PL1 ™

Photoluminescence
Time -Resolved
Confocal Microscope

PL1, the compact time-resolved confocal microscope for material sciences with single molecule detection sensitivity.

- Spatial resolution down to 250 nm
- Spectral resolution down to 0.05 nm
- Wide range of lifetime measurements from 100 ps to 100 ms
- Excitation wavelengths from 266 nm to 1000 nm
- Spectral detection from 300 nm to 1700 nm
- Large-scale scanning capability up to 100 mm^2
- A versatile platform for the add-on experimental control devices
- An extendable platform for the integration with AFM and Raman Spectroscopy

Applications

Materials Science Research
- Semiconductor characterization
- Solar cells and photovoltaic
- Crystals

Chemical Biology

Biomedical Research

ISS has more than 30 years of innovation in research-grade photoluminescence instrumentation. PL1 is the solution for Quantitative Imaging and Analysis on a microscopic scale .Contact us for more information at microscopy@iss.com

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focus and discover

The PL1 Design

The high precision opto-mechanical components of the PL1, designed and produced in house by our skilled technical team, delivers a robust and stable compact confocal microscope for measurements that take from one minute to several hours. The computer controlled variable aperture pinhole, automatic filterwheels and shutters are built for maximum productivity and minimum downtime. The instrument is fully controlled by our Vistavision software that includes routines for 3D lifetime maps, FLIM images acquisition, Fluorescence Fluctuation Spectroscopy acquisition, as well as data processing and analysis.

Routine Measurements

Intensity and Lifetime Imaging

- Lifetime Measurements from 100 ps to 100 ms
- Photoluminescence Confocal Intensity Imaging
- Photoluminescence Confocal Lifetime Imaging in X, Y, Z and t in both scanning and single-point modes

Fluorescence Fluctuations Spectroscopy

- Fluorescence Correlation Spectroscopy (FCS & FCCS)
- Photon Counting Histogram (PCH)
- Fluorescence Lifetime Correlation Spectroscopy (FLCS)

Single Molecule Imaging

- Burst Analysis
- Single Molecule FRET Analysis

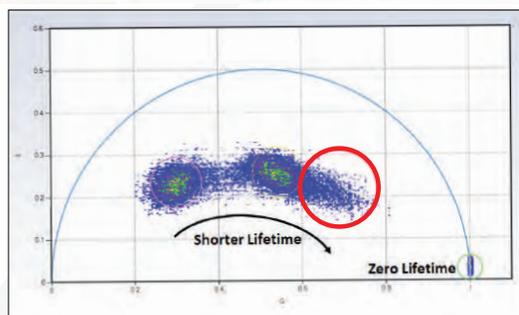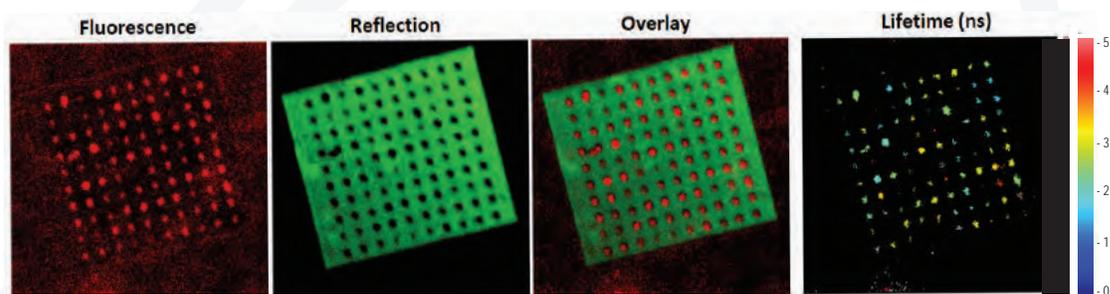## Measurement Examples

- Quantum Dots

Fig 1- Phasor plots separate different lifetime species of Quantum Dots coated on the substrate, directly from the raw data. Ex. 470 nm, Em. 499-632 nm (Fluorescence), 475/35 nm (Reflection), scanning area 17.5μm x 17.5μm. *(Courtesy of Dr. Wenjie Liu and Dr. Yaowu Hu; Purdue University; West Lafayette, IN; USA)*

- Perovskite characterization

Intensity (counts)

Lifetime (ns)

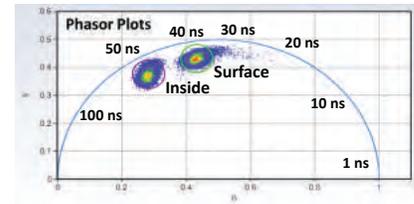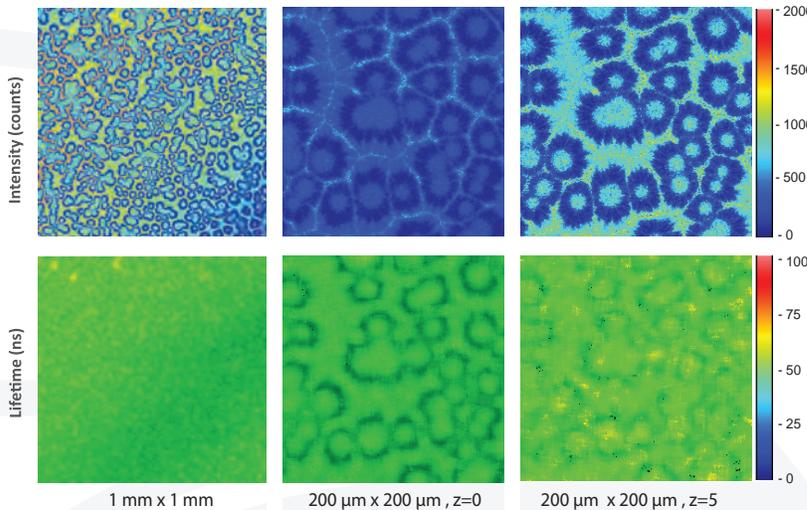1 mm x 1 mm   200 μm x 200 μm , z=0   200 μm x 200 μm , z=5

Fig 2-The measurements of Perovskite confocal microscope provide 3-D lifetime maps simultaneously, in a large area and with a fine resolution. Excitation is 488 nm; emission is through a 520 nm long-pass filter. (*Courtesy of Dr. Hu Yue at HUST, Wuhan, China*).

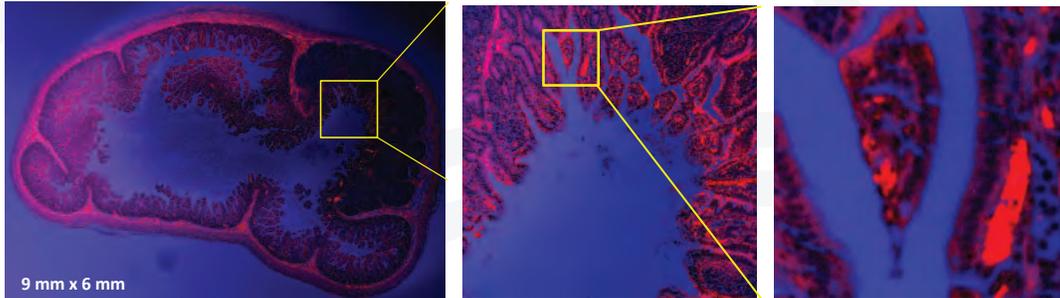## - Large Scale FLIM Tissue Scan

9 mm x 6 mm

Fig 3- The PL1 FastFLIM confocal microscope allows acquiring the whole fixed tissue slide (up to 100 mm x 100 mm) in a single scan and selecting interested areas for zoom-in scans at the high spatial resolution. The sample is a H&E stained pig intestine tissue slide. Excitation 375 nm. Emission (red channel) bandpass filter 610/75 nm; blue channel 460/40 nm. (*Courtesy of Dr. Mayandi Sivaguru at UIUC-IGB- Champaign;Il*).

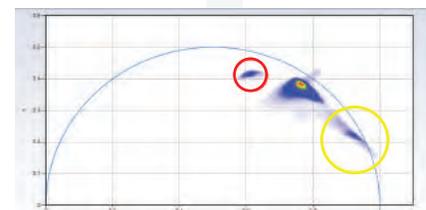## - Microscopic to Mesoscopic FLIM Images

Fig 4- A FLIM image(2048 x 1024) of a US Treasury bill measured by the PL1 FastFLIM confocal microscope. Excitation is 375 nm; emission is through a 420 long-pass filter. Multiple decay times are detected ranging from 1.8 ns (yellow) to 6 ns (red).

Specifications

Microscope and Coupling	Frame format: Upright or Inverted research microscope
	Magnification: 10X AIR and 60X WI oil immersion objective (standard); optional: from 2X to 100X
	Spatial Resolution: diffraction limited
	Eye Observation: bright field by 10X eyepiece with diopter adjustment, field of view: 22 mm
	Imaging Modes:
	  -Transmission mode: HAL Kōhler illumination for bright field imaging by a CMOS camera
	   with options for phase contract and DIC
	  - Confocal photoluminescence imaging: laser illumination , single-point or stage scan

XYZ Stage Scan	Closed-loop DC servo control - XY axis range of travel: 100mm x 100 mm (upright), 120mm x 75mm (inverted) - XY axis: Encoder step Resolution = 22 nm, max velocity = 7 mm/sec, RMS repeatability < 700 nm - Z axis: Resolution = 50 nm, maximum velocity = 0.6 mm/sec, repeatability = 100 nm
Laser Sources	CW or pulsed diode laser, repetition rate up to 80MHz (tunable by software) The laser launcher can accommodate up to 6 lasers, ranging from 375 nm to 980 nm Each laser has its own intensity control and shutter (operated by software)
Data Acquisition Unit FastFLIM	Lifetime measurement range: from 100 ms to 100 ps Data Acquisition Mode: Photon mode, Time-tagged mode, Time-resolved time-tagged mode (TTTR) Dead Time: 3.125 ns, Up to 60×10^{6} counts/second Computer Connection: USB
Detectors	SPADs: Dark counts <100 counts /sec; TTS, 350ps; Wavelength Range: 350-1050 nm; QE > 70% at 700 nm. Spectrograph: CCD camera, TE cooled, back-illuminated 1340 x 100 (20 μm x 20 μm) pixels; Wavelength: 350 – 1000 nm; QE > 95% at 700 nm. Other detectors (such as GaAsP and NIR InGaAs) are available.
Software	VistaVision Windows 10 64 bit
Scan Modes	X, XY, XZ, XYZ, t, Xt, XYt, XZt, XYZt
Image format	Other than the proprietary file formats which contain the imaging parameters information, VistaVision also supports exporting the acquired data in various formats including JPEG, TIFF, PNG, AVI, etc.
Image Processing & Analysis	Visualization by various look-up tables, Contrasting, Thresholding, Smoothing, Filtering, Scaling, Statistical analysis by histogram or line profiling, etc.
Lifetime data analysis routines	- Non-linear least square constrained deconvolution fitting routines based on the Marquardt-Levenberg minimization algorithm in both time and frequency domains. - The model-free phasor plots approach for instant and unbiased results
Computer & Monitor	High performance computer CPU(Xeon) RAM ≥ 32 GB, Video RAM ≥ 1 G, Hard Drive≥ 2TB (SSD 256 GB) Windows 10, 64 bit professional Flat Panel LED Monitor ≥27 inches, resolution ≥ 2556 x 1440
Power requirements	Universal power input: 110-240 V, 50/60 Hz, 100 VAC

FastFLIM is covered by US Patent 8,330,123; other patents are pending.

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