

PTI Technical Note

Lifetime Technique

PTI lifetime instruments employ two basic techniques: our patented, award winning Stroboscopic Technique for time-resolved fluorescence and our Gated Voltage-Controlled Integrator (VCI) for phosphorescence. Both techniques utilize pulsed light sources.

The Stroboscopic Technique

The Stroboscopic Technique is the simplest, fastest and the most direct way of measuring fluorescence lifetimes. It employs either our high-performance thyatron-gated nanosecond flash lamp or our powerful pulsed nitrogen/dye laser system, which features extraordinary wavelength coverage. In fact, the laser source, with an optional frequency doubler, can cover the excitation wavelength range from 235 nm to over 900 nm in an almost continuous fashion. The key feature of the stroboscopic technique is a pulsed photomultiplier as part of the detection system. A very short electrical pulse, whose timing is synchronized by a high precision crystal clock with the optical excitation pulse, activates the photomultiplier. The timing of the clock is under software control. By repetitive pulsing and by varying the timing of the gating pulse, the decay curve is recorded by measuring the photocurrent on the photomultiplier. The pulsed photomultiplier is extremely sensitive and achieves excellent temporal resolution. The timing is very precise, with steps as small as 25 ps. As a direct consequence of software control over the timing clock, the stroboscopic technique has a unique ability to acquire data with a nonlinear time base and at random time intervals. For example, with the use of our Logarithmic Timebase Acquisition protocol it is possible to measure lifetimes differing by four orders of magnitude in one single experiment! The Random Acquisition mode, on the other hand, eliminates bias when measuring samples that are inherently unstable. The measurement of time-resolved spectra is as easy as with the steady state system: the required time delay after the flash is entered in the software menu and the emission monochromator scans the desired wavelength range.

The Gated VCI Technique

The technique for measuring phosphorescence is also very simple. Since the time domain is microseconds and longer, the triggering of the light source, (either our versatile Xenon flash lamp or the pulsed nitrogen/dye laser) and the timing of the readout gate of the detector signal are under software control. This way, a decay curve is easily recorded by moving the detector gate over the time window of interest or a time-resolved spectrum is measured by fixing the gate position and scanning the monochromator. By varying the gate position and the gate width, fluorescence and phosphorescence spectra can be easily separated due to their lifetime difference.



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