



future's  
in the making

# RAMOS

## Confocal Raman Microscopes



מבית  
המדרש  
החדש  
של  
התורה

## Content

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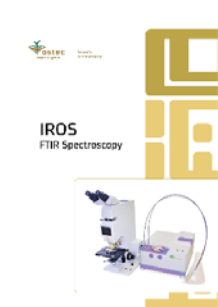
Ostec Instruments produces and offers hi-tech innovative scientific and analytical equipment.

Our mission is to be a company that finds, selects, protects and develops cutting-edge ideas to create new products and technologies and deliver technological progress. That is why the symbol of our company is a growing sprout.

We provide complete solutions for our clients: the best equipment to meet customer's requirements, deep knowledge of customer's applications, qualified and reliable maintenance support.



OUR other products:



IROS FTIR Spectroscopy



IROS P series Industrial FTIR Spectrometers



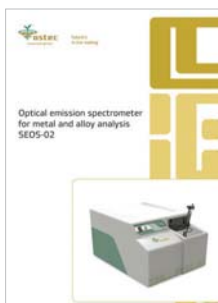
OCOS Optical components



LIOS 500N Laser elemental analyzer



AVOS Vibration control solutions



SEOS 02 Optical emission spectrometer



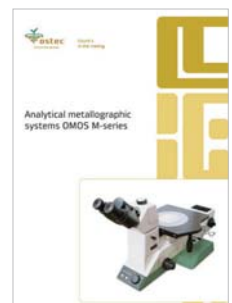
NIOS Nanomechanical testers



Accessories for Scanning Probe Microscopes



FiPOS ATR fiber probes



OMOS M series Analytical metallographic systems

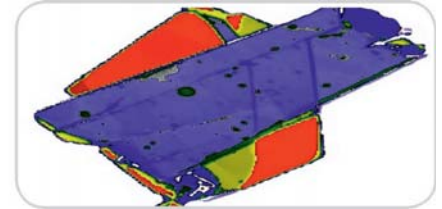
# RAMOS N500

## 3D Scanning Laser Raman Microscope



## Simultaneous multifunctional analysis

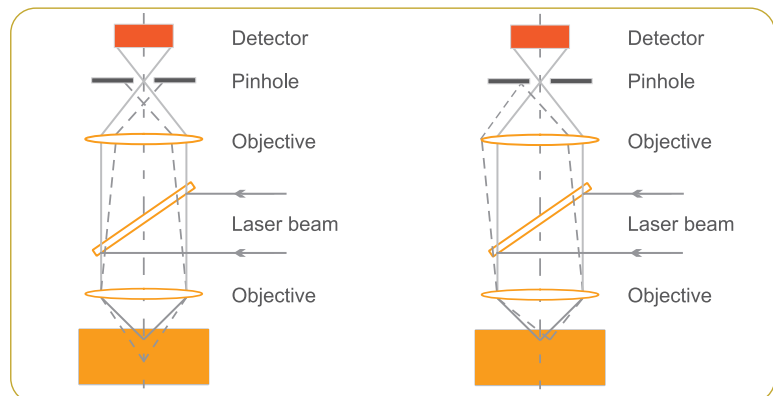
- Raman Measurements
- Luminescence Measurements
- Laser Reflection & Transmission Measurements
- Spectral and Polarization measurements



3D high-contrast images in reflected light  
3D confocal Raman measurements

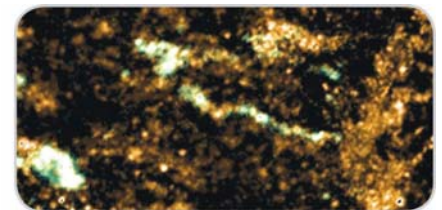
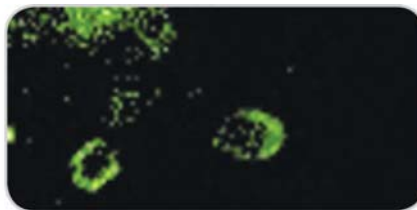
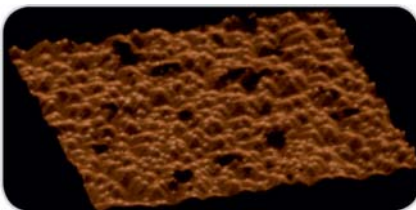
## Confocal detection principle

Confocal Laser Scanning Raman Microscope has become a widely recognized research instrument in recent years. Confocal microscopy offers several advantages over conventional widefield optical microscopy, including the ability to control depth of field, elimination or reduction of background information away from the focal plane and the capability to collect serial optical sections from thick samples. The image of the extended sample is generated by scanning the focused laser beam across a defined area.

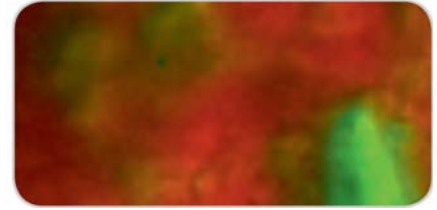
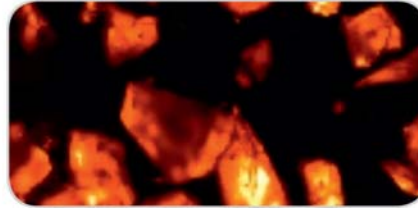
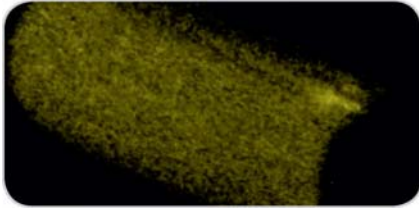


The pinhole aperture rejects the residual scattered rays originated from any out-of-focus points on a sample.

We have created the instrument that is right for you



## High spectral resolution



Spatial resolution: less than 200 nm (in plane) and less than 500 nm (in Z)

Spectral resolution:  $\sim 0.25 \text{ cm}^{-1}$

Wavelength accuracy in spectrum with CCD detector: 0.005 nm (1800 l / mm)

## Applications

### Semiconductors

High spatial resolution Raman confocal microscopy can provide information on dopant concentrations and stress distribution in semiconductor materials.

### Geology

Confocal Raman microscopy is an excellent technique for characterization of minerals, detection of components distribution and their phase transitions.

### Material science

Confocal Raman offers excellent spatial resolution for characterization of materials (superconductor, polymers, coatings, composites, carbon nanotubes, graphene, etc.)

### Biology

Raman spectroscopy allows easy visualization of cellular components with minimum perturbation.

### Cosmetology

Confocal Raman microspectroscopy is a promising technique which enables measuring the skin care products as well as their penetration capability.

### Heritage and Art, Gemology

Raman spectroscopy allows identification of pigments and binders used in paintings. The spectroscopic analysis of archaeological samples (ceramics, glasses, etc.) provides information on their origin and history. Raman technique allows rapid identification of colored stones, natural and synthetic diamonds.

### Pharmaceutics

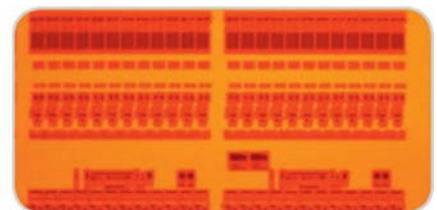
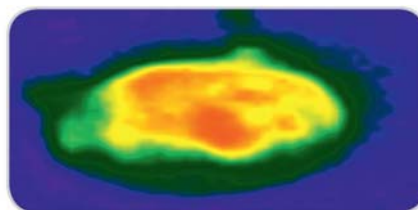
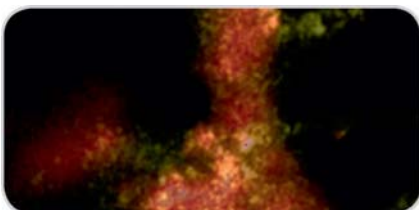
Confocal Raman spectroscopy allows chemical compounds and molecular conformers in various drugs to be identified and their distribution mapped with high spatial resolution.

### Forensics

Application areas include identification of unknown substances, different types of fibers, glasses, paints, explosive materials, inks, narcotic and toxic substances, proof of authenticity of documents.

and many more...

Raman megapixel image for 3 sec  
Fully automated system with up to 5 integrated lasers



## High spatial resolution and sensitivity

### Major features

The highest spectral and imaging resolution with specially designed spectrometer

Specially designed imaging spectrometer incorporates many features that makes it ideal for confocal Raman measurements. The image of pinhole is projected to a multichannel detector without any aberrations.

The smaller amount of illuminated pixels on the CCD matrix leads to the smaller dark counts and the higher spectral resolution.

Spectral resolution of RAMOS N500 with an Echelle grating is  $0.25 \text{ cm}^{-1}$ .

High optical throughput for enhanced sensitivity

The 4th order Silicon band at  $1940 \text{ cm}^{-1}$  can be observed in less than one minute using a low intensity laser.

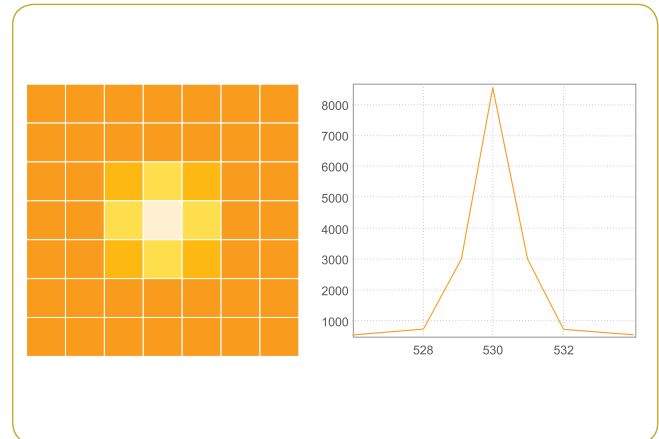
2D / 3D images can be acquired rapidly.

Fully automated

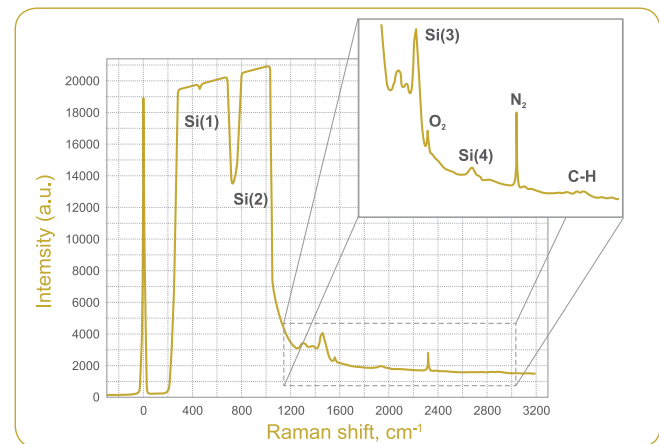
Raman spectrometer RAMOS N500 is highly modular and fully automated. Up to 5 lasers can be used in a single system with no manual filters/grating changes.

The lasers can be switched from one to another by just one click.

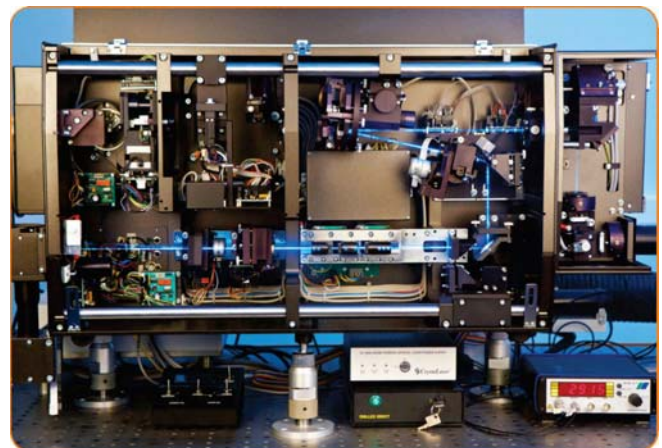
Motorized control for laser power, beam diameter, polarization orientation, pinhole size and grating is provided.



Spectral image of the pinhole on the CCD camera (aberration free).  
CCD pixel size is  $12 \mu\text{m}$ .



Silicon 4th order sensitivity.



Fully automated system



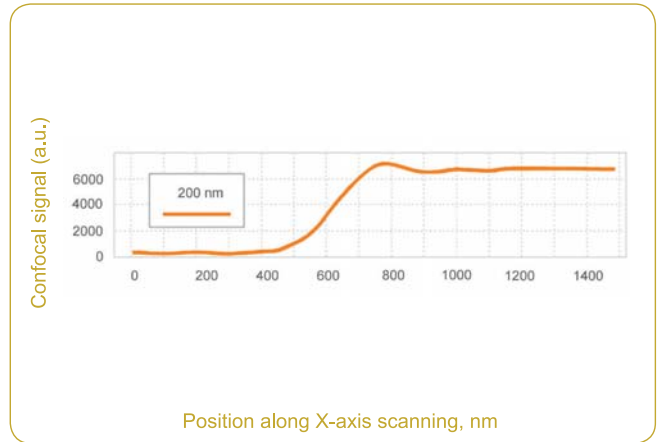
# True confocal design with variable cross-slit

## High spatial resolution

Confocal Raman microscope RAMOS N500 can achieve:

- lateral resolution close to theoretical limitation

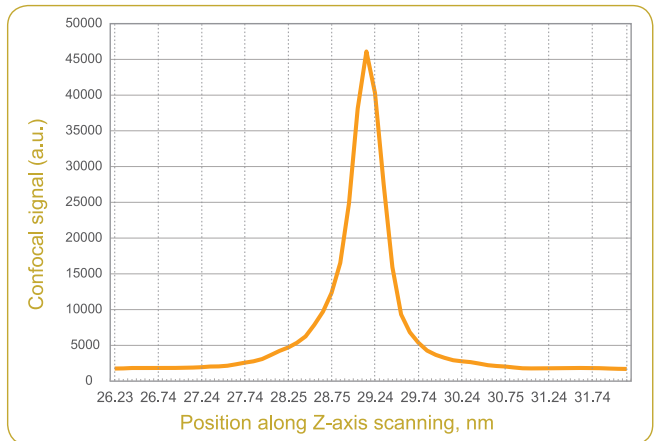
Laser wavelength, nm	Objective	XY - plane resolution, nm
488	100x, NA = 0.9	250
532	100x, NA = 0.9	275
633	100x, NA = 0.9	320
785	100x, NA = 0.9	390



RAMOS N500 can take high definition Raman images ( $\lambda = 514$  nm, 100x, NA = 1.4).

- axial resolution (in depth direction, 100x, NA = 0.9)

Laser wavelength, nm	Z (axial) resolution, nm
488	520
532	560
633	660
785	800



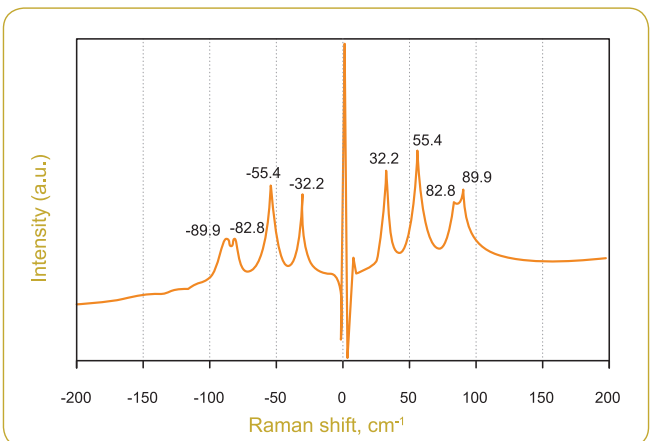
Axial resolution of 450 nm ( $\lambda = 488$  nm, 100x, NA = 0.95).

## Wide Raman shift measurement range

Raman shift measurement range with Edge filters

Laser wavelength, nm	Wavenumber range, $\text{cm}^{-1}$
325	125 - 8000
355	115 - 8000
473	80 - 6000
532	50 - 8000
633	50 - 6000
785	40 - 2800

Low frequency Raman shift measurement range can be expanded using Bragg notch filters.



Low frequency Raman bands of Acetaminophen (Stokes and Anti-Stokes bands) are detectable as close as 7  $\text{cm}^{-1}$  to the laser line

## Megapixel Raman image for 3 sec

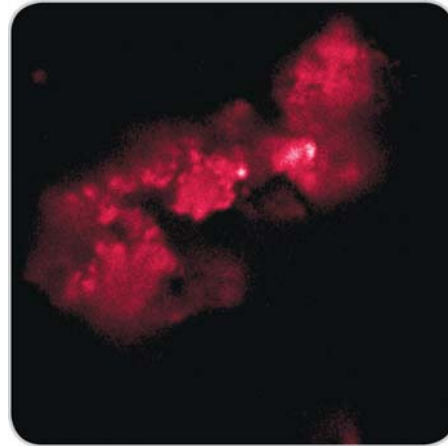
### Ultrafast Raman imaging

3D scanning laser confocal Raman microscope RAMOS N500 provides the acquisition of two images within a single scan: a Rayleigh image (using laser light reflected from a sample) and a spectral image by Raman scattering.

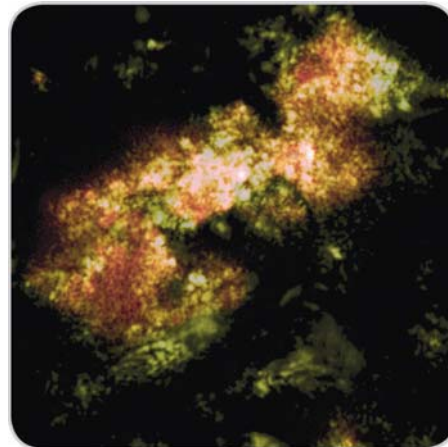
Ultrafast imaging option allows to get confocal image in 3 sec (3  $\mu$ s/pixel).

RAMOS N500 uses fast beam scanning by galvanic mirrors.

Layout of galvanic mirror scanner module allows mapping with no intensity losses from image center to its edges.



Rayleigh image of Granite Gneiss India.  
Anatase distribution (1000 x 1000 pixels, time per 1 pixel is 3  $\mu$ s).



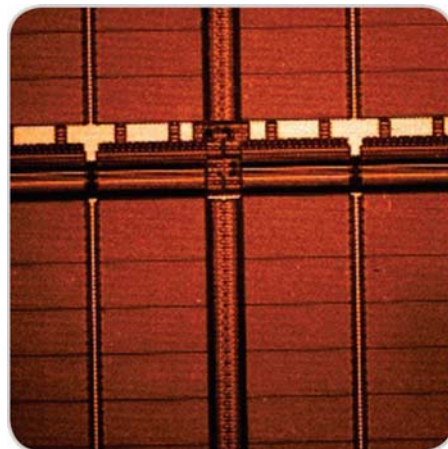
Raman image of Granite Gneiss India.  
Anatase distribution (1000 x 1000 pixels, time per 1 pixel is 43  $\mu$ s).

### Fast imaging mode with EMCCD / CCD

RAMOS N500 system can be used with a number of different detectors.

Up to three detectors can be used simultaneously. Proprietary algorithm for taking high speed of Raman imaging with fast spectral CCD (EMCCD) is offered.

The use of an EMCCD (Electron Multiplying CCD) camera can greatly increase Raman detection efficiency and speed.



Raman image of Silicon / SiO<sub>2</sub> sample.  
Si distribution (500 x 500 pixels, time per pixel is 5 ms).

## Fully automated system

## Software package with powerful analytical functionality

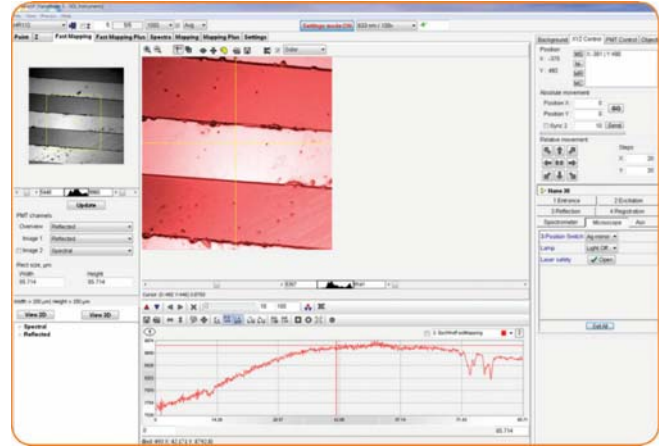
### Ultrawide field Raman imaging

Uniform, large size scanning area of a galvanic scanner module:

- 150  $\mu\text{m}$  x 150  $\mu\text{m}$  (objective lens 100x)
- 320  $\mu\text{m}$  x 320  $\mu\text{m}$  (objective lens 40x)
- 680  $\mu\text{m}$  x 680  $\mu\text{m}$  (objective lens 20x)

Automatic XY stage can be used for ultrawide field imaging.

The panoramic image (hyper image) by automatic stitching of a series of images obtained with the use of galvanic scanner.



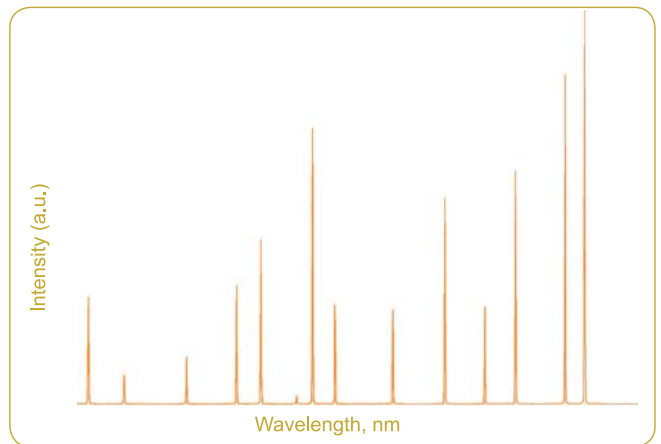
### High precision spectrometer calibration

RAMOS N500 is equipped with a neon lamp (option) for spectral calibration.

Calibration is possible at any wavelength by one click in the software.

### More capabilities

- microscope can be equipped with a heating or cooling stage, vacuum or high pressure cell
- fiber optics probe for remote measurements



### Data Acquisition and Data Analysis software

RAMOS N500 software "Nano SPO" with powerful analytical functionality is designed for hardware operating, data acquisition and data analysis.

2D and 3D image creation

Autofocus control during mapping

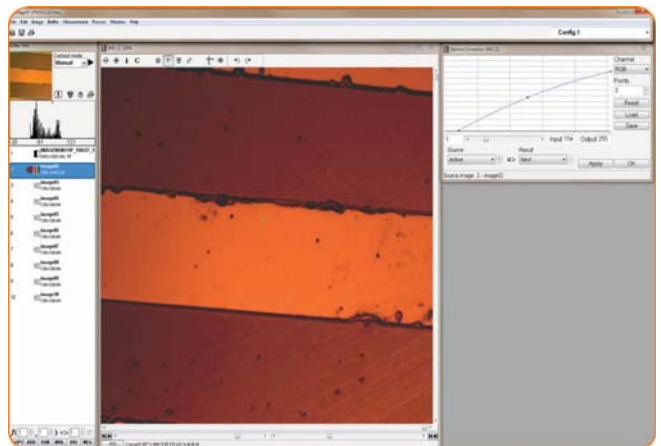
Automatic background subtraction, cosmic ray removing, peak shift imaging, etc.

Support for external spectral databases

Data export to popular file formats

Intuitive user-friendly interface

Compatible with Windows XP, Vista, 7



## Specification

*MICROSCOPE		
Type:	inverted Nikon Ti-S and upright Nikon Ni-U	
*Objective lenses:	CFI Plan Fluor 4x, 10x, 20x, 40x, 60x, CF Epi Plan APO 100x	
Stage:	automated	
- travel range:	114 x 75 mm	
- accuracy (1 mm of translation) / XY repeatability:	0.06 $\mu\text{m}$ / $\pm$ 1 $\mu\text{m}$	
Z-scanner:	piezo scanner	
- objective translation range:	80 $\mu\text{m}$	
- minimal translation step / repeatability:	50 nm / < 6 nm	
OPTICAL-MECHANICAL UNIT (OMU)		
Optimized optics for the spectral range:	325 - 1100 nm	
Laser radiation delivery:	single, double, triple or penta input port	
Polarizers (excitation and detection channels):	Glan-Taylor prizm, 325 - 1000 nm	
Half-wave plate ( $\lambda / 2$ ) positioner:	automated three- / five-position	
Beam expander:	automated vario telescope, magnification factor 1 - 4	
Edge filter positioner:	automated three- / five-position	
Interference filter positioner:	six-position	
OMU and microscope coupling:	three- or five- position switch	
IMAGING MONOCHROMATOR-SPECTROGRAPH MSO 5004i		
Optical configuration:	vertical	
Focal length:	520 mm	
Imaging spatial resolution (aberration limited):	compensated, < 5 $\mu\text{m}$	
Ports:	1 input, 2 output	
Flat field:	28 x 10 mm	
Grating unit:	automated 4-position turret	
Grating choice:	150, 300, 600, 1200, 2400, 3600, l / mm, Echelle (75 l / mm)	
Spectral resolution:	0.25 $\text{cm}^{-1}$ Echelle grating, wavelength 500 nm	
	0.9 $\text{cm}^{-1}$ (1800 l / mm grating)	
Confocal pinhole:	width 0 - 1.5 mm; step size 1 $\mu\text{m}$	
Wavelength accuracy with CCD camera:	0.005 nm (1800 l / mm grating)	
SCANNING UNIT		
Scanning method:	galvanometer scanners of with X, Y mirrors	
Max. Scanning speed:	3 sec (1001 x 1001 pixels, min step 20 nm)	
Scanning region:	150 $\mu\text{m}$ x 150 $\mu\text{m}$ (using 100 $\times$ objective lens)	
CCD CAMERA FOR SPECTROGRAPH		
Type:	digital CCD camera HS101H	
Sensor:	back-thinned CCD array 2048 x 122	
Pixel size:	12 x 12 $\mu\text{m}$	
Cooling:	Two-stage Peltier cooling with temperature stabilization to - 45 $^{\circ}\text{C}$	
Dynamic range:	1000	
CONFOCAL LASER MICROSCOPE UNIT		
Pre-pinhole objective positioner:	three-coordinated (X, Y, Z)	
Laser beam attenuator:	VND filter	
Confocal pinhole:	variable from 0 to 1.5 mm, step size 1 $\mu\text{m}$	
Detector:	PMT	
LASERS		
The system configuration allows of using up to 5 lasers:		
Type:	Wavelength, nm	Power, mW
HeCd laser:	325	10, 15, 30, 40, 50
HeCd laser:	441.6	50
DPSS laser:	473	22      50
DPSS laser:	532	22      50
Helium-neon laser:	633	10
Semiconductor laser:	785	100

\* Microscope, objective lenses and type of lasers can be offered on customer's request

## RAMOS E/M series

### 3D scanning laser Raman microscopes provide rapid, high sensitivity analysis and unprecedented convenience in use.

RAMOS E/M Series Raman spectrometers are designed on the basis of research grade optical microscopes allowing realization of the following light microscopy methods:

- Raman measurements
- Transmitted light
- Reflected light (bright field and dark field illumination)
- Confocal microscopy
- Fluorescence measurements
- Polarization contrast and phase contrast imaging
- Differential interference contrast

The innovative approach to system design of Raman spectrometers ensures extremely high temperature and temporal stability of spectral measurements.

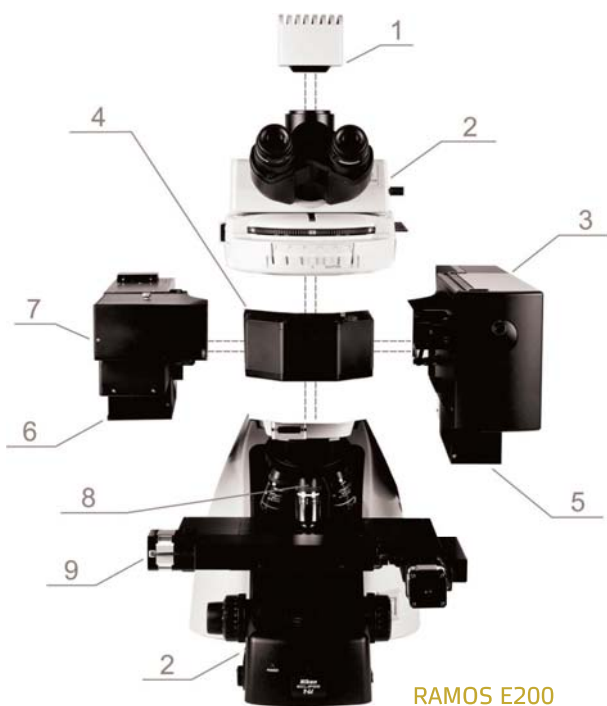
All components of RAMOS E200 system are fully integrated within an optical microscope providing compactness and mobility of the system.

In RAMOS M350, M520, M750 systems external imaging spectrographs are connected via optical fibers.

Raman measurements with the RAMOS E/M Series systems can be started in several minutes by turning a system key.

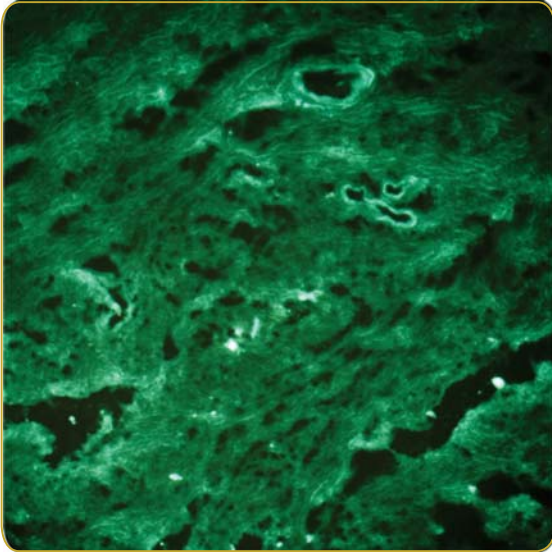


RAMOS E/M Series



RAMOS E200

1. High resolution colour video camera for a sample observation
2. Optical microscope
3. Raman optical module
4. Automated 3-position turret with mirrors for input / output radiation
5. Confocal laser microscope module ("Reflection" module)
6. Two-channel imaging spectrometer
7. XY galvano mirror scanner
8. Z piezo scanner
9. Automated microscope stage

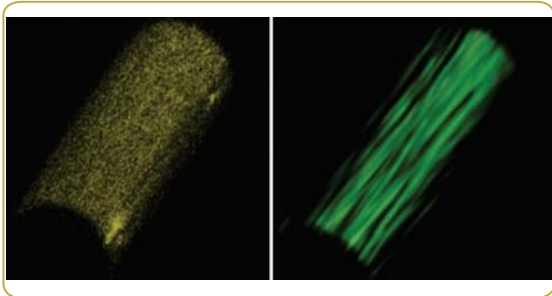


Confocal Raman microscope with scanning speed of 1000 x 1000 pixels within total acquisition time of 3 sec

Fast raster and start-stop scanner operational modes

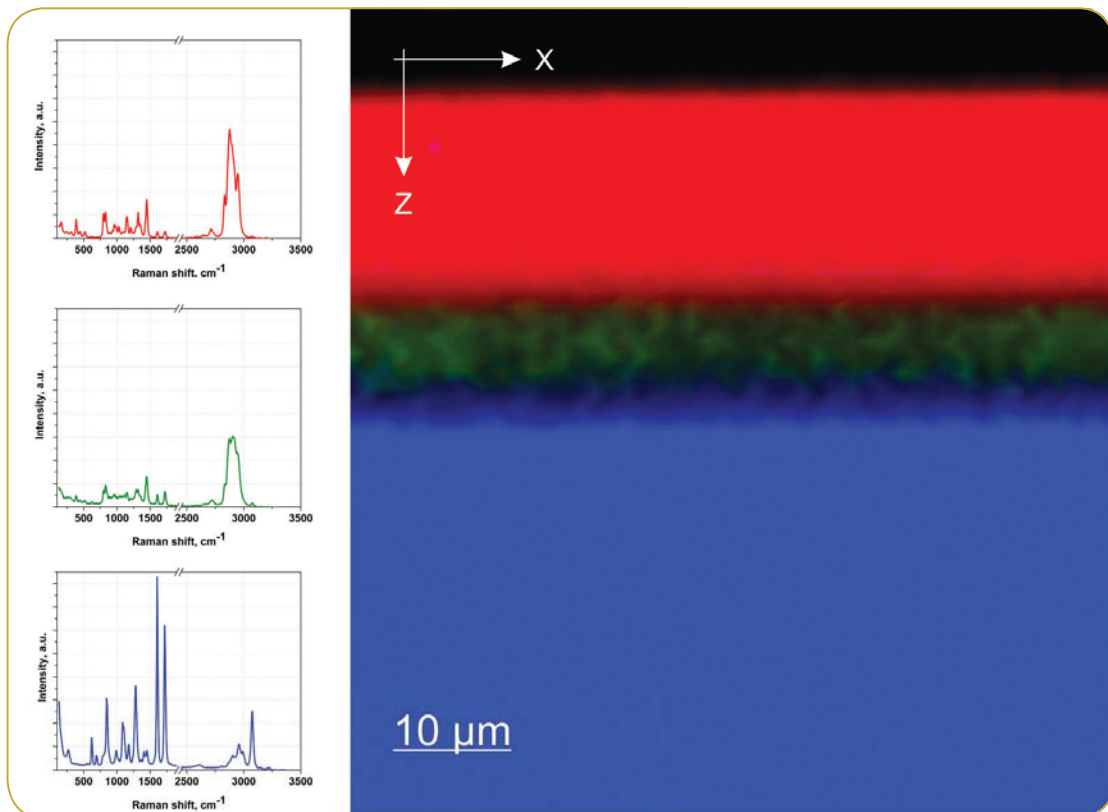
Spatial resolution of confocal images (100x, NA = 0.95)

Laser wavelength, nm	XY - plane resolution, nm	Z (axial) resolution, nm
473	390	550
532	440	620
633	520	730
785	650	910

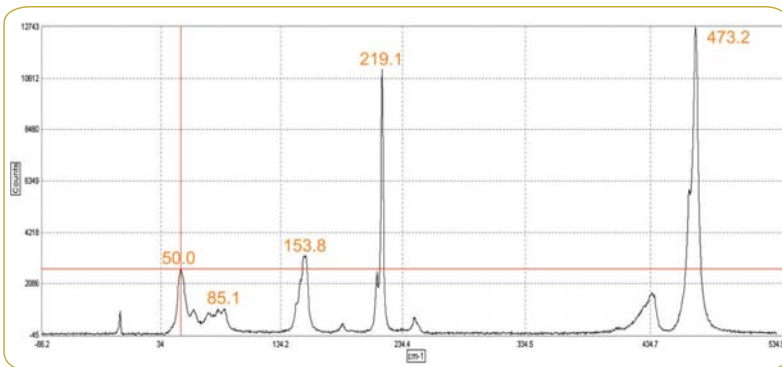
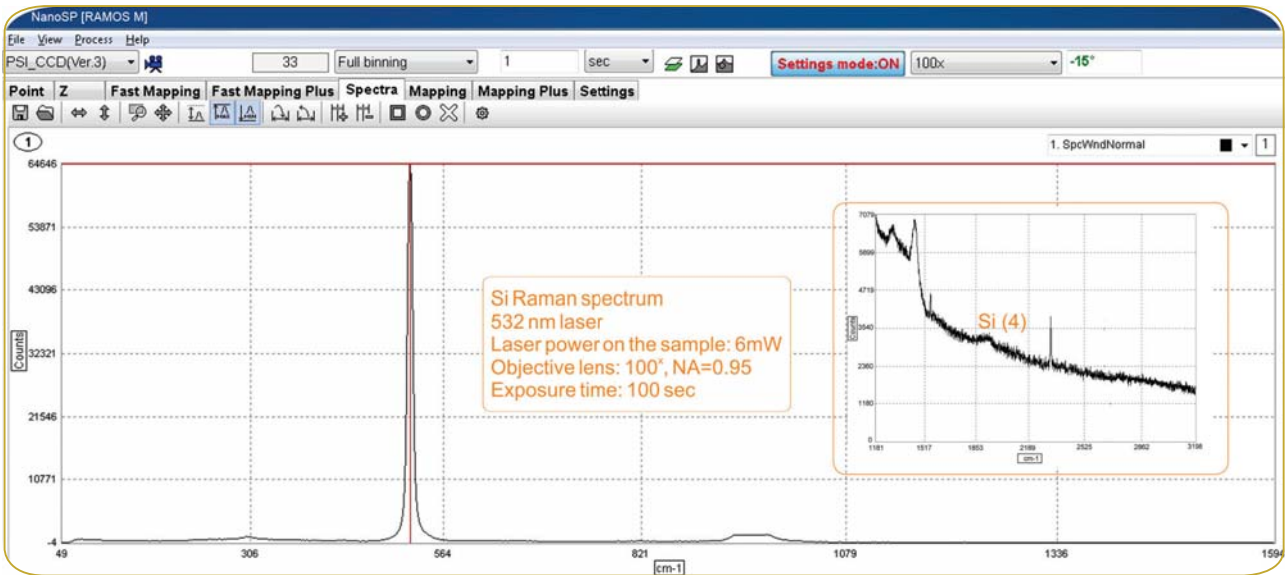


Simultaneous 2D / 3D laser confocal and Raman imaging with full spectra saving in each point

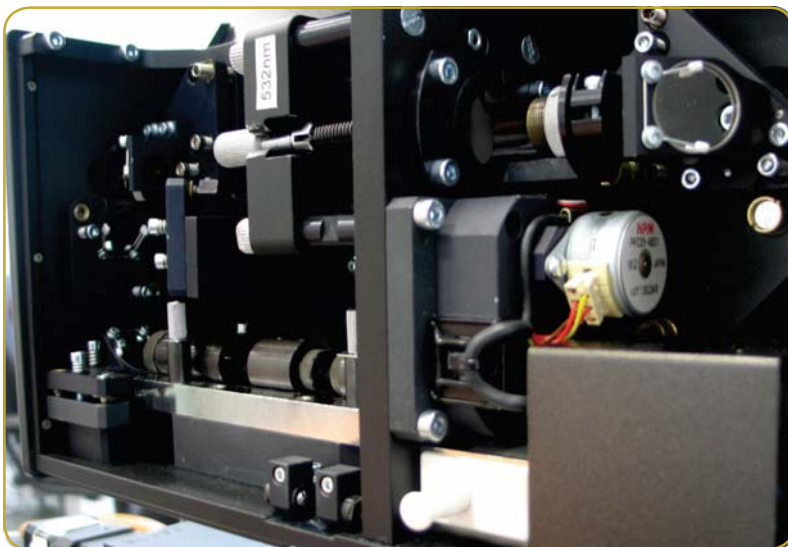
Confocal imaging of deep sample layers



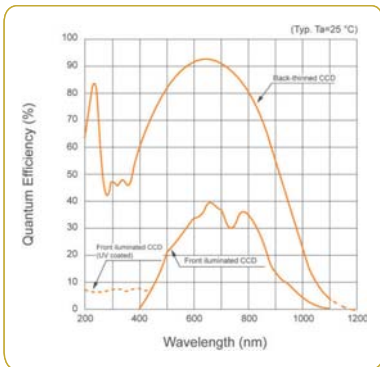
High-performance optics ensures super system sensitivity and high signal-to-noise ratio (S/N ratio)



Wide spectral range, ultimate accuracy of Raman shift measurements, high spectral resolution



Fast system configuration changing (lasers and filters switching) without additional system alignment



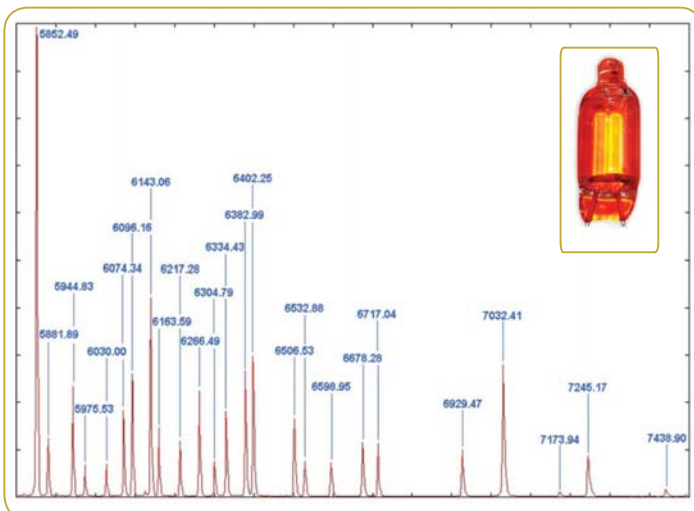
Extremely sensitive detectors for Raman signal registration

- Spectral CCD camera provides outstanding performance due to the increased number of pixels (the number of pixels is 2048) and the smaller pixel pitches (12 x 12 μm)
- Photodetector quantum efficiency is up to 95%. Low dark signal level due to two-stage thermoelectric sensor cooling
- Detectors operating internal memory with the capacity of up to 128 MB
- High speed Ethernet interface for data transfer



The system may be completed with the following options:

- Automated XY stage for ultra wide field of scanning
- High temperature and vacuum cells
- Cryostat
- Remote fiber probe



High-precision spectrometer calibration

RAMOS E/M Series spectrometers can be optionally equipped with a neon lamp for high-accuracy spectral calibration



## Specification

	RAMOS E 200	RAMOS M 350	RAMOS M 520	RAMOS M 750
Image acquisition mode:	3D (XYZ) confocal laser and Raman images			
Scanning type:	XY galvano-mirror scanners XY motorized stage (option) Z piezo scanner			
Scanning speed:	1000 x 1000 pixels per 3 sec (3 μs/pixel)			
Spatial resolution:	XY: 440 nm, Z: 620 nm (532 nm laser, 100 <sup>x</sup> , NA = 0.95)			
Spectral range:	50 – 8500 cm <sup>-1</sup> (532 nm laser)	50 – 9700 cm <sup>-1</sup> (532 nm laser)		
Excitation source:	Build-in 473 nm or 532 nm laser, connection of additional external lasers 455 nm, 633 nm, 785 nm is possible			
Laser beam attenuator:	Automated unit with VND filter, continuously changeable from 0.1% to 100%			
Reyleigh rejection filters:	A pair of Edge filters with cut-off starting from 50 cm <sup>-1</sup> (for 532 nm laser)			
Spectrometer configuration:	2-channel imaging spectrometer directly coupled to a microscope	External imaging spectrograph		
Focal length:	200 mm	350 mm	520 mm	750 mm
Spectral resolution (for 532 nm laser):	1 cm <sup>-1</sup> /pixel (grating 2400 gr/mm) 2 cm <sup>-1</sup> , FWHM (grating 2400 gr/mm)	1.60 cm <sup>-1</sup> (grating 1800 groove/mm)	0.76 cm <sup>-1</sup> (grating 1800 groove/mm)  0.25 cm <sup>-1</sup> (Echelle grating)	0.44 cm <sup>-1</sup> (grating 1800 groove/mm)
Number of gratings:	2 gratings, 4 optionally	4 mounted on motorised turret, more gratings with manual changing		
Detection system:	CCD sensor 2048x122 pixels, with Peltier cooling	CCD sensor 2048x122 with two-stage cooling, quantum efficiency upto 95%		
Options:	Heating & cooling stages, fiber optic probe, EMCCD sensor for ultimate Raman mapping speed			

FLIM option is available.

Combination with AFM is possible.

RAMOS M350

Compact confocal Raman microscope RAMOS M350 is intended for various spectral measurements with submicrometer scale image resolution. The device features a high throughput and a high spectral resolution.



RAMOS M520

Confocal Raman microscope RAMOS M520 with high-end class capabilities is applicable for spectral measurements with submicrometer scale image resolution. The device possesses all features of M350, but ensures the enhanced spectral resolution.



RAMOS M750

Confocal Raman microscope RAMOS M750 is perfect for spectral measurements with the extremely high spectral resolution.



Up to two detectors can be used simultaneously in the above three system models .

The intuitive for anyone, powerful RAMOS NanoSPO software package has a user-friendly interface. RAMOS NanoSPO software delivers a unique environment for instrument control, data collection and data processing.

Control of all automated units and modules

The screenshot displays the control interface for the RAMOS NanoSPO. It is divided into several sections:

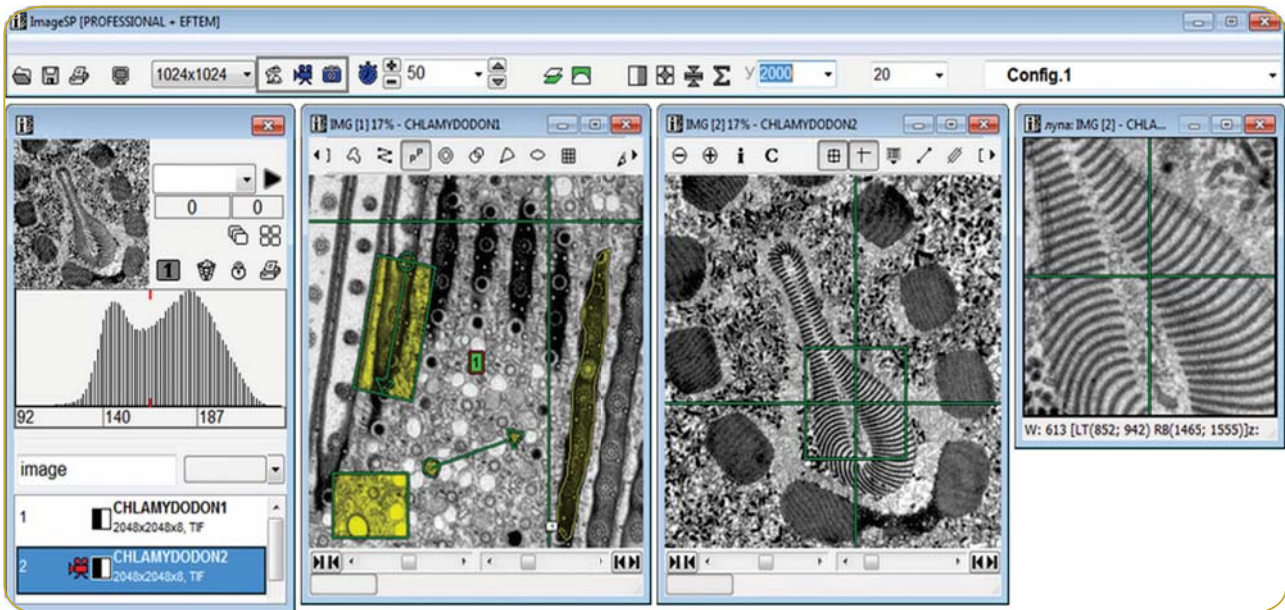
- Position:** Shows coordinates X: 0, Y: 0 and target coordinates X: 167 | Y: -17495 and X: 222 | Y: -17223. Buttons for MS, M-, MR, and MC are visible.
- Absolute movement:** Includes input fields for Position X (0) and Position Y (0), a 'GO' button, and a 'Send' button for Sync 2 (10).
- Relative movement:** Features directional arrow buttons and a 'Steps' section with X: 10 and Y: 10.
- Spectrometer:** A detailed control panel for the spectrometer with the following settings:
  - Shutter 1: Open
  - Shutter 2: Closed
  - ND filter: 3.000
  - step: 1
  - Shutter: Open
  - Pinhole: 600 um
  - Exit Slit: 1000 um
  - Grating: Grating 600/600
  - Wavelength: 547.0566 nm
  - Max WL: 3246.7476, D, nm/mm: 3.1824
  - Exit Mirror: CCD
  - 3-Pos switch: Ag mirror
  - Laser safety: Open

- easy in use
- no need in a user's special training
- intuitive apprehensible interface
- convenient software HELP
- multiscreen operation

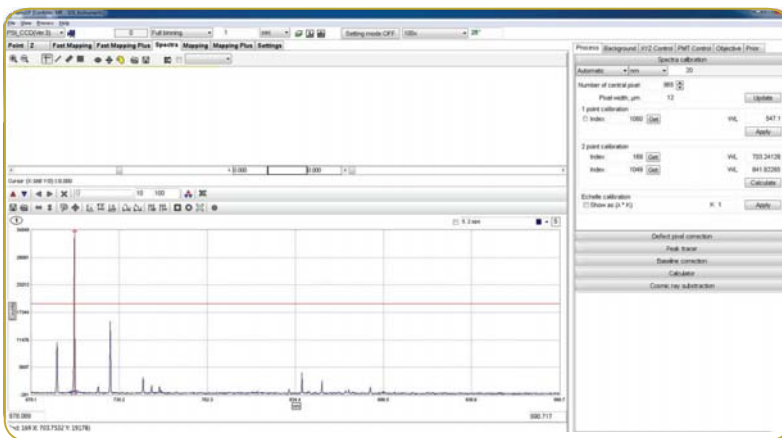
Raman and/or fluorescence spectra detection, confocal laser and spectral imaging

This screenshot shows the full RAMOS NanoSPO software interface. The central area displays a 2D spectral image with a corresponding 3D topographic view. Below these images is a Raman spectrum plot with a y-axis labeled 'Counts' and an x-axis labeled 'Wavenumber'. Two peaks are highlighted with vertical lines and labeled '1600.07' and '1571.44'. The interface includes a top menu bar, a left sidebar with 'Fast Mapping Plus' and 'Spectra' tabs, and a right sidebar with control panels for 'Position', 'Absolute movement', 'Relative movement', and 'Spectrometer'.

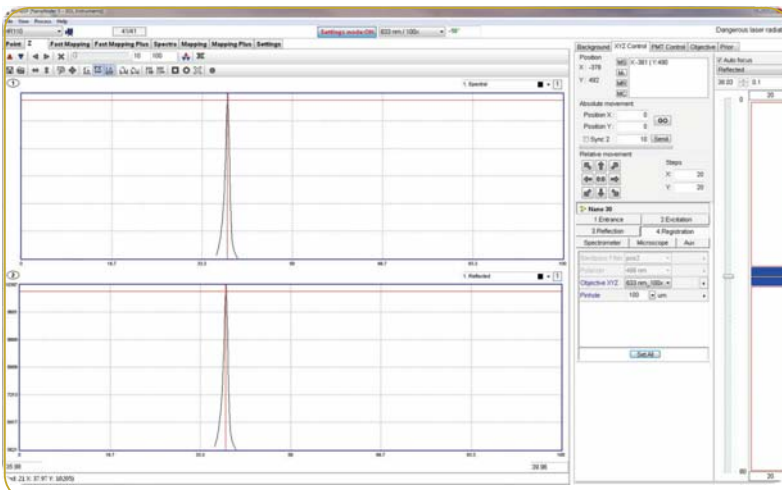
RAMOS E/M Series and statistical image processing



- distances and areas measurements
- minimum, maximum, sum, root mean square deviation, etc. determination
- cross sections

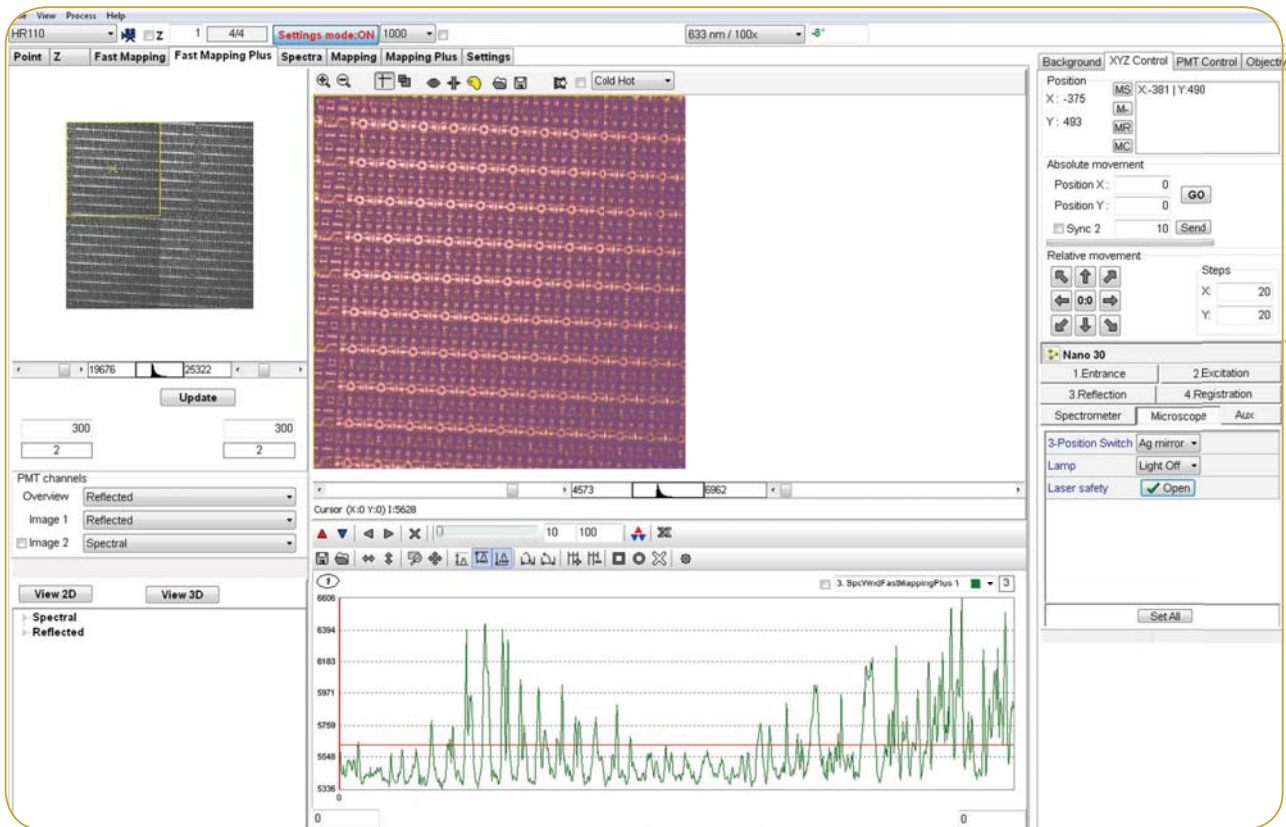


Automated spectral calibration with the built-in source

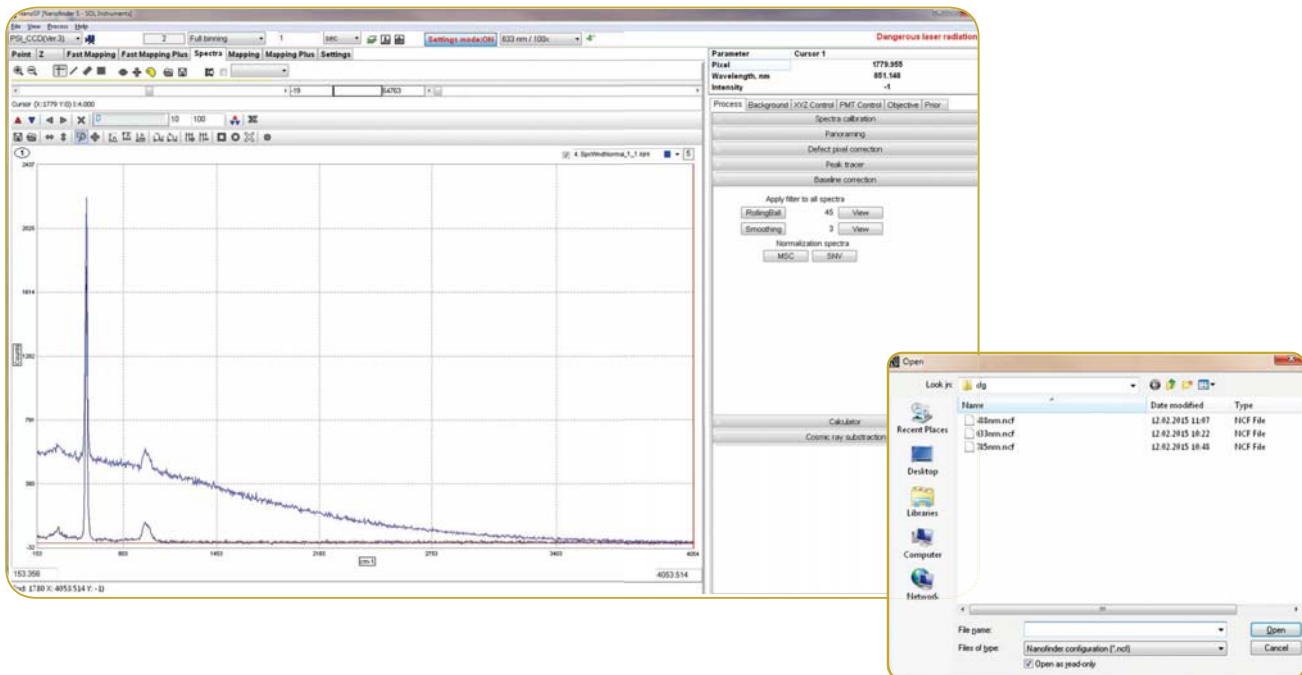


Automated focusing with the confocal laser microscope module ("Reflection" module)

Rapid panoramic mapping of a large sample area with the use of a galvano mirror scanner and an automated stage

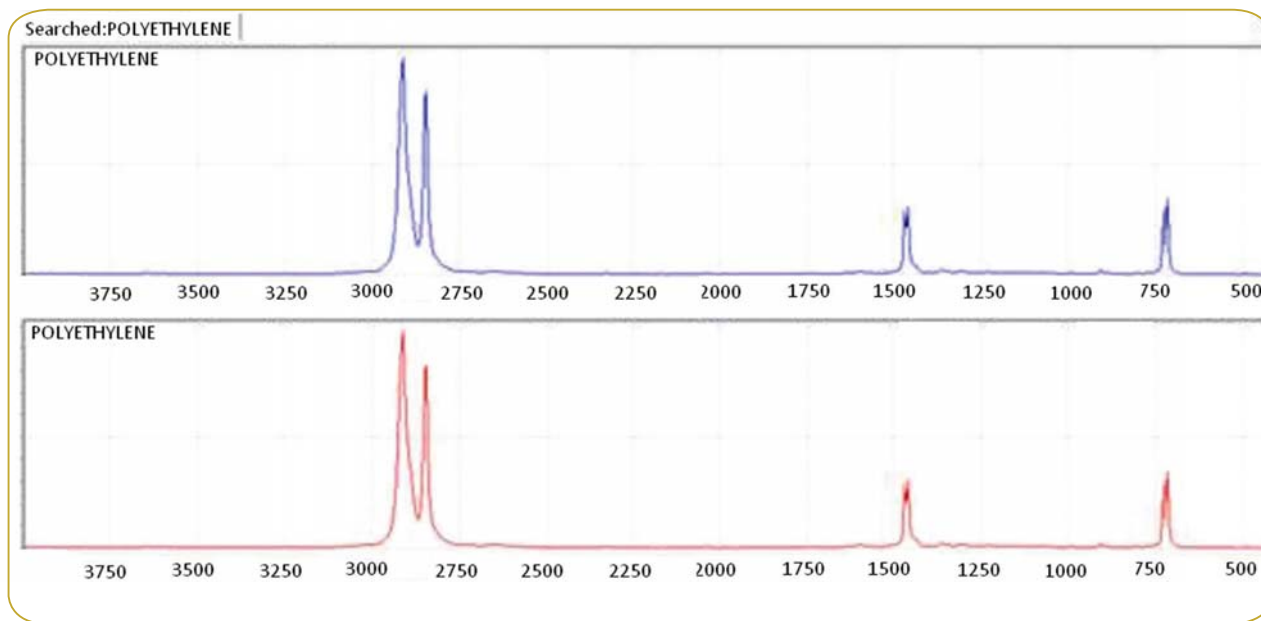


Automated fluorescence background subtraction, mathematical operations with spectra, spectra stitching, peak fitting, cosmic ray removal, etc.



Functional processor, experiment automation and program configuring

Link to the Raman spectral database



Chemometric software program package as an option

The screenshot displays the RAMOS software interface. On the left, a Raman spectrum is shown with a y-axis from 0 to 4000 and an x-axis from 1800 to 200 cm⁻¹. A menu is open over the spectrum, listing various processing options such as Integrate, Crop Data, and Peak Picking. On the right, the 'Functional Group Analysis of Yaman™' window is active, showing a zoomed-in view of the spectrum with several peaks highlighted in green. Below this window are two tables: 'Corresponding Chemical Classification Rules' and 'Matching Functional Groups'.

Corresponding Chemical Classification Rules				
Vibration	Start Wavenumber	End Wavenumber	Threshold	Priority
C-F Def	620	510	Weak	Hi
C-F Def	770	650	Weak	Ver
C-F Stretch	1200	1105	Variable	Hi
C-F Stretch	1290	1175	Variable	Hi
C-F Stretch	1375	1260	Variable	Hi

Matching Functional Groups		
Quantity	Functional Group	Chemical Class
100	C-F stretch	Fluorine compound
99	Aryl Ether, Aryloxy (possible +sub)	Phenoxy or Aryloxy Ether
90	Aliphatic Sulfide	Aliphatic Sulfonyl compound
90	Inhibitory Substituent	Substituent Group
66	Methyl Mercapto	Aliphatic Thioether
61	Ethoxy Silane	Silyl Ethers
61	Linear Chloro Compound	Aliphatic Chlorinated Compound
53	Linear Bromo Compound	Aliphatic Brominated Compound
53	Unsaturated Hydrocarbon, Cyclic, > C5	Alkene

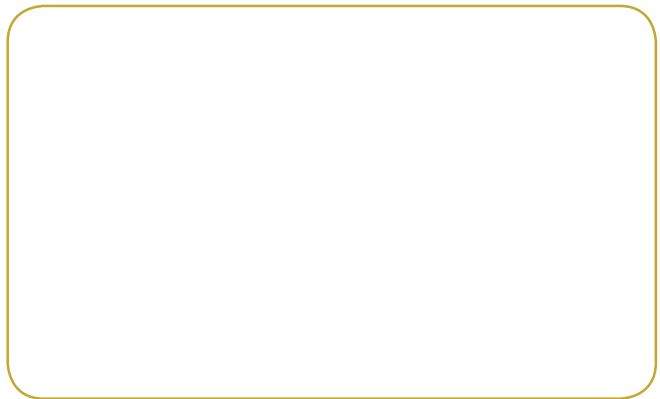




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All configurations and specifications are subject to change  
without notice