

Counterflow Heat Recovery Fan

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FFG

Austrian
Research Promotion Agency

Existing Principle

Combination of Fan and Heat Exchanger

Principle:

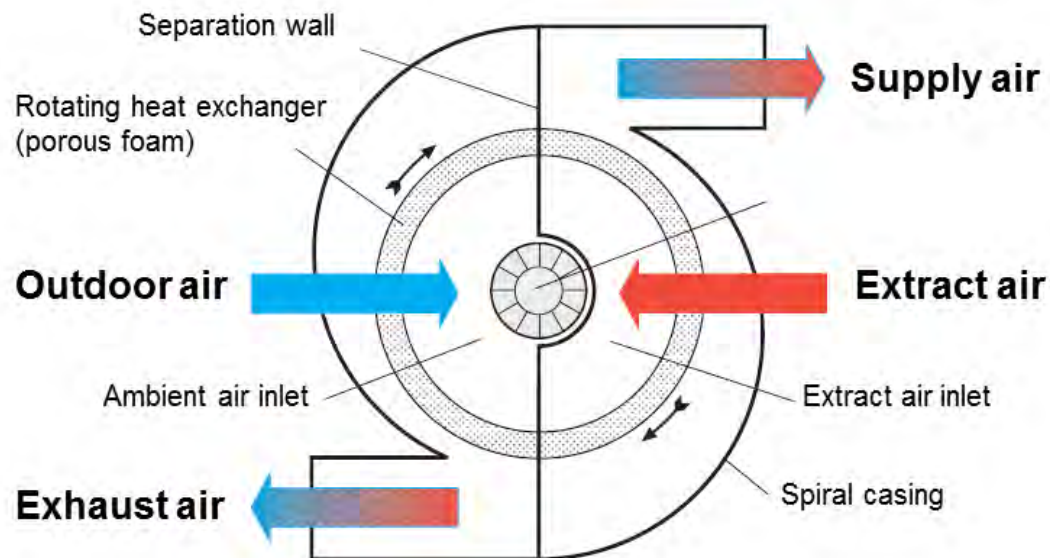
- rotating porous material for ventilation and heat recovery
- double spiral casing
- wall for separation of warm and cold air flow

Advantages:

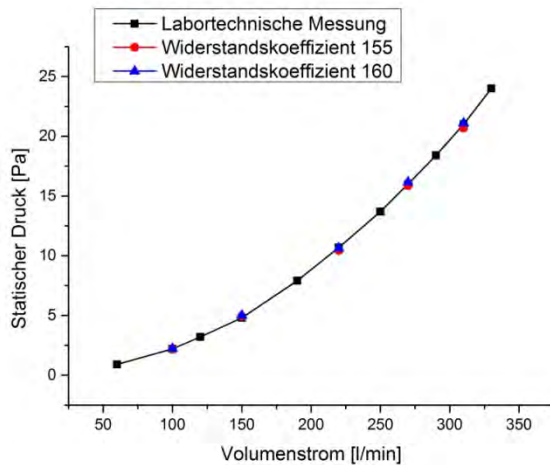
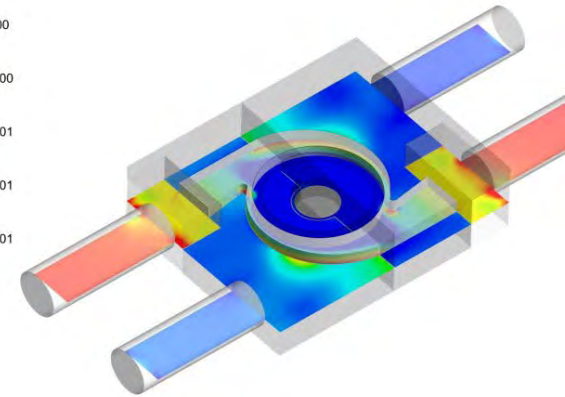
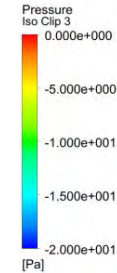
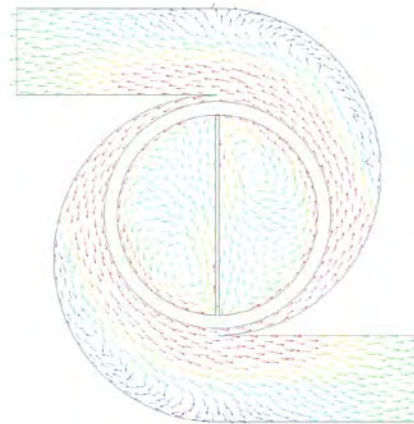
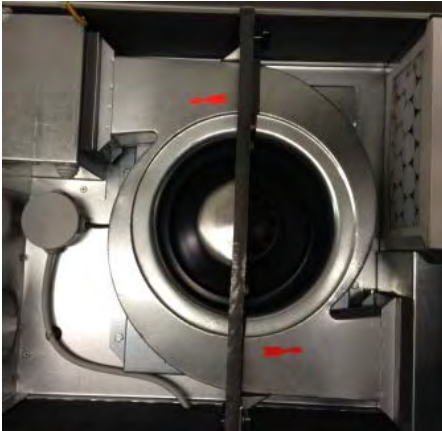
- cheap production
- compact design
- no frost protection needed
- humidity recovery

Disadvantages:

- low ventilation efficiency
- low heat recovery rate



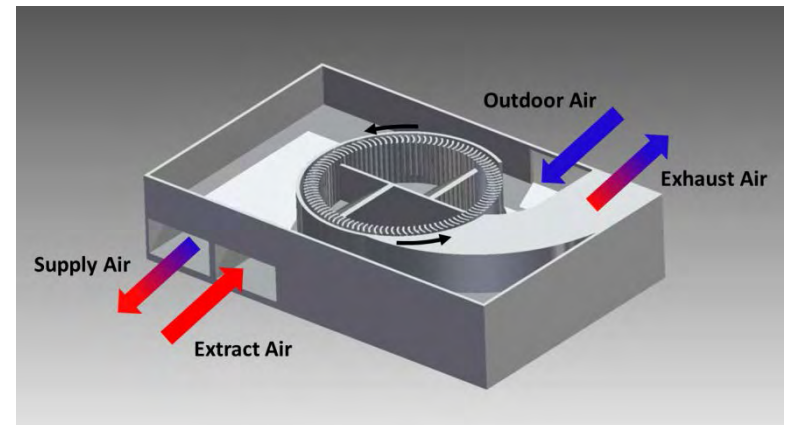
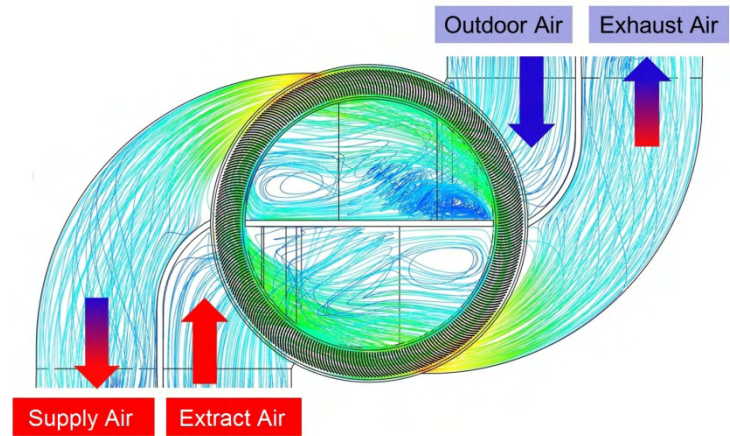
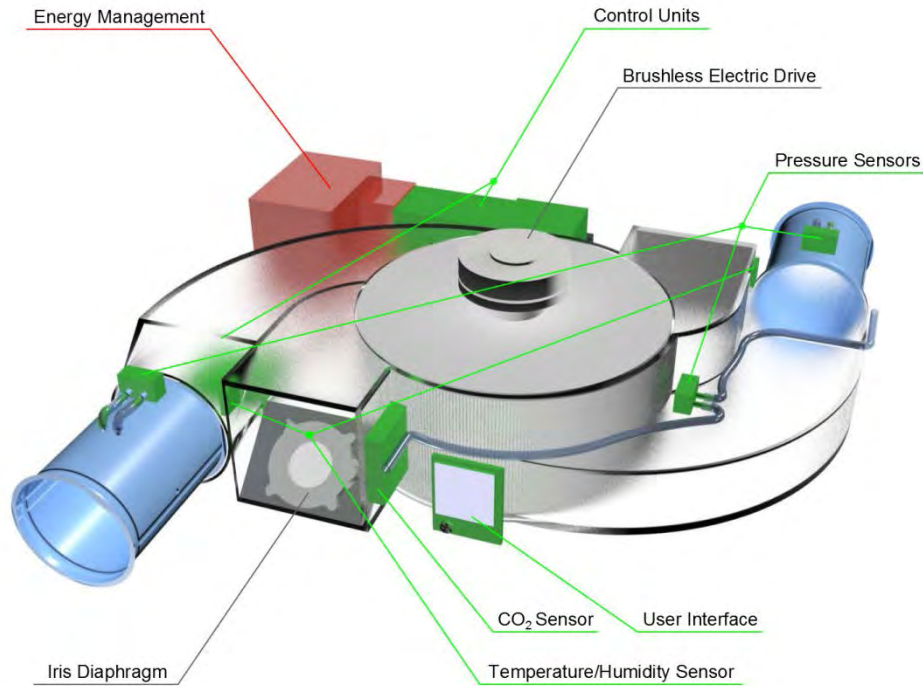
Measurement and Simulation of the existing system



	Messung	Simulation	Messung	Simulation
Betriebspunkt	Drehzahl [Hz]	Drehzahl [Hz]	Volumenstrom Fortluft [m³/h]	Volumenstrom Fortluft [m³/h]
Stufe 1	15,2	15,2	103	104,5
Stufe 2	19,7	19,7	136	137,8
Stufe 3	22	22	150	154,1

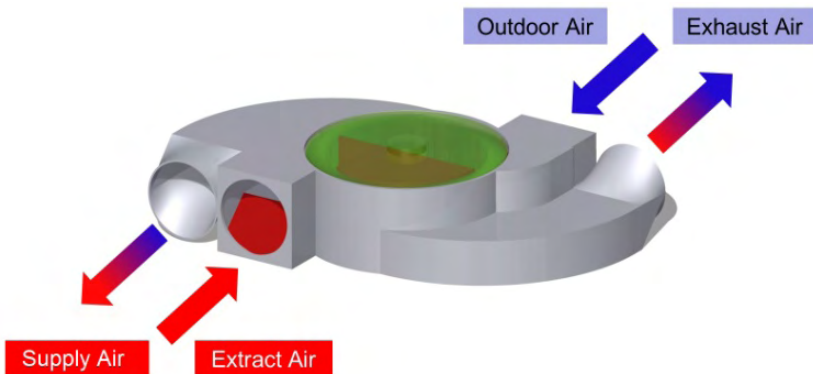
	Messung	Simulation	Messung	Simulation
Betriebspunkt	Drehzahl [Hz]	Drehzahl [Hz]	Statischer Druck Außenluft [Pa]	Statischer Druck Außenluft [Pa]
Stufe 1	15,2	15,2	-15,9	-15,6
Stufe 2	19,7	19,7	-27,2	-27,1
Stufe 3	22	22	-34	-33,8

Modified Concept

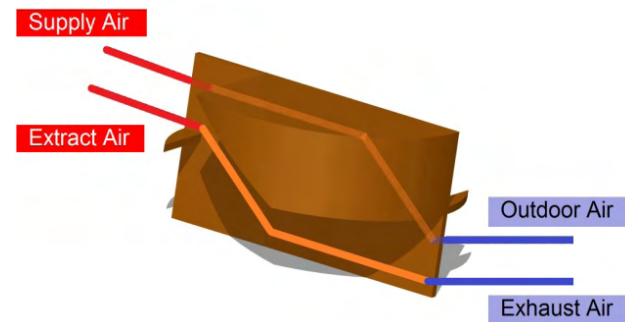


Flow Conduction of the Counterflow Heat Recovery Fan

CFD-model of the flow conduction



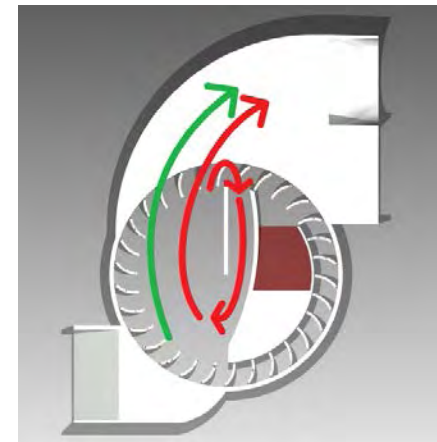
Interior part of the fan



First small scale prototype

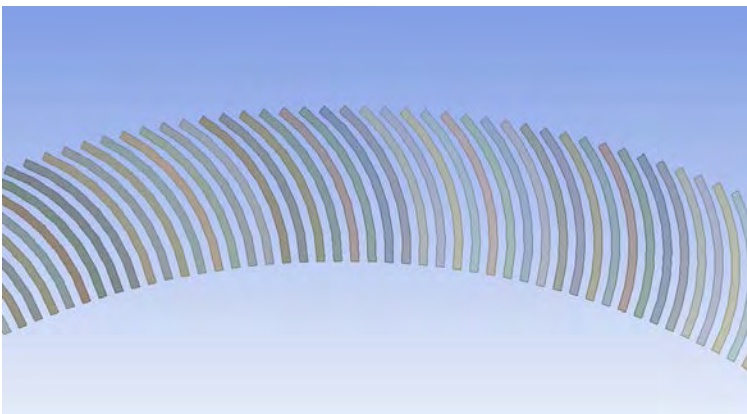


Flushing chambers



Rotor Concepts

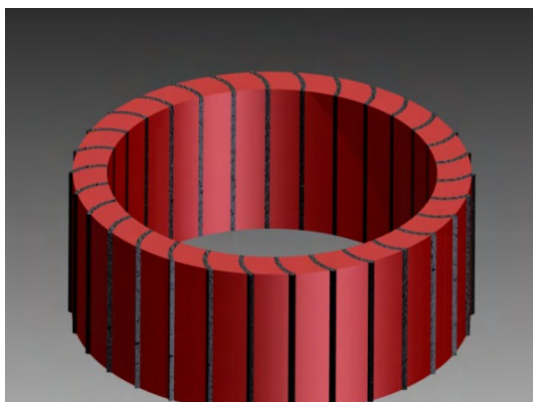
Rotor with numerous fan blades



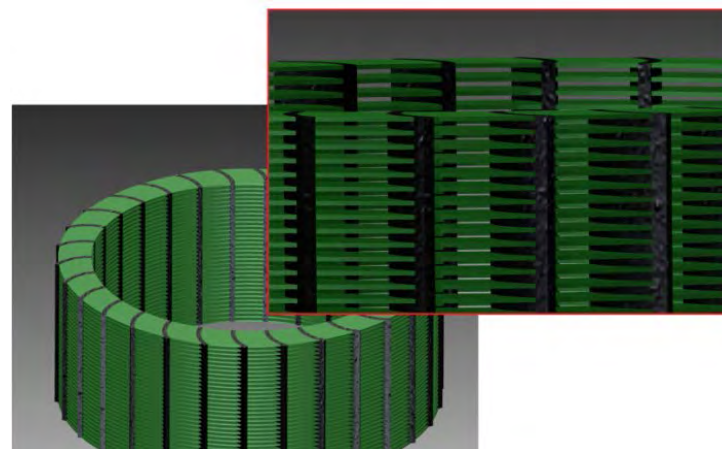
Rejuvenation along the fan blades



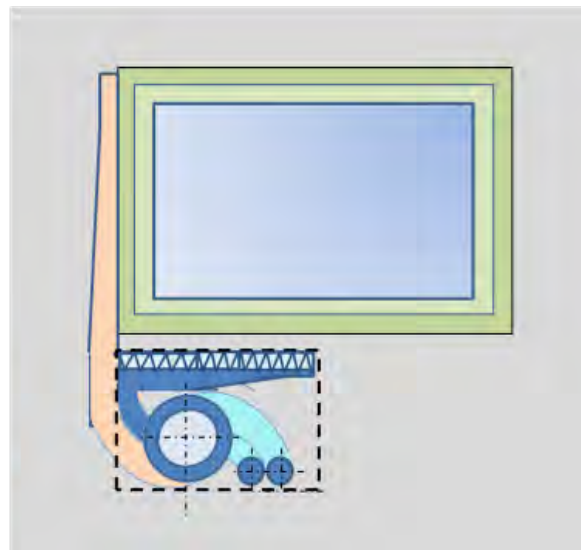
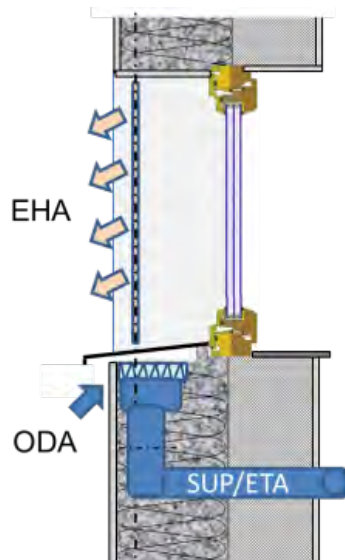
Rotor with implemented porous foam



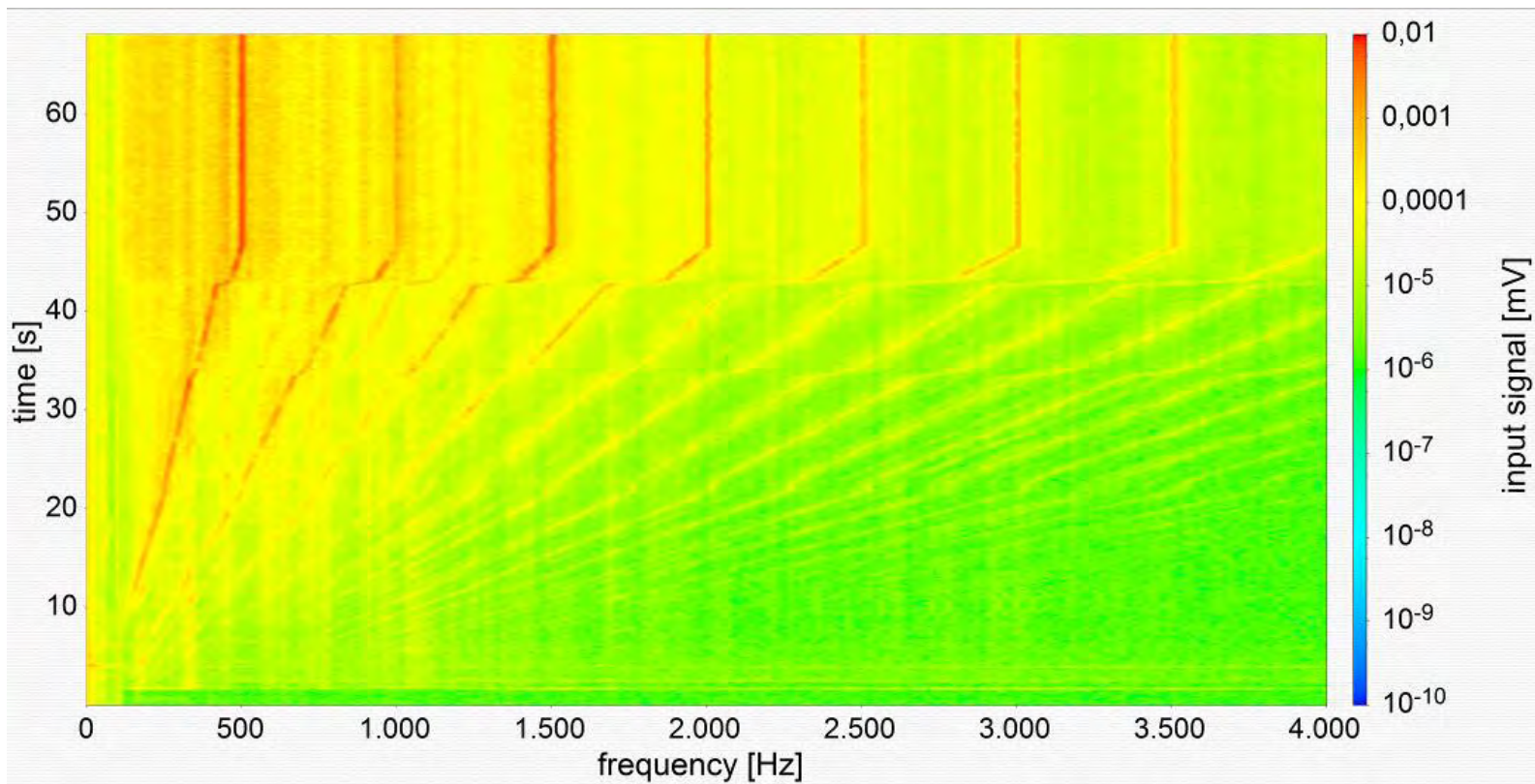
Rotor with implemented horizontal layers



Laboratory prototype and installation concept

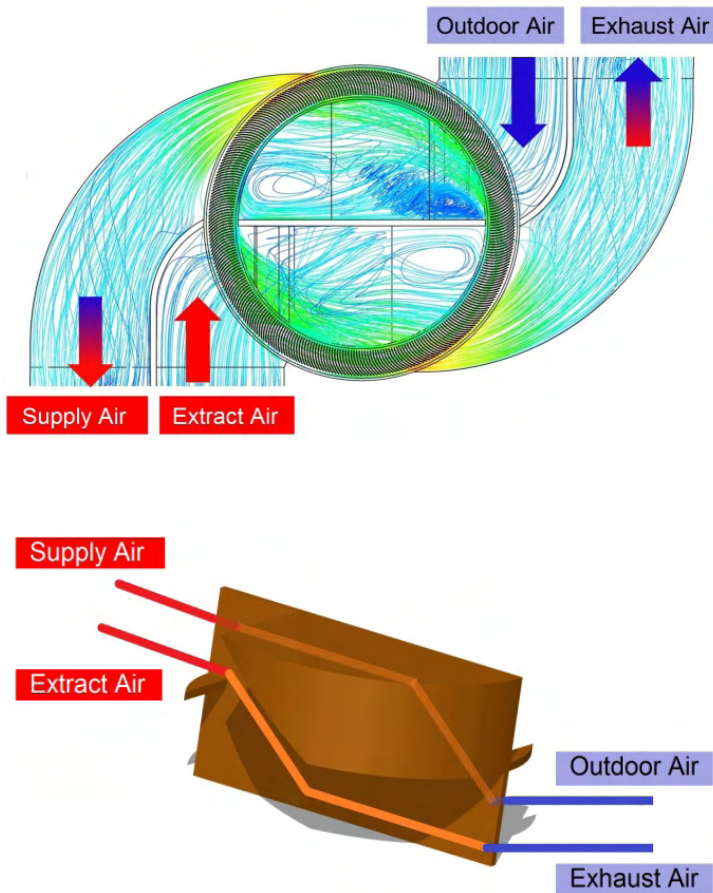


Acoustic Measurements

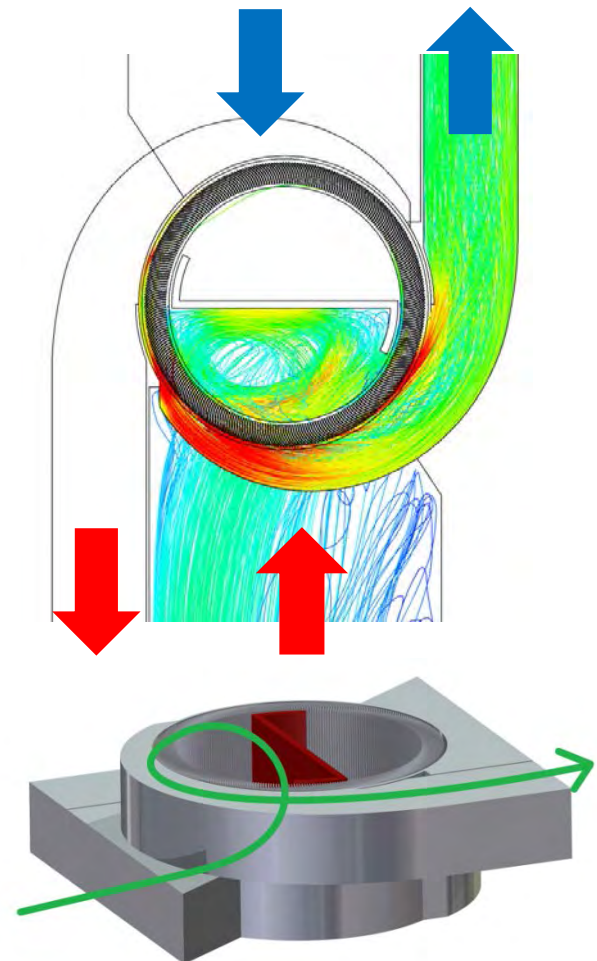


Concept of the modified CHRF

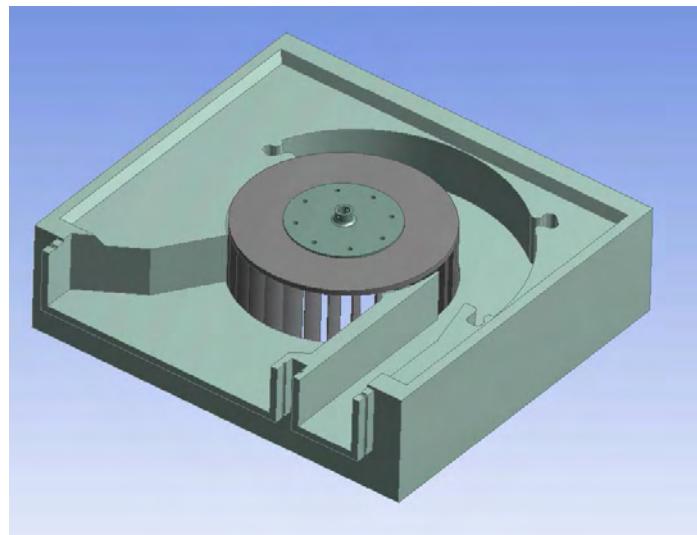
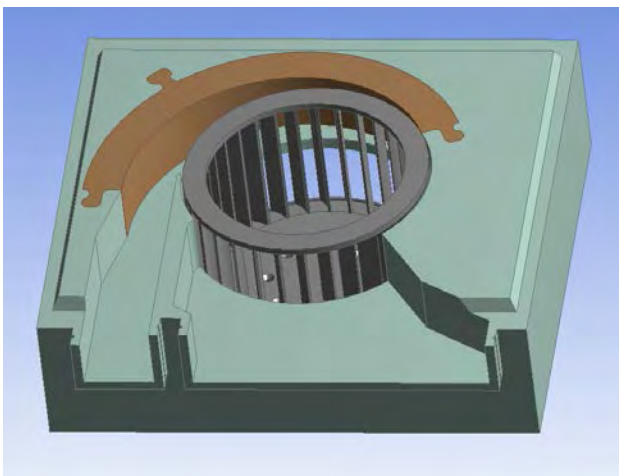
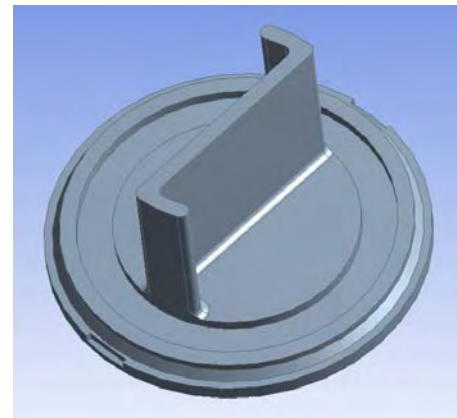
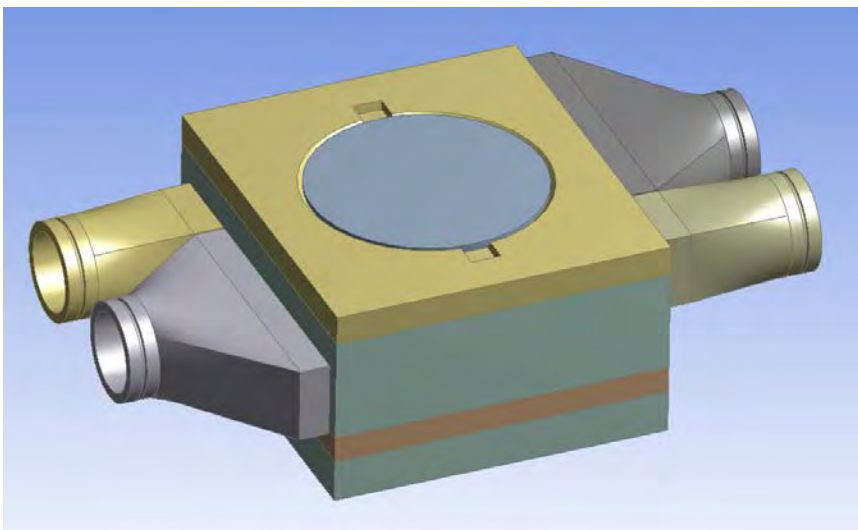
First CHRF Concept



Modified CHRF Concept

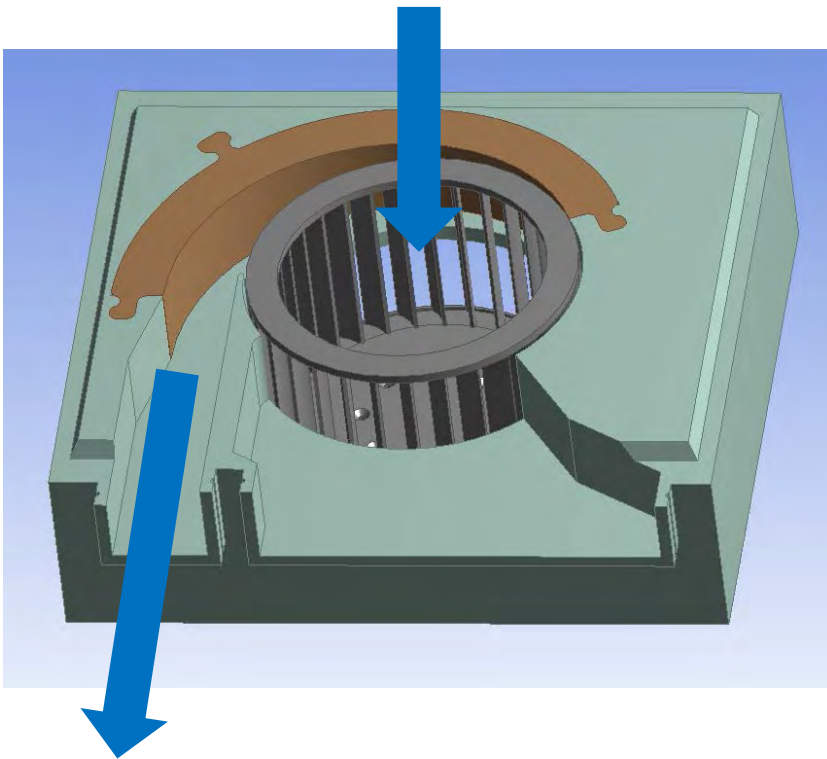


CAD of the new laboratory prototype



Concept for Ventilative Cooling

Outdoor air intake axially



The “**cross flow fan**” can be used as **radial fan**

Advantages

The entire fan area can be used for cooling mode
High flow rates
Energy efficient ventilation

Challenges to solve for the cooling mode

Removal of the inner part
Removal of the heat recovery unit
(foam or horizontal layers)
Flow conduction for axial outdoor air intake

Simulation results and potential of the CHRf

Single Room Unit

dimensions	350x400x200 mm
fan diameter	190 mm
rotational speed	15 Hz
ext. pressure drop	100 Pa (at 50 m ³ /h)

Heat recovery mode

flow rates	30-60 m ³ /h
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Cooling mode

flow rates	150-250 m ³ /h
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Cooling potential

Radial Fan – e.g. Ebm G4E180-FS11-01

diameter	180 mm
flow rate	820 m ³ /h
ext. Pressure drop	90 Pa
power consumption	140 W
spec. consumption	0,17 W/(m ³ /h)

Potential and Outlook

- The geometry of the CHRf can be optimized for the cooling mode to increase the flow rates.
- Through axial outdoor intake, the fan can be used as efficient radial fan with large diameter.
- For the cooling mode the rotational speed and thus the flow rates can be further increased.
- Technical issues for the bypass and the opening/closing of in-/outlets for the cooling mode must be worked out.

Thank you for your attention

Counterflow Heat Recovery Fan – Heat X Fan

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