



INTERNATIONAL CONFERENCE ON ADDITIVE MANUFACTURING (ICAM)



Wednesday, 20 September
11:00 to 12:30



Room 3A, Convention Center
EMO Hannover Fairground



Automation as a Key Factor in LPBF

Process Quality Assurance

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#ICAM2023

M.Riccio – Additive Industries – ICAM 2023 – EMO 2023





 Born & growing in
Brainport, world leading
optics & mechatronics
cluster

We are
close to our customers



● = Agent or Ambassador

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Additive Industries is the only dedicated OEM for integrated industrial 3D metal printing systems



MetalFAB G2
Core



MetalFAB G2
Continuous Production

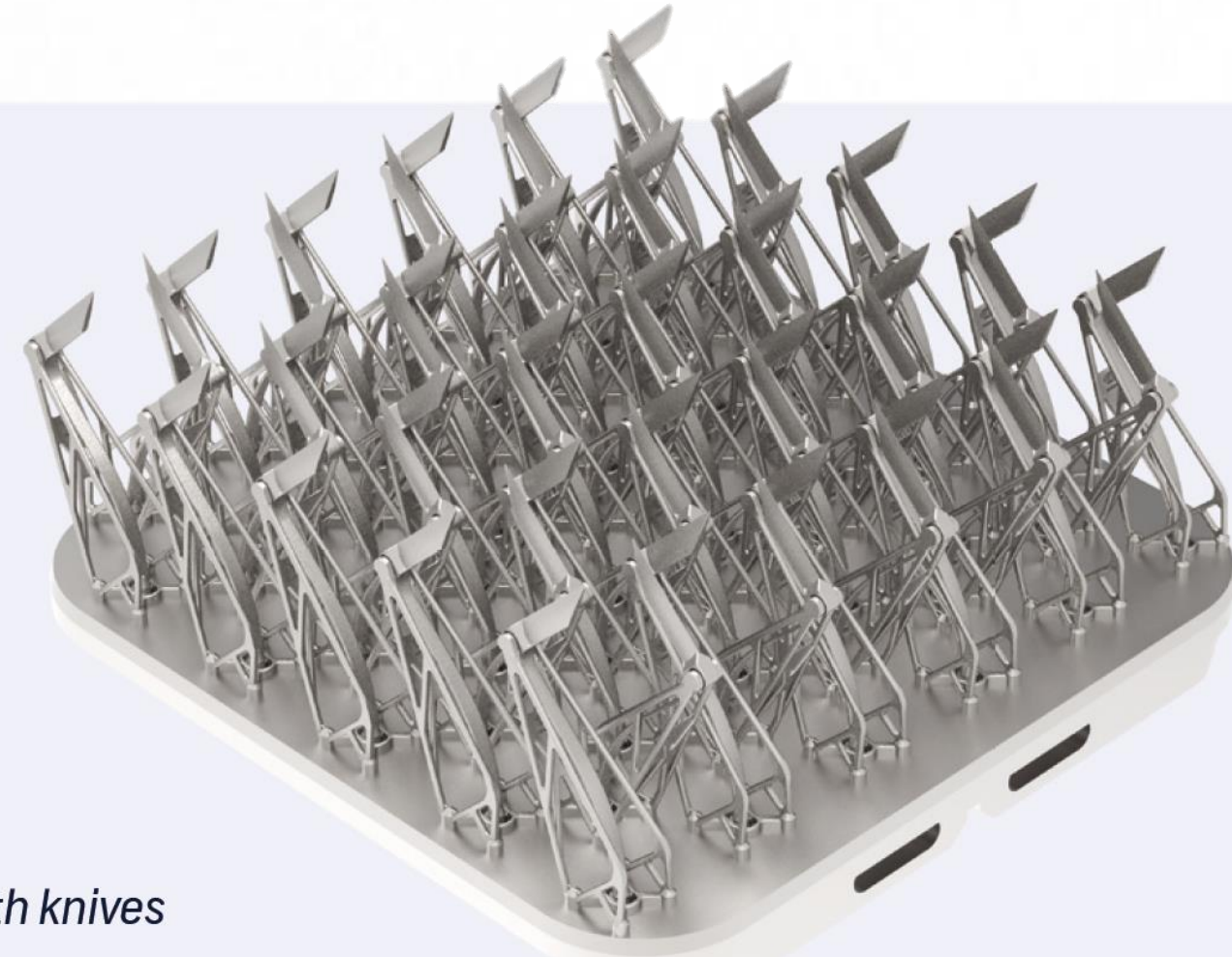
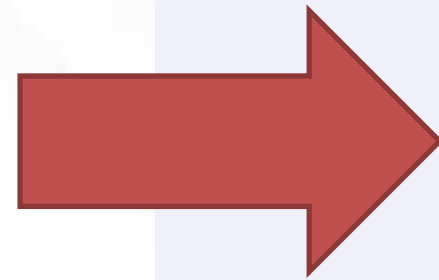
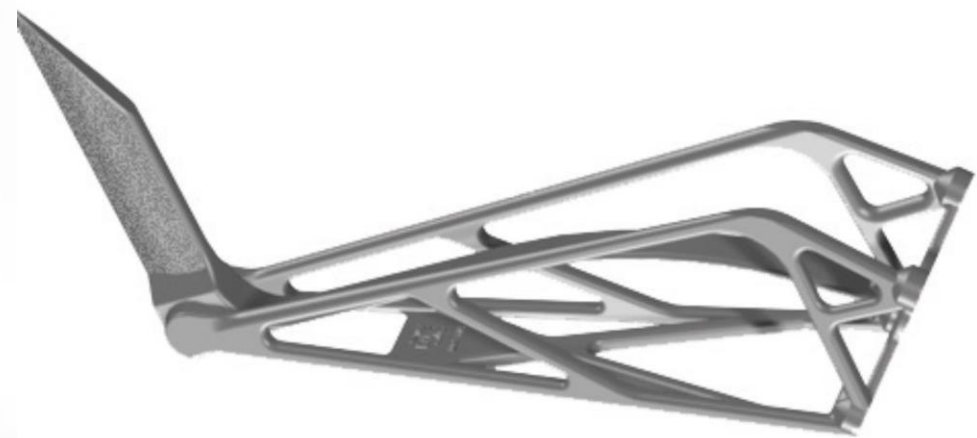


MetalFAB G2
Automation

Why Automation is a key?

The Challenge: Serial Production with LPBF process

The Challenge: Serial production with LPBF process



Industrial Robot Dough Cutting Knife
Winner of the TCT Awards 2019
Additive Industries & K3D

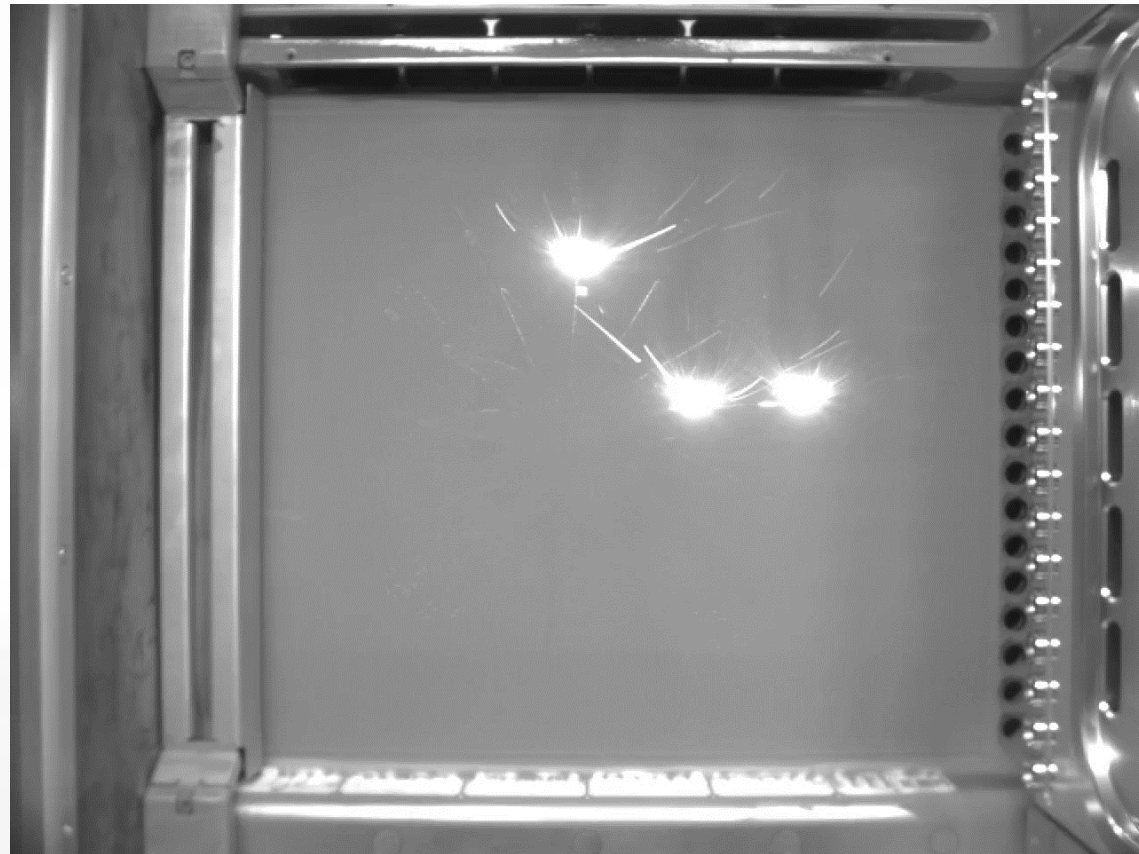
Build plate filled with knives

...High productivity, scalability and repeatability are fundamental!

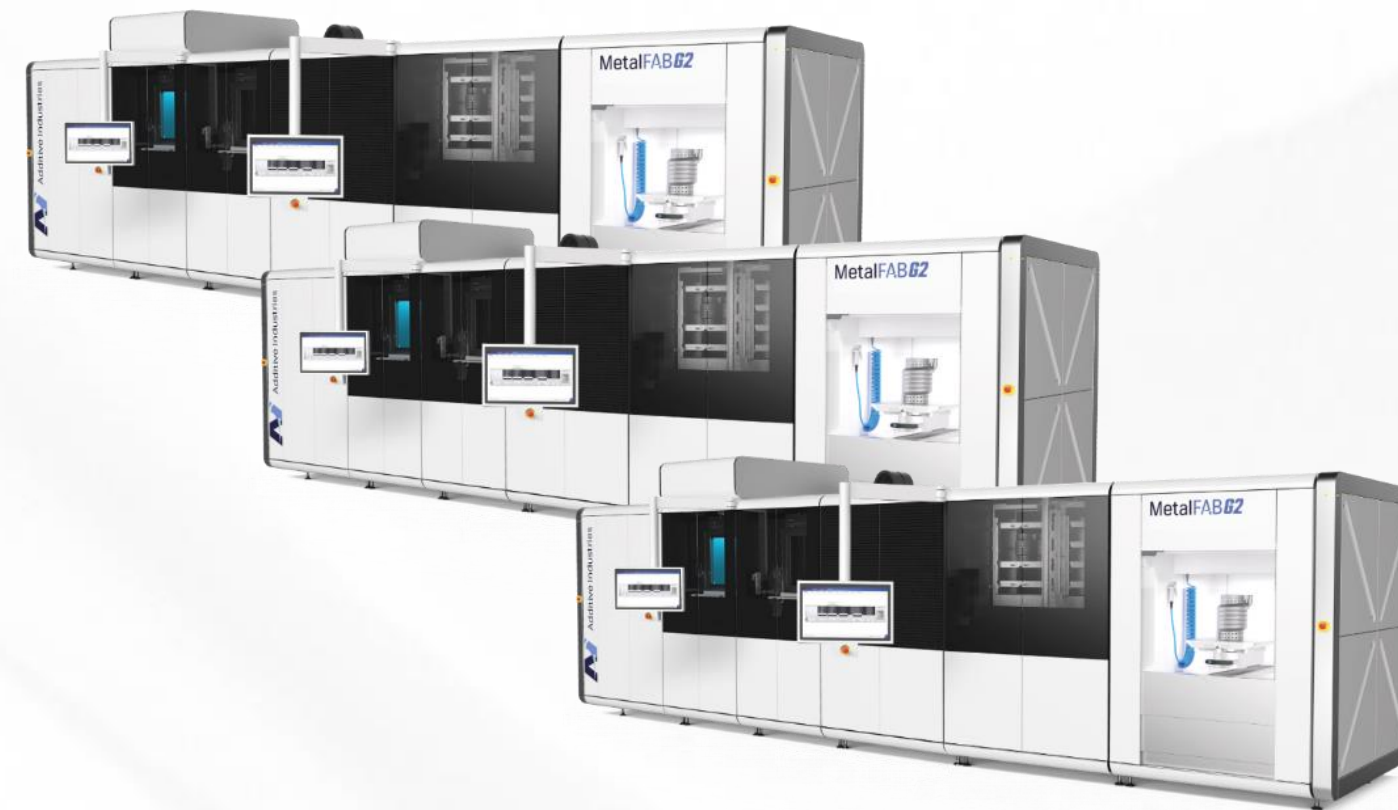
Productivity and Scalability



Multi LASER systems

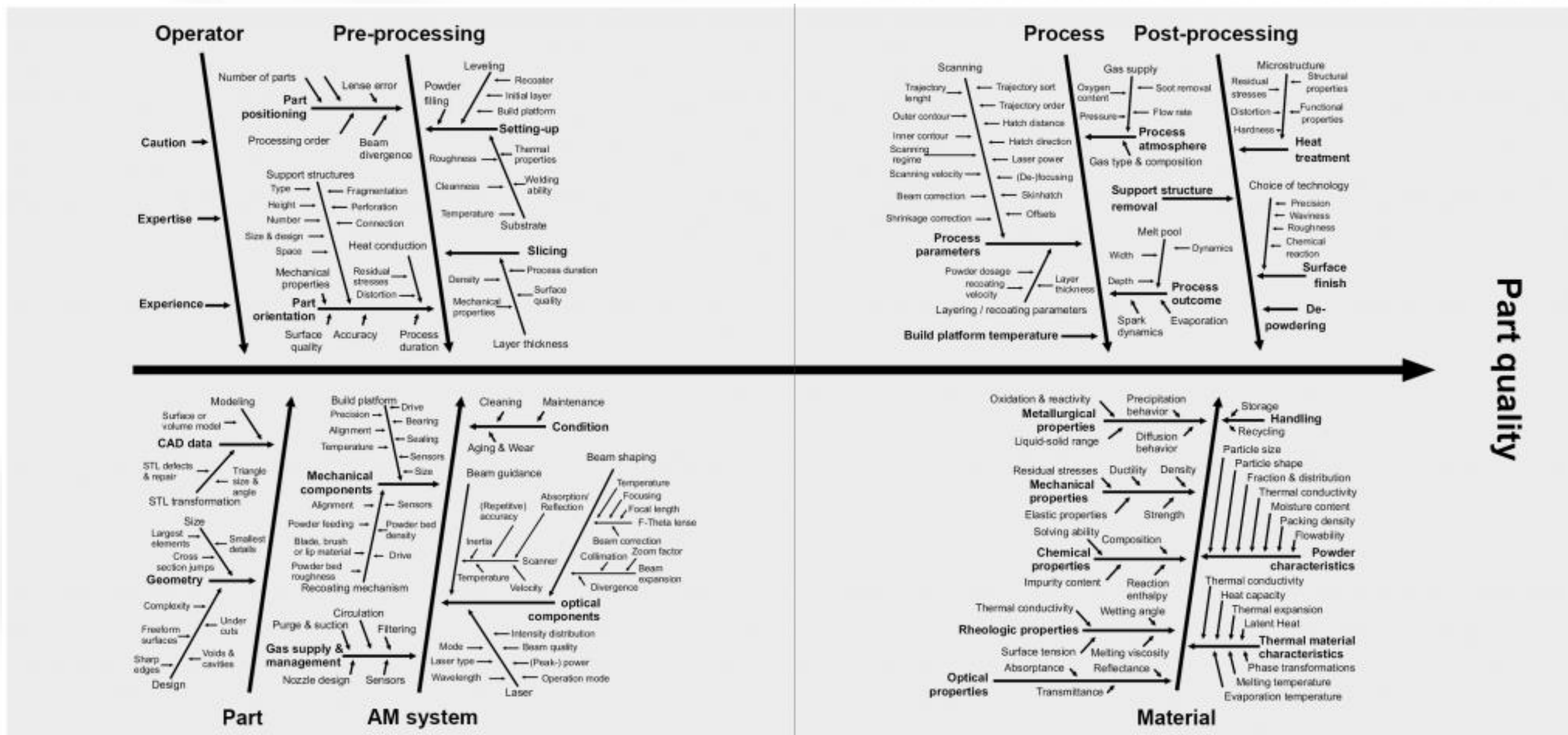


Multi System (and/or multi core) production



To increase **productivity** and have a process **scalability**,
LASER to LASER and SYSTEM to SYSTEM **repeatability** needs to be controlled!

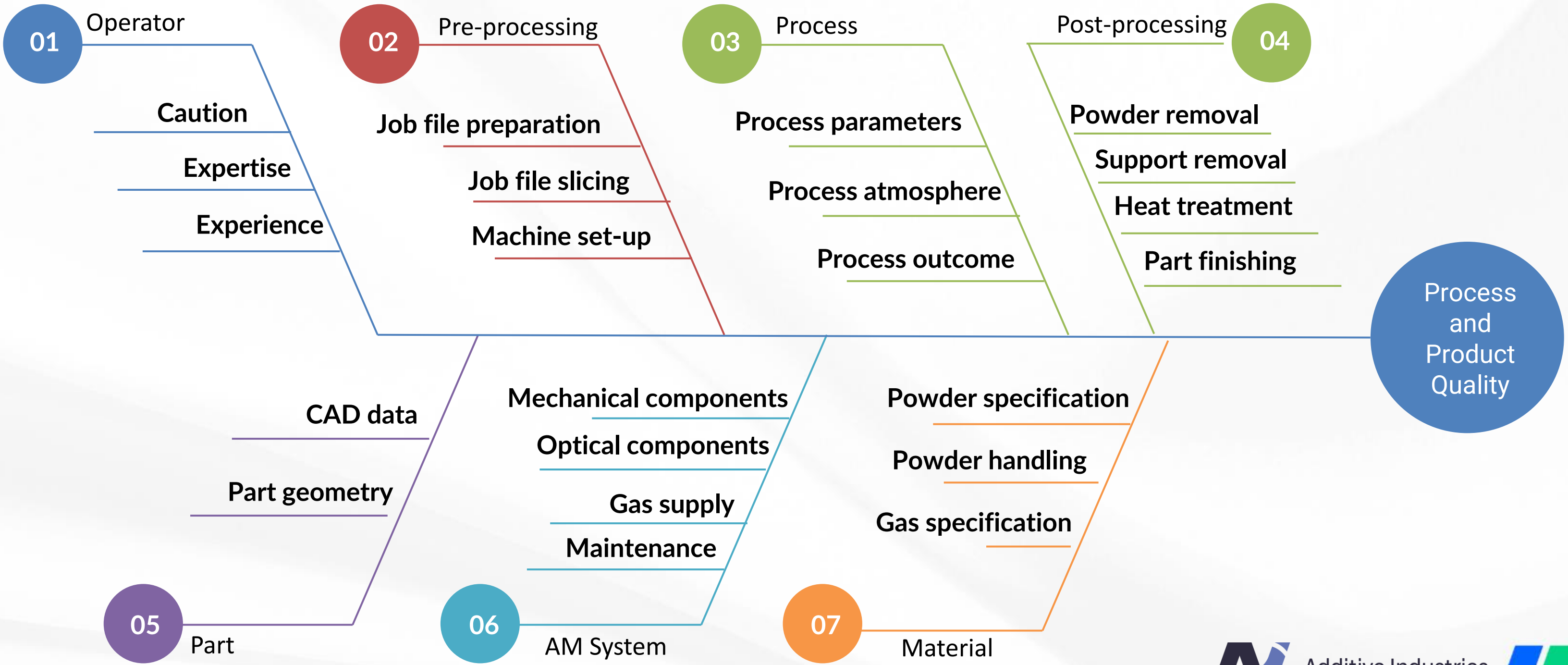
Metal AM is a complex special process



Ishikawa diagram of parameters affecting metal AM parts (Courtesy Dr Christoph Haberland, Siemens Industrial Turbomachinery AB)



Metal AM is a complex special process

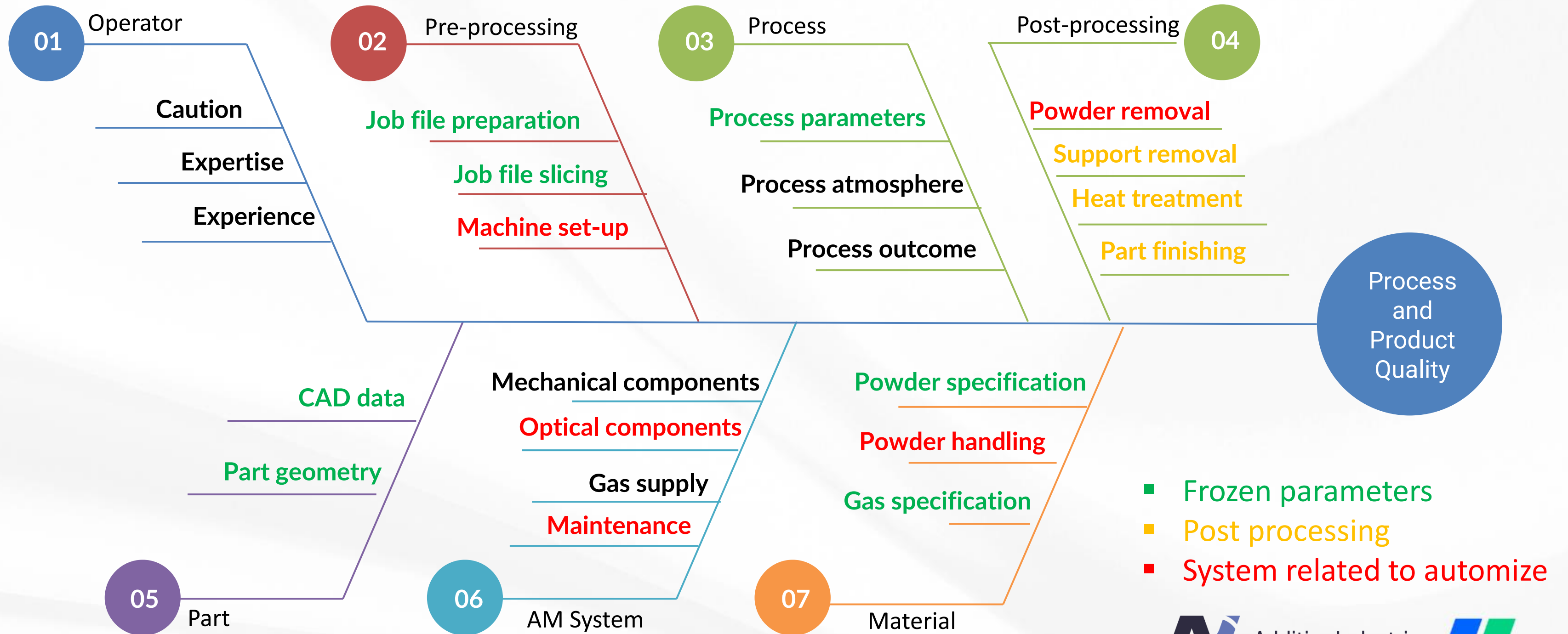


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...we need to minimize Human operations

When in serial production...



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...we need to minimize Human operations



AUTOMATION is a KEY



- BP exchanges
- BP levelling

Physical automation

- Laser validation
- Laser to Laser
- Laser focus

Automated calibration

- Powder loading
- Powder recycling/sieving
- Powder removal

Automated powder handling



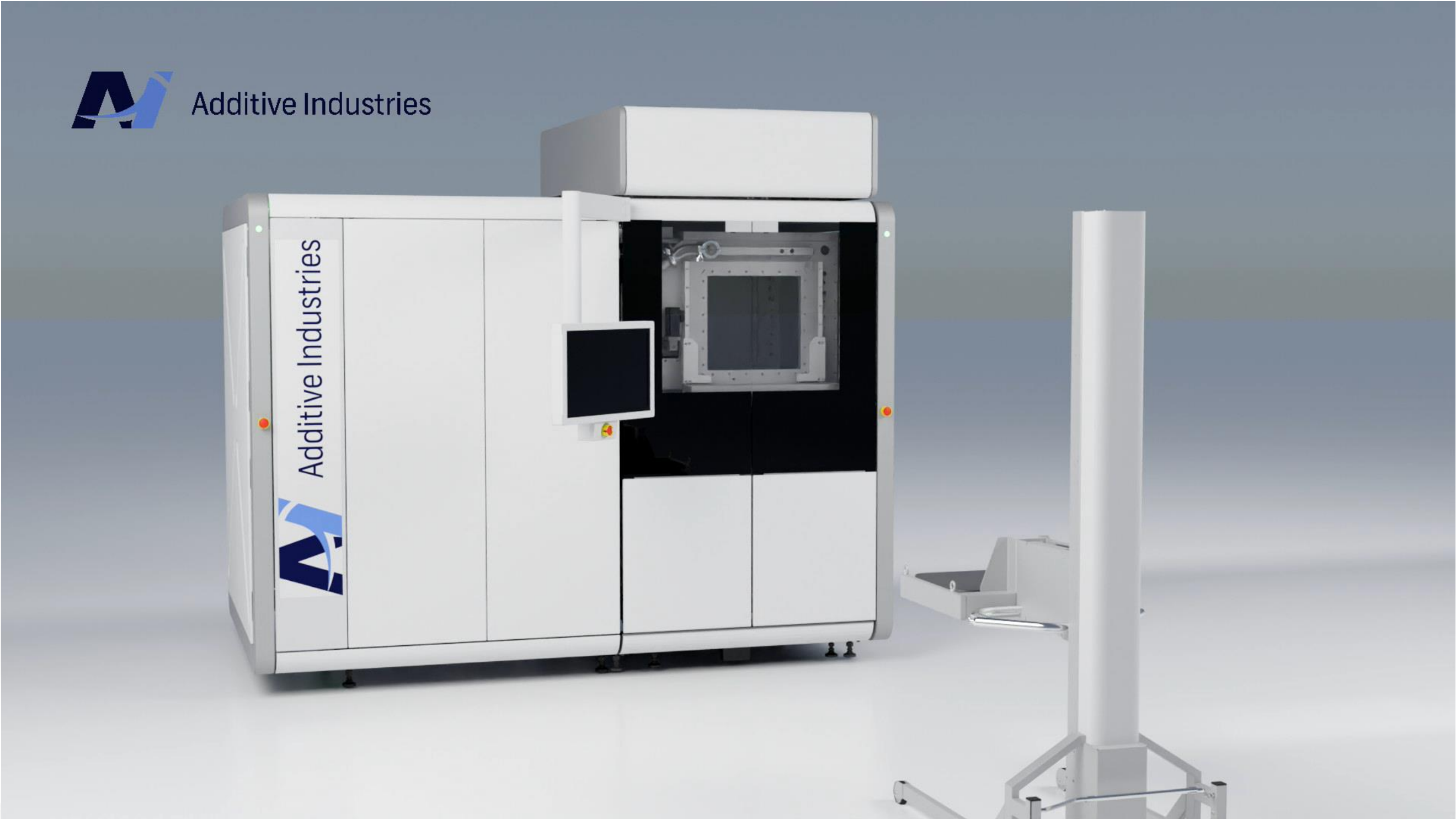
The MetalFAB modular and automated system

Physical automation

MetalFAB G2: Core configuration



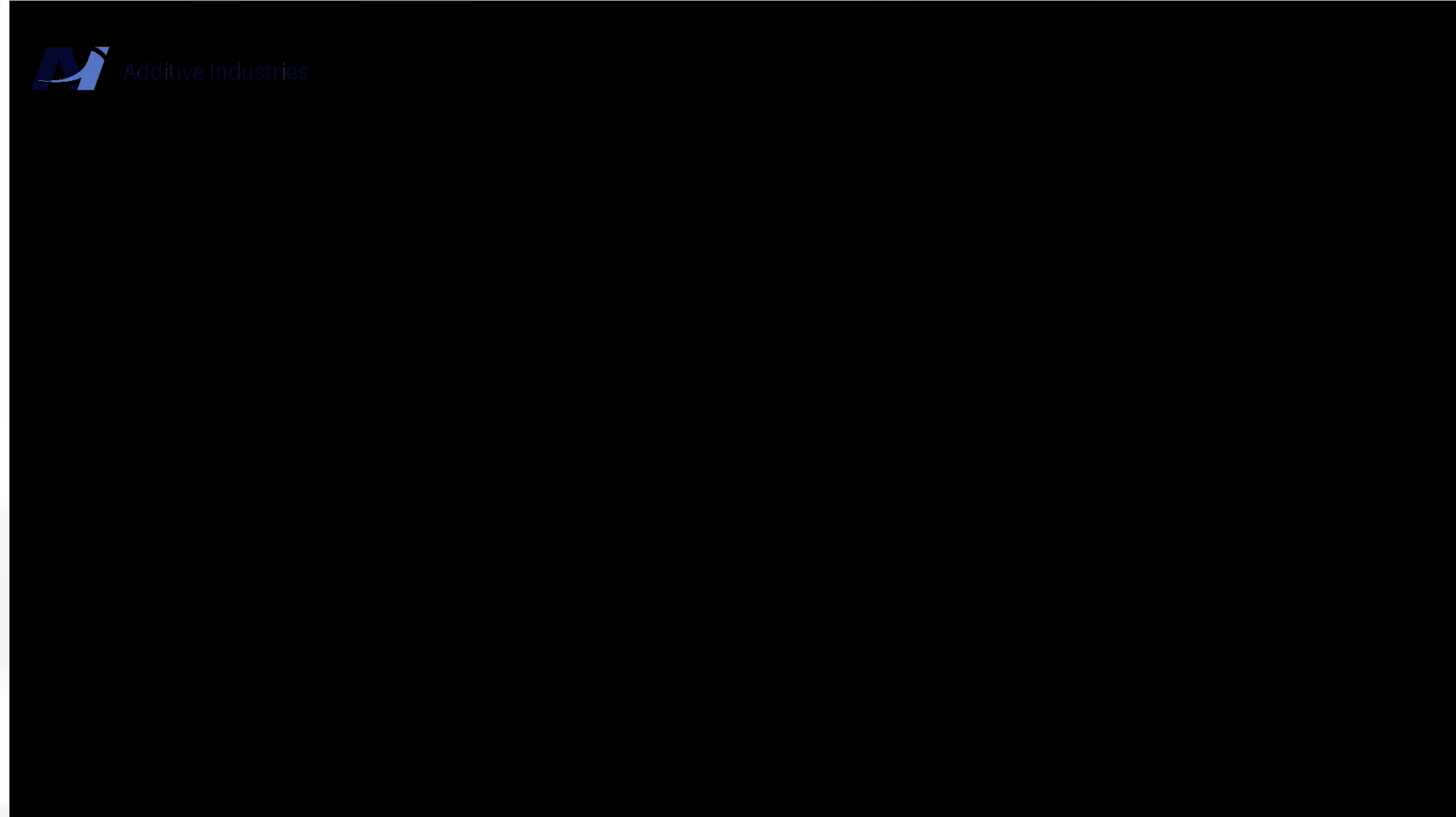
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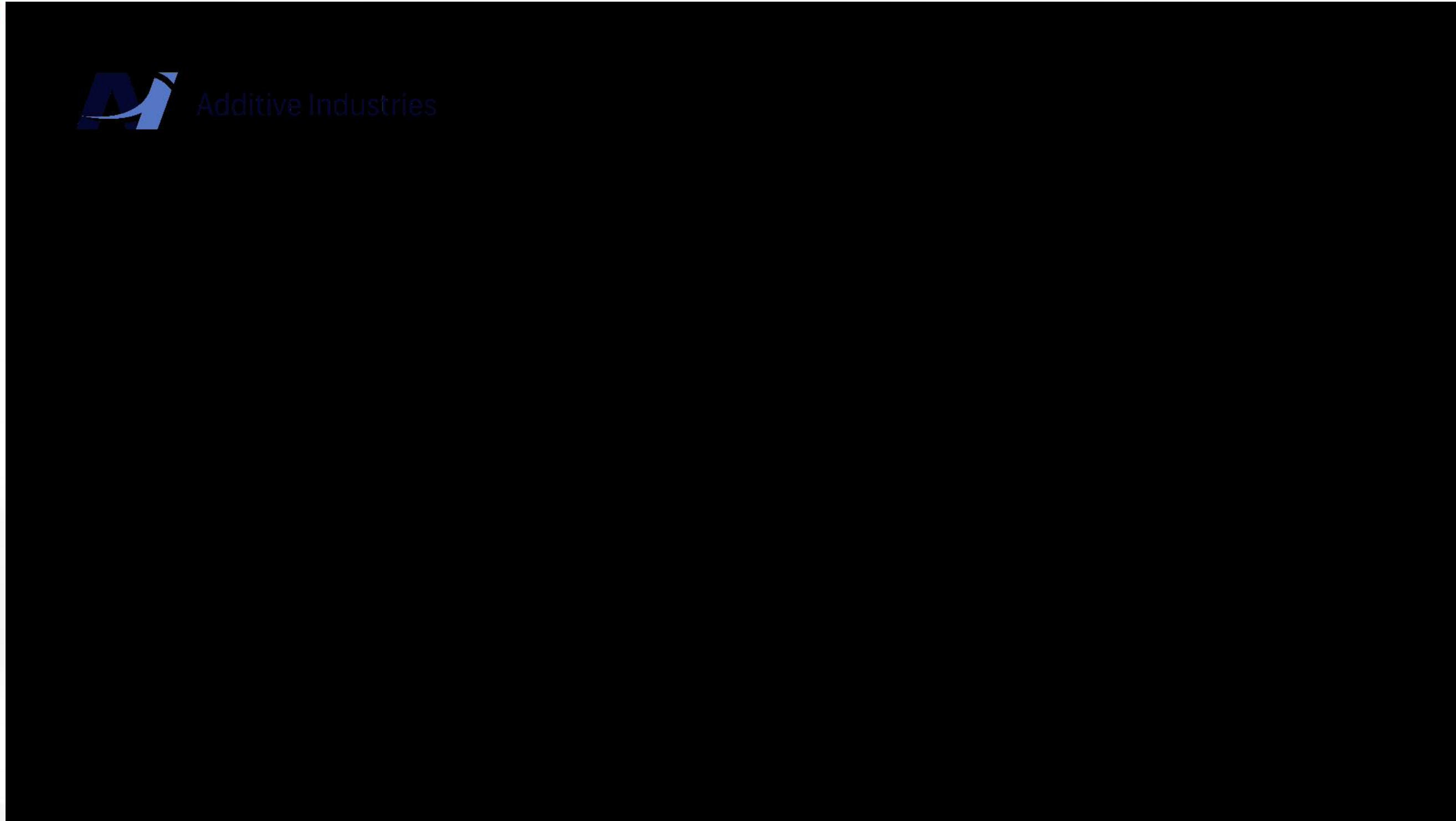
MetalFAB G2: Automation



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MetalFAB G2: System modularity

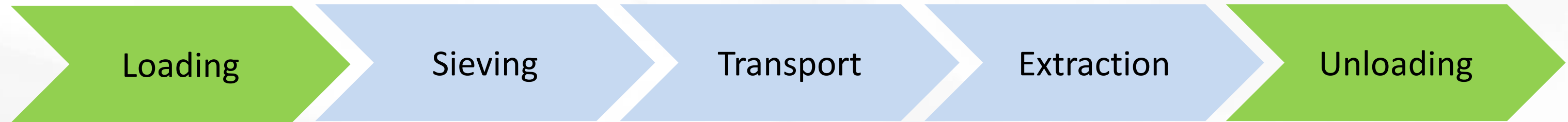


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From Powder Production to Post Print de-powdering under inert condition

Automated Powder Handling

Powder is automatically handled in inert condition



with no contact with atmosphere, Powder quality over the builds is ensured.



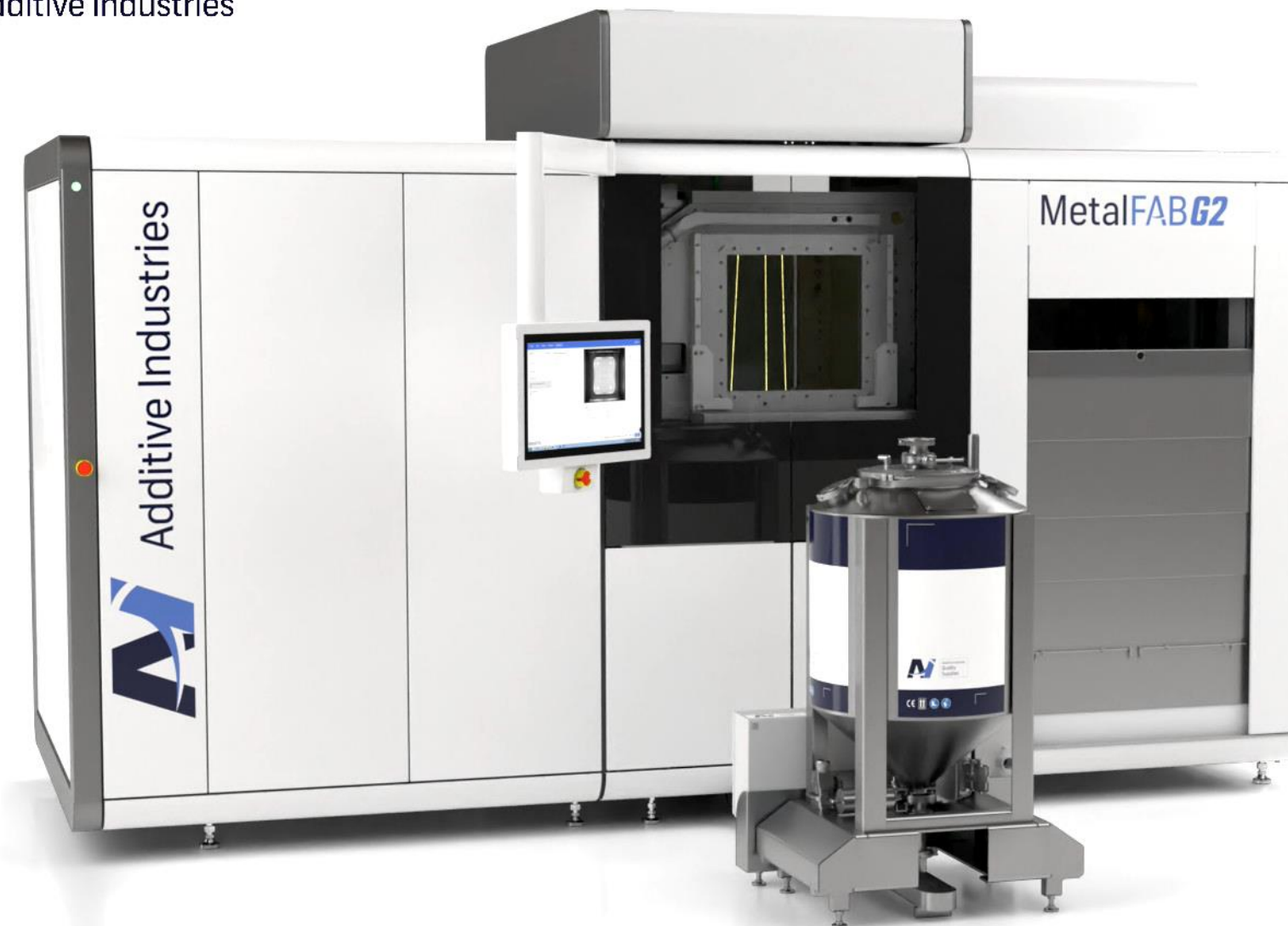
The Powder Load Tool (PLT) increases the overall MetalFAB system's productivity, consistency of part quality and safety

Pre-filled from metal powder supplier

The PLT container is certified for transport over land, air and sea and can arrived pre-filled from the metal powder supplier.

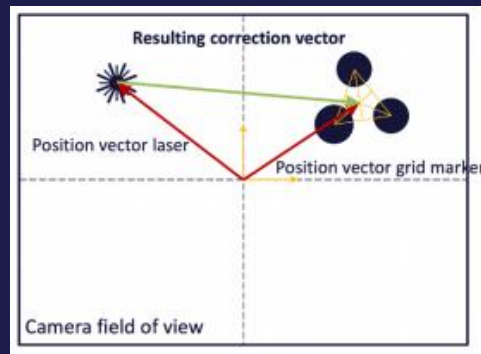
Filled on-site

The PLT container can also be filled on-site from a larger batch, or manually using the optional powder unpack tool.



A focus on Automated Laser Calibration

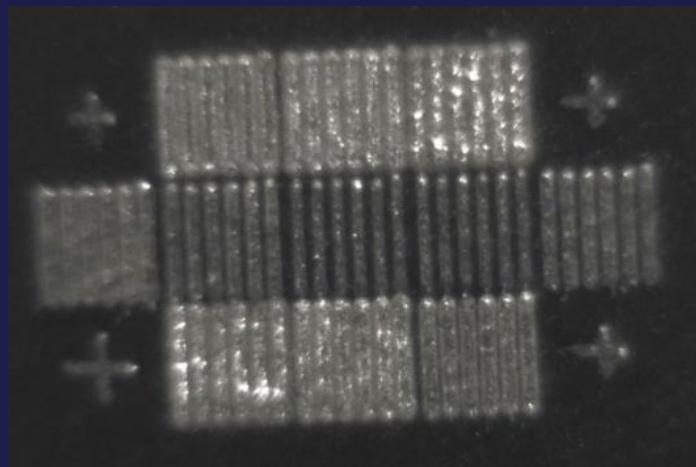
Beam Position



Part accuracy



Beam focus

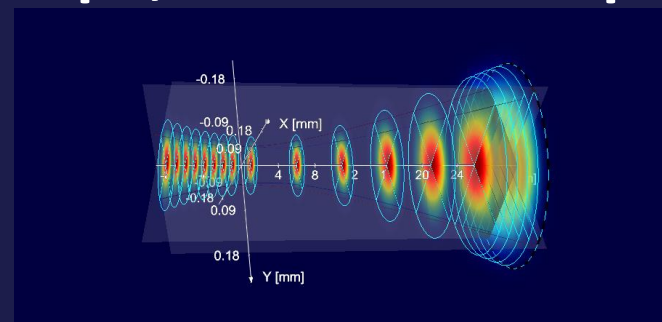


**ACCURATE
CONTROL**

Material quality



Beam shape, size and laser power



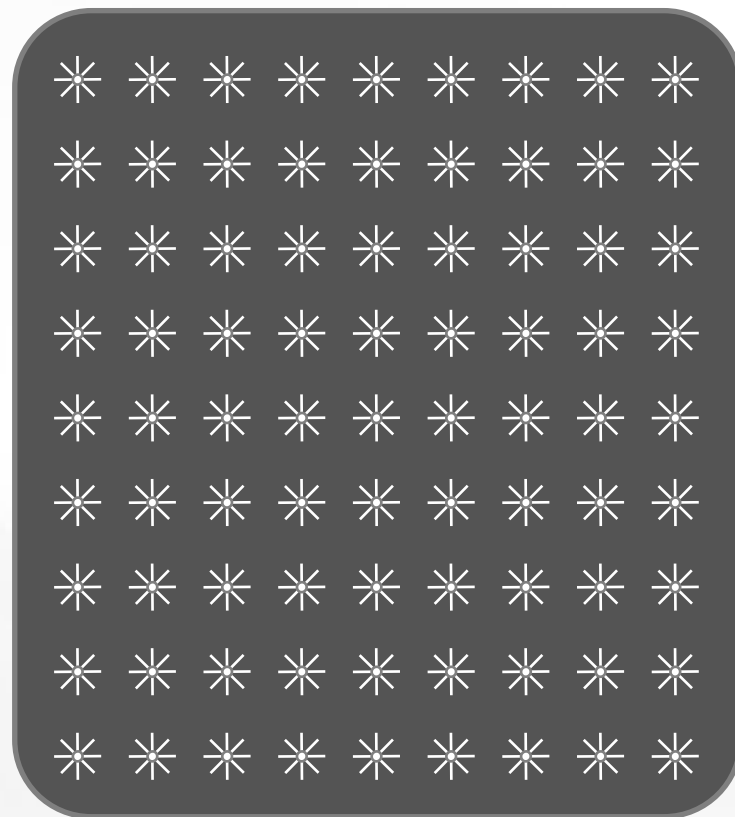
Process reproducibility



The Tools

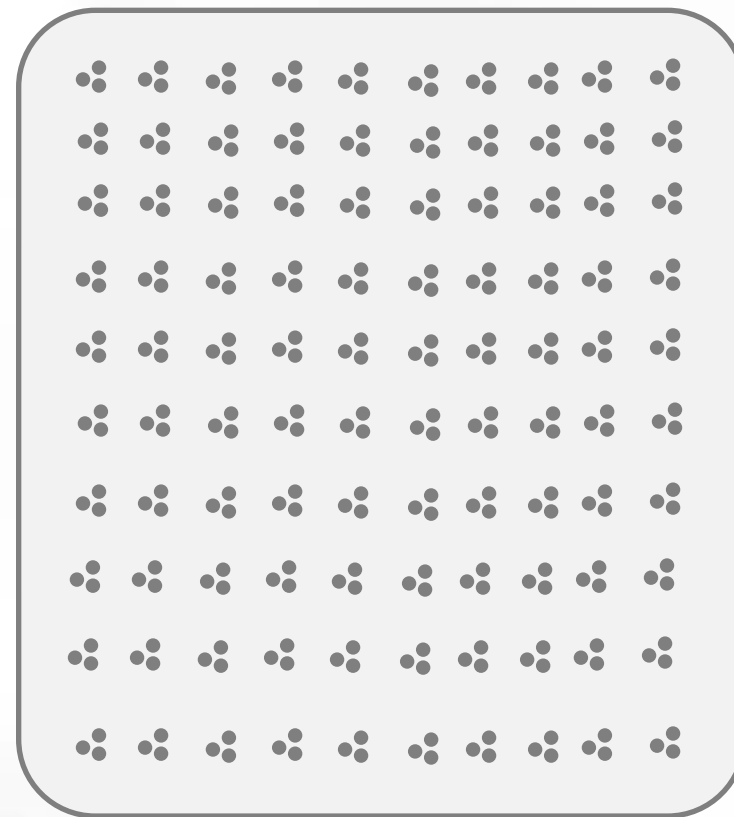


Black anodized plate



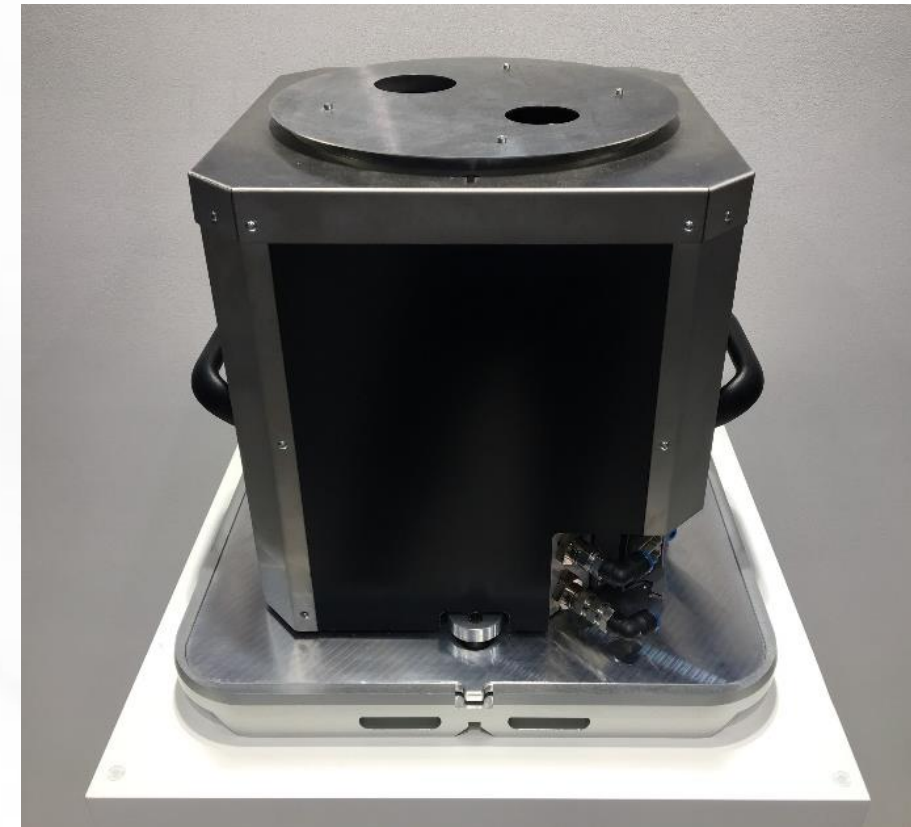
Focus Calibration
Focus Validation
Laser to Laser Validation

Grid Calibration plate



Laser Position Calibration

Multi Beam tool that houses power and profile sensors

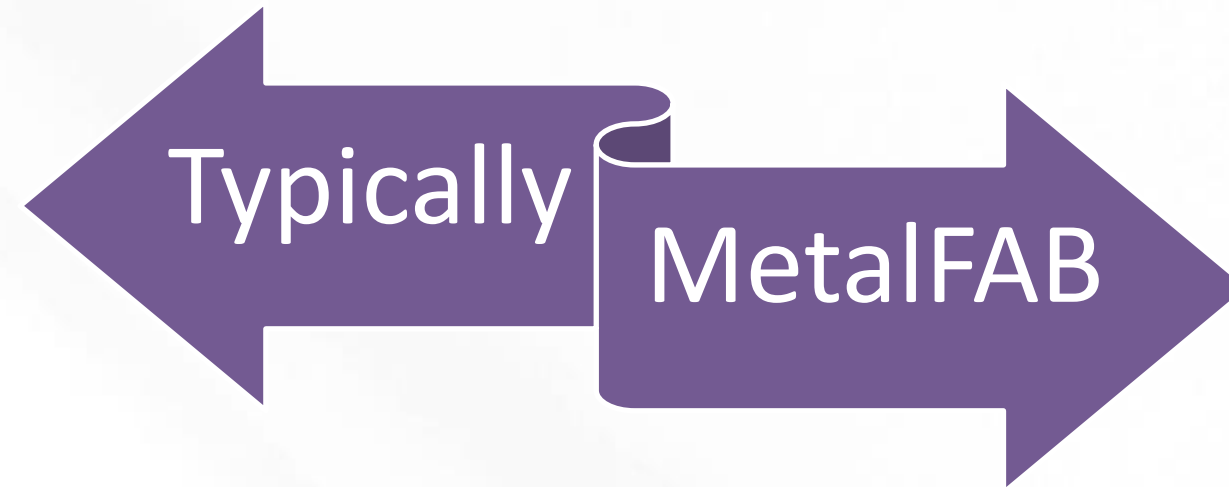


Power Calibration
Profile Validation
Focus Drift Validation



Software suite to automate all measurements

The MetalFAB has an automated beam position calibration system

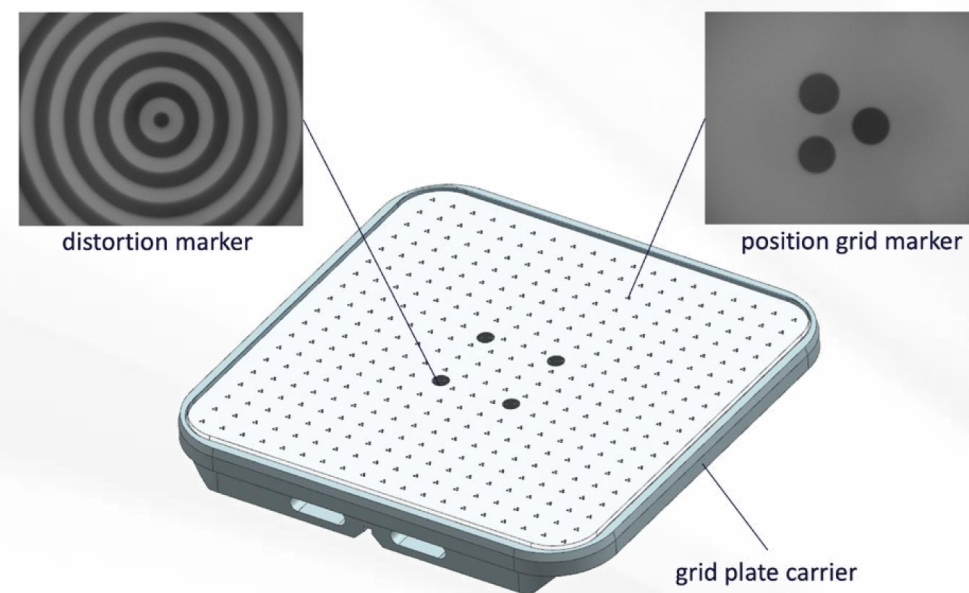


- A calibration plate is marked
- It is measured offline
- A calibration file is generated and uploaded on the system

- A calibration plate is marked
- An integrated vision system uses a calibration plate (specs <20 um accuracy), to determine position calibration
- It automatically recognizes focus markers over a full build plate to determine calibration
- Calibration is uploaded online

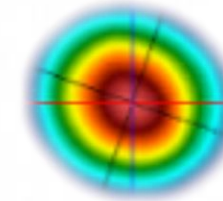
Results:

- Long iteration time
- Low accuracy and reproducibility

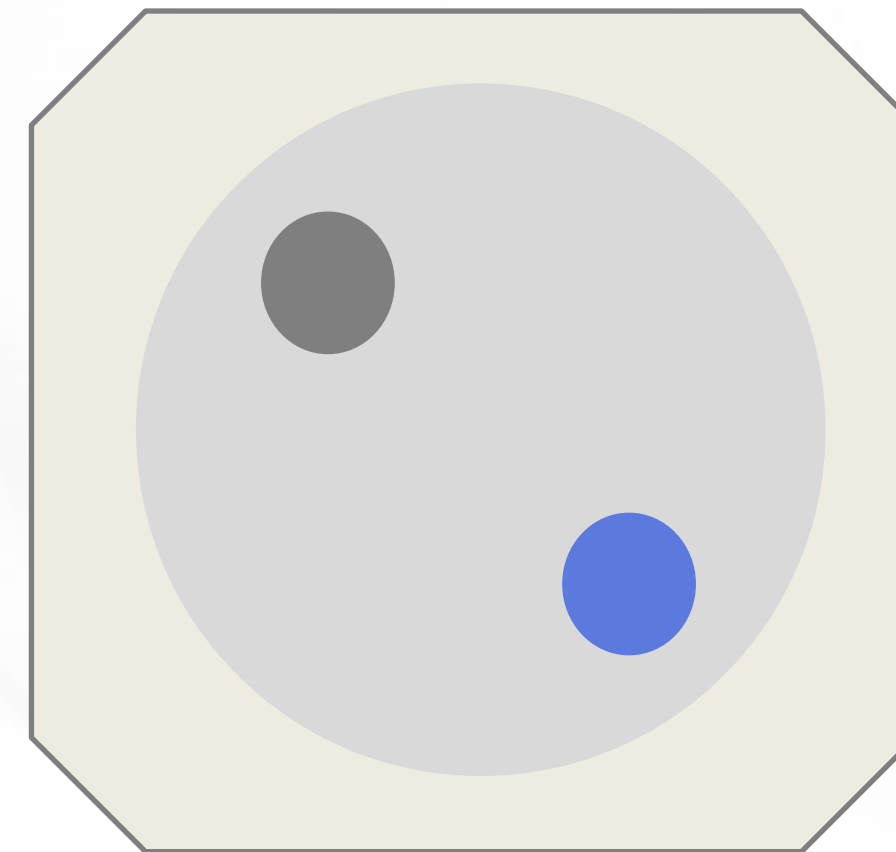
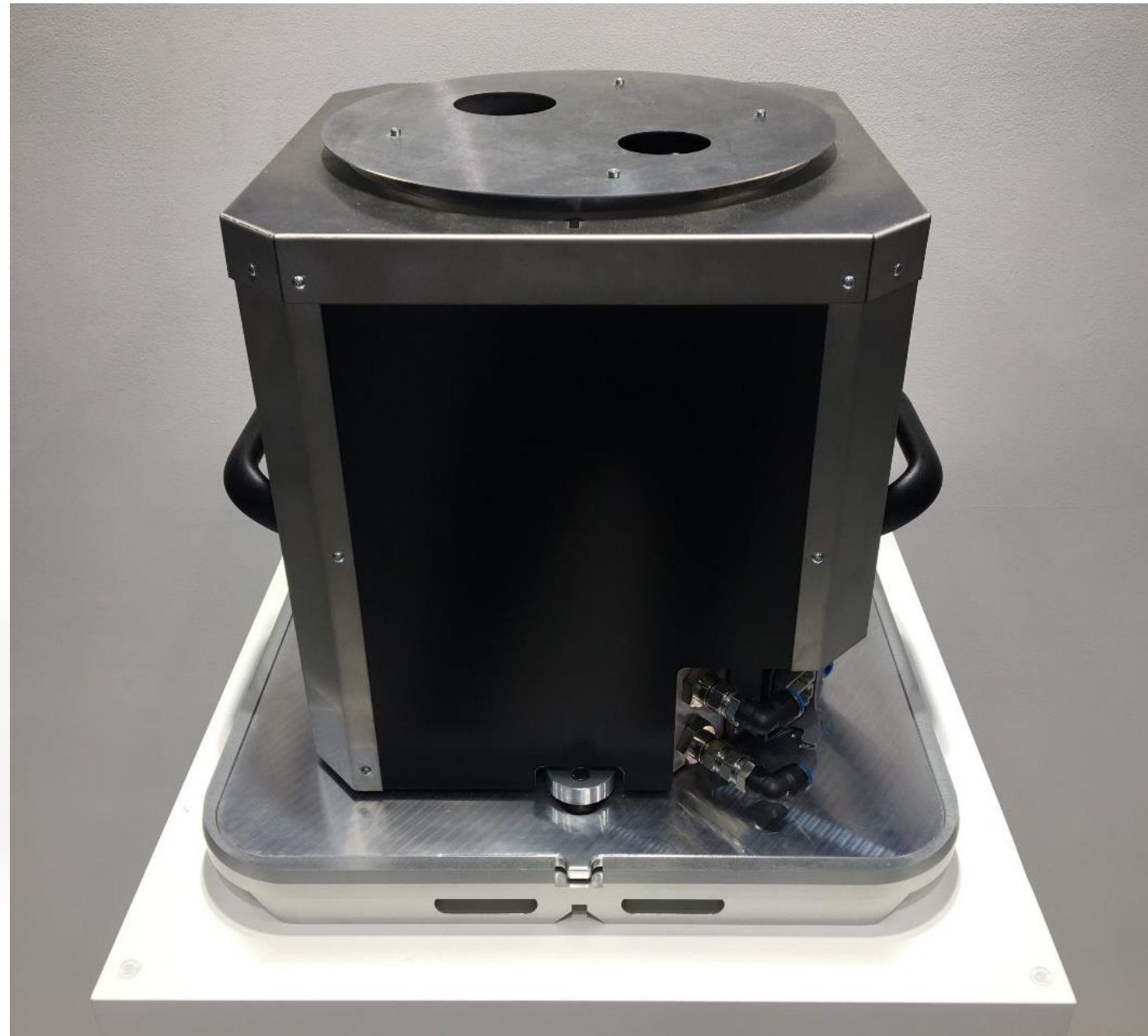


All tests performed as request form the ISO/ASTM 52941:2020

Beam Calibration and Validation Tools



Grey is a Laser power meter
Blue is a Caustic profilometer



Measures beam profile and power in one

[...]

- LPBF is a complex process and we need to minimize human operations to ensure process and product quality
- Automation is a key on 3 levels
 - Physical automation
 - Powder handling automation
 - Automated Laser Calibration
- Material quality is affected by Laser fluctuation
- Online and Inline Laser validation and calibration increase repeatability and reduce service time
- Part dimensional accuracy and repeatability, and material quality, are achieved thanks to MetalFab automated calibration both on standard sized and thin-walled components

Conclusions



THANK YOU!

See you at ICAM 2025



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