Modification of Trapping Potential by Inverted Sidekick Electrode Voltage during Detection Extends Time-Domain Signal Duration for Significantly Enhanced Fourier Tranform Ion Cyclotron Resonance Mass Resolution

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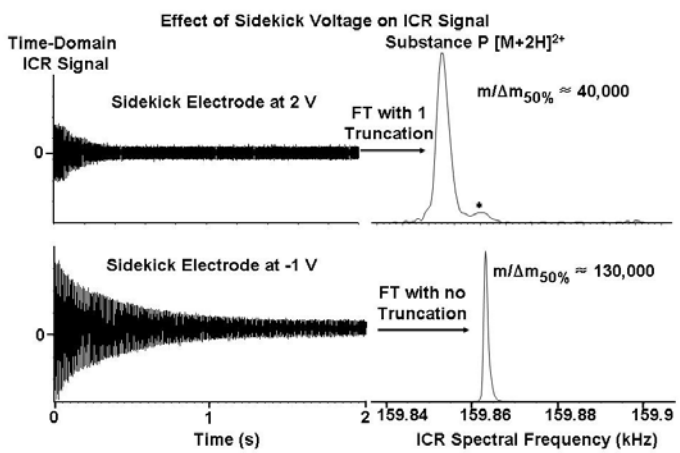
Results and Discussion

Applying an inverted voltage to the "sidekick" electrodes during ion cyclotron resonance detection improves both Fourier transform ion cyclotron resonance (FT-ICR) mass spectral signal-to-noise ratio (at fixed resolving power) and resolving power (at fixed signal-to-noise ratio) [1]. The time-domain signal duration increases by up to a factor of 2 or more. The method has been applied to 7 T FT-ICR MS of electrosprayed positive ions from substance P (see Figure) and human growth hormone protein (~22,000Da, $m/\Delta m_{50\%} \approx 200{,}000$), without the need for pulsed cooling gas inside the ICR trap. The modification can be easily adapted to any FT-ICR instrument equipped with sidekick electrodes. The present effects are shown to be comparable to electron field modification by injection of an electron beam during ICR detection, reported by Kaiser and Bruce [2]. Although the exact mechanism is not fully understood, computer simulations show that a flattening of the radial potential gradient along the magnetic field direction and formation of an inverted local potential gradient well in the ICR trap may contribute to the effects. This study provides not only a way to enhance the quality of FT-ICR mass spectra but also offers insight into understanding of ion motions inside an ICR ion trap.



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References

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[2] Kaiser, N. K. *et al.*, Anal. Chem. **77**, 5973-5981 (2005).