

AA

Varian
Atomic Absorption
Spectrometers



VARIAN

Varian is synonymous with innovation and reliability in Atomic Absorption, and has over 50 years of comprehensive experience in analytical instrumentation.

Varian's AA range enables analysts to extend the performance and productivity boundaries of AA determinations, and is equally at home in routine laboratories where reliability and simple operation is vital.

The Varian AA range includes the stylish and easy-to-use AA280 and AA240 series. Combining Fast Sequential design with up to eight lamp capability, the AA240/280 flame instruments provide high performance and lower running costs. If you require superior furnace performance and accurate

background correction, the AA280 Zeeman instrument delivers, with fast transverse Zeeman background correction and our new GTA120 graphite furnace. For an economical analysis solution, choose the AA240 series, which provides four lamp capacity and a choice of automation options.

AA choices for every application

Varian's wide range of hardware features, advanced software solutions and automation advantages are designed to cater for every application need. Select from:

Feature	AA280 FS	AA280Z	AA240 FS	AA240Z	AA240	AA140
Fast Sequential capability	●		●		○	
Dedicated furnace with Zeeman Correction		●		●		
Full automation	●	●	●	●	○	○
PC control	●	●	●	●	●	●
Deuterium background operation	●		●		●	●
True double beam optics	●		●		●	
Integrated accessories	●	●	○	○	○	○

● Standard Feature

○ Optional Feature



AA Innovation

1957

Built components for world's first AAS (as Techtron)

1964

Developed the AA3, Techtron's first commercial AA

1966

Nitrous-oxide/acetylene burner introduced

1971

Varian applies for a patent on Zeeman background correction

1971

Pioneered graphite furnace techniques with the transverse heated Model 61

1977

Automated GFAAS analyses with the ASD-53 – the first furnace autosampler



1981

Fully automated AA-975 for multi-element analysis

1985

Introduced centralized instrument control with the AA-30/40

1987

Dedicated Zeeman graphite furnace AAS

1994

Patented SIPS providing online calibration and fast online dilution for flame AA

1995

Worksheet software – an innovative spreadsheet concept for data display

1997

Patented Fast Sequential AAS reduces analysis times by up to 50%

2001

Varian's Duo AA introduces simultaneous flame and furnace analyses

Real productivity improvements

No matter what the application, Varian AA systems deliver real productivity improvements in flame AA. High productivity means reduced gas, reagent and lamp usage, and more results every day. Here's how:

Fast Sequential AA

Achieve the productivity and speed of sequential ICP with Varian's patented Fast Sequential* AA systems. By measuring all elements in each sample before moving to the next one, Varian's Fast Sequential (FS) AA280 and AA240 provide complete results in minutes.

- Determine your entire element suite without repeatedly aspirating samples
- Improve productivity by up to 50% by reducing the sample analysis delays
- Get full elemental coverage, no matter how many elements you are determining
- Reduce sample consumption – with less delays throughout analysis, less sample is wasted
- Save labor and reduce running costs – the more elements you determine, the greater your savings
- Improve precision and accuracy with online internal standard corrections – this corrects for physical differences, sample preparation errors, or drift

How does Fast Sequential AA work?

1. Determination time is optimized as the FS wizard sorts the elements by wavelength and flame type
2. Optimum flame conditions are used for each elemental determination – the patented Hammer gas control** initiates instantaneous changes to programmed flows and provides superb reproducibility
3. Reproducible wavelength positioning is achieved with minimal delays by the high speed wavelength drive (2,000 nm/min) operating under intelligent software control
4. Simultaneous operation of all lamps in FS mode
5. Fast lamp selection using a motor driven mirror

* US patent no. 6,236,457

** US patent no. 5,355,214

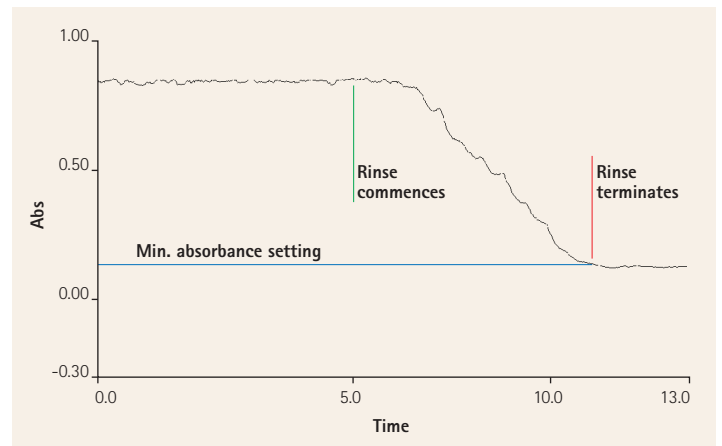
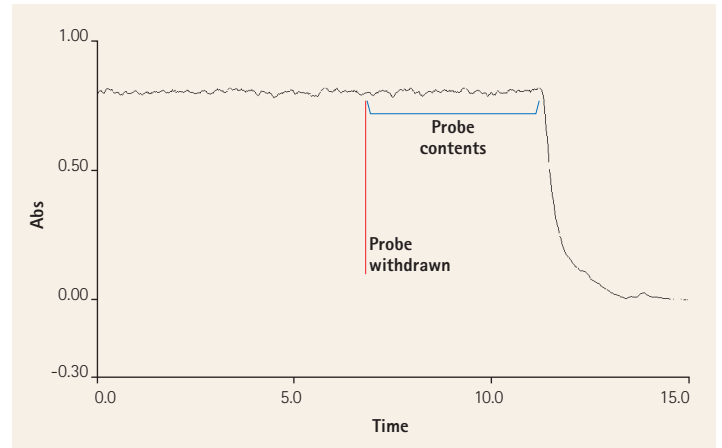
Conventional AA determines only one element at a time, so samples are analyzed time and time again during a multi-element sequence (top).

Using Fast Sequential AA, samples are only aspirated once and all elements are measured before progressing to the next sample (bottom).

Flexible sample handling choices

If you deal with diverse samples, your productivity solution is Varian's Sample Preparation Systems (SPS). The SPS autosamplers feature:

- Fastest ever sample to sample changes
- High sample capacity to enhance laboratory productivity
- Advanced rinse options to reduce carryover
- Traveling Rinse: the most rapid rinse option, which enables rinsing of the probe as it is drawn up out of the sample. This enhances throughput by minimizing probe movements
- Flexible configuration with economical laboratory racks for different tube types and probes
- Online dilution using the optional built-in diluter system
- Complete sample preparation capability using the optional diluter and software for offline standard and sample preparation
- Optional environmental enclosure for purging/fume extraction



Varian's latest innovations for flame autosampling include:

Pre-emptive sampling (top)

- Reduces analysis times by an additional 15%
- Reduces sample to sample delays
- Moves the autosampler probe to the next solution while the reading is still in progress
- Lowers sample consumption – the reading is completed using remaining excess solution in the transfer line

Smart Rinse (bottom)

- Optimizes rinse time for each sample
- Eliminates excessive rinse times
- Automatically extends rinse times for those solutions that need it
- Eliminates carry over as Smart Rinse monitors the wash-out until minimum absorbance reached
- Reduces sample analysis times
- Simplifies method development

Varian's Sample Introduction Pump Systems (SIPS) improve productivity with a range of unique benefits for flame AA.

- No tedious, multiple standard preparation. Performs online multi point calibration from a single standard
- Fast, online dilution of over range samples
- No costly, time consuming manual dilution and re-analysis
- Enhance accuracy and precision with < 2% error – no more dilution errors

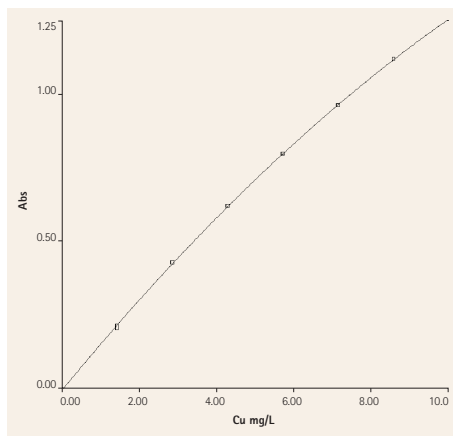
Varian's dual pump SIPS-20 further reduces sample preparation before analysis, with a unique range of productivity benefits.

- Adds modifiers such as ionization suppressants online during analysis
- Performs online spiking of samples for spike recovery studies
- Automates the tedious task of flame standard addition calibrations
- Enhances accuracy and precision during extended runs by enabling automated flame internal standard corrections

Vapor Generation made easy

Extend analyses to trace levels with Varian's continuous flow VGA-77. This allows determinations of mercury and hydride forming elements (As, Se, etc.) at part-per-billion (ppb) levels. The VGA-77 offers:

- Convenience of flame AA operation
- Better sensitivity than flow injection
- Exceptional precisions of 1-2% RSD at ppb levels
- High sample throughput of up to 70 samples/hour
- Simple operation, as the integral pump provides automatic reagent addition
- Low sample consumption < 8 mL per element during analysis
- Reduced setup time and elimination cross contamination when switching between elements with conflicting chemistries. Simply change modules



SIPS dilution performance

Actual Conc. mg/L	Measured Conc. mg/L	Dilution Factor	Dilution Error %
1.2	1.2	1.0	0.2
6.0	6.0	1.0	0.4
10.0	10.1	3.3	0.2
50.8	50.8	7.5	0.1
56.4	56.7	18.7	0.6
101.6	102.8	35.5	1.2
202.8	204.4	55.0	0.8
400.0	401.6	62.4	0.4
456.7	455.8	78.3	0.2
500.0	497.2	138.4	0.6
500.0	501.3	151.8	0.3

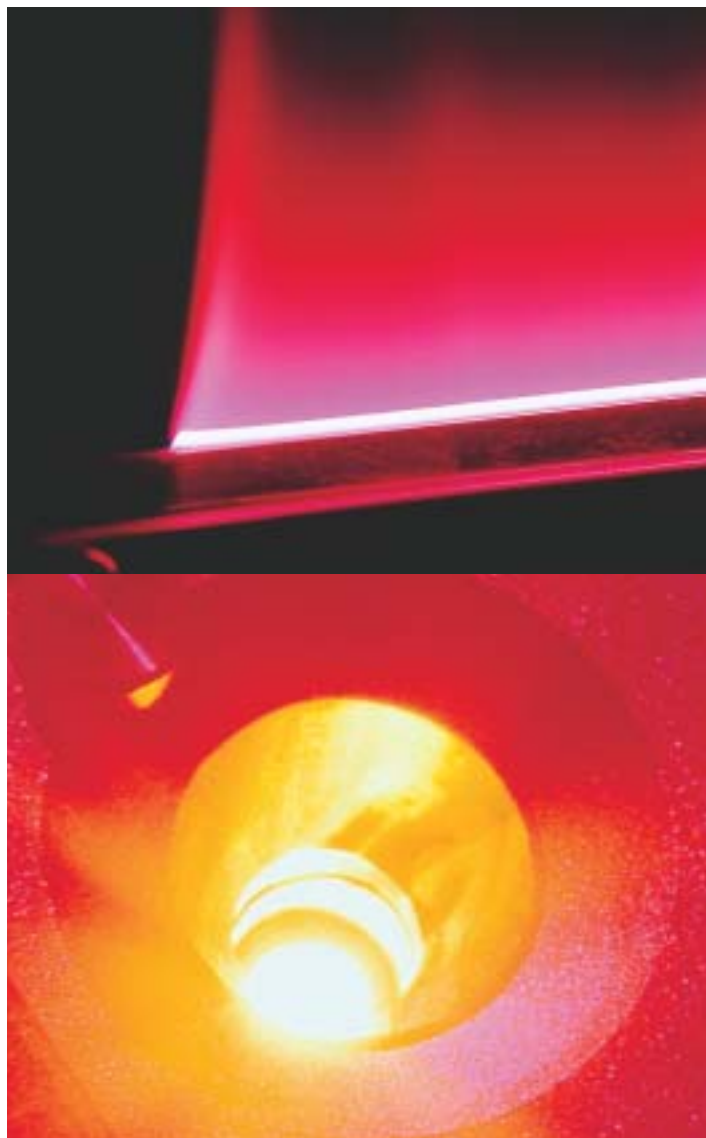
- Fully automated hydride determinations when coupled with the SPS series Sample Preparation Systems
- Increase sensitivity by 30% and improve detection limits with the ETC-60 Electrothermal Temperature Controller



Duo systems double your AA productivity

The Varian AA Duo systems are the world's only AA systems providing true simultaneous operation of flame and graphite furnace from a central computer. With an AA Duo, operation is more flexible, setup and change-over times are eliminated and productivity is doubled.

- Ideal for busy environmental, chemical or industrial laboratories
- Be more productive with simultaneous operation of flame/hydride and graphite furnace
- Customize the system to your needs by combining flame or hydride atomizers with either a deuterium or Zeeman corrected graphite furnace
- Centralize data and method storage in one location on the single controlling PC
- Save time with dedicated atomizers that eliminate complex setup and time consuming change-overs
- Each atomizer is permanently aligned for immediate use and never needs re-alignment
- Analyze any sample with the widest linear dynamic range from sub ppb (using furnace and hydride techniques) to percent levels (flame)
- Simplify setup and operation with advanced features such as automated wavelength and slit selection
- Fast Sequential technology provides the world's fastest flame AA
- Acclaimed worksheet software delivers rapid instrument setup, easy operation and simple method development
- Varian's range of accessories and autosamplers means the AA Duo system can develop with your needs



Varian's Duo systems provide simultaneous operation of flame and graphite furnace atomizers from a central computer, so you can double the productivity of your laboratory.

Superior furnace capabilities

Varian's integrated GTA120 and Zeeman GTA120 Graphite Tube Atomizers provide superior furnace performance, no matter how difficult the sample.

Constant Temperature Zone design

Varian's superior furnace performance is achieved via the Constant Temperature Zone (CTZ). The furnace power supply is matched to low thermal mass, end heated graphite tubes with optimized wall thickness. This ensures rapid, controlled and even heating, creating a CTZ centred around the injection hole. Benefits of the CTZ design include:

- Extremely fast atomization even with difficult sample matrices
- Best signal-to-noise characteristics, due to the long atom cell. This ensures the best detection limits and sensitivities
- Excellent tube lifetimes and reduced memory effects
- Accurate temperature control from 40–3000 °C during both fixed and ramped temperature stages without using inaccurate optical temperature sensors
- Greater reproducibility, as heating rates are software controlled to a maximum of 2000 °C/sec.

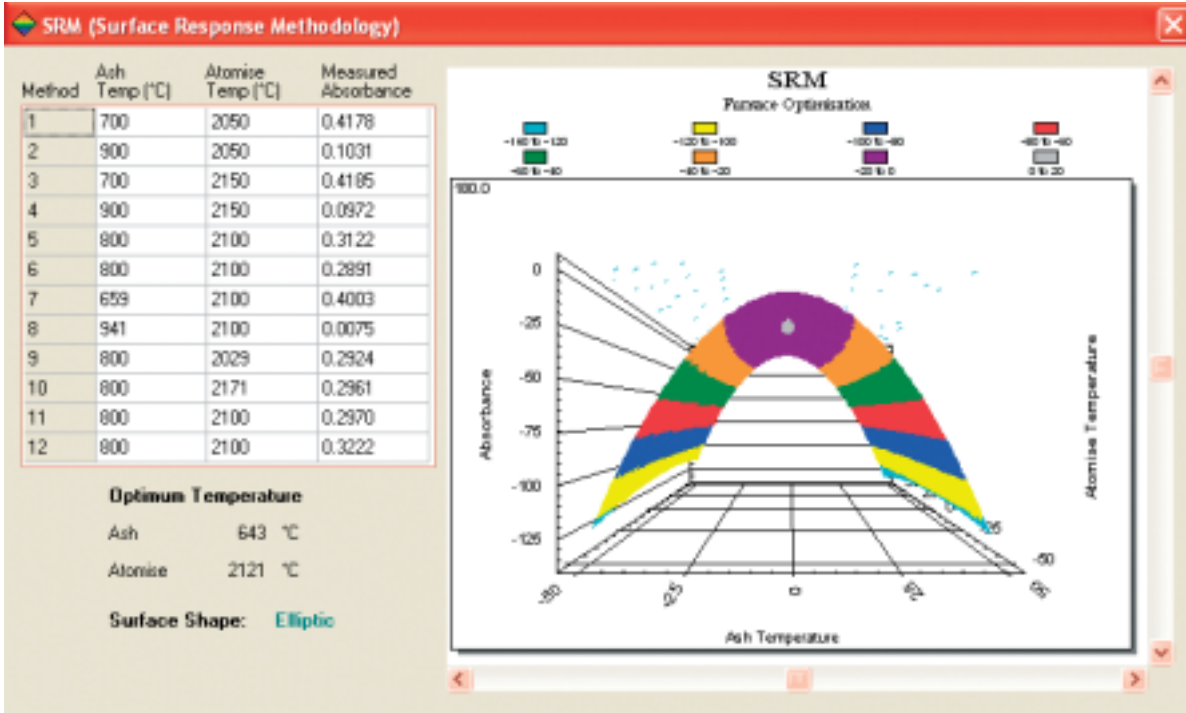
The GTA120:

- Reduces running costs with extended tube lifetimes and a 40% decrease in gas consumption
- Allows real time viewing of the injection zone using the optional built-in Tube-CAM. You can also capture still images or video the analysis
- Simplifies method development. Use Tube-CAM to accurately set the probe dispensing height and confirm the optimum drying and ashing temperatures
- Provides extended capacity for up to 135 solutions with the PSD120 Programmable Sample Dispenser
- Extends operation and reduce carousel changes in laboratories with high sample workloads, using the high capacity carousel

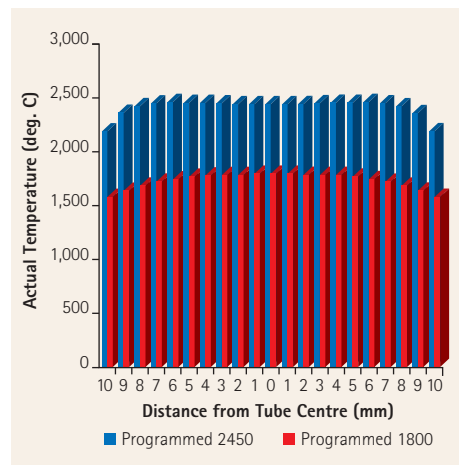
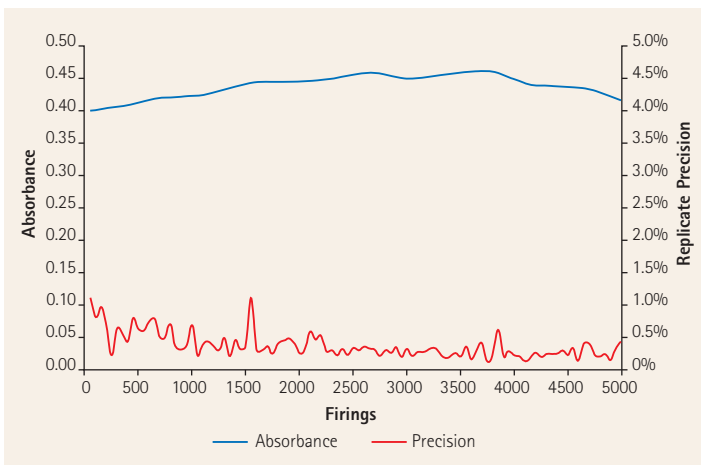


- Eliminates method development with the SRM Wizard. This automatically optimizes the furnace parameters and creates a method utilizing the recommended conditions
- Automates preparation of calibration standards and standard additions spikes, performs automatic over range volume reduction and utilizes flexible dispensing options such as hot inject or multi-inject with the sophisticated sampling of the PSD120
- Ensures reduced analytical cycle times as the autosampler is synchronized with furnace operation – solutions are collected while the furnace is in operation
- Provides operator friendly fume extraction during furnace operation using the optional fume extraction system
- Provides flexible programming with up to 20 temperature steps and choice of gas type and flow
- Enables simple and rapid change-over from flame to furnace

The high capacity carousel reduces changes and can hold up to 135 solutions.



Simplify method development for all users using the powerful and convenient SRM Wizard. An optimization study for Pb with phosphate modifier is shown.



The Constant Temperature Zone ensures a uniform temperature profile along the length of the tube, reducing interferences and improving accuracy.



Speed up method development and get more reliable results by using Tube-CAM to monitor your analysis in real-time (left).

Extend tube lifetimes and reduce gas consumption by 40% with the GTA120. Typical lifetimes for an aqueous copper standard with an atomization temperature of 2300 °C are shown (above).

Varian's patented Zeeman background correction* enhances graphite furnace system performance with correction over the full wavelength range for structured background, spectral interferences and high background absorbances.

- Outstanding performance at ppb levels from the Constant Temperature Zone furnace design
- Easy alignment – only a single light source is required
- Most accurate correction with Varian's unique magnetic waveform providing double the background correction speed of competing Longitudinal Zeeman instruments
- Three point polynomial interpolation of the background signal ensures accurate background signal measurement
- Polynomial interpolation provides up to an 11-fold improvement in correction accuracy over competing systems using simple linear interpolation (bracketing)
- Flexibility to handle difficult samples quickly and effectively. Optimum conditions for your analysis (drying, ashing and atomization temperatures, modifiers, injection volumes, etc.) can be rapidly developed using the SRM Wizard and Tube-CAM
- Optimum conditions ensure high sensitivity and freedom from interferences. Competing systems may compromise performance by limiting elements or the wavelengths available for analysis, or even compromising furnace conditions
- Ultra trace level detection limits using Varian's high intensity UltrAA lamps, which boost the emission intensity for reduced noise and enhance sensitivity
- Simple plug-in capability for high performance UltrAA lamps. No additional power supply is required



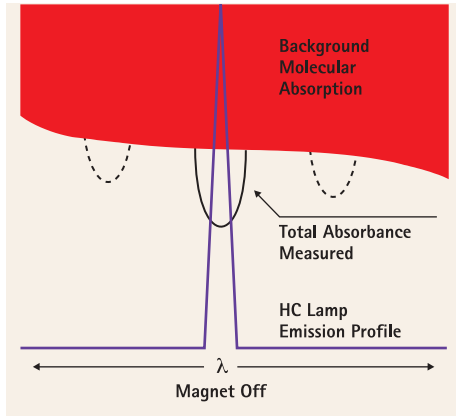
Zeeman background correction has been widely accepted by international regulatory agencies (such as the US EPA) as the most effective background correction technique. Varian Zeeman systems have developed a reputation for outstanding sensitivity and maximum performance with challenging samples.

* US patent no. 4,341,470

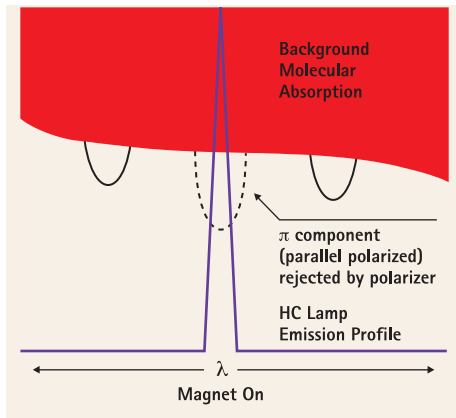
Achieving accurate Zeeman background correction

The principle of the transverse (AC) Zeeman technique.

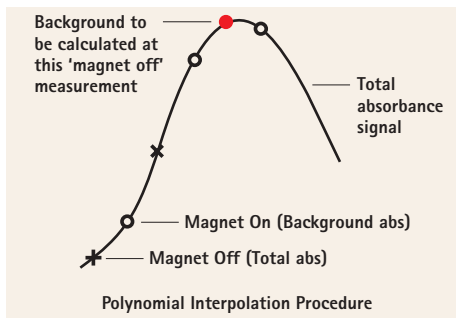
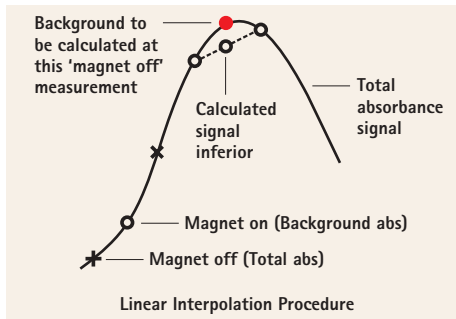
Magnet Off – the total absorbance is measured.



Magnet On – Zeeman splitting of the atomic absorption profile occurs and the polarizer excludes the central pi component. This allows only background absorbance to be measured at the exact analytical wavelength.



Varian Zeeman systems use three point polynomial interpolations to accurately track the background signal, resulting in an 11-fold improvement in correction accuracy.

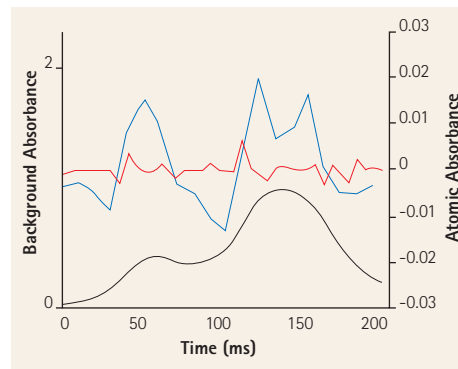


What is the Zeeman effect?

The Zeeman effect is the splitting and polarization of atomic spectral lines in the presence of a magnetic field. The magnetic field has little effect on molecular species and particulates that can cause background absorption. The Zeeman technique uses the magnetic field to achieve accurate background correction. With the magnet off, the total absorbance is measured. Once the magnetic field is applied to the atomizer, the spectral profile is split and only the background absorbance is measured. The background absorbance (magnet on) is then subtracted from the total absorbance (magnet off) to determine the atomic absorbance.

Varian's Zeeman solution

Varian Zeeman systems feature the transverse AC modulated Zeeman configuration with the field applied across the atomizer. This avoids the sensitivity losses observed with a DC (permanent) magnet, and maximizes light throughout compared with longitudinal designs where end caps restrict the light passing through the pole pieces of the magnet. Varian's unique magnetic waveform provides a delay time of less than 5 ms between measurements and collects 100/120 data points every second (at 50/60 Hz).



A typical background signal is shown (black). Varian's 100/120 Hz modulation and polynomial interpolation with twice as many measurements provides improved correction (red). Errors are much higher when using conventional linear interpolation (bracketing) at mains frequency (blue).

Satisfying your analysis challenges

Every analysis presents its own challenges. Tune performance to achieve the best, most accurate results as quickly as possible with Varian's Mark 7 atomization system. No other system is as flexible or convenient.

- Tune performance using the externally adjustable impact bead
- Achieve high sensitivity – typically > 0.9 Abs. from 5 mg/L Cu
- Optimize precision – typical performance is < 0.5% RSD from ten 5 second integrations
- Mixing paddles provide a fine aerosol, extending operation with high dissolved solids solutions
- Thorough mixing ensures precise, accurate determinations with reduced interferences

- Efficient drainage eliminates spiking, memory effects or long wash-out times, enabling higher sample throughput
- Simple to use 'twist and lock' assembly simplifies routine maintenance
- Corrosion-resistant components provide increased durability
- Minimal burner blockage is assured by the contoured burner design. This provides outstanding resistance to blockage, even with the most difficult samples
- Compatibility with organic solvents – simply fit organic resistant o-rings

The key components of the Mark 7 atomization system – the patented* nebulizer, spray chamber and burner – are designed to give best precision, efficient drainage, minimal burner blockage and reduced interferences.



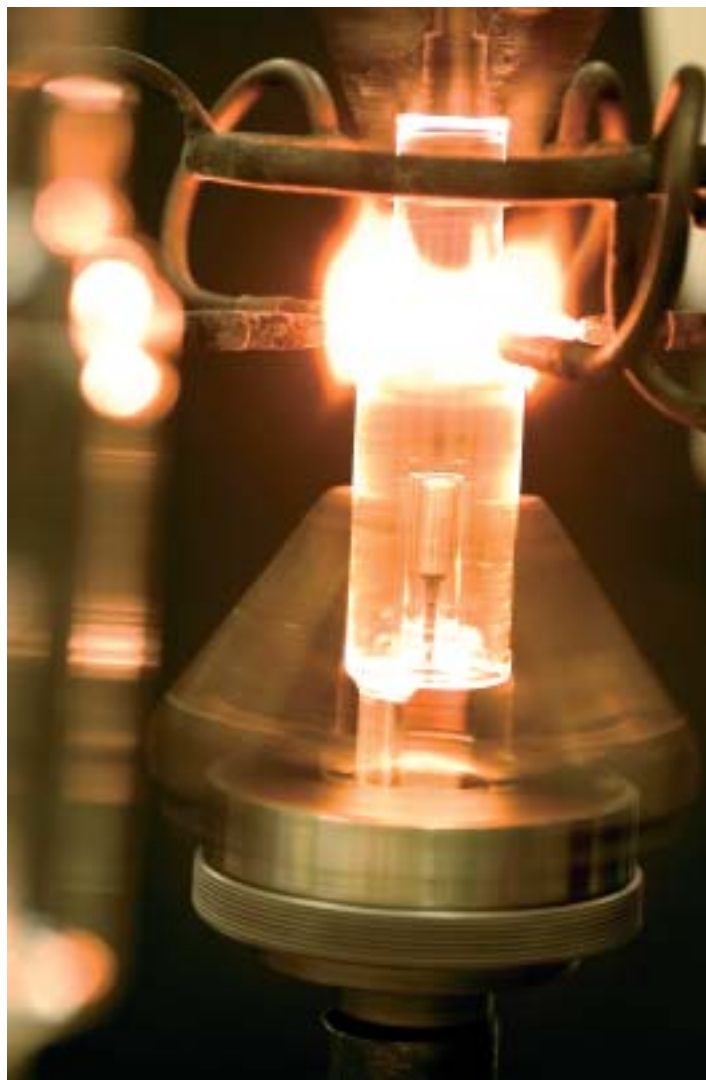
* Australian patent no. 737783

Value added consumable products

Continue to benefit from the superior performance of your Varian AA by selecting only genuine Varian consumables.

Only Varian has the experience required to consistently produce high performance lamps. Since the development of Techtron's first range of hollow cathode lamps in the 1960s, Varian has continued to research and manufacture its own range of lamps. Varian's extensive range includes single-element and solid-cathode multi-element lamps, plus high-intensity UltraAA lamps for superior cost-effective performance. Continuum lamps for background correction systems are also available.

Varian is committed to providing a full range of consumable products and supplies at affordable prices, supported by superior customer service. Call today to request your free copy of our comprehensive analytical supplies catalog. This features thousands of products for GC, LC, MS, AA, ICP-OES, ICP-MS, UV-Vis-NIR, Fluorescence and Sample Preparation from Varian and other leading manufacturers. You can also shop online at www.varianinc.com



Varian manufactures its own range of lamps to guarantee performance and reliability.

Confirm data validity

- Extensive rate and label driven Quality Control Protocols are provided to enable you to check precision, monitor QC standards and more
- Satisfy reporting requirements for international regulatory agencies using the optional PRO software, which provides additional QC capabilities
- Customize the QC capabilities of the PRO software to suit your laboratory's QC system using the simple equation editor

Eliminate compliance headaches

Optional SpectrAA CFR software helps you achieve compliance with the US FDA 21 CFR 11 ruling, and provides:

- Multi-level access with specific privileges for each user
- Secure electronic records, full data audit trails and three levels of electronic signing (comment, review or final acceptance)

Certify instrument performance

- Certify performance of your instrument using Varian's Qualification services
- Comprehensive qualification plans for flame, furnace and vapor operation are available in Varian's validation documentation
- Automate OQ testing with minimal user input using Varian's AA Validate software
- Ensure a secure audit record with the qualification test records
- Qualification services can be included as part of a comprehensive support agreement

Timely solutions for your support needs

Purchasing a Varian instrument is just the beginning of our partnership. Enhance productivity, minimize downtime and maximize the return on your investment with Varian's comprehensive range of technical support services.

These include:

- Direct access to technical experts operating our support hotlines in North America and Europe*
- Expert on-site support from our worldwide network of highly skilled, factory trained customer service representatives
- Online Teliagnostics™ support, enabling remote troubleshooting and diagnosis at any location
- On-site applications development and support
- Classroom or customized on-site training in your laboratory for both new and experienced users

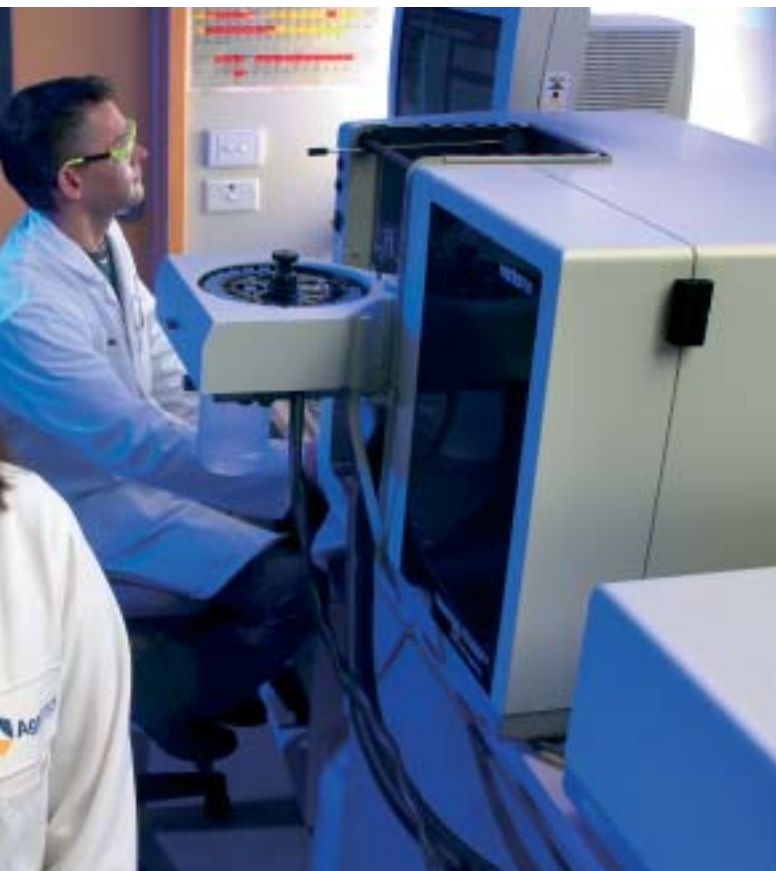
Varian's well established global network of subsidiaries and representatives offers complete sales, service, training, and applications support for our range of scientific instruments.



"Varian understands our needs and our business. The support from Varian helps us to confidently deliver our results at the level our customers expect."

Doreen Fernandez,
Laboratory Operations
Manager, Agrifood Technology

* Support hotlines may be available in selected other regions



Confirming Australia's grain quality

Agrifood Technology, a worldwide leader in grain testing, rely on Varian AA and GC instruments to maintain their competitive edge. Agrifoods pride themselves on the quality of their results and turnaround time. With thousands of samples to run, critical deadlines and instruments running up to 24/7, Agrifoods "cannot wait days for service support" and "can't service the growing demand for pesticide analysis without the right equipment". Varian service contracts provide them with cost effective solutions for both preventative maintenance and urgent repairs.

Web integrated

The SpectrAA software links you directly to all of Varian's support resources. Use the Varian website www.varianinc.com to download applications and software updates, shop online, track your order status, view the latest product updates, or you can email us with your questions.

Safety

It is Varian's policy to manufacture safe products and to meet all legal requirements governing the design, manufacture and sale of safe products. As with all similar products, the following hazards may be present: high temperatures, high pressure gases, explosive gases, UV and visible light, and electricity. Each product is designed to protect operators from potential hazards.

Varian, Inc. supplies instructions that describe the correct procedures for the operation and maintenance of each product.

For clarity, some images in this brochure may show the spectrometer operating without safety covers. Ensure all safety covers, chimney, etc. are in place for normal operation.

Varian atomic absorption spectrometers are designed to determine the concentrations of trace and major elements in solution.

CE Varian AA instruments are certified to comply with the requirements of the EMC and LV directives of the European Union.

Varian Zeeman AA instruments also comply with the guidelines established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) for occupational exposure to time-varying magnetic fields.

Varian, Inc.

serving worldwide markets in:

- Agriculture
- Basic Chemical
- Biotechnology
- Clinical
- Electronics
- Environmental
- Photonics
- Toxicology
- Pharmaceutical
- Food and Beverage
- Metals and Mining
- Petroleum and Petrochemical



Varian, Inc. 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.

• Varian Sales and Dealer Offices



All trademarks are the property of their respective owners.

Specifications subject to change without notice.



VARIAN

Varian, Inc. • www.varianinc.com

- **North America** 800.926.3000, 1.925.939.2400
- **Europe** The Netherlands 31.11.867.1000
- **Asia Pacific** Australia 613.9560.7133
- **Latin America** Brazil 55.11.3845.0444
- **China** 86.21.6375.6969
- **Japan** 81.3.5232.1239
- **Korea** 82.2.3452.2452
- **Taiwan** 886.22.698.9555
- **India** 91.22.2431.3069

Other sales offices and dealers throughout the world

GC • LC • MS • AAS • ICP • UV-Vis-NIR • Fluorescence • Dissolution • NMR • Consumable Products

8510214700 5/04 Printed in Australia