

PHAROS

High-Power Femtosecond Lasers



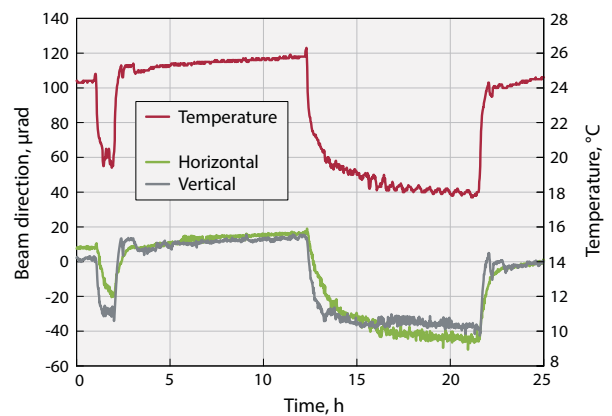
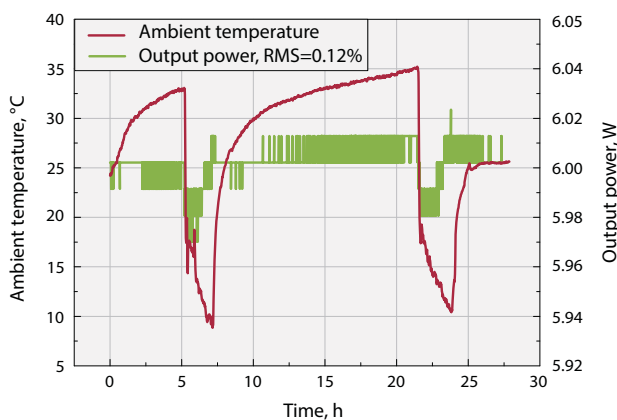
FEATURES

- 190 fs – 10 ps tunable pulse duration
- 2 mJ maximum pulse energy
- 20 W output power
- Single shot – 1 MHz tunable base repetition rate
- Pulse picker for pulse-on-demand operation
- Rugged, industrial grade mechanical design
- Automated harmonics generators (515 nm, 343 nm, 257 nm, 206 nm)

PHAROS is a single-unit integrated femtosecond laser system combining millijoule pulse energies and high average power. PHAROS features a mechanical and optical design optimized for industrial applications such as precise material processing. Market-leading compact size, integrated thermal stabilization system and sealed design allows PHAROS integration into machining workstations. The use of solid state laser diodes for pumping of Yb medium significantly reduces maintenance cost and provides long laser lifetime.

Most of the PHAROS output parameters can be easily set via PC in seconds. Tunability of laser output parameters allows PHAROS system to cover applications normally requiring different classes of lasers. Tunable parameters include: pulse

duration (190 fs – 10 ps), repetition rate (single pulse to 1 MHz), pulse energy (up to 2 mJ) and average power (up to 20 W). Its deliverable power is sufficient for most of material processing applications at high machining speeds. The built-in pulse picker allows convenient control of the laser output in pulse-on-demand mode. It comes along with an extensive external control interface dedicated for easy laser integration into larger setups and machining workstations. PHAROS compact and robust optomechanical design includes easy to replace modules with temperature stabilized and sealed housings ensuring stable laser operation across varying environments. PHAROS is equipped with an extensive software package, which ensures smooth hands-free operation.



PHAROS output power with power lock enabled under unstable environment

SPECIFICATIONS

Model	PHAROS-6W	PHAROS-10W	PHAROS-15W	PHAROS-20W	PHAROS SP	PHAROS SP 1.5	PHAROS 2mJ
Max. average power	6 W	10 W	15 W	20 W	6 W		6 W
Pulse duration (assuming Gaussian pulse shape)	< 290 fs				< 190 fs		< 300 fs
Pulse duration range	290 fs – 10 ps				190 fs – 10 ps		300 fs – 10 ps
Max. pulse energy	> 0.2 mJ / > 0.4 mJ				> 1.0 mJ	> 1.5 mJ	> 2 mJ
Beam quality	TEM ₀₀ ; M ² < 1.2				TEM ₀₀ ; M ² < 1.3		
Base repetition rate	1 kHz – 1 MHz ¹⁾						
Pulse selection	Single-Shot, Pulse-on-Demand, any base repetition rate division						
Centre wavelength	1028 nm ± 5 nm						
Output pulse-to-pulse stability	< 0.5 % rms ²⁾						
Power stability	< 0.5 % rms over 100 h						
Pre-pulse contrast	< 1 : 1000						
Post-pulse contrast	< 1 : 200						
Polarization	Linear, horizontal						
Beam pointing stability	< 20 μrad/°C						
Oscillator output	Optional, please see specifications of FLINT oscillators on page 20						

PHYSICAL DIMENSIONS

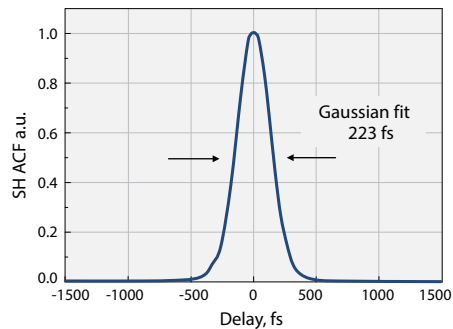
Laser head	670 (L) × 360 (W) × 212 (H) mm
Rack for power supply and chiller	640 (L) × 520 (W) × 660 (H) mm

UTILITY REQUIREMENTS

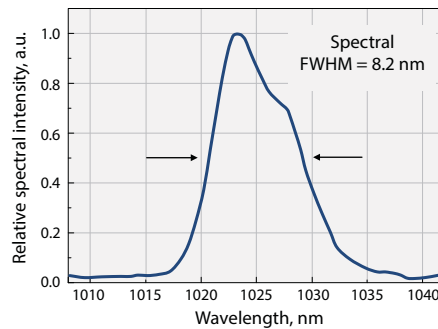
Electric	110 V AC, 50 – 60 Hz, 20 A or 220 V AC, 50 – 60 Hz, 10 A
Operating temperature	15 – 30 °C (air conditioning recommended)
Relative humidity	20 – 80 % (non condensing)

¹⁾ Some particular repetition rates are software denied due to system design.

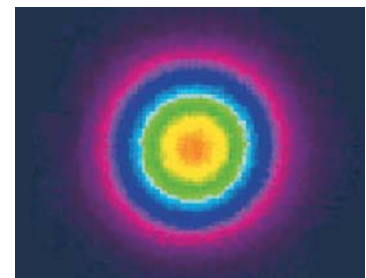
²⁾ Under stable environmental conditions.



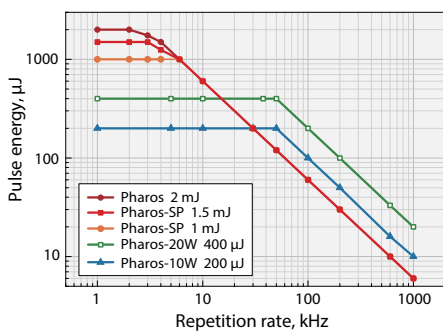
Pulse duration of PHAROS



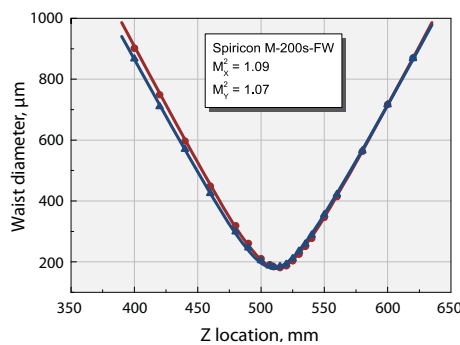
Spectrum of PHAROS



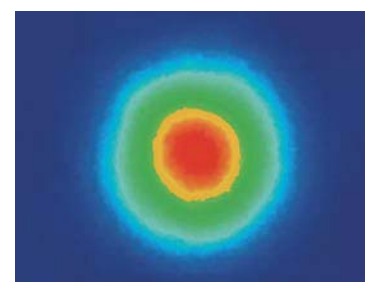
Typical PHAROS far field beam profile at 200 kHz



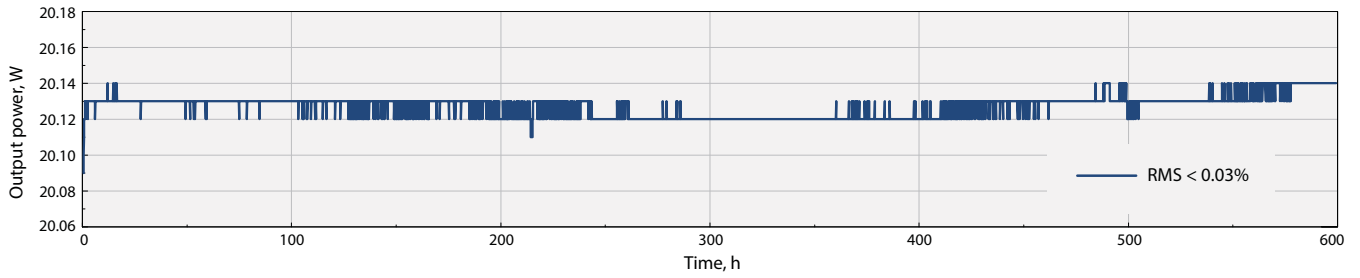
Pulse energy vs base repetition rate



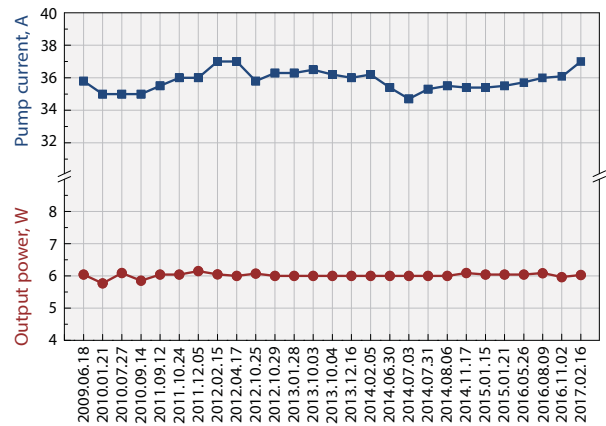
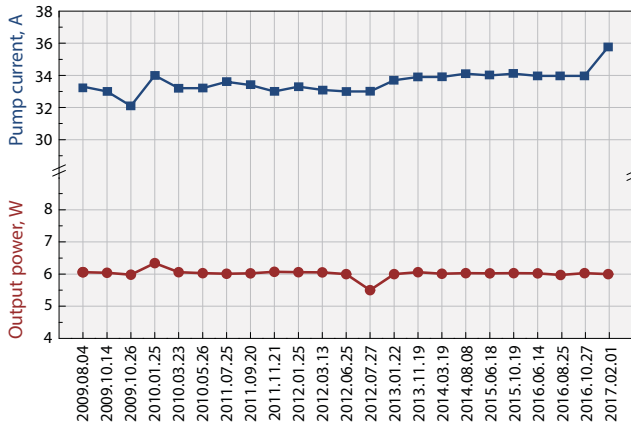
Typical PHAROS M² measurement data



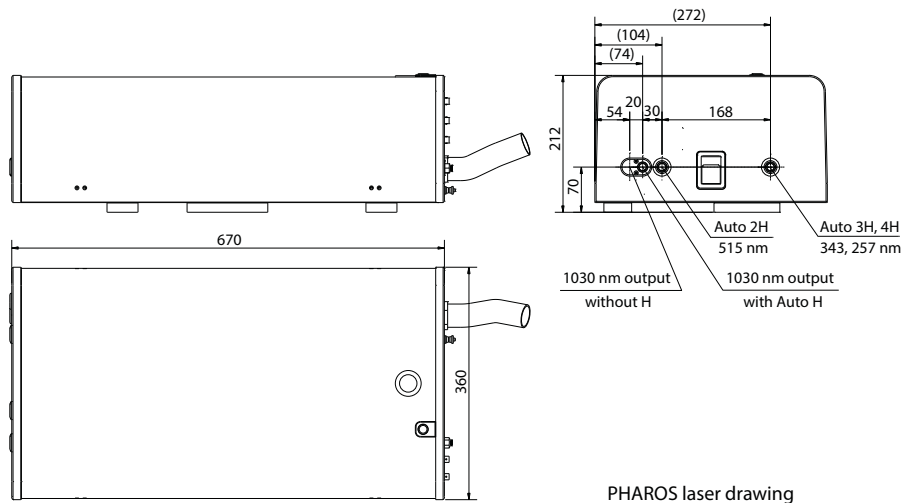
Typical PHAROS near field beam profile at 200 kHz



PHAROS long term stability graph



Output power of industrial PHAROS lasers operating 24/7 and current of pump diodes during the years



PHAROS

Automated Harmonics Generators



FEATURES

- 515 nm, 343 nm, 257 nm and 206 nm
- Output selection by software
- Mounts directly on laser head and integrated into the system
- Rugged, industrial grade mechanical design

PHAROS laser can be equipped with optional automated harmonics modules. Selection of fundamental (1030 nm), second (515 nm), third (343 nm), fourth (257 nm) or fifth (206 nm) harmonic output is available by software control. Harmonics generators are designed to be used in industrial applications where a single output wavelength is desired. Modules are mounted directly on the output of the laser and integrated into the system.

SPECIFICATIONS

Model	2H	2H-3H	2H-4H	4H-5H
Output wavelength (automated selection)	1030 nm 515 nm	1030 nm 515 nm 343 nm	1030 nm 515 nm 257 nm	1030 nm 257 nm 206 nm
Input pulse energy	20 – 2000 μ J	50 – 1000 μ J	20 – 1000 μ J	200 – 1000 μ J
Pump pulse duration	190 – 300 fs			
Conversion efficiency	> 50 % (2H)	> 50 % (2H) > 25 % (3H)	> 50 % (2H) > 10 % (4H) *	> 10 % (4H) * > 5 % (5H)
Pump laser beam quality (M^2)	< 1.2 / < 1.3 depends on a model			
Beam quality (M^2) $\leq 400 \mu$ J pump	515 nm: M^2 (pump) + 0.1	515 nm: M^2 (pump) + 0.1 343 nm: M^2 (pump) + 0.2	515 nm: M^2 (pump) + 0.1 257 nm: n/a	n/a
Beam quality (M^2) > 400 μ J pump	515 nm: M^2 (pump) + 0.2	515 nm: M^2 (pump) + 0.2 343 nm: M^2 (pump) + 0.3	515 nm: M^2 (pump) + 0.2 257 nm: n/a	n/a

* Max 1 W output.

