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SHANGHAI JIAO TONG UNIVERSITY



WELCOME

上海交通大学——模具CAD国家工程研究中心

上海申模计算机系统集成有限公司

Shanghai Shen Mo Computer System Integration Co., Ltd.

<http://www.shenmo.sh.cn>

徐学春 常务副总经理 13917290205



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申模简介

创立于1998年，是依托上海交通大学模具CAD国家工程研究中心成立的系统集成公司，上海市高新技术企业，以提供C3P（CAD/CAM/CAE/PDM）技术为主的咨询服务见长。



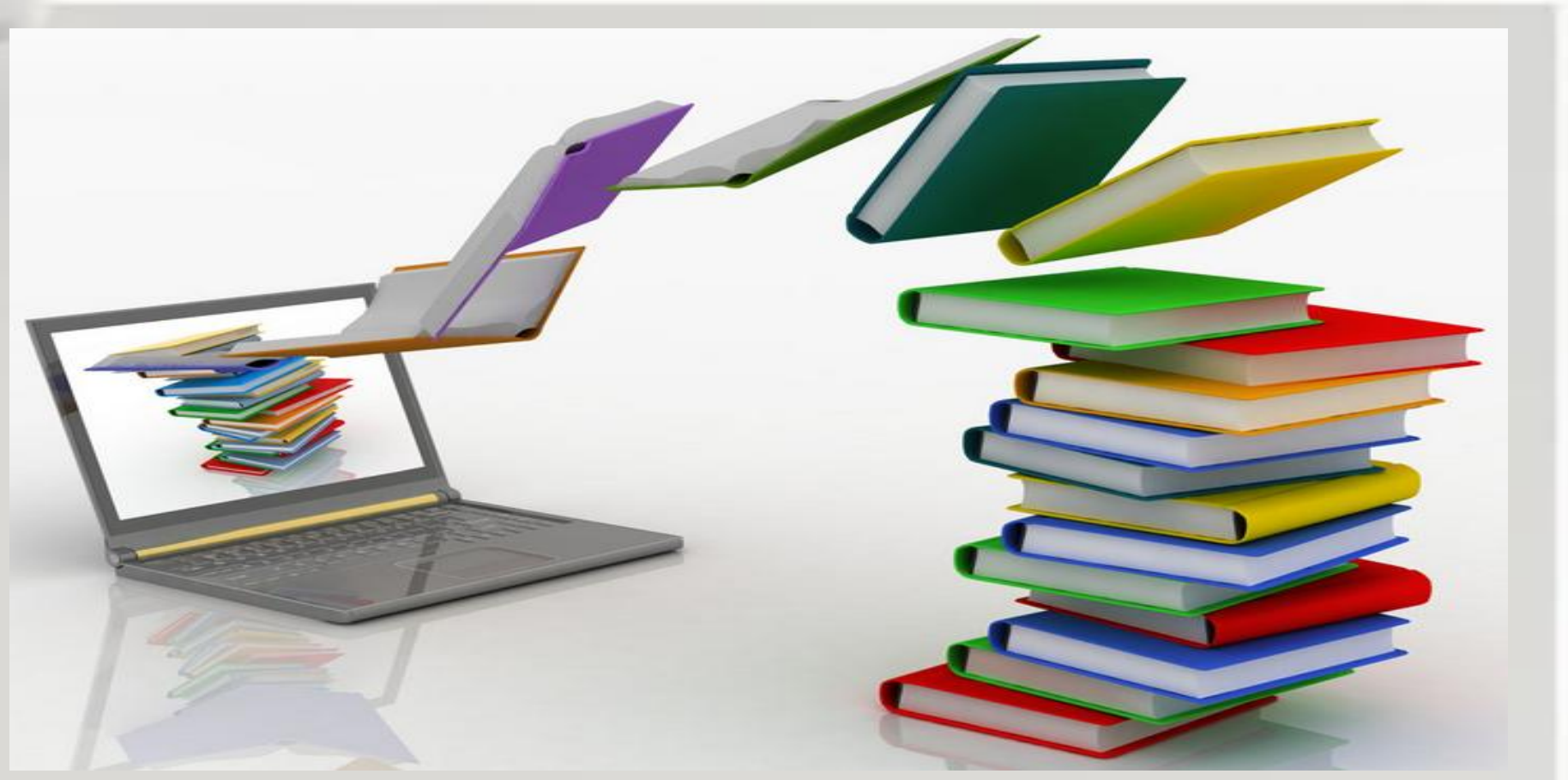


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CAE——仿真模拟

科学计算





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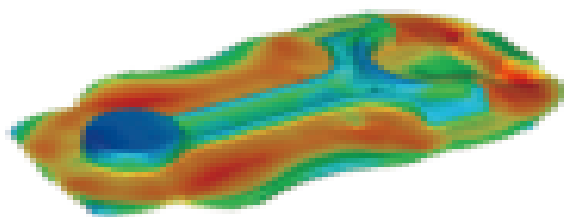


C3P业务：软件销售



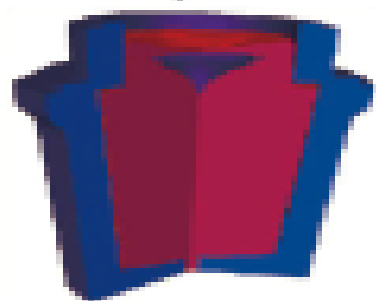
法国Transvalor公司中国区独家全面合作商

FORGE® N×T
The reference in metal forming simulation



锻造工艺仿真软件

THERCAST®
Metal foundry processes simulation



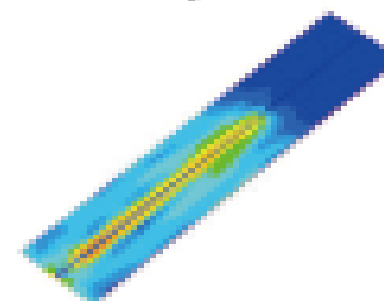
铸造工艺仿真软件

REM3D®
3D Injection molding simulation



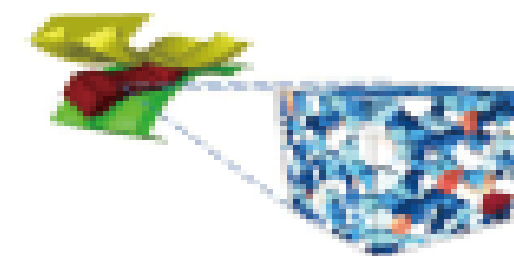
注塑工艺仿真软件

TRANSWELD®
Dedicated to welding processes simulation



焊接工艺仿真软件

DIGIMU®
The digital solution for microstructural evolution



微观组织仿真软件



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中法共建《联合技术中心》



National Engineering Research
Center of Die & Mold CAD
P.R. China



TRANSVALOR S.A.
France

Collaboration Center



上海交通大学
SHANGHAI JIAO TONG UNIVERSITY



《基于REM3D的若干关键工艺仿真技术应用》

—— 技术演讲嘉宾（Rem3D亚太区技术总监）

严波

博士、美国IUPUI机械工程系博士后
副教授、硕士生导师

上海交通大学模具CAD国家工程研究中心



Rem3D[®] 5.0

SOFTWARE

by Transvalor

A BRAND NEW EFFICIENT MODELLING SOLUTION FOR INJECTION MOLDING PROCESSES



About Transvalor SA

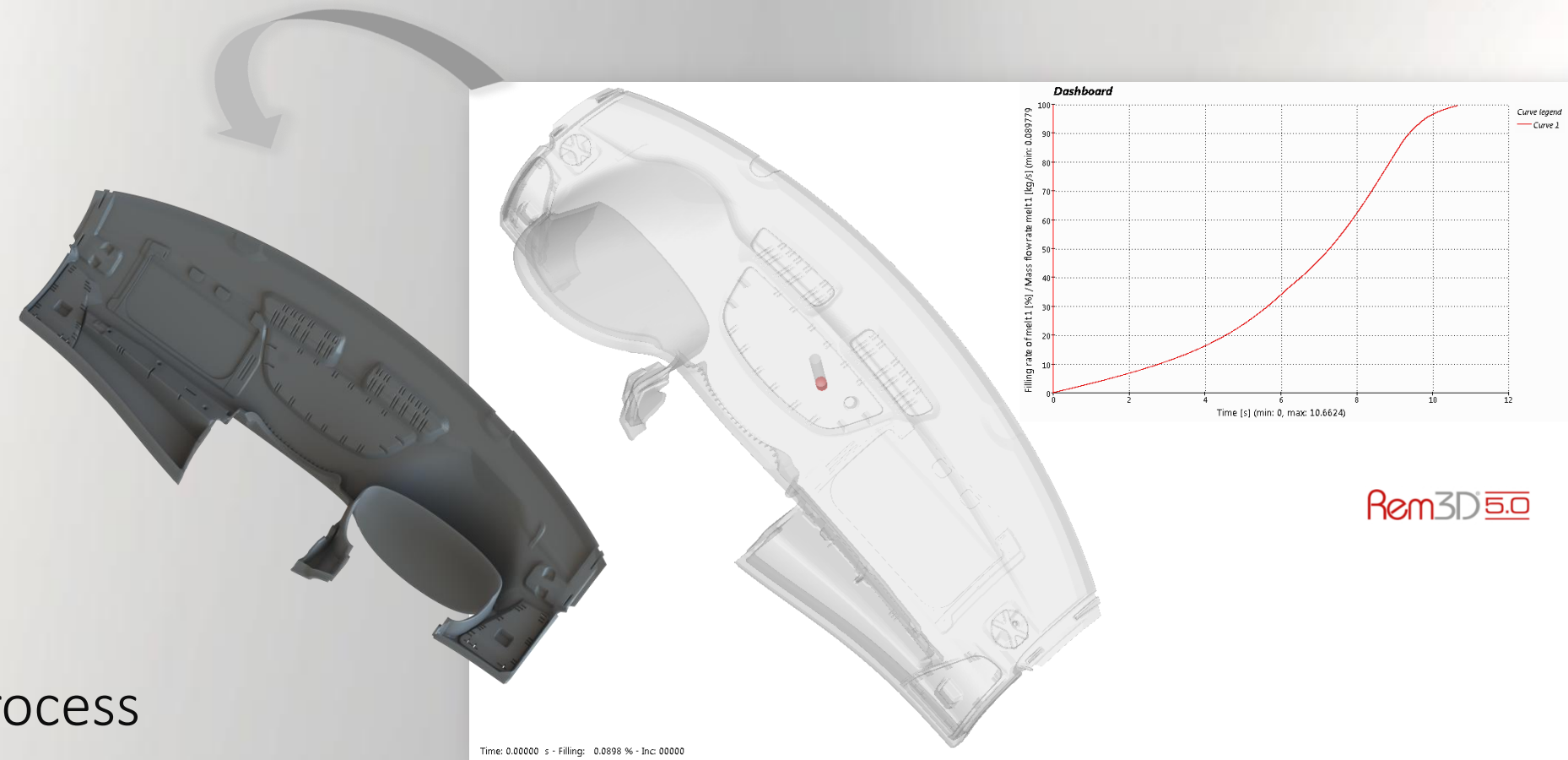
What does Rem3D[®] aim to do ?

Rem3D[®] most valuable characteristics

Optimize assisted-like or co-injection process

Simulate process for fiber-reinforced plastics

Design foam injection-expansion process





Company

About Transvalor SA



Goals

What does Rem3D[®] aim to do ?



Key features

Rem3D[®] most valuable characteristics



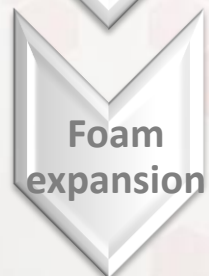
Multifluids

Optimize assisted-like or co-injection process



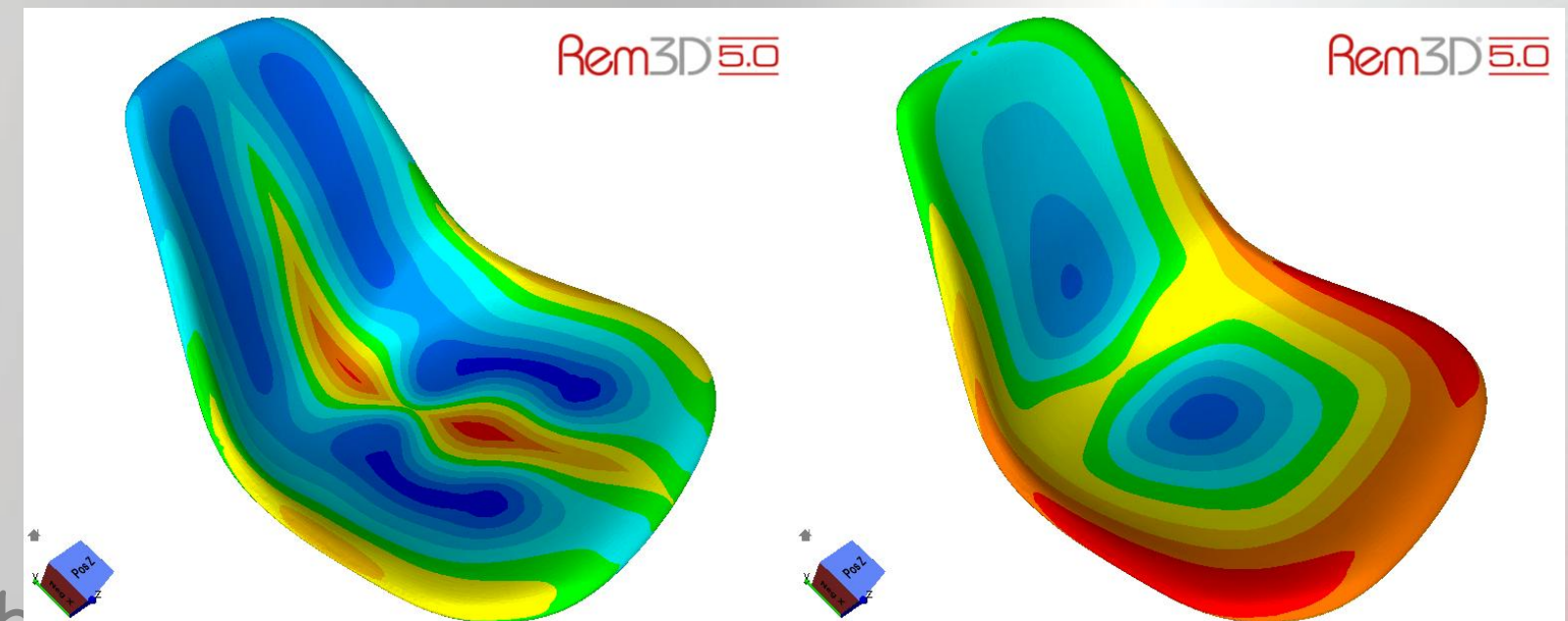
Reinforced injection

Simulate process for fiber-reinforced plastics



Foam expansion

Design foam injection-expansion process



Company

Goals

Key features

Multifluids

Reinforced injection

Foam expansion



Rem3D[®] is a continuously improved & innovative product

- An industrial product validated by reference companies in EMEA:
 - ✓ Polymer Producers
 - ✓ Product Manufacturers
 - ✓ Automotive Manufacturers
 - ✓ Aerospace and Defense
- Continuously enriched with new functionalities and features through R&D projects
- Achievement of long-term Research Program in close collaboration with :



WHAT DOES REM3D® AIM TO DO ?



Rem3D® is a brand new software solution for injection molding process:

- ✓ Perfect to simulate the full injection cycle of polymers.
- ✓ 3D native FEM resolution.
- ✓ Applicable to thermoplastics & thermosets.



Reduce mold design time

How? → **Rem3D** determines the best position for runners and coolers and/or heating cartridges.



Analyze the filling defects

How? → **Rem3D** simulates the filling of a complex mold in 3D with major variations of thickness.



Optimize your injection process

How? → **Rem3D** calculates the inner pressure and consequently optimize the clamping force.

SIMULATION OF THE ENTIRE INJECTION CYCLE



Company

Goals

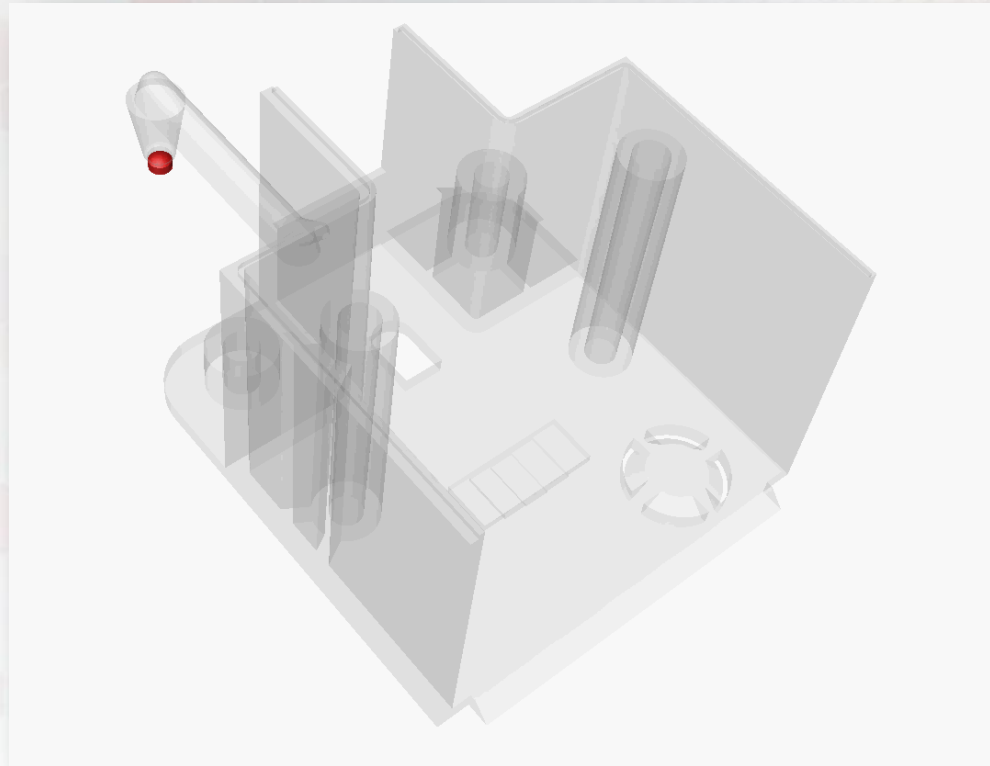
Key features

Multifluids

Reinforced injection

Foam expansion

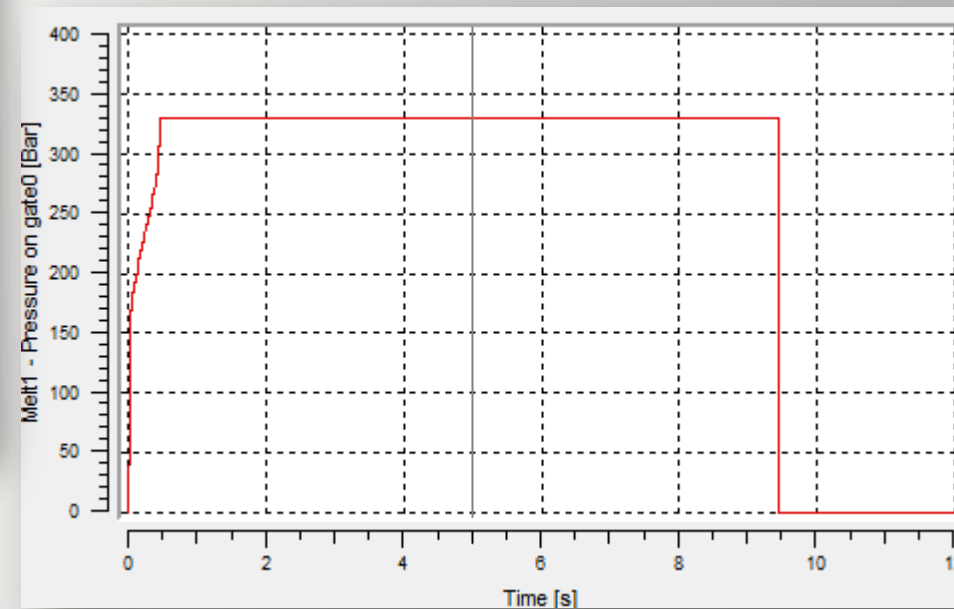
From filling ...



Melt front evolution



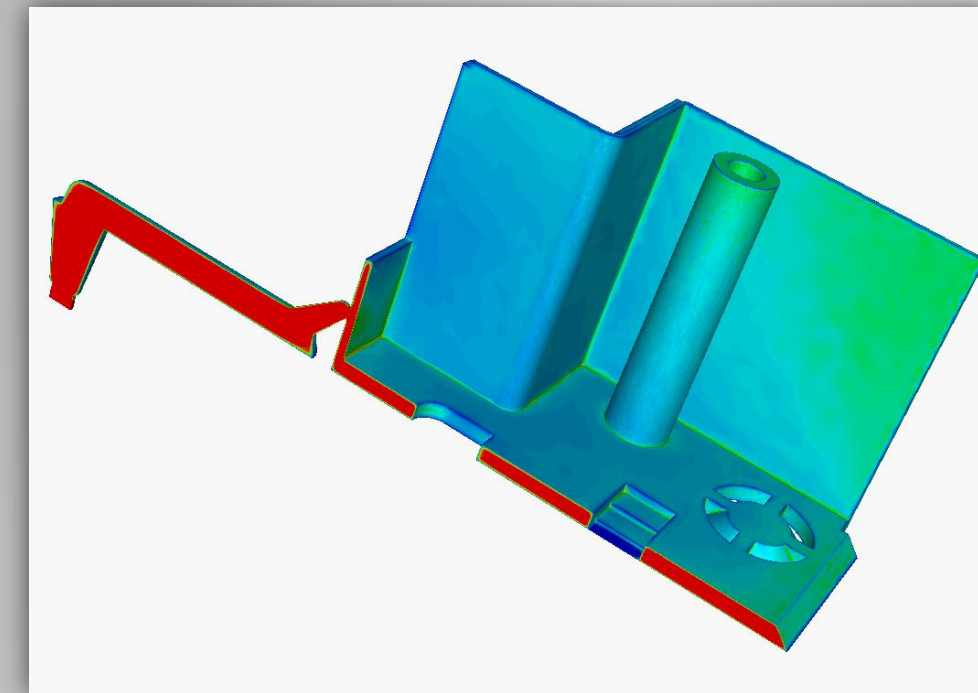
Packing



Injection pressure vs Process time



...to Cooling



Temperature variation

COMPREHENSIVE ANSWERS TO PRACTICAL ISSUES

Company

Goals

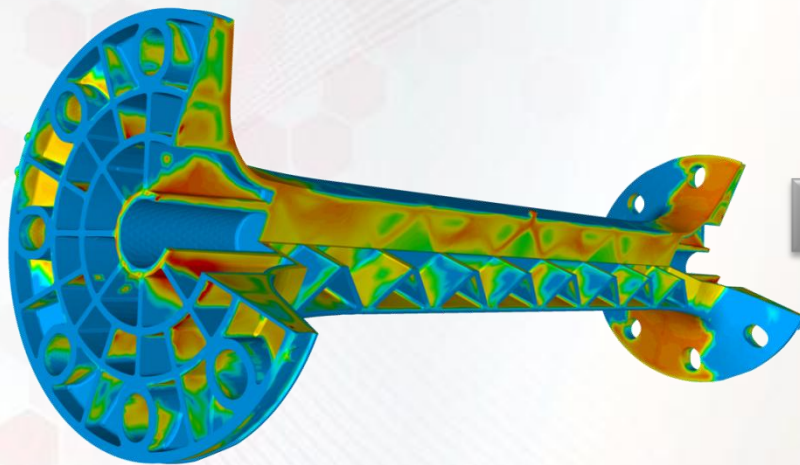
Key features

Multifluids

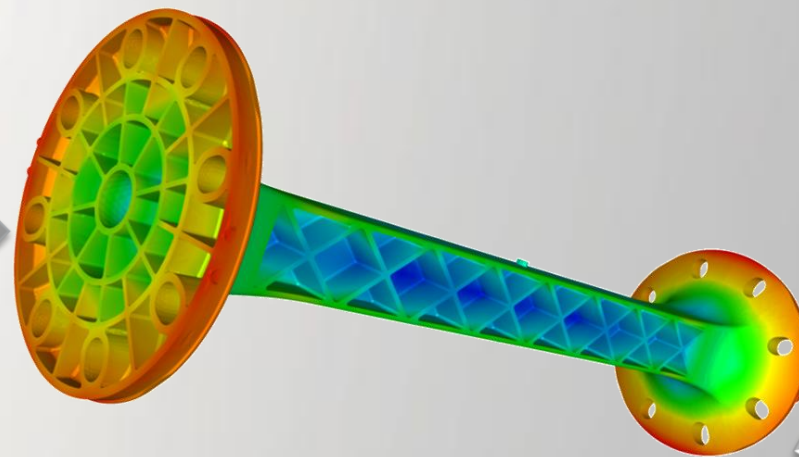
Reinforced injection

Foam expansion

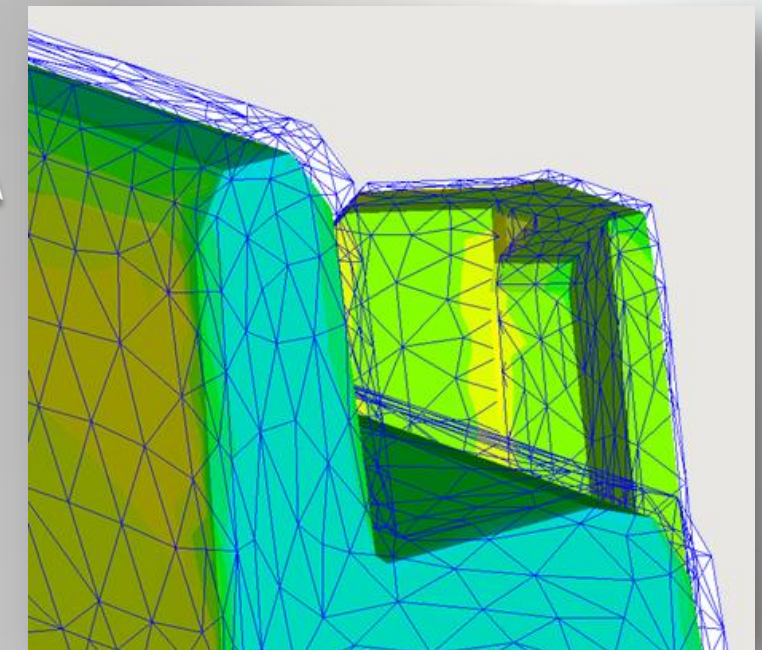
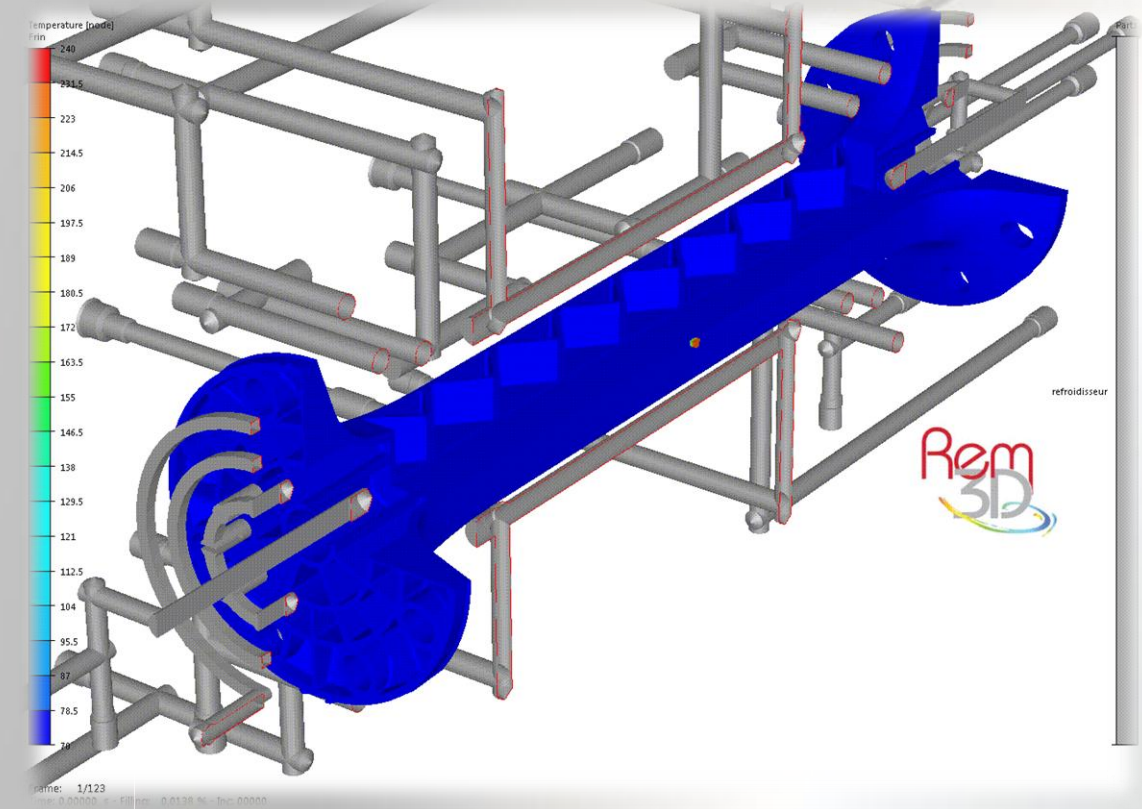
Meshing and fully coupled mold/part thermal analysis provide accurate thermal profile and material flow to uncover : *underfilling*, *shrinkage*, *warpage*, *cooling effect*, *optimum gate location*...



Temperature distribution inside the part and at the wall during the filling



Final warpage displayed on the part



Part visualization before & after warpage



Company

About Transvalor SA



Goals

What does Rem3D[®] aim to do ?



Key features

Rem3D[®] most valuable characteristics



Multifluids

Optimize assisted-like or co-injection process



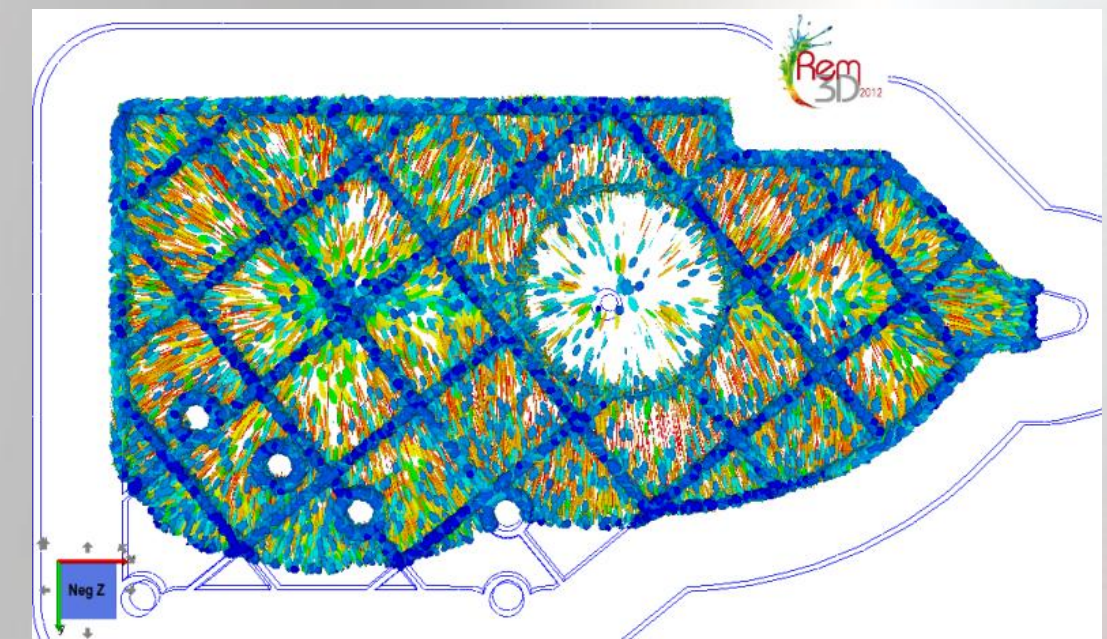
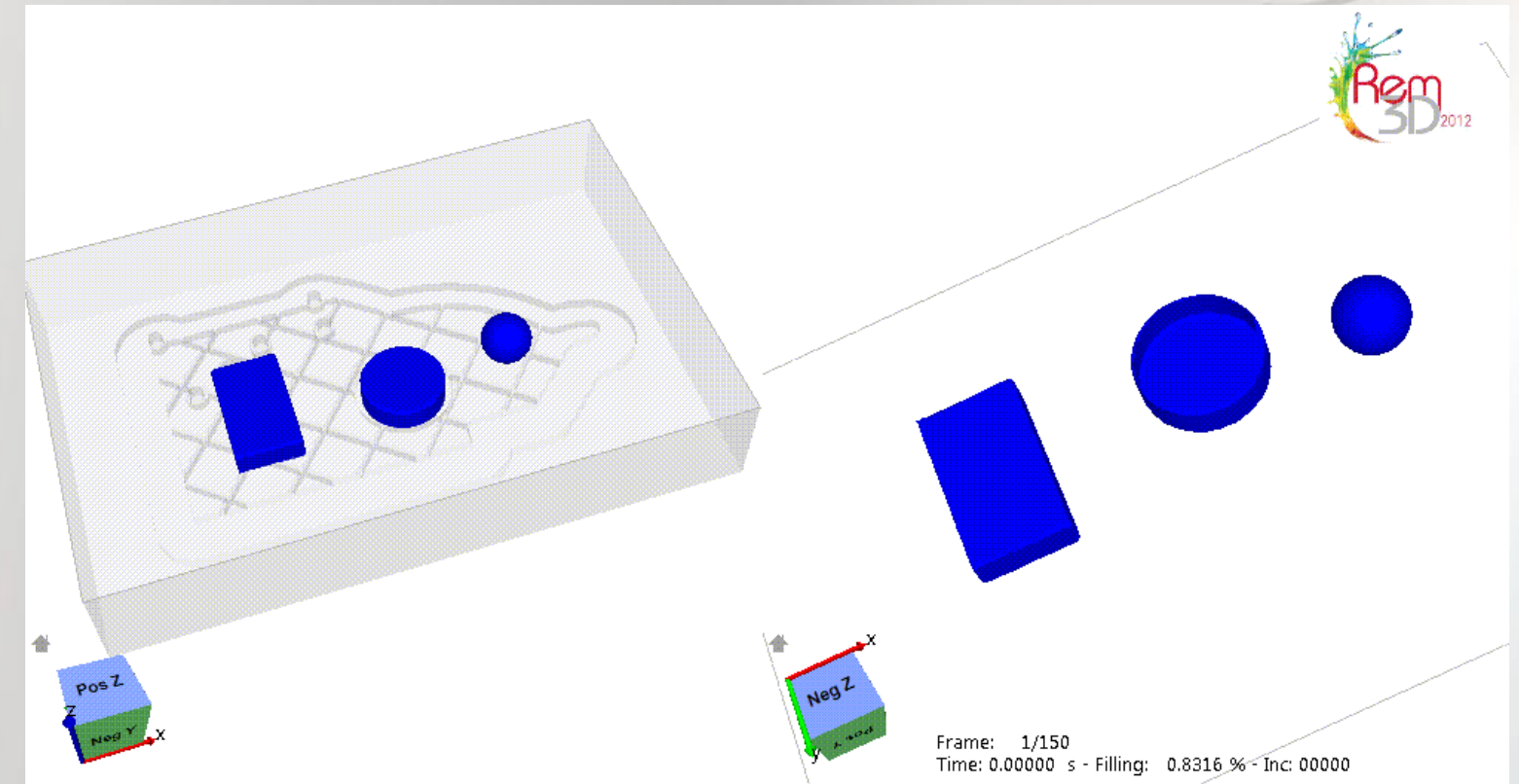
Reinforced injection

Simulate process for fiber-reinforced plastics



Foam expansion

Design foam injection-expansion process



ACCURATE & RELIABLE



Rem3D® provides a true-accurate prediction of the polymer flow.

Company

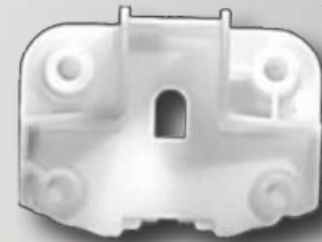
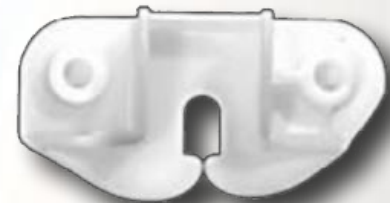
Goals

Key features

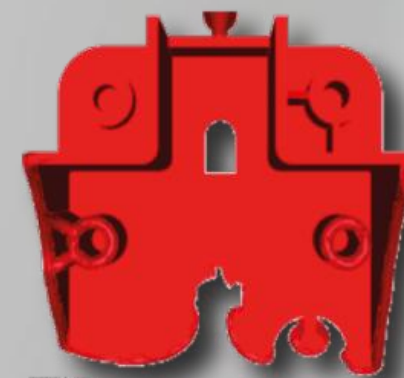
Multifluids

Reinforced injection

Foam expansion



Courtesy of 



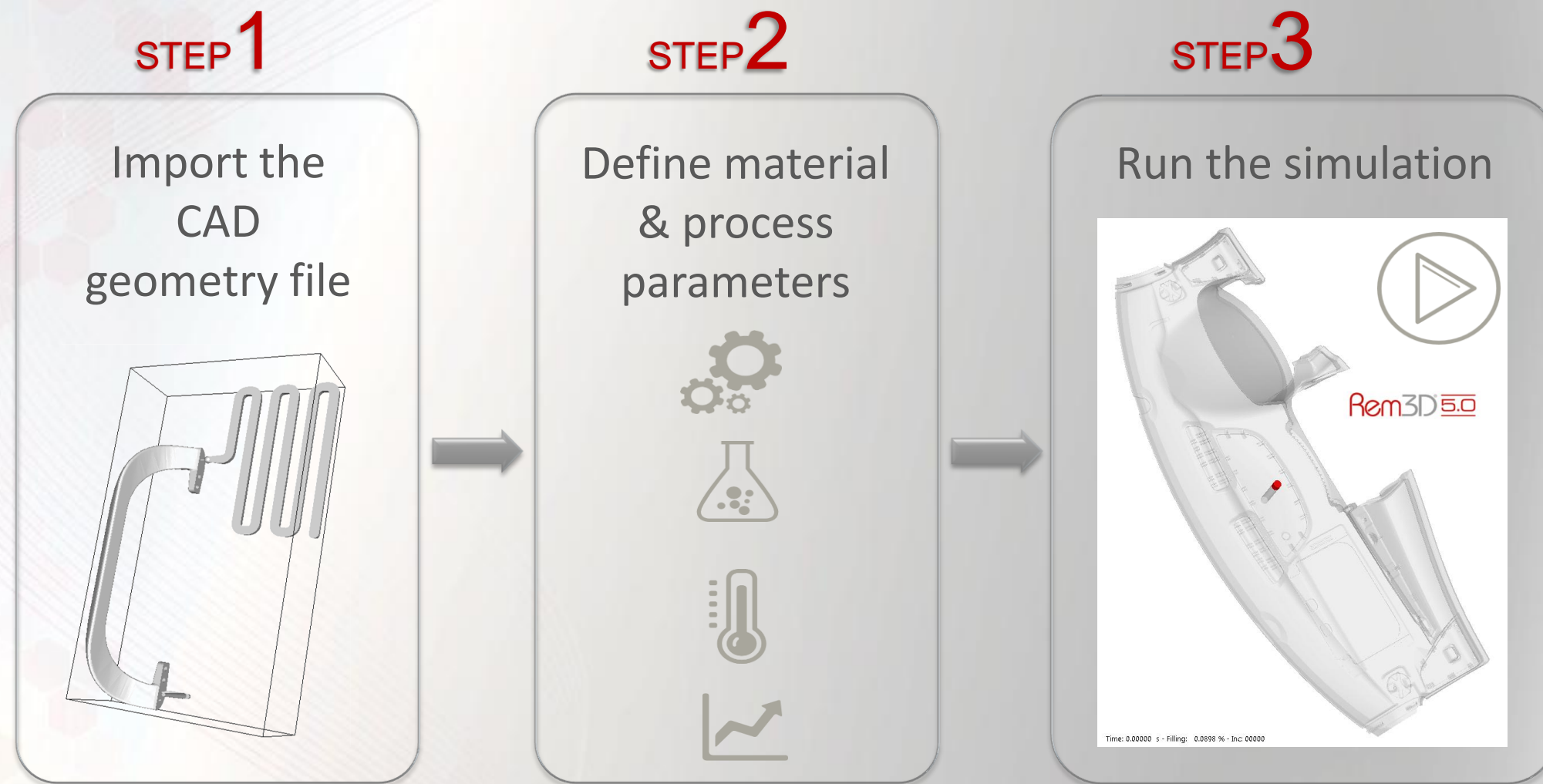
Short shots of electrical housing – Comparison Experiment vs Rem3D® simulation (in red)

PRE-PROCESSING : QUICK & EASY SETUP



Rem3D® Graphical User Interface offers a user-friendly experience to setup the model, run the analysis and post-process the results.

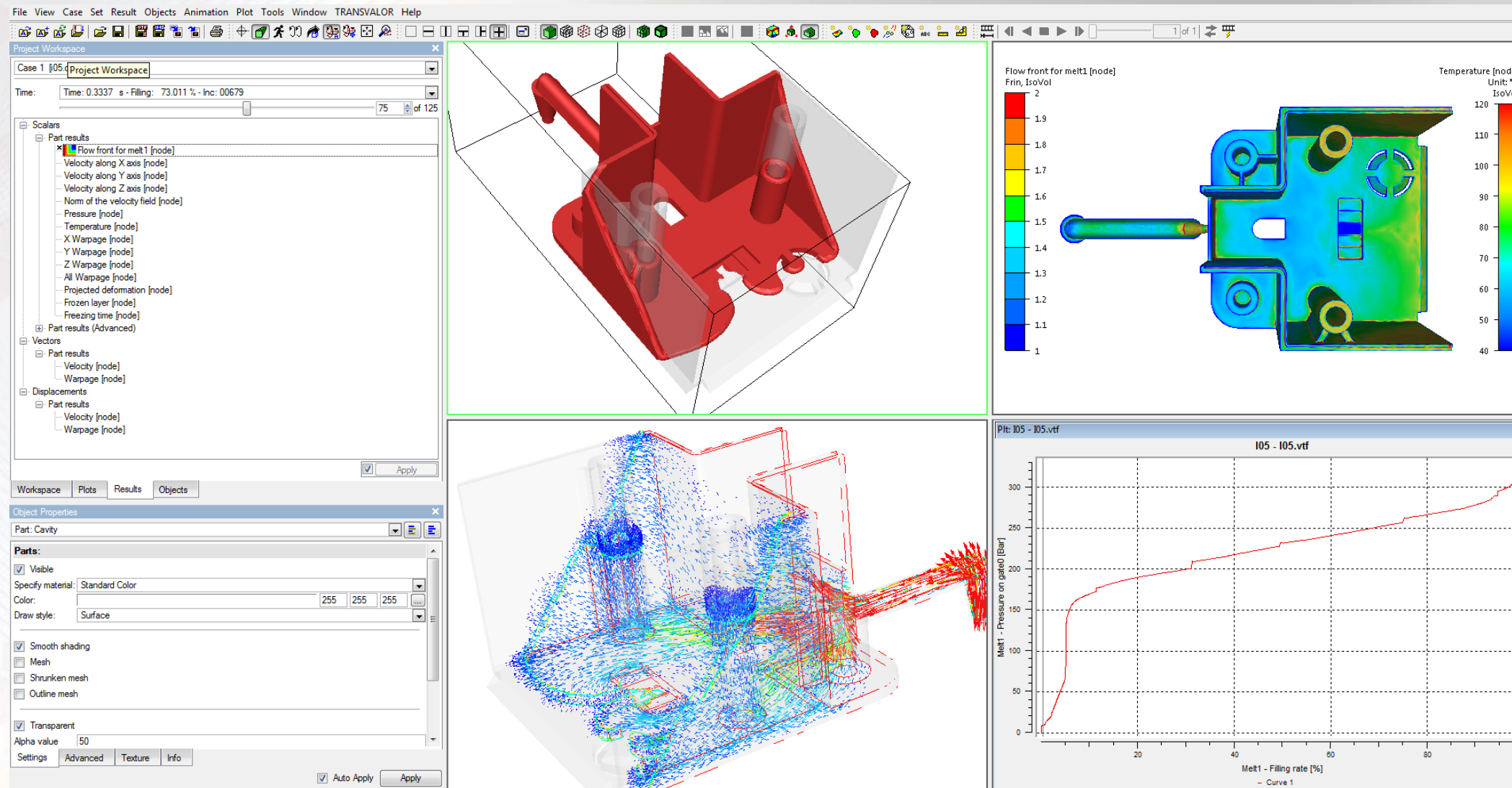
- Company
- Goals
- Key features**
- Multifluids
- Reinforced injection
- Foam expansion



POST-PROCESSING : A COMPLETE UNDERSTANDING OF THE PROCESS



Rem3D® provides all results for a complete understanding of the process (scalar & vector, cutplanes, point tracking, texture & transparency, animations, plots, export images & videos, ...).



Multiple projects can be analysed within the same interface (incl. synchronized navigation)

Company

Goals

Key features

Multifluids

Reinforced injection

Foam expansion

AAA MESHING (1/3)

 AAA = Automatic Meshing

End-users expect simplified setups without numerical parameters and initial meshing steps. Thanks to Automatic Meshing, preparation time is shortened => no more initial or manual meshing steps.

Company

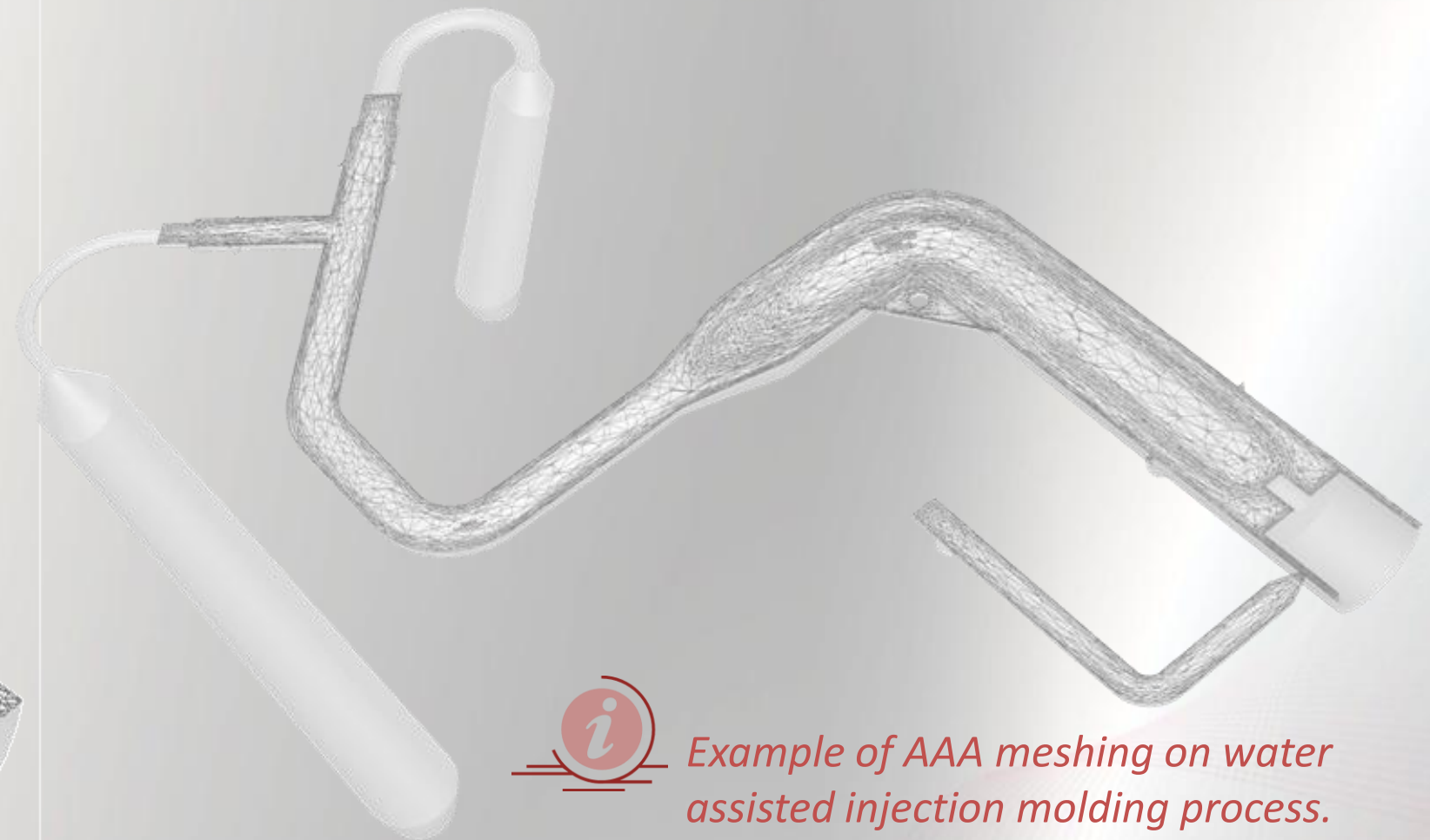
Goals

Key features

Multifluids

Reinforced injection

Foam expansion



Example of AAA meshing on water assisted injection molding process.

Native Full 3D Design



Full Parallelized Resolution



Automatic Meshing



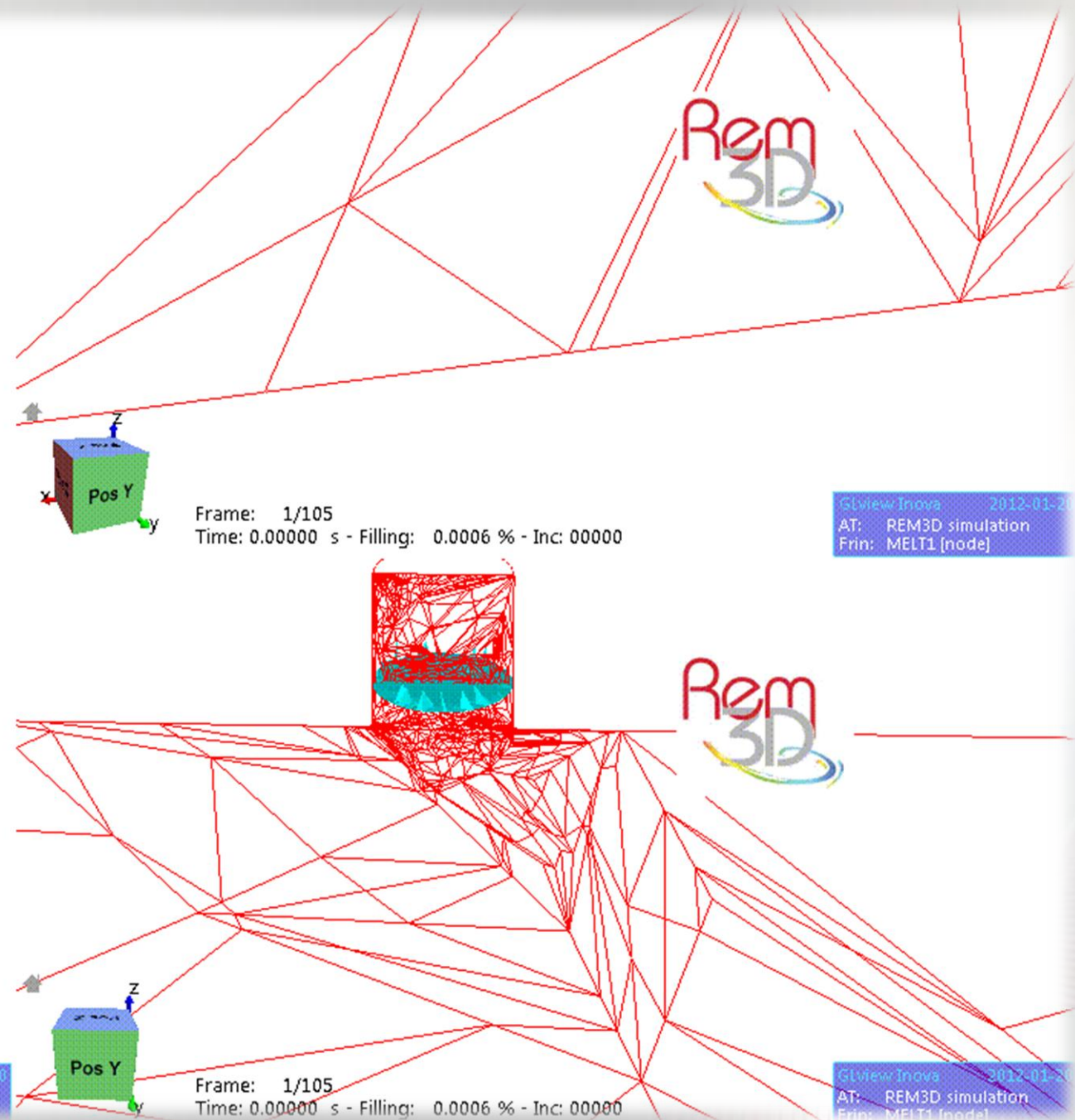
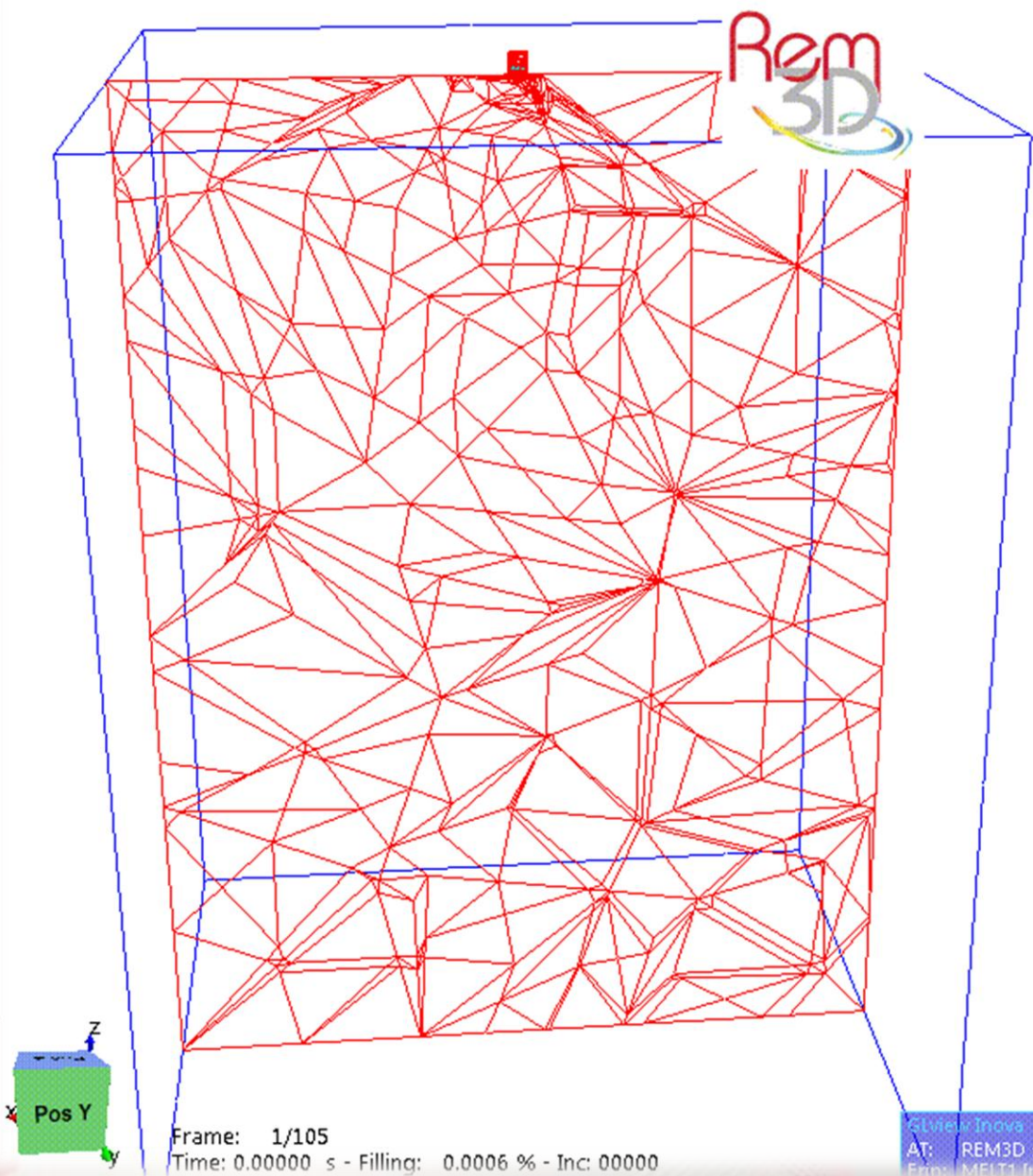
Anisotropic Meshing



Adaptive Meshing



Accurate Front prediction



Company

Goals

Key features

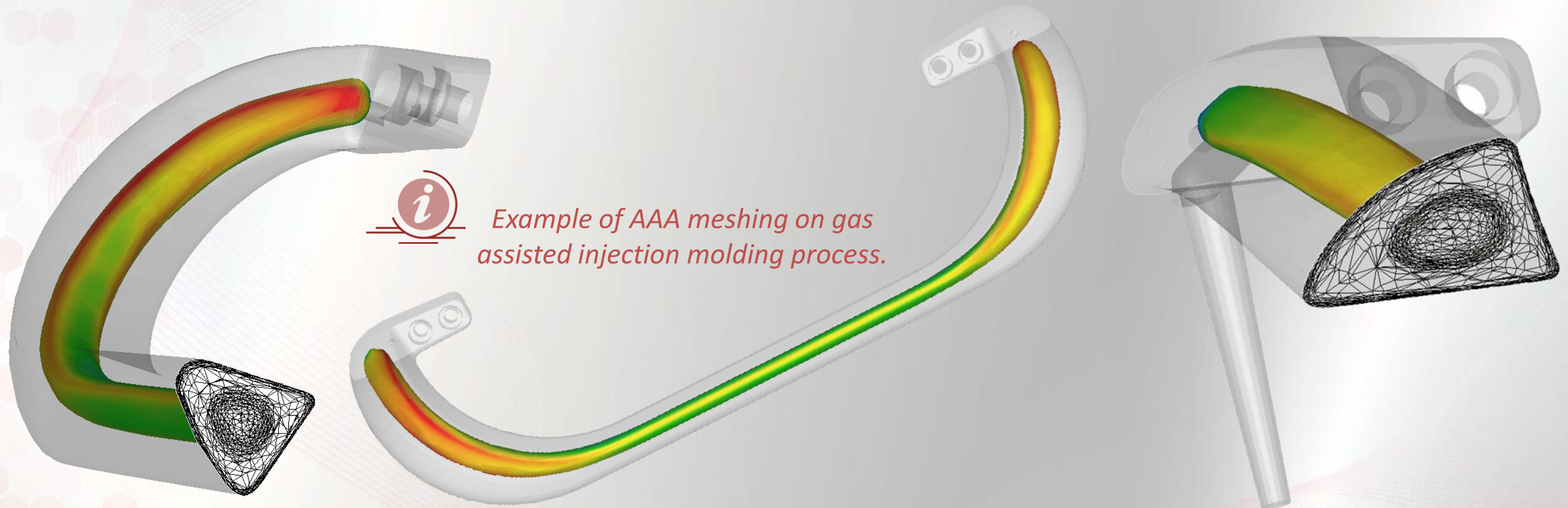
Multifluids

Reinforced injection

Foam expansion

 AAA = Adaptive Meshing

Mesh adaptation is triggered all along the process time with smaller elements to guarantee the most accurate results. Mesh is dynamically adapted at each increment based on flow front position and local velocity gradients.



Company

Goals

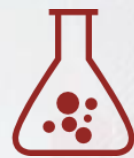
Key features

Multifluids

Reinforced injection

Foam expansion

Thermoplastics and Thermosets polymers are included in the standard database. End-users can modify or enrich the database with custom materials using the above laws:



Rheological Laws:

- Newtonian
- Power
- Cross
- Carreau-Yasuda



PVT Laws:

- Tait
- IKV



Percolation model:

- Macosko



Thermal Laws:

- WLF: William Landel Ferry
- Arrhenius



Kinetic model:

- Kamal & Sourour



Polymers material characterization done by Transvalor is available on demand.

3 – OPTIMIZED PARALLELIZATION



Company

Goals

Key features

Multifluids

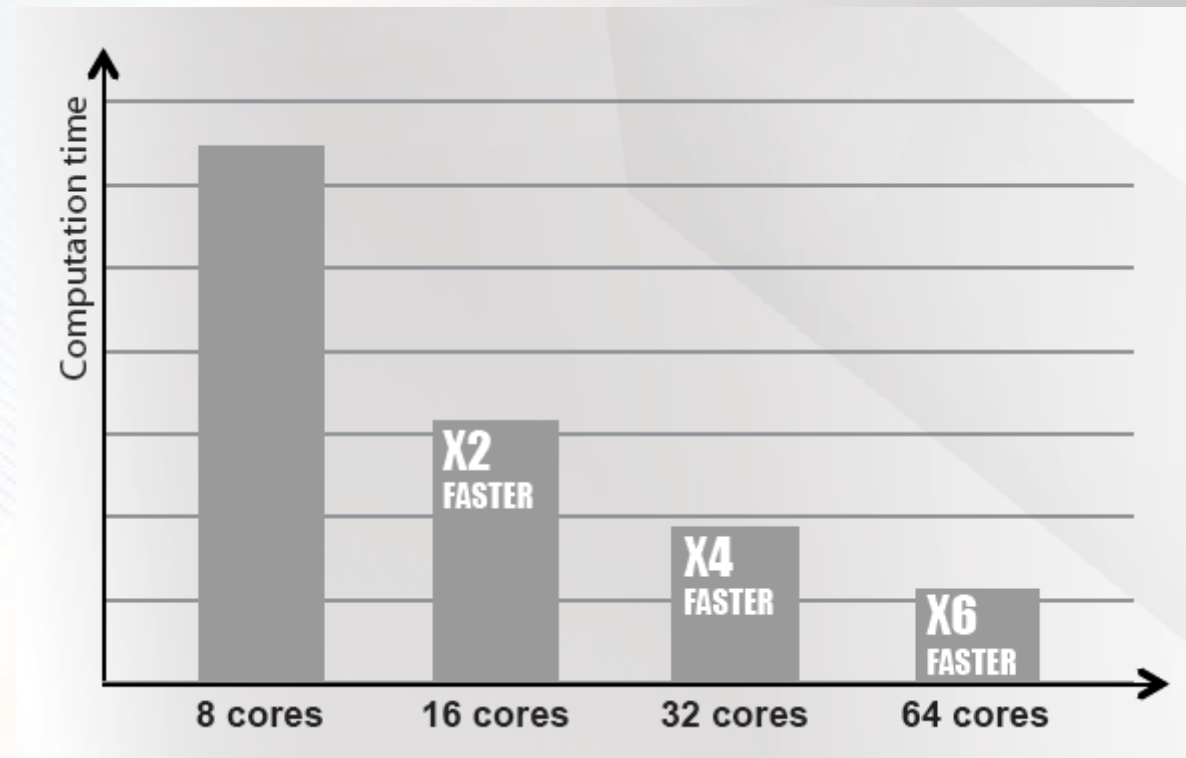
Reinforced injection

Foam expansion

Transvalor is market leader in parallel computation and numerical techniques to shorten computation time.

As every Transvalor software, Rem3D[®] 5.0 inherits of these successful technologies.

Rem3D[®] is based on a performance-optimized architecture and can be operated on one or many cores, providing the level of simulation power you need without limitation !



Computation time versus number of computer cores



Company

About Transvalor SA



Goals

What does Rem3D[®] aim to do ?



Key features

Rem3D[®] most valuable characteristics



Multifluids

Optimize assisted-like or co-injection process



Reinforced injection

Simulate process for fiber-reinforced plastics



Foam expansion

Design foam injection-expansion process

ASSISTED INJECTION PROCESS (1/2)



Thanks to AAA Meshing, sharp interface representation and mold/part coupled thermal resolution, Rem3D[®] predicts gas (or water) core thickness with a realistic smooth skin effect.

Company

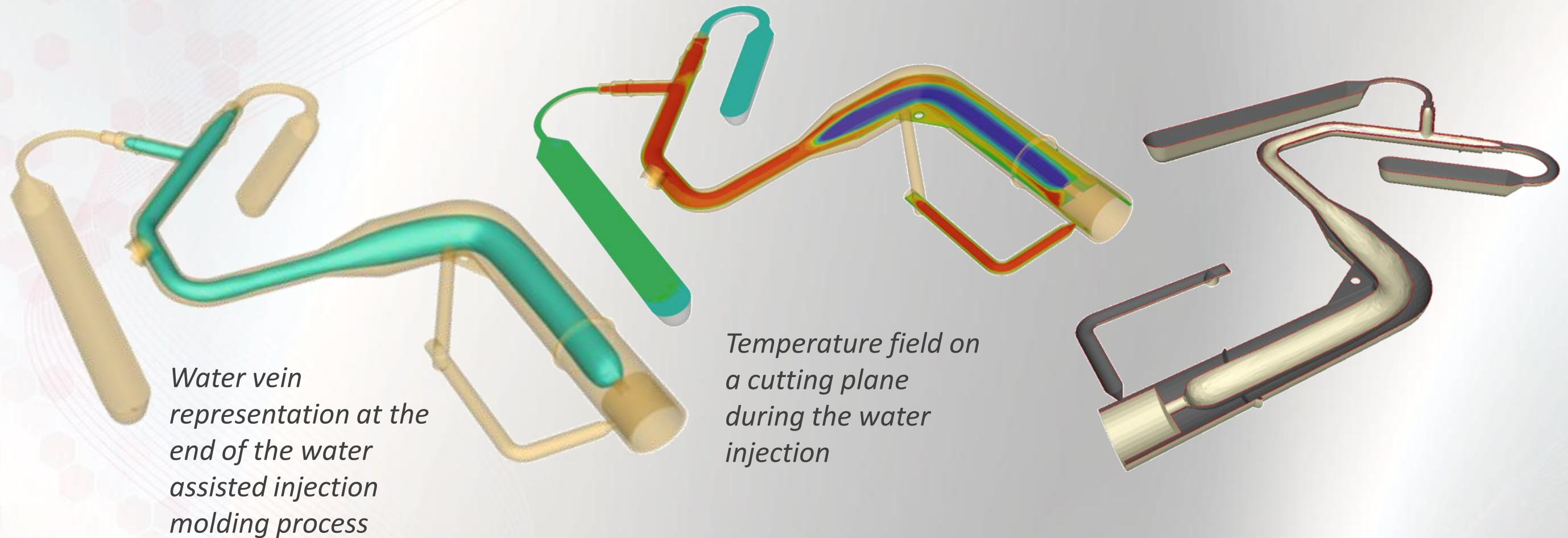
Goals

Key features

Multifluids

Reinforced injection

Foam expansion



Water vein representation at the end of the water assisted injection molding process

Temperature field on a cutting plane during the water injection



Export of the final hollowed and warped part in .stl format for further structural analysis !

ASSISTED INJECTION PROCESS (2/2)

Company

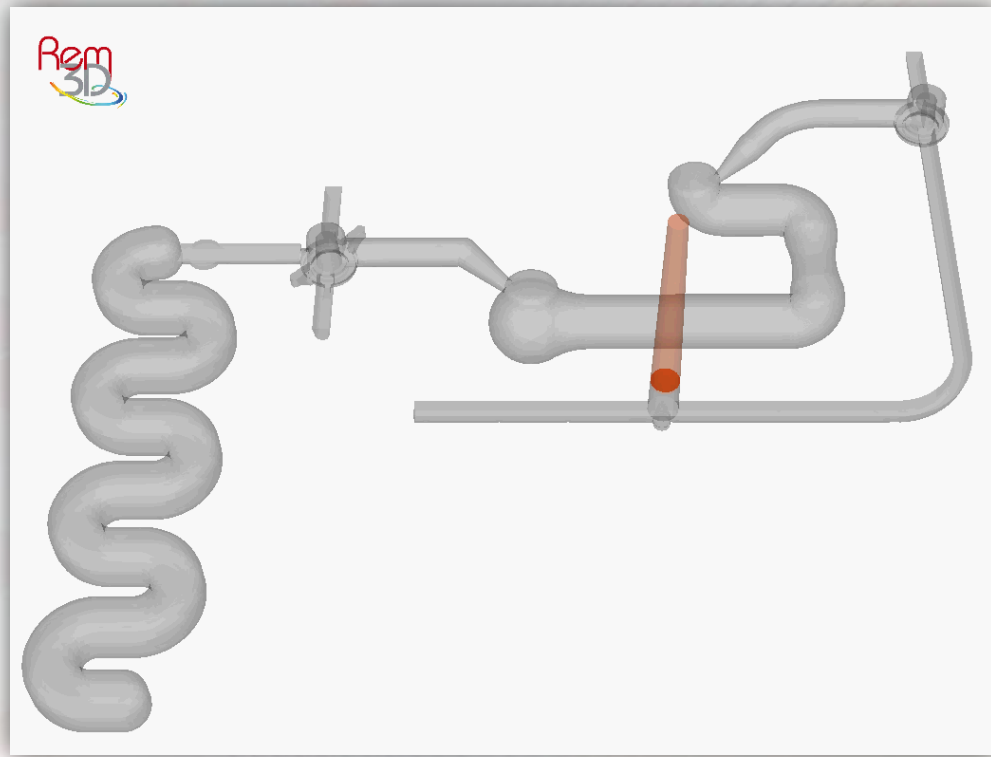
Goals

Key features

Multifluids

Reinforced injection

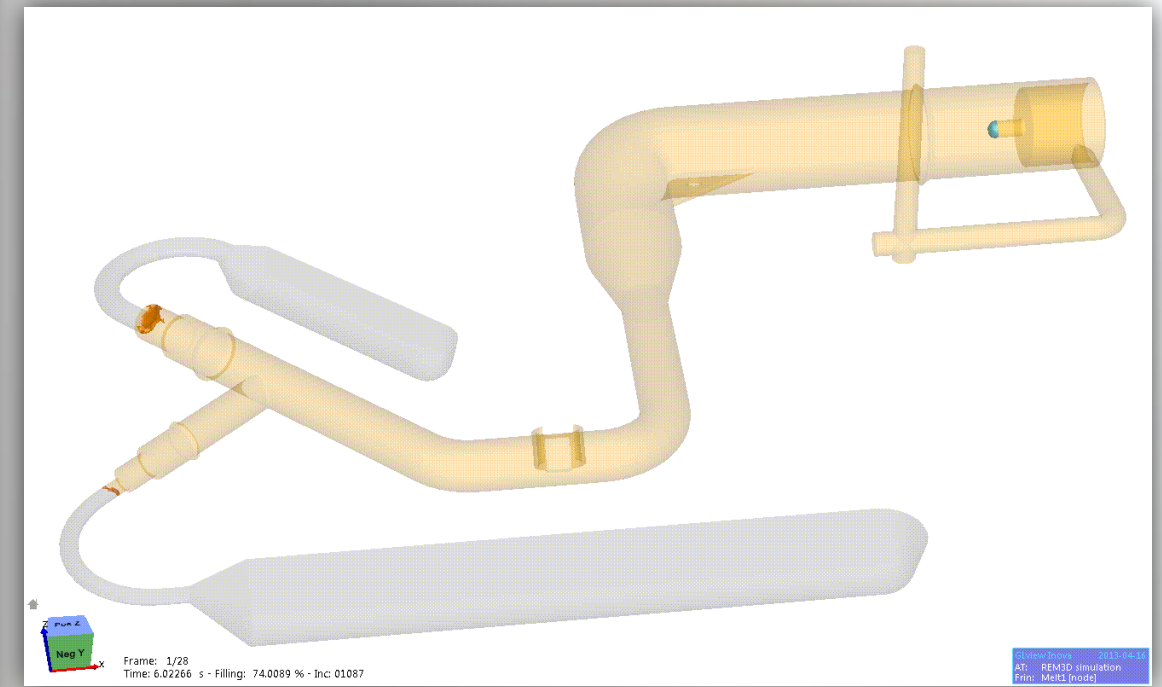
Foam expansion



Handle appliance



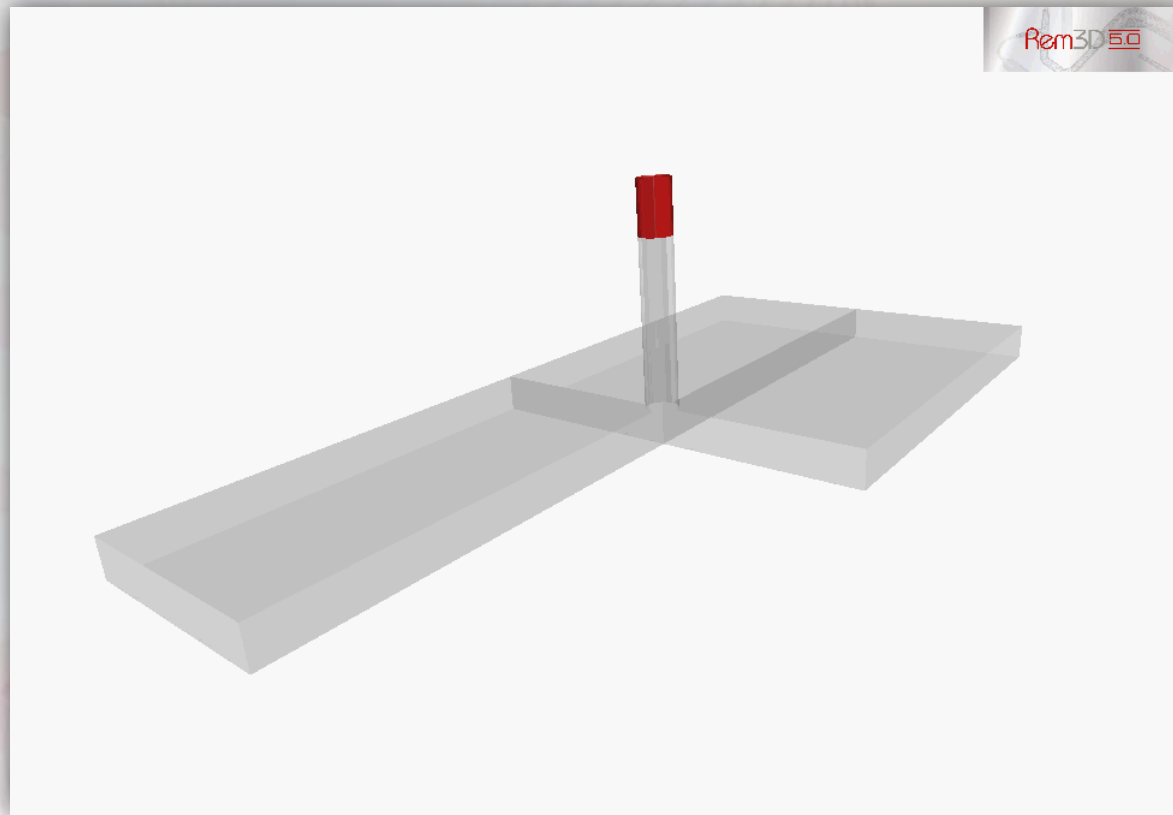
Outdoor chair



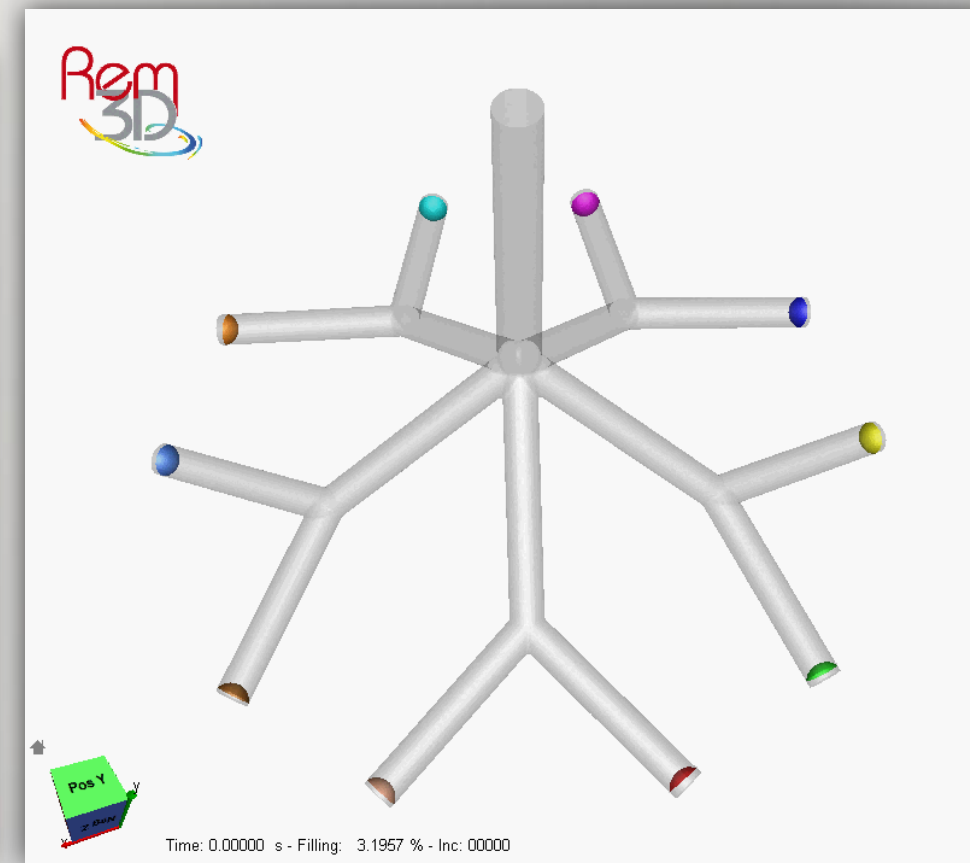
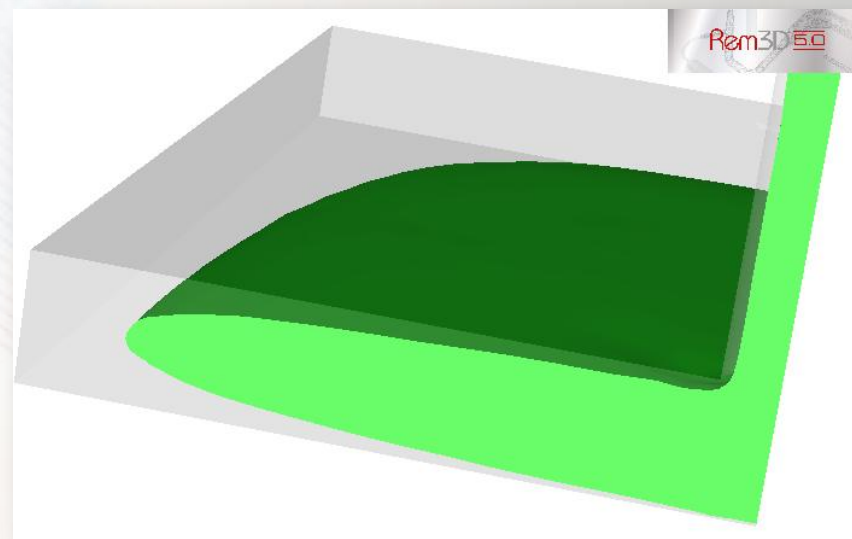
Tube application

CO-INJECTION & BI-INJECTION PROCESSES

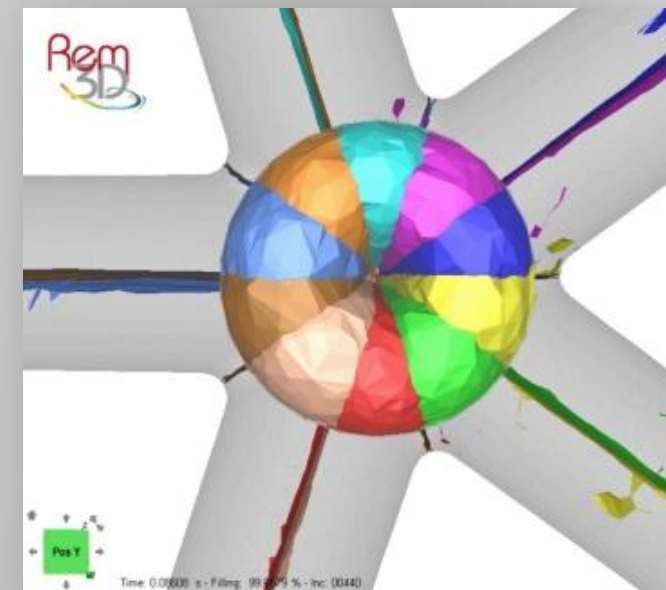
- Company
- Goals
- Key features
- Multifluids**
- Reinforced injection
- Foam expansion



Typical co-injection of a plate



Injection of 10 melts starting from 10 different gates.



Perfect equilibrium observed by the end of filling.

FIBERS ORIENTATION PREDICTION (1/2)



Company

Goals

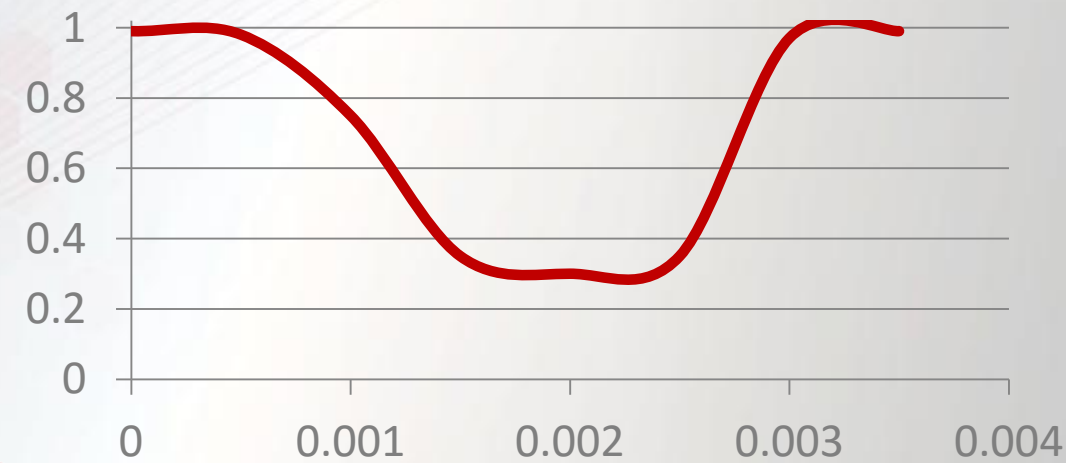
Key features

Multifluids

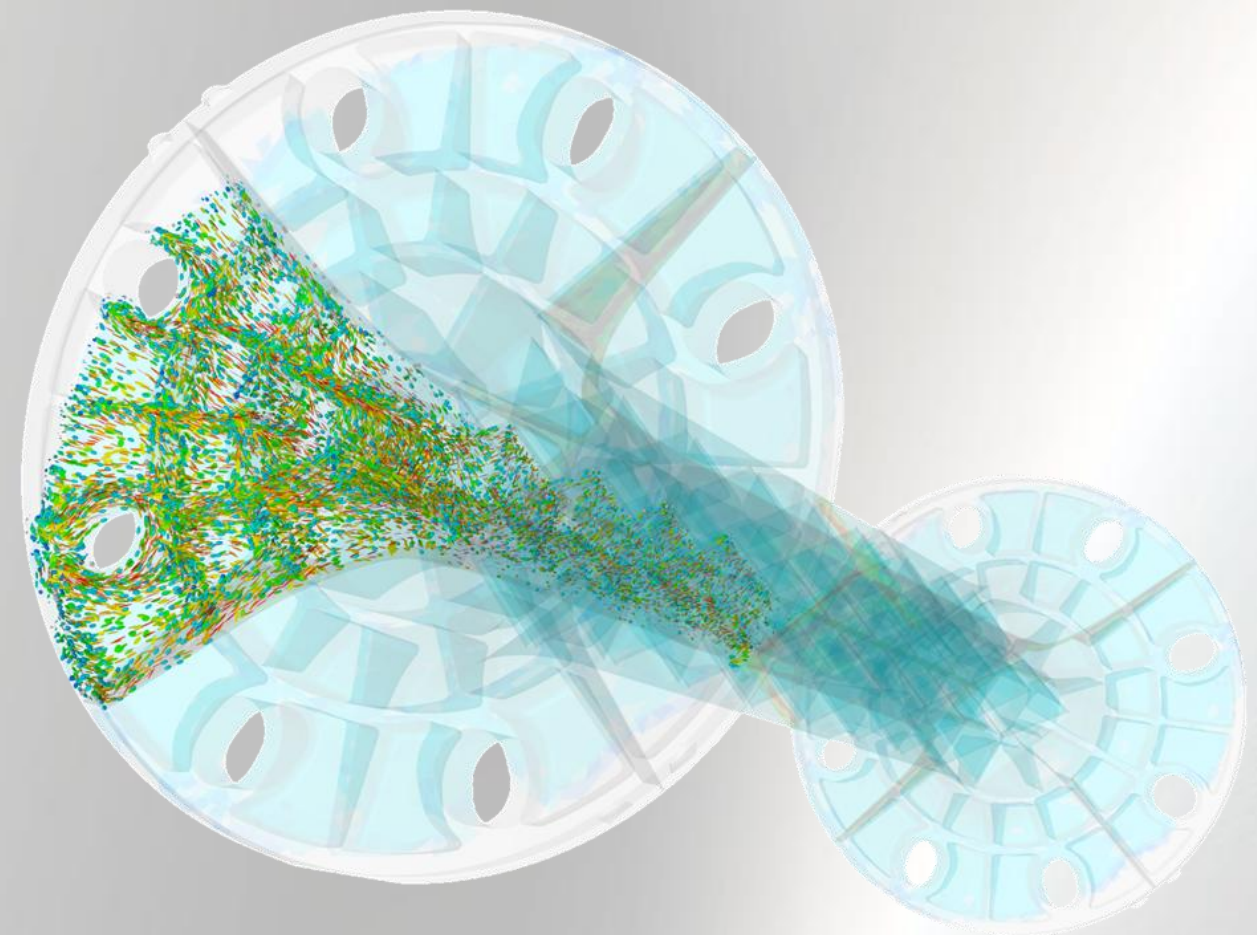
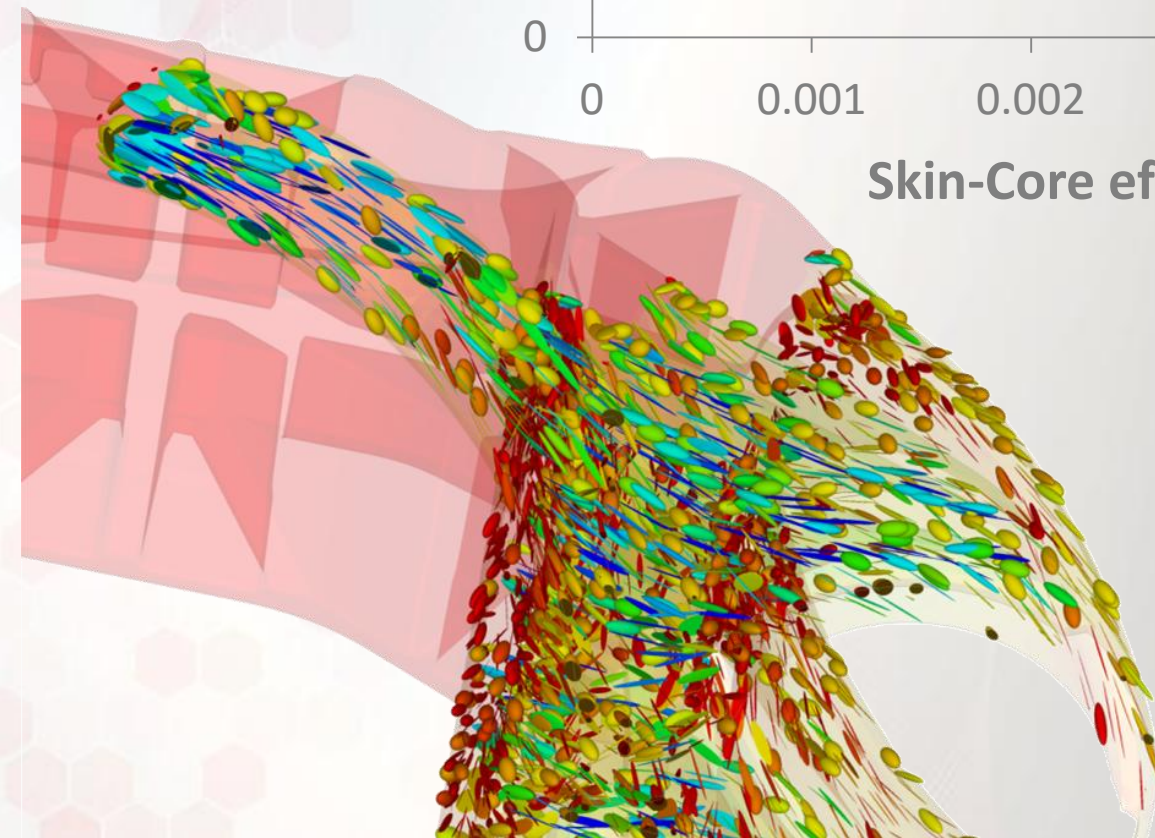
Reinforced injection

Foam expansion

With a real native full 3D Design and AAA Meshing, fibers distribution is computed across the thickness. Skin-Core effect is not limited to an average value but is also predicted across the thickness.



Skin-Core effect

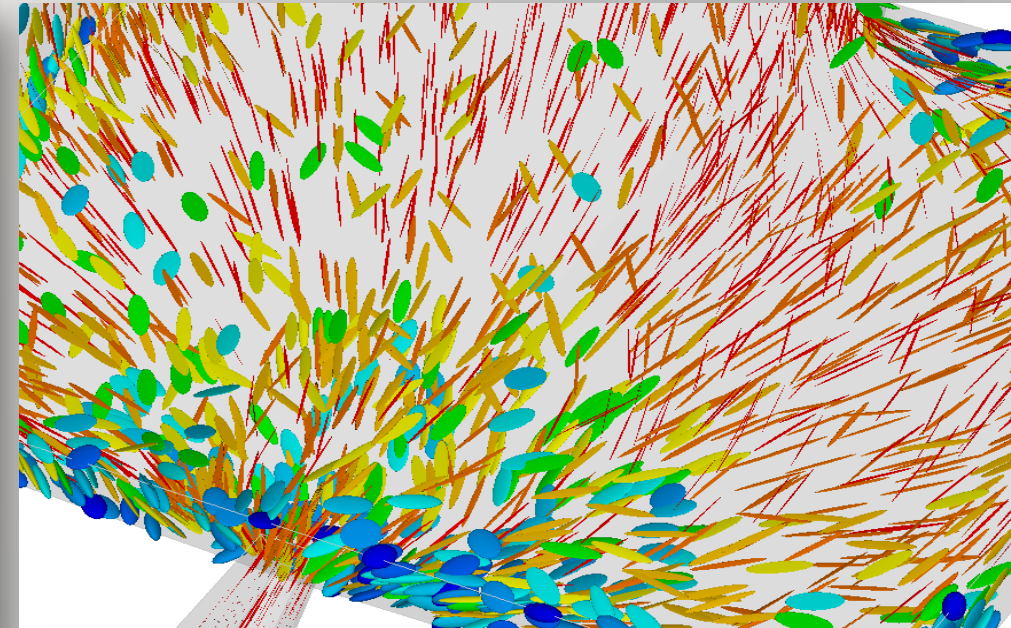
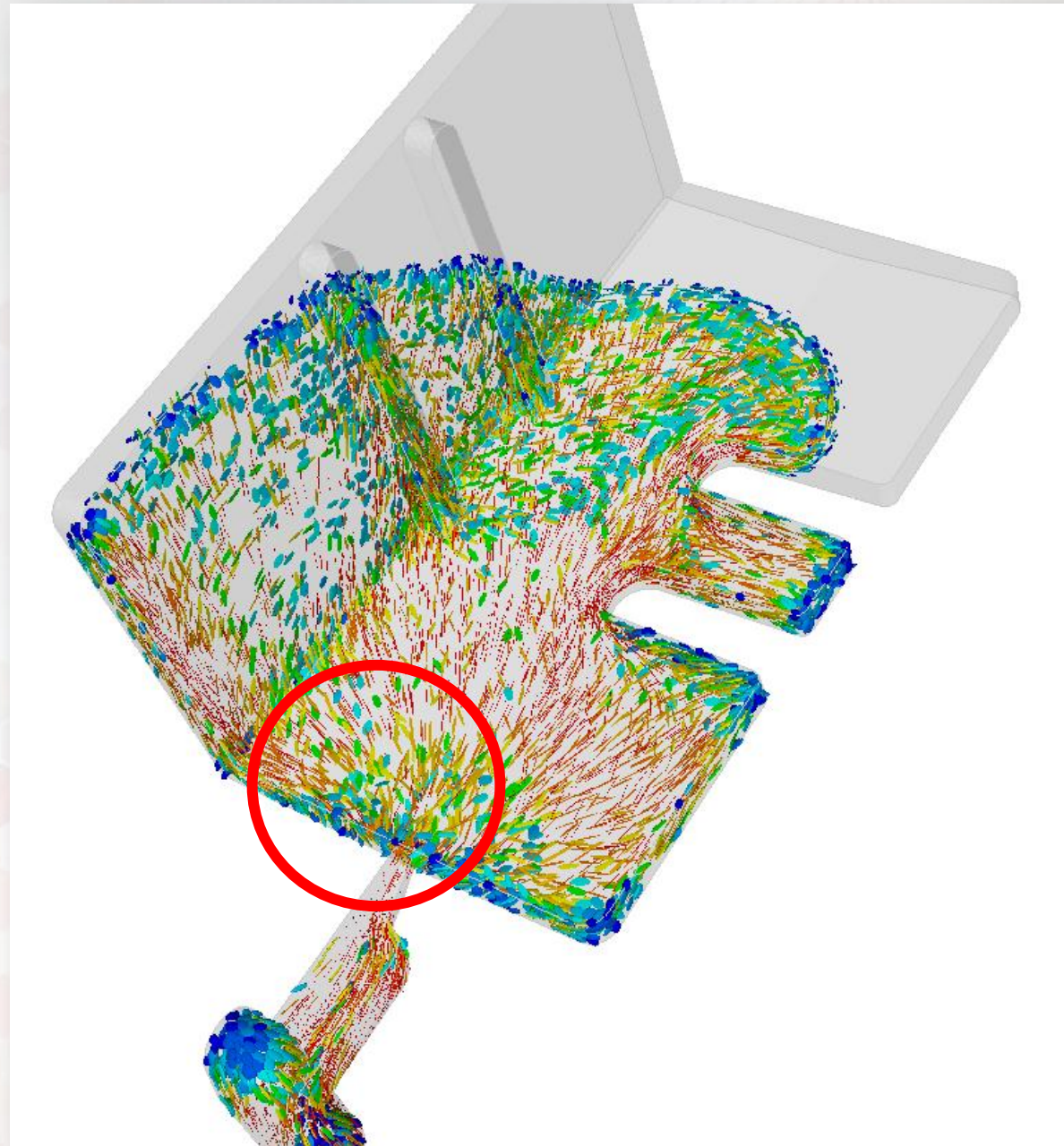


Unique intuitive 3D tensor visualization dedicated to fibers orientation !

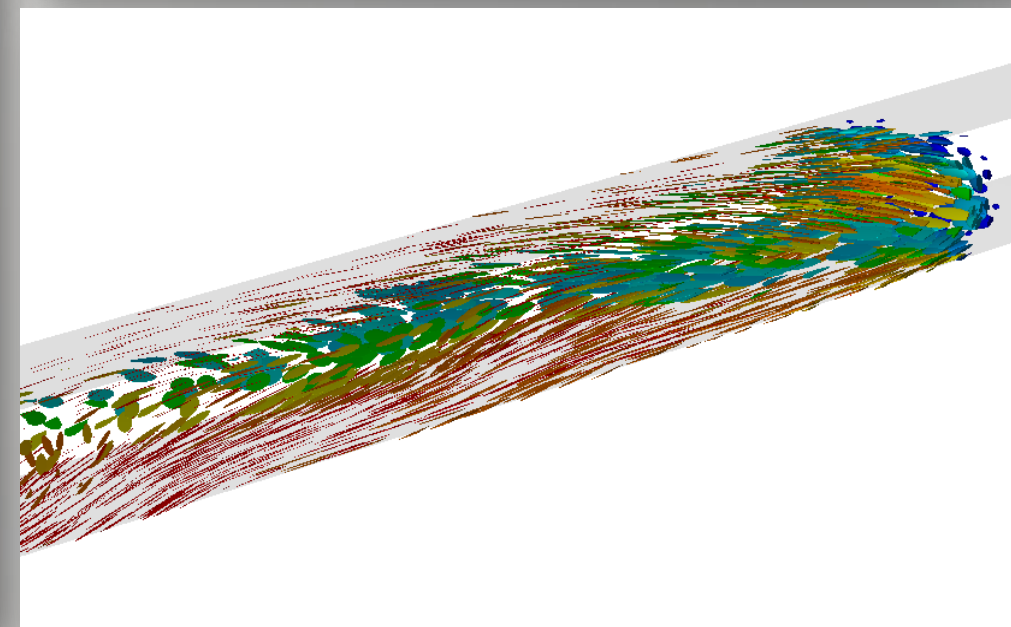
FIBERS ORIENTATION PREDICTION (2/2)



- Company
- Goals
- Key features
- Multifluids
- Reinforced injection**
- Foam expansion



Zoom in area of interest
The red color of ellipsoids indicates a major & consistent fiber orientation.



Section view
See red very elongated ellipsoids at the wall and green-yellow flatten ellipsoids deep inside. Skin-core effect is highlighted,

Injection of a bracket with reinforced PP

FOAM INJECTION-EXPANSION PROCESS (1/5)

Company

Goals

Key features

Multifluids

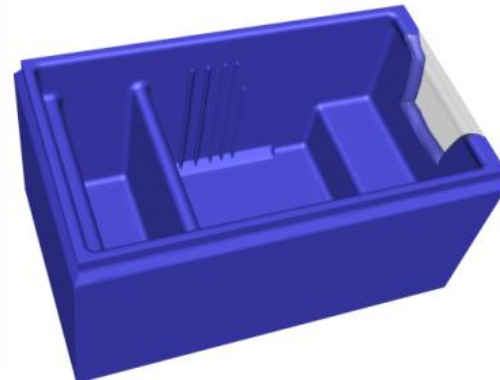
Reinforced injection

Foam expansion



Determine optimum mass for full filling:

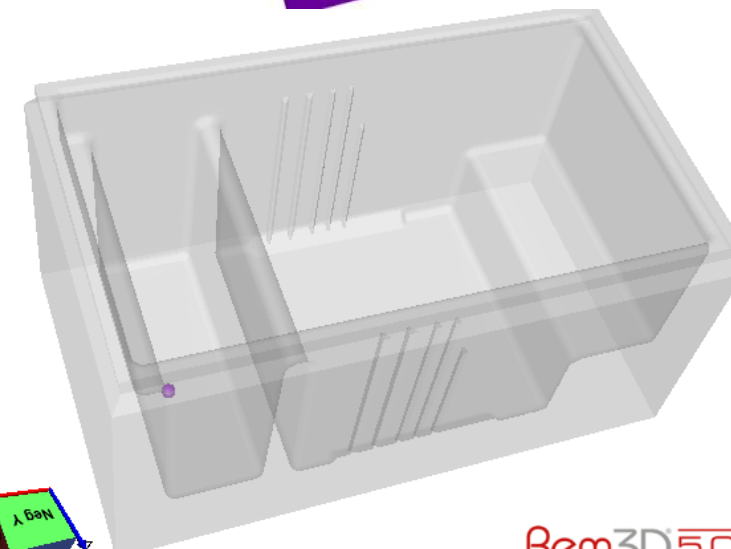
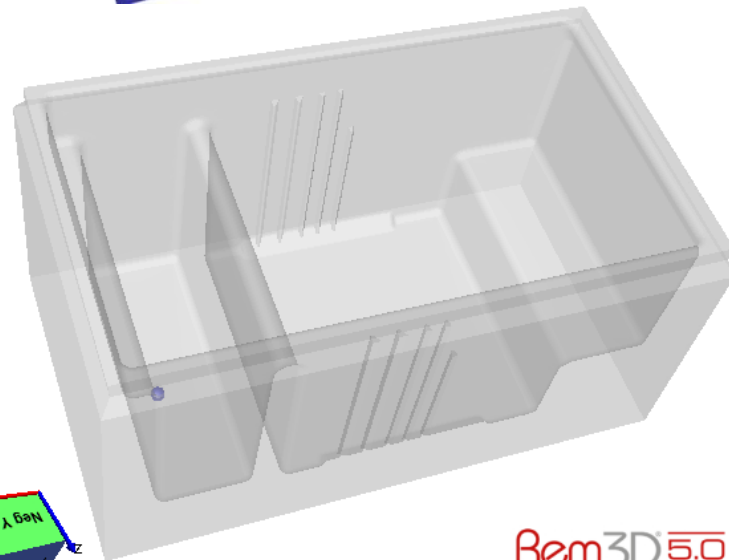
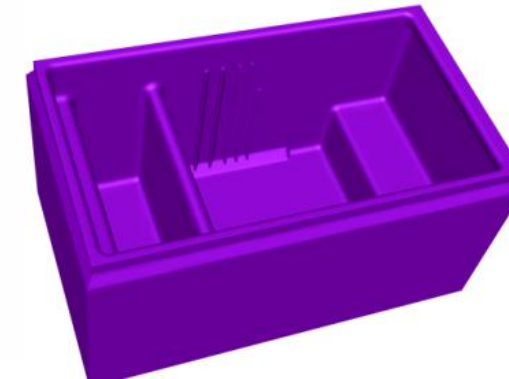
Initial Mass = 6 Kg



Polyurethane Foam

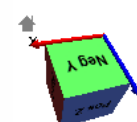
OPTIMUM

Initial Mass = 6,4 Kg



Time: 0.00000 s - Filling: 0.0051 % - Inc: 00000

Rem3D 5.0



Time: 0.00000 s - Filling: 0.0051 % - Inc: 00000

Rem3D 5.0

FOAM INJECTION-EXPANSION PROCESS (2/5)



Company

Goals

Key features

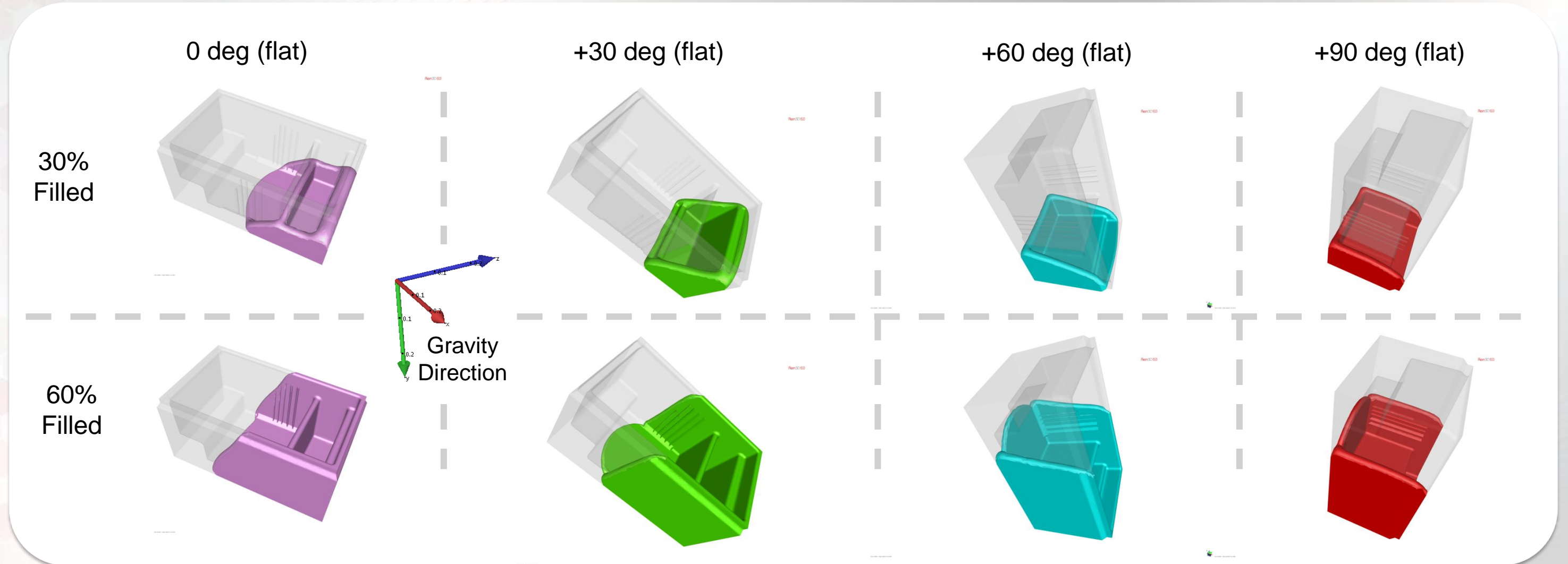
Multifluids

Reinforced injection

Foam expansion



Determine optimum mold balancing:



Multi foam process can be simulated coupled with the Multifluids Module.

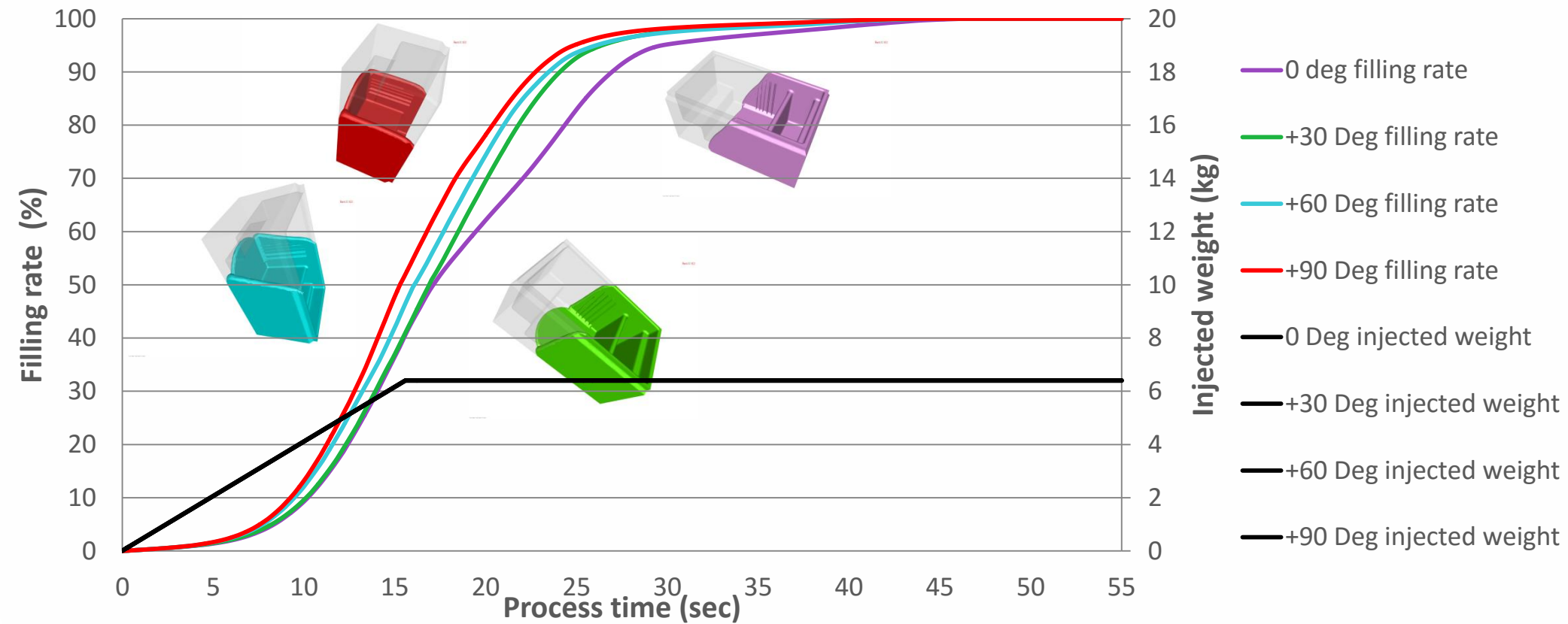
FOAM INJECTION-EXPANSION PROCESS (2/5)



- Company
- Goals
- Key features
- Multifluids
- Reinforced injection
- Foam expansion



Determine optimum mold balancing:



Mold balancing	Filling Time (sec)
0 deg flat	47.34
+ 30 deg	45.47
+ 60 deg	44.18
+ 90 deg	44.31

Rem3D 5.0



Injected foams can be reinforced with fibers and consequently fibers orientation can be observed in injection-expansion process.

Company

Goals

Key features

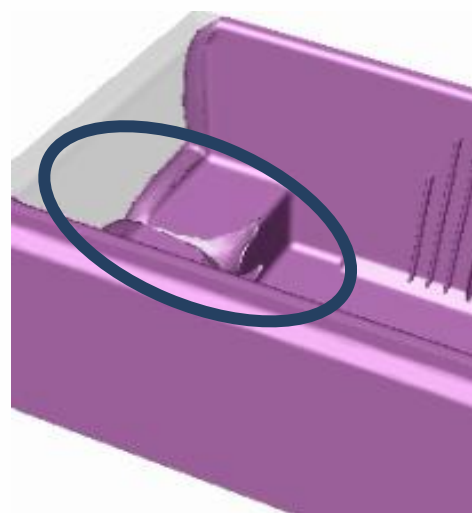
Multifluids

Reinforced injection

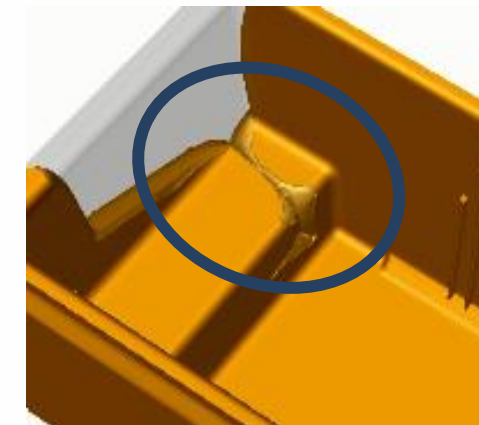
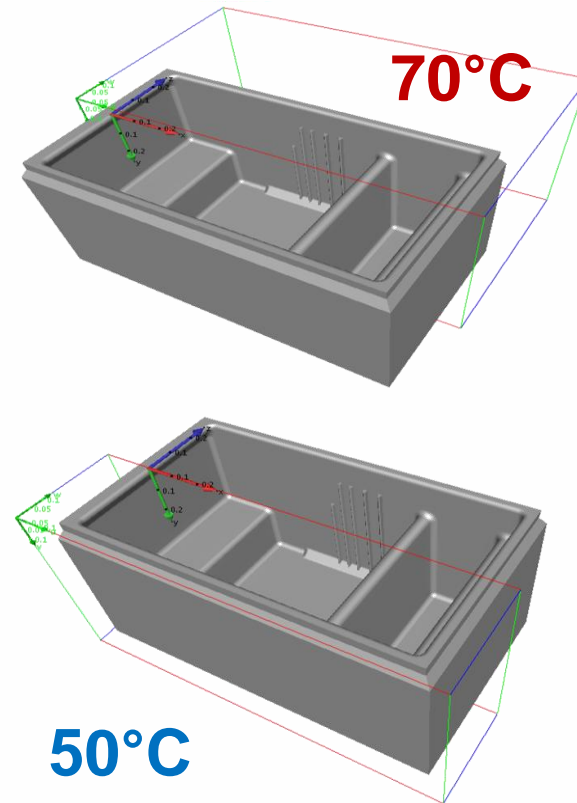
Foam expansion



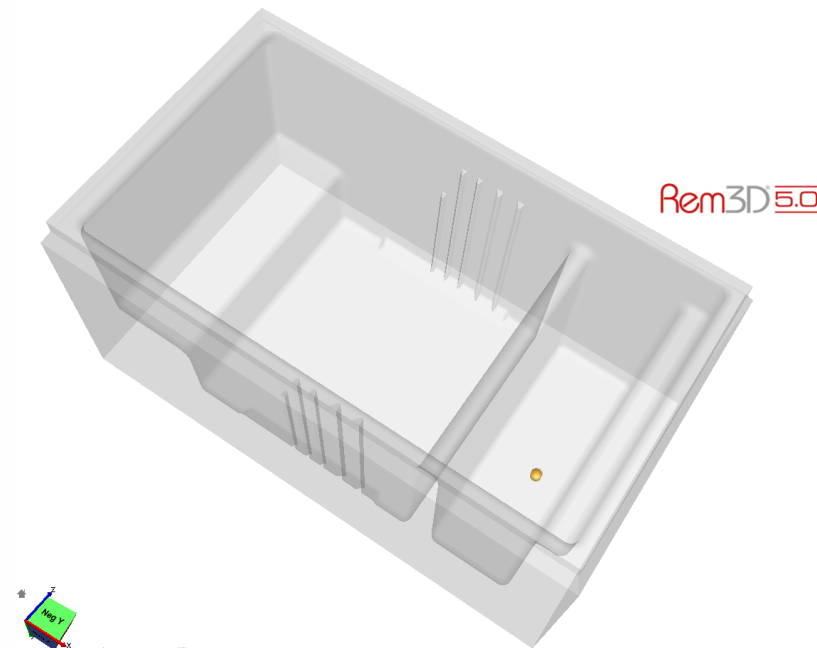
Optimization of mold thermal conditions:



Reference case



Case with different thermal mold conditions



In this case, the impact of different mold conditions is observed. Unbalancing is noticeable, this is due to the uneven thermal conditions.

FOAM INJECTION-EXPANSION PROCESS (5/5)



Company

Goals

Key features

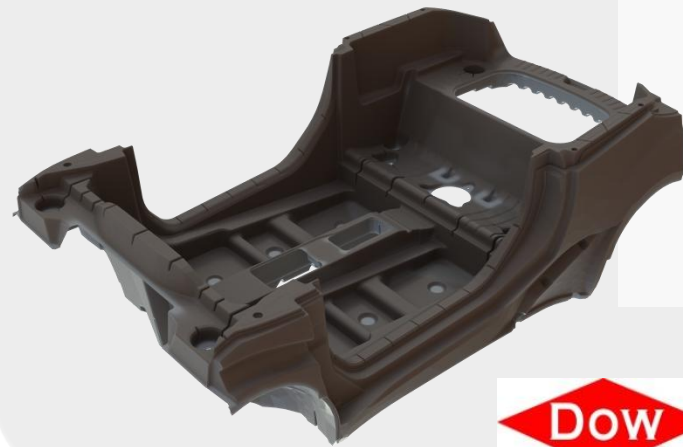
Multifluids

Reinforced injection

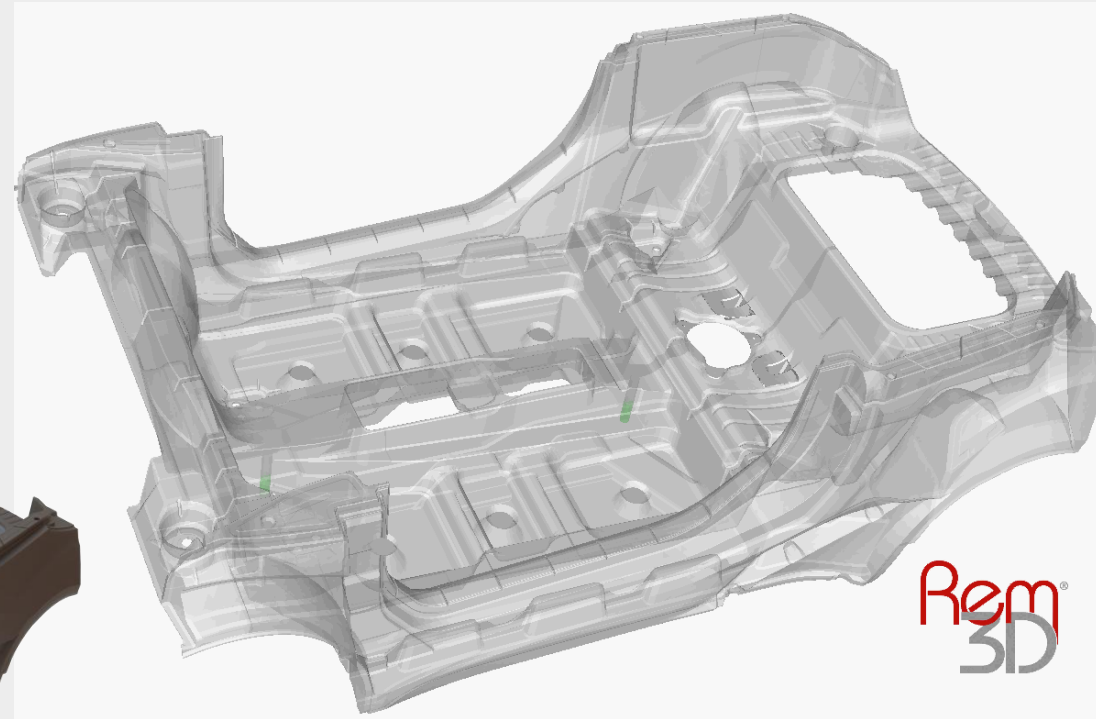
Foam expansion



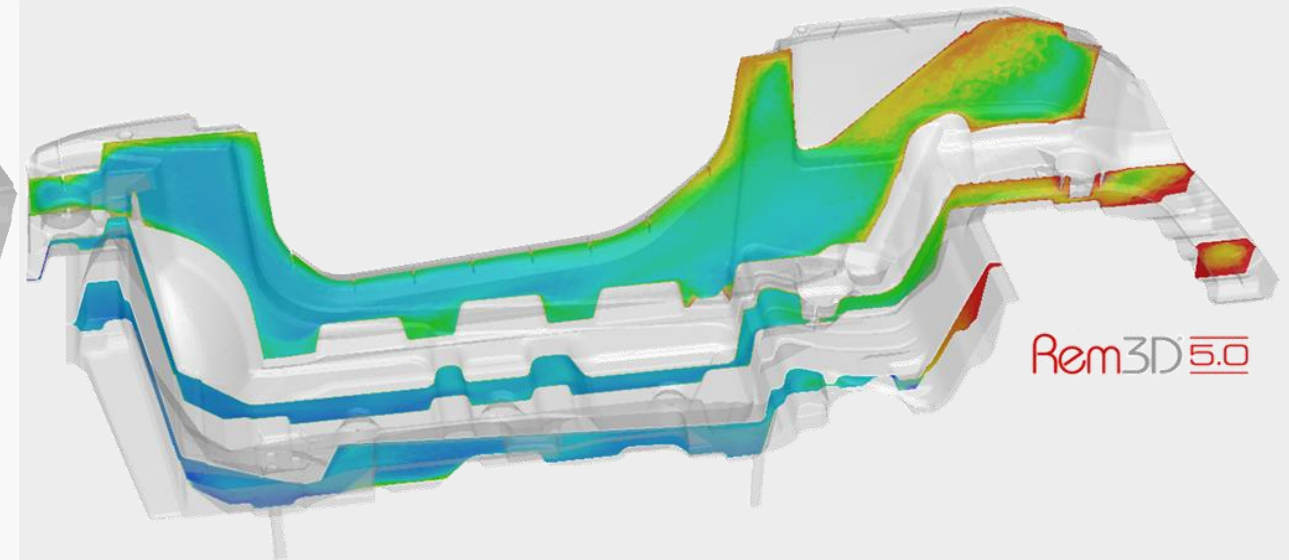
Final density distribution through the thickness:



Polyurethane foam



Rem3D



Final density distribution

Rem3D 5.0

Company

Goals

Key features

Multifluids

Reinforced injection

Foam expansion

Rem3D[®], a differentiating and innovative product:



Designed to run any simulation, especially complex parts and innovative processes.
Provides results with unmatched accuracy within reduced computation time.

Rem3D[®], a powerful assistant for decision making:



Reduces risks level during design phase.
Saves Engineering time and cost of design

Rem3D[®], a unique value proposition:

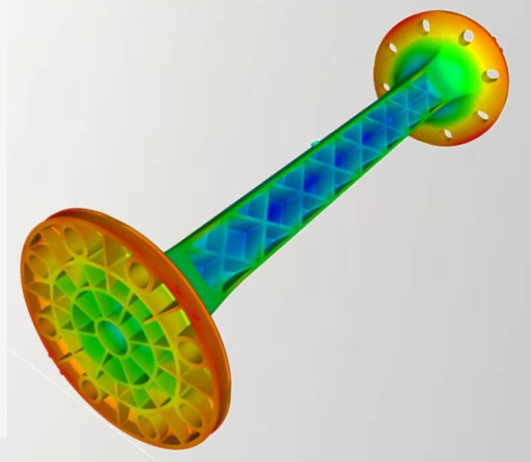
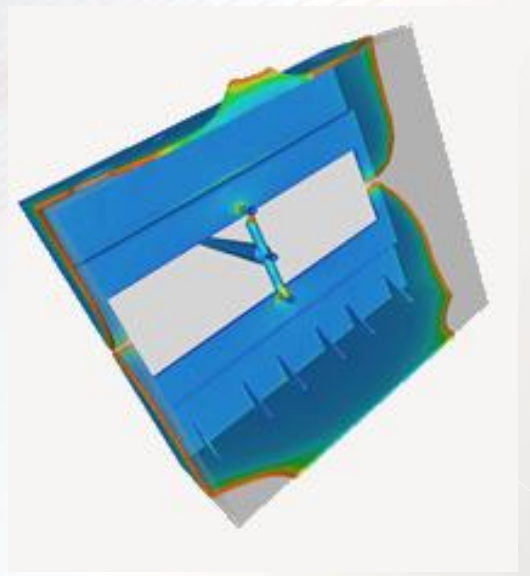
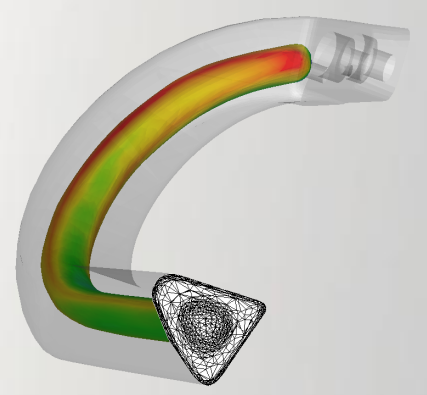
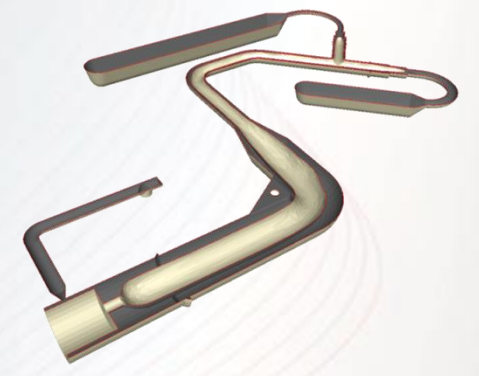
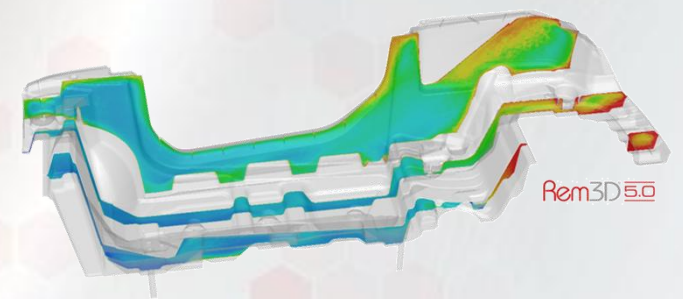


Unlimited access to pre- and post-processors
Cost effective upgrade strategy



Rem3D[®] 5.0

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Thank you for your attentions

