AMPERE

Reliable and scalable hybrid 4D manufacturing for smart systems

innovation across borders

Neotech AMT GmbH - who is who & where

Florens Wasserfall: Project Leader, Machine Learning

David Gessner: Processes & Design

Jochen Zeitler: CAD/CAM – Motion 3D

Laura Maurelo: GUI and Vision

Stefan Werner: PLC

Neotech offices and production facility on the Auf AEG area (former AEG site) in Nuremberg.

Fabian Hanke: Extrusion Processes

Neotech Capabilities

Leading manufacturer of 5-axis systems for 3D Printed Electronics (3DPE) that combine:

1. Printed Electronics - Jetting (Piezo, Aerosol & Ink Jet) and Dispensing
2. Conventional Electronics – Pick & Place of Surface Mount Devices (SMD)
3. Additive Manufacturing – Structural Fused Filament Fabrication, Pellet Extrusion and dispensing of Polymers & Ceramics
4. Post-treatment (thermal, IR, UV, Laser)

All processes driven by proprietary Motion 3D CAD/CAM Tool dedicated to 3D PE

Applications: Circuits, antenna, heaters and sensor systems for mobile devices, automotive, medical and industrial use.

Neotech AMT contribution to AMPERE

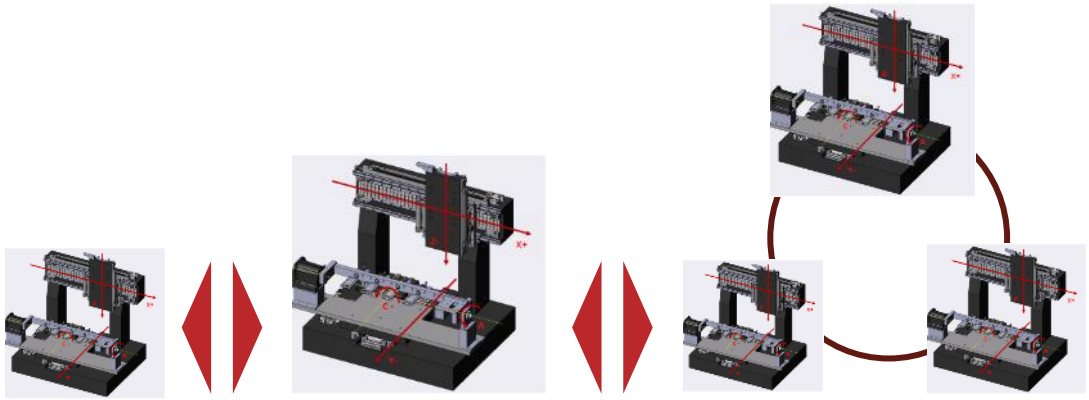
Structural Build
- 5X-FFF
- Pellet Extrusion
- Freeform SLA

Printed Electrics
- Jetting
- Dispensing
- Laser Treatment

Enhanced CAD/CAM
- 5X Slicing
- E-CAD
- Automated Routines

SMD Components
- Pick&Place
- Interconnection

In-line process control
- Dimensional
- Camera Vision
- Machine Learning



Scalable Process Line for 4D Printed Electronics

XENON, who is who and where

Dr. Jens Müller
XENON Project Leader

Norman Rother
Department Leader Development

Tobias Dreher
Demonstrator Construction

Nicola Szöke
Finance

XENON main site Dresden

XENON, our capabilities

Automotive

Electronics

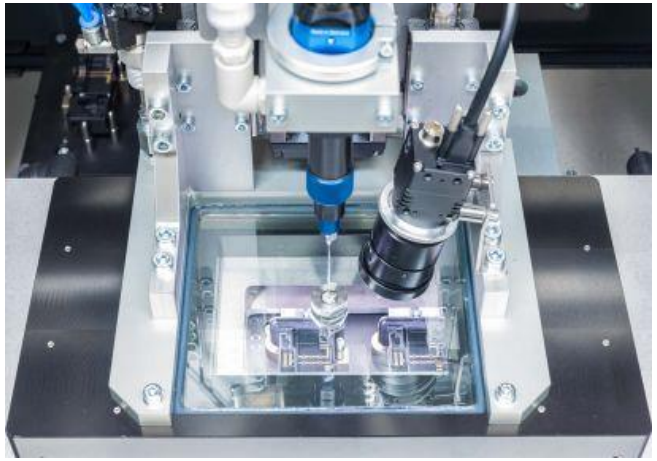
Medical

- Assembly Automation
- Inspection Automation
- Injection Molding Automation
- Robot Automation
- Digital Services

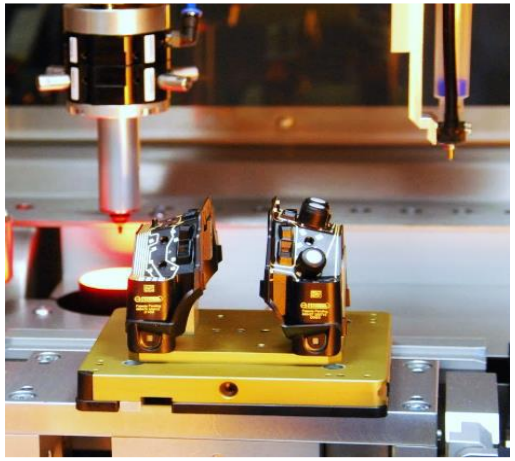
ISO 9001 certified

XENON, our contribution to AMPERE

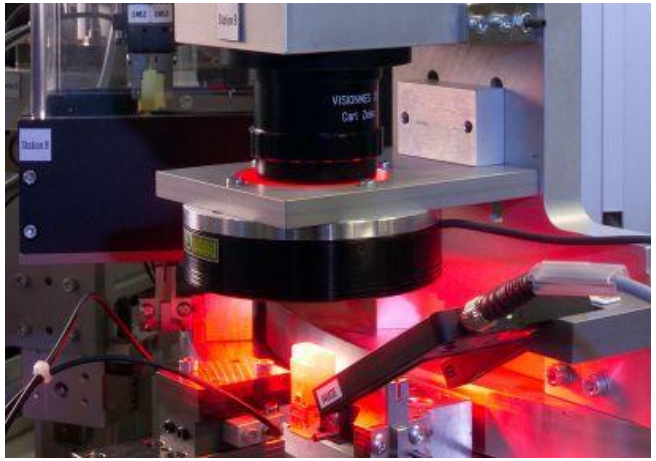
- Expertise in automation technologies and industry standards
- Prototype Demonstrator Device for high precision 3D-printing of electrical conductive lines on 2D- and 3D-surfaces with integrated functions for mounting of electrical components
- Evaluation of product concepts with regard to automatation, as well as testing of sub-processes of production using XENON's Prototype Demonstrator Device



Dispensing



Mounting



Inspection

Fraunhofer IFAM, who is who and where

Dirk Godlinski
Project Leader

Jonas Deitschun
Project Manager AM

Arne Haberkorn
Project Manager Materials

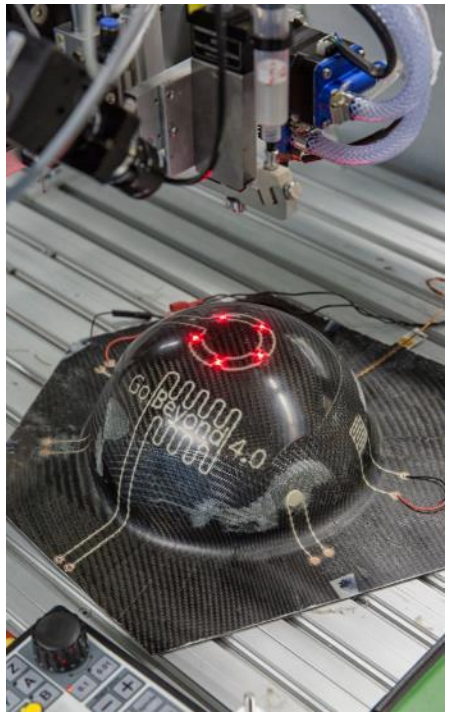
Main site of Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM is located in the Technologiepark Bremen, working in the fields of aviation industry, automotive sector, energy technologies, medical technology, life sciences and maritime technologies.

Department „Smart Systems“ with the research groups „Functional Printing“ and „Functional Composites“ are involved in AMPERE.

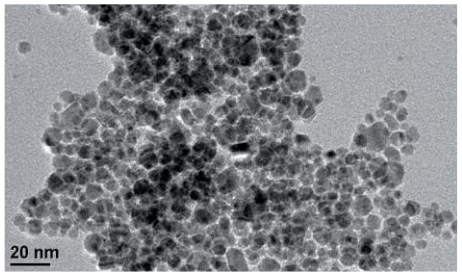
Fraunhofer IFAM, our capabilities

Applied R&D in the field of materials and manufacturing for smart systems

Labs for material development and characterization (metal, polymer, composites)



Labs for (additive) manufacturing of smart components (different “printing” technologies for part dimensions from mm to m and functional integration)



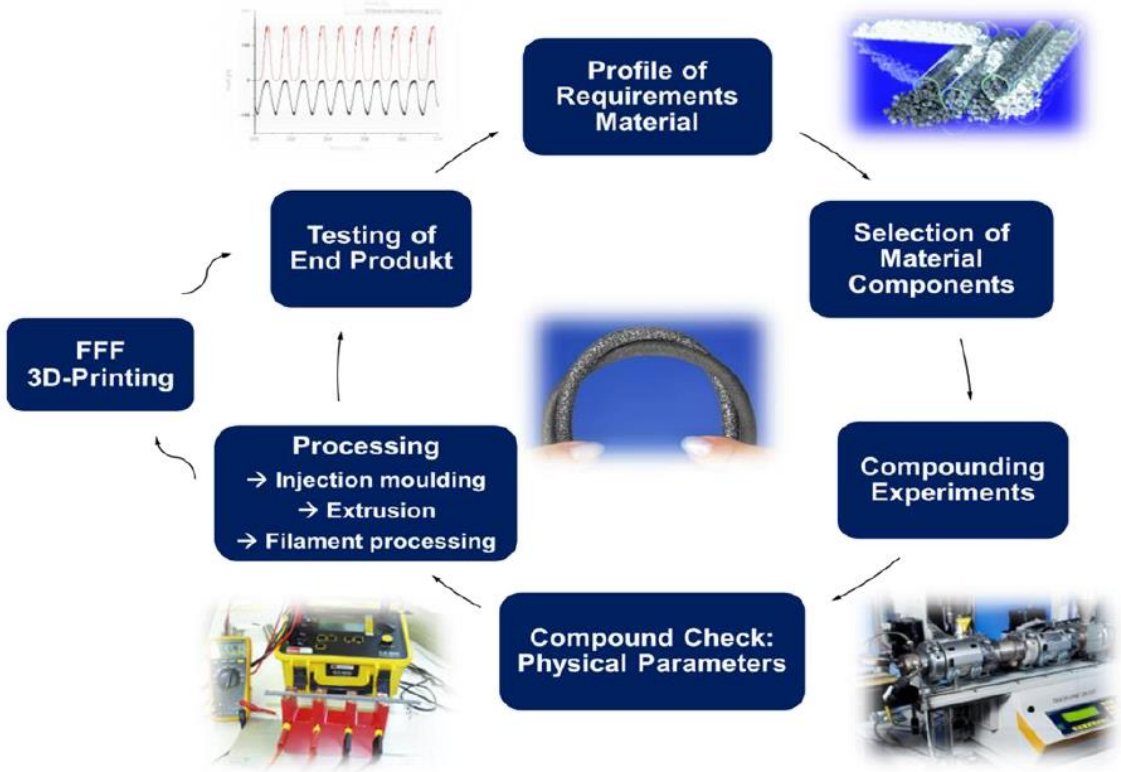
Our Services

- Materialography
- Scanning Electron Microscopy
- Thermal Analysis
- Powder Measurement Technology
- Trace Analysis
- X-Ray Analysis
- Damage analysis of metallic components
- Equipment

Service center for analytics and materialography (DIN EN ISO 9001:2008 / DIN EN ISO/IEC 17025:2005), testing

Fraunhofer IFAM, our contribution to AMPERE

- Develop/qualify FFF-materials suitable for 4D-manufacturing with focus on mechanical and electrical performance
- Use/further development of 4D-manufacturing technologies
- Characterization of samples, and testing the feasibility in demonstrators



Signify, who is who and where

Rob van Asselt
Project Leader & Product Architect

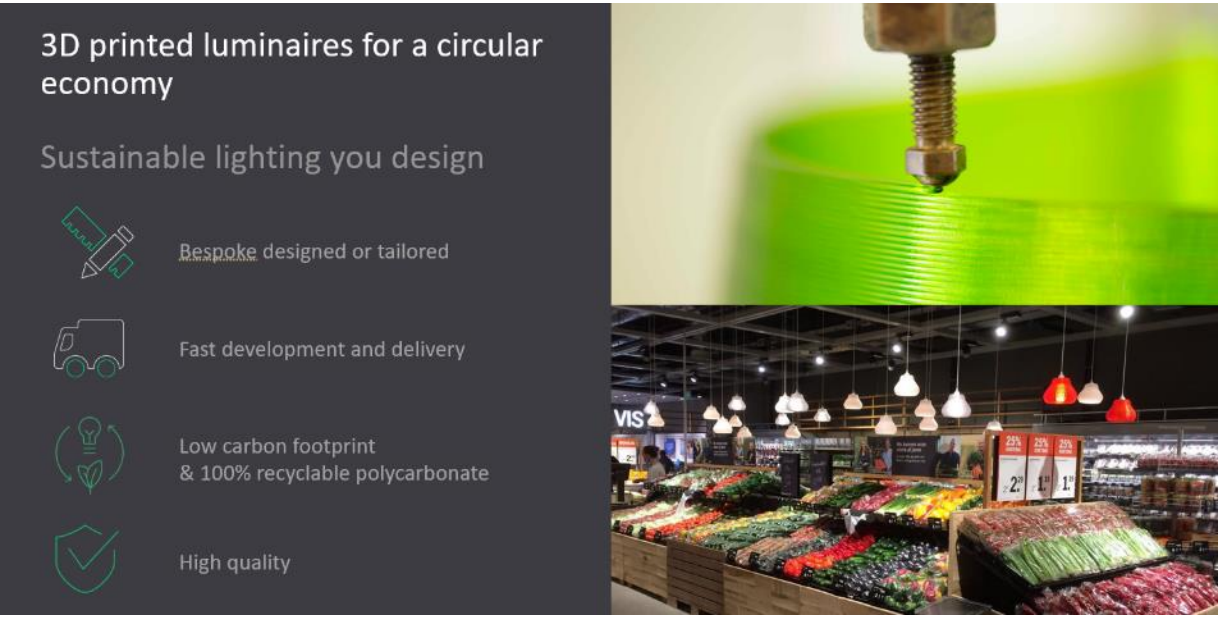
Oliver Burke
Product design

Ronald Maandonks
Open Innovation

High Tech Campus 7
Eindhoven

AMPERE

Signify, our capabilities

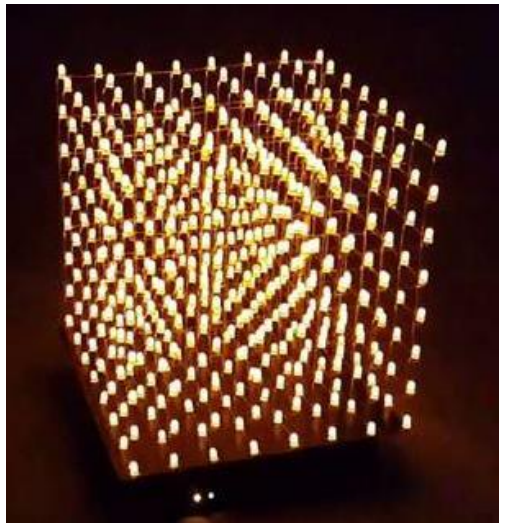


- 3D printing
- Product architectures
- Electronics design and realization
- Thermal and mechanical product design
- Product characterization
- Reliability: accelerated testing, modeling
- Optics

Signify, our contribution to AMPERE

Develop new LED lighting applications enabled by 4D hybrid manufacturing.

- Lead WP5: Demonstrators
- Definition of product specifications and derived process requirements.
- Identification of LED lighting electrical functionalities and options for hybrid manufacturing.
- Design and manufacturing of LED luminaire prototypes.
- Evaluation and stress testing of prototypes and verification against requirements.



VSL, who is who and where

Richard Koops
Research scientist

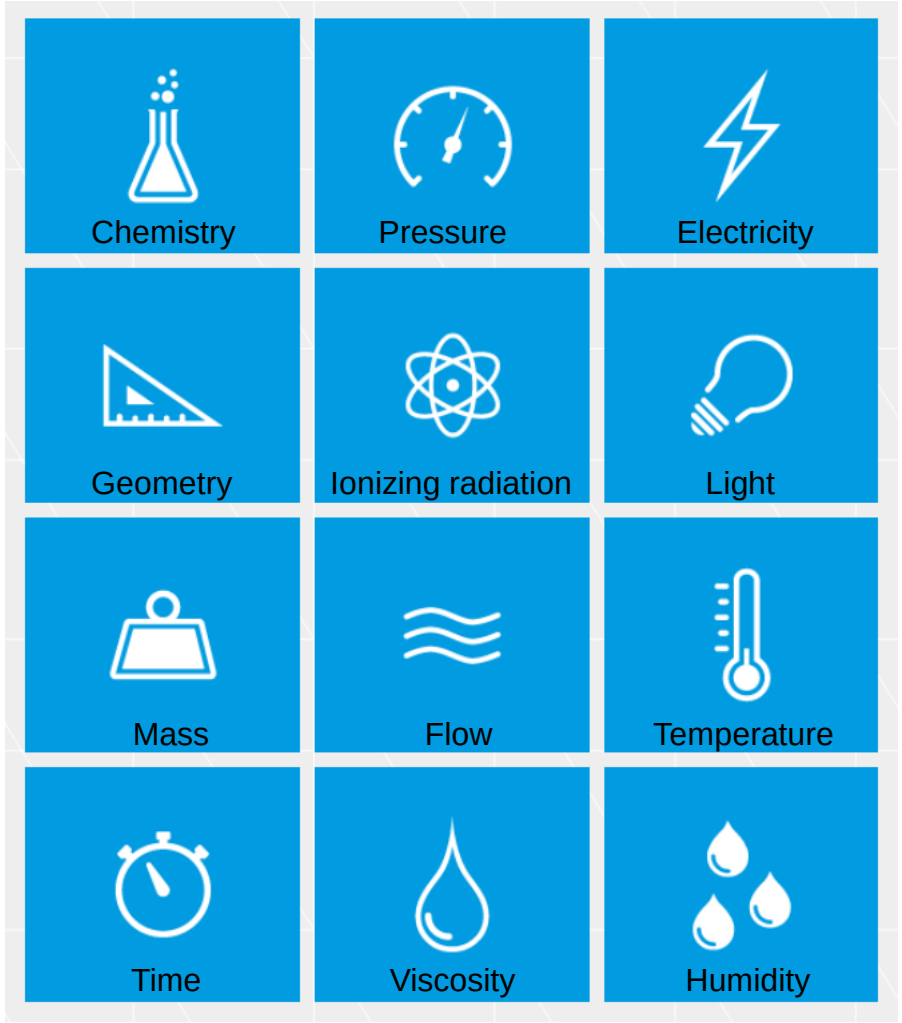
VSL National Metrology Institute

VSL is the Dutch National Metrology Institute, located in Delft, The Netherlands

Paula van Lieshout
Project manager

VSL, our capabilities

- **National Metrology Institute** of the Netherlands: appointed by the Dutch government to maintain and develop the **national measurement standards**
- **Research institute** in the field of metrology
- Provides **metrology services** to customers, i.e. calibration, consultancy and training
- Contributes towards the **reliability, quality and innovation of products and processes**
- **ISO 17025** accredited

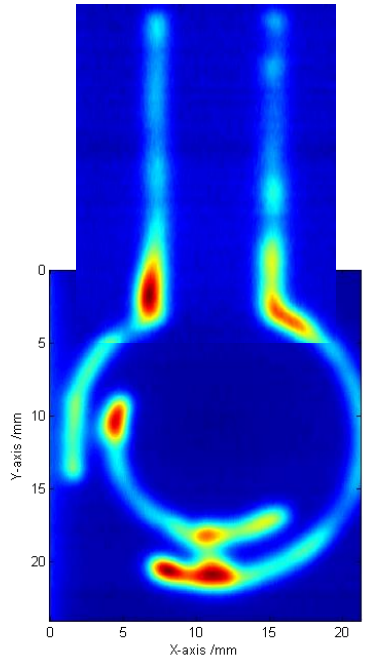


VSL, our contribution to AMPERE

- **Provide innovative metrology solutions**
- **Apply concept of measurement uncertainty**
- **Support quality management**

Signify USB key with hidden printed conductors

Non-contact detection of subsurface conductors



VSL non-contact metrology tool developed in Hyb-Man project to detect subsurface conductors

VSL National Metrology Institute

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Philips, who is who and where

Johan Klootwijk
Project Leader

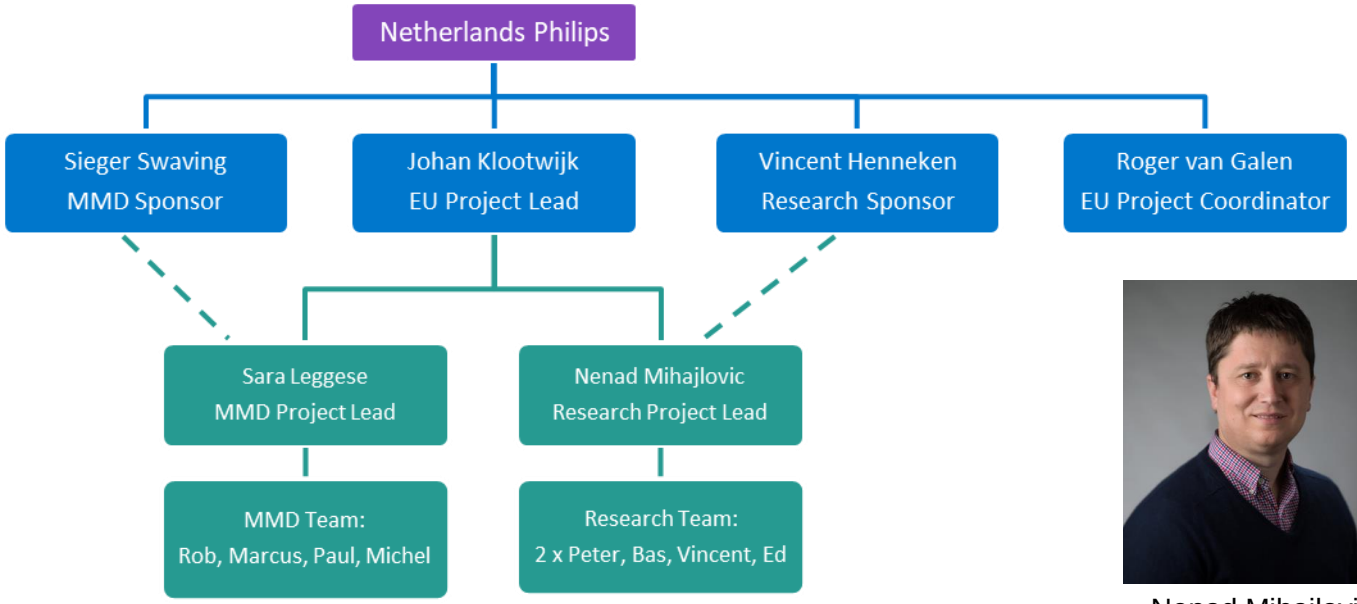
Roger van Galen
Project Coordinator

Sara Leggese
Philips Project Leader

Nenad Mihajlovic
System Architect and
Technical (project) Lead

Building HTC4 at the High Tech Campus Eindhoven, housing the MEMS foundry of Philips Product Engineering and Technology Research groups.

Philips, team introduction



Sara Leggese
Project Leader

Nenad Mihajlovic
System Architect and
Technical (project) Lead

Rob v Schaijk
CMUT Architect,
Design and Test

Marcus Louwerse
F2R Architect,
Design and Test

Paul Dijkstra
Micro Assembly
Architect

Michel Somers
Process
Development,
Characterization

Peter Dirksen
CMUT FEM
Design Modelling

Peter Timmermans
CMUT FEM Design
Modelling

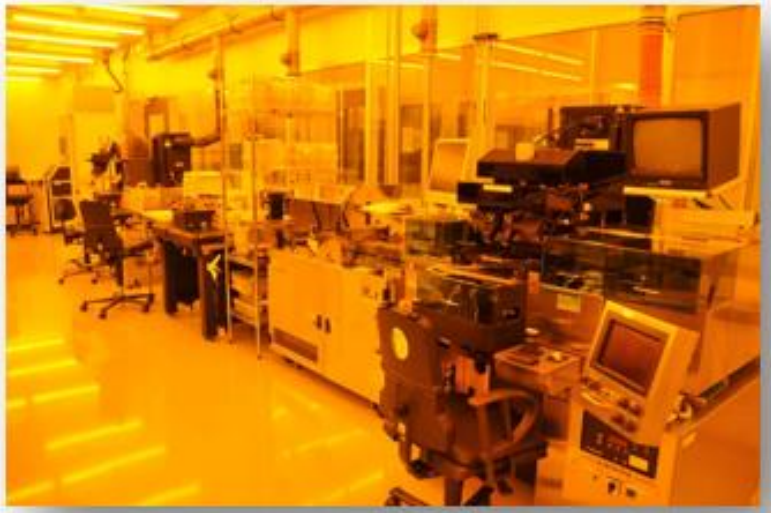
Bas Jacobs
Lead Extraction
Device Architect
and Design

Vincent Henneken
Demonstrator
Architect

Ed Berben
Concept Window
Design

Philips, our capabilities

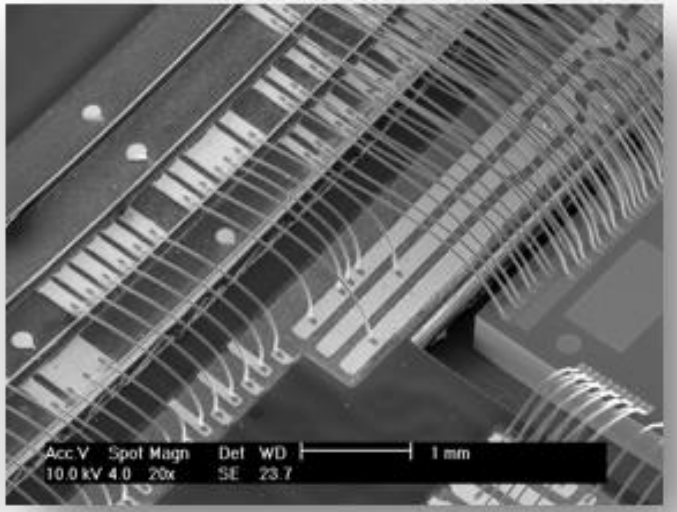
CMUT and F2R processing and assembly for medical devices, e.g. smart catheters



MEMS Foundry
Micro-fabrication
2650 m2 Clean room

ISO13485 certified for development & manufacturing

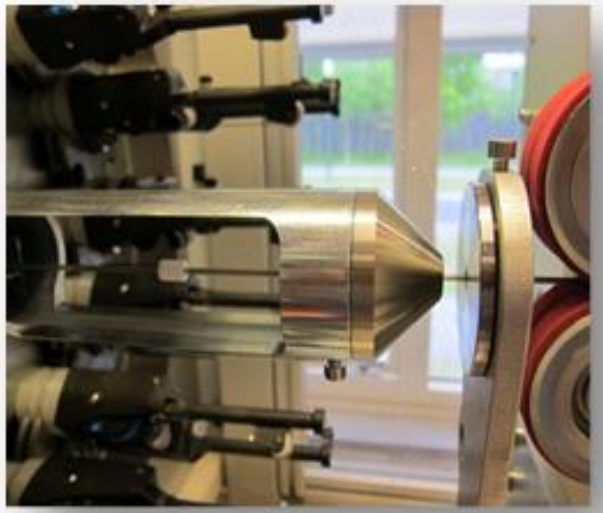
High Tech Campus-Eindhoven



Greenhouse/Micro Assembly
die/board level
3500 m2

ISO13485 certified for development & manufacturing

'Strijp' -Eindhoven



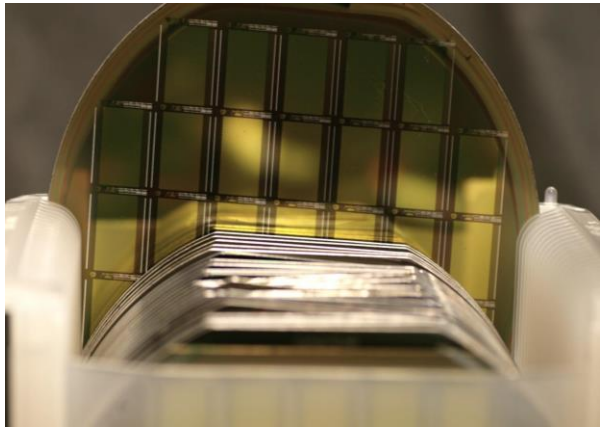
Smart catheters,
in- and on-body devices
Workshop, 300 m2

ISO13485 certified for development

High Tech Campus--Eindhoven

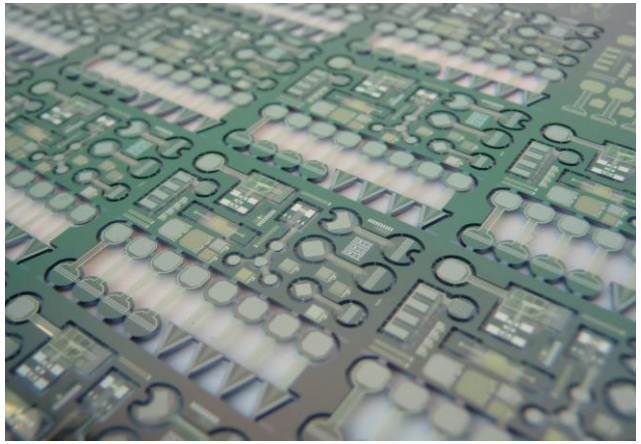
Philips, our contribution to AMPERE

- Develop CMUT and Flex-to-Rigid (F2R) miniaturization technology
- Use these technologies to realize the “lead extraction” demonstrator
- Demonstrate together with partners the feasibility of a 4D printed smart catheter tip



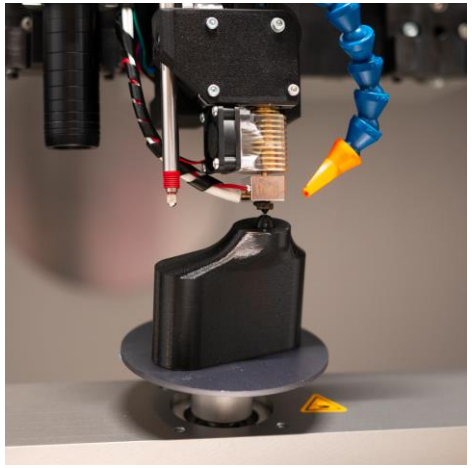
CMUT / MEMS
ultrasound transducers

+



Flex-to-Rigid
micro assembly platform

+



4D
printing

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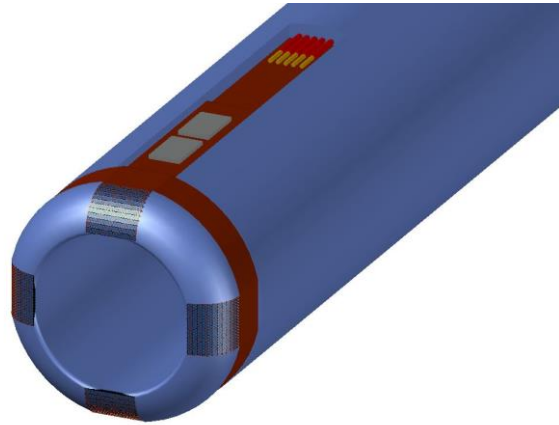
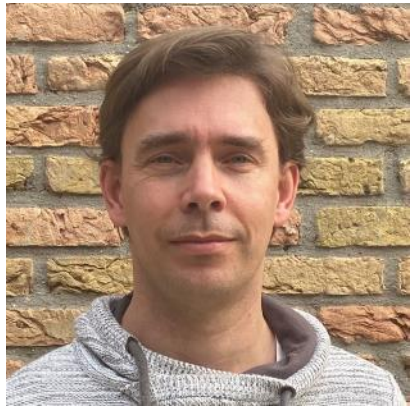


smart minimally invasive
instruments

Reden B.V., who is who and where

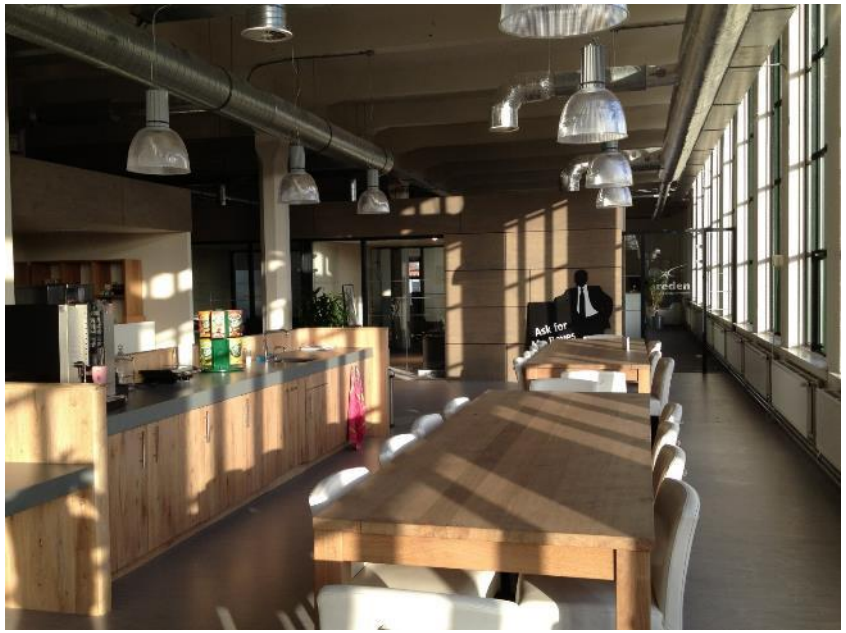


Jakko Nieuwenkamp
Reden Project Leader

Niels Nijenmanting
Software architect

Frits de Prenter
Simulation Expert

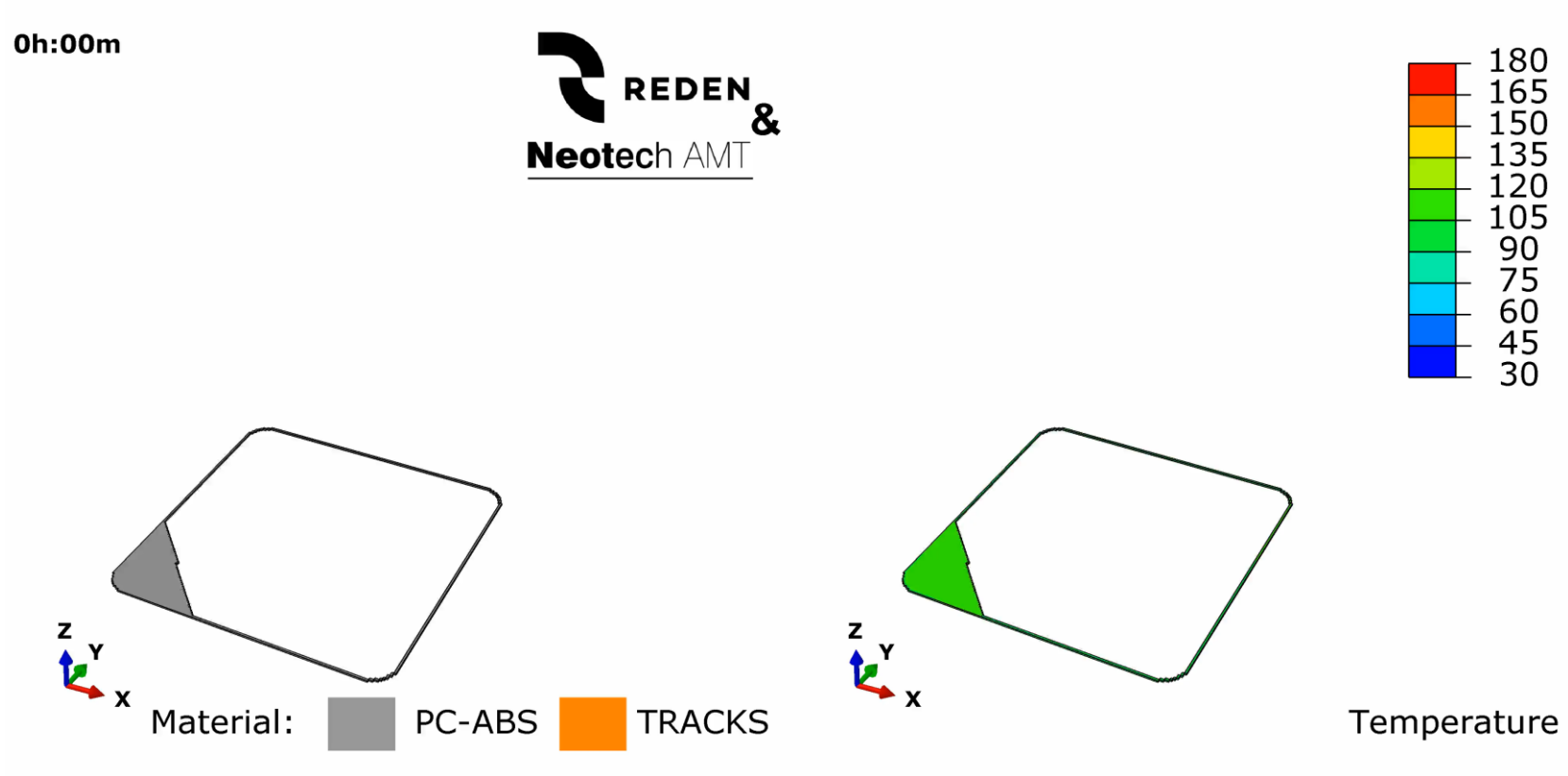
REDEN



Hazemeijer Hengelo
Building A04

Reden, our capabilities

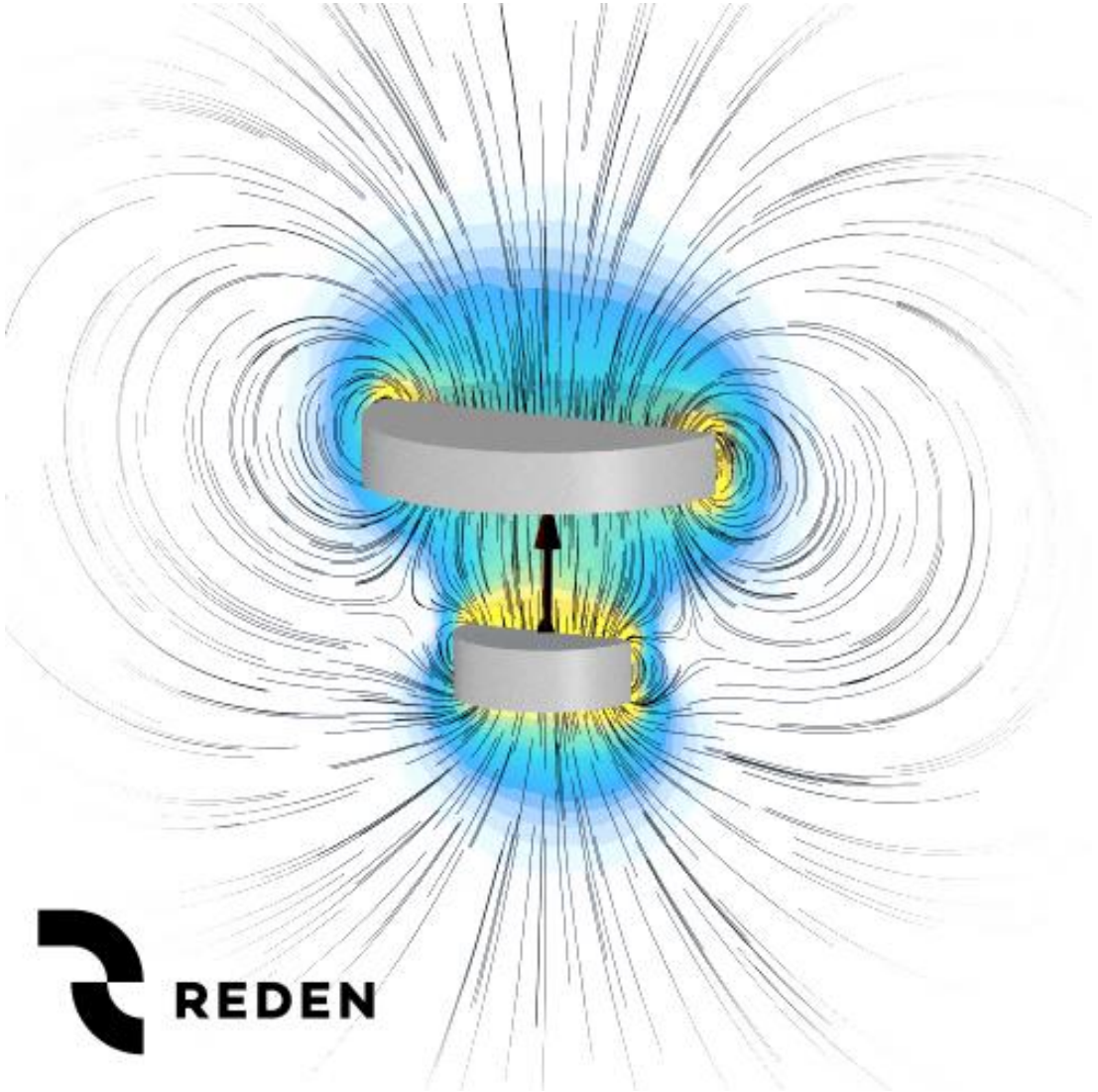
Process simulation



AMPERE

Reden, our capabilities

Multi-physics simulation



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innovation across borders

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Reden, our capabilities

Software development

REVES
Design Space Navigator

Penta

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innovation across borders

Reden B.V., our contribution to AMPERE

- Develop fundamental knowledge on key aspects of 4D printing technology
- Translate this knowledge in efficient and easy to access design tools

Task	Description
T4.1	Advanced material models development
T4.2	Efficient AM simulation techniques development
T4.3	Multi-physics simulation for embedded functionality analyses
T4.4	Design tool development

Holst Centre, who is who and where

Jeroen van de Brand
Program manager

Corné Rentrop
Project Leader

Rob Hendriks
Technology lead

Lotte Willems
Business development

Hessel Maalderink
AM technology

Fabien Bruning
AM technology

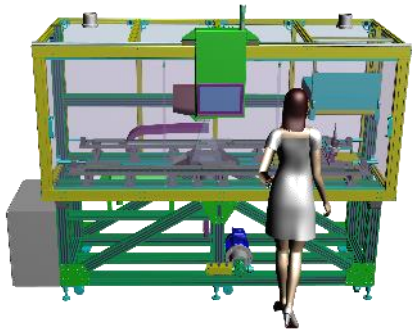
Building HTC31 at the High Tech Campus Eindhoven and labs in building HTC29.

Holst Centre, our capabilities

Multi-material 3D printing platforms and hybrid printed electronics infrastructure

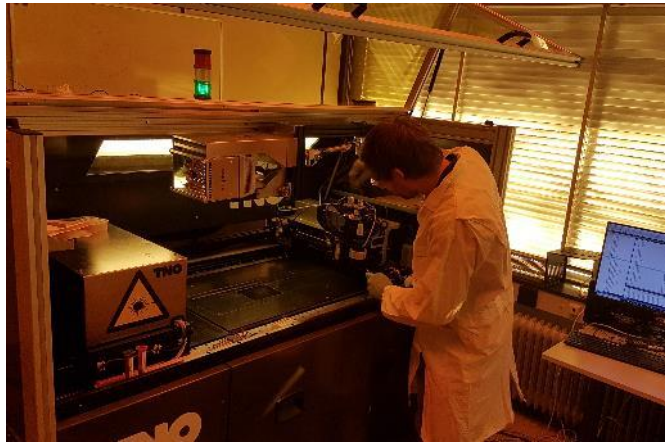
LEPUS NXT Platform

- 3D printing for prototyping
- Products: millimeter – centimeter
- Low electronics content



New Platform (in development)

- 3D printing for high throughput
- Products: micrometer - millimeter
- High electronics content



3D Printing lab

Printing & Bonding lab

Laser lab

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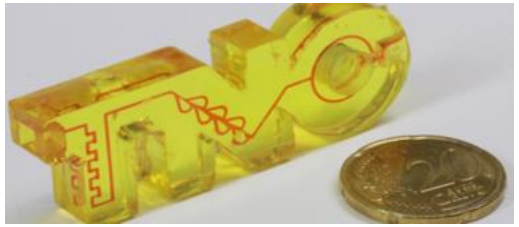
Holst Centre, our contribution to AMPERE

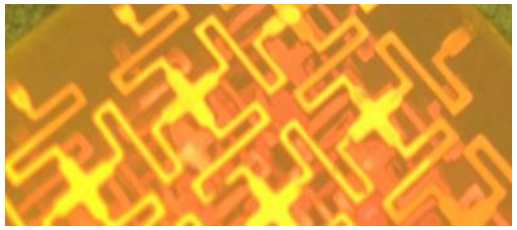
- High resolution 3D printing technology: < 50 µm line/spacing
- 3D Integration of electronic components, down to 150x150 µm^2 (bare dies)
- Material compatibility analysis by in-situ resistance measurements

Electronics

Waveguides

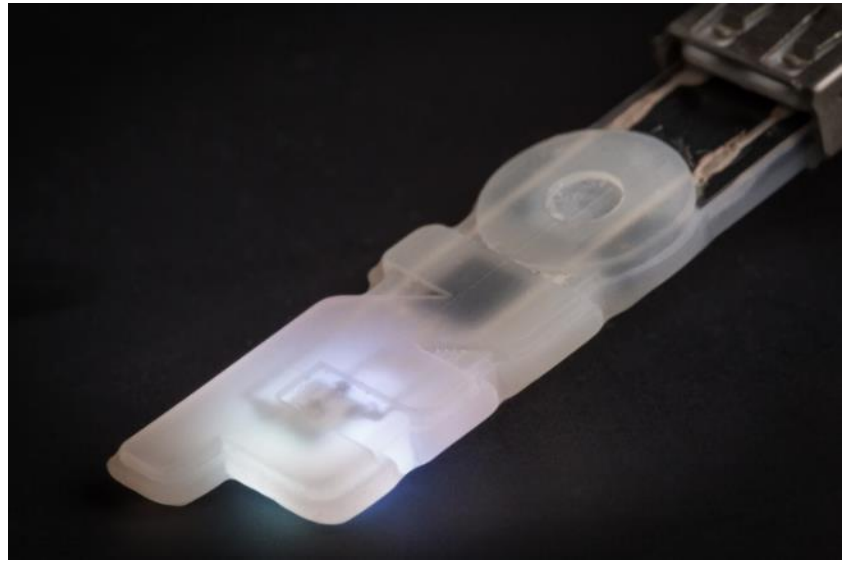


Microfluidics



Antenna's

Integration



Multi-functional freeform product

TU Eindhoven, who is who and where

Joris Remmers
Project Leader

Olaf van der Sluis
Supervisor

PhD
Candidate

Marc van Maris
Lab manager

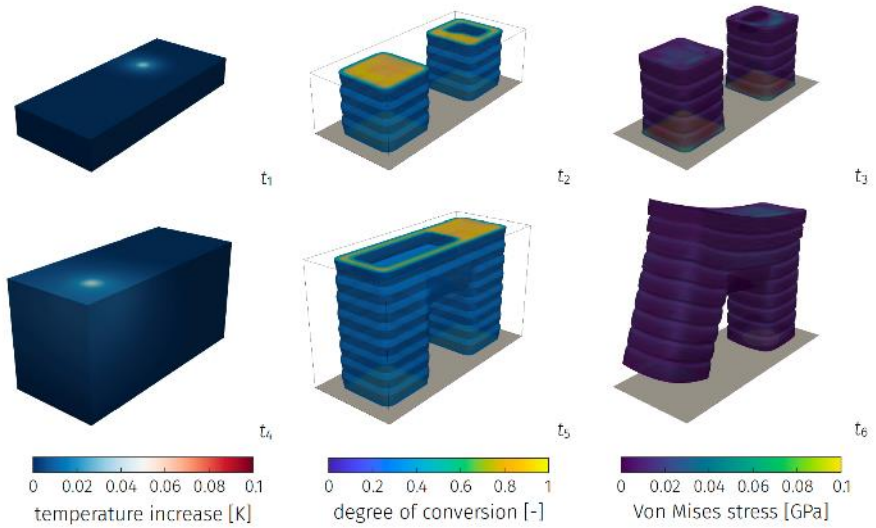
Working in adjacent projects:
Marc Geers, Britt Cordewener, Bram Dorussen, Phani Ram Babbepalli

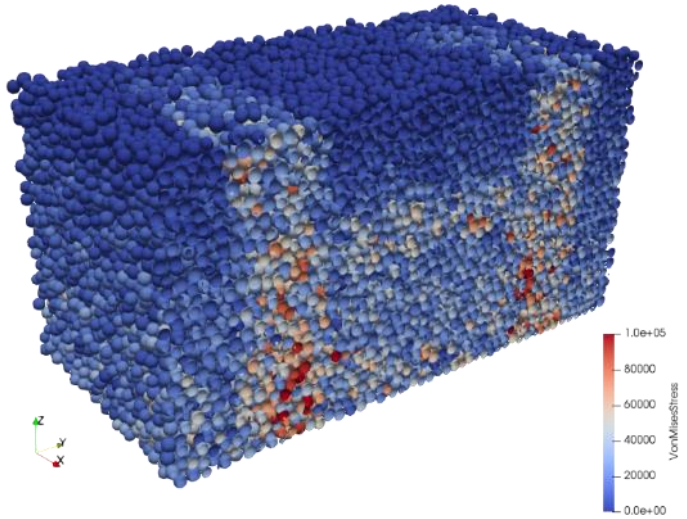
Eindhoven University of Technology, Eindhoven, The Netherlands

Building Gemini

TU Eindhoven, our capabilities

Multiscale analysis of thermo-mechanical behaviour of 3D printed materials





Numerical analysis

In house developed codes for the electro-thermo-mechanical analysis of AM processes.

- Finite element analysis (reduced order modelling)
- Constitutive modelling
- Discrete element analysis

Experimentation / Material characterization

Multiscale lab: On campus laboratory for material characterization on the microscale

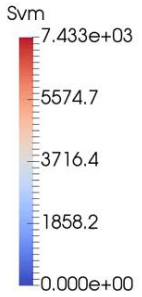
- Scanning Electron Microscopes / CT Scanner
- Digital Image Correlation techniques
- Various micro-scale stages / indenters.

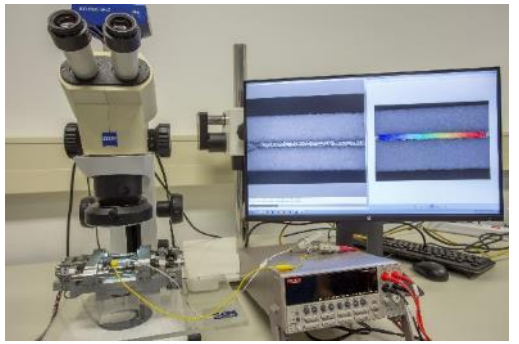
AMPERE

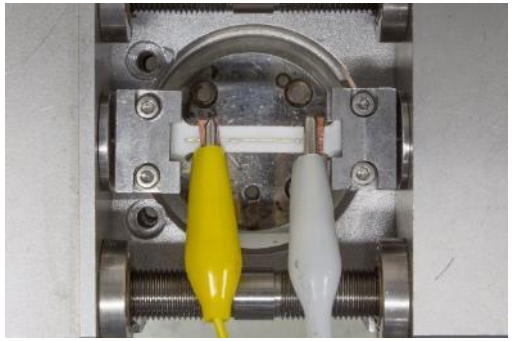
TU Eindhoven, our contribution to AMPERE

- Develop thermo-mechanical models for a detailed description of the evolution of material properties in the product during printing.
- Develop model order reduction techniques to decrease calculation times
- Integration of models in design procedure (including material characterisation)

AM Process Simulation based on GCode data







HYBMAN

TU/e

Penta

EUREKA innovation across borders

Würth Elektronik eiSos, who is who and where

Christoph Völcker
Project Leader

Jiyeon Kang
Material Specialist

Christian Robert
Project Coordinator

WÜRTH ELEKTRONIK

TEAM

Demonstrator architects

Competence Center
Berlin

Headquarter

Waldenburg
(Baden-Württemberg)

Würth Elektronik eiSos, our capabilities

Würth Elektronik eiSos is one of Europe's biggest manufacturer of electronic & electromechanical components

Passive Components

Optoelectronic Components

Electromechanical Components

Würth Elektronik Research & Innovation Center

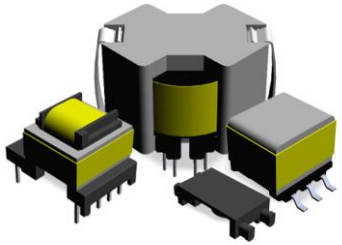
Künzelsau

Hightech Innovation Center

Munich

Automotive

Custom Magnetics



Wireless Connectivity & Sensors

Venta

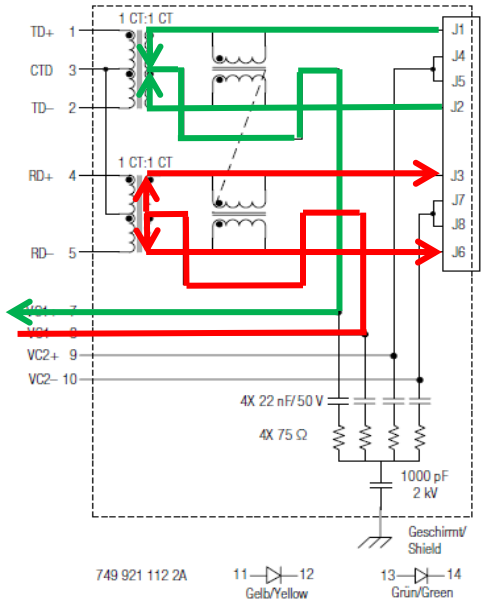
EUREKA

innovation across borders

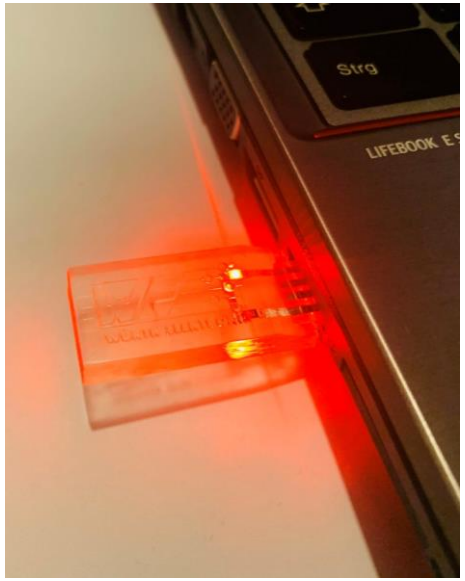
WE eiSos, our contribution to AMPERE

- Expertise in designing, simulating and testing electronic components and circuits
- Development and production of electromechanical components using 3D printing

Printed Electromechanical Components



Electronic Circuits



Hybrid Printing Technologies

Testing

AMPERE

Agenda 3rd March 2021 Online

Time	Topic	Speaker
9:00	Welcome	Ronald Dekker
9:15	Short introduction round	All
9:30	PENTA	Patrick Cogez
10:00	Project Introduction & SotA 4D printing	Martin Hedges
10:30	Break	
10:45	Partner introductions (5min each)	All
11:45	Introduction of the three use cases (15 min each)	Signify, Wűrth, Philips
12:30	Lunch	
13:30	WP1 – WP5 introduction (15 min each)	WP leaders
15:00	Break	
15:15	Dissemination & Exploitation	Ronald Dekker
15:30	Way of Working	Roger van Galen
16:00	Closure	Ronald Dekker