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# Novel thermography solutions for NDT on metal parts

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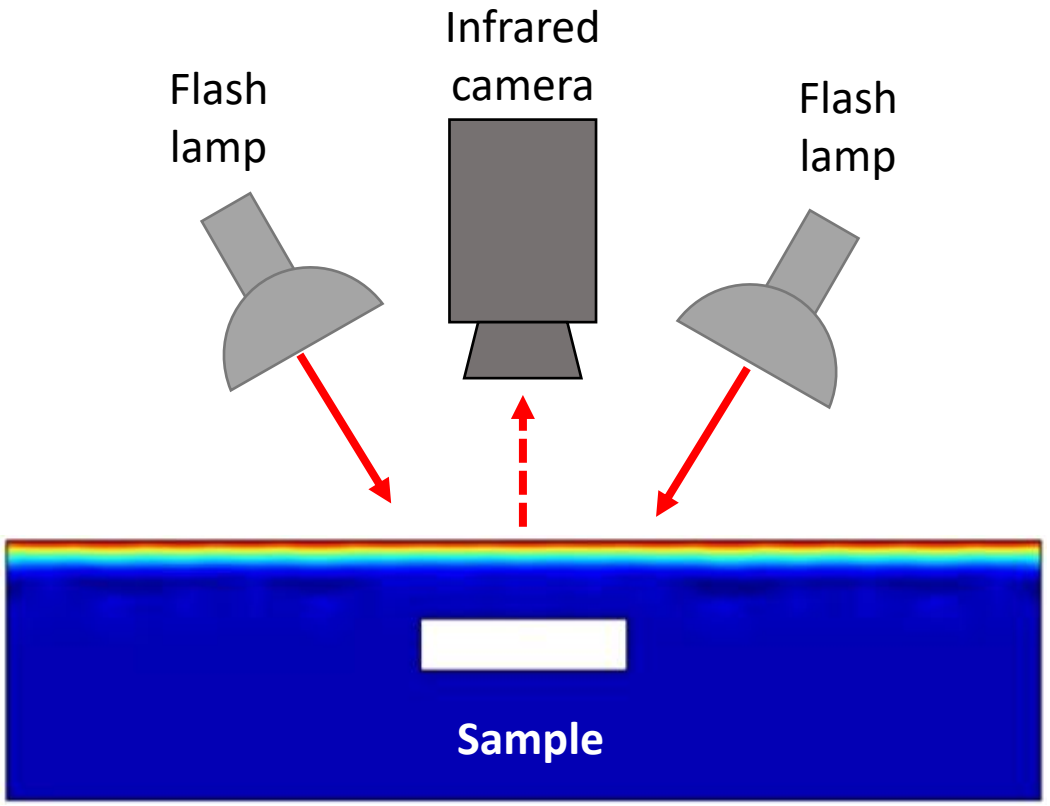
# Overview

- Active Thermography – A brief overview
- Fast temperature changes: Thermography & metals
- Application examples
- Contact
  Acknowledgements

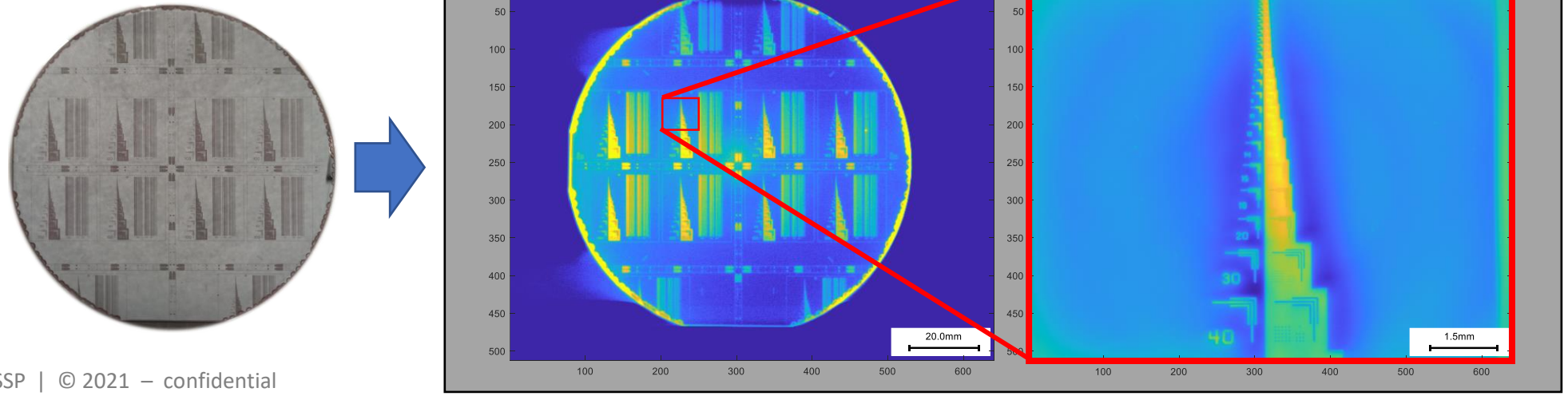
# Active Thermography

- **Principle:**
  - Thermal excitation + Imaging-based thermal sensing
- **Applications:**
  - Detection of hidden defects
  - Characterization of material properties
- **Advantages:**
  - Non-destructive
  - Non-touching
  - Imaging-based → large areas can be observed
  - Radiation in a harmless spectral range



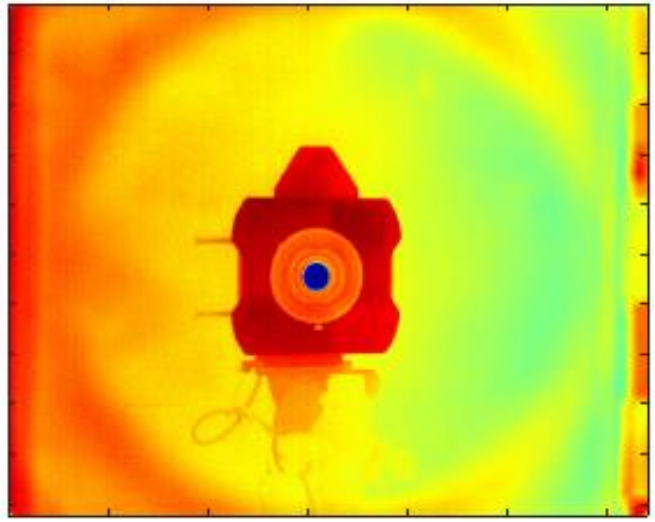
# Active Thermography

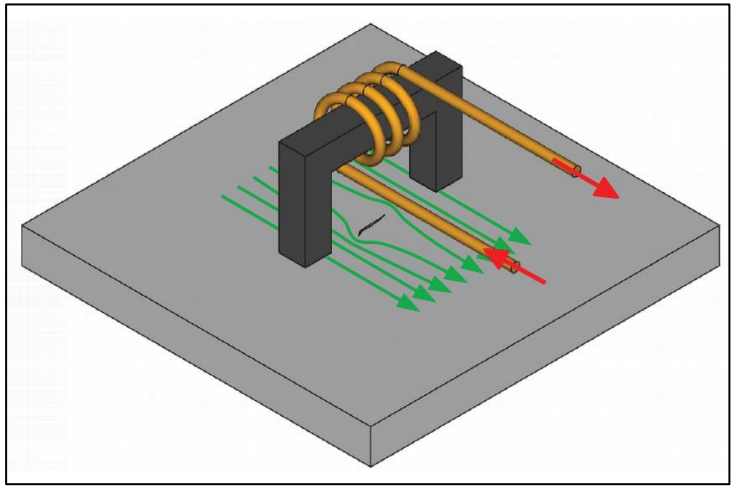
- Various techniques for thermal excitation:
  - Optical excitation (e.g. laser, flash lamps, halogen lamps)
  - Ultrasonic excitation
  - Eddy current excitation
- Scientific grade infrared cameras:
  - Megapixel sensors
  - High-speed frame rates (1kHz full frame; up to 29kHz in subwindow mode)
  - Spatial resolutions down to 5µm/pixel

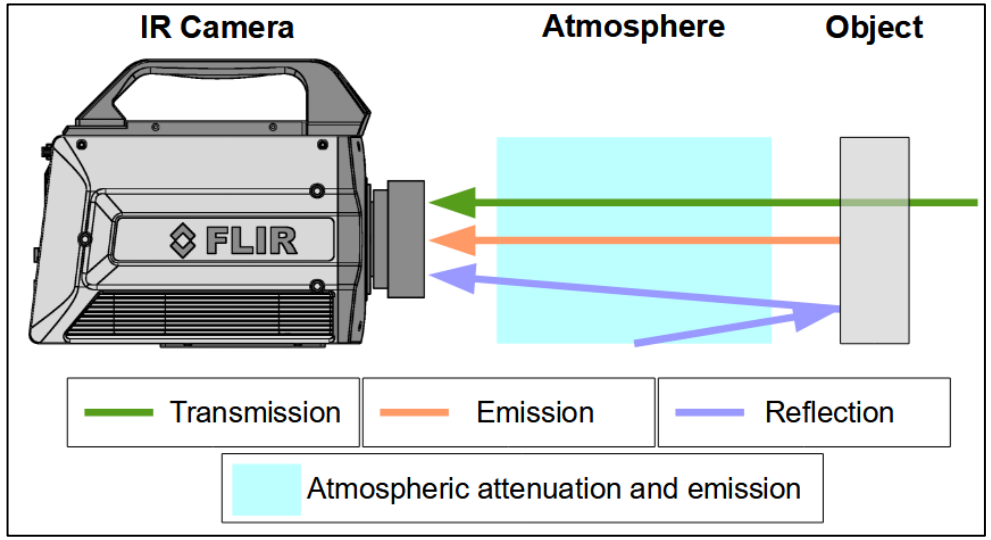


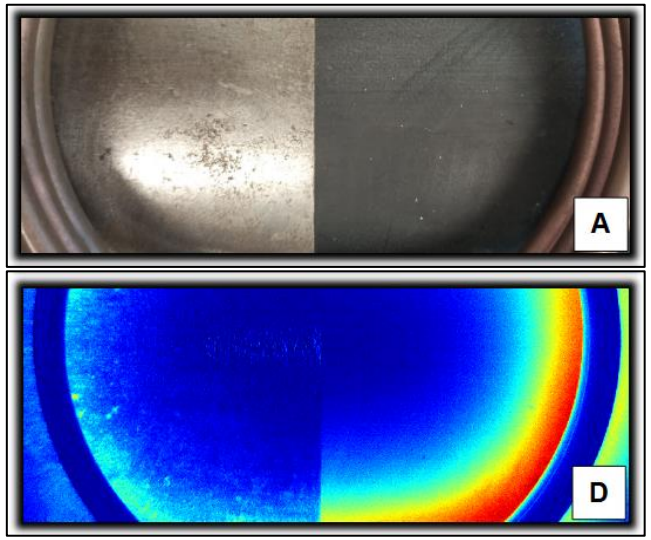
# Thermography & Metals

- **Key aspects:**
  - Thermal excitation:
    - Low surface absorbance → Low energy input (optically)
  - Thermal sensing
    - Low surface emissivity → Less temperature-based emissions
    - Reflective surface → Interfering environmental reflections
    - High thermal diffusivity → Fast diffusion processes



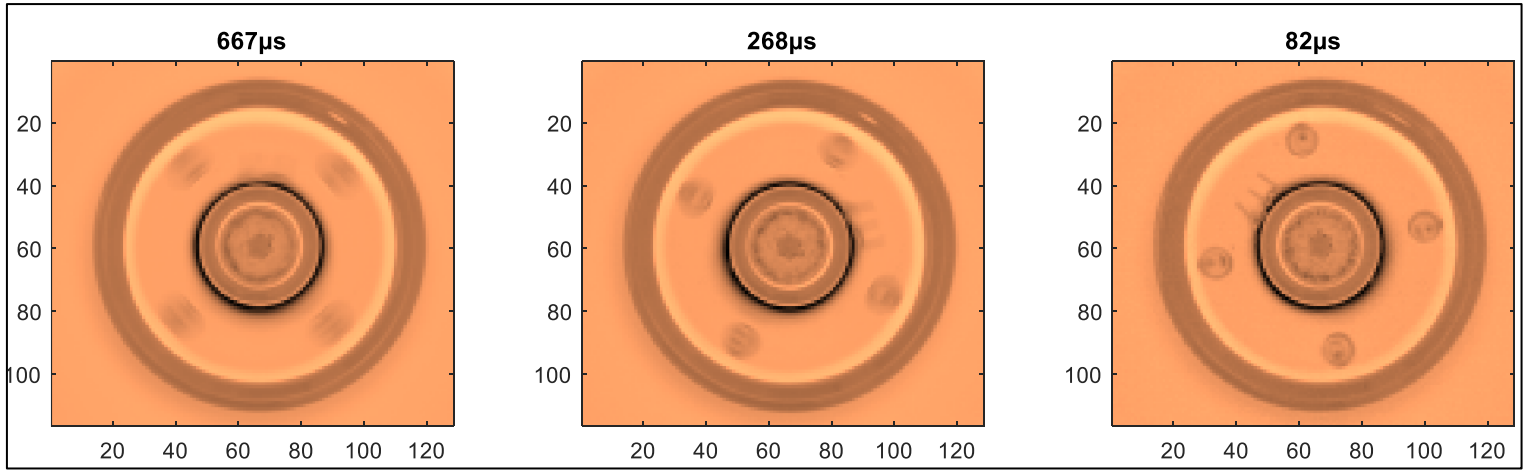


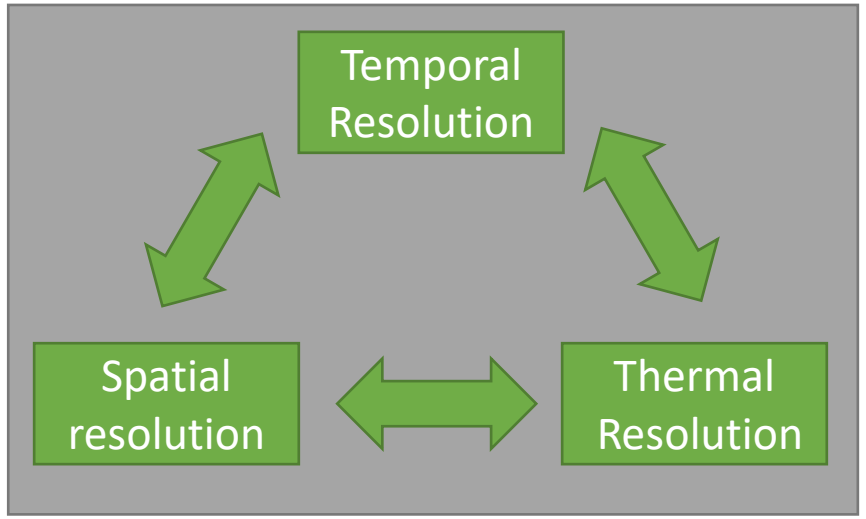


# Thermography & Metals

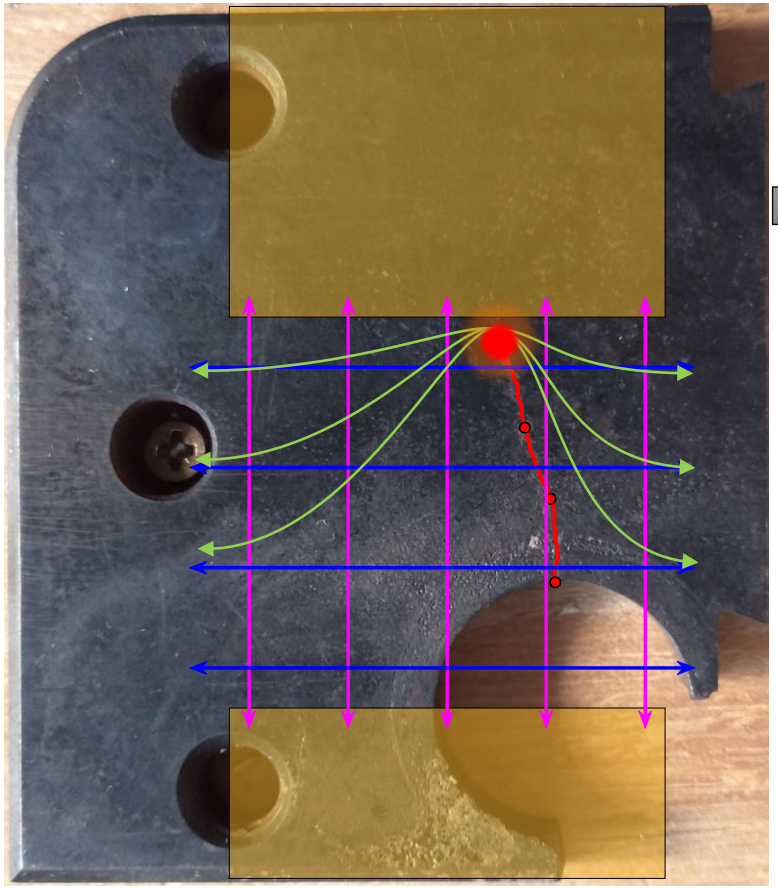
- Metrological aspects:
  - Conflicting measurement parameter

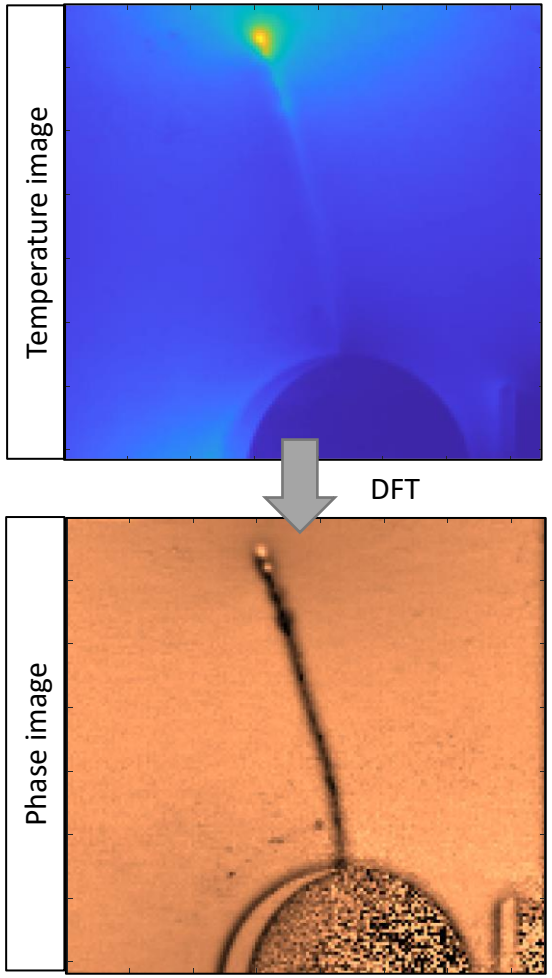


# Applications

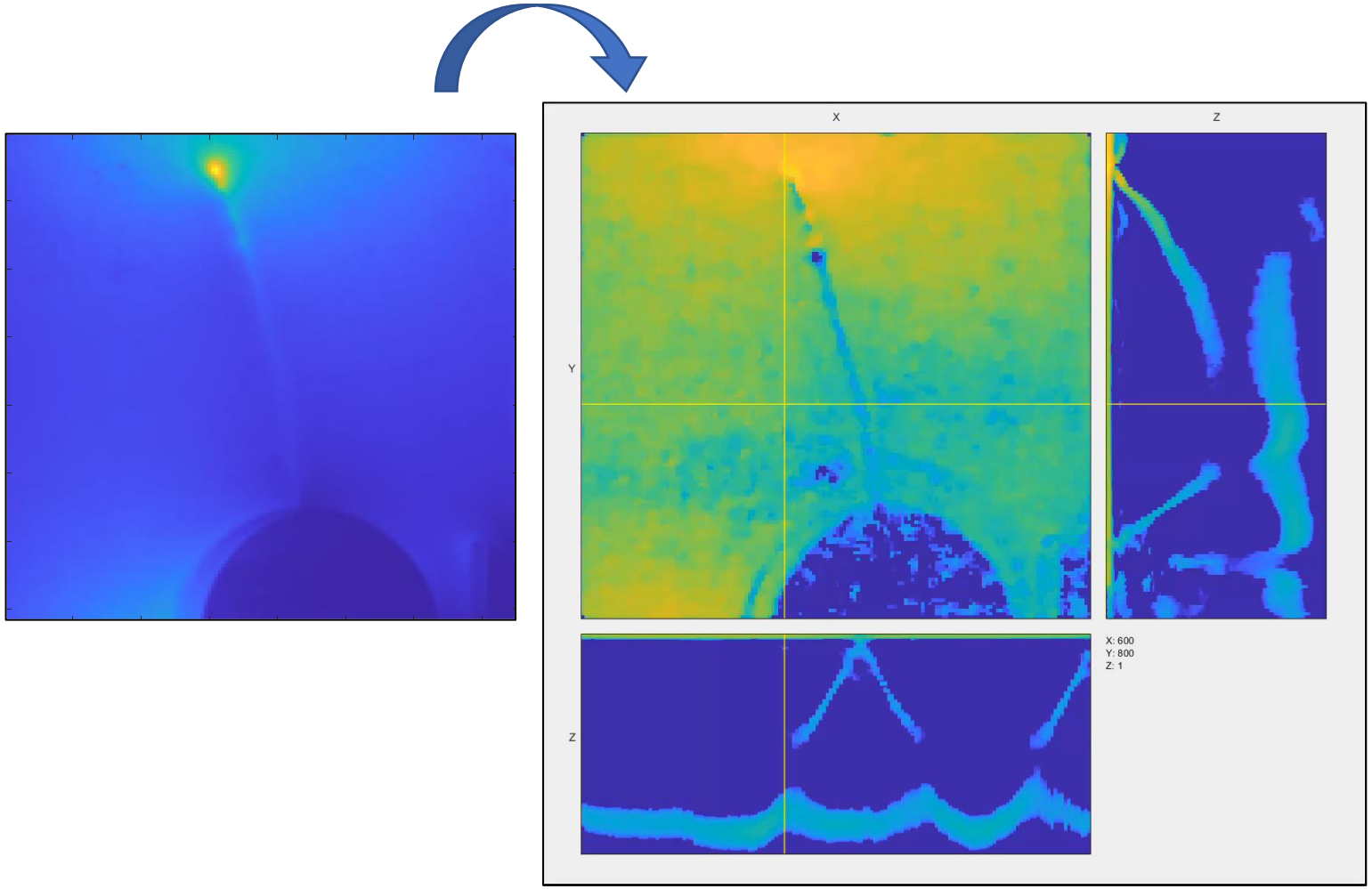
- Eddy current thermography
- Stationary investigation of a crack
- Defect segmentation using phase images





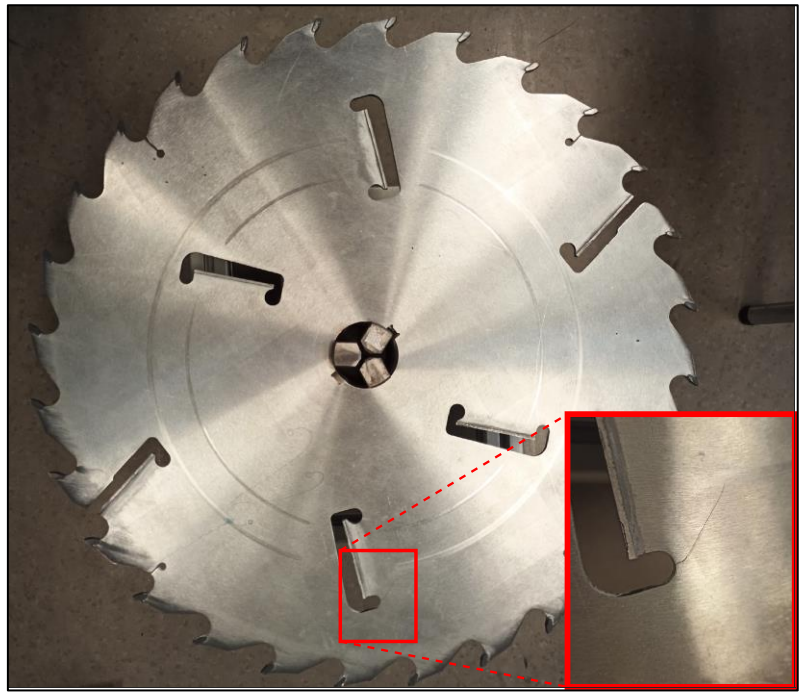
# Applications

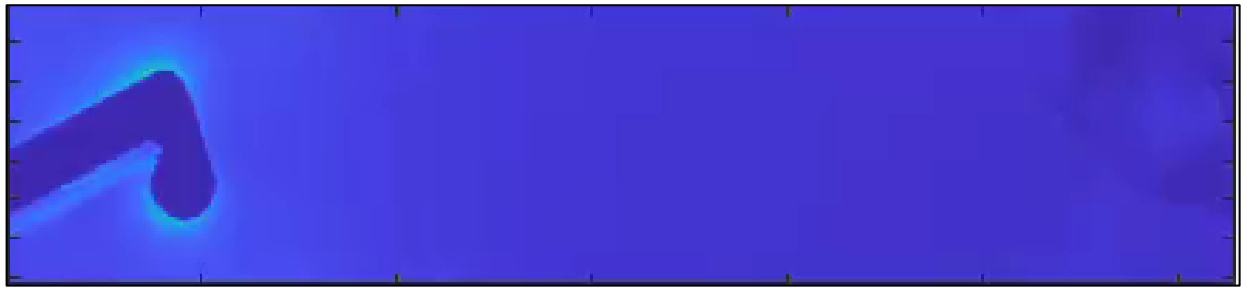
- Novel evaluation method: Virtual Wave Concept (VWC)
  - Visualization of the heat propagation
  - Determination of the thickness or the thermal diffusivity



# Applications

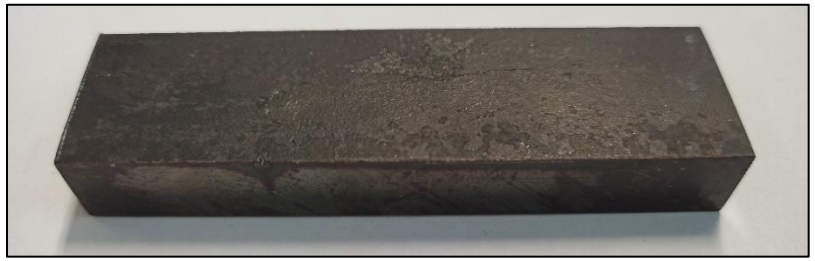
- Eddy current thermography
- Contrast-based defect detection

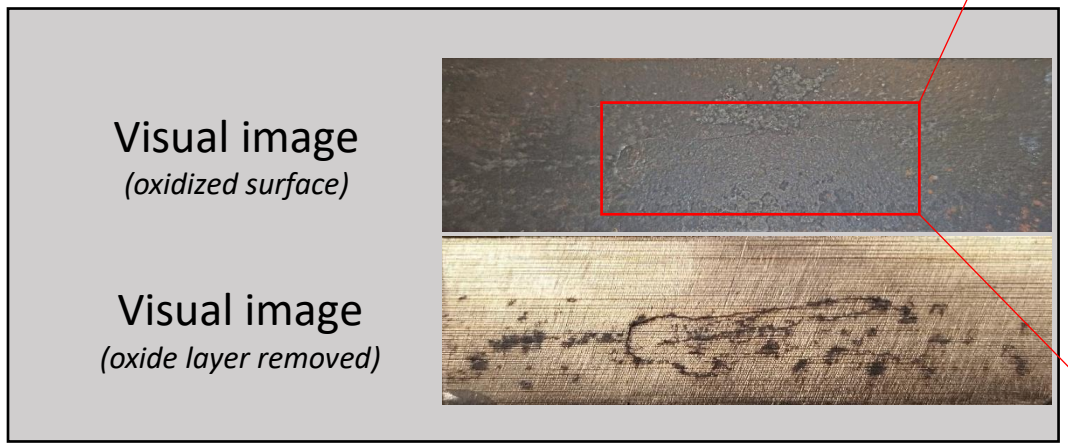


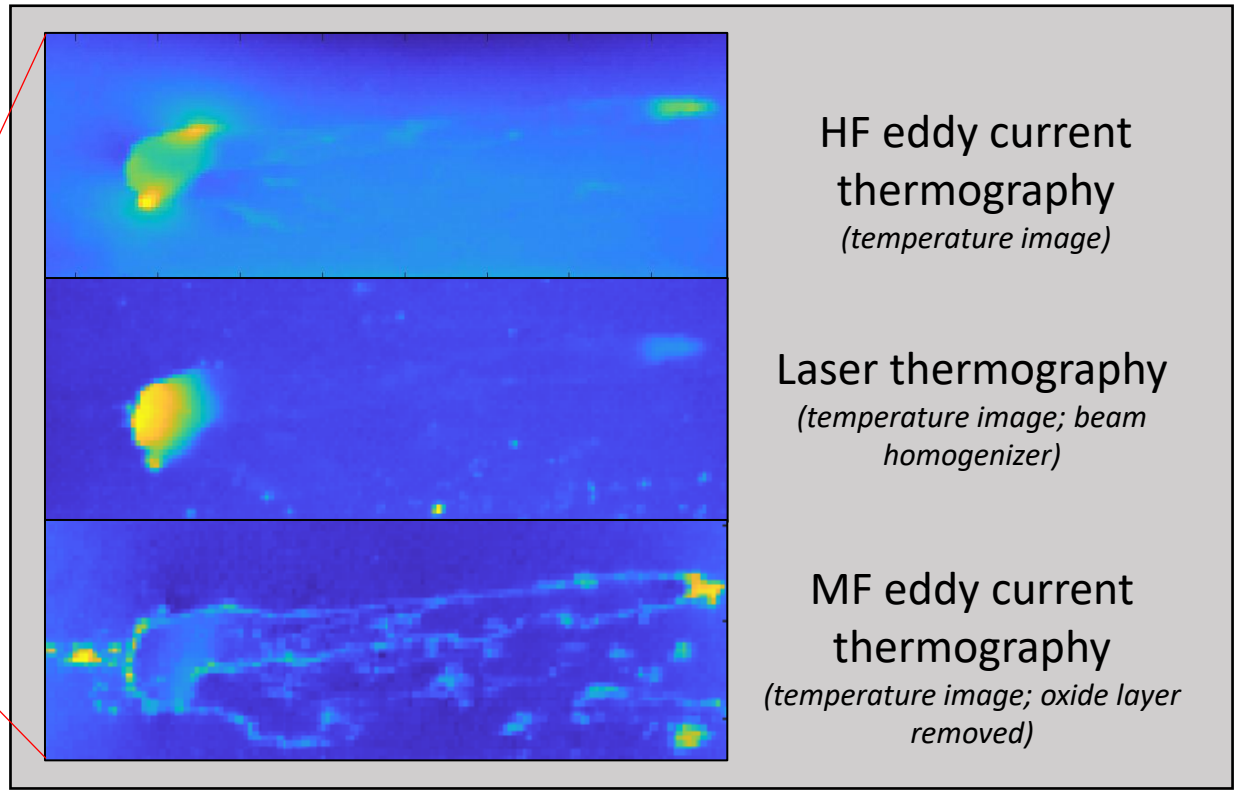


# Applications

- Sample: Steel slab with a rolling defect
- Inspected using laser thermography, eddy current thermography, and X-ray CT

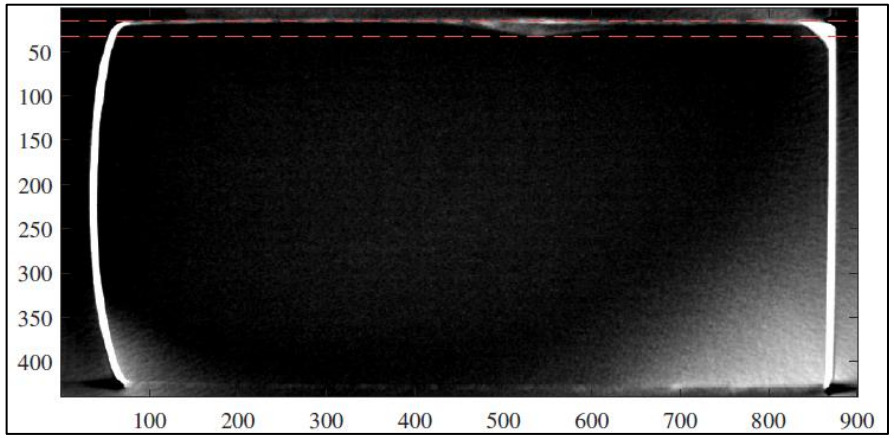


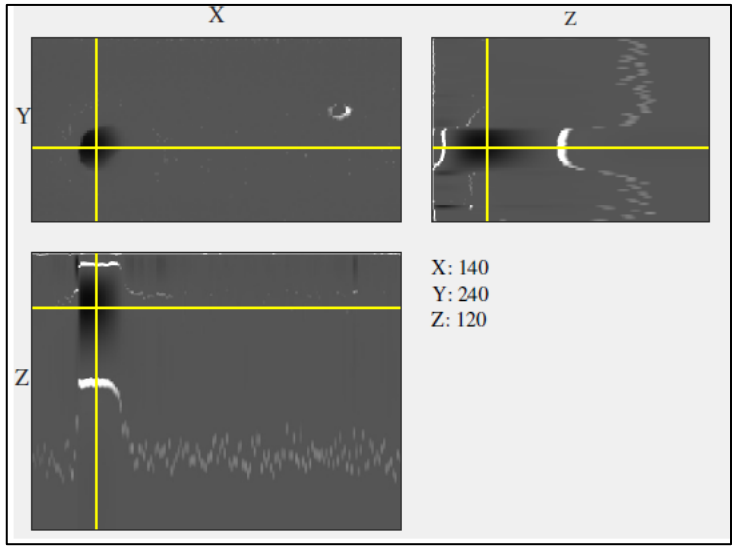


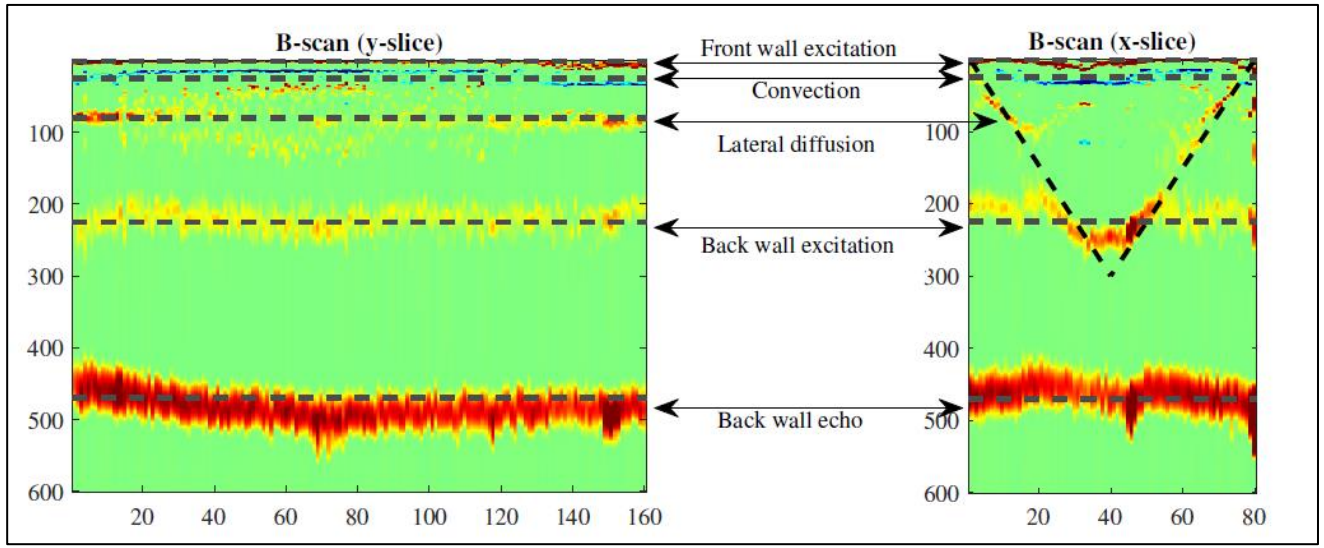



# Applications

- Determination of the defect depth using the VWC-method



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# Acknowledgements

*PSSP ist ein Projekt im Kompetenzzentren-Programm COMET der FFG und wird aus Mitteln der Bundesministerien BMK und BMDW und aus Mitteln vom Land Oberösterreich und Land Steiermark (vertreten durch die Steirische Wirtschaftsförderungsgesellschaft m.b.H. - SFG) gefördert.*