TechnicalNOTE

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QUATTRO PREMIER™: MRM ACQUISITION SPEED

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Introduction

Due to advances in HPLC and the arrival of UPLC™, chromatographic peaks are becoming extremely narrow. It is generally accepted that if reproducible peak area quantification is required chromatographic peaks should be defined by no less than 15 data points. To maintain this peak definition as peaks become narrower, tandem quadrupole mass spectrometers need to acquire faster. The Waters® Micromass® Quattro Premier™ benchtop mass spectrometer has been designed to operate in the multiple reaction monitoring (MRM) mode with the shortest of acquisition cycle times (10 milliseconds per data point, 100 data points per second).

The cycle time per MRM transition is composed of two parameters: a dwell period where ions are monitored, and an inter-channel delay period between successive MRM transitions to allow ions to be cleared from the collision cell. Following the inter-channel delay the collision cell must be rapidly filled with ions of the next transition. If this does not occur rapidly enough (i.e., when the dwell time is very short) the signal intensity will fall.

At short MRM cycle times the ion transit time of ions in standard RF only collision cells (several milliseconds) could be a significant problem in relation to signal intensity. The T-Wave™ collision cell utilizes a travelling wave, superimposed on the confining RF field to reduce ion transit time, ensuring that the cell is completely refilled before acquisition commences and allows operation at very short dwell times without any loss in signal intensity.

Example Data

The data presented (Figure 1) is for the MRM analysis of reserpine. Direct loop injections were made reducing the dwell time on each injection until an MRM cycle time of 10 ms/data point was achieved (100 data points/second). Signal intensity is not affected by MRM dwell time.

The chromatograms shown in Figure 2 were obtained as part of a multi-pesticide residue study. This LC/MS/MS assay required 27 MRM channels to be monitored simultaneously. The assay utilized a dwell time of 40 ms per transition (5 ms inter-channel delay).

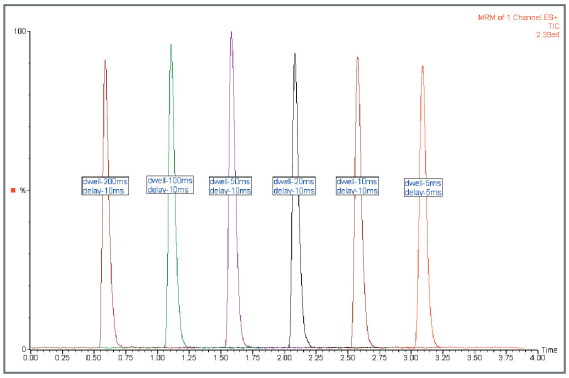

Figure 1. Direct loop injections of reserpine showing the effect of dwell time on MRM signal intensity.

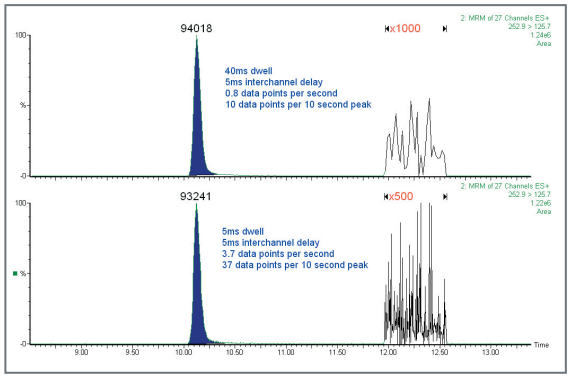

Figure 2. The effect of MRM acquisition speed on the LC/MS/MS analysis of Thiacloprid (part of a multi-pesticide residue assay).

Unfortunately this resulted in only 8 data points per peak for an average peak width of 10 seconds. This was considered insufficient for reliable peak area quantification. Consequently, the assay was repeated using a dwell time of 5 ms per transition (5 ms inter-channel delay) resulting in 37 data points per 10-second peak. The data for Thiacloprid is presented, demonstrating that the use of a higher data sampling rate has not affected the peak area and has only a minor affect on the signal-to-noise ratio (detection limit).

The data presented demonstrates that the travelling wave maintains signal intensity, even when using the shortest of MRM acquisition cycle times, enhancing the fast acquisition performance of the Quattro Premier mass spectrometer.

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