



## Agilent 7000B Triple Quadrupole GC/MS

**The world's first MS/MS designed specifically for GC.**

Our measure is your success.



## Agilent 7000B Triple Quadrupole GC/MS

# Extraordinary sensitivity and selectivity— plus day-after-day reliability.

Agilent's new 7000B Triple Quadrupole GC/MS delivers advanced high-speed GC/MS/MS quantitation for ultra-trace analysis of the most complex samples. Engineered from the ground up for ease of use and routine high performance operation, this is the world's first MS/MS designed specifically for GC analyses.

The triple quadrupole analyzer perfectly complements the front-end separation capabilities of the industry-leading Agilent 7890A GC. With new sample injection options and breakthrough Capillary Flow Technology, the powerful combination handles the most challenging analytical tasks quickly and efficiently—and is the ideal choice for labs requiring maximum sensitivity, maximum uptime and maximum productivity.



The Agilent 7000B Triple Quadrupole GC/MS combines industry-leading reliability with femtogram-level sensitivity in complex matrices.

## Industry-leading sensitivity and selectivity

Whether you are measuring pesticides in food and water, drugs in complex biological matrices or contaminants in environmental samples, you need consistent, ultra-trace detection limits. Analyte signal must be maximized; all sources of noise must be minimized. Every 7000B component—source, quadrupoles, collision cell and detector—has been optimized to deliver:

- Routine femtogram-level limits of detection and quantitation
- Ultra-low noise
- Superior selectivity

## Faster analysis, higher throughput

Multi-compound screening methods place stringent demands on electronics, ion transmission, ion dissociation, firmware and software of the GC/MS/MS system. The 7000B maintains excellent sensitivity and exceptional area precision even at a dwell time of 1 msec and an acquisition speed of 500 transitions per second—with zero cross-talk between transitions. You will be able to screen and quantitate hundreds of analytes today and add more later to meet new method requirements.

## Day-after-day reliability and simple, robust operation

Over several decades, in thousands of labs worldwide, Agilent MSD solutions have earned a legendary reputation for reliability and hassle-free operation. The 7000B system's advanced design incorporates proven, highly reliable Agilent technology developed specifically for GC/MS applications—and all of the new components adhere to the same exacting engineering standards. The result is a unique combination—an optimally robust GC, plus an optimally robust MS/MS, plus optimally robust software.



### New 7890A GC components

*New 7693 Autosampler, new multimode inlet (splitless, PTV, split) and high efficiency back-flush deliver maximum analyte to the MS while protecting the system from high boiling matrix.*



### New high-sensitivity electron ionization (EI) source

*More precursor ions entering the quadrupole result in improved S/N and precision. Solid inert materials—not a coating—and programmable temperature up to 350° C ensure robust compatibility with complex matrices.*



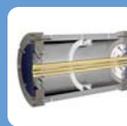
### Positive and Negative Chemical Ionization (CI) source

*The high molecular ion intensity of CI provides an ideal precursor ion for MS/MS. Based upon the stable, high sensitivity source of the 5975C MSD, the PCI/NCI source delivers trouble-free CI performance.*



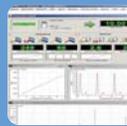
### Hot quartz hyperbolic quadrupoles

*High temperature is just as important for the quadrupole analyzer as it is for the ion source. Agilent's gold-plated hyperbolic quartz quadrupole is the only analyzer that can be heated to 200° C—without any loss of resolution or sensitivity.*



### Proprietary hexapole collision cell

*Efficient dissociation, wide mass bandwidth ion transmission, zero cross-talk and novel helium quench noise reduction—all the benefits you need for high performance MS/MS.*



### Agilent MassHunter software

*From simple, time-saving AutoTune to “Batch-at-a-glance” review to customizable Excel reports, MassHunter software maximizes your GC/MS/MS productivity.*

# Superior GC/MS/MS performance starts with the world's best GC.

MS/MS selectivity is a remarkable tool for complex matrix analysis, but its full value can't be realized without accurate, robust operation of the GC inlet and column. As sample complexity increases, the front-end separation performance becomes even more important, and the GC must be able to deliver:

- Precise sample introduction without mass discrimination for small and large injection volumes
- Precise separations without large retention time shifts due to altered selectivity from matrix artifacts

Agilent's 7890 GC meets all these requirements—and delivers consistently efficient separations for your most difficult MS/MS analyses. Plus, of course, industry-leading Agilent reliability.



The Agilent 7693A Automatic Liquid Sampler injects extra productivity into your gas chromatography.

In addition to proprietary Agilent fast-injection and expanded 150-vial capacity, the all-new sampler offers a full range of enhanced capabilities, such as sandwich injections using up to 3 layers with air gap. Add a second injector and a heater/mixer/barcode reader, and the 7693A becomes a versatile sample preparation station that automates many bench tasks.

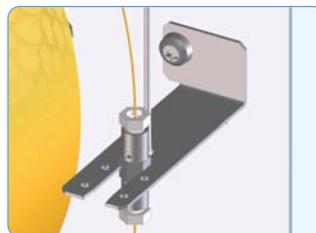
## Agilent Capillary Flow Technology makes column backflush simple

Complex matrices can create a number of problems for GC/MS/MS analyses: compromising separation efficiency, shortening column life and reducing ion source performance. Backflushing—reversing column flow immediately after the last compound of interest has eluted—can significantly improve your analytical results and maximize your return on your GC/MS/MS investment.

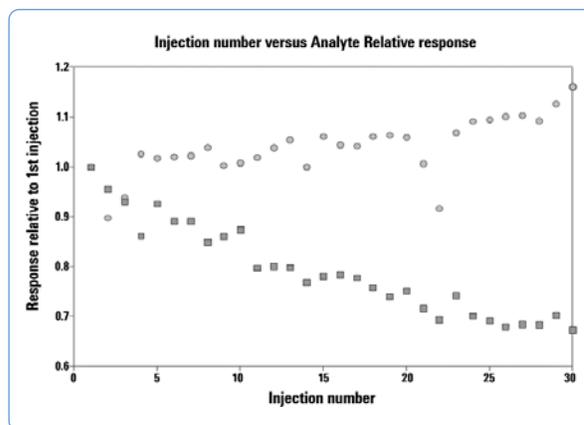
Agilent's novel Capillary Flow Technology takes the complexity out of column backflushing and makes this valuable technique simple and routine for any GC/MS lab.<sup>1</sup>

## Agilent Capillary Benefits of backflushing

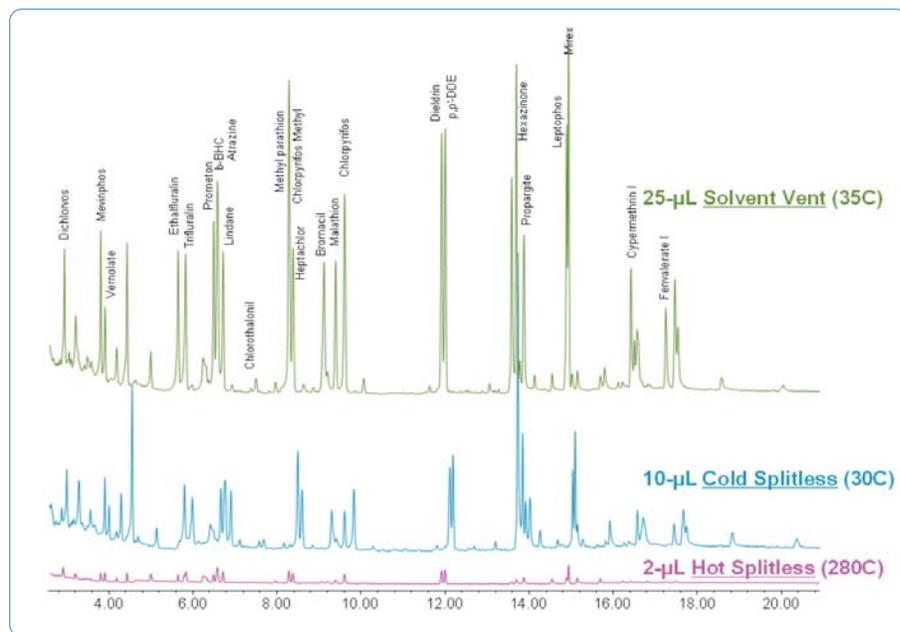
- Extends column life by eliminating long, high temperature bake-out
- Reduces the frequency of ion source cleaning by keeping column bleed and high boiling matrix out of the mass spectrometer
- Improves retention time precision by eliminating carry-over that alters column selectivity
- Increases sample throughput by reducing bake-out (in some configurations, bake-out can even begin before the analysis has been completed)



**Backflush with the new Purged Ultimate Union.** This new ultra-inert, low-mass, low-dead volume device guarantees optimal peak shapes and response for the most difficult analytes.



**Backflushing maintains sensitivity.** The analysis of lipid peroxidation products in whole blood without backflush led to a rapid loss of sensitivity. Backflush not only eliminated the sensitivity degradation but actually allowed the system to slowly improve as the entire system baked out more completely.<sup>2</sup>



**Multimode Inlet.** Agilent's stellar split/splitless inlet performance is now perfectly complemented by two additional injection modes: cold splitless, for extra sensitivity or maximum sensitivity large volume injection (LVI). Setup is easy, thanks to software that calculates proper inlet parameters.

<sup>1</sup> Brochure 5989-9804EN: Reduce run time and increase laboratory throughput—Capillary Flow Technology Backflush

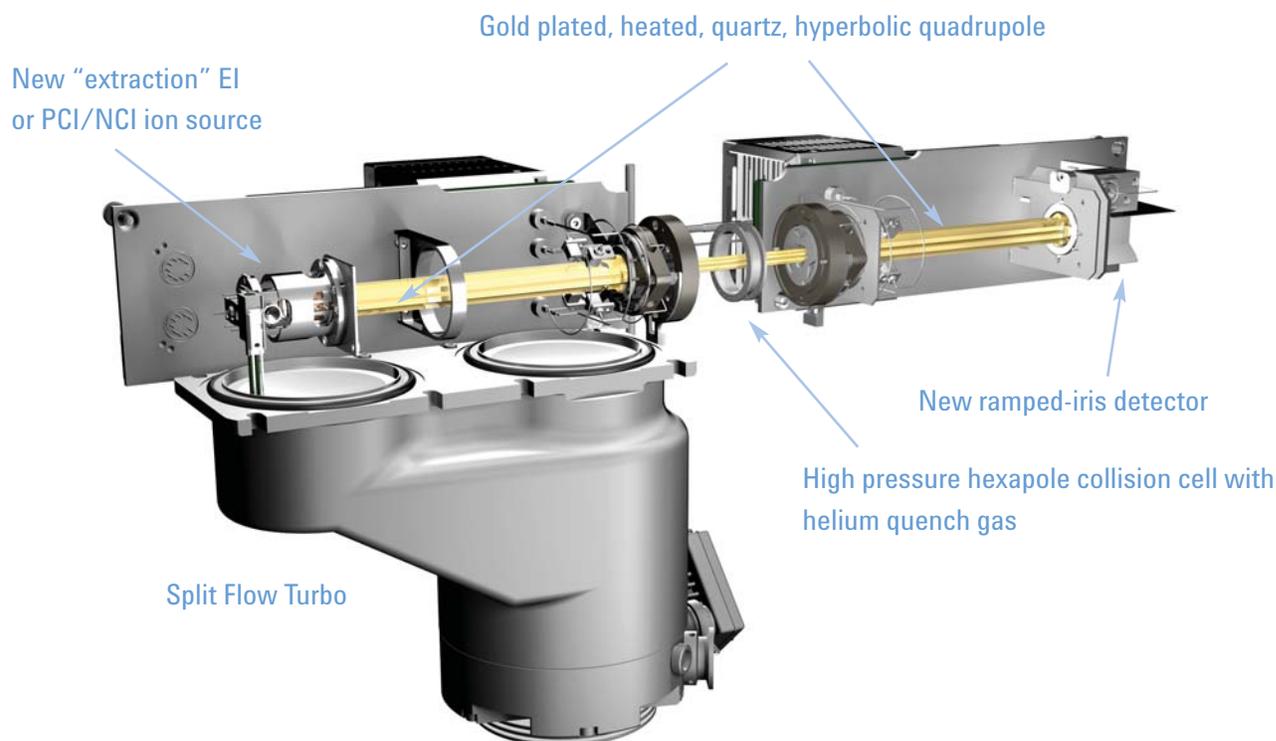
<sup>2</sup> Application Note 5989-9359EN: Capillary Flow Technology for GC/MS: Efficacy of the Simple Tee Configuration for Robust Analysis Using Rapid Backflushing for Matrix Elimination

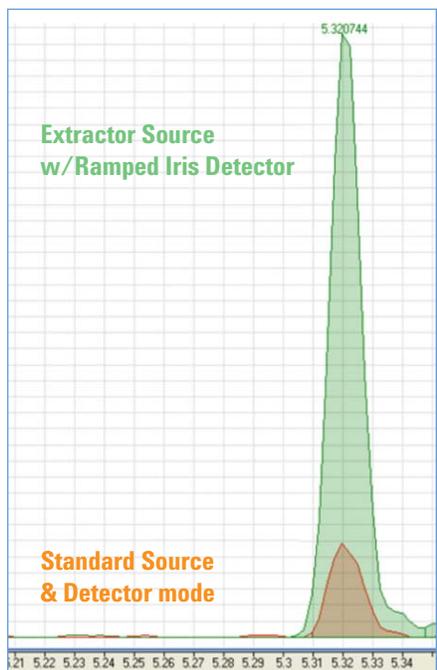
## Advanced MS/MS technologies designed specifically for GC.

The high boiling molecules that flood out of the GC column at the end of the separation create special requirements for the ion source and the mass analyzer. In fact, for the complex matrices typically separated in GC/MS/MS methods, this concentration of high boilers often approaches a worst-case scenario.

Agilent's 7000B system is the only MS/MS designed to operate at temperatures as high as 200°C. Because the quadrupole can be kept at this high temperature and at vacuum, it stays clean even with the complex, high boiling samples—eliminating frequent time-consuming maintenance and ensuring superior mass analyzer performance.

The ultra-low coefficient of expansion for quartz allows the quadrupoles to be heated without any significant change in dimensions—and without any loss of ion transmission or loss of resolution. As a result, Agilent's hot quartz analyzer remains maintenance-free, even after years of high throughput analyses of complex samples.

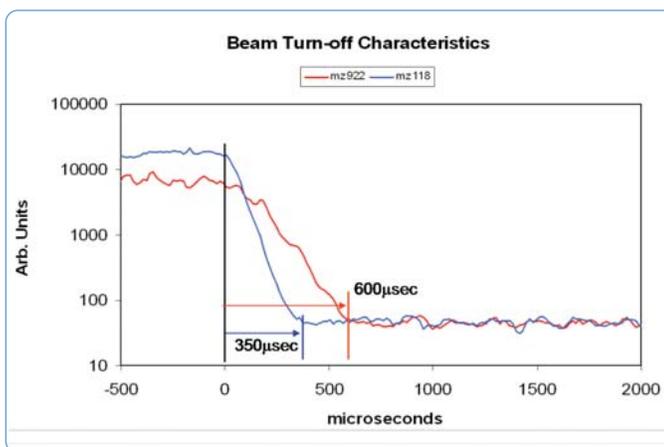




**New EI source and detector boost MS sensitivity.**  
Sensitivity is improved across the entire mass range for even lower limits of detection.

## A collision cell optimized for GC applications

Because the multiple reaction monitoring (MRM) process essentially eliminates all chemical noise, neutral noise from the highly energetic metastable helium is the primary GC/MS/MS noise source. Agilent engineers started with the proven collision cell design of the 6400 Series LC/MS/MS and retuned the dimensions and voltages for GC applications. They also added a novel helium quench gas technology, in which a small, supplemental flow of helium is mixed with nitrogen collision gas. This allows highly efficient dissociation, rapid re-focusing of product ions, rapid clearance of the cell (for zero cross-talk)—as well as significant reduction of neutral noise.



**Measured collision cell clearing time less than 1 msec** ensures zero cross-talk between transitions. (Ask for a copy of ASMS 2009 Poster MPZ 656: High Speed Quantitative GC/MS/MS Data Acquisition.)

| Dwell Time (msec)   | 10           | 5            | 3            | 2            | 1            |
|---------------------|--------------|--------------|--------------|--------------|--------------|
| # Transitions       | 18           | 33           | 50           | 66           | 99           |
| Cycle Time          | 198          | 198          | 200          | 198          | 198          |
| <b>MRM/sec</b>      | <b>91</b>    | <b>167</b>   | <b>250</b>   | <b>333</b>   | <b>500</b>   |
| n                   | 10           | 10           | 10           | 10           | 10           |
| <b>Average Area</b> | <b>37686</b> | <b>37673</b> | <b>37465</b> | <b>36887</b> | <b>35180</b> |
| SD Area             | 940          | 1925         | 1439         | 1557         | 1447         |
| <b>% RSD</b>        | <b>2.5%</b>  | <b>5.1%</b>  | <b>3.8%</b>  | <b>4.2%</b>  | <b>4.1%</b>  |

### Precision, precision, precision.

Sensitivity without precision can result in unacceptable MRM ratios and poor quantitation results. As MS/MS baseline noise approaches zero, signal-to-noise ratio (S/N) becomes almost meaningless as a measure of performance; under ultra-low noise conditions, RSD

of peak response is a better benchmark. The 7000B delivers the essential precision that you need to make accurate qualitative and quantitative decisions, even at dwell times as low as 1 or 2 msec.

# Agilent MassHunter software helps you make the most of every analysis and every workday.

MassHunter software seamlessly integrates acquisition, data analysis and reporting and makes it easy even for non-expert operators to take full advantage of the advanced capabilities of the Agilent 7000B Triple Quadrupole GC/MS. The powerful combination of MassHunter tools delivers accurate results, faster—enabling you to analyze more samples with less data review. Highlighted features include:

- Dynamic MRM (*available Q1, 2010*) and Optimizer simplify method development
- Compound-centric data discovery tools with sample-centric data navigation
- Rapid “Batch at a Glance” data review
- Easy-to-use parameter-less integration of GC/MS peaks
- Outlier detection with over 20 user-selectable criteria
- Customizable reporting with Microsoft Excel® 2007 + XML

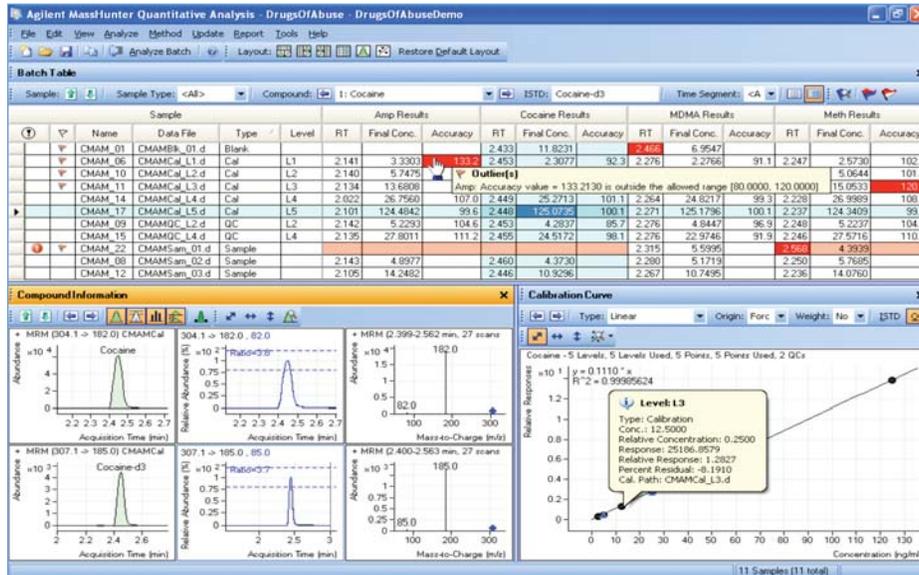
## Data processing for your other MSD and GC detectors

In addition to supporting the advanced capabilities of the 7000B MS/MS, MassHunter also supports traditional GC/MS analyses:

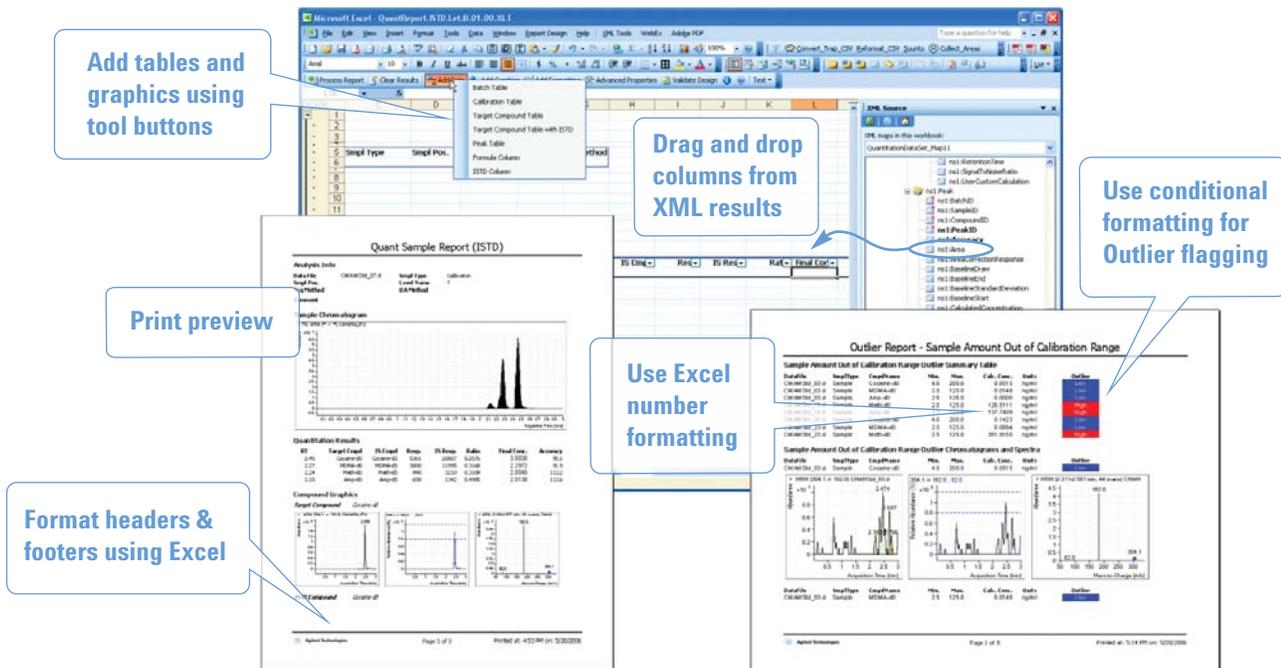
- Supports acquisition/processing of GC detectors on a 7000 Series system and analysis of MSD data
- EI spectral library searching using NIST, Wiley and Agilent Retention Time Locked (RTL) library collections
- Advanced analysis of unknowns using integrated deconvolution tools, retention index data and RTL databases



**Single screen acquisition and control.** MassHunter's instrument control panels will be instantly familiar to any Agilent GC/MS user, so you'll be productive right from day one. Consistent software across all Agilent MS platforms—GC, LC and ICP—helps to shorten learning curves and reduce training costs.



**"Batch at a Glance" review with outlier detection.** Flexible spreadsheet organization of the data is complemented by color-coded outlier detection that draws your attention to results that require closer inspection. Click on a result, and all associated peaks, spectra and calibration data are immediately displayed. Additional pop-up information is available for most data.

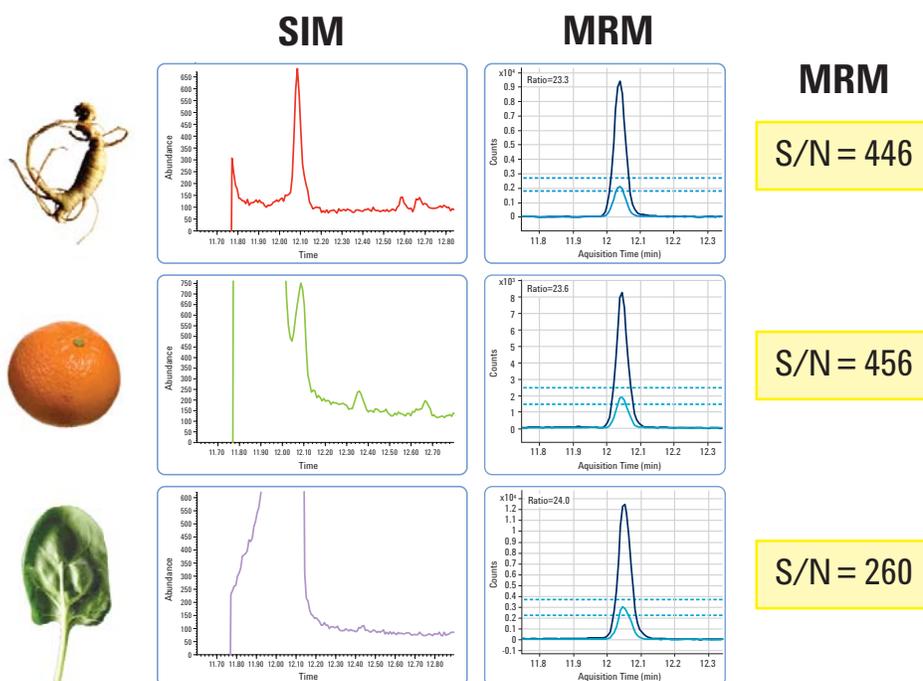


# Advanced GC and MS/MS technologies translate into everyday high performance.

MS/MS techniques are most often cited for consistent, ultra-low detection limits with very complex sample matrices. Multi-target screening methods—pesticide residues in foods, drugs in biological fluids and environmental contaminants in soil and water—have dominated much of the literature. But what's often overlooked is that any SIM method can benefit from MS/MS, with better qualitative and quantitative results. Benefits include:

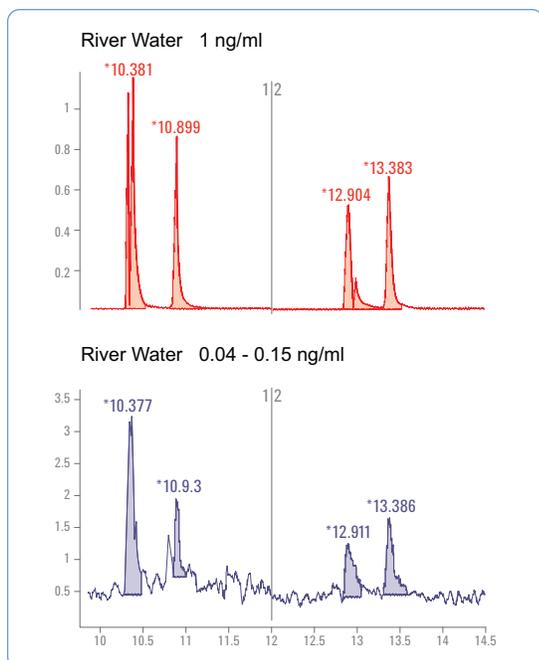
- Elimination of chemical and neutral noise in the spectral region of the product ions—translating into lower detection limits than SIM
- Higher probability of a more unique (more selective) product ion—translating into fewer false negatives and false positives than SIM

For complex samples, even isotope ions (A+1, A+2, etc.) of intense matrix peaks can cause interference with SIM methods. MS/MS delivers detection limits that are lower than SIM without these sources of interference.

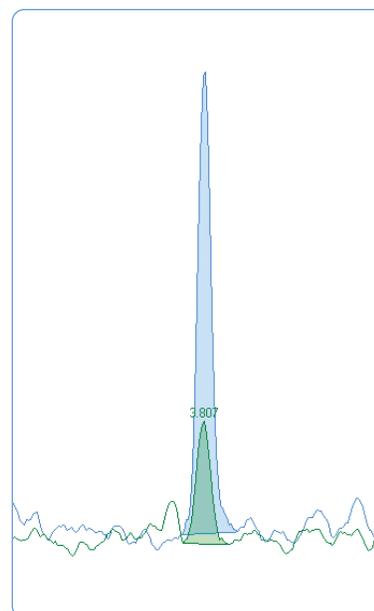


**Consistent MS/MS results, independent of matrix.** Analysis of spiked *p,p'*-DDE at 10 ppb using Agilent J&W HP-5ms Ultra Inert columns. All injections are 1  $\mu$ L. SIM *m/z* 246. MRM transition 246.0  $\rightarrow$  176.1.<sup>1</sup>

<sup>1</sup> Application Note 5990-3578EN: A Method for the Trace Analysis of 175 Pesticides Using the Agilent Triple Quadrupole GC/MS.



**Outstanding sensitivity for PAHs in river water.** Upper chromatogram: 3 pg loading (1 ppb) of a polycyclic aromatic hydrocarbon (PAH) standard mixture. Lower chromatogram: PAHs in a river water sample at 0.04–0.15 ppb, or 120–450 fg on column. Reconstructed Total Ion Chromatogram (RTICC) from EI-MRM analysis.



**Ultra-trace quantification of THC acid with NCI Mode/Ammonia.** Reconstructed MRM chromatogram for a standard of carboxy-tetrahydrocannabinol-TFA derivative (1 pg sample; 40 fg on column). The quantifying transition is  $m/z$  590.0  $\rightarrow$  422.0, and the qualifying transition is  $m/z$  422.0  $\rightarrow$  402.0 (22% of the peak area of the quantifying transition).

For more information about the MS/MS analysis of pesticides, PCBs, nitro-PAHs, organo-tins, melamine, drug screens, PBDE fire retardants, steroids and other compounds in matrices such as fruits, vegetables, biota, infant formula, traditional Chinese medicines, body fluids, water and air, please contact your Agilent sales representative or the Agilent website.

### MS/MS selectivity and sensitivity enhance your productivity equation

There is another, practical side to MS/MS: MS/MS selectivity and sensitivity let you adjust other aspects of the workflow to increase your lab's productivity. For example:

#### MS/MS sensitivity

- Allows separations with less sample injected on-column, requiring less maintenance for the inlet, column and source

#### MS/MS selectivity

- Enables less sample preparation
- Allows use of shorter, lower resolution columns, for faster analysis cycles and quicker bakeout or backflush
- Provides faster and easier peak integration for streamlined data review and more confident analysis

In fact, for many labs, MS/MS productivity gains can offset the incremental purchase price of a GC/MS/MS during the first year of the 10-year guaranteed product life of the 7000B system!

## Faster, better GC/MS results with Agilent J&W Ultra Inert columns

Agilent's new line of Ultra-Inert GC columns are specifically tailored to meet the demands of GC/MS/MS.

They feature exceptionally low column bleed and the highest degree of column inertness—

providing maximum analyte transfer to the detector, better peak shapes for active compounds, fast baseline stabilization for minimized conditioning time and excellent thermal stability for reduced instrument downtime.



## Agilent certified MS supplies help keep routine maintenance routine

Our capillary column ferrules, O-rings and septa are packaged to remain clean and ready for use. An exclusive non-stick plasma coating on our premium inlet septa and pre-cleaned O-rings makes maintenance quicker and easier—no unscheduled inlet maintenance due to residue on the inlet surface and shorter bakeout times after preventive maintenance, so you can start running samples sooner.



### For more information

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