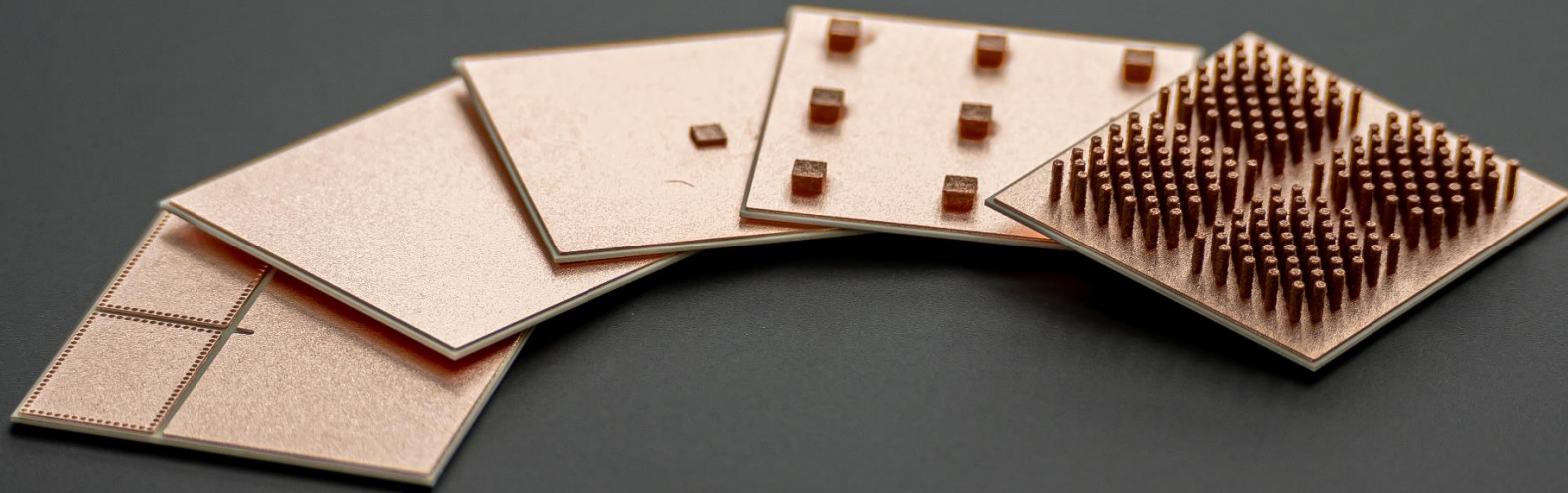


## GlobalAM

Enabling Laser Powder Bed Fusion for  
Large Scale Production of Multi-Material Components

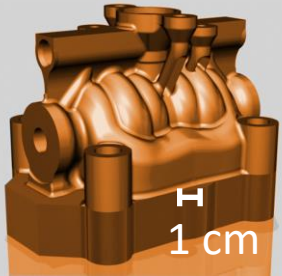


Funded by the European Union under grant agreement no. 101138289. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Health and Digital Executive Agency (HADEA) (granting authority). Neither the European Union nor the granting authority can be held responsible for them.

Metal laser powder bed fusion (LPBF-M) of metals is an established manufacturing technique with great potential in terms of flexibility, digitalization, geometric freedom.

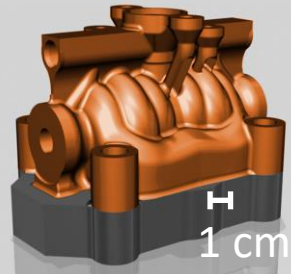
**But:** Productivity of LPBF-M is still too low to penetrate mass markets.

## Classical AM



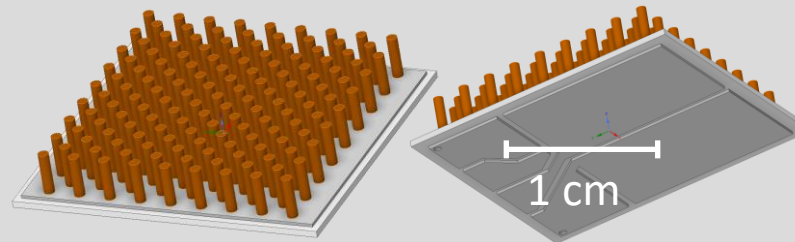
- Printing massive components
- Focus: metal on metal substrate
- Cycle time
- Cost
- No

## Hybrid AM



- Hybrid printing of massive component
- Focus: metal on metal inlay
- Cycle time
- Cost
- Fit t

## Feature Based Hybrid AM



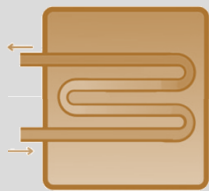
- Printing *tiny features*
- Cycle time: ~ s ↓
- Powder demand ↓
- Cost-benefit ratio ↑

**GlobalAM approach:** Focus additive manufacturing on (small) functional elements

**LPBF-M fits mass manufacturing e.g for electronic components.**

**GlobalAM aims to unlock the potential of additive manufacturing for large scale production by feature based hybrid production on dissimilar substrate materials.**

## Key Exploitable Results:



competitive **high performance cooling device** as industrialization demonstrator



**advanced machine concept** for highly reduced cycle times + precision positioning of substrates



**superior material systems** for defect-free products with improved functional performance

## Project Key Facts:



**8**  
Project partners



**36 months**  
Project duration

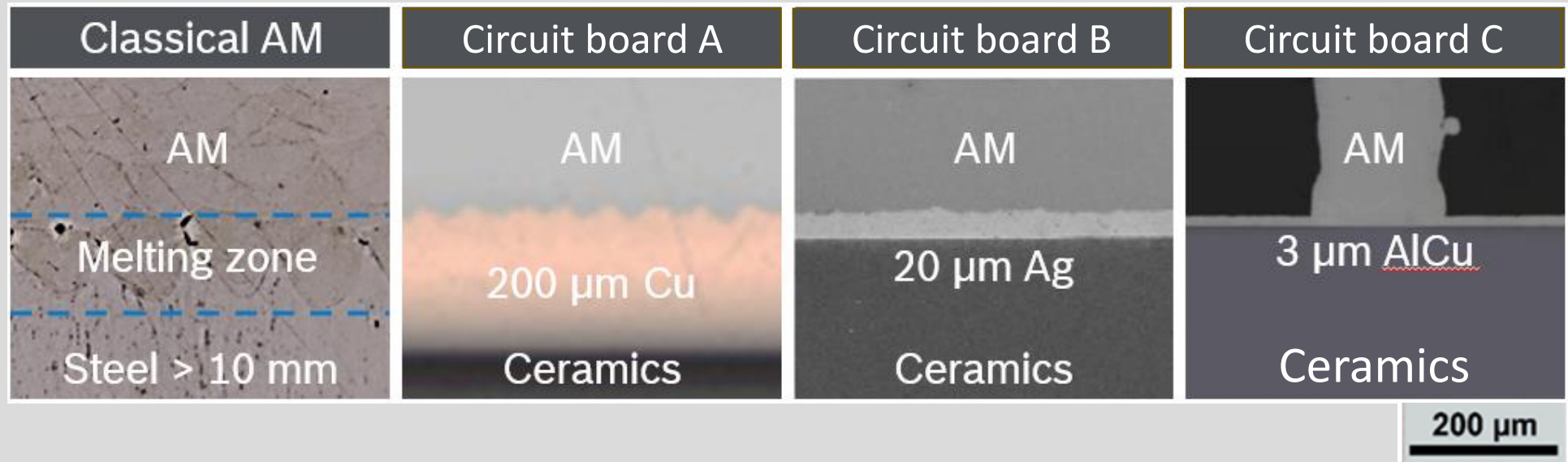


**Jan. 1<sup>st</sup> 2024**  
Starting date



**4.0 Mio. €**  
Budget

## Mastering Multi-Material AM on Fragile Substrates



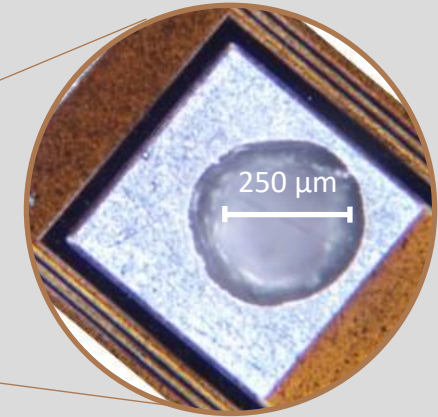
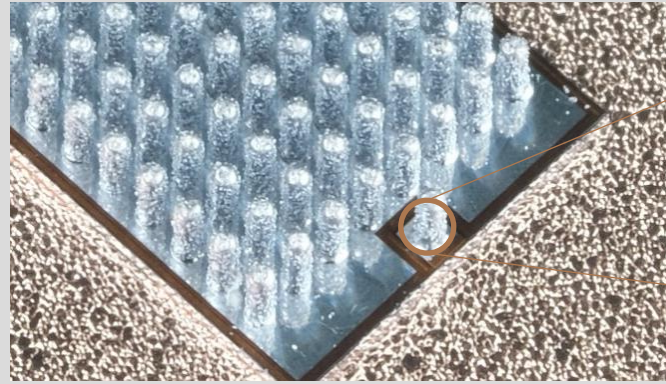
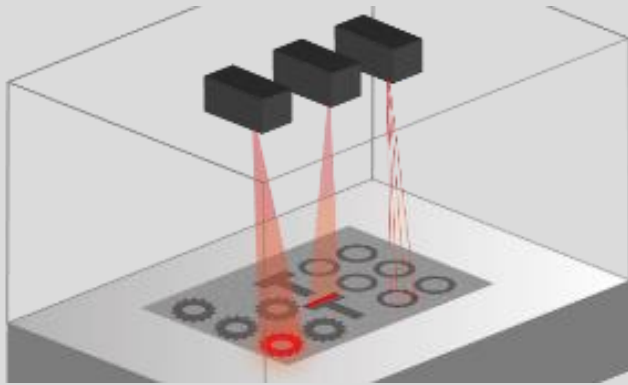
### Challenges

- (1) Multi-material systems: substrate + metalization + AM part
- (2) Strictly limited melting zone: < metalization thickness
- (3) Substrates vulnerable to cracks → low residual stress process

### Solutions

Simulation-supported process development  
Adapted process strategies

## Mastering Productivity, Precision & Automation



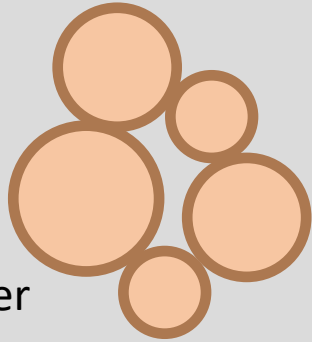
### Challenges

- (1) High productivity & cost efficiency  
→ Short AM cycle times ( $< 5 \text{ min / batch} \cong \text{s / part}$ ),...
- (2) Highly precise adjustment of laser(s) vs. substrate  
→ Positional accuracy  $< 50 \mu\text{m}$
- (3) Full line integration  
automated loading and depowdering

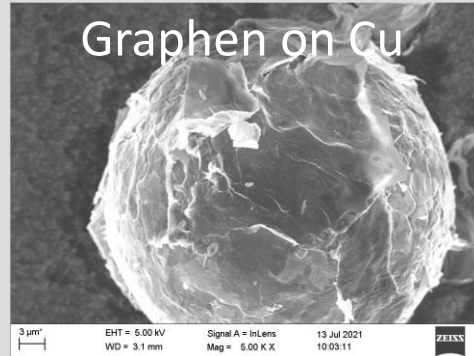
### Solutions

- Laser beam shaping & splitting
- In-line process monitoring and defect compensation
- Substrate fixation & positioning system

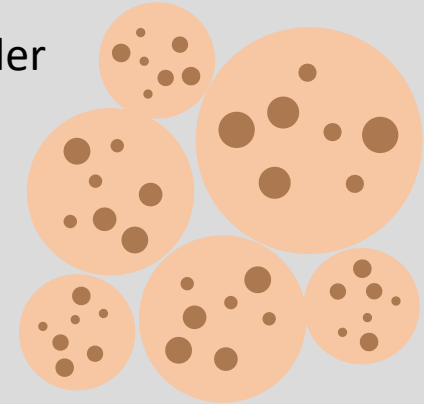
## Mastering Functional Properties, Aging, Scalability



core-shell powder



metal matrix powder

**Challenges**

(1) Reliably joining of dissimilar materials

→ life time requirements for automotive applications

(2) Best functional properties

→ high flowability/absorption/conductivity, low aging, ...

(3) Recycling of powder

→ mass production scale powder recycling for economic and environmental compatibility

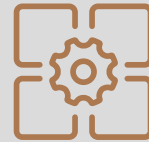
**Solutions**

- core shell powders
- metal matrix composites
- non-standard materials

Key Enabling Technologies employed + responsible partners to achieve project goals:



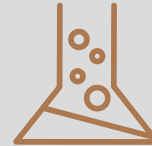
## Process & Defect Monitoring



## Substrate Fixation



## Beam Shaping & Splitting



## Multi-material Powders



## Substrate Positioning



## Multi-scale Modelling

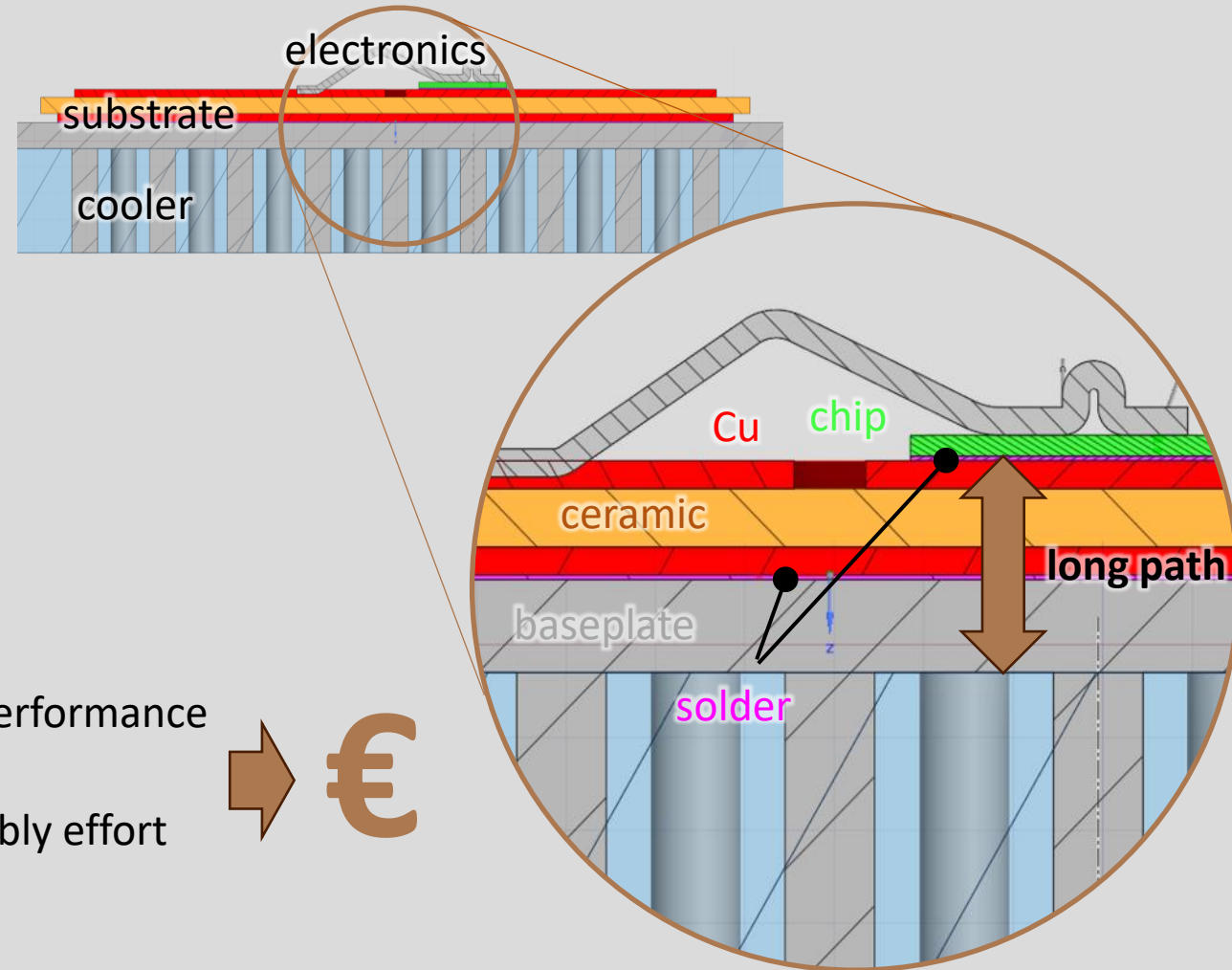
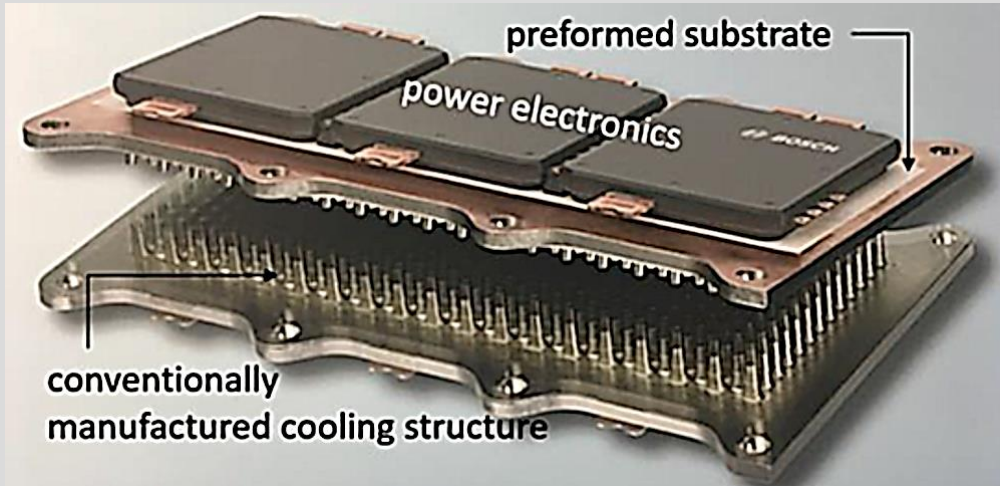


## In-line Defect Compensation



## High Resolution Residual Stress Analysis

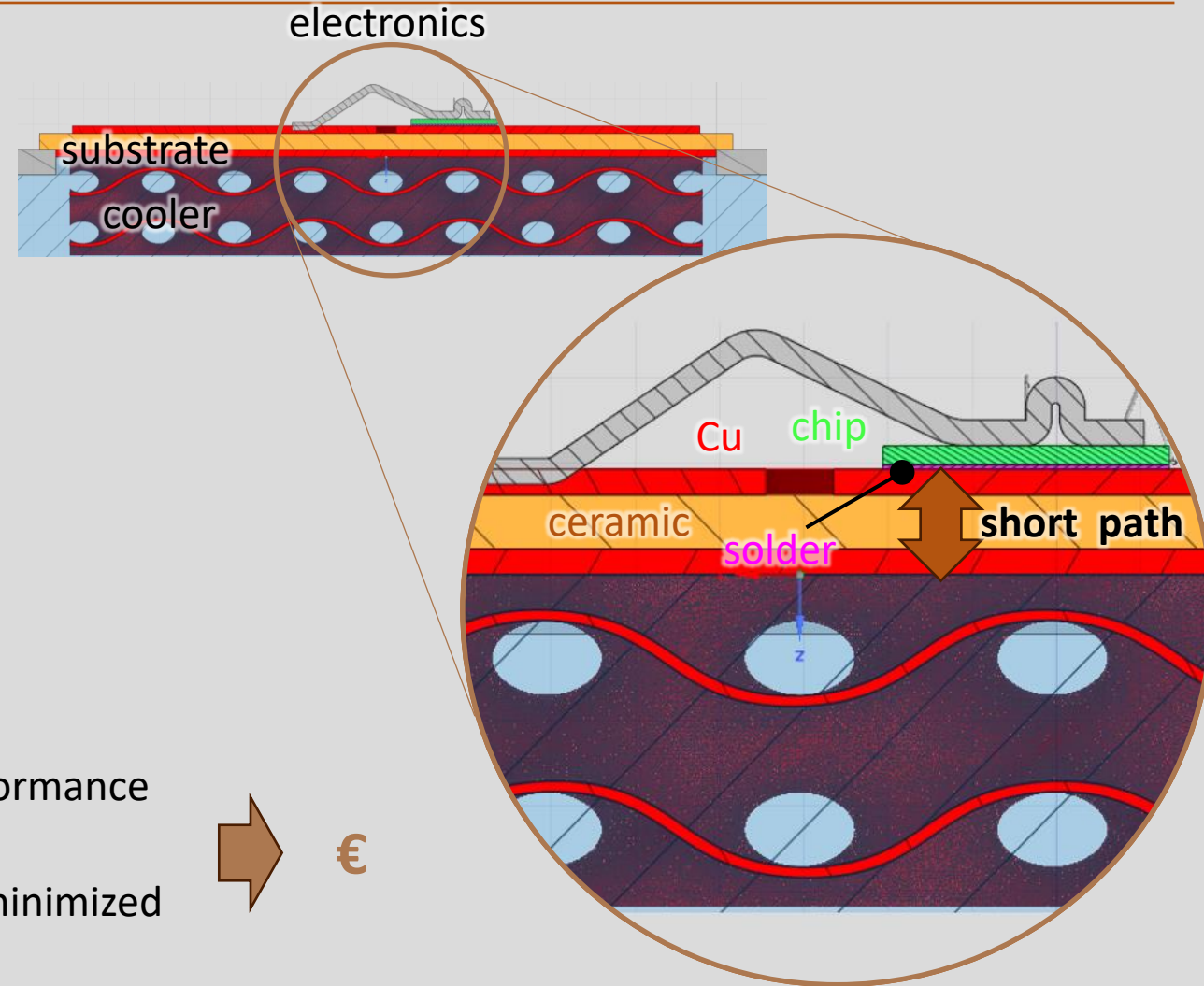
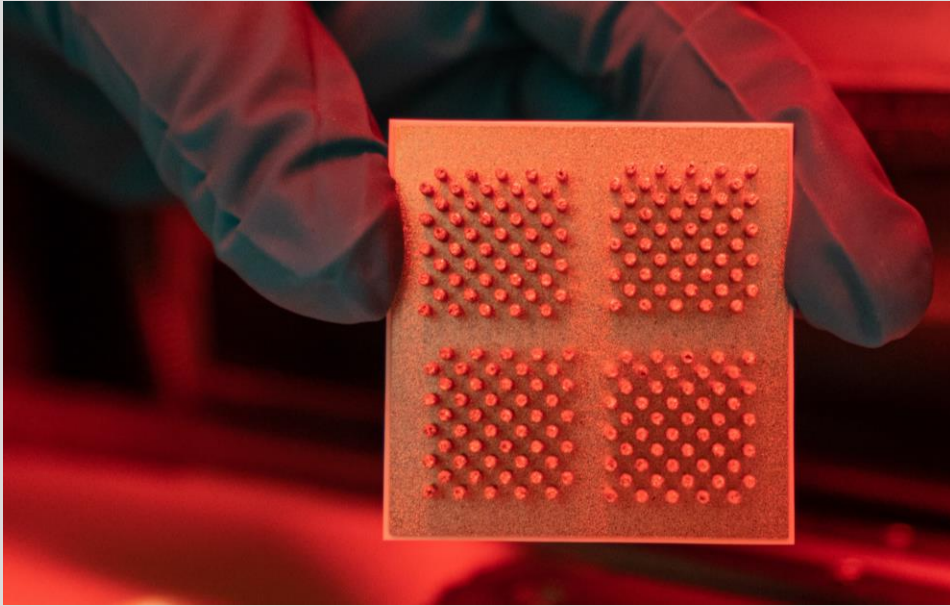




## Conventional cooler design

- relatively long cooling path
  - soldering/sintering required
  - high material usage
  - limited design flexibility
- ➔
- limited cooling performance
  - large chip size
  - additional assembly effort
- ➔ €





## GlobalAM cooler concept

- + minimum cooling path
- + integrated joining process
- + minimum material usage
- + complexity for free



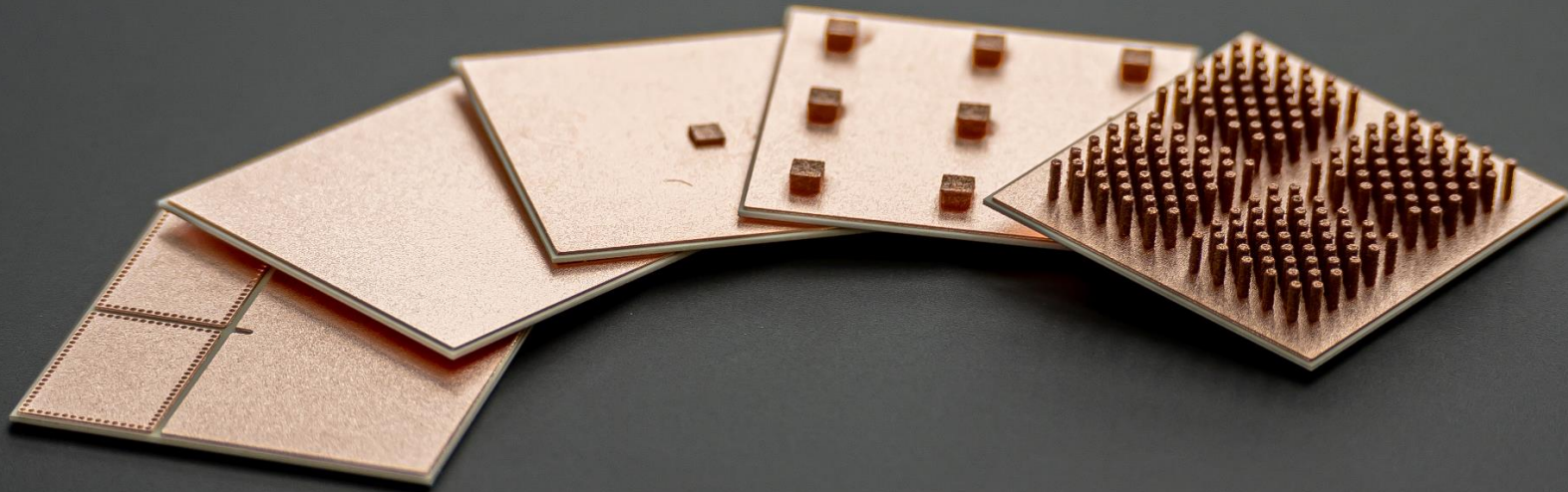
- + high cooling performance
- + reduced chip size
- + assembly effort minimized



€

# GlobalAM

– your ace in Laser Powder Bed Fusion.



**Interested in partnering up? Ideas for your applications? Keen to bring in new materials?  
You are welcome to contact us!**



**Project Homepage:**

<https://www.globalam-project.eu/>

**Contact:**

Robert Bosch GmbH, Dr. Frank Sarfert

Tel.: +49 711 811-10785

Mail: [frank.sarfert@bosch.com](mailto:frank.sarfert@bosch.com)