plasma 3

Enhanced Abundance Transfer Optic

The term abundance sensitivity describes the tailing of a major isotope peak into adjacent lower masses, mainly caused by collisions of ions with background gases within the mass analyser. This tailing can cause significant accuracy issues in actinide isotope measurements.

Specifically, abundance sensitivity is conventionally defined as the relative abundance of mass 237 in respect to ^{238}U. Due to the unique pumping system of the plasma 3, the analyser section routinely operates in the 10^{-9} mbar range, which affords exceptional abundance sensitivity with standard optics, typically less than 2 ppm pre-deceleration filter and less than 0.5 ppm post-deceleration filter.

For the more demanding actinide applications, an additional lens element EATO (patent pending) has been designed, which can be easily installed by users without the need to vent the analyser.

This device is inserted into the instrument transfer chamber and limits the amount of argon atoms/ions entering the mass analyser, and provides a significant abundance sensitivity improvement, typically less than 1 ppm pre-filter and less than 0.05 ppm post-filter (Table 1).

	Abundance Sensitivity (237 relative to ^{238}U) (ppm)	
	Deceleration Filter Off	Deceleration Filter On
Without EATO	1.80	0.45
With EATO	0.70	0.03

Table 1: Abundance sensitivity improvement using the EATO device.

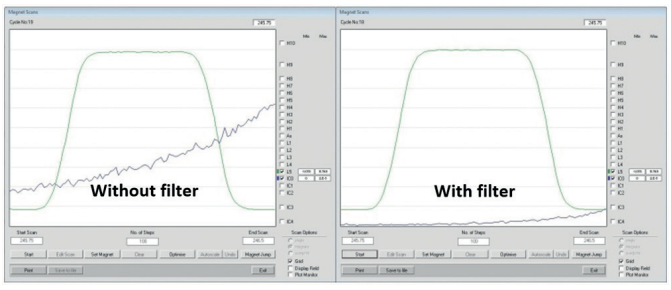

Figure 1: Examples of abundance sensitivity measured at mass 237 in respect to ^{238}U using EATO with and without a deceleration filter.

A set of 12 repeat analyses of a 250 ppb CRM-145 U standard was performed on the instrument both with and without the EATO device. Solution was introduced into the instrument using a glass cyclonic spray chamber and a glass nebulizer with 0.2 ml/min uptake rate. ^{235}U and ^{238}U were both measured on Faraday cups connected to pre-amplifiers each fitted with a 1011 ohm resistor. The U sensitivity achieved was around 45 V/ppm both with and without EATO. No mass bias correction was applied. The external reproducibility achieved was 0.033% (2 RSD) for the $^{235}U/^{238}U$ without EATO, and 0.025% (2 RSD) with EATO. Thus demonstrating that the improvement in abundance sensitivity performance is achieved without compromising transmission or mass bias stability (Figure 2).

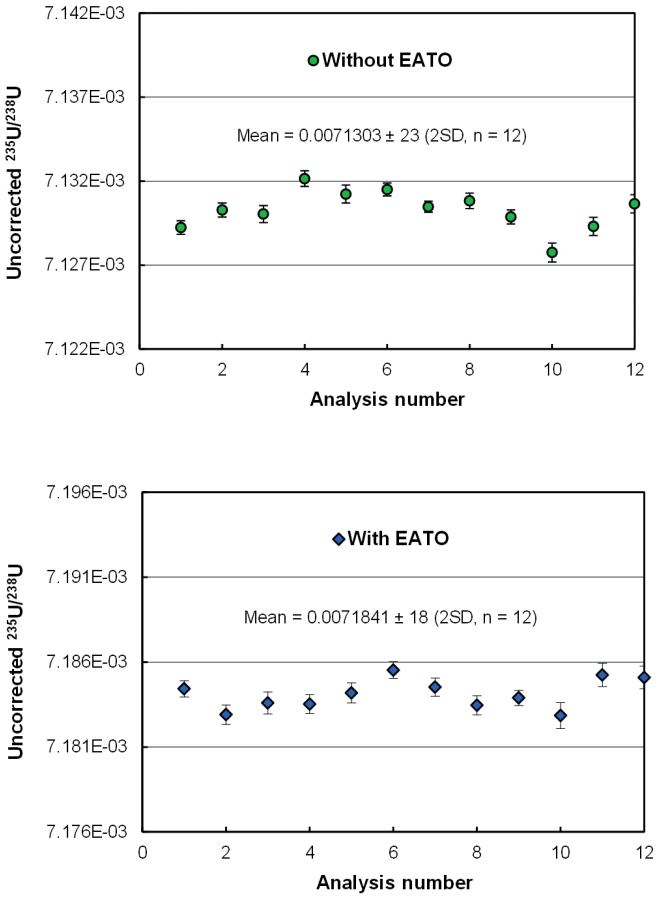

Figure 2: Uncorrected $^{235}U/^{238}U$ measured with and without the EATO device. Error bars are 2 SE.