The background of the slide is a 3D moldflow simulation. It shows a complex mold cavity with various features like ribs and holes. The simulation results are visualized with a color gradient: blue and green on the left side, transitioning to yellow and orange on the right side. This likely represents different material properties or flow characteristics within the mold. The overall image is a high-quality 3D rendering of a manufacturing process simulation.

Moldflow Summit 2019

Low Constant Pressure Molding Simulation

Dan Lumpkin

Vice President of Manufacturing – iMFLUX – lumpkin.dd@imflux.com

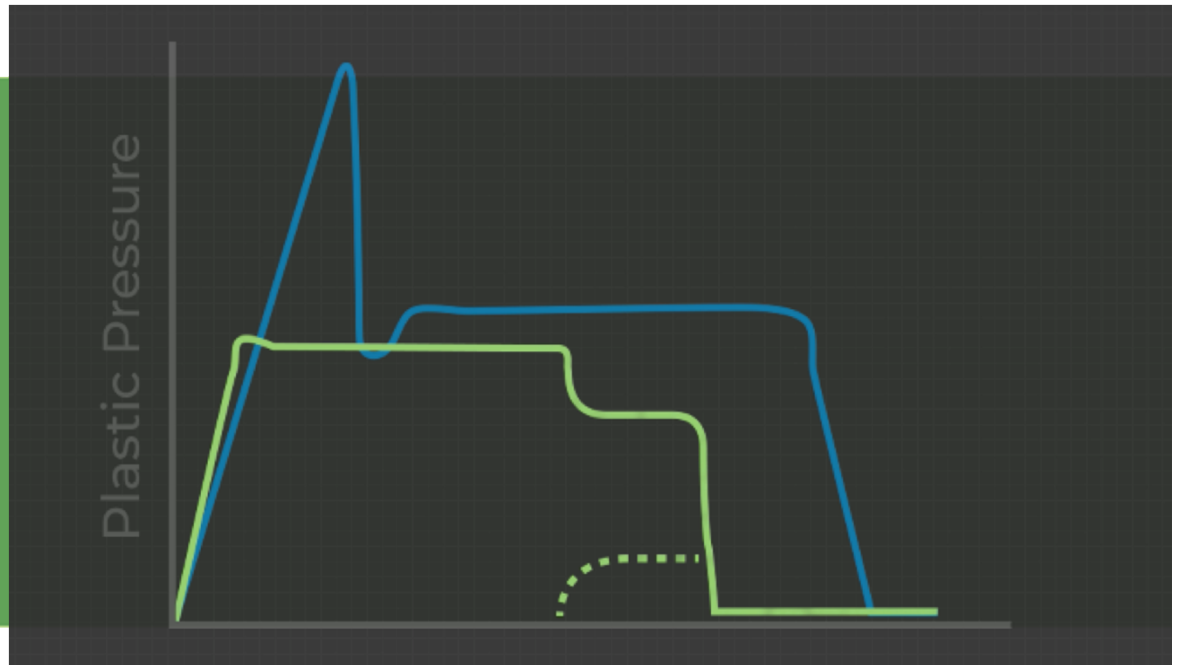




The image shows a 3D CAD model of a complex mold assembly, likely for injection molding. A semi-transparent, light blue and green overlay is applied to a portion of the model, representing a simulation of fluid flow or pressure distribution. The overlay features a 'Green Curve' that traces a path through the internal channels of the mold. The background is a light gray, and the overall image has a technical, engineering aesthetic.

Low Constant Pressure Molding: The iMFLUX ‘Green Curve’

- 25%-50% Lower Pressures
- Up to 40% Reduction in Clamp
- Faster Cycle Time Possible
- Automated/Autonomous Molding
- Intelligent Feedback to Engineers
- New Design Freedoms



OPTIMIZES



AUTOMATES



ADAPTS



OPTIMIZES



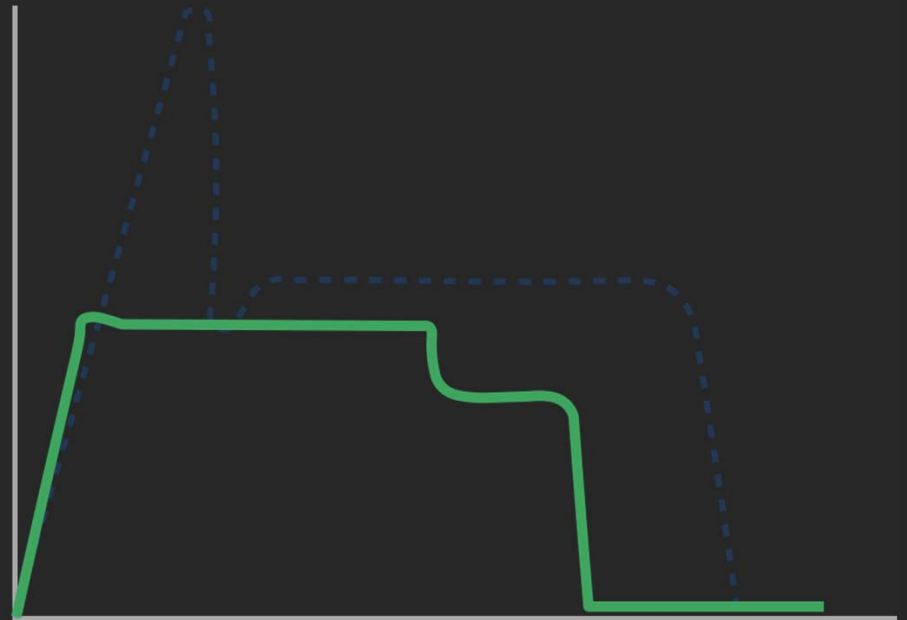
Identifies minimum pressure to fill the system

Holds that pressure constant at all times

Constantly adjusting melt front velocity

Cavity tells the machine how to behave

PLASTIC PRESSURE



AUTOMATES



Material Changes

Mold Behavior

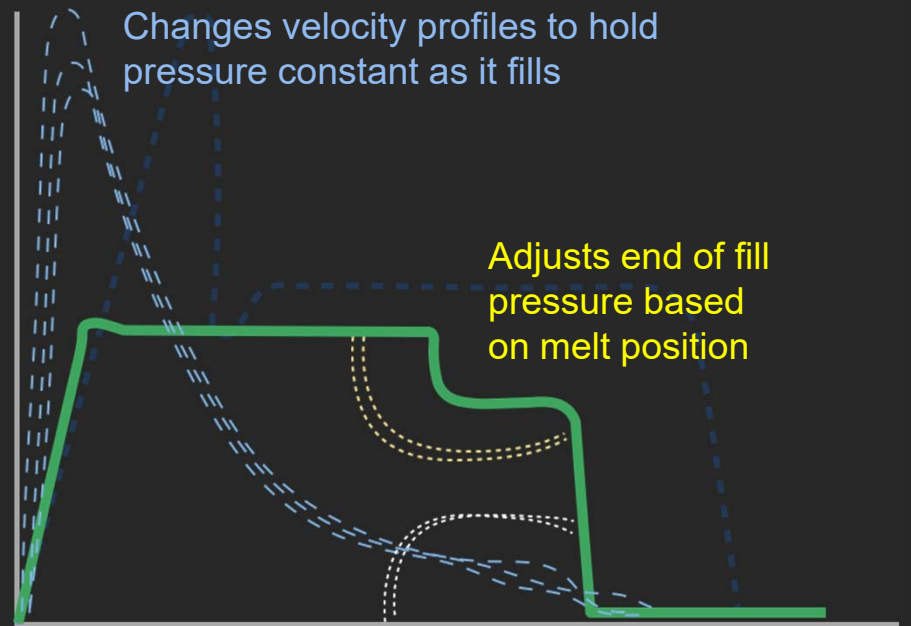
Machine Changes

Environmental Changes

PLASTIC PRESSURE

Changes velocity profiles to hold pressure constant as it fills

Adjusts end of fill pressure based on melt position



ADAPTS



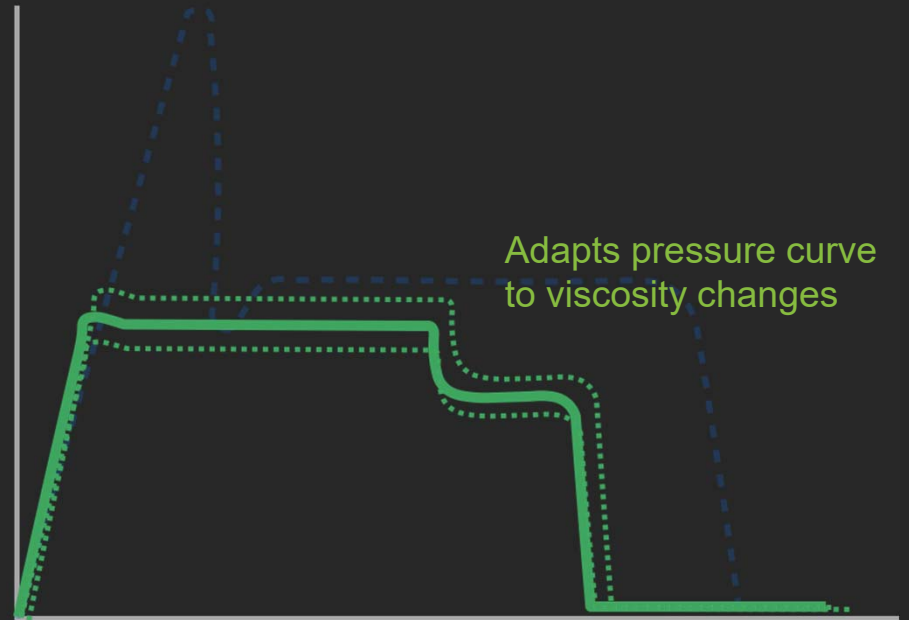
Check ring slips/leaks

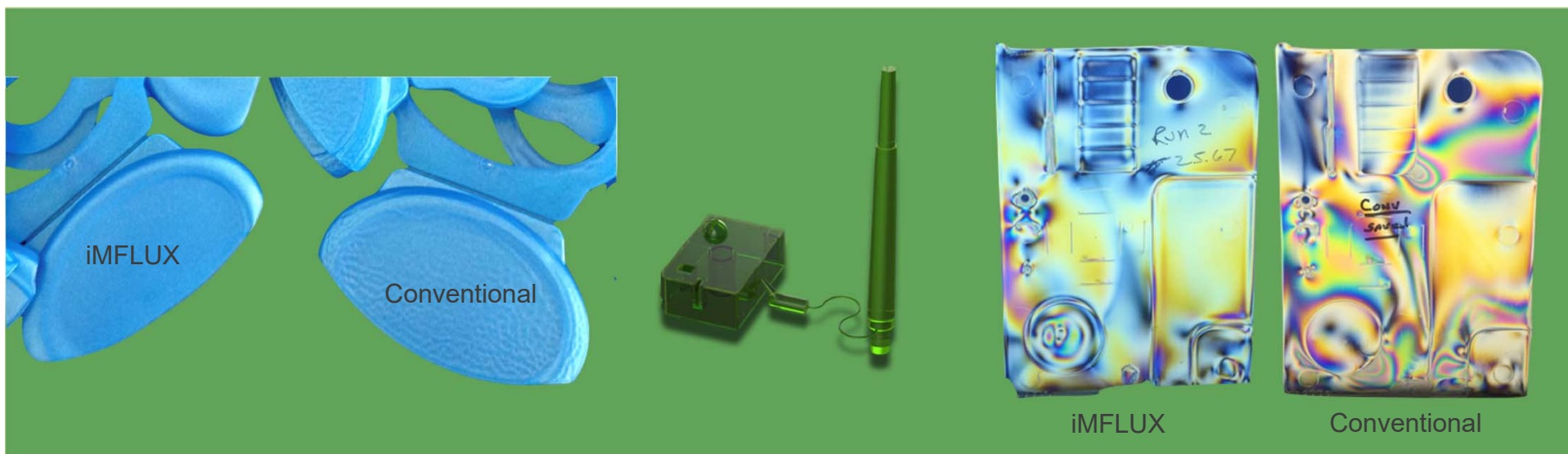
Heater band faults

Downed cavities

Material changes

PLASTIC PRESSURE





The Green Curve Enables



The Green Curve Enables



FASTER CYCLE



Re-Invest Pressure Savings

Lower Melt Temperatures

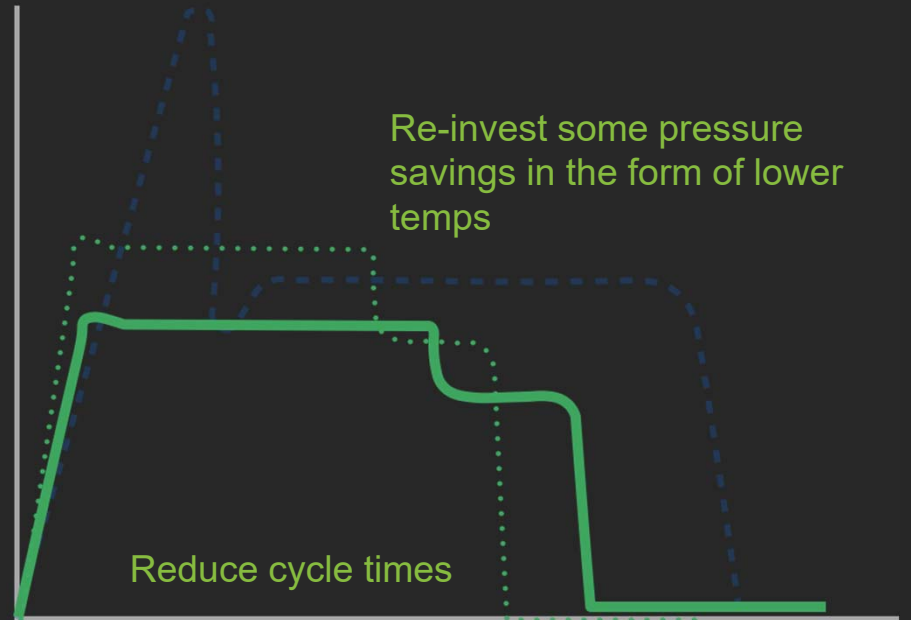
Lower Mold Temperatures

Less Shear Heat

PLASTIC PRESSURE

Reduce cycle times

Re-invest some pressure savings in the form of lower temps



**PRESSURE,
TONNAGE
REDUCTIONS &
REPEATABILITY**

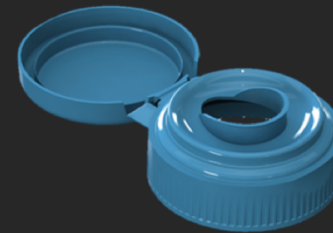


Lower Pressure

Lower Clamp Force

Up Cavitation

Design Flexibility



Conventional

iMFLUX

750T

Machine Size Limit

750T

23T

Tonnage per Cavity

15T

32

Max Cavities Possible

48

SUSTAINABILITY ADVANTAGES



Wide Viscosity Ranges

Adaptive & Automated

Easier to Maintain Quality

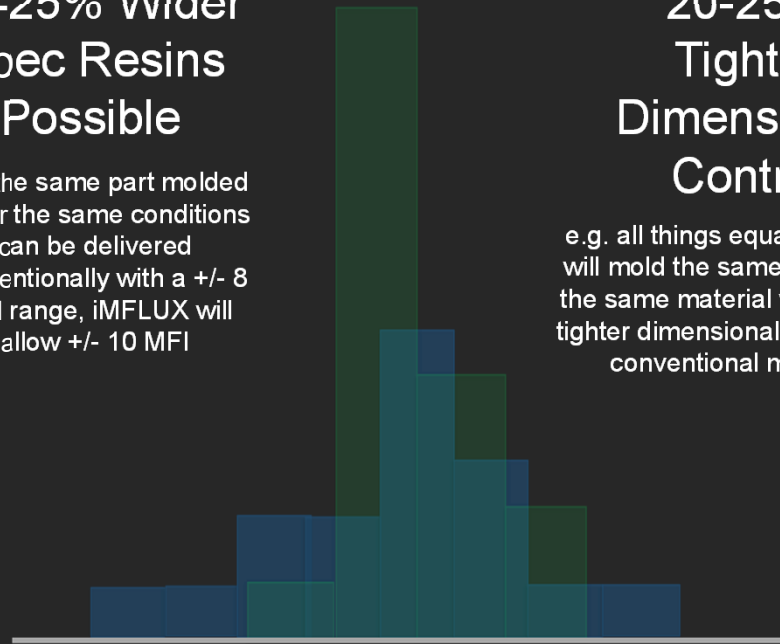
Less Operator Interventions

20-25% Wider Spec Resins Possible

e.g. the same part molded
under the same conditions
can be delivered
conventionally with a ± 8
MFI range, iMFLUX will
allow ± 10 MFI

20-25% Tighter Dimensional Control

e.g. all things equal, iMFLUX
will mold the same part using
the same material with a 24%
tighter dimensional range than
conventional molding





OUR PURPOSE

PARTNER WITH WORLD CLASS
TECHNOLOGY PROVIDERS
TO UNLOCK ALL THE
BENEFITS OF OUR
TECHNOLOGY



OUR VISION

PROVIDE IMFLUX & MOLDFLOW
CUSTOMERS THE ABILITY
TO SIMULATE THE IMFLUX
PROCESS

How to Simulate the Process



STRIP FILES
& PRESSURE
CURVES

1

UNIQUE
PROCESS
SET-UPS

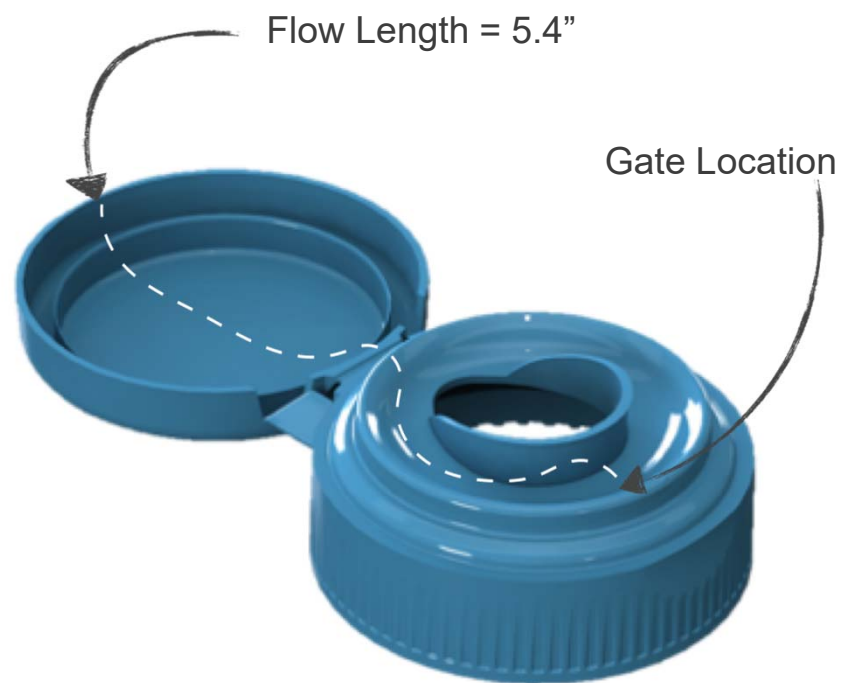
2

ITTERATIVE
ANALYSES
ROUTINES

3

WISH
FORS

4

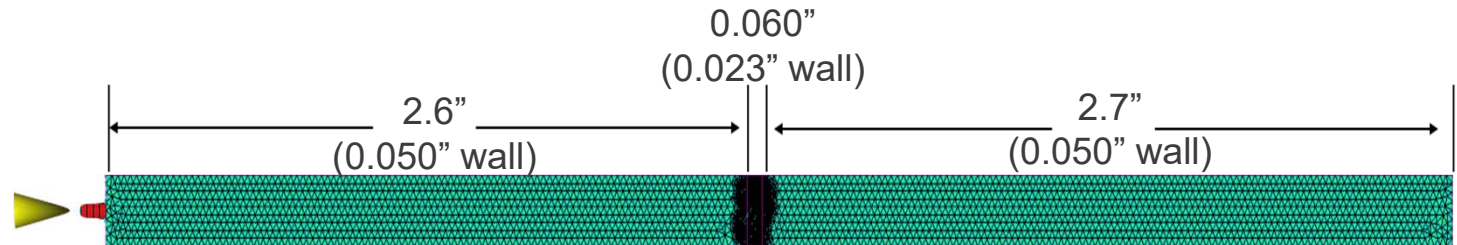


Projected Area	Sq inch	6.3
Estimated Tons/Sq In	Tons	3.5
Basell RP 549M	MFI	11
Final Part Weight	grams	9.06
Flow Length	inches	5.4
Nominal Wall	inches	0.050



1

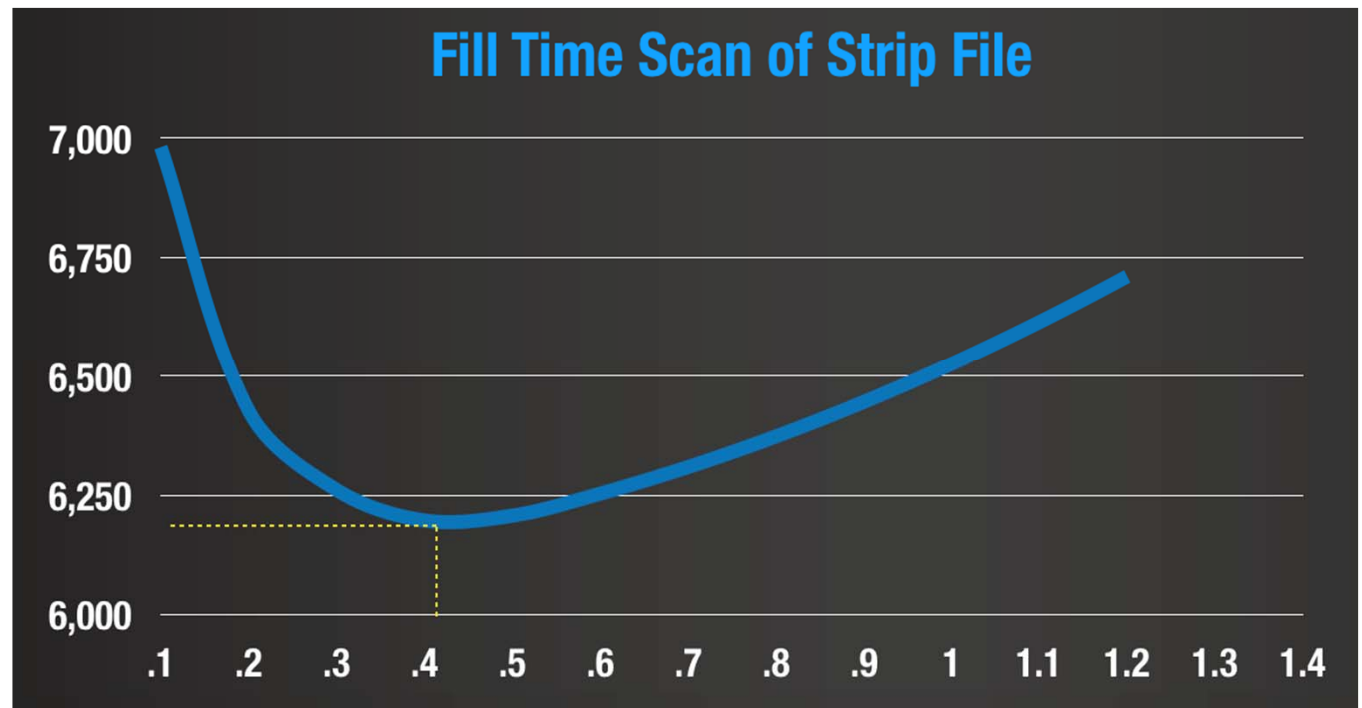
Strip Files & Pressure Windows

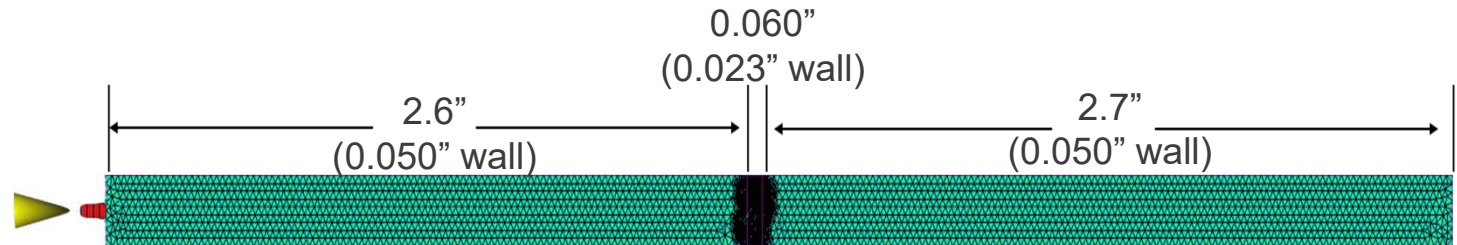


STRIP FILES & PRESSURE CURVES

1

Strip Files



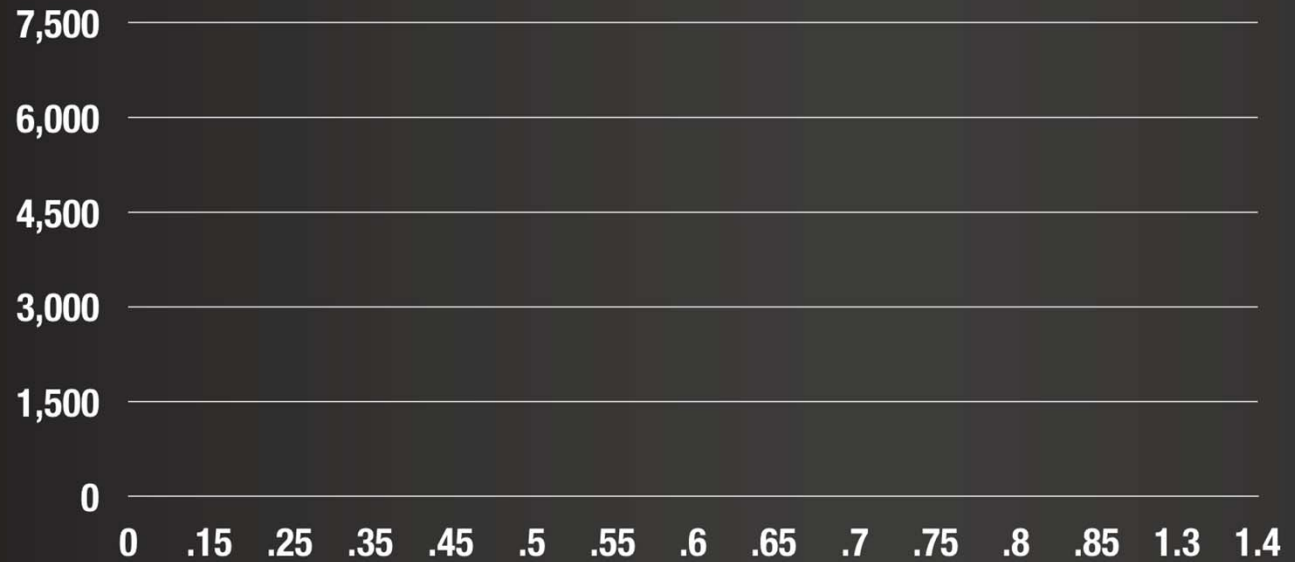


STRIP FILES & PRESSURE CURVES

1

Strip Files

Low Constant Pressure Fill Window



STRIP FILES & PRESSURE CURVES

1

Process Set-Ups

Process Settings Wizard - Fill+Pack Settings

Mold surface temperature: 90 F

Melt temperature: 420 F

Filling control

Injection time: 0.1 s [0:]

Velocity/pressure switch-over

By %volume filled: 0.1 % [0:100]

Pack/holding control

Packing pressure vs time: Edit profile...

Cooling time

Specified: 3 s [0:]

Advanced options...

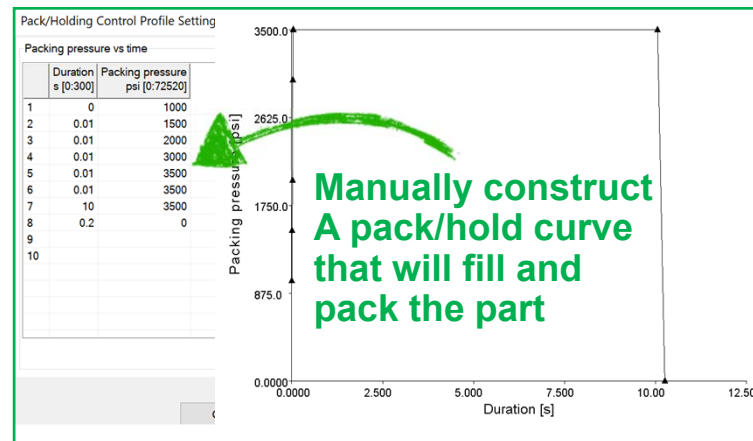
Fiber Solver Parameters...

☒ Fiber orientation analysis if fiber material

☒ Crystallization analysis (requires material data)

OK Cancel Help

Set V/P switch over to 0.1%



Injection molding machine

Description: Injection Unit Hydraulic Unit Clamping Unit

Machine pressure limit

Maximum machine injection pressure: 26107.2 psi [0.72520]

Intensification ratio: 10 (0.30)

Machine hydraulic response time: 0.01 s (0.10)

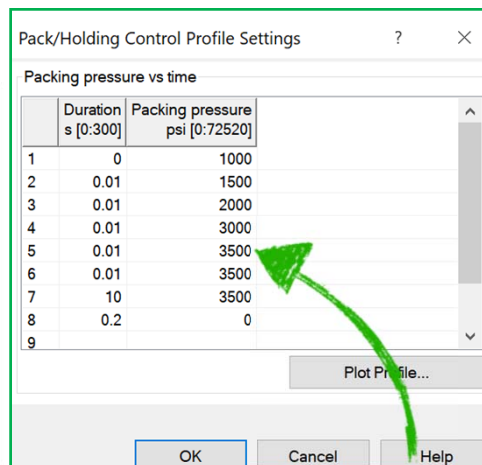
Name: Default injection molding machine

OK Cancel Help

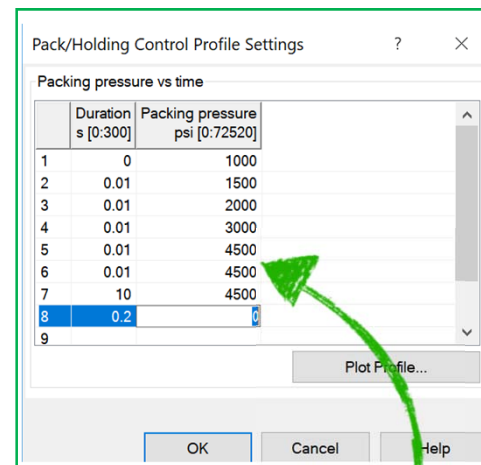
Set hydraulic response to 0.01 seconds

STRIP FILES & PRESSURE CURVES

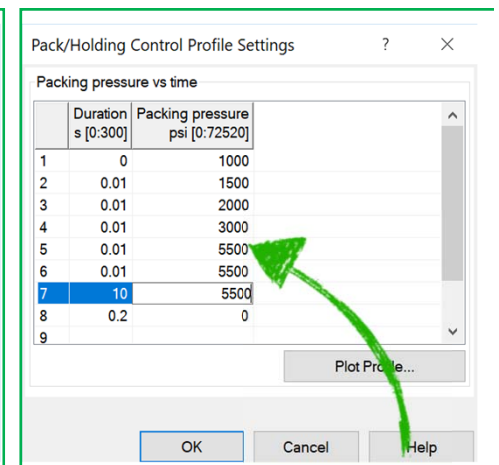
1



Constant pressure of 3,500 psi



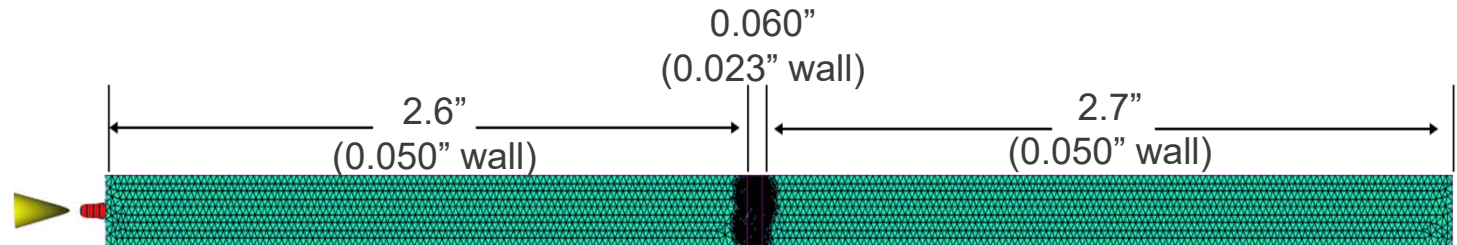
Constant pressure of 4,500 psi



Constant pressure of 5,500 psi

...and so on

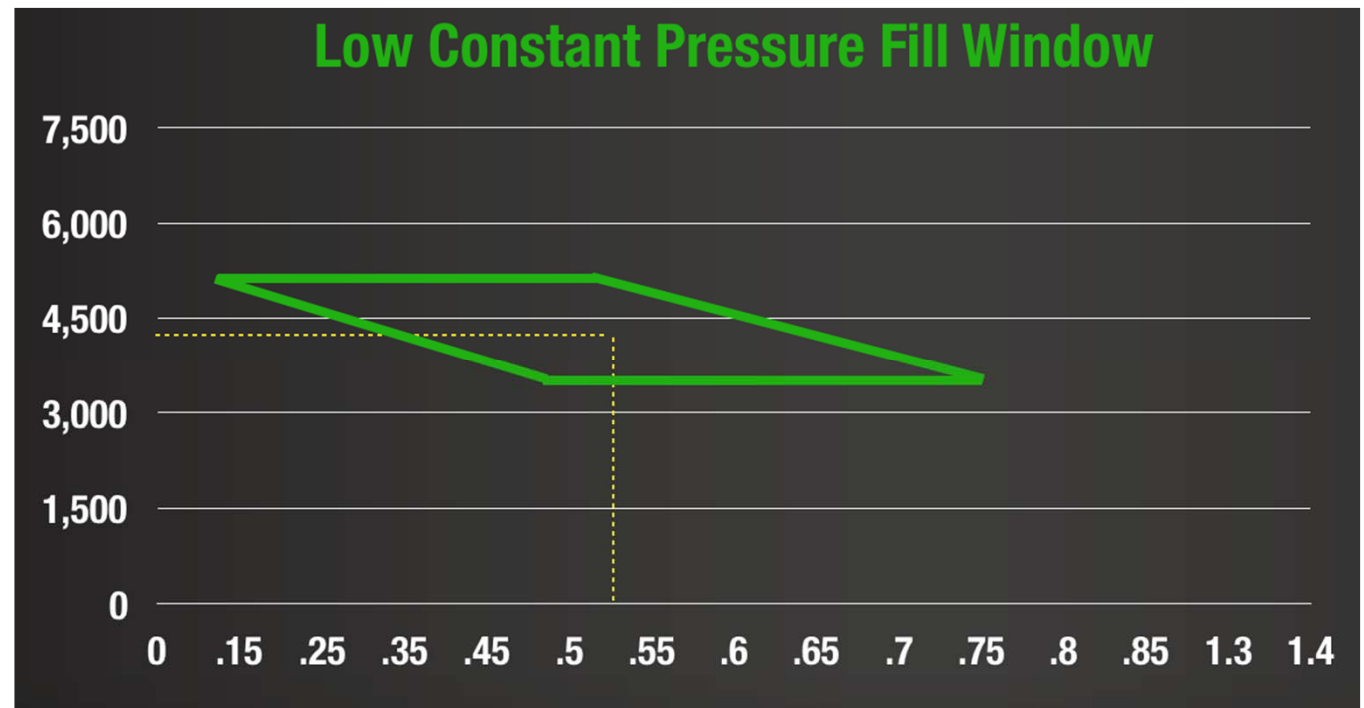
Process Set-Ups



STRIP FILES & PRESSURE CURVES

1

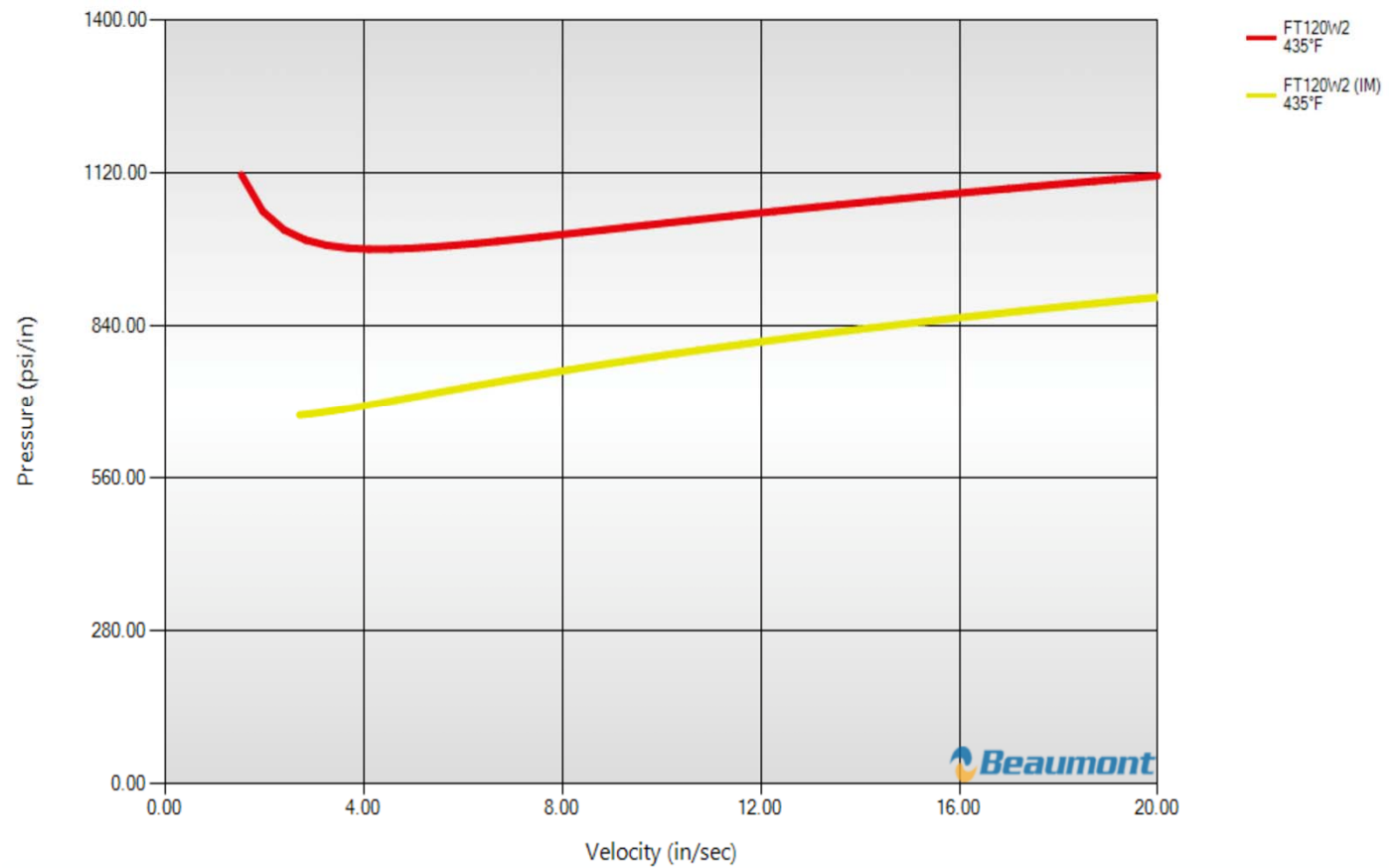
Strip Files



STRIP FILES & PRESSURE CURVES

1

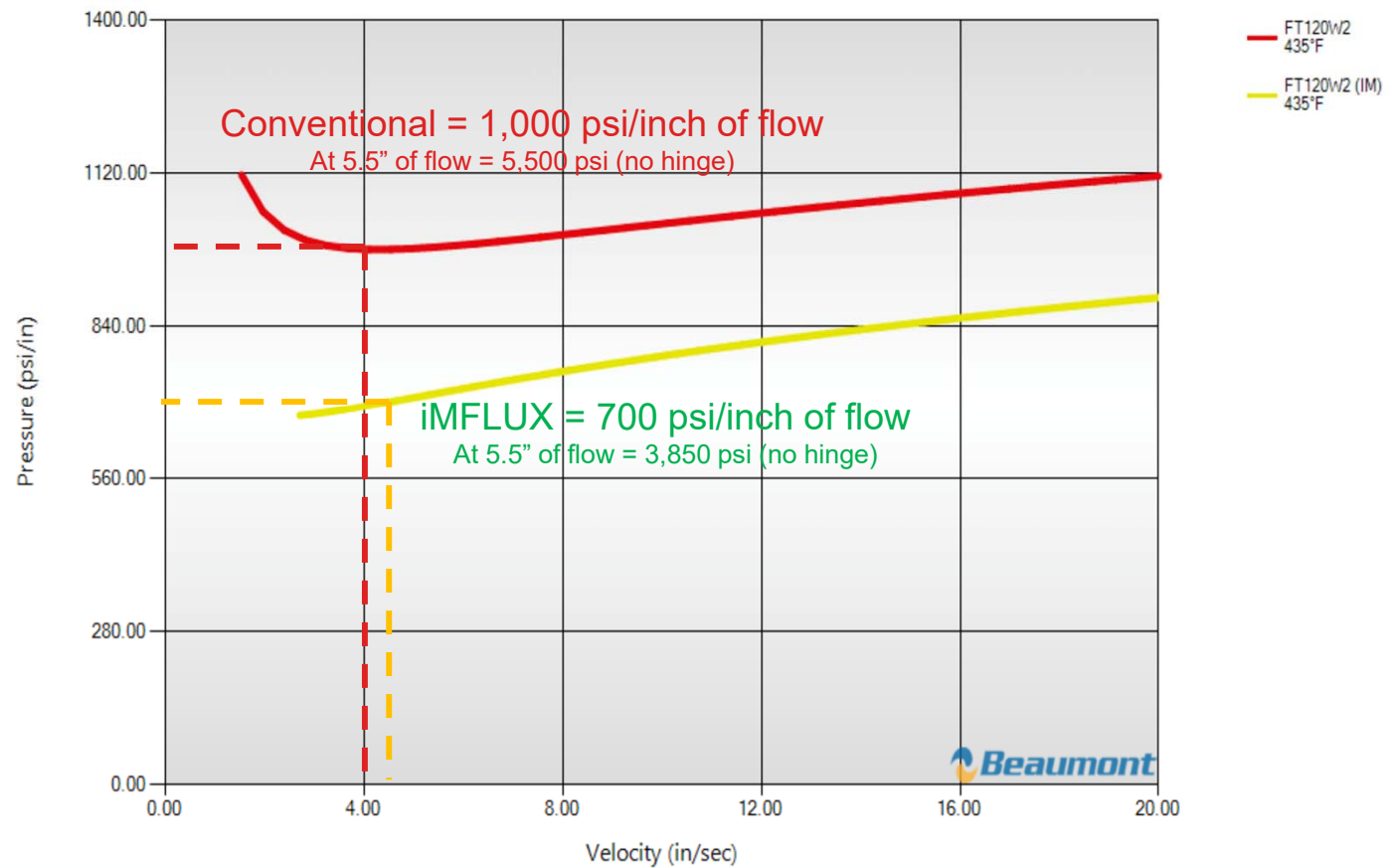
Thermaflo
Beaumont Technologies
(alternative option)



STRIP FILES & PRESSURE CURVES

1

Thermaflo
Beaumont Technologies
(alternative option)



Strip File Summary

STRIP FILES & PRESSURE CURVES

1

Strip Files



		Conventional	iMFLUX	ThermaFlo Conventional	ThermaFlo iMFLUX
Fill Pressure	psi	6,100	4,400	5,500	3,900
Fill Time	sec	0.4	0.55	n/a	n/a

STRIP FILES
& PRESSURE
CURVES

1

The importance of a simplified range finding method for the **optimal low constant pressure** is to be able to iterate through multiple solutions quickly rather than waiting on dozens of large models. This simplified process gets you very 'close to the pin' and saves significant time.

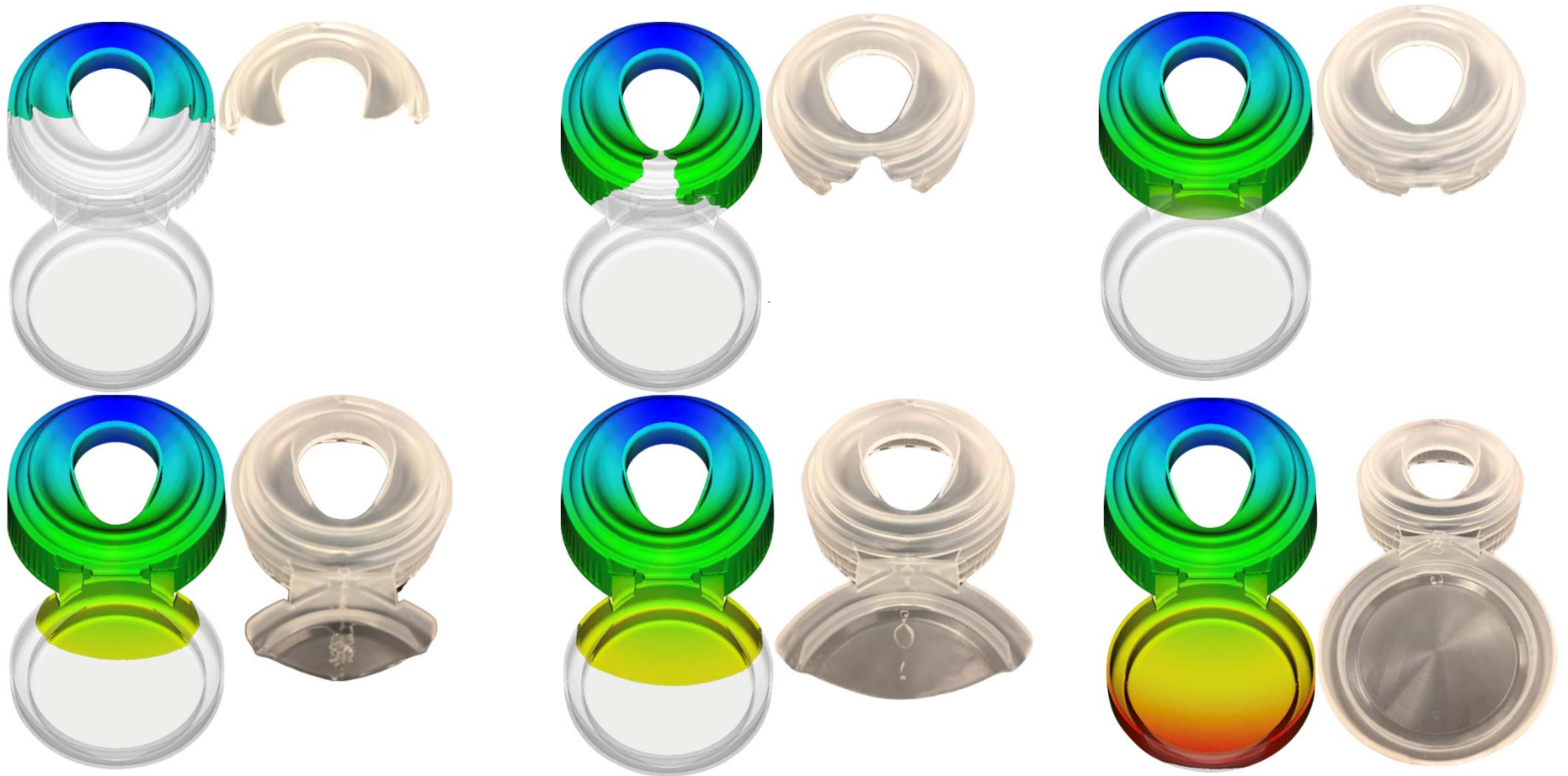


A 3D CAD model of a mechanical component, possibly a bracket or housing, is shown. The model is rendered in a light gray color. Overlaid on the model is a finite element analysis (FEA) visualization. The analysis results are shown as a color-coded stress or strain distribution. The colors range from blue (low stress) to red (high stress). The highest stress areas are concentrated in the upper right and lower right sections of the part. The number '2' is displayed in a large, bold, black font in the center of the image.

2

Full Finite Element Analysis

Conventional Fill Pattern



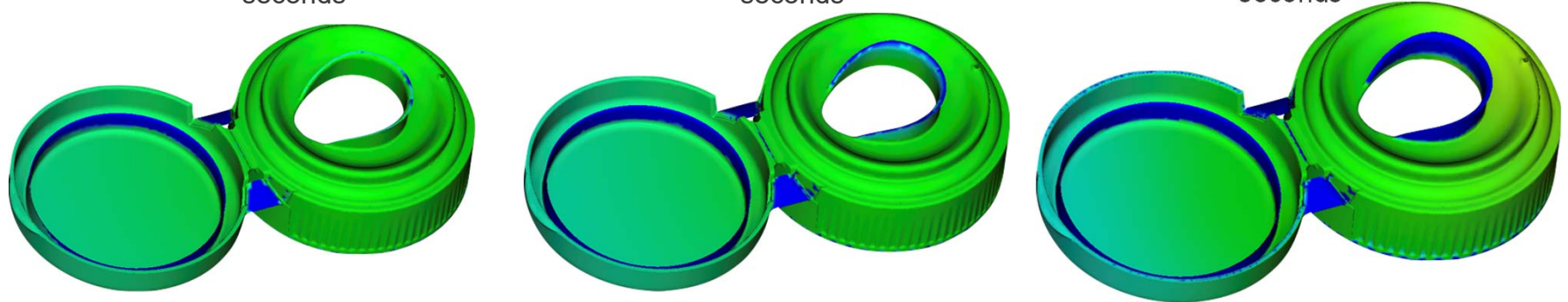
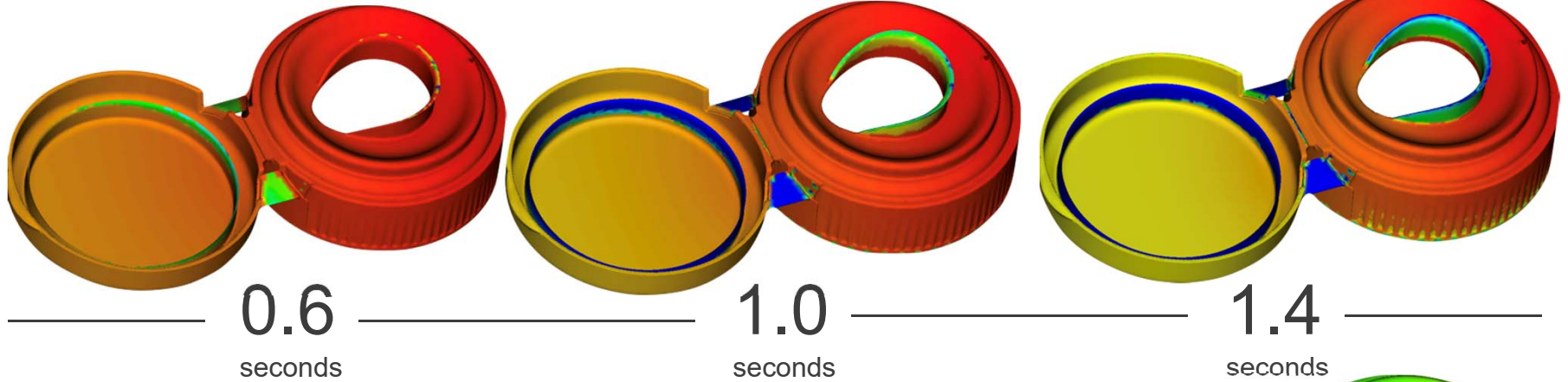
iMFLUX Fill Pattern



Cavity Pressure Comparison

0 psi 11,000 psi

conventional

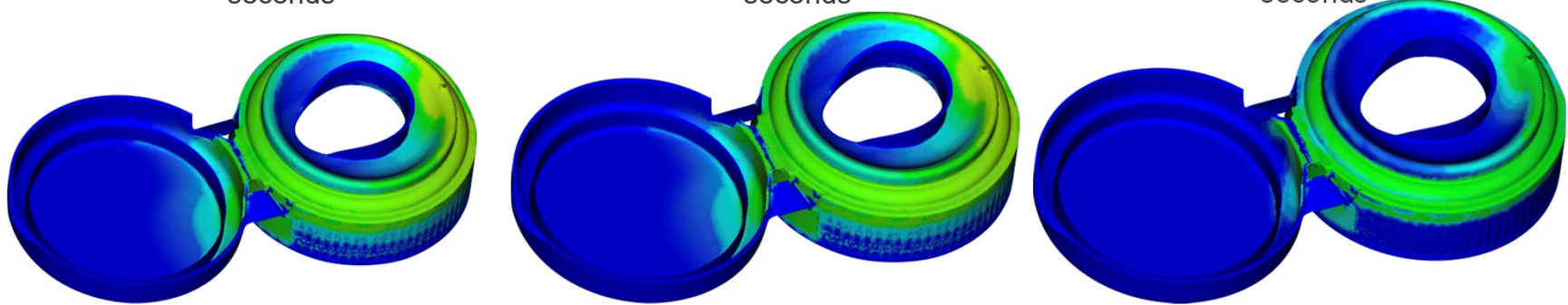
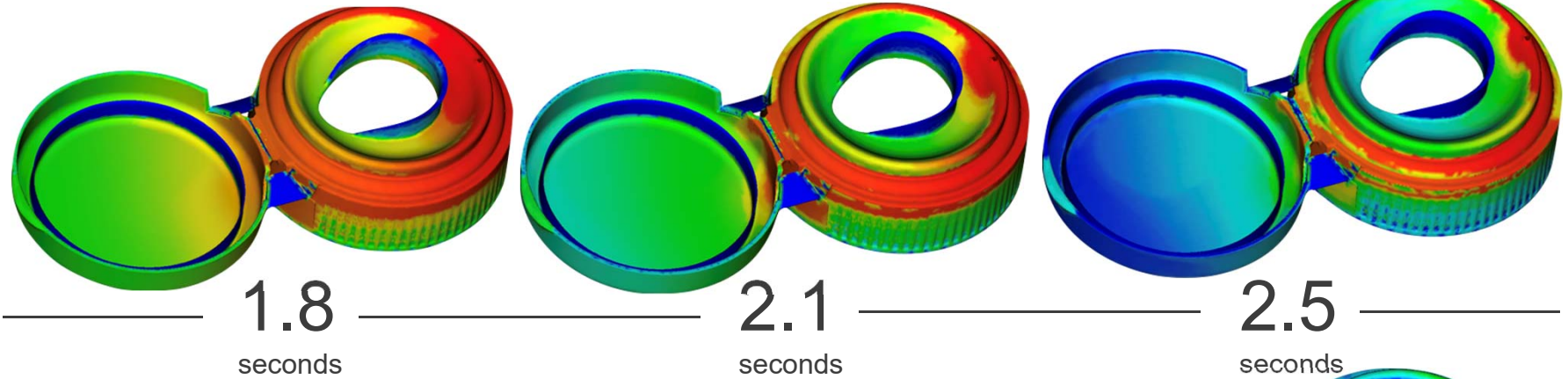


iMFLUX

Cavity Pressure Comparison

0 psi 11,000 psi

conventional



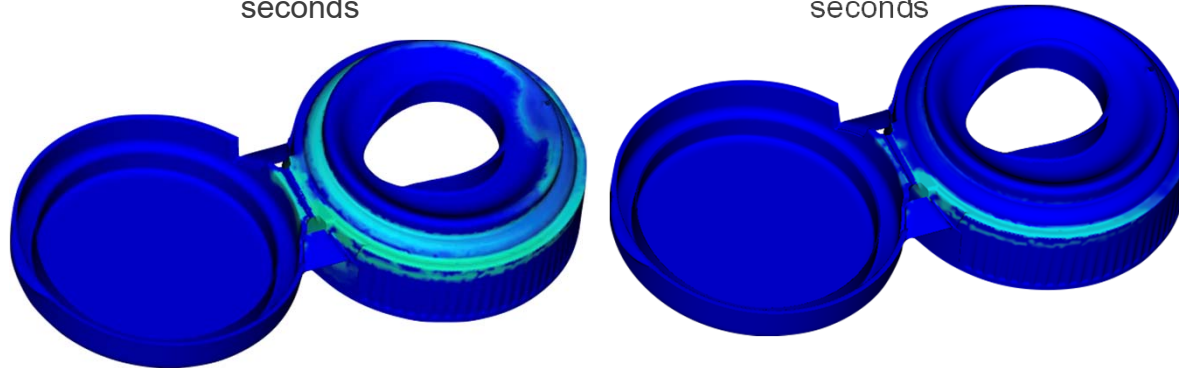
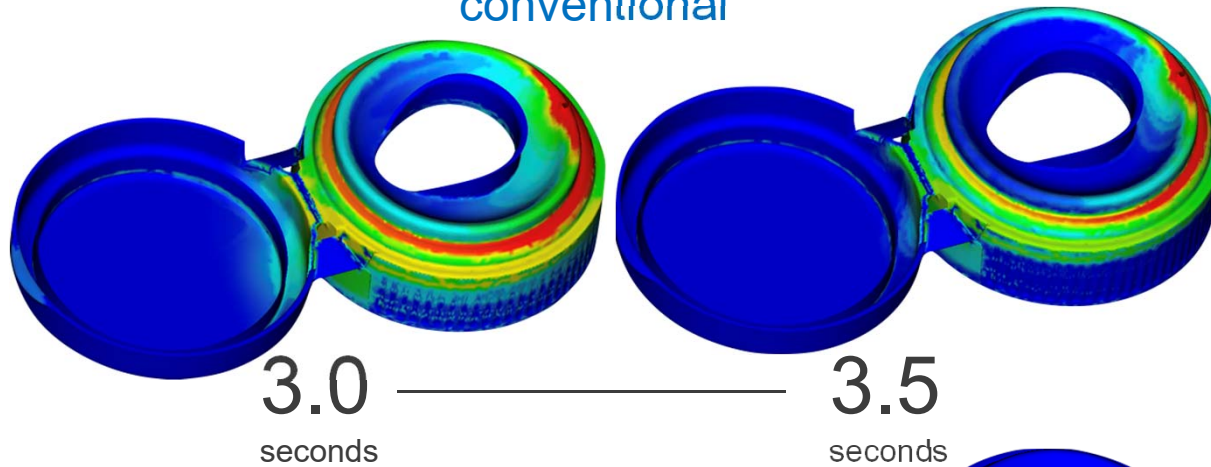
iMFLUX

Cavity Pressure Comparison

0 psi 11,000 psi

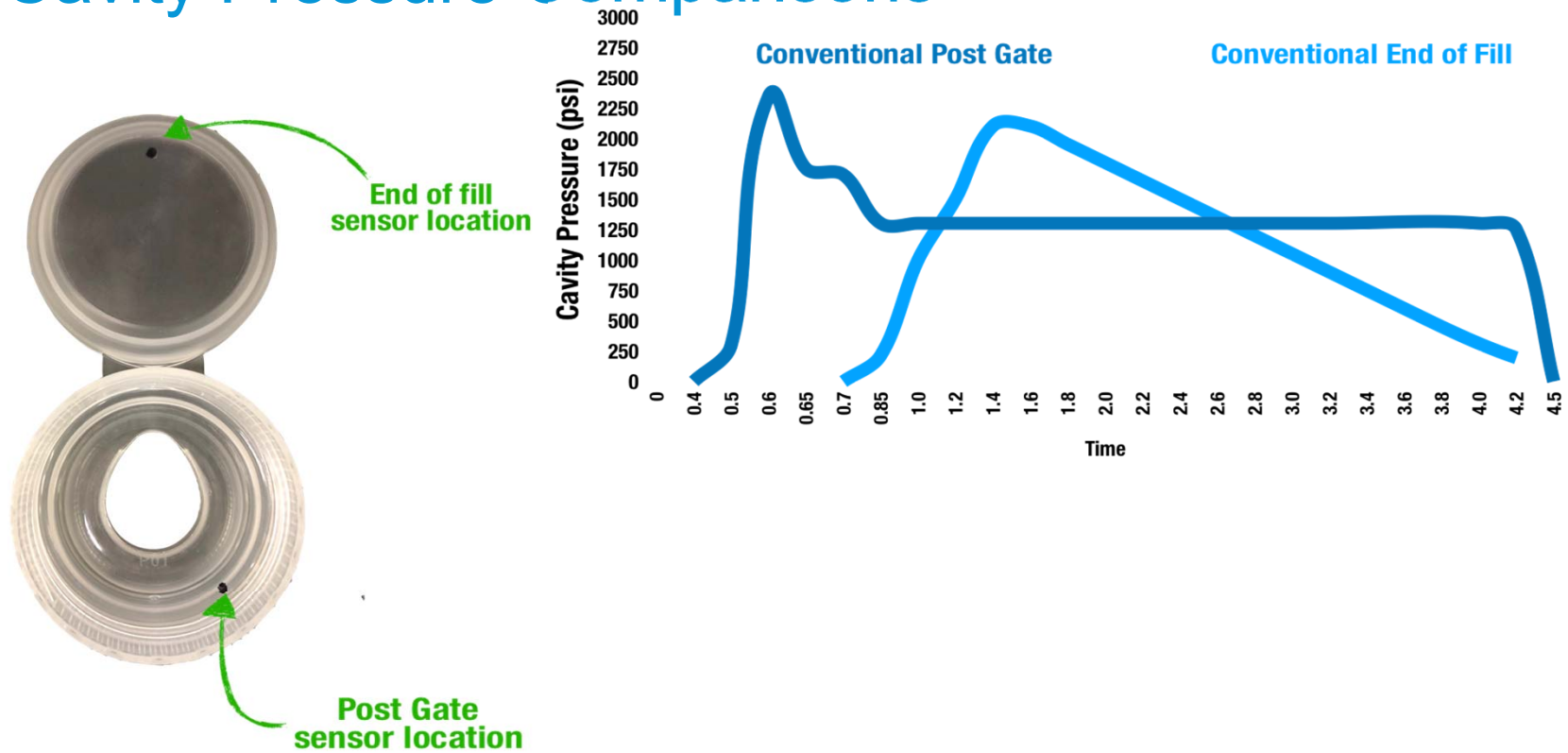


conventional

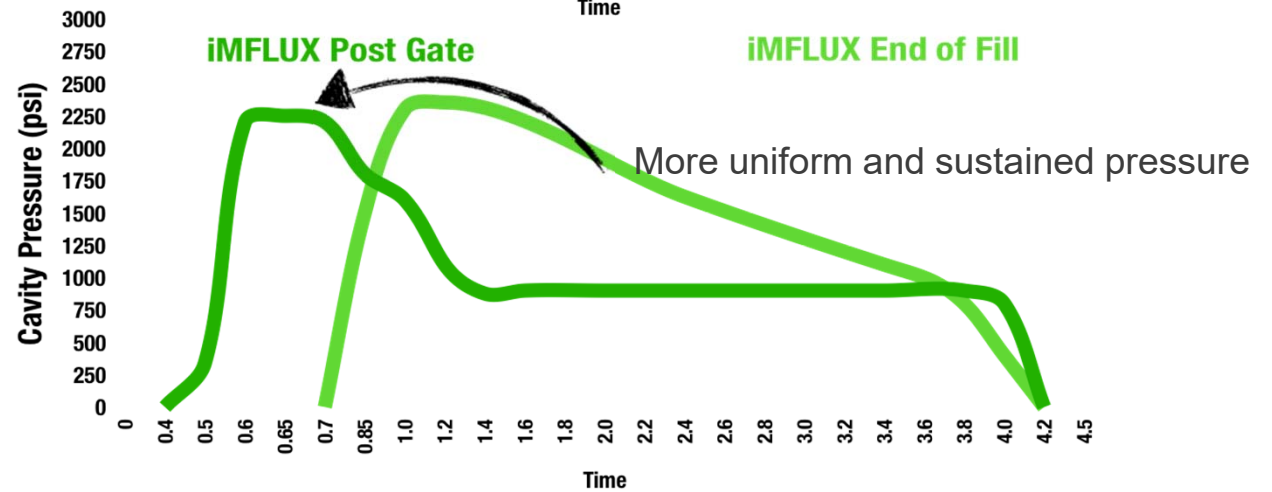
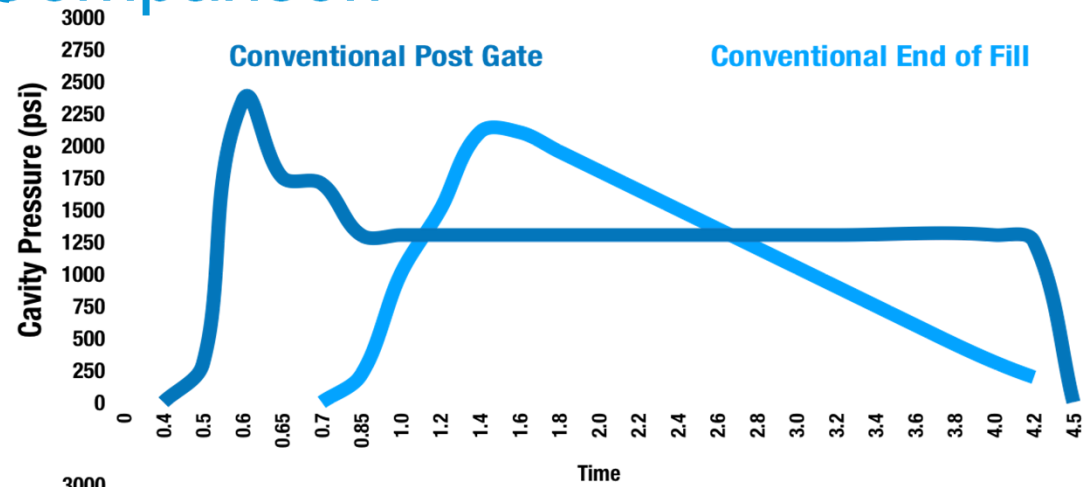
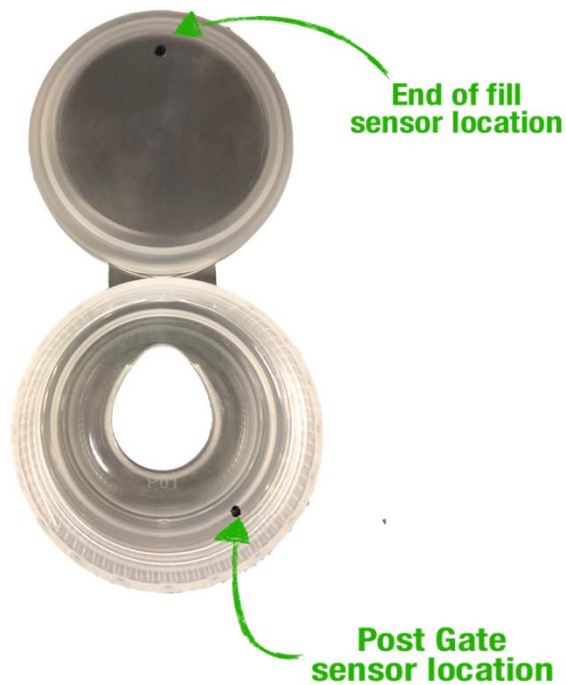


iMFLUX

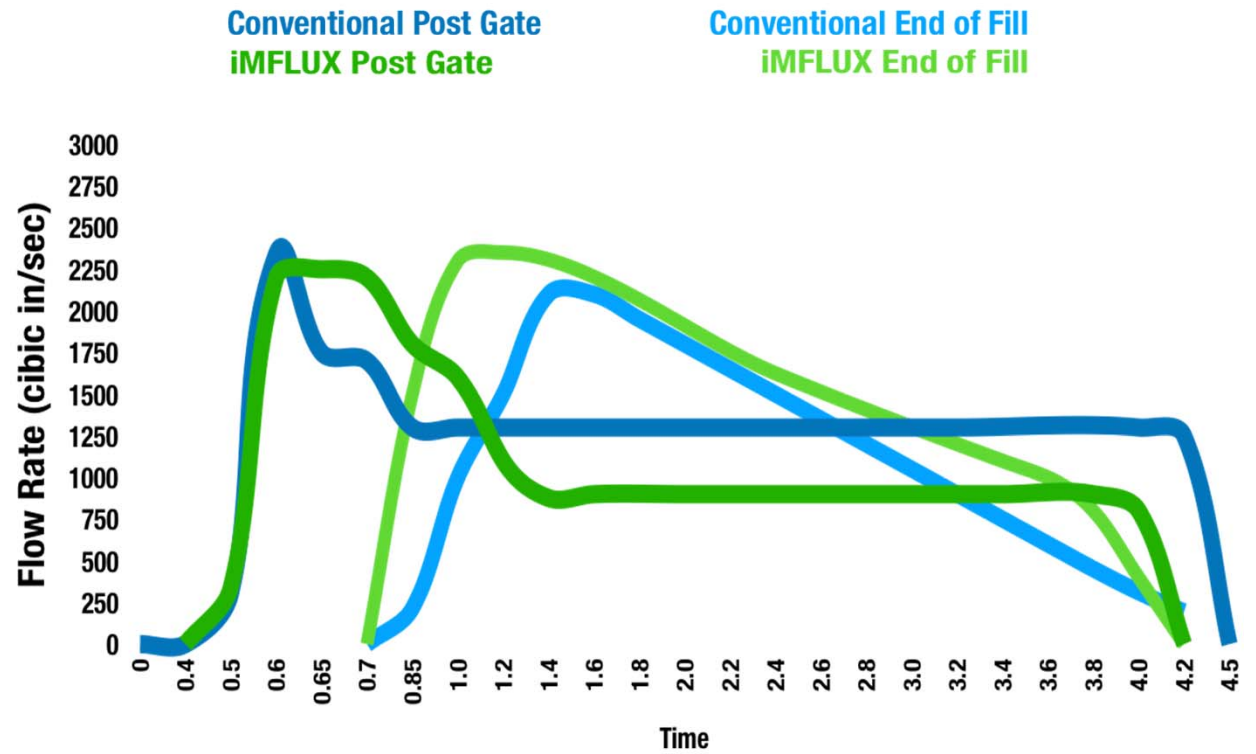
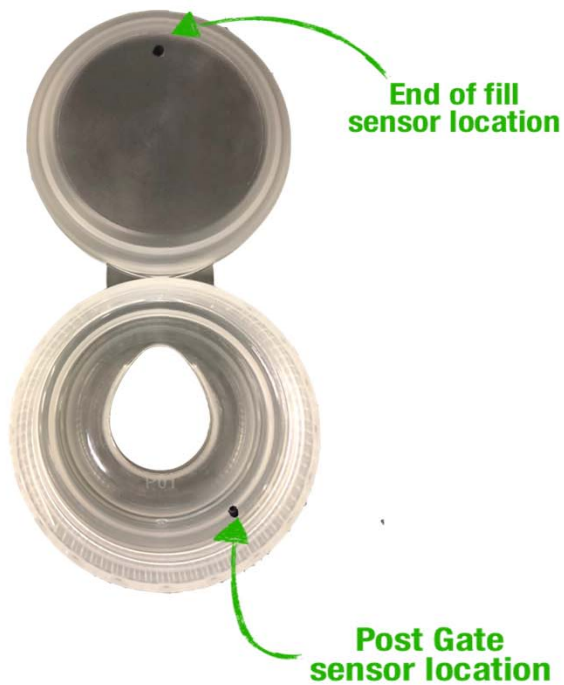
Cavity Pressure Comparisons



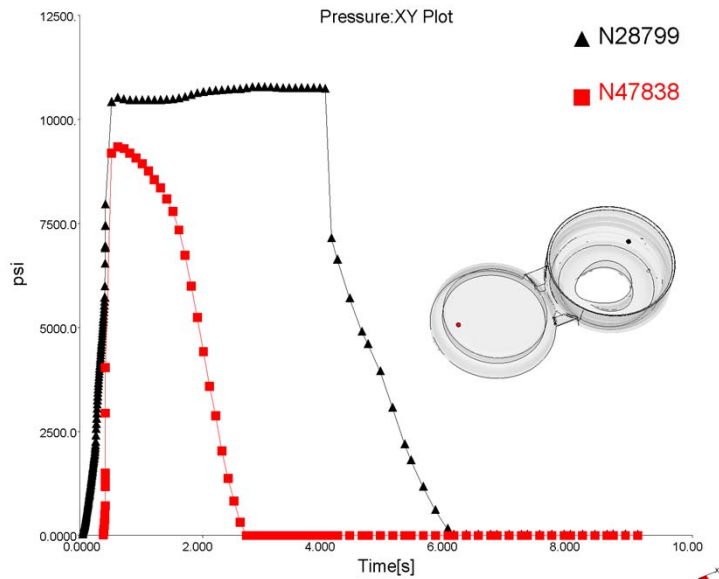
Cavity Pressure Comparison



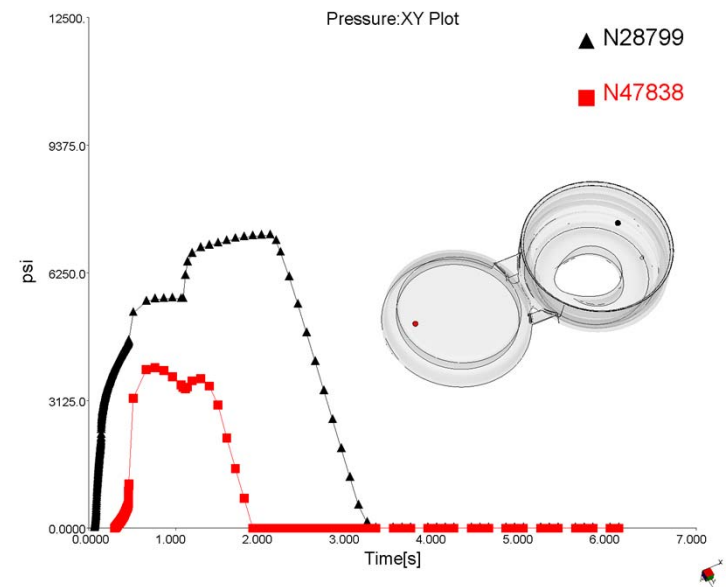
Cavity Pressure Comparisons



Cavity Pressure Comparison



conventional

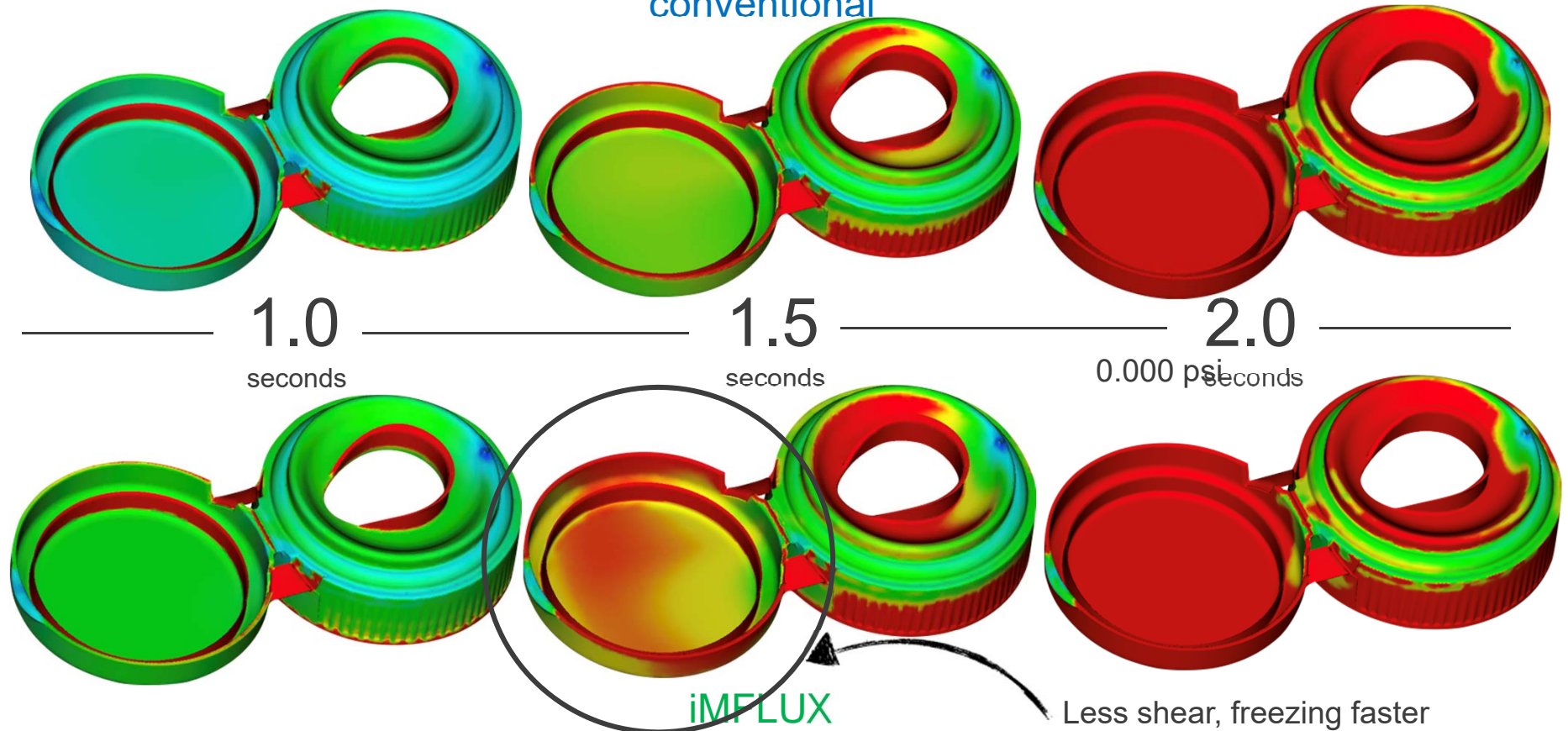


iMFLUX

Frozen Layer Fraction Comparison



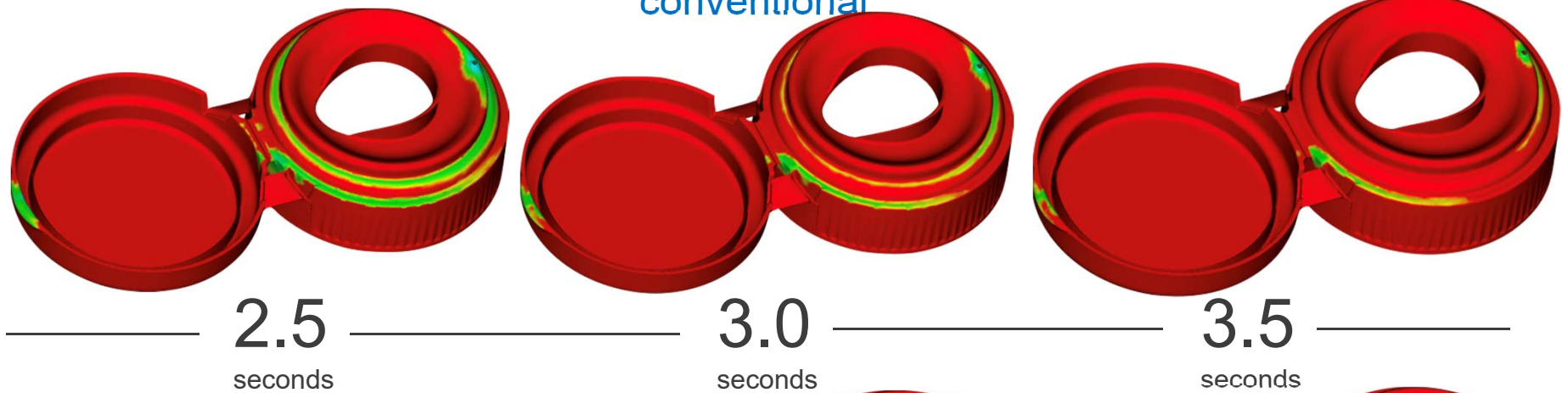
conventional



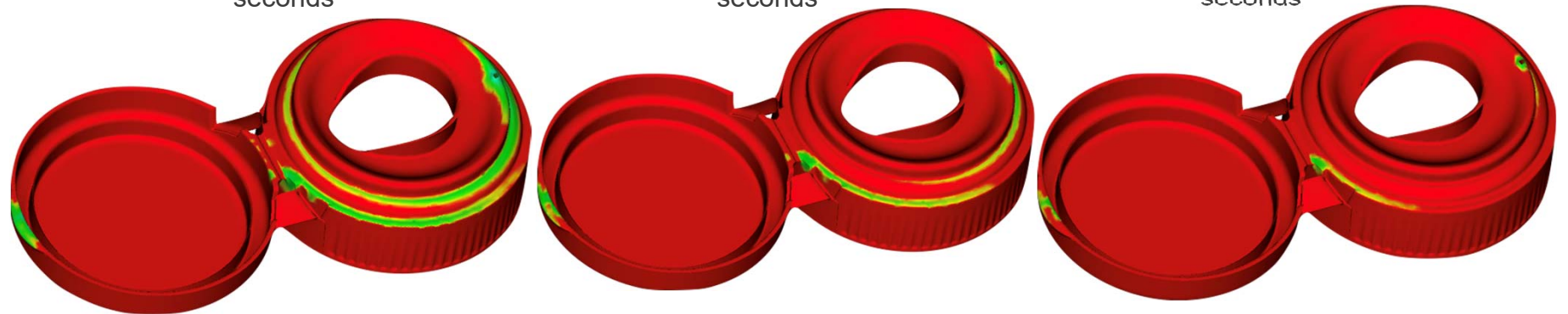
Frozen Layer Fraction Comparison



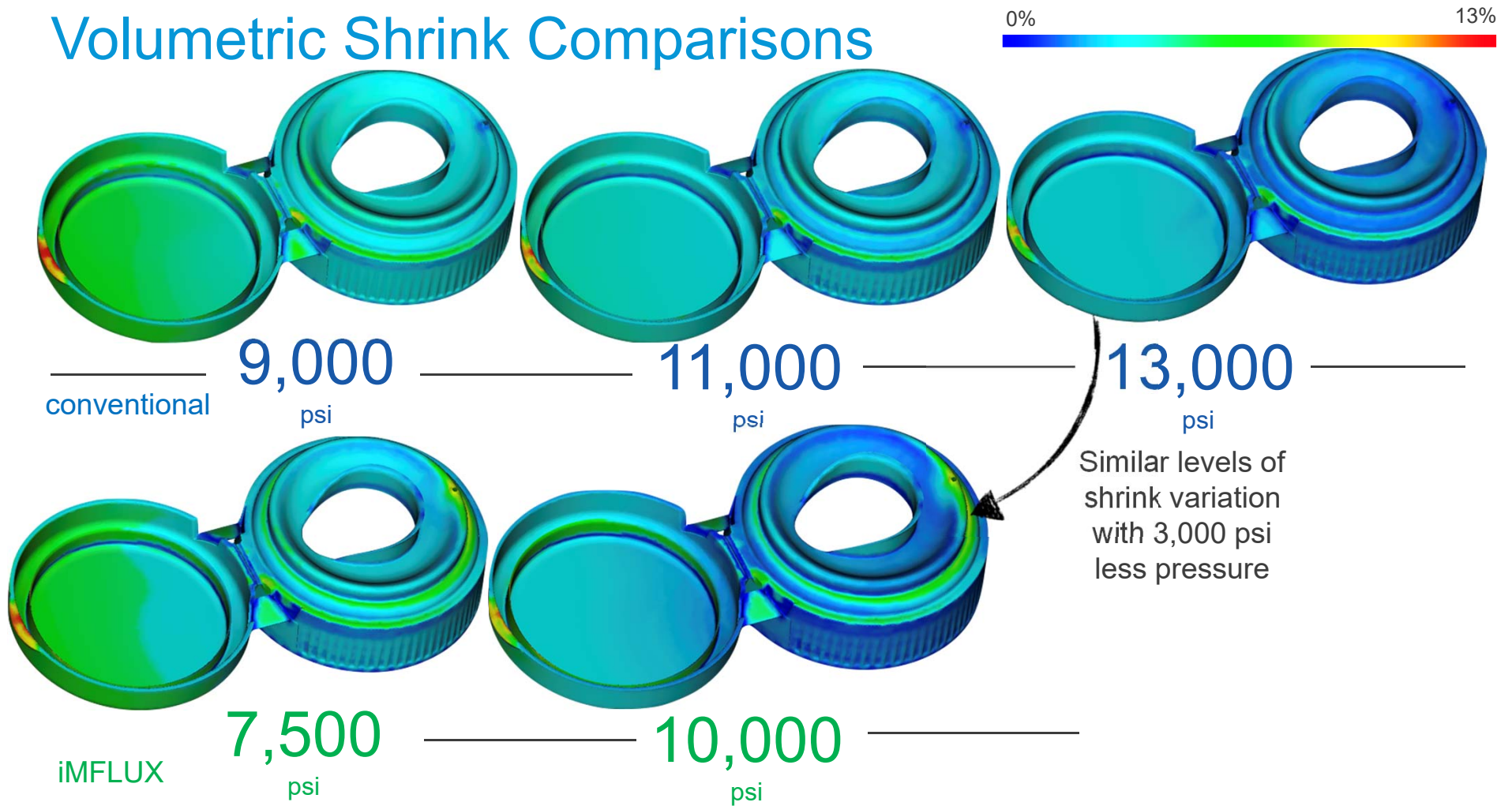
conventional



iMFLUX



Volumetric Shrink Comparisons



Residual Stress Comparisons



Stress just under
skin layer
(highest)

Polarized light
(all layers)

conventional



Stress just under
skin layer
(highest)

Polarized light
(all layers)

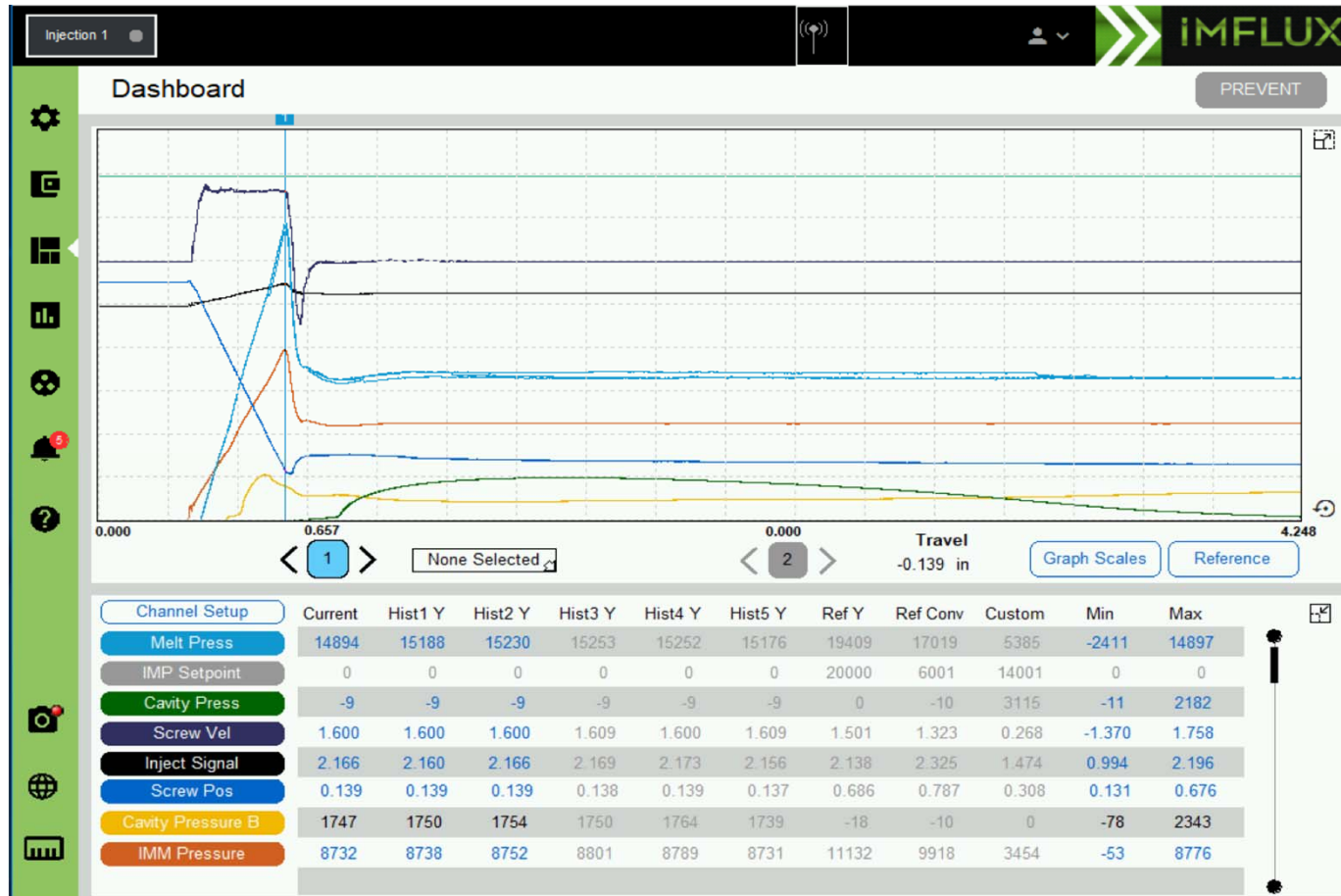
iMFLUX

A 3D visualization of a mold assembly, likely for injection molding. The mold is shown in a semi-transparent, exploded view. The top half of the mold is colored in shades of blue and green, while the bottom half is a solid orange. The number '3' is prominently displayed in the center of the image, overlaid on the mold's internal structure. The background is a light gray, showing the physical mold components.

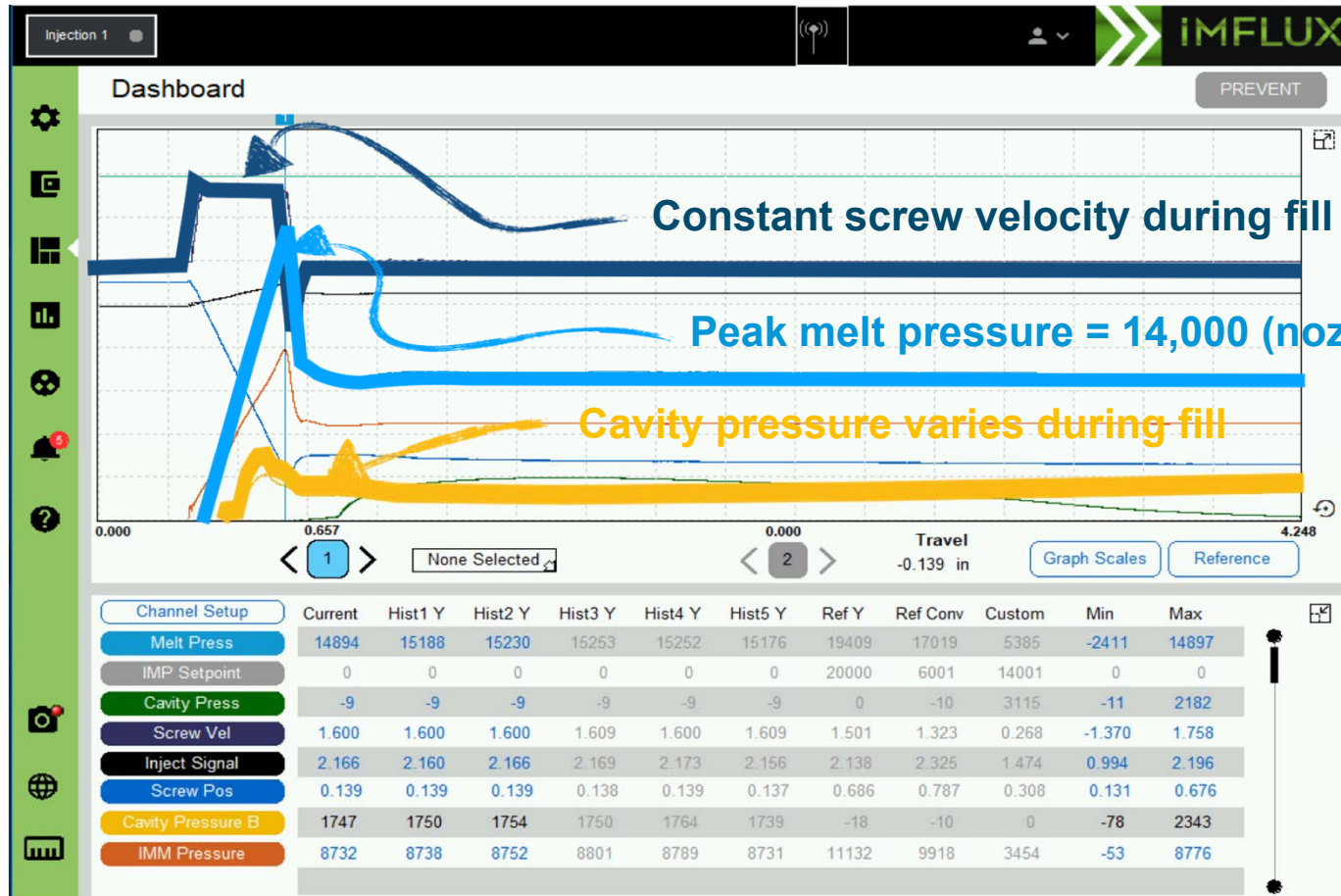
3

Molding Trial Results

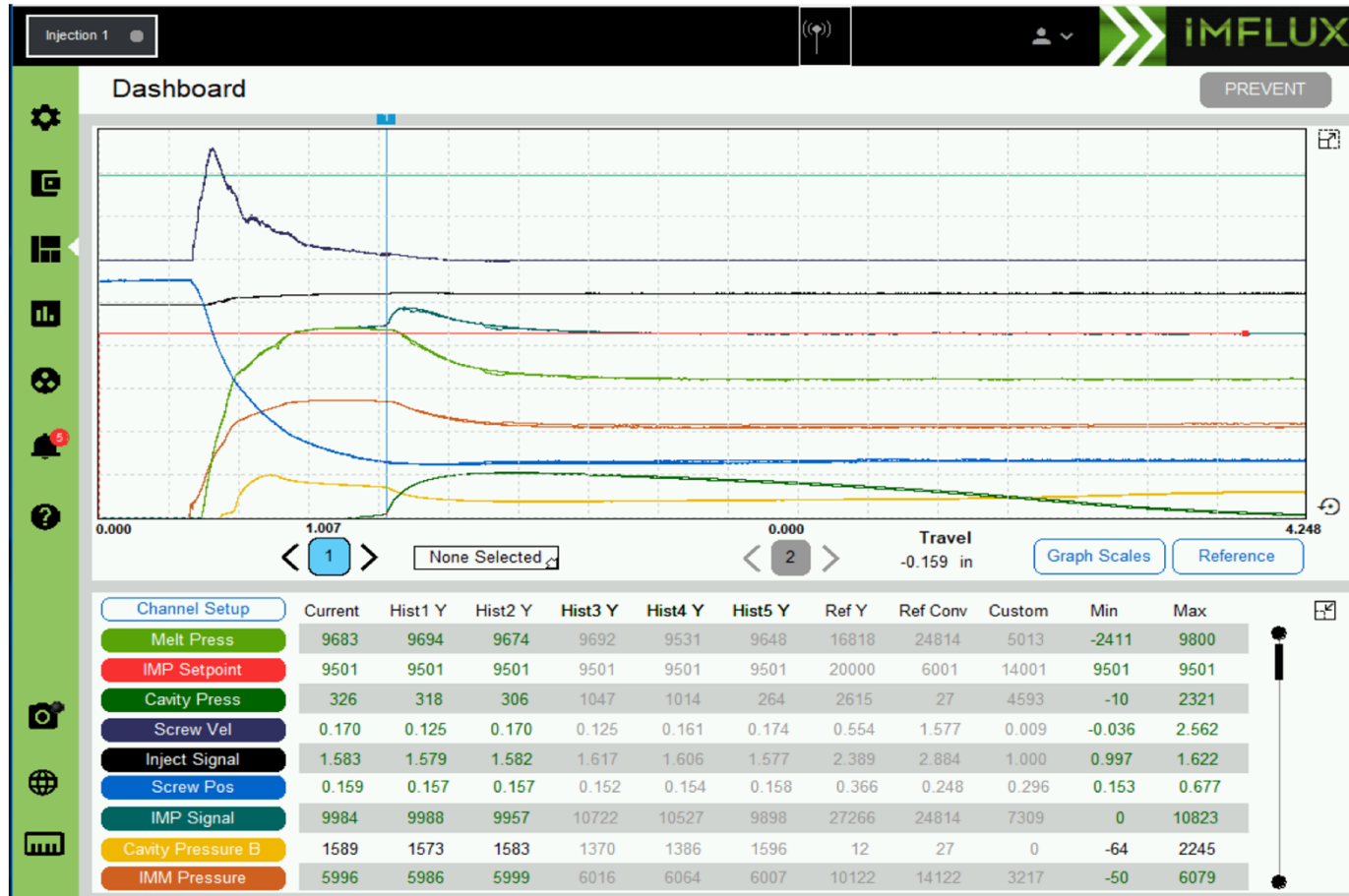
Conventional Process Curves



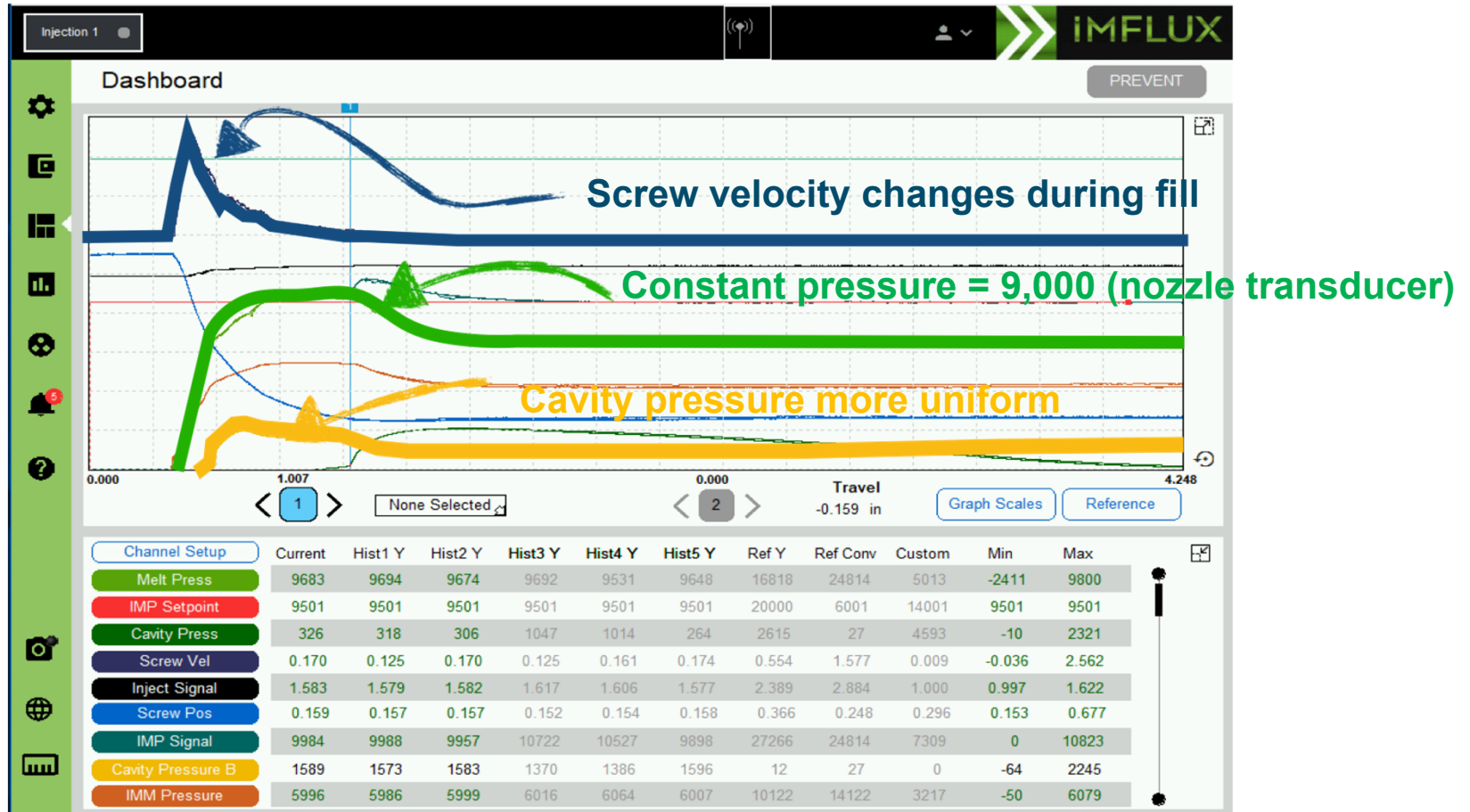
Conventional Process Curves



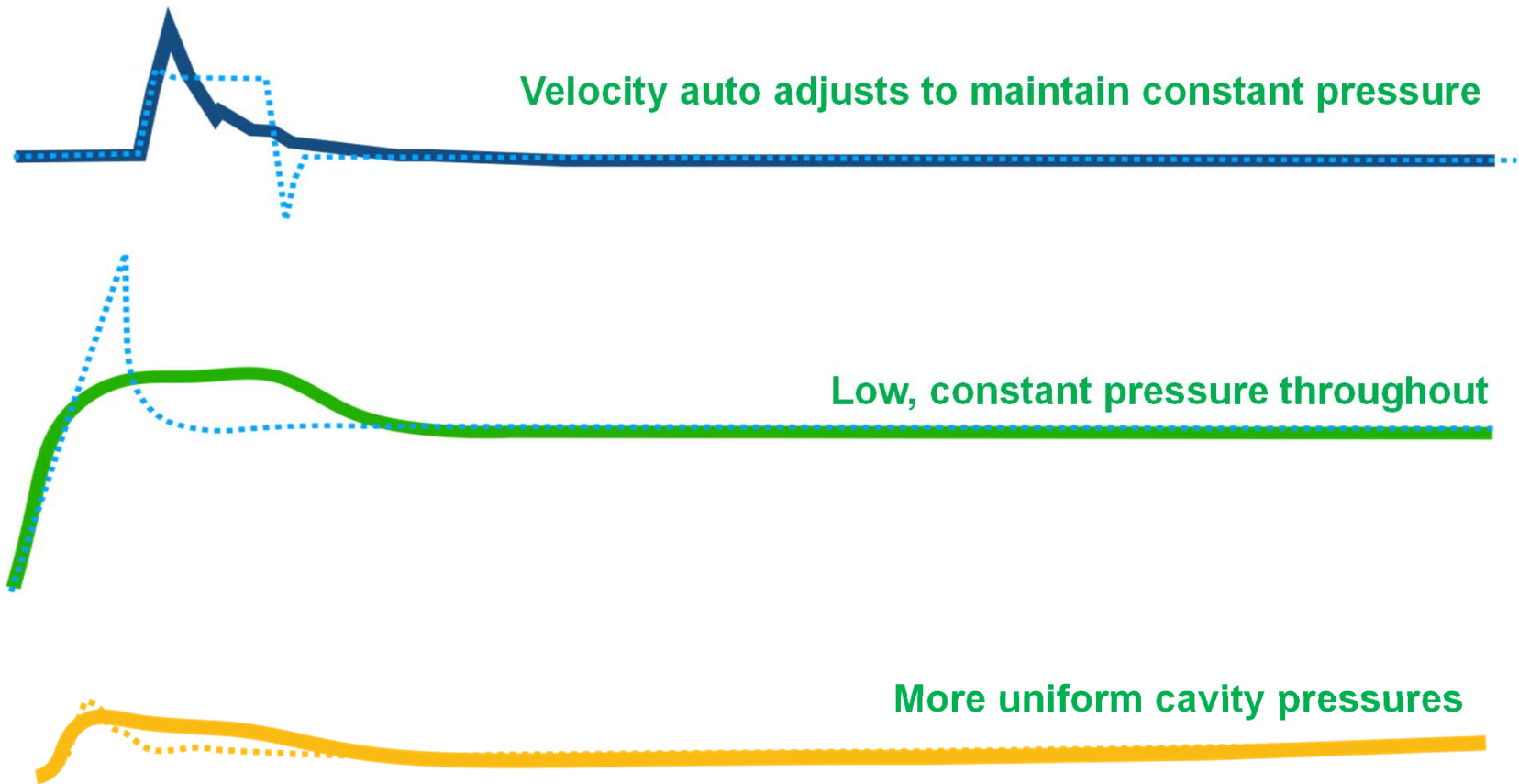
iMFLUX Process Curves



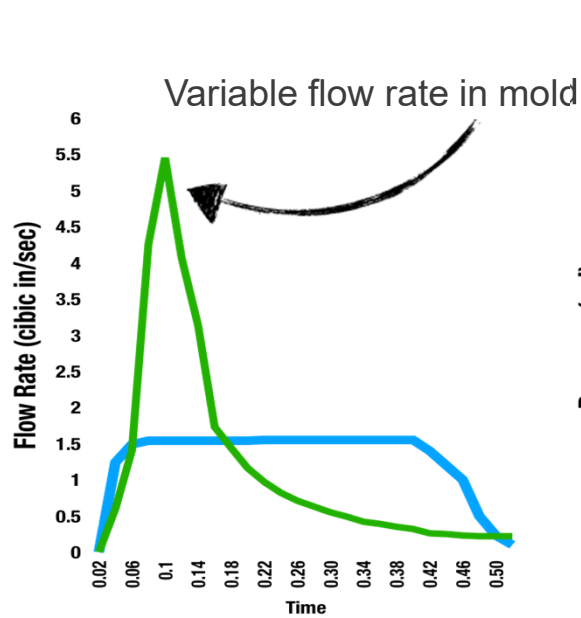
iMFLUX Process Curves



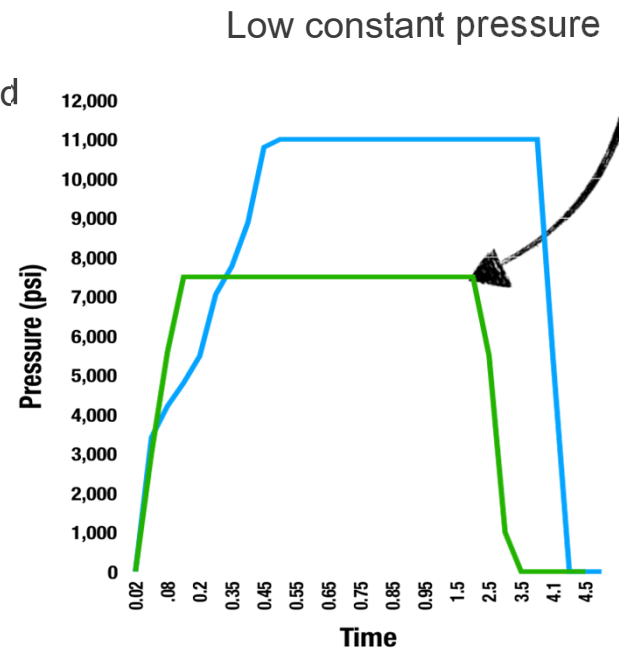
iMFLUX Process Curves Summary



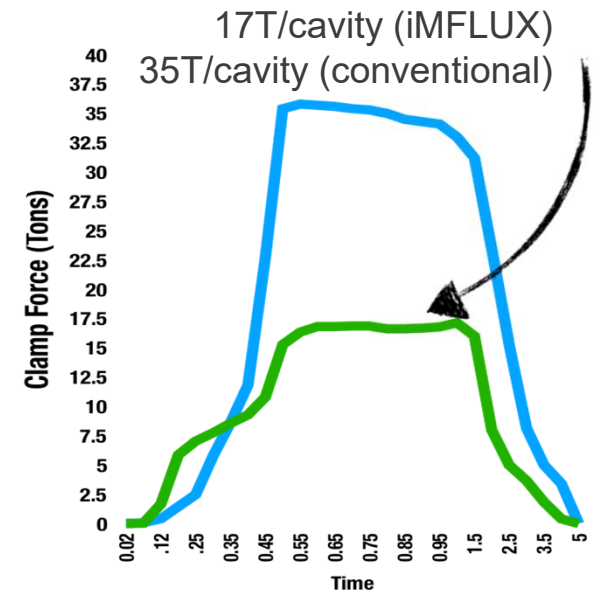
Moldflow Log File Results



Melt Front Velocities



Fill/Pack Pressure Profiles



Clamp Forces

Summary

4



Fill Pressure	Clamp Force	Cycle Time	Residual Stress
<div>ACTUAL</div> <div>32%</div> <div>Reduction</div> <div>13,900 to 9,500 psi</div>	<div>ACTUAL</div> <div>18T</div> <div>Reduction N/A</div> <div>Reached Low Limit of Press</div>	<div>ACTUAL</div> <div>15%</div> <div>Reduction</div> <div>11.85 to 10.05 seconds</div>	<div>ACTUAL</div> <div>N/A</div>
<div>SIMULATION</div> <div>32%</div> <div>Reduction</div> <div>11,000 to 7,500 psi</div> <div>Did not model nozzle/sprue</div>	<div>SIMULATION</div> <div>51%</div> <div>Reduction</div> <div>35T to 17T</div>	<div>SIMULATION</div> <div>13%</div> <div>Reduction</div> <div>12.0 to 10.5 seconds</div>	<div>SIMULATION</div> <div>48%</div> <div>Reduction</div> <div>4,900 to 2,500 psi (in lid)</div>

Simulation 'Wish For(s)'

AUTO
PREDICTION
OF MINIMUM^[L]_{SEP}
PRESSURE
TO^[L]_{SEP} FILL
CAVITY

PRESSURE
CONTROL
FILLING
SIMULATION

OPTIMIZE
SLOPE/RAMP
AT START OF
PRESSURE
CURVE



THANK YOU

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