Maximizing analytical output from sensitivity on the ZenoTOF 8600 system

There is always a demand for faster, more sensitive instrumentation. Improvements in ion generation, capture, transmission, and detection can help achieve this increased sensitivity. The ZenoTOF 8600 system is a new accurate mass system that combines the proven ion source and ion filtering technologies from the SCIEX 7500+ system, our most sensitive and resilient triple quadrupole, with the versatility of the ZenoTOF 7600+ system.

This new platform delivers a 10x improvement in sensitivity compared to existing accurate mass systems, along with the speed to unlock enhanced performance across a wide range of accurate mass workflows. The novel combination of the OptiFlow Pro ion source, DJet ion guide, Mass Guard technology, and a new optical detection system makes it possible for the instrument to operate effectively at higher ion currents while protecting it from contamination.

This performance lets you do more with a single system, from high-sensitivity targeted quantitation to untargeted approaches that yield more comprehensive discovery datasets. It generates higher-quality EAD spectra faster, unlocking new approaches such as rapid data-dependent acquisition (DDA) to gain deeper insights into lipid biology, protein modifications, and metabolite structures.

The added flexibility of ZT Scan 2.0 DIA, where the Q1 dimension enables subunit precursor resolution, supports comprehensive profiling across a broader range of applications, allowing you to quantify what you previously struggled to identify.

To complement these technological advancements, SCIEX OS software 4.0 is designed to enhance the user experience and streamline workflows. It enables users to track instrument performance and health, and supports enhanced automated system tuning, helping to ensure optimal performance is easily achieved and maintained.

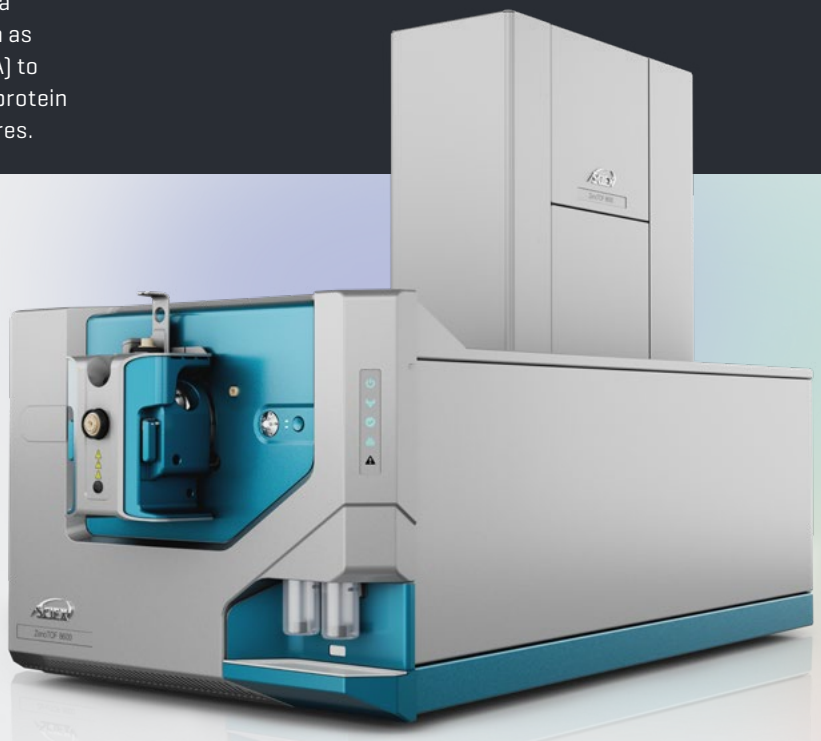

Figure 1. The ZenoTOF 8600 system

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Introduction

Fragment-centric workflows are the design philosophy behind SCIEX QTOF instruments. These workflows aim to deliver precise identification and quantitation of all molecule types, without compromising core fundamentals. Central to this is maximizing analytical performance through increased sensitivity, so customers can extract more information from less sample.

The ability to perform fast scanning without sacrificing resolution or mass accuracy in either MS or MS/MS modes supports a wide intra- and inter-scan linear dynamic range (LDR), delivering rich analytical data from smaller sample volumes.

The ZenoTOF 7600 system introduced the Zeno trap, a trapping and releasing component that achieves a >90% duty cycle compared to classical QTOF designs. This innovation has demonstrated a 4-20x boost in sensitivity. Combined with flexible fragmentation options and diverse discovery approaches, it became the most versatile SCIEX accurate mass system. Building on this foundation, the ZenoTOF 8600 system further extends versatility (Figure 2). Sensitivity remains a critical performance demand across all mass spectrometry platforms, which is why triple quadrupole systems are often preferred for quantitative workflows.

The SCIEX 7500 system introduced DJet ion guide technology into the ion optics and source, enabling new levels of quantitation across a wide range of sample types and workflows. The SCIEX 7500+ system advanced this further, enhancing robustness and resilience without compromising performance. Mass Guard technology includes the option to apply a high m/z cut-off above the target precursor ion, effectively filtering out unwanted high m/z species that contribute to contamination.

These technological advancements reinforce SCIEX leadership in quantitation. The ZenoTOF 8600 system evolved from these innovations, making it the most sensitive accurate mass system in our portfolio. By combining proven ion source and ion filtering technologies from our most sensitive triple quadrupole system with our most versatile accurate mass innovation and a new optical detection system, this new platform delivers up to 10x improvement* in sensitivity. This, together with functional speed improvements, unlocks enhanced performance across a multitude of accurate mass workflows.

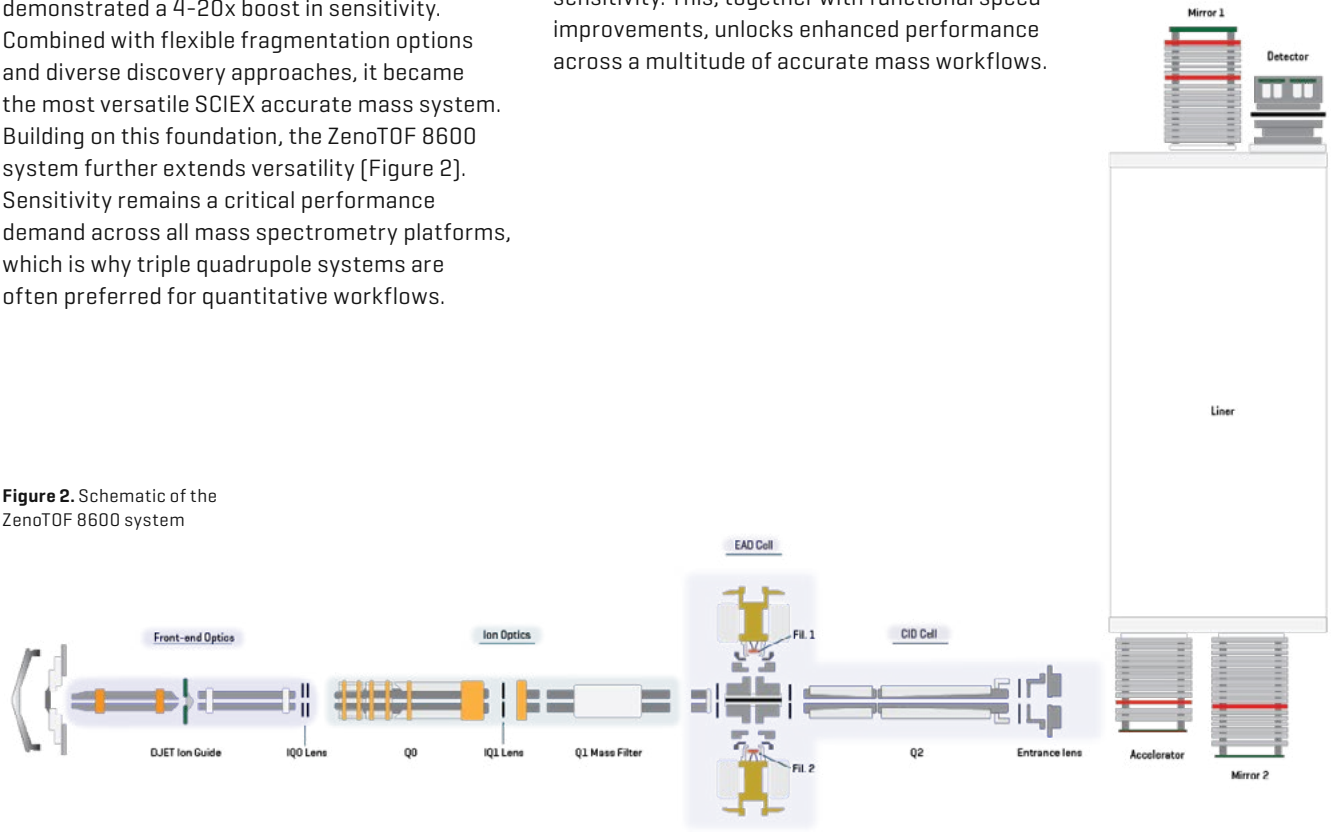


Figure 2. Schematic of the ZenoTOF 8600 system

Technology to enable greater sensitivity

Achieving greater sensitivity requires gains in ion generation, transmission, and/or detection. However, these improvements must be balanced with strategies to minimize contamination, especially when operating at high ion currents.

OptiFlow Pro ion generation

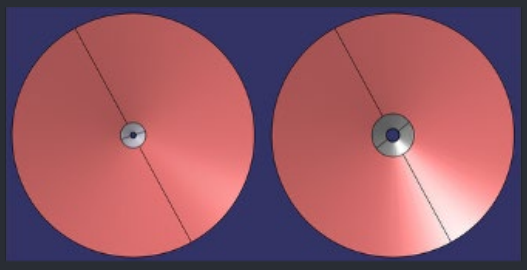
The fourth-generation OptiFlow Pro ion source builds upon the Turbo V ion source and requires no physical adjustments to deliver optimal sensitivity under all conditions and reduces user-to-user variation. It is a single source for all flow rates, delivering maximum performance from 100 nL/min to 3 mL/min using drop-in probes and electrodes. This versatility supports wide compound coverage, interchangeable ESI and APCI towers, and a dedicated nanoflow module for flow rates below 500 nL/min.

Also featured on the SCIEX 7500+ system, the OptiFlow Pro ion source includes the option of activating the E Lens probe, which for certain workflows can enhance sensitivity in ESI with increased field strength and ion generation through more energetic droplet desolvation. The E Lens also changes the electric field within the ionization chamber to drive more ions into the MS inlet.

For the ZenoTOF 8600 system, the E Lens probe has been replaced with a dual-function calibration sprayer that combines the electrical potential-shaping effect of the E Lens probe with probe to introduce calibrant ions. While the benefit decreases at higher flow rates, due to larger droplets being less influenced by the electric field, a meaningful improvement in gaseous ion capture and overall system sensitivity is still achieved.

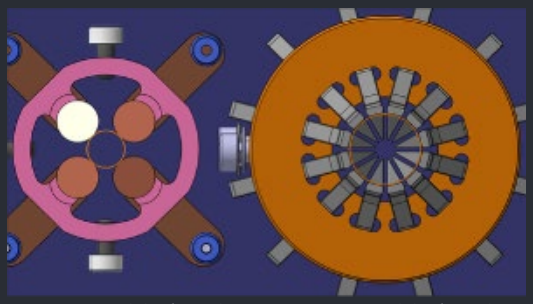
To simplify mass accuracy maintenance across all flow rates, the OptiFlow Pro source includes independently controlled dual probe ports. This allows the calibration sprayer to remain in place while the analytical sprayer operates at optimal gas and voltage settings. The calibrant probe is positioned off-axis relative to the inlet, improving robustness while enabling calibration and enhancing sensitivity through electric field shaping.

Figure 3. Enlarged inlet and assembly of DJet and QJet ion guides, attributed to the majority of the up to ~10x system sensitivity improvement (>1 µL/min flow rates). Nano flow (<500 nL/min ~3-5x improvement**).



ZenoTOF 7600 inlet (curtain and orifice plates)
Orifice: 0.61 mm

ZenoTOF 8600 inlet (curtain and orifice plates)
Orifice: 1.5 mm



ZenoTOF 7600 inlet (curtain and orifice plates)

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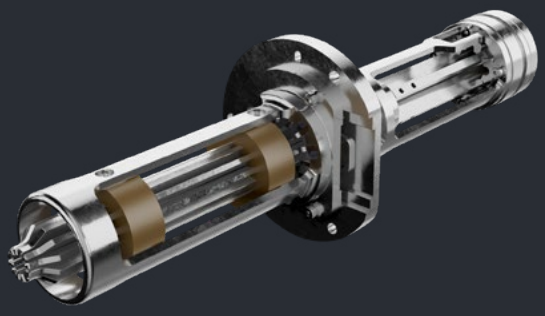

Ion capture and transmission using combined QJet and DJet ion guides

The QJet ion guide was first introduced in the API 5000 system to capture ions in the high-pressure region behind the orifice, focus them, and transfer them to Q0. This innovation carried through to the SCIEX 5500 system, marking the launch of the "blueline" platform, with similar sensitivity and a redesigned pumping configuration. The QJet ion guide was lengthened from 5 cm to 12 cm to reduce impact pressure, and further sensitivity gains were realized in the SCIEX 6500+ system through the combination of dual QJet ion guides, the IonDrive source, and an enlarged inlet diameter.

With the launch of the SCIEX 7500 system, the dual QJet ion guides evolved into the dual-stage DJet and QJet ion guides for improved ion capture and transfer. The DJet ion guide efficiently captures ions in the high gas flow behind the orifice plate. Its front section features a tapered dodecapole geometry that focuses ions into the second-stage QJet ion guide, which has a square-rod quadrupole design and captures the ions under their optimal pressure regime.

The QJet and DJet ion guides work together to capture ions in the high-pressure region, focus them and transfer them to Q0. The DJet ion guide captures high velocity ions in the plume as they enter the higher pressure first vacuum stage after the orifice, which has a 6X greater area on the ZenoTOF 8600 system. The DJet ion guide configuration also includes an additional vacuum chamber in front of the QJet ion guide, operating at 5-6 Torr. Its wider inscribed diameter improves ion capture and transmission to the next vacuum stage compared to the standard QJet ion guide design.

In nanoflow regimes, the nano inlet consumes the entire spray plume. While this is true for both the ZenoTOF 7600 system and the ZenoTOF 8600 system, transmission is improved on the ZenoTOF 8600 system, resulting in up to a 2.5x increase in sensitivity.

The dual-frequency QJet ion guide provides the benefit of tailoring the applied RF frequency to improve performance in both low m/z and high m/z ion experiments. Operating the QJet ion guide in low-frequency (LF) mode increases the effective potential at comparable applied RF voltages, extending the efficiently transmitted mass range. High-frequency (HF) mode benefits low m/z ions by widening the transmission window, enabling simultaneous transmission of low and high m/z ions at a single RF level and providing additional signal boost.

On the SCIEX 7500 system, declustering can be achieved through a voltage differential between the QJet ion guide and the IQ0 lens or between the IQ0 lens and Q0 rods. This configuration can be used to de-tune the signal, remove interferences, and improve the signal-to-noise ratio. On the ZenoTOF 8600 system, the ion transmission control hardware at the IQ0 lens was redesigned with pulsing bars to improve robustness and support higher ions currents (Figure 3).

Mass Guard technology and optical detector

Earlier systems exposed the Q1 region to a wide mass range. In product ion (MS/ MS) or SWATH DIA modes, only ions that pass through Q1 reach Q2 and the TOF detector. However, the range of ions entering Q1 can be broad, often exceeding the scanned mass range, which can lead to contamination of lens elements, up to and including Q1.

Mass Guard technology was first introduced in the SCIEX 7500+ system in 2024. In the 7500+ system, a contamination filter was introduced that acts as a bandpass filter to eliminate high-mass contaminant ions, typically 100 Da above the precursor mass. Following from the innovations introduced in the 7500+ system, the enhanced Q0 region in the ZenoTOF 8600 system incorporates T Bar electrodes to create a high m/z cut-off above the target precursor ion (Figure 4). This effectively removes unwanted high m/z species and narrows the m/z range of ions transmitted downstream (IQ1 and Q1, for example). The bandpass filter reduces the load of charged debris reaching critical downstream lens or mass analyzer elements, helping to minimize contamination and maintain instrument performance (Figure 4).

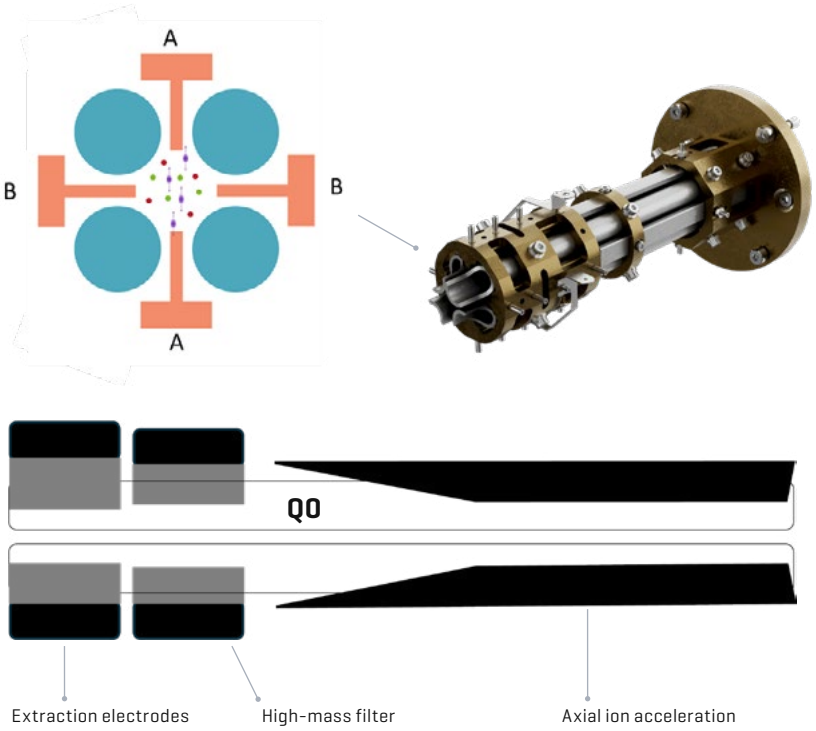

Figure 4. Illustration of key components of a Q0 T Bar assembly.

Illustration of high-mass ion filter using T Bar electrodes. A DC potential difference (bandpass DC) was symmetrically applied between the two T Bar poles, which creates electric field conditions that remove high m/z ions2. Given a Q1 precursor m/z and a desired HMCO window size, we can calculate DC offset potential applied on T Bar electrodes. A high m/z cutoff at m/z values of a few Da (e.g. 100 or 200 Da) higher than an ion of interest can be created. When both T Bar poles (A and B) have the same offset potential as Q0, the bandpass is disabled and no HMCO is applied.

A symmetrical DC potential difference is applied between the two T Bar electrodes, reducing radial confinement of ions traveling through Q0 where the T Bar electrodes are active. This configuration allows higher mass ions to be selectively filtered from the ion beam and directed to the T Bar electrode surfaces, effectively removing them from the beam and preventing contamination of Q1. In this way, the T Bar electrodes function like a guard column in liquid chromatography, protecting the Q1 region, where key selectivity occurs, from contamination.

This protective mechanism was first implemented in the SCIEX 7500+ system and is now integrated into the ZenoTOF 8600 system. The technology was adapted to support wide mass range acquisition typical of TOF MS experiments, while also enabling ion transmission control. The design was enhanced with auxiliary electrodes that assist ion guidance along the Q0 ion guide.

Despite operating at approximately 10x higher ion current, the Mass Guard technology in the ZenoTOF 8600 system helps maintain performance (Figure 5). In these robustness tests, the stop criterion was defined as a 2x loss in either TOF MS or MS/MS signal. The new Q0 ion guide enabled at least a 4x increase in the total matrix load that could be sprayed before reaching this threshold, compared to the ZenoTOF 7600 system without high-mass ion filter.

To further support sustained performance under increased ion flux, the ZenoTOF 8600 system features a redesigned detection system. This includes a novel 4-channel optical-based detector and advanced ADC signal capture technology (Figure 6).

Traditional chevron-stacked multichannel plate (MCP) detectors require significant electron amplification to detect single ions. In particular, the second MCP plate often experiences extreme electron loads, millions of electrons per ion, which leads to rapid depletion and reduced detector lifetime.

To overcome this limitation, the ZenoTOF 8600 system replaces the second MCP with a more robust charge amplification technology: photomultiplier tubes (PMTs). This design significantly extends detector lifetime. Highly accelerated lifetime testing predicts a ~5-year operational lifespan, even under the increased ion load of the ZenoTOF 8600 system.

To preserve timing precision, extend dynamic range, and further boost longevity, the detection area is subdivided into four independently controlled and monitored detection zones. Each zone contains its own PMT, effectively creating four parallel detection channels. This configuration provides up to a 4x improvement in linear dynamic range (LDR) and detector lifetime compared to single-channel designs. It also mitigates the impact of MCP plate flatness on flight time measurements.

To reduce electronic noise and establish ground-referenced output signals, the system optically decouples the AC and DC components of the output signal. This process converts ions to electrons, then to photons, which encode critical information to determine ion time of flight and intensity and are ultimately projected through vacuum onto the PMTs. This optical decoupling allows charge amplification to continue with less concern for accelerated charge depletion.

Each channel features independent gain control, enabling output normalization for consistent response and enhanced LDR. Because the AC signals are optically decoupled from high voltage, the resulting ground-referenced signals exhibit reduced noise, allowing for lower detection thresholds and improved sensitivity and dynamic range at the system level.

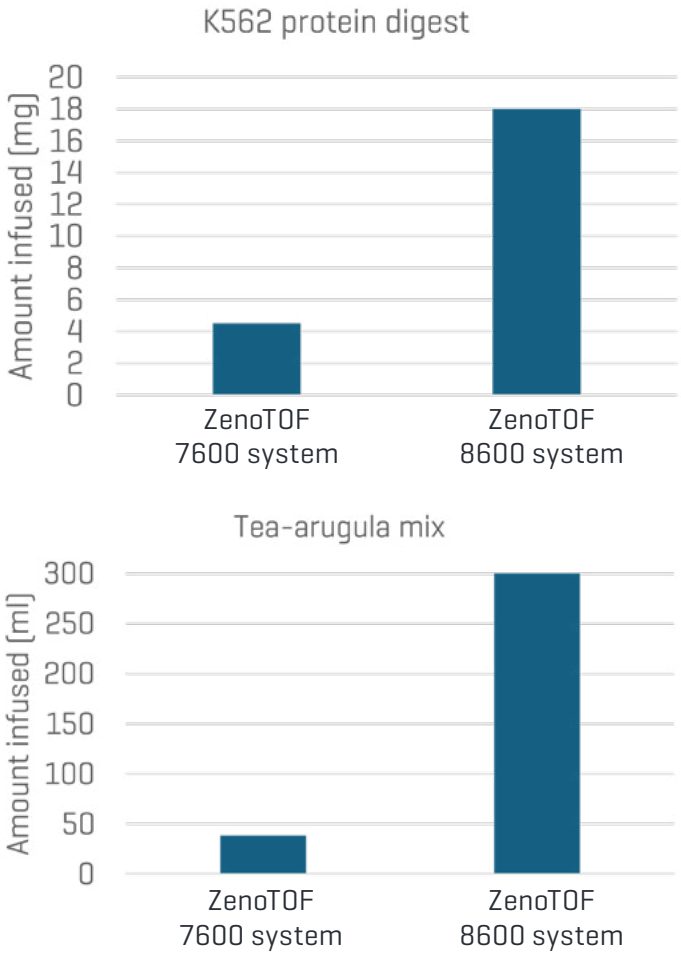

Figure 5. Results of robustness tests with infusion of (a) K562 protein digest and (b) Tea-arugula matrix.

Results of robustness tests with infusion of (a) K562 protein digest and (b) Tea-arugula matrix.

The stop criteria for the robustness tests was a 2x loss in either TOF/MS or MS/MS, and the new Q0 ion guide gave at least 4x increase in the total matrix that could be sprayed prior to reaching the stop criteria, when compared to a SCIEX ZenoTOF 7600 system without the band-pass capability. In the tests, the ZenoTOF 8600 system also showed about 10x higher signals than the ZenoTOF 7600 system across a wide range of compounds and workflows.

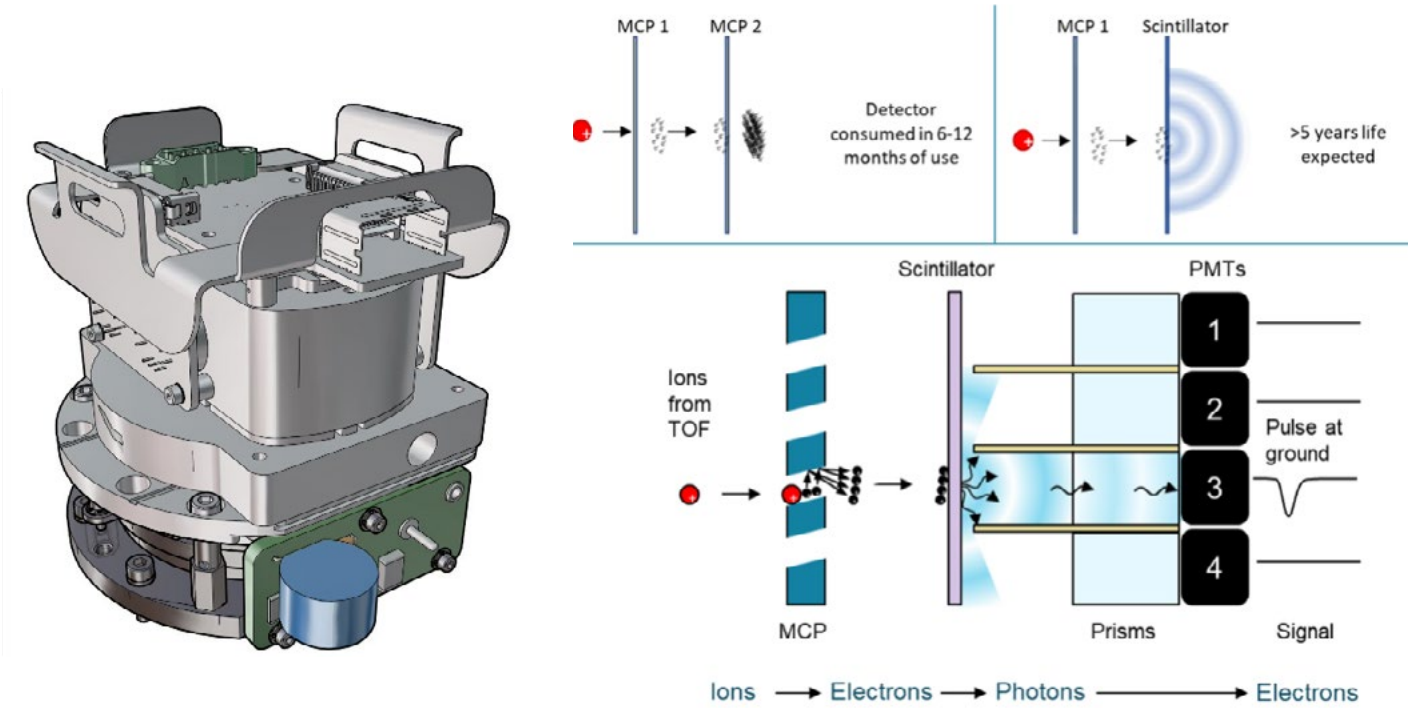

Figure 6. The optical detection system

The output pulses from the optical detector are captured using an ADC card. Software-based strategies extract ion arrival times and intensities, enabling accurate spectral information to be measured across a broader range of intensity levels in the ZenoTOF 8600 system.

Traditional time-to-digital converter (TDC)-based pulse measurement systems can accurately measure ion arrival times but cannot distinguish between pulses generated by single ions and those produced by multiple ions arriving simultaneously. The ZenoTOF 7600 system addressed this limitation by implementing analog-to-digital converter (ADC) pulse detection technology, which enables both precise timing and quantitation of ion arrivals at the detector.

However, ADC systems have a defined input range. When the detector output exceeds this range, the resulting signals become clipped, leading to potential non-linear ion counting. With the ZenoTOF 8600 system, the average ion flux has increased significantly compared to the ZenoTOF 7600 system. Although the photomultiplier tube (PMT) output remains linear across a broad input range, it is still possible for the detector signal to exceed the linear range of the ADC.

Rather than discarding these clipped pulses, the ZenoTOF 8600 system uses pulse width measurements at specific reference levels to estimate key attributes such as precise arrival time and total ion count. This approach ensures that the detection system's linear dynamic range (LDR) remains aligned with the extended ion current range transmitted to the detector.

Increased sensitivity benefits identification and quantitation

Incorporating proven SCIEX triple quadrupole technology enables fast, sensitive quantitation with up to 10-fold lower limits of quantitation (LOQs) and a linear dynamic range (LDR) of up to five orders of magnitude.

The raw signal increases observed in MS1 and MS2 are not accompanied by proportional increases in noise, resulting in improved signal-to-noise ratios and enhanced quantitative performance. The instrument's ability to scan fast enough to capture sufficient data points per ion, even as sample complexity increases or chromatography runs shorten, is critical, especially when the likelihood of co-elution rises.

While nominal mass systems can monitor many multiple reaction monitoring (MRM) transitions per cycle, they cannot deliver full-scan MS/MS data at speed. Some accurate mass systems achieve fast scan speeds by compromising MS/MS resolution and sensitivity. In contrast, SCIEX QTOF instruments maintain mass resolution, mass accuracy, and sensitivity independent of scan speed.

High-resolution MS/MS-based quantitation also benefits from the ability to eliminate co-eluting isobaric analytes, contaminants, and background noise. These interferences can compromise analyte extraction when using nominal mass or intact precursor masses from high-resolution full-scan MS data, even at very high resolution. Leveraging MS/MS-level data for peak extraction and integration significantly improves quantitation quality by virtually eliminating interferences. This leads to lower detection and quantitation limits and improved quantitative accuracy.

With this capability, you can confidently identify and quantify thousands of analytes from complex samples in short acquisition times and with high precision. The wide intra- and inter-scan dynamic range enables simultaneous detection and quantitation of both low- and high-abundance analytes in a single run, helping to ensure accurate, reproducible results even in complex biological matrices.

Sensitivity improvements across MS1 and MS2 enhance the instrument's quantitative capacity and enable high-precision identification of low-abundance proteins, lipids, and metabolites using both data-independent acquisition (DIA) and data-dependent acquisition (DDA) methods. These capabilities support deeper insights into disease mechanisms, novel drug targets, and biomarker discovery.

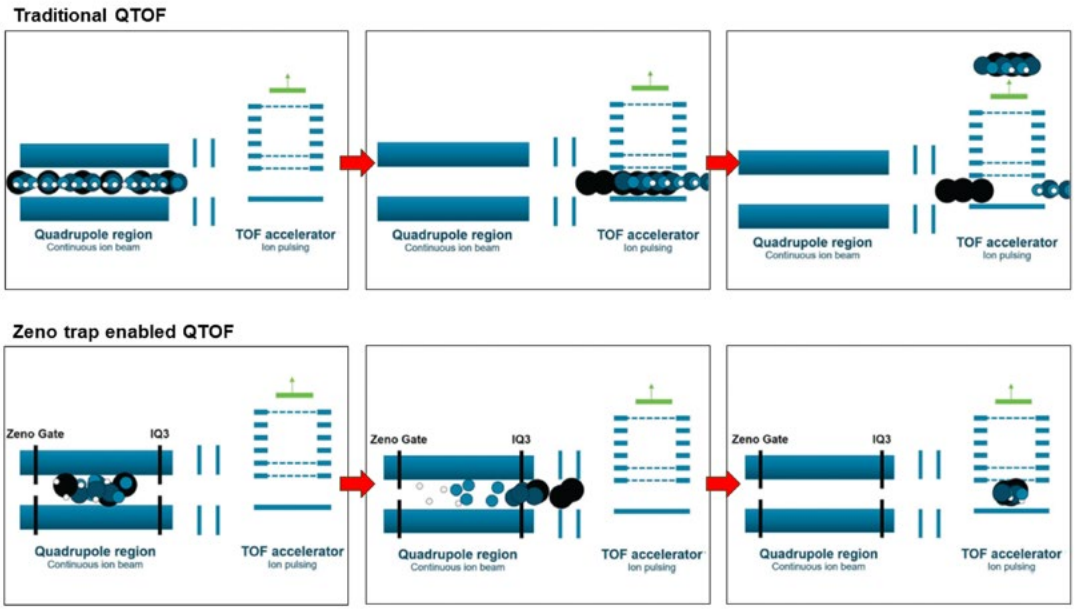

Figure 7. Schematic of ion control and duty cycle in (a) traditional QTOF or (b) Zeno trap enabled QTOF. (a) In the traditional QTOF design ions are continuously lost to vacuum during TOF acquisition, resulting in a low duty cycle and reduced sensitivity. (b) The Zeno trap captures and synchronizes ion release with the TOF pulse, significantly increasing the duty cycle and enhancing ion transmission efficiency.

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ZenoTOF systems' technologies enable versatility

The ZenoTOF 8600 system delivers its most significant sensitivity improvements through advancements in ion generation and transmission. However, its versatility is further enhanced by the integration of the Zeno trap and electron activated dissociation (EAD) cell. Together, these innovations improve MS1 and MS2 sensitivity, elevating data quality across a wide range of workflows and enabling users to accomplish more with a single system.

The Zeno trap

The Zeno trap was developed to address the sensitivity limitations caused by low duty cycles in traditional accurate mass systems (Figure 7). In conventional QTOF designs, ions are injected orthogonally into the TOF analyzer, resulting in substantial ion loss and a typical duty cycle of only 5 -25% (a). The Zeno trap overcomes this by accumulating ions and then rapidly pulsing them into the TOF analyzer, enabling up to 20x more fragment ions to be detected (b). This significantly increases the amount of useful MS/MS information, particularly for low-abundance species that were previously undetectable.

The Zeno trap manages the ion beam from the collision cell to the accelerator. Ions are first pre-trapped in a region preceding the Zeno trap, then transferred to a short linear ion trap at the end of the collision cell. They are released sequentially based on potential energy, generally resulting in an ordered release from higher m/z ions and decreasing to lower m/z ions. This results in ions from a wide m/z range arriving simultaneously in the accelerator region. With matched axial and orthogonal energies, they are collected as an axially compressed ion packet, enhancing overall MS/MS sensitivity.

On average, the Zeno trap transmits 10x more ions, making it particularly effective for low-intensity ion signals, such as those encountered in MS/ MS acquisitions. The Zeno trap is dynamically activated during acquisition based on an intensity threshold, ensuring broad dynamic range and optimal performance. When ion intensity falls below the threshold, the Zeno trap activates to boost sensitivity and improve the lower limit of quantitation (LLOQ). This threshold can be adjusted to fine-tune quantitative performance.

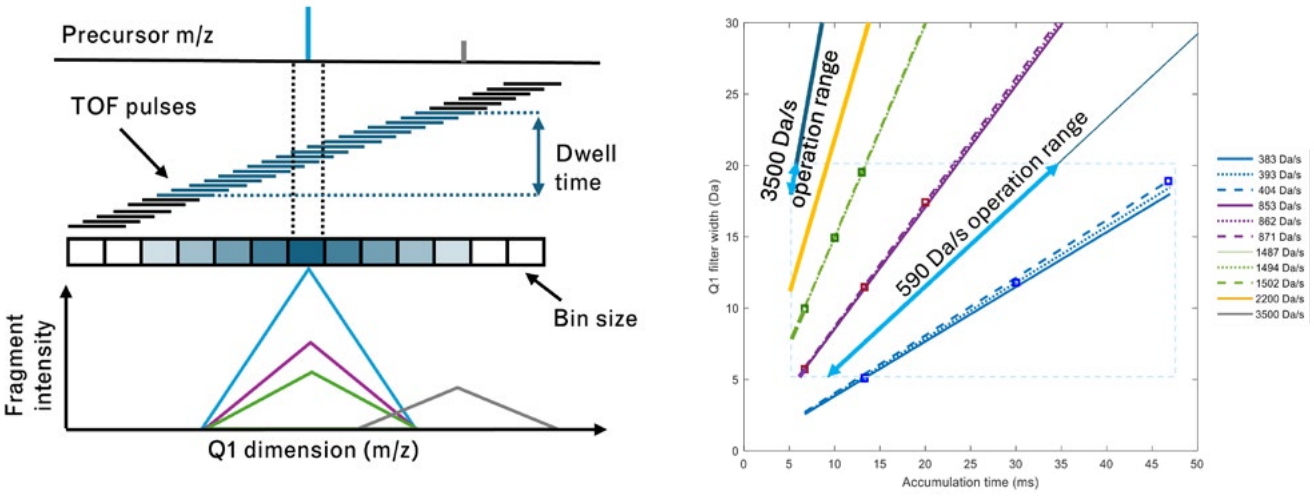


Figure 8. (A) ZT Scan DIA 2.0 utilizes scanning quadrupole dimension along with LC dimension for correlating fragments to precursors and (B) The lines in the figure correspond to different scanning speeds ranging from slow to faster. The lower speeds depict more Q1 window options allowing increased selectivity.

ZT Scan 2.0 DIA : A comprehensive DIA for all applications

ZT Scan DIA was first introduced on the ZenoTOF 7600+ system. The initial implementation included three predefined acquisition settings with fixed mass ranges, optimized for typical proteomics data-independent acquisition (DIA) workflows using +2 charge state precursors.

ZT Scan 2.0 DIA builds on this foundation by automatically determining acquisition settings based on user-defined parameters (Figure 8). It supports flexible precursor ranges and adjustable collision energy based on charge state, enabling both proteomics and small-molecule workflows. ZT Scan generates data that allows precursor-fragment correlation through the scanning dimension. This makes ZT Scan 2.0 DIA the most comprehensive SCIEX DIA approach and a powerful high-throughput discovery tool for all molecule types.

The new method builder in SCIEX OS software allows users to easily tailor acquisition methods to suit their chromatography. Editable parameters include:

- Cycle time for sufficient sampling of the LC peak
- Precursor scan range
- Fragment scan range
- Collision energy regimes (fixed, dynamic, or custom)
- Zeno trap activation based on sample load

SCIEX OS software calculates ZT Scan DIA 2.0 settings, such as Quad speed and isolation width, based on the selected cycle time and scan range. It presents a range of viable settings that offer different levels of selectivity and signal-to-noise, minimizing the effort required for acquisition optimization. The auto-populated settings yield high-quality data suitable for both identification and quantitation.

A significant performance enhancement in ZT Scan 2.0 DIA includes optimized .raw to .wiff file conversion. New algorithms generate cleaner spectra and smaller file sizes without loss of information, and conversion times no longer exceed acquisition times

The EAD cell

Electron activated dissociation (EAD) is a gas-phase ion dissociation method that uses free electrons to induce unstable radical states, triggering fragmentation through radical chemistry (Figure 9). EAD encompasses a range of mechanisms, including electron capture dissociation (ECD), hot ECD, electron impact excitation of ions from organics (EIEIO), negative ion ECD (niECD), electron detachment dissociation (EDD), electron ionization dissociation (EI+D), and electron induced dissociation (EID), classified by the kinetic energy of the electron beam and the charge state of the precursor ions. EAD excludes electron transfer dissociation (ETD), which uses reagent anions rather than free electrons.

The reagent-free, energy-tunable EAD cell in the ZenoTOF 8600 system supports a wide variety of free-electron-based fragmentation mechanisms. It generates a rich array of diagnostic fragment ions not accessible through conventional collision-induced dissociation (CID), enabling deeper insights into complex samples. This includes the differentiation of isobaric moieties and the fragmentation of compounds previously considered intractable.

The EAD cell in the ZenoTOF 8600 system supports higher kinetic energy regimes, up to 50 eV, extending its capabilities in negative ion mode. At these energy levels, in-situ nitrogen plasma generation becomes possible, providing an efficient means of dissociation for oligonucleotides and other challenging analytes.

High-capacity, fast Electron Activated Dissociation (EAD)

EAD technology was first introduced in the ZenoTOF 7600 system. The tunable EAD cell allows electron energy to be adjusted to match the specific precursor, enabling optimized fragmentation for both singly charged precursors (such as lipids and metabolites) and multiply charged precursors (such as peptides). The reaction speed, efficiency, and overall instrument sensitivity make EAD compatible with fast UHPLC chromatography.

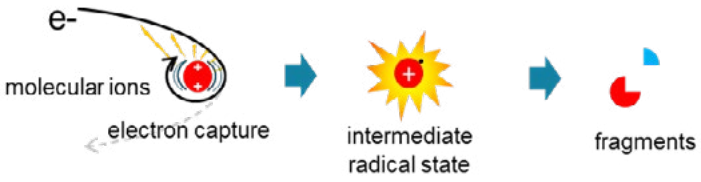
Alternative fragmentation techniques like EAD have proven valuable for detecting structural variations and localizing modifications, deepening our understanding of biological processes. Historically, the lower fragmentation efficiency of EAD compared to collision-induced dissociation (CID) limited its use, especially for endogenous analytes, which often required higher concentrations or longer accumulation times to generate sufficient fragment intensity. As a result, EAD was primarily used as a research tool.

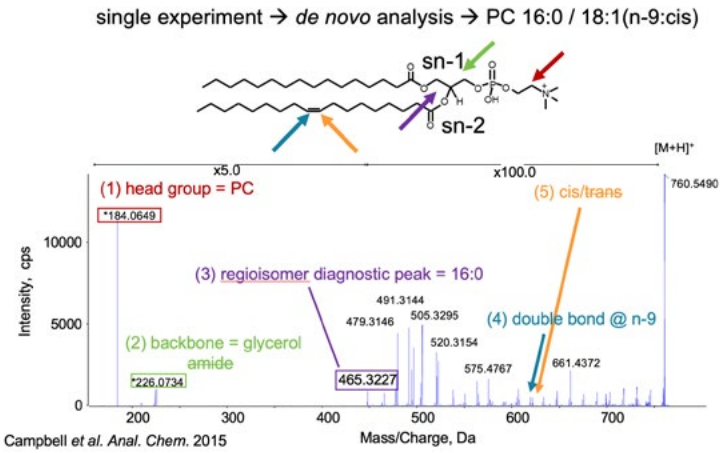
However, with the launch of additional software and spectral libraries, EAD adoption has expanded beyond proteomics into lipidomics. On the ZenoTOF 8600 system, increased sensitivity significantly improves the quality of EAD MS/MS spectra. This sensitivity gain also enables shorter reaction times and maximizes data acquisition from a single injection.

Thanks to faster EAD reaction times and reduced accumulation requirements, EAD profiling can now be performed on the same timescale as CID. This elevates EAD from a specialized research tool to a viable option for routine analysis. The ability to acquire higher-quality EAD spectra more quickly unlocks new approaches, such as rapid data-dependent acquisition (DDA), and enables deeper insights into lipid biology, protein modifications, metabolite structures, and oligonucleotides.

Enhanced sensitivity in MS1 and EAD MS/ MS modes has also demonstrated improved structural characterization of phase I and II drug metabolites, supporting more confident and comprehensive analysis.

Figure 9. The EAD cell. Electron-based fragmentation such as electron capture dissociation (ECD), "hot ECD" and electron impact excitation of ions from organics (EIEIO), enabling the analysis of a wide range of molecules from multiply charged to singly charged ions. An example lipid EAD spectra is shown.





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Conclusions

Technology must continue to evolve to support scientific discovery and deepen our understanding of biological systems. These advancements can take many forms, some tailored to specific workflows or applications, but a common thread across most is the need for sensitivity, whether as a direct performance metric or as an enabling capability.

However, sensitivity gains alone are not sufficient. They must be matched with complementary detection systems and robust mass spectrometry technologies to ensure consistent, high-quality performance. The ZenoTOF 8600 system integrates the innovations required to meet this challenge: OptiFlow Pro ion source, DJet ion guide, Mass Guard technology, and a novel optical detection system.

Together, these technologies enable simultaneous qualitative and quantitative analysis at levels comparable to triple quadrupole systems. This raw sensitivity allows for the identification and quantitation of low-abundance analytes with greater precision, enhancing profiling capabilities and enabling deeper exploration of complex biological samples, all from a single injection.

The system also elevates the performance of electron activated dissociation (EAD), bringing low-abundance diagnostic ions out of the noise for confident structural annotation. Singly charged workflows benefit from increased fragment ion intensity, transforming sensitivity into speed. With the ability to perform data-dependent acquisition (DDA) using both CID and EAD on equivalent timescales (>10 ms), the ZenoTOF 8600 system expands the scope of the analysis.

ZT Scan DIA 2.0 further advances this capability. The additional specificity of the Q1 dimension enables an effective unit precursor ion resolution, comparable to ion selection on a nominal mass platform. This represents a paradigm shift for small-molecule workflows, where DIA has historically lacked the specificity and quantitative precision needed to uncover meaningful biological insights. This acquisition mode is ideally suited for high-throughput workflows and large cohort studies, delivering confidence and high quantitative accuracy across datasets.

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