Nanoscribe

Buse Unlu

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BM 4110

MICRO-373, 2025

École polytechnique fédérale de Lausanne

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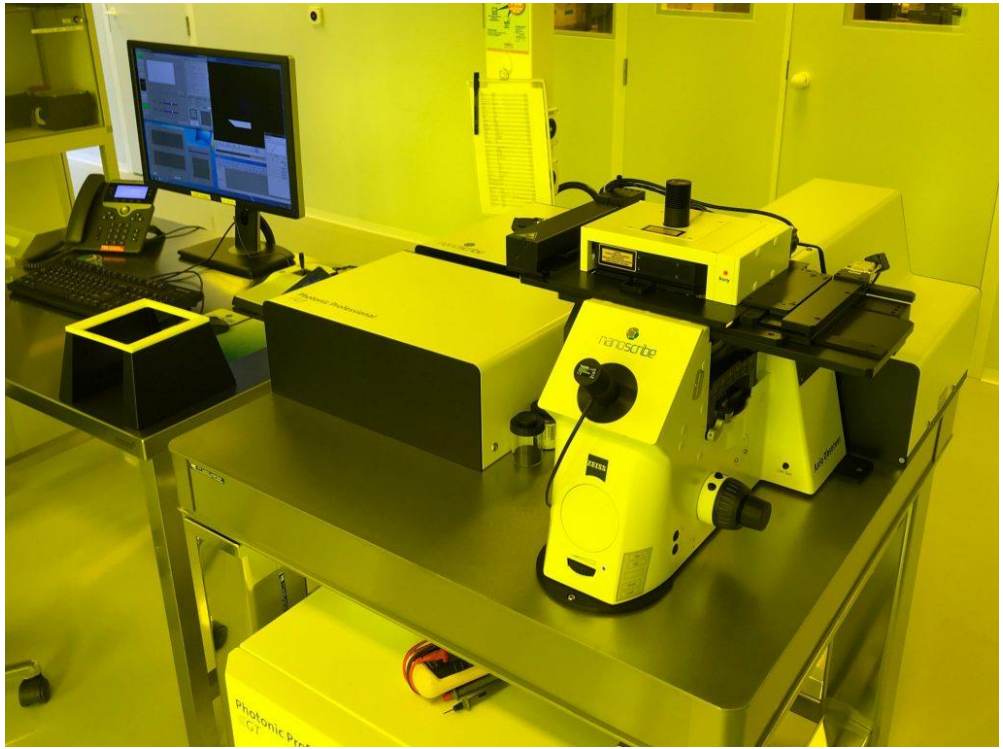
Nanoscribe Photonic Professional GT+



- A high-resolution 3D printer for microfabrication
- Two-photon polymerization (2PP) technology
- Submicron precision for complex structures

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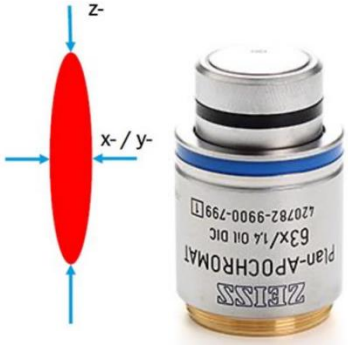
Nanoscribe Photonic Professional GT+

- Voxel dimensions (resolution) and writing speed -

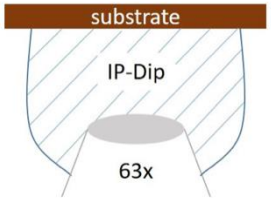
OBJECTIVES	X-/Y- DIAMETER	Z- HEIGHT
63X (IMMERSION)	< 200NM	< 700NM
25X (IMMERSION)	< 600NM	< 2UM
10X (IMMERSION)	< 1.2UM	< 6UM
20X (AIR)	< 800NM	< 5UM



- Objective: 63x NA1.4, 360um working distance (WD).
- Standard Resist: IP-Dip, with $n_{IP\text{-}Dip}$ = 1.511 @ 780nm.
- Standard substrates: quartz or silicon.
- Structure maximal volume ~ 0.1 mm^3.

Dip-in laser lithography (DILL) mode

→ The lens dips in the liquid resist → provide refractive-index matching and increase the numerical aperture of the lens



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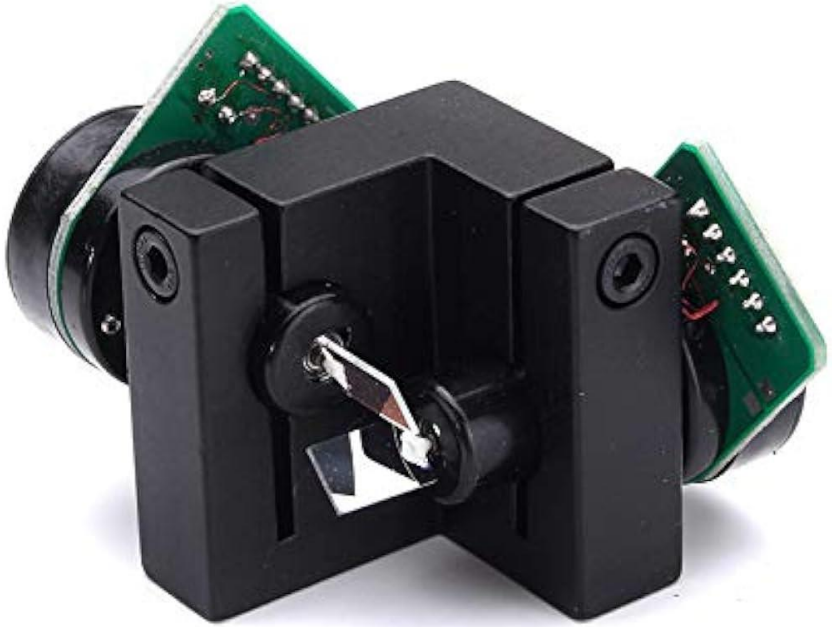
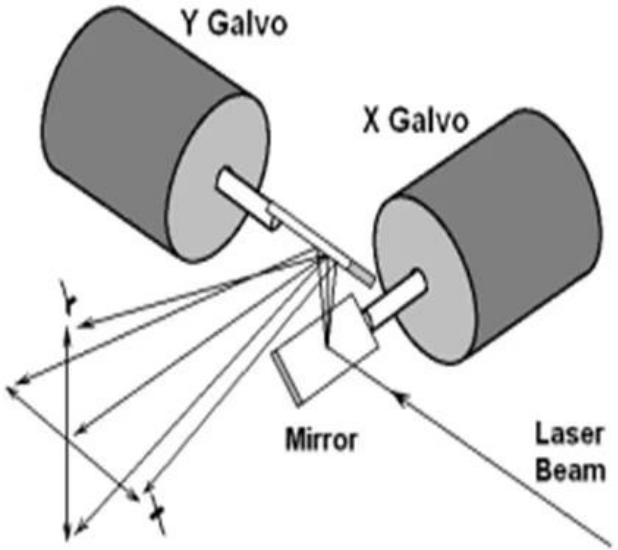
- Laser beam scanning-

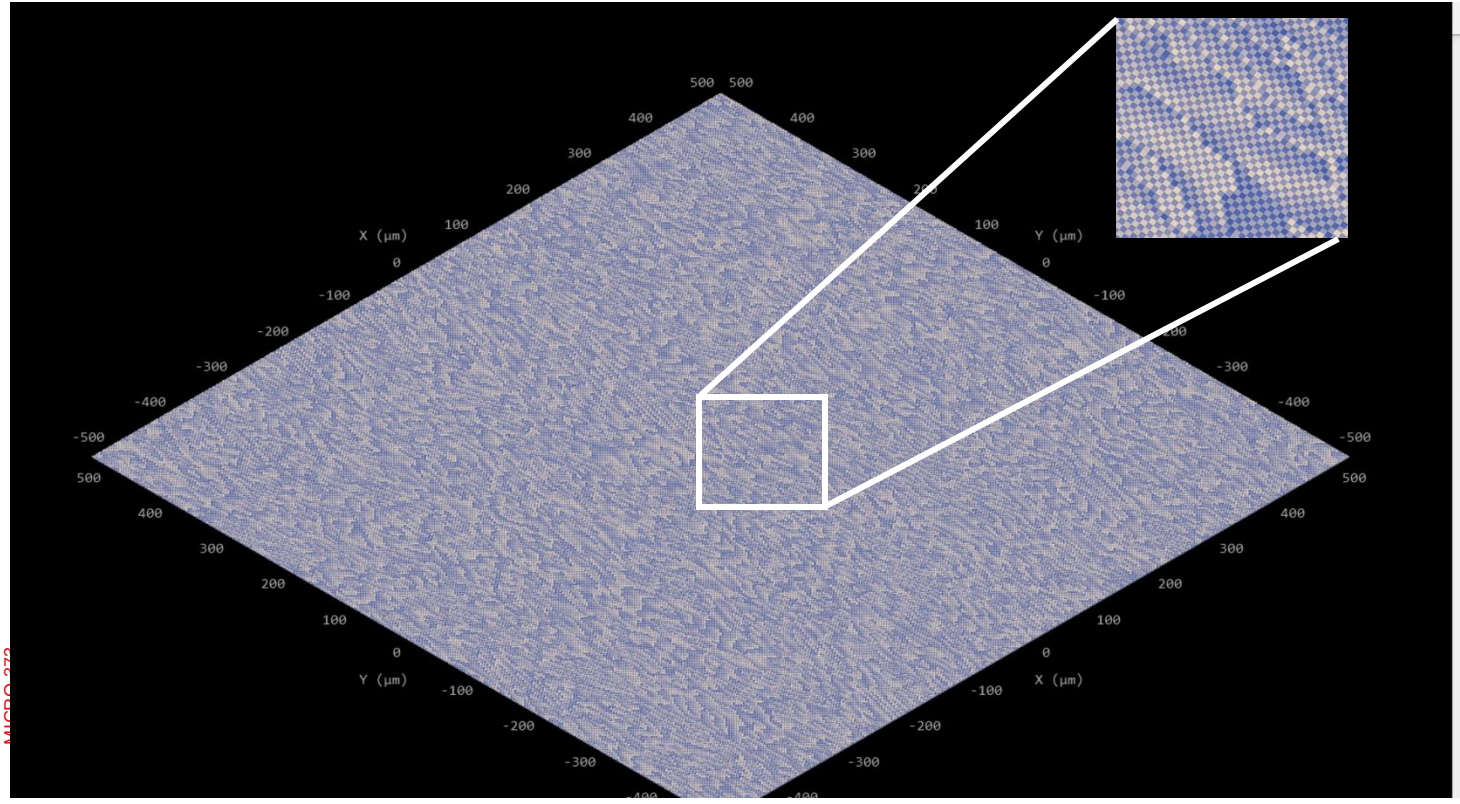
•Ultrafast galvo mirrors → scan the laser focal point in x- and y- directions through the lens



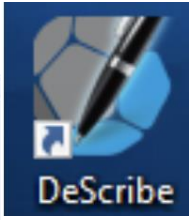


Describe

- Slicing/hatching software
- Converting a .STL/.png format to the internal language of the Nanoscribe and generating an exposure job. file



Describe



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DOE_EPFL-logo-512_16levels_655nm_job.gwl

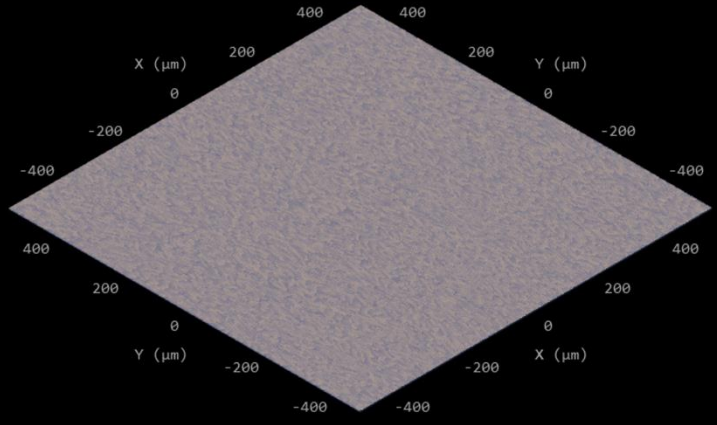
```
% File generated by DeScribe 2.7

% System initialization
InvertZAxis 1

% Writing configuration
GalvoScanMode
ContinuousMode
PiezoSettlingTime 10
GalvoAcceleration 2
StageVelocity 200

% Scan field offsets
XOffset 0
YOffset 0
ZOffset 0.35

% Writing parameters
PowerScaling 1.0

% Solid hatch lines writing parameters
var $solidLaserPower = 40
var $solidScanSpeed = 10000

% Base writing parameters
var $baseLaserPower = 40
var $baseScanSpeed = 10000

var $interfacePos = 0.5

% Include slicer output
include DOE_EPFL-logo-512_16levels_655nm_data.gwl
```

Error List

0 Errors | 0 Warnings | 0 Messages

Description	File	Line

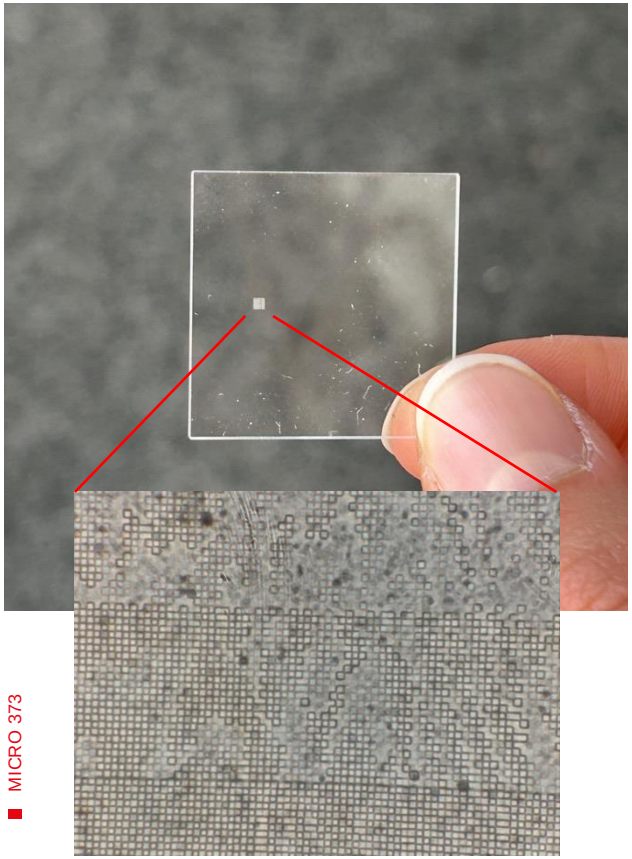
3D Preview - DOE_EPFL-logo-512_16levels_655nm_job.gwl

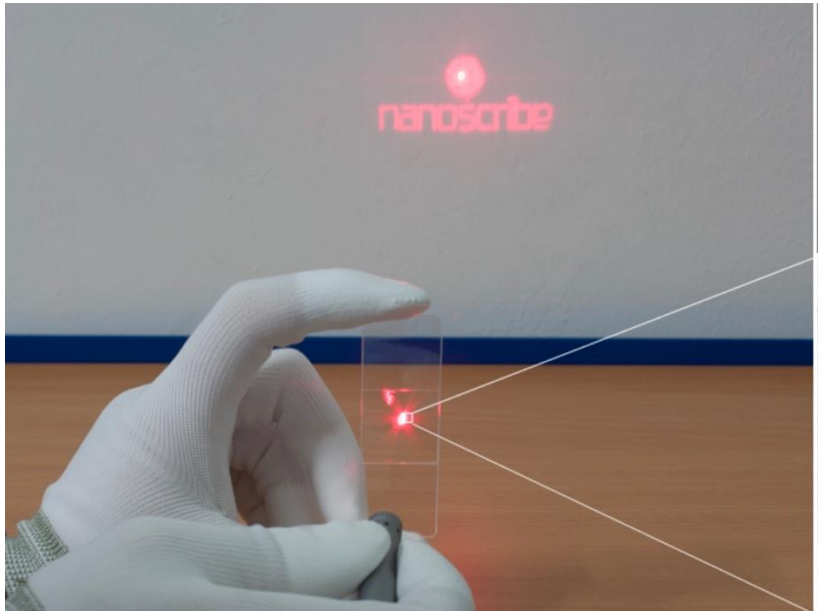


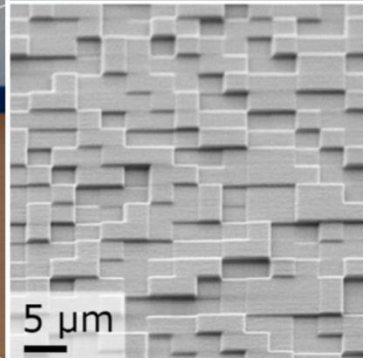
Simulation objective 10x 25x 63x Recalculate 3D preview

04:28:00 / 04:28:00

Printed DOE on a transparent substrate







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Weekly Schedule

Week 2 – 28 February → General Presentation

Week 3 – 7 March → Theory of Two-Photon Polymerization

Week 4 – 14 March → CGH Design – How to Generate Iterative Algorithms (e.g., Gerchberg-Saxton Algorithm), Phase Encoding, Applications
& Short introduction to Describe–Nanoscribe

Week 5 – 21 March → Mask Design in GDS Using MATLAB Package → No lecture – self work

Week 6 – 28 March → Mask Design in GDS Using MATLAB Package & introduction to Nanoscribe (how to use)

Week 7 – 3 April 8 am to start→ First Print of Students' Design with Nanoscribe and Phase Contrast Imaging of Structure

Week 8 – 10 April 8 am to start→ Second Print of Students' Design with Nanoscribe

Week 9 – 2 May → Coating the Sample with Sputtering and Imaging with SEM

Week 10 – 9 May → Building the Setup for Illumination and Transmission Testing in the Lab

Week 11 – 16 May → Report Writing

Week 12 – 23 May → Report Writing

Week 13 – 30 May → Short Presentation of the Report