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ASMS 2023: New Product Introductions

ASMS 2023 brought several new product introductions as vendors seek to expand and improve their MS portfolios. The introduction included extensions of the well-known timsTOF and Orbitrap franchises, new triple quads and systems resulting from recent technology acquisitions. Themes included ongoing improvements in speed and sensitivity, new developments in chromatography-free approaches and a focus on proteomics.

At ASMS 2023, **Agilent Technologies** introduced the fourth generation of its popular 6495 LC triple quad devices, the 6495D LC/TQ. The 6495D LC/TQ boasts a completely redesigned front-end dual-stage ion funnel along with new ion optics that allow greatly increased sensitivity and speed. The new system can analyze twice as many compounds as the previous offerings, with dwell times of about a half a second. Jennifer Gushue, PhD, Associate Vice President, Mass Spectrometry Marketing for Agilent told *IBO*, "We have a significant increase in sensitivity, on average at least three times. This brings it down to sub-femtogram levels." The device has numerous applications such as metabolomics, lipidomics, proteomics and environmental testing. With additional intelligence features, the device allows for optimization routines.

Alongside the new device was an announcement for a new workflow for PFAS, which when combined with the 6495D's increased sensitivity allows for improved PFAS detection. The workflow also includes a new Agilent Bond Elut PFAS WAX SPE Cartridge, specifically designed for PFAS analysis using challenging EPA Draft Method 1633. "PFAS are very challenging when it comes to sample prep. We've been working with [customers] all the way through that workflow...all the sample prep used plus the standards plus the solvents," commented Sudharshana Seshadri, Vice President & General Manager of Agilent's Liquid Chromatography, Mass Spectrometry and Automation Divisions. "Also, we have our new hybrid auto sampler which is perfect for PFAS analysis because you've got these really strong solvents, and so now you get much better peak shapes and sensitivity."

Agilent also introduced the Revident LC/QTOF. The device features a new modular architecture that allows for easier manufacturing and service and enables future system improvements. The redesign includes intelligence systems to isolate problems to specific modules. Other improvements over previous Agilent qTOFs include redesigned optics, collision cells and acquisition systems that ultimately improve peak "purity" and mass accuracy. The new device is targeted for food safety and environmental applications such as pesticide identification and other identification experiments. The product introduction coincided with the release of new Mass Hunter Explorer software, which assists with non-targeted identification experiments found on the Revident and other Agilent LC/QTOFs.

In the field of proteomics, **Bruker** continues to expand its timsTOF line of MS systems with the timsTOF Ultra, making it the fifth timsTOF system in the franchise. The timsTOF Ultra features newly improved and expanded capabilities based on the SCP timsTOF system. Bruker launched the timsTOF SCP system two years ago (see *IBO* 6/15/21). The timsTOF SCP systems can be upgraded in field to an Ultra system.

Rohan Thakur, PhD, President of the Bruker Life-Science Mass Spectrometry described several component changes that helped make the timsTOF Ultra possible. These include an enlarged capillary for bringing in more ions, a fourth generation dual-TIMS cell, the development of the CSI-Ultra source, and a 14 bit digitizer to process the higher ion-flux. Commenting specifically on the CSI-Ultra source, Dr. Thakur explained, “What the CSI Ultra did was allowed for conductance matching, which lets you optimize the gas flow from atmospheric pressure into the first vacuum stage in the mass spectrometer.”

As a result, the timsTOF Ultra provides a performance improvement compared to the timsTOF SCP. “With the timsTOF Ultra, you get sensitivity that no other comparable technology can deliver, making it key for immunopeptidomics research both in academia and pharma, together with its ability to analyze LCM captured cells from tumor tissue for deep proteomics from one or two cells,” stated Dr. Thakur. “Both these highly specialized applications are gaining traction in oncology research and the timsTOF Ultra seems to be the preferred platform due to its unique performance characteristics driven by TIMS/PASEF [Parallel Accumulation Serial Fragmentation] capability.”

Bruker also launched the IMPACT II VIP, HRMS qTOF, which features the new VIP-HESI (Vacuum Insulated Probe Heated Electrospray Ionization) source coming fully integrated at purchase. VIP-HESI greatly increases ion yield compared to standard electrospray, while also utilizing the VIP which allows for heat shielding the eluent stream containing relevant compounds.

For applied markets, Bruker introduced the EVOq DART-TQ+, a high-performance triple quad that utilizes the DART technology to provide chromatography-free ionization. This is the first system from Bruker to fully integrate DART, and is designed for routine analysis and workflows, while offering simplified tuning and methods development.

SCIEX introduced at ASMS 2023 the Intabio ZT system, a specialized combination of the ZenoTOF 7600 and a new iciEF-UV sample introduction system. The new system incorporates imaged capillary isoelectric focusing (iciEF), a method of isolating charged variants in a sample that are detected using UV light. The technology was acquired through SCIEX’s 2021 purchase of Intabio (see *IBO* 2/1/21). SCIEX expects to start device shipments in September 2023.

A major application of the system is charge heterogeneity analysis. “Right now, one of the key techniques they use for that is capillary isoelectric focusing,” explained Chris Lock, PhD, Vice President Global Research and Development at SCIEX. “The traditional way that has been done up till now is that you would do this electrophoretic separation, and then separately you would do an LC/MS analysis of a fraction purified by ion exchange chromatography, or on the digested sample, and try to find the particular proteoforms or peptides that are correlated with the peaks in isoelectric focusing separation.”

This created long wait times and difficulty finding matching data as researchers attempted to correlate the iciEF data AND the MS data. This was a challenge in previous efforts to connect capillary isoelectric focusing to mass spec, explained Joe Fox, President of SCIEX. “What we've found is to do that in a way that doesn't result in significant peak broadening and loss of any of the benefit of being able to map which peak in the isoelectric focusing electropherogram is equivalent to the peak in the mass spec.”

Describing the Intabio ZT system, Dr. Lock called it “a unique technology that combines CE and MS within a microfabricated glass chip. What it can do is do the isoelectric focusing within the device and image it, which is the first step that everybody does today, but the cool thing is that it can then mobilize that separation into the mass spectrometer.” He further noted, “It can take that electropherogram of all the separated charge variants and push it into the mass spec to do direct mass spec analysis immediately after the isoelectric focusing separation.” Dr. Lock added, “I can do my separation and I can mobilize that into mass spec and directly correlate now the mass spec information. I don't have to do the digestion step anymore.”

At ASMS 2023, **Thermo Fisher Scientific** introduced the Orbitrap Astral, its latest hybrid MS. The instrument introduces the Astral analyzer, a three-part system that is made up of quadrupole, Orbitrap and TOF analyzers combined to offer flexible analysis options with improved performance. The introduction of the three analyzers also brings a new workflow that captures 80% of the available ions and allows for a depth of 12,000 proteins in an hour with a single shot, according to the company. John Lesica, President of Thermo Fisher's Chromatography and Mass Spectrometry Division, discussed with **IBO** some of the benefits of the Astral, “It's really around large cohorts, providing that sensitivity [and] that robustness that that customers need. If you think about going from research into translational and in the future into the clinic. That's really how we're looking at building out the Thermo Scientific Orbitrap Astral mass spectrometer line.”

The new system aims to allow high-throughput of samples, and while advertised at a starting point of 180 samples per day with eight-minute gradients, Mr. Lesica told **IBO** that they have collaborators reaching just under 300 samples per day. He added, “So for us it's really just the start.” While the new system is targeted at proteomics, Thermo Fisher sees opportunities in metabolomics, small molecules, and PFAS and new contaminants, with new collaborations in these application areas.

Thermo Fisher also announced updates to its Ardia software platform, which was announced last year at ASMS (see **IBO** 6/15/22). They have now fully launched the enterprise platform within the Ardia framework, with several individual applications such as Proteome Discoverer and Xcaliber joining the Ardia software solution, integrating data from multiple sources into one analytical database. Ardia now provides several lab manager capabilities, being able to see their entire installation of devices, streamlines support for their devices through proactive customer support for device health, and can support over 300 instruments through Thermo's Chromeleon software. Another new features include a Multi-Attribute Method (MAM)-specific solution that is powered by Ardia. The first version of the Ardia server are on-premise servers, with planned introductions of cloud-centric offerings.

Mr. Lesica commented, “The way to think about Ardia is like the ‘Apple Operating System.’ So, in the future, we will launch new applications that tie into it as well as add new functionality for lab managers and scientists to connect their lab and improve productivity.” Currently, Thermo Fisher's chromatography and MS systems are now connected to the platform. “If you have a GC, an ion chromatography instrument, any mass spectrometer, you now have all of that data in one location. It's one interface for a customer to log into to manage their data....They can collaborate with one another very easily,” he noted.

With the theme of continued improvement at ASMS 2023, **Waters** introduced several upgrades and enhancements to existing systems. Among these were new improvements to the SELECT SERIES

MRT. The upgraded device features boosted core performance, enabling three times faster acquisition speed in all scanning modes. “The other innovation builds on the electrospray MRT that we had last year [at ASMS]. We've now introduced a resolution enhancement mode that boosts the resolution by 50% up to over 300,000 FWHM,” commented Steve Smith, Vice President, Discovery & Development at Waters.

Waters also introduced the Resolution Enhancement Mode (REM), which essentially doubles the large path length of their multi-reflecting TOF tunnel by pulsing the ions back through the path before hitting the analyzer, greatly increasing the resolution of the device. The new upgrades are largely based on electronic configuration, allowing easy infield upgrades for existing customers.

Describing how it compares to the previous MRT system, James Langridge, PhD, Senior Director, Discovery, Characterization & Imaging Mass Spectrometry, for Waters, told *IBO* “What we’ve done this year is actually a very neat little trick with the MRT electronics to actually pulse the ions back just before they hit the detector. They’ve undergone this 48 meter flight path, and just before they hit the detector, we pulse them back into the analyzer, so they effectively do another pass through the MRT analyzer. This doubles the effective flight path of the system and therefore fundamentally improves the underlying performance in terms of the mass resolving power.”

Waters also introduced targeted DESI XS targeted imaging system utilizing the XEVO TQ Absolute MS, first introduced last year (see *IBO* 6/2/22), The new system features improved DESI-source sensitivity through changes to the heated transfer line. The DESI source now integrates into the XEVO TQ Absolute, allowing one millisecond dwell and interscan delay times while maintaining the spatial resolution of the scan due to the high sensitivity of the MS. The new system is thus five times more sensitive compared to Waters’ qTOF MALDI or DESI systems, allowing for 5 µm pixel size resolution.

As Dr. Langridge explained, Waters’ other TOF solutions are more focused on the biomedical research and molecular spatial distribution studies, but the latest system serves a different application space. “With the targeted solution [with DESI,] there are two primary advantages. One is the ability to look at therapeutic levels of drug treatments,” he explained. “With a radiotracer-type experiment when we're looking at drug discovery and development, it's been very difficult to detect a therapeutic level of the drug by mass spectrometry imaging in pharmaceutical applications. But we’re actually looking at developing alternative technologies like DESI combined with mass spectrometry and imaging for this work.”

The system is also suited to another market. “The second application is really in academia and governmental testing environments where people are looking at specific markers, such as in translational research, where people are moving from discovery to translation,” noted Dr. Langley.

Waters tells *IBO* that the key difficulty with the integration was integrating the software with the stage movement and data acquisition but that ultimately the minimal amount of changes to the XEVO TQ Absolute system will enable in field upgrades to be fairly simple.