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INSTRUMENTS

# FS5

Spectrofluorometer

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# FS5 v2 Spectrofluorometer

The FS5 Spectrofluorometer is a compact, high-performance benchtop system designed for the comprehensive characterisation of fluorescent and phosphorescent samples. Since its launch in 2013, the FS5 series has become a trusted solution for fluorescence research, contributing to thousands of scientific publications worldwide.

The FS5 v2 is the latest evolution of the FS5, offering enhanced performance and expanded capabilities to meet the growing demands of modern photoluminescence spectroscopy.

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## FS5 Key Features

**1**

### Quick-Exchange Sample Modules

Swap sample modules in seconds with automatic software recognition

**2**

### Long-Lifetime Xenon Lamp

150 W Xenon lamp with power saving auto on/off

**3**

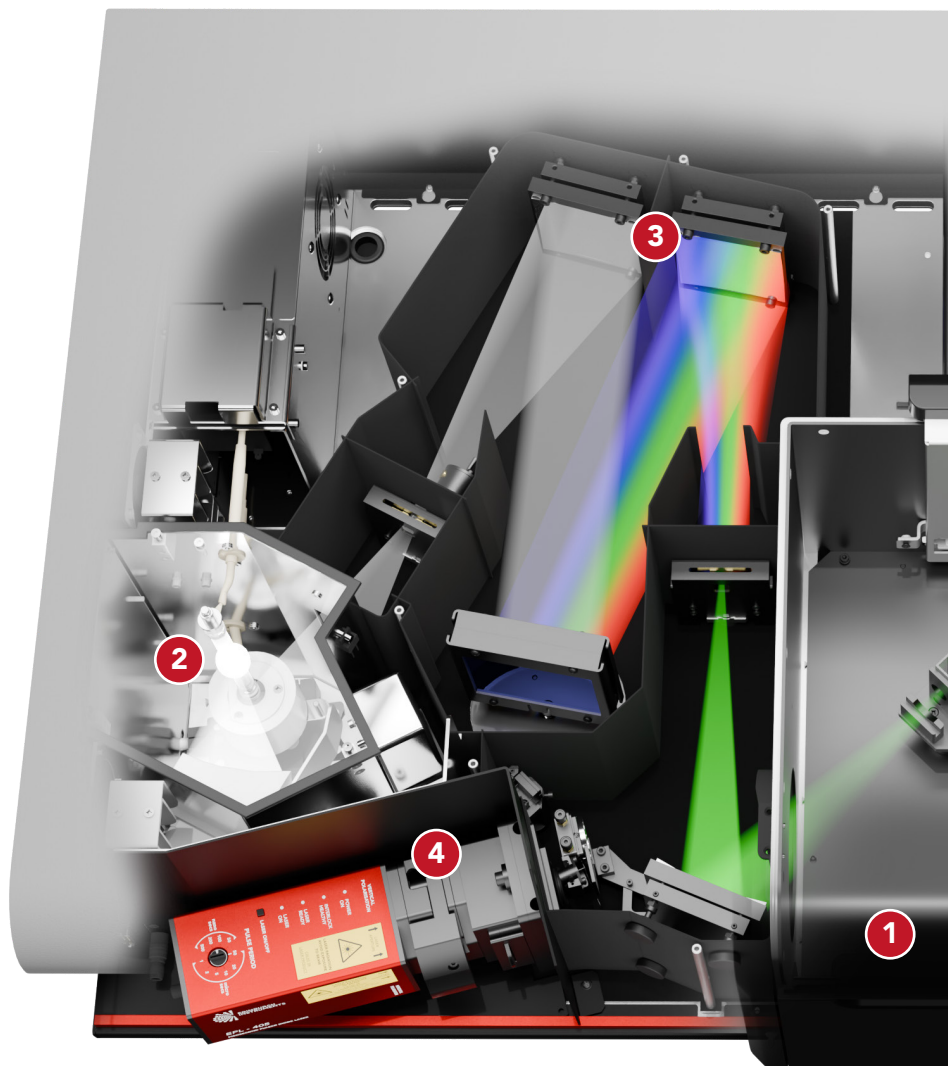
### High Performance Monochromators

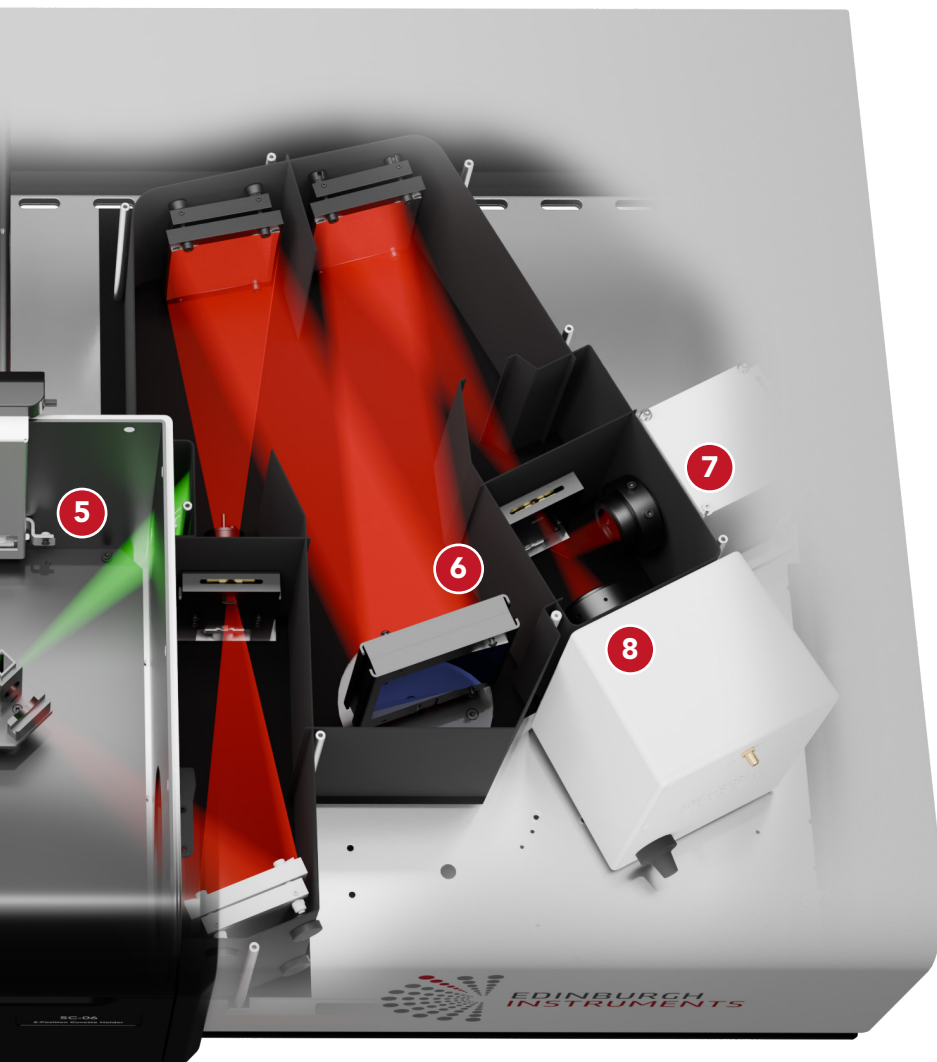
Advanced optical design for ultra-low stray light

**4**

### Photoluminescence Lifetime

Time-resolved fluorescence and phosphorescence measurements from picoseconds to seconds





### **5 2-in-1 Absorption and Fluorescence**

Acquire both absorption and fluorescence spectra using a single instrument

### **6 Spectral Correction**

Excitation and emission correction with automated second-order removal

### **7 Photon-Counting Sensitivity**

The v2 delivers enhanced sensitivity, setting the standard for benchtop spectrofluorometers with an SNR of 12000:1

### **8 NIR Detection up to 2.05 $\mu\text{m}$**

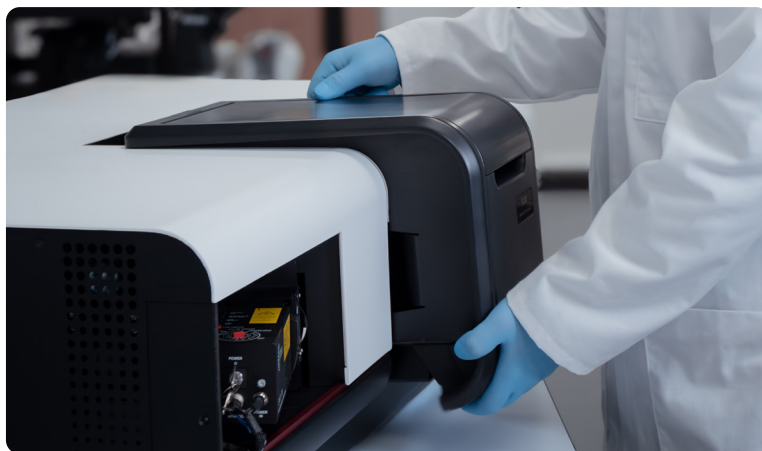
The v2 has an extended NIR detection range, out to 2.05  $\mu\text{m}$ , enabling photoluminescence studies deeper into the NIR



## Sample Modules

The FS5 features plug-and-play sample modules that are automatically recognised by the software. Configure your FS5 with multiple sample modules to support a range of applications and sample types.

Additional sample modules can be purchased at any time.



### SC-05

#### Standard Cuvette

12 mm cuvette holder



### SC-20

#### Thermostatic Cuvette

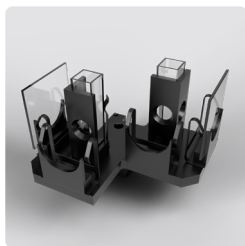
External circulator  
-10 °C to +60 °C



### SC-06

#### Dual Cuvette

Two-position cuvette holder for automated absorption measurements



### SC-24,25,26

#### TE Cuvette

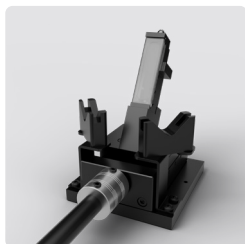
Software controlled  
-50 °C to +150 °C



### SC-10

#### Solid Sample

Holder for slides, films, and powders



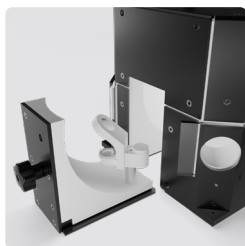
### SC-27

#### 4-Position TE Cuvette

Automatic sample exchange  
-15 °C to +105 °C







## SC-30

### Integrating Sphere

Quantum yield of solids, liquids, and powders



## SC-70

### LN<sub>2</sub> Dewar

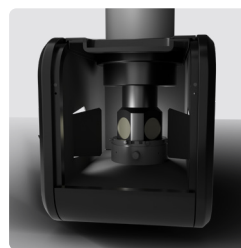
Solid and liquid samples  
room temperature or -196 °C



## SC-41

### Microplate Reader

Spectra and lifetime of  
up to 384 well microplates



## SC-80

### LN<sub>2</sub> Cryostat

Solid and liquid samples  
-196 °C to +226 °C



## SC-50

### Optical Fibre Launcher

Couple accessories such as  
fibre probes and microscopes



## SC-90

### Cryostage

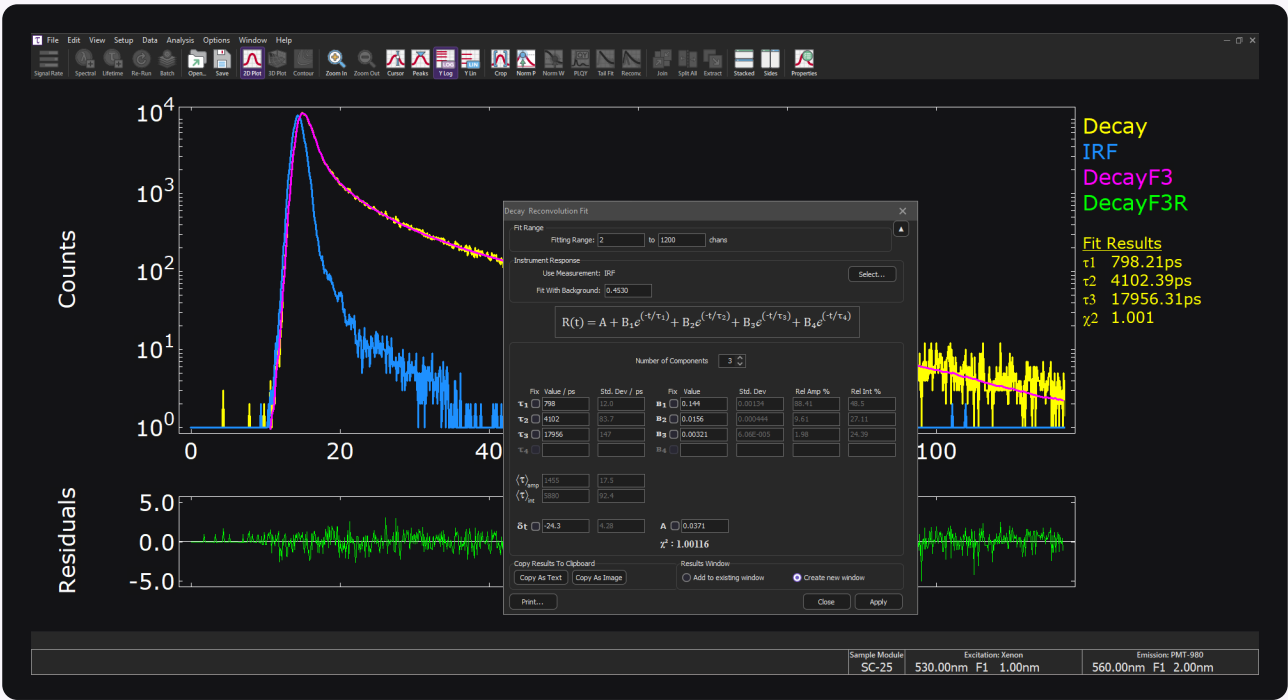
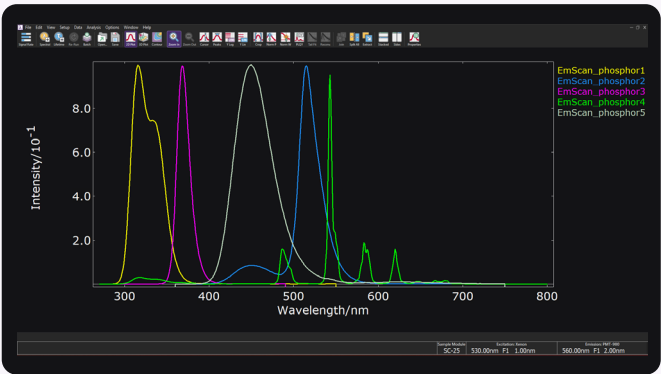
Fibre-coupled horizontal  
temperature stage  
-196 °C to +600 °C



# Fluoracle® Software

The latest version of Fluoracle brings improvements to data acquisition, analysis, and presentation, making photoluminescence spectroscopy easier than ever.

Fully integrated with the FS5, it offers seamless software control over excitation sources, acquisition techniques, and detectors.







## Fluoracle Standard Features

- + Sample Module Recognition
- + FluoAuto
- + Quantitation
- + Spectral Correction
- + Chromaticity Analysis
- + Trend Analysis
- + Validation Scans



## Upgrade Features

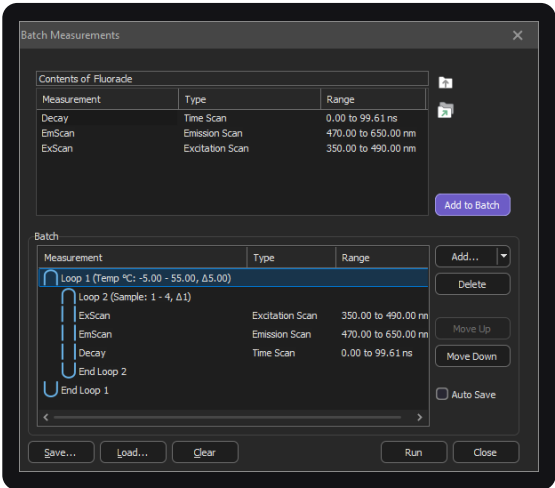
- + Lifetime Exponential Component Analysis
- + Time-Resolved Emission Spectra
- + Quantum Yield Analysis
- + Temperature Maps
- + Spectral Anisotropy
- + Time-Resolved Anisotropy

## FluoAuto

FluoAuto lets you program a sequence of automated measurements, streamlining experiments that once took hours into a single setup. It supports temperature control, multi-position sample holders, delays, loops, and sending commands to external accessories.

## Quantitation

Fluoracle's quantitation feature allows you to generate calibration curves based on intensity, band area, or ratios. It also includes spectral band analysis and estimated decay lifetimes, enabling quick decision-making in research.



FluoAuto setup



Calibration curve measurement



## Core System Capabilities

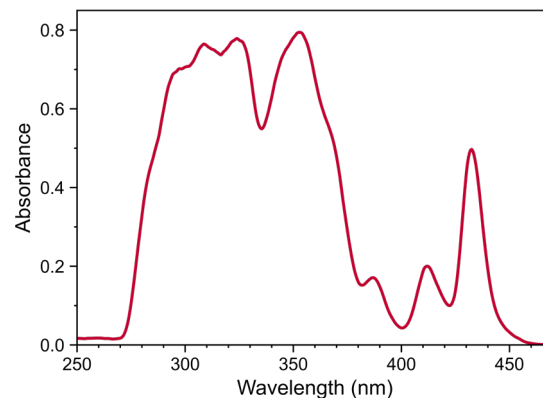
### Absorption Spectra

The FS5 features a high-sensitivity transmission detector for measuring the absorption spectra of solutions.

Users can manually exchange the sample and blank in the SC-05 or opt for the SC-06 module for fully automated acquisition.

Absorbance Range: 0 – 2 A

Wavelength Range: 230 nm – 1000 nm

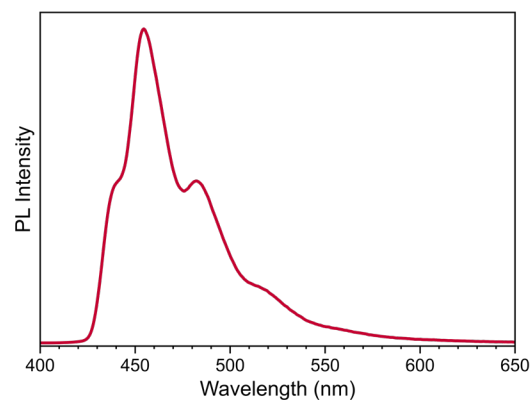


Absorption spectrum of 9-aminoacridine

### Emission Spectra

At the heart of the FS5 is a high-sensitivity photon-counting photomultiplier tube (PMT) detector, designed to capture emission spectra with exceptional sensitivity – even from the weakest fluorophores.

Wavelength Range: 230 nm – 870 nm

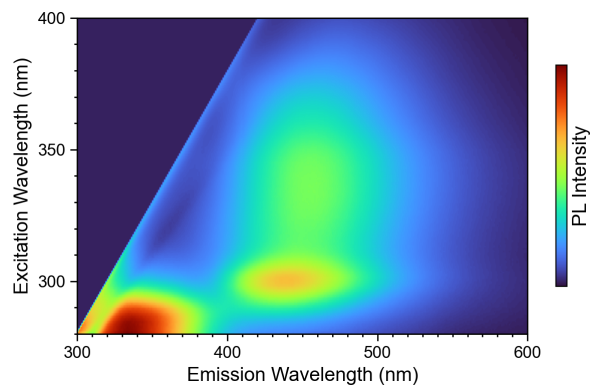


Emission spectrum of 9-aminoacridine

## Excitation-Emission Maps

An excitation-emission map (EEM) visualises the fluorescence intensity as a function of both excitation and emission wavelength. EEMs enable the analysis of multiple fluorescence transitions and complex mixtures, making it ideal for applications in environmental and food analysis.

Wavelength Range: 230 nm – 870 nm

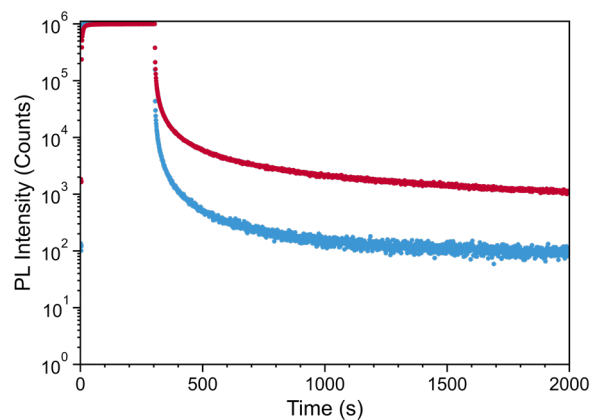


EEM of orange drink

## Kinetics

Kinetic measurements are ideal for studying long luminescence decays, such as persistent luminescence and afterglow. They also offer valuable insights into reaction mechanisms and chemiluminescence, especially when combined with a stopped-flow accessory.

Time Resolution: 10 ms



Kinetic emission measurements of phosphorescent inks



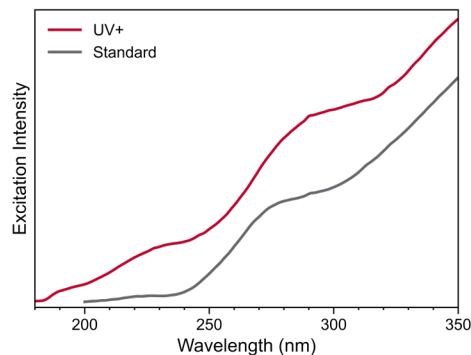
## Wavelength Extension Upgrades

### UV+

Extend the excitation wavelength range to <200 nm with a UV-optimised diffraction grating and ozone-generating xenon bulb.

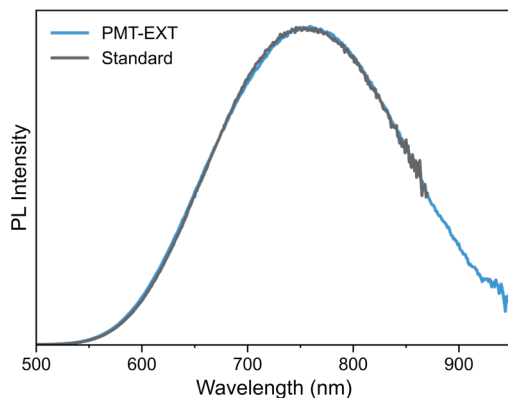
Recommended for samples requiring excitation below 230 nm.

Excitation intensity for standard FS5 and UV+ version



### PMT-EXT

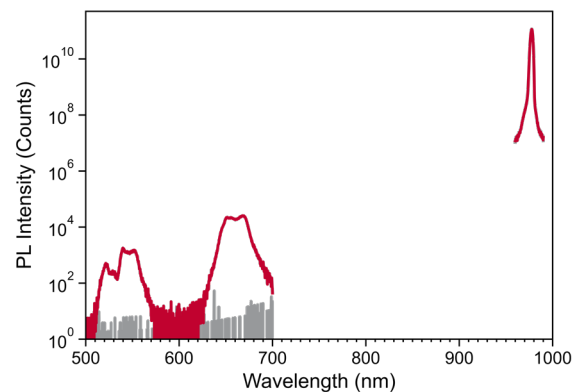
Replace the standard PMT-900 detector with the extended-range PMT-980. Ideal for samples with emission tails extending beyond 870 nm and up to 950 nm.



Emission spectrum of silicon nanoparticles with standard detector and PMT-EXT option

### PMT-UC

Add a PMT-1010 detector for measuring upconversion quantum yields with 980 nm laser excitation.

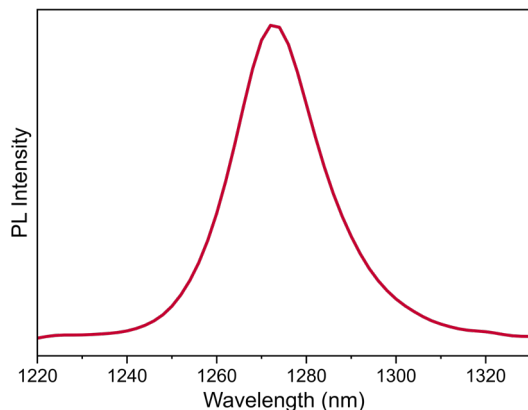


Quantum yield measurement of lanthanide upconversion nanoparticles

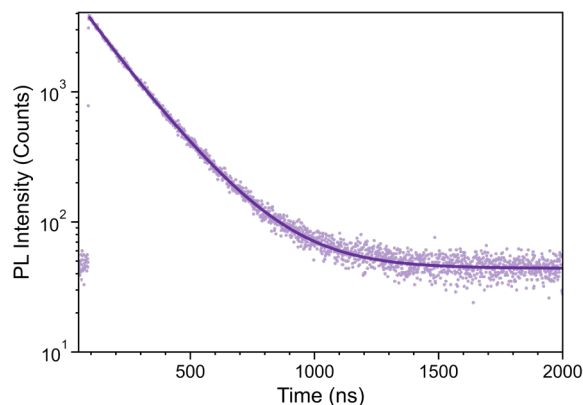
## NIR-TE & NIR-LN

Add a photon-counting NIR PMT for studying weakly emitting NIR samples and measuring NIR lifetimes.

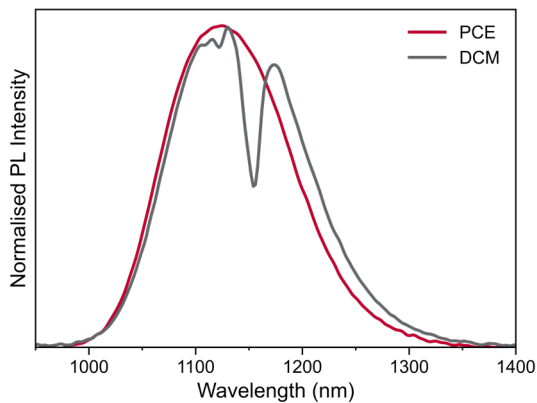
Choose between a liquid nitrogen-cooled or TE-cooled detector with a 1400 nm or 1650 nm cut-off wavelength, depending on your spectral coverage, sensitivity, and temporal response requirements.



$^1\text{O}_2$  from rose bengal in acetonitrile. Most sensitive option up to 1400 nm, ideal for singlet oxygen



TCSPC decay from quantum dots emitting at 1350 nm



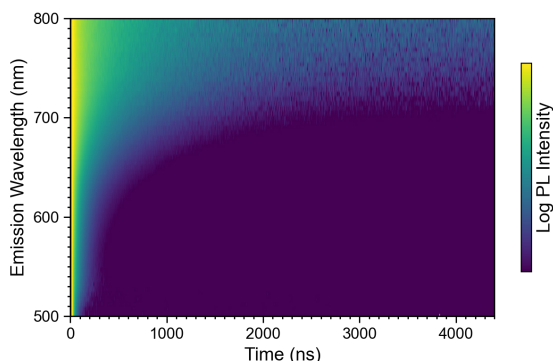
## NIRA

Add an analogue NIR detector for measuring NIR spectra, with options out to 1650 nm or 2050 nm.

Emission spectrum of quantum dots in different solvents



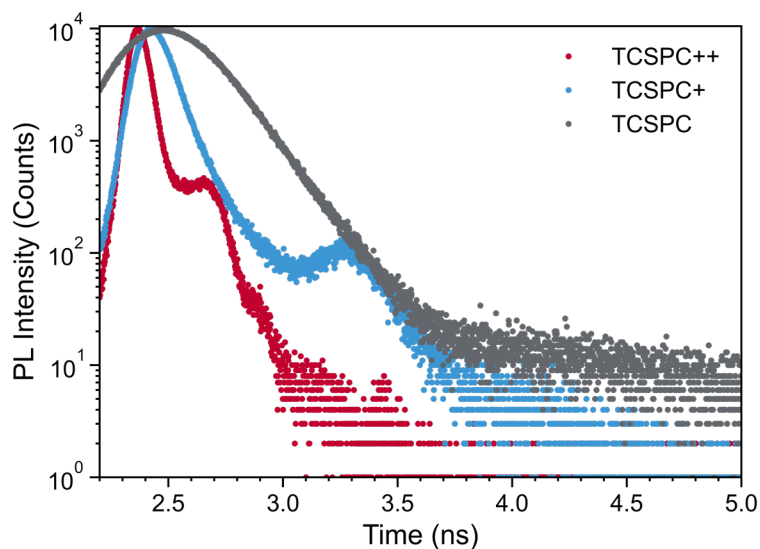
## Fluorescence Lifetime Upgrade



### TCSPC

Measure fluorescence lifetimes from  $<150$  ps to  $>10$   $\mu$ s with high-resolution time-correlated single photon counting electronics. This upgrade adds a dedicated port for coupling pulsed laser diodes and LEDs to the FS5. A range of pulsed sources is available from 250 nm to 980 nm.

Time-Resolved Emission Spectrum from indium phosphide quantum dots



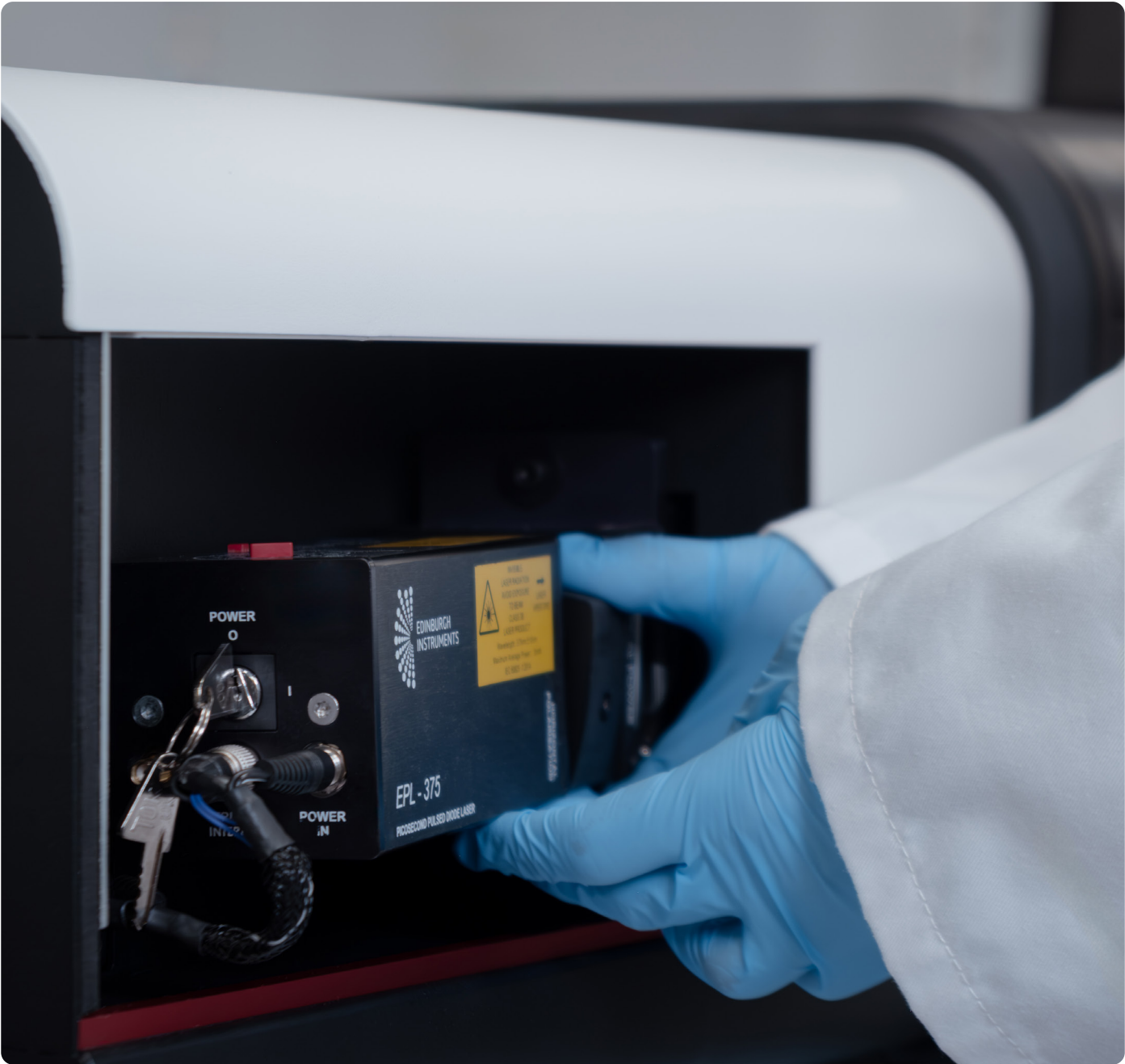
### TCSPC+ & TCSPC++

TCSPC+ enables lifetime measurements down to  $<25$  ps with a high-speed PMT detector.

TCSPC++ delivers the ultimate temporal resolution, featuring a hybrid photodetector for lifetime measurements as short as  $<15$  ps (source dependent).

Typical instrument response function with an EPL-375 source



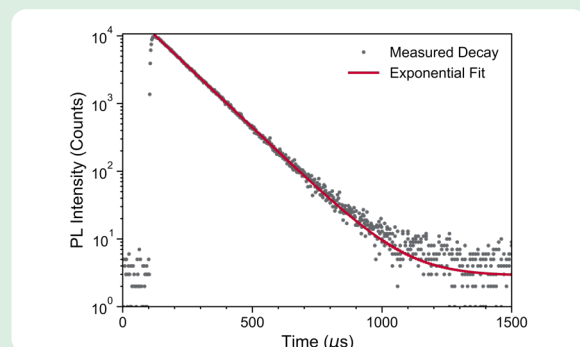




# Phosphorescence Lifetime Upgrade

## MCS

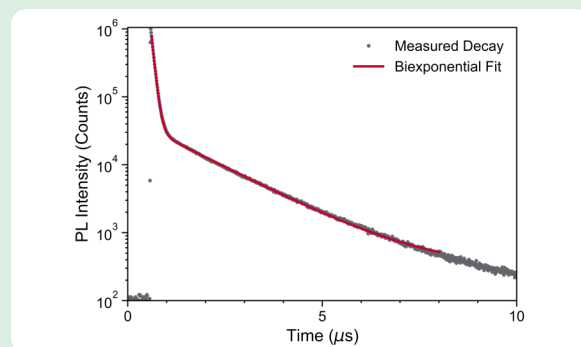
MCS enables time-resolved luminescence decay measurements down to 5  $\mu\text{s}$  lifetime, making it ideal for phosphorescence studies. This option features a Xe flashlamp for tunable excitation from <230 nm to 1000 nm.



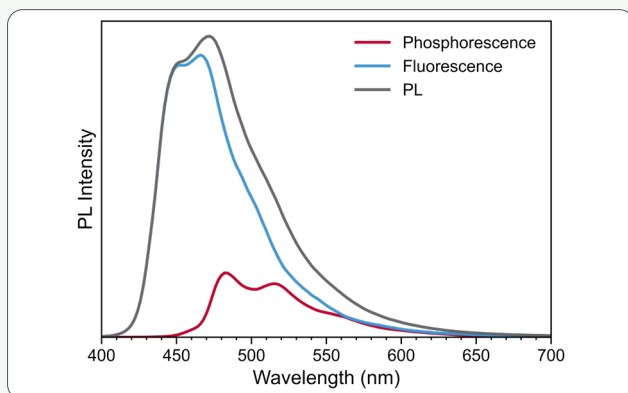
PL decay of europium and single exponential tail fit result

## MCSL

MCSL utilises a pulsed laser, enabling lifetime measurement down to 50 ns. A wide range of pulsed sources is available, with options optimised for ns,  $\mu\text{s}$ , and ms lifetimes.



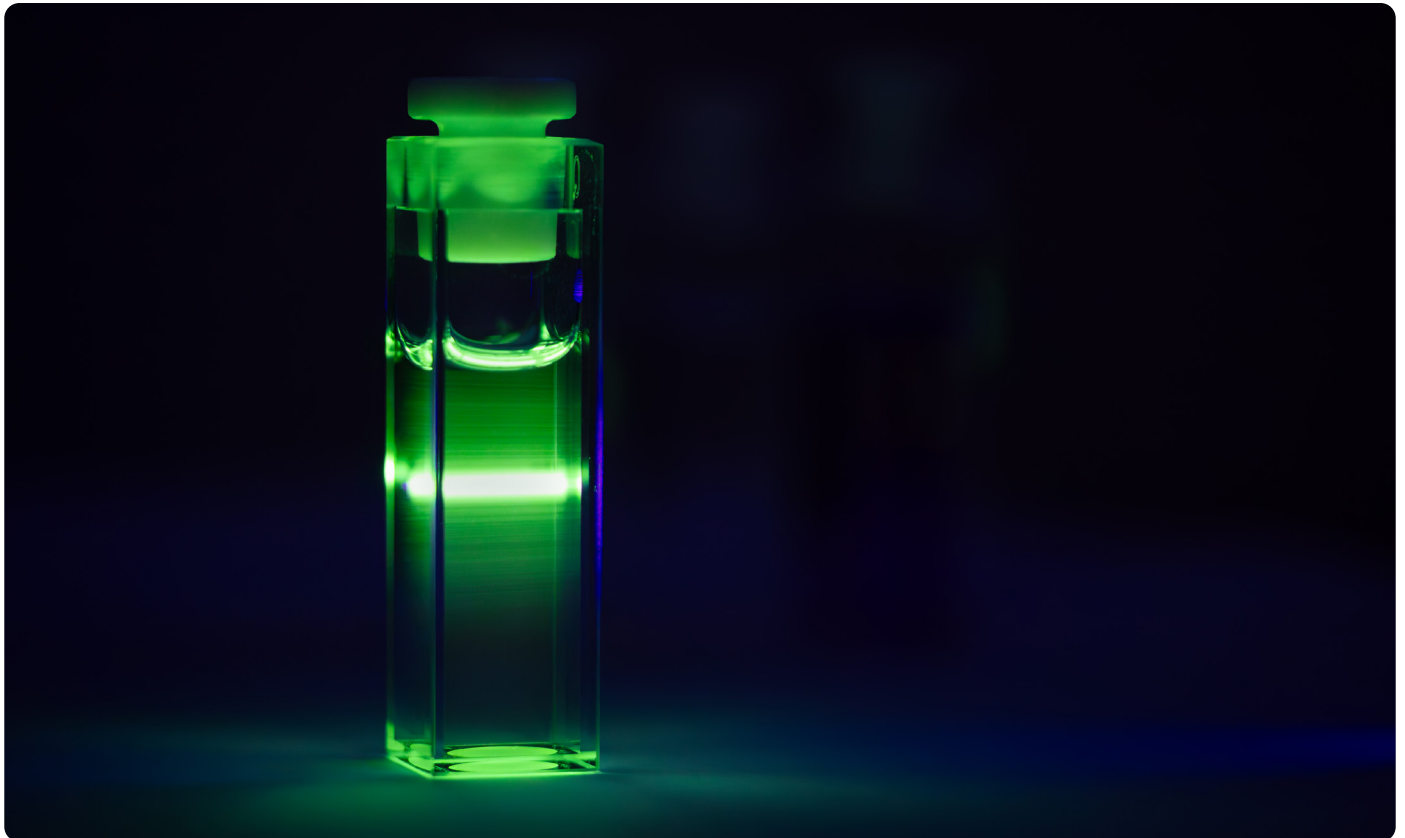
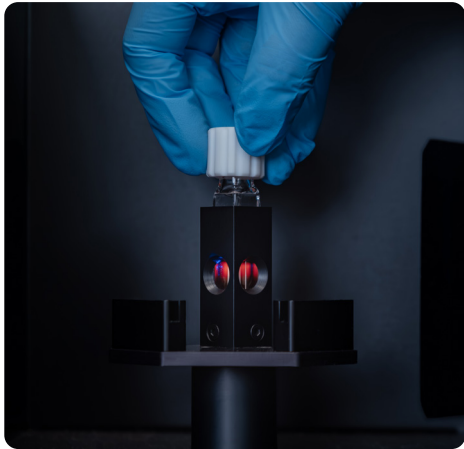
Prompt fluorescence and thermally activated delayed fluorescence fitted to a two-exponential model

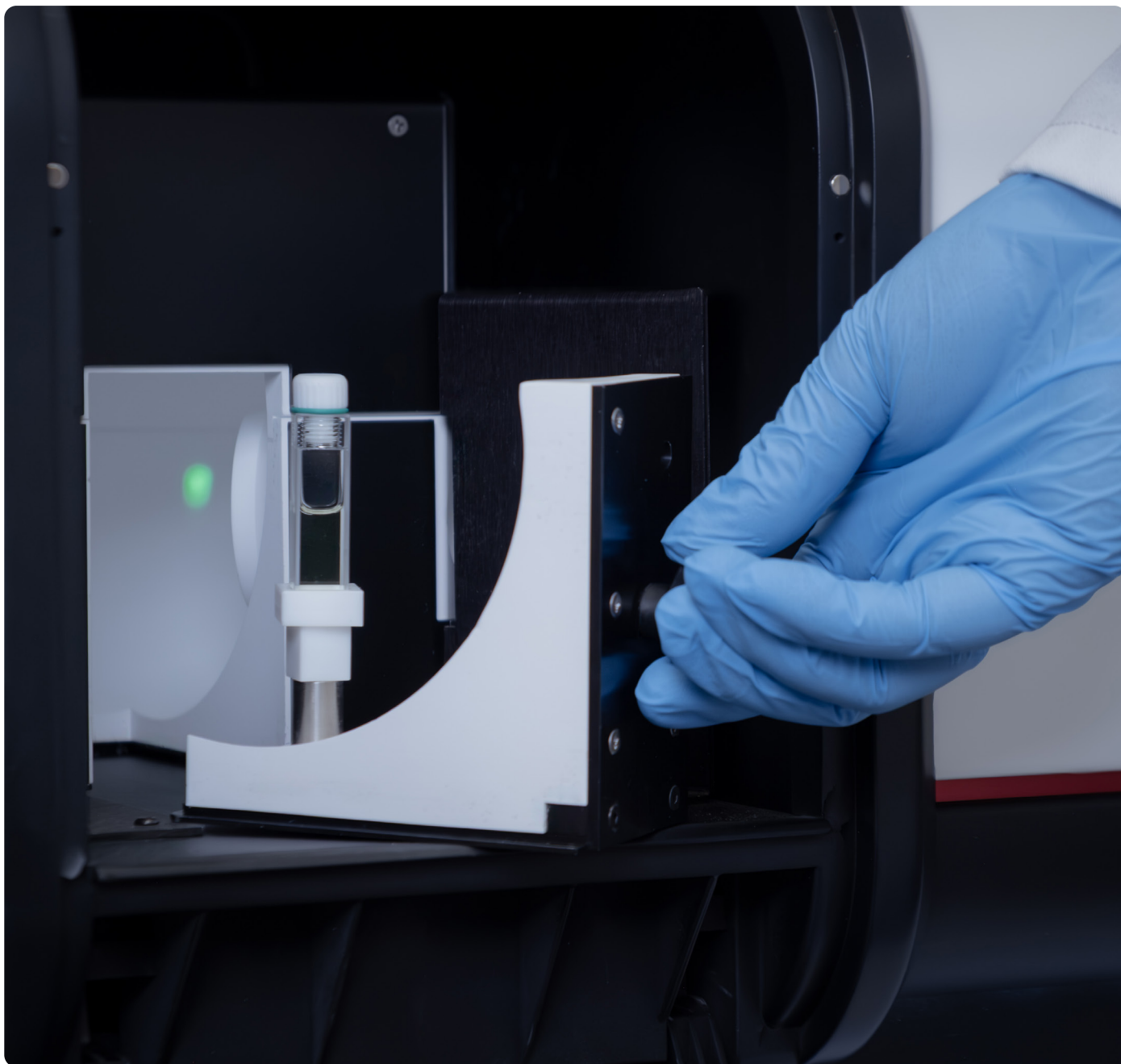


## Active Gating

Active Gating enables the rapid separation of overlapping fluorescence and phosphorescence spectra. It prevents detector overexposure when measuring weak phosphorescence alongside strong fluorescence, ensuring accurate and reliable spectra.

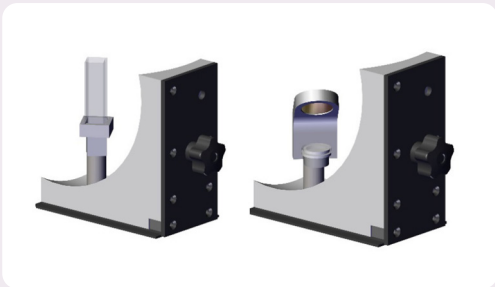
Fluorescence, phosphorescence, and photoluminescence spectra at low temperature







# Quantum Yield

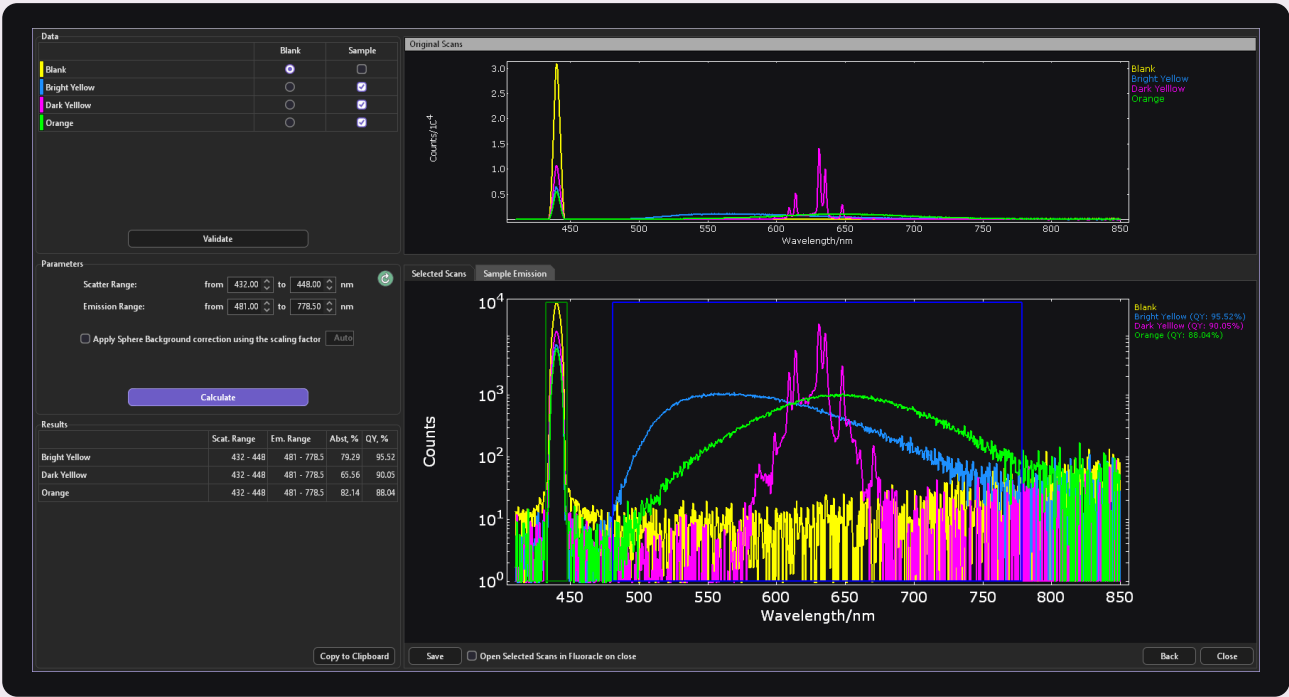


Cuvette and solid sample holders for the SC-30 Integrating Sphere

The SC-30 integrating sphere module measures the absolute quantum yield of liquids, films, and powders and includes both cuvette and solid sample holders.

FS5 v2 features a new smart quantum yield analysis workflow to simplify quantum yield measurements. In addition to quantum yield, the chromaticity coordinates of the emission can be calculated.

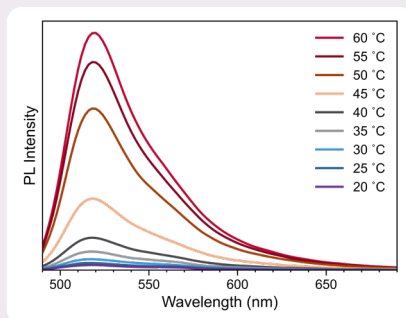
An electroluminescence sample holder is available for characterizing LEDs and other emitting devices. The SC-30 can also measure reflectance and absorbance spectra of non-transparent samples.



Quantum Yield Analysis in Fluorace



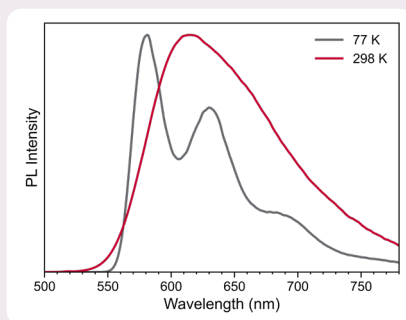
## Temperature Control



### TE Cuvette

TE-cooled modules allow temperature-dependent cuvette measurements from -50 °C to +150 °C, fully controlled in Fluoracle. A four-position version, the SC-27, is also available.

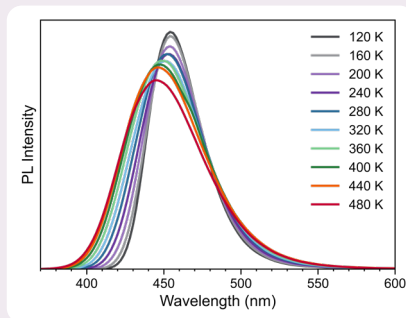
Temperature-dependent emission spectrum from a molecular beacon probe



### Liquid Nitrogen Dewar

The SC-70 is a cost-effective cryogenic module for measurements at room temperature or 77 K. It accommodates both solutions and powder samples in quartz EPR tubes.

Excitation and emission spectra of an OLED emitter at 77 K and room temperature



### Cryostats & Cryostages

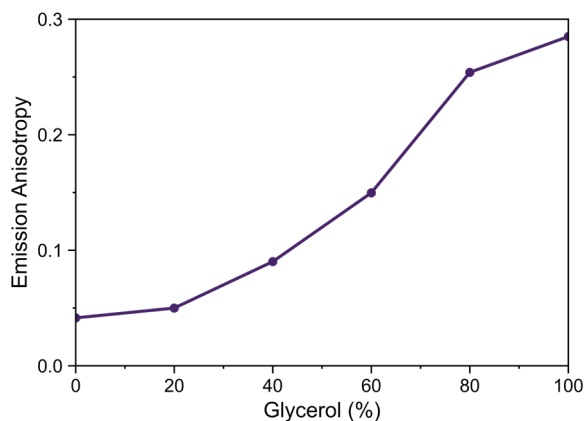
These advanced holders provide precise temperature control from 77 K to 500 K, enabling the study of solutions, films, and powders across a wide temperature range. Fully controlled by Fluoracle, they allow automated temperature maps to be acquired.

Temperature dependent emission spectra of a phosphor





## Additional Options



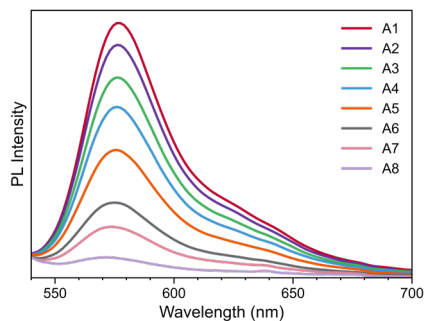
### Polarisation

The polarisation option enables spectral anisotropy measurements to investigate molecular orientation and intermolecular interactions. Time-resolved anisotropy provides insights into fluorophore size and its local environment and requires the TCSPC upgrade.

Emission anisotropy of rhodamine in varying concentrations of glycerol

### Microplate Reader

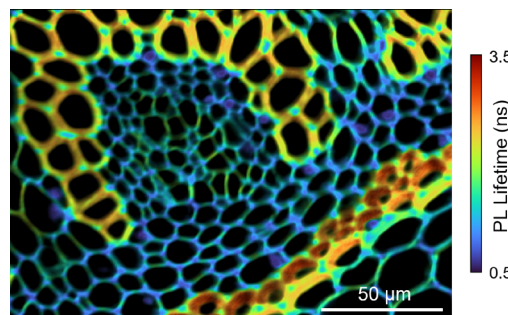
The SC-41 microplate reader module provides high-throughput sample analysis, supporting plates with up to 384 wells. Ideal for bioassay development, it is fully compatible with spectral, TCSPC and MCS operation.



Emission spectra of rhodamine B at varying concentrations

### MicroPL

Perform spectral and lifetime studies at the microscopic scale by coupling a microscope to the FS5 via liquid light guides. A wide range of microscope configurations, source coupling, and detector options are available.



FLIM map of stained *convallaria*



# Core Specifications

Standard Configuration	Optics	All-reflective
	Detection Technique	Single Photon Counting
	Light Source	150 W Xenon arc lamp
	Monochromators	Czerny-Turner with dual grating turret
	Excitation Spectral Range	<230 nm – 1000 nm
	Emission Spectral Range	200 nm - >870 nm
	Filter wheels	Fully automated
	Bandpass	0 – 30 nm, continuously adjustable
	Wavelength Accuracy	±0.5 nm
	Scan Speed	100 nm/s
	Integration Time	≥1 ms
Detectors	Emission Detector	Cooled Single Photon Counting PMT900 200 nm – 870 nm
	Reference Detector	UV enhanced photodiode 200 nm – 1000 nm
	Absorbance Detector	UV enhanced photodiode 200 nm – 1000 nm
Sensitivity	Signal-to-Noise Ratio	>12000:1 *
	*SQRT method. $\lambda_{\text{ex}}$ = 350 nm, bandpass = 5 nm, integration time = 1 s, $\lambda_{\text{peak}}$ = 397 nm, noise measured at 450 nm	
Dimensions	W x D x H	104 cm x 59 cm x 32 cm
	Weight	65 kg



# Upgrade Specifications

Excitation Range Extension	Upgrade		UV+	
	Excitation Coverage		<200 nm – 1000 nm	
Emission Range Extension	<b>PMT-EXT</b> Replaces PMT 200 nm – >980 nm Lifetime possible	<b>PMT-UC</b> Second detector 200 nm – 1010 nm Lifetime possible	<b>NIRA1650</b> Second detector 870 nm – >1650 nm Spectral only	<b>NIRA2050</b> Second detector 870 nm – >2050 nm Spectral only
	<b>NIR1400-TE</b> Second detector TE Cooled 950 nm – 1400 nm Lifetime possible	<b>NIR1700-TE</b> Second detector TE Cooled 950 nm – 1650 nm Lifetime possible	<b>NIR1400-LN</b> Second detector LN <sub>2</sub> Cooled 500 nm – 1400 nm Lifetime possible	<b>NIR1700-LN</b> Second detector LN <sub>2</sub> Cooled 500 nm – 1650 nm Lifetime possible
Polarisation / Anisotropy	Upgrade		POL	
	Spectral Coverage		220 nm - 900 nm excitation 240 nm - >2000 nm emission	
Phosphorescence Lifetime	Upgrade	<b>MCS</b>	<b>MCSL</b>	
	Lifetime Range *	< 5 µs - >10 s	50 ns – >10 s	
Fluorescence Lifetime	Upgrade	<b>TCSPC</b>	<b>TCSPC+</b>	<b>TCSPC++</b>
	Lifetime Range *	90 ps – 10 µs	<25 ps – 10 µs	<15 ps – 10 µs
*Source dependent				



Edinburgh Instruments has been providing high performance instrumentation in the Molecular Spectroscopy market for over 50 years. Launched in 2013, the FS5 series of spectrofluorometers has become a well-established solution for fluorescence research, leading to thousands of scientific publications.

FS5 v2 is the latest generation of the FS5 spectrofluorometer with expanded capability and even better performance.

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