OBRIST
ENGINEERING

Innovative Components for Additional Heating Systems

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Introduction

Issue 1

- A/C operation leads to moisture and/or water storage on the evaporator
  - Microbial cultivation
  - Creation of odor
  - Surface treatments
  - Water drop spatter

Introduction

Issue 2

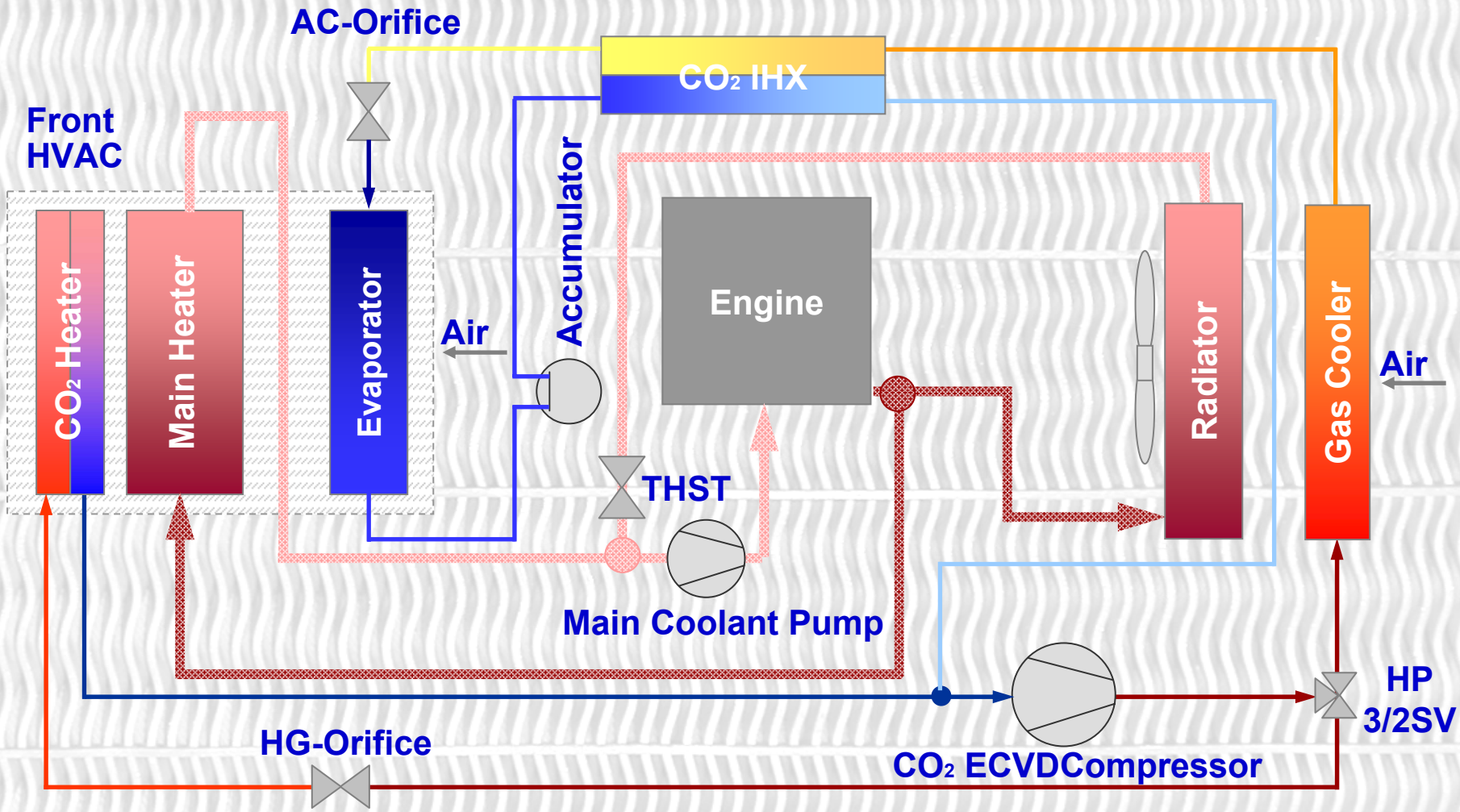
- Waste heat deficiency
  - Additional heating required (e.g. FFH, electrical, etc.)
- R744 has the potential to be used not only for A/C but also for additional heating operation (e.g. HP or HG)
- Direct system heat exchanger needed in the cabin
  - HG heat exchanger can be low pressure 
  - HP heat exchanger is high pressure side 

Introduction

Issue 1 and 2

- For flash fogging reasons such a system would need a 2nd heat exchanger: one for AC, one for HG
- The need of an extra heat exchanger causes:
  - Increased packaging space for the HVAC-unit
  - Airflow and distribution issues
  - Additional costs caused by supplemental components
  - Extra weight

Airside Low Cost CO_2 – A/C & Heating System



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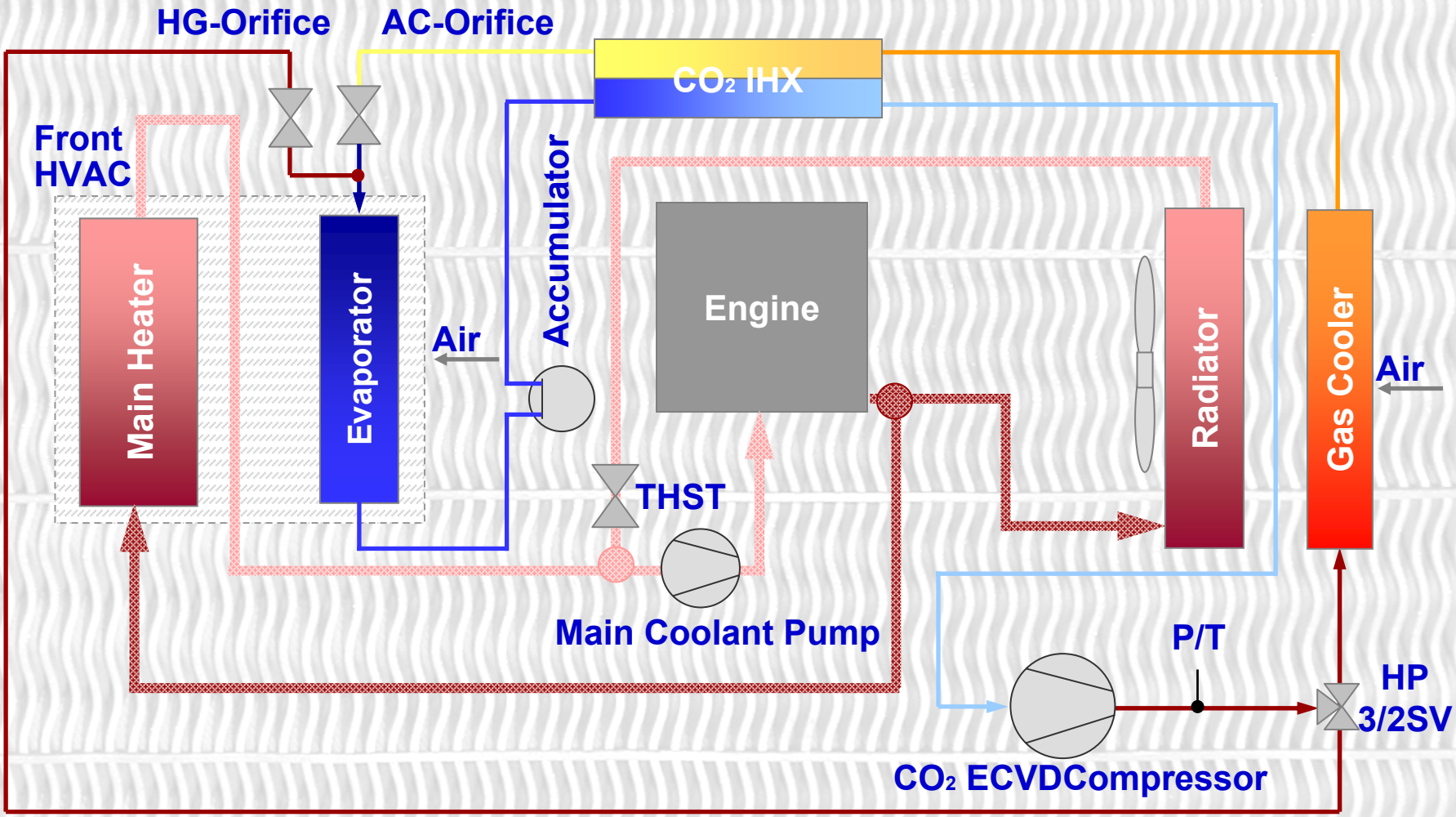
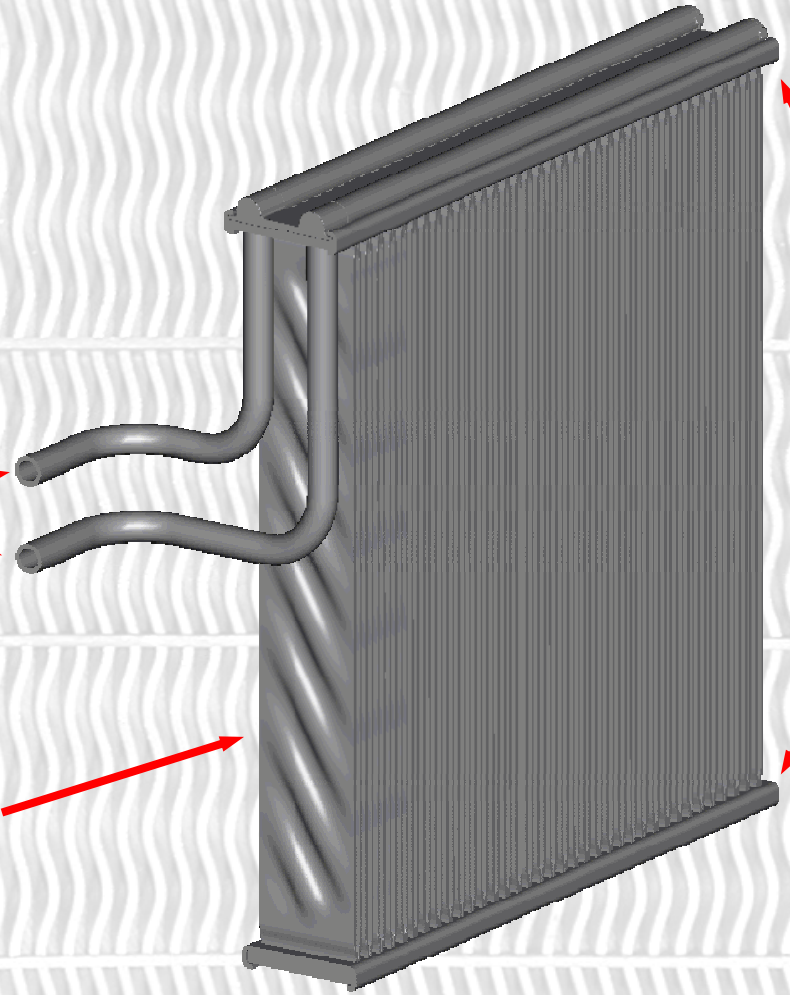


Concept

- Finless design (no secondary heat exchange surface)
- Parallel arrangement of MC-tubes
- Increase of the primary heat exchange surface by:
  - Increasing the number of MC-tubes
  - Implementation of preformed MC-tubes

Concept



In & Outlet

Manifolds

Preformed
MC-tubes

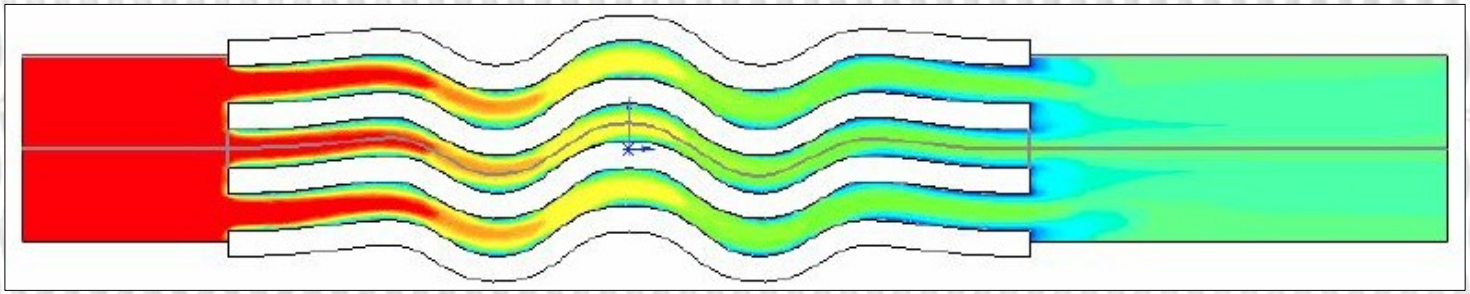
Concept

Advantages

- Optimized drainage & reduced storage of moisture
- Preformed MC-tubes:
  - Enhanced conditions for airside heat exchange
  - Improved performance of evaporation
- Locally reduced velocities for AC and HG lead to an excellent NVH behavior
- Minimized airside temperature spread through refrigerant distribution management giving access to a low ΔT even under inhomogeneous airflow distribution situations
- Increased dynamic and performance of the A/C and heating system
- Single A/C-additional heating-system cabin heat exchanger (only one)

Realization

- Theoretical calculation and simulation of the evaporator



- Manifold layout & design
- Tooling for preformed MC-tubes
- Assembly & process investigation
- Brazing process: NOCOLOK®
- Surface treatment investigation

Tests Conducted

- Burst pressure & operating pressure test
- Cooling capacity (air side & refrigerant side)
- Pressure drop (both sides)
- Temperature spread of the evaporator at different air flow rates
- Water retention

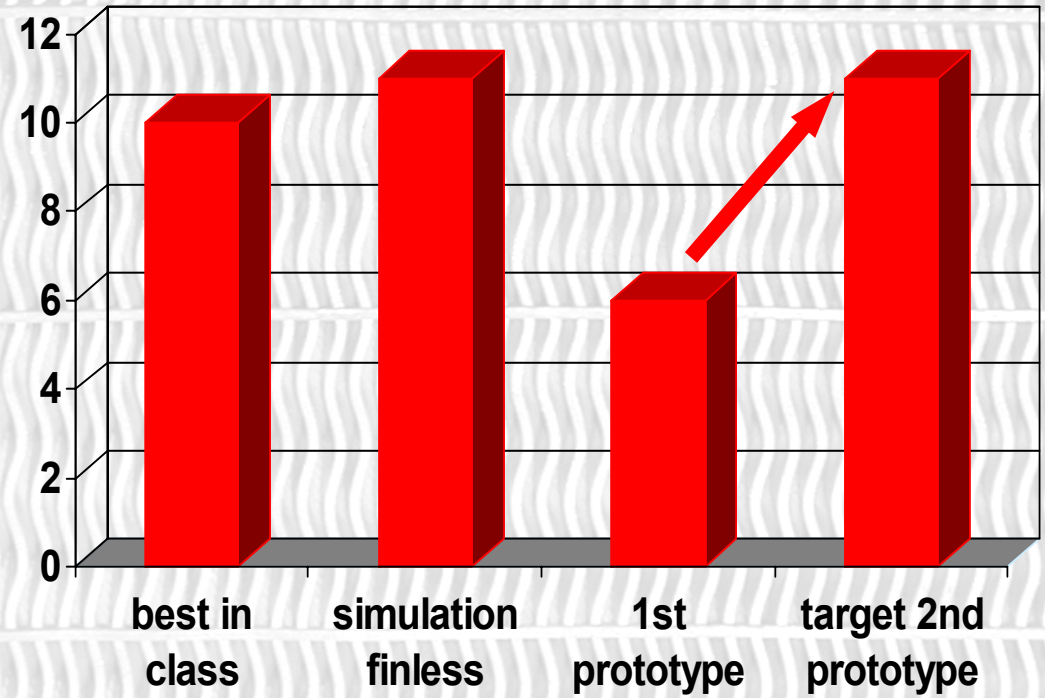
Results on 1st Prototype

Burst pressure & operating pressure test

Initial burst pressure was 108 bar.

Results on 1st Prototype

max. cooling capacity [kW]

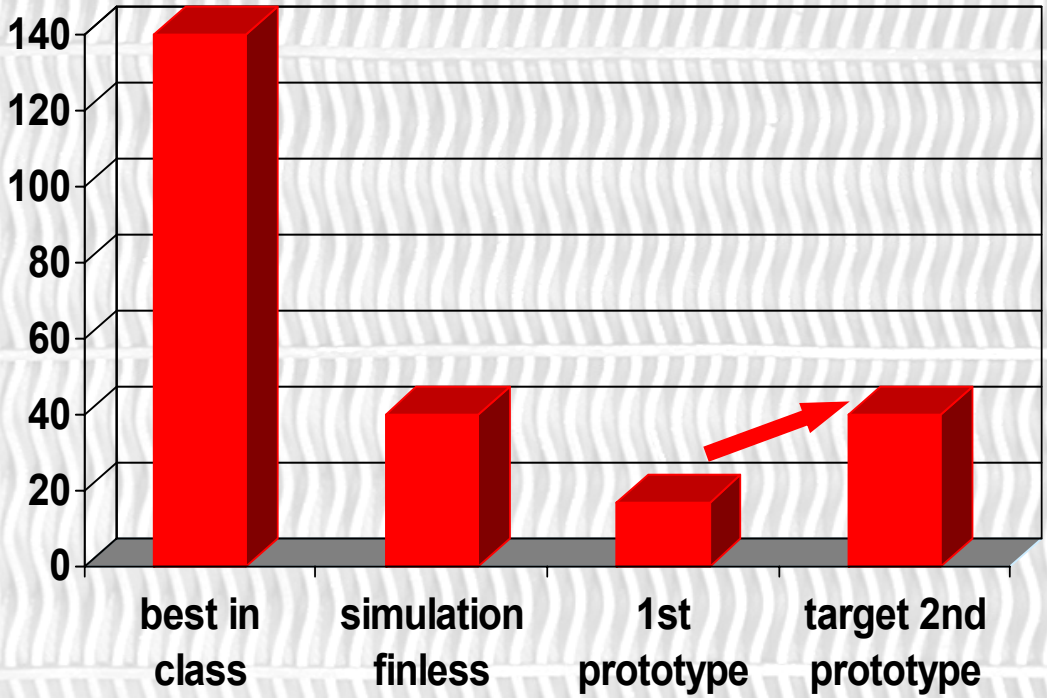


measures:

- **MC-tube homogenity optimisation**
- **Preformed MC-design improvement**

Results on 1st Prototype

airside pressure drop [Pa]



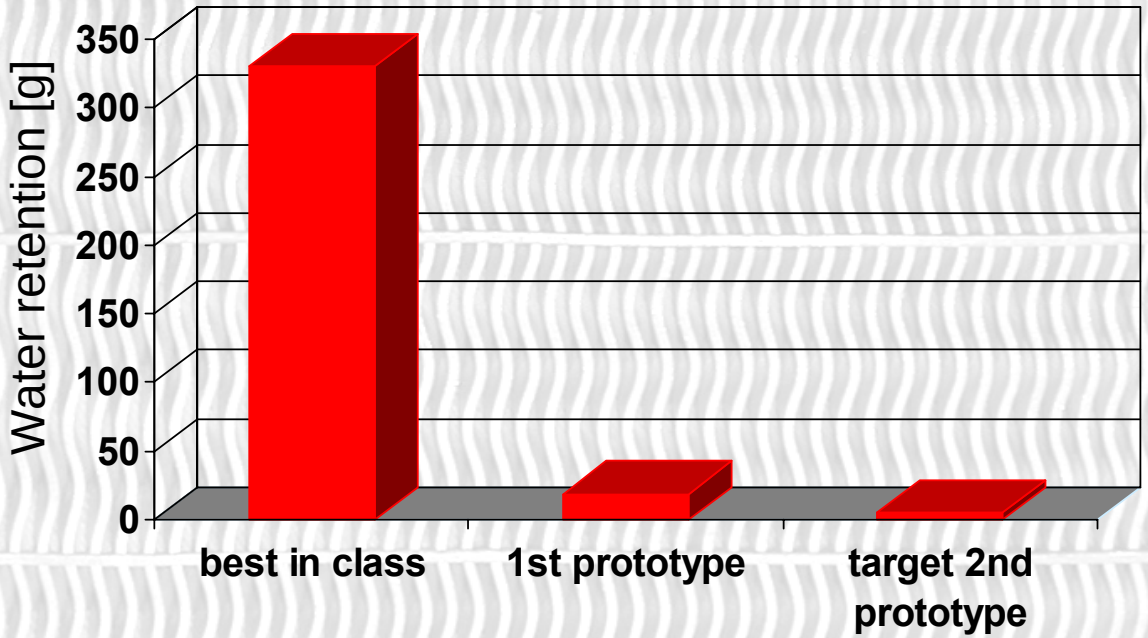
measures:

- **MC-tube homogenity optimisation**
- **Preformed MC-design improvement**

Results on 1st Prototype

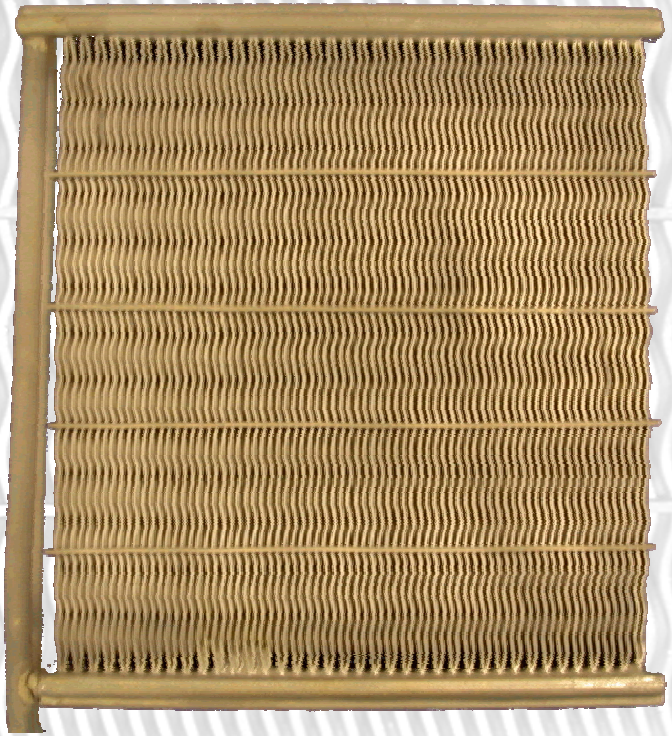
Water retention – test procedure

- Component is completely submerged in water
- Drainage time 1st prototype: <<1sec



Outlook

- Improved design realized with 2nd prototype



- Evaluation process ongoing
  - Cooling capacity and pressure drop
  - Temperature spread
  - System testing
  - NVH
  - Automotive standards

- Marketing
  - Interest on OEM side
  - Licensing to system & heat exchange suppliers
  - Development project

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