Welcome @ Sirris

YOU HAVE A CHALLENGE ? WE CAN PROPOSE WAYS TO SOLVE IT !

innovation
forward

What is Sirris ?

NON-PROFIT ORGANISATION

ISO CERTIFIED

IP STAYS IN COMPANY

OF HANDS-ON EXPERIENCE

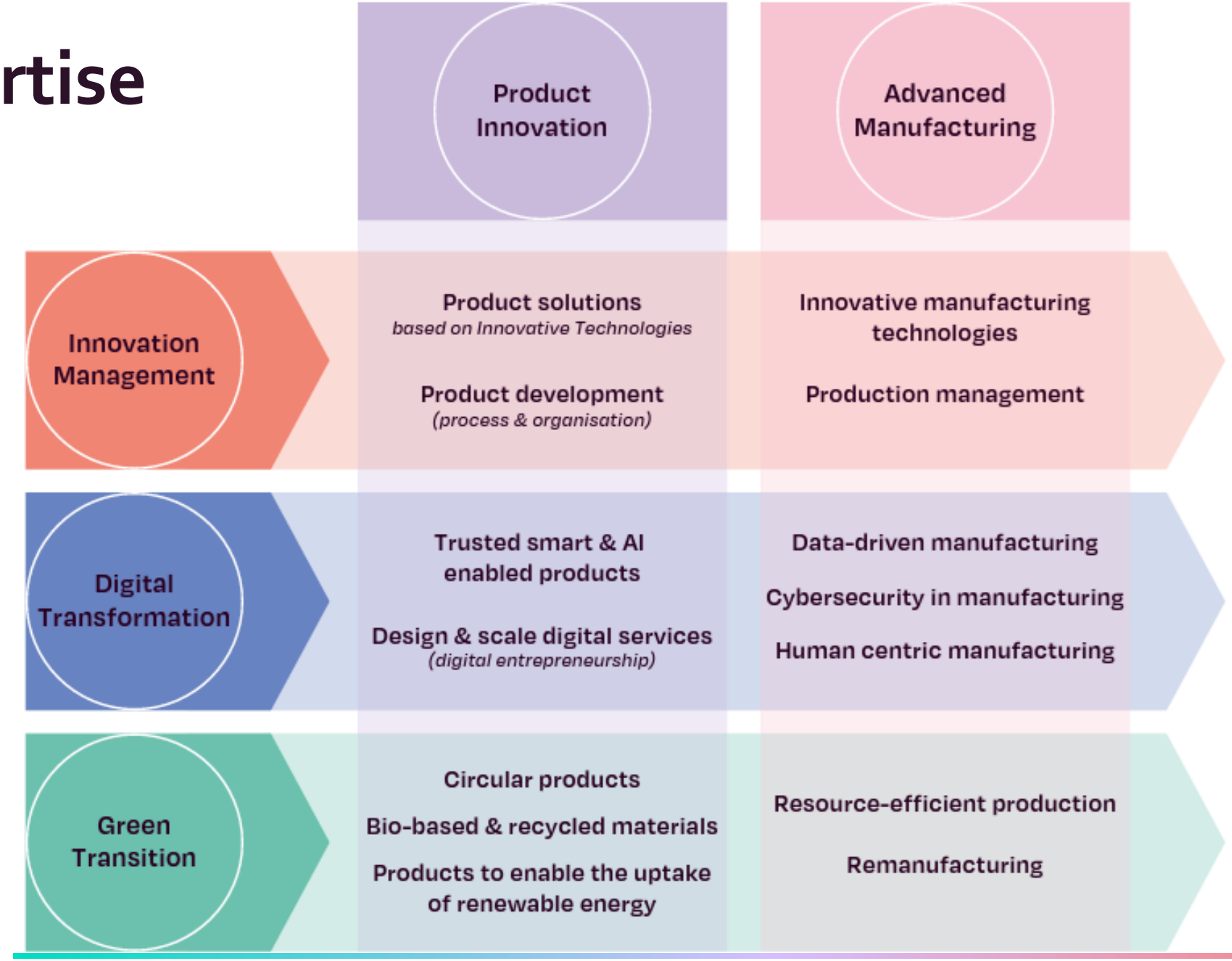
Sirris is a **R&D collective innovation centre**, helping companies to understand and integrate suitable technological innovations, to reduce associated risk.

Sirris is part of Agoria and is therefore mainly related to the **manufacturing sector**.

AGORIA
SIRRIS the strength of a trusted community

Aerospace / Energy Technology / Building Technology / Safety, Security & Defence Technologies / Mobility & vehicle technology / Manufacturing & Process Technology / Co-Creation, Contracting & Materials / Telecom Industries / Digital Industries

Expertise



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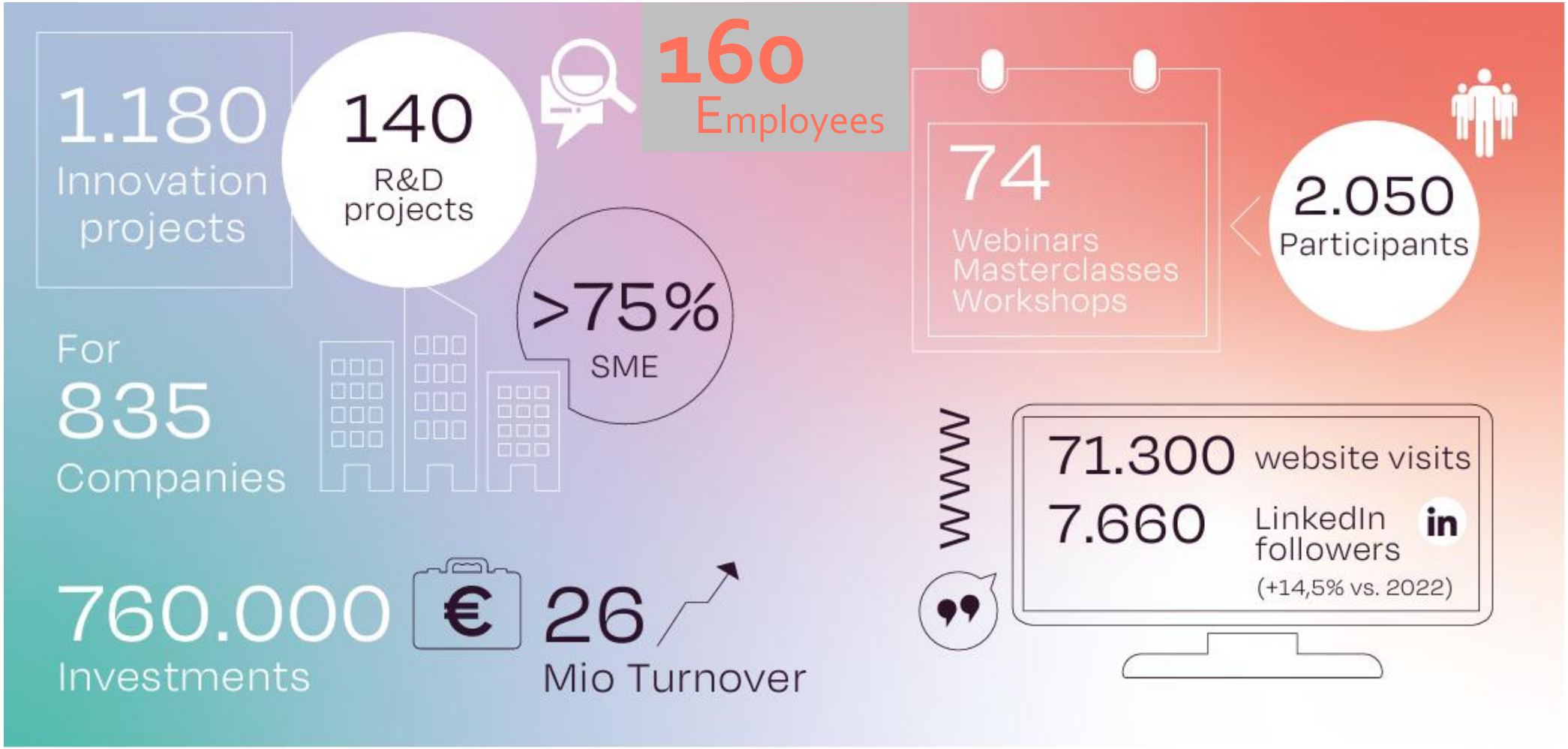
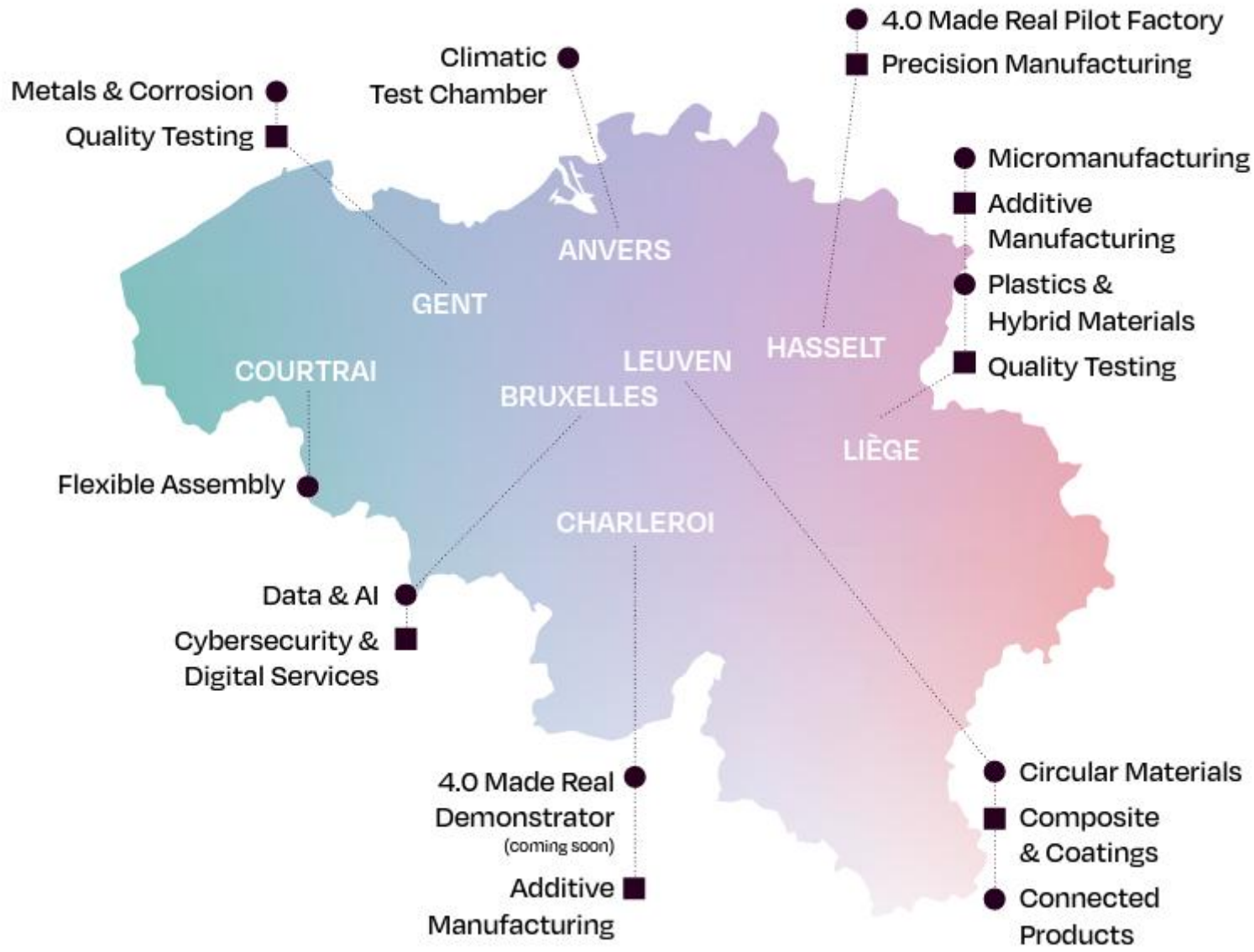
Some 2023 numbers



A national infrastructure



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A very complete infrastructure

Metals

- Material selection, treatment & characterization
- Metal Product Development
- Design validation & structural health
- Anti corrosion management
- Foundry technologies
- Test Lab

Plastics & Light Materials

- Product Development Hub
- Plastic materials
- Composite materials
- Hybrid materials
- Product Design
- FEM/CFD simulation
- Smart products
- Micro Manufacturing
- Freeform 3D printing
- Test Lab

Innovation in Circular Economy

- Product transformation
- Production transformation
- Business transformation towards Circular Economy
- Circular Design
- Bio-based materials
- Coating & Composites
- Recycled materials
- Product lifetime extensions

Mechatronics

- Conceptual Engineering
- Sensing solutions
- Smart Connected Products
- Smart manufacturing
- Computer Vision
- Machine system architecture
- Machine connectivity

Offshore Wind

- Climatic test facility
- Offshore test & measurement
  - Vibration
  - corrosion
  - Thermal
- Icing test

Precision Manufacturing

- Conventional Machining
  - Tool/material selection, machineability
  - Workshop organization
  - Digitization, CAD
- Advanced Machining
  - Model/Sensor based Machining
- Innovative Machining
  - Finishing Near Net Shapes
  - Sustainable Machining
- Functional surfaces
  - Friction, Hydrophobic, Anti-bacterial, Thermal

Additive Manufacturing

- Engineering for AM
  - Function integration / t°, weight (post) Process simulation
- Material for AM
  - Powder/material characterization
  - Material validation
- AM process
  - Diverse open AM processes
  - Pure copper for e- application
  - On site monitoring system
- Quality control
  - Data, dimensions, internal constraints, material health

Smart & Digital Factory

- Industrial automation
- Collaborative robots
- AGV/AMR
- Digital Twin
- IIoT
- Operator support
  - digital work instructions classic advanced (AR, VR))
- OT cyber security
- Made Different
- Quick Response Management

Data Innovation

- Fleet-based analytics
- Product usage monitoring
- Smart environment analytics
- Hybrid/hyper modelling
- Data fusion
- Knowledge propagation
- Fingerprinting
- EluciDATA Community
- StarterKit platform
- Hands-on trajectory
- Masterclasses

Digital Services

- TechStack / Architecture
- Digital Transformation
- Scaling / Digital Entrepreneurship
- Digitalization strategy
- Security/privacy/trust
- Data trust

- IOT & SW engineering
- Smart product

What is the interest to work with Sirris ?

- **CAPABILITY** – We cover almost all manufacturing technologies with expertise and equipment.
- **NEUTRALITY** – We are **NOT** bounded to technology providers. Our objective is to guide you toward the best suited solution, whatever it is.
- **FLEXIBILITY** - You discover that you need more than expected during a project with us ? We have in-house the mean to fulfil this extra requirement and avoid dead-ends.
- **DE-RISKING** – Too much uncertainties at early stage ? We can guide you through funding initiatives to reduce the risk.
- **TRANSPARENCY** – You will know the truth about the technology, not only the bright side.
- **INSPIRATION** - Rushing all around the clock could have make you miss an interesting way of development. We can highlight this.

Why work with Sirris in AM?

- To guarantee the quality of a product made by AM = not simple
- Validate the processability of new materials on AM = not simple
- Using data for First time Right = not simple
- Requires multi-disciplinary mastery → all the value chain
- Sirris, thanks to its multidisciplinary teams, offers specialized competences in each part of this value chain

Additive Manufacturing - AM

A WHOLE WORLD OF EXPERTISE

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The AM principle

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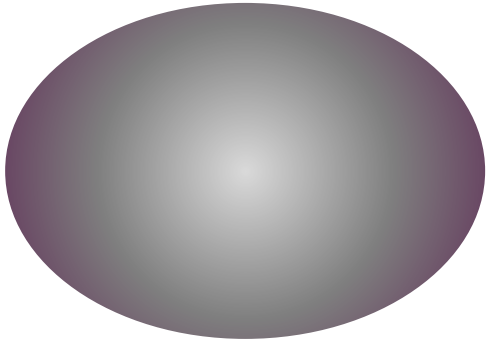
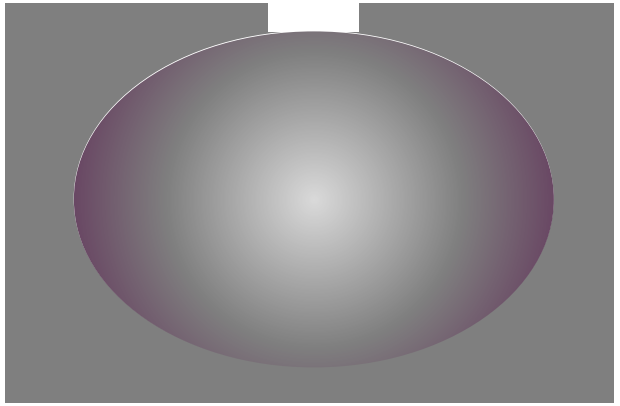
What is Additive Manufacturing ?

THE LAYER BY LAYER APPROACH

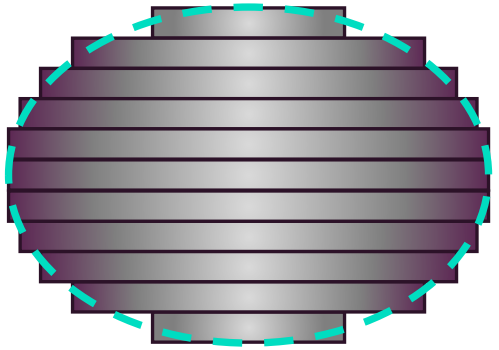


Machining

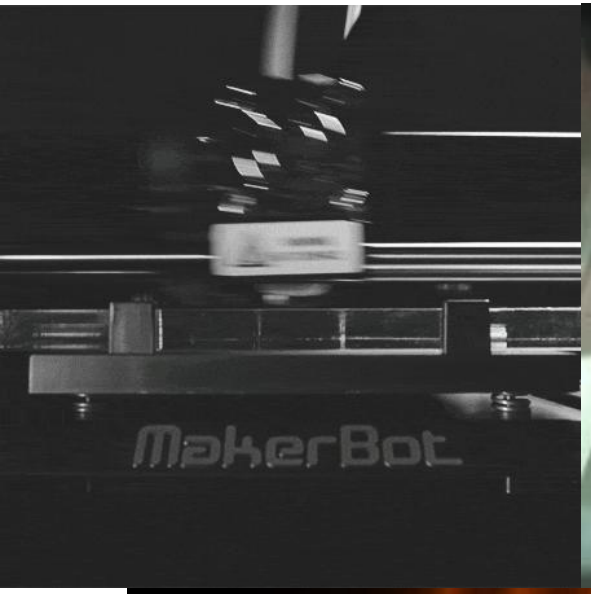
Casting/Injection

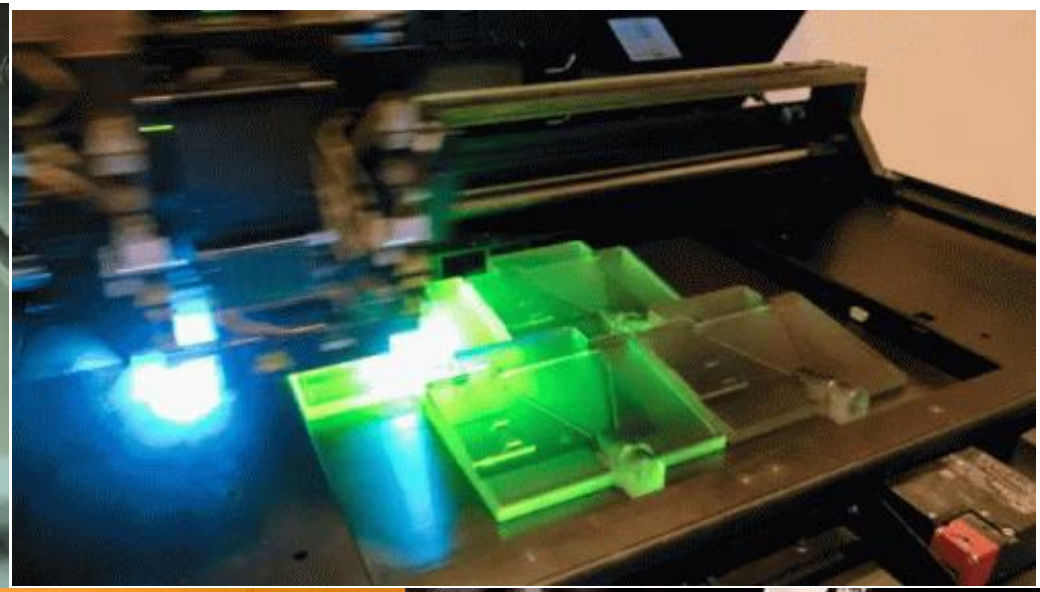


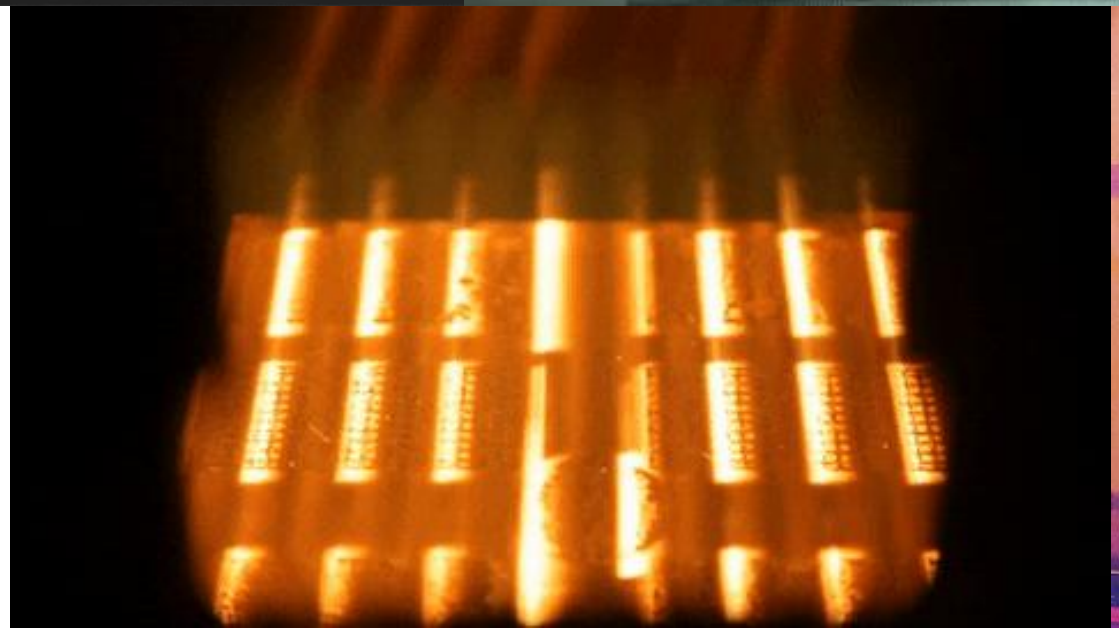
AM



How does it work ?

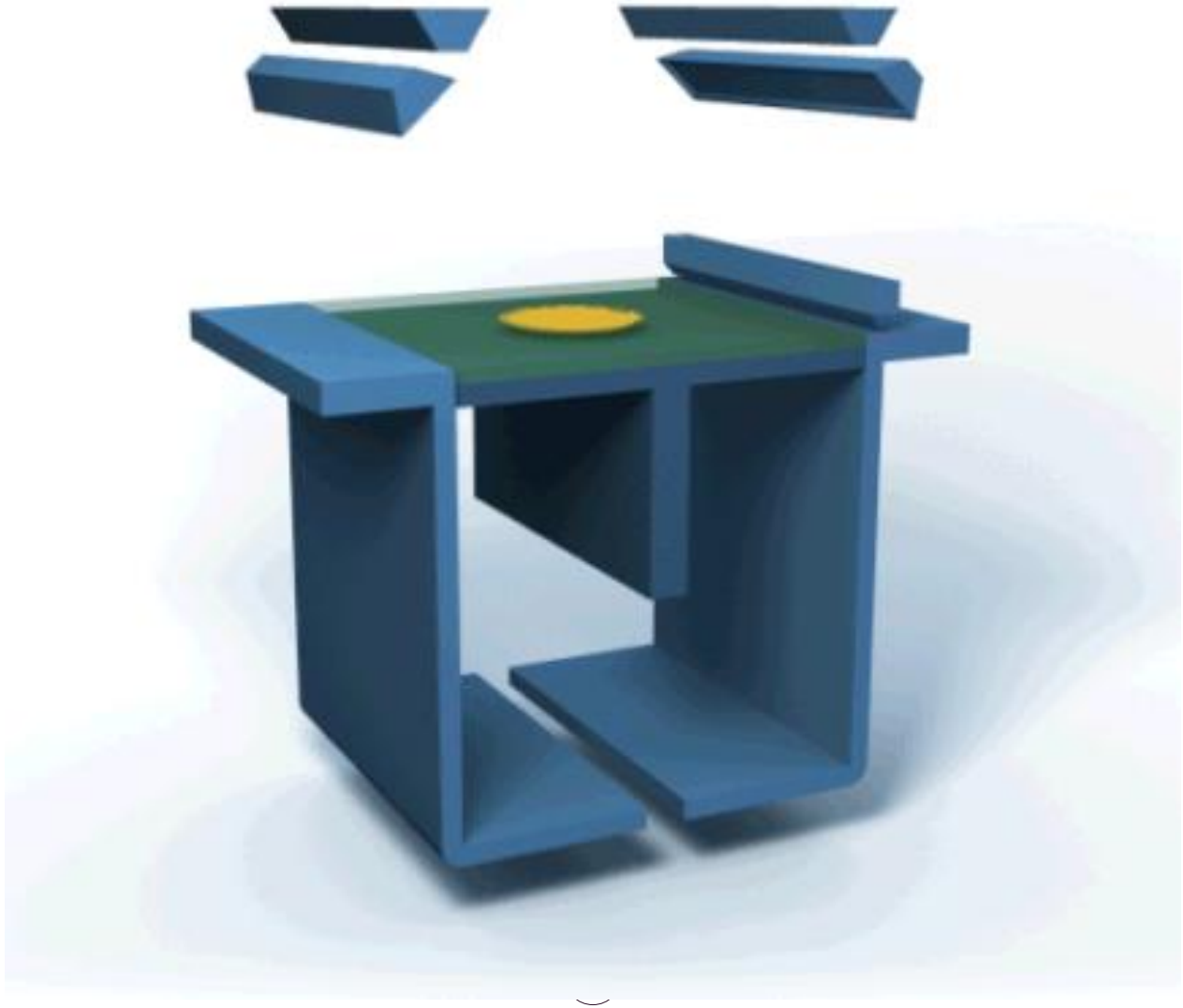






A common principle

ACCELERATED…



*Accelerated : 0,05 mm height = ± 1 minute

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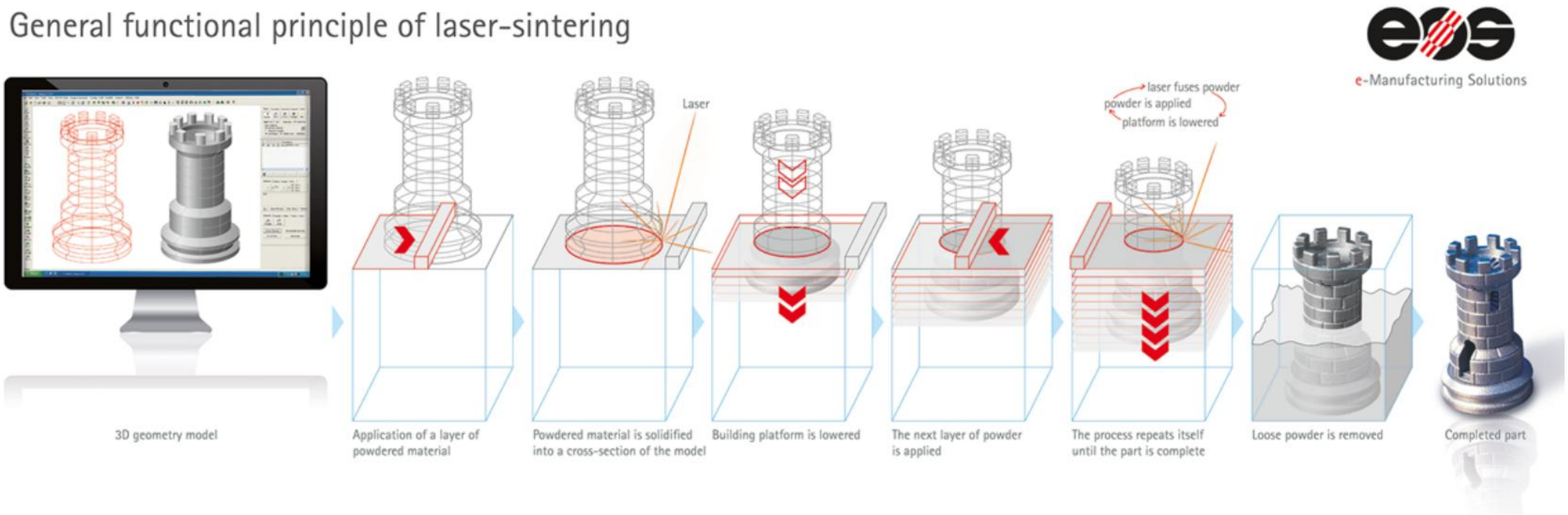
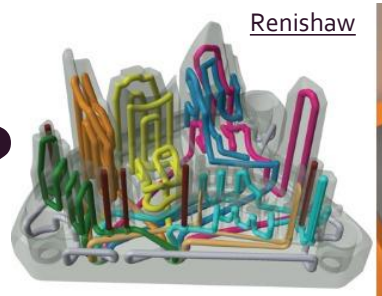
A common principle

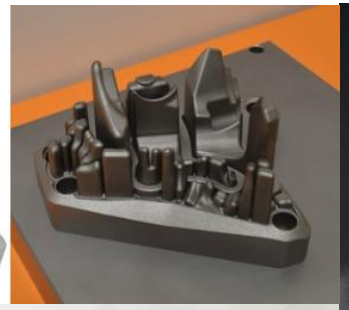
STEP BY STEP



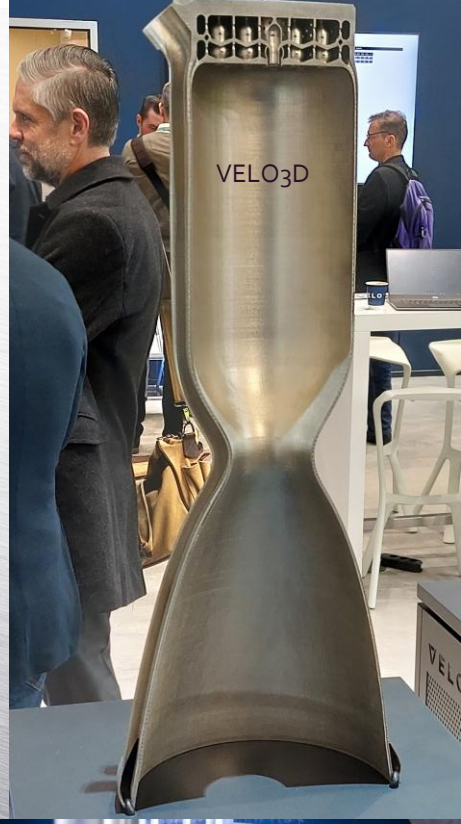
To make what ?

METAL PARTS

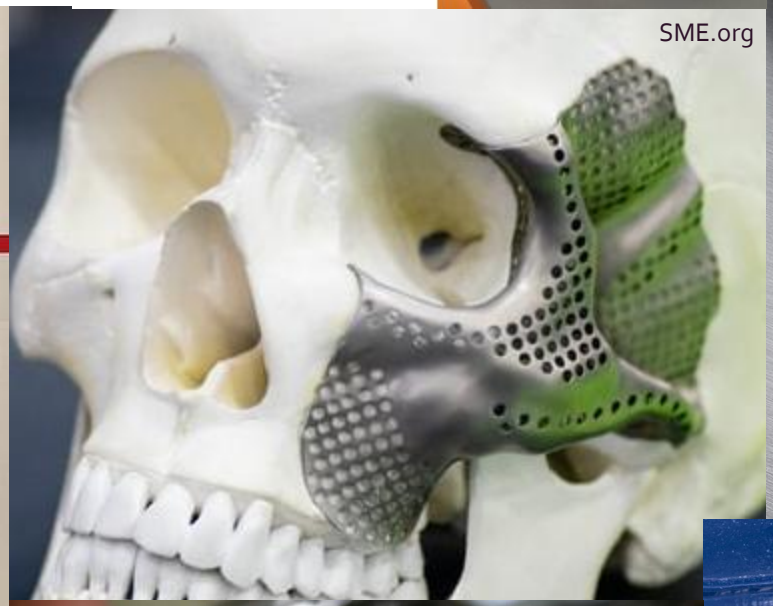

Renishaw




Rolls Royce




AMCM


SME.org


US Air Force

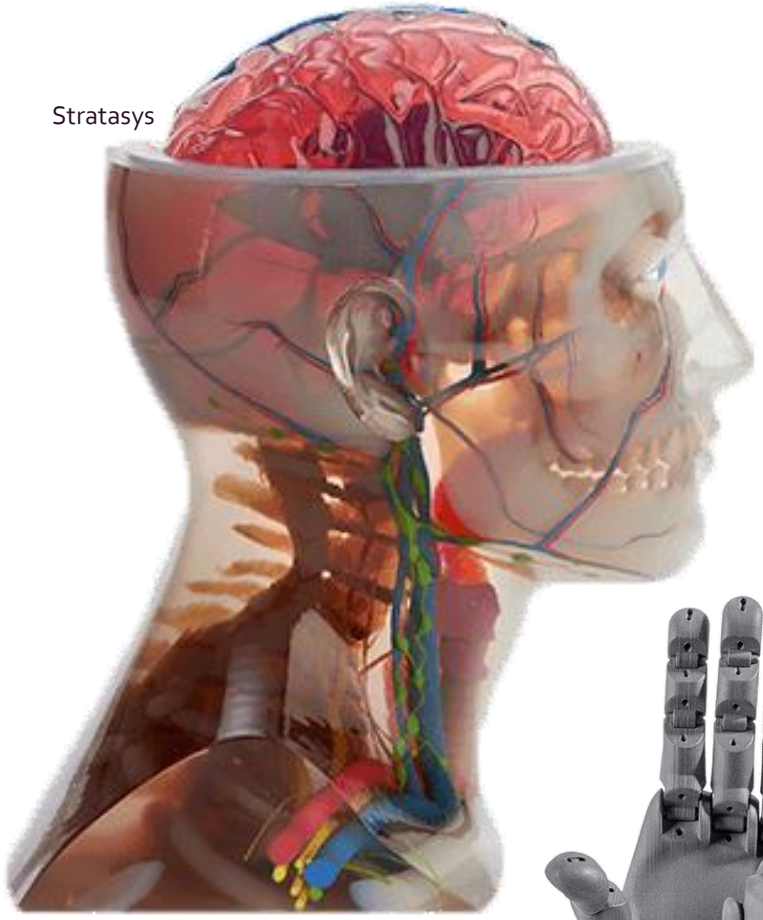

BMW

To make what ?

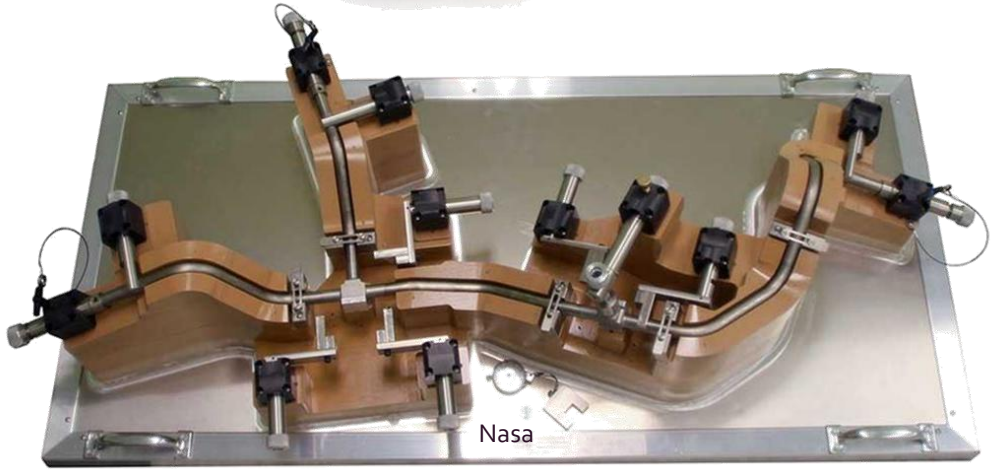
POLYMER/COMPOSITES PARTS


Windform

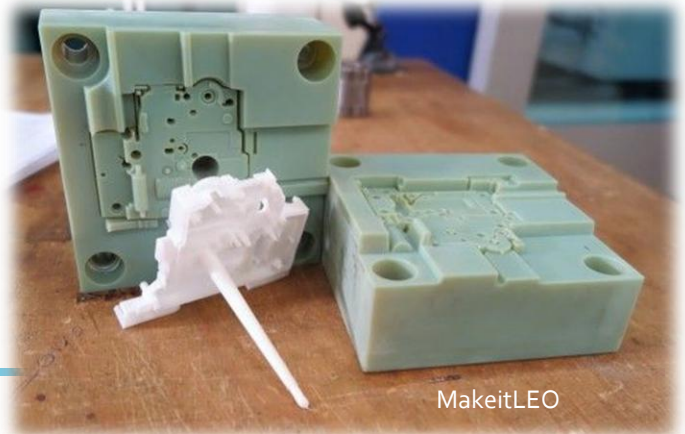
Stratasys




Markforged


Nasa

Sinterit


MakeitLEO


3D Systems

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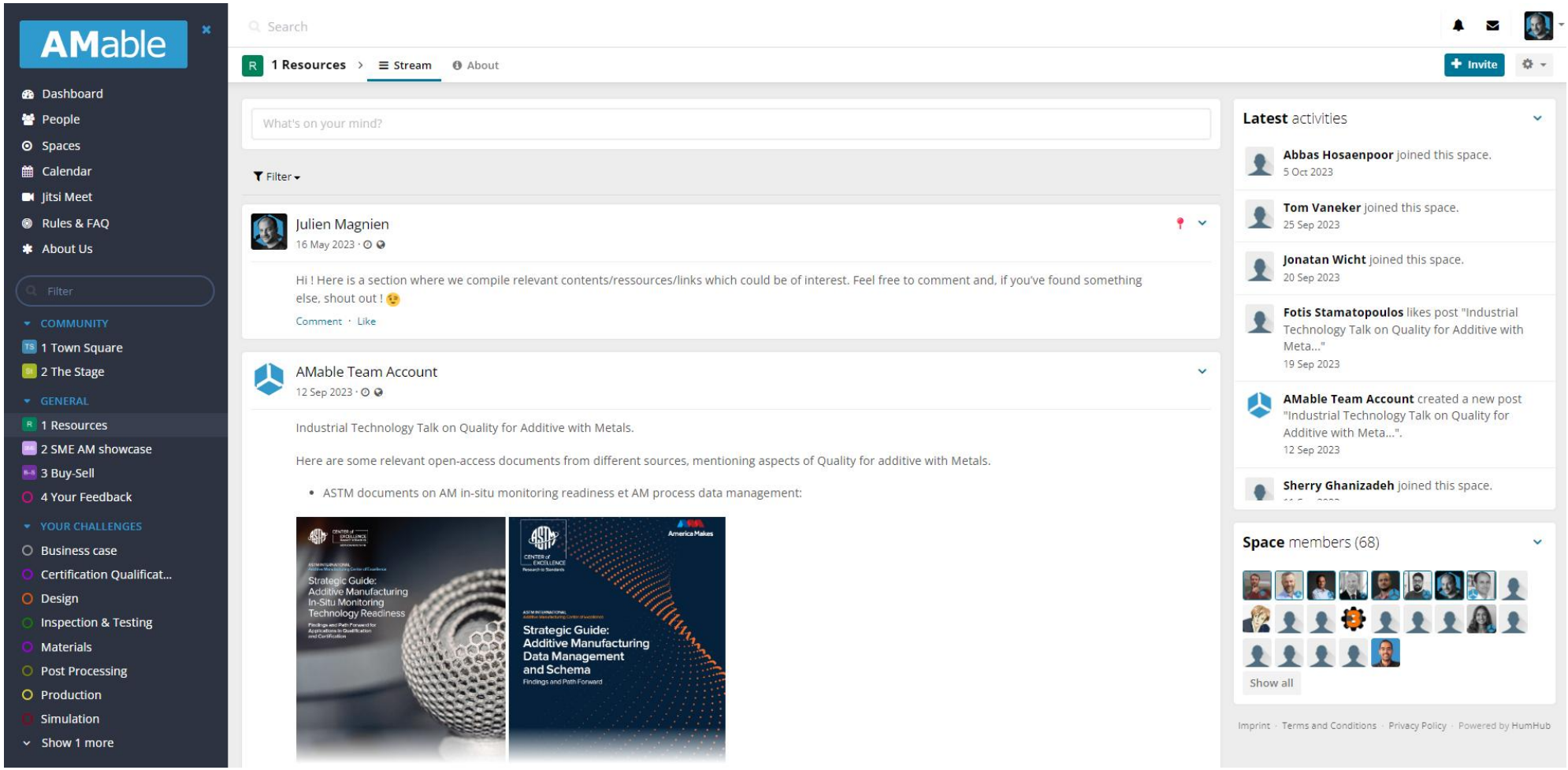
Want to discuss AM in free EU expert community ?

[HTTPS://COMMUNITY.AMABLE.EU/](https://community.amable.eu/)



What are we doing ?

COVERING ALL THE VALUE CHAIN

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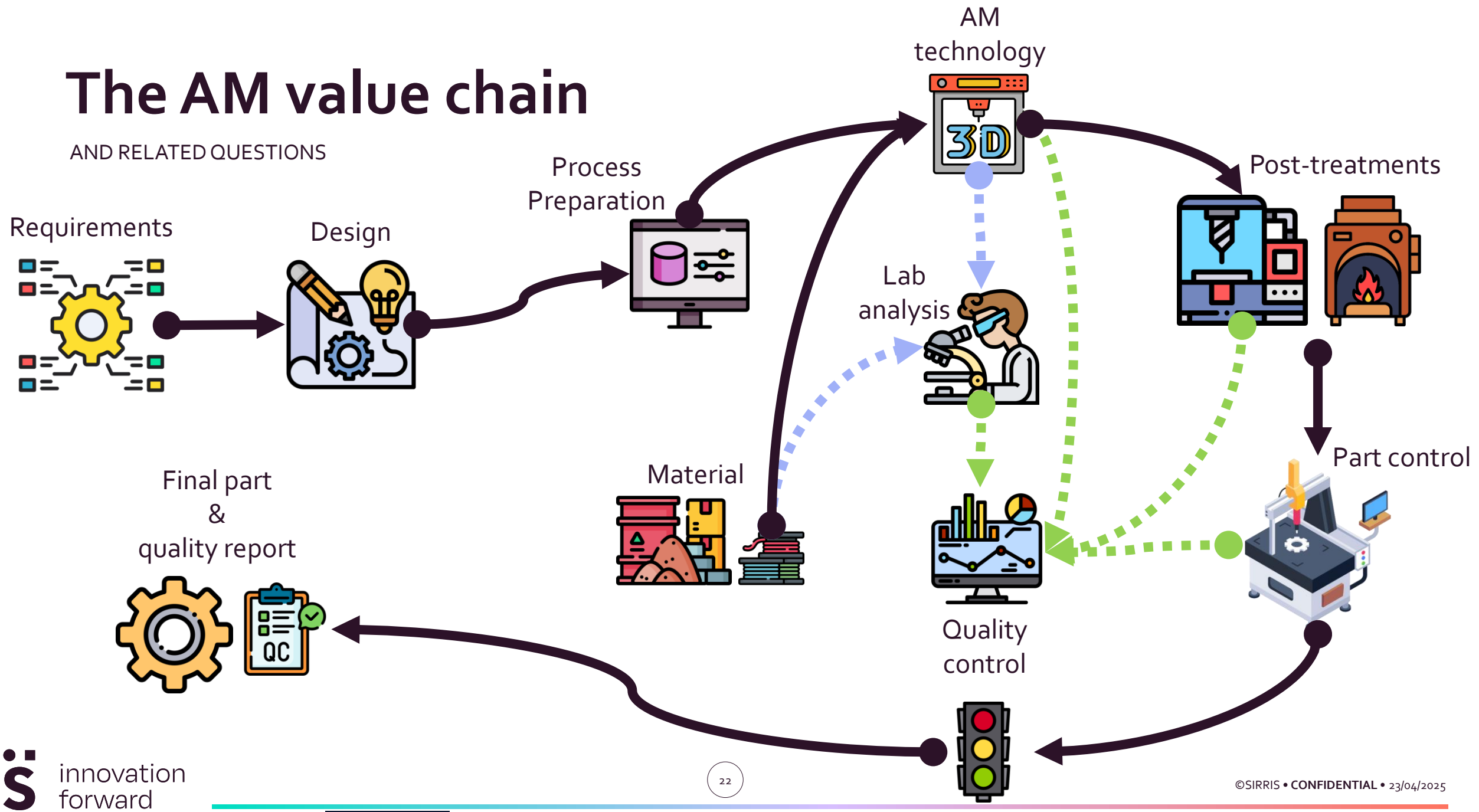
The AM value chain

AND RELATED QUESTIONS



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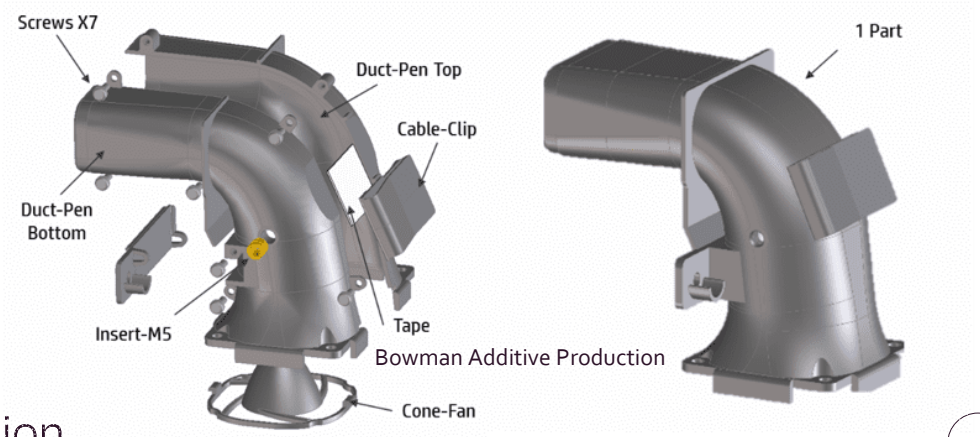
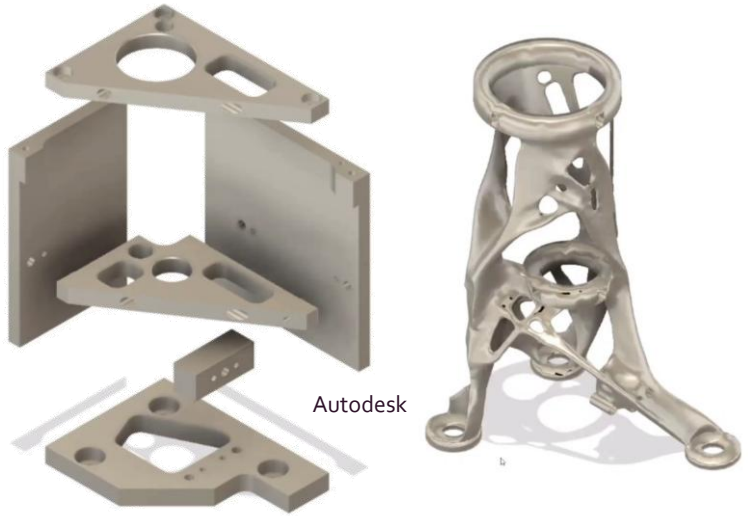
Images from FLATICON

Design Services

YOU HAVE THE REQUIREMENTS, AND YOU WANT TO MAKE THE MOST EFFICIENT PART

- (Re-)design a part to suit to AM
- Suggest or make some improvements to increase the efficiency and reduce overall costs
- Reverse engineering based on 3D scan
- Topology optimization, customization, assembly reduction,…

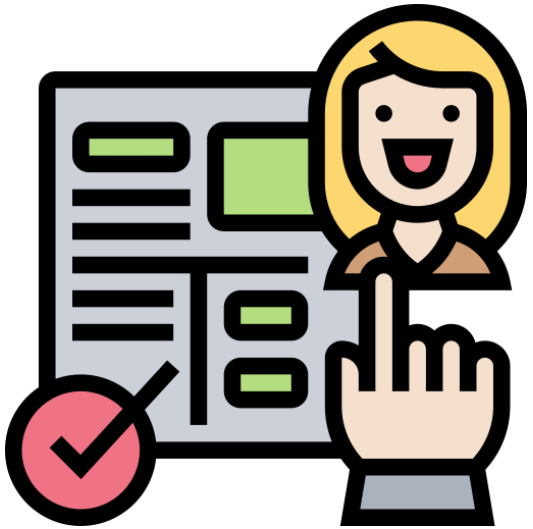




Process preparation Services

YOU HAVE AN AM-COMPATIBLE DESIGN AND WANT TO OPTIMIZE THE NEXT STEP

- Advice on how to select and deal with a AM service supplier
- Help on finding manufacturing partners
- Assistance to benefit from subsidies opportunities



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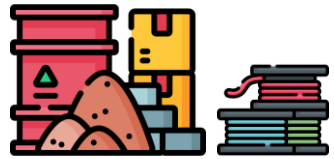
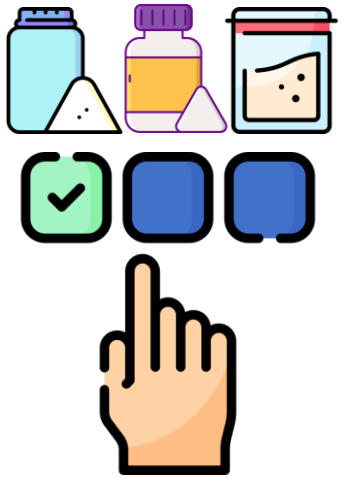
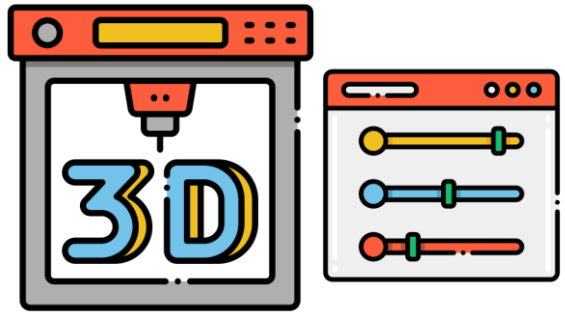


Material Services

YOU ARE LOOKING FOR A SPECIFIC MATERIAL

- Investigation on most suitable AM material based on requirements
- Project on how to make a material AM-compatible
- Investigate the best quality achievable in AM with a given material





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Images from FLATICON

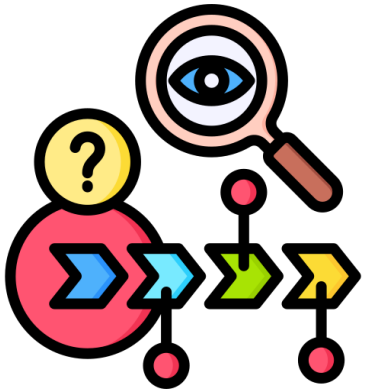
Lab Services

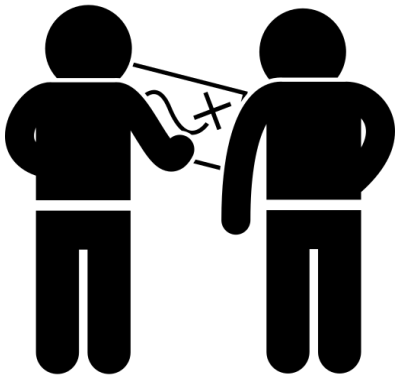
YOU WANT TO GET DATA FROM YOUR MATERIAL FOR BETTER UNDERSTANDING/FOLLOW-UP/QUALITY/…

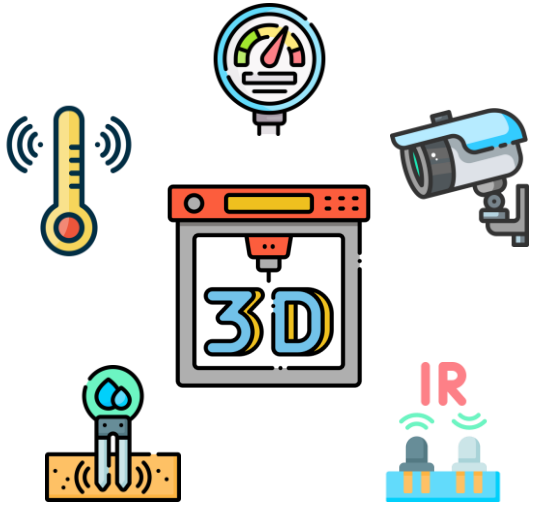
- One of the most complete laboratory for powder and fibers analysis
  - Shape and size distribution (Occhio 500 nano XY)
  - Packing density (Granupack)
  - Flowability (Granudrum)
  - Electrostatic behaviour (Granucharge)
  - Humidity content (Karl Fisher)
  - True density (pycnometer)

Additive Manufacturing services

- Investigate of new exotic materials on the AM process
- Root cause analysis on failed production at customer side
- Offer a deep dive into AM processes and related technologies
- Share a space on an open machine to test/validate a specific sensor -> demonstrator







Images from FLATICON

Additive Manufacturing equipment

MATERIAL EXTRUSION MEX (AKA FDM)

Creality Ender 3 V2

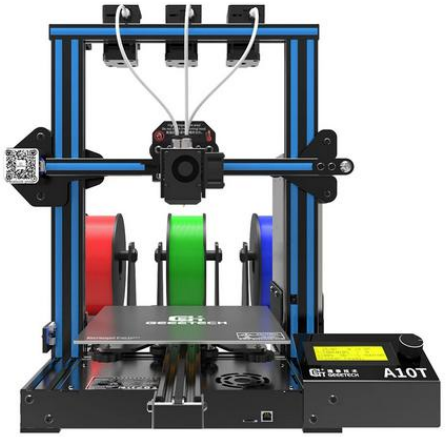
220 X 220 x 250 mm

Affordable, rigid only

Elegoo Neptune 3 Pro

225 X 225 x 280 mm

Affordable, flexible compatible



Geeetech A10T

220 X 220 x 250 mm

Up to 3 materials

Raise 3D Pro 2

300 X 300 x 300 mm

Enclosed. Nozzle up to 300°C

Orion A460

460 x 300 mm

Radiative head to process PEEK

3Devo Composer 450

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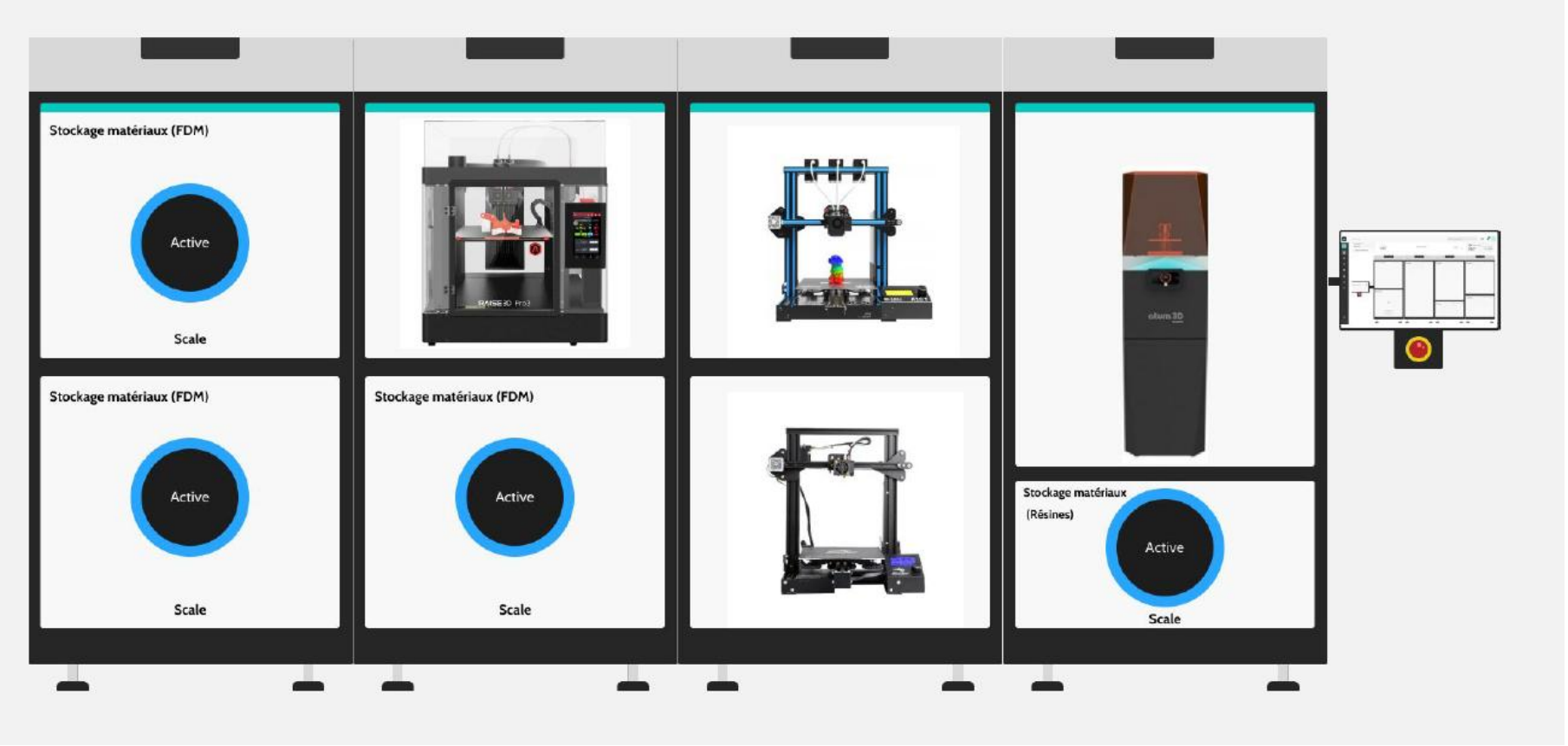
Additive Manufacturing equipment

Soon: August 2024

ADDITIVE FARM MATERIAL EXTRUSION MEX (AKA FDM)



Additive Manufacturing equipment

MATERIAL EXTRUSION (MEX, AKA FDM)

Hyrel 3D Hydra 16

330 x 330 x 250 mm³

MEX & Syringe hybrid

Kuka 500 + extruder

Reach 2900 mm

Pellet REV3RD extruder, large size (tooling)

Additive Manufacturing equipment

VAT PHOTOPOLYMERIZATION (VPP)

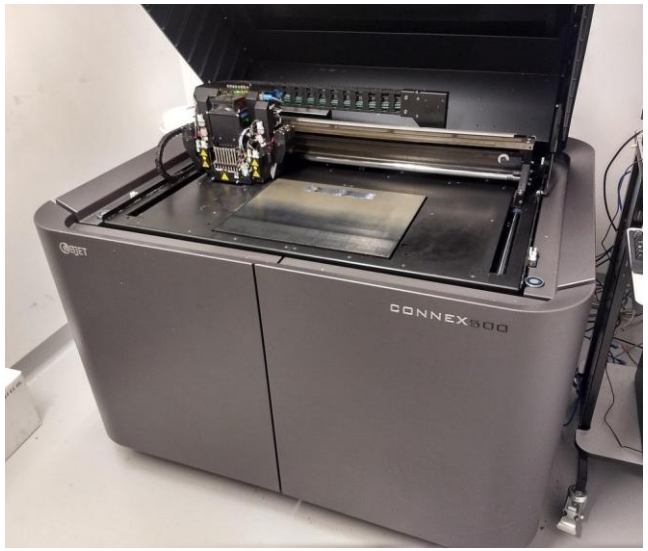
Elegoo Mars 2 Pro
120 X 80 x 160 mm³
Small desktop, mask

Elegoo Saturn 2
220 X 120 x 250 mm³
Large desktop, mask

Atum 3D DLP Station 5
192 X 108 x 250 mm³
Digital Light Processing

Additive Manufacturing equipment

MATERIAL JETTING (MJT)



Objet Connex 500
490 X 390 x 200 mm³
Mix up to 2 resins, high accuracy

Hyrel 3D Hydra 16
330 x 330 x 250 mm³
MEX & Syringe hybrid

Additive Manufacturing equipment

POWDER BED FUSION (PBF)

Sharebot Snowhite
100 X 100 x 100 mm³
Polymer, Laser, low powder quantity trial

Prodways P1000
300 X 300 x 300 mm³
Polymer, Laser, part stacking

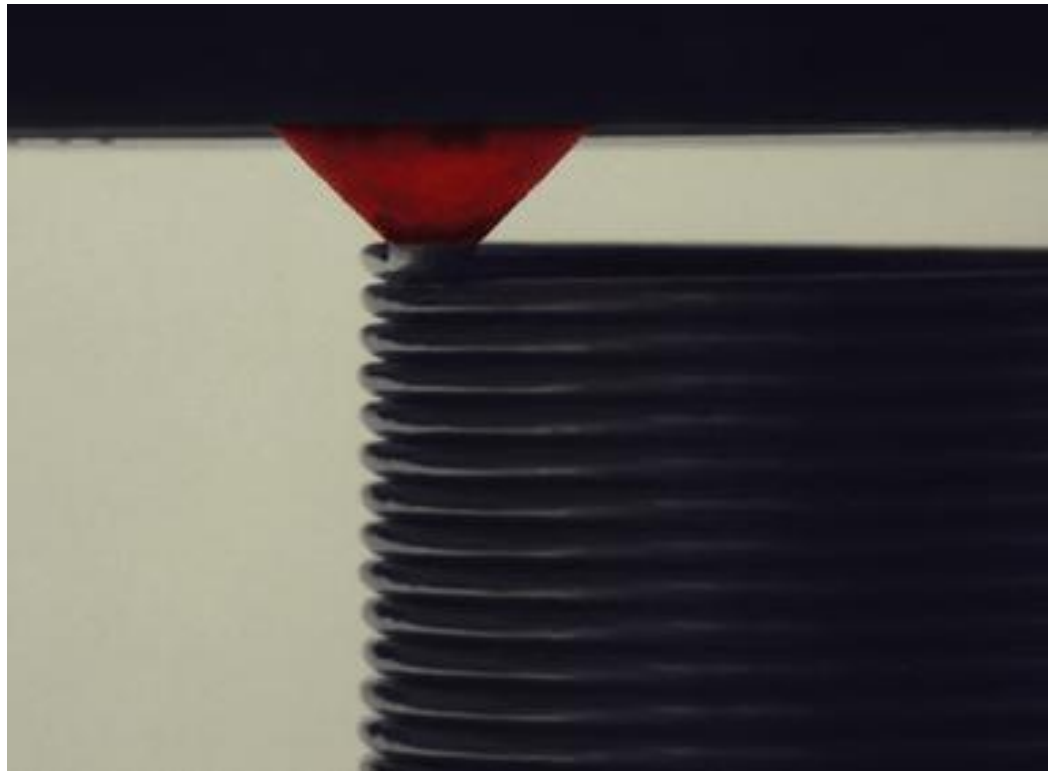
SLM Solutions SLM250HL
250 X 250 x 350 mm³
Metal, laser, open to modifications

SLM Solutions SLM280HL
280 X 280 x 350 mm³
Metal, laser, full upgrade

Arcam A2
210 X 210 x 300 mm³
Metal, Electron Beam high preheating

Additive Manufacturing equipment

MOLTEN METAL DEPOSITION



Quality control services

- **Share data** across all process chains
- Validate results of process step(s) **modelling**
- Document of a first trial to prepare for **qualification/certification**
- Demonstration of added value of **digitalization** of a process for process engineers (not data scientist)
- Definition of triggering values and their correlated effect on **part/process quality** (e.g. number of powder recycling allowed)
- Quantify the impact of a **process modification**

Capture data

WHERE DO WE CAPTURE IT ?

Operator

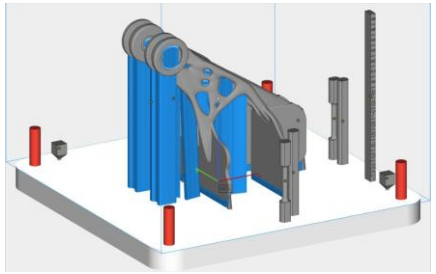
Labo

Machine

Powder

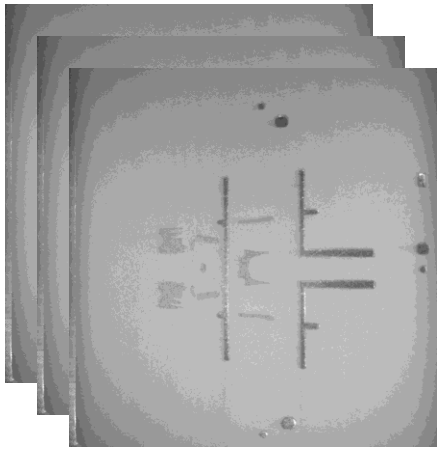
- Density
- Granulo-morphology
- Flowability
- Electrical behaviour
- ...

File preparation



Part sizes, features, position

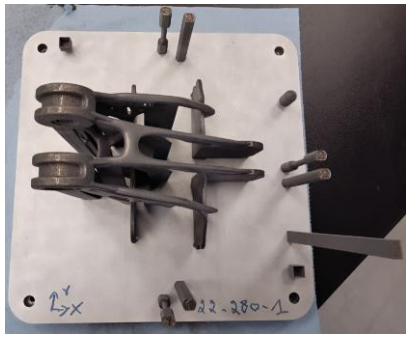
Manufacturing



- Actions on machine
- Powder handling
- Steps reporting

- Meltpool
- Laser Power
- Layer pictures
- Eddy current answer
- Events
- Sensors
- Electrical consumption

Post-treatments & control



- Steps reporting
- Quality control
- Heat Treatment
- Density
- Mechanical properties

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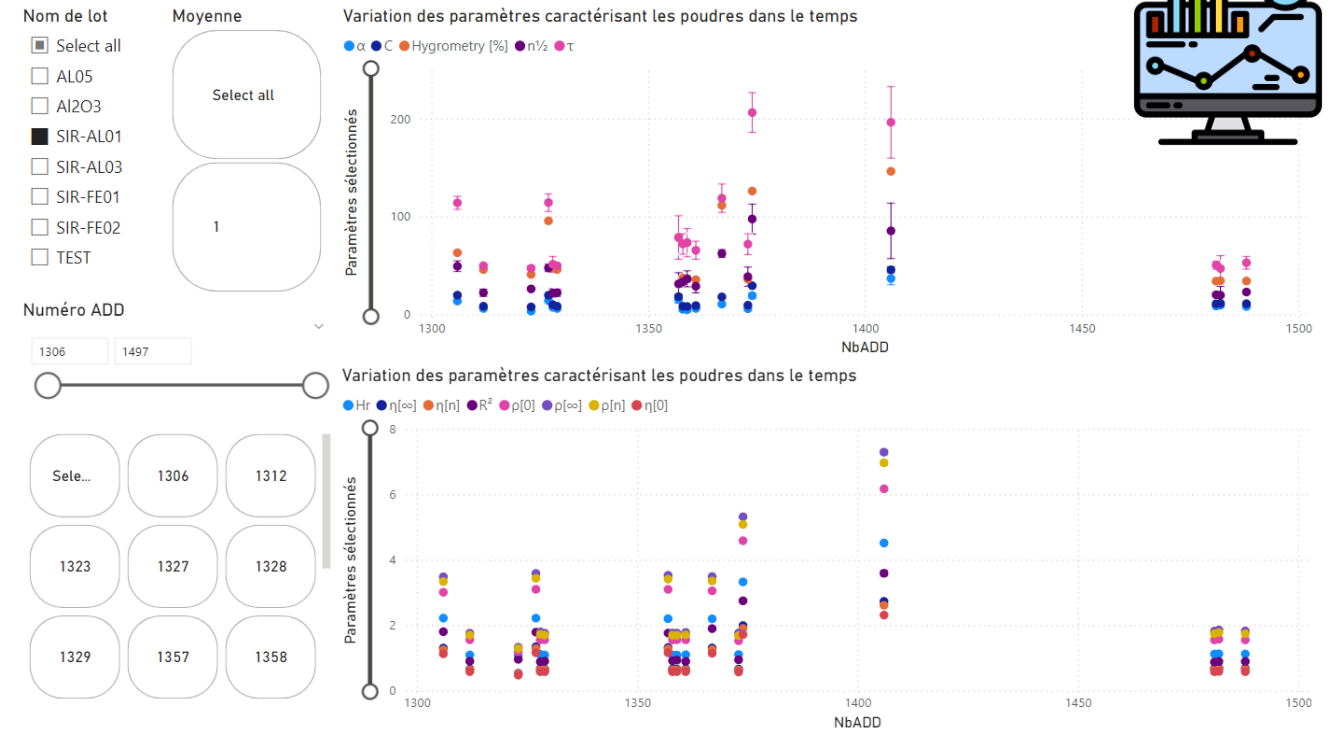
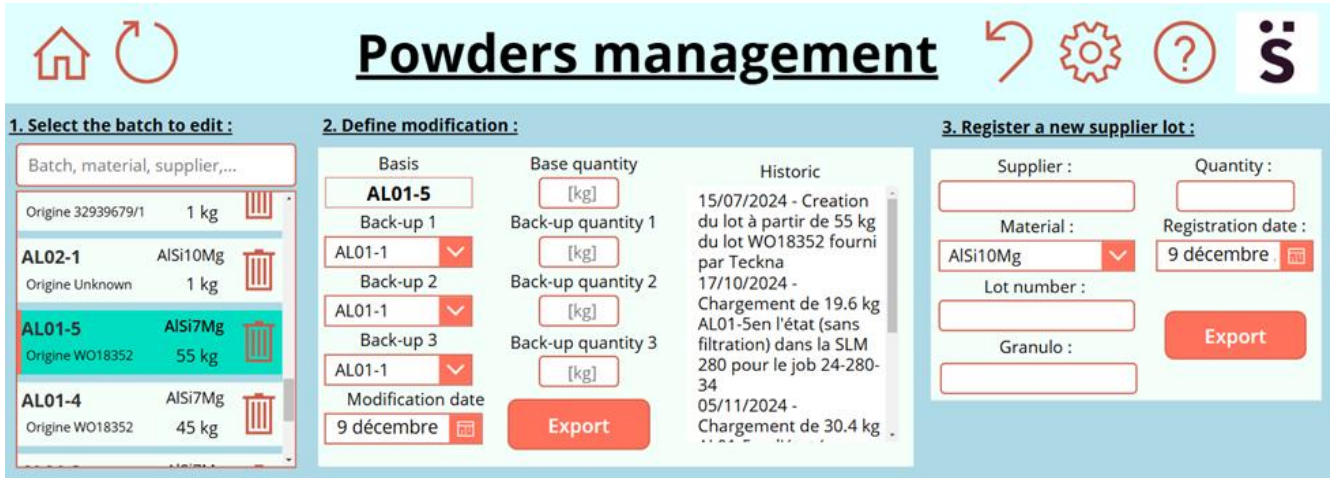
Powder monitoring

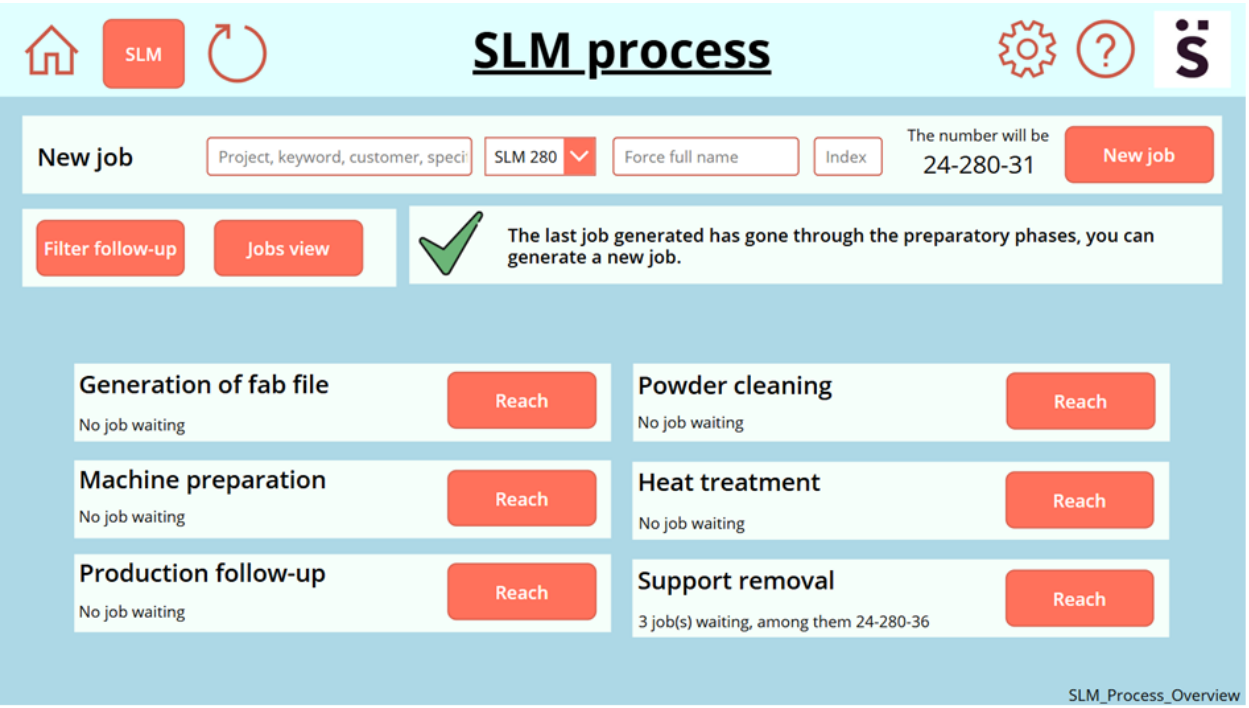
- Traceable powder batch history (origin, mixing, filtering, losses,…)
- Tracking of operator powder handling operations
- Follow-up of powder properties across time to detect drift

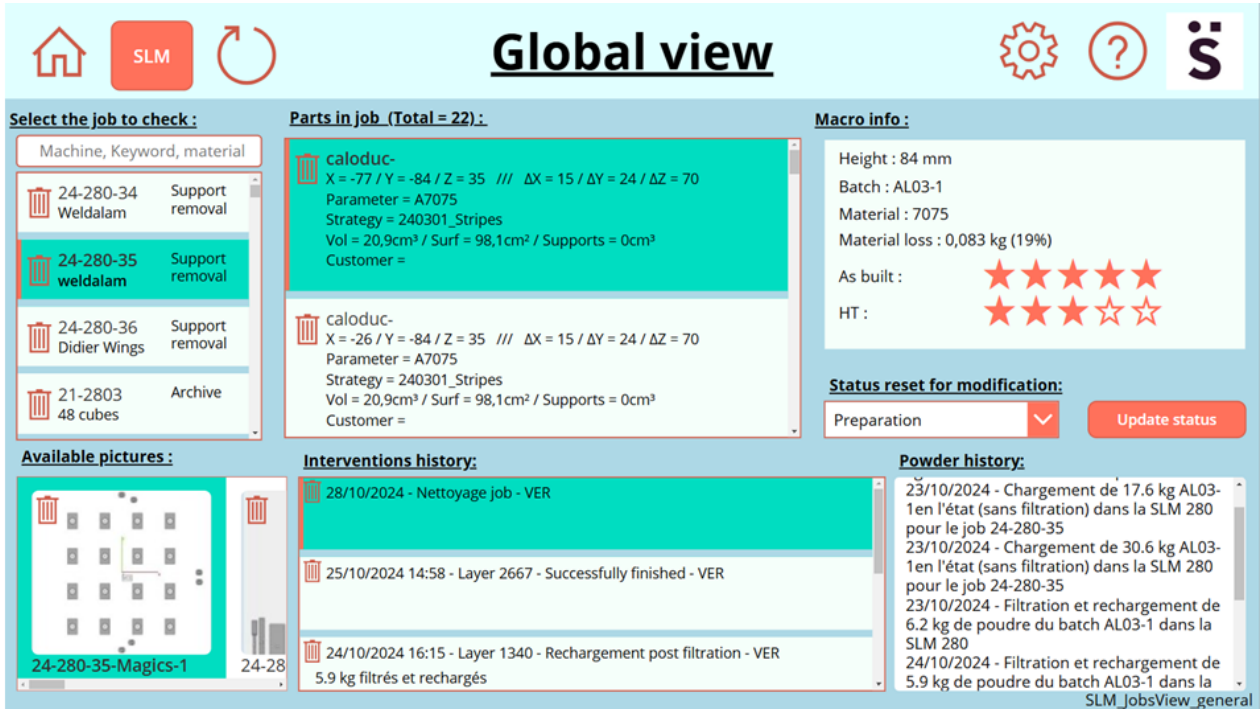




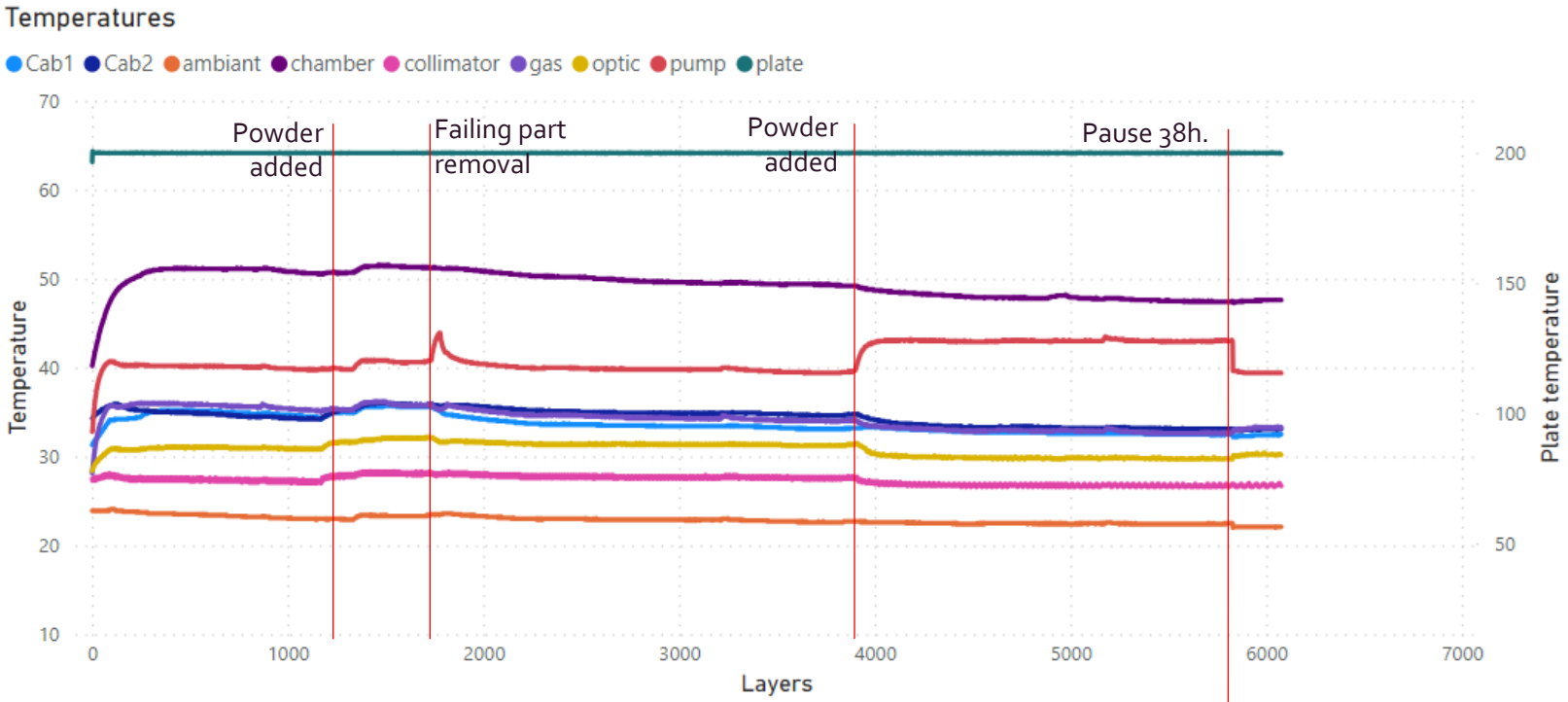
Operator follow-up

- Operators record info only once
- Each job & part has its own history





Logfile dashboard



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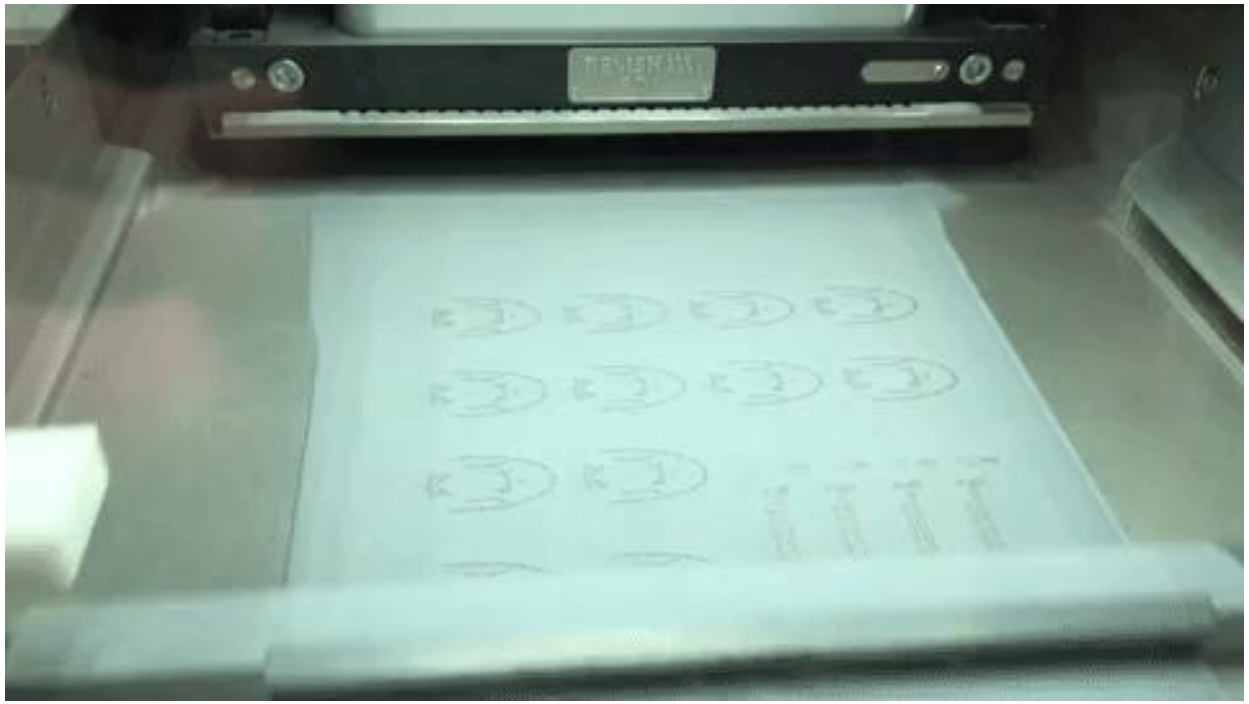
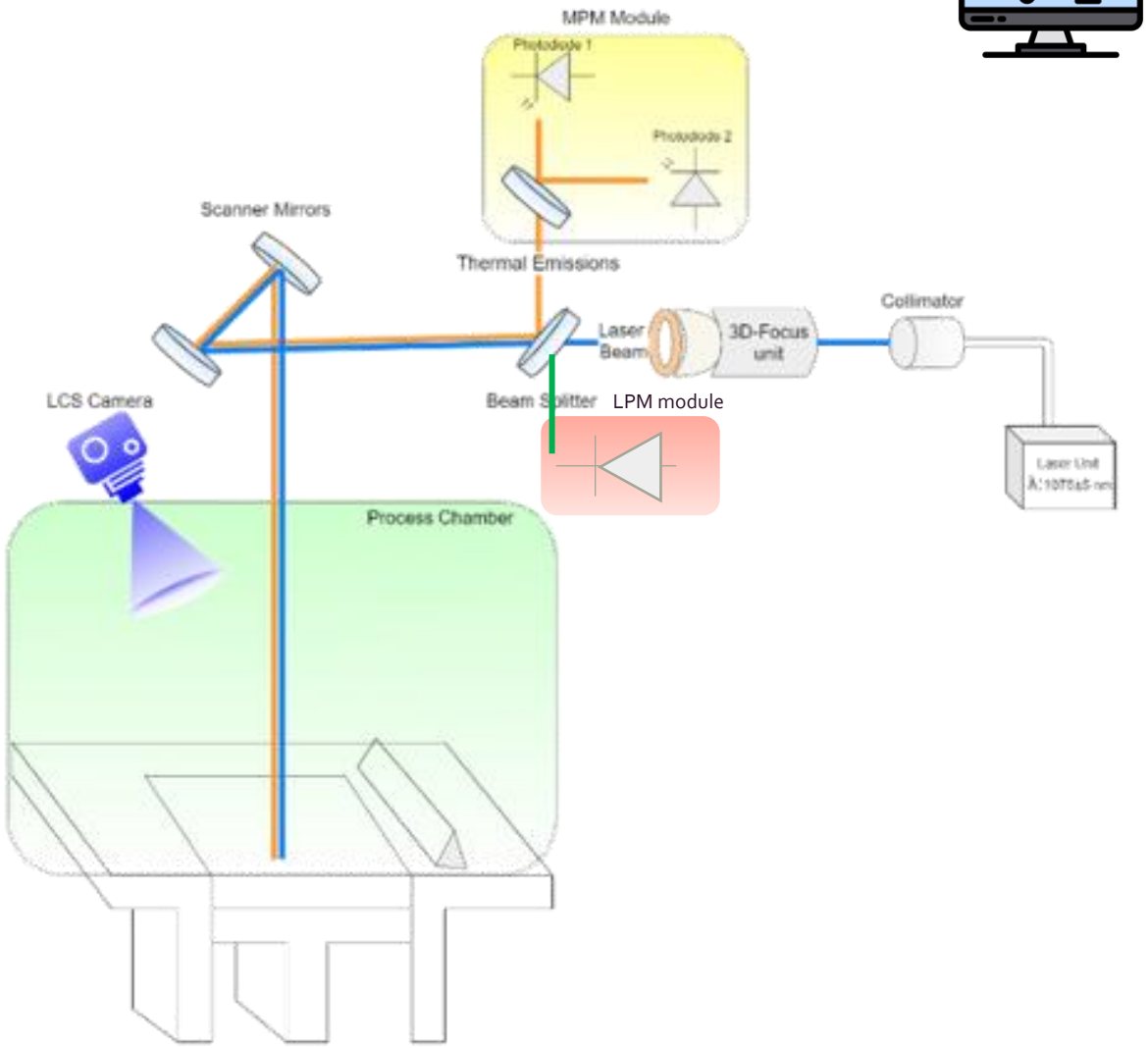
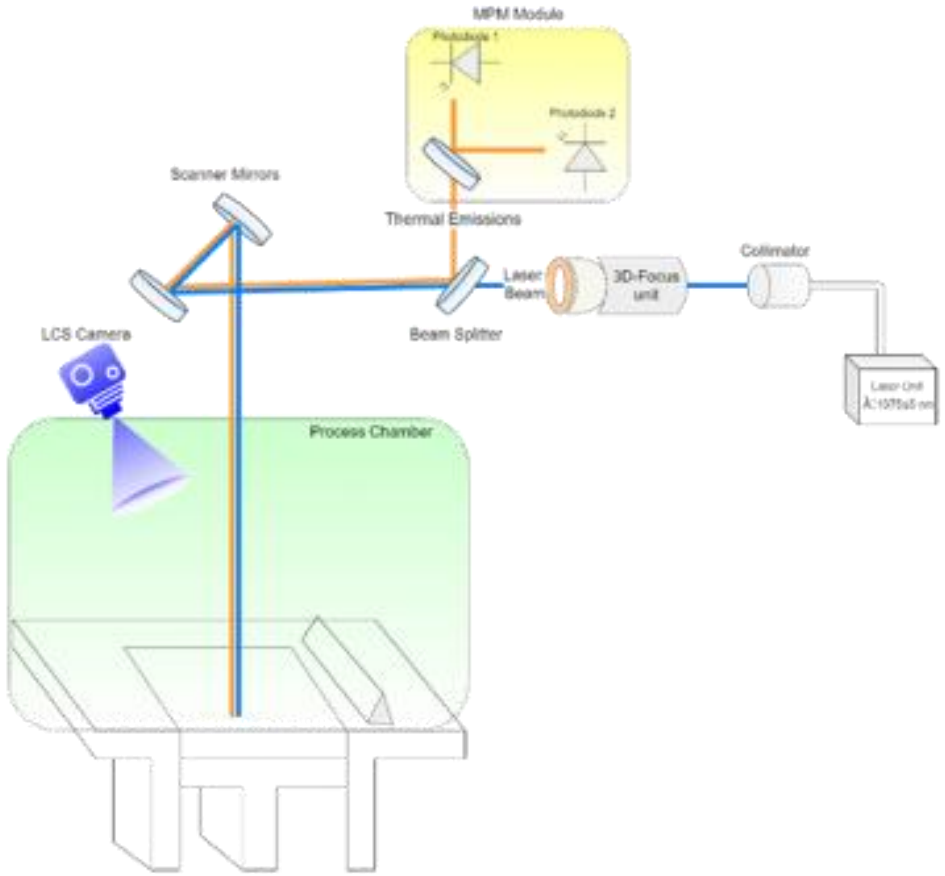
Machine monitoring

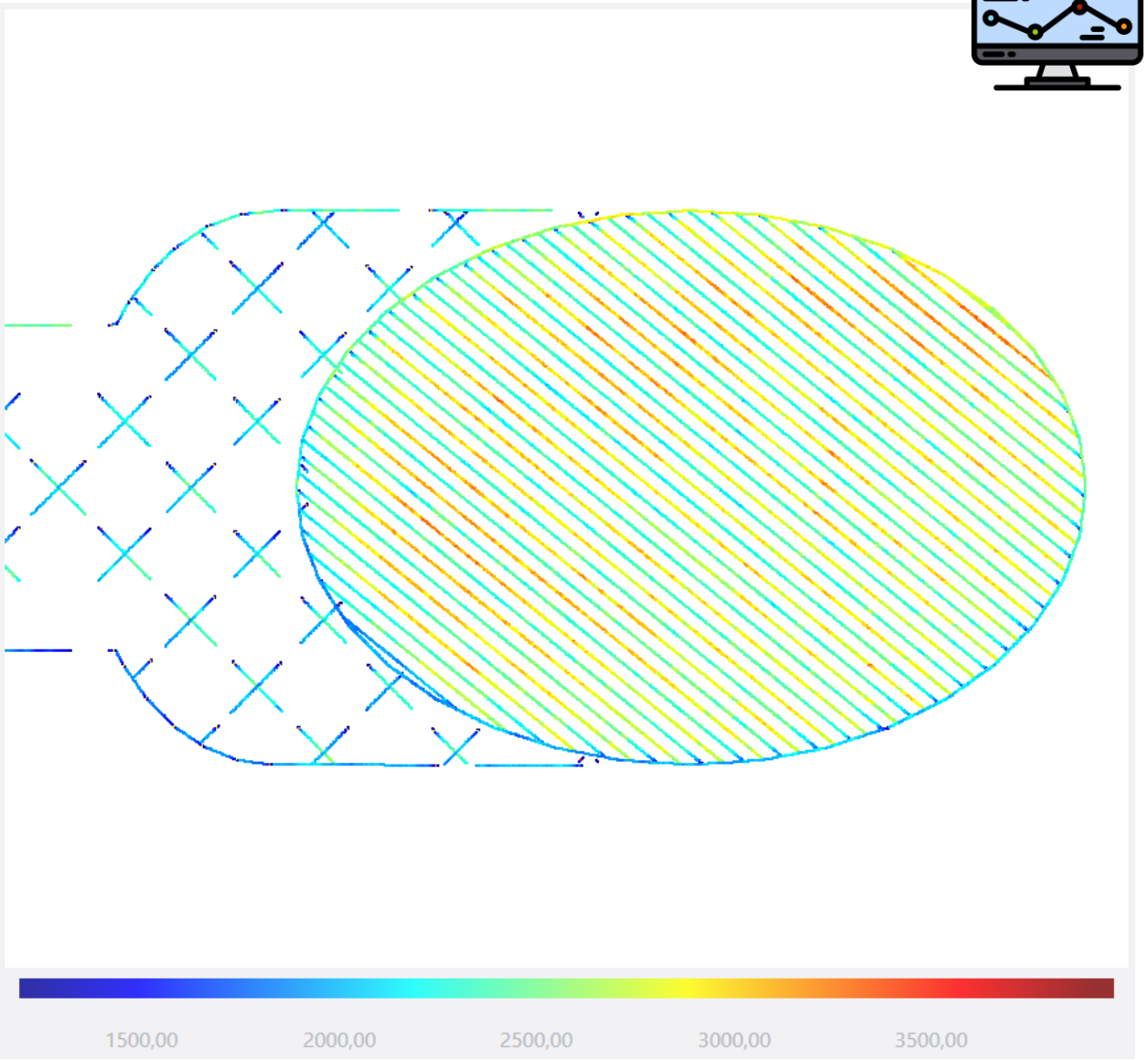


additivemanufacturing.media

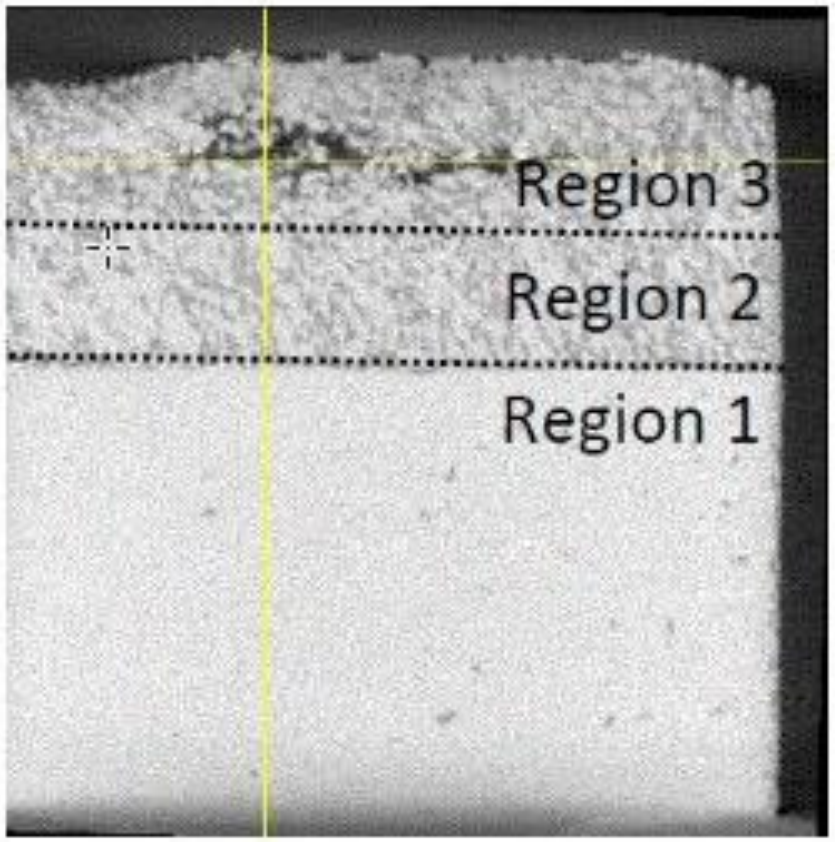


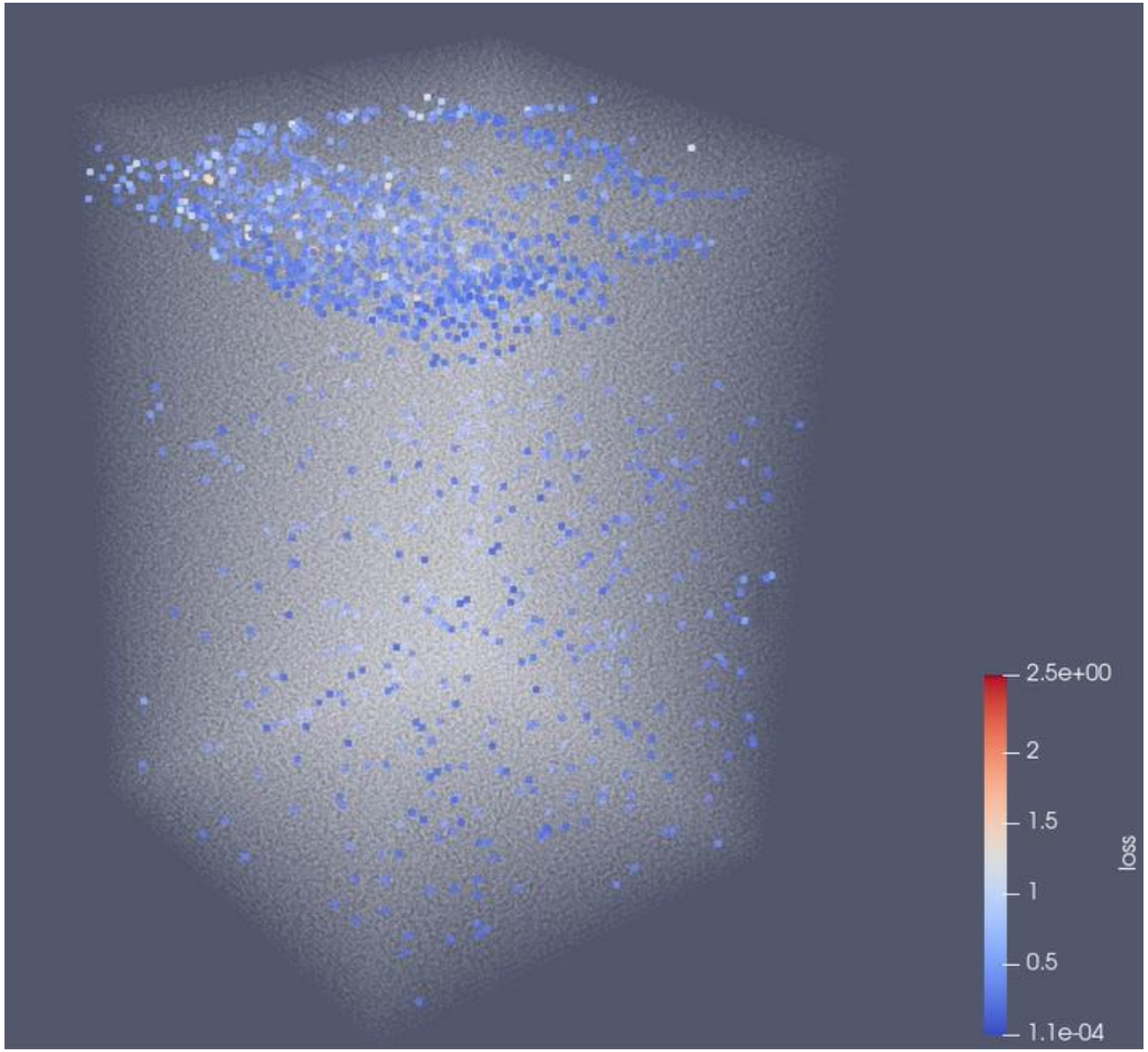
MeltPool Monitoring



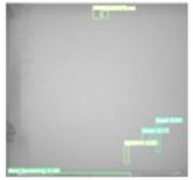
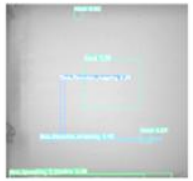


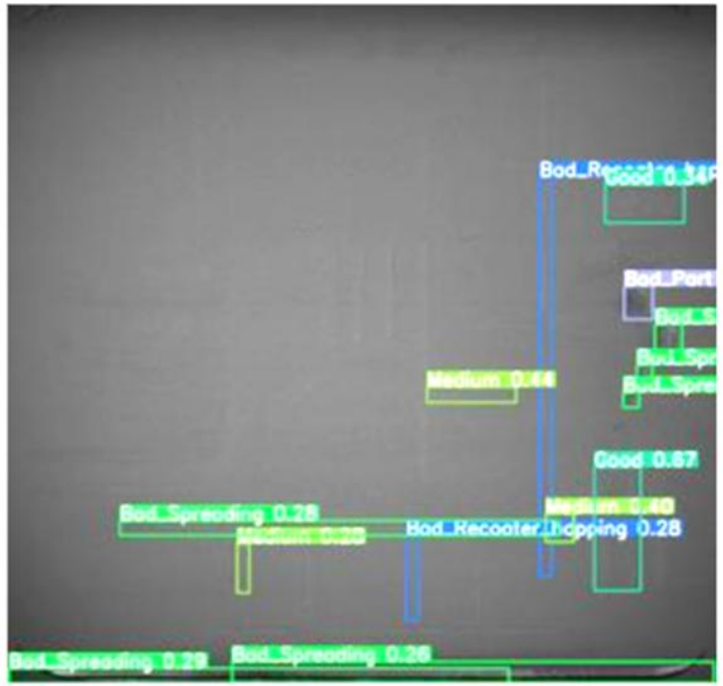
MeltPool Monitoring





Layer picture automated defect labelling

layer	image_with
2023-11-09_16-11-02_layer_00015	
2023-11-09_16-12-10_layer_00016	
2023-11-09_16-12-33_layer_00017	
2023-11-09_16-13-41_layer_00018	
2023-11-09_16-14-04_layer_00019	
2023-11-09_16-15-12_layer_00020	

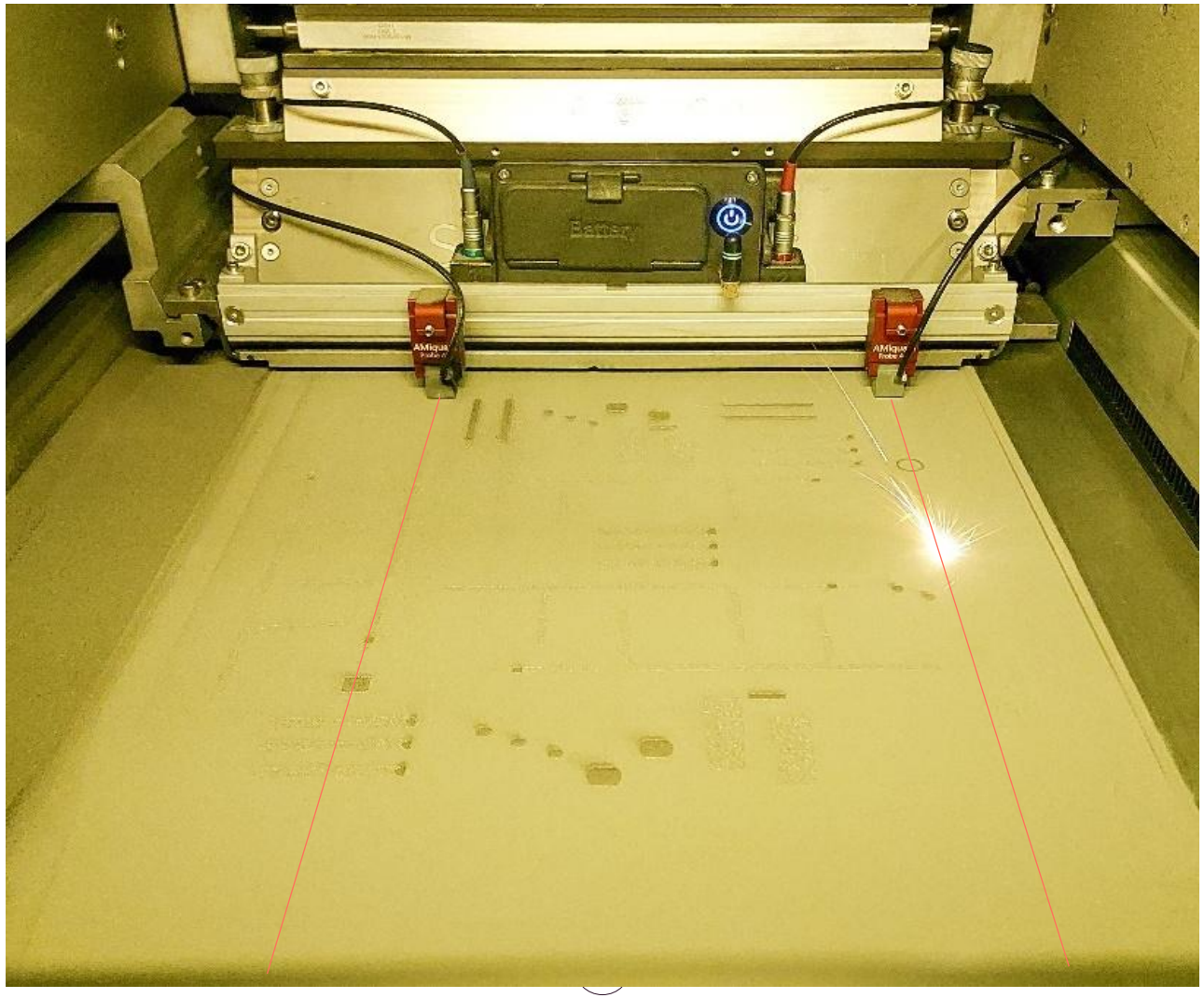


run-id
2023-05-05_08-47-24_23-280-21
2023-11-09_15-56-50_23-280-39
2023-11-16_14-07-43_23-280-40
2023-11-21_14-21-31_23-280-41
2024-01-18_14-59-22_24-280-01
2024-01-26_17-18-50_24-280-2
2024-01-30_15-55-28_24-280-3
2024-02-12_12-12-00_24-280-4
2024-03-01_16-10-19_24-280-6

name	Count of name
Medium	3
Good	3
Bad_Spreading	6
Bad_Recoater_hopping	2
Bad_Part damage	1
Total	**15**

innovation forward

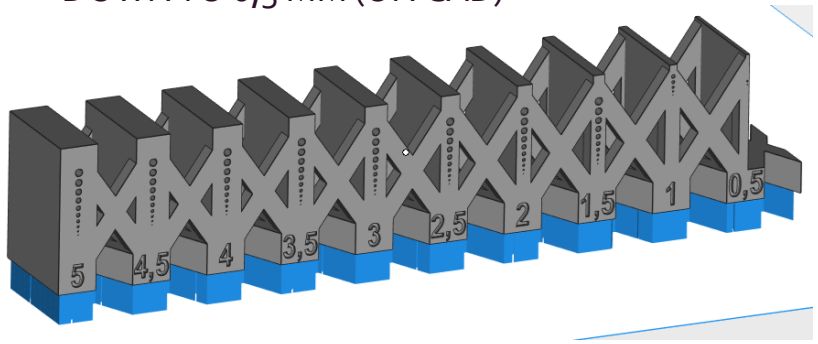
Eddy currents

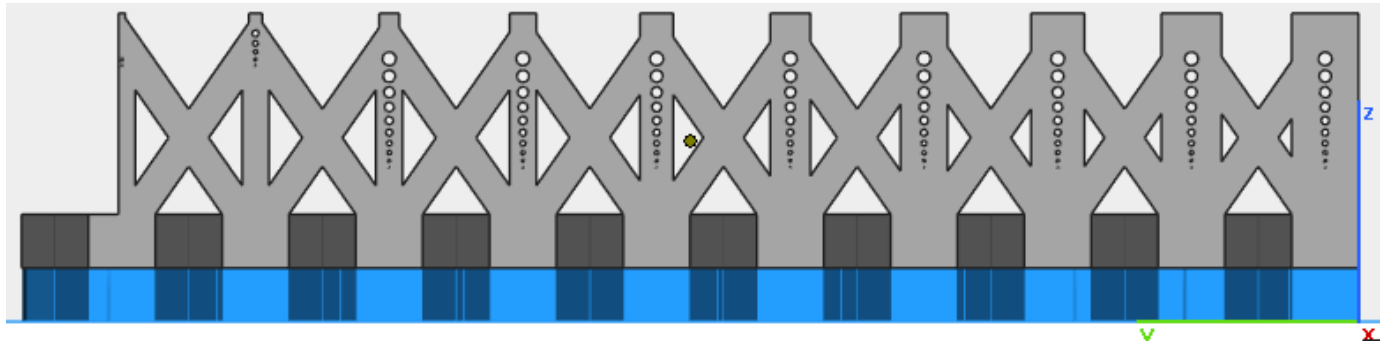


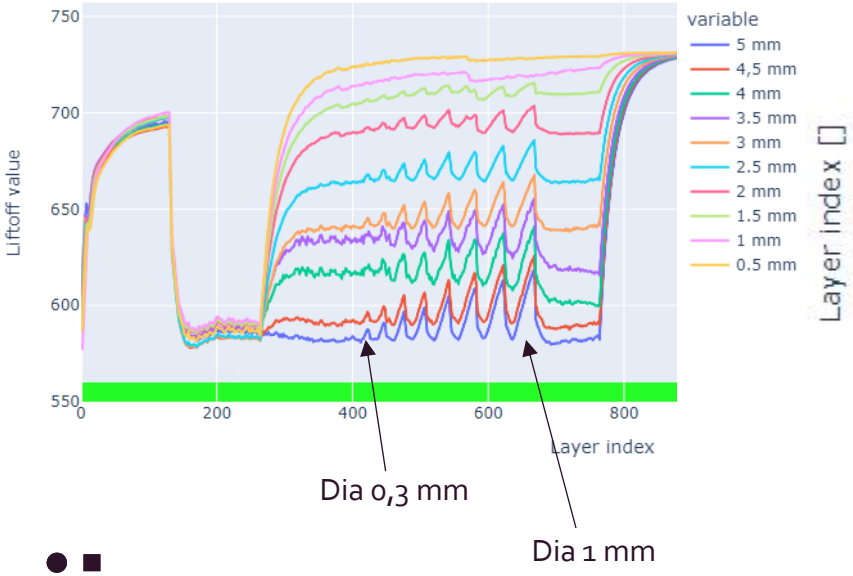
innovation forward

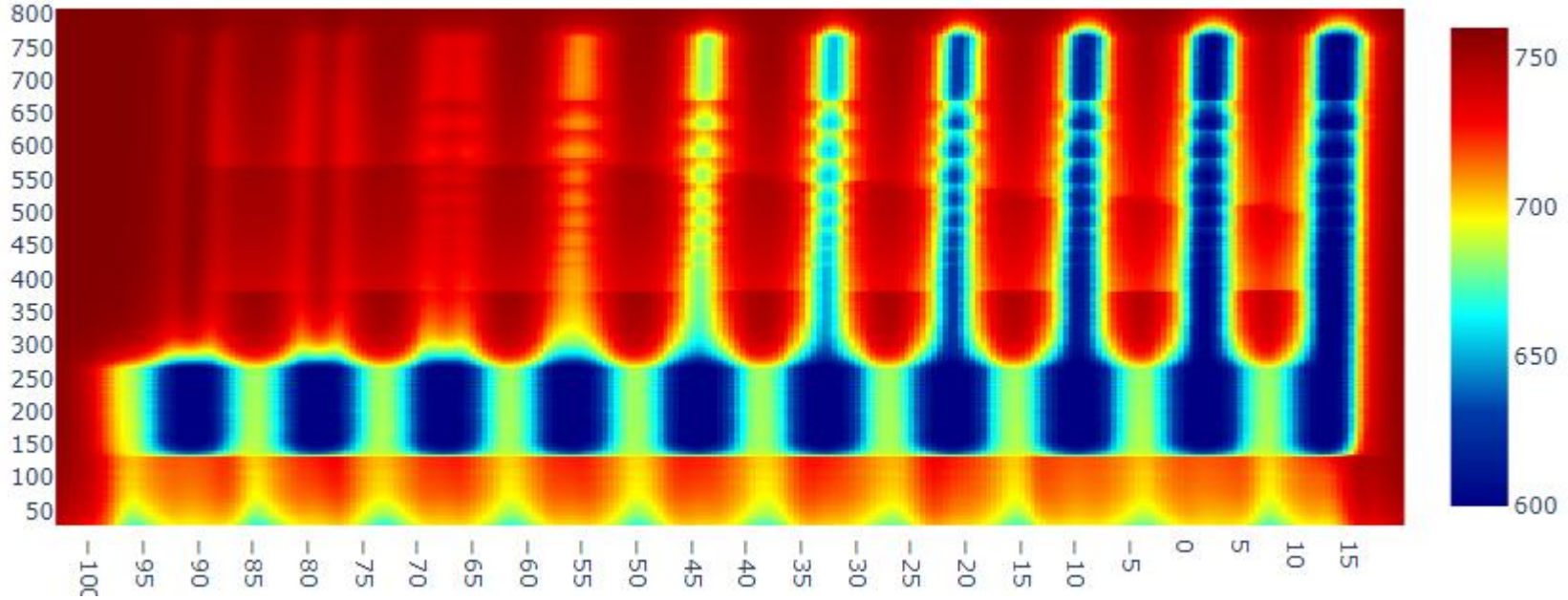
Eddy currents

DOWN TO 0,3 MM (ON CAD)









innovation forward

Power consumption follow-up

Load CSV File

- [x] Phase 1 power
- [x] Phase 2 power
- [x] Phase 3 power
- [ ] Phase 1 compresseur
- [ ] Phase 2 compresseur
- [ ] Phase 3 compresseur

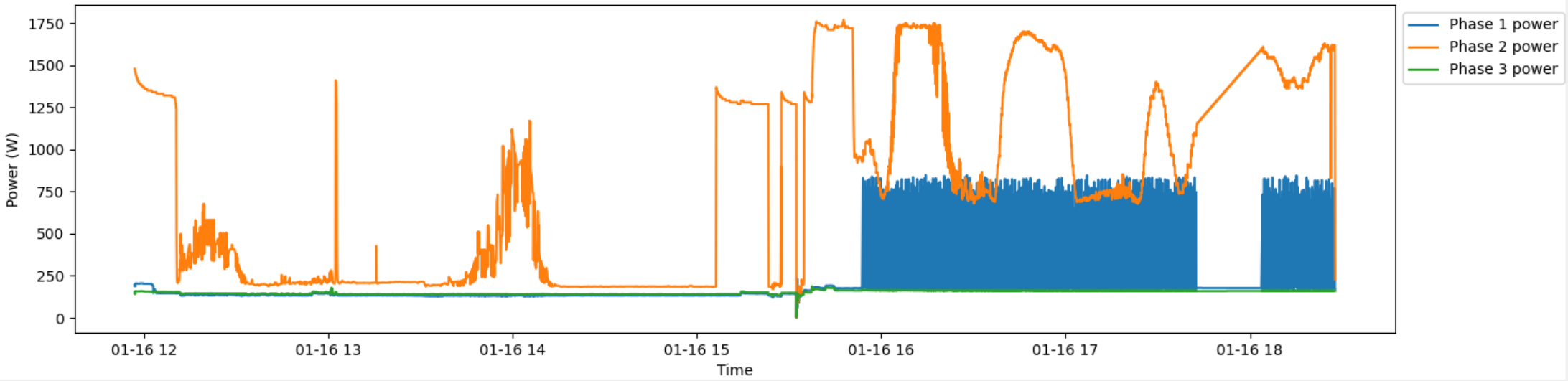
Calculate and Generate Graph

```
First Timestamp: 2025-01-16 11:57:04
Last Timestamp: 2025-01-16 18:27:44
Total Duration: 6.51 hours

Total Consumption (all columns): 7.6 kWh

Average Power: 1.17 kW

Column: Phase 1 power
Total Consumption: 1.41 kWh
Max Power: 848.0 W at 2025-01-16 16:14:30
Min Power: 0.0 W at 2025-01-16 15:32:25

Column: Phase 2 power
Total Consumption: 5.25 kWh
Max Power: 1770.0 W at 2025-01-16 15:47:43
Min Power: 0.0 W at 2025-01-16 15:32:25

Column: Phase 3 power
Total Consumption: 0.98 kWh
```

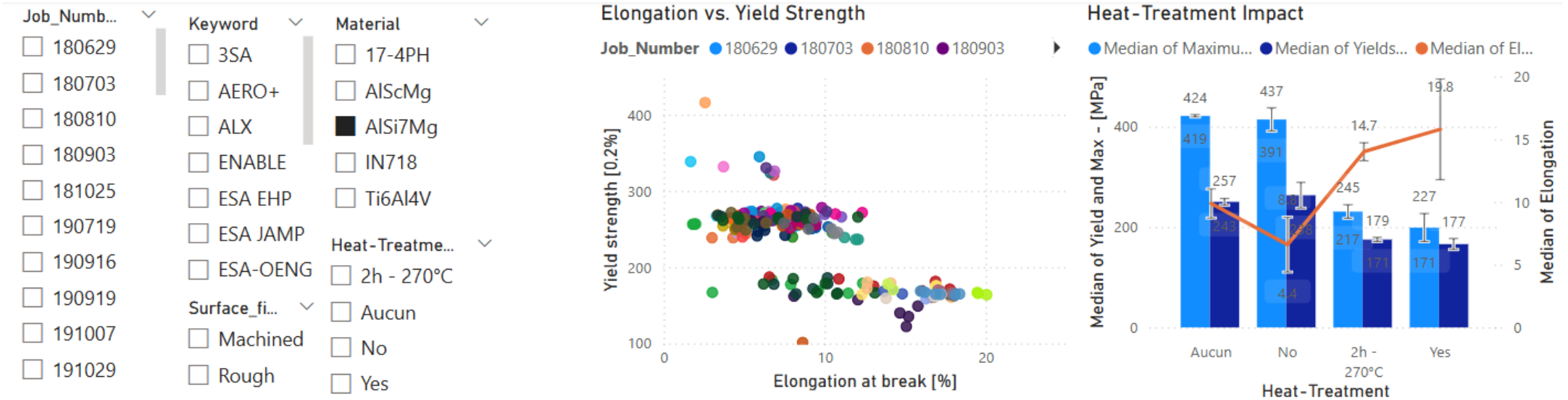
Copy to Clipboard

Job Reference (format 'YY-280-XX'):

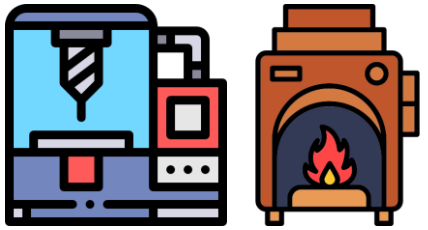
Archive Consumption in SharePoint



Mechanical properties follow-up



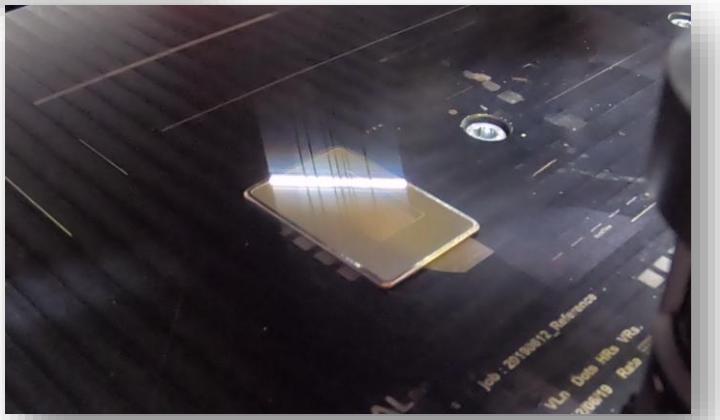
Post-treatments services



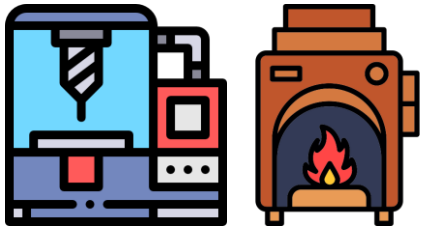
- Optimize a heat treatment (e.g. based on residual stresses measurement)
- Long experience in AM part machining specific conditions (combined with 3D scan)

Machining capabilities

- Standard capabilities (milling (3-5 axis, up to 900 mm), turning, EDM (wire & die sinking)
- Micro capabilities :
  - Milling with a tool size down to 50-10 µm (Ra < 100 nm -> optical)
  - Micro EDM (wire cutting & die sinking)
  - Special micron scale milling (Sarix SX-100 HPM)
    - optical finish on metal (Ra < 50 nm)
    - Positioning precision +- 1 µm
    - Radius corner down to 3 µm
  - Laser texturing (e.g. hydrophobic effect)



Ovens capabilities



Name	Size (mm)	Pressure (mbar)	Temperature (°C)	Heating rate (°C/min)	T° uniformity	Atmosphere	Heating source
ECM Cristal 40/40	**Ø 400 x 290**	$5x10^{-5}$ – 1150	600 – 1500	0 – 15	+- 5 (vacuum) +- 10 (gaz)	Vacuum, H_2, N_2, Ar	Electrical
TT technofour	**Ø 800 x 1100**	1 - 1000	300 - 1200	0 - 15	+-1 (>700°C)	Ar, N_2	Electrical
Vertical P	**Ø 400 x 500**	Atm	600 - 1200	-	-	air	Electrical
Autoclave	**Ø 600 x 1200**	1.000 – 10.000	35 - 400	6	+- 2	N_2	Electrical
Etuve Technofour	**1600 x 800 x 1000**	Atm	35 – 280	-	+- 5	air	Electrical
Memmert	700 x 400 x 600	Atm	35 - 220	-	-	air	Electrical

Part control services

YOU WANT TO GET DATA FROM YOUR PART FOR BETTER UNDERSTANDING/FOLLOW-UP/QUALITY/...

- One of the most complete laboratory for part properties assessment

Mechanical

Traction, flexion, notched, hardness,...

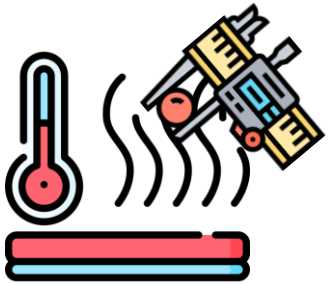
Chemical

GDOES (metal), FTIR (polymer),...

Volume

Relative density, internal stresses

More info ?
-> Go to
testlabs.sirris.be

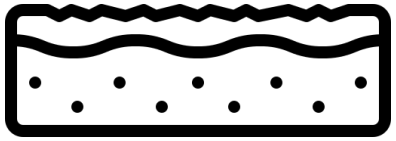


Thermal

Phase transition T°, CTE, HDT, Heat capacity, fatigue -150 -> 500°C,...

Dimensional

3D scan, CMM, photogrammetry



Surface

Roughness, wear resistance, micro-hardness,...

Images from FLATICON

Services in a nutshell

- Validation of **new polymer** or **loaded polymer materials**.
- Validation of **new metallic materials**.
- **Speed up material** development by **using Data**
- **Monitor the process** for tending to **first time right**.
- **Powder characterization** and failure **root cause analysis**
- **Material characterization** and failure **root cause analysis**:
- **Dimensional control** from the **very small part** to the **very large part**.
- Finding **root cause** of part **deformation from small to Large parts**

Development focus

NON-STANDARD MATERIALS, DATA ACQUISITION & SPECIAL APPLICATIONS

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Non-standard materials

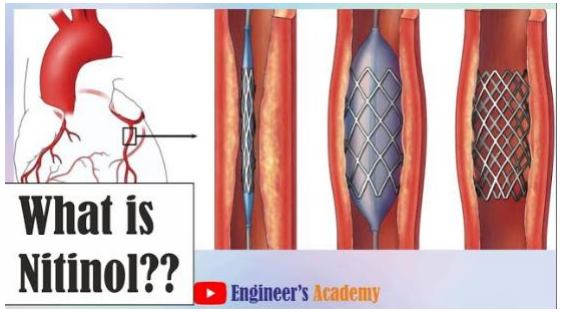
FACILITY DEVELOPMENT ORIENTED FOR THIS SPECIFIC NEED

Bio sourced

Wood, shells, sands, mushrooms, ashes,...

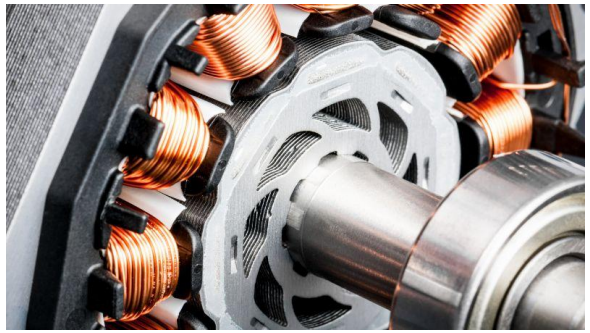
Shape memory

Nitinol, Ni-Mn-Ga, Fe-Mn-Si,...



Magnetic

Neodymium, Ferrite, AlNiCo, Samarium Cobalt,...

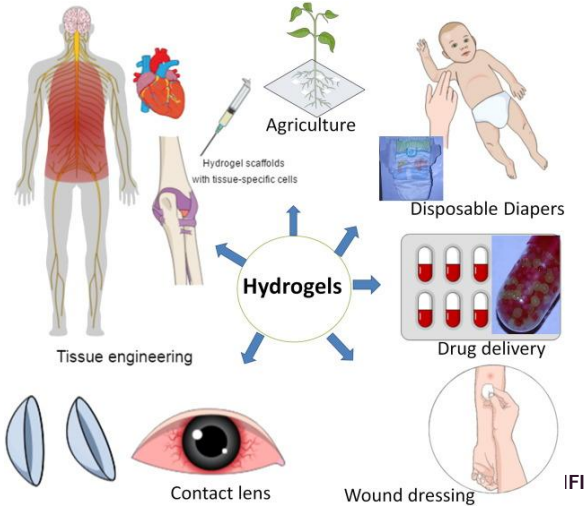


Glassomer

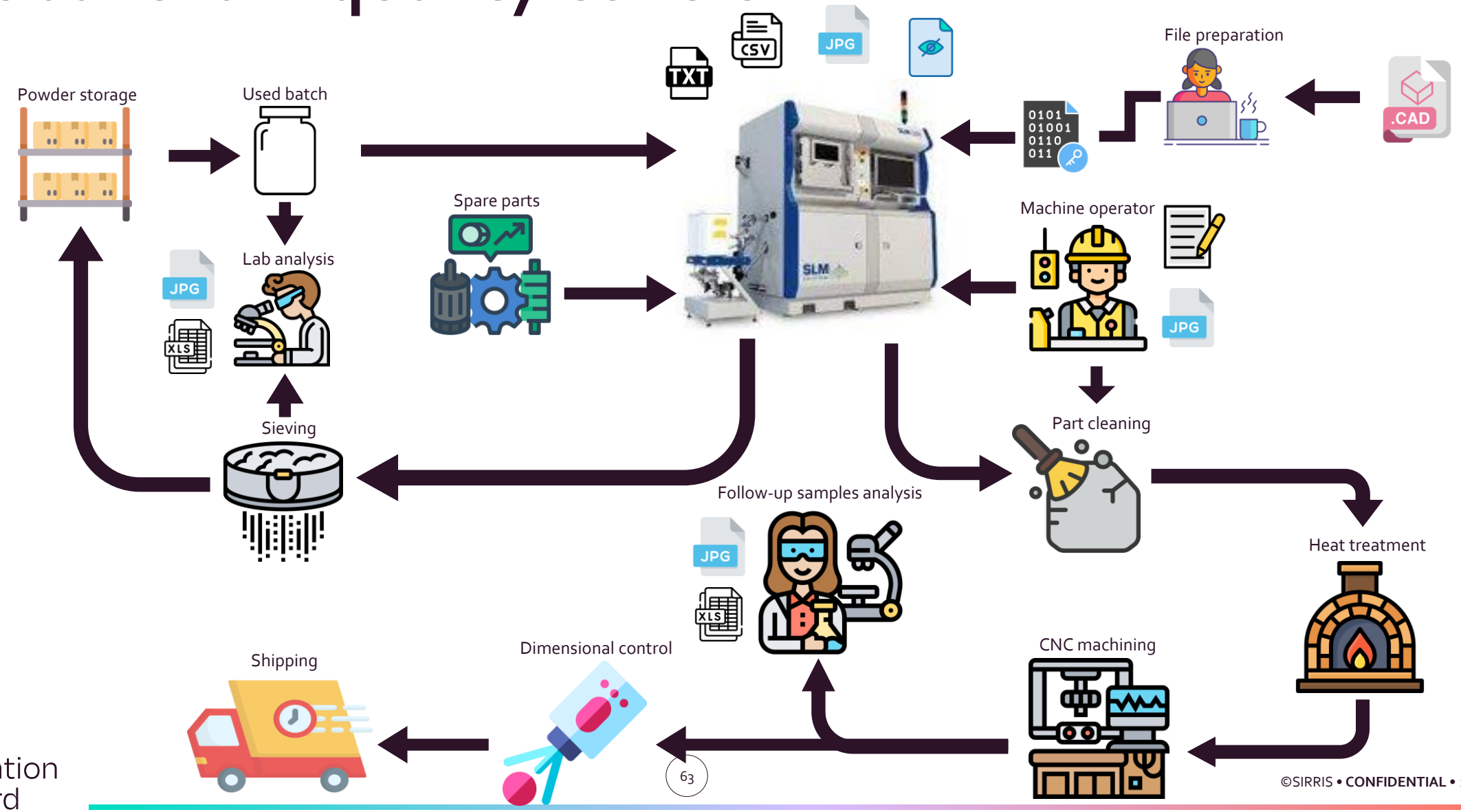
Special alloys

Pure copper, hydrogen-resistant,...

Hydrogels



Global chain quality control



Images from FLATICON

Case studies

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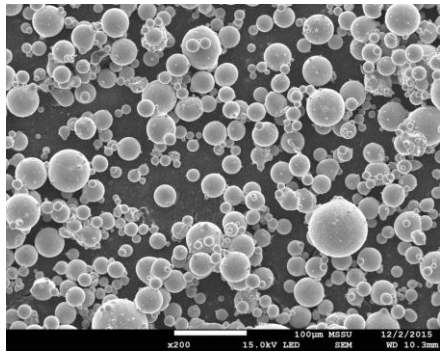
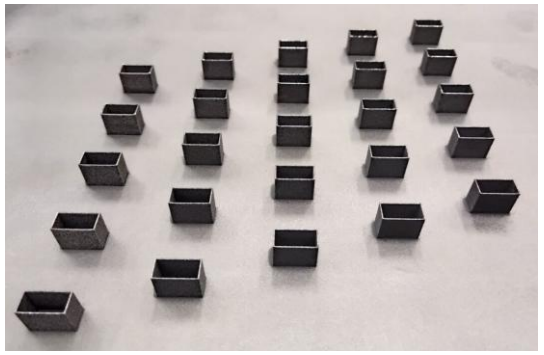
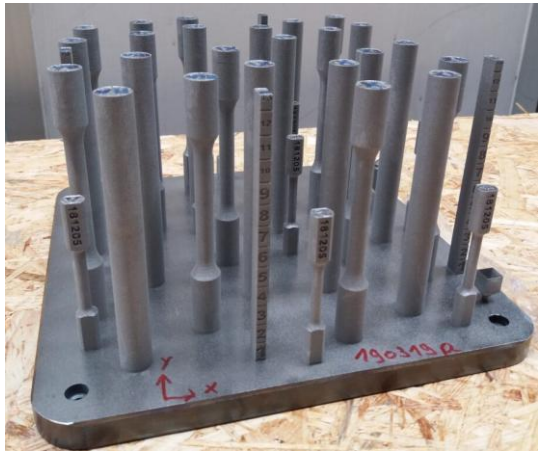
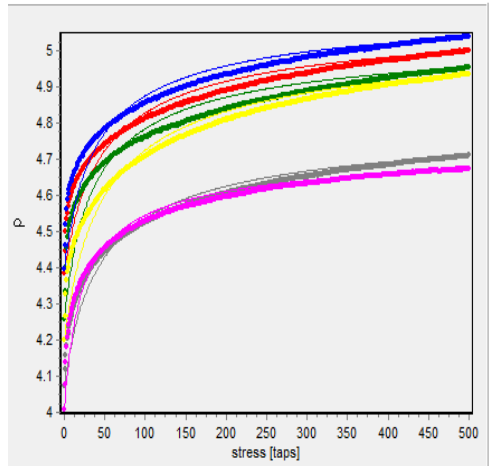
Material validation





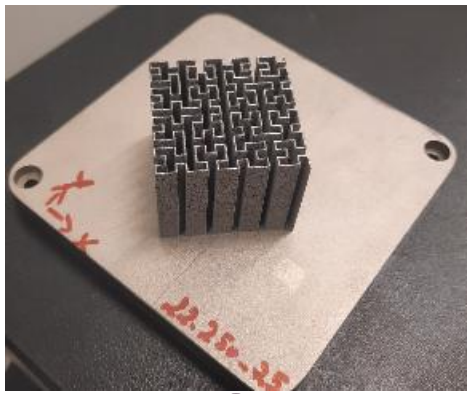


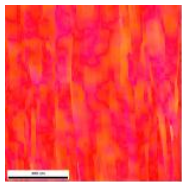


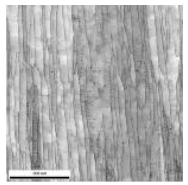
- Challenge :
  - Knowing the potential of specific material for AM application
- Solution :
  - Minimal powder consumption
  - **Neutral** measurement of powder characteristics
  - Fully **documented** test campaign (digitalized process chain)
  - Achieved mechanical properties with **optimum parameters set**
  - Testing of **powder robustness** (recyclability, moisture trapping,…)
  - Optimize **heat treatment** to preserve AM microstructure
  - Partnership to improve **powder AM compatibility**

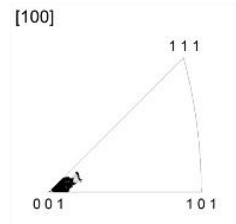
Metallic material validation

- Projects in a nutshell :
  - Optimize parameter of 316L on **several AM technologies** (L-PBF & DED) for a powder provider
  - Process **pure copper** on EBM (99,98% density)
  - Make **Aluminium 7075** compatible for AM application
  - Process soft magnets (**FeSi**) with adequate microstructure



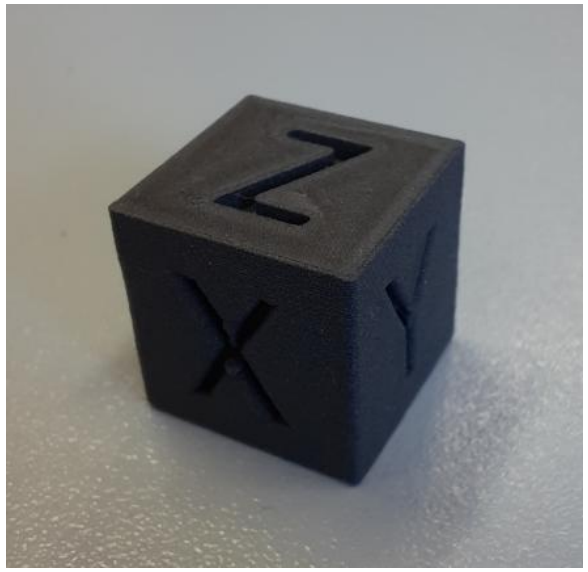


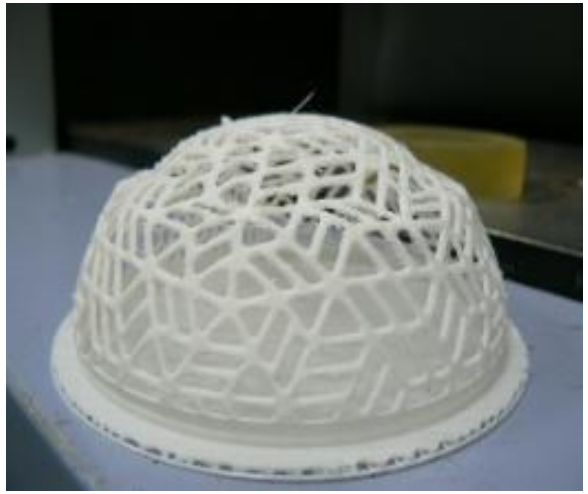


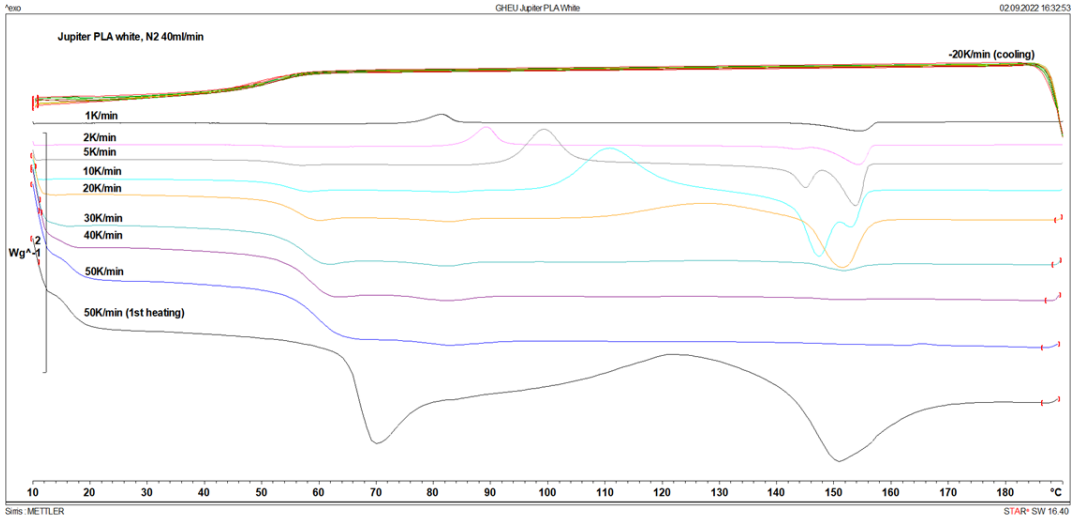


Polymer material validation

- Projects in a nutshell :
  - 80%wt. **NdFeB** (magnetic) loading in PA12 filament.
  - Bio-based **PLA-PCL** material (for breast implant)
  - **TPU** (flexible) validation on SLS process
  - **Material analysis** for process optimization







innovation forward

AM standards

YOUR PARTNER FOR A CLEARER VIEW OF STANDARDS

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forward

Standards & AM

A standard:

- is an agreement (manufacturing of a product , providing a service, application of a process, application of a management system)
- defines best practices (industry, service and public sectors)
- is voluntarily applied (customers, producers, suppliers, service providers)
- is protected by copyright (document)

Standards for Additive Manufacturing:

- Additive manufacturing: CEN/TC 438 & ISO/TC 261 (ISO/TC 119 Powder Metallurgy)
- 27 (CEN) and 99 (ISO) standards published
- 31 (CEN) and 41 (ISO) standards in development

Standardization in Belgium

ACTORS

NBN

AGORIA

SIRRIS

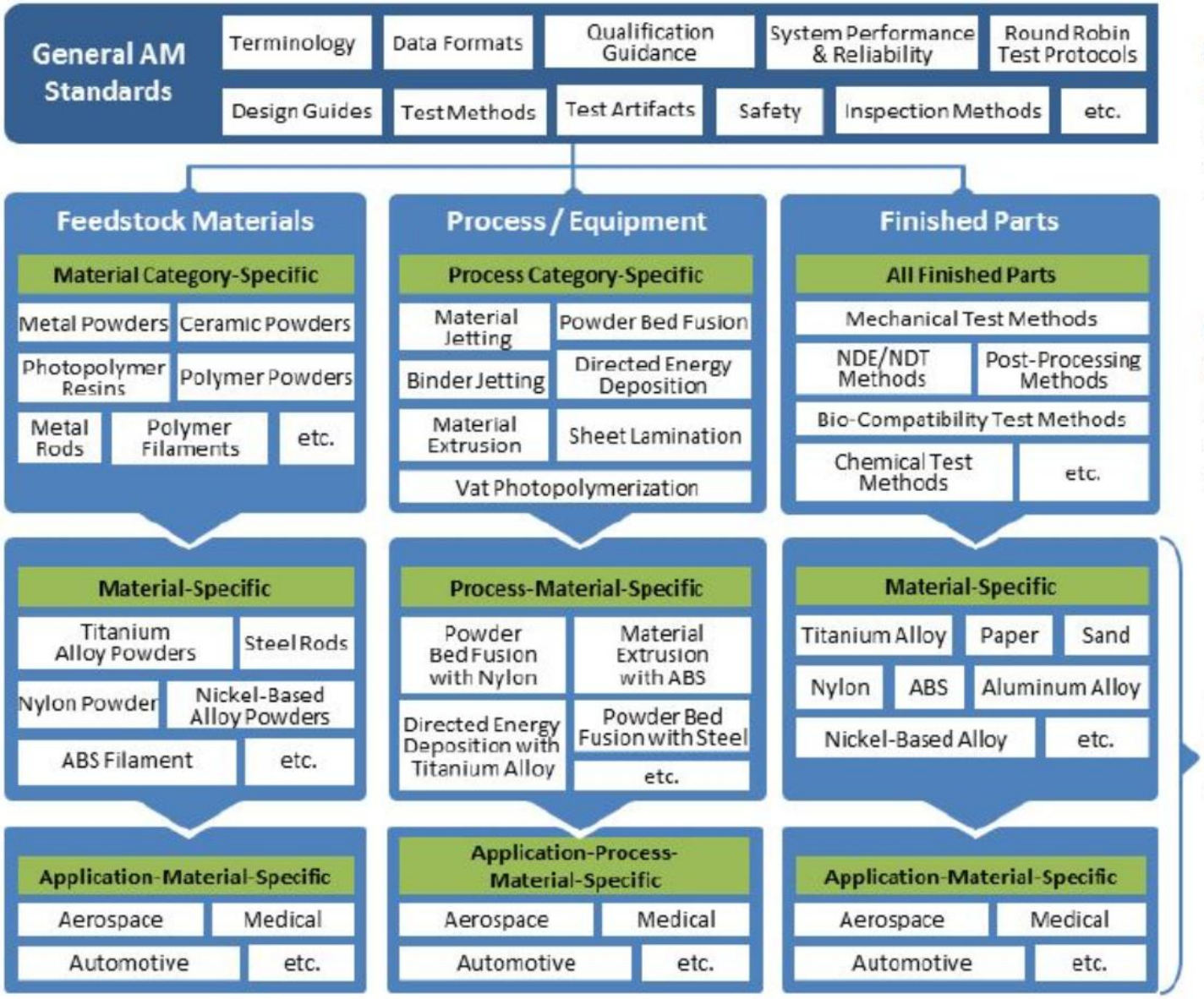
NBN is an agency of the federal government

- Develop Belgian (NBN), European (EN), International standards (ISO) and ensure the Belgian interests
- Stimulate the use of standards
- Develop solutions for easy and effective access to standards
- Portfolio of more than 50000 standards
- Approx. 2000 new standards each year
- 3500 experts in about 800 commissions

SIRRIS – AGORIA: National Mirror Committees

- Develop, comment and vote on CEN / ISO standards (<= You can also participate!)
- Monitor the published standards and inform stakeholders
- Accompany stakeholders in the application of standards
- (Write NBN standards)

AM standards structure



General Top-Level AM Standards

- General concepts
- Common requirements
- Generally applicable

Category AM Standards

Specific to material category or process category

Specialized AM Standards

Specific to material, process, or application

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A 2-slides summary

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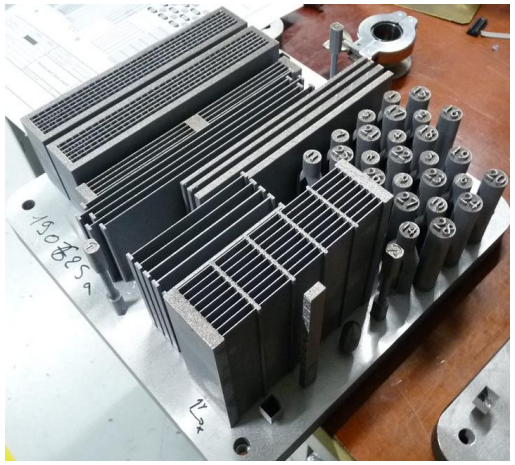
forward

	Engineering for AM	Materials for AM	AM Processes	AM Quality
Typical Services	• Optimize **design for AM**. • Select best **AM candidates** from current products • Improve product **added-value.** • Understand AM **costs & requirements**. • **Reverse engineering**	• Investigate **material "printability"** • Material **characterization**. • **Alter a material** to fit AM need.	• **Understand** AM processes • AM process **selection** • Generate **process data** for modelling and simulation • **Find & deal** with AM business partners or subcontractors • **Failure root-cause** analysis • Assess impact of **AM integration** • Process **exotic materials**	• **Fully Transparent** follow-up of AM production • **Dimensional** control from mm to m • **Internal stresses** measurement • Support for **certification/qualification** • Assess new **monitoring sensor** added-value
Facility	• Dedicated design software. • Process simulation software. • AM experience since 1990. • Conventional expertise via other departments.	• Powder/fiber-oriented characterization lab. • Thermal properties equipment (FTIR, DSC, TMA, DMA,...). • Internal stresses (DRX). • Classic mechanical testing lab. • Complementary expertise & facilities via partners' network	• Polymer, metal and ceramics processes • 16+ internal complementary AM machines • Ovens for heat treatments • Post-process workshop	• One of the most complete metal AM monitoring solution across all process steps. • 3D scanner • Mechanical testing

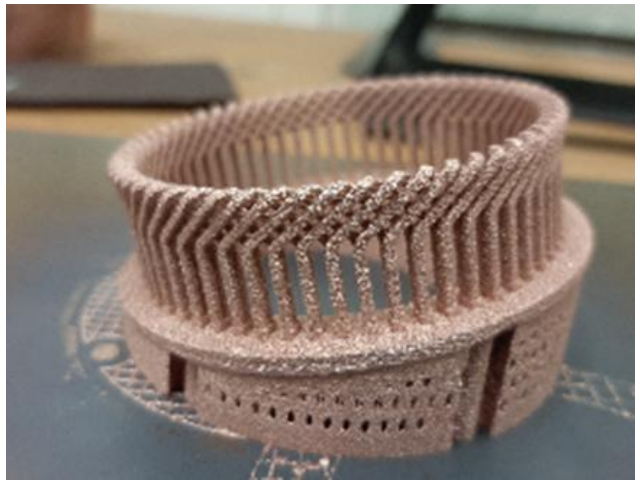
Project examples

Frame for electronic components. Frigorific heat pipe embedded. Mounted on satellite. Aluminium

Optimization of a bottle encapsulating system. Switch from metal 316L to polymer (PA12). Weight : -90% - cost : -65%

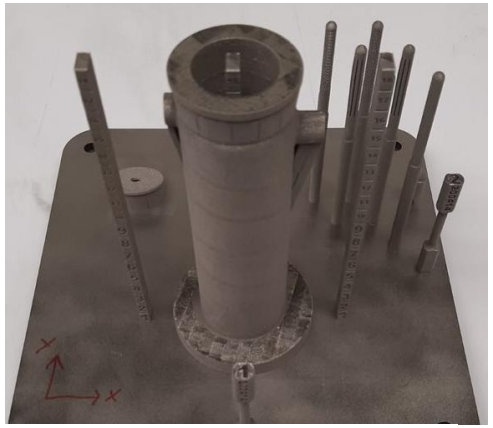


Heat exchanger optimization samples Aluminium



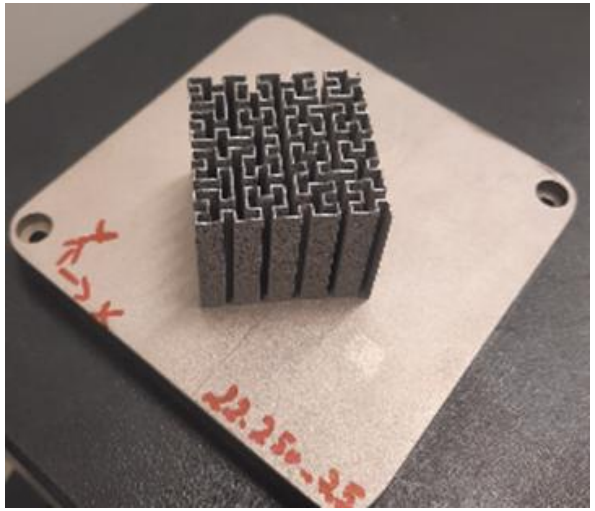
Pure copper processing

Housing of sun sensor. Printed electronic on the surface. Aluminium



Chemical reactor optimization. Lifetime increased, size & cost reduced, same efficiency. Titanium

Heat sink designs developments for lamp Aluminium



Magnetic materials processing (soft magnet in FeSi)

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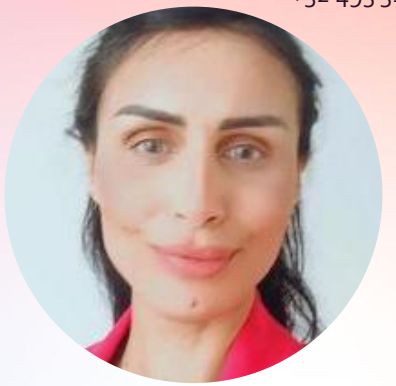

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