



LASER MICRO MACHINING IN THE WATCH INDUSTRY

EPHJ 2014

**Thomas Bewer
Head of Advanced Development**

Baar, 18.06.2014

Facts about TRUMPF

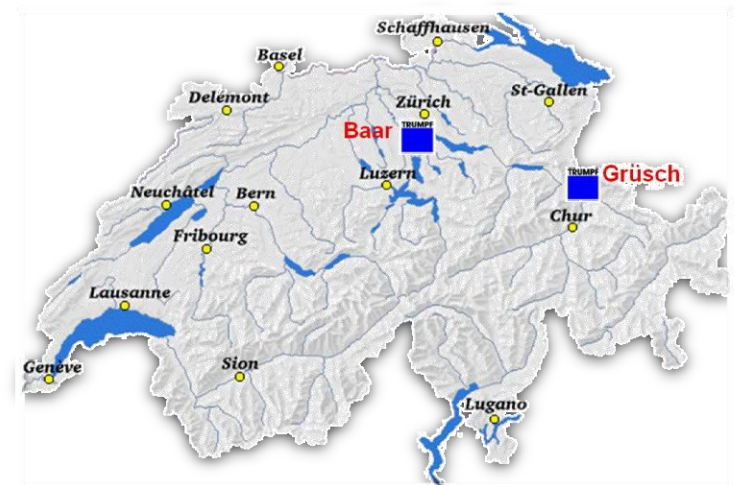
The TRUMPF Group is a technology and world market leader for industrial lasers and laser systems for sheet metal processing with emphasis on

- Cutting & Welding
- Marking & Micromachining (ablation, drilling, patterning, ...)



- Family business since 1923
- Approximately 10.000 employees worldwide
1.400 employees in R&D
- 58 subsidiaries worldwide (R&D, Sales & Service)
CH locations: Grüşch and Baar

<http://www.ch.trumpf.com/>



TRUMPF Laser portfolio

For every application the right laser und the right wave length

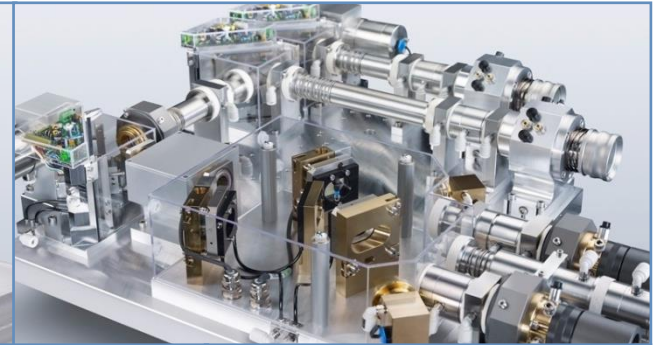
CO₂-Laser
TruFlow & TruCoax



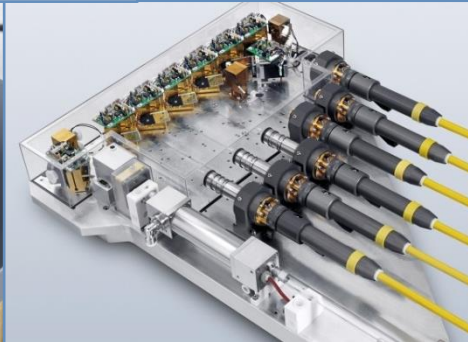
Disk laser
TruDisk



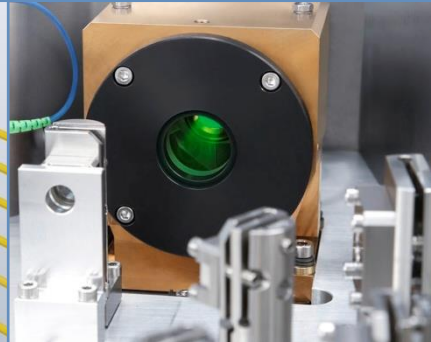
Diode laser
TruDiode



Fiber laser
TruFiber



pulsed SSL
TruPulse



(Ultra-)shortpuls laser
TruMicro

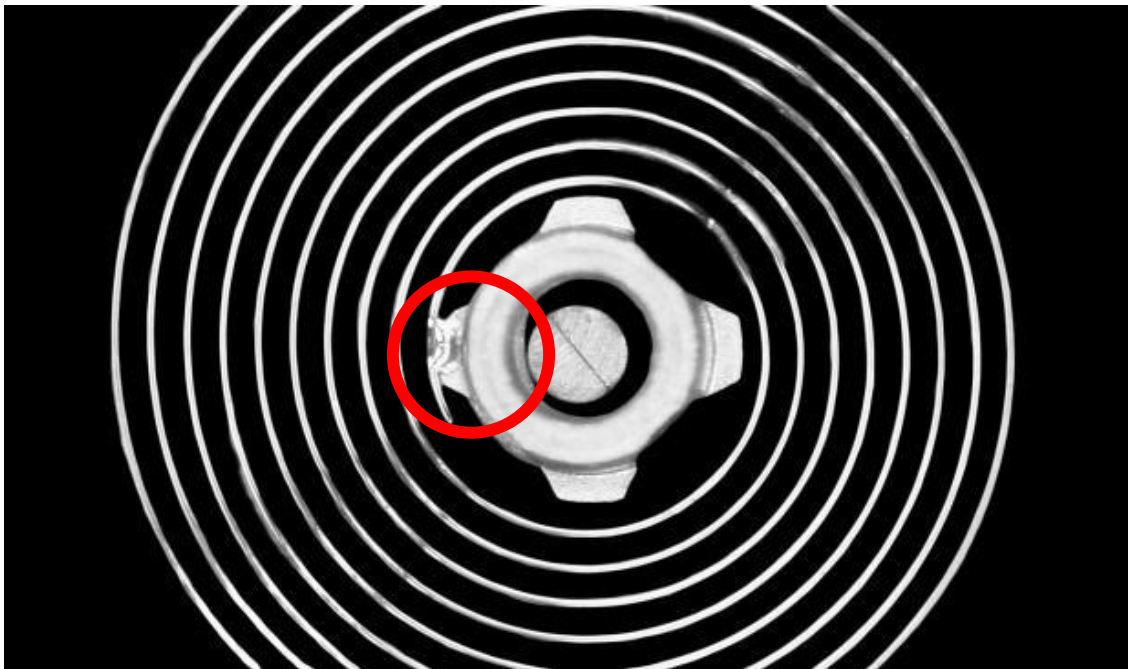


Marking laser
TruMark

„Historical“ application: Mikro welding with ns lasers

Type of laser: TruFiber ($M^2 < 1,1$; $P = 200 - 400 \text{ W}$), TruPulse 21
 Machine: 3 axis, XY-accuracy of 0,005 mm
 Material: CuBe, Laiton, gold, stainless steel

Examples: balance wheel, wristband, Lünette

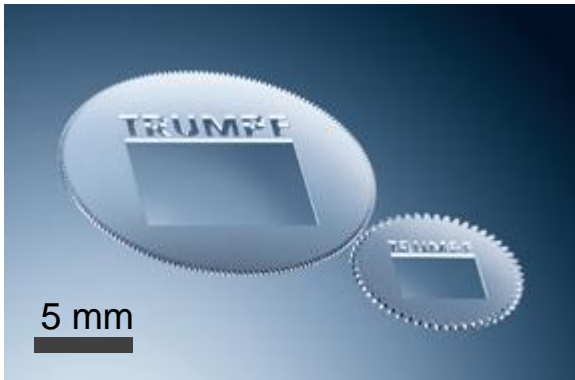


Welding spot on a hair spring (Haas Laser)

„Classical“ application: laser fine cutting

Type of laser: TruFiber ($M^2 < 1,1$; $P = 200 - 400 \text{ W}$)
 Machine: 3 axis, XY-accuracy of 0,002 mm
 Material: CuBe, Laiton, gold, stainless steel, ruby

Examples:
 escapement, gear wheel, hands, bearings



gear wheels



Bearing stones



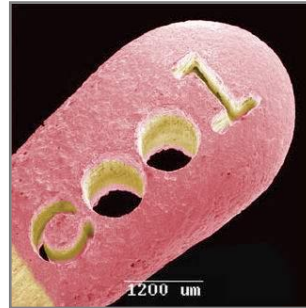
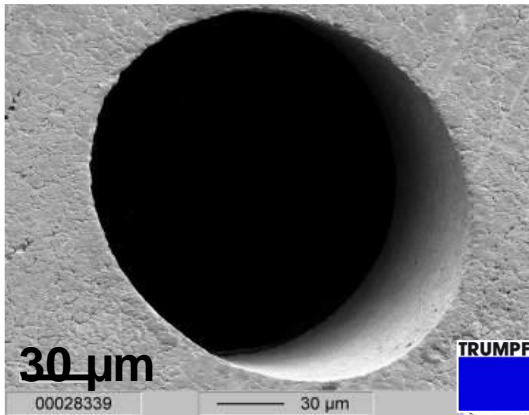
hands



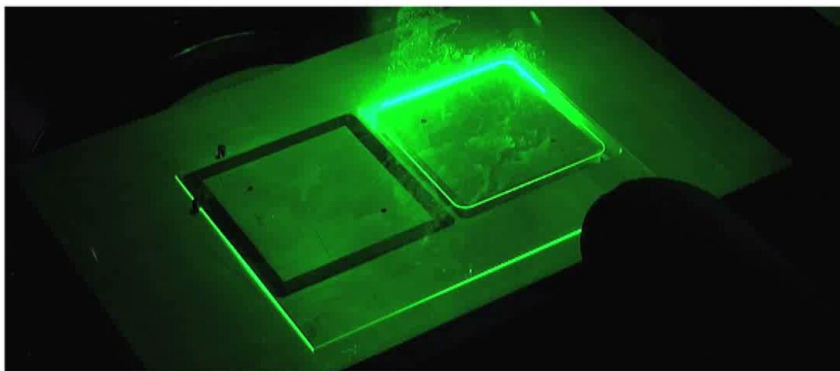
TruFiber

Ultrashort pulses do it better

ps and fs Pulses allow „cold processing“



ps laser are an industry-established tool which run 24/7 in several hundred units



Video: cutting glass with the TruMicro

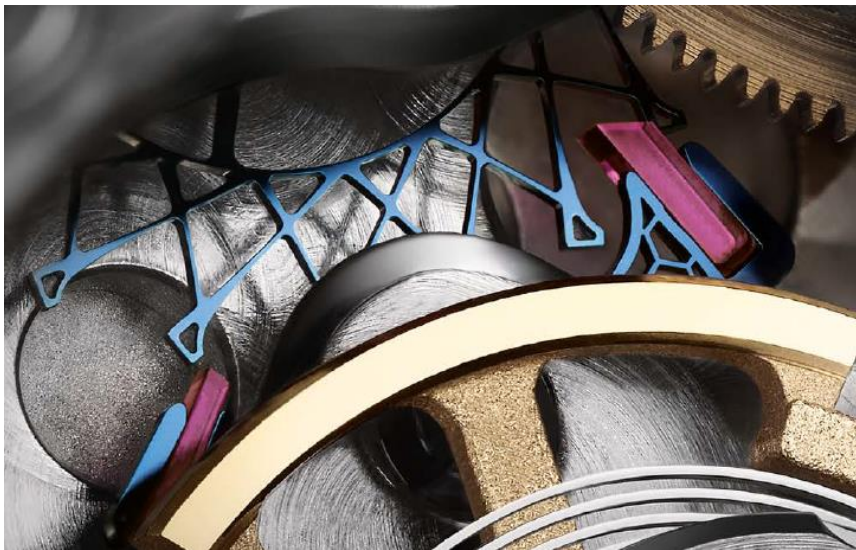


DEUTSCHER ZUKUNFTSPREIS
Preis des Bundespräsidenten
für Technik und Innovation

Micro machining with ps laser

Type of Laser: TruMicro Serie 5000
 Machine: 3-5 axis, XY-accuracy of 0,002 mm
 Material: sapphire, silicon, Si3N4, CuBe, Laiton, gold, Durnico, ceramics, Sandwich Materials

Examples: Cutting of gear wheels, Cutting of silicon escapement wheels, Cutting/Drilling of cover glasses, Drilling and ablating of ceramic cases



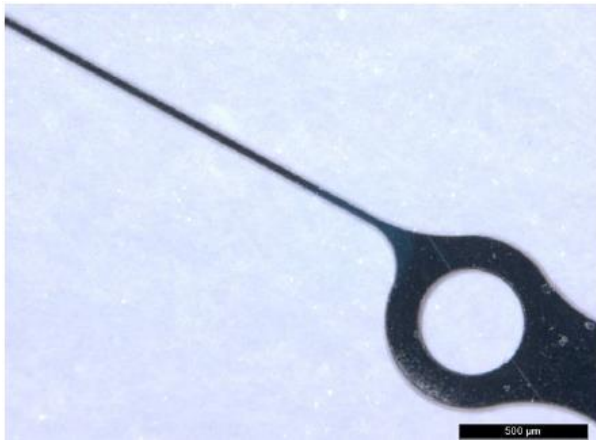
Cutting of Si escapement wheels



Drilling/Interior marking of Sapphire dials

Getting more specific

Cutting of metals



Durnico

Why laser

- freedom of geometry
- freedom of material
- no tooling

Why ps laser

- very small feature sizes (e.g. 40 micron fillets)
- without changing material properties (no heat)



Laiton



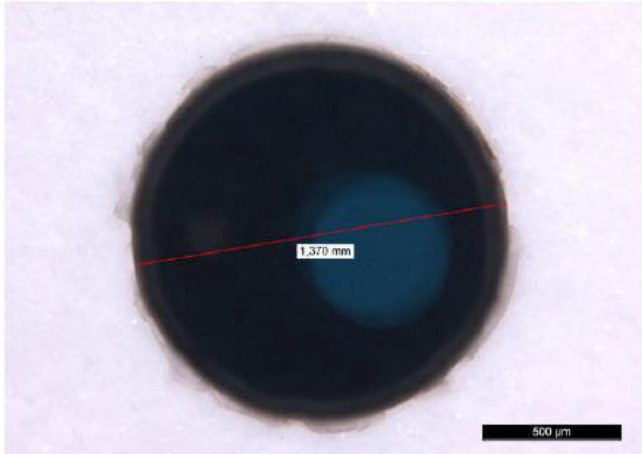
Stainless steel



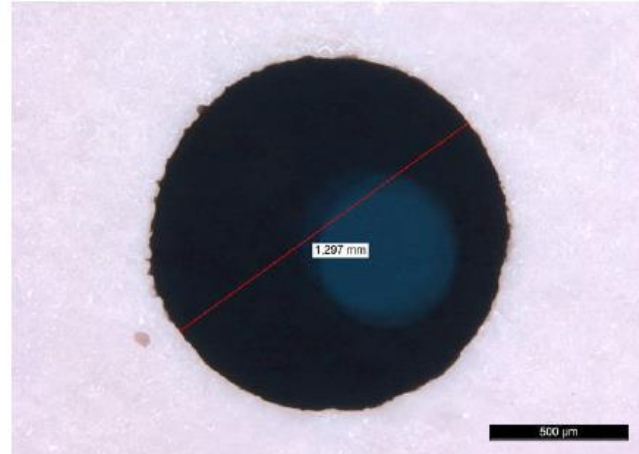
Getting more specific

„Sandwich“ materials – e.g. Drilling of coated metals

Front



Rear



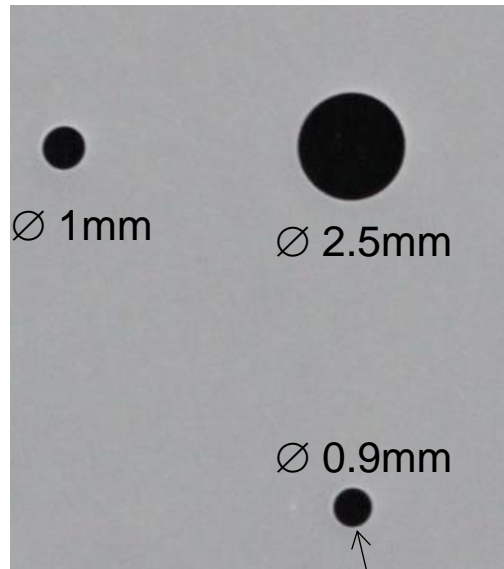
Why ps laser

- „Sandwich materials“ can be processed in „one shot“
- no rework needed

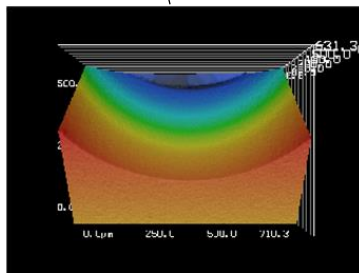
→ Parts can be processed by ps lasers late in the process

Getting more specific

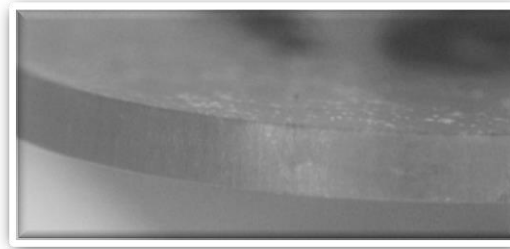
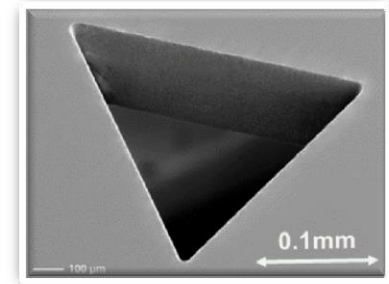
Cutting/Drilling of sapphire



Thickness 0.6 mm

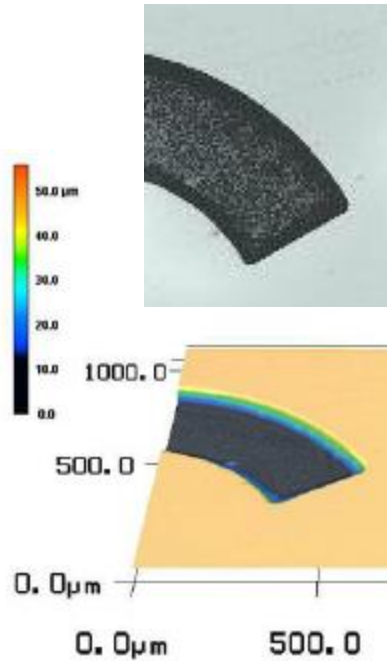


- Why ps laser**
- no tooling
 - flexibility
 - burr free
 - crack free
 - smooth cutting surface

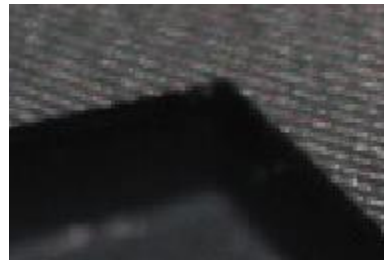


Getting more specific

Cutting, ablating and drilling of ceramics



Ablation of white ceramics



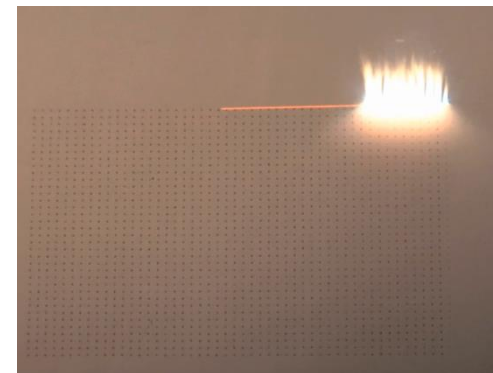
Ablation drilling of Zirconia



Cutting of ceramics

Why ps laser

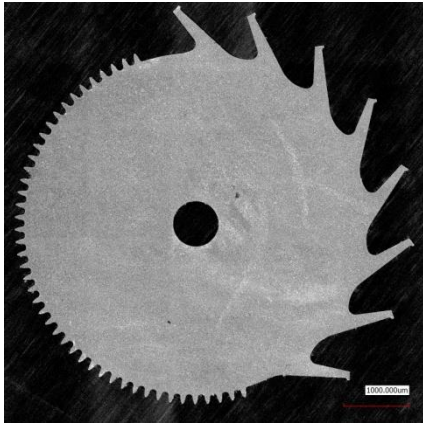
- no heat impact
- burr free
- very low residues compared to mechanical manufacturing
- small cutting width
- freedom of geometry
- high removal rate compared to metals



Drilling of AlN 20holes/s

Cutting of Si and Si₃N₄ parts

Under development

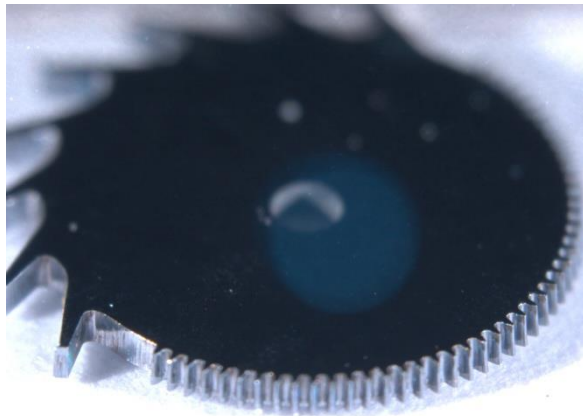


Si₃N₄



Why ps laser

- no tooling needed
- no clean room needed
- no restriction in materials
- new materials can be processed without costly process development



Silicon

Design aspects

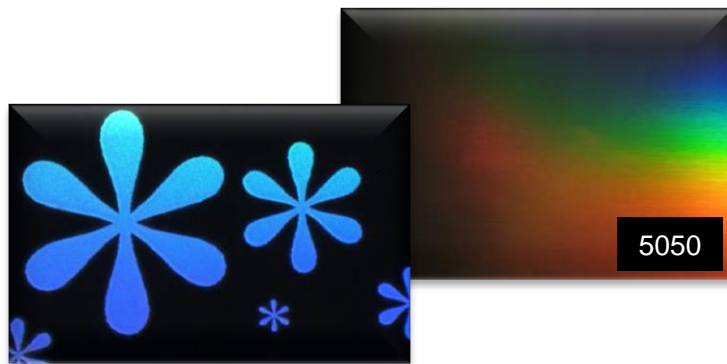
- Perforating of leather with high quality



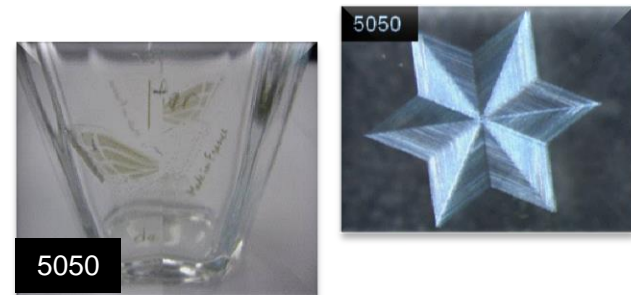
- Blackmarking of anodized aluminium



- Rainbow effect on black finished stainless steel

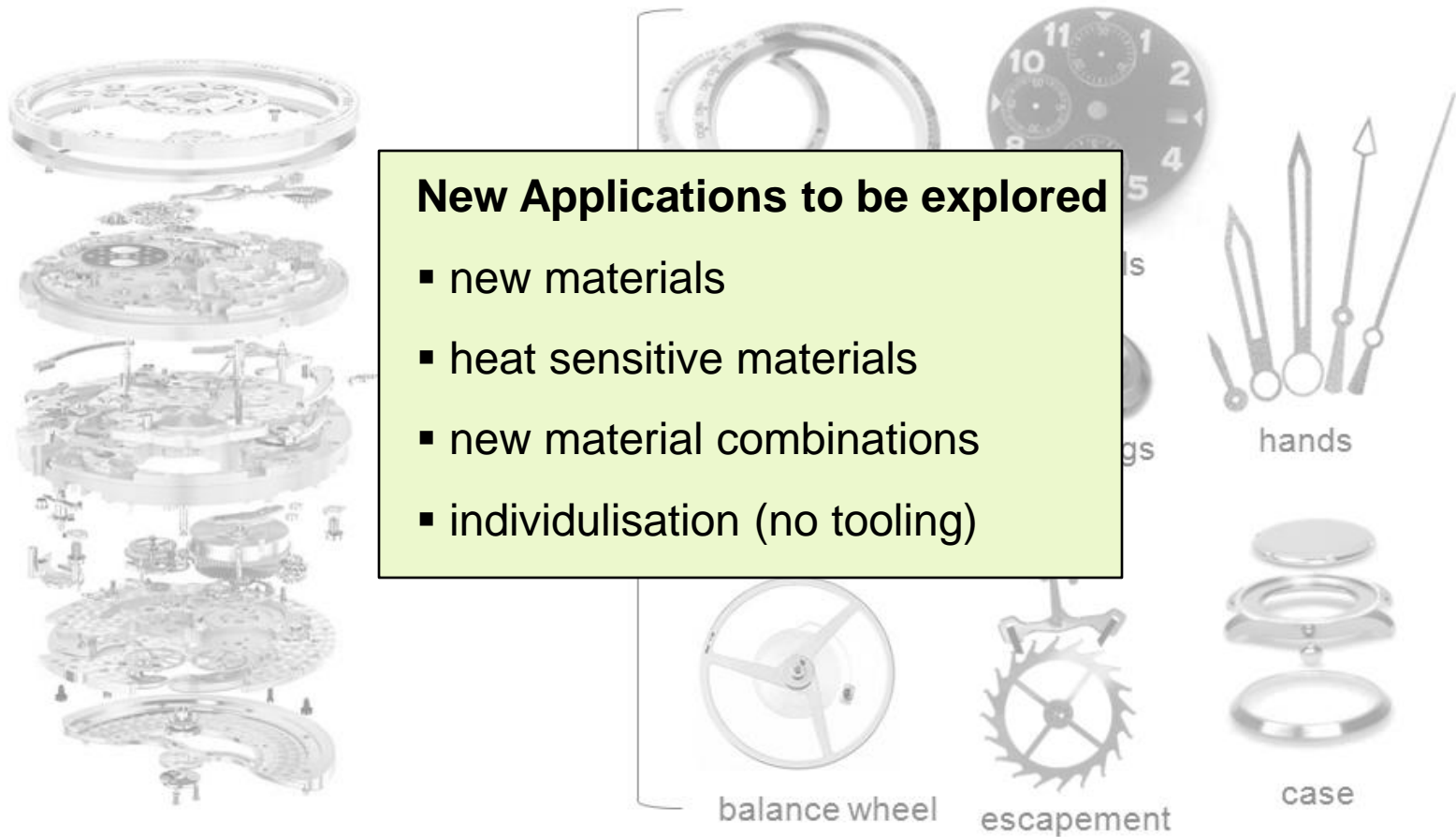


- Marking of glass without thermal damages or cracks



Outlook: Laser technology in the watch industry

Your ideas are waiting to be tested



New Applications to be explored

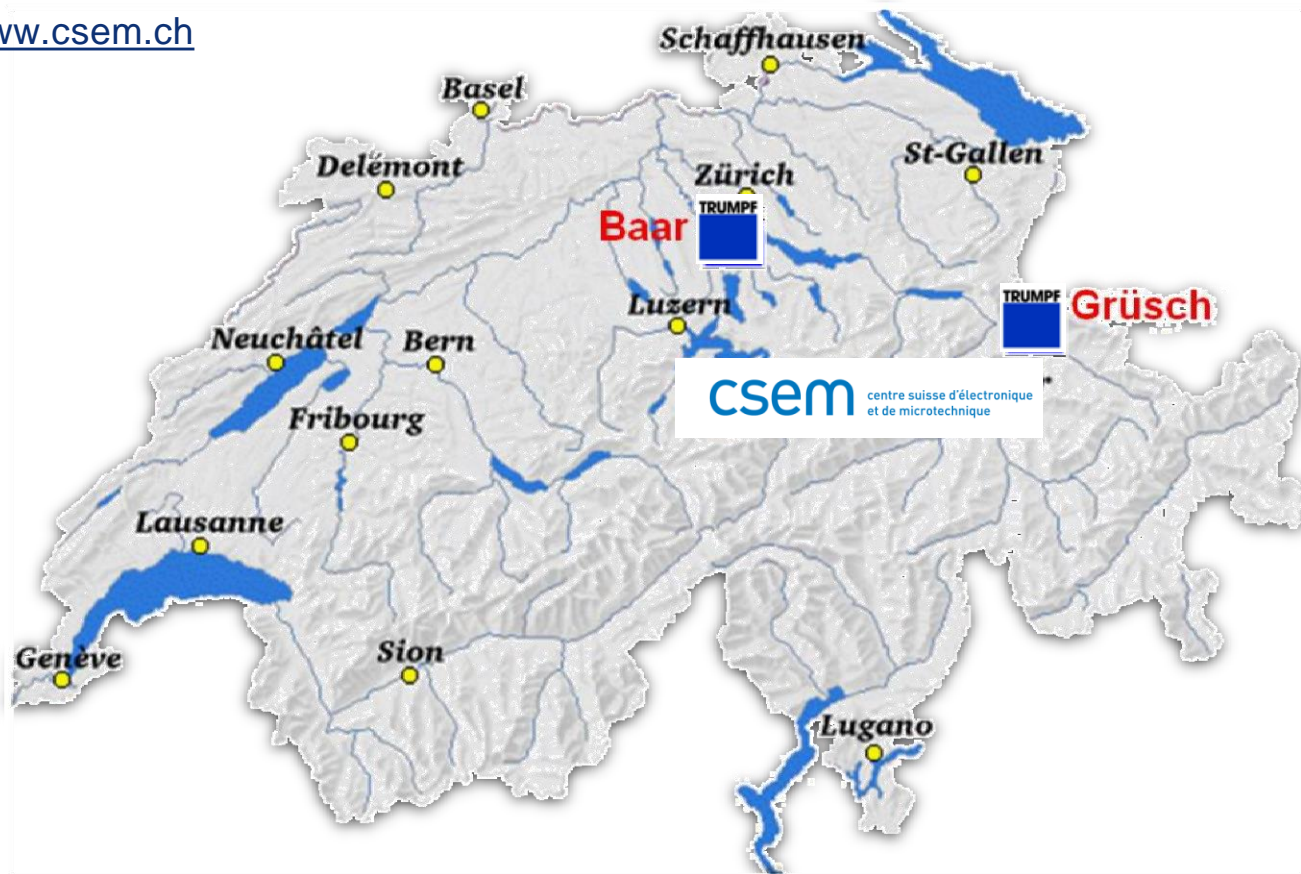
- new materials
- heat sensitive materials
- new material combinations
- individualisation (no tooling)

TRUMPF Laser-Applikation labs in Switzerland



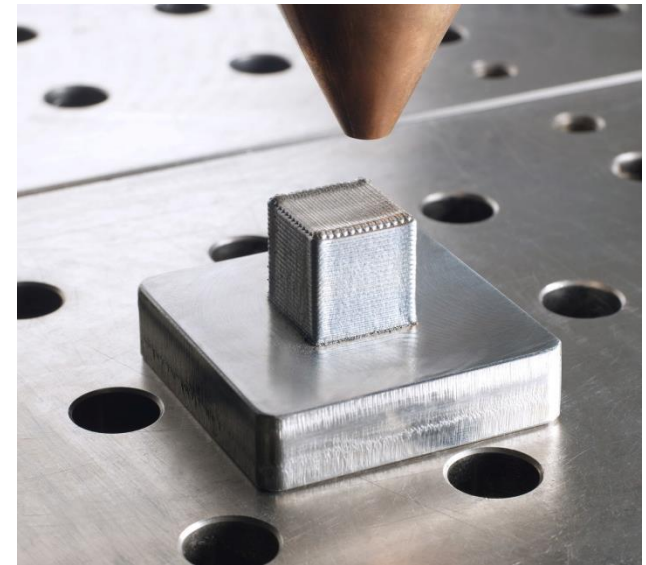
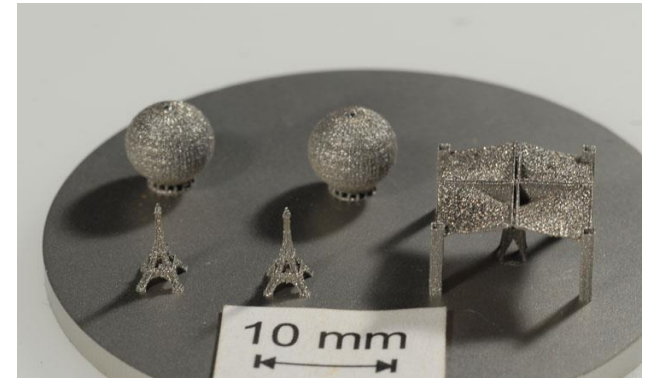
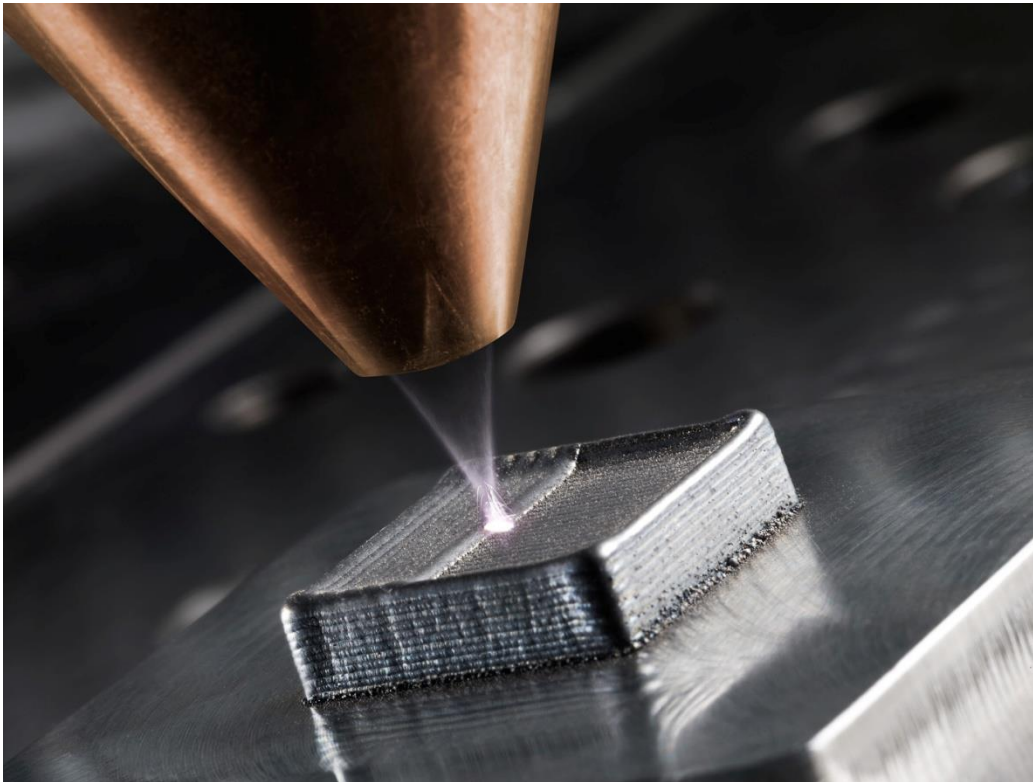
Grüsch and Baar: <http://www.ch.trumpf.com>

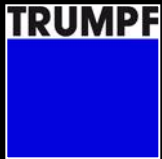
CSEM: <http://www.csem.ch>



Outlook for lasers in the watch and jewelry: Additive Manufacturing

Additive techniques allow unmatched Individualization
- e.g. for manufacturing watch cases





TRUMPF:

***We are not selling only a product,
but solutions!***

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***Come and see us
at our booth D101!***