

Pushing toward next generation Ion-Trap-MS: ion formation, transfer and trapping

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Introduction

Ion-Trap MS are well established work-horses for a wide range of analytical application. Achieving significant improvements in system performance requires simultaneous enhancements in ion formation, ion transfer and ion trapping and activation. The presented new generation of amaZon Ion-Traps incorporates advancements in in the related performance factors: speed, sensitivity and resolution.

Methods

- The Desolvation Stage has been redesigned to achieve efficient analyte desolvation, direct, fast potential control and high ion yield
- A Dual stage, narrow spaced, large volume Ion-Funnel has been introduced for extra high ion acceptance and wide mass transmission profile characteristic
- The High Performance Ion-Trap Analyzer has been equipped with an additional separation and conditioning stage for better control of buffer-gas composition and injection

Results

- The new desolvation stage allows performing polarity switching without the need of additional stabilization delays
- 20 Hz MS acquisition rate can be achieved in alternating polarity mode (Fig. 2)
- 10 x sensitivity gain in MS/MS on Reserpine, shifting limits below 50 fg (Fig. 3)
- Isotopic resolution (FWHM < 0,5 Th) in XtremeScan mode at 52,000 Th/s (Fig. 4)
- Resolving 6-fold charged protein fragments in full scan operation with resolution $R = 21,500$ at m/z 2850 Th

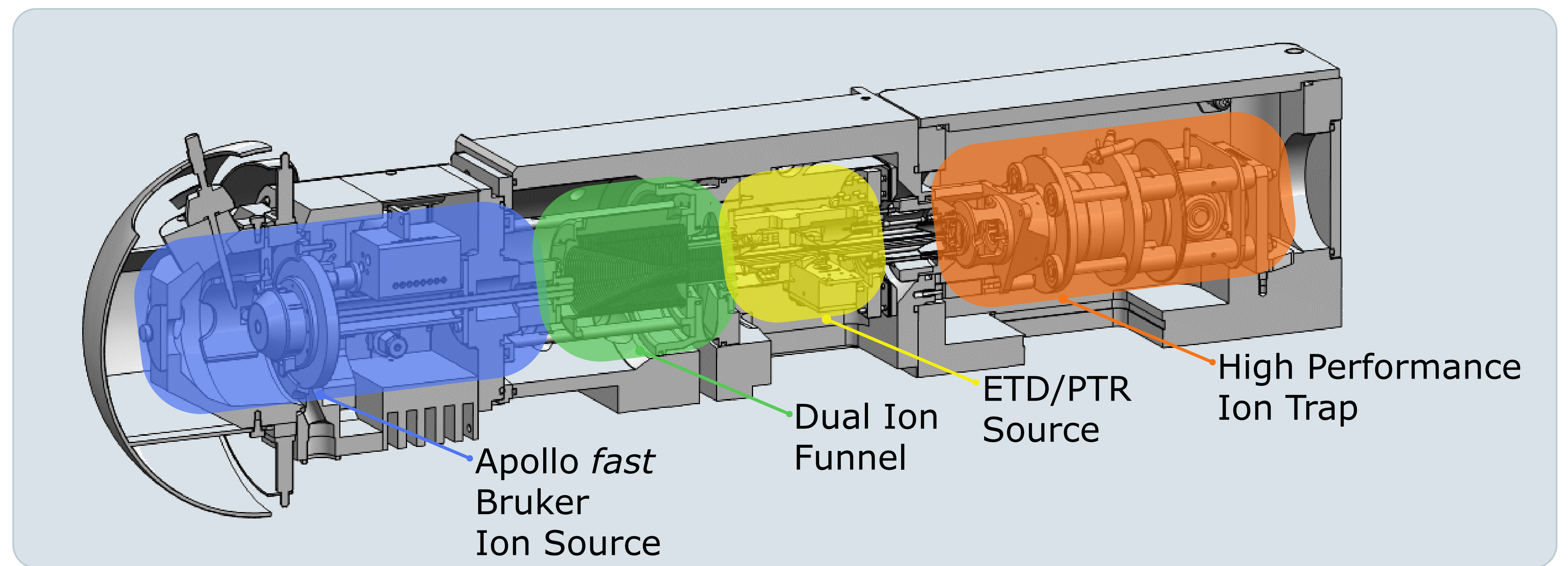


Fig. 1: Cross-section through ion path of amaZon ETD™

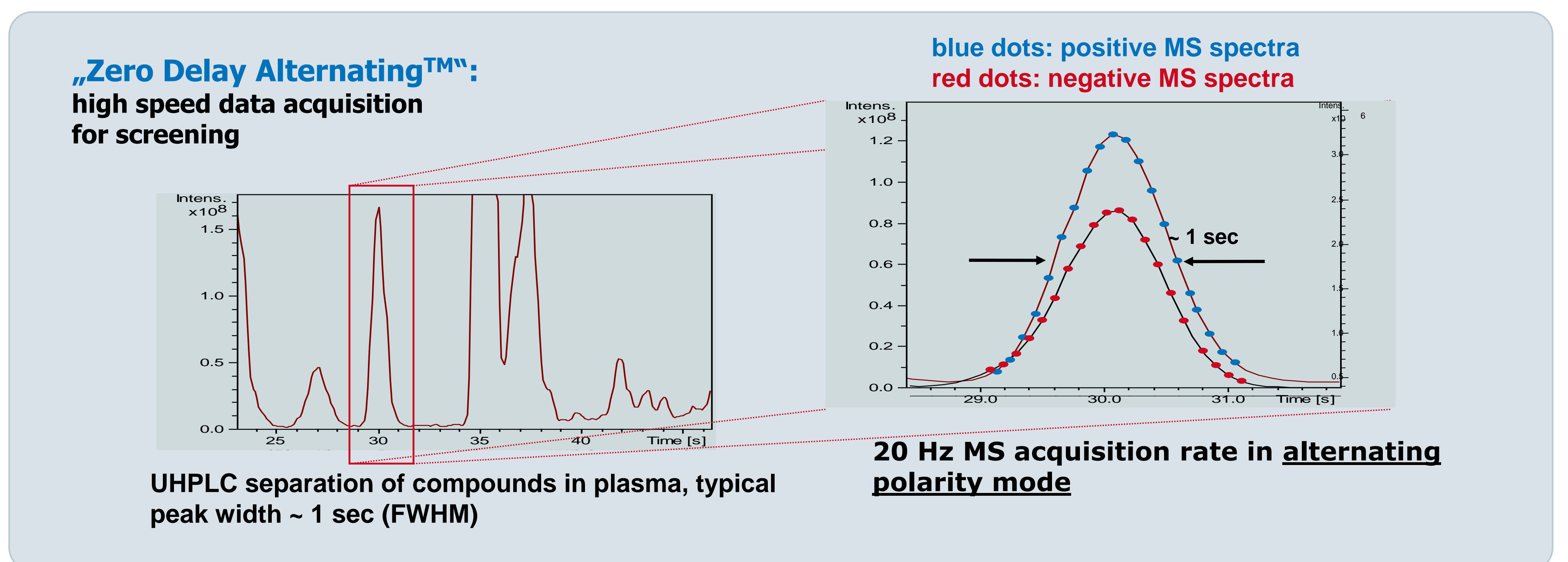


Fig. 2: UHPLC separation of compounds in plasma, typical peak width ~1 sec (FWHM): 20 Hz MS acquisition rate in alternating polarity mode.

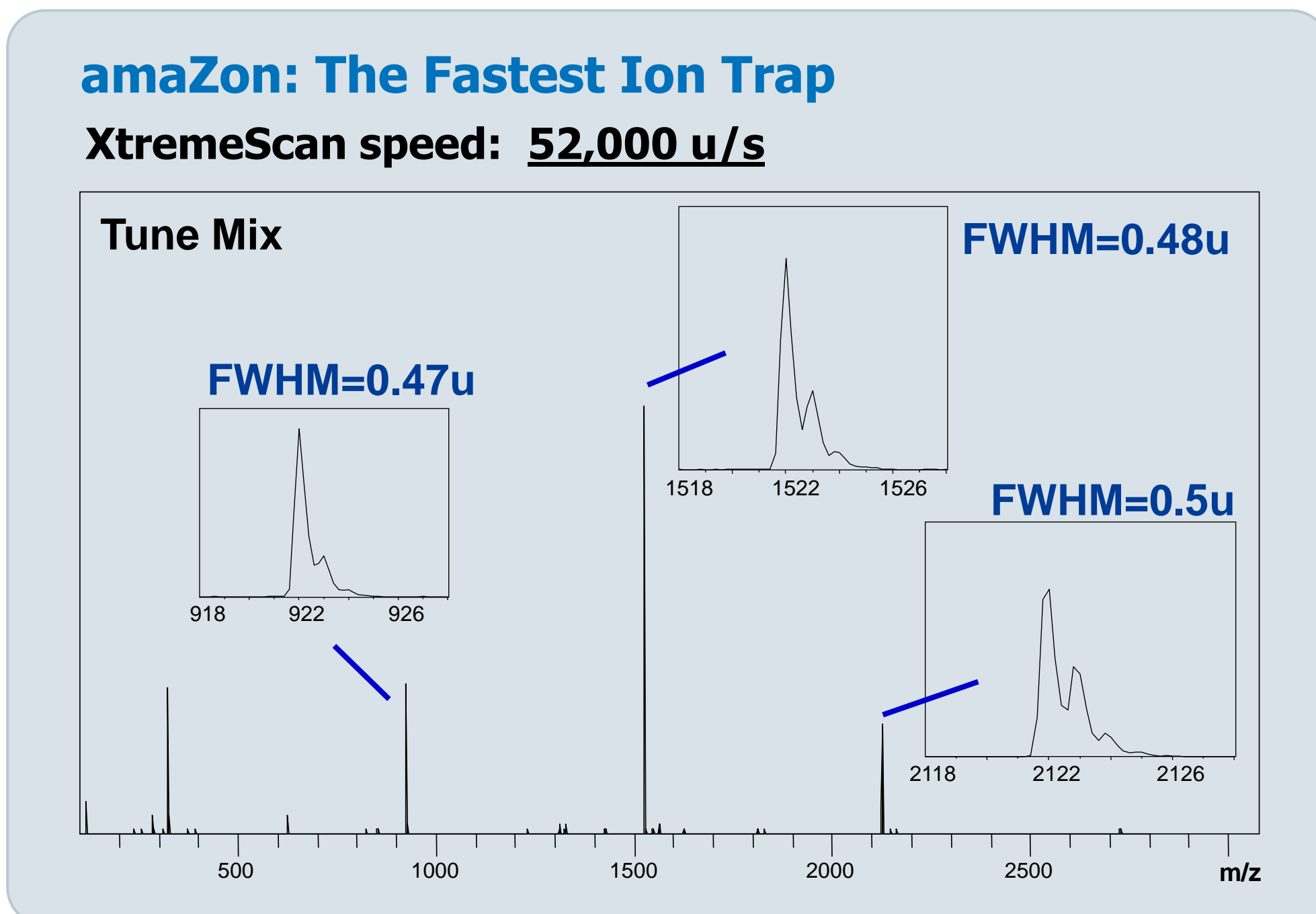


Fig. 4: Better than unit-resolution in XtremeScan mode at 52,000 u/s.

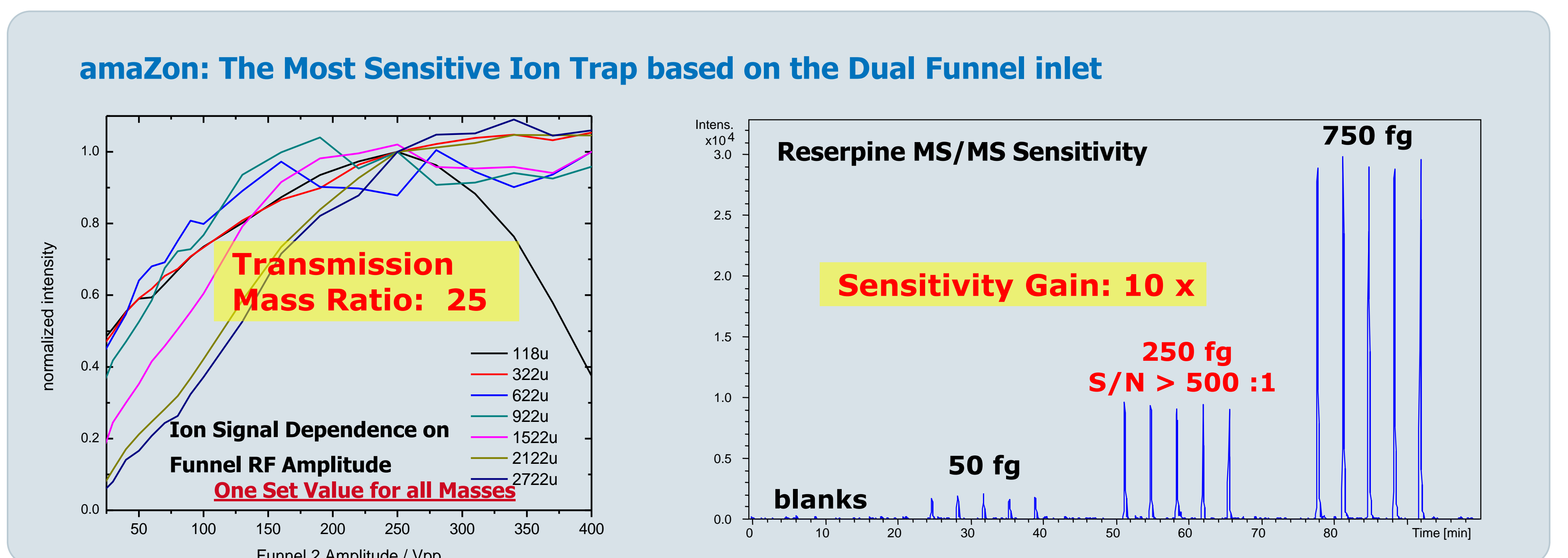


Fig. 3a: Evaluation of mass transmission profile of Dual Ion-Funnel: dependence of ion signal intensity for a wide range of m/z values. All ions are near to optimum in a single range of settings, resulting in a transmission mass ratio of 25.

Fig. 3b: 10 x Sensitivity improvement in MS/MS for Reserpine. $S/N > 500:1$ at 250 fg Reserpine injected. Robust signal even at amounts of 50 fg.

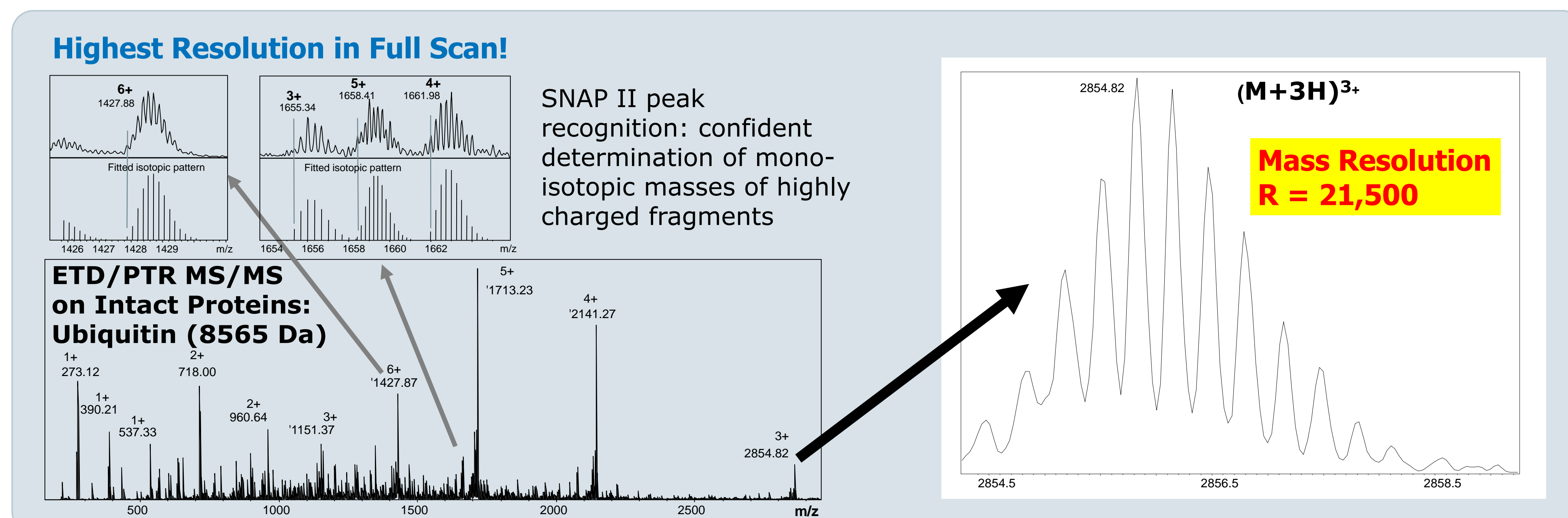


Fig. 5: Highest resolution in full scan mode! Resolving even 6-fold charged ions. Resolution $R > 21,500$ at 3000 m/z .

CONCLUSION

- The amaZon Ion-Trap MS reaches new levels in speed, sensitivity and resolution
- 10x higher sensitivity is ideally suited for bottom up analysis of complex protein samples
- Most sensitive, robust and easy-to-use ETD/PTR setup
- Ion Traps are the most versatile instruments for proteomics

Ion Trap