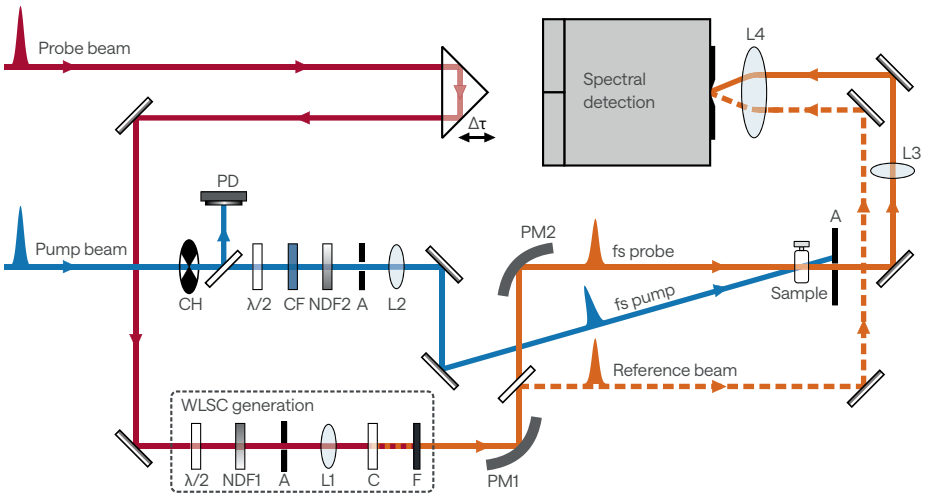
HARPIA | TA

Ultrafast Transient Absorption Spectrometer

Layout example

- Excellent performance at a high repetition rate
- Measurement range from UV to MIR
- Market-leading sensitivity
- Modules for time-resolved, and multi-pulse experiments
- High-level automation in a compact footprint

HARPIA-TA optical layout for pump-probe experiments

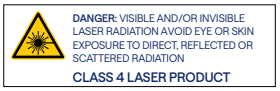


A – aperture
C – crystal
CF – spectral filter
CH – chopper
F – filter
L – lens
PD – photodiode
PM – parabolic mirror
NDF – neutral density filter
WLSC – white light supercontinuum
Δτ – delay
λ/2 – half-wave plate

Specifications

Configuration	UV-VIS	VIS	VIS-NIR	UV-VIS-NIR	MIR
Measurement range [1]	350 – 1100 nm	460 – 1100 nm	460 – 1600 nm	350 – 1600 nm	2000 – 13000 nm
Pump range	240 – 2200 nm				240 – 700 nm
Delay range (resolution)	8 ns (8.3 fs)				4 ns (4.2 fs)
Temporal resolution	≤ laser pulse duration or better				
Laser repetition rate	1 – 200 kHz [2]				
Maximum data acquisition rate	3 kHz				Laser repetition rate
Physical dimensions (L × W × H) [3]	730 × 420 × 160 mm				

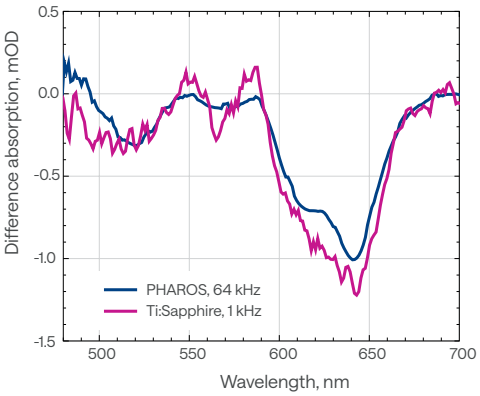
[1] *For laser pulse duration of up to 400 fs.*
[2] *Higher repetition rates available; contact sales@lighton.com for details.*
[3] *Without external spectrograph.*



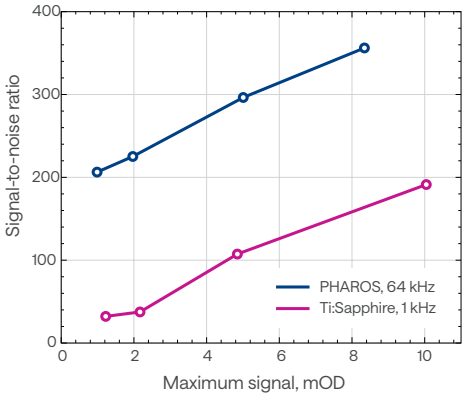
Performance at high repetition rates

The **HARPIA** spectroscopy system achieves an excellent signal-to-noise ratio at a high repetition rate and low energy excitation conditions. The graphs below compare the signal-to-noise ratio (SNR) of difference absorption spectra obtained with a Ti:Sapphire laser operating at 1 kHz and a **PHAROS** laser operating at 64 kHz with the same acquisition time.

Measured difference absorption spectra of CdSe/ZnS quantum dots using low- and high-repetition rate lasers with 5 s acquisition time



Best-effort SNRs, achieved with **HARPIA-TA** spectrometer driven by a Ti:Sapphire laser at 1 kHz (magenta) and a **PHAROS** laser at 64 kHz (blue)



Software

HARPIA Service App

Control and data acquisition software

A single software solution for all measurement modes, featuring:

- User-friendly interface
- Measurement presets
- Measurement noise suppression
- Diagnostics and data export
- Continuous support and updates
- API for remote experiment control using third-party software (LabVIEW, Python, MATLAB)

CarpetView

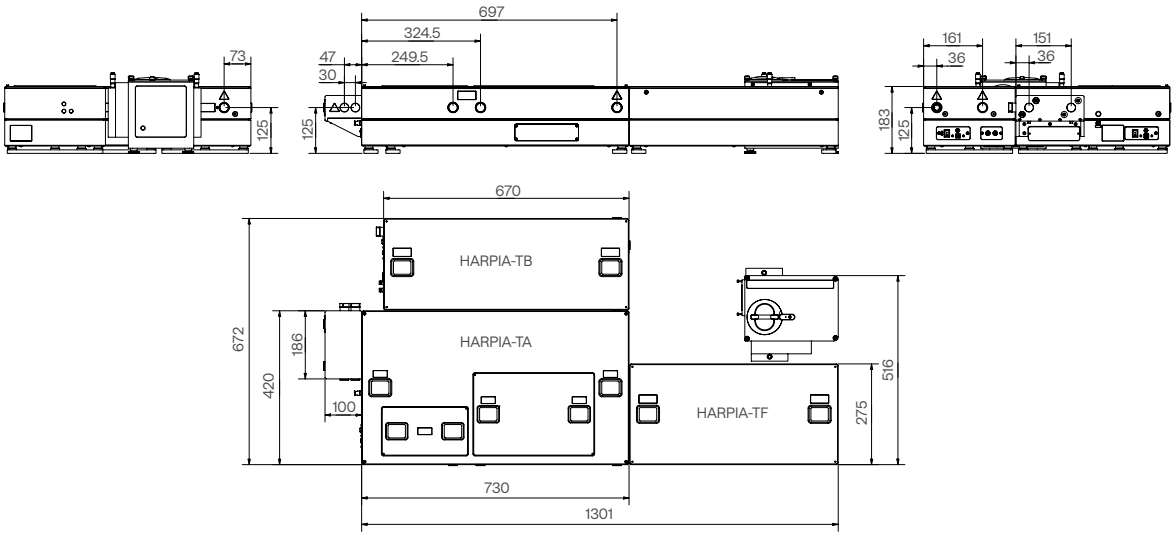
Data analysis software

An ultrafast spectroscopy data analysis software, featuring:

- Advanced data wrangling: slicing, merging, cropping, smoothing, fitting, etc.
- Advanced global and target analysis
- Probe spectral chirp correction, calibration and deconvolution
- Support for 3D data sets (2D electronic spectroscopy, fluorescence lifetime imaging)
- Publication-ready figure preparation and data export

Drawings

Drawings of **HARPIA** system with **HARPIA-TB** and **HARPIA-TF** modules



Modules and accessories

HARPIA | TF Time-Resolved Fluorescence Module

Time-resolved fluorescence spectroscopy carries information on the molecular processes in the excited states. **HARPIA-TF** combines different measurement modes, thus allowing the observation of fluorescence dynamics at different time scales.

NEW

Kerr gate

Easy to use. Simpler alignment and maintenance. The entire spectrum is measured at once.

Fluorescence upconversion (FU)

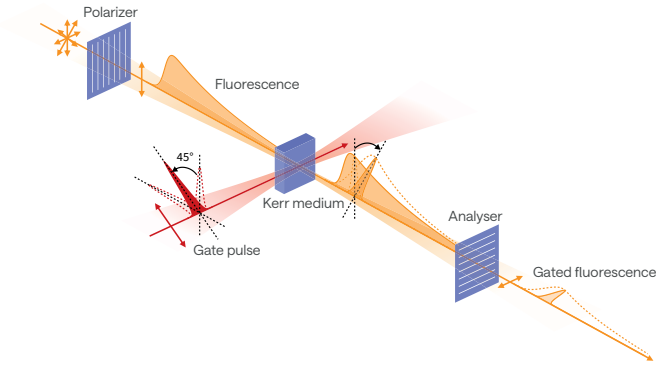
Better temporal resolution for measuring fast fluorescence events.

Time-correlated single-photon counting (TCSPC)

Fluorescence lifetime measurements are extendible to measure phosphorescence signals.

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.

Principle of Kerr gate spectroscopy



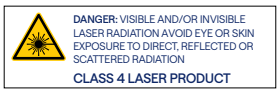
Specifications

Module	HARPIA-TF		
Mode	Kerr gate	Fluorescence upconversion	TCSPC
Spectral range	250 – 1100 nm	330 – 820 nm	220 – 820 nm [1]
Pump range	240 – 2200 nm		
Temporal resolution	400 – 500 fs	≤ laser pulse duration or better	< 180 ps [2]
Max measurement range	8 ns		∞ [3]
Delay resolution	8.3 fs		n/a
Gate beam requirements	20 – 25 µJ		n/a
Compatible with	TCSPC		Kerr gate or fluorescence upconversion

[1] *Spectral range is extendable to NIR; contact sales@lighton.com for details.*

[2] *High-speed detector available (< 50 ps); contact sales@lighton.com for details.*

[3] *Maximum measurement range depends on the phosphorescence signal.*



HARPIA | TA-FP Flash Photolysis – Nanosecond TA Module

NEW

The flash photolysis experiment is designed to measure the long-lived states of molecular systems.

The principle of flash photolysis is analogous to the femtosecond transient absorption (TA) experiment but with a delay in a nanosecond–millisecond range.

Specifications

Module	HARPIA-TA-FP				HARPIA-TA-FP-UV			
HARPIA-TA module	UV-VIS	VIS	VIS-NIR	UV-VIS-NIR	UV-VIS	VIS	VIS-NIR	UV-VIS-NIR
Measurement range	450 – 1100 nm		450-1600 nm		350 – 1100 nm		350 – 1600 nm	
Delay range	up to 8 ms				up to 500 µs			
Delay resolution	100 ps							
Temporal resolution	2 ns				1 ns			
Maximum data acquisition rate	3 kHz							

HARPIA | TB Third Beam Delivery Module

When standard spectroscopy tools are not enough to unravel the intricate ultrafast dynamics of photoactive systems, multi-pulse time-resolved spectroscopic techniques can be utilized to yield additional insight.

Femtosecond stimulated Raman scattering (FSRS)

Delivering frequency-narrowed picosecond pulses allows to perform FSRS measurements. It is a time-resolved spectroscopy technique for observing changes in the vibrational structure of optically excited molecular systems.

Multi-pulse time-resolved transient absorption

Multi-pulse time-resolved spectroscopic techniques are a way to manipulate the reactions and access new regions of the higher excited states.

Specifications

Module	HARPIA-TB	
Mode	Pump for multi-pulse experiments	NIR probe
Wavelength range	240 – 700 nm / 450 – 2200 nm	1600 – 2600 nm
Delay range (resolution)	4 ns (4.2 fs)	

HARPIA | MM Microscopy Module

An add-on to the **HARPIA-TA** spectrometer, enabling spatially resolved pump-probe measurements.

The microscopy module features a motorized XYZ sample stage, broadband, and monochromatic probe options, as well as transmission and reflection modes, and brightfield mode to observe the sample and to determine the pump-probe spot location.

Switching between bulk and microscopic pump-probe modes is implemented using self-contained modules, allowing experiment reconfiguration without disturbing the sample.

Specifications

Module	HARPIA-MM	
Spatial resolution [1]	monochromatic	polychromatic
	< 2 µm	< 10 µm
Full spectral range	460 – 1100 nm	
Pump range	240 – 700 nm	
Temporal resolution	500 fs	
Maximum working distance [2]	13 mm	
Sample motion range	13 × 13 × 13 mm	

[1] *White light generation has axial color at focus and wavelength-dependent mode size and NA. Focused white light will exhibit focus shift and spot size variation depending on the chosen spectral range. Polychromatic spot size is given at full spectral range, monochromatic is at 500 nm with a 10 nm bandwidth.*

[2] *Depends on the objective used.*

Microscopy module

Bulk module

Options

Cryostat Mounting

HARPIA-TA supports cryostats that can be mounted externally or internally.

Sample Stirrer

Liquid samples are mixed up to avoid overexposure and ensure fresh samples.

Motorized Pump Mirror

Used to automatically optimize pump and probe overlap.

External Beam Steering

To lock the optical beam paths for OPA wavelenghts (350 – 1100 nm).

Beam Profiler

For checking beam shape/size at any position before/ after measurement inside **HARPIA**.