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# 10E13 Ω Resistor Amplifiers in MC-TIMS for Precise and Accurate U Isotope Analysis

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Accurate and precise uranium isotopic analysis in nuclear safeguards is challenged by the extreme range of relative U isotopic abundances, limitations in analyte quantities, applicable instrumental mass fractionation methods, and requirements for certified isotopic reference materials.
The present study on a Thermo ScientificTM TRITON PlusTM mass spectrometer is aimed at investigating the level of accuracy and precision obtainable for extreme U isotopic ratios by using, for the first time, 10E13 Ω amplifiers for U analysis on a TIMS instrument. Accordingly, the IRMM-187 standard with certified U isotope ratios of 234U/238U = 0.000071965 (39) and 236U/238U = 0.00038700 (16) (ref. 1) was selected. Sample loads of 1 microgram were run following the modified total evaporation protocol developed by the New Brunswick Laboratory, the Safeguards Analytical Services of the International Atomic Energy Agency, the Institute for Transuranium Elements, and the Institute for Reference Materials and Measurements1, combining 10E11 Ω amplifiers on major U ion beams, and the newly developed 10E13 Ω amplifiers on 234U, 236U ion beams and the 233.7, 234.4, 235.7 and 236.4 half masses. Mean 234U and 236U ion beams were ≤ 10 mV. Each measurement comprised three ion beam cup-settings, thus allowing analysis of U isotopes and a per mass cycle subtraction of half-masses, for optimized correction of peak tailing effects from the major U isotopes. The internal uncertainty obtained was 0.17 ‰ on 234U/238U and 0.59 ‰ on 236U/238U (2RSE). Measurement performance, expressed as the sum of the absolute deviation of the measured relative to the certified value (2RSD) plus the absolute measurement uncertainty (2RSE) is 5.10-7 for both 234U/238U and 236U/238U, in line with the IAEA requirement of better than 10-6.
[1] Richter et al. 2011 JAAS 26, 550.

## Country or International Organization

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