

## LabRAM Soleil Nano™

Real-time and Direct Correlative  
Nanoscopy

Fully integrated system based on the **OmegaScope** scanning probe microscope and the **LabRAM Soleil** Raman microscope

- Direct co-localized AFM-Raman/ Photoluminescence (PL) measurements
- Simultaneous or sequential AFM and Raman/ PL acquisitions
- Tip-Enhanced Raman and Photoluminescence Spectroscopy (TERS/ TEPL)
- Compatible with the environmental chamber for the OmegaScope



LabRAM Soleil Specifications		
<b>Optical microscope (standard):</b>	Open Space / Upright*	Nikon Series Research Open Space Microscope <ul style="list-style-type: none"> <li>• 200 mm space under objective turret, ideal for large samples</li> <li>• 5 MegaPixel camera</li> <li>• White light reflection illumination</li> <li>• 5x, 100x objectives including SmartID™ automatic recognition using NFC technology<sup>(1)</sup></li> <li>• Wide range of long working distance* and other objectives*, including Schwarzschild 74x objective* (NA: 0.65) for fully achromatic capability from sample to objective</li> <li>• White light transmission illumination* with independent Z axis. Can accommodate samples up to 55 mm thick</li> </ul>
<b>Spectral range:</b>	UV-VIS-NIR	Standard : 300 nm -1600 nm
<b>Built-in Lasers:</b>	Up to 4	532 nm (included) & user selectable*: 405 nm, 473 nm, 638 nm, 785 nm. Fully motorized and computer controlled (non-exhaustive list)
<b>External Lasers:</b>	Unlimited	325 nm HeCd and other gas lasers, ultrafast lasers...
<b>Laser filters:</b>	Up to 6 motorized	Dielectric Edge (standard) & user selectable*: Notch filters, VBG Notch filters and long pass filters for Raman and Photoluminescence measurements
<b>Laser power control:</b>	Down to 0.01 %	25 position neutral density filter wheel, guaranteeing fine tuning of laser power
<b>Number of gratings:</b>	Unlimited	EasySwap 4 grating fully computer-controlled turret. Turrets easily exchanged by users within seconds
<b>Open Electrode CCD (standard):</b>	HORIBA <i>Sincerity</i> ™ or equivalent	HORIBA manufactured, high efficiency versatile deep cooled (-60°C) open electrode CCD- Recommended for users with wide range of applications, multi-user facilities and multi laser configurations. 1024 x 256 pixels, 26 µm width
<b>EMCCD*</b>	HORIBA <i>SynapseEM</i> ™ or equivalent	HORIBA manufactured, electron multiplying deep cooled front illuminated CCD for ultrafast imaging Recommended for acquisition times below 100 ms per spectrum 1600 x 200 pixels, 16 µm width

Spectrometer Detailed Specifications	Ultimate capability <sup>(2)</sup>	Typical Specification <sup>(3)</sup>
<b>Throughput from laser to microscope:</b>	> 70 %	> 60% at 532 nm and 785 nm laser, measured with standard configuration and an 5X objective, measured at the sample
<b>Laser auto-alignment* time:</b>	<10 s	< 15 s, sample independent and fully computer controlled, routine can be run remotely
<b>Super-Low frequency cut-off (Standard):</b>	15 cm <sup>-1</sup>	< 30 cm <sup>-1</sup> measured on sulfur Built-in motorized filter holder to optimize cut-off according to spectroscopic mode, sample scattering and reflectivity
<b>Ultra-Low frequency cut-off*:</b>	5 cm <sup>-1</sup>	< 10cm <sup>-1</sup> at 532, 638 and 785nm lasers, VBG technology
<b>Spectral resolution FWHM:</b>	<0.3 cm <sup>-1</sup>	<ul style="list-style-type: none"> <li>• at 325 nm excitation wavelength ≤ 4 cm<sup>-1</sup> with 3000 grooves/mm</li> <li>• at 532 nm excitation wavelength ≤ 1.2 cm<sup>-1</sup> with 2400 grooves/mm</li> <li>• at 638 nm excitation wavelength ≤ 1.3 cm<sup>-1</sup> with 1800 grooves/mm</li> <li>• at 785 nm excitation wavelength ≤ 0.9 cm<sup>-1</sup> with 1800 grooves/mm</li> </ul>
<b>Spectral dispersion (luminescence):</b>	< 0.004 nm/pixel	< 0.03 nm/pixel on average with standard 1800 g/mm grating
<b>Spectral scanning speed:</b>	400 nm/s	With standard 600 g/mm grating
<b>Spectral reproducibility:</b>	< 0.05 cm <sup>-1</sup>	< 0.1 cm <sup>-1</sup> . Measured on Si 520 cm <sup>-1</sup> line
<b>Spectral stability RMS:</b>	< 0.01 cm <sup>-1</sup>	< 0.02 cm <sup>-1</sup> RMS Measured on Si 520 cm <sup>-1</sup> line
<b>Spectral scanning linearity:</b>	< ± 0.5 cm <sup>-1</sup>	< ± 1 cm <sup>-1</sup>

OmegaScope Measuring Modes	
<b>Basic modes:</b>	<ul style="list-style-type: none"> <li>• Contact AFM</li> <li>• Semicontact AFM</li> <li>• True Non-contact AFM</li> <li>• Top Mode™</li> <li>• Phase Imaging</li> <li>• Dissipation Force Microscopy</li> <li>• Contact AFM in liquid*</li> <li>• Semicontact AFM in liquid*</li> </ul>
<b>Electrical modes:</b>	<ul style="list-style-type: none"> <li>• Single / Double pass Kelvin Probe Force Microscopy (KPFM) AM and FM</li> <li>• Capacitance Microscopy (SCM)</li> <li>• Single / Double pass Electric Force Microscopy (EFM)</li> <li>• Piezo Response Force Microscopy (PFM)</li> <li>• PFM with High Voltage*</li> <li>• PFM-Top mode™</li> <li>• Conductive AFM*</li> <li>• Conductive AFM High Voltage*</li> <li>• I-Top mode™*</li> <li>• I-V Spectroscopy*</li> <li>• Photocurrent Mapping*</li> <li>• Volt-ampere characteristic measurements*</li> </ul>
<b>Nanomechanical modes:</b>	<ul style="list-style-type: none"> <li>• Lateral Force Microscopy (LFM)</li> <li>• Force Modulation Microscopy (FMM)</li> <li>• Force Curve Measurement (Force Distance (F-D) Spectroscopy and Mapping)</li> <li>• Nanolithography</li> <li>• Nanomanipulation</li> </ul>
<b>Nanospectroscopy:</b>	<ul style="list-style-type: none"> <li>• Confocal Raman, Photoluminescence imaging and spectroscopy</li> <li>• Tip-Enhanced Raman and Photoluminescence (TERS/TEPL)</li> <li>• Near-field Scanning Optical Microscopy (NSOM/SNOM), with fiber-based and cantilever-based SNOM probes*</li> </ul>
<b>Special modes:</b>	<ul style="list-style-type: none"> <li>• Single / Double pass Magnetic Force Microscopy (MFM)</li> <li>• Tunable Magnetic Field*</li> <li>• Shear-force Microscopy with tuning fork (ShFM)</li> <li>• Normal-force Microscopy with tuning fork*</li> </ul>
<b>Other:</b>	<ul style="list-style-type: none"> <li>• Scanning Tunneling Microscopy (STM)*</li> <li>• Scanning Tunneling Spectroscopy*</li> </ul>

OmegaScope Scanner and Base	
<b>Sample scanning range:</b>	100 x 100 x 15 μm <sup>3</sup> (+/-10%)
<b>Non-linearity:</b>	XY < 0.05%, Z < 0.05%
<b>Noise:</b>	<ul style="list-style-type: none"> <li>• &lt; 0.1 nm RMS in XY dimension in 100 Hz bandwidth with capacitance sensors on</li> <li>• &lt; 0.02 nm RMS in XY dimension in 100 Hz bandwidth with capacitance sensors off</li> <li>• &lt; 0.1 nm RMS in Z dimension in 1000 Hz bandwidth with capacitance sensor on</li> <li>• &lt; 0.03 nm RMS in Z dimension in 1000 Hz bandwidth with capacitance sensor off</li> </ul>
<b>Resonance frequency:</b>	XY: 7 kHz (unloaded); Z: 15 kHz (unloaded)
<b>Open loop XY drift:</b>	< 0.5 nm / min
<b>Motorized approach range:</b>	17 mm
<b>Maximum sample size:</b>	40 x 50 mm <sup>2</sup> , 15 mm thickness
<b>Sample positioning: Motorized sample positioning range:</b>	5 x 5 mm <sup>2</sup>
<b>Motorized approach range:</b>	17 mm

OmegaScope AFM Head	
<b>Laser wavelength:</b>	1300 nm No registration laser influence on photovoltaic measurements or on biological sample Avoid optical interferences for Raman application
<b>Fully motorized:</b>	4 stepper motors for cantilever and photodiode automated alignment
<b>Access:</b>	Free access to the probe for additional external manipulators and probes
<b>Illumination:</b>	Illumination intensity is software controlled

OmegaScope Optical Access	
<b>Top/side optical access:</b>	Capability to use simultaneously top and side plan apochromat objectives – Up to 100x, NA = 0.7 from top or side / Up to 20x and 100x simultaneously
<b>Objective scanner:</b>	<ul style="list-style-type: none"> <li>• Closed loop piezo Objective Scanner for ultra-stable long term spectroscopic laser alignment</li> <li>• Range 30 x 30 x 10 <math>\mu\text{m}^3</math></li> <li>• Resolution: 1 nm</li> </ul>

OmegaScope Options	
Conductive Unit (Current range 100fA $\div$ 10 $\mu$ A / 3 current ranges (1nA, 100nA and 10 $\mu$ A) switchable from the software)	
Liquid Cell / Electrochemical Cell (Capability of liquid exchange)	
Temperature control for liquid cell (heating up to 60°C)	
Environmental Chamber	
Humidity control system (Relative humidity range 10-85% / Relative humidity stability $\pm$ 1%)	
Heating Cooling module (from -50°C to +100°C)	
Heating module (heating up to 300°C / Temperature stability 0.1°C)	
Heating module (heating up to 150°C / Temperature stability 0.01°C)	
Combined Shear-force and Normal-force tuning fork holder	
STM holder	
Signal Access Module	

Software & User Experience	
<b>Computer:</b>	Win10 64 bit, i7 16 Gb RAM, 256 Gb SDD & 2 Tb HD provided with 27" monitor or better
<b>Omega AFM Software:</b>	<ul style="list-style-type: none"> <li>• Acquisition of AFM, Raman and Photoluminescence signals in TERS/TEPL and AFM-Raman/PL co-localized measurement modes</li> <li>• Automatic alignment of tip registration system</li> <li>• Automatic configuration with preset parameters for standard measuring techniques</li> <li>• Automatic cantilever resonance frequency adjustment</li> <li>• Macro language (Lua) for programming user functions, scripts and widgets</li> <li>• Capability to reprogram DSP macro language of the controller in real time without reloading control software</li> <li>• Spring constant calibration (Thermal method)</li> </ul>
<b>LabSpec6 Software:</b>	LabSpec 6 for Raman acquisition, browsing, data and image pre-processing, statistical analysis and chemical identification (see Labspec 6 datasheet)
<b>IAPro:</b>	<ul style="list-style-type: none"> <li>• Process AFM images in coordinate space including making cross-sections, fitting and subtracting of polynomial (up to 12 degrees) surfaces</li> <li>• FFT processing with the capability to treat images in frequency space including filtering and analysis</li> <li>• Processing up to 5000x5000 pixel images</li> </ul>
<b>3<sup>rd</sup> party software communication:</b>	DigitalSurf Mountains, Wiley KnowItAll, Eigenvector <i>Solo</i> <sup>TM</sup> +MIA, VBS ActiveX, EasyTime <sup>TM</sup>
<b>Spectral intensity correction:</b>	Built-in automatic ICS method
<b>Spectral calibration:</b>	Built-in automatic <i>AutoCAL</i> method
<b>Calibration reference:</b>	Built-in Ne lamp or user selectable internal reference ( <i>Sample-Ref</i> option)
<b>Attenuation of fluorescence:</b>	Built-in FLAT On-the-fly background subtraction mode for all laser lines
<b>Sample navigation*:</b>	Patented <i>EasyNav</i> <sup>TM</sup> package including <i>NavMap</i> <sup>TM</sup> , <i>NavSharp</i> <sup>TM</sup> and <i>ViewSharp</i> <sup>TM</sup> to quickly find the region of interest and navigate with ease to the optimum focus
<b>Raman image wizard*:</b>	<i>EasyImage</i> <sup>TM</sup> guided operation application allows beginners to quickly generate expert level hyperspectral images
<b>Particle analysis*:</b>	<i>ParticleFinder</i> <sup>TM</sup> for shape, size, morphology and automated Raman <sup>TM</sup> chemical analysis of particles, built-in LabSpec 6 software
<b>Multivariate analysis*:</b>	<i>MVAPlus</i> <sup>TM</sup> for large datasets analysis (up to 4 million pixels), including decomposition algorithms (PCA, MCR) and clustering algorithms (HCA, K-means)
<b>Spectral database*:</b>	KnowItAll <sup>®</sup> informatics system offers fully integrated software and spectral databases. Provides researchers with multiple tools such as database building, management, mining/ search, analysis, structure drawing, and reporting, all within a single user interface



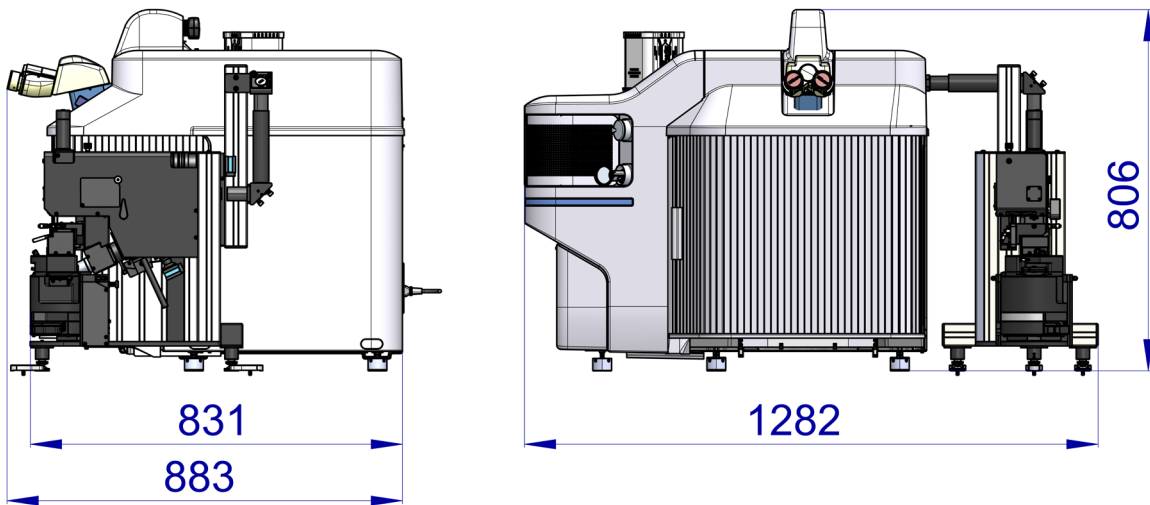
Figure: LabRAM Soleil Nano equipped with the environmental chamber\*

**Specifications subject to change without prior notice.**

1. NFC functionality included as a standard in all instruments. Restrictions apply in the territories of the USA, Japan and Germany territories; please contact our local sales office for more information.
2. The ultimate instrument specification requires the optimal environmental conditions and the selection of proper appropriate individual configuration items and options. The ultimate specifications are not guaranteed values.
3. The specifications shown here represent the average performance of the instrument. These specifications are typical values, not guaranteed values. The guaranteed specifications, which can be demonstrated at time of acceptance, are configuration dependent and listed in a separate document, provided upon request at time of ordering.

\* Optional

**LabRAM Soleil Nano dimensions (with internal lasers only)**



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



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