NU ATTOM HR-ICP-MS

APPLICATION NOTE **AN17**

THE NU ATTOM HIGH RESOLUTION ICP-MS: Long-Term Stability of the Crossover Calibration of the Unique "Dual" Mode Ion Counting System

INTRODUCTION

High resolution instruments such as the Attom from Nu Instruments are a powerful tool for the identification of a large number of elements at varying concentrations. The samples analysed with such instruments can have very low concentrations of trace and ultra-trace elements but at the same time, some of the major elements may be of interest, too. Therefore, it is important to be able to analyse these at the same sample dilution without prior knowledge of the concentrations with a versatile detector system that is able to cope with the varying signal intensities.

The default detector system commonly used is an electron multiplier operating in pulse-counting mode. This is able to cope with ion beams of up to 2-3 million counts per second (cps). For larger beam sizes, instead of using a dual-mode multiplier in "analogue" mode, the Attom uses a unique attenuation system. This deflects the ion beam through a grid which attenuates the ion beam by a pre-determined factor which then can be detected in pulse-counting mode. This yields a dynamic range of the pulse-counting electron multiplier of up to 9 orders of magnitude. An optional Faraday can be fitted to further extend the dynamic range by up to 3 orders. This is depicted in Figure 1.

The switchover between different detector modes needs to be fast and automatic. Furthermore, the crossover calibration needs to be mass independent and very stable over the course of sample analysis sessions.

In this note we show a set of cross calibration data of the unique dual mode ion counting system which is a standard feature of the Attom. This set of data was taken over the course of a month using the detector calibration function of the software.

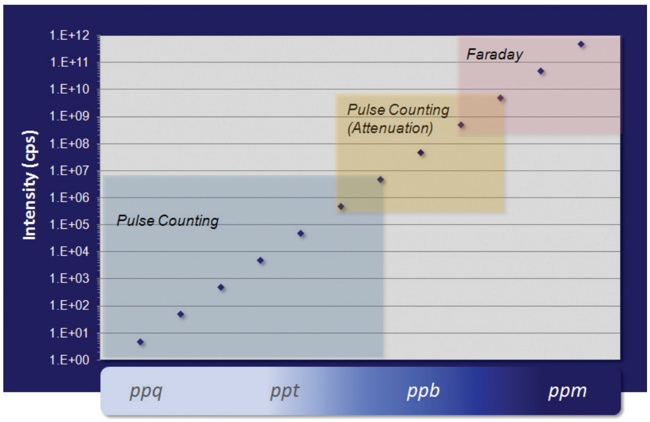

Figure 1: *Detector modes for the Attom HR-ICP-MS*

Instrumentation

The Nu Attom is a double-focusing, high-resolution magnetic sector mass spectrometer. The instrument is entirely purpose designed and built to provide the best performance and reliability coupled with flexibility and ease-of-use for precise and accurate elemental and isotope ratio analysis. A unique detector system gives the Nu Attom a large dynamic range, and its electrostatic scanning capability has the widest range in its class (40%). Furthermore, the continuously variable high resolution means that sufficient resolution for isobaric separation can be selected with minimum compromise in sensitivity.

Experiment

A 1 ng/g ICP standard solution containing Li, Mg, Sc, Co, Y, In, Cs, Tb, Tm, Pb and U was repeatedly analysed using the detector calibration method of the software at the Nu Instruments factory. The experiment was repeated a number of times over the course of a month.

The calibration establishes the factor by how much the ion beam is reduced when it is passed through the grid by measuring the ion beam in normal (un-attenuated) and attenuated mode for the elements listed above. The average factor is then applied for any consecutive analysis until the calibration is performed again.

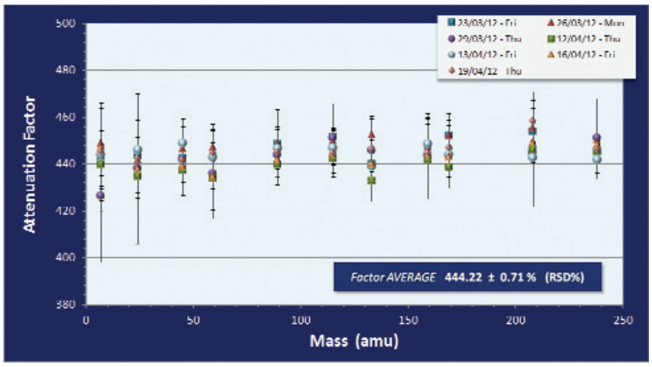

Figure 2: *Attenuation factor versus mass over a period of ~1 month*

Discussion

The results are shown in a graph of attenuation factor versus mass (Figure 2). Error bars for the measured cross over (attenuation) factors for each element are given as 1 standard deviation. It can be seen that the attenuation factor is mass independent and the average factor is stable to better than 1% RSD over the course of a month.

Conclusions

The Nu Attom is a high resolution ICP-MS that is ideal for the most demanding ICP-MS requirements where sensitivity, precision, and speed of analysis are paramount. The results of this experiment highlight that the detector system is suitable for the analysis of samples with varying concentrations in a range of materials.