

LabRAM HR

Evolution



Research Raman Made Easy!

Cutting-Edge Applications with the

Leader in Raman & NanoRaman™ TERS

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.

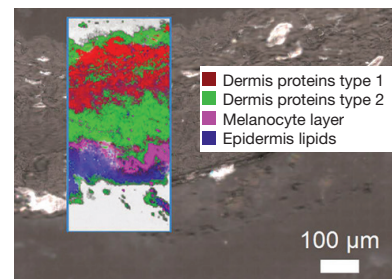
The LabRAM HR systems are ideally suited to both micro and macro measurements, and offer advanced confocal imaging capabilities in 2D and 3D. The true confocal microscope enables the most detailed images and analyses to be obtained with speed and confidence.

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.

Life sciences

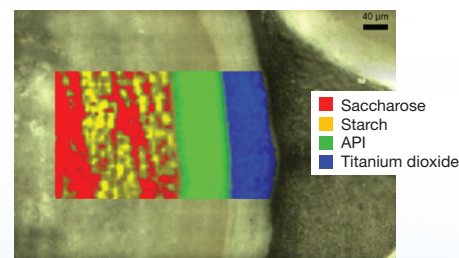
Disease diagnosis, dermatology, cell screening, cosmetics, microbiology, protein investigations, drug interactions and many more: the LabRAM HR offers new characterization methods for life sciences.



High resolution multivariate image of a skin cross section showing the different constituents of epidermis. Courtesy of O. Piot and M. Manfait, Faculty of Pharmacy, University of Reims Champagne Ardenne, France

Pharmaceuticals

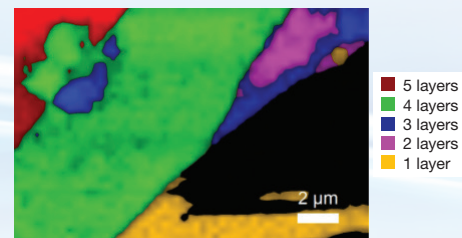
Active pharmaceutical ingredients (API) and excipients mapping and characterization, polymorph identification, phase determination: the high information content of the Raman spectrum affords researchers and QC technicians deeper insight into the performance and quality of their materials.



API, excipients and coating of a pharmaceutical drug delivery bead

Materials

Graphene and 2D materials, polymers and monomers, inorganics and metal oxides, ceramics, coatings and thin films, photovoltaics, catalysts: the LabRAM HR Evolution contributes to a better knowledge of materials and is a reliable tool for routine analysis.

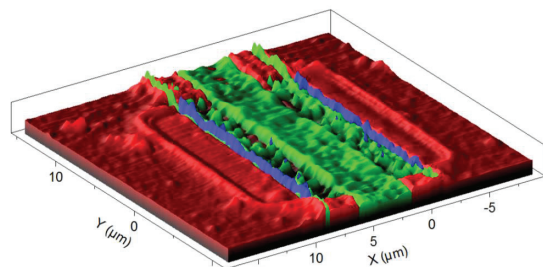


Ultra low frequency Raman imaging of MoS₂. Courtesy of Prof. Abhay Shukla, IMPMC, Université Pierre et Marie Curie, Paris, France

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.

■ cSi
■ polySi
■ ncSi

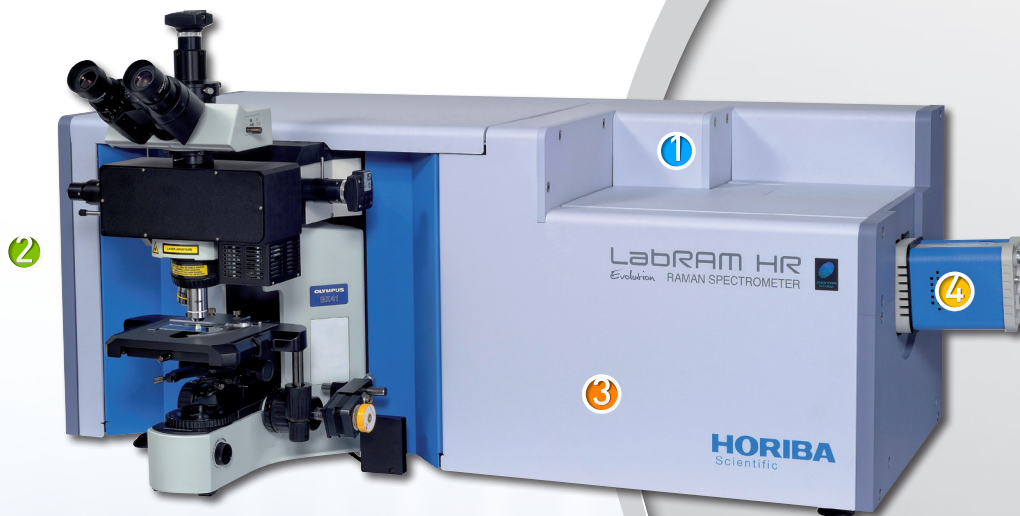


Raman imaging of a silicon chip with crystalline, poly and amorphous silicon regions.

Raman spectroscopy provides 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.

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 four detectors can be attached simultaneously

Key Features

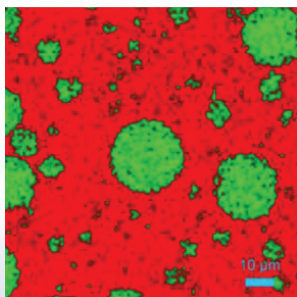
- Ultra fast Raman imaging with SWIFT™ and DuoScan™ technologies
- Diffraction limited spatial resolution
- Unequaled spectral resolution with high efficiency long focal length spectrometer
- Wide spectral range capability due to a unique achromatic design, and compatibility with multiple lasers and detectors
- Fully automated system, with powerful software control
- Flexible platform for NanoRaman™, photoluminescence, SEM

A High Performance and Easy-to-Use Raman System

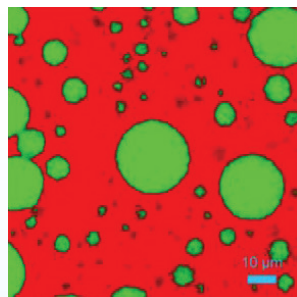
Ultra-Fast Confocal Imaging

- 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, without moving the sample.**
- The **SWIFT™ module** couples the LabRAM HR's high optical throughput with optimized detector-stage coordination to make **fast confocal Raman mapping** a reality. High resolution images can be acquired in seconds, even on a macro-scale!
- The **SWIFTXS** pushes the speed of confocal Raman imaging to the next level. The SWIFTXS module integrates HORIBA's newest Synapse™ EMCCD detector, combining unmatched speed and ultra-sensitivity. This allows sample throughput up to 1400 spectra per second. **Now that's Supercharged Raman!**

Standard Mode vs SWIFTXS - Polymer Blend Mapping



Standard Mode



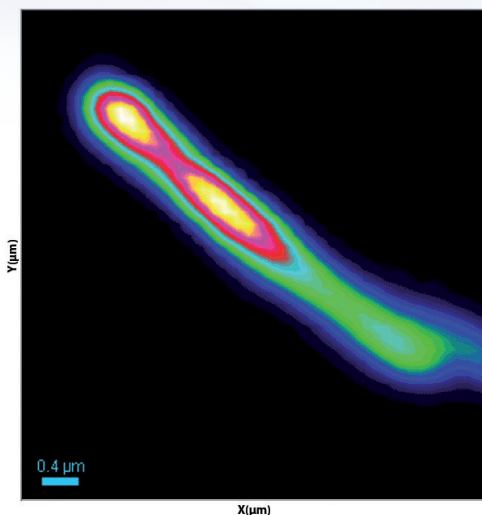
SWIFTXS

10 000 spectra
Scan range = 100 µm x 100 µm
Step size = 1 µm
Enhanced contrast with SWIFTXS

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.

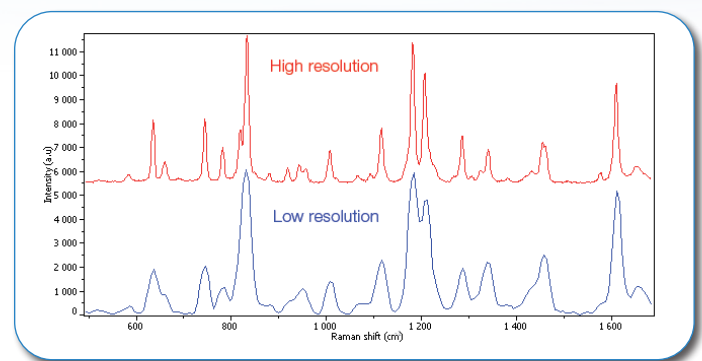


ZnO nanowires imaged with the LabRAM HR micro PL laser 325 nm and 40x NUV objective
Courtesy of laboratorio SENSOR, Università di Brescia e IDAR-CNR, Italy.

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 length allows subtle sample information such as crystallinity, polymorphism, strain, H-bonding and other band shape analysis to be characterized with ease.



Ibuprofen spectra

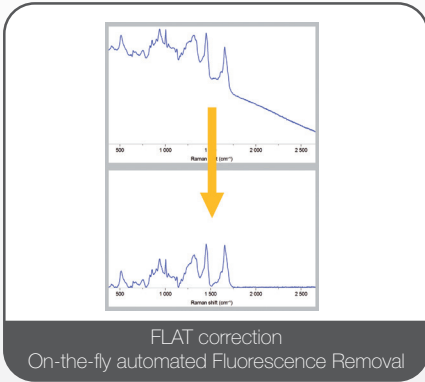
Simply Powerful Software



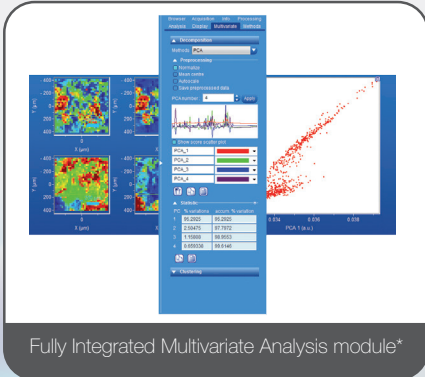
HORIBA Scientific's LabSpec 6 software delivers a unique environment for complete instrument control and data processing. It combines simplicity with powerful analytical functionality, and opens up the full range of experiment protocols, ranging from basic spectrum acquisition to hyperspectral confocal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

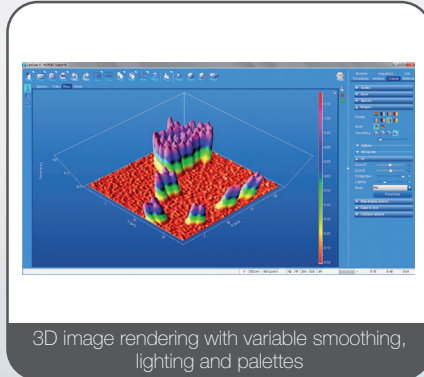
LabSpec 6 offers advanced automation, recordable **methods** for custom automation and full **Visual Basic Scripting** (VBS) and **ActiveX** for in-software programming and remote control. **Connect device** is a new functionality offering the possibility to connect temperature control stages and photocurrent mapping units.



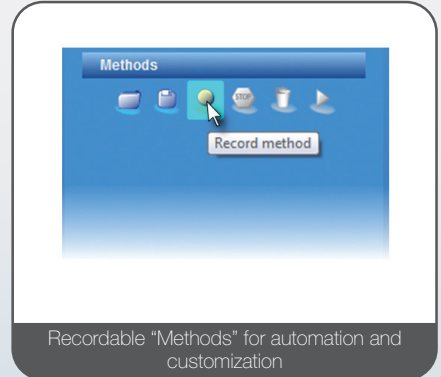
FLAT correction
On-the-fly automated Fluorescence Removal



Fully Integrated Multivariate Analysis module*

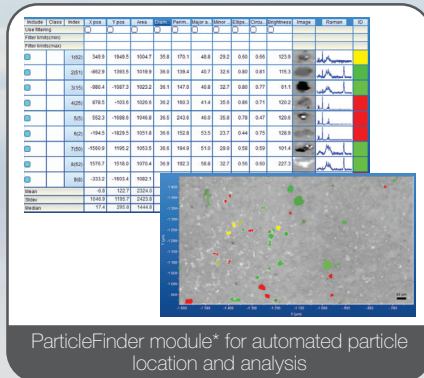


3D image rendering with variable smoothing, lighting and palettes

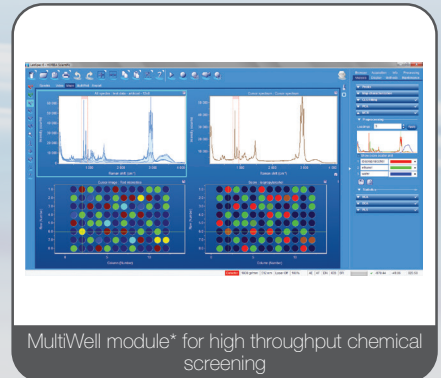


Recordable "Methods" for automation and customization

LabSpec 6 **ProtectionPlus*** offers a fully configurable security and data integrity module compliant with the requirements of FDA 21CFR Part 11. In addition, LabSpec 6 comes with an advanced **MultiWell*** module for high throughput screening and the updated **ParticleFinder**™* module for automated particle location, statistical analysis, and Raman analysis, making it the ideal spectroscopy software for self-running operation.



ParticleFinder module* for automated particle location and analysis



MultiWell module* for high throughput chemical screening

* options

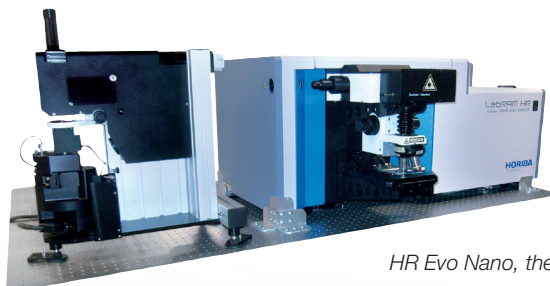
Flexibility with Multiple Configurations

Push the Frontiers from MicroRaman to NanoRaman™

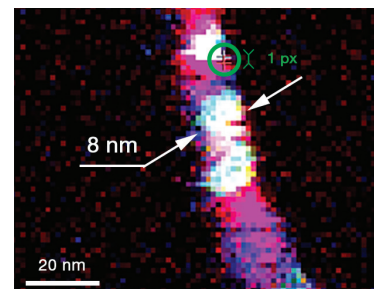
Compact, fully automated and easy-to-use, the **NanoRaman™ platform** concentrates the power of **AFM** (Atomic Force Microscopy) and **Raman spectroscopy** into a full-featured package, making **high speed TERS** (Tip Enhanced Raman Spectroscopy) imaging a reality for real world applications.

Reliable and efficient **AFM-TERS tips** are available for our NanoRaman™ platforms.

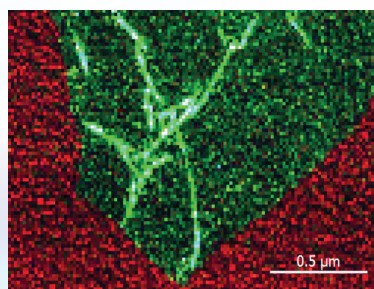
Allowing all modes of TERS operation (illumination/collection from the top, side and bottom), HORIBA TERS tips are guaranteed to provide TERS imaging and **spatial resolution down to 10 nm**.



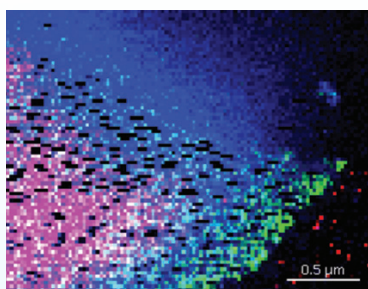
HR Evo Nano, the TERS Proven System



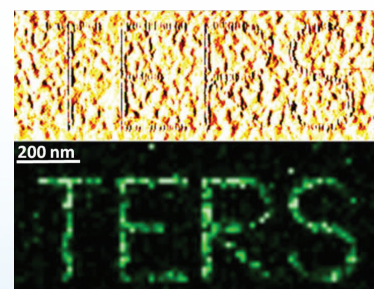
TERS imaging of a carbon nanotube with 8 nm resolution



TERS imaging of graphene oxide



TERS imaging of MoS₂

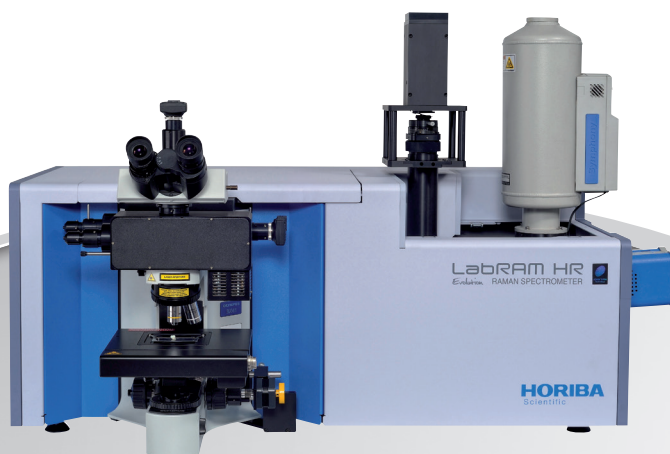


AFM and TERS images of patterned graphene oxide flake by pulsed-force lithography

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 2200 nm** due to its **multilaser** and **multidetector** capabilities. The optional InGaAs detector pushes the detection range to the NIR up to 2200 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.



Whatever your Sample and Analytical Conditions

HORIBA Scientific offers you a **full range of research grade optical microscopes**.

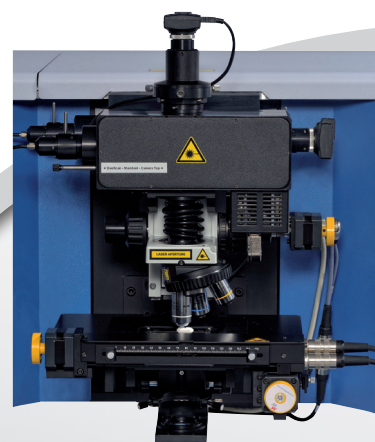
The LabRAM HR Evolution comes standardly equipped with the **open-space microscope** giving you free space under the objective to adapt numerous accessories like large cryostats, broad travel range stages... or even customized sampling configurations.

The optional **inverted microscope** enables 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.

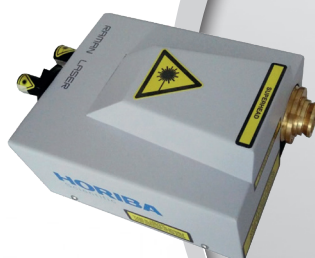
Configurations with dual microscopes are proposed upon request as well.

A **transmission Raman** accessory opens up further analytical possibilities, and is ideally suited to bulk analysis of opaque/turbid materials, to study 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

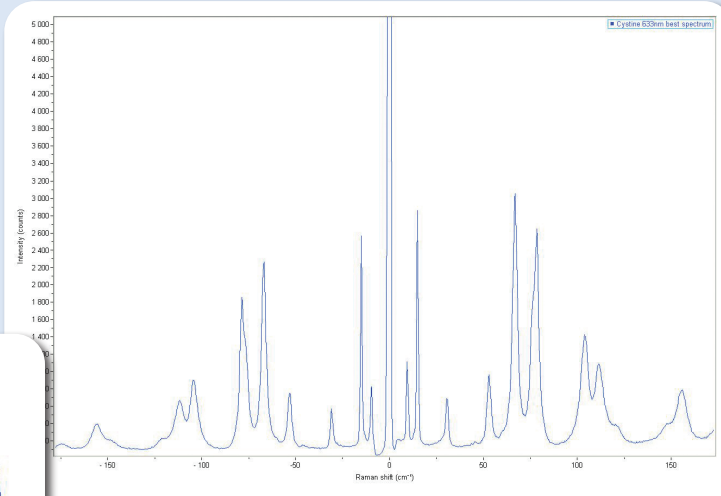
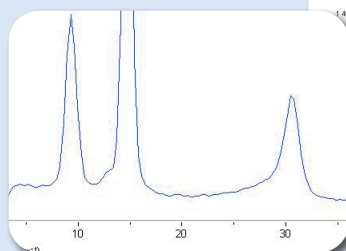


Multi-wavelength transmission accessory

Ultra-Low Frequency Module

HORIBA Scientific now gives you access **to frequencies down to 3.5 cm⁻¹*** 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⁻¹ are clearly resolved.

Find out more at www.horiba.com/raman

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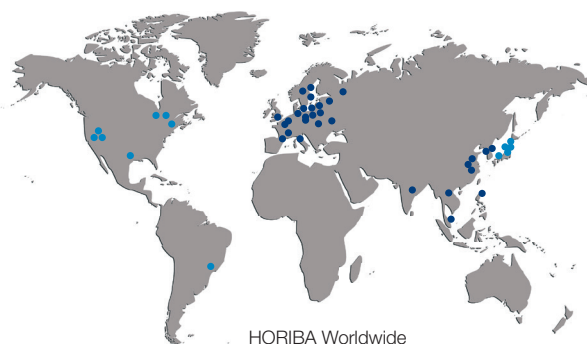
Worldwide Training and Technical Support

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.

Our staff of experienced application and service engineers, located around the world, provides full support for your instrument.

Well equipped application laboratories allow for sample analysis and hands-on training for new and experienced users.



HORIBA Worldwide



www.ramanacademy.com

Free learning tools for new and experienced Raman users. Available to anyone who is interested in learning more about Raman.

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

