Improving quality and productivity with ProCAST

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Public

Innovation Without Compromise

Improving quality and productivity with ProCAST

Case studies of SIMPLAC and IRONCASTINGS

SIMPLAC

Aluminium Engine Mount

- SIMPLAC is a mould and tool manufacturer specialized in die casting moulds design and production for aluminium and magnesium alloys for High-Pressure Die casted parts.
- The company has almost 40 years of experience in the industry and is committed to **continuous improvement** in management, staff, products, and services to better satisfy the needs of their customers.
- SIMPLAC started to **diversify** its services in the past decade and now produces the complete pack of tools, including Die Casting Moulds, Trimming Dies, and Hydraulic Clamping Fixture Tools.
- The company uses **ProCAST**, an advanced simulation software, to **improve its engineering process and production.**

IRONCASTINGS SPA

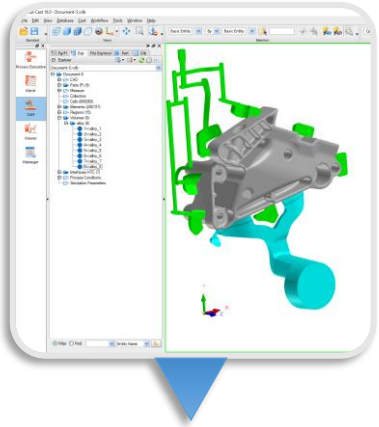
GJS 500-7 Knuckle

- Ironcastings SPA is an Iron foundry that produces casting parts made of grey iron, ductile iron, and austempered ductile iron (ADI). The company's products serve a range of industries, including trucks, wind power, forklifts, agricultural machinery, and construction, with part weights ranging from 10 kg to 250 kg.
- The company uses sand casting simulation to address the **challenges** of delivering **high-quality** iron castings despite **growing part complexity.**
- The introduction of ProCAST in 2021 has been a turning point in the way they design and deliver their castings, allowing them to better utilize their metallurgical **know-how**, optimize microstructure, mechanical properties, and porosity formation. **ProCAST** enabled the company to solve residual stress problems and **reduce part costs**.

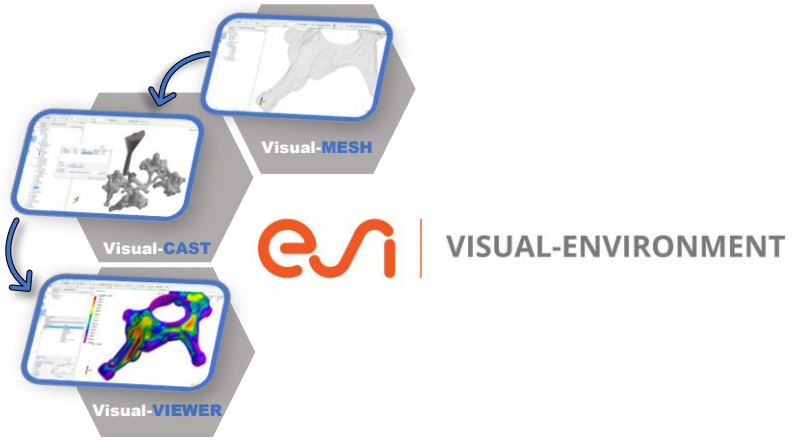
The Solution – ProCAST ™

esi | ProCAST

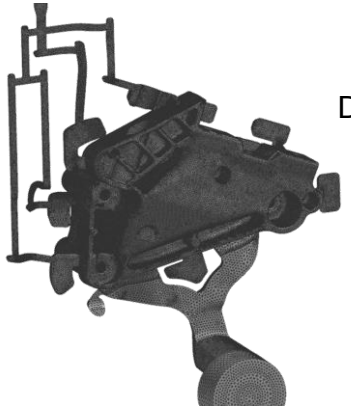
Visual Environment, ProCAST and QuikCAST Solvers



User interface



ProCAST solver

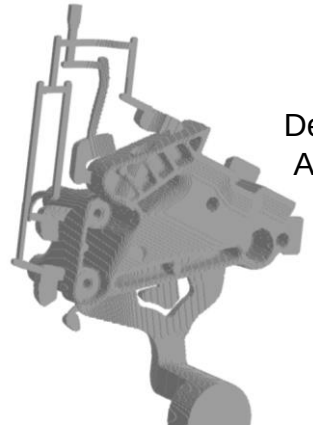


Finite Elements

Starts in 1987

Developments with PCC Airfoils & GE Aircraft

QuikCAST solver



Finite Volumes

Starts in 1985

Developed initially by Aluminium Pechiney

SIMPLAC DIE CASTING TOOLS AND DIES
courtesy

SIMPLAC - Why

- Implement aggressive and ambitious continuous improvement in the business.
- Address complex and evolving challenges.
  - Stay competitive and sustainability in the industry.
  - Enable light weighting drive for consumers.
- Attain qualitative leaps in their simulation capabilities.
  - Guarantee quality and increase productivity of their aluminium and magnesium alloy high-pressure die-casted parts.
  - Add value to customer partnerships & support the OEMs/Suppliers especially in complex projects.
  - Push for higher accuracy and competitiveness in their engineering process and production.

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SIMPLAC - What

- Anticipate and identify the main issues related to filling and solidification that met the quality requirements imposed by their customer.
- Properly define and design the gating system and tooling from the feasibility stage to the final part validation.
- Validate the entire cooling system with CFD calculation in the cooling channels, avoid critical shrinkage porosity defects, reduce cycle times, and ensure dimensional tolerances of each part thanks to thermomechanical simulation.
- Using ProCAST, SIMPLAC was able to build a more faithful virtual prototype by modelling all the different stages of the casting process.

SIMPLAC
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SIMPLAC - How

- SIMPLAC used the advanced capabilities offered by ProCAST to virtually prototype their mould during high-pressure casting processes and support them during decision-making phases from dosing to part ejection

- With the Aluminium Engine Mount they wanted to move from a single cavity die to a three cavity one and overcome several major difficulties.

    - larger mould size.
    - New and more complex gating system.
    - Selection of the new Die Casting Machine.
    - Avoid distortions of the part.

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Aluminium Engine Mount

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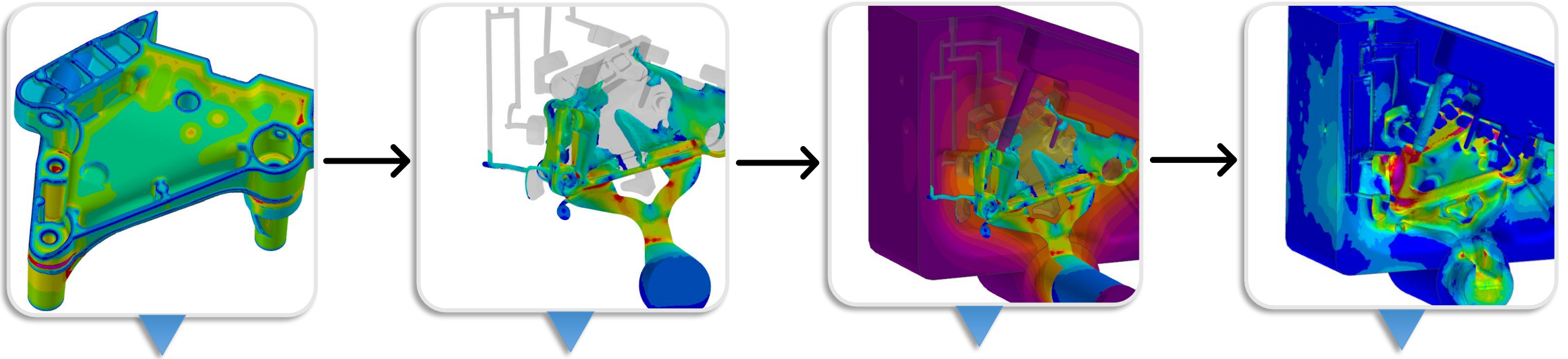
Different Modelling Stages



Analysis of the part alone

Castability check of the part thanks to analysis of critical thickness, draft angle, last solidified area, etc.

Validation of the casting

Filling simulation on the casting only that permits to test different gating and venting systems

Validation of the mold

Complete mold analysis that considers thermal cycling, dosing, shot piston, third stage effect, etc.

Advanced modelling

Advanced modelling like stress analysis of die or parts, casting process optimization, etc.

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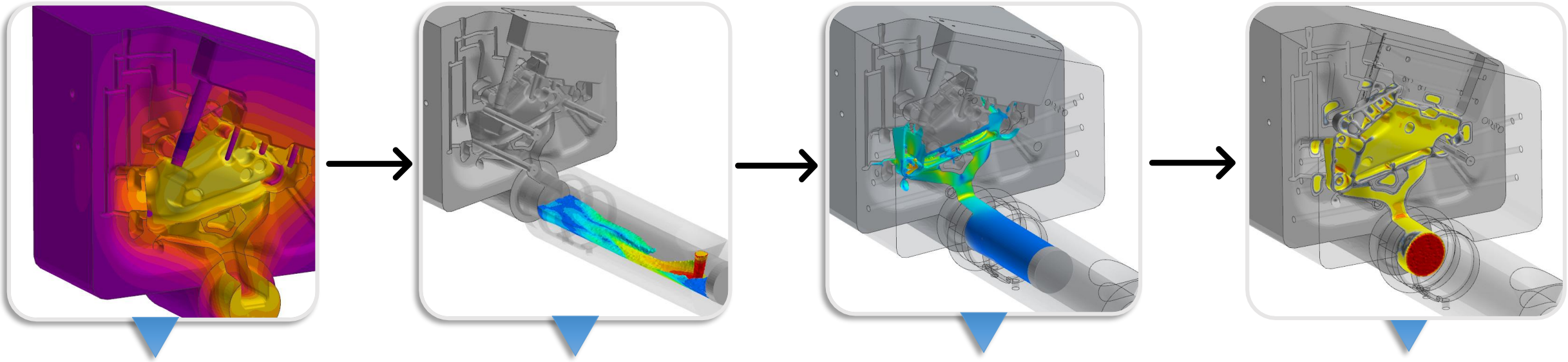
Validation of the Mould



Mold cycling

Thermal analysis of the mold that permits to model the temperature map obtained during production.

Dosing

Thermal and flow analysis that allow user to model temperature drop of the alloy during the filling of the chamber.

Shot (V_1 + V_2)

Thermal and flow analysis that allows to validate and optimize the piston displacement curve in order to avoid wave in the chamber.

Solidification & Third stage effect

Thermal analysis of the alloy solidification by considering the third stage effect.

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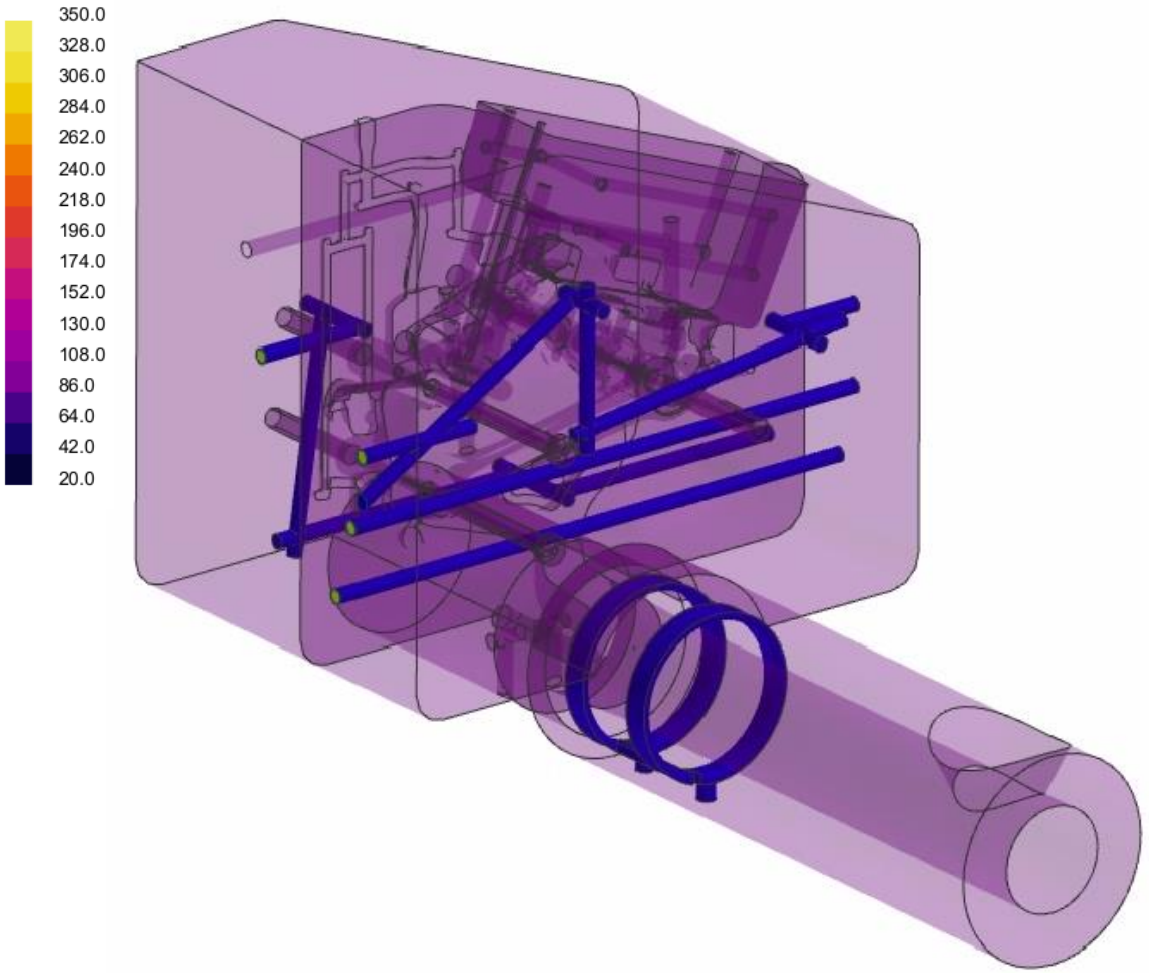
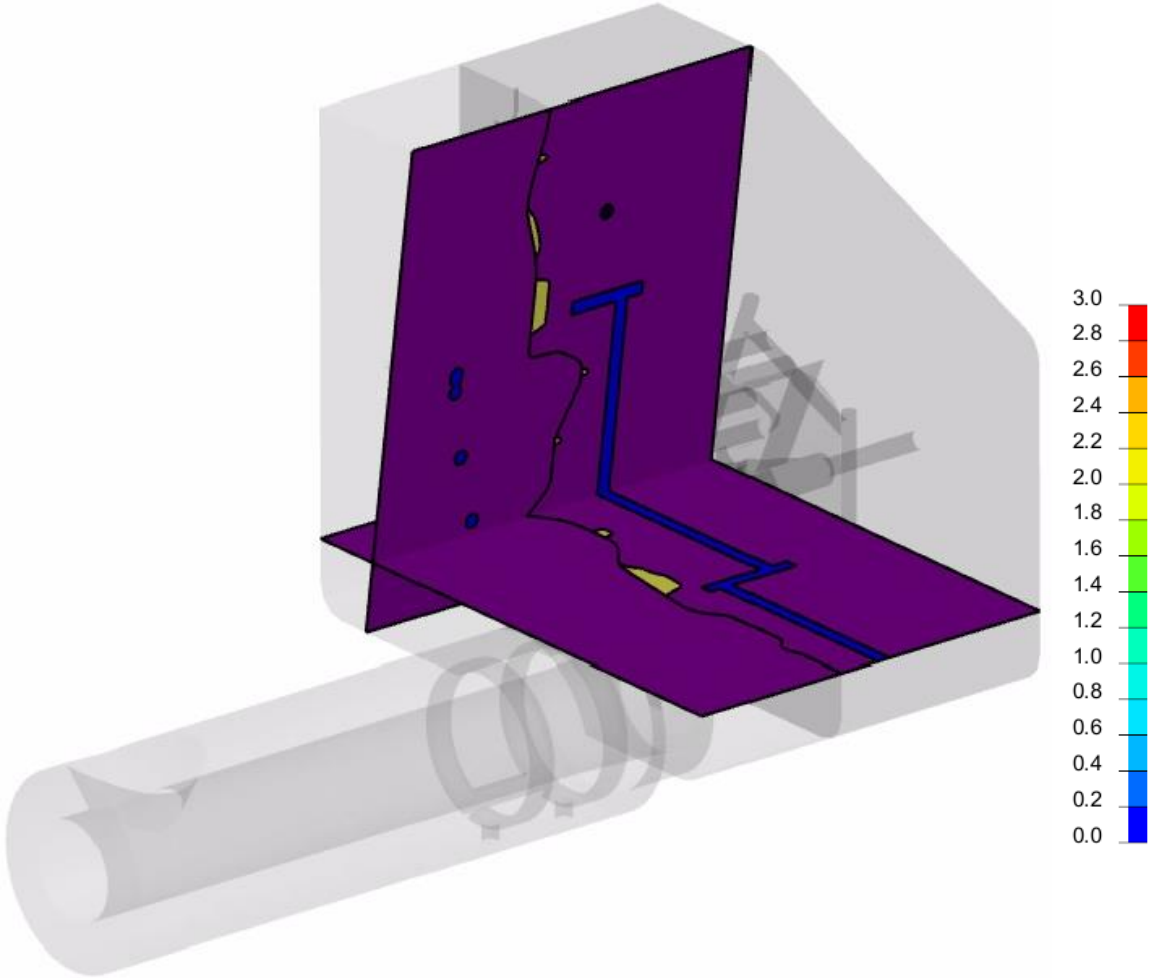
3D CFD Cooling Channels





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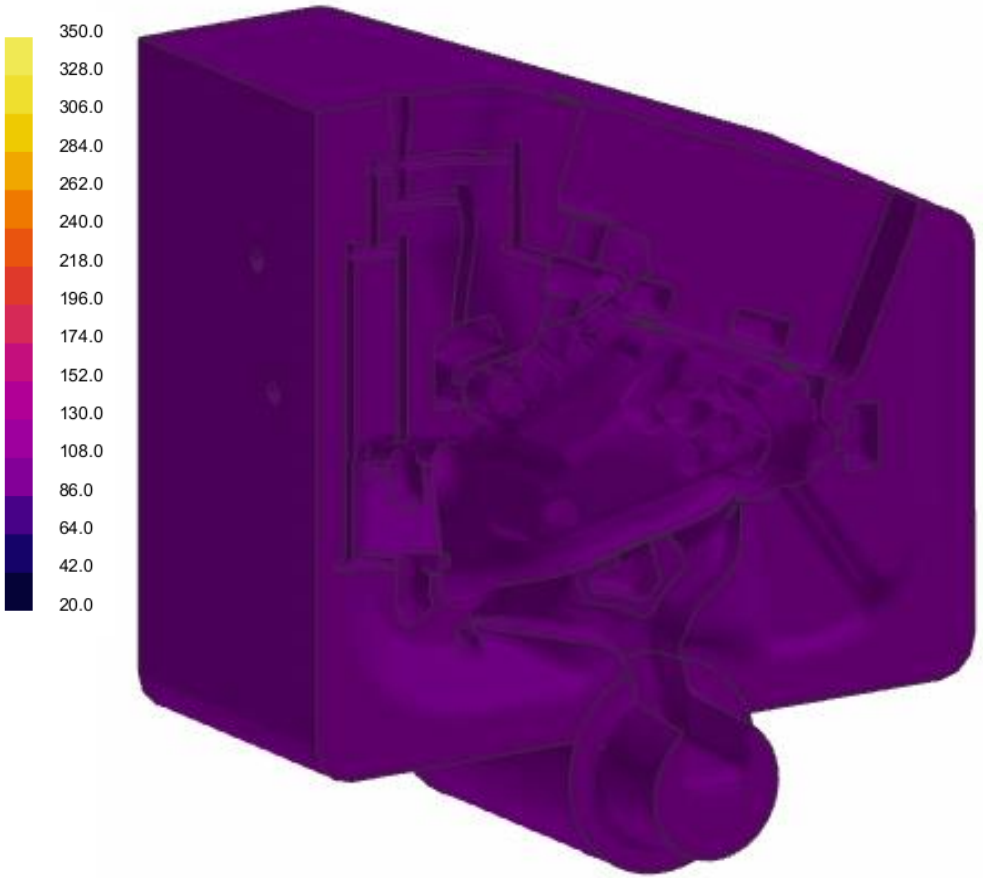
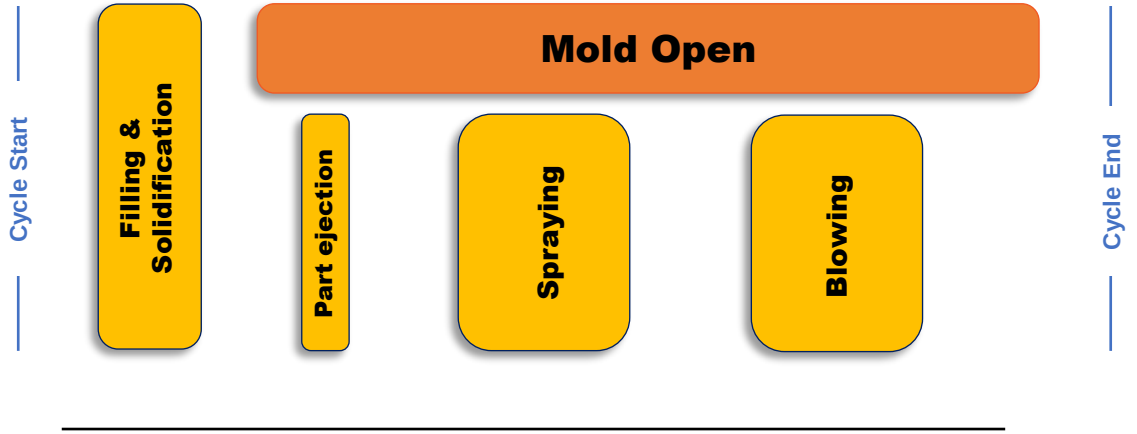
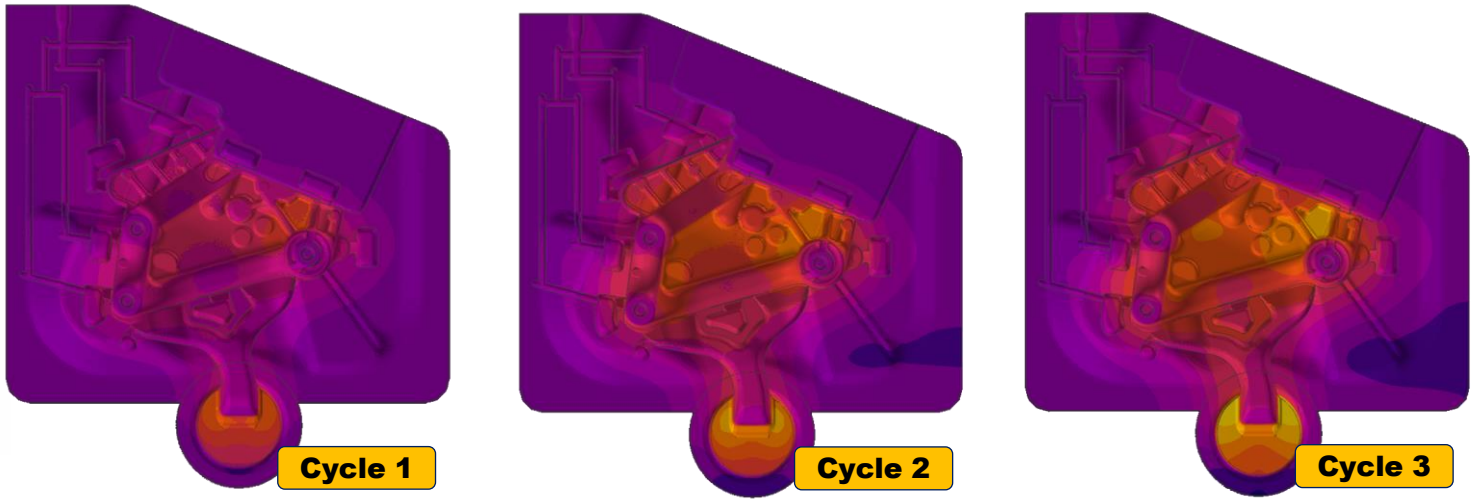
Validation of the Mould

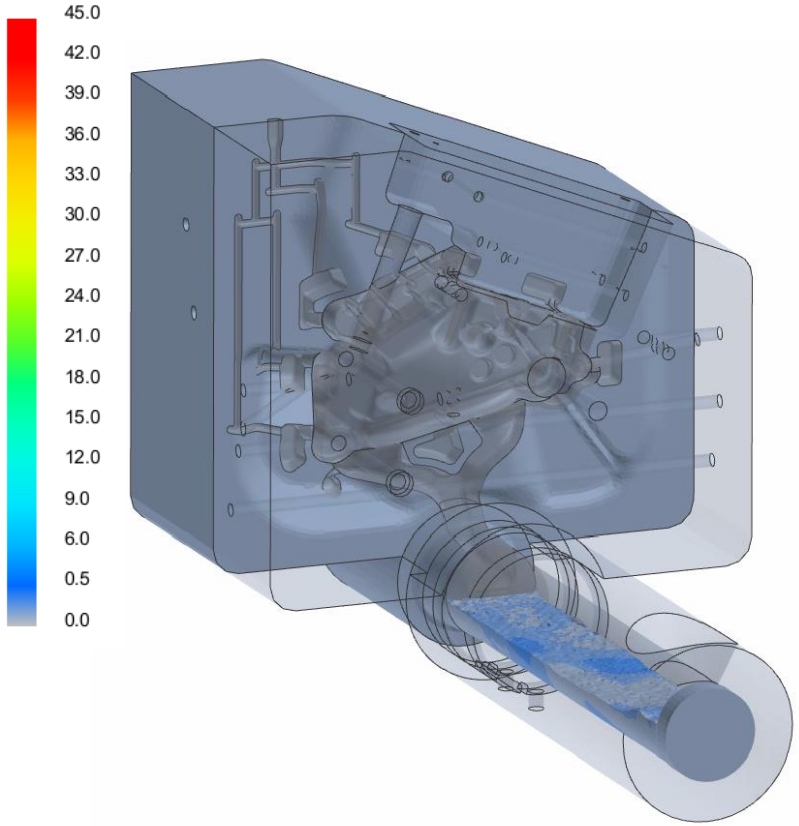


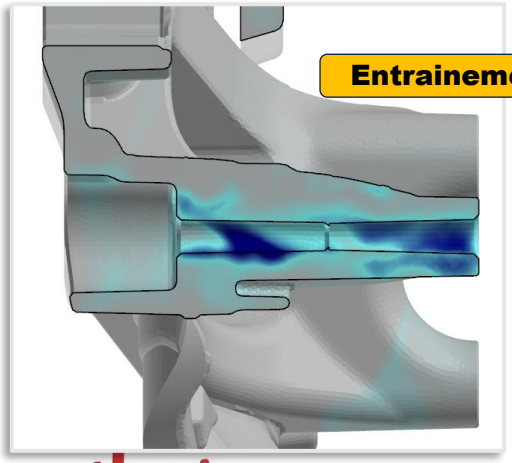


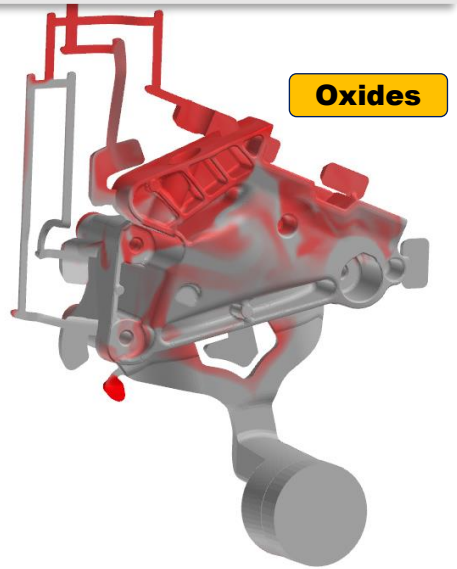


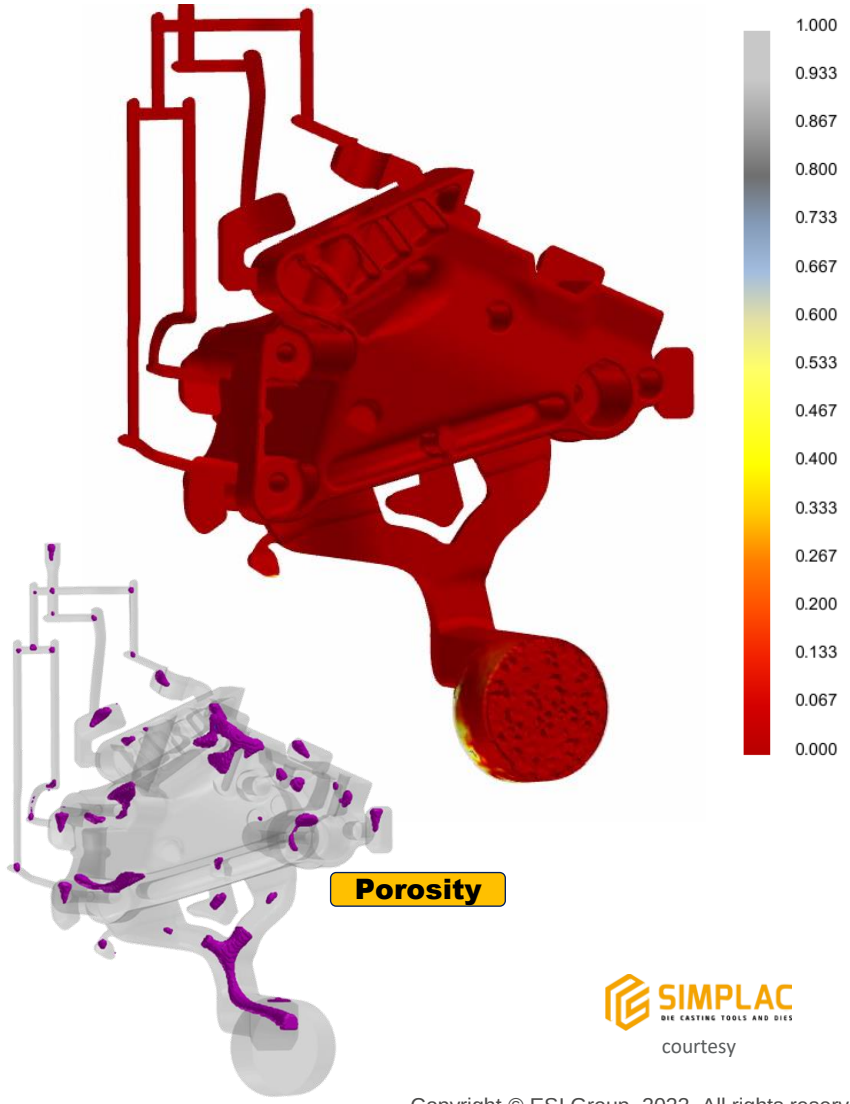
Aluminium Engine Mount

Filling and Solidification





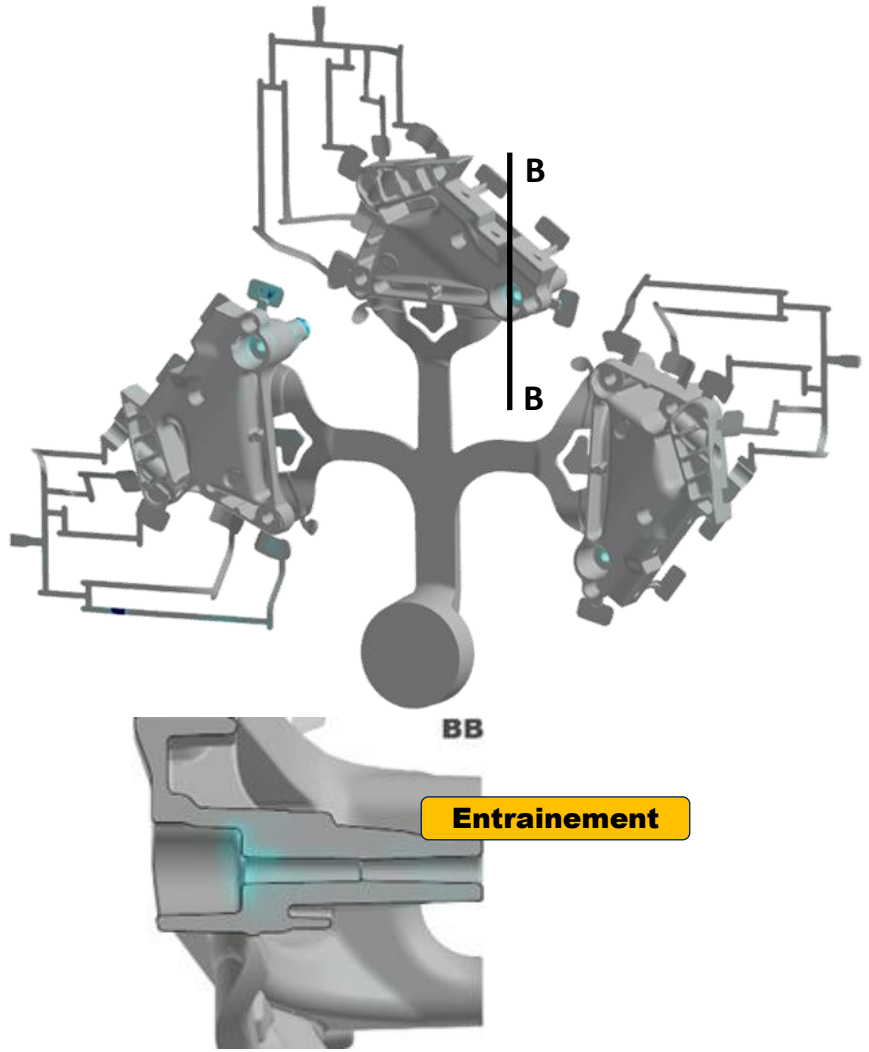




courtesy

SIMPLAC - Outcome

- Address light weighting challenge and meet the complex demands of their customers,
- Produce high-quality products efficiently while also improving relationships with customers
  - Focus on continuous improvement and the use of advanced simulation tools.
    - Deliver high-quality products at the lowest production cost and best production time,
    - Increase the competitiveness and sustainability of the company.
- The result of moving from a single cavity die to a three cavity one was as follows:
  - an increase in the production rate on their customer's plant by a factor of 2.2
  - Improve operating margins by selecting an optimal 1200T DCM .



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IRONCASTINGS - Why

- The use of ProCAST, allowed the company to better utilize their metallurgical know-how and address the right weighting challenges of today.
  - Delivering industry required higher-quality iron castings despite growing part complexity.
  - Differentiating themselves on the market to meet their customer’s more demanding needs.

IRON CASTINGS courtesy

IRONCASTINGS - What

- Sand casting simulation in ProCAST enabled IRONCASTINGS SPA reach various objectives without modifying the part design supplied by the customer.
  - Predict and optimizing microstructure, mechanical properties, and porosity formation.
  - Precisely solve residual stress problems.
  - showcase their simulation capabilities and differentiate themselves in the market.
- Drive the business to reach greater levels of efficiency for their foundry process.
  - Achieve higher production rates, yield maximization, and part cost reduction.

IRON CASTINGS courtesy

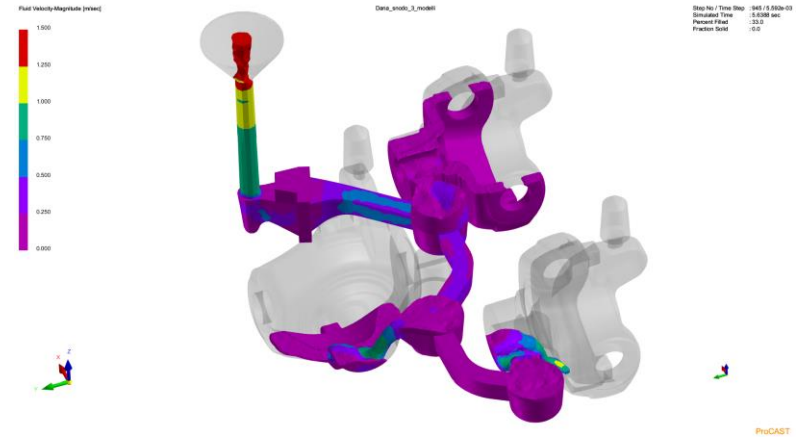
IRONCASTINGS - How

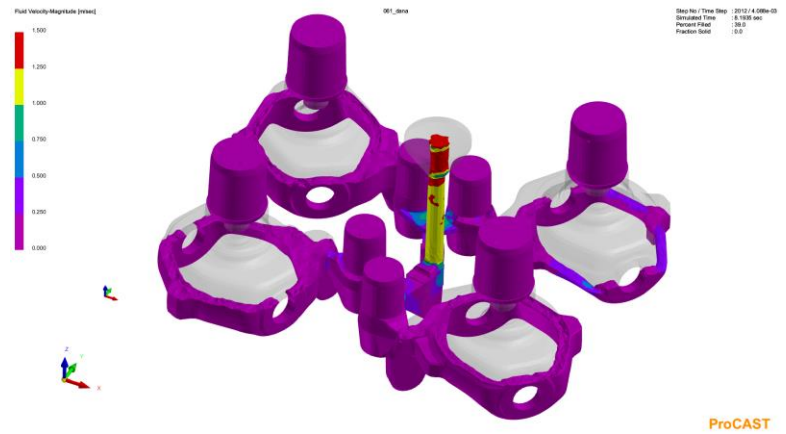
- The challenge was to meet customer quality standards for a GJS 500-7 knuckle despite the complex geometry and tight tolerances.
- IRONCASTINGS SPA had a configurations for a 3-cavity mould, but it wasn't entirely efficient (scrap issues).
- When they rotated the parting plane by 90°, it allowed them to add one more cavity. The ProCAST simulation results matched reality in an optimal manner, with a final quality assessment in line with what they had estimated initially from simulation.

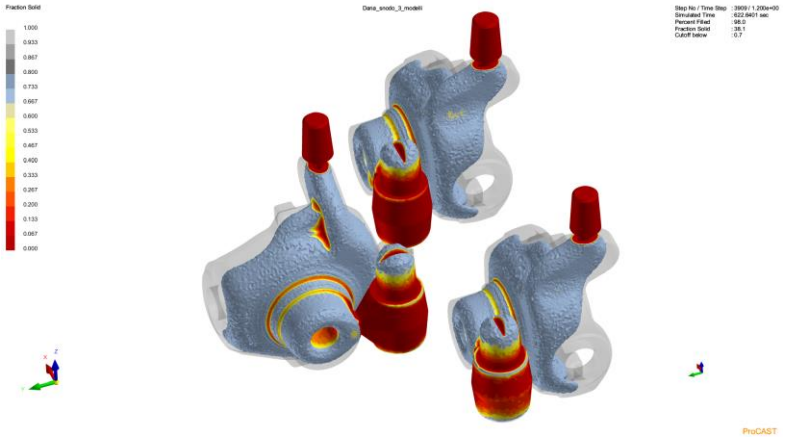
IRON CASTINGS courtesy

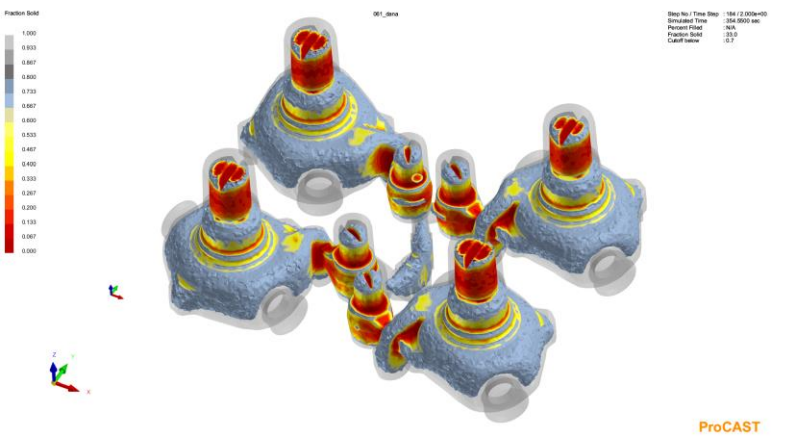
GJS 500-7 Knuckle

Filling & Solidification









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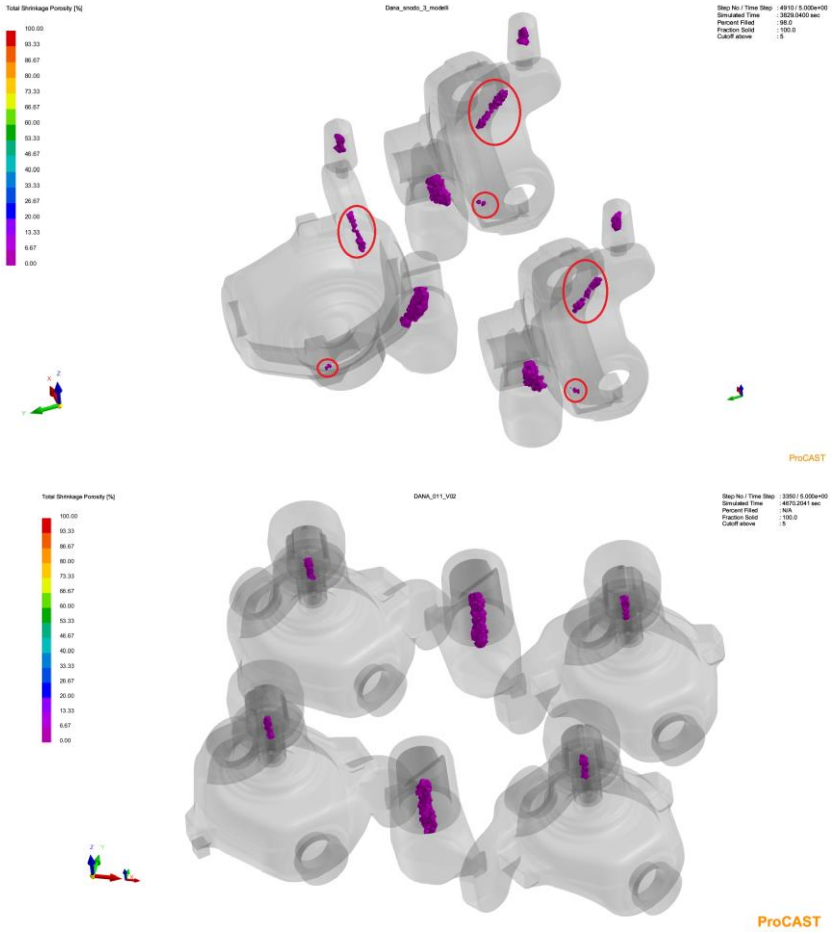
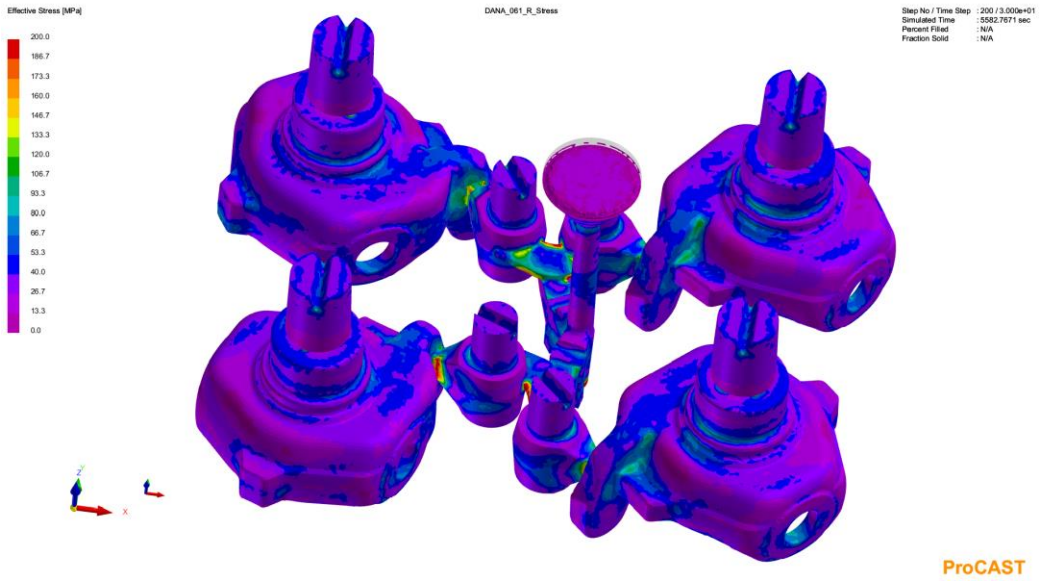
GJS 500-7 Knuckle

Porosity & Stress





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IRONCASTINGS - Outcome

- Reduction in material costs and the production of high-quality castings
- Optimised their metallurgical know-how and precisely solve residual stress problems
- Predicted optimizing microstructure, mechanical properties, and porosity formation.
- Test and validate different mould configurations and feeder designs virtually using the software
- The optimized 4-cavity mould layout:
  - Helped raise production rates by 33%
  - reduce core weight by 92%, thus reducing their material costs.
    - Saved around 0.3€ per kilo of the final net weight of the casting, translating to overall savings of over 400,000 Euros annually.

IRON CASTINGS courtesy

Any Questions?