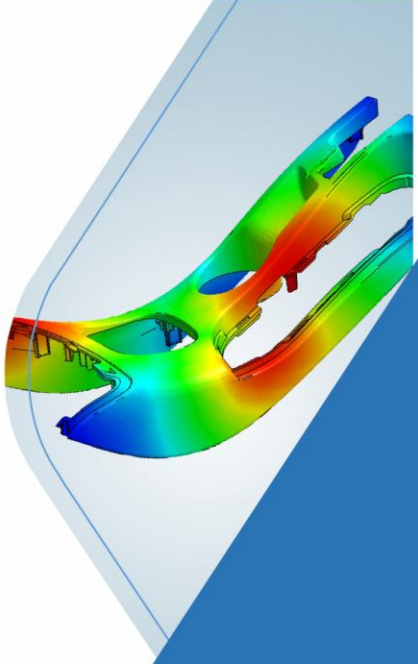
Moldex3D
MOLDING INNOVATION



Moldex3D R13.0 Release Note

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Release Note of Moldex3D R13.0

Release Version: R13.0

Release Date: 06-27-2014

Supported Operating Systems

Moldex3D R13.0 supports Windows versions Microsoft mainly provides. Windows Server 2008 and Windows 8/7 Professional are the most recommended.

Moldex3D R13.0 also supports enterprise editions of Red Hat's Red Hat Enterprise Linux (RHEL) and SUSE Linux Enterprise Server for remote computing node.

Platform	OS	Remark
Windows / x86	Windows 8.1 and 8 Windows 7 family	Professional, Enterprise, Ultimate versions
Windows / x64	Windows 8.1 and 8 Windows 7 family Windows Server 2008 Windows HPC Server 2008 Windows Server 2012	Professional, Enterprise, Ultimate versions
Linux / x86-64	CentOS 5 and CentOS 6 family RHEL 5 and RHEL 6 family SUSE Linux Enterprise Server 11 SP2	Pre and post applications do not support Linux platform

Moldex3D R13.0 New Features

1. Moldex3D Designer BLM Mode

In the last version, Moldex3D introduced Moldex3D Designer BLM mode as a mesh solution to improve both the meshing efficiency and its quality. Moldex3D keeps expanding Designer's capability to support more analysis types for actual cases, add

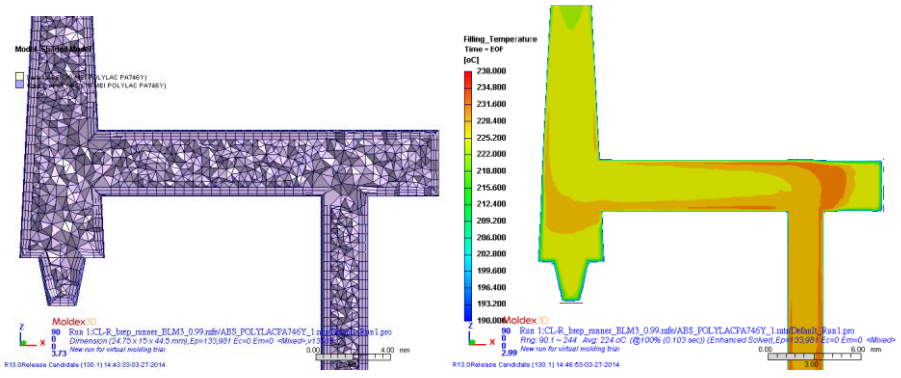
useful fixing tools for mesh improvements, and enhance the usability.

1.1 Robust Support for More Analysis Types

Moldex3D has expanded the functionalities of Designer BLM mode to support diverse molding processes, including multiple component molding (MCM), 3D cooling channel, compression molding, powder injection molding (PIM), MuCell® molding, gas-assisted injection molding, water-assisted injection molding, co-injection molding, and bi-injection molding. By utilizing the enhancements, the effort for mesh preparation is greatly reduced but the mesh quality has not been compromised. The procedures of utilizing the features are greatly reduced than those you have used before.

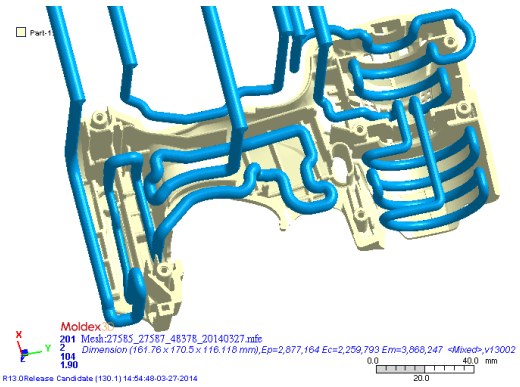
1.2 Efficient Solid Meshing for Complex Runner and Cooling Systems

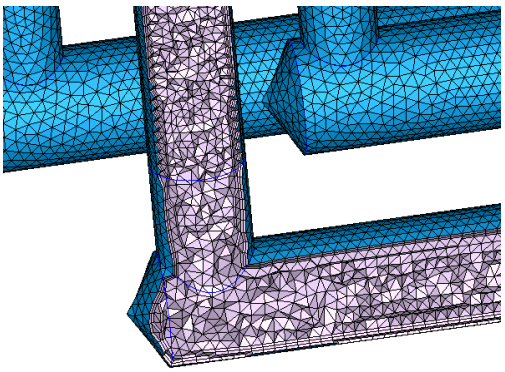
The new release unleashes the limitation that user cannot directly import the runner or cooling system from CAD. Moldex3D Designer now supports runner and cooling systems designated not only inside Moldex3D Designer but also from CAD, making model design more flexible and closer to the real cases than ever before.



This improvement benefits mostly to conformal cooling mesh, whose geometry was often complex and could only run fast cool simulation. With the solid meshing capabilities of this release, the most concerned cooling effect of the conformal cooling design can be assessed by 3D solid cooling channel analysis by building 3D meshes for cooling systems (Computation Parameter > Cool > Cooling channel analysis by > Run 3D solid cooling channel analysis).

To conclude, this release reduces the time of meshing preparation but keeps the accuracy of flow predication of both melt and coolant.

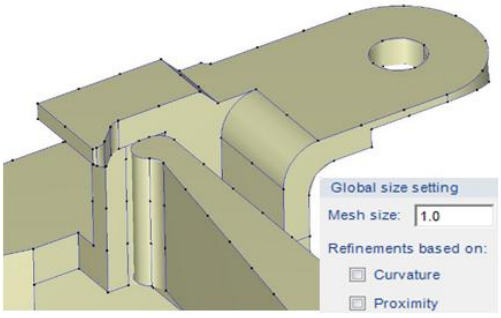


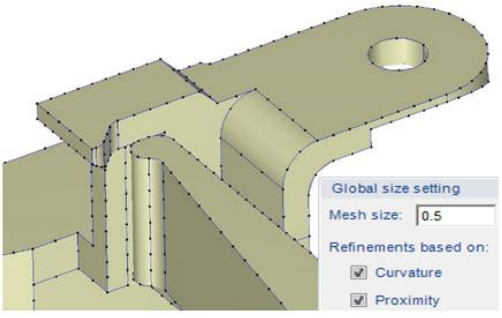


1.3 Optional Seeding Mechanism

In the last version of Moldex3D, node seeding for surface mesh could be refined manually for cases with thickness variations or micro structures. This release introduces an optional mechanism for auto seeding, which enables you to refine node seeding on local areas by Curvature or Curvature&Proximity rule. Several options supports both rules, including the specification of the number of segments, mesh size and biasing types, which includes linear, exponential, and bell curve.

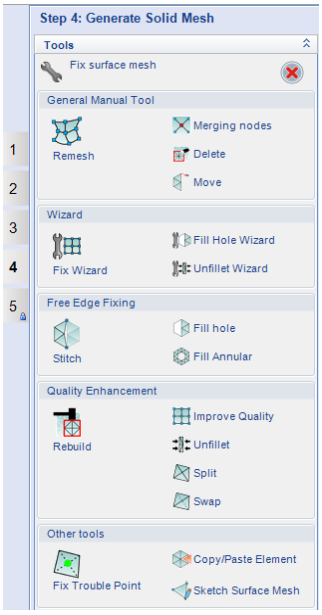
By applying Curvature rule, the node density of feature with curvature becomes denser than that of features without curvature. User can also apply Proximity rule to refine the density around small feature, which has shorter feature line than the others.





1.4 Efficient fixing functions

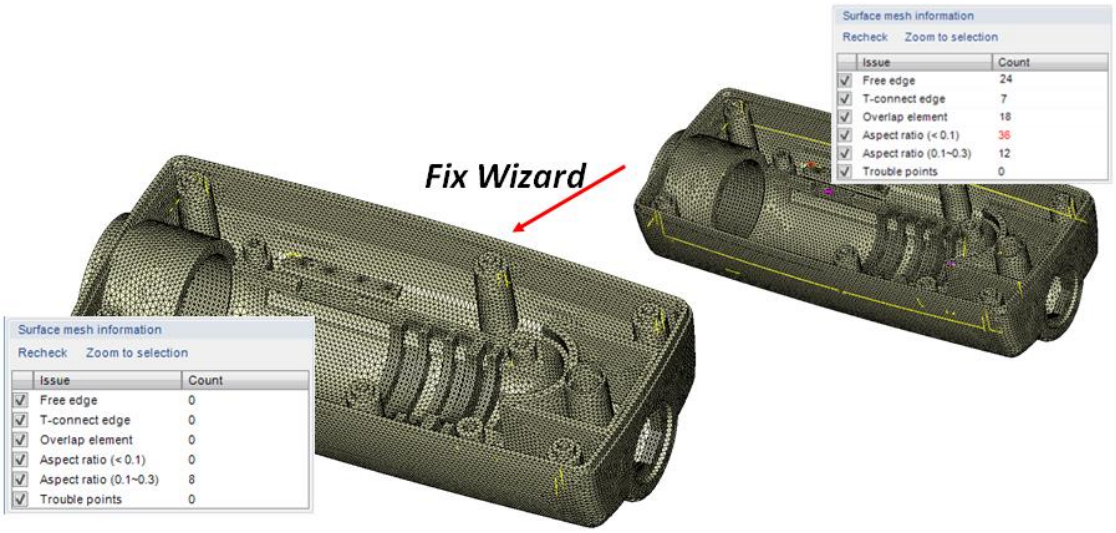
Designer BLM mode provides not only functions for solid mesh generation but also useful fixing tools for mesh quality enhancement. The mesh quality table shows several surface issues, including free edge, t-connect edge, overlap and aspect ratio. Designer BLM mode provides to each issues corresponding fixing solutions, categorized and arranged in target-oriented way, assisting user to conveniently handle the mesh defects. The new functions are available in Step 4 of Moldex3D Designer BLM mode. Click Generate (Step 4: Generate Solid Mesh > Generate) and set up the meshing options. If the model contains surface mesh defects, the program will automatically bring up Fix Tools before generating solid mesh.



The following passage will go through a brief navigation of highlighted tools.

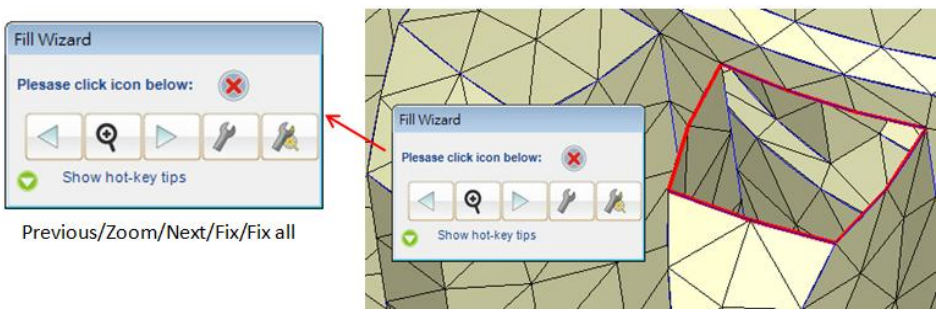
- **Fix Wizard**

Fix Wizard provides four fixing steps for surface defects. Select the object needed to be fixed, Fix Wizard will guide you through steps, including merging mesh, deleting overlap, filling hole, and fixing quality. Each step can be skipped according to users' judgment. After executing Fix Wizard, improvement of surface mesh can be viewed in the surface mesh table.



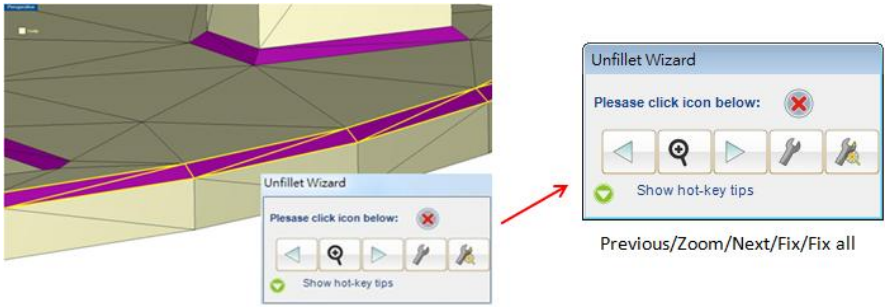
- **Fill Hole Wizard**

The holes in mesh would lead to failure of solid mesh generation. Thus, Moldex3D presents Fill Hole Wizard particularly for the defects of holes among the mesh. Fill Hole Wizard will patch the hole detected and marked by the program. You may choose to fix the found issues one by one or to fix all at once.



- **Unfillet Wizard**

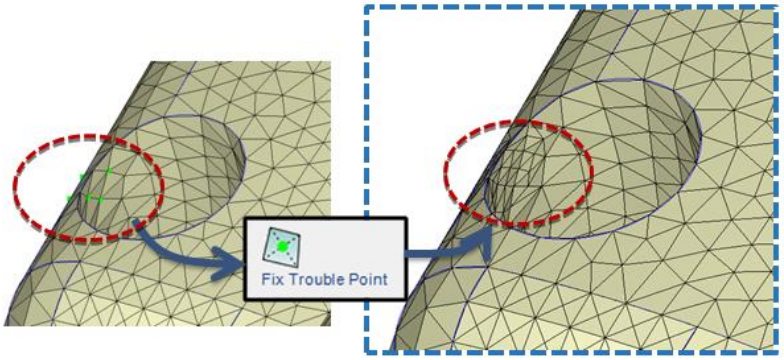
Like the issue of hole described previously, fillet in mesh will also cause failure in the mesh generation. Thus, Moldex3D presents Unfillet Wizard particularly for the defects of fillets among the mesh. Unfillet Wizard will remove fillets for the smoothness of surface mesh. Like the previous feature, you may choose to fix the found issues one by one or to fix all at once.



- **Trouble Point Repair Tool**

In some cases, the surface mesh has no defect; however, the solid mesh generation fails because of the low density of surface mesh with respect to part local thickness. To avoid this situation, the Designer BLM mode provides functions to automatically detect and fix the trouble points, which are the defects that caused solid mesh generation failed.

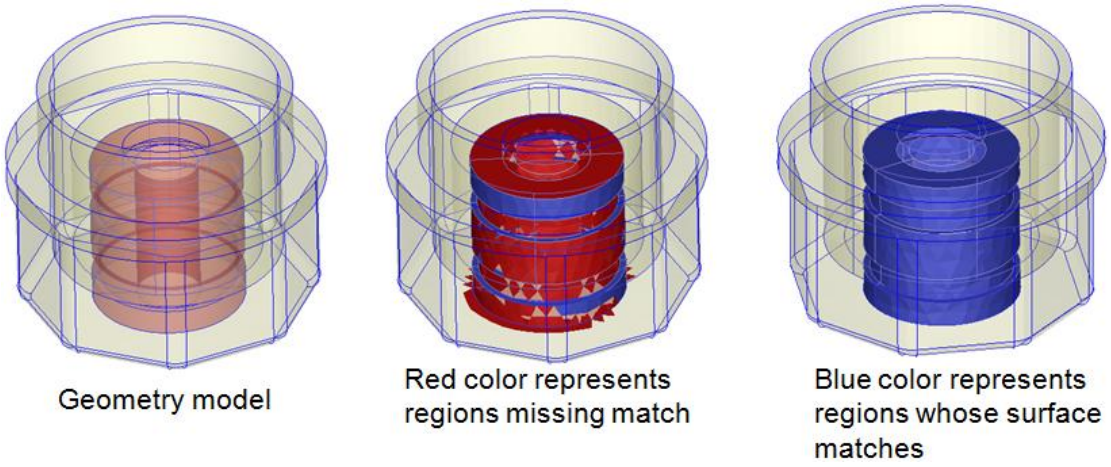
You may check the existence of trouble points with surface mesh table. Click Fix Trouble Point to locally refine the surface mesh marked as trouble points.



- **Auto Stitch Contact Faces**

In previous versions, the meshing of MCM (multi-component molding) models is always a complex and tedious task. Users often have to manually make match of the contact faces between part and insert. However, in this release of Designer BLM mode, auto-stitch tool is available to save your time and efforts.

Using auto-stitch tool, the program will first mark in red the non-matching surface mesh that between part and insert. Then, there is an option to auto-match the contact faces between part and insert. The perfect matching contact faces are displayed in blue as shown in the figure below.



Geometry model

Red color represents regions missing match

Blue color represents regions whose surface matches

- **Other Features**

Enhanced the robustness of auto-refinement kernel to improve the mesh quality around holes and curves.

User friendly interface, arranged in a way to provide clear procedures for BLM generation, makes the generation processes easy to learn and follow.

- **Improvement of Surface Meshing Efficiency for Large Faces**

Tetra meshing kernel has been enhanced to speed up the mesh generation processes, in which the average tetra generation speed of R13 is 60% faster than that of R12.

Note that this enhancement is also applied to Moldex3D Mesh.

Case No.	Element Count	CPU Time (R13)	CPU Time (R12)	Speedup Ratio
1	515,489	14 sec	21 sec	1.50
2	1,021,768	18 sec	37 sec	2.05
3	2,056,150	57 sec	87 sec	1.52
4	4,197,353	104 sec	165 sec	1.59
5	8,209,516	216 sec	369 sec	1.71
6	20,522,805	820 sec	1,126 sec	1.37
Average				1.62

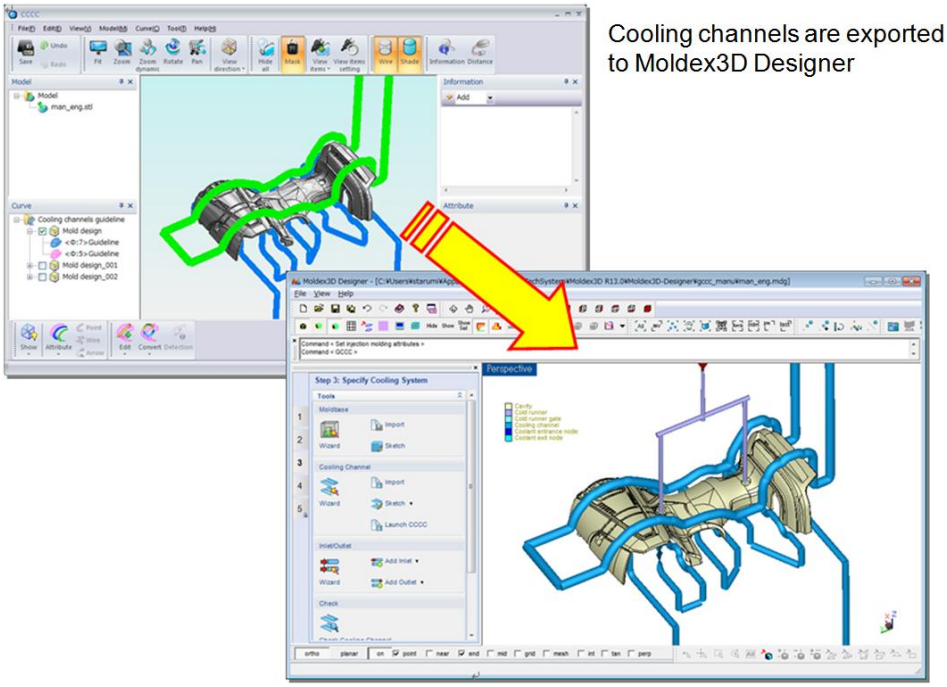
2. 3D Cooling Channel Tools

In order to enhance the capability of 3D cooling analysis, Moldex3D introduces a new module, Cooling Channel Designer (CCD), providing useful tools for conformal cooling channel design.

Secondly, 3D cooling channel analysis is also enhanced to support eDesign project, analyze extra simulations, and show additional results for cooling channel design verification. In other words, from this release, 3D cooling channel simulation can be run with eDesign mesh, reducing a large amount of time for mesh preparation.

2.1 Cooling Channel Designer (CCD)

Embedded in cooling system generation of Moldex3D Designer, CCD assists cooling channel design. By launching CCD, the design of conformal cooling channel can be completed through few steps with a precise user interface.

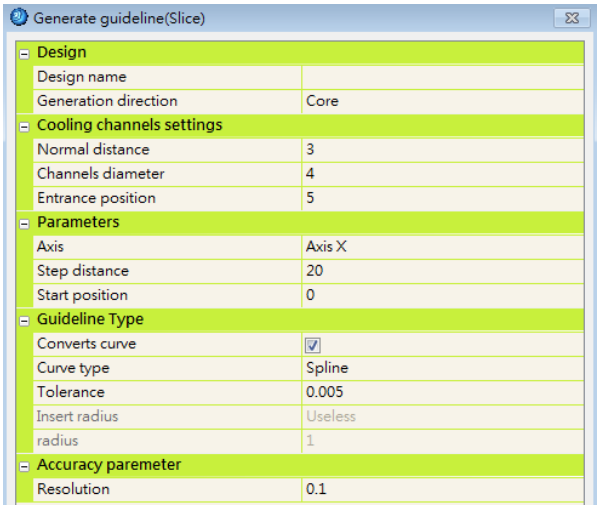


Cooling channels are exported to Moldex3D Designer

The following passage shows a brief navigation of CCD tools.

- **Generate Guideline**

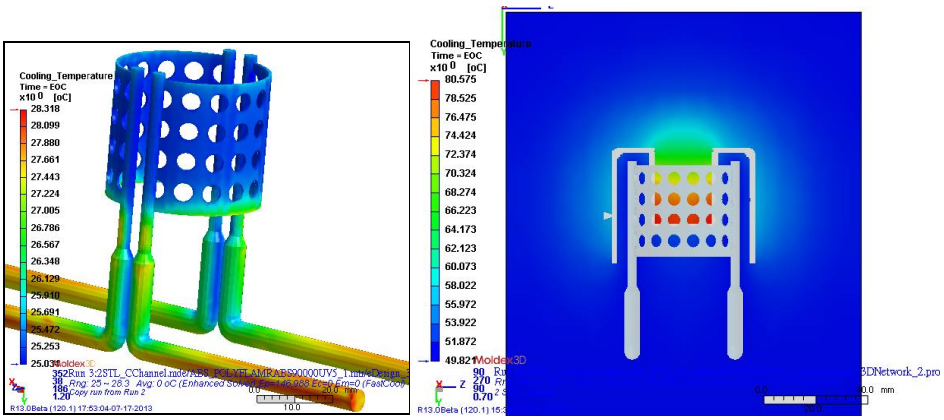
After launching CCD from Designer, the panel to characterize guideline pops up. In the panel, it allows the design control of conformal cooling channel by changing parameter such as direction, size, position and shape. As the example shown below, the setting indicates the cooling channels in the core side with 3 mm distance from cavity surface and diameter of 4 mm, growing in x-direction. It also defines the type of guideline, the step distance between reference conformal slices, and the tolerance for how the channel pass way fitting the cavity shape. Customizable setting of the design parameters makes cooling channel design more flexible and optimal.



2.2 Supports 3D Solid Cooling Channel Analysis for eDesign Projects

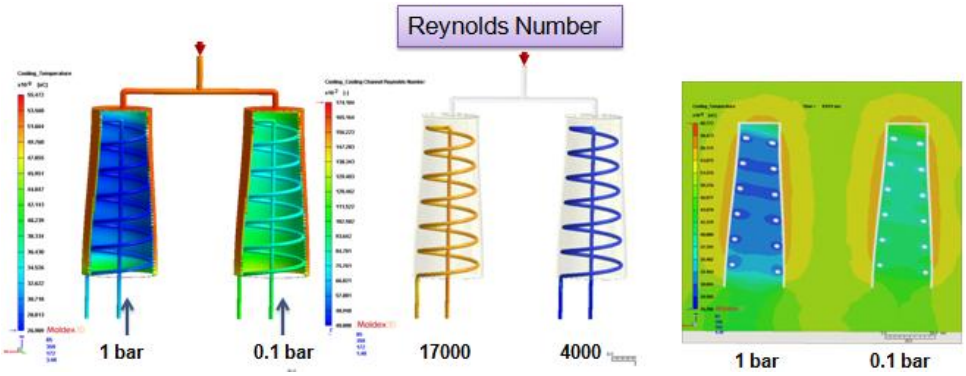
3D solid cooling channel analysis can obtain the temperature distribution and variation in each channel, assess the outcome of cooling layout and predict the cooling effect on the part; especially for cases with conformal cooling design. Previously, 3D solid cooling channel analysis was available only for solid projects, which is not convenient for users who take advantage of Moldex3D eDesign meshing technology to generate model's mesh. In this release, Moldex3D extends this feature to eDesign projects. You may benefit from not only the fast meshing by eDesign but also the accurate cooling result by 3D solid cooling channel analysis.

Note that this feature also applies on the STL format of cooling channels in eDesign projects.



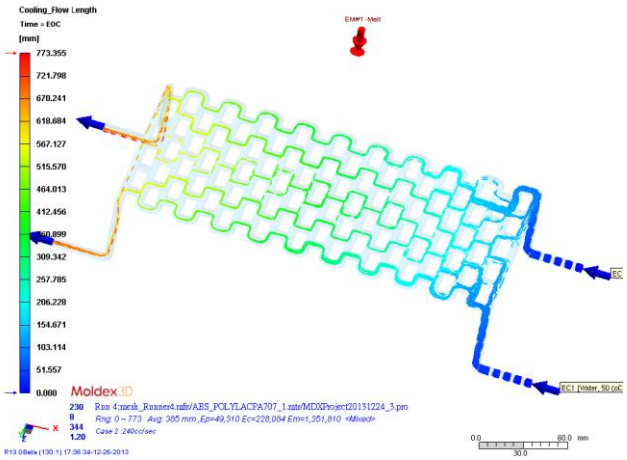
2.3 3D Cooling Analysis Result-Reynolds Number

To accurately evaluate the heat transfer of cooling channel, it is important to recognize if the flow reaches turbulence. The turbulent flow usually absorbs heat more efficiently than the laminar flow does. R13.0 enables displaying the Reynolds Number of each cooling channel as a reference of flow turbulence and its impact on the part cooling.



2.4 Supports Multiple Coolant Inlet/Outlet

Newly supported in R13.0, the multiple coolant inlet/outlet unleashes the capability of 3D cooling analysis for more complex simulation. This feature benefits the simulation of flow interaction in networking cooling channel, especially for that of conformal cooling.



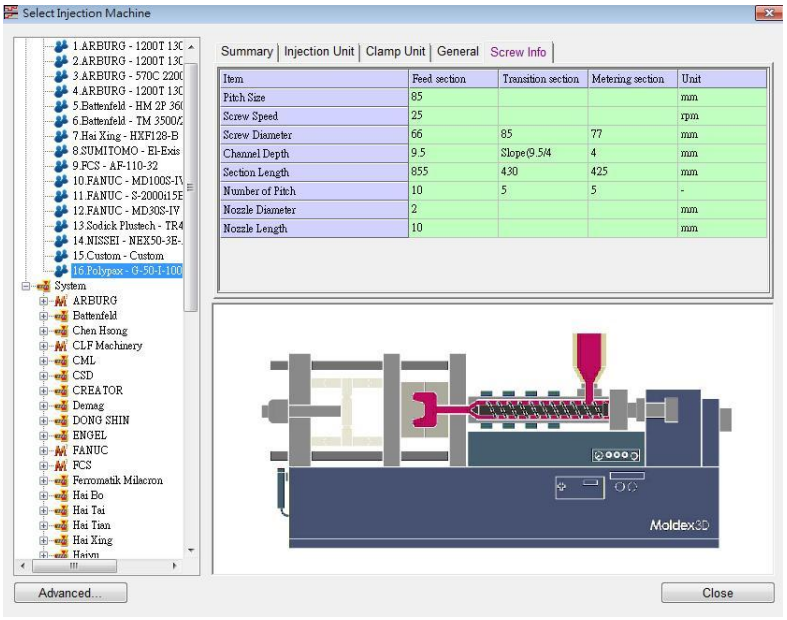
3. Fiber

3.1 Screw-induced Fiber Length and Breakage

Fiber-reinforced material is commonly applied in injection molding for strengthening part structure. However, the breakage of fibers, induced by the screw during transmitted to nozzle, will shorten the fiber length and weaken the structural strength of the part. R13.0 enhances the Fiber module to take into consideration the fiber breakage and shortening effect in order to provide more realistic simulation result.

Follow the steps below to activate this function.

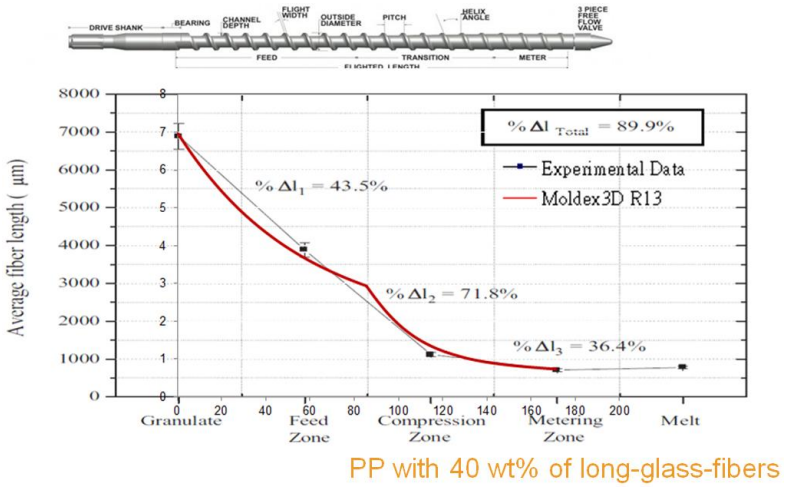
1. Input the screw data in process wizard.



2. Then, check Consider fiber breakage calculation in Filler Parameter (Computation Parameter > Flow/Pack > Advanced…) for fiber breakage calculation.

- **Fiber Length Validation**

The polypropylene filled with 40 wt% of long-glass-fibers is used in the example below. The figure shows the average fiber length versus the location along the screw. The initial fiber length was 10 mm, and the final fiber length was reduced to about 2 mm.

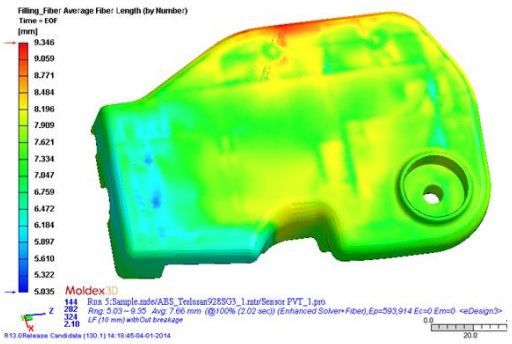


Characterization of Fiber Length Distribution in Short and Long-Glass-Fiber Reinforced Polypropylene during Injection Molding Process, KASETSART JOURNAL: NATURAL SCIENCE, Vol. 42, pp. 392 - 397 (2008)

As mentioned, the screw motion will cause significant fiber breakage before the melt entering the cavity. Without considering this impact, the left figure below displays the distribution of fiber length, resulting over-predicting ranging from 5.0 to 9.3 mm. On the other hand, the right figure shows the result with screw-induced fiber breakage considered, with a more reasonable distribution ranging from 0.5 to 1.0 mm.

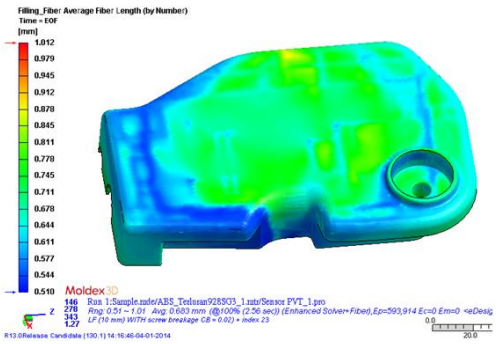
Do not consider fiber breakage in screw

Range from 5.0 - 9.3 mm

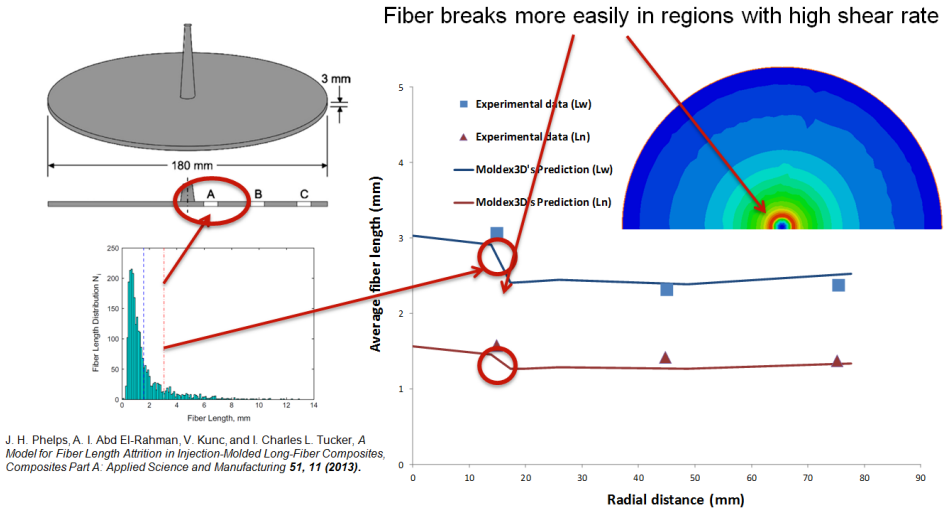


Consider fiber breakage in screw

Range from 0.5 - 1.0 mm



Considering screw-induced fiber breakage in a center-gated mold filling, computational result by Moldex3D is validated with the result from previous analytical work, shown in a perfect agreement. Fiber length distribution is monitored in the three regions, A, B, and C along the radial direction, indicating the locations of near-gate, middle point, and near-end-of-filling, respectively. During part-filling, the fiber length degrades with further distance from the gate, especially in the high shear rate region like the vicinity of the gate. Due to the breakage by screw, the fiber length reduces abruptly near region A from the initial value of 13 mm to about 2.8 mm, as can be seen in the figures below.



J. H. Phelps, A. I. Abd El-Rahman, V. Kunc, and I. Charles L. Tucker, *A Model for Fiber Length Attrition in Injection-Molded Long-Fiber Composites, Composites Part A: Applied Science and Manufacturing* ***51, 11 (2013).***

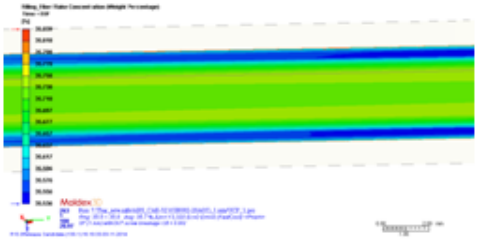
3.2 Fiber Concentration Distribution

In addition to fiber breakage, fiber concentration is another main factor for the assessment of part strength and design.

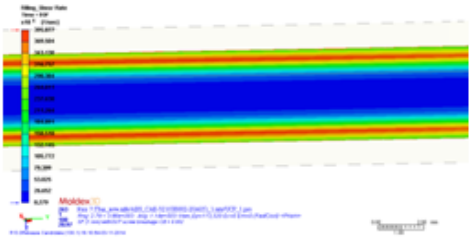
The shear-induced variation of fiber concentration shows that the concentration is inversely proportional to shear rate. In other words, the higher shear rate is shown, the lower fiber density is resulted.

Phase separation between melt and fiber, also called the shear-induced particle migration, is a phenomenon in fiber involved process. In general, higher shear rate

around cavity wall will result in lower fiber concentration. In Moldex3D R13.0 Fiber, Fiber concentration distribution can be calculated accurately from the analysis result and visualized for the users. To show this result, you may check “Consider concentration calculation” in “Filler Parameter” (Computation Parameter > Flow/Pack > Advanced…) to enable fiber concentration calculation.



Fiber concentration in the thickness direction

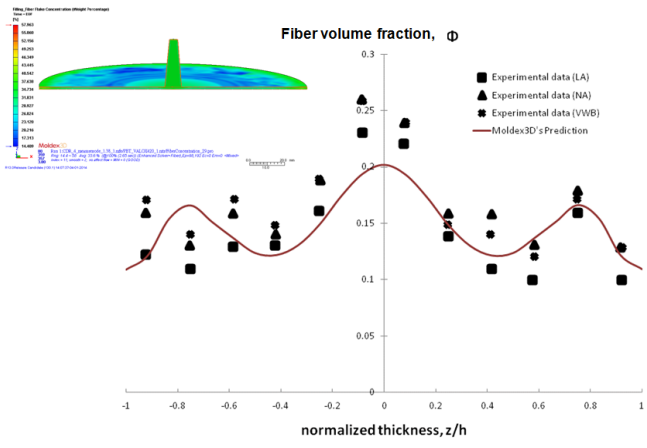


Shear rate distribution in the thickness direction

- **Fiber Concentration Validation**

Low fiber concentration occurs near the wall due to high shear rate, compared to the concentration in the center where the shear rate is lower. This again indicates shear-induced fiber migration causing the fiber concentration variation in the mold filling. Furthermore, shown in the figure below, the predicted fiber concentration is in a good agreement with the experimental data by Vélez-García et al. In addition, the concentration in the core region is higher than in the shell layer.

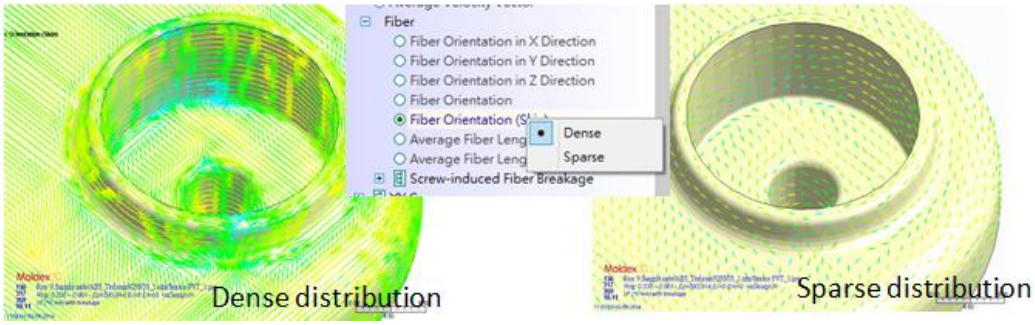
> The fiber concentration variation in thickness direction



Gregorio M. Velez-Garcia, Peter Wapperom, Donald G. Baird, Alex O. Aning, Vlastimil Kunc, Unambiguous orientation in short fiber composites over small sampling area in a center-gated disk, Composites: Part A 43 (2012) 104–113

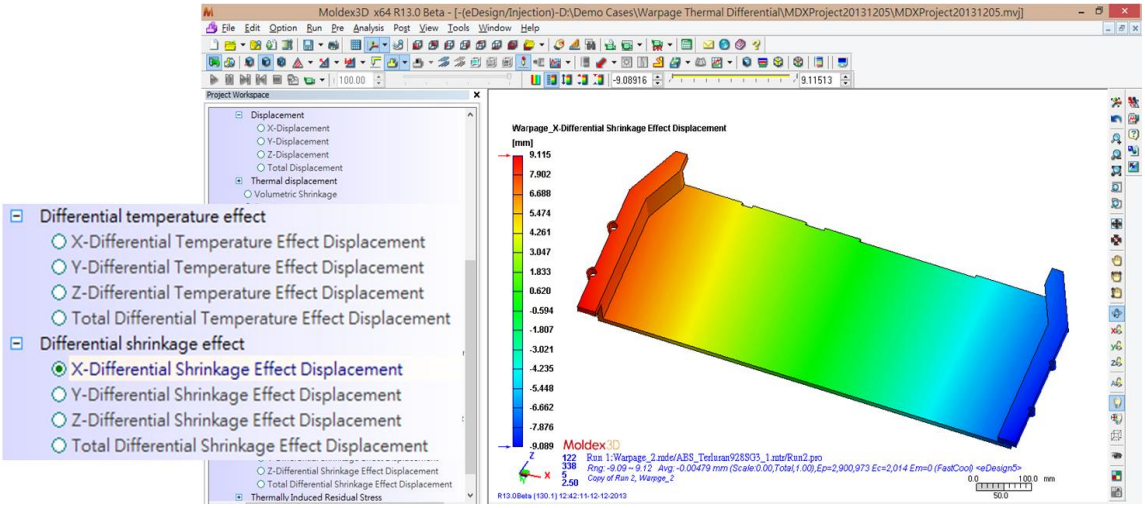
3.4 More Display options

In the previous versions, when it comes to fiber orientation, Moldex3D displays the fiber direction on each single mesh element. However, once the amount of mesh element gets larger, the image is very difficult to identify the direction trend of individual fiber. Thus, Moldex3D offers another display option, sparse, to simply fiber result presentation, as shown below. Right-click on “Fiber Orientation (Skin)” will enable the selection between Dense or Sparse model for fiber orientation display.



4. Shrinkage and Warpage Prediction Tools

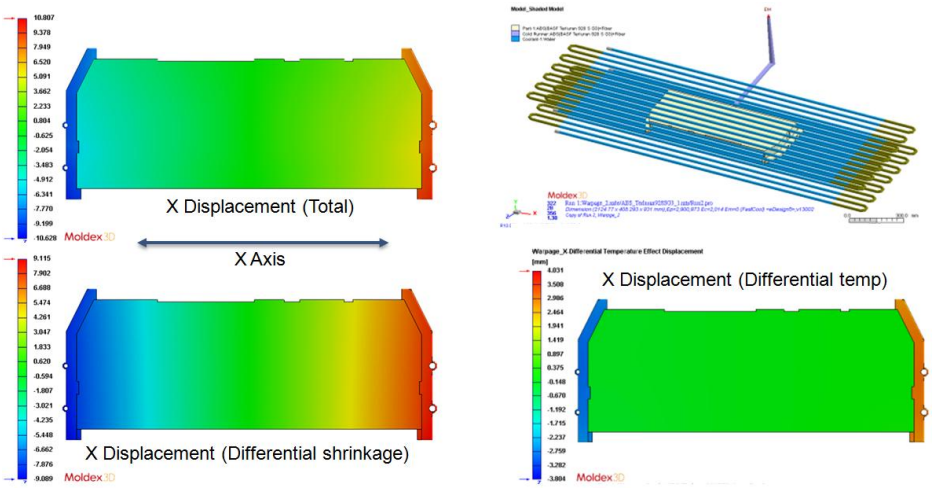
In the past, Moldex3D supports the displacement result for product deformation analysis with a combining effect of shrinkage and warpage. This allows fast producing of part displacement result, but also makes difficulty to determine the main cause of displacement between shrinkage and warpage. Moldex3D improves the result analysis capability to separately display the contribution of effect by differential shrinkage and that by differential temperature, which gives better clue to the molding revision.



Mold compensation is a common way to resolve part deformation. By enlarging the mold, the shrunk part is compensated and makes the part size matching the product requirements. Since the optimized value of the required enlarge is very difficult to obtained, mold designers normally rely on only experience or trial-and-error method, which wastes large amount of time and money. However, Moldex3D provides a tool, shrinkage compensation setting, to help you obtain a reference for mold compensation in this release.

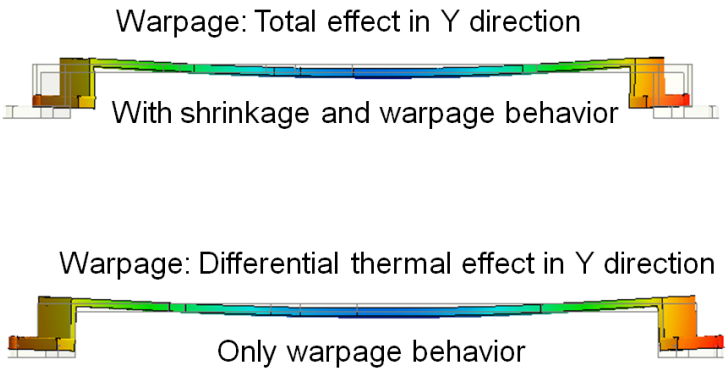
4.1 Differential Shrinkage Effects

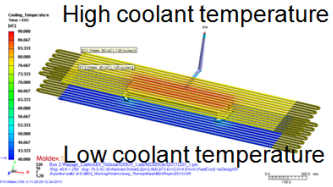
Moldex3D enables presenting the result of only differential shrinkage effect, eliminating temperature effect on the part. To consider differential temperature and shrinkage separately in the deformation result, you may check the option under Computation Parameter (Computation Parameter > Warp > Consider differential temperature and shrinkage analysis). As shown below with the case under optimized cooling, the displacement result is divided into two, considering only differential shrinkage and only differential temperature. A proper cooling can diminish warpage, thus shrinkage is clearly more dominant on the part deformation, shown in the comparison below.



4.2 Differential Temperature Effects

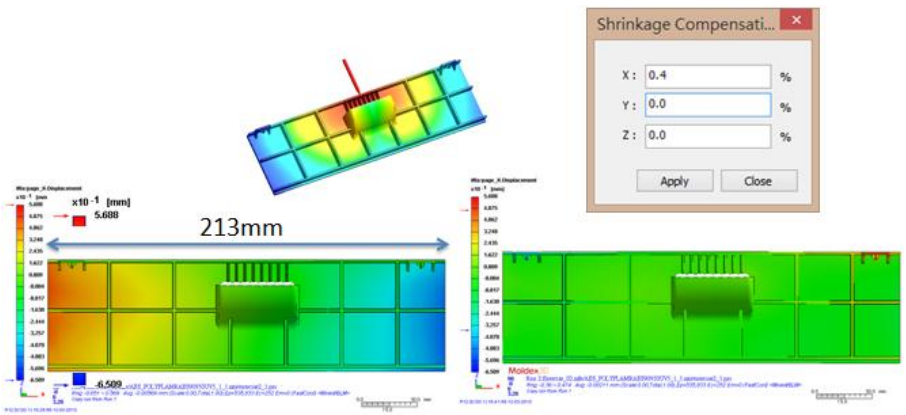
Moldex3D allows extracting the differential temperature effects from the overall deformation analysis. This can be enabled in Computation Parameter (Computation Parameter > Warp > Consider differential temperature and shrinkage analysis). This allows the comparison of contribution between differential shrinkage and differential temperature effect, and as well as the combined of them. Due to the differential temperature effect, imbalanced cooling will cause temperature difference between core side and cavity side and results warpage . In contrast of the previous case, the case shown below has different coolant temperature between the core and cavity side, thus the warpage caused by the differential temperature becomes more significant, compared to the overall effect on displacement.





4.3 Mold Compensation Setting

Part shrinkage will lead to a defective product due to unqualified dimension change after molding, and as mentioned, mold compensation is a common solution for this. In this release, Moldex3D provides a new tool, Shrinkage Compensation Setting, to provide a reference value for mold size adjustment. Through a simple panel (open at Warpage Scale > Shrinkage compensation setting), you can set the mold compensation values in X-Y-Z directions and the result with mold compensation will be displayed in real time. As shown below, with compensation of 0.4% in x direction, the displacement of part is improved significantly.



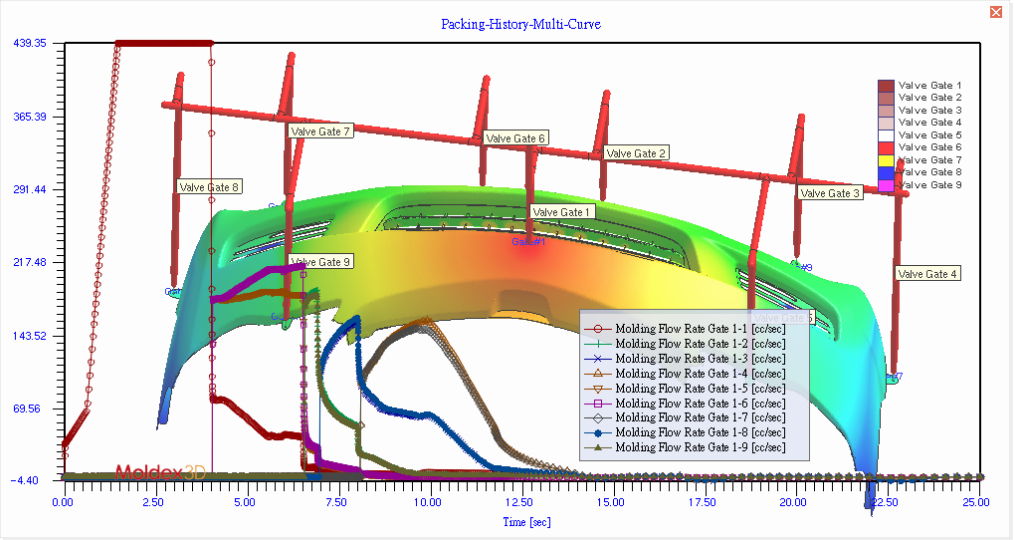
5. Hot Runner Simulation Tools

To approach the hot runner control in real cases, Moldex3D extends valve gate

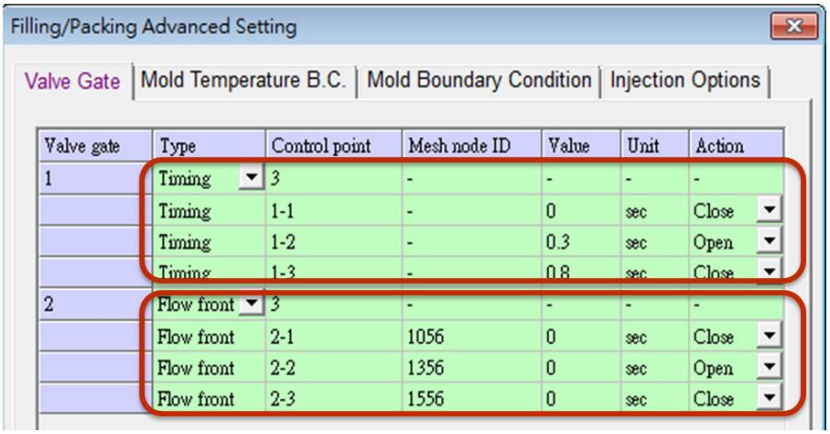
control in packing stage and allows multiple control settings for each valve gate to satisfy the process conditions on the spot. A comprehensive control mechanism is necessary for the hot runner cases, as well as its verification and evaluation. Moldex3D introduces several advanced tools for hot runner design, covering the auto detection of insulation air gap, the temperature distribution display of hot runner, and the verification of hot runner rod/coil.

5.1 Valve Gate Setting for Hot runner

Moldex3D supported valve gate control for the filling process. In some real cases, however, the valve gate control will be applied during packing stage as well. Therefore, Moldex3D extends the control feature to packing stage, so one can now switch valve gate off during the packing stage if need in the design.

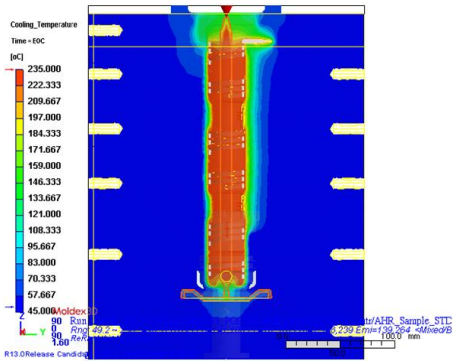


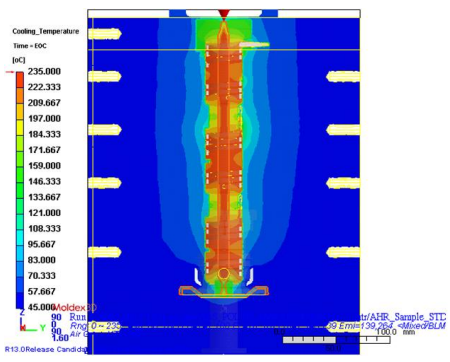
In actual cases, the proper control of valve gates always plays a critical role for molding a qualified product. The timing to open/close a valve gate affects the flow behavior, and product quality as well. Moldex3D presents a control panel for each of the switch of valve gate by time or flow front in this release. It becomes easier to set multiple controls of valve gates to fit the processing conditions in real case.



5.2 Automatic Detection of Insulation Air Gap in Standard Solid Cool Solver

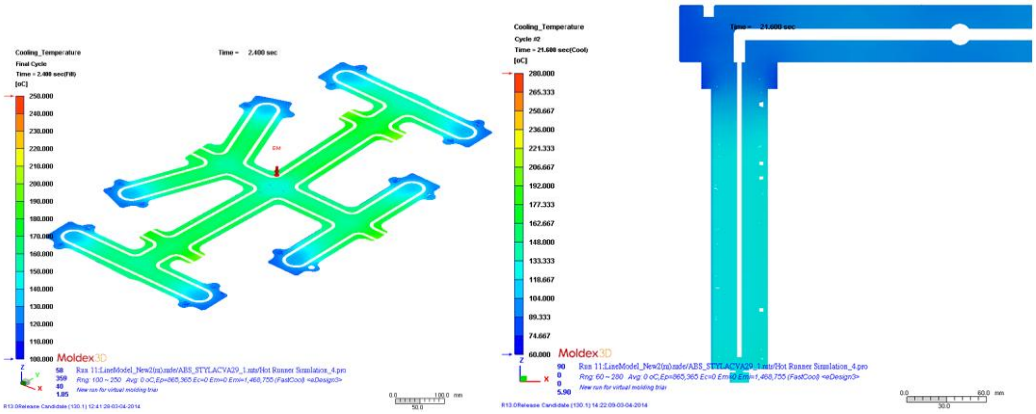
In the past, manual mesh development is required in defining the gap between mold base and hot runner metal as insulated air gap for the case of solid standard cool, which could be very time consuming due to the large amount of tiny meshes. For easier meshing preparation, Moldex3D adds auto air gap detection into solid standard cool solver. You can import the solid mesh model without setting air gap attribute into Moldex3D Project, and the solver will automatically detect and define the insulation for air gap. The figures below illustrate the comparison of the results between the cases utilizing old and new method, shown in a good agreement. The left case refers to the old time-consuming method, while the right case has the new convenient tool to assist.





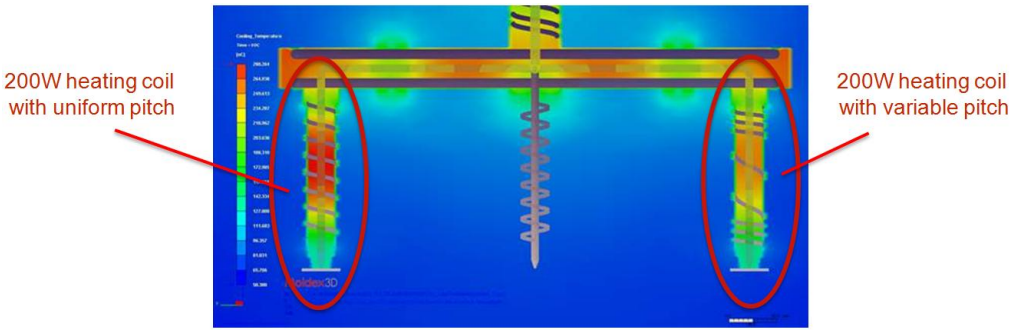
5.3 Temperature Distribution Visualization

Moldex3D improves the cooling analysis for the hot runner systems by enabling the temperature distribution display of each individual hot runner metal component and the control to show/hide switch of each component when using clipping or slicing function. The manipulation of this feature is easy: just select Temperature in Result, turn on Model Manager to control the show/hide of specific component, and run clipping or slicing function. This feature makes it easier to realize the inner temperature distribution of each hot runner component.



5.4 Fast Verification on the Heating Rod/Coil Design

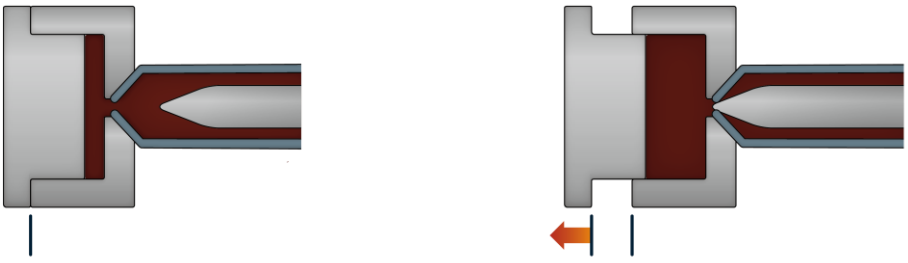
A proper design of the heating rod/coil in hot runner system matters a lot in the entire molding processing. Moldex3D implements a steady state approach to catch the temperature distribution of the heating rod/coil in this release, which will verify if the heating function and effect meets the design object in the design stage. Moreover, based on a new method, the temperature calculation efficiency in hot runner system speeds up 100 times to obtain the verification result shortly.



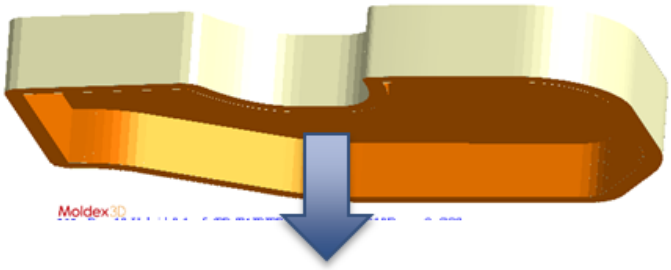
6. MuCell®

6.1 Core-back Process

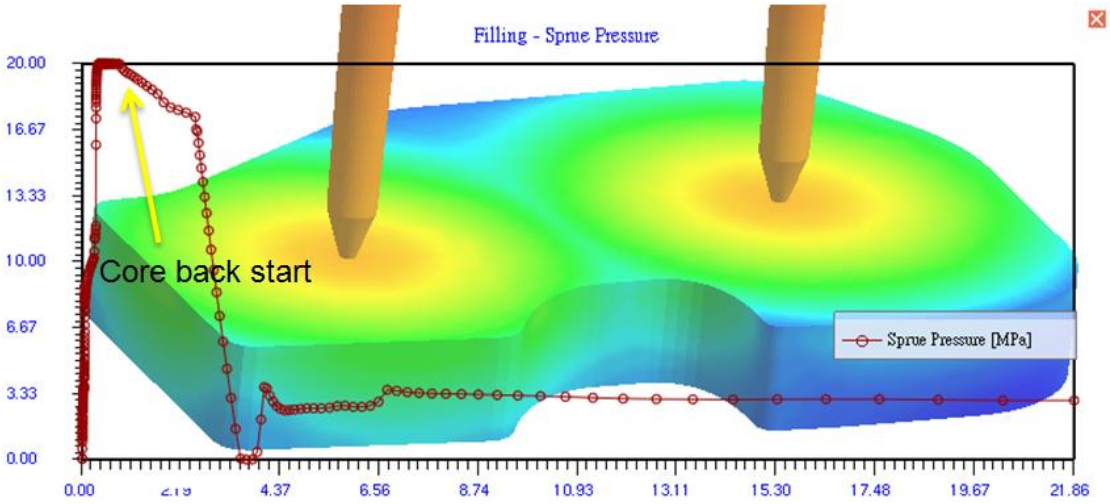
Core-back is an advanced technology applied to manage cell size and density during cell foaming. The core side of the mold is moved back during foaming while the cavity is fully-filled. A proper control of core-back mechanism, in the matter of product surface quality, should form the part skin with enough thickness and strength and the inside core meanwhile remains hot and soft to continue foaming. Moldex3D develops the new simulation capability of core-back process into MuCell® Module, with the molding control options including delay time, core-back speed and core-back distance.

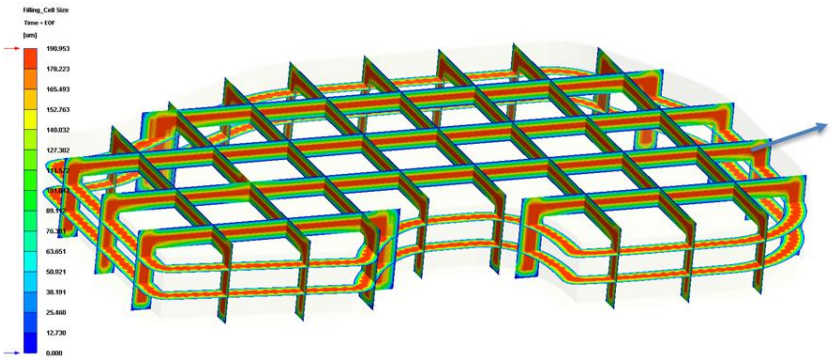


Results of core-back analysis include the distribution of cell size and cell density during core-back process, for evaluating the design of core-back processing condition.



Core-back



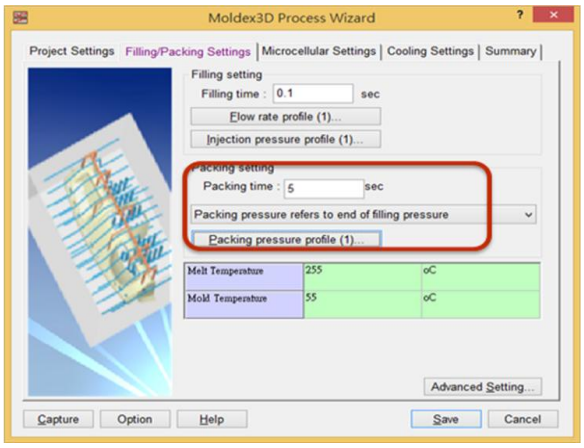


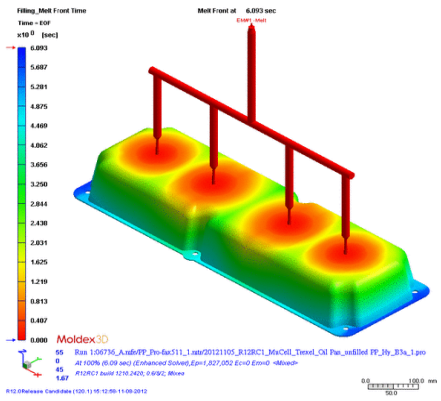
Larger cell size at core region, and smaller cell size at skin region

6.2 Extends Packing Support in MuCell® Module

Moldex3D enables packing analysis for MuCell® model. Defining packing parameters,

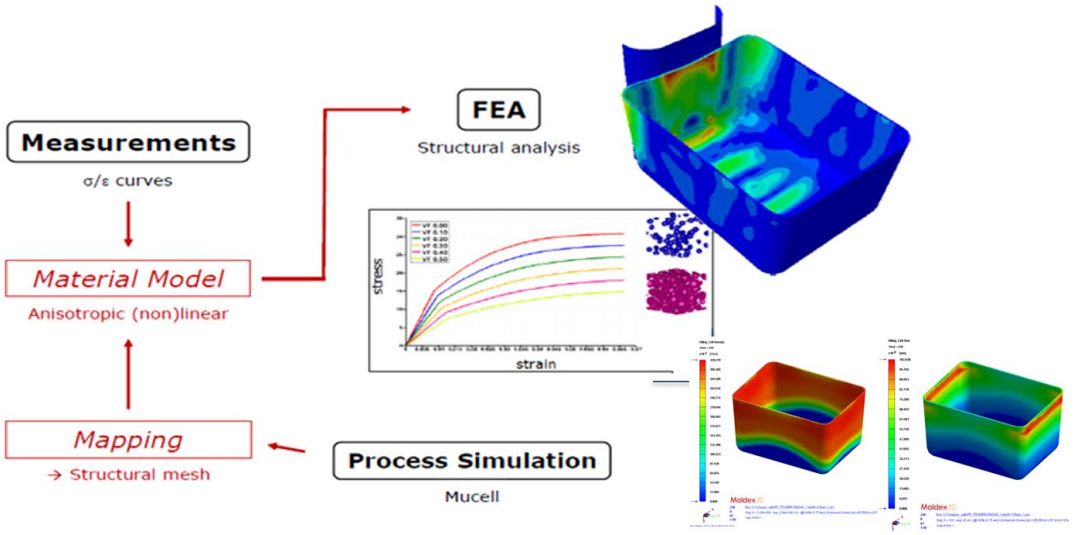
such as packing time, packing pressure base, and packing pressure profile, MuCell® analysis makes your simulation closer to the real processing conditions.





6.3 Newly Adds Output MuCell® results in Micromechanics Interface

Moldex3D supported the molding simulation of MuCell® analysis to produce the key results, such as cell size and cell density, which in the previous time is not invoked for the further structural performance assessment of MuCell® parts. Moldex3D improves the interface for MuCell® parts to integrate with Structural Analysis Softwares and Digimat. By activating Microcellular output in Micromechanics Interface, MuCell® can output results of mesh ID and the distribution of cell size and cell density for structure analysis through Digimat.



7. Enhancements in Moldex3D Flow

Several enhancements for Moldex3D Standard Modules are brought in with this release.

7.1 Output of Filled Volume Data in Log

In the analysis log, the filled volume and the percentage from each gate are now listed clearly for you to catch the detail of flow behavior.

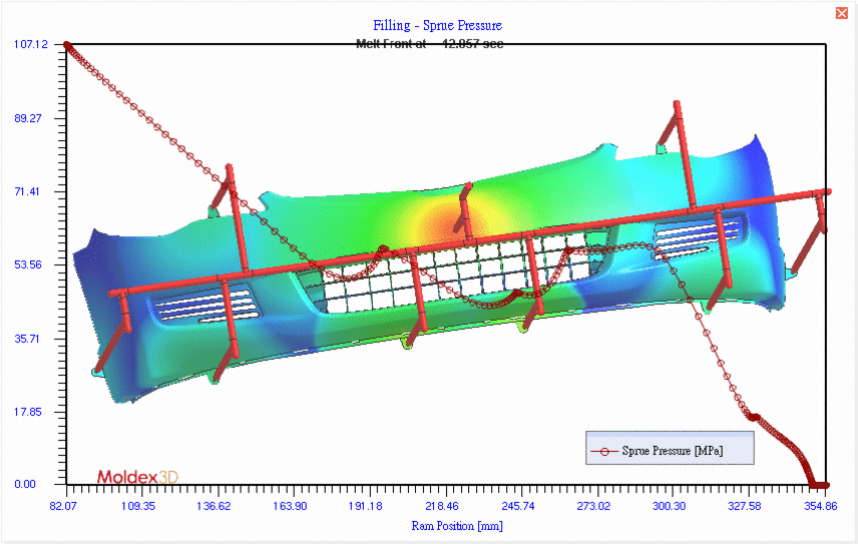
```
------------------------------------------------------
<Summary>
    CPU Time for Fill Analysis =         3.5 hr
    Mold-Opening Direction     =          Z-axis
    Clamping Force at EOF      =       311.6 Ton

    Part Weight of Cavity #1          = 1008.227 g
    Total Weight(Cold runner + Parts) = 1016.461 g

    Volume filled of Gate #1          = 430.692 cc (53.2%)
    Volume filled of Gate #2          = 197.048 cc (24.3%)
    Volume filled of Gate #3          = 183.459 cc (22.5%)
</Summary>
```

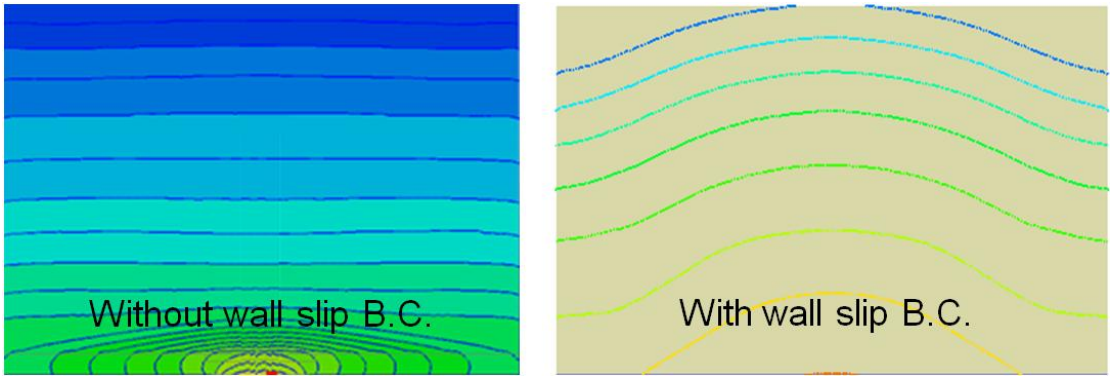
7.2 Melt Front Result by Ram Position

During filling and packing stages, melt is driven into cavity by screw. Beside of time, Moldex3D provides screw ram position as the other option to represent process steps. Shown in X axis of the XY Plot below as example below, this will help to trace the variation of melt front and sprue pressure respecting to screw ram position.



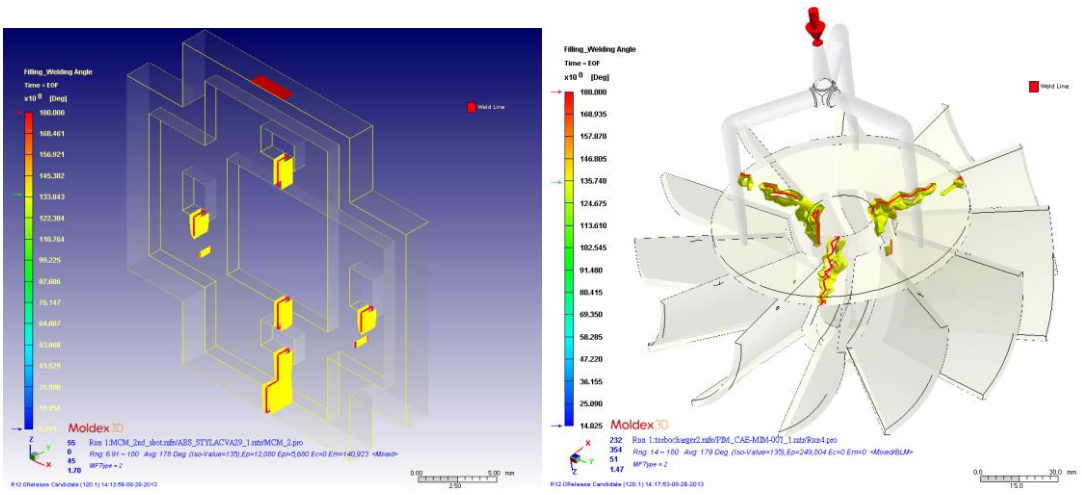
7.3 Wall Slip Boundary Condition

In the cases with high filler material IC packaging and PIM, or high part surface requirement, such as parts of optics, wall slip appears often and affects the melt filling and pressure during molding. Moldex3D provides a new option to consider wall slip and its phenomena. The friction according to the mold surface roughness is considered with defining wall friction coefficient and wall shear stress threshold parameters in Computation Parameters. (Computation Parameters > Fill/Pack (Cure) > Advanced > Wall Slip BC) Consideration of slip with friction affects significantly in some of the cases, as shown below, which provides more accurate melt filling pattern and pressure variation for the defect prediction and part design compared to the real cases.



7.4 Welding Surface Display

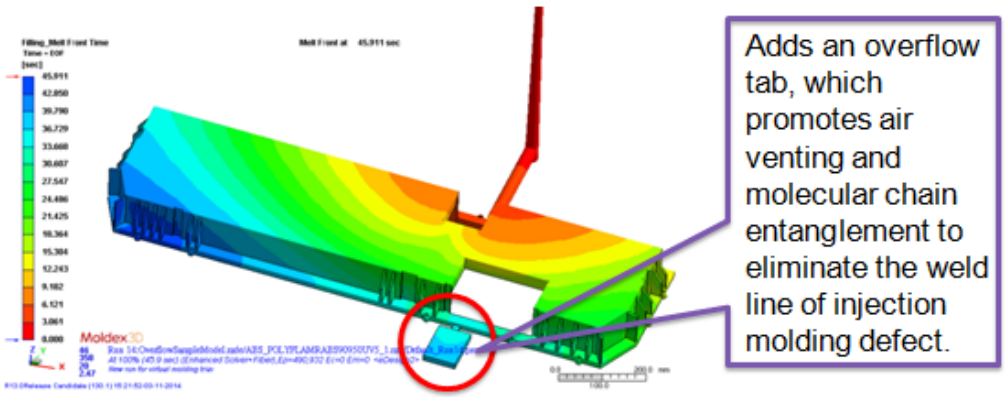
Weld line on the surface is known to weaken the structure of the part. In the past, however, interior weld lines on the spot are difficult to detect through analysis compared to the surface weld line. However, Moldex3D in this release improves the function to display the potential weld line below surface inside of the part. With the interior welding structure efficiently identified, potential defects and mechanical strength weakness can be further detected.



7.5 Overflow

Overflow design gives a space for redundant melt during molding, which protects the mold and ensures part molding. Moldex3D expands overflow feature to all molding processes in Moldex3D. In addition, for Gas-assisted injection molding and Water-assisted injection molding, Moldex3D Specifically provides the function to switch on/off the overflow region by time.

Note that in Moldex3D, overflow region is not required and not considered for short shot detection and warpage analysis.



7.6 F/P solver

Peak memory usage of head node in F/P solvers is reduced. 30+% usage is lowered in general for the peak memory of head node in a 4 cluster computing environment.

Computing resource: 2×1×4

	R12	R13	Reduce %
1.0 M	0.44	0.37	16%
2.0 M	0.8	0.69	14%
4.2 M	1.45	1.25	14%
7.6 M	2.59	2.16	15%

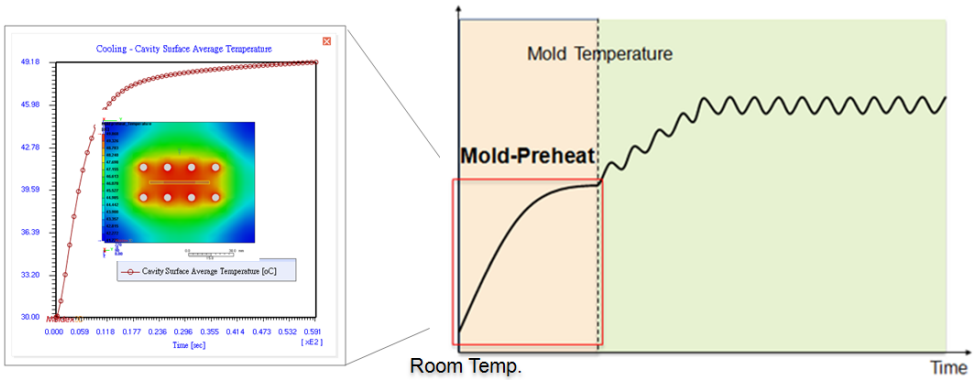
Computing resource: 4×1×4

	R12	R13	Reduce %
1.0 M	0.40	0.27	31%
2.0 M	0.71	0.47	34%
4.2 M	1.31	0.85	35%
7.6 M	2.26	1.43	37%

8. Enhancements in Moldex3D Cool

8.1 Mold Preheat Analysis

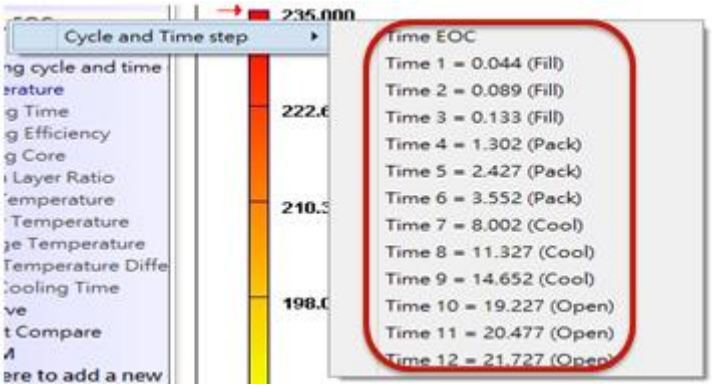
In real cases, mold sometimes is preheated to a proper temperature. In this new release, the temperature variation inside the mold affected by controller is able to observe better for the temperature management in mold preheat stage. To set preheat analysis in Moldex3D, it just requires to input mold preheat parameters in Cooling Setting (Process Wizard > Cooling Setting) and customize the analysis sequence. The temperature results will show as the reference to evaluate the cooling layout.



8.2 Stage Mark for Each Time Step Output Result

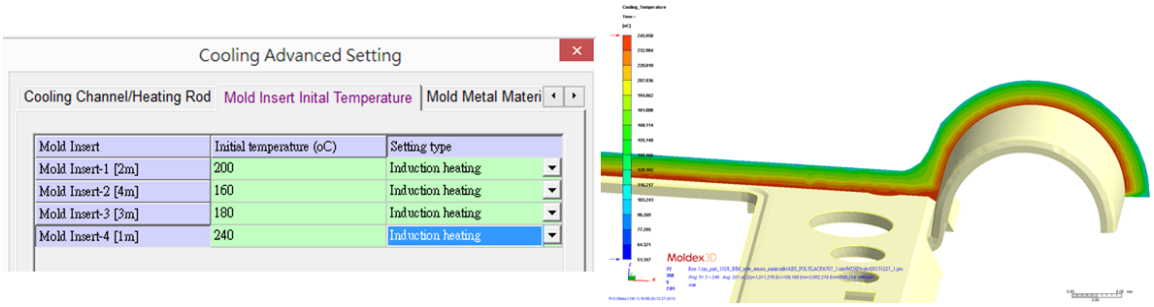
Each step of the output time will be marked with its process stage of molding.
Right-click the result categories to choose result for a specific output step of time on

the expanded list as shown below.



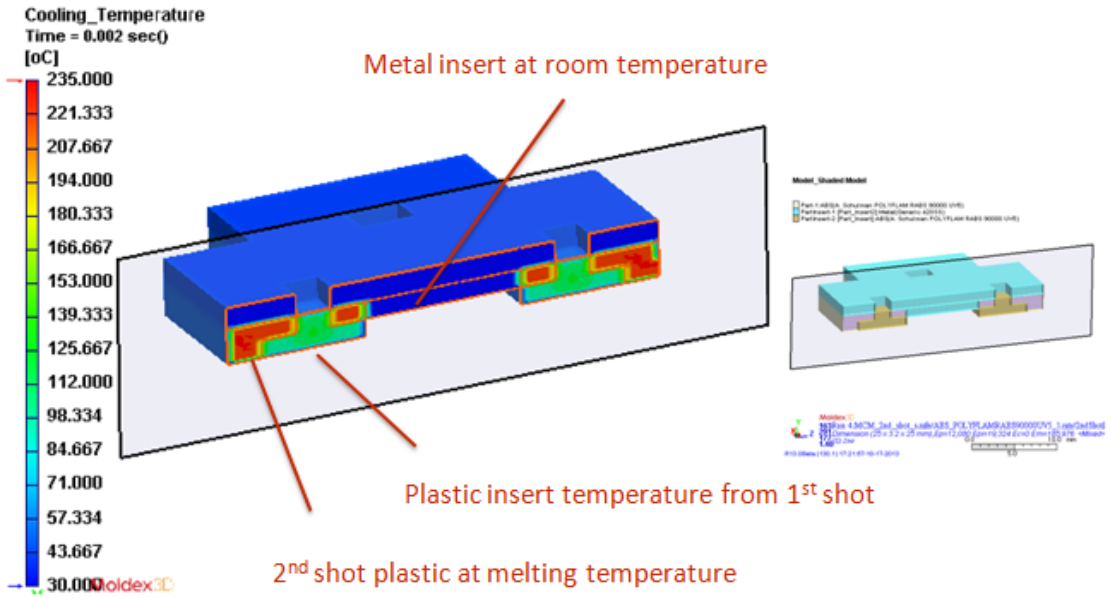
8.3 Parting Surface Heating Simulation

To achieve the smooth surface or avoid flow hesitation during molding, advanced heating technologies, such as induction heating, flame heating and other parting surface heating method, are sometimes applied, resulting a local thermal adjustment. It is now allowed to locally set the initial temperature of each molding cycle to catch the temperature change on the mold surface of each object.



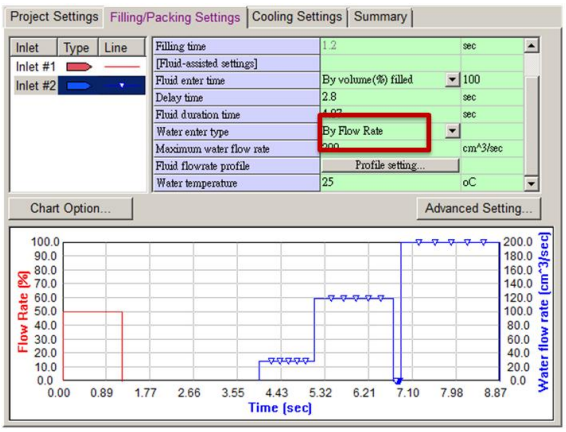
9. Enhancements in Moldex3D MCM

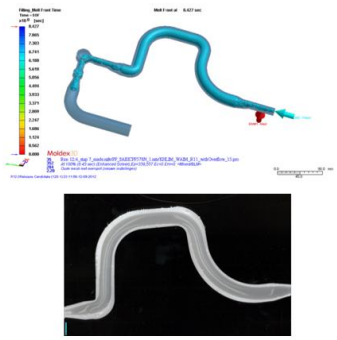
In MCM cases, with multiple shots and materials, the material property of each shot respectively affects the temperature distribution and molding quality of the part as well. By enabling MCM analysis (Computation Parameter > MCM), it allows to analyze for one shot following the result of previous shot.



10. Enhancements in Moldex3D WAIM

WAIM is supported with user-defined water flow rate setting to approach the real setting condition.



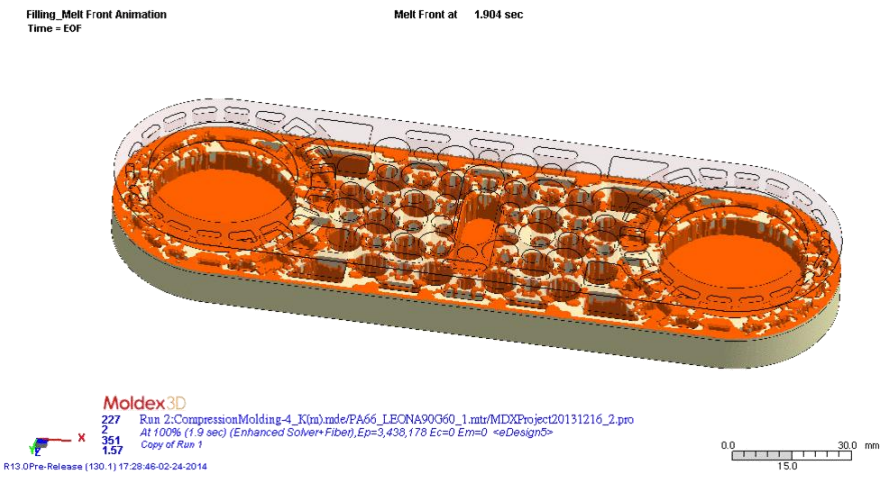


Ref: S.Sannen, M. De Munck, J. De Keyzer, P. Van Puyvelde, "Water-assisted Injection Molding: Validation of 3D Simulations by Experimental Data", *ANTEC paper*, (2012)

11. Enhancements in Moldex3D Compression Molding

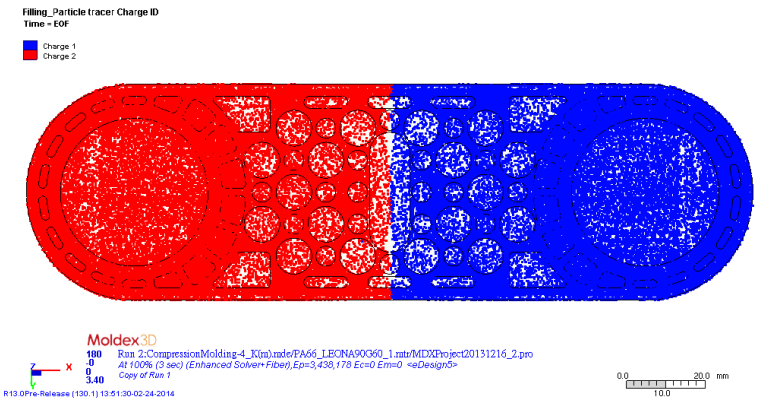
11.1 Supports eDesign project

Beside Moldex3D Mesh, the mesh for compression molding case can now be generated also with eDesign mesh in Moldex3D Designer. Moldex3D enhances the kernel and capability of Moldex3D Designer to support hybrid type of mesh, which enables eDesign mesh in the compression zone by pushing the boundary of the geometry limitation due to the mesh quality.



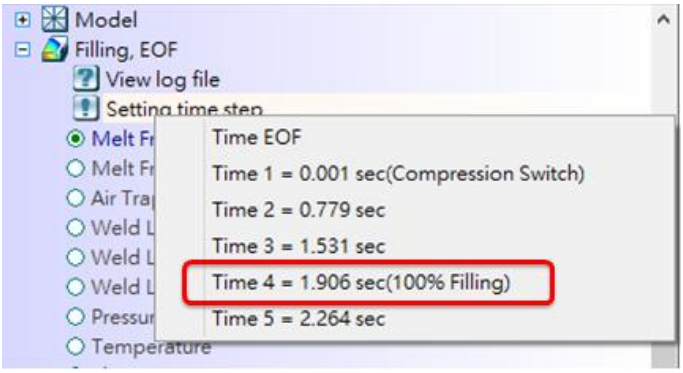
11.2 Charge Distribution

Charges are compressed into the mold to fill the cavity. The distribution of charge size and position is critical since it affects how cavity is filled and what potential defects may occur. Moldex3D in this release visualizes the charge distribution by tracking approach. Defining the charge size and position, the melt filling contribution and appearance of each charge can be observed for further design revision. The charges and particle can be set in Computation Parameter, and the result can be checked in Particle Tracer.



11.3 100% Filling Stage Output

The result at the time of 100% filling is important, and thus automatically output and marked in Compression Molding. This helps the understanding of polymer properties at 100% filling stage as a reference to process revision of compression molding.

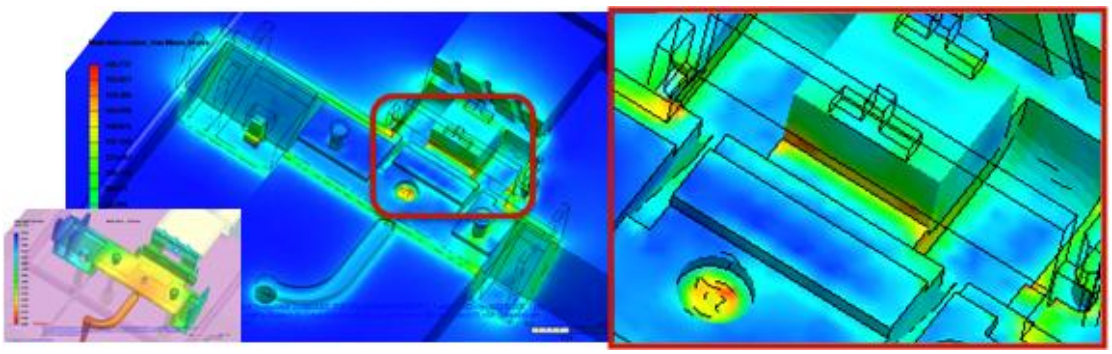


12. Enhancements in Moldex3D Stress

12.1 Mold Deformation Analysis

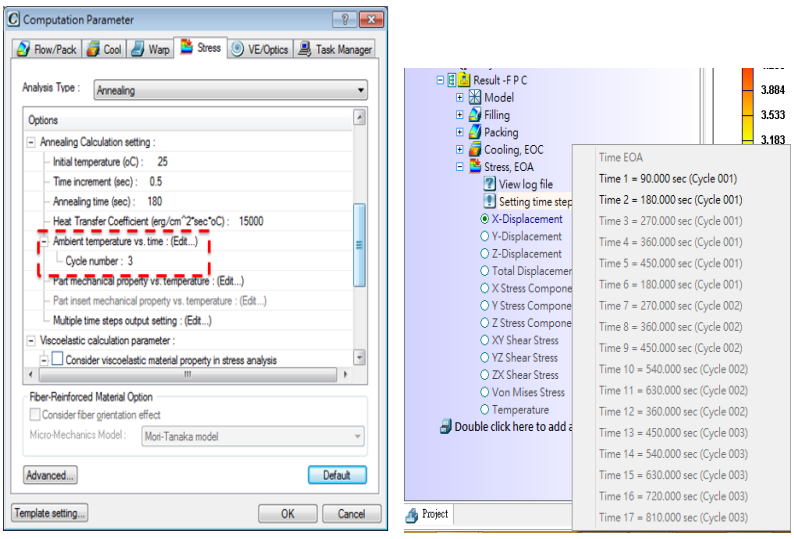
Beside of the polymer, mold condition is also a very critical factor to part molding. Moldex3D introduces a new module to simulate mold deformation and its effect. Mold deformation behavior induced by the pressure loading effect in the filling stage and mold thermal loading effect in the cooling stage can be analyzed and visualized

for the defects detection and the design reference of mold and part. You may set user-defined boundary conditions in Computation Parameter (Computation Parameter > Mold Deformation), and run analysis to obtain specific results of mold deformation. As shown below, the color difference indicates the concentration of stress, which can cause defect on the part and mold as well.



12.2 Multiple Cycles Setting in Annealing Analysis

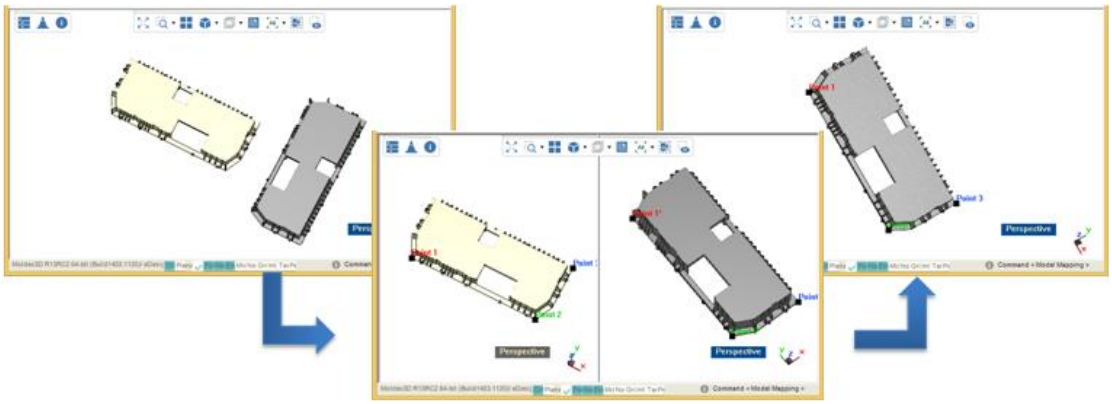
The multiple cycles setting is supported in annealing analysis by user-defined cycle number, which allows easy defining of the thermal cycling history variation while running annealing analysis (Computation Parameter > Stress).



13. Enhancements in Moldex3D FEA Interface

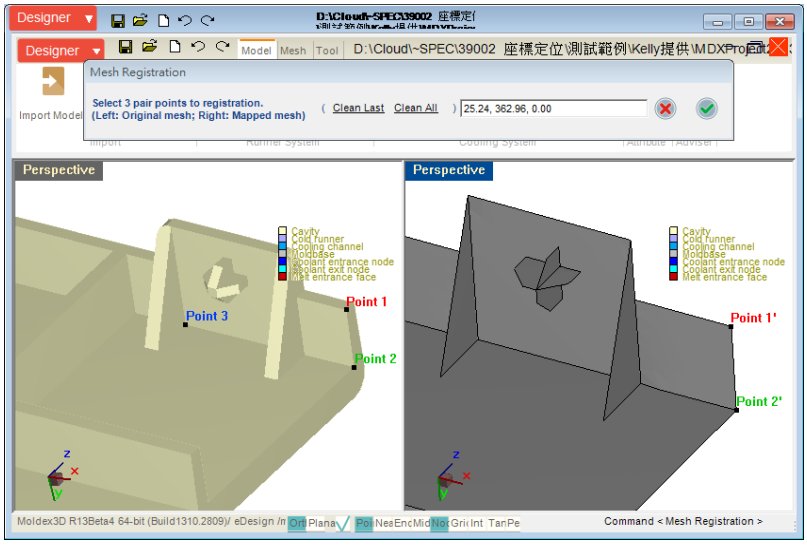
13.1 Coordinate Adjustment for Mapped Meshes

The different geometric coordinate between the structural software and Moldex3D makes the exported results unable to be used directly. In this release, Moldex3D eliminated the differences between Moldex3D and structural CAE software by offering an easy way to adjust the coordinate applied on mapped meshes. You may use model mapping tools (FEA Interface Function Option > View/Edit model mapping) to adjust the coordinate. Via this feature, the inconsistency of coordinate system between exported result and target mesh is eliminated.



13.2 Mapping 3D Results to Shell Mesh

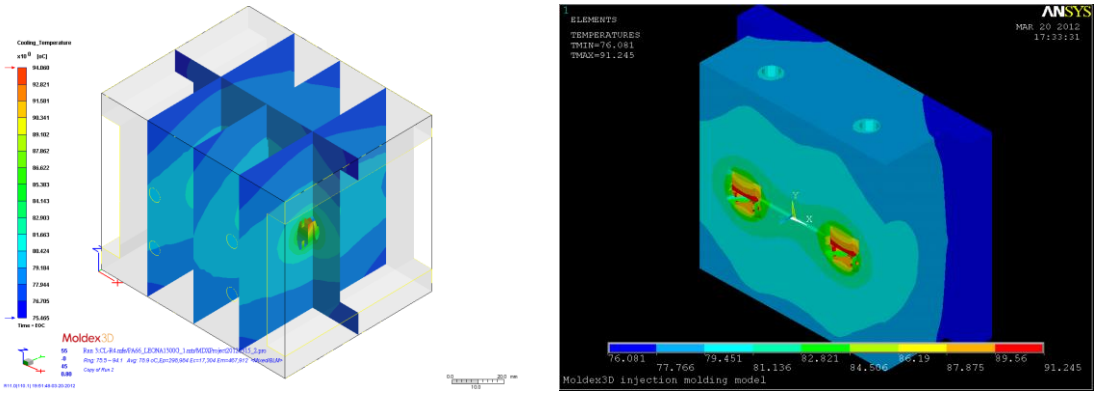
Moldex3D newly supports that 3D results mapping to shell mesh for LS-Dyna structural analysis. The results, which are beneficial to the structural analysis in LS-Dyna and available for 3D results to shell mesh mapping, includes temperature at EOP and EOC, volume shrinkage (as initial strain), and fiber orientation.



Moldex3D also supports outputting LS-Dyna MAT157 format from shell projects for advanced structural analysis. LS-Dyna MAT157, a file type that records the fiber orientation data, is a combination of anisotropic elastic material model (MAT_002) and anisotropic plastic material model (MAT_103_P).

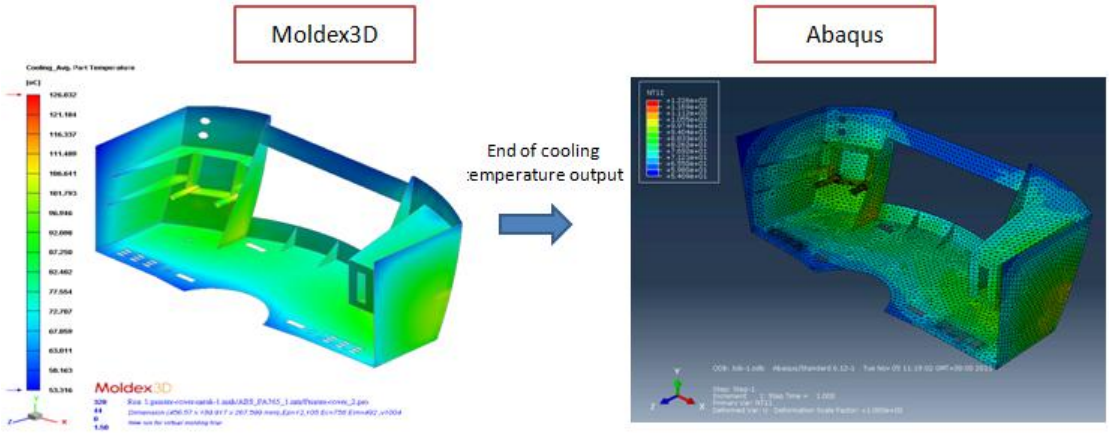
13.3 Export Multiple Time Step Result of Mold Temperature

Multiple time step data of mold temperature is now available to be exported. This feature can export the variation history of mold temperature to predict the model deformation behavior in structure software. You may select the output of mold temperature in FEA Interface.



13.4 More Output Options for ABAQUS Structural Analysis

FEA Interface extends the number of output results for ABAQUS 2D analysis, covering initial strain, packing phase temperature, and end of cooling temperature.



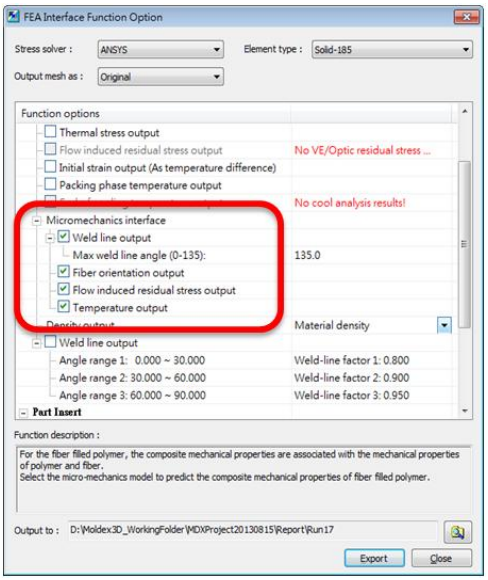
13.5 FEA supported Versions of Stress Solvers:

ANSYS	**ANSYS 10, 11, 12, 13, 14 and 15**
ABAQUS	**ABAQUS 6.8 ,6.9 ,6.10, 6.11 and 6.12**

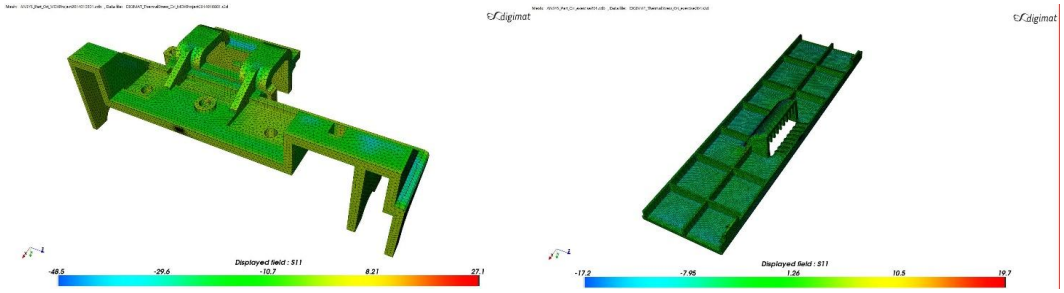
LS-DYNA	**LS-DYNA v9.71 R4.2**
MSC Marc	**MSC Marc 2010,2011 and 2012**
MSC Nastran	**MSC Nastran 2010,2011 and 2012**
NE Nastran	**NE Nastran V8.3**
NX Nastran	**UGS NX 7.0**
Radioss	**HyperWorks10.0, 11.0 and 12.0**

14. Micromechanics Interface

Combining with structural analysis, nonlinear multi-scale material modeling software that provides the capabilities to simulate the composite materials at micro-macro levels, such as Digimat and Converse, gives the opportunity to solve complex non-linear multi-scale finite element problems. In this release, Moldex3D introduces a new module, Micromechanics Interface, to connect with nonlinear multi-scale material modeling software. By using newly supported Micromechanics Interface, results output for advanced analysis application, such as ANSYS, ABAQUS, MSC-Nastran, Marc, LS-Dyna and Radioss, becomes more effective and efficient.



More options of micromechanics properties are available in this release, such as model fiber orientation, weld line region data, residual stress, temperature distribution of part and part insert object at EOP and EOC.



15. Enhancements in Moldex3D Designer

15.1 Gate Location Adviser

R13.0 enhances Gate Location Adviser to give more reasonable advices on where to put the gates. The highlighted features are as followed:

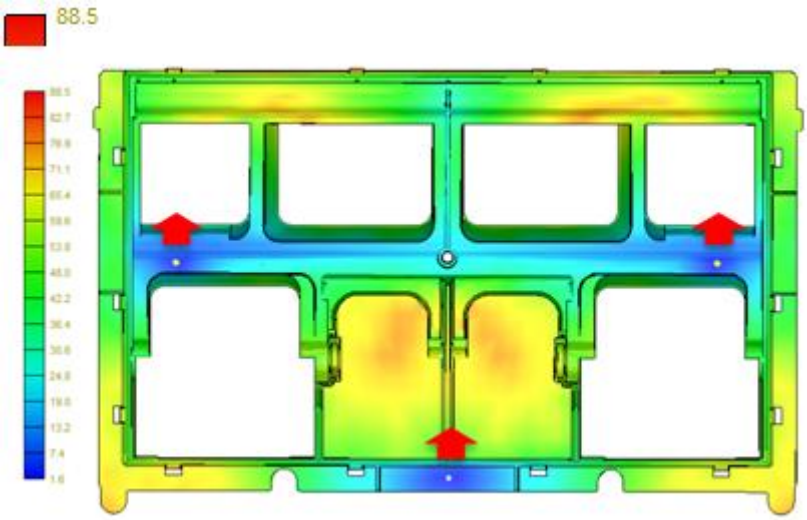
-Set up constraint regions for gate placement. This feature will allow Gate Location Adviser to avoid suggesting the gate placement on the region selected.

-Add, move, and remove gate manually in Gate Location Adviser.

-L/T (Length to Thickness ratio) prediction based on the gate location and geometry of the part

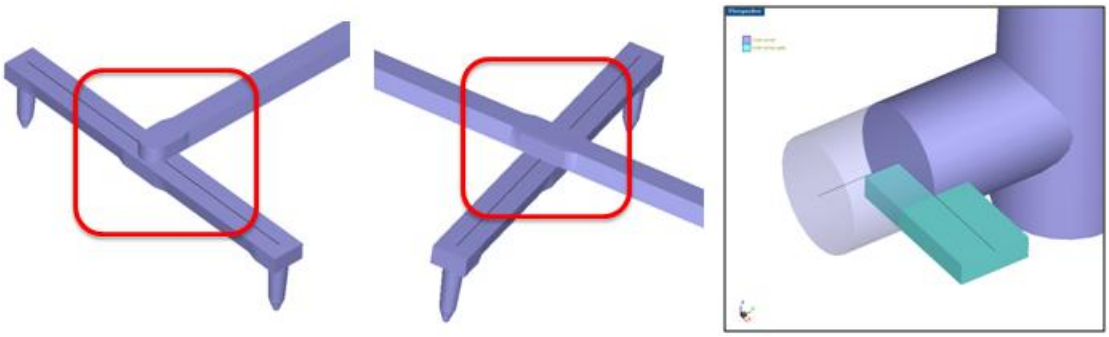
-Highlighted regions with user-specified L/T ratio

Moldex3D enables auto optimization on the gate generation with a desired maximum L/T ratio, s the example shown below. You may find this function in Step 2: Build Runner System in Moldex3D Designer.



15.2 Lapped Runner Design

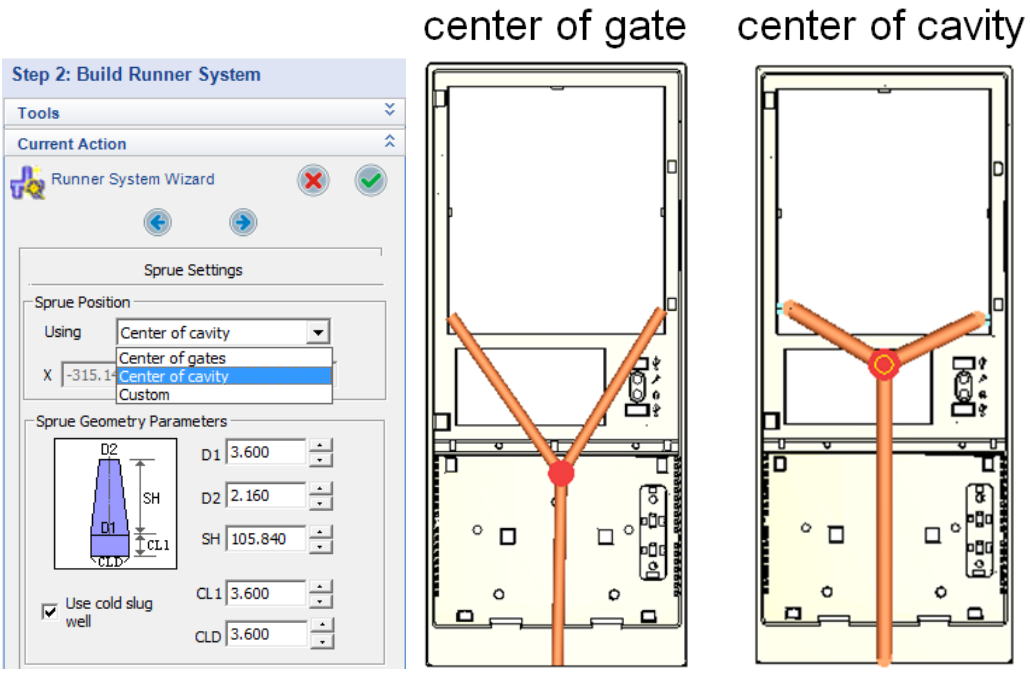
Moldex3D breaks limitations of runner system creation by supporting Lapped runner and cold slug of edge gate. This capability makes runner layout and design verification easier and more flexible than before.



15.3 Other features

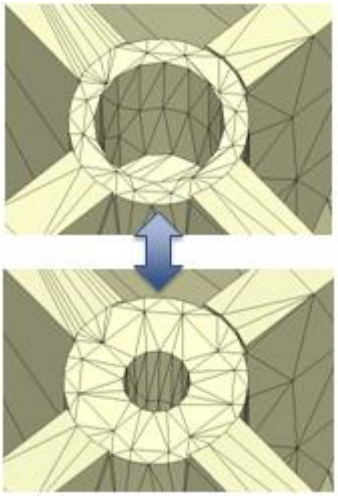
- **Center of Cavity as Option of Sprue Location**

Center of cavity is added as an option to set up sprue location in runner wizard. You may set up the types of position from the drop down menu under the sprue settings.



- **Adjust the Thickness of Boss Structure**

Expanded the ability of Modify Thickness to adjust the thickness of boss structure.



- **Auto Mesh Export**

Additionally, Moldex3D adds options to automatically export the mesh right after the

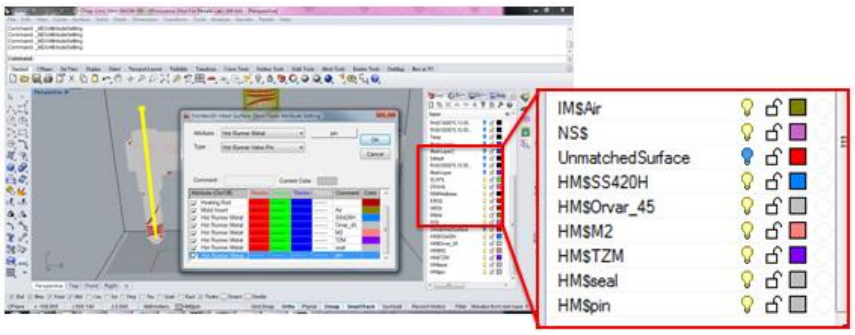
eDesign mesh generation is finished.

16. Moldex3D Mesh

- **User Experience Enhancement**

Moldex3D Mesh expands capabilities to reduce your time preparing solid mesh using Moldex3D Mesh.

-Add layer definition for hot runner metal components. This feature helps distinguish hot runner metal from different molding components.

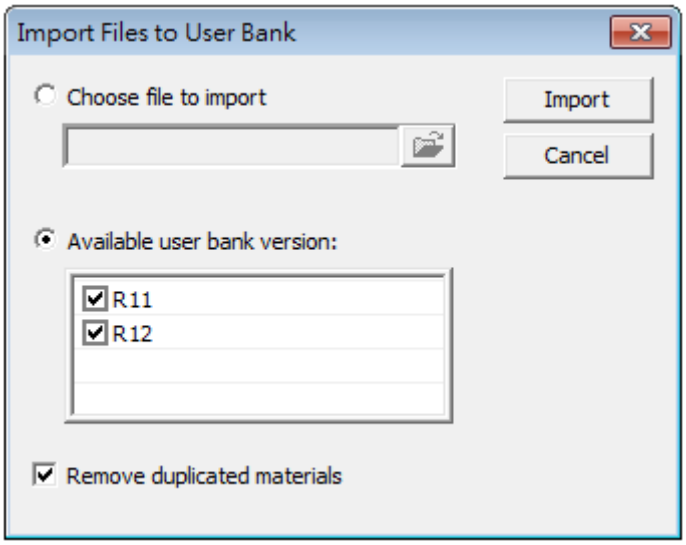


-Auto surface mesh extraction from solid mesh object of cooling channel or heating rod components activates if necessary when outputting mesh model.

17. Material Wizard

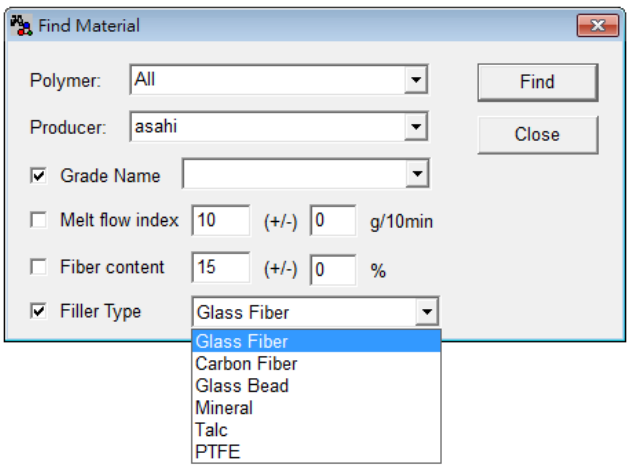
17.1 Import Material from the Previous Version of Moldex3D

User defined material data saved in the previous version of Moldex3D will no longer be a trouble when updating to the latest version. In this release, the material data that is in the user bank of the previous version can be imported by selecting the data, automatically listed at the import panel of Material Wizard. This feature assists you to reuse the existed material data of your own. You may click Import from File to execute this action (Material Wizard > File > Import).



17.2 Material search option

Searching a filler material becomes easier in this release. Material Wizard supports searching material by filler types. Select the filler type from the drop down menu and click Find to get a specific material that fit your need. (Material Wizard > Moldex3D Bank > Material on toolbar > Find).



17.3 Material Database Upgrade

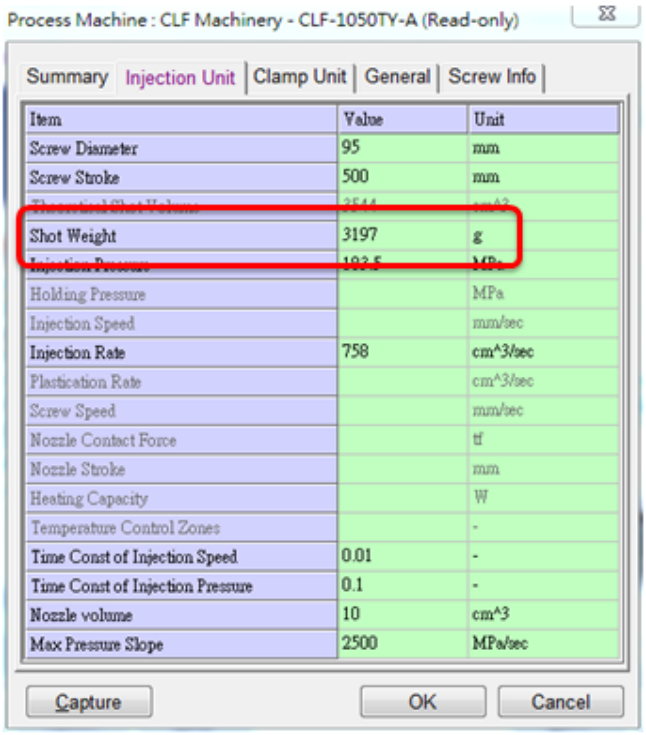
41 materials are newly added: ASA(1), PA(4), PE(1), PBT(1), PC(1), PC+ABS(2), POLYBLEND(3), Polyester(1), PP(8), PPO(PPE)(15), PPS(1), SPS(1), TPO(2)

The properties of 438 materials are updated, including viscosity, PVT, mechanical and temperature.

18. Process Wizard

18.1 Shot Weight Information in Machine Database

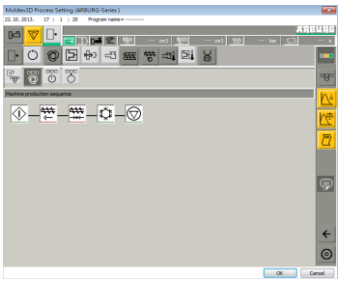
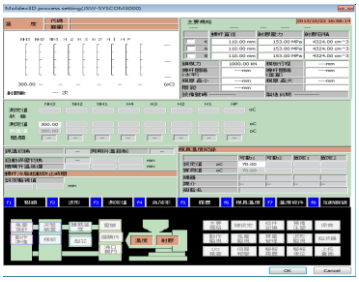
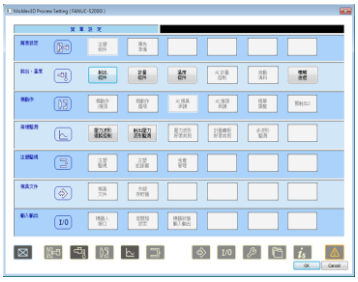
Process Wizard adds a useful information item, shot volume, in the database as well.

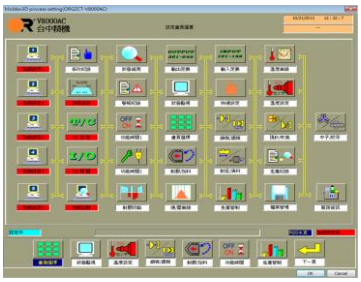
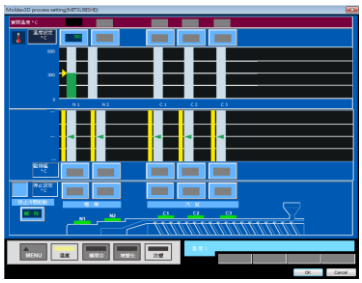


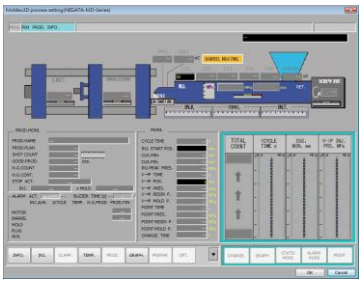
18.2 More Injection Molding Machine UI

Six UI settings of injection molding machine in Process Wizard are listed as following:

ARBURG / JSW / FANUC-S2000I / Victor Taichung / MITSUBISHI (Electric Machine & Hydraulic Machine) / NIIGATA / CLF

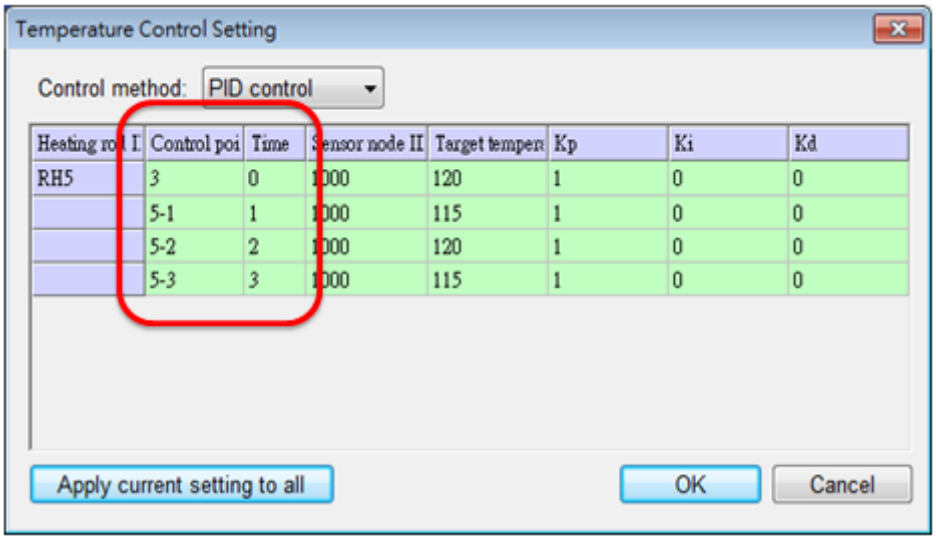
ARBURG	JSW	FANUC-S200I
		

Victor Taichung	MITSUBISHI - Electric Machine	MITSUBISHI - Hydraulic Machine
		

NIIGATA	CLF
	

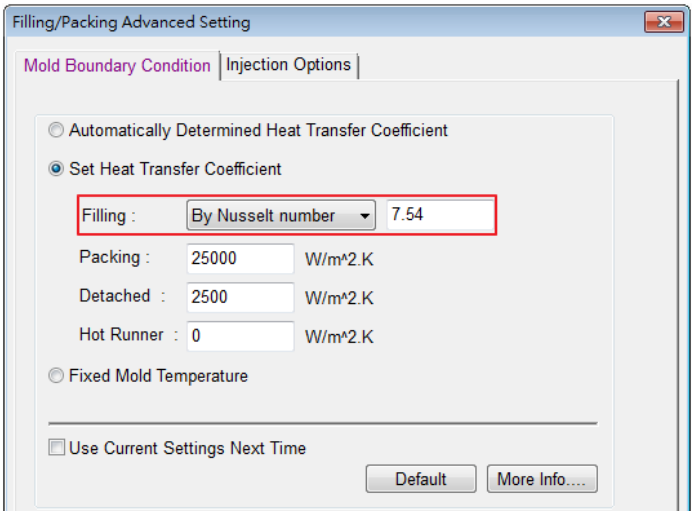
18.3 Multiple Targets for Temperature Control

To enhance the effectiveness of temperature control, Moldex3D gives a new setting option of multiple targets for heating rod temperature.



18.4 New Heat Transfer Coefficient Method

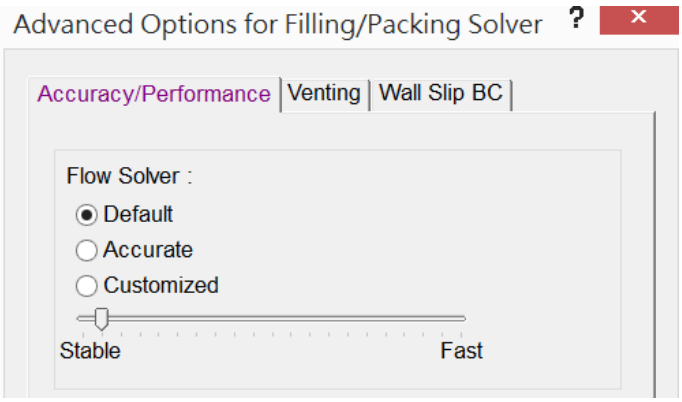
Moldex3D devoting on HTC application to all molding stages adopts a new HTC setting option by theoretical approach-Nusselt Number in this release to provide you another solution.



19. Project

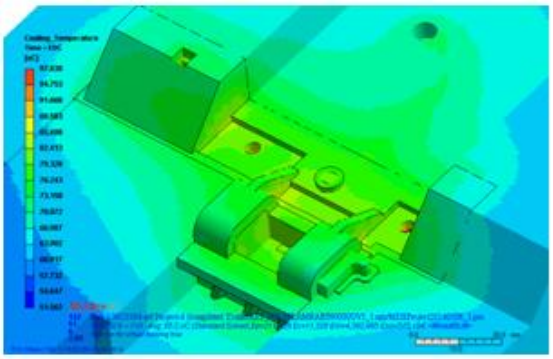
19.1 Flow Solver Accuracy/Performance

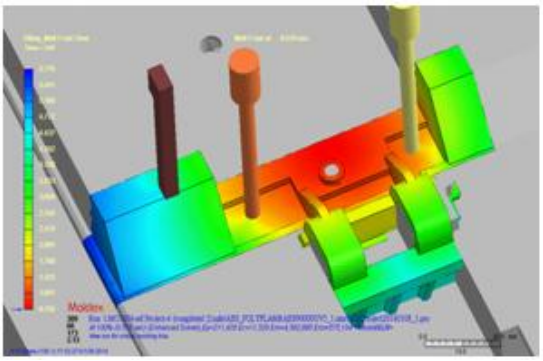
The new solver control UI provides three controls for Accuracy/Performance, Default, Accurate, and Customized. Control of Default represents the setting keeps the criterion the program sets originally, control of Accurate is to obtain accurate filling results which may increase calculation time, and the last option, Customized, gives user-defined control of the solver calculation.



19.2 Enhancements in Part/Mold Insert Display

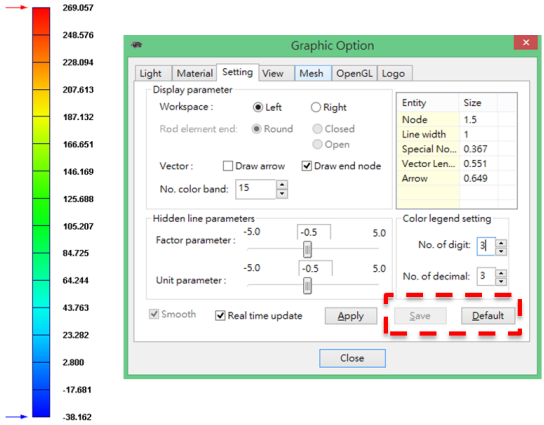
Moldex3D Project continues to enrich your view experience, and in this release, it enables individual part insert and mold insert object show/hide and clip/slice to validate your part design in detail.

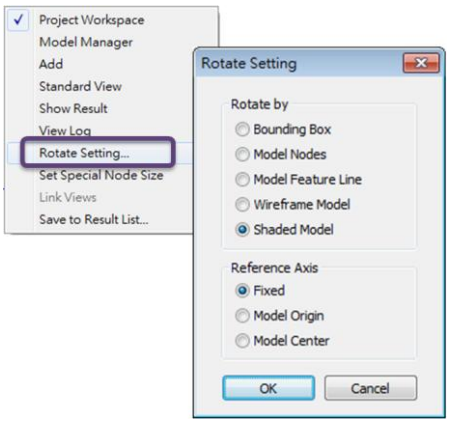




19.3 More Options for Post Display Setting

More control options, such as decimal number at legend and additional Reference Axis of Rotate Setting by Fixed. In this release, users have more display controls to meet the needs of model observation.





19.4 Rendering Efficiency Enhancements

Increasing enhancement of rendering efficiency by 2 – 5 times makes the display response quicker to meet your need.

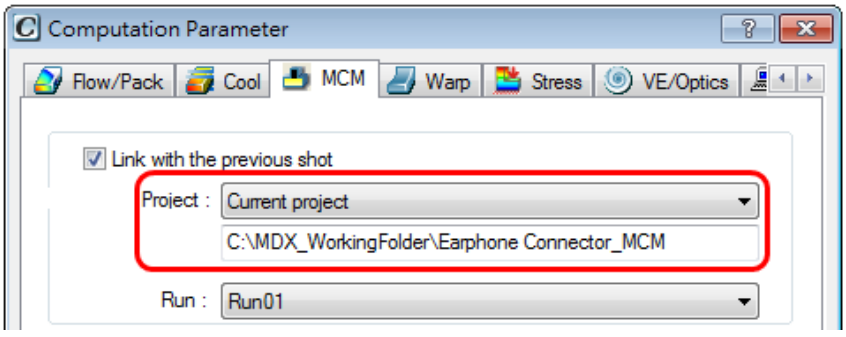
Model Information		Model Rendering Efficiency			Flow/Pack Rendering Efficiency			Cool Rendering Efficiency			Warp Rendering Efficiency		
Mesh Type	Element Count	R12 (FPS)	R13 (FPS)		R12 (FPS)	R13 (FPS)		R12 (FPS)	R13 (FPS)		R12 (FPS)	R13 (FPS)	
ML5	1.2 M	3.28	11.63	3.5	2.52	7.69	3.1	4.44	7.87	1.8	3.66	7.87	2.2
	2.2 M	2.80	10.10	3.6	2.21	6.54	3.0	3.57	6.54	1.8	3.21	6.54	2.0
	3.0 M	2.20	7.45	3.4	1.65	4.92	3.0	2.77	4.92	1.8	2.09	4.92	2.4
	3.8M	2.53	8.48	3.4	1.71	5.56	3.3	3.16	5.56	1.8	2.24	5.56	2.5
Solid	1.2 M	2.47	11.91	4.8	2.33	7.25	3.1	3.46	7.25	2.1	2.74	7.25	2.6
	2.2 M	2.65	10.53	4.0	3.05	6.76	2.2	3.98	6.67	1.7	3.15	6.67	2.1
	4.0 M	1.84	7.63	4.1	1.93	4.83	2.5	2.83	4.81	1.7	2.18	4.81	2.2
	8.0 M	0.67	2.60	3.9	0.50	1.74	3.5	1.03	1.72	1.7	0.80	1.72	2.2

The testing is under shaded mode display

Test Platform:
OS: Windows 7 @ Standard 64 Bits
CPU: Intel® Core™ i7- 920 @ 2.67GHz, 12.0 GB RAM
Graphic Card: NVIDIA GeForce 9500 GT

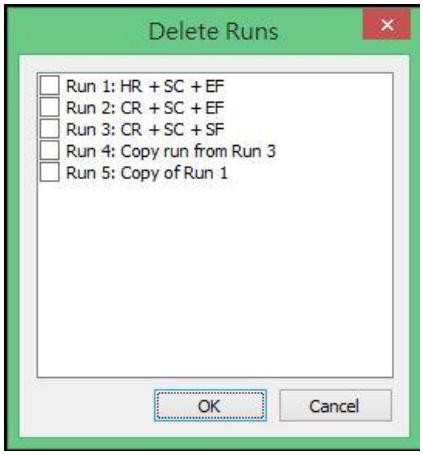
19.5 Combination of Different Molding Processes

In MCM cases, due to the limitation of project management, it was difficult to realize the combination of shots analyzed in different processes in the past, but it changes now. Moldex3D makes it possible and flexible to access the data of previous shots in other projects. You may easily select the path through Computation Parameter UI to get the data.



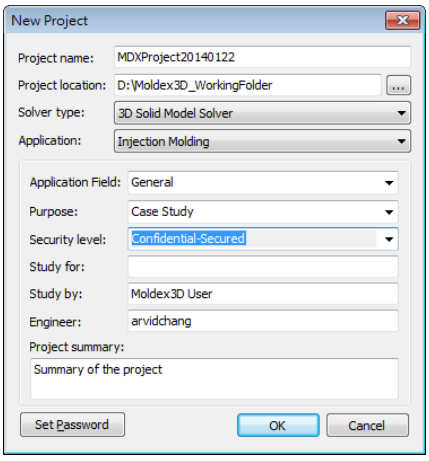
19.6 More Control Options to Delete Run Data

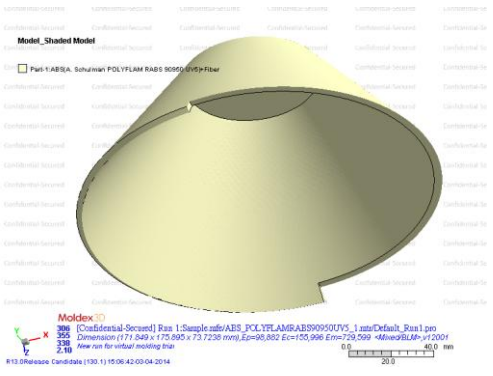
Options, such as delete multiple run data at once, and individual analysis result, are provided for removing redundant data efficiently.



19.7 Confidential-Secured Project Level

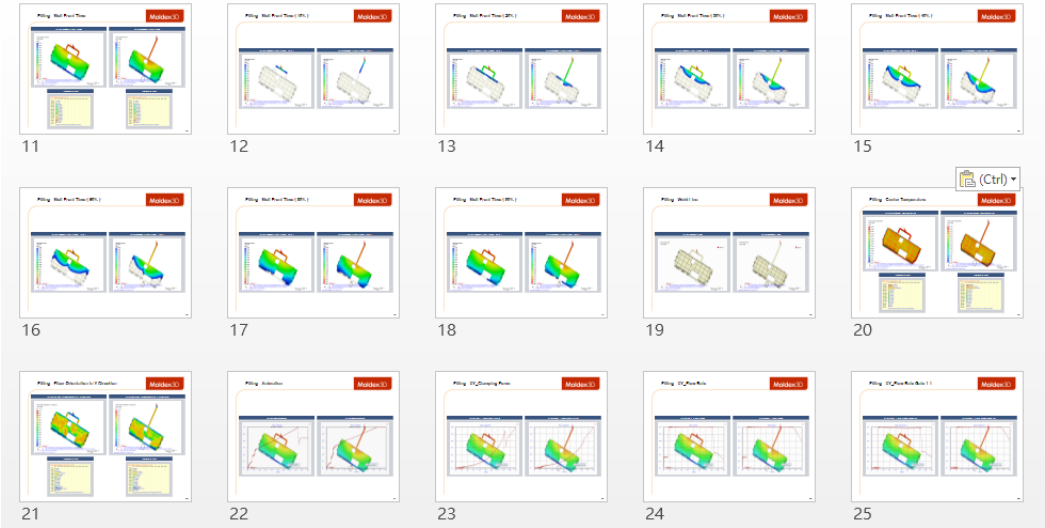
Watermark is activated in this level of security, following a request of setting password and security rule of RSV output. All pictures and animation then are marked with security term to rise up the level of protecting your projects.



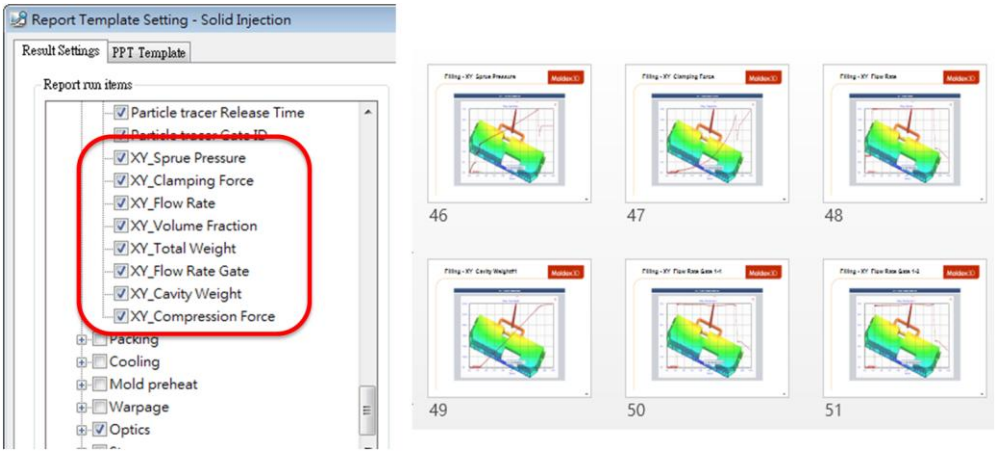


19.8 Report Wizard

Supported by Moldex3D Report Wizard, the result comparison with multiple runs becomes more efficient and effective in this release. Result comparison can be presented between up to 4 runs per report, supported with all report types, HTML, PPT and PDF.



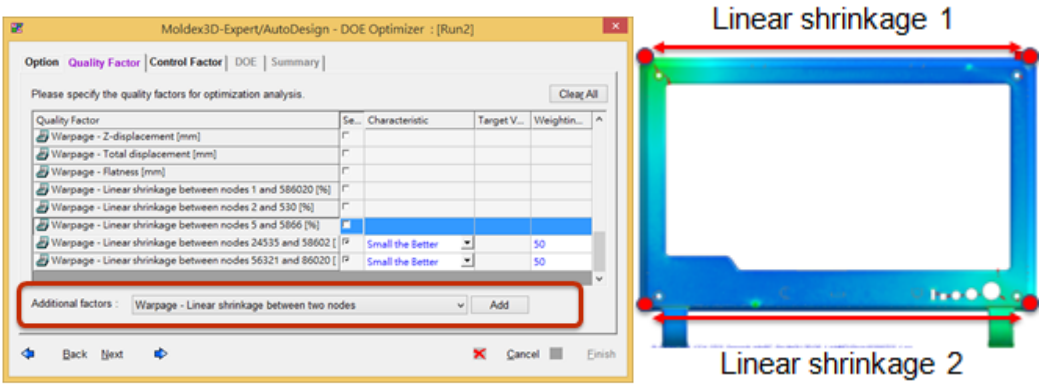
Specifying XY curve output with user-defined function can assist to present analysis results in a more effective way.



20. Expert

- **Linear shrinkage as Quality Factor**

In this release, Moldex3D enables the setting of linear shrinkage between two nodes in Quality Factor in Expert to locally optimize the part shrinkage. Controlling the design characteristic and parameter in Expert control panel, it helps to obtain an optimal linear shrinkage between two nodes.

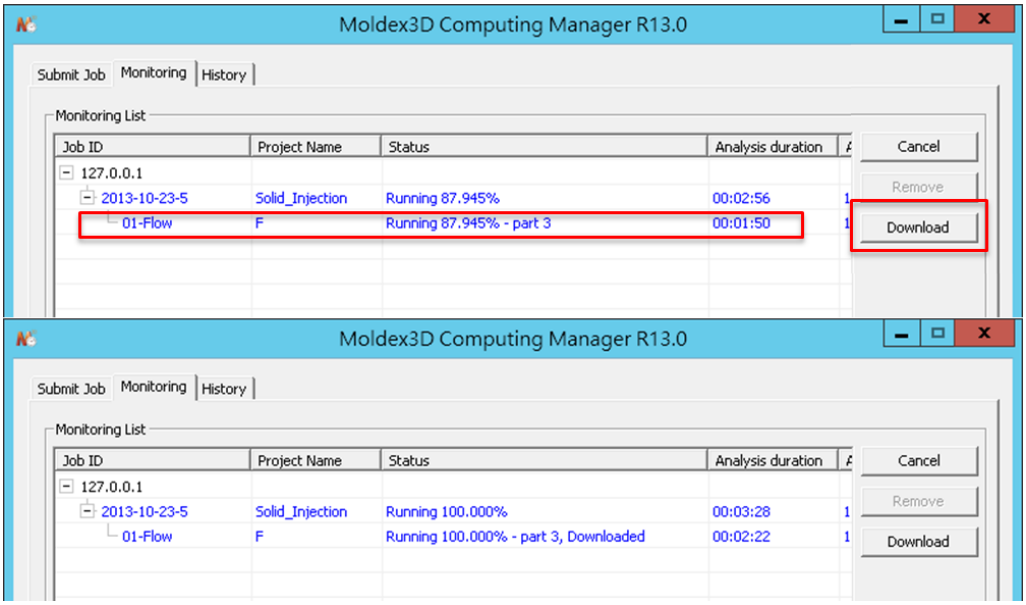


21. Remote Computing

21.1 Computing Manager

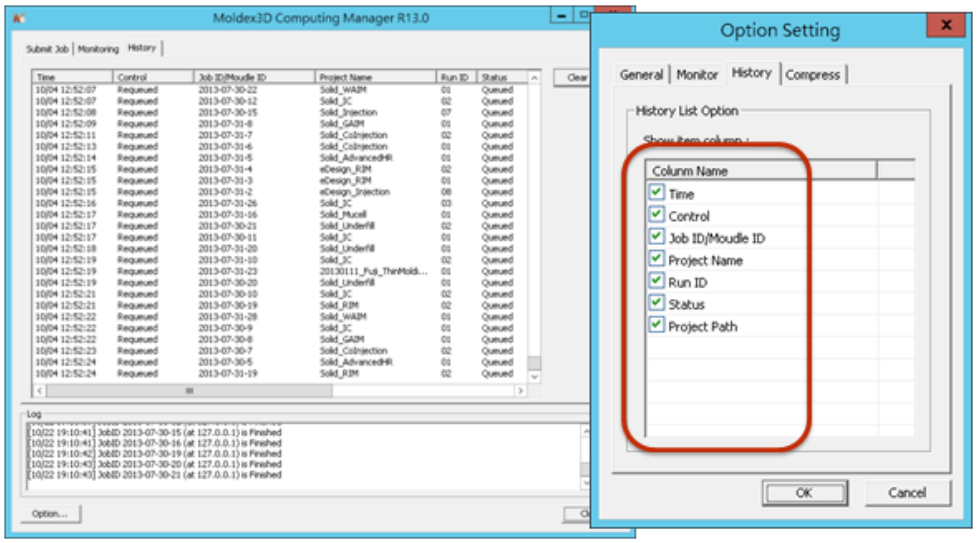
- **Multiple Time Step Download Function**

Remote Computing allows downloading not only the results, as supported previously, after finishing all analysis jobs but also the results for any specific completed stage or run during analyzing, provided by Moldex3D in this release.



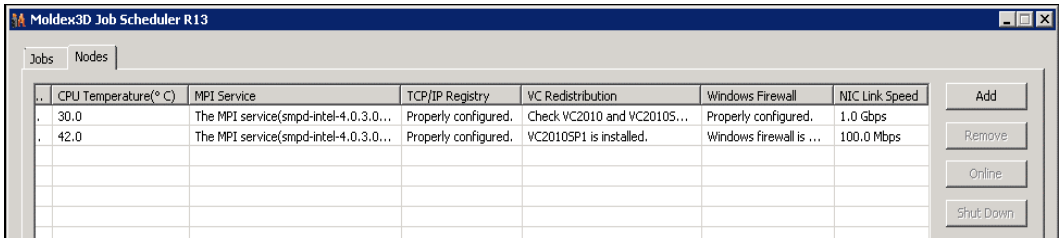
- **Display Item Control in History Page**

It enables choosing what items to show in the history page.



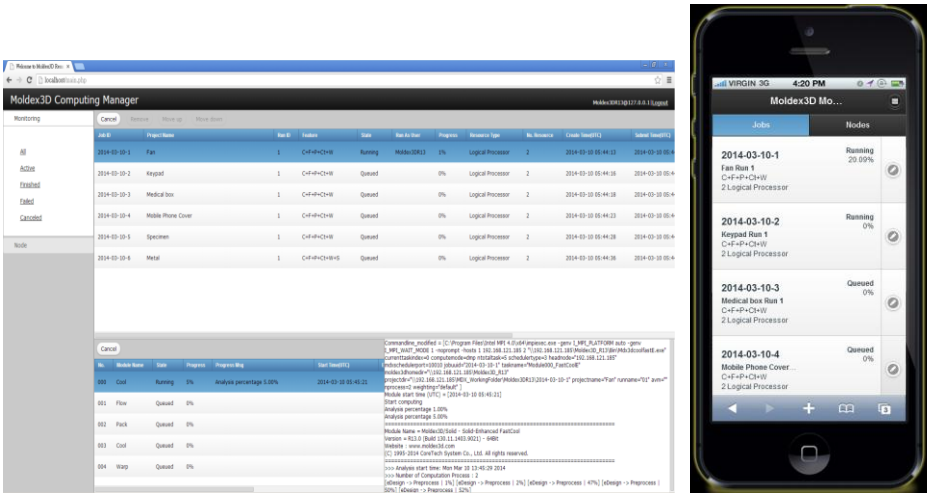
21.2 Job Scheduler

Extra cluster node information is provided, including CPU Temperature, MPI Service, TCP/IP Registry, VC Redistribution, and NIC Link Speed, as shown below. By monitoring cluster status through this feature, it is more convenient to verify if it is ready to start parallel computing.



21.3 Manage Job and Node via Browser

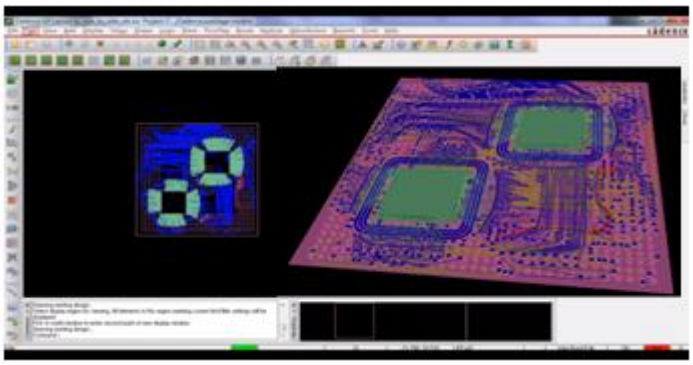
The information of jobs and nodes can be monitored via PC or mobile browser, which helps controlling analysis jobs at any location and any time with portable devices.

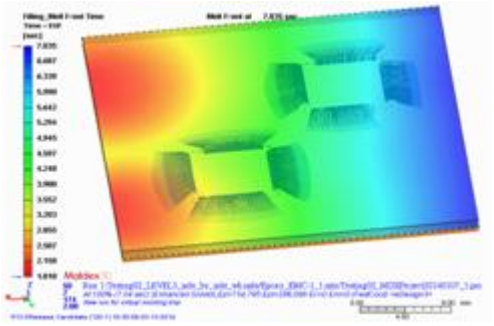


22. IC Packaging

22.1 Cadence-Moldex3D Integration

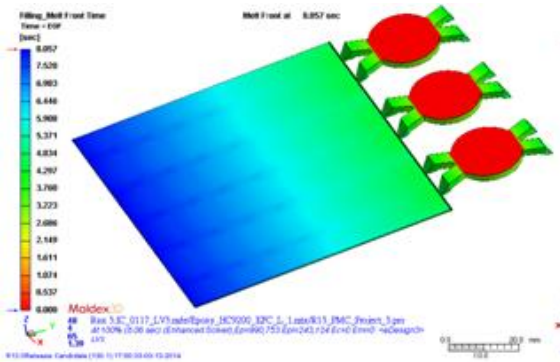
Moldex3D supports Cadence file (*.3di) to import full data of packaging model, including object attributes developed in ECAD software.

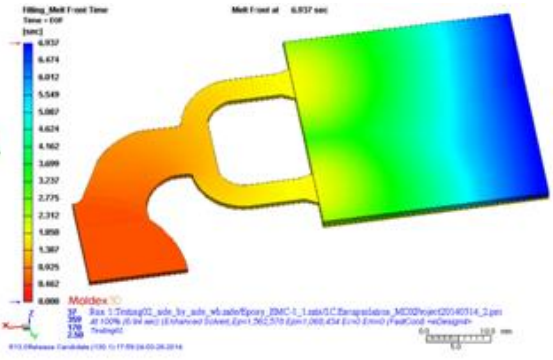




22.2 IC Packaging Simulation with eDesign Mesh

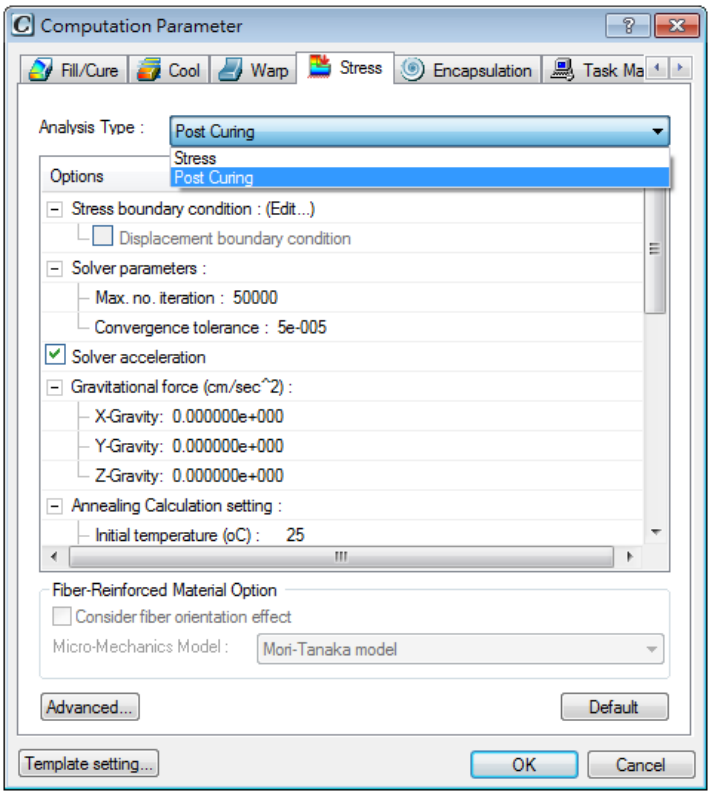
Mesh generation for IC Packaging, only supported with solid mesh previously, is time-consuming. In this release, eDesign mesh is implemented to save time in the pre-processing while keeping the high mesh quality. Through eDesign mesh in Moldex3D Designer, it significantly eases and speeds up the mesh preparation and IC Packaging analysis as well. With the same procedures to the general cases, it supports the simulation of F/P/W/wire sweep, except paddle shift.





22.3 Post Mold Cure Analysis

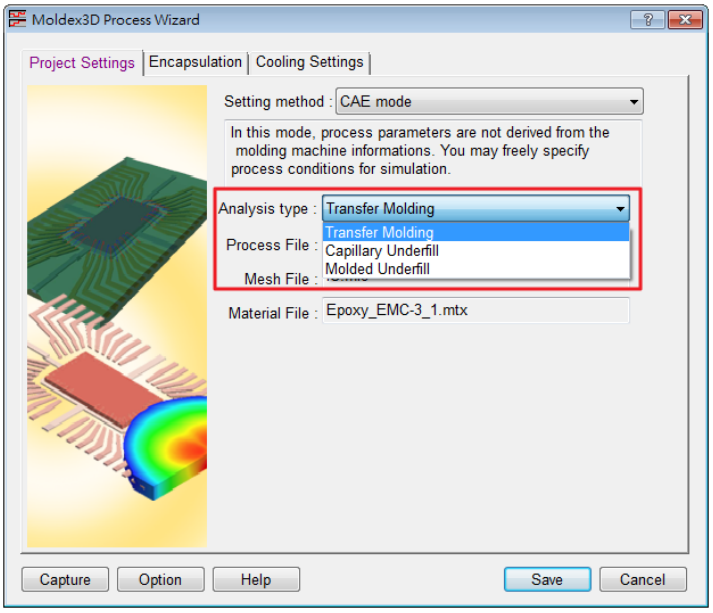
Moldex3D introduces Post mold cure analysis for IC packaging to calculate the conversion change, model deformation, viscoelastic model, considers the volumetric shrinkage due to the conversion change. Also, it supports to output the post mold cure results to other FEA software for a further analysis, providing a more comprehensive result in deformation behavior during in-mold and post-mold processes. Post Curing can be enabled in the setting of analysis type under Computation Parameter (Computation Parameter > Stress > Analysis Type).



22.4 UI Improvement for Packaging Process

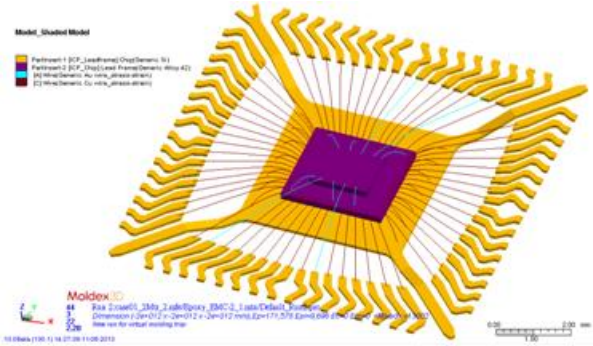
Moldex3D improves the user interface for packaging analysis by covering major processes in IC Packaging industry, including Transfer Molding, Capillary Underfill,

Molded Underfill, Compression Molding, Embedded Wafer Level Package, and No Flow Underfill / Non-Conductive Paste. Moldex3D Process Wizard can automatically detect the mesh attributes and suggest the proper analysis types, making the analysis precise and flexible.



22.5 Wire with Multiple Materials

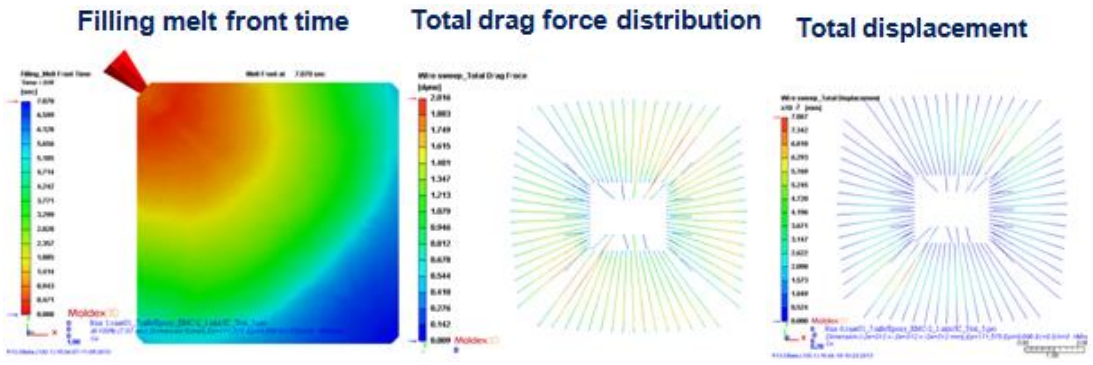
It is enabled to have different materials to each set of the wires in one model. The difference in elastic module between each of materials affects directly the wire deformation. Moldex3D supports multiple wire material definitions for wire sweep analysis in this release to obtain the behavior closer to the real case.



Wire ID	WSI(%)	
	Au	Cu
1	1.55	1.36
31	1.47	1.29
82	2.41	2.12
84	2.27	2.00

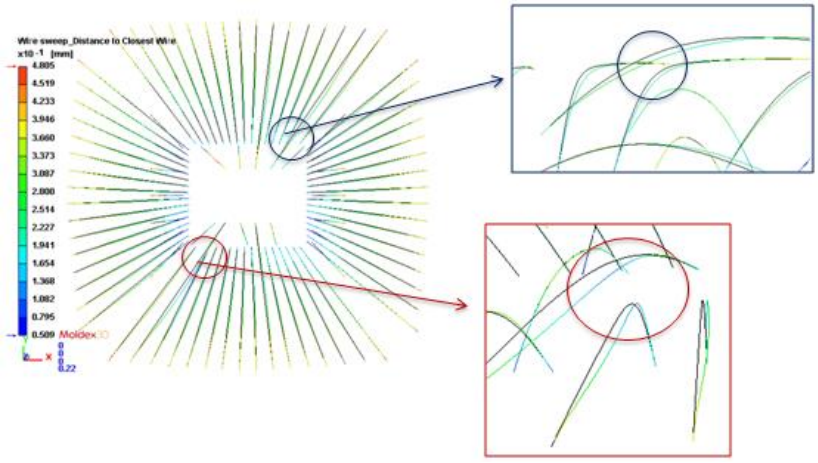
22.6 Drag Force Distribution

The display of drag force distribution is supported for understanding the cause of wire sweep.



22.7 Minimum Distance between Two Wires

The prediction of minimum distance between two deformed wires is provided in this release to help finding where potential trouble point is after wire sweep analysis for design revision to avoid wire short.



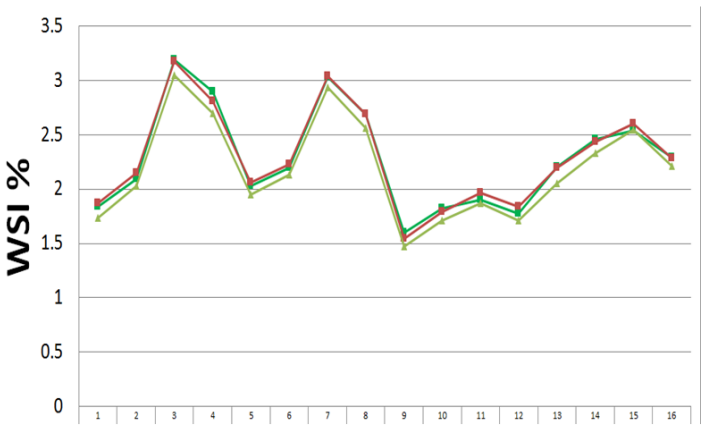
22.8 Output Wire Sweep Result Options

Several output options for wire sweep result are provided, such as

-Define wires to output the analyzed wire sweep result as *.csv file, which will be the source of WSI distribution curve for the comparison with experimental data

-Output the data of wire distance which falls within the customizable range

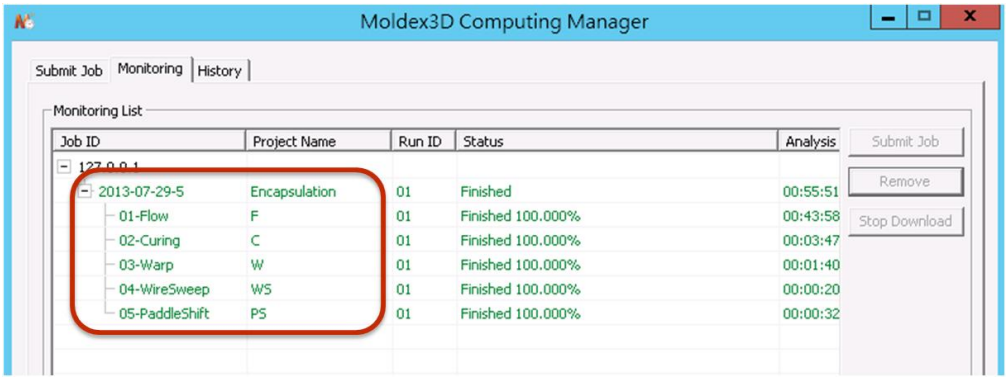
-Output the deformed wire layout as .dxf file format



1	Unit=mm; Search range = 0.200000 mm		
2	Wire1	CWire2	
3	C.No=1	0.1246	
4	Wire2	CWire3	CWire1
5	C.No=2	0.1246	0.1246
6	Wire3	CWire2	CWire4
7	C.No=2	0.1246	0.1246
8	Wire4	CWire5	CWire3
9	C.No=2	0.1246	0.1246
10	Wire5	CWire4	CWire6
11	C.No=2	0.1246	0.1246
12	Wire6	CWire7	CWire5
13	C.No=2	0.1246	0.1246
14	Wire7	CWire8	CWire6
15	C.No=2	0.1146	0.1246
16	Wire8	CWire7	CWire9
17	C.No=2	0.1146	0.1246

22.9 IC Packaging Analysis through RC

IC Packaging analysis now is supported to be carried out through Moldex3D remote computing mechanism, including wire sweep, paddle shift and stress analyses. Thus, the available computation sources are allocated more effectively.



22.10 DOE Analysis for IC Packaging Projects

DOE analysis is available for Transfer molding process only. Via DOE, multiple design factors can be applied as control parameter for optimization, in which the factors can be wire sweep index, wire sweep - Total displacement, wire sweep - Total drag force, paddle shift - Total displacement, and paddle shift - Von Mises stress.