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# DETECTION AND ANALYZATION OF BEARING CURRENT ON THE MAIN SHAFT OF WIND TURBINE


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ELECTRIC POWER ENGINEERING


## Reference group

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Sponsor: Energimyndigheten and reference group

# Test result from SKF

## Effect of current, visible in laboratory tests (#1)

8h lab test

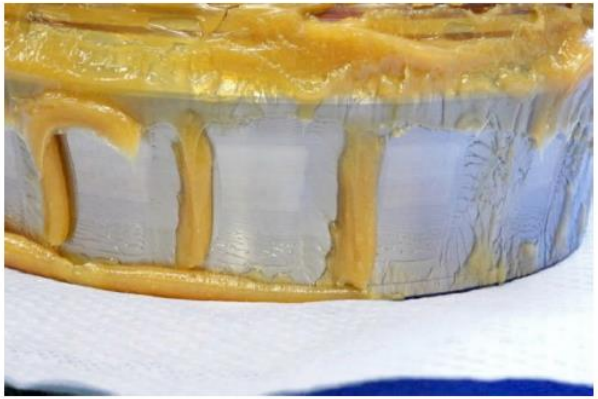
Thrust load scaled to replicate turbine conditions

Similar κ ratio to turbine

2A current

# Effect of current, visible in laboratory tests (#2)

Test result from SKF



100 h operation - No current

24 h more same conditions + Current

Grease color changed & roller race damaged

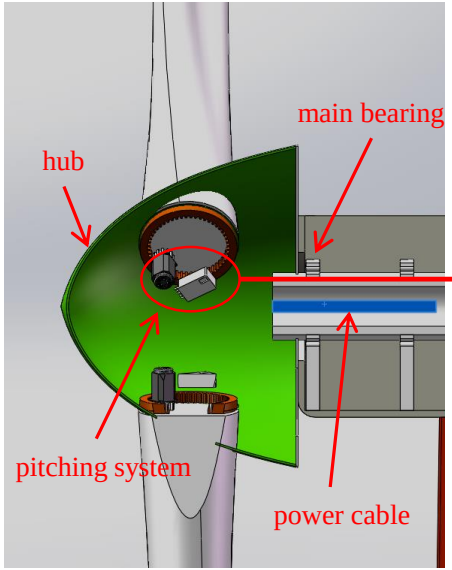
# Aim

The main aim of the project is to understand the origin of bearing currents in wind turbines and thus the possibility to counteract the same.

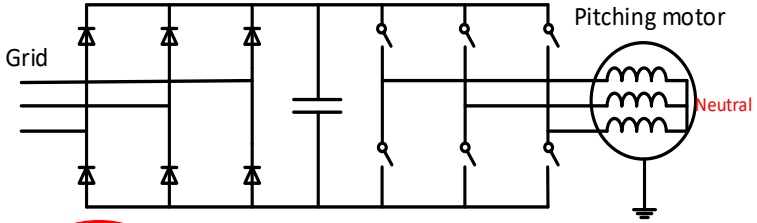
The objectives of the project are as follows:

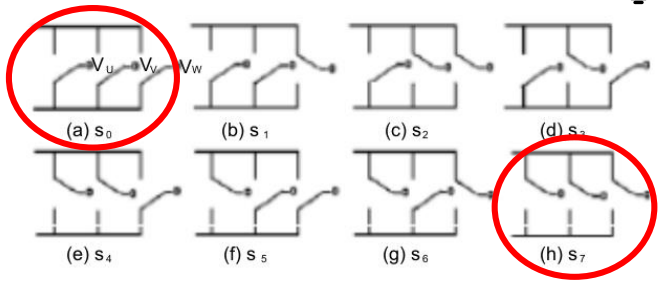
- To develop knowledge that describes how bearing currents occur.
- To develop methods for measuring bearing currents.
- To develop methods that prevent the bearing currents.

# Common mode voltage in pitching system




Pitching converter

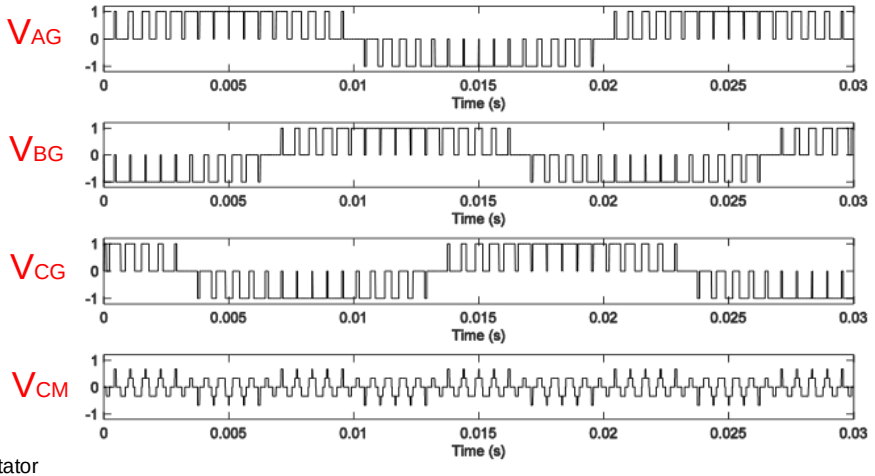


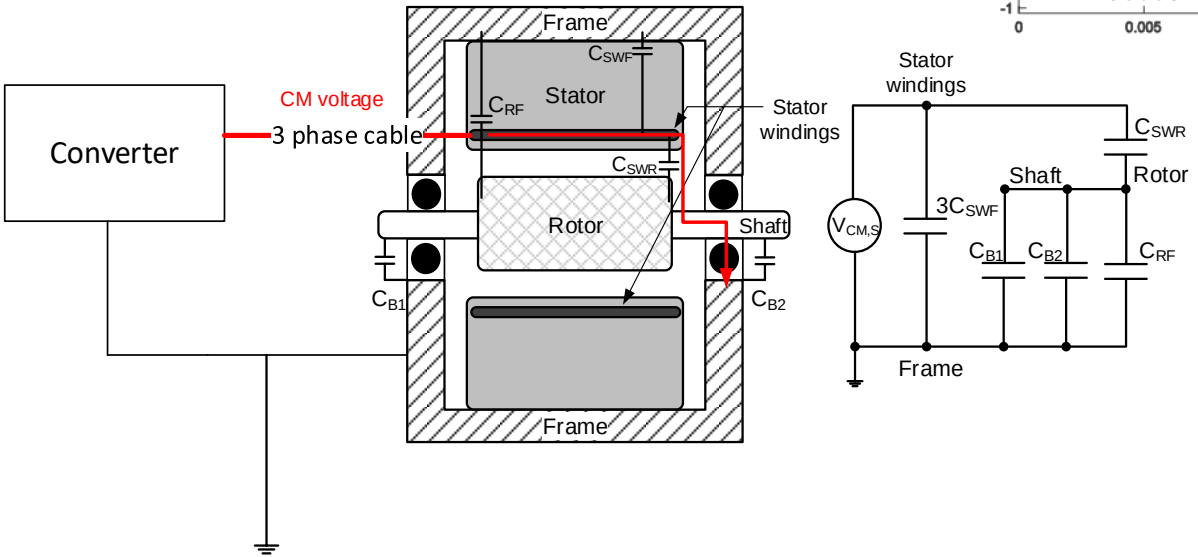




PWM feed converter with 3 bridges has 8 combination of switch state, $S_0$ and $S_7$ state have no loop in winding， the voltage direct drop on the neutral point

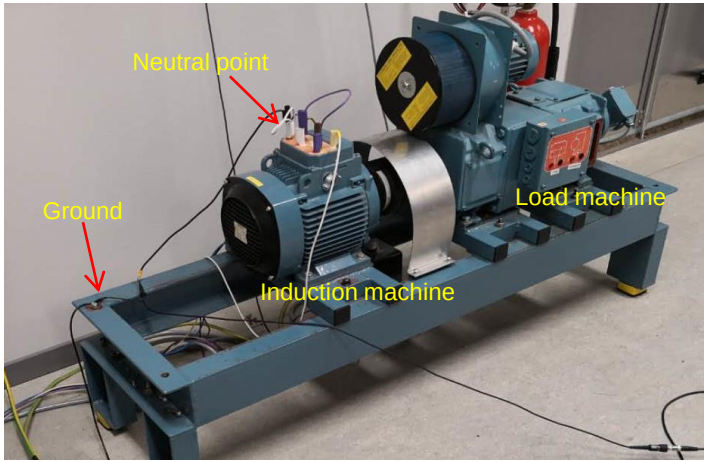
# Common mode voltage

$$V_{CM} = \frac{V_{AG}+V_{BG}+V_{CG}}{3} = \pm\frac{V_{DC}}{2}, \pm\frac{V_{DC}}{6}$$

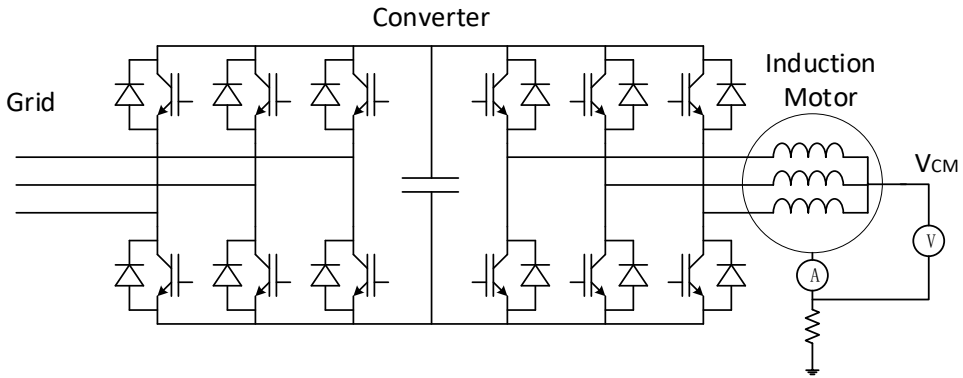


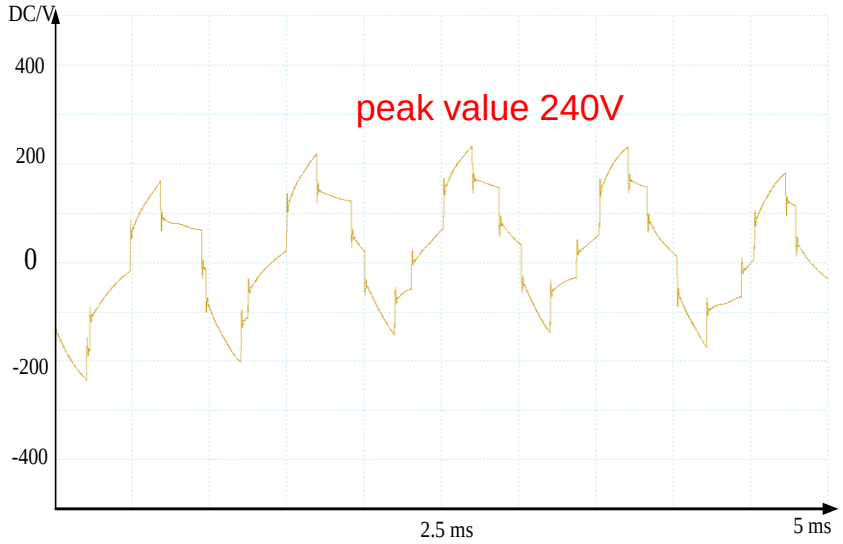



# Laboratory test of CM voltage



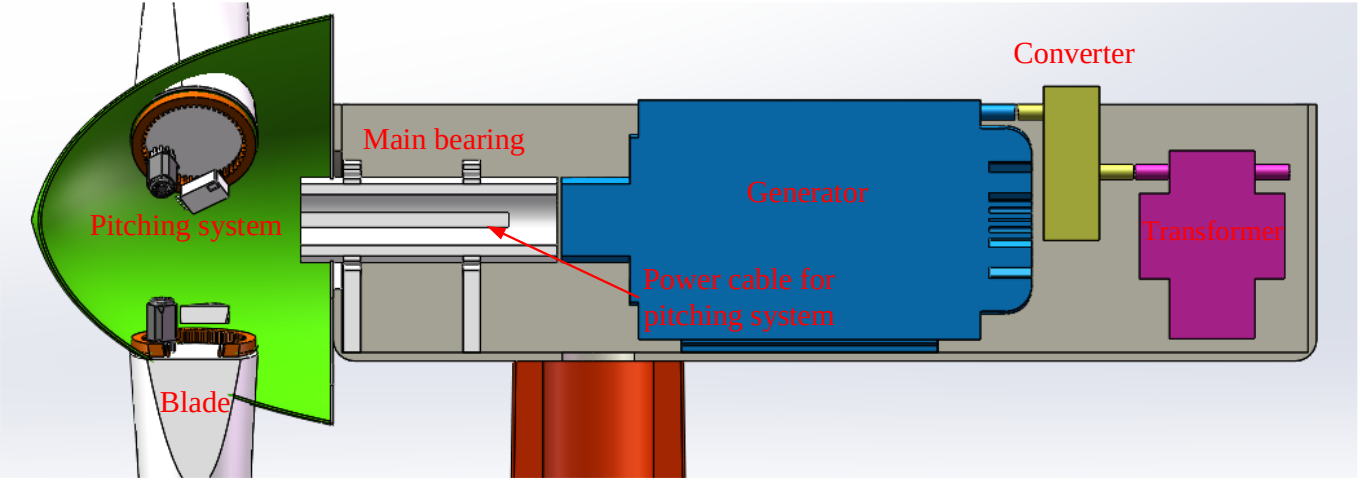

- Converter feed induction machine
- Neutral point floating
- CM voltage peak up to 240V

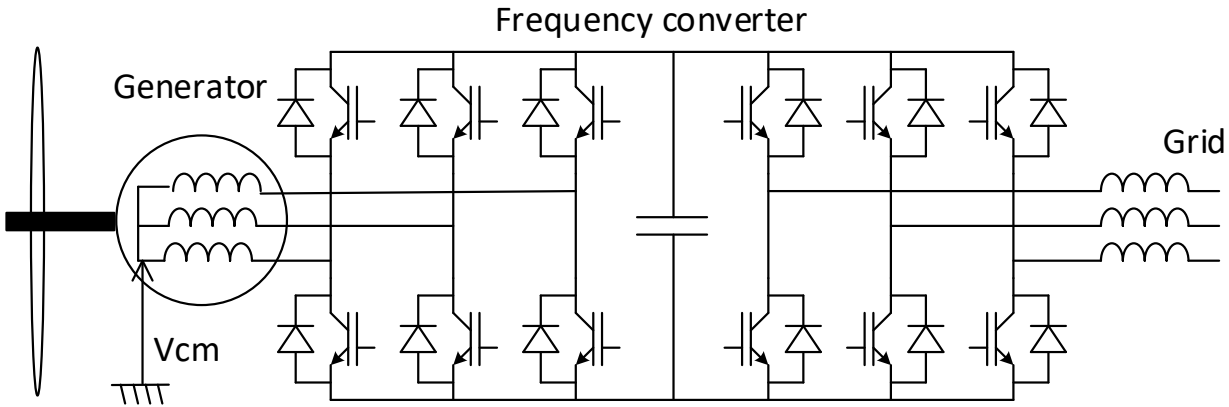


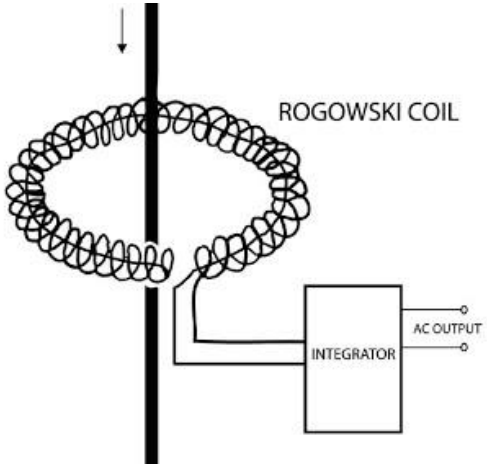
# On board test in Big Glenn

# Electrical and mechanical System in Big Glenn wind turbine



# Test System




Rogowski Coil


Picoscope

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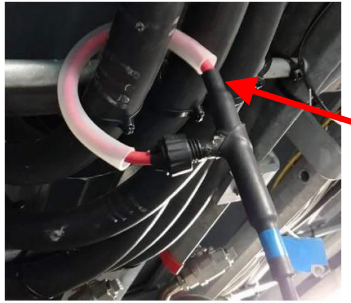
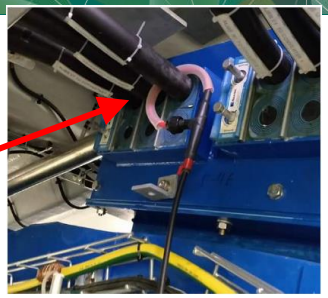
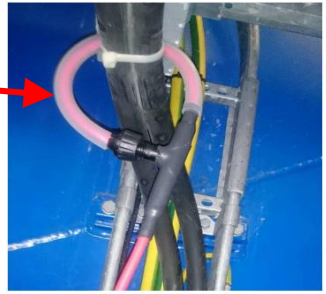
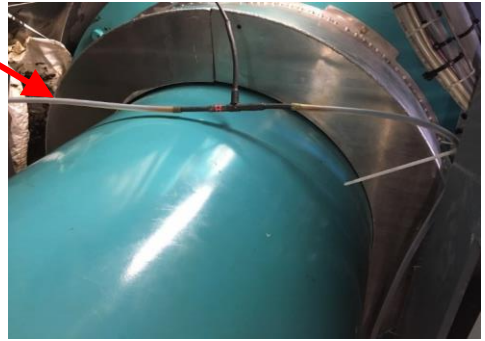
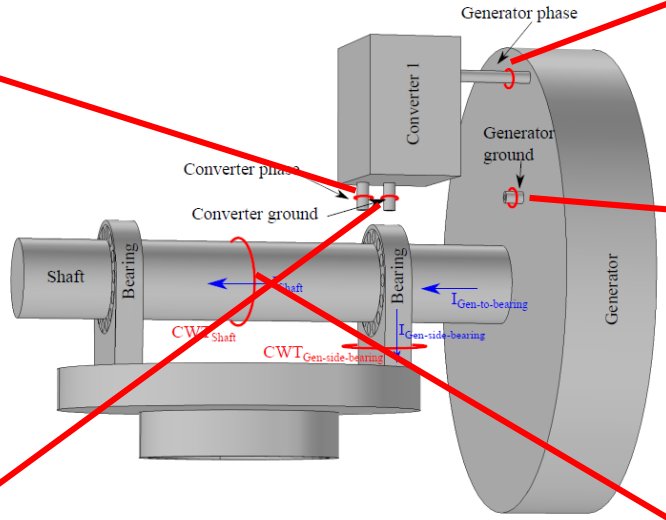
# Test coil setup



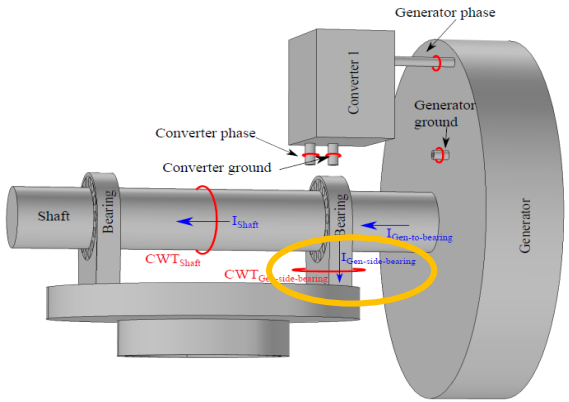


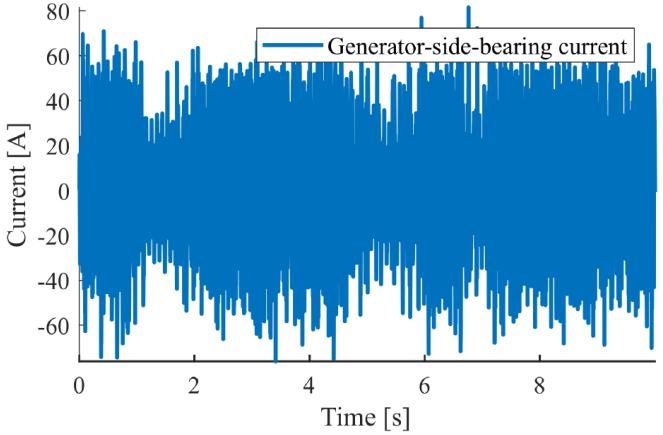


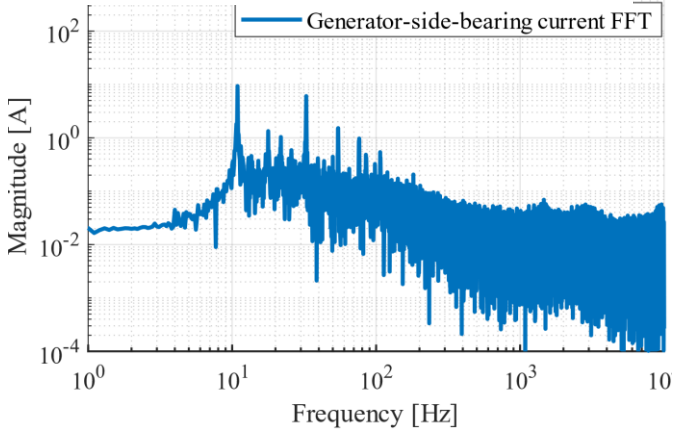


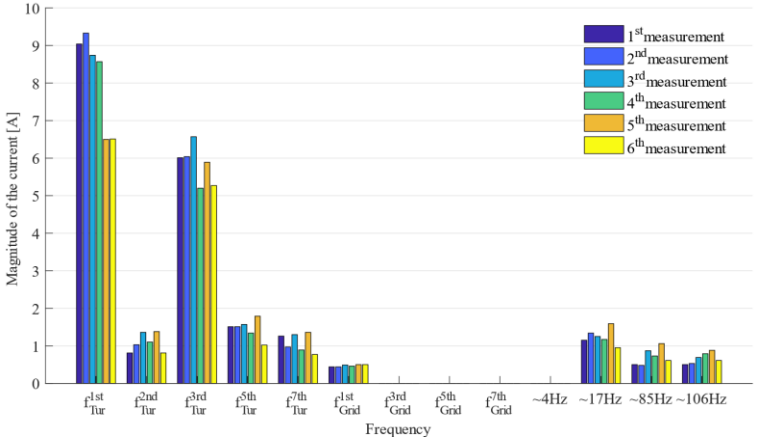


# Generator side bearing current



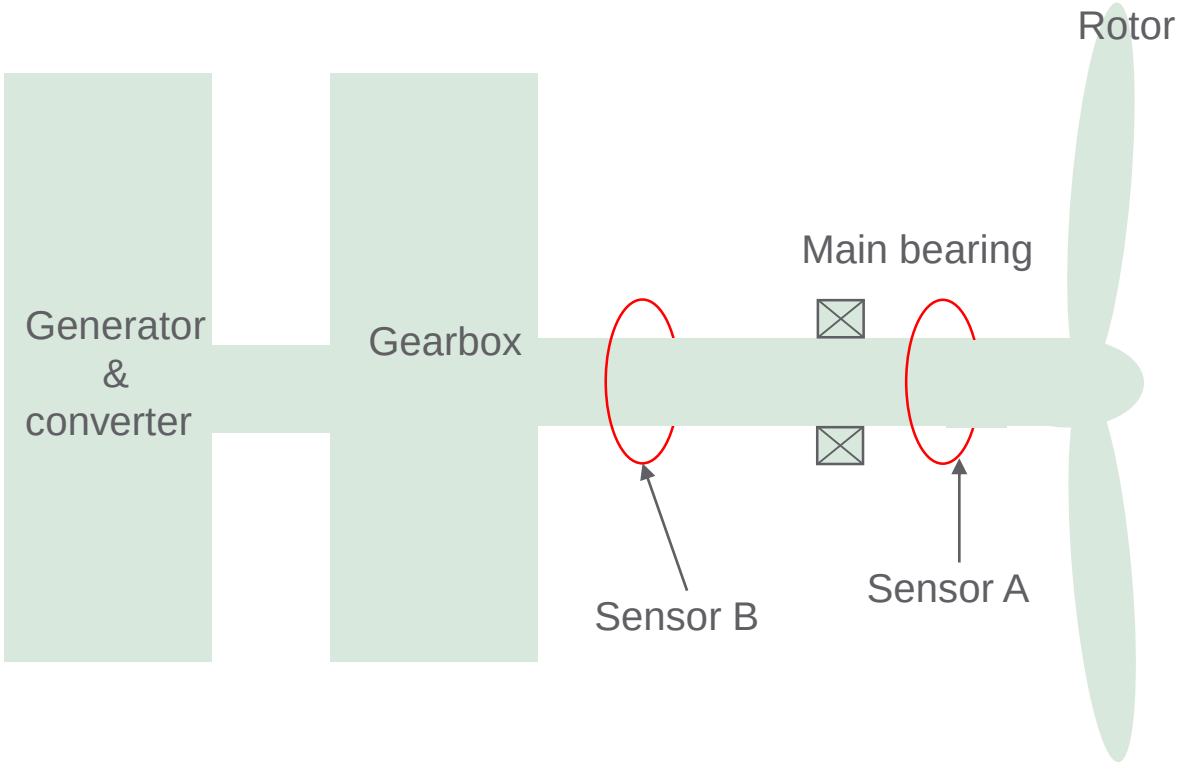
# Observations from Big Glenn

- There was a  noise from the bearings
- There were high temperatures of the bearings
- There were high current trough the bearings

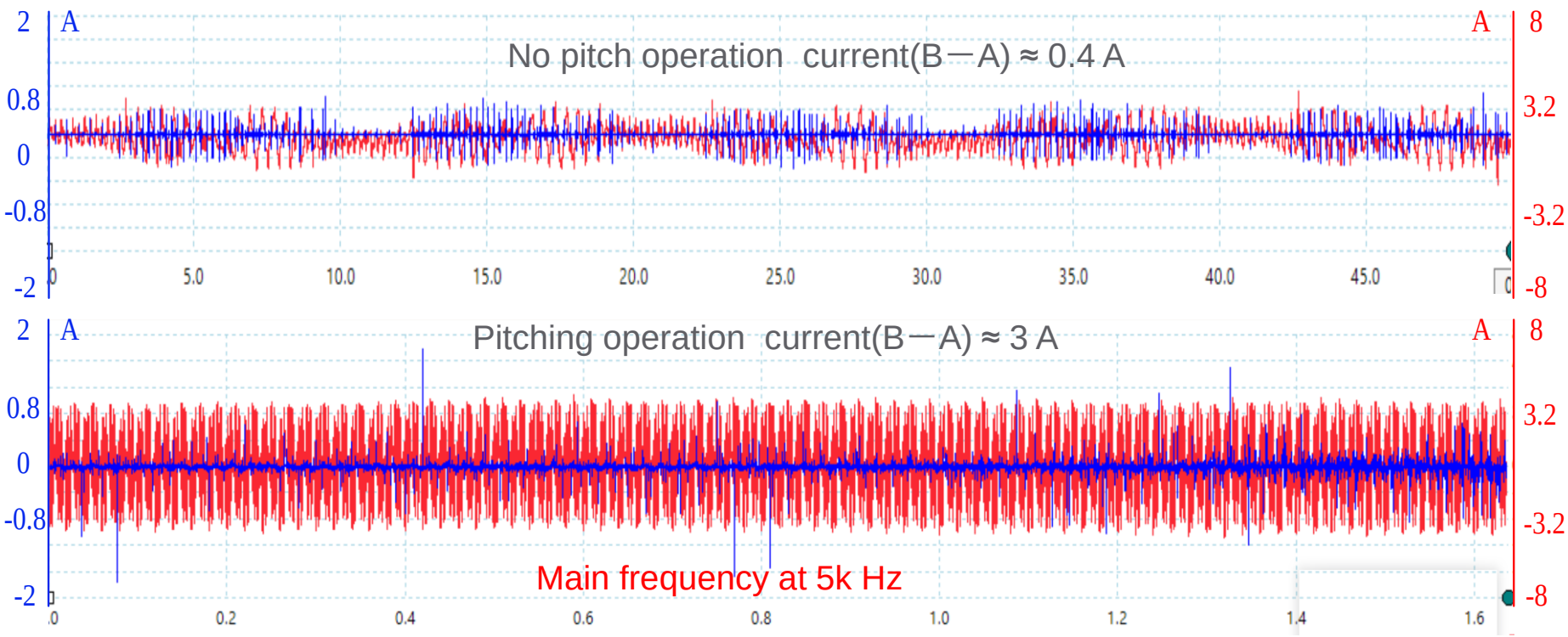
**The wind turbine is taken down,**
the bearing problems was one reason

# Measurements from Gårdsten, 2 MW

# Simplified turbine geometry



# Bearing Current during pitching



- Conclusion
  - Electrical pitching system generate CM voltage
  - CM voltage damage the main bearing
- Future work
  - Build more advanced online realtime test system
  - Analysis and eliminate CM voltage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