

**AG** bliedtner

Laser | Optik | 3D-Druck

# Group Production and Automation (Head: Prof. Dr. Jens Bliedtner)

- Working group production and automation
- Research projects and application
- Example: Starting an AM process (cloud based)
- Lab session

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# Introducing the working group

## Department of SciTec at University of Applied Sciences Jena

- Prof. Dr. Jens Bliedtner
- 3 laboratory engineer
- 6 PhD's
- 27 scientific and technical staff
- 1 Apprentice



## Main focus

- Laser material processing
- Optical technologies
- Additive Manufacturing

## Performance of

- Public and government research and funding
- Studies and developments of new technologies
- Advanced training in the field of lasers and optics



Bundesministerium  
für Wirtschaft  
und Energie



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für Bildung  
und Forschung



# Laser Material Processing

-Development of **laser based technologies and systems**

-Manufacturing **different kinds of materials**

- Laser cutting
- Laser marking
- Laser (micro) welding (down to 5  $\mu\text{m}$ )
- Laser metal deposition
- Laser polishing
- Laser ablation
- Laser surface texturing

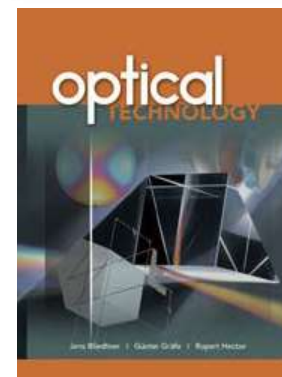
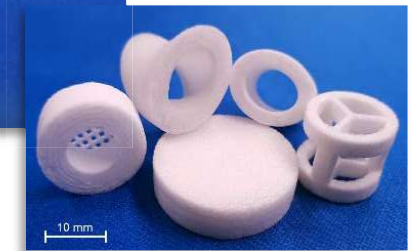


# Optical Technologies

-Development of new technologies and **hybrid process chains** between conventional manufacturing and laser solutions

-Focus of **complex shaped** (3D)

- Ultrasonic grinding (5 axis) of glass and ceramics
- Fine grinding of glass
- Laser polishing of glass
- Laser thermoforming of glass
- Selective laser sintering of fused silica powder
- Laser ablation of glass and ceramics



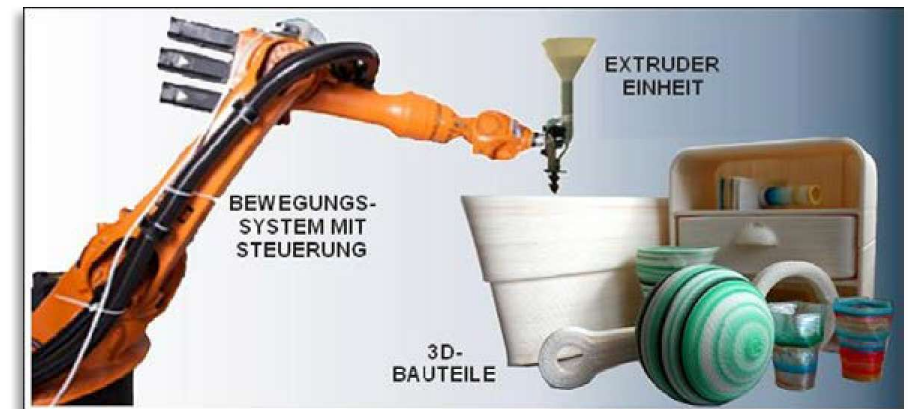
*Jens Bliedtner, Guenter Graefe & Rupert Hector: Optical Technology. McGraw Hill. New York*

# Additive Manufacturing

-Research and **development of different additive techniques**

-**material range:** polymer, metal, glass

- Stereo lithography (SLA/DLP)
- Fused Deposition Modeling (FDM)
- Laser sintering (SLS)
- Polyjet
- Laser metal deposition
- Reverse Engineering



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- Working group production and automation
- Research projects and application
  1. Mittelstand 4.0
  2. THAT
  3. Application example (short overview)
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# Funding initiative - Mittelstand 4.0



Gefördert durch:



aufgrund eines Beschlusses  
des Deutschen Bundestages

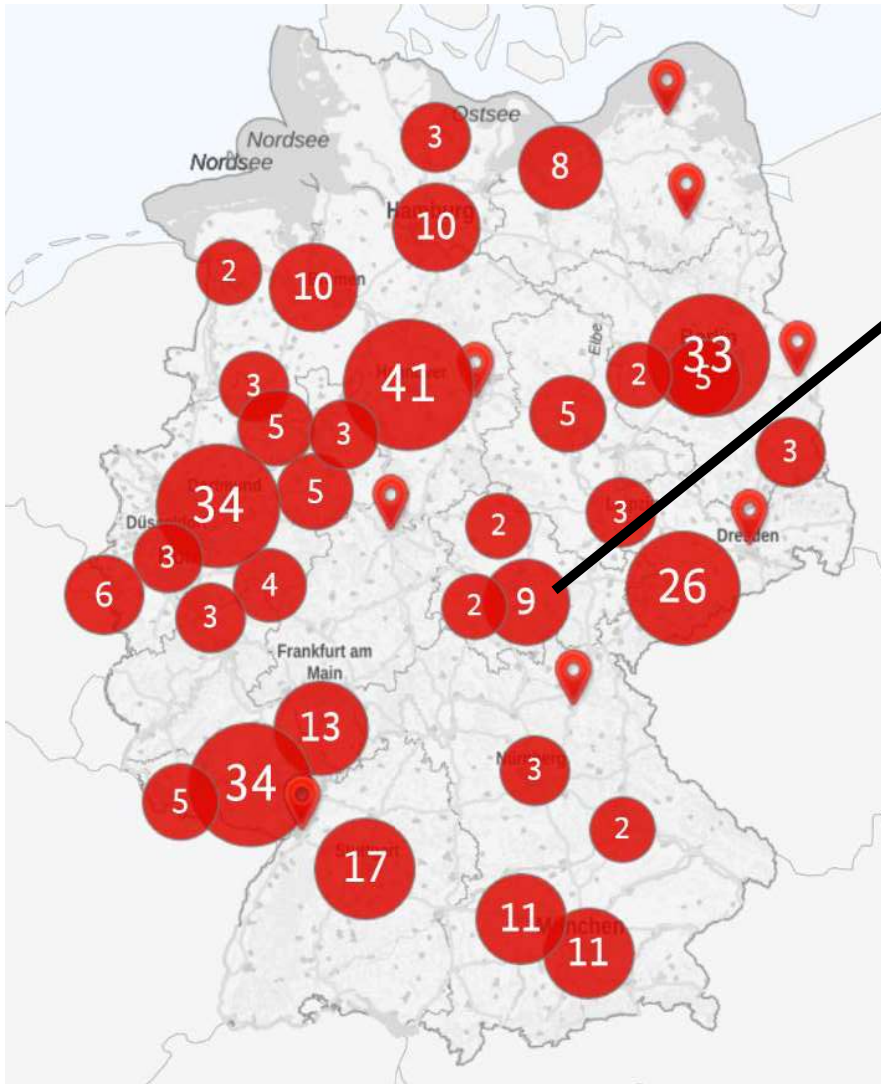
## Mittelstand-Digital – Strategies for the digital transformation of SMEs

Mittelstand 4.0 –  
Digital Production  
and Work Processes  
funding initiative

eStandards

Usability

# Funding initiative - Mittelstand 4.0

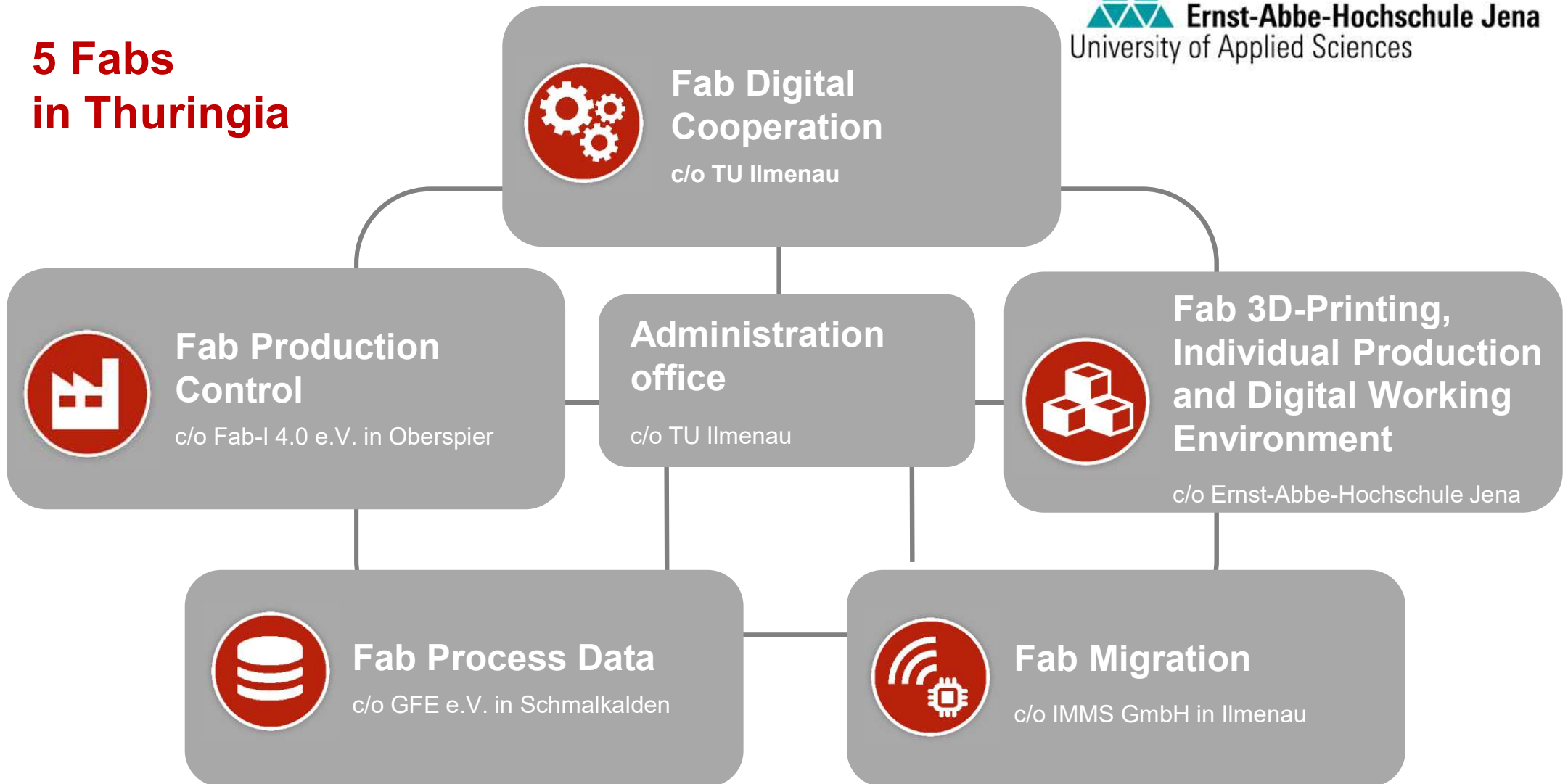


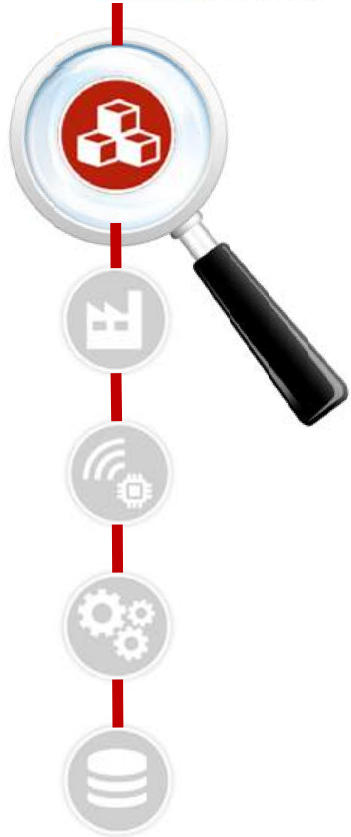
## Main aims

- To inform small and medium sized companies
- Awareness about digitalization
- Provide information, training and the opportunity for companies to view and test new solution
- No charges

# Funding initiative - Mittelstand 4.0

## 5 Fabs in Thuringia





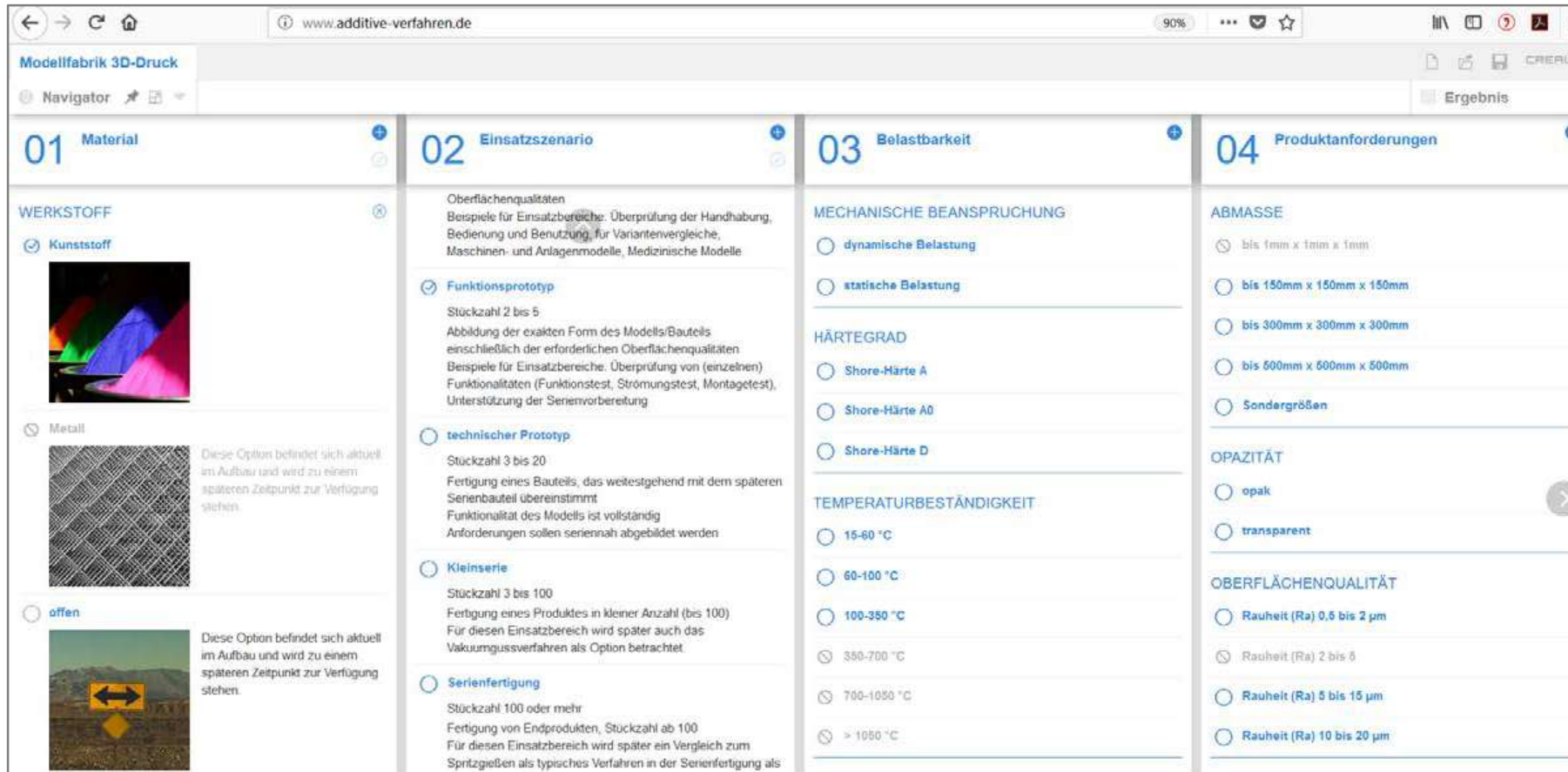
## Fab

### 3D-Printing, Individual Production and Digital Working Environment

- **3D-Printing:** applications, requirements, necessary surroundings, data handling, security and optimization
- **Individual Production:** laser processes for individual applications, cloud solution, robot concepts and automation
- **Digital Working Environment:** new training concepts, digital work flows and digital business

# Funding initiative - Mittelstand 4.0

## Demonstration examples



Modellfabrik 3D-Druck

01 Material

WERKSTOFF

Kunststoff

Metall

offen

02 Einsatzszenario

Oberflächenqualitäten  
Beispiele für Einsatzbereiche: Überprüfung der Handhabung, Bedienung und Benutzung, für Variantenvergleiche, Maschinen- und Anlagenmodelle, Medizinische Modelle

Funktionsprototyp

Stückzahl 2 bis 5  
Abbildung der exakten Form des Modells/Bauteils einschließlich der erforderlichen Oberflächenqualitäten  
Beispiele für Einsatzbereiche: Überprüfung von (einzelnen) Funktionalitäten (Funktionstest, Strömungstest, Montagetest), Unterstützung der Serienvorbereitung

technischer Prototyp

Stückzahl 3 bis 20  
Fertigung eines Bauteils, das weitestgehend mit dem späteren Serienbauteil übereinstimmt  
Funktionalität des Modells ist vollständig  
Anforderungen sollen seriennah abgebildet werden

Kleinserie

Stückzahl 3 bis 100  
Fertigung eines Produktes in kleiner Anzahl (bis 100)  
Für diesen Einsatzbereich wird später auch das Vakuumgussverfahren als Option betrachtet

Serienfertigung

Stückzahl 100 oder mehr  
Fertigung von Endprodukten, Stückzahl ab 100  
Für diesen Einsatzbereich wird später ein Vergleich zum Spritzgießen als typisches Verfahren in der Serienfertigung als

03 Belastbarkeit

MECHANISCHE BEANSPRUCHUNG

dynamische Belastung

statische Belastung

HÄRTEGRAD

Shore-Härte A

Shore-Härte A0

Shore-Härte D

TEMPERATURBESTÄNDIGKEIT

15-60 °C

60-100 °C

100-350 °C

350-700 °C

700-1050 °C

> 1050 °C

04 Produktanforderungen

ABMASSE

bis 1mm x 1mm x 1mm

bis 150mm x 150mm x 150mm

bis 300mm x 300mm x 300mm

bis 500mm x 500mm x 500mm

Sondergrößen

OPAZITÄT

opak

transparent

OBERFLÄCHENQUALITÄT

Rauheit (Ra) 0,5 bis 2 µm

Rauheit (Ra) 2 bis 5

Rauheit (Ra) 5 bis 15 µm

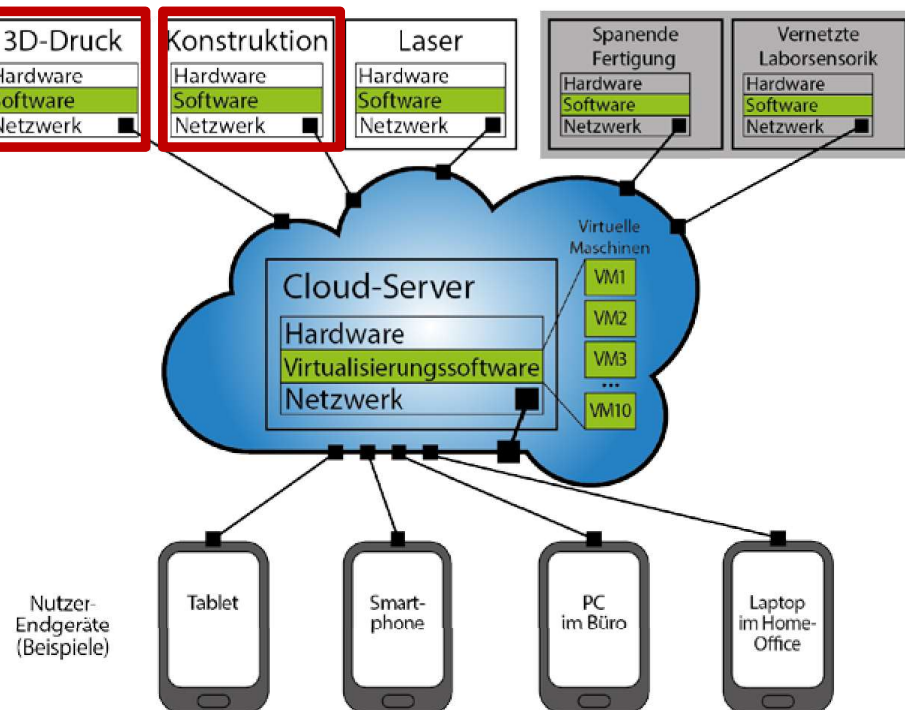
Rauheit (Ra) 10 bis 20 µm

Online tool to select AM technique depending on your specific purposes

## Demonstration examples

Live demonstrations in our labs

1. Starting an AM process
2. Programming CAD CAM chain Trumpf TruCell (laser cutting)



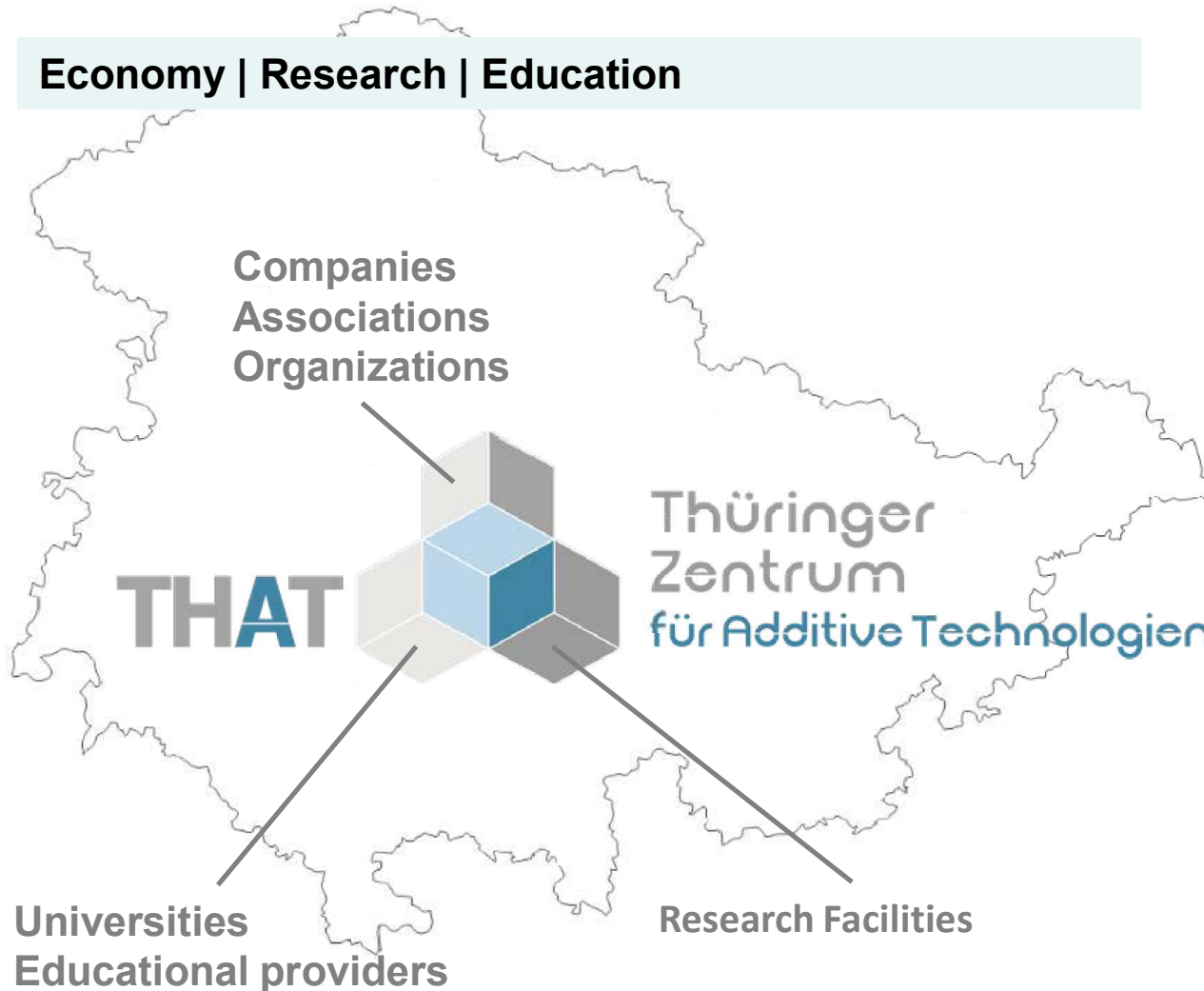
## Cloud based software



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# THAT Thuringia center for AM

**Economy | Research | Education**



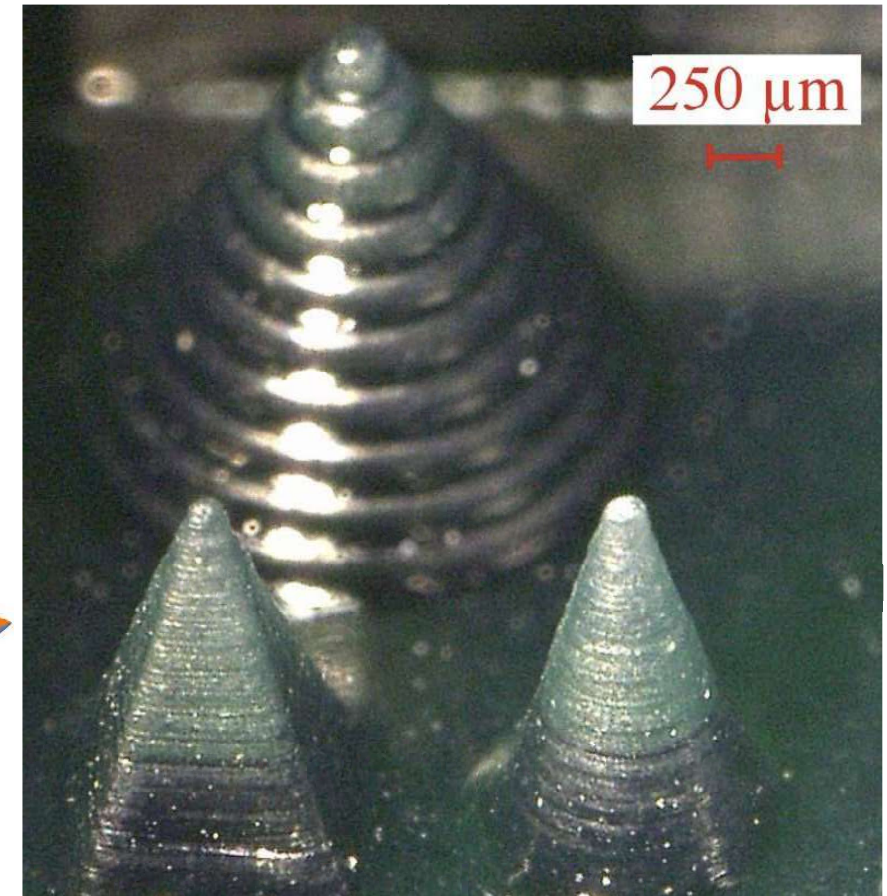
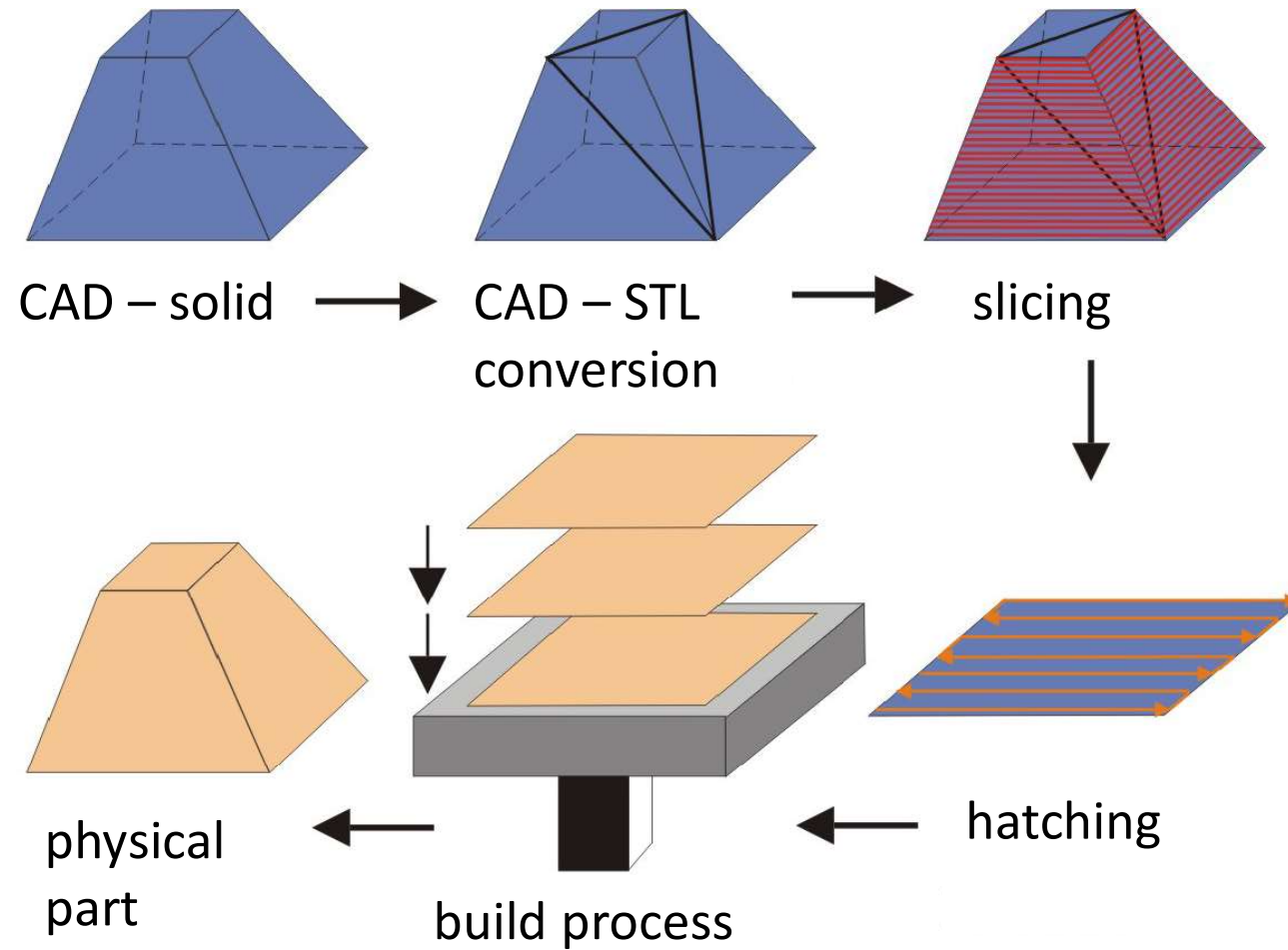
## **Aims:**

- fast and efficient access to new AM techniques
- Extract technical potentials for companies
- Extend the visibility of regional research institutes
- Short term: fast solutions for companies with problems concerning AM
- Long term: center for AM technologies

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# Additive Manufacturing

## Basics and process chain



**Stair-Stepping-Effect**

# Additive Manufacturing

## Fused Deposition Modeling (FDM)

Research project:  
HP3D (High Performance 3D-Druck)

- Individualized products
- High strength
- Large scales

Example: individual canoe

- Time: **12 h**
- Costs: 18 kg of ABS (**2,68 €** per kg)



GEFÖRDERT VOM

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**Ernst-Abbe-Hochschule Jena**  
University of Applied Sciences



# Additive Manufacturing

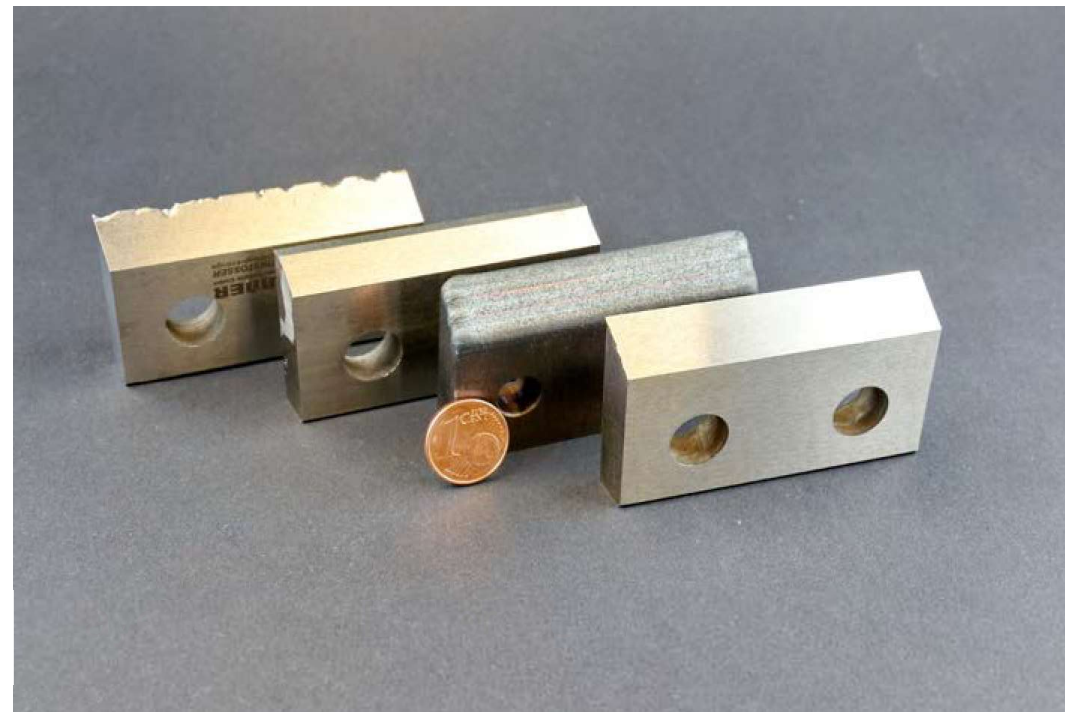
## Laser Metal Deposition (LDM)

Research project:

ProLain (Development of an individual and automated process chain for repairing cast aluminum parts)

- Rejection rate during casting < 15 %
- Repair small detected defect
- Remove the defect area
- Deposit it with layers of aluminum alloy

**More possibilities for repairing of metal parts!**



More detailed information and examples follow during the lab tour

# Optical Technologies

## Laser thermoforming of glass

Research project:

HT3D and LaUmCo (flexible shaping of thin glass applying laser radiation)

- 3D freeform lead to new product design in consumer electronics and automotive industry
- Individual radius (deviation  $< \pm 200$  nm)
- Decreasing process time

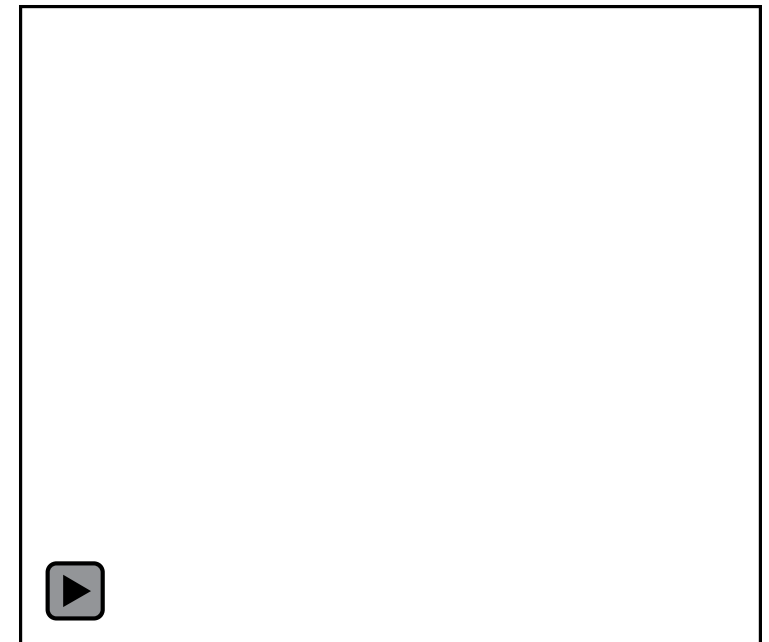
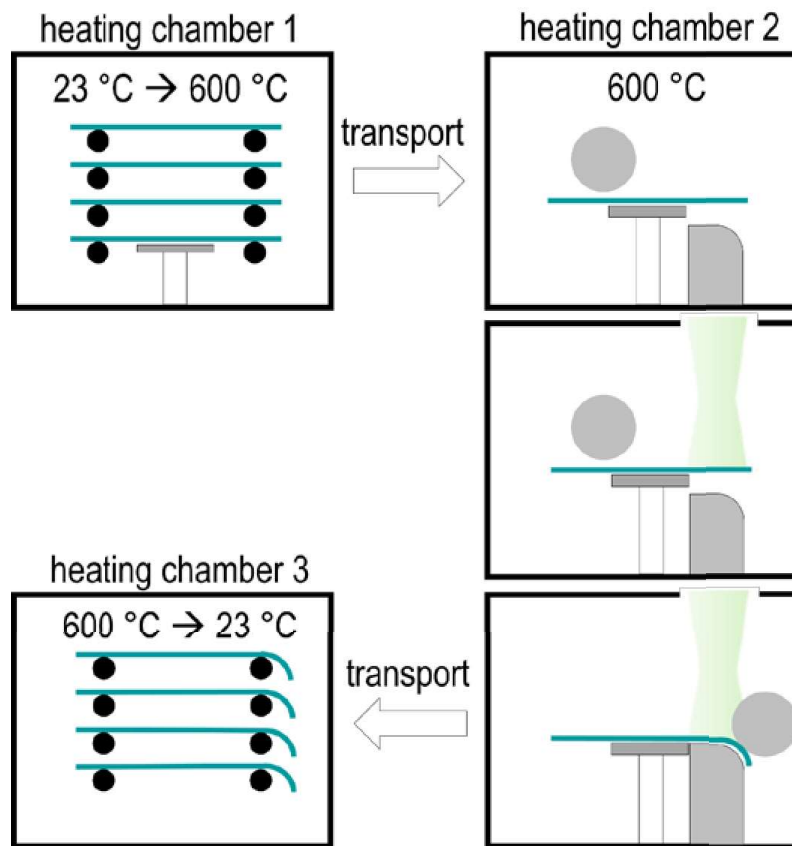


More detailed information and examples follow during the lab tour

# Optical Technologies

## Laser thermoforming of glass

### Experimental setup



More detailed information and examples follow during the lab tour



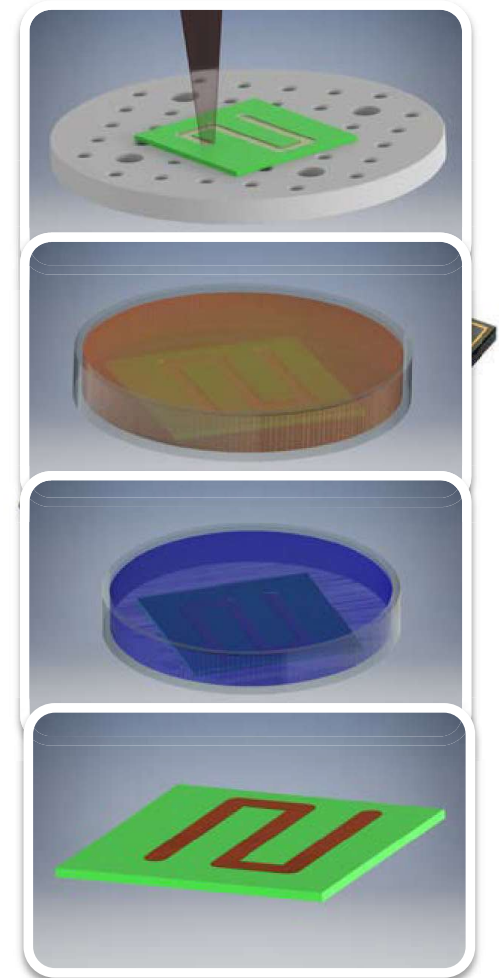
# Laser Material Processing

## Laser surface texturing

PolymerAktiv (Functionalization of 2D and 3D polymer parts applying short pulse laser radiation)

### New process chain

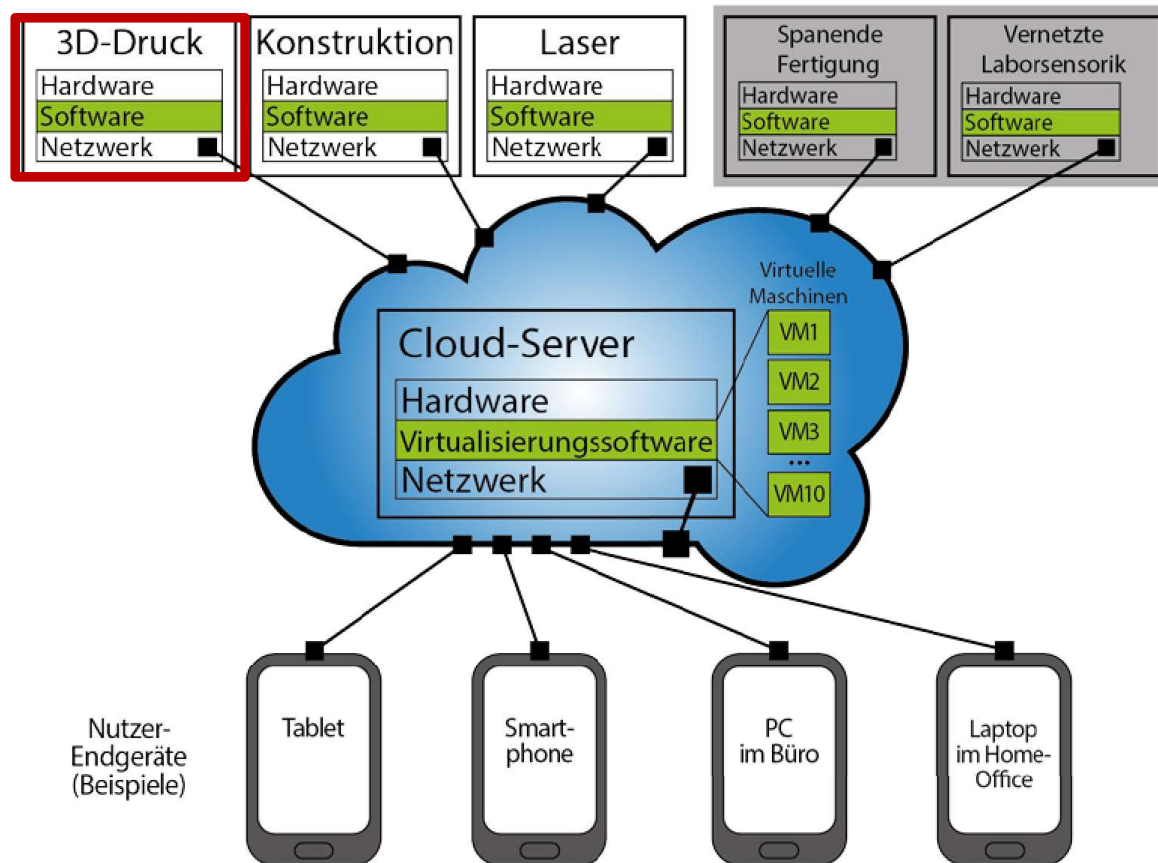
1. Laser structuring
2. Wet chemical infection
3. Cu metallization
4. Final component



More detailed information and examples follow during the lab tour

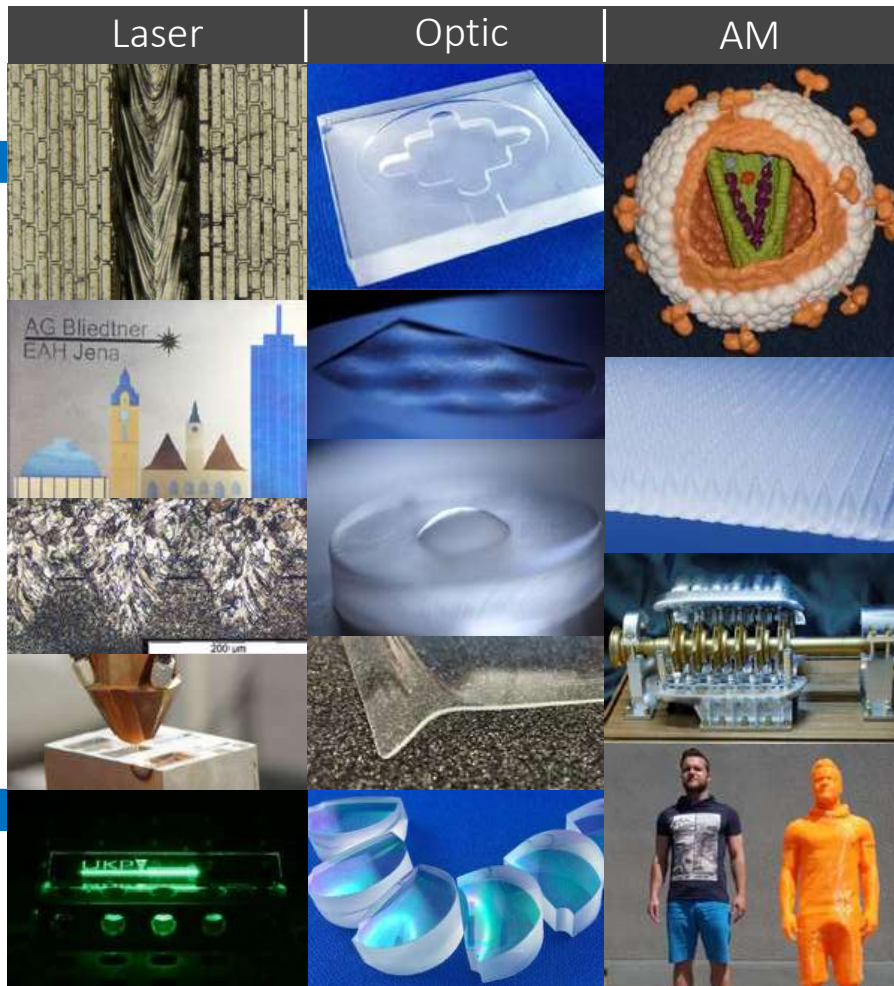
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# Starting AM process



With our AM engineer  
Patrick Ongom-Along

Live demonstration



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Further information: [www.ag-bliedtner.de](http://www.ag-bliedtner.de)

Start of the lab session