Laser Micromachining Technologies

Manuel Gomez Marzoa – Laser Business Support Engineer – GF Machining Solutions

Manufacturing Technology Conference Tech Talk

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- GF Machining Solutions technology portfolio and markets.

- Laser micro-engraving applications.

- Laser micro-cutting and micro-drilling applications.

- Key takeaways.

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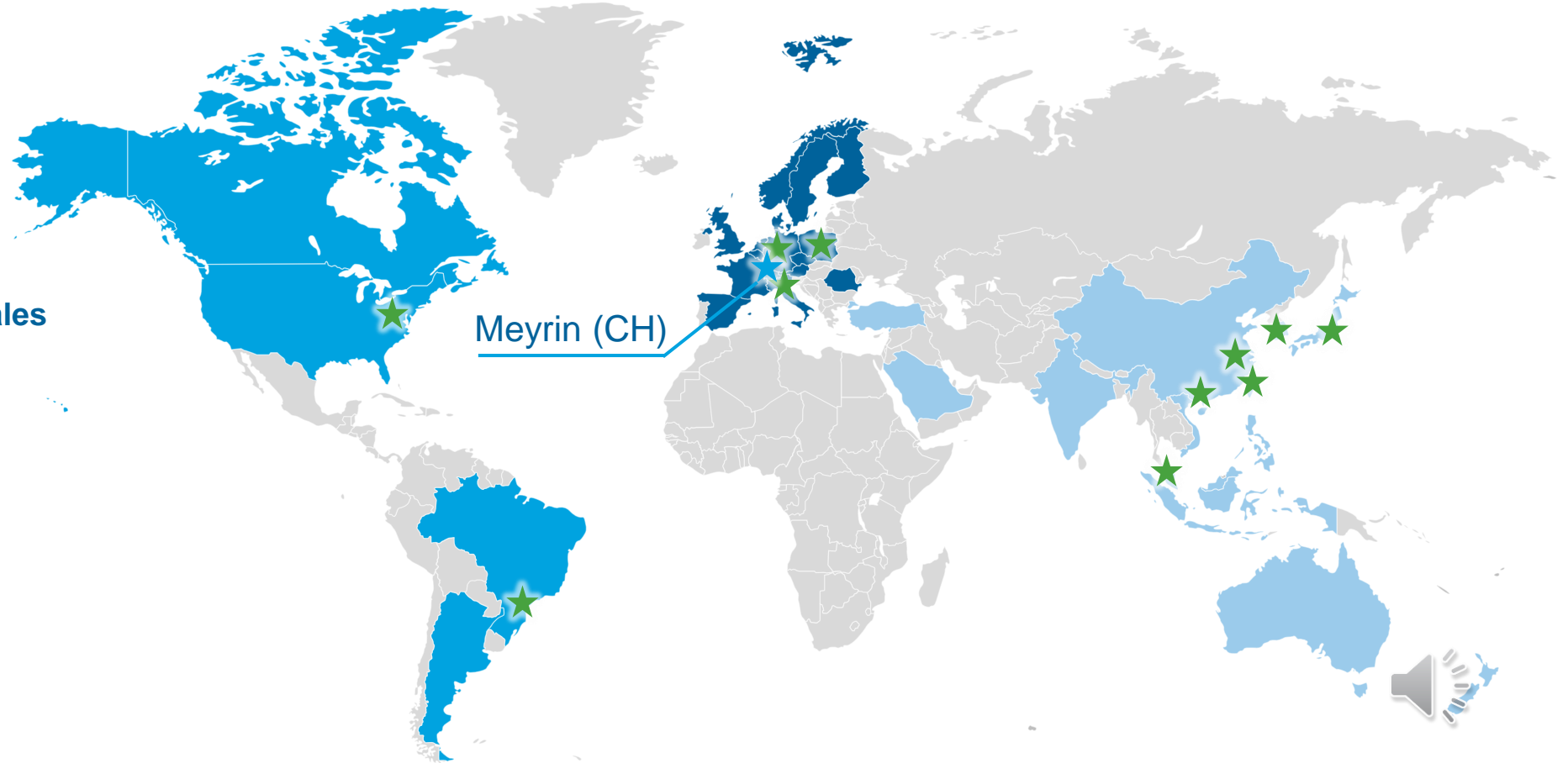# GF Machining Solutions: a global partner close to you

In 2023:

887
Million CHF in Sales

3 377
employees

41 countries

Meyrin (CH)

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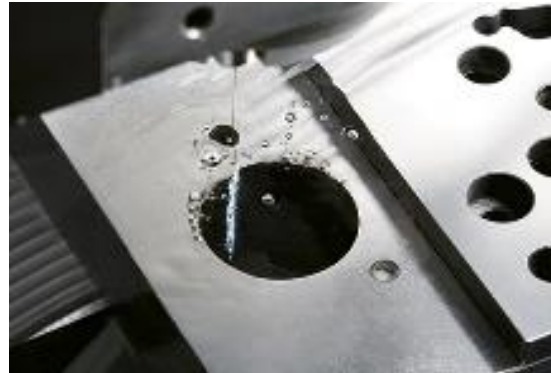
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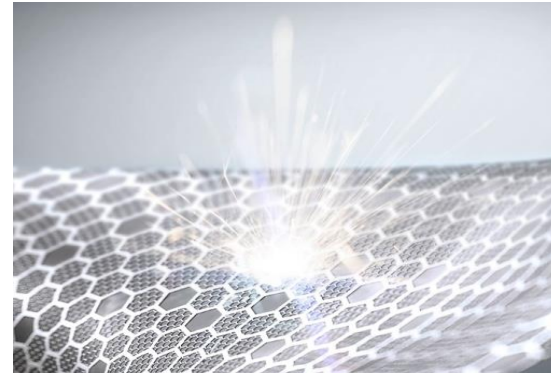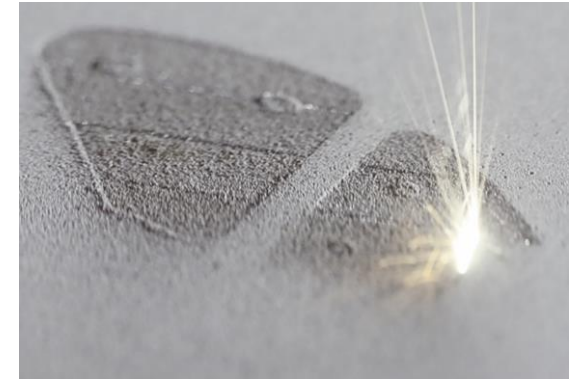# Unique **TECHNOLOGY** portfolio

Milling

EDM

Laser and Micromachining

Additive Manufacturing

Spindles

Tooling and Automation

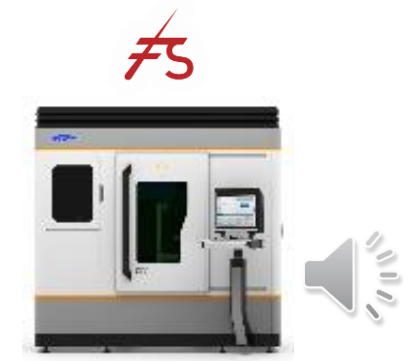Digital Business

Services and Training

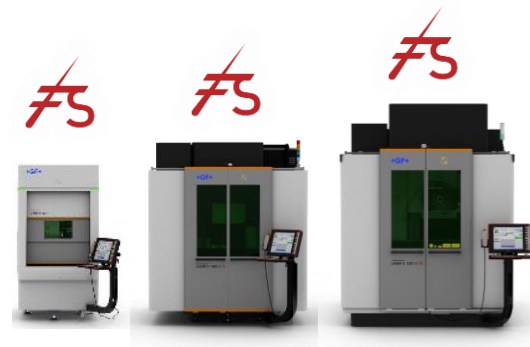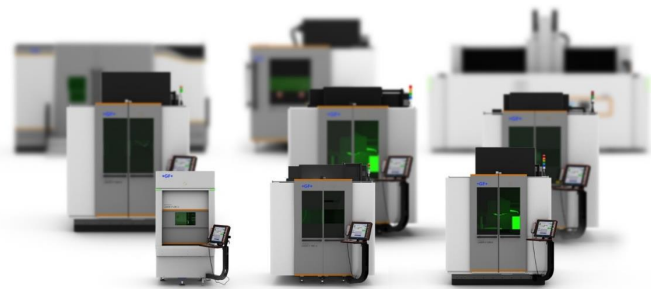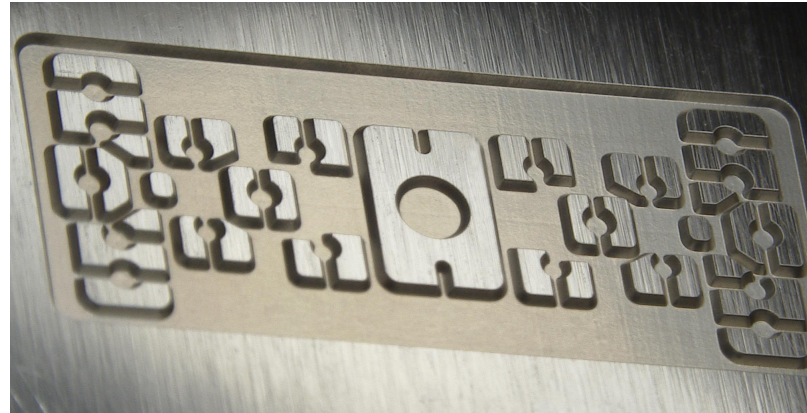Manufacturing Technology Conference 2024 | GF Machining Solutions | Manuel Gomez Marzoa
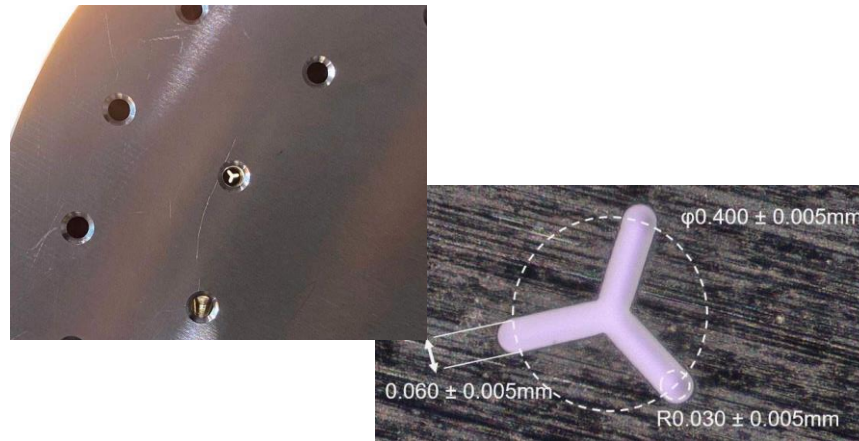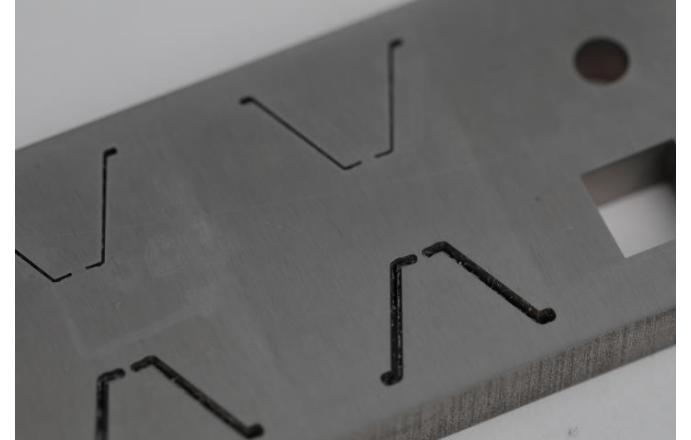
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Unique **LASER** portfolio

3D Surface Processing

Micromachining

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3D Surface Processing

Automotive

Medical

Packaging

Consumer goods & electronics

Laser micromachining

Watchmaking

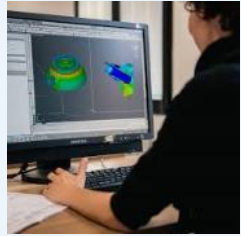Tooling

φ0.400 ± 0.005mm

0.060 ± 0.005mm

R0.030 ± 0.005mm
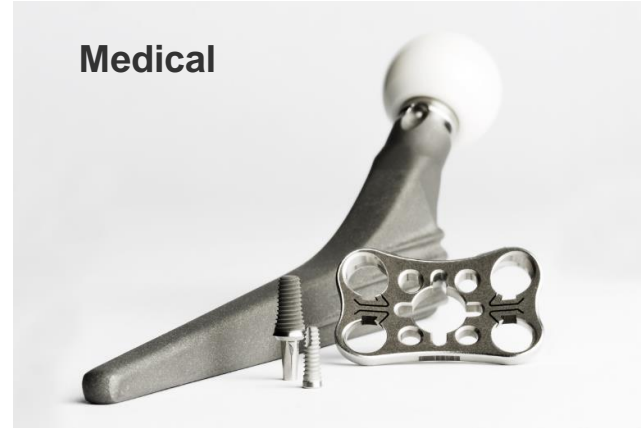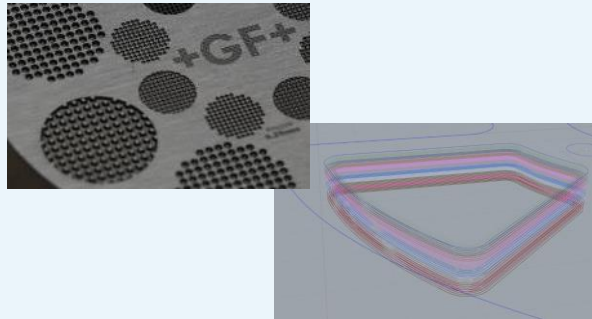
Unique **SOFTWARE** portfolio

LaserSUITE360

Workstation

LaserCAM
- Engraving, cleaning
- Cutting and drilling

LaserDESIGN
- Texturing
- Structuring
- Laser Blasting

LaserTOOLBOX
- LaserCONTROL
- LaserSIMULATOR
- LaserVIEWER
- LaserPMT

Laser Machine

Laser program

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Laser micro-engraving

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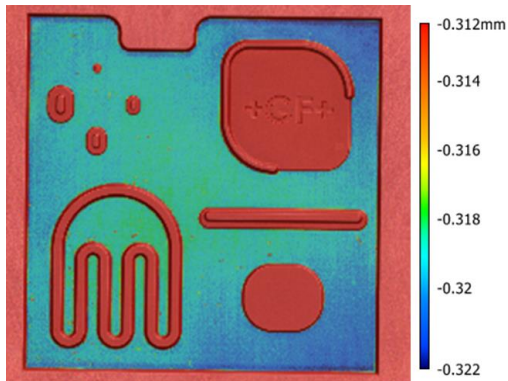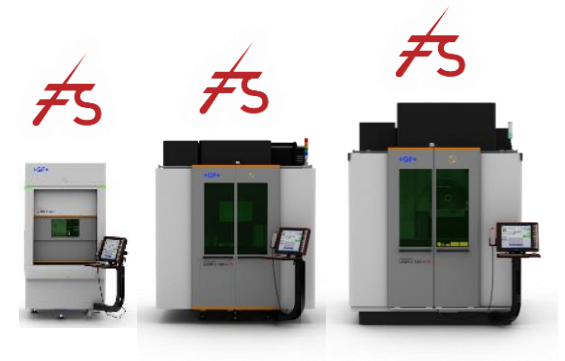
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Laser microengraving Application examples

Embossing die

Ultrasonic welding tool

Surface chip mount inductor

Embossing die

42 mm
42 mm
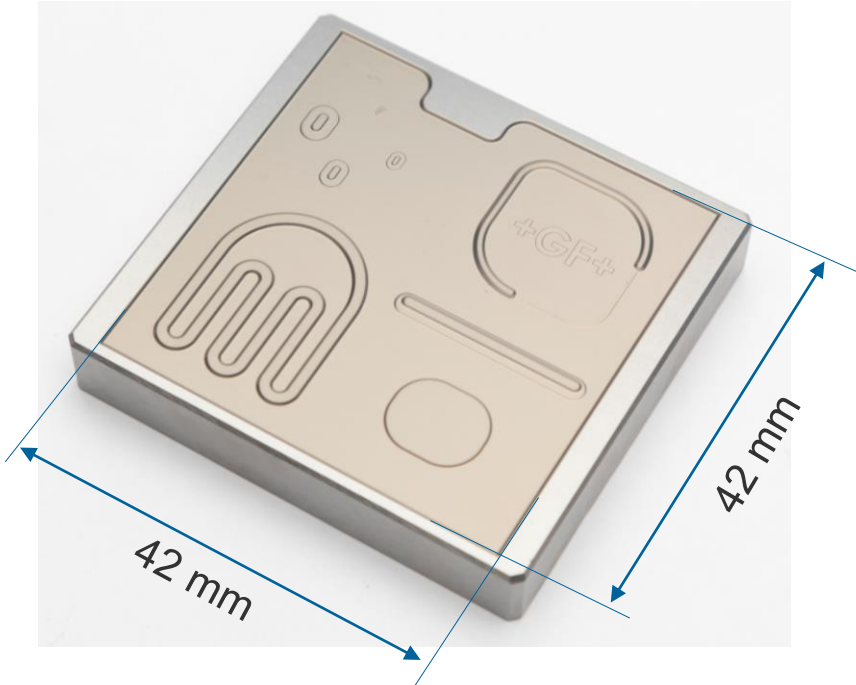
Conditions:

- Material: Tungsten carbide (H40S).
- Starting surface: polished (Ra < 0.1 μm)
- Plate flatness: ± 2 μm

Goals:

- Target depth: 0.287 mm.
- Surface roughness Ra < 0.40 μm

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Embossing die
Flatness measurements

Standard toolpath
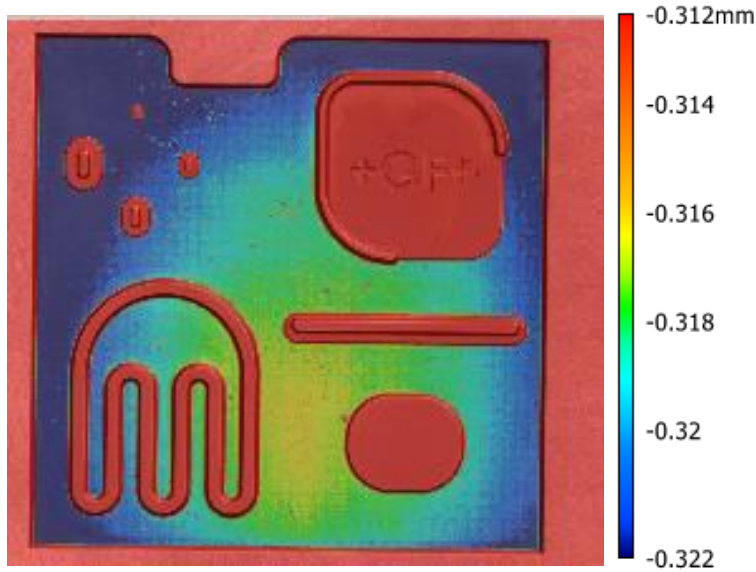
Cavity flatness ± 7 µm

Precision toolpath

Cavity flatness **± 3 µm**

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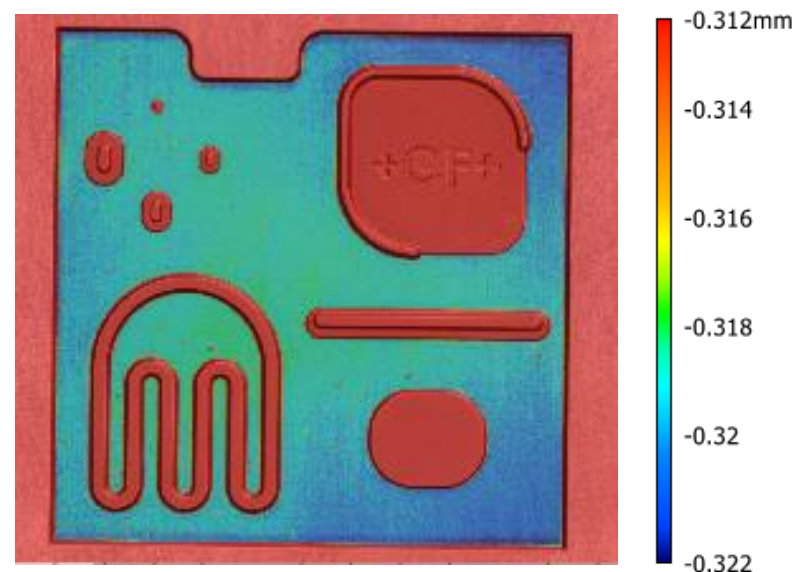
Embossing die
Dimensional measurements
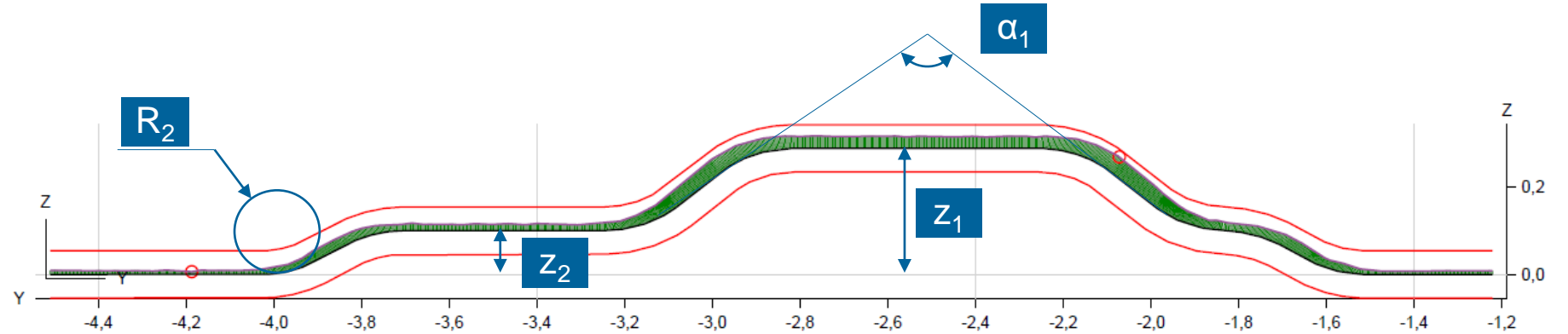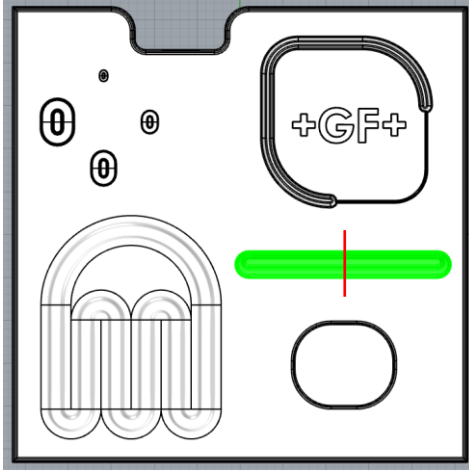
Dimension	Measurement	CAD	Delta
α_1	39.035 deg	38.237 deg	0.798 deg
z_1	0.1145 mm	0.1000 mm	0.0145 mm
z_2	0.3117 mm	0.2870 mm	0.0247 mm
R_2	0.2641 mm	0.2770 mm	-0.0129 mm

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Embossing die
Surface roughness measurements
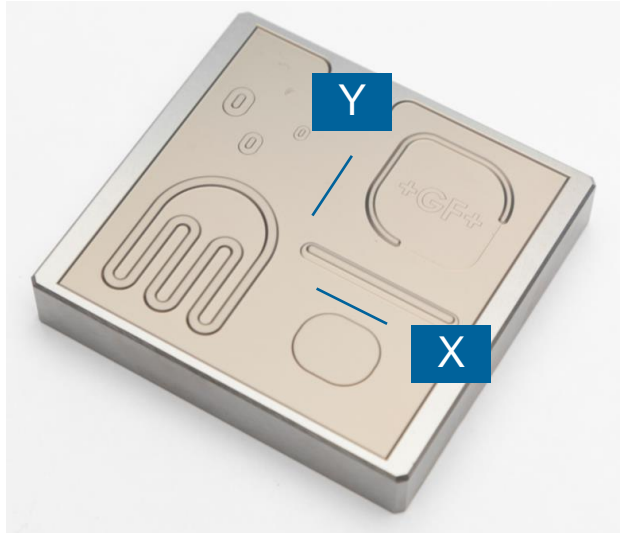
Measured values:

- Ra on X = 0.231 µm
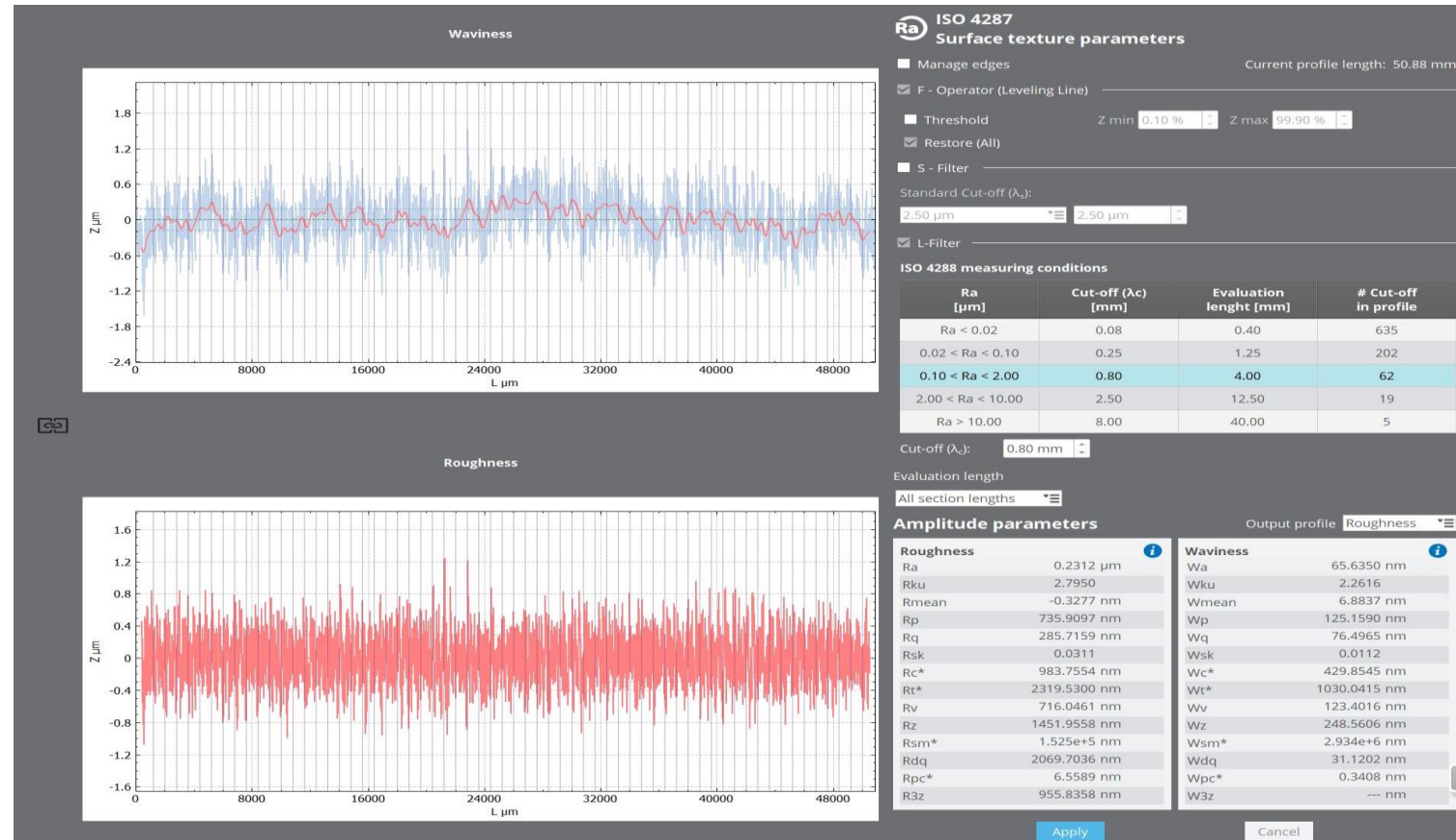
- Ra on Y = 0.233 µm

Micro-patterns on tungsten carbide

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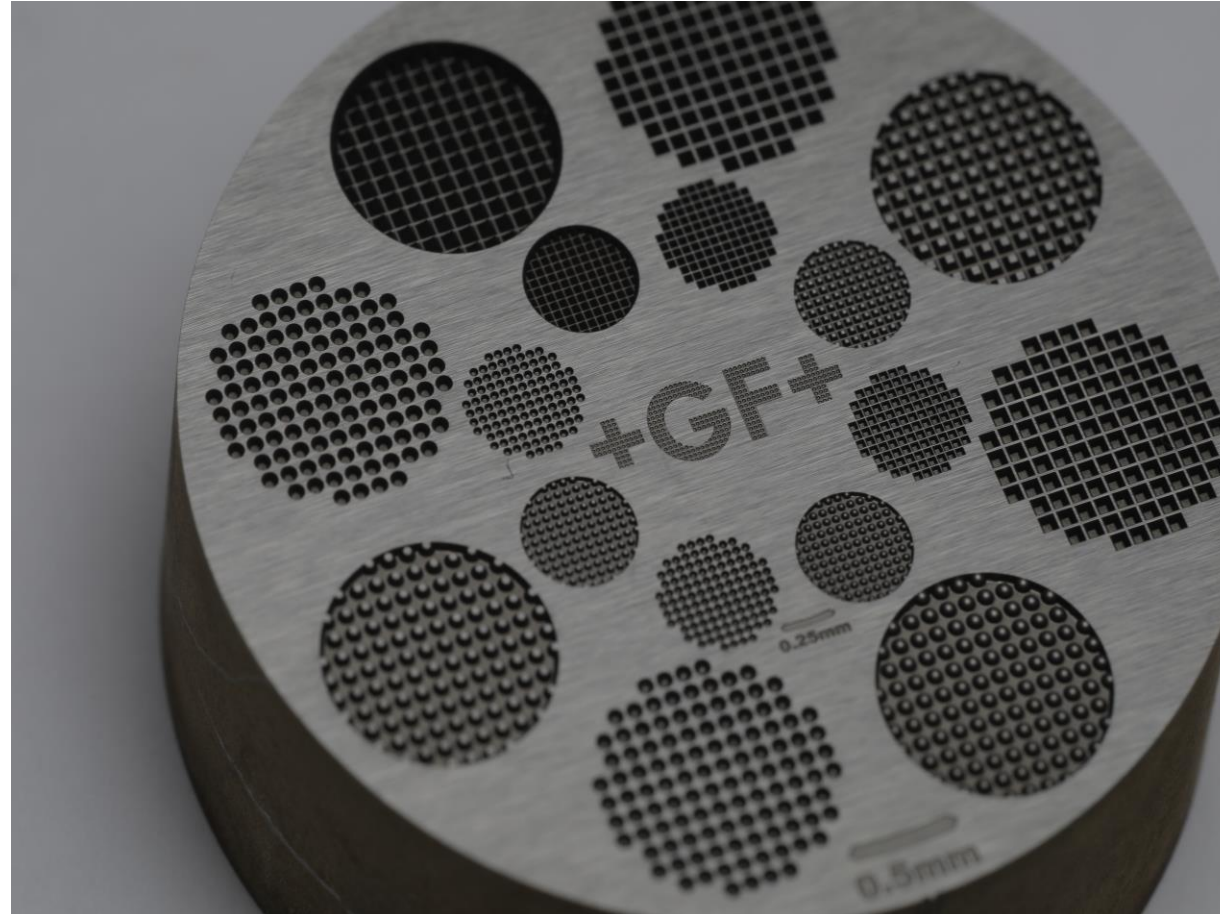
Micro-patterns on tungsten carbide
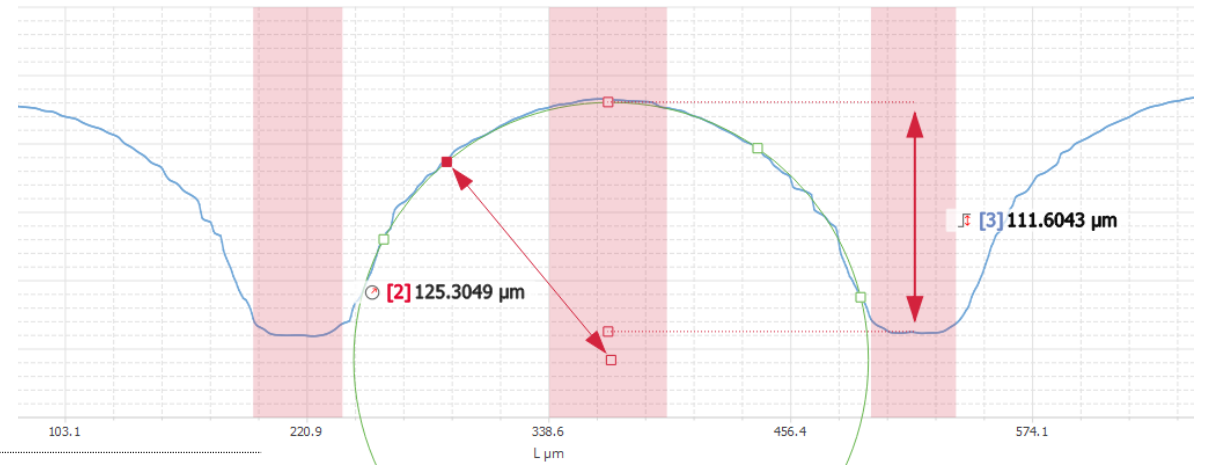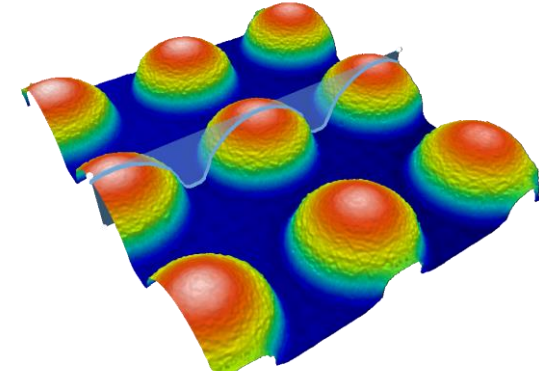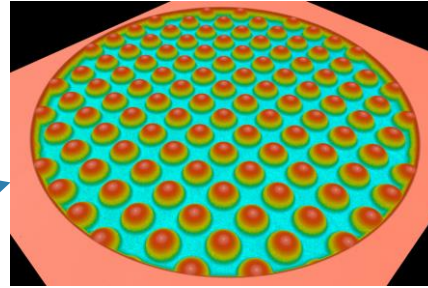
Dimension	Measurement	CAD	Delta
Radius	0.1253 mm	0.1250 mm	0.0003 mm
Depth	0.1116 mm	0.1125 mm	-0.0009 mm

Industry case
Roughing Laser, finishing DS EDM

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Industry case:
Manufacturing a surface chip mount inductor
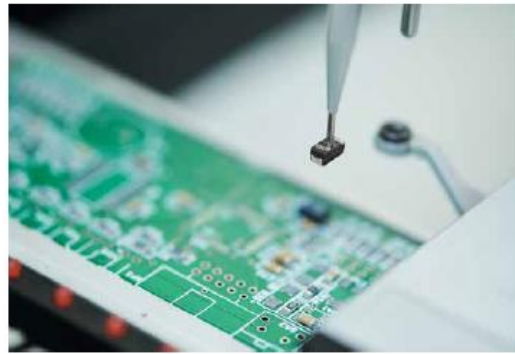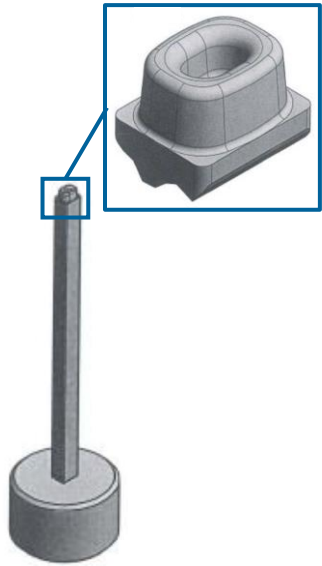
Challenge:

- Tooling now requires two types of electrodes
- Electrodes made of WCu
- Shape accuracy required: ± 10 µm

	EDM Electrodes required	Machining time
Roughing & finishing EDM	6 electrodes per tool	34 min 17 sec per tool
Roughing Laser Finishing EDM	3 electrodes per tool	21 min 9 sec per tool

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Industry case:
Synergy Laser / EDM / System 3R

Setup

Raw tool on System3R clamp

Laser roughing

LASER P 400

3 min 19 s

Finishing & texturing EDM

FORM P 350

3x electrodes

17 min 18 s

Total combined time
21 min 9 s

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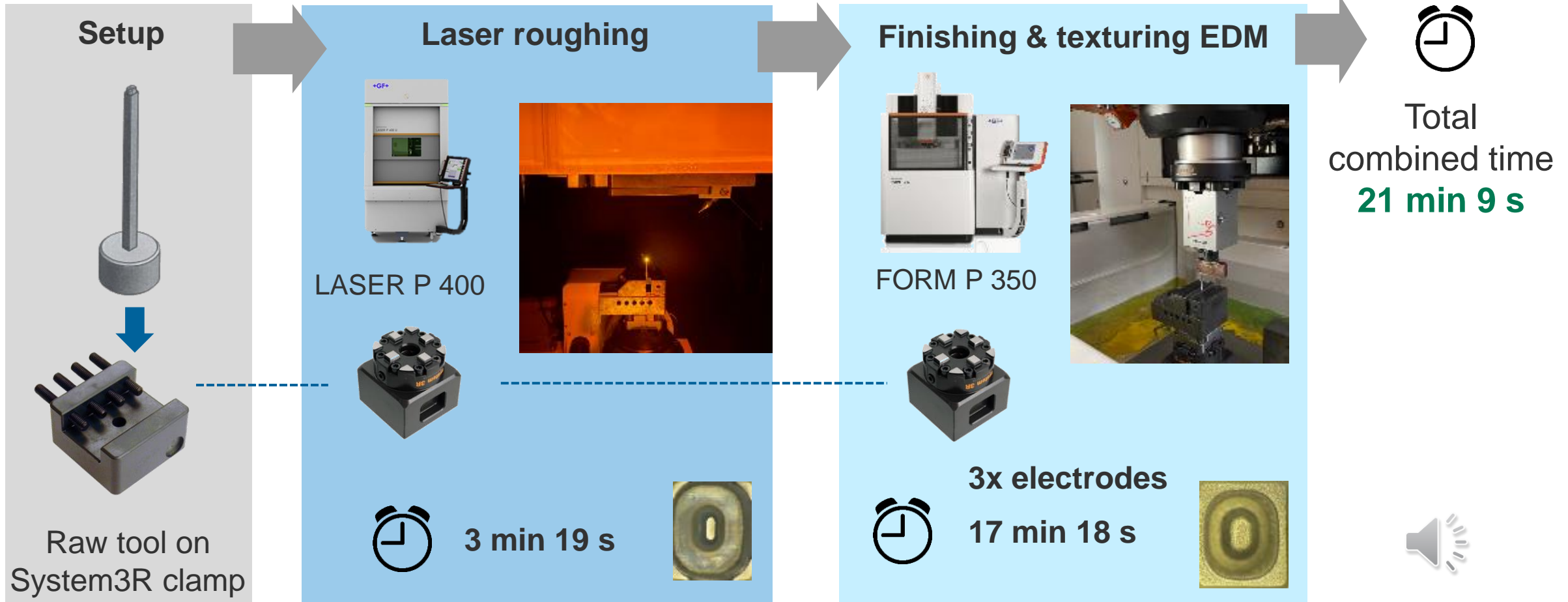
Industry case:
Synergy Laser / EDM / System 3R

Customer benefits:

- **38%** shorter manufacturing time.

- **Excellent machining accuracy:**
  - Depth ± 2.5 μm
  - Lateral size ± 3.5 μm

- **High repositioning accuracy** with **System3R chuck.**

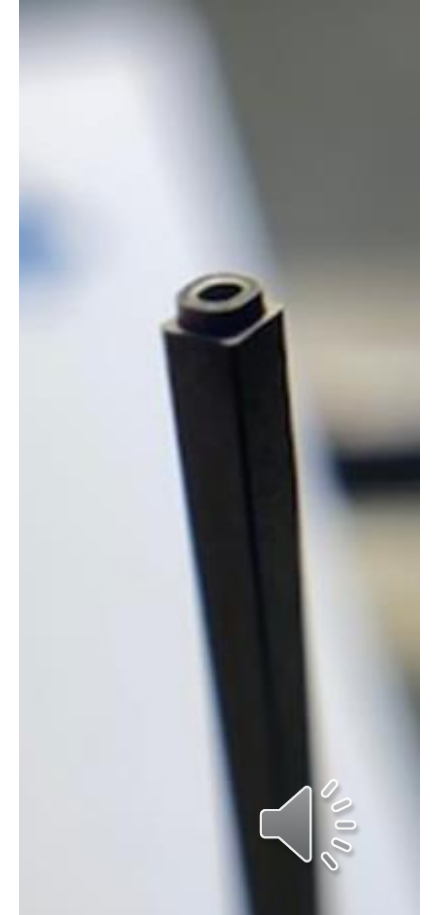- **50%** less electrodes required

Laser micro-cutting and micro-drilling

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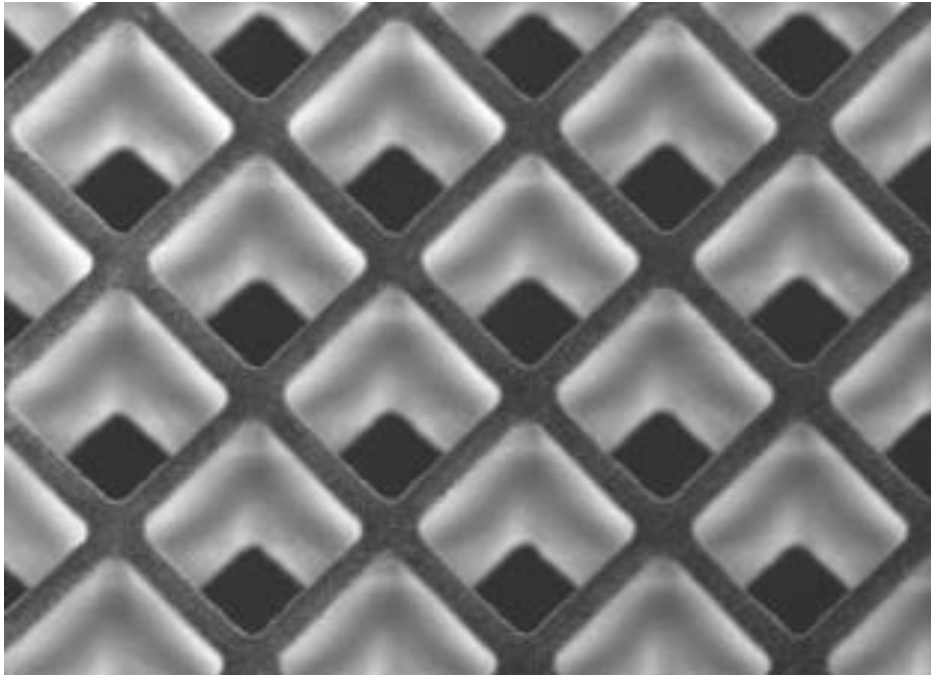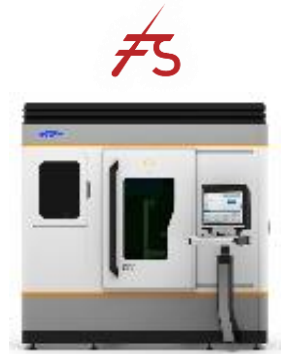
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Laser micro-drilling and micro-cutting Application examples

Laser drilling of probe card guide

Watchmaking: movement part

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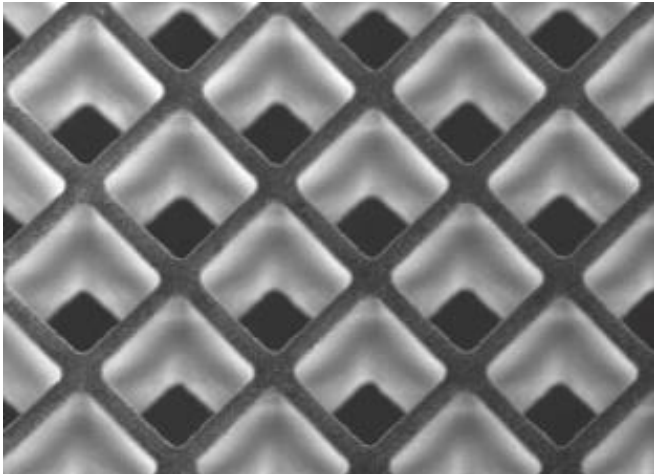© GF v3.1

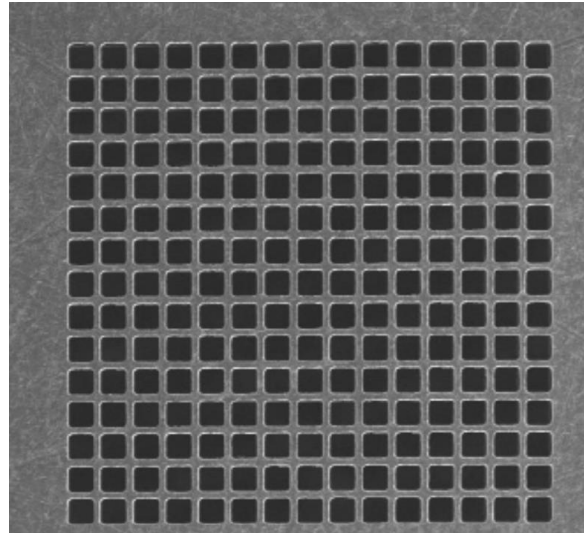# Laser drilling of probe card guide

- 35 μm x 35 μm through 300 μm SiN
- 7 μm wall thickness
- 3.5 μm corner radii

- Positioning accuracy < ± 3 μm
- Minimum distance between adjacent holes < 7 μm
- Minimum hole size: 30 x 30 μm
- Hole size accuracy < ± 0.6 μm
- Corner radii on rectangular holes ≤ 4 μm
- Aspect ratio 1:10
- Material thickness: ~ 400 μm typical

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Watchmaking: movement part (13 x 10 mm)
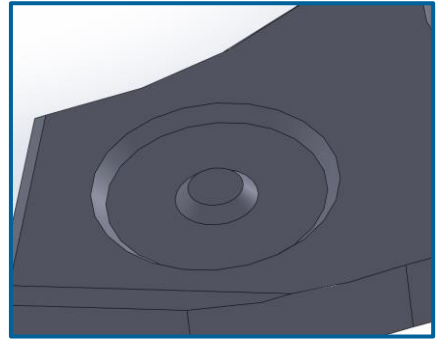
Blind cavity
Ø 0.8 mm, 0.05 mm deep
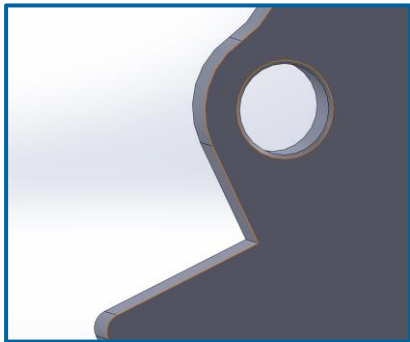
Straight wall cutting
30 µm corner radius
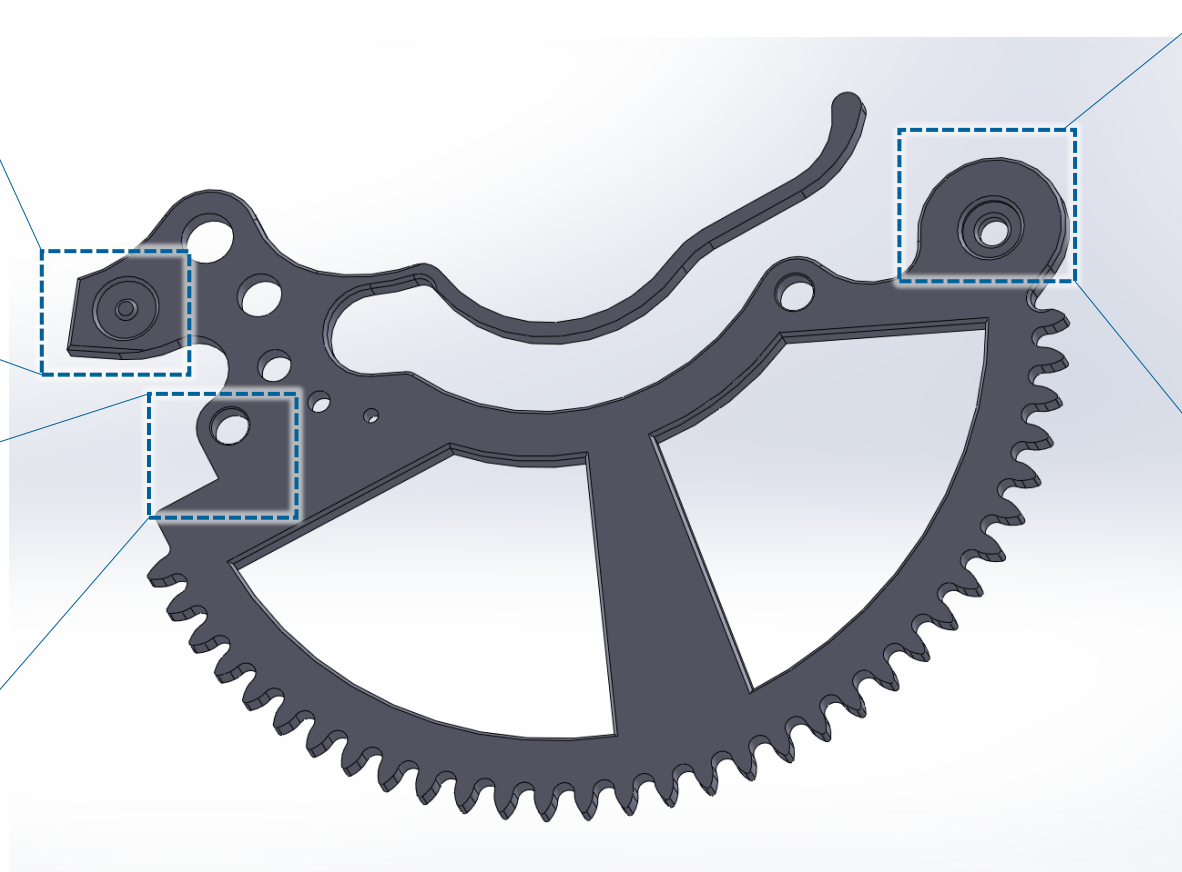
Counterbore: Ø 0.8 mm, 0.1 mm deep
Chamfering: 20 µm at 45°
Hole: Ø 0.8 mm, 0° taper

Durnico, 0.3 mm thick

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Microlution ML-5
Demo watch part, 13 x 10 mm

- Machining time: **20 min 32 s**

- Programming time: ~ **1 h 30 min***

Material, thickness, quality and operations are known and validated beforehand.

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Key takeaways

- GF Machining Solutions is a key supplier of Laser micromachining equipment.

- Complete micromachining portfolio.

- Global company, local support.

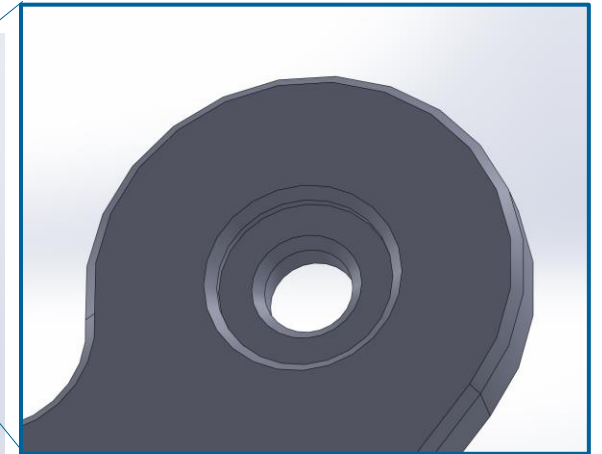- Proprietary CAM solutions for maximum quality and productivity.

- Possible to combine Laser with traditional manufacturing technologies to obtain the best results.

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Thank you for your attention

Manuel Gomez Marzoa – manuel.gomez-marzoa@georgfischer.com

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