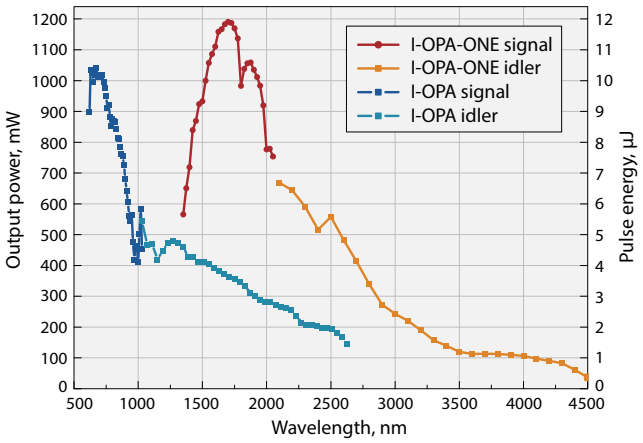
PHAROS

Industrial grade Optical Parametric Amplifier

FEATURES

- Based on experience with ORPHEUS line
- Manually tunable wavelength
- Industrial grade design provides excellent long-term stability
- Very small footprint
- Bandwidth limited or short-pulse configurations available
- CEP option

I-OPA is an optical parametric amplifier of white-light continuum pumped by the PHAROS laser. This OPA is focused on generating long-term stable output with reliable and hands-off operation. Manually tunable output wavelength extends the application possibilities of a single laser source, instead of requiring multiple lasers based on different technologies.
In comparison to standard ORPHEUS line of devices, the I-OPA lacks only computer controlled wavelength selection. On the other hand, in-laser mounted design provides mechanical stability and eliminates the effects of air-turbulence, ensuring stable long-term performance and minimizing energy fluctuations.



I-OPA module energy conversion curves.
Pump: PHAROS-10W, 100 µJ, 100 kHz

PHAROS i-OPA MODEL COMPARISON TABLE

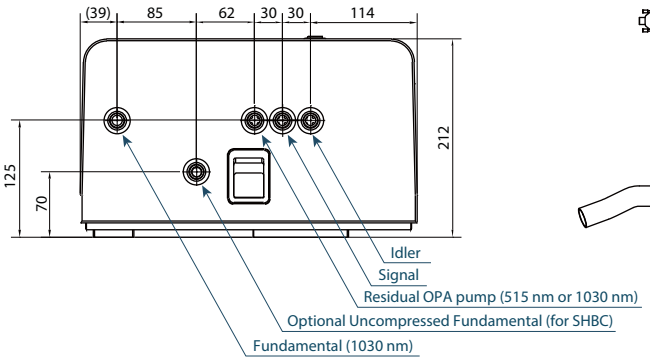
Model	I-OPA	I-OPA-F	I-OPA-ONE	I-OPA-CEP
Based on OPA	ORPHEUS	ORPHEUS-F	ORPHEUS-ONE	–
Pump pulse energy	10 – 500 µJ	10 – 400 µJ	20 – 500 µJ	150 – 500 µJ
Pulse repetition rate	Up to 1 MHz			Up to 100 kHz
Tuning range, signal	630 – 1030 nm	650 – 900 nm	1350 – 2060 nm	–
Tuning range, idler	1030 – 2600 nm	1200 – 2500 nm	2060 – 4500 nm	1400 – 2500 nm
Conversion efficiency signal+idler combined	> 12 %	> 10 %	> 14 %	> 10 %
Pulse energy stability < 2 % STD over 1 min.	650 – 950 nm 1150 – 2000 nm	650 – 850 nm 1350 – 2000 nm	1500 – 3500 nm	1400 – 2000 nm
Pulse bandwidth	100 – 150 cm^{-1}	200 – 600 cm^{-1}	80 – 200 cm^{-1}	~ 150 cm^{-1}
Pulse duration	150 – 250 fs	30 – 80 fs	200 – 300 fs	< 200 fs
Applications	Micro-machining Microscopy Spectroscopy	Nonlinear microscopy Ultrafast spectroscopy	Micro-machining Mid-IR generation	OPCPA front-end

[1] *Better stability can be specified for a specific wavelength (e.g. < 1% STD at 800 nm).*
[2] *Output pulse duration depends on wavelength and pump laser pulse duration.*
[3] *I-OPA-F outputs broad bandwidth pulses which are compressed externally.*

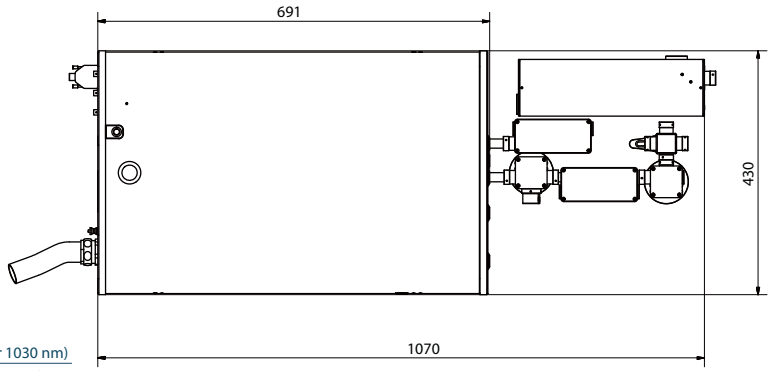
COMPARISON WITH OTHER FEMTOSECOND AND PICOSECOND LASERS

Laser technology	Our solution	HG or HIRO	I-OPA-F	I-OPA-ONE
		Pulse energy at 100 kHz, using PHAROS-10W laser		
Excimer laser (193 nm, 213 nm)	5H of PHAROS (205 nm)	5 µJ	–	–
TH of Ti:Sa (266 nm)	4H of PHAROS (257 nm)	10 µJ	–	–
TH of Nd:YAG (355 nm)	3H of PHAROS (343 nm)	25 µJ	–	–
SH of Nd:YAG (532 nm)	2H of PHAROS (515 nm)	50 µJ	35 µJ	–
Ti:Sapphire (800 nm)	OPA output (750 – 850 nm)	–	10 µJ	–
Nd:YAG (1064 nm)	PHAROS output (1030 nm)	100 µJ		
Cr:Forsterite (1240 nm)	OPA output (1200 – 1300 nm)	–	5 µJ	–
Erbium (1560 nm)	OPA output (1500 – 1600 nm)	–	3 µJ	15 µJ
Thulium / Holmium (1.95 – 2.15 µm)	OPA output (1900 – 2200 nm)	–	2 µJ	10 µJ
Other sources (2.5 – 4.0 µm)	OPA output	–	–	1 – 5 µJ

Note that the pulse energy scales linearly in a broad range of pump parameters. For example, a PHAROS-20W laser at 50 kHz (400 µJ energy) will increase the output power twice, and the pulse energy – 4 times compared to the reference table above. The pulse duration at the output is <300 fs in all cases. The OPA output is not limited to these particular ranges of operation, it is continuously tunable as shown in energy conversion curves.



Pharos with I-OPA output ports



PHAROS with I-OPA-F and compressors for signal and ilder

Pharos with integrated I-OPA