BETTER THAN 100 FS
TEMPORAL RESOLUTION

FOG -100

FLUORESCENCE UP-CONVERSION SYSTEM

FOG-100

Sum frequency generation (up-conversion) is used in the femtosecond optically gated (FOG) fluorescence kinetic measurement system FOG-100 to achieve a temporal resolution of better than 100 femtoseconds. FOG-100 is the first complete measurement system for femtosecond kinetic spectroscopy. It has been designed to be matched with any type of femtosecond laser system operating at > 4 KHz pulse repetition rate.

KEY FEATURES:

Detection of laser induced fluorescence with better than 100 fs temporal resolution

Fluorescence kinetic measurements in solutions, vapor cells, thin films and solid samples.

Fluorescence anisotropy measurements

A wide dynamic range better than 1000:1

Covers fluorescence phenomena from femtoseconds to 1.7 ns

Standard configurations designed for femtosecond Ti:sapphire laser and laser - amplifier - OPA systems. Recommended laser pulse repetition rate : 4 KHz - 100 MHz

Fluorescence collection with achromatic doublet or Schwarzschild - Cassegrain reflecting objective.

Main fields of application: molecular spectroscopy, photochemistry, biophysics, solid state physics, material science

SYSTEM CONFIGURATION

FOG-100 is a complete measurement system. It contains the optical unit, monochromator, selected photon counting PMT, electronic unit and Lumex 2.5 software for IBM compatible PC. The electronic unit contains photon counter, step motor driver, computer controlled PMT power supply and low voltage power supplies.

SYSTEM OPERATION

Laser induced fluorescence is produced by a femtosecond laser pulse and directed onto an optical nonlinear crystal. Sum frequency radiation is generated in the nonlinear crystal only during the time that a delayed femtosecond gate pulse is present. As a result of optical delay scanning, the fluorescence rise or decay kinetics are measured at a wavelength determined by the monochromator and the nonlinear crystal adjustments.

The system sensitivity depends on the average power of the fluorescence excitation light, pulse repetition rate, radiative lifetime of the sample, conversion efficiency of the FOG system, dark count of the photon counting system, and the measurement time. The most important factor is the laser stability during the kinetic measurements.

The temporal resolution is determined by the convolution of the excitation and gate pulses and depends on the laser pulsewidth. The temporal resolution of the system is better than 150 fs (<100 fs typical) for all lasers recommended below.

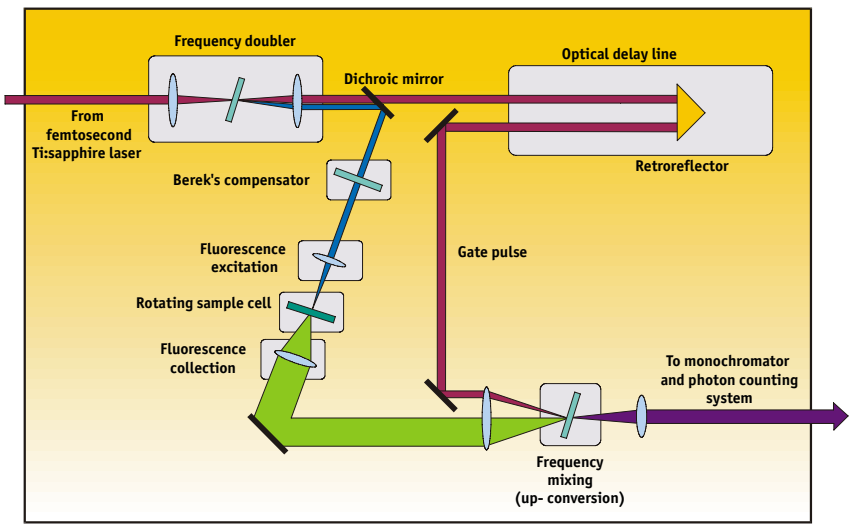
A wide dynamic range better than 1000:1 can be achieved for specific fluorescence kinetics at >1 MHz pulse repetition rates. Electronic gating of the photon counter makes it possible to increase the dynamic range at lower repetition rates.

Fluorescence anisotropy kinetics are measured with a unique Berek's compensator that gives a possibility to get any polarization for excitation radiation at any wavelength

The spectral range is determined by the laser used in the experiment. The list of some recommended femtosecond laser systems and corresponding spectral regions are summarized in the table:

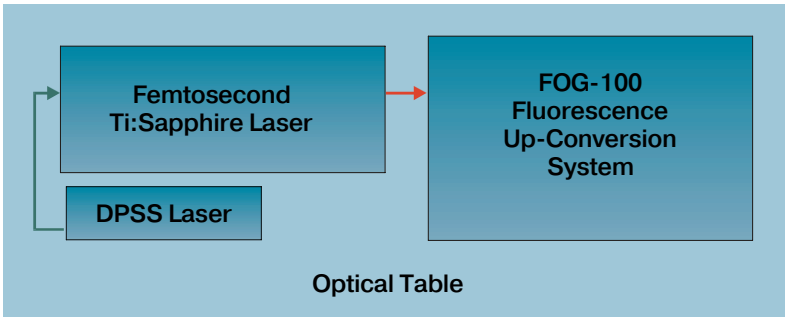
Fluorescence excitation wavelength, nm	Gate pulse wavelength, nm	Recommended femtosecond laser (τ_{pulse} < 100 fs)	Average laser power	Fluorescence wavelength, nm	Typical laser pulse rep. rate
360 - 490[1)]	720 - 980	Ti:sapphire + SHG	>100 mW	>370	70-100 MHz
490 - 700	480 - 700	Amplified Ti:sapphire + OPA	>1 mW	>500	4-200 KHz
700 - 980	700 - 980	Ti:sapphire	>100 mW	>710	70-100 MHz

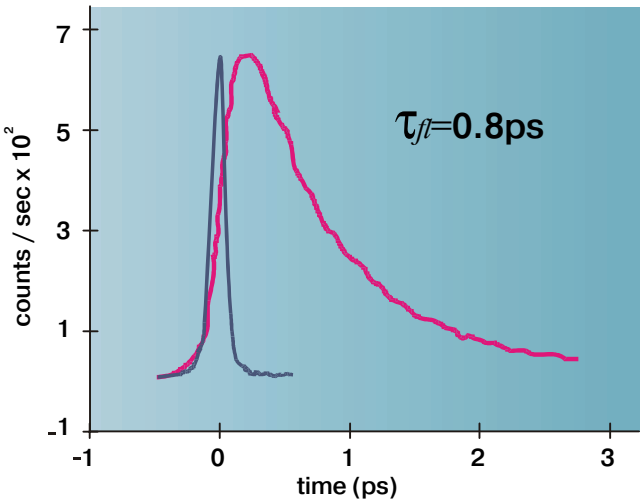
[1)] Frequency doubler is used



Typical schematic layout of the FOG-100 optical unit. Fluorescence excitation, collection and up-conversion are shown. Reflection configuration of fluorescence collection is also possible. Frequency doubler for femtosecond Ti:sapphire laser is installed inside the optical unit.

This scheme femtosecond laser facility guarantees the best and fastest way to get femtosecond kinetics for your scientific publication...





An example of femtosecond fluorescence decay measured with the FOG-100 femtosecond fluorescence system. The test sample is solution of Malachite Green triphenilmethane dye in ethanol. Correlation function between excitation and gate pulses (response function) with 110 fs FWHM is shown also. Excitation and gate wavelengths are 615 nm, fluorescence wavelength is 720 nm and pulse repetition rate is 8 KHz.

DI

Optical unit:
810 (L) x 500 (W) x 230 (H)

Monochromator:
484 (L) x 245 (W) x 198 (H)

Electronic unit:
483 (W) x 350 (D) x 44 (H)
(19'' rack mountable)

SPECIFICATIONS:

Temporal resolution (FWHM response function): <150 femtoseconds at <100 fs laser pulsewidth

Fluorescence spectral range: 370 — 1500 nm (depends on the excitation wavelength)

Recommended excitation and gate pulse repetition rate: 4 KHz — 100 MHz

Maximum delay between excitation and gate pulses: 70 ps with 1.4 fs/step optical delay line; 1.7 ns with 6.25 fs/step optical delay line

Dark count of the photon counting system: <5 counts/sec at room temperature (2 counts/sec typical)

Maximum photon counting rate: 2 x 10^6 counts/sec

Monochromator: 380-mm Solar/TII single monochromator (double monochromator on request).