SWISS PHOTONICS

SNAPP

Swiss National Applicaton Laboratory for
Photonic tools and Photonic manufacturing

Details of SNAPP

Look into the laboratories of the partner

Swiss National Photonics Labs

SNAPP

Swiss National Applicaton Laboratory for Photonic tools and Photonic manufacturing

History:
The SNAPP group was formed in 2009 and consists of the following four laboratories today, with the following contact persons:

- **EMPA Thun**, Prof. Dr. Patrik Hoffmann
- **UAS Burgdorf**, Prof. Dr. Beat Neuenschwander
- **UAS Windisch**, Beat Lüscher
- **ETH Zürich**, Josef Stirnimann

+ 2 other interested partners from academia and industry

UAS = University of Applied Sciences (Fachhochschule)

Why SNAPP?

- The laser laboratories in Switzerland are relatively small, compared to foreign laboratories
- They are mainly publicly funded (State, CTI, SNF, Industrial service projects, ...) and have a relatively small budget in contrast to foreign labs
- The equipment is expensive → share equipment
- Contact point for industrial partners
- The laboratories are usually focused on a specific area.

Target: ***success together!***

Fields of activity

- Different type of laser sources and their applications (wavelength, pulse width, power, ...)
- Material processing with laser (micro to macro)
- Laser beam delivery (all optical components)
- Medical sector, space technology and aerospace, renewable energies (solar cells, coatings, …)

Target: ***common projects in R&D!***

Organisation

- Meeting of the core team every three months
- Each meeting will be held at one of the partners, with a visit of the laboratories
- Each meeting focuses on one topic (for example: ultrashort pulsed lasers, tribological structures, coatings, ...)
- Organisation of workshops and courses on SNAPP specific areas

Swiss Photonics GA and Workshop

SNAPP: FHNW Laser Lab

3D-Laser micro material processing

Laser sources:

wavelength	355 nm	355 nm	1064 nm	1064 nm
output power	5 W	7 W	15 W	15 W
M2 (TEM00)	< 1,3	< 1,3	< 1,3	< 1,3
pulse width	< 10 ps	< 12 ns	< 10 ps	< 20 ns
min. repetition rate	5 kHz	50 kHz	5 kHz	cw
max. repetition rate	1000 kHz + 8x Burst	300 kHz	1000 kHz + 8x Burst	64 kHz

Beam guiding :

– XY Scanner with varioscan in Z (digital)

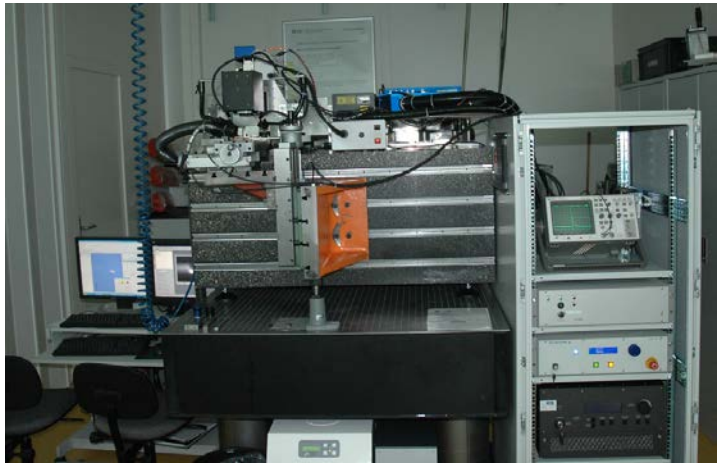
– XYZ axis + 4th axis (rotary axis) CNC axes

– focusing optics from 32mm until 250mm

Control & software:

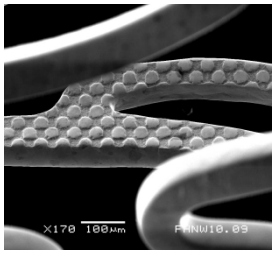
– PC interface board: Scanlab RTC5

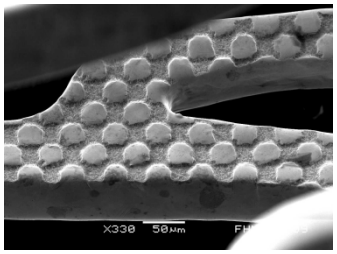
– Software: Scaps SAM3D

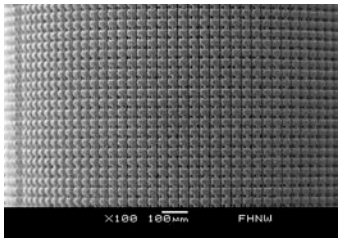


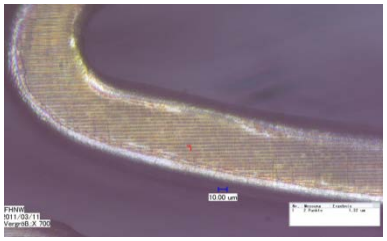
application examples 3D-Laser micro material processing

3-D cavities in metals, plastics, …

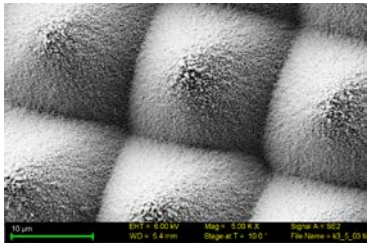


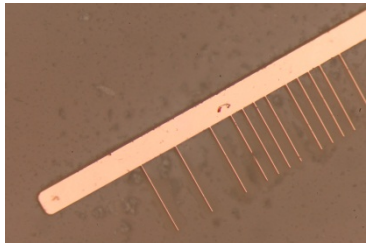






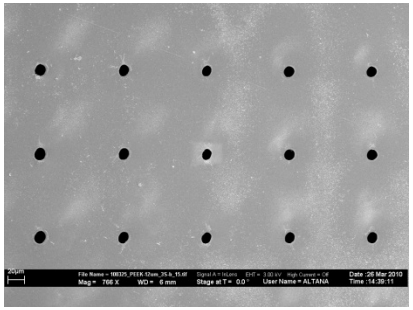
microstructures in stents 1 – 20 **µ**m



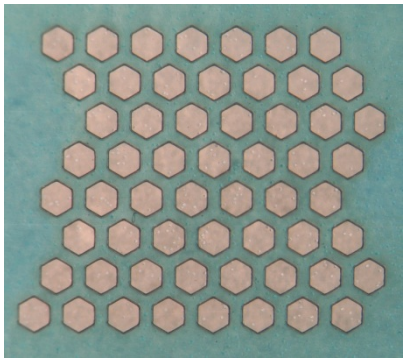


microstructures and geometries in ceramics 20 µm

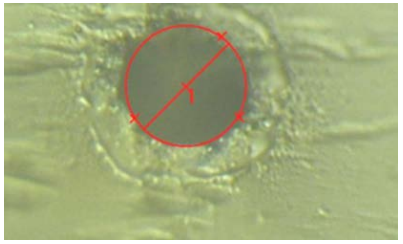
Bearbeitung von Kunststoffen + Folien



holes in PEEK 20 µm



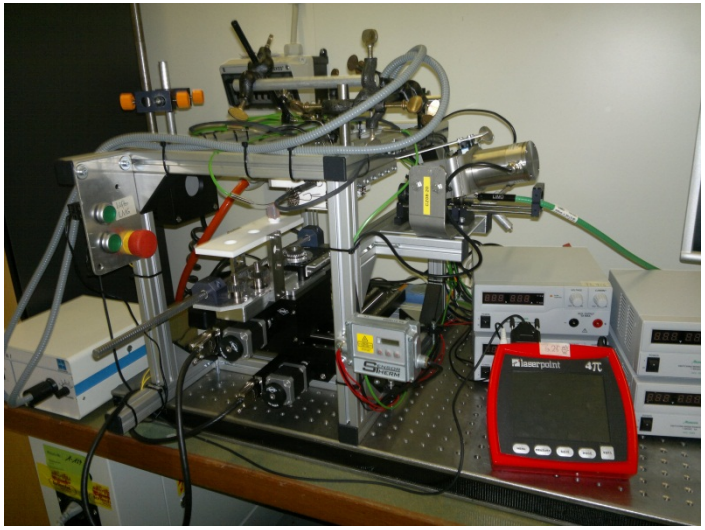
microstructuring high-performance polymeric100-800 µm



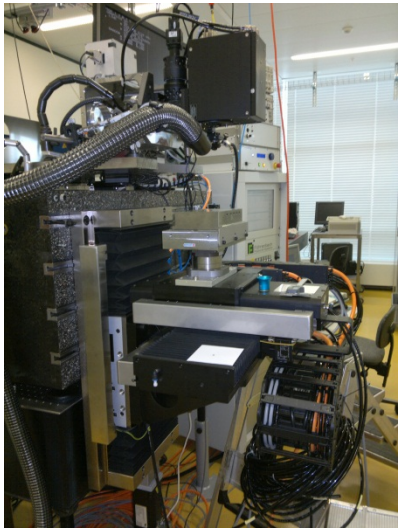
holes in PC 12µm 300µm depth aspect ratio 25

Core competencies of FHNW

- 3D-laser micro material processing
- Laser processing of plastics
- FHNW is able to build prototype systems



System for medical (confidential)



ps-lasersystem with linear axes

ps-lasersystem for structuring of solar cells

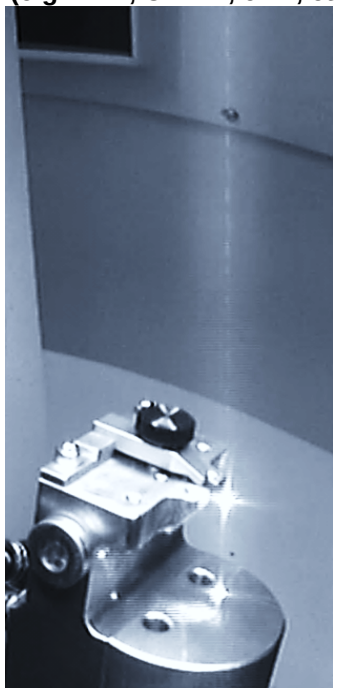
Swiss Photonics GA and Workshop

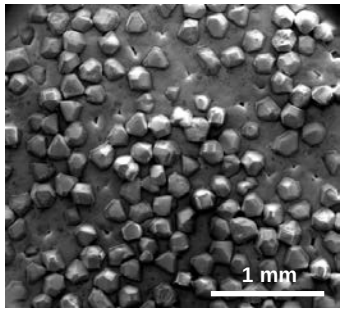
SNAPP: IWF – Inspire Laser Lab

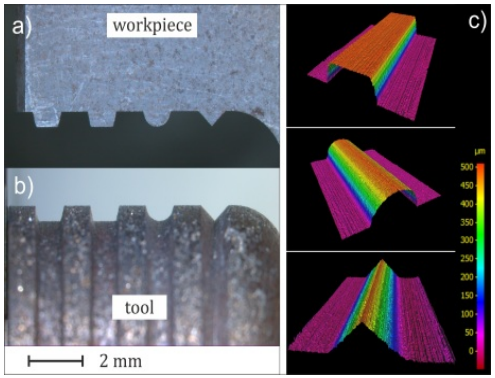
Research in laser micromachining at IWF-Inspire

Laser machining of ultra hard materials

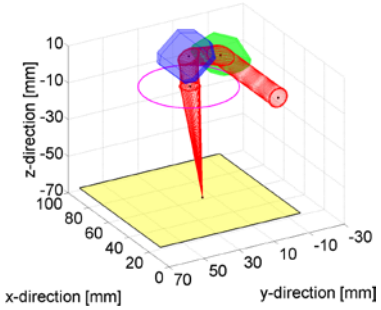
(e.g. PKD, CVD-D, cBN, etc.)

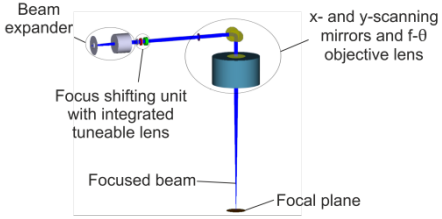




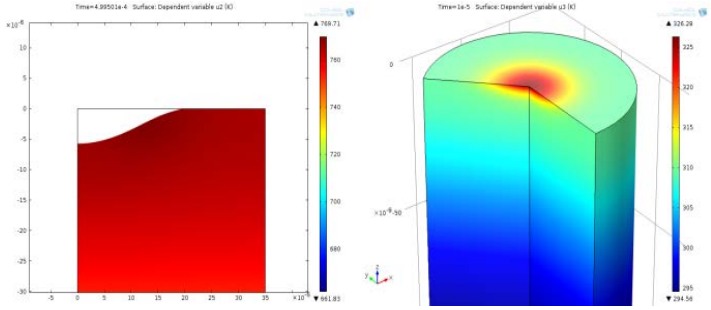


Simulation of scanning units

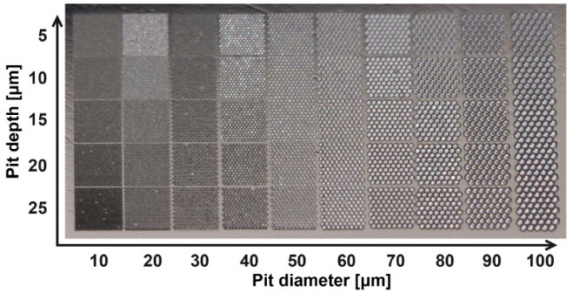




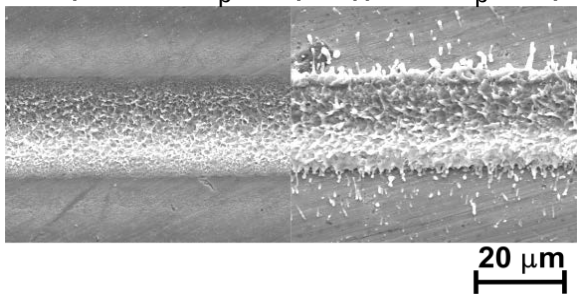
Simulation of short and ultrashort laser pulses



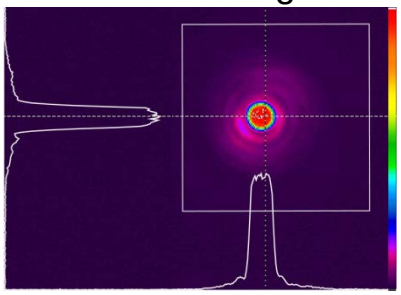
Laser treating of BMG



Comparison τ_p=10ps (l) und τ_p=50ps (r)

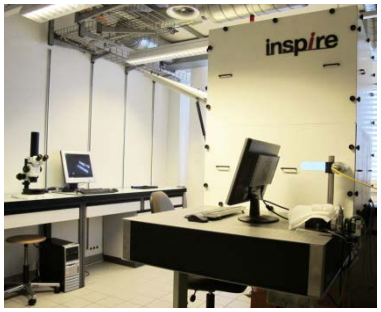


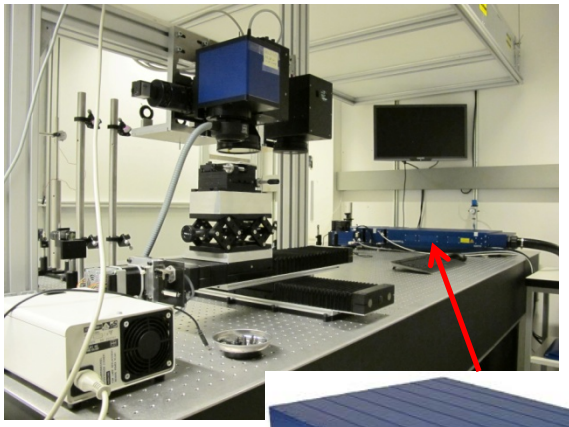
Beam forming



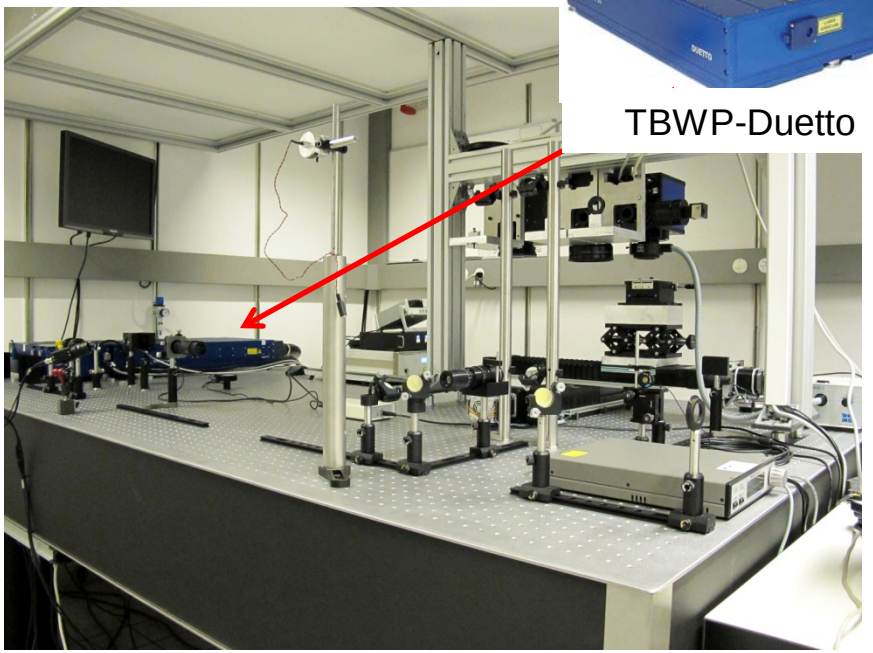
Micro machining lab

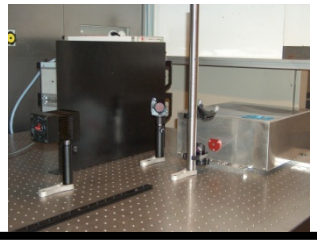
ETH Zürich





TBWP-Duetto





SWISS PHOTONICS

ETH Zürich

Equipment micro machining lab

Laser	λ [nm]	τ_p	P_{avg} [W]	e_p [µJ]
IPG YLP-HP	1064	125 ns	100	1000 @ 100 kHz
Trumpf VectorMark compact	355	< 200 ns	0.7	20 @ 35 kHz
Time-Bandwidth Duetto	1064, 532, 355	10 ps	10-15	200 @ 50 kHz
Trumpf TruMicro 5050	1030	10 ps	50	125 @ 400 kHz
OneFive Katana-10 HP	1064	30 ps	10	10 @ 1 MHz

IPG YLP-HP
Faserlaser

Trumpf VectorMark

Time-Bandwidth Products
MOPA DPSS-Laser

Ownership IWF-inspire

Trumpf TruMicro 5050

OneFive Katana-10
HP Prototyp

On loan for projects

ETH Zürich

Equipment macro machining lab

Laser	λ [nm]	τ_p	P_{avg} [W]	e_p [µJ]
Trumpf Trulaser Cell 7020	10'600	cw	5000	-

Trumpf TruLaser Cell 7040

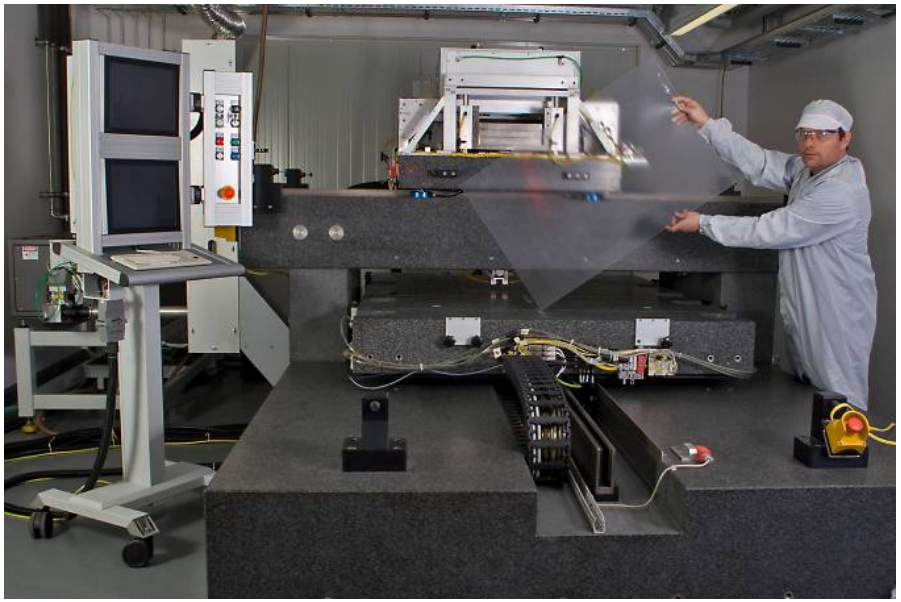
5-axis laser machining center with 3 laser heads for laser cutting, -welding and -deposition

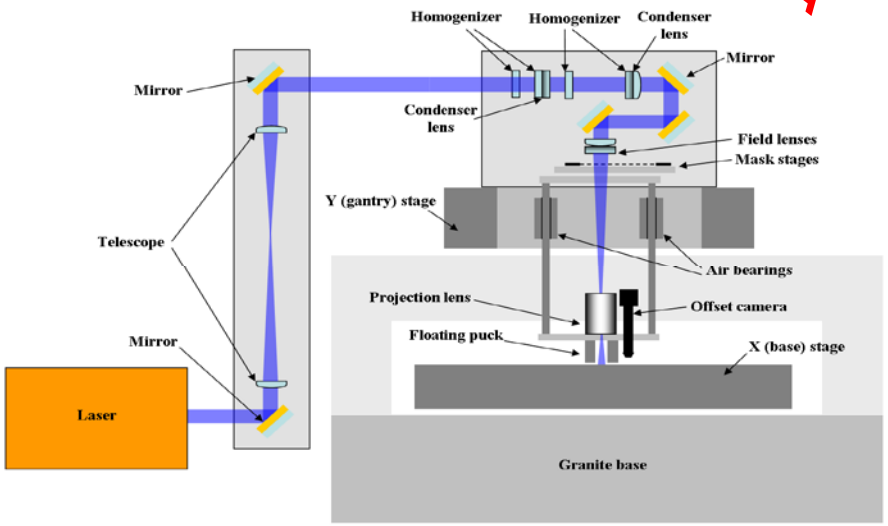
Swiss Photonics GA and Workshop

SNAPP: EMPA Thun Laser Lab

Exitech PPM-601E Gen6 Tool

EMPA





Specification	Unit	X-axis	Y-axis
		Spec	Spec
Travel	Mm	> 2200	> 1450
Payload	Kg	~ 115	~ 280
Speed	mm/s	200	360
Acceleration [1]	m/s²	0,75	1
Resolution	µm	0,04	0,04
Bi-directional repeatability	µm	±2	±2
Accuracy (before calibration) [2]	µm	±4,5	±3
Straightness, bi-directional	µm	±2	±1,5
Flatness, bi-directional	µm	±5	±5
Roll, bi-directional	Arcs	2	1
Pitch, bi-directional	Arcs	2	1
Yaw, bi-directional	Arcs	2	2
Orthogonality (after calibration)	Arcs	2	

Some highlights

- 3 m^2 exposure area
- Ultra high precision: x/y axis < 40 nm resolution (laser interferometer based encoders)
- Repeatability 3 um over full travel (+/- 1.5 ppm)

Wide range of materials can be ablated

Polymers

Metals

Glasses

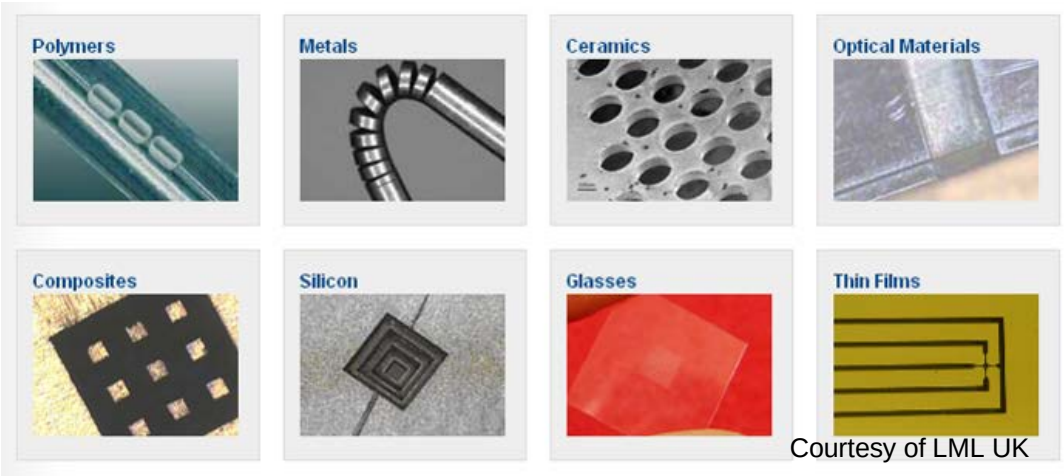
Silicon

Optical materials

Composites

Ceramics

Thin films



Courtesy of LML UK

Swiss Photonics GA and Workshop

SNAPP: UAS Burgdorf Laser Lab

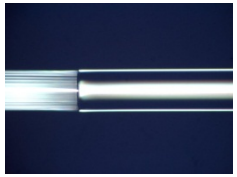
Institute for Applied Laser, Photonics and Surface Technologies

Cometencies and Research Groups:

Site Burgdorf:

- Laser Surface Engineering
  B. Neuenschwander

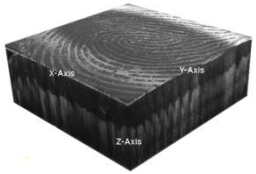
- Applied Fiber Technology
  V. Romano



- Thin Films & Surfaces
  P. Schwaller

Site Biel:

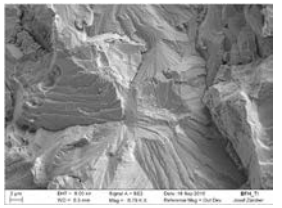
- OptoLab
  Ch. Meier



- Material Techn. & Heat Treat.
  J. Rufer

- Nanometrology
  P. Walter

- Lab for Material and Surface Analysis (M. Baak, J. Zürcher)



SWISS PHOTONICS

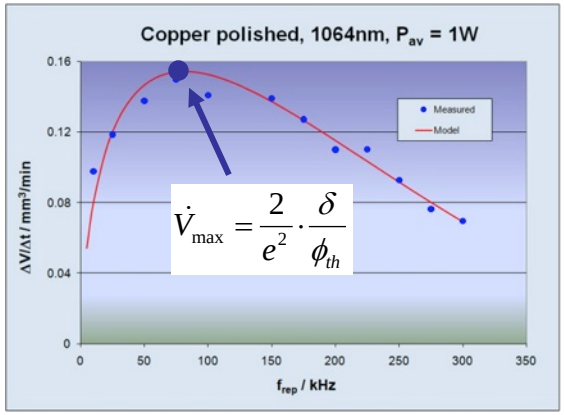
UAS Burgdorf

The Laser surface engineering group

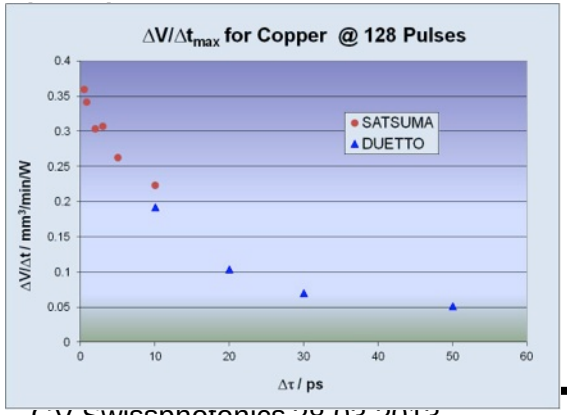
Laser micro-processing with ultra-short pulses

Efficiency

Maximize process efficiency

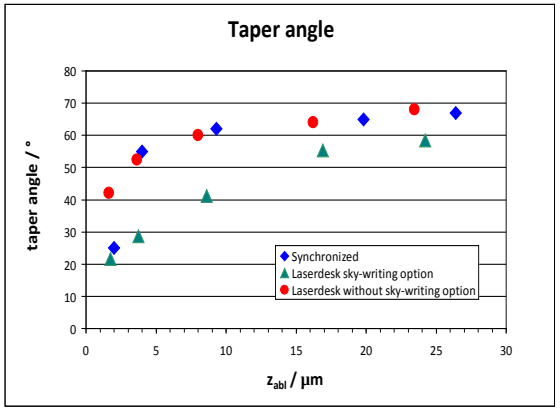


and use best suited pulse

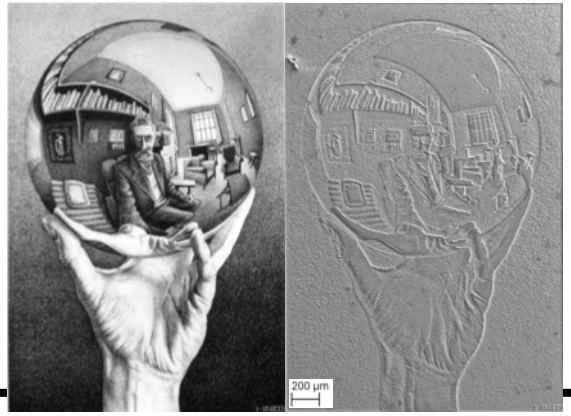


Strategy

Optimize the structuring

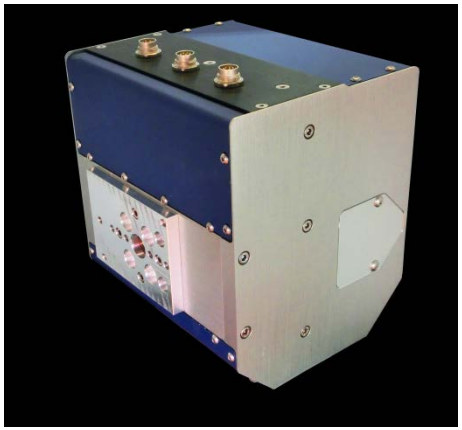


and synchronize axes with the

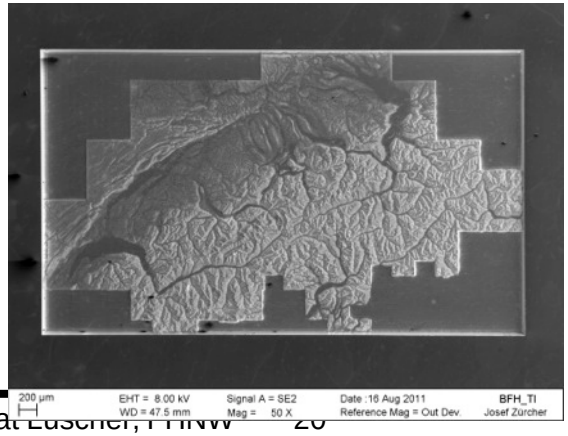


Throughput

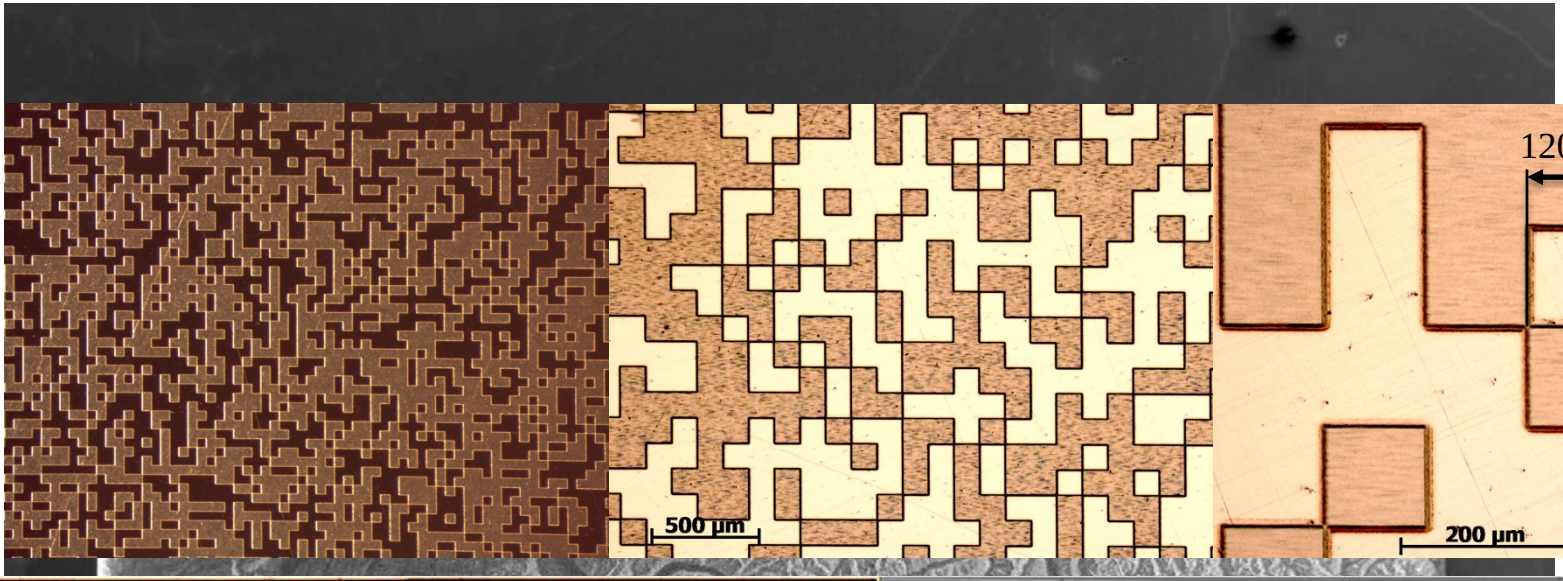
Use fast moving axes

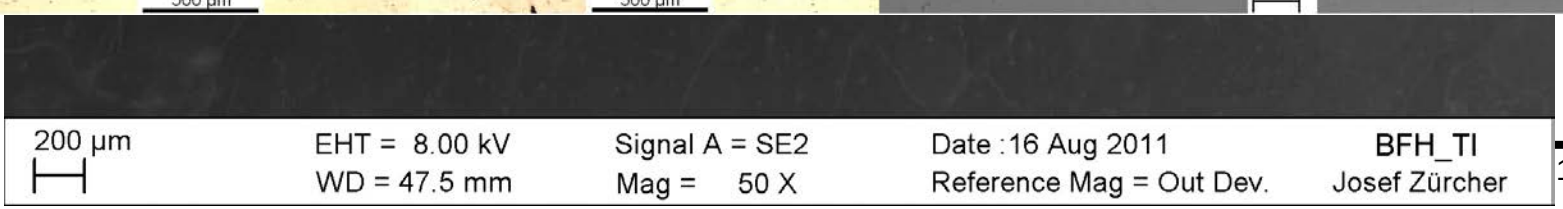


to obtain high throughput



Some Examples





UAS Burgdorf

Infrastructure

- Fully equipped “dust free” optical laboratory (clean room)
- FUEGO ps-Systm with 45W - IR
- DUETTO ps-System (with additional Amplifier for high energies and variable pulse duration up to 50ps)
- Scanner Systems for 1064nm, 532nm and 355nm,
  Intelliscan14$_{de}$ in synchronized mode for 1064nm and 532nm
- NextScan Line Scanner LSE170, synchronized with FUEGO System
- IPG ns NIR Fiber Laser ($\Delta\tau$ = 4, 8, 14, 20, 30, 50, 100, 200 ns; P_{av} = 20W)
- IPG ns Green Fiber Laser ($\Delta\tau$ =1.5ns, P_{av} = 5W)
- Laser Scanning Microscope LSM5 PASCAL for surface topography
- Modern SEM with EDX, AFM
- Coherent Verdi V6
- Coherent Diamond E150 CO_2 – Laser

Contact

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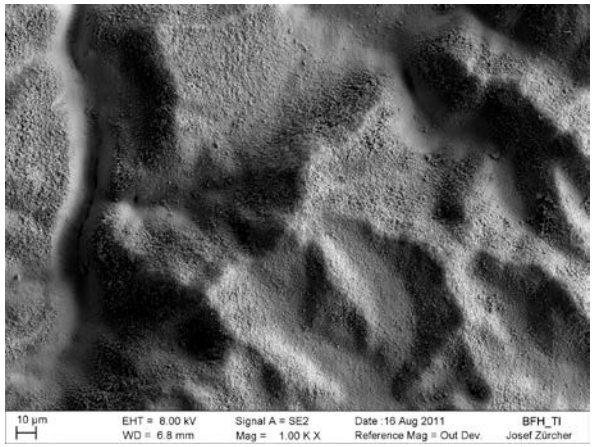
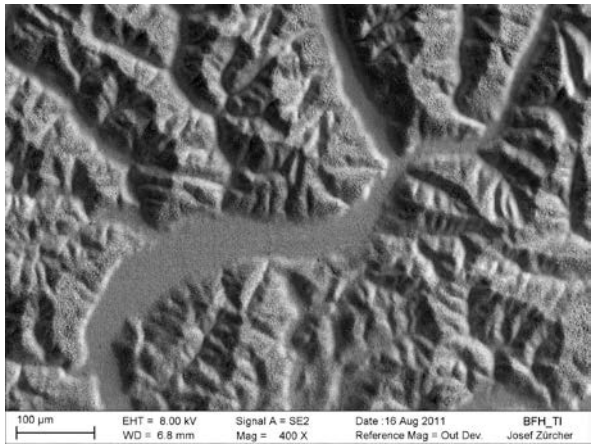
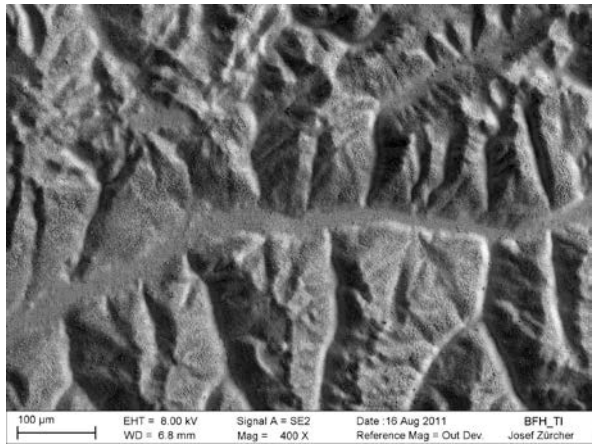


Eiger, Mönch and Jungfrau



Ticino



Valais