ICP-oTOFMS
TECHNICAL NOTES

The advantages of simultaneity and full mass range capability of ICP-TOFMS

GBC

Simultaneous measurement eliminates noise and maximises sensitivity, required for transient analysis

The pseudo-simultaneous nature of ICP-TOFMS allows the virtual elimination of noise associated with instrumental drift and instability (flicker noise). With traditional sequential mass analysers these noise sources can limit the precision of isotope ratio measurements. The absence of flicker noise in the ICP-TOFMS means that the isotope ratios can be measured to the statistical limit of ion counting (shot noise limits).

This is illustrated in Figure 1 which shows $^{107}Ag/^{109}Ag$ ratio precision for a 10 ppb sample for a varying number of acquisition times. The data (solid dots) is closely correlated to the statistical limit (crosses). The line is only to guide the eye. Figures 2 and 3 show the same behaviour for two isotopes of widely different isotopic abundance, $^{235}U/^{238}U$ over a wide range of concentrations. The ability to measure isotopic ratios at low element concentration is necessary for the measurement of transient samples.

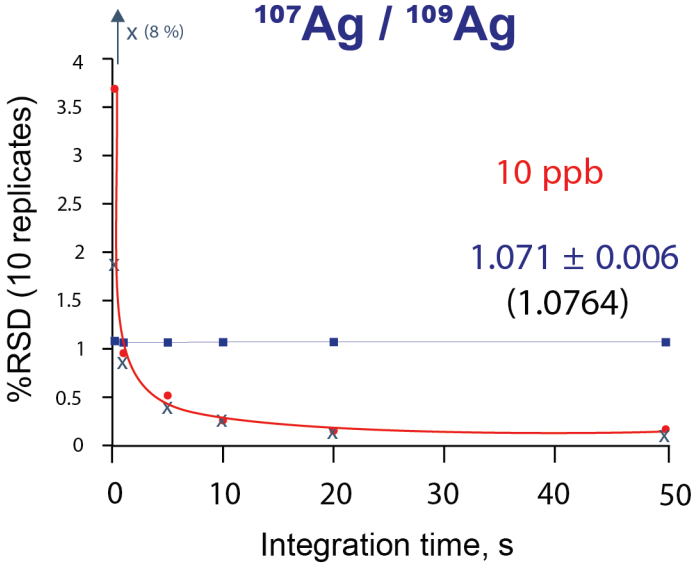

Figure 1: ^{107}Ag / ^{109}Ag ratio precision for a 10 ppb sample with different acquisition times

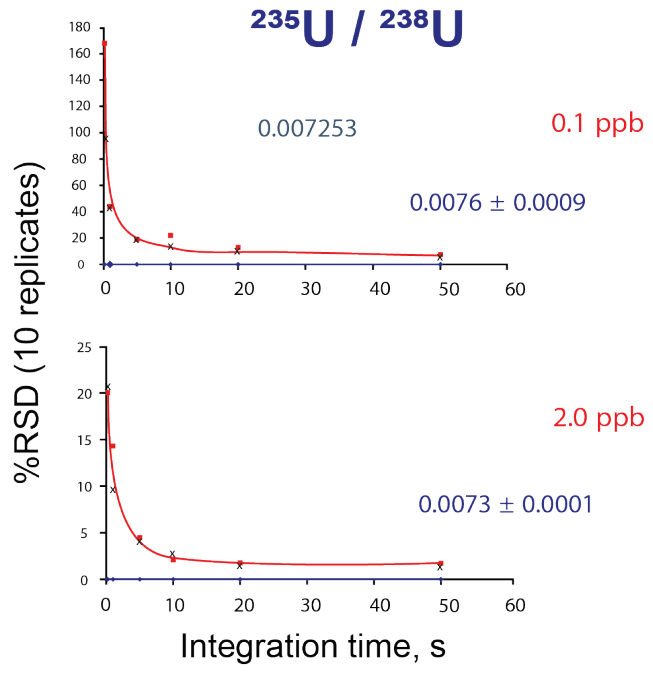

Figure 2: ^{235}U / ^{238}U ratio precision for samples of 0.1 and 2.0 ppb with different acquisition times

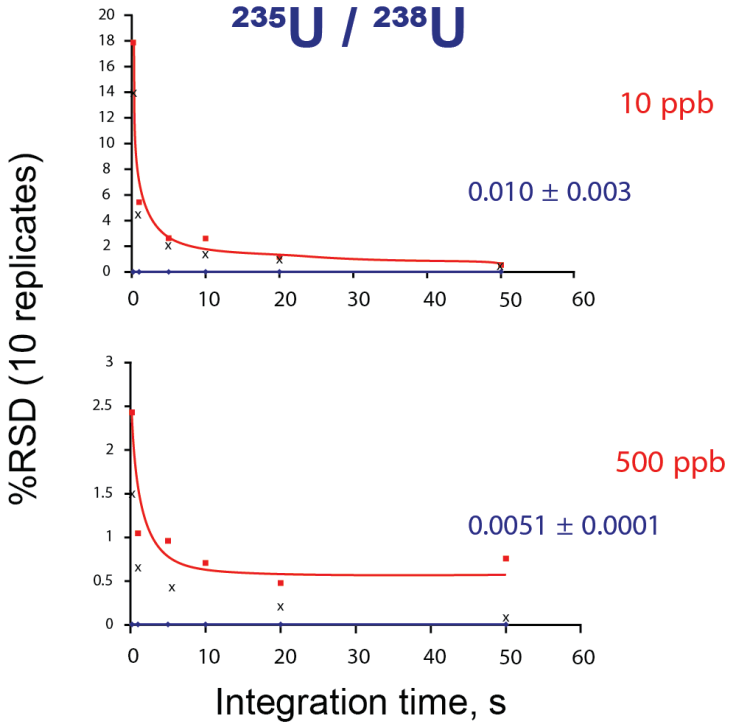

Figure 3: ^{235}U / ^{238}U ratio precision for samples of 10 and 500 ppb with different acquisition times

Statistics-limited isotope ratios can be obtained across the full mass range for transient sample introduction

The speed of data collection and total mass range coverage of ICP-TOFMS make it ideally suited for the analysis of transient samples. Transient samples can last from fractions of a second to a few minutes and temporal resolution required can be from a few milliseconds to a few seconds. Examples of transient sample introduction are flow-injection, ETV, laser-ablation, spark erosion, chromatography, etc.

Figure 4 shows a flow-injection transient of a 10 ppb solution of Ag taken with a temporal resolution of 0.25 s. The transient lasts for approximately 10 s and the variation in the ^{107}Ag and ^{109}Ag signal due to peristaltic pump oscillations can be clearly seen. Figure 5, however, shows that the isotope ratio of $^{107}Ag/^{109}Ag$ stays constant throughout the transient within statistical limits. Isotope ratios for other elements are shown in Figure 6. This graph illustrates that statistics-limited isotope ratios can be obtained across the mass range for transient sample introduction. The data for all elements was collected in the same 10 s transient, which demonstrates the full mass range capability of ICP-TOFMS.

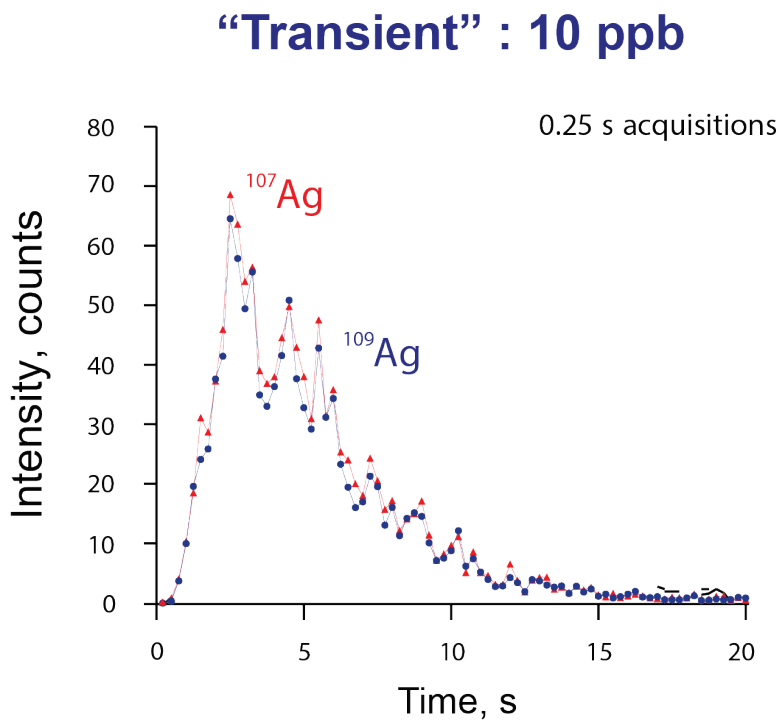

Figure 4: Flow injection of a 10 ppb Ag solution, temporal resolution 0.25 s

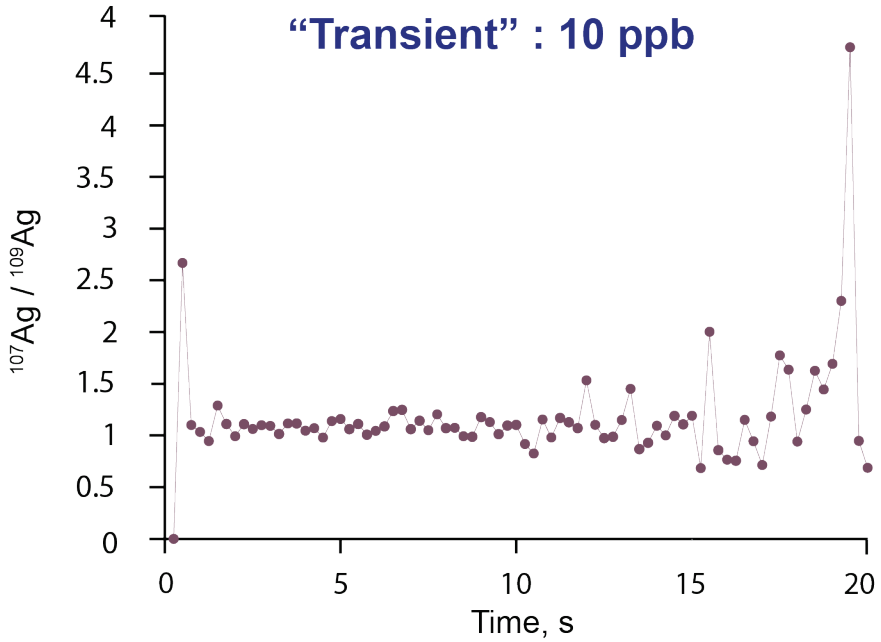

Figure 5: The isotope ratio of ^{107}Ag / ^{109}Ag stays constant throughout the transient within statistical limits

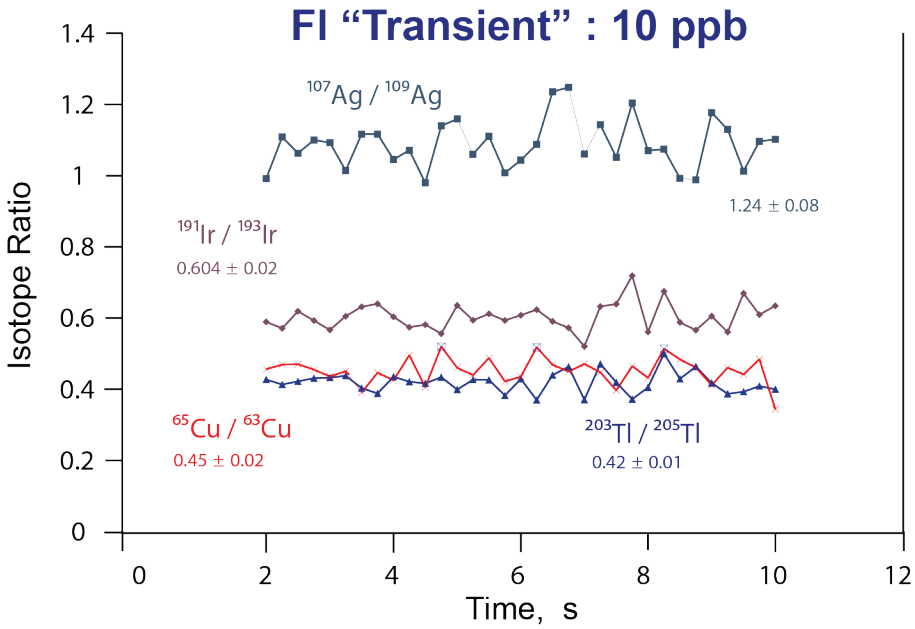

Figure 6: Statistics-limited isotope ratios can be obtained across the mass range for transient sample introduction

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