Case study | 004253

GC-MS

Empowering analytical discovery with GC Orbitrap technology: Real-world success from scientists around the globe

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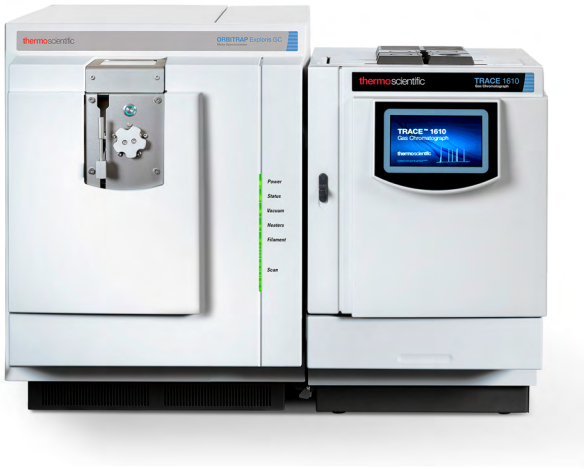
>
> **—Brooklynn McNeil, Columbia University Mailman School of Public Health"**

Over the past decade, Thermo Scientific™ GC Orbitrap™ technology has redefined what is possible in analytical science. Across disciplines—from environmental monitoring and exposomics to food authenticity and clinical research—scientists are pushing boundaries with high-resolution mass spectrometry (HRMS). The Thermo Scientific™ Orbitrap Exploris™ GC Mass Spectrometer series provides unmatched mass accuracy through high resolution, full-scan data acquisition, and the versatility to tackle both targeted and untargeted analyses from a single sample injection. This case study compilation showcases the voices of four global scientists whose stories exemplify how Orbitrap technology transforms complex analytical challenges into opportunities for discovery. Each story is a testament to how Thermo Fisher Scientific's innovation empowers researchers to see more, know more, and do more in their research.



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Dr. Kerstin Krätschmer – Food safety and persistent organic pollutants

Institution: Wageningen Food Safety Research, Netherlands
Application: Food safety, chlorinated paraffins, PFAS
Years with GC Orbitrap technology: 9

Tackling complexity in food safety

At the heart of Europe's efforts to ensure food safety, Dr. Kerstin Krätschmer leads a team at Wageningen Food Safety Research focused on monitoring persistent organic pollutants (POPs). Her work centers on detecting POPs such as chlorinated paraffins and PFAS—molecules with vast structural diversity and environmental persistence in highly complex sample matrices. For scientists like Kerstin, analytical precision isn't just a luxury—it's a necessity. These compounds often exist in trace concentrations and co-elute in complex food matrices, making it nearly impossible to identify them without ultra-high mass resolution. The challenge was clear: achieve both comprehensive coverage and uncompromising accuracy.

The GC Orbitrap MS breakthrough

By integrating Thermo Scientific™ GC Orbitrap™ MS into her workflows, Kerstin gained access to an unprecedented combination of resolution, sensitivity, and reliability. The instrument's 120,000 resolving power allowed her to confidently distinguish overlapping isomers and minimize spectral interference, while full-scan acquisition provided the flexibility to explore unknowns retrospectively. She also embraced the system's ability to combine targeted and non-targeted analysis in a single run, streamlining method development and expanding data depth.

"The 120,000 resolving power available on the GC Orbitrap MS enabled us to see what otherwise would have been impossible," she explains. "It gives us the confidence to detect compounds that might have gone unnoticed with lower-resolution systems."

Delivering results and confidence

Today, Kerstin's team uses the GC Orbitrap MS as a cornerstone of their POPs and contaminant analysis methods. The technology has enabled them to combine regulatory monitoring with cutting-edge research, ensuring consumer safety while advancing the science of environmental chemistry. She values the platform's consistency, robustness, and contribution to data integrity across global food safety networks. "It's more than an instrument—it's a partner in ensuring public health," she adds.

Brooklynn McNeil – Exposomics and emerging contaminants

Institution: Columbia University, Mailman School of Public Health
Application: Exposomics, persistent organic pollutants, emerging contaminants
Years with GC Orbitrap technology: 4

Understanding the human exposome

Brooklynn McNeil, a staff associate at Columbia University's Mailman School of Public Health, is passionate about uncovering how environmental exposures shape human health. Her work in exposomics focuses on detecting the chemical signatures of our surroundings—from the air we breathe to the food we eat—and understanding their biological effects. With tens of thousands of potential pollutants in our environment, the analytical challenge lies in detecting trace-level contaminants accurately and efficiently.

Brooklynn's early exposure to mass spectrometry ignited a fascination for how technology can expand scientific horizons. She quickly recognized that high-resolution systems like the GC Orbitrap MS could revolutionize exposomics by allowing broad-spectrum screening and retrospective analysis from a single dataset.

Empowering comprehensive chemical screening

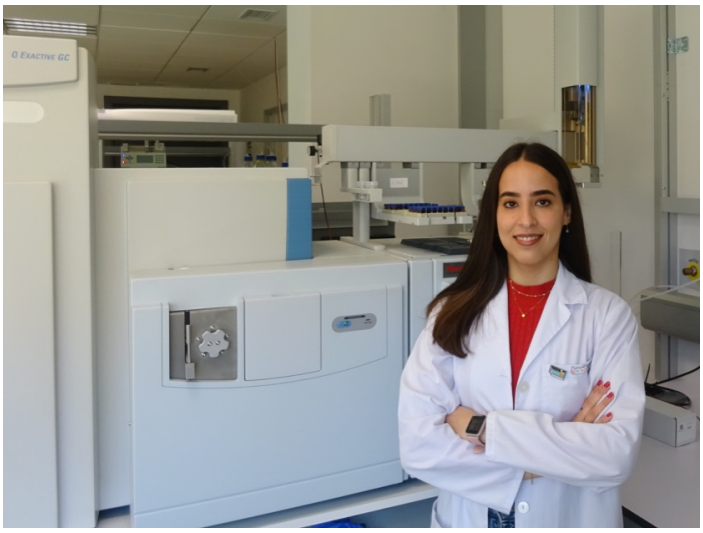
In her research, the GC Orbitrap HRMS provides the precision and flexibility needed to characterize thousands of chemicals across complex biological samples. Its sub-ppm mass accuracy and dynamic range enable simultaneous detection of low- and high-abundance compounds, while advanced data processing software such as Thermo Scientific™ Compound Discoverer™ Software turns vast data into actionable insights. Brooklynn praises how the system's full-scan data allows her to revisit datasets to identify new compounds as scientific questions evolve.

"The sensitivity to detect low-level compounds with sub-ppm mass accuracy allows us to annotate thousands of chemicals in a single analysis," she explains. "It means we can uncover connections between environmental exposure and human health that were previously hidden."

Driving discovery and impact

For Brooklynn, GC Orbitrap technology isn't just about analytical capability—it's about empowerment. The instrument's ability to capture complete, high-quality data accelerates her team's ability to identify emerging contaminants and translate findings into actionable public health insights. Her story embodies the essence of scientific curiosity supported by innovation, and she believes the GC Orbitrap system will continue to play a defining role in advancing human exposomics worldwide.

Dr. Araceli Rivera-Pérez – Food authenticity and metabolomics



Institution: University of Almería, Spain
Application: Food authentication, metabolomics, fingerprint analysis
Years with GC Orbitrap technology: 6

Safeguarding food integrity

In southern Spain, surrounded by rich agricultural tradition, Dr. Araceli Rivera-Pérez dedicates her research to protecting consumers and ensuring the authenticity of food products. Her work at the University of Almería focuses on detecting adulteration and verifying origin through advanced metabolomic profiling. With food fraud and mislabeling affecting global markets, her mission is to bring transparency and trust back to customers.

Araceli's challenge lies in analyzing the subtle differences in the chemical fingerprints of complex food matrices. Traditional targeted methods often miss unknown markers essential to verifying authenticity, especially in products like honey, thyme, and pepper, where quality and provenance define value.

Revealing hidden signatures with Orbitrap technology

Using GC Orbitrap HRMS, Araceli's team can now perform full-scan, untargeted analyses that uncover molecular profiles with extraordinary detail. The system's sub-ppm accuracy and full-scan capability allow her to detect unknown authenticity markers, while high-resolution data ensures confidence in every identification. Her studies have identified new chemical signatures linked to botanical origin—breakthroughs that would have been impossible with lower-resolution instruments.

"GC Orbitrap technology allowed us to discover new botanical origin markers with high identification reliability for authenticity purposes," says Araceli. "It's transforming how we verify and protect food integrity."

Strengthening trust and science

Araceli's work is now helping shape the future of food authentication. Her discoveries not only protect consumers but also support honest producers and transparent trade. The GC Orbitrap system's ability to combine reliability, ease of use, and deep analytical power empowers her research group to maintain productivity without compromising data quality. Her story demonstrates how innovation and passion converge to make food safer and science stronger.

Scott Borden – Breathomics and clinical research

Institution: BC Cancer Research Institute, Canada

Application: Breathomics, disease biomarker discovery, unknown identification

Years with GC Orbitrap technology: 5

Innovating non-invasive disease detection

In Vancouver, Canada, Research Associate Scott Borden is redefining how we understand disease through the emerging field of breathomics—the analysis of exhaled compounds to detect health conditions. Working at BC Cancer Research Institute, Scott's mission is to develop non-invasive tools for early disease diagnosis. But with each breath sample containing hundreds of volatile compounds, the complexity of the analysis poses a formidable challenge. Scott needed an analytical platform capable of extreme sensitivity, high throughput, and reliability to handle 24/7 operation.

Orbitrap technology in action

The GC Orbitrap MS provides the perfect blend of performance and practicality for Scott's demanding workflow. Its high-resolution data and stability enable confident identification of unknowns, while its user-friendly maintenance features—such as the Thermo Scientific™ NeverVent™ Ion Source—minimize downtime. This robustness ensures continuous productivity and consistent results even under heavy use. Scott's team values how quickly the instrument transitions between projects and how seamlessly it integrates into their data-driven environment.

"The GC Orbitrap MS is robust and user-friendly—being able to swap ion sources without venting is a game-changer for our high-throughput lab," Scott explains. "It keeps our research moving without sacrificing accuracy or uptime."

Transforming research into real-world impact

Scott's research has already yielded promising discoveries in biomarker identification, offering a glimpse into how breath analysis could revolutionize healthcare screening. By combining high-resolution accuracy with operational reliability, GC Orbitrap technology empowers his lab to explore new frontiers in precision medicine. As he looks to the future, Scott envisions even deeper integration of GC Orbitrap MS data with AI and machine learning—turning complex datasets into insights that could one day save lives.

Conclusion

From environmental contaminants to clinical biomarkers, GC Orbitrap technology continues to empower scientists to turn complexity into clarity. These four stories reveal more than technical success—they highlight collaboration, curiosity, and the relentless pursuit of discovery. Each scientist, in their own field, demonstrates how the precision and confidence of GC Orbitrap mass spectrometry translate into tangible results that improve science and society. As we look to the future, Thermo Fisher Scientific remains committed to advancing analytical innovation—enabling researchers everywhere to push boundaries, uncover the unknown, and transform data into discovery.

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