OPCPA

Optical Parametric Chirped-Pulse Amplification Systems

FEATURES OVERVIEW

- Shortest pulses, extreme peak and average powers
- 800 nm, 1600 nm, 2000 nm, and 3000 nm wavelengths
- TW-level peak power
- Down to 6 fs pulse duration
- Up to 1 MHz repetition rate
- < 250 mrad CEP stability

Optical parametric chirped-pulse amplification (OPCPA) is the only currently available laser technology simultaneously providing high peak and average power, as well as few-cycle pulse duration required by the most demanding scientific applications. Our answer to these demands is a portfolio of cutting-edge OPCPA products based on years of experience in developing and manufacturing optical parametric amplifiers and femtosecond lasers.

OPCPA system delivering 5.5 TW peak power (6.6 fs, 36 mJ) pulses.

Built for ELI-ALPS in collaboration with Ekspla.

ORPHEUS | OPCPA

Compact, Few-cycle, CEP-stable OPCPA Systems

FEATURES

- < 6 fs transform-limited pulse duration
- Up to 1 MHz repetition rate
- Up to 320 W pump power
- Up to 8 mJ pump pulse energy
- CEP stabilization option
- Compact footprint

Benefiting from the industrial-grade stability and reliability of the PHAROS and CARBIDE lasers, ORPHEUS-OPCPA delivers few-cycle, CEP-stable pulses in a package as compact as our standard parametric amplifiers. All of the ORPHEUS-OPCPA models use the same base architecture to produce CEP-stable, few-cycle pulses in one of the four center wavelengths: 800 nm, 1600 nm, 2000 nm, and 3000 nm. ORPHEUS-OPCPA is available in versions with pulse compressors for direct use in applications or in versions intended as seed sources, delivering background-free pulses with near-single-cycle bandwidths, excellent spectral phase coherence, and CEP stability.

By using bundled CARBIDE or PHAROS lasers, pump power of up to 320 W and pump pulse energy of up to 8 mJ is accessible. The use of other pump sources for higher power, such as thin-disk or innoslab lasers, is available upon request.

SPECIFICATIONS

Model	ORPHEUS-OPCPA			
Center wavelength	800 nm	1600 nm	2000 nm	3000 nm
Pump source [1]	PHAROS / CARBIDE			
Pump power [1]	20 – 320 W			
Pump pulse energy [1]	0.2 – 8 mJ			
Repetition rate	1 kHz – 1 MHz			
Conversion efficiency [2]	> 7%	> 10%	> 9%	> 6%
Pulse duration [2]	< 10 fs	< 40 fs	< 25 fs	< 45 fs
Transform-limited pulse duration [2] [3]	< 6 fs	< 30 fs	< 15 fs	< 35 fs
CEP stability, 1h [2] [4]	< 250 mrad			
Long-term power stability, 8 h [2] [5]	< 1.5%			
Pulse-to-pulse energy stability, 1 min [2] [5]	< 1.5%			

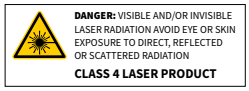
[1] *For using other pump sources, such as thin-disk or innoslab lasers, contact sales@lightcon.com.*

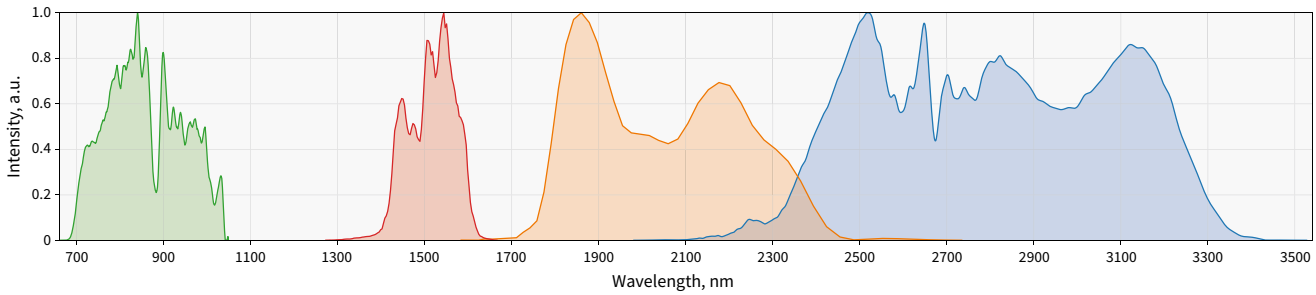
[2] *Typical values. For custom inquiries, contact sales@lightcon.com.*

[3] *Uncompressed, for seeding larger amplifiers.*

[4] *CEP values calculated from unaveraged, single-shot measurements.*

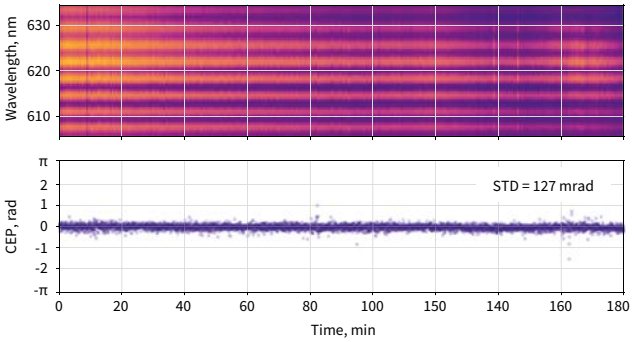
[5] *Expressed as normalized root mean squared deviation (NRMSD).*





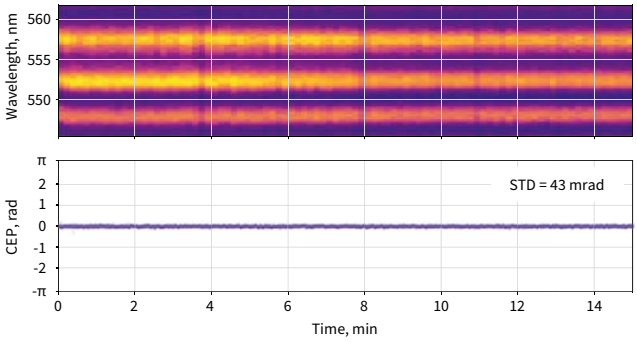
Example spectra of four models of ORPHEUS-OPCPA

STABILITY



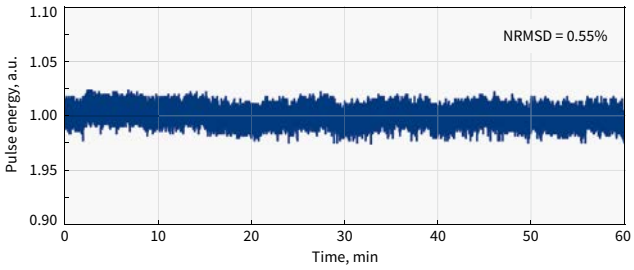
CEP stability of ORPHEUS-OPCPA (800 nm, 100 kHz)

All CEP values calculated from unaveraged, single-shot measurements!

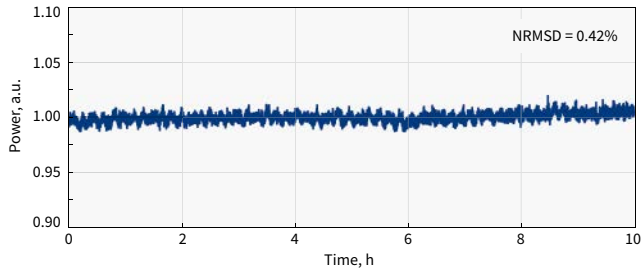


CEP stability of ORPHEUS-OPCPA (3 µm, 1 kHz)

All CEP values calculated from unaveraged, single-shot measurements!



Pulse-to-pulse energy stability of ORPHEUS-OPCPA at 800 nm



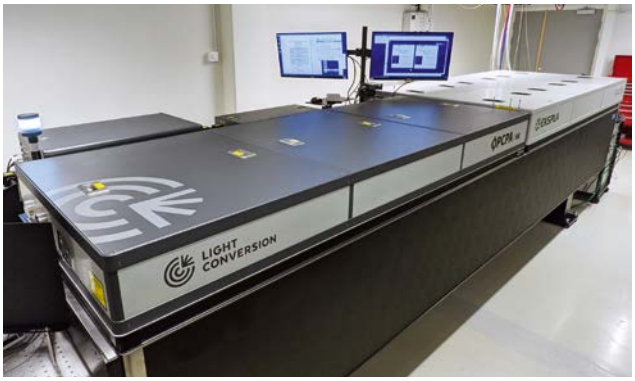
Long-term output stability of ORPHEUS-OPCPA at 800 nm

OPCPA | HE

High-Energy OPCPA Systems

FEATURES

- Multi-TW peak-power pulses at up to 1 kHz
- > 10^{12} pre-pulse contrast
- < 250 mrad CEP stability
- < 1.5% pulse energy stability
- < 9 fs pulse duration
- < 1-hour warm-up time
- Spectral–temporal output pulse shaping options



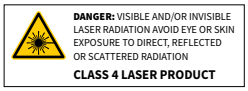
Applications like high-energy attosecond pulse generation, generation of high harmonics from solid targets, and laser electron acceleration all benefit from few-cycle pulse durations and excellent pulse contrast while requiring multi-millijoule pulse energy. Our most powerful high energy OPCPA systems are scalable to multi-TW peak powers at kHz repetition rates while maintaining few-cycle pulse durations. Thus, they fit the most demanding requirements while providing stability and reliability unprecedented for systems of this scale.

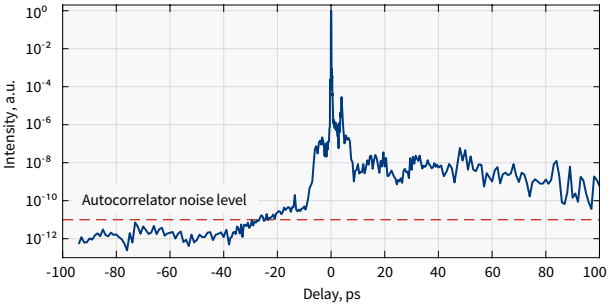
Furthermore, > 10^{12} pre-pulse contrast is obtained without complex and lossy nonlinear pulse cleaning techniques, while < 250 mrad CEP stability and < 1.5% pulse energy stability are maintained throughout a full day of operation, making it a robust and reliable multi-TW system.

SPECIFICATIONS

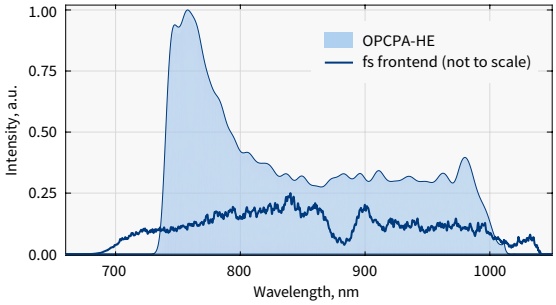
Model	OPCPA-HE		
Center wavelength	800 nm	1600 nm	2000 nm
Pump source	Picosecond Nd:YAG lasers, seeded by ORPHEUS-OPCPA		
Repetition rate	10 Hz – 1 kHz		
Maximum output pulse energy [1]	120 mJ	100 mJ	50 mJ
Pulse duration [1]	< 9 fs	< 50 fs	< 30 fs
CEP stability, 1h [1] [2]	< 250 mrad		
Long-term power stability, 8 h [1] [3]	< 1.5%		
Pulse-to-pulse energy stability, 1 min [1] [3]	< 1.5%		

[1] *Typical values. For custom inquiries, contact sales@lightcon.com.*
[2] *CEP values calculated from unaveraged, single-shot measurements.*
[3] *Expressed as as normalized root mean squared deviation (NRMSD).*

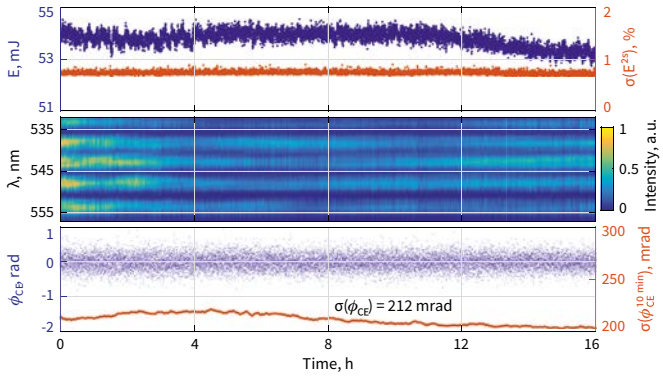




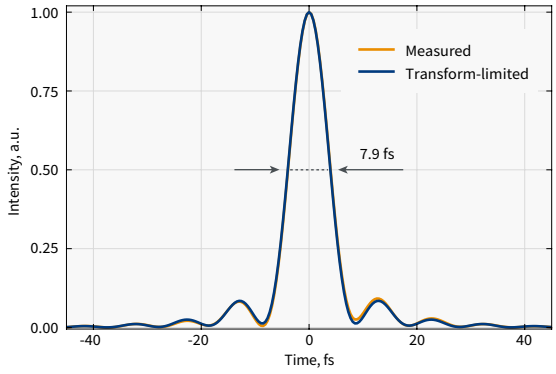
High-dynamic-range third order autocorrelation measurement of an OPCPA-HE system



OPCPA-HE output spectrum



OPCPA-HE pulse energy, f-2f interferogram and CEP stability measured over 16 h



Temporal profile of OPCPA-HE output pulses measured with a self-referenced spectral interferometry device