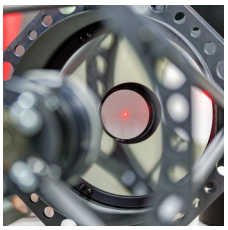
HORIBA Scientific

Raman Spectroscopy

QScan™: Voice-Coil Technology for Multimodal Imaging



Technical Note

RA TN-08

Introduction

The inherent high-performance properties (low noise, high pointing accuracy with high acceleration speeds) of voice coil driven Fast-Steering Mirrors (FSM) enable a variety of functions, including tracking, scanning, pointing, beam stabilization, and alignment. They have become key components in diverse applications such as astronomy, laser communications, military target acquisition and imaging systems. They offer numerous advantages in high-precision applications. They deliver infinite position sensitivity, limited only by the encoder used for feedback. The force-versus-stroke curve is perfectly smooth.

HORIBA's patented *QScan*™ makes use of these high-performance FSM unique flexure suspension designs to eliminate bearings common to XY galvanometers. With higher optical performance than galvo-scanners, FSMs have larger apertures, and lower wavefront distortion. The rotational axes of our FSM intersect at a single pivot point, enabling them to work constantly in the optical axis of the optical system, and therefore allowing laser beam scanning over the full field of view of the objective.

Customer benefits

- True point-and-shoot operation
- 3D confocal global imaging with « confocal lightsheet » illumination
- Mapping without moving in specialist cells (cryo, furnace, DAC)
- High-quality sub-micron imaging for heavy and large objects

QScan™ : patent WO2015159035

General description of *QScan*™ patented laser rastering system

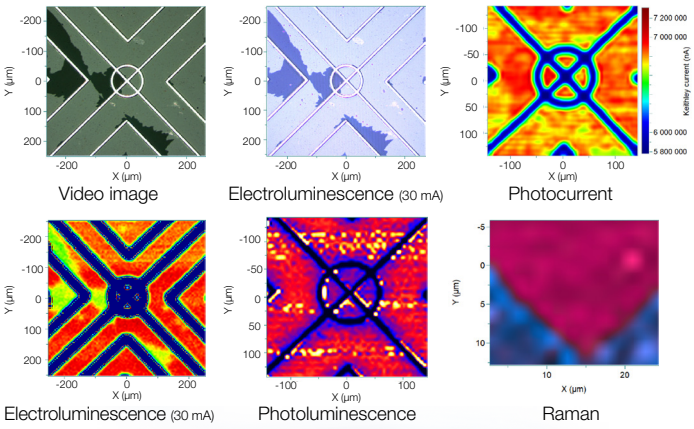
QScan™ is unique to **LabRAM Soleil™** Raman Multimode Microscope, and is compatible with all laser excitation wavelengths, from NUV to NIR. Like most of the options available on **LabRAM Soleil™**, QScan™ is easily upgradable in the field, due to the modular design of the platform.

Contrary to line scanning and other fast imaging solutions in the market, *QScan*™ doesn't affect confocality of the microscope and is fully achromatic, enabling laser excitation and Raman / PL collection from the same probed volume.

Practically, it means one can advantageously use *QScan*™ to create a map of the full field of view of the objective, in a true confocal manner.

This is beneficial to users working on thin-film multilayers, manufacturers of coatings, or scientists needing to generate large maps of a sample which cannot be easily moved because electrodes or micromanipulators are attached to it, or it is placed in a low temperature cell or a furnace environment where the weight exceeds the capabilities of high-precision sample stages.

Combined with a motorised sample stage, *QScan*™ enables, like its predecessor Duoscan, a survey map to be generated, with variable macrospot size, shape and confocality.



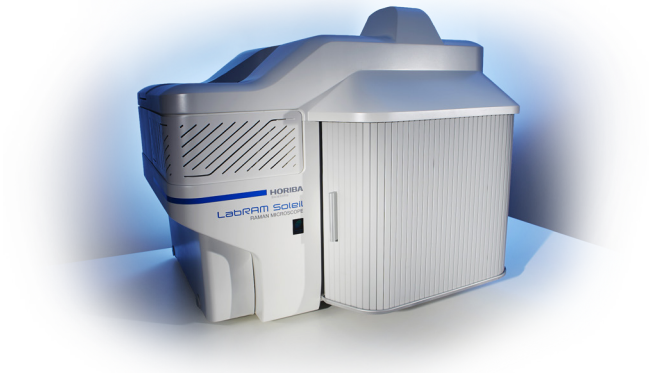


*Figure 1: HORIBA **LabRAM Soleil™** Raman multimode microscope*

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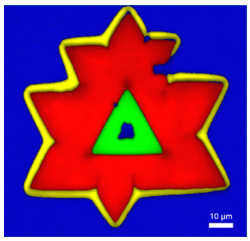
QScan™ for mapping without moving

Mapping without moving is key for people who want to measure their sample in large or heavy cells like furnaces, cryostats, incubators, Diamond Anvil Cells, or within magnetic environments.

Additionally *QScan*™ facilitates the realization of Raman maps of samples connected with pipettes (injection kinetics) or electrodes (photocurrent / photovoltage or electroluminescence measurements) in place during long measurements.

The field of view achievable with *QScan*™ even with high magnification objectives is an enabler for new applications.



WS2 WSSe WSe2 Si substrate
heterojunction mapped without moving

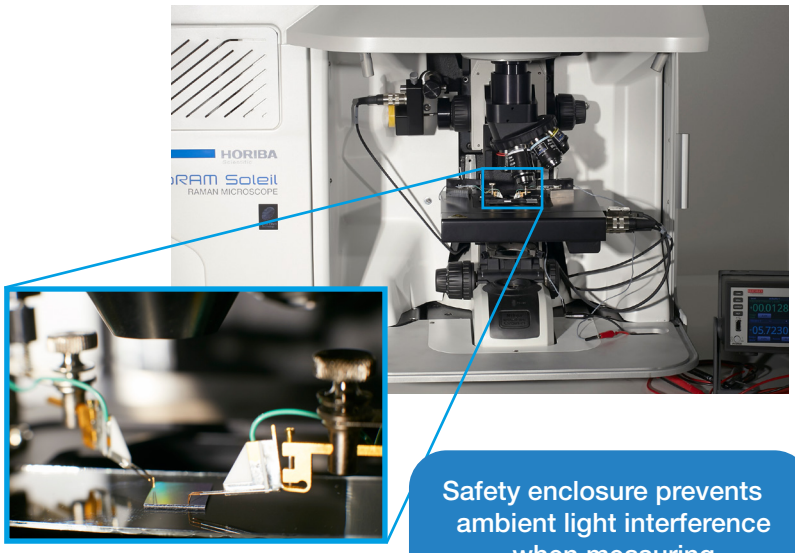
QScan™ used for multilayer and bulk structures investigation

Observing small defects in large areas multilayer polymer materials is often a challenge, because the analyst needs to quickly cover large areas and detect microscopic artifacts, which are barely visible to the eye.

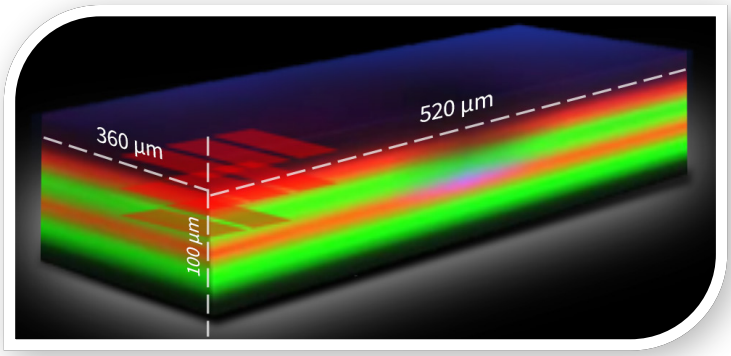
Raman imaging is the technique of choice to identify whether or not those defects are leading to material failure; however, this non-destructive technique is often considered not fast enough for large area mappings.

QScan™ is the answer to this problem.

QScan™ enables survey confocal maps by the use of a macrospot combined with the mapping stage. Capable of simultaneous great Z confocality (~1µm) and >100µm² XY spot, *QScan*™ is unique in unravelling the chemical molecular composition of artifacts embedded in multilayered materials.



Safety enclosure prevents ambient light interference when measuring electroluminescence maps



Lightsheet confocal illumination enables localisation of the 1µm blue defect in this multilayer polymer 10 times faster than standard 3D confocal Raman imaging!

info.sci@horiba.com **www.horiba.com/scientific**

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USA:	+1 732 494 8660	**France:**	+33 (0)1 69 74 72 00	**Germany:**	+49 (0) 6251 8475 0
UK:	+44 (0)1604 542 500	**Italy:**	+39 06 51 59 22 1	**Japan:**	+81(75)313-8121
China:	+86 (0)21 6289 6060	**India:**	+91 (80) 4127 3637	**Singapore:**	+65 (6) 745-8300
Taiwan:	+886 3 5600606	**Brazil:**	+55 (0)11 2923 5400	**Other:**	+33 (0)1 69 74 72 00