INTERNATIONAL CONFERENCE ON ADDITIVE MANUFACTURING (ICAM)

Wednesday, 20 September
11:00 to 12:30

Room 3A, Convention Center
EMO Hannover Fairground

The Autodesk Machine Control Framework

International Conference on Additive Manufacturing (ICAM)

AUTODESK

SCANLAB
innovators for industry

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Director Additive Manufacturing | @alexanderoster

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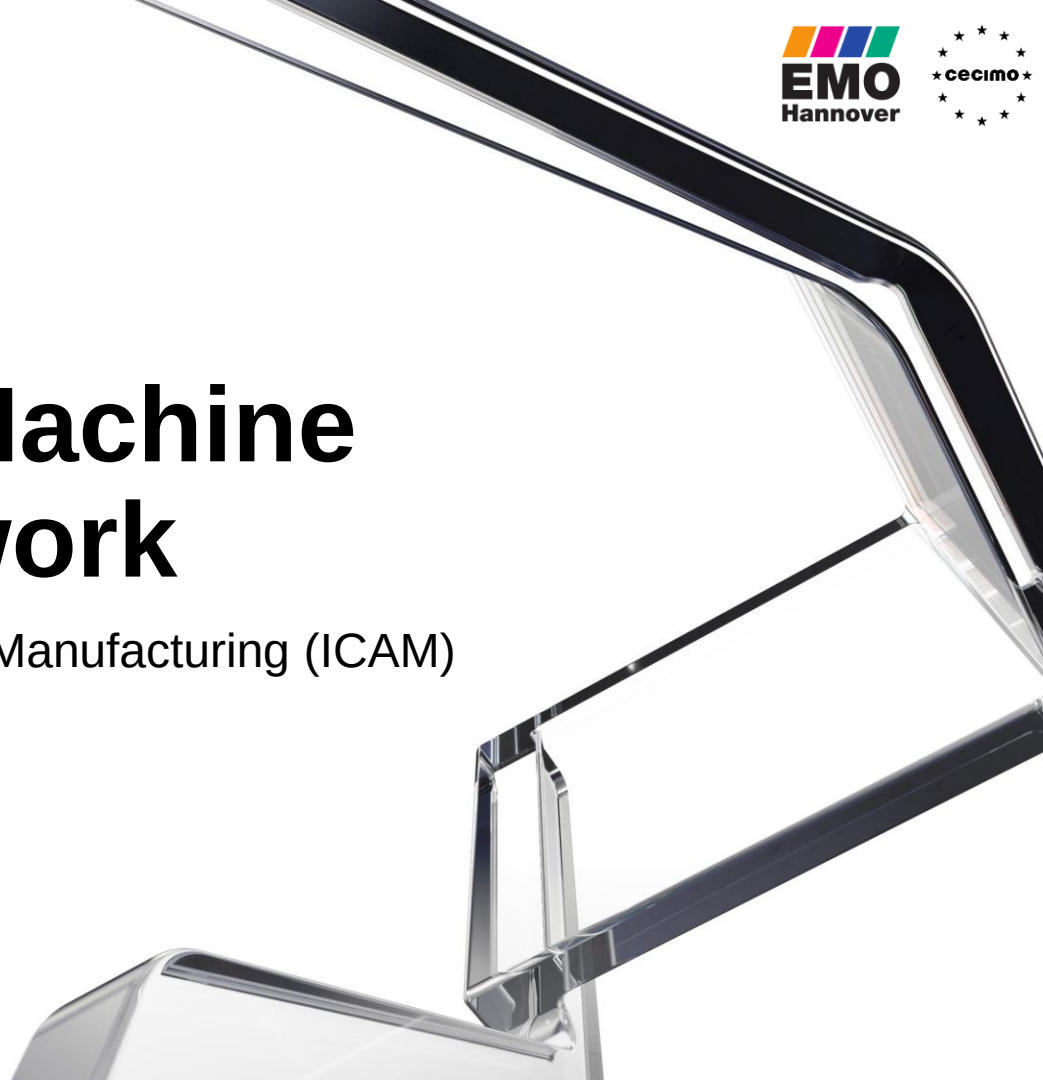

Image courtesy of Tesla Motors, Inc.

Image courtesy of Gensler.

AUTODESK

Founded
1982

Headquarters
San Francisco, CA

Employees (2022)
12,600+ worldwide

In FY22

$4.4B
Total revenue

6M
Total subscribers

$1.1B
R&D investment

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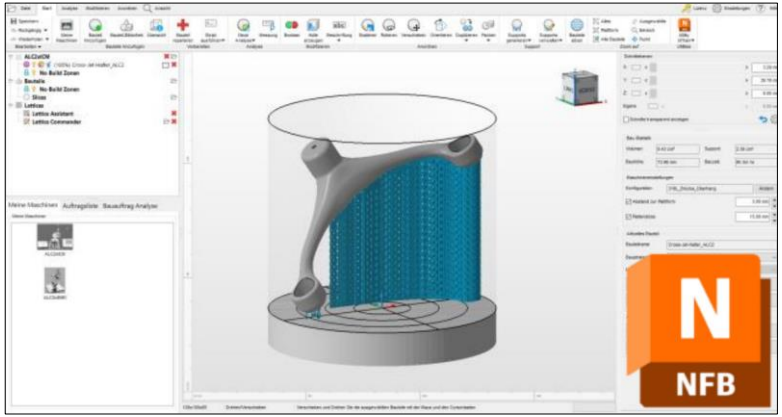
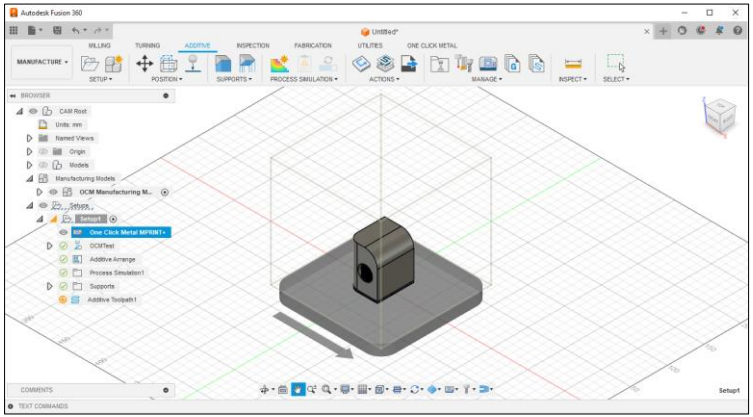
Outline

- Concept and Overview
- Commercial Point of View
- Technical Details
- Case Studies
- Conclusion

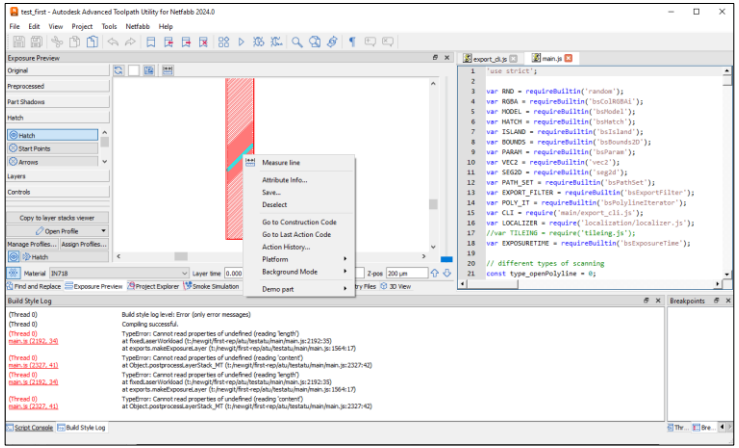
Concept and Overview



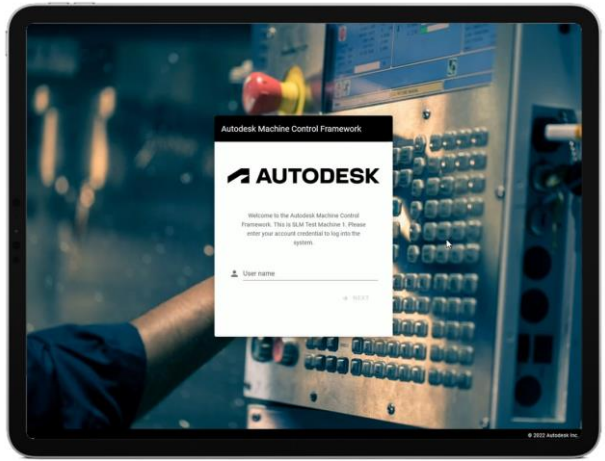
Autodesk Netfabb: Specialist Data Preparation, Support Generation, Process Simulation



Autodesk Fusion 360: Parametric In-CAD Data Preparation for the mass market



Autodesk Advanced Toolpath Utility: Build processor development IDE and deployment mechanism



Autodesk Machine Control Framework

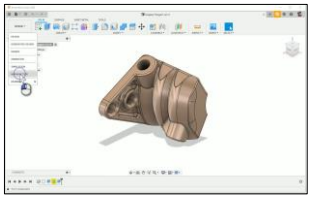
Android and the mobile phone industry

Samsung Galaxy S20

Example closed loop application stack

Integrated in one CAD/CAM/CAE system

AUTODESK Fusion 360



CAD, Data Preparation, Nesting, Support Structure Generation, Toolpath generation, Process Simulation

submits build files

AUTODESK Machine Control Framework

Process control, build file mangement, hardware control, subsystem synchronization, error handling

controls hardware

SCANLAB Controller + B&R PLC

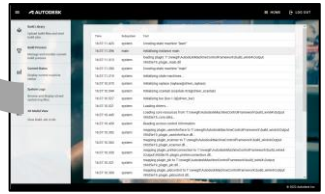
Real time control of laser system and mechanical system

SCANLAB Open Interface Extension

Sensor synchronisation and data collection

reports measurements

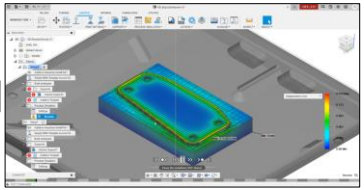
AUTODESK Machine Control Framework



Data recording and process monitoring

provides data

AUTODESK Fusion 360



Inspection and mapping to CAD geometry

Commercial Point of View

Simple and open licensing model

Unrestricted commercial use

Code is 100% released as Open Source under BSD License.

Use, implement and modify with no restrictions and no associated costs!

A tale of the machine development cycle

Traditional and organic development path

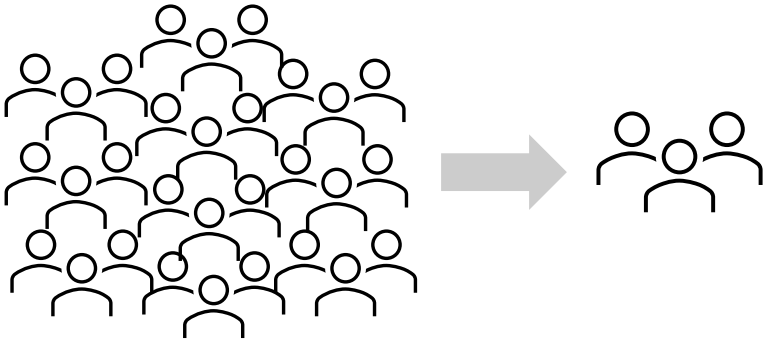
Build file handling, Laser Control, HMI, User Levels	Release 1 (after year 1)
Version Management, Custom Toolpathing, Network Build Files, Monitoring API, Multilaser Synchronization	Release 2 (after year 2)
CAD Integration, Process monitoring, UPCUA, Control over Network	Release 3 (after year 3)
MES Integration, Cloud Connectivity, Amazon IOT, Corporate Single Sign on	Release 4 (after year 4)
Over the air updates, 100% traceability, Data Analytics	Very hard (i.e. much later)
Virtual machine simulators, Digital Twin	Impossible (Never)

Development path with proper Open Source stack

Build file handling, Laser Control, HMI, User Levels	Release 1 (< 1 year)
Version Management, Custom Toolpathing, Network Build Files, Monitoring API, Multilaser Synchronization	Release 1 (< 1 year)
CAD Integration, Process monitoring, UPCUA, Control over Network	Release 1 (< 1 year)
MES Integration, Cloud Connectivity, Amazon IOT, Corporate Single Sign on	Release 1 (< 1 year)
Over the air updates, 100% traceability , Data Analytics	Release 1 (< 1 year)
Virtual machine simulators, Digital Twin	Release 1 (< 1 year)

Unbelievable productivity boost

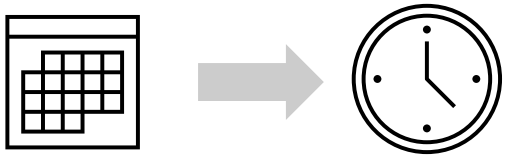
16x reduction of workload



32 developer years
(4 years x 8)

2 developer years
(8 months x 3)

6x reduction of time to market



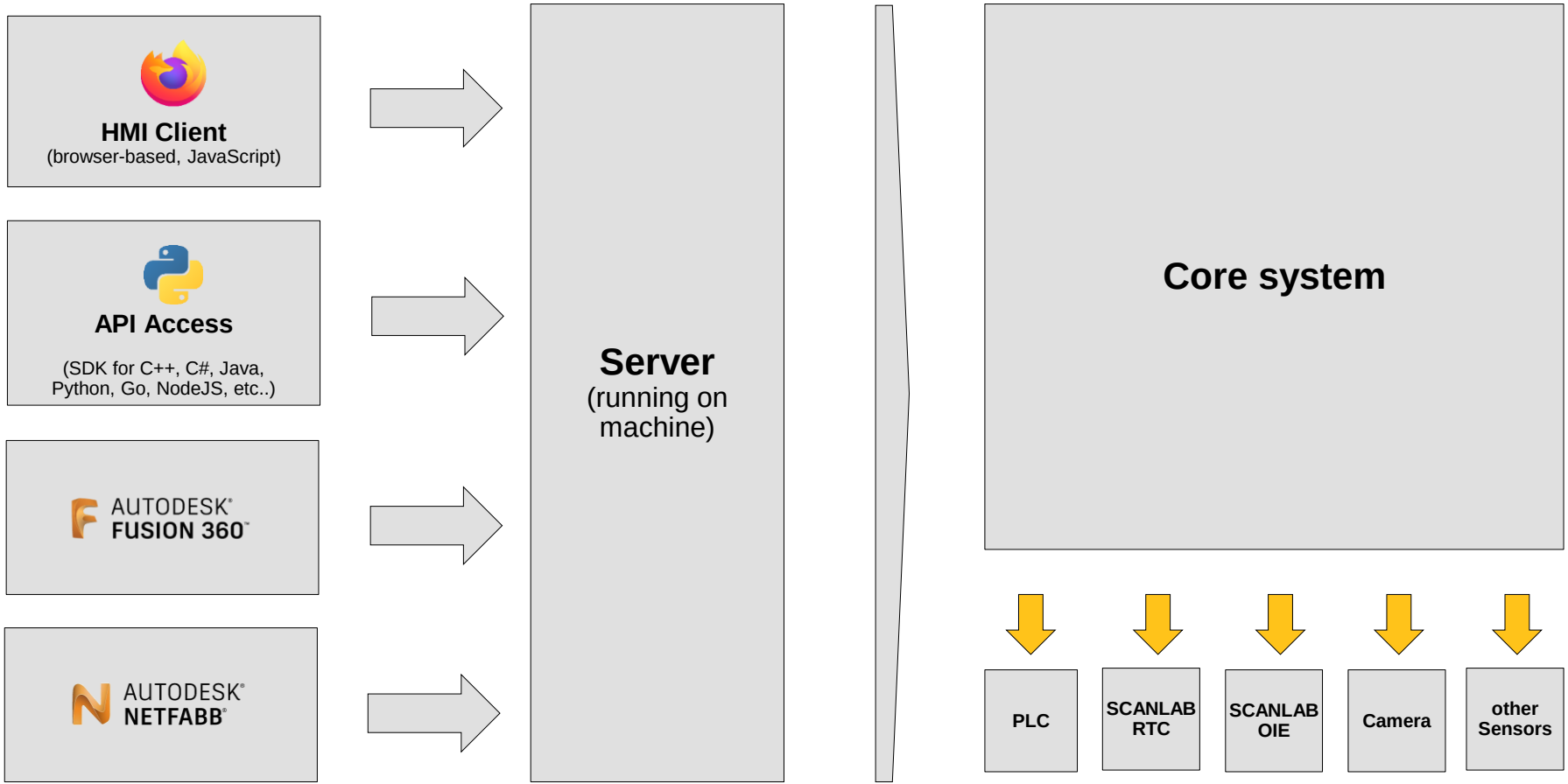
4 years

8 months

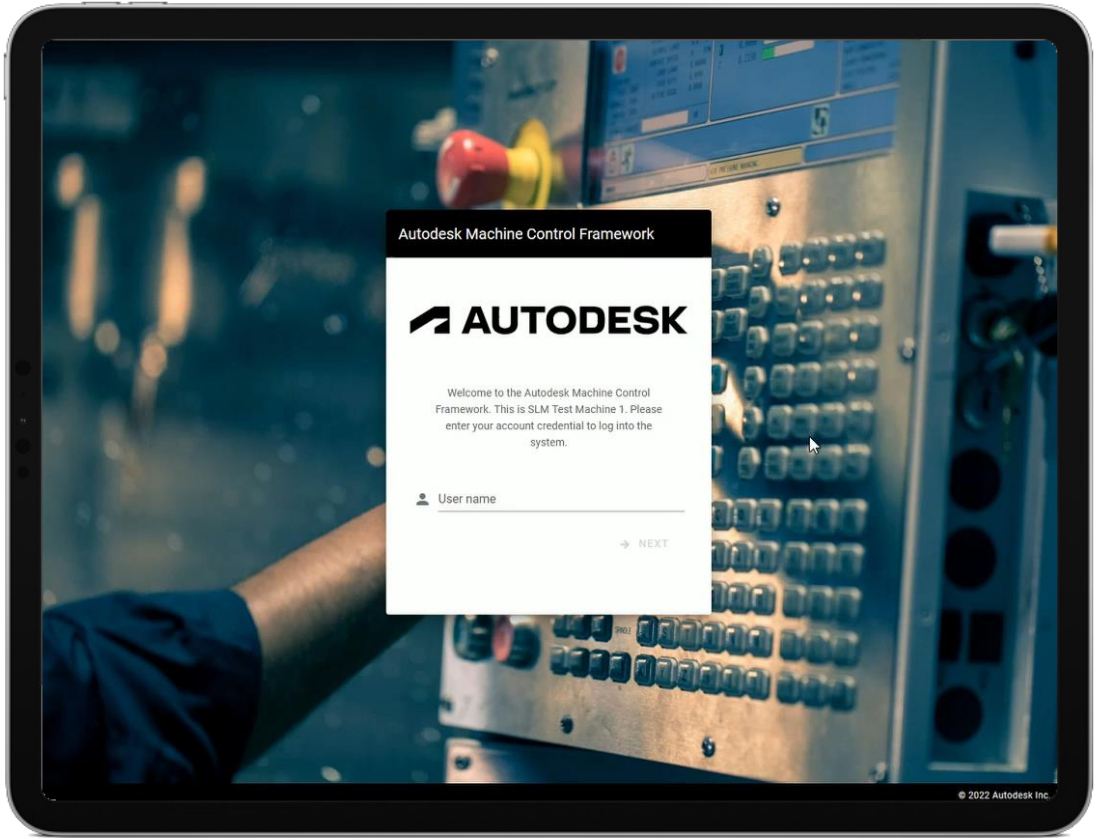
96x increased development productivity

Technical Details

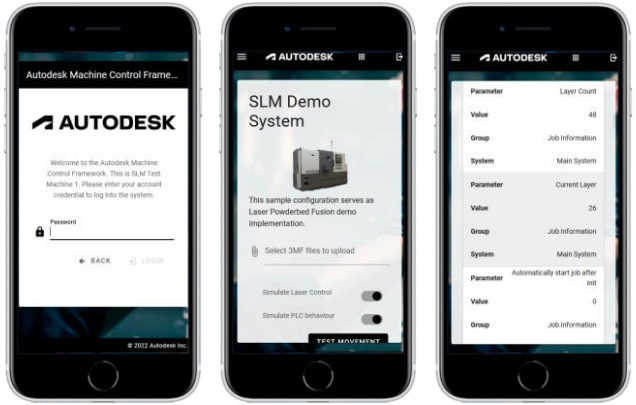
Modern Client Server Architecture



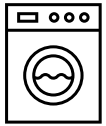
Browser based HMI client



- Modern and responsive user interface framework
- Configurable to the smallest detail
- Powerful widgets enable rich state of the art features



Machine maker stays in full control



Using open source does not necessarily mean creating a fully open machine concept for everybody.

BSD Licensing allows to use the framework code in a proprietary environment.

“Security” is not by “Obscurity”. Open Encryption standards in 3MF allow granular control over which content is printable how often by whom via the system.

The framework will be able to integrate a Trusted Platform Module to allow for a cohesive security concept.

Unprecedented requirements engineering

- Closed loop laser power control
- Multilaser synchronization
- Dynamic Microvectoring
- Cloud Data Streaming and Storage
- In-Browser 3D Sensor Analysis

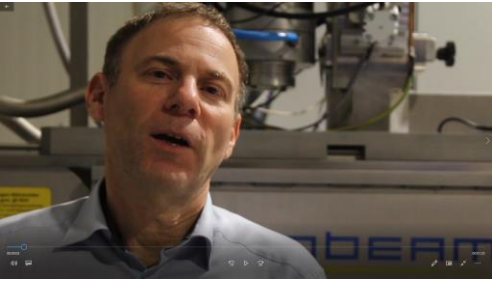
Built on best practices of thousands of developer years

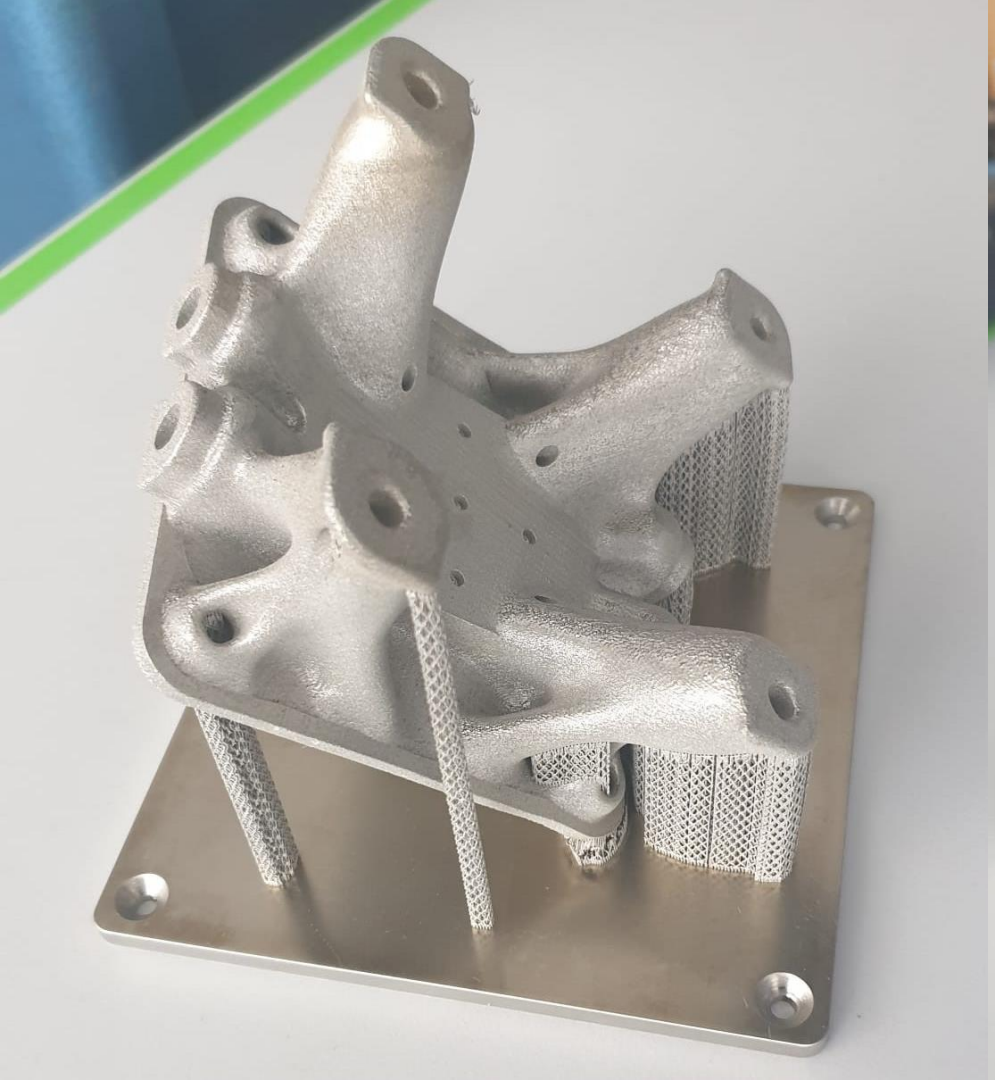
- Modern multi-language plugin architecture
- GIT-centric version control
- Included Package management
- Over the air updates
- Special versions for special customers

Case Studies

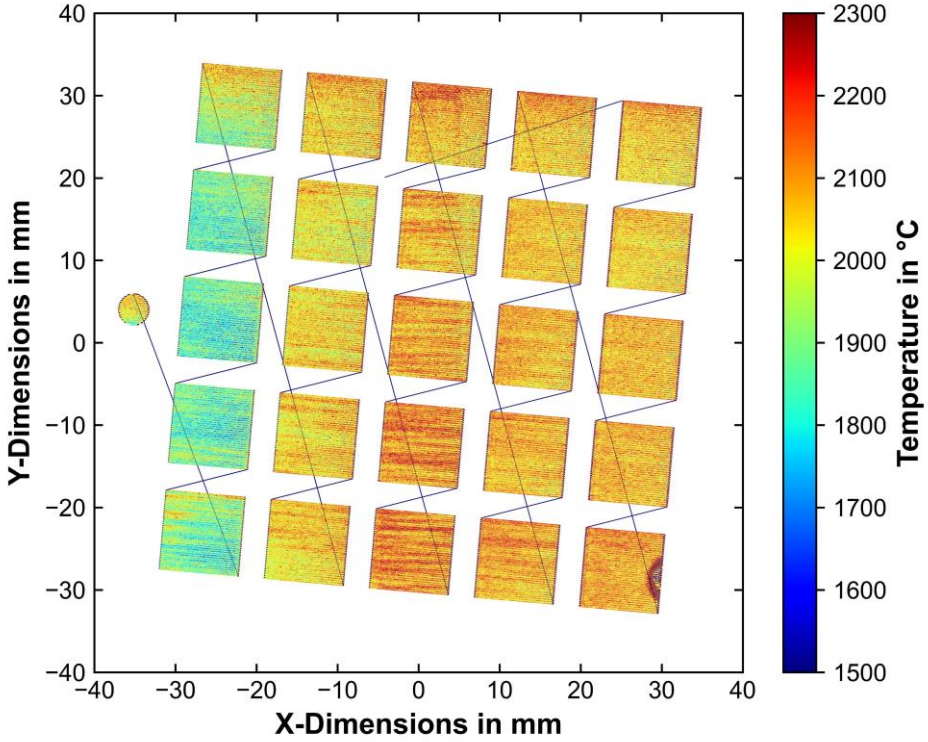
Industrial - Evobeam

- Specialist in Electron and Laser Beam Welding, Diffusion Bonding and Vacuum Technology
- Offers tailored machines for Additive Manufacturing Research and OEMs
- **Example**: High temperature powder bed fusion in vacuum and atmosphere. Up to 1000°C process chamber.





Universität Stuttgart - M. Fitzlaff, M. Käß


Y-Dimensions in mm
X-Dimensions in mm
Temperature in °C
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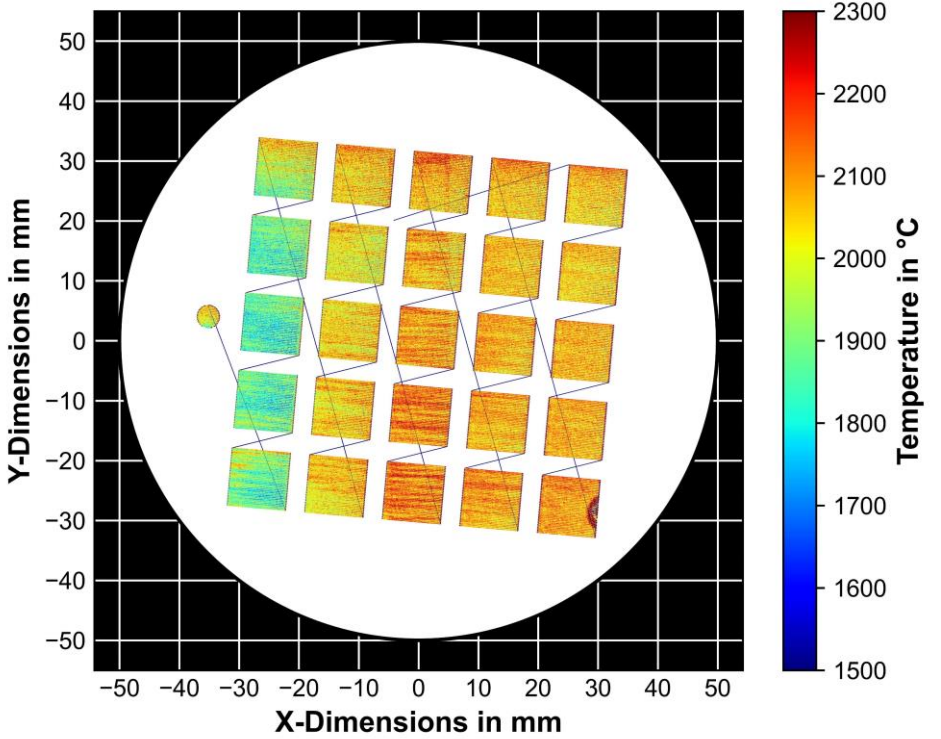
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X-Dimensions in mm
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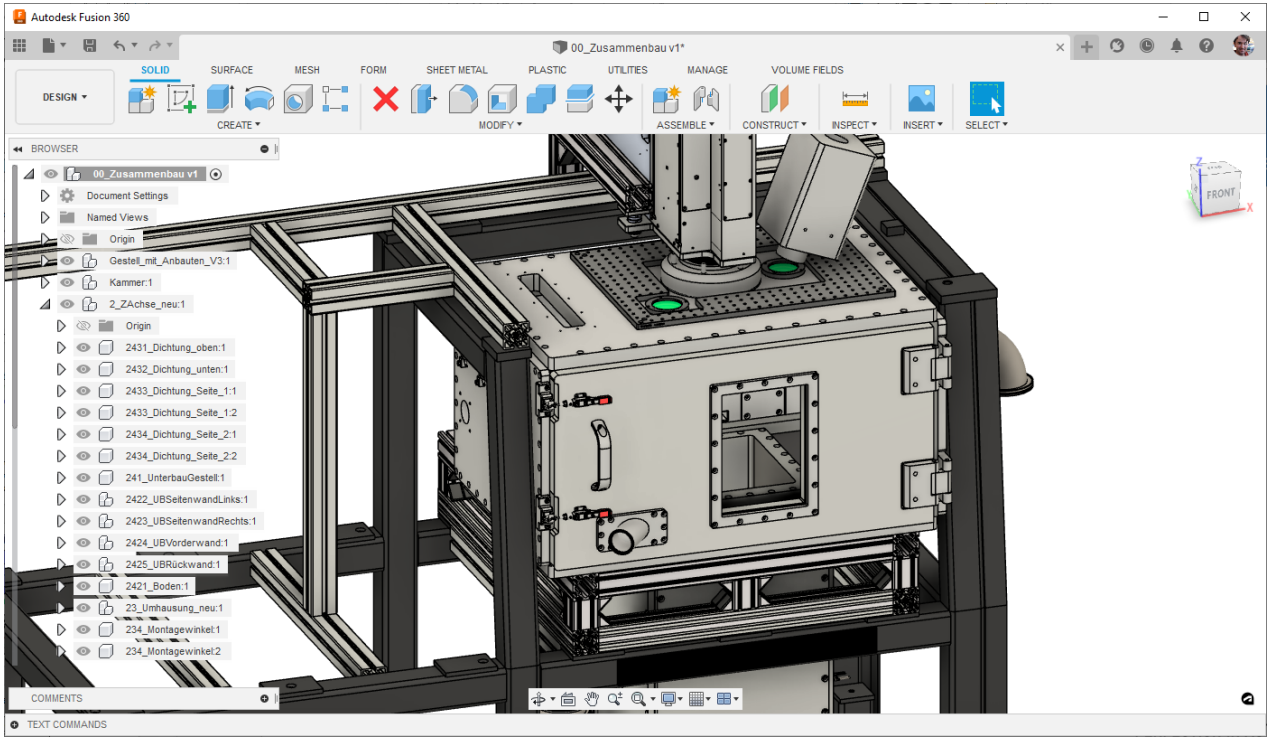
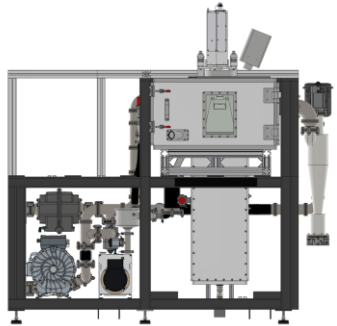
Academia - iwb

Powder bed fusion machine for research on process monitoring and control



- Full-scale system
- Superior to the state of the art
- Modular plant design
- Good accessibility



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Academia - iwb

Powder bed fusion machine for research on process monitoring and control

- Extensive process monitoring
- Fast exchange of components
- Integration of additional modules

- **100 % Open Source**
  - CAD Design
  - PLC Software
  - Machine Control Software

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THANK YOU!

See you at ICAM 2025

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