253 Plus - New 10 kV Isotope Ratio Mass Spectrometer: Robust Precision and Accuracy for Low Abundance Isotope Research

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The clumped isotope application requires precise and accurate measurements of rare isotopologues on small sample sizes. The 253 Plus is a further development of the successful MAT253 mass spectro-meter, which has been the instrument of choice since clumped isotope science developed.

Careful ion optical design investigations led to reshaping of the magnet which significantly improved peak shapes. Building on the experience of the MAT253 the surfaces of the gas inlet system and the ion source are machined to minimize scrambling and isotope exchange effects. All along the ion optical path special care has been taken to minimize any scattering, which could disturb the analytical baseline and possibly affect Δ_{47}-CO_2 linearity effect. A Faraday cup between mass positions in the collector array is introduced to monitor the baseline during analysis. A new software workflow, LIDI (Long Integration Dual Inlet), is integrated into ISODAT to support higher productivity, reduced sample consumption, improved sample utilization and hence increased sensitivity. The LIDI workflow allows analysis of smaller samples to enable high resolution studies.

High-gain 10^{13} ohm amplifier technology is integrated into the 253Plus, to further reduce the amplifier noise by a factor of 3. These instrumental improvements will push the boundaries for clumped isotope applications as well as for GC-IRMS where sensitivity, precision, stability and low noise are key features for high precision measurements.

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