

# HARPIA-TA

new

## Ultrafast Transient Absorption Spectrometer



### APPLICATION FIELDS

- Photochemistry
- Photobiology
- Photophysics
- Material science
- Semiconductor physics
- Time-resolved spectroscopy

The popular transient absorption spectrometer HARPIA has been reimagined and redesigned to meet the needs and standards of today's scientific world. The new improved HARPIA offers a sleek and compact design and together with intuitive user experience and easy day-to-day maintenance. Adhering to the standards raised by the OPRHEUS line of devices, the entire spectroscopic system is now contained in a single monolithic aluminum casing that inherently ensures excellent optical stability and minimal optical path for the interacting beams. In contrast to its predecessor, the dimensions of the device are greatly reduced. The area was reduced roughly by 2.6x, whereas volume was reduced by nearly 4x. The new HARPIA can be easily integrated with both PHAROS / ORPHEUS and Ti:Sa / TOPAS laser systems. Just like its precursor, it features market leading characteristics such as  $10^{-5}$  resolvable signals along with other unique properties such as the ability to work at high repetition rates (up to 1 MHz) when used with PHAROS/ORPHEUS system. High repetition rate allows measuring transient absorption dynamics while exciting the samples with extremely low pulse energies (thereby avoiding exciton annihilation effects in energy transferring systems or nonlinear carrier recombination in semiconductor/nanoparticle samples).

A number of probe configurations and detection options are available starting with simple and cost effective photodiodes for single wavelength detection and ending with spectrally-resolved broadband detection combined with white light continuum probing. Data acquisition and measurement control are now integrated within the device itself and offer such improved detection capabilities as:

- Single (sample-only) or multiple (sample and reference) integrated spectral detectors;
- Simple integration of any user-preferred external spectrograph;
- Beam monitoring and self-recalibration capabilities (both along the optical path of the pump/probe beams and at the sample plane) and an option for automated beam readjustment;

- Straightforward switching between transient absorption or transient reflection measurements;
- Capability to combine both transient absorption and Z-scan experiments on the same device;

Moreover, different delay line options can be selected to cover delay windows from 2 ns to 8 ns and HARPIA may house either standard linear leadscrew (20 mm/s) or fast ball-screw (300 mm/s) optical delay stages.

A number of optomechanical peripherals are now compactly enclosed in the HARPIA casing, including:

- An optical chopper that can either phase-lock itself to any multiple of the frequency of the laser system or operate in a free-running internally-referenced regime (standard);
- Motorized and calibrated Berek's polarization compensator that can automatically adjust the polarization of the pump beam (optional);
- Motorized transversely translatable supercontinuum generator (applicable for safe and stable supercontinuum generation in materials such as  $\text{CaF}_2$  or  $\text{MgF}_2$ ; optional);
- Automated sample raster scanner that translates the sample in the focal plane of the pump and probe beams, thus avoiding local sample overexposure (optional).

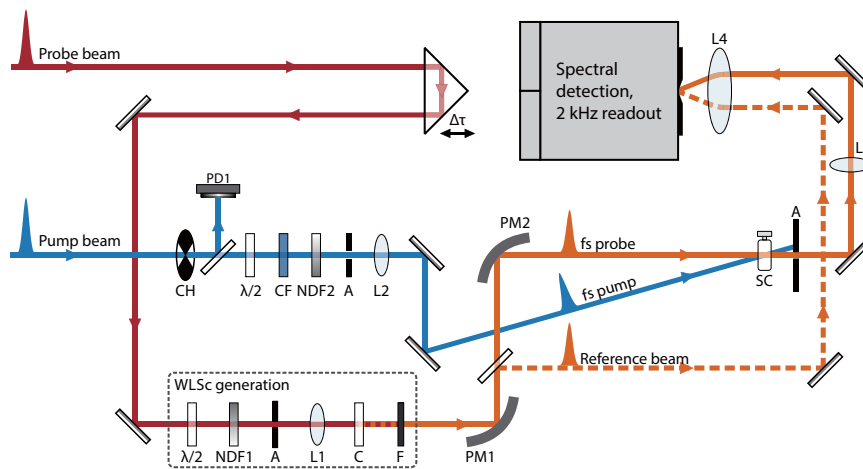
Moreover, the new HARPIA is designed to be compatible with any user-favored cryostat and/or peristaltic pump system (see mounting scheme). Capabilities of the new HARPIA can be further extended by introducing a third beam to the sample plane, thus allowing the user to perform multi-pulse transient absorption measurements.

In addition to experiment automation software, HARPIA includes data analysis package CarpetView for inspecting the acquired data and performing global and target analysis, probe dispersion compensation, exponential fitting etc. The software package features an intuitive and user friendly interface; it is delivered with a data analysis tutorial that offers seamless transition from the raw data to publication quality graphs and model based parameter estimation. All the software runs under MS Windows and it is easy to use. Even a novice will become an analysis expert in a matter of days!

**SPECIFICATIONS**

Probe wavelength range, supported by the optics	240 – 2600 nm
Probe wavelength range, white light supercontinuum generator, pumped by 1030 nm	350 – 750 nm, 480 – 1100 nm
Probe wavelength range, white light supercontinuum generator, pumped by 800 nm	350 – 1100 nm
Probe wavelength range of the detectors	200 nm – 1100 nm, 700 nm – 1800 nm, 1.2 μm – 2.6 μm
Spectral range of the spectral devices	180 nm – 24 μm, achievable with interchangeable gratings
Delay range	4 ns, 6 ns, 8 ns
Delay resolution	4.17 fs, 6.25 fs, 8.33 fs
Laser repetition rate	1 – 1000 kHz (digitizer frequency <2 kHz)
Time resolution	< 1.4 x the pump or probe pulse duration (whichever is longer)
Physical dimensions LxWxH	730 x 420 x 160 mm <sup>1)</sup>

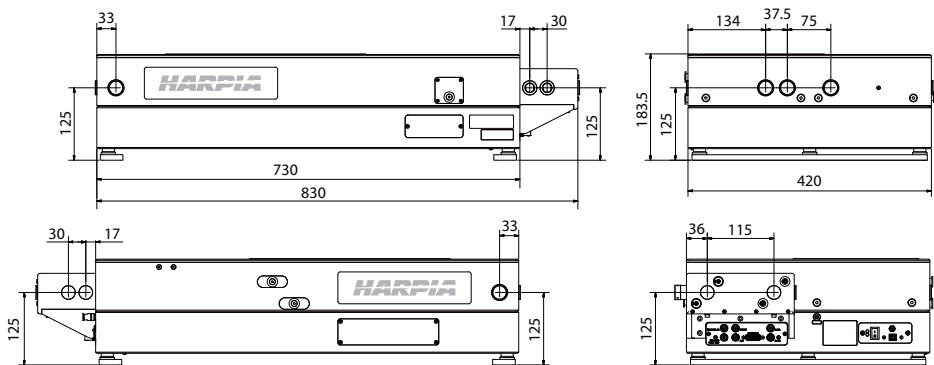
<sup>1)</sup> Without external spectrograph.



HARPIA-TA optical layout



Cryostat mounting scheme



HARPIA-TA outline drawings

# HARPIA

new

## Extended Spectroscopic Systems



Capabilities of HARPIA-TA spectrometer can be further expanded by HARPIA-TF and HARPIA-TB extensions. Fundamentally, the all-integrated HARPIA system can be viewed as a miniaturized lab facilitating all the most popular time-resolved spectroscopy experiments in a single package. The all-inclusive HARPIA system can provide an extensive comprehension of the intricate photophysical and photochemical properties of the investigated samples.

Switching between different experimental realizations is fully automated and requires very little user interference. The optical layout of HARPIA system is refined to offer both an incredibly small footprint (see the dimensions below) and an easy and intuitive user experience. Despite its small size, HARPIA is easily customizable and can be tailored for specific measurement needs. All the experiments that the HARPIA system provides are managed by a new and improved user application with experiment guiding wizards, measurement presets, and development kit for custom applications.

### HARPIA setup unifies multiple time-resolved spectroscopy capabilities, including:

- Femtosecond transient absorption
- Femtosecond transient reflection
- Femtosecond multi-pulse transient absorption/reflection measurements
- Femtosecond fluorescence upconversion
- Hundred picoseconds-to-microsecond time-correlated single photon counting (TCSPC)
- Automated measurements of intensity dependence of transient absorption and time-resolved fluorescence signal
- Possibility to perform time resolved femtosecond stimulated Raman scattering (FSRS) experiments

## Available HARPIA configurations

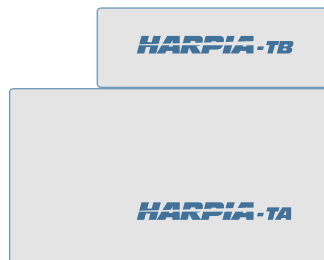
### **HARPIA**

Ultrafast Transient Absorption, TCSPC and Fluorescence Upconversion Spectroscopic System



### **HARPIA**

Ultrafast Multi-pulse Transient Absorption Spectroscopic System



### **HARPIA**

Ultrafast Multi-pulse Transient Absorption, TCSCP and Fluorescence Upconversion Spectroscopic System

