FIG WORKING WEEK 2025
AND Locate25 THE NATIONAL GEOSPATIAL CONFERENCE
Collaboration, Innovation and Resilience: Championing a Digital Generation
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Underwater Laser Scanning: Integration and Testing in different environments

M.Sc. Annika L. Walter
annika.walter@hcu-hamburg.de

Annika L. WALTER, Ellen HEFFNER, Annette SCHEIDER and Harald STERNBERG

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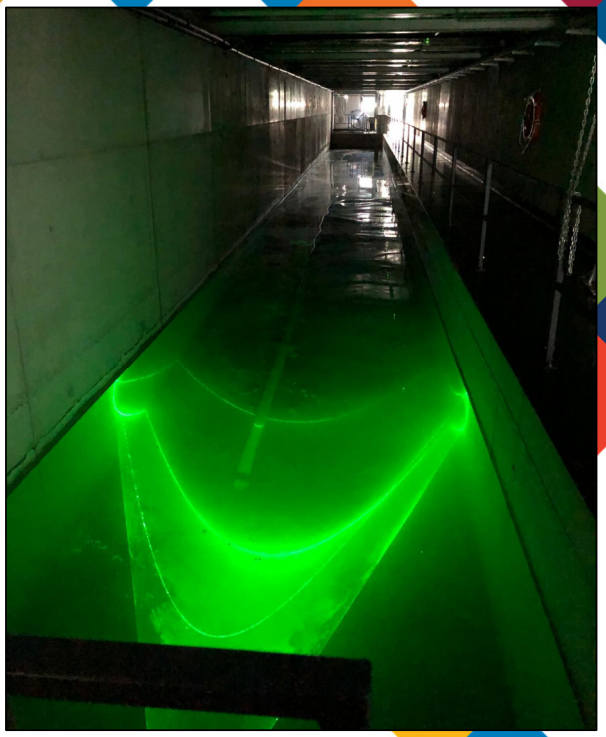
Motivation - Advantages of the new underwater laser scanner

- Higher accuracy and resolution in comparison to acoustic instruments
  - Precision in the range of submillimeters
  - Sensor outperforms conventional sonar systems by a factor of 10
  - More accurate and detailed capture of objects
- Usage of ToF
  - Range in turbid waters is three times larger compared to other optical systems
- Delivers a full waveform
  - Derivation of more information compared to a single pulse return
  - Habitat Mapping, detection and analysis of underwater vegetation etc.

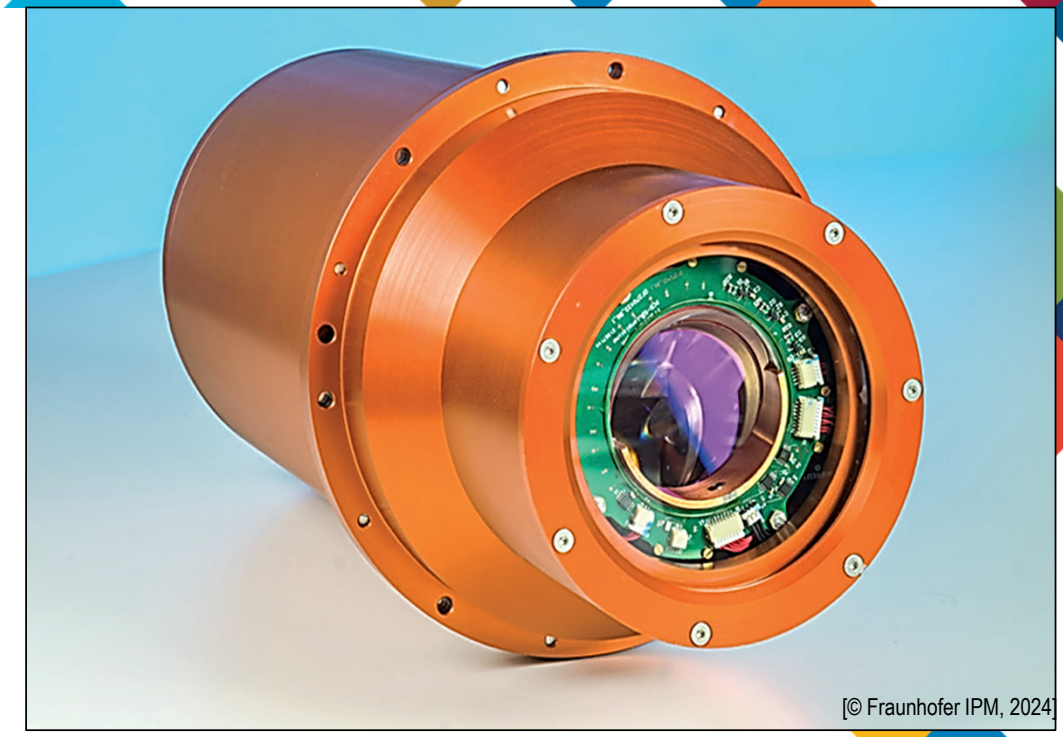
→ Testing the performance in different water bodies (turbidity)



Sensor Technology - ULi

Scanning Unit

- Depth of up to 300 m
- Green laser (λ = 532 nm)
- 2 rotating wedge prisms
- 44 ° FoV
- Pulse repetition rate of 100 kHz
- Linear, Circular, Planar



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Sensor Technology - ULi

Processing Unit

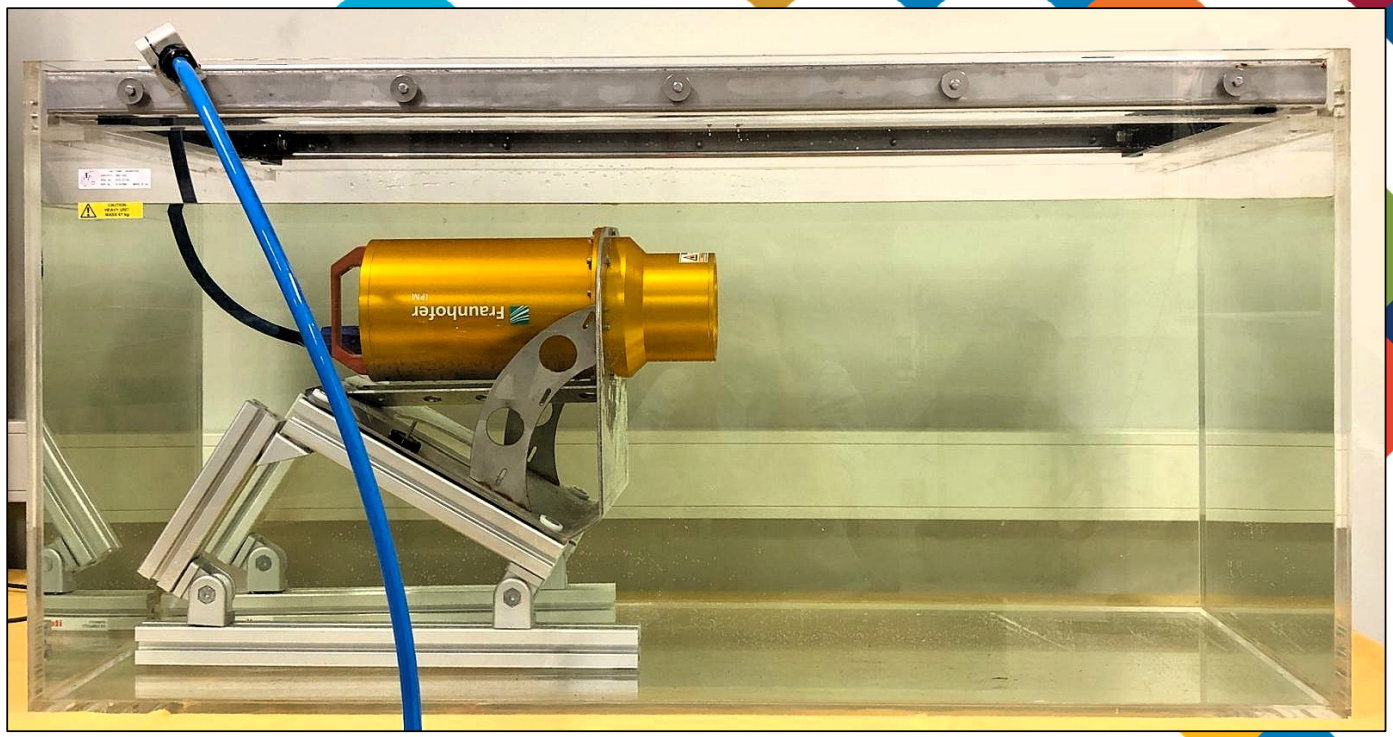
- Backside with 4 cable connection inputs:
  - 1 x Pressure Sensor
  - 1 x 24 V Power Supply
  - 1 x Ethernet to Switch
  - 1 x Proprietary blue cable to the sensor for power supply and data transmission

- Frontside with:
  - Pressure Switch
  - Lock to start the scanner in 3B mode
  - Laser On Lamp
  - Power OFF / ON switch

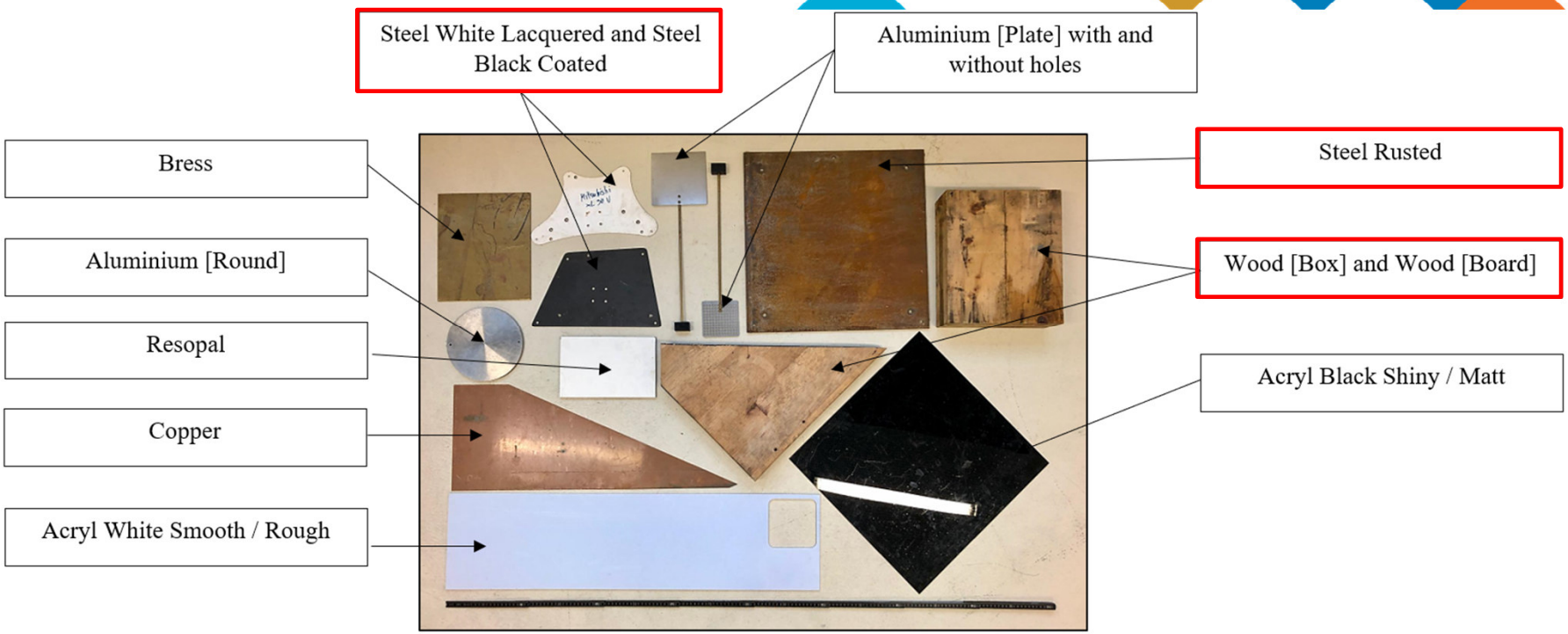
Test Environment - Test Basin

Laboratory Environment

- 1.2 m x 0.6 m x 0.6 m
- Water Level = 0.45 m
- Distance = 0.56 m
- Clear Water with T = 0.00 NTU

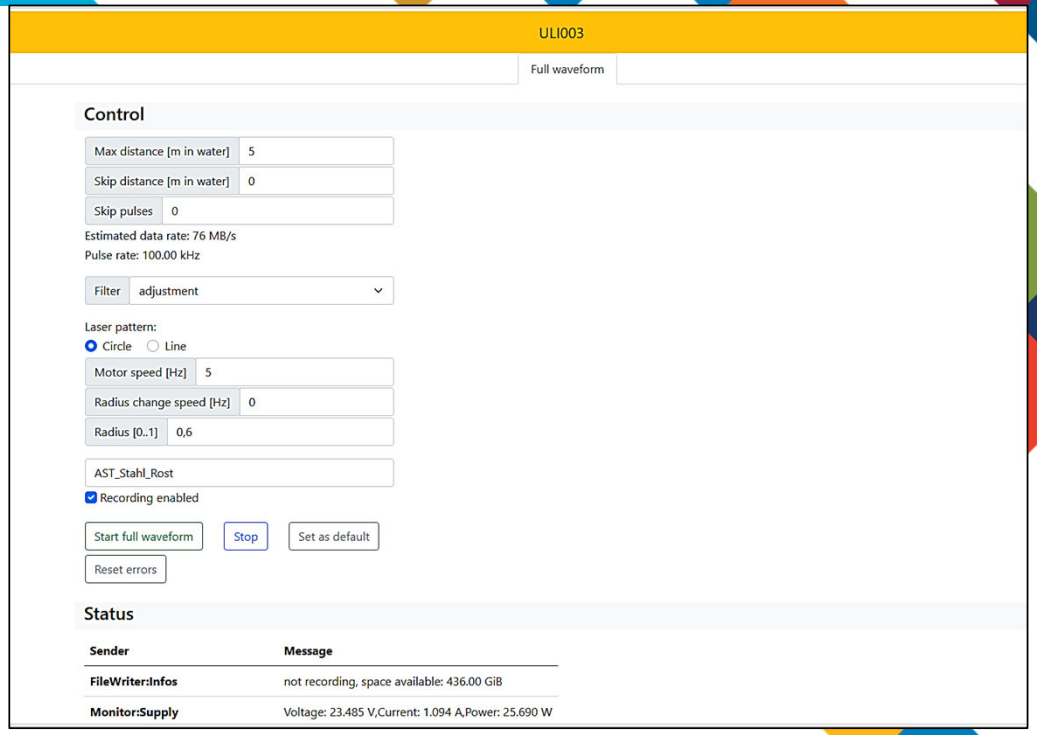


Test Environment - Targets



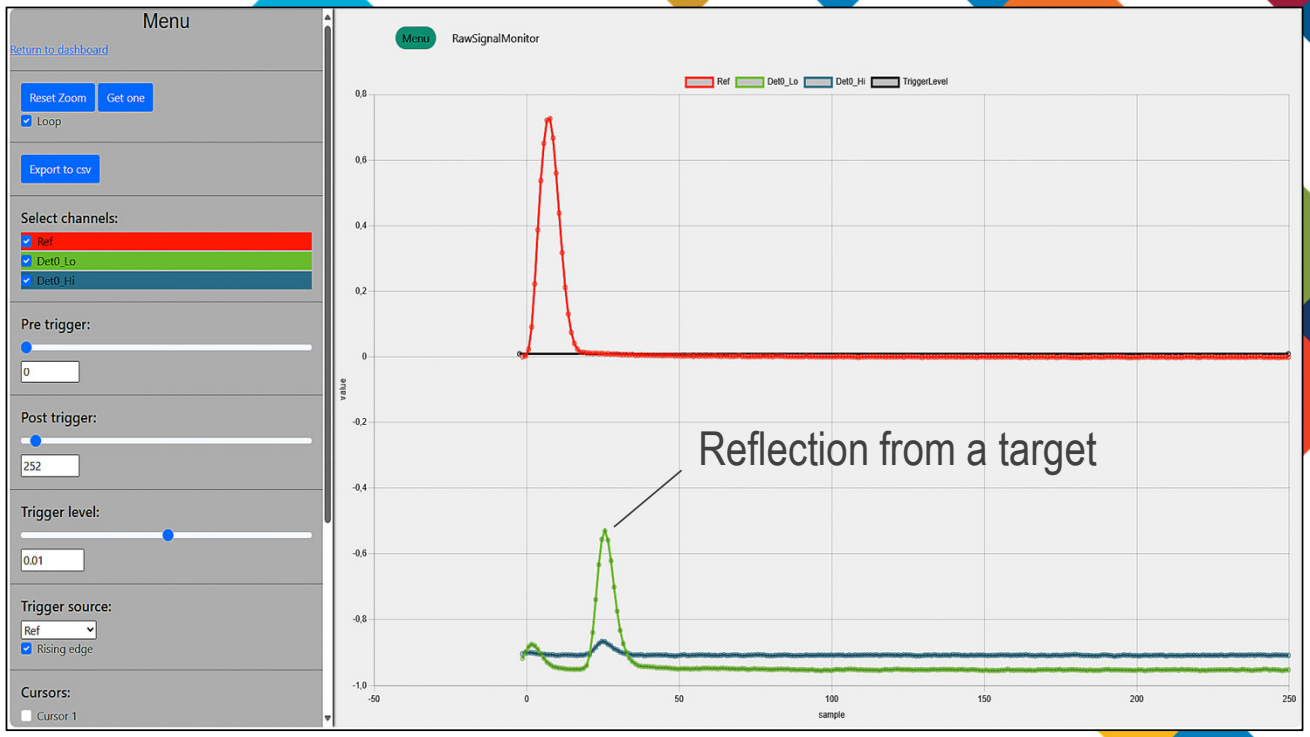
Test Environment - Data Acquisition

- Colour Bar indicates the status of the Laser
- Specify certain parameters i.e. max distance
- Select Filter Mode:
  - Adjustment (Laser class 2 M)
  - Medium (Laser class 3 B)
  - None (Laser class 3 B)
- Set the Laser Pattern:
  - Circular
  - Linear
  - Planar
- Start / Stop / Record the measurement



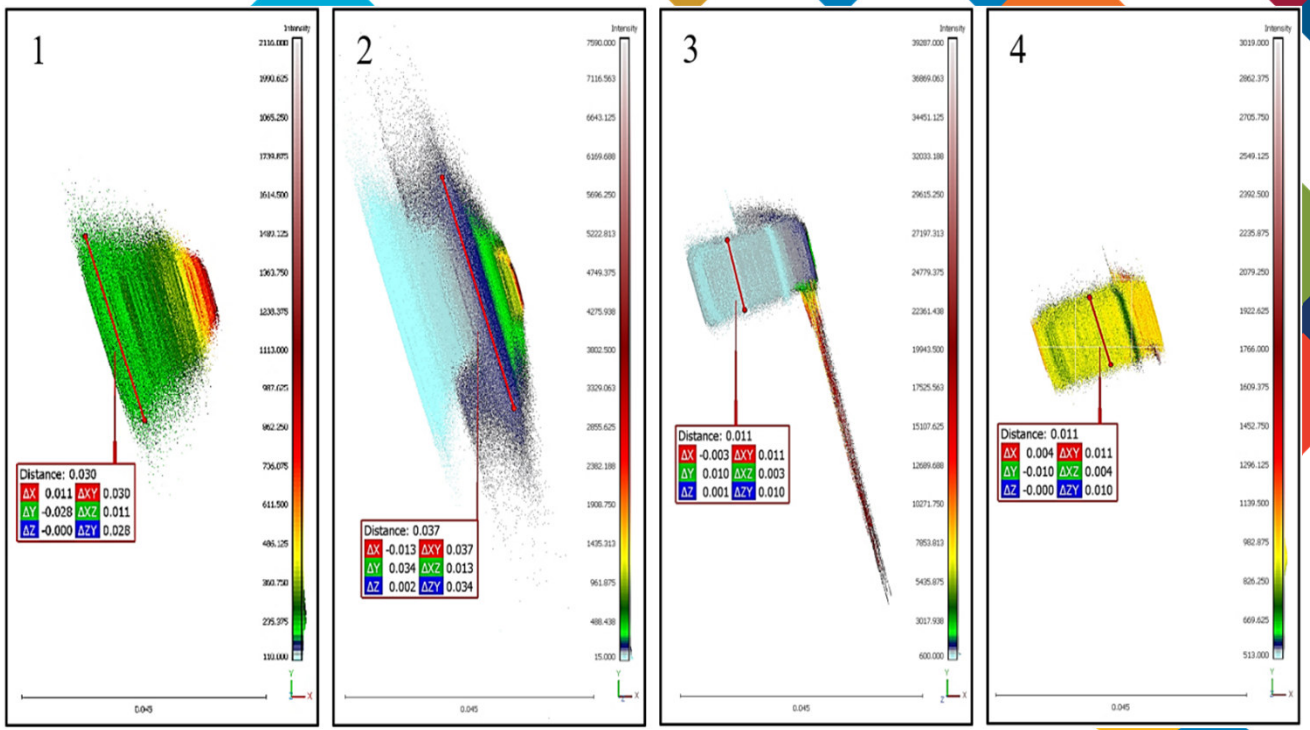
Test Environment - Data Acquisition

- Raw Signal Monitor
- Displayed Signals:
  - Red:
    Internal Reference Signal
  - Blue:
    Less sensitive channel
  - Green:
    Sensitive channel:
    Attenuation of the
    signal by factor 10

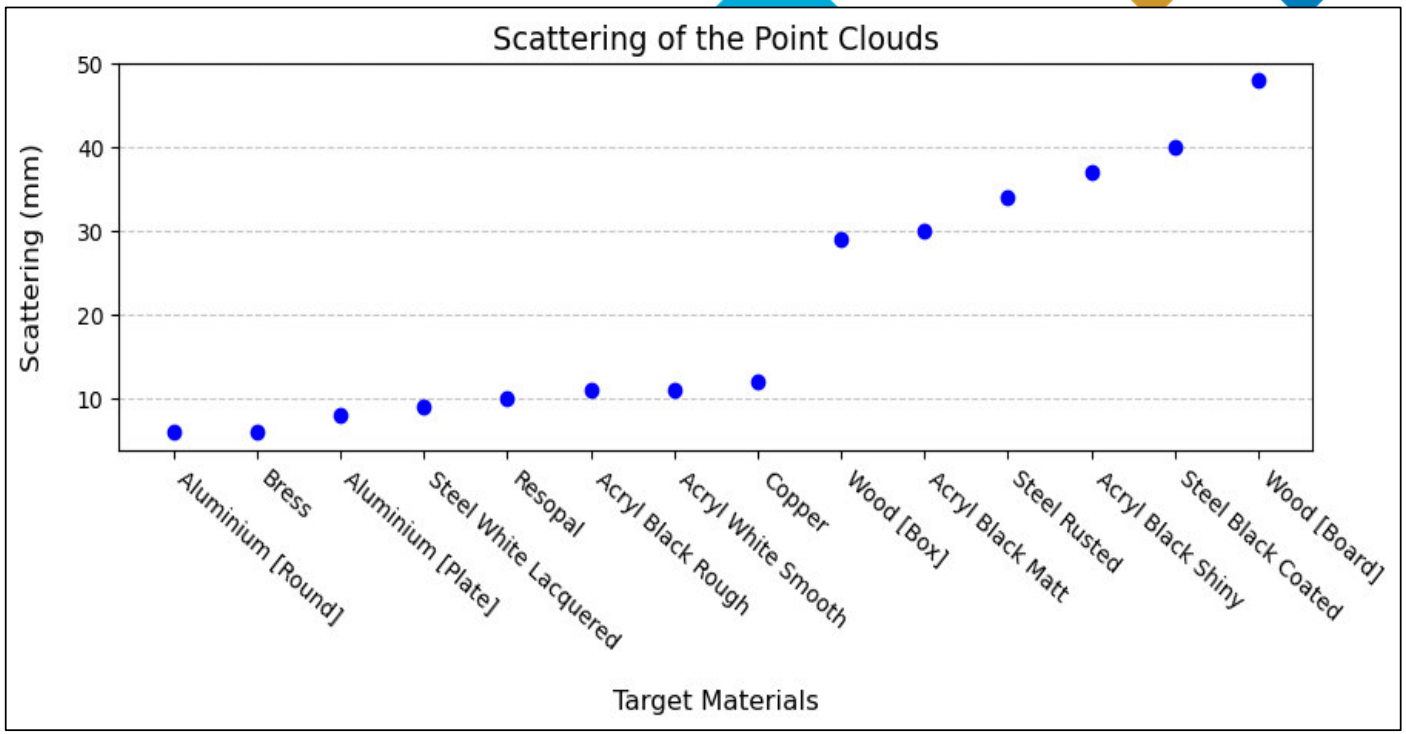


Post Processing - Results

- Black Acryl matt [1], Black Acryl shiny [2] White Acryl smooth [3], White Acryl rough [4]
- Intensity differs
- Scattering
- Near Field mesurements

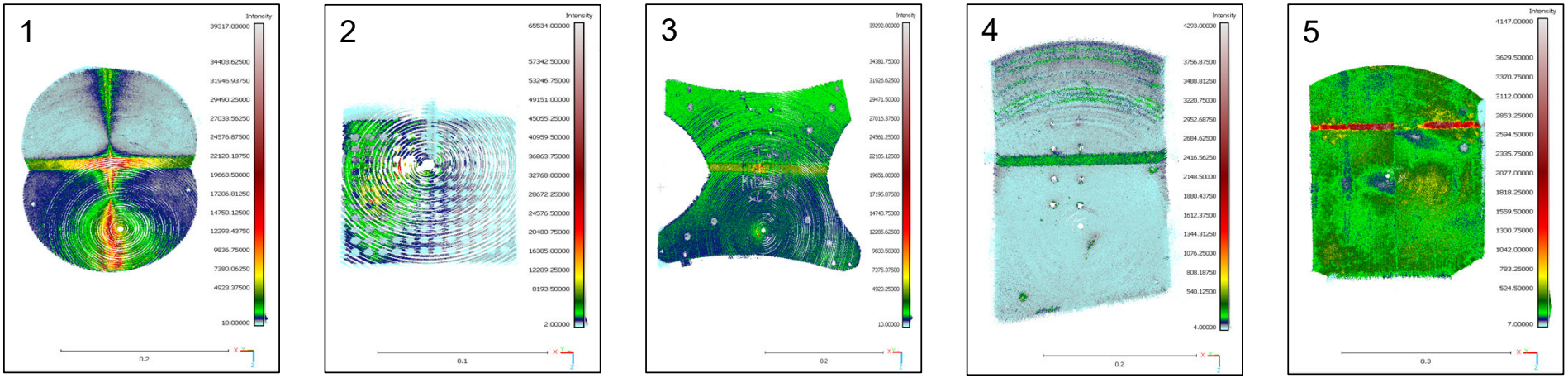


Post Processing - Results



Post Processing - Results

- Aluminium Round [1], Aluminium Plate w. holes [2], Steel White Lacquered [3], Steel Black Coated [4], Wood [Box] [5]



- Ability to detect structures in the range of mm

Results & Outlook

- Quality of the point cloud depends on the surface characteristics of the target
- Man-made and organic structures down to the mm-scale can be indentified

- Measurements with ground truth data
- Measurements with varying distances
- Dynamic scenarios
- Varying water bodies (turbidity)

The most relevant SDGs related to the presentation and theme of this session

1st relevant SDG

2nd relevant SDG

3rd relevant SDG

SUSTAINABLE DEVELOPMENT GOALS

International Federation of Surveyors supports the Sustainable Development Goals