

A New Tandem-in-time and –in-space Mass Spectrometer for High-Throughput MS/MS

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Introduction

Triple quadrupole and quadrupole ion trap instruments must scan the mass analyzer (Q3 or QIT) to obtain a MS/MS spectra. To overcome this limitation, development has focused on hybrid multipole/time-of-flight (TOF) instruments (e.g., QqTOF, QIT/TOF) because product ion spectra can be obtained significantly faster without scanning. However, in all such instruments, untargeted parent ions are rejected during any particular MS/MS scan. Placing an ion mobility spectrometer upstream from the QqTOF temporally separates the parent ions, thereby improving the duty cycle. However, the IMS is unable to arbitrarily control parent ion selection and spacing in time. We are developing a new hybrid mass spectrometer that promises significantly higher MS/MS throughput while maintaining the advantages and alleviating the deficiencies noted above.

Methods

The new hybrid mass spectrometer is comprised of standard components: a TOF-MS, an ion trap, and a quadrupole. The physical arrangement of components, combined with the associated unique method of operation, allows for generation of MS/MS spectra via a tandem-in-time and –in-space process.

Results

The new hybrid mass spectrometer has the capability to perform MS/MS analysis on multiple packets of parent ions selected arbitrarily from a single heterogeneous ion population. Thus, it is possible to generate a complete three-dimensional mass spectrum of parent and product ions from each ionization event. The instrument promises to provide significant enhancement in the overall throughput for MS/MS, while retaining the advantages and overcoming the limitations of current hybrid mass spectrometers in such applications. Simple modifications to the basic configuration and operating mode can yield embodiments that should further enhance the overall duty cycle and efficiency of the instrument.

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