

6.192 - A Low Power, High Mobility Cavity Ring-Down Spectroscopy Analyzer for In Situ Measurements of CO₂, CH₄, and H₂O

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INTEGRATED CARBON SYSTEMS



Introduction

- High-precision greenhouse gas (GHG) measurements in remote locations are typically conducted by mobile labs that host cumbersome and high-power analyzers.
- The GasScouter is a new generation of high-performance and low-power GHG analyzers.
- In this poster, we introduce the GasScouter and present the results collected through various lab testing and field deployments to validate the performance of the analyzer.

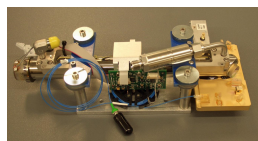
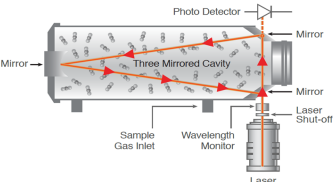
GasScouter, G4301: CRDS Analyzer

- Simultaneously measures CO₂, CH₄, and H₂O concentrations with high precision and stability:

Performance Specifications

	CO ₂	CH ₄	H ₂ O
Raw precision	0.4 ppm	3 ppb	100 ppm + 5%
Precision (5 min)	0.04 ppm	0.3 ppb	10 ppm + 5%
Drift (24 hr, 50 min avg.)	0.5 ppm	1 ppb	-
Measurement range	0 – 3%	0 – 800 ppm	0-3% (non-condensing)

- Proven technology: Cavity Ring-Down Spectroscopy (CRDS).

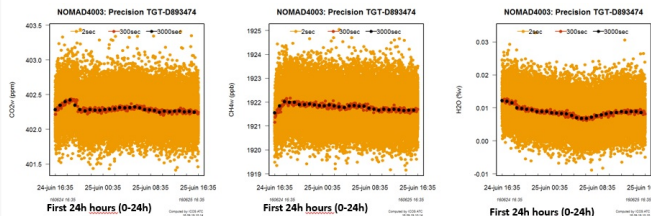


- Compact, mobile, and lightweight: 25 lbs
- Low power consumption: 25W
- Built-in Li-ion battery for 8-hr autonomy
- Hot-swappable battery for uninterrupted measurements
- WiFi connectivity to tablet or smartphone
- Built-in vacuum pump for open or closed-loop path



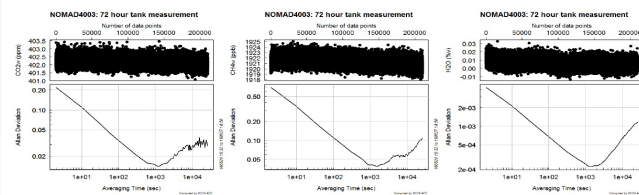
ICOS ATC Metrology Lab Evaluation

- Continuous Measurement Repeatability (CMR) and Stability (drift) Assessments:** measure continuously from a tank filled with dry natural air for 72 hours. No calibration applied.

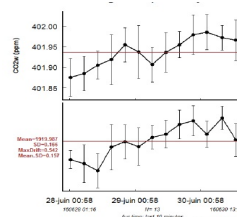


	CO ₂ (ppb)			CH ₄ (ppb)			H ₂ O (%)		
	0-24h	24-48h	48-72h	0-24h	24-48h	48-72h	0-24h	24-48h	48-72h
30 sec average raw data CMR Precision (1σ) over 24h	77,2	81,6	79,6	0,232	0,235	0,268	0,0018	0,002	0,0016
5 min average raw data CMR Precision (1σ) over 24h	47,5	57,8	52,3	0,138	0,148	0,191	0,0014	0,0016	0,001
Drift (over 24h, peak-to-peak 50 min average)	178,6	189,5	156,9	0,464	0,469	0,583	0,0054	0,005	0,0032

Allan Variance Plots from ICOS ATC Metrology Lab



- Long Term Repeatability (LTR) Assessment:** measure alternatively over 72 hrs from a tank filled with dry natural air for 30 min, and ambient air (not dry) for 270 minutes.



	CO ₂ (ppb)	CH ₄ (ppb)
Long term repeatability (1 σ, 10 minute average raw data)	36	0,166
MaxDrift (peak to peak, 10 minute average raw data)	110	0,542

Field Deployment #1

- Continuous measurements from calibration cylinder while walking outdoors in a non-temperature-controlled environment.
- Calibration Cylinder S/N: FB04123 from LBNL
[CH₄]: 1.9771 ppm; [CO₂]: 398.17 ppm

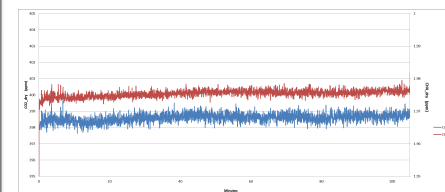


Photo by LBNL

	CO ₂ (ppm)	CH ₄ (ppb)
Raw Mean Value	398.3	1975.4
Raw Precision (1-sigma)	0.3	1.1

Field Deployment #2

- Flux measurements of fugitive emissions of methane at a coal outcrop site in the Four Corners Region, USA in spring 2016.

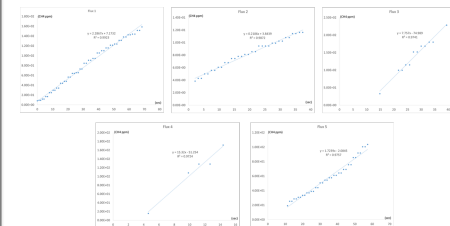


Photo by Koveva Ltd

- CH₄ fluxes measured in Four Corners region ranged from 1 to 73 μmol/m²/s. CH₄ fluxes were measured across four orders of magnitude.
- Flux measurements lasted between 10 and 70 seconds.
- Maximum CH₄ concentration measured was 230 ppm while typical methane concentration in the atmosphere is 2 ppm.

Conclusions

- A third-party lab evaluation validated the drift performance and the Allan variance of GasScouter.
- High measurement performance was maintained in various field deployment applications.

