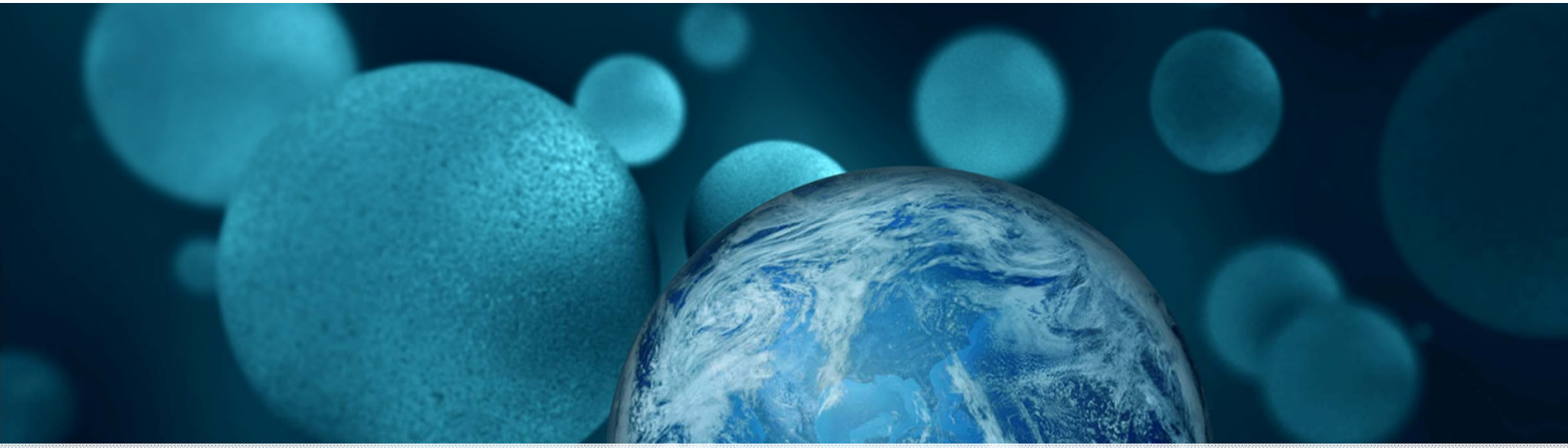


ThermoFisher SCIENTIFIC

Introducing the LC-MS/MS Portfolio – TSQ Quantis and Altis

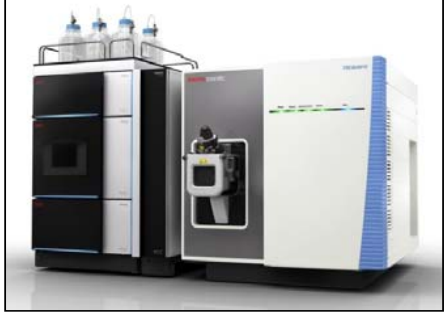
Osama Abu-Nimreh
CMD Sales Support Specialist
MECEC , Dubai

Introduction to TSQ Altis and TSQ Quantis

Performance: Sensitivity, Selectivity (H-SRM)

TSQ Altis

TSQ Quantis

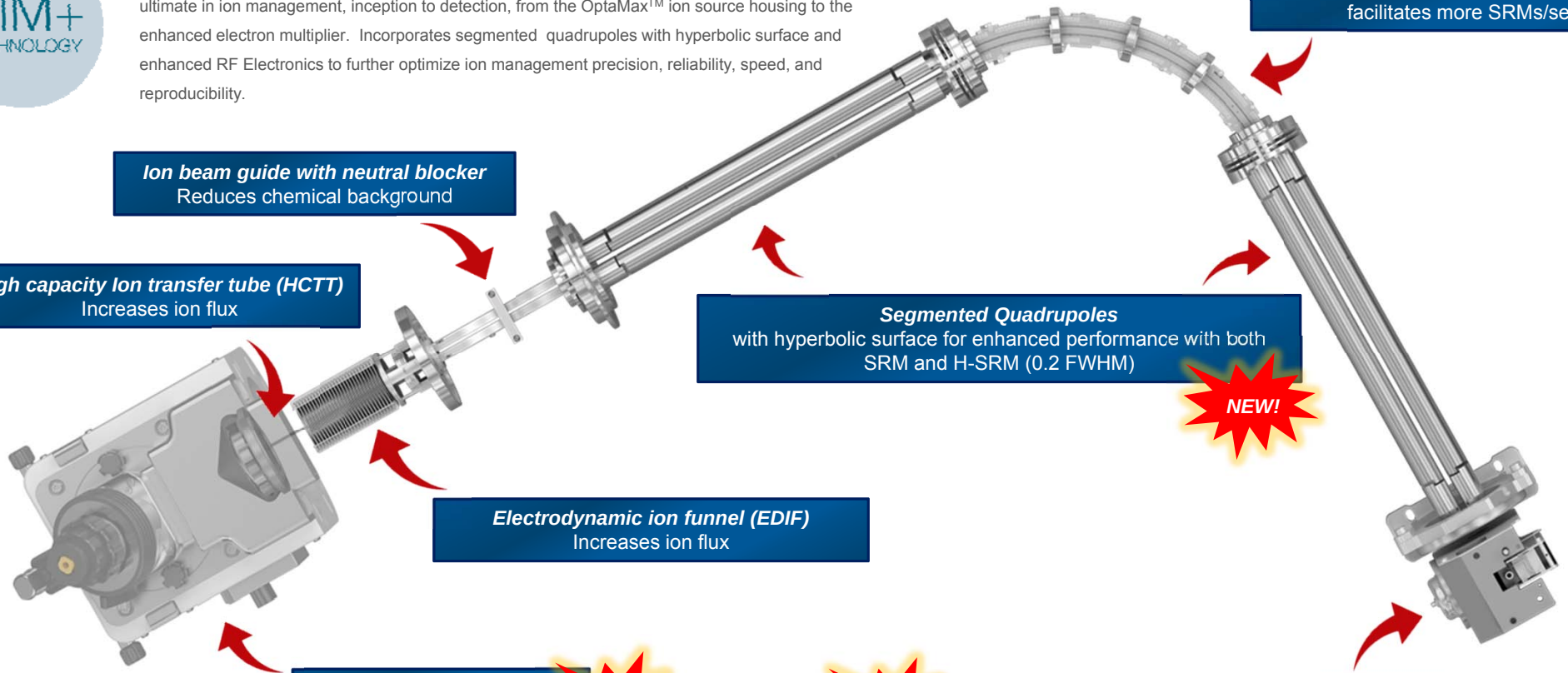


	Thermo Scientific™ TSQ Altis™ *High-end*	Thermo Scientific™ TSQ Quantis™ *Mid-tier*
Mass Range	5-2000	5-3000
SRM/sec	600	600
Selectivity (H-SRM)	0.2 Da FWHM	0.4 Da FWHM
Sensitivity (HESI Reserpine 1 pg)	500,000:1	150,000:1
Targeted Market	Omics, Research, Pharma/Biopharma, Clinical Research and Forensic Toxicology	Environmental and Food Safety, Clinical Research, and Forensic Toxicology

Robustness, Reproducibility, Speed, Ease-of-Use, Flexibility

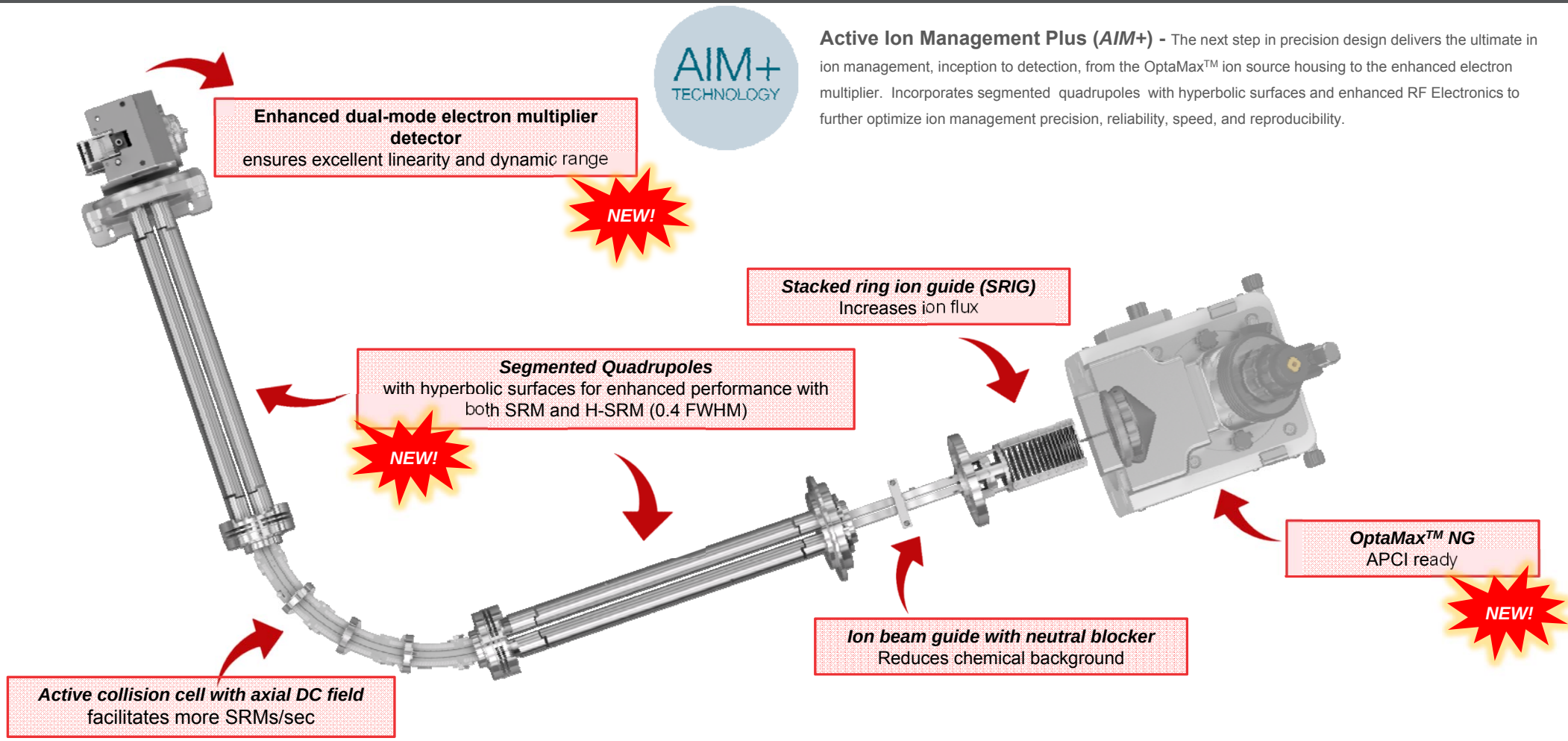
TSQ Altis: Sensitivity with Robustness, No Compromises

Active Ion Management Plus (*AIM+*) - The next step in precision design delivers the ultimate in ion management, inception to detection, from the OptaMax™ ion source housing to the enhanced electron multiplier. Incorporates segmented quadrupoles with hyperbolic surface and enhanced RF Electronics to further optimize ion management precision, reliability, speed, and reproducibility.



TSQ Quantis: Unprecedented Robustness, Day After Day

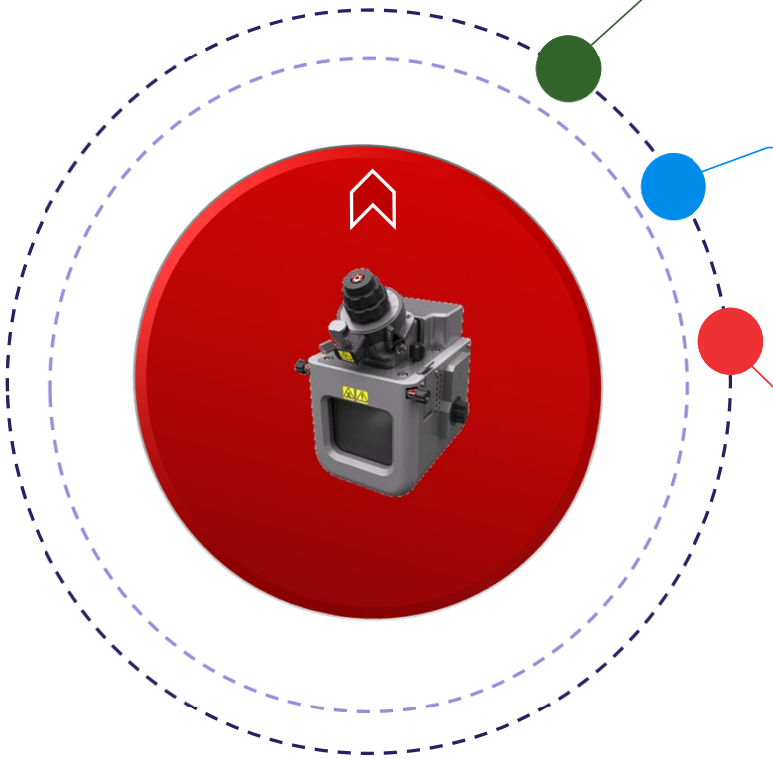
Active Ion Management Plus (*AIM+*) - The next step in precision design delivers the ultimate in ion management, inception to detection, from the OptaMax™ ion source housing to the enhanced electron multiplier. Incorporates segmented quadrupoles with hyperbolic surfaces and enhanced RF Electronics to further optimize ion management precision, reliability, speed, and reproducibility.



ThermoFisher SCIENTIFIC

OptaMax NG Source Housing

Benefits: Reliable and consistent performance with improved usability!



Re-designed APCI discharge assembly

- Built-in to every source (separate APCI sprayer required for APCI mode)
- Re-designed on/off switch (to improve usability)

Re-designed HESI Sprayer

- Needle adjustment is no longer possible during acquisition (locked position)
- Tool available to help the user to correctly set needle protrusion

Usability and Consistency

- Vertical adjustment moved to the side for easier access
- New drain insert with improved latching and locating pin to prevent rotation
- Improved sprayer alignment and stability
- New finer threads on HESI and APCI sprayers to make installation easier

ThermoFisher SCIENTIFIC

Segmented Quadrupoles

Benefits: Increased Sensitivity (more significant at higher mass range)
Flat tuning for consistent and robust performance

- The use of RF only pre-filters (segments) between the entrance lens and the quadrupole minimizes the effects of fringe fields, leading to improved transmission (and therefore sensitivity) at unit and higher resolution.

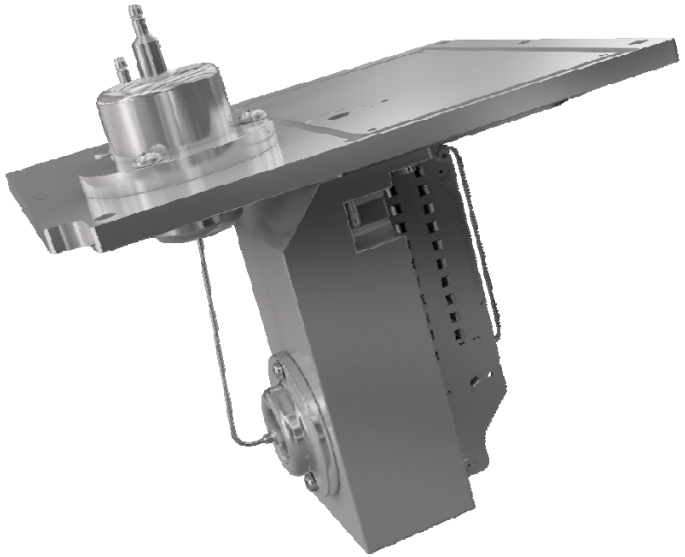
- With the RF only pre-filter, the tuning of several lenses is flat across mass range allowing the voltage to be set and not tuned. This helps reducing the complexity of the tune and making the systems more consistent.

ThermoFisher SCIENTIFIC

Detector

Benefits: Increased electron multiplier lifetime. Increased Uptime!

- Increased number of dynodes (21) for extended lifetime.
- Improved electron multiplier calibration routine.
- Excellent linearity and dynamic range across the mass range.
- Reduced number of service visits leading to more uptime.

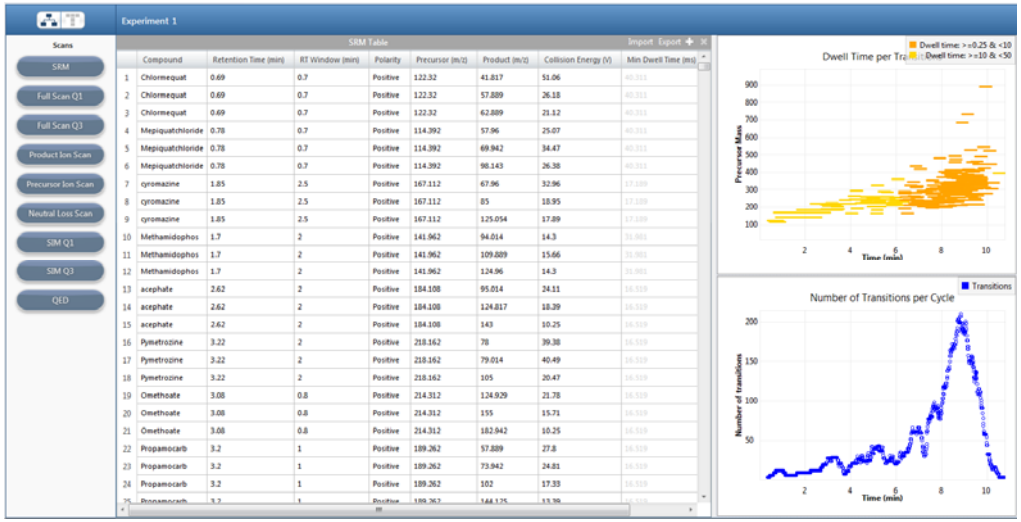


ThermoFisher SCIENTIFIC

RF Circuitry

Benefits: More compounds in the same run or longer dwells on existing method

- New main RF/DC electronics
- Analyze more compounds in the same time window or better Quantitation results with better ion statistics (more scans across your chromatographic peak)
- Up to **600 SRM/sec**



ThermoFisher SCIENTIFIC

What Makes the new Triple Quads Robust?

Robustness

The ability to perform at the expected level (LOD, LOQ, MRL) under adverse conditions (complex samples, limited sample preparation) for the desired period of time without maintenance.

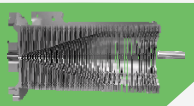
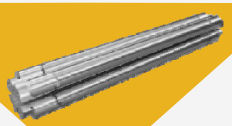
OptaMax NG	ITT/Sweep Cone	Ion Beam Guide
Re-designed source housing	**Ion transfer tube and sweep cone**	**Ion beam guide with neutral blocker**
NEW!		
Reliable and consistent performance with improved usability!	*No need to break vaccum for basic maintenance!*	*Blocks neutral keeping the ion path clean while reducing noise!*

ThermoFisher SCIENTIFIC

What Makes the new Triple Quads Consistent?

Consistency

The ability to report equivalent results every time independently of the system or the user (day-to-day and system-to-system)

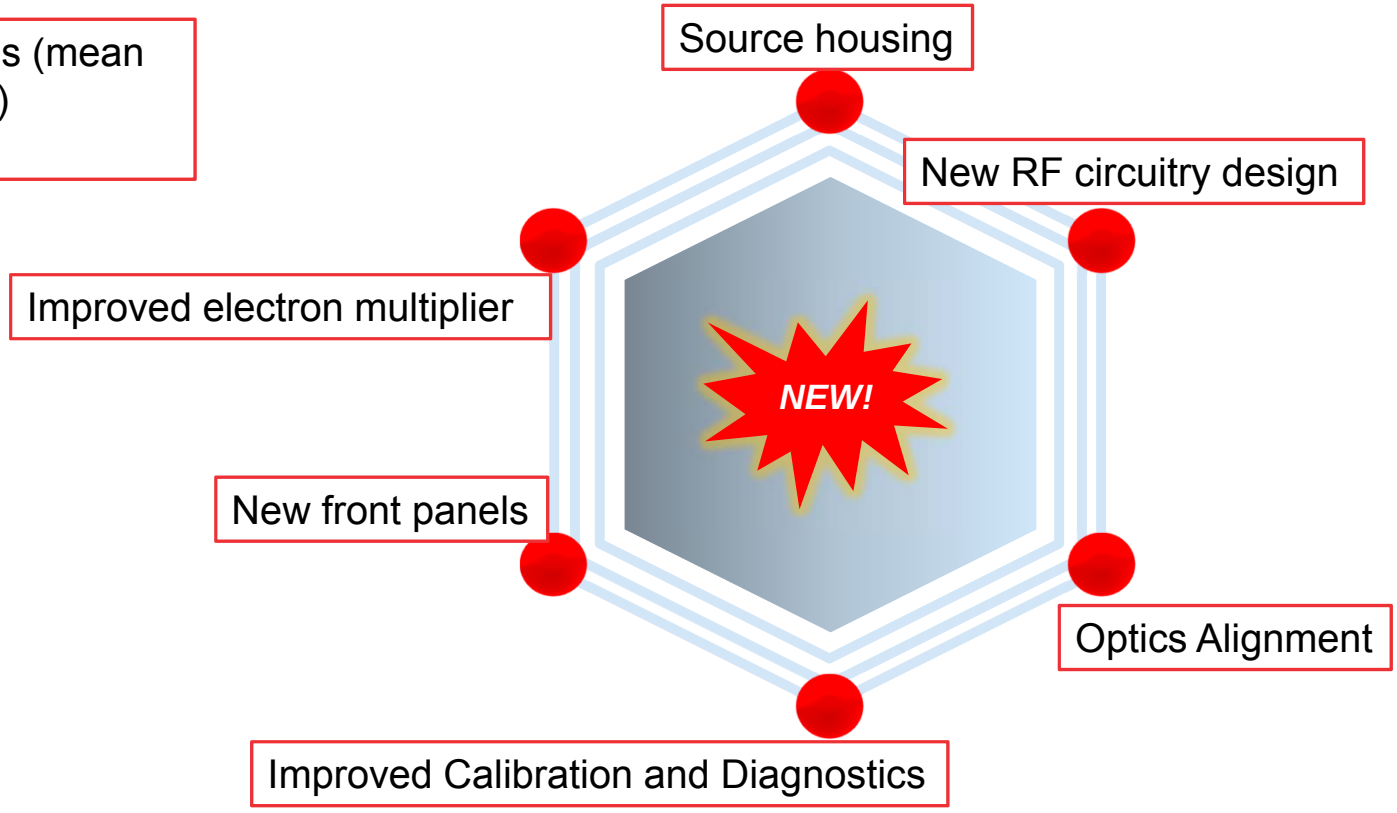
OptaMax NG	Optics	Segmented Quads
		
Re-designed Source Housing	**Improved Optics Alignment**	**Segmented Quads with hyperbolic surfaces**
NEW!	NEW!	NEW!
Reliable and consistent performance with improved usability!	*More consistent performance from system-to-system!*	*Flat tuning across the mass range!*

ThermoFisher SCIENTIFIC

What Makes the new Triple Quads Reliable?

Reliability

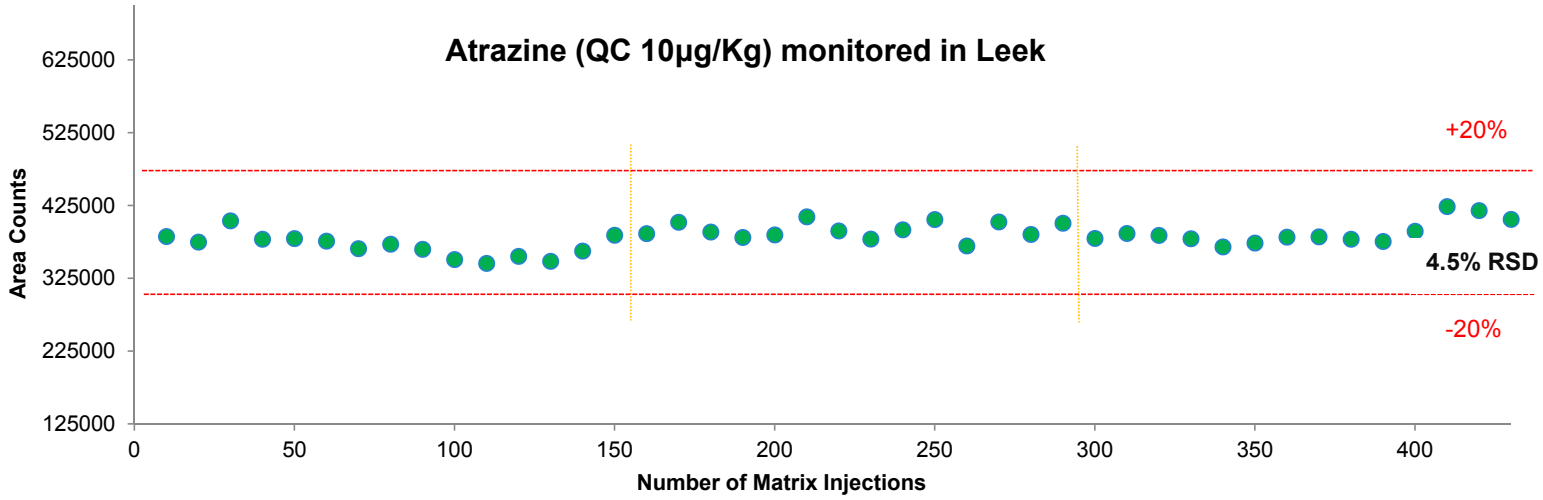
Increased time between service calls (mean time between failure- MTBF)
Increased uptime



ThermoFisher SCIENTIFIC

Demonstration of Robustness – Food Safety

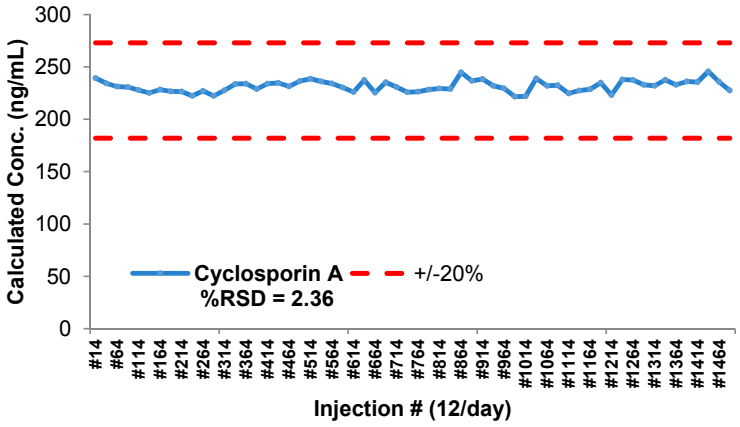
Atrazine QC monitored in leek for more than 400 injections with 4.5% RSD . Red lines represent ± 20% response at 10 µg/Kg. Yellow lines show the time the system was placed in standby mode for 12h to demonstrate consistent performance after standby period

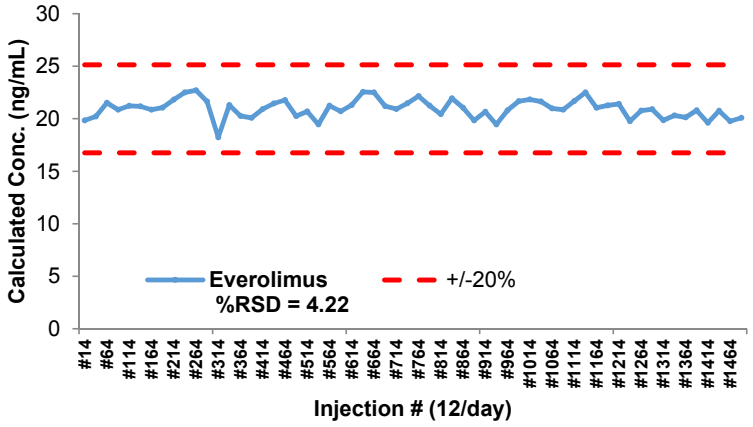


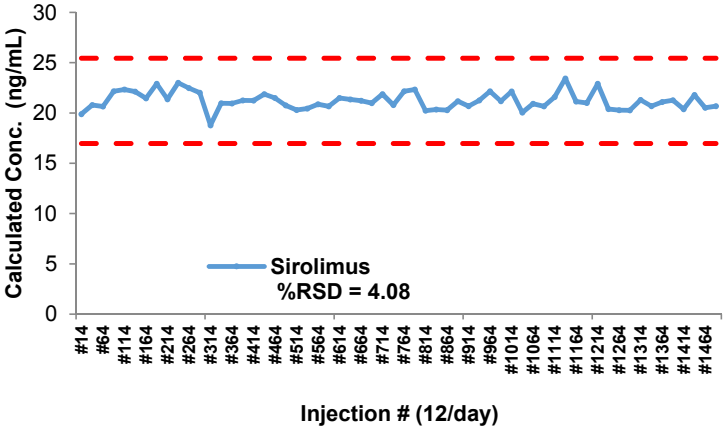
ThermoFisher SCIENTIFIC

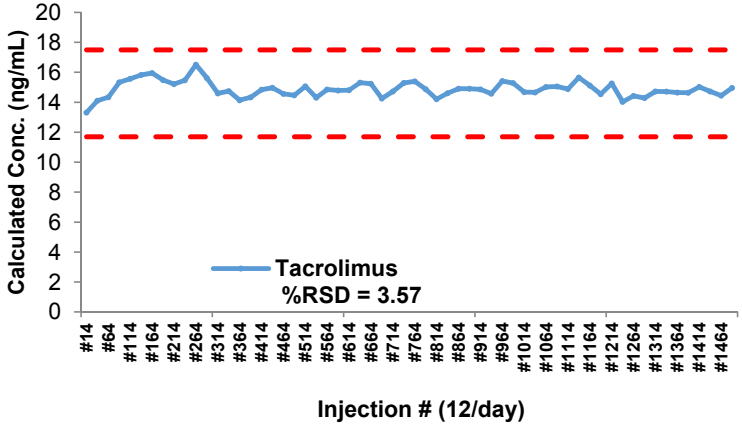
Demonstration of Robustness – Clinical Research

Immunosuppressants (Cyclosporin A, Everolimu, Sirolimus and Tacrolimus) monitored in crashed whole blood for more than 1500 injections. Red lines represent ± 20% of calculated amounts (ng/mL)



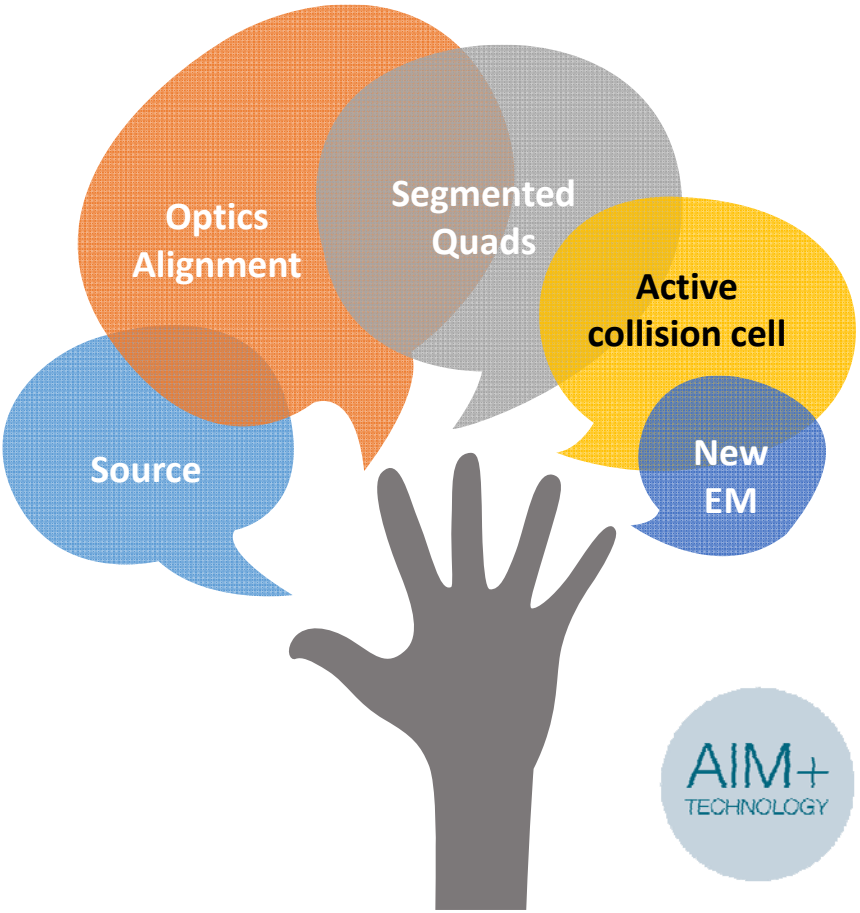


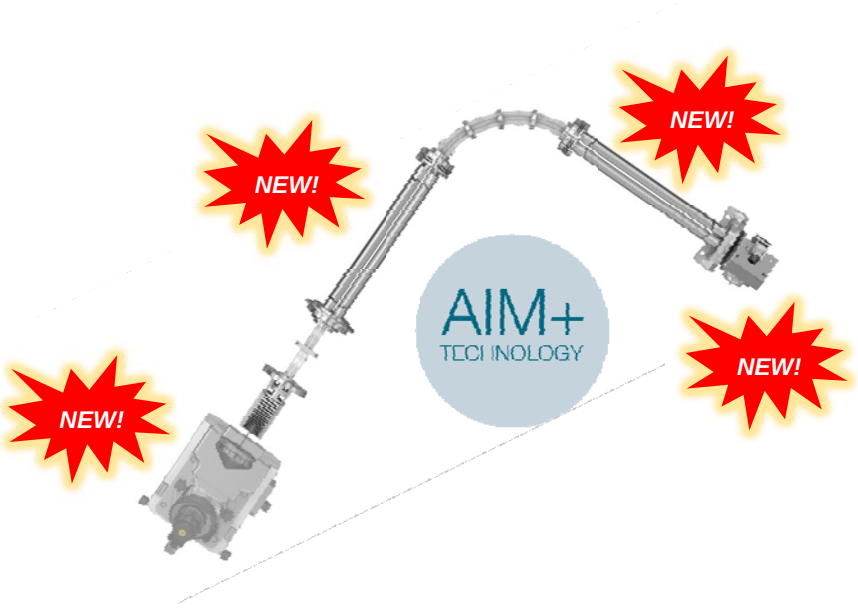




ThermoFisher SCIENTIFIC

Sensitivity with Reproducibility





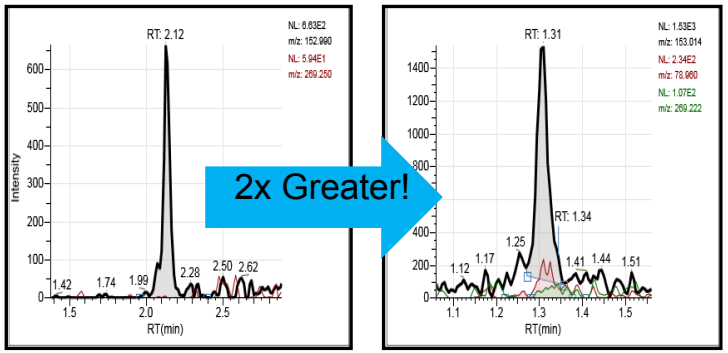
Active Ion Management Plus (*AIM+*)
The next step in precision design delivers the ultimate in ion management, inception to detection, from the OptaMax NG source housing to the enhanced electron multiplier. Incorporates segmented quadrupoles and enhanced RF Electronics to further optimize ion management precision, reliability, speed, and reproducibility.

TSQ Altis: Collaboration with Beatson Institute for Cancer Research

LPA 17:0 @ 0.01 ng/mL

TSQ Quantiva

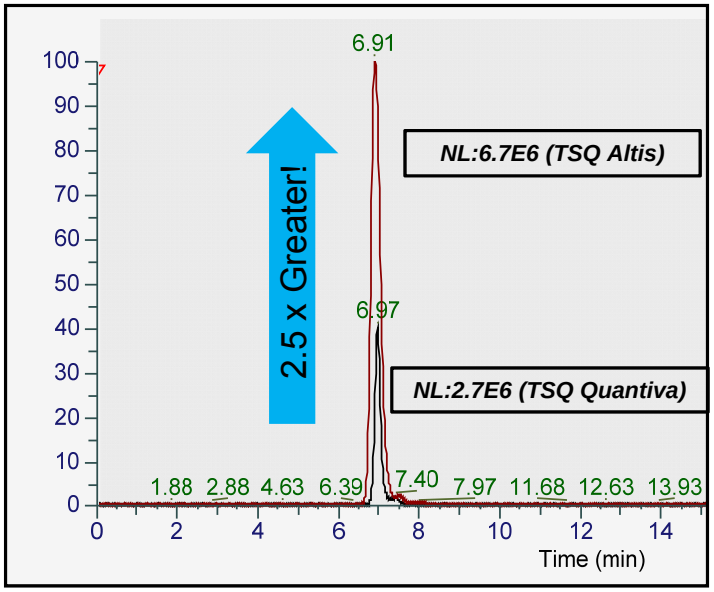
TSQ Altis



RSD 3.4% (n=3)

RSD 0.9% (n=3)

Glutamic Acid



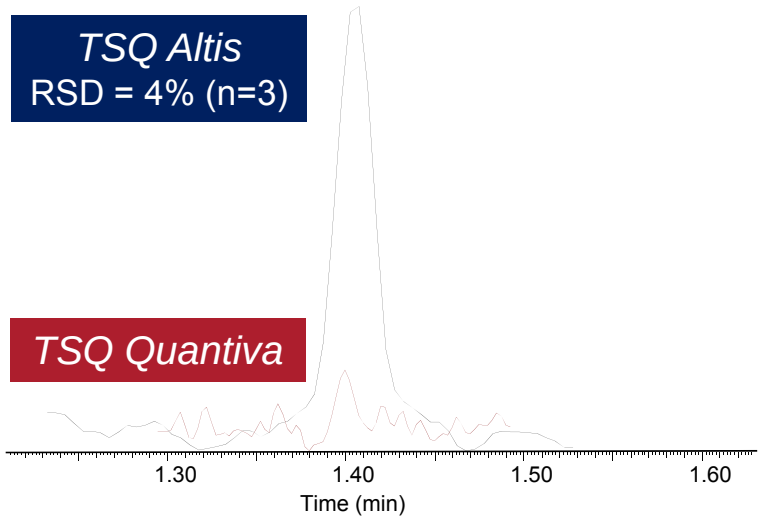
LPA at 0.01 ng/mL with RSD below 1%! 2 x greater response on TSQ Altis! Confirming Ion detected on TSQ Altis!
A 2.5 fold response increase was observed when transferring the metabolomics assay from TSQ Quantiva to TSQ Altis.

ThermoFisher SCIENTIFIC

TSQ Altis: Quantitation of Therapeutic Drugs in Plasma

Compound Name	TSQ Quantiva LOQ (pg/mL)	TSQ Altis LOQ (pg/mL)
Desomorphine	5	5
Desmethyldoxepin	10	2.5
Flecainide	2.5	1
Midazolam	5	2.5
Imipramine	10	2.5
Amitriptyline	10	2.5
Fluoxetine	5	5
Diazepam	5	2.5

Quantitation of Desmethyldoxepin in plasma
2.5 pg/mL



~ 2.5 X average sensitivity improvement over TSQ Quantiva

ThermoFisher SCIENTIFIC

TSQ Altis: Confident Quantitation of Challenging Analytes in Environmental Matrices

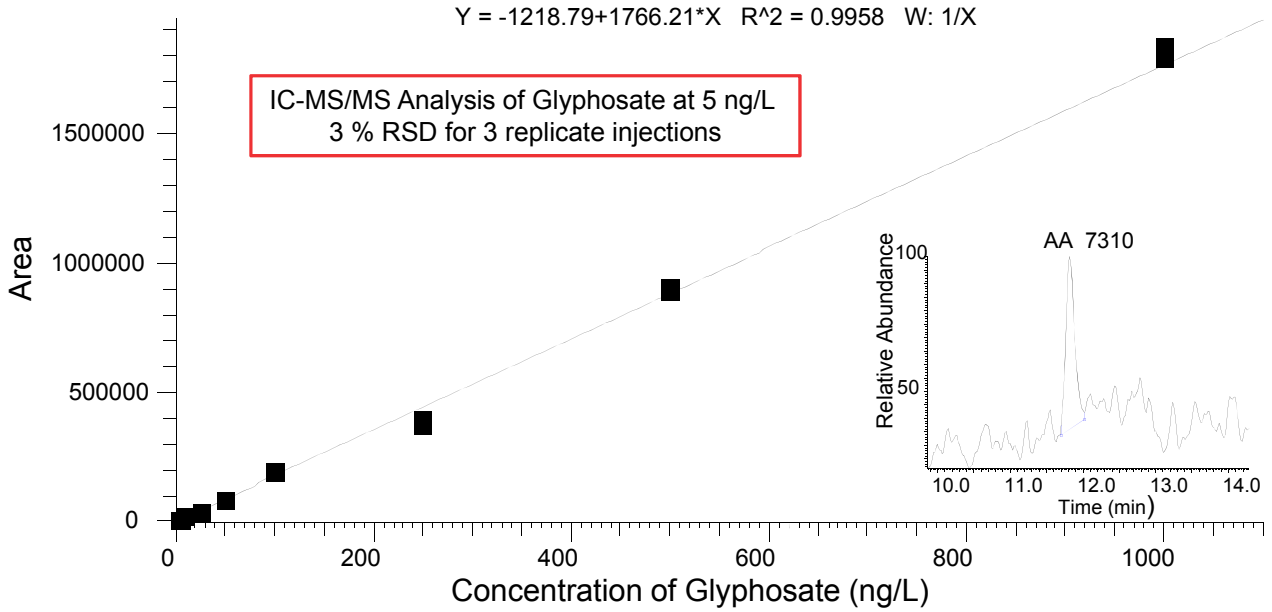
IC-MS/MS solutions for environmental analysis
Quantitation of **Glyphosate** at **5 ng/L**, **3% RSD**

Experimental Details

ICS 5000+
Flow rate: 0.3 mL/min
Eluent Source: Eluent Generator
Mobile Phase: KOH

MS: TSQ Altis

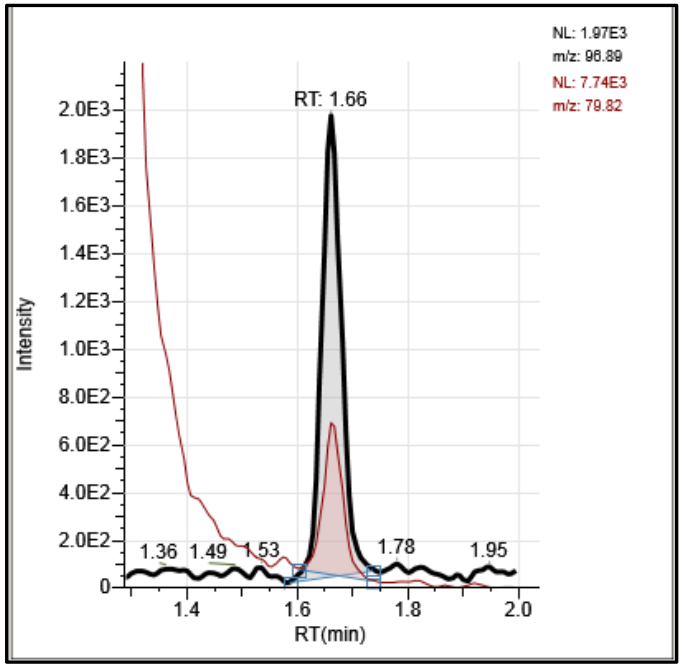
Software: TraceFinder Software 4.1



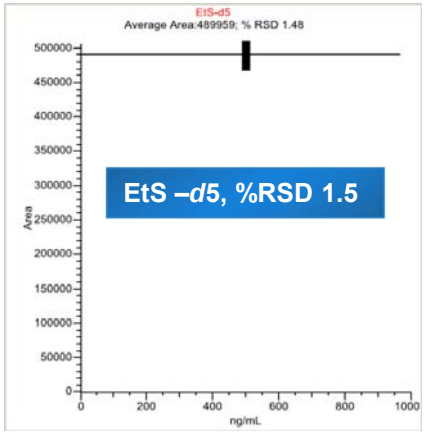
ThermoFisher SCIENTIFIC

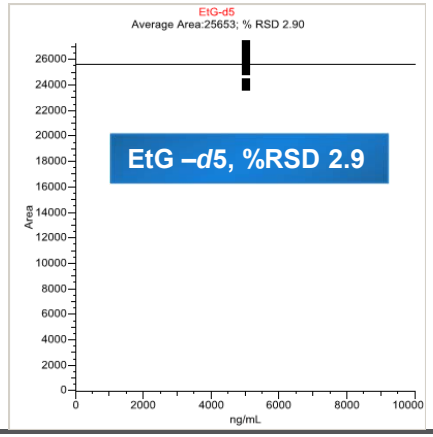
TSQ Quantis: Robust Quantitation of ETG and ETS

Excellent Precision for the most challenging quantitative assays



50 pg on column for Ethyl Sulfate in Urine





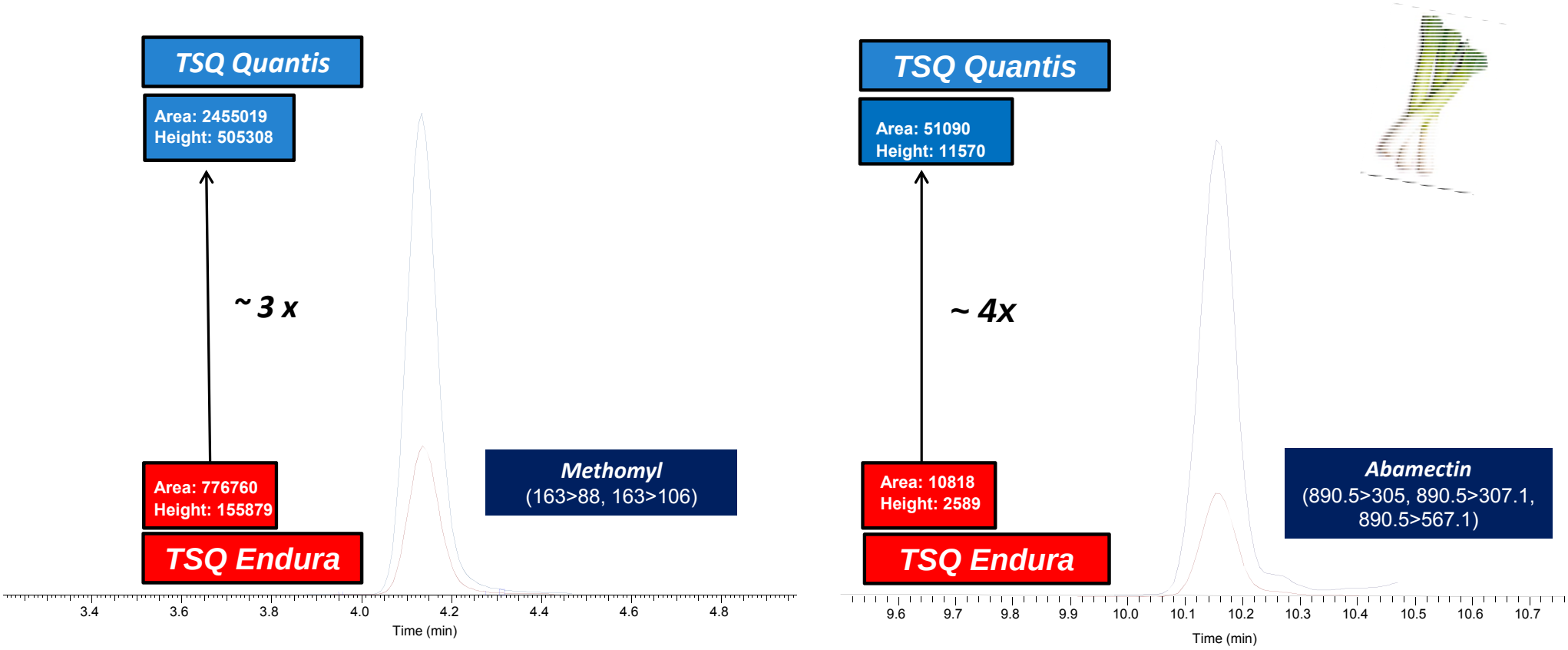
Experimental Details

UHPLC : Vanquish Flex Binary
Flow rate: 0.4mL/min
Solvent A: 0.1%FA in H_2O
Solvent B: 0.1%FA in MeOH

For Research Use Only

ThermoFisher SCIENTIFIC

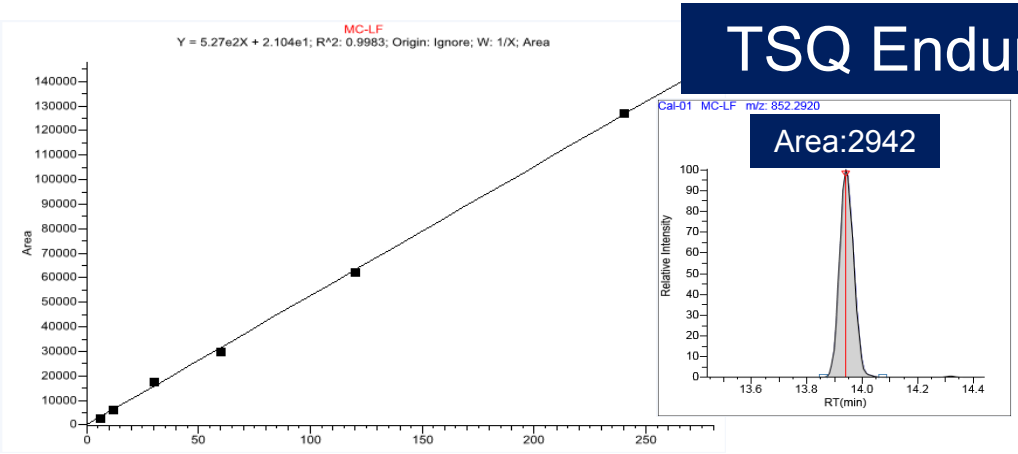
TSQ Quantis: Sensitivity Improvement for Pesticide Residue Analysis



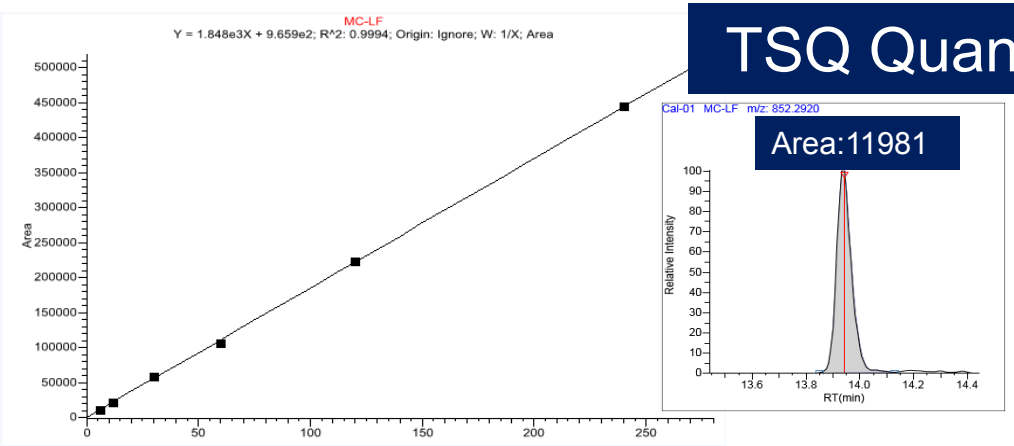
3 x average sensitivity improvement across mass range!

ThermoFisher SCIENTIFIC

TSQ Quantis: Sensitivity in Regulatory Methodology (EPA 544)



TSQ Endura

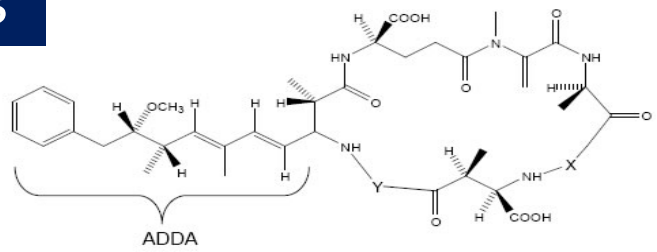


TSQ Quantis

In 2014, half-a-million people were without drinking water in the state of Ohio due to high toxin level!

Algae blooms in Western Lake Erie

EPA 544 released in February 2015



~ 4 x average sensitivity improvement over TSQ Endura

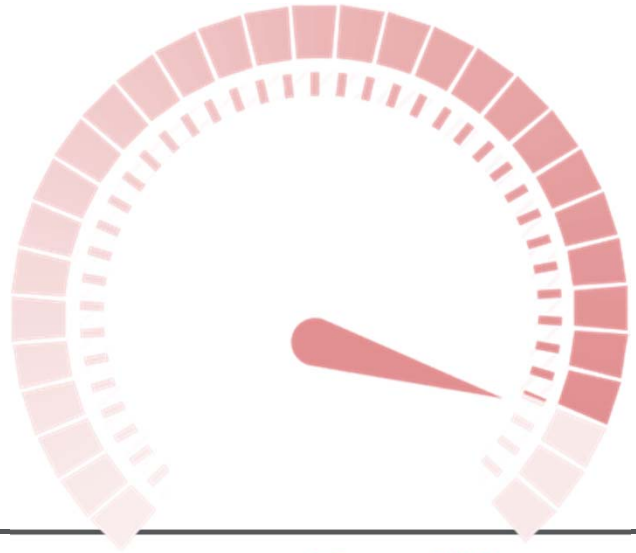
ThermoFisher SCIENTIFIC

Speed

- **Active Collision Cell with axial DC field**
  - 90° cell design for noise reduction

- **New main RF/DC electronics**
  - Analyze more compounds in the same time window or better Quantitation results with better ion statistics (more scans across your chromatographic peak)
  - Up to **600 SRM/sec**

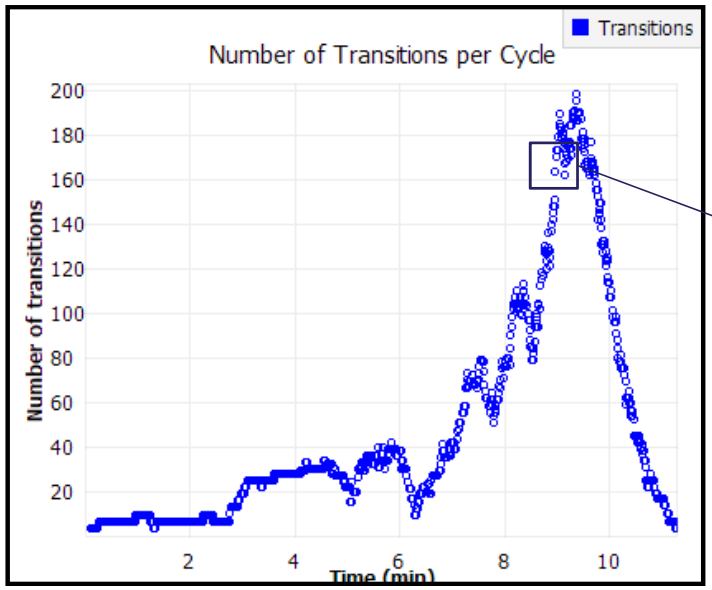
NEW!



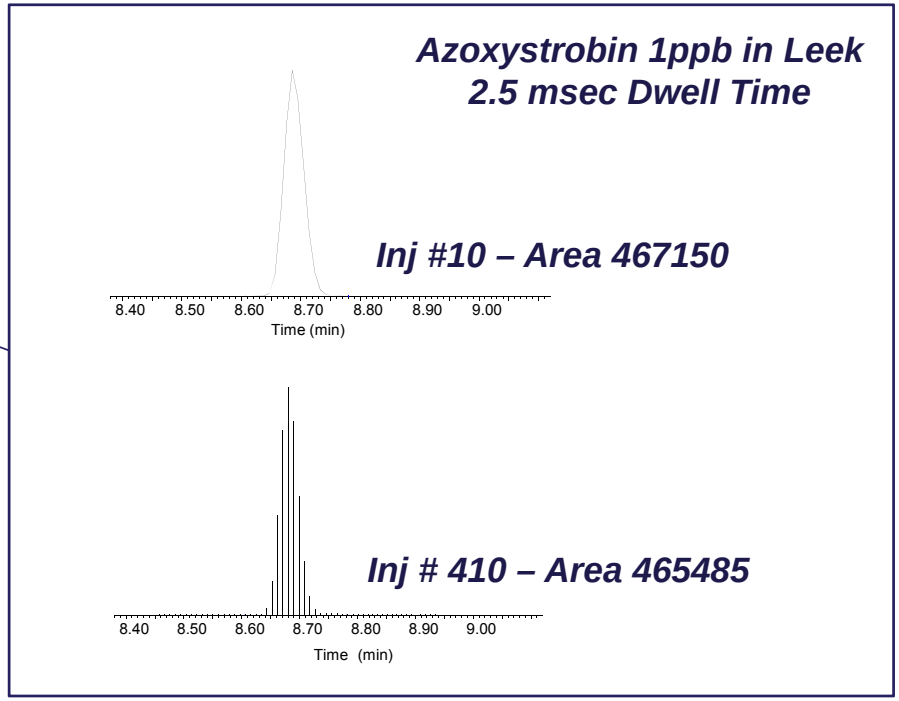
ThermoFisher SCIENTIFIC

Robust, Reliable, Fast Quantitation Workflows

Excellent Quantitative Performance at Lower Dwell Times!



SRM Visualization from Instrument Control Software 3.0 displaying the number of transitions per unit time

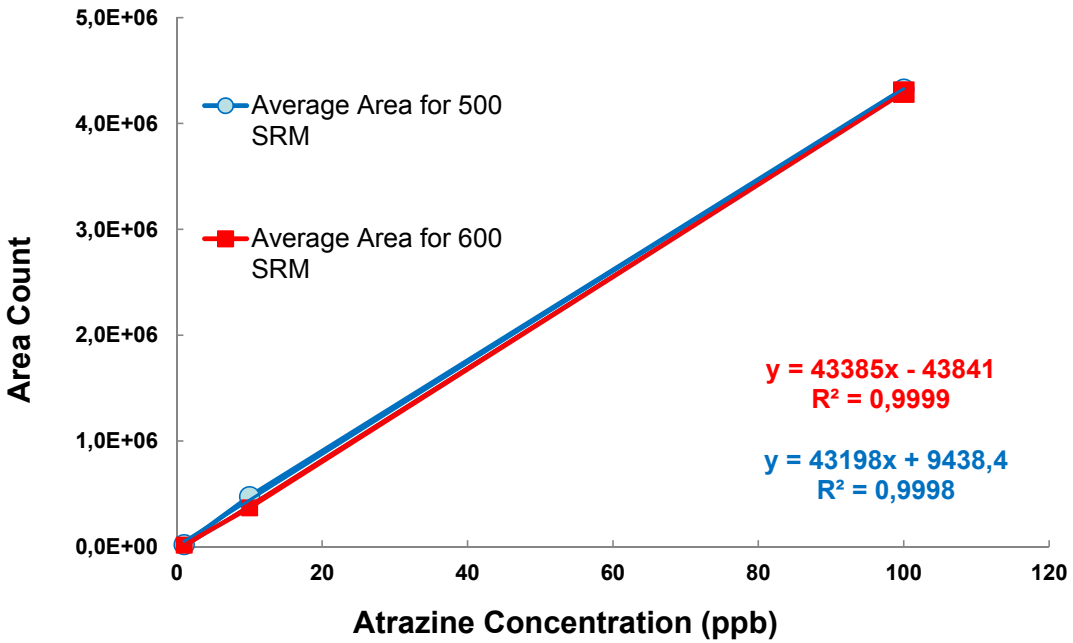


~ 160 Transitions Monitored Simultaneously with Polarity Switching. Excellent Reproducibility (% RSD 2.3) below the MRL

ThermoFisher SCIENTIFIC

Performance at Extreme Speeds – 500 SRMs/sec vs 600 SRMs/sec

Equivalent Quantitative performance between 500 and 600 SRMs/sec!
Good Performance at extremely low dwell times!



SRMs/Sec	Total Number of Transitions	Dwell Time (mSec)
500	1075	0.769
600	1291	0.437

Atrazine Concentration (ppb)	500 SRM/Second		600 SRM/Second	
	Average Area	%CV	Average Area	%CV
1	21682	9	18090	9
10	475465	4	369612	5
100	4326117	1	4296555	1

ThermoFisher SCIENTIFIC

Selectivity with High Resolution SRM (H-SRM)

New segmented quadrupoles with hyperbolic surfaces

TSQ Altis – 0.2 Da FWHM

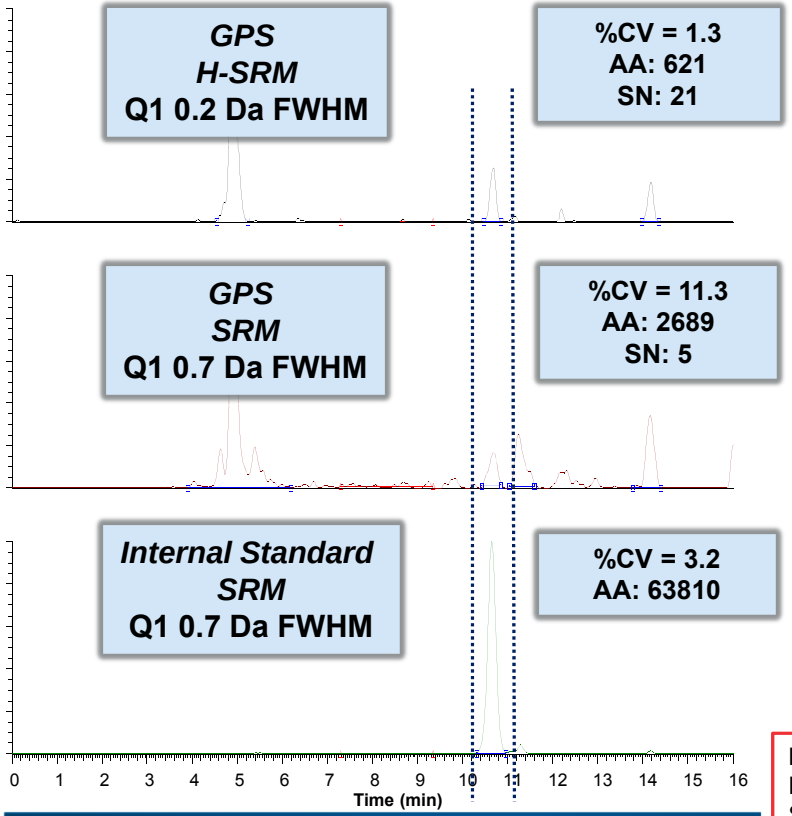
TSQ Quantis – 0.4 Da FWHM

Reduced noise when analyzing complex matrices – better S/N – lower LOD/LOQ

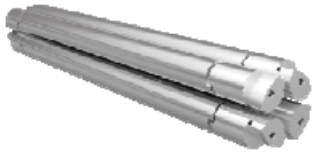
ThermoFisher SCIENTIFIC

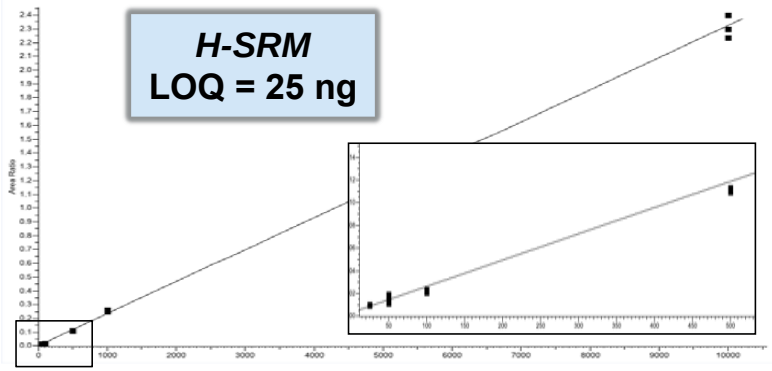
Superior Sensitivity with H-SRM (0.2 Da FWHM) – GPSVFPLAPSSK

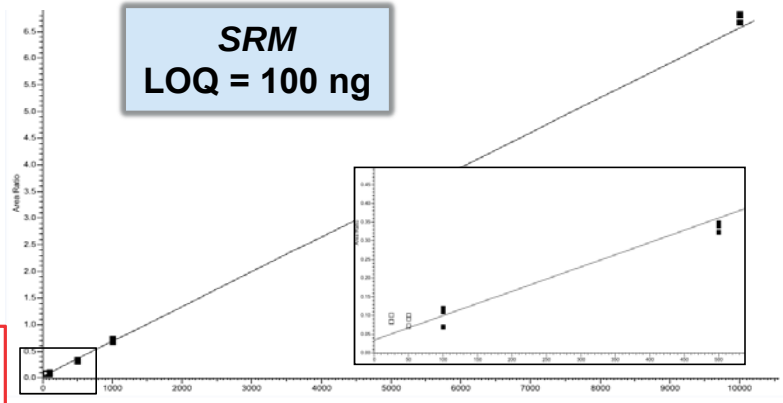
GPSVFPLAPSSK - Peptide from monoclonal antibody hinge region



25 ng GPSVFPLAPSSK and *IS*







Experimental Details

LC : Ultimate NCS-3500RS
Flow rate: 25µL/min
Solvent A: 2% ACN in H_2O w/0.1% FA
Solvent B: 5% H_20 in ACN w/0.1% FA

ThermoFisher SCIENTIFIC

Ease-of-Use

- **Market Specific Software: Thermo Scientific™ TraceFinder™ software**
  - SRM databases for Environmental, Food Safety, Clinical Research and Forensic Toxicology applications: easy instrument method setup
  - Compatible with GC and LC high resolution systems. One software package for different platforms
  - Customized reports
  - Flexibility on Data Review – compound or sample centric modes for easy data review. Customized flagging system for easy review of important criteria.

- **Instrument Control Software: Tune 3.0**
  - **User**
    - Automated Compound Optimization (via infusion or Autosampler)
    - Dynamic Retention Time (dRT)
    - Method Conversion Tool (Agilent/Sciex)
    - Improved Auto tune and Calibration Routines (Faster with improved reporting)
    - Favorites – Easy to setup source settings for Calibration
  - **Service**
    - New/Smarter Diagnostics – better serviceability of the system – improved reporting for service.

NEW!

ThermoFisher SCIENTIFIC

Basic Maintenance

5 min operation!
No need to break vacuum!

OptaMax NG

Re-designed source housing

NEW!

New tool available to ensure consistent positioning of HESI needle

ITT/Sweep Cone

Ion transfer tube and sweep cone

No need to break vaccum for basic maintenance
5 minute Operation!

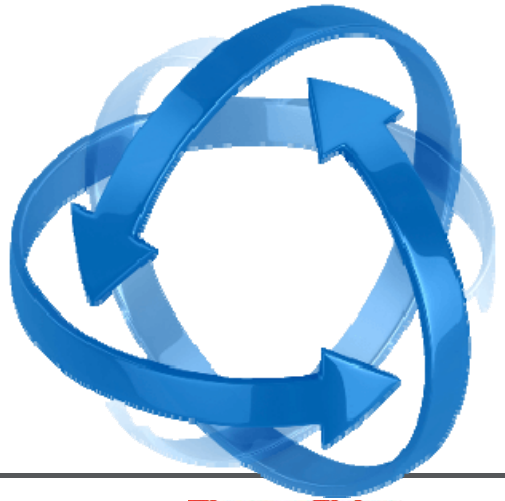
ThermoFisher SCIENTIFIC

Flexibility

- **LC Options**
  - **High Sample Throughput**
    - Multi channel – Transcend and Prelude
    - CTC PAL 3 – reduced time between injections, barcode reading
  - **High Performance LC**
    - UHPLC – Vanquish Horizon and Vanquish Flex

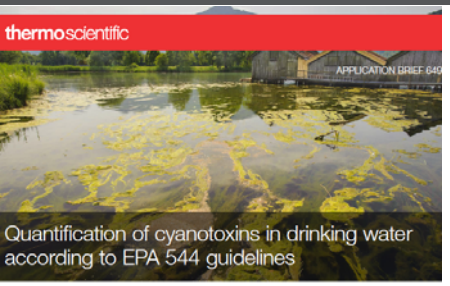
- **MS Ion Sources**
  - H-ESI
  - APCI
  - OptaMax – APCI ready (only need to change the sprayer – 2 min operation)
  - APPI
  - Easy spray source and flex for nanoLC applications

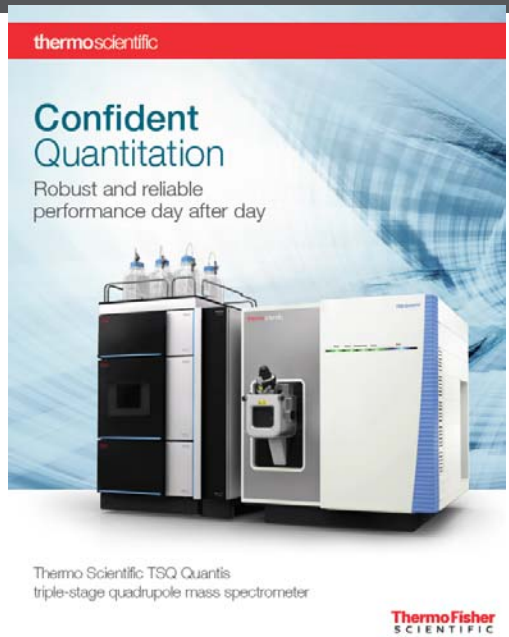
- **Software Options**
  - TraceFinder Software
    - Method development to automated report generation – offering comprehensive solution for every target application
  - Thermo Scientific™ Chromeleon™ Software
    - Data acquisition and processing
  - AB Sciex Skyline Software
    - Compatibility with TraceFinder

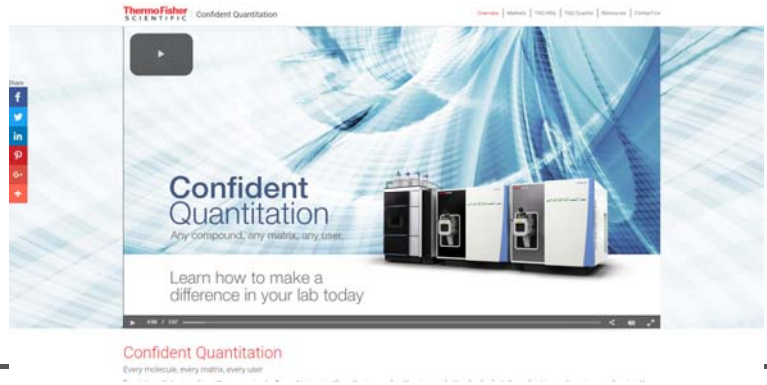


ThermoFisher SCIENTIFIC

Critical Resources Worth Looking At







For Research Use Only

Confident Quantitation

Any compound, any matrix, any user.

ThermoFisher SCIENTIFIC