Design of a Prototype Digital Ion Trap for High Resolution Ion Trap Analysis

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Digital ion trap frequency scanning methods, where scanning is achieved by ramping the frequency of a square waveform with fixed amplitude, have attracted wide attention from high mass protein analysis to ultra-high mass nano particles research. Here, a quadrupole ion trap driven by a digital waveform has been studied, where a high speed, 990 Hz, continuous frequency scan was applied to obtain 990 mass spectra per second over a mass range of 500 amu. In high speed continuous injection mode of operation, ions are injected into the trap continuously during the mass scan, which enables mass scan in ultra-high repetition rate. Automatic gain control could be realized by control of the EI source current, which shows its impact in mass resolution in the experiments. Both mass selective instability scan and resonance ejection mode were tested. Although mass resolution is compromised in exchange for high repetition rate, specific applications might benefit from this mode of operation, for example, when high volume fast scanning is needed for very specific application, such as for airport screening of explosives or for ultra-fast GC/MS coupling.