

MELTIO

**3D Metalldruck
durch additives
Laserschweißen
am Roboter**



www.k-wilhelms.de



MELTIO

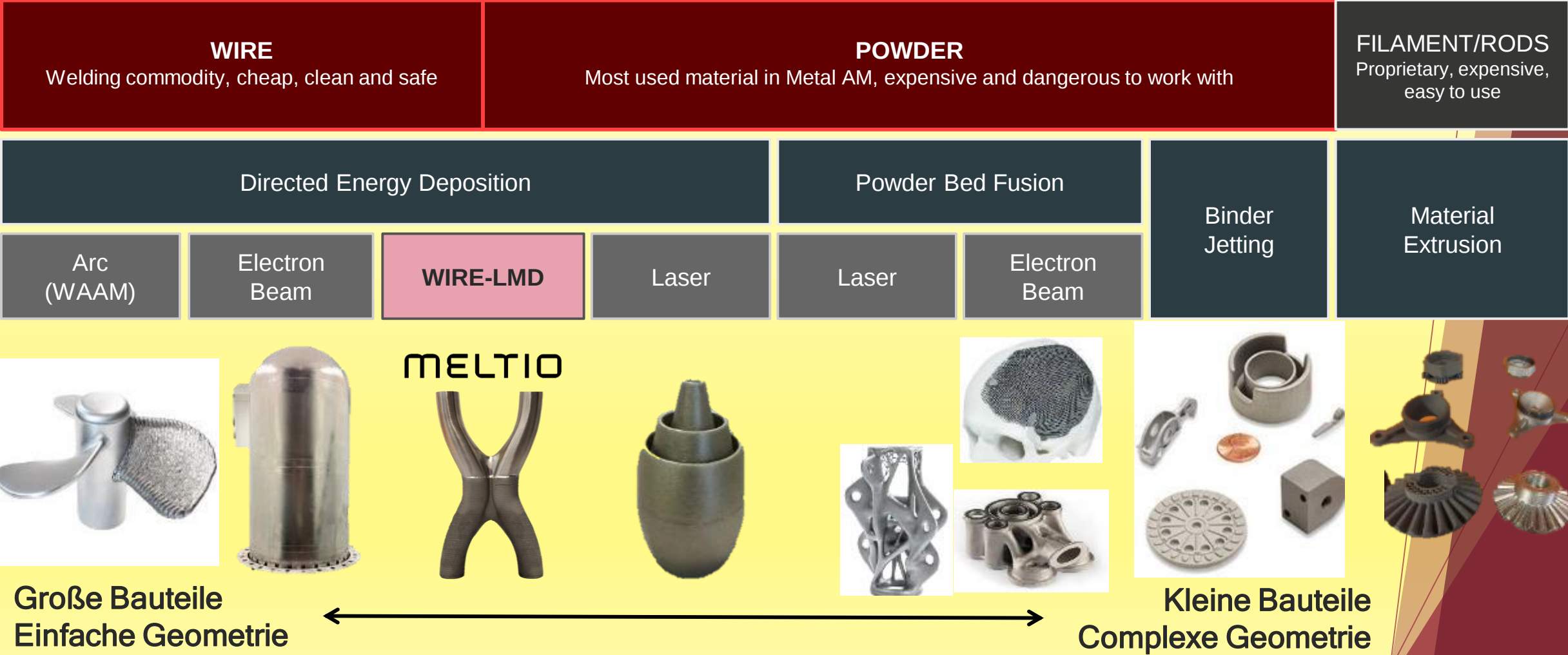
3D Metalldruck



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Metal AM Technologien

are classified by feedstock and energy source



Hybrid
Manufacturing

Near Net Shape
Manufacturing

Repair and
Feature Addition

Mass
Manufacturing

Short-runs

One-offs

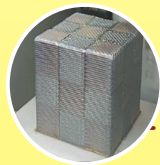
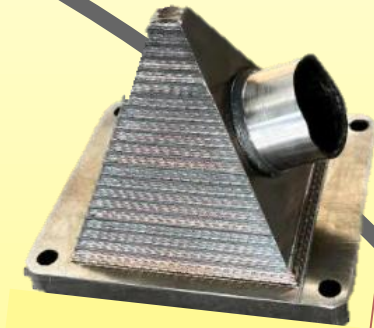
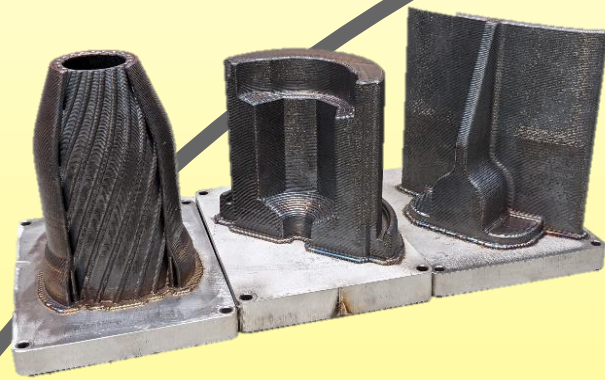
RESEARCH

PROTOTYPING

MOLDS &
TOOLING

MANUFACTURING

REPAIRS &
END OF LIFE



MIT STOLZ IN SPANIEN HERGESTELLT

Neue Fabrik : Start 2020

1.800 qm (ca. 19.375 m²)

brandneue Fabrikationsanlagen in
Linares, Spanien.

>80 Mitarbeiter

Unabhängige Produktionslinien

Für die Montage von Meltio M450,
Meltio Engine,

geplante Produktionskapazität

200 Maschinen pro Monat

Bisher **über**
160 Maschinen
am Markt



Metal additive manufacturing barriers for industrial adoption



High Investment,
Development and Running
Costs

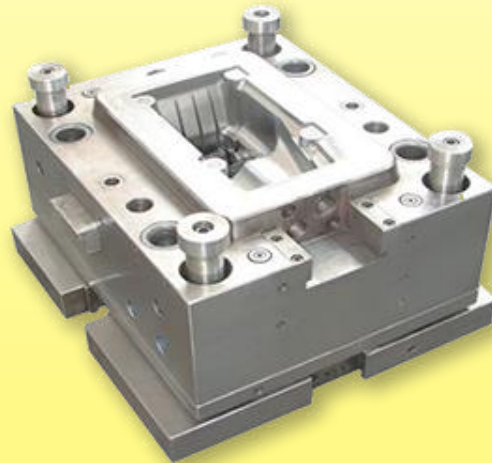


Limited Part Size and
Part Properties



Subpar User Experience
and Convenience

Traditional markets like **CNC** are growing at 5% YoY but valued at **\$81.15B**, **increasing market value at +\$4B/year**, more than the whole Metal AM market today.



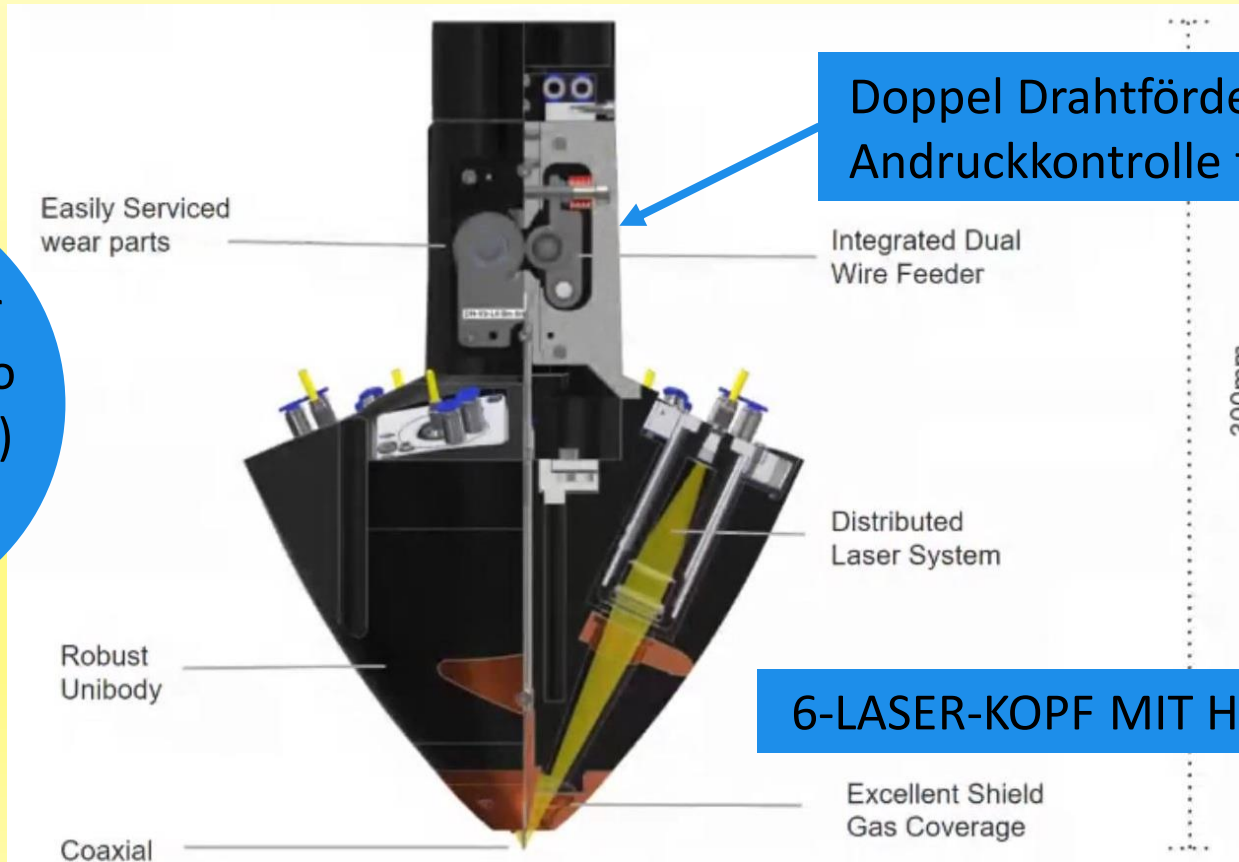
MELTIO SYSTEM

FORTSCHRITTLICHES LASER-METALL-AUFTRAGSSCHWEISSVERFAHREN

Patentierte Multi-Laser-Konstruktion

- Gleichzeitige Draht- und Pulverzufuhr möglich

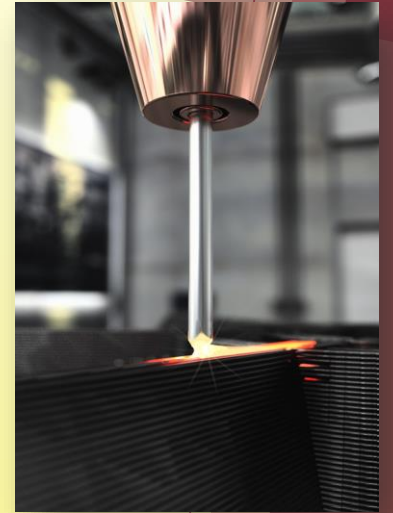
Hochkompakter
Beschichtungs-
kopf: 200mm (B/T)
x 300mm (H)



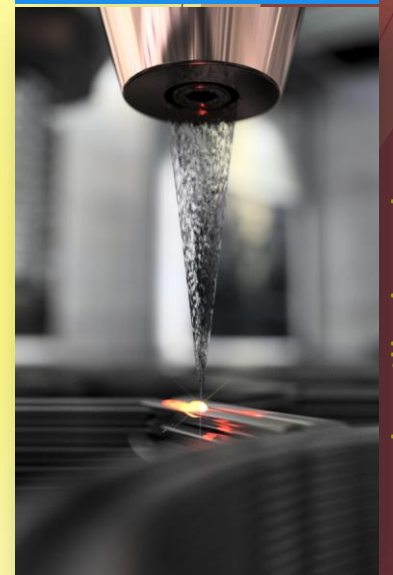
Doppel Drahtförderer mit
Andruckkontrolle für 0,8-1,2mm

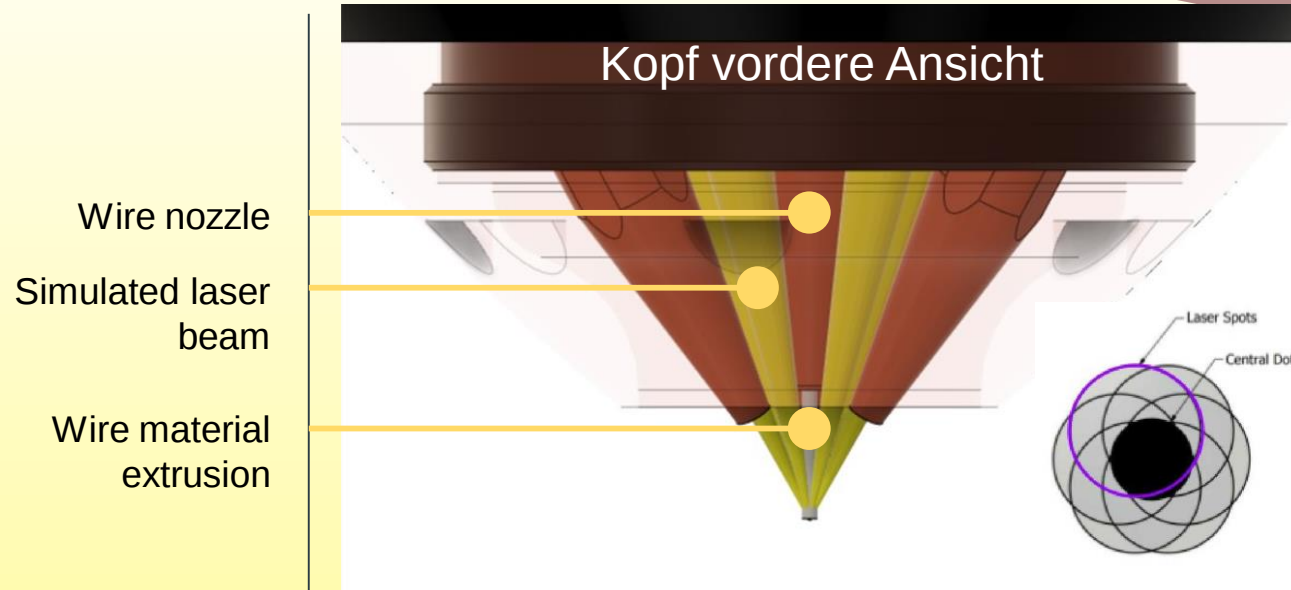
6-LASER-KOPF MIT HOHER LEISTUNG

DRAHTABSCHIEDUNG

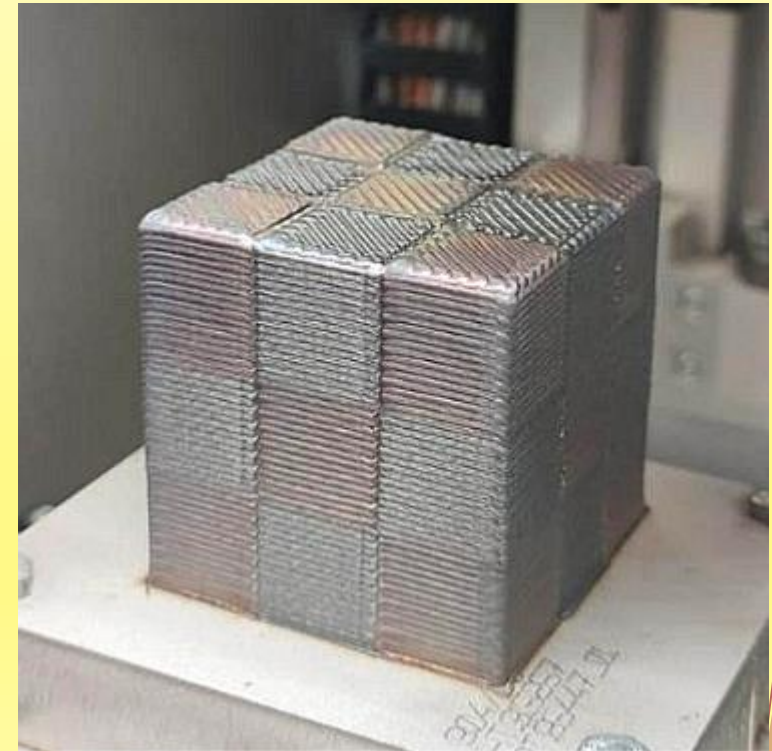
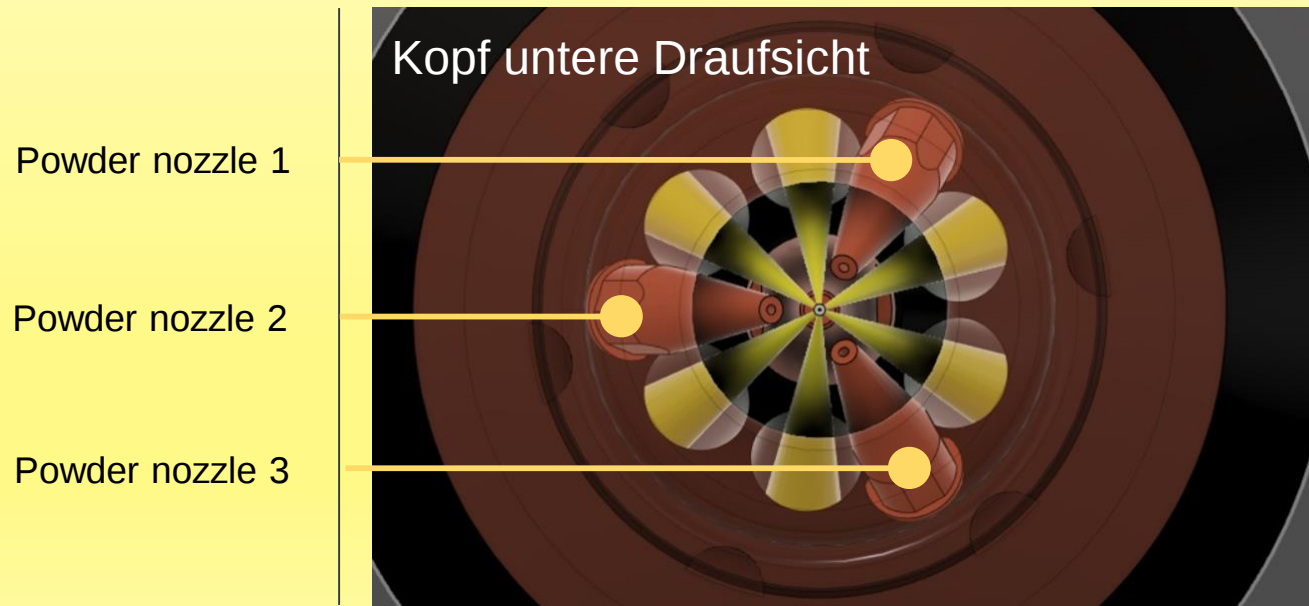


PULVERABSCHIEDUNG





SCHWEISSKOPF 2x Draht wechselbar und Pulver parallel



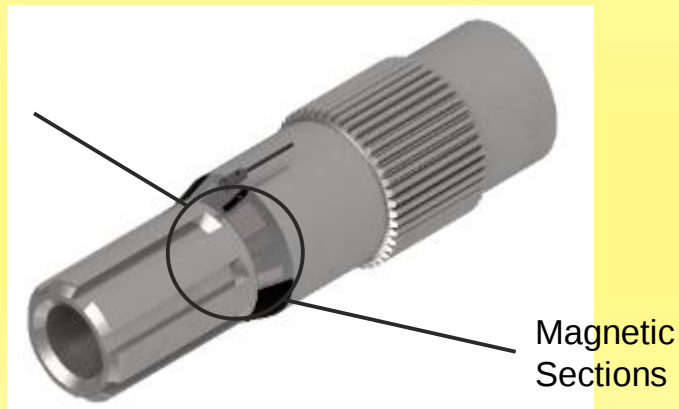
Dual Wire Integrated Functionality

Seamless integration of encoder in shaft for rotation and position measurement.

- The shaft is made from stainless steel 316L (non-magnetic)
- The inserts are printed from mild steel. (magnetic)
- A hall sensor is used to detect the position and speed of the shaft.
- Because the mild steel inserts are completely covered by the stainless steel shaft, corrosion performance of the shaft is preserved.

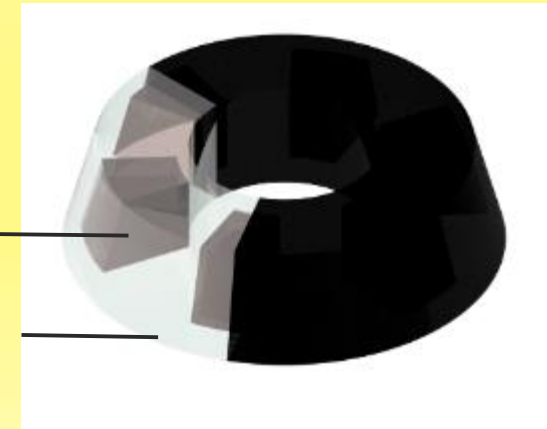


Hall Effect
Sensor



Mild Steel Insert

Stainless steel Jacket

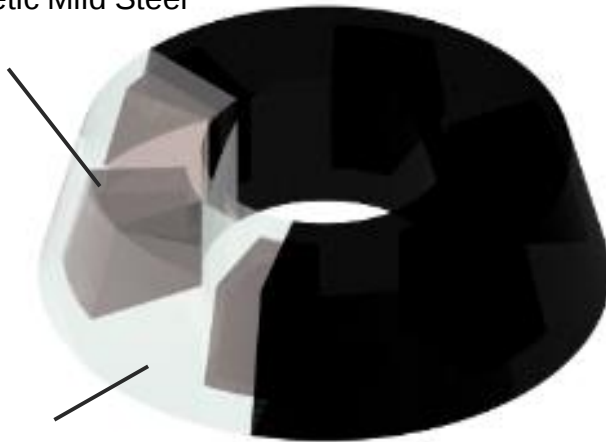


MELTIO

Zwei Werkstoffe In einer Lage, bietet viele Möglichkeiten



Magnetic Mild Steel
Insert



Stainless steel Jacket

Dual Wire for Wear Resistance

Turbine Fan Blade

Locally increase wear resistance with
leading edge from Inconel.

Material 1: Blade: Stainless Steel
316L

Material 2: Leading Edge: Inconel
718

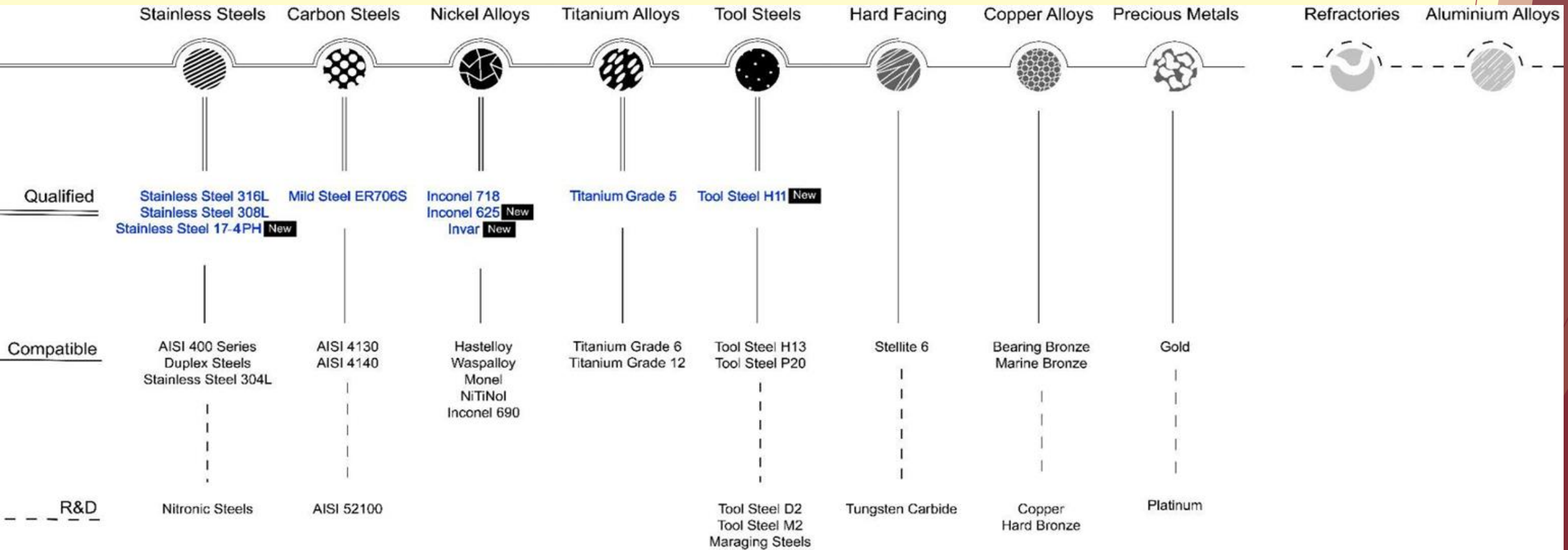


Dual Wire Material Compatibility

		Wire 1					
Compatible							
In development							
Incompatible							
Wire 2 or Substrate	Material	Stainless Steel	Mild Steel	Tool Steel	Titanium	Inconel	Copper
	Stainless Steel						
	Mild Steel						
	Tool Steel						
	Titanium						
	Inconel						
	Copper						

Unlimited Third Party Material Choice

Choose the ideal commodity welding wire for your application



MELTIO WERKSTOFFE

Edelstahl 316	Norm Eigenschaften	Gussteil	Meltio XY	Meltio XZ
Zugfestigkeit (MPa)	515	550	635 ± 13	650 ± 7
Streckgrenze (MPa)	208	260	390 ± 30	380 ± 17
Dehngrenze (%)	40	35	52 ± 3	46 ± 4

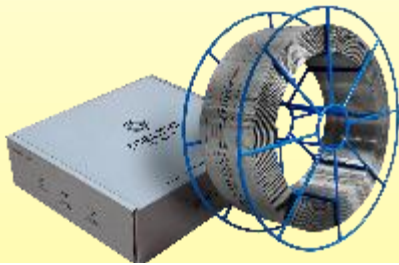
Titan 64	Norm Eigenschaften	Gussteil	Meltio XY	Meltio XZ
Zugfestigkeit (MPa)	930	860	950 ± 5	-
Streckgrenze (MPa)	860	758	882 ± 5	-
Dehngrenze (%)	>10%	>8%	12 ± 0.5	-

Inconel 718	Norm Eigenschaften	Gussteil	Meltio XY	Meltio XZ
Zugfestigkeit (MPa)	1241	802	1308 ± 10	1235 ± 11
Streckgrenze (MPa)	1034	758	1128 ± 20	1040 ± 12
Dehngrenze (%)	10	5	6.6 ± 2.1	8.5 ± 0.7

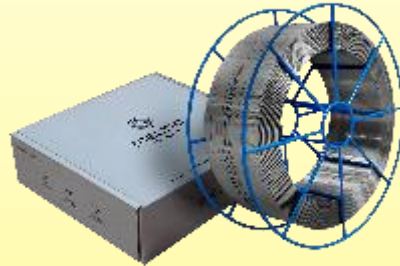


First-time-right with Meltio Materials

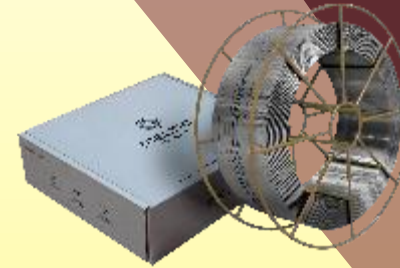
Guaranteed part properties with optimized profiles



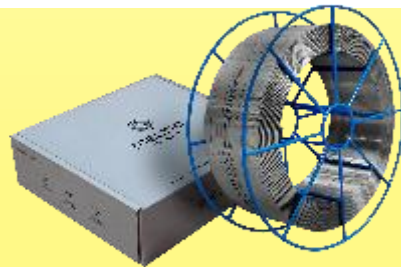
Meltio Stainless Steel 316L - from 20€/kg
Highly corrosion-resistant grade of austenitic stainless steel with great mechanical properties.



Meltio Stainless Steel - 308L - from 14€/kg
All-round Stainless steel with adequate corrosion resistance and good mechanical properties.



Mild Steel ER70S - from 5€/kg
Mild steel with adequate mechanical properties and high ductility. Easily welded and machined.



Meltio Titanium 64 - from 85€/kg
High strength Alpha+Beta alloy with excellent fracture toughness, corrosion resistance and biocompatibility.



Meltio Nickel 718 - from 105€/kg
High strength nickel-super alloy with large working temperature range. Highly resistant against cracking while protecting well against corrosion.

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Best-in-class Material Datasheets

During 2022 the process team of Meltio is set to produce the most complete material datasheets for directed energy deposition. Current datasheets (website) are valid and show promising results, however they are back-dated to 2020 and substantial improvements in process control and material justify a cohesive lab study.

In 2022 results will be published for: stainless steel 316L, tool steel H13, titanium 64, inconel 718 and cobalt-chrome.



Phase 1

A large range of parameters are tested to define the process window.

Tested Attributes:

- Density
- Hardness



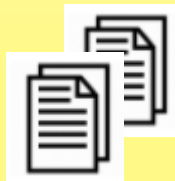
**+ 18 samples
per material**

Phase 2

Subselection of best results from phase 1 we build sufficient samples for statistically significant testing for each parameter set.

Tested Attributes:

- Density
- Hardness
- Tensile Strength
- Impact Strength
- Metallography



**+ 24 samples
per material**

Phase 3

Selection of best parameter set from phase 2. Statistically significant advanced analysis including fatigue, chemical, surface and RDX.

Tested Attributes:

- Density
- Hardness post Heat-treatment
- Tensile Strength
- Impact Strength
- Metallography
- Surface Roughness
- Fatigue Testing
- Chemical Analysis
- RDX testing



**+ 72 samples
per material**

HART BESCHICHTEN MIT 66 HRC = 870 HV



Anstatt Härten,
Rissfrei schweißen

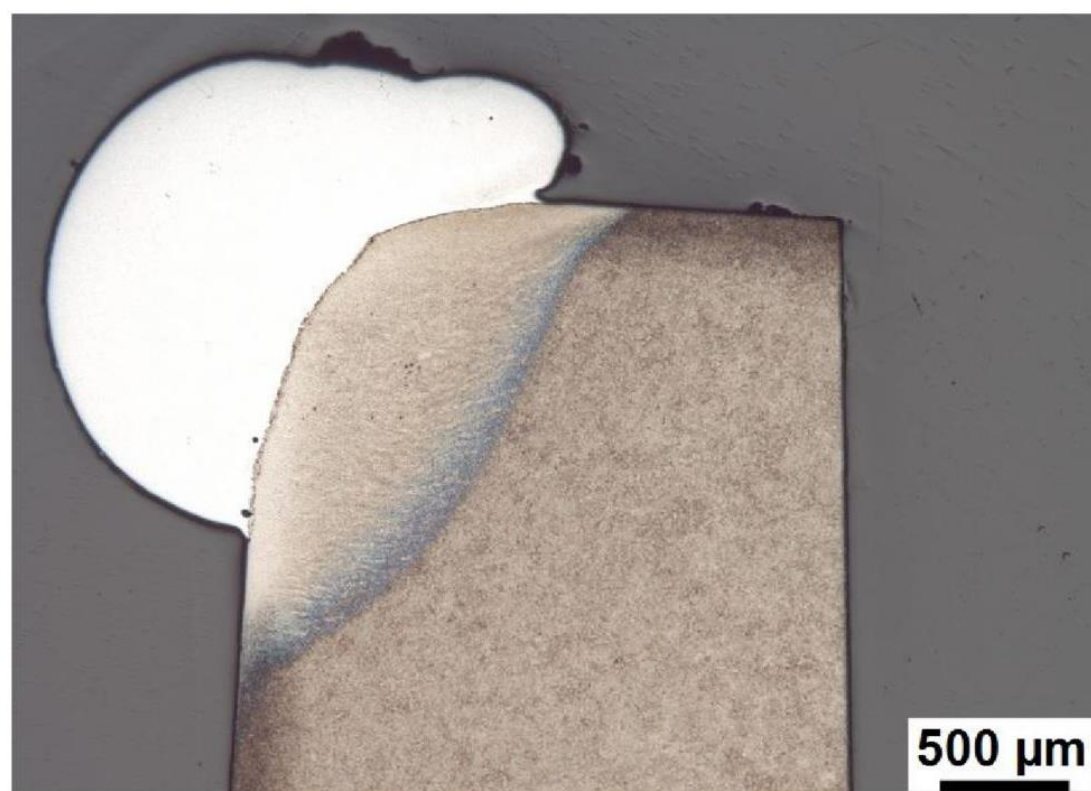


Bild 1.3 Lichtmikroskopische Aufnahme SN 1 Übersicht

Ätzung: 10%ige alk. HNO₃

Bild-Nr.: 1.7 Lichtmikroskopische Aufnahme SN 1 Detail

Vorteile

MELTIO-MATERIALEIGENSCHAFTEN

Zugfestigkeit des jew. Vollmaterial

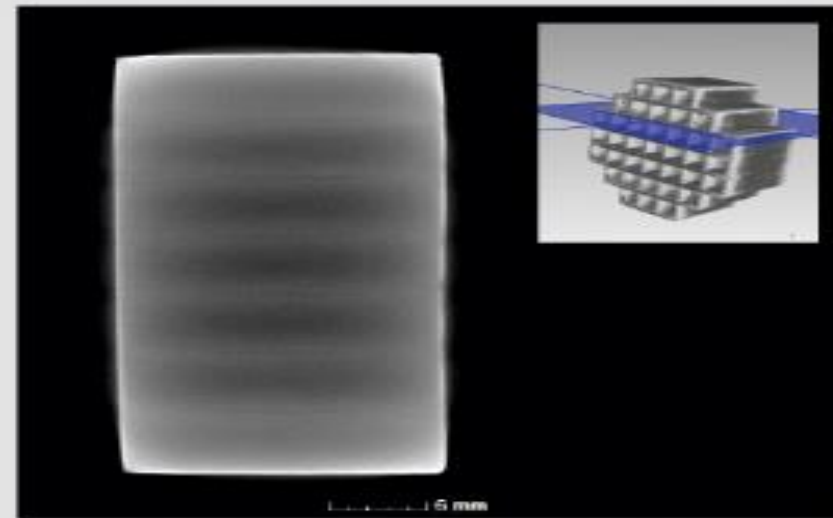
FULL DENSITY

Axial Tomography Report



SAMPLE

Inspection resolution: 28 μm



CT RESULTS

Good densification in vertical walls of the samples

Metal AM Cost Comparison

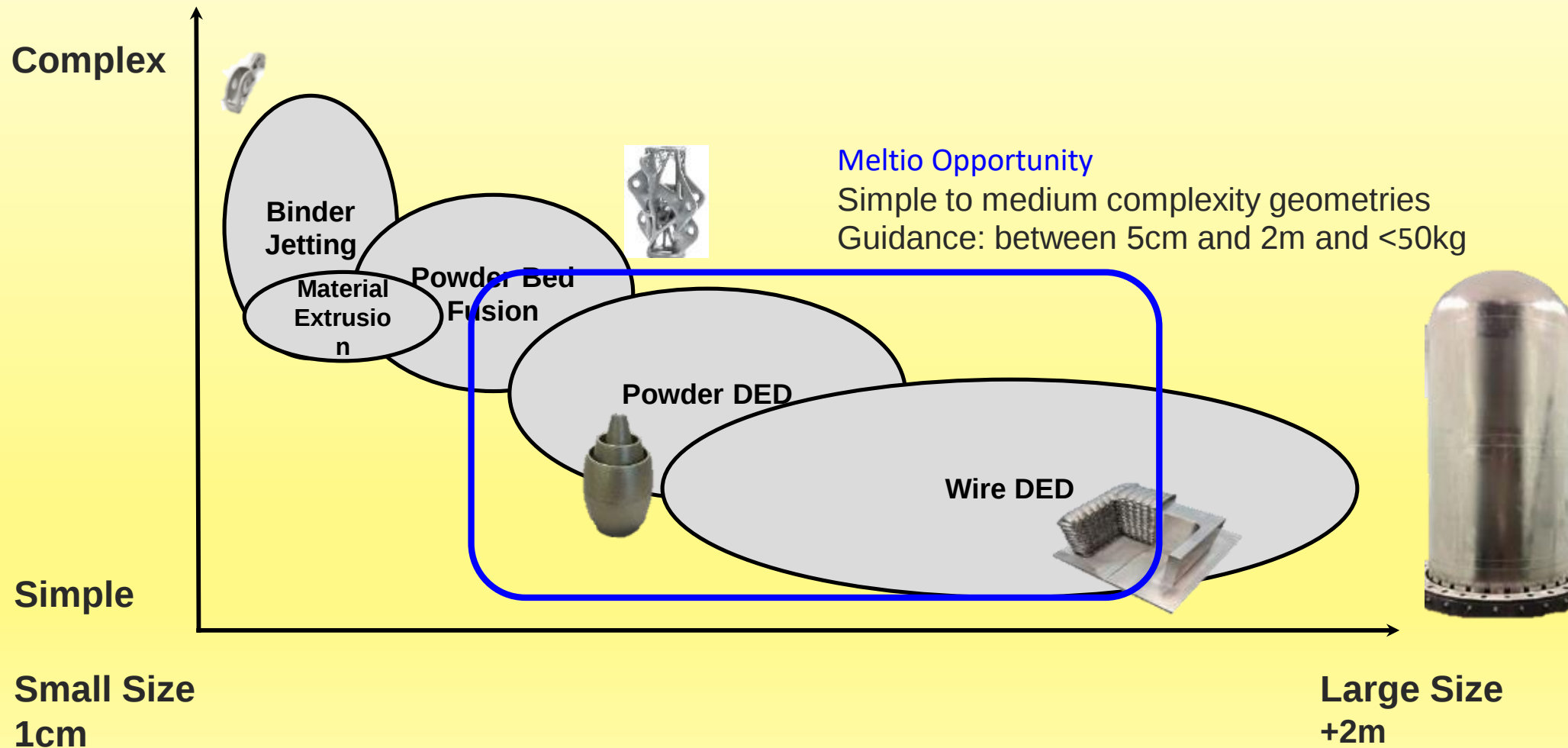
Meltio is the process with the lowest investment, lowest material and energy requirements.

Process	3D Printer and Accessories*	Materials
Arc (WAAM) DED	200k - 1M€	10-100€/kg
MELTIO Wire LMD	120k – 160k€	10-100€/kg
Powder DED	250k – 2M€	60-200€/kg
PBF Powder Bed Fusion	150k – 2M€	100-500€/kg
Binder Jetting	350k-1M€	100-300€/kg
Material Extrusion	150-250k€	200-400€/kg

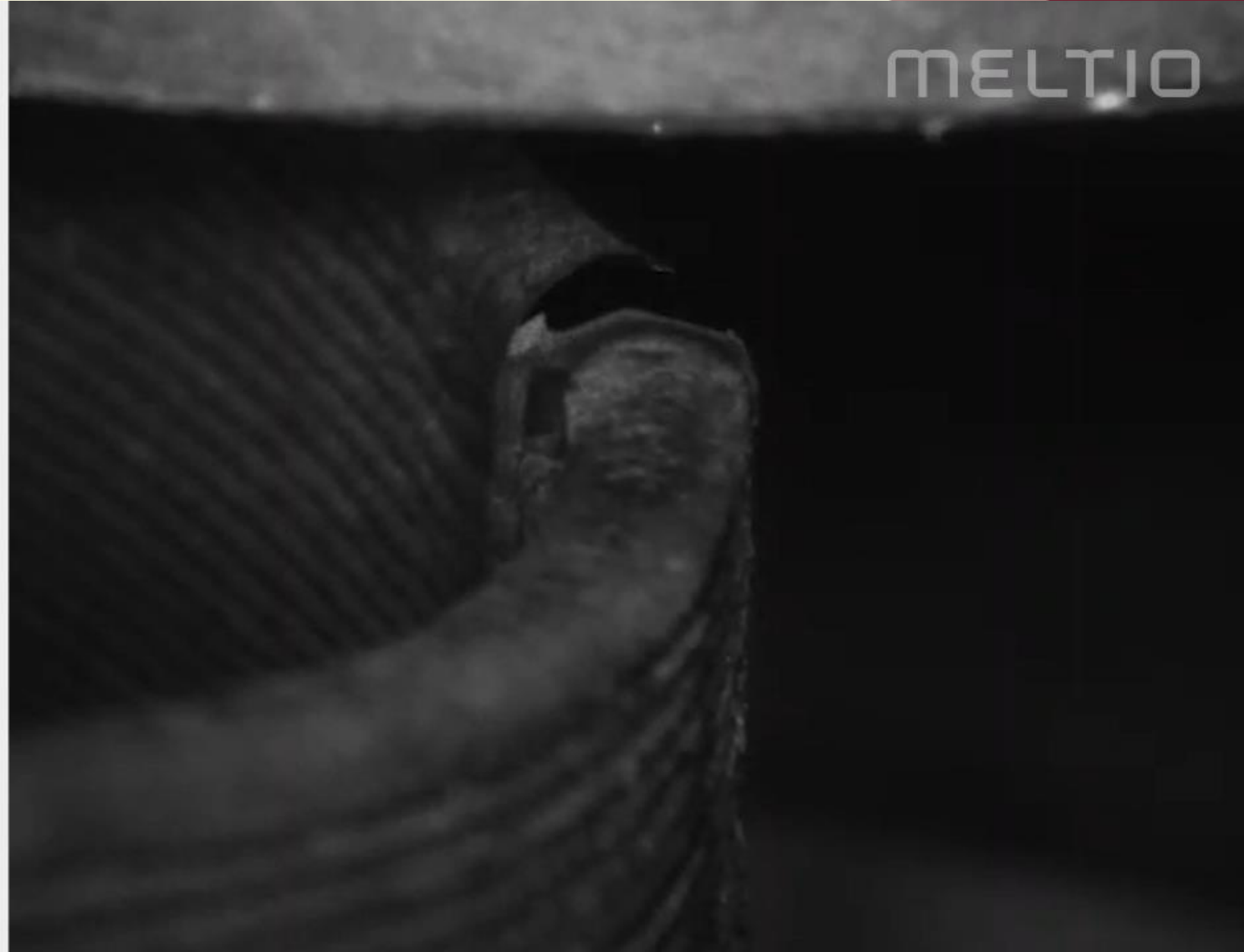
**Considering equipment necessary to get a dense metal component*

Vorteile

MELTIO LASER-METALLAUFTRAGSSCHWEISSVERFAHREN



Meltio M450



PRODUKTPALETTE

Industrieller Metall-
3D-Drucker mit
kleiner Stellfläche



M450

Turn Key Drucker

Motor für
Metall-3D-
Druck



Engine



Hybrides AM-System

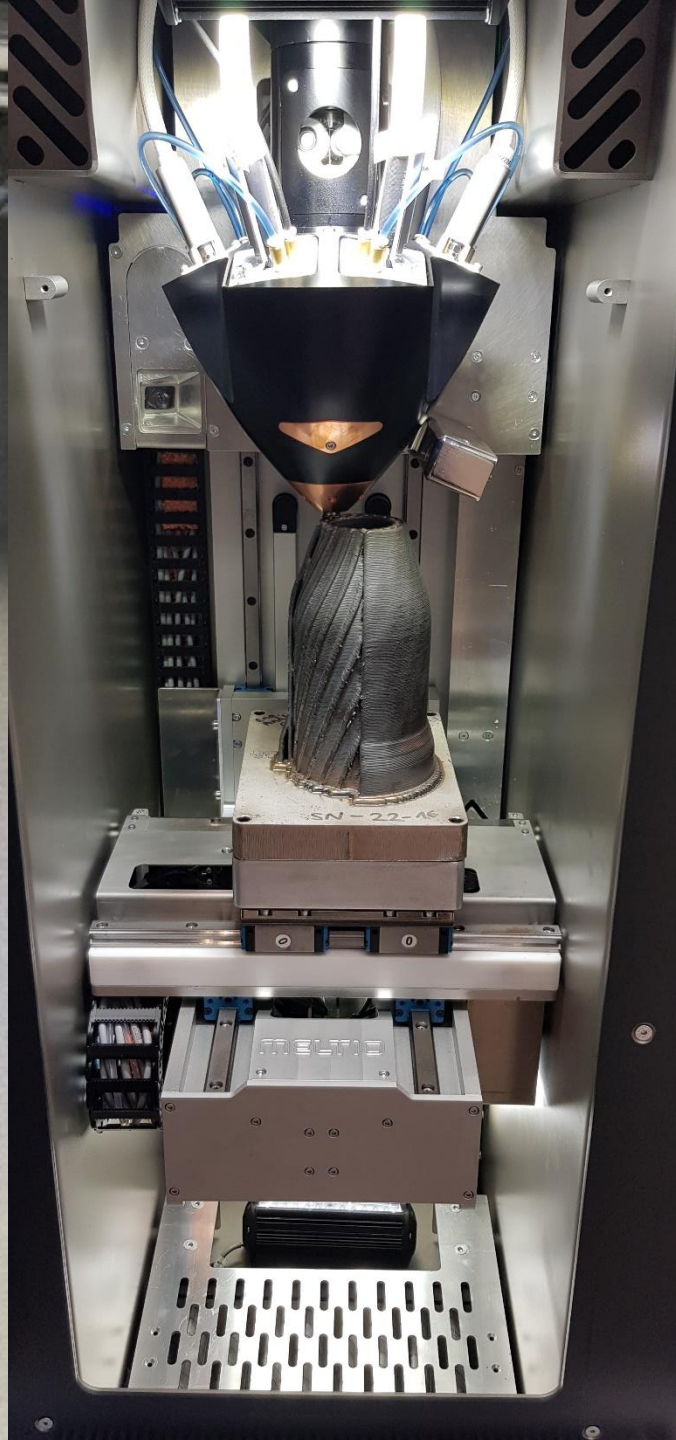


AM-Roboter-System

Kundenspezifische
Drucker
(OG-Drucker für ISS)



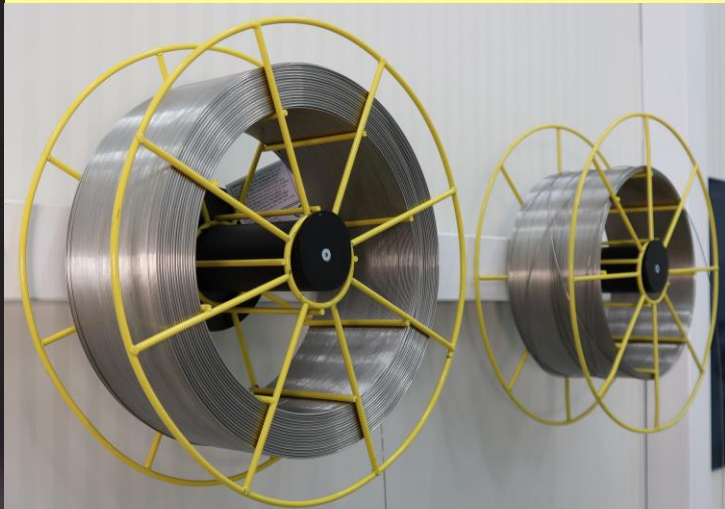
Kundenspezifisch



MELTIO

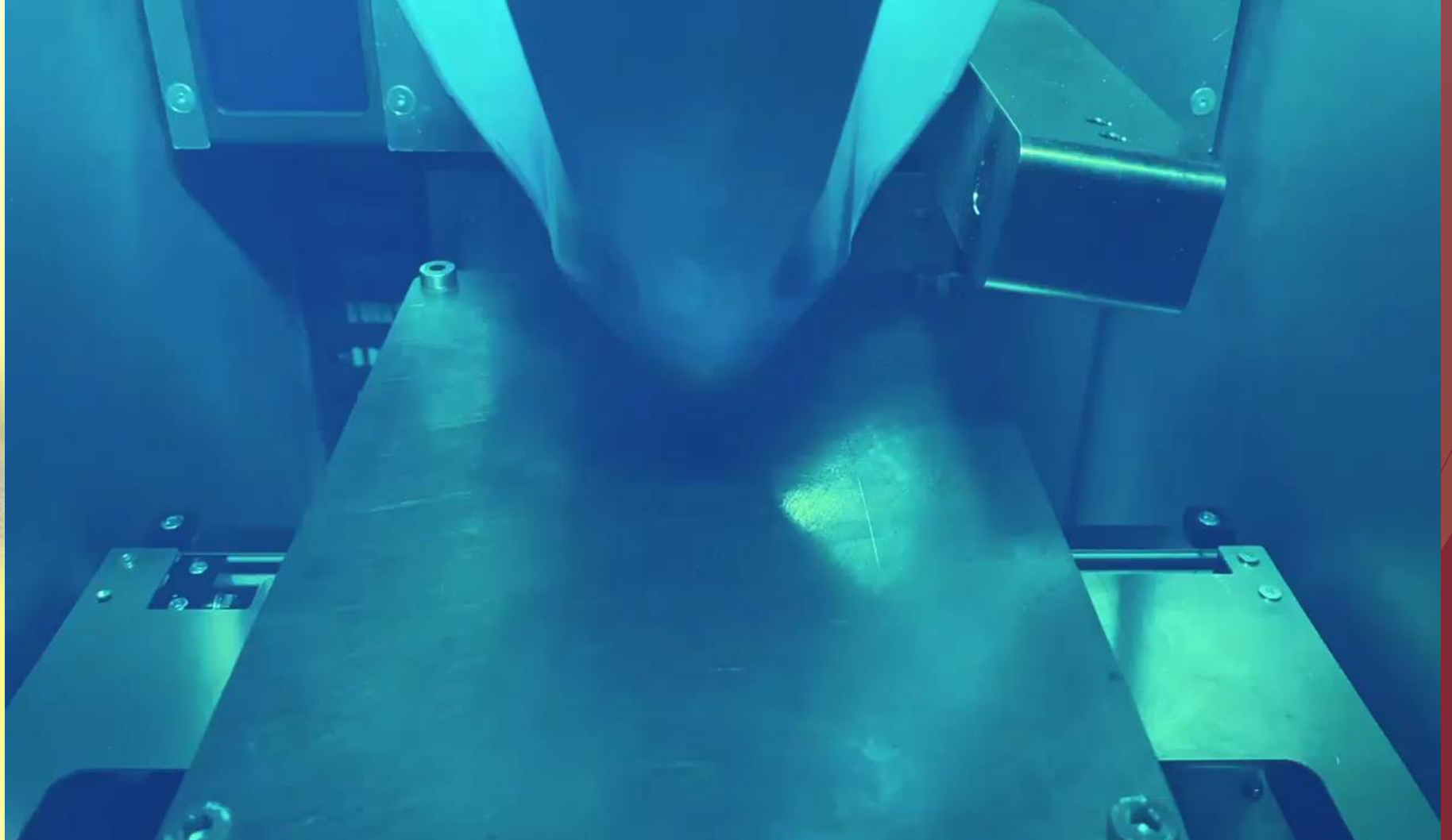


M450
3D METALLDRUCKER
komplett
Schlüsselfertig
mit 2x Draht



DER PROZESS

DRAHTAUFTRAGSSCHWEISSEN: TITANLAUFRAD

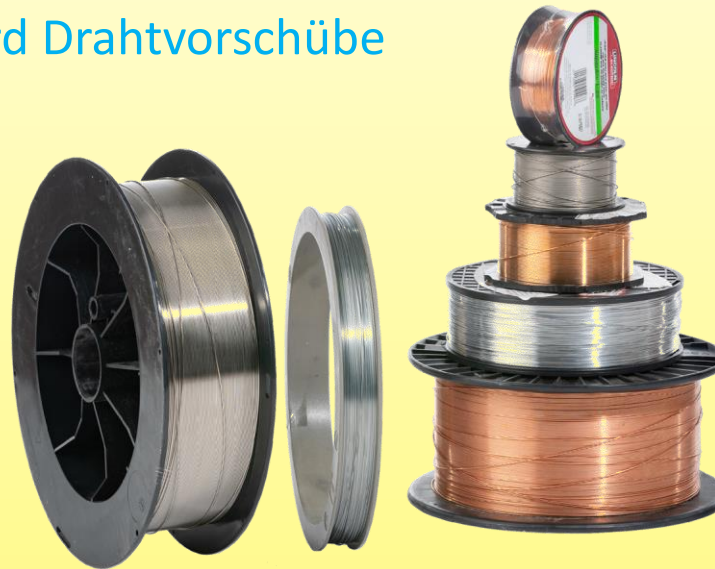


ENGINE

Für Roboter oder CNC 5 Achs METALL AM



Zwei On-Board Drahtvorschübe



Verwendet handelsübliche
Schweißdrähte

Multi-Laserkopf bearbeitet
Draht und Pulver

Der beste kommerziell
erhältliche Pulver/Draht-
LMD-Motor

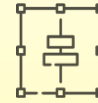
Extrem leistungsstark mit
bis zu 1,2 kW Laserleistung
und Hot-Wire-
Zuführungsoption

Niedriger Verkaufspreis ab
1/3 bis 1/6 von
Konkurrenzsystemen, die
nicht den gleichen
Funktionsumfang bieten

MELTIO ROBOT SLICER

(coming soon)

Easy to use robot metal 3D printing software



Cell Configuration

Robot library and post-processor built-in for ABB, KUKA and FANUC, with no extra cost.



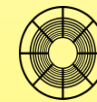
Toolpath Strategies

Planar, non planar and variable extrusion toolpaths easily defined. 2-axis positioner interpolation in 2 clicks.



Robot Simulation

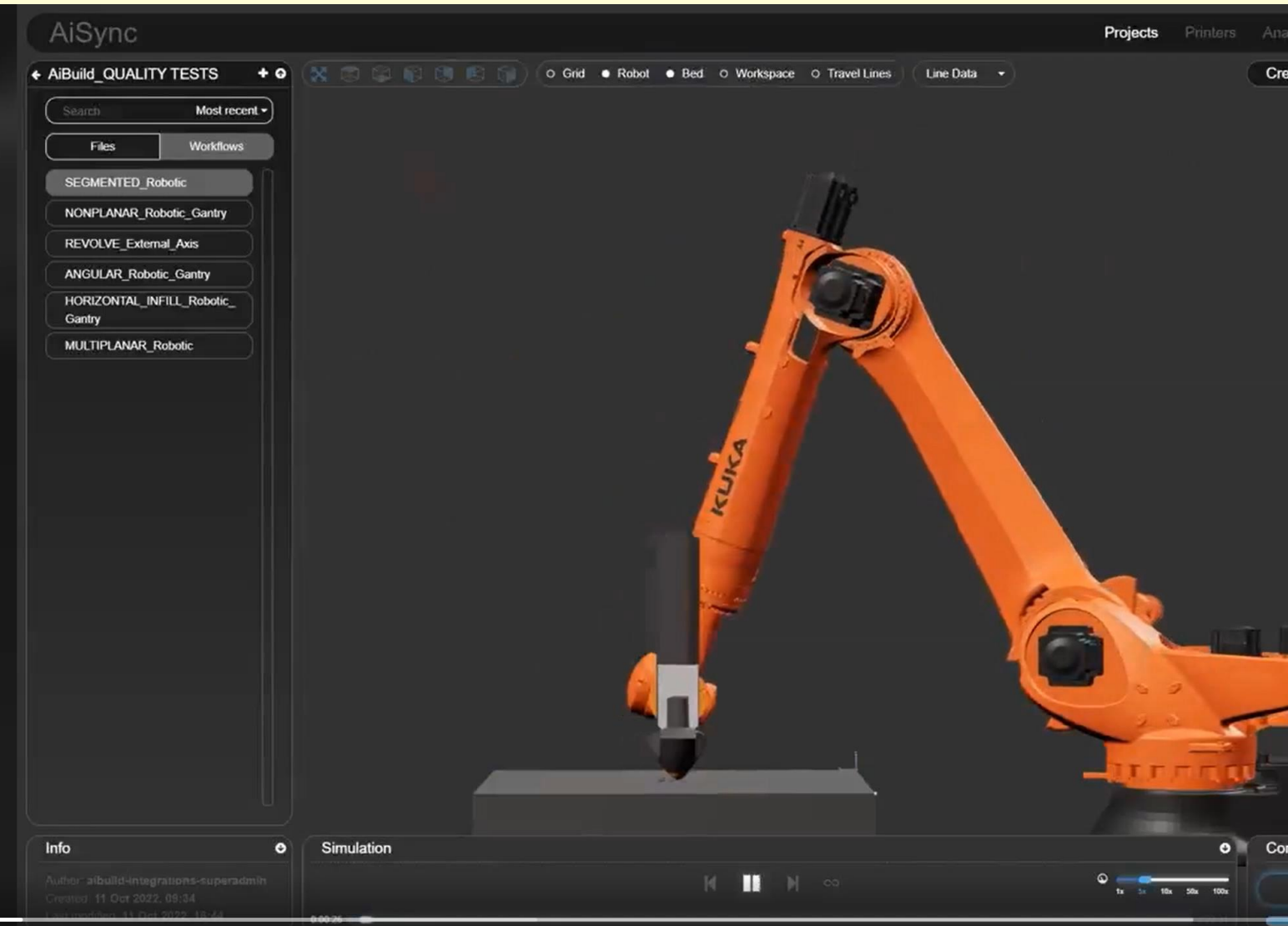
Virtual model of real robot movement to ensure great results. Collision check with the part as being printed.

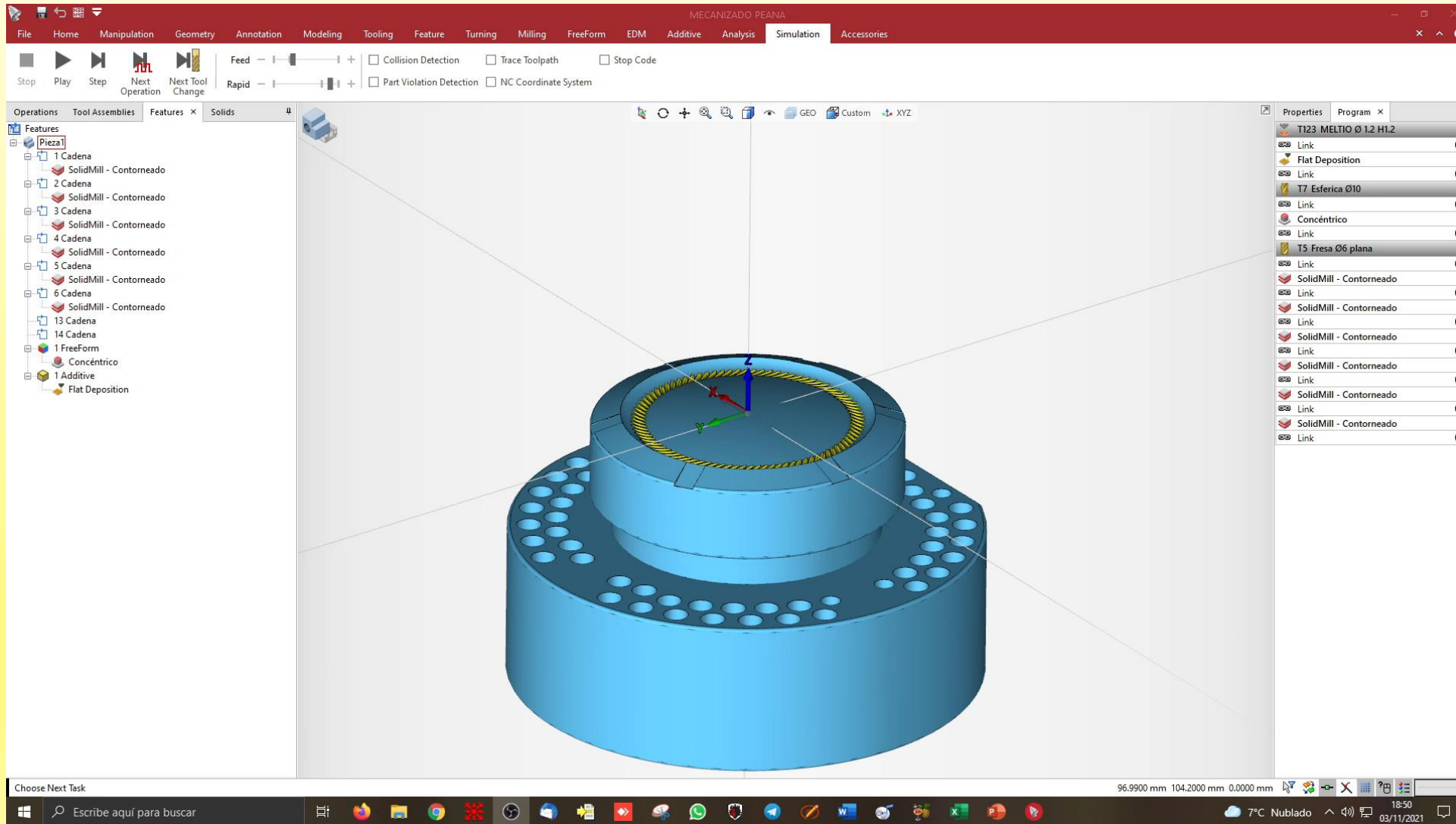


Print profiles

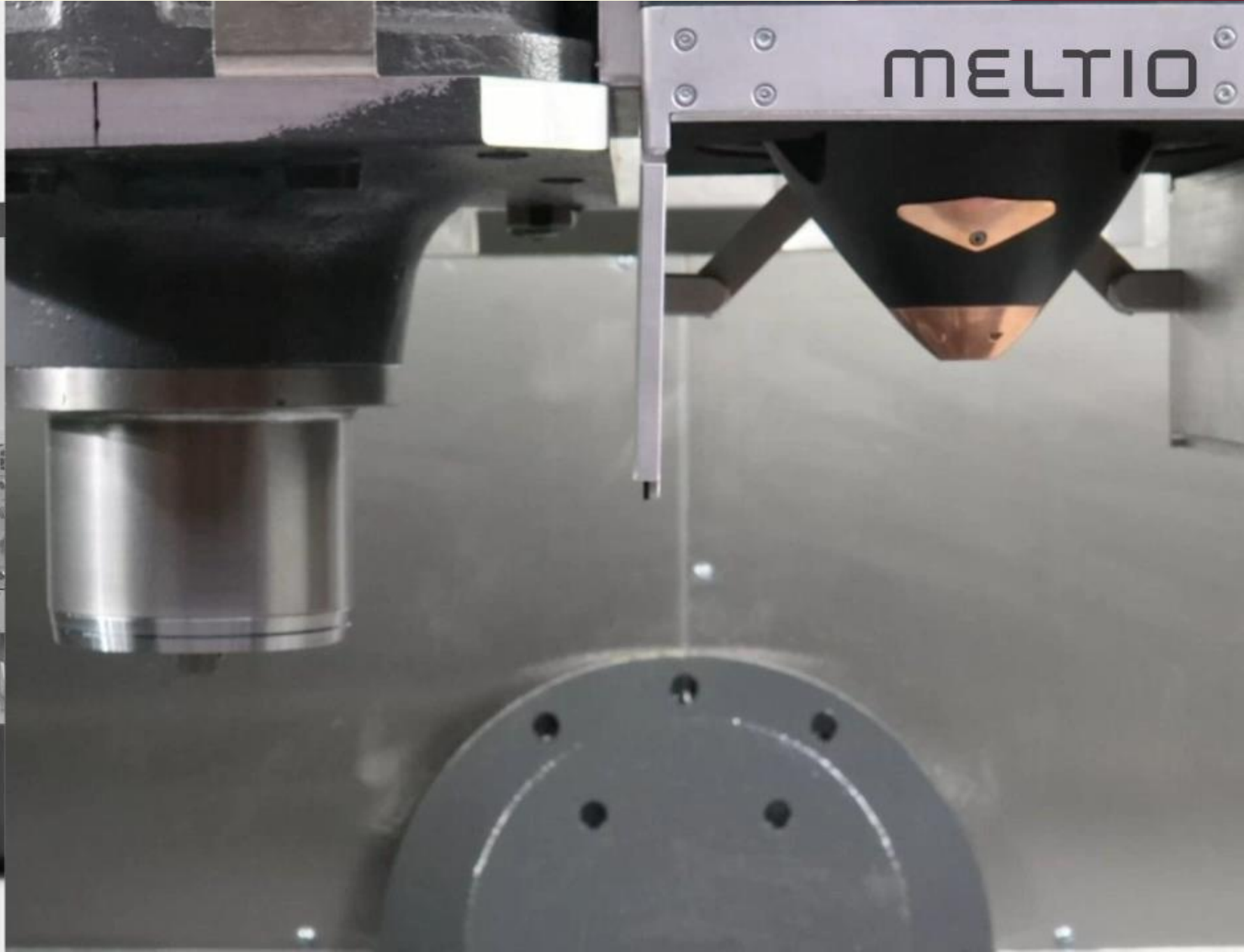
Optimized material and geometry parameters for most applications.

CAM System zur Auswahl



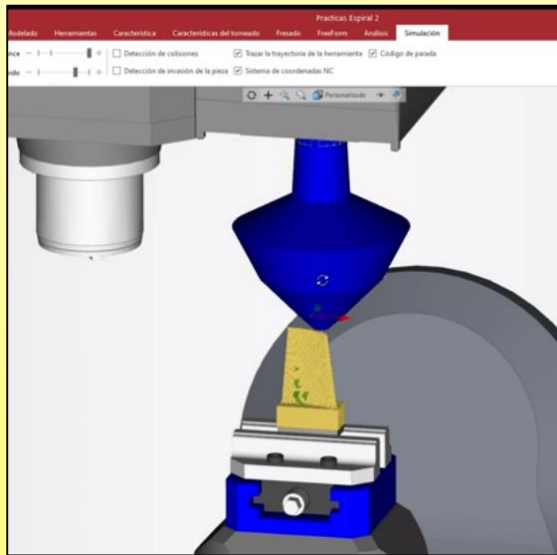


Meltio Engine CNC Integration



Hybrid Manufacturing

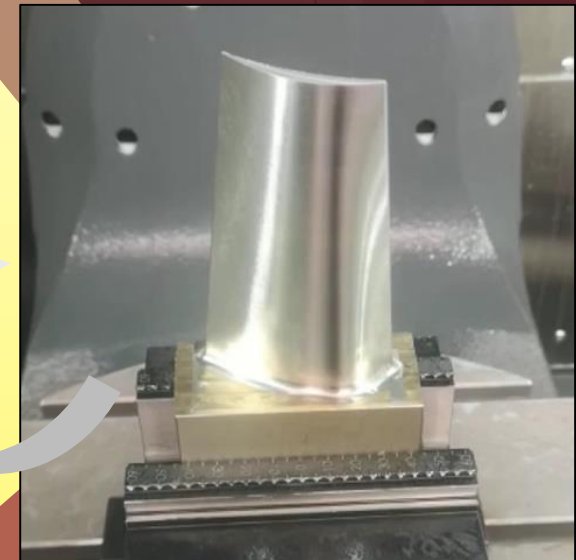
Hybrid manufacturing processes seek to combine the strengths of additive manufacturing (3D printing) with those of traditional CNC Milling / Subtractive manufacturing, to create a single manufacturing workflow that effectively uses both at once.



1. Hybrid Toolpath



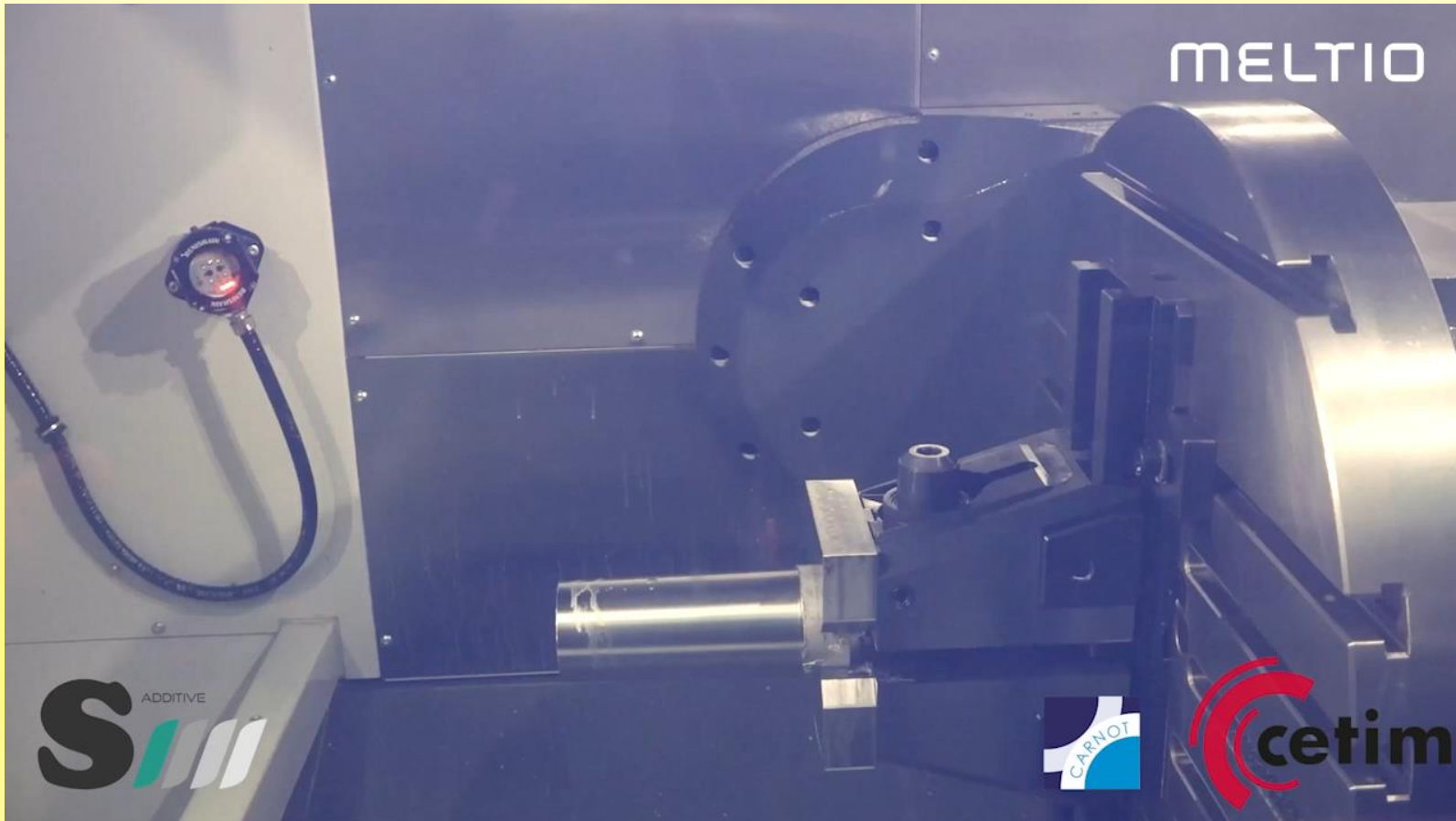
2. Metal 3D
Printing



3. CNC Machining

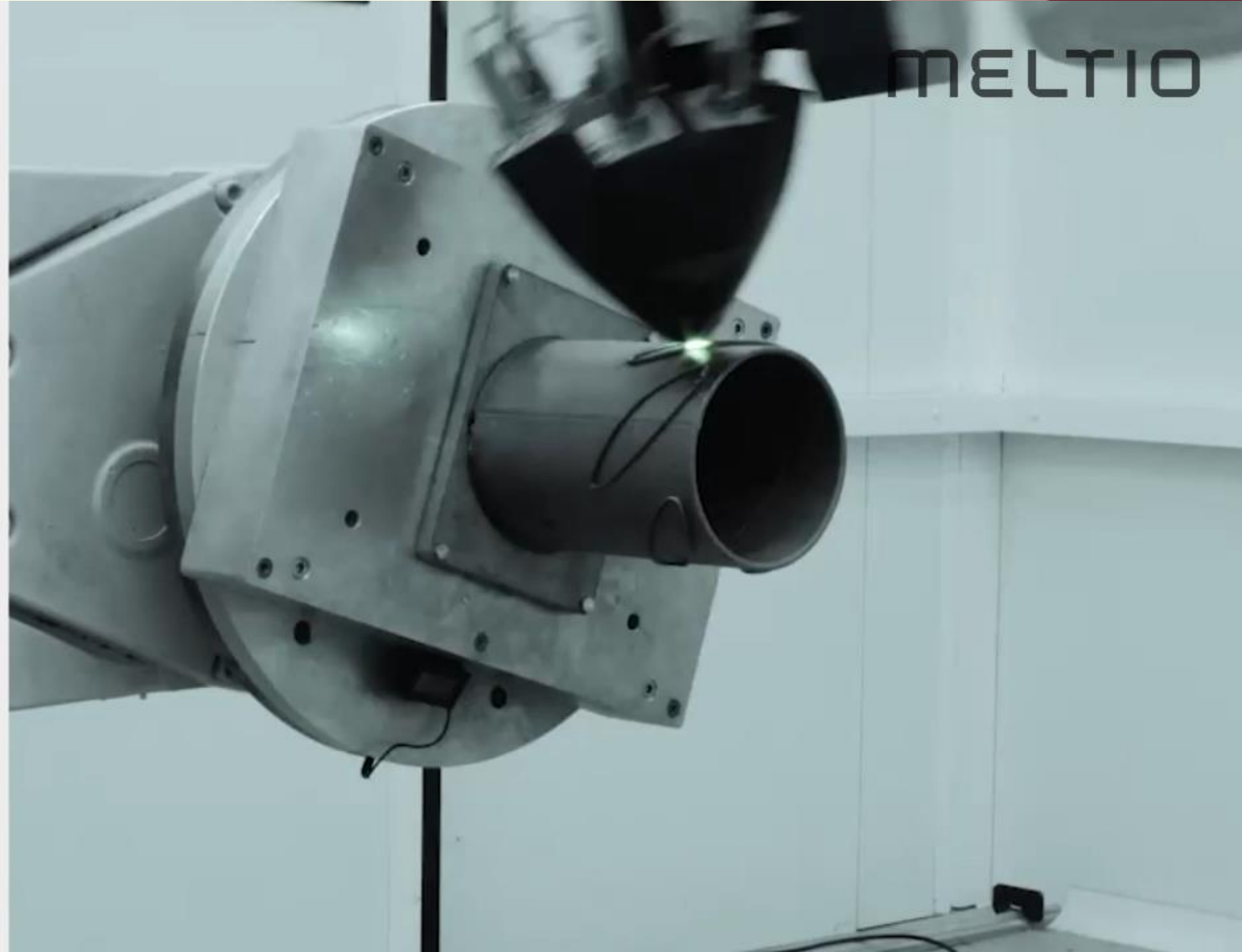
Hybrid Manufacturing of Complex Parts

Meltio Timelapse Video



Schweißen in 0°- 90°! Mit Positionierer

Meltio Engine
Robot Integration



Auspuffkrümmer





MELTIO

ABB

Flügel

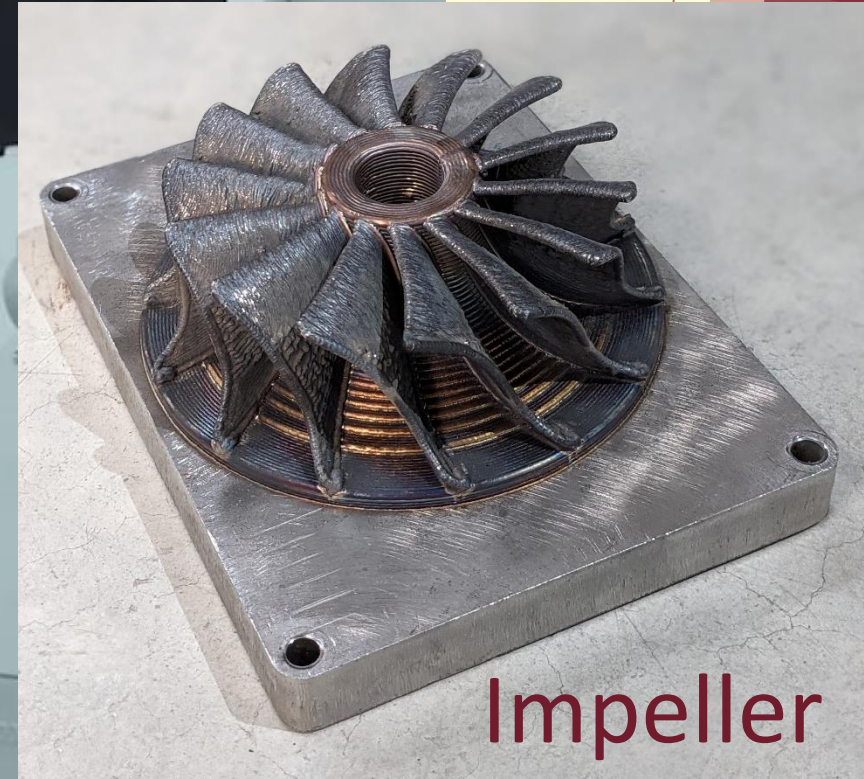
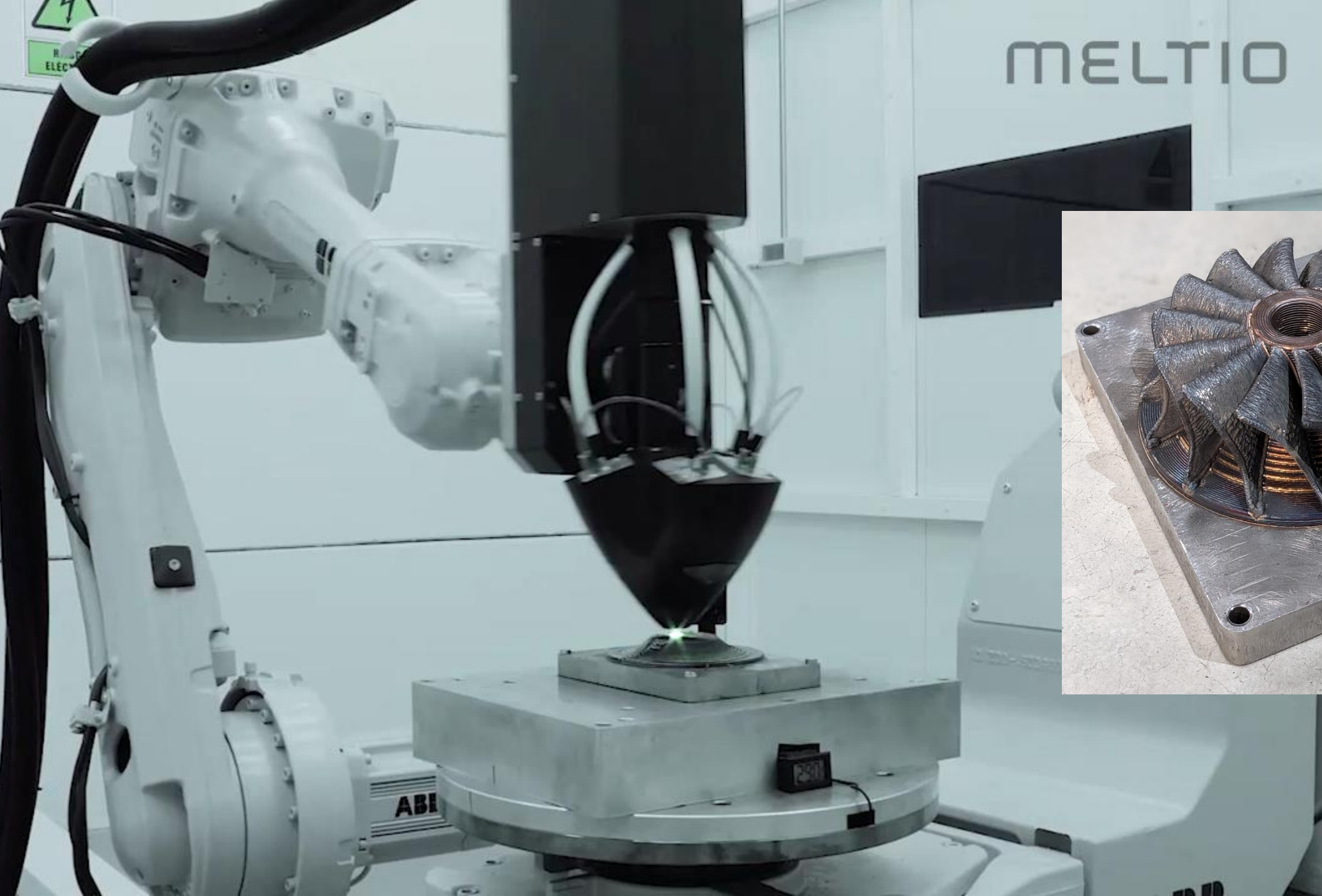
1,7m hoch,

1,5 mm
Wandstärke

stabile Prozess-
steuerung

Standard Material als Grundlage im Teil

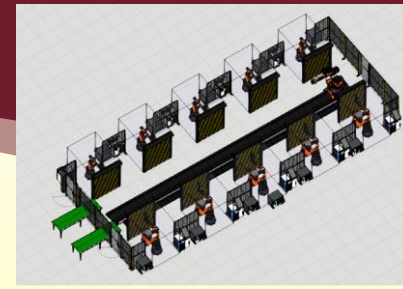
Da braucht man
viel weniger Draht
vom Teil aufbauen



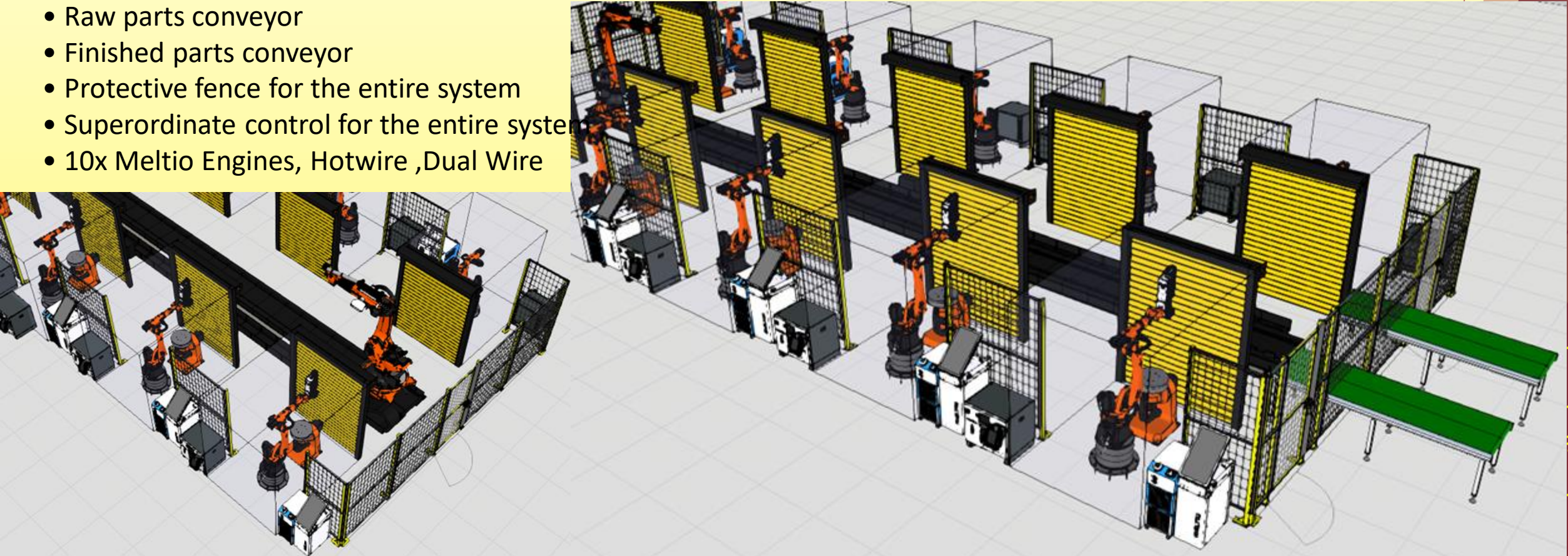
Impeller

SERIENANLAGE

- Mechanical + Electric Construction
- Software H5CAM
- Control cabinet construction
- 10 x KR 22 with DKP (without clamping device)
- 10 x cell with automatic door
- KR120 with 15m linear unit
- Raw parts conveyor
- Finished parts conveyor
- Protective fence for the entire system
- Superordinate control for the entire system
- 10x Meltio Engines, Hotwire ,Dual Wire



3.700.000€





zertifiziert nach DIN EN ISO 9001:2015



Knowhow Wilhelms GmbH

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