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THE 25th IIR INTERNATIONAL CONGRESS OF REFRIGERATION
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ACOUSTIC EMISSIONS AND NOISE ABATEMENT OF AIR TO WATER HEAT PUMPS // PART2

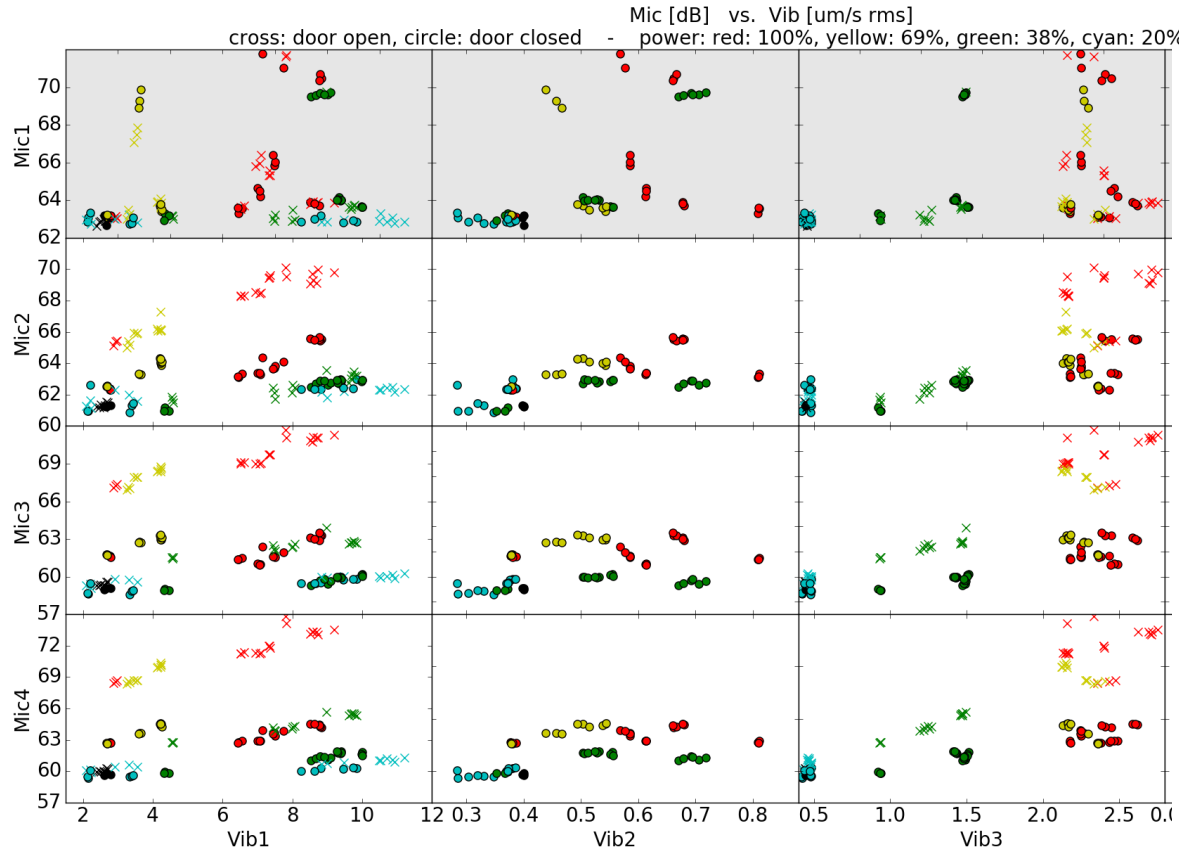
Acoustic Signatures of Heat Pumps
IEA HPT Annex 51

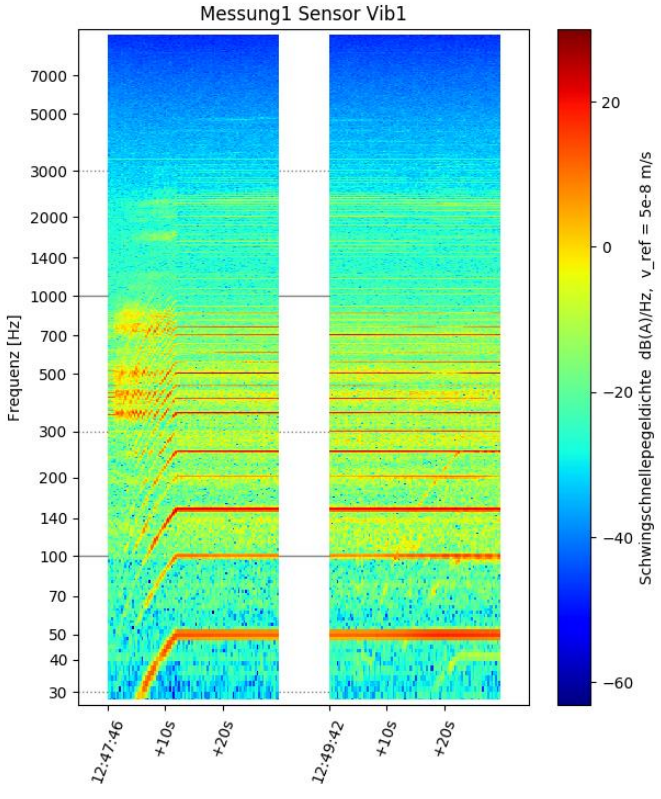
Acoustics of Heat Pumps

Workshop, 29.08.2019

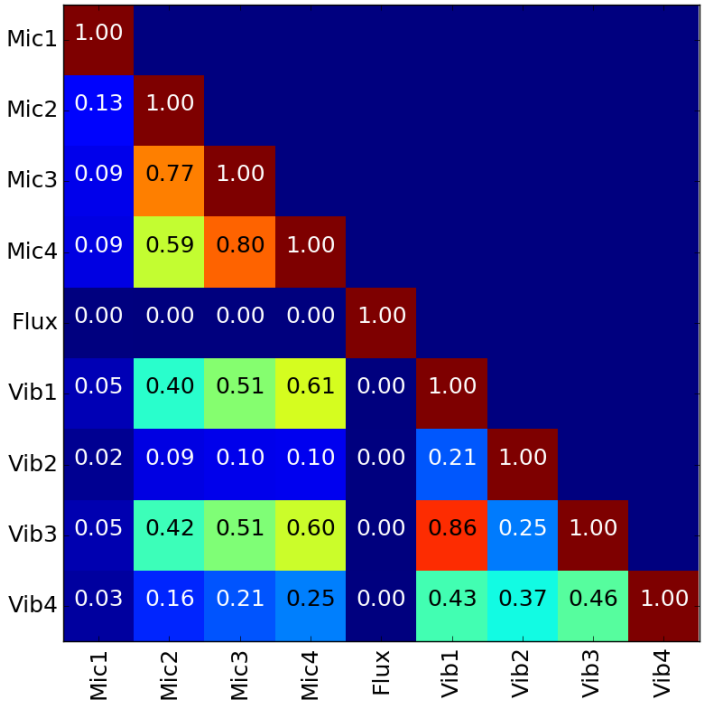
Christoph Reichl, Peter Wimberger, Felix Linhardt, Johann Emhofer

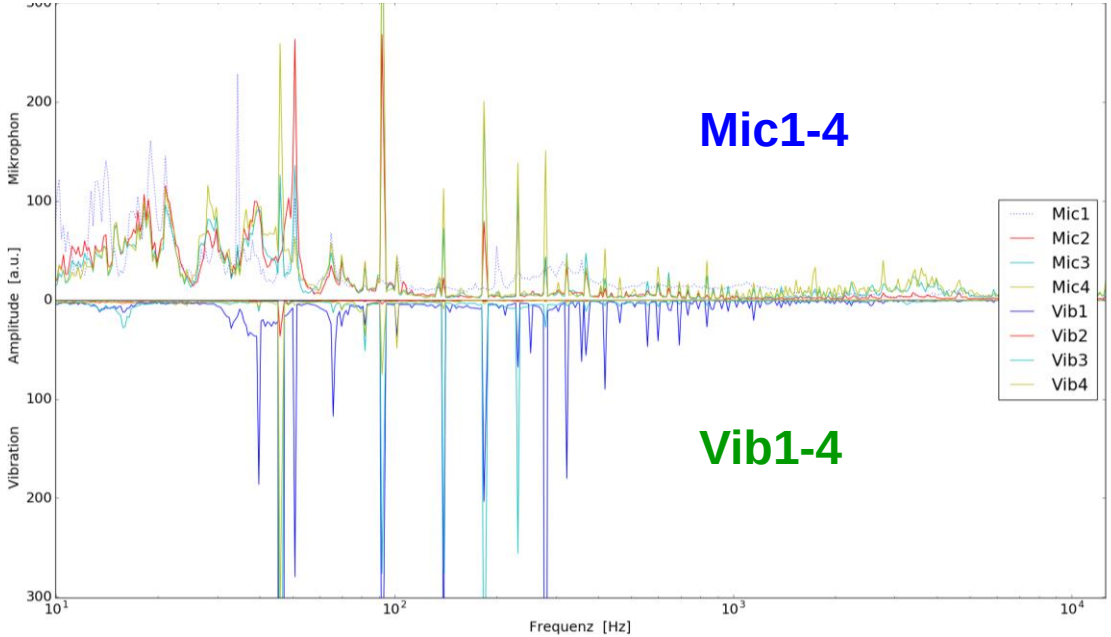
CORRELATED ACOUSTICS – VIBRATION & FLOW





CORRELATED ACOUSTICS – VIBRATION & FLOW



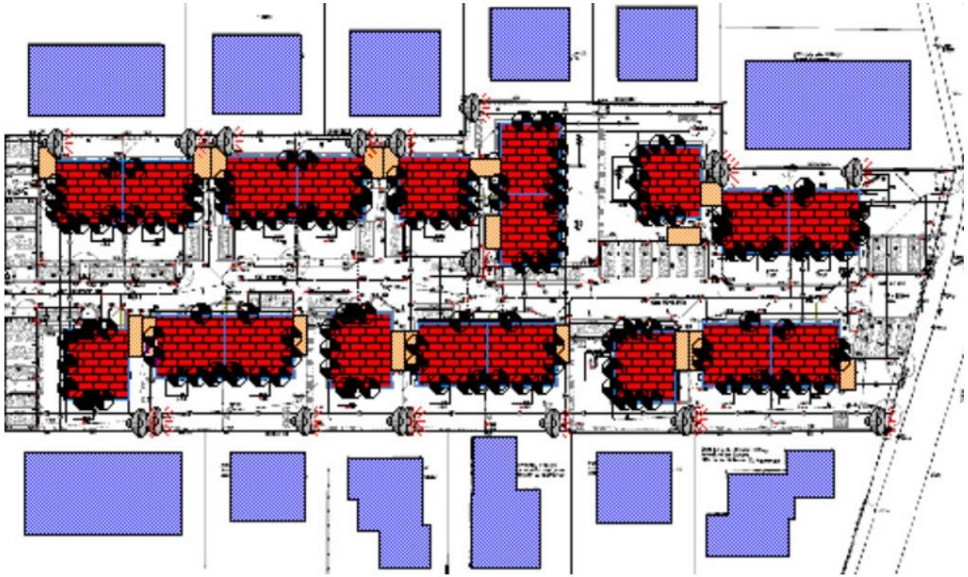


NUMERICAL METHODS – NOISE PROPAGATION SIMULATION

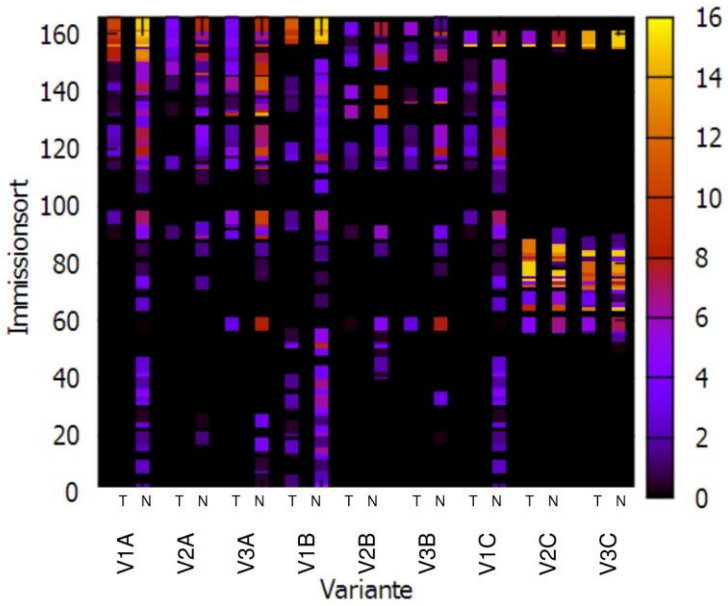
Immission recording at window faces

NUMERICAL METHODS – NOISE PROPAGATION SIMULATION

Heat pump placement



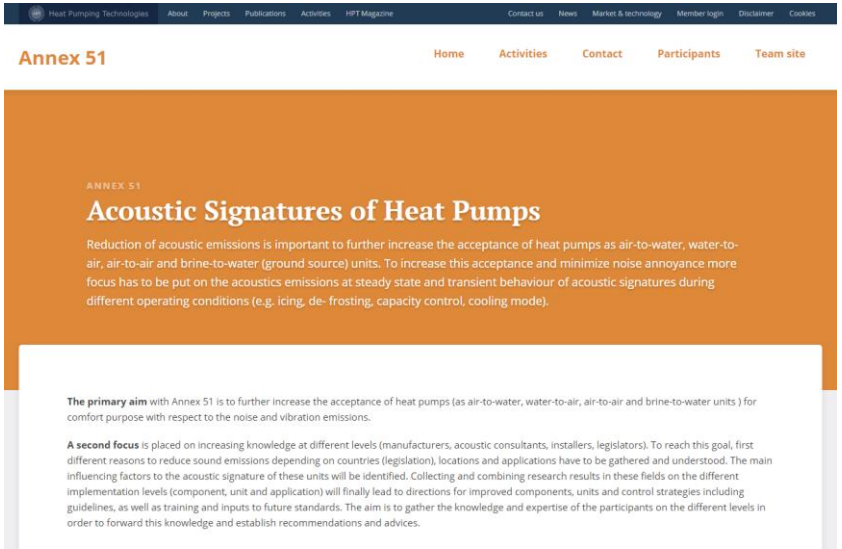
penalty point analysis



RESULTS

	Measure	Mechanism	Influence of SPL
	Constructive measures		
1	Compressor encapsulation	Extremely important, if compressor is in the outer unit	-
2	Insulation of compressor against structure born noise		-
2a	Insulation of compressor against airborne noise	Mounting of a compressor cover	reduction: <1 dB(A)
3	Insulation of fan against structure born noise	Reduced transmission of structure born noise to case and channels	-
4	Improvement of flow field in vicinity of fan	Diffusor	reduction: 2 dB(A)
4	Sound absorbing channel insulation	Insulation material	reduction: <4 dB(A) at maximum fan rotation
6	Angled channel deflection including additional lining	Channel deflection used as sound absorber; channel dimensions should be large; optimal sound radiation to the top	reduction: 2 dB(A)
7a	Absorption sound absorber	deflection coulisse sound absorber	reduction: 2.5 dB(A)
7b	Absorption sound absorber	deflection	reduction: 2.5 dB(A)
8	Avoidance of channel resonance	Coordination of length and cross section of channels	-
9	Guiding vanes in bends and elbows	Reduced turbulences and reduced pressure drop	-
	Component specific measures		
10	Low-noise compressor	Noise reduction of source	-
11	Low-noise fan	Reduction of fan noise	reduction: 8 dB(A)
12	Sound deadening of fan blades	Reduced structure born-noise emission of the fan blades	see 11
13	Optimization of operating points of fan	Reduction of fan noise because of improved flow conditions	see 4
14	Optimization of evaporator	Reduction of pressure drop of the evaporator r	Dependent on fan characteristics (e.g. 5 dB(A) when dividing pressure drop by a factor of 2)
15	Anti-ice coatings	Delay of frosting onset; change of defrosting behavior of evaporator	No change in SPL
	Control measures		
16	Optimization of fan rotation speed	Simple fan rotation speed reduction using different wiring or use of resistances	Dependent on fan characteristics (e.g..: 5 dB(A) when reducing fan speed by 100 rpm)
17	Optimization of control	Less on/off switching operations und reduced operating time in the night; part load operation in the night.	Using A2W35 und night setback (12h): 10 dB(A), day: +4.5 dB(A)
18	Defrosting strategies	Changed frost accumulation behavior	Noise level of defrosting smaller than standard noise level

DOWNLOAD OF FINAL REPORT OF SILENTAIRHP



https://heatpumpingtechnologies.org/annex51/

The official final report will be linked there …

SUMMARY AND OUTLOOK

EXPERIMENTAL METHODS
Dome, Beamforming, Correlations

NUMERICAL METHODS
Noise Propagation, 1D heat pump models

RESULTS
list of measures, mechanisms and influence on sound power level

DOWNLOAD
full report via the Annex 51 website soon

ACKNOWLEDGEMENTS

The work on “IEA HPT Annex 51” is financially supported within the framework of the “IEA Research Cooperation”, the project "SilentAirHP" within the framework of the "Klima Energy Fonds" on behalf of the “Austrian Federal Ministry for Transport, Innovation and Technology”.

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and Technology

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IEA RESEARCH COOPERATION

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THANK YOU!

Christoph Reichl
for the SilentAirHP team

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Acoustics of Heat Pumps

Workshop, August, 29th 2019

Montréal, Québec, Canada

8:30 – 10:10

WORKSHOP PROGRAM

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AIT AUSTRIAN INSTITUTE OF TECHNOLOGY

- Acoustic Signatures of Heat Pumps in the framework of the International, Energy Agency Technology Collaboration Programme on Heat Pumping Technologies (IEA HPT TCP)
- Acoustic Regulations of Heat Pumps
- 1D modelling of heat pumps including acoustics
- Simultaneous energy efficiency and acoustic evaluation of heat pump systems using dynamic simulation models
- Acoustic Emissions and Noise Abatement of Air to Water Heat Pumps
- Testing campaign on the energetical and acoustical behaviour of a heat pump
- Heat pump noise – operation dependence and seasonal averaging
- Panel Discussion

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THANK YOU!

The „Acoustic of Heat Pumps“ Workshop team