



## Hemvati Nandan Bahuguna Garhwal University

(A Central University)

Department of Chemistry

Srinagar (Garhwal), Uttarakhand-246174, India

### To Whom It May Concern

Date:12/04/2024

I, Dr. Bibhisan Roy, the Principal investigator of the SERB-sponsored project titled "Incredible Power of Triplet States: Triplet-Triplet Diffusion Assisted High Energy Fluorescence Photon Generations Covering the Applications into the Hydrogen Generation, 3D Printing and Challenging Bond Activation Reactions" (File Number: EEQ/2023/000192) hereby notifying to the anonymous company/common public that under the above mentioned project, with the permission of concerned university authority and the DST-SERB guidelines, the PI is going the Purchase the Photoluminescence Spectrophotometer from the Horiba Scientific, USA, based on the **proprietary certificate** submitted by **Horiba Scientific, USA** under the sanctioned budget (the proprietary features certificate and other related documents has been attached with this notice). The prime requirement should be the future upgradation possibility into the domain of lifetime (picosecond to second), steady state phosphorescence etc. The Horiba Scientific, USA is claiming under the intellectual proprietary certificate that they are the only one in the world can fulfill our necessary requirement within the sanctioned budget.

If any anonymous company/public have any objections regarding the claim of the Horiba Scientific, USA described in proprietary certificate of Photoluminescence Spectrophotometer (Fluoromax Plus C) can contact immediately with Dr. Bibhisan Roy (Email: [bibhisanroy90@gmail.com](mailto:bibhisanroy90@gmail.com)/ Mobile no: +91 7318994992).

The Dead to receive the Objection: 25/04/2024

No objection from any anonymous company/public will be entertained and the PI of the project will not be responsible for any objection after the mentioned deadline

Thank you  
With regards

  
(Dr. Bibhisan Roy)

PI of the Project EEQ/2023/000192

12/04/2024

**Dr. Bibhisan Roy**  
**Assistant Professor, Ph.D.**  
**Department of Chemistry**  
**H.N.B. Garhwal University (A Central University)**  
**Garhwal Campus, Srinagar, Uttarakhand, 246174**

April 10, 2024

TO WHOM IT MAY CONCERN

## **PROPRIETARY FEATURES OF FLUOROMAX PLUS SYSTEM**

1. Water Raman Sensitivity Specification of > 10,000:1 (FSD method with no optical filters, no smoothing of data and no repeat scans).
2. The system has all reflective optics, to allow for achromatic illumination of sample and emission collection and precise illumination of micro or reduced volume samples.
3. Mechanical monochromator resolution (wavelength drive step size) .0625nm
4. Use of plane-ruled gratings in the monochromator as opposed to cheaper holographic ones, because ruled gratings are much less dependent on polarization. This ensures the highest possible dynamic range and sensitivity when making anisotropy/polarization measurements.
5. Optical Resolution of 0.3 nm FWHM.
6. Optional TCSPC enhancements with 100 MHz sources and TCSPC electronics that can collect at 100 MHz! This is for avoidance of photobleaching and also for lifetime kinetics research.
7. Single timing module to cover picosecond to seconds time range, both TCSPC and MCS (Multichannel scaling) modes are included in the same electronic controller, no need to switch cables. Changing measurement time range automatically changes pulse source's repetition rate, no need to manually adjust repetition rate to match the measurement time window.
8. TCSPC electronics dead time of 10ns or less to be able to match 100MHz repetition rate. Required for high frequency acquisitions with high frequency laser diodes or white laser.
9. TCSPC electronics, detection and software capable of acquiring up to 1,000 entire decays per second for the kinetic study the fluorescence lifetime changes.
10. Internal direct coupled PLQY integrating sphere (121mm diameter) with spill proof loading for powder samples.

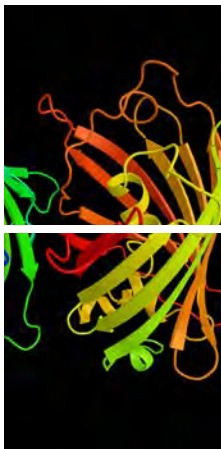
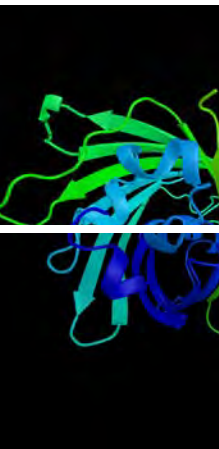
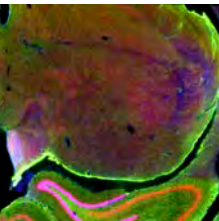
Sincerely,



Boqian (Ben) Yang, Ph.D.  
Export Manager  
HORIBA Scientific  
20 Knightsbridge Road, Piscataway, New Jersey USA 08854  
Email: boqian.yang@horiba.com

## FluoroMax<sup>®</sup> Plus

Sensitive, Flexible, Trusted Spectrofluorometer



High End Research  
Performance with  
Benchtop Convenience

[fluoromax.com](http://fluoromax.com)



# FluoroMax<sup>®</sup> Plus

**5th Generation** of the

World-renowned FluoroMax Benchtop Spectrofluorometer  
30 years of innovation and improvement...



## FluoroMax Plus Series 30 years of innovation and improvement

The FluoroMax<sup>®</sup> Plus Series is the culmination of decades of HORIBA's industry-leading experience in development of the highest level of spectrofluorometer performance in a convenient, affordable, easy-to-use benchtop model. The FluoroMax Plus, with its exquisite, optically perfect, all reflective optics, combined with photon counting detection, and multitude of accessories, provides the best sensitivity and versatility of any tabletop spectrofluorometer.

The FluoroMax Plus can be enhanced to suit a broad range of luminescence experiments, with a variety of optional accessories to expand capabilities and performance, as follows.

- An affordable LN-cooled NIR InGaAs detector for spectral detection to 1,700 nm
- Enhanced TCSPC fluorescence lifetime detectors for very short (down to 25 ps) lifetime measurements
- Extended NIR PMTs for spectral and TCSPC detection to 1,700 nm
- PLQY integrating spheres
- Phosphorescence pulsed light source and detection
- Automated microwell plate reader for high sample throughput
- Fluorescence microscopy, including PL mapping

The FluoroMax Plus is ideal for measuring solid and liquid samples, with high throughput screening, cryogenic or elevated temperatures, absolute quantum yields, microliter volumes, stopped flow mixing or titration, and even micron scale measurements using microscopes. With the most extensive list of accessories, the FluoroMax Plus offers unparalleled flexibility to meet all of your lab's experimental needs.

### Future Ready

All accessories can be added to your system at any time as your needs change, or funds become available.

- Research Level Performance
- Enhanced Modularity
- Perfect for any Application!

With thousands operating in universities and research labs around the world, the FluoroMax Plus is considered the reference benchtop spectrofluorometer. The FluoroMax Series has proven itself to be perfect for demanding steady state, time-resolved, TCSPC, PLQY and NIR luminescence needs.

The new FluoroMax Plus is manufactured at HORIBA's brand new, state of the art, 132,000 square foot facility in Piscataway, New Jersey, featuring the highest quality manufacturing processes and efficiencies.

The FluoroMax Plus is the instrument you can trust for your most demanding steady state, time-resolved, TCSPC, PLQY and NIR luminescence needs.



Made in the USA



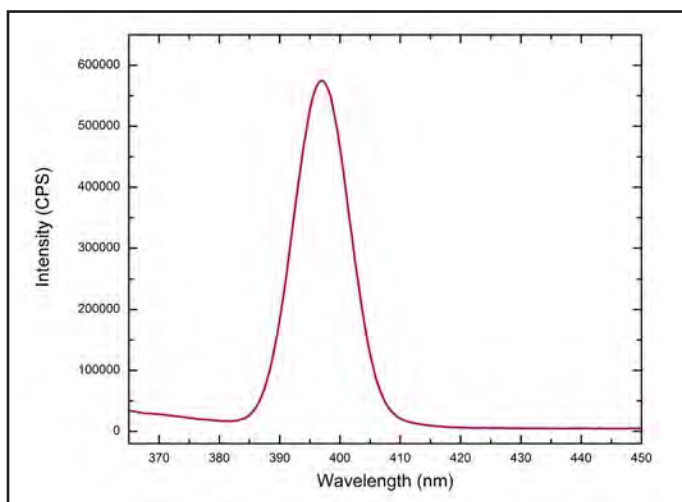
# Performance by design

## Maximizing Signal, Minimizing Noise

It can be confusing to compare the sensitivity of one instrument with another, considering the multiple specifications and differing definitions that exist. Rest assured that the FluoroMax Plus offers the highest sensitivity available in a benchtop spectrofluorometer.

Sensitivity of a spectrofluorometer is sometimes reported as a minimum measurable concentration of a fluorophore (commonly Fluorescein), or the signal-to-noise ratio (S/N) of the Raman scattering peak of water. Most companies opt for the second method to report sensitivity, as it is a more easily verified number, especially since ultrapure water is readily available around the world. Unfortunately, however, this specification can be confusing since two calculation methods prevail in the industry: First Standard Deviation (FSD) and Root Mean Square (RMS). The FSD method is only applicable to photon counting fluorometers, and the RMS method is equally applicable for analog or photon counting fluorometers.

The Raman band of ultrapure water was measured with FluoroMax Plus in a standard 1 cm quartz cuvette. HORIBA qualifies its instruments with the signal to noise ratio based on the First Standard Deviation (FSD) of light from its standard Xenon lamp source.



The FluoroMax Plus is a photon counting spectrofluorometer that offers far superior sensitivity to analog-based PMT fluorometers. Consequently, the HORIBA fluorescence group quotes the water Raman S/N using the FSD method to specify sensitivity.

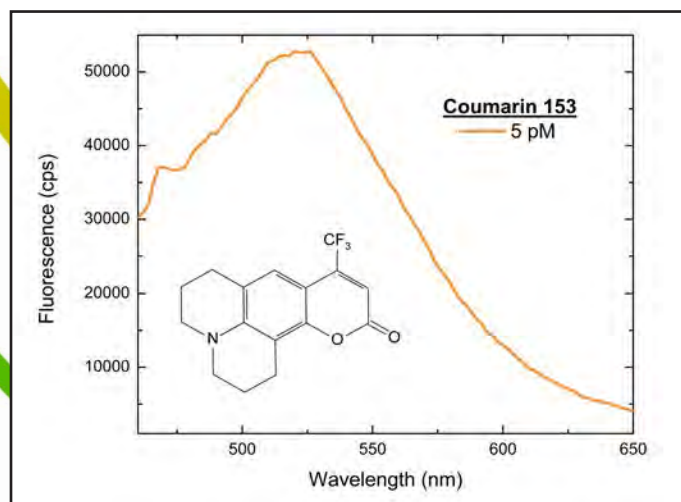
The FSD signal-to-noise ratio formula is shown below.

$$\frac{S}{N} = \frac{S_{397 \text{ nm}} - S_{450 \text{ nm}}}{\sqrt{S_{450 \text{ nm}}}}$$

The peak signal is measured at the water Raman peak intensity at 397 nm (for 350 nm excitation) and the noise in a region where no Raman emission is present (450 nm). Acquisition parameters for the FluoroMax Plus water Raman standard measurements are as follows:

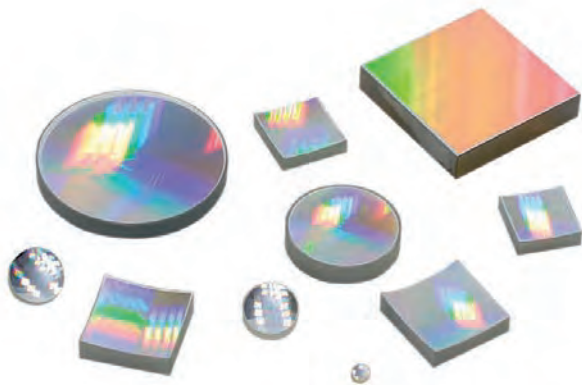
- Excitation:** 350 nm with 5 nm bandpass
- Emission scan:** 365–455 nm with 5 nm bandpass
- Emission wavelength step interval:** 0.5 nm
- Integration time per step:** 1 second
- Single emission scan:** (no repeats)
- No smoothing of data points**
- No optical filters of any kind**

Coumarin 153 was serially diluted to a concentration of 5.0 pM in Ethanol. The spectrum shown represents the subtraction of fluorescence data from a blank to remove solvent background and Raman scatter.



## HORIBA Quality Optics

No matter how you measure it, the FluoroMax Plus has always been the most sensitive benchtop spectrofluorometer commercially available. This is the result of an optimized design, including the use of all reflective optics, photon counting detection, and the reduction of stray light by the use of our world famous HORIBA Jobin Yvon (JY) quality gratings and optical elements.



## Measure Smaller Samples, Detect Smaller Changes

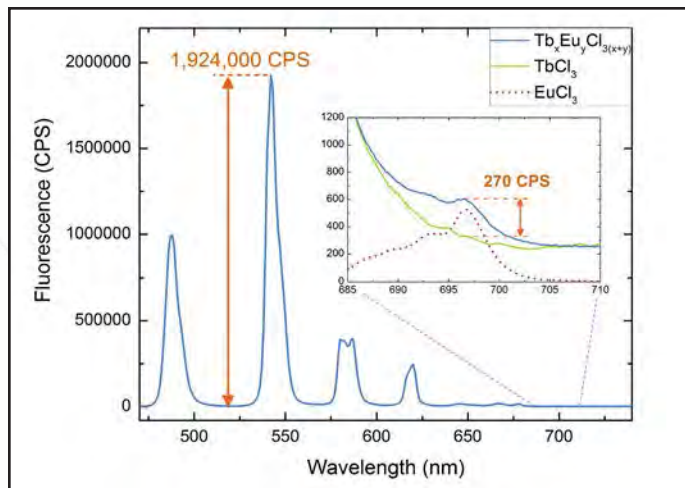
### Big discoveries come from small changes

Don't let your research get lost in the noise. Using the most sensitive fluorometer means having confidence in small changes in your data—the same small changes that drive curiosity and new discoveries.

### Dilute and small volume samples

Higher sensitivity also means you can measure more dilute samples, or need less sample to begin with. Given the cost and effort often required for sample preparation, this means you save both time and money.

Spectrum of a mixture of terbium chloride and europium chloride in ultrapure water. The inset is a zoomed view of the spectrum showing the very weak europium chloride peak measured in the same scan as the extremely strong terbium chloride peaks recorded in the same measurement. The spectra of pure terbium chloride and pure europium chloride are also shown in the zoomed in view for reference.



## Sensitivity Means Speed

The real limit on how rapidly you can acquire data is not how fast you can physically scan the monochromator grating, but how long you have to measure at each wavelength to get an acceptable signal-to-noise. The higher sensitivity of the FluoroMax Plus means that not only can you measure weaker samples, but also that you can actually measure them faster than by using lower sensitivity fluorometers. If speed of acquisition is really important to you, be sure to compare the speed and quality of spectra of the FluoroMax Plus on your particular sample.

## Dynamic Range

Fortunately not all fluorescence samples are weak. Some samples are quite strong. But some are both, which creates a challenge to measure the strong and the weak peaks in the same scan. With an intra-spectral range of over 6 orders of magnitude, even wildly varying multi-component spectra are easily measured in one scan. Not only does this save time, but it is essential for kinetics studies when one cannot afford to repeat a measurement at different integration times to keep all peaks within range.

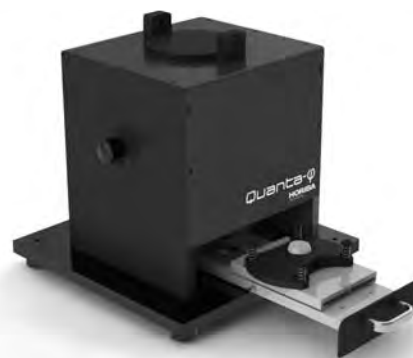


# Enhanced measurements

## Absolute Quantum Yield Measurements

Photoluminescence Quantum Yield (PLQY) measurements are critical for a broad range of applications including new material development, photovoltaics and the development of new fluorescence probes. With thousands of PLQY citations around the world, the FluoroMax has long been recognized for its superior quality of PLQY performance for the most demanding applications.

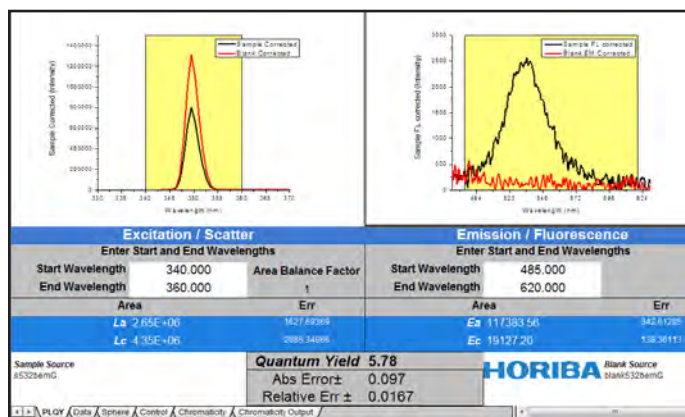
The FluoroMax Plus continues this tradition and now offers two different PLQY integrating sphere options so you can choose what is best for your application: An 81 mm diameter sphere tray assembly that directly couples inside the sample compartment, and our larger 152 mm diameter external sphere, called Quanta-Phi, which is fiber-coupled to the FluoroMax Plus. Both spheres are provided by HORIBA with sphere correction curves obtained with standard reference materials (SRMs) from the National Institute of Standards and Technology (NIST), and the PLQY accuracy of the entire FluoroMax Plus with either sphere is validated with two different globally accepted PLQY standards. Both PLQY spheres allow for accurate PLQY determination, even below 1%, depending on the sample. The smaller sphere is an excellent value option for a customer with a limited budget who still wants a very accurate PLQY system. The larger sphere has benefits inherent with its larger size, in particular, slightly better precision.



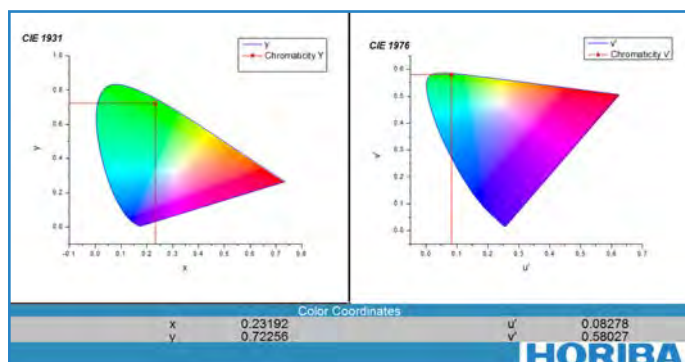
Quanta-Phi  
External Fiber-coupled Integrating Sphere



K-Sphere-Petite  
Internal, Directly-coupled Integrating Sphere



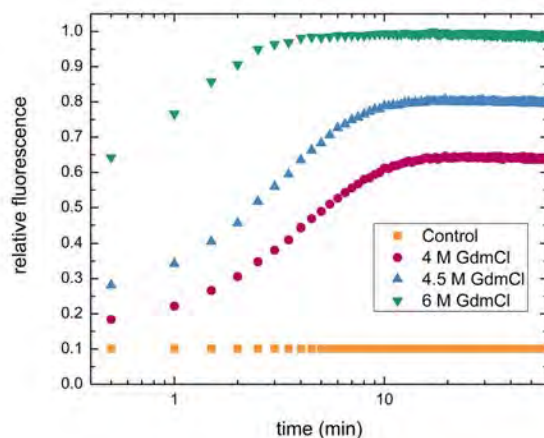
High precision absolute quantum yield characterization of a quantum dot sample enabled by the Quanta-φ integrating sphere accessory.



FluoroMax software also automatically generates colorimetric CIE 1931 and 1976 values for your sample.

## Kinetics

Measuring temporal variations in fluorescence spectra can yield information beyond that available from single time point measurements. For example, monitoring protein stability and folding in controlled solution conditions is crucial for developing targets for structure-based medicines. The FluoroMax Plus Series lets you measure dynamics on a scale from milliseconds to hours.



Kinetics of lysozyme dissolved in several concentrations of the chaotrope, guanidinium hydrochloride, monitored by measuring native tryptophan fluorescence simultaneously for 1 hour in a multi-sample changer. Data corrected for photobleaching using a control sample.

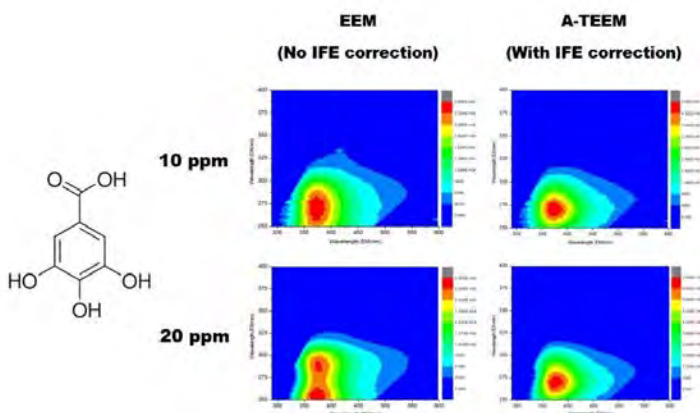
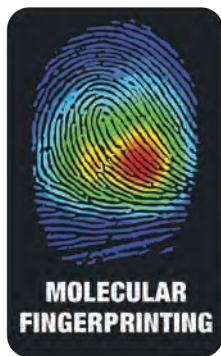


## Absorbance/Transmittance Accessory

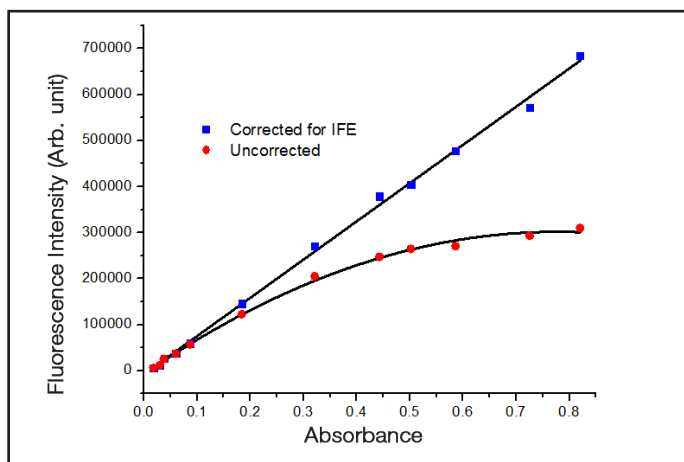
Add absorbance to your fluorescence measurement.

### Featuring IFE Correction

With the addition of an absorbance accessory, the FluoroMax Plus can correct an Excitation Emission Matrix (EEM) for the inner filter effect (IFE) to provide a true molecular fingerprint of a sample. IFE limits the linearity of the fluorescence signal at higher sample concentrations due to primary and secondary re-absorption of fluorescence. IFE correction is essential for accurate chemometric component analysis which can be accomplished with third party software analysis tools.



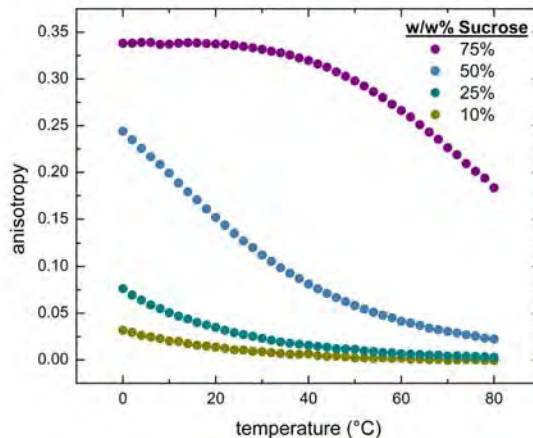
EEMs collected on FluoroMax Plus of gallic acid at two different concentrations, with and without, absorbance corrections. The EEMs collected on the left are the uncorrected EEM fingerprint. The Absorbance Transmission Excitation Emission Matrices (A-TEEM™) collected on the right is corrected for inner filter effects. The bottom left EEM at 20 ppm, clearly shows a distortion due to IFE, but the A-TEEM on the bottom right is the same as the fingerprint, at the slightly lower concentration of 10 ppm.



The fluorescence intensity of a compound loses linearity at higher concentrations. Shown is the ability of inner filter effect corrections to extend the linear dynamic range of fluorescein detection to much higher concentrations than traditional fluorimeters that cannot correct for IFE.

## Polarization

Adding optional polarizers to a FluoroMax Plus allows you to study molecular rotation. This indirect measure of the local viscosity gives information on sample aggregation, structural changes, molecular binding, and other mechanisms. The FluoroMax Plus polarizers are Glan-Thompson prisms, providing the highest efficiency across the whole wavelength range from the UV to the NIR.



Fluorescein dissolved in four aqueous solutions of sucrose. With increased solution temperature, viscosity decreases, yielding faster rotation times and correspondingly lower anisotropies. Similarly, anisotropy is an excellent tool for understanding changes in macromolecule shape, as well as molecular binding.

# Technologies and applications

The FluoroMax Plus covers the broadest range of luminescence research.



Materials Research • Earth Sciences • C



chemistry • Food Science • Life Sciences

# TCSPC

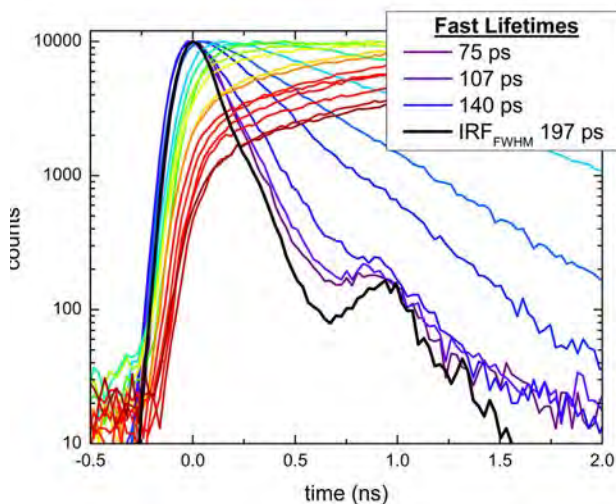
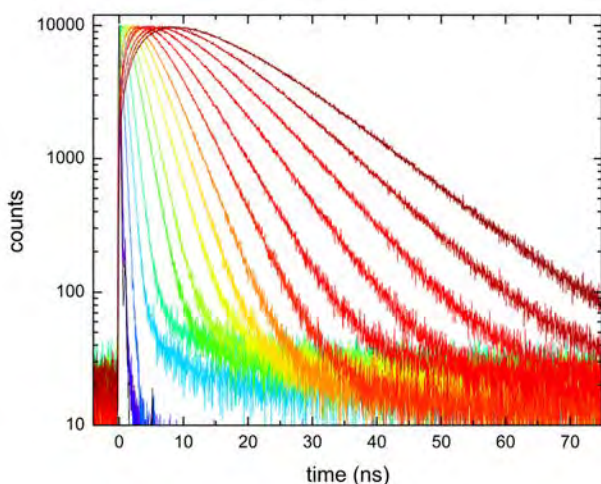
## Take Your Measurements to the Next Dimension with Fluorescence Lifetimes

### Time Correlated Single Photon Counting

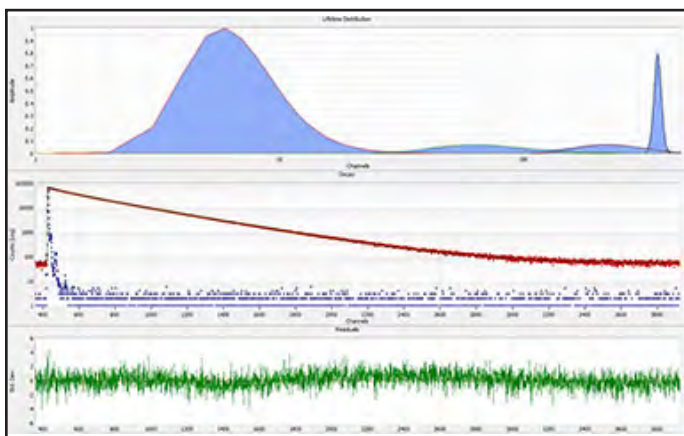
Add lifetime measurement to any FluoroMax Plus with the DeltaTime™ TCSPC accessory. Working in the time domain removes the confounding influences of concentration and photobleaching. With its industry-leading true 100 MHz system operation, DeltaTime offers TCSPC acquisition rates, with fast decays being acquired in mere milliseconds, allowing for TCSPC lifetime kinetics of fast reactions. Its crystal-locked timing circuits never require recalibration. Select from our current catalog of over 70 compact pulsed light sources, with more being added all the time. And once you get your data, powerful analysis software lets you choose among 9 fitting models.

### Unique TCSPC Benefits

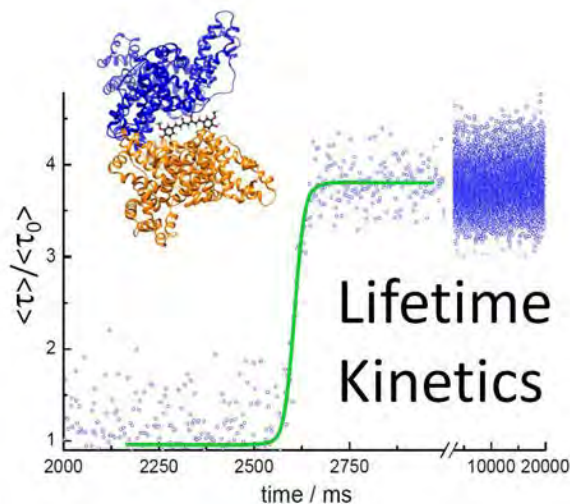
- 40 years of experience in TCSPC innovation
- Industry-leading true 100 MHz system operation
- TCSPC decay acquired in the blink of an eye
- TCSPC lifetimes kinetics acquisition time up to 1,000 decays per second
- Lifetimes from 25 ps to seconds
- True plug and play sources do not require recalibration switching from one to the other
- Unique SpectraLED LED series for highest efficiency phosphorescence measurements
- TCSPC lifetimes, anisotropy, TRES, and kinetics.
- Robust data, independent of concentration and photobleaching



Lifetimes of rhodamine 6G in methanol measured using optional ultrafast PPD detector. At high concentrations, self-quenching results from homodimers and trimers formation. Lifetimes as short as 75 ps are seen, as well as homo-FRET at lower concentrations.



Non-extensive distribution fits: 1,8-ANS exists in free solution and partitions into several disparate environments in bovine serum albumin. Within each environment, a distribution of states exists with a corresponding distribution of lifetimes. FluoroMax software not only offers standard discrete exponential fitting, but also several energy transfer and distribution models, including the proprietary non-extensive distribution shown here.

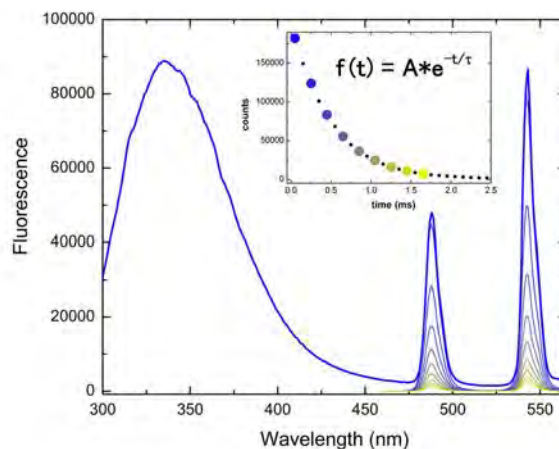


Sample photobleaching corrupts kinetic data by adding an exponential term. Lifetimes are more robust than steady state intensities. To support rapid kinetics, the FluoroMax is capable of measuring a complete lifetime decay in as little as every 10 ms. Example shown is the binding of curcumin to serum albumin.

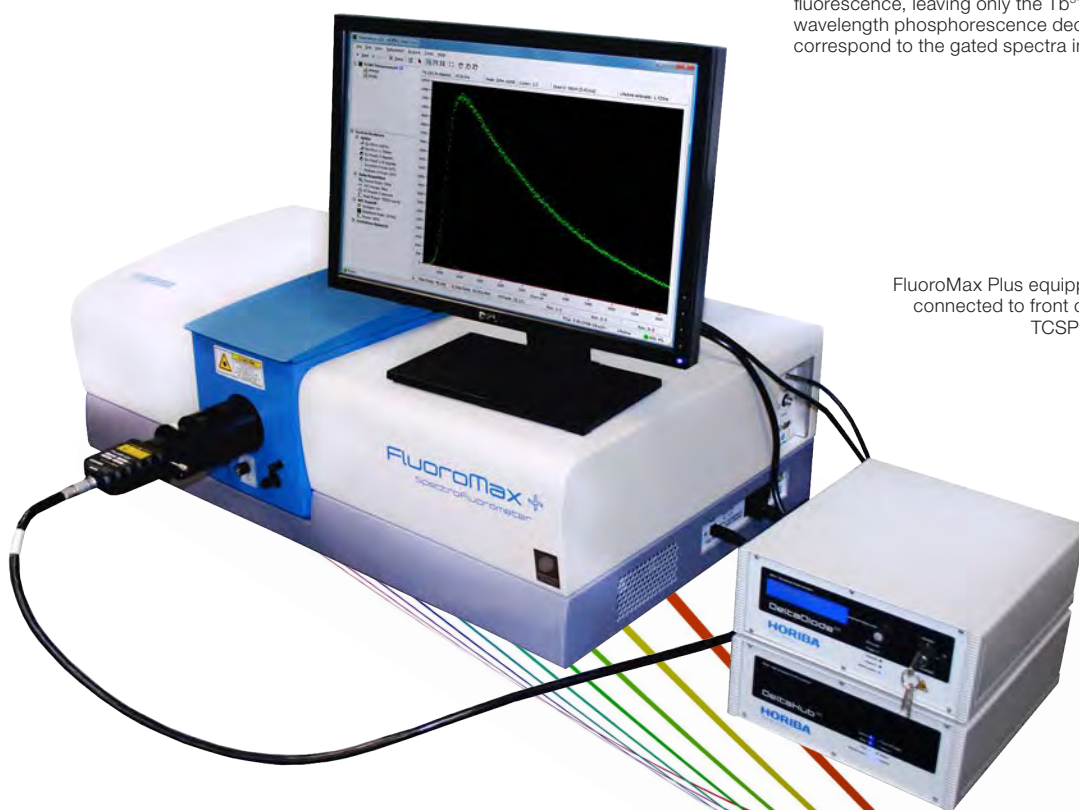
## Phosphorescence

### Measure phosphorescence spectra, or phosphorescence lifetimes from microseconds to seconds

The FluoroMax Plus “P” versions add an optional pulsed xenon flash lamp, enabling lifetime measurements down to 10  $\mu\text{s}$  with no additional electronics or detectors. Ideal for measuring lanthanide-tagged samples or rare earth phosphors used in a variety of applications.



Complex solutions like this mixture of bovine serum albumin (BSA) and terbium chloride can be challenging to interpret. Using the pulsed light source of the phosphorescence option allows you to temporally “gate out” the BSA fluorescence, leaving only the  $\text{Tb}^{3+}$  phosphorescence. Inset shows the single wavelength phosphorescence decay of  $\text{Tb}^{3+}$  in this mixture; colored circles correspond to the gated spectra in the main figure.



FluoroMax Plus equipped with 100 MHz DeltaDiode, connected to front of sample compartment and TCSPC electronics.

### Enhanced Phosphorescence with SpectraLED LED Sources

HORIBA SpectraLED sources can also be optionally selected to enhance phosphorescence lifetime measurements. They are fixed wavelength sources that connect to the front of the FluoroMax Plus sample compartment to illuminate directly on the sample. Compared to a pulsed xenon lamp, all SpectraLED sources have the benefit of operating at higher repetition rates for faster acquisitions, and at varying pulse durations, all under software control. For example, with a SpectraLED set to the shortest pulse duration, the FluoroMax Plus can measure shorter phosphorescence lifetimes. A SpectraLED can also be set to have a very long pulse duration to enhance the sensitivity of longer phosphorescence lifetime samples.

# Extend the spectral or lifetime range of your FluoroMax Plus

In addition to all the standard capabilities of the FluoroMax Plus, the system allows you to add a second detector on the emission monochromator, as well as a dual grating turret for extended NIR wavelength detection. The second detector is fully automated with a computer-controlled slit, detector flipping mirror and dual grating turret selection.

The standard PMT detector in the FluoroMax Plus detects from 185 to 900 nm and can be used for spectral measurements, or with the addition of TCSPC accessories, fluorescence lifetime measurements. However, you can replace that standard PMT with a NIR-extended PMT that covers the range from 185 to 980 nm. This option does not require the addition of a second detector port being added to the emission monochromator.

**The unique all reflective optics design of the FluoroMax Plus always focuses all wavelengths of light to the same precise point.**

This is not true of lens-based spectrofluorometers. Lenses introduce chromatic aberrations, which means that different wavelengths of light are focused through a lens to different points. This phenomenon gets much worse at farther and farther wavelengths, so when you want to work out to 1,700 nm with an extended NIR detector, you really want to be sure you have an all-reflective instrument. *Only the HORIBA FluoroMax Plus provides this optimized performance at all wavelengths, even in the NIR.*



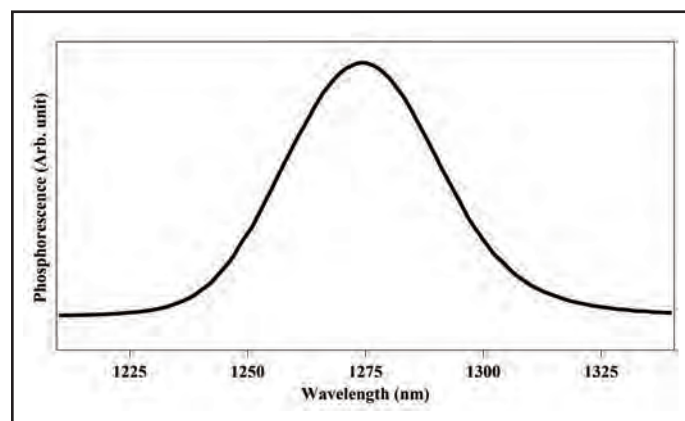
## Available FluoroMax Plus Second Detectors

### • Extended NIR:

**LN-Cooled InGaAs Detector:** This is an excellent affordable alternative for spectral detection from 800 to 1,700 nm

**Cooled-NIR PMT:** A broad range photomultiplier for spectral, TCSPC and phosphorescence detection from 200 to 1,010 nm

**Deep-cooled NIR PMT:** Deep-cooled NIR PMTs for spectral, TCSPC and phosphorescence detection. Choose from enhanced 950 to 1,400 nm, or 950 to 1,700 nm options



Phosphorescence spectrum of singlet oxygen generated by rose bengal in methanol demonstrates the exquisite sensitivity of the FluoroMax Plus equipped with LN-cooled IGA detector.

### • ENHANCED TCSPC for Ultra Short Lifetimes:

#### PPD and HPPD Detectors for Shorter Lifetime Detection.

The standard FluoroMax Plus PMT detector can be used for collection of steady state spectra, TCSPC fluorescence lifetime detection down to 130-150 ps, and gated phosphorescence detection. However, HORIBA offers our optional PPD and HPPD TCSPC detectors which allow for the ability to measure TCSPC fluorescence lifetimes as short as 25 picoseconds.

#### Additional Gratings for Dual-Grating Turret

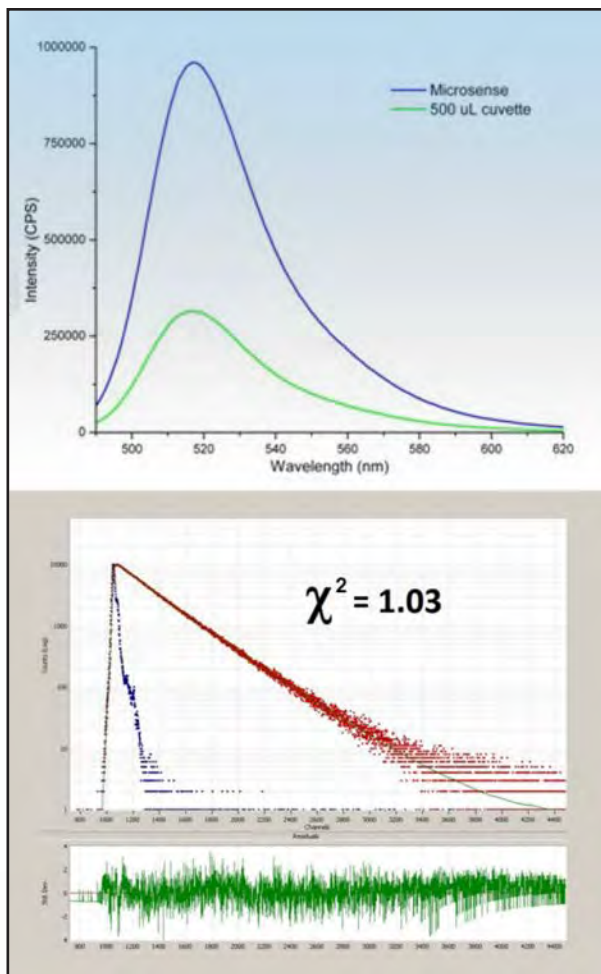
- 1200 grooves/mm blazed at 500 nm
- 600 grooves/mm blazed at 1  $\mu\text{m}$ , gold coated for optimized NIR response
- Other gratings available on request.

# Accessories

## Microvolumes

**Measure ultra-low sample volumes with easy sample recovery.**

HORIBA's Microsense, the most advanced microliter accessory on the market, is designed to get cuvette-quality steady state or lifetime data from just 1-5  $\mu\text{L}$  of sample.



Using the Microsense, 5  $\mu\text{L}$  of AlexaFluor 488 labeled IgG is enough to get steady state or TCSPC data with FluoroMax Plus.

Avoiding dilution and nearly total sample recovery minimizes the waste of samples, while preserving measurement sensitivity. Based on all quartz optics, Microsense is compatible with UV to NIR measurements.

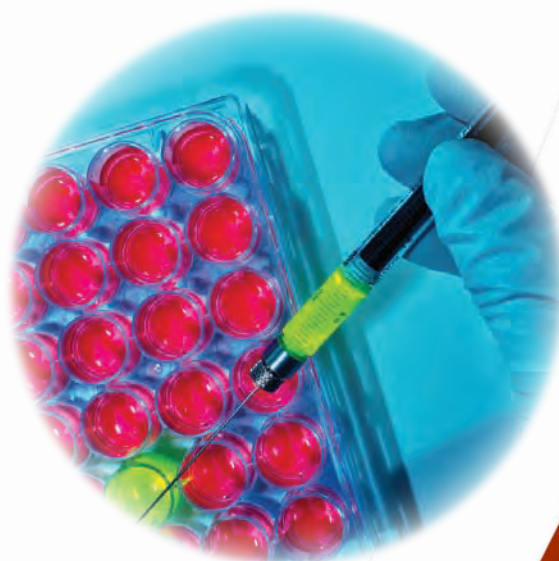
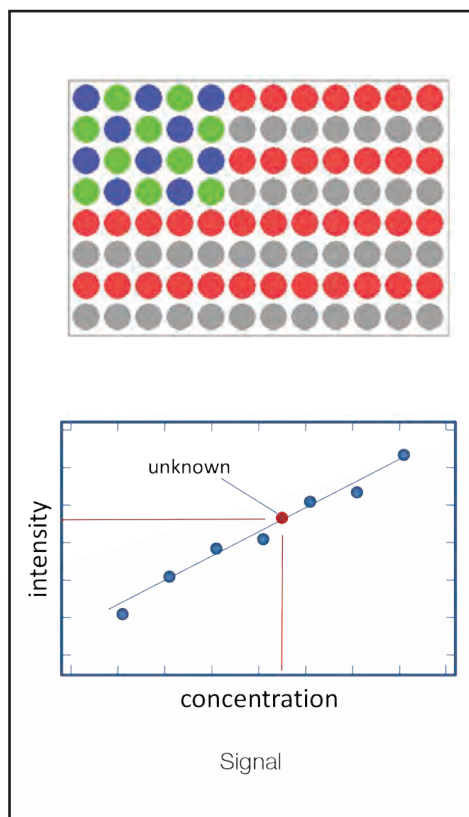
## Microplate High Throughput Accessory

### Maximize your throughput

Search for "hits" or automate measurements of a large number of samples.

The MicroMax 384 accessory lets you automate your measurements for high throughput data collection.

Based on standard well plates, MicroMax Plus saves you time and money by automating spectral, kinetics, single point, and time-resolved measurements on anywhere from 6 to 384 samples at a time. FluoroMax Plus software includes calibration curve routines for simple quantification of your results.



## Full Spectral Microscopy

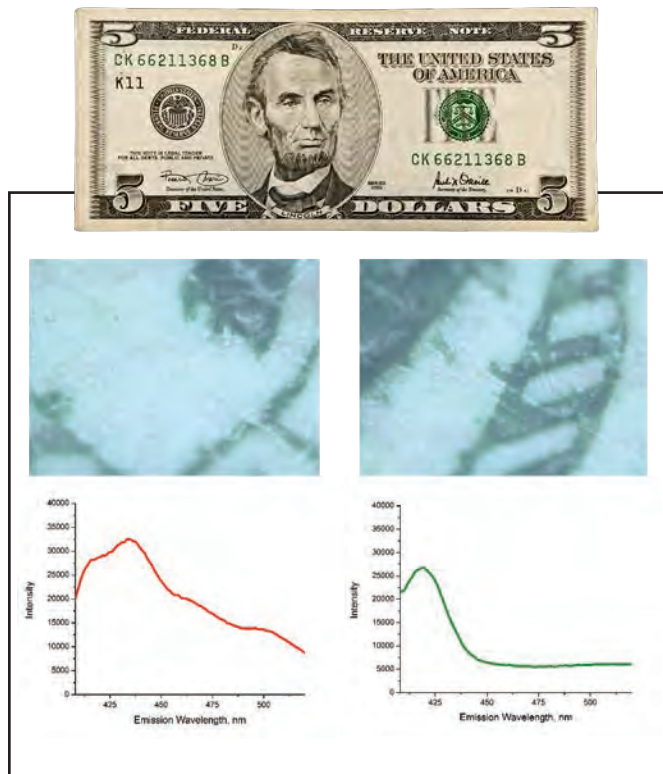
All FluoroMax Plus systems can be fiber-coupled to virtually any upright or inverted fluorescence microscope. Our microscope coupling allows you to go beyond simple filter-based fluorescence microscopy to full spectral analysis of spatially varying, or extremely small volume samples.

### Couple a microscope to a FluoroMax Plus and:

- Measure a complete spectrum of a sample as small as 1  $\mu\text{m}$
- Get spectra from as little as a few molecules of sample
- Perform localized FRET measurements

### Add an automated stage and camera, and:

- Create complete spatial/spectral maps
- Perform repetitive QC characterization of structured samples like photovoltaics



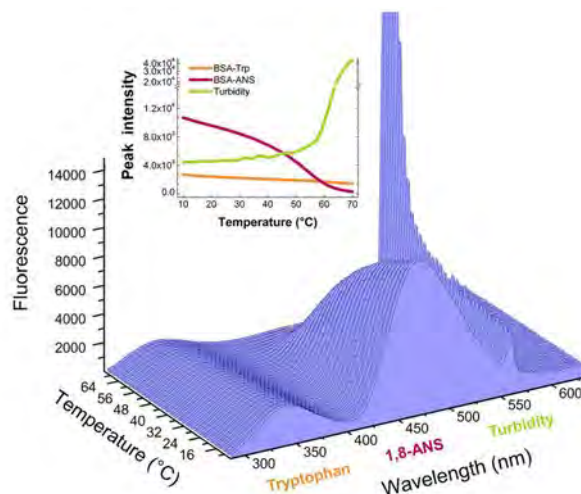
Data from a real and forged US five dollar bill. Fluorescence imaging shows no obvious differences. However it is easy to spectrally distinguish the real from the fake bill.

## Peltier-based Heated/Cooled Cuvette Holders

Rapid temperature control in single or multiple cuvette models with built-in magnetic stirring.

Precise temperature control for precise data on your protein folding, micellization, solubility, conformation, phase, and rotational transitions.

Rapidly vary sample temperature over a range of -25 to 105° C (-40 to 150° C optional). FluoroMax software also simplifies automating temperature dependence measurements, including complex ramps and profiles.



Thermal unfolding of bovine serum albumin in PBS and 1,8-ANS followed using three observables: The quenching of intrinsic tryptophan fluorescence by water, the quenching of the 1,8-ANS, and the increased 2nd order scattered light which reports turbidity from protein aggregation.

## Temperature Bath

An alternative to Peltier-based units for fixing a temperature without the need for variable temperature control, such as clamping biological sample temperature. Better precision (0.01° C), range (-25 to 100° C) and long term stability, but with much slower temperature ramping.



## Optional LN<sub>2</sub> and He Cryostats

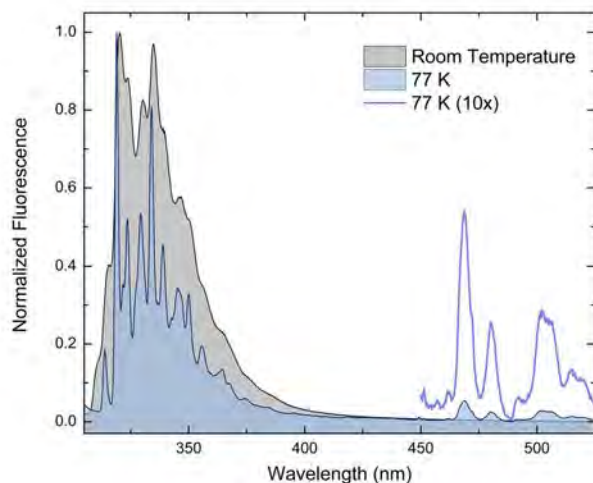
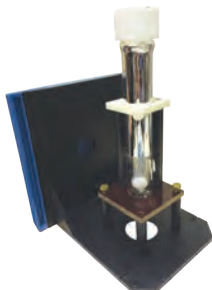
For greater temperature range and sample type flexibility, the FluoroMax Plus supports various cryostats offering temperature control down to 4 K.





## Economic LN Temperature Dewar Accessory

Cryogenic temperatures enable measurements of fine structure, enhanced phosphorescence, and rare conformations/states often not possible at room temperature. This low cost accessory readily permits measurements of liquid or solid samples at 77° K.



Temperature can add thermal broadening to fluorescence spectra and increase phosphorescence quenching. Spectra of naphthalene dissolved in methanol measured at room temperature (298° K) and in a liquid nitrogen dewar accessory (77° K). The low temperature spectrum reveals rich vibrational structure and longer wavelength phosphorescence. Phosphorescence peaks are also shown magnified 10x for clarity.

## Other Accessories

The FluoroMax Plus Series includes the most comprehensive line of accessories that enable researchers to extend the utility of their instrument to as many experiments as possible. The following is a partial list of accessories available, in addition to those previously discussed.

- Solid sample holder designed for viewing front-face fluorescence of thin films, powders, pellets, paper, fibers, or microscopic slides. Variable alignment angle
- 2 and 4 position thermostated sample holder with magnetic stirring bar
- 4-position sample holder with magnetic stirring bar
- Auto-titrator (injector) dual syringe, dual valve
- Hi-tech SFA-20 stopped flow, rapid kinetics accessory
- Fiber-optic probe, bifurcated, randomized, which is ideal for samples which cannot fit inside a standard sample chamber (requires fiber adapter)
- Sealed water standard in scratch-proof housing for water Raman S/N verification
- Emission correction factor kit
- Excitation correction factor kit
- Purge port, quartz windows for sample compartment for use with nitrogen purging.
- Up conversion laser accessories
- 250 µl reduced volume cell
- 500 µl cuvette 5x5 mm
- 20 µl HPLC flowcell



# FluorEssence™ software

**Simple enough for the occasional user but powerful for the most elaborate experiments.**

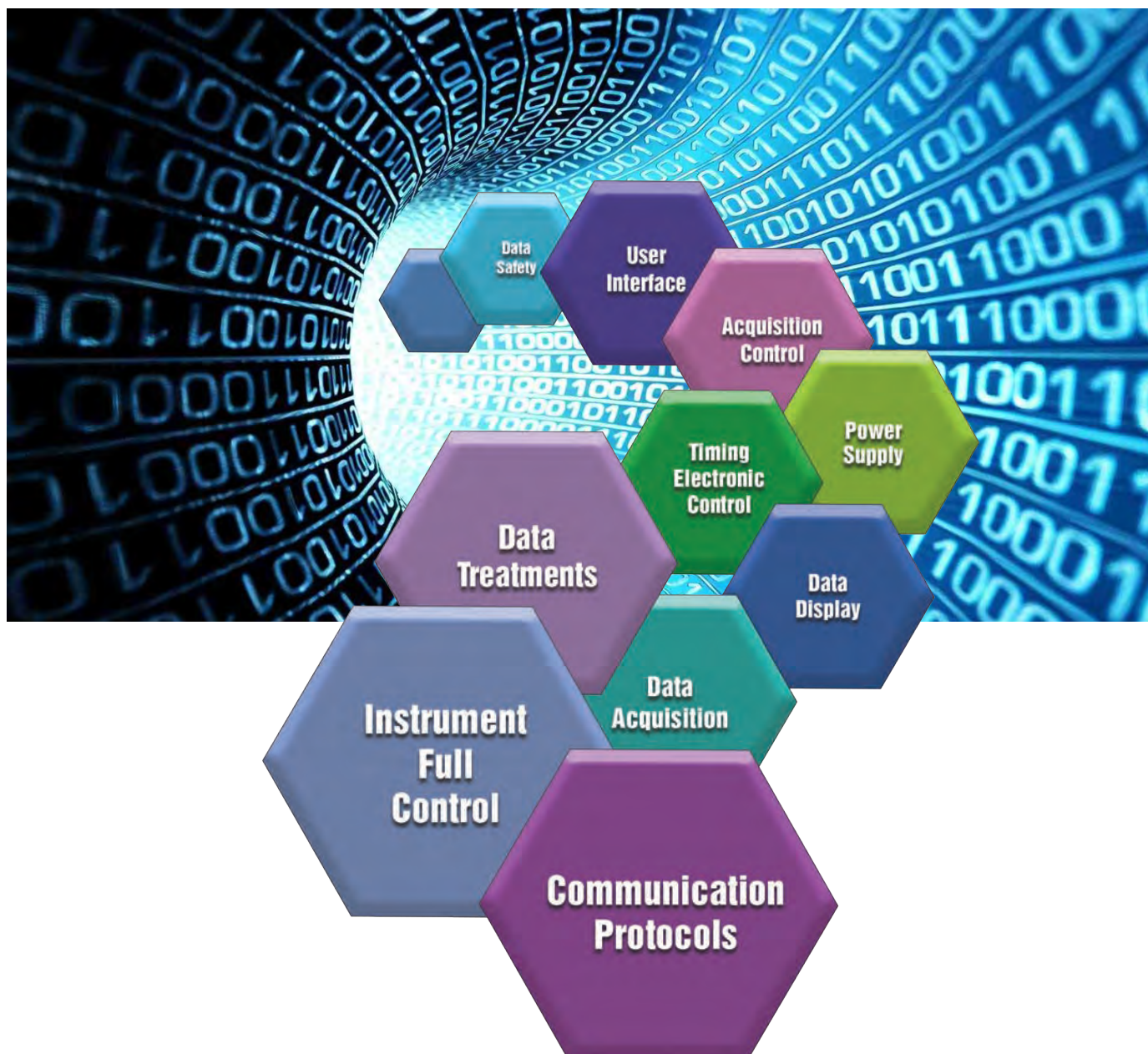
**Fluorescence software that works like you do:**

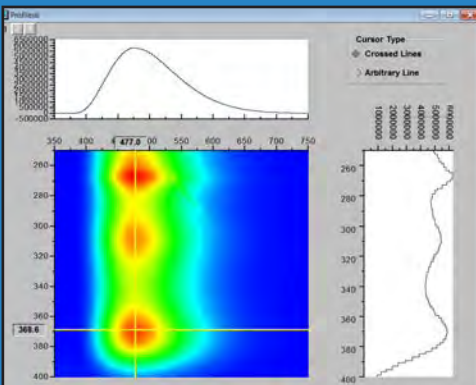
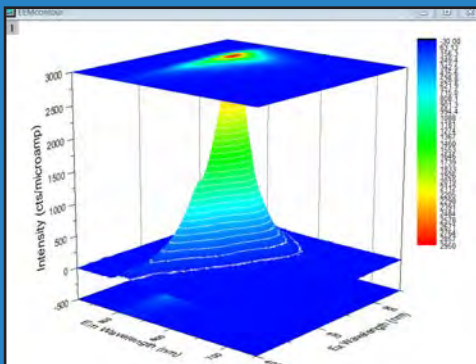
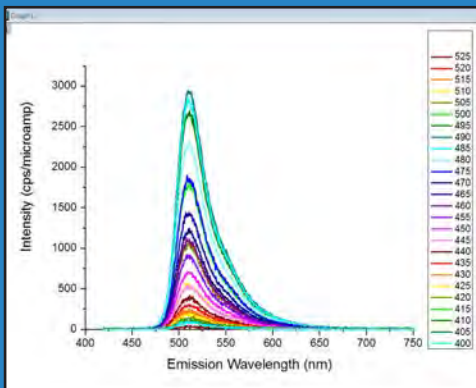
- Efficiently develop your experimental method, and then save it for future use
- Data collection, analysis and report generation are easily streamlined
- Full software control of accessories
- Automate repetitive experiments with a built-in batch mode
- All instrument calibration parameters are automatically applied per method

Of course, all experimental parameters are always saved along with the data file for comparison with previously collected data.

**Convert data to answers**

Powerful processing and data management tools of OriginPro, the most used data treatment software in scientific labs. Allows for immediate export to other computers.







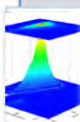
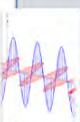


### Experiment:

- Spectra: Excitation, emission and synchronous spectrum
- Kinetics: Time-based intensities
- 3D Excitation Emission Matrix scan (EEM)
- Anisotropy vs. emission, excitation wavelength vs. time, temperature vs. single point
- Single point
- Phosphorescence vs. emission or excitation, help decay acquisition
- Lifetime options:
  - Lifetime decay
  - Anisotropy decay (up to 5 exponential)
  - TRES
  - MCS lifetime (phosphorescence)
  - Global analysis

**A complete library of video tutorials to help get you started.**

### Features:

- Data views in workbook formats, keeping graphs, tables and notes together for each experiment
- Zooming and scaling
- Contour maps and profiles from 3D plots
- Peak finding
- Integrate, differentiate, or fit fluorescence data to Gaussian, Lorentzian, and custom curves
- Standard arithmetic
- 3D perspective
- Smoothing
- Deconvolution
- Excitation/emission correction
- Interpolation and extrapolation
- Blank subtraction
- Normalization
- PLQY calculator wizard (for use with Quanta-φ™ accessory)

 <p><b>Spectra</b></p> <ul style="list-style-type: none"> <li>•Excitation Spectrum</li> <li>•Emission Spectrum</li> <li>•Synchronous Scan</li> </ul>	 <p><b>Kinetics (time-based intensities)</b></p>	 <p><b>3D Excitation Emission Matrix Scans</b></p>
 <p><b>Anisotropy</b></p> <ul style="list-style-type: none"> <li>•Vs. Emission wavelength</li> <li>•Vs. Excitation wavelength</li> <li>•Vs. time</li> <li>•Vs. temperature</li> <li>•Vs. single point</li> </ul>	 <p><b>Single Point (calibration curves)</b></p>	 <p><b>Phosphorescence (using xenon flash lamp)</b></p> <ul style="list-style-type: none"> <li>•Vs. Emission spectrum</li> <li>•Vs. Excitation spectrum</li> <li>•Decay by Delay</li> <li>•Decay by Sample</li> </ul>

# FluoroMax Plus specifications

Optics	All reflective optics for high sensitivity at all wavelengths and for microsamples
Source	150 W CW ozone-free xenon arc lamp
Monochromators	Czerny-Turner design with plane gratings for optimized focus at all wavelengths and minimum stray light
Excitation Grating	1200 groove/mm blazed at 330 nm
Emission Grating	1200 groove/mm blazed at 500 nm
Optional Second NIR Grating	600 groove/mm blazed at 1 $\mu$ m, gold coated, on a computer-controlled turret
Bandpass	0 to 30 nm, continuously adjustable
Wavelength Accuracy	$\pm$ 0.5 nm
Integration Time	1 ms to 160 s
Base Detector	Photomultiplier R928P, 185 to 900 nm, air-cooled and stabilized
Reference Detector	UV-enhanced silicon photodiode
Standard Filter Holders for Excitation and Emission Path	2" square filters can be added for any specific use
Water Raman S/N	10,000:1 FSD method
Steady State Reaction Kinetics Acquisition Rate	1 KHz to 0.02 Hz
Dimensions	83 cm (w) x 28 cm (h) x 48 cm (d)
Weight	34 kg
Optional Extended NIR Base Detector	Photomultiplier R13456, 185 to 980 nm, air-cooled and stabilized
Optional Cooled NIR PMT Detector	200 nm to 1050 nm
Optional Cooled Extended NIR PMT Detector	950 nm to 1700 nm
Optional Extended LN-cooled NIR InGaAs Detector	800 to 1700 nm spectral detection
Optional Transmission Detector	UV-enhanced silicon photodiode
Optional Pulsed Xenon Lamp for Phosphorescence	10 Watt (software controlled from 0.03 to 25 Hz)
Optional Automated Plate Reader	96 or 384 well plates
Optional Integrating Spheres for PLQY	Easy, quick change of either internal 80 mm diameter sphere, or external 150 mm sphere
<b>Lifetime Options</b>	
TCSPC:	
Lifetime Range with Standard PMT Detector	<150 ps to 1 s
Lifetime Range with Optional Fast PPD Detector and HPPD Detectors	<25 ps to 1 s (PPD) <5 ps (HPPD)
Instrument Response Function (IRF) with Optional PPD and HPPD Detectors	PPD <200 ps HPPD ~50 ps
Transit Time Spread (TTS) with Optional PPD detector	<180 ps typical at 405 nm
Repetition Rate of Laser Diodes with Optional DeltaDiode lasers	100 MHz to 10 KHz
TCSPC Electronics Dead Time	10 ns
TCSPC Lifetime Kinetics Acquisition Time	1 ms
TCSPC Lifetime Kinetics Acquisition Rate	Up to 1,000 TCSPC decays per second
Phosphorescence Lifetime Range with SpectraLED Phosphorescence Source	<10 $\mu$ s to 10 s

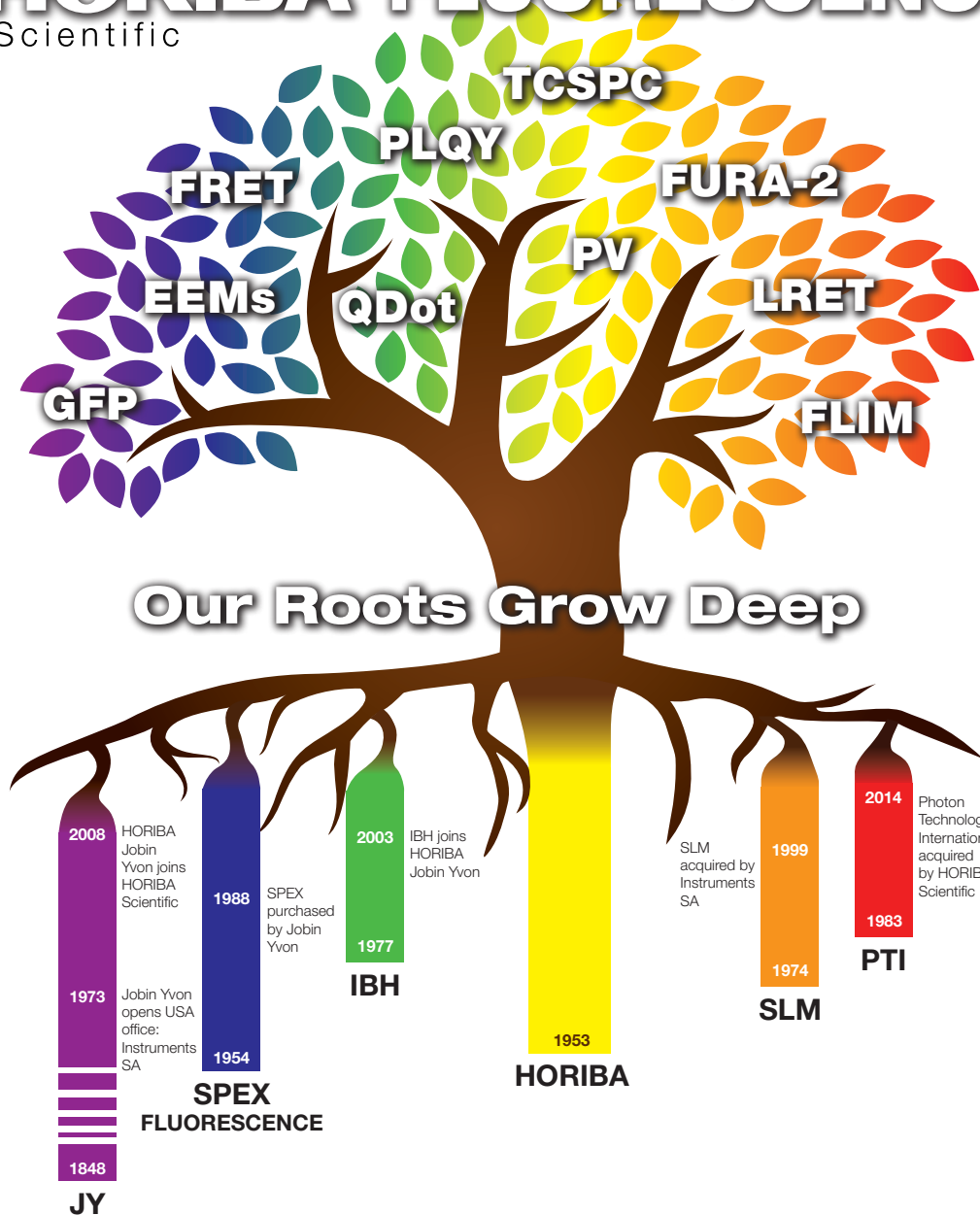
HORIBA Scientific has a policy of continuous product development, and reserves the right to amend part numbers, descriptions and specifications without prior notice.

# Family of fluorescence systems



# HORIBA FLUORESCENCE

Scientific



Our Roots Grow Deep

FluoroMax Plus is a registered trademark in the United States of HORIBA Instruments Incorporated.

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## Annexure I

### HIGH SENSITIVITY SPECTROFLUOROMETER SPECIFICATION

<b>Parameter</b>	<b>Required Specification</b>
Source	150W or higher ozone free Xenon lamp for doing steady state Fluorescence measurements
Optics	Should be mirror based system
Wavelength Range	200-950 nm or better
Monochromator	Single monochromator with Czerny-Turner design in both excitation and emission side.
Grating	Excitation Grating: 1200 gr/mm grating blazed between 300-330 nm Emission Grating 1200 gr/mm grating blazed between 500-550 nm
Band pass	Continuously adjustable by computer from 1-30nm or better.
Scan Speed	Minimum 4800 nm/min
Wavelength Accuracy	+/- 0.5 nm or better
Signal to Noise Ratio	10,000:1 or better (FSD Method)
Reference Detector	Photodiode detector lamp correction
Emission Detector	PMT with wavelength range from 250-850 nm. It should be operated in Photon Counting mode.
Sample Compartment	It should be a cryostat compatible
Sample holders	<ul style="list-style-type: none"><li>➤ Solid Sample holder for thin films and powders</li><li>➤ Cuvette: 10 mm path length cuvette</li></ul>
Software	Windows based software should be provided for data collection and system control
PC	Factory tested branded PC should be supplied along with the system
UPS and AC	2KVA UPS having 30 minutes backup and 1 Ton AC to be provided.
<b>Warranty</b>	<b>Minimum three year from the date of installation.</b>

**Upgradation Possibility:** The instrument must be upgradable to the lifetime mode (ns, ps and ms) and phosphorescence mode.