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SYSTEMS, INC.

Revealing What Others Leave Unseen

Forensic Fingerprinting of the Unseen:

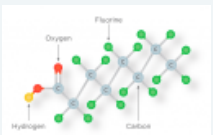
Revealing the Dark Secrets of PFAS with High-Resolution Ion Mobility

Frederick G. Strathmann, PhD, MBA, DABCC (CC, TC)
SVP Global Business
MOBILion Systems

Thomas Lubinsky (MOBILion)
Taryn McKnight (Eurofins)
Eric Redman (Eurofins)
Thep Phomsopha (Eurofins)
Andrew Patterson (Eurofins)

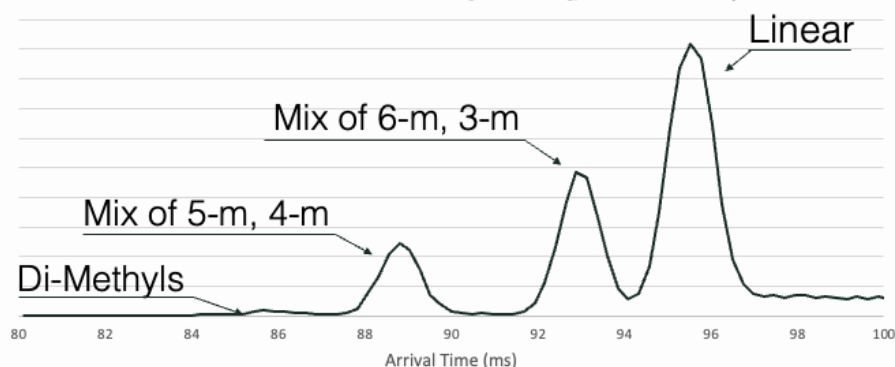
Rapid Screening to NTA to PFAS Forensic Fingerprinting

- Rapid Screening for High-Throughput Applications
- Non-Targeted Analyses with the power of CCS prediction
- Fingerprint Analyses compatible with UPLC for < 7-minute full isomeric profiles



Rapid Screening without Specificity Loss

Arrival Time Distribution T-PFOA [M-H-CO₂], 2-Minute Analysis



Linear and Branched Isomers Resolved with HRIM

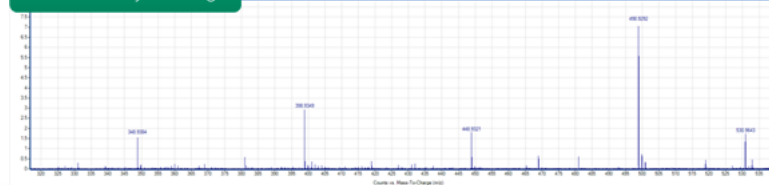
- HRIM resolves when LC is unable
- Fast screening with deeper characterization available when needed

Mobility Filtering for Low Signal Detection in Complex Matrices

Before Mobility Filtering



After Mobility Filtering



Mobility separation from Interferences

- Complex matrices can be digitally filtered without data loss
- Low concentration species revealed and easier to identify with fragmentation

HRIM as a Rapid 2nd Dimension of Separation



Efficiency

Highest resolving power across the entire mass range measured physically separates interferences without requiring long chromatographic separations to help reduce complex sample preparation and troubleshooting challenges.



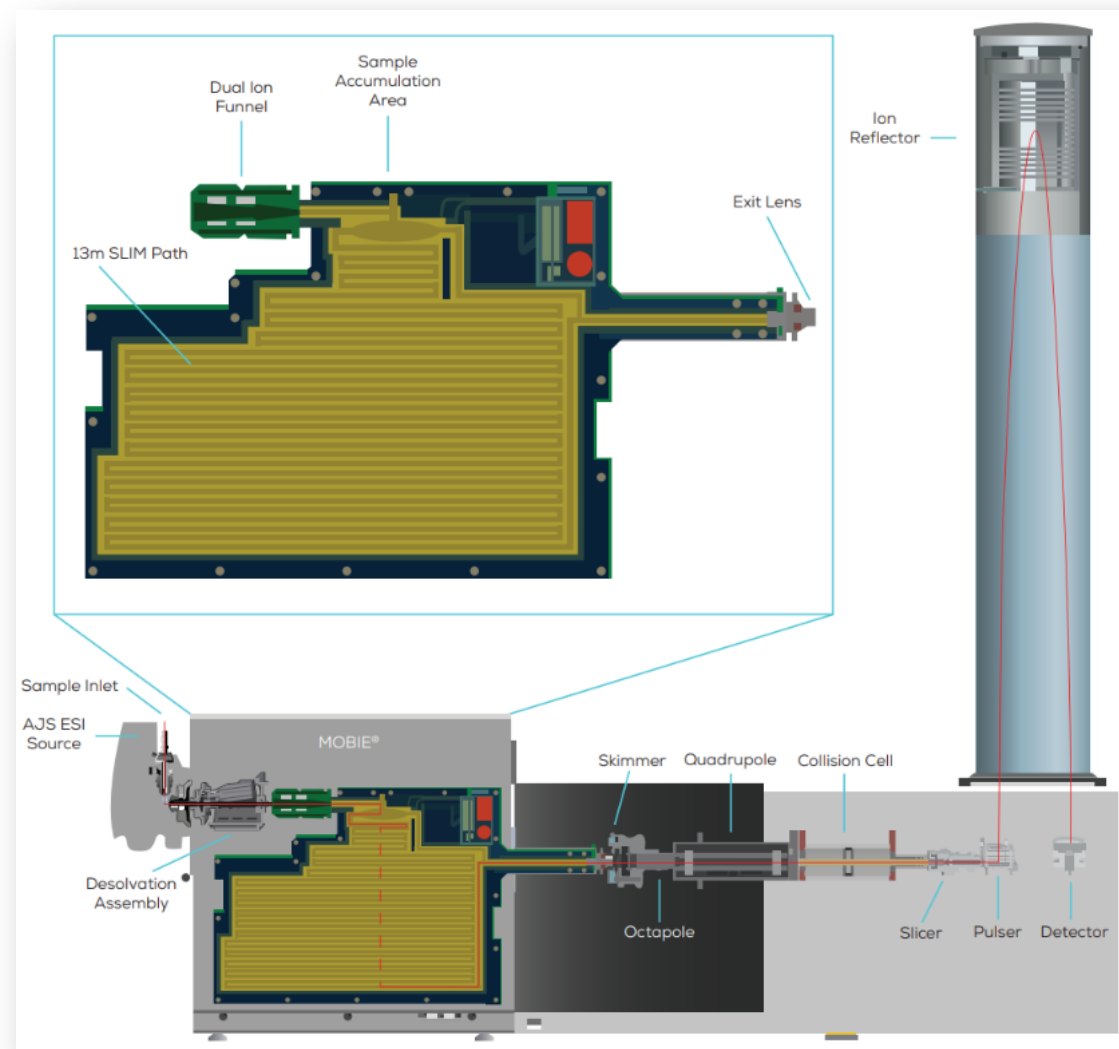
Greater Speed

Unparalleled peak capacity with $RP > 250$ provides separation capabilities that reduce reliance on chromatography and boosts throughput without sacrificing specificity.

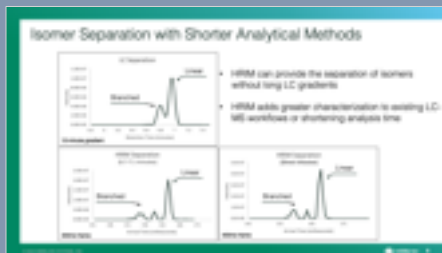


Reproducibility

CCS values provide a highly reproducible, unique molecular identifier for added confidence even when reference standards are lacking.



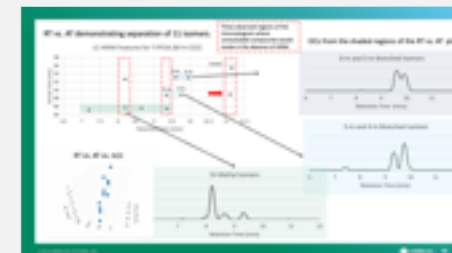
Rapid Screening



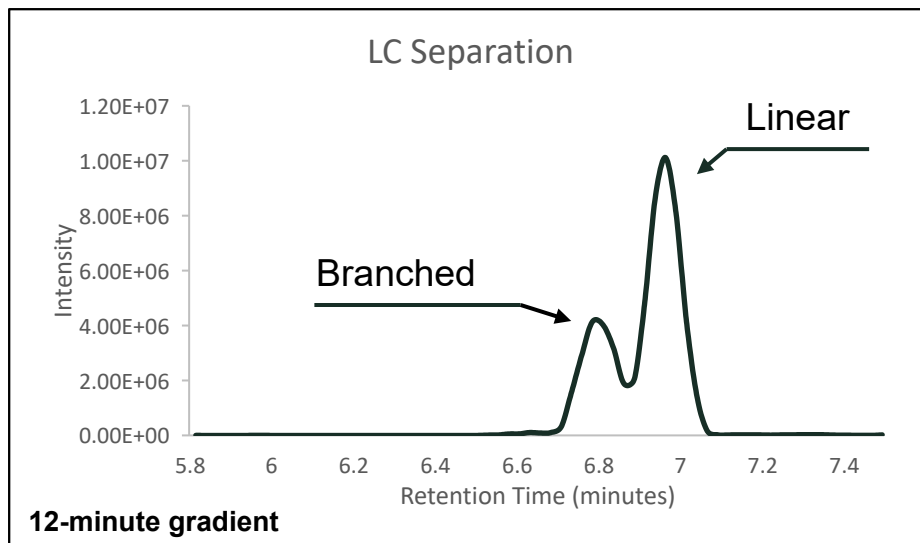
Non-Targeted Analysis



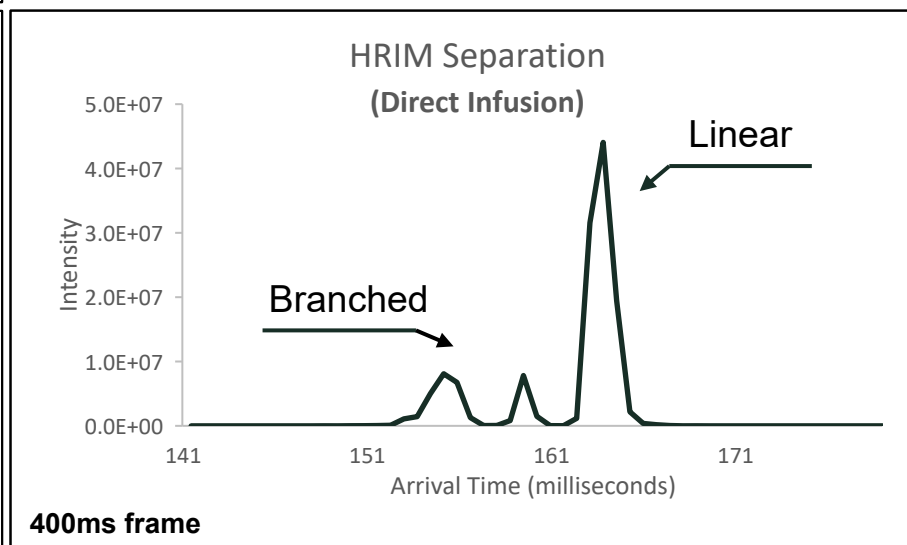
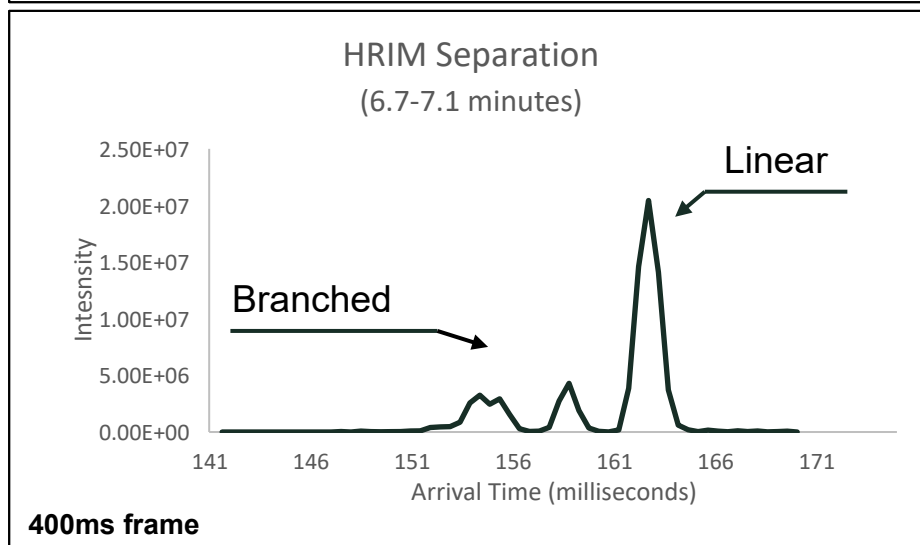
Fingerprint Analysis



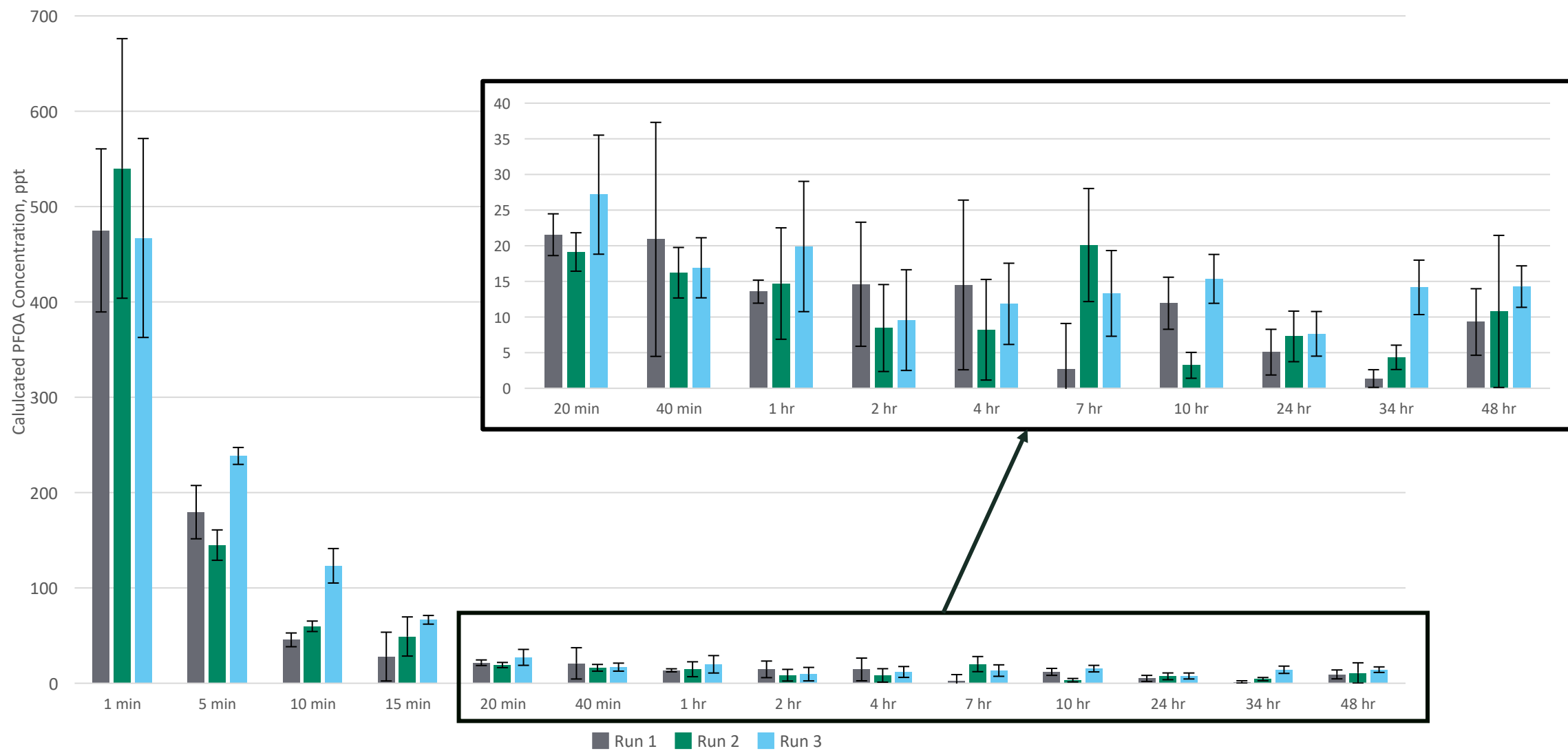
Isomer Separation with Shorter Analytical Methods



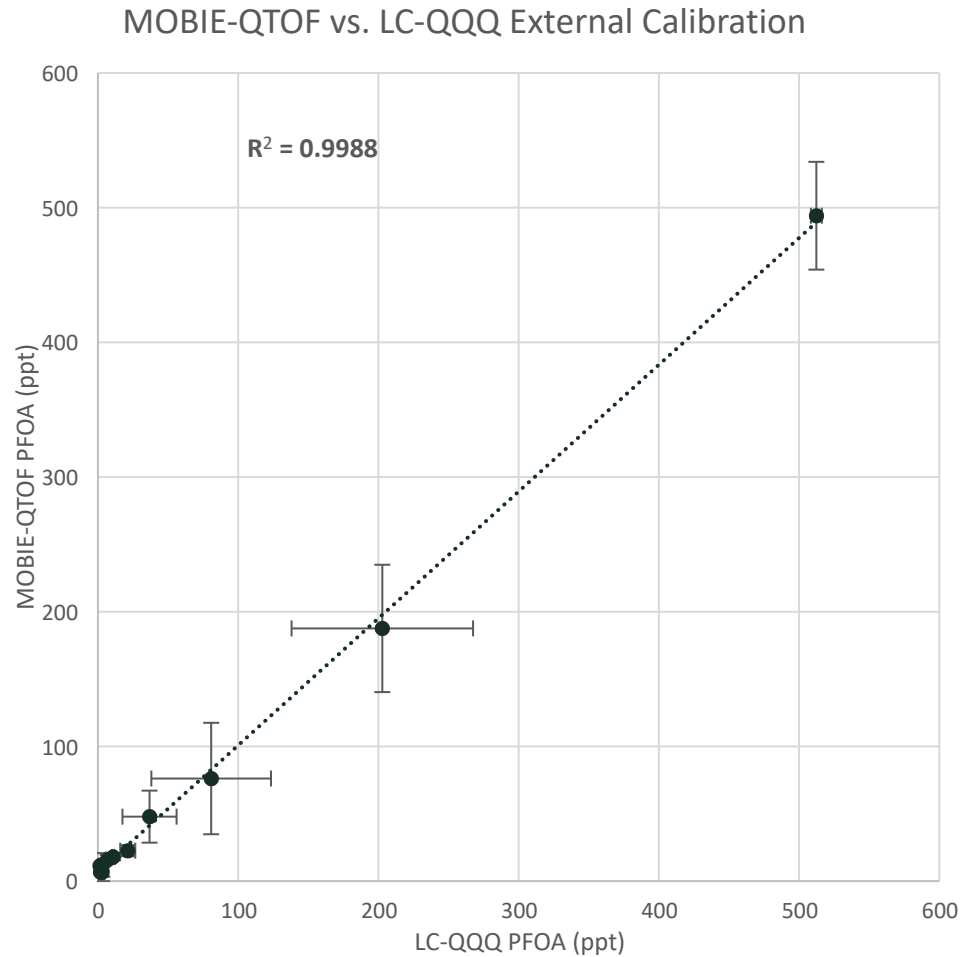
- HRIM can provide the separation of isomers without long LC gradients
- HRIM adds greater characterization to existing LC-MS workflows or shortening analysis time



Concentration of PFOA_{1ppb} Following Treatment

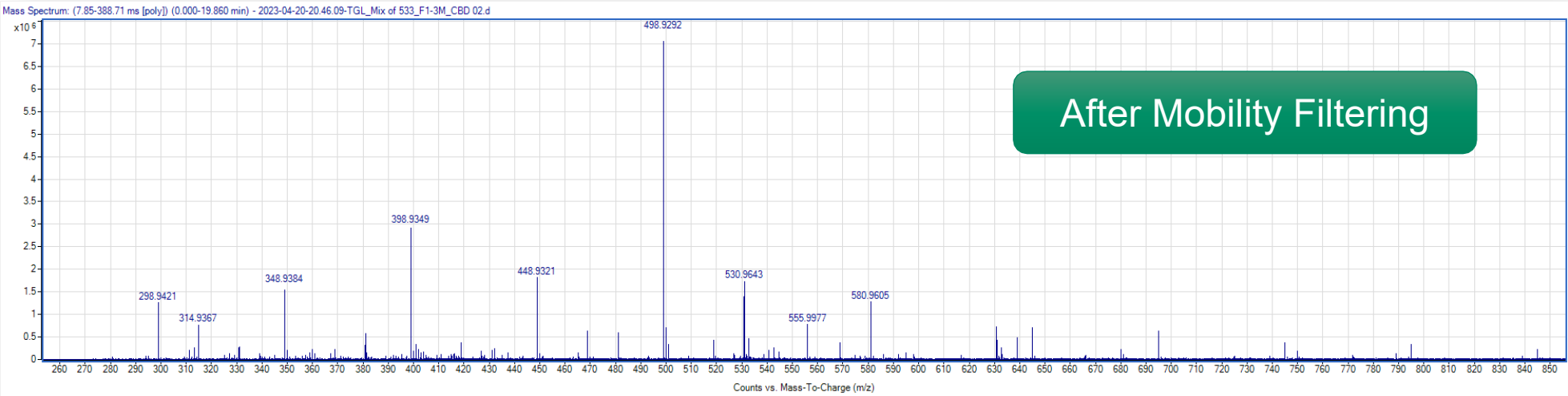
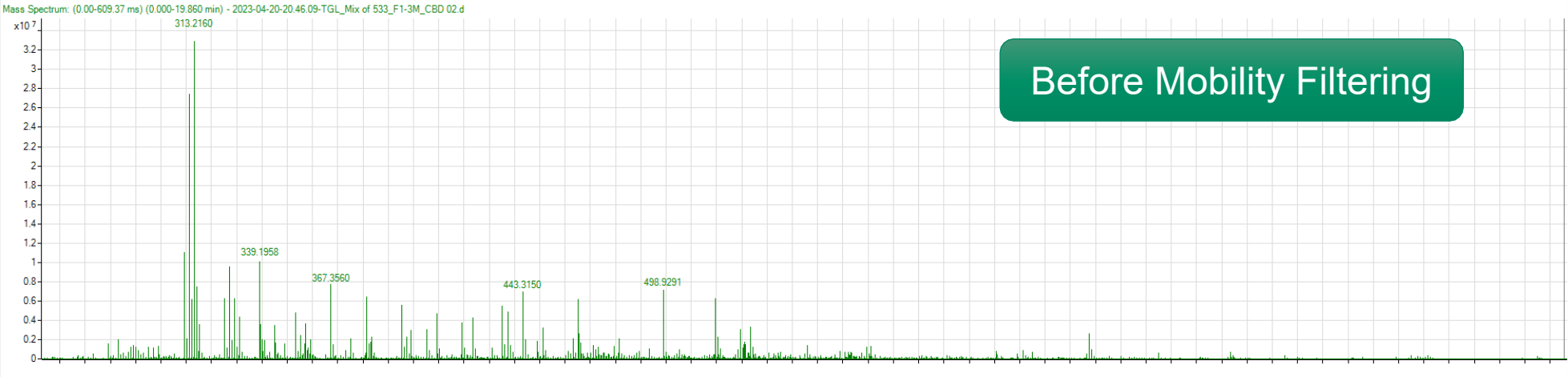


Envisioning a High Throughput PFAS Screen



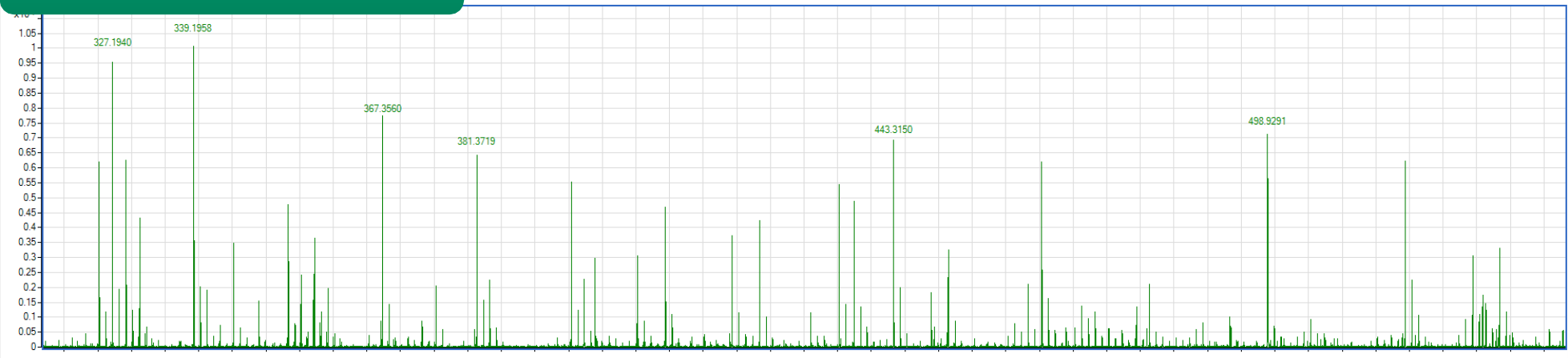
- *3-minute FIA method (no LC)*
- *Absolute quantitation with external calibration*
- *LLOQ 5ppt*

HRIM Filters Noise to Make Compounds Easier to ID

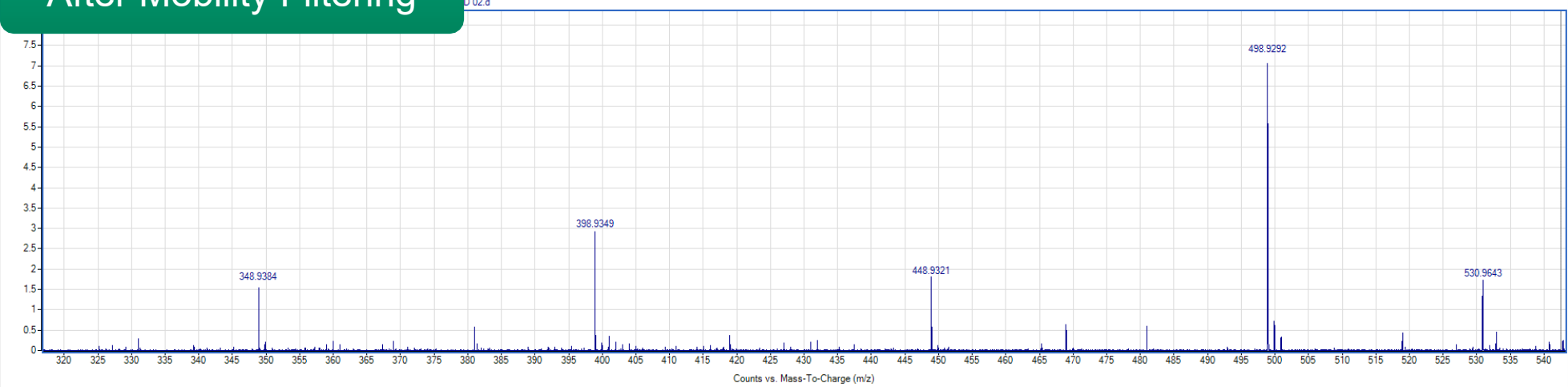


Peaks Hidden in Noise Are Revealed

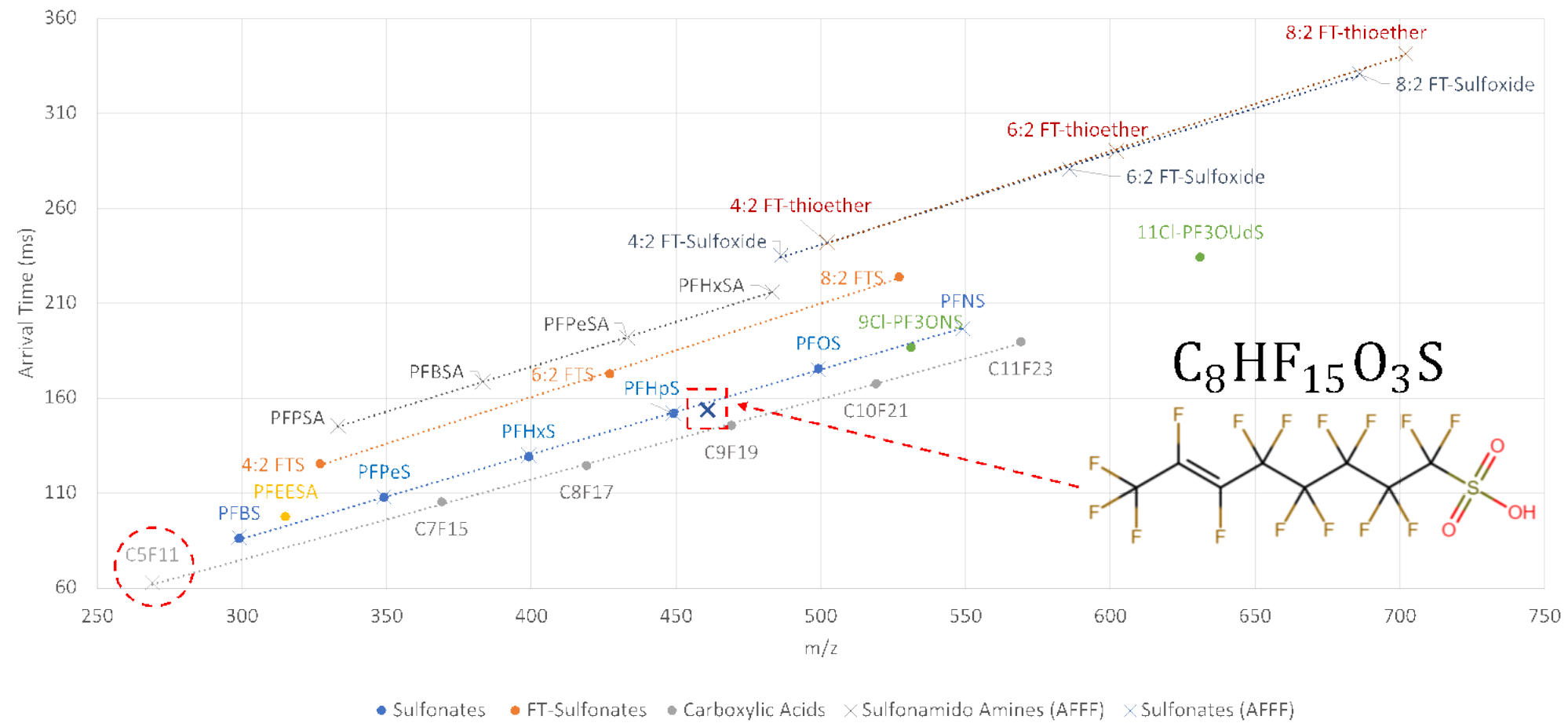
Before Mobility Filtering



After Mobility Filtering

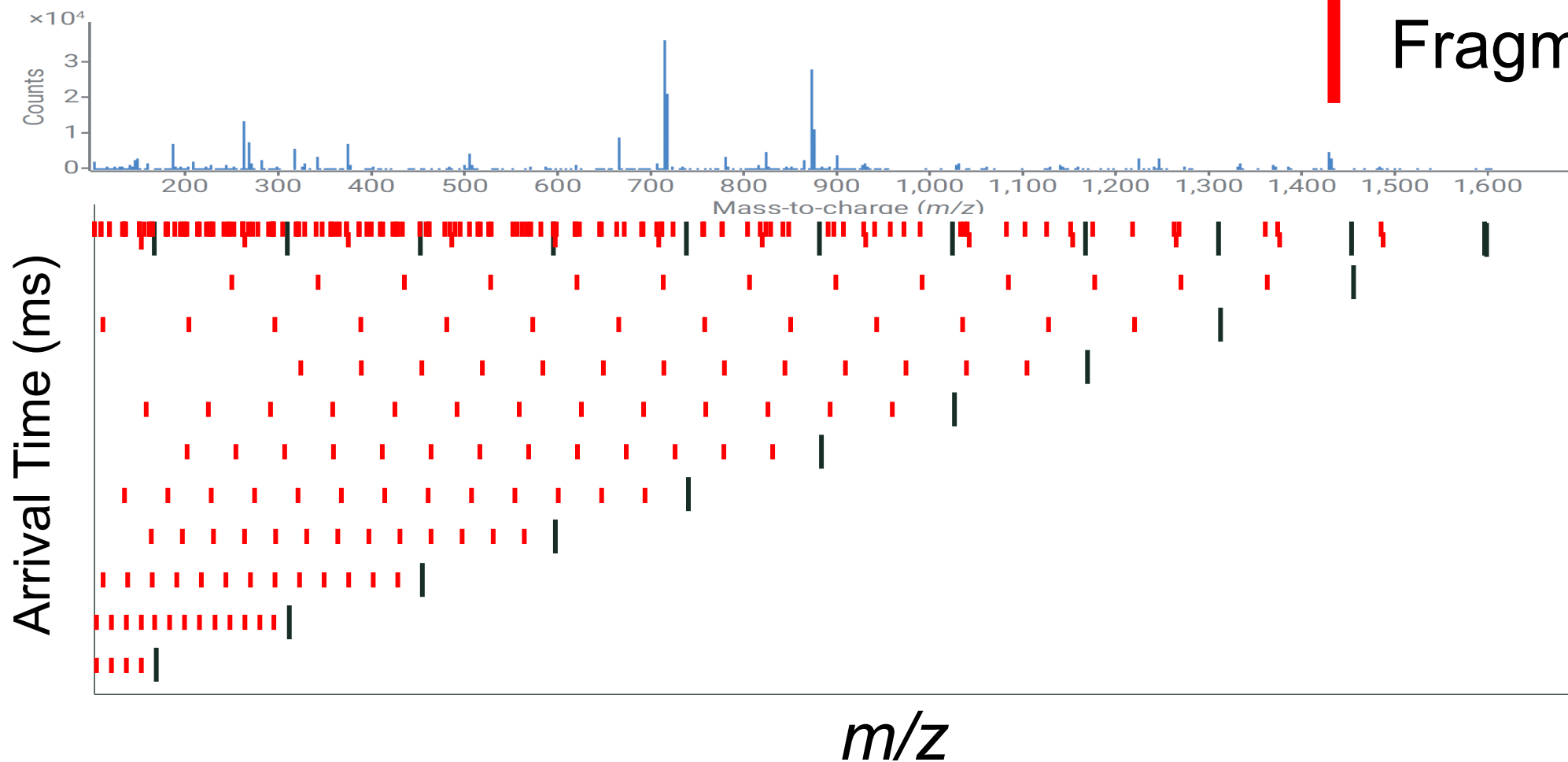


Characteristic Trendlines Allow Unknown Annotation



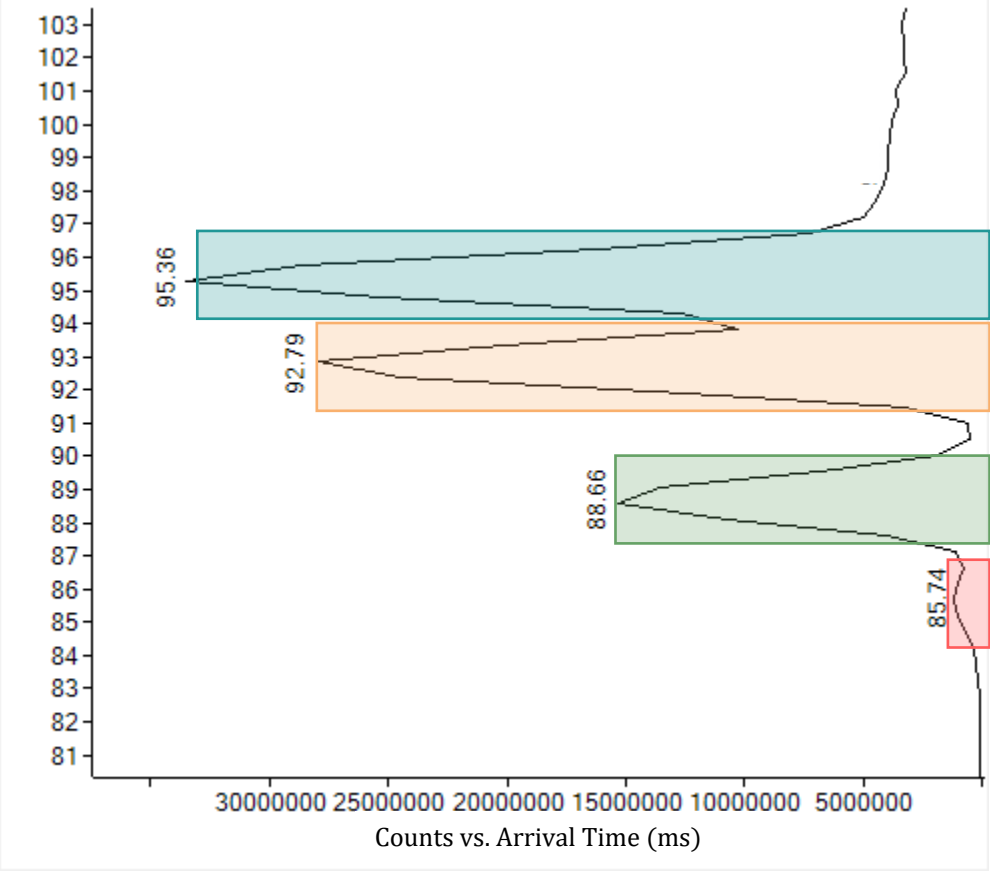
Mobility Aligned Fragmentation

Reducing complexity with AIF

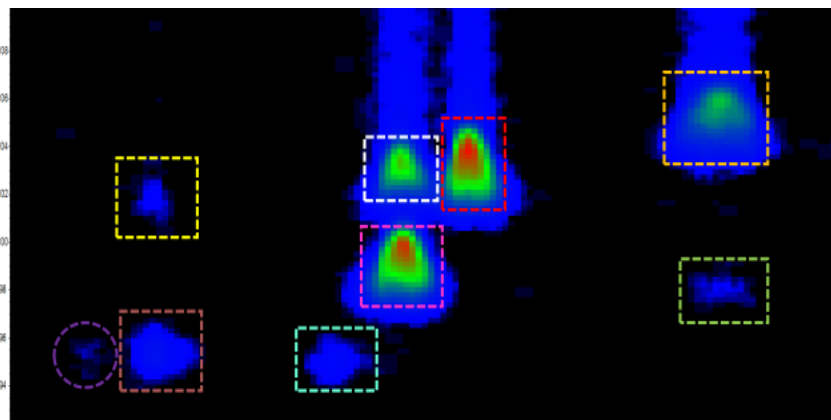


Mobility Aligned Fragmentation for Greater Detail

10ng/ml T-PFOA
Direct Infusion at 0.4ml/min

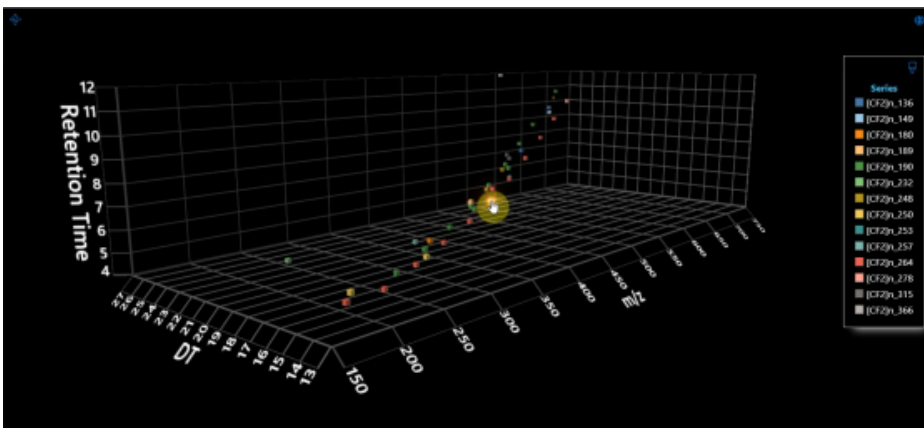
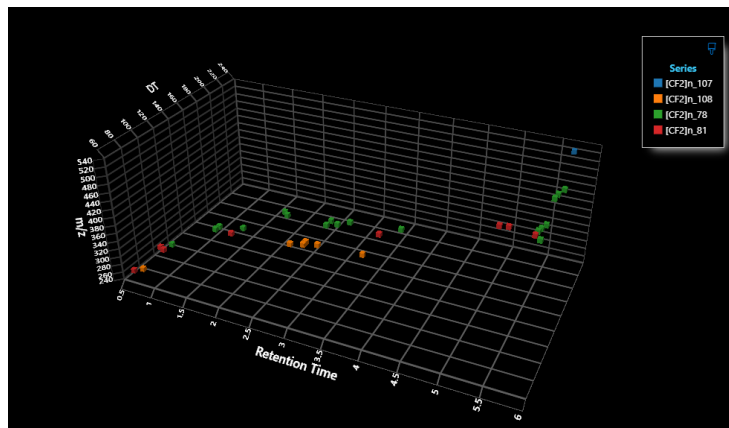
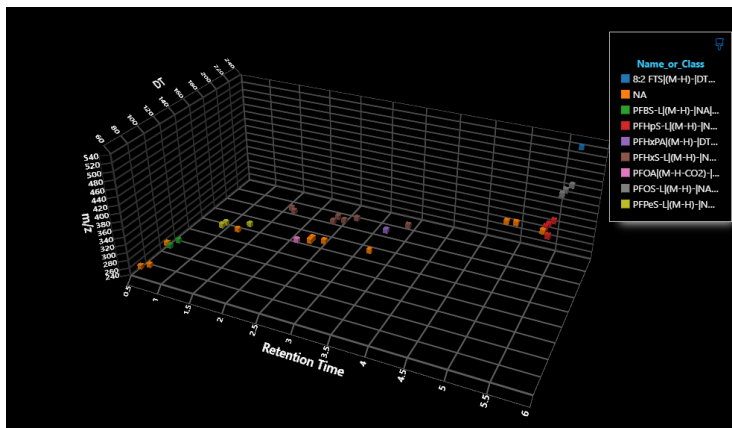
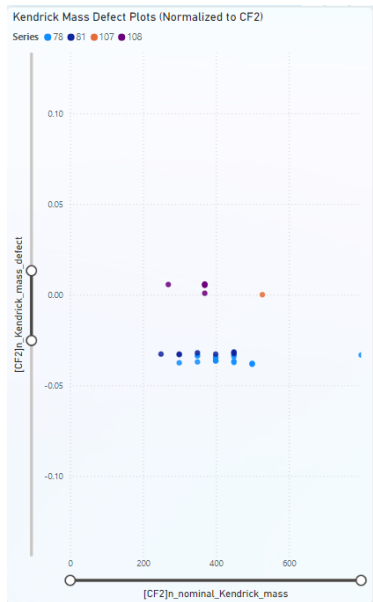


FluoroMatch (Innovative Omics) for NTA



AT (ms) vs Acquisition Time (min)

Score	Name	m/z	RT (min.)	AT (ms)	CCS (Å²)	Abundance
A	PFOA (M-H-CO2)-	368.9789	2.271	101.94	138.2	15426
A	PFOA (M-H-CO2)-	368.9775	3.042	103.401	138.84	5049964
A	PFOA (M-H-CO2)-	368.9776	2.878	103.164	138.73	2218899
A	PFOA (M-H-CO2)-	368.9777	3.652	105.544	139.76	2312560
C+	PFOA (M-H-CO2)-	368.9782	3.655	98.059	136.52	4316
C+	PFOA (M-H-CO2)-	368.9786	2.276	95.424	135.37	171695
C+	PFOA (M-H-CO2)-	368.979	2.713	95.057	135.21	56745
C+	PFOA (M-H-CO2)-	368.9776	2.88	99.365	137.09	4450618



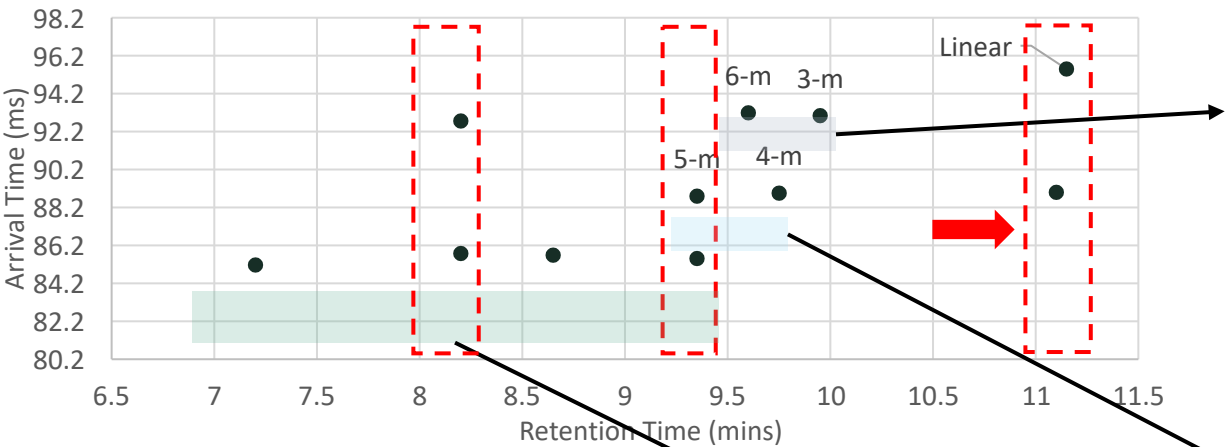
MassProfiler 4D IMFE → FluoroMatch

<https://innovativeomics.com/software/fluoromatch-im/>

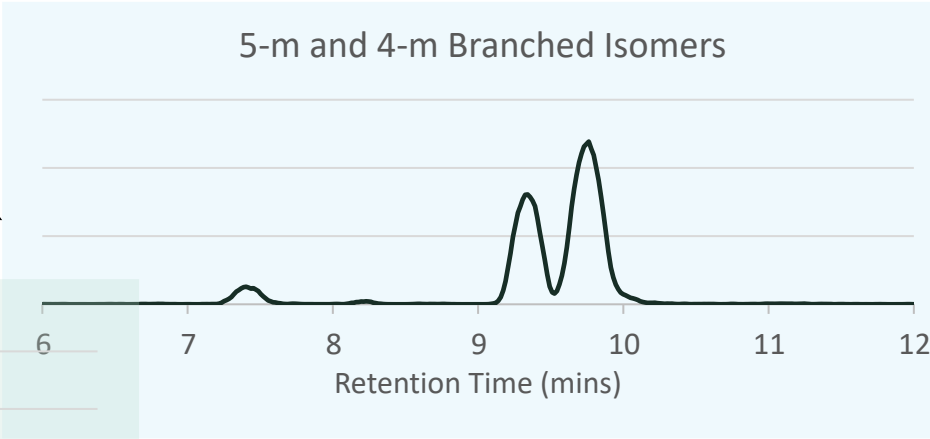
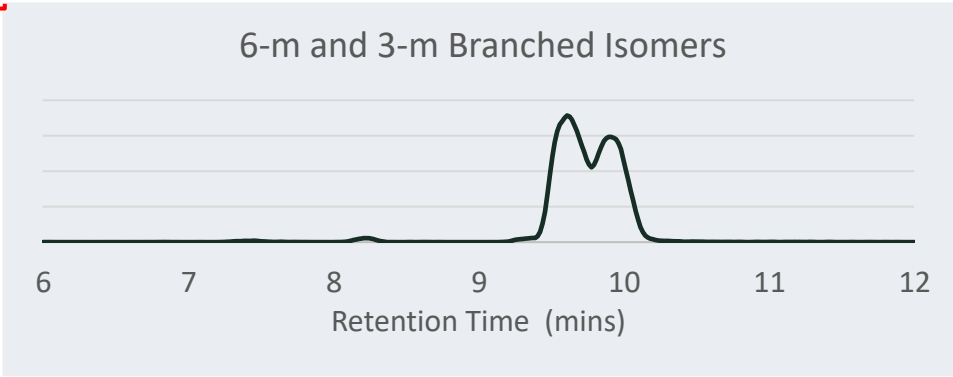
RT vs. AT demonstrating separation of 11 isomers.

LC-HRIM Features for T-PFOA [M-H-CO2]

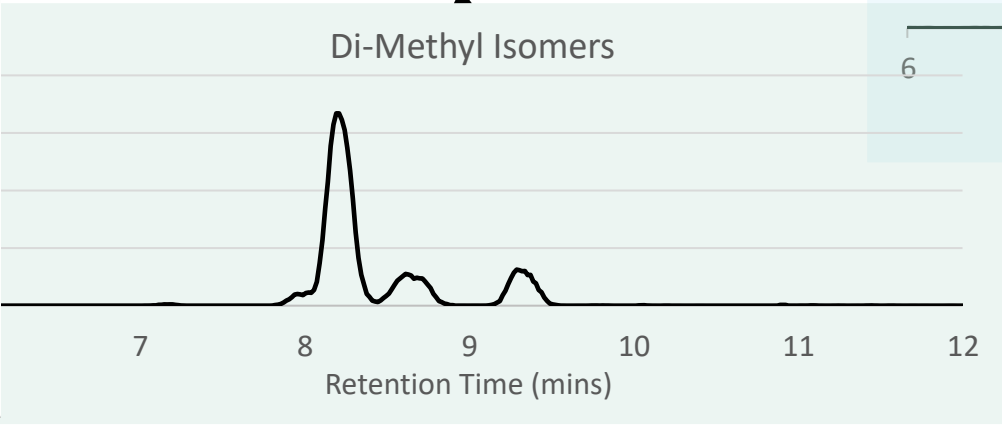
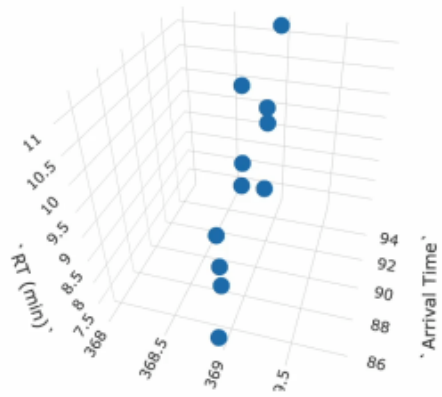
Three observed regions of the chromatogram where unresolvable compounds would reside in the absence of HRIM.



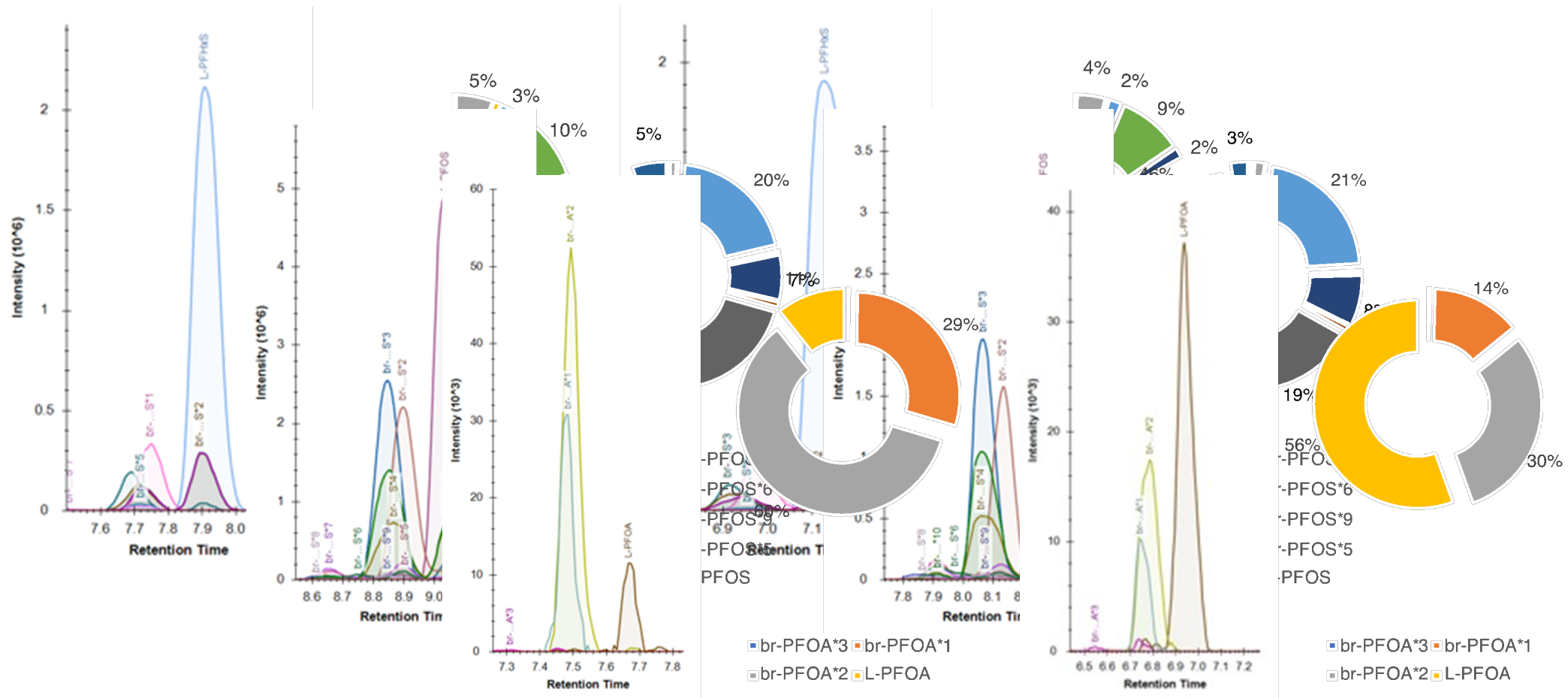
EICs from the shaded regions of the RT vs. AT plot.



RT vs. AT vs. m/z



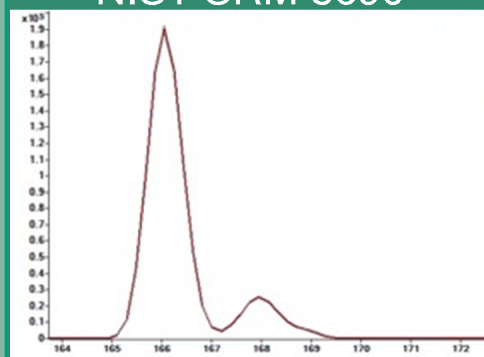
ECF Formulation Comparisons: Differences Revealed



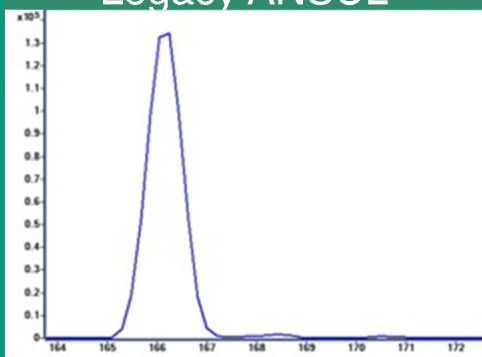
ECF Differences Compared to Fluorotelomerization

Arrival Time Distributions of 6:2 FTS [M-H]⁻

NIST SRM 8690

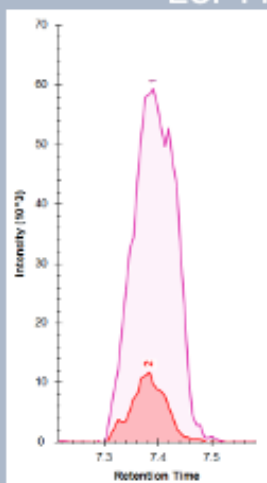


Legacy ANSUL

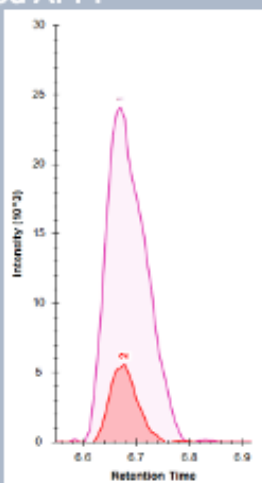


Mobility-Filtered Extracted Ion Chromatograms of 6:2 FTS [M-H]⁻

ECF Produced AFFF

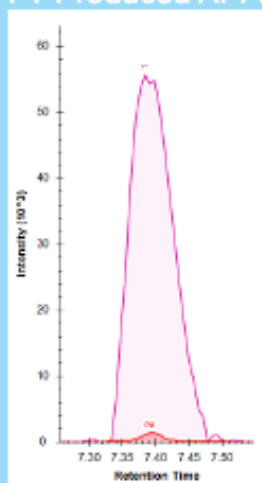


NIST SRM 8690



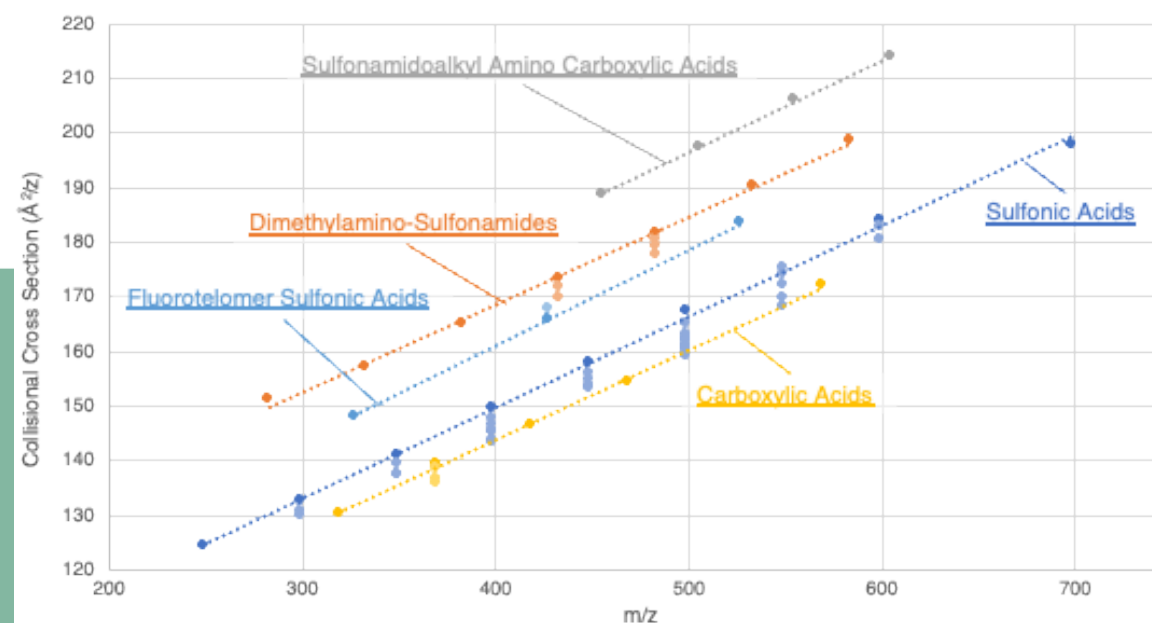
Legacy 3M

FT Produced AFFF

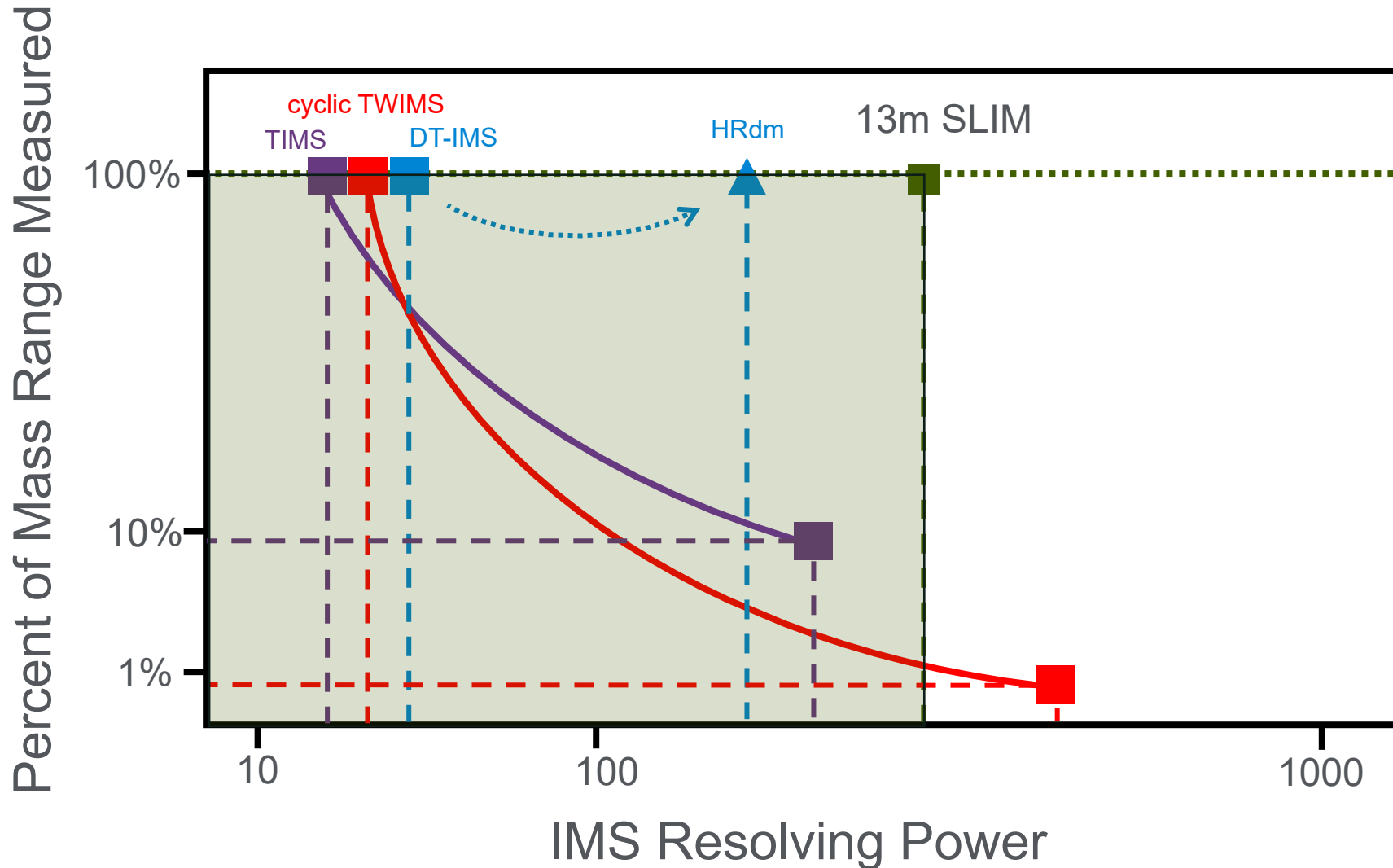


Legacy Ansul

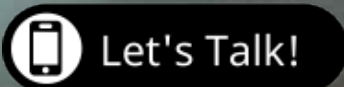
Conformational Space Mapping of PFAS Homologues & Branched Isomers



IMS Field of View vs Resolving Power



- SLIM is the only commercial HRIM system that provides full mass range detection with $RP > 250$
- Other HRIM systems require mass range reduction to achieve higher resolution resulting in loss of data



Thomas Lubinsky (MOBILion)
Taryn McKnight (Eurofins)
Eric Redman (Eurofins)
Thep Phomsopha (Eurofins)
Andrew Patterson (Eurofins)

Alan McKenzie-Coe (MOBILion)
Rahúl Hernández Sánchez (Rice Univ)

Revealing What Others Leave Unseen



E-mail
frederick.strathmann@mobillionsystems.com



Phone
+1 484 246 6060 x125



Website
www.mobillionsystems.com



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