



IDD.Blade - Increase your energy yield

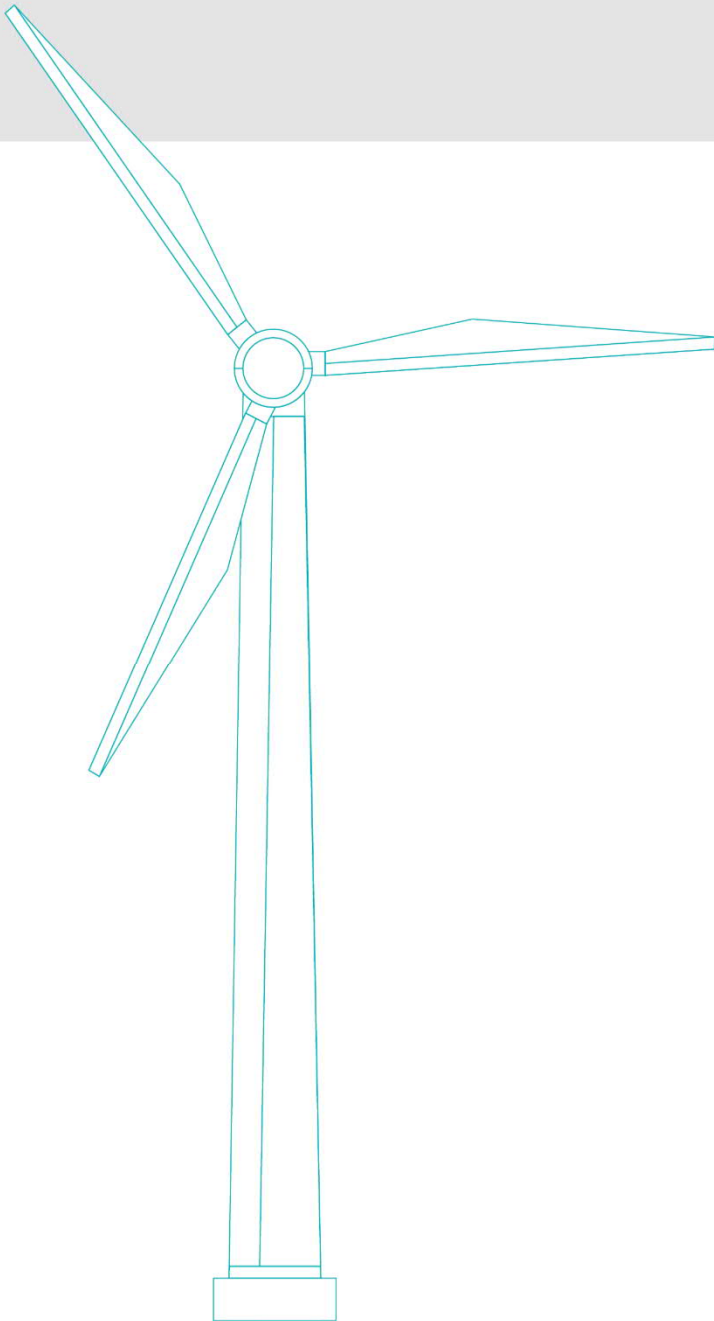




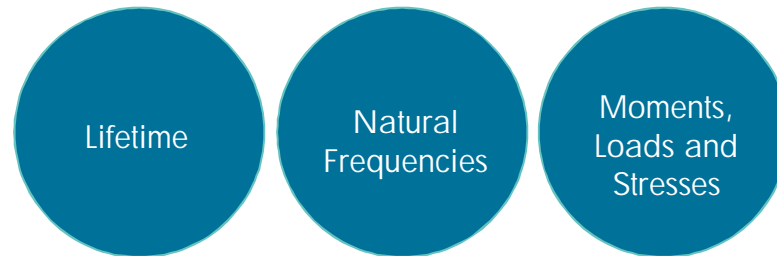
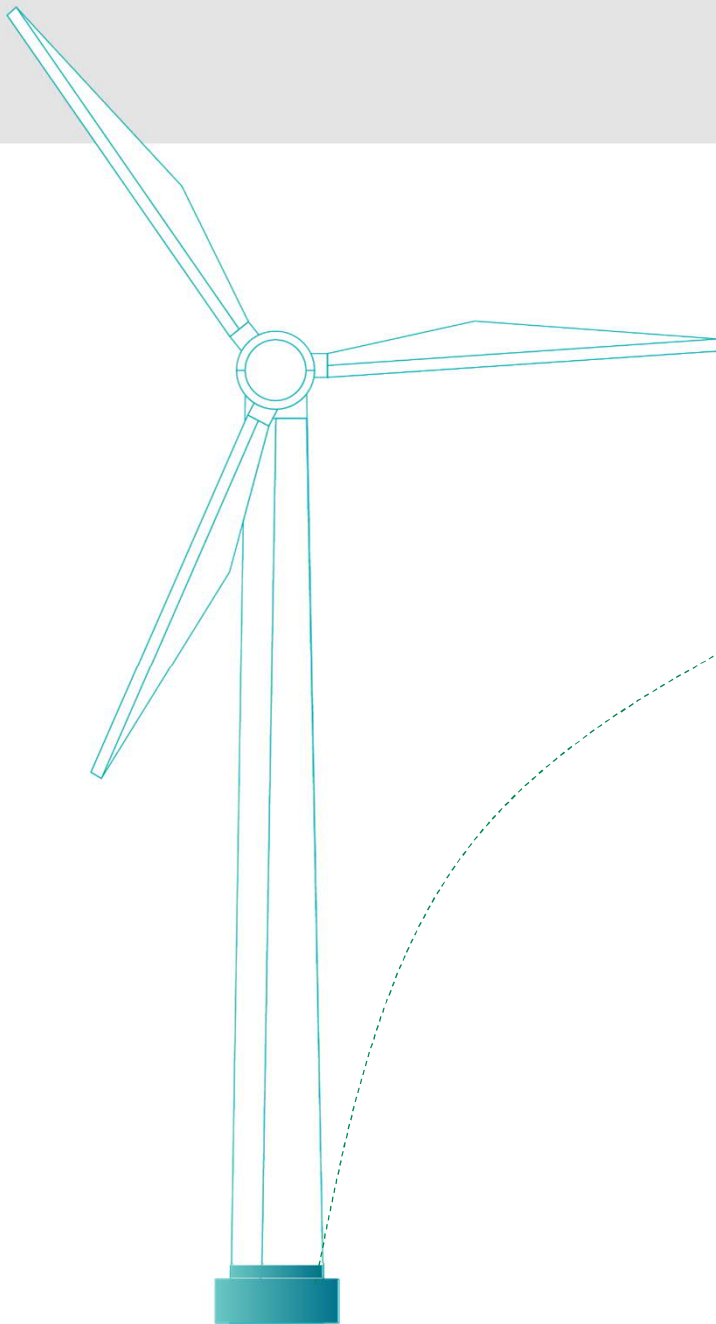
Connection to wind industry?



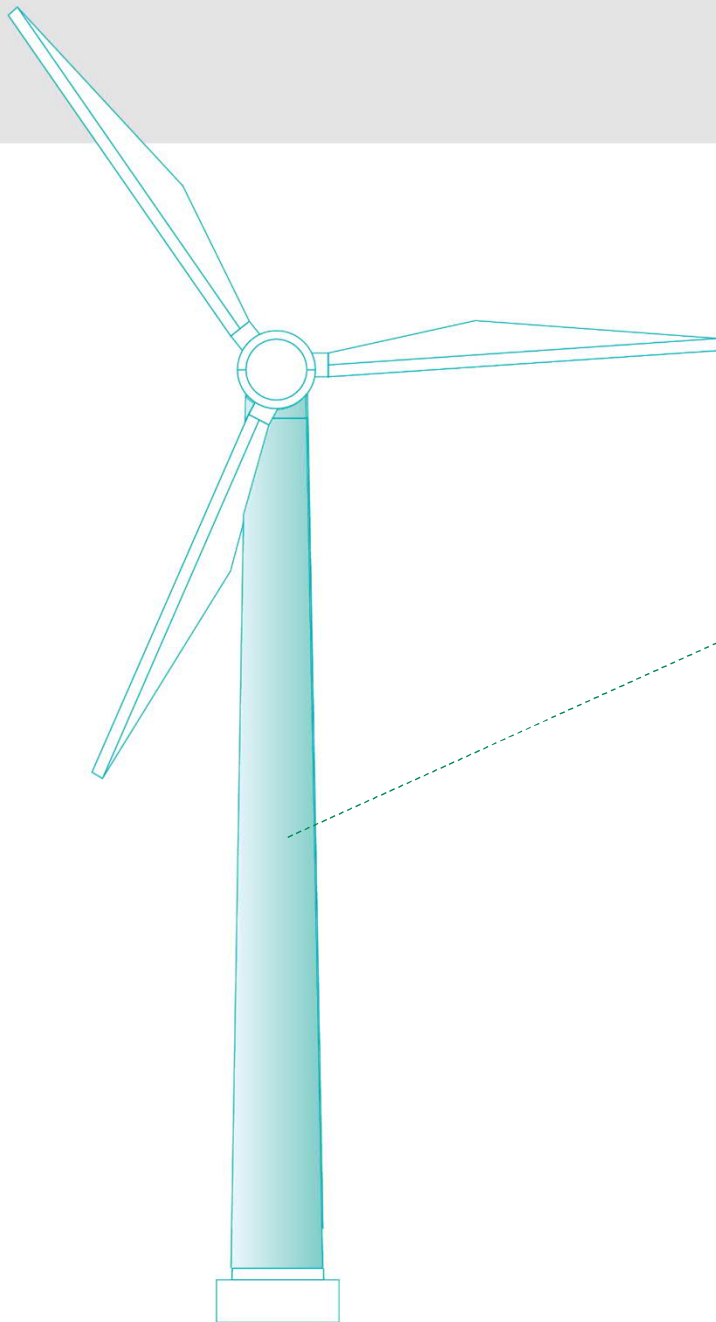
# Wölfel Structural Health Monitoring



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Vibration-based  
Tower Monitoring

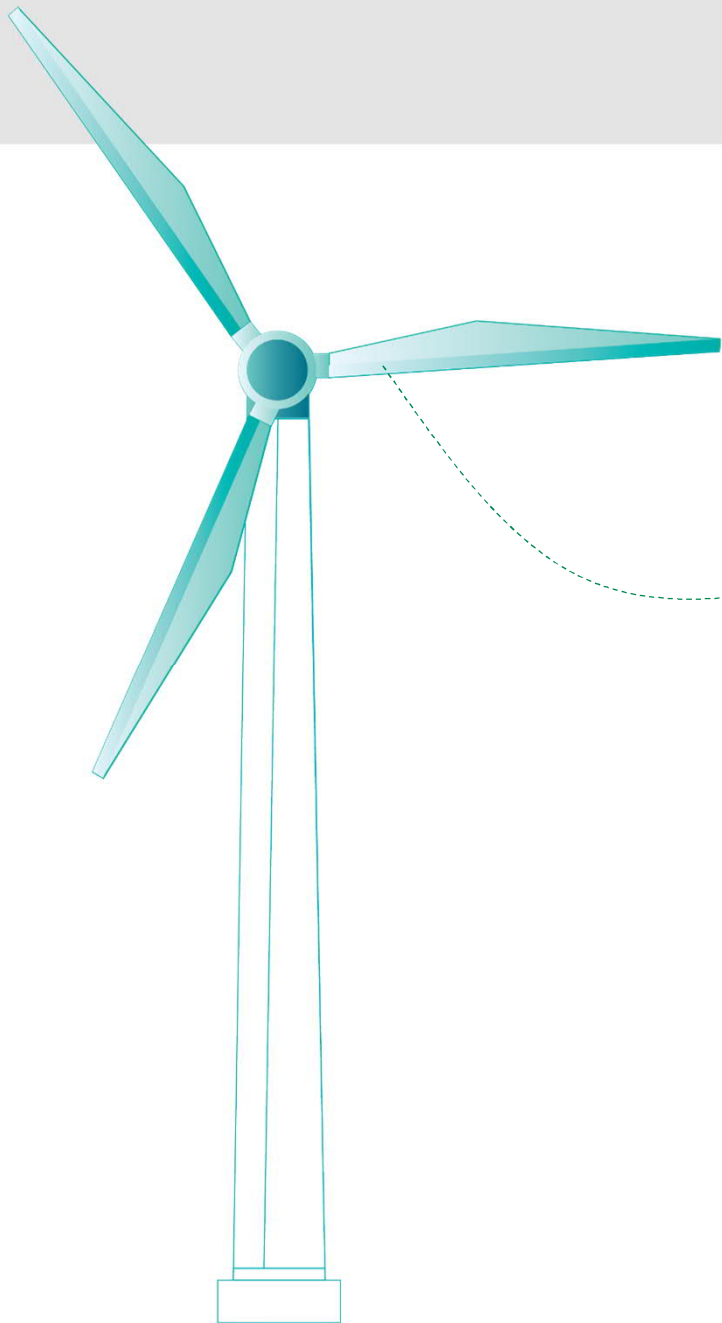
Lifetime

Natural  
Frequencies

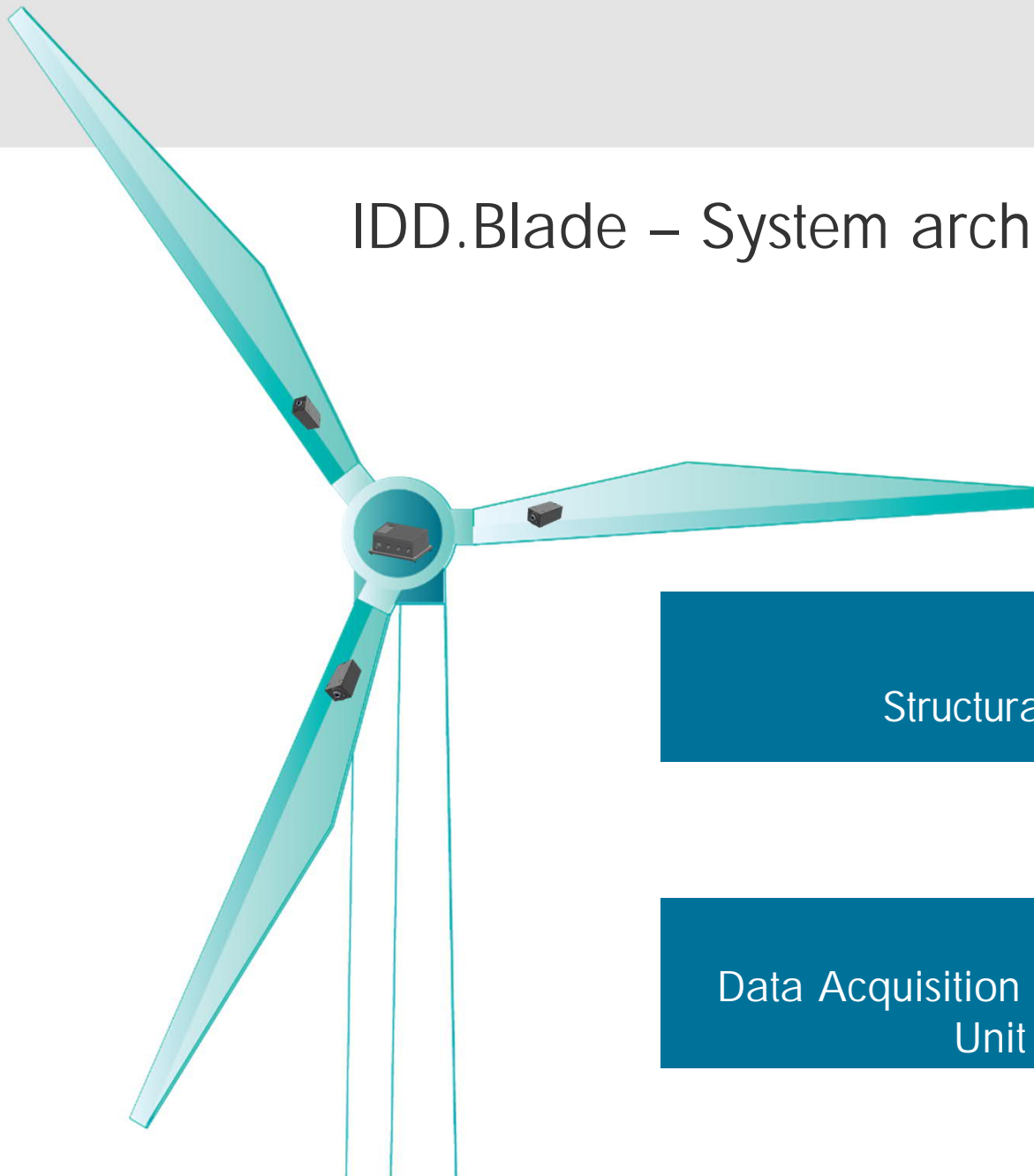
Rotor  
Imbalances

Moments,  
Loads and  
Stresses

# Wölfel Structural Health Monitoring



# IDD.Blade – System architecture



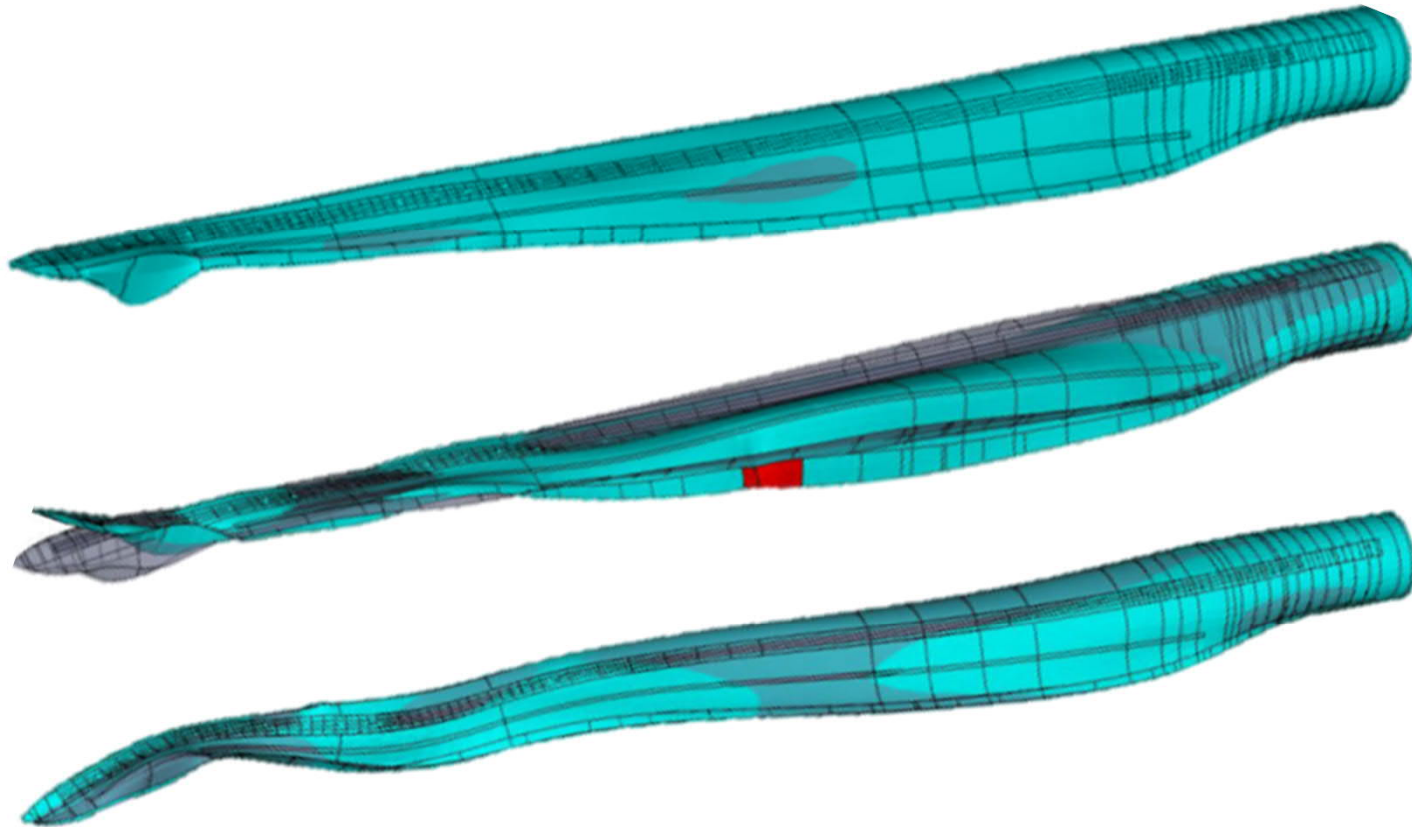
SNS  
Structural Noise Sensor

DAPU  
Data Acquisition and Processing  
Unit – Interface PLC





## Physical Principle



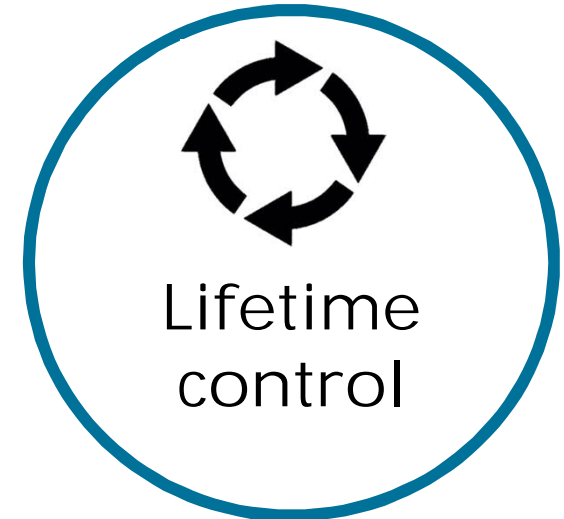
Rotor blade vibrations give us information about the state of the structure:

- Damage
- Ice

Structural damages and ice change the natural frequencies:

- Structural damages reduce the stiffness
- Ice increases the rotor blade mass







- Hazard to people as a result of flying ice chunks must be prevented. No ice throw!
- Regulations vary per country
- State of the art technology with increased security level.
- Automatic Restart certified



<https://www.americanexperiment.org/2018/02/mn-wind-turbines-shut-safety-concerns-ice/>



## TYPE CERTIFICATE

Certificate No.: TC-DNVGL-SE-0439-03577-0 Issued: 2018-01-27 Valid until: 2020-01-26

Issued for:  
**Ice Detection System  
 IDD.Blade**  
 Specified in Annex 1

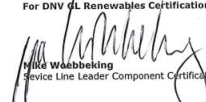
Issued to:  
**Wölfel Wind Systems GmbH**  
 Max-Planck-Str. 15  
 97204 Höchberg, Germany

According to:  
**DNVGL-SE-0439:2016-06 Certification of condition  
 monitoring**

Based on the documents:  
 CR-DNVGL-SE-0439-03577-0

Certification Report Ice Detection System IDD.Blade,  
 dated 2018-01-27

Changes of the system design, the production or the manufacturer's quality system are to be approved by DNV GL.

Hamburg, 2018-01-27  
 For DNV GL Renewables Certification  
  
 Mike Wæbbeking  
 Service Line Leader Component Certification

  
 Deutsche  
 Akkreditierungsstelle  
 D-26119 51-01-01  
 By DAKKS according DIN EN ISO/IEC 17065  
 accredited Certification Body for products. The  
 accreditation is valid for the fields of certification  
 listed in the certificate.

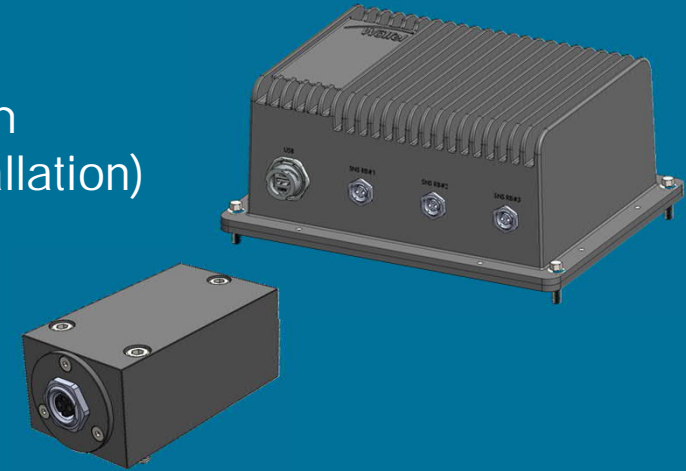
Hamburg, 2018-01-27  
 For DNV GL Renewables Certification  
  
 Robert Kasch  
 Senior Project Manager

The accredited certification body is Germanischer Lloyd Industrial Services GmbH, Brooktorkai 18, 20457 Hamburg.  
 DNV GL Renewables Certification is the trading name of DNV GL's certification business in the renewable energy industry.



### Update of hardware platform

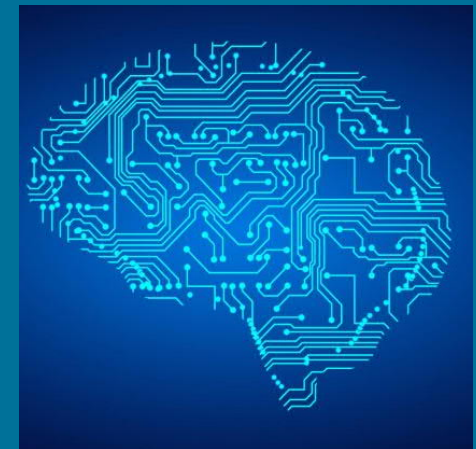
- Cost efficient (production + installation)
- Less space required
- Latest technology inside



### Implementation of Artificial Intelligence

Machine learning algorithm is updating the accuracy permanently.

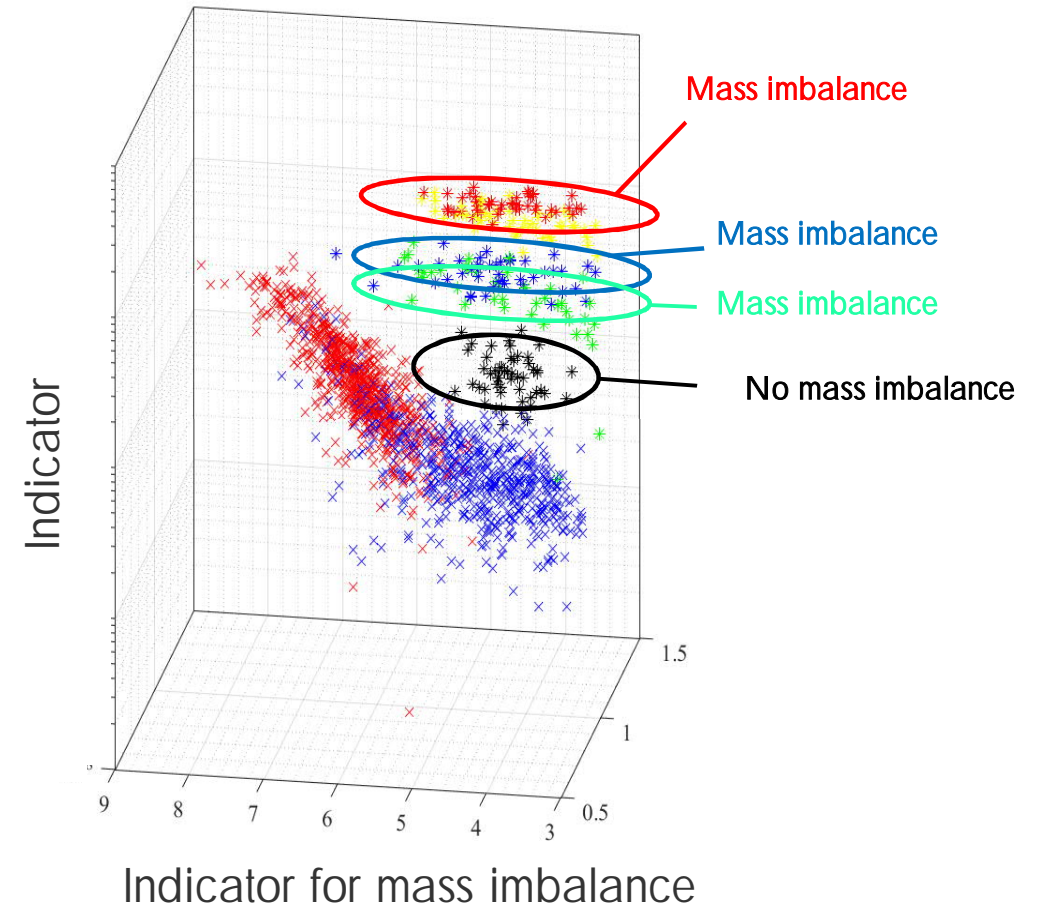
Higher Accuracy during longer Operation.





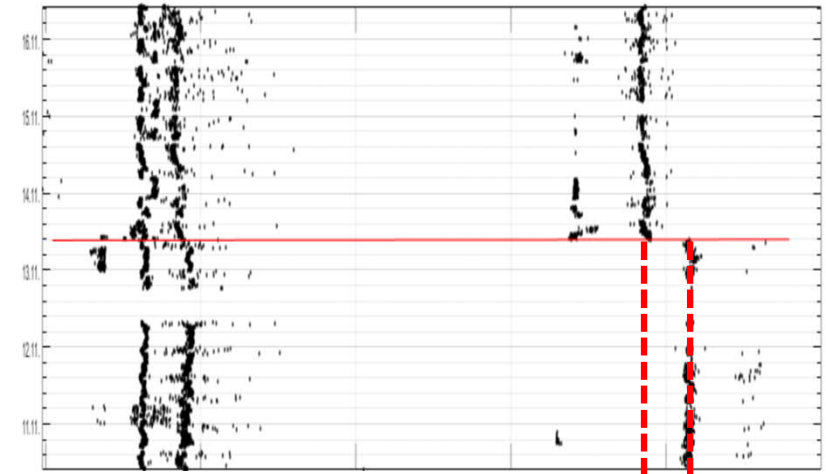
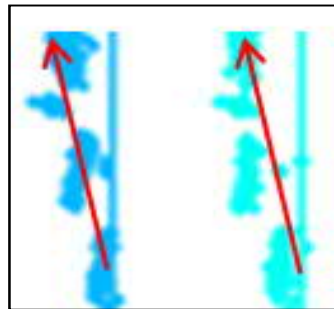
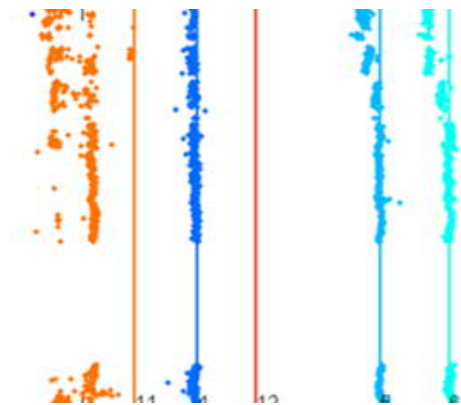
Higher loads and imbalances can lead to damages to the structure:

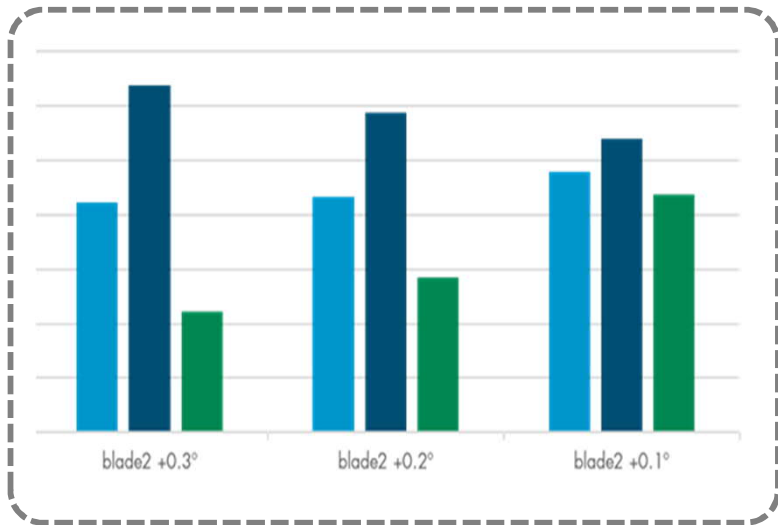
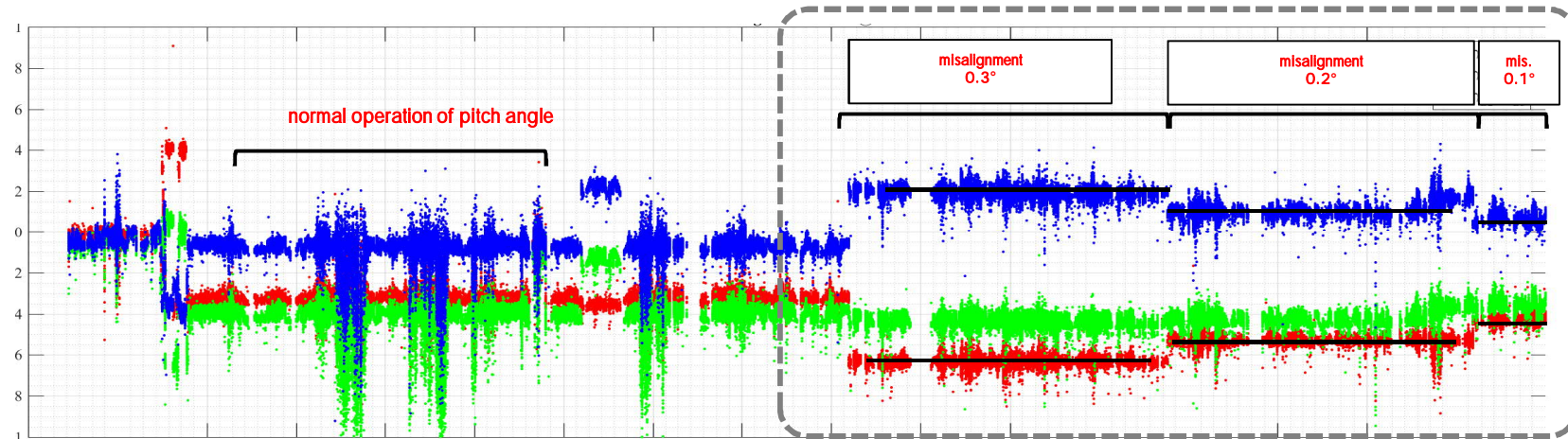
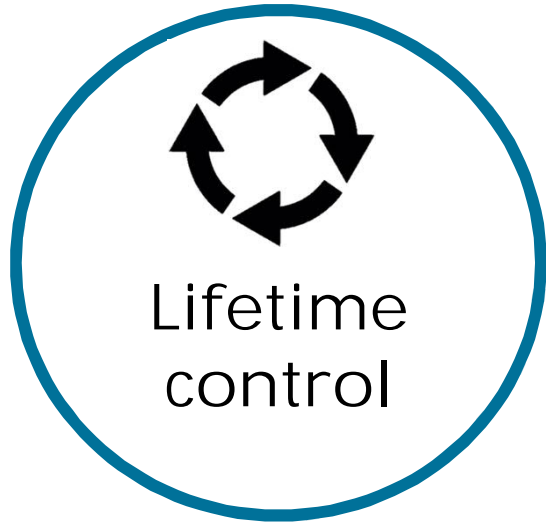
- enormous loss of revenue
- less lifetime for main components



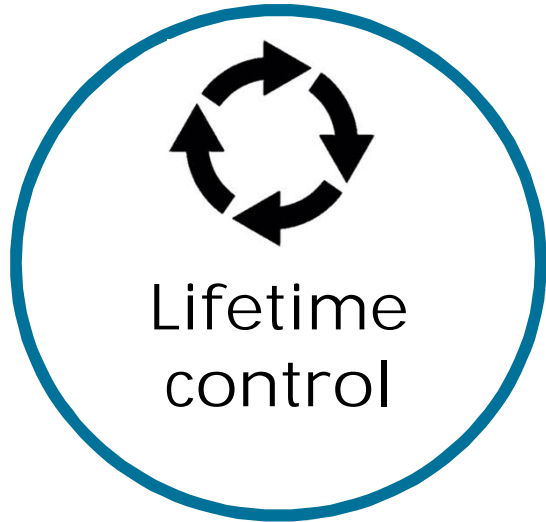


Rotor blade damage indication by a frequency shift

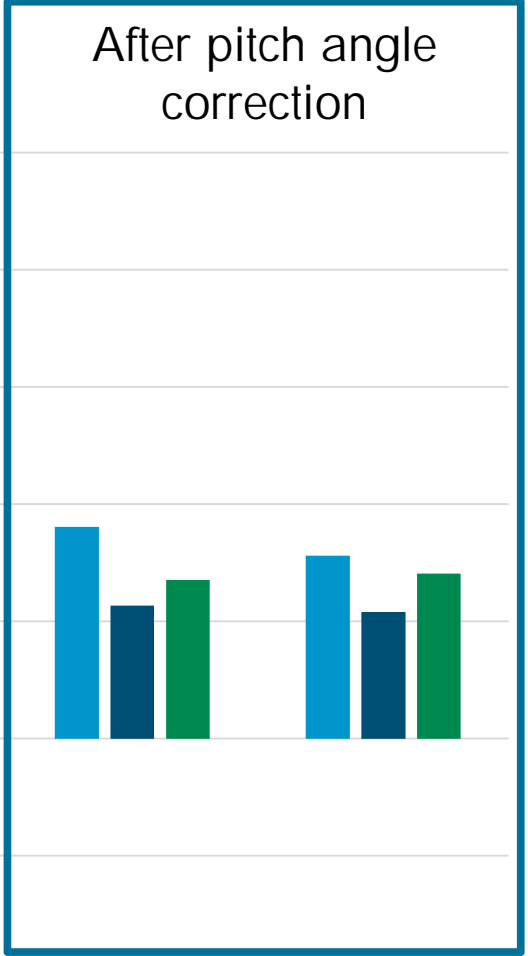
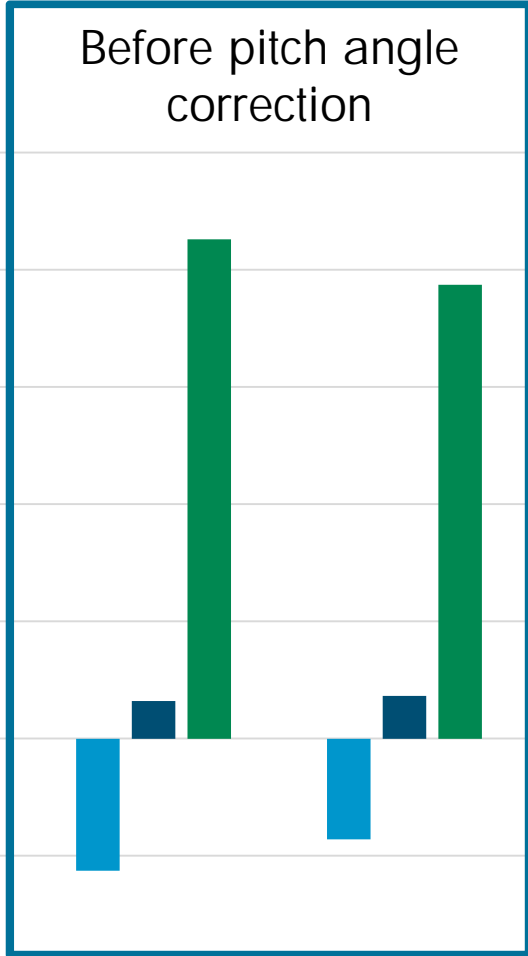


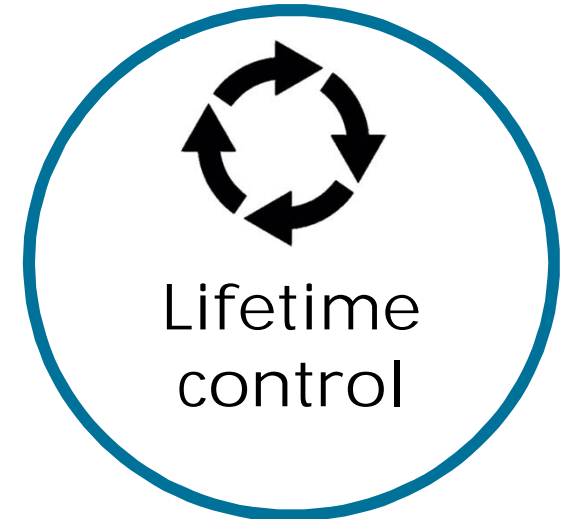


Pitch misalignment leads to different aerodynamic loading of the blades



Passive control algorithm for optimizing of pitch angles based on real loads of each blade







# Keep your control - MIC.Wind

