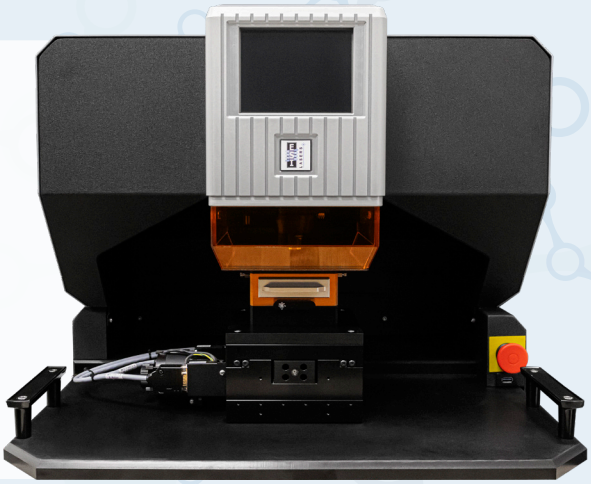
Bobcat LAIR-UV

Accurate and precise C isotope ratio measurements using optimized cell dynamics, resulting in low-flow operation, simple sample exchange, and a ~5 minute sample-to-sample time



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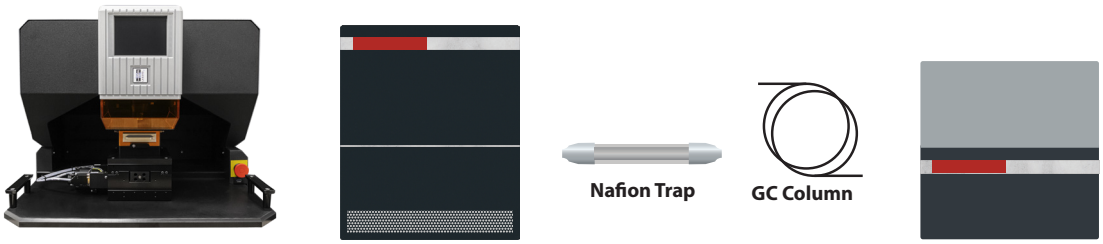
Characterization of Bobcat LAIR-UV and its Application in Providing Rapid and Accurate C Isotope Ratios

Synopsis

Bobcat LAIR-UV chamber allows for stable isotope measurement, giving low backgrounds of carbon and oxygen due to the small internal volume and leak-free design. The system enables fast and simple sample exchange by way of a quick release sample holder design, enabling sample to sample times of around 5 minutes. The sample holder enables straightforward analysis of multiple sample types by use of specific sample inserts. Current options include: tree cores, a well insert for individual grains and an insert for thin sections. Bobcat LAIR-UV was coupled to an Elementar isoprime precisION IRMS & iso FLOW GHG system. Sample material was ablated in the sample chamber, transported to a high temperature furnace for combustion, cryo-trapped, and passed through the GC column before being analyzed using the IRMS. Initial testing showed low background signal from the cell, typically <0.3 nA CO_2. Small amounts of ablated material, using a laser spot size of 50 µm (~100 ng carbon) achieved strong signals peaks of at least 4 nA under standard operating procedures. Results showed strong agreement between the calibrated LAIR-MS $\delta^{13}C$ values and the EA-IRMS published values. These values give a LOD of <30 ng Carbon Absolute.



A schematic of the instrumental pathway used to couple Bobcat LAIR-UV to the Elementar iso FLOW GHG and isoprime precisION for the LAIR-MS analysis of gelatin and sugar samples.

Learn More

1 - Elemental Scientific, Inc., Omaha, NE
2 - Elementar Americas Inc., Ronkonkoma, NY

Rapid and Accurate Low-Flow Bobcat LAIR-UV

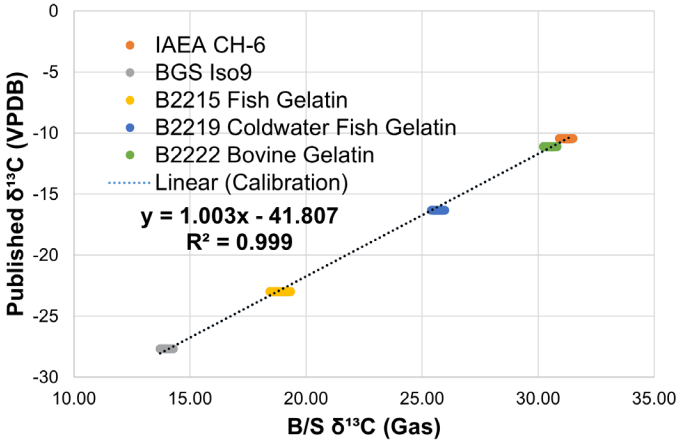
LAIR-MS Comparison of Measured $\delta^{13}C$ Values for Gelatin Reference Materials Compared to EA-IRMS Certified Values

Standard	Substance	No. of Ablations	$\delta^{13}C$ (VPDB, Measured)	St. Dev. ‰ (Measured)	$\delta^{13}C$ (VPDB, Published)	St. Dev. ‰ (Published)
B2215	Fish Gelatin	40	-22.80	0.21	-22.98	0.19
B2219	Cold-Water Fish Gelatin	26	-15.97	0.16	-16.33	0.10
B2222	Bovine Gelatin	30	-11.13	0.14	-11.11	0.09

Gelatin data were blank corrected and calibrated with a two point calibration curve made using IAEA CH-6 and BGS Iso9. The gelatin standards were run as unknown samples and the results compared to the published values from the reference material provider (Elemental Microanalysis Ltd). The results showed excellent agreement between the measured and the published values (accuracy of 98% - 99%, with the values falling within one standard deviation for B2215 and B2222 and within two standard deviations for B2219.

Assessment of the Linearity and Precision of Response from LAIR-MS Analysis of Reference Materials

Standard	Substance	No. of Ablations	St. Dev (‰) (Measured)	St. Dev (‰) (Published)	Source for Published Value
IAEA CH-6	Sucrose	54	0.14	0.03	Reference Materials-IAEA-CH-6
BGS Iso 9	Beet Sugar	25	0.16	0.06	BGS Dataset
B2215	Fish Gelatin	40	0.21	0.19	Elemental Microanalytics Ltd.
B2219	Cold-Water Fish Gelatin	26	0.16	0.10	Elemental Microanalytics Ltd.
B2222	Bovine Gelatin	30	0.14	0.09	Elemental Microanalytics Ltd.



BGS Iso9 and IAEA CH-6 standards were used to create a two point calibration, achieving a linear response with an R^2 value of 0.999. B2215, B2219 and B2222 were analyzed as samples to assess the linearity of signal response when measured values were plotted against published values. In all cases there was extremely good accordance to the calibration line, indicating a linear increase in the measured result with increasing published $\delta^{13}C$ values. Furthermore, the precision of the measurements was excellent, especially considering the small mass sampled, with IAEA CH-6 achieving 0.14 ‰, BGS Iso9 achieving 0.16 ‰, B2215 achieving 0.21 ‰, B2219 giving 0.16 ‰ and B2222 giving 0.14 ‰.

Conclusion

Bobcat LAIR-UV gives low background with blank values typically between 0.3 to 0.5 nA. 4 nA peaks from 100 ng carbon yield LOD of <30 ng C absolute. Rapid sample throughput of ~5 minutes is comparable to EA-IRMS without the need for complex sample preparation. The system gives excellent agreement between calibrated LAIR-MS $\delta^{13}C$ and EA-IRMS published values.