[TECHNOLOGY BRIEF]

Dramatically Enhanced Analytical Sensitivity with the Use of Novel StepWave Ion Transfer Technology in the SYNAPT G2-S System

GOAL

To demonstrate that off-axis StepWave™ ion transfer technology, now integrated in the SYNAPT® G2-S System, provides a significant increase in the sensitivity of the system in all available data acquisition modes by fundamentally improving the efficiency of ion transfer from the ion source to the MS analyzer.

BACKGROUND

When combined with state-of-the-art Waters® UPLC® separations technology, SYNAPT G2, an exact mass tandem MS platform enabled with high-efficiency ion mobility separations, provides very high performance for qualitative and quantitative applications. However, the needs of increasingly challenging experiments continue to drive demands for lower limits of detection.

In 2010, Waters successfully introduced a novel off-axis ion transfer technology, known as StepWave, onto a high performance tandem quadrupole mass spectrometer. The incorporation of this technology resulted in an instrument that enabled users to access limits of quantification previously thought to be beyond their reach.

The new SYNAPT G2-S System incorporates this StepWave Technology. Ions generated in atmospheric pressure region of the ion source enter the mass spectrometer through a sampling cone. The hole in the cone that the ions pass through is approximately twice the size of the one that was used with previous instruments.

The performance of one of the most powerful analytical instruments available, a high performance hybrid quadrupole ion mobility enabled Time-of-Flight mass spectrometer has been significantly enhanced by the incorporation of novel off-axis StepWave ion transfer technology.

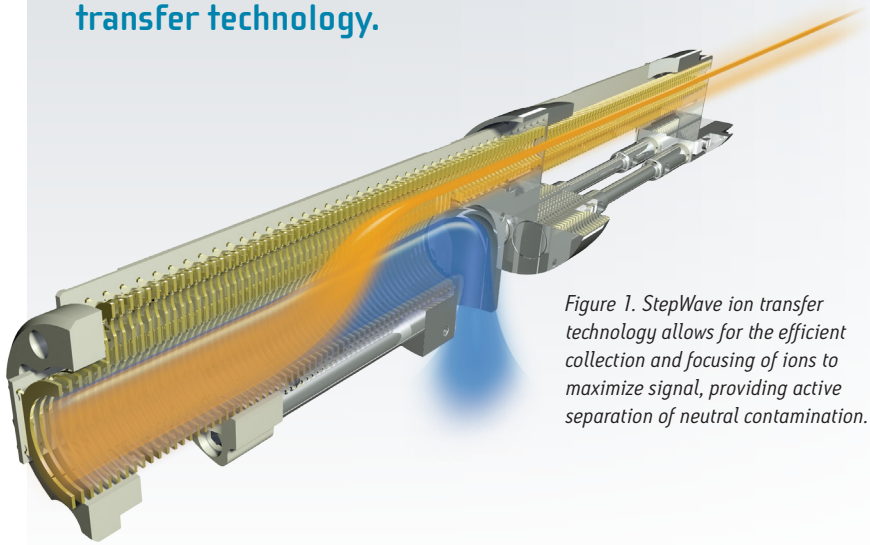

Figure 1. StepWave ion transfer technology allows for the efficient collection and focusing of ions to maximize signal, providing active separation of neutral contamination.

This allows more ions to enter the instrument, and increased detection of the ions generated in the ion source. Design changes were made to the vacuum system to ensure that the increased gas load is properly managed. Ions do not pass through the cone as a nice focused beam, but instead emerge into the first evacuated region as a dispersed cloud. This dispersed cloud of ions needs to be captured and focused before it is delivered to the MS analyzer; otherwise the extra ions that have just been introduced using the larger cone orifice are dissipated. The clever design of StepWave's ion transfer optics ensures that all of the ions are captured in this disperse cloud, where they are very efficiently funnelled into a highly focused beam, maximizing ion transmission.

THE SOLUTION

The MS/MS analysis of a peptide

An experiment was performed to determine the effect of utilizing StepWave transfer ion technology on spectral data obtained when performing the MS/MS fragmentation analysis of glufibrinopeptide (GFP).

Data presented in Figure 2 was obtained during back-to-back experiments performed using SYNAPT G2 and SYNAPT G2-S; the latter incorporating StepWave's ion transfer optics. The data were acquired for the direct infusion analysis of GFP (100 fmoles/µL solution infused at a flow rate of 5 µL/min). The SYNAPT G2-S instrument was operated in MS/MS mode.

SUMMARY

The new SYNAPT G2-S System is a high resolution, exact mass platform which incorporates novel StepWave ion transfer technology. Data presented here demonstrate that the StepWave Technology dramatically increases the efficiency of ion transfer from the ion source to the MS analyzer. The result is a system that is significantly more sensitive, providing higher quality data and lower limits of detection. At the same time, StepWave's off-axis design actively eliminates undesirable neutral contaminants, maximizing both the reproducibility of the data and the robustness of the instrumentation.

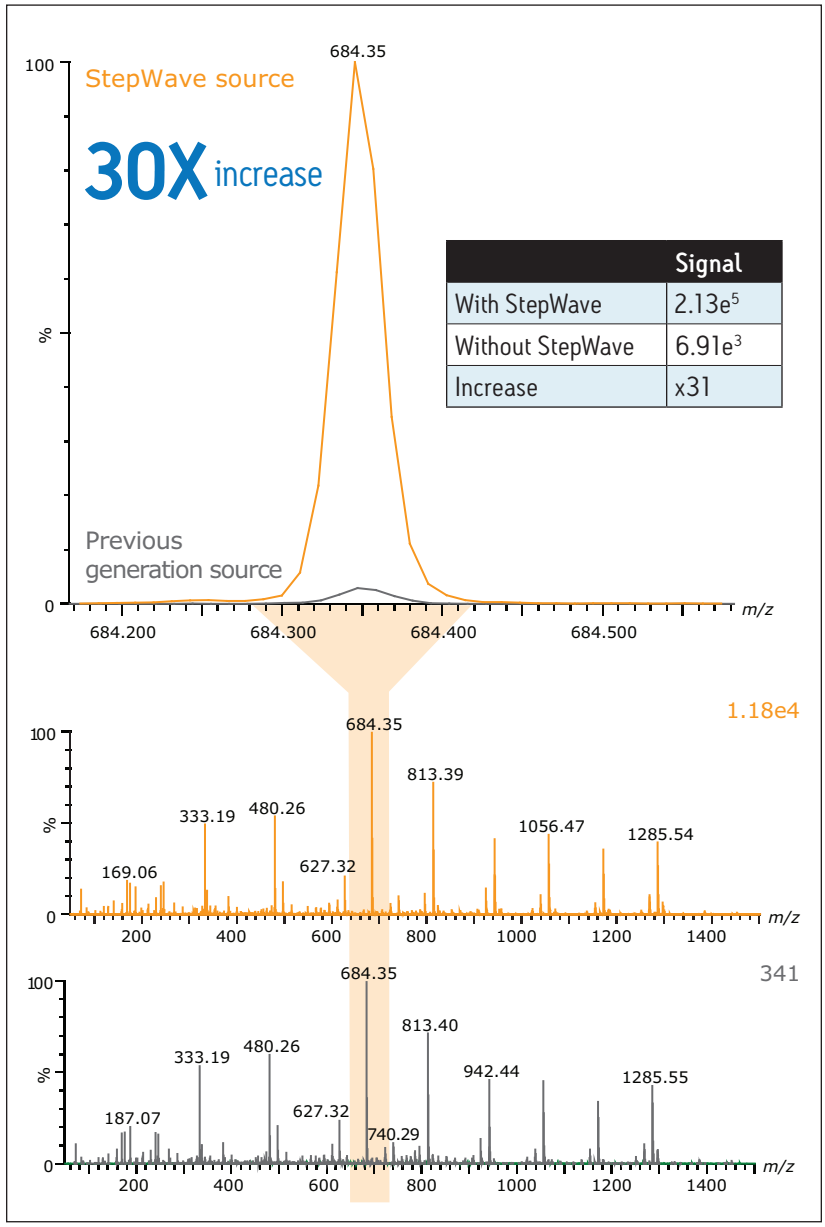

Figure 2. Direct infusion, electrsopray positive, MS/MS spectral data showing increase in signal intensity enabled by the use of StepWave transfer technology.

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