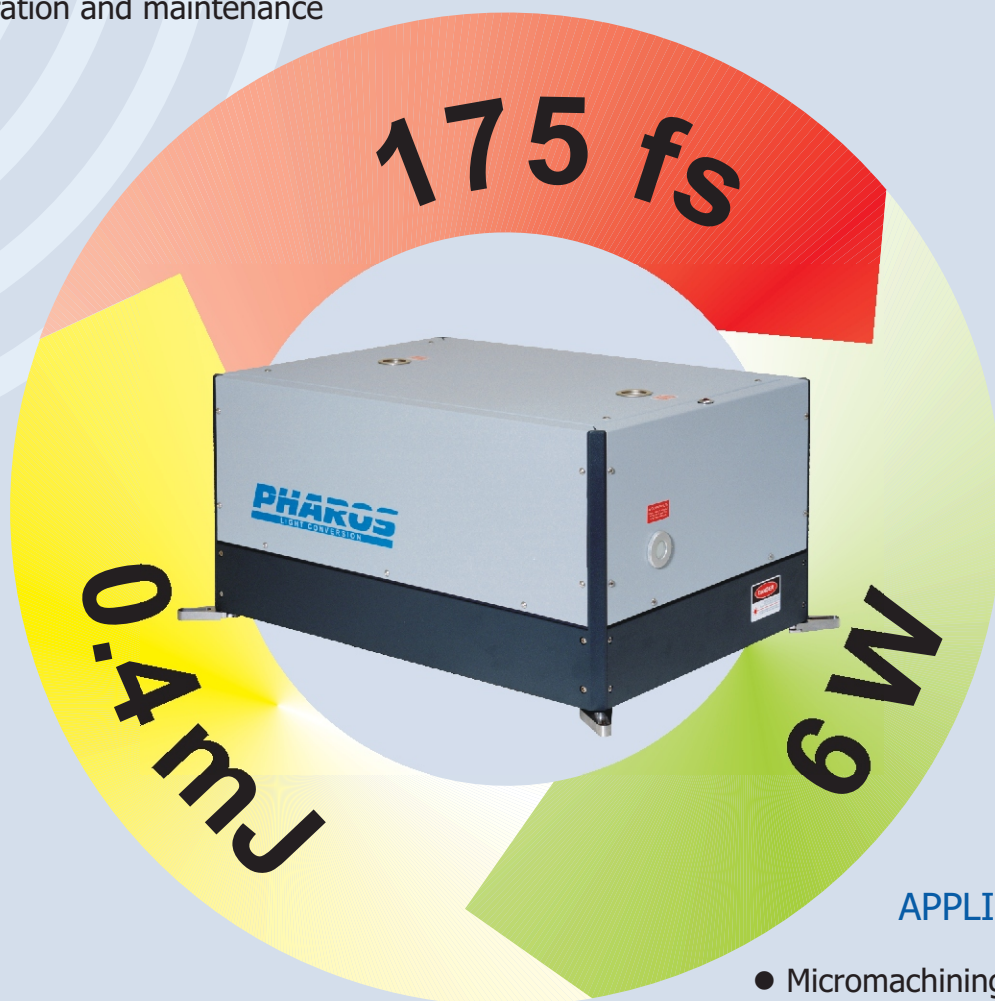


FEATURES

- ◆ <180 fs pulses
- ◆ 6 W average power
- ◆ Flexibility in repetition rate - 1...350 kHz
- ◆ Sealed oscillator and amplifier modules
- ◆ Interchangeable pump modules
- ◆ Broad range of frequency conversion options (harmonic generators, OPA)
- ◆ Low operation and maintenance costs

PHAROS

HIGH POWER FEMTOSECOND LASER SYSTEM



APPLICATIONS

- Micromachining
- Micro- and nano-structuring
- Writing Bragg gratings and waveguides
- Multi-photon polymerization
- Nonlinear optics
- Time-resolved spectroscopy
- Biomedical applications

PHAROS is a Yb:KGW based system that delivers power suitable for a number of materials processing applications and has a pulse duration that is attractive for the ultrafast research community.

Design and performance

PHAROS is built on the traditional chirped pulse amplification concept, employing a seed oscillator, regenerative amplifier and pulse stretcher / compressor. The oscillator is Kerr lens mode-locked with chirped mirrors used for group velocity dispersion compensation. Typical average output power of the seed oscillator is in excess of 700mW with sub-100 fs pulse duration. The regenerative amplifier's laser crystal is non-collinearly pumped by two high brightness custom designed diode bar modules that deliver up to 50W at 980nm. The low loss BBO Pockels cell supports operation at repetition rates up to 350kHz. The average power at repetition rates above 100kHz exceeds 6W. Maximum pulse energy for standard systems is 0.4mJ and can be increased beyond 1mJ for low repetition rates (using a modified cavity design). In the standard PHAROS the output pulse duration is 280fs, somewhat varying with the repetition rate due to change in saturation level of the laser crystal. In PHAROS-SP (Short Pulse) spectral pre-shaping of the high power seed leads to nearly doubled bandwidth that is sufficient to support ~100fs pulses. The shortest pulses demonstrated to-date were about 170fs in Gaussian fit. The stretcher/compressor unit employs transmitting gratings that exhibit high efficiency and excellent power handling capability.

Mechanics and electronics

PHAROS' opto-mechanical design features sealed modules for the oscillator, regenerative amplifier and stretcher/compressor, and has a very small footprint (570x400mm). This footprint includes space for harmonic generators and Pulse Picker. For OEM applications the sealed modules can be used without the external box, which reduces the overall size to 500x300x280mm.

A timing circuit (placed near the amplifier unit) controls switching of Pockels cells for the regenerative amplifier and pulse picker and provides protection against optically damaging the laser crystal with a high intensity pulse. Power supply box (520x520x320mm) includes drivers for laser diode bars and HV supply for Pockels cell driver.

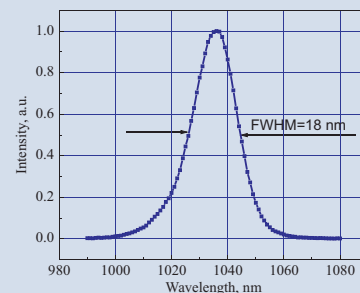
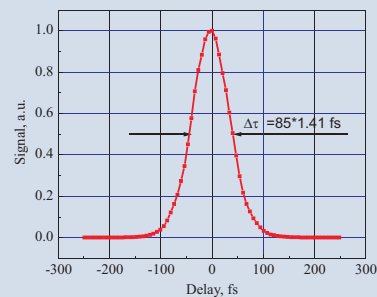
The operation and long-term stabilization of complete system is controlled by a set of microcontrollers linked together by industrial CAN bus. Parameters of the laser can be set and monitored using Remote control pad or / and external PC via USB or RS232 interface. Extensive PC software control is available for setting the operation parameters. Software Development Kit is included with the system, allowing the user to create own control applications and to interface with other equipment.

Laser specifications

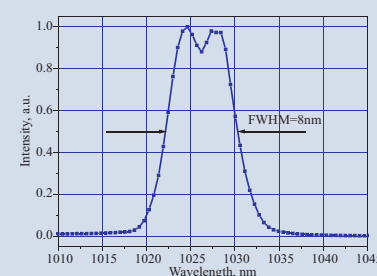
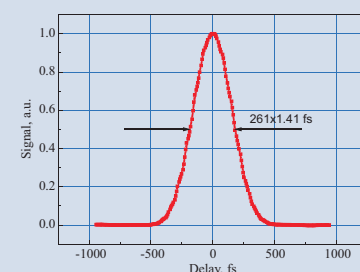
	Pharos SP	Pharos
Max. average power	4 W	6 W
Pulse width*	<180 fs	<300 fs
Max. pulse energy	0.4 mJ**	
Repetition rate	up to 350 kHz	
Wavelength	1030 nm	
Output stability	<1% rms	
Beam quality	TEM ₀₀ ; M ² <1.2	

* at repetition rate 50 -350 kHz

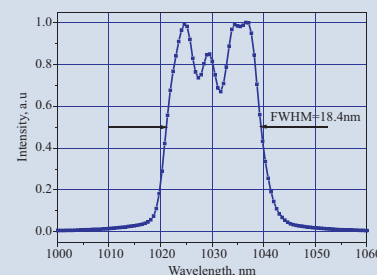
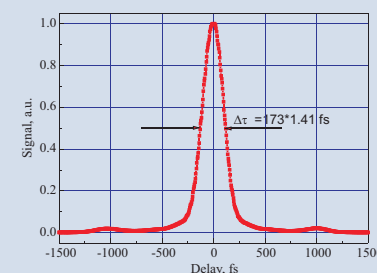
** inquire about high energy models



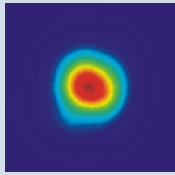
Autocorrelation and spectrum of oscillator output pulse



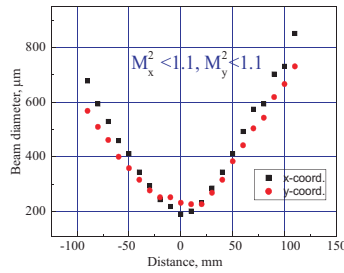
Autocorrelation and spectrum of PHAROS output pulse



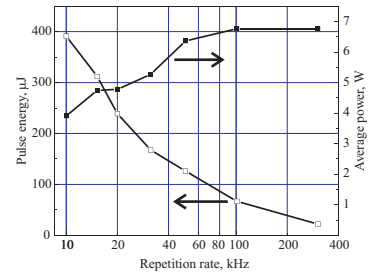
Autocorrelation and spectrum of PHAROS SP output pulse



Beam profile at the output of laser (5 W)



Focused output beam diameter variation with propagation distance



Output power and pulse energy versus repetition rate

Optional Accessories

External Pulse Picker for "pulse-on-demand" operation

OPA (pumped by 515 nm)

Harmonic generators

Continuum generators

OPA (pumped by 515 nm)

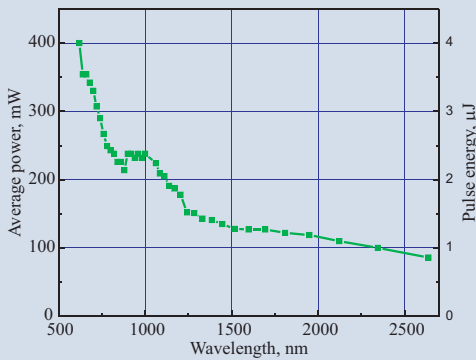
Tuning range	signal + idler	630...2600 nm
	SH of signal and idler	315...630 nm
	FH of signal	210...320 nm

Pulse duration (signal) *** < 120 fs

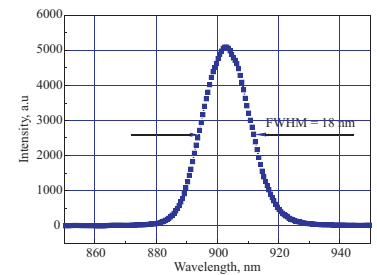
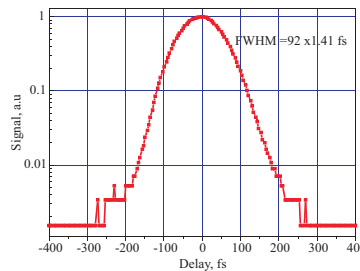
Energy conversion to signal+idler > 30% at peak

Beam quality $M^2 < 1.5$

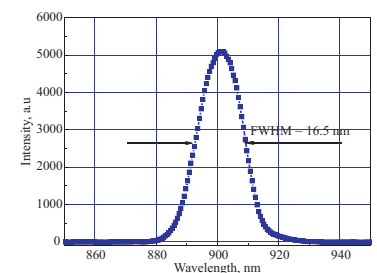
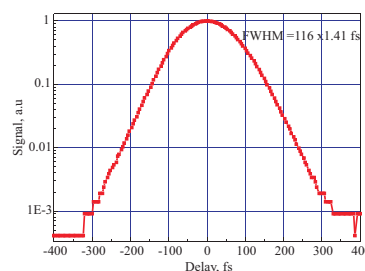
*** for Pharos SP



Preliminary OPA tuning curve @ 100 kHz.



Autocorrelation and spectrum of unsaturated OPA. Output power 80 mW. Repetition rate 100 kHz.



Autocorrelation and spectrum of saturated OPA. Output power 240 mW. Repetition rate 100 kHz.

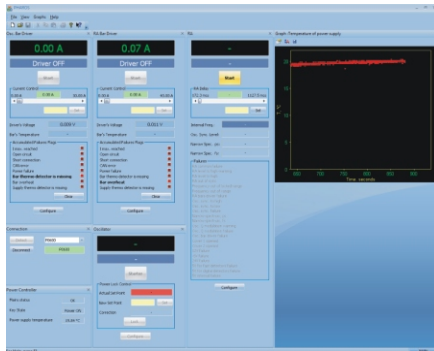
Harmonic generators

Output energy		10 kHz	50 kHz	100 kHz
second harmonic	$\lambda=515$ nm	>190 μ J	>60 μ J	>30 μ J
third harmonic	$\lambda=343$ nm	>120 μ J	>45 μ J	>20 μ J
fourth harmonic	$\lambda=257$ nm	>95 μ J	>30 μ J	>15 μ J

Continuum generators

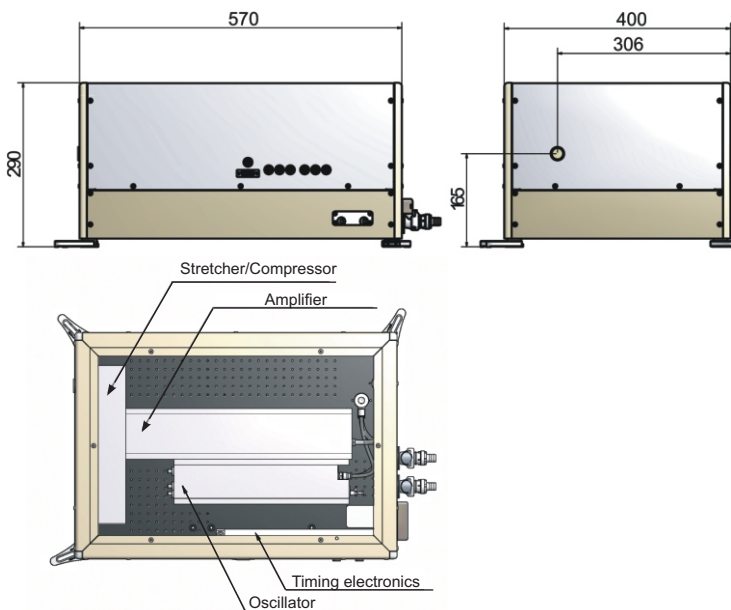
Wavelength range	1030 nm pump	480...1200 nm
	515 nm pump	350...630 nm

Computer based control software



Physical Dimensions

Laser head	570 L x 400 W x 290 H (mm)
Power supply	520 L x 520 W x 320 H (mm)
Chiller (400W)	330 L x 280 W x 330 H (mm)



Utility requirements

Electric	110 VAC, 60 or 50 Hz, 20 A or 220 VAC, 60 or 50 Hz, 10 A
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Note: Light Conversion follows a policy of continuous product improvement. Specifications are subject to change without notice.

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