



Fraunhofer
IPM

Remote gas detection

Gas leakage detection using laser spectroscopy

Sensitive · specific · cross-sensitivity-free

Gas leaks pose a safety risk to the gas infrastructure. Measuring technology by Fraunhofer IPM detects even minor gas leaks from distances of up to 15 meters.

The infrastructure for transporting natural gas is constantly being expanded and modernized. At present, the German gas pipeline grid covers more than 500,000 kilometers. At the same time, legal requirements for leak tightness are increasing. Fraunhofer IPM provides sensitive measurement technology for quantitative leak testing of gas infrastructure based on laser spectroscopy.

Gas leaks: Safety risk and unwanted emissions

Natural gas leaks pose a high safety risk to gas infrastructure. Apart from the safety issue, providers have an interest in limiting the environmental impact of unwanted gas emissions. This applies not only to the gas pipeline grid, but also to infrastructure in the oil and gas industry, or to biogas plants. Just like gas pipeline operators, they need powerful measuring systems for leakage testing that reliably and sensitively detect natural gas or certain process gases remotely.

Handheld measuring devices by Fraunhofer IPM are based on laser spectroscopy and

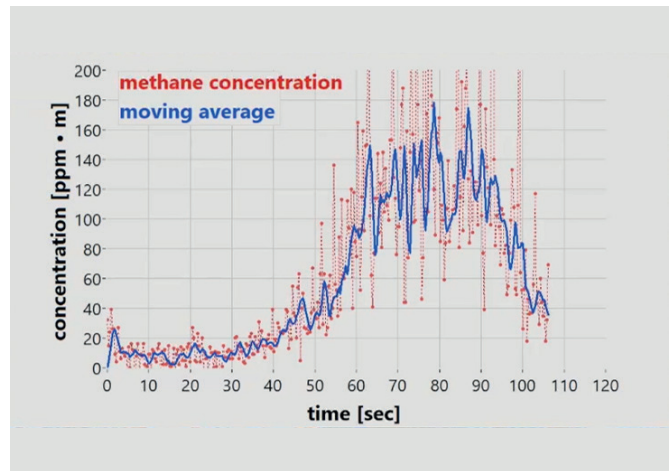
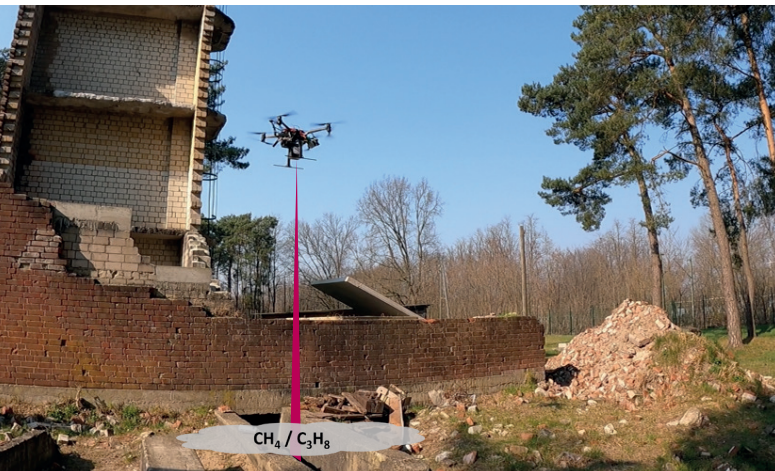
enable efficient and reliable leak testing and leak detection. Among other things, imaging gas cameras are used in which optics and image processing are adapted to the respective measurement task.

Laser wavelength adaptable to target gas

In developing the gas-specific cameras, we rely on extensive experience with laser spectroscopic measurement systems, data analysis and the use of thermal imaging cameras [1]. Our gas-specific leakage measurement systems are based on lasers of all wavelength ranges adapted to the respective target gas.

Advantages at a glance

- Contactless
- Sensitive
- No cross-sensitivities
- High accuracy
- Transferable to other applications and gases
- Mobile application: handheld, vehicle, airborne



As part of a research project, Fraunhofer IPM together with partners from research develops an airborne system for remote gas detection. It is intended for use over collapsed infrastructure in order to warn rescue workers of potentially explosive areas.

CH₄ concentration readings from an artificial leak (1000 ml/min) during a flyover (left image)

Leak detection in industrial processes

In addition to methane in natural gas detection, the devices can thus also be used for gas detection in industrial processes. For example, in leakage testing for the transport and storage of ammonia, or in the packaging and food industry where the inert gas atmosphere during storage or packaging of foodstuffs has to be monitored.

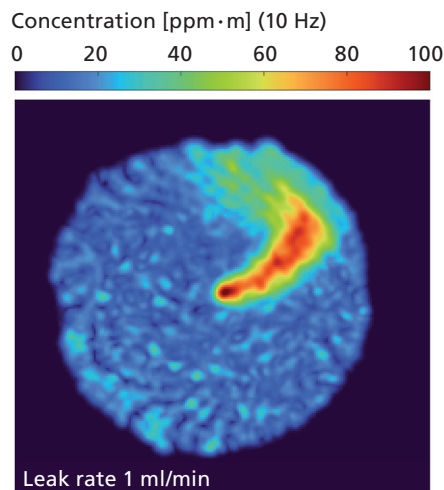
Our leakage measurement systems for remote detection are available as hand-held systems but can also be used on mobile platforms, especially vehicles. In an ongoing project, we are developing a leakage measurement system for use on a drone.

Publication

[1] Thomas Strahl, Johannes Herbst, Armin Lambrecht, Eric Maier, Jonas Steinebrunner, and Jürgen Wöllenstein, "Methane leak detection by tunable laser spectroscopy and mid-infrared imaging," *Appl. Opt.* **60**, C68-C75 (2021)

Technical specifications

Technology	Semiconductor laser for NIR or MIR wavelength range
Measurement method	Direct absorption spectroscopy of backscattered laser light
Sensitivity	1 ppm · m
Range	Up to 15 m
Setup	Hand-held or airborne, battery powered



Gas plume from an artificial gas leak (1 ml/min CH₄) imaged by a laser-based gas camera

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