

ESL LA-IRMS Sample Chamber

Accurate and precise carbon isotope data made possible with a low He flow optimized sample chamber



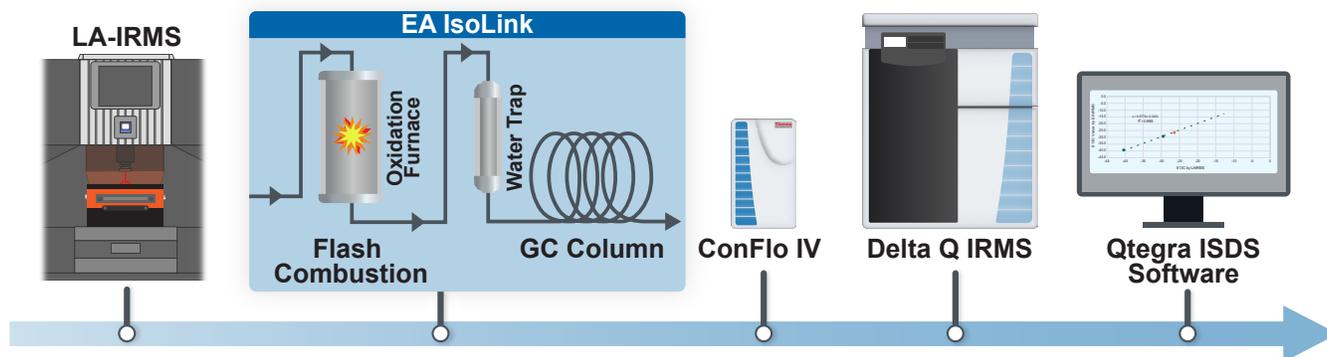
Author: Joseph Ready¹, Ciaran O'Connor¹, David Douglas¹, Brett Davidheiser²

Determination of the Accuracy and Precision of the ESL LA-IRMS Sample Chamber when Coupled with the DELTA Q IRMS

Synopsis

Certified organic materials were analyzed by LA-IRMS. The ESL213 laser ablation system, fitted with the new IRMS sample chamber, was coupled to a Thermo Fisher Scientific DELTA Q gas-source IRMS to assess the accuracy and precision of the integrated setup under routine operating conditions. The materials were quickly and easily loaded into the chamber. Laser ablation was performed using 250 μm spot; the

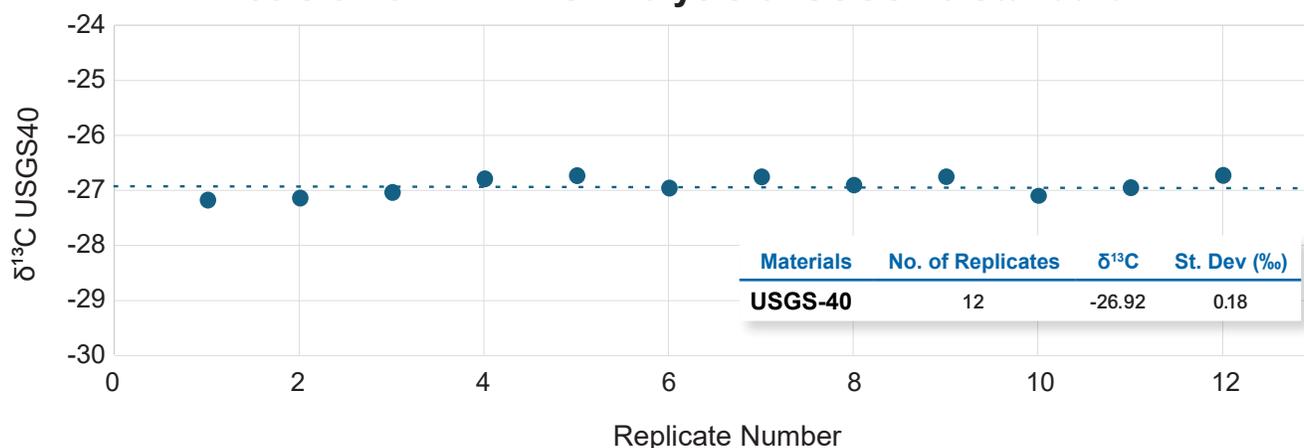
generated aerosol was transported to the IRMS using the low helium carrier flow required for stable IRMS operation. Data reduction and peak integration were completed in Qtegra ISDS, then compared to published certified values and to EA-IRMS measurements of the same materials. LA-IRMS results showed excellent agreement for all standards and high reproducibility; USGS-40 produced a standard deviation of 0.18 ‰ (n = 12).



Schematic of the instrument set up used to carry out this work. The ESL IRMS chamber couples to a DELTA Q IRMS (Thermo Fisher Scientific) with material being transported from the cell, through the EA Isolink and finally to the DELTA Q IRMS via ConFlo IV.

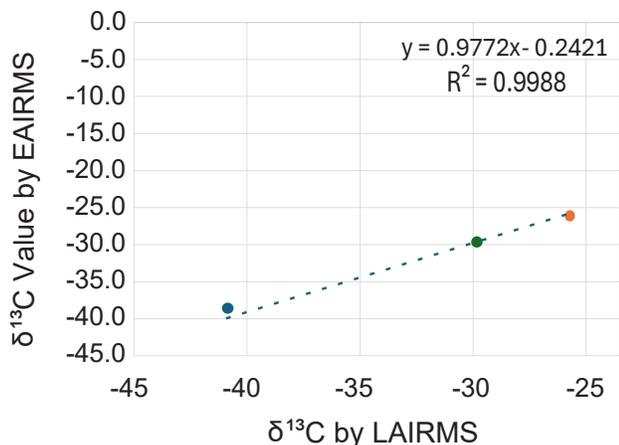
Testing the performance of the ESL IRMS Chamber when Combined with the DELTA Q IRMS

Precision of LA-IRMS Analysis of USGS 40 Standard



Results showing the precision of LA-IRMS analysis using the USGS 40 Certified Reference Material. The analysis was repeated using twelve subsequent ablation craters. Results showed excellent precision with a standard deviation value of only 0.18 ‰. Importantly, the results were obtained with the absence of a liquid nitrogen cooled trap since the sensitivity was acceptably high without it. However, the same quality of result, with the sharpest possible peaks, can be obtained using smaller spot sizes by employing a liquid nitrogen cooled trap.

Study of the Linearity of LA-IRMS Analysis of Known Standards



LA-IRMS analysis was carried out on a range of Certified Reference Materials to assess the agreement of the data generated to data obtained by traditional EA-IRMS analysis. The slope of the known to unknown was 0.9772, with a R² of 0.9988. This shows a very strong agreement between the two techniques. Furthermore, in all cases, the standard deviation of the results was excellent (0.02 to 0.2 ‰).

Materials	δ ¹³ C Measured	St. Dev (‰) by LAIRMS	δ ¹³ C Published	St. Dev (‰) by EAIRMS
Act-2	-29.30	0.20	-29.50	0.02
USGS-40	-26.50	0.03	-26.39	0.04
EDTA	-39.40	0.02	-40.38	0.01

Conclusion

The ESL213 and IRMS optimized sample chamber, yielded accurate and precise δ¹³C results, for a range of materials when combined with the DELTA Q IRMS instrument. The technique has been shown to be highly reproducible over a number of replicates on the same sample, giving a standard deviation of just 0.18 ‰. Importantly, the data was obtained without the use of a liquid nitrogen cooled trap which further simplifies the workflow. Results demonstrate the applicability of the LA-IRMS technique in providing high quality data, maintaining spatial integrity of the sample, and with minimal sample preparation.

