OPCPA Systems

LIGHT CONVERSION

Product Catalog

lightcon.com

LIGHT CONVERSION is a global leader in ultrafast technology, designing and manufacturing:

- Femtosecond Lasers,
- Wavelength-Tunable Sources,
- OPCPA Systems,
- Microscopy Sources,
- Spectroscopy Systems.

The comprehensive portfolio represents the best-in-class lasers tailored for industry, science, and medicine.

About Us

Founded in 1994, LIGHT CONVERSION has evolved into a leading company in ultrafast laser technology with over 9000 systems installed worldwide and 600 employees, 15% of whom focus on R&D. The company's lasers are used in all of the top 50 universities worldwide, highlighting its commitment to state-of-the-art research, while also ensuring the reliability and performance in 24/7 industrial applications. With international offices in the US, China, and Korea, along with a global representative network, the company ensures worldwide sales and service.

Contents


DANGER

OPCPA Systems

Optical parametric chirped-pulse amplification (OPCPA) is currently the only laser technology that can simultaneously provide high peak and average power with a few-cycle pulse duration, required for the most demanding scientific applications.

ORPHEUS | OPCPA

Delivers few-cycle, CEP-stable pulses at one of the four center wavelengths - 800 nm, 1600 nm, 2000 nm, or 3000 nm - in a package as compact as our standard parametric amplifiers.

OPCPA | HE

High-energy OPCPA systems are scalable to multi-TW peak powers at kHz repetition rates while maintaining few-cycle pulse durations. Thus, they meet the most demanding requirements while providing stability and reliability unprecedented for systems of this scale.

From tabletop systems to extreme light infrastructures

High peak and average power with a few-cycle pulse duration

State-of-the-art CEP and pulse energy stability

ORPHEUS | OPCPA

Compact, Few-Cycle, CEP-Stable OPCPA Systems

- Few cycle pulses in a compact footprint
- 800 nm, 1600 nm, 2000 nm, or 3000 nm output
- High repetition rate, up to MHz
- High contrast seed source for CPA and OPCPA systems
- Exceptional power, pulse energy and CEP stability
- SH / TH options

Specifications

Center wavelength	800 nm	1600 nm	2000 nm	3000 nm
Pump source [1]	PHAROS / CARBIDE			
Pump power [1]	20 – 480 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, 1 h [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%			

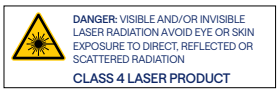
[1] *For using other pump sources, such as thin-disk or innoslab lasers, contact sales@lightcon.com.*

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

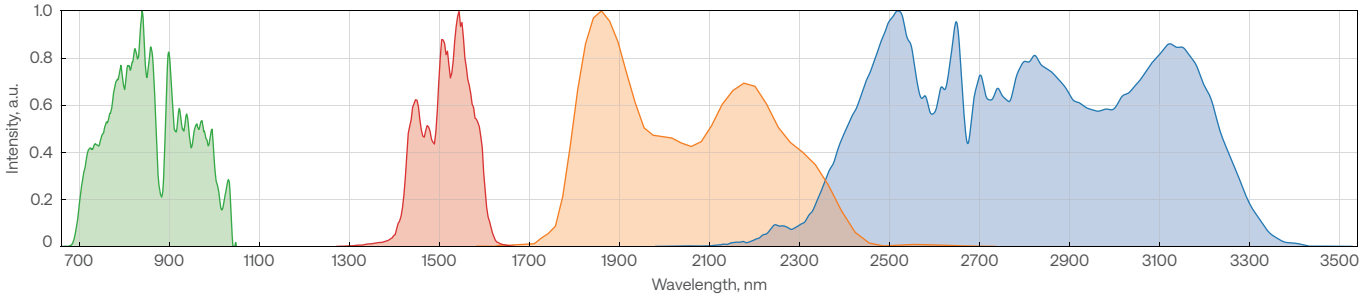
[3] *Uncompressed, for seeding larger amplifiers.*

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

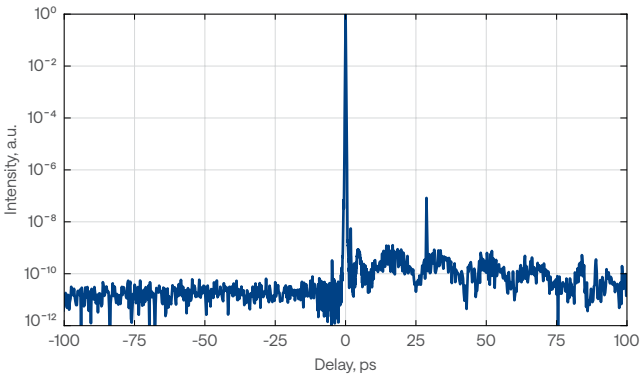
[5] *Expressed as normalized root mean squared deviation (NRMSD).*



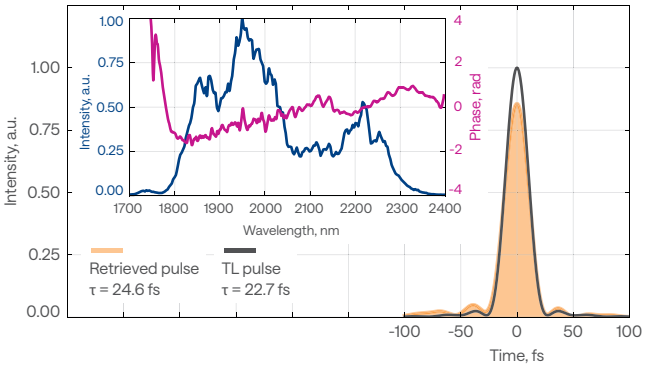
ORPHEUS-OPCPA example spectra of four models



ORPHEUS-OPCPA high-dynamic-range third order autocorrelation measurement system at 800 nm

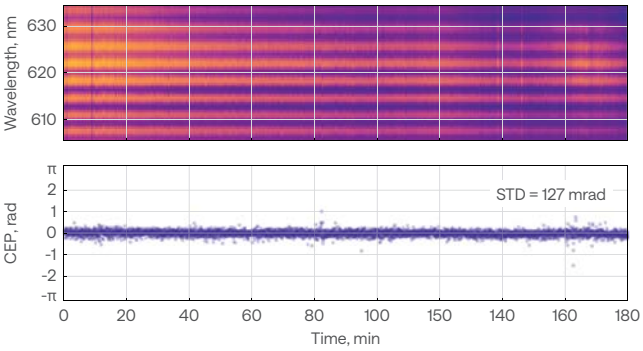


ORPHEUS-OPCPA temporal profile output pulses at 2 µm

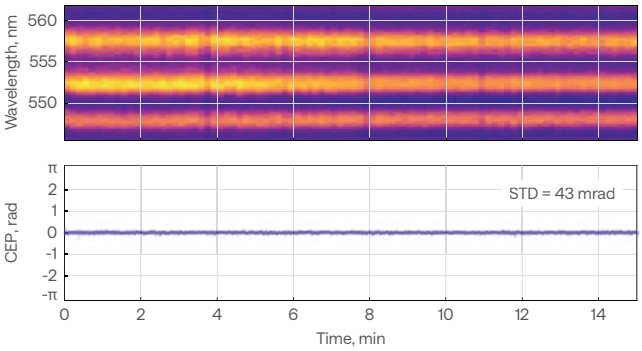


Stability

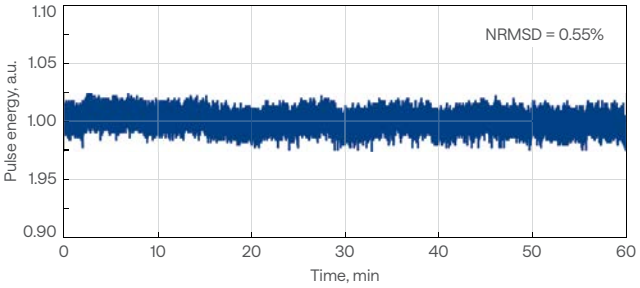
ORPHEUS-OPCPA CEP stability* (800 nm, 100 kHz)



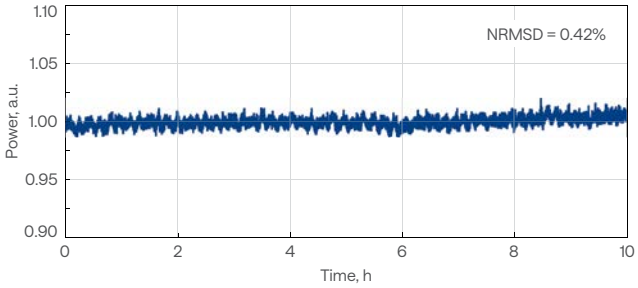
ORPHEUS-OPCPA CEP stability* (3 µm, 1 kHz)



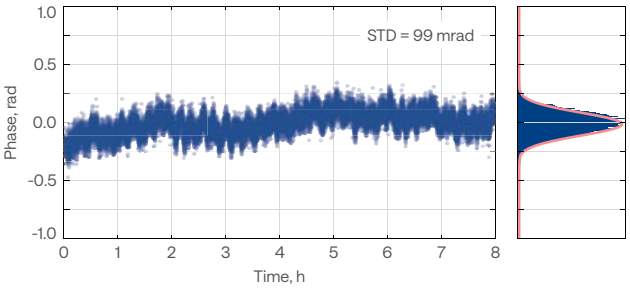
ORPHEUS-OPCPA pulse-to-pulse energy stability at 800 nm



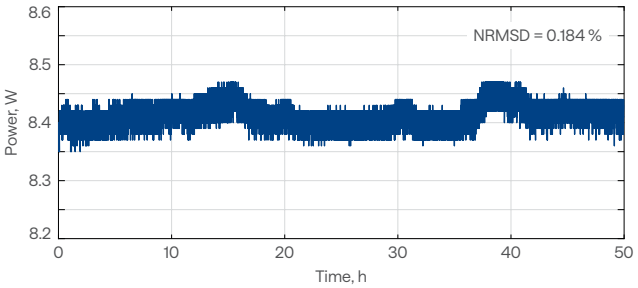
ORPHEUS-OPCPA long-term output stability at 800 nm



ORPHEUS-OPCPA CEP stability* (2 µm, 100 kHz) without slow-loop CEP stabilization



ORPHEUS-OPCPA long-term output stability at 2 µm



** All CEP values calculated from unaveraged, single-shot measurements.*

OPCPA | HE

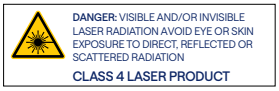
High-Energy OPCPA Systems

- Multi-TW peak-power pulses at up to 1 kHz
- 800 nm, 1600 nm, or 2000 nm output
- Few-cycle pulse duration and high pre-pulse contrast
- Robust design with a warm-up time of < 1 hour
- Exceptional CEP and pulse energy stability
- Spectral-temporal pulse shaping options

Specifications

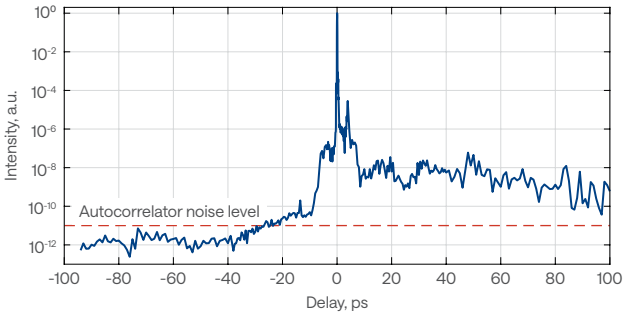
Center wavelength	800 nm	1600 nm	2000 nm
Pump source	Picosecond Nd:YAG lasers, seeded by ORPHEUS-OPCPA		
Repetition rate	10 Hz – 1 kHz		
Maximum output pulse energy [1]	250 mJ	100 mJ	50 mJ
Pulse duration [1]	< 9 fs	< 50 fs	< 30 fs
CEP stability, 1 h [1] [2]	< 250 mrad		
Long-term power stability, 8 h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

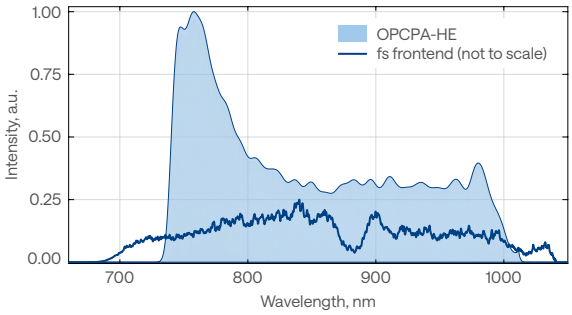


Performance at 800 nm

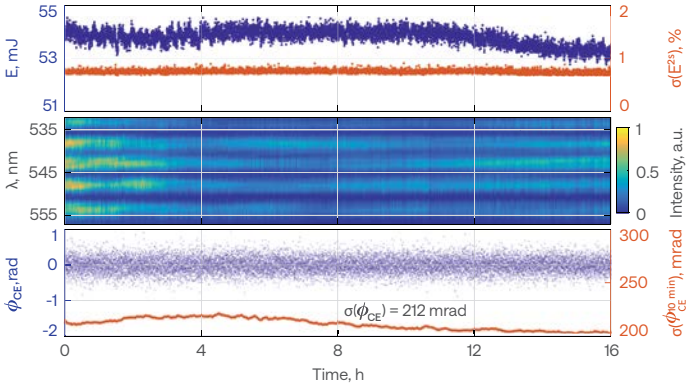
OPCPA-HE system high-dynamic-range third order autocorrelation measurement



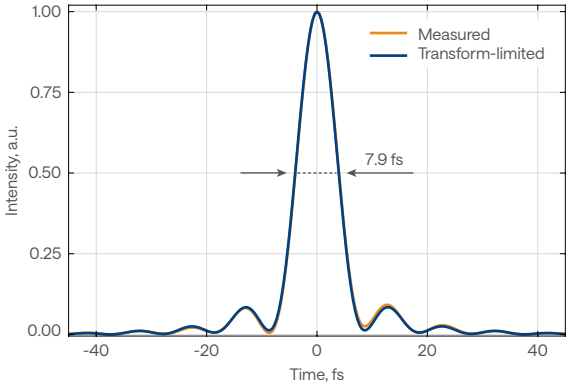
OPCPA-HE output spectrum



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

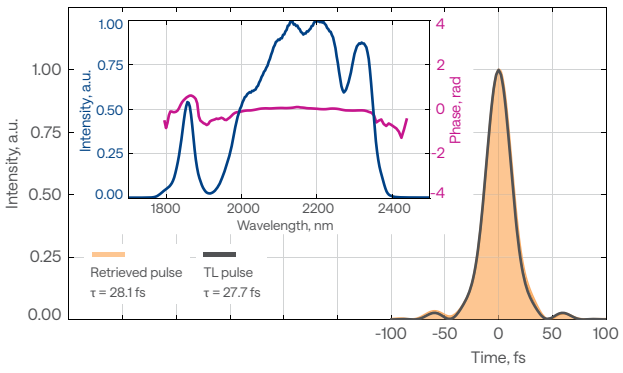


OPCPA-HE output pulses' temporal profile measured with a self-referenced spectral interferometry device

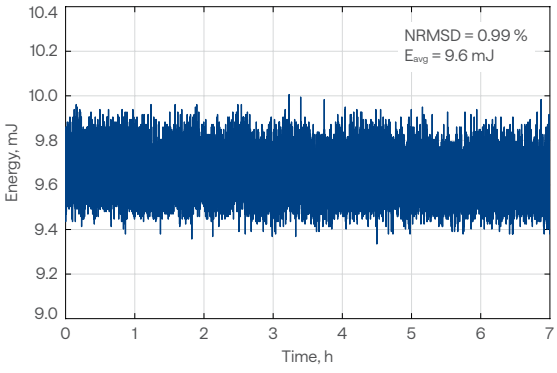


Performance at 2000 nm

OPCPA-HE output pulses' temporal profile at 2 µm



OPCPA-HE pulse-to-pulse energy stability at 2 µm




PHAROS
LIGHT CONVERSION
CARBIDE
LIGHT CONVERSION
FLINT

Femtosecond Lasers

LIGHT CONVERSION is world-renowned for its industrial-grade Yb-based femtosecond lasers, covering a wide range of scientific, industrial, and medical applications.

CARBIDE	Compact industrial design in air-cooled and water-cooled models, providing up to 120 W, 1 mJ or 80 W, 2 mJ with excellent output stability.
PHAROS	Scientific flexibility and process-tailored output parameters, providing pulse duration down to 100 fs and pulse energy of up to 4 mJ.

High average power and high pulse energy at a high repetition rate

Market-proven industrial-grade stability and reliability

Tailored to the needs of industry and science

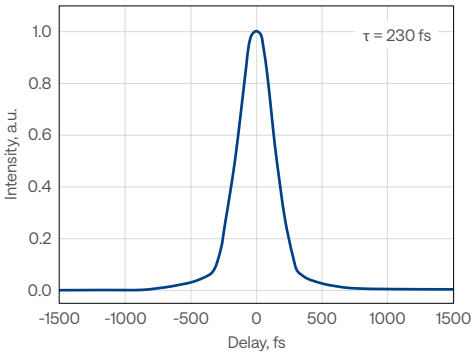
CARBIDE

Unibody-Design Femtosecond Lasers for Industry and Science

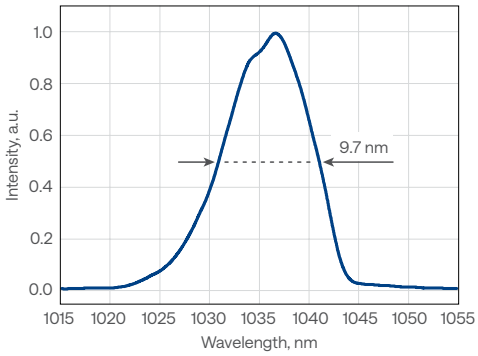
CARBIDE-CB3

- Tunable pulse duration, 190 fs – 20 ps
- Maximum output of 120 W, 1 mJ or 80 W, 2 mJ
- Single-shot – 10 MHz repetition rate (NEW)
- Pulse-on-demand and BiBurst for pulse control
- Up to 5th harmonic or tunable extensions
- Air-cooled and water-cooled models
- Compact industrial-grade design

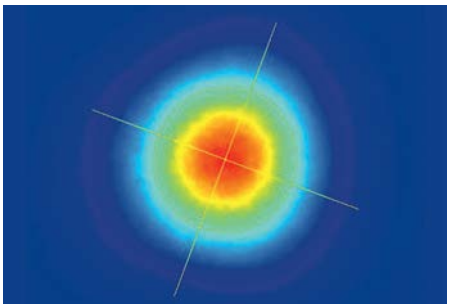
CARBIDE-CB3
Typical pulse duration



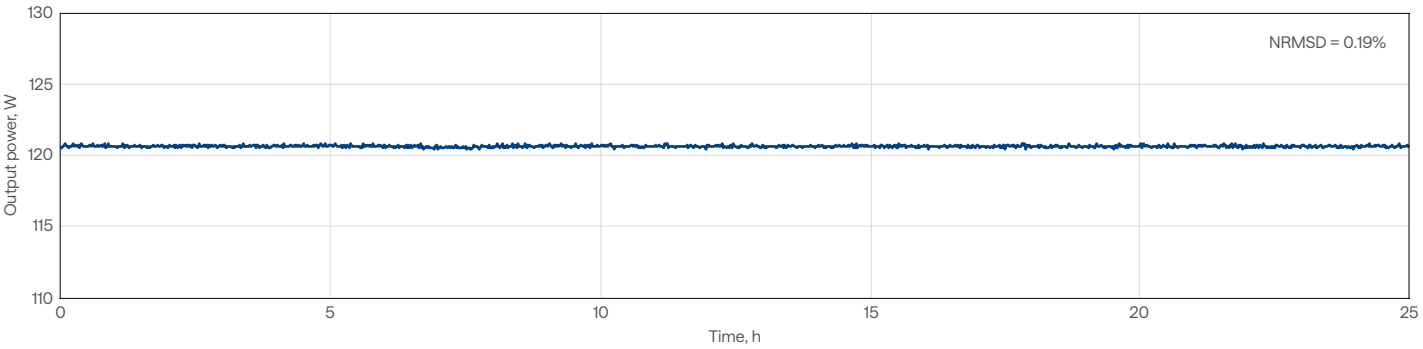
CARBIDE-CB3
Typical spectrum



CARBIDE-CB3
Typical beam profile



CARBIDE-CB3-120W
Long-term power stability



CARBIDE-CB3 specifications

NEW

Model	CB3-20W	CB3-40W	CB3-80W	CB3-120W

OUTPUT CHARACTERISTICS

Cooling method	Water-cooled				
Center wavelength	1030 ± 10 nm				
Maximum output power	20 W	40 W	80 W		120 W
Pulse duration [1]	< 250 fs			< 350 fs [2]	< 250 fs
Pulse duration tuning range	250 fs – 10 ps			350 fs – 10 ps	250 fs – 10 ps
Maximum pulse energy	0.4 mJ		0.2 mJ	0.8 mJ	2 mJ	1 mJ
Repetition rate	Single-shot – 1 MHz	Single-shot–1 MHz (2 MHz on request)	Single-shot – 10 MHz	Single-shot – 2 MHz	
Pulse selection	Single-shot, pulse-on-demand, any fundamental repetition rate division				
Polarization	Linear, vertical; 1 : 1000				
Beam quality, M^2	< 1.2				
Beam diameter [3]	3.9 ± 0.4 mm			4.2 ± 0.4 mm	5.1 ± 0.7 mm	5 ± 0.5 mm
Beam pointing stability	< 20 µrad/°C				
Pulse energy control	FEC [4]		Attenuator [5]	FEC [4]	
Pulse picker leakage	< 0.25%		< 0.5%	< 0.25%	
Pulse-to-pulse energy stability, 24 h [6]	< 0.5%				
Long-term power stability, 100 h [6]	< 0.5%				

MAIN OPTIONS

Oscillator output	< 0.5 W, 120 – 250 fs, 1030 ± 10 nm, ≈ 65 MHz [7]		
Harmonic generator [8]	515 nm, 343 nm, 257 nm, or 206 nm		
Optical parametric amplifier [9]	320 – 10000 nm		n/a
BiBurst option	Tunable GHz and MHz burst with burst-in-burst capability		

PHYSICAL DIMENSIONS

Laser head (L × W × H)	633 × 350 × 174 mm		
Chiller (L × W × H)	585 × 484 × 221 mm	680 × 484 × 307 mm	
24 V DC power supply (L × W × H)	280 × 144 × 49 mm [10]	320 × 200 × 75 mm	376 x 449 x 88 mm

ENVIRONMENTAL AND UTILITY REQUIREMENTS

Operating temperature		15 – 30 °C		
Relative humidity		< 80% (non-condensing)		
Electrical requirements	Laser	100 V AC, 7 A – 240 V AC, 3A; 50 – 60 Hz	100 V AC, 12 A – 240 V AC, 5 A 50 – 60 Hz	100 V AC, 15 A – 240 V AC, 7 A 50 – 60 Hz
	Chiller	100 – 230 V AC; 50 – 60 Hz	200 – 230 V AC; 50 – 60 Hz	
Rated power	Laser	600 W	1000 W	2000 W
	Chiller	1400 W	2000 W	
Power consumption	Laser	500 W	900 W	1500 W
	Chiller	1000 W	1300 W	1800 W

[1] *Assuming Gaussian pulse shape.*

[2] *Pulse duration can be reduced to < 250 fs if pulse peak intensity of > 50 GW/cm² is tolerated by the customer setup.*

[3] *FW 1/e², using maximum pulse energy.*

[4] *Fast energy control (FEC) provides fast, full-scale individual pulse energy control; an external analog control input is available.*

[5] *Waveplate-based variable optical attenuator (VOA); an external analog control input is available.*

[6] *Under stable environmental conditions. Expressed as normalized root mean squared deviation (NRMSD)*

[7] *Available simultaneously, requires a scientific interface. Contact sales@lightcon.com for more details or customized solutions.*

[8] *Integrated. For external harmonic generator, refer to HIRO.*

[9] *Integrated. For more options and OPAs, refer to www.lightcon.com.*

[10] *Power supply can be different if optional 2 MHz version is selected.*

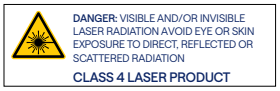
DANGER: VISIBLE AND/OR INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT, REFLECTED OR SCATTERED RADIATION

CLASS 4 LASER PRODUCT

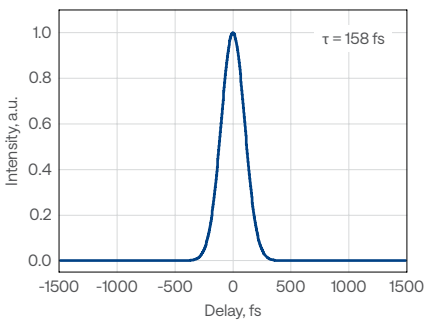
CARBIDE-CB5 (air-cooled) specifications

Model	CB5		CB5-SP
OUTPUT CHARACTERISTICS			
Cooling method	Air-cooled [1]		
Center wavelength	1030 ± 10 nm		
Maximum output power	6 W	5 W	
Pulse duration [2]	< 290 fs		< 190 fs
Pulse duration tuning range	290 fs – 20 ps		190 fs – 20 ps
Maximum pulse energy	100 µJ	83 µJ	100 µJ
Repetition rate	Single-shot – 1 MHz		
Pulse selection	Single-shot, pulse-on-demand, any fundamental repetition rate division		
Polarization	Linear, vertical; 1 : 1000		
Beam quality, M^2	< 1.2		
Beam diameter [3]	2.1 ± 0.4 mm		
Beam pointing stability	< 20 µrad/°C		
Pulse energy control	Attenuator [4]	AOM [5]	Attenuator [4]
Pulse picker leakage	< 2%	< 0.1 %	< 2%
Pulse-to-pulse energy stability, 24 h [6]	< 0.5%		
Long-term power stability, 100 h [6]	< 0.5%		
MAIN OPTIONS			
Oscillator output	n/a		
Harmonic generator [7]	515 nm, 343 nm, 257 nm, or 206 nm		
Optical parametric amplifier [8]	320 – 10000 nm		
BiBurst option	n/a		
PHYSICAL DIMENSIONS			
Laser head (L × W × H)	633 × 324 × 162 mm		
Chiller	Not required		
24 V DC power supply (L × W × H)	220 × 95 × 46 mm		
ENVIRONMENTAL AND UTILITY REQUIREMENTS			
Operating temperature	17 – 27 °C		
Relative humidity	< 80% (non-condensing)		
Electrical requirements	100 V AC, 3 A – 240 V AC, 1.3 A; 50 – 60 Hz		
Rated power	300 W		
Power consumption	150 W		

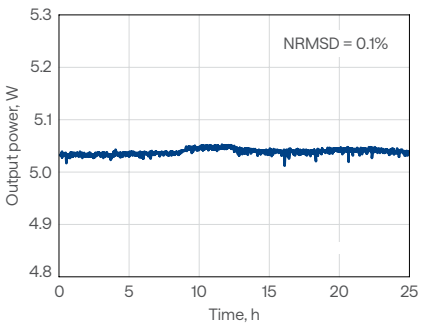
1) *Water-cooled version available on request.*
2) *Assuming Gaussian pulse shape.*
3) *FW 1/e², using maximum pulse energy.*
4) *Waveplate-based variable optical attenuator (VOA); an external analog control input is available.*
5) *Enhanced contrast AOM. Provides fast amplitude control of output pulse train.*
6) *Under stable environmental conditions. Expressed as normalized root mean squared deviation (NRMSD).*
7) *Integrated. For external harmonic generator, refer to HIRO.*
8) *Integrated. For stand-alone OPAs, refer to www.lightcon.com.*



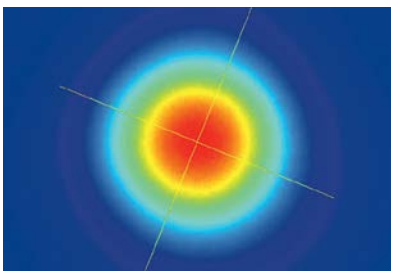
CARBIDE-CB5-SP
Typical pulse duration



CARBIDE-CB5
Long-term power stability

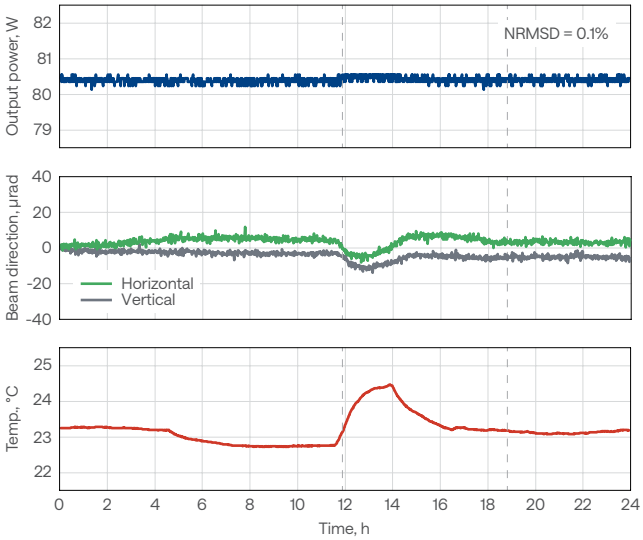


CARBIDE-CB5
Typical beam profile

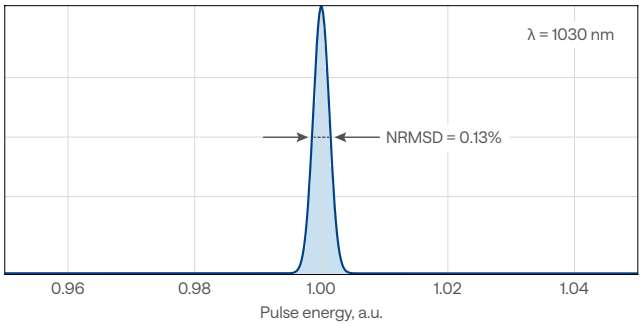


Stability measurements

CARBIDE-CB3 output power and beam direction stability with power lock enabled, across varying environmental conditions

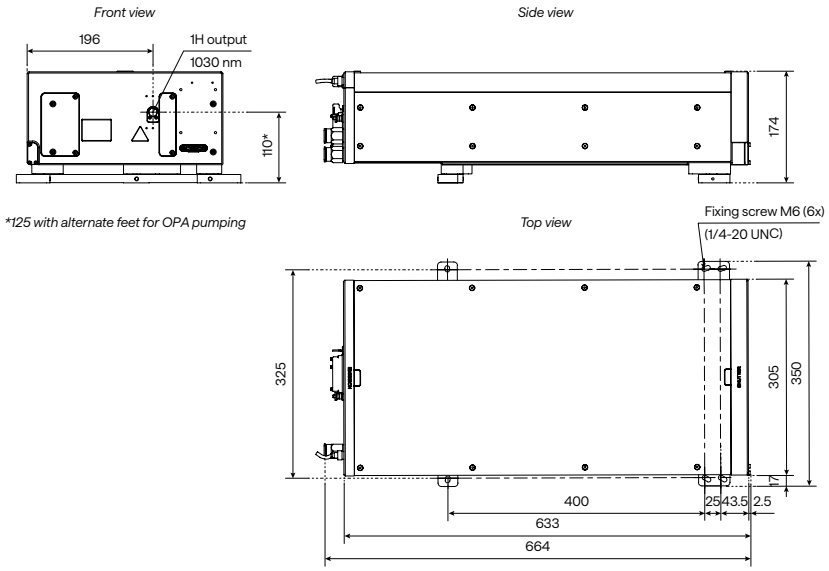


CARBIDE-CB3
Typical pulse-to-pulse energy stability

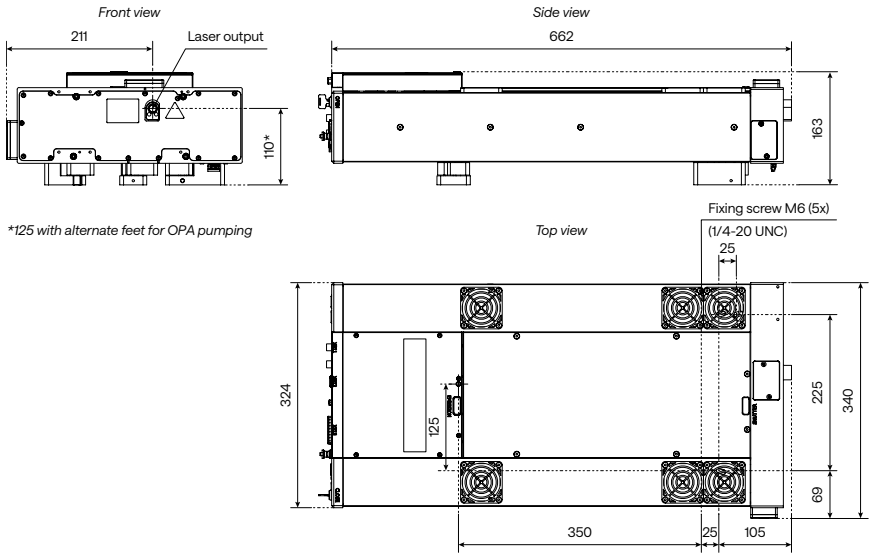


Drawings

CARBIDE-CB3 drawing



Air-cooled **CARBIDE-CB5** with attenuator drawing

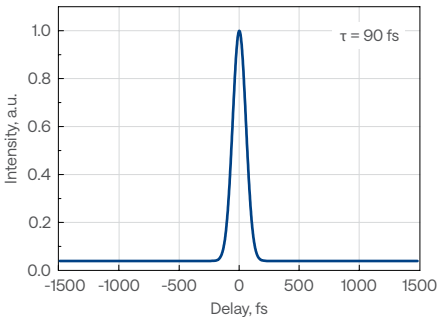


PHAROS

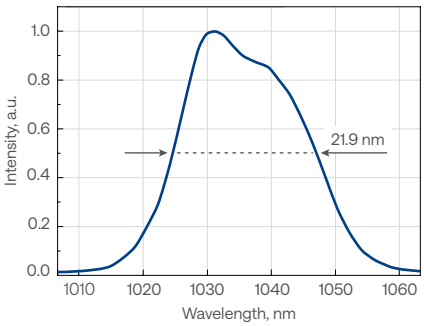
Modular-Design Femtosecond Lasers for Industry and Science

- Tunable pulse duration, 100 fs – 20 ps
- Maximum pulse energy of up to 4 mJ
- Down to < 100 fs right at the output
- Pulse-on-demand and BiBurst for pulse control
- Up to 5th harmonic or tunable extensions
- CEP stabilization or repetition rate locking
- Thermally-stabilized and sealed design

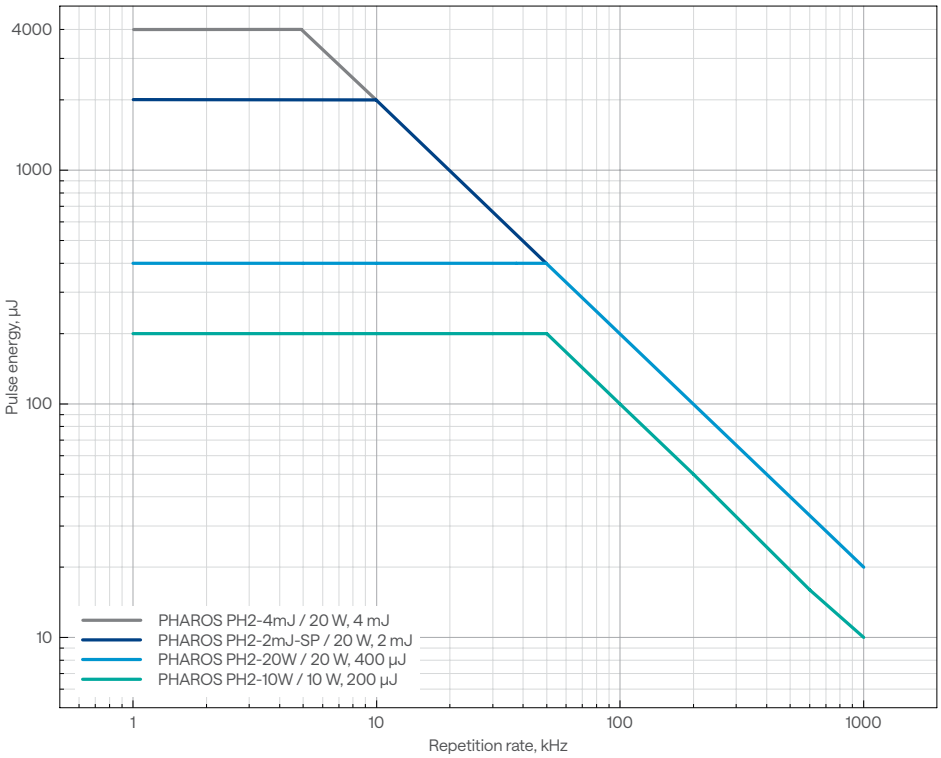
PHAROS-PH2-UP
Typical pulse duration



PHAROS-PH2-UP
Typical spectrum



PHAROS
Pulse energy vs fundamental repetition rate



Specifications

Model	PH2-10W	PH2-20W-SP			PH2-4mJ	PH2-UP	
OUTPUT CHARACTERISTICS							
Center wavelength [1]	1030 ± 10 nm						
Maximum output power	10 W	20 W					
Pulse duration [2]	< 290 fs	< 190 fs			< 450 fs [3]	< 100 fs	
Pulse duration tuning range	290 fs – 10 ps (20 ps on request)	190 fs – 10 ps (20 ps on request)			450 fs – 10 ps	100 fs – 10 ps	
Maximum pulse energy	0.2 mJ	0.4 mJ	1 mJ	2 mJ	4 mJ	0.4 mJ	1 mJ
Repetition rate	Single-shot – 1 MHz						
Pulse selection	Single-shot, pulse-on-demand, any fundamental repetition rate division						
Polarization	Linear, horizontal						
Beam quality, M^2	< 1.2	< 1.3				< 1.2	
Beam diameter [4]	3.3 ± 0.5 mm	4.0 ± 0.5 mm	4.5 ± 0.5 mm	6.8 ± 0.7 mm		4.5 ± 0.5 mm	6 ± 0.5 mm
Beam pointing stability	< 20 µrad/°C						
Pre-pulse contrast	< 1 : 1000						
Post-pulse contrast	< 1 : 200						
Pulse-to-pulse energy stability, 24 h [5]	< 0.5%						
Long-term power stability, 100 h [5]	< 0.5%						
MAIN OPTIONS							
Oscillator output [6]	1 – 7 W, 50 – 250 fs, ≈ 1035 nm, ≈ 76 MHz						
Harmonic generator [7]	515 nm, 343 nm, 257 nm, or 206 nm						
Optical parametric amplifier [8]	320 – 10000 nm						
BiBurst option	Tunable GHz and MHz burst with burst-in-burst capability						
CEP stabilization	*See page 19*						
Repetition rate locking							
PHYSICAL DIMENSIONS							
Laser head (L × W × H) [9]	730 × 419 × 230 mm				827 × 492 × 250 mm	770 × 419 × 230 mm	
Chiller (L × W × H)	590 × 484 × 267 mm						
24 V DC power supply (L × W × H) [9]	280 × 144 × 49 mm						
ENVIRONMENTAL & UTILITY REQUIREMENTS							
Operating temperature	15 – 30 °C (air conditioning recommended)						
Relative humidity	< 80% (non-condensing)						
Electrical requirements – Laser	100 V AC, 12 A – 240 V AC, 5 A, 50 – 60 Hz						
Electrical requirements – Chiller	100 – 230 V AC, 50 – 60 Hz						
Rated power – Laser	1000 W						
Rated power – Chiller	1400 W						
Power consumption – Laser	600 W						
Power consumption – Chiller	1000 W						

[1] *Precise wavelengths for specific models are available upon request.*

[2] *Assuming Gaussian pulse shape.*

[3] *Pulse duration can be reduced to < 250 fs if pulse peak intensity of > 50 GW/cm² is tolerated by the customer setup.*

[4] *FW 1/e², measured at laser output, using maximum pulse energy.*

[5] *Under stable environmental conditions. Expressed as normalized root mean squared deviation (NRMSD).*

[6] *Available simultaneously. Contact sales@lightcon.com for more details or customized solutions.*

[7] *Integrated. For external harmonic generator, refer to HIRO.*

[8] *Integrated. For more options and OPAs for -4mJ and -UP models, refer to www.lightcon.com.*

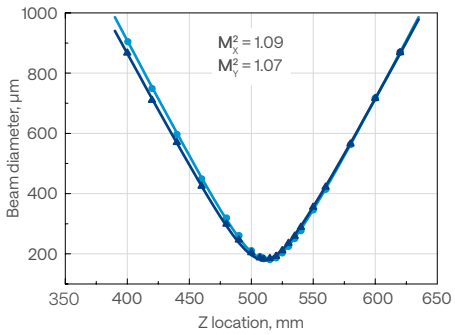
[9] *Dimensions depend on laser configuration and integrated options.*

DANGER: VISIBLE AND/OR INVISIBLE LASER RADIATION AVOID EYE OR SKIN EXPOSURE TO DIRECT, REFLECTED OR SCATTERED RADIATION

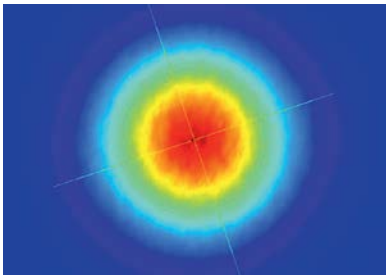
CLASS 4 LASER PRODUCT

Beam properties

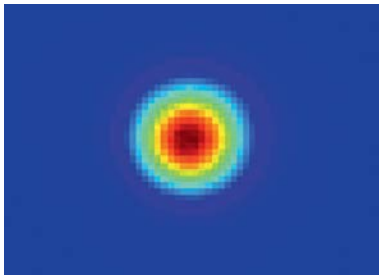
PHAROS
Typical M^2 measurement data



PHAROS
Typical near-field beam profile

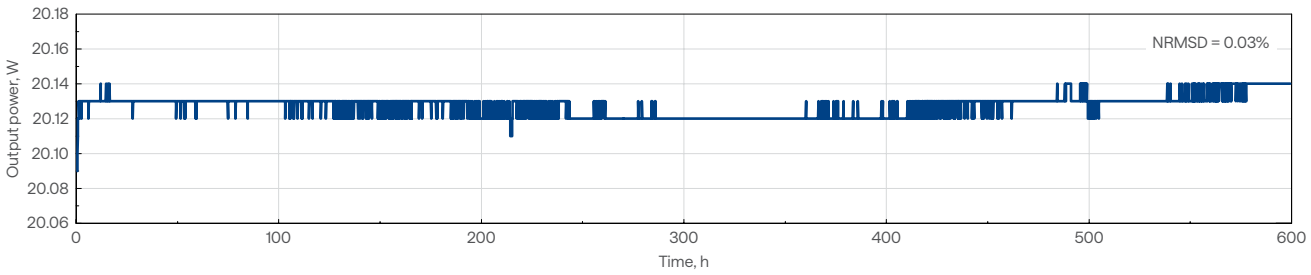


PHAROS
Typical far-field beam profile

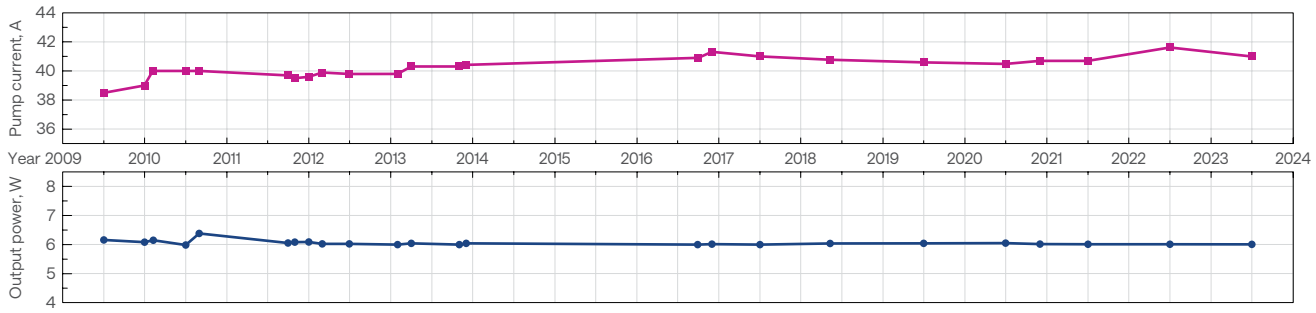


Stability measurements

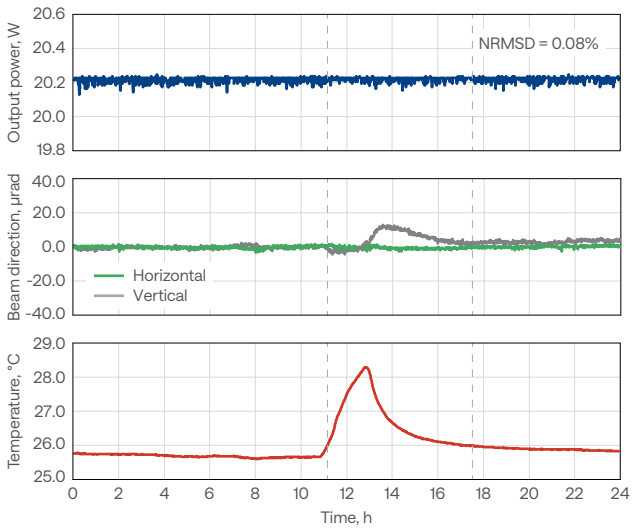
PHAROS
Long-term power stability



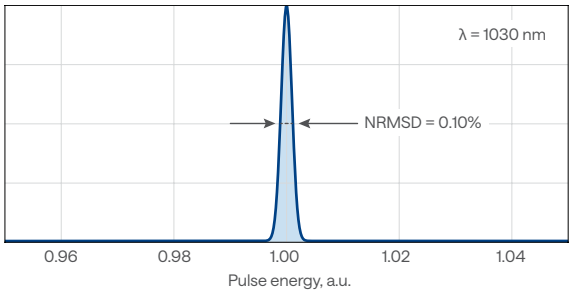
Output power of industrial-grade **PHAROS** lasers operating 24/7 and the current of the pump diodes over the years



PHAROS output power and the stability of beam direction with power lock enabled, across varying environmental conditions



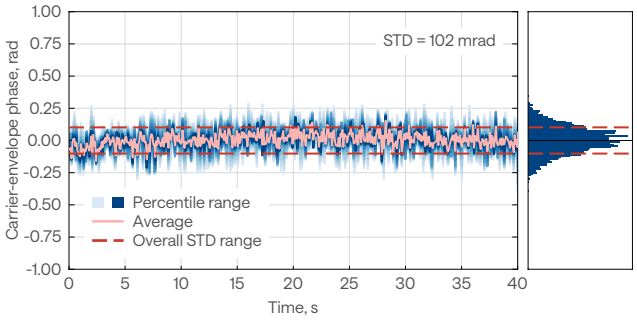
PHAROS
Typical pulse-to-pulse energy stability



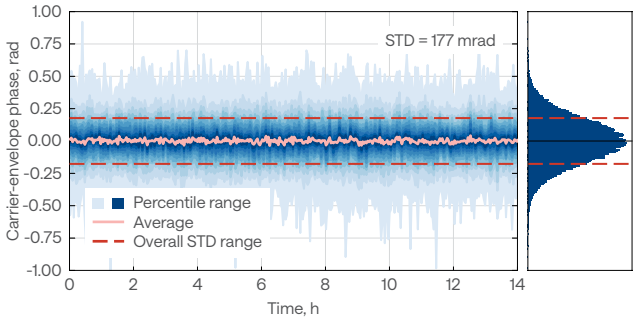
CEP stabilization

PHAROS lasers can be equipped with feedback electronics for carrier-envelope phase (CEP) stabilization of the output pulses. The carrier-envelope offset (CEO) of the **PHAROS** oscillator is actively locked to 1/4th of the repetition rate with a < 100 mrad standard deviation. The CEP stable pulses from the synchronized amplifier have a < 350 mrad standard deviation. The CEP drift occurring inside the amplifier and the user's setup can be compensated with an out of loop f-2f interferometer, which is a part of the complete **PHAROS** active CEP stabilization package.

PHAROS
Short-term CEP stability operating at 200 kHz repetition rate



PHAROS
Long-term CEP stability operating at 200 kHz repetition rate

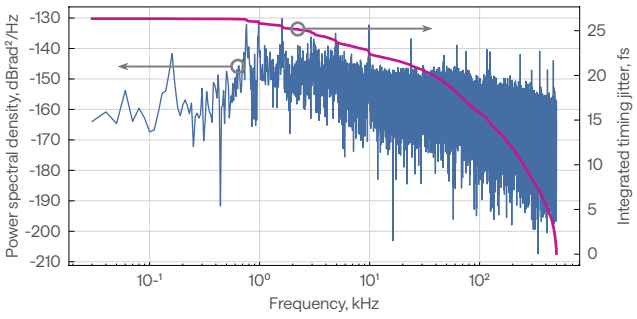


Repetition rate locking

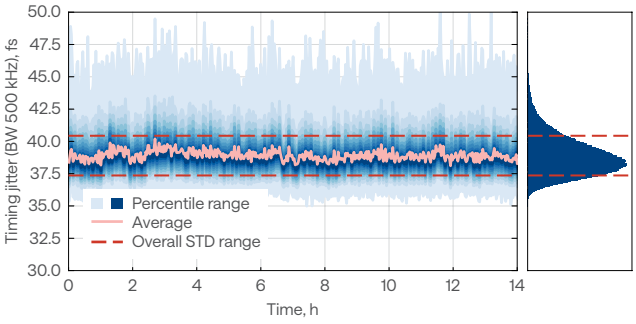
The oscillator of **PHAROS** laser can be customized for repetition rate locking applications. Coupled with the necessary feedback electronics, the repetition rate is synchronized to an external RF source using the two piezo stages installed inside the cavity.

The repetition rate locking system can assure an integrated timing jitter of less than 200 fs for RF reference frequencies larger than 500 MHz. Continuous phase shifting is available on request.

Phase noise data of **PHAROS** oscillator
locked to a 2.8 GHz RF source

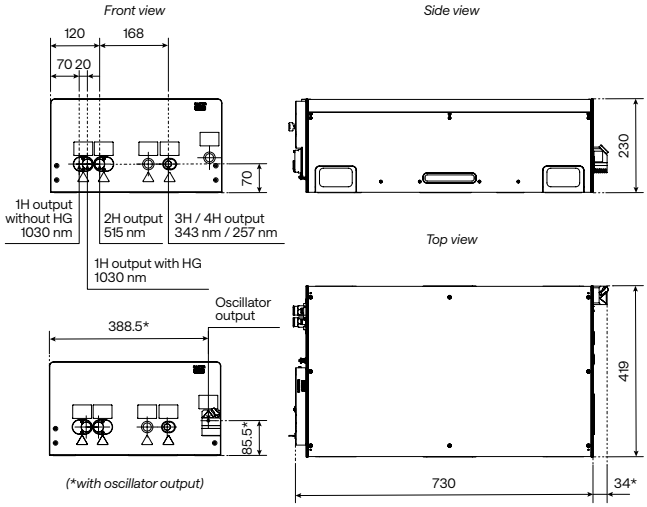


Timing jitter stability over 14 h
PHAROS oscillator locked to a 2.8 GHz RF source

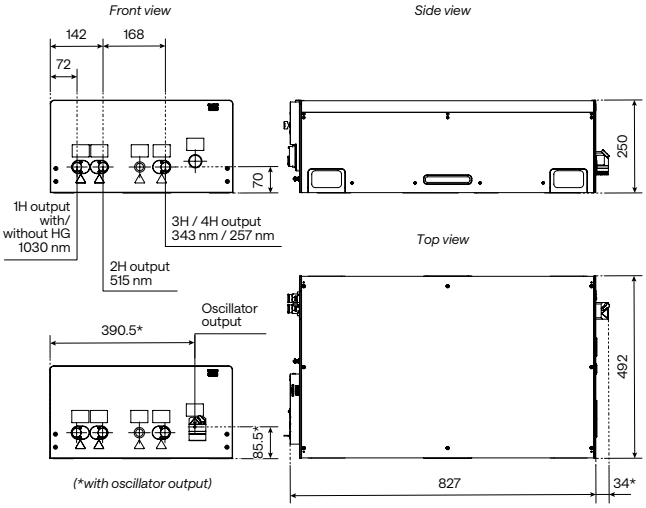


Drawings

PHAROS-PH2-730 drawing.
PH2 or PH2-SP with FEC, BiBurst, or harmonics;
also, PH2-UP without harmonics



PHAROS-PH2-827 drawing
PH2 with -HE harmonics, PH2-4mJ, or PH2-UP with harmonics



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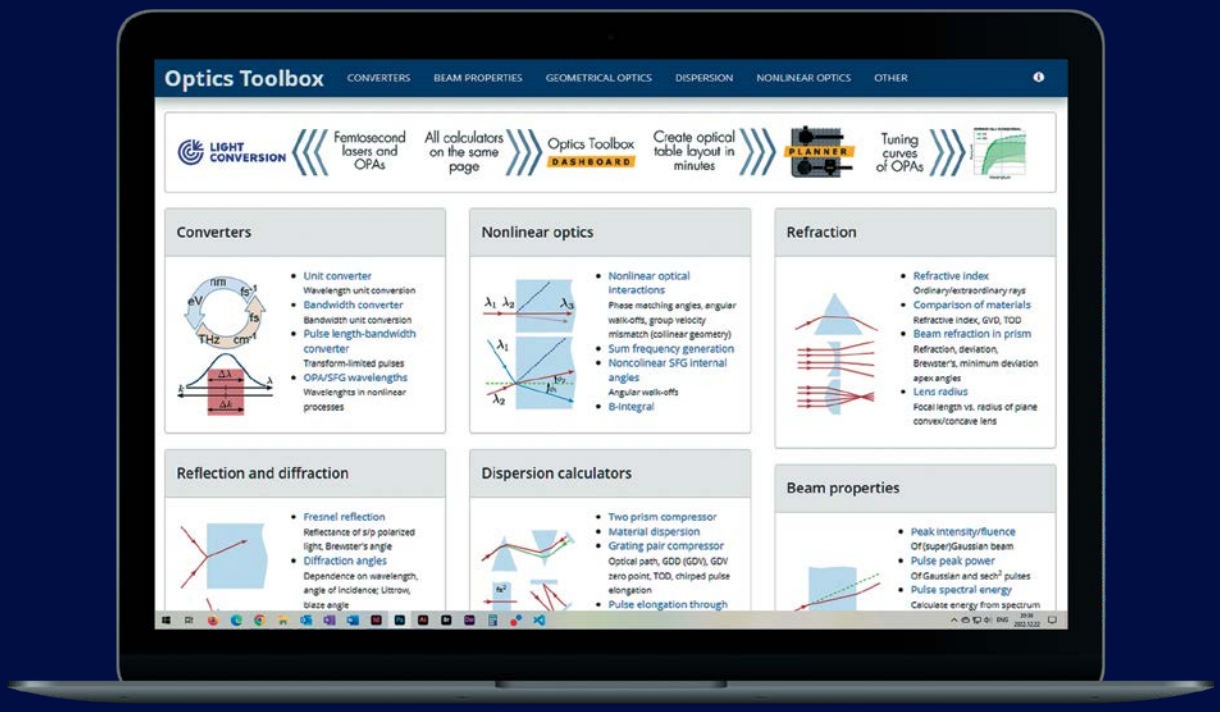
Optics Toolbox



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All calculators on the same page

Optical table layout planner

Custom OPA tuning curves

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