Sound Visualization with an Acoustic Camera

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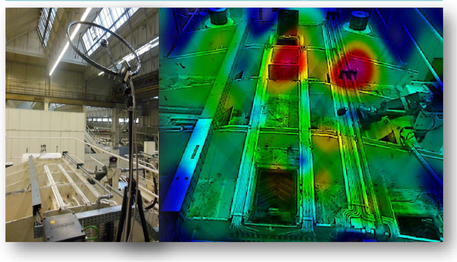
Motivation

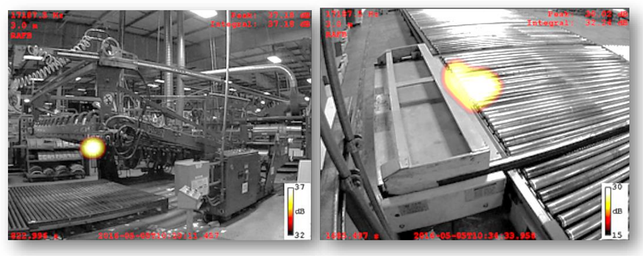
- Current solution for sound pressure measurements: SPL meters (point by point).
- Acoustic cameras enable us to "see" sound, i.e. to analyze entire areas at once & characterize unknown sources.

Diagnosis without dismantling



Source: The Acoustic Camera as a tool for machinery maintenance (Böck, 2015).

Compressed air leak detection



Source: Optinav

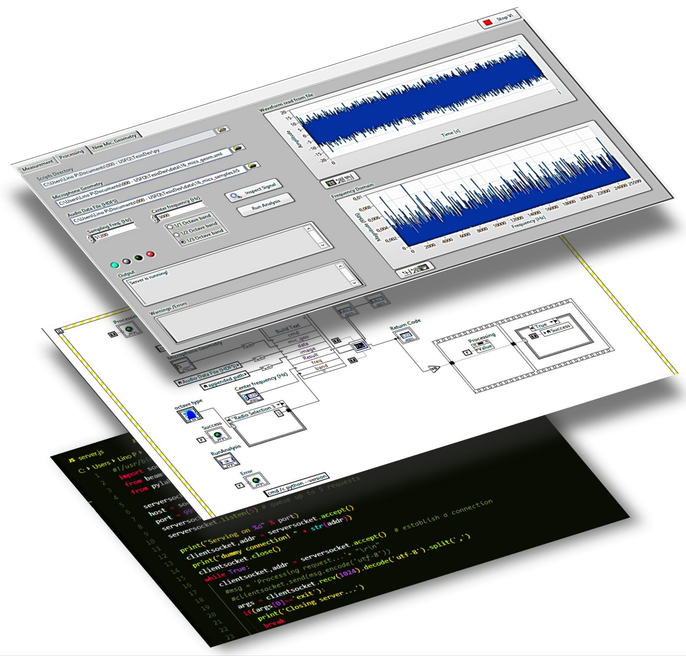
Hardware Components

Microphone Array

Data Acquisiton Card

NI cDAQ 9178

Software Layers



User Interface

LabView 2017

Processing

Python server + Acoular Beamforming library v19.01

Results

Single Sound source (White Noise)

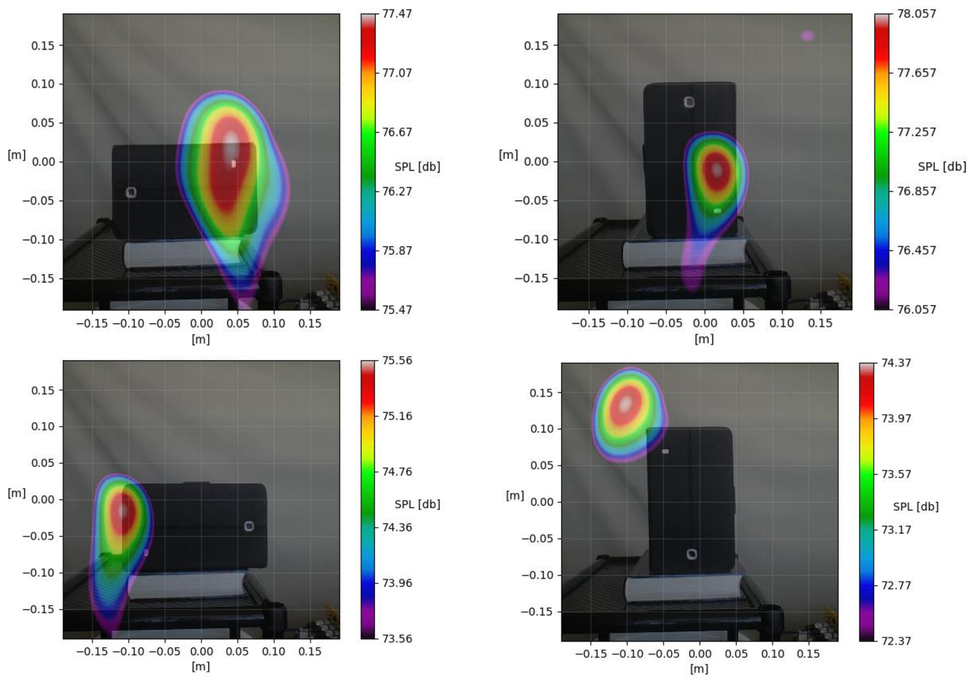


Figure 1. Resulting acoustic maps for single sound source test.
(Distance: 0.5 m, Freq. Range: 3000- 5000 Hz)

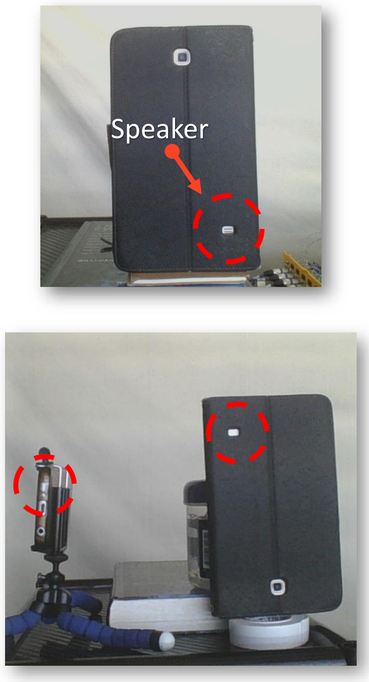


Figure 2. Single and double sound source test setup.

Two sound sources (White Noise)

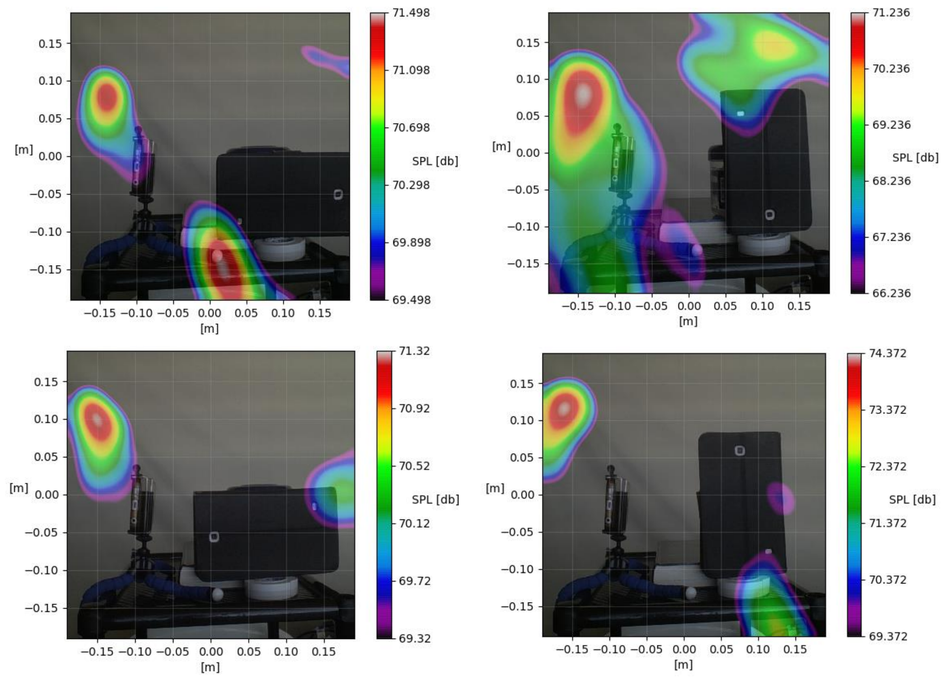


Figure 3. Resulting acoustic maps for double sound source test.
(Distance: 0.5 m, Freq. Range: 3000- 5000 Hz)

Conclusions

- The current prototype allows to locate and characterize sound sources, albeit in a narrow frequency range (2.8 to 6 kHz), and with a visible spatial error.
- The device works best at a distance between 0.5 and 0.8 meters of the analyzed object/scenario.
- Ease of use has been achieved. It is posible to record the signals, take the picture & generate the acoustic map with 1 click.

Room for improvement

- A higher 'unique intra-sensor spacing ratio' (F parameter) in the array would lower spatial aliasing effects thus expanding the working frequency range of the device. (current F parameter is 0.2, the ideal is 1).
- Ensure the correct alignment of microphones and camera. Discrepancies between the sensor positions passed to the program and the actual positions can greatly affect results.

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