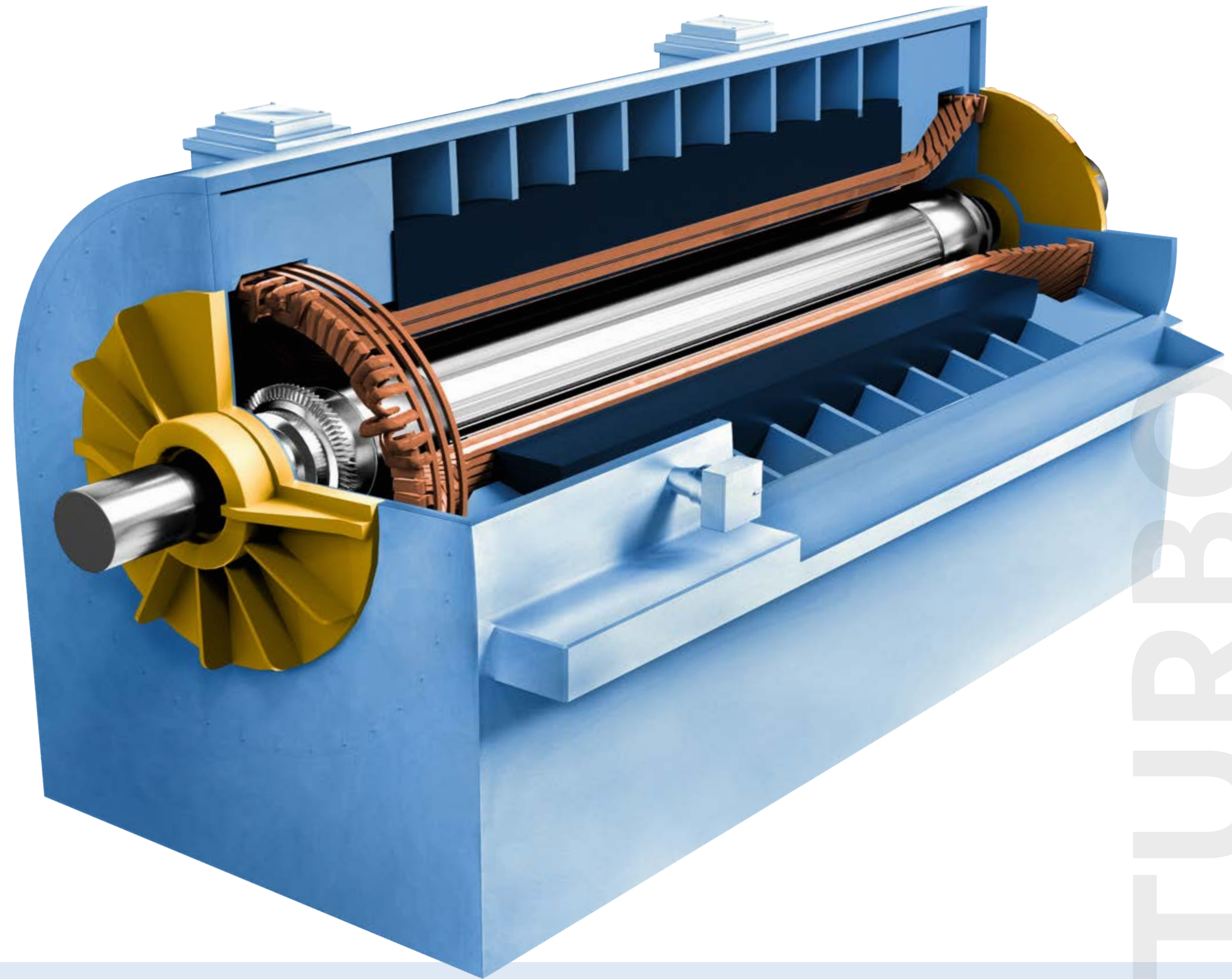


# COMPLETE MONITORING SOLUTIONS & DIAGNOSTICS SERVICES

for the **Turbo Industry**



TURBO

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**ZOOM  
WATCH**™



# Generator Diagnostics Asset Management Tool

By offering to its customers the first web based diagnostic platform ZOOMWatch, a revolutionary online machine management platform that meets a growing need in the industry.

Once again VibroSystM is the pioneer in machine diagnostic and management solutions.





- Mobile friendly, web-based diagnostic platform
- 24/7 on-demand support at your fingertips
- Analysis results displayed in easy to understand graphs

**TRY IT NOW**

## Cyber Security Map (CSM)

Watch the video

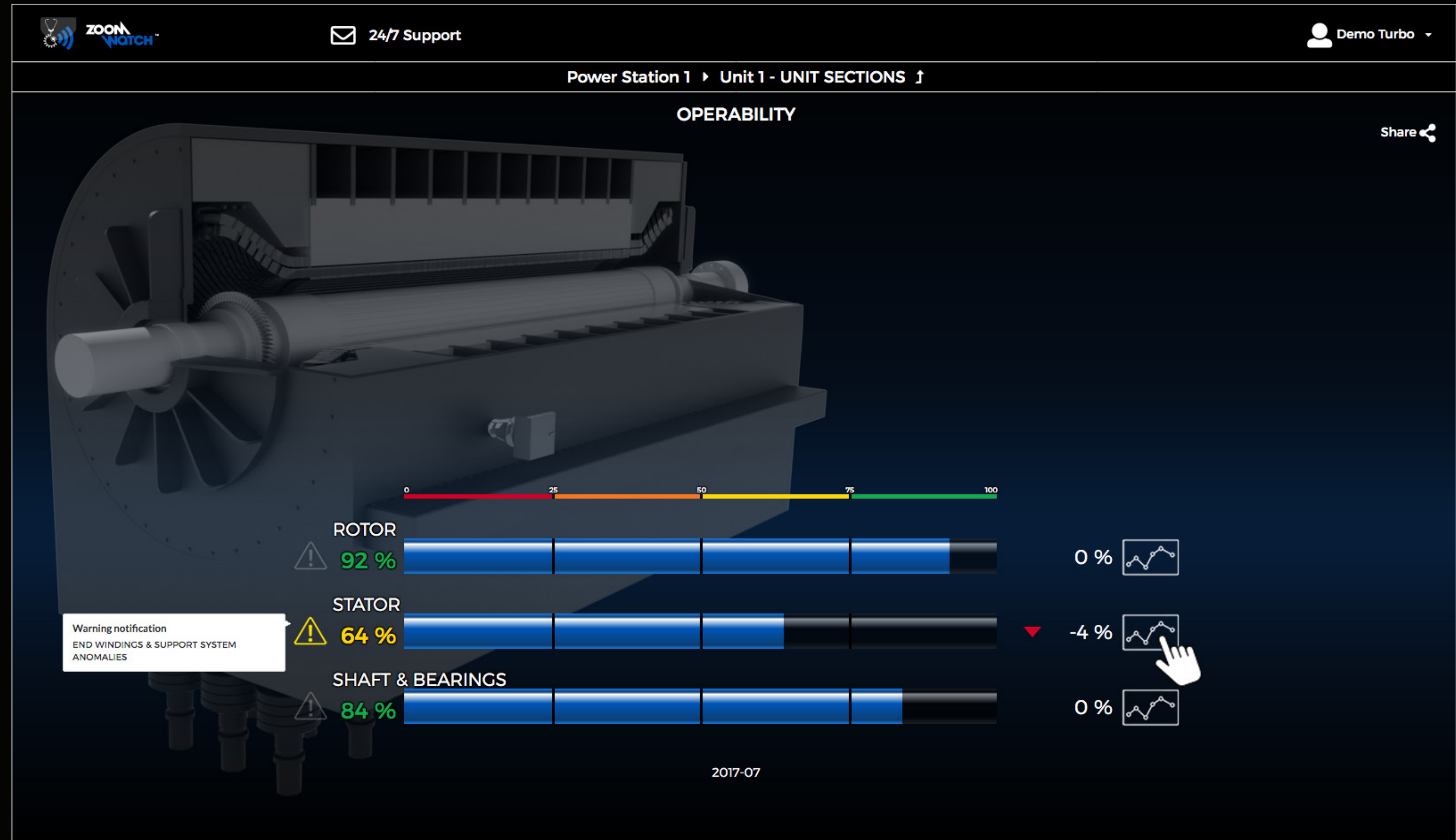


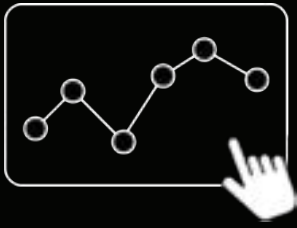
# Operability levels

Operability assessment of the various sections of the Unit accompanied by intervention recommendations

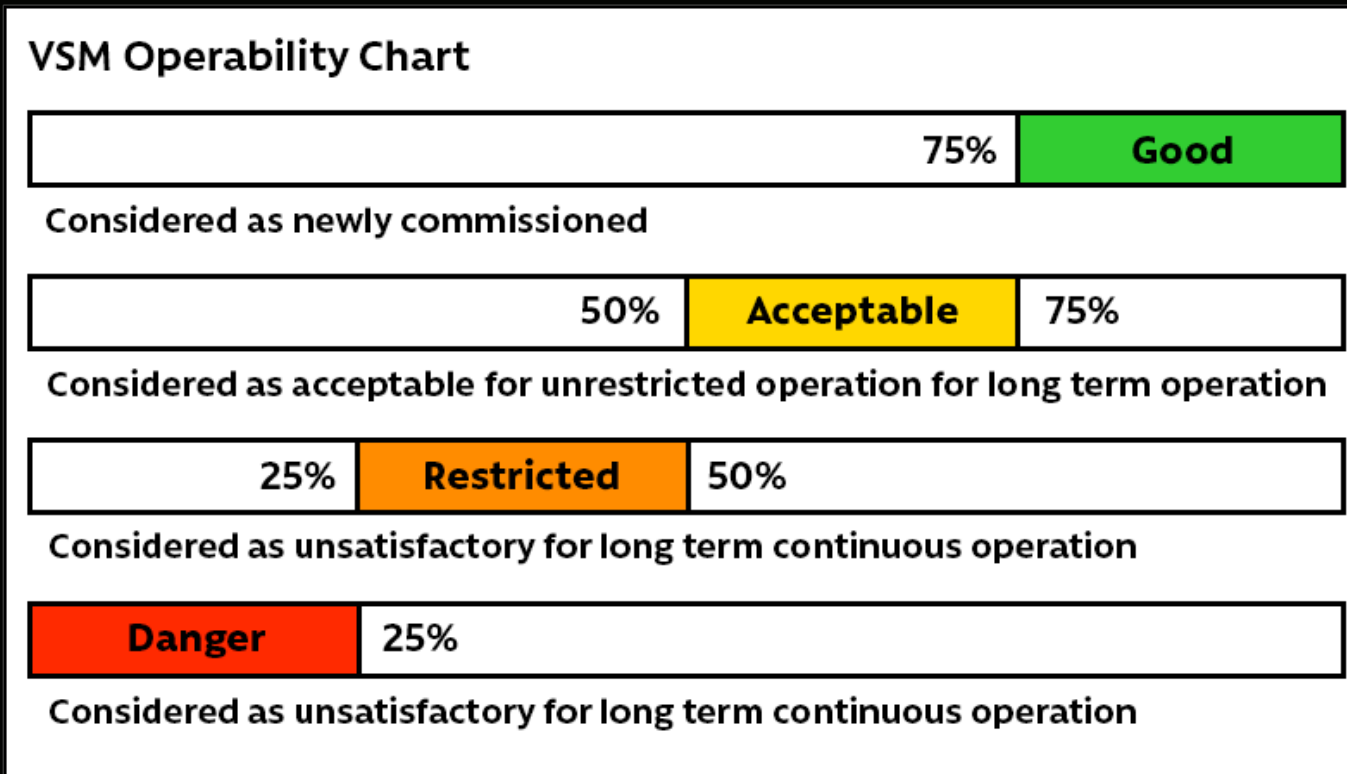
These values represent the overall operability of any given section of the Unit, based on the severity levels of each phenomenon monitored associated to the section of the Unit.

Each value gives a good indication of the overall health of a section of the Unit and more importantly, an early detection tool to identify any deteriorating condition of the Unit.





Operability level based on current and previous results providing a trending of results over time



**Simplified results** displayed on an intuitive interface:

- Can be used by plant managers, both engineers and non-engineers
- Eliminates the need to have experts available

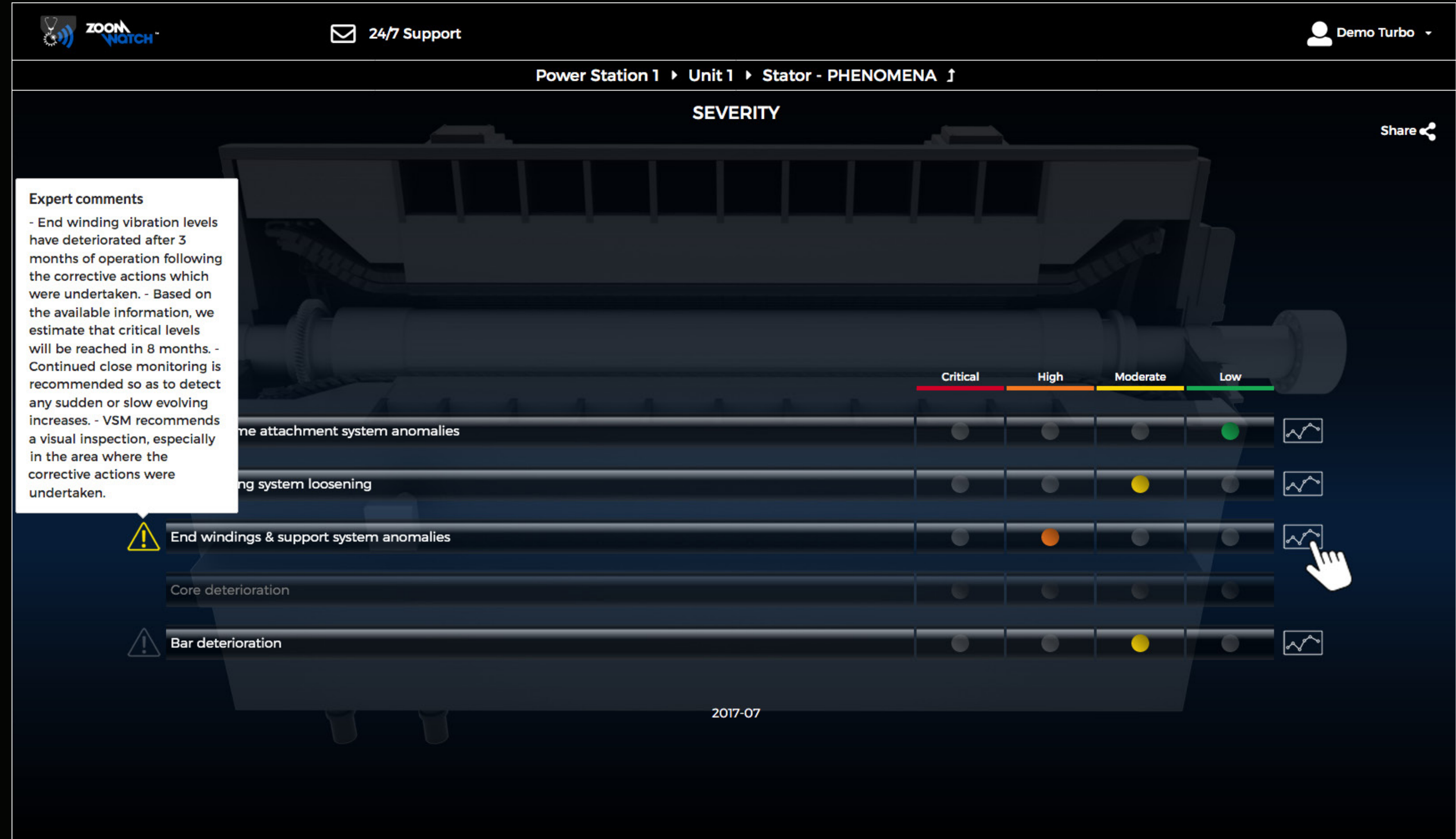


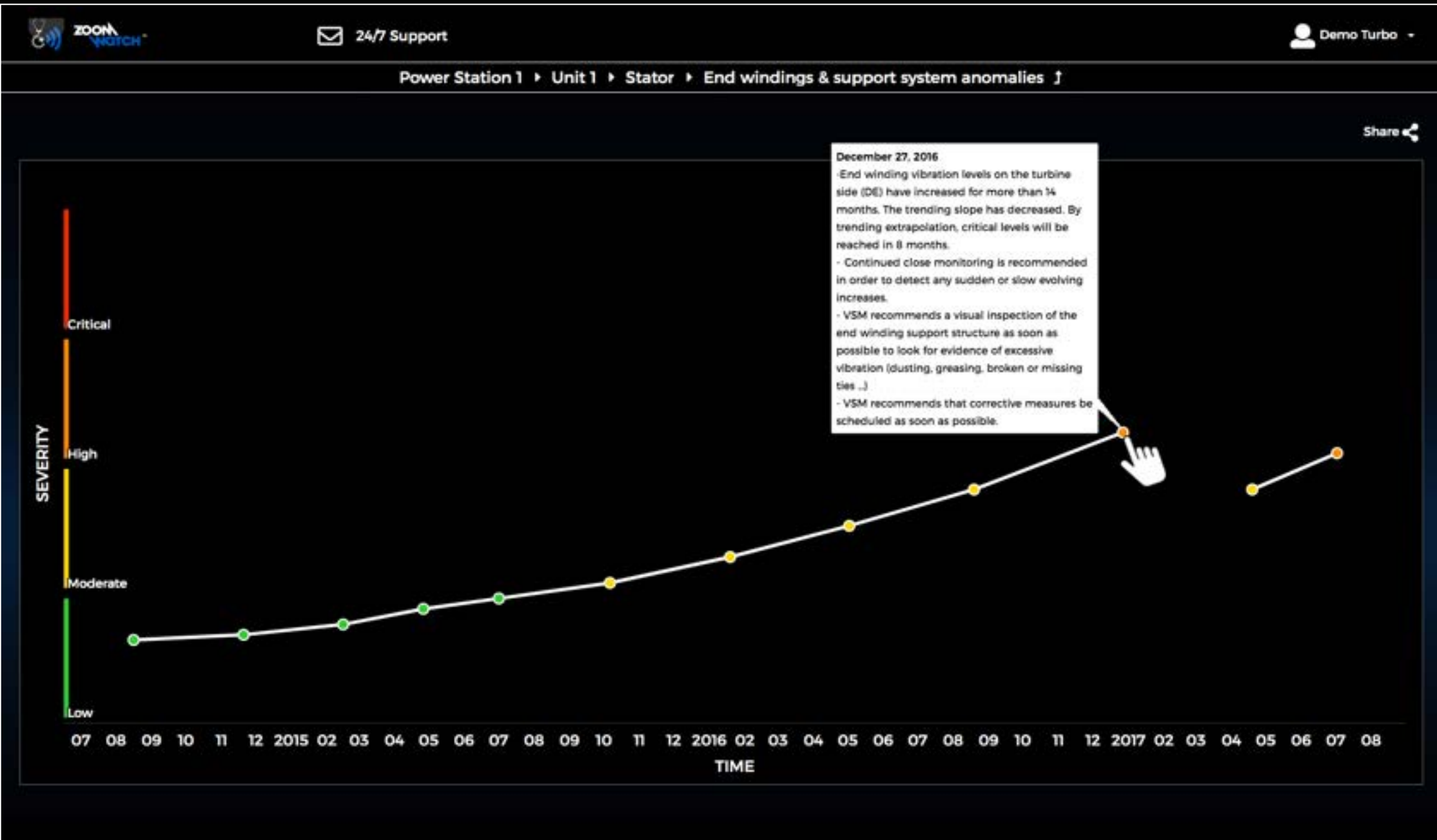
# Severity levels

Represent the severity of any given phenomenon monitored on the Unit. These results are made **much easier to understand** by providing results per phenomenon, and displaying these results based on existing tolerances and standards, in an easy to understand graphical environment making it much easier to evaluate and react.

*Severity results for all phenomenon monitored on the unit section will be used to assess the operability level of the Unit section.*

Actual severity of each phenomenon on the asset





1

Unit 1 ▶ Stator ▶ End windings & support system anomalies ▶ REPORTS ↑

### REPORTS

	ROTOR	STATOR	SHAFT & BEARINGS		
	●	●	●	↓	i
	●	●	●	↓	i
<b>RIS-10 - 2016 Dec</b>	●	●	●	↓	i
RIS-9 - 2016 Aug	●	●	●	↓	i
RIS-8 - 2016 May	●	●	●	↓	i
RIS-7 - 2016 Jan	●	●	●	↓	i
RIS-6 - 2015 Oct	●	●	●	↓	i
RIS-5 - 2015 Jul	●	●	●	↓	i
RIS-4 - 2015 Apr	●	●	●	↓	i
RIS-3 - 2015 Feb	●	●	●	↓	i
RIS-2 - 2014 Nov	●	●	●	↓	i

2





# RIS report

## Results Interpretation Service

The specialists in our Tests & Diagnostics division provide clients with detailed reports on the general condition of their machines. They analyze and correlate all the information our systems collect and provide comprehensive training sessions on how to understand their machine behavior.

## Analysis & Diagnostic reports

In combination with our powerful ZOOM software, VibroSystM's results interpretation service puts decades of experience at work, allowing our clients to extract the most out of their monitoring systems. The service helps users identify patterns and anomalies that are both meaningful and informative. Our RIS is among the many tools we put directly into the hands of our customers around the world empowering them to make informed business decisions that will have a direct impact on the bottom line of plant management.





# Phenomena requirements

SEVERITY	SENSORS REQUIRED							
	STRAY FLUX	VIBRATION & DISPLACEMENT				TEMPERATURE		FLANGE
	MFP	FOA	SBV	VSM797S	Proximity probes	FOT	TWS	Flanges*
<b>ROTOR</b>								
Pole shorted turns	X							X
<b>STATOR</b>								
Stator core & frame attachment system anomalies	O			X			O	X
Stator bar wedging system loosening		O	X				O	X
End windings & support system anomalies	O	X				O		X
Stator core deterioration				X			X	X
Stator bar deterioration		X	X				X	X
<b>SHAFT &amp; BEARINGS</b>								
Shaft & bearing anomalies				O	X			

X mandatory O optional

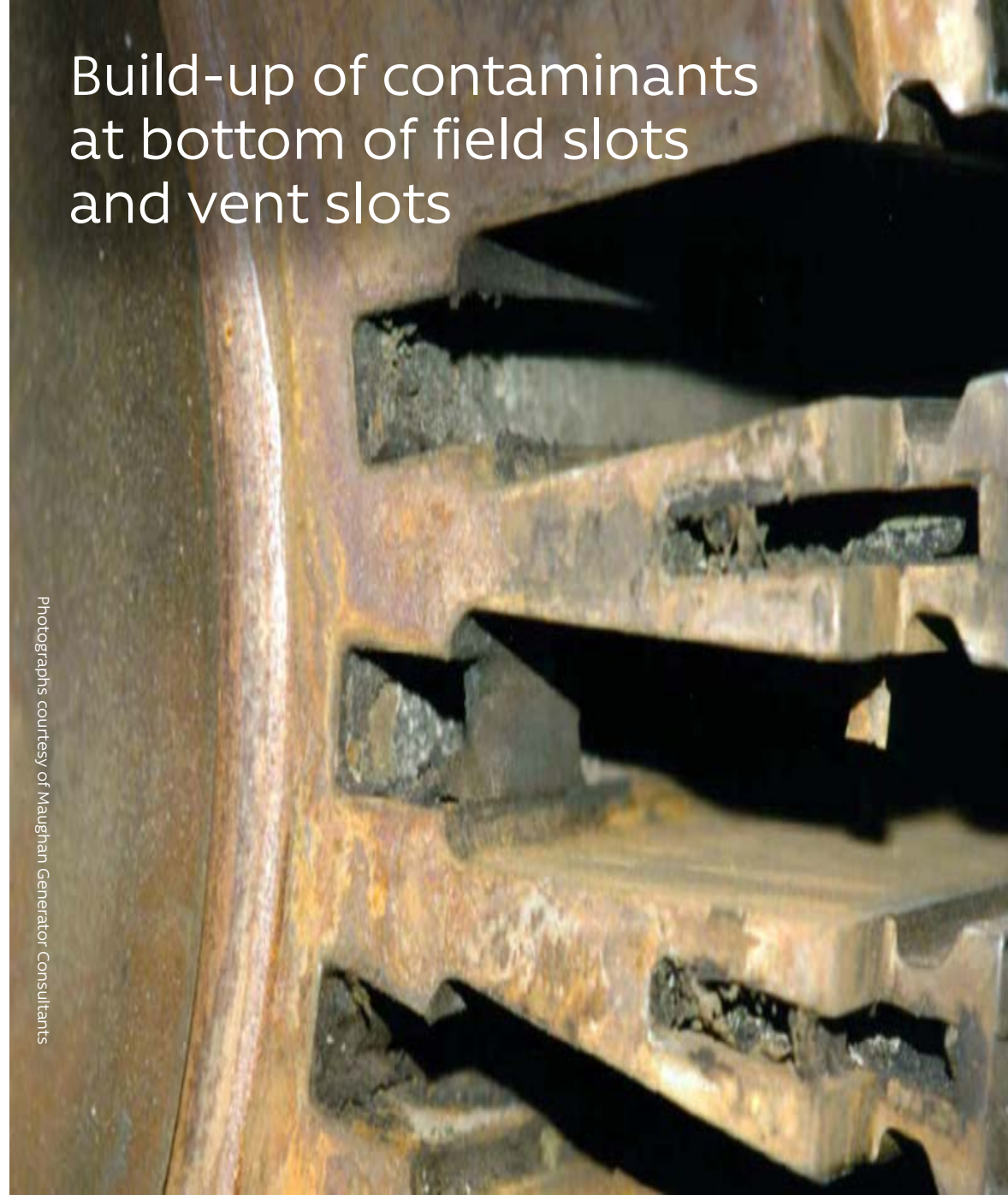
\* Hydrogen-cooled



Failures near the end caps



Build-up of contaminants at bottom of field slots and vent slots



Photographs courtesy of Maughan Generator Consultants

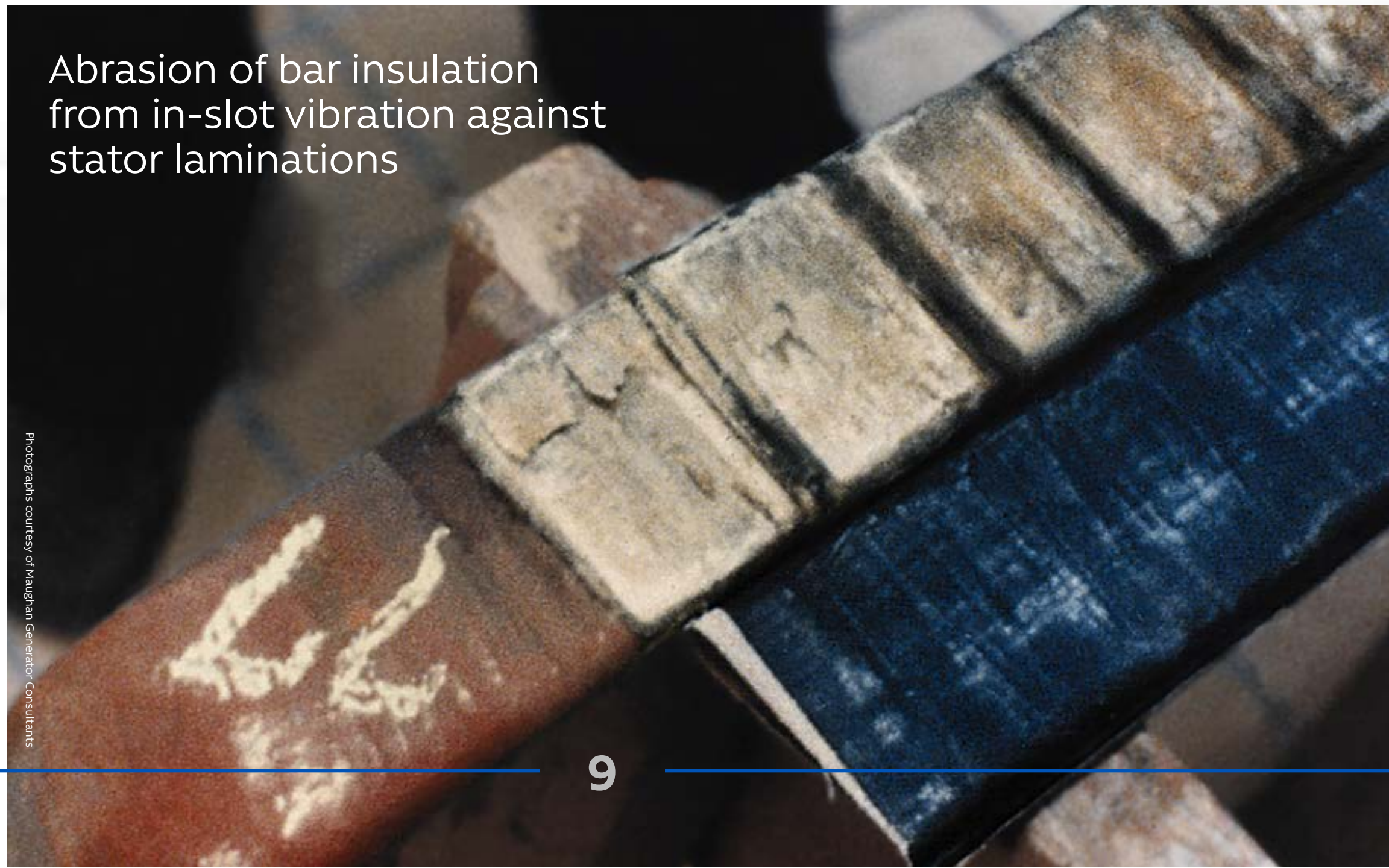
Deformed end turns causing short-circuits



Photograph courtesy of ACT Services



Abrasion of bar insulation from in-slot vibration against stator laminations

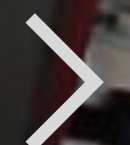


Photographs courtesy of Maughan Generator Consultants

Shorts between end turns caused by coil deformation under CRR



Photographs courtesy of Rotek Engineering



Photograph courtesy of Arizona Public Services (APS)



# Sensors

## Precision & Reliability

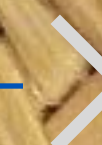
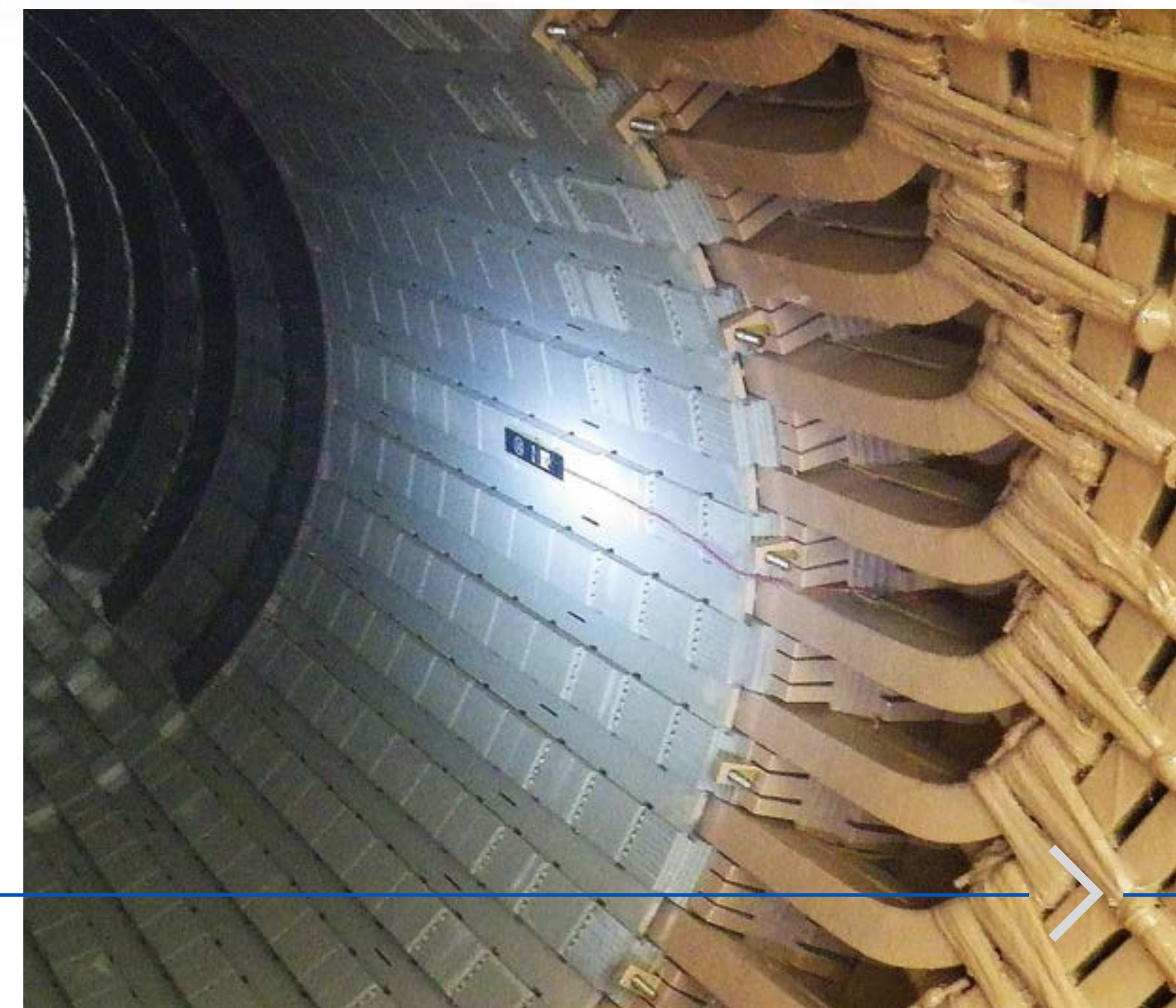
In order to give our customers a precise prognosis on the condition of their machine, data accuracy is essential. VibroSystM sensors were all designed to withstand the harsh and robust variety of environments they are to be installed in, without compromising the accuracy needed to correctly monitor and protect your machine.

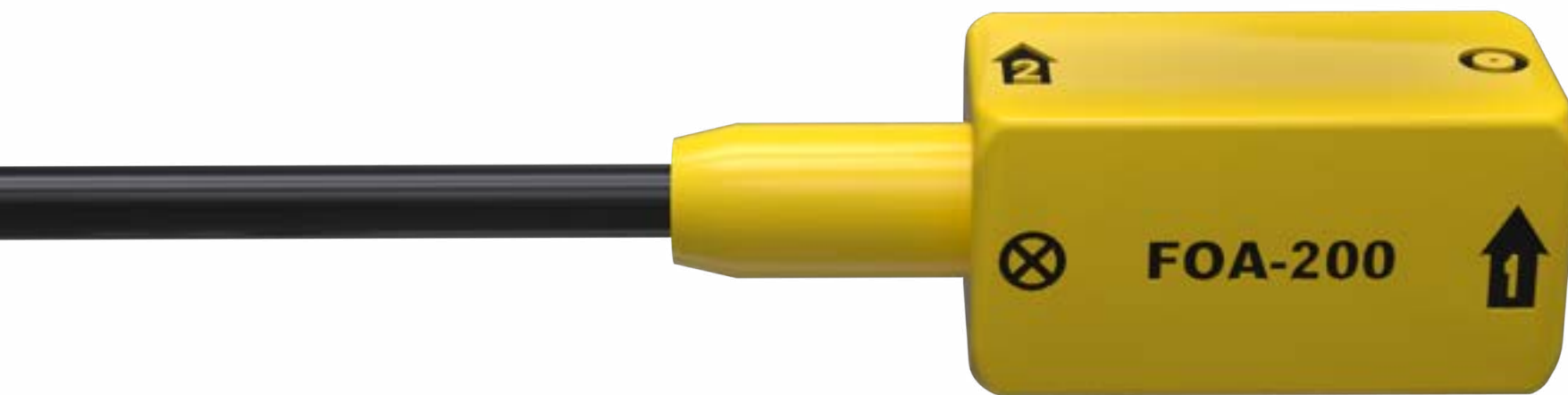
### ■ Stray Flux (Pole Shorted Turns Detection)

#### **MFP™-100**

The MFP-100 sensor for turbo-generators is designed to measure magnetic imbalances caused by interturn short-circuits in rotor windings that contribute to machine vibration, overheating, and excessive stress on rotor and stator components.

VibroSystM's monitoring system accepts third-party probes.





- Stator bar absolute vibration
- End winding absolute vibration
- Phase leads absolute vibration
- Iso-phase bus absolute vibration
- Iso-phase drop absolute vibration

### FOA™-100/200

The FOA fiber optic accelerometer was designed to measure vibration amplitudes of high voltage components that are exposed to electrodynamic and mechanical stress, such as stator end-windings. Its robust design, made of non-metallic and electrically non-conducting materials, makes it suitable for hostile environments. No field calibration is required.

- Stator bar relative vibration

### SBV™-202

The SBV stator bar vibration capacitive sensor was designed for non-contact in-slot measurements of stator winding vibration. Built to be immune to strong magnetic fields, this sensor provides reliable and accurate information on bar vibration and displacement. It allows early detection of wedging looseness under all operating conditions to avoid excessive vibration.





- Stator frame absolute vibration
- Stator core absolute vibration
- Pressure plates absolute vibration
- Bearing absolute vibration

### VSM797S™

The VSM797S is a piezoelectric accelerometer designed to measure absolute vibration of bearing housing in harsh industrial environments. This sensor was developed to ensure accurate results throughout the entire operating temperature range.



- End-winding temperature
- Phase leads temperature
- Iso-phase bus temperature

### FOT™-200

The FOT fiber optic temperature sensor was developed to monitor temperature of high voltage components, such as generator end-windings, isophase bus bars, exciter brushes and knife switches. Its robust design, made of non-metallic and electrically non conductive materials, makes it suitable for hostile environments. No field calibration is required





- Stator core temperature
- Stator bars temperature
- Pressure plates temperature (end core)

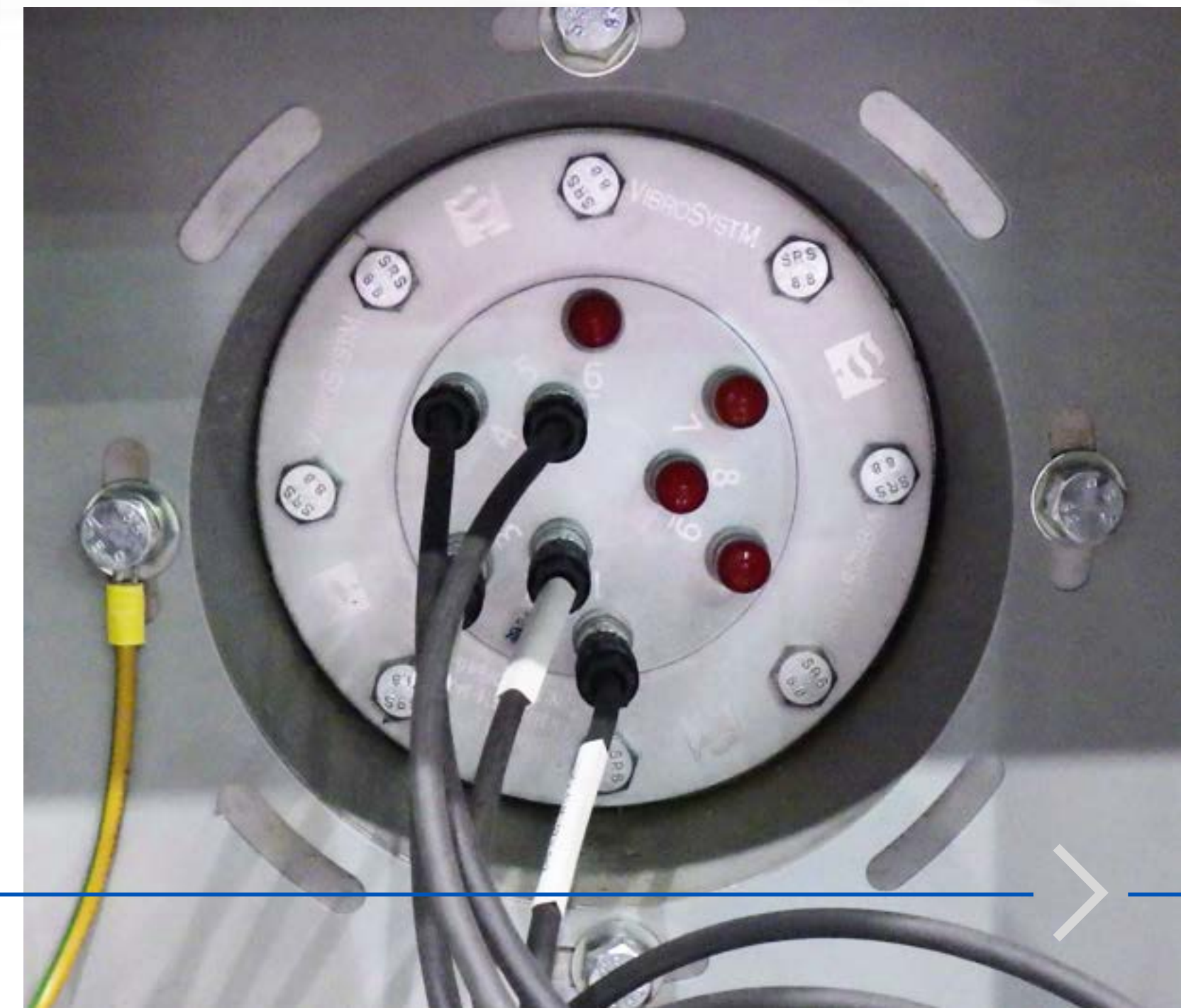
### TWS™

The TWS ThermaWatch stator sensor is a real-time multipoint temperature sensor for the stator core and windings. It provides valuable information about the thermal behavior of a stator core, especially the hot spots or shorted laminations.



### Flange

The M12 x 9 connectorized internal flange is factory tested to withstand very high pressure levels and comes with a high quality O-ring seal that guarantees trouble-free operation. The M12 connectors also offer the flexibility to transmit a wide variety of signal types.



# Acquisition Units

Protection, Monitoring & Analysis Unit



## ZPU™-5000 Protection, Monitoring & Analysis Unit

The ZPU-5000 is a multi-channel acquisition instrument designed for monitoring and protecting large rotating machines. Available in a network (with a ZOOM server), the ZPU-5000 can simultaneously monitor multiple parameters and communicate with the ZOOM software.



## SFA-200™ Protection, Monitoring & Analysis Unit

The SFA-200 Stray Flux Analyser unit is an instrument that collects and analyzes flux density data to detect inter-turn short-circuits in the rotor windings of two-pole and four-pole turbogenerators while the machine is in operation.

# ZOOM® Monitoring Cabinet

Our ZOOM cabinet comes pre-wired, fully tested and complemented with as-built drawings for a fast and effective on-site installation. Its robust design keeps VibroSystM's monitoring hardware protected, extending its longevity.







# ZOOM® Software

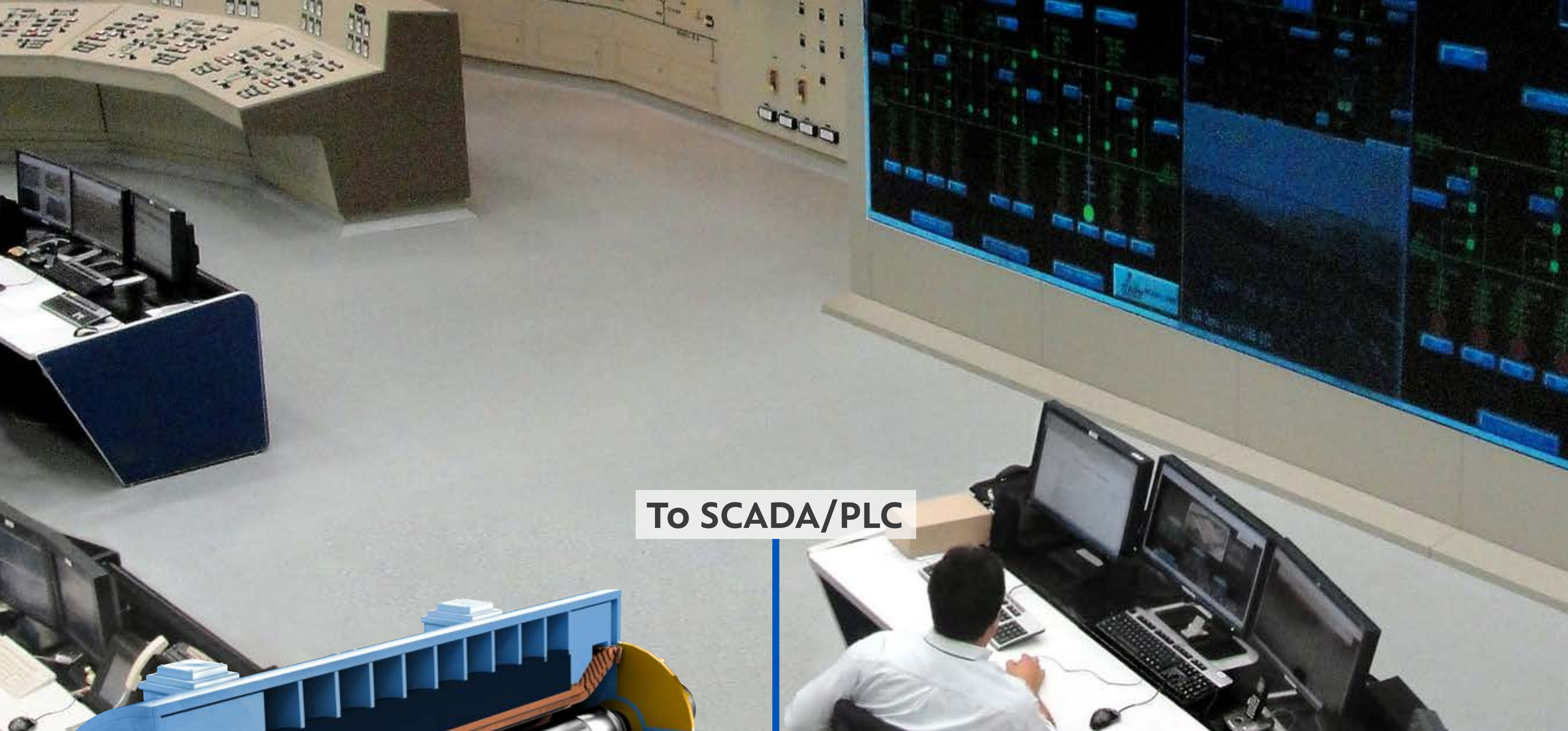
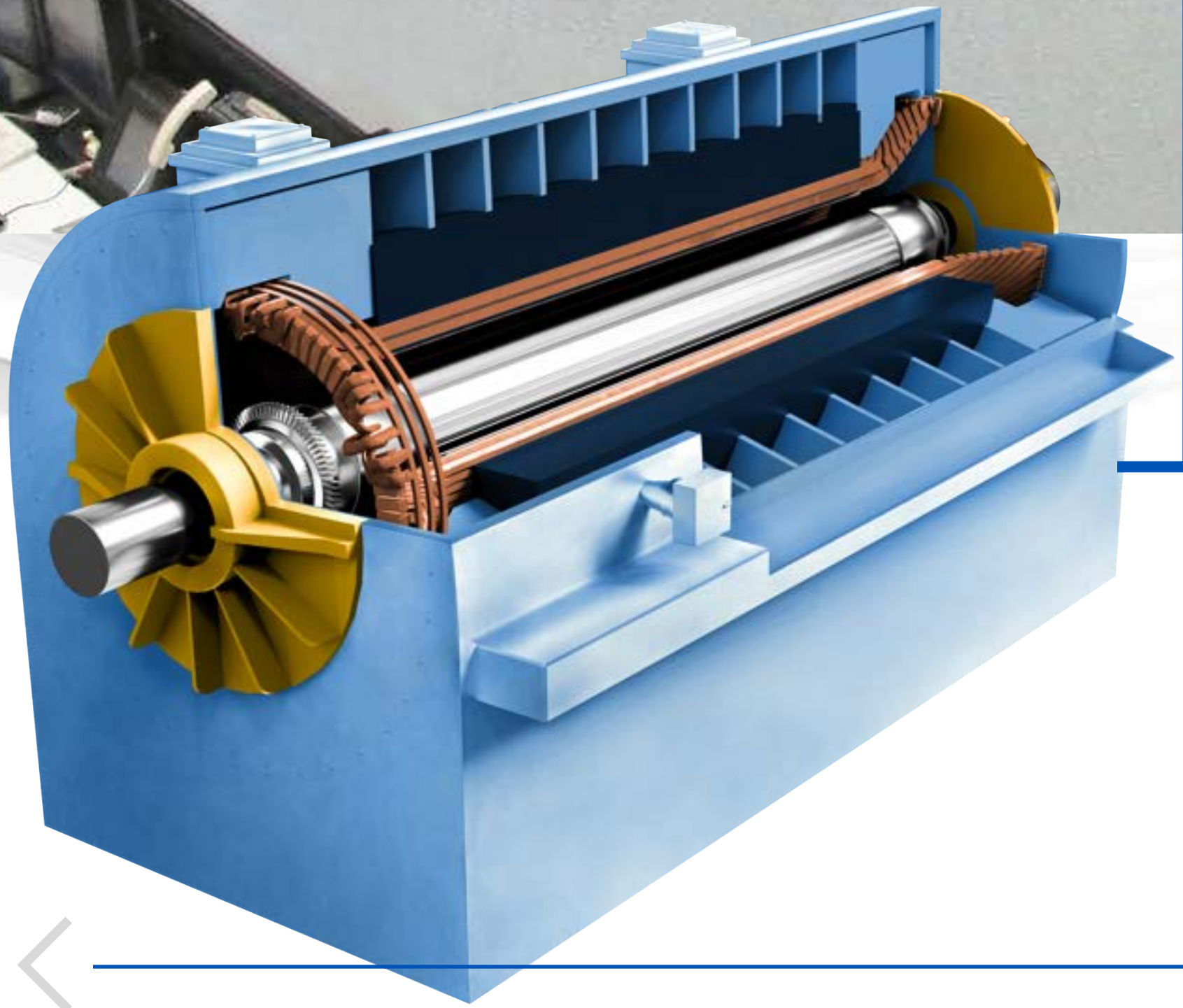
Zero Outage  
Online Monitoring

VibroSystM's ZOOM software provides its users with a clear, real-time picture on the condition of their machine in any operating mode. The ZOOM software suite is the only one on the market that can be tailored to a user's specific needs. It is composed of various acquisition services, which gives its users the possibility of choosing the parameters to be monitored on their machines.

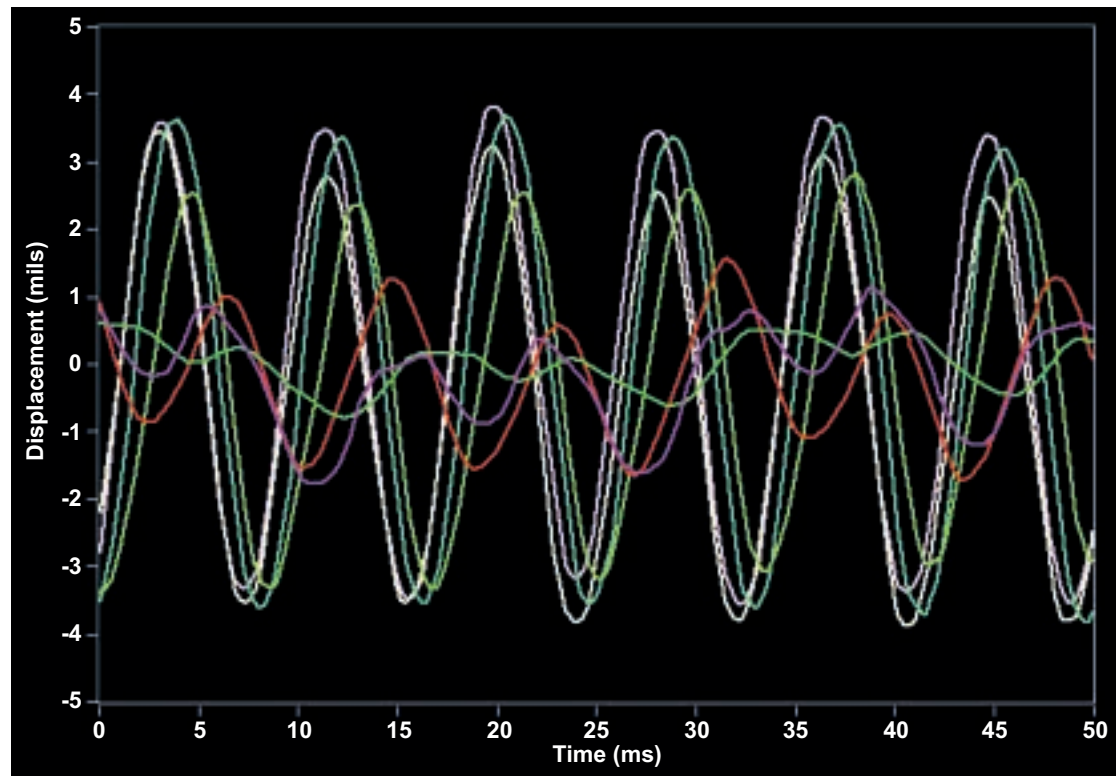
To SCADA/PLC

## Bi-directional communication Services

ZOOM Software can be complemented by Modbus® and OPC® bi-directional communication services that collect and send data to and from the **plant's control system**.

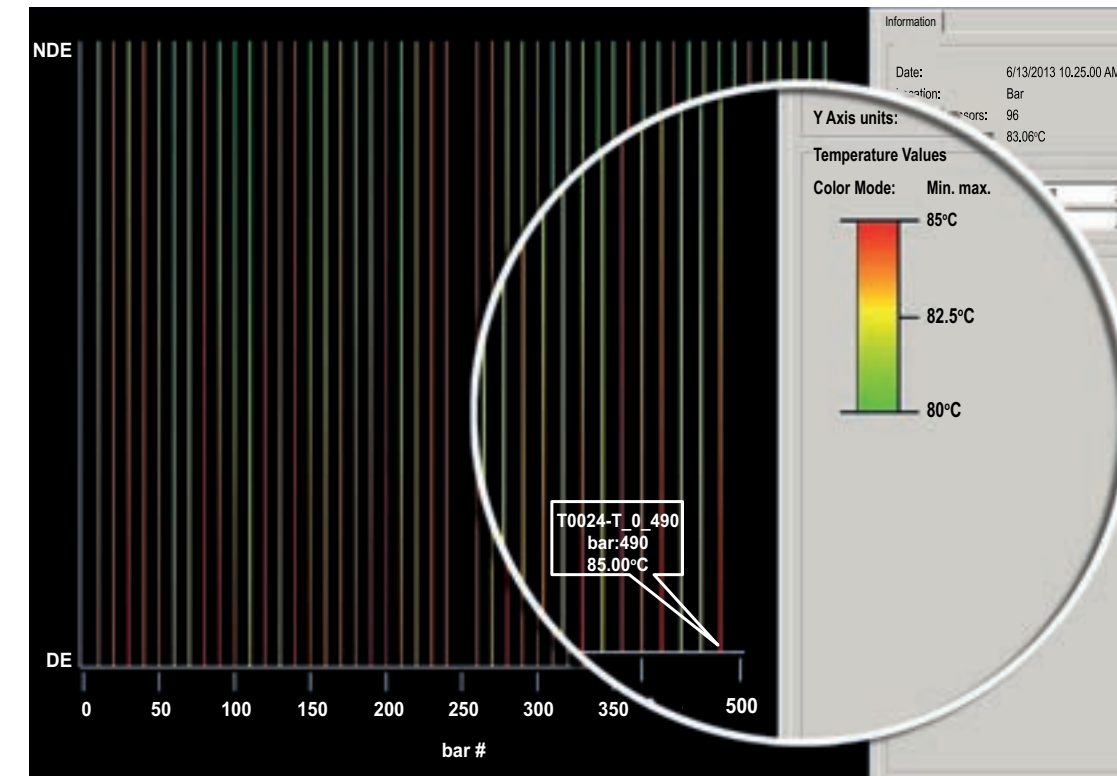


# ZOOM® Software



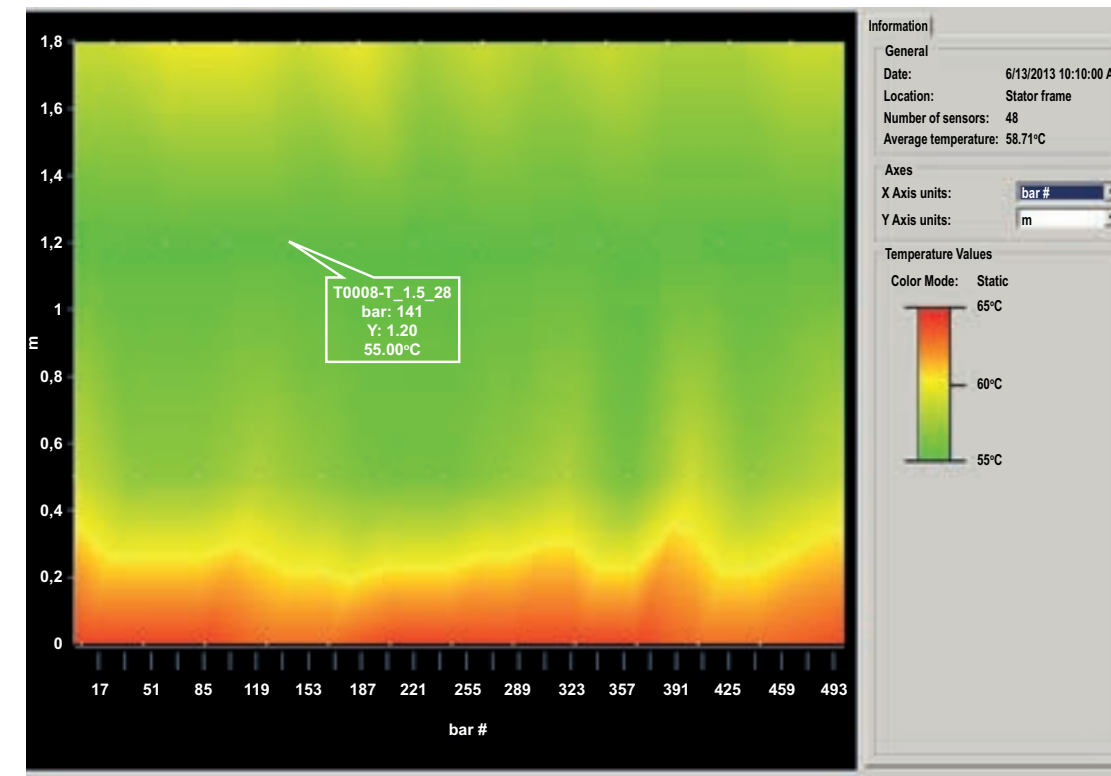
### FOA + ZPU + ZOOM

Raw acceleration signals from different sensors, at various amplitudes, during normal operation



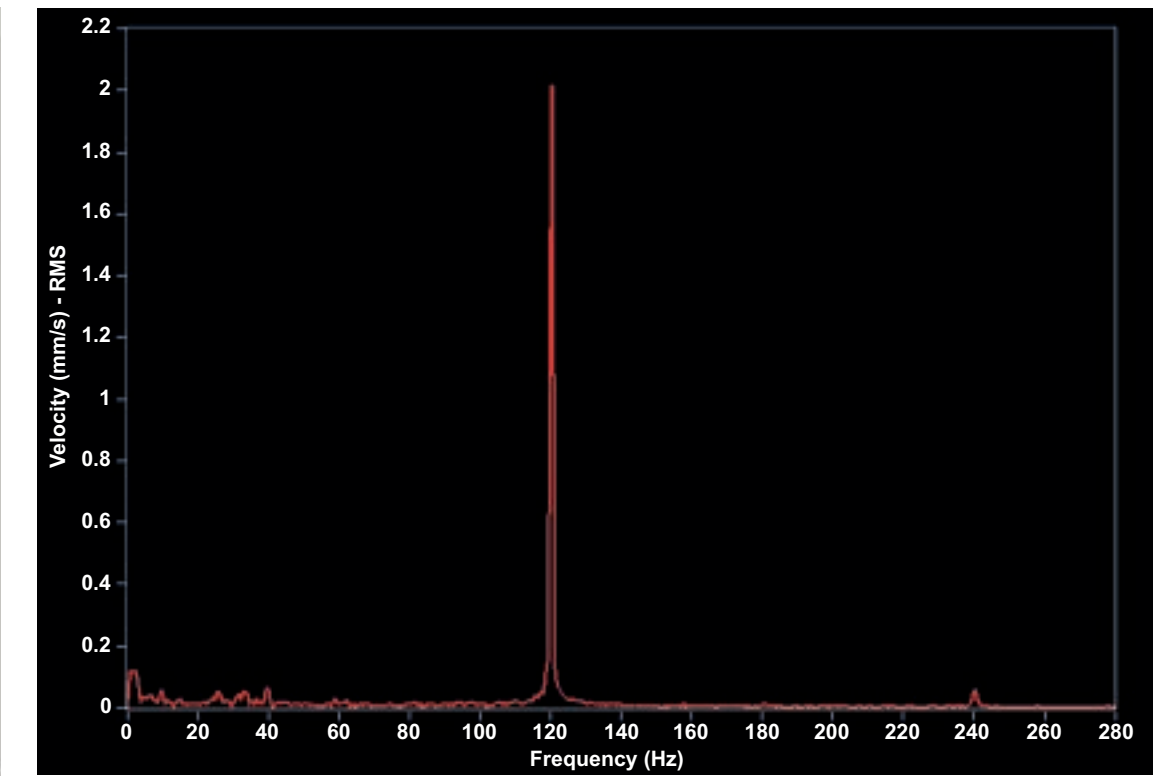
### TWS + ZPU + ZOOM

Graph showing temperature measurements of the stator bars



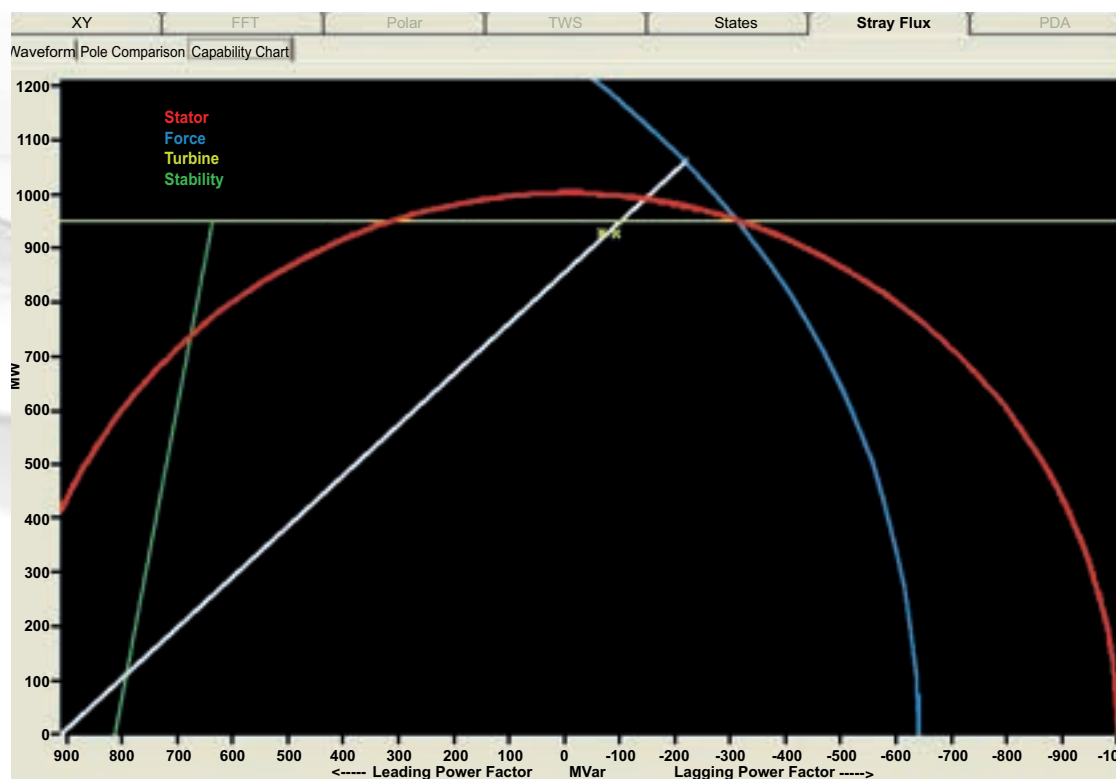
### TWS + ZPU + ZOOM

Stator thermal mapping, provides valuable information about the thermal behavior of a stator core, especially the hot spots or shorted laminations



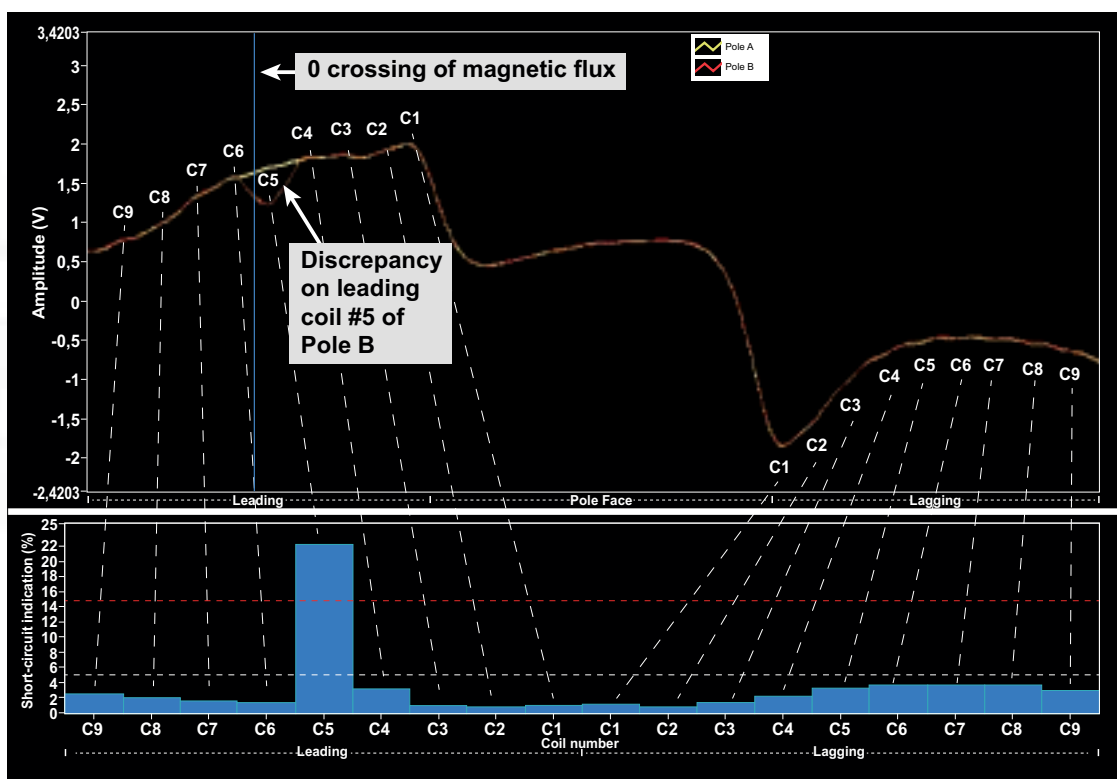
### VSM797S + ZPU + ZOOM

Absolute vibration monitoring  
Spectrum graph of stator core vibration



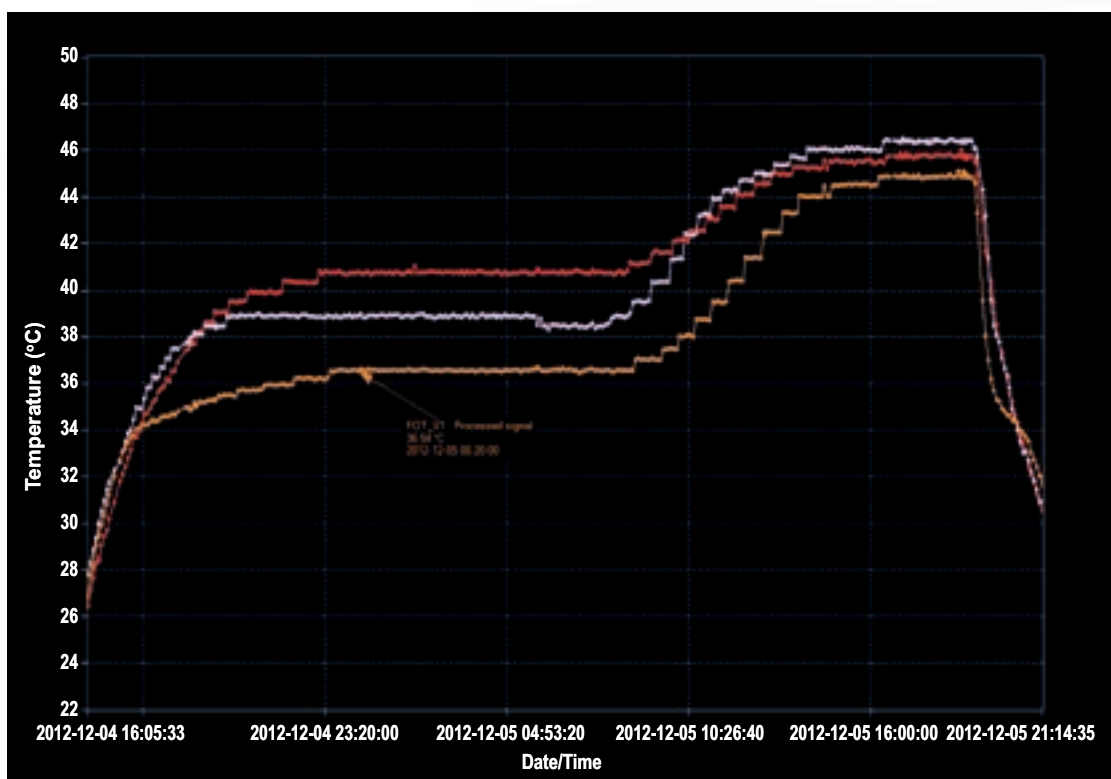
### MFP + SFA + ZOOM

Capability Chart  
Visual representation showing both regions of allowed operation (inside the curve) and forbidden operation (outside the curve)



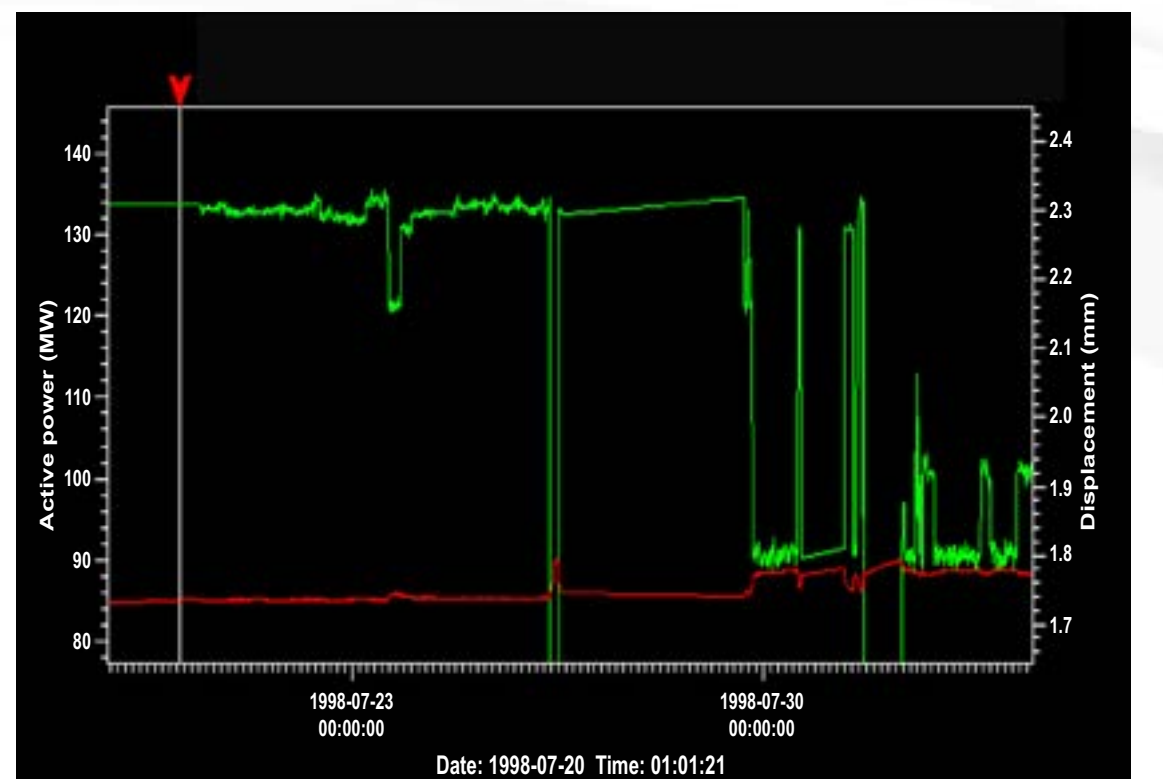
### MFP + SFA + ZOOM

The pole comparison graph superimposes the flux profiles of poles A and B



### FOT + ZPU + ZOOM

Temperature trend of a switchgear



### SBV + ZPU + ZOOM

Trend graph, correlating bar position and active power (MW). This graph shows that the bar is magnetically pulled inward into the slot as the load is increased



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