Moldflow Summit 2019
Low Constant Pressure Molding Simulation

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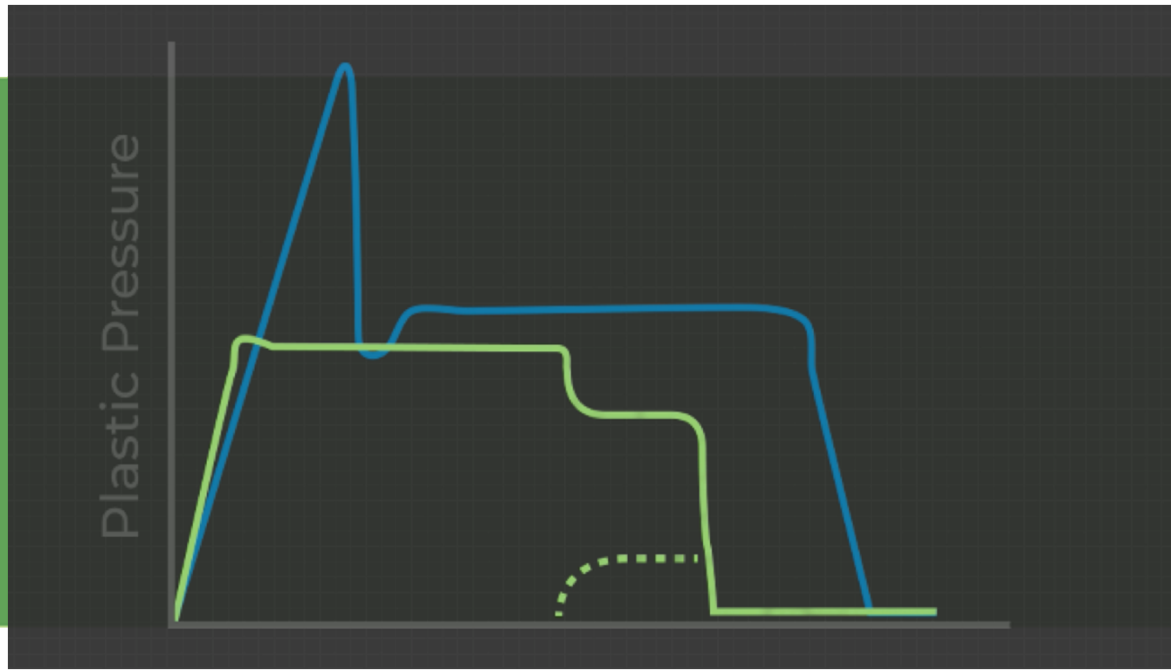
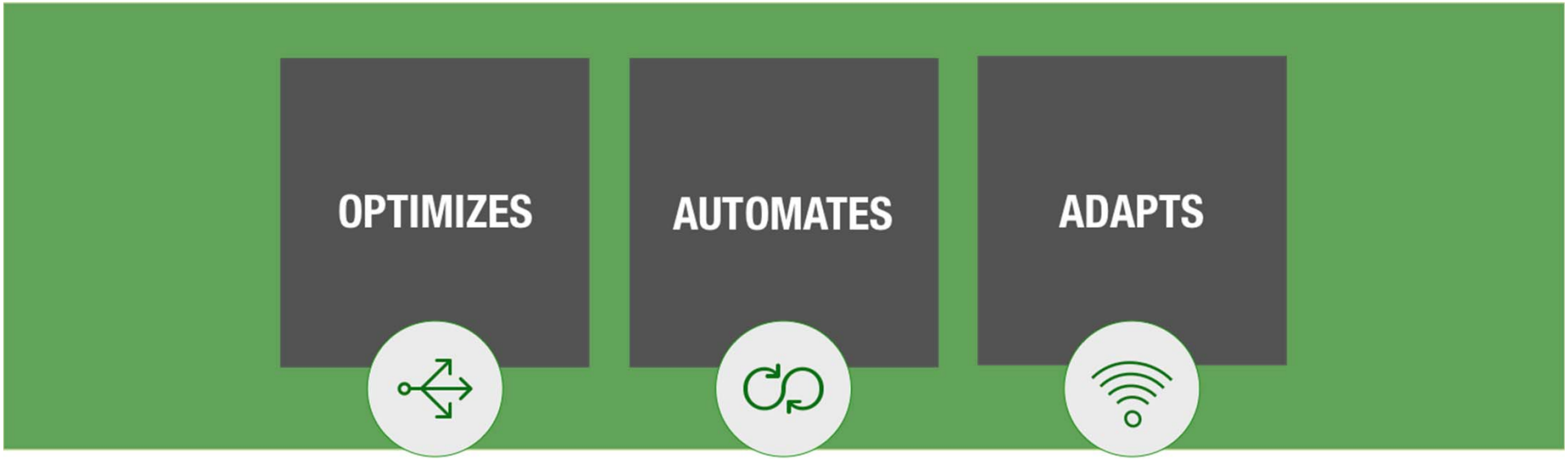
AUTODESK.

Low Constant Pressure Molding:
The iMFLUX ‘Green Curve”

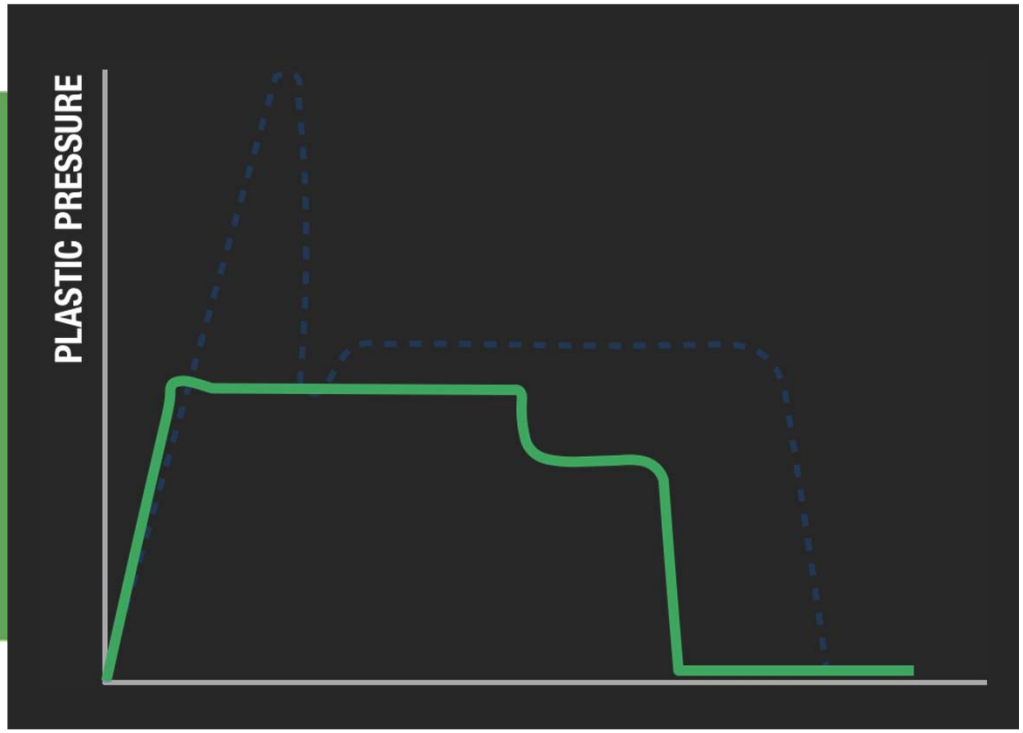
- 25%-50% Lower Pressures
- Up to 40% Reduction in Clamp
- Faster Cycle Time Possible
- Automated/Autonomous Molding
- Intelligent Feedback to Engineers
- New Design Freedoms




OPTIMIZES
AUTOMATES
ADAPTS

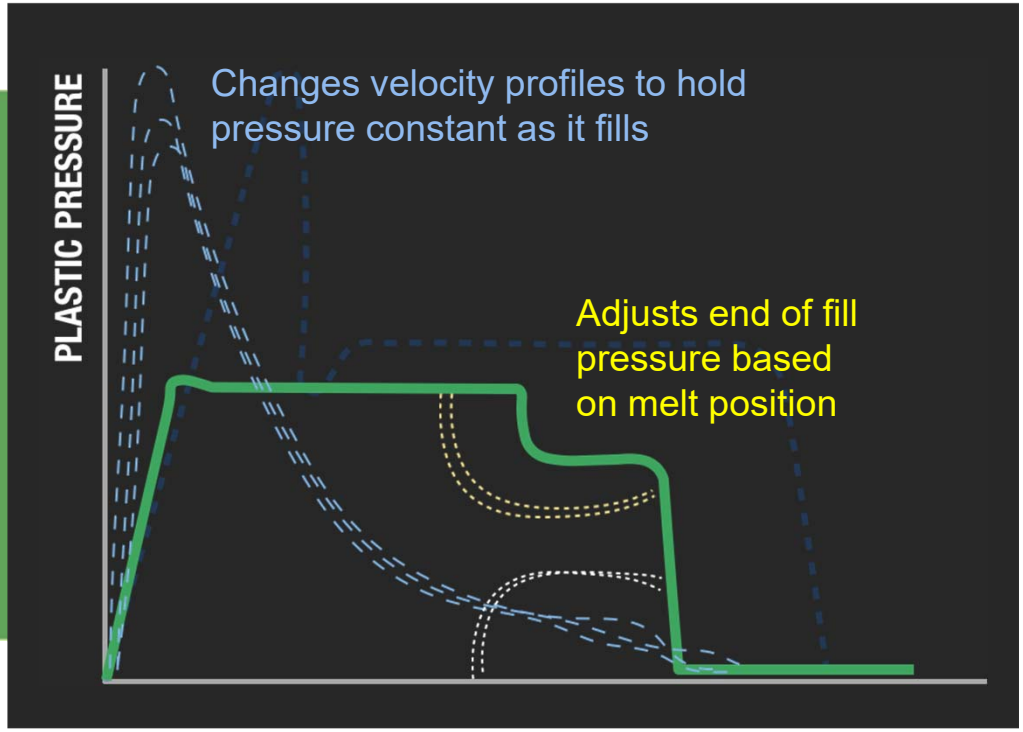
OPTIMIZES

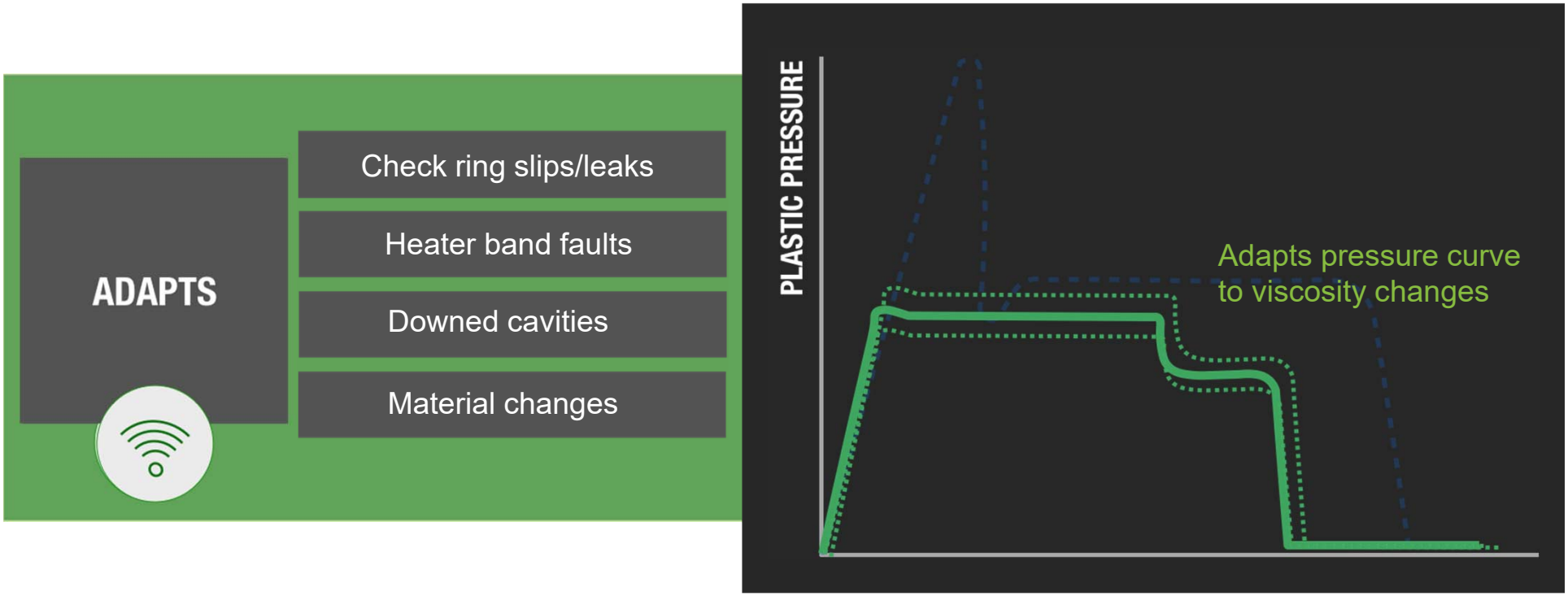
- Identifies minimum pressure to fill the system
- Holds that pressure constant at all times
- Constantly adjusting melt front velocity
- Cavity tells the machine how to behave

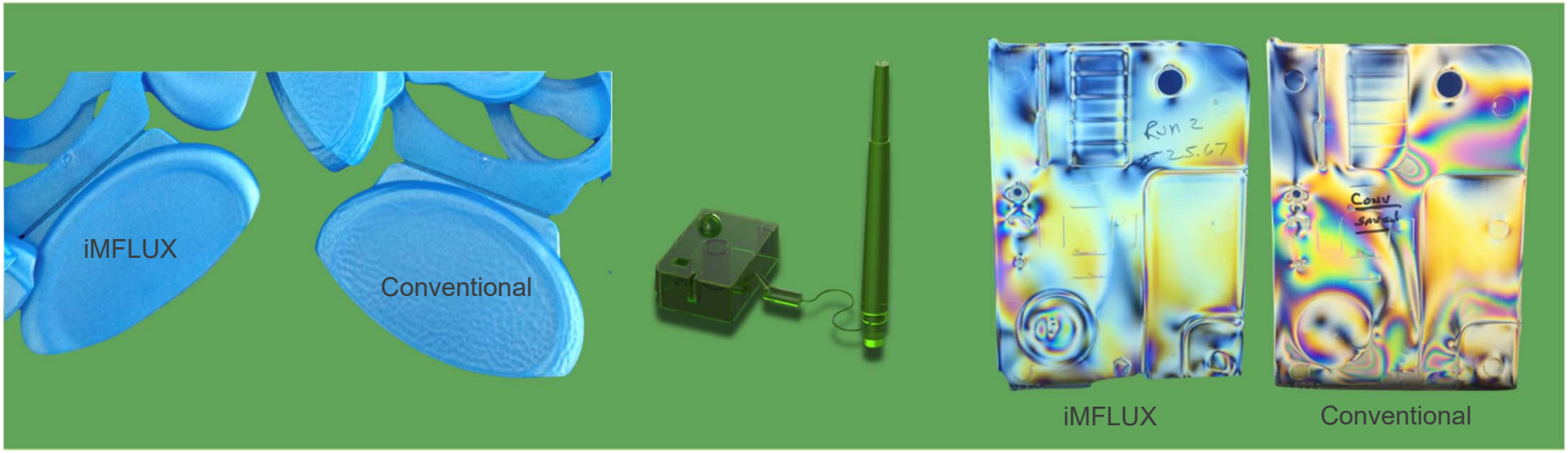


AUTOMATES

- Material Changes
- Mold Behavior
- Machine Changes
- Environmental Changes




ADAPTS
Check ring slips/leaks
Heater band faults
Downed cavities
Material changes
PLASTIC PRESSURE
Adapts pressure curve
to viscosity changes

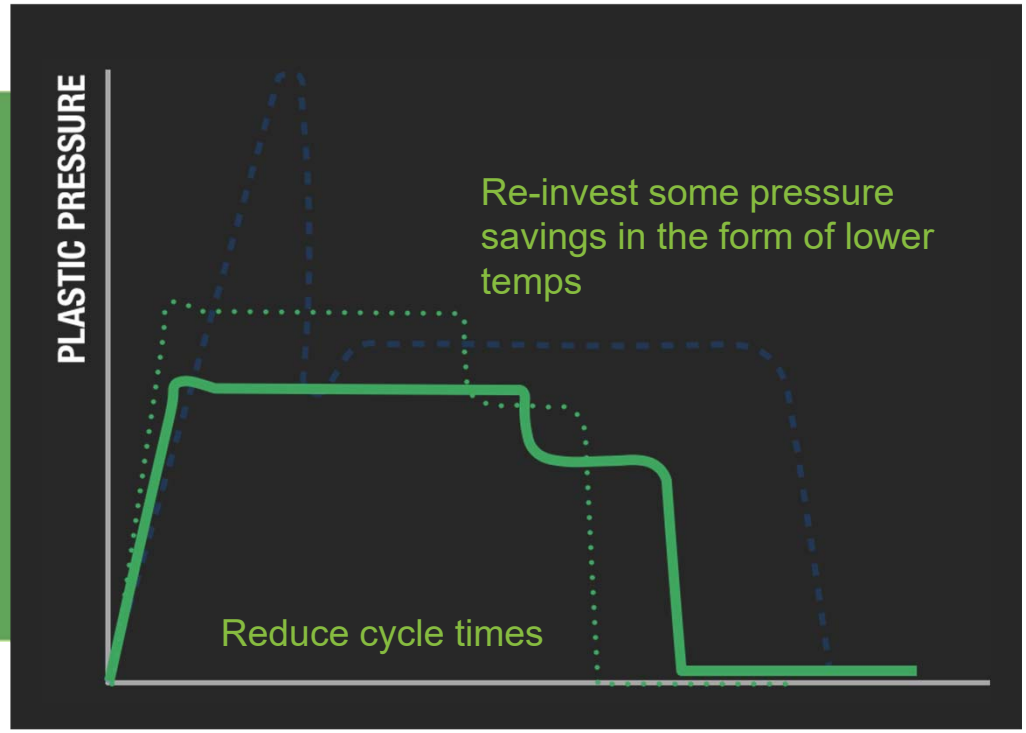

iMFLUX
Conventional
Run 2
2.5.67
Conv
iMFLUX
Conventional

The Green Curve Enables

The Green Curve Enables

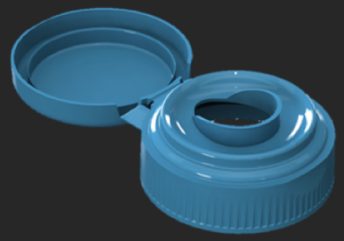
FASTER CYCLE

- Re-Invest Pressure Savings
- Lower Melt Temperatures
- Lower Mold Temperatures
- Less Shear Heat



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

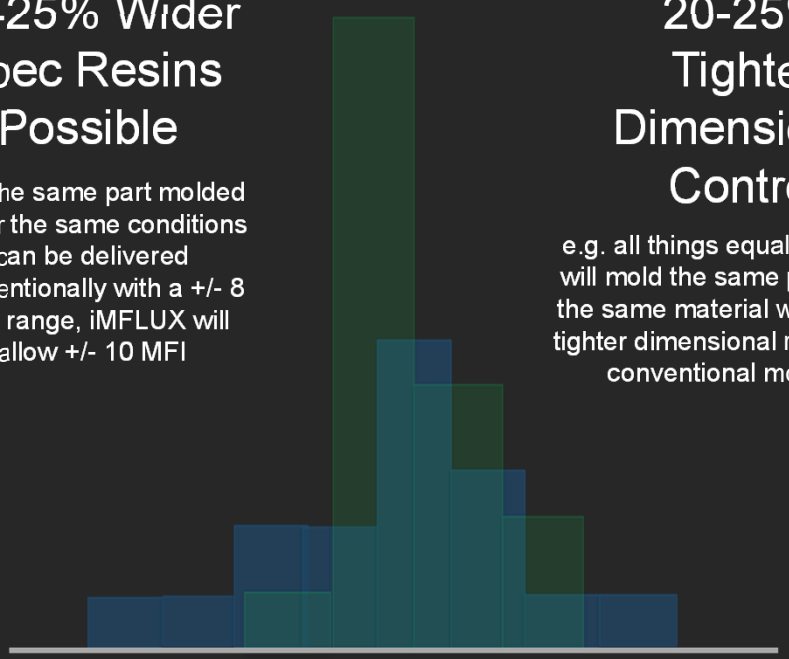
- Wide Viscosity Ranges
- Adaptive & Automated
- Easier to Maintain Quality
- Less Operator Interventions

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



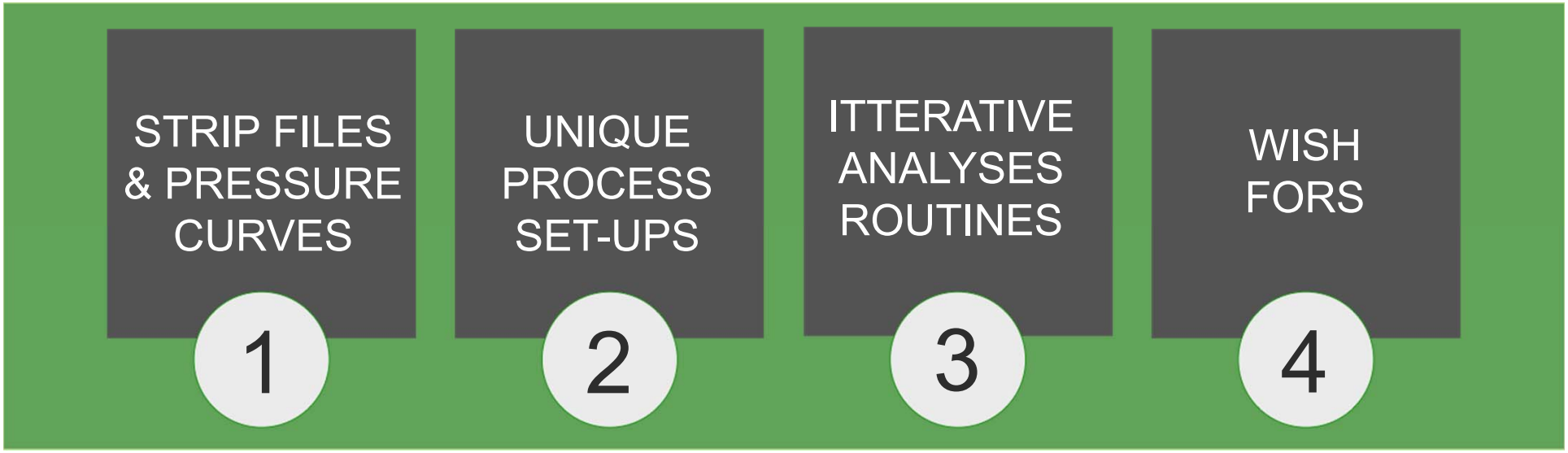
OUR PURPOSE

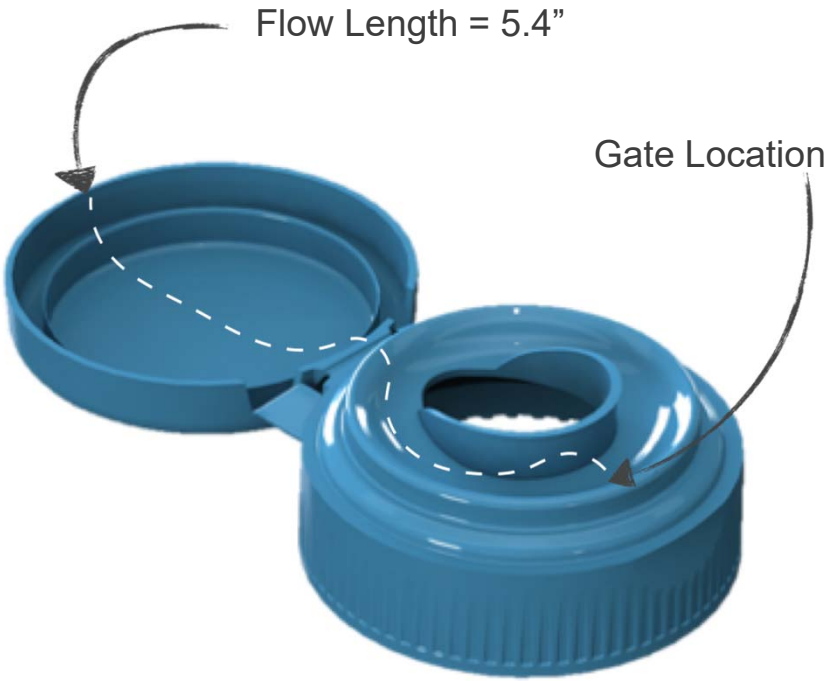
PARTNER WITH WORLD CLASS TECHNOLOGY PROVIDERS TO UNLOCK ALL THE BENEFITS OF OUR TECHNOLOGY

OUR VISION

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

How to Simulate the Process

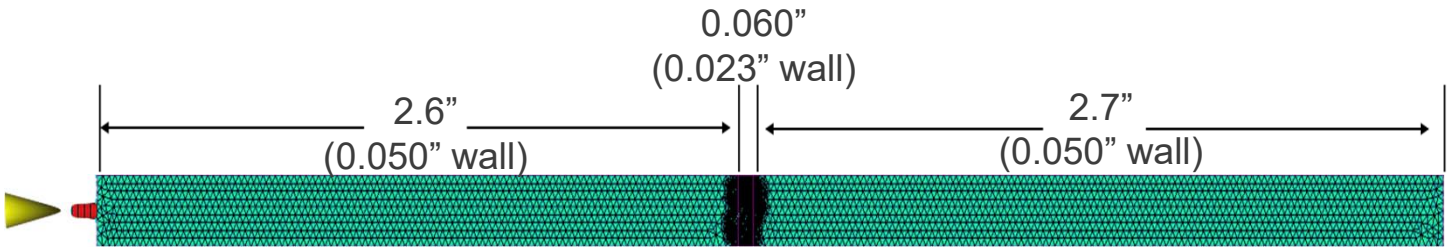

STRIP FILES & PRESSURE CURVES
1
UNIQUE PROCESS SET-UPS
2
ITTERATIVE ANALYSES ROUTINES
3
WISH FORS
4



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

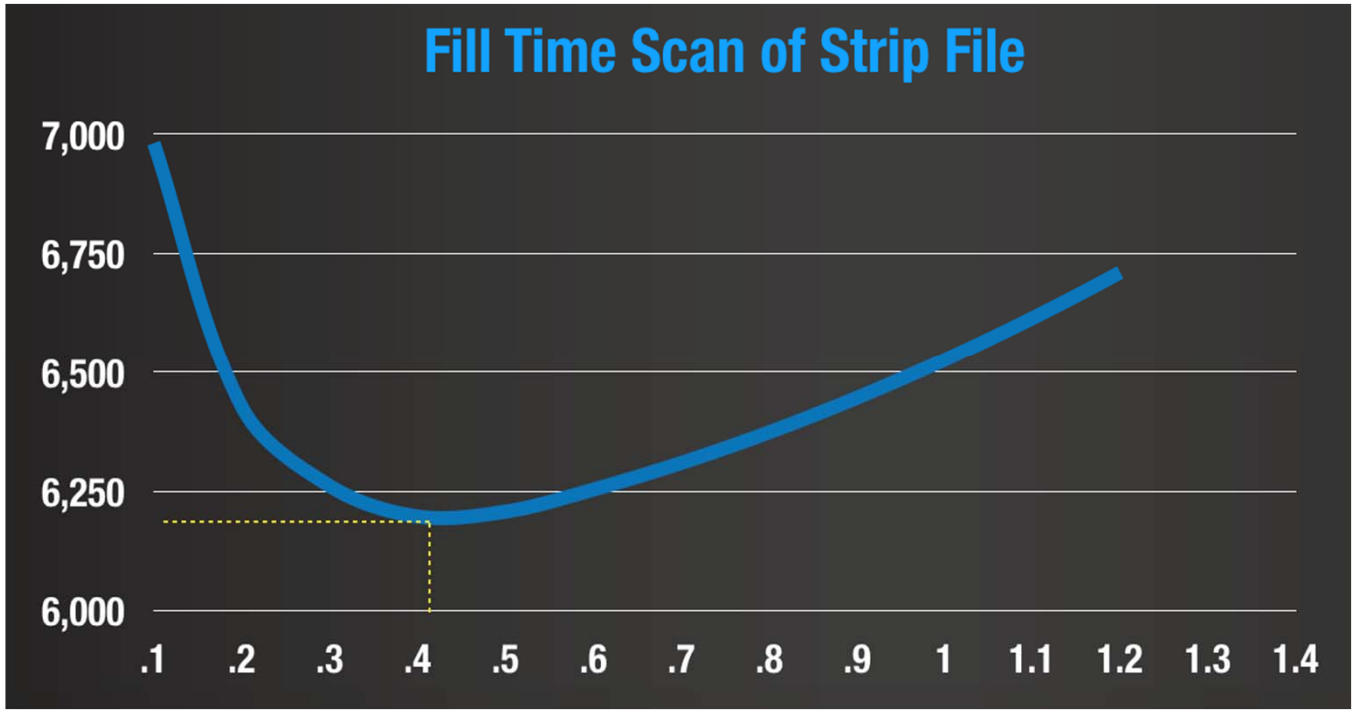
Strip Files & Pressure Windows

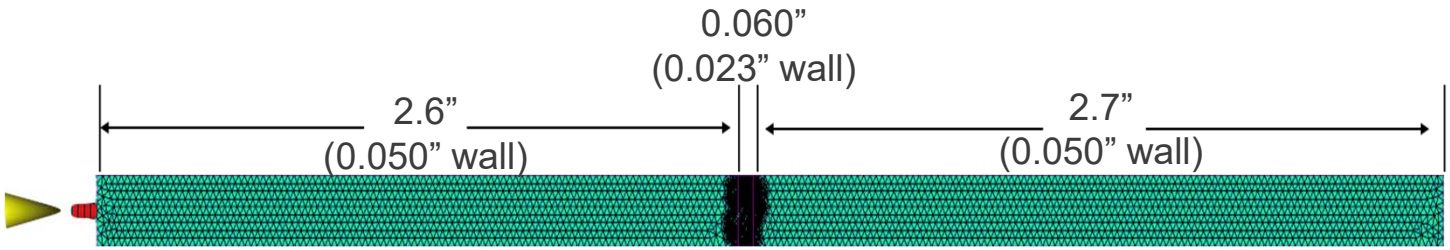


STRIP FILES & PRESSURE CURVES

1

Strip Files

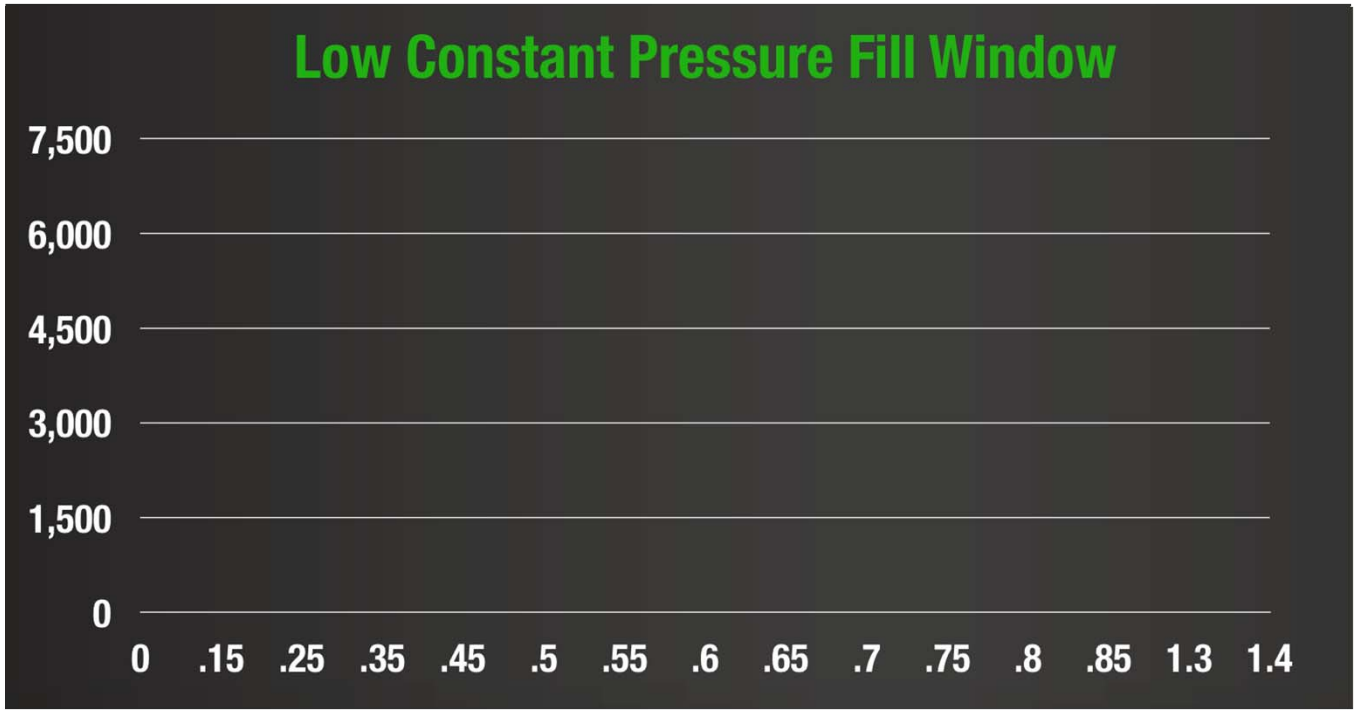




STRIP FILES & PRESSURE CURVES

1

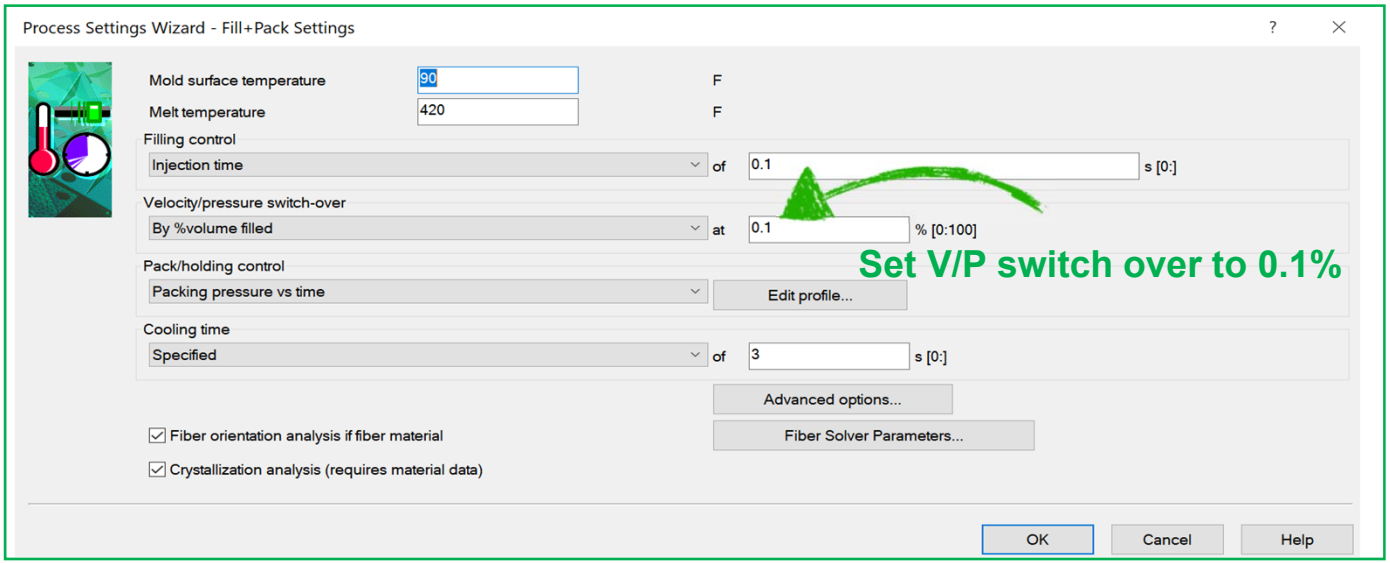
Strip Files

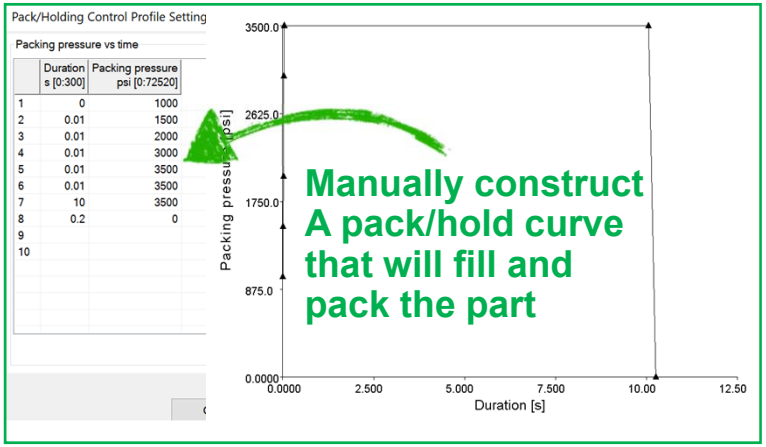


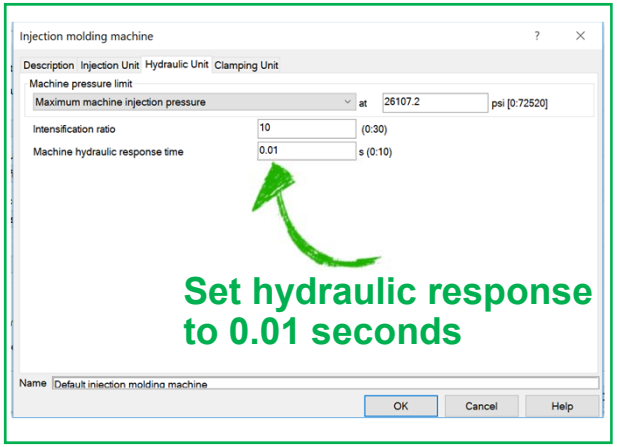
STRIP FILES & PRESSURE CURVES

1

Process Set-Ups

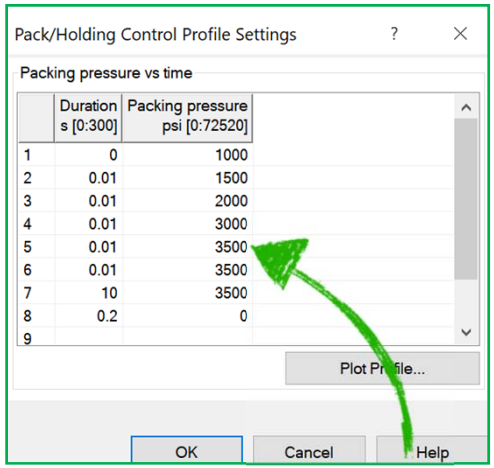




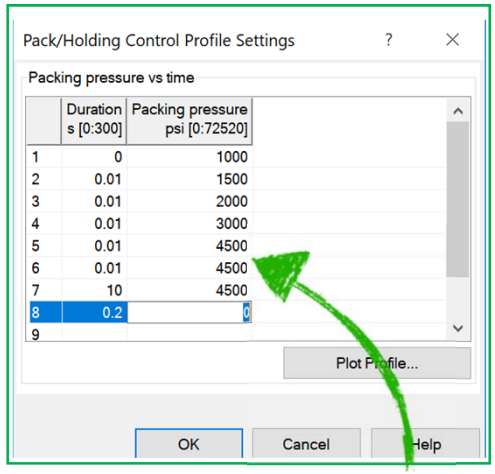


STRIP FILES & PRESSURE CURVES

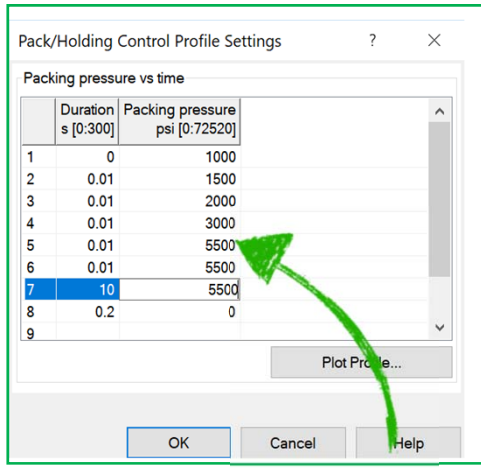
1



Constant pressure of 3,500 psi



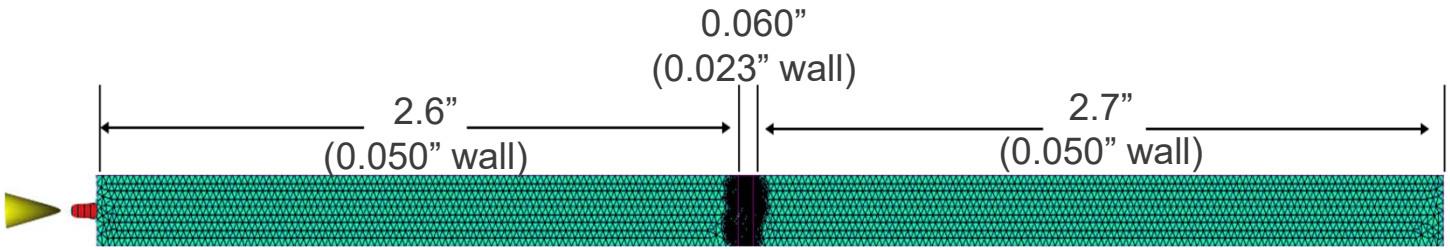
Constant pressure of 4,500 psi



Constant pressure of 5,500 psi

…and so on

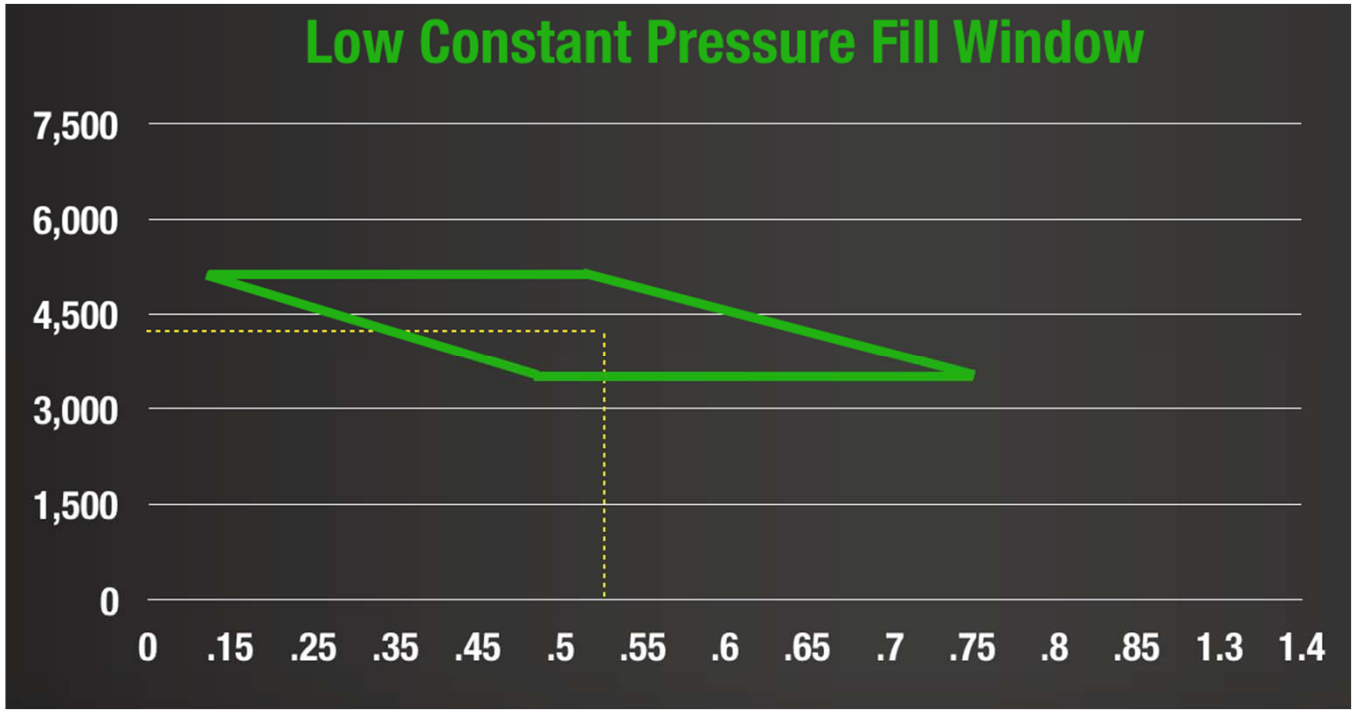
Process Set-Ups



STRIP FILES & PRESSURE CURVES

1

Strip Files

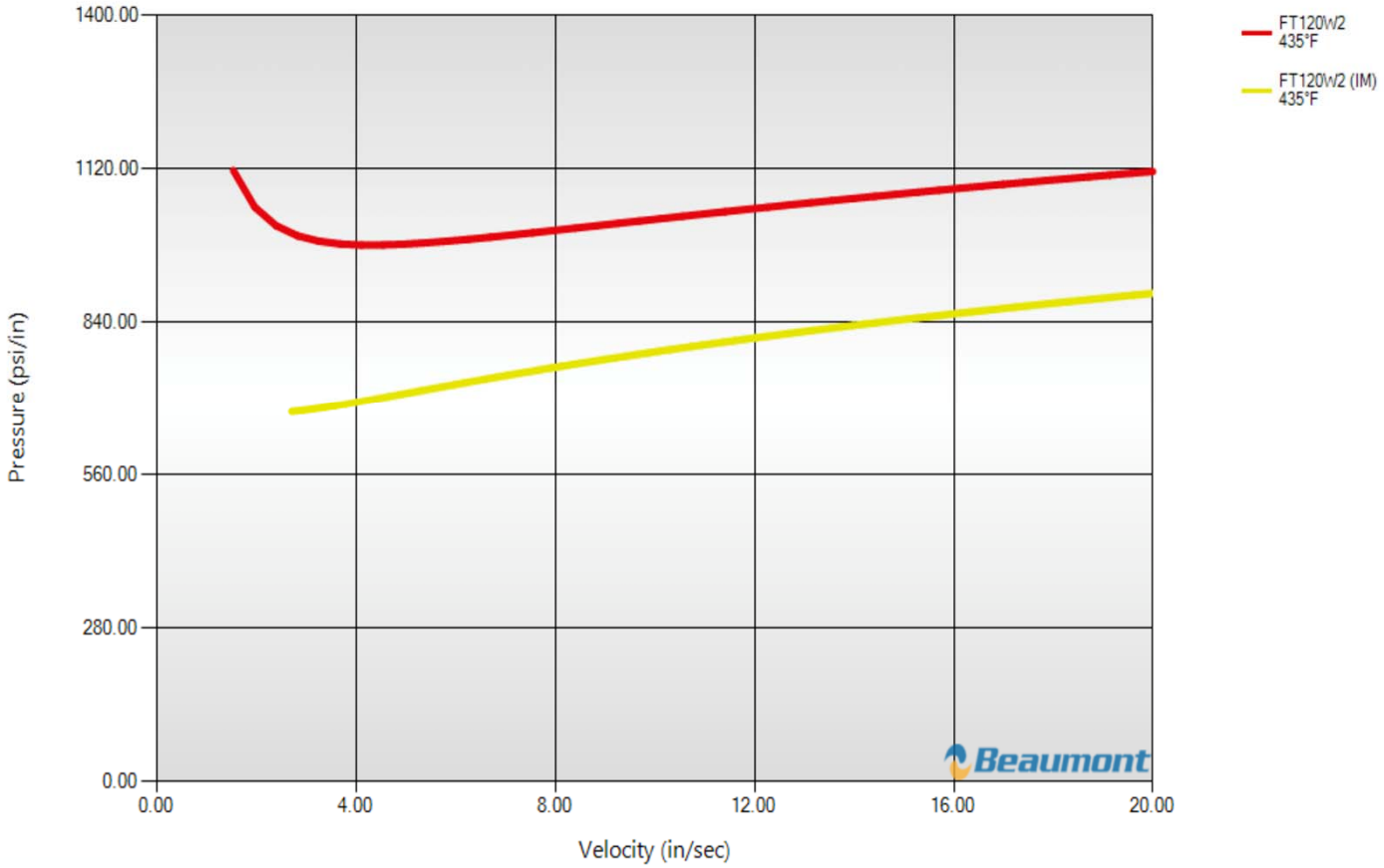


STRIP FILES & PRESSURE CURVES

1

Thermaflo

Beaumont Technologies
(alternative option)

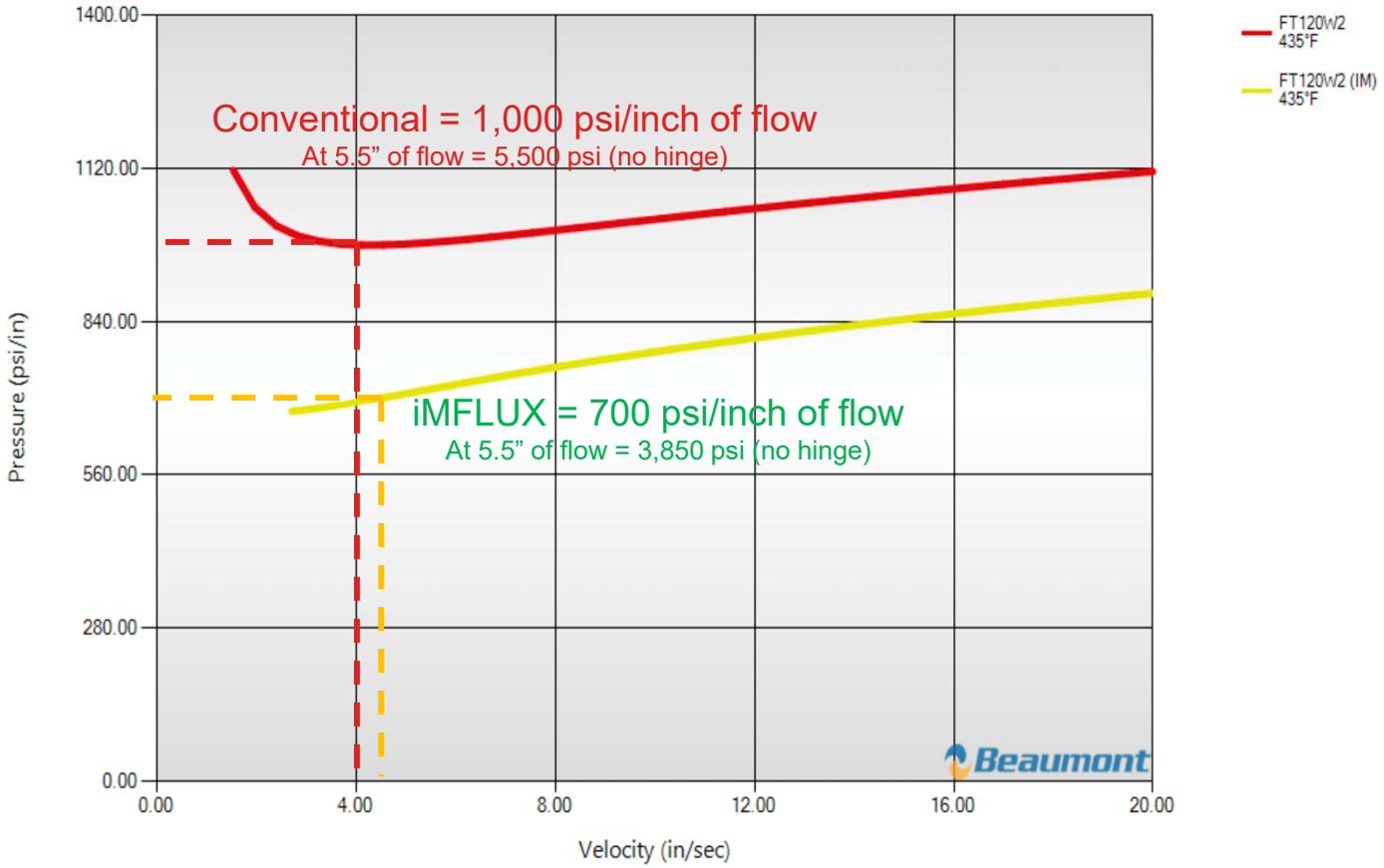


STRIP FILES & PRESSURE CURVES

1

Thermaflo

Beaumont Technologies
(alternative option)



Strip File Summary

STRIP FILES & PRESSURE CURVES

1

		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

STRIP FILES & PRESSURE CURVES

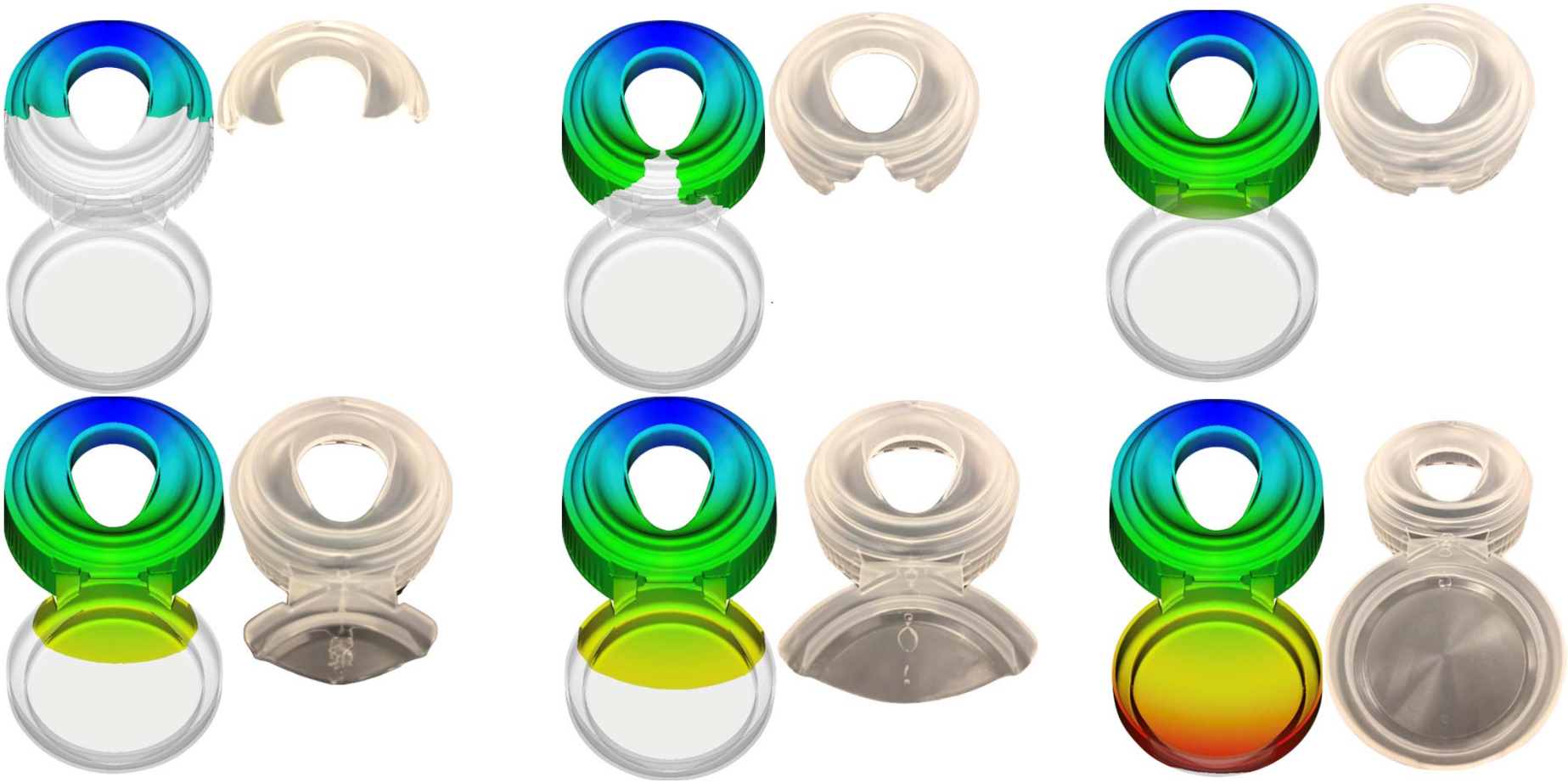
1

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.

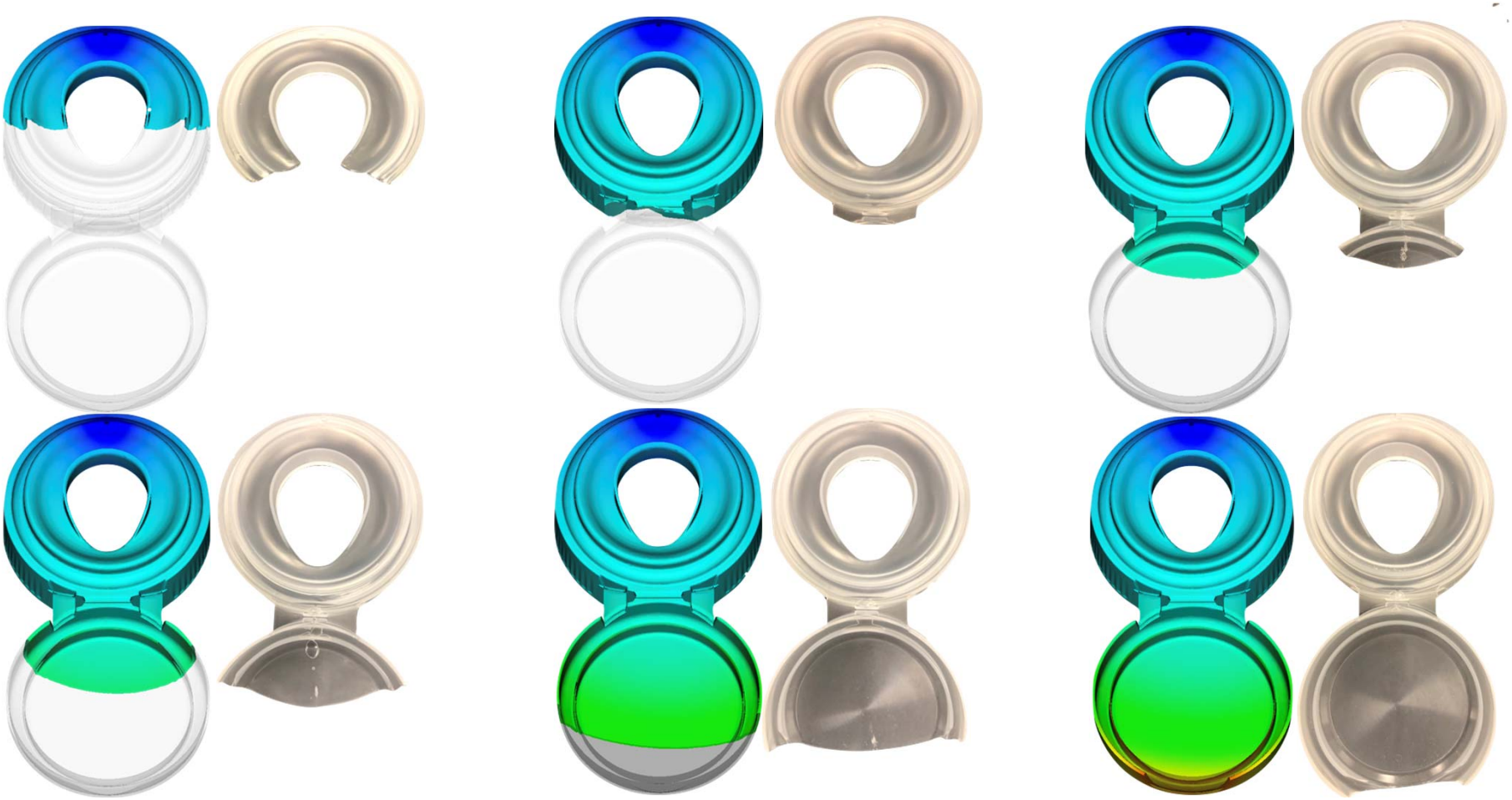
2

Full Finite Element Analysis

Conventional Fill Pattern

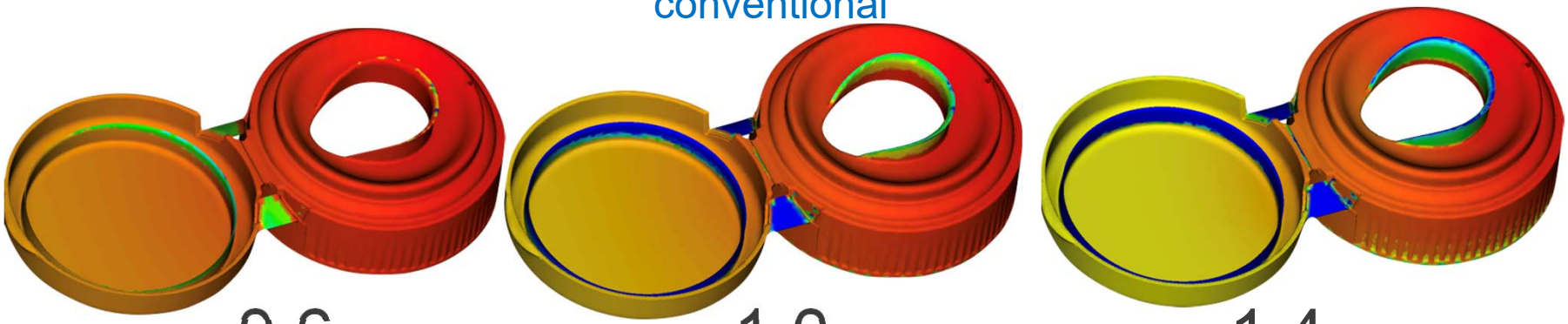


iMFLUX Fill Pattern

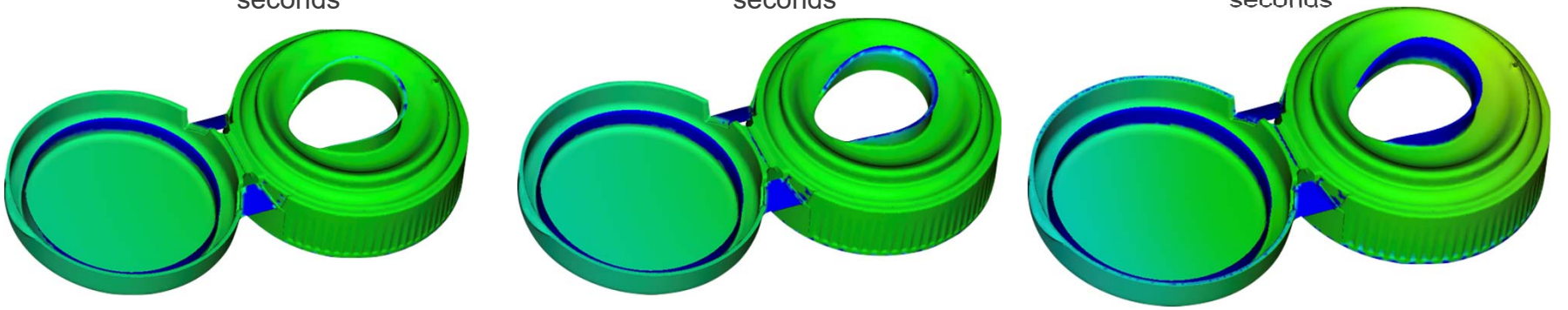


Cavity Pressure Comparison

conventional



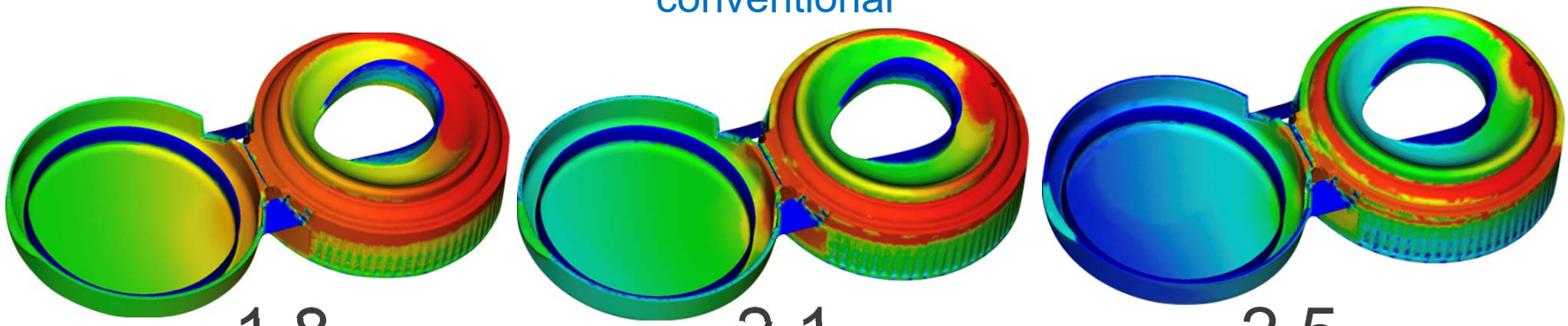
0.6 seconds — 1.0 seconds — 1.4 seconds



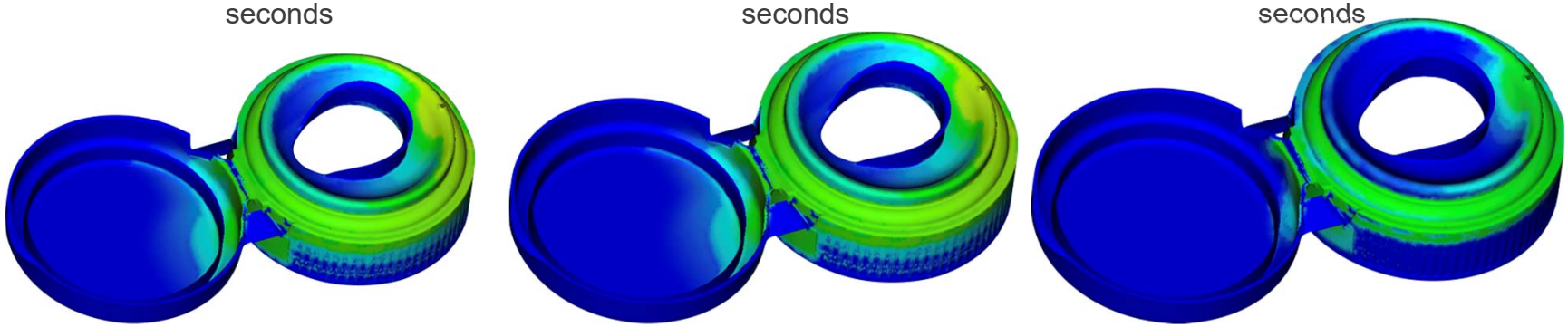
iMFLUX

Cavity Pressure Comparison

conventional

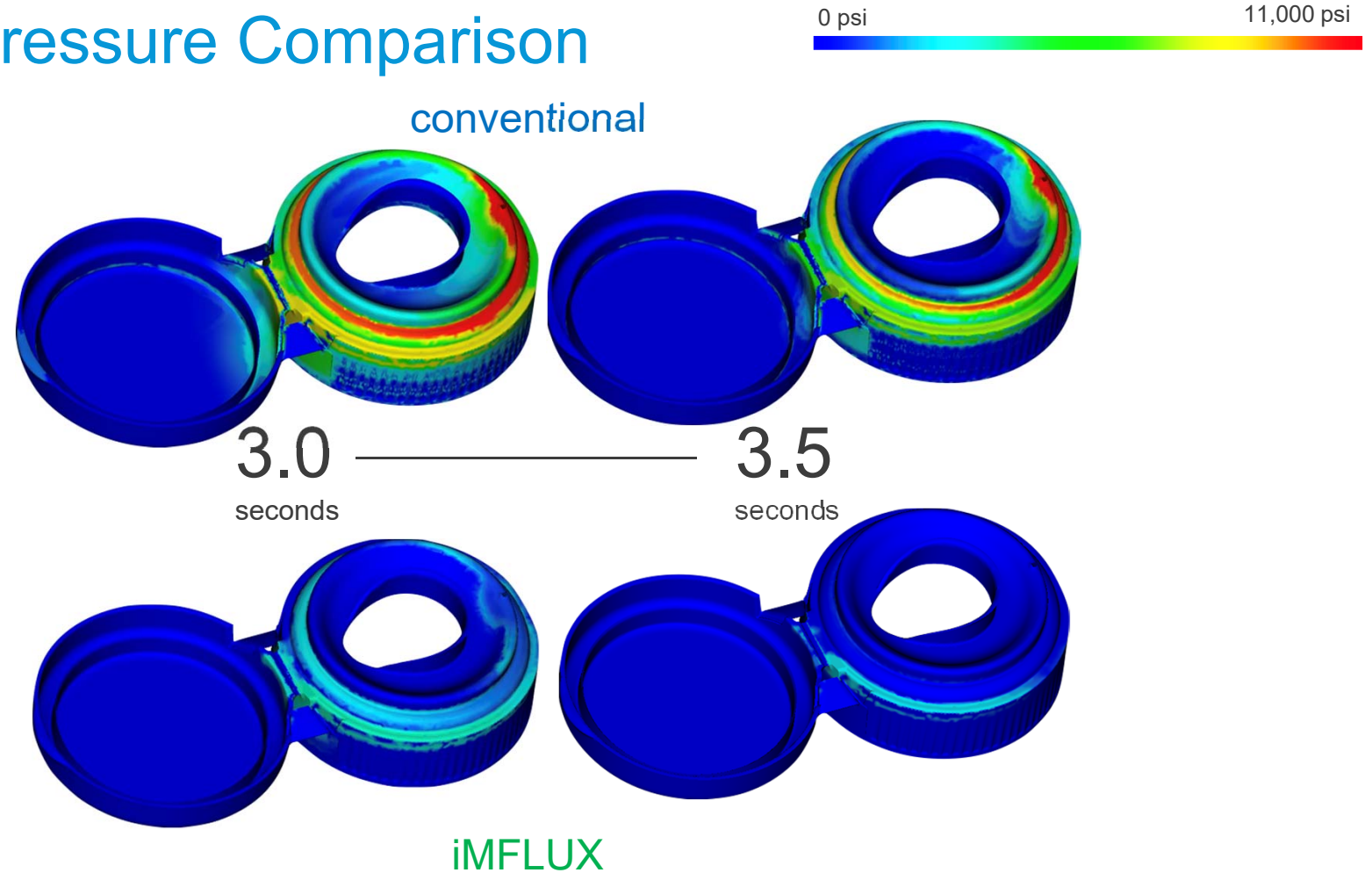


1.8 seconds — 2.1 seconds — 2.5 seconds

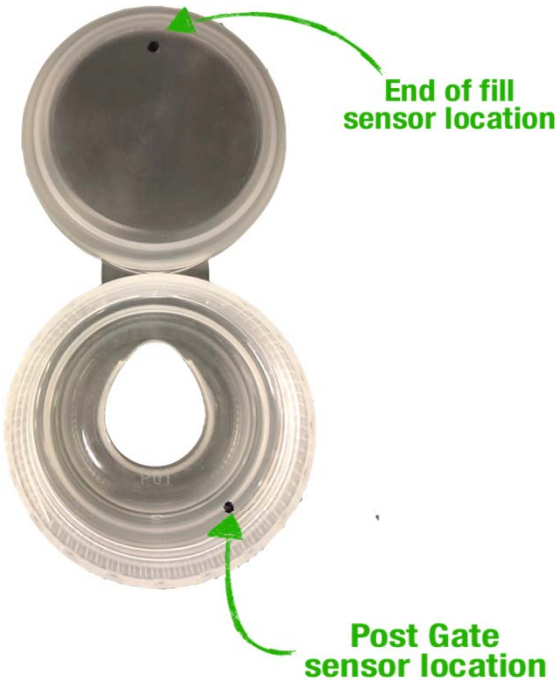


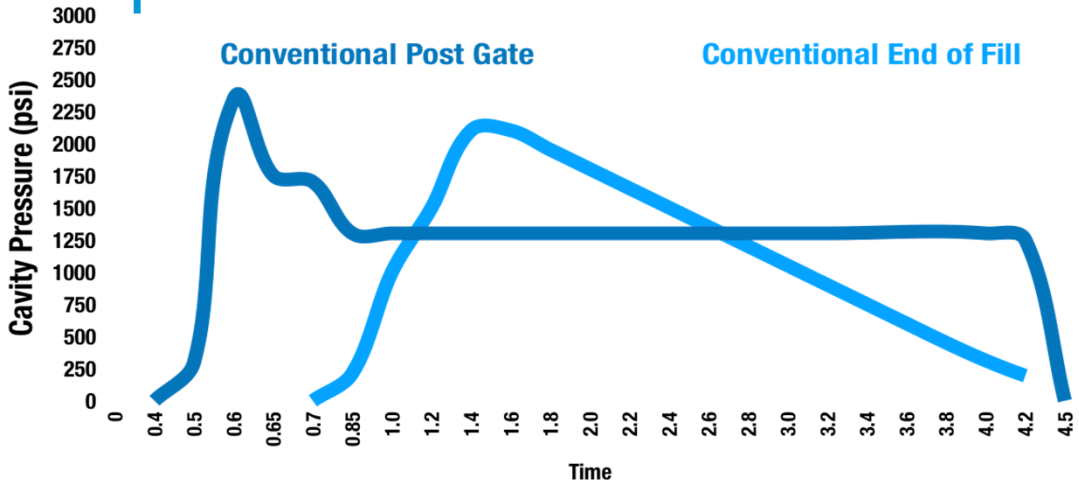
iMFLUX

Cavity Pressure Comparison



Cavity Pressure Comparisons





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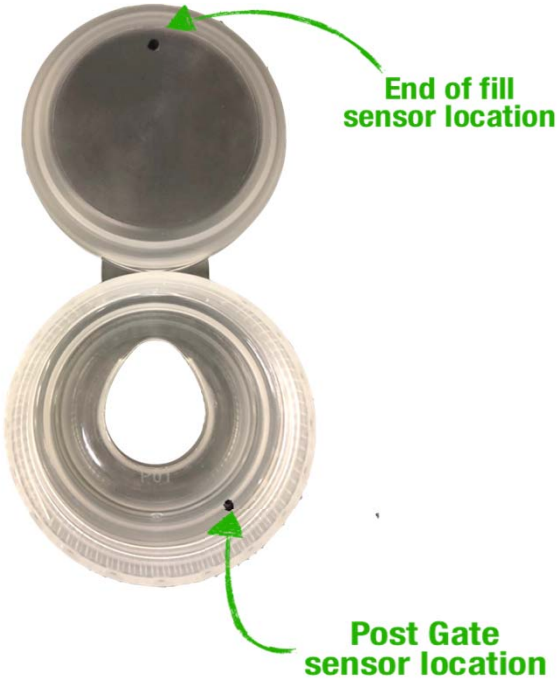
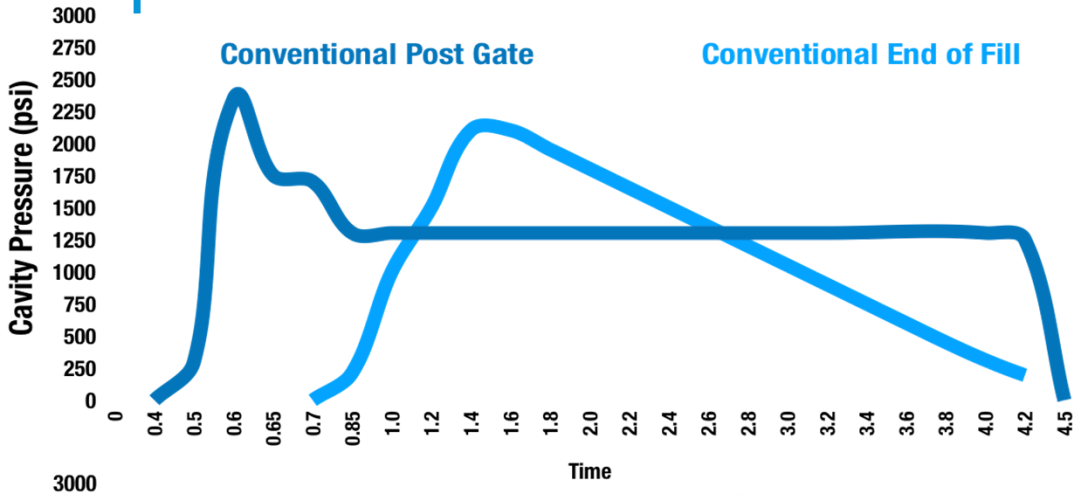
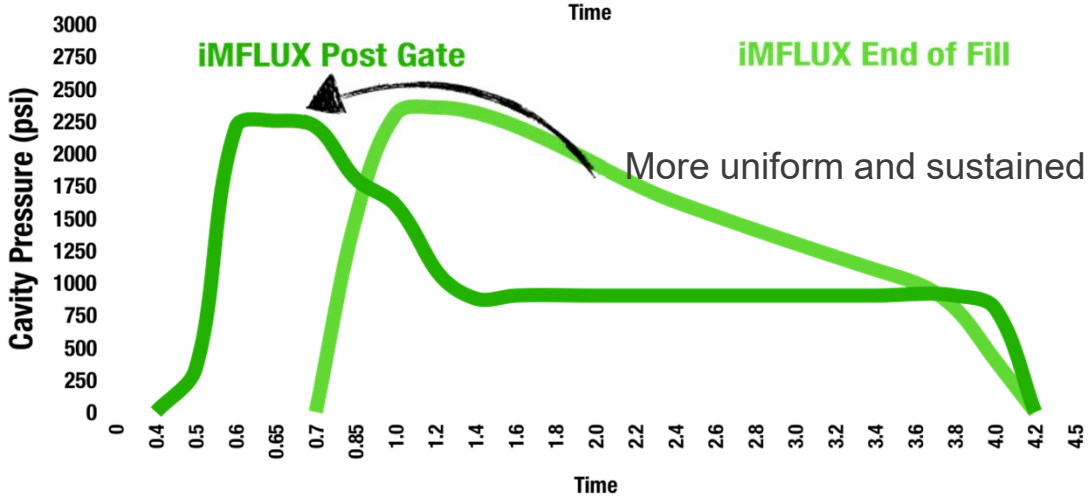
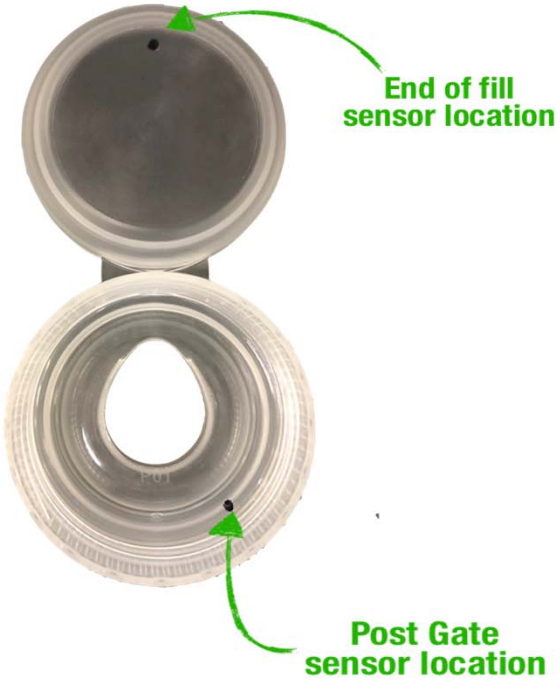


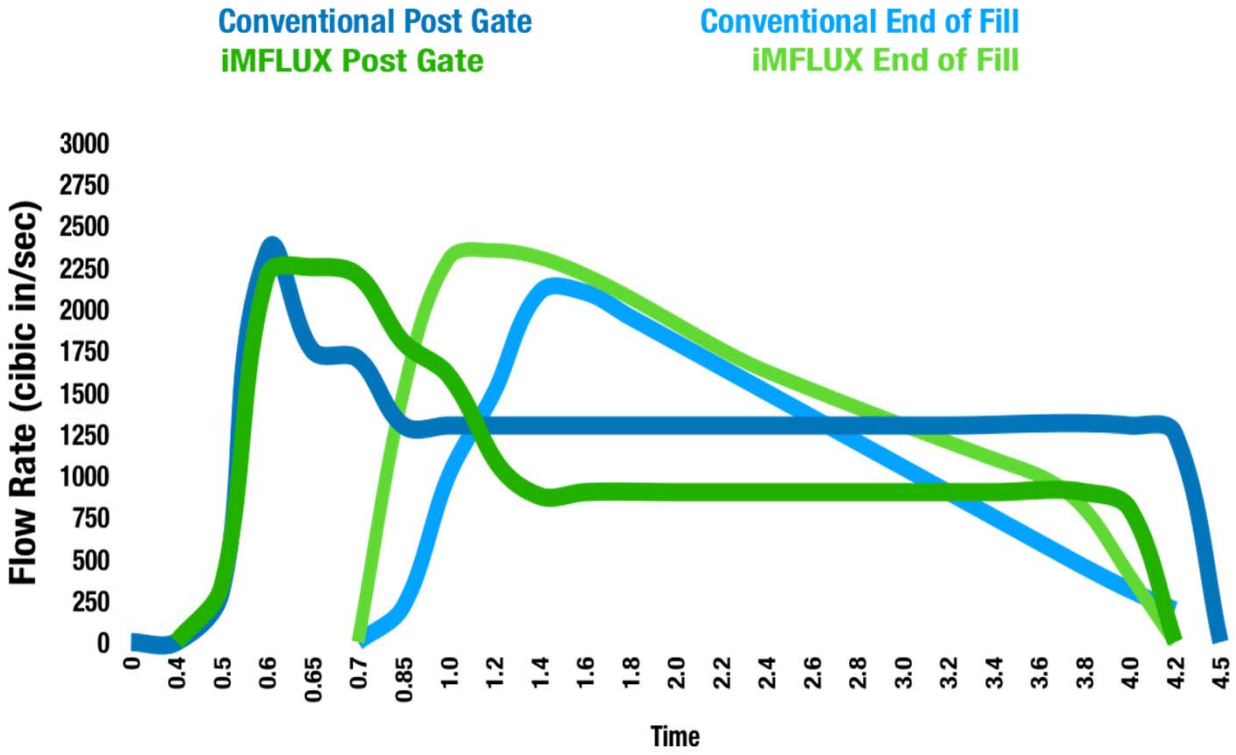




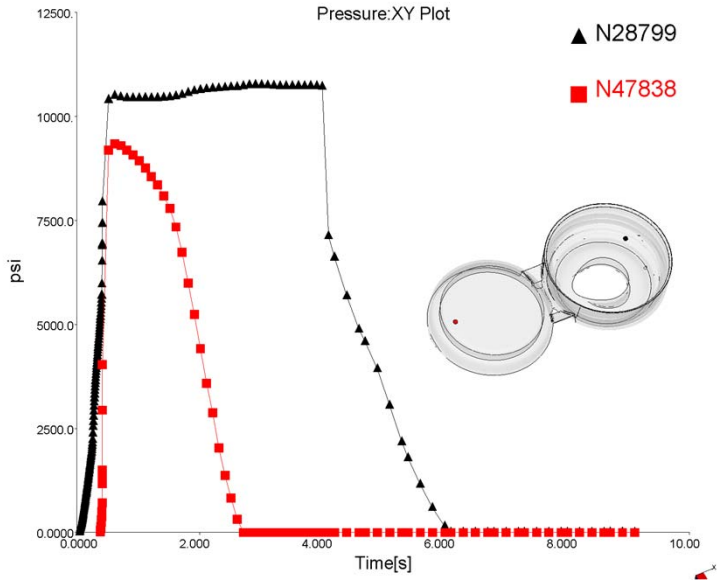
More uniform and sustained pressure

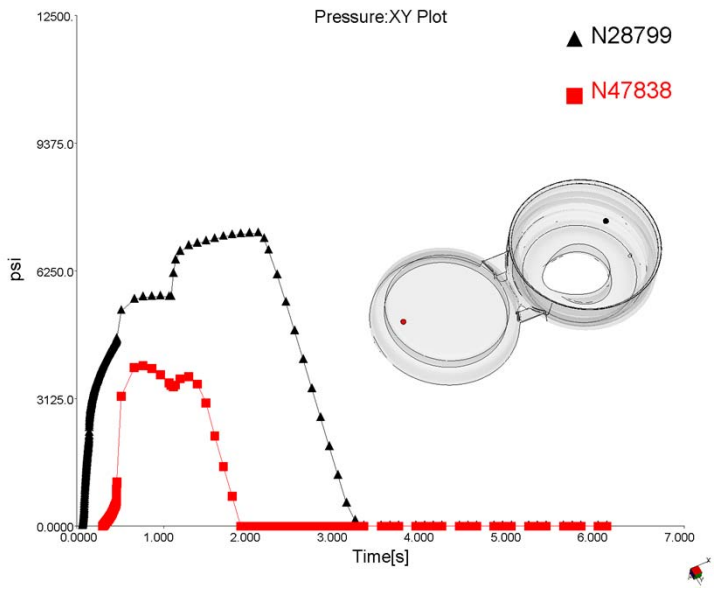
Cavity Pressure Comparisons





Cavity Pressure Comparison

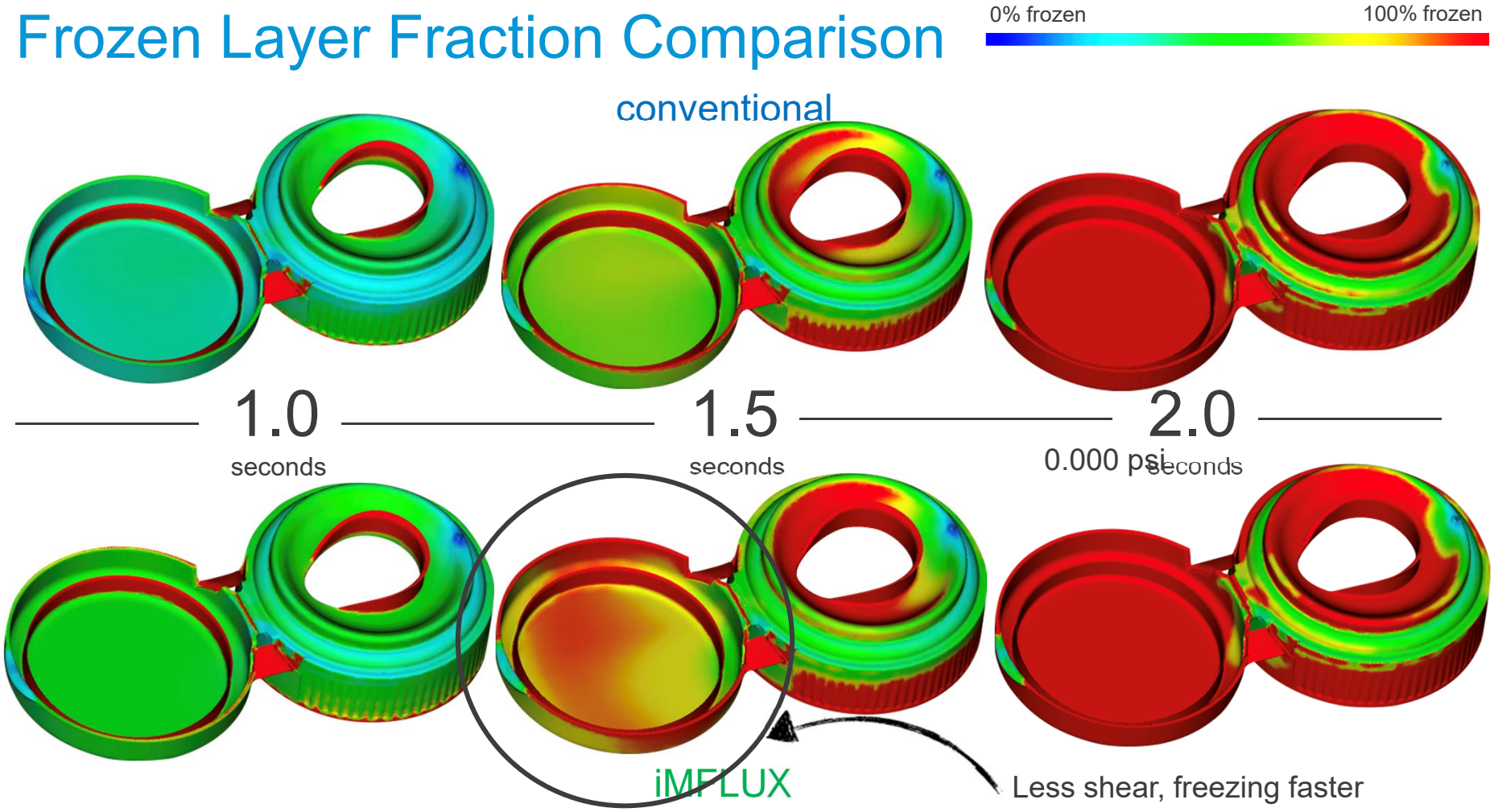




conventional

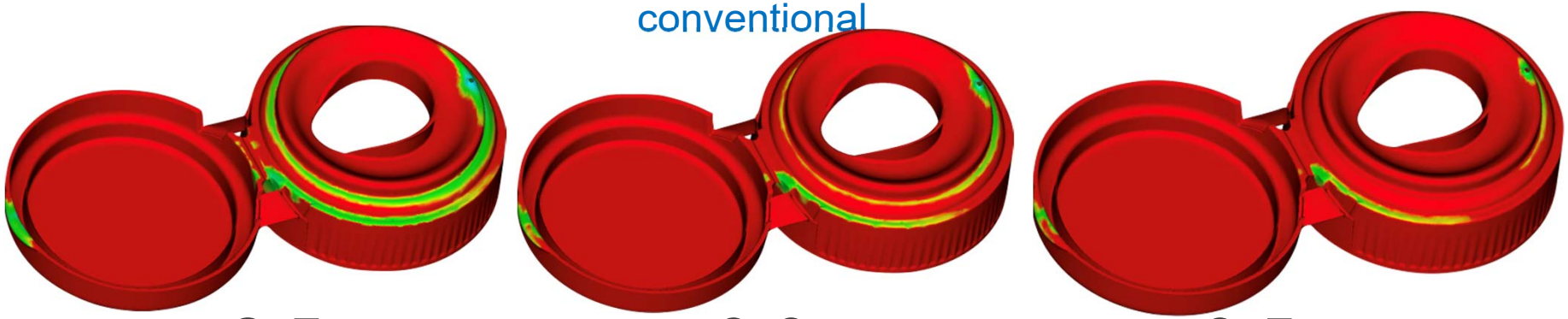
iMFLUX

Frozen Layer Fraction Comparison

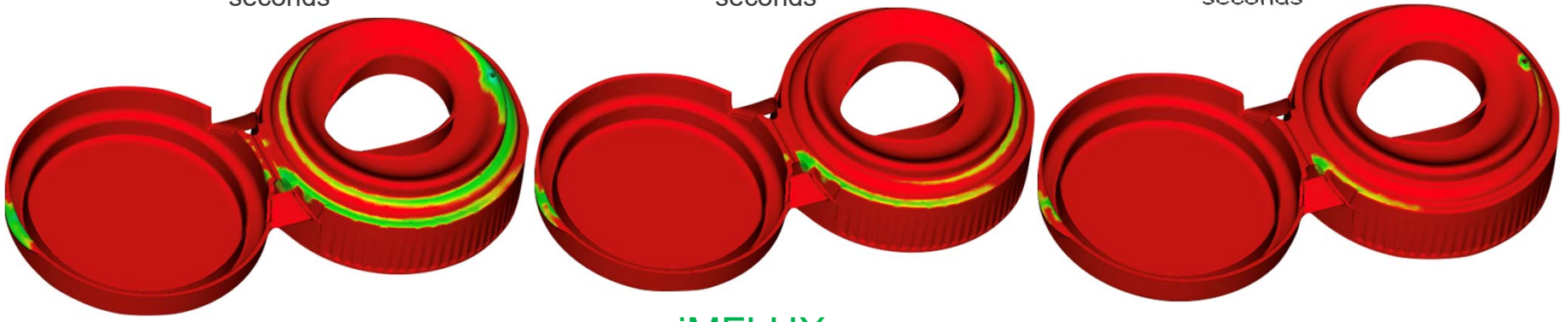


Frozen Layer Fraction Comparison

conventional

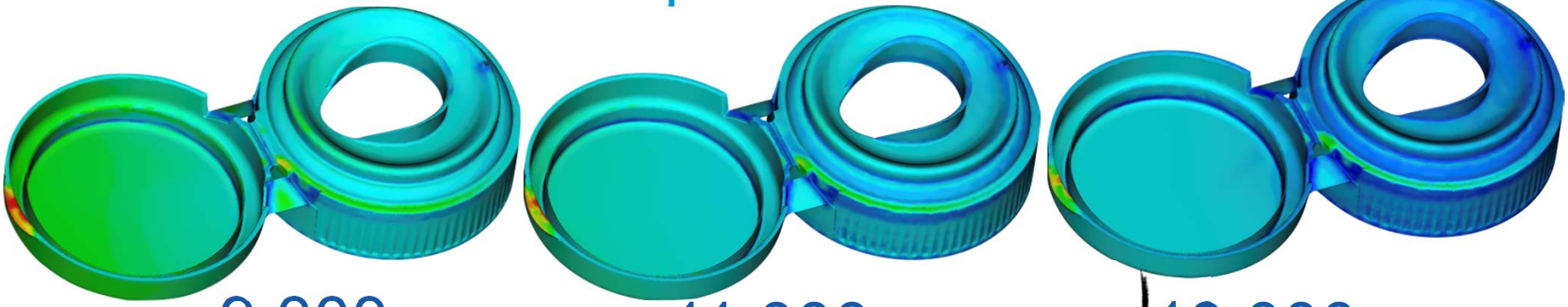


2.5 seconds — 3.0 seconds — 3.5 seconds



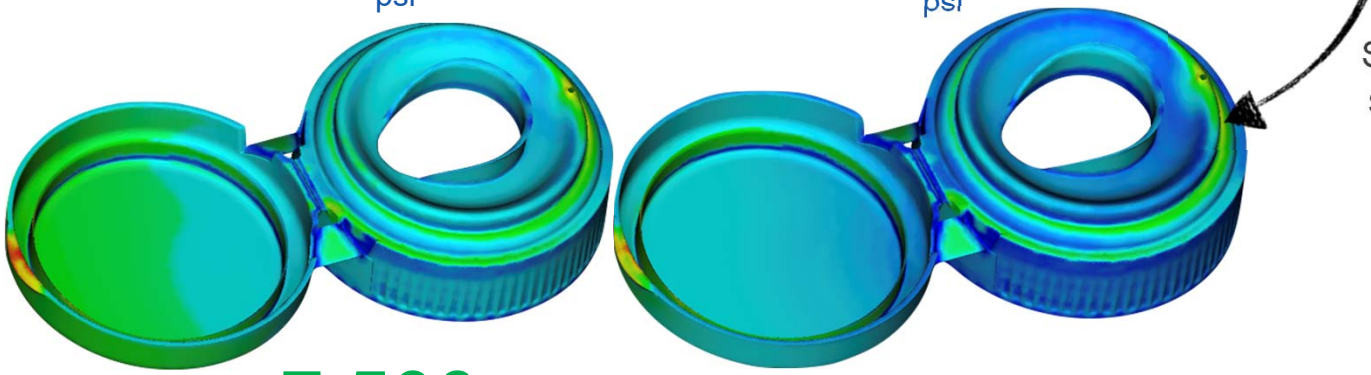
iMFLUX

Volumetric Shrink Comparisons



conventional — 9,000 psi — 11,000 psi — 13,000 psi

Similar levels of shrink variation with 3,000 psi less pressure



iMFLUX — 7,500 psi — 10,000 psi

Residual Stress Comparisons

Stress just under skin layer (highest)

Polarized light (all layers)

conventional

Stress just under skin layer (highest)

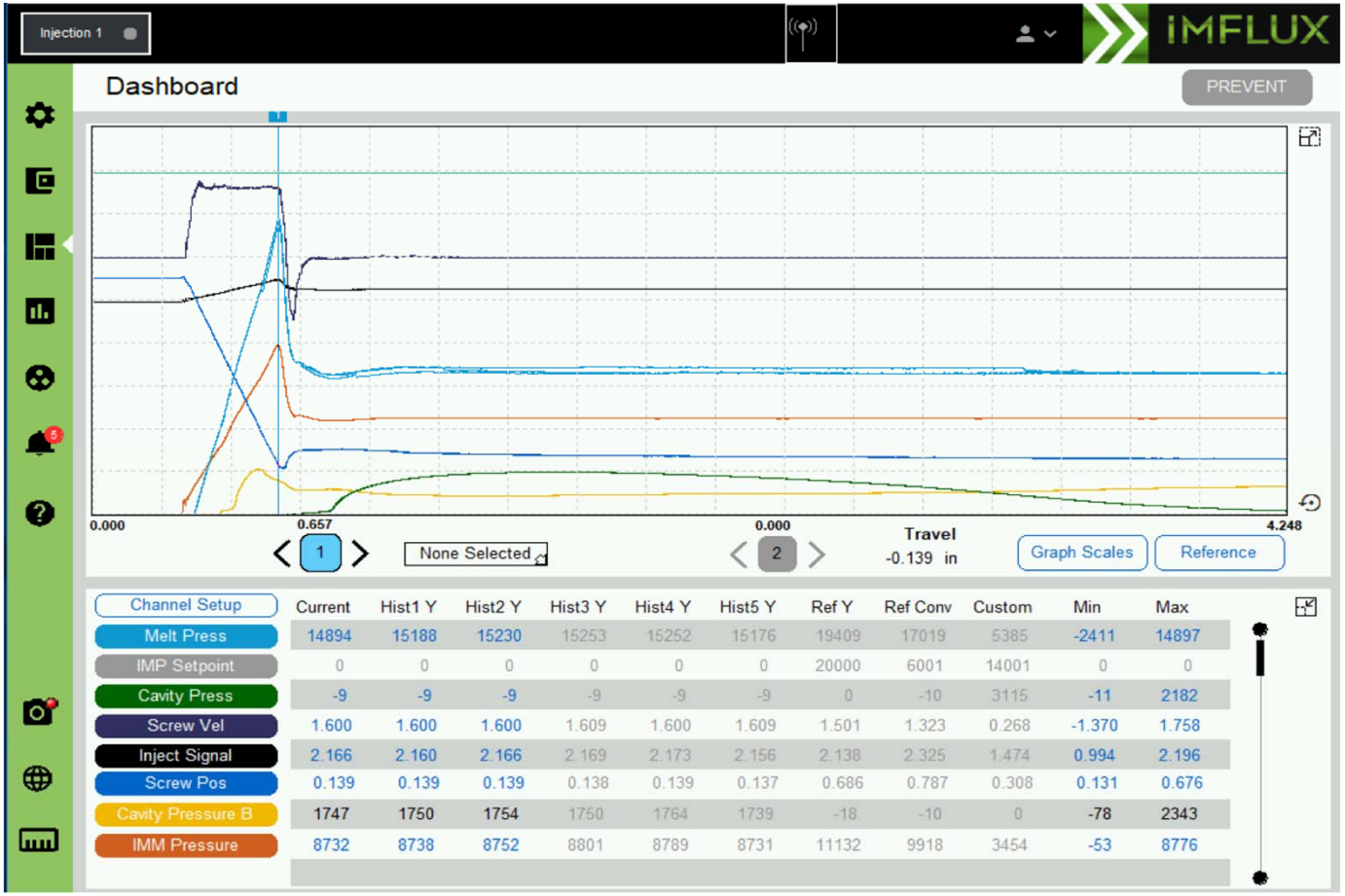
Polarized light (all layers)

iMFLUX

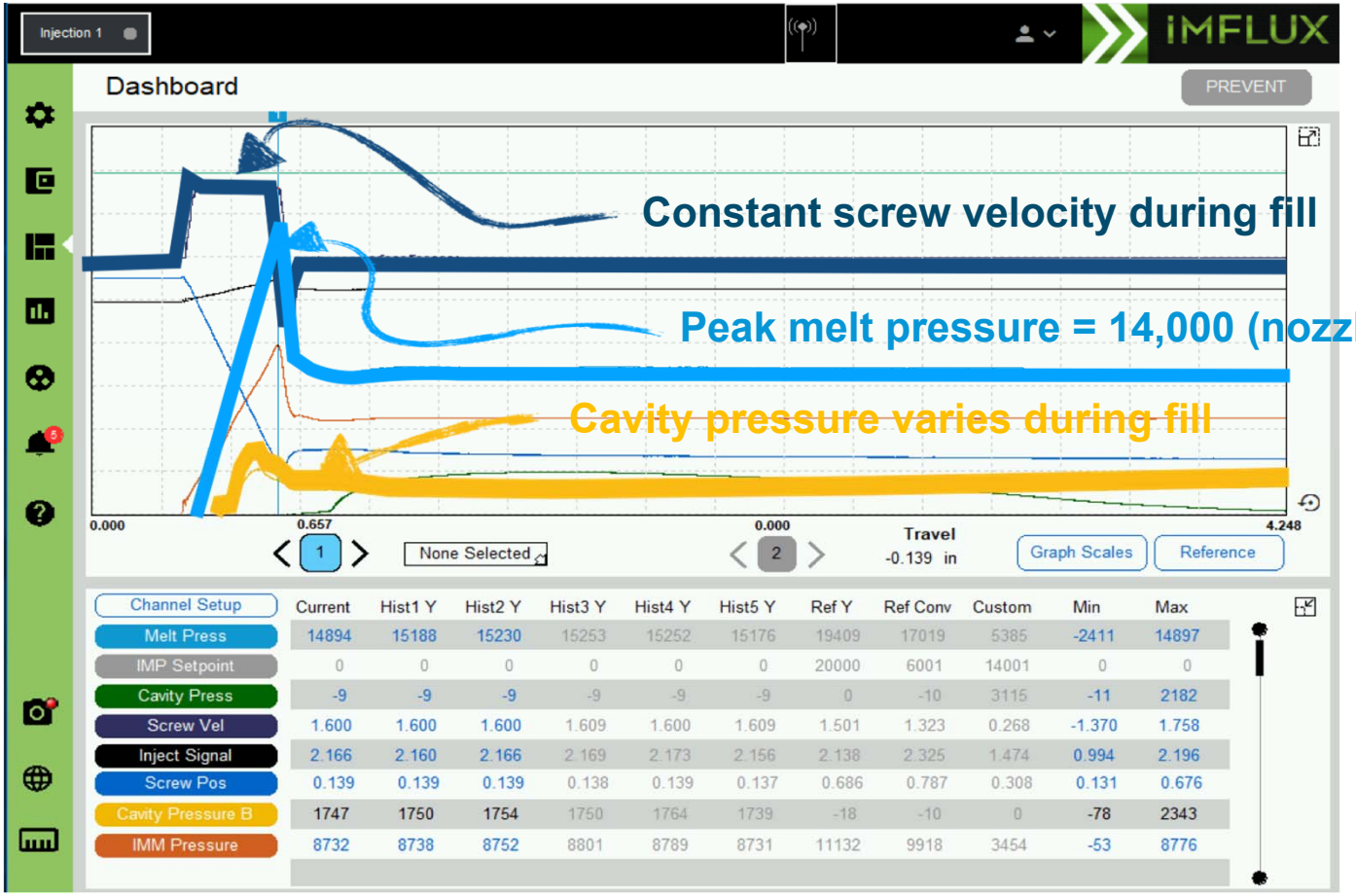
3

Molding Trial Results

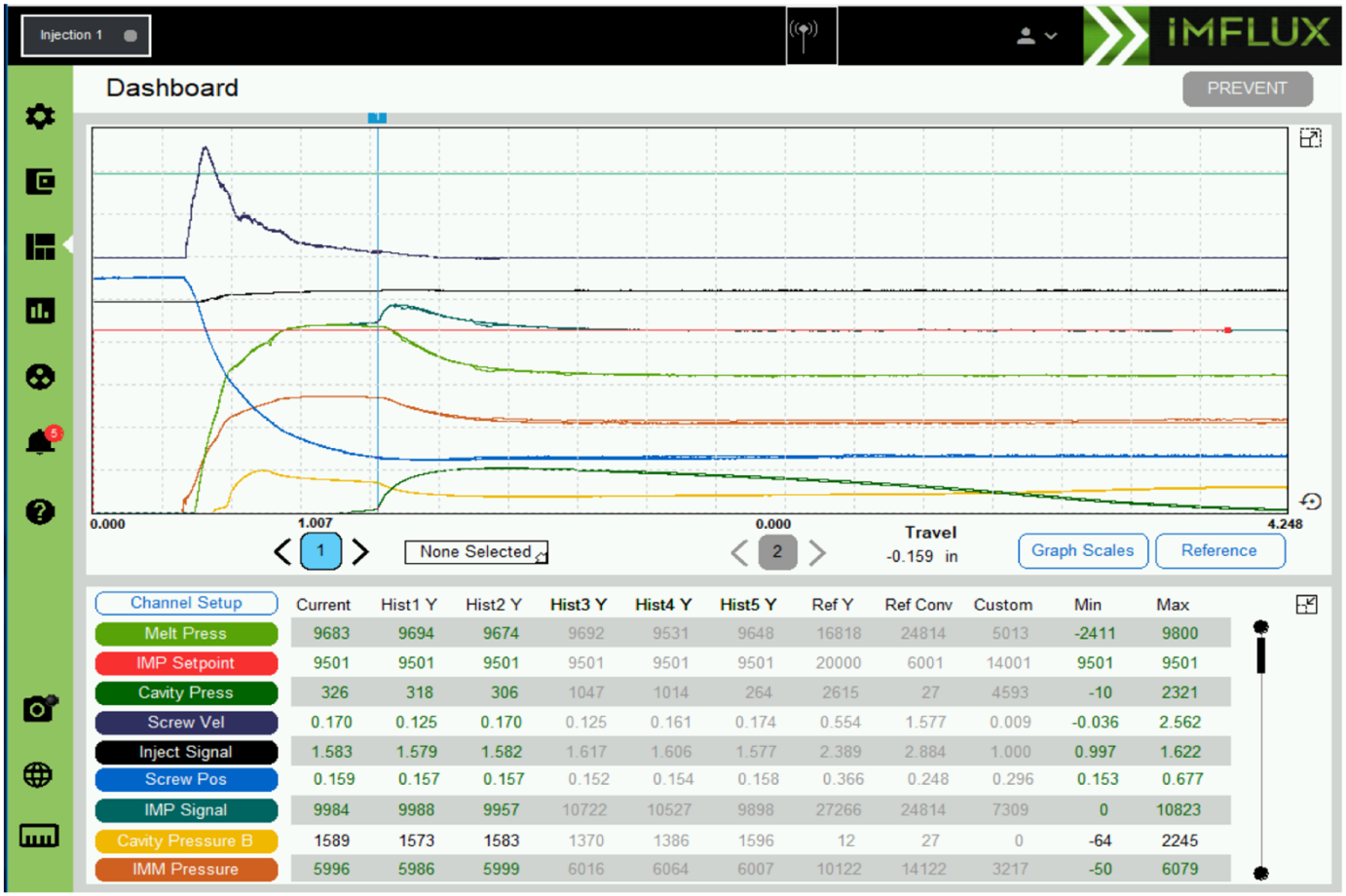
Conventional Process Curves



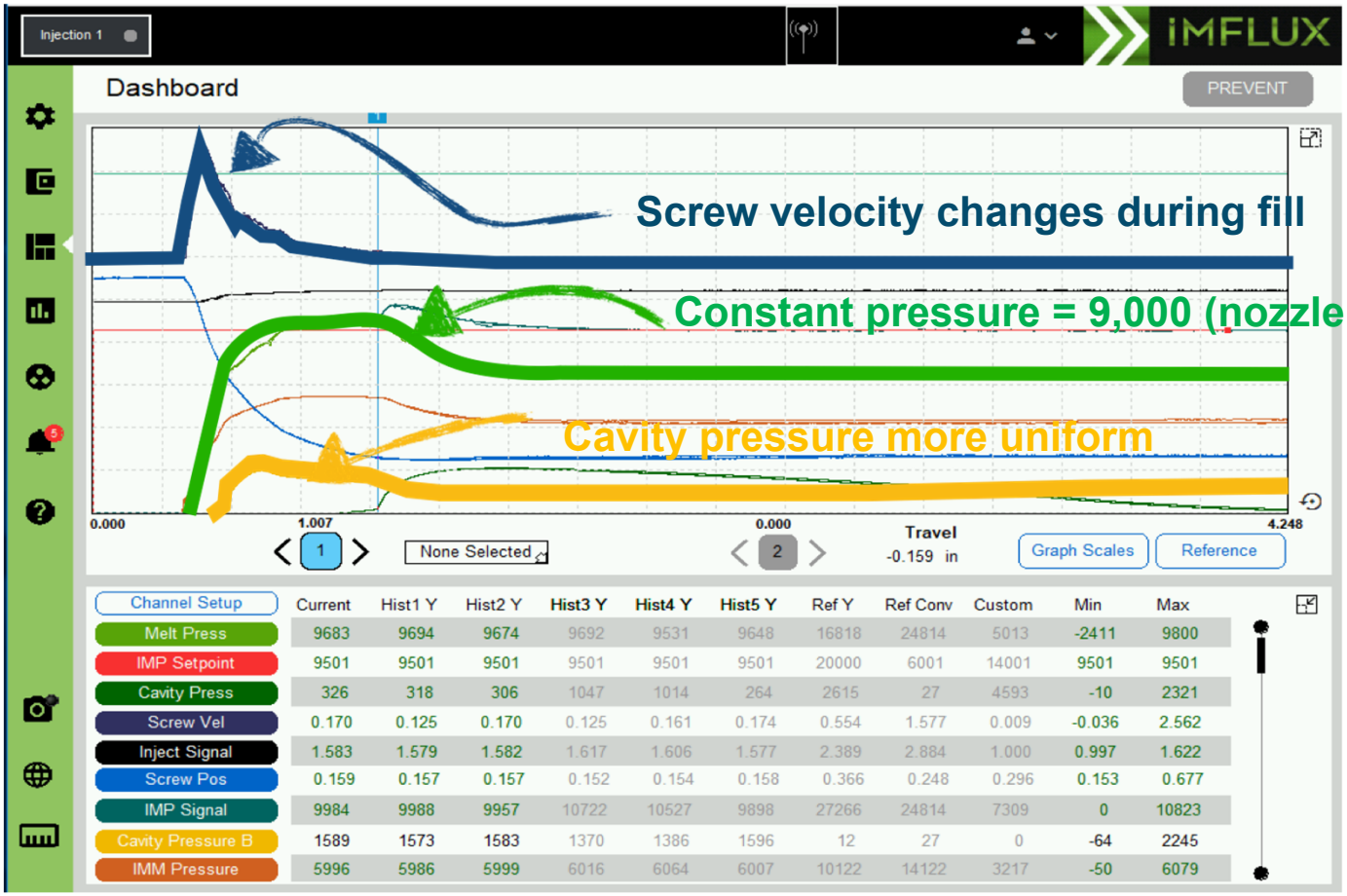
Conventional Process Curves



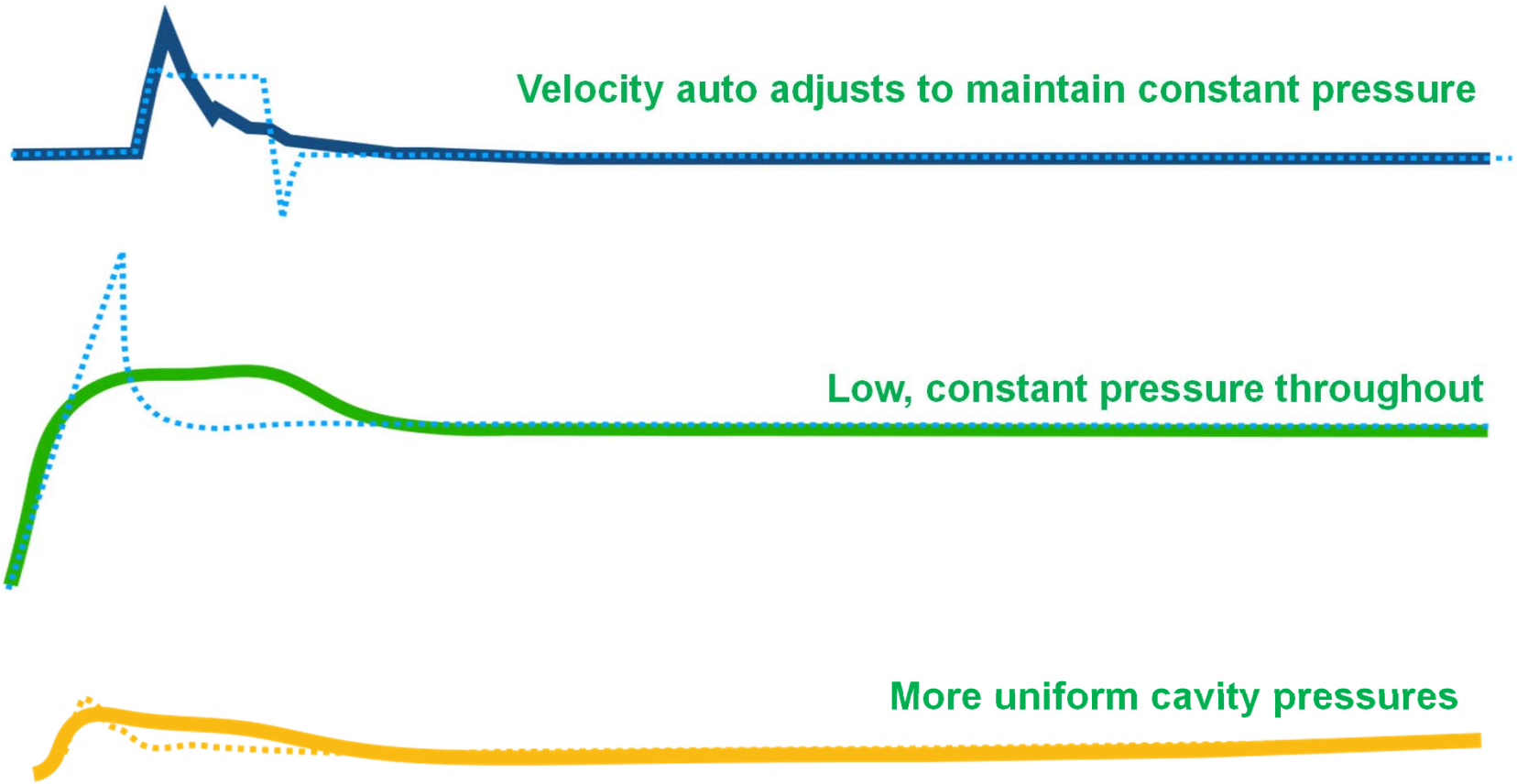
iMFLUX Process Curves



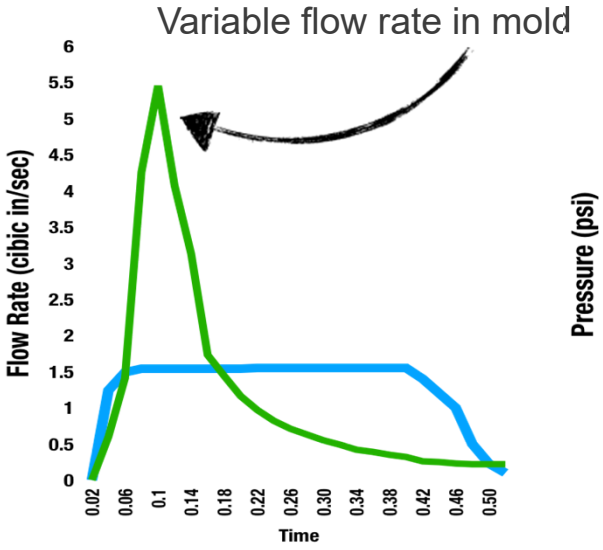
iMFLUX Process Curves



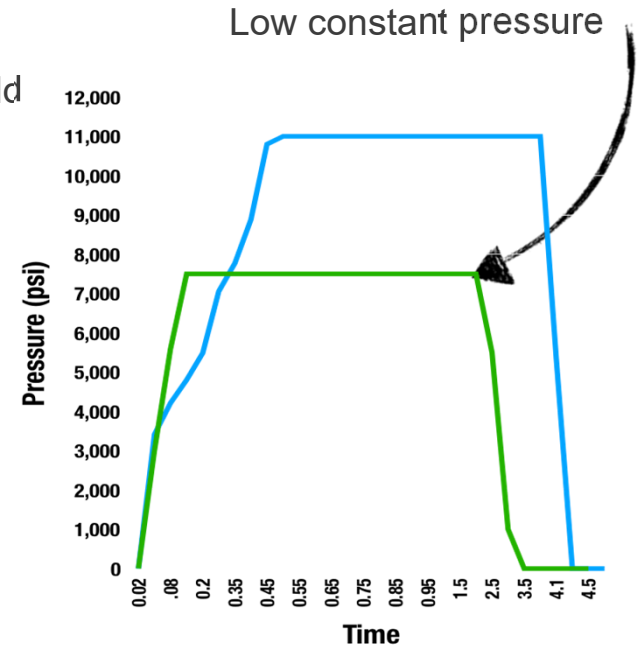
iMFLUX Process Curves Summary



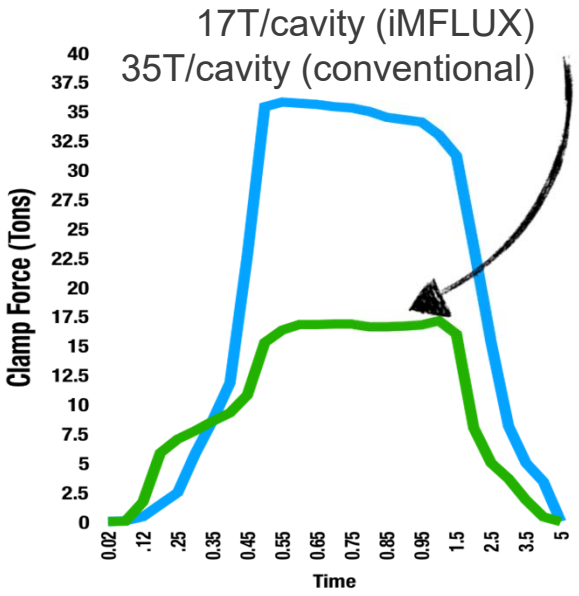
Moldflow Log File Results



Melt Front Velocities



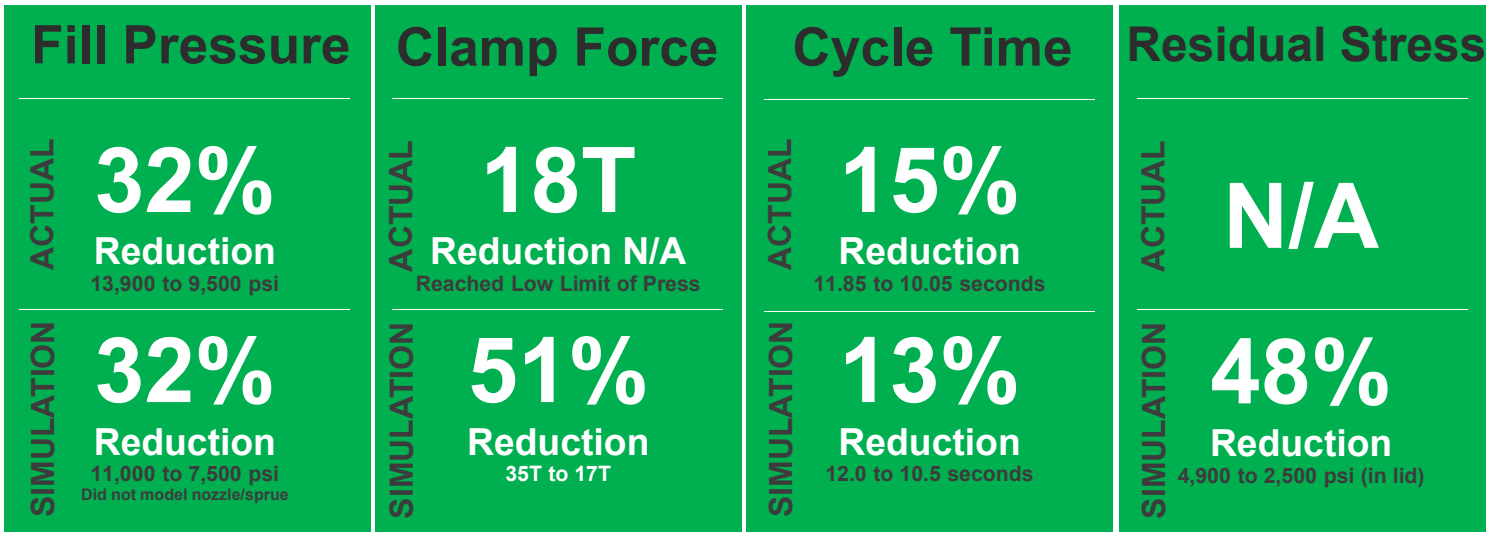
Fill/Pack Pressure Profiles



Clamp Forces

4

Summary


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

Simulation ‘Wish For(s)’

AUTO PREDICTION OF MINIMUM PRESSURE TO FILL CAVITY

PRESSURE CONTROL FILLING SIMULATION

OPTIMIZE SLOPE/RAMP AT START OF PRESSURE CURVE

THANK YOU