APPLICATION NOTE

2D Outdoor Measurement

THE ACOUSTIC CAMERA FOR ENVIRONMENTAL NOISE ANALYSIS AND HEAVY EQUIPMENT

CHALLENGE

The energy company Vattenfall Europe Wärme AG introduced noise reduction measures to their power plants in Berlin. Before taking action against noise pollution, the loudest noise sources needed to be identified. After the implementation of acoustic treatments, their effectiveness needed to be analyzed.

SOLUTION

The Acoustic Camera as a mobile system allows high flexibility for outdoor measurements. All measurements can be conducted during machine operation. After localizing the sound sources, changes can be designed and implemented to reduce the noise pollution. The measurements using the Acoustic Camera validated the effectiveness of the noise reduction treatments on the vents. As a contribution to a cleaner environment with minimal noise impact, Vattenfall is integrating the Acoustic Camera in a comprehensive long-term measurement campaign.

BENEFITS

- Fast and easy set-up
- No expensive machine down-time
- Big measurement distance
- Mobile system for flexible measurement positions
- Spectral analysis for efficiency check

MEASUREMENT

Measurement Object	Vents of steam turbine transformers
Microphone Array	Star48 AC Pro
Software	NoiseImage 4
	Acoustic Photo 2D
	Recorder
	Spectral Photo
	Advanced Algorithms
Data Acquisition	Data Recorder mcdRec

Within a couple of months, two measurements were conducted. The Acoustic Camera was set up across the vent deck on an oil tank at a height of 23 m. Both times, the Star array was put at the same spot at a distance of 25 m to the objects of interest. Both measurements were conducted during operation of the vents. In the first measurement, the noise sources were analyzed. In the second measurement, the effectiveness of the noise reduction treatments was analyzed.

RESULT

In the first session, the loudest noise sources on the vents were identified. The results showed that the area around the middle vent produced the highest noise level, as seen in the Acoustic Photo in Fig. 1 on the left. Based on the analysis results, the appropriate noise reduction methods could be implemented. The loudest vent was equipped with a converter which allows for an adjustment of the rotation speed if necessary. In addition, the blowout of the middle vent was outfitted with damping material. The two other vents were damped from the outside.

The second measurement tested the effectiveness of the noise mitigation efforts. The right side of Fig. 1 shows the analysis result with the same scaling after implementing the changes. The overall sound pressure level was reduced by 7 dB, and the left vent was identified as the second loudest source.

In order to pinpoint the changes of sound pressure levels (SPL) within specific frequencies, a frequency-selective analysis was conducted. The result is a great tool to visualize changes in SPL. Various comparisons are shown in Fig. 2 – 5 (before on the left, after on the right) with an integration interval of one second in each calculation.

The introduction of the converter and the blowout on the middle vent resulted in a strong decrease in both the overall and frequency-specific sound pressure levels. The same measures could also be introduced to the other vents.

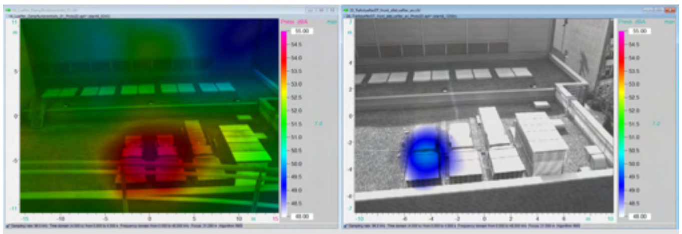

Fig. 1 *Overall result*

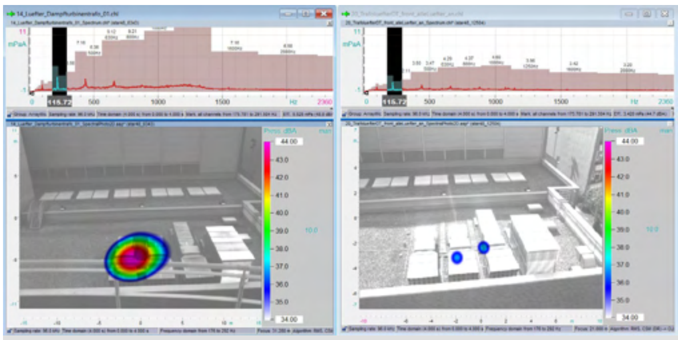

Fig. 2 *Spectral analysis for the third octave bands of the second peak in the spectrum*

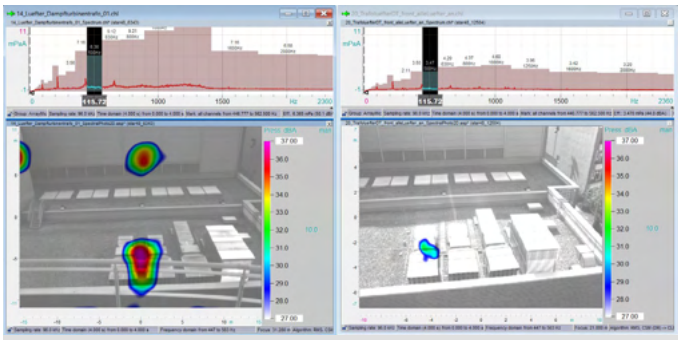

Fig. 3 *Spectral analysis for the third octave bands of 500 Hz*

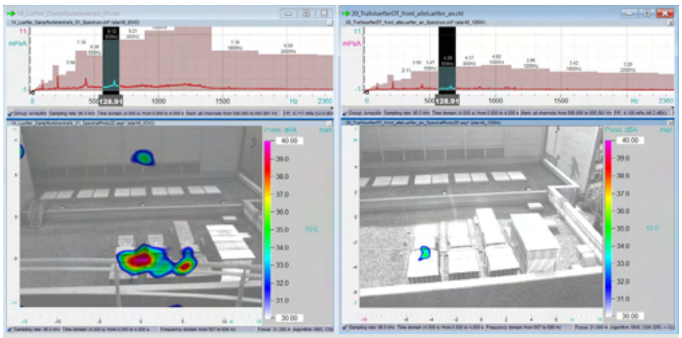

Fig. 4 *Spectral analysis for the third octave bands of 630 Hz*

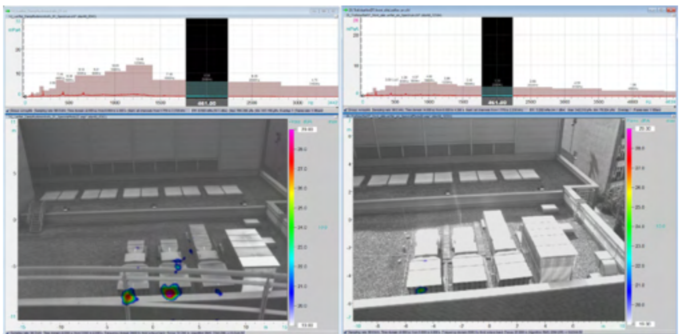

Fig. 5 *Spectral analysis for the third octave bands of 2 kHz*

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