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Faculty of Architecture / ETH Zurich

Decentralized (heat) pumping

Enabling more intelligent and effective system operation

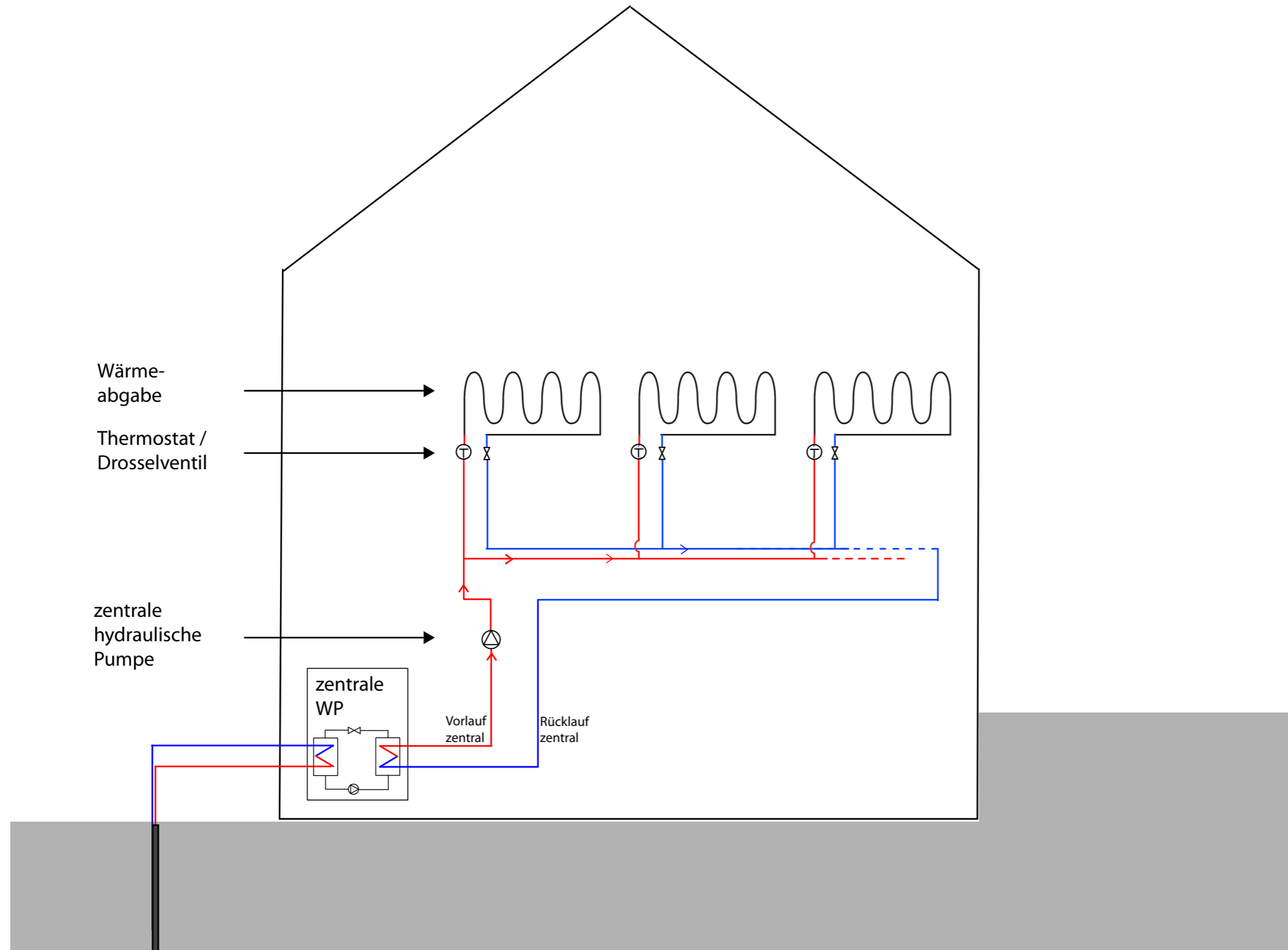
Matthias Mast
Professur für Gebäudetechnik
26. November 2010

ETH

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Conventional heating system

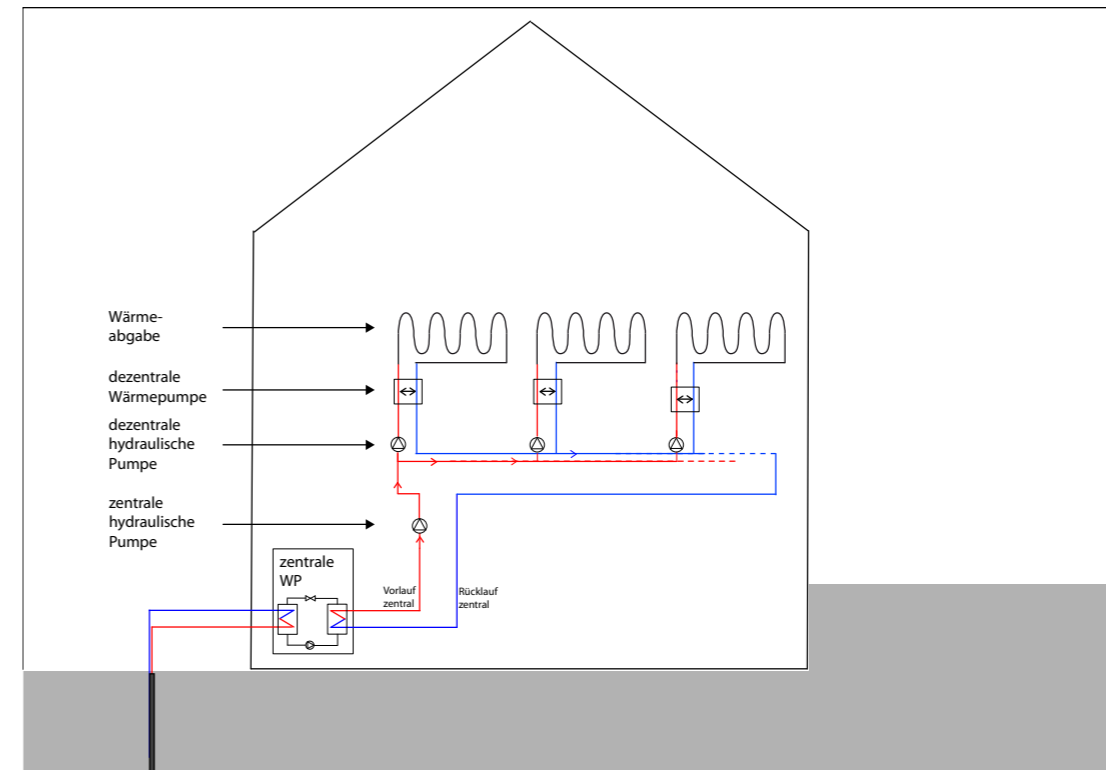
Schematic view



New system layout

Benefits

- system can react faster and has more degrees of freedom, leading to new control strategies
- supply temperature and thereby temperature lift of main heat pump could be reduced
- no need for 3-pipe systems (important for renovation projects)



Local hydraulic pumping

Research and Hardware

- simulation and measurements by TU Dresden
- led to commercial system by WILO SE (Germany)
- system consists of pumps and communication network
- at HPZ and B35:
 - simple DC-pumps without special communication network
 - controlled via digitalstrom



Zahlen Richter ?!



Local hydraulic pumping

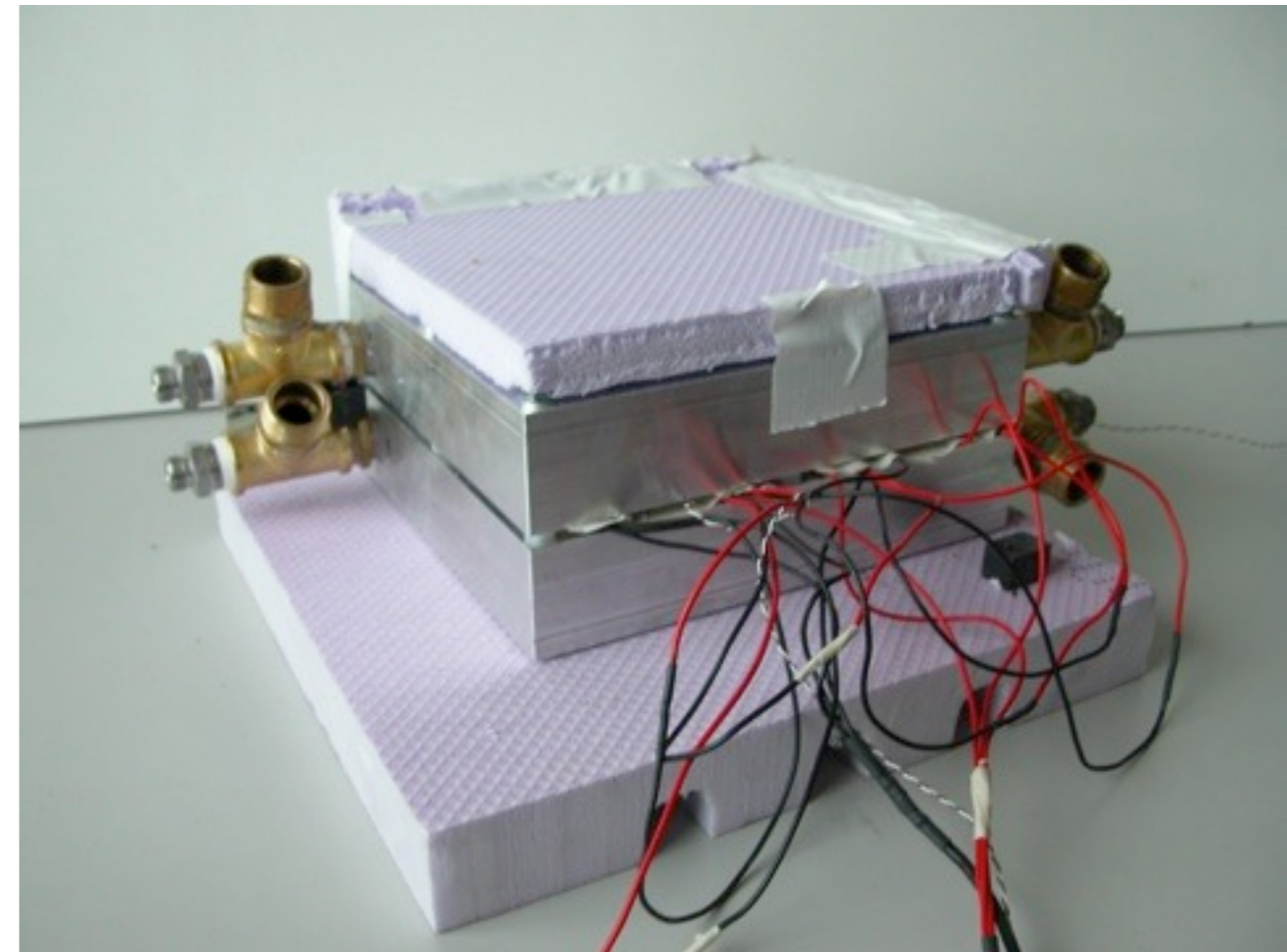
Example from WILO SE



Local heat pumping

Hardware

- At the moment no such system on building level exists
- as part of the research:
 - construction of a prototype, using thermoelectric modules
 - development of model to simulate system

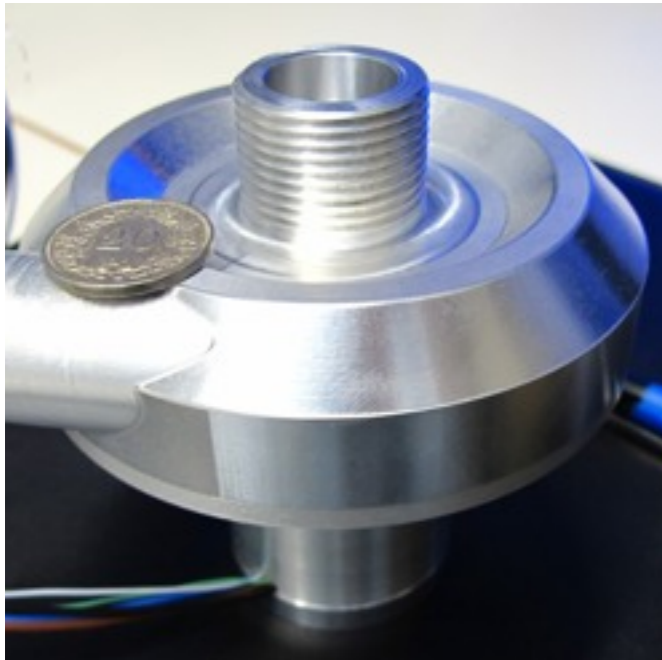




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Turbocompressor heat pumps

Research collaboration with HS Luzern and Celeroton



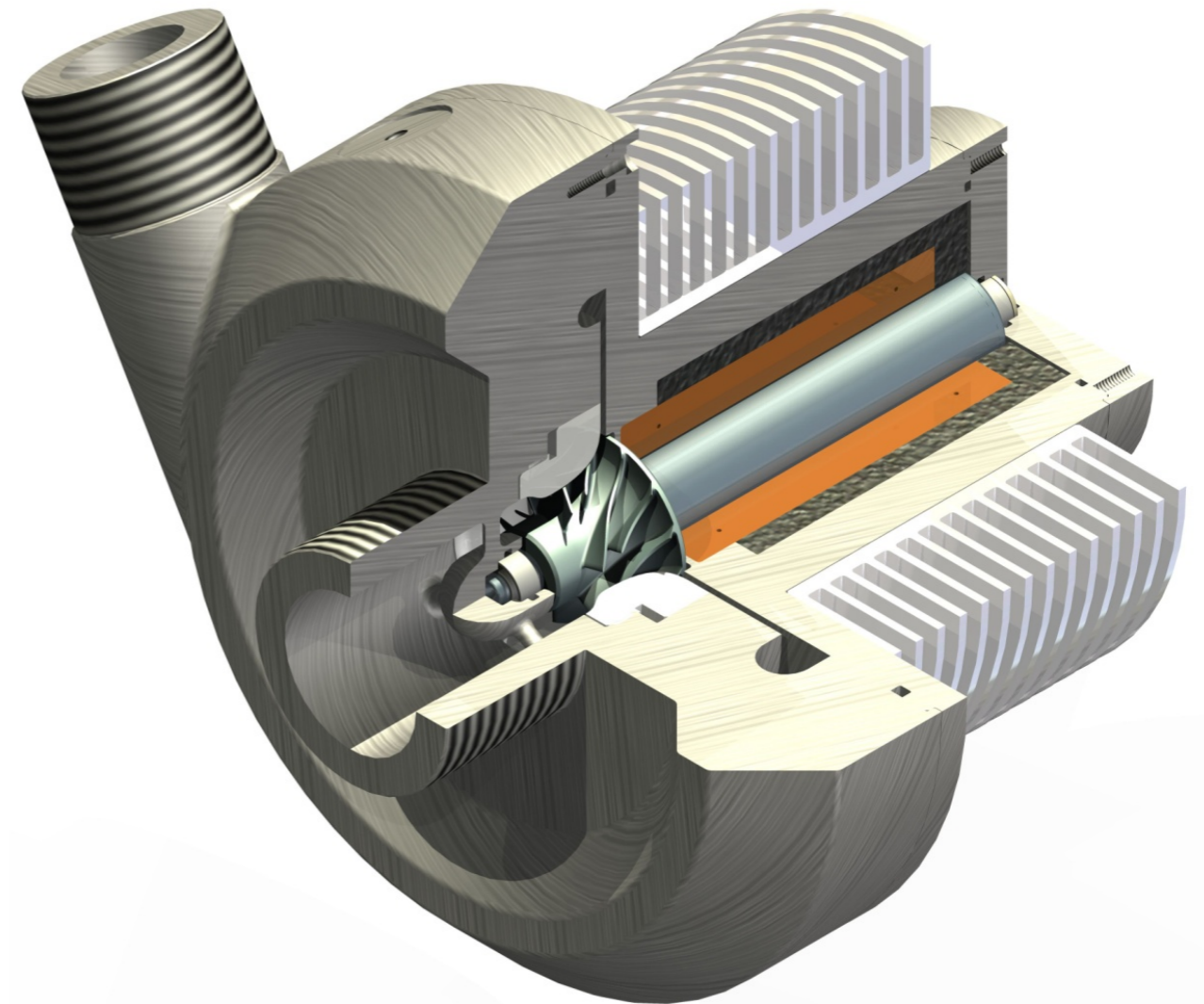
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Turbo compressors for heat pump

General overview

- Turbo compressors used in units with high power
- Could be efficient compressors for small temperature lifts or miniature heat pumps



Turbocompressor heat pump

research collaboration with HS Luzern and celeroton

- **Prototype of electric turbocompressor heat pump:**

- **working fluid: butane**

- **Temperature lift: 28 K**

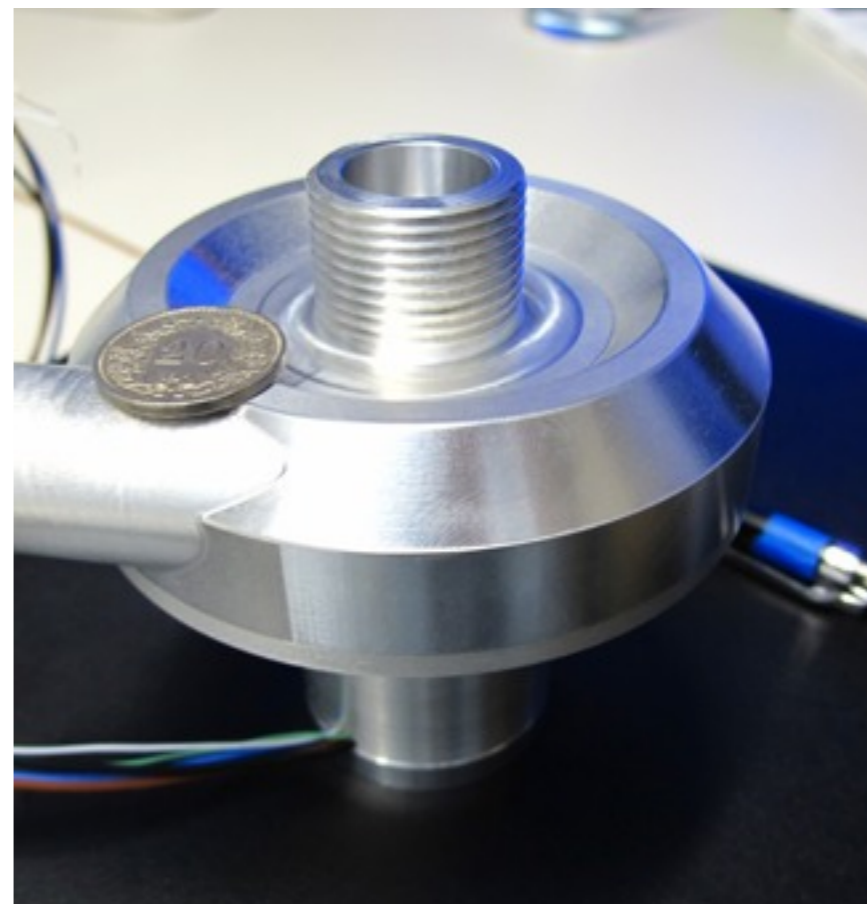
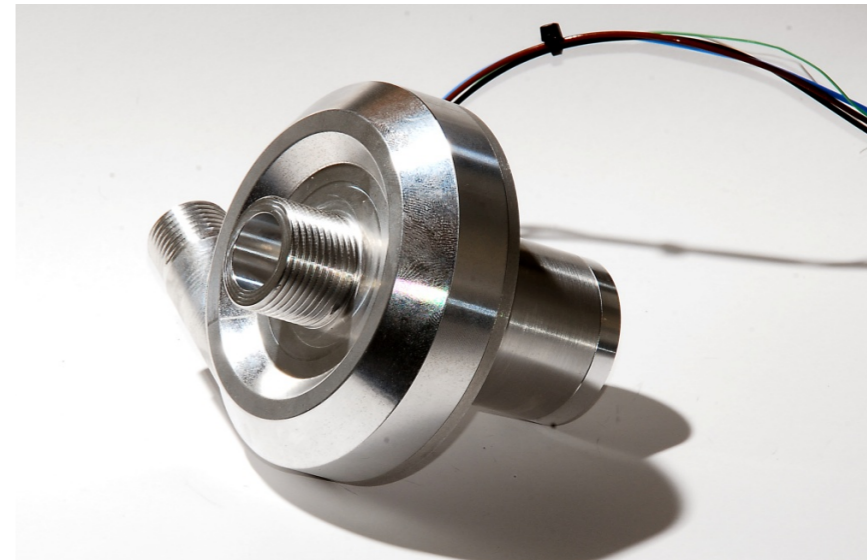
- **Heating power: 10 kW (th)**

- **oil free bearings**

- **size:**

- **length: 90 mm**

- **diameter: 40 mm / 90 mm**



Outlook

Next steps

- Prototyp of compressor has been built
- Measurements in 2011 determining COP and compressor performance map
- miniaturization of electronics

