

Introducing the latest addition to our TILDAS lineup!

TILDAS Dual Clumped Isotope Analyzer for CH₄ Gas Samples

Direct Non-Destructive Spectroscopic Measurement of $\Delta^{13}\text{CH}_3\text{D}$ and $\Delta\text{CH}_2\text{D}_2$ with No Isobaric Interference

Features

- Direct measurement of $\delta^{13}\text{CH}_4$, $\delta^{12}\text{CH}_3\text{D}$, $\delta^{13}\text{CH}_3\text{D}$ and $\delta\text{CH}_2\text{D}_2$.
- Precision for $\Delta^{13}\text{CH}_3\text{D}$ better than 0.1 ‰ (1 σ) in 60 minutes
- Precision for $\Delta\text{CH}_2\text{D}_2$ better than 1 ‰ (1 σ) in 60 minutes
- Low operating costs

Applications

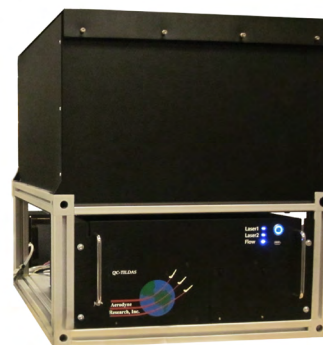
- Clumped methane thermometry.
- Methane source attribution.
- Non-equilibrium clumped isotope signatures in microbial methane.

Advantages

- Measurement precision comparable to much larger and more expensive IRMS instruments.
- Powerful TDLWintel software provides flexible instrument control and real-time data analysis.
- Valve control capable of complex scheduling and automatic background and calibrations.
- Optional automated sample handling systems.
- Turn-key design allows unattended operation.

TILDAS TECHNOLOGY

Aerodyne instruments use **tunable infrared laser direct absorption spectroscopy (TILDAS)** at mid-IR wavelengths to probe molecules at their strongest “fingerprint” transition frequencies. We further enhance sensitivity by employing a patented multi-pass broad-band absorption cell that provides optical path lengths up to 400 meters. Direct absorption spectroscopy allows for fast (<1 sec) absolute trace gas concentrations without need for elaborate calibration procedures. Moreover, TILDAS instruments are relatively free of measurement interference from other molecular species, enabling extremely specific detection.

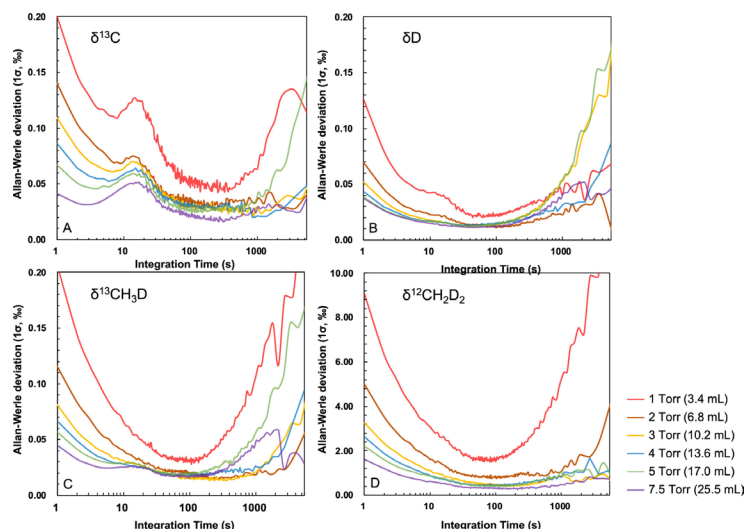


Rugged, field-ready instruments

Direct absorption spectroscopy allows for highly specific and accurate gas detection

Mid-IR detection enables maximum measurement sensitivity

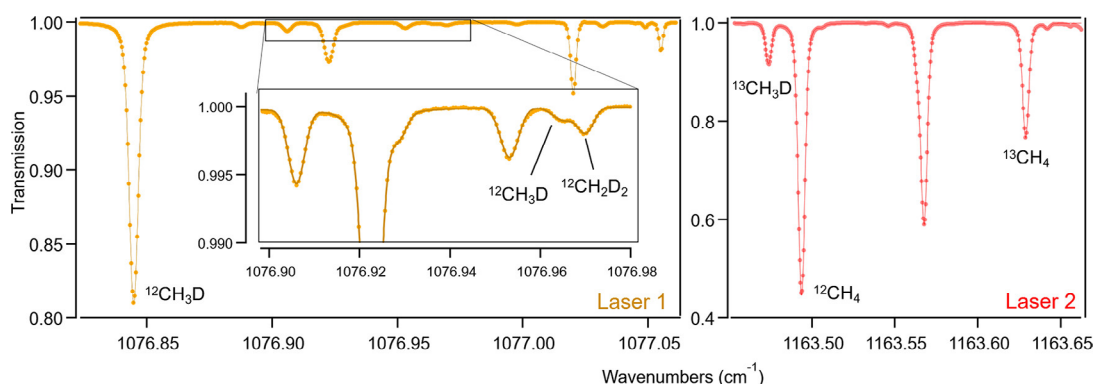
Allan-Werle deviation for individual isotope deltas at different cell pressures, i.e., methane sample amounts.



Allan-Werle and Transmission Spectrum figures used under the Creative Commons Attribution 4.0 International License - <https://creativecommons.org/licenses/by/4.0/>

Zhang N, Prokhorov I, Kueter N, Li G, Tuzson B, Magyar PM, Ebert V, Sivan M, Nakagawa M, Gilbert A, Ueno Y. Rapid High-Sensitivity Analysis of Methane Clumped Isotopes ($\Delta^{13}\text{CH}_3\text{D}$ and $\Delta^{12}\text{CH}_2\text{D}_2$) Using Mid-Infrared Laser Spectroscopy. Analytical Chemistry. 2025 Jan 8

TILDAS Dual Clumped Isotope Analyzer for CH₄ Gas Samples



Measured (point) and fitted (line) transmission spectrum in the spectral range covered by laser 1 and laser 2 at 7.5 Torr cell pressure of pure methane.

Target Performance for NEW Instrument

Discrete Sample Specifications for CH₄ Dual Clumped Isotope Monitor

Note: These measurements are normalized to a working reference and the time to do so is included in the quoted measurement time. The working reference has a mixing ratio, pressure and matrix composition similar to the sample.

	$\Delta^{13}\text{CH}_3\text{D}$	$\Delta\text{CH}_2\text{D}_2$
One Sample: 20 ml (STP) CH ₄ 0.9 m-moles 6 minutes measurement cycle	0.2 ‰	3%
Ten Samples: 200 ml (STP) CH ₄ 9 m-moles 60 minutes measurement cycles	0.07 ‰	1%

Related Instruments

- Dual laser isotope monitor for $\delta^{13}\text{CH}_4$ and $\delta^{12}\text{CH}_3\text{D}$ of CH₄
- Dual laser isotope monitor for $\delta^{13}\text{CH}_4$ and $\delta^{12}\text{CH}_3\text{D}$, $\delta^{13}\text{CH}_3\text{D}$ of CH₄

Data Outputs

RS-232, USB drive, ethernet

Size, Weight, Power

Dimensions: 560 mm x 770 mm x 640 mm (W x D x H)

Weight: 75 kg

Electrical Power: 250-500 W, 120/240 V, 50/60 Hz
(without pump)

REFERENCES

- Zhang N, Prokhorov I, Kueter N, Li G, Tuzson B, Magyar PM, Ebert V, Sivan M, Nakagawa M, Gilbert A, Ueno Y. Rapid High-Sensitivity Analysis of Methane Clumped Isotopes ($\Delta^{13}\text{CH}_3\text{D}$ and $\Delta^{12}\text{CH}_2\text{D}_2$) Using Mid-Infrared Laser Spectroscopy. *Analytical Chemistry*. 2025 Jan 8.
- Ono, S., Wang, D. T., Gruen, D. S., Sherwood Lollar, B., Zahniser, M. S., McManus, B. J., Nelson, D. D., Measurement of a Doubly Substituted Methane Isotopologue, $^{13}\text{CH}_3\text{D}$, by Tunable Infrared Laser Direct Absorption Spectroscopy. *Analytical Chemistry*, 86(13), pp. 6487-6494, 2014.
- Gonzalez, Y., Nelson, D. D., Shorter, J. H., McManus, J. B., Dyroff, C., Formolo, M., Wang, D. T., Western, C. M., Ono, S., Precise Measurements of $^{12}\text{CH}_2\text{D}_2$ by Tunable Infrared Laser Direct Absorption Spectroscopy. *Analytical Chemistry*, 91(23), pp. 14967-14974, 2019.

Installation

Benchtop system

Instrument Operations

Operating Temperature: -20 to +40 °C

Instrument Components

Dual Laser Spectrometer

Thermoelectric chiller

Keyboard, mouse, and monitor

Vacuum pump (customer specified)

Inlet sampling system (customizable)

Aerodyne specializes in collaboration and custom design. Please contact us if you would like to discuss additional measurement options and applications.