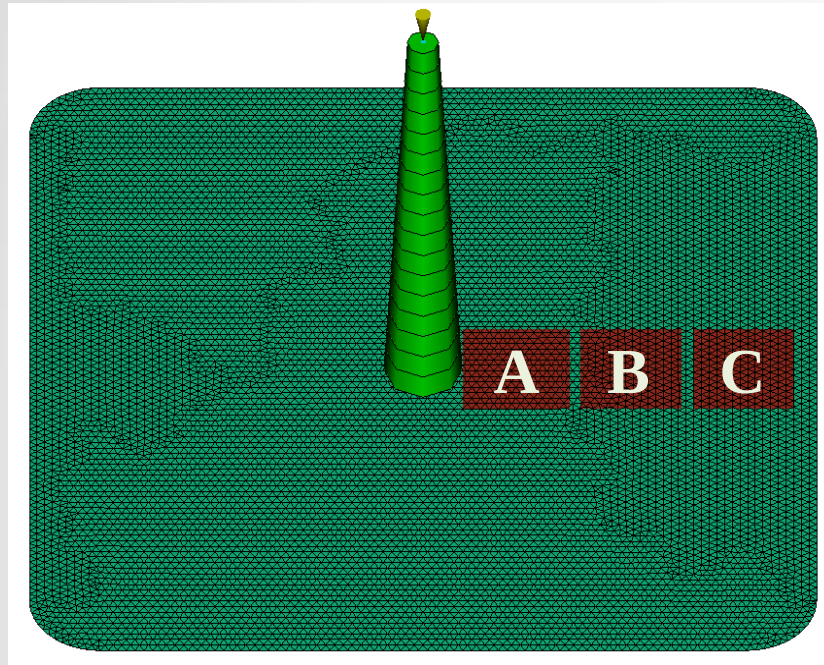
Long Carbon Fiber Orientation Validation: Edge Gated

50%wt LCF/PP (Midplane)



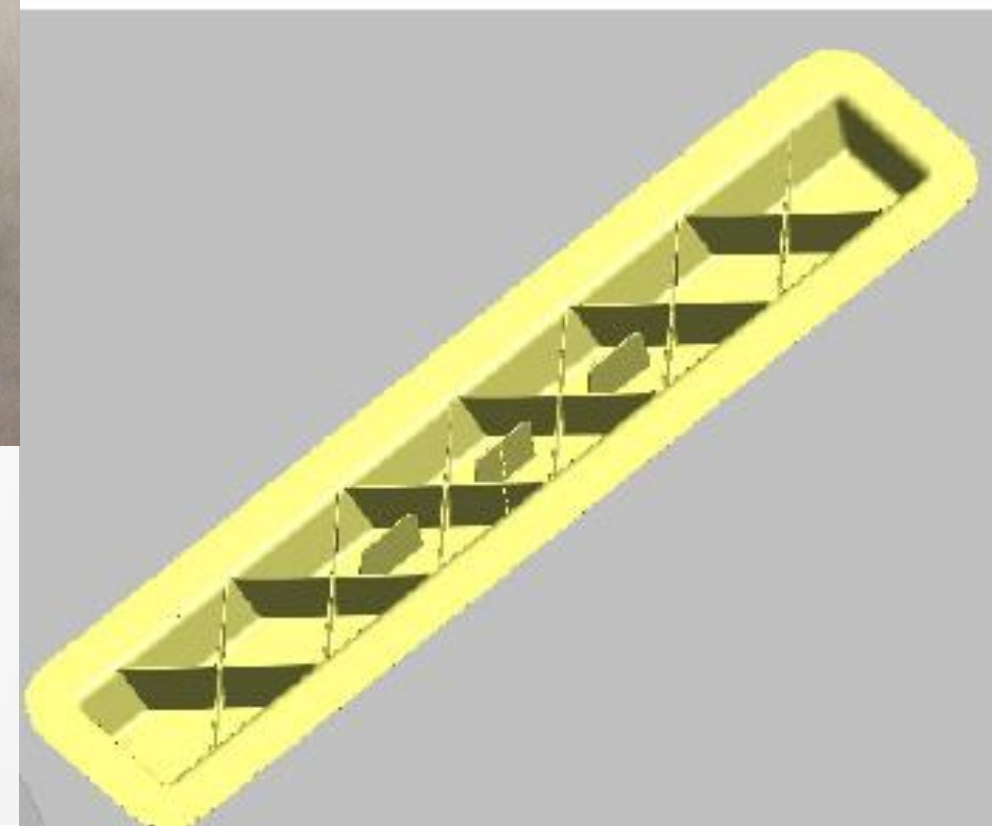
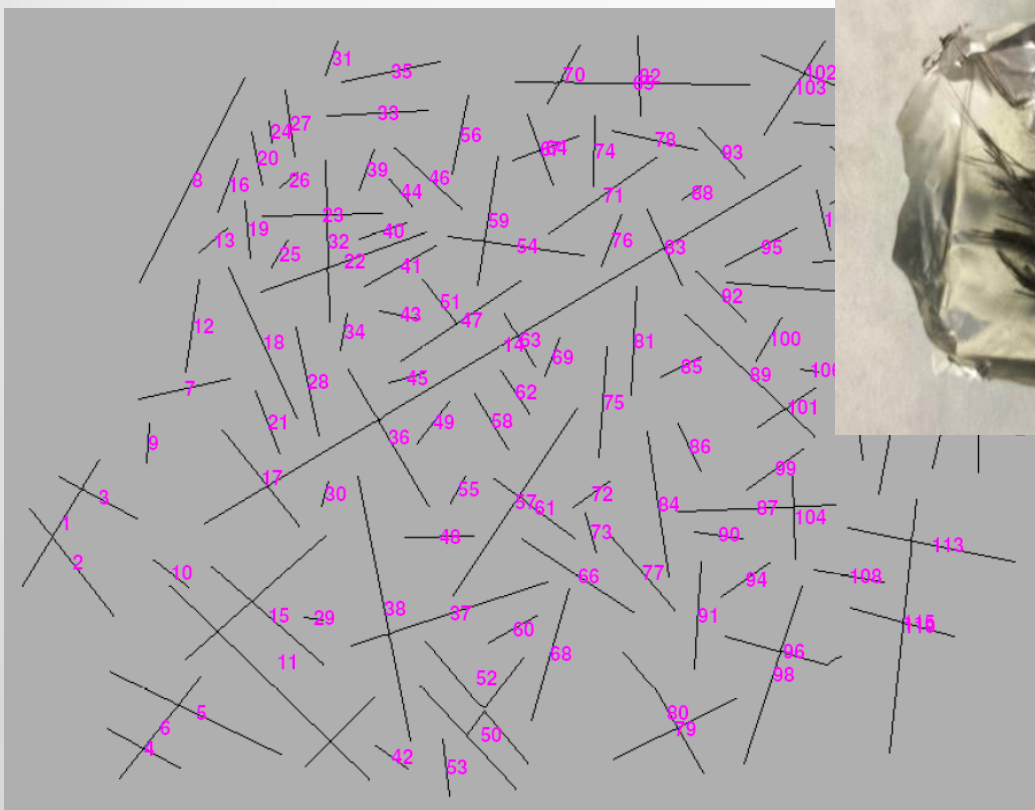
Long Carbon Fiber Orientation Validation: Center Gated

50%wt LCF/PP (Midplane)



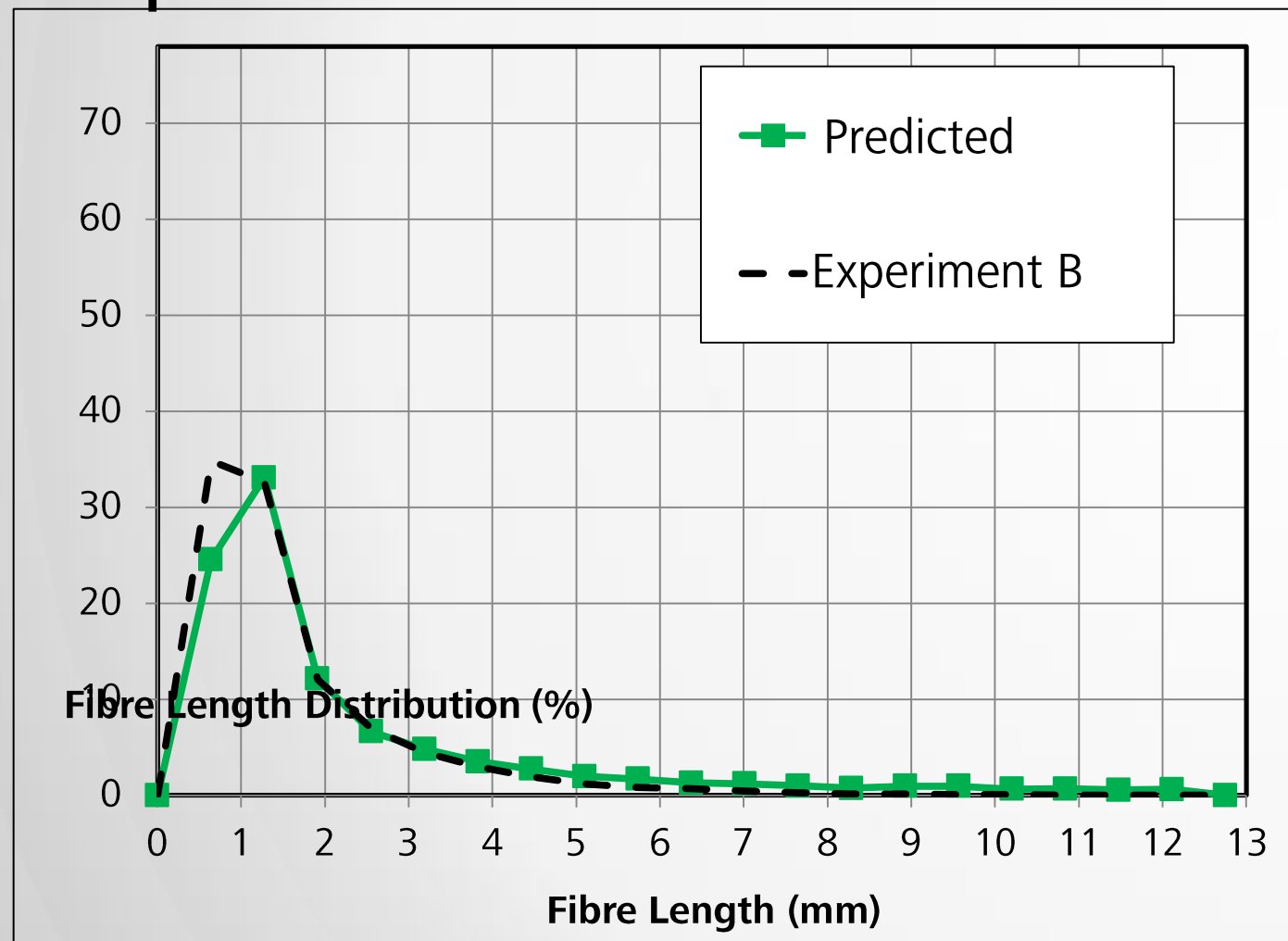
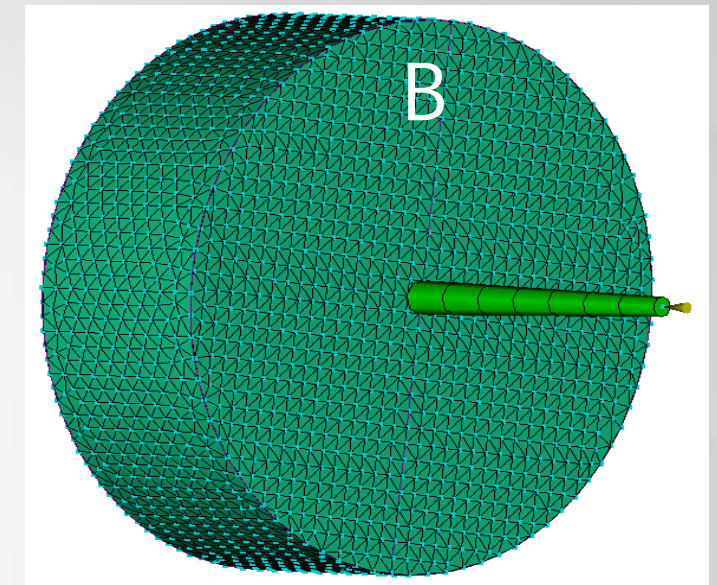
Long Carbon Fiber Thermoplastic: Predictive Eng Tool

- Working to validate 3D long fiber orientation predictions
- Waiting for fiber length (breakage) data to be available
 - Improved Fiber Breakage Model
- Phase 2: Molding of complex structural part

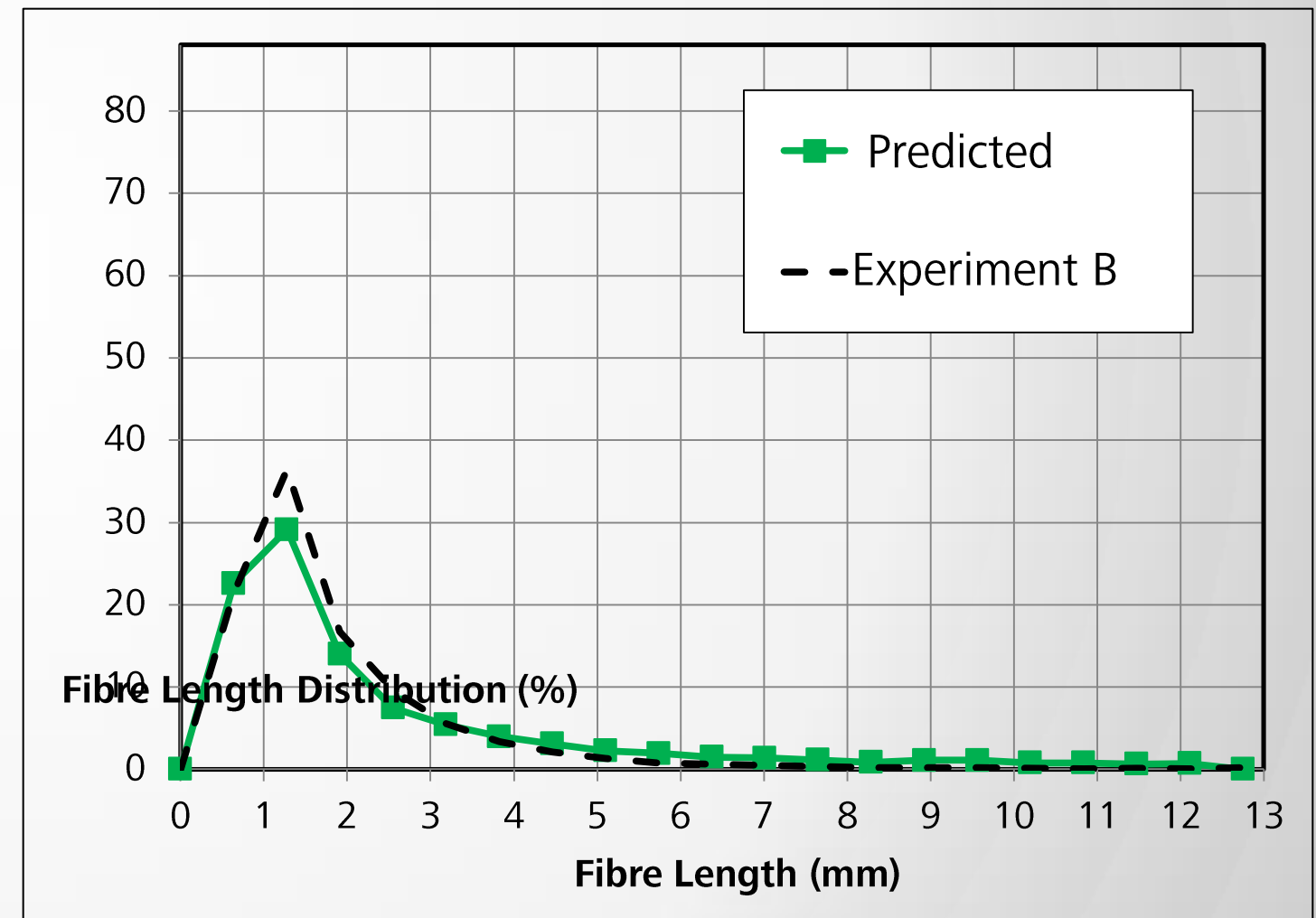


University of Bradford: Long Fiber Breakage

30%wt LGF/PP. Initial Fiber Length 12.5mm
Midplane



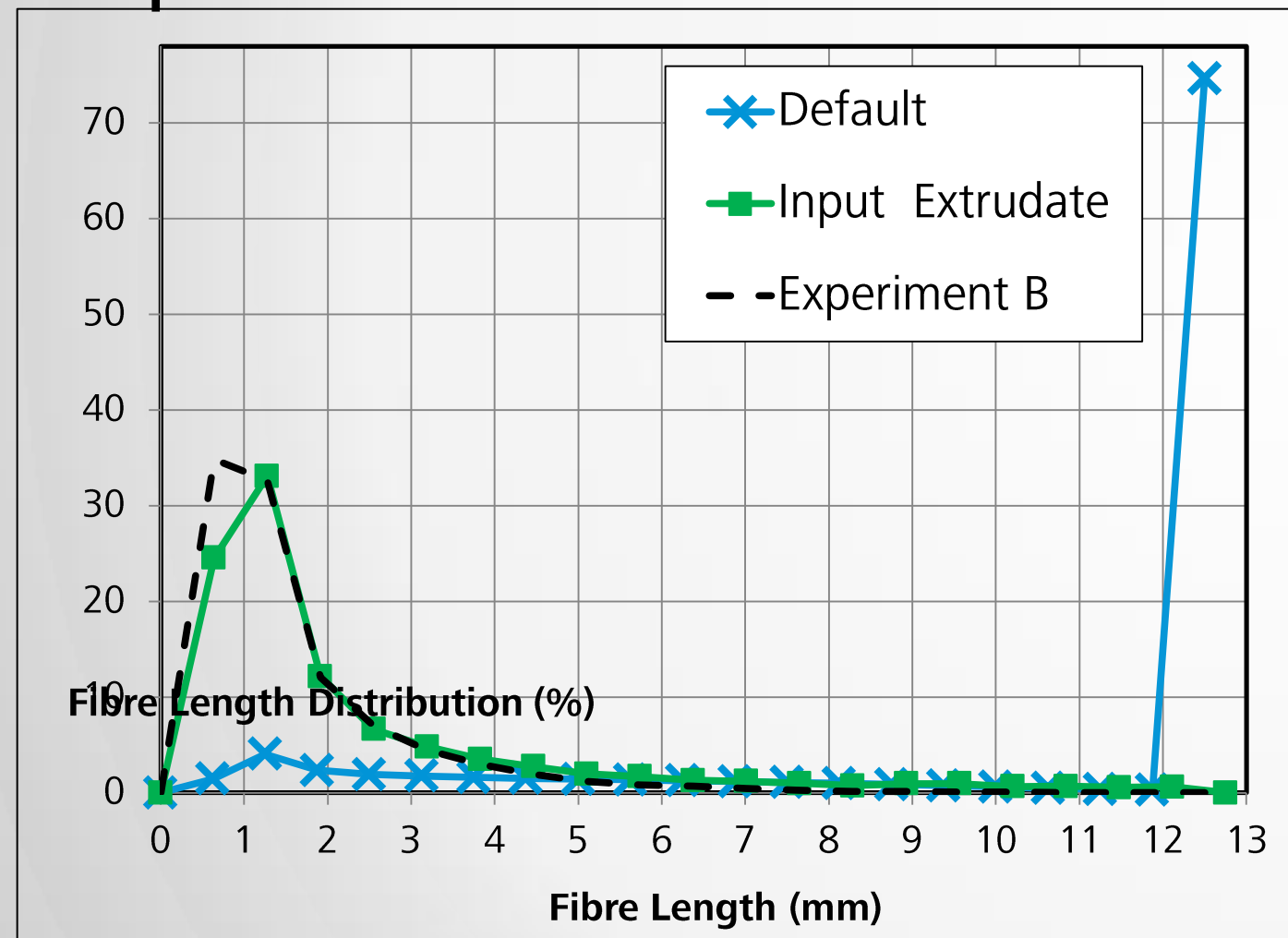
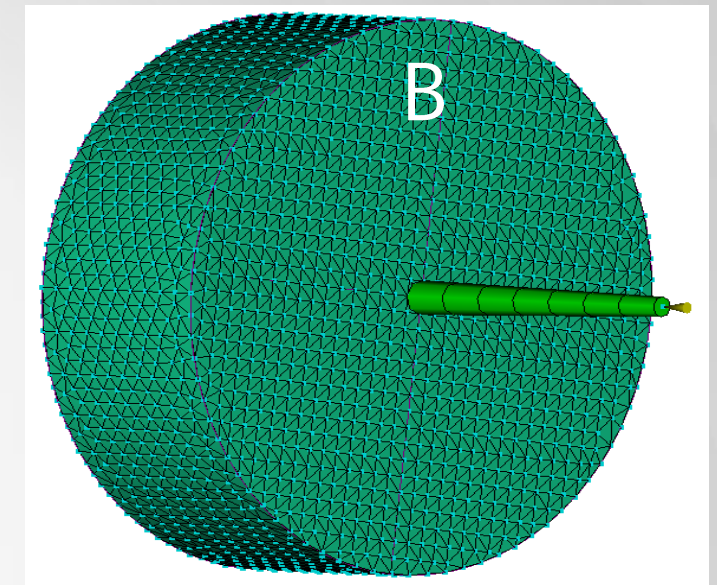
1mm Thick



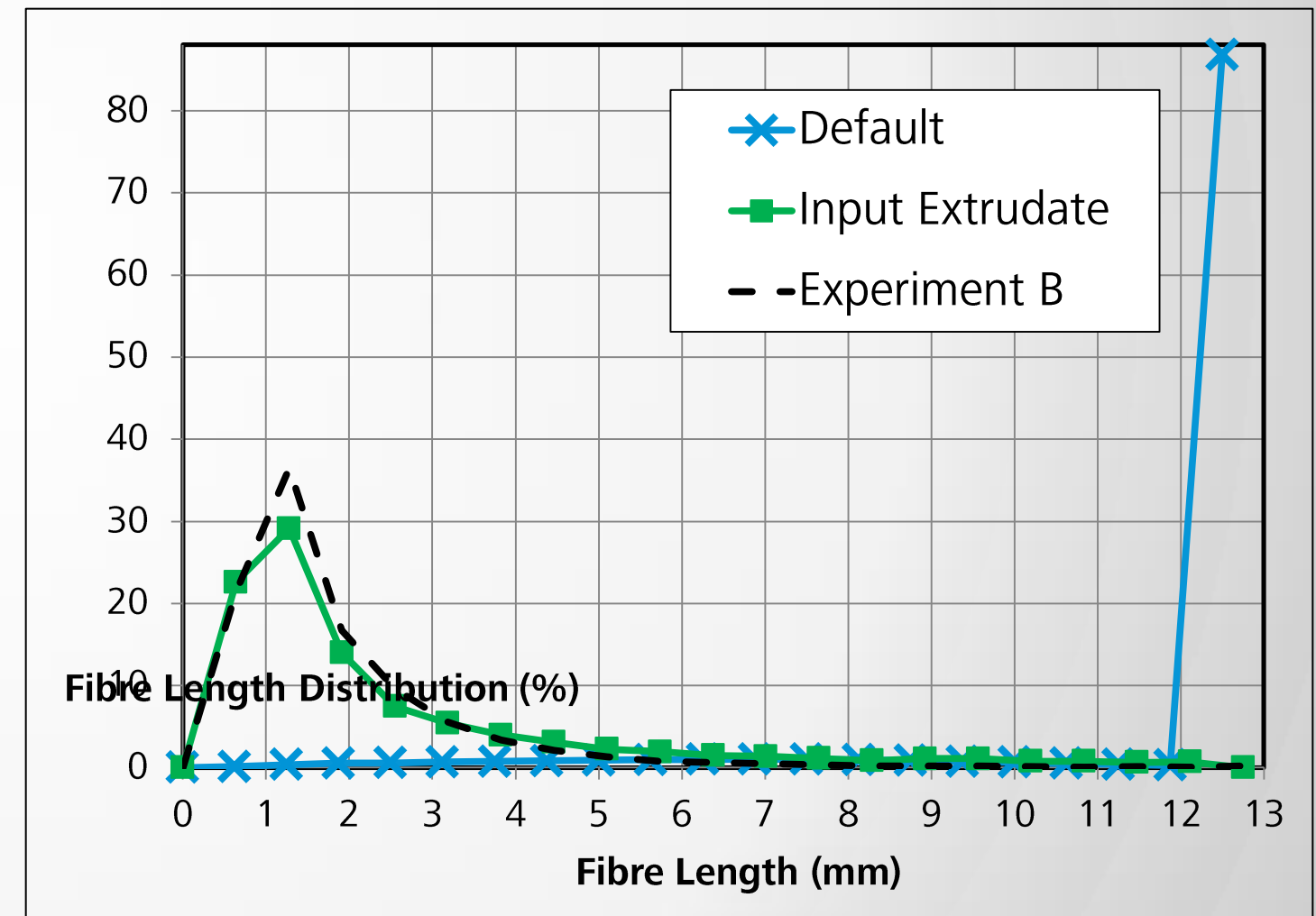
2mm Thick

University of Bradford: Long Fiber Breakage

30%wt LGF/PP. Initial Fiber Length 12.5mm
Midplane



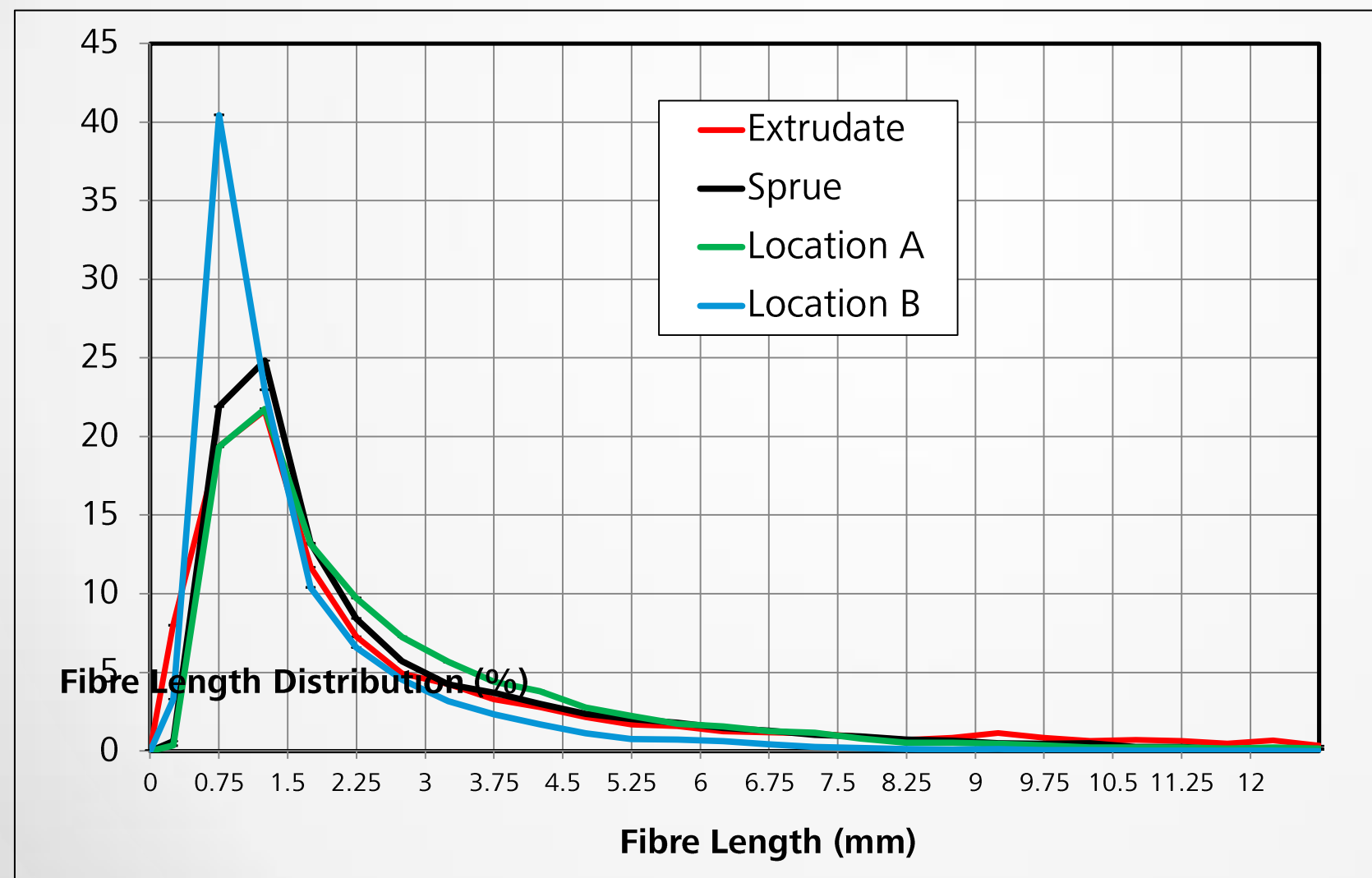
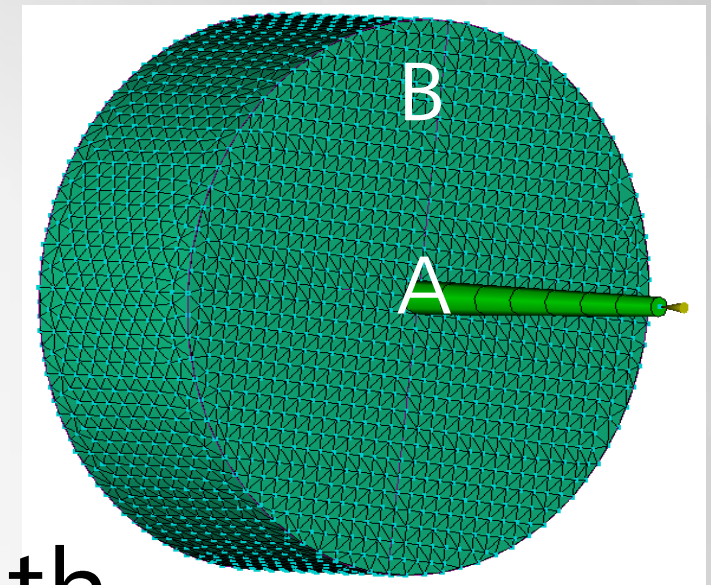
1mm Thick



2mm Thick

University of Bradford: Long Fiber Breakage

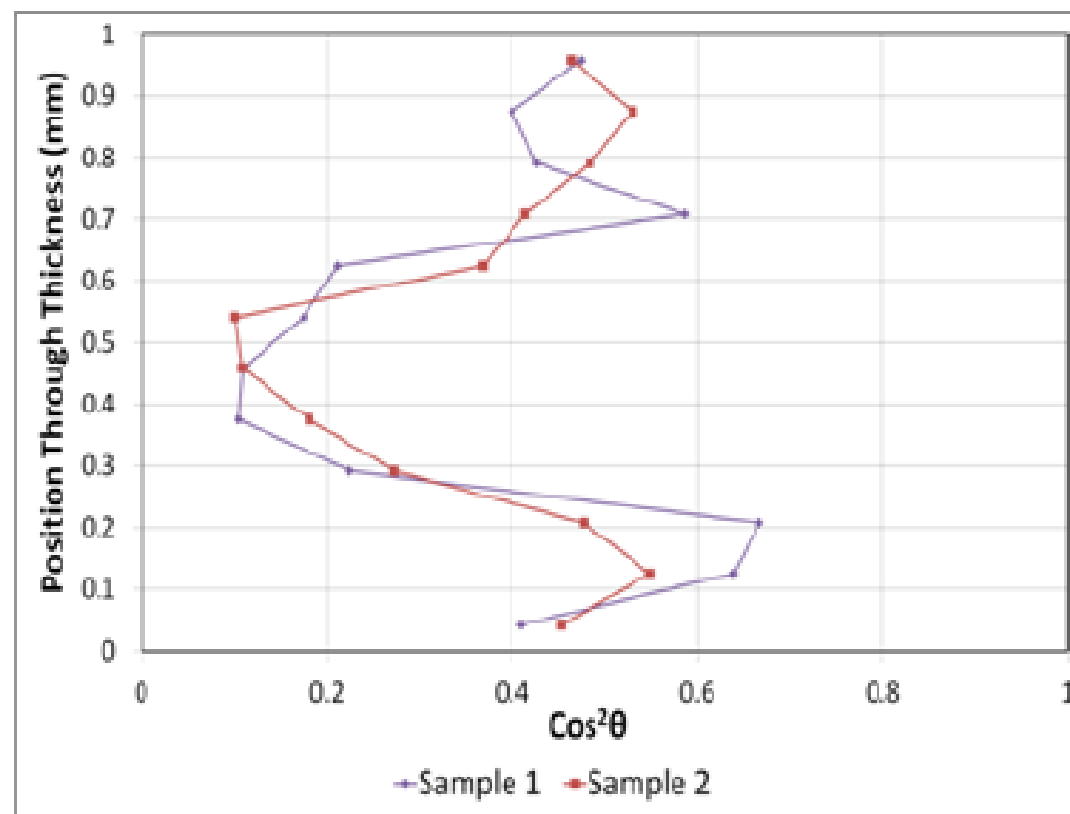
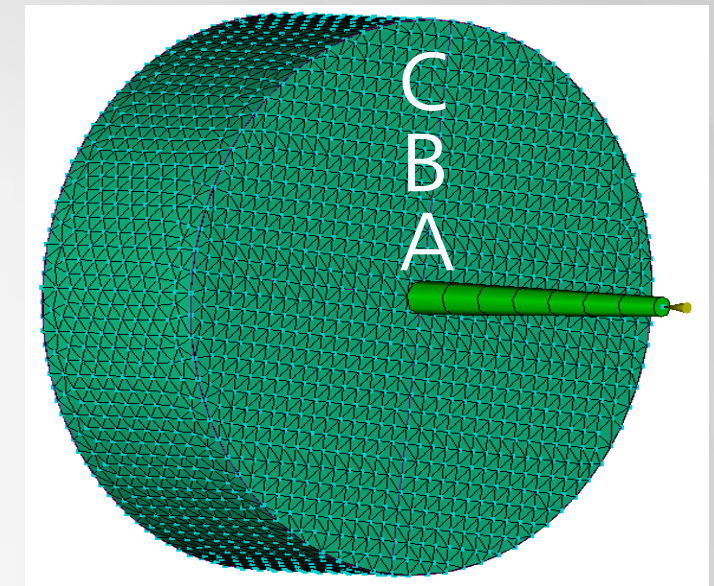
30%wt LGF/PP. Initial Fiber Length 12.5mm
Measured FLD at various points along flow path



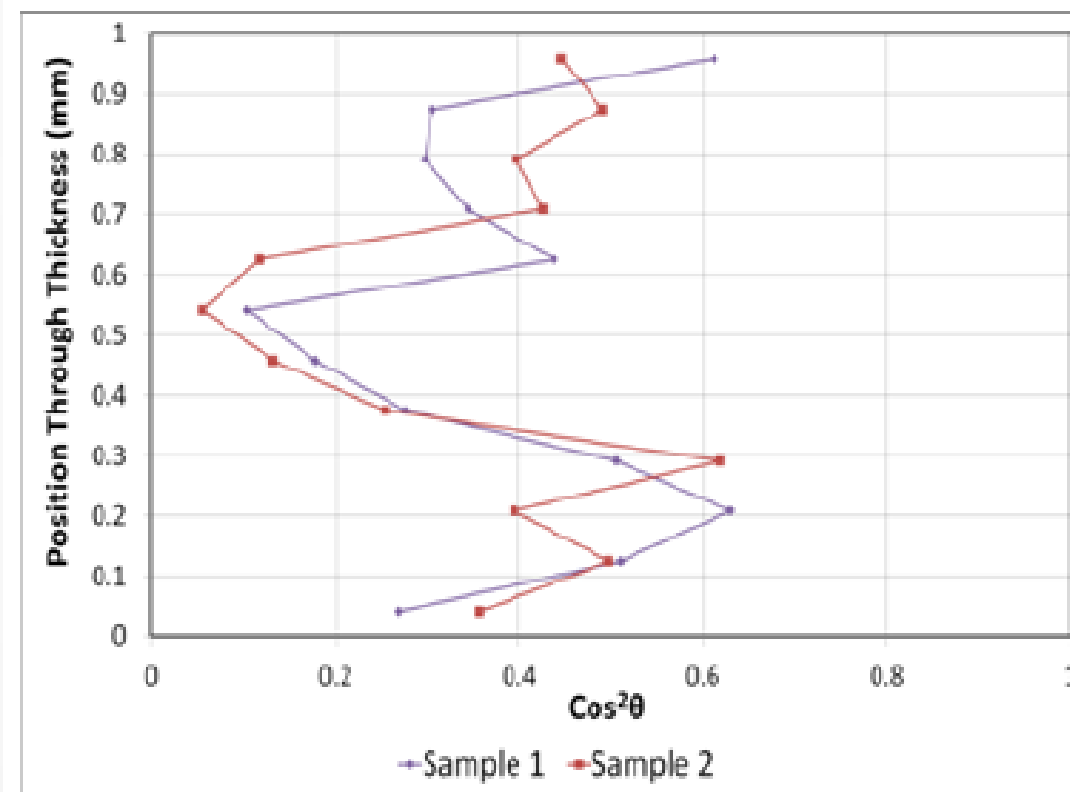
1mm Thick Part
3.5mm Sprue

University of Bradford: Long Fiber Orientation

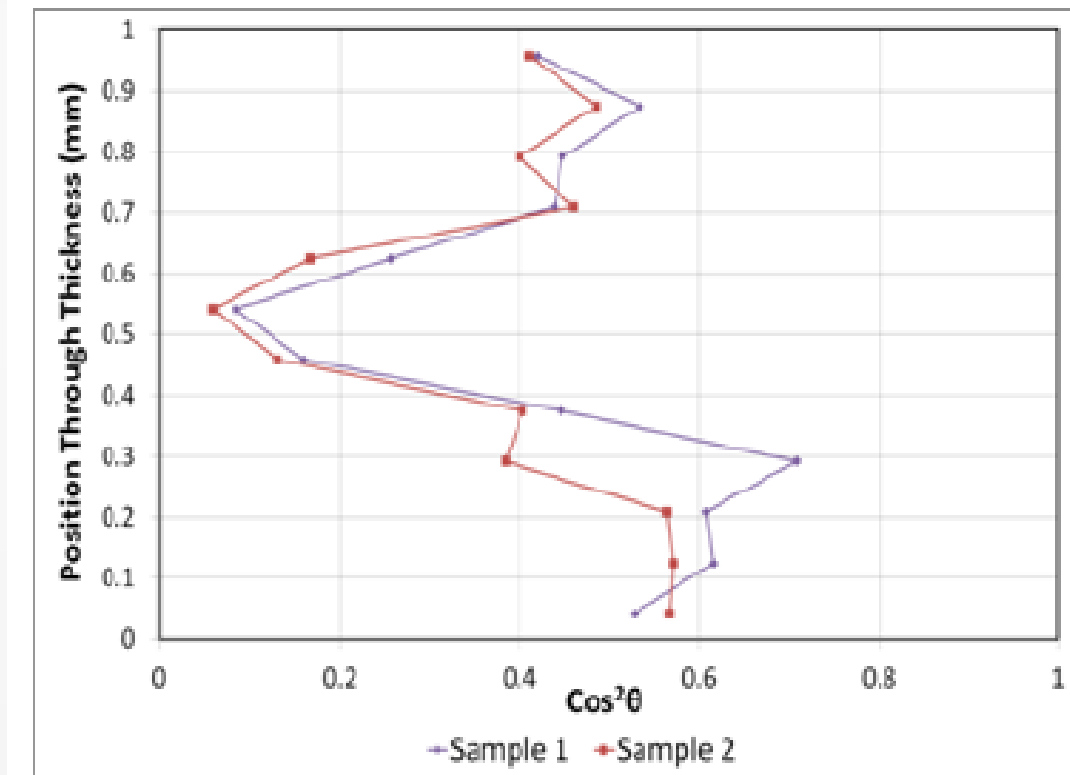
30%wt LGF/PP. Initial Fiber Length 12.5mm
Measured Orientation in Repeat Samples
1mm Thick Part, 3.5mm Sprue



Location A



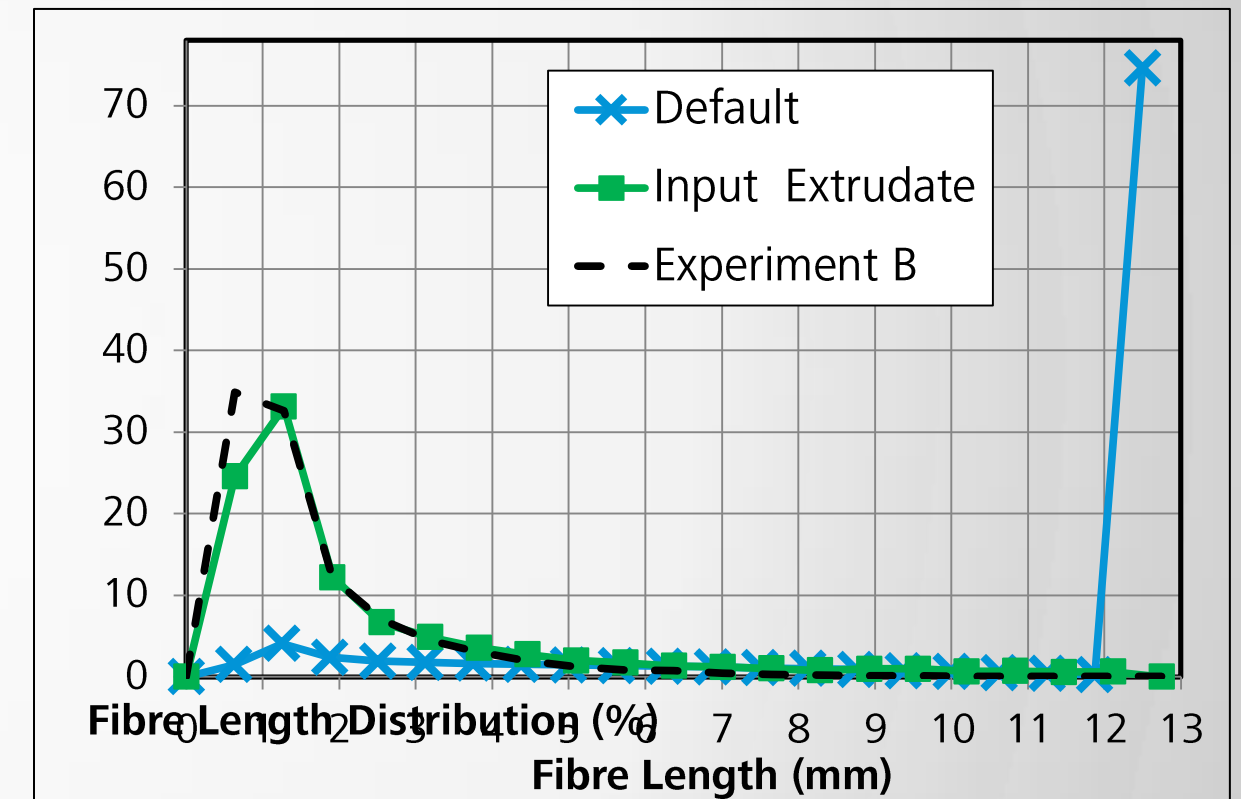
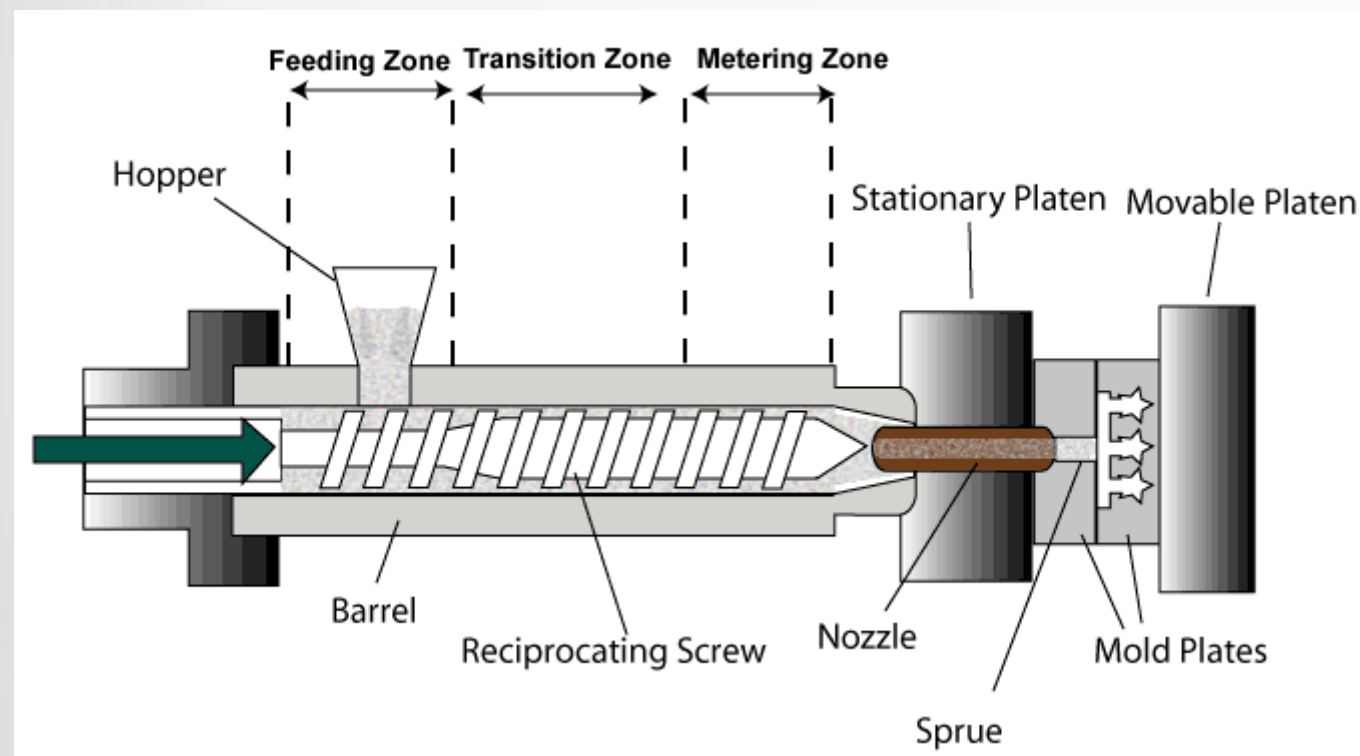
Location B



Location C

Fiber Breakage in Barrel – University of Bradford

Measurement and Prediction of long fiber breakage during melting in injection barrel

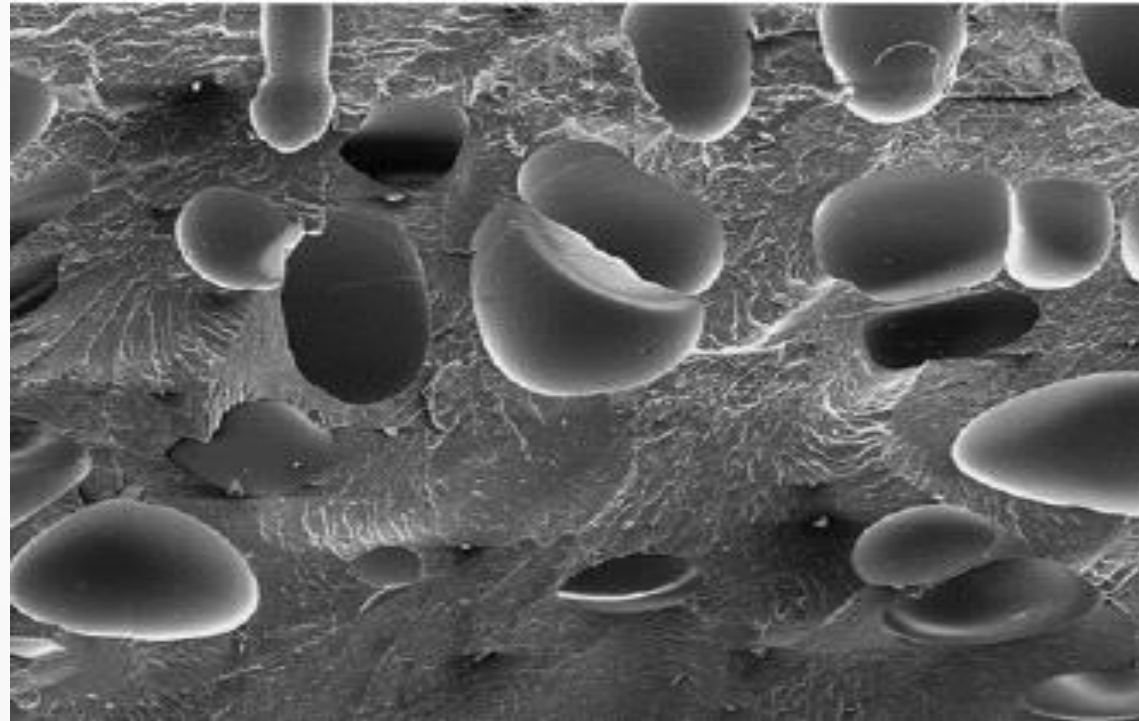


New Project: Started Oct 2014

Microcellular Foaming Bubble Nucleation

University of Toronto

New models and validation to predict cell nucleation, dependent on pressure history, and local stresses around fillers (talc, fiber, etc)

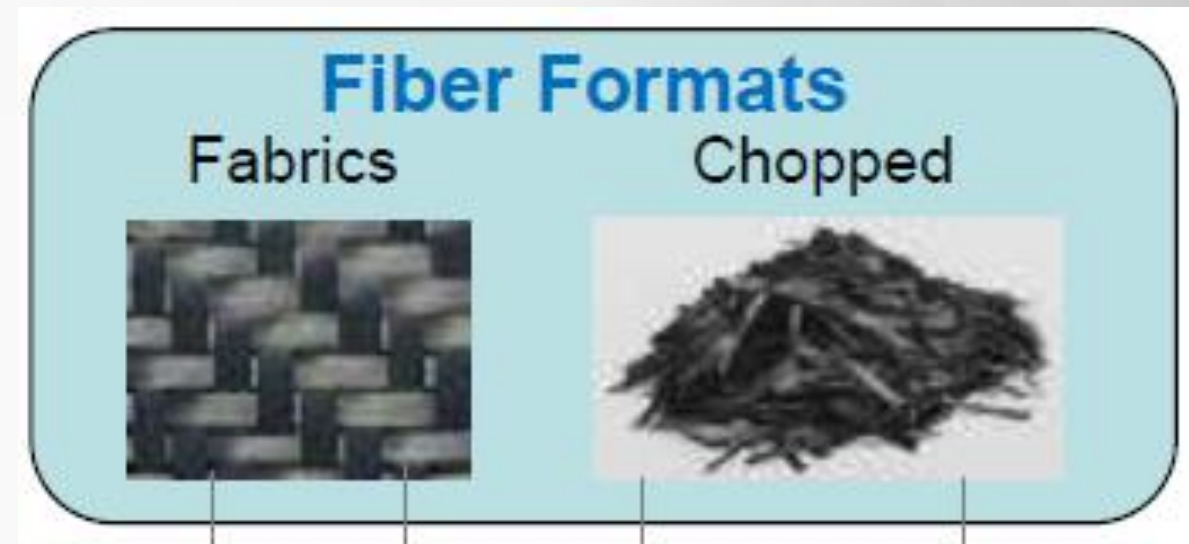


New Project: Starting Dec 2014

Chopped Carbon Fiber Compression FORD

US DOE funding to develop predictive models for carbon fiber draping and compression molding

- Started Oct 2014 (4 year project)



Autodesk involved for process modeling

Compression molding

Fiber Orientation

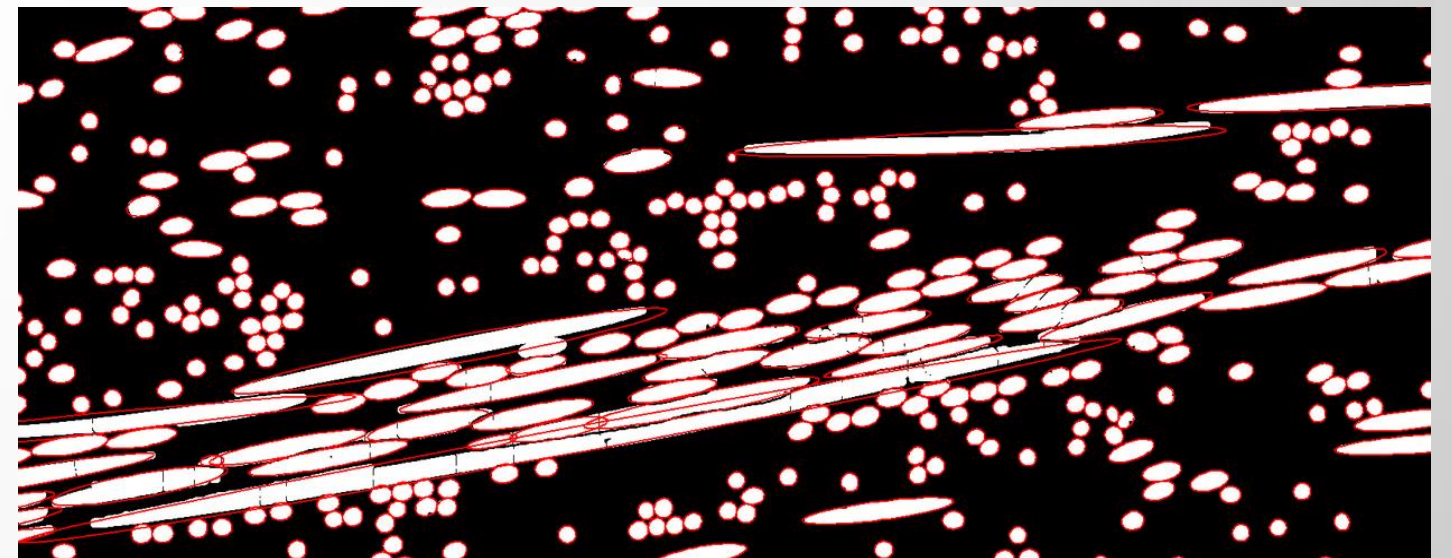
May include Infusion of resin into fiber bundles (tows)

Notice

- Four slides containing sensitive information regarding internal and some external collaborations are not included in this download

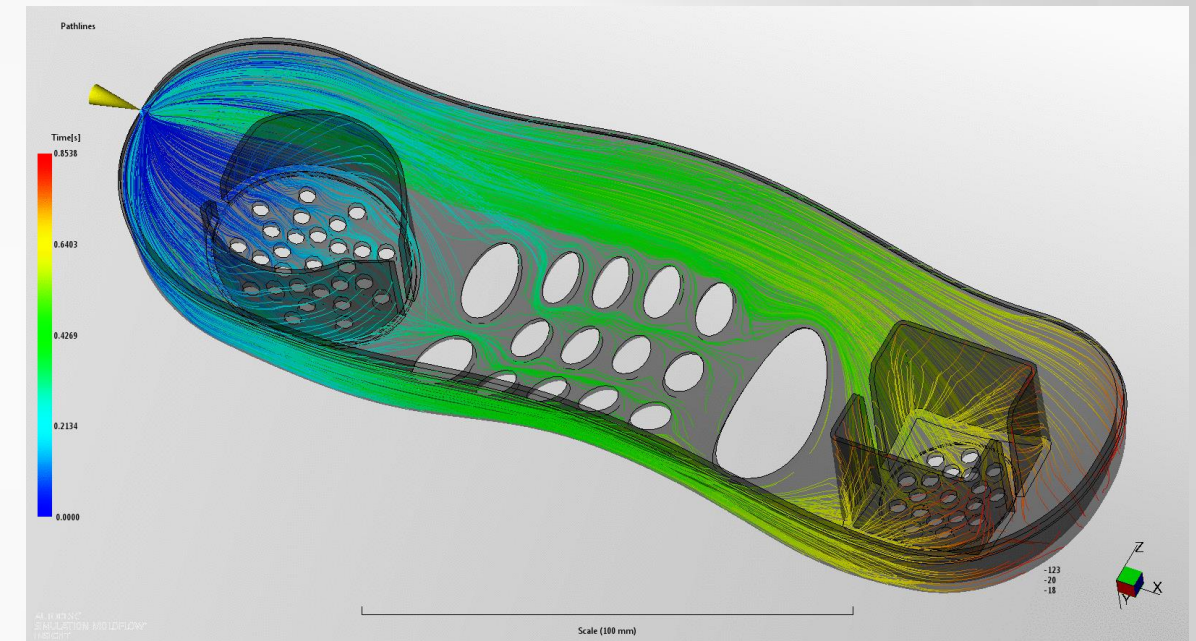
Summary

- Long Term Research Collaborations
 - Long Carbon Fiber Inj Molding
 - Long Fiber Breakage & Orientation
 - Flow advancement at part edges
 - Microcellular Foaming
 - Composite Overmolding
 - Viscosity Effects



Questions

- 2015 Scandium Technology Preview
- Moldflow Insight 2016 Beta
- Some API Tools
- Long Term Research Collaborations





A group of four people (three men and one woman) are jumping joyfully in a modern office space. They are all smiling and have their arms raised. The background shows a brick wall, a window, and a desk with a computer monitor. A semi-transparent white box is overlaid on the image, containing text.

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