

# LabRAM HR

*Evolution*

## Research Raman Made Easy!



### Raman Spectroscopy Systems

Powered by:



# LabRAM HR Evolution

Deeply involved in Raman spectroscopy for decades, HORIBA Scientific has been providing an extensive array of Raman instruments for diverse applications. High quality and trustworthy performance make HORIBA the leader in Raman instrumentation. The LabRAM HR Evolution is the latest spectrometer in the proven LabRAM series.

In fact, in the last ten years alone, scientists have generated more than 23,000 articles based on results acquired on LabRAM systems.

The LabRAM HR systems are ideally suited to both micro and macro measurements, and offer advanced confocal imaging capabilities in 2D and 3D. The true confocal microscope enables the most detailed images and analyses to be obtained with speed and confidence.

Highly versatile, each LabRAM HR is a flexible base unit which can be expanded with a range of options, upgrades and accessories to suit all budgets and applications. Specialized dedicated and/or customized solutions can be supplied where required, so, whatever spectral resolution, laser wavelength or sampling regime is needed, HORIBA Scientific can provide the best solution.

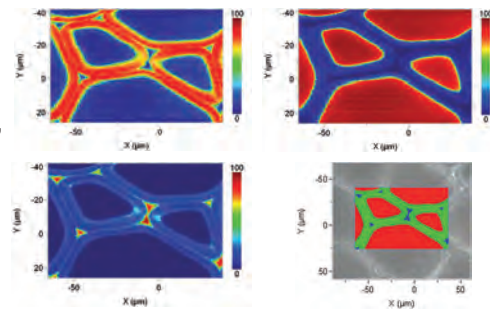
With guaranteed high performance and intuitive simplicity, the LabRAM HR Evolution is the ultimate instrument for Raman spectroscopy.

**Raman spectroscopy can provide key information about chemical composition and material structure.**  
**The Raman effect results from the interaction of laser light with molecular vibrations within the sample, and is highly sensitive to small changes in chemistry and molecular environment.**

## Cutting-Edge Applications with the

### Life sciences

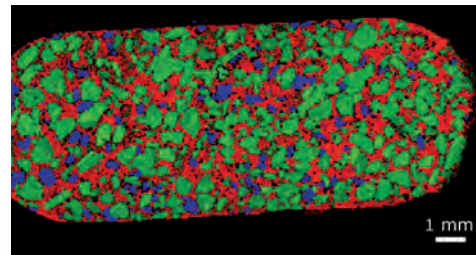
Disease diagnosis, dermatology, cell screening, cosmetics, microbiology, protein investigations, drug interactions and many more: the LabRAM HR offers new characterization methods for life sciences.



Raman imaging of wood cells.

### Pharmaceuticals

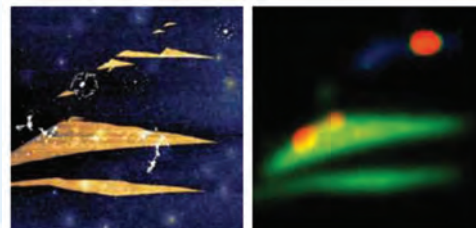
Active pharmaceutical ingredients (API) and excipients mapping and characterization, polymorph identification, phase determination: the high information content of the Raman spectrum affords researchers and QC technicians deeper insight into the performance and quality of their materials.



Tablet imaging showing the distributions of different chemical compounds.

### Materials

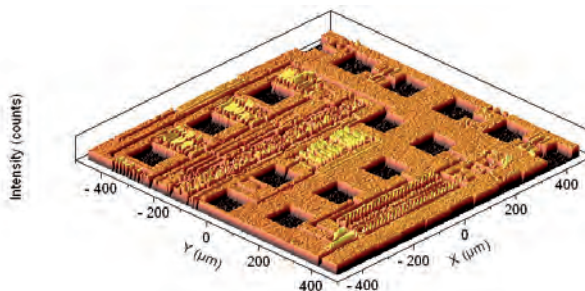
Graphene and carbon nanotubes, polymers and monomers, inorganics and metal oxides, ceramics, coatings and thin films, photovoltaics, catalysts: the LabRAM HR contributes to a better knowledge of materials and is a reliable tool for routine analysis.



AFM topography image (left) and Raman chemical image (right) of graphene. The Raman image highlights single (red), double (green) and triple (blue) layered structures. (Courtesy of Prof. Lukas Eng's group, IAAP, Dresden, Germany.)

### Semiconductors

Stress/strain measurements, alloy composition, ultra-thin cap layer characterization, imaging of etched chip structures, band gap analysis: Raman and photoluminescence (PL) studies of semiconductor materials enable specialists to collect crucial information about the composition and behavior of their components.



Raman imaging of an etched silicon chip.

Art - Carbon - Catalysis - Chemistry - Forensics - Geology  
Physics - Polymers ...

# LabRAM HR Evolution



## 1 Multilaser capability

From UV to near IR, direct laser coupling, automated laser switching

## 2 True confocal microscope

High spatial resolution, automated mapping stages, full microscope visualization options

## 3 High performance Raman spectrometer

Ultimate spectral resolution performance, multiple gratings with automated switching, wide spectral range analysis for Raman and PL, full system automation

## 4 Multiple Detectors

CCD, iCCD, EMCCD, InGaAs, PMT... for extended spectral range and specialized applications. Up to three detectors can be attached simultaneously

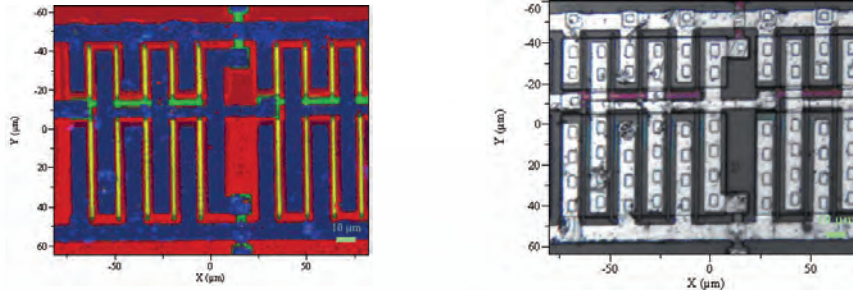
- Ultra-fast Raman imaging with SWIFT™ and DuoScan™ technologies
- Diffraction limited spatial resolution
- Unequalled spectral resolution with the high efficiency long focal length spectrometer
- A flexible platform for diverse experiments, including Raman-AFM and TERS, photoluminescence, sample heating and cooling, and many others
- Wide spectral range capability due to a unique achromatic design, and compatibility with multiple lasers and multiple detectors
- Fully automated system, with powerful software control

# A High Performance and Easy-to-Use Raman System

## Ultra-fast confocal imaging

- The DuoScan™ imaging technology is a confocal imaging mode, with high precision, ultra-fast rastering mirrors creating variable sized laser macro-spots, and also allowing nano-step mapping **from deep UV to NIR**.
- The SWIFT™ module couples the LabRAM HR's high optical throughput with optimized detector-stage coordination to make **ultra-fast confocal Raman mapping** a reality. High resolution images can be acquired in seconds, even on a macro-scale!

*Etched silicon Raman map. This image was obtained with 1 ms acquisition time per point in only 122 s!*

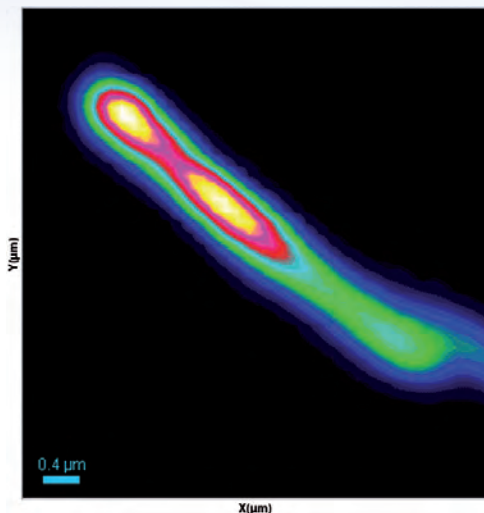


- **Electron Multiplying CCD (EMCCD)** uses the latest technology **to enhance the signal to noise ratio (S/N)** in measurements where extremely low signal levels are present. The use of EM gain allows Raman images to be acquired with higher sensitivity and/or dramatically shorter measurement times.

## High spatial resolution

The optimization of all optical components results in the highest spatial resolution at the diffraction limit.

*The high spatial resolution of the LabRAM HR Evolution enables users to analyze nano-objects like nanowires.*

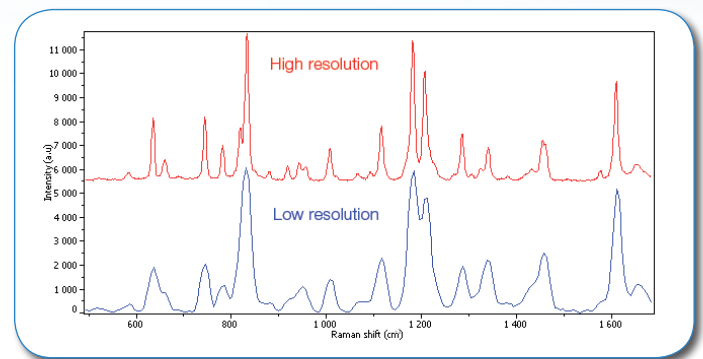


*ZnO nanowires imaged with the LabRAM HR micro PL laser 325 nm and 40x NUV objective.  
(Courtesy of laboratorio SENSOR, Università di Brescia e IDAR-CNR, Italy.)*

## High spectral resolution

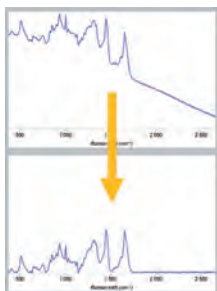
With its high throughput 800 mm single stage spectrometer, the LabRAM HR Evolution combines high sensitivity with the highest spectral resolution on the market.

*The spectra show the importance of the spectral resolution. The 800 mm focal allows subtle sample information such as crystallinity, polymorphism, strain, H-bonding and other band shape analysis to be characterized with ease.*



*Ibuprofen spectra.*

# Simply Powerful Software



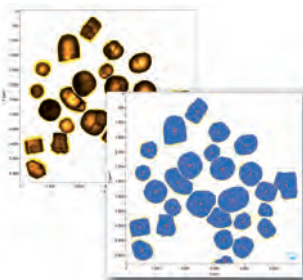
FLAT correction  
On-the-fly automated Fluorescence Removal

HORIBA Scientific's LabSpec 6 software delivers a unique environment for complete instrument control and data processing. It combines simplicity with powerful analytical functionality, and opens up the full range of experiment protocols, ranging from the basic spectrum acquisition through to hyperspectral confocal imaging.

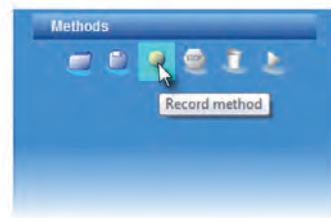
All data, whether a single spectrum or a hyperspectral map comprising hundreds of thousands of spectra, can be processed with standard spectroscopic functions. Comprehensive analysis routines are available, including integrated multivariate analysis\*. Spectrum identification is possible using the advanced capabilities of Bio-Rad's KnowItAll® informatics suite\*.



Fully Integrated Multivariate Analysis module\*



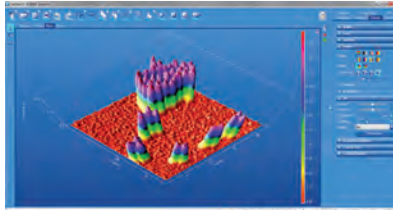
ParticleFinder module\* for automated particle location and analysis



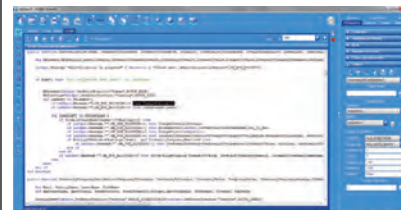
Recordable "Methods" for automation and customization

LabSpec 6 offers advanced automation, including ParticleFinder\*, recordable methods for custom automation and full Visual Basic Scripting (VBS) and ActiveX for in-software programming and remote control.

\* options



3D image rendering with variable smoothing, lighting and palettes



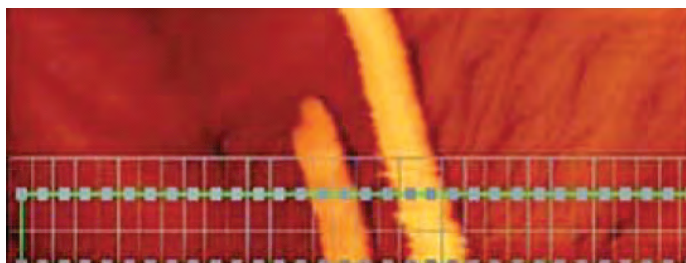
VBS and ActiveX control allow customized system automation

# Flexibility with Multiple Configurations

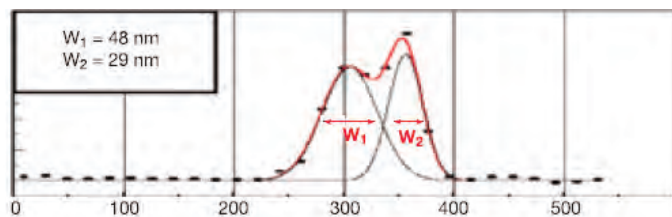
## Discover what else your sample can tell you: AFM hyphenation

The development of Scanning Probe Microscopy (SPM), which includes Atomic Force Microscopy (AFM), has made visualization of the nano-world easy and affordable compared to other microscopy or scanning techniques. Combining Raman with AFM gives access to nanometric visualization and chemical characterization of samples.

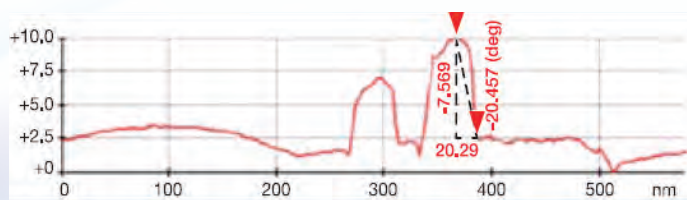
Tip-Enhanced Raman Scattering (TERS) uses a metal coated AFM tip as a dipole antenna that enhances the Raman signal coming from the contact area, providing the ability to produce chemical images with nanometric resolution.



Scanning Tunneling Microscopy (STM) image.



Profile of the Raman G band.



STM profile.

Carbon nanotubes analyses with AFM/Raman coupling reveal new information about composition and behavior.

## From UV to NIR without compromise

The LabRAM HR Evolution is a **fully achromatic spectrometer** covering a very wide spectral range from **200 nm to 2100 nm** due to its **multilaser** and **multidetector** capabilities. The optional InGaAs detector pushes the detection range to the NIR up to 2100 nm, making infra-red **photoluminescence spectroscopy** a possibility on the spectrometer. Typical applications include band gap determination, recombination mechanisms observation and control of material quality.



Wide spectral range Raman/PL configuration.

## Whatever your sample and analytical conditions

HORIBA Scientific offers you a **full range of research grade optical microscopes**. Standardly equipped with the **upright microscope**, an **open-space microscope** can be installed giving you free space under the objective to adapt numerous accessories like large cryostats, broad travel range stages... or even customized sampling configurations.

The optional **inverted microscope** brings the possibility of illuminating the sample from below, and gives you free space on top of the sample, which is particularly appropriate for life science applications.

A **transmission Raman** accessory opens up further analytical possibilities, and is ideally suited to bulk analysis of opaque/turbid materials, such as content uniformity or polymorphism in pharmaceutical tablets.

Finally, remote measurements are also possible with the use of the SuperHead **fiber optic probes** enabling in-situ monitoring of reactions or on-site analysis.



Open-space microscope configuration with DuoScan.



Remote probe.

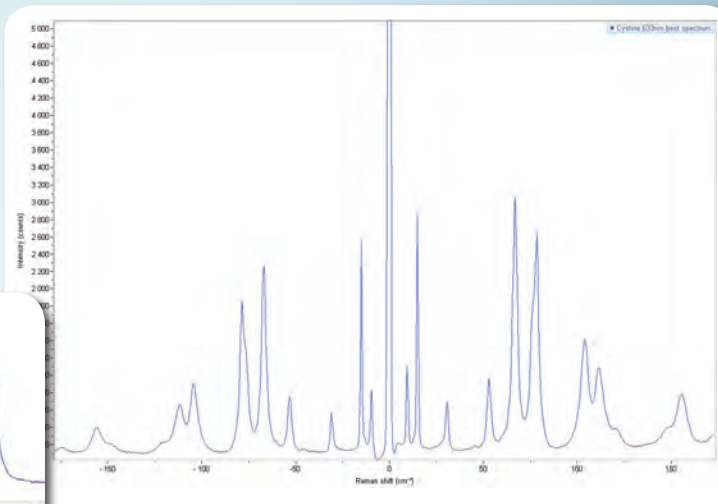
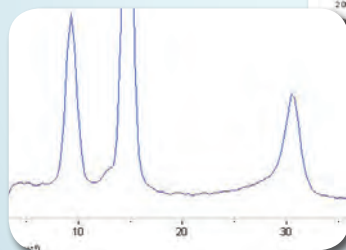


Transmission accessory.

## Ultra-low frequency module

HORIBA Scientific now gives you access to **frequencies down to 5 cm<sup>-1</sup>\*** on the LabRAM HR Evolution. The latest generation of notch and bandpass filters with very narrow bandwidth offer the possibility to obtain **ultra-low frequency spectral data**. With this solution, the LabRAM HR Evolution combines simple access to very low frequencies with a **high throughput single stage spectrometer**.

\* Depending on excitation wavelength, specification <math><10\text{ cm}^{-1}</math> at 532 nm, 633 nm and 785 nm



ULF Raman measurements of L-Cysteine at 633 nm wavelength. Stokes and Anti-Stokes bands at 9 cm<sup>-1</sup> are clearly resolved.

# Experts in Spectroscopy

HORIBA Jobin Yvon, established in 1819, and now part of the HORIBA Scientific segment, is one of the world's largest manufacturers of analytical and spectroscopic systems and components.

The HORIBA Scientific teams are committed to serving our customers with high performance products and superior technical support.



## Molecular and Microanalysis

- Raman Spectroscopy
- Fluorescence
- SPRi
- EDXRF
- Forensics

## Elemental Analysis

- ICP-OES
- C/S, O/N/H Analyzers
- S & Cl in Oil Analyzers

## Surface, Thin Film and Particle Characterization

- Ellipsometry
- Cathodoluminescence
- GD-OES
- Particle Characterization

## Optical Components

- Diffraction Gratings
- Spectrometers
- VUV Instrumentation
- Detectors



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