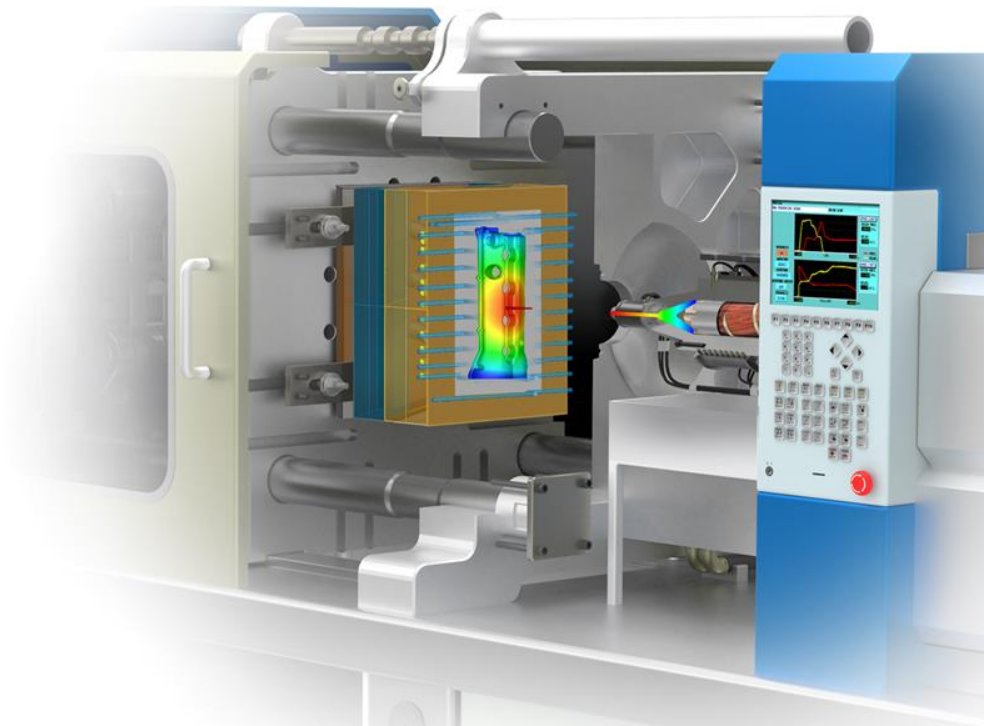


What's New in Moldex3D R17

Version: R17 OR



Outline

1. Studio

- Enhanced Usability
- New Capability
- Performance

2. Solver Capability

- Solver Enhancement
- Advanced Analysis
- Machine Response & Characterization
- Fiber Analysis

3. Molding Innovation

- RTM Solver Capability
- Foaming Molding Solution
- Other Molding Types

Outline

4. Pre/Post-processing Tools

- CAD & Mesh Tool
- Meshing Kernel
- Modeling Wizard

5. Usability & Database

- Speeding Up Calculation
- Interface & Integration
- Database Update

Supported Platforms

- > Moldex3D supports Windows 64-bit platform for all purposes such as pre-processing, solving and post-processing, and Linux platform is supported as calculation resource
- > Moldex3D Mesh R17 for Rhino5 64-bit platform only

| Platform | OS | Remark |
|------------------|--|--|
| Windows / x86-64 | Windows 10 series Windows 8 series Windows 7 series Windows Server 2012 R2 Windows Server 2016 | Moldex3D R17 is certified for Windows 10 |
| Linux / x86-64 | CentOS 6 series CentOS 7 series RHEL 6 series RHEL 7 series SUSE Linux Enterprise Server 12 | Linux platform is used for calculation resource only. Moldex3D LM, Pre-processor and post-processor do not support Linux platform |

New Module and Terminology

- > Moldex3D Studio is now the standard Moldex3D platform



- > **New Terminology:** Barrel Compression, Machine Response
- > **New License:** EnhancedFiber, MachineResponse

Studio – New Standard Platform

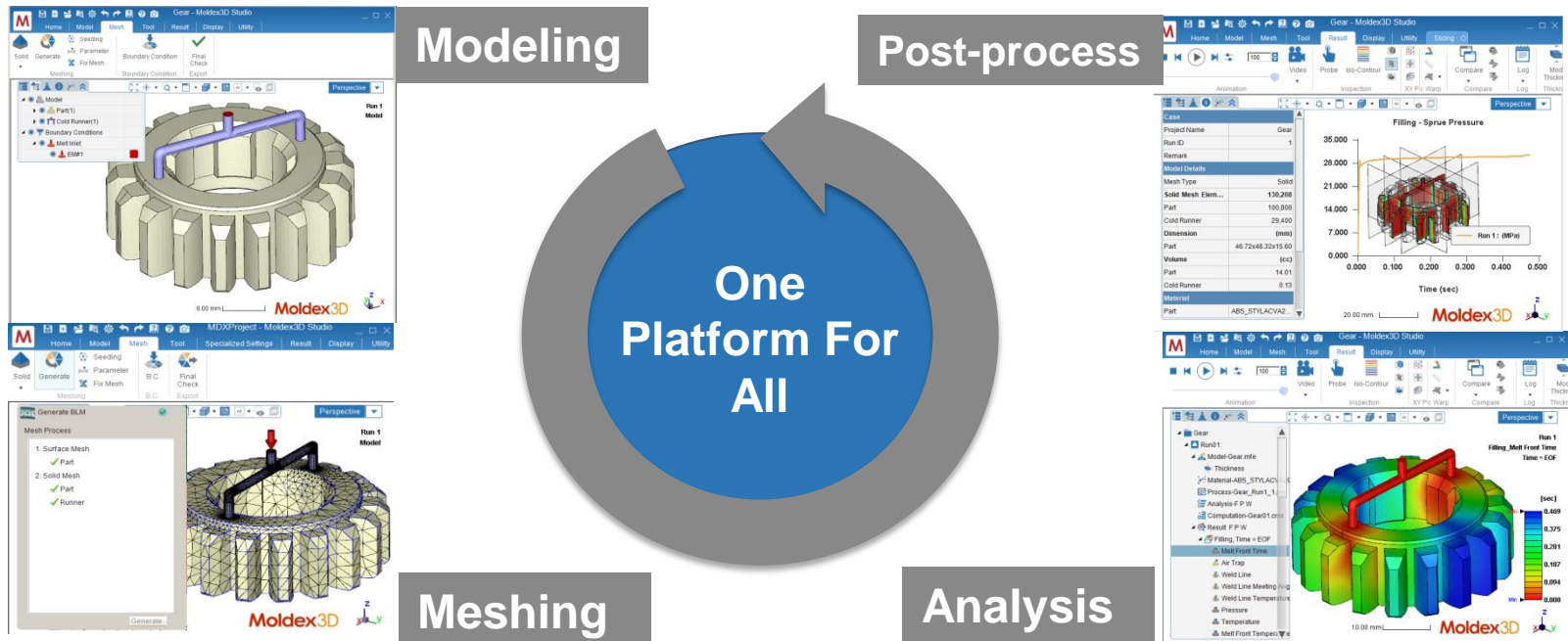
Enhanced Usability

New Capability

Performance

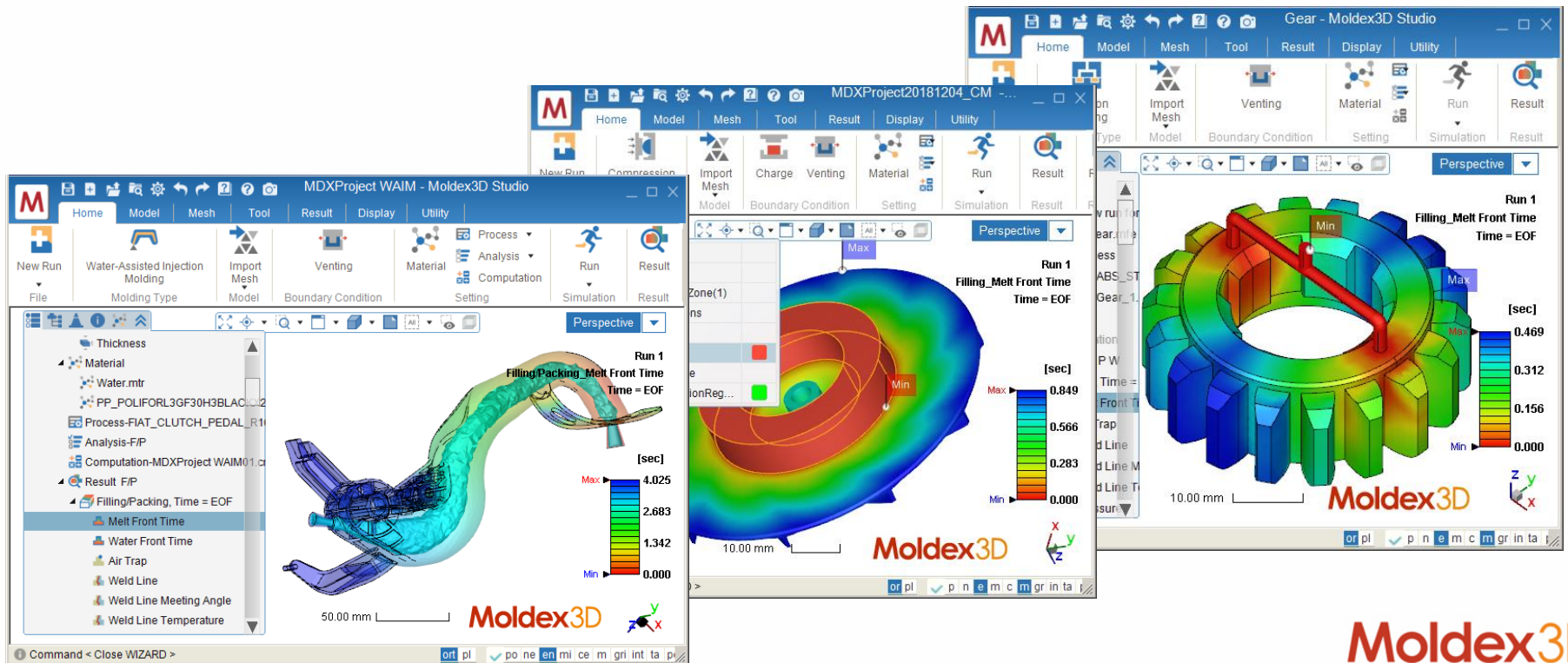
Enhanced Usability: All Tasks in One Platform

- > Allow going back anytime to pre-processing stage
 - Consistent model and project information through out
 - Provide option to copy or replace current project and model
- > **Benefit**
 - Fully integration through modeling tools, analysis setup and post-processing tools for user to switch anytime when needed



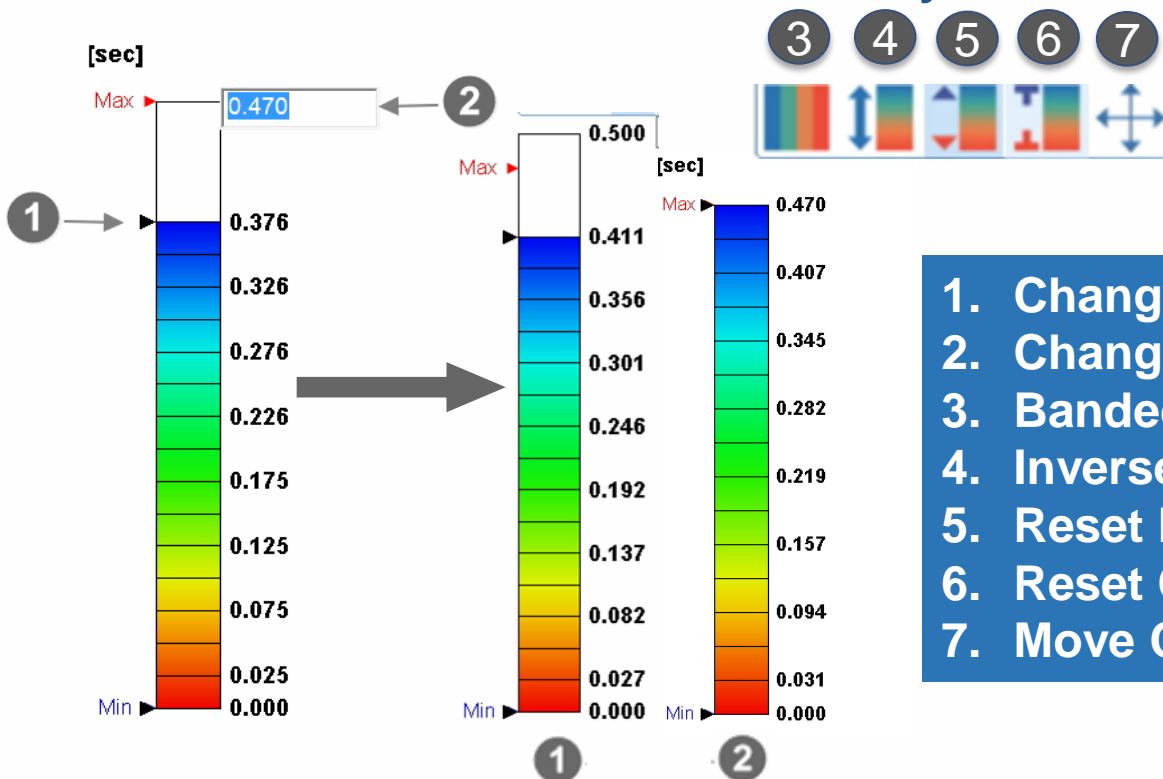
Enhanced Usability: Variety of Molding Simulation

- > Support a variety of molding project and simulation
 - Co-injection Molding (CoIM), Bi-injection Molding (BiIM) 、 Gas/Water Assisted Injection Molding (GAIM/WAIM),
 - Powder Injection Molding (PIM), Foam Injection Molding (FIM), Chemical Foaming Molding (CFM),
 - Compression Molding (CM), Injection Compression Molding (ICM)



Preference Setting : Color Legend

- > Directly and Intuitively make modification on color bar:
 - Provide color bar option when moving cursor on it
 - Allow pulling color bar to change its location (left/right)
 - Allow pulling Max/Min mark to change color fill range
 - Click and enter value to modify bar Max/Min value

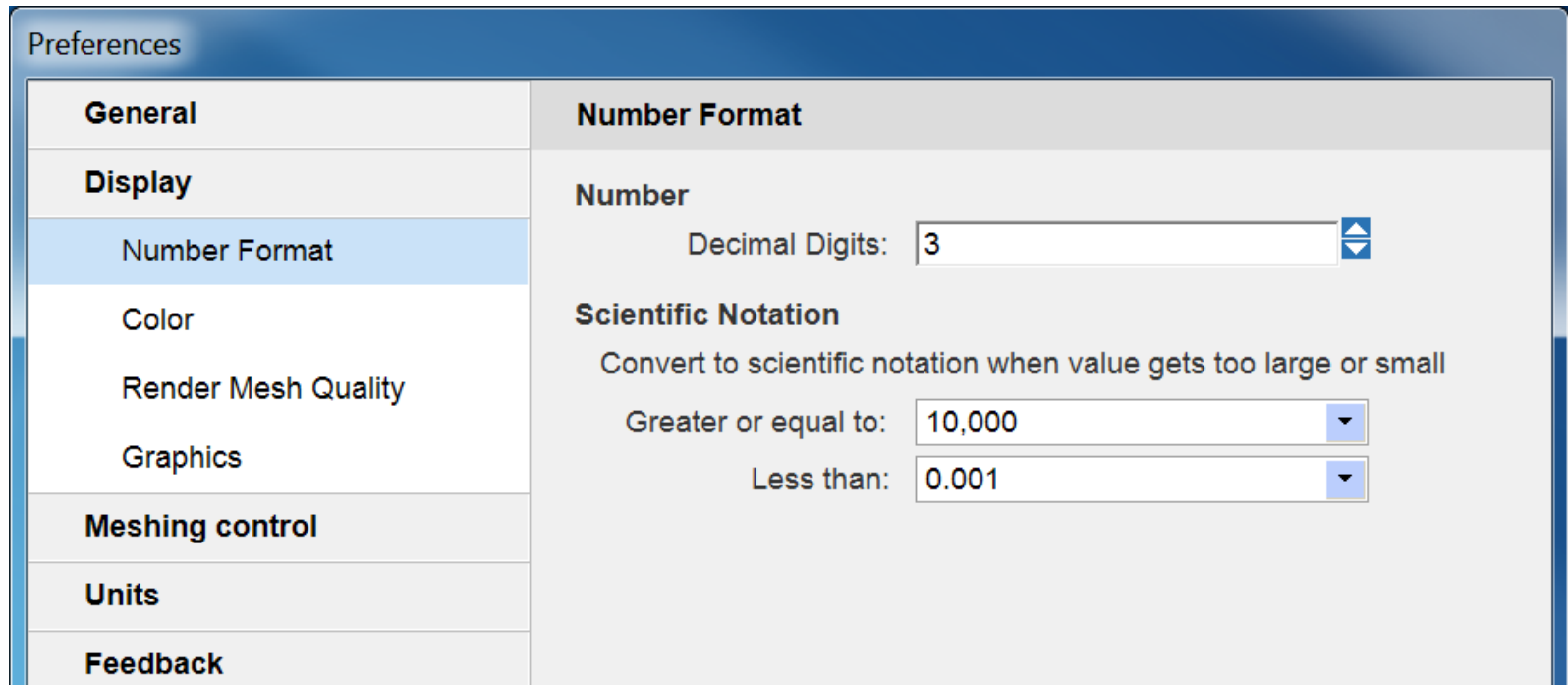


1. Change Fill Range
2. Change Color Bar Range
3. Banded Distribution
4. Inverse Color Legend
5. Reset Fill Range
6. Reset Color Bar Range
7. Move Color Bar (Left/Right)

Preference Setting : Global Parameter

Preference of Number Format

- **Modify Scientific Notation/ Decimal Digits display in Preferences**
- **Default Decimal Digits = 3**
- **Default to show Scientific Notation for value between 10^{+4} to 10^{-3}**
- **Benefit:** Customized number format to conform user's preference



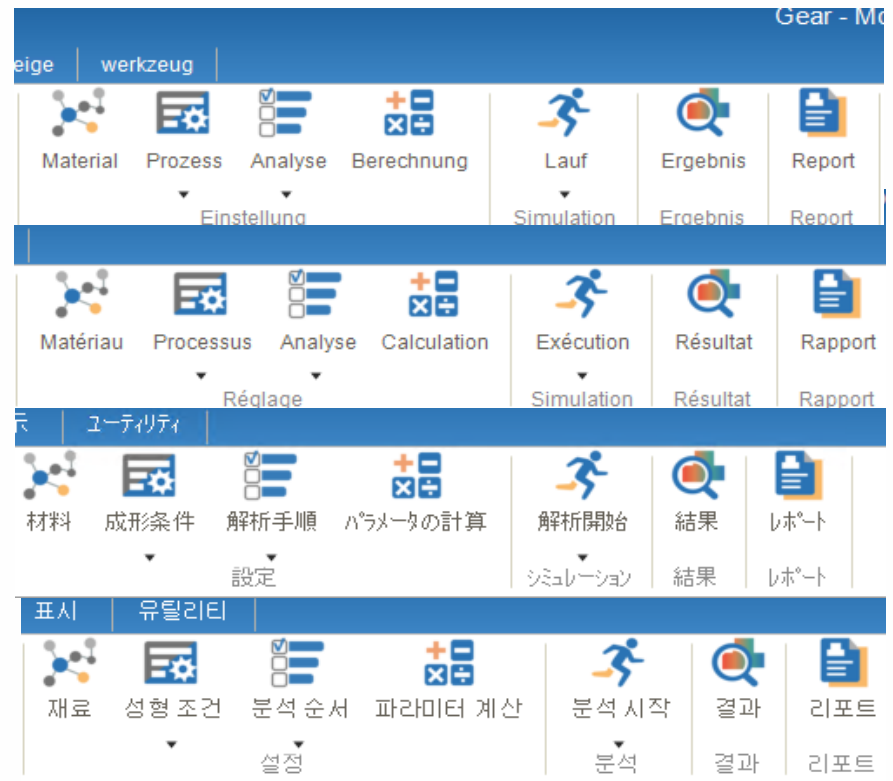
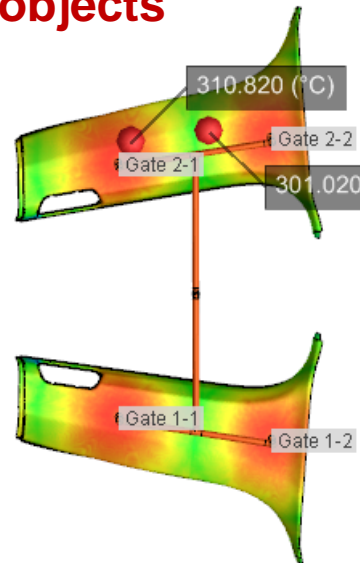
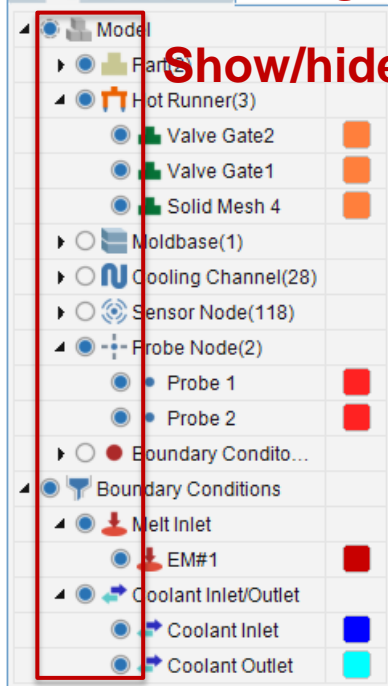
Other Usability Enhancements in Studio

- > Allow Show/hide control in Display Window such for Melt Inlet/Coolant Inlet/Gate/Valve gate/Sensor Node/Part IDs
- > Allow saving and editing preference view option
- > Allow Language Pack download for Multi-Language interface



Show/hide marks

Show/hide objects



Language Packs will be provided with Service Pack

Moldex3D

Studio – New Standard Platform

Higher Usability

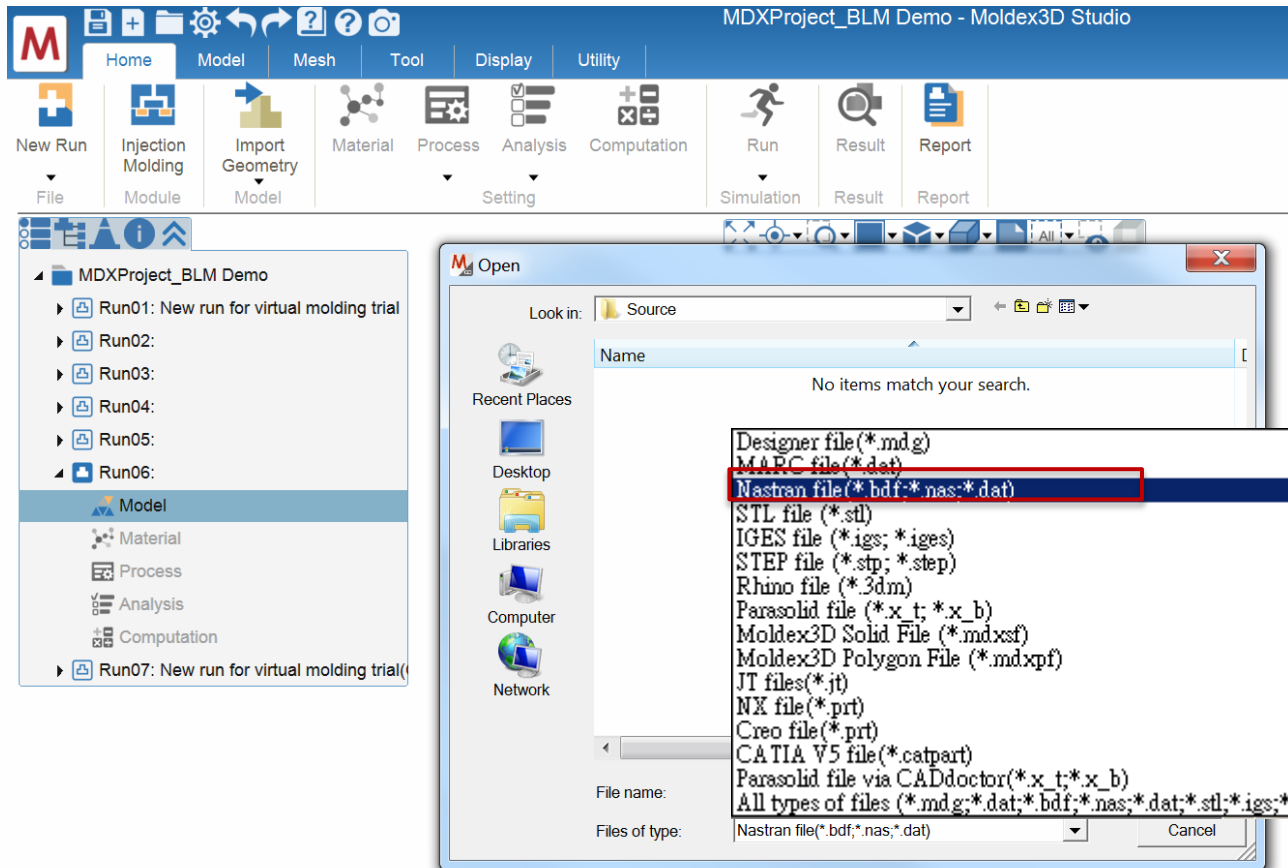
New Capability

Performance

CAD Tool: Import of Nastran BDF file

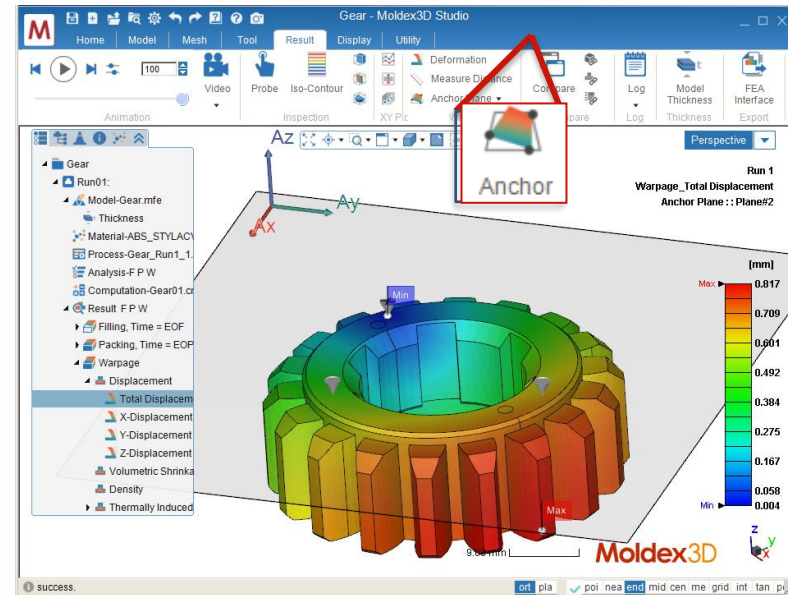
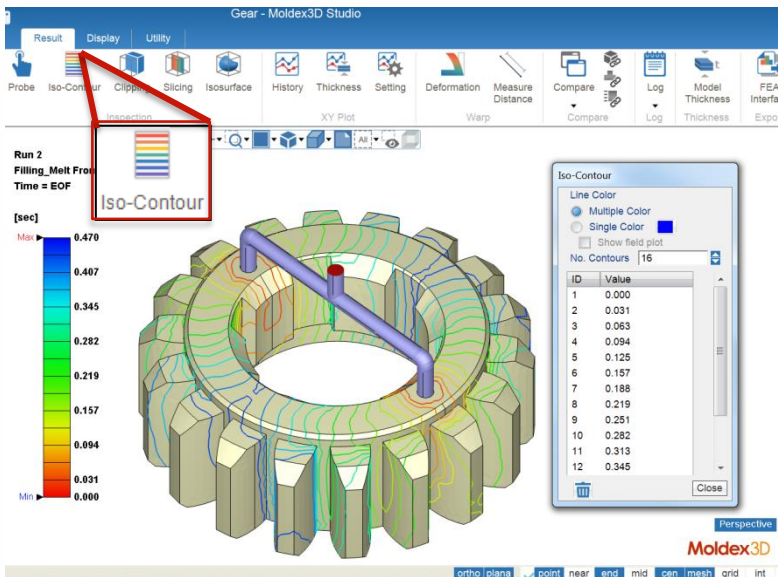
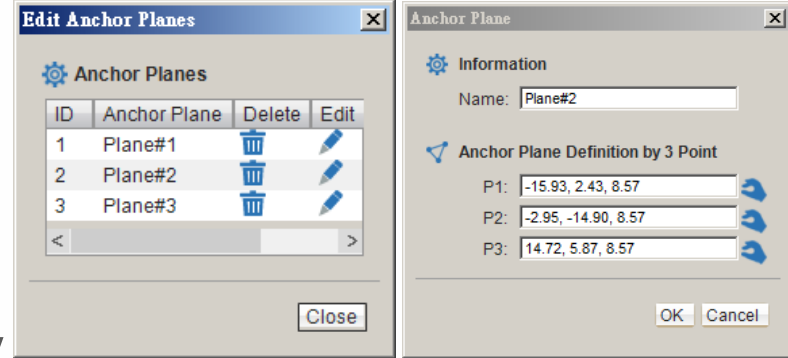
Support BDF format surface mesh file

- Import Nastran BDF for surface mesh and then continue with solid mesh generation in Moldex3D
- **Benefit:** Convenient workflow for Nastran users



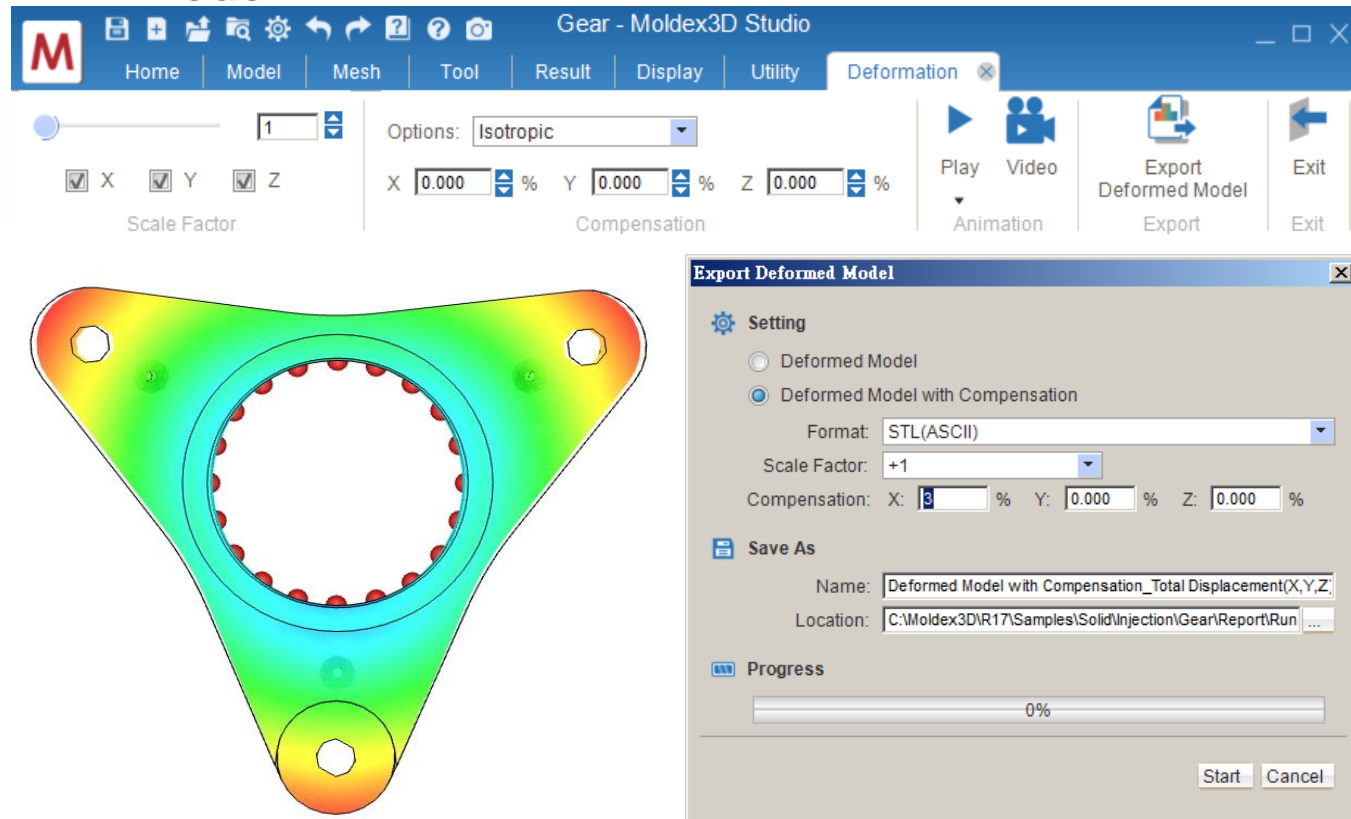
Inspection: Variety of Post-processing Tools

- > Support Anchor Plane setting for deformation scale of Warpage
 - Update result value based on the anchor plane applied
 - Allow multiple anchor plane
- > Enable Iso-contour result display
 - Allow single color, legend color line or on top of field plotting



Inspection: Warpage Result and Export

- > Deformation result display with scaling or mold compensation
 - Control scaling and compensation individually in each direction
 - The value of Measure function will updated for scaled result
 - Model export and anime for deformation or mold compensation model



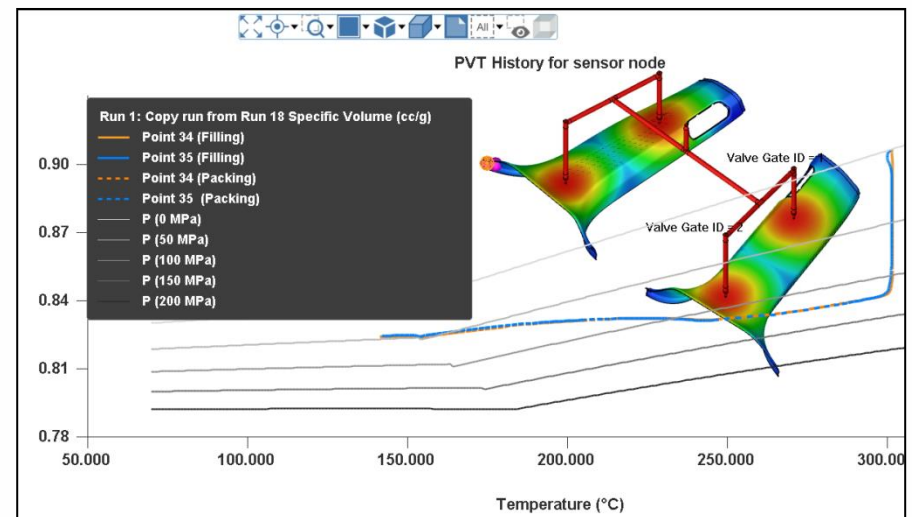
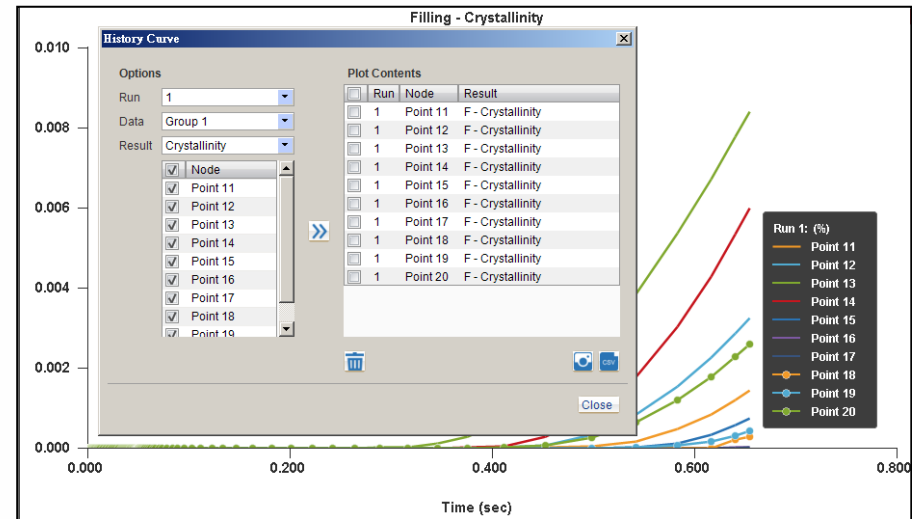
XY Plot : History Curve Plotting

> Plotting result change with time

- Support local history on Probe and Sensor nodes
- Support global history of molding properties
- Display specific volume history with reference line of PvT behavior
- Enable crystalline history

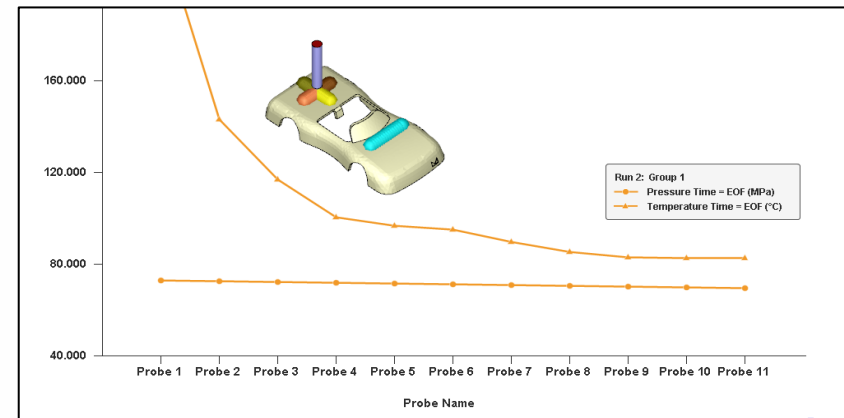
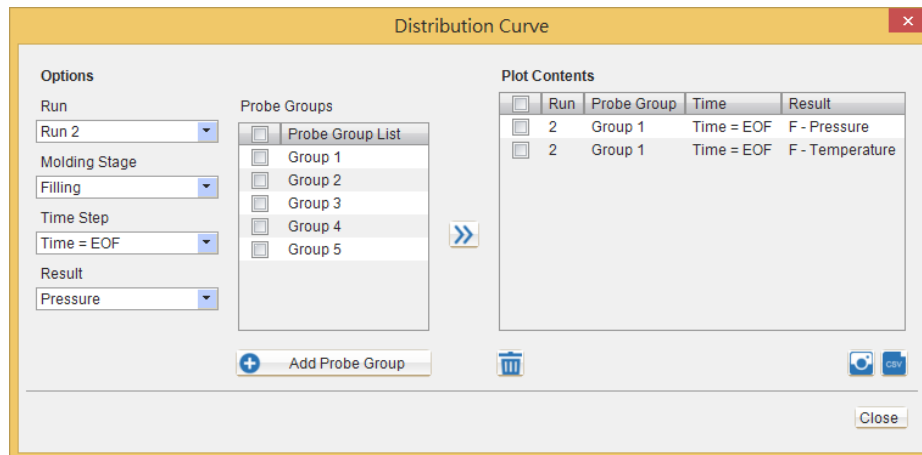
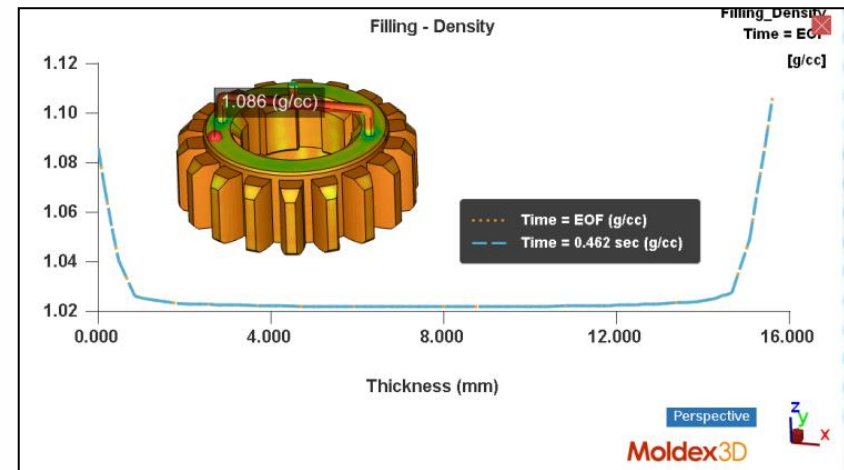
> XY plot customization

- Allow combination of different node and data
- Allow data export as CSV and JPG files



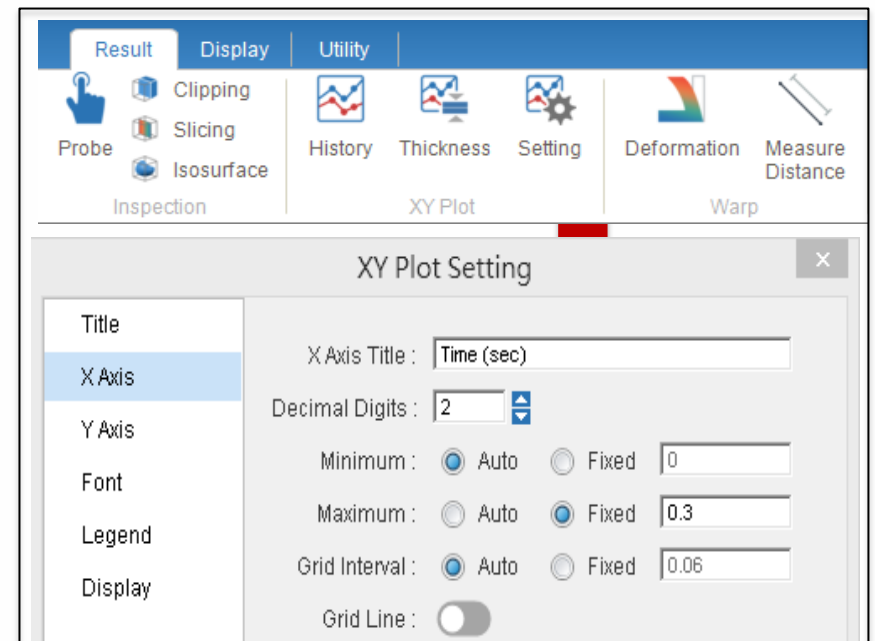
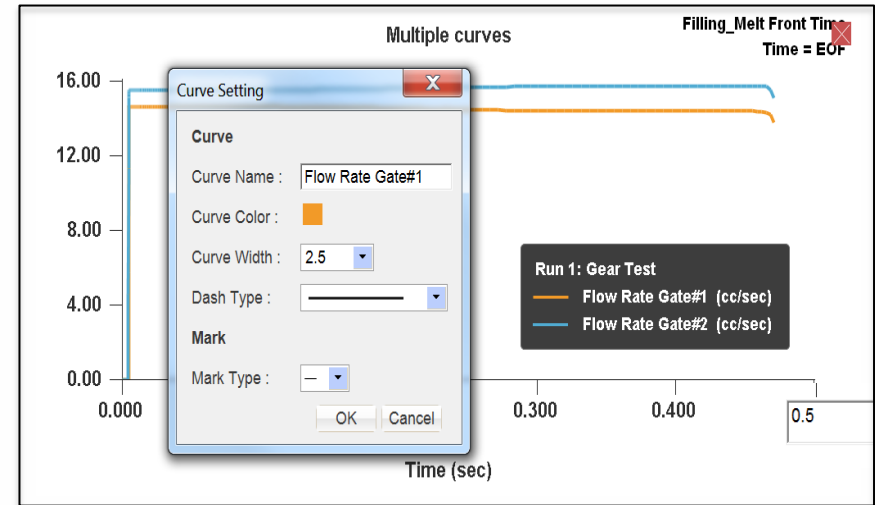
XY Plot: Distribution Curve Plotting

- > Plotting thickness direction variation curve
 - Inspect the variation inside
- > Plotting result distribution
 - Add curve by Probe group
 - Add multiple time steps data
- > Support Probe selection and data export (JPG & CSV)



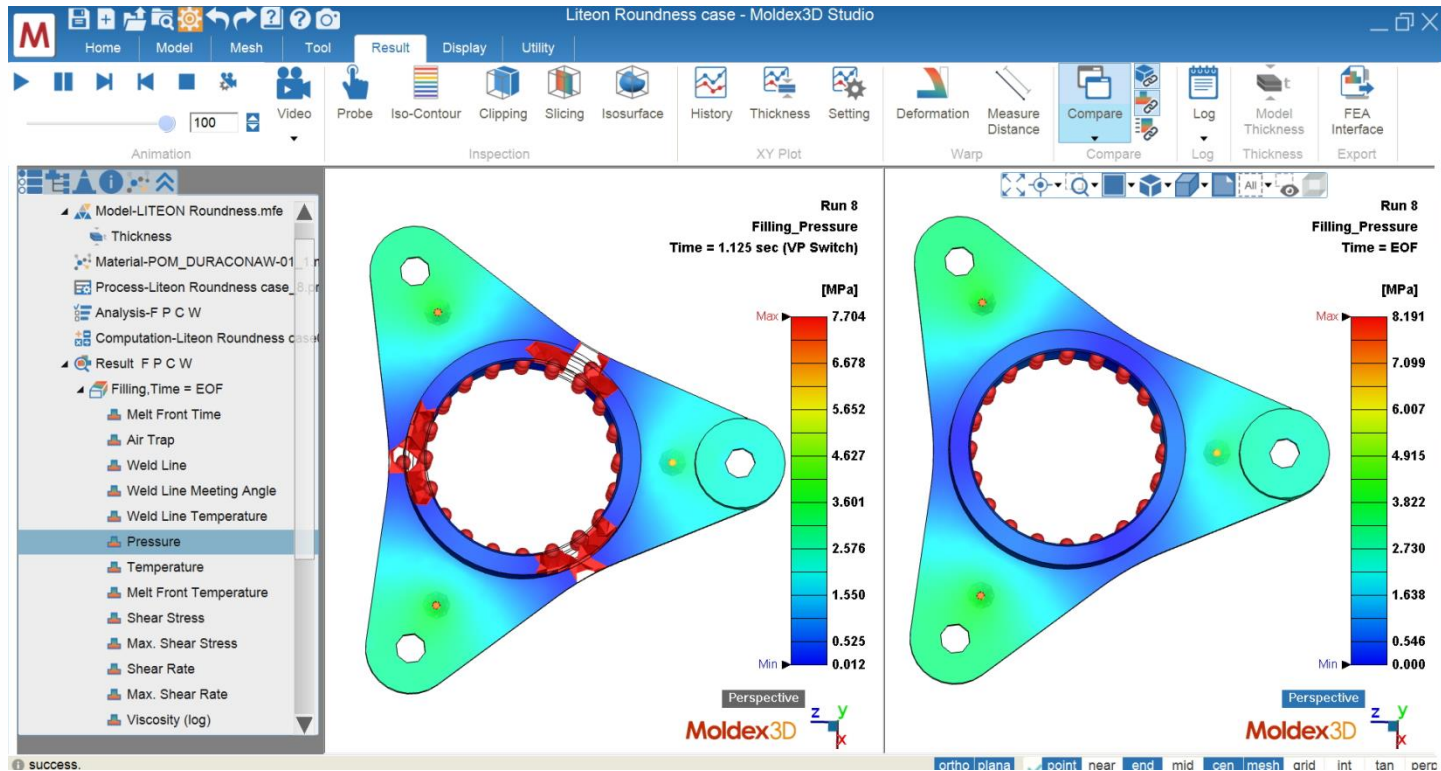
XY Plot : Preference Setting

- > Provide quick edit function directly on XY Plot
 - Double click on different place to modify plot setting
- > Provide Plot setting wizard:
 - Directly launch on XY plot
 - X and Y axes format & title
 - Style change on legend / font size / curve sort
 - Option to display model and tracer on XY Plot
- > **Benefit:** Customized style for performance in different company format presentations



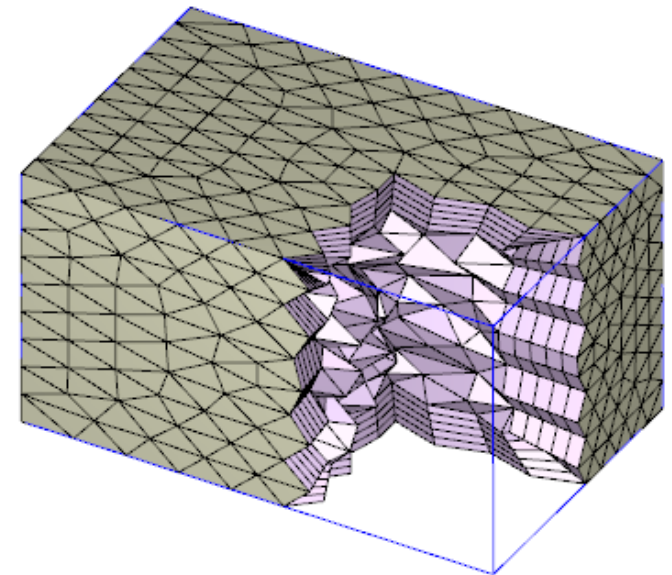
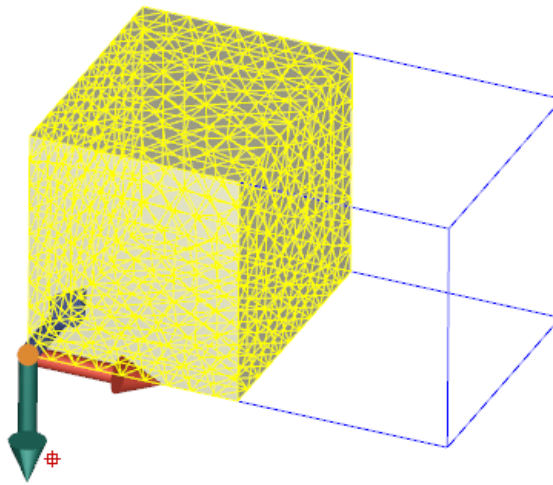
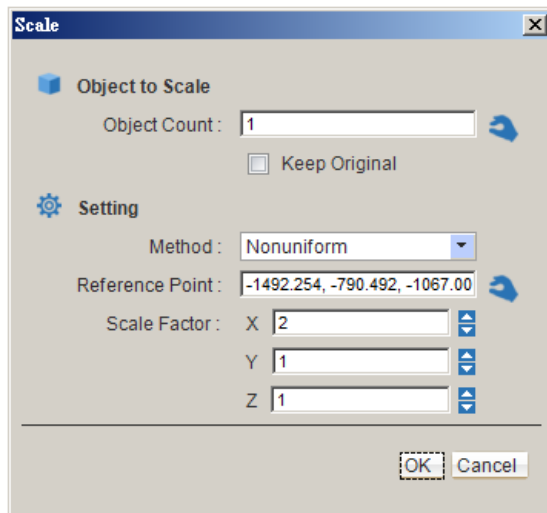
Compare: Multi-window Result Comparison

- > Cross-group/time/result comparison
 - Compare results from different time, runs and result items
 - Provide flexible Sync setting for different purpose
 - **Benefit:** Compare result difference with controlled factor



Other New Capabilities in Studio

- > Support former Designer function in
 - Add Rotation function based on C plane in CAD tools
 - Add Extraction function in improve surface mesh tools
- > Enable Compuplast MTC mesh file export
- > Add model scaling function in CAD tools



Studio – New Standard Platform

Higher Usability

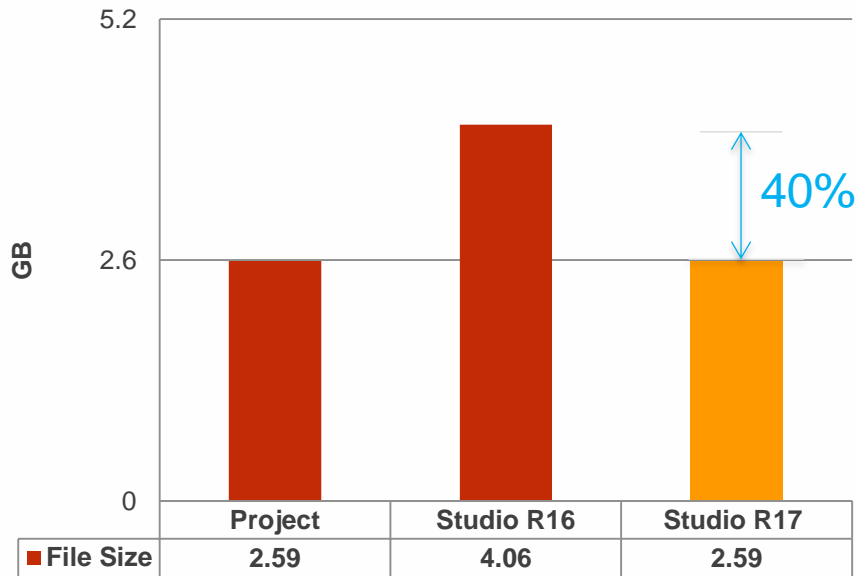
New Capability

Performance

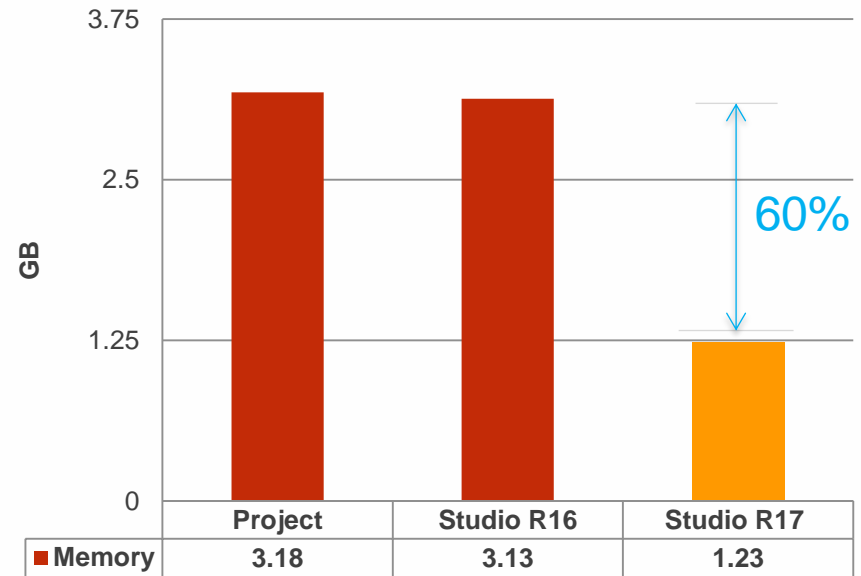
Render: More Efficient Project Management

- > File size 40% reduced
- > Memory usage 60% reduced
- > Up to **50X smooth** rendering performance

Reduced File Size



Reduced Memory Use



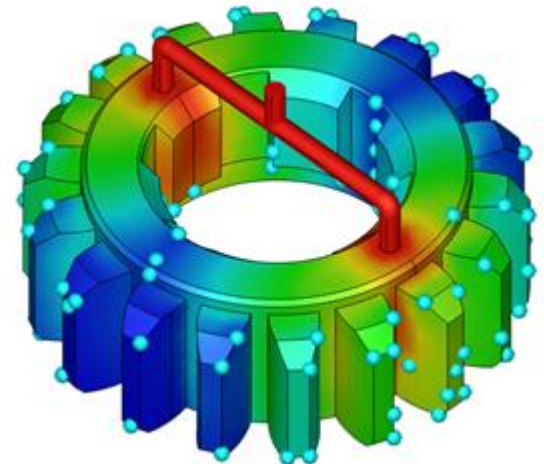
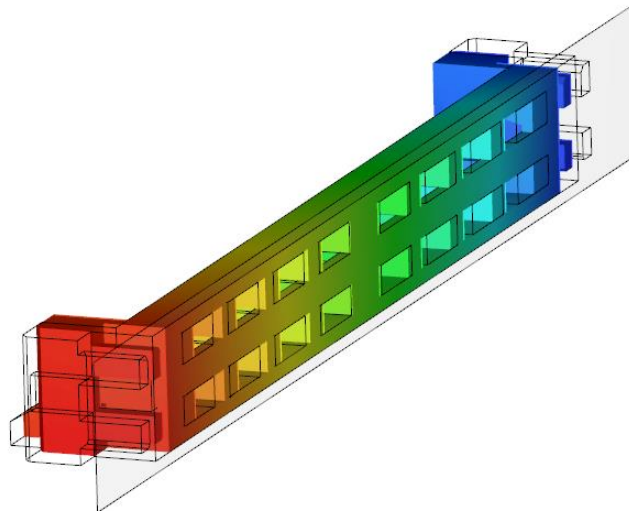
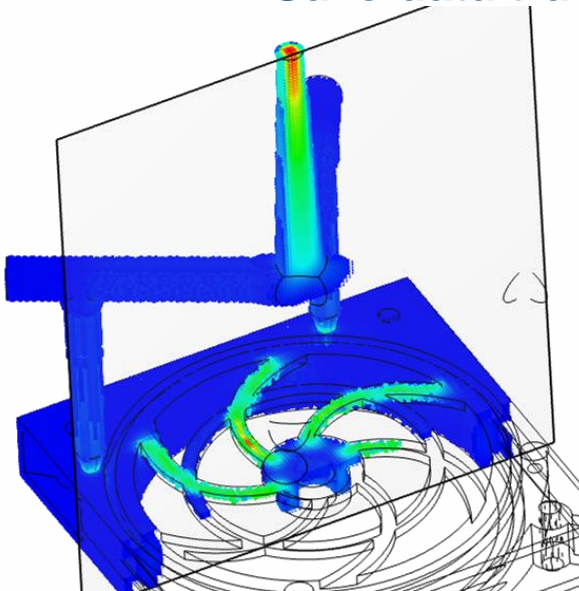
* Test mode Information:

Cell Count: 4.7 Million

Results Data: Filling (5 time-step) + Packing (5 time-step) +C+W

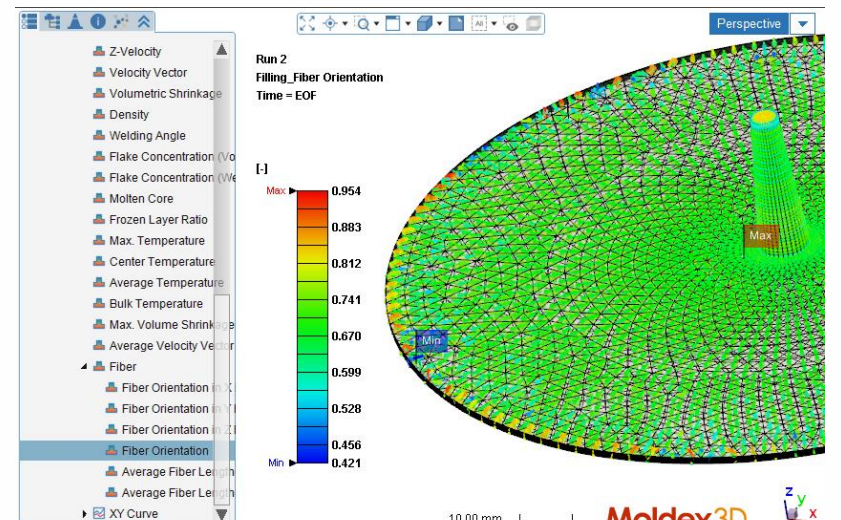
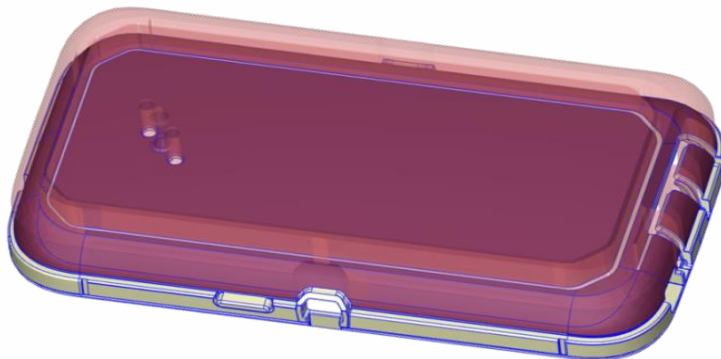
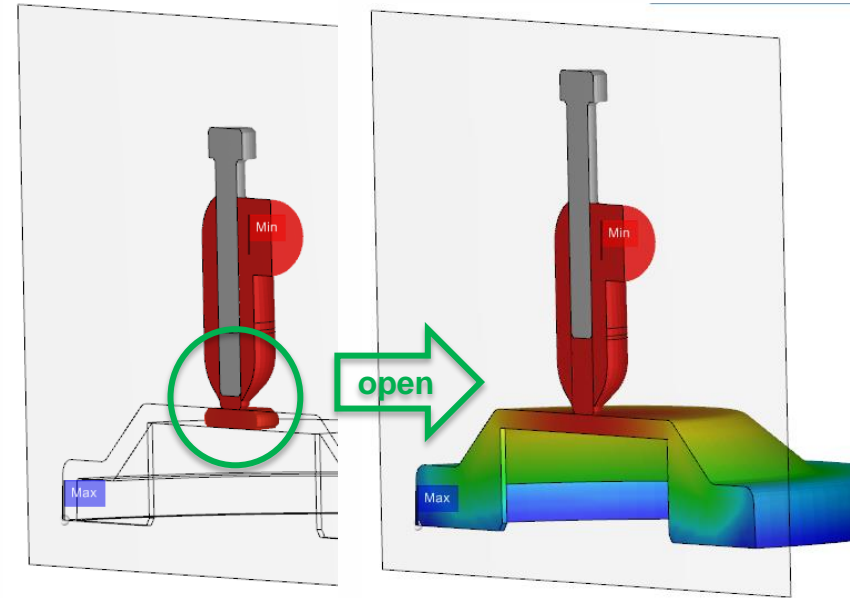
Render : Enhanced Display Kernel

- > New display kernel: Speed up project open and result reading
 - Save the time in data transfer and avoid RSV file issues
- > Enhanced Clipping display with Velocity vector and Warpage Deformation results
- > Render Enhancement: Improved Air Trap display accuracy
 - Allow superimposed with other type results display
 - Save data transfer time, file size and memory usage



Render: Advanced Analysis and Display

- > Venting Analysis
 - Assign BC and venting pressure profile
- > Pin Movement Simulation
 - Pin Movement modeling and result display
- > Fiber Orientation Prediction
 - Fiber Orientation and Alignment Display
- > Compression Zone & Charge
 - Assign BC and Property



Solver Capability

Solver Enhancement

Advanced Analysis

Machine Response & Characterization

Fiber Analysis

Important Factors for Injection Molding Simulation

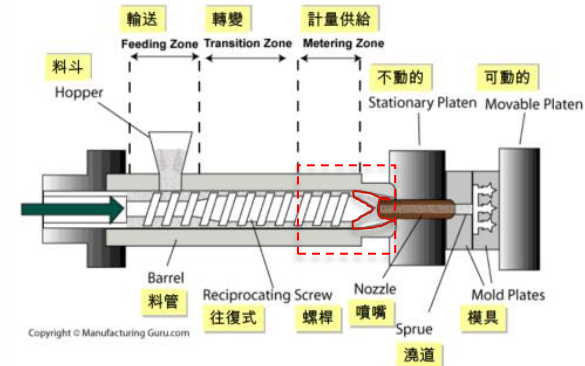
Process Modeling

- Modeling domain and procedures
- Governing equations of molding process

Barrel, Screw, Nozzle

Filling, Packing, Cooling

Response and control



Material Modeling

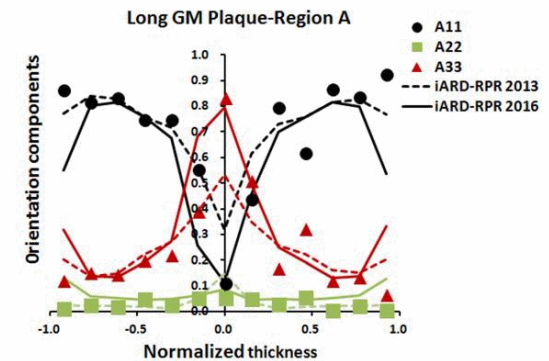
- Constitutive equations of material
- Material phase transition function

Fiber orientation modeling

Crystallization modeling

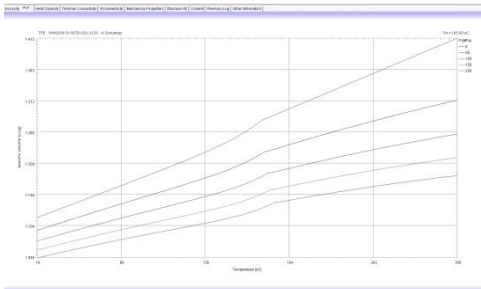
Viscoelastic modeling

Micromechanics modeling

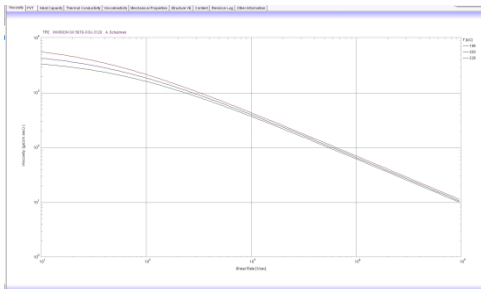


Material: Enhanced Material Checking Kit

- > Cross check different material properties to ensure consistent material behavior for accuracy
 - Solver will launch checking and put result in analysis log
 - Checking criteria is according to basic material behavior (transition point and etc..) consistency
 - Improper items will be listed for their possible reasons
 - Support for thermo-plastic material



Viscosity, PVT, Cp, K...



Material Checking Kit

Polymer: TPE
Producer: INVISION GX 5070-G3U-3120
Grade Name: A. Schulman

Checking list

| Viscosity | PVT | Cp | K | Structure VE | Process Condition |
|-----------|-----|----|---|--------------|-------------------|
| V | V | V | V | - | X |

Checking result

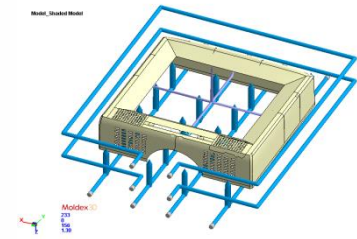
Structure VE:
This version does not support "checking of Structure VE properties".

Processing:
Freeze temperature might be not reasonable.

Close

Cool : Mold Temperature Controller Advisor

- > Predict flow rate and pressure drop of cooling channel, and heat dissipation of mold
 - Initially elevate mold up to operating temperature, maintain the temperature during operation and compensate for heat losses
- > Adopt the pump performance curve (user input parameters)
 - For evaluating the mold temperature controller whether its performance is sufficient or not



Simulate

| _MoldTempRequired.csv | | | | | | |
|-----------------------|---------|------------------------|--------------------------------|-------------------------------|-----------------|-------|
| | A | B | C | | D | |
| | InletID | PressureDrop(bar) | Inlet FlowRate(cm3/sec) | Inlet FlowRate(L/min) | Heat Remove(kW) | |
| 1 | | | | | | |
| 2 | 1 | | 3 | 495.27 | 29.72 | 3.05 |
| 3 | 2 | | 3 | 948.25 | 56.89 | 3.92 |
| 4 | 3 | | 3 | 581.91 | 34.91 | 6.006 |
| 5 | 4 | | 3 | 717.48 | 43.05 | 3.342 |
| 6 | 5 | | 3 | 495.27 | 29.72 | 2.853 |
| 7 | 6 | | 3 | 484.69 | 29.08 | 4.282 |
| 8 | 7 | | 3 | 948.25 | 56.9 | 3.814 |
| 9 | | | | | | |
| 10 | | | | | | |
| 11 | | Pressure Required(bar) | Total FlowRate Required(L/min) | Cooling Capacity Required(kW) | | |
| 12 | | 3 | 280.27 | 27.268 | | |
| 13 | | | | | | |

Max. pressure requirement

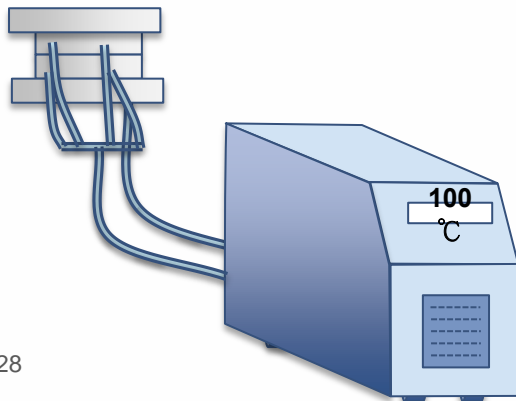
Total flow rate requirement

Cooling capacity requirement

Select

Evaluate

Evaluate with Controller's Specification



Cool: Mold Temperature Controller Evaluation

> Example: Regloplas P161XL specification

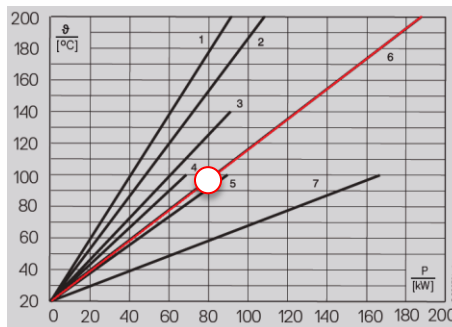
| | Analysis requirements | Evaluation |
|-------|--|---|
| Step1 | Max. pressure requirement 3bar | Refer to pump performance curve.P161XL need flow rate 120 (l/min)underpressure 3 bar. |
| Step2 | Total flow rate requirement 280 l/min | 280(l/min)/120(l/min) ≈at least need 3 temperature controller |
| Step3 | Cooling capacity requirement 27kW | Refer to cooling capacity curve. · P161XL provide 80kW cooling capacity. That's enough. |

REGLOPLAS 

| Technical data | | P161XL * |
|----------------------------------|--------|---------------|
| Outlet temperature max. | °C | 160 |
| Heat transfer fluid | | Water |
| Filling quantity | l | 10,0 |
| Expansion volume | l | 5,0 |
| Heating capacity at 400 V | kW | 20/40/60 |
| Cooling capacity | kW | 135 |
| at outlet temperature | °C | 150 |
| Cooler (K) | | SK |
| Diagram (Fig.) | | 6 |
| Pump capacity/ Type | | SM85 |
| Flow rate | l/min. | 200 |
| Pressure | bar | 8,0 |
| Power consumption | kW | 4,0 |
| Diagram (Fig.) | | 4 |
| Control | | RT100 |
| Measuring mode (Standard) | | Pt100 |
| Connections | | |
| Outlet/inlet | | G1 1/2 "IG |
| Cooling water mains | | G3/4 " |
| Dimensions W/H/D | mm | 436/1356/1554 |
| Weight approx. | kg | ca. 255-265 |



Pump performance curve



- 1 P140S SK, P160S SK, P160M(D) SK
- 2 P140S 2SK, P160S 2SK, P160M(D) 2SK
- 3 P140smart 1K
- 4 P100S 1K, P100M 1K
- 5 P100S 2K, P100M 2K
- 6 P141XL SK, **P161XL SK,**
- 7 P100S DK, P100M DK

Cooling capacity curve

Solver Capability

Solver Enhancement

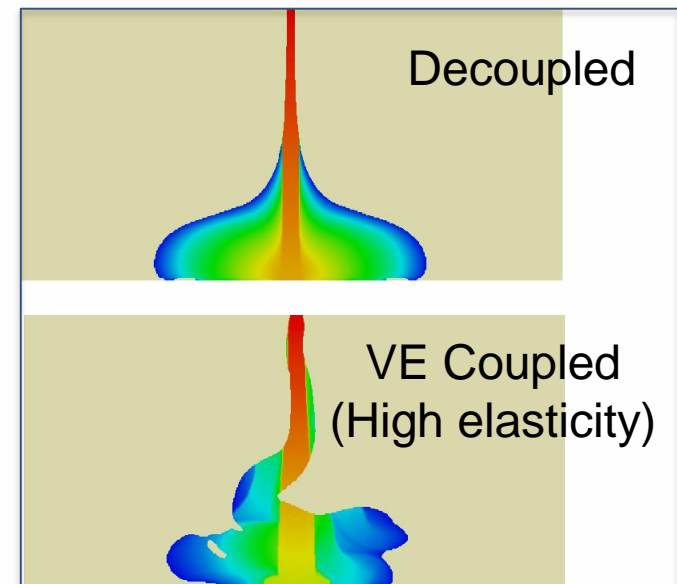
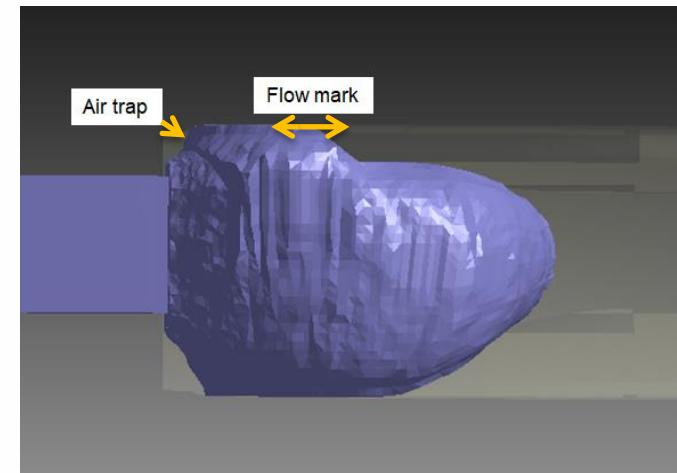
Advanced Analysis

Machine Response & Characterization

Fiber Analysis

VE: Common Application of Flow-VE Coupling Analysis

- > Jetting Prediction
 - Common slight jetting behavior in the thick part
 - May cause some defect likes flow mark, air trap....
- > Simulation Trend Correction
 - Optical behavior
 - Cavity pressure
 - Warpage
- > Advanced Molding Behavior
 - Die swell
 - Buckling



VE : Enhanced Capability for Flow-VE Coupling

- > Higher speed and stability calculation
 - Up to 2 times faster
- > Improved material modeling for Flow and Structure VE
 - Consistency on model display and setting workflow
- > More accuracy on Flow-VE coupling Simulation
 - Better prediction on vortex flow, warpage and optical behavior

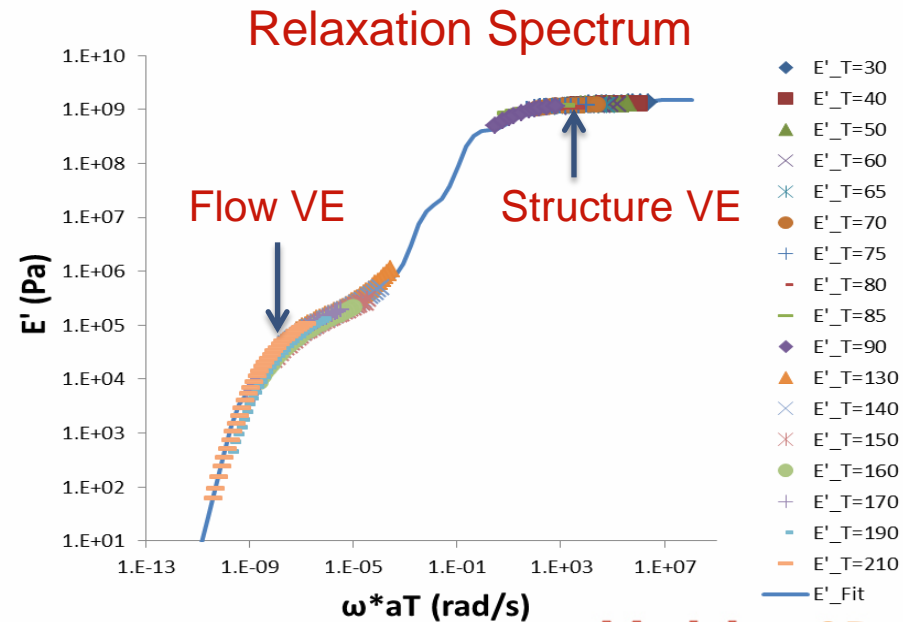
Step 5: Viscoelasticity

| | | |
|-----------|-------|---|
| A1 | 40.16 | - |
| A2 | 51.6 | K |
| Tf | 375 | K |
| T* | 0 | K |
| T0* | 0 | K |
| DeltaHt/R | 0 | K |

Step 9: Structure VE

| | | |
|------------|---------|-----------|
| A1 | 40.16 | - |
| A2 | 51.6 | K |
| Tf | 375 | K |
| T* | 0 | K |
| T0 | 0 | K |
| DeltaHt/R | 0 | K |
| G Infinity | 3.62319 | dyne/cm*2 |

| | G (dyne/cm*2) | Lambda (sec) |
|---|---------------|--------------|
| 1 | 1.13768e+009 | 4.17e-007 |
| 2 | 1.13768e+009 | 2.36e-005 |
| 3 | 1.13768e+009 | 0.00134 |
| 4 | 1.13768e+009 | 0.0759 |
| 5 | 1.13768e+009 | 4.3 |



Stress : Annealing Analysis with Fiber Orientation

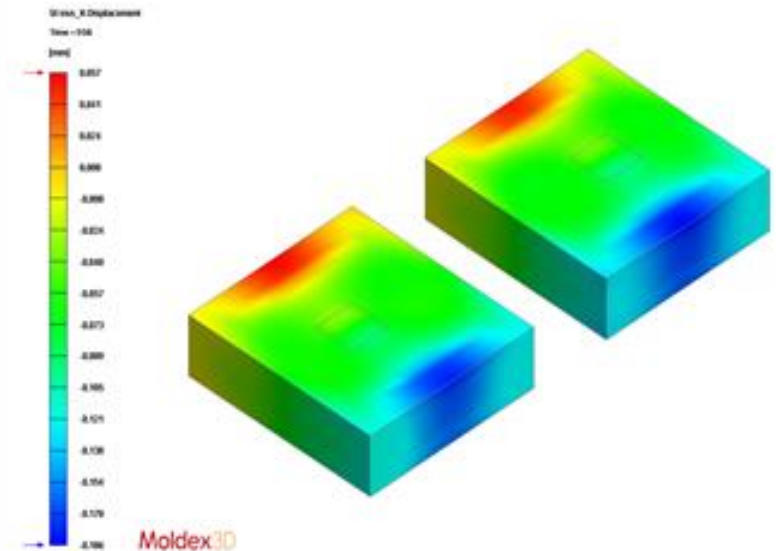
- > Consider the fiber orientation effect in annealing simulation
 - Annealing analysis automatically read fiber orientation data output from Flow-Fiber analysis
 - Use Mori-Tanaka model to consider fiber orientation effect on mechanical property
 - Perfect validation with leading FEA product

```
>>> Analysis start time: Thu Jul 26 10:59:11 2018
```

```
<Computation parameter setting>
```

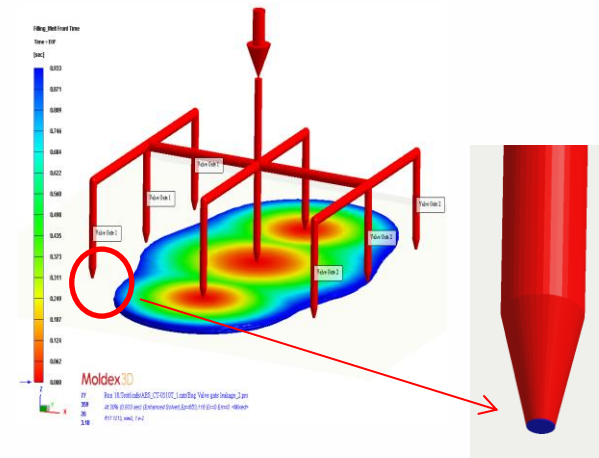
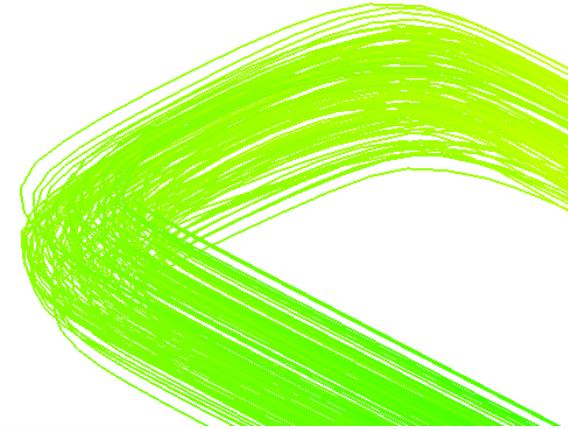
```
Consider fiber orientation effect      = on
Link with the Previous Shot           = off
Consider Weld Line effect             = off
Consider Gravity effect               = off
Micro-Mechanics Model                 = Mori-Tanaka model
Consider flow-induced residual stress = off
Max. no. iteration                    = 5000
Convergence tolerance                 = 5.000000e-005
Solver acceleration                   = on
```

```
</Computation parameter setting>
```

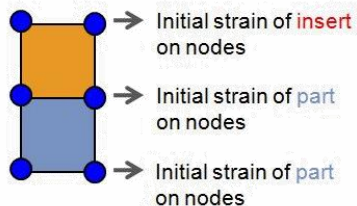


Other Solver Enhancement

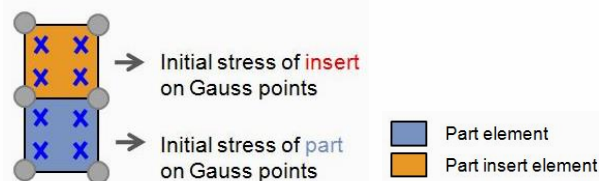
- > [3D CFD] Enhance stream line calculation
- > [Hot Runner] Enhance valve gate control simulation accuracy
- > [Fiber/PIM] Enhance fiber/powder/filler concentration prediction
- > [FEA-I] Initial stress can be output via FEA Interface.
 - The initial stress output is equivalent to the initial strain output in application.
 - **Benefit:** Avoid interfacial co-node effect between part and part insert on numerical discrepancy for initial strain output.



Initial strain output :



Initial stress output :



Solver Capability

Solver Enhancement

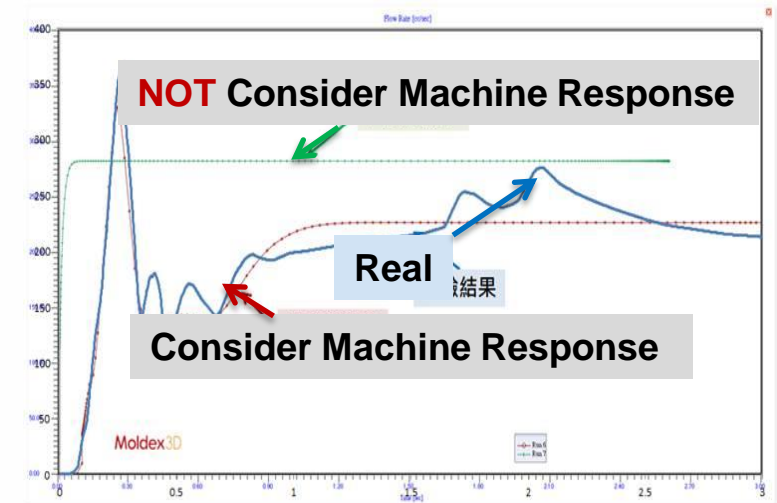
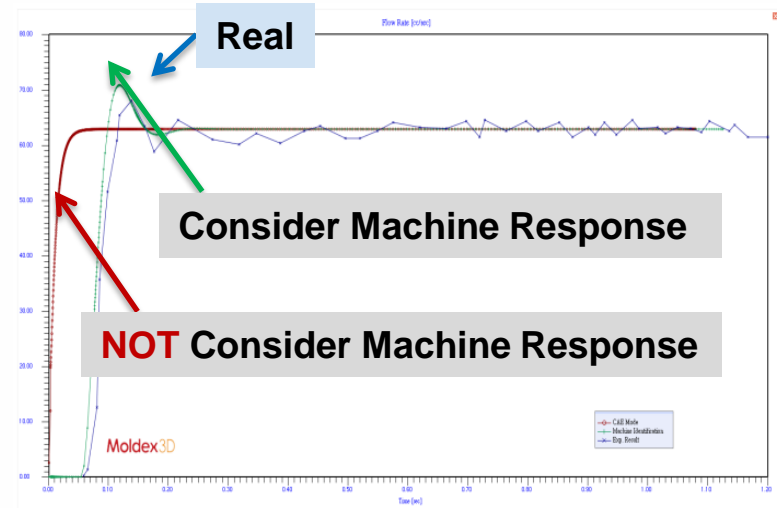
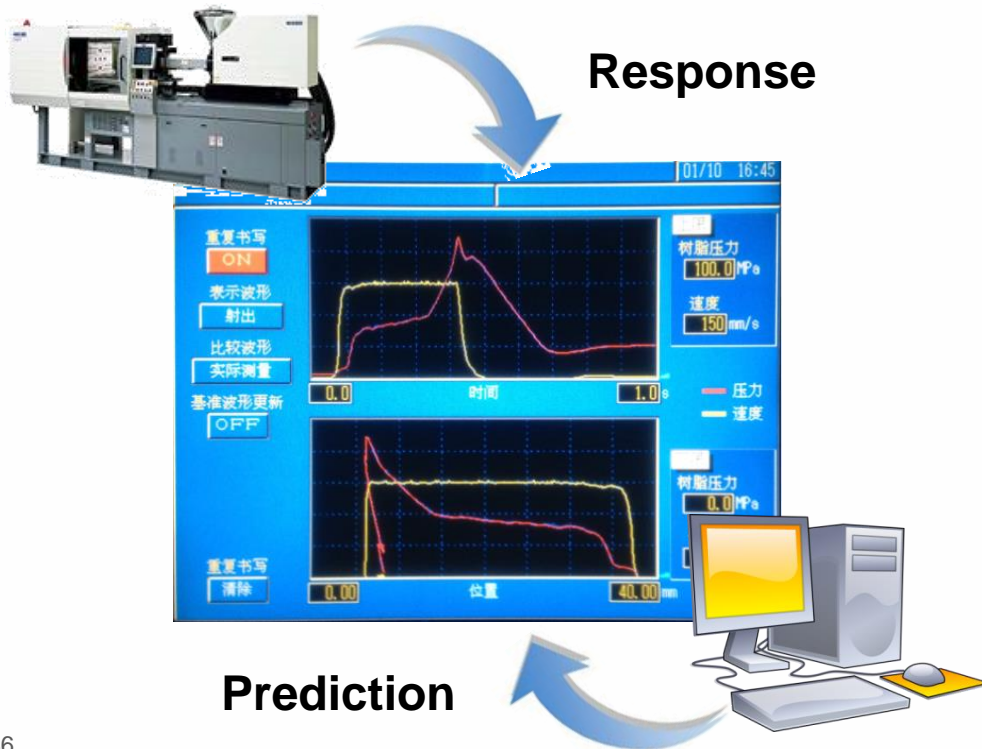
Advanced Analysis

Machine Response & Characterization

Fiber Analysis

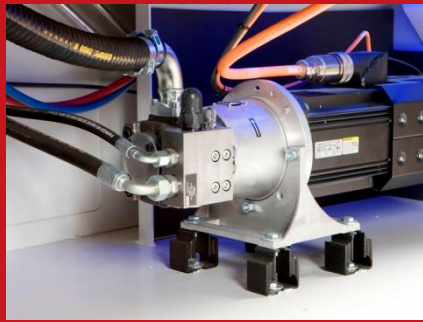
Machine Response : Machine Response Simulation

- > Consider the difference between operator process setting and actual injection behavior
 - Machine response can be highly diversified for different type machines and controllers



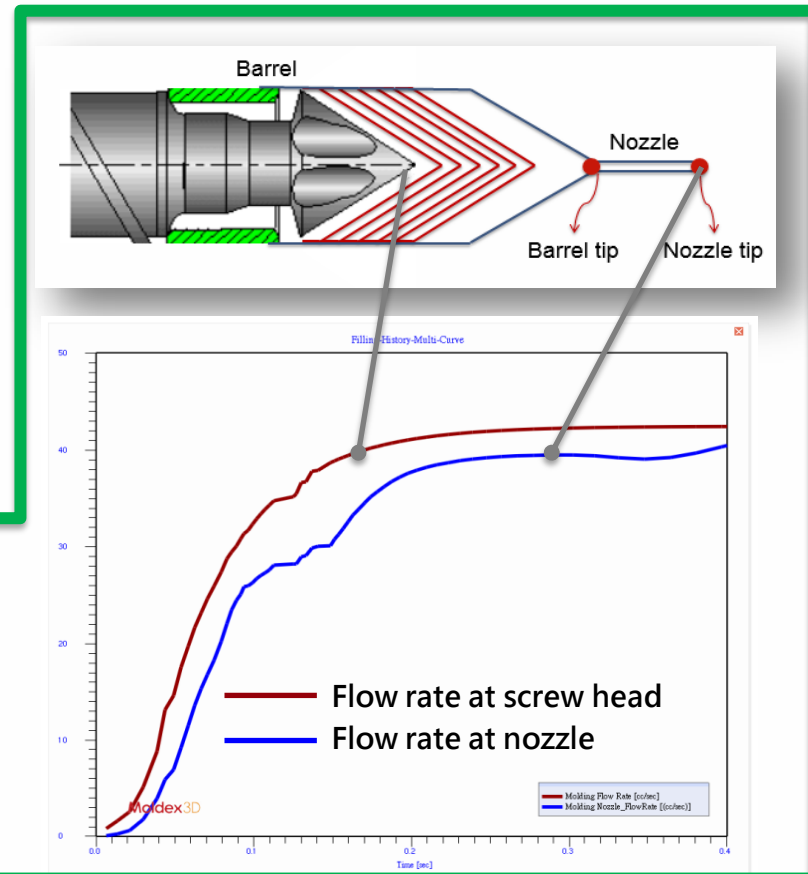
Machine Response : Melt Compressibility Effect inside the Barrel

- > Can collaborate with barrel compression consideration
 - Solver calculation option with Machine mode
 - Virtual nozzle and barrel will be considered automatically



Machine Response
(Drive unit)

New in R17



Nozzle



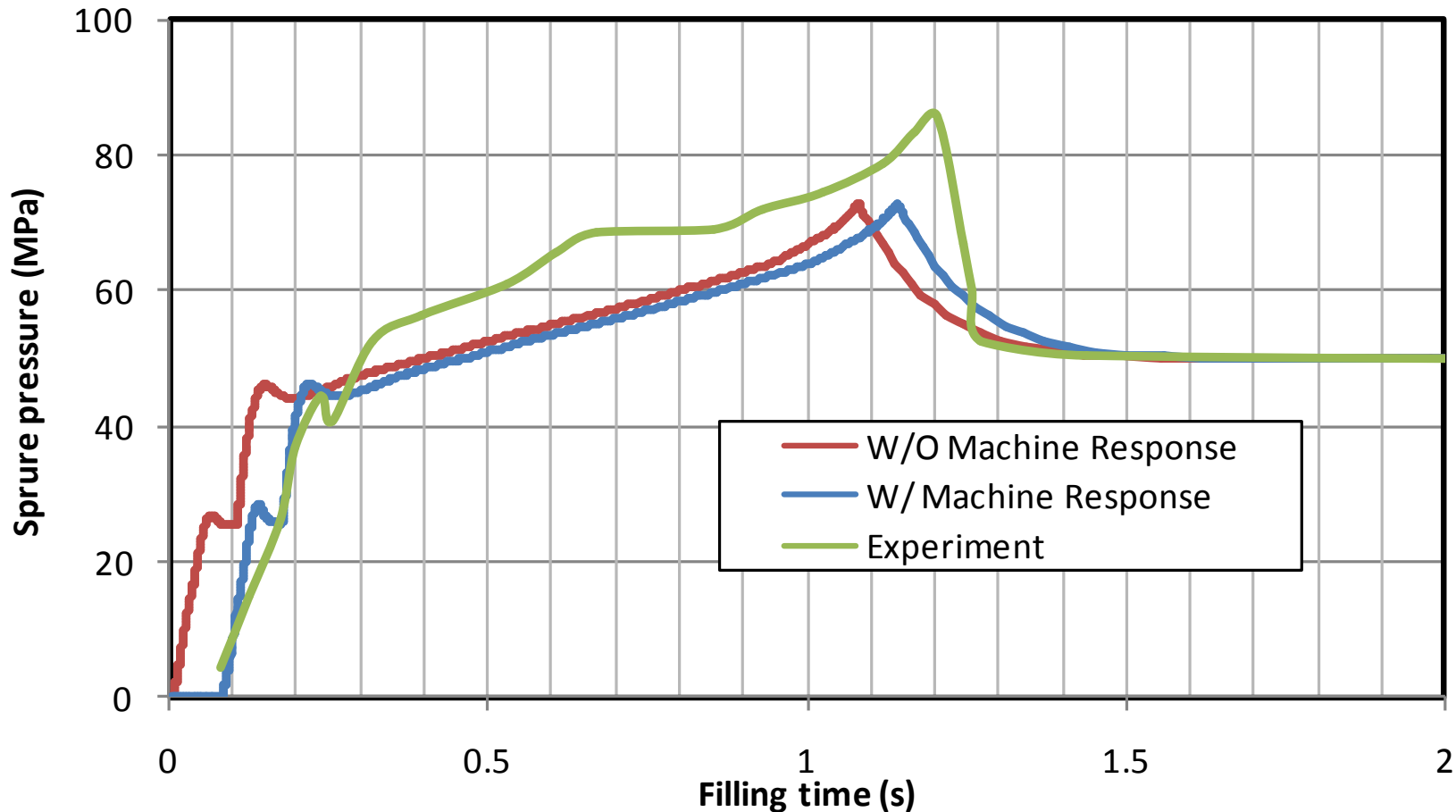
Screw (Barrel)

Before R17

Moldex3D

Machine Response : The effect of Machine Response

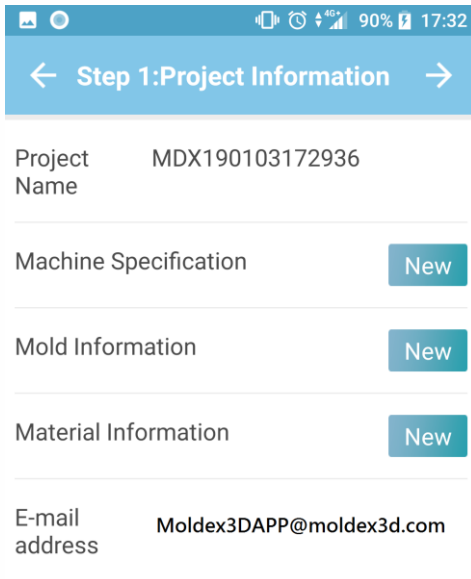
> Machine response with compressibility behavior inside barrel



Machine Response : Machine Characterization APP

> 5 Steps to Complete Machine Characterization

- Submit data to Moldex3D for receiving machine response file
- Import machine response file (MMIP) in Machine Bank



Step 1: Project Information

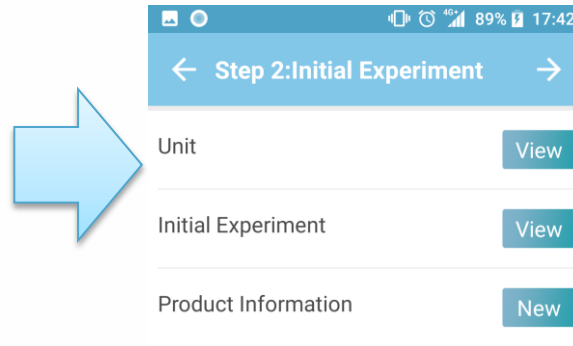
Project Name MDX190103172936

Machine Specification [New](#)

Mold Information [New](#)

Material Information [New](#)

E-mail address Moldex3DAPP@moldex3d.com

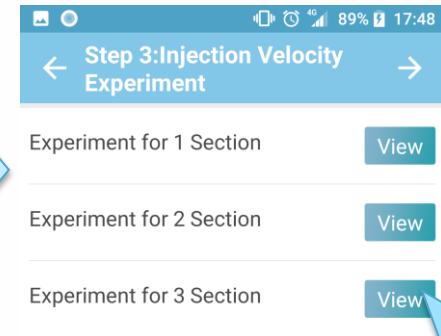


Step 2: Initial Experiment

Unit [View](#)

Initial Experiment [View](#)

Product Information [New](#)

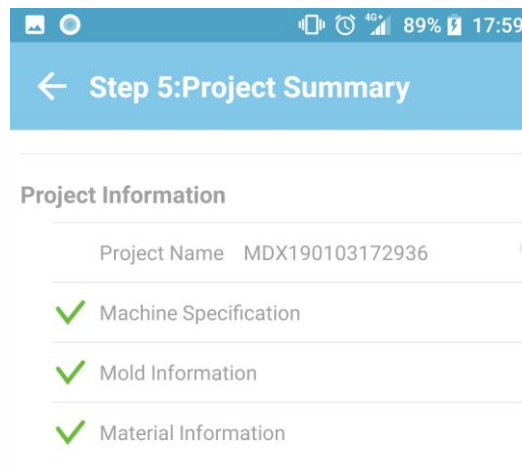


Step 3: Injection Velocity Experiment

Experiment for 1 Section [View](#)

Experiment for 2 Section [View](#)

Experiment for 3 Section [View](#)

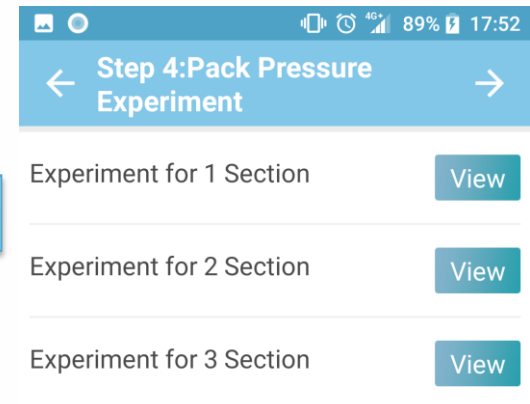


Step 5: Project Summary

Project Information

Project Name MDX190103172936

- ✓ Machine Specification
- ✓ Mold Information
- ✓ Material Information



Step 4: Pack Pressure Experiment

Experiment for 1 Section [View](#)

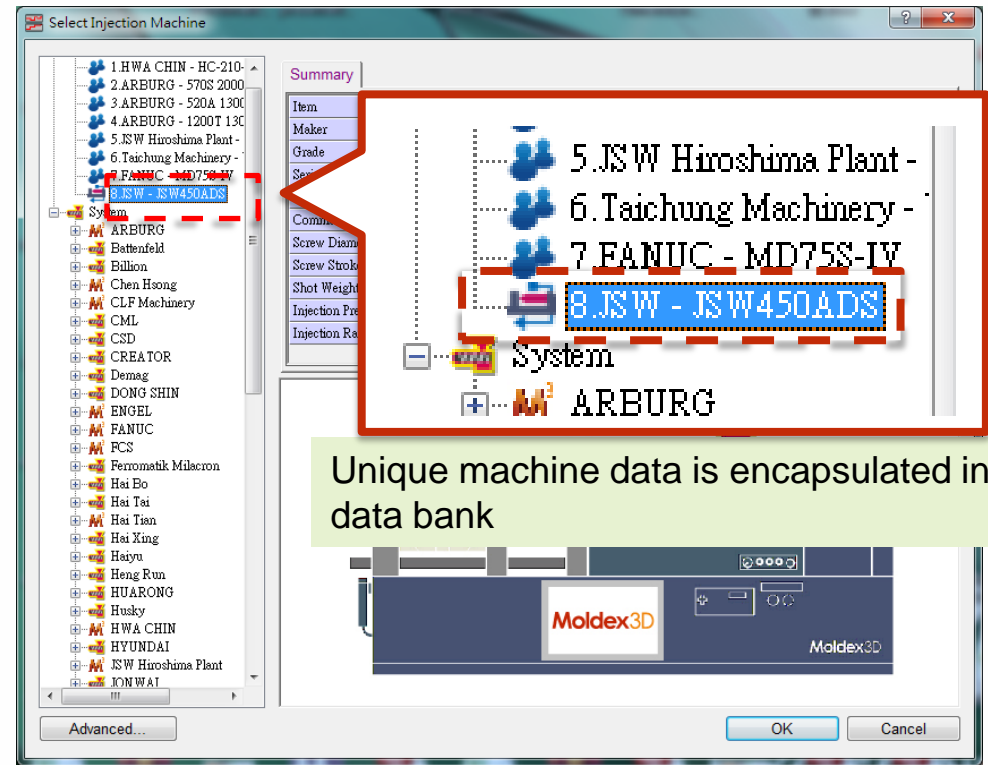
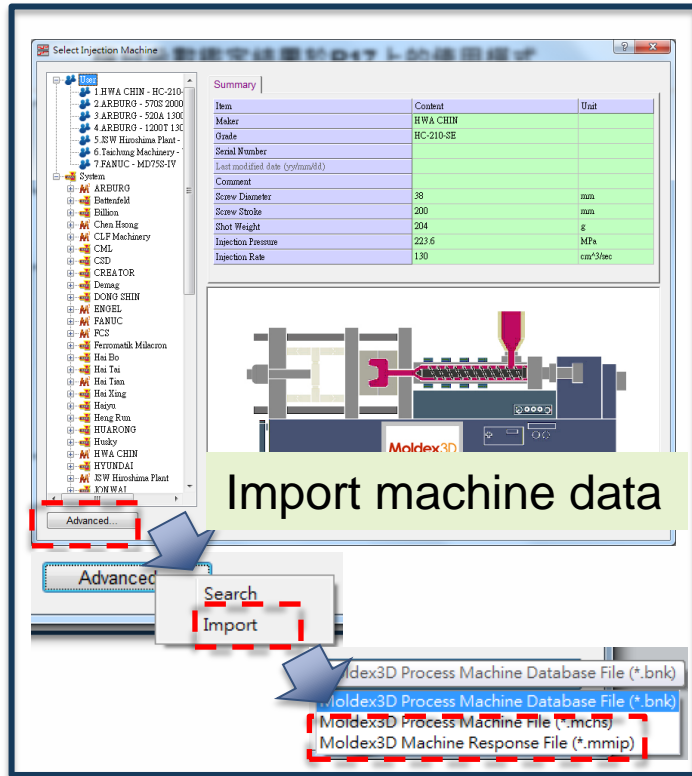
Experiment for 2 Section [View](#)

Experiment for 3 Section [View](#)

Initial Experiment

Machine Response: Characterization for Specified Machine

- > Additional license required
- “MachineResponse”



Solver Capability

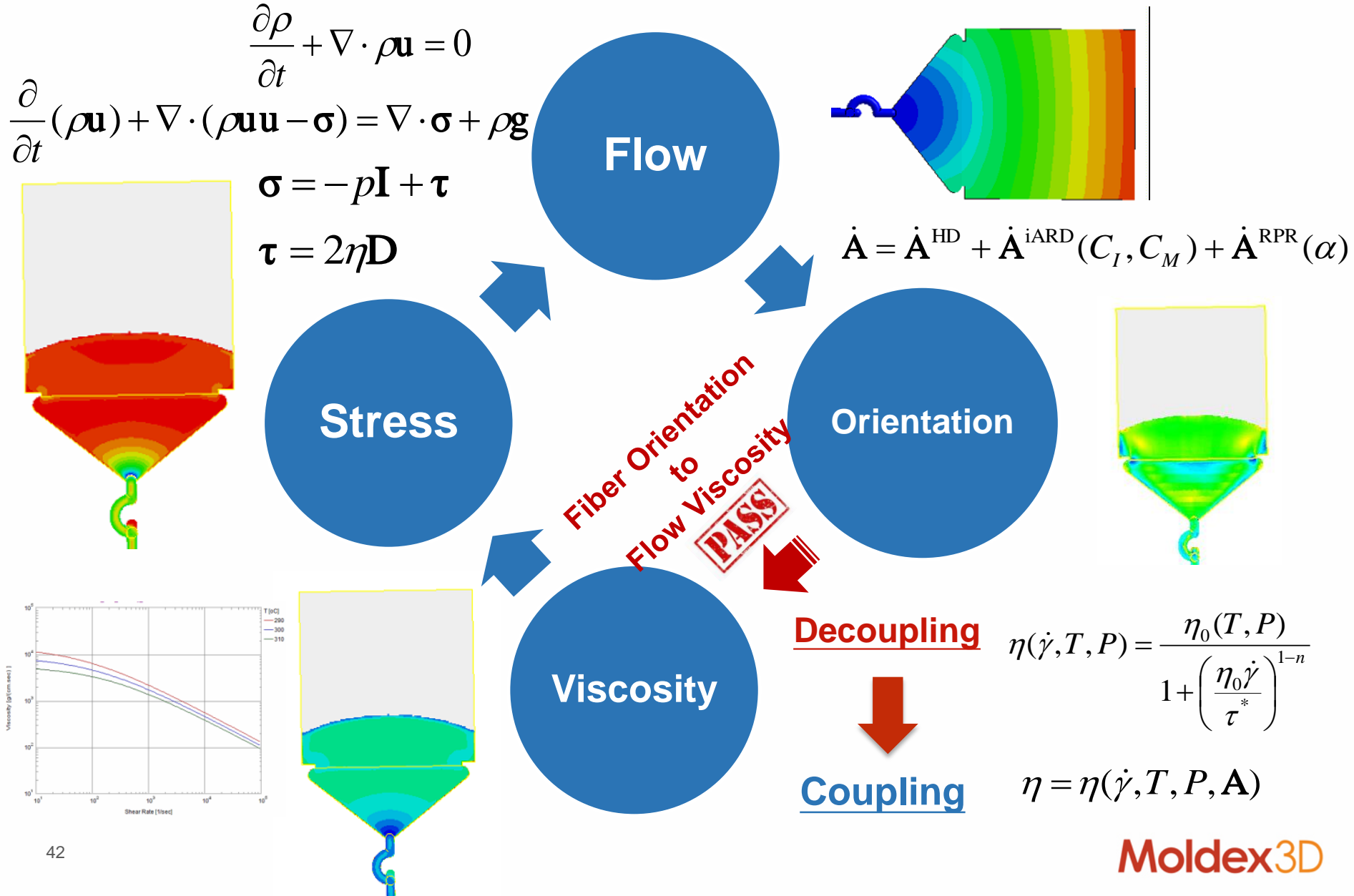
Solver Enhancement

Advanced Analysis

Barrel Compressibility & Machine Response

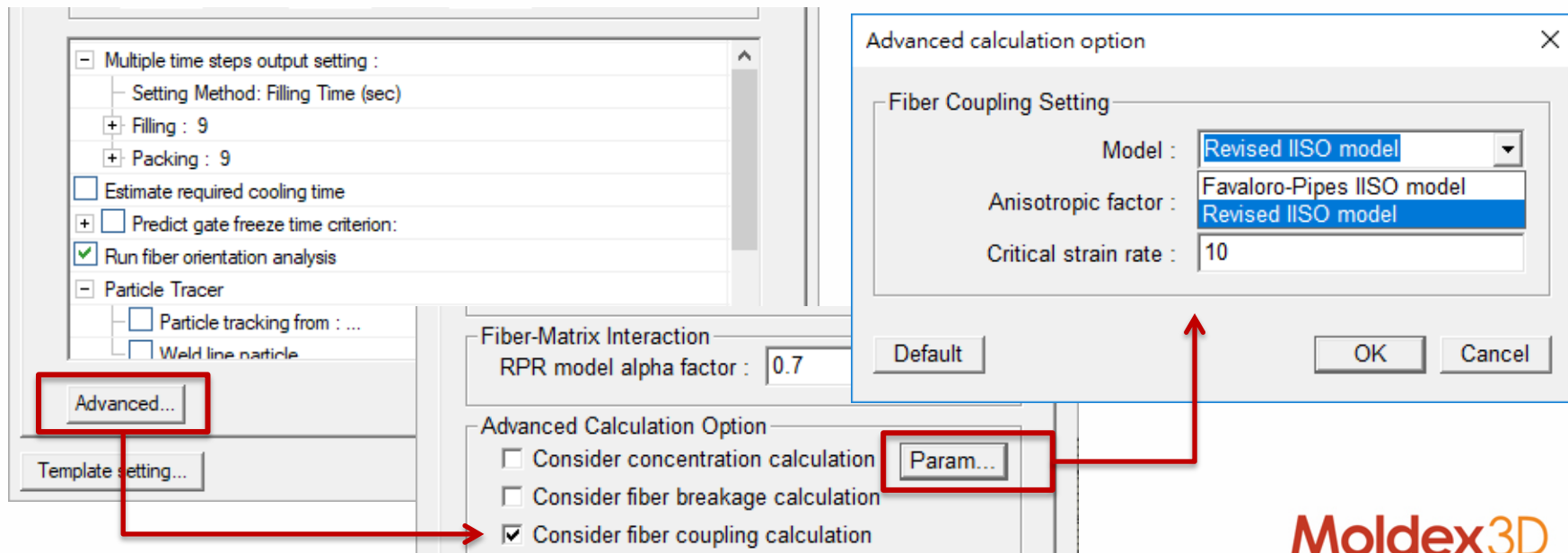
Fiber Analysis

Fiber: Flow-Fiber Coupling – Analysis Theory



Fiber: Flow-Fiber Coupling – Computation Parameters

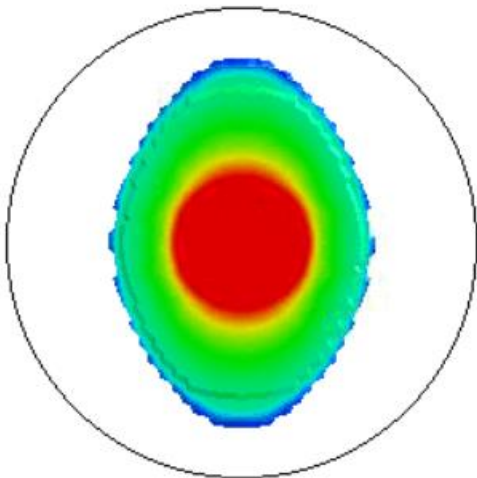
- > Apply two anisotropic viscosity models from collaborated research by Moldex3D (Ivor) and Purdue University (Pipes)
 - Favaloro-Pipes IISO model: Better for Compression Molding (CM)
 - Revised IISO model: Default, better for Injection Molding(IM)
 - Require additional license: EnhancedFiber
 - **Benefit:** advanced simulation of anisotropic flow behavior induced by fiber orientation of FRP material



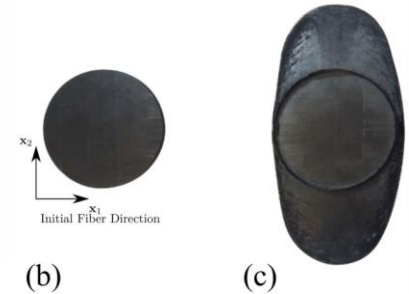
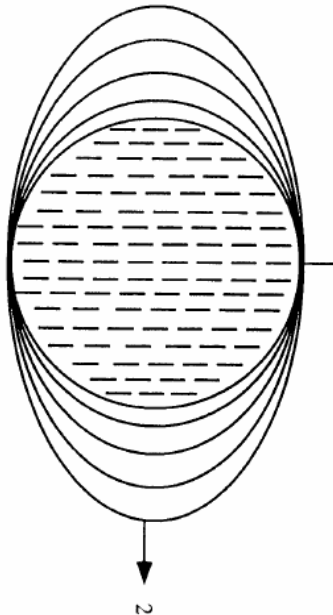
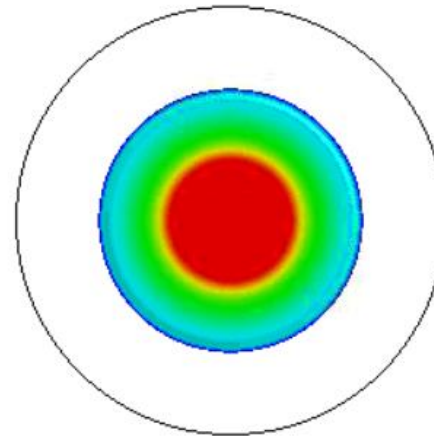
Fiber: Flow-Fiber Coupling for Compression Molding

- > Full coupled fiber-flow analysis to simulation anisotropic flow
 - Compression molding: GMT. SMC
 - with high fiber concentration: >> 20 vol%
 - Effect of high fiber orientation on flow behavior

Fully Coupled

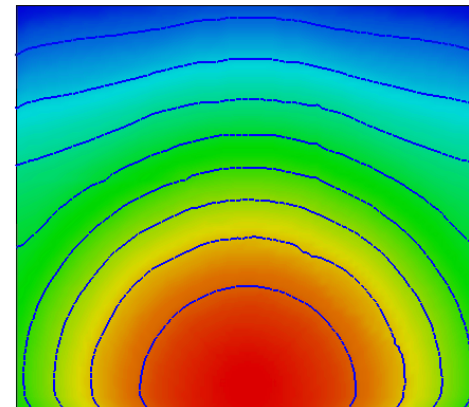
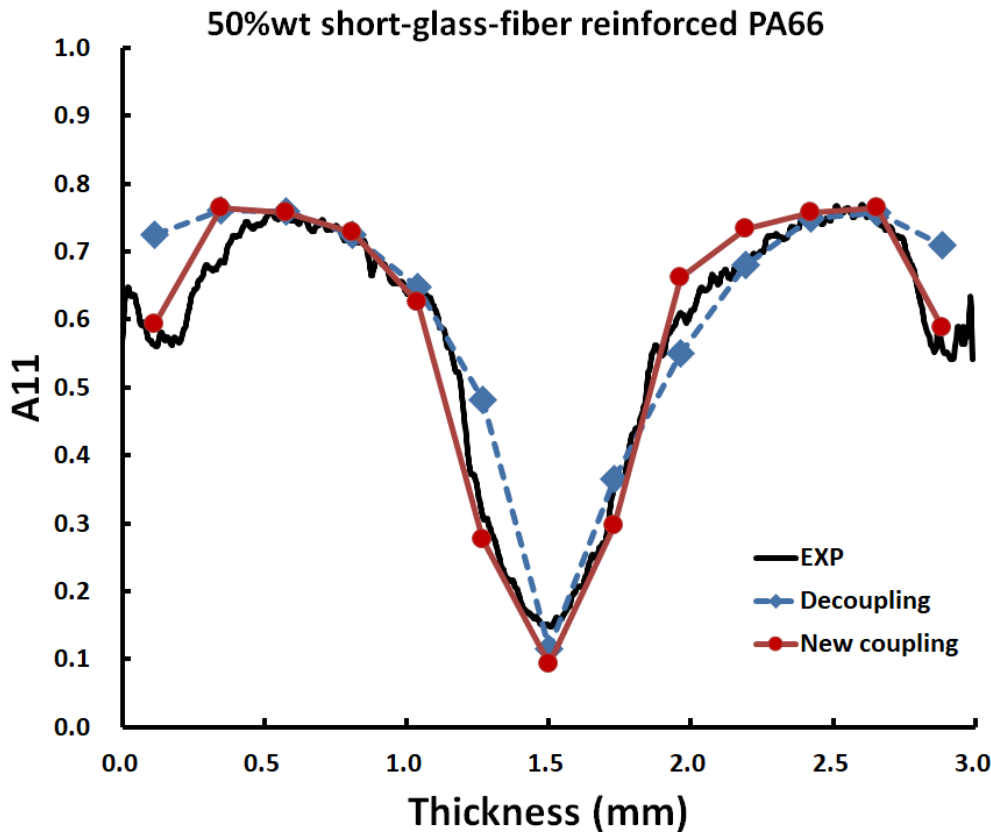


Decoupled

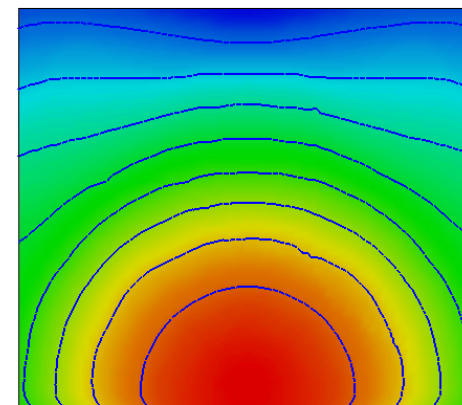


Fiber: Flow-Fiber Coupling for Injection Molding

- > Full coupled flow and fiber orientation simulation for anisotropic viscosity and flow in Injection Molding
 - flow advances faster near the edge than in the center



Decoupled



Fully Coupled

Fiber: Flat Fiber – New Type Filler in Simulation

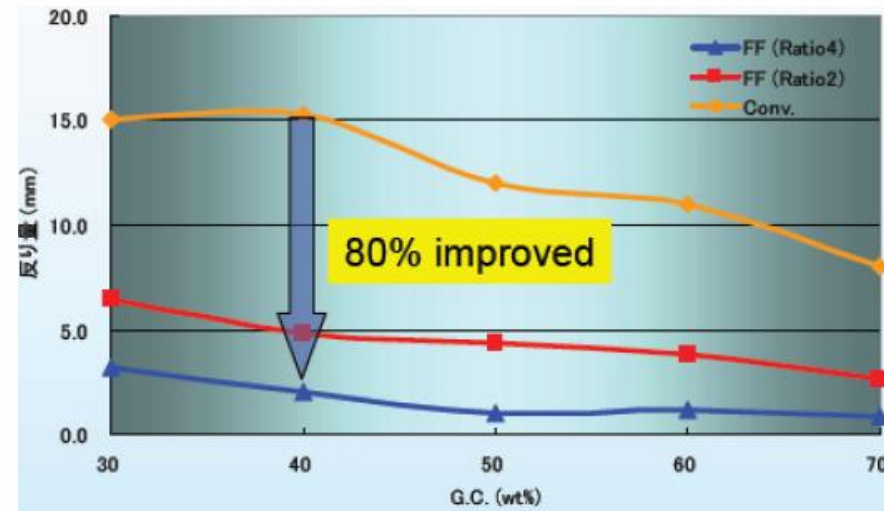
- > Flat fiber has different cross section shape to regular fiber
- > Significant effect on improving warpage result in experiment



Oval cross-sectional shape



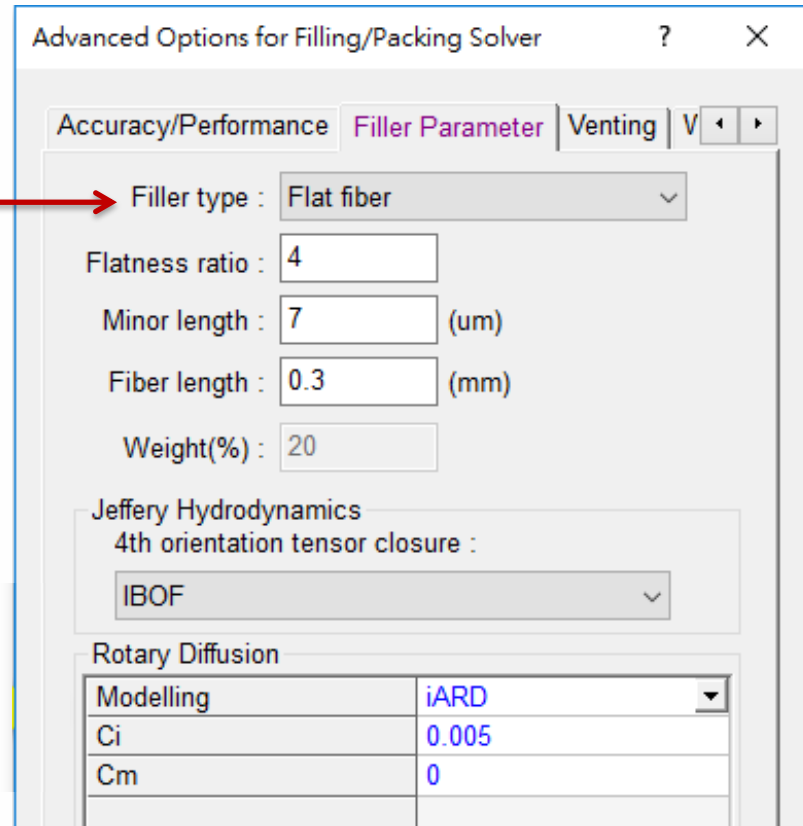
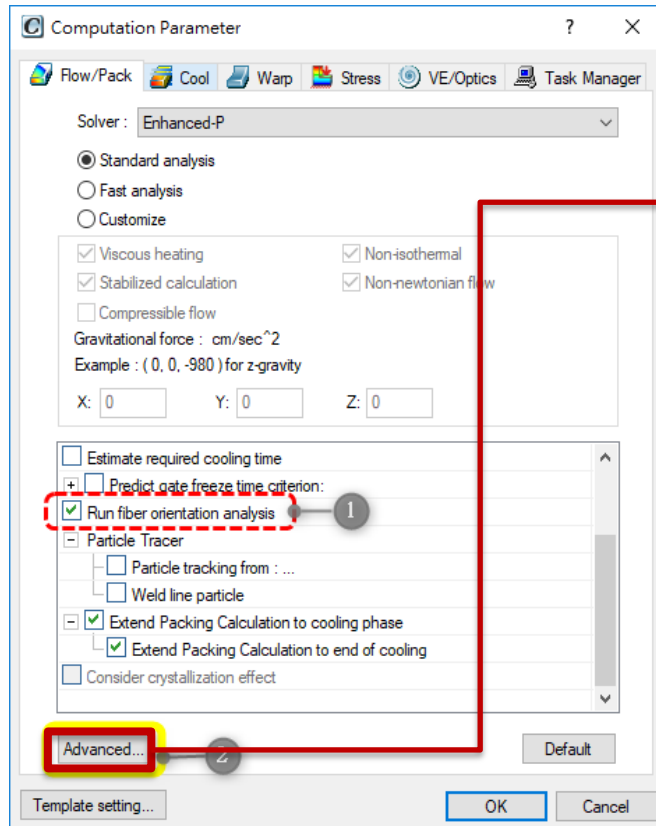
<http://www.nittobo.co.jp/business/glassfiber/frtp/hisff.htm>



Moldex3D

Fiber : Flat Fiber Simulation & Computation Parameters

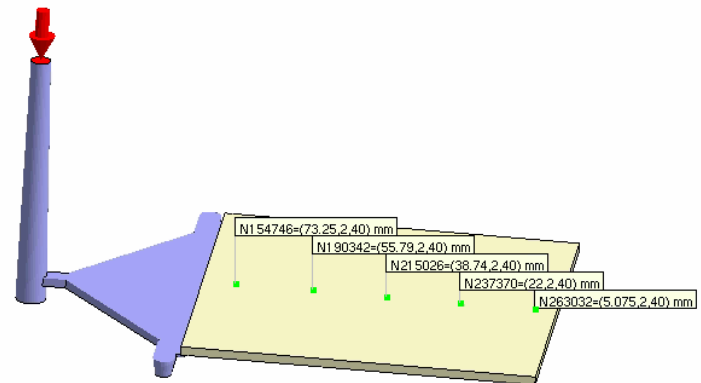
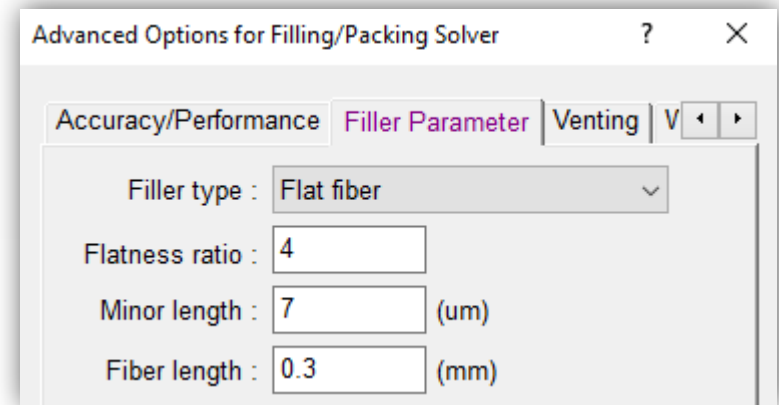
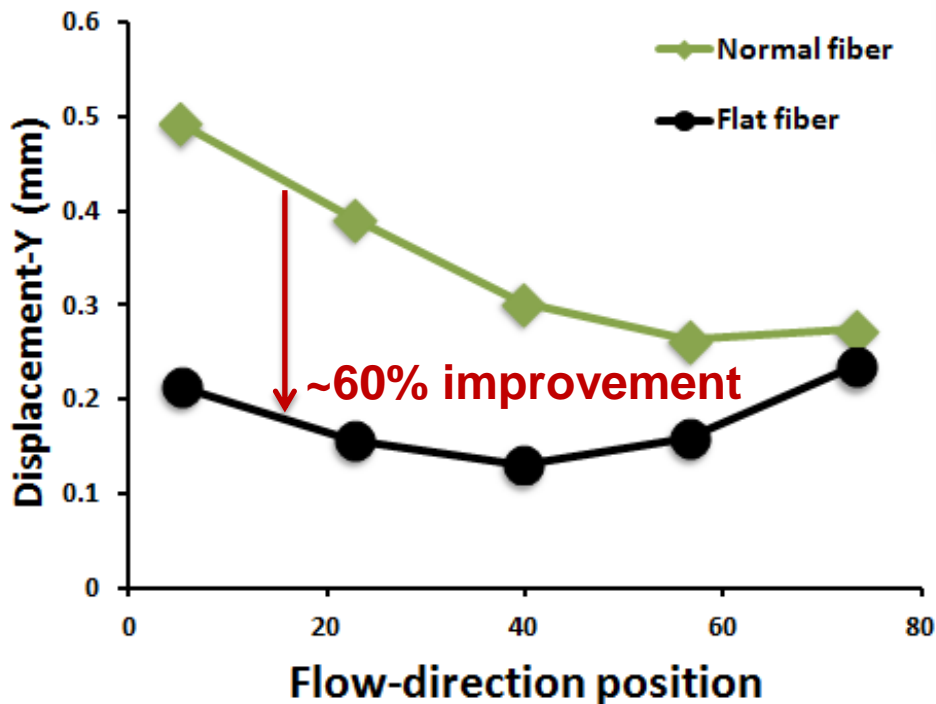
- > [Fiber] Support Fiber analysis with flat fiber
 - Require additional license: EnhancedFiber
 - Additional filler option in Computation Parameter
 - **Benefit:** Expand Fiber analysis capability for new reinforced filler



Fiber: Flat Fiber – Warpage Improvement Validation

> By having this oval shape of glass fiber, various properties as a base material for injection molding are shown improved :

- Fluidity
- Dimensional stability
- Tensile strength



Moldex3D

Moldex3D

Molding Innovation

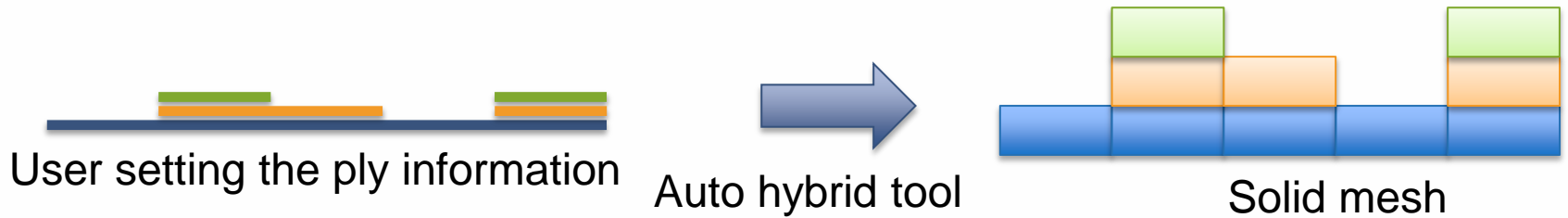
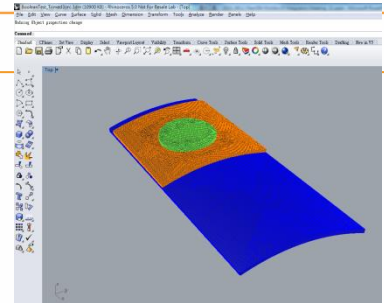
RTM Solver Capability

Foaming Molding Solution

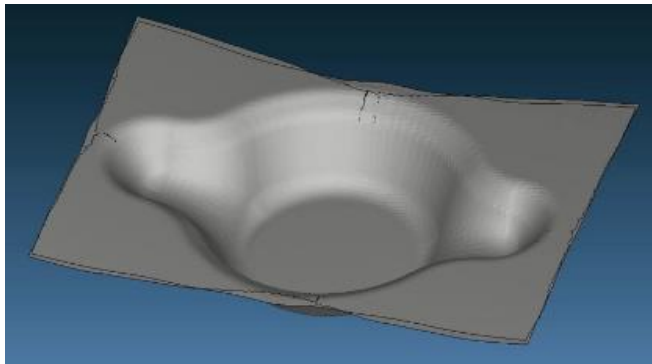
Other Molding Types

RTM : Easier Mesh Preparation for RTM

- > 1. Auto Hybrid tool:
 - Extrude solid mesh from surface



- > 2. Multiple layers from LS-Dyna draping result



Support user to import multiple layers draping result.

RTM : Melt Overflow Data Output and Curing Mold Temperature Profile Setting

- > Output overflow amount through vent to LOG after analysis
- > Set mold temperature profile in Curing stage
 - **Manufacturer raises the mold temperature to reduce curing time.**

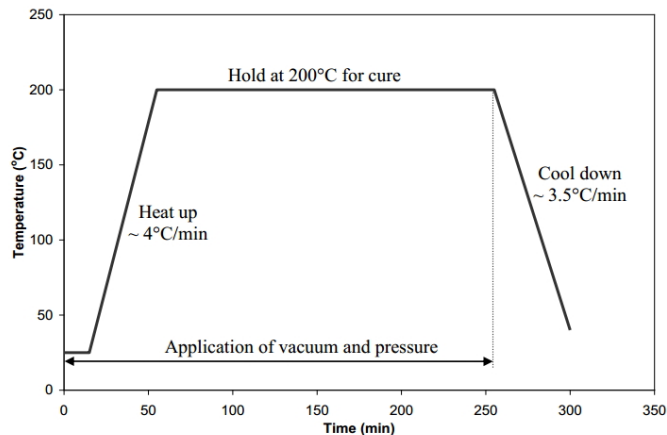
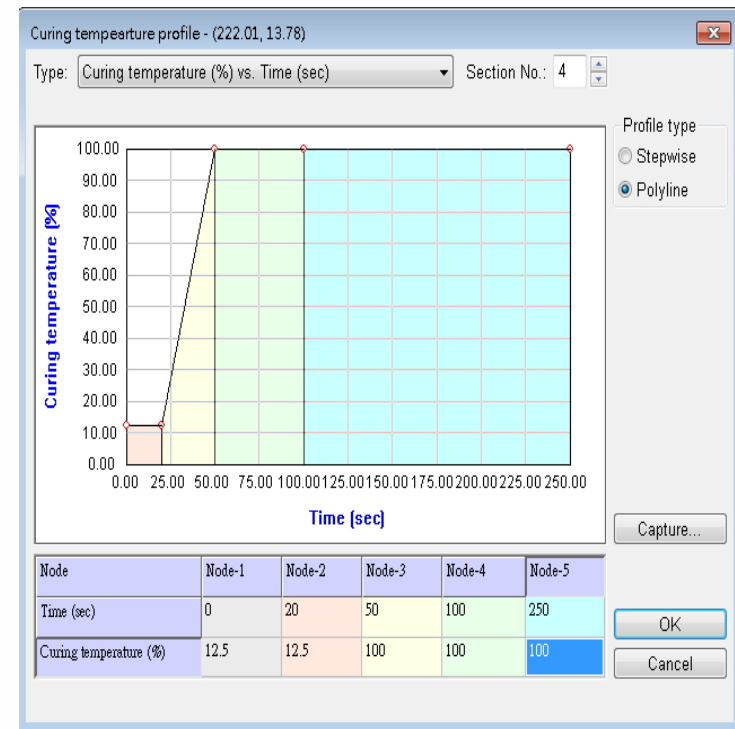


Figure 1.7: Temperature profile utilized during autoclave curing of 24 plies of AS4/3501-6 graphite/epoxy prepregs.

Ref : Effect of post-fill pressure and nanoclay on void morphology in resin transfer molded composites.



Molding Innovation

RTM Solver Capability

Foaming Molding Solution

Other Molding Types

CFM: Enhanced Foaming Kinetics Model

- > Foaming Analysis with Specified Expansion Ratio
 - Improved simulation accuracy validated with FOAMAT experiment for fine material data and process conditions

Model and Parameters

Foaming Kinetics Model:
Modified Combined Model with Expansion Ratio

$$\frac{d\alpha}{dt} = (K_a + K_b \alpha^n)(1 - \alpha)^n$$

$$K_a = A \exp\left(\frac{-T_a}{T}\right), T_a = \frac{E_a}{R}$$

$$K_b = B \exp\left(\frac{-T_b}{T}\right), T_b = \frac{E_b}{R}$$

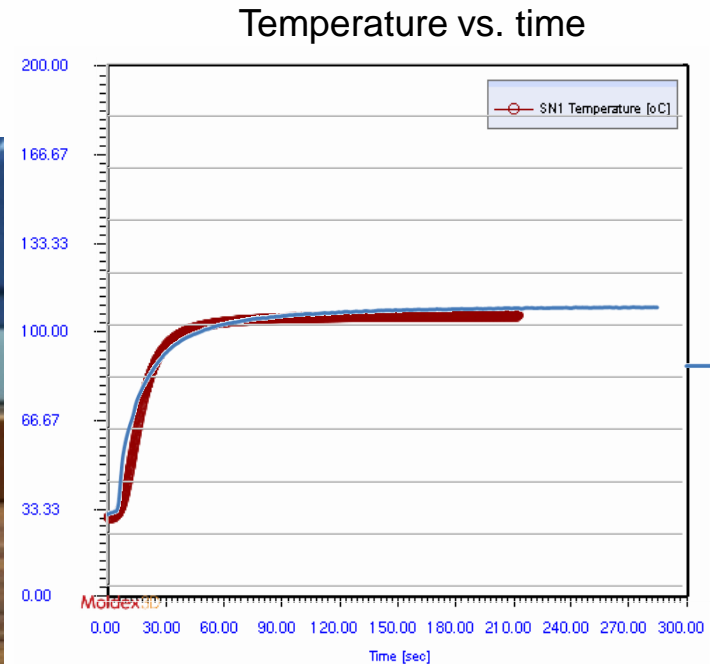
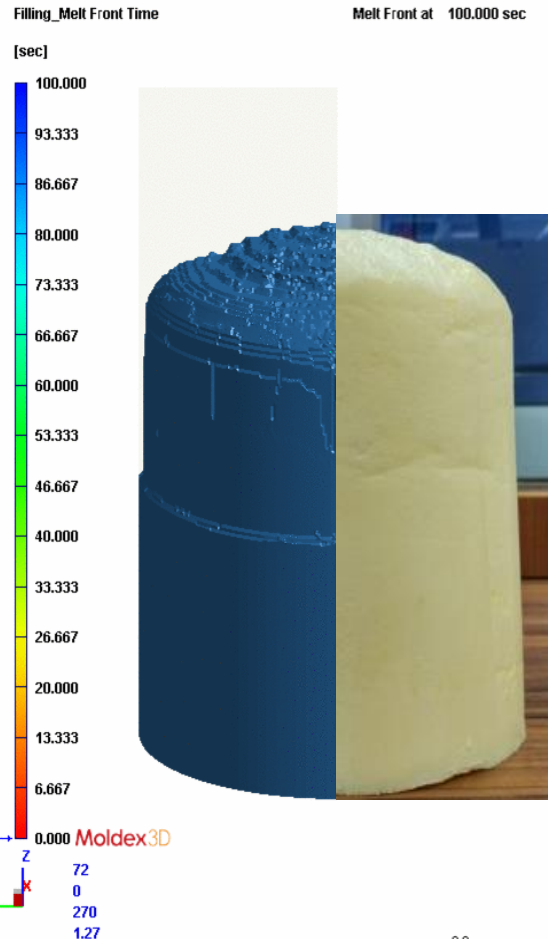
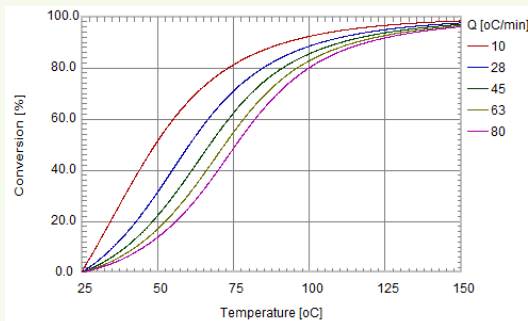
$$b = b_0 \exp\left(\frac{T_{diff}}{T}\right), T_{diff} = \frac{E_{diff}}{R}$$

$$\alpha_g = 1 - \exp[-\Psi(T - T_0)]$$

$$\text{Expansion Ratio (ER)} = \frac{V_{final}}{V_{initial}}$$

| | | |
|-------|----------|-------|
| m | 1 | - |
| n | 2 | - |
| A | 1500 | 1/sec |
| B | 1.2e+010 | 1/sec |
| Ta | 1200 | K |
| Tb | 6000 | K |
| b0 | 0.3065 | - |
| Tdiff | 2600 | K |
| Psi | 0.0357 | - |
| T0 | 281 | K |
| dH | 6e+007 | erg/g |
| ER | 5 | - |

Close



FIM: Improved Coreback Simulation

- > Consider bubble convection during FIM (Foam Injection Molding) Coreback process
 - To better observe bubble transportation during cavity expansion
 - Better stability and accuracy on bubble distribution prediction
 - Good result for moderate Coreback distance



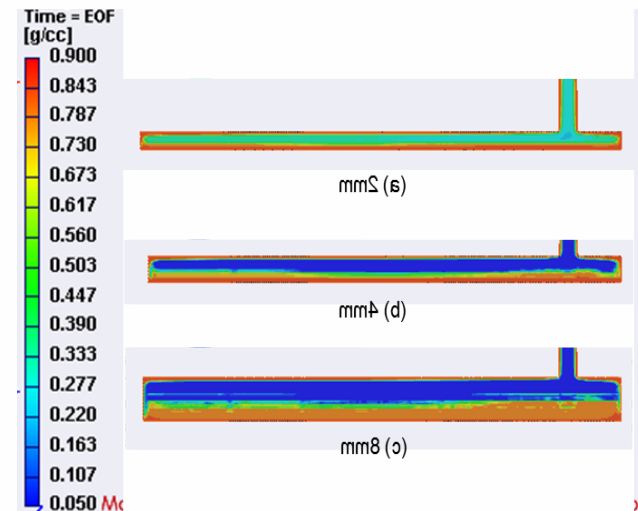
Coreback distance 2mm



Coreback distance 4mm



Coreback distance 8mm



Molding Innovation

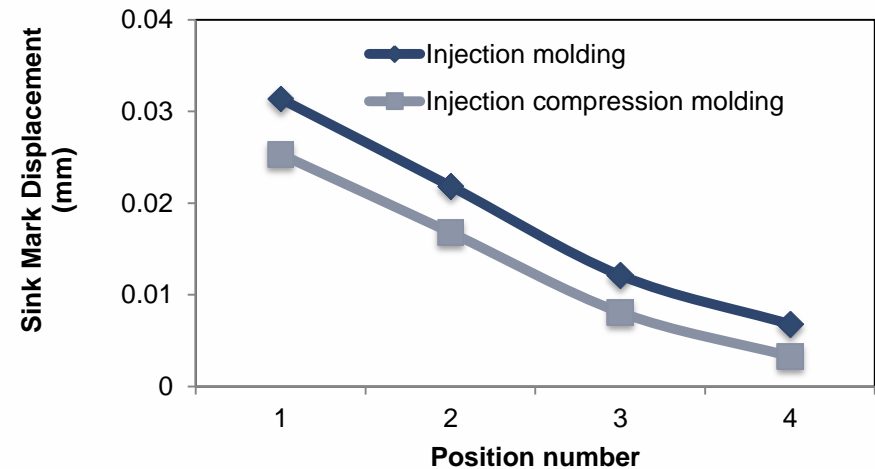
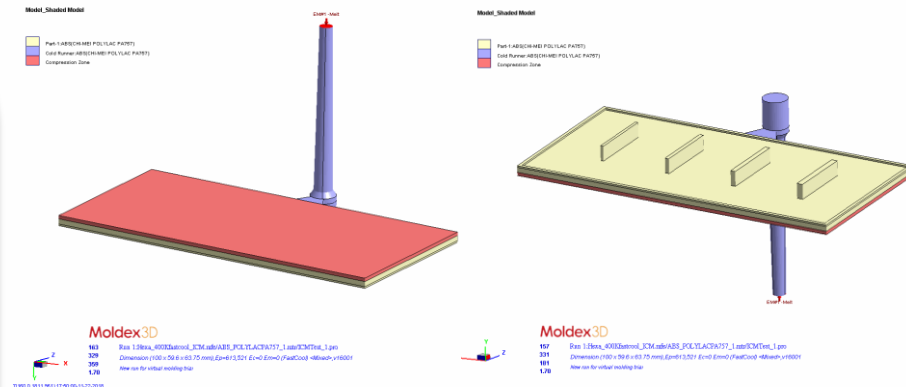
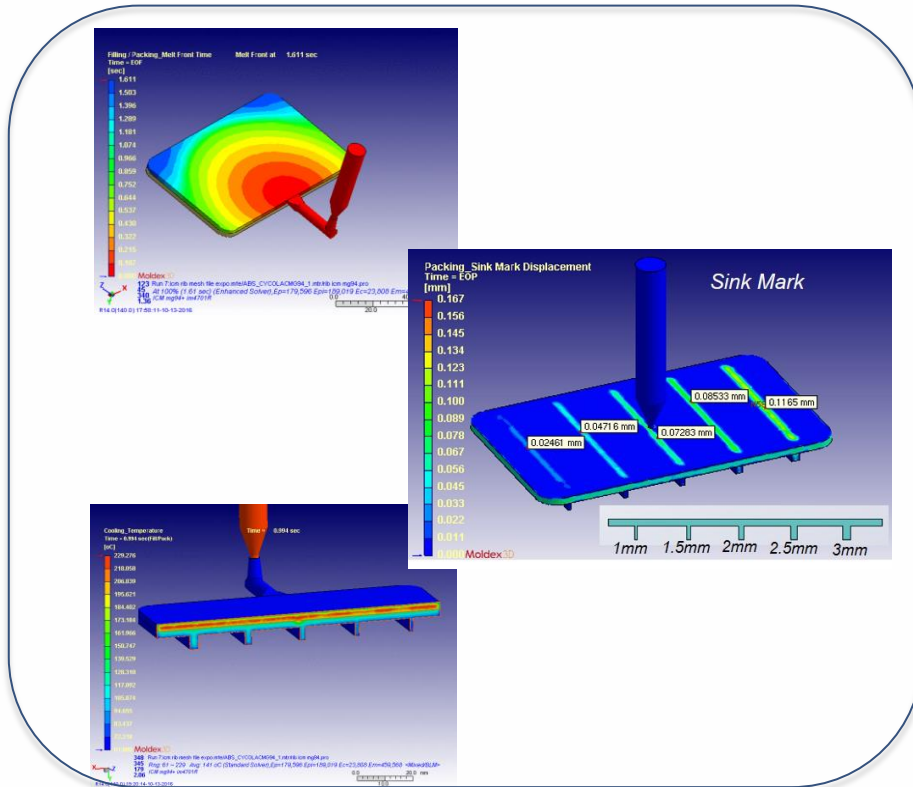
RTM Solver Capability

Foaming Molding Solution

Other Molding Types

ICM: Sink Mark Output for ICM Simulation

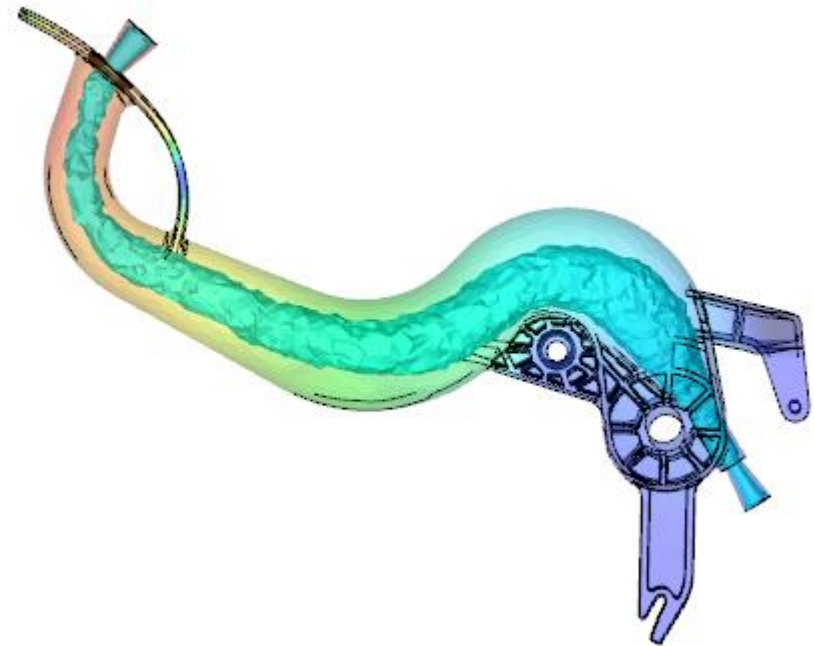
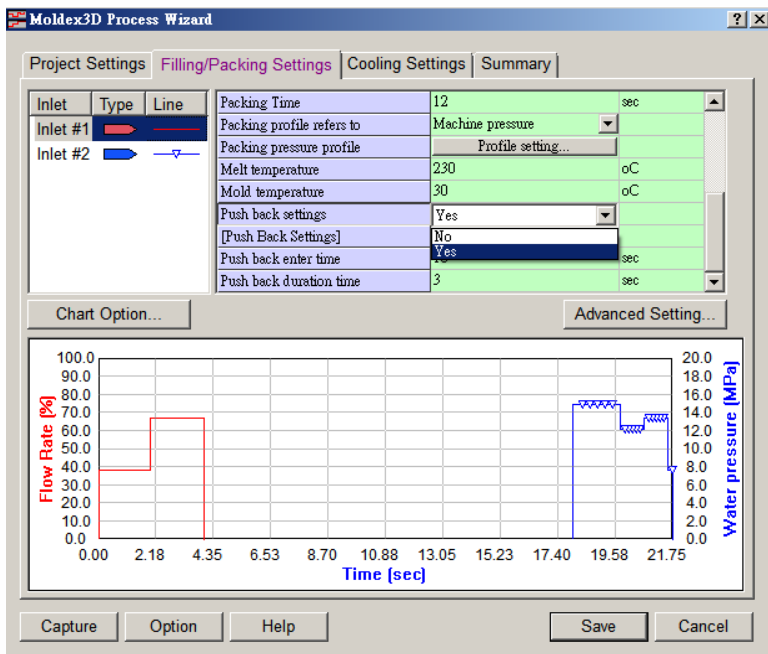
- > Fully support Sink mark prediction for ICM process.
 - Compression part is modeled by compression zone



2K-ICM Simulation Framework to Enable Design Optimization for Surface Aesthetics
<http://www.moldex3d.com/en/2018-gita-winners-company-n10/>

GAIM : Support Push-back Process

- > The process set gate and fluid inlet on different side of cavity
 - GAIM use gas with lower thermal transport ability, and thus will cause more core-out volume in part especially near inlet
 - **Benefit:** reduce flow mark by short-shot process and recycle the material push back to barrel to avoid overflow waste



PIM: New PVT Model

- > New PVT model: Modified Tait Model (3)
 - To more accurately present compressibility change of PIM (Powder Injection Molding) material under different pressure
 - Coefficient C becomes fitting instead of fixed parameter

Model and Parameters

PVT Model:
Modified Tait Model (3)

$$\hat{V} = \hat{V}_0 [1 - C \ln(1 + P/B)] + \hat{V}_t$$

$$\hat{V}_0 = \begin{cases} b_{1S} + b_{2S} \bar{T}, & \text{if } T \leq T_t \\ b_{1L} + b_{2L} \bar{T}, & \text{if } T > T_t \end{cases}$$

$$B = \begin{cases} b_{3S} \exp(-b_{4S} \bar{T}), & \text{if } T \leq T_t \\ b_{3L} \exp(-b_{4L} \bar{T}), & \text{if } T > T_t \end{cases}$$

$$\hat{V}_t = \begin{cases} b_7 \exp(b_8 \bar{T} - b_9 P), & \text{if } T \leq T_t \\ 0, & \text{if } T > T_t \end{cases}$$

$$\bar{T} = T - b_5 \quad T_t = b_5 + b_6 P$$

| | | |
|-----|-----------|-----------|
| b1L | 0.188443 | cc/g |
| b2L | 3.89e-005 | cc/(g.K) |
| b3L | 4.21e+008 | dyne/cm^2 |
| b4L | 3.09e-008 | 1/K |
| b1S | 0.182281 | cc/g |
| b2S | 2.16e-005 | cc/(g.K) |
| b3S | 1.87e+009 | dyne/cm^2 |
| b4S | 5.87e-008 | 1/K |
| b5 | 426.15 | K |
| b7 | 1.4e-008 | cc/g |
| b7 | 0.00456 | cc/g |
| b8 | 0.116 | 1/K |
| b9 | 1.71e-009 | cm^2/dyne |
| C | 0.0096757 | - |

Pre/Post-processing Tools

CAD & Mesh Tool

Meshing Kernel

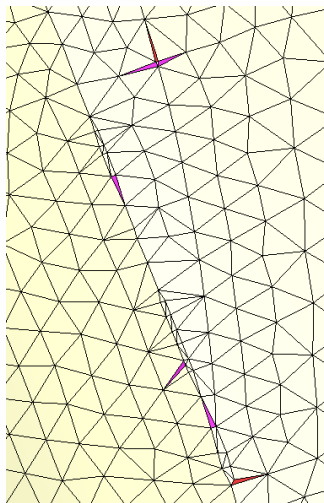
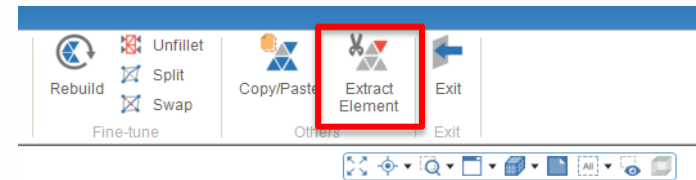
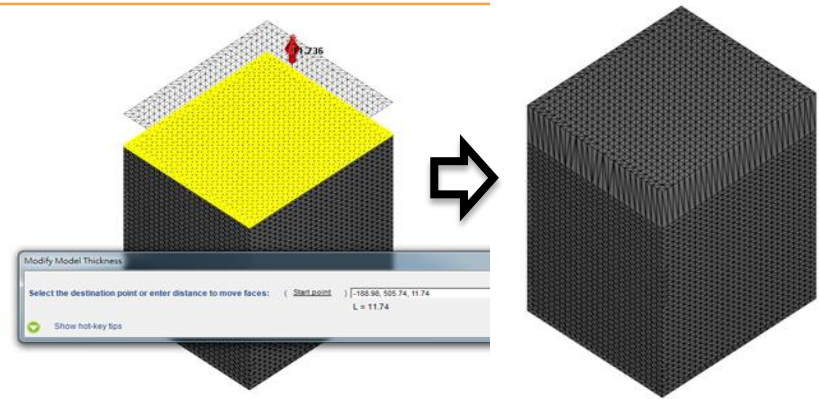
Modeling Wizard

BLM : Improve Surface Mesh

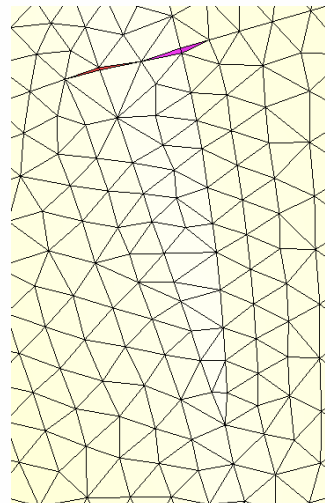
> Allow locally modify thickness by scaling surface mesh

> Support to extract element
– Consider feature line during surface mesh generation

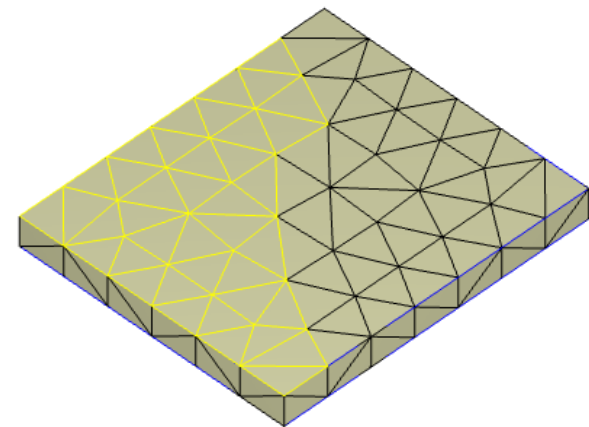
> Enhance Unfillet Wizard
– Better Performance and Speed



Original Result

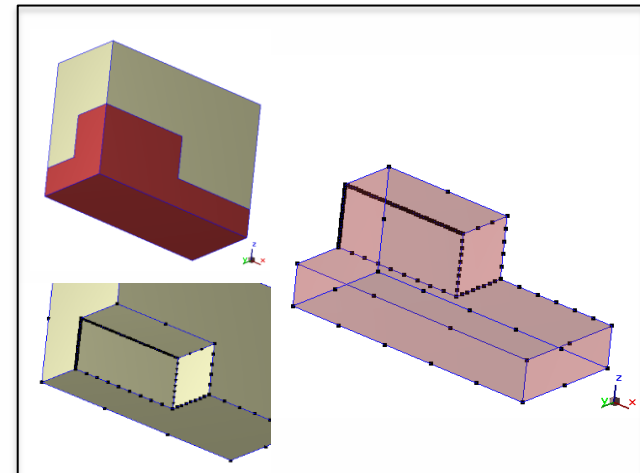
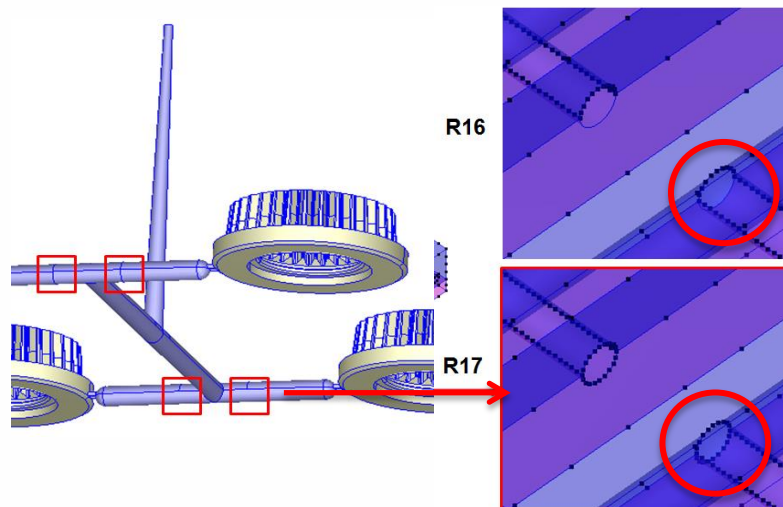
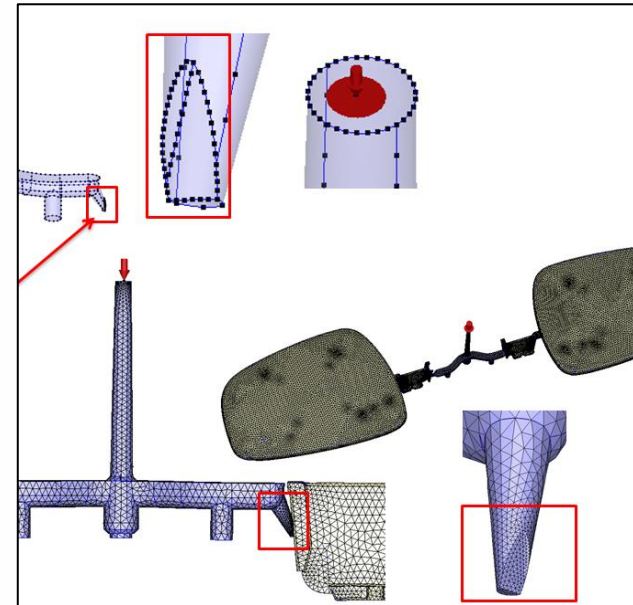


New Result



BLM: Node Seeding Auto-refined Enhancement

- > Node seeding auto-refine for geometry runner system
 - Mesh refine around inlet/outlet of geometry runner and cooling system
 - Adjust mesh parameter for runner and cooling system
- > Full mold quick seeding function
 - Support Edge to Face seeding mapping
 - Support seeding mapping from Part/Part insert to other components



Pre/Post-processing Tools

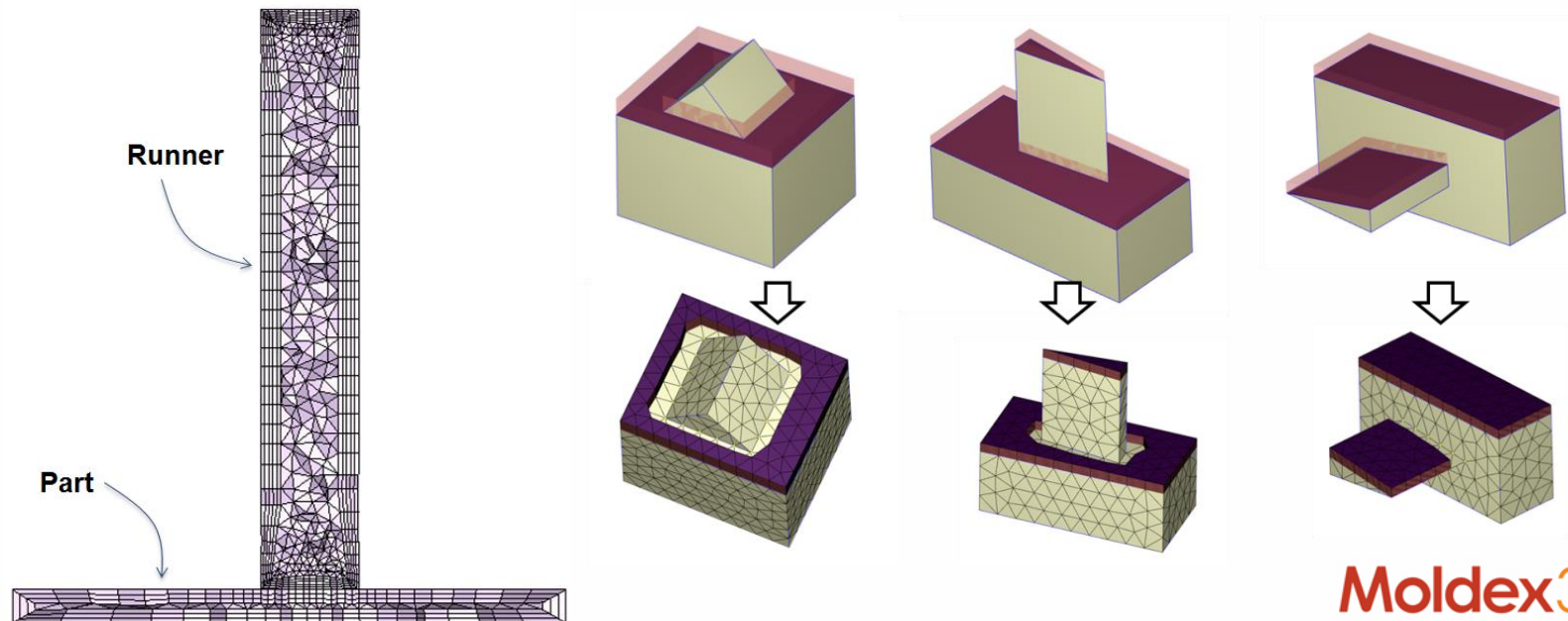
CAD & Mesh Tool

Meshing Kernel

Modeling Wizard

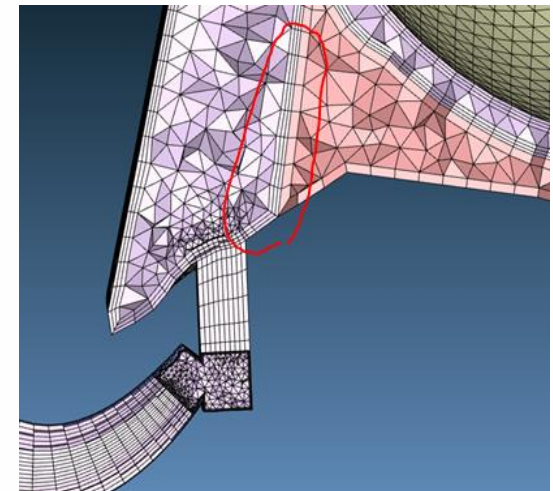
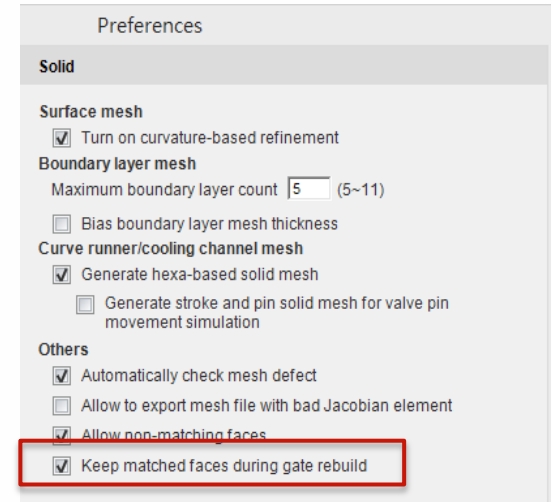
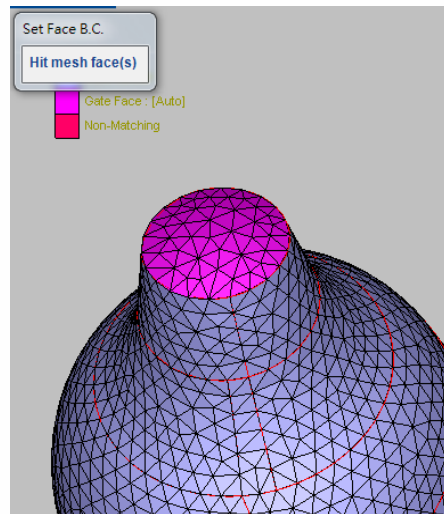
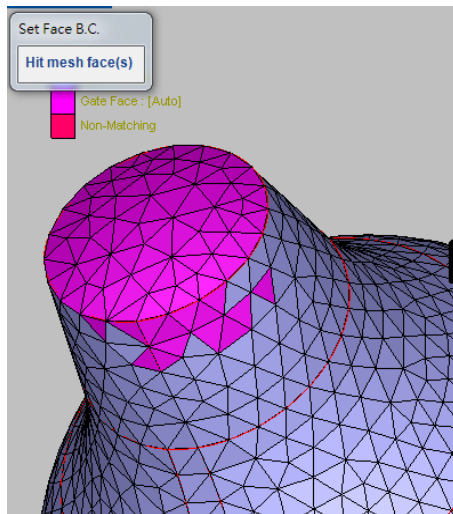
BLM: Mesh Generation Performance Enhancement

- > Add option for auto BLM offset ratio adjustment
 - Separated BLM parameters for part and other components
- > Support Prism mesh element for Compression Zone
 - Add option to switch mesh type between BLM and Prism in wizard with corresponding parameters to modify
 - Skip unsupported feature to avoid interference during mesh generation (too large angle / nearly vertical / concave corners)



BLM : Gate Rebuild Capability Enhancement

- > Gate rebuild can keep surface mesh after matching faces
- > Allow editing and fixing gate face BC
 - Show Gate Face BC when contact issue found during mesh generation for users to manually fix it (Add/Remove BC)

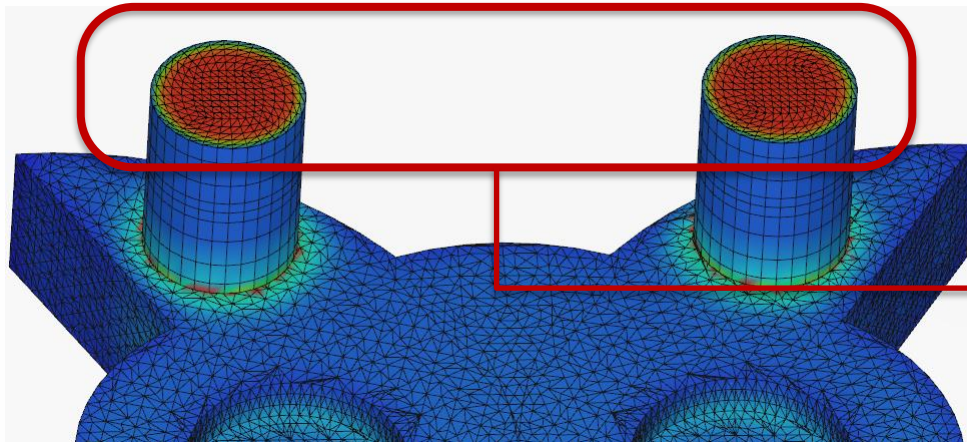


BLM : Non-matching Mesh Enhancement

- > **Non-matching Moldbase / Mold Plate Meshing Enhancement**
- > **Improved Node Seeding**
 - **Auto density control: Part 、 Runner 、 Gate 、 Cooling Channel 、 Moldbase 、 Mold insert 、 Mold Plate**
- > **Check Model interference between Components**
- > **Check Mesh Defect and Issue**
 - **Highlight Trouble point and Bad orthogonality**
 - **Find and fix mesh interference**

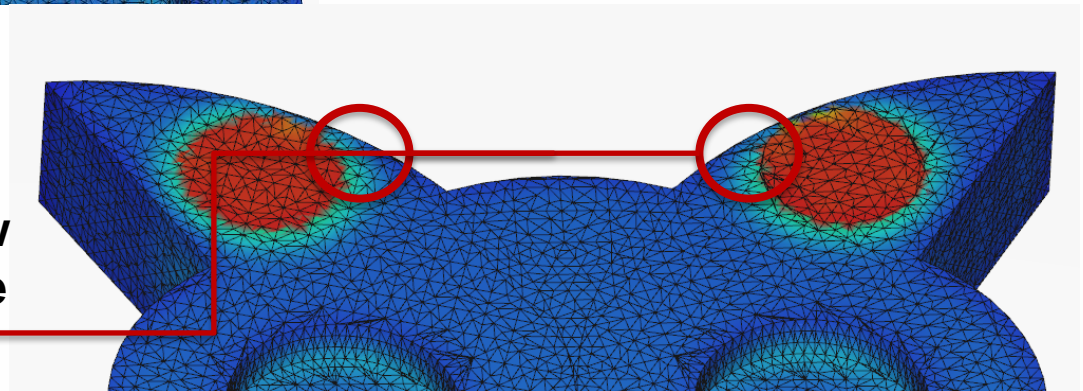
eDesign: Enable Hexa-based Runner Mesh

- > Hexa-based mesh kernel is available in eDesign Mode
 - Better to observe flow and thermal behavior especially near the junction of part and runner



Hexa-based Structural Runner Mesh

Better Prediction of Flow Pattern and Temperature Distribution



Pre/Post-processing Tools

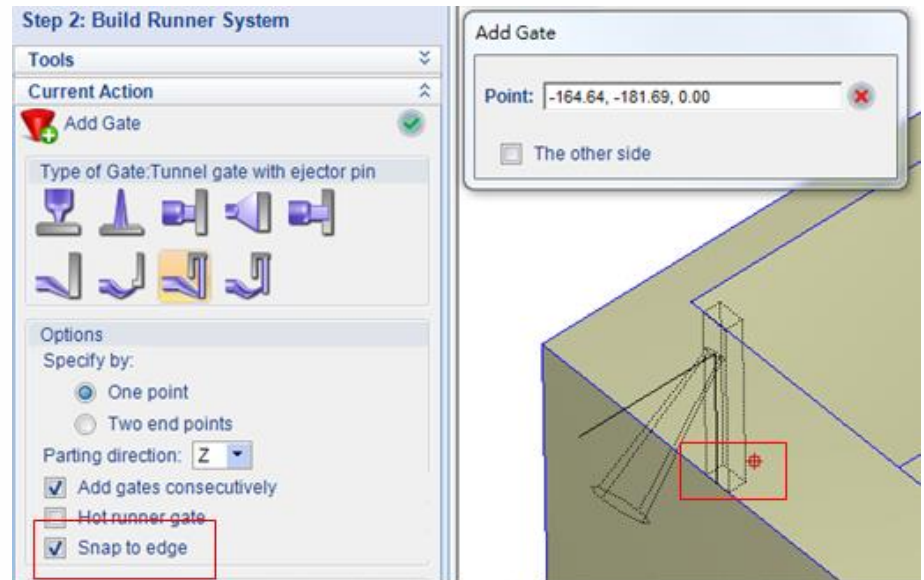
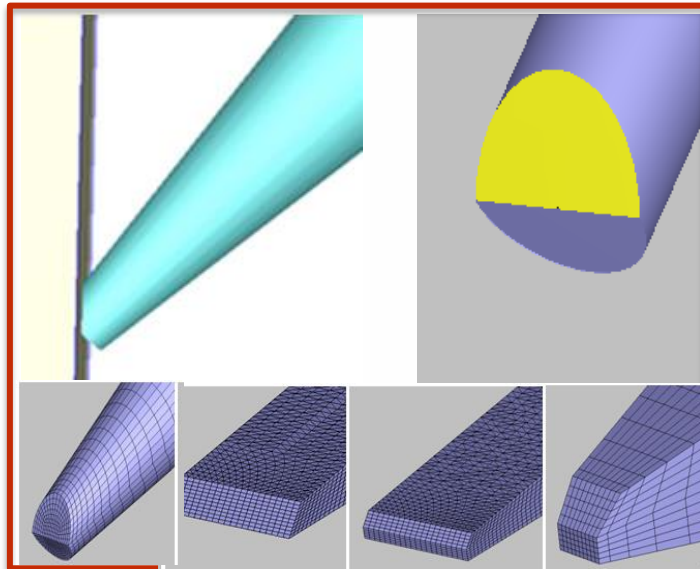
CAD & Mesh Tool

Meshing Kernel

Modeling Wizard

Designer: Gate/Runner Wizard Enhancement

- > Set Hexa based runner mesh as default
- > Allow Tunnel Gate gating shape adjustment for D-shape gating
- > Allow attribute setting for multiple joints in the same time
- > Allow snap to edge for Tunnel/Cashew gate with ejector pin



Designer: Cooling Channel Wizard Enhancement

- > Enhance cooling channel template workflow
 - Improved user interface and template arrangement
 - Provide setting parameters according to selected template

The image displays the Moldex3D Designer interface for the Cooling Channel Wizard. It is divided into several sections:

- Left Panel (Group ID: 1):** Shows the 'Channel Direction' (X-Axis, Y-Axis, Z-Axis) and 'Channel Parameters' (D: 8.000, N: 6, C: 24.000, H: 16.000). It includes buttons for 'Default', 'Templates...', and 'Guide...', and a checkbox for 'Use the original view window'.
- Center Panel (Moldex3D Designer):** Displays a selection screen for templates. The prompt is 'Please select a template: MDX_D3'. Several 3D wireframe templates are shown, each with dimensions labeled L1 through L6. A large green arrow points from this panel towards the right.
- Right Panel (Step 3: Specify Cooling System):** Shows the 'Cooling Channel Layout Wizard' with the current action 'cooling channel template: MDX_D4'. It includes a table of channel segments:

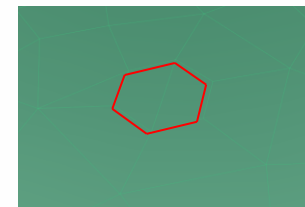
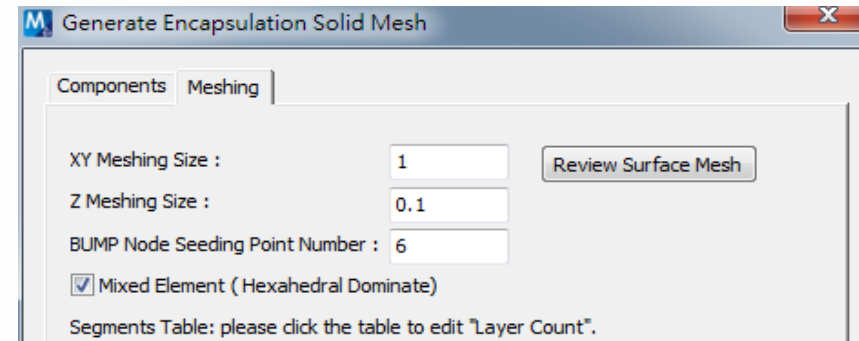
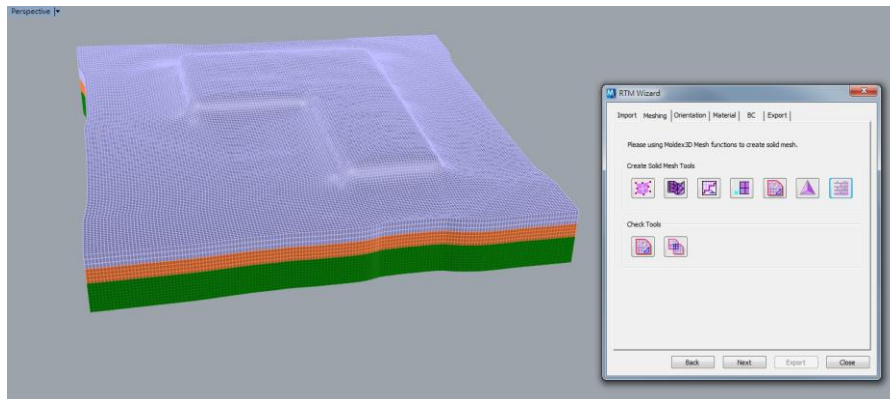
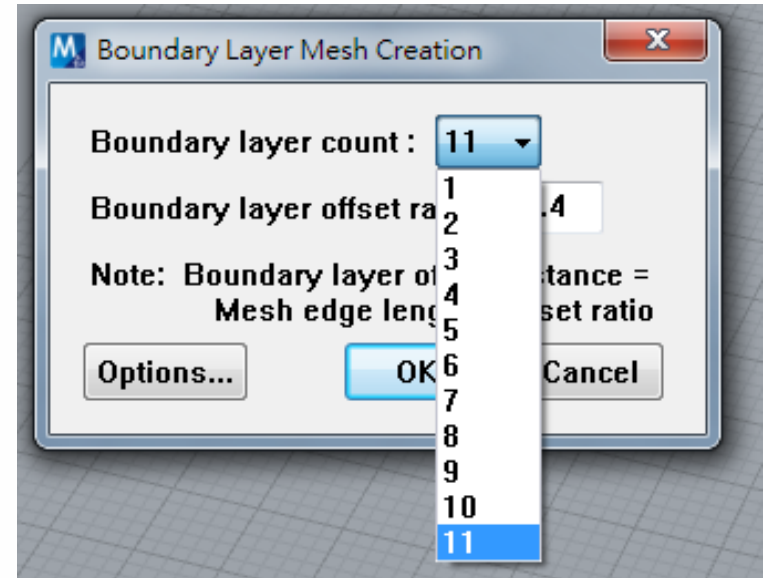
| Number | Length |
|--------|--------|
| L1 | 60.00 |
| L2 | 60.00 |
| L3 | 60.00 |
| L4 | 120.00 |
| L5 | 60.00 |
| L6 | 60.00 |

Below the table are 'Settings' for direction (x-axis, y-axis, z-axis), mirror (TB Mirror, LR Mirror), and position (Front the part, Back the part). A small 3D model of a mold block shows the channel orientation with axes W, L, and MB.

- Far Right Panel:** A 3D model of a mold cavity with cooling channels. The channels are highlighted in yellow and blue. Dimensions for the channels are shown, such as L = 50.305, W = 109.305, and L3 = 40.614. A legend identifies the components: Part (yellow), Cold Runner (blue), Cooling Channel (light blue), Moldbase (grey), and Melt Inlet Face (red).

Mesh: Moldex3D Mesh (on Rhino) Enhancement

- > Enable BLM max layer count adjustment
- > Enhance RTM Wizard
 - Extrusion Solid Meshes from Multi LS-DYNA Files
- > Reduce element count for Auto IC Solid mesh generation
 - Support quad surface element and solid mesh hexa cells
 - Allow BUMP node seeding adjustment



Usability & Database

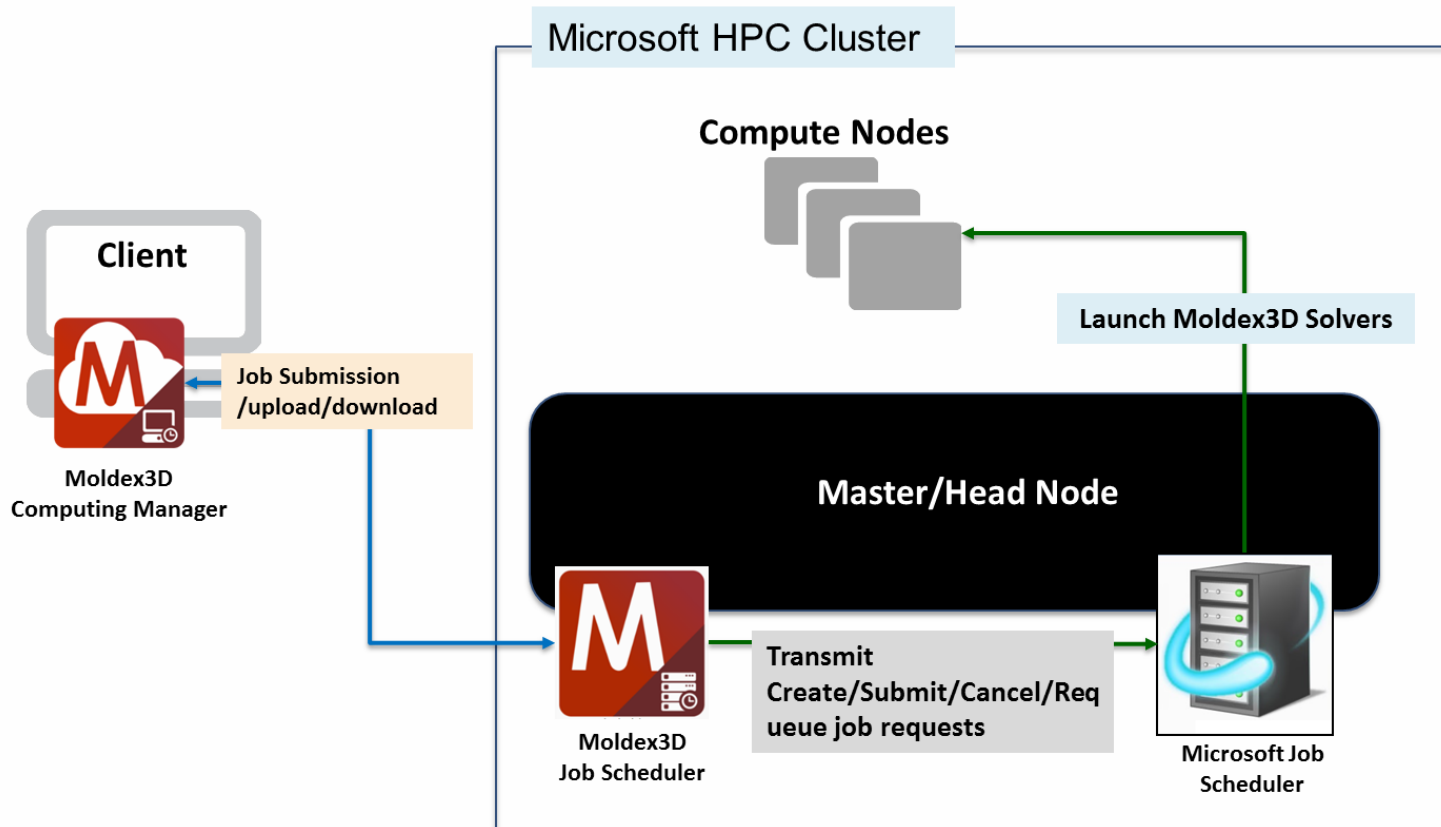
Speeding Up Calculation

Interface & Integration

Database Update

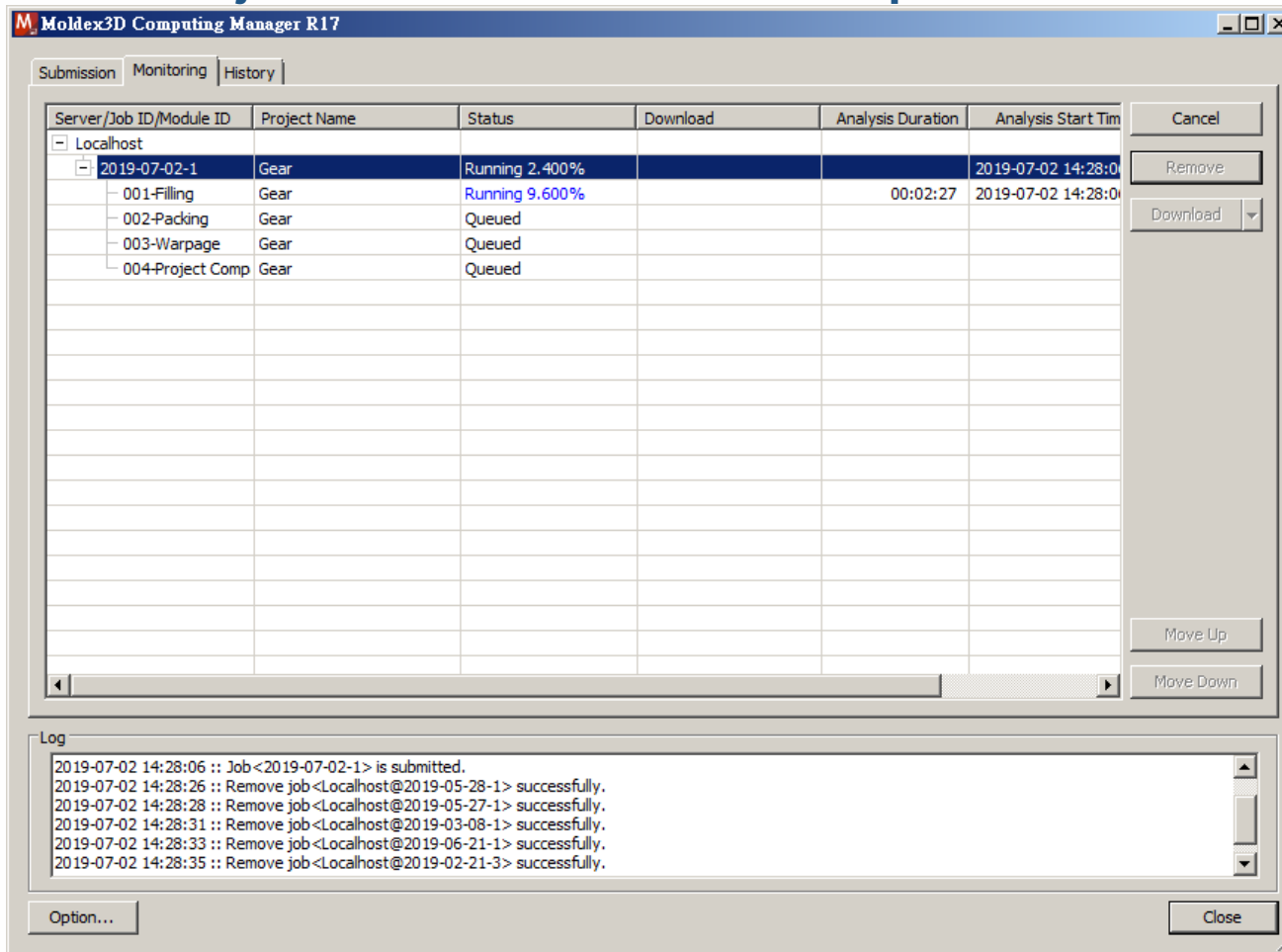
RC : Remote Computing Capability Enhancement

- > Support Remote Computing with Microsoft MPI
- > Enhance Remote Computing to minimize access request to IT system and network



RC : Remote Computing Usability Enhancement

- > Add overall progress ratio display for each analysis job
- > Allow window size adjustment for Computing Manager
 - The adjusted window size will be kept when closed



Usability & Database

Speeding Up Calculation

Interface & Integration

Database Update

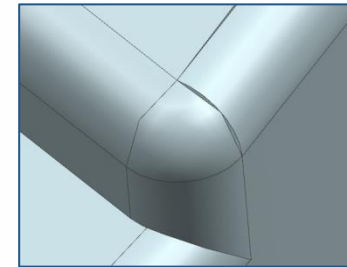
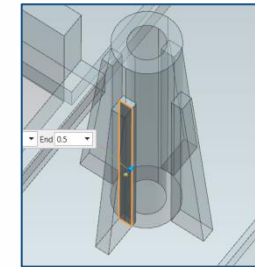
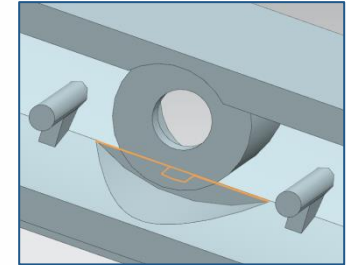
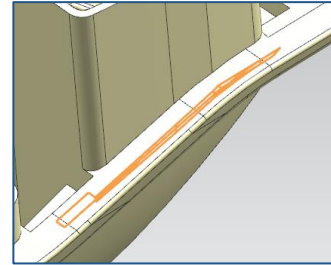
SYNC : New Installation Package

- > Individual Installation Package
 - Specific light product package for Moldex3D entry users
 - Require only SYNC installation, no more Moldex3D installation
 - Avoid potential issue of different version solver and mesh kernel
- > New SYNC Installer interface
 - Check issue before start installing
 - New style (Silent Mode & Parallel setting included)

| | SYNC R16 | | SYNC R17 | |
|----------------|----------|----------|----------|----------|
| | SYNC | Moldex3D | SYNC | Moldex3D |
| Pre (Meshing) | O | | O | |
| Solver | | O | O | |
| Post-processor | O | | O | |

SYNC: Pre/Post Tools Enhancement

- > Geometry fixing workflow for mesh generation
 - Will remove bad faces during mesh generation
- > Support Machine Interface and Machine Response
- > Enhanced Report Wizard
 - A variety of customized options



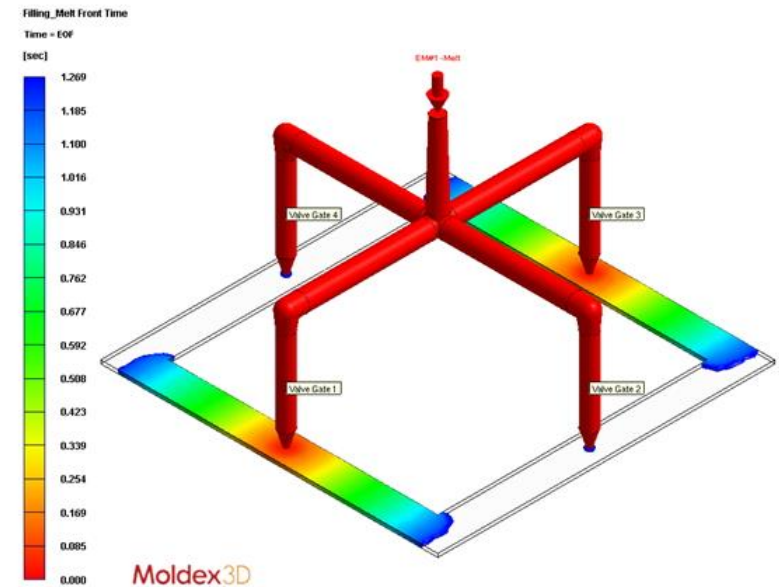
The screenshot displays the 'Generate Report' dialog box in Moldex3D. The dialog is divided into several sections:

- Display Tools:** Includes sliders for 'Upper Limit' (set to 1.42e+00) and 'Lower Limit' (set to 1.00e-10). Checkboxes for 'Color Legend', 'Part', and 'Runner' are all checked.
- Animation Tools:** Includes a 'Current Steps' slider (set to 100,000), a 'Display Speed' slider, and a 'Display Step' dropdown (set to 5,000). 'Play' and 'Save' buttons are present.
- Advanced Tools:** Includes checkboxes for 'Clipping Function', 'Slicing Function', and 'Isosurface Display'. Below is an equation input field: $aX + bY + cZ = d$, with input fields for a, b, c, d, and Value (all set to 0.000). 'Reset' and 'Close' buttons are at the bottom.
- Generate Report Section:** Includes fields for 'Type' (PPT), 'Name' (Report), 'Author' (Moldex3D), and 'Remark' (N/A). A 'Detail Information' section is expanded to show 'Report Content' with a list of options: Product Information - Product Information, Product Information - Thickness Distribution, Filling - Melt Front Time (selected), Filling - Air Trap, Filling - Weld Line, Filling - Pressure, Filling - Temperature, Filling - Volumetric Shrinkage, Filling - Max. Shear Stress, Filling - Max. Shear Rate, and Filling - Frozen Layer Ratio. A 'Remark' field and 'Modify Image' button are also present.
- Report Path:** A text field containing the path '\\MDX_WorkingFolder\CREO_SAMPLE_MODEL_1_ASM_SYNC_20181225_1722\Report\'. A 'Browse' button is next to it.
- Buttons:** 'OK' and 'Cancel' buttons are at the bottom right.

To the right of the dialog, a 3D model of a mold part is shown with a color-coded stress distribution, ranging from blue (low stress) to red (high stress).

API: More Capability through API Control

- > Support Valve gate Control
 - Establish analysis tasks with customized interface
 - Support the combinations of different gate switch control



Customer
Defined IT
System

Moldex3D API

Moldex3D

Usability & Database

Speeding Up Calculation

Interface & Integration

Database Update

Material: Database Update

- > [Material] Update material database
 - 39 thermoplastic materials are newly added
 - PA(26), PFA(3), TPE(5), TPV(5)
 - 0 thermoset is newly added
 - 6 material information is updated for properties including viscosity, PVT, specific heat and thermal conductivity
 - PA(4), TPE(3), TPV(2)

Material: Material Wizard Usability Enhancement

- > Improved material search options:
 - Long Fiber / Mold Temperature / Melt Temperature / Structure VE
- > Show Material Bank version in Content page
 - Ensure the latest material file for simulation accuracy
- > No longer support ASC format as exterior source

Polymer: Find
 Producer: Close
 Grade Name: <<
 Melt flow index: (+/-) g/10min
 Density: (+/-) g/cc
 Fiber content: (+/-) %
 Filler Type:
 Melt temperature: ~ oC
 Mold temperature: ~ oC

| Polymer | Grade Name | Producer |
|---------|-------------------------------|-----------------------------|
| LCP | SUMIKASUPER LCP E6006L | SUMITOMO |
| LCP | SUMIKASUPER LCP E6807LHF | SUMITOMO |
| LCP | SUMIKASUPER LCP E7006L | SUMITOMO |
| PA6 | Celstran PA6-GF40-01 | Celanese |
| PA66 | CELSTRAN PA66-GF30-02 | Celanese |
| PA66 | CELSTRAN PA66-GF50-02 | Celanese |
| PA66 | Zytel 75LG50 HSL BK031 | DuPont |
| PA66 | Redistrong A LGF50W 3739 B... | Radici Performance Plastics |
| PA66 | VLF 80207 EM HS | RTP |
| PA66 | Verton RF-700-12 EM HS | SABIC (LNP) |
| PA66 | Verton RF-7008 EM SH | SABIC (LNP) |
| PA66/6 | Grlon TSGL-50/4 | EMS-GRIVORY |
| PA9T | PA9T-CF40-01 (L9) P01 | Daicel Polymer |
| PA9T | PA9T-GF50-01 (L9) P02 | Daicel Polymer |
| PPA | Grvory GCL-3H | EMS-GRIVORY |
| PPA | Grvory GVL-6H | EMS-GRIVORY |
| PPA | Verton PDX-U-03320 | SABIC |
| PPA | Verton NV70041RV | SABIC (LNP) |

34 material(s) found.

| Viscosity PVT Heat Capacity Thermal Conductivity Viscoelasticity Mechanical Properties Structure VE Content Revision Log Other Information | |
|--|----------------------|
| Polymer | POLYESTER |
| Grade Name | ULTRABLEND-KR-4084_1 |
| Producer | EASFP |
| Comment | |
| Last modified date | 2018/06/12 |
| Moldex3D Bank Version | 1016.3(Modified) |
| | |
| Process condition | |
| Melt temperature (minimum) | 260 oC |
| Melt temperature (normal) | 280 oC |
| Melt temperature (maximum) | 300 oC |
| Mold temperature (minimum) | 100 oC |
| Mold temperature (normal) | 120 oC |
| Mold temperature (maximum) | 140 oC |
| Ejection temperature | 226 oC |
| Freeze temperature | 246 oC |

Machine: New Added Machine Interface

- > Add Machine Interface of BAIFENG mold temperature controller
 - Expand Machine Interface to mold temperature controller
 - Provide straightforward information for machine operator
- > New injection machine and new Machine Interface
 - Add YIZUMI 444 injection machine to Machine Bank
 - Add Machine Interface: SUMITOMO/ Hwa Chin / Taichung Machinery /JSW/Hai Tian and the corresponding machine controllers

Cooling Channel/Heating Rod | Mold Metal Material | Estimate Cooling Time

Cooling channel

Setting : By flow rate

Machine Interface

| Channel ID | Control point | Time (sec) | T (oC) | Q (cm ³ /sec) | Coolant | D (mm) | Re |
|----------------|---------------|------------|--------|--------------------------|---------|--------|---------|
| EC1 (Group ... | 11 | 0 | 175 | 120 | Steam | 2 | - |
| | 1-1 | 1 | 175 | 120 | Steam | 2 | - |
| | 1-2 | 2 | 175 | 0 | Water | 2 | 0 |
| | 1-3 | 6 | 175 | 0 | Water | 2 | 0 |
| | 1-4 | 10 | 25 | 0 | Water | 2 | 0 |
| | 1-5 | 11 | 25 | 120 | Water | 2 | 85223.4 |
| | 1-6 | 14 | 25 | 0 | Water | 2 | 0 |
| | 1-7 | 24 | 25 | 0 | Water | 2 | 0 |

Apply current setting to group Apply current setting to all

Report: Customized Report Format and Content

- > Support report format and content customization to show material/process information or key data (Max/Min/Avg/SD)
 - Use standard TAG items to modify report content
 - Support Max/Min/Avg/SD value, curve peak and scaled result
 - Support control through API

Template

#Text_Result_Warp_TotalDisplacement_Deformation

#Text_Result

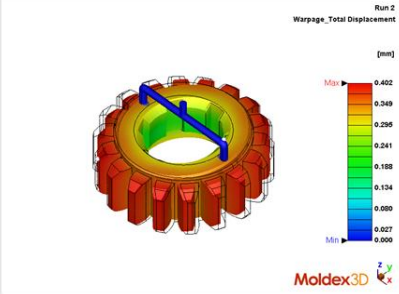
#Image_Result_Warp_TotalDisplacement_Deformation(ICHECK)

| #Text_Result_Warp_TotalDisplacement_DeformationFactor | #Text_Result_Warp_TotalDisplacement_DeformationMaxDisp | Unit |
|--|--|--------------|
| #Value_Result_Warp_TotalDisplacement_DeformationFactor | #Max_Result_Warp_TotalDisplacement_Deformation | #Unit_Length |

Derived PPT

Warpage - Total Displacement Deformation

Result



| Deformation Factor | Max Total Displacement | Unit |
|--------------------|------------------------|------|
| 5 | 0.402 | mm |

115

Moldex3D

| | Text | Image | Video | Statistics | Description | Max | Min | Avg | SD | Rng | Value |
|---|------|-------|-------|------------|-------------|-----|-----|-----|----|-----|-------|
| Result_Warp_XDisplacement_DeformationFactor | v | v | x | x | x | x | x | x | x | x | v |
| Result_Warp_YDisplacement_DeformationFactor | v | v | x | x | x | x | x | x | x | x | v |
| Result_Warp_ZDisplacement_DeformationFactor | v | v | x | x | x | x | x | x | x | x | v |
| Result_Warp_TotalDisplacement_DeformationFactor | v | v | x | x | x | x | x | x | x | x | v |

Command Pool

Moldex3D

M O L D I N G I N N O V A T I O N