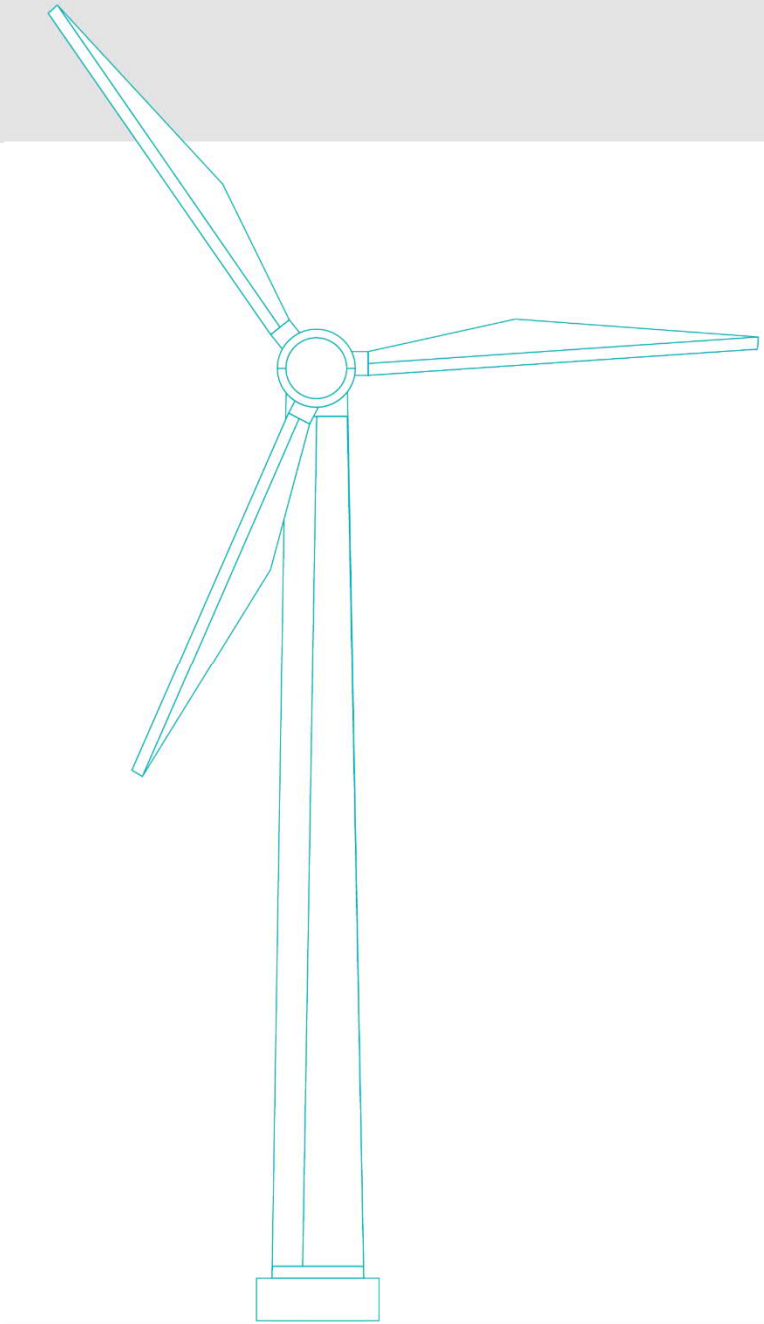
IDD.Blade - Increase your energy yield

Wölfel

Connection to wind industry?



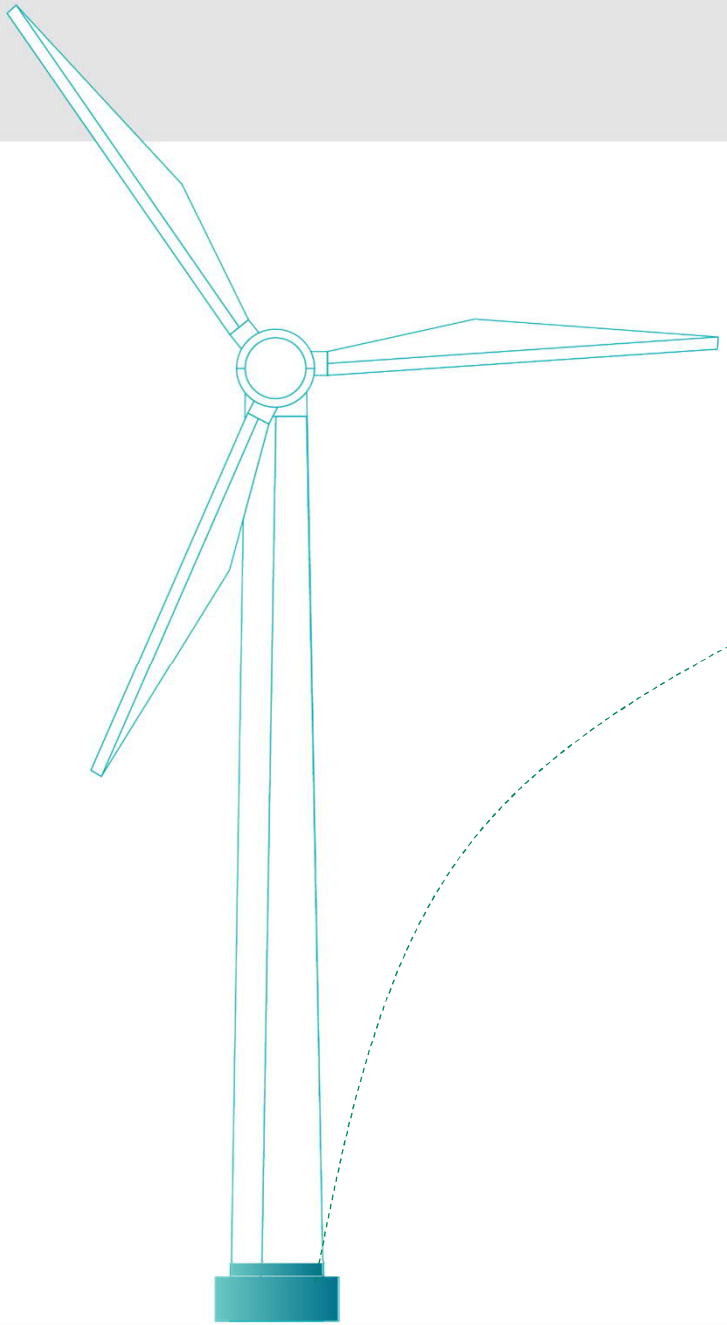
Wölfel Structural Health Monitoring

SHM Blade®

SHM Tower®

SHM Foundation®

Wölfel Structural Health Monitoring

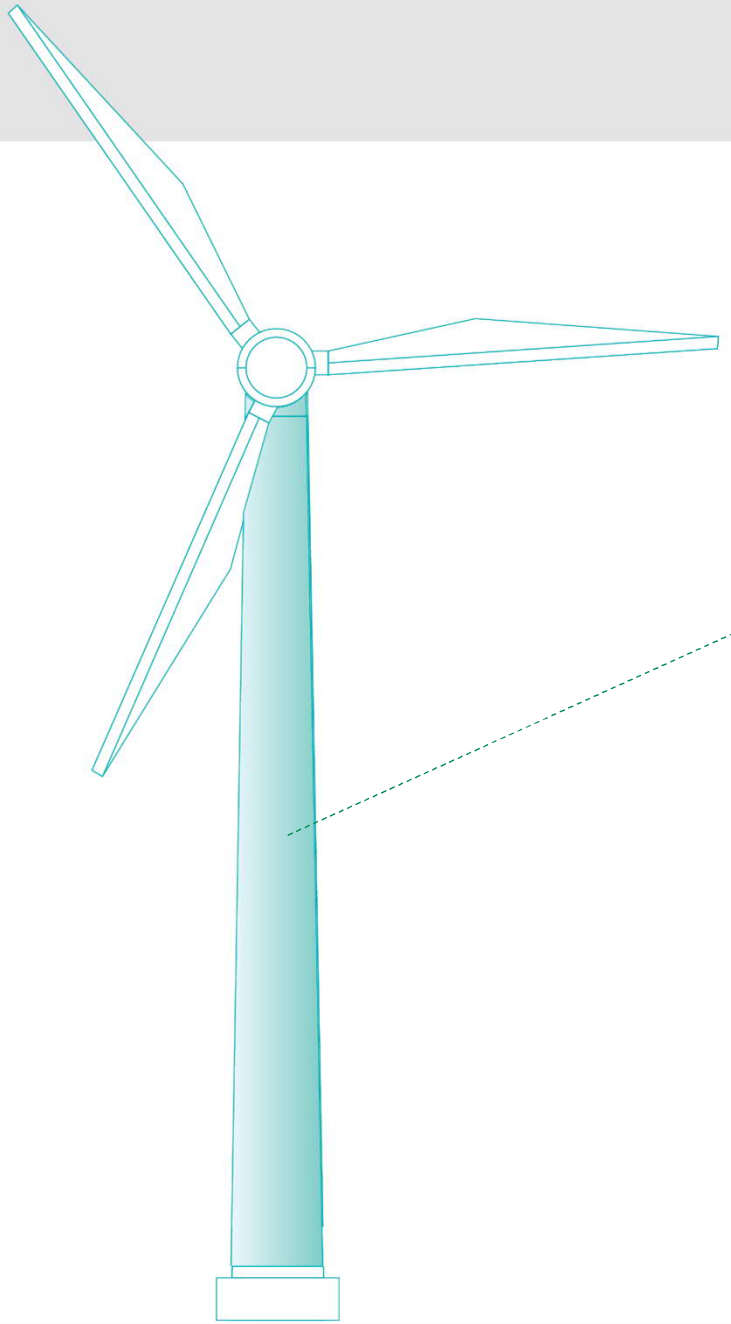


SHM Foundation®

Vibration-based Monitoring
of foundation Structures

- Lifetime
- Natural Frequencies
- Moments, Loads and Stresses

Wölfel Structural Health Monitoring

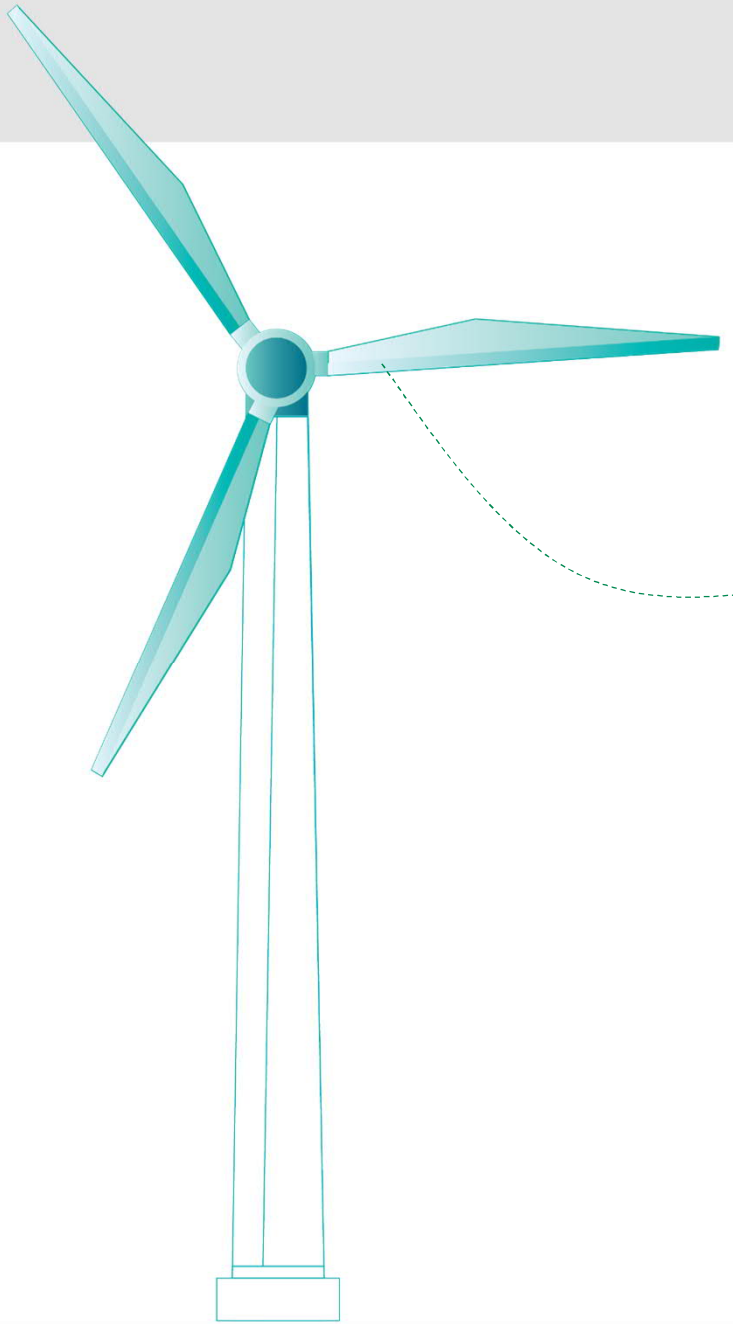


SHM Tower®

Vibration-based Tower Monitoring

- Lifetime
- Natural Frequencies
- Rotor Imbalances
- Moments, Loads and Stresses

Wölfel Structural Health Monitoring



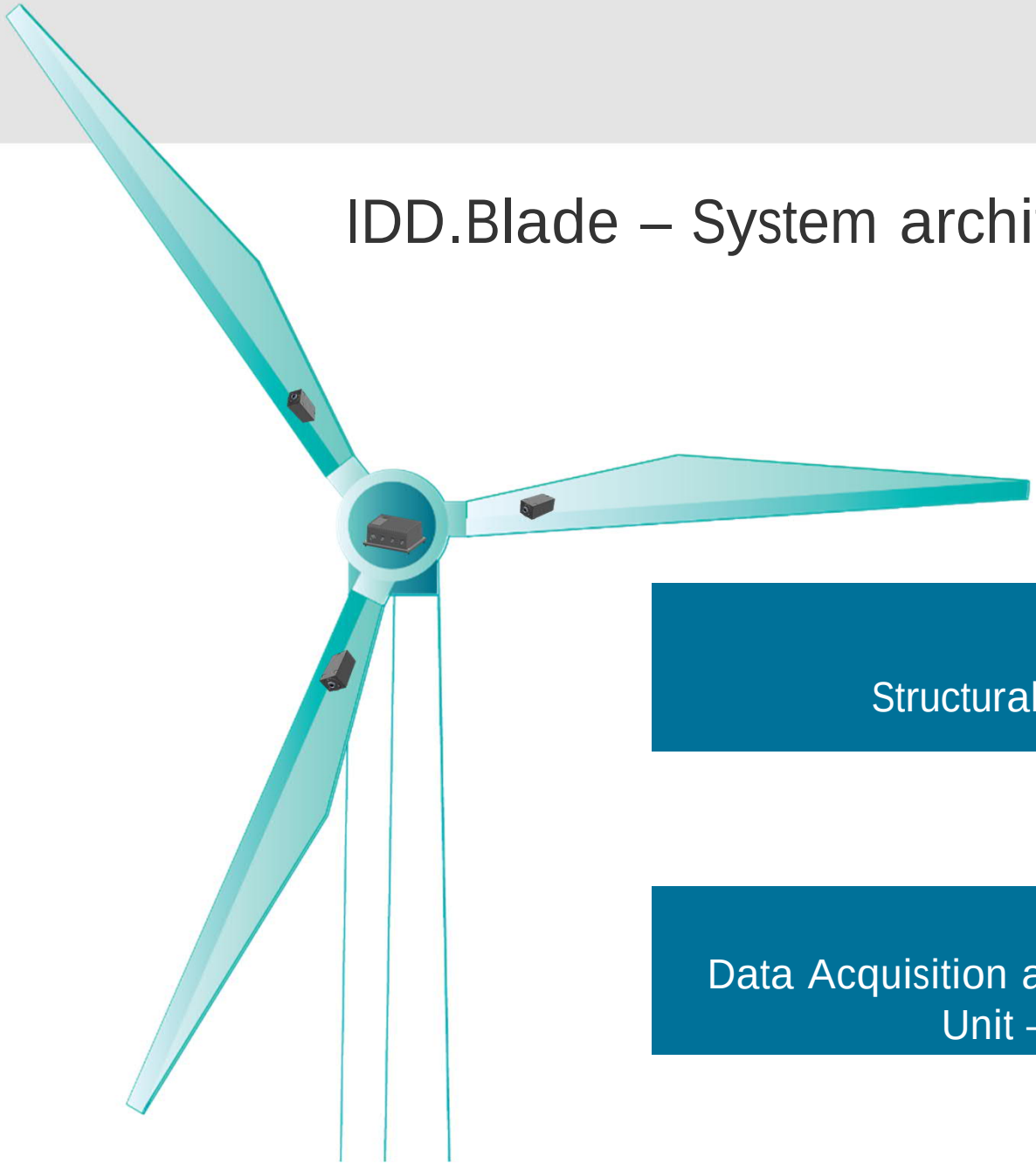
SHM Blade®

Vibration-based
Blade Monitoring

- Lifetime
- Ice detection
- Damage Detection
- Rotor Imbalances
- Pitch Angle Monitoring

IDD Blade

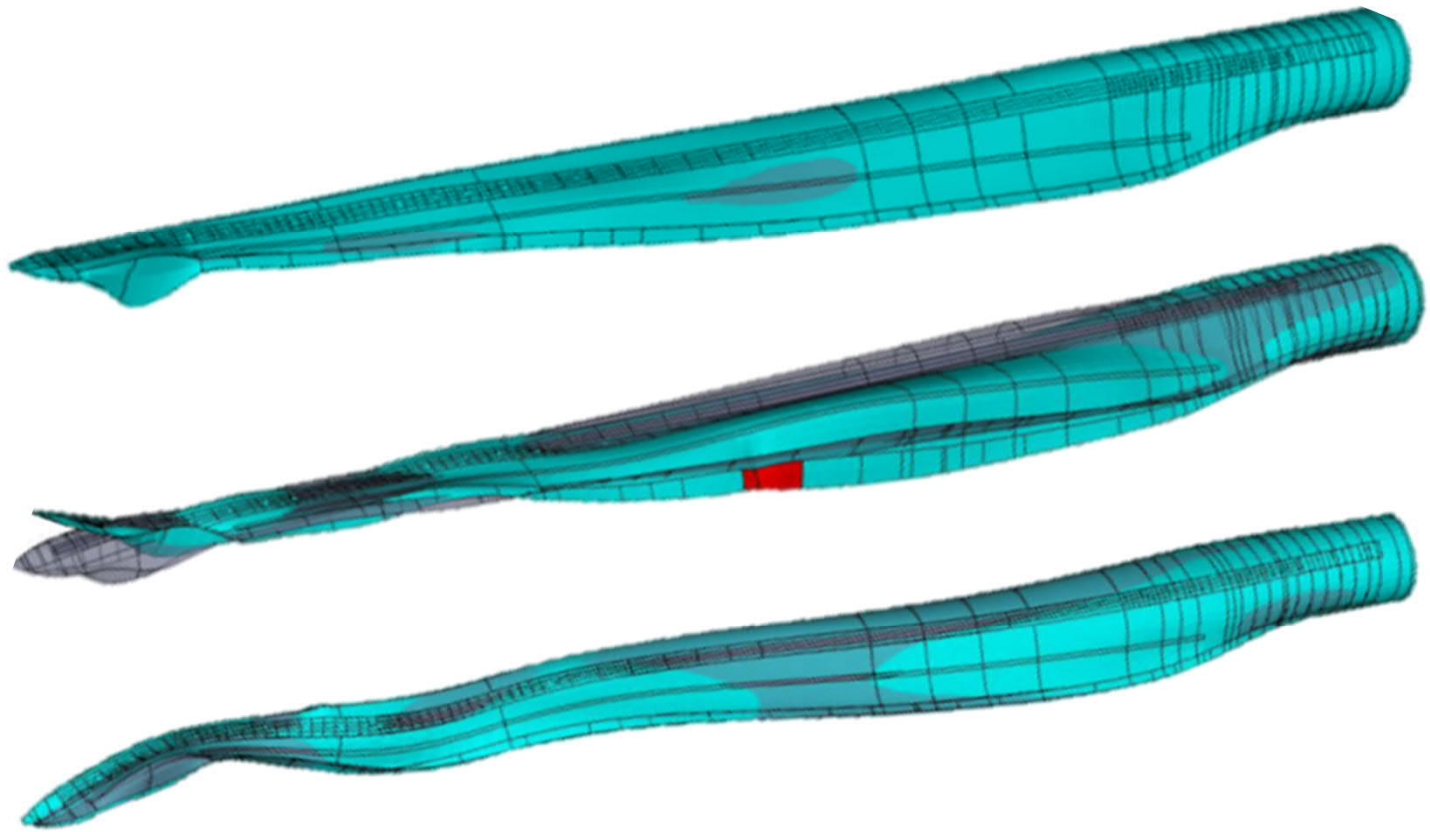
IDD.Blade – System architecture



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

Public Safety

Lifetime control

Accurate Ice Detection

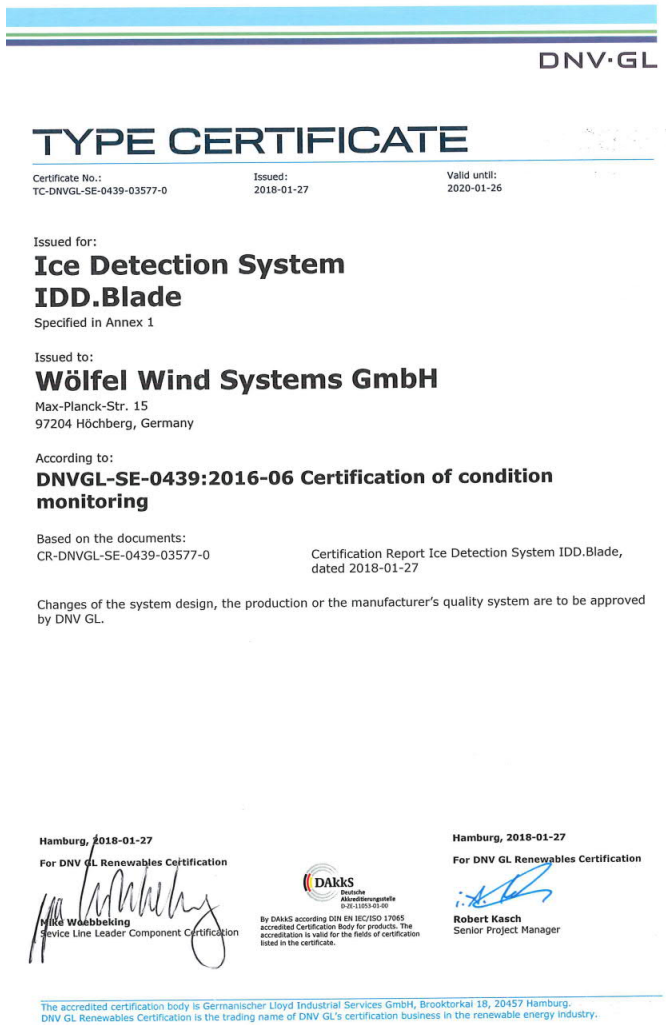
Material Damage

Public Safety

- 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/



DNV·GL

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 Woebbeking
Service Line Leader Component Certification

DAkkS Deutsche Akkreditierungsstelle D-ZE-11053-01-00
By DAkkS according DIN EN IEC/ISO 17065 accredited Certification Body for products. The accreditation is valid for the fields of certification listed in the certificate.

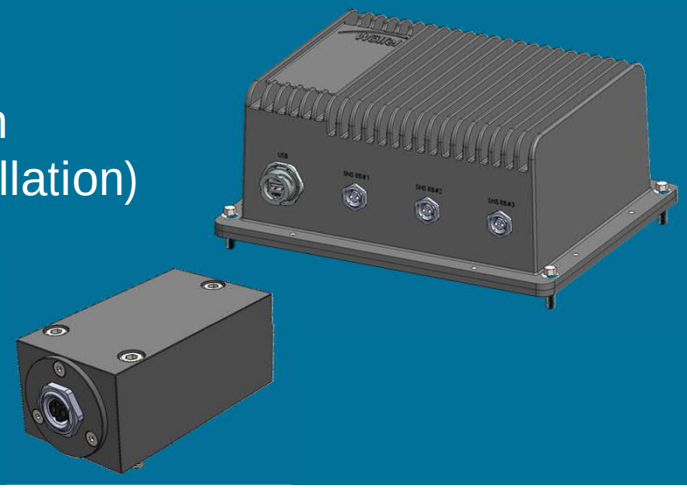
Hamburg, 2018-01-27
For DNV GL Renewables Certification
Robert Kasch
Senior Project Manager

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.

Accurate Ice Detection

Update of hardware platform

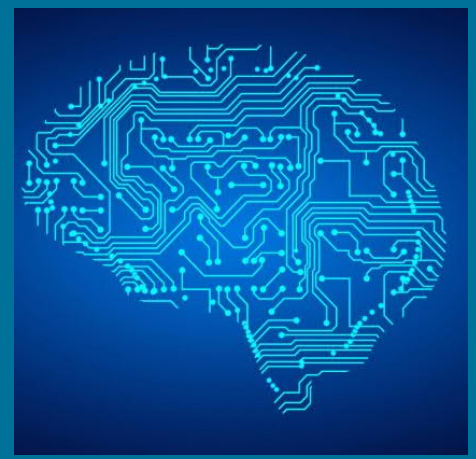
- Cost efficient (production + installation)
- Less space required
- Latest technology inside



Implementation of Artificial Intelligence

Machine learning algorithm is updating the accuracy permanently.

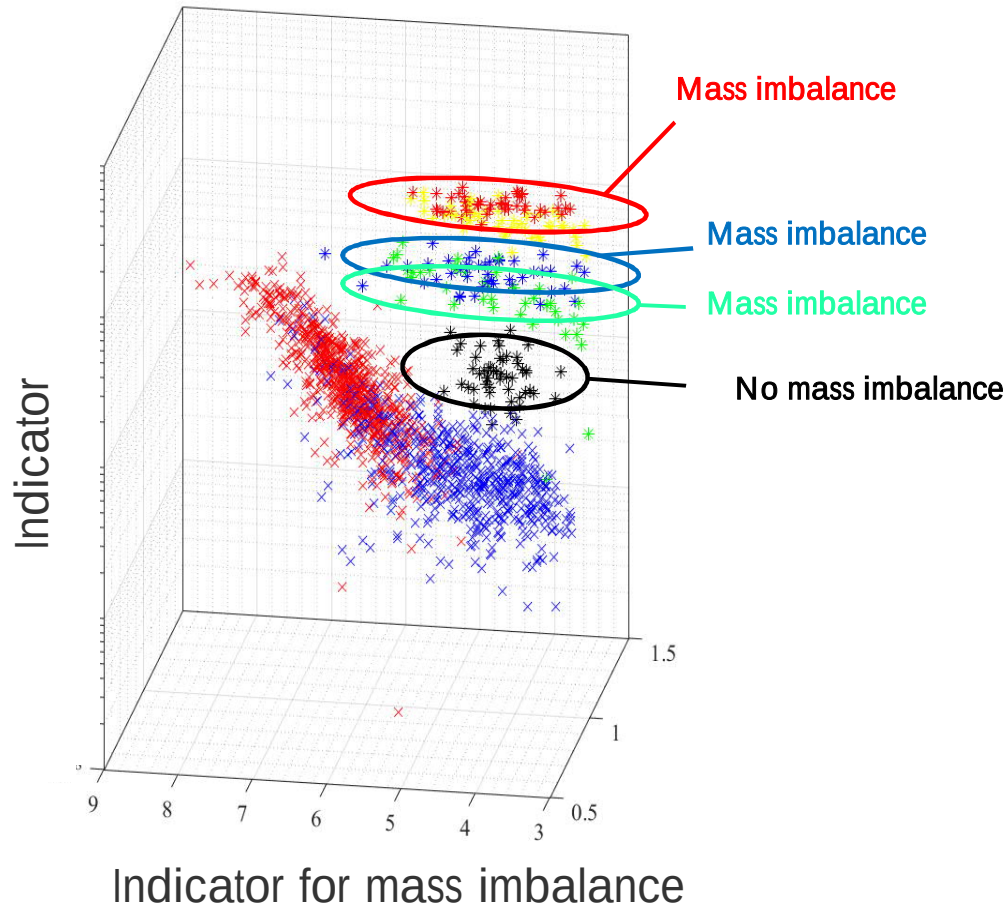
Higher Accuracy during longer Operation.



Material Damage

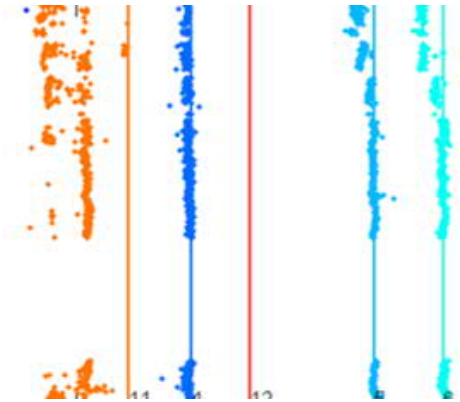
Higher loads and imbalances can lead to damages to the structure:

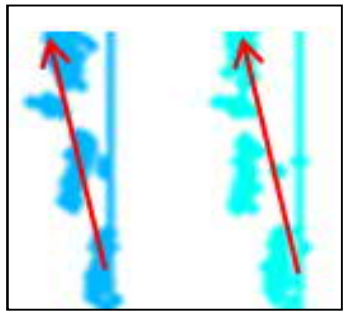
- enormous loss of revenue
- less lifetime for main components

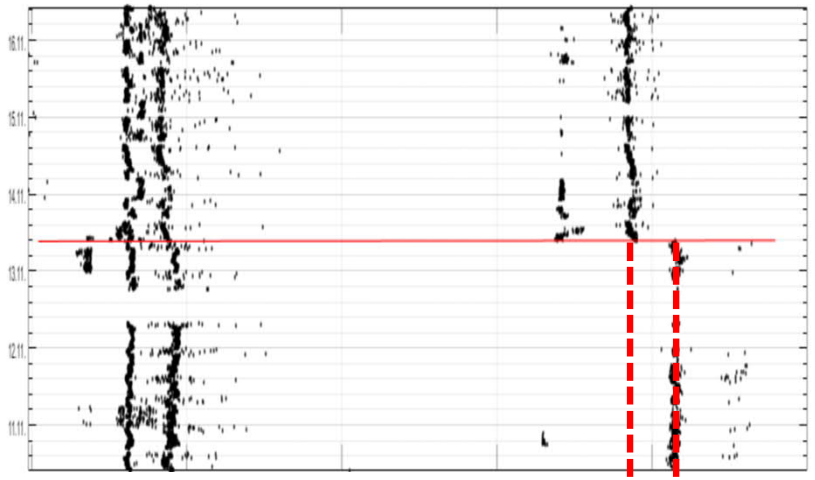


Lifetime control

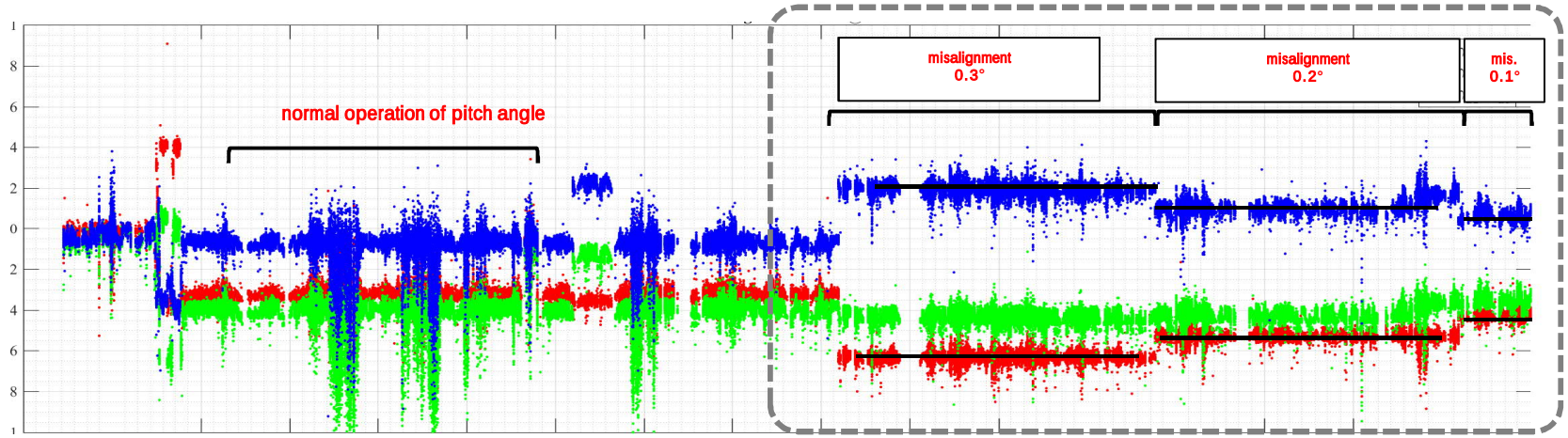
Rotor blade damage indication by a frequency shift

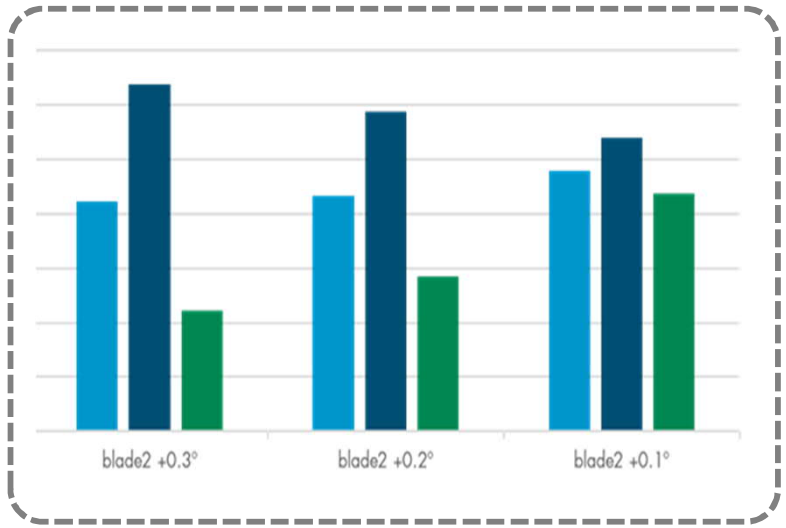






Lifetime control

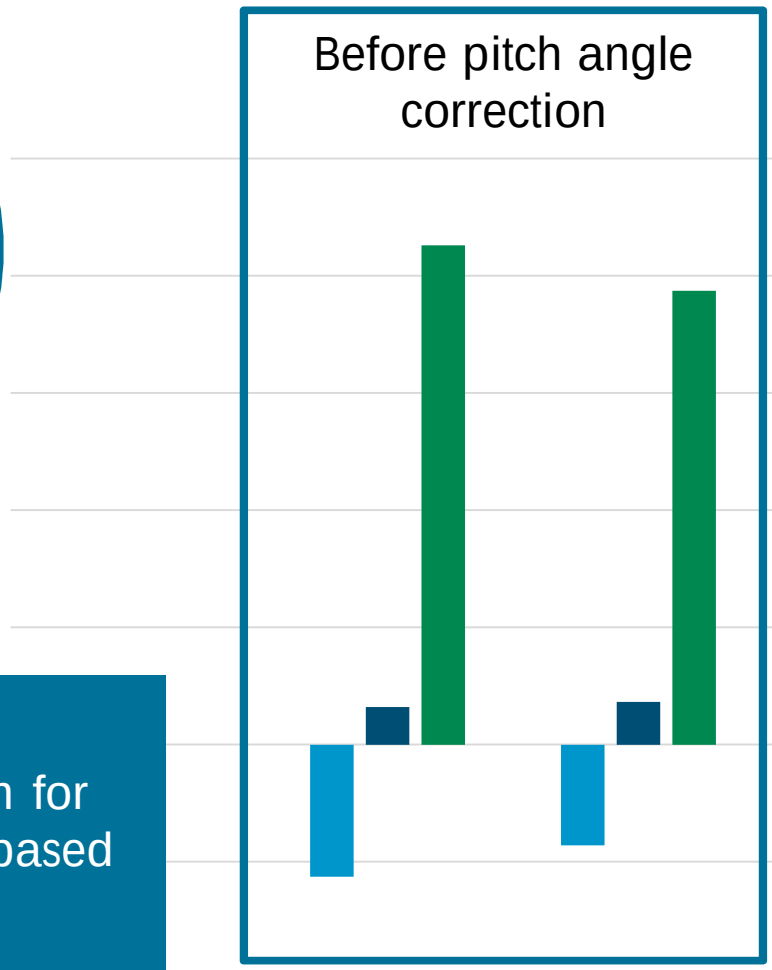


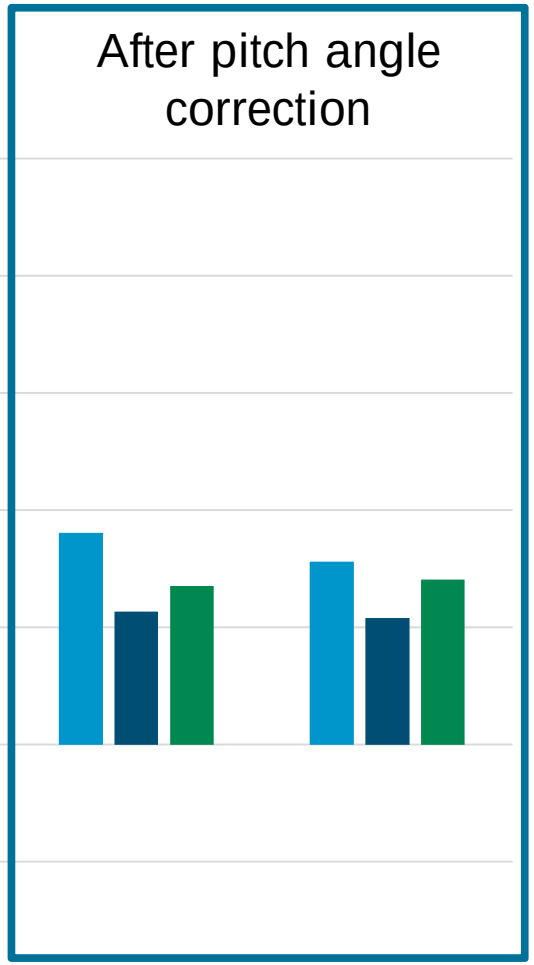


Pitch misalignment leads to different aerodynamic loading of the blades

Lifetime control

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





Public Safety

Lifetime control

Accurate Ice Detection

Material Damage

Keep your control - MIC.Wind