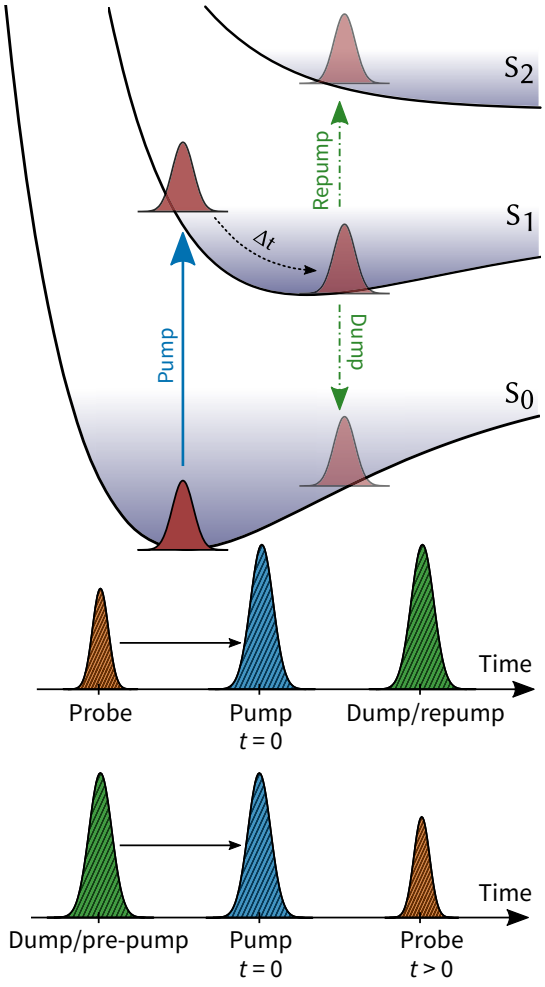
HARPIA | TB

Third Beam Delivery Module

FEATURES

- Can be installed as an add-on to a HARPIA-TA
- Provides an additional temporal dimension to pump-probe measurements
- Provides additional insight into complex photodynamic systems
- Full control of the third beam:
  - Polarization (using a manual or automated Berek polarization compensator)
  - Intensity (using a manual or an automated continuously variable neutral density filter)
  - Delay (using an automated 2 ns or 4 ns optical delay line)
- Z-scan support



State transitions and pulse timing in multi-pulse time-resolved transient absorption spectroscopy

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. The HARPIA-TB is a third beam delivery module for the HARPIA-TA main unit that adds an additional dimension to time-resolved absorption measurements. It allows an additional temporally-delayed laser pulse to be introduced before or during the pump-probe interaction in order to perturb the ongoing photodynamics.

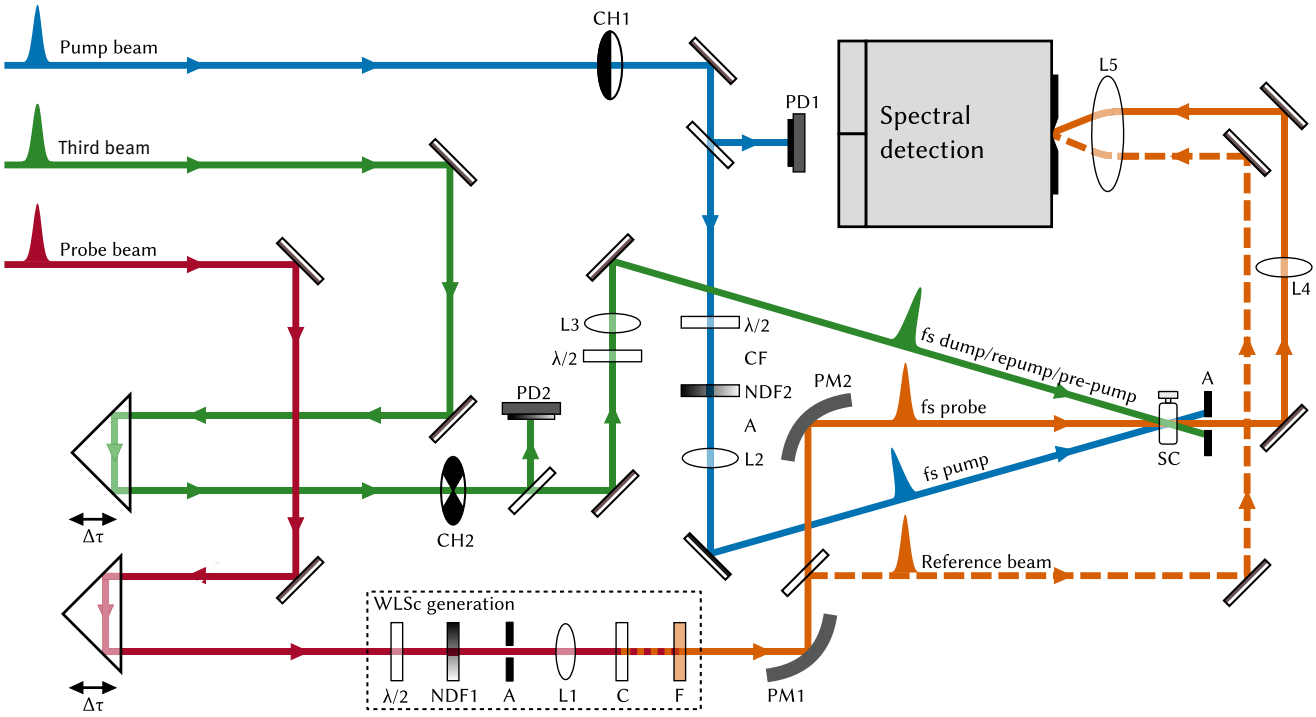
In a pump-dump-probe (PDP) configuration, an auxiliary pulse resonant to a stimulated emission transition band can deliberately depopulate the excited state and thereby revert the excited system back to the ground state.

In a pump-repump-probe (PrPP) configuration, the wavelength of the additional pulse corresponds to an induced absorption resonance and thus is able to elevate the system to a higher excited state (which may or may not be detectable in the nonperturbed photoevolution), or return it to an earlier transient state.

In a pre-pump-pump-probe (pPPP) configuration, the auxiliary pulse is resonant to an electronic ground-to-excited state transition, i.e., $S_0 \rightarrow S_n$, which makes it possible to either replenish the excited state population or to prepare a small portion of the excited state population before the main pump pulse.

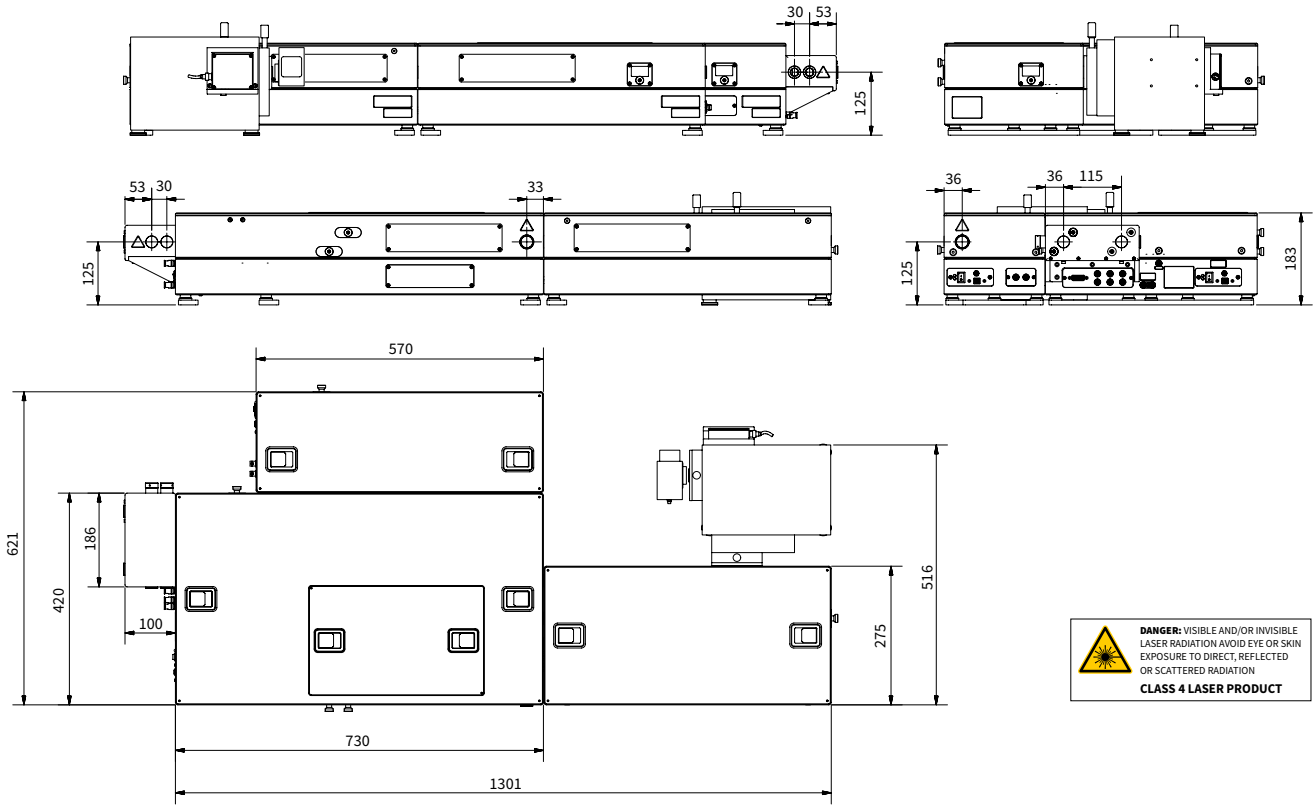
Since the probe and the auxiliary pulse can be delayed in time with respect to each other, kinetic trace and action trace experiments can be performed using a HARPIA-TB module. In kinetic trace mode, the evolution of the system perturbed by the additional pulse is tracked by scanning the time delay of the probe pulse. In action trace mode, the influence of the exact timing of the peturbation is investigated by scanning the delay of the additional pulse.

Moreover, HARPIA-TB can be utilized to deliver frequency-narrowed picosecond pulses, thus providing the capability to perform time-resolved femtosecond stimulated Raman scattering (FSRS) measurements.



HARPIA optical layout for multi-pulse experiments

OUTLINE DRAWINGS



Outline drawings of HARPIA system with HARPIA-TB and HARPIA-TF modules