Metal Additive Manufacturing
from lab to fab


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A blank sheet was the starting point in 2013
A clear and ambitious goal was defined ...

Development and realisation of a world class, industrial grade additive manufacturing system
- for direct printing of functional parts
- meeting the demands of experienced industrial metal AM users
- ready for use by the first customer (Beta system) Q1 2016

This is achieved by:
- Setting up a solid process for the system development
- Creating a highly motivated competent development team
- Committing renowned experts with different expertise and background
- Involving excellent development partners and suppliers
- Development of a world class system architecture
- Acquiring knowledge using the latest SLM equipment
... and an operational model to support the development process

Marketing & product management → Customers

- User Requirement
  - System Requirement
  - System Design
  - Module Req.
  - Module Design

- System Validation
  - User Req.
  - System Req.

- System Testing
  - System Design
  - Module Req.
  - Module Design

- System Realisation
  - Parts Realisation
  - Module Realisation

- Risk Assessment

Operational & technical management → Suppliers

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- Risk Assessment

Beta system design, realisation & testing

- Beta system design, realisation & testing

Functional Model (FuMo) design, realisation & testing

- Functional Model (FuMo) design, realisation & testing

Check design & requirement documents from previous phase

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Additive Industries

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3 focal points for the MetalFab 1 system were defined to outperform the current equipment

- Predictability & Reproducibility
- Productivity
- Flexibility
Our scope was clear from the start: an integrated AM system
A highly modular concept is chosen to cover the scope and focal points ...

Minimal scope: 3+1 modules
Optional: additional modules
Productivity is maximized with multiple lasers and multiple process chamber ...

500W lasers and with higher power on the roadmap

Multiple (1-4) full field laser maximizes printing speed

Industrial robust design yields high industrial standard uptime

Industrial inherent safe filter solution

Effective Build Volume: 420x420x400 [mm]

Job to job waiting time is eliminated with 2 process chambers
... automated powder handling enables process automation ...

Powder stock is continuously monitored using load cells.

Powder is automatically extracted from the build chamber after printing.

Inline sieving and waste removal.
... in combination with automated handling by a robot and storage module for 24/7 unmanned operation ...
Reproducible and predictable processing is enabled by robust design and smart feedback control strategies.

- Inline drift calibration
- Stitching is eliminated by using full field lasers
- Automated laser to laser calibration
- Automated optical calibration strategies are used to calibrate spot position and focus

- Build plate heating up 200°C
- Robust thermal design
- High quality inert conditions: oxygen level <50 ppm
- High speed gas knife prevents window contamination
... integrated post processing (heat treatment) increases process predictability and product quality ...

Stress relieve and heat treatment up to 1100 °C

High quality inert conditions: oxygen level <50 ppm

Automated loading and unloading of build plates
... and operator centred design gives unrivalled operator safety ...
... and an user-friendly interface ...
Maximum flexibility is created by a highly modular design ...

Lasers can be added and upgraded in the field

Instant switching between multiple materials gives an unprecedented flexibility

Modular scalable design allows for expansion of capacity, functionality and number of materials

Different materials can be used in each Additive Manufacturing Core
... allowing a variety of configurations a customer can choose from:

**MetalFAB1 Max** (11 slots)
- 1 Controls Module
- 1 Exposure Module
- 4 AM Cores
- 2 Heat Treatment Modules
- 1 FXM
- 2 Storage Modules
- 1 Exchange

**MetalFAB1 Productivity Beta** (6 slots)
- 1 Controls Module
- 1 Exposure Module
- 2 AM Cores
- 1 Heat Treatment Module
- 1 Storage Module
- 1 Exchange

**MetalFAB1 Basic** (3 slots)
- 1 Controls Module
- 1 Exposure Module
- 1 AM Core
- 1 Exchange
The Additive World Platform connects MetalFAB1 with support software and data storage.

Industrial Additive Manufacturing Equipment

Application Software Platform

- Request handling
- Simulation (3DSIM)
- 3D print process management (resource planning)
- Quality Control (SigmaLabs)
- Infrastructure Monitoring

Data storage and analysis

- Designs
- Builds/parts
- Settings

Open for 3rd party systems

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The Additive World Platform supports the full additive manufacturing workflow

1. Assess
   - User registration
   - AM Assessments

2. Design
   - Design optimization
   - Version history
   - File management
   - Multi user projects & parts
   - Request handling
   - Simulation

3. Prepare
   - Sales support & planning
   - Cost price calculation
   - Machine planning insight (for lead time definition)
   - Builds assembly based on parts in queue

4. 3D Print
   - Collection & storage of all build/process related data
   - Scheduling of builds
   - Build plate, machine and materials registration and planning for multiple locations
   - Check lists for parameter registration

5. Post Process
   - Scheduling & monitoring of post processing (on build & part level)
   - Registration of measurement data

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Questions?
Thank you for your attention!