Dynamic response time correction algorithms for high precision isotope ratio measurements using high gain current amplifier technology

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A recent development in multi-collector ICP-MS and TIMS at Thermo Fisher Scientific has been the introduction of Faraday cup amplifiers incorporating high gain 10^{13} ohm resistor technology. The new amplifier technology has been demonstrated on the Thermo Scientific TRITON *Plus* to effect significant improvements in precision for small ion beams on Sr [1], Nd [1], Pb [2] and U [2] isotope systems.

One of the major challenges is the control of the different time constants of the different amplifiers, especially when mixed with 10^{12} and 10^{11} ohm amplifiers. When dealing with unstable ion beam intensities (laser ablation, GC), the different time constants lead to bias. Kimura *et al* [3] describe a correction strategy for the application of 10^{13} ohm amplifiers to measure Pb isotope ratios by laser ablation on the Thermo Scientific Neptune *Plus*.

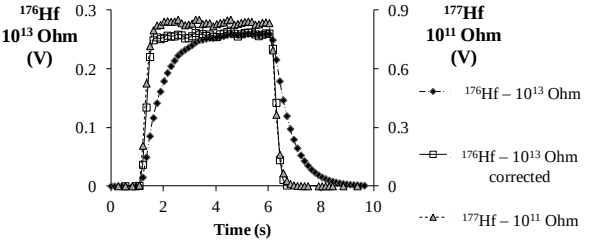

Figure 1: Dynamic correction of ^{176}Hf, 10^{13} ohm amplifier.

We report on the application of dynamic, response time-based, correction to high precision isotope ratio measurements on the Neptune *Plus*. Transient isotope signals, collected with mixed pairs of 10^{11}-10^{13} ohm amplifiers, were generated by ablation of known reference materials. Dynamic corrections were performed based on reported signal intensity and the tau responses of the associated amplifiers (Figure 1), resulting in up to fourfold improvement in precision.

[1] Koornneef (2014) *Anal. Chim. Acta*, **819**, 49–55. [2] von Quadt (2016) *J. Anal. At. Spectrom.,* DOI*:* 10.1039/C5JA00457H. [3] Kimura (2016) *J. Anal. At. Spectrom.,* DOI*:* 10.1039/C5JA00374A.