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Improvements in Sensitivity in IRMS Measurements

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An increase in the sensitivity of isotope ratio mass spectrometers is required to meet the demands of researchers for (i) smaller sample sizes associated with higher resolution sampling, and (ii) new developments in clumped isotope ratio analysis where high precision is required for multiply substituted isotopologues which are present at low natural abundances on the order of tens of ppm or lower.

Following an analysis of the electron and ion optics of the Sercon 20-22 Nier type electron impact ion source we have made modifications to the source optics. The improvements in sensitivity resulting from the modifications are significant. For CO2 and N2 a near factor of two improvement in sensitivity in both continuous flow and dual inlet modes is observed, whilst the improvement for H2 is lower. Using this source modification in a large radius magnetic sector dual inlet IRMS we report a sensitivity of <450 molecules per CO2 ion. This is the highest sensitivity yet reported for any IRMS instrument.