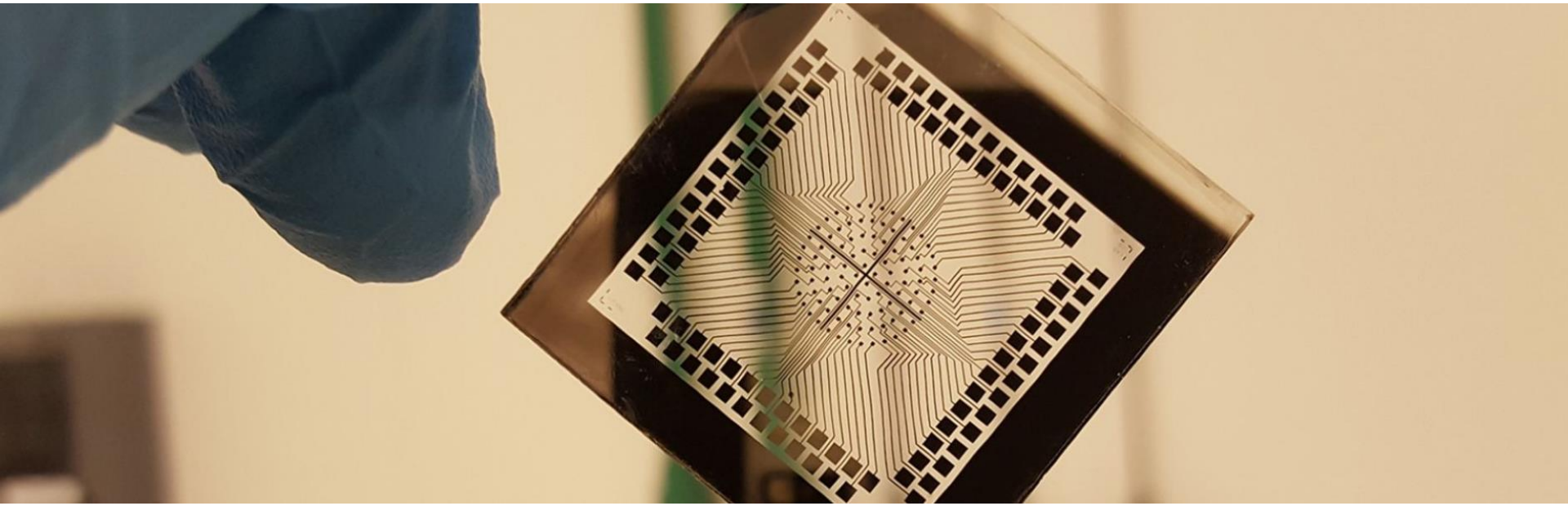
MUTECH
Microsystems



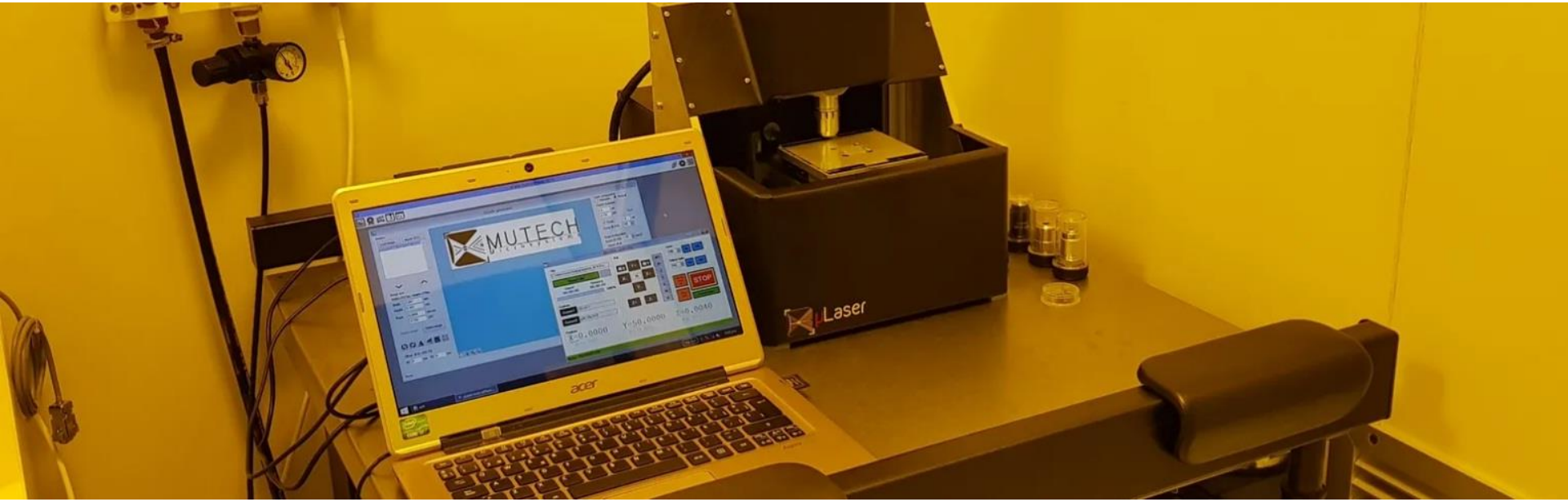
Bringing nanotechnology closer

Microfabrication equipment.

Consulting services.

Education.

µLaser



µLaser is a low cost direct optical lithography system oriented to universities and research facilities looking to expand their capabilities.

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Technical specifications.

Laser wavelength: 405 nm

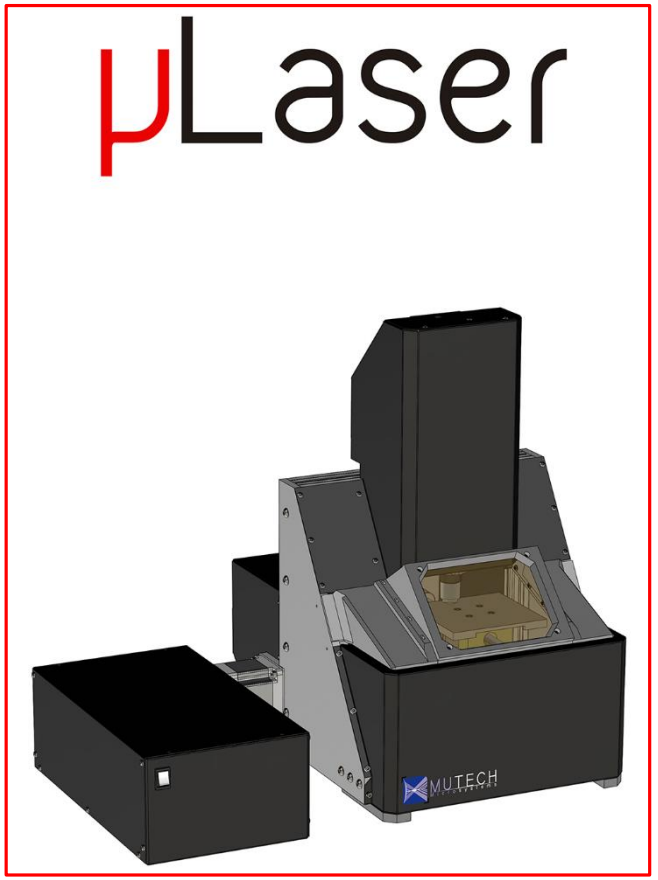
XY Stage

Typical writing speed	10-12 cm/s
Maximum area	10x9,2 cm^2
Mech. short range noise on slow and on fast axis	< 1 µm

Realistic minimum feature size: 6-15µm depending on the feature (see pictures next for examples)

Software

Supported formats	PNG,GDSII
In-software transformations	Rotation, Reflection, Inversion, Rescaling, Add border



Multiple designs from different files can be written in one process

Tilted/warped substrate compensation via 3-point focus or 4-point bilinear measurement

Mesh type calibration for full-bed curvature compensation

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Optics

-Confocal microscope for laser focusing, aligning and inspection
-Secondary independent yellow illumination
-Laser wavelength: 405nm (optional 375nm

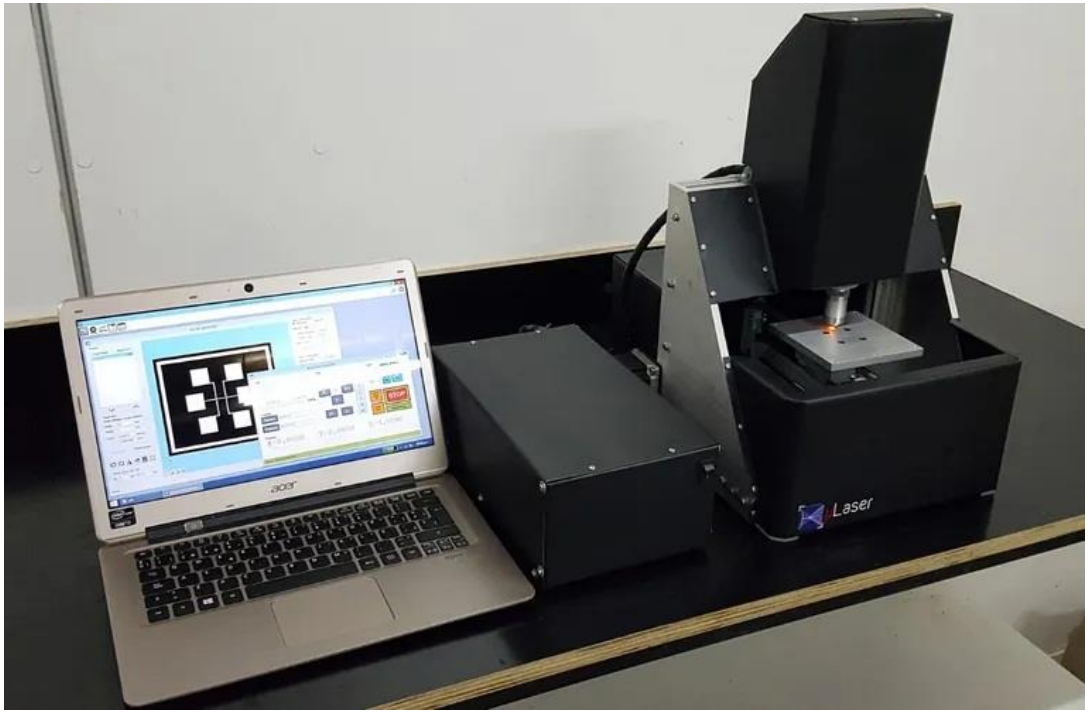
Recommended raster step of included objectives:

-Fine(40x NA0.65): 0.8 µm
-Medium(10x NA0.25): 2 µm
-Coarse(4x NA0.1): 5 µm

Effective writing speed of included objectives on big areas (unidirectional writing):

-Fine: 1.7 mm^2/min
-Medium: 4.25 mm^2/min
-Coarse: 10.6 mm^2/min

Speed doubles in bidirectional writing mode.



Bigger Numerical Aperture of the objective means:

- Smaller spot
- Smaller depth of field
- Higher resolution
- Walls end up less vertical
- flatness of the substrate is more critical.

The best resolution is obtained with a thin photoresist with high contrast like AZ1512HS. We also use microposit S1800

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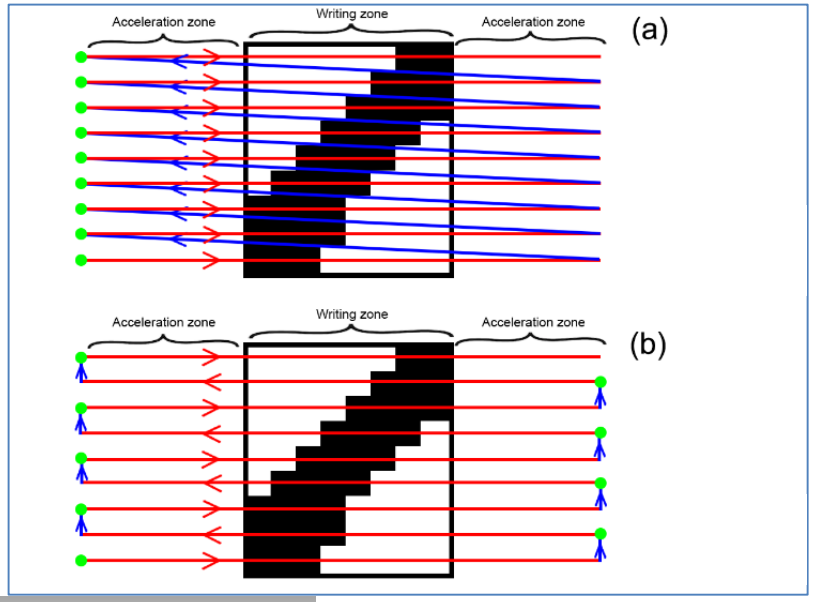
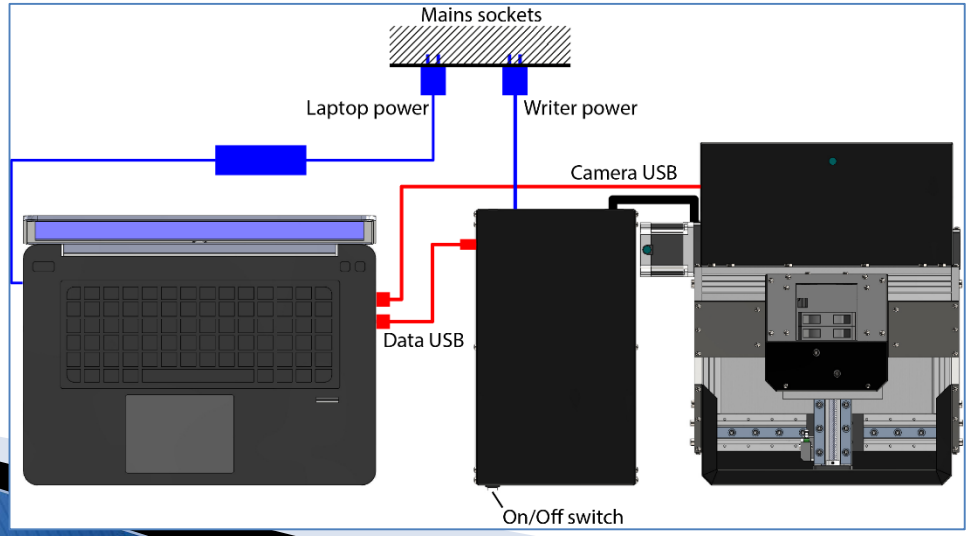
Raster writing modes, unidirectional and bidirectional.

Unidirectional is more precise, bidirectional takes about half the time

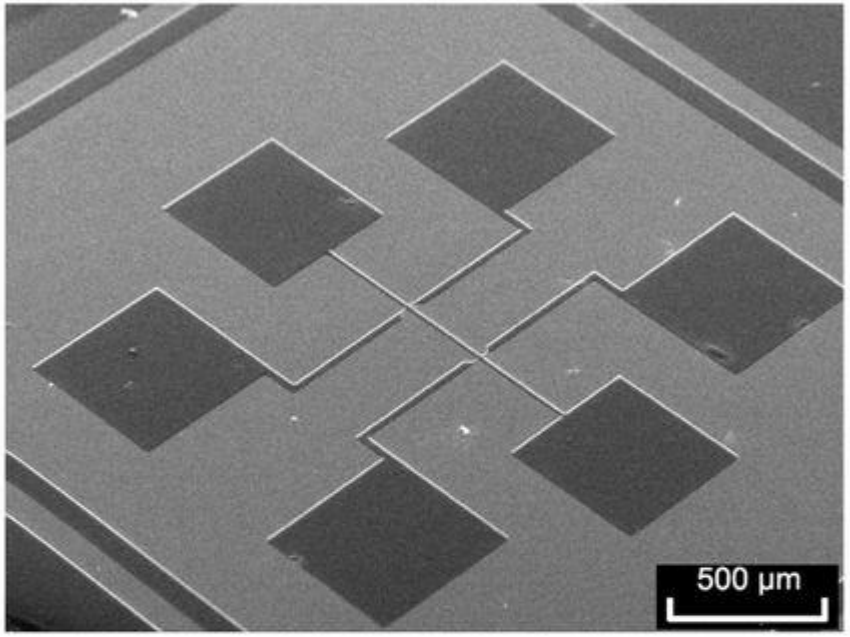


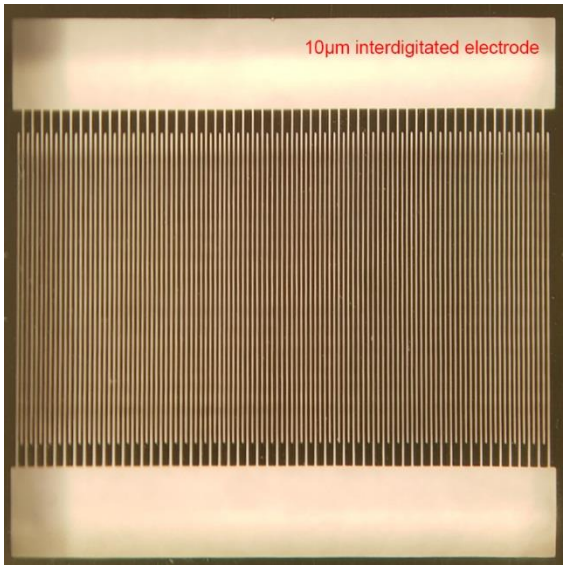
Wiring of the microlaser to the control laptop

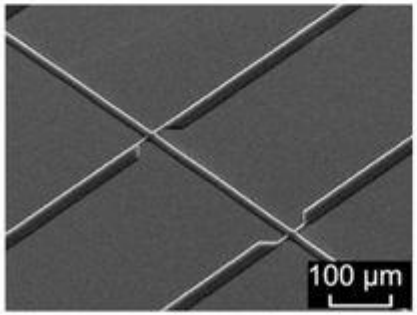


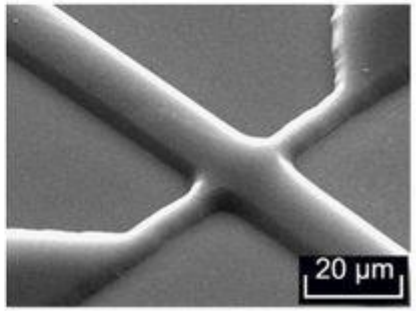
Examples.

Electrical transport









Current and voltage contacts with longitudinal and parallel configuration (left) and 10 µm interdigitated capacitor (right)

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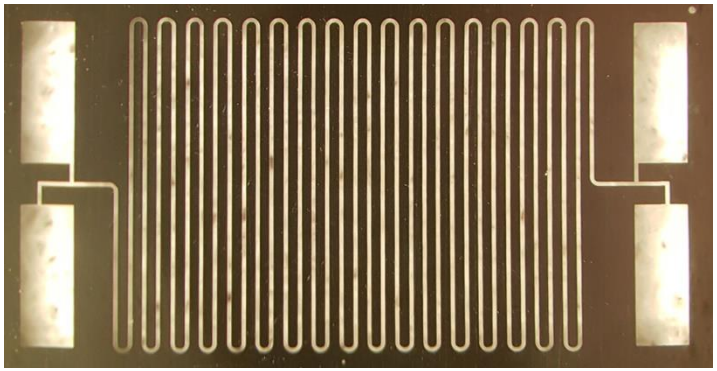
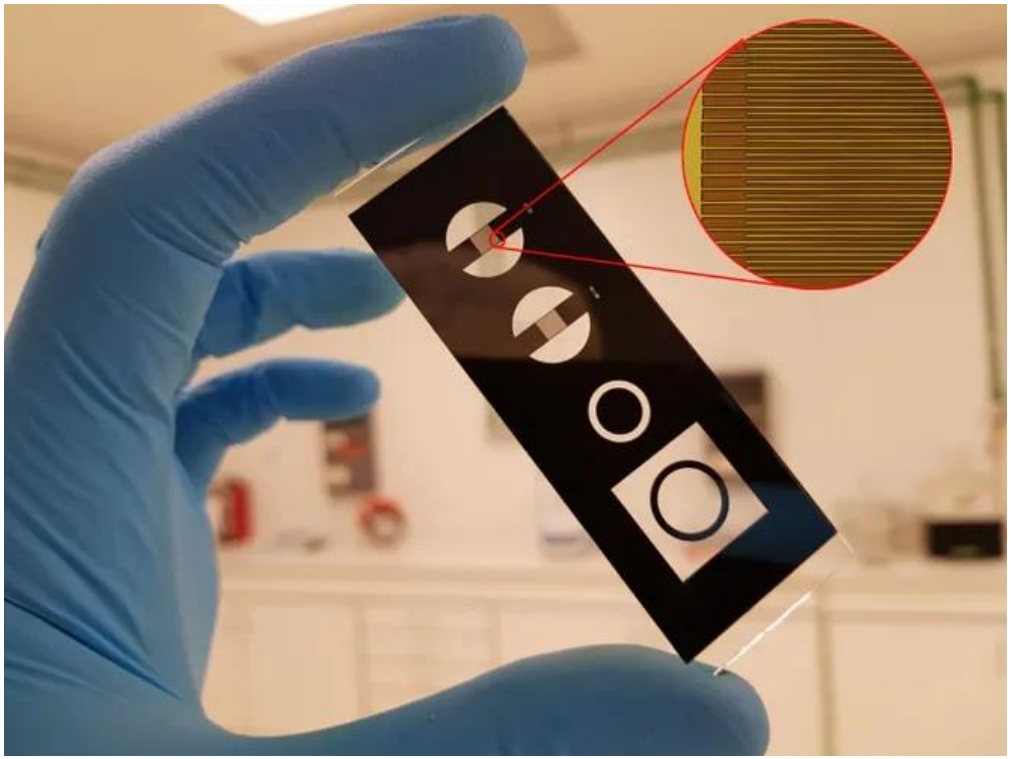
Examples.

Electrical transport



Mask for a platinum resistor for temperature measurement (40um track)



Full microscope slide mask with small 12um features

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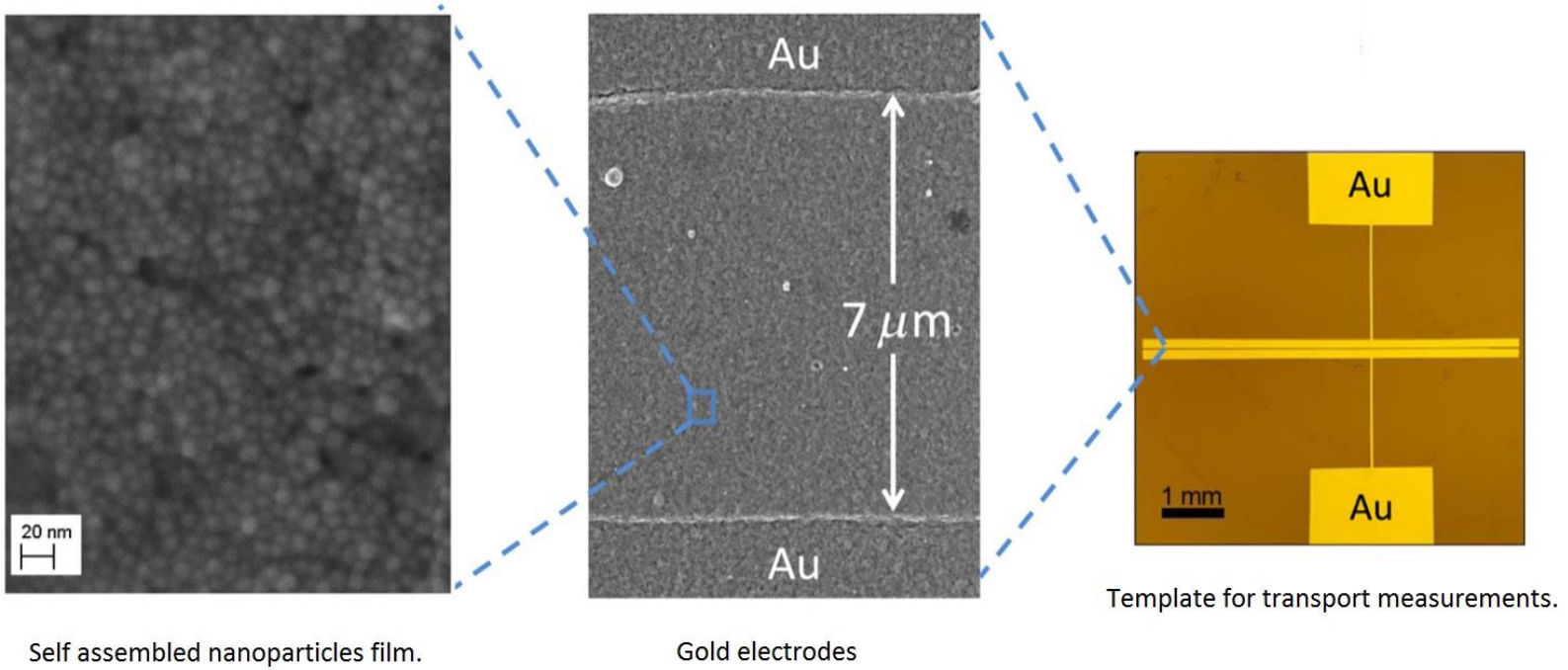
Tunnel Magnetoresistance in Self-Assemblies of Exchange-Coupled Core/Shell Nanoparticles

Fernando Fabris,[1] Enio Lima Jr.,[1] Cynthia Quinteros,[1] Lucas Neñer,[1] Mara Granada,[1] Martín Sirena,[1] Roberto D. Zysler,[1] Horacio E. Troiani,[1] Victor Leborán,[2] Francisco Rivadulla,[2] and Elin L. Winkler[1,*]



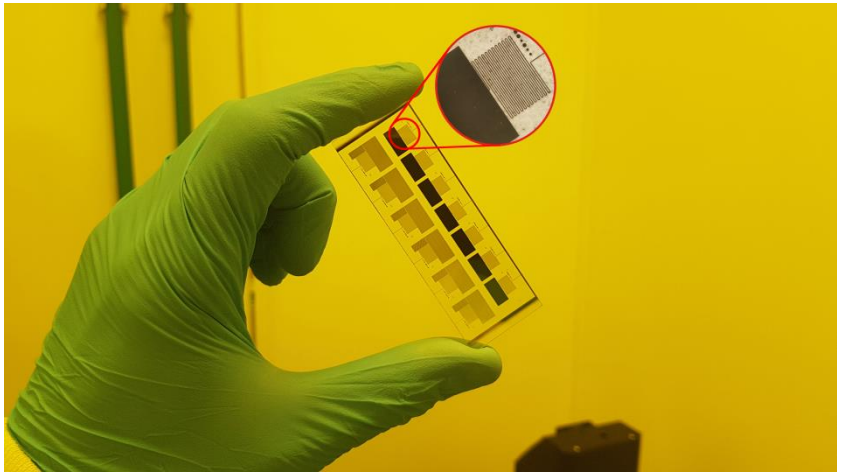
Self assembled nanoparticles film.

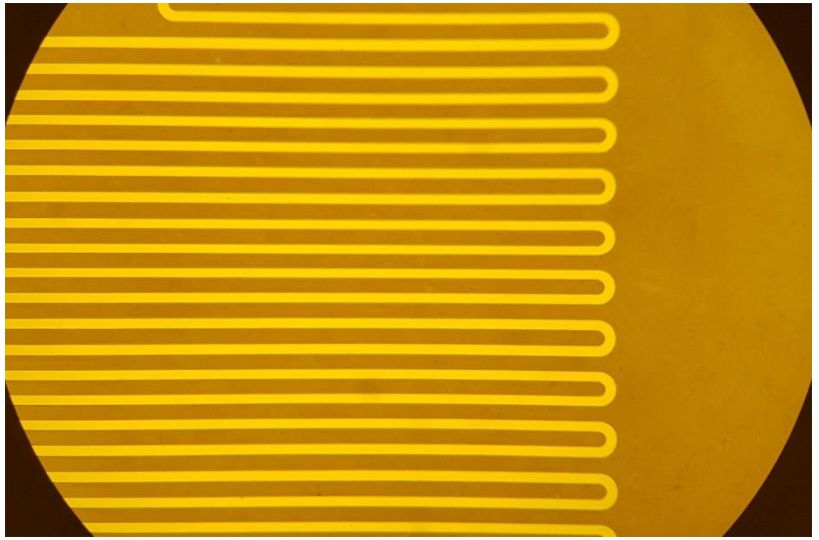
Gold electrodes

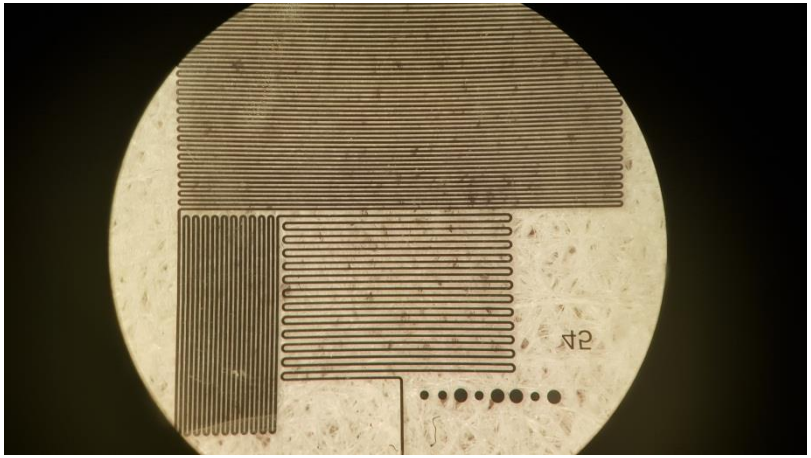
Template for transport measurements.

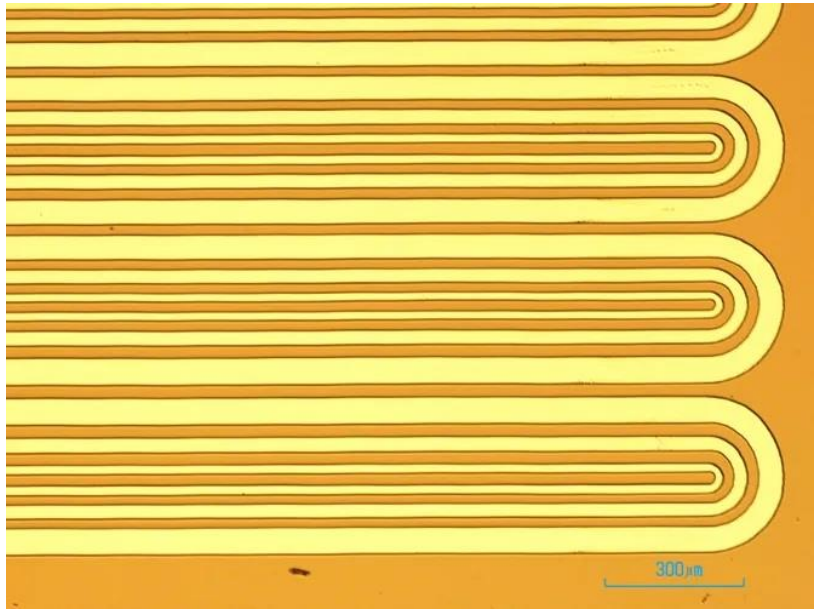
Transport template: Self assembled nanoparticles film.
Gold electrodes 7 μm separation over several millimeters

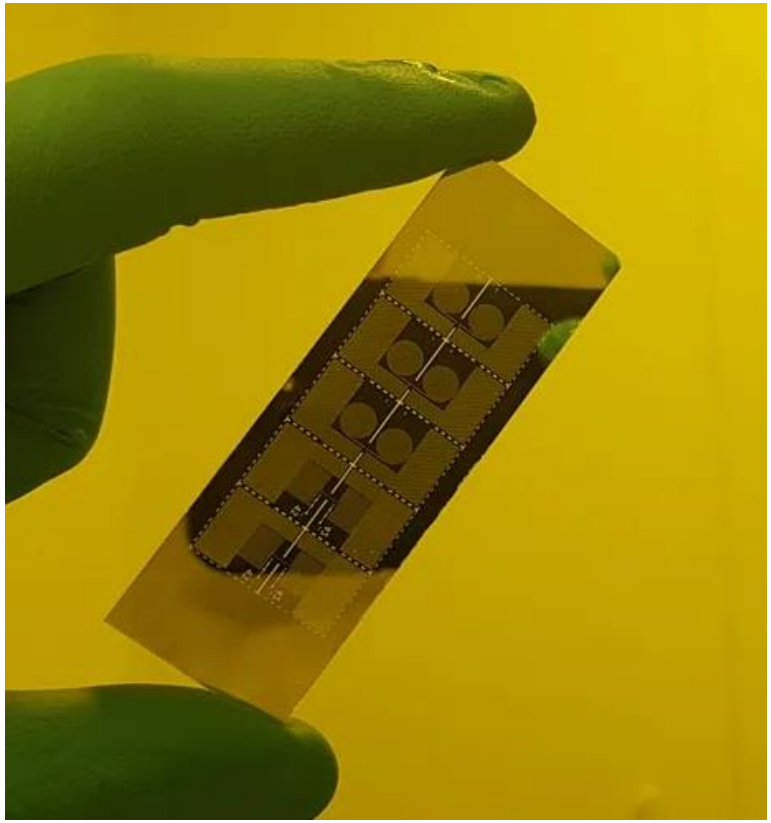
Microfluidic applications

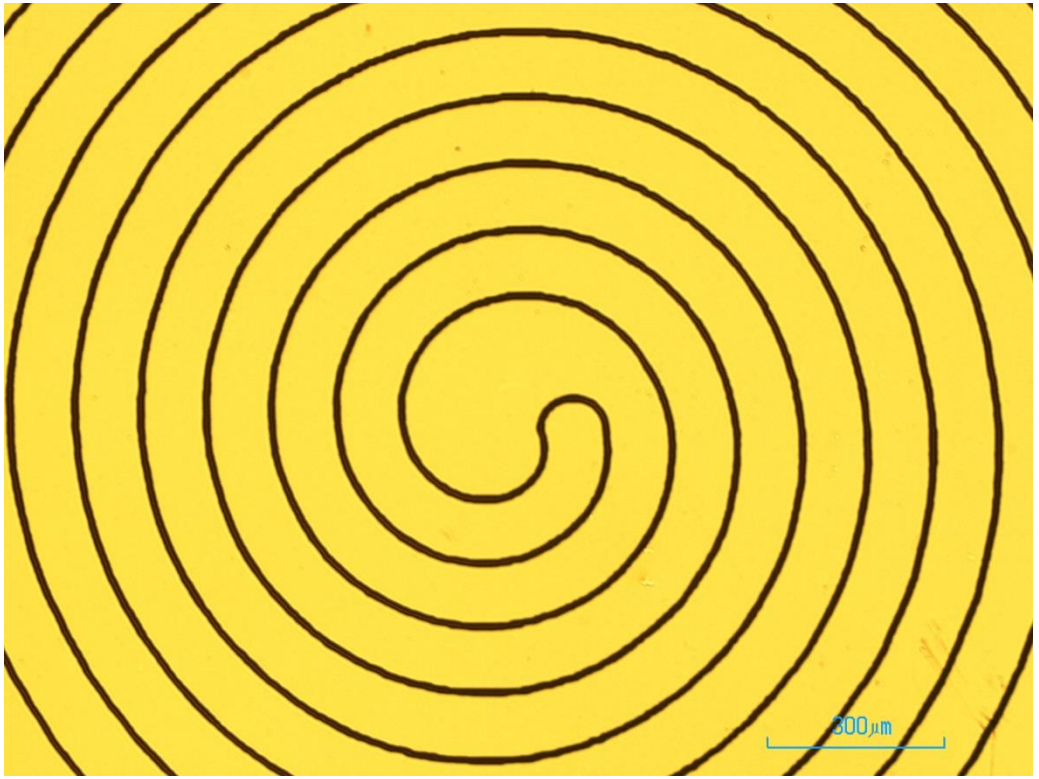












Curved and very long 10um microchannels

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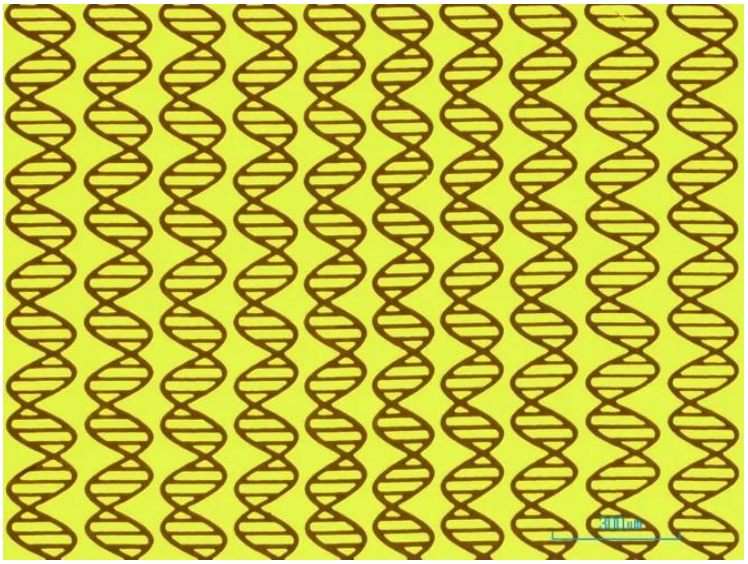
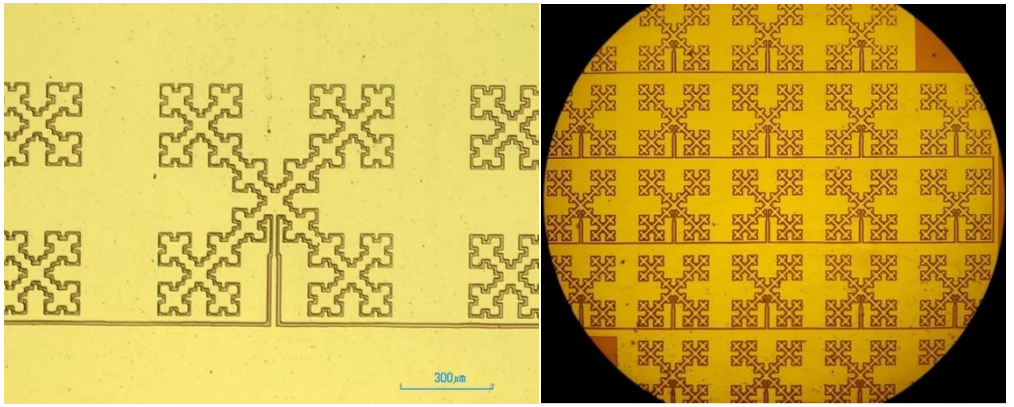
Others

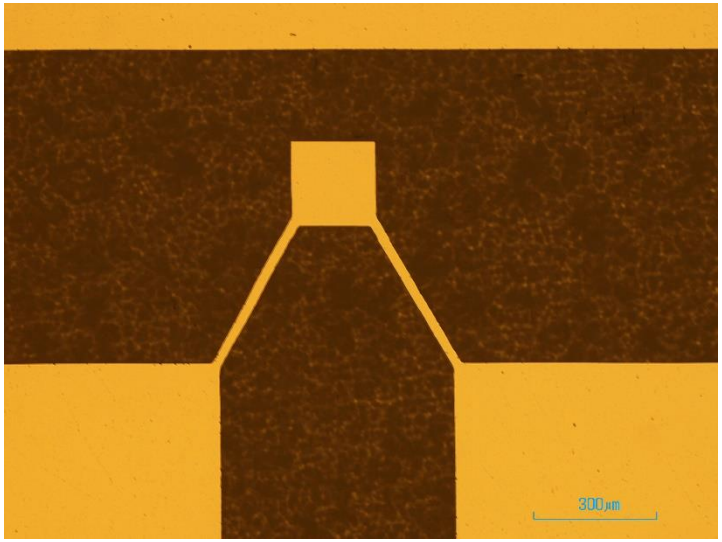


ADN diffraction grating



Fractal micro antennas

Positive and negative writing



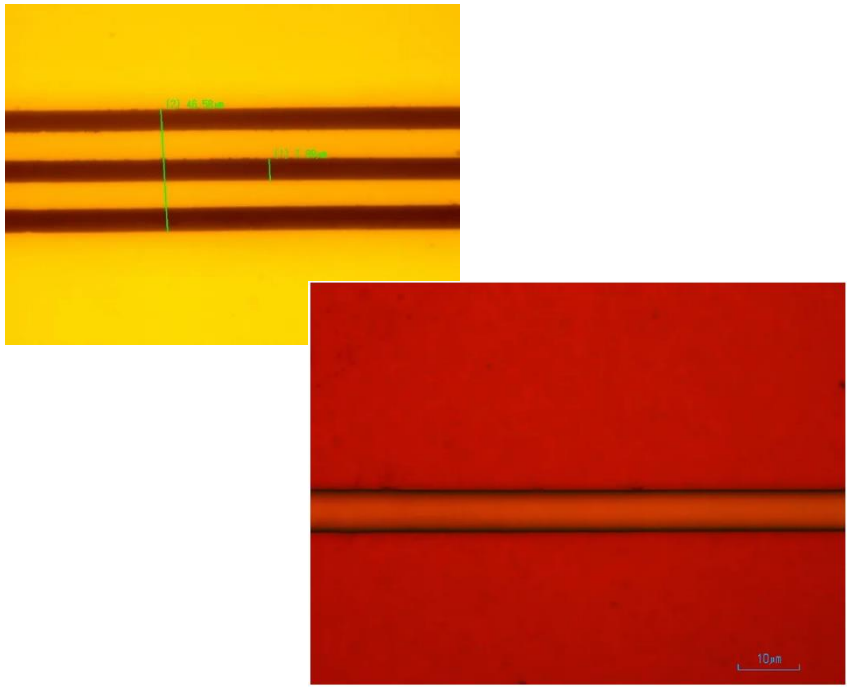
MEMS oscillator photomask

100 µm

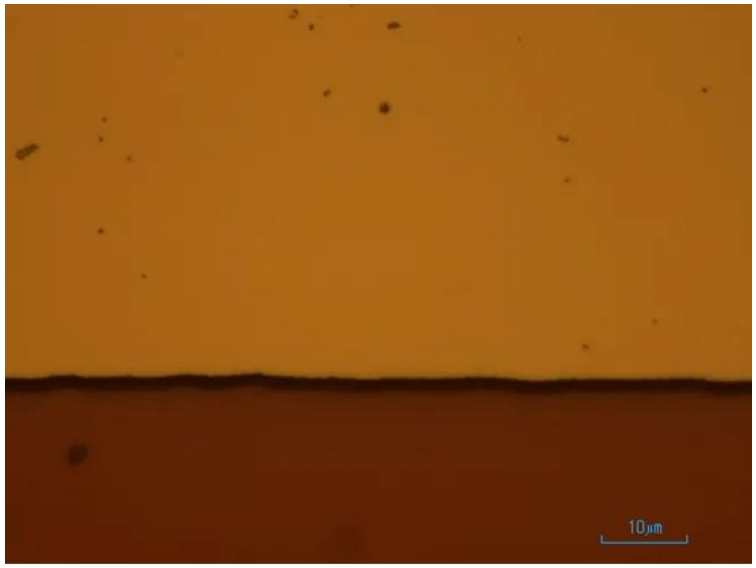
Tests

-Thermally controlled room.
-Pneumatic table (it's for isolation of external vibrations)
-Flat substrates (glass, silicon wafers)
-Using the recommended parameters, Standard exposition and developing times

All the previous examples and the following tests are performed using standard everyday conditions.



Fast (Y) axis mechanical noise



Slow (X) axis mechanical noise

- recommended minimum feature size: 10 µm
- writing time of a 25x75mm design at 0.8um unidirectional mode: 20hs

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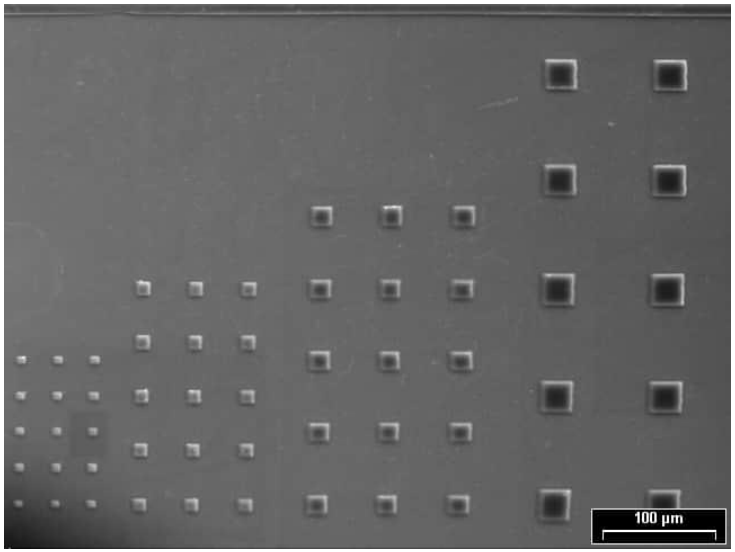
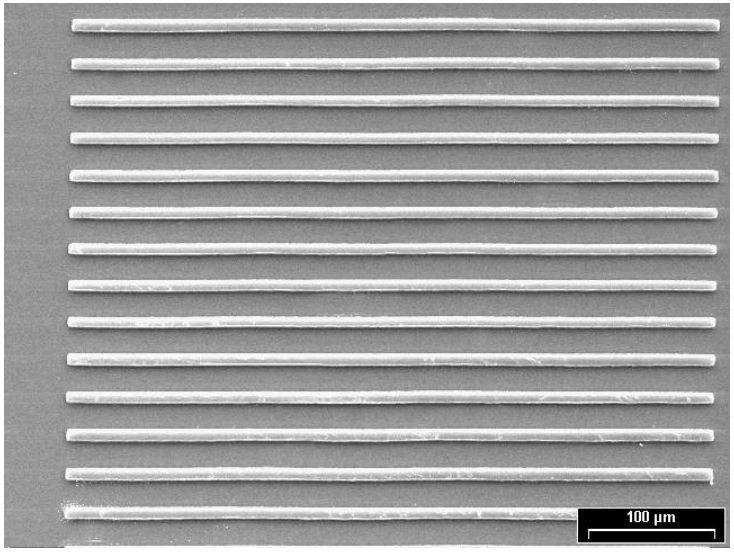
Tests





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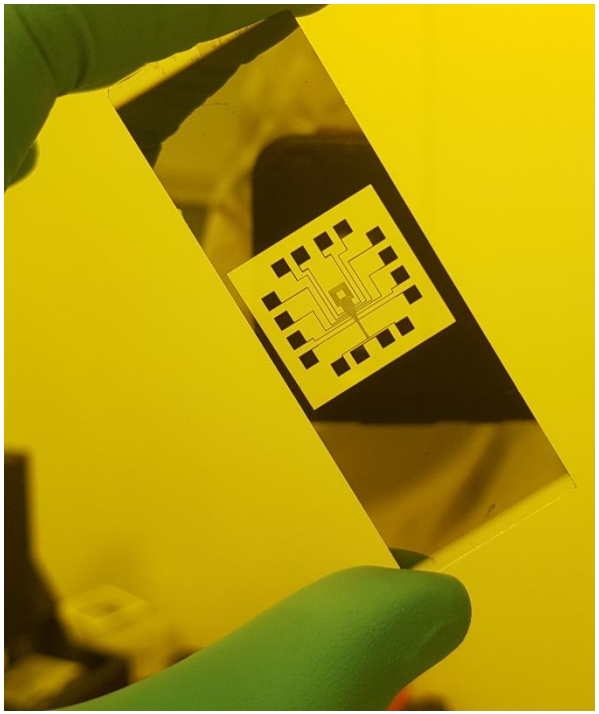
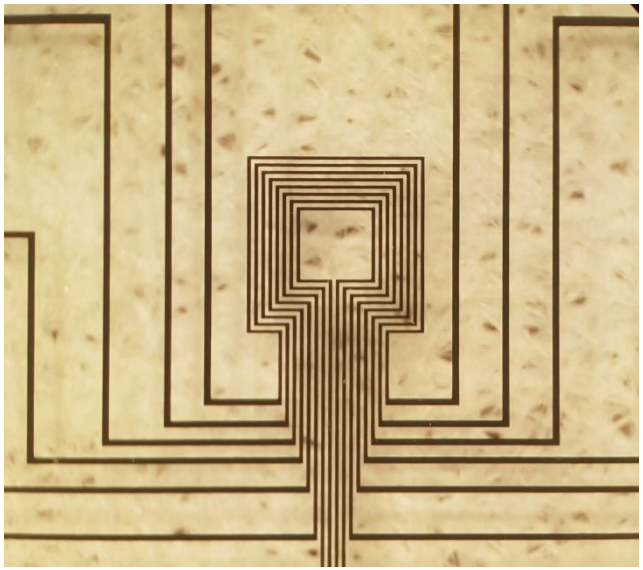
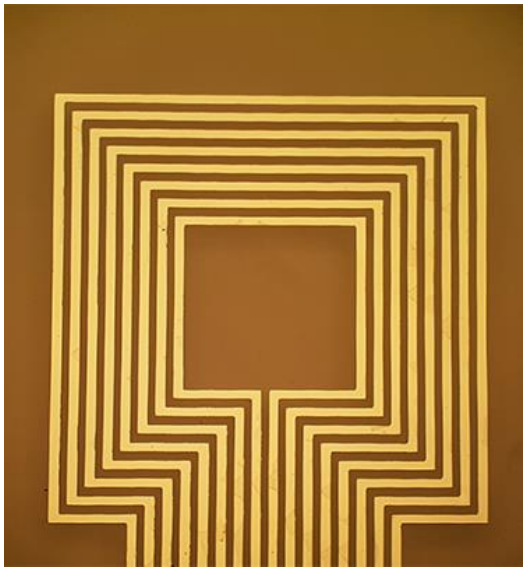
Low resolution (fast) mode

This is using the 4x objective with 5um raster step

- The tracks of the example are 50um
- This writing took about 80min in unidirectional mode (40min in bidirectional mode)







Very useful for electrical contacts for wire bonding, planar transformers, etc.

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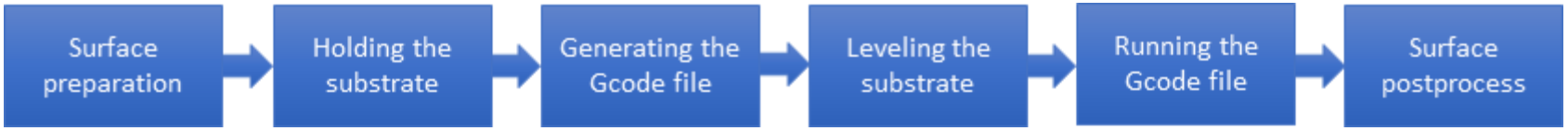
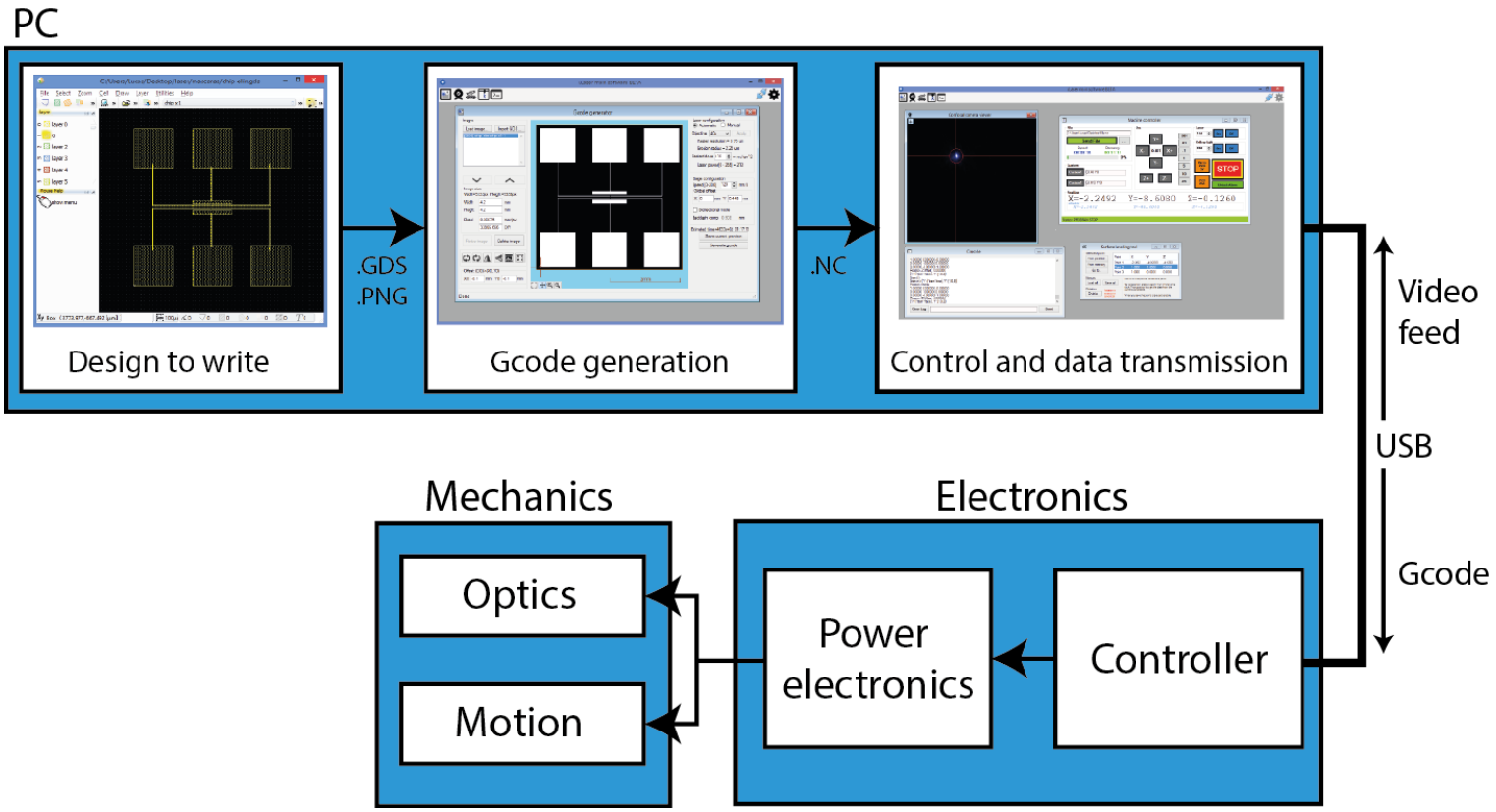
Software.

Typical flow of writing process



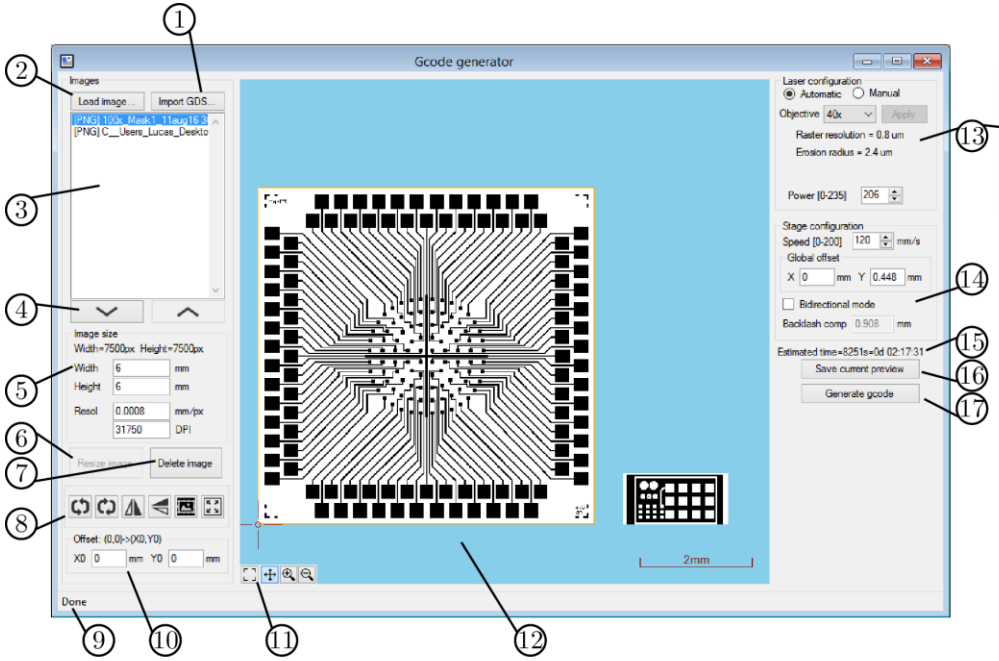


Software.

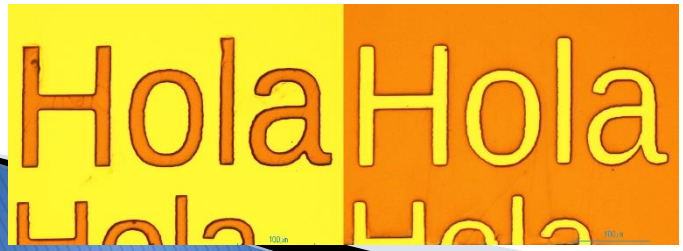
Gcode generation

- Imports one or more cells from GDS files
- Imports PNG files
- Full rescaling and rotation(90deg steps)/mirroring/inversion/border support
- Multiple imported designs on one project

- Recommended step configuration for provided objectives already on the software
- the user can change almost all the configurations manually for experimentation
- Full GPU based algorithm to achieve accurate clear field and dark field features



1:Imports a GDS file
2:Imports a PNG file
3:List of images for writing
4:Changes the writing order of the images
5:Image resizing panel
6:Applies a resize operation
7:Deletes the selected image
8:Transformations panel
9:Status bar
10:Offset of the selected image
11:Mouse function on the preview
12:Preview
13:Laser power and resolution panel
14:Stage configuration panel
15:Estimated time
16:Saves the preview as an image
17:Generates the gcode file



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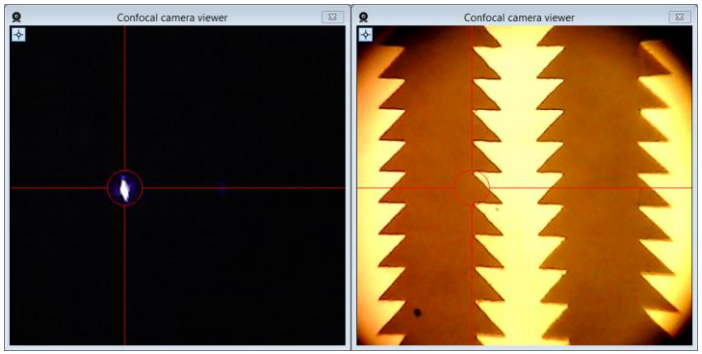
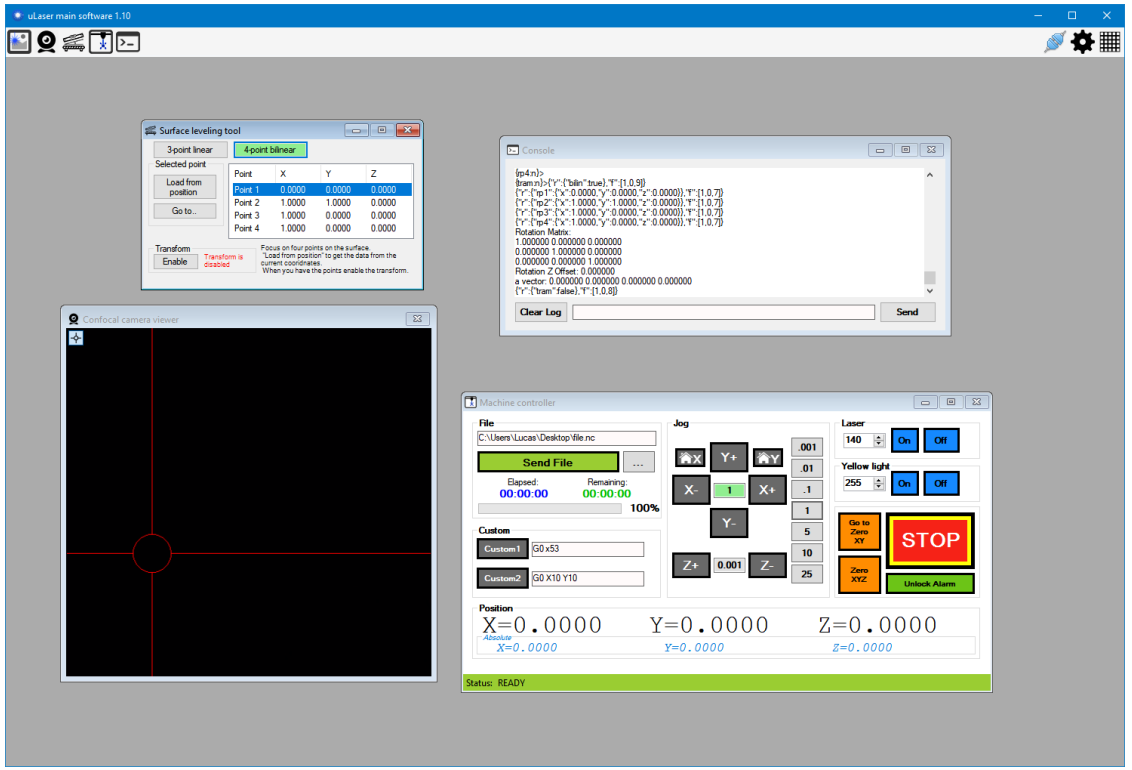
Software.

Machine control

- For someone familiar to 3d printing or CNC the controls are similar and easy to learn
- The confocal camera is used for focusing the laser around the area to write, on 3 or 4 points to level the surface.
- It can also be used as a microscope with yellow confocal light.





Applications and client segment

The best use is as a complementary tool of mask aligners. Fabrication of masks for a wide range of applications.

Research and development for Start ups, Universities and research groups.

Educational purposes

Universities, research groups working with thin films, simple lithography tasks (e.g. contact fabrications), device development, microfluidic applications, micro-electrical machines (MEMs), Bio-MEMs, etc.

Advantages:

- Low cost.
- very robust and simple
- Reduced requirements and easier maintenance

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