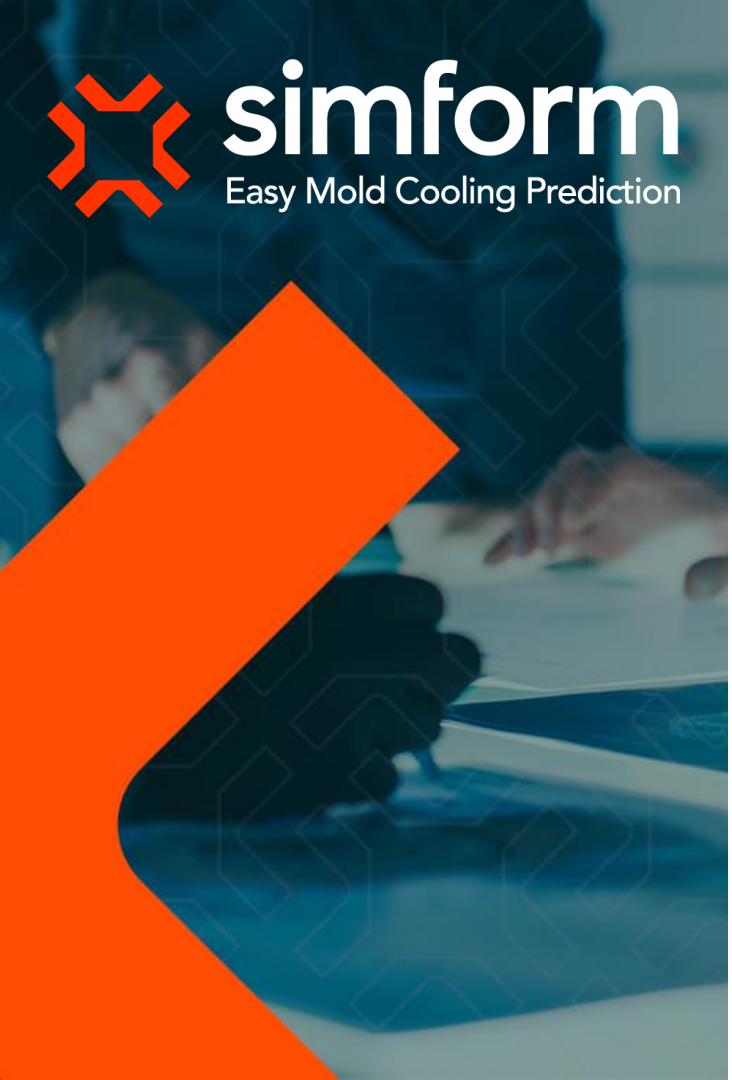

Build a strong business case for bringing 3D printing into your plastic injection operations

Arnaud Divialle

June 1st, 2023

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Software-Driven Engineering Solutions

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Main take-aways

There are several ways 3D printing can benefit the Plastic Injection Industry. Conformal Cooling is one of the most promising.

Most of the challenges preventing the adoption of conformal cooling have solutions, except the business case aspect

Front-end simulation can help build a strong business cases to facilitate the adoption of conformal cooling.

3D Printing in the plastic injection industry

a 5.2 B$ market

How to best use 3D printing in the Plastic Injection Industry?

Multiple usage

- Part
- Mold
- Insert

Multiple impacts

- Part design & performances
- Mold design & performances
- Injection process

Several materials

- Metals
- Plastics

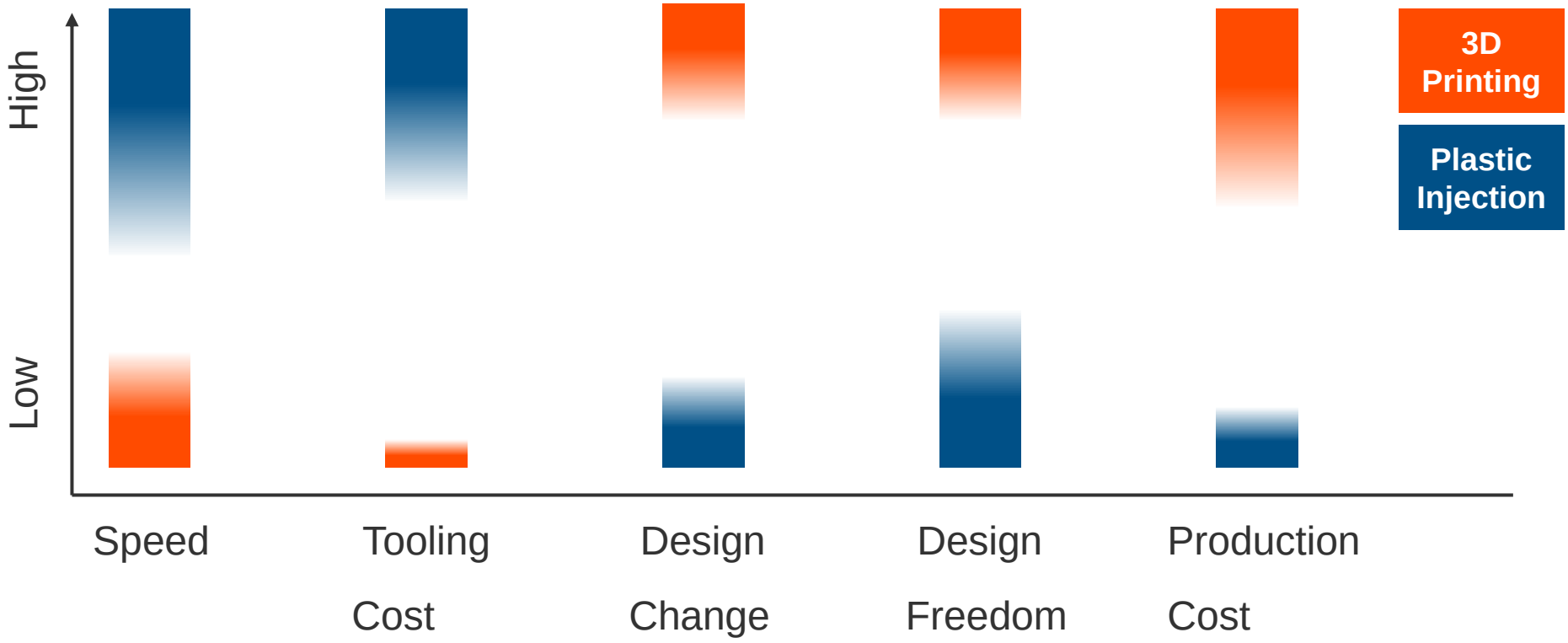
Multiple technologies

- Powder
- Filament / Wire
- Liquid bath

Several procurement approaches

- In-house
- Outsourced

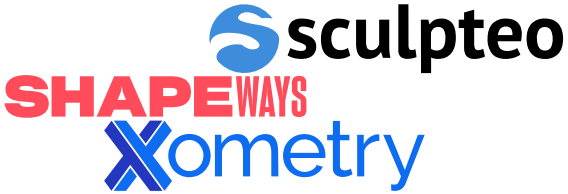
How to best use 3D printing in the Plastic Injection Industry?



How to best use 3D printing in the Plastic Injection Industry?

1. 3D print the parts directly

Applications	Pros	Cons
▪ Prototyping / Mock-up ▪ Test functionalities ▪ Customers research	▪ Very short cycle time to get the first part (< 2 weeks) ▪ No tooling cost ▪ Easy part design iterations	▪ Low volume (<100 parts) ▪ High part cost ▪ Not the same look & feel ▪ Not the same mechanical performances



How to best use 3D printing in the Plastic Injection Industry?

2. Inject the parts in a 3D printed plastic mold.

Applications

- Initial Production
- Customers research

FORTIFY

Pros

- Easy & rapid part design iterations
- Short cycle time to get the first part batch
- Medium volume
- Very similar look & feel
- Very similar mechanical performances

Cons

- Higher cost
- Longer cycle time to get the first part
- Slow process (120+ sec cycle time)
- Very few parts produced per mold (100+ parts/mold)

How to best use 3D printing in the Plastic Injection Industry?

3. Inject the parts in a metal mold with metal 3D printed components

Applications

- Initial Production
- Customers research

MANTLE

NXC MFG

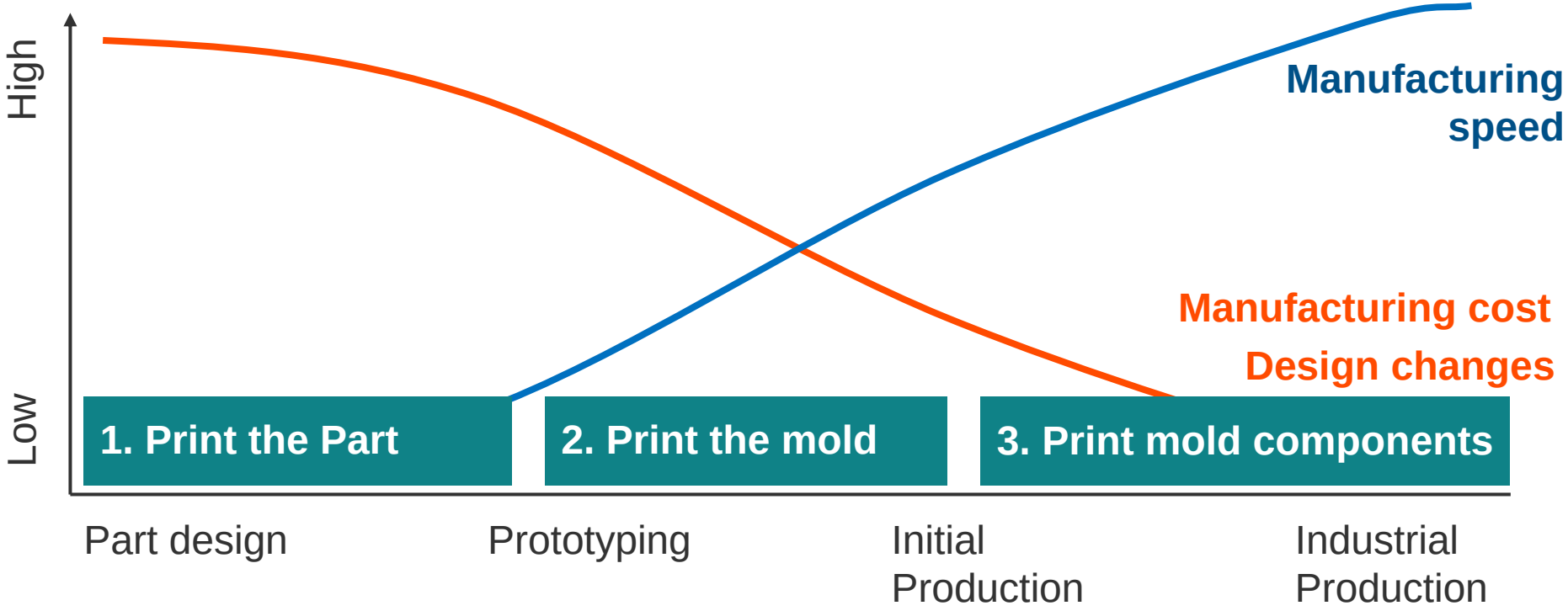
Pros

- High volume (>10,000 parts)
- Very similar look & feel
- Very similar mechanical performances
- Short cycle time to get the first part batch
- Easy part design iterations

Cons

- Higher cost
- Longer cycle time to get the first part (> 6 weeks)
- More complex cooling setup

How to best use 3D printing in the Plastic Injection Industry?



Opportunities & challenges related to conformal cooling

Reduce cooling time

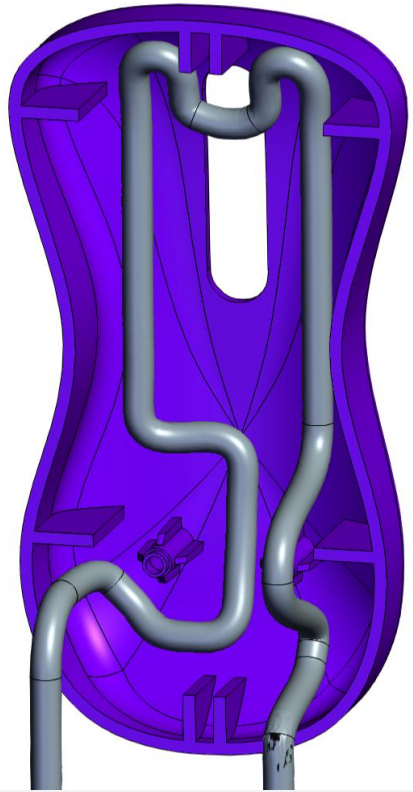
(Remove heat locally)

Simpler mold

(No plugs or diverters to install & test)

Reduce part defects (warpage)

Mature supply chain



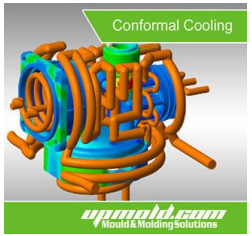
Poll

Are you using conformal cooling?

Opportunities & challenges related to conformal cooling

More complex Design

- New & updated software
- New « Design For Additive Manufacturing Guidelines »
- Included in the University Curriculum



Different materials

- Increasing list of materials available
- More and more « Same as » materials
  - « Same as P20 », « Same as H13 »
- Decreasing powder price

High Cost

- More machines on the market at lower price
- More mature machines
- More service bureaux selling parts
- High price due to increased performance

Perceived problems with multiple solutions being implemented

Opportunities & challenges related to conformal cooling

Need to build a business case

- Conformal cooling business case
- Trade-off between **Reduced cycle time**
  - Increase productivity & profitability for the Molder
- And increased mold cost
  - Additional investment
- No impact on leadtime (usually)
- New technology with limited knowledge
- ➢ **When is it cost effective?**

"I spent 6 months trying to convince Molders to use conformal cooling but they were not able to build the business case to justify the additional expense."

- Mold Maker CEO

50% cycle time reduction VS **5,000 $ additional investment**

Opportunities & challenges related to conformal cooling

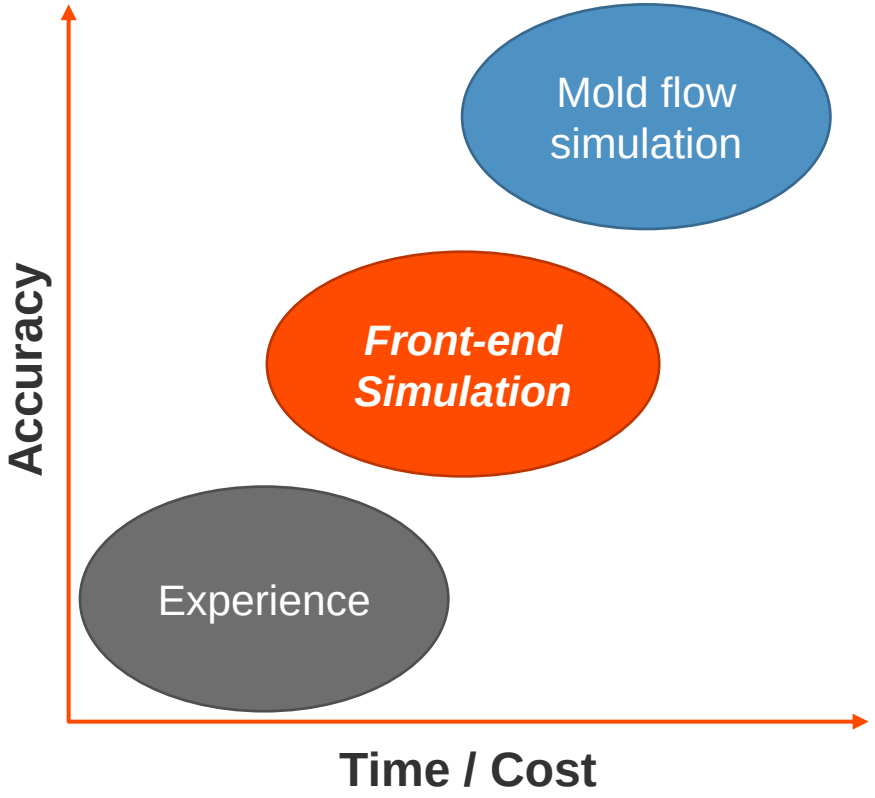
	LEAP OF FAITH	SCIENTIFIC METHOD	FRONT-END SIMULATION
Risk of failure	✗	✓	✓
Total cost (part, tool, simulation)	✓	✗	~
Leadtime to get parts	✓	✗	~
Design Optimization	✗	✗	✓

Front-end simulation to build strong business cases

Front-end Simulation:

Simulation made to be used by designers & project managers during the mold development process

- Quantitative results to act upon
- Easy to setup
- Very fast results
- Affordable



Front-end simulation to build strong business cases

Quick & Early mold cooling predictions for Mold Designers

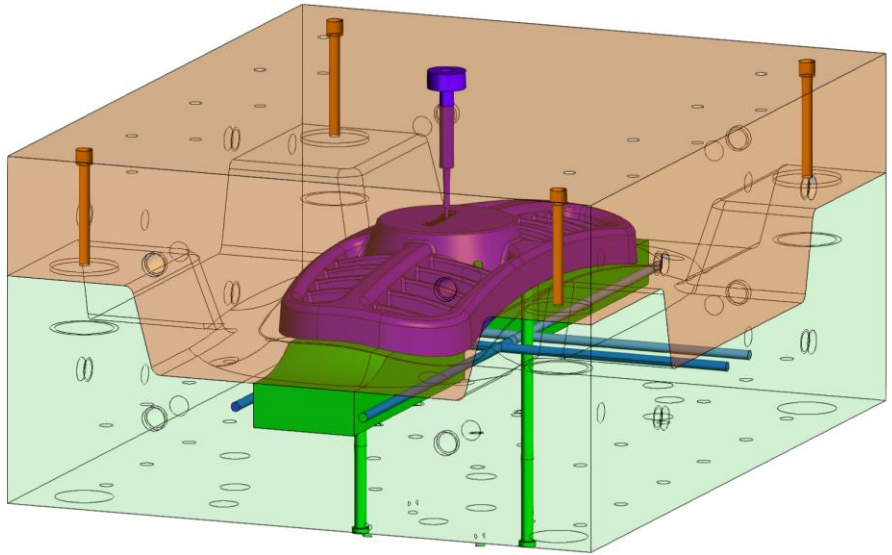
- Easy “What-if” scenarios
- Reduce design effort
- Reduce mold cooling time
- Estimate cooling time
- Improve part temperature uniformity
- Quantify hot spots

Front-end simulation to build strong business cases

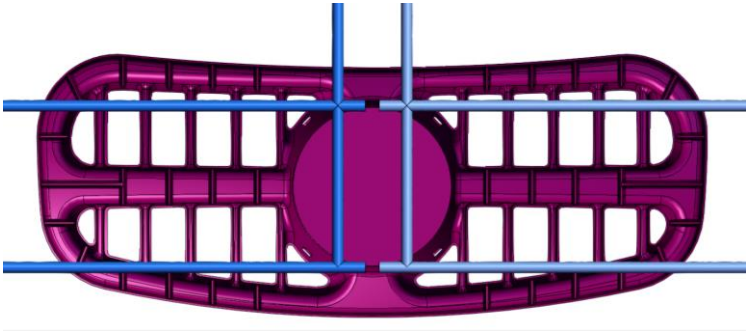
- Metal inserts
  - Location of the insert
  - Very wide design freedom
    - Insert material
    - Cooling lines location
    - Cooling lines shape

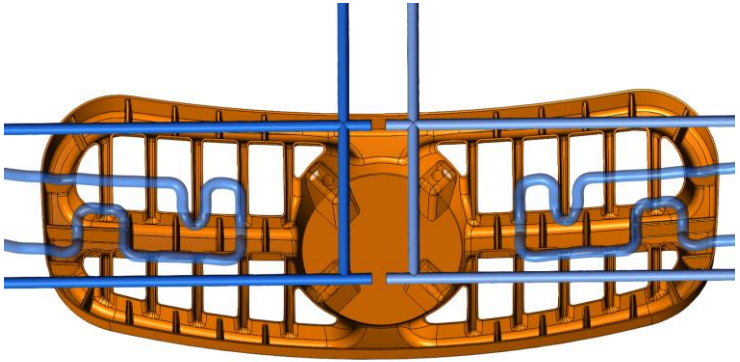
➢ Where to put the cooling lines to get efficient cooling?

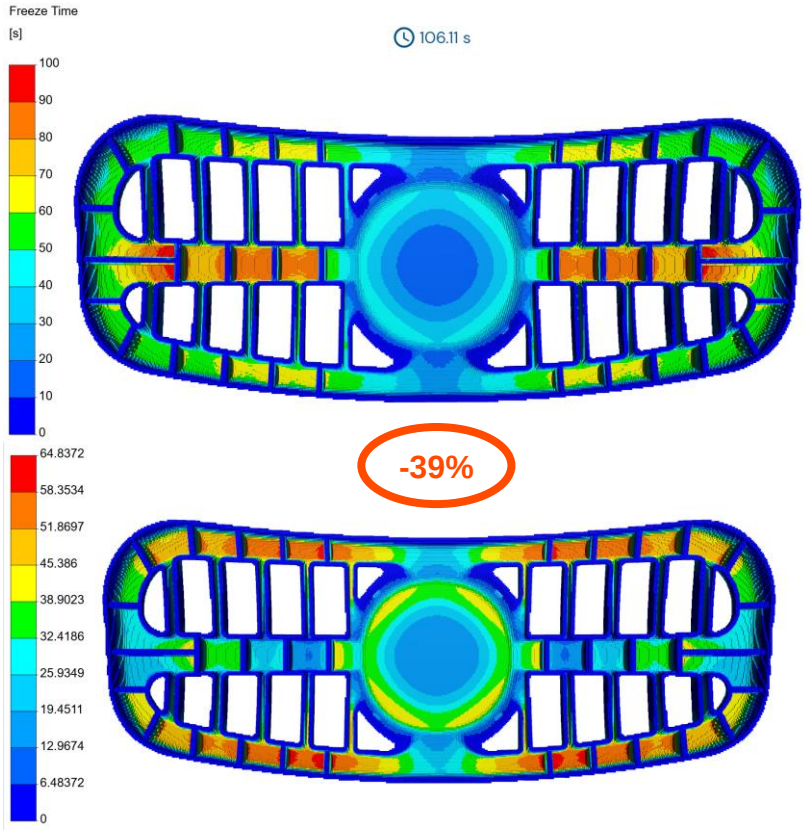
➢ **What's the shortest cycle time you can get?**



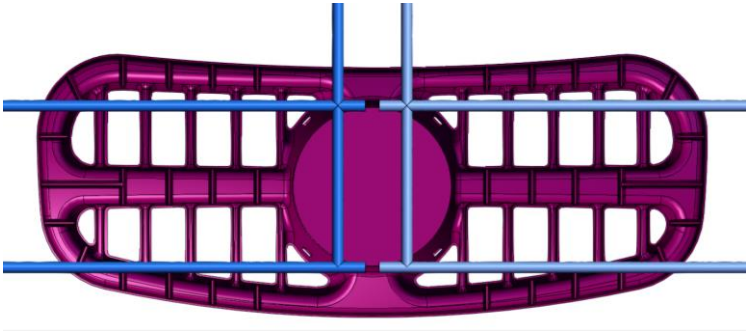
Front-end simulation to build strong business cases

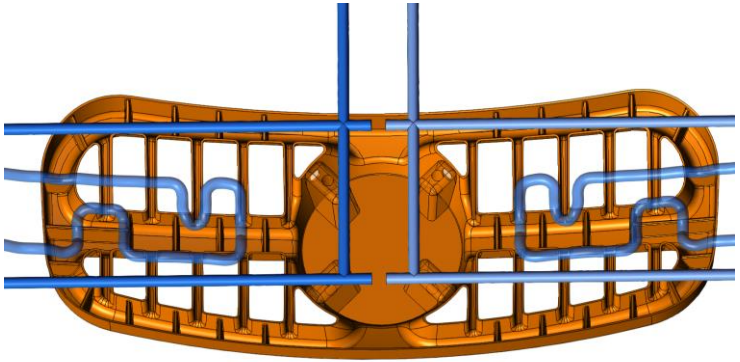


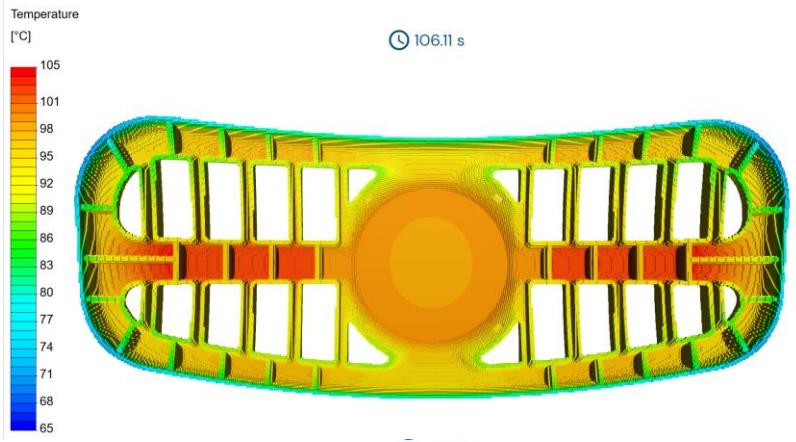


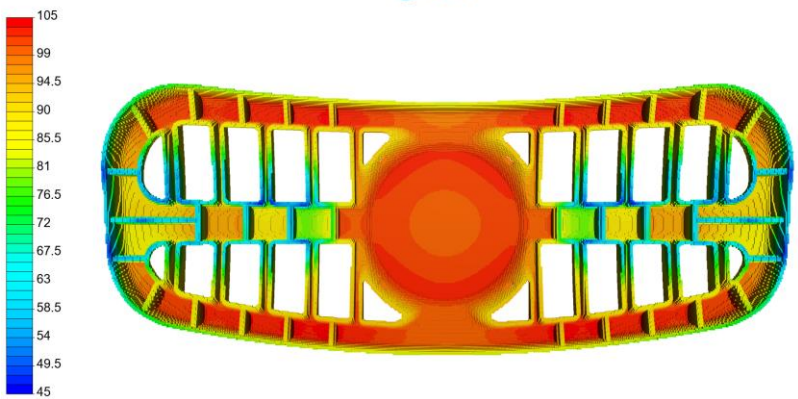


Front-end simulation to build strong business cases









Conformal cooling business case

Is the cycle time reduction sufficient to justify Conformal Cooling?

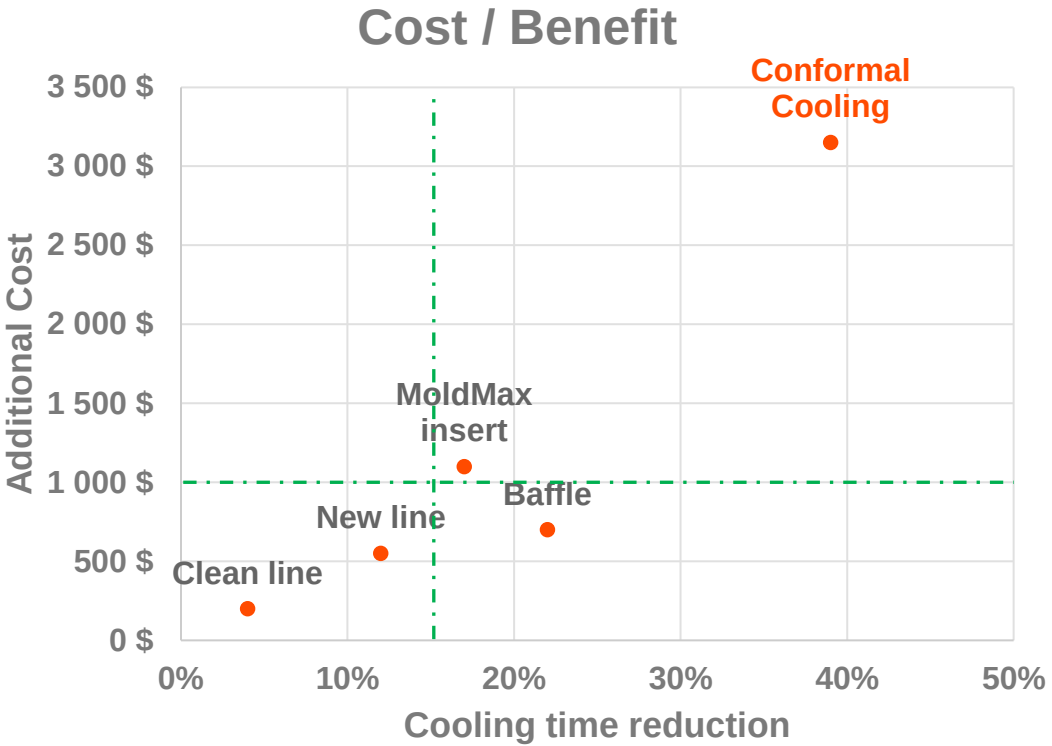
- Cycle time reduction: 41 sec
  - 224 extra parts per day
  - 560$ additional revenues per day
- Additional investment
  - 3D print the insert: 5,000$
  - Inset design: 200$
  - Front-end simulation: 100$
- **ROI < 10 days**

	Reference	Conformal Cooling	Variation
Mold cost	50 000 $	50 000 $	- $
Cooling time (s)	106,1	64,8	-41,3
Cycle time	126,1	84,8	-41,3
Production (parts/hr)	28	42	14
Production (parts/day)	448	672	224
Part price	2,50 $		- $
Print cost	- $	5 000 $	5 000 $
Design cost	2 000 $	2 300 $	300 $
Simulation cost	- $	100 $	100 $
Total Investments	52 000 $	57 400 $	**5 400 $**
Total daily Revenues	1 120 $	1 680 $	**560 $**
ROI		9,6	days

Front-end simulation to build strong business cases

When you need to reduce the cycle time, there are many options.

- Which one to choose?
- How to choose?
- How to justify the decision?



Main take-aways

There are several ways 3D printing can benefit the Plastic Injection Industry.

- 3D printing is a great tool
  - Mature technology
  - Mature supply chain
- Clear benefits in the plastic injection industry with several use cases
  - Depending on your priority: time to market vs. Production time vs. Part cost
    1. Print the part
    2. Print the mold in plastic
    3. Print some inserts in metal

Main take-aways

Conformal Cooling is very promising. Most of the challenges preventing the adoption of conformal cooling have solutions, except the business case aspect

- Significant cycle time reduction possible (up to 50%)
- Many remaining constraints for adoption but most have solutions available
  - Design flexibility
  - Material
  - Cost
- One of the most overlooked challenge is customer’s acceptance, that is the Business Case.

Main take-aways

Front-end simulation can help build a strong business cases to facilitate the adoption of conformal cooling.

- Business Case is hard to setup
  - Limited approach Leap-of-faith vs Full moldflow simulation
  - Front-end simulation
    - Quick & early reliable evaluation of the impact
    - Cost of the improvement based on supply chain & experience
- SimForm is helping you make the best decision to get the best result
  - Easily compare options and make decisions based on data
  - Easy to defend decision; Fast; Affordable and Easy to use

Thank You! Any Questions?

For More Information and to try front-end simulation firsthand

Get your free trial now:

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