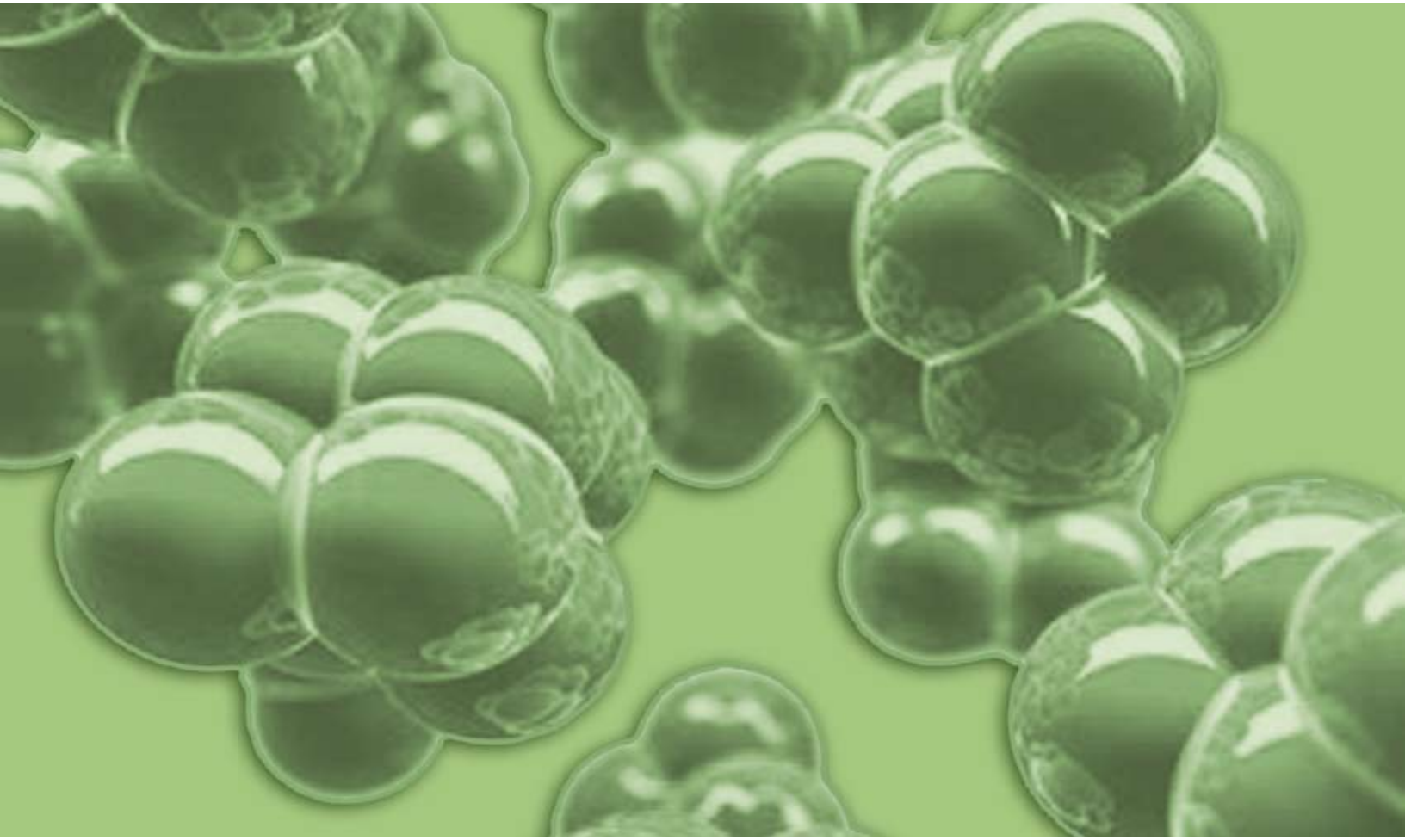
QuantaMaster



Fluorescence - Luminescence
UV VIS - NIR

Photon Technology International, Inc.

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The Fluorescence Solution Company

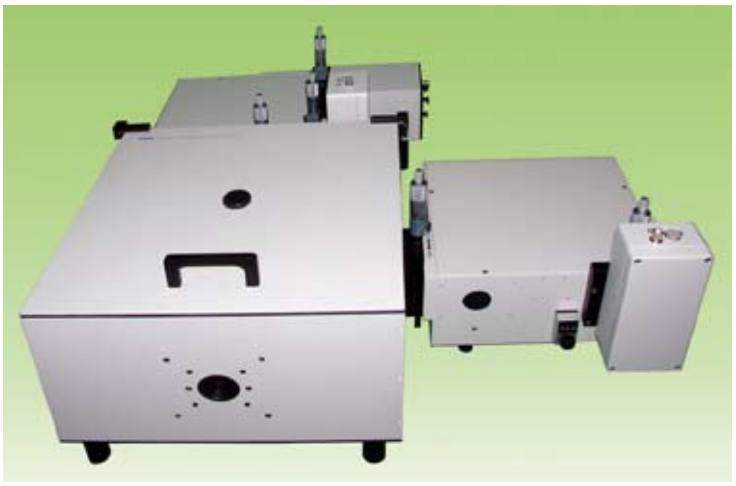
Steady State – Continuous Excitation

Ultimate in Sensitivity

The QuantaMaster™ series of research grade spectrofluorometers are versatile systems for steady state fluorescence measurements. The foundation of a fluorescence spectroscopy laboratory is built on steady state intensity measurements such as wavelength scans, time-based experiments, and synchronous scans. All of these acquisitions are easily handled by the QuantaMaster™ series while boasting the highest sensitivity in the industry. The highest sensitivity allows for the most minute traces of fluorescent materials to be detected and identified in mixtures. Oil samples can be fingerprinted and identified. Distances within macromolecules can be easily measured. The dynamics of protein folding can be studied. Concentrations of ions can be measured inside living cells. Membrane structure and function may be studied with fluorescence probes. These are just some of the examples of the many applications that the QuantaMaster™ system can handle.

In addition, the QuantaMaster™ series modular design offers reassurance that your system can be easily customized and adapted to your growing research capabilities.

Phosphorescence – Pulsed Excitation



Prevent Photobleaching
Ideal for Luminescence/Phosphorescence

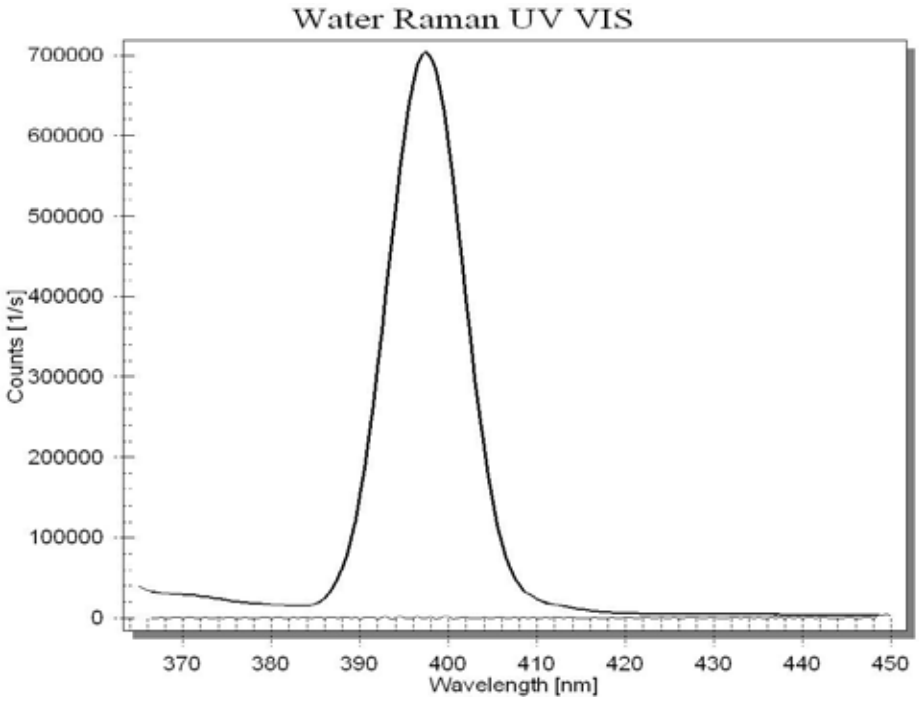
The QuantaMaster™ can be equipped with a pulsed light source. The continuously tunable repetition rate (up to 300Hz) of the Xe lamp is of great benefit to users who utilize fluorescent probes that are prone to photobleaching. With the pulsed Xe lamp, the sample is exposed to light for only 0.03% of the duration of the experiment. Therefore, this configuration is ideal for all photosensitive kinetic assays such as GFP and many biological samples. The pulsed Xe lamp combined with a gated detector is also used for the determination of phosphorescence spectra and phosphorescence lifetimes. This is achieved by introducing a user selectable detection time window in the data acquisition software. When the window is fixed and placed away from the excitation pulse, a phosphorescence spectrum can be measured. Alternatively, the window can be swept in time yielding a phosphorescence decay curve. The pulsed Xe source and the gated detector are especially advantageous for all lanthanide-based probes. The long lifetimes of these probes make it possible to place the detection window far enough away from the excitation pulse, thus completely removing organic fluorescence and scattered light contamination from the signal. It is an ideal system for measuring long-lived photoluminescence of lanthanide-based probes.

QuantaMaster

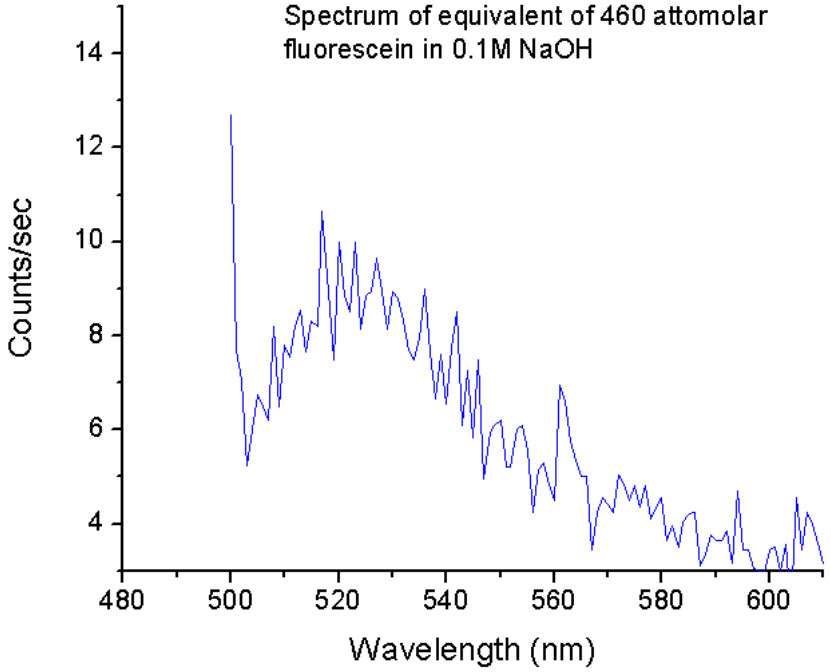
Sensitivity

The industry standard for sensitivity is a signal to noise ratio for a measurement of a water Raman spectrum. Yet, what does that actually mean in terms of a real world application? The truth is that there is no standardized experiment to measure water Raman. While we at PTI demonstrate the industry standard water Raman test to illustrate signal to noise ratio, we also show the true detection limit of our system using the fluorescein fluorophore – the lowest detection available in today's market.

Signal to Noise Ratio of a QuantaMaster™ 4 CW



Water Raman spectrum measured with a regular, production grade steady state QuantaMaster™ system. Minimum specification for the QuantaMaster™ series is 10,000:1 signal to noise. However this is the minimum specification and often our systems are able to achieve much higher S/N values, as illustrated here by the Raman signal resulting in S/N = 16,000:1. Experimental conditions: λex = 350 nm, spectral bandwidth (ex, em) = 5 nm, integration time = 1 s.

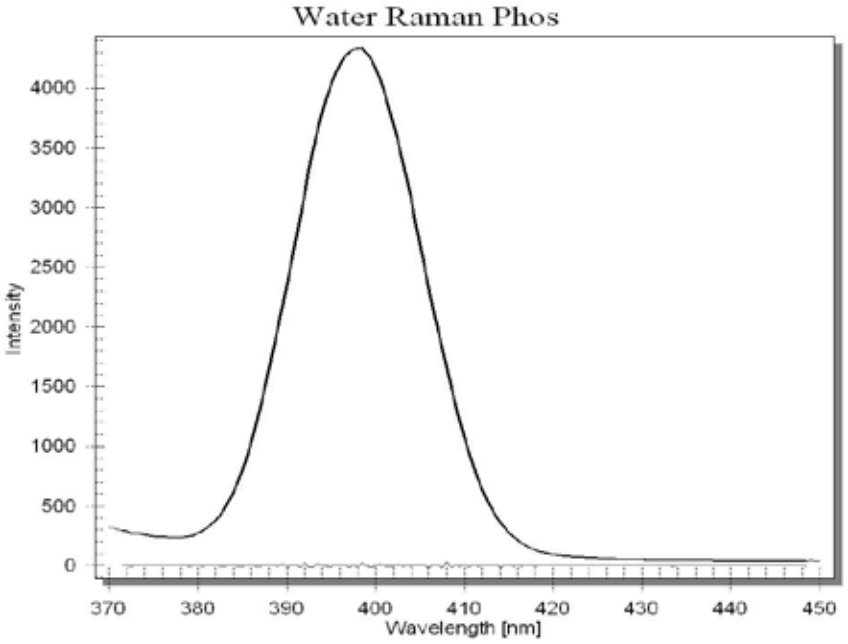


Attomolar sensitivity of the QuantaMaster™ 4 CW. A true sensitivity test utilizing a real fluorophore – unsurpassed performance of the QuantaMaster™ equipped with a continuous 75W Xe light source and a photon counting PMT detector.

Why Sensitivity Of An Instrument Is The Most Important Parameter

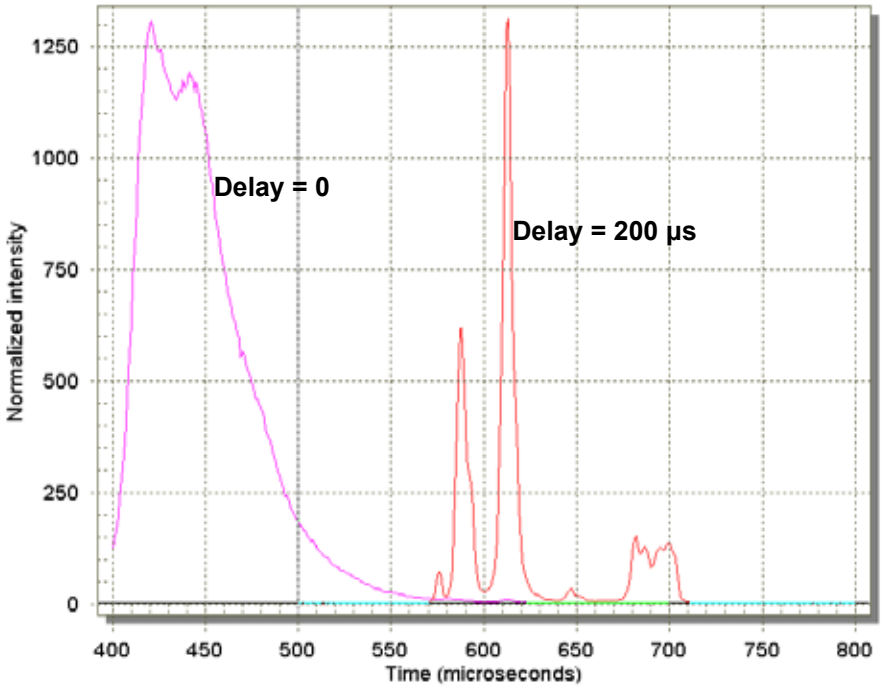
Sensitivity is important to you because the sensitivity of an instrument determines the accuracy of measurements at low concentrations. High sensitivity accrues better accuracy at low concentrations. By using lower concentration samples, you will save valuable resources such as money and time.

Signal to Noise Ratio of a QuantaMaster™ 3 PH



Water Raman spectrum obtained with the QuantaMaster™ 3 PH equipped with a pulsed Xe lamp and gated detector. The minimum specification of a pulsed QuantaMaster™ system is 3,000:1. Often a much higher S/N is attainable. This S/N represents the highest sensitivity on the market for this type of instrument.

Chelated Europium

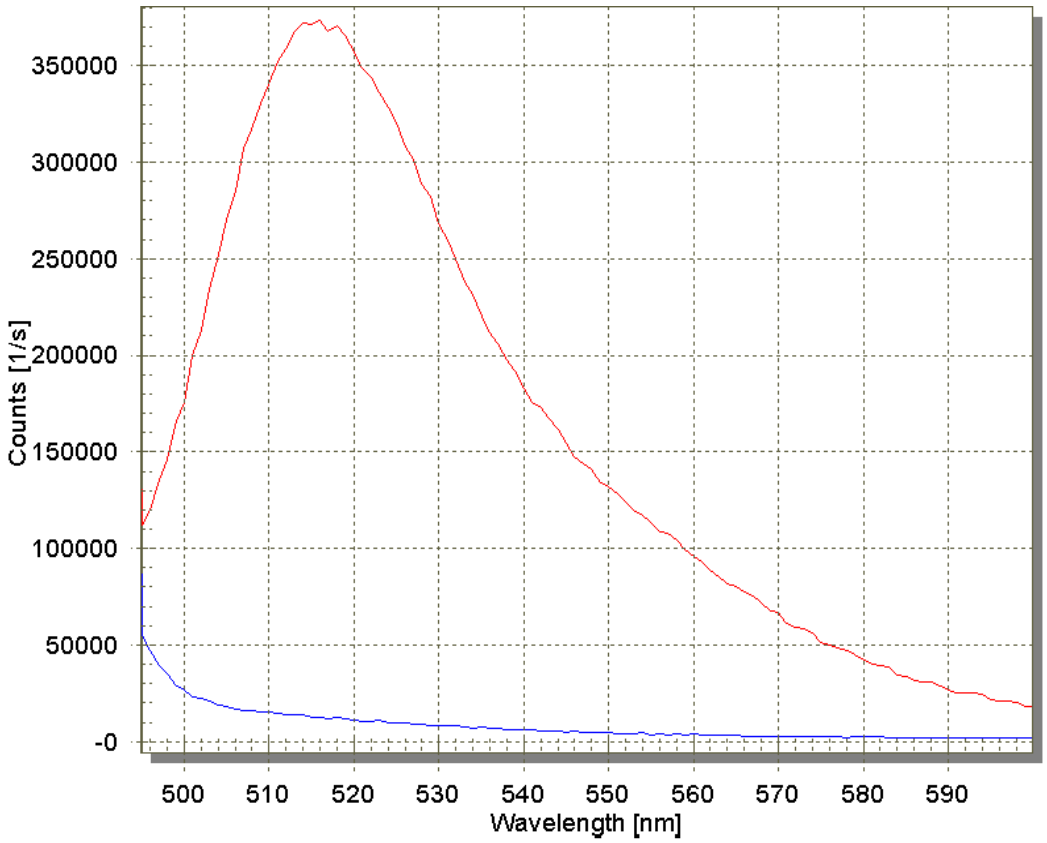


The QuantaMaster™ 3 PH system equipped with a pulsed lamp and a gated detector is invaluable in boosting the detection sensitivity of otherwise almost undetectable europium emission obscured by fluorescence (trace at delay = 0) from organic ligand. By placing the detection gate 200 microseconds away from the excitation pulse, a clean spectrum of europium ion is observed (trace at delay = 200 µs), while the impurity fluorescence is completely suppressed.

QuantaMaster

Stray Light

Suppression of stray light is one of the most critical factors when measuring highly scattering or low quantum yield samples. Every QuantaMaster™ series spectrofluorometer is custom made with the highest quality optics to insure the lowest amount of scatter. This allows for the best detection of the true fluorescence signal. The QuantaMaster™ series boasts a high stray light rejection: 10^{-4} in a single excitation monochromator configuration and 10^{-8} with double monochromators.



Fluorescence spectrum of highly turbid suspension of fluorescein-labeled beads (red trace) and the background sample (blue trace) excited at 488 nm. Excellent stray light rejection performance (double excitation and single emission monochromators) allows for emission scanning very close to the excitation wavelength.

Signal Detection For Any Application

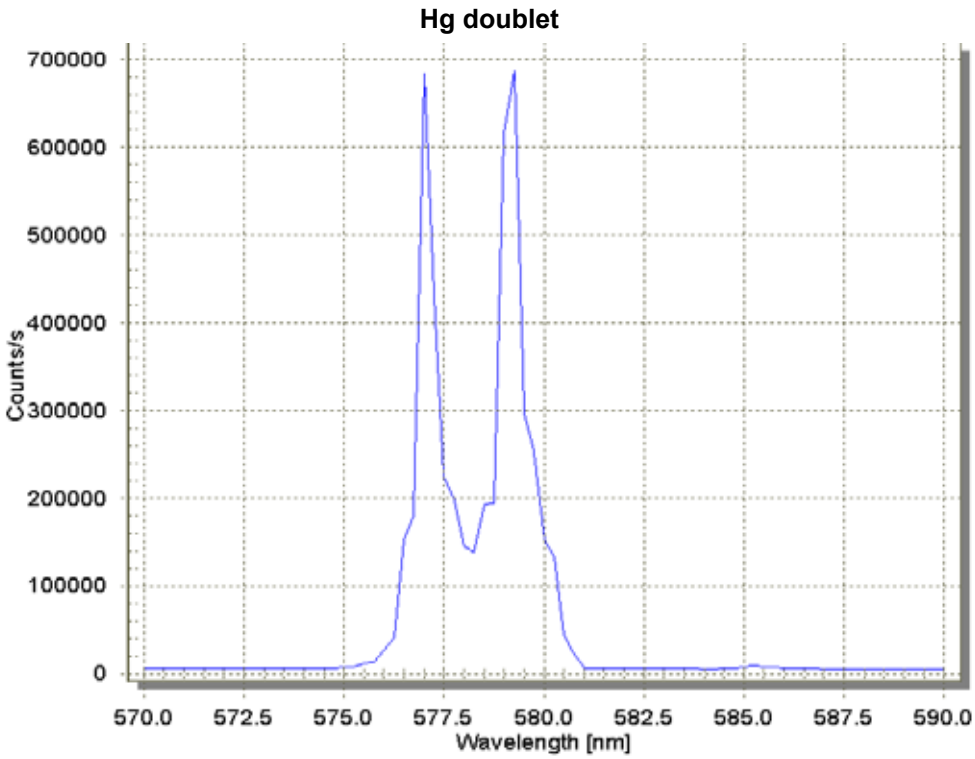
For most applications, the typical detector employed is a photomultiplier tube (PMT). Every QuantaMaster™ features a highly sensitive PMT, with the option of an analog or digital output. PTI offers you the ability to customize the system to meet your applications needs. Digital detection, or photon counting, offers the highest sensitivity as it records single photon events. The analog detection measures the current that is generated on the PMT anode and provides for additional detection gain ranges. This greatly enhances the dynamic range of the instrument, especially for higher intensity signals.

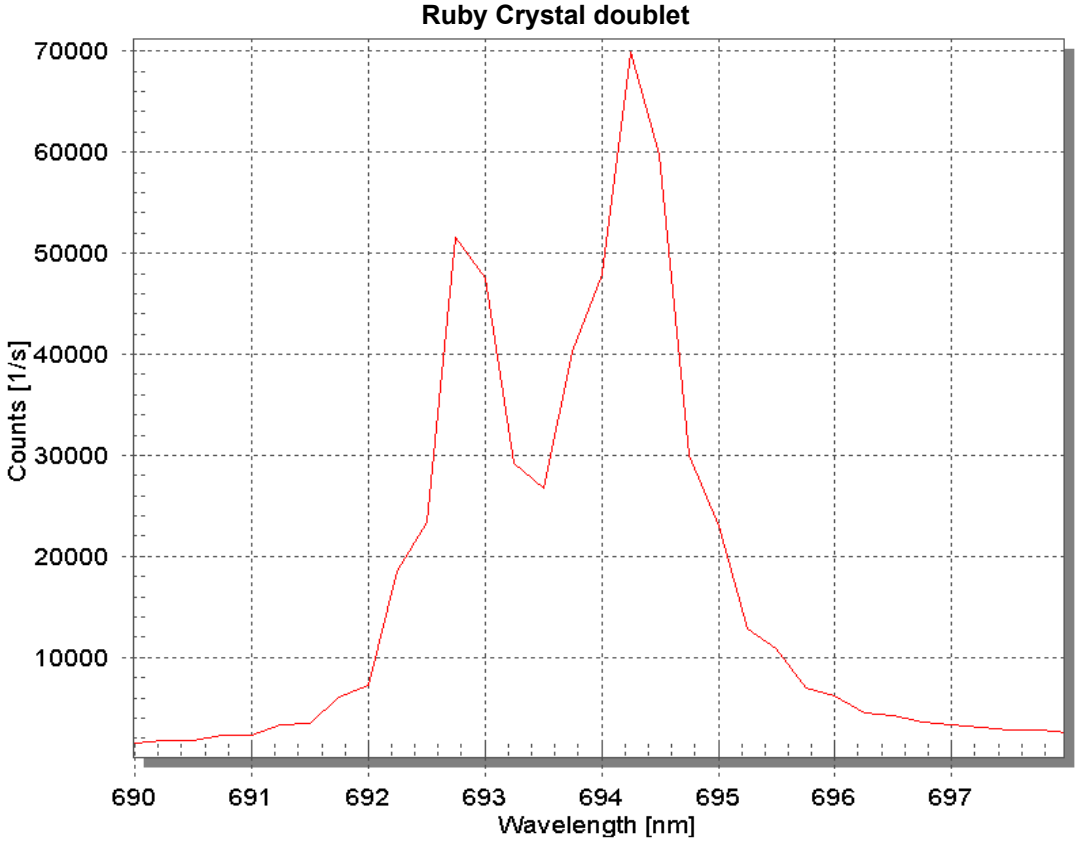
For NIR and IR applications, we also offer specialized PMTs and solid state detectors such as InGaAs diode detectors that are capable of detecting out to 2.2 microns. Gated detectors for luminescence lifetime measurements are also available.

Resolution

The QuantaMaster™ spectrofluorometers use a precision driven Czerny-Turner monochromator with custom gratings to meet your specific application needs. More than 30 different gratings are available. Due to the combination of the computer-controlled motor with micro-stepping resolution and available grating selection, it is possible to achieve 0.1 nm step size. This means that you can resolve spectral features as close as 0.2 nm apart in the UV and VIS spectral regions.

Hg doublet measured with the standard 1200 lines/ mm grating and bandpass of 0.25 nm.





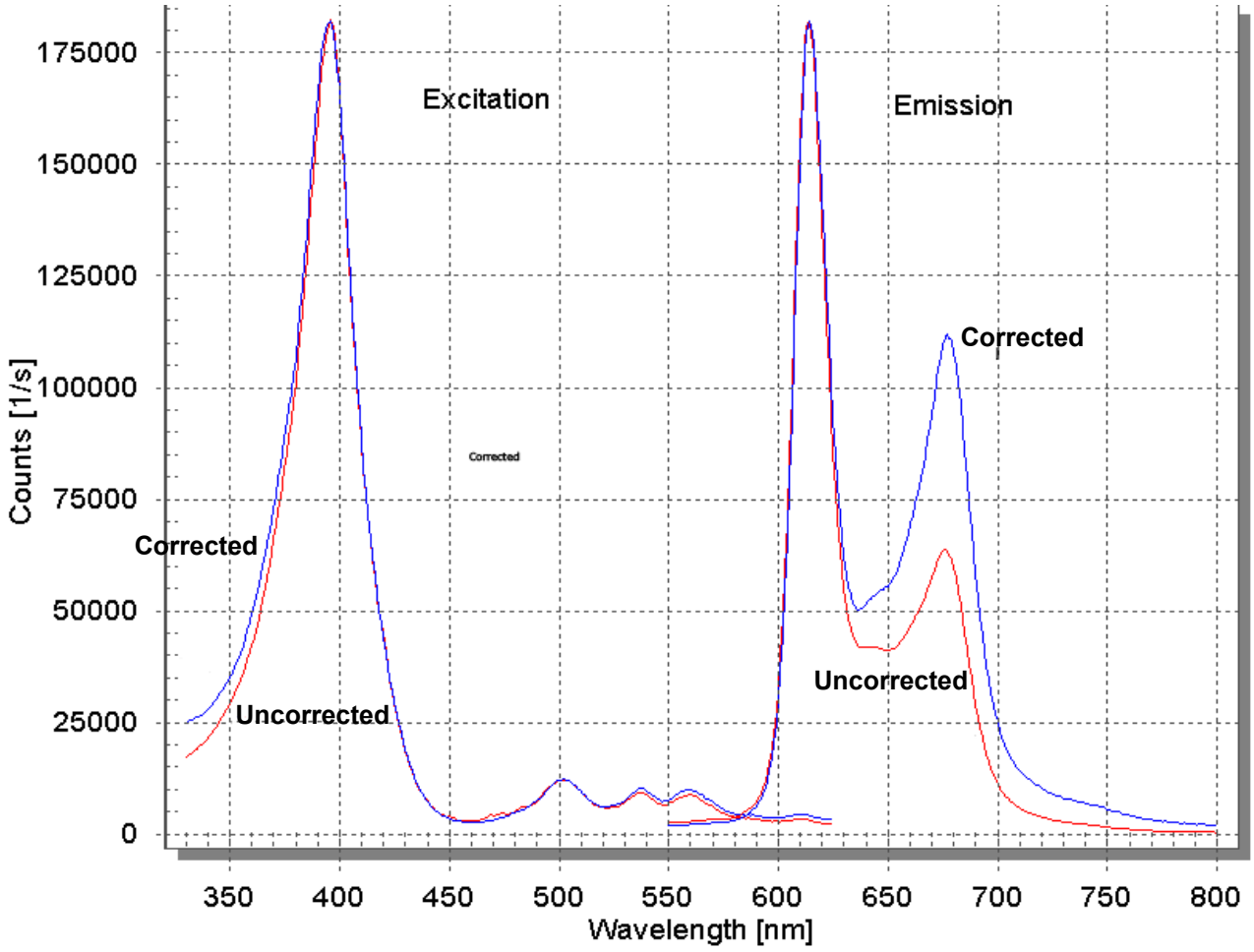
Ruby crystal doublet easily resolved with the QuantaMaster™ system equipped with a double emission monochromator with 1200 lines/mm gratings

Excitation And Emission Correction

PTI offers you peace of mind concerning the many factors in attaining true fluorescence excitation and emission data. All light sources emit light that is not of equal intensity across the output spectrum, and this can lead to errors in the measurement of an excitation spectrum. The raw data must then be corrected for this discrepancy. PTI systems utilize a reference diode detector that has been calibrated and installed at the factory. Excitation correction is performed in real-time. During an experiment, part of the excitation beam is diverted prior to reaching the sample. This fraction of photons is measured and then corrected. The reference detector then provides a corrected output that is independent of the excitation source characteristics or any temporal fluctuation of the lamp intensity, thus ensuring excellent stability of the signal.

A similar phenomenon exists for emission data. Since the detection efficiency of the optics, gratings, mirrors and detector is not equivalent at all wavelengths, some type of correction must be performed to account for these variations. Typically, the emission channel is calibrated at the factory with a known light source such as a NIST-traceable standard. This information is used to construct a correction file, which is then stored locally on your computer. Multiplication of the raw data by this correction file yields the true corrected emission spectrum. This correction can be performed in real-time or can be recalled in later analysis of the raw data and applied in the easy to use FeliX32™ software.

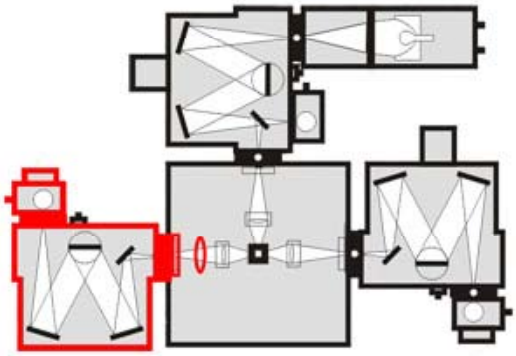
Raw and corrected Hematoporphyrin excitation and emission spectra. Corrected data shown in blue.



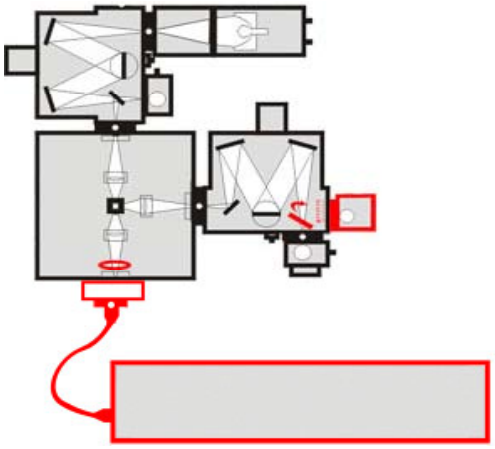
Modularity To Grow With

The QuantaMaster™ series features an open architecture design that provides the ultimate in versatility, allowing your instrument to adapt to your future fluorescence application needs. You can optimize the initial configuration by choosing the light source, gratings, PMT tubes, as well as a wide array of available accessories. The number of available configurations is limitless!

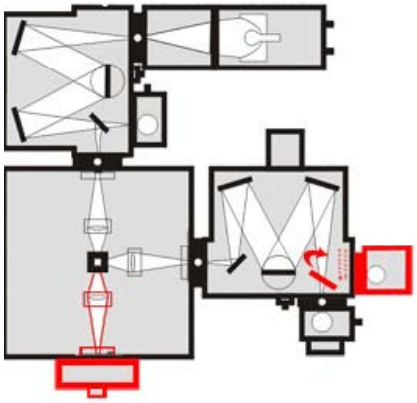
PTI's universal QuadraCentric™ sample compartment has a spacious design that provides accessibility and can accommodate a wide selection of sample accessories. Choose from sample temperature controllers to various holders for solids, liquids, and powders, and many other options. See the Accessories page for more details.



Add a second emission channel

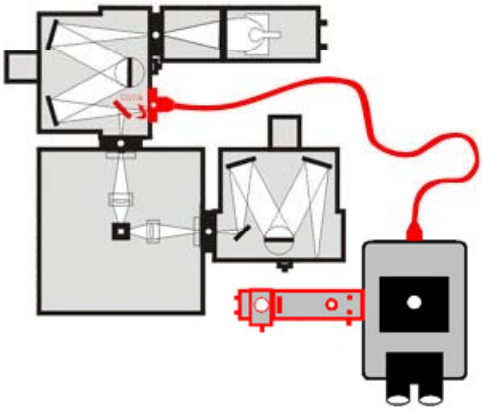


Add lifetime capability with a pulsed nitrogen/dye laser

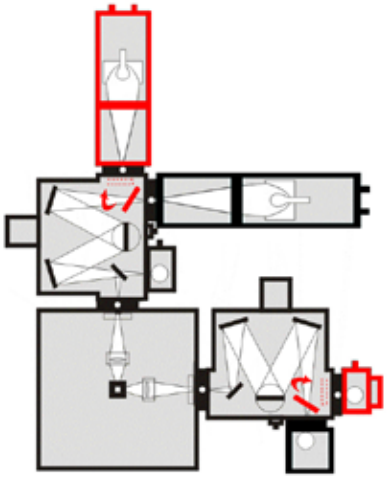


Add lifetime capability with pulsed nano-LEDs

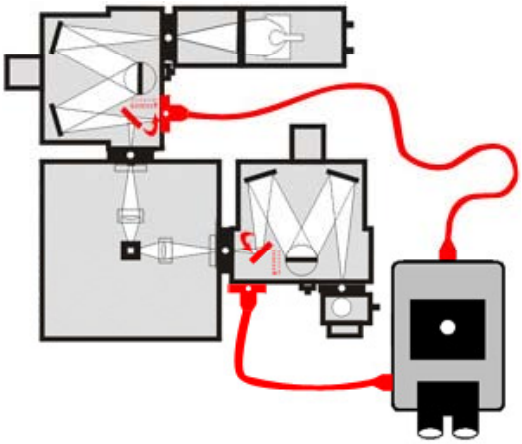
The Open Architecture design also allows for application and methodology changes. As your application needs grow, so can your QuantaMaster™. For example, if you develop a need to measure dynamic anisotropy, you can add a second emission channel and a set of polarizers. If you want to complement your steady state data with lifetime measurements, you can do so by adding a laser or LED-based excitation to your initial configuration. After completing initial Fura-2 studies, you may decide you would like start imaging the events. The system can be easily coupled with any fluorescence microscope. Whether you choose to add NIR detection or a second excitation source, the possible configurations are endless...



Upgrade to fluorescence microscopy with an additional PMT detector equipped with an eyepiece aperture



Add a pulsed light source and a gated detector for phosphorescence or lanthanide emission



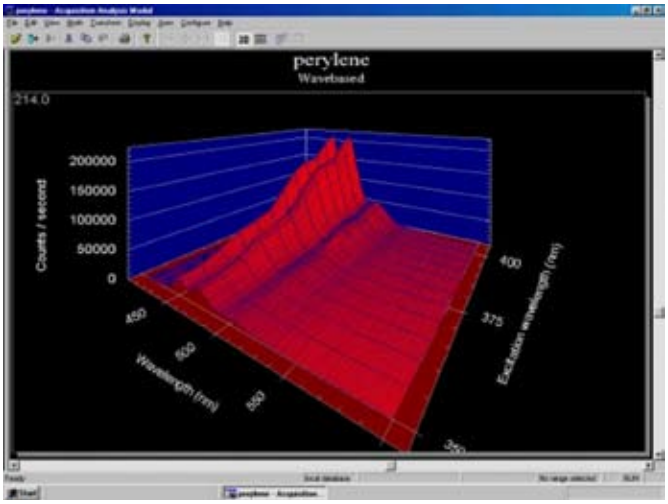
Couple to a microscope and feed back into the existing emission monochromator

Software

PTI's FeliX32™ is the most comprehensive software package on the market. It's easy to use Windows™ based interface offers one software solution for all your fluorescence measurements. FeliX32™ uses full 32-bit implementation graphic capabilities, including sophisticated 3-dimensional plotting and full motion rotation. All major data handling packages are included: multi-exponential fits, global analysis, non-exponential analysis, anisotropy decay as well as maximum entropy methods. FeliX32™ also uses script controlled data acquisition so that specialized experimental routines can be easily created by the end user via FeliX32™ macro commands. This allows for unsurpassed flexibility in acquisition, calculation, and illustration of data.

Time Resolved Luminescence with FeliX32™:

- Fluorescence & phosphorescence decays
  - Measure fluorescence lifetimes down to 100 ps and phosphorescence lifetimes down to 400 ns
- Fluorescence & phosphorescence timebased measurements
  - Study reaction kinetics
- Gated scans
  - Time-resolved organic phosphorescence and contamination-free lanthanide spectra
- Various collection modes
  - Collect decays in Random mode for non-biased data
- Various time scales
  - Choose from linear, arithmetic, or logarithmic timescales for unsurpassed multiple lifetime resolution
- For single or multiple lifetime determination
  - 1-to-4 exponential and Global analysis
- Complex decays in heterogeneous environment
  - MEM and ESM lifetime distribution analysis
- Special kinetics, restricted geometries
  - Micelle kinetics (Infelta-Graetzel) and non-exponential decay
- Anisotropy decay software
  - Determine rotational motion of the molecule
- Time-Resolved Spectra (TRES) and Decay Associated Spectra (DAS)
  - Study ps-ns relaxation phenomena or spectrally discriminate components in a mixture

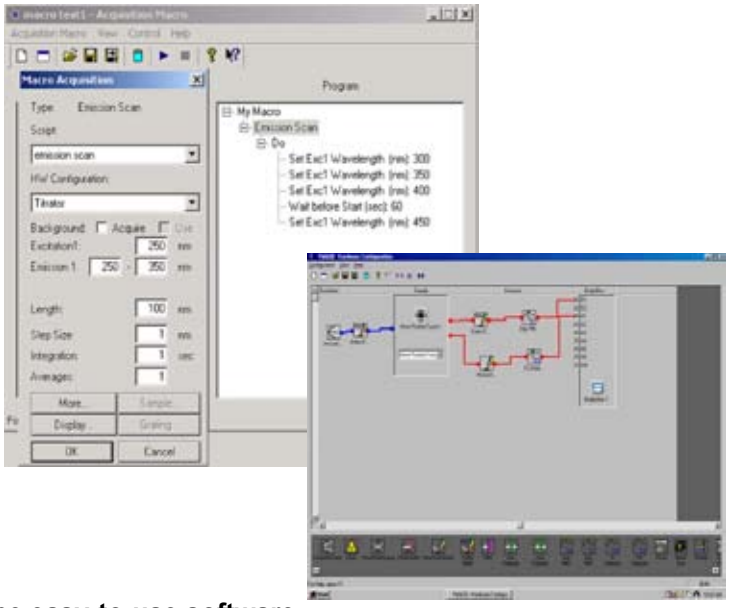


The most comprehensive software package!

Steady State Fluorescence with FeliX32™:

- Excitation & emission ratios
  - Determine ion concentrations using shifted probes
- Excitation, emission, & synchronous scans
  - Determine spectra or purity of samples
- Multidye analysis
  - Study Fura-2 for calcium and BCECF for pH
- Time-based polarization
  - Measure antibody-antigen binding and follow structural transitions in proteins and nucleic acids
- Automated excitation and emission spectra correction
  - Real-time excitation correction
- Automated routine builder
  - Create and save automated protocols
- Contour maps and 3D plots
  - Generate rotating three-dimensional plots
- Extensive mathematical analysis tools
  - Linear fits, averages, derivative, integrations, smoothing, and much more!

Create and save automated protocols-
Set it up and walk away!



One easy-to-use software for all measurement capabilities

QuantaMaster 3 Phosphorescence

Sensitivity

Detection Limit	50 femtomolar fluorescein in 0.1 M NaOH
Signal to Noise Ratio	3,000:1 or better Water Raman Spectrum Excitation wavelength = 350 nm Spectral bandwidth 10 nm, 750 flashes, 2 averages

Excitation Source

Type	Pulsed xenon arc lamp
Spectral Range	200-2,000 nm
Adjustment	XYZ, focusing, rear mirror
Repition Rate	1-300Hz, continuously tunable
Pulse Width	2 µs

Monochromators

Type	Czerny-Turner	
Focal Length	200 nm	
Stray Light Rejection	10^{-4} (10^{-8} for double monochromators)	
F #	4	
Bandpass	0 to 25 nm	
Accuracy	+/- 1 nm	
Resolution	0.5 nm	0.5 nm
Minimum Step Size	0.25 nm	0.25 nm

Grating

	Excitation	**Emission**
Type	Ruled	Ruled
Standard	1,200 l/mm	1,200 l/mm
Blazed	300 nm	400 nm

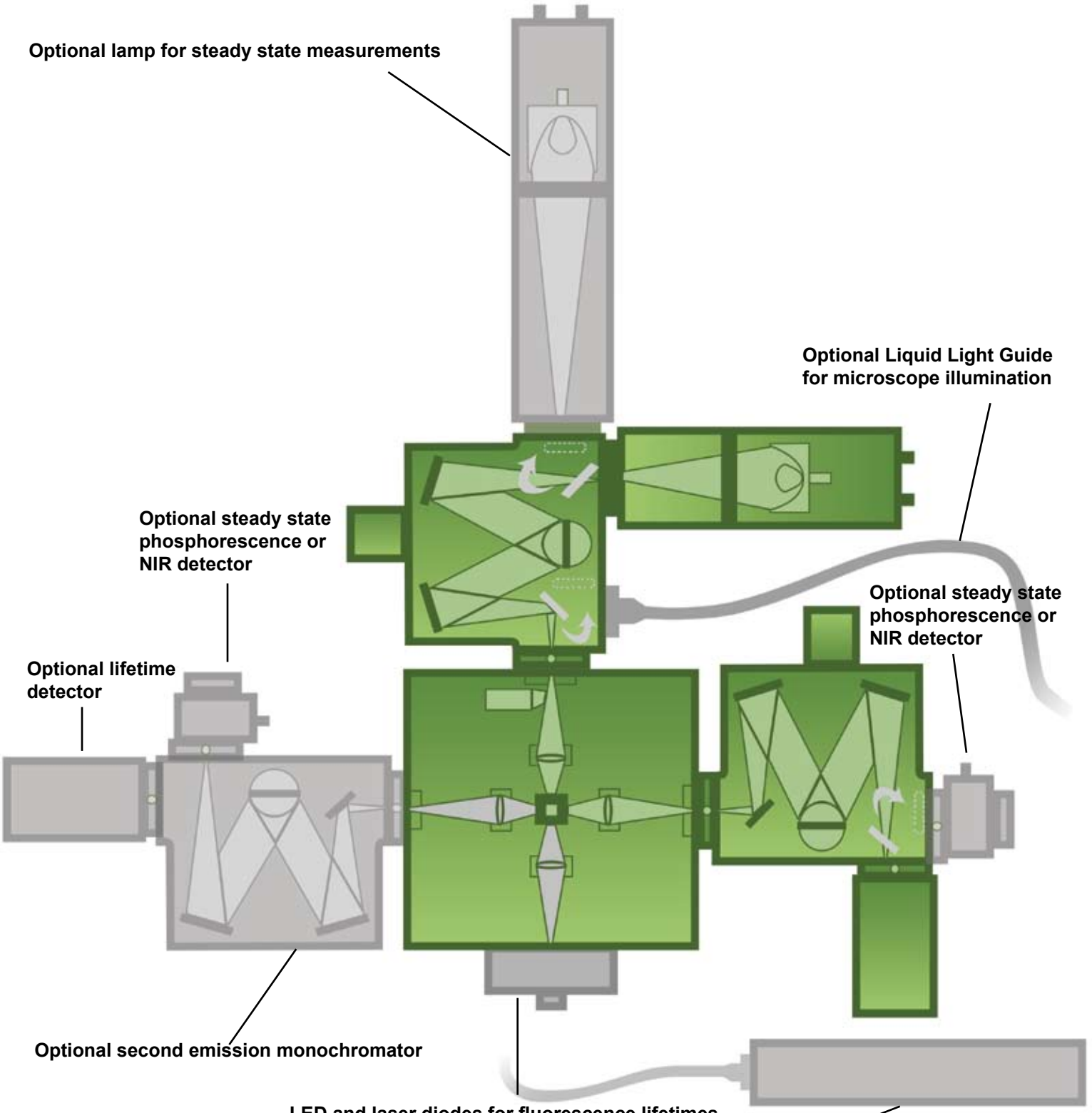
Options: an extensive selection of gratings optimized from 75-2400 grooves/mm is available in addition to holographic models.

Detector

	Standard	**Optional**
Photomultiplier	PMT 1527	PMT 928
Spectral Range	185 to 680 nm	185 to 900 nm

Sample Compartment

PTI's universal QuadraCentric™ sample compartment comes standard with a 10 x 10 mm thermostatable cuvette holder equipped with a variable speed stirrer, high efficiency quartz optics, filter holders, active excitation correction, lid activated emission shutter, and one quartz cuvette. The Open Architecture modular design allows for numerous options such as polarizers, solid or powdered sample holder, cryostats, polarizers, titrators, stop flows, and many other options for limitless application solutions. For sample chamber accessories see the Accessories page.


Optional lamp for steady state measurements
Optional Liquid Light Guide for microscope illumination
Optional steady state phosphorescence or NIR detector
Optional steady state phosphorescence or NIR detector
Optional lifetime detector
Optional second emission monochromator
LED and laser diodes for fluorescence lifetimes
Optional laser for fluorescence lifetime measurements