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Improved measurement precision of $^{234}U/^{238}U$ with IRMM184 uranium standard using the Isotopx ATONA® and ZEPTONA Faraday detector systems

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High precision determination of $^{234}U/^{238}U$ is important in many geological research applications. Normally, low abundance ^{234}U ($^{234}U/^{238}U$ = 0.000053196 in IRMM184) necessitates the use of ion counters, while the much larger ^{238}U is measured on a Faraday detector. The ^{235}U ($^{235}U/^{238}U$ = 0.007263) is often used to calibrate the ion counter/Faraday gain. The resulting live gain correction adds significant complexity to the measurement, means gain drift and deadtime have to be accounted for, and ultimately has a large determination on measurement precision.

The development of the Isotopx ATONA® and ZEPTONA amplifier systems allow this measurement to be made on a Faraday only detector system, avoiding the difficulties inherent in the use of ion counting.

In this data, the $^{234}U/^{238}U$ of IRMM184 natural Uranium standard was measured using an Isotopx Phoenix TIMS equipped with a standard array of 9 ATONA Faraday cups plus an ultra-low noise ZEPTONA rear Faraday situated behind a WARP abundance sensitivity filter. The reproducibility of the obtained data is improved by almost a factor of two compared to data obtained in a similar way using a resistor amplifier main array of Faraday cups and an ion counting Daly, which has until now represented the gold standard for these measurements.

This demonstrates that precise and accurate data with beams of less than 10,000 CPS can be obtained using the ZEPTONA Faraday, but that through careful method optimisation to exceed the performance of ion counting systems at these beam intensities.

Additionally, the greater simplicity, robustness and dynamic range of the Zeptona Faraday make this data far easier to obtain routinely.