

# CMS in Wind From Big to Smart Data's



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2018 – 03 - 22

# Agenda

1. SKF / CMS / Remote Monit.
2. Turbine adjustment / Fleet Analysis
3. Fleet Comparison
5. Conclusion

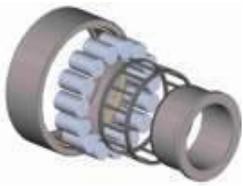
# 1

SKF / CMS / Remote Monit.

# SKF – Key figures

Established:	1907
Sales 2011:	SEK 66,575 million
Employees:	46,775
Production sites:	around 130 in 32 countries
SKF presence:	in over 130 countries
Distributors/dealers:	15,000 locations
Global certificates:	ISO 14001 OHSAS 18001 certification

# SKF market launches towards Wind Energy



New CRB-design with extra-high carrying capacity (2006) + new (2010) separable version

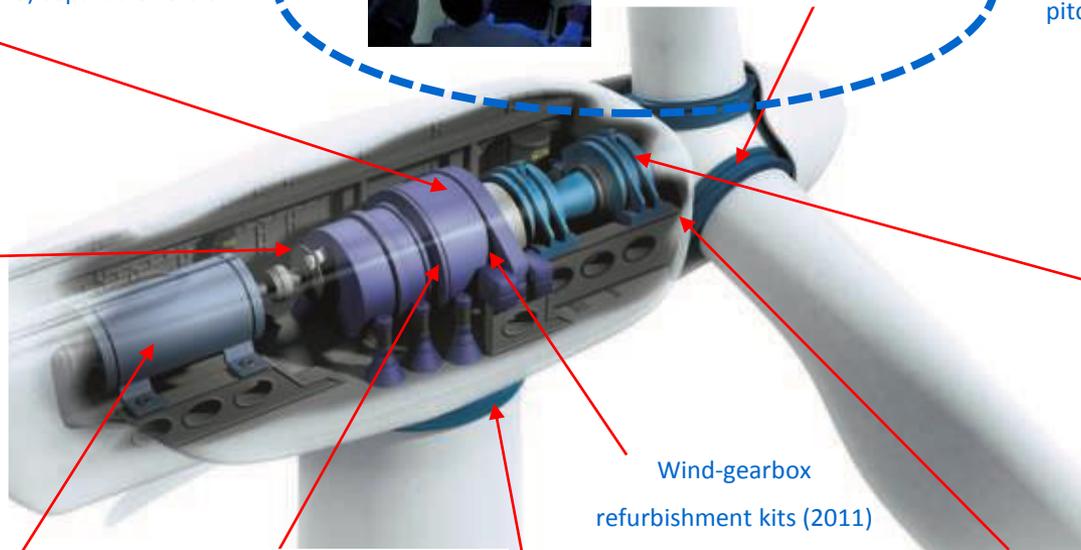


Remote monitoring & failure analysis of wind farms (2007)

New high endurance slewing bearing design for active windturbine pitch applications (2012)



CMS - WindCon 3.0 for early detection of mechanical failures (2008)



Nautilus range extension with a range of additional customized features (2012)



Wind-gearbox refurbishment kits (2011)



Black-oxidized gearbox bearings for improved run-in performance (2010)

Automatic centralized lubrication for reduced maintenance costs (2007)



Reinforced rubber sealing solutions for windturbines (2011)

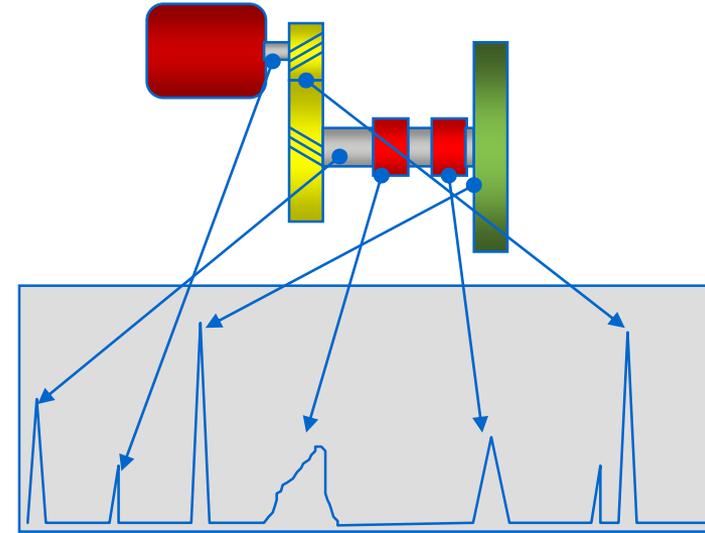
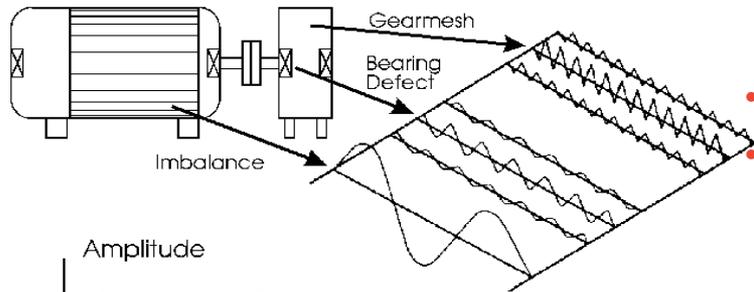
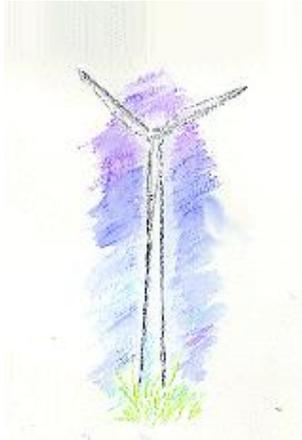


XL Hybrid bearings with ceramic balls for superior insulation of wind-generators (2007)

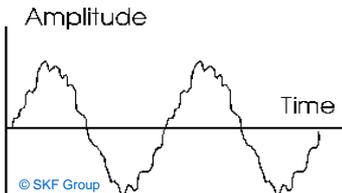


# Preliminary: Condition Monitoring using Vibration measurements

- Bearing is the heart of any rotating machinery.
- Bearing failure – “ Root cause of unplanned breakdown”
- Machine vibration is the parameter that gives the best overall measure of the condition to rotating machines

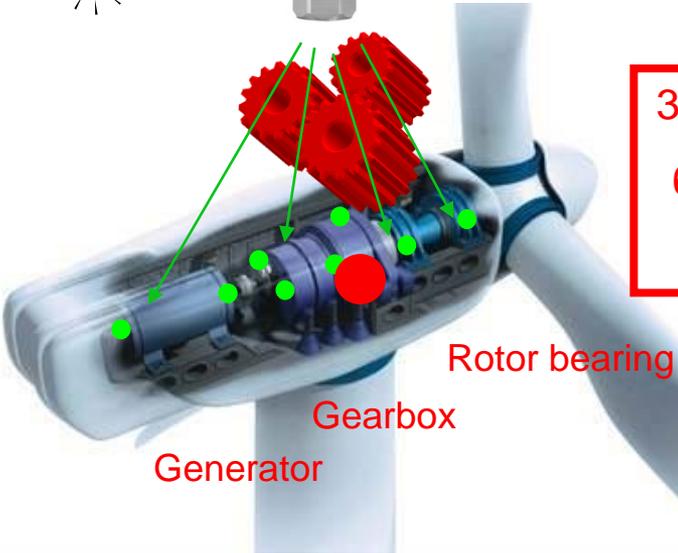


- Vibration **Amplitude** indicates the **Severity** of the problem.
- Vibration **Frequency** indicates the **Source** of the problem.



# Vibration Monitoring on wind turbines

Acceleration sensors



3 000 trend pts/WTG/year  
600 spectra's/WTG/year  
= BIG DATA's



Monitoring Unit  
(SKF IMX)

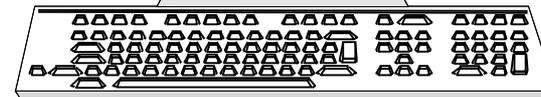


Automatic alarms

Data analysis and  
Condition investigation  
&  
Recommendation to the  
customer



SKF RDC  
Remote  
Diagnostic  
Centre



Event Report		SKF	
Condition:	63056_EX	Severity:	7
<p>Event No: 63056/2009/01 Windpark: [redacted] Wind Turbine: Nordic N1000 Manufacturer: [redacted]</p>			
Component:	Generator	Manufacturer:	[redacted]
Location:	[redacted]	Manufacturer:	[redacted]
Manufacturer:	[redacted]	Manufacturer:	[redacted]
<p>The classification is specified as follows:</p> <ul style="list-style-type: none"> <li>normal operation or wear - no action required</li> <li>visible defect indicators - no change necessary; watch other</li> <li>serious defect; an immediate replacement is necessary to prevent</li> <li>consequential damages</li> </ul>			
Date:	Hamburg, 18.08.2009	By:	Heid Wittke
Reported by:	[redacted]	Approved by:	Christian Alberts

# CMS / RDC contracts / Turbines Refs. / Global Presence

Approx 4 000 CMS sold since 2005

Approx 2 000 of them are monitored by SKF

> 40 WTG types from 15 OEM's

Manufacturer	Model	Number	Manufacturer	Modl	Number
Gamesa 	G47	12	<b>SENVION</b> wind energy solutions	MD77	63
	G58	9		MM70	4
	G90	15		MM82	129
GE Energy 	1.5sl & 1.5s	232		MM92	120
				5M/6M	52/36
	V42, V52	1	Frisia	68/750	1
	V44	5	NEG-Micon	64c/1500	10
	V47	5		52/900	1
	V66	66	Nordtank	500/37	1
	V80	75	Tacke	1.5s	1
	V90 2M 3M	>500	Clipperwind	2.5	1
SIEMENS	1.3MW	75		N60	19
Ingetur	1.5MW	1		N100	29
				N117	100
IMPSA	2MW	1	Mitsubishi	MHI 1.0	49



# 2

## Turbine adjustment / Fleet Analysis

# Work process – SL = Service Level

1. Adjusting phase  
SLO (3 month)

Data collecting 2MB/day/WTG

Individual alarm setting /early warning  
„as low as possible and as high as necessary“

Evaluation of status  
„check spectra’s“

comparison of machines

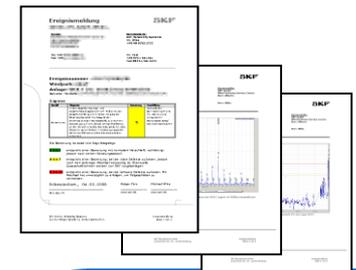
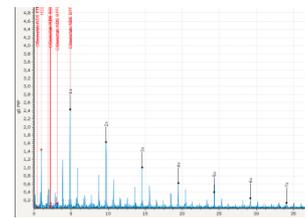
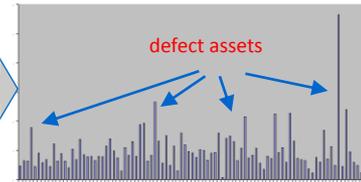
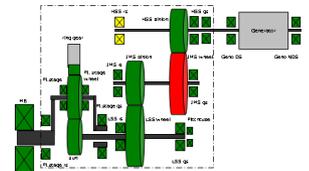
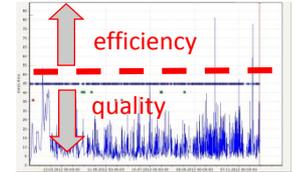
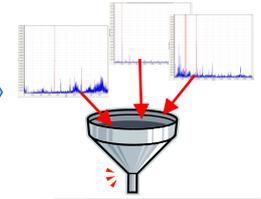
Adjusted system

2. Condition monitoring  
SL1

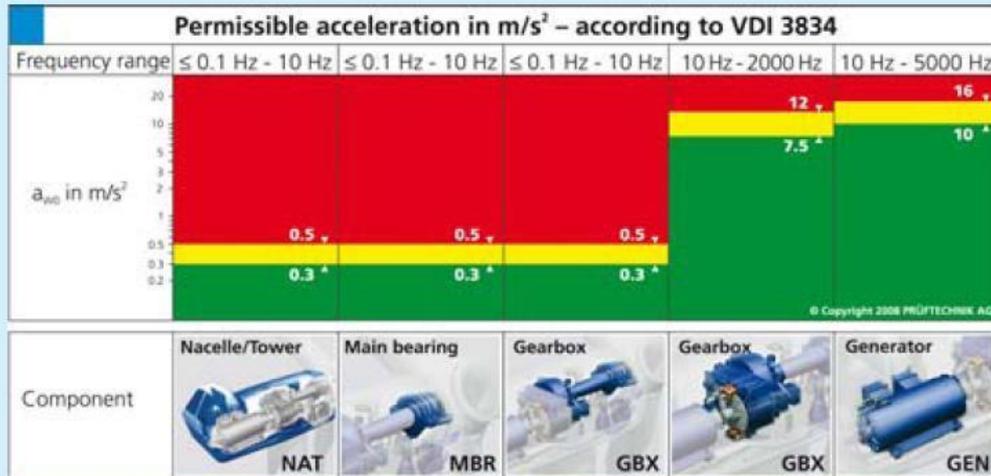
1. Alarming as a trigger event

2. Analysis

3. Reporting



# Basic of fleet comparison

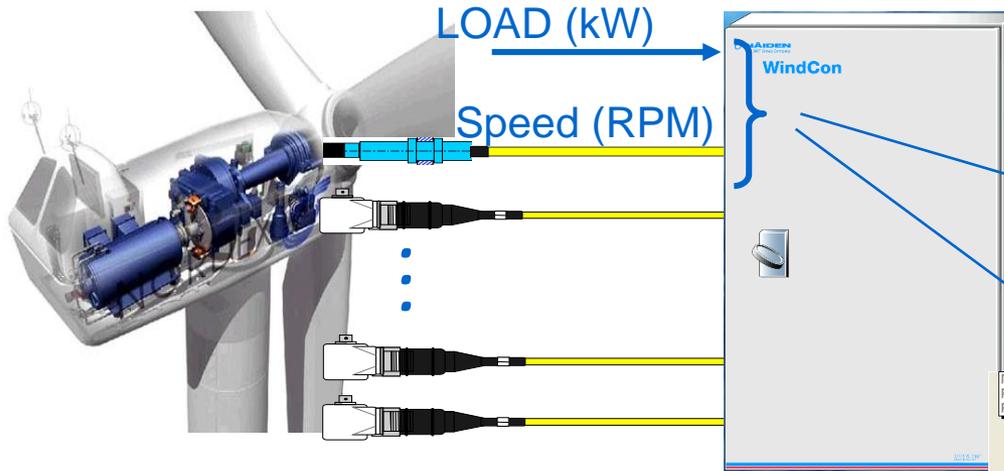


Permissible evaluation accelerations

VDI 3834 acceleration  
alarm for wind turbine application

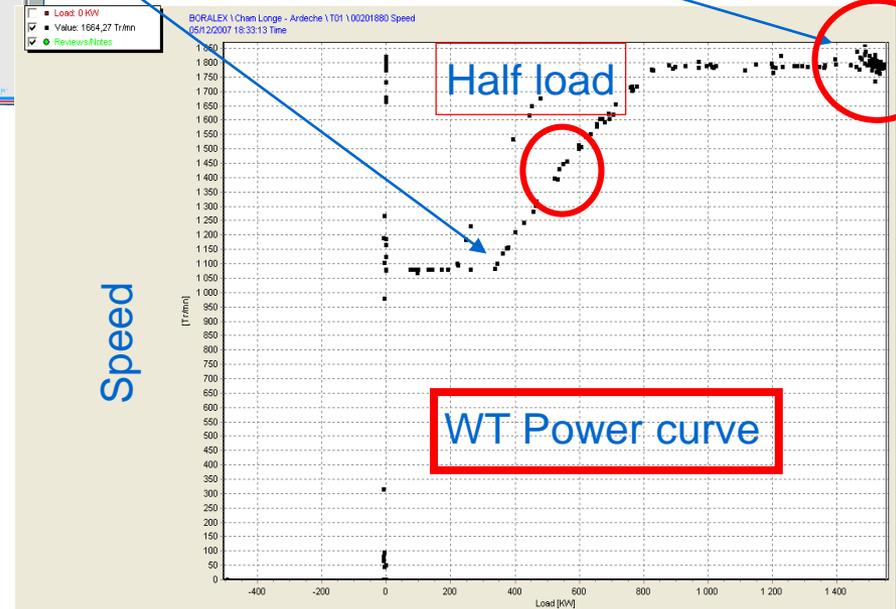
1. Identical machines
2. Identical components
3. Sensor positions
4. Same Parameter
5. Age
6. Location

# Technology: Active Range - Always measure in same conditions for efficient trend Data comparison

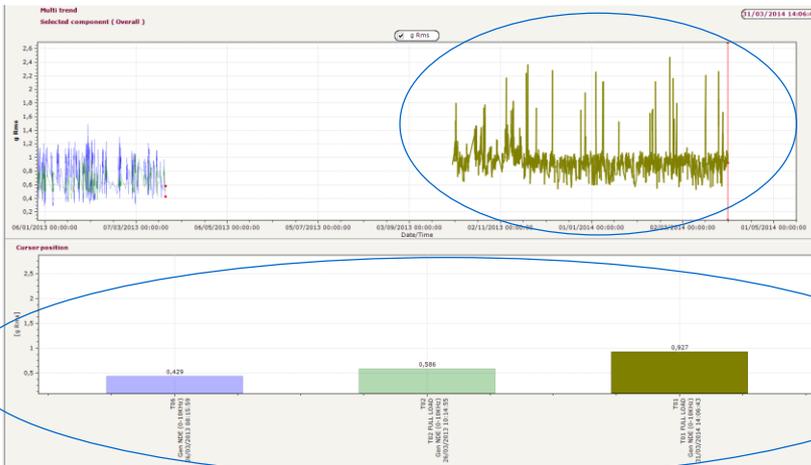


Measurement Range(s) :  
1 or 2 load classes

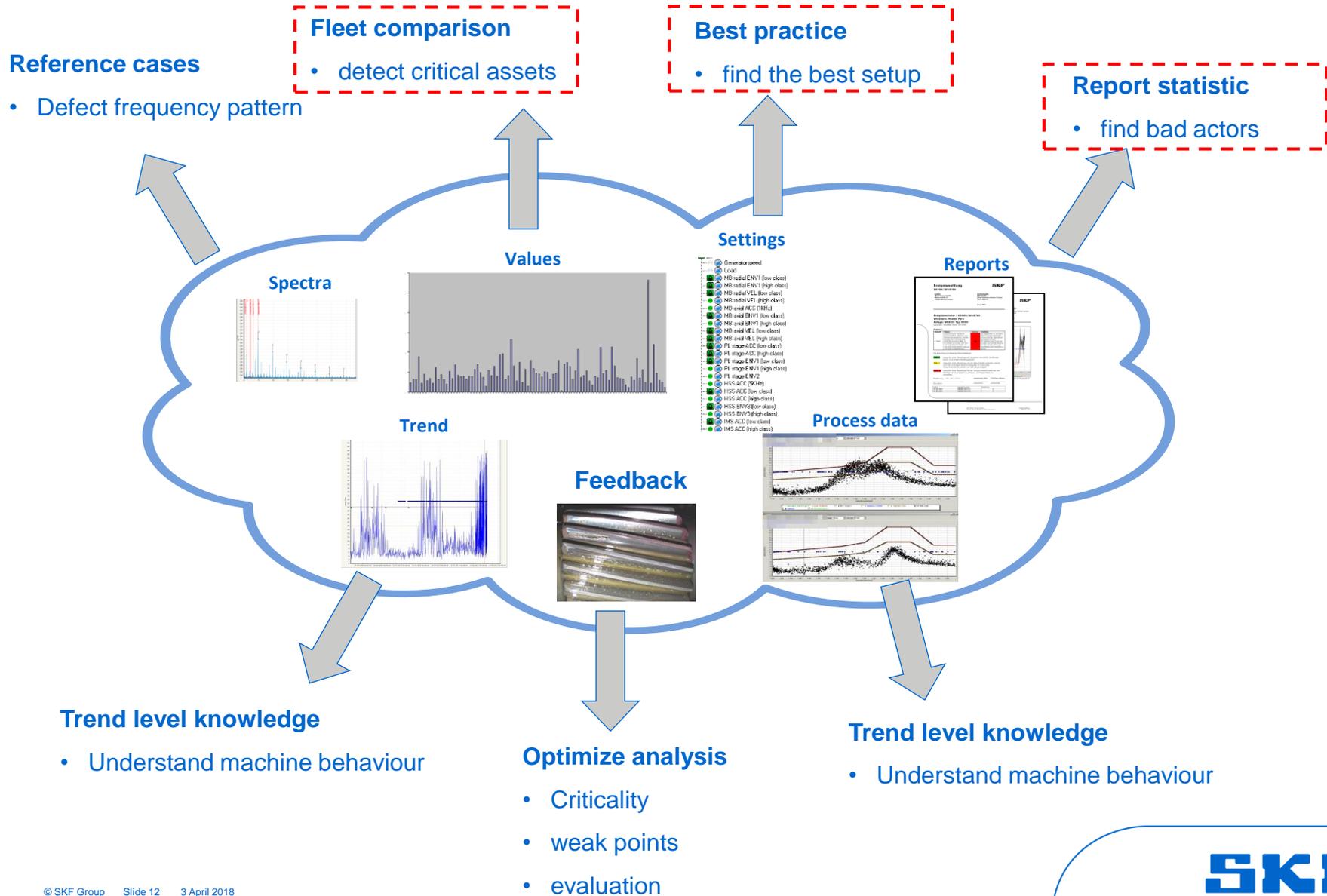
Full load



Load



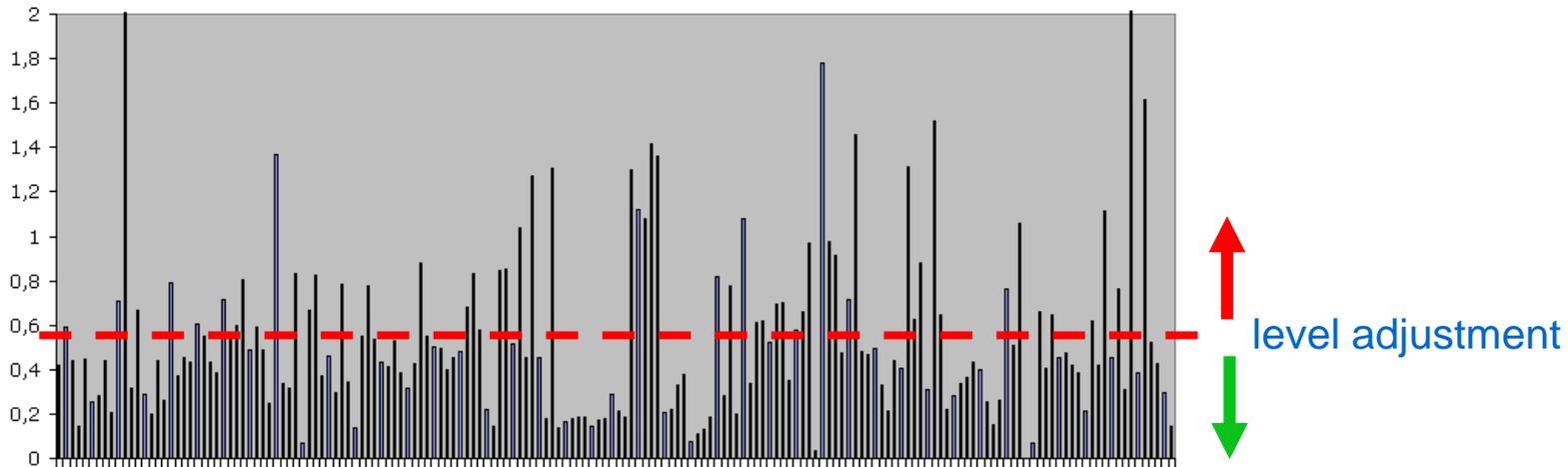
# What does „fleet analysis“ mean ?



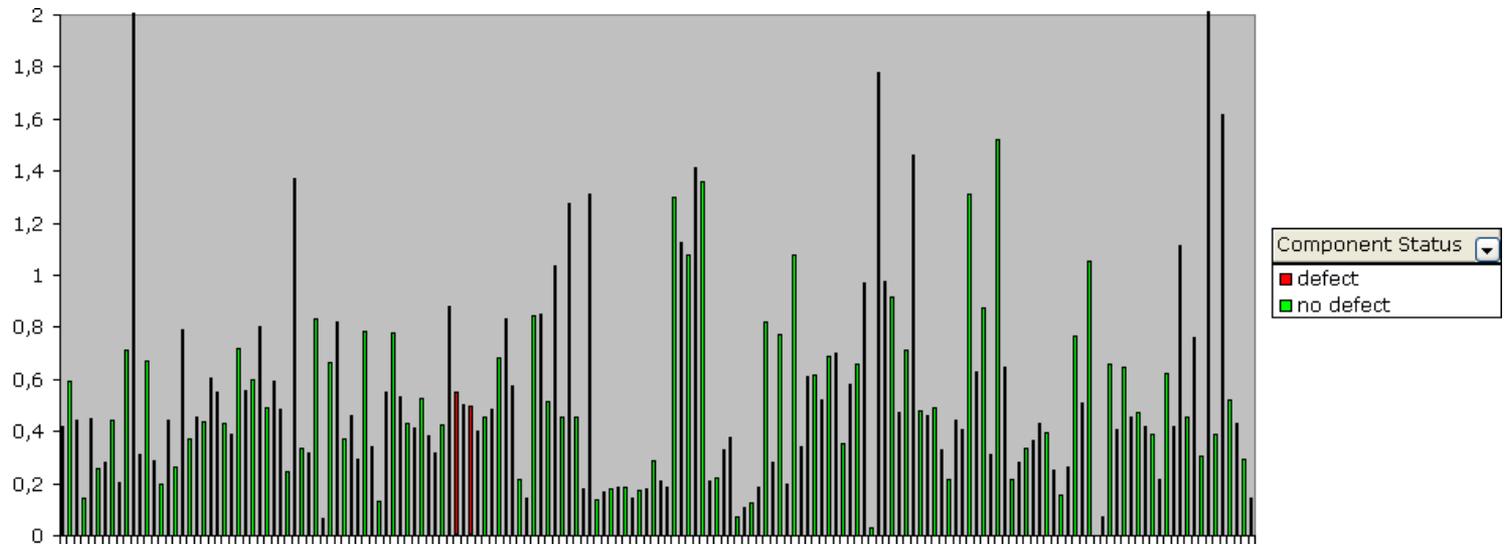
# 3

## Fleet comparison

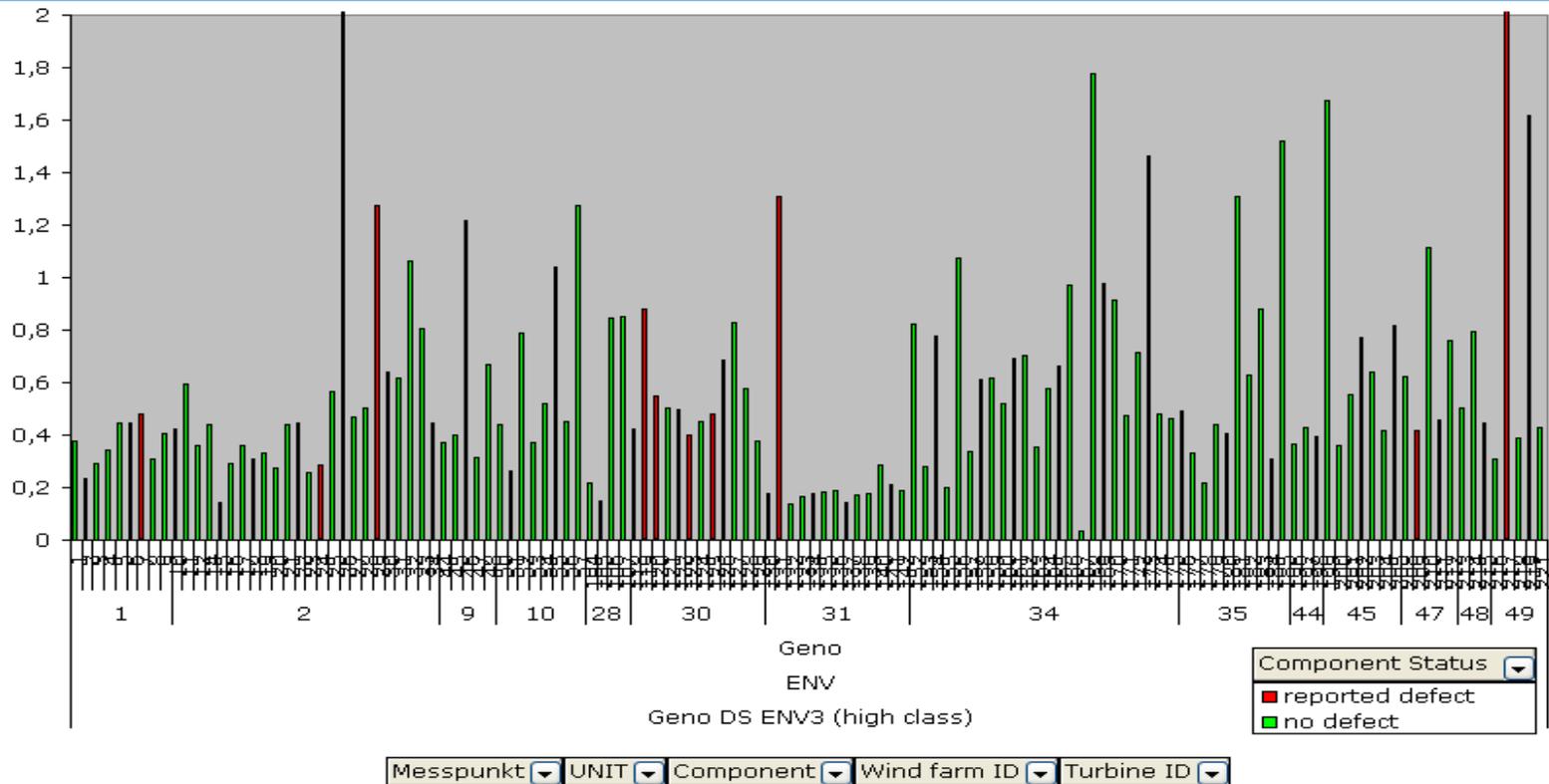
# Comparison of Measurement Data



absolute values of the total pool of wind turbines



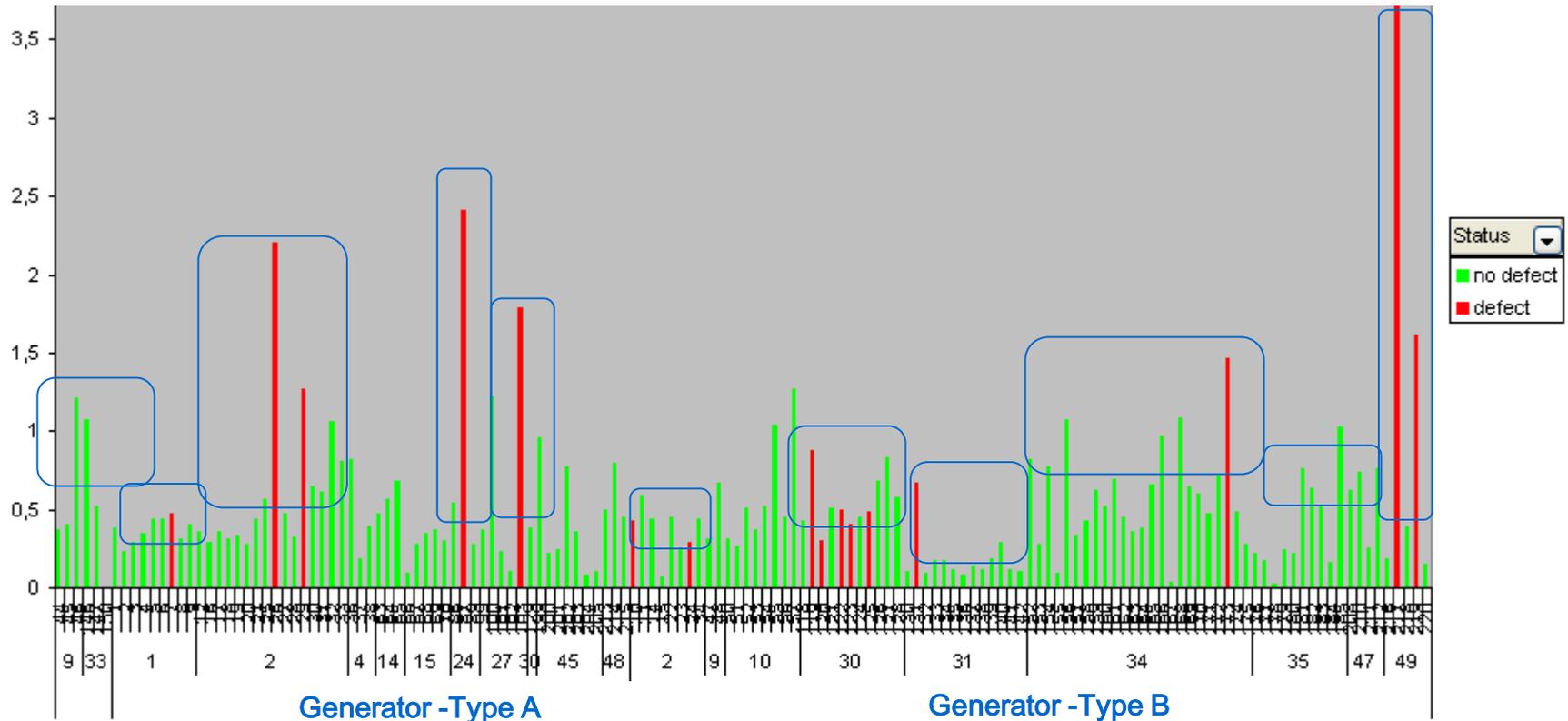
# Selection of trend data



## Filter parameter

- Machine
- Sensor position
- Measurement parameter

# Filtering and Correction of the Pool



## Influence factors:

- local influences (different wind farms)
- statistical selection
  - elimination of known defects
  - Correctness factors

Result = Decision guidance

# 5

## Conclusion

# From Big to Smart Data's

- Ensure to take measurements in comparable conditons
- Classify following criteria's of comparison
- Fleet comparison
- In depth analysis on suspicious cases
- Allows a better Detection rate + work efficiency

# Questions ?

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