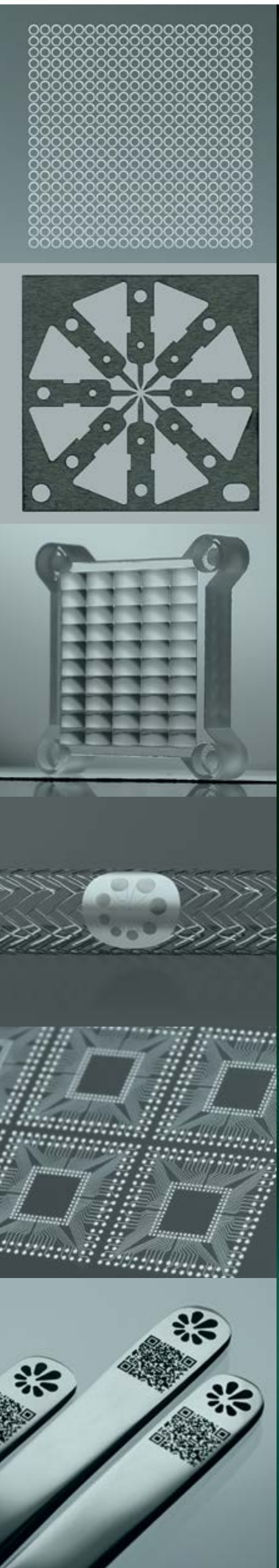
EKSPLA

Advanced Laser Technologies

Industrial Femtosecond Lasers



PRISM AWARDS WINNER

2024

FemtoLux Series

Award winning tools for micromachining applications

2025

Rev#
250708

Industrial Femtosecond Lasers

SPECIFICATIONS AT A GLANCE

Not all output specifications may be available simultaneously.
Please refer to the catalog page for exact specifications and available options.

Model	Available output wavelengths	Pulse duration [1]	Max output power [1]	Max repetition rate	Max pulse energy [1]	Page
FemtoLux 50	1030 nm 515 nm 343 nm	400 fs – 1 ps	> 45 W (typical 50 W)	2 MHz	300 μJ	6
FemtoLux 30	1030 nm 515 nm 343 nm	350 fs – 1 ps	> 27 W (typical 30 W)	4 MHz	100 μJ or 1 mJ	6
FemtoLux 3	1030 nm 515 nm	300 fs – 5 ps	3 W	10 MHz	3 μJ	18

1) At fundamental wavelength.

Due to the constant product improvements, EKSPLA reserves its right to change specifications without advance notice.

Learn more about EKSPLA

Latest information about Industrial Lasers
www.ekspla.com

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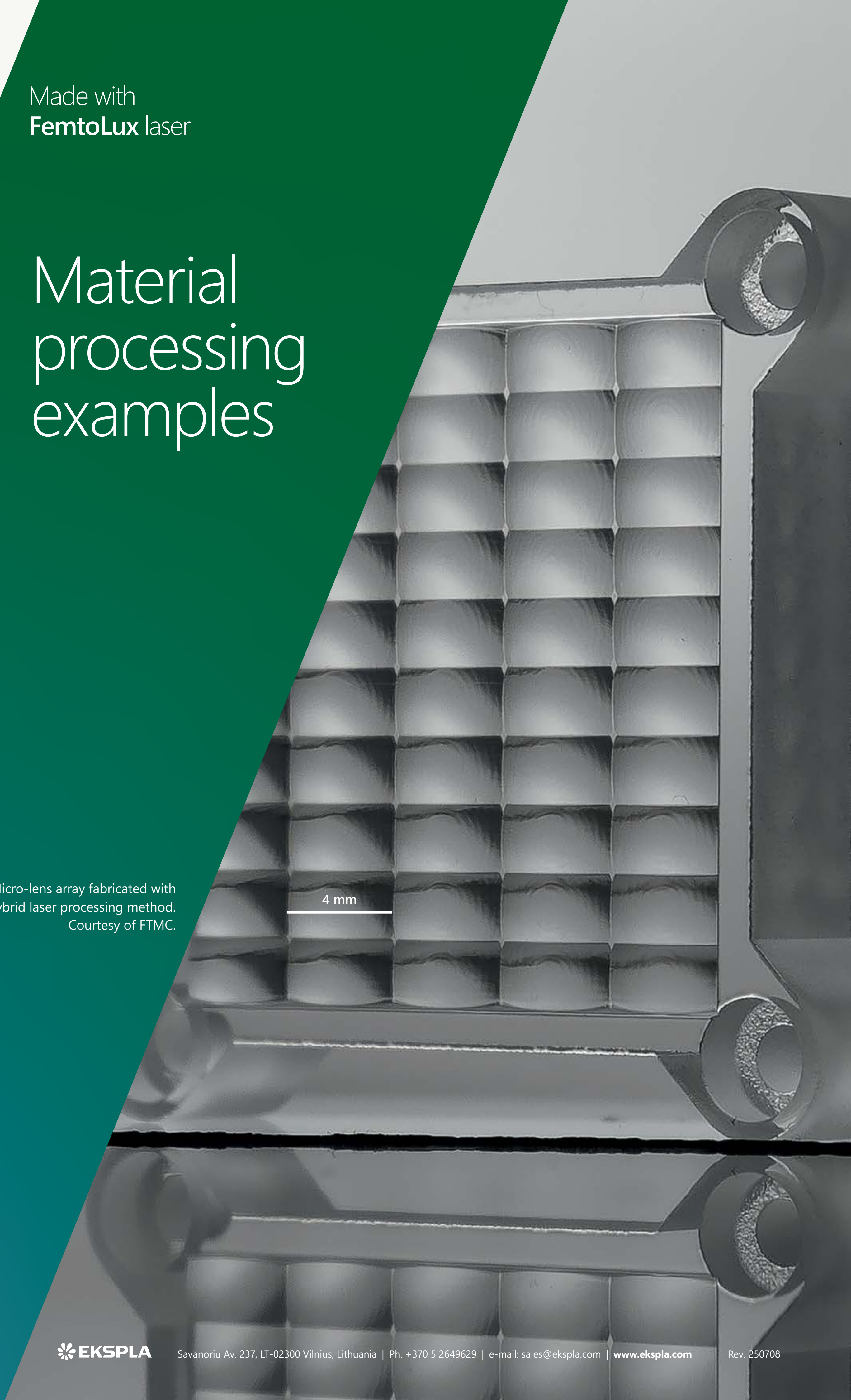
Made with
FemtoLux laser

Material processing examples



Micro-lens array fabricated with hybrid laser processing method. Courtesy of FTMC.

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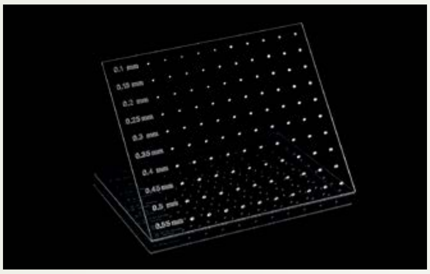
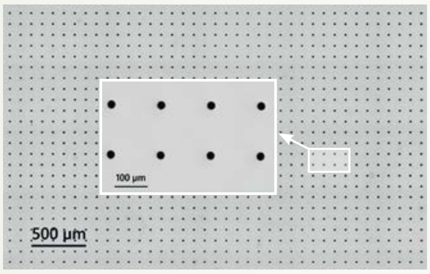
Rev. 250708

Glass

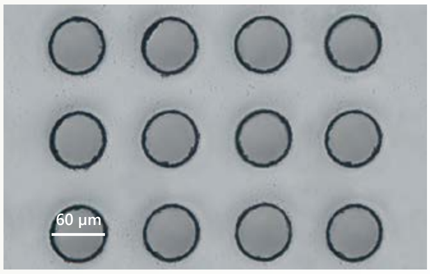
Glass is difficult to machine due to the brittleness and sensitivity to thermal stress. Due to very short pulse duration of femtosecond lasers, it's possible to process glass in high precision and quality. This makes them well-suited for drilling, milling, scribing, and selective etching in fused silica, borosilicate, soda-lime, and sapphire substrates. The ultrashort pulse duration also allows formation of features such as high aspect ratio holes, microfluidic structures, and freeform geometries – finding applications in optics, semiconductor, and consumer electronics fields.



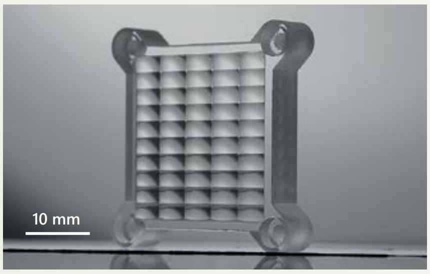
Femtosecond laser induced selective etching of various diameter holes in fused-silica.
Courtesy of WOP.



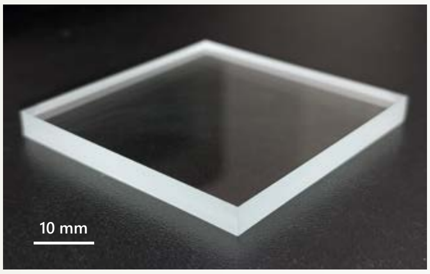
GHz burst assisted percussion drilling of high aspect ratio holes in EXG glass.
Courtesy of Akoneer.



Bottom-up milling of 60 um holes in 0.5 mm thickness BF33 glass, achieving aspect ratio of 1:8.
Courtesy of FTMC.

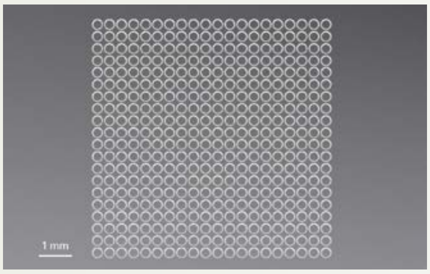


Micro-lens array fabricated with hybrid laser processing method.
Courtesy of FTMC.

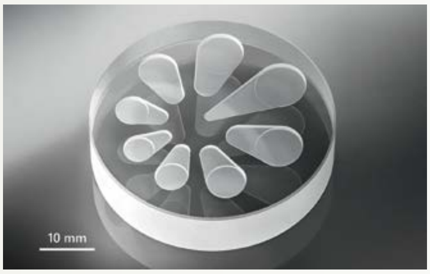


Laser-based Bessel beam scribing of soda-lime glass.
Courtesy of FTMC.

Fused-silica milling.
Courtesy of FTMC.

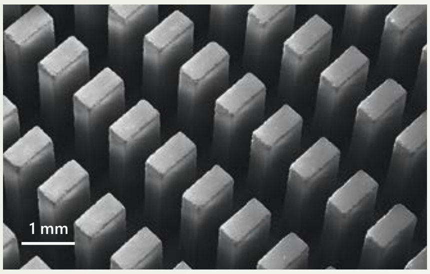


300 µm hole drilling in thin borosilicate glass.
Courtesy of FTMC.



UVFS milling.
Courtesy of FTMC.

Sappfire milling.
Courtesy of FTMC.



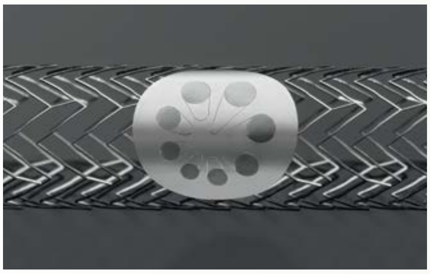
Bottom-up milling of fused-silica glass.
Courtesy of FTMC.

Soda-lime milling.
Courtesy of FTMC.

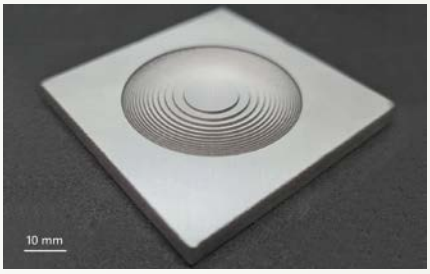
Femtosecond laser induced selective etching of bistable switch.
Courtesy of Femtika.

Metal

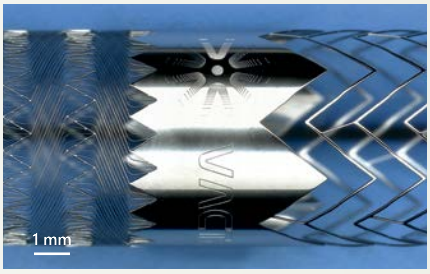
Femtosecond lasers enable high-precision processing of metals with minimal thermal impact, making them ideal for fabricating intricate microstructures, fine cuts, and surface modifications. Their ability to process a wide range of metals – including stainless steel, titanium, aluminum, and nitinol—supports applications from medical devices to microelectronics. In addition to cutting and drilling, femtosecond lasers allow for black/white marking and true color generation without chemical additives or surface contamination.



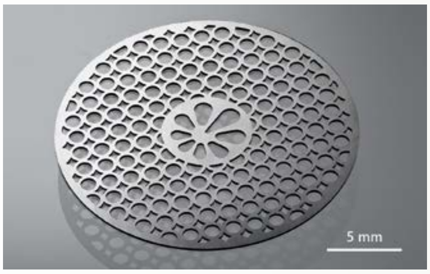
Nitinol stent cutting.
Courtesy of Vactronix Scientific.



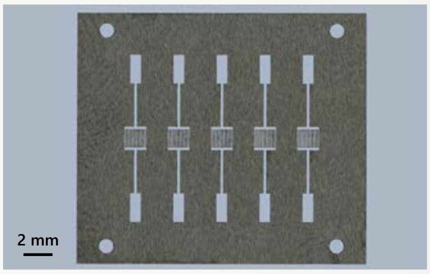
Laser milled aluminium Fresnel lens mould, diameter 35 mm.
Courtesy of FTMC.



Nitinol stent cutting.
Courtesy of Vactronix Scientific.



Stainless steel cutting.
Courtesy of FTMC.



50 um thickness stainless steel cutting.
Courtesy of Laser Micromachining Ltd.

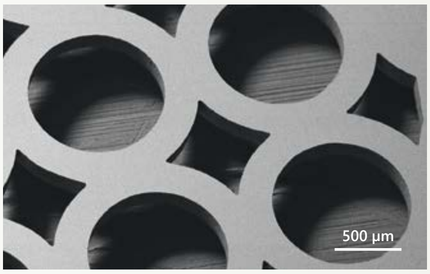
Black marking of tweezers.
Courtesy of FTMC.

Stainless steel cutting.
Courtesy of FTMC.

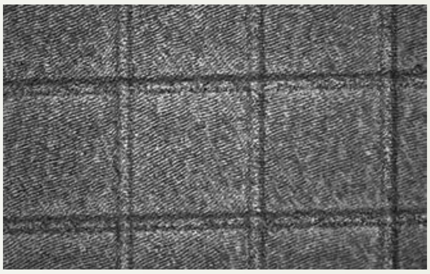
Stainless steel cutting.
Courtesy of FTMC.

Stainless steel coloring with GHz burst feature.
Courtesy of Akoneer.

Titanium film coloring with GHz burst feature.
Courtesy of Akoneer.



Stainless steel cutting.
Courtesy of FTMC.



Grid surface texturing with LIPSS of nitinol.
Courtesy of UNIMORE.

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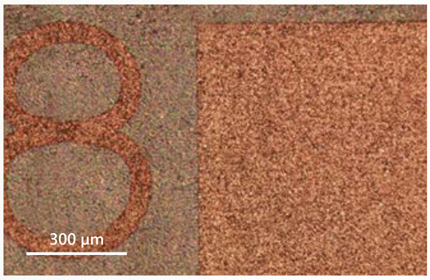
Polymer

Polymers are widely used in various applications, including automotive, medicine, and consumer electronics. However, due to their inherent property of low heat conductivity, polymers are quite sensitive to heat.

Femtosecond lasers, with their very short pulse durations, offer a solution to this problem by enabling the precise machining of polymers while preserving process quality.



Insulation layer removal from PCB.
Courtesy of FTMC.

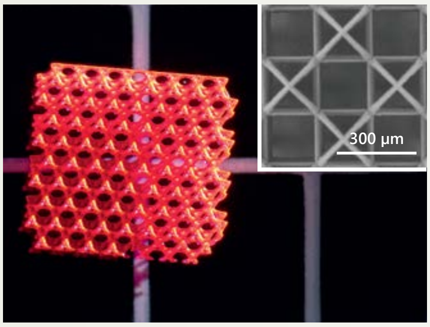


Photo-polymerization.
Courtesy of Femtika.

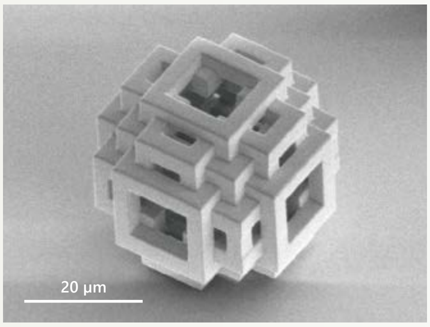
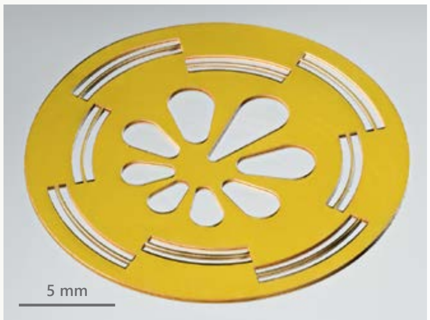


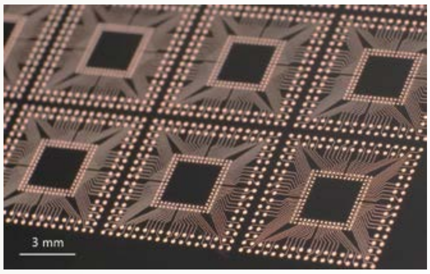
Photo-polymerization.
Courtesy of WOP.



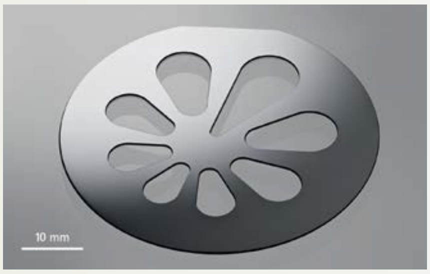
Polymide cutting.
Courtesy of FTMC.

Other materials

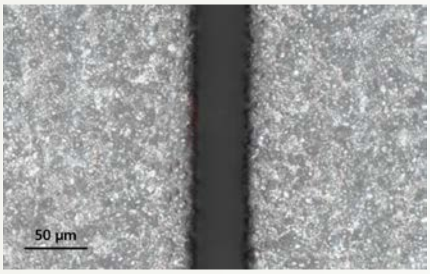
Femtosecond lasers, with pulse durations in the hundreds of femtoseconds, generate high intensities that make it possible to process almost material. Complex 3D structures, as well as non-conventional shapes can be obtained.



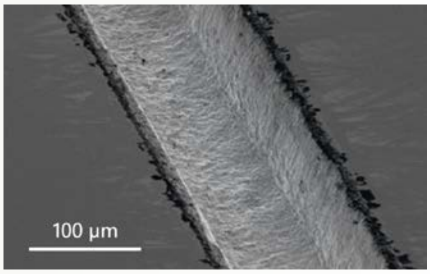
SSAIL technology on PI.
Courtesy of Akoneer.



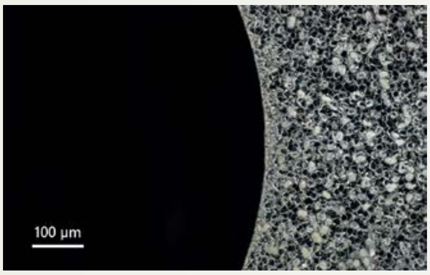
Crystalline silicon cutting.
Courtesy of FTMC.



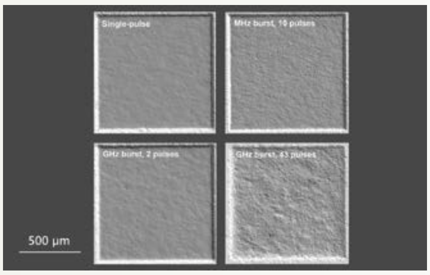
50 µm depth groove formation in ceramic.
Courtesy of FTMC.



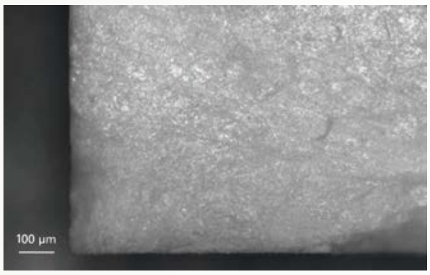
Groove formation in GaAs in water environment.
Courtesy of FMTC.



Crystalline silicon cutting.
Courtesy of FTMC.



Optical 3D profilometer image showing milled square patterns in aluminum oxide ceramics.



Heat-sensitive organic material cutting.
Courtesy of FTMC.

FemtoLux

Reliability Redefined

A reliable & versatile tool for micromachining

/ Glass, sapphire and ceramics micro processing

/ Microelectronics manufacturing

/ Glass intra volume structuring

/ Micro processing of different polymers and metals

/ LCD, LED, OLED drilling, cutting and repair

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Rev. 250708

Industrial Dry Cooled Femtosecond Laser

FemtoLux

Designed from the get-go for maximum reliability, seamless integration and non-stop 24/7/365 zero maintenance operation with innovative "dry" cooling.

The FemtoLux femtosecond laser has a tunable pulse duration from <350 fs to 1 ps and can operate in a broad AOM controlled range of pulse repetition rates from a single shot to 4 MHz.

The maximum pulse energy is more than 300 μJ operating with single pulses and can reach more than 750 μJ in burst mode, ensuring higher ablation rates and processing throughput for different materials.

The FemtoLux beam parameters will meet the requirements of the most demanding materials and micro-machining applications.

Innovative laser control electronics ensure simple control of the FemtoLux laser by external controllers that could run on different platforms, be it Windows, Linux or others using REST API commands.

This makes easy integration and reduces the time and human resources required to integrate this laser into any laser micromachining equipment.

Seamless User Experience

Easy integration – remote control using REST API via RS232 and LAN.

Reduced integration time – demo electronics is available for laser control programming in advance.

Easy and quick installation – no water, fully disconnectable laser head. Can be installed by the end-user.

Easy troubleshooting – integrated detectors and constant system status logging.

No periodic maintenance required.

Features

Typical max output power
50 W at 1030 nm,
20 W at 515 nm,
10 W at 343 nm

Typical max output energies
> 300 μJ at 1030 nm,
> 50 μJ at 515 nm,
> 25 μJ at 343 nm

Up to 1 mJ high energy version available

MHz, GHz, MHz+GHz burst modes

> 750 μJ in a burst mode

< 350 fs – 1 ps

Pulse duration extension **up to 1 ns**

Single shot – up to 4 MHz (AOM controlled)

Pulse-on-demand (PoD), with jitter as low as 20 ns (peak-to-peak)

<0.5% RMS power long term stability over 100 hours

$M^2 < 1.2$

Beam circularity > 0.85

Zero maintenance / "Dry" cooling

Learn more about FemtoLux
www.ekspla.com

"Dry" Cooling

Direct Refrigerant Cooling System

The FemtoLux laser employs an innovative cooling system and sets new reliability standards among industrial femtosecond lasers. No additional bulky and heavy water chiller is needed.

The chiller requires periodic maintenance – cooling system draining and rinsing and water and particle filter replacement. Moreover, water leakage can cause damage to the laser head and other equipment. Instead of using water for transferring heat from a laser head, the FemtoLux laser uses an innovative Direct Refrigerant Cooling method.

The refrigerant agent circulates from a PSU-integrated compressor and condenser, to a cooling plate via armored flexible lines.

The entire cooling circuit is permanently hermetically sealed and requires no maintenance.

Benefits

Military-grade reliability

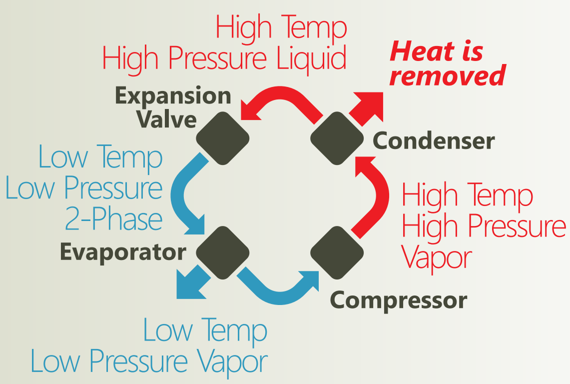
Permanently hermetically sealed system **>90,000 hour MTBF**

No maintenance

High cooling efficiency

>45% lower power consumption compared to water cooling equipment

Compact and light



Compressor picture.
Courtesy of Aspen Systems Inc.

Simple & Reliable Cooling Plate Attachment

The cooling plate is detachable from the laser head for more convenient laser installation. The laser cooling equipment is integrated with the laser power supply unit into a single 4U rack-mounted housing with a total weight of 15 kg.

Detachable cooling plate

Integrated cooling equipment with the laser power supply

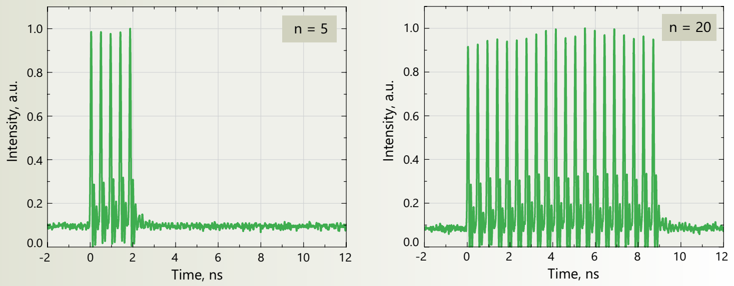
Simple and reliable cooling plate attachment

GHz Burst Option

Patent-Pending Method for Ultra-High Rate Bursts

Short GHz burst

Fig 1. Measured 2.2 GHz intra-burst PRR burst of pulses containing a different number of pulses of equal amplitudes at 31.5 W average output power



Long GHz burst

Fig 2. Measured 2.2 GHz pre-shaped bursts of 1000 pulses at 233 kHz burst repetition rate for the desired rectangular-like burst shape

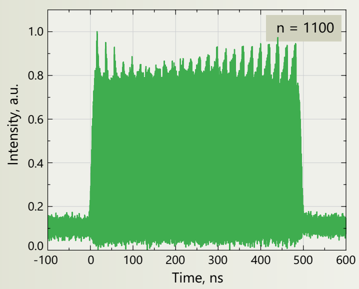
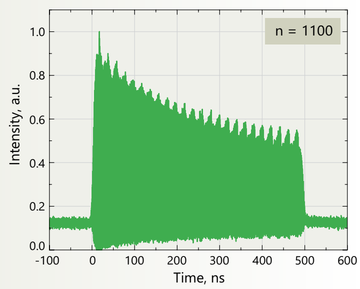


Fig 3. Measured 2.2 GHz non-pre-shaped bursts of 1100 pulses at 233 kHz burst repetition rate



MHz + GHz burst mode

Fig 4. Measured 4 bursts of 50 MHz BRR containing 4 pulses of 2.5 GHz intra-burst PRR

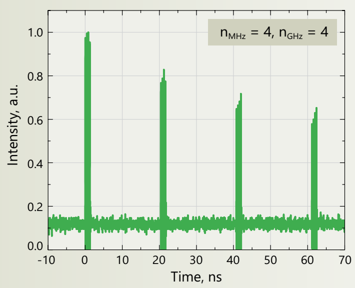
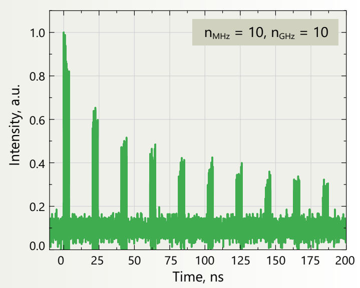


Fig 5. Measured 10 bursts of 50 MHz BRR containing 10 pulses of 2.5 GHz intra-burst PRR



Benefits

The Femtolux laser can operate in the **single-pulse** mode, **MHz burst** mode, **GHz burst** mode, and **MHz + GHz burst** mode.

The burst formation technique based on the use of the AFL is a very versatile method as it allows to overcome many limitations encountered by other fiber- and/or solid-state-based techniques.

Any desired intra-burst PRR can be achieved independently from the initial PRR of the master oscillator

Identical pulse separation inside the GHz bursts is maintained

Short- and long-burst formation modes can be provided.

/ A short burst is up to about 10 ns burst width (from 2 to tens of pulses in the GHz burst).

/ A long burst is from ~20 ns up to a few hundred ns in burst width (from tens to thousands of pulses in the GHz burst)

MHz+GHz burst mode

An adjustable amplitude envelope of the GHz bursts is provided

No pre/post pulses in GHz burst. Pure GHz bursts

Ultrashort pulse duration is maintained inside the bursts

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A new versatile patent-pending method to form ultra-high repetition rate bursts of ultrashort laser pulses.

The developed method is based on the use of an all-in-fiber active fiber loop (AFL). A detailed description of the invention can be found on:

[1] Andrejus Michailovas, and Tadas Bartulevičius. 2021 Int. patent application published under the Patent Cooperation Treaty (PCT) WO2021059003A1.

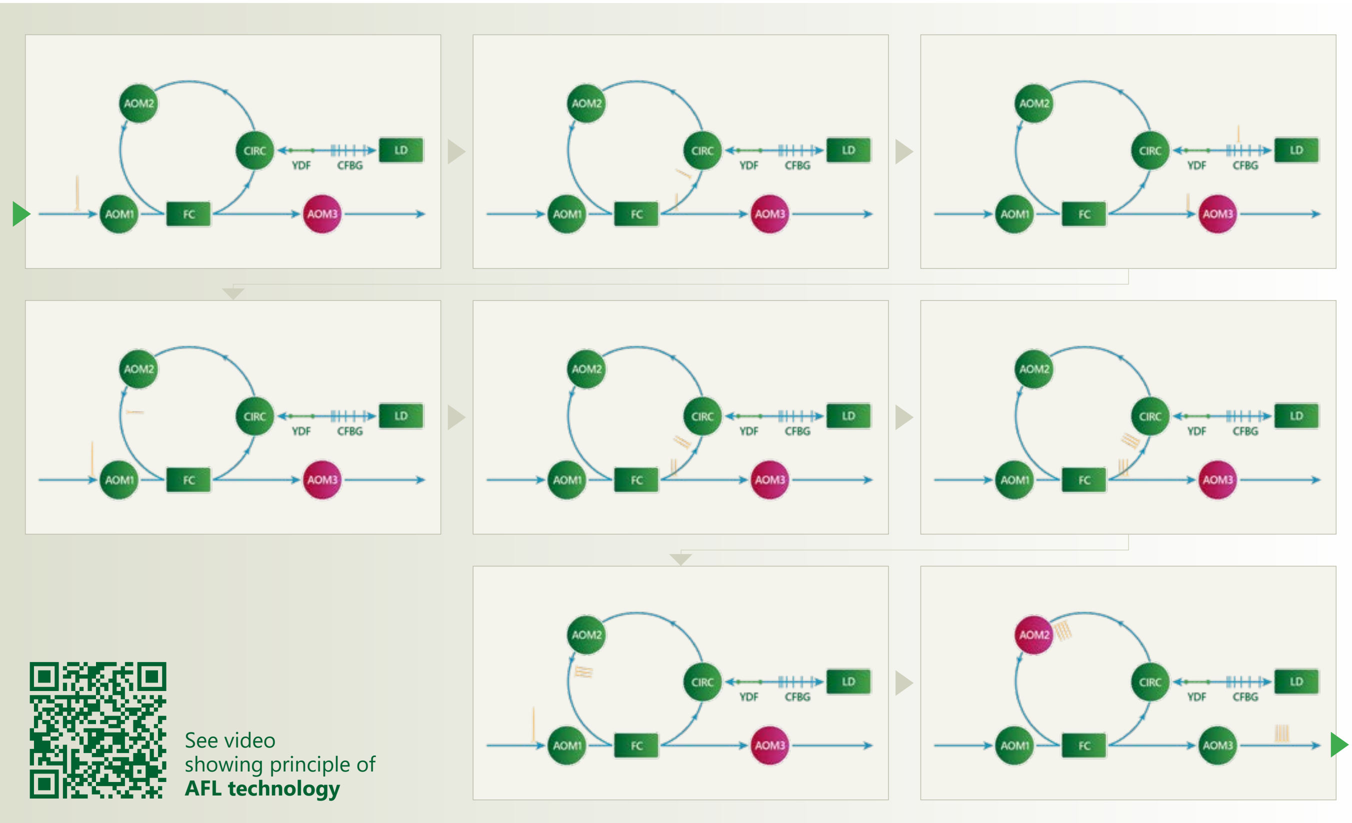
[2] Tadas Bartulevičius, Mykolas Lipnickas, Virginija Petrauskienė, Karolis Madeikis, and Andrejus Michailovas, (2022), "30 W-average-power femtosecond NIR laser operating in a flexible GHz-burst-regime," Opt. Express 30, 36849-36862.

Specifications

Burst repetition rate	up to 650 kHz	
Intra-burst pulse repetition rate [1]	2 GHz	
GHz burst mode	**short**	**long**
GHz burst length	0.5 – 10 ns	20 – 500 ns
Number of pulses [2]	2 – 20	40 – 1000
Shape	square, rising, falling	falling, pre-shaped [3]
MHz + GHz burst mode		
Number of pulses in MHz burst	2 – 10	
Number of pulses in GHz burst [2]	2 – 20	

1) Custom intra-pulse PRR is available upon a request.
2) Depends on the intra-pulse PRR.
3) For more information, please inquire sales@ekspla.com.

Principle of AFL Technology



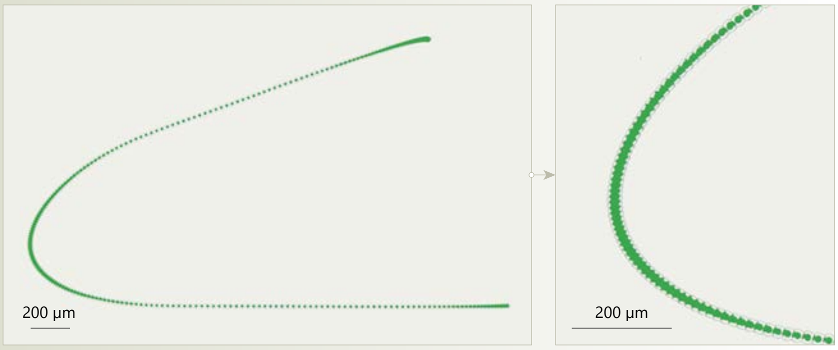
See video
showing principle of
AFL technology

Pulse-on-Demand (PoD)

Traditional laser triggering techniques struggle to maintain equally spaced pulses at high speeds (Fig.1, 2). Pulse-on-demand feature tackles this challenge and enables high-speed micromachining (Fig. 3).

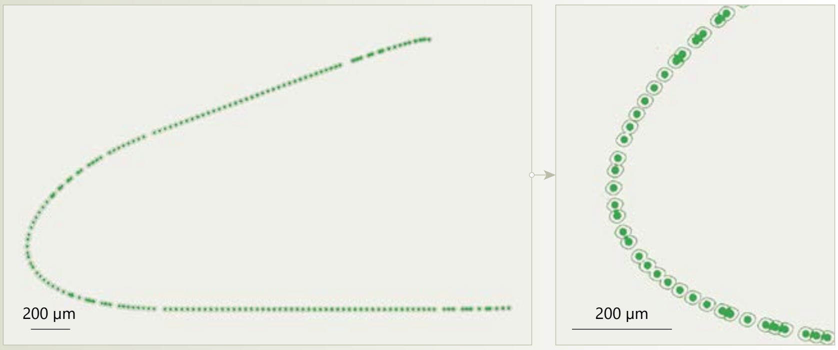
Time based laser triggering

Fig 1. Complex shape scanned with time based laser triggering mode with a pulse repetition of 200 kHz and scanning speed of 6 m/s. The scanning started from the top right to the bottom right area. Overlapping pulses result in an overheated area.



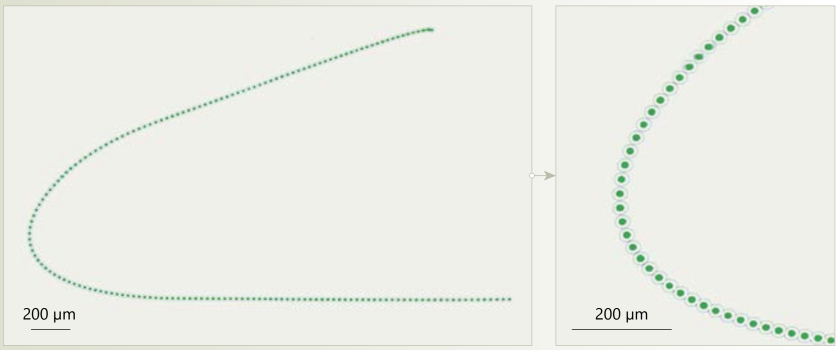
Position based laser triggering

Fig 2. Complex shape scanned with position based laser triggering mode with a pitch of 30 µm and scanning speed of 6 m/s. The scanning started from the top right to the bottom right area. Jitter of tens of µs results in random pulse spacing.



Pulse-on-demand (PoD)

Fig 3. Complex shape scanned with pulse-on-demand (PoD) and position based laser triggering mode with a pitch of 30 µm and scanning speed of 6 m/s. The scanning started from the top right to the bottom right area. PoD feature preserves equidistant pulse spacing at high speeds.



Benefits

Jitter lower than 20 ns ensures consistent and equidistant pulse spacing for high-speed micromachining

Adjustable repetition rate for processing complex geometries

Faster processing speeds, increased productivity

PoD feature enables the laser to fire a pulse only when required, rather than at a constant rate, enabling precise control over the laser's output and resulting in higher efficiency, accuracy and quality.

This capability is especially valuable in various micromachining applications where a high processing speed, constant energy, and accuracy are essential. To follow complex curvature at high speed and to maintain equidistant spacing it is necessary to ensure that the repetition rate of the pulses is adjusted. To achieve these requirements, it is necessary to ensure that the repetition rate of the pulses is adjusted to follow complex curvature at high speed and to maintain equidistant spacing. One may try to use position based laser triggering but, due to laser system limitations, the jitter will be from several µs to tens of µs, which will result in random spacing of the pulses. On the other hand, the usage of time based laser triggering results in overheat areas, due to excessive overlap of pulses. The FemtoLux laser has the pulse-on-demand feature with jitter as low as 20 ns (peak-to-peak), and it can therefore tackle all the challenges and maximize process efficiency, precision and quality at high speed.

Specifications [1]

New!

Model		FemtoLux 30	FemtoLux 50
Main specifications			
Central wavelength	fundamental	1030 nm	
	with second harmonic option	515 nm	
	with third harmonic option	343 nm	
Pulse repetition rate (PRR) [2]		200 kHz – 4 MHz	100 kHz – 2 MHz
Pulse repetition frequency (PRF) after frequency divider		PRF = PRR / N, N=1, 2, 3, ... , 65000; single shot	
Average output power	at 1030 nm [3]	> 27 W (typical 30 W)	> 45 W (typical 50 W)
	at 515 nm	> 11 W [4]	> 20 W [5]
	at 343 nm	> 6 W [4]	> 10 W [5]
Pulse energy	at 1030 nm	> 300 μJ, 1 mJ available [6]	> 300 μJ [7]
	at 515 nm	> 55 μJ [4]	> 50 μJ [5]
	at 343 nm	> 30 μJ [4]	> 25 μJ [5]
Number of pulses in MHz burst [8]		2 – 10	
Maximal energy in burst mode [9]		> 450 μJ	> 750 μJ
Power long term stability (Std. dev.) [10]		< 0.5 %	
Pulse energy stability (Std. dev.) [11]		< 1 %	
Pulse duration (FWHM) @ 1 MHz		tunable, < 350 fs [12] – 1 ps [13]	tunable, < 400 fs [12] – 1 ps [13]
Optional pulse duration extension		tunable, up to 1 ns	
Beam quality		M^2 < 1.2 (typical < 1.1)	
Beam circularity, far field		> 0.85	
Beam divergence (full angle)		< 1 mrad	
Beam pointing thermal stability		< 20 μrad/°C	
Beam diameter ($1/e^2$) @ 1030 nm		2.5 ± 0.4 mm @ 65 cm	
Polarization		vertical	
Triggering mode		internal / external	
Pulse output control		frequency divider, pulse picker, burst mode, packet triggering, power attenuation, pulse-on-demand [14]	
Control interfaces		RS232 / LAN	
Length of the umbilical cord		3 m, detachable. Custom length option available	
Laser head cooling type		dry (direct refrigerant cooling through detachable cooling plate)	
Physical characteristics			
Laser head (W × L × H)		434 × 569 × 150 mm	
Power supply unit (W × L × H)		483 × 534 × 184 mm	
Operating requirements			
Mains requirements		100 – 240 V AC, single phase, 50/60 Hz	
Maximal power rating		800 W	
Operating ambient temperature		18 – 27 °C	
Relative humidity		10 – 80 % (non-condensing)	
Air contamination level		ISO 9 (room air) or better	

1) Due to continuous improvement, all specifications are subject to change without notice. Parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture. All parameters are specified for a shortest pulse duration. Unless stated otherwise, all specifications are measured at 1030 nm and for basic system without options.

2) When frequency divider is set to transmit every pulse. Fully controllable by integrated AOM.

3) At 1 MHz.

4) At 200 kHz.

5) At 400 kHz.

6) Standard energy is 100 μJ at 200 kHz. 300 μJ at 50 kHz is optional. 1 mJ is at 10 kHz, high energy version of Femtolux. Other combinations of energy and repetition rate available.

7) At 100 kHz.

8) Oscillator frequency ~50 MHz, ~20 ns separation between pulses.

9) MHz burst mode or MHz+GHz burst mode at 50 kHz PRR.

10) Over 100 h after warm-up under constant environmental conditions.

11) Under constant environmental conditions.

12) At PRR > 500 kHz. At PRR < 500 kHz shortest pulse duration is < 400 fs.

13) Custom pulse duration by request. For example – fixed 50 fs available.

14) Optional feature. Jitter < 20 ns. Trigger-to-pulse delay < 1 μs.

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Performance of FemtoLux 50

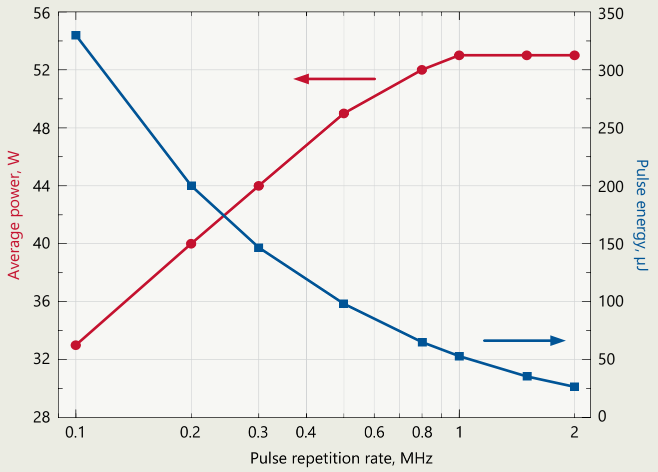

Fig 1. Typical dependence of output power and pulse energy of FemtoLux 50 laser at 1030 nm on pulse repetition rate

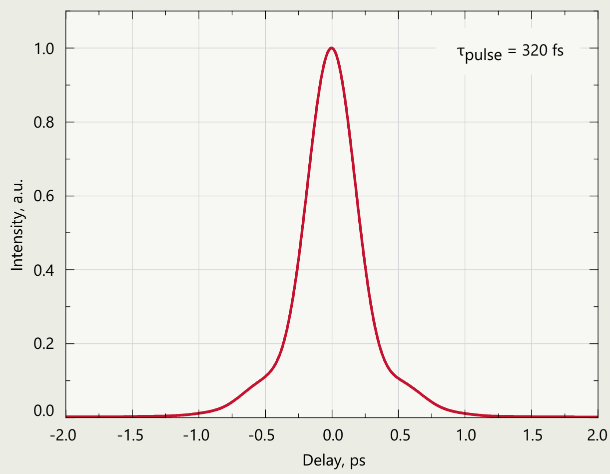

Fig 2. Typical FemtoLux 50 laser output pulse autocorrelation function at 1030 nm @ 1 MHz

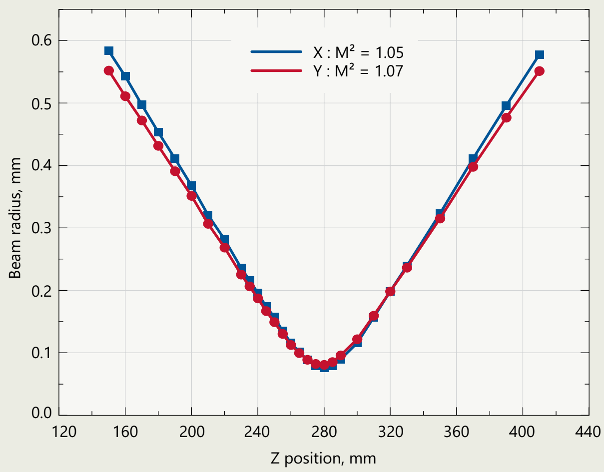

Fig 3. Typical M^2 measurement of FemtoLux 50 laser at 1030 nm

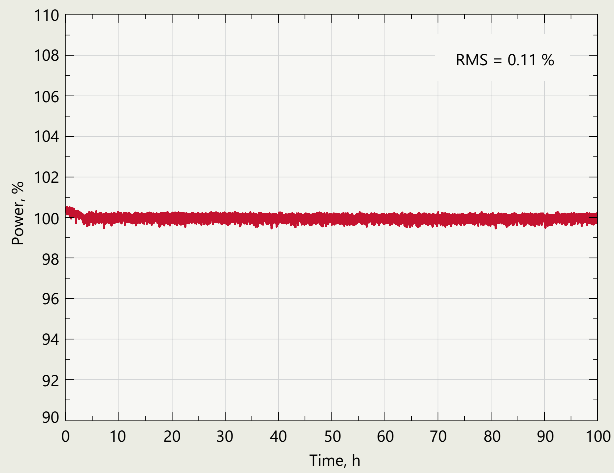

Fig 4. Typical long term average power stability of FemtoLux 50 laser at 1030 nm under constant environmental conditions

Performance of FemtoLux 30

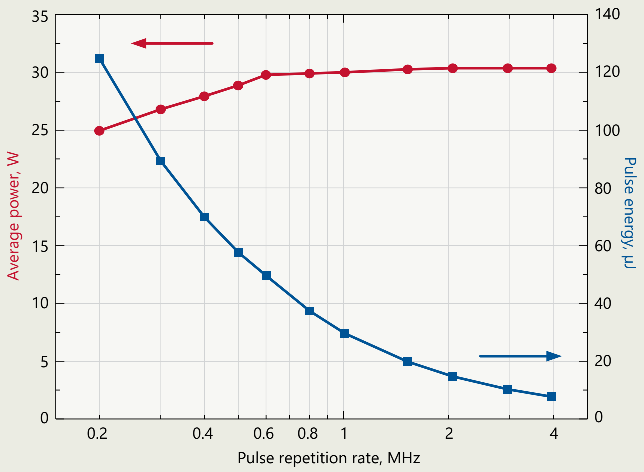

Fig 5. Typical dependence of output power and pulse energy of FemtoLux 30 laser at 1030 nm on pulse repetition rate

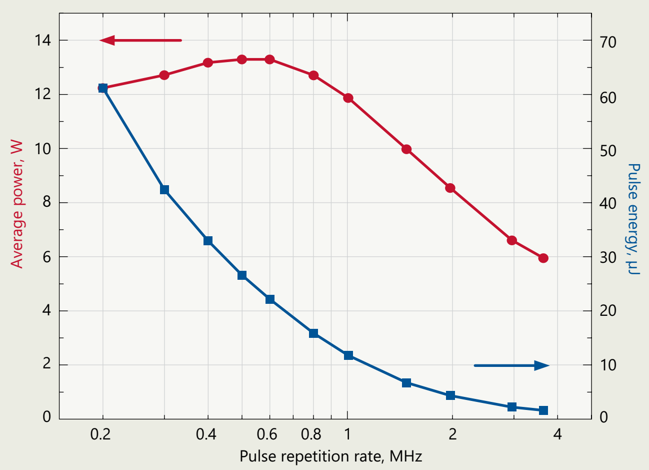

Fig 6. Typical dependence of output power and pulse energy of FemtoLux 30 laser at 515 nm on pulse repetition rate

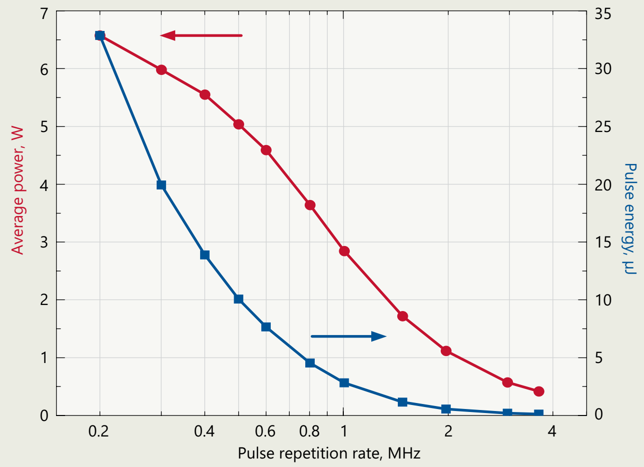

Fig 7. Typical dependence of output power and pulse energy of FemtoLux 30 laser at 343 nm on pulse repetition rate

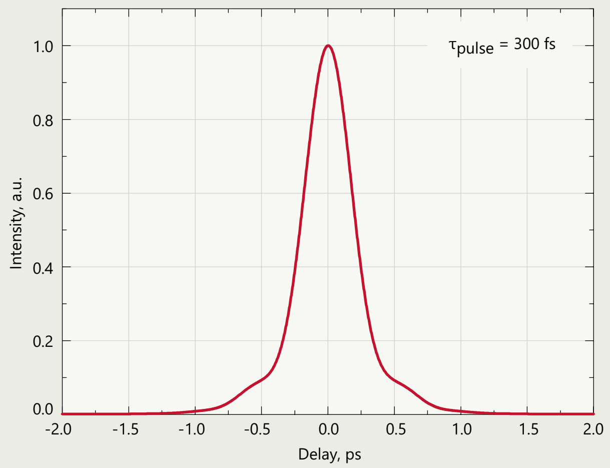

Fig 8. Typical FemtoLux 30 laser (at 1030 nm) output pulse autocorrelation function

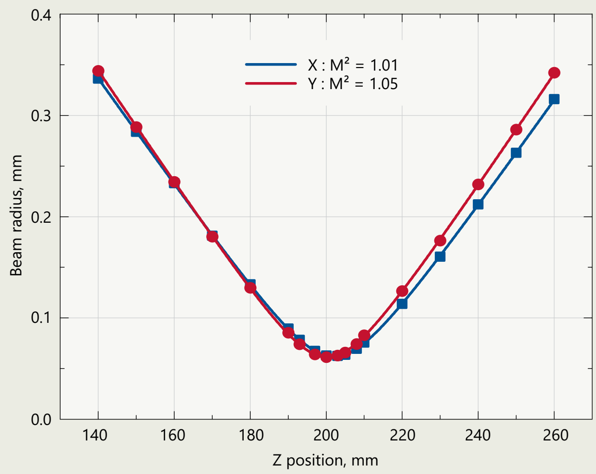

Fig 9. Typical M^2 measurement of FemtoLux 30 laser at 1030 nm

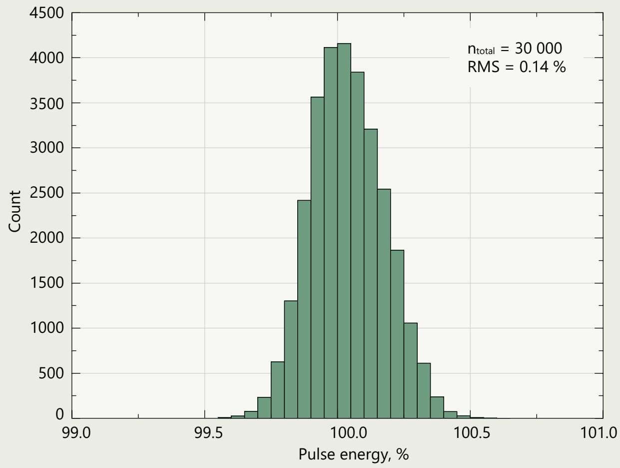

Fig 10. Typical pulse-to-pulse energy stability of FemtoLux 30 laser at 200 kHz over 30 000 pulses. RMS was calculated by using a set of mean values of 10 consecutive laser shots

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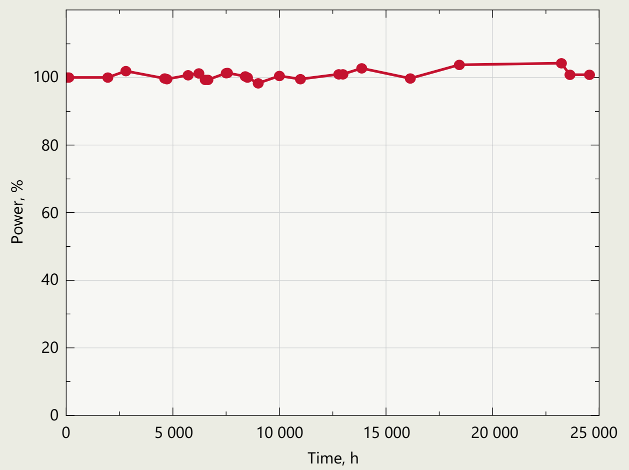


Fig 11. Long-term average power stability of the FemtoLux 30 laser at 1030 nm under constant environmental conditions over an extended duration of 25,000 hours

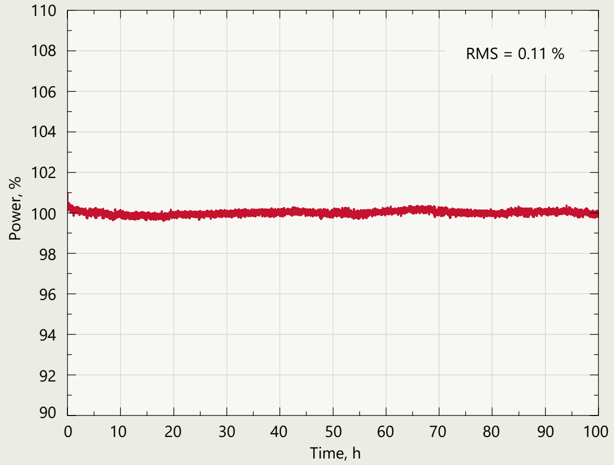


Fig 12. Typical long term average power stability of FemtoLux 30 laser at 1030 nm under constant environmental conditions

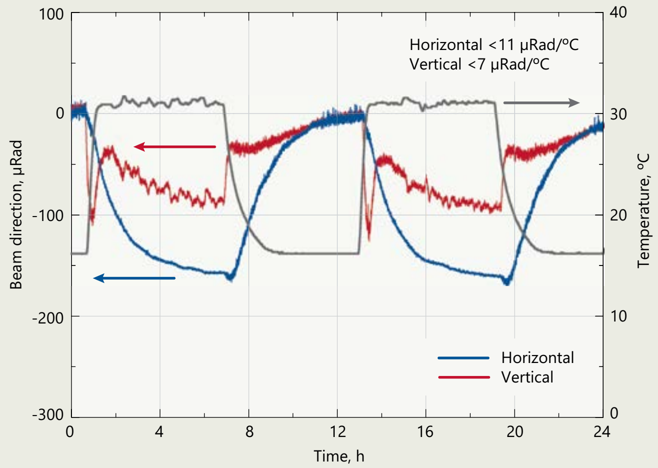


Fig 13. Typical beam direction stability of FemtoLux 30 under harsh environmental conditions

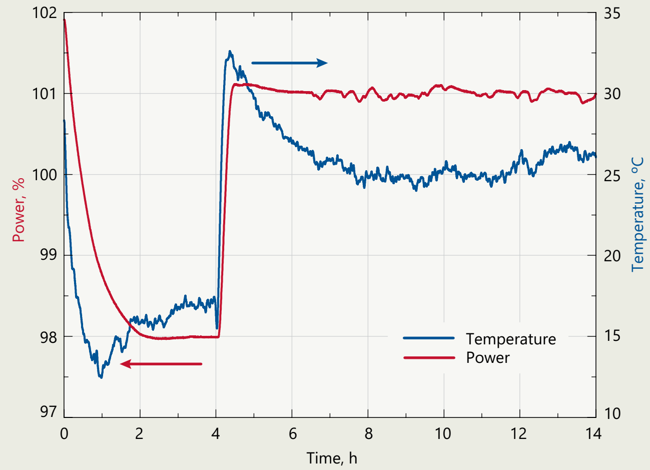


Fig 14. Average output power dependance of FemtoLux 30 laser on ambient temperature at 1030 nm

FemtoLux with harmonics module and power supply

Drawings

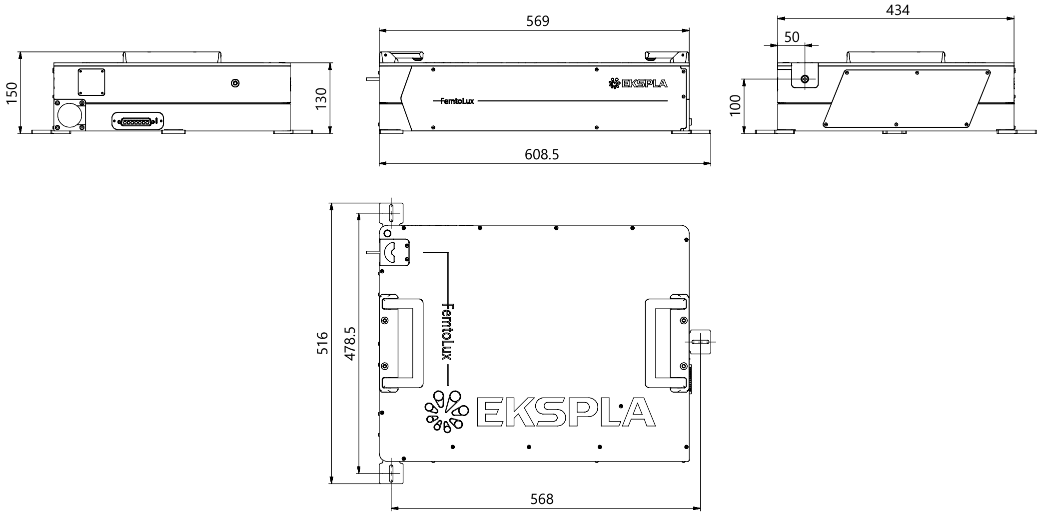


Fig 11. FemtoLux laser head outline drawing

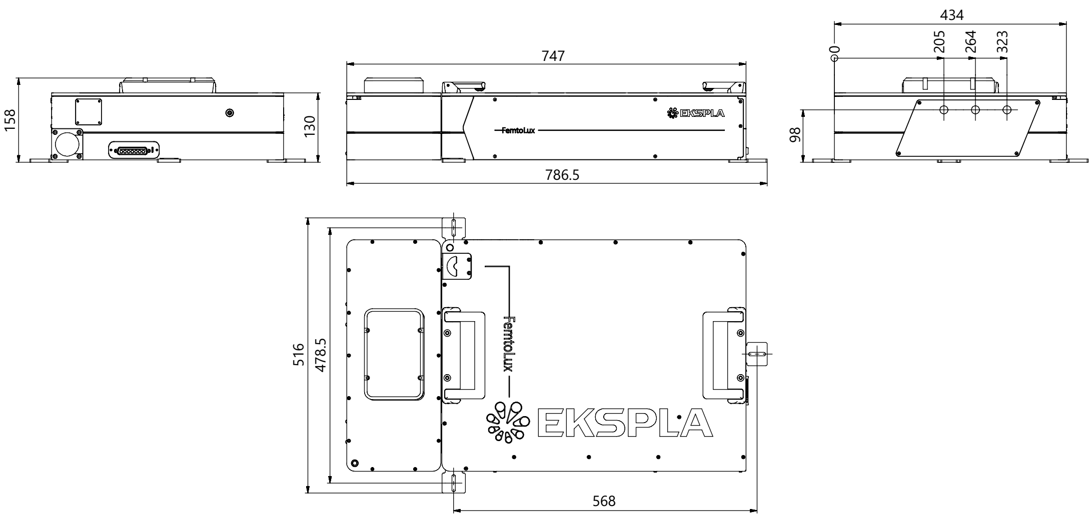


Fig 12. FemtoLux with harmonics module. Laser head outline drawing

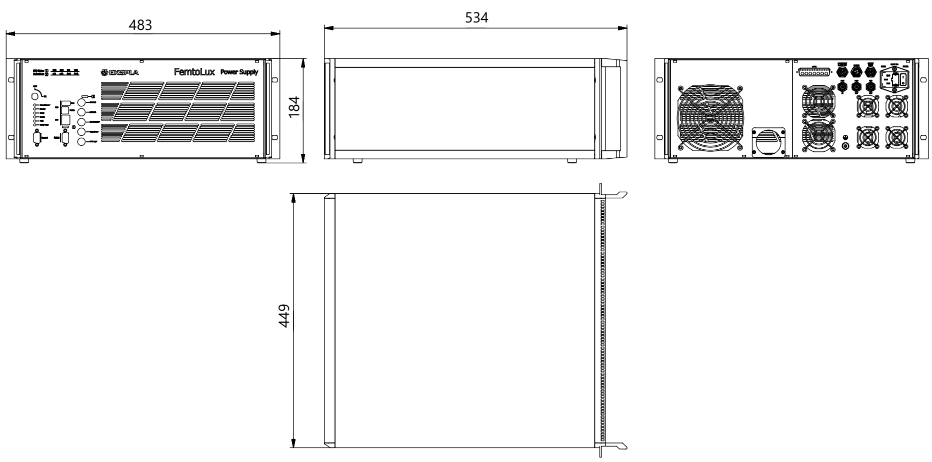
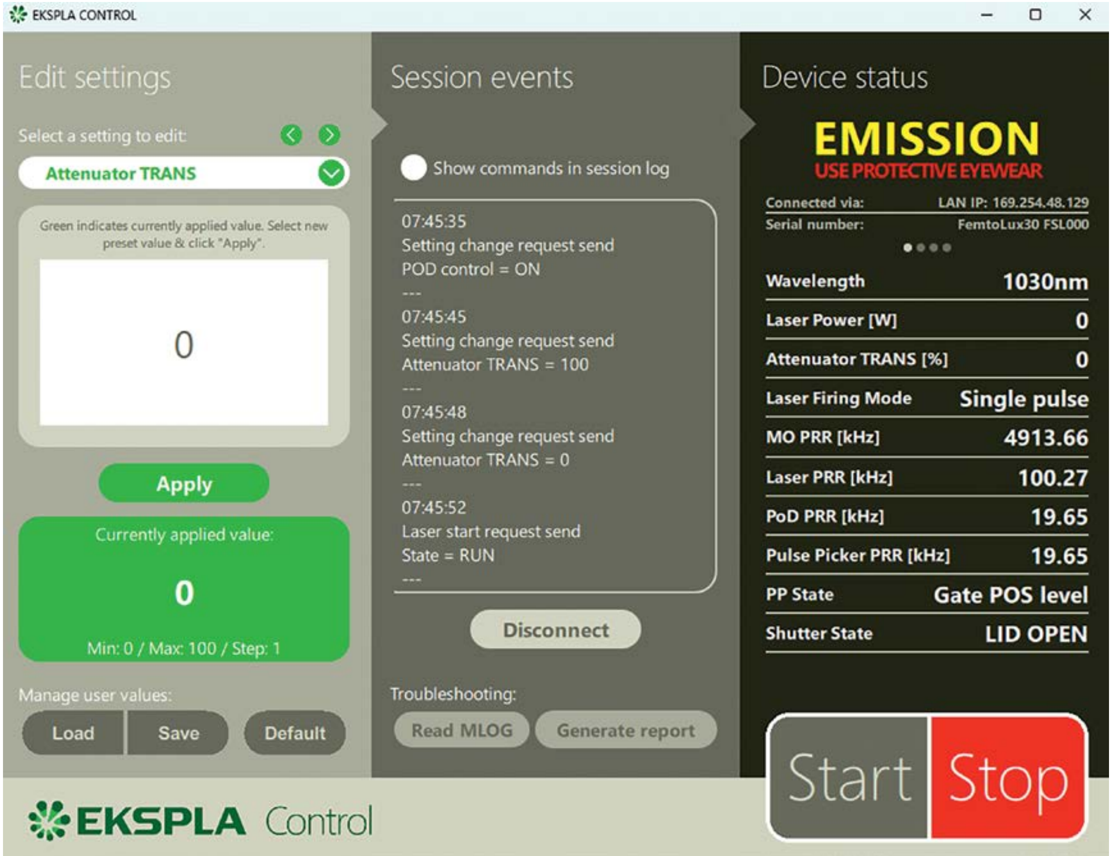


Fig 13. Power supply outline drawing

Laser control application

Ekspla Control Application is a software tool intended for day-to-day routine operation control. It is used to control the laser in API level through LAN or RS-232 communication types, the control capabilities are stored in the laser system itself, software is self-adaptive to the system, one application can be used with multiple systems and can run on different platforms – be it Windows, Linux or others using REST API commands.



FemtoLux 3

Applications

/ Inner volume marking of transparent materials

/ Marking and structuring

/ Micromachining of brittle materials

/ Photopolymerization

/ Ophthalmologic surgery

/ Biological Imaging

/ Pumping of femtosecond OPO/OPA

/ Microscopy

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Microjoule Class Femtosecond Industrial Lasers

FemtoLux 3

FemtoLux 3 is a modern femtosecond fiber laser aimed for both R&D use and industrial integration.

Tunable pulse duration in a range of 300 fs – 5 ps, adjustable pulse repetition rate up to 10 MHz and adjustable pulse energy up to 3 µJ allows optimization of laser parameters for the desired application. These include marking and volume structuring of transparent materials, photopolymerization, biological imaging, nonlinear microscopy and many others. To expand the scope of applications even further this laser can be equipped with a second harmonics module.

With burst mode enabled, FemtoLux 3 can generate bursts of pulses with energy above 10 µJ which can significantly improve the efficiency of processes.

Having a rigid, compact, passive air-cooled laser head FemtoLux 3 can be integrated with different equipment, be it laser equipment for material micro-processing, microscopy or any other research equipment.

FemtoLux 3 laser with control unit

Features

Output power
3 W at 1030 nm,
1.2 W at 515 nm

Up to **3 µJ/pulse** and **10 µJ/burst** (at 1030 nm)

Up to **1.2 µJ/pulse** and **5 µJ/burst** (at 515 nm)

< 300 fs ... 5 ps tunable pulse duration

M^2 < 1.2

Versatile laser control and syncronisation capabilities

Up to **10 MHz** pulse repetition rate

Smart triggering for synchronous operation with polygon scanner and PSO

Instant amplitude control

Passive air cooling of the laser head

24/7 operation

	Output power	Pulse energy	Burst mode
At 1030 nm	3 W	3 µJ	10 µJ
At 515 nm	1.2 W	1.2 µJ	5 µJ

Learn more about FemtoLux 3
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Specifications [1)]

Model		FemtoLux 3
Main specifications		
Central wavelength	fundamental	1030 nm
	with second harmonic option	515 nm
Minimal pulse duration (FWHM) at 1030 nm		< 300 fs (typical ~230 fs)
Pulse duration tuning range		300 fs – 5 ps
Maximal average output power [2)]	at 1030 nm	> 3 W
	at 515 nm	> 1.2 W
Power long term stability (Std. dev.) [3)]		≤ 0.5 %
Maximal pulse energy [2)]	at 1030 nm	> 3 µJ
	at 515 nm	> 1.2 µJ
Pulse energy stability (Std. dev.) [4)]		< 2 %
Pulse repetition rate (PRR) [5)]		1 – 10 MHz
Pulse repetition frequency (PRF) after frequency divider		PRF = PRR / N, N=1, 2, 3, ... , 65000; single shot
External pulse gating		via TTL input
Burst mode [6)]		1 – 10 pulses
Max burst energy	at 1030 nm	> 10 µJ
	at 515 nm	> 5 µJ
Burst shape control		via analog input
Power attenuation		0 – 100 % from remote control application or via analog input
Polarization orientation		linear, vertical
Polarization extinction ratio		>1000:1
M^2		< 1.2
Beam divergence (full angle)		<1.0 mrad
Beam circularity (far field)		> 0.85
Beam pointing stability (pk-to-pk) [7)]		< 30 µrad
Beam diameter ($1/e^2$) at 20 cm distance from laser aperture	at 1030 nm	2.0 ± 0.3 mm
	at 515 nm	1.0 ± 0.2 mm
Operating requirements		
Mains requirements		100–240 V AC, single phase 47–63 Hz
Maximal power consumption		< 500 W
Operating ambient temperature		15 – 30 °C
Relative humidity		10 – 80 % (non-condensing)
Air contamination level		ISO 9 (room air) or better
Physical characteristics		
Cooling of the laser head		air, passive
Laser head size (L×W×H)	at 1030 nm	459.5 × 362 × 111 mm
	at 515 nm	615.3 × 362 × 139 mm
Power supply unit size (L×W×H)	stand-alone	496 × 483 × 184 mm
	19" rack mountable	548 × 483 × 184 mm
Umbilical length		5 m
Classification		
Classification according EN60825-1		CLASS 4 laser product

1) Due to continuous improvement, all specifications are subject to change without notice. Parameters marked typical are not specifications. They are indications of typical performance and will vary with each unit we manufacture.

2) See typical power and energy curves for other pulse repetition rates at Fig 1., Fig 2. and Fig 4.

3) At 1 MHz PRR during 24 h of operation after warm-up under constant environmental conditions.

4) At 1 MHz PRR under constant environmental conditions.

5) When pulse picker is set to transmit every pulse.

6) Pulse separation inside the burst is about 20 ns.

7) Beam pointing stability is evaluated as a movement of the beam centroid in the focal plane of a focusing element.

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

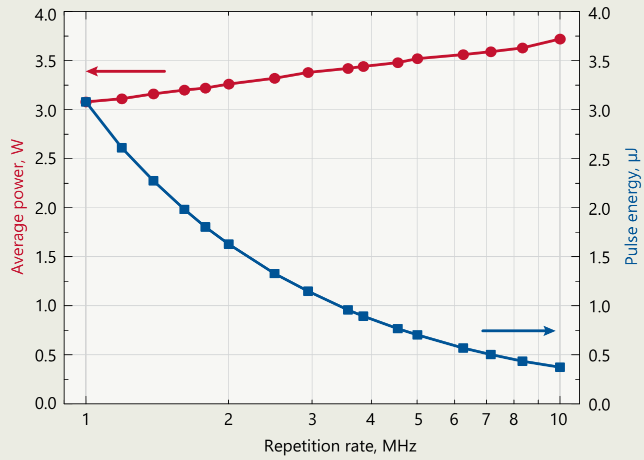

Fig 1. Typical dependence of output power and pulse energy of FemtoLux 3 laser at 1030 nm when changing internal repetition rate of the laser

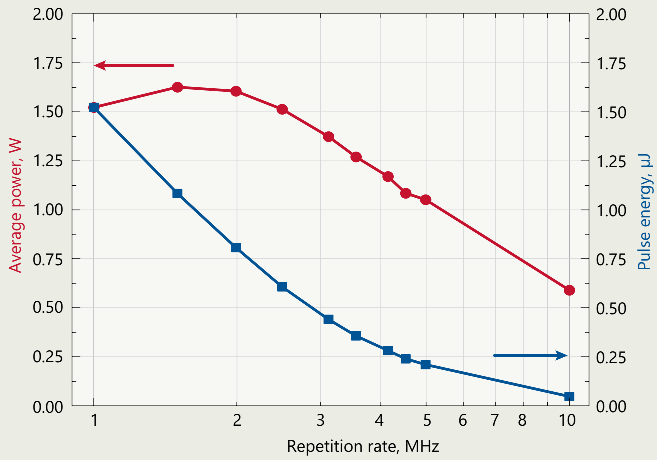

Fig 2. Typical dependence of output power and pulse energy of FemtoLux 3 laser at 515 nm on pulse repetition rate

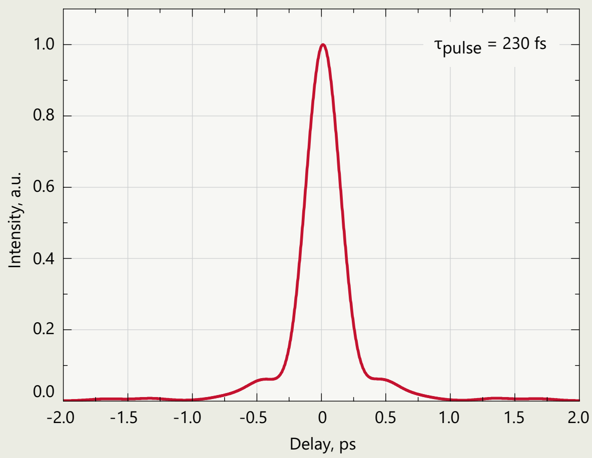

Fig 3. Typical FemtoLux 3 laser (at 1030 nm) output pulse autocorrelation function at 3 µJ pulse energy. Calculated pulse duration is 230 fs

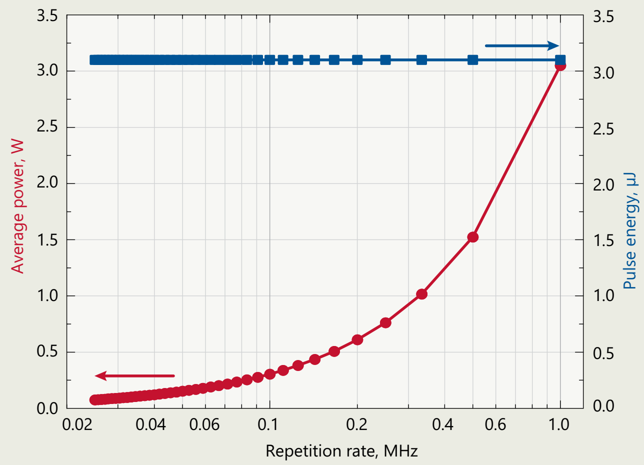

Fig 4. Typical dependence of output power and pulse energy of FemtoLux 3 laser at 1030 nm when repetition rate is reduced by pulse picker. Internal repetition rate of the laser in this case is 1 MHz

Stability

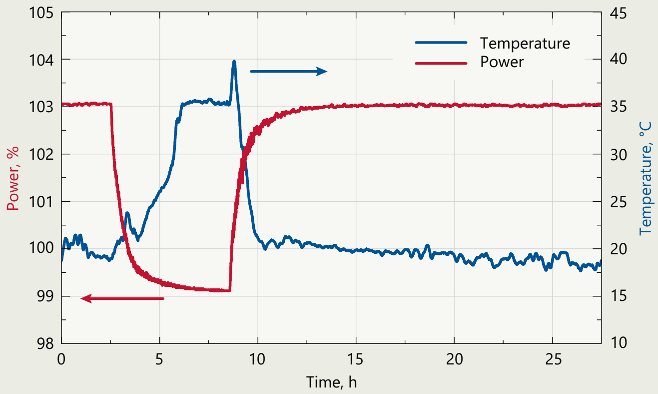

Fig 5. Average output power dependance on ambient temperature at 1030 nm

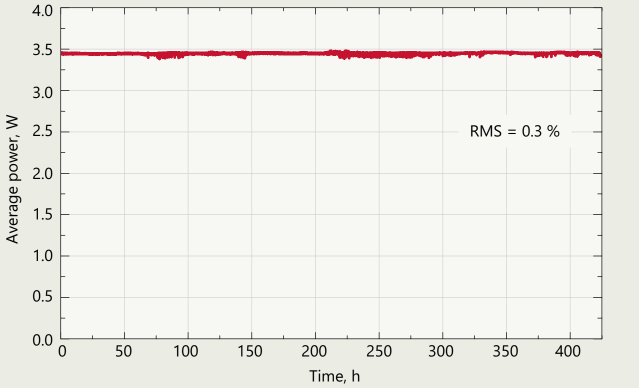

Fig 6. Typical long term average output power stability of FemtoLux 3 laser at 1030 nm under constant environmental conditions

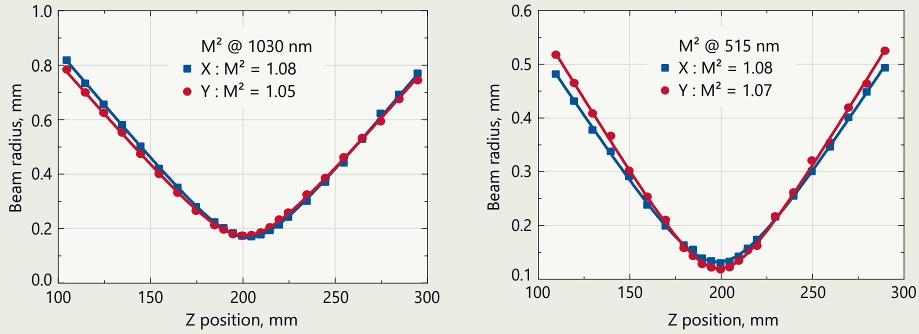

Fig 7. Typical M^2 measurement of FemtoLux 3 at 1030 nm (left) and 515 nm (right)

Fig 8. Typical beam profiles along propagation axis of FemtoLux 3 series laser

Drawings

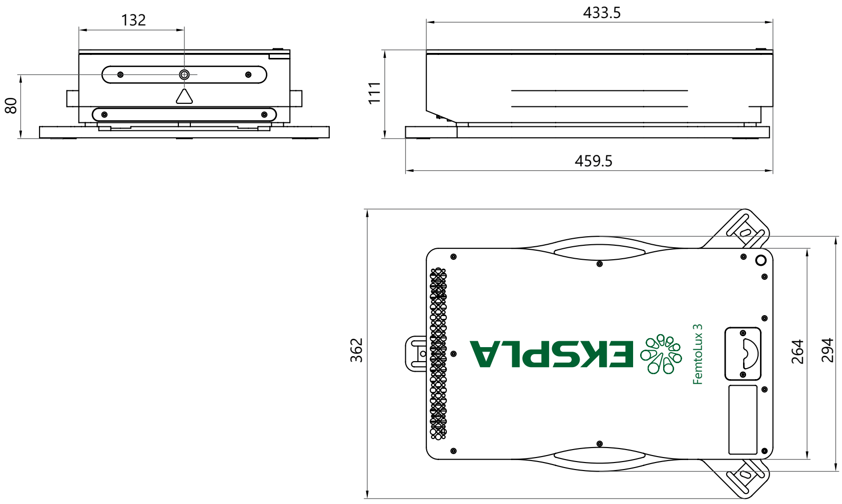

Fig 10. Outline drawings of FemtoLux 3 laser head

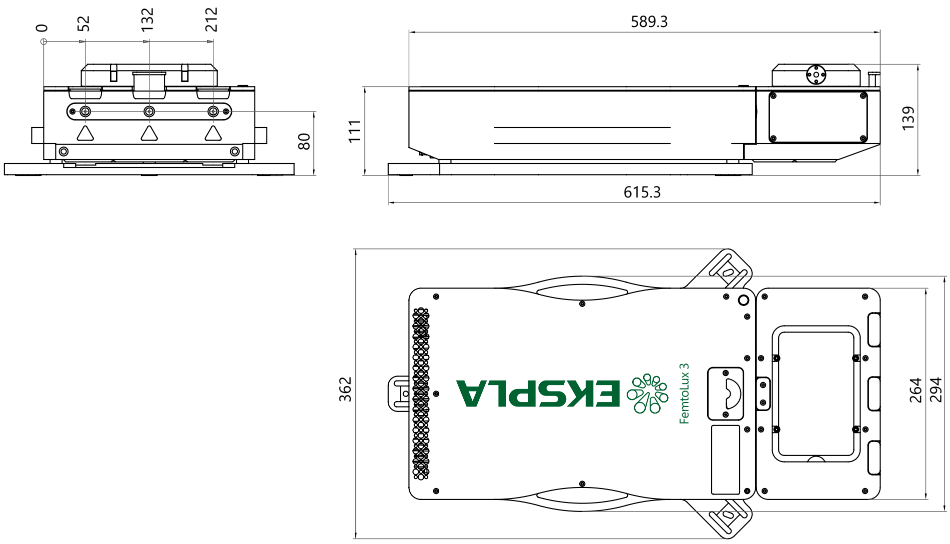

Fig 11. Outline drawings of FemtoLux 3 laser head with second harmonic option

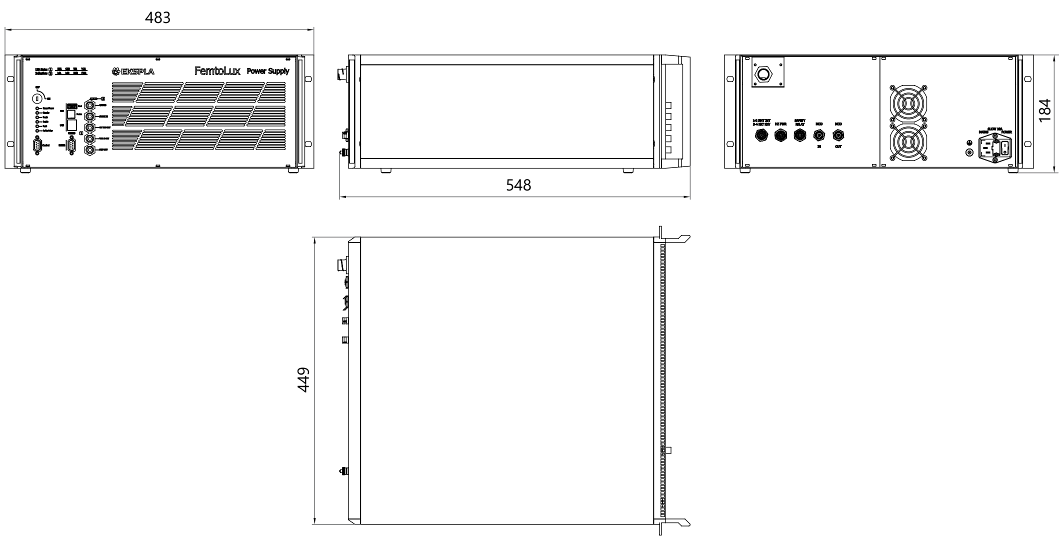

Fig 12. Outline drawings of FemtoLux 3 power supply and control unit

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Specifications	Due to the constant product improvements, EKSPLA reserves its right to change specifications without advance notice.

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