

PICARRO A0314

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The World's Leading Instruments for Carbon and Water Cycle Measurements

Small Sample Isotope Module 2

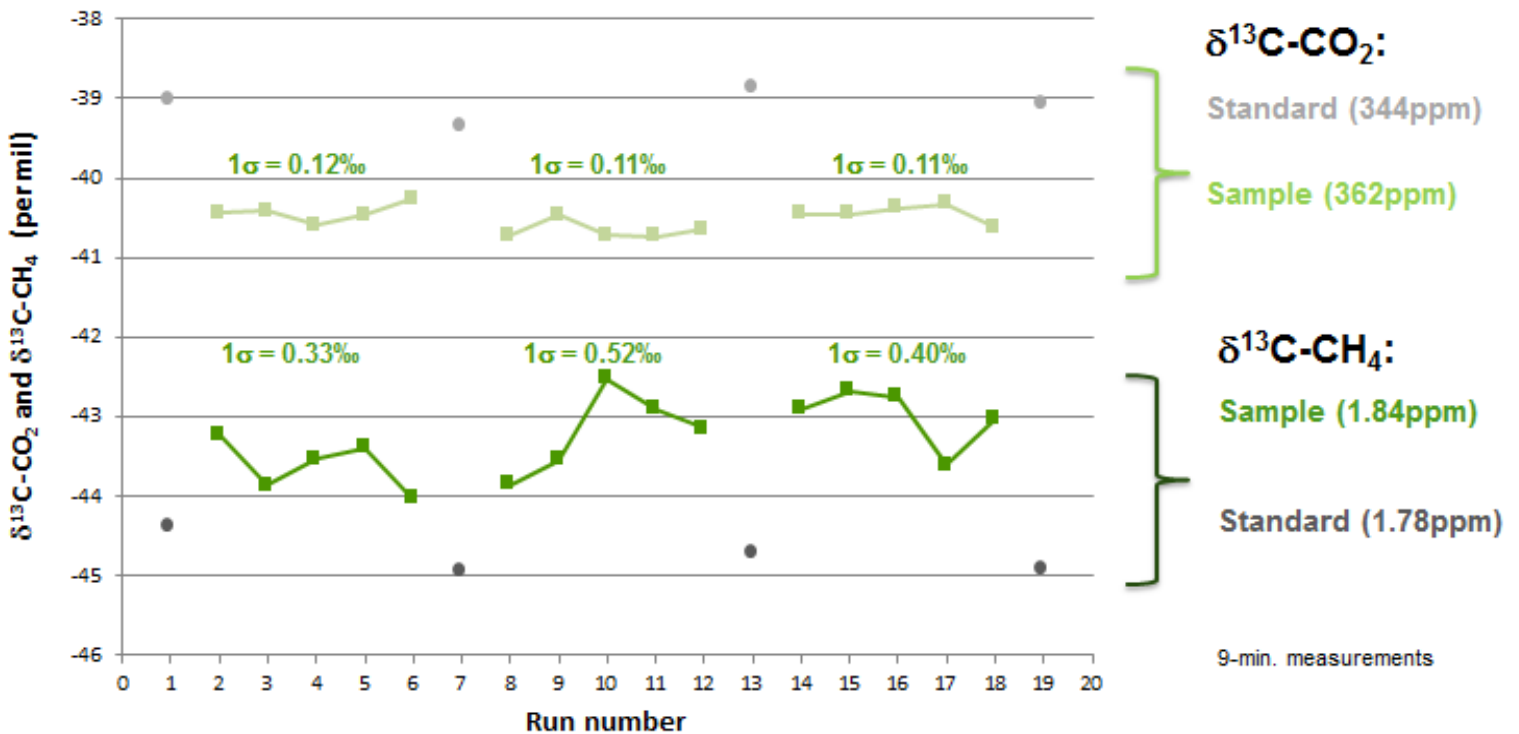
High-precision $\delta^{13}\text{C}$ measurements of small volume CO_2 and CH_4 gas samples

The Small Sample Isotope Module 2 (SSIM2) is Picarro's front end that transforms our continuously-sampling $\delta^{13}\text{C}$ analyzers for CO_2 and CH_4 into instruments capable of measuring small, discrete gas samples. The SSIM2 is an excellent solution for soil, headspace, plant, and other studies that provide CO_2 or CH_4 in limited volumes.



- Run gas samples as small as 20ml at ambient CO_2 or CH_4 concentrations. Use even less volume for concentrated samples with built-in dilution.
- Introduce single samples manually or automatically process up to 8 samples using Picarro's 16-Port Manifold.
- Inject sample by syringe
- Automatically measure reference gas between samples.
- Review data on-the-fly with our intuitive software.
- Go to the field, set up quickly, and make $\delta^{13}\text{C}$ measurements in the remote locations where CO_2 and CH_4 are produced and consumed.

With the SSIM2, one can make measurements like those shown in the following graph, which depicts simultaneous $\delta^{13}\text{C}$ - CO_2 and $\delta^{13}\text{C}$ - CH_4 measurements for 20ml samples at ambient concentrations of CO_2 and CH_4 . These data were recorded with the SSIM2 and a Picarro G2201-*i*. The excellent precision shown is the 1σ standard deviation of the five replicates of each sample.



How does the SSIM2 work? When the measurement sequence begins, a 20ml sample chamber within the SSIM2 is purged and evacuated. The user then introduces 20ml of gas to the sample chamber from a bag, syringe, or other container. If less than 20ml is used, the SSIM2 can be set to dilute the sample to 20ml automatically. Note that the final concentration must be within the analyzer's dynamic range. The sample gas is then slowly injected into the analyzer cavity for an extended, stable measurement.

Connecting to the SSIM2 is straightforward. The sample input is a standard 1/8" Swagelok® fitting, so users can easily introduce samples from bags or flasks, or attach a septum holder for syringe injection. When paired with the Picarro 16-Port Distribution Manifold, the SSIM2 allows researchers to automatically measure $\delta^{13}\text{C}$ from as many as eight sample containers.

Configuring the SSIM2 for reference standard gas and sample gas processing requires only a few minutes. The number of sample replicates and the number of reference standard runs between each replicate can be adjusted by the user. One can select either 4- or 9-minute measurement time. Immediately after each replicate, the software shows the measured $\delta^{13}\text{C}$ value and other data for real-time review.

System Specifications	
Compatible analyzers and peripherals	G2101- <i>i</i> , G2121- <i>i</i> , G2131- <i>i</i> , G2132- <i>i</i> , G2201- <i>i</i> , G5131- <i>i</i> 16-Port Manifold (A0311)
Method for determining precision	Sample a gas cylinder 5 times and calculate the standard deviation of the 5 $\delta^{13}\text{C}$ values. Repeat the set of 5 measurements multiple times and calculate the mean of the standard deviations.
Guaranteed $\delta^{13}\text{C}$-CO₂ precision 9-minute measurement time	< 1.0 ‰, 500 ppm CO ₂ < 0.5 ‰, 1,500 ppm CO ₂ < 0.2 ‰, 3,000 ppm CO ₂
Guaranteed $\delta^{13}\text{C}$-CH₄ precision 9-minute measurement time	< 1.6 ‰, 1.8 ppm CH ₄ (High-precision mode) < 0.8 ‰, 10 ppm CH ₄ (High-range mode)
Guaranteed $\delta^{18}\text{O}$, $\delta^{15}\text{N}$, $\delta^{15}\text{N}\alpha$ and $\delta^{15}\text{N}\beta$-N₂O precision 9-minute measurement time	< 3 ‰
Minimum sample volume, 1 replicate	20 ml directly into the SSIM2 23 ml through the 16-port manifold
Minimum sample volume with dilution within the SSIM2, 1 replicate	10 μl of pure CO ₂ (0.45 μmoles or 20 μg of CO ₂) or the equivalent volume of CO ₂ in air will produce 500 ppm CO ₂ in the analyzer to meet guaranteed precision spec above.
CO₂ / CH₄ concentration dynamic range	See analyzer dynamic range specifications
CO₂ / CH₄ concentration accuracy	The concentrations reported by the SSIM2 are 2-6% lower than the actual values due to residual gases within the analyzer. The SSIM2 is not recommended for concentration measurements.
Sample throughput	10 or 15 minutes, replicate-to-replicate (Corresponds to 4- or 9-minute measurement time)
Fittings	1/8" Swagelok ®
Dimensions	SSIM2: 21.6 cm x 10.2 cm x 22.9 cm (8.5" w x 4" h x 9" d) Pump: 19 cm x 10.2 cm x 28 cm (7.5" w x 4" h x 11" d)
Weight	SSIM2: 5.4 kg (12 lbs), Pump: 3.62 kg (8 lbs),
Power requirements	SSIM2 powered through the USB 2.0 port of the analyzer. <3 watts additional power draw through analyzer. Pump: 35 watts steady state
Gas requirements	Zero air as carrier gas Standards in zero air at appropriate concentrations
Safety	This product is not intended for use in explosive atmosphere environments or for analyzing explosive levels of gases like methane.