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## Digital Assessment of Coating Damages to Offshore Wind Power Structures

International RAVE Workshop 2022, Hamburg, Germany, 03 February 2022





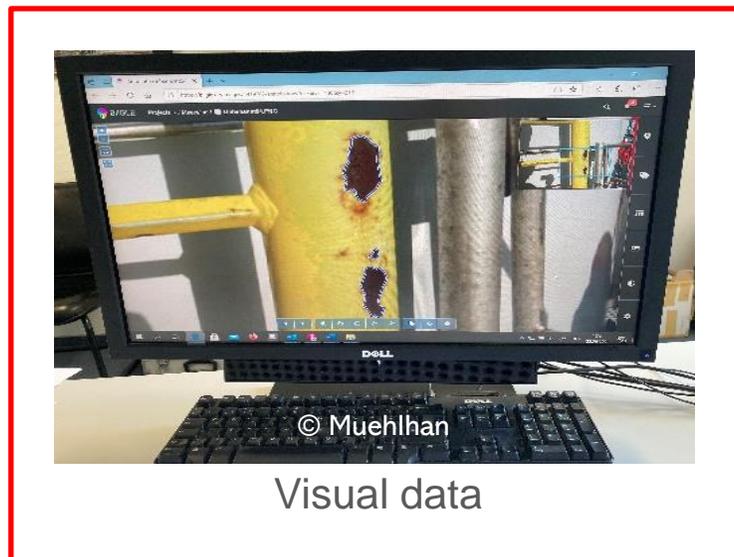
1. **Project introduction**
2. General approach
3. Image transfer
4. Image annotation



Development of a data-based monitoring and maintenance programme for surface protection systems



UNIVERSITÄT  
BIELEFELD



Visual data



Sensor-based data



Remote-control data

**Scope of the presentation**

# Agenda

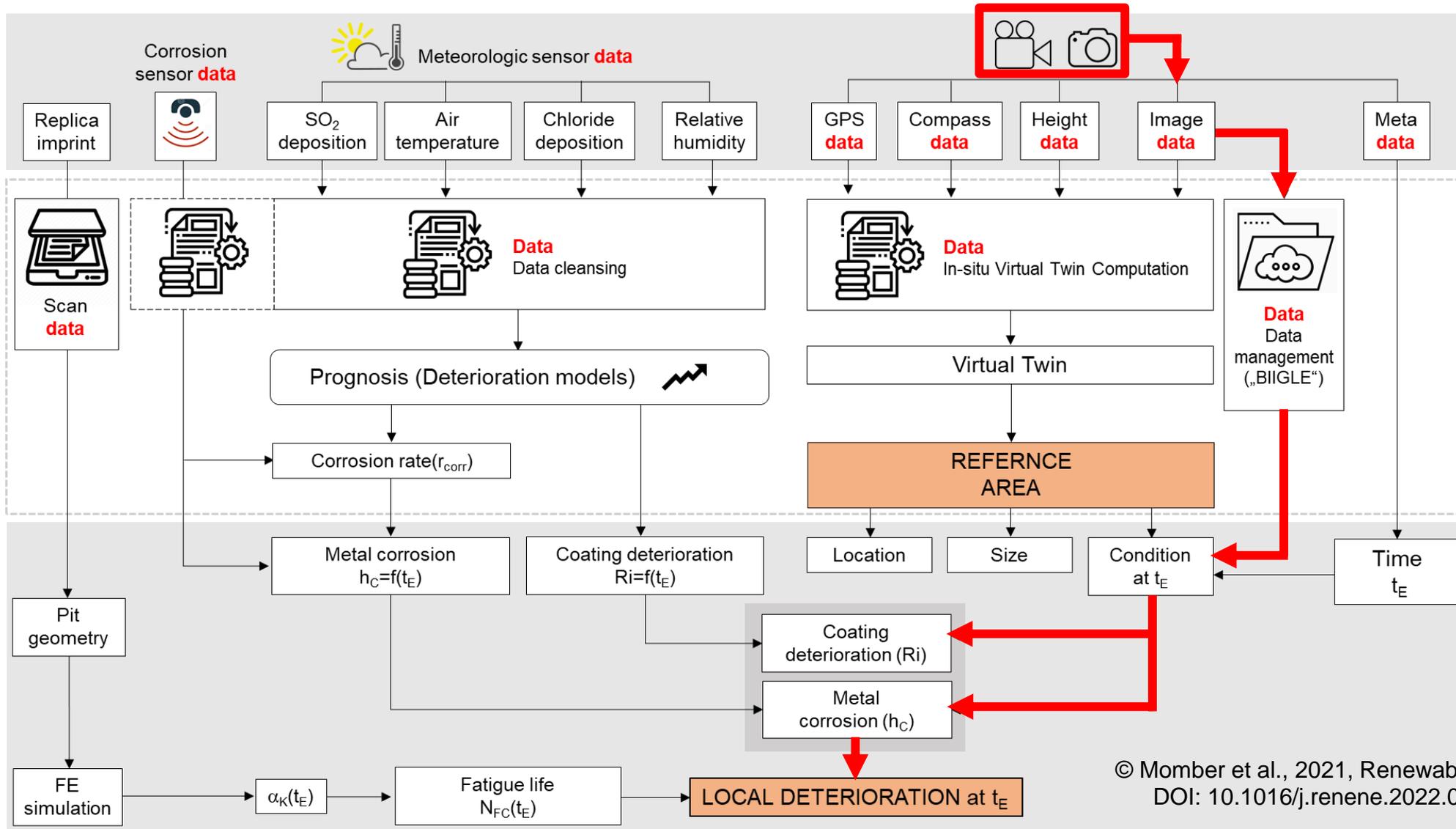
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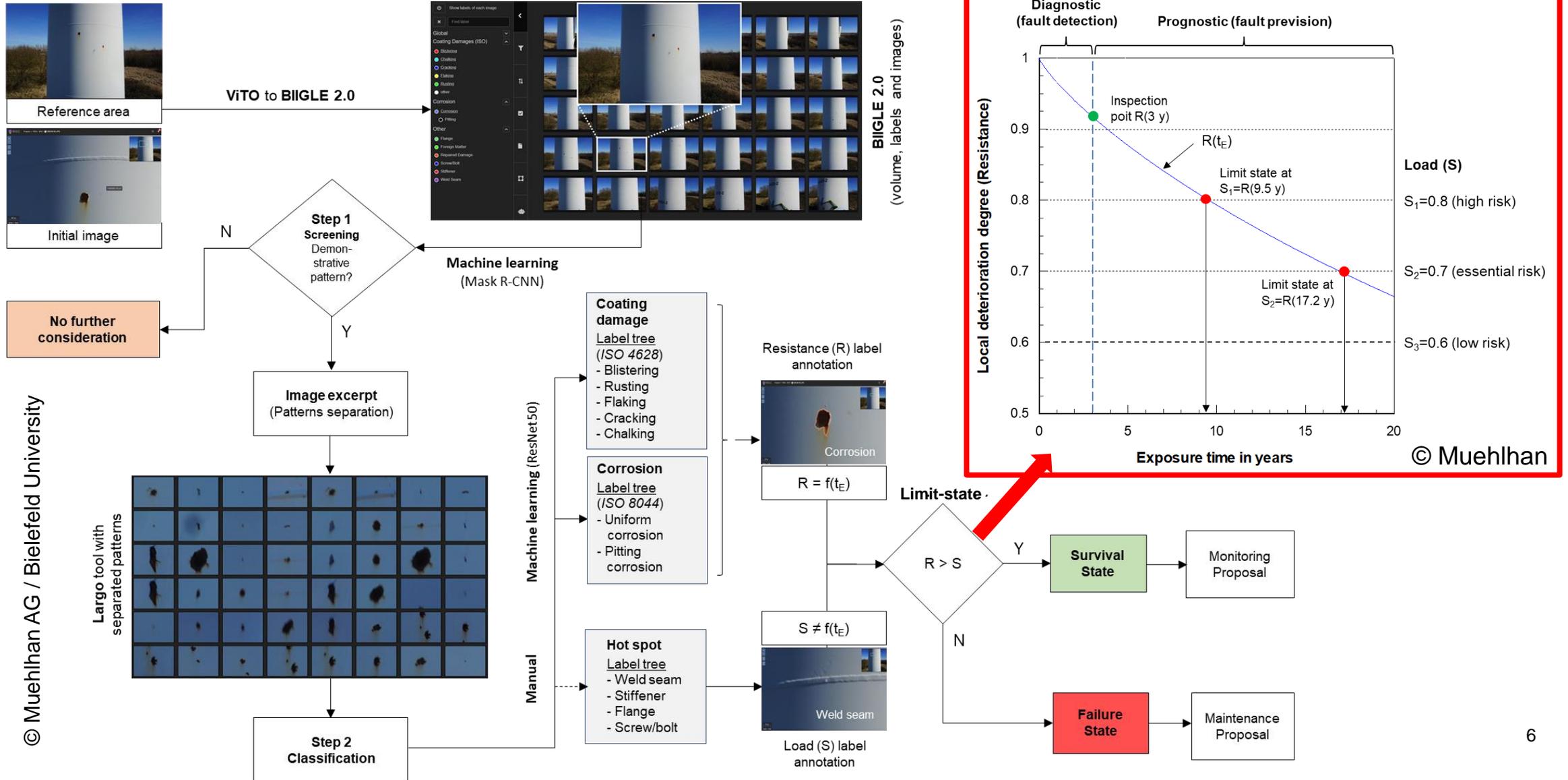
1. Project introduction
2. **General approach**
3. Image transfer
4. Image annotation



# Digital image-based condition assessment algorithm



# Digital image-based condition assessment algorithm



# Agenda

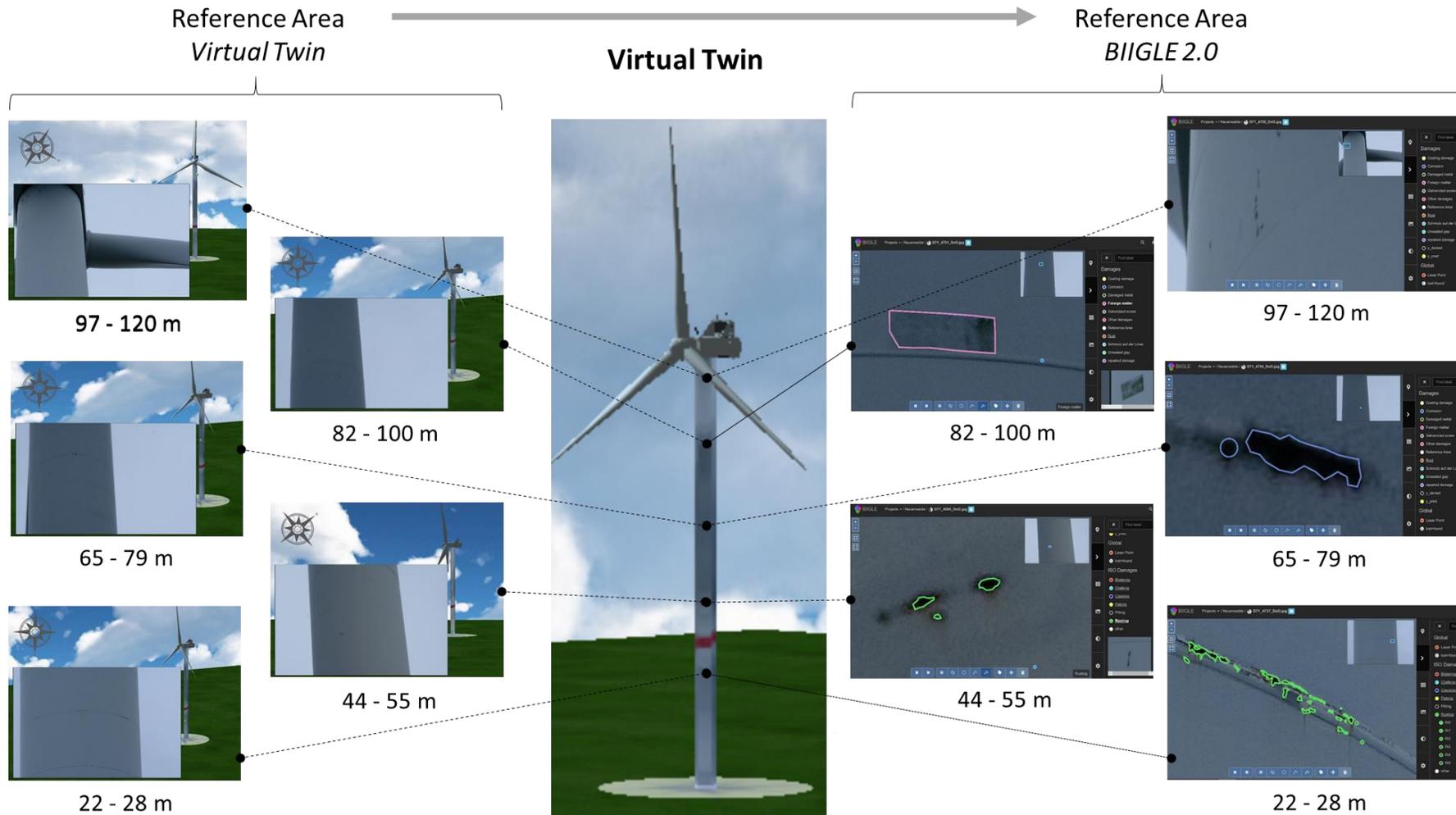
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1. Project introduction
2. General approach
- 3. Image transfer**
4. Image annotation



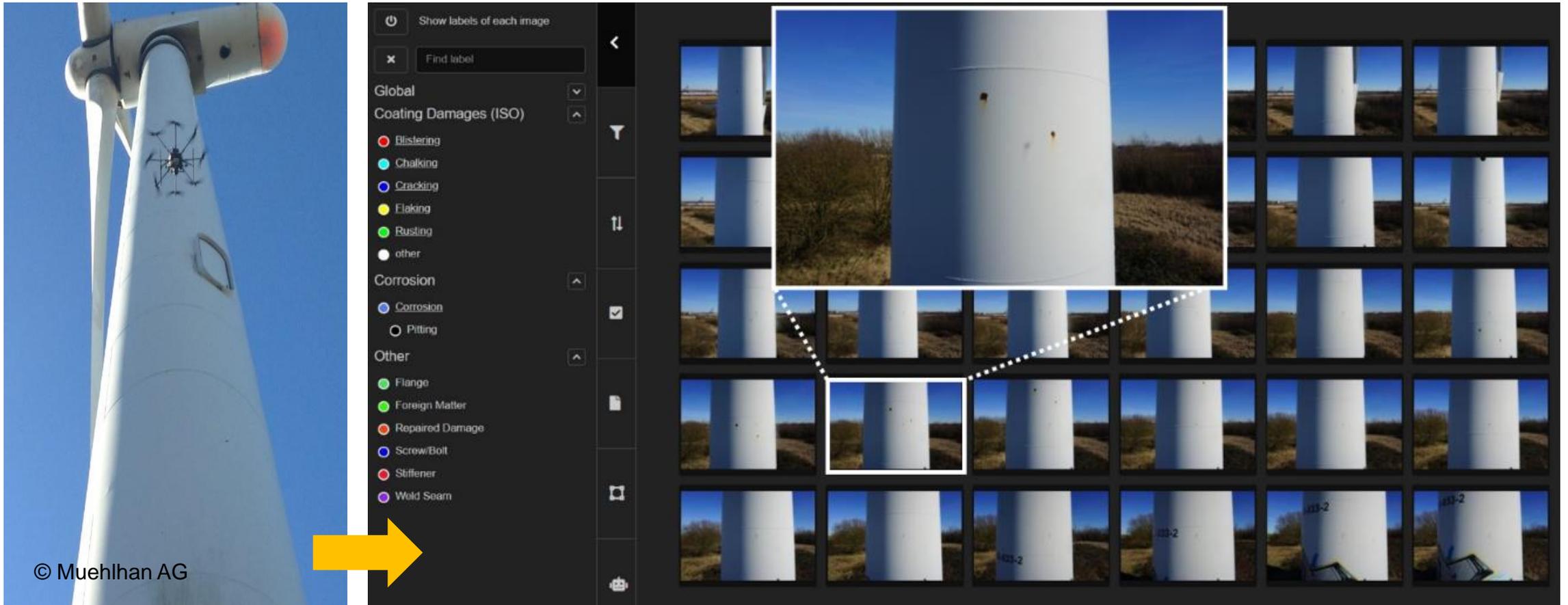
# Virtual Twin with reference areas and interface to annotation tool



# Image transfer (frozen video images) from monitoring tool to annotation tool



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# Agenda

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1. Project introduction
2. General approach
3. Image transfer
4. **Image annotation**

# Annotation tool (BIIGLE 2.0): Folder „FINO 1“ with labels



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Show labels of each image

Find label

**Labels**

- Corrosion
  - Corrosion
- Other
  - Flange
  - Foreign Matter
  - Repaired Damage
  - Screw/Bolt
  - Stiffener
  - Weld Seam
- Global
  - Laser Point
  - lost+found
- Coating Damages (ISO)
  - Blistering
  - Chalking
  - Cracking
  - Flaking
  - Rusting
  - other

# Annotation tool (BIIGLE 2.0): Folder „alpha ventus“ with labels



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Show labels of each image

Find label

**Labels**

- Corrosion
  - Corrosion
- Other
  - Flange
  - Foreign Matter
  - Repaired Damage
  - Screw/Bolt
  - Stiffener
  - Weld Seam
- Global
  - Laser Point
  - lost+found
- Coating Damages (ISO)
  - Blistering
  - Chalking
  - Cracking
  - Flaking
  - Rusting
  - other

# Examples for label marking tools



# Examples for label annotations



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Weld seam

Weld seam

Corrosion

Corrosion

Corrosion

Screw

Screw

Flange

Screw

Screw

Corrosion

Corrosion

Find label

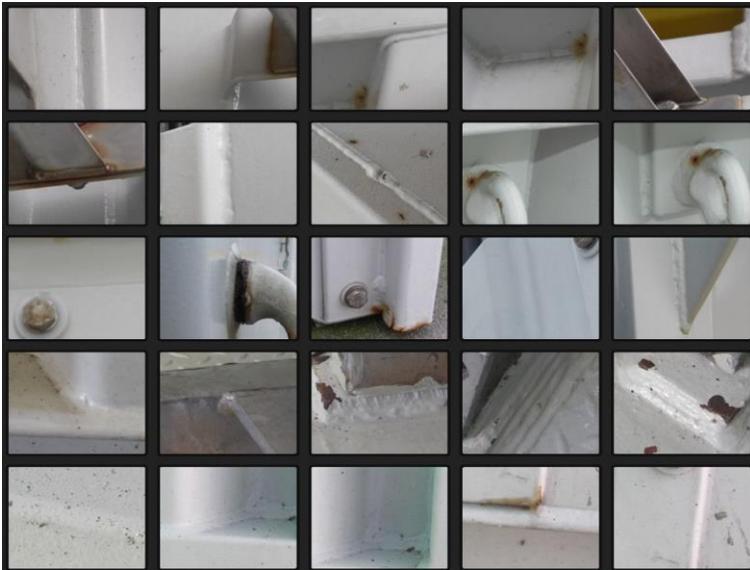
- Corrosion
  - Corrosion
  - Pitting
- Other
  - Flange
  - Foreign Matter
  - Repaired Damage
  - Screw/Bolt
  - Stiffener
  - Weld Seam
- Global
  - Laser Point
  - lost+found
- Coating Damages (ISO)
  - Blistering
  - Chalking
  - Cracking
  - Flaking
  - Rusting
  - other

4

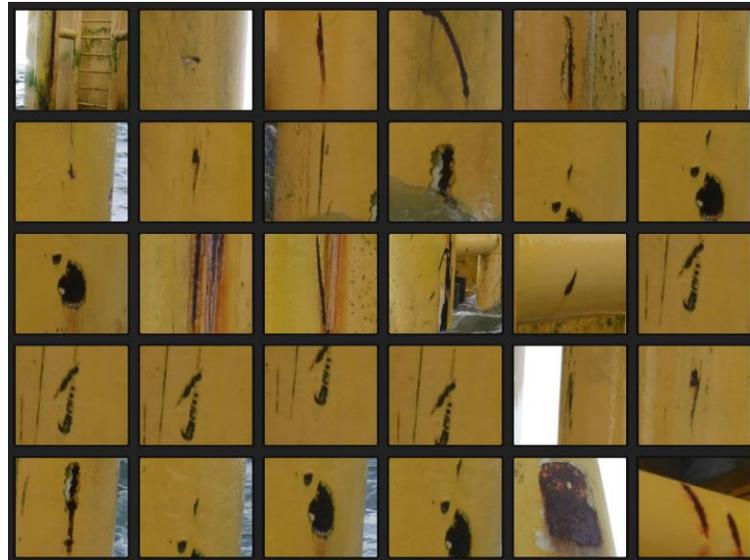
# Label selections for one folder



Label: Weld seam



Label: Corrosion



Label: Coating underrusting



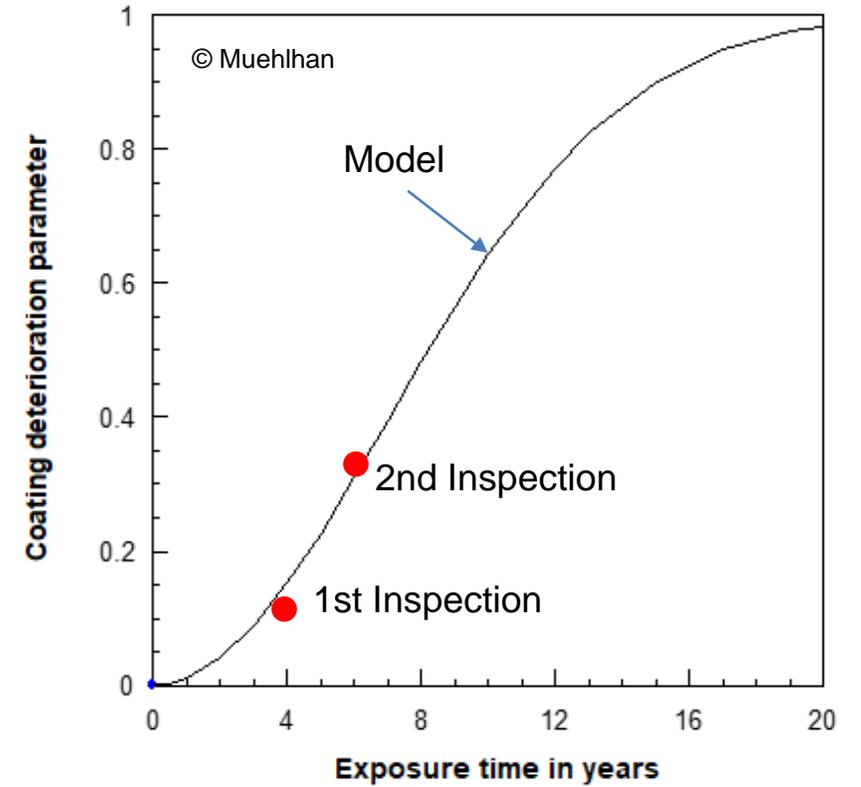
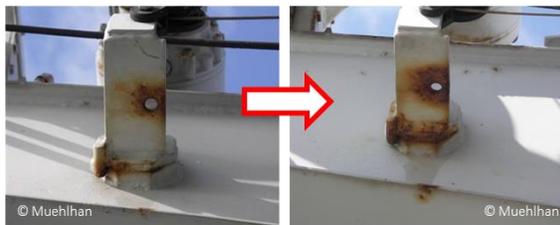
Label: Screws and bolts



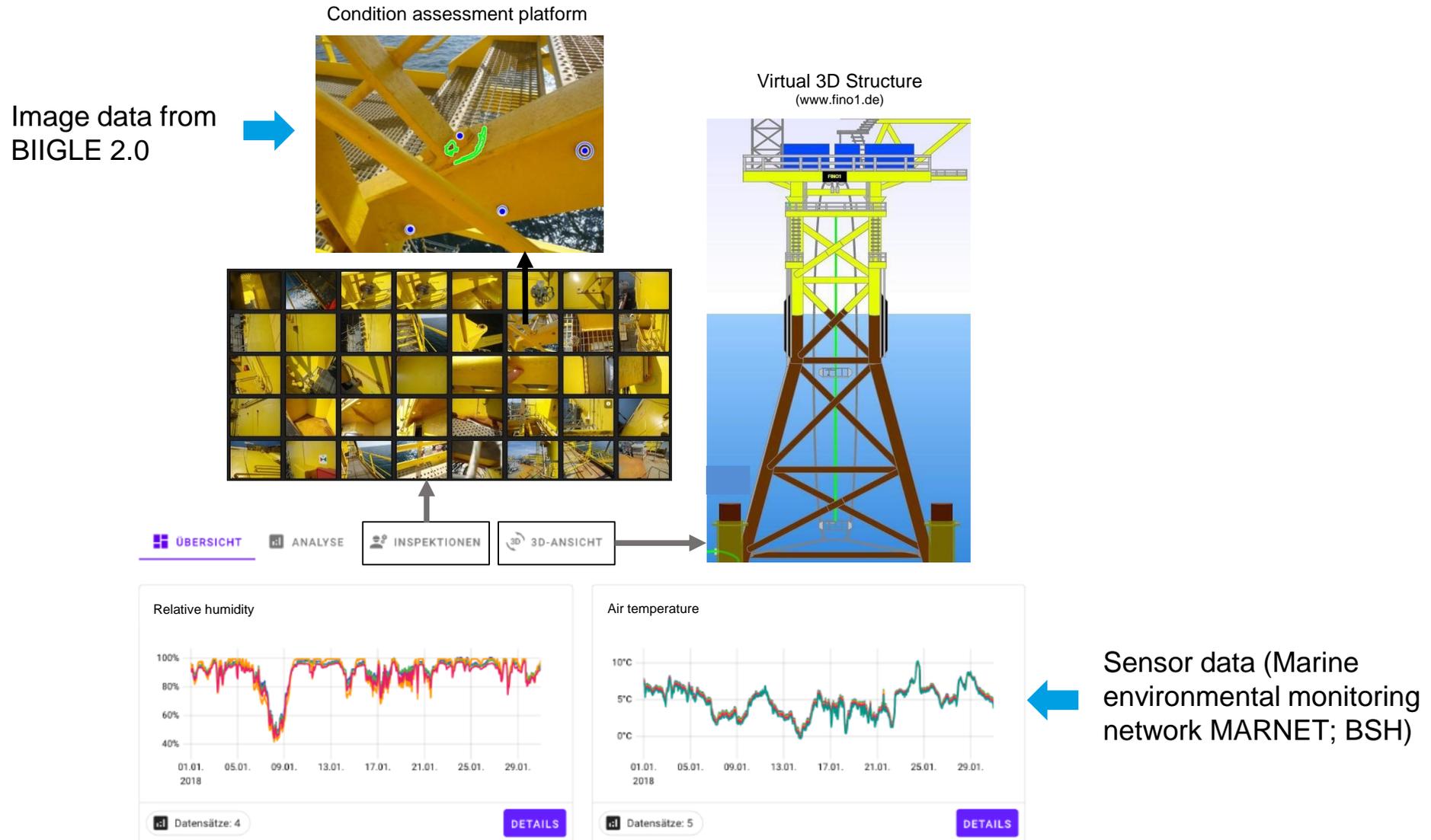
# Coating damage progress function



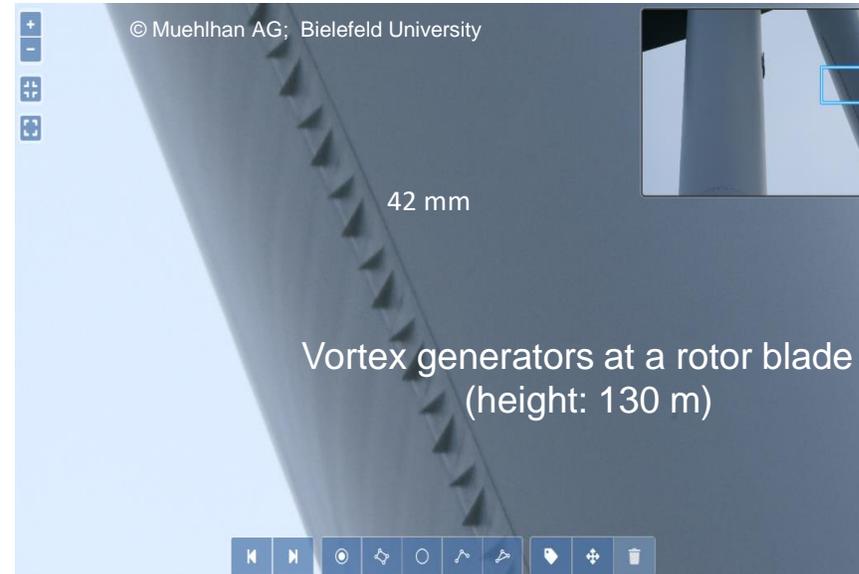
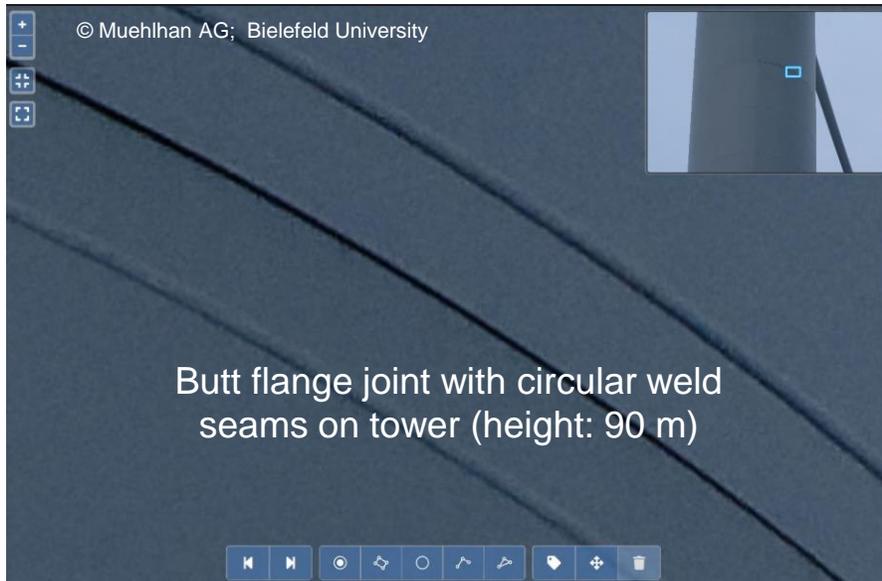
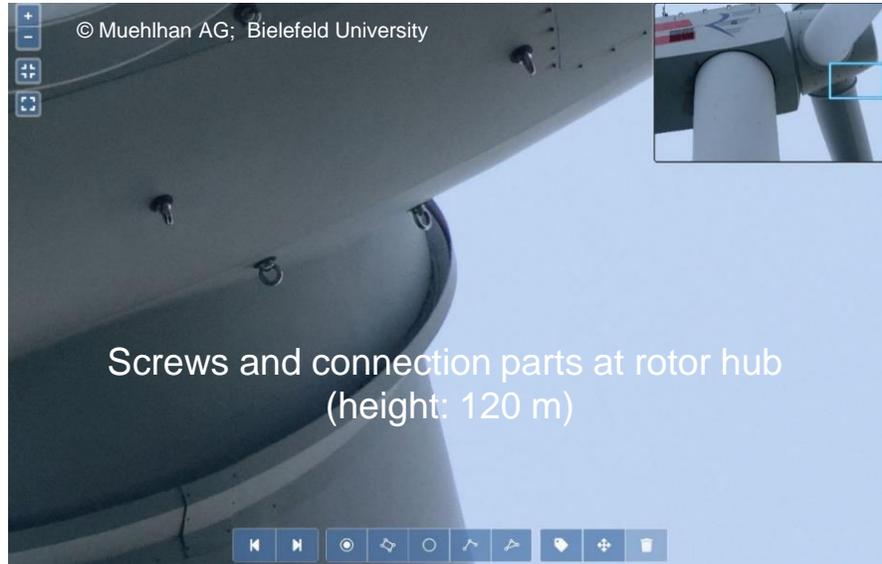
Korrosionsfortschritt innerhalb zweier Jahre  
Mittlere Zunahme korrodierte Fläche: 20%



# Data-based online maintenance platform



# Monitoring options



© Momber et al., 2021, Wind Engineering, DOI: 10.1177/0309524X211060550

© Momber et al., 2021, Renewable Energy,  
DOI: 10.1016/j.renene.2022.01.022

# Acknowledgements

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The project ISyMOO is funded through the Federal Ministry for Economic Affairs and Energy. The grant number is 0324254A-F.



Federal Ministry  
for Economic Affairs  
and Energy



Projektträger Jülich  
Forschungszentrum Jülich