

TOPAS

Optical Parametric Amplifiers for Ti:Sapphire Lasers

TOPAS is a series of femtosecond optical parametric amplifiers (OPAs) for Ti:Sapphire lasers which delivers continuous wavelength tunability from 189 nm to 20 μm , high conversion efficiency, high output stability, and full computer control. With more than 2000 units installed worldwide, TOPAS

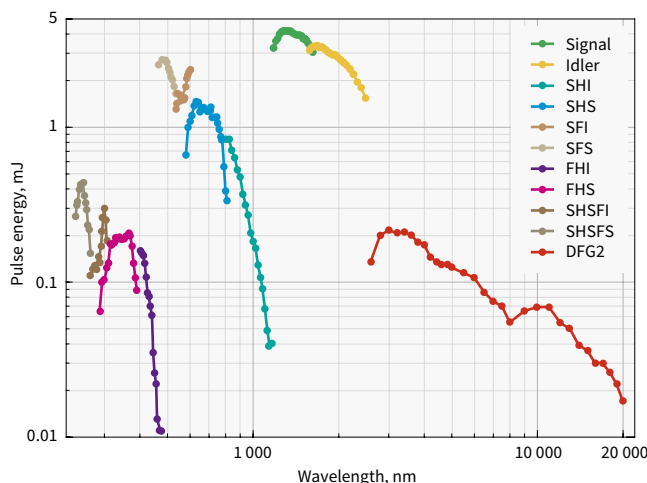
has become an OPA market leader for numerous scientific applications. TOPAS can be pumped by Ti:Sapphire lasers with pulse duration from 20 fs to 200 fs and pulse energy from 15 μJ to 60 mJ. Custom solutions beyond the given specifications are available; contact sales@lightcon.com for more details.

TOPAS | PRIME-HE

High Energy Optical Parametric Amplifier

FEATURES

- 189 nm – 20 μm tuning range
- Up to 60 mJ pump pulse energy
- Up to 50% conversion efficiency
- High output stability
- CEP stabilization of Idler
- Fresh pump channel for improved temporal and spatial properties of sum-frequency options



TOPAS-PRIME-HE tuning curves. Pump: 22 mJ, 45 fs, 805 nm

TOPAS-PRIME-HE is a high-energy femtosecond optical parametric amplifier based on TOPAS-PRIME with an additional high energy and low dispersion amplification stage which allows using pump pulse energy of up to 60 mJ while maintaining the shortest possible pulses at the output. The standard TOPAS-PRIME-HE model accepts pump pulse energy of up to 8 mJ @ 35 fs (up to 20 mJ @ 100 fs), while TOPAS-PRIME-HE-PLUS accepts higher pump pulse energy, up to 18 mJ @ 35 fs (up to 47 mJ @ 100 fs). The pump pulse energy of 60 mJ is possible with longer pulses, ca. 150 fs. Both models come with wavelength extension options, covering the wavelength range from 189 nm to 20 μm for TOPAS-PRIME-HE and 240 nm to 20 μm for TOPAS-PRIME-HE-PLUS.

TOPAS | PRIME

Collinear Optical Parametric Amplifier

FEATURES

- 189 nm – 20 μm tuning range
- Up to 5 mJ pump pulse energy
- > 25% conversion efficiency
- High output stability
- CEP stabilization of Idler
- Fresh pump channel for improved temporal and spatial properties of sum-frequency options



TOPAS-PRIME is a collinear femtosecond optical parametric amplifier designed for Ti:sapphire lasers. The standard TOPAS-PRIME model accepts pump pulse energy of up to 3.5 mJ @ 35 fs (up to 4 mJ @ 100 fs), while TOPAS-PRIME-PLUS accepts higher pump pulse energy, up to 5 mJ @ 35 – 100 fs. Both models come with wavelength extension options, covering a wavelength range from 189 nm to 20 μm .

TOPAS | SHBC-400

Narrow-Bandwidth Optical Parametric Amplifier

FEATURES

- Femtosecond pulse conversion to 20 cm^{-1} spectral bandwidth
- 240 nm – 10 μm tuning range
- Up to 4 mJ pump pulse energy
- High output stability

TOPAS-SHBC-400 combines a second harmonic bandwidth compressor (SHBC) and an optical parametric amplifier (OPA) for the generation of tunable pulses with a spectral bandwidth of 3 – 20 cm^{-1} when pumped by femtosecond pulses with a spectral bandwidth of 150 – 500 cm^{-1} . The device is designed



to be pumped by a fundamental harmonic of a femtosecond Ti:Sapphire laser and covers a wavelength range from 480 to 2400 nm.

Optional frequency mixers extend the tuning range down to 240 nm and up to 10 μm .

TOPAS | TWINS

Dual Optical Parametric Amplifier

FEATURES

- Two independently tunable outputs
- 240 nm – 20 μm tuning range, in each channel
- > 25% conversion efficiency
- High output stability

TOPAS-TWINS consists of two independently tunable optical parametric amplifiers (OPAs) integrated into a single housing. Both OPAs share the same white light source to provide excellent stability of both outputs, and CEP stabilized MIR pulses in a tuning range of 4.5 – 15 μm .



Both OPAs come with wavelength extension options, covering the wavelength range from 240 nm to 20 μm . Output specifications for each OPA are the same as those of TOPAS-PRIME. The maximum pump pulse energy depends on the pulse duration; see the specifications for more details.

FRESH PUMP OPTION

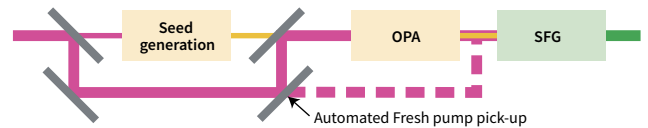
TOPAS-PRIME option for sum-frequency generation (SFG) in 475 – 580 nm range.

DEPLETED PUMP OPTION

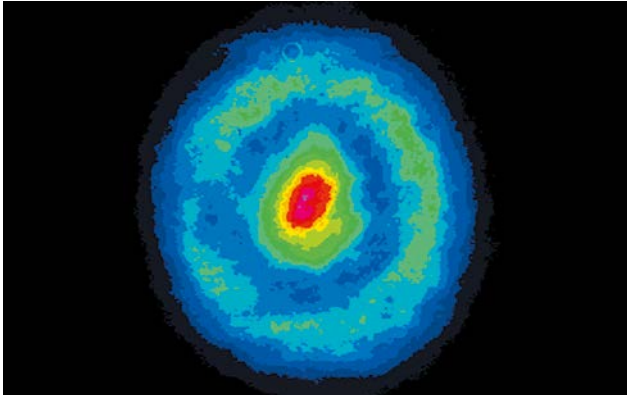


Optical scheme with depleted pump for SFG

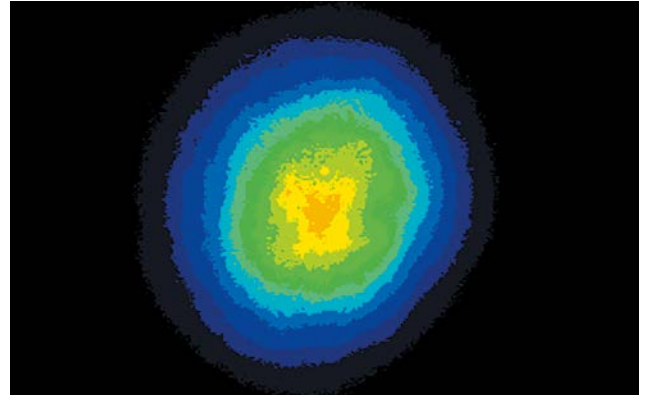
FRESH PUMP OPTION



Optical scheme with fresh pump for SFG



SFG output beam profile using depleted pump

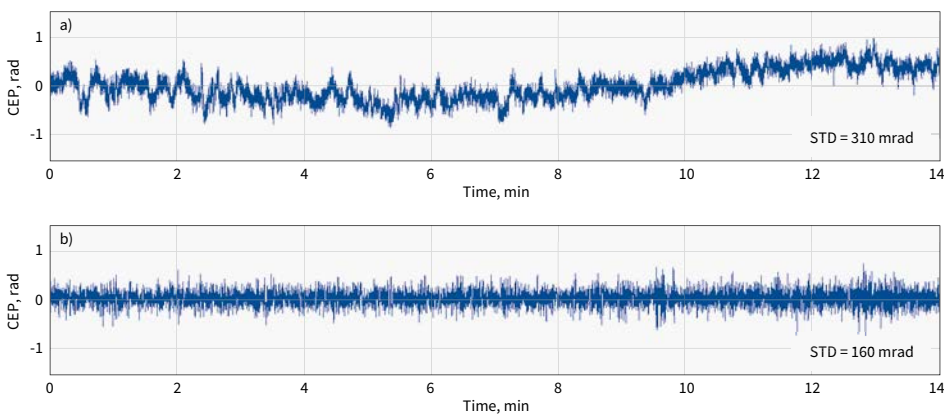


SFG output beam profile using fresh pump

CEP STABILIZATION OF IDLER

TOPAS Idler (1600 – 2600 nm) is passively CEP locked due to a three-wave interaction. However, a slow CEP drift may persist because of changes in pump beam pointing or environmental conditions. Such a drift can be compensated by employing

an f-2f interferometer and a feedback loop controlling the temporal delay between seed and pump in the power amplification stage of TOPAS-PRIME and TOPAS-PRIME-HE.



CEP stability of Idler over 14 min.
 (a) without compensation of drift, (b) with compensation of drift with a slow loop

NIRUVIS

Frequency Mixer for TOPAS

FEATURES

- Automated wavelength tuning and separation
- Wavelength extension down to 189 nm
- Controlled output beam polarization
- High output pulse contrast
- High conversion efficiency



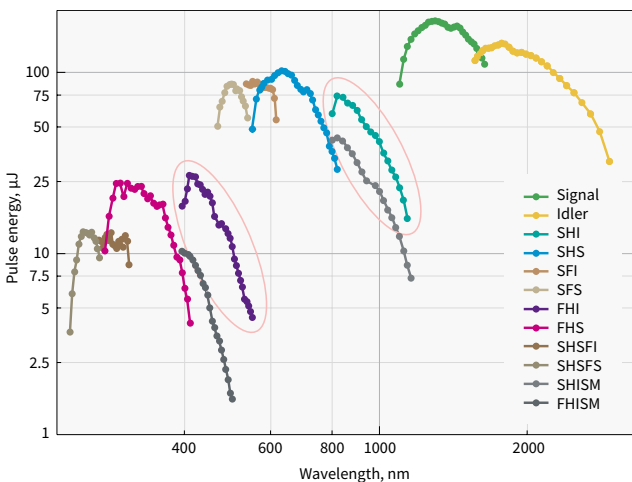
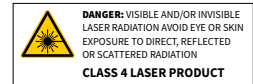
NIRUVIS is a frequency mixer for TOPAS-PRIME and TOPAS-PRIME-HE. It consists of three automated nonlinear crystal stages in a monolithic housing. The output is generated by a second and fourth harmonic generation as well as sum-frequency generation. In contrast to free-standing

frequency mixers, NIRUVIS offers high conversion efficiency, simple operation, compact design, and low environmental sensitivity. Furthermore, wavelength separation after each nonlinear interaction ensures high output pulse contrast.

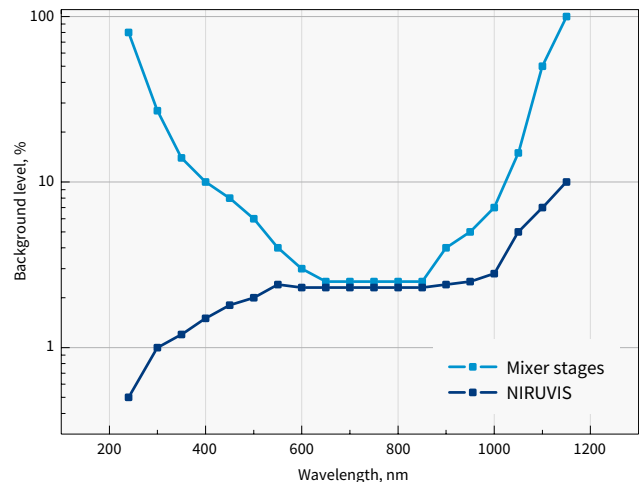
SPECIFICATIONS

Model	Automated NIRUVIS	Standard NIRUVIS	NIRUVIS-DUV
Maximum tuning range	240 – 1160 nm		189 – 1160 nm
Type of tuning	Fully automated	Manual, using wavelength separators	
Number of output ports	Single output port for all wavelengths	4 output ports (wavelength-dependent)	
Fresh pump option ¹⁾	Included	Optional	Included

¹⁾ See page 44 for details.



Tuning curves of TOPAS-PRIME with fresh pump option and NIRUVIS (SHISM and FHISM achieved with separate mixing stages). Pump: 1 mJ, 100 fs, 800 nm.



Background level comparison between NIRUVIS and separate mixing stages