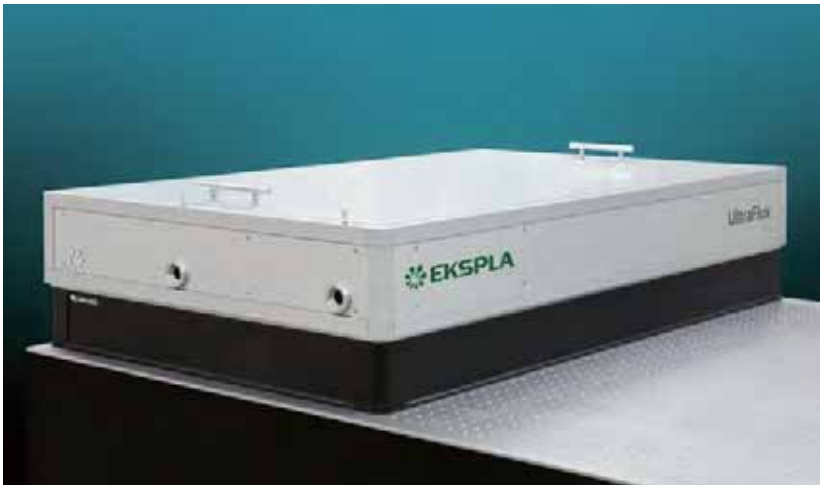
UltraFlux
FT300 SERIES

Tunable Wavelength Femtosecond Laser Systems



UltraFlux FT300 series is a compact high energy tunable wavelength femtosecond laser system which incorporates the advantages of ultrafast fiber laser, solid-state and parametric amplification technologies. Novel OPCPA front-end technology uses the same picosecond fiber laser for seeding both picosecond DPSS pump laser and femtosecond parametric amplifier by spectrally broadened output. This approach greatly simplifies the system – excludes femtosecond regenerative amplifier and eliminates the need of pump and seed pulse synchronization. In addition to that, contrast of the output pulses in picosecond to nanosecond time scale is potentially increased.

All UltraFlux series laser systems are assembled on a rigid breadboard to ensure excellent long-term stability. Modular internal design offers high level of customization and easy scalability. These systems can be customized according to customer requirements.

Incorporation of parametric amplification technology together with a novel ultrafast fiber laser helped to create and bring to the market a new tool for femtosecond pump-probe, nonlinear spectroscopy, emerging high harmonic generation experiments and other femtosecond and nonlinear spectroscopy applications. With this laser ultrafast science breakthrough is closer to any photonics lab than ever before.

FEATURES

- *Based on the novel **OPCPA** (Optical Parametric Chirped Pulse Amplification) technology – simple and cost-efficient operation*
- *Patented front-end design (patents no. EP2827461 and EP2924500)*
- *Hands free wavelength tuning*
- *Up to **1 kHz** repetition rate*
- *Up to **3 mJ** pulse energy*
  - *Excellent pulse energy stability: < 1.5 % rms*
  - *Excellent long-term average power stability: < 1.5 % rms over > 12 hour period*
- *High contrast pulses without any additional improvement equipment*

APPLICATIONS

- *Broadband CARS and SFG*
- *Femtosecond pump-probe spectroscopy*
- *Nonlinear spectroscopy*
- *High harmonic generation*

OPTIONS

- ***SH/TH** harmonics module:*
  *SH **375 – 480 nm,***
  *TH **250 – 320 nm***
- ***SH/TH/FH** harmonics module:*
  *SH **375 – 480 nm,***
  *TH **250 – 320 nm***
  *FH **210 – 230 nm***
- *Optically synchronized ps output*
- *PLL (Phase Locking Loop) for precise (<1 ps, rms) locking with external synchronization pulse*

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REV. 20200123

SPECIFICATIONS [1]

Model	UltraFlux FT031k	UltraFlux FT31k	UltraFlux FT310
MAIN SPECIFICATIONS			
Max. Pulse energy	300 µJ	3 mJ	
SH output [4]	–	20 % conversion at 440 nm	
TH output [4]		5 % conversion at 290 nm	
FH output [4]		1 % conversion at 220 nm	
Wavelength tuning range			
Standard version	700 – 1010 nm	750 – 960 nm	
SH output [4]	–	375 – 480 nm	
TH output [4]		250 – 320 nm	
FH output [4]		210 – 230 nm	
Scanning steps			
SH output [4]	–	5 nm	
TH output [4]		3 nm	
FH output [4]		2 nm	
Pulse duration	35 – 60 fs	20 – 60 fs	
Pulse repetition rate	1 kHz		10 Hz
Pulse energy stability	< 1.5 %, rms		
Long-term power stability	< 1.5 %, rms		
Spatial mode	Super Gaussian		
Beam diameter ($1/e^2$)	2 mm	7 mm	
Pulse contrast [2]	≥ 10^{-6} : 1 (within ± 50 ps)		
	≥ 10^{-8} : 1 (in ns range)		
Polarization	Linear, horizontal		
Beam pointing stability	≤50 µrad, rms		
Optical to RF signal jitter [3]	< 1 ps		
Footprint on optical table	1.2 × 0.75 m	1.2 × 2.0 m	

[1] Presented parameters are from delivered systems and can be customized to meet customer's requirements.

[2] Pulse contrast is only limited by amplified parametric fluorescence (APF) in the temporal range of ~90 ps which covers OPCPA pump pulse duration and is better than 10^6 : 1. APF contrast depends on OPCPA saturation level (Fig. below). Our system is ASE-free and pulse contrast value in nanosecond range is limited only by measurement device capabilities (third-order autocorrelator). There are no pre-pulses generated in the system and post-pulses are eliminated by using wedged transmission optics.

[3] With -PLL option purchased.

[4] With SH/TH or SH/TH/FH module.

PERFORMANCE

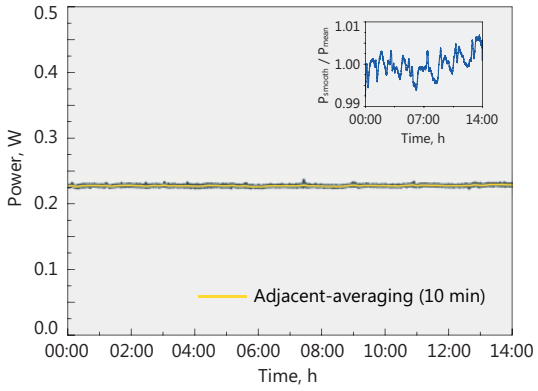

Fig 1. Long-term power stability measurement at 800 nm wavelength

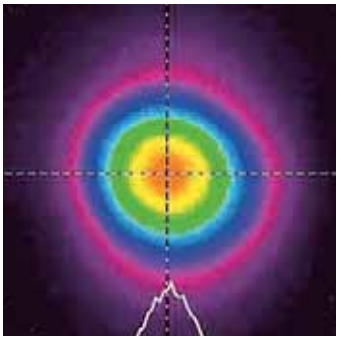

Fig 2. Typical beam profile of FT031k. Output pulse energy 0.3 mJ at 890 nm

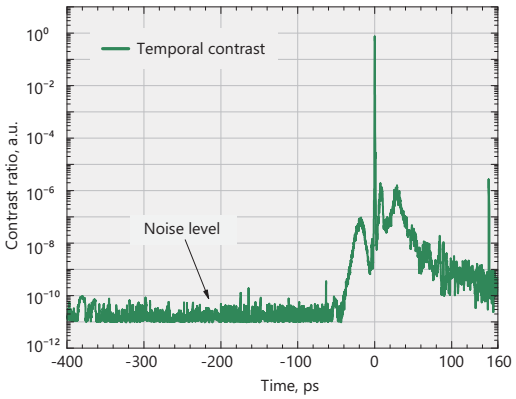

Fig 3. Typical temporal contrast of UltraFlux systems

DELIVERED SYSTEMS

UltraFlux FT310. Customised compact (1.2 × 0.9 m), fully diode pumped, tunable wavelength femtosecond laser system delivering up to 2.5 mJ pulse energy with pulse duration down to 20 fs. Optically synchronized (low jitter) fs and ps outputs available.

UltraFlux
FF/FT 5000 SERIES

High Energy
Tunable Wavelength
Femtosecond
Laser Systems

UltraFlux FF/FT 5000. Custom high pulse energy femtosecond fixed wavelength laser system delivering up to 40 mJ pulse energy with pulse duration down to 11 fs.

FEATURES

- *Based on the novel OPCPA (Optical Parametric Chirped Pulse Amplification) technology – simple and cost-efficient operation*
- *Patented front-end design (patents no. EP2827461 and EP2924500)*
- *Hands free wavelength tuning*
- *Up to **1 kHz** repetition rate*
- *Up to **50 mJ** pulse energy*
  - *Excellent pulse energy stability: < 1.5 % rms*
  - *Excellent long-term average power stability: < 1.5 % rms over > 12 hour period*
- *High contrast pulses without any additional improvement equipment*

APPLICATIONS

- *Broadband CARS and SFG*
- *Femtosecond pump-probe spectroscopy*
- *Nonlinear spectroscopy*
- *High harmonic generation*
- *Particle acceleration in plasma*

The UltraFlux FF/FT 5000 laser is a 2 TW tabletop femtosecond OPCPA (Optical Parametric Chirped Pulse Amplification) based system operating at 10 Hz. Originally built for ELI-ALPS (Extreme Light Infrastructure – Attosecond Light Pulse Source) in Hungary, this laser is now available for a wide variety of applications.

The master oscillator is a patent pending (EP2827461A2) all-in-fiber Yb fiber picosecond laser seed source with two fiber outputs. One seeds the OPCPA Front-End and another seeds the Picosecond Pump Laser (PPL). Both outputs originate from the same fiber so they are synchronized optically. This approach eliminates the need for a complex temporal synchronization system typically present in other OPCPA systems.

The Nd:YAG Picosecond Pump Laser (PPL) system is comprised of several sub-systems: diode pumped Regenerative Amplifier, diode pumped Preamplifier, two flash lamp pumped Amplifiers, and Second Harmonic Generators which convert fundamental 1064 nm wavelength to 532 nm. PPL outputs four beams at 532 nm and 10 Hz pulse repetition rate. One beam is directed to NOPCPA Front-End subsystem and others are directed to NOCPA stages.

The Front-End NOPCPA (Non-collinear Optical Parametric Chirped Pulse Amplifier) consists of several sub-systems: Picosecond Optical Parametric Amplifier (ps-OPA) amplifying oscillator output pulses, Grating Compressor compressing ps-OPA output pulses, White Light Generator (WLG) broadening the spectrum of ps-OPA output pulses and Femtosecond Non-collinear Optical Parametric Amplifier (fs-NOPA) amplifying WLG output pulses.

The Stretcher sub-system is a Grism (diffraction gratings combined together with prisms) based pulse stretcher, which stretches output pulse from NOPCPA Front-End and Dazzler (Acousto-Optic Programmable Dispersive Filter) for high order phase compensation.

Three stages of NOPCPA (Non-collinear Optical Parametric Chirped Pulse Amplifiers) are used to amplify the stretched pulse from the Stretcher up to 50 mJ.

Finally, amplified pulses are compressed down to 11 fs in the Pulse Compressor. Bulk glass compressors are combined together with chirped mirror compressors. Pulse energy after Compressor is >40 mJ.

The built-in Output Diagnostics stage ensures reliable, turn-key operation by monitoring critical parameters such as energy, duration, and beam profile.

SPECIFICATIONS [1]

Model	UltraFlux FT5010	UltraFlux FF50100
MAIN SPECIFICATIONS		
Max. Pulse energy	50 mJ	
SH output [4]	inquire	
TH output [4]	inquire	
FH output [4]	inquire	
Wavelength tuning range		
Standard version	750 – 960 nm, fixed at desired wavelength	
SH output [4]	375 – 480 nm	
TH output [4]	250 – 320 nm	
FH output [4]	210 – 230 nm	
Scanning steps		
SH output [4]	5 nm	
TH output [4]	3 nm	
FH output [4]	2 nm	
Pulse duration	20 – 60 fs	10 – 20 fs
Pulse repetition rate	10 Hz	100 Hz
Pulse energy stability	< 1.5 %, rms	< 2.0 %, rms
Long-term power stability	< 1.5 %, rms	
Spatial mode	Super Gaussian	Top-Hat
Beam diameter ($1/e^2$)	7 mm	20 mm
Pulse contrast [2]	≥ 10^{-6} : 1 (within ± 50 ps)	
	≥ 10^{-8} : 1 (in ns range)	
Polarization	Linear, horizontal	
Beam pointing stability	≤50 µrad, rms	
Optical to RF signal jitter [3]	< 1 ps	
Footprint on optical table	1.2 × 2.0 m	1.2 × 4.8 m

[1] Presented parameters are from delivered systems and can be customized to meet customer's requirements.

[2] Pulse contrast is only limited by amplified parametric fluorescence (APF) in the temporal range of ~90 ps which covers OPCPA pump pulse duration and is better than 10^6 : 1. APF contrast depends on OPCPA saturation level (Fig. below). Our system is ASE-free and pulse contrast value in nanosecond range is limited only by measurement device capabilities (third-order autocorrelator). There are no pre-pulses generated in the system and post-pulses are eliminated by using wedged transmission optics.

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BLOCK DIAGRAM

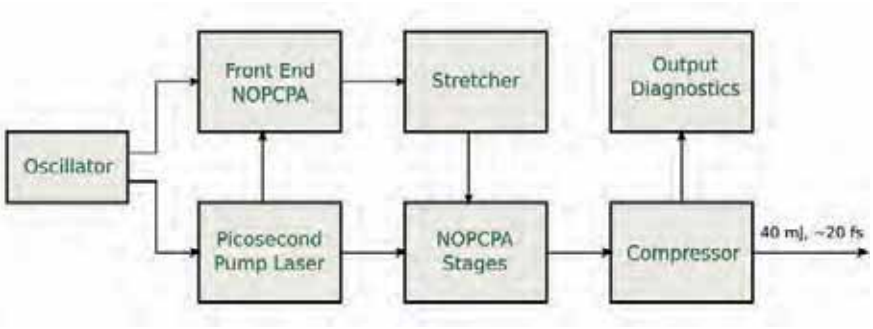

Fig. 1. UltraFlux FF/FT 5000 laser block diagram

PERFORMANCE

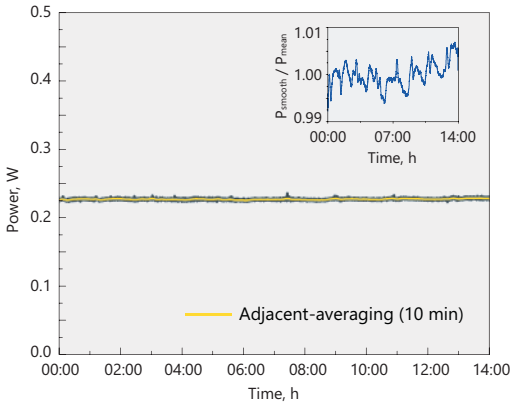

Fig 2. Long-term power stability measurement at 800 nm wavelength

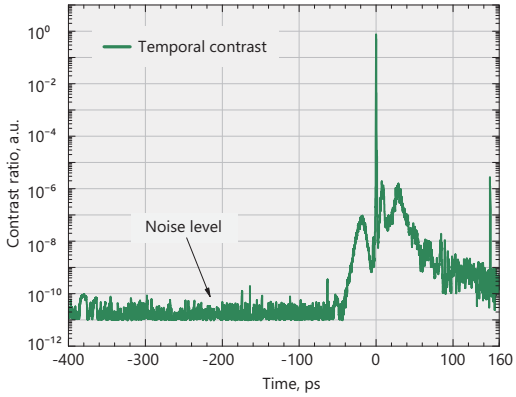

Fig 3. Typical temporal contrast of UltraFlux systems

BEAM PROFILE

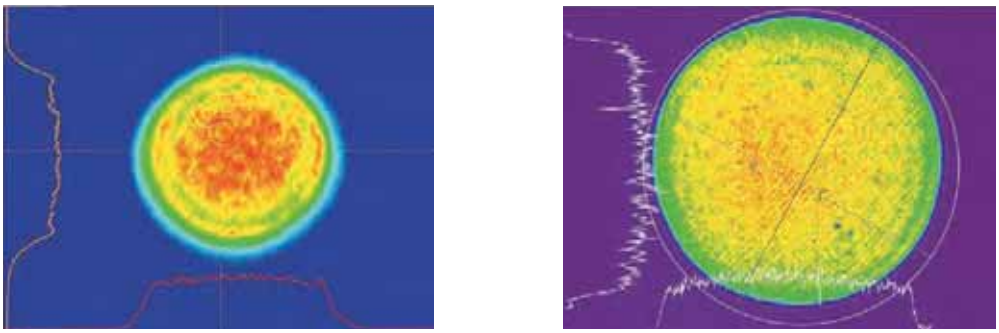

Fig 4. Typical UltraFlux system output at ~60 mJ energy (left) and 532 nm pump beam at 2.5 J energy (right) beam profiles