Compact OEM TDLS based gas sensor module for trace gas detection in exhaled breath

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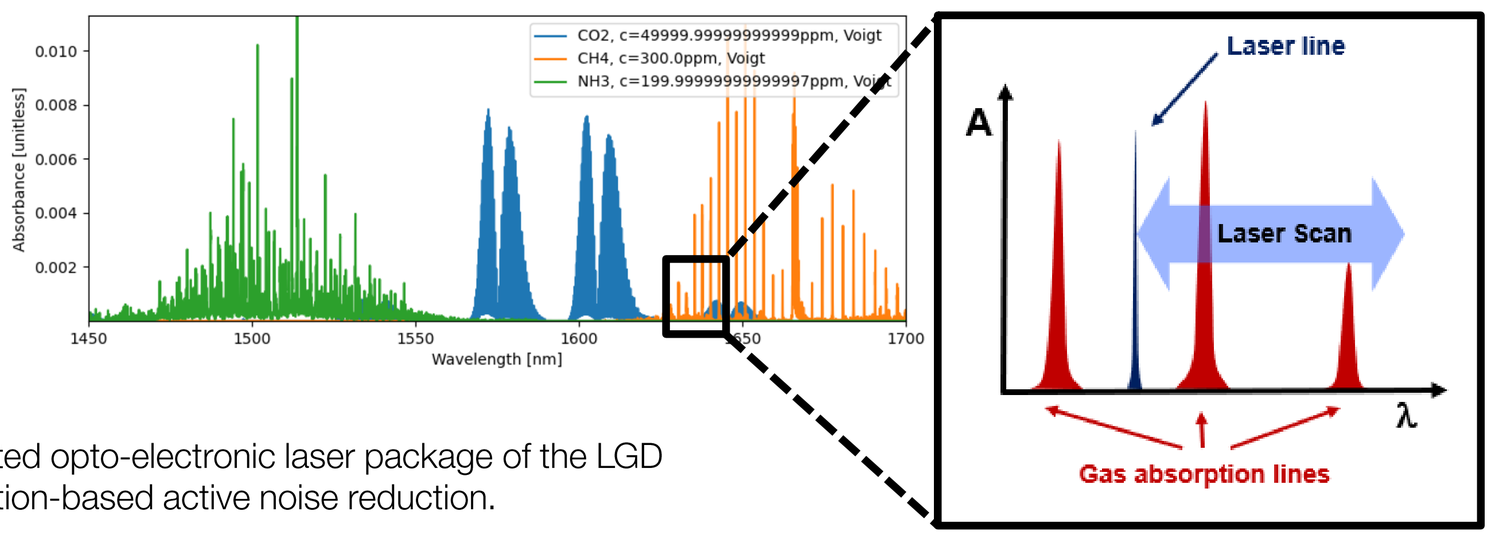
Abstract

Axetris presents the new TDLS-based platform “LGD Compact”. This sensor module is specifically designed for OEM customers with applications where real-time measurement and low detection limits matter, like for medical breath analysis. Several gases like CH4, NH3, CO and CO2 can be detected by near-IR laser spectroscopy in an unmatched cost-performance ratio. Further planned developments that advance into the mid-IR area enable the detection of gases such as C2H4, C2H6 and C2H4O.
The sensing module comprises a small gas cell volume for fast T_{90} time of less than 15s (at flow rates of 0.3 l/min) and detection limits in the sub ppm region. Its long-term stable performance without a need for recalibration results in a low cost-of-ownership of the LGD Compact. This makes it a valid alternative to gas detection methods like mass spectrometry or other conventional measuring technologies.
The can-sized design of the sensing module, which is 160mm long and has a diameter of 50mm (w/o electronics), can be well integrated in small and portable enclosures suitable for operation in hospitals or doctor`s offices.

TDLS Technology

Tunable Diode Laser Spectroscopy is a method where a very narrow laser beam scans over an absorption band of target gas peaks. The scanning is realized by varying current or temperature of the laser diode.
With this procedure it is possible to detect multiple gases at the same time without any cross-interferences.
Electronic lock-in technology allows separating the gas absorption information from electro-optical system information, leading to a detection method eliminating the need for a physical reference channel.

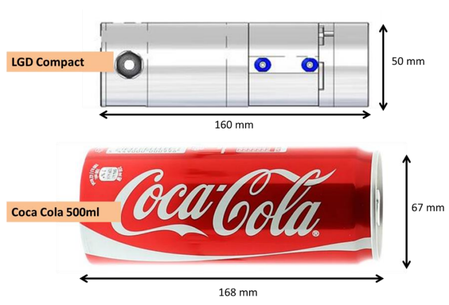


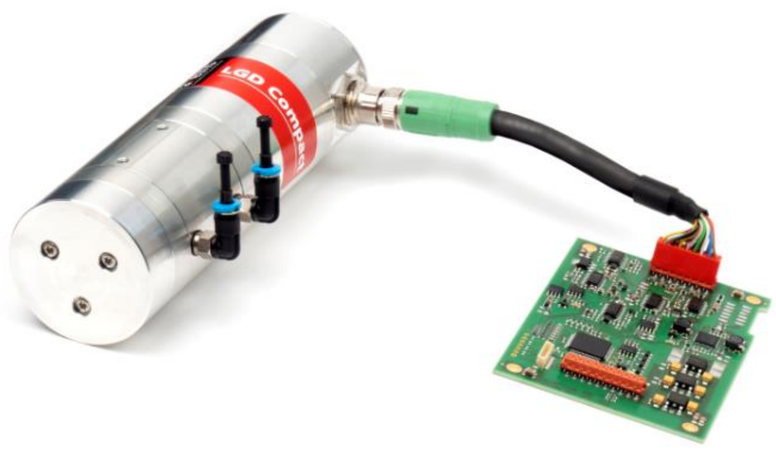
This method combined with the unique and highly integrated opto-electronic laser package of the LGD Compact achieves further advantages like a laser modulation-based active noise reduction.

LGD Compact Platform

Small size: 160mm long x diam. 50mm;

Low weight: <600gr

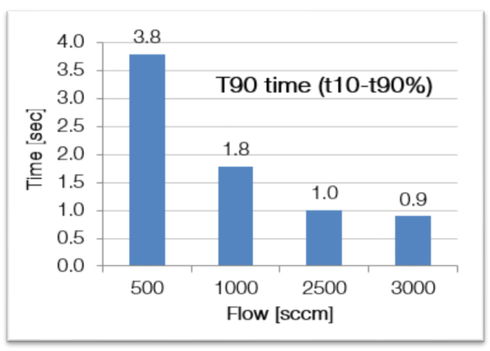




- Fast reaction time due to small gas cell volume of 19ml
- Robust design with enhanced long-term stability against pollution (dust, dirt)
- EMC norms: EN 61326-1, EN 61000-6-2, EN 60601-1-2

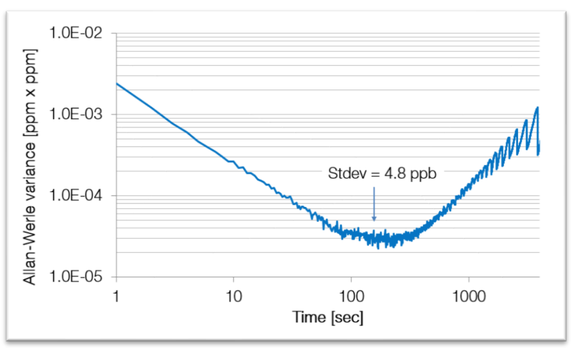
Performance Facts for CH4

T90 reaction time

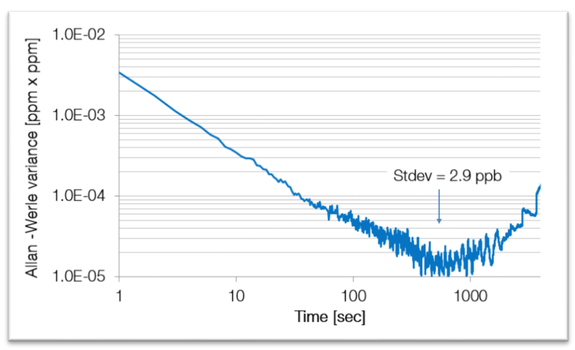


Lower Detection Limit (Allain-Werle plots)

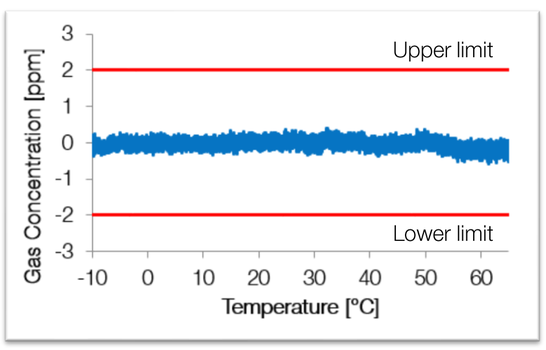
Non-temperature stabilized



Temperature stabilized



Robustness against ambient temperature changes



Applications in Medical Breath Gas Analysis

Gastrointestinal Diseases and Food Intolerances

Liver and Kidney Diseases

Asthma and Airway Inflammations

Diabetes

Conclusion

Summarizing, the combination of fast gas exchange rate, performance, long-term stable design and competitive-pricing presents a very interesting TDLS based approach which allows for substituting more expensive gas detection technologies in the medical market for breath analysis.