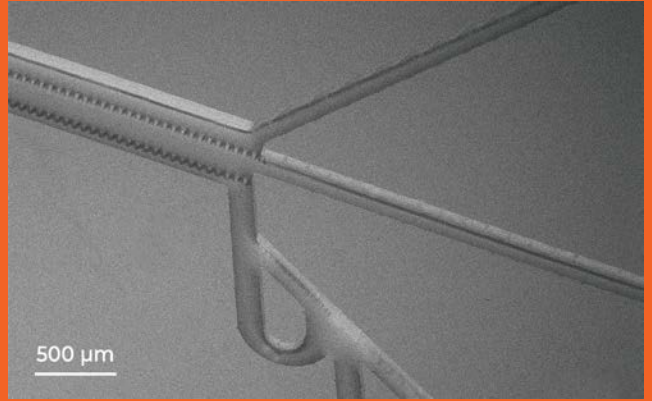
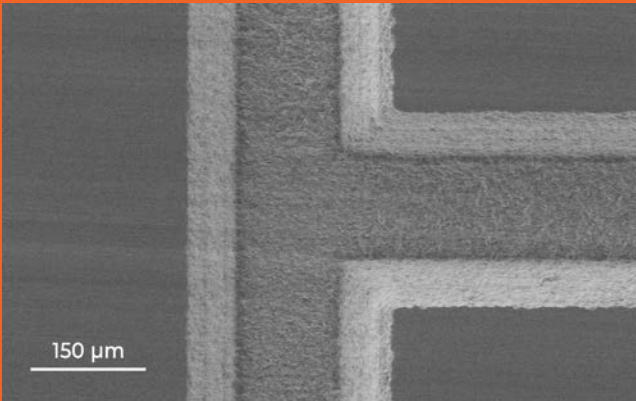


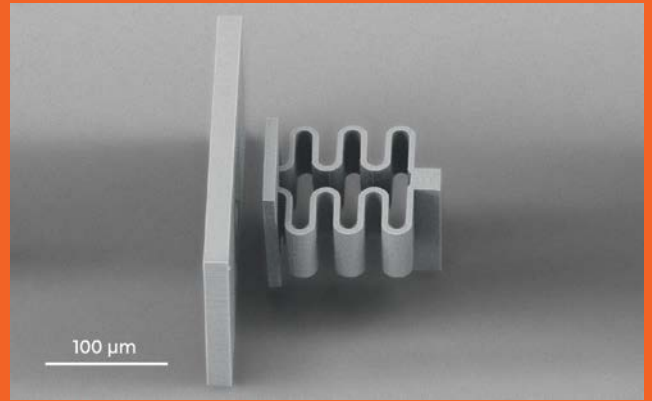
Lab-on-Chip Device



Liver-on-Chip



Lab-on-Chip Device



Micromechanical Sensor

# 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 | <b>Multiphoton Polymerization</b> | <b>Selective Laser Etching</b> | <b>Hybrid</b> |
|------------|-----------------------------------|--------------------------------|---------------|

### LASER SOURCE

|                   |                           |                         |                             |                                |   |                                    |
|-------------------|---------------------------|-------------------------|-----------------------------|--------------------------------|---|------------------------------------|
| Femtosecond laser | Wavelength                | 780 nm                  | 1030 ± 10 nm<br>515 ± 10 nm |                                | 1030 ± 10 nm                            | 1030 ± 10 nm<br>and<br>515 ± 10 nm |
|                   | Repetition rate           | 100 MHz                 | 11 MHz ...<br>76 MHz        | Single-shot –<br>1 MHz         | Single-shot –<br>1 MHz                  | Single-shot –<br>1 MHz             |
|                   | Pulse duration            | < 100 fs                | 50 fs<br>120 fs<br>170 fs   | 290 fs –<br>20 ps<br>(tunable) | 250 fs<br>(450 fs) –<br>10 ps (tunable) | 190 fs – 10 ps<br>(tunable)        |
|                   | Max. average power        | 250 mW                  | 2 W                         | 5 W                            | 10 W                                    | from 5 W<br>to 20 W*               |
|                   | Long-term power stability | < 0.5% RMS<br>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 –<br>from 0.25 to<br>0.45 NA * | Objectives –<br>from 0.25 to<br>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

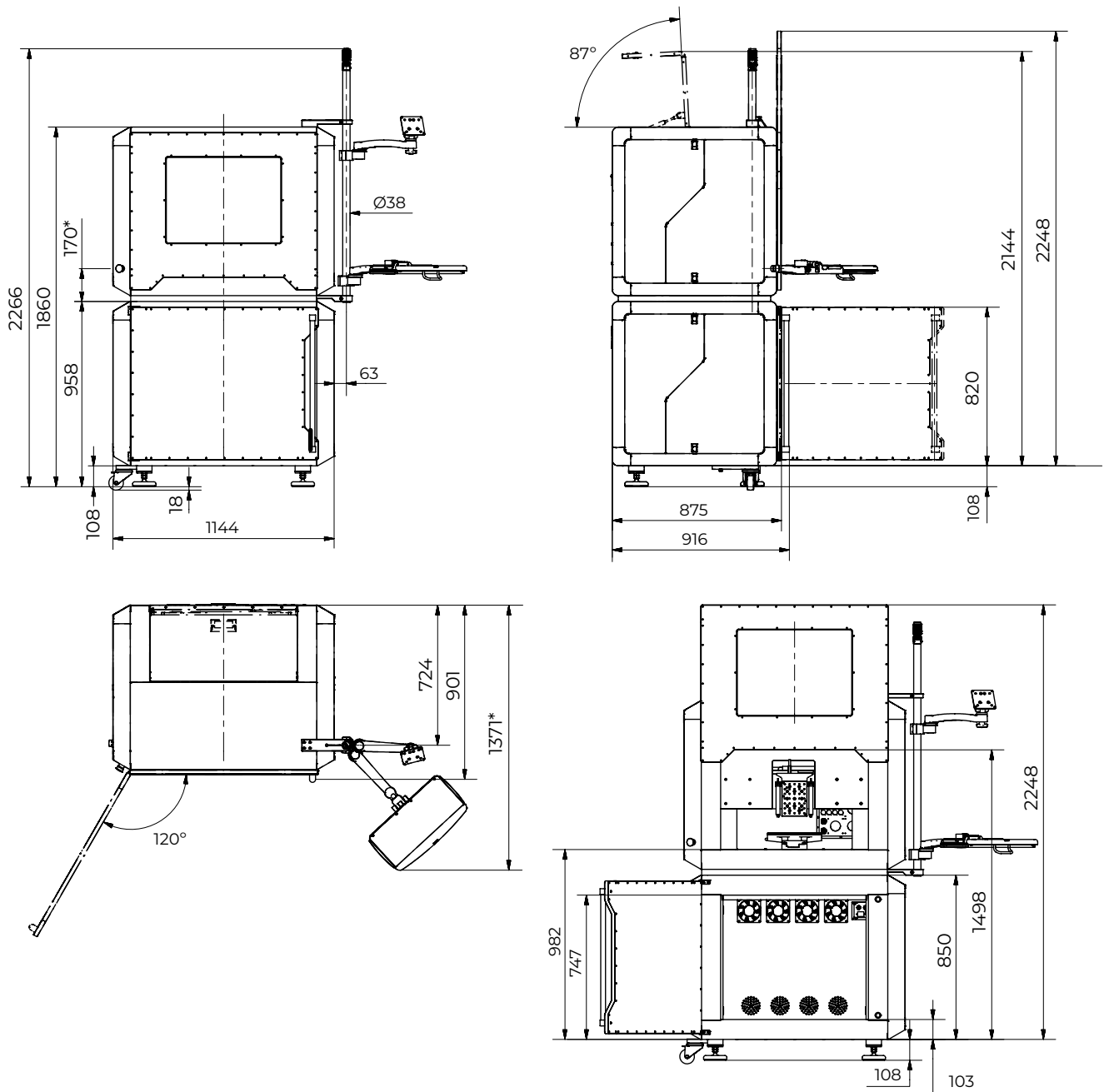


Figure 1. Laser Nanofactory dimensions in millimeters

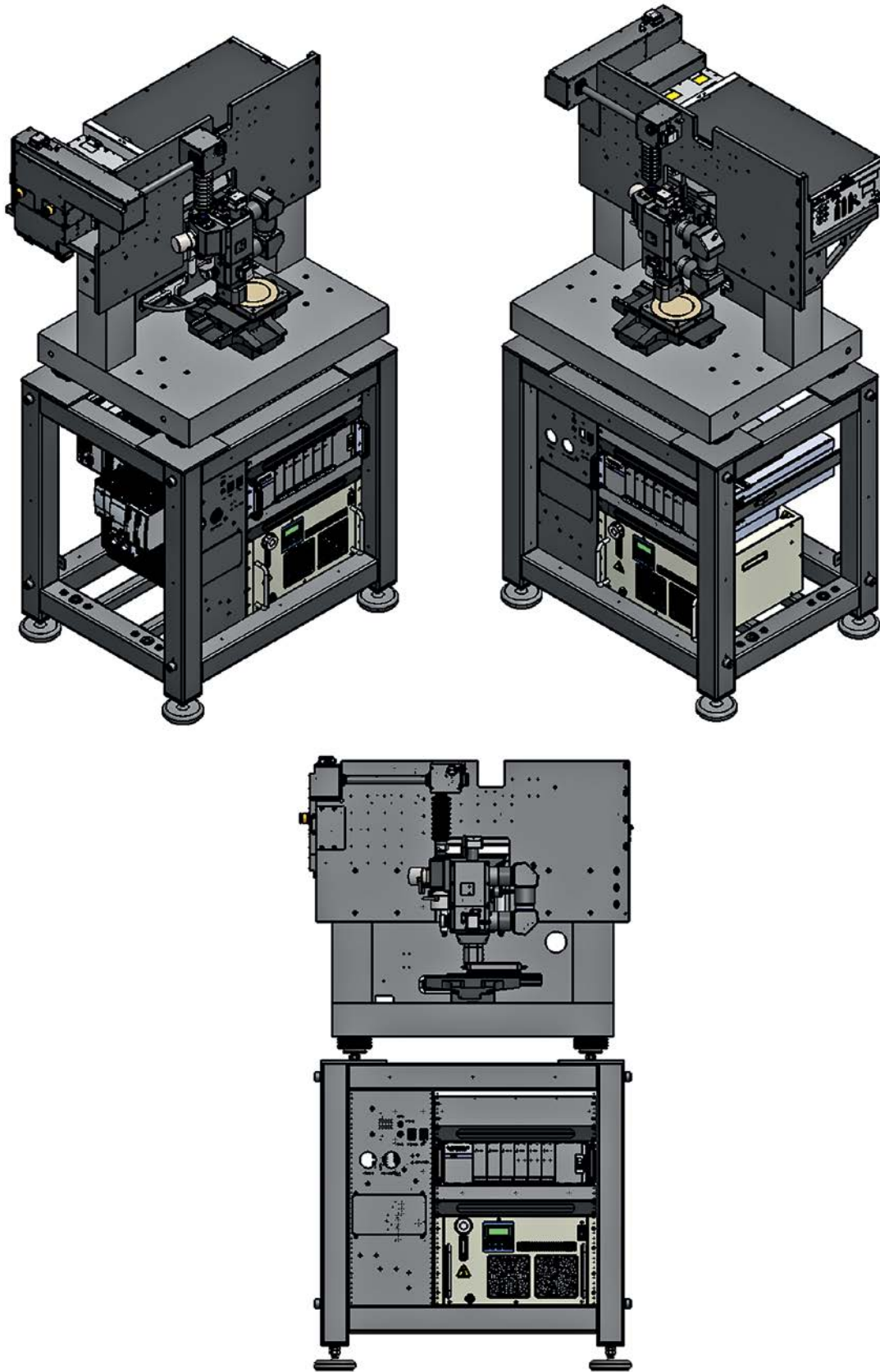


Figure 2. Laser Nanofactory drawings