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Mass Filter Integration For Aligned LA-ICP-MS

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Imaging of elemental and isotope ratio distributions by LA-ICP-MS has shown great utility in a range of fields[1] due to its high sensitivity, spatial resolution and wide dynamic range, though imaging at high spatial resolution comes with a significant time penalty[2]. Fast-response ablation cells (e.g “S155 Fast Funnel”, “ARIS”, “TwoVol”, “Cobalt”, etc...) have been developed to reduce washout times down to 1–2 ms (to 1%) which is approaching the response time of the plasma[3]. Many modern laser systems are capable of firing at hundreds of Hz, so the acquisition time is determined by the scan speed which is limited by washout time.

However, with single detector mass spectrometers being ubiquitous and the rise in popularity of these fast-response cells, the issue of aliasing, or “beats”, in LA–ICP–MS data sets becomes problematic[4]. When using aligned LA–ICP–MS[5] the firing of the laser is aligned with the scan/sweep cycle of the mass spectrometer so that the arrival of the ablated aerosol reaches the detector at the same moment of every sweep.

Our alignment circuit (called ”QuadLock”) uses a high impedance voltage divider to measure the DC component of the superimposed AC and DC mass filter voltages. QuadLock can also interface with single collector magnetic sector field mass spectrometers (e.g. Thermo Scientific “Element” or Nu Instruments “Attom”) by measuring the DC voltage applied to the electrostatic analyser, with the additional challenge that the ESA typically floats at the acceleration potential of the instrument.

Here we describe how to measure the mass filter position in real-time without affecting the performance of the instrument, and how QuadLock is physically interfaced with a range of mass spectrometer hardware from various manufacturers.

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