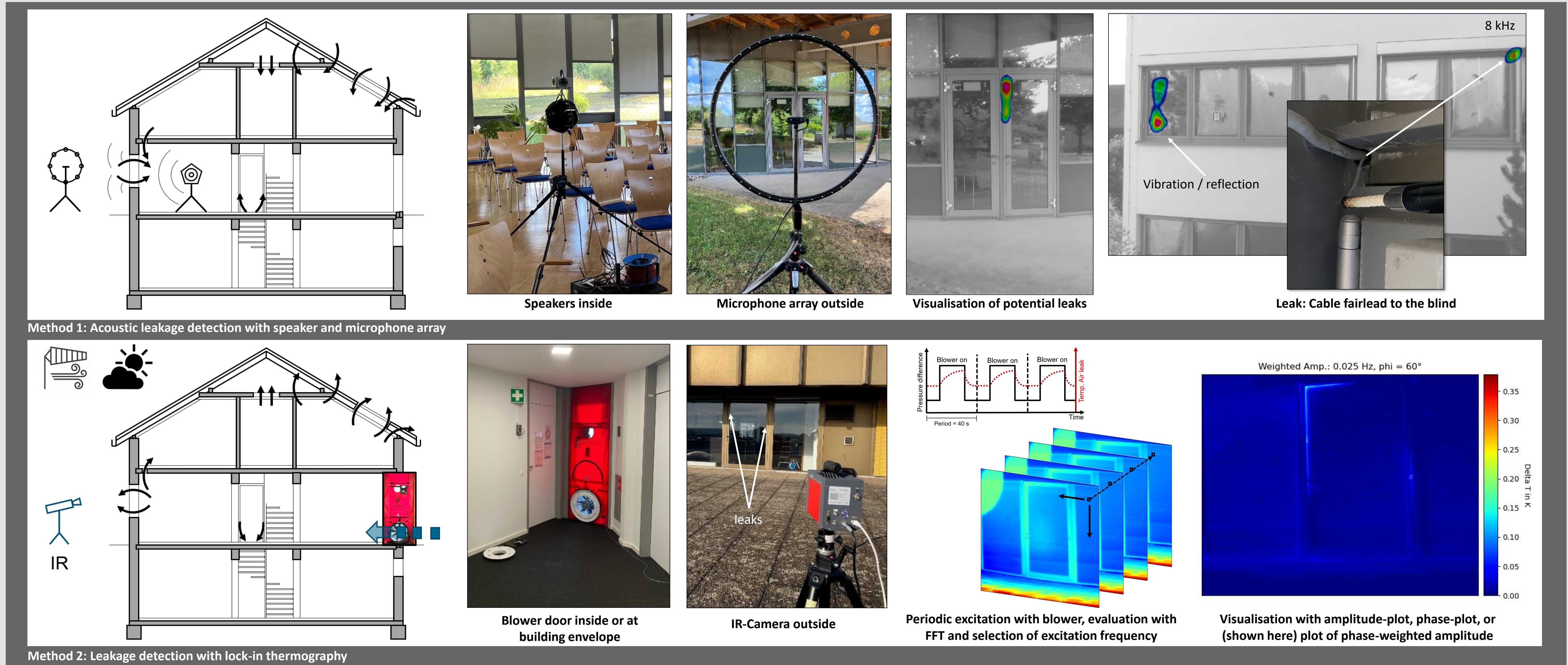


Locating Air Leakages in Building Envelopes – Acoustic Camera and Lock-in Thermography Air Leak Detection

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Motivation

- The **building sector** is responsible for a significant proportion of Germany's energy consumption and greenhouse gas emissions
- Unintentional air exchange** through the building envelope accounts for approx. 30-50% of heating and cooling energy → 32-54 m. t CO₂ p. a. in 19 m. German residential buildings
- Blower Door** testing is an established and standardized method of determining integral airtightness. However, **quantifying and identifying** individual leaks using this method is difficult and time-consuming. It also depends heavily on the experience of the energy consultant.

Goals

- Development of new measurement methods that significantly **simplify the detection, location and assessment of leaks** in the building envelope
- Provide a **quicker assessment** of the condition of a building for the refurbishment
- Provide a **tool** for
 - quality assurance of workmanship in new buildings,
 - assessing refurbishment needs** and
 - quality control** of existing building refurbishments

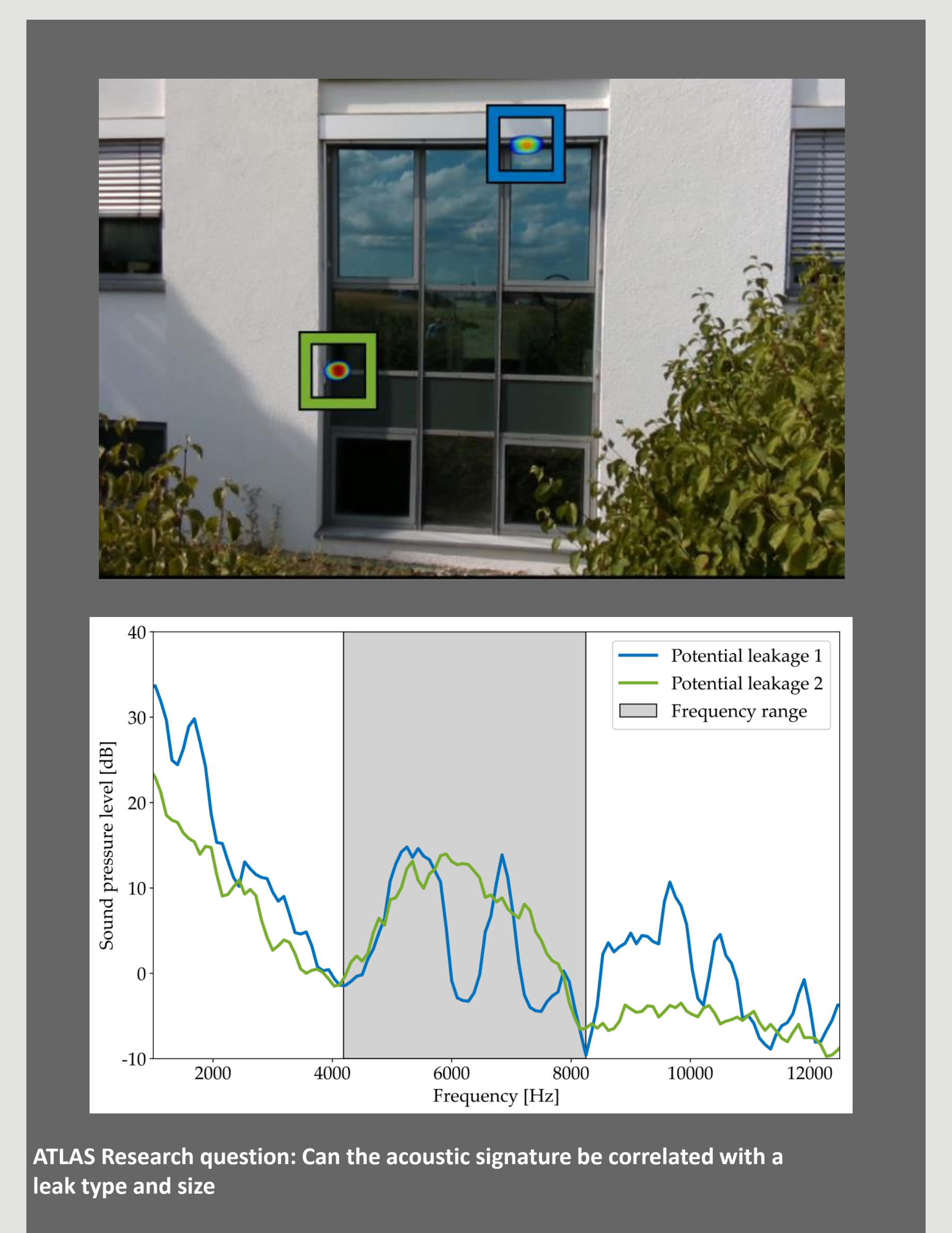
Papers

- Kölsch, Pernpeintner, Schiricke, Lüpfer: „Air leakage detection in building façades by combining lock-in thermography with blower excitation”
- Schiricke, Diel, Kölsch: “Field Testing of an Acoustic Method for Locating Air Leakages in Building Envelopes”



DLR Patents

- Lock-in thermography: DE 10 2022 102 824 B3
- Acoustic-thermal method: DE 10 2023 100 701 B3



ATLAS – Experimental Setup

- Accessible airtight test facility
- Residual leakage: 0,1 m³/h @ 50 Pa
- Two pressure frames for test specimens of different sizes
- BlowerDoor MiniFan with Micro Leakage Meter (MLM) for measurement of leak sizes (volume flow at given pressure)
- Internal space for speakers and heating
- External space for acoustic camera and IR camera

ATLAS – Research Questions

- How do the measurement systems react to various types of leaks (different leakage paths, leakage sizes, materials etc.)?
- Which are the influencing factors of the measurement configuration on the detectability and localization of various leaks (viewing angles and distances, pressure differences, etc.)?
- What is the role of different spectral ranges (audible to ultrasonic range, narrow or broadband, etc.) and the optimum loudspeaker signals (noise, frequency sweeps, music)?
- Can the acoustic signature be correlated with different leak types and sizes?
- What are optimal excitation parameters for lock-in thermography? How robust is lock-In thermography with regards to external disturbances like wind, changing irradiance, changing radiation environment?
- Are there other algorithms (e.g. machine learning) that could be used to evaluate a combined thermography and fan measurement system?

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