

Augmented Reality meets Laser-Ultrasonics

Catalysts
software is our passion

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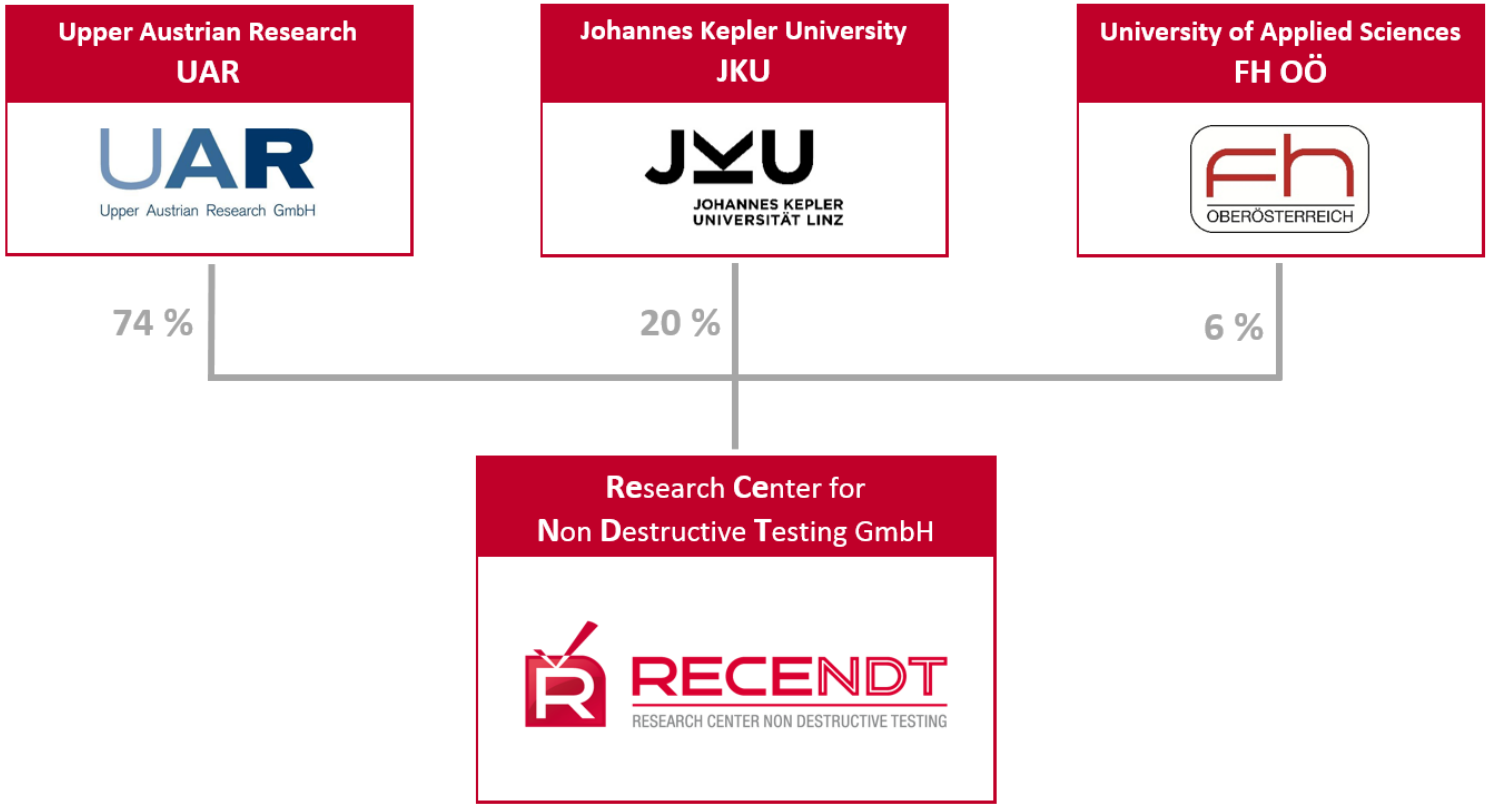
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Bernhard Reitinger

Agenda

- Introduction
  - Company
  - Laser Ultrasound @ RECENDT
- Augmented Reality
  - Idea
  - Technology
  - Software Tool
  - Example
- Conclusion

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RECENDT – Member of UAR

Member of UAR INNOVATION NETWORK

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RECENDT Research Center Non Destructive Testing

LCM Linz Center of Mechatronics GmbH

PCCL Polymer Competence Center Leoben

PROFACTOR

Pro²Future

RISC Software GmbH

scch software competence center hagenberg

TCKT Transfercenter für Kunststofftechnik GmbH

WOOD K PLUS

Partners of UAR Innovation Network

AIT Austrian Institute of Technology

CEST

Energie Institut an der Johannes Kepler Universität Linz

LIFEtool computer aided communication

FFoQSI Austrian Competence Center for Feed and Food Quality, Safety and Innovation

K1 MET metallurgical competence center

MATH Consult GmbH

mcl

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RECENDT - Research Topics

- **Laser Ultrasound (LUS) and Acoustic Emission (AE)**
  Technology for non-destructive testing of metals and carbon fibre composites
- **Photoacoustic Imaging (PAI)**
  High-resolution photoacoustic tomography with integrating detectors
- **Infrared Spectroscopy (IR)**
  method for in-line process control and quality assurance, e.g. analysis of chemical compositions
- **Terahertz Technology (THz)**
  Technology for non-destructive material characterization (imaging
  and spectroscopy) of non-conductive materials
- **Optical Coherence Tomography (OCT)**
  Technology for non-destructive characterisation of the internal structures of plastics, ceramics,…

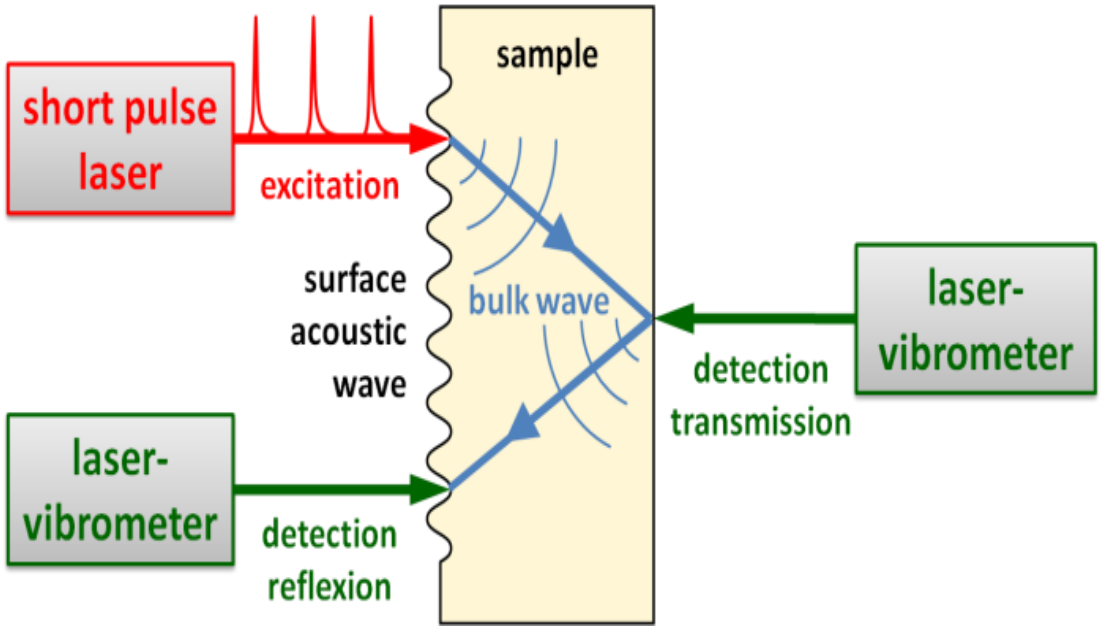


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Principle Laser Ultrasound

Laser ⇒ sudden heating of sample volume ⇒
volume expansion
⇒ Generation of broadband ultrasonic wave



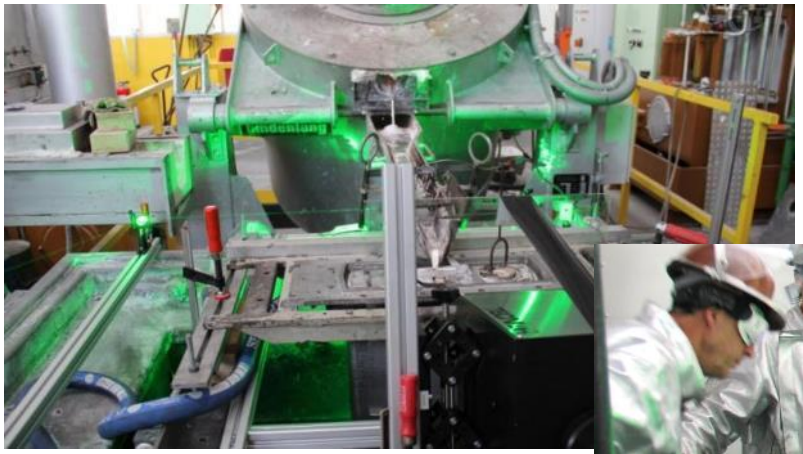
Benefits:

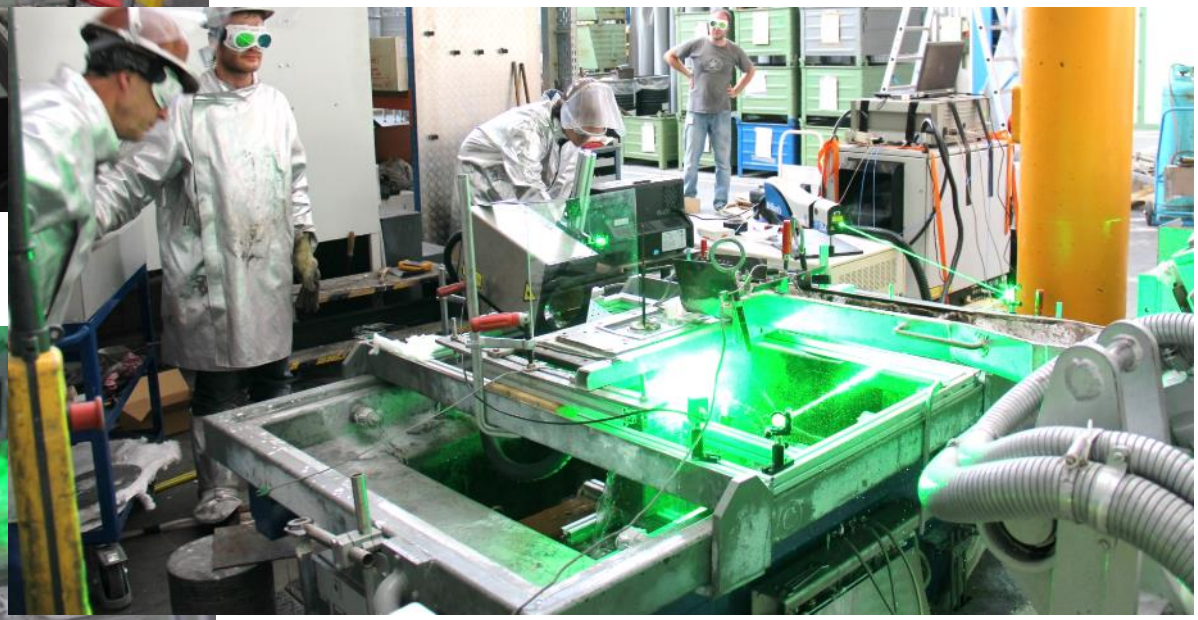
- Contactless
  - Large stand off:
    Typ: >50cm
    Max: 2m
- High bandwidth
  - Typ: 50MHz
  - Max: 700MHz
    (in our lab.)

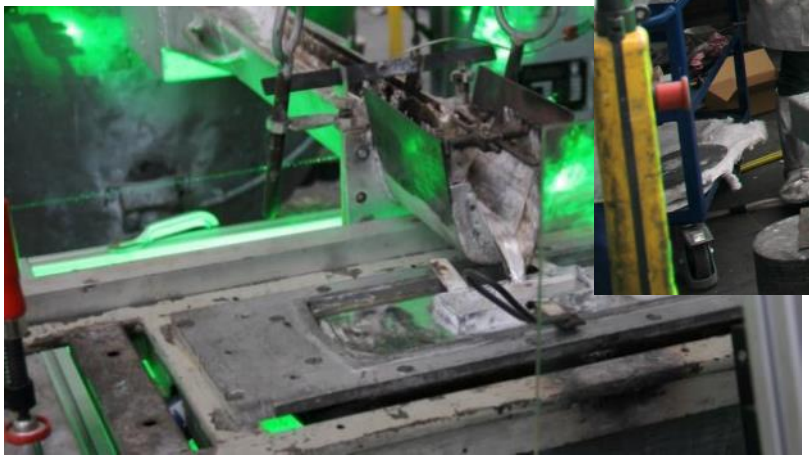
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Research at the industrial partners place
→ Aluminum

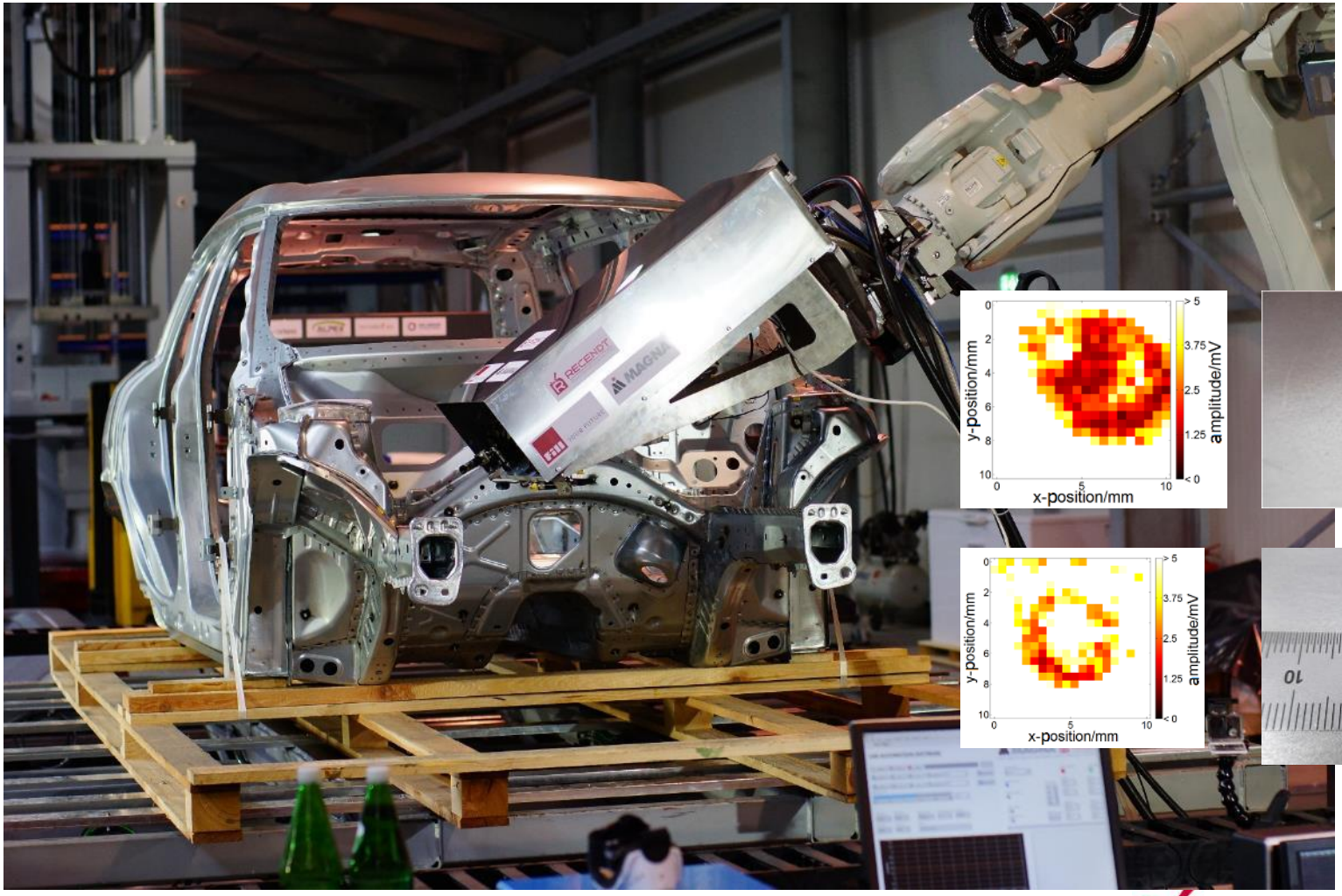






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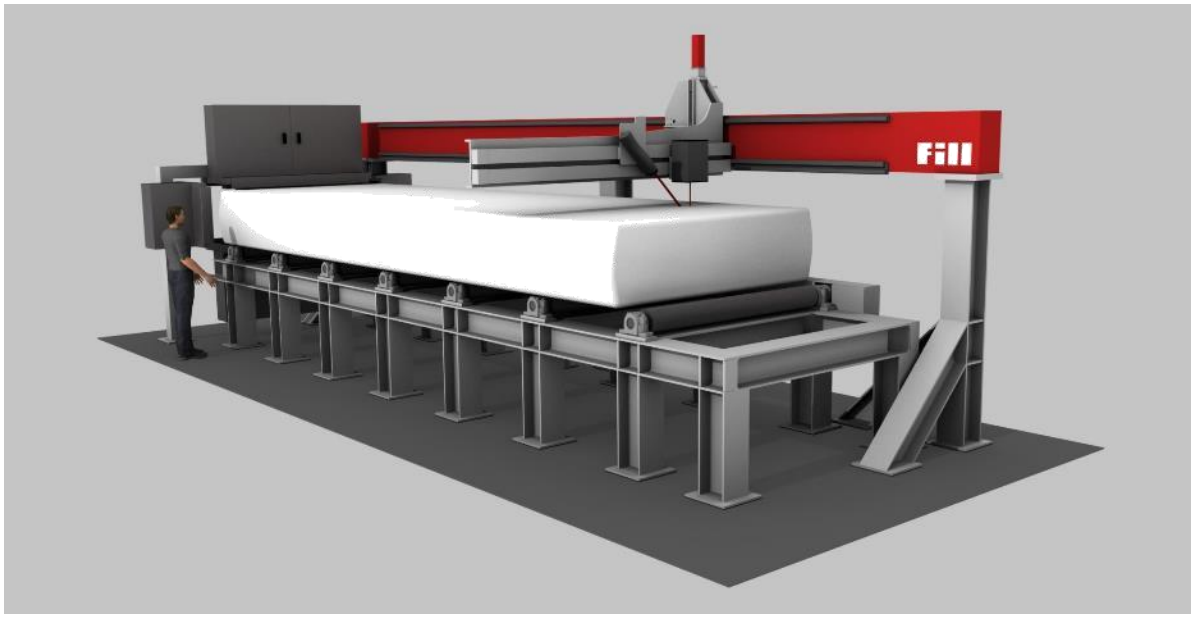
Research at the industrial partners place
→ Weld spot analysis



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Prototypes and Concepts

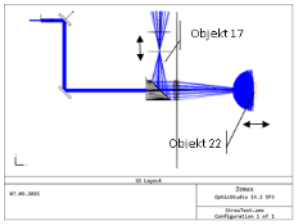


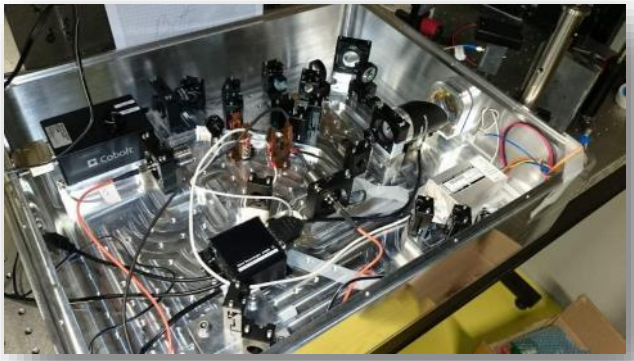


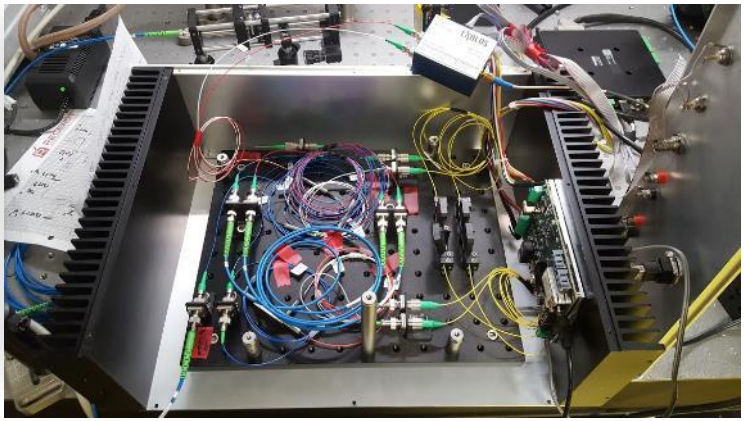


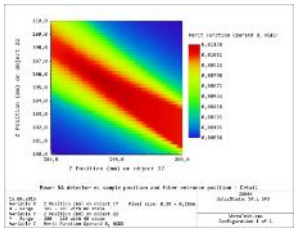
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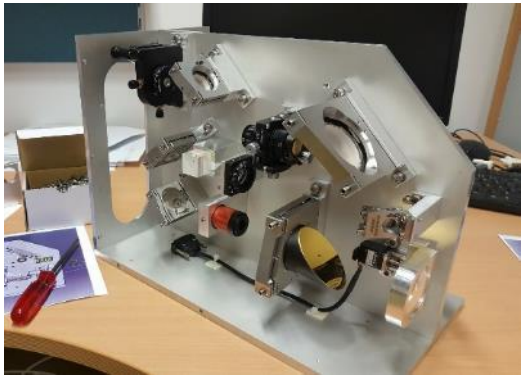
Research on detectors
Own developments

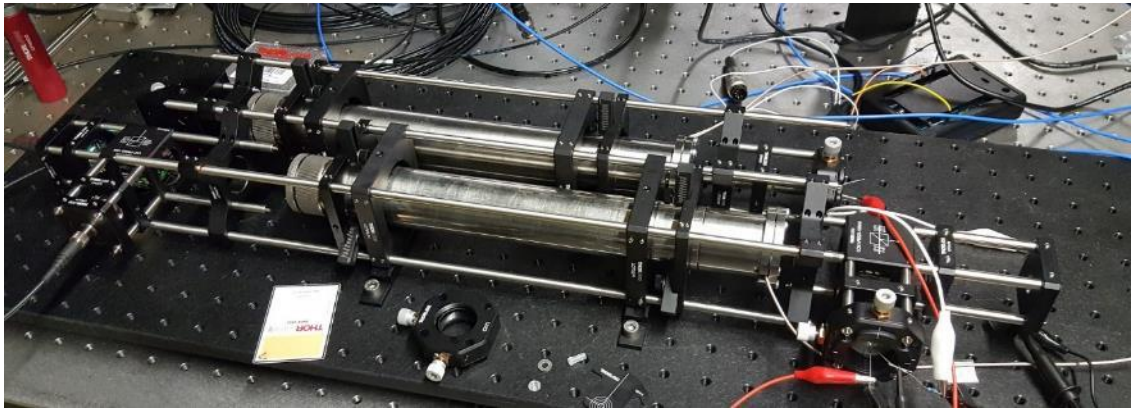












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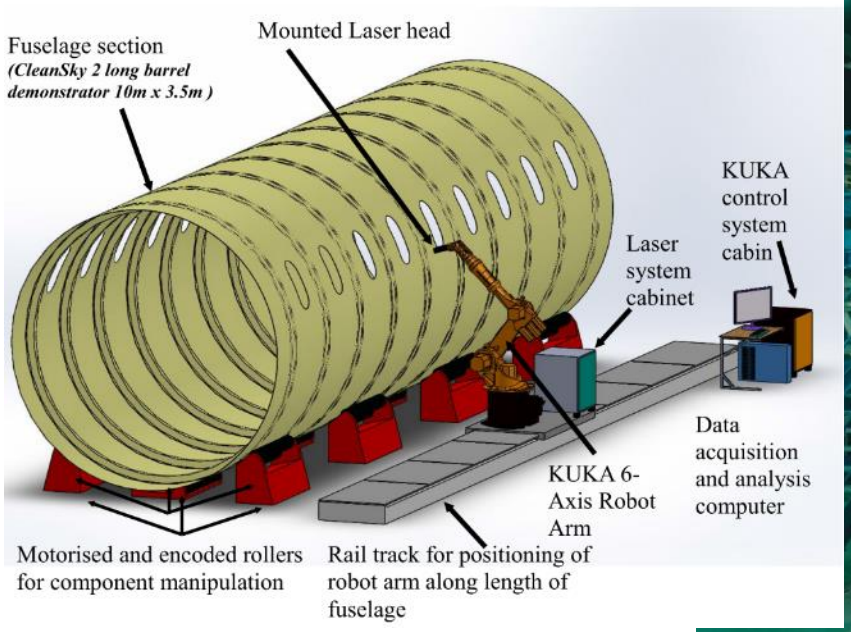
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Aurea-NDT

Augmented Reality for NDT

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Aurea-NDT Idea





Development of a low cost, low weight and **flexible LUS NDT system**
H2020 Cleansky 2 funded project **ACCURATe.**

Partners: TWI, Kuka, Innolas Laser, RECENDT

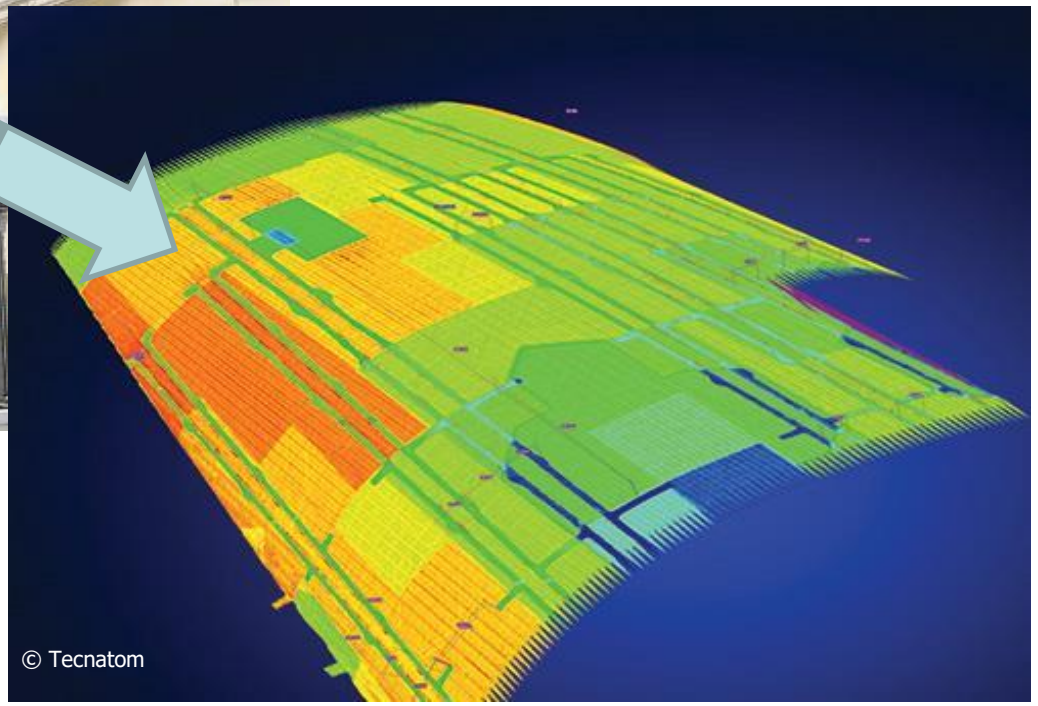
http://www.accurate-project.eu/

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Aurea-NDT





Typically NDT result is imaged on a PC screen.

Aurea-NDT / Augmented Reality



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AUREA-NDT / AR Hardware



Meta 2





Daqri Helmet / Smart Glasses



Microsoft HoloLens



ODG R9



Aryzon Headset



Magic Leap One (not tested)

Tested at AWE conference in 2017 in Munich for:

- Tracking
- Visibility
- Field of view
- Resolution
- Jitter

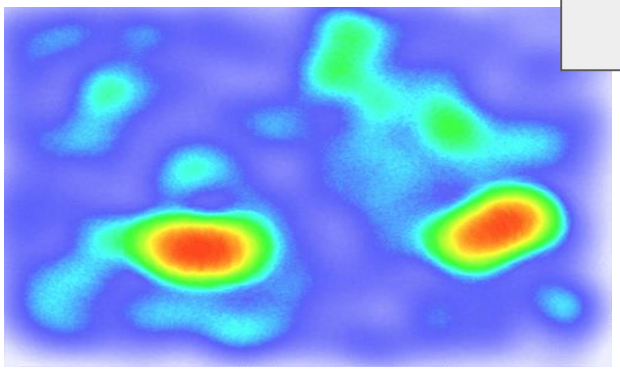
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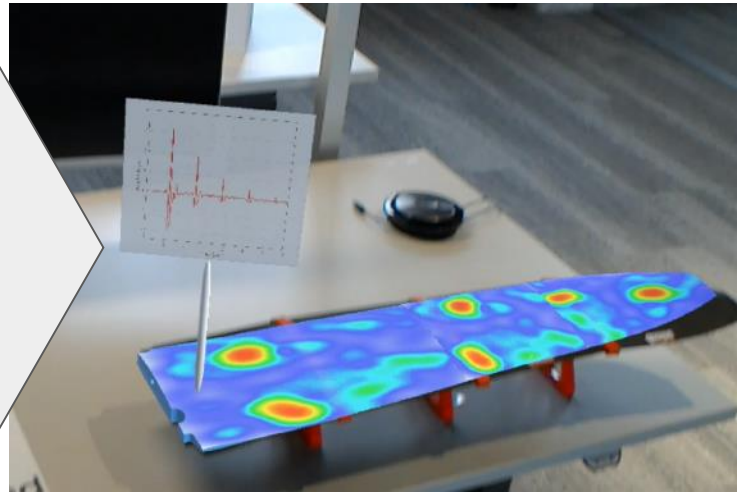
Aurea-NDT Idea

CAD Data





NDT Data



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Aurea-NDT Data Convention Multimodal approach

Data format open to different NDT technologies
(i.e. Thermography, Ultrasonics, X-Ray Tomography,…)

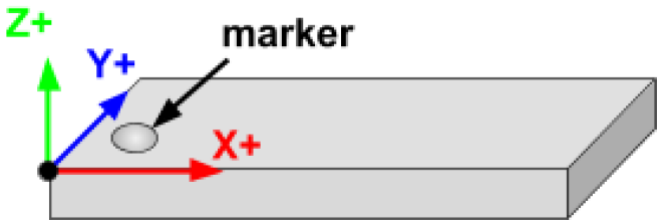
General Fields

These fields are present in both 2D and 3D data sets.

field name	data type	description
version	integer required	version of this file current value: 1
scan_type	string required	type of scan, one of (no other value allowed) 3D 2D
scan_offset	1D array of float optional	translational offset along each axis (in positive direction) of this relative to the point of origin of the physical object MAY be 2 or 3 elements long. MUST NOT contain NaN's or inf's.

Fields for scan type "3D scan"

field name	data type	description
data	3D array of float required	MUST NOT contain NaN's or inf's. the actual scan data indexed as [x,y,z]
resolution	1D array of float required	MUST be 3 elements long MUST NOT contain NaN's or inf's. size of one data point along the [x,y,z] axis given in mm.

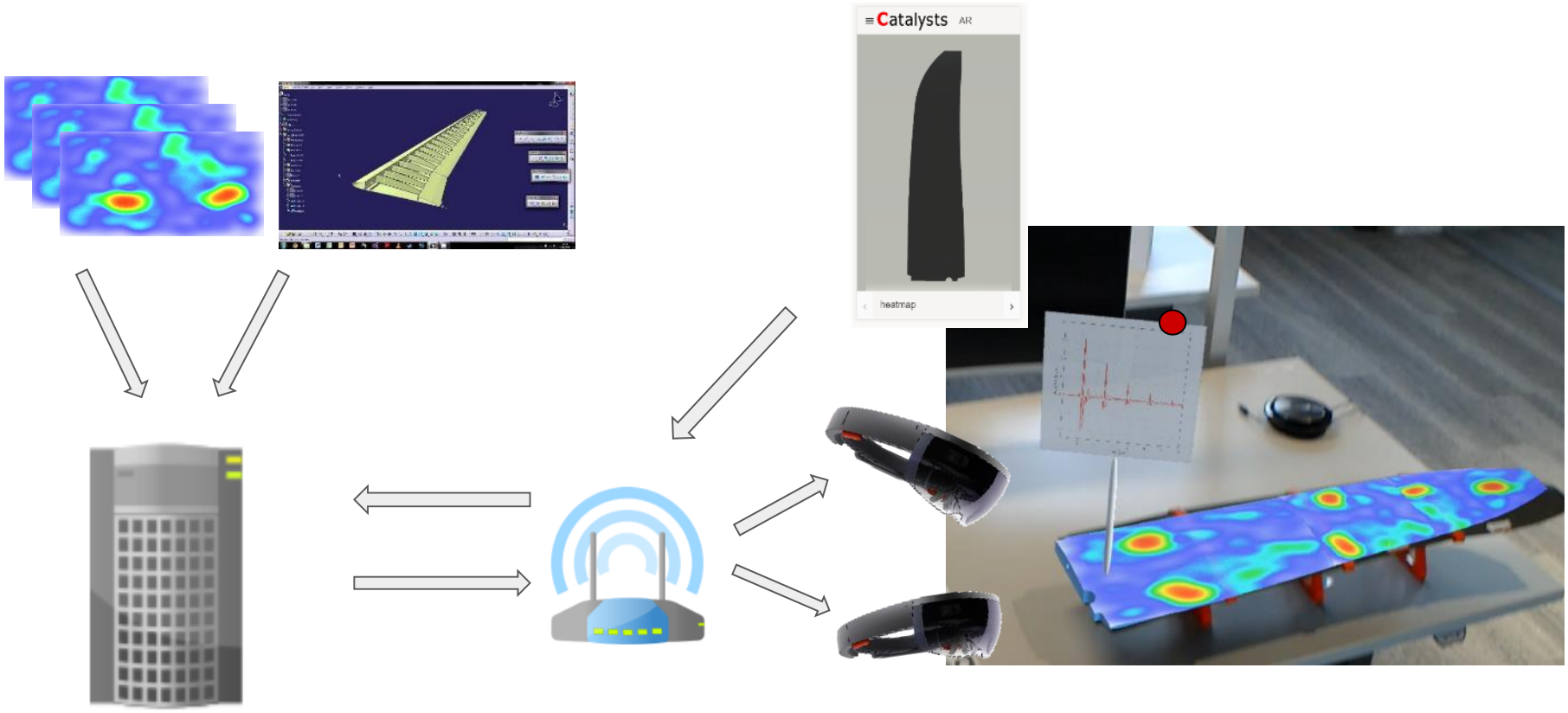


Fields for scan type "2D scan"

field name	data type	description
data	2D array of float required	the actual scan data indexed as [x,y]. MUST NOT contain NaN's or inf's
resolution	1D array of float required	MUST be 2 elements long MUST NOT contain NaN's or inf's. size of one data point along the [x,y] axis given in mm.

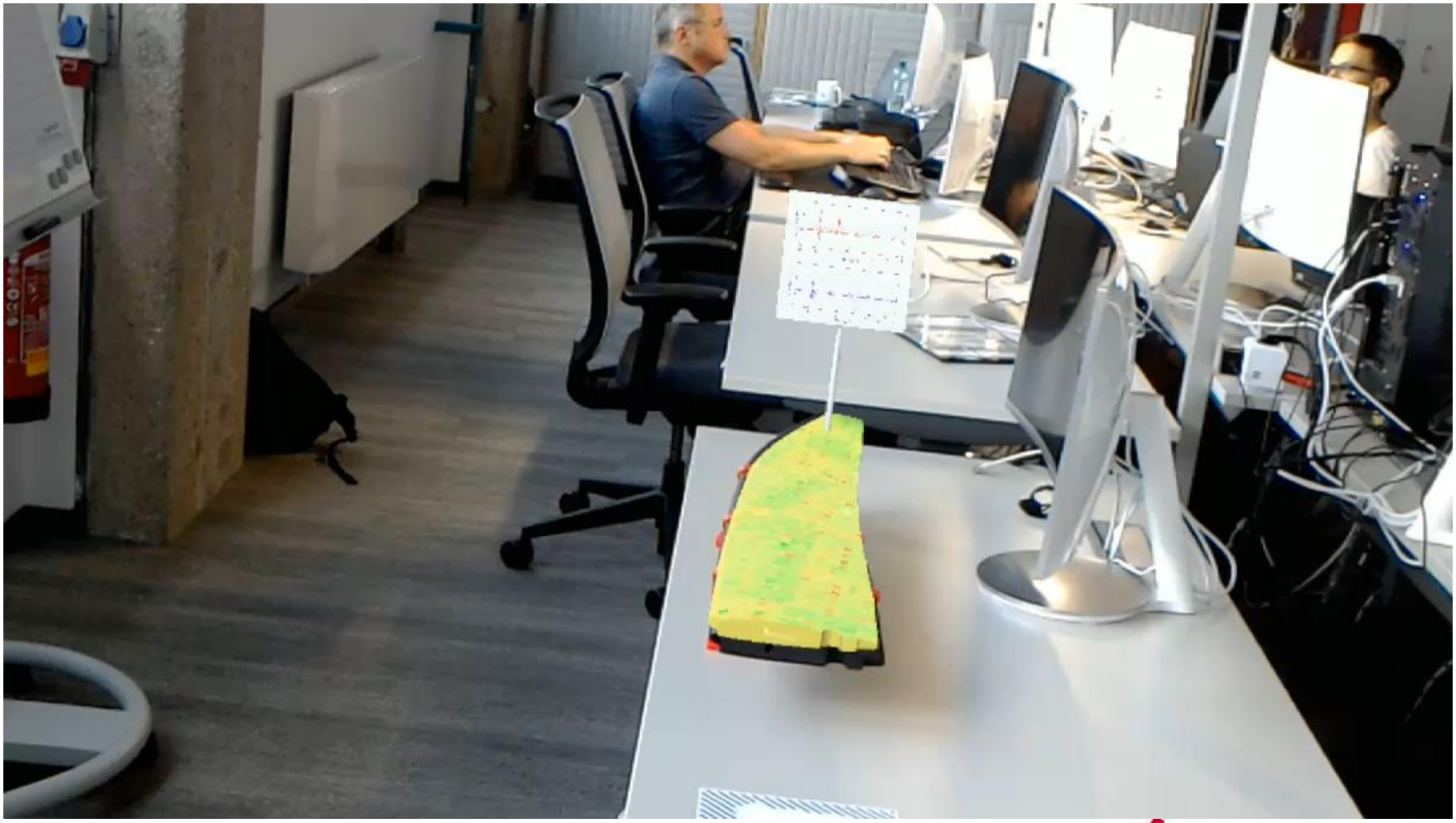
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Aurea-NDT Hardware Topology



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Aurea-NDT / Preview
Microsoft HoloLens



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Aurea-NDT / Preview
Mobile (Android)



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Conclusion

- Within the Aurea-NDT project a fully flexible Software is developed
- The software is open for almost every NDT technology which produces images (volumes)
  - Open data format: 3D or 2D data, HDF5 format
- AR Technology at the moment needs better tracking
  - Second generation of Hololens available in **????**
  - Developing for the future!!!
- First preview with Low cost AR with Android
  - (much faster Hardware and Software evolution)

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Vision

We're looking into it!

„It is our mission
to gain insight into **materials, substances** and **processes** in **novel and non-destructive ways**."

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