SKF

WindCon

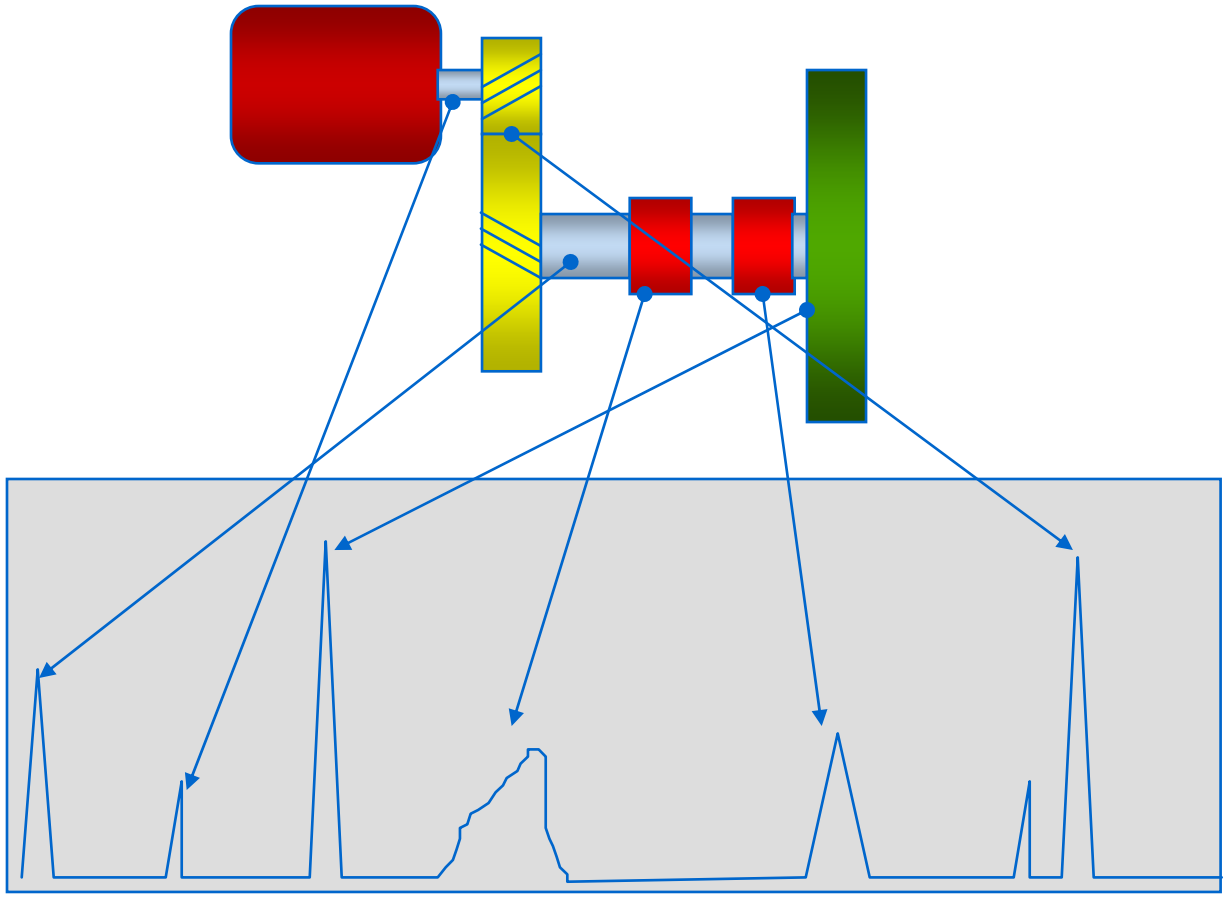
Condition Monitoring for Wind farms

2006 Wind Turbine Reliability Workshop

Presented by Harry Timmerman
Product Manager WindCon

2006-10-19

Condition Monitoring
vibration analysis

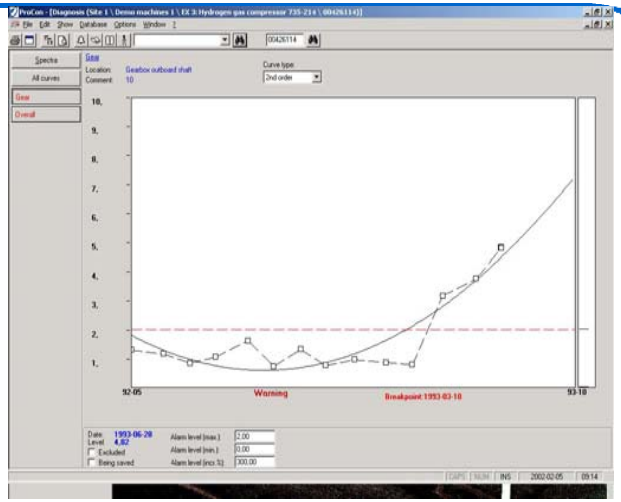


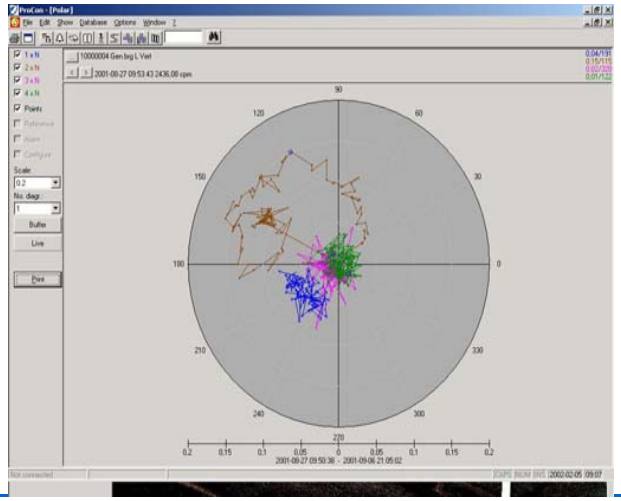
Wind Energy Industry is different

INDUSTRY	COST
STEEL MILL	10 000 US $ / Hour
PAPER MILL	10 000 US $ / Hour
POWER PLANT (600 MW)	15 000 US $ / Hour
CAR PLANT (paint shop)	100 000 US $ total
PETROCHEMICAL	Millions of US $ (1 stop = 3 to 4 days
CEMENT MILL	
FOOD PROCESSING	5000 US $ / Hour
Offshore Wind Turbine	100 U$ / Hour

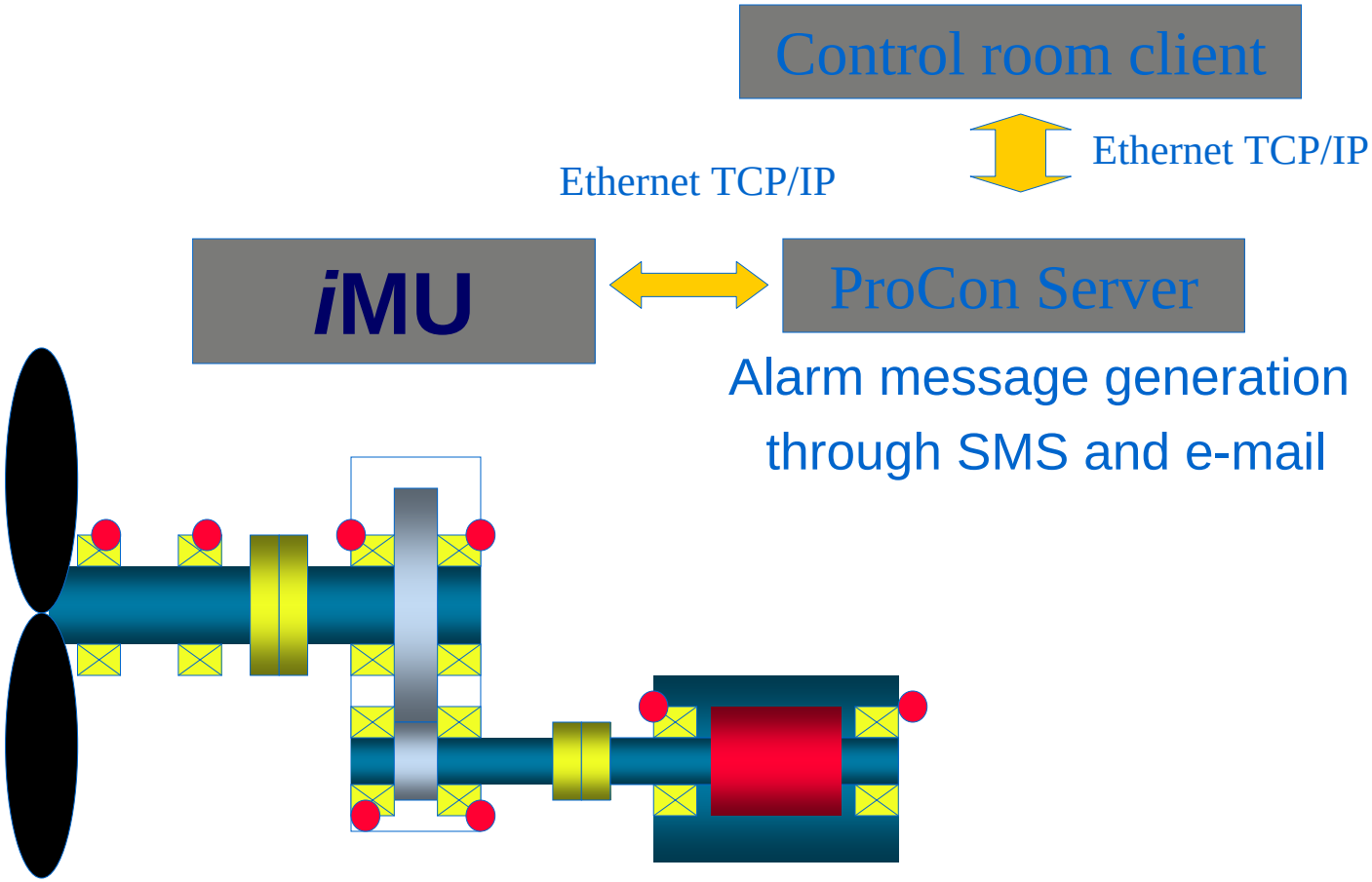
ProCon Wind Turbine Root Causes

- Unbalance
- Alignment errors
- Bearing problems
- Damage on gear wheels
- Bend shafts
- Mechanical looseness
- Tower vibrations
- Blade vibrations
- Electrical problems
- Resonance problems

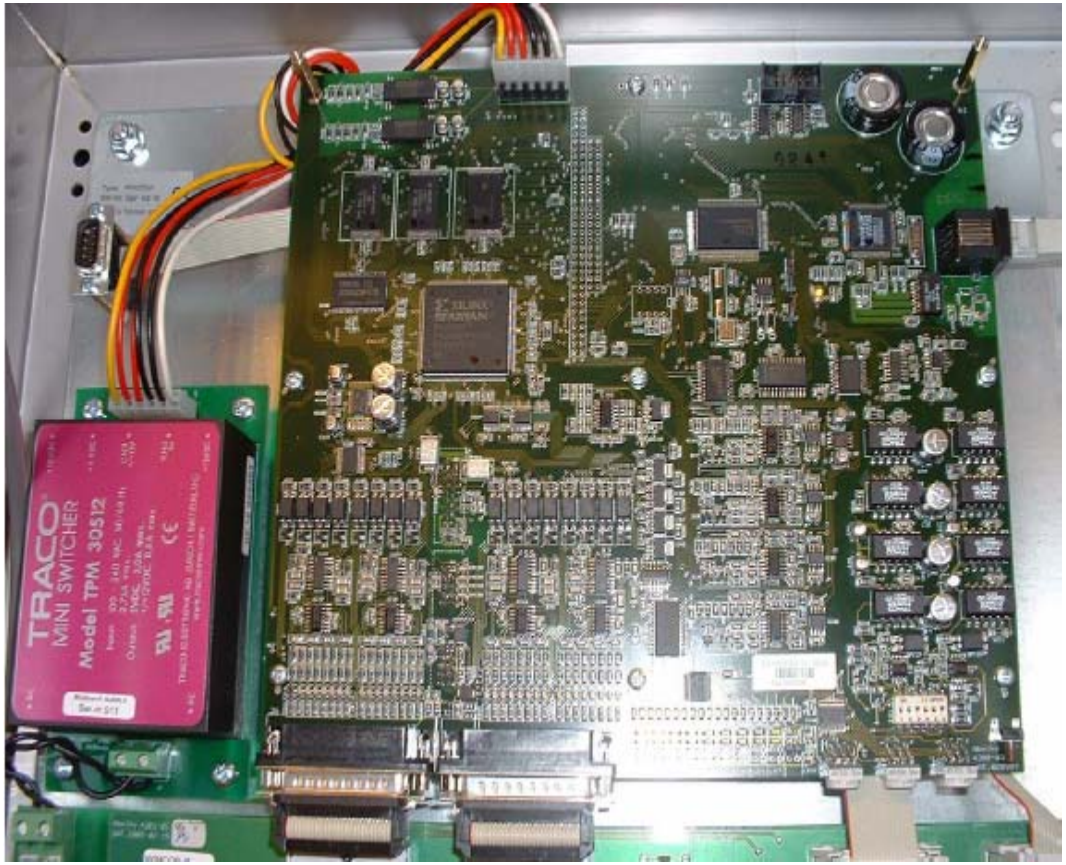




System Lay out…



iMU 16 channel board



4 x 4

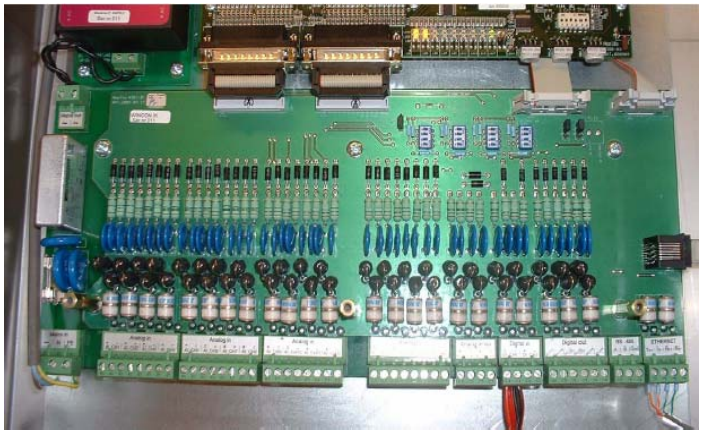
Robustness ……

Lightning protection: EN61000-6-2:1999, EN61000-4-5: 4 kV

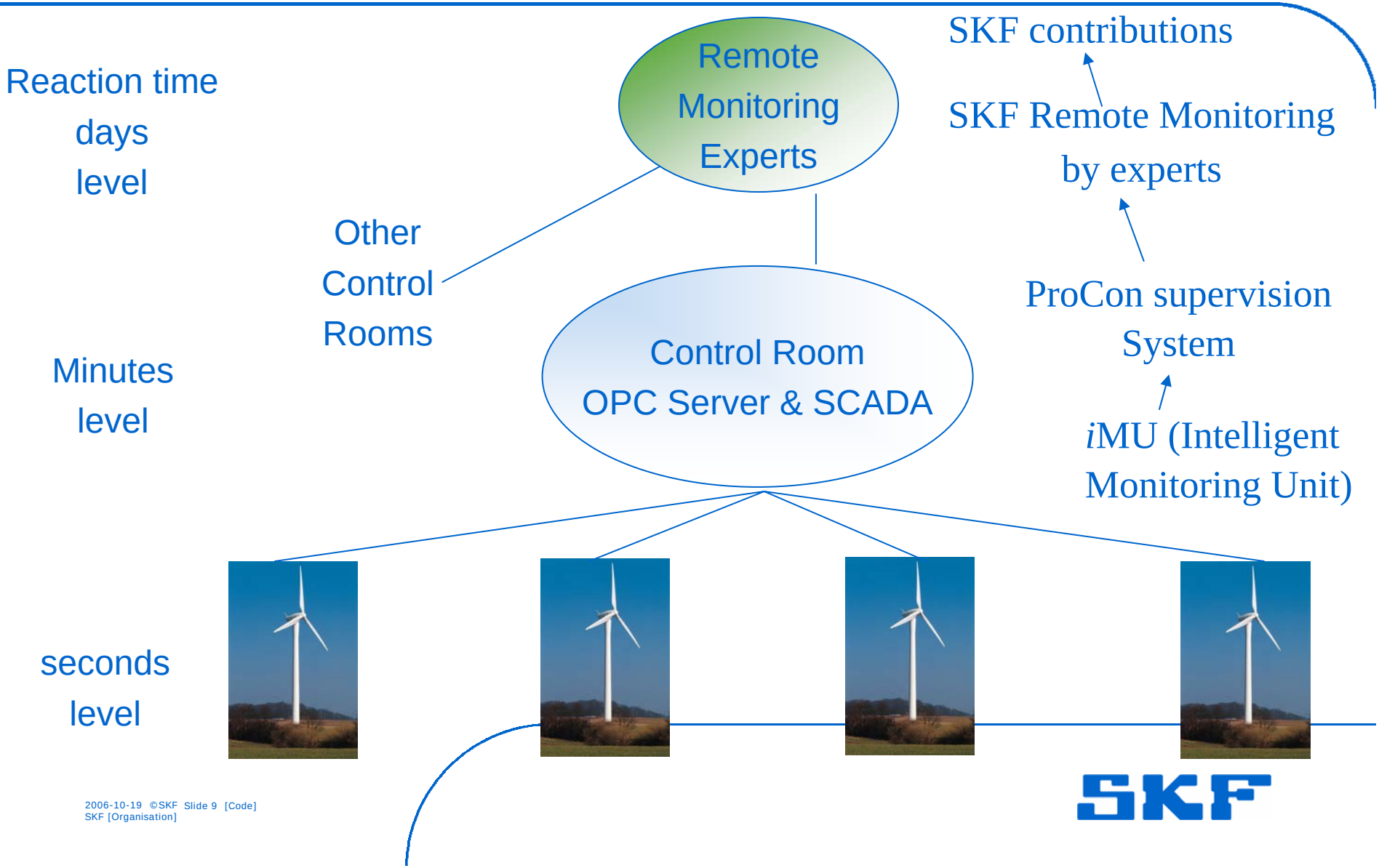
Off shore: iMU has Stainless Steel Box IP65, Stainless Steel Sensor IP67

For artic versions temperature range extended to minus 30°C

CE certified according to EN50081-2:1993



Line of command ……



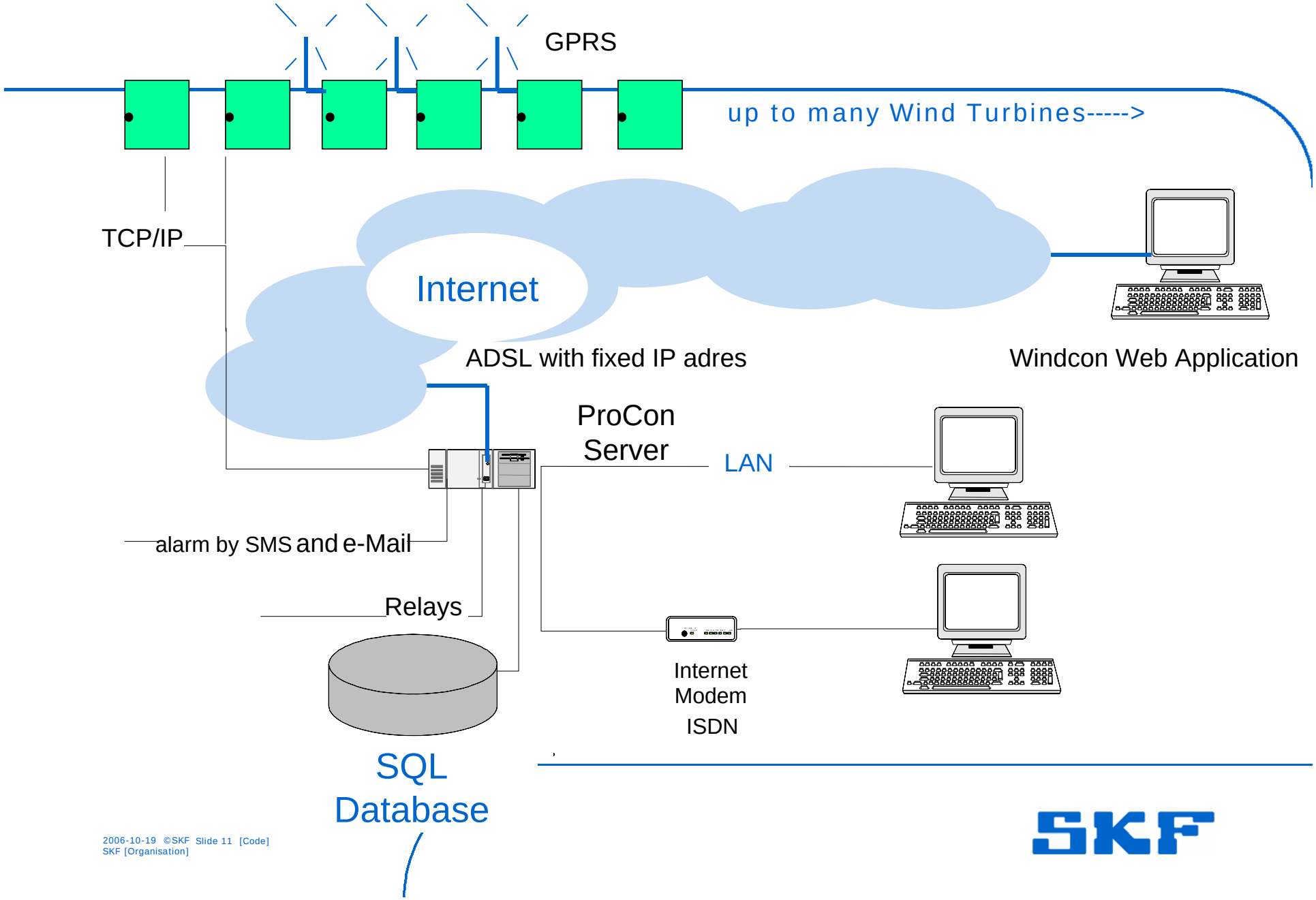
Variable Working conditions ……

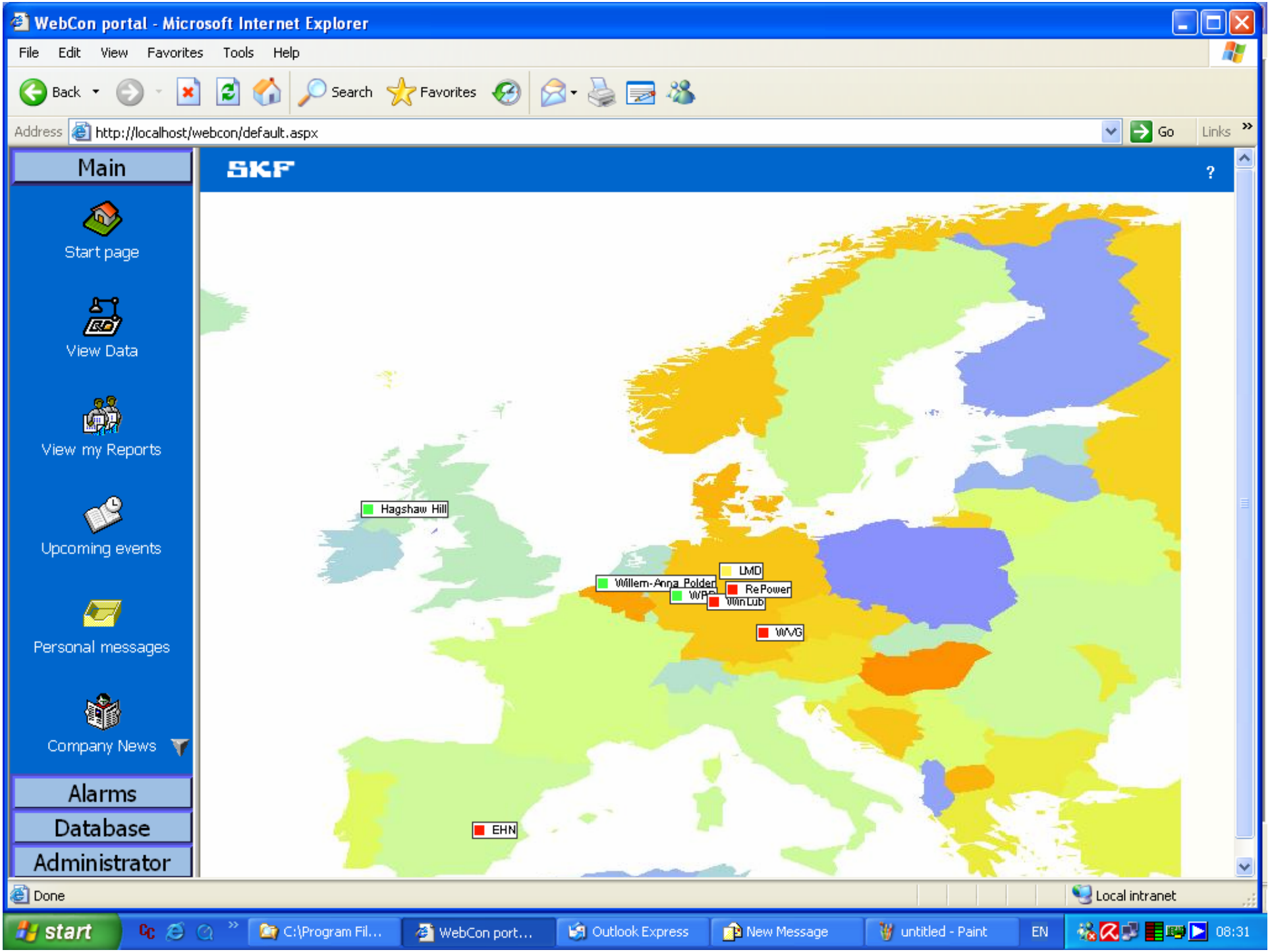
- WindCon continuously recalculates fault frequencies.

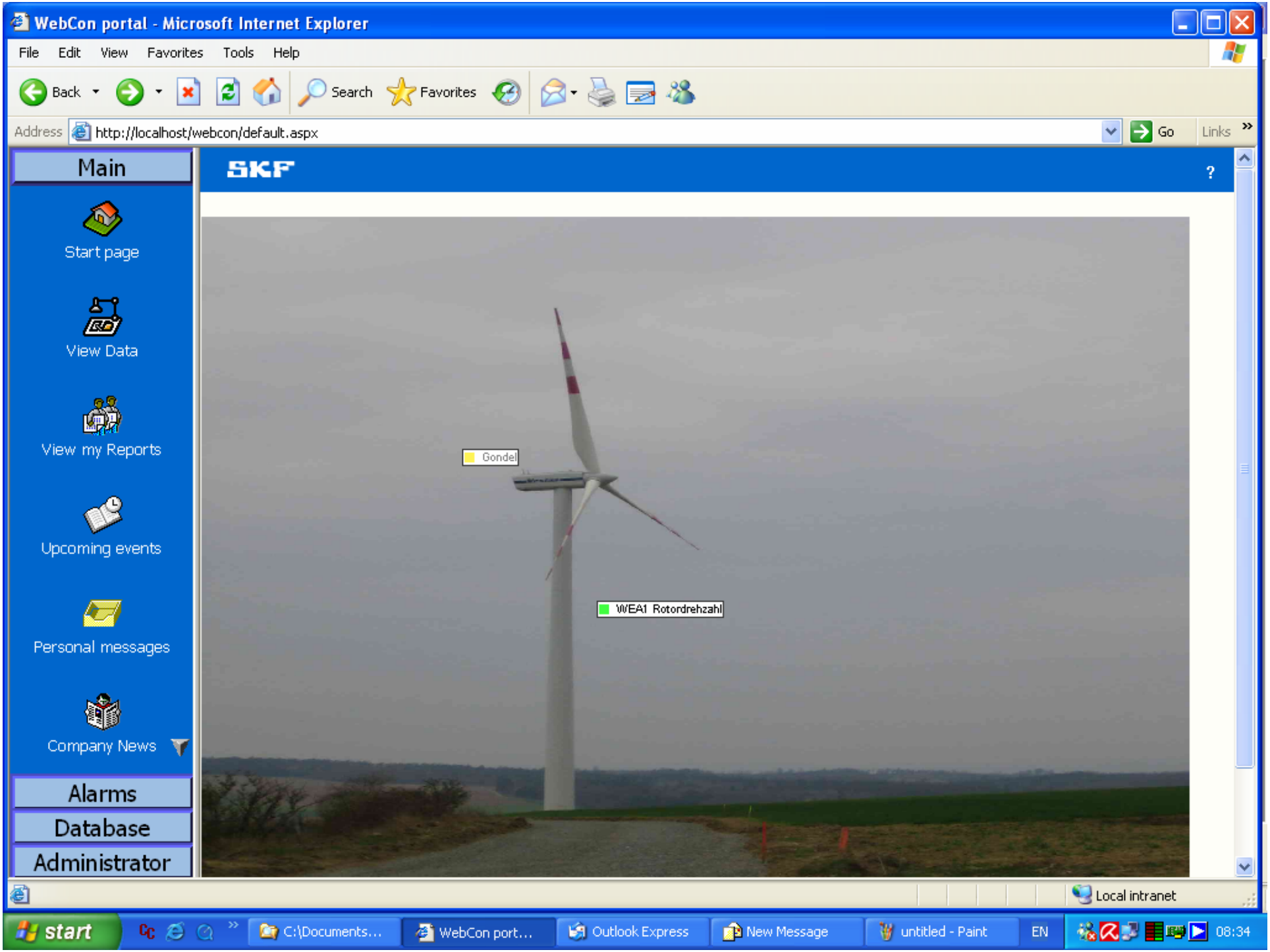
- WindCon can make alarm levels dependent of speed or any other process signal

- Trending based on classes of working conditions. (Allianz)

Communication/ GPRS




WebCon portal - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Address http://localhost/webcon/default.aspx
Go Links
Main
Start page
View Data
View my Reports
Upcoming events
Personal messages
Company News
Alarms
Database
Administrator
SKF
?
Hagshaw Hill
Willem-Anna Polder
LMD
RePower
WinLub
WVG
EHN
Done
Local intranet
start
C:\Program Fil...
WebCon port...
Outlook Express
New Message
untitled - Paint
EN
08:31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Company News
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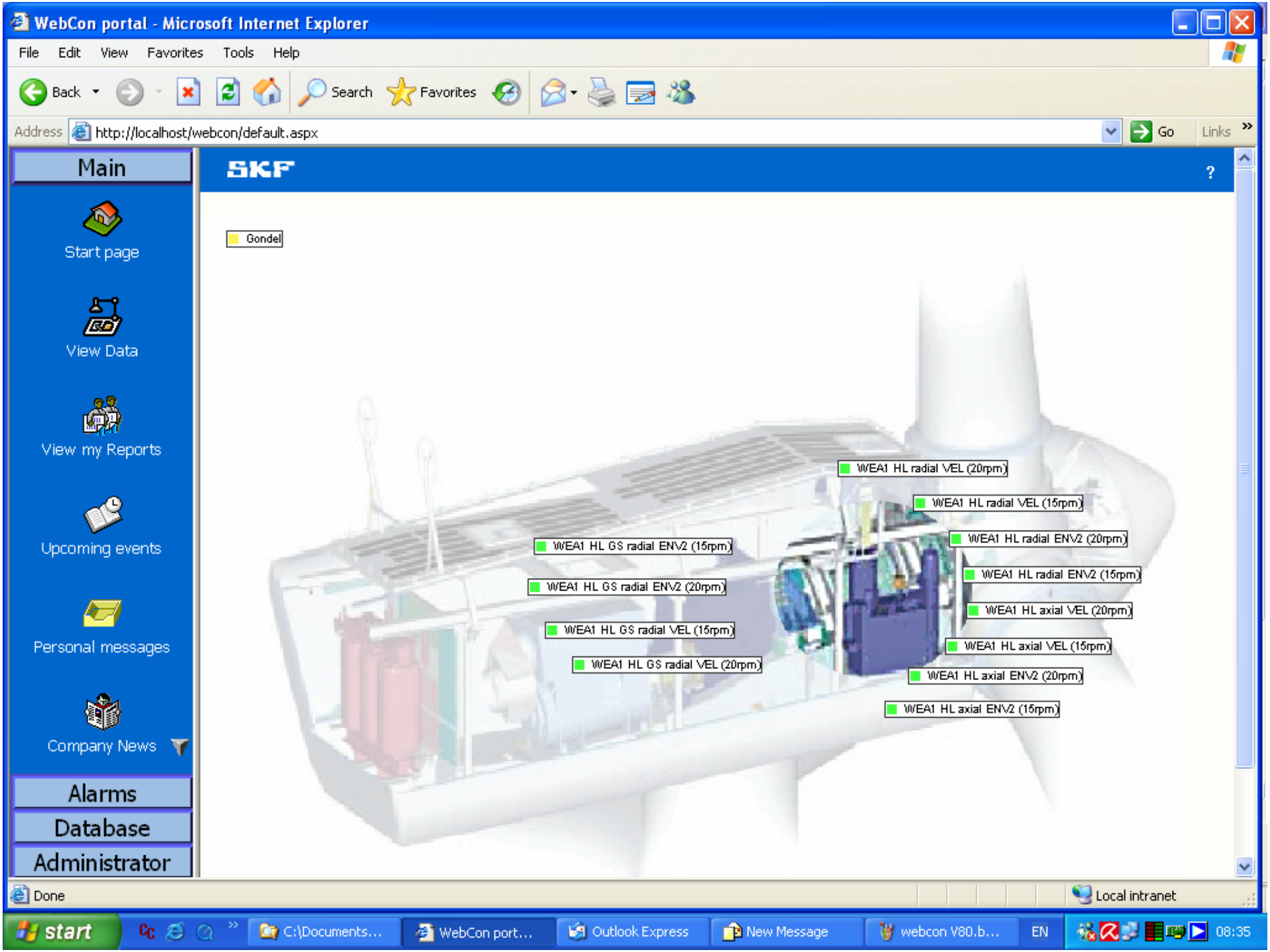
Administrator
SKF
?
Gondel
WEA1 Rotordrehzahl
Local intranet
start
C:\Documents...
WebCon port...
Outlook Express
New Message
untitled - Paint
EN
08:34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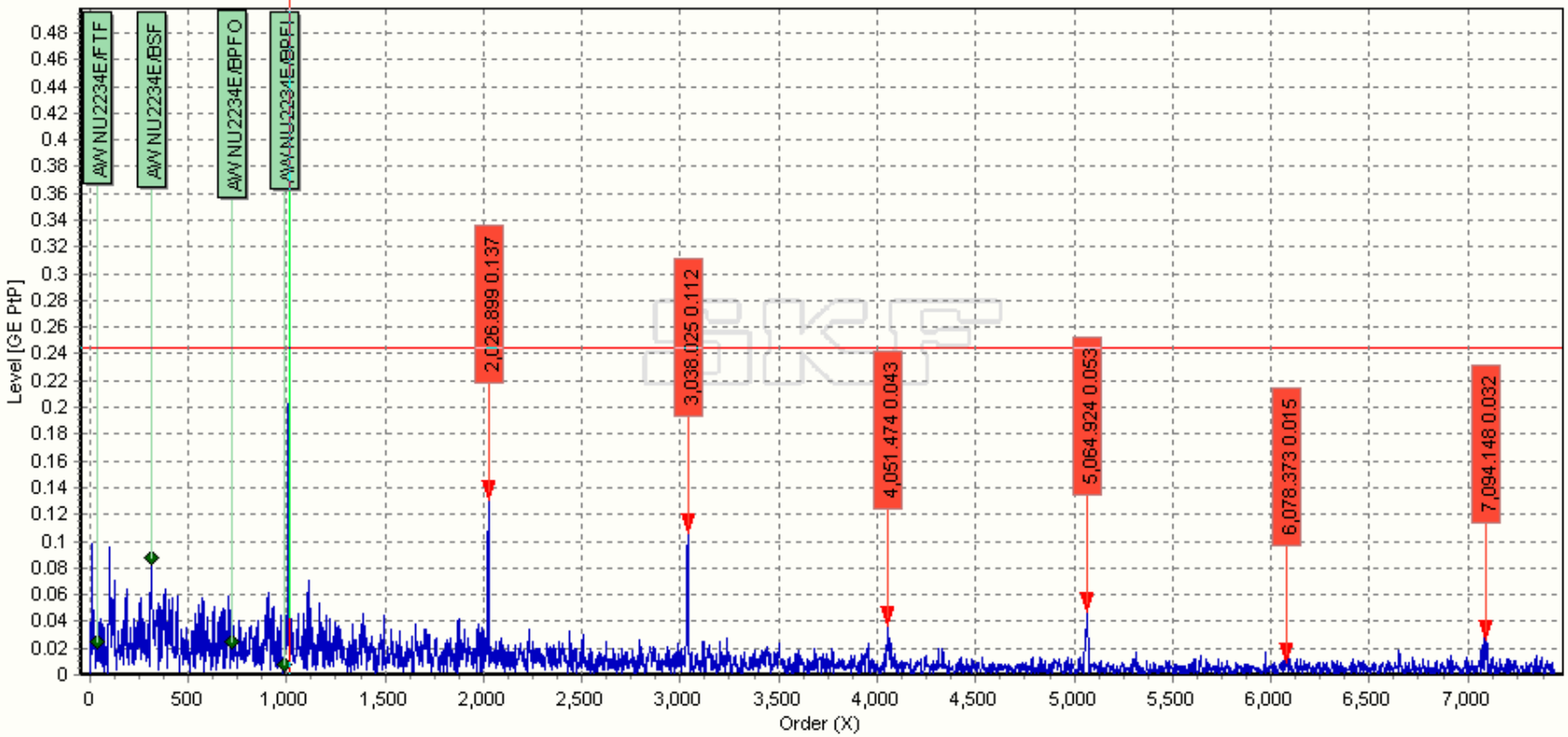
Database
Administrator
SKF
?
Gondel
WEA1 HL radial VEL (20rpm)
WEA1 HL radial VEL (15rpm)
WEA1 HL radial ENV2 (20rpm)
WEA1 HL radial ENV2 (15rpm)
WEA1 HL axial VEL (20rpm)
WEA1 HL axial VEL (15rpm)
WEA1 HL axial ENV2 (20rpm)
WEA1 HL axial ENV2 (15rpm)
WEA1 HL GS radial ENV2 (15rpm)
WEA1 HL GS radial ENV2 (20rpm)
WEA1 HL GS radial VEL (15rpm)
WEA1 HL GS radial VEL (20rpm)
Done
Local intranet
start
C:\Documents...
WebCon port...
Outlook Express
New Message
webcon V80.b...
EN
08:35

Spectrum - Microsoft Internet Explorer

SKF Print Reset marks Grid On/Off Zoom 3/31/2006 2:18:47 AM Order Envelope Lin ?

Spectra diagram for point WEA1 Getr. AW ENV3 (20rpm) -> 3/31/2006 2:18:47 AM; Speed:16.1(cpm); Load: 25448.6; Order (X): 1,015.77



☑ Spectra 0.24	☐ Speed	☑ Harmonics	☐ Sideband
☐ Hohlwelle	☐ Hohlwelle 23984	☐ Hohlwelle 23992	☐ Rotorwelle
☐ Hauptlager RS 230/630	☐ Planetentr. NCF2984V	☐ Planetentr. NCF18/560V	☐ Durchführung 6024
☐ Planet gear 1	☐ Planet gear 2	☐ Rotorblatt	☐ Hauptlager GS 24188CA
☐ Zahnrad 94 Zähne HW	☐ Zwischenwelle	☐ Ritzel 22 Zähne Zwischenwelle	☐ ZW NU2340
☐ ZW NU2336	☐ Zahnrad Z116 Zwischenwelle	☐ Abtriebswelle	☐ Ritzel Z28 Abtriebswelle
☐ AW QJ328	☐ AW NU232E	☐ Geno 6330	☑ AW NU2234E

start C:\Documents... WebCon port... Spectrum - Mi... 2 Outlook Ex... WebCon 80 d... EN 08:38

Spectrum - Microsoft Internet Explorer

SKF Print Reset marks Grid On/Off Zoom 4/2/2006 1:00:19 AM Hz Envelope Lin ?

Spectra diagram for point MP8 WEA5 Geno BS ENV3 (1500rpm) -> 4/2/2006 1:00:19 AM; Speed:1697.1(cpm); Load: 1600.3

Level [GE PtP]

0.26 0.24 0.22 0.2 0.18 0.16 0.14 0.12 0.1 0.08 0.06 0.04 0.02 0

50 100 150 850 900 950 1,000

TeeChart Print Preview

Printer: Setup... Print Close

Orientation: Portrait Landscape

Margins (%) 15 15 15 15

Reset Margins

View Margins

Detail: More Normal

Proportional

Spectra
Genera
Planetenwelle
Ritzel Z21 ZW
Planetenlager GS
AW RS LSL192322
Durchführung 29424E
Zahnrad 92 Planetenwelle
Hauptlager 240/630
Planetenlager RS
Generatorlager 6330
Rotorwelle
Planetenträger GS
Zwischenwelle NU 1964 M
Planetenräder Z21
Rotor
Planetenträger RS
AW GS 32230
Hohlrad Z93

start C:\Documents and S... 4 Internet Explorer 2 Outlook Express WebCon V80 Outerr... EN 08:58

Procon - Microsoft Internet Explorer provided by SKF

SKF

Show new alarm Show old alarm Show all alarm Update

Alarms for point Getri. AW ENV3(1080rpm,200kW)

AlarmDate	Place	Title	Status	ReceiptedDate	Signature	
9/23/2003 2:01:23 PM	Getri. AW ENV3 (1080rpm,200kW)	AW Zahnrad 24	High Alarm			Spectra
9/23/2003 4:17:03 AM	Getri. AW ENV3 (1080rpm,200kW)	ZW Zahnrad 21	High Alarm	9/23/2003 9:40:27 AM	Demo	Spectra
9/19/2003 5:10:57 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 31322, AW Lager RS 30322J2	High Alarm	9/19/2003 3:35:14 PM	Demo	Spectra
9/19/2003 3:59:25 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Zahnrad 24	High Alarm	9/19/2003 3:35:15 PM	Demo	Spectra
9/18/2003 7:02:29 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 31322	High Alarm	9/19/2003 3:35:15 PM	Demo	Spectra
9/13/2003 10:56:07 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 31322	High Alarm	9/19/2003 3:35:49 PM	Demo	Spectra
9/11/2003 3:08:34 PM	Getri. AW ENV3 (1080rpm,200kW)	AW Zahnrad 24	High Alarm	9/12/2003 12:55:10 PM	Demo	Spectra
9/9/2003 8:00:02 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 31322, AW Lager RS 30322J2	High Warning	9/19/2003 3:36:34 PM	Demo	Spectra
9/9/2003 7:04:02 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 30322J2, AW Lager RS 31322	High Alarm	9/19/2003 3:36:34 PM	Demo	Spectra
9/9/2003 5:18:44 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 30322J2	High Warning	9/19/2003 3:36:35 PM	Demo	Spectra
9/9/2003 4:23:53 AM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 30322J2, AW Lager RS 31322	High Alarm	9/19/2003 3:36:35 PM	Demo	Spectra
9/8/2003 10:27:05 PM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 30322J2	High Warning	9/19/2003 3:37:01 PM	Demo	Spectra
9/6/2003 8:57:56 PM	Getri. AW ENV3 (1080rpm,200kW)	AW Lager RS 31322	High Warning	9/19/2003 3:37:02 PM	Demo	Spectra

Compatibility

Gastops:

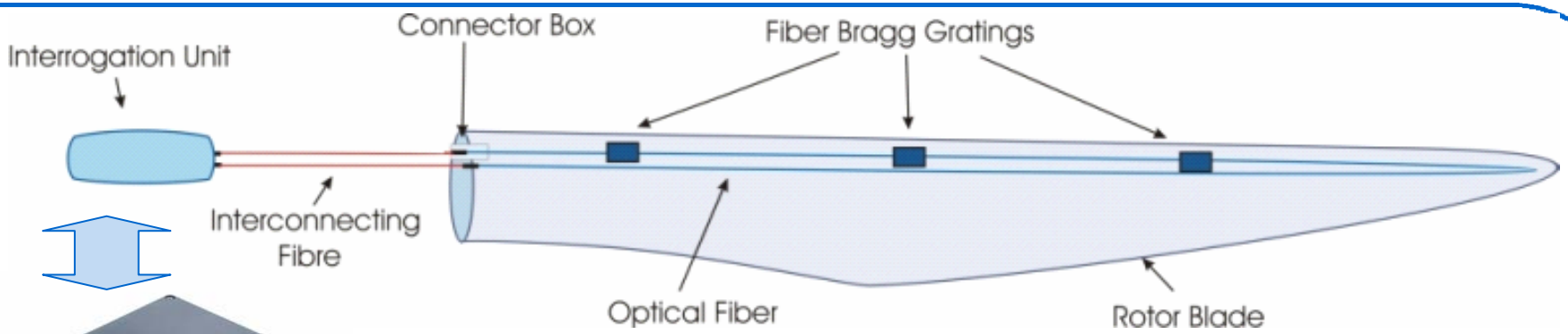
- Particle counter in the lubrication system.
- Ready and tested, ready for sale.

Vogel:

- Central automated lubrication system.
- Not ready yet.

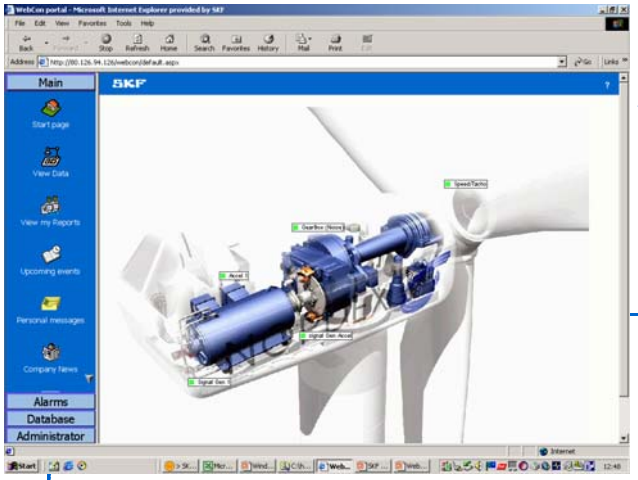
Insensys:

Equipment Schematic



Rotor blade data

Insensys WT-1030 measurement system (located in the turbine hub)



Internet

SKF WindCon Condition Monitoring unit (located in the turbine nacelle)

Certifying Bodies

- Germanischer Lloyd

Insurance companies

- Allianz, Gothear, Marsh, Royal Sun Alliance.
- SKF is Allianz Certified

IEC Standard 61400-25

- Standard on Condition Monitoring in Wind Turbines.
- IEC task force working on it.

Questions ?