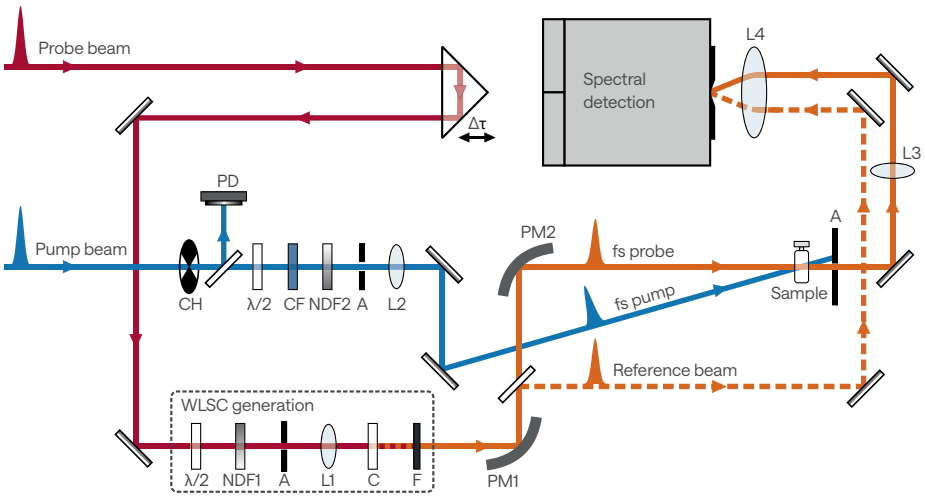
HARPIA | TA

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

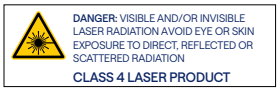


A	– aperture
C	– crystal
CF	– spectral filter
CH	– chopper
F	– filter
L	– lens
PD	– photodiode
PM	– parabolic mirror
NDF	– neutral density filter
WLSC	– white light supercontinuum
Δτ	– delay
λ/2	– half-wave plate

Specifications

Configuration	UV-VIS	UV-VIS-NIR	MIR
Probe spectral range	350 – 1100 nm	350 – 1600 nm	2000 – 13000 nm
Pump range	240 – 2200 nm		450 – 2200 nm [1]
Delay range (resolution)	8 ns (8.3 fs)		4 ns (4.2 fs)
Temporal resolution	≤ laser pulse duration or better		
Laser repetition rate	1 – 100 kHz		
Maximum data acquisition rate	3850 Hz		Laser repetition rate
Modes	Reflection and transmission		

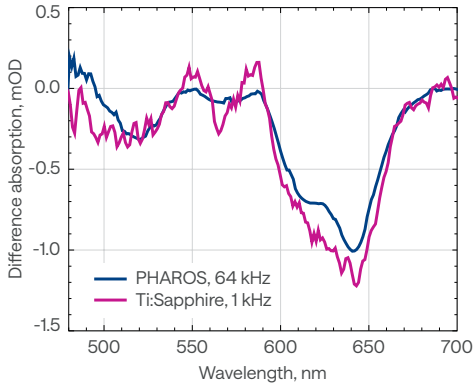
[1] *Wavelength range is configurable to 240 – 700 nm. Contact sales@lightcon.com for more details.*



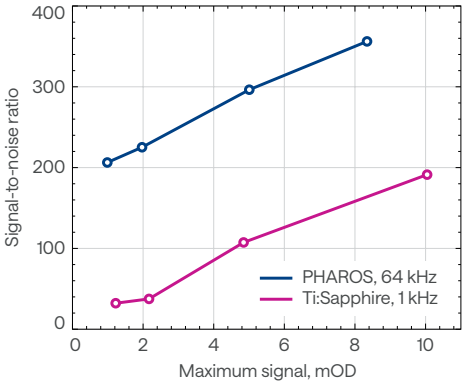
Performance at high repetition rates

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)

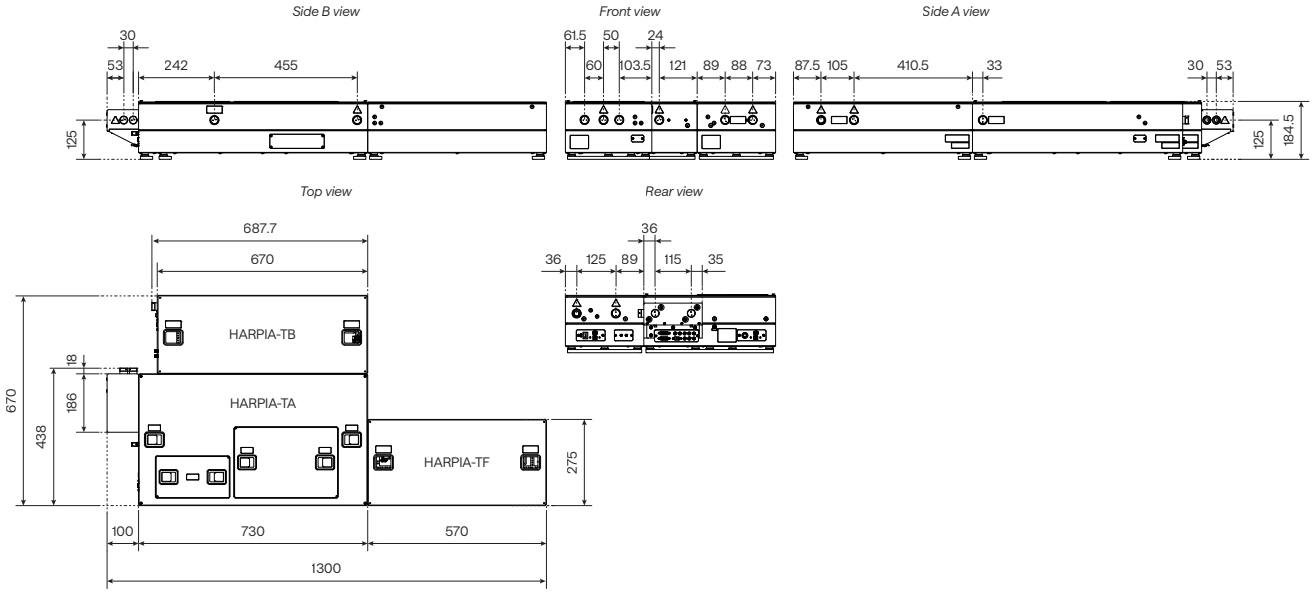
Data analysis software

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



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.

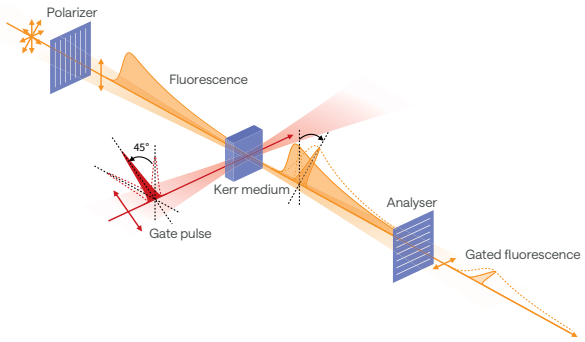
Using a high-repetition-rate **PHAROS** or **CARBIDE** laser, the fluorescence dynamics can be measured while exciting the samples with pulse energies down to several nanojoules.

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.

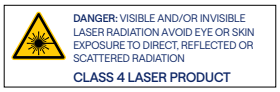
Principle of Kerr gate spectroscopy



Specifications

Module	HARPIA-TF		
Measurement technique	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 or < 50 ps
Max measurement range	8 ns		5 µs
Delay resolution	8.3 fs		n/a
Gate (probe) beam requirements	25 – 30 µJ		n/a
Compatible with	TCSPC		Kerr gate or fluorescence upconversion
Modes	Transmission		

[1] *Spectral range is extendable with an additional NIR detector (measurement range 1000 - 1700 nm); contact sales@lightcon.com for more details.*



HARPIA | TA-FP Flash Photolysis – Nanosecond TA Module

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 configuration	UV-VIS	UV-VIS-NIR	UV-VIS	UV-VIS-NIR
Probe spectral range	450 – 1100 nm	450 – 1600 nm	350 – 1100 nm	350 – 1600 nm
Pump range	240 – 2200 nm			
Delay range	up to 8 ms		up to 500 µs	
Delay resolution	100 ps			
Temporal resolution	2 ns		1 ns	
Probe laser repetition rate	1850 Hz			
Maximum data acquisition rate	3850 Hz			
Modes	Reflection and transmission			

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	
Configuration	Pump for multi-pulse experiments	NIR probe
Acceptable wavelength range	450 – 2200 nm [1]	1600 – 2600 nm
Delay range (resolution)	4 ns (4.2 fs)	
Modes	Transmission	

[1] *Wavelength range is configurable to 240 – 700 nm. Contact sales@lightcon.com for more details.*

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**.