# **HARPIA** | TF

# Femtosecond Fluorescence Upconversion and TCSPC Module

## **FEATURES**

- Picosecond-to-microsecond fluorescence TCSPC
- Automated switching between fluorescence upconversion and TCSPC measurements
- Automated spectral scanning and calibration
- Optional operation as a stand-alone unit



The HARPIA-TF is a time-resolved fluorescence measurement module that combines fluorescence upconversion and TCSPC techniques. In fluorescence upconversion, the signal from the sample is mixed in a nonlinear crystal with a gating femtosecond pulse to achieve high temporal resolution, which is limited by the duration of the gate pulse and is in the range of 250 fs. For fluorescence decay times exceeding 150 ps, the instrument can be used in time-correlated single-photon counting (TCSPC) mode to measure kinetic traces in the 200 ps – 2 μs range. The combination of the two methods enables the measurement of spectrally-resolved fluorescence decay in the femtosecond to microsecond range. Using a high repetition rate PHAROS or CARBIDE laser, the fluorescence dynamics can be measured while exciting the samples with pulse energies down to several nanojoules.



HARPIA optical layout for fluorescence upconversion measurements

# **SPECIFICATIONS**

#### **TCSPC MODE**

Becker&Hickl SPC 130	
Becker&Hickl PMC-150 or HPM-100	
300 – 820 nm	
< 200 ps	
< 1.2 ns <sup>1)</sup>	
< 100 : 1, assuming 5 s averaging per trace <sup>2)</sup>	

### **UPCONVERSION MODE**

Wavelength range	300 – 1600 nm <sup>3)</sup>
Wavelength resolution	Limited by the bandwidth of the gating pulse, typically around 100 cm <sup>-1</sup>
Delay range	2 ns, 4 ns, or 8 ns
Delay resolution	2.1 fs, 4.2 fs, or 8.3 fs
Time resolution	< 1.4× of the pump or probe pulse duration, whichever is longer; 420 fs with a PHAROS laser <sup>4)</sup>
SNR	65 : 1, assuming 0.5 s averaging per point <sup>5)</sup>
<sup>1)</sup> Estimated as the FWHM of the upconverted whi	te-light supercontinuum 4 Estimated as the FWHM of the upconverted white-light supercontinuum

5)

and configurations.

<sup>1)</sup> Estimated as the FWHM of the upconverted white-light supercontinuum generated in the sample.

- <sup>2)</sup> Estimated by fitting a kinetic trace measured in Rhodamine 6G solution at 580 nm with multiple exponents, subtracting the fit from the data and taking the ratio between the standard deviation of the residuals and the 0.5× maximum signal value; 250 kHz repetition rate. Not applicable to all samples and configurations.
- <sup>3)</sup> Depending on the gating source, full range covered with different nonlinear crystals.



Principle of time-correlated single-photon counting (TCSPC)



generated in the sample or the derivative of the rise of the upconversion signal.

measured in Rhodamine 6G dye at an upconverted wavelength of 360 nm using

a PHAROS laser running at 150 kHz repetition rate. Not applicable to all samples

Estimated as the standard deviation of a set of 100 points at 50 ps intervals

Principle of time-resolved fluorescence upconversion

DANGER: VISIBLE AND/OR INVISIBLE LASER RADIATION AVOID EVE OR SKIN EXPOSURE TO DIRECT, REFLECTED OR SCATTERED RADIATION

**CLASS 4 LASER PRODUCT** 





