

# GC/MS

Varian  
Saturn 2200



**VARIAN**

## The Best Choice for Today... The Best Choice for Tomorrow!

The affordability of benchtop GC/MS has improved dramatically in the last decade, yet careful evaluation is still key in making the best purchase decision. The system you choose must meet your immediate needs for sensitivity, precision, and sample throughput. And, the system must meet these requirements for 7 or even 10 years more, when the demands on your laboratory have changed significantly.

*So, how do you secure that future?*

*How do you guarantee continued success?*

*How do you stay ahead of technology obsolescence?*

The Saturn® 2200 answers these questions with the CP-3800 GC and the 2000 Series Ion Trap MS! These components create a platform for the world's most versatile GC and flexible MS. Both deliver unequalled performance—a Saturn tradition. And, both components support a remarkable array of highly productive, easy-to-use options.

Under Saturn Workstation control, complex configurations become very simple to operate. The Saturn 2200 is the platform that easily expands and evolves to support your continued success.



# Saturn 2200 = Maximum GC + Maximum MS

## Flexible, reliable AutoSamplers

- CP-8400 handles up to 100 samples in liquid or ambient headspace mode
- CP-8410 provides flexibility with a fixed sample tray supporting multiple vial sizes
- Combi PAL offers maximum robotic flexibility with liquid, heated headspace, and SPME modes
- Archon™ with Tekmar 3100 Purge and Trap

## Superb flow control, injectors and column oven

- Electronic Flow Control (EFC) of all gases with gas saver mode
- CP-1177 Split/Splitless Injector with optimized flow profiles for precise vaporization and sample transfer
- 1079 PTV Temperature Programmable Injector for maximum control and sample compatibility
- Rapid-MS™ column technology for faster analyses
- Spacious oven for multiple columns and valves



## GC detectors to complement MS applications

- ECD for ultra-high sensitivity halogen selective detection
- PFPD for selective detection of sulfur, phosphorus, nitrogen and 25 additional elements
- TSD for selective detection of nitrogen/phosphorus with Varian's reliable ceramic bead
- FID with a patented, inert tip for universal detection of organic compounds
- Simultaneous operation with the MS using single column/split effluent or parallel columns

## Saturn MS – the performance standard for benchtop mass spectrometry

- Highest Electron Ionization (EI) sensitivity at installation and after years of routine use
- Most consistent quantitative response
- Library searches with commercial databases: NIST, Wiley, PMW
- SIS (Selected Ion Storage) for library searches of trace components in complex matrices
- "No tools" removal of the analyzer—the benchmark for MS hardware simplicity
- Varian V-70 Turbomolecular Pump for clean, rapid pumpdown

## Powerful and easy-to-use MS options

- MS/MS for selectivity beyond full scan or SIM operation, and applications beyond NCI
- MS<sup>n</sup> delivered only through ion trap technology
- PCI (Positive Chemical Ionization) with the sensitivity and convenience of EI
- Multi-reagent CI for automated selection of up to three CI reagents (liquids or gases)
- SilChrom Inert Analyzer for sensitivity and ideal peak shape of polar analytes
- ChromatoProbe combines the advantages of a GC separation with the benefits of a probe for solids, liquids, and slurries

## A truly complete workstation

- Single point control of the system and peripherals for GLP compliance
- Flexible automation sequences and batch reprocessing
- Quantitative analysis covering the full range of calibration and peak processing for all GC and GC/MS applications
- Choice of search algorithms: INCOS or optional NIST
- Standard reports with user-defined formats
- Custom reports for environmental and toxicological analyses
- Automated switching from EI to CI and between all MS modes (full-scan, SIS, MS/MS) within the same analysis



# A Saturn 2200 for Any Application

## The versatile platform with a guaranteed future



**Pesticide Residue Analysis**  
*CP-8400 AutoSampler (duplicate injection),  
dual injectors (CP-1177 and 1079 PTV), EI-MS/MS,  
and second detector (ECD, TSD, or PFPD)*



**Flavor Analysis**  
*Solid Phase Microextraction (SPME), 1079 PTV, EI-MS,  
acetonitrile PCI-MS, and PFPD*



**Aromatics and VOCs in Soil**  
*Headspace, CP-1177, EI-MS, and FID*



**Drug Analysis**  
*Dual injectors (CP-1177 and 1079 PTV),  
ChromatoProbe, EI and CI, MS, and MS/MS*



**Soil/Drinking Water Analysis**  
*Archon, Tekmar 3100, CP-1177, and EI-MS. Just add the CP-8400 AutoSampler for semi-volatiles.*

**Add options, any or all, as you need them!**

# The Perfect GC

## Expand your creativity and productivity

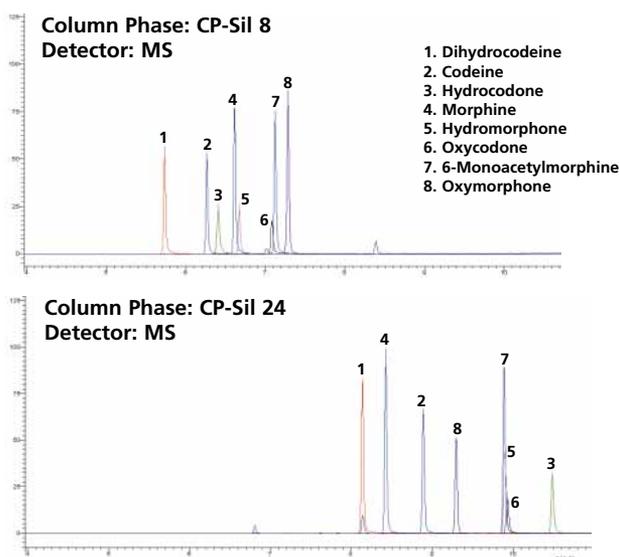
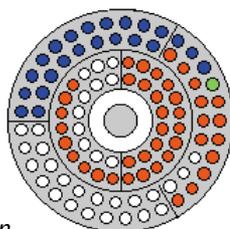
Get the most from the Saturn 2200 by thinking beyond single purpose GC/MS solutions. Begin your thought process with autosamplers and injectors. Consider the modes you use now and the modes you may need later: headspace/split, large volume/PTV, SPME/splitless. The CP-3800 GC accommodates three injectors with maximum performance always assured. All Varian autosamplers support multiple injector operation. And, remember detectors such as an ECD or powerful technologies like MS/MS can be added at any time.

Take full advantage of switching between injectors, columns, and detectors for immediate results and increased productivity. Easily expand 38 inches/95 cm of precious bench space into a multi-purpose platform from a simple GC/ECD to a GC/MS, or to the ultimate selectivity of GC/MS/MS.



**Combi PAL for more sampling modes and maximum capacity.** Syringe options: left, liquids; center, heated headspace; right, SPME.

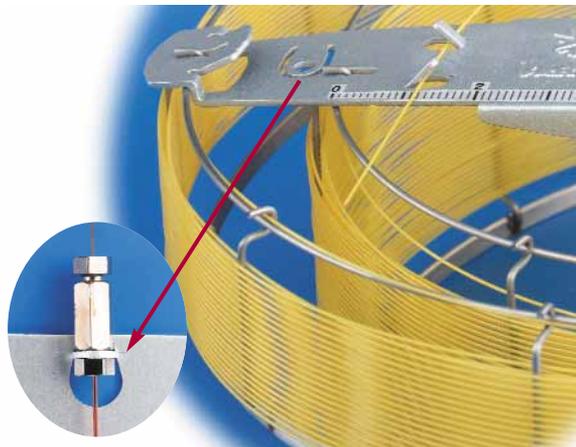
**Small and flexible with special features.** Varian's CP-8400 AutoSampler delivers matchless performance with dual or duplicate mode and internal standard addition.



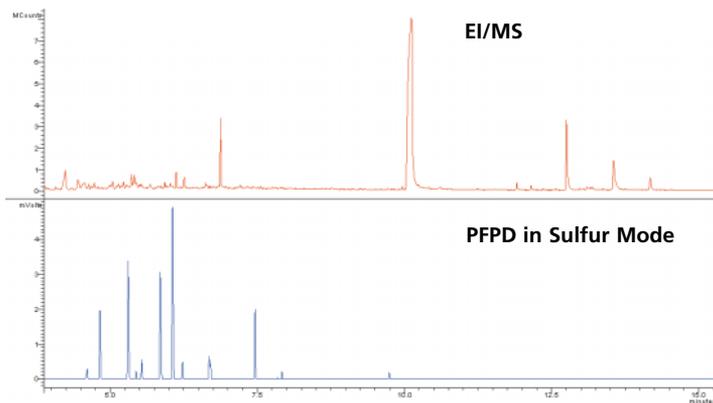
**More columns, more solutions.** The CP-3800 supports many combinations of injectors and columns to ensure that extra selectivity you need to characterize difficult mixtures.

## Room to Work

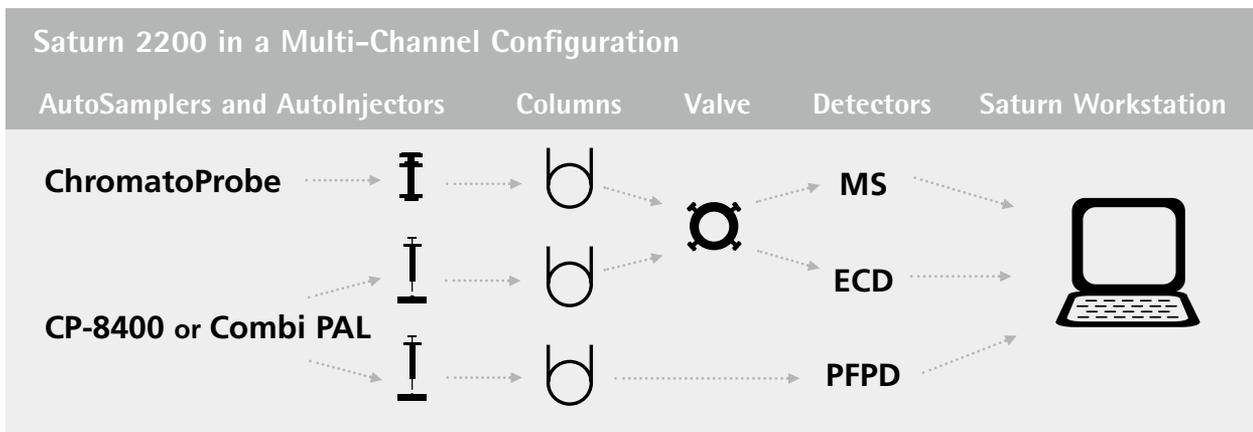
For GC ovens, performance certainly matters, and so does size. The CP-3800's larger oven means better access to multiple columns, injectors, and detectors. There is even room for valves and other custom chromatography configurations. Add the convenience of Varian's Chrompack columns with EZ-GRIP™ and words like "perfect" come to mind.



**Varian columns with EZ-GRIP.** Patented EZ-GRIP bar simplifies installation and supports a vacuum-tight union to the MS transfer line.



**Two detectors are better than one.** Combine the specificity of a Varian PFPD or the sensitivity of an ECD with your Saturn MS for complementary information. Add an FID for quick screens before MS confirmation.



**Immediate Choices.** In this example, the Saturn's CP-3800 GC is configured with three injectors and detectors plus a simple, inert valve for column and detector selection. Immediately, five different problem-solving tools are available without downtime. These choices give you the freedom to explore new solutions and gain unequaled efficiency—all in one GC/MS platform.

# Saturn MS Technology

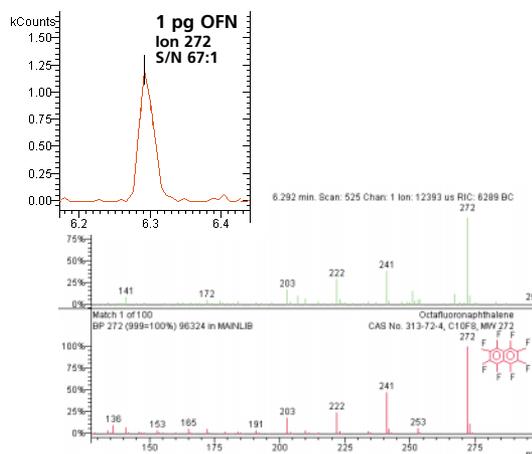
## Electron Ionization for unequaled detection limits

Quadrupole ion trap mass spectrometers offer performance advantages which begin with the most basic EI applications. The ionization and storage process occurs simultaneously at the center of the ion trap electrodes. This process translates into outstanding analytical value:

- consistent response across the full mass range
- highly efficient ion storage for maximum sensitivity
- durable, rugged performance

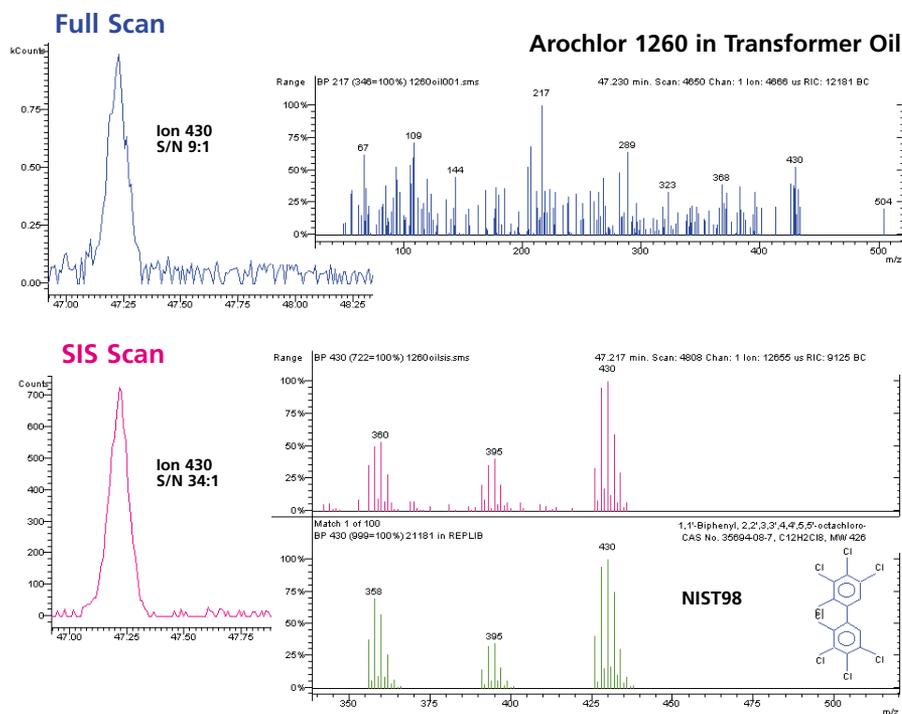
Since Saturn 2200 does not have the lenses and other components of an external ion source, frequent cleaning is just not required. Also, Saturn's RF-only trapping field assures stable mass calibrations for weeks or even months. You enjoy high quality, high sensitivity spectra at installation and for the life of your system.

### Superior Signal-to-Noise for Trace Analysis



Searchable spectra at picogram levels. *Superb signal-to-noise is equally essential for qualitative analysis.*

### Selected Ion Storage for Improved Library Searches in Complex Matrices



SIS, a standard feature for Saturn 2200, extends library search performance beyond full scan mode. When transmission quadrupoles default to two or three ions to maintain sensitivity, SIS continues to generate library searchable spectra—even near the limits of detection.

## Positive CI, the easily accessible complement to Saturn EI

The advantage of the 2200's internal ionization analyzer is further established by the remarkable performance of its unique, low pressure PCI process.

- If you think CI means low sensitivity, you haven't used Saturn PCI
- If you consider CI to be troublesome or complex, you haven't tried Saturn PCI using liquid reagents

If you have never applied the many benefits of PCI to your samples, take a careful look at PCI on the Saturn 2200. The PCI option gives you performance, convenience, and is always available as an upgrade for MS or MS/MS systems.

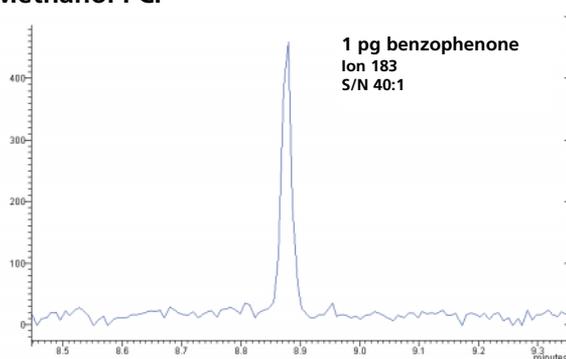
### Liquid CI Reagents



### PCI - EI's Partner

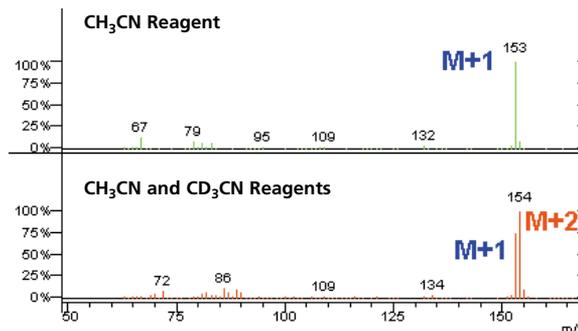
- No hardware changes from EI to PCI
- No loss of calibration from EI to PCI to EI
- Rapid equilibration of reagent pressure
- Contamination-free operation using low pressure reagents
- Superb sensitivity in either mode
- Routine EI and routine PCI with trouble-free performance

### Methanol PCI



**The PCI sensitivity benchmark.** *Saturn is the sensitivity standard for all benchtop systems, and only Saturn delivers this performance with gases or safe, inexpensive liquids.*

### Acetonitrile PCI



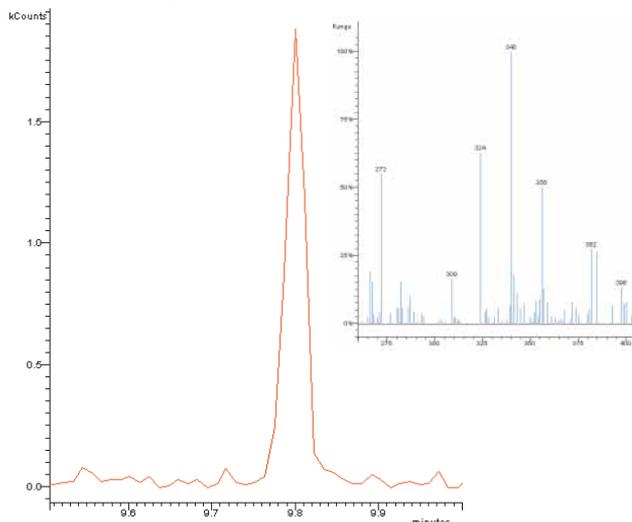
**Better than low intensity adduct ions!** *A mixture of acetonitrile and its inexpensive, deuterated analogue generate an intense doublet (M+1 and M+2) to confirm the molecular ion of vanillin.*

# MS/MS — for more selectivity when full scan, SIM, and SIS are not enough

In 1994, Varian introduced the first benchtop GC/MS/MS and changed the image of MS/MS. Originally, MS/MS was a tool used only by research labs. Today, thousands of labs routinely rely on the performance of this low cost, easy-to-use technology.

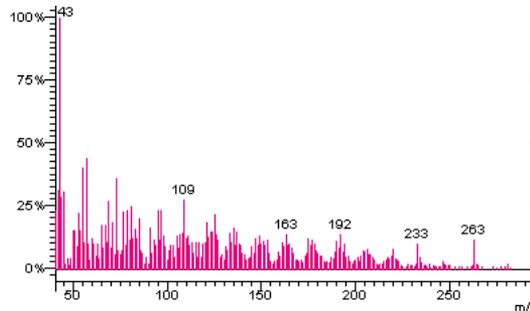
MS/MS delivers enhanced selectivity and improved detection limits for every application. For especially complex, "dirty" samples, Saturn 2200 MS/MS completes an accurate analysis where other GC/MS systems fail. The success of Saturn users repeatedly proves that MS/MS is the logical step toward better GC/MS analyses.

## 6-Monoacetylmorphine in Urine

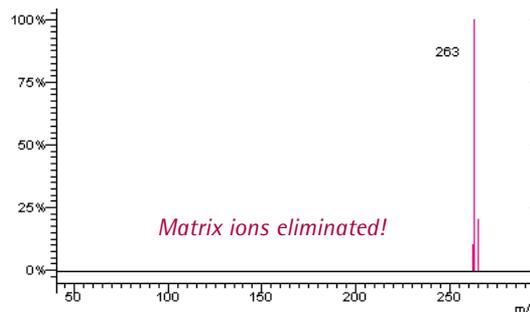


**Drug Analysis.** Saturn MS/MS meets and exceeds the stringent specificity and low detection limits essential to trace analysis.

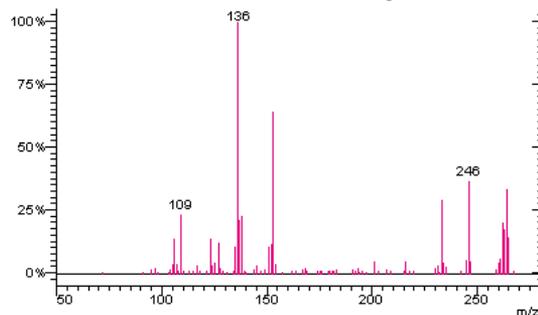
## I. Ionization — EI Spectrum with Matrix Ions



## II. Isolation — Precursor Ion



## III. Dissociation — Product Ion Spectrum



**Varian MS/MS—the simple path to enhanced selectivity.** Coeluting sample matrix can obscure an analyte's spectrum even after background correction. Matrix also contributes chemical noise that limits trace detection.

*I. MS begins with the ionization process.*

*II. In MS/MS, the isolation step clears all background ions from the analyzer.*

*III. Product ions from the Collision-Induced Dissociation (CID) are measured against a noise-free background. The unique product ions yield better quantitative data and matrix-free spectra for qualitative decisions.*

## MS<sup>n</sup> = (Solutions)<sup>n</sup>

MS/MS is often considered along with Negative Ion Chemical Ionization as the “ultimate” analytical solution in GC trace analysis. While both techniques have utility, MS/MS is clearly easier to use and more widely applicable as shown in the table below.

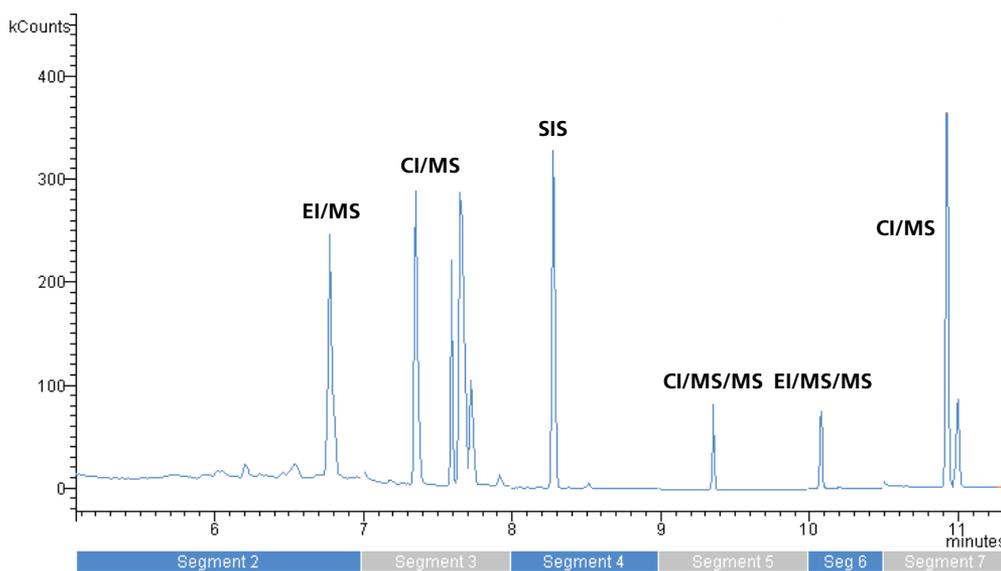
EI MS/MS Benefits		
	EI MS/MS	Negative Ion CI/MS
Halogenated compounds	Yes	Yes
Non-halogenated compounds	Yes	No
Reagent gas needed	Never	Always
Source change	Never	System Dependent
Mode selection automated	Yes	System Dependent
Multi-ion spectrum for structural confirmation	Often	Seldom

*“The major advantage of the ion trap MS/MS over the existing methods, electron capture negative ionization mass spectrometer or electron capture detector, is its excellent selectivity. Interference from other organochlorines can virtually be eliminated. Therefore, the developed MS/MS method may be used as a reliable alternative to*

*high resolution mass spectrometry for measurement of toxaphene in environmental samples with relatively low-cost instrumentation.” H.M. Chan, J. Zhu, and F. Yeboah. Chemosphere 36 (1998) 2135-2148.*

## A Single Run with All The Technologies to Meet Your Requirements

Varian's GC/MS Workstation control is truly unique! With just the PC, move easily and automatically between standard and optional MS technologies within a single run. Every Saturn technology is accessed, optimized, and time-programmed from the PC. Start with the simplest mode, EI full-scan.

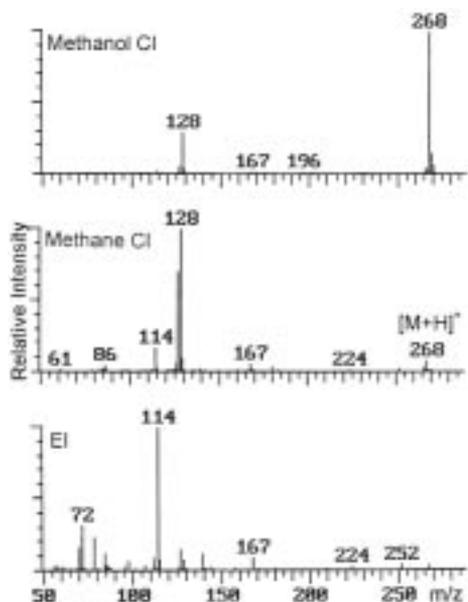


Then, to improve selectivity or sensitivity, program MS/MS, SIS, or CI into the same method—even for one peak at a time. Every MS technology is routine with Saturn Workstation control.

# EI to CI, MS to MS<sup>n</sup>. . . Satisfaction Guaranteed

The power and performance of Saturn technology is a well established fact. Satisfied users take advantage of Saturn's technologies every day as they work on a wide range of applications. Saturn 2200 runs all standard MS methods. More importantly, Saturn 2200 gives you a comprehensive set of additional MS tools to apply better solutions for your ever-changing application needs. With Saturn 2200, satisfaction is guaranteed—year after year, application after application!

## Chemical Warfare Agents, CI/MS

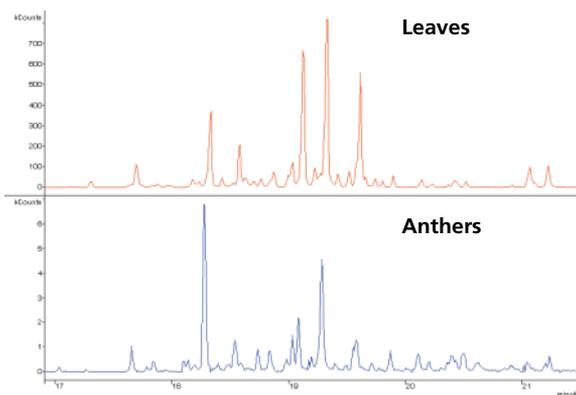


*"Methanol CI ... is an excellent technique for the detection and identification of VX degradation products .... Reduced fragmentation was observed relative to the use of methane or ammonia as CI reagent gases .... Methanol ... offers potential logistical advantages for environmental analysis by being cheaper, easier to transport and safer to use ...."* D.K. Rohrbaugh. *Journal of Chromatography A* 893 (2000) 393-400.

## Fire Debris, EI/MS/MS

*"... the correlation [using GC/MS/MS] is much better than that obtained using GC/MS ... (time programmed MS/MS) allows us to choose certain key compounds such as the alkylbenzenes and alkyl substituted PAH's ... and exclude all other matrix ions."* M. Froneman and B-J Visser. Council for Scientific and Industrial Research, Pretoria, S.A. *Varian GC/MS Application Note No. 62.*

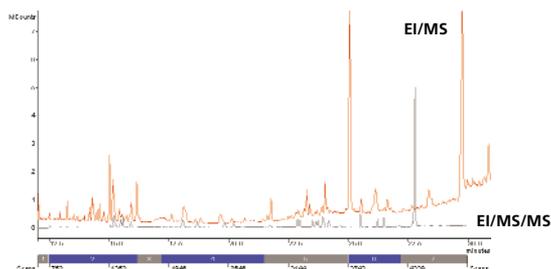
## Essential Oils, EI/SIS, ChromatoProbe



*"... small pieces of a selected part of the plant material can be placed into the sample holder .... This approach is capable of detection and identification of essential oils in a single anther (of *Verticordia n. and r.*)"* S. Wilkinson, Chemistry Centre, and P. Ladd. Murdoch University, Western Australia. *Varian GC/MS Application Note No. 65.*

## Comments from Saturn Users

### Dioxins in Soil, EI/MS vs EI/MS/MS



*"Results for the CID MS/MS technique were reproducible, with very little reduction in sensitivity or spectral quality during the analyses of all test samples. MS/MS data acquisition was initiated after calibration using 2-1500 pg standards and three to four selected ions in each MS/MS spectrum. The responses were linear for all ions calibrated."*  
D.J. Hayward. *Organohalogen Compounds* 23 (1995) 119-124.

### 1,4-Dioxane in Water, CI/MS/MS

*"Methanol CI-MS-MS offered the potential of detection limits three orders of magnitude lower than the electron ionization MS."*  
W.M. Draper, J.S. Dhoot, J.W. Remoy, and S.K. Perera. *Analyst* 125 (2000) 1403-1408.

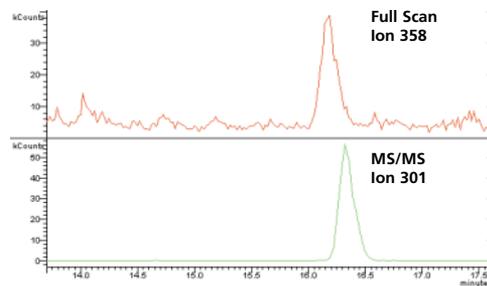
### Air Analysis, EI/MS

*"We have extended our target list of compounds that can be analyzed hourly by our field-deployable autoGC-MS system to 100 compounds, including biogenic and anthropogenic ozone precursors and oxygenated VOCs."*  
E.H. Daughtrey Jr., J.R. Adams, K.D. Oliver, K.G. Kronmiller, and W.A. McClenny. *Journal of Geophysical Research* 103 (1998) 22375-22386.

### Pesticides in Serum, ECD, EI-MS/MS

*"Two GC methods, using ECD or MS/MS detection mode, have been developed and validated for the analysis of endosulfan, a and b, and three metabolites, sulphate, ether and lactone, in human sera samples. ... better selectivity required for the analysis of biological samples was achieved with the GC/MS/MS method. The tandem capabilities of the ion trap allow the elimination of interference peaks that make difficult the quantitation of pesticide traces ...."*  
J.L. Martinez Vidal, M. Moreno Frias, A. Garrido Frenich, F. Olea-Serrano, and N. Olea. *Rapid Communications in Mass Spectrometry* 14 (2000) 939-946.

### Steroids in Urine, EI/MS/MS



*"The analytical method used is highly sensitive, accurate and reliable, easy to optimize, specific in confirming the anabolic substances and makes it possible to save time in routine analysis."*  
J. Munoz-Guerra, D. Carreras, C. Soriano, C. Rodriguez, and A.F. Rodriguez. *Journal of Chromatography B* 704 (1997) 129-141.

# A Complete Workstation — That Works Full-Time for You

The Saturn 2200 fully exploits advances in high performance PCs and Windows®-based software. Every function is under Workstation control. In fact, if it were not for adjustment of the calibration gas and CI reagent flows, you might forget the hardware even exists.

The 2200 Workstation is intuitive, comfortable, and efficient. It has to be to satisfy both new users and high throughput laboratories. Within a few days from installation, Varian's GC/MS Workstation will become your favorite lab assistant.

See our Saturn CD Brochure for detailed software tutorials. Better yet, ask for a demonstration of our software today.

## Complete Workstation Control

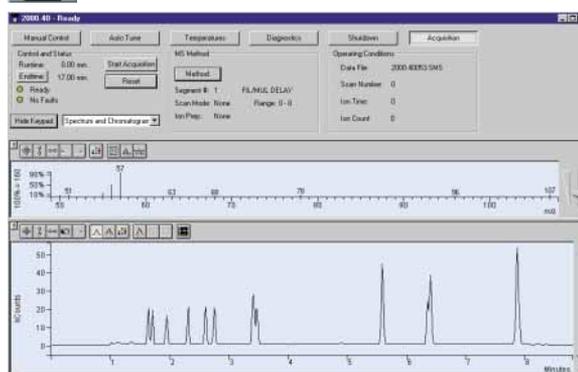
- Easy setup of all autosampler, GC, and MS components
- Streamlined automation for a single sample or large batches
- Superior qualitative and quantitative analyses
- Extensive standard and custom reporting

## Saturn CD Brochure



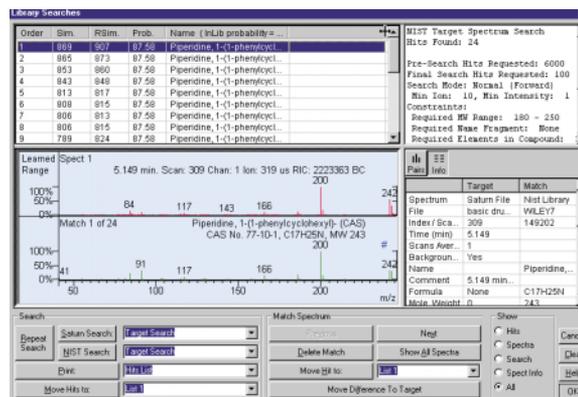
## System Control/Automation

*This screen links to system setup functions and allows real-time monitoring of analysis.*



## Review/Process MS Data

*Versatile, intuitive icons within this window facilitate initial evaluation of ion chromatograms or spectra and links to additional qualitative and quantitative tools.*



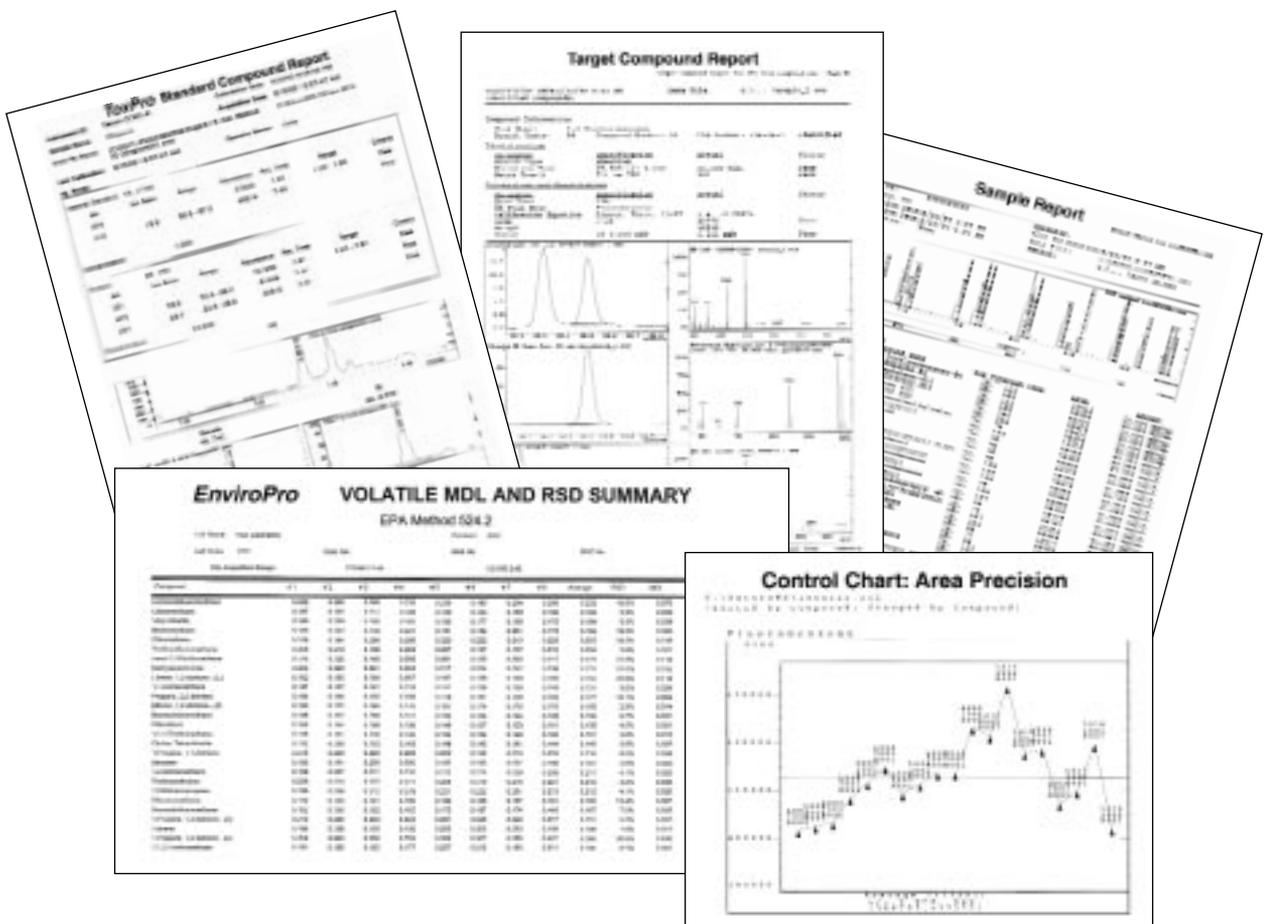
## Reports, Reports, and More Reports

Information-rich detectors like the 2200 MS generate vast amounts of data. Reports address qualitative, quantitative, QC/QA, and GLP issues. A great MS workstation helps run your samples and analyze your data, and puts you in full control of report formats. The Saturn Workstation, with its wide array of reports, lets you focus quickly on the critical aspects of your data. Use 'standard' or 'custom' reports to tailor the presentation of results for your customers. All reporting is completely automated so you can spend time on other tasks.

**Standard Reports.** Reports and control charts may be printed in a variety of formats or archived as ASCII files.

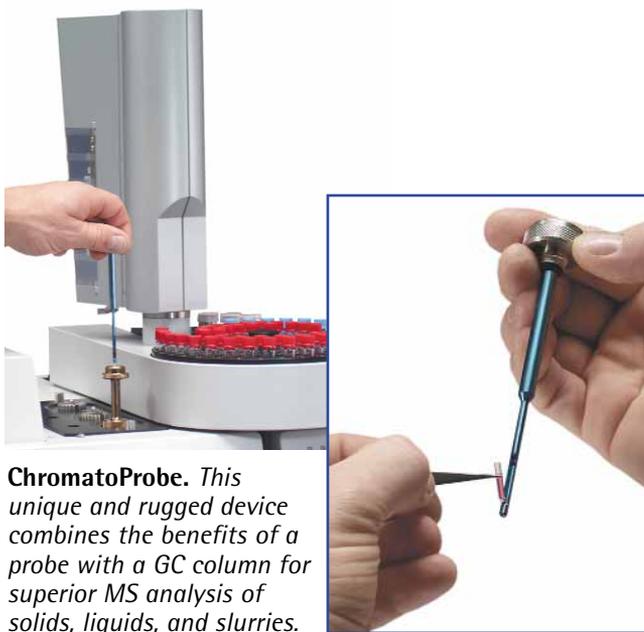


**Custom Reports.** For applications with specific reporting requirements, Custom Reports such as EnviroPro and ToxPro meet your needs with minimal effort.



## Options That Make the Difference — In performance and productivity

Along with all of the GC and MS technology delivered by the Saturn 2200, a number of affordable add-ons can be very valuable for selected applications. Your Varian Representative is ready to describe the benefits that these enhancements can bring to your laboratory.



**ChromatoProbe.** *This unique and rugged device combines the benefits of a probe with a GC column for superior MS analysis of solids, liquids, and slurries.*



**Custom configurations and application testing.** *Consult with us on your special application needs. Varian saves you time and cost by assembling and testing your customized system in our ISO-Certified manufacturing process.*



**SilChrom Analyzer.** *Optimal peak shapes and maximum response for polar analytes like drugs and pesticides are guaranteed with this inert surface.*



**Multi-Reagent CI.** *Extend the convenience of the world's most sensitive PCI technology. Automatically select methanol or deuterated acetonitrile and generate information not possible with other MS detectors.*

# Varian Chromatography and Spectroscopy Supplies Performance, Selection, and Value

Varian's 50-plus years of continuous innovation in analytical instrumentation assures you the best in high performance products. Varian is committed to providing analytical products and supplies at affordable prices supported by superior customer service.

To maximize Saturn 2200 performance, select the best value in analytical supplies ranging from sample vials and sample preparation products to CP-Sil Low-Bleed/MS capillary columns. Call today to request your free Varian Chromatography and Spectroscopy Supplies catalog.



**Varian injector septa and liners.** *Products proven to meet the exacting performance the Saturn 2200 delivers.*

**Autosampler and autoinjector vials.** *Vials with septa manufactured from materials specifically designed to eliminate GC/MS system contamination.*



**CP-Sil Low-Bleed/MS capillary columns.** *These columns are available in all the popular polarities. Low column bleed means higher precision, especially for trace analysis.*

**CP-Gas Clean Filters.** *Extremely efficient filters remove moisture and oxygen to extend column life and improve system performance.*



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Clinical  
Electronics  
Environmental  
Photonics  
Toxicology  
Pharmaceutical  
Food and Beverage  
Metals and Mining  
Petroleum and Petrochemical



Varian is committed to a process of continuous improvement which demands that we understand and then meet or exceed the needs and expectations of our customers – both inside and outside the company – in everything we do.

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