HYBRID FABRICATION

APPLICATIONS

- Micromechanics
- Lab-on-Chip
- Microfluidics
- Sensors

FEATURES

- Additive and subtractive techniques combined in one Laser Nanofactory system
- Arbitrary-shaped 3D structures from micrometers to centimeters scale
- Fast switch from additive to subtractive microfabrication
- Customizable configuration – integrate additional devices

Femtosecond lasers are extremely versatile tools allowing a great variety of different microfabrication processes. Each process has its own requirements for laser, beam delivery or material parameters. Our Laser Nanofactory workstation allows **hybrid fabrication**, meaning that various processes are supported by the same equipment. The two of our most frequently used processes are multiphoton polymerization and selective glass etching, however that is far from all! By precisely tuning its parameters the same machine is capable to perform more processes including:

- Refractive index modification of transparent materials
- Micro-ablation
- Surface structuring
- Micro-welding

In addition, Laser Nanofactory is a modular system, allowing further adaptation to your application. It supports various sample holders (e.g. for microscope slides, wafers, fibers) and different fabrication heads, optimized for your desired laser applications.

TECHNICAL SPECIFICATIONS

Technology		Multiphoton Polymerization			Selective Laser Etching	Hybrid
LASER SOURCE						
Femtosecond laser	Wavelength	780 nm	1030 ± 10 nm 515 ± 10 nm		1030 ± 10 nm	1030 ± 10 nm and 515 ± 10 nm
	Repetition rate	100 MHz	11 MHz ... 76 MHz	Single-shot – 1 MHz	Single-shot – 1 MHz	Single-shot – 1 MHz
	Pulse duration	< 100 fs	50 fs 120 fs 170 fs	290 fs – 20 ps (tunable)	250 fs (450 fs) – 10 ps (tunable)	190 fs – 10 ps (tunable)
	Max. average power	250 mW	2 W	5 W	10 W	from 5 W to 20 W*
	Long-term power stability	< 0.5% RMS over 24 h	< 0.5% RMS over 100 h			
POSITIONING						
Linear stages with synchronized Galvano scanners	XYZ POSITIONING STAGES MOUNTED ON GRANITE BASE WITH BRIDGE					
	Travel (XYZ)	160 mm × 160 mm × 60 mm *				
	Accuracy (XYZ)	± 300 nm				
	Resolution (XYZ)	1 nm				
	Maximum speed (XY)	200 mm/s				
	GALVANO SCANNERS					
	Accuracy	50 µrad				
	Repeatability	0.4 µrad RMS				
OTHER PARAMETERS						
Monitoring on time		The fabrication process is monitored by an integrated machine vision system				
Stitching		Stitchless fabrication using Infinite Field of View (IFoV)				
Focusing optics		Objectives – from 0.4 to 1.4 NA *			Objectives – from 0.25 to 0.45 NA *	Objectives – from 0.25 to 1.4 NA *
Autofocus system		Automatic glass/polymer or glass/air interface optical detection				
Self-Align-System (SAS)		Automatic laser beam path alignment system				
Substrate		Universal vacuum sample holder with computer-controlled, position synchronized illumination for transparent samples				

Technology	**Multiphoton Polymerization**	**Selective Laser Etching**	**Hybrid**

Beam delivery & control	Motorized attenuator, polarization rotator, beam expander. Integrated power meter enables real-time power monitoring
Software	Convenient control of all necessary process parameters and machine settings. The software handles standard formats of 3D designs created by popular CAD programs, like STL
Laser safety	Ergonomic housing to ensure laser safety class 1 and environment stability conditions for laser microfabrication process

* Customizable.

PHYSICAL DIMENSIONS

Dimensions when all doors are closed (W × L × H)	1790 mm × 920 mm × 2270 mm
Dimensions when doors are opened (W × L × H)	2680 mm × 1900 mm × 2300 mm
Weight	~ 700 kg

ENVIRONMENTAL & UTILITY REQUIREMENTS

Operating temperature	20 °C ± 2 °C
Relative humidity	≤ 60%
Electrical requirements	110 V AC, 20 A – 230 V AC , 10 A
AC power (normal operation)	typical 2 kW

The conditions of the environment are preferred to be as stable as possible.

DRAWINGS

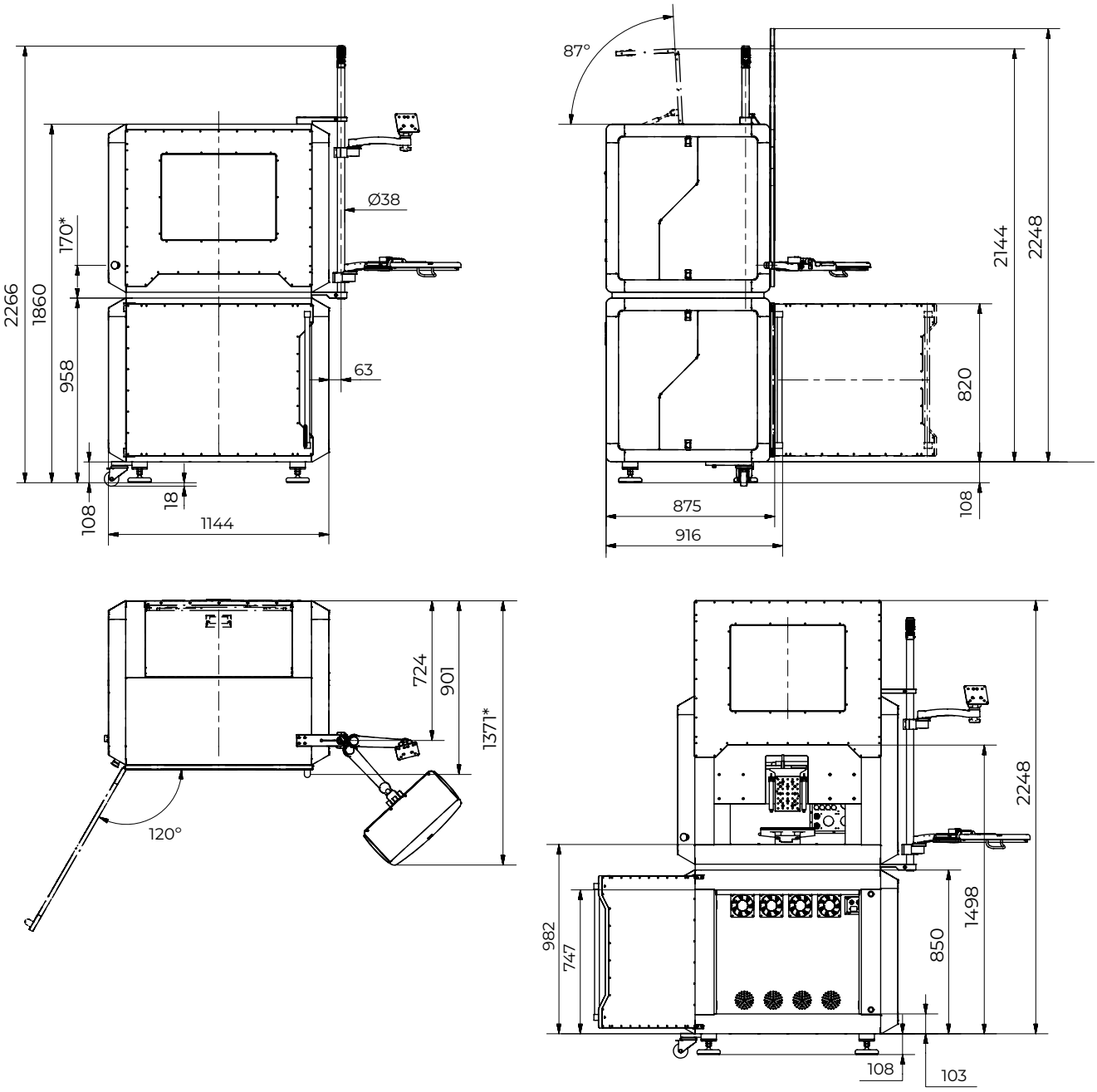

Figure 1. Laser Nanofactory dimensions in milimeters

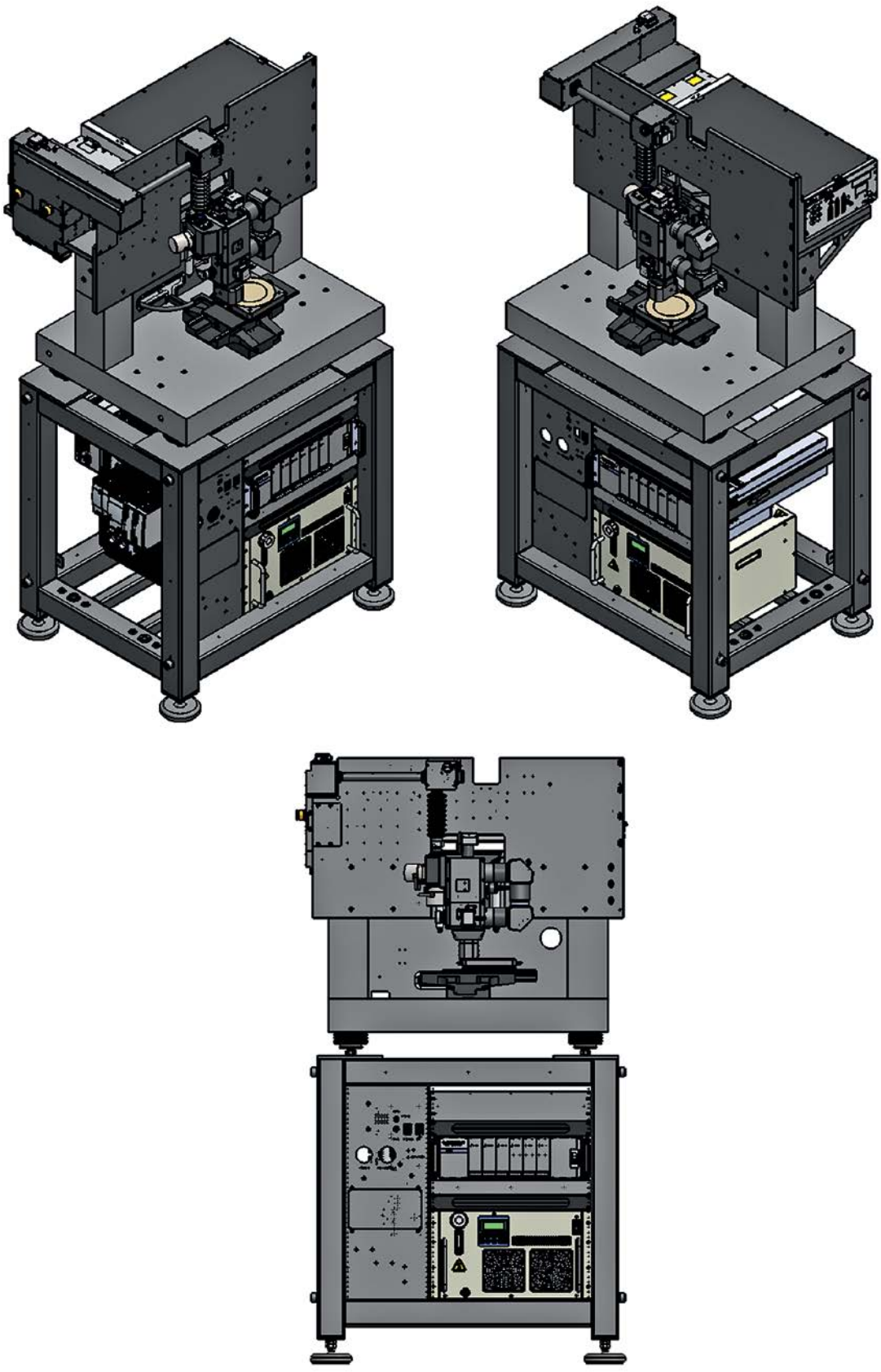

Figure 2. Laser Nanofactory drawings