



10 July 2024

GF Machining Solutions e Biotec S.r.l. insieme per la produzione di componenti dentali con un processo produttivo end to end.






Claudio Rossi, Product specialist advanced manufacturing



+GF+

Company overview

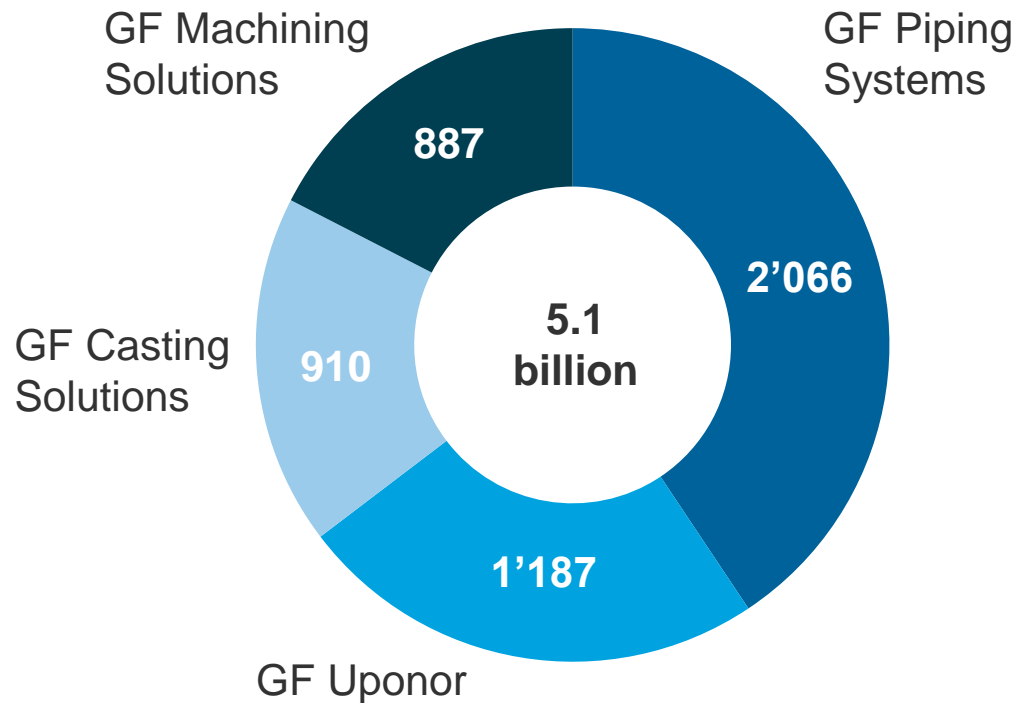
Pioneering industrial technology

GF Corporate	GF Piping Systems	GF Casting Solutions	GF Machining Solutions	GF Uponor
<p>1802 GF founded in Schaffhausen</p> 	<p>1864 First piping systems product</p> 	<p>1897 First automotive part</p> 	<p>1921 First machinery</p> 	<p>2023 A fourth division</p> 
<p>Johann Conrad Fischer</p>	<p>Malleable iron fitting</p>	<p>As of 1900 GF develops wheels made of cast steel for trucks and cars</p>	<p>GF acquires the Machine Factory Rauschenbach for agricultural machinery</p>	<p>GF acquires the Finnish company Uponor</p>

Today GF stays at the forefront of new technologies

2023 sales pro-forma¹

per division (in CHF million)



Our core strength lies in applying **state-of-the-art industrial technologies**



We are specialists in developing tailored solutions to meet the **needs of our customers**



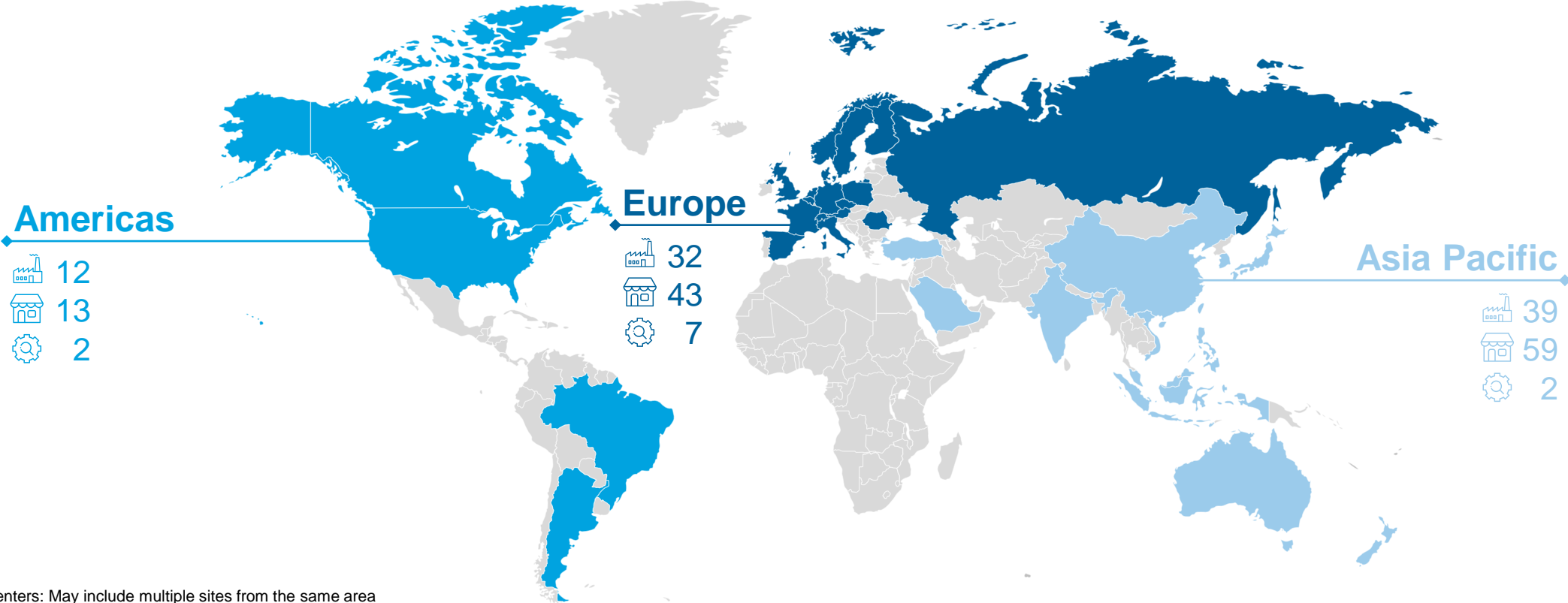
We operate in markets with high technology, complex processes and certification requirements

¹ Uponor included pro-forma for the full-year, GF stand-alone ("comparable")

A global footprint with local services

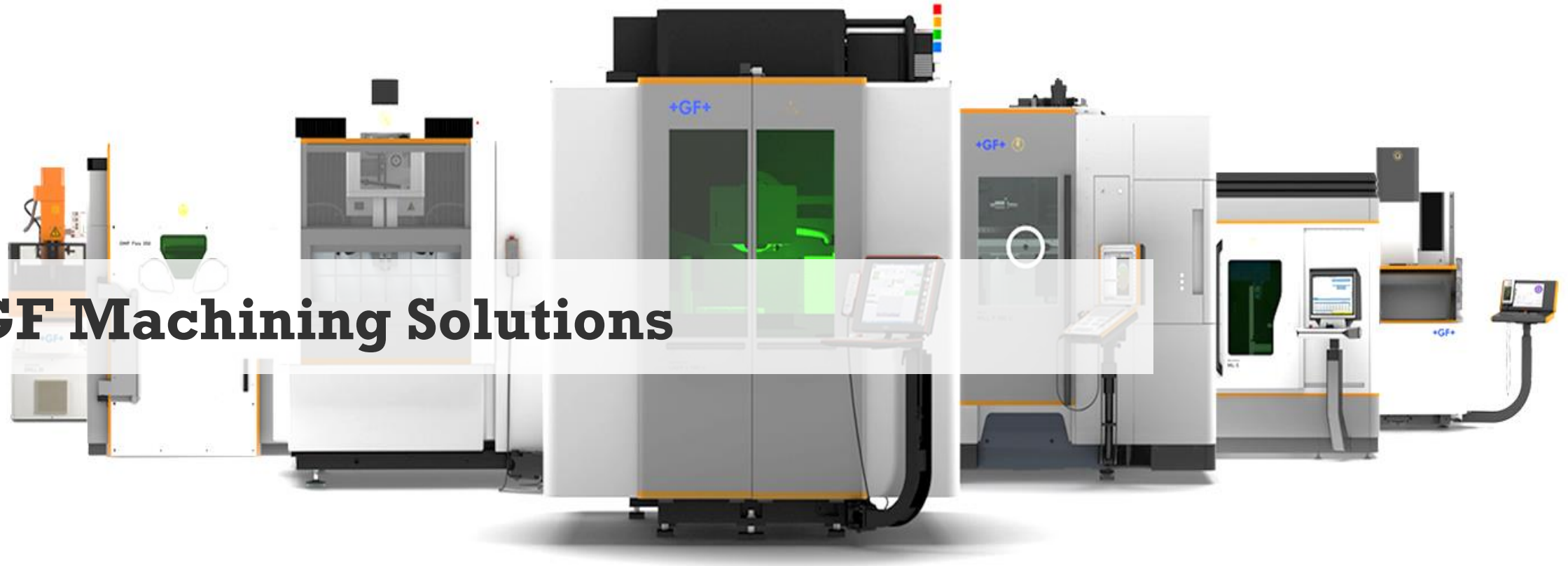
Present in 41 countries with 15'207 employees

83 production sites 115 sales sites 11 R&D centers



R&D centers: May include multiple sites from the same area

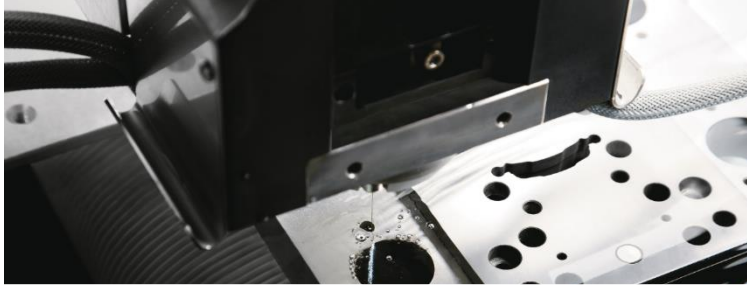
GF Machining Solutions





GF Machining Solutions

Our technology brands



AgieCharmilles

Wire-cutting, die-sinking and hole-drilling EDM solutions and Laser texturing



Mikron Mill

High-speed, high-performance and high-efficiency Milling technologies



Microlution

Specialized in femtosecond Laser for hole-drilling and micro-cutting in a wide range of industries



Liechti

Leader in five-axis airfoil machining solutions for the turbine industry



Step-Tec

High-end motor Spindles and subassemblies

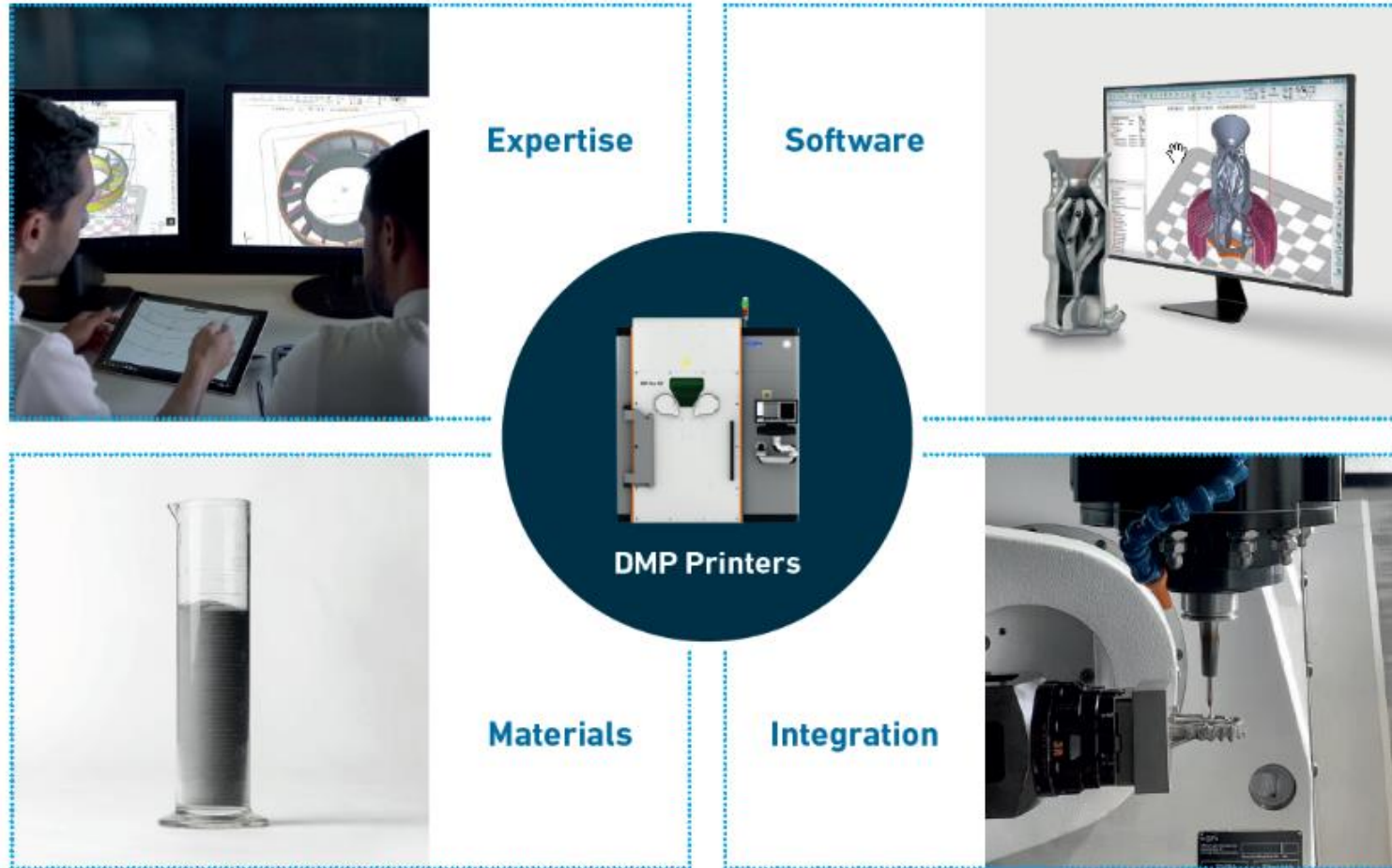


System 3R

Productivity-boosting Automation, Tooling and Software systems



Our unique complete offer in AM





The AM machines (LPBF)



DMP Flex 350

Print Volume:

275 x 275 mm (L x W) x 420 mm (H)
350 x 350 mm (L x W) x 350 mm (H)

Laser Power:

1-2-3 x 500W



DMP Factory 350

Print Volume:

275 x 275 mm (L x W) x 420* mm (H)

Laser Power:

1-2 x 500W



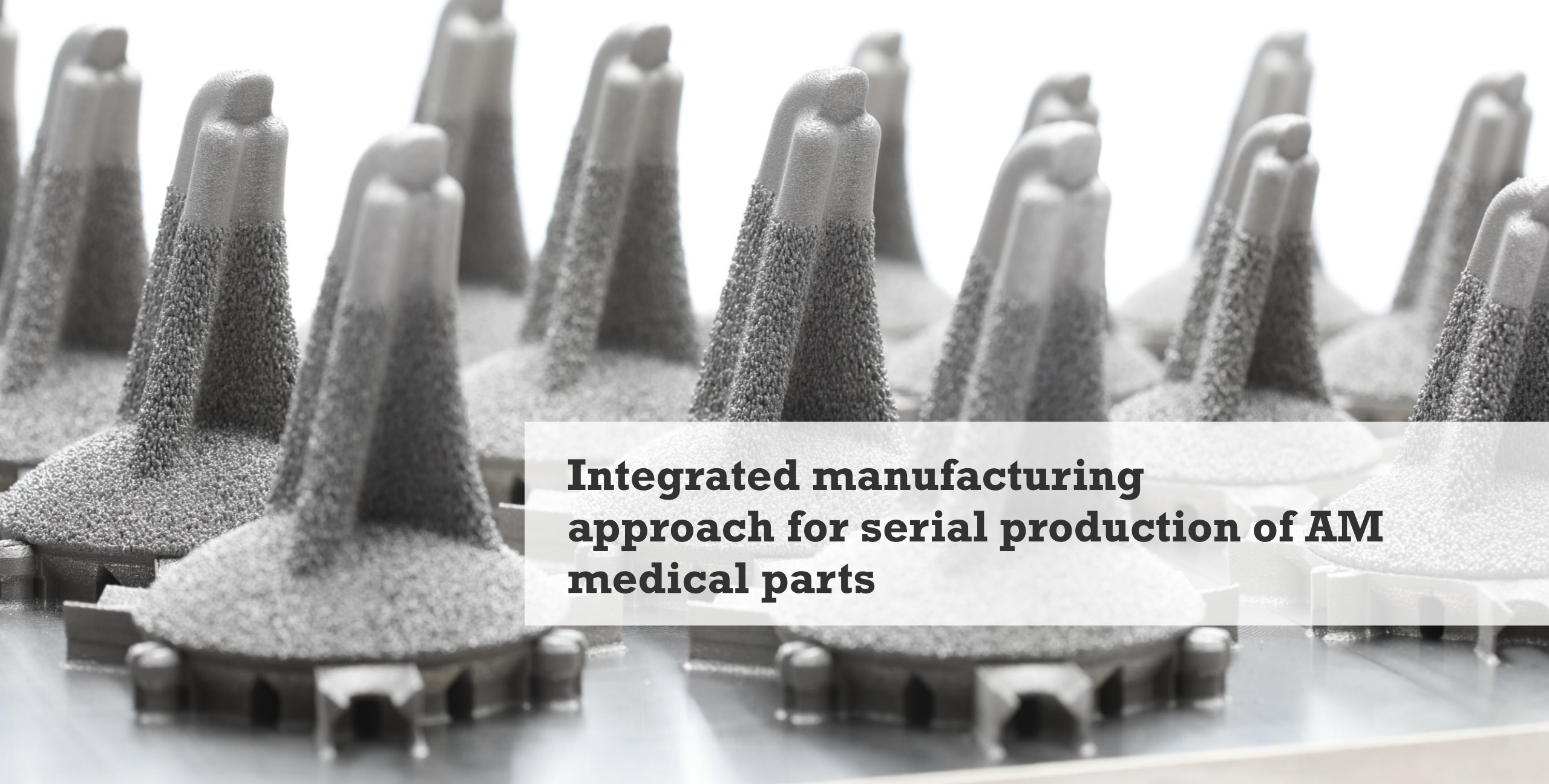
DMP Factory 500

Print Volume:

500 x 500mm (L x W) x 500* mm (H)

Laser Power:

3 x 500W



**Integrated manufacturing
approach for serial production of AM
medical parts**



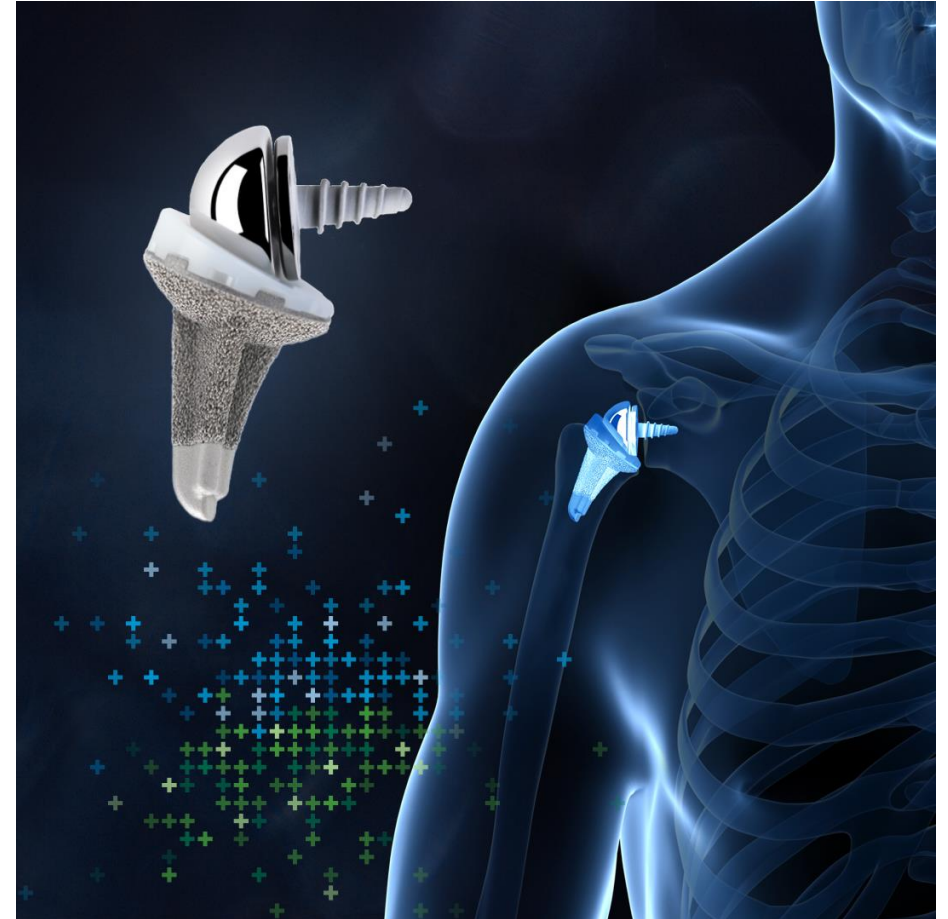
Shoulder Implant

- Reliably print high-quality trabecular structures for better Osseo integration.

- Achieve consistent material quality, batch after batch, with low oxygen content (3D DMLS).

- Minimize waste with 100% traceability

- Complete digital workflow / reproduction



+ Shoulder Implant

Technology: **DMP Direct Metal Printing with Post Processing**



Machine models for AM inserts:
DMP 350 Flex, CUT AM 500, Mill S 400U

Material

LaserForm® Ti6Al4V / TiGr23 Titanium

Two implant size: 36mm / 42mm (base diameter)

Layer Thickness 60µm

Print Time: 95min (**single laser**)

EDM Separation time: 9min

Milling Time: 14min

Test objective

The humeral component is the largest part of the implant and is always made from titanium. The goal was reliably print high quality lattices and porous structures for a better osseointegration. Second to achieve a good surface finish, accuracy of the mounting features.

Traditional such production are produced by casting, forming technologies or machined directly from bar stock. To ensure osseointegration, there are plasma coated with hydroxyapatite (calcium-phosphate material good for accelerating bone growth / bonding with bone).

There are two types of shoulder implants; "normal" and "reverse". The shoulder Implant we choose is "reverse", this means the glenoid (ball) component is attached to the scapula (shoulder blade).

Test result

Our workflow solution shows that if rework is considered in the design before 3D printing, such hard-to-clamp parts can be easily, safely and accurately finished. This also provides the ability to identify (mark) each part so that traceability can be ensured throughout the process and for each individual part.

Customer

GFMS Internal

Segment

Medical Orthopedics and Trauma

Lattice structures

AM enables Engineers to create products that might have been considered even inconceivable a few years ago. Almost all AM medical products nowadays correlate specific designs to biological relevance. Lattice structures are a well-known added value of AM in the medical sector:

- being able to simulate morphological properties of surrounding bone (structure, stiffness,...)
- accounting for loading conditions of patients

GF Machining Solutions



System 3R – the heart of the fixture

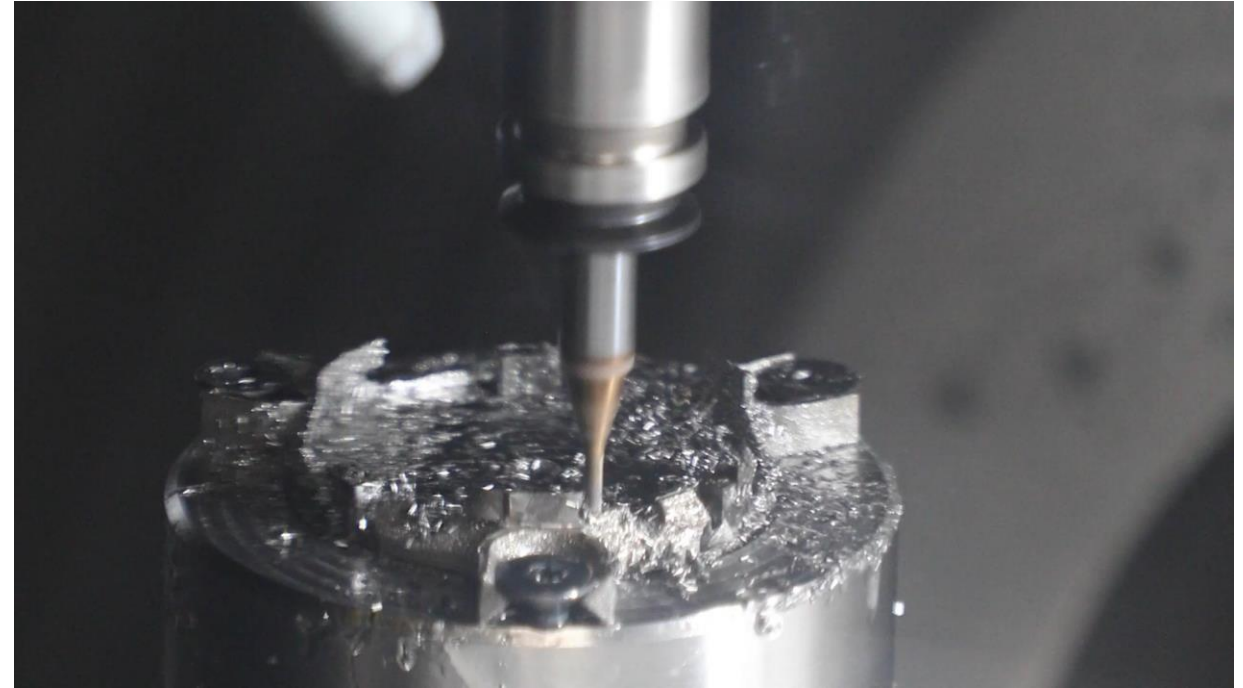
- Zero point clamping
+/- 2 μ (Macro) +/- 3 μ (Delphin)
- Fully automatic loading possible –
change parts in seconds
- Interface for all types of machine tools
(milling, EDM, laser machining, Additive
Manufacturing)
- Also available as part a "BuildPal" 3D
metal printing platform that allows
printing and separation of individual
parts





Milling

- Mikron MILL S 400 U
- StepTec 30k spindle / HSK 40E interface
- Challenge is milling vertical tabs
 - Smooth surface finish, high dimensional accuracy ($\pm 10 \mu$)

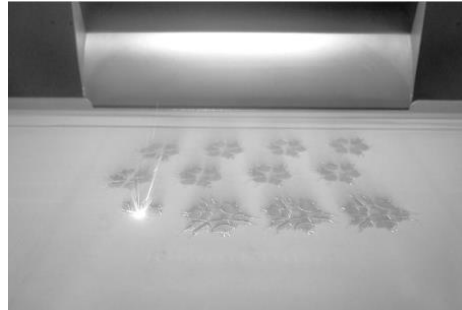




Total Machining Time

Operation 1: DMP 350 Flex / 24hours/day utilization

Preparation	- LaserForm® Ti6Al4V - BuildPal 273	3 hours
Printing	- LT 30µm / 60µm	95 min
Total for 2 x 8 parts		31.5 hours



Operation 2: CUT AM 500 / 24hours/day utilization

Setup	- BuildPal 273 on Delphi	1 hour
Separation	- One printing plate contains Inserts for two segments	9 min/part
Total for 2 x 8 parts		3.7 hours



Operation 3: Mill S 400 U / 16hours/day utilization

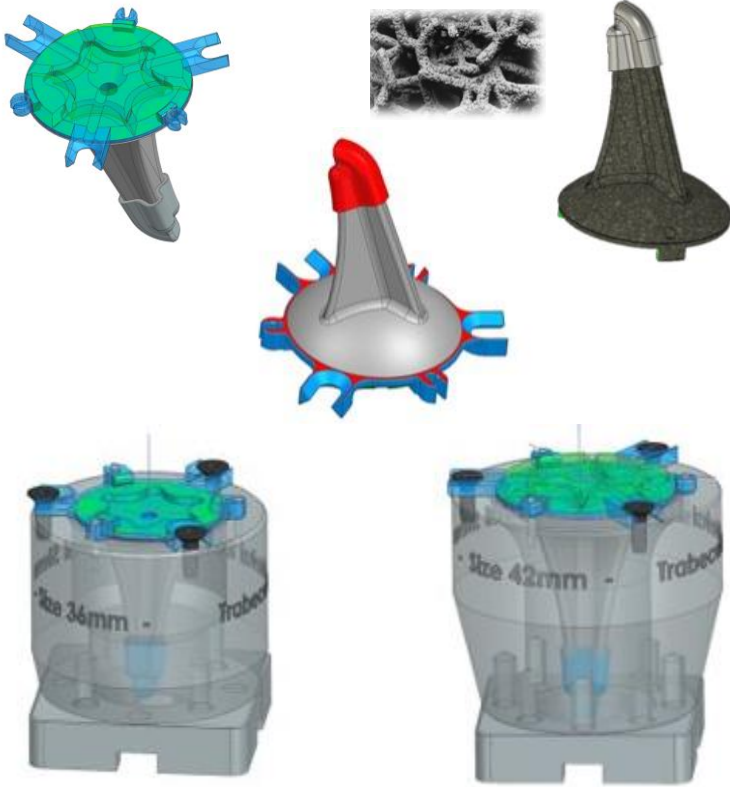
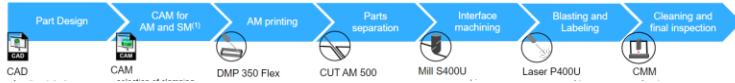
Setup	- Machine setup / referencing. Special fixture on Macro	1 hours
Machining	- Side, bottom and length finishing	14 min/part
Total for 2 x 8 parts		5.2 hours



Total Machining
time for one part:
135 min



GFMS / design data for printing and post-processing



GFMS / 3DXpert data preparation printing



Time estimation

Calculation

From: 0 μm

To: 58,500 μm

Start

Scan time

- Group: 36mm_ShoulderImplant_v03062102: 47h 31m (+ 0.79h)
- Group: 42mm_ShoulderImplant_v03062102: 1h 18m 4s (+ 1.30h)
- Group: 7 slices of 36mm_ShoulderImplant_v03062102: 3h 12m 42s (+ 5.59h)
- Group: 7 slices of 42mm_ShoulderImplant_v03062102: 3h 16m 31s (+ 5.17h)

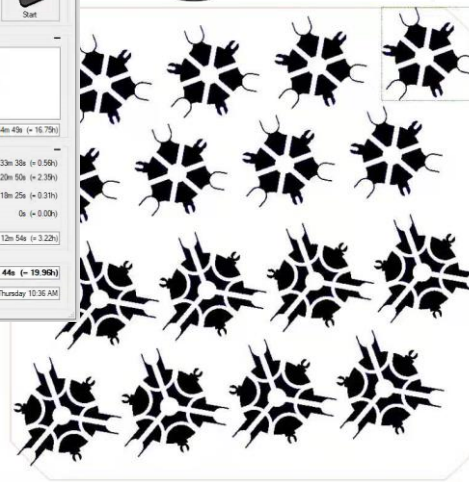
layers: 975 (19h 44m 49s (+ 16.79h))

Machining time

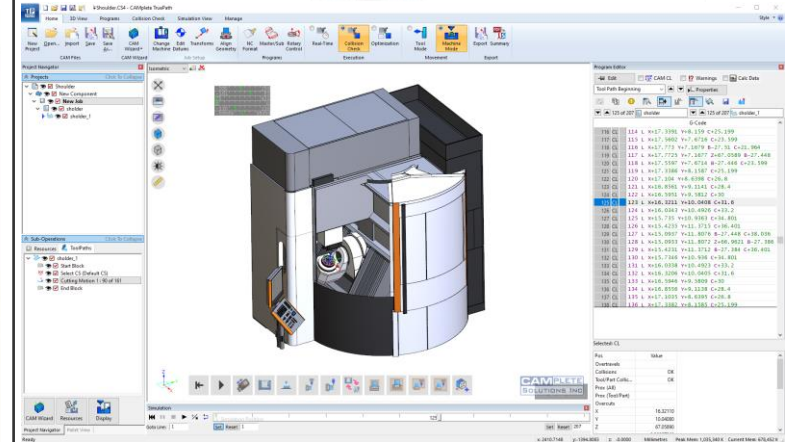
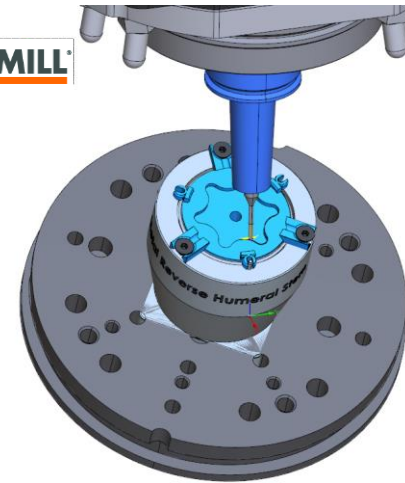
- Cooking time: 33h 38m (+ 0.59h)
- Net layer deposition time: 2h 20m 50s (+ 2.35h)
- Minimum layer time: 13h 25m (+ 0.31h)
- Keep cooler at home positions: 0s (+ 0.00h)
- Single direction coating: 3h 12m 54s (+ 3.22h)

Total: 19h 57m 44s (+ 19.96h)

Completion time: Thursday 10:36 AM



GFMS CAM data preparation post processing





Biotec srl



The only partner you need in modern Implantology

For over 25 years, we have been providing professionals in Implantology with our exclusive know-how, creating certified and high-quality medical devices. All internal productive processes are subject to the most accurate and detailed inspection procedures performed by our highly specialized personnel.

Superior reliability, customized services and enviable quality/price ratio guarantee our partners' needs absolute satisfaction.



Biotec srl case

Market segment:

Dental

Application:

Implants

Mesh for guided bone regeneration

Veterinary prosthetics

Reasons for success:

Modular concept

Durability of titanium (oxidation prevention)

Internal sieving station for the maximum safety

Bigger printing volume

GF Workflow: DMP350>>System 3R>>Mikron Mill S400



DMP350 Factory

Weblink:

<https://www.btk.dental/en/>



Actual process

Build area 100x100mm

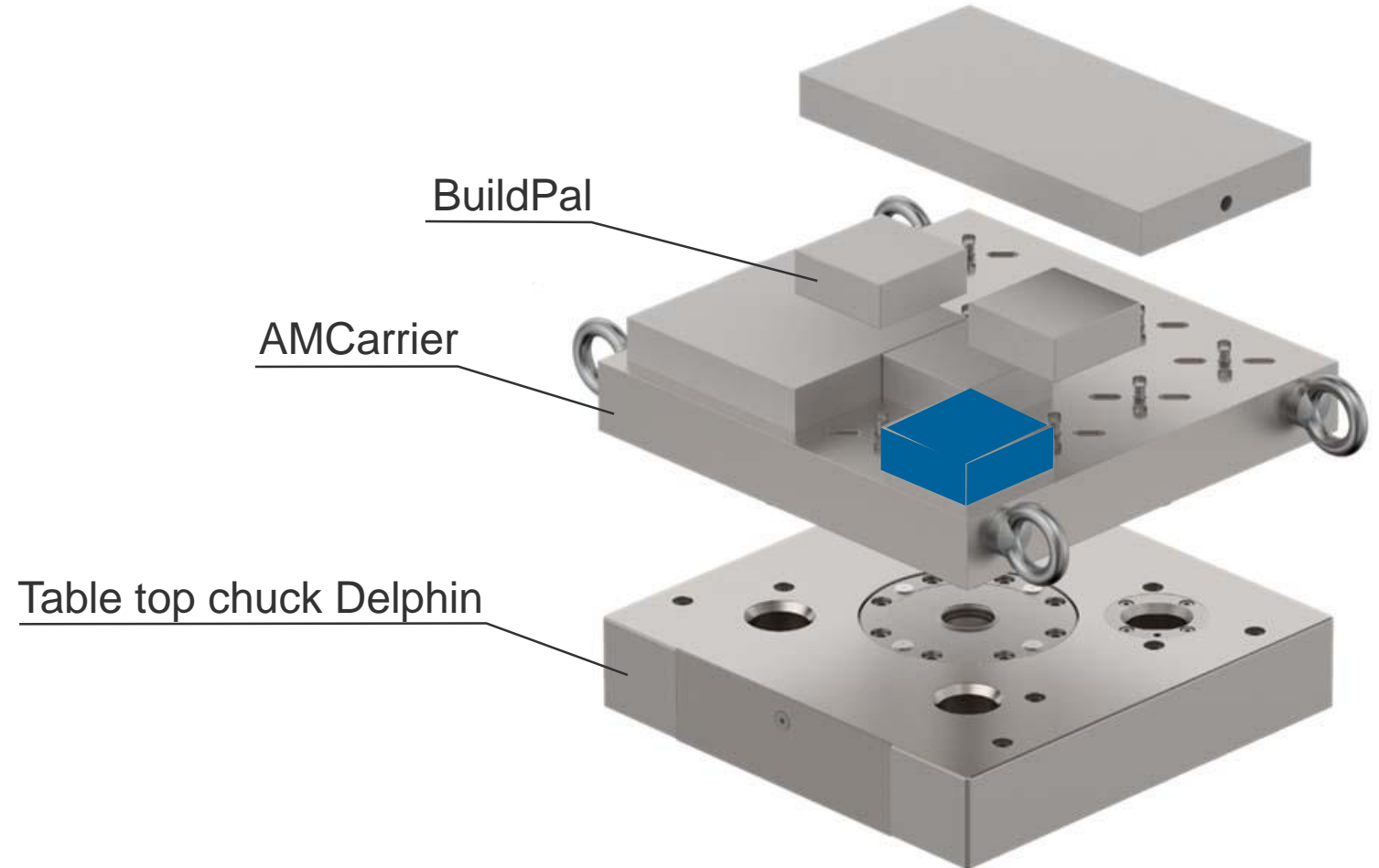
Buildplate is fixed on a System 3r pallet

Part is finished in a Mill S400





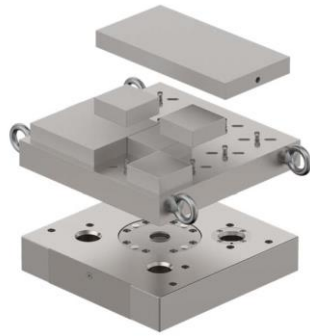
DMP350 + System 3R – the heart of the fixture



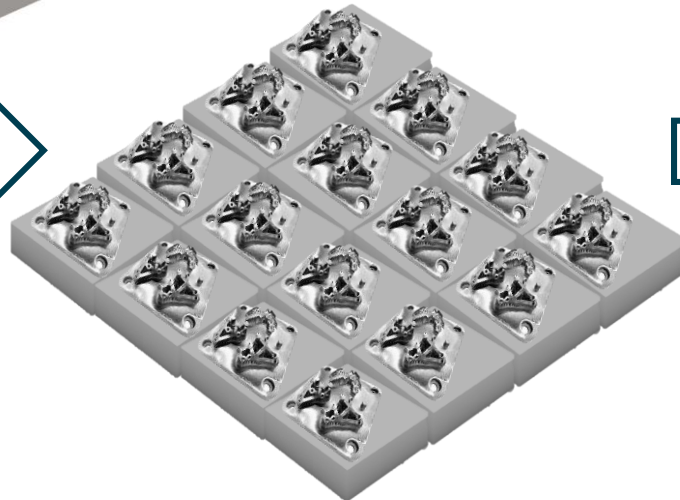


New process

Build area 275x275 mm



Parts printed directly on
Macro pallets



Part is finished in a Mill S400



Thank you!