

Rising to the Challenge of Future Food Analytics

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SEA

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Bangkok, Thailand



Who We Are at Agilent

A global, collaborative team, serving vital industries in 6 key markets



Pharma and Biopharma



Food and Feed



Chemicals and
Advanced Materials



Environmental
and Forensics



Diagnostics and Clinical



Academia and
Government

Committed to

Accelerating the
advancement of science

Providing **complete,
integrated solutions**

Championing
your success

Agilent in Food and Feed Safety, Quality, and Authentication



- Agilent supports the **testing and surveillance of the supply chain** to ensure the world's food supply is safe and wholesome
- Agilent helps **labs set/ensure the highest standards** of food safety, quality, and authenticity
- Agilent works with leading researchers and labs **to develop new standards for detecting** pesticides, veterinary drug residues, and emerging contaminants

Agilent Serves the Entire Food and Feed Analysis Value Chain

Research

Development

Quality Assurance and Compliance



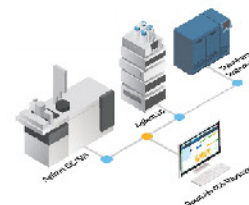
Sample preparation



Separation



Detection



Data analysis



Reporting

Agilent
CrossLab
From Insight to Outcome

- Instrument service
- Training, consulting and operational expertise
- Enterprise lab management
- Columns, supplies and chemical standards

1000 Pesticide Residues Analyzed Following SANTE 12682/2019 Guidelines

Challenges in Pesticide Analysis

- Diversity of pesticides
- Complexity of food matrices
- Low limits of detection

Agilent Solution

- Wide Coverage
 - >1000 targets in dMRM
 - tailored QuEChERS kits for commodity groups
- Entire Pre-verification
 - Verified-based SANTE
 - Intra-Lab
 - Inter-Lab
- Excellent Sensitivity
 - LODs for >99% targets meet MRL
- Innovations in HW and SW

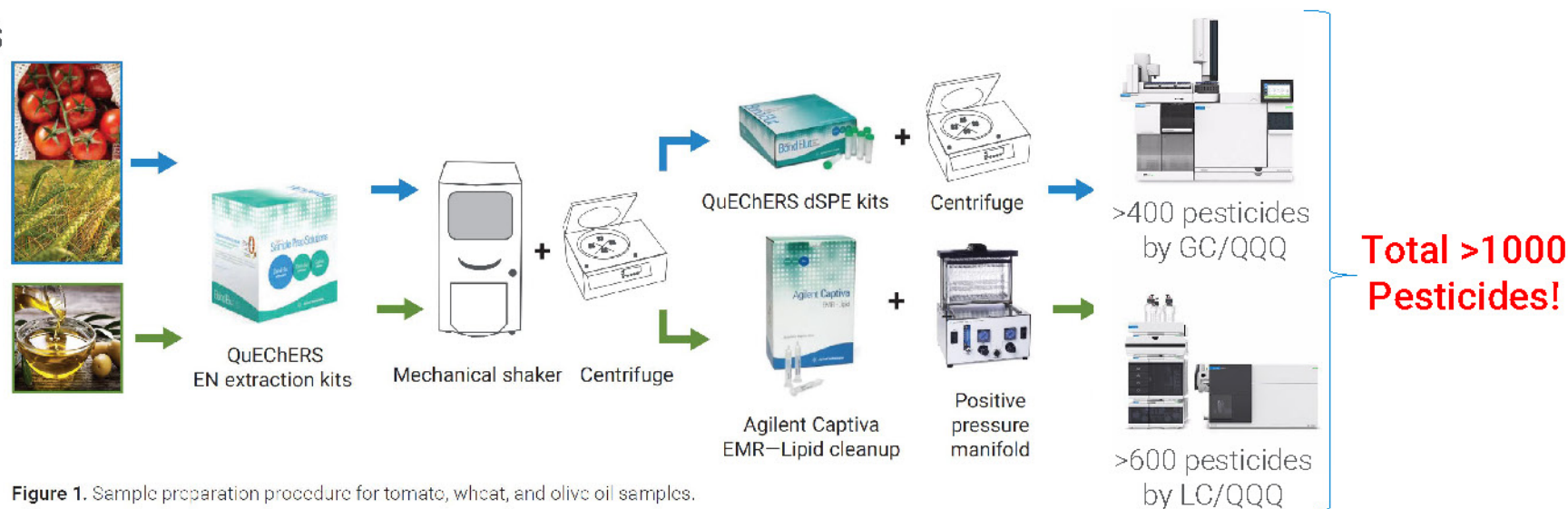


Figure 1. Sample preparation procedure for tomato, wheat, and olive oil samples.

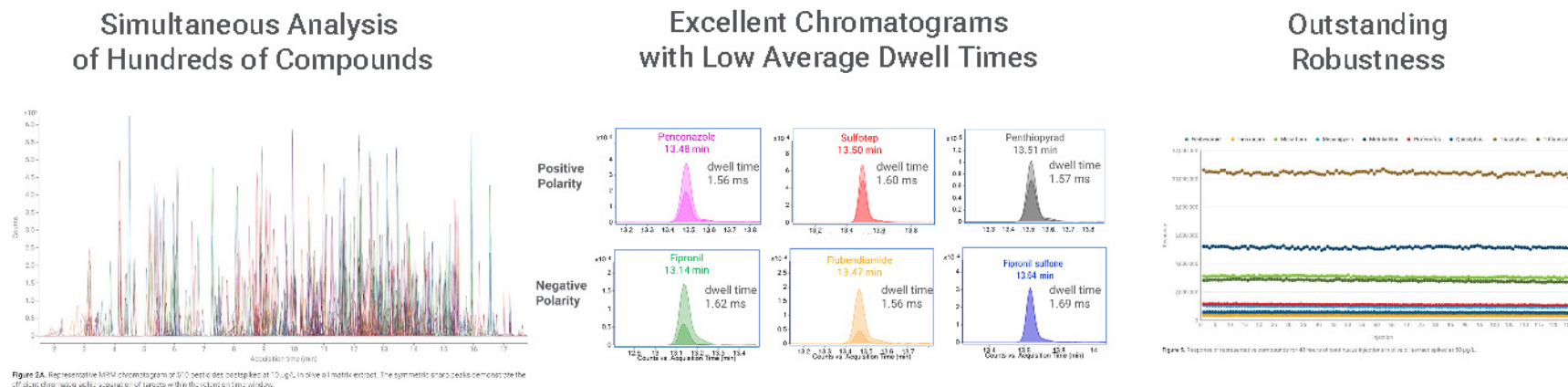


Figure 2A. Representative MRM chromatogram of 970 pesticides postspiked at 10 µg/L in olive oil matrix extract. The symmetric sharp peaks demonstrate the off-line chromatographic separation of targets within the narrow time window.

Figure 2C. Reproducibility of peak heights for 40 spiked pesticides injected in triplicate at 10 µg/L.

[Webinar](#) by Marcus Chadna, A Novel Workflow to Determine over 1000 Pesticide Residues in Compliance with SANTE 12682/2019 Guidelines in Various Food Matrices; App Notes: 5994-2370EN and 5991-7303EN; and work by Linfeng Wu

The 6475 LC/QQQ: Consistently **Robust and Versatile** hardware and **End-to-End System Intelligence** – Many new features

Maximize instrument uptime with **VacShield**



*No venting required:
perform maintenance
in 30 minutes*

6 hours



30 minutes

Routine Maintenance Speed



Procedure	Time Without VacShield (min.)	Time With VacShield (min.)
Cool down to acceptable temperature	15	Not needed
Break vacuum and leak air into the instrument	15	Not needed
Remove and clean ion injector capillary	20	20
Power on and pump down	300 (5 hours)	Not needed
Check tune or autotune instrument	10 (Check tune) 45 (Autotune)	10 (Check tune) 45 (Autotune)
Total	360 to 395 (6.0 - 6.6 hours)	30-65 (0.5-1.1 hours)



Active System Monitoring

Early Maintenance Feedback
helps keep an eye on system health

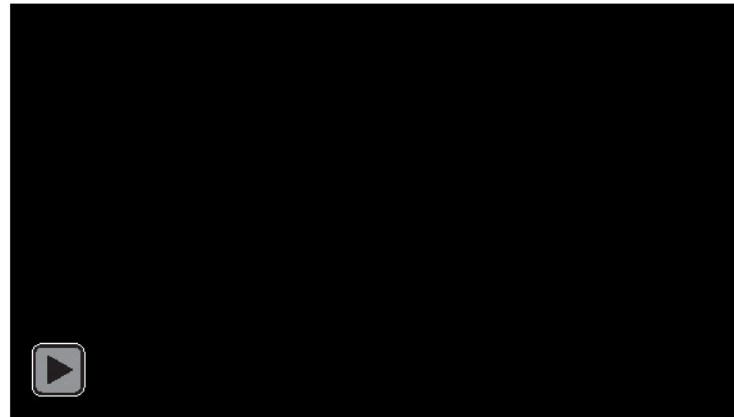
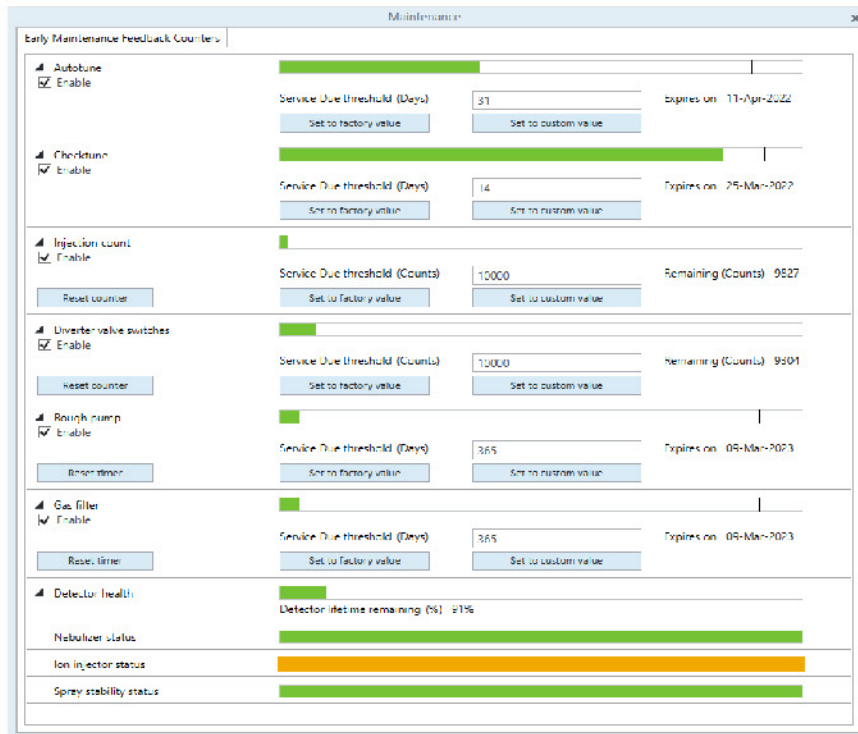


Maintenance Automation

Scheduled Autotune/Checktune
automatically verifies system readiness



Event timers read like a battery bar to help anticipate maintenance events



5AM → *Instrument tunes before anyone arrives*

Scientist arrives → *Instrument is ready to go*



Event flags detects and pinpoints when an adverse event has occurred

Schedule Tune

Scheduling: Weekly Monthly

Recur every 1 week(s) on:

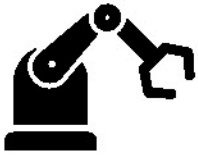
Monday Tuesday Wednesday Thursday Friday
 Saturday Sunday

Start: 2/19/2022 Time: 8:30 AM

Polarity: Both Positive Negative

Buttons: Save, Cancel

Context Menu (TQ):
 On
 Standby
 Calibrant
 LC
 Vent
 Pump Down
 Schedule Tune
 Review Tune Report



Method Development Automation

Fully Automated MRM and Ion Source optimizer helps develop new methods or fine-tune existing methods quickly

Create new or load existing method

Input chemical formulas

Select optimization parameters

Select "Guided" or "Automated"

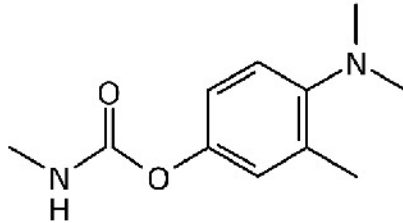
Execute workflow

Review Results

Finalize and Save to database

Define Target:

Aminocarb



Automatically find MRMs

MRM1: 209.1 → 152.0

MRM2: 209.1 → 137.2

Automatically find Parameters

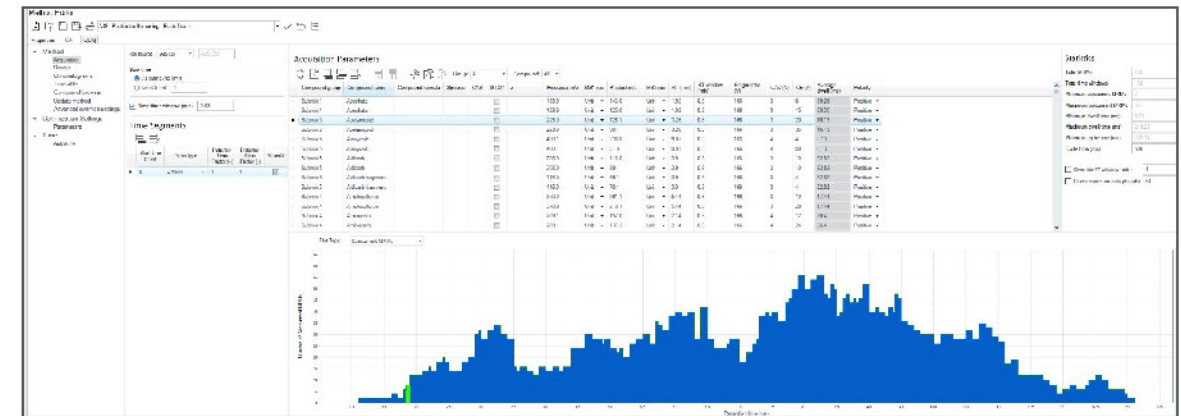
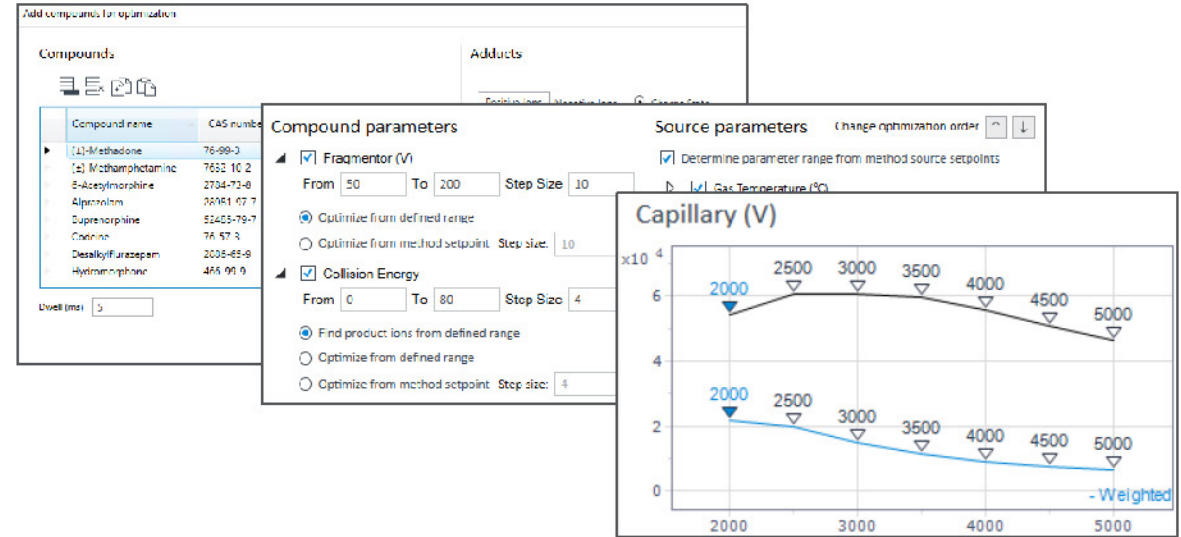
Collision Energies, Fragmentor

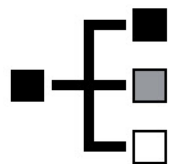
Consolidate Method

MRMs Defined

MRMs Optimized

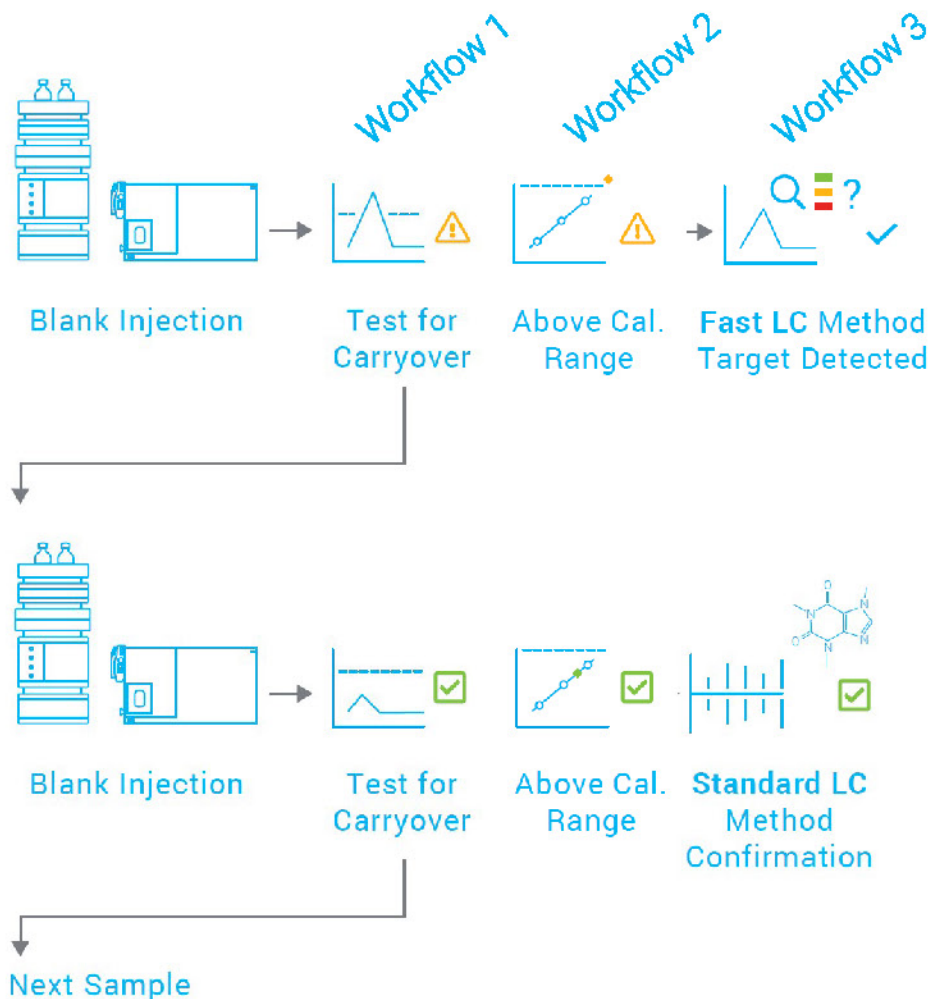
Ion Source Optimized





Reflexive Injection Logic

Intelligent Reflex helps assure samples are in spec or to increase throughput



	Status	Method	Data File	Sample Type	iReflex Type	
1	Completed	ESDemo_MRM method.m	Blank_1.d	Blank	Carryover	Warning
2	Completed iReflex	ESDemo_MRM method.m	Blank_1-CarryoverBlank-001.d	Blank	Carryover	Warning
3	Completed	ESDemo_MRM method.m	Sample_1.d	Sample	No iReflex Workflow	Checkmark
4	Completed	ESDemo_MRM method.m	Sample_2.d	Sample	No iReflex Workflow	Checkmark
5	Completed	ESDemo_MRM method.m	Blank_2.d	Blank	Carryover	Warning
6	Completed iReflex	ESDemo_MRM method.m	Blank_2-CarryoverBlank-001.d	Blank	Carryover	Warning
7	Completed iReflex	ESDemo_MRM method.m	Blank_2-CarryoverBlank-002.d	Blank	Carryover	Warning
8	Completed	ESDemo_MRM method.m	Sample_3.d	Sample	No iReflex Workflow	Checkmark

Additional blank injections inserted if carryover was detected

Food Authenticity/Identity

Food Fraud

The deliberate and intentional substitution, addition, tampering or misrepresentation of food, food ingredients or food packaging, labelling, or false or misleading statements made about a product for economic gain.

- Substitution
- Addition/Dilution
- False Claims

Challenges

- Meeting regulatory requirements
- Availability of authentic samples
- Speed of analysis
- Extensive method development required
- Extensive validation required



MassHunter Classifier

A simple tool for automated sample classification

The screenshot displays the Agilent MassHunter Classifier 1.0.0 interface. The main window is titled "Ataulfo_sample6_1". The interface is divided into several sections:

- Tool Bar:** Located at the top, it includes icons for New, Open, Save, Close, Details, Add, Remove, 2D, 3D, Generate Report, and About.
- Sample Table:** A table on the left side listing samples and their classifications. A blue callout box labeled "Sample Table" points to this section.
- Data Visualization:** A 3D scatter plot in the center showing the separation of samples into three clusters: Ataulfo (orange), Keitt (teal), and Tommy (purple). Blue callout boxes with the names "Ataulfo", "Keitt", and "Tommy" point to their respective clusters. A small image of a yellow mango is associated with the Ataulfo cluster, and a small image of a red mango is associated with the Tommy cluster. A blue callout box labeled "Data Visualization" is positioned above the plot.
- Compound Table:** A table on the right side listing compounds and their properties. A blue callout box labeled "Compound Table" points to this section.

Sample Table Data:

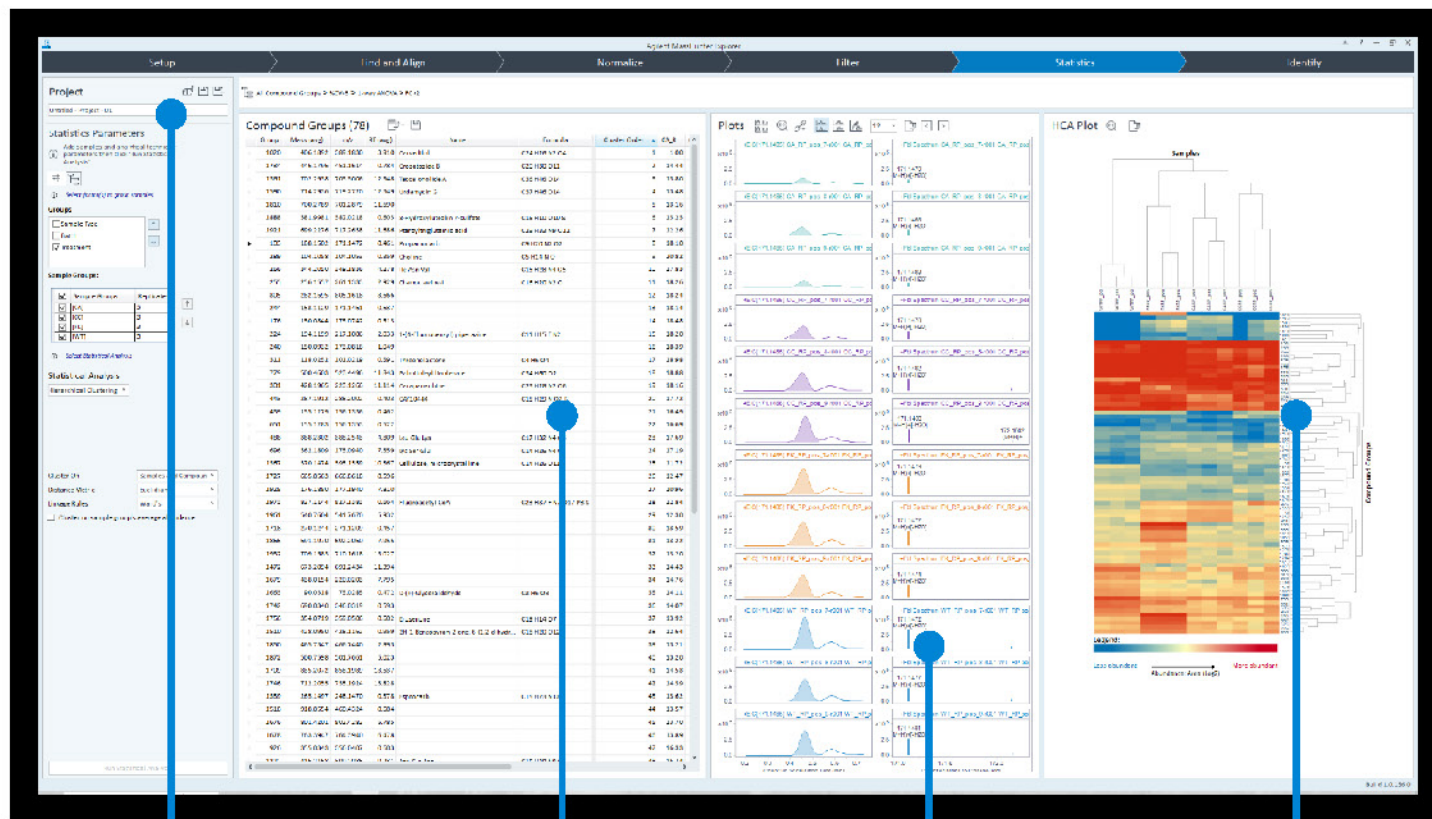
Sample	Class	Confidence
Ataulfo_sample6_1	Ataulfo	0.08
Ataulfo_sample6_2	Ataulfo	0.08
Ataulfo_sample6_3	Ataulfo	0.08
Keitt_sample6_1	Keitt	0.08
Keitt_sample6_2	Keitt	0.07
Keitt_sample6_3	Keitt	0.08
Tommy_sample6_1	Tommy	0.06
Tommy_sample6_2	Tommy	0.05
Tommy_sample6_3	Tommy	0.08

Compound Table: Ataulfo Data (Partial):

Mass	RT	Abundance	Flag	Profile
463.2422	10.619	19.509	●	-
325.1374	5.998	19.147	●	-
468.1974	10.620	18.888	●	-
283.0218	1.807	18.235	●	-
328.4989	19.153	18.151	●	-
470.2128	10.852	18.110	●	-
206.1308	10.844	17.769	●	-
469.2160	7.315	17.546	●	-
459.2106	8.647	17.366	●	-
287.1369	7.355	17.345	○	-
224.1414	10.852	17.303	●	-
465.2576	10.828	17.171	●	-
371.0380	1.805	17.087	●	-
219.1100			●	-
330.0920			●	-
359.1580			●	-
470.2130	10.884	16.577	●	-
195.0057	1.811	16.335	●	-
148.0526	7.075	16.310	●	-
454.1191	11.005	16.287	●	-
356.0353	1.816	16.202	●	-
383.1450	7.318	16.163	●	-
148.0523	7.323	16.161	●	-
148.0525	9.591	16.156	●	-
804.5006	19.403	16.112	●	-
162.0681	7.624	16.015	●	-
394.1603	10.304	15.887	●	-
354.1655	10.357	15.869	○	-
832.5316	20.327	15.859	●	-
389.2051	10.300	15.854	●	-
375.1663	10.954	15.824	●	-
584.4225	21.355	15.755	●	-

MassHunter Explorer: for non-targeted LC/QTOF applications

Draw critical insights from complex data - Simple, efficient path to differential analysis



Linked interactive navigation of all results in one application

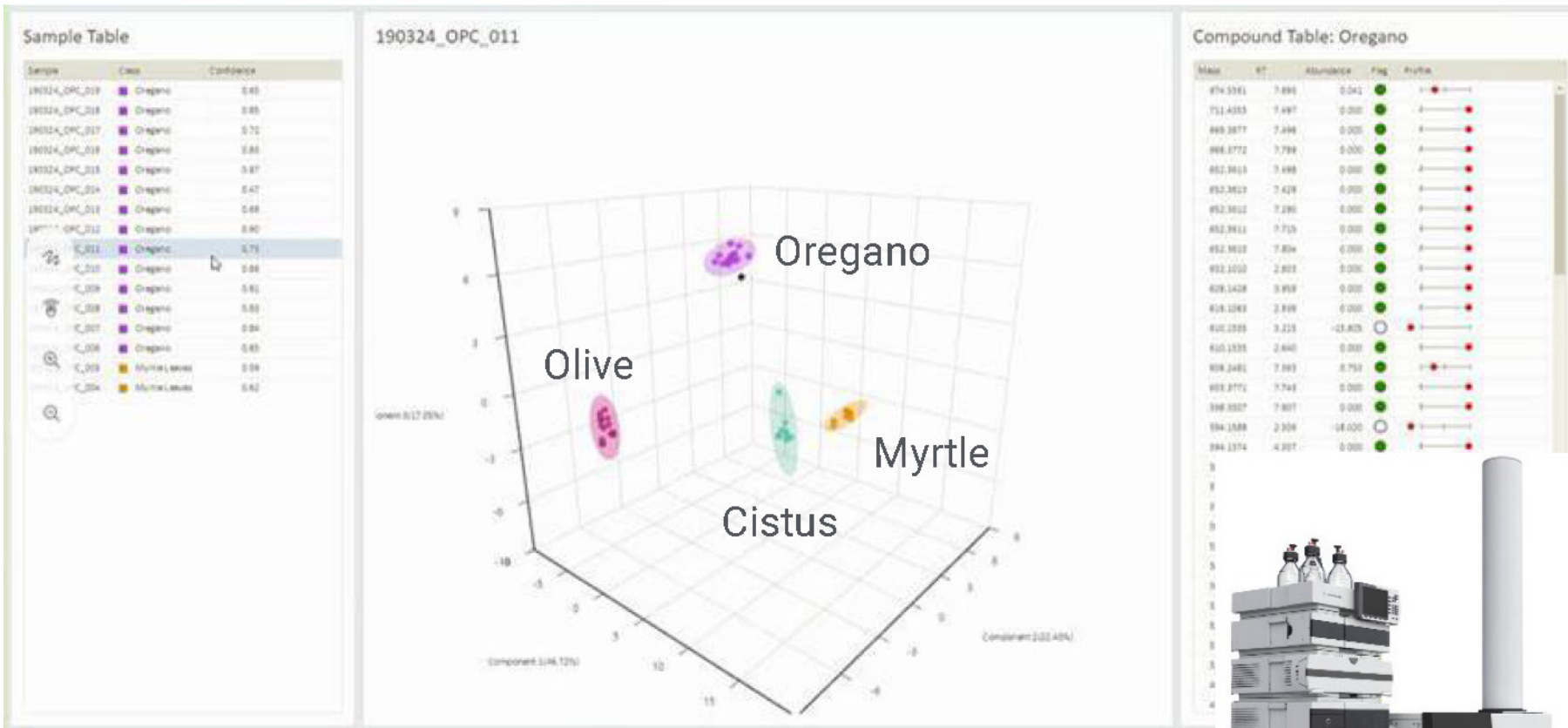
Project-based guided workflow

Compound Identifications

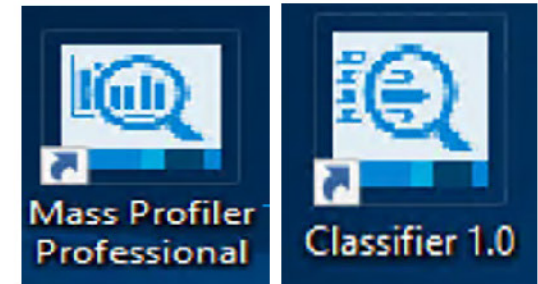
Instrument data

Statistical analyses

Identity Fingerprinting of Herbs with LC QTOF



Oregano (Purple 14 samples) Myrtle (Yellow 10 samples)
Cistus (Green 10 samples) Olive leaves (red 15 samples)

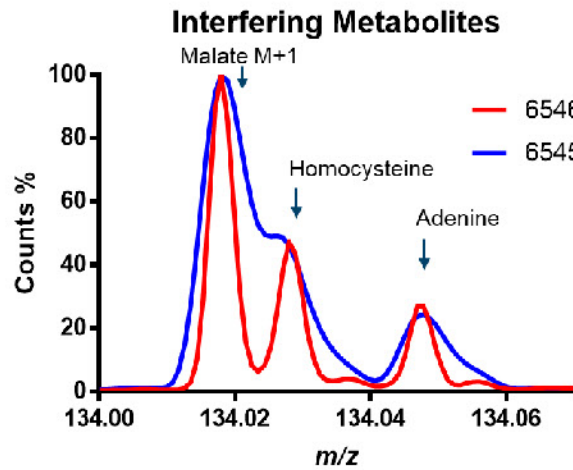


Professor Chris Elliott, OBE
Institute for Global Food Security,
Queens University, Belfast

6546 LC/Q-TOF MS for Food Analysis

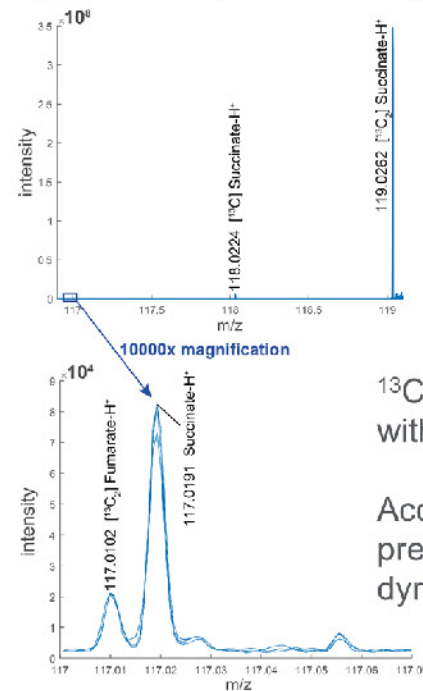
Benefiting from the design innovations

Resolving coeluting metabolites

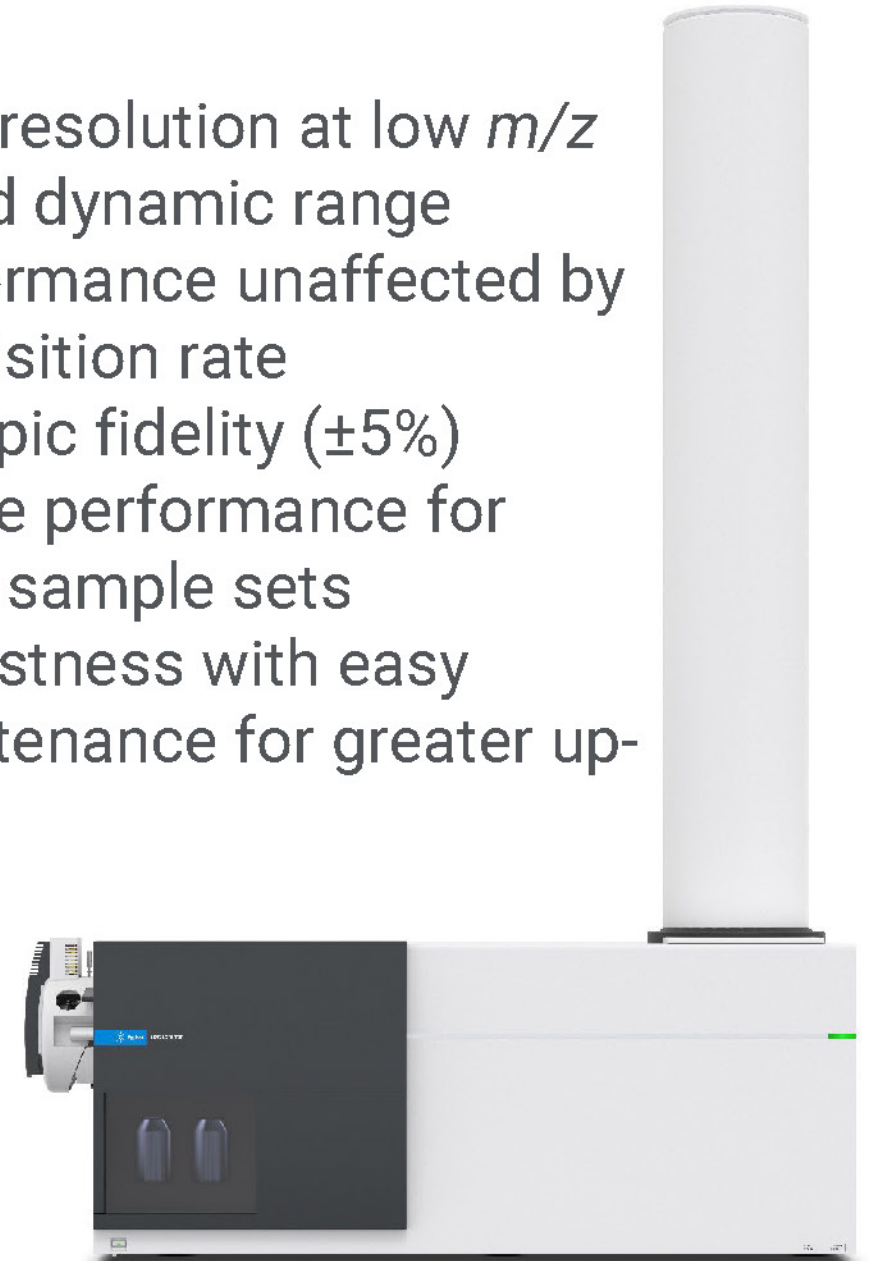


Malate M+1 [M-H]⁻ is 134.0176
Homocysteine [M-H]⁻ is 134.0281
Adenine [M-H]⁻ is 134.0472

In-spectrum dynamic range: >4 orders



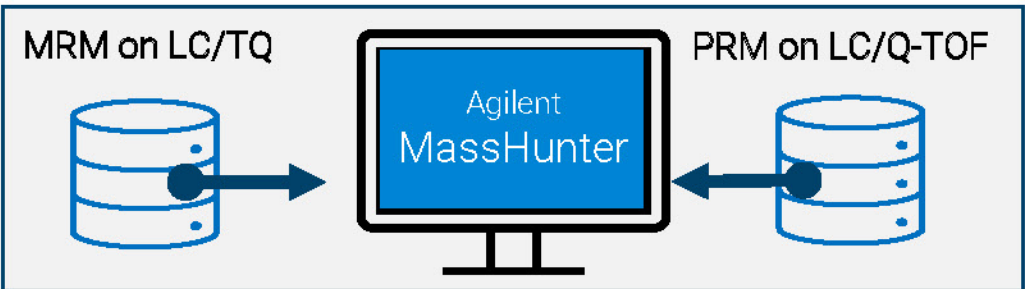
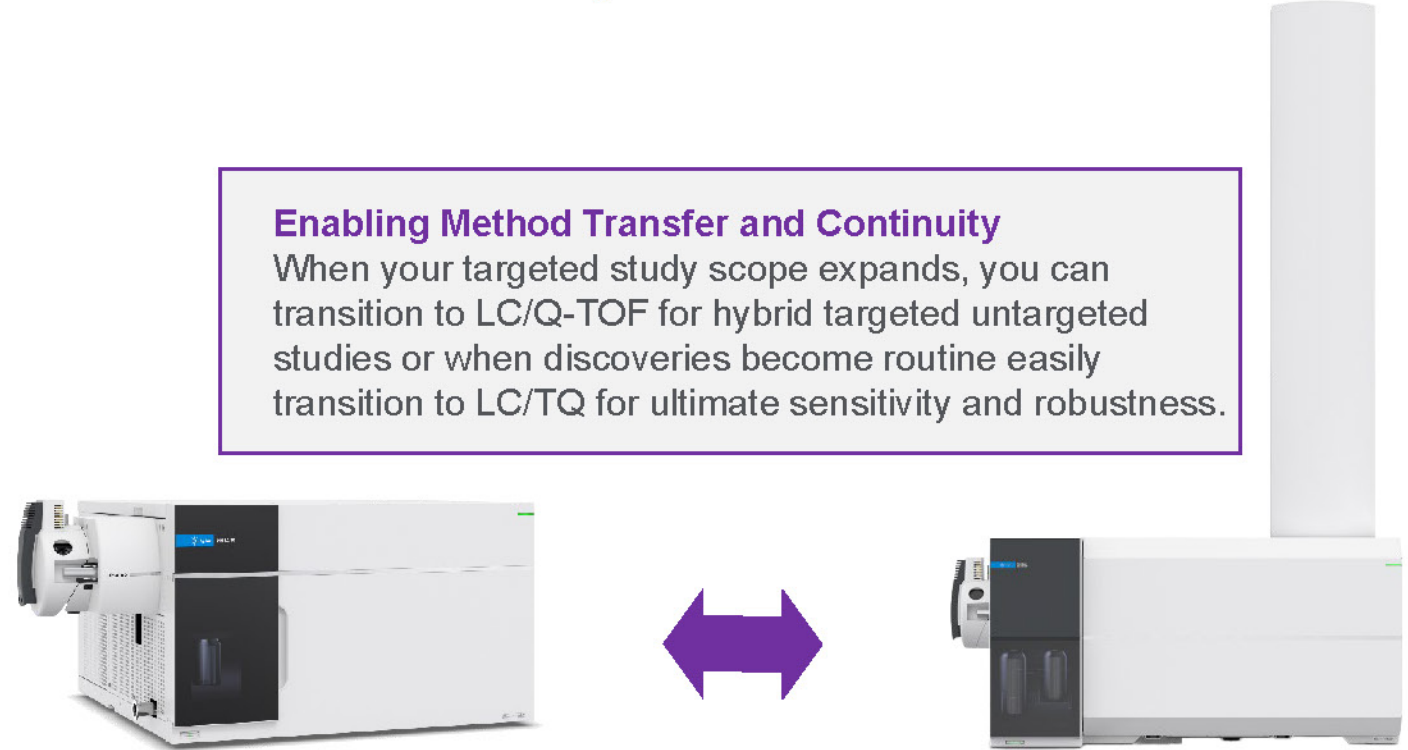
- High resolution at low m/z
- Broad dynamic range
- Performance unaffected by acquisition rate
- Isotopic fidelity ($\pm 5\%$)
- Stable performance for large sample sets
- Robustness with easy maintenance for greater up-time



Agilent 6546 LC/Q-TOF: Gaining Higher Confidence and Throughput in Metabolite Analysis. Agilent application note 5994-0724EN

Intelligent Mass Spectrometers are Backed by Highly Curated Workflows to Decrease Method Development Time And Accelerate Research

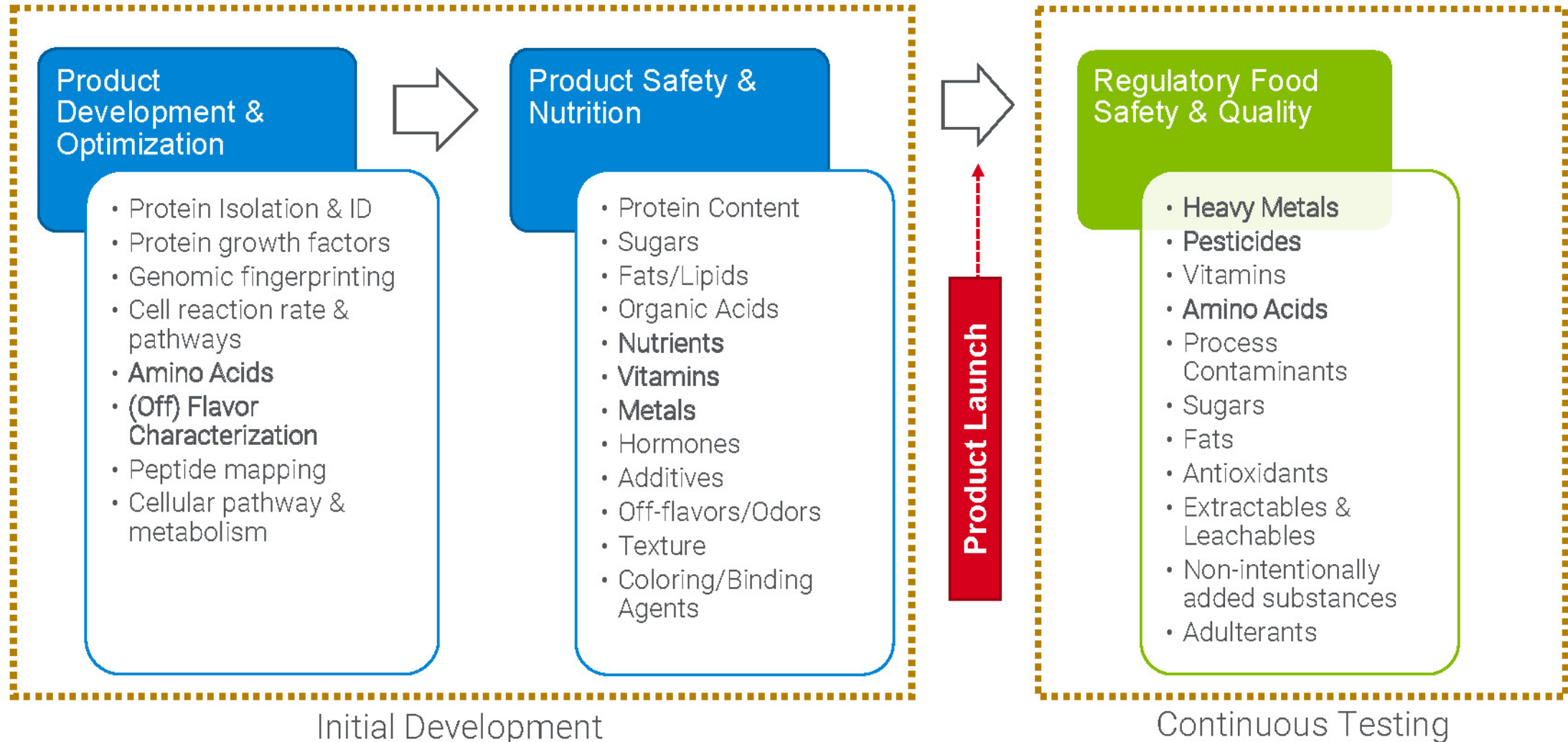
Enabling Method Transfer and Continuity
When your targeted study scope expands, you can transition to LC/Q-TOF for hybrid targeted untargeted studies or when discoveries become routine easily transition to LC/TQ for ultimate sensitivity and robustness.



Testing Workflow for Alternative Proteins

Testing needs vary based on protein source

Testing needs vary based on regulations and final product type, with similar tests used in conventional products



Upendra Khurana, Tarun Anumol

LC/Q-TOF Analysis and Nontargeted Chemometric Profiling of Meats and Plant-Based Alternatives

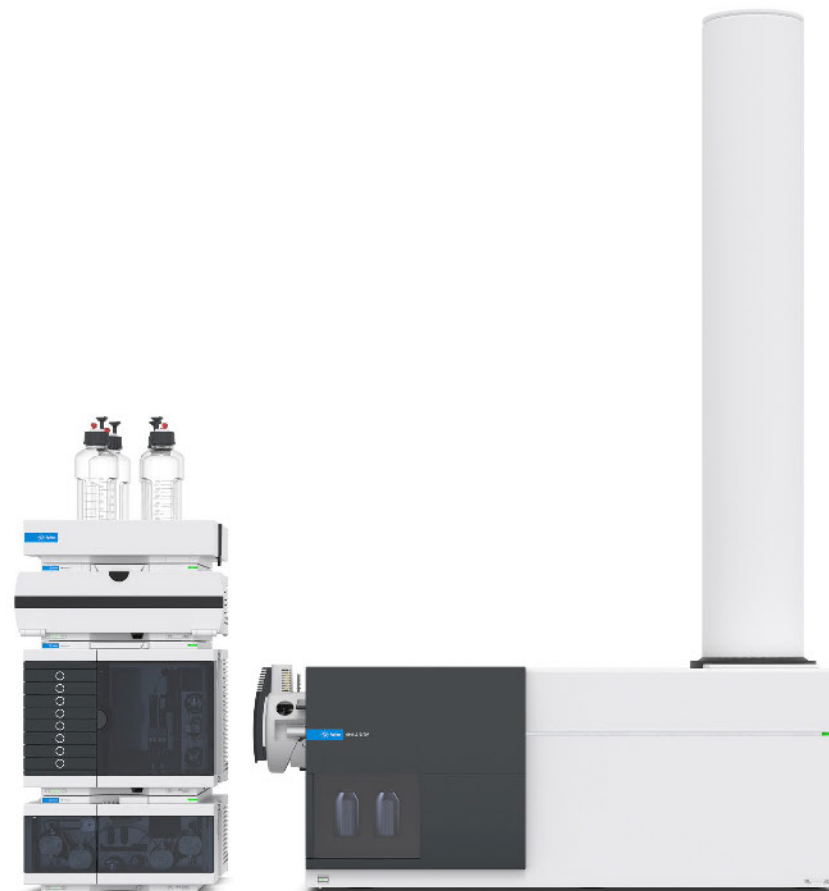
Food sensory testing using the Agilent 1290 Infinity II LC and Agilent 6546 Q-TOF

Authors

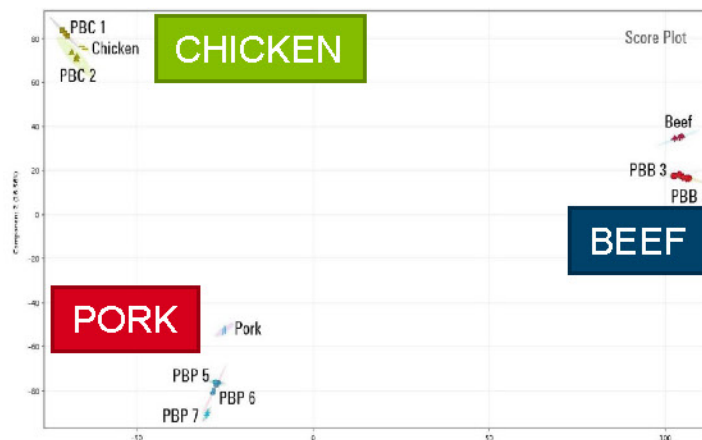
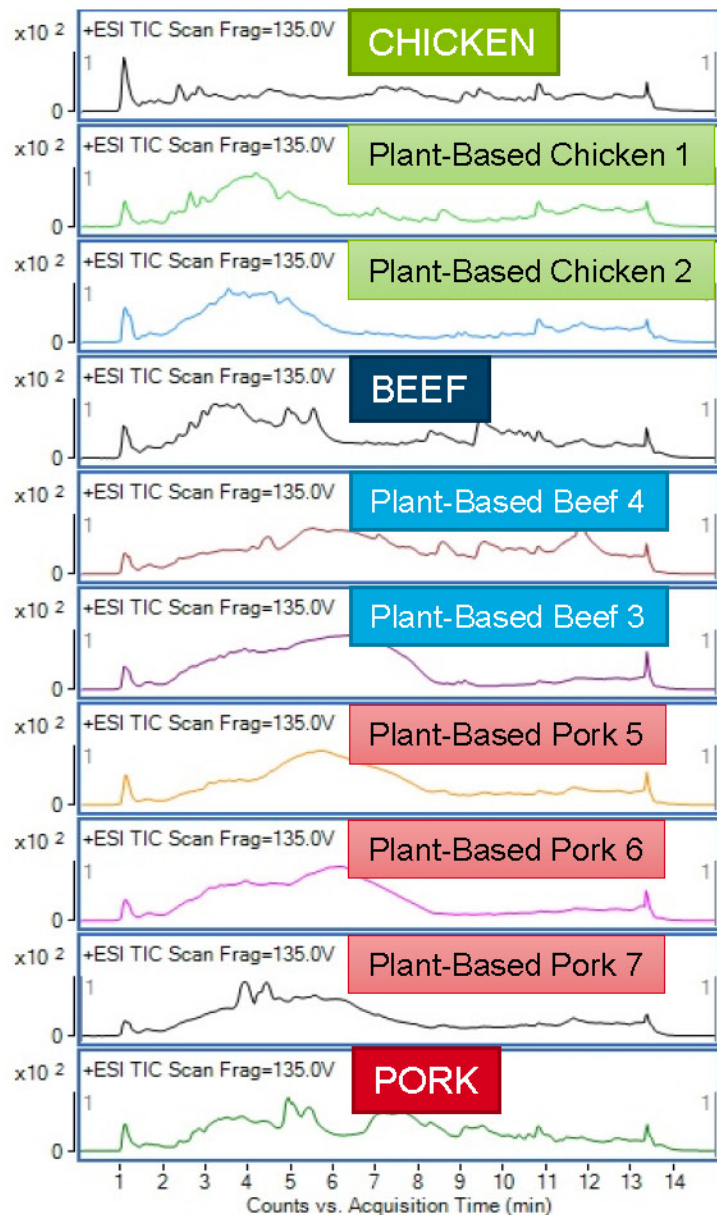
Toh Seok Hwa,
Upendra Khurana,
Tarun Anumol, and
Daniel Cuthbertson
Agilent Technologies, Inc.

Abstract

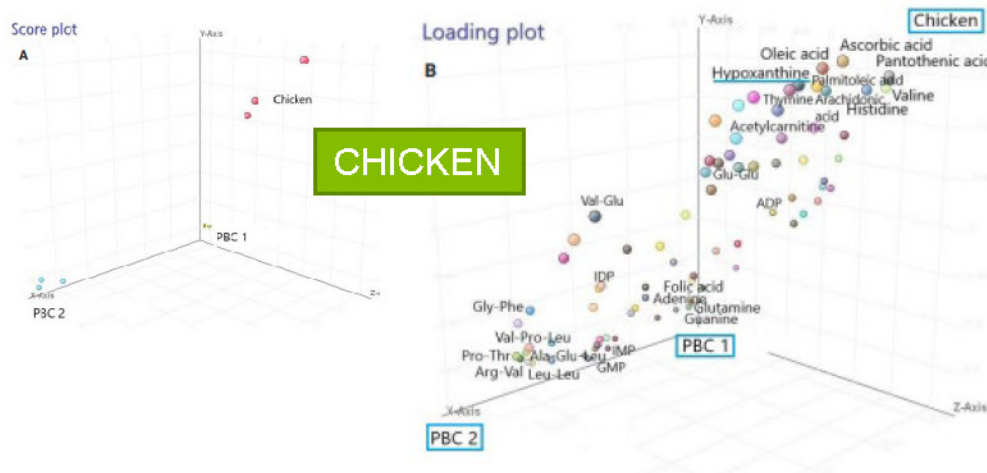
Meat-alternative sources of protein, including plant-based and cell-based foods, are gaining popularity globally due to a combination of consumer interest, regulatory changes, and global food systems. For example, as Singapore aims to achieve 30% of its food production levels through self-production by 2030, many established food companies and startups are developing meat-substitute products. The main drivers of Singapore's food production target are around health and environmental concerns. Historically, plant-based meat substitute foods have struggled to achieve the same texture and taste as animal meats. However, recent analogs of plant-based meats are significantly more similar in taste, texture, and composition as traditional meats due to technological advances in production methods. This application note describes a nontargeted profiling method to characterize chemical components of unknown foods, using a high-resolution accurate mass LC-Q/TOF. Also, various statistical tools are presented that translate accurate mass LC/Q-TOF data into more easily understandable information. Principal component analysis (PCA) of the data can be used to identify compounds, abundance distribution of the compounds in different samples, and how the compounds correspond to target taste profiles. Heat maps and hierarchical clustering of raw ingredients show similar distribution of proteins with target taste profiles.



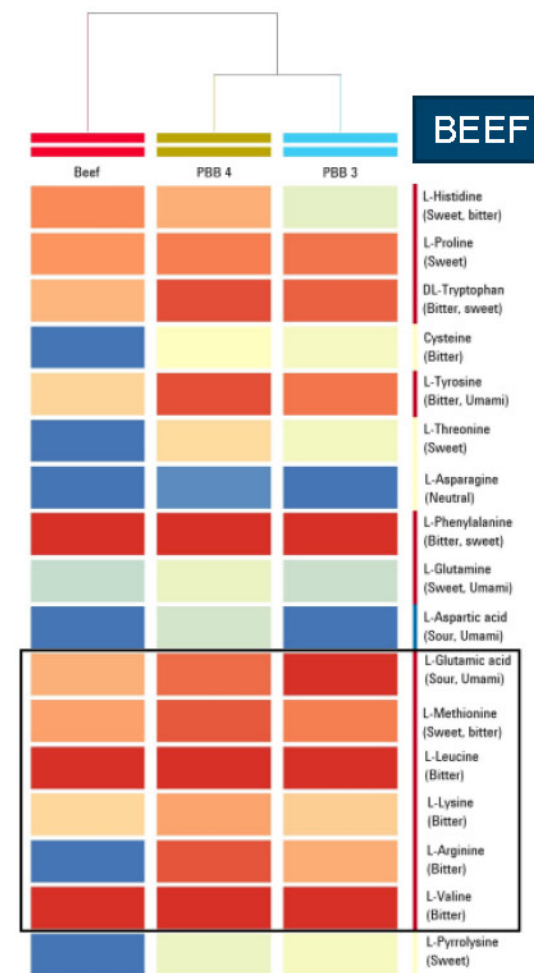
Chemometric Profiling of Meat & Plant-Based Alternatives using LC-QTOF MS



3D PCA plots of chicken and alternatives



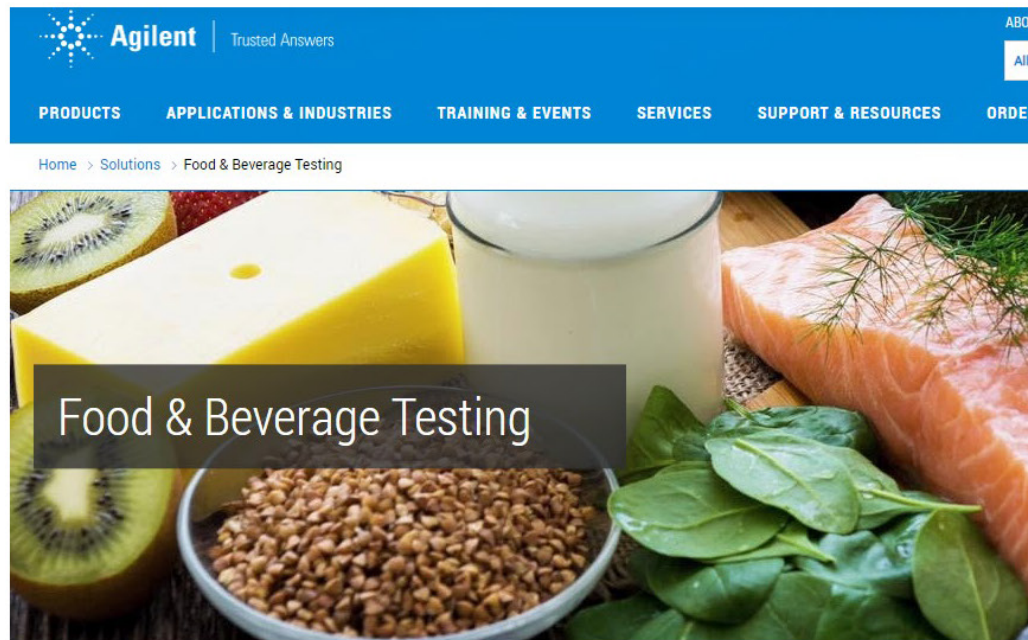
Heat map of amino acids in beef and alternatives



App Note: 5994-5130EN

Toh Seok Hwa et al.

For more information, check out www.agilent.com



Agilent Food and Beverage Testing Solutions: Helping You Achieve Food Safety, Quality, and Authenticity

Ensuring food safety and quality is increasingly challenging. Whether you're analyzing for pesticide residues, ensuring that label claims are correct and accurate, or profiling for food authenticity, Agilent works with you, helping you deliver what your customers demand. Agilent Technologies food and beverage testing products and services keep you at the forefront of the latest trends, ahead of issues, and focused where you need to be – delivering highest quality and value to your customers.

[Contact Us](#)

Food & Beverage Testing Applications



Food Safety Testing

Manage risks and ensure food safety and quality with Agilent food and beverage testing solutions.

[Learn more](#)



Food Authenticity Testing

Detect, identify, and quantify known and unknown compounds to assess food authenticity, ensure consumer safety, and protect industry brands.

[Learn more](#)



Food Processing & Packaging Testing

Processing and packaging food can sometimes introduce unwanted and potentially unsafe chemical contaminants into foods.

[Learn more](#)



Food Nutrition & Health Testing Solutions

Agilent's nutritional analysis testing solutions help you to comply with product specifications and labelling requirements to



Beverage Testing

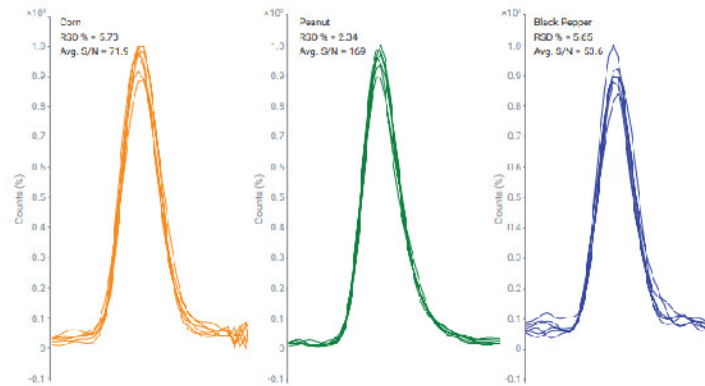
Evaluating quality and safety in coffee, tea, wine, and spirits is fast and accurate with Agilent's proven food and beverage testing.

Summary: Agilent Provides Complete Solutions for Testing Food and Feed Safety, Quality, and Authenticity

Continuous innovation to increase productivity, lower costs, and increase compound coverage in one test. New regulations monitored to ensure Agilent solutions stay relevant.

Agilent workflows

- Enable laboratories conducting surveillance and food-safety risk assessments from imported and exported food.
- Provide industry with approaches for testing vitamins, minerals, and oils in food, helping to ensure label claims are correct.
- Support food chemists working to ensure the authenticity of food products.



Agilent strengths

- Solutions for quantification and food profiling.
- Highly skilled chemists who develop unique and differentiated workflows.
- Outstanding service and support for hardware, software, and applications.



Agilent

Trusted Answers