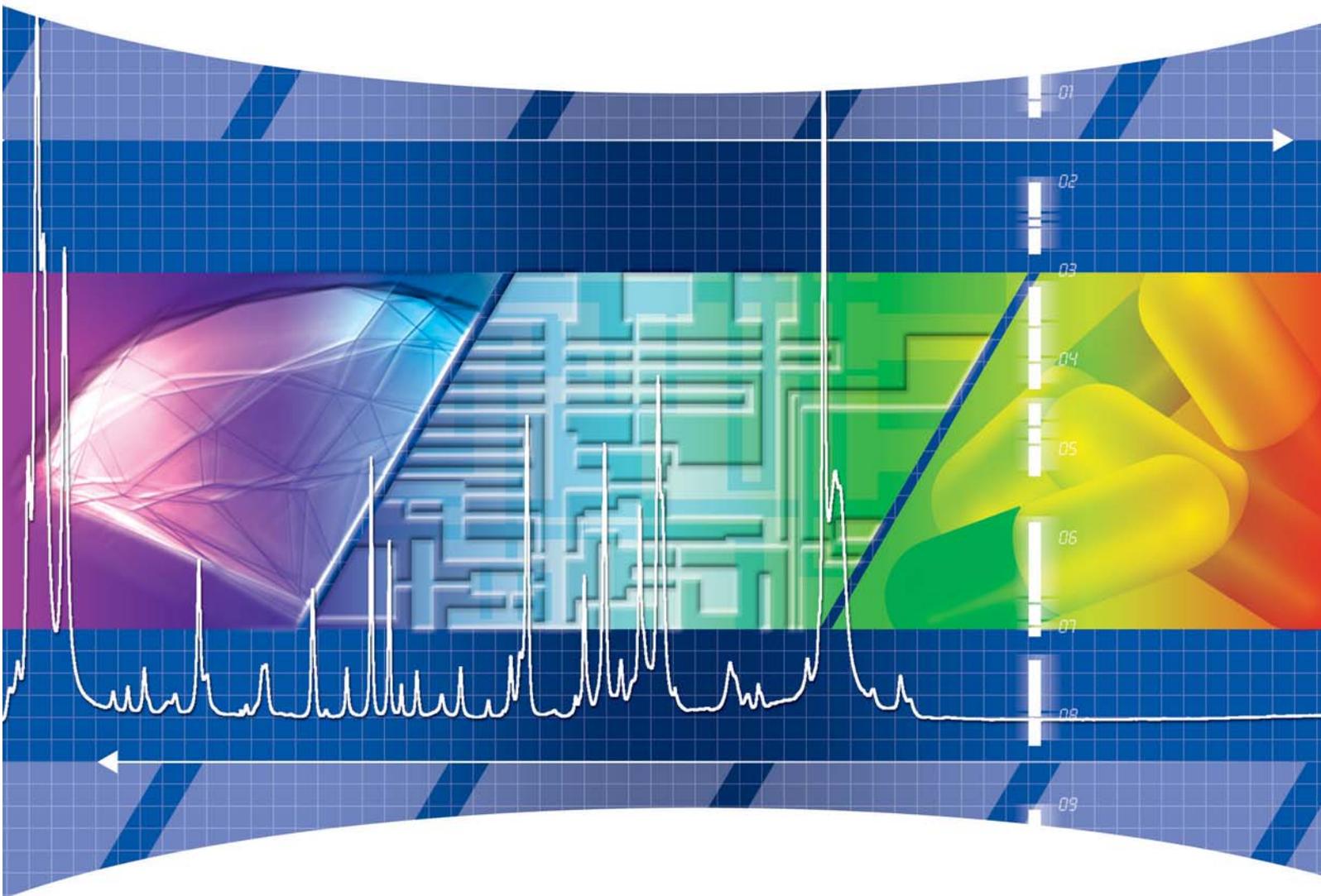


LabRAM Series

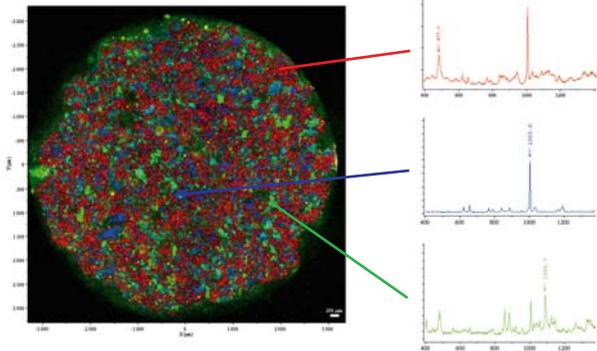


The advantages of Raman spectroscopy

- Non destructive
- Non-invasive
- No need for sample preparation
- Information rich
- Highly specific chemical fingerprints

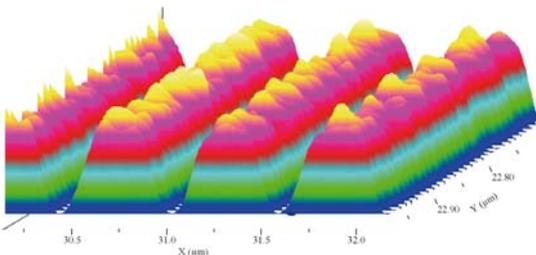
Whether the goal is qualitative or quantitative data, Raman spectroscopy can provide key information, easily and quickly, detailing the chemical composition and the structure of the investigated material.

Pharmaceuticals and Cosmetics



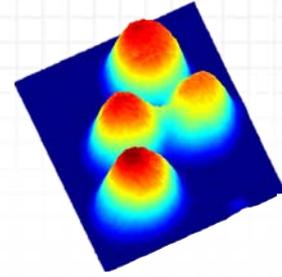
Raman chemical image of pharmaceutical tablet showing distribution of the three major constituents.

Semiconductors



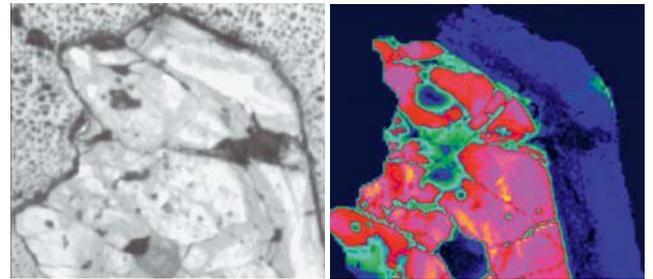
Confocality and spatial resolution is pushed to the sub-micron limit. This example shows 250 nm features of a semiconductor structure resolved using our confocal micro Raman system. (Data courtesy of ATMEL Rousset Université Paul Cezanne, France)

Polymers



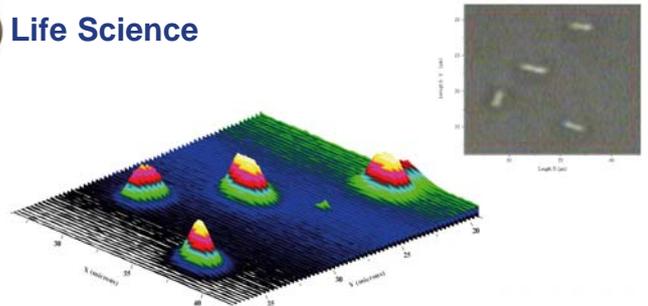
A chemical image of four micro-spheres using the LabRAM ARAMIS Raman microscope showing the high spatial resolution possible with this technique.

Geology / Mineralogy / Gemmology



High resolution Raman mapped image of a mineral sample, showing Metamictisation of $ZrSiO_4$ by self irradiation due to radioactive decay of Uranium and Thorium incorporated in zircon crystals. (Data courtesy of Dr. L. Nasdala, University of Mainz, Germany)

Life Science

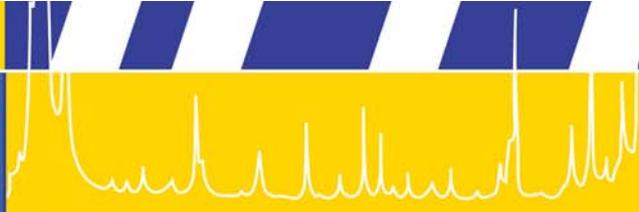


3D image of single cell bacteria on a substrate. The high spatial resolution enables single cells to be characterized and studied in great detail. (Data courtesy of Dr Wei Huang, CEH Oxford, UK)

Applications

Art • Biomedical • Carbon • Catalysis
Chemistry • Forensics • Geology • Materials
Pharmaceuticals • Physics • Polymers
Process • Semiconductors

Raman Spectroscopy



World leaders in Raman spectroscopy

The HORIBA Jobin Yvon Raman Division is the world leader in Raman spectroscopy. We have designed and manufactured state-of-the-art Raman systems for over four decades, and introduced ground breaking innovations such as the first commercial Raman microscope, the first holographic diffraction gratings and the world's first remote Raman sampling probe.



The Raman Division consists of the combined expertise of the Jobin Yvon, Dilor and SPEX brand names and is proud of having more than 5000 Raman systems installed worldwide.

Our Raman instruments are available as part of a complete range of HORIBA analytical, research and industrial solutions. The HORIBA group has become one of the world's largest instrumentation companies and has a reputation for supplying reliable and high performance equipment in the environmental, research, analytical and process monitoring areas of application.



Looking for Raman: Why look any further?

Performance through innovative technology

The Raman microscope has become an invaluable analytical tool for many different applications including pharmaceuticals, polymers, semiconductors, forensics and even life science.

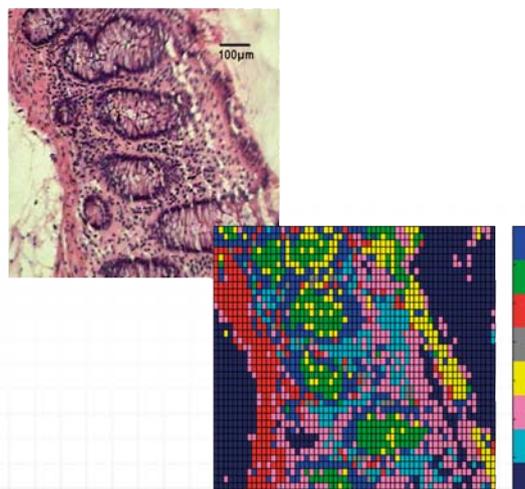
The latest series of LabRAM Raman microscopes incorporates leading edge technology in detectors, lasers and optics to provide fast, sensitive and flexible analytical measurements. The LabRAM series features the true confocal Raman microscope for the highest possible spatial and depth resolution. Analysis of samples down to the micron scale and below, and automated high definition Raman images can be rapidly and easily obtained.

LabRAM Series of Raman Microprobes Feature

- Automated Raman mapping and imaging
- True confocal Raman microscope
- Versatile micro and macro sampling
- Multiple laser excitations from UV to NIR
- Combination with FTIR, PL, TCSPC and AFM technologies
- Remote *in-situ* sampling capabilities

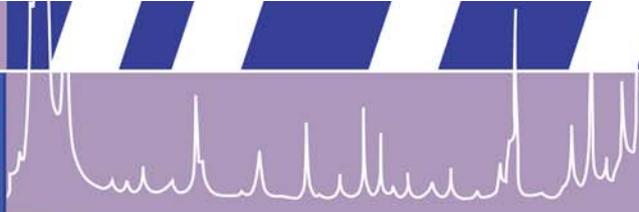
Fast Raman Images

The advanced optical technology, high sensitivity and powerful software of the LabRAM systems provide access to faster and more detailed chemical images. The LabRAM systems can maximize your laboratory output.



Raman mapped pixelated image showing cluster chemometric analysis of cells. (Data courtesy of M. MANFAIT, Univ de Reims, France)

System Concept

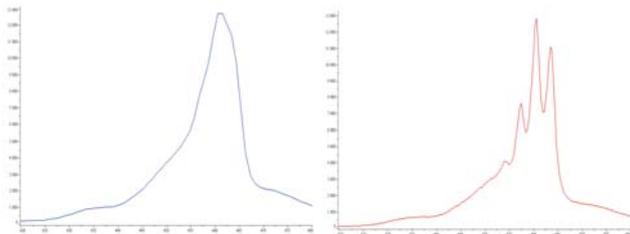


Spectral resolution and range

The LabRAM system incorporates a fast achromatic Czerny-Turner spectrometer with a rugged high-stability design. Raman analysis with unsurpassed spectral resolution and range gives the most detailed chemical analyses and images.

The high resolution version, the LabRAM HR, is the most powerful analytical system available on the market with exceptional spectral performance. Even in the UV, its unique 800 mm focal length spectrograph provides uncompromised efficiency and spectral resolution. No other Raman system offers such easily accessed performance.

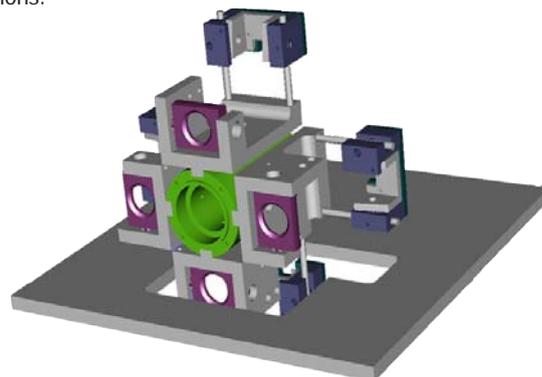
- High throughput optics optimized for the UV, VIS, NIR range
- High precision spectrometer for reliable and robust Raman spectra
- Motorized computer controlled operation for ease of use and speed of acquisition.
- High precision grating turret offers easy optimisation for different lasers or resolutions
- True confocal microscope for the most detailed images



CCl₄ spectrum at room temperature obtained with a short focal length (300mm) and a long focal length (800mm) spectrograph. Clear separation of the peaks is obtained only with the long focal length spectrograph.

Multiple laser excitations

The Raman microscope benefits greatly from the use of different laser wavelengths to expand the range of samples that may be analysed. The LabRAM systems incorporate a high stability optical design to enable fast and reliable switching for multiple laser sources. An internal HeNe (633nm) laser can be complemented by Ar⁺, solid state, and diode lasers covering a broad range of wavelengths, be it for resonance Raman optimized for sensitivity, for fluorescence suppression, or for sample penetration. Other laser sources can even be supplied for specialized UV and NIR applications.



Patented 4 Rayleigh filter selector enables easy selection and optimisation for different laser wavelengths

Integrated true confocal microscope

- Standard, Open or Inverted microscope
- Motorized adjustable confocal aperture
- Automated wavelength selection (up to 4 lasers)
- Class I laser enclosure



High stability rugged spectrograph design

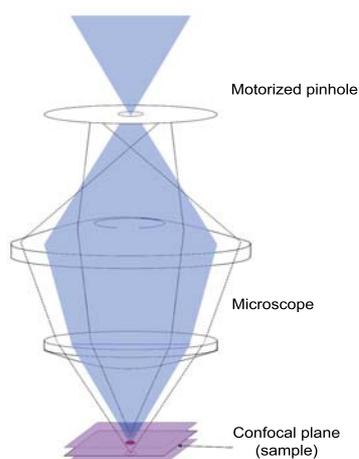
- Long focal length for high spectral resolution
- High precision grating turret (up to 4 gratings)
- Fiber port for remote probe measurements
- Dual detection ports for additional PL and NIR Raman measurements

Special features and accessories

- FTIR module: Reflective and contact ATR microscopy
- Macro chamber: 90° and 180° excitation
- Fluorescence microscopy and extended visualisation options
- Heating/cooling stages

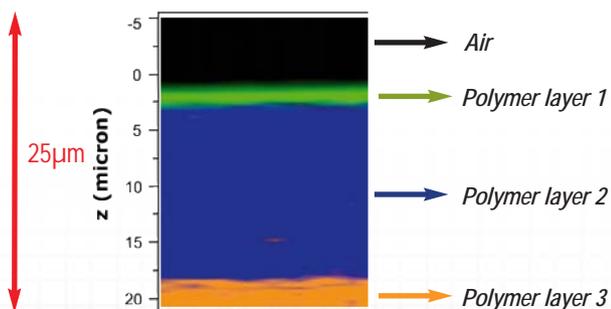
True confocal microscope optics

The true confocal entrance optics of the LabRAM microscopes offer the ultimate performance in spatial resolution and depth discrimination. The most detailed Raman images are obtained with increased speed and efficiency. The integrated design ensures total stability, whilst the continuously adjustable and motorized confocal aperture perfectly matches the investigated volume or particle area.



Confocal microscope principle

Only true confocal performance provides the ultimate in Raman mapped images and depth profiling. HORIBA Jobin Yvon confocal Raman microscopes approach the diffraction limit and offer the smallest possible sampling volumes. Where correctly matched objectives and laser wavelengths are used the LabRAM system can reach sub-micron resolutions.

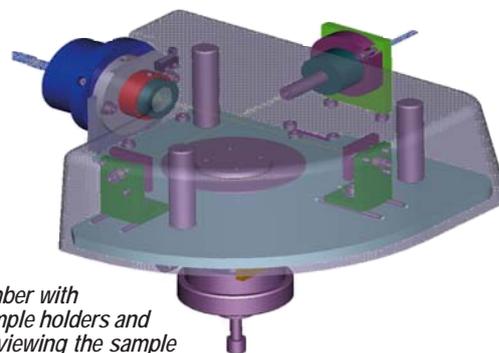


Confocal depth measurement on a laminar polymer film enables the characterisation of successive layers without cross-sectioning or significant blurring of layer boundaries

Macro measurements

The macro chamber available on several of the LabRAM instruments is designed to perform efficient Raman studies on bulk, solid or liquid samples. The chamber integrates on the side of the instrument through direct coupling and enables both 90° and 180° scattering measurements for added flexibility.

- Multipass effect for higher sensitivity
- Direct coupling for maximum efficiency
- Capillaries and cuvette holders
- XYZ and rotation sample holder
- Viewing camera

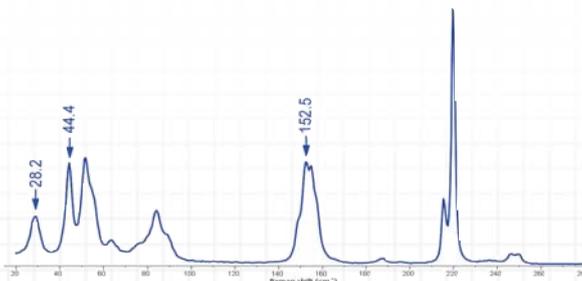


Macro chamber with multiple sample holders and camera for viewing the sample prior to analysis

Optimal laser rejection

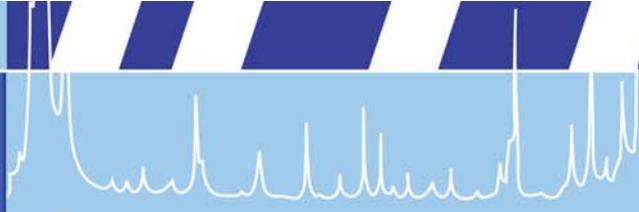
The LabRAM series offers state-of-the-art Rayleigh rejection filters in order to ensure optimal laser rejection, increased throughput efficiency and extended filter lifetime. Standard holographic filters are also available for where special antistokes Raman measurements are required.

The low frequency region of the Raman spectrum down to 30 cm^{-1} or less is reached through the use of our low frequency filter options. This information-rich region is ideal for the analysis of lattice vibration bands such as those found with subtle drug polymorphism and crystal phases, with many inorganic samples and with carbon nanotubes.



Low frequency Raman spectrum of sulphur illustrates the easy access to sub 100 cm^{-1} ranges with the LabRAM series

LabRAM Series



Robust and sensitive Raman

The LabRAM family from HORIBA Jobin Yvon offers a complete range of compact, dedicated high performance Raman microscopes suited to both the scientific researcher and the industrial analyst.

This new generation of technically advanced instrumentation combines ease of operation with superior performance. The LabRAM provides enhanced sensitivity, flexibility and long term stability. Incorporating new and optimized high throughput single spectrographs, measurement times are extremely fast, requiring often only seconds to obtain a complete and reliable Raman "fingerprint".

Raman images can be recorded quickly and with a full spectrum contained in each pixel. The speed of measurement and software capabilities allow each spectrum to be obtained in milliseconds (for an example see the image below right). Switching between modes of operation, laser sources and resolution options is quick with fully automated versions available to maximize laboratory throughput.

Versatile sampling and technology

The LabRAM systems are ideally suited to micro and macro measurements, to 2-D and 3-D imaging and depth profiling. The TRUE confocal microscope enables the most detailed images and analyses to be obtained with speed and confidence.

Highly versatile, each LabRAM can be supplied as a base unit which can be expanded with a range of options, upgrades and accessories to suit all budgets and applications. Specialized, dedicated or customised solutions can even be supplied where required, so, whatever spectral resolution, laser wavelength or sampling regime is needed HORIBA Jobin Yvon can provide a solution.

Be it for analytical, industrial or research measurements there is a LabRAM system ideally matched for you.

YOUR CHOICE !

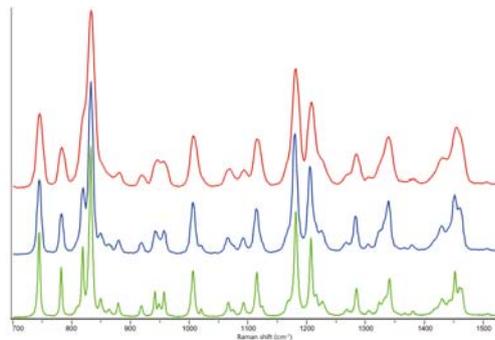
The LabRAM series designed for performance, engineered for reliability.

LabRAM ARAMIS

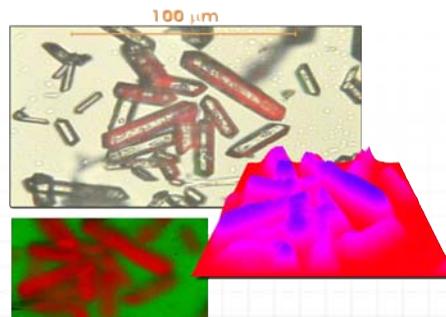
High Performance Raman Made Easy

The LabRAM ARAMIS offers automated, intelligent Raman analysis with uniquely simple but high performance operation.

Patented QUAD grating and filter technology ensures fast and sensitive Raman imaging. Automation and reliability provides simple and effective "point and shoot" chemical analysis.



Spectra of Ibuprofen taken at three different resolutions. The LabRAM ARAMIS easily illustrates the subtle Raman information that can be found when the higher spectral resolution mode is used (green spectrum shown above)



Fast Raman map of pharmaceutical crystals with 100ms/point

LabRAM HR

High Resolution Raman

The integrated and robust high performance Raman microscope. The LabRAM HR features high spectral resolution, multiple laser and detector options, UV-VIS-NIR range options, and complete flexibility. It offers the highest performance Raman microscope on the market and is ideally suited to pushing research to the very limits.



LabRAM IR²

Combined Raman and FTIR on the same system

The unrivaled dual Raman and FTIR LabRAM system that uniquely couples the confocal Raman microscope with complementary FTIR micro analysis.

For the first time a single bench-top system offers the complete molecular vibrational characterisation from the same sample location in a fast and robust single package.



LabRAM HTS

The ideal system for High Throughput Screening

The LabRAM HTS version of the family is optimized for rapid and routine Raman analysis and assays. Specialized automatic wellplate handling and on-line data analysis and interrogation provide a powerful tool for pharmaceutical and chemical HTS requirements.



LabRAM INV

The best for Bio-Chemical studies

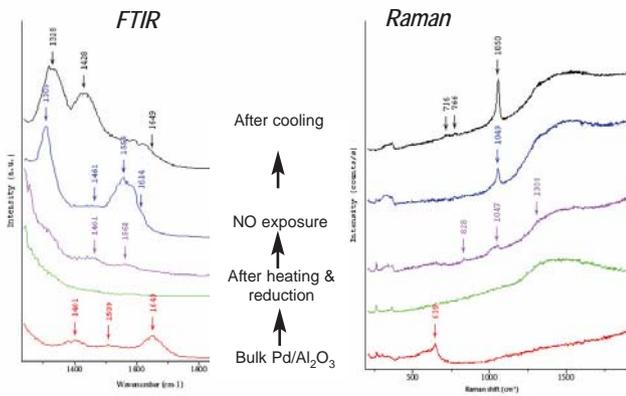
The LabRAM INV is an innovative inverted Raman microscope with either standard or high resolution versions. It provides true confocal microscope performance and full inverted Raman microscopy. Ideally suited to life science and biological samples such as cell and tissue media, the LabRAM INV is the perfect analytical tool for the bio and life science researcher.





Raman and FTIR

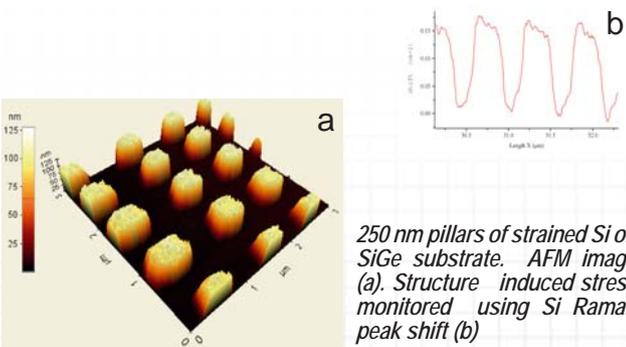
The unique LabRAM IR² system combines both micro Raman and micro FTIR analysis upon the same instrument enabling complementary spectroscopies to be undertaken easily. This heralds the beginning of hybrid Raman analysis, where several spectroscopies can be combined to provide a wider analytical picture.



Combined Raman and FTIR in-situ measurements of a Pd/Al₂O₃ catalyst. Absorbed species are best analysed using FTIR while lower frequency oxide components are characterised using Raman. (Data in collaboration with Dr E Payen LCL, Villeneuve d'Ascq, France)

Raman and AFM

The use of Raman microscopy has become an important tool for the analysis of materials on the micron scale. The unique confocal and spatial resolution of the LabRAM series has enabled optical far field resolution to be pushed to its limits with sub-micron resolution now achievable. To develop spatial resolution still further and into the near field, the LabRAM series provides an ideal platform for combining Raman with AFM and scanning probe microscopy. Specialised interfaces allow new and emerging techniques such as TERS and SNOM, to be explored with confidence.



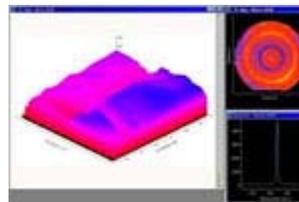
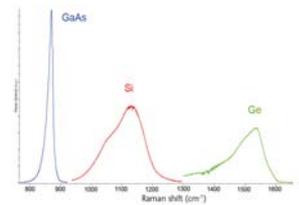
250 nm pillars of strained Si on SiGe substrate. AFM image (a). Structure induced stress monitored using Si Raman peak shift (b)

Raman and Photoluminescence

HORIBA Jobin Yvon offers unique Raman/PL dedicated configurations for the LabRAM HR and LabRAM ARAMIS. Using a combination of both vibrational and electronic/optical analyses the combined Raman/PL system yields a greater depth of information on many important materials.

This is particularly true in the characterization of semiconductor materials, quantum dots and carbon nanotubes and can provide information directly related to sample structure, the production conditions, homogeneity, purity and performance.

PL excited at 532nm and detected in NIR range of three different semiconductor materials using an InGaAs array detector

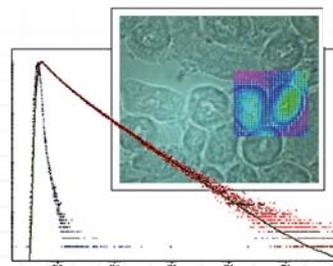


The screenshot shows Raman spectra and PL maps of a silicon wafer, derived from thermal donor characteristics

Raman and TCSPC

Time-Correlated Single Photon Counting (TCSPC) is a fluorescence lifetime measurement technique which provides sensitive probing of low light level signals into the picosecond realm. This technique can now be coupled to the LabRAM instruments. Both vibrational and fluorescence lifetime information can be recorded from the same sample on the same equipment platform.

This unique innovation opens the door to new applications and new solutions in the fields of analytical chemistry, biomedical imaging and material science.

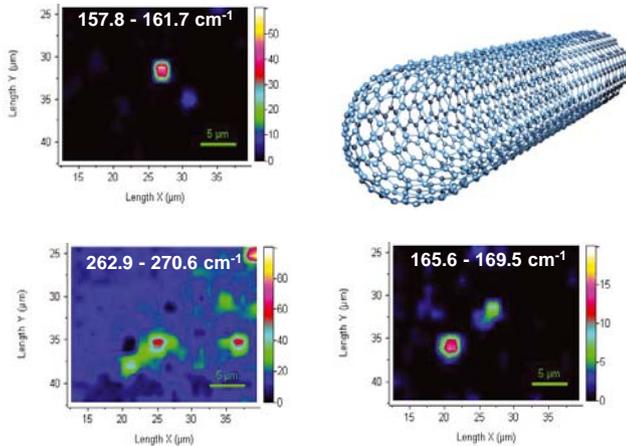


Fluorescence lifetime image obtained on a TCSPC microscope attachment from HORIBA Jobin Yvon

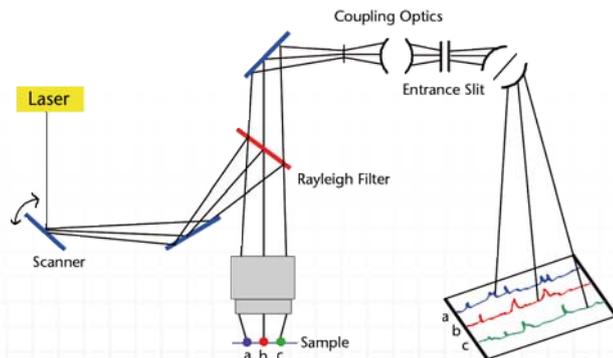
Raman imaging

The new generation of Raman confocal microscopes offers a non-destructive method of sample analysis at the micron and sub-micron level. It is possible to obtain fast and accurate 'chemical' images. Raman mapping from HORIBA Jobin Yvon has been designed to produce the fastest and most detailed Raman images. It is achieved by moving the sample with a precise motorized XY sample stage or by scanning the laser in the sample plane. A complete and confocal Raman spectrum is obtained for each point on the sample. The Raman hyperspectral image is then reconstructed in the sophisticated LabSpec Raman software to produce the highly accurate final image.

- Three-dimensional imaging of heterogeneous samples
- Extended video mode to visualize the sample beyond the microscope field of view
- Chemical component distribution with sub-micron resolution
- Fast mapping capability



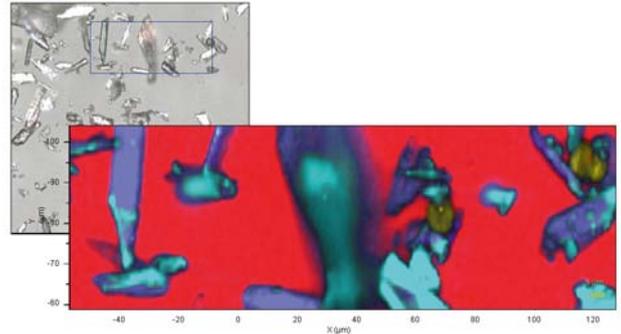
Images of isolated Single-Wall Carbon Nanotubes (SWCNTs) of different diameters on a Silicon wafer are generated from specific spectral features



Patented LineScan system for the fastest Raman imaging

Fast mapping

Advances in detection technology and optical design combine with new software capabilities to speed up the acquisition of Raman 'chemical' images. At the forefront of microscopy innovations, HORIBA Jobin Yvon has developed pioneering solutions for Raman imaging and offers ground-breaking acquisition times.

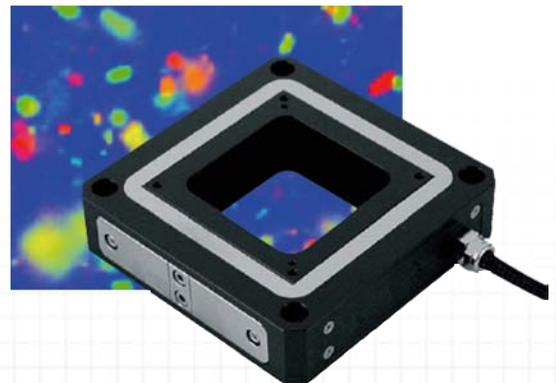


Raman map generated with 200ms/point and 1μm step, providing chemical identification of the various crystals

Mapping accessories

Where applications demand, specialized microscope options and accessories can be readily interfaced to our Raman systems.

- High precision motorized XY stages (up to 300 x 300mm)
- Z axis translation for depth profiling
- Fast and accurate autofocus
- Piezo driven stages for ultimate precision in X, Y and Z



High resolution 200 x 200 x 200 μm piezo electric stage

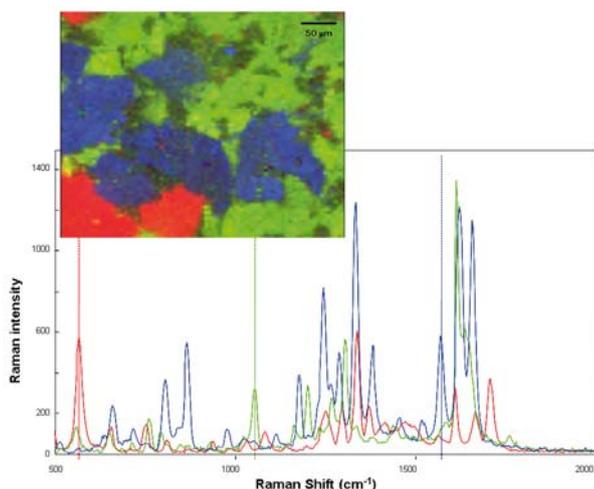
LabSpec software



The LabSpec software has been developed by our in-house team of software engineers. It has been designed for Raman, luminescence and hyperspectral imaging measurements. This highly powerful software offers an efficient and easy-to-use tool for both research and analytical operators. Icon driven screens and wizards control the different instrument functions, data acquisition and data processing.

Raman image generation

The powerful Raman imaging functions of LabSpec enable Raman maps to be produced from a range of parameters including band position, integral, FWHM, correlation fit to models, etc.



Active ingredients identification and distribution in a pharmaceutical tablet

Full function control

- Automatic ND filter wheel, confocal aperture and excitation wavelength selection
- Motorized stages for XY and Z mapping and autofocus
- Video image capture and digital storage
- Autocalibration routines
- External triggering and additional detection systems
- Powerful Visual Basic Script (VBS) editor for customized automated routines and experiments

Extensive data treatment

- Band fitting and de-convolution
- Spectral subtraction and baseline correction
- Univariate and multivariate analysis
- Linear and nonlinear filtering functions
- Data file export/import and compatibility with commercial spectral search softwares (e.g. direct data links with Spectral ID library module)

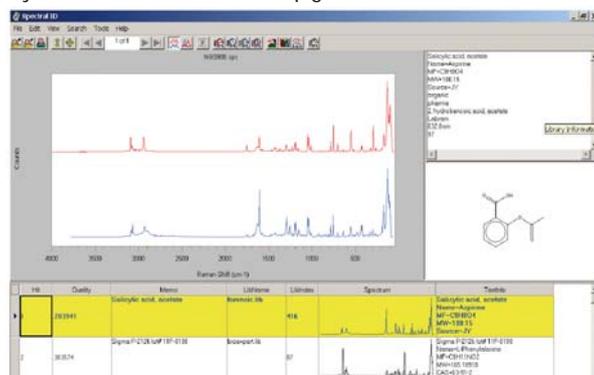
Spectral libraries



LabSpec enables fast and user-friendly access to spectral libraries through the Spectral ID module. The active Raman spectrum can be automatically searched from within LabSpec to enable simple chemical identification of an unknown compound. Powerful algorithms find the best match and assign a quality value to the assignment of the sample.

- Compatible with most commercially available databases
- Create and manage new customized libraries

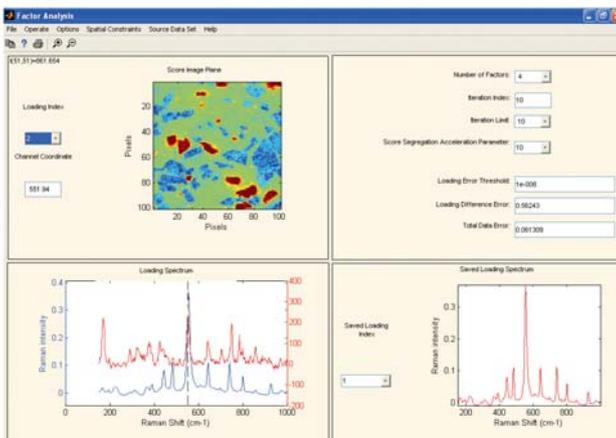
The Spectral ID module is provided with the HORIBA Jobin Yvon libraries containing over 1500 spectra of organic and inorganic compounds, pharmaceutical ingredients, semiconductors, polymers, minerals, ancient art pigments, etc.



Advanced chemometric analysis



ISys™ has become the industry standard imaging software for advanced chemometric analysis. The software offers robust assessment of chemical image data by providing flexible file management (Import and Export), data preprocessing, including spectral and spatial preprocessing, powerful data visualization tools, and a range of alternative methods of Statistical Pattern Recognition.



Microscope options

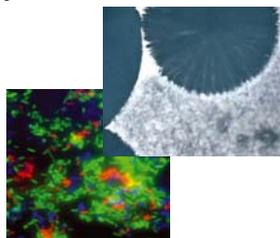
Where applications demand, specialized microscope options and accessories can be readily interfaced to our Raman systems.



- Unique Free Space Microscope (FSM) for larger samples and sample cells
- Multiwell plate for automated high throughput screening
- Optimized long working distance, UV and NIR microscope objectives for optimal results
- Dual microscope options for extended versatility

Many specialized illumination and visualization options can be added to our Raman microscope systems in order to enhance contrast and sample observation.

- Binoculars/Trinoculars
- Polarized light visualization
- Dark field illumination
- Differential Interference Contrast
- Phase contrast
- Fluorescence microscopy



Specialized stages

A range of specialized stages can be attached to the instrument for in-situ analysis in various conditions:

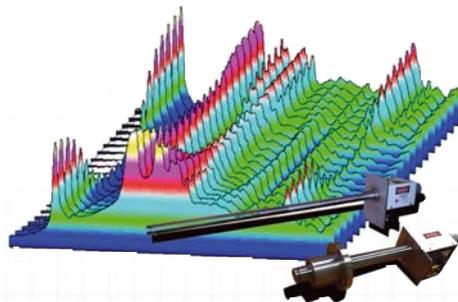
- Heating/Cooling stages up to 1500°C or down to 4K
- Catalytic Operando cell reactor for corrosive or conductive carrier gases
- Controlled humidity (vapor pressure) stages
- Electrochemical cells
- Diamond anvil and pressure cells



Heating / cooling stage and catalytic cell are readily interfaced under the LabRAM Raman microscope

Remote sampling accessories

The LabRAM microscopes can couple to a range of sampling accessories, which enable *in-situ*, non-invasive chemical analyses to be undertaken. Typically connected via optical fibres, a rugged Raman sampling probe is ideal for remote Raman measurements and is well adapted to process monitoring and control applications.



- SuperHead high efficiency fiber probe
- Video probe with white light imaging
- Confocal probe for high spatial resolution and depth profiling
- Various macro sampling options and accessories
- Wide selection of resistant immersion accessories

Detection options

The LabRAM systems have a dual detector port capability and offer a large range of detector options to enable the broadest range of possible measurements. CCD detectors, NIR detectors, and fast single channel detection are all possible upon the same instrument.



Backthinned, open electrode and front illuminated CCD chips can offer enhanced detection. All are provided as a high grade 1024 pixel 1" CCD chip format.

- Peltier or liquid nitrogen (LN₂) cooling
- UV, visible or NIR enhanced CCD chips
- Large high resolution 2048 x 512 pixel CCD chip option
- IR array (InGaAs) detection for measurement up to 1.6 μm
- iCCD for time-resolved measurements
- Specialized single channel IR detectors for measurements up to 2.5 μm or for time resolved applications

FLUORESCENCE



OPTICAL SPECTROSCOPY

ATOMIC EMISSION SPECTROSCOPY/ ELEMENTAL ANALYSIS



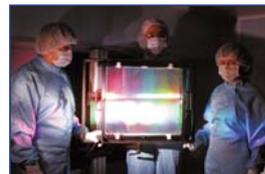
DETECTORS

RAMAN ANALYSIS



OEM SPECTROMETERS AND GRATINGS

X-RAY FLUORESCENCE



CUSTOM GRATINGS AND VUV BEAMLINES

PARTICLE SIZE ANALYSERS



ELLIPSOMETRY

FORENSICS



THIN FILM PROCESS CONTROL

www.jobinyvon.com

COMPANY PROFILE

HORIBA Jobin Yvon, is one of the world's largest manufacturers of analytical and spectroscopic systems and components and we are committed to serving our customers with superior products and technical support.

Established in 1819, Jobin Yvon is part of the HORIBA Group which employs more than 4,000 people worldwide, with annual sales in excess of \$935,000,000. HORIBA, Jobin Yvon, Sofie, Dilor, SPEX and IBH are some of our well known and respected brand names.

CLASS 1 LASER PRODUCT

$\lambda = 325 - 1064 \text{ nm}$, $P \leq 500 \text{ mW}$
 VISIBLE OR INVISIBLE LASER RADIATION
 AVOID EXPOSURE TO BEAM
 CLASS 3B LASER PRODUCT

- The content of this catalogue is subject to change without prior notice
- It is forbidden to copy from the contents of this catalogue in part or in full
- Please read the instruction/operation manual before using these products



This instrument complies with 21CFR 1040.10 and IEC 60825-1 (08/2001)

*Laser safety classifications depend on individual systems and options