ColdStream

Diabati

Creating Opportunities for Thermal Management through Generative Design

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Chief Product Officer

Cooling is on the critical path of product development

Multi-physics,
Multi-objective,
Multi-constraint

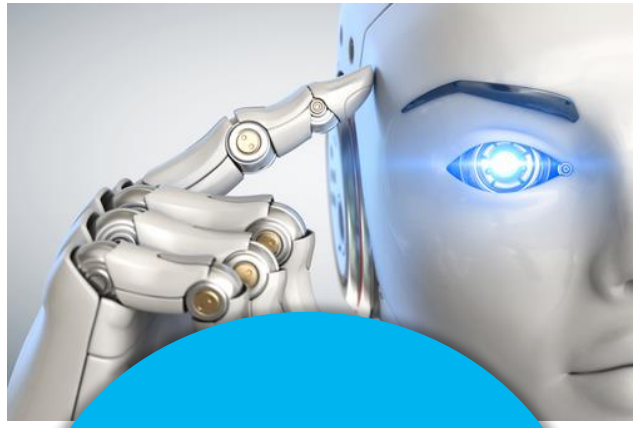
you can’t be an expert in all fields…

Our Vision

We believe that smart algorithms can empower engineers to design beyond imagination

Generative Design: A New Frontier

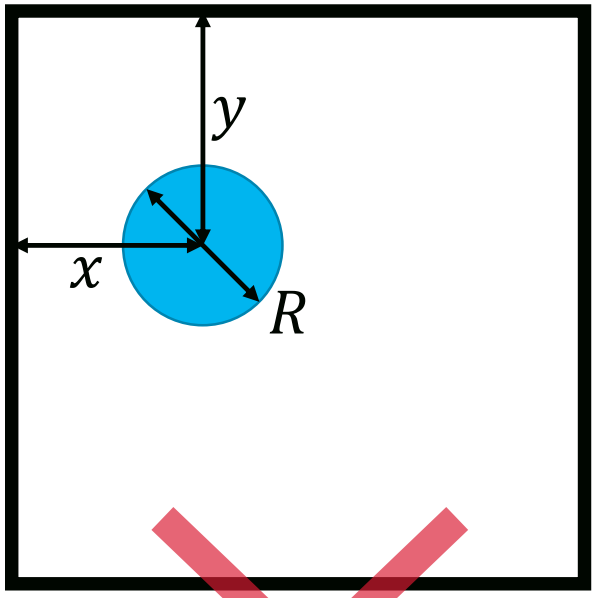
AI-driven design



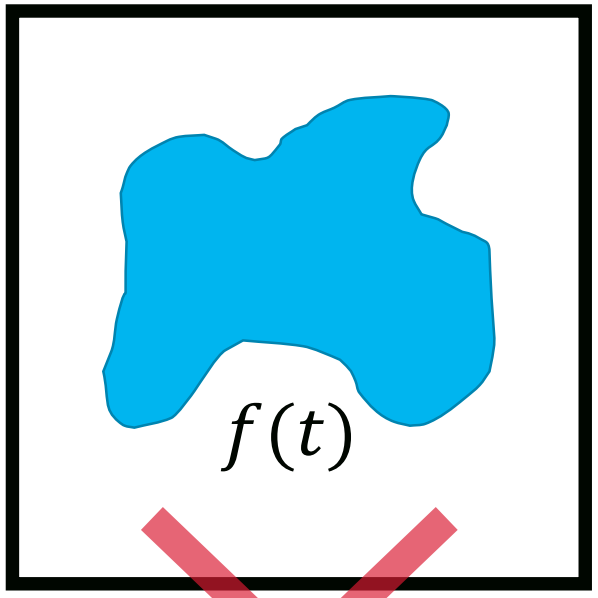
Physics Simulation

Massive computational resources

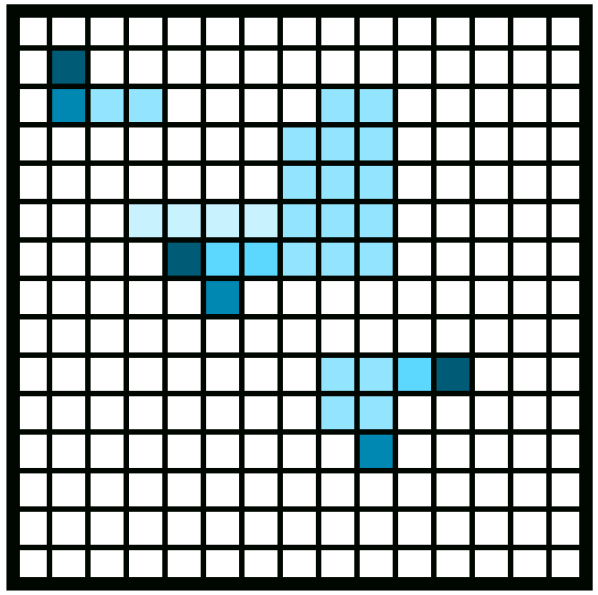
Start from Scratch, Generate the Solution



Parameter optimization



Shape optimization



Generative design

Thermal Management by Design

Time is money	• Automate as much as possible
Easy of use	• User-friendly and intuitive
Performance	• Optimal performance
One tool for complete design cycle	• Each step of the development cycle is covered
Don’t reinvent the wheel	• Integration with other software tools • Develop your own tools via API

Conventional Design Cycle

Design challenge

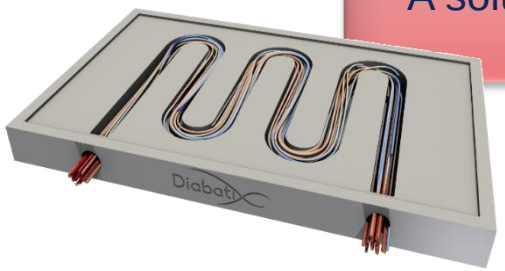
(Re)Create CAD model

Setup CFD simulation

Post-process results

Analysis/ Testing

A solution



Generative Design Cycle

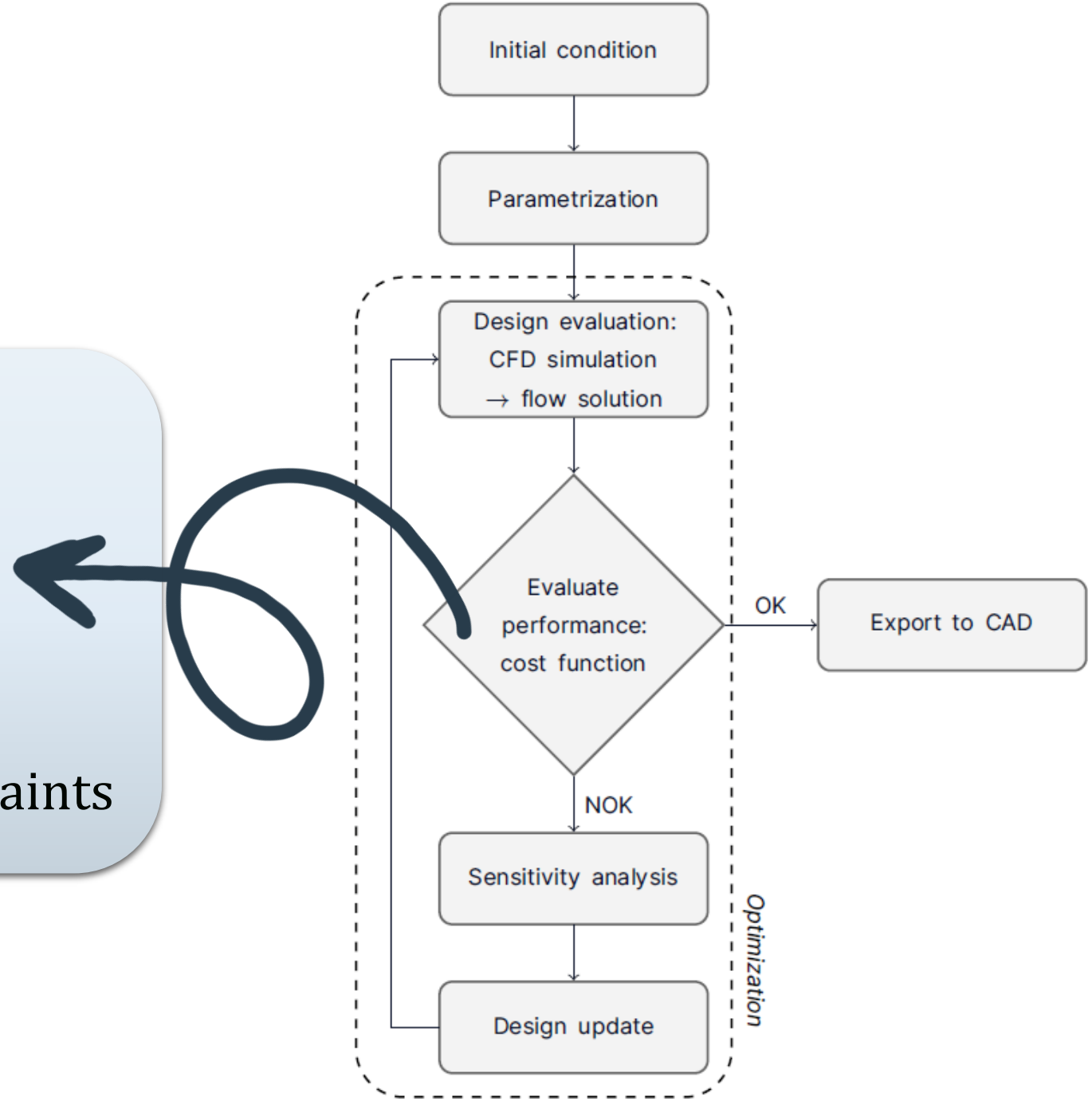
Input data

Generative design

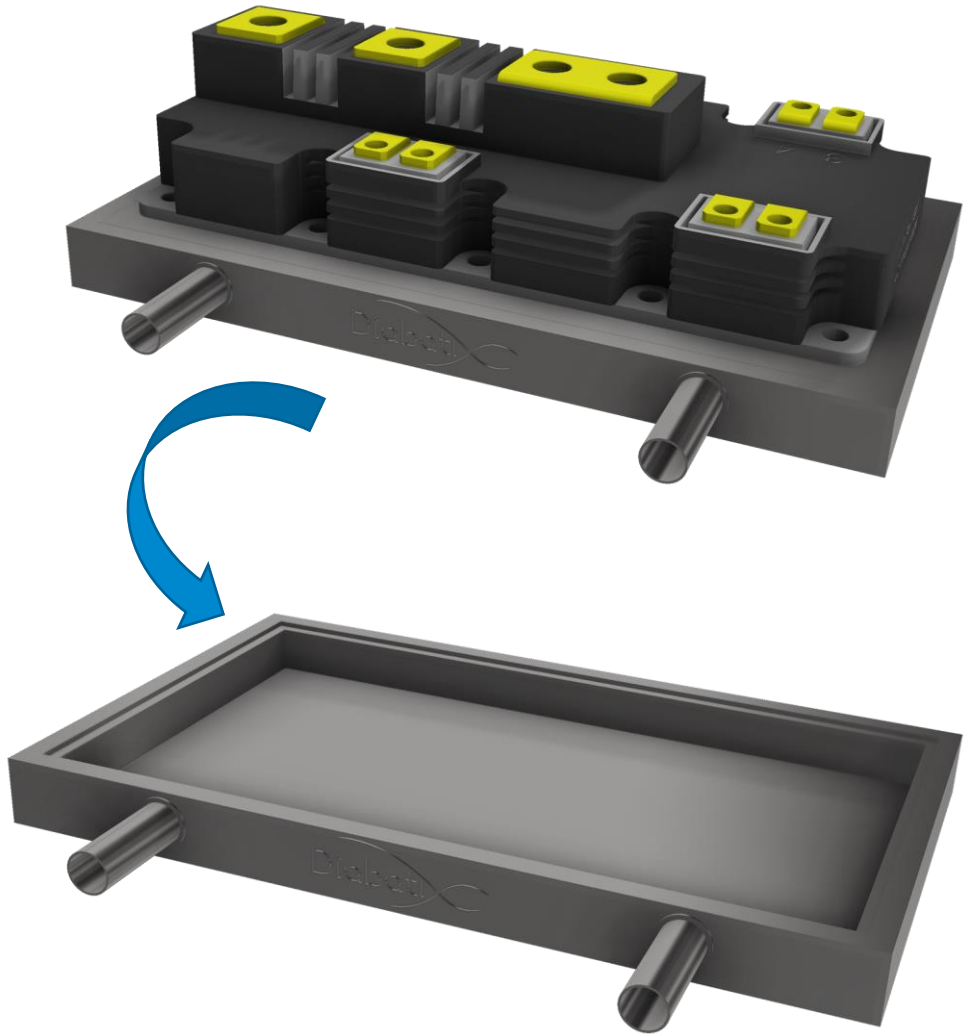
Optimal Solution

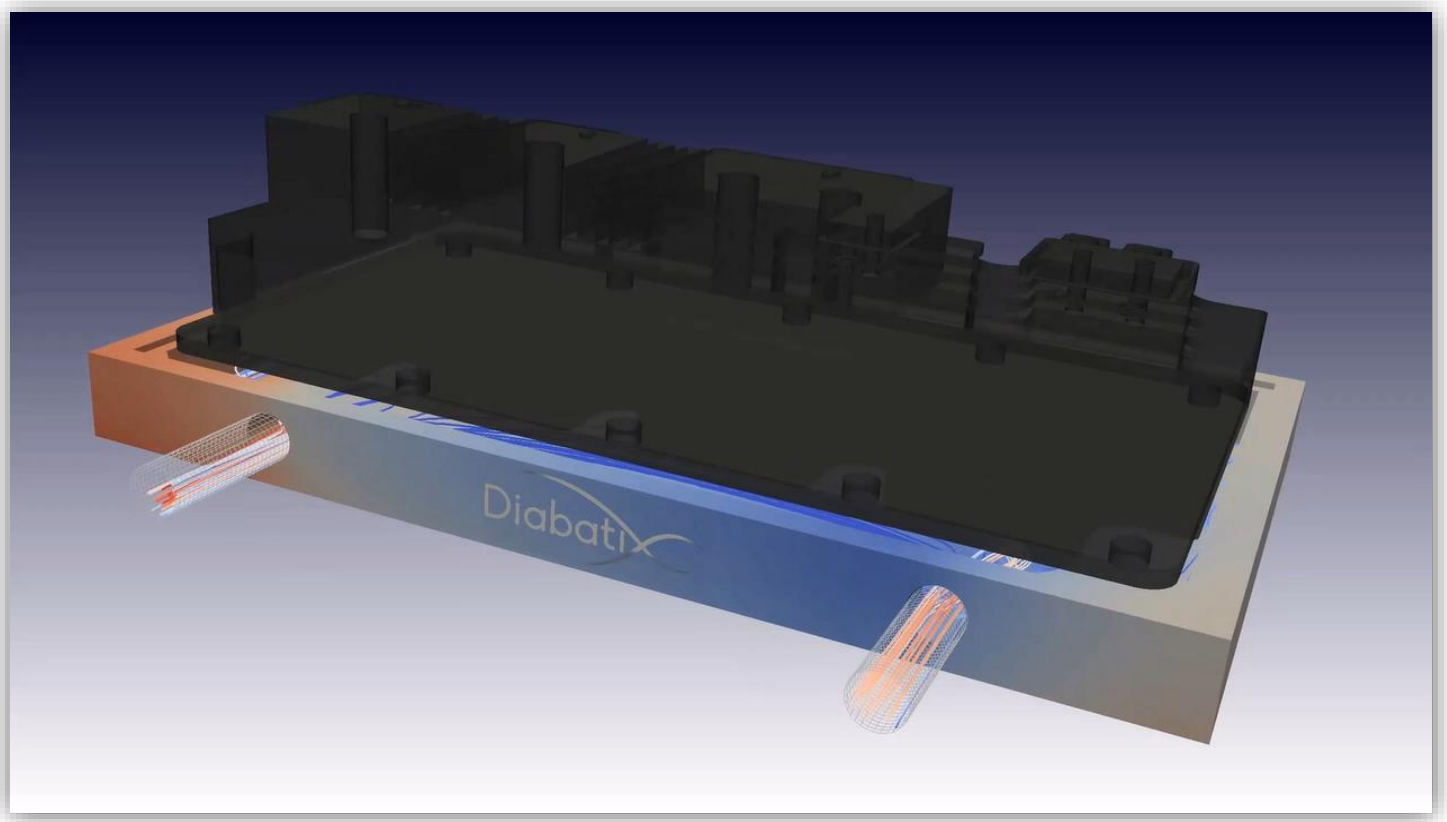
Generative Design Loop

- $\min \int T d\Omega$
- s.t.
  - $p_{in} \leq p_{max}$
  - manufacturing constraints



IGBT Cold Plate Liquid Cooling

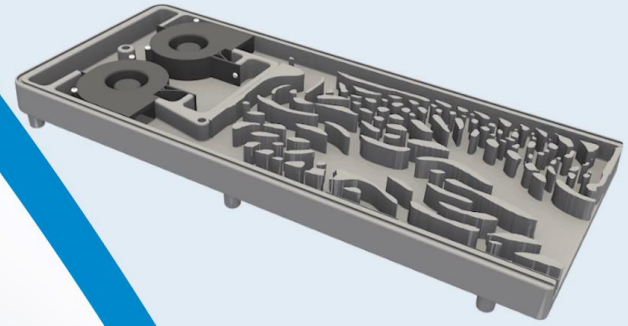




PE Module Air Cooling

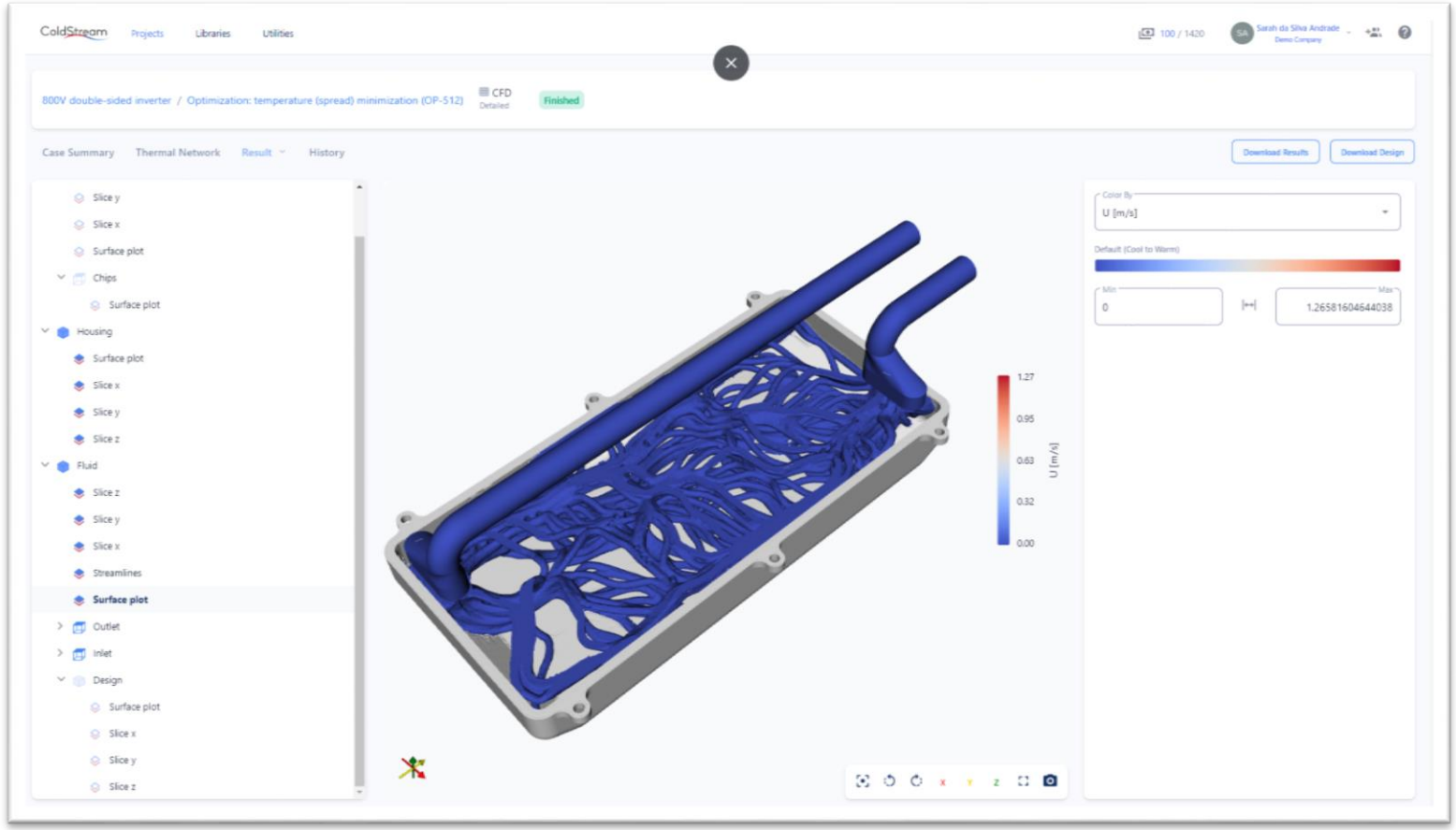
GENERATIVE DESIGN

DIE-CASTED AIR COOLED POWER INVERTOR



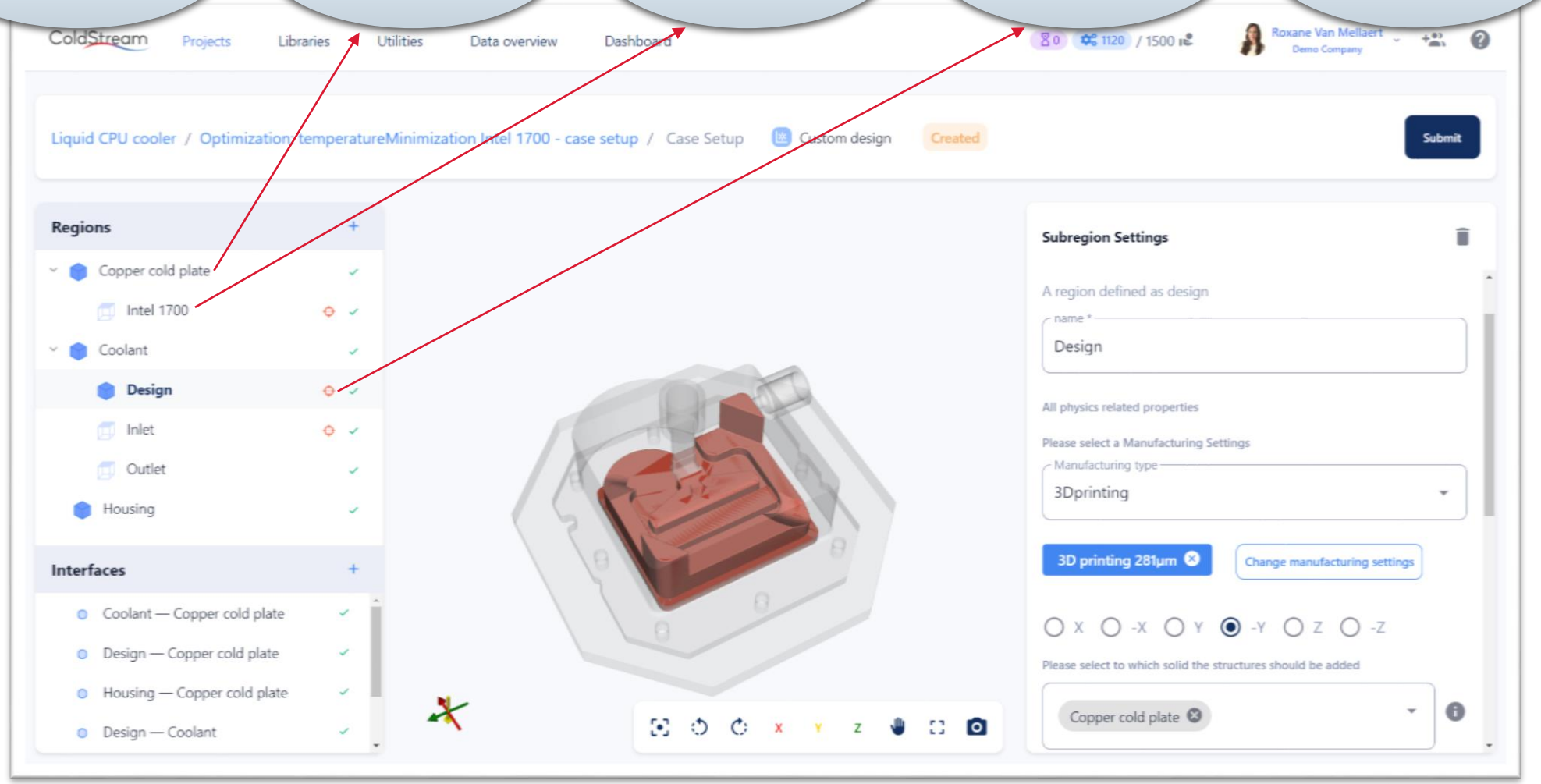
Our Product: ColdStream

- ✓ CFD-based topology optimization for thermal and flow components
- ✓ Cloud-based SaaS
- ✓ Capabilities
  - Thermal design
  - Heatsink selection
  - Thermal analysis
  - Thermal network

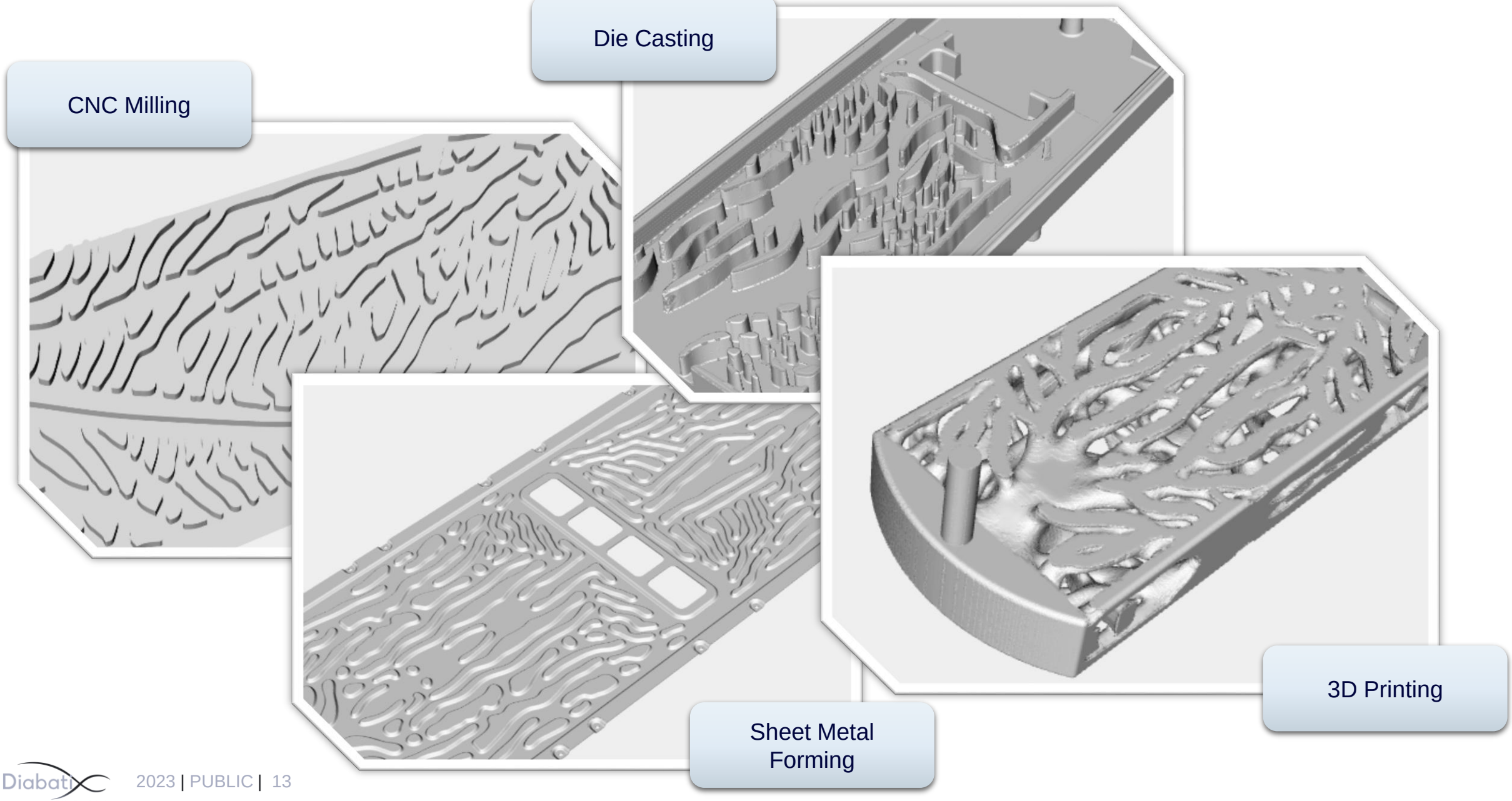


Simplicity Put in Practice

Upload geometry → Set solids and fluids → Set boundary conditions → Set target → Download result



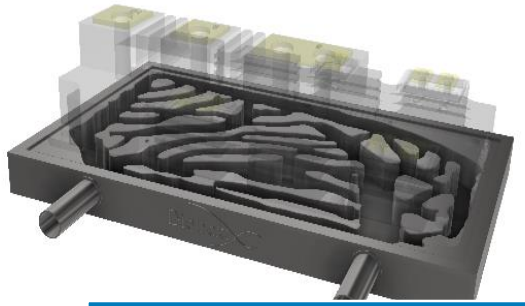
Limitless Design Freedom for Optimal Design



Thermal management is not an island

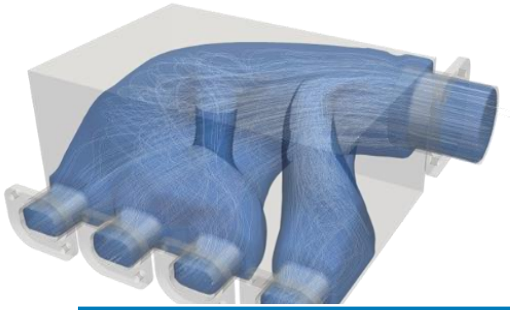
Limitless Applications

Air Cooled Electronics

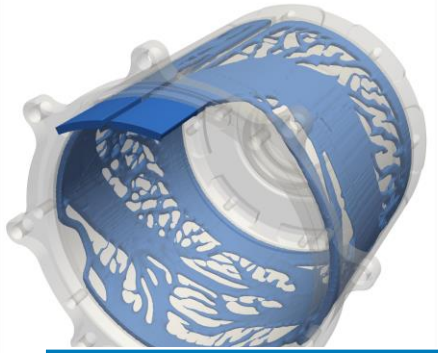


Liquid Cooled Electronics

Battery Cooling

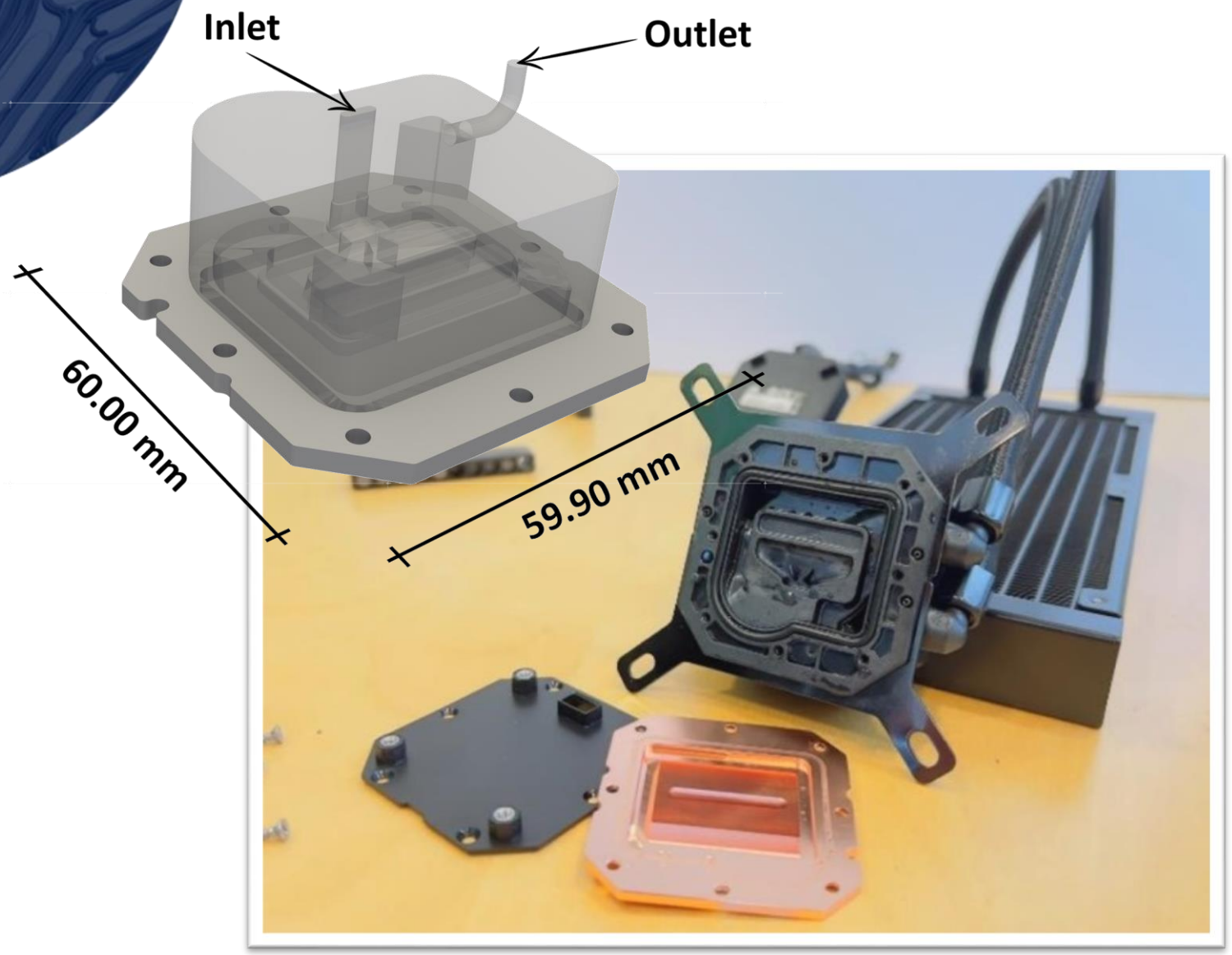


Flow Optimization



E-motor Cooling

CPU Cooling



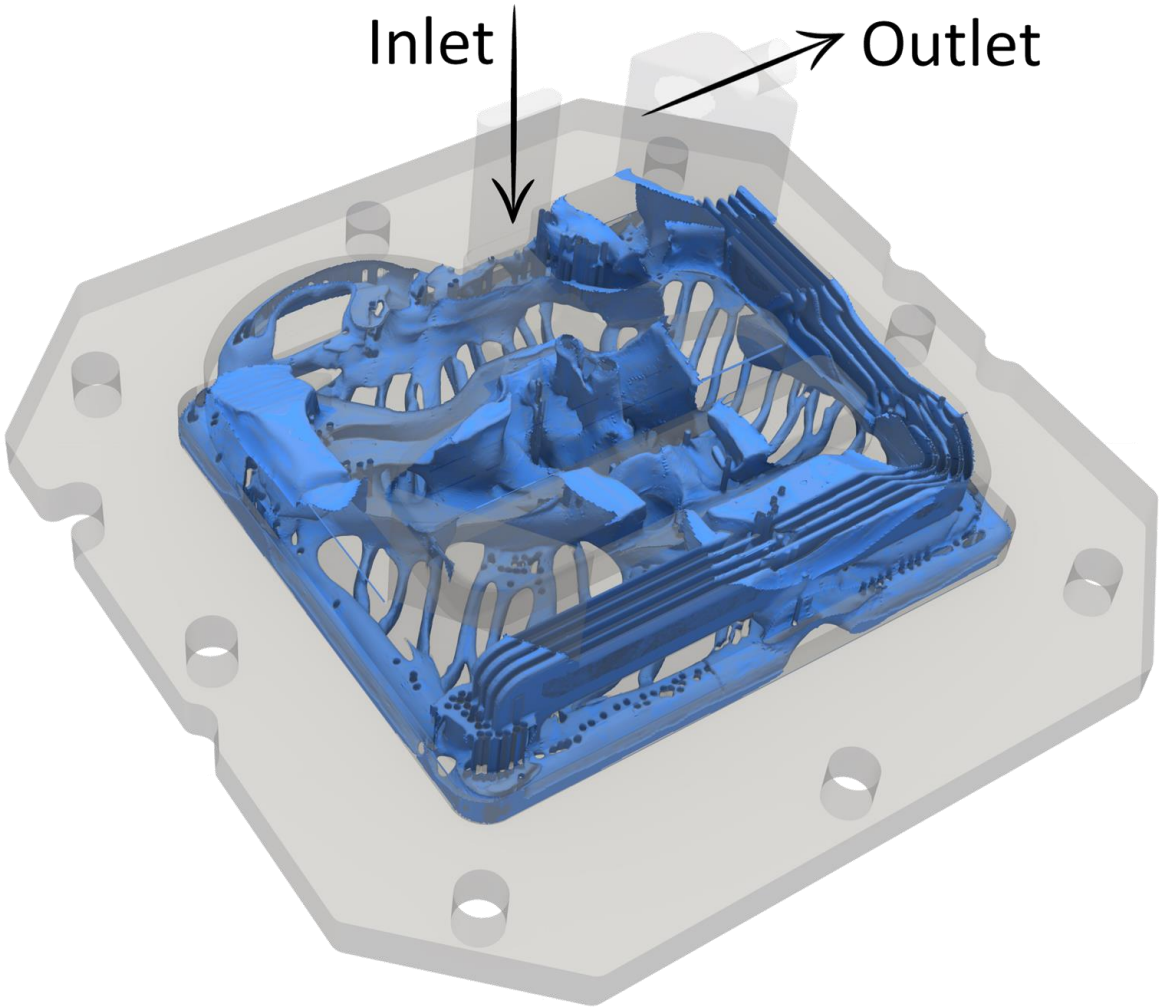
Case Study: Intel 1700 Heatsink

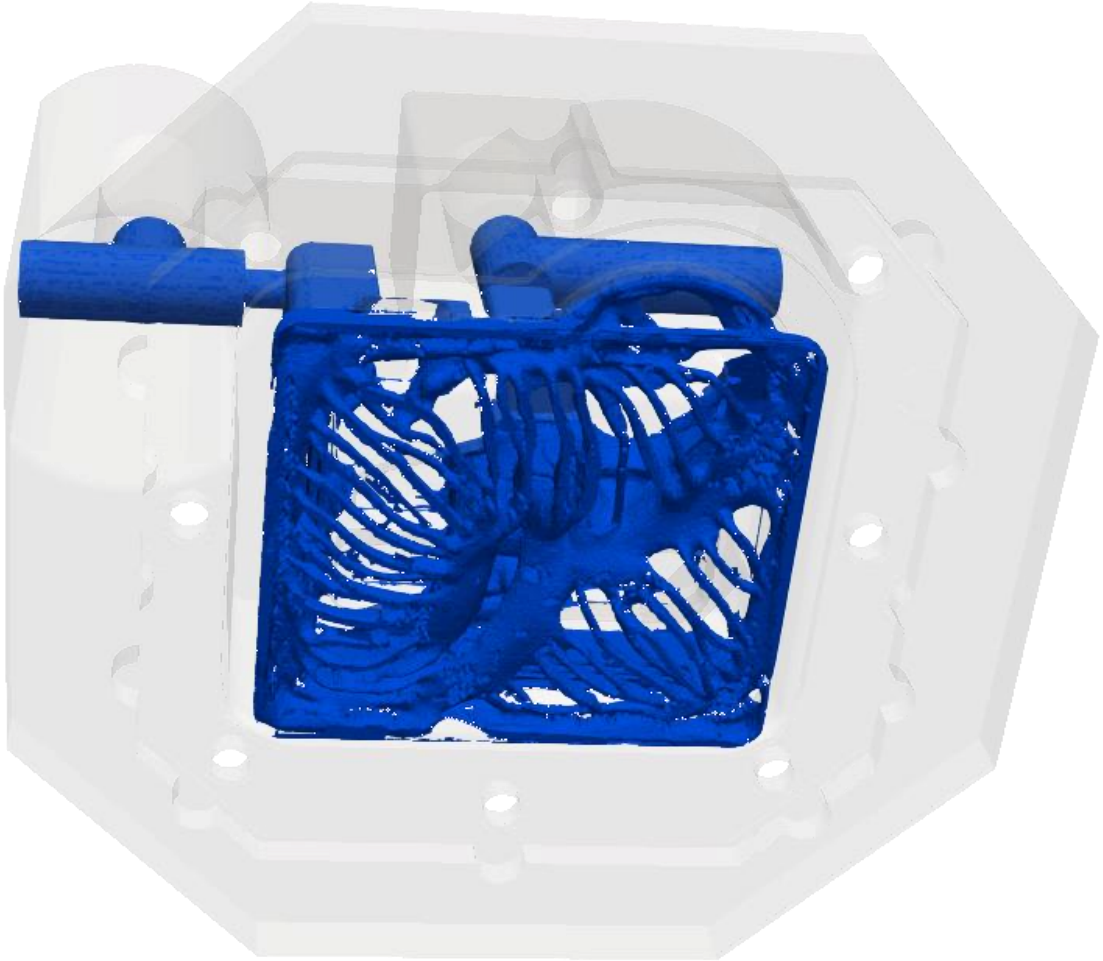
- Heat source
- Q = 250 W
- min(T)

- Coolant
- Water-glycol 40/60
- p < 11 kPa

- Copper
- 0.28mm feature size
- 360 W/mK
- 8910 kg/m³

Water Cooled CPU Cooler

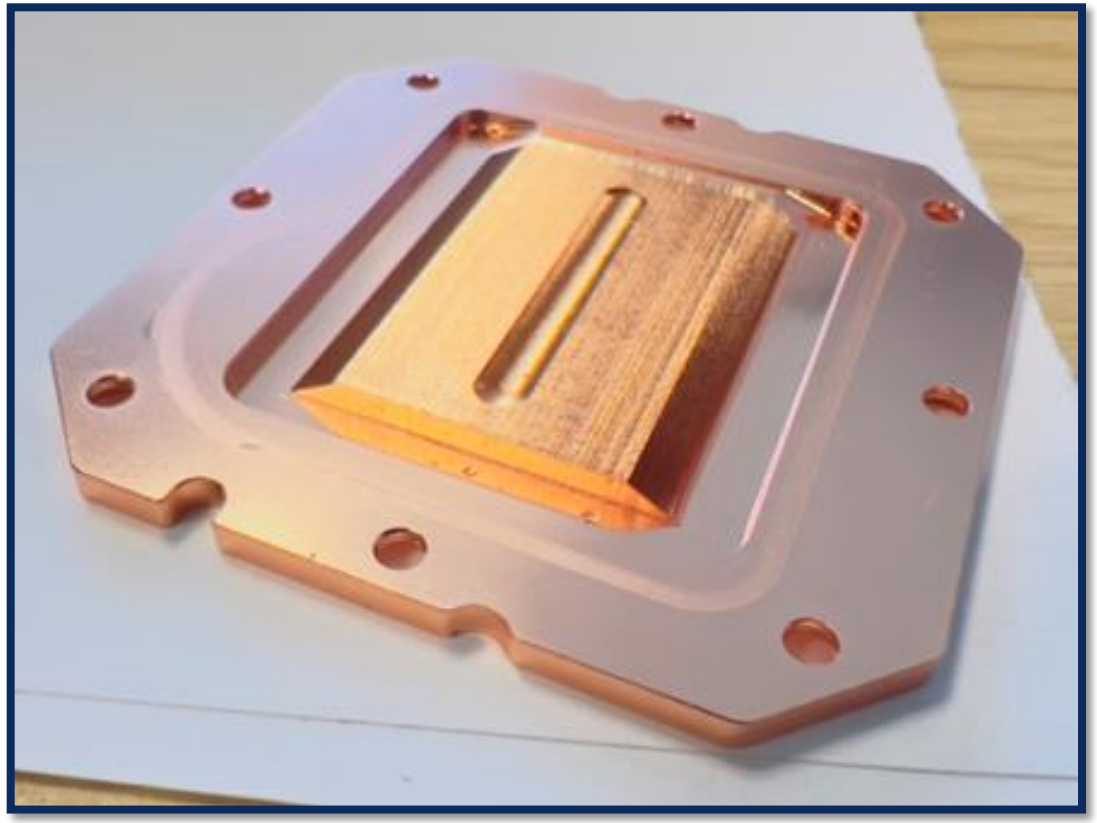


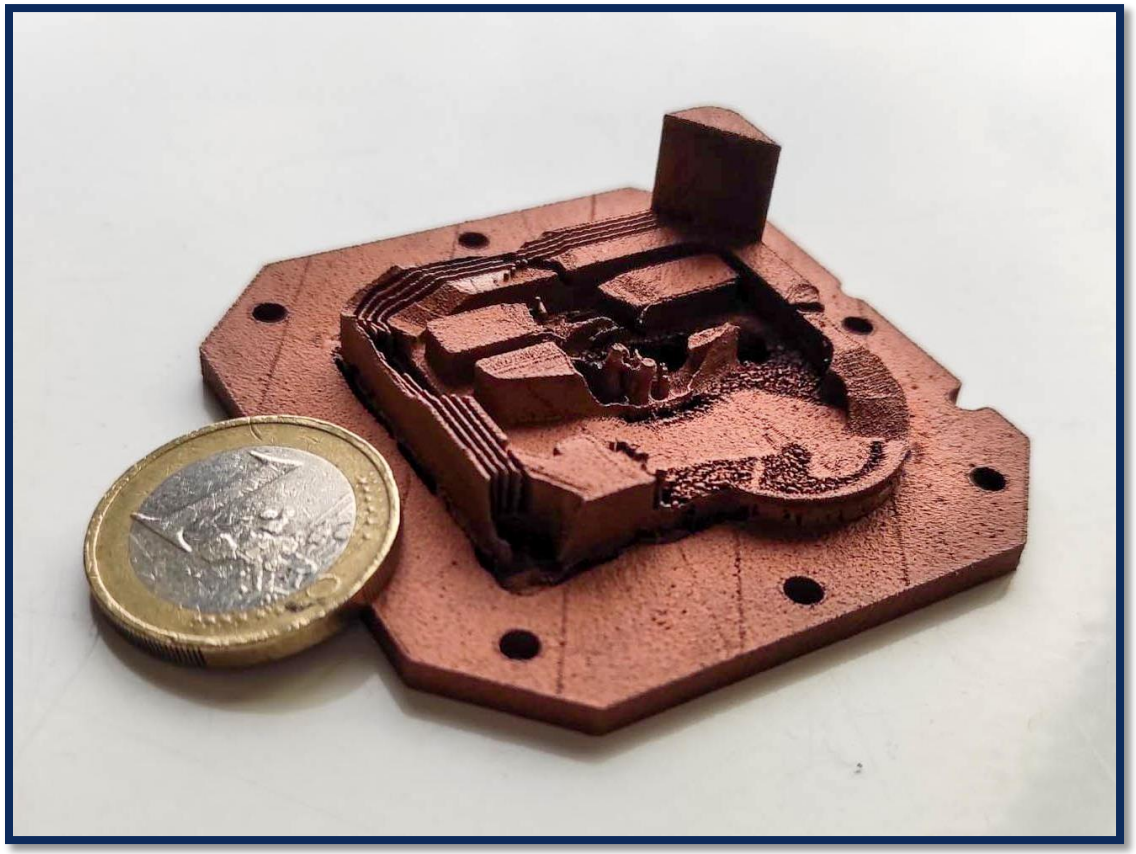


Conventional design

Skived fins

0.1 mm feature size



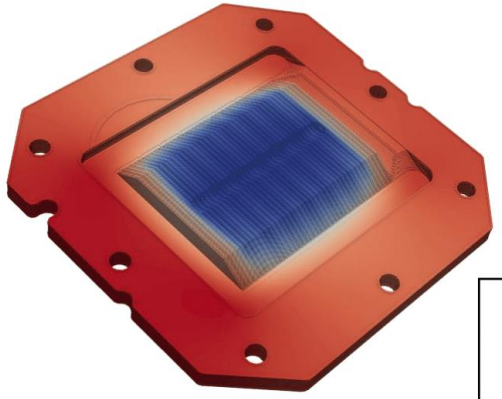
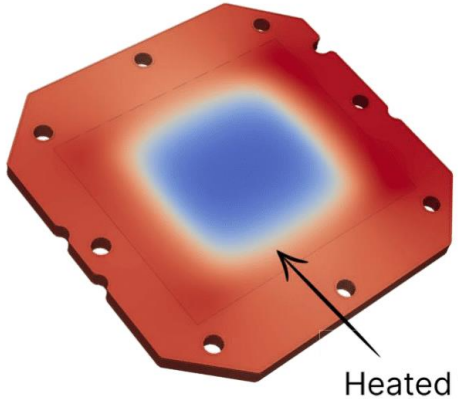
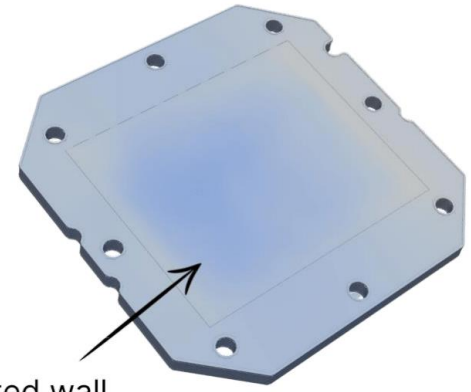


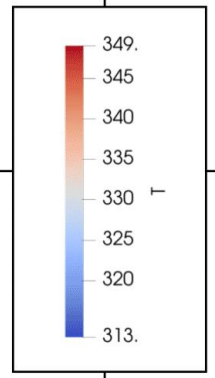
Diabatix design

3D printed

0.28 mm feature size

Generatives Design vs. Conventional Design

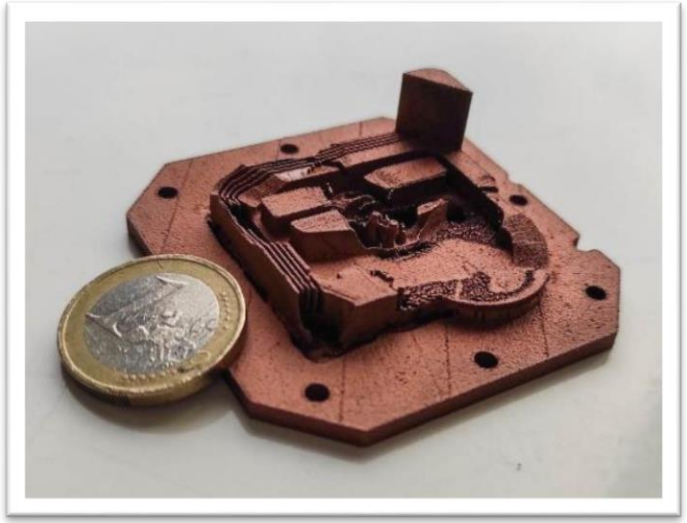
	Traditional Skived Cold Plate	Generative Design Cold Plate
Top view: Fluid Cooled Side		
Bottom view: CPU Side		



Thermal Resistance -55%

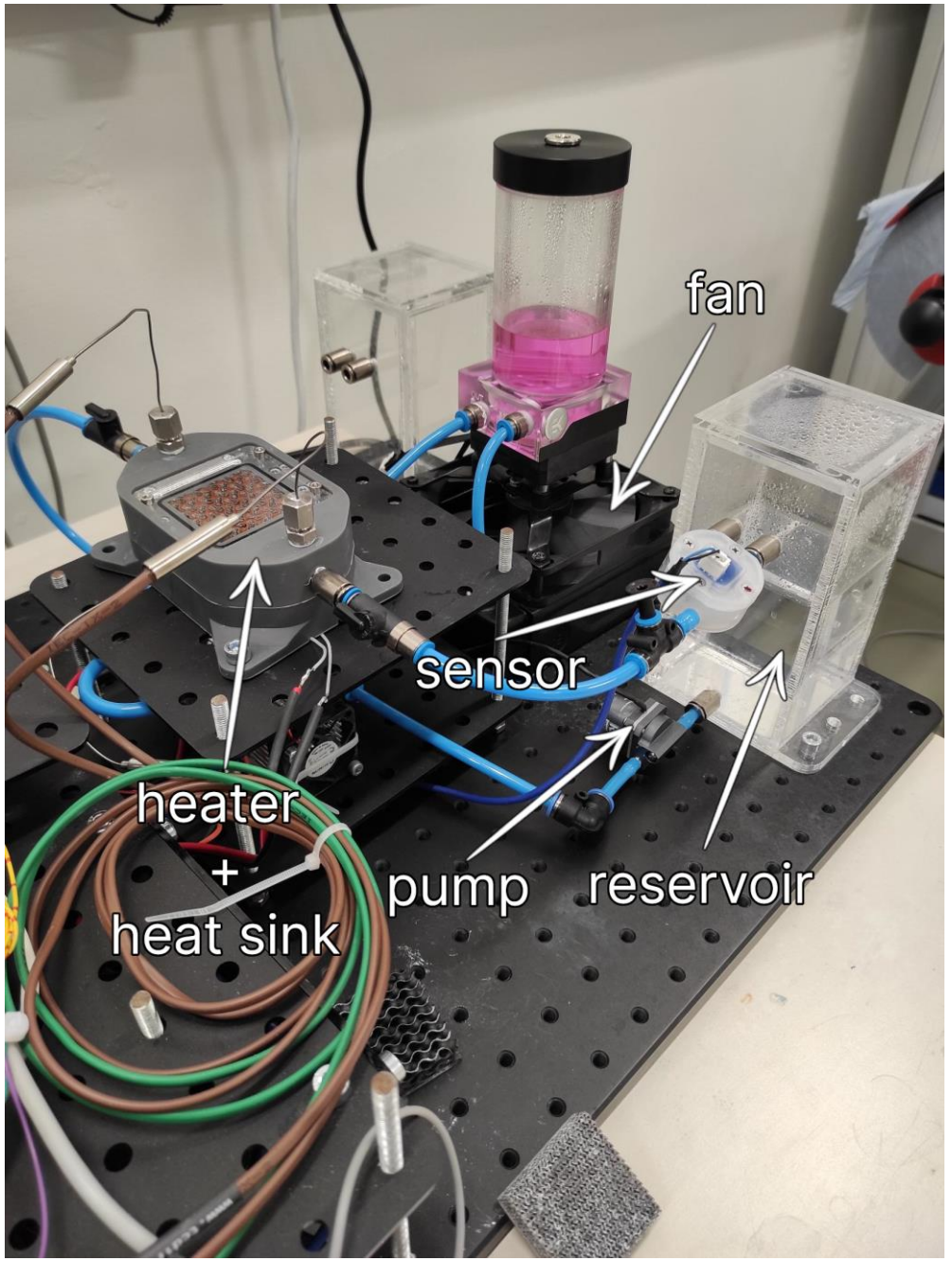
Temperature Uniformity +80%

Equal Pressure Drop

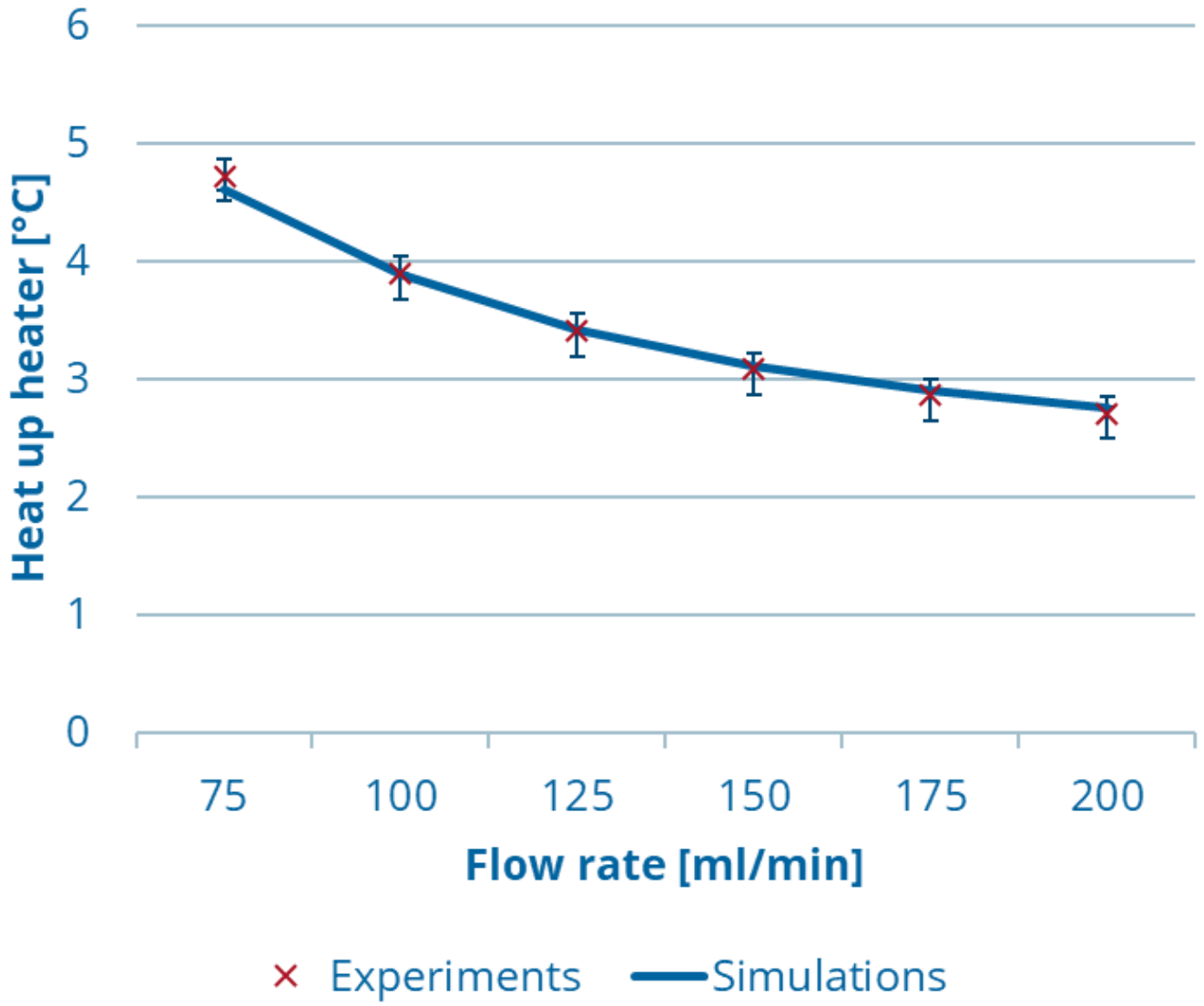


Experimental Setup

- Test conditions
  - Flow rate: 75 ml/min to 200 ml/min
  - Inlet temperature: 20 ℃
  - Heat sink material: Copper
  - Heat dissipation: 22.5W
- Performed by KU Leuven



Excellent Match



Conclusion

- ✓ Generative design offers an innovative design strategy
- ✓ Combine multiple objectives and constraints
- ✓ Expandable to multi-physics
- ✓ Manufacturing ready components

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