

CoDiS Computerized Diagnostic System

Hydro generator monitoring system

AN-02-HG-Software modules

Applicable to:

Vertical and horizontal hydro generators, HV electric motors

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CoDiS (Computerized Diagnostic System) is a condition monitoring and diagnostics platform for large rotating machinery like hydro generators that allows complete integration of all quantities of interest (such as mechanical, electrical and hydraulic quantities).

The system is designed to extract and present valuable machine health and condition data from the measured signals.

CoDiS is used as an early warning and predictive maintenance system for rotating machinery in hydro electric power plants. The key advantage of CoDiS is that it is based on open software architecture which enables flexible system configuration, easy customization for the end user and easy future upgrades.

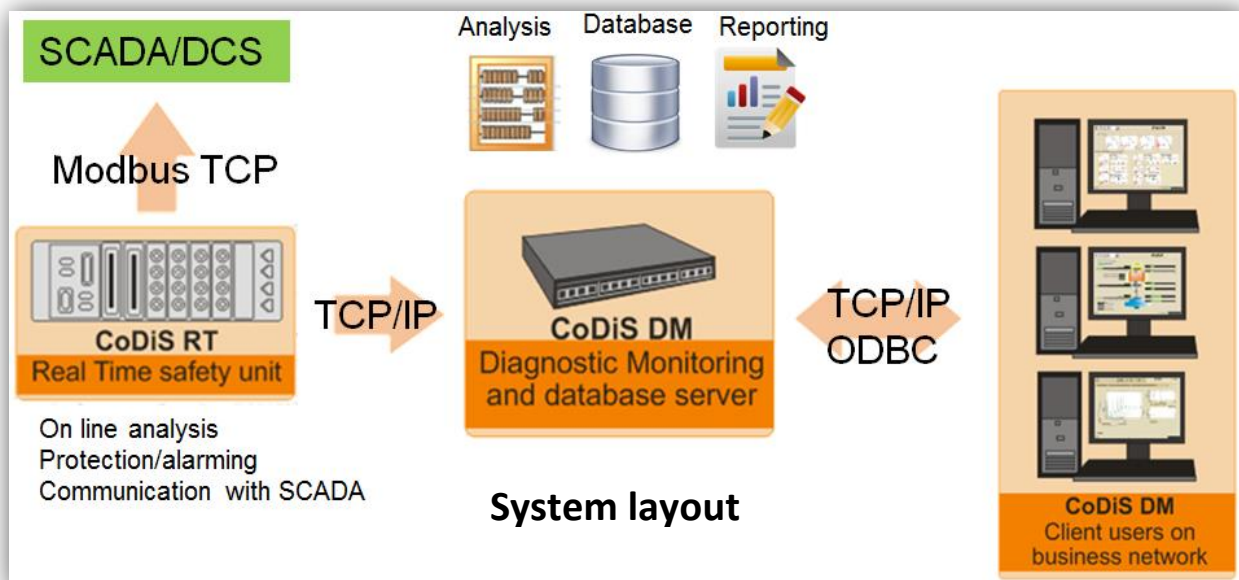
It is designed not only to collect the data but to provide and present the effective solutions to its users! Automatic data storage is organized differently for transient, steady state and event conditions enabling the effective cross relation of monitored values.

Transient conditons – full Vector storage resolution (e.g. each 0.5, 1 , 2 sec)

Steady state operation – Long term Vector data storage resolution (e.g. each 1, 2, 10 min)

Event driven recording (alarm or user created) – Raw Data streaming (2 s to 10 min with adjustable pre triggering)

CoDiS system is designed to exchange the data with the plant control systems enabling the integration into asset protection and management systems.



Standard data analysis tools:

History trend analysis
Bode plot, Nyquist plot
2D and 3D orbit analysis
2D and 3D shaft centerline
Run Out Compensation

Air Gap polar plot and stator geometry
Magnetic field pole profile
FFT spectrum, CPB spectrum
Waterfall spectrum

Partial Discharge
Stator frame displacement
Process quantities

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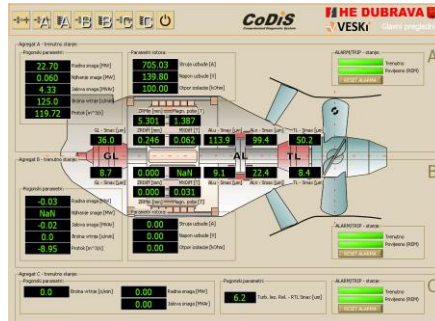
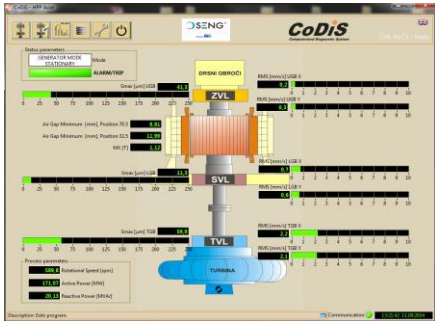
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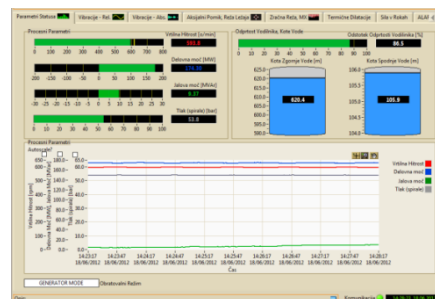
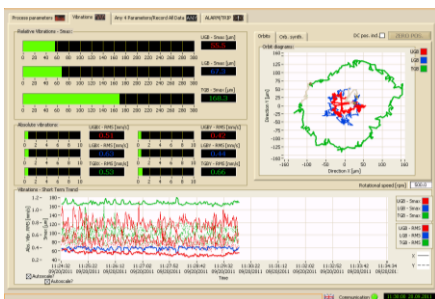
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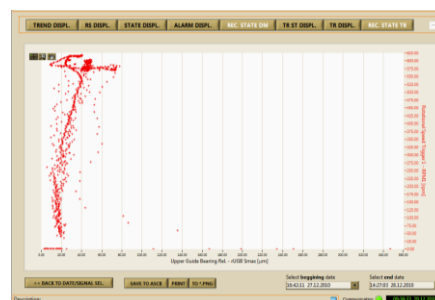
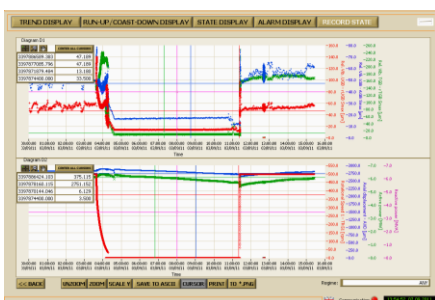
Main screen

Display of the main parameters on unit/plant/cascade level (Real time data, alarm information/power and RPM)



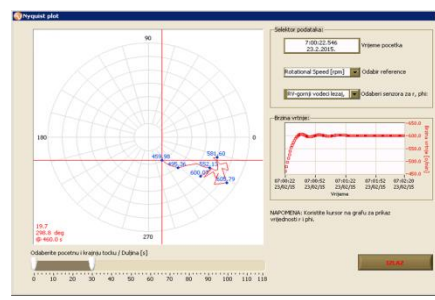
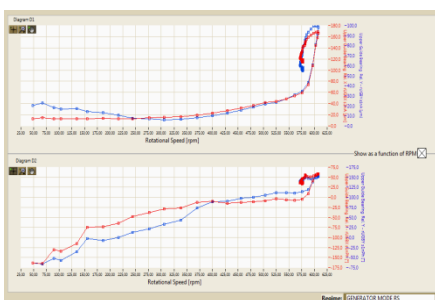
On-line data

Display of the main parameters for each unit in real time



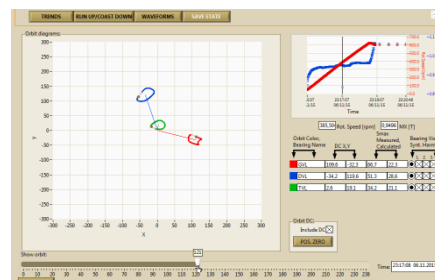
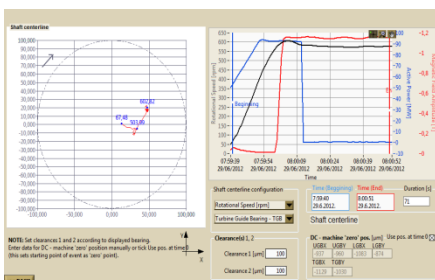
Data trends

History trends and X vs Y trend



Bode and Nyquist (polar) plot

1X amplitude and phase vs Speed (time and flux reference on polar plot)



Shaft centerline and obits with shaft centerline

Interactive event analysis

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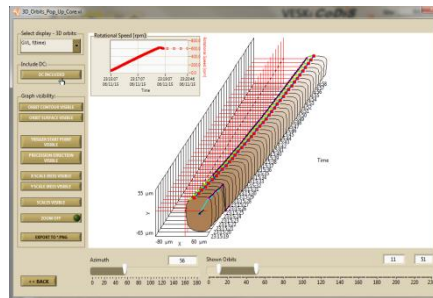
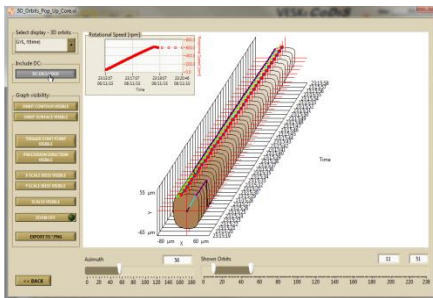
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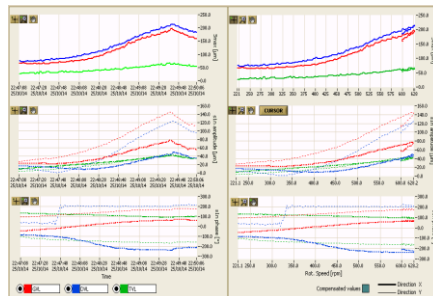
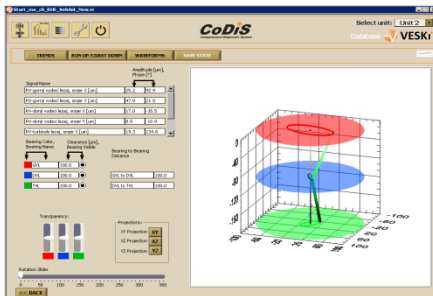
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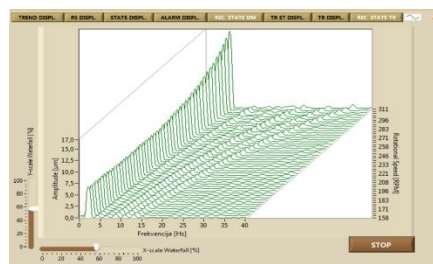
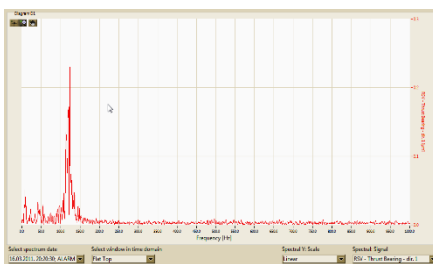
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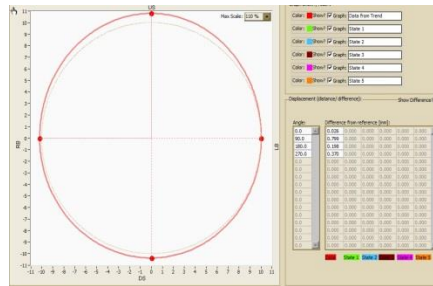
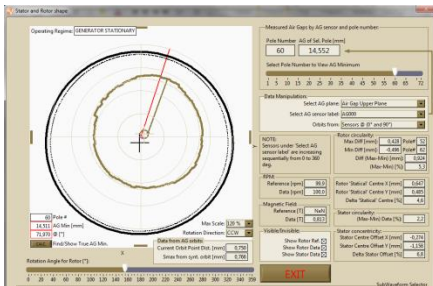
Cascade orbits
With and without shaft centerline reference



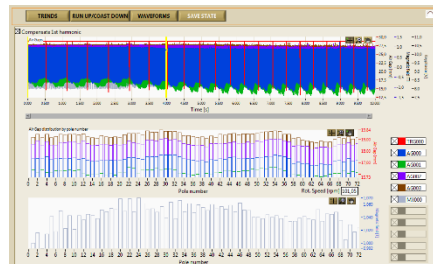
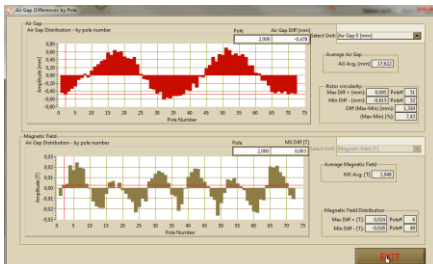
3D shaft Run Out and Run Out compensation
3D shaft centerline in slow roll
Run out compensation plots



FFT and Waterfall spectrum
FFT (with CPB) and Waterfall spectrum



Air Gap and stator frame
Air Gap stator and rotor shape
Stator frame deformation



Air Gap and flux pole over average and flux shorted turn detection

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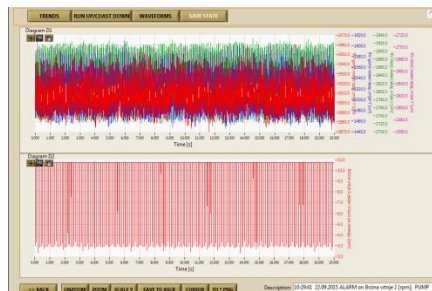
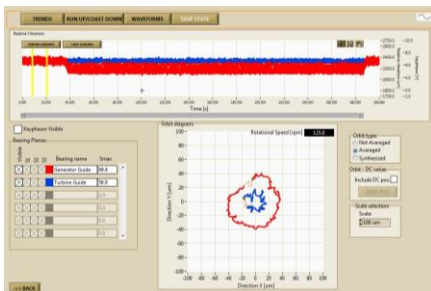
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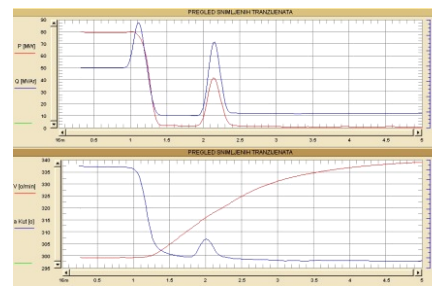
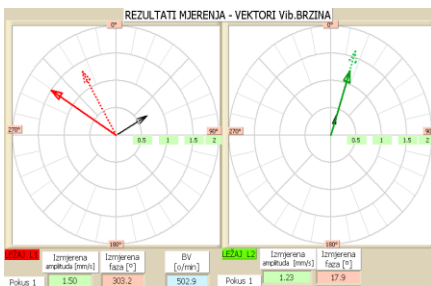


Orbits and raw data analysis

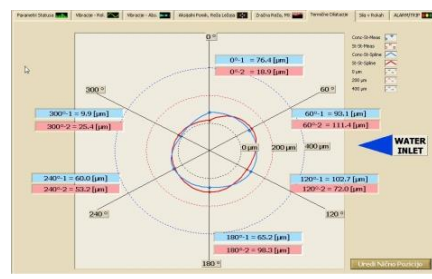
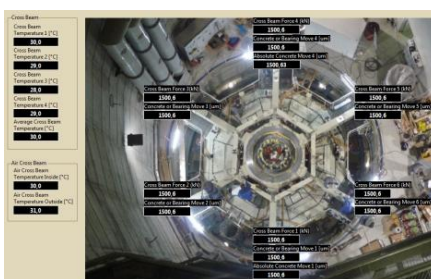
Expert data analysis tools:

Bearing and structure stiffness identification
 Critical speed identification
 Statistical analysis of history trends
 Balancing software
 Load Angle monitoring

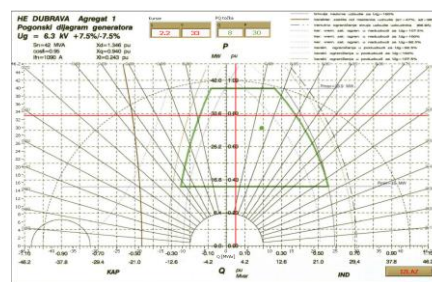
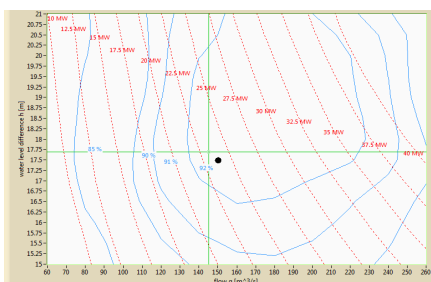
Automated reporting
 Turbine efficiency monitoring
 PQ diagrams
 Forces and strain monitoring
 Rotor pole temperature



Balancing software and vector graphics
 Electrical Load angle



Forces in bracket vs bracket deformation



Turbine efficiency and Capability (P vs Q) chart

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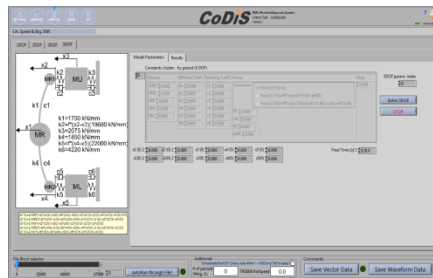
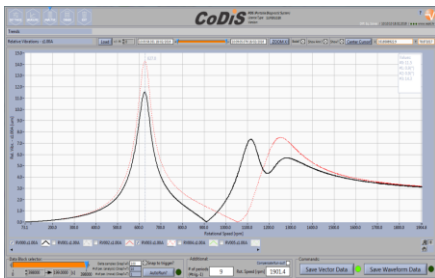
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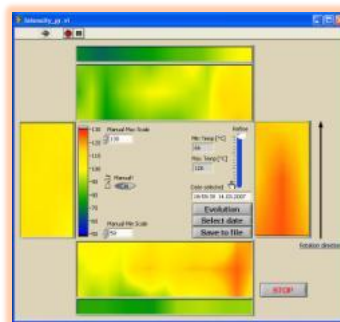
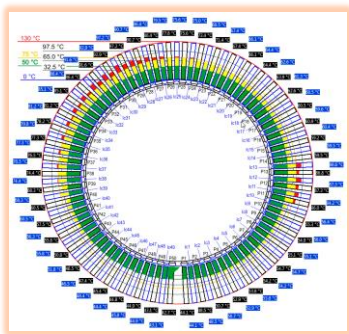
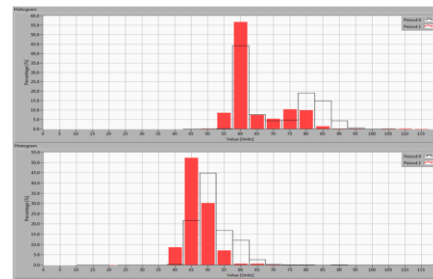
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Mode	Frequency [Hz]	Damping [%]	Amplitude [mm/s]	Phase [deg]	Order	Direction	Comments
1st	100.00	0.00	100.00	0.00	1.00	X	
2nd	200.00	0.00	50.00	0.00	2.00	Y	
3rd	300.00	0.00	30.00	0.00	3.00	Z	
4th	400.00	0.00	20.00	0.00	4.00	X	
5th	500.00	0.00	15.00	0.00	5.00	Y	
6th	600.00	0.00	10.00	0.00	6.00	Z	
7th	700.00	0.00	8.00	0.00	7.00	X	
8th	800.00	0.00	6.00	0.00	8.00	Y	
9th	900.00	0.00	5.00	0.00	9.00	Z	
10th	1000.00	0.00	4.00	0.00	10.00	X	



Bearing and structure stiffness identification

Critical speed identification

Automated reporting (database extraction) and histogram analysis

Rotor pole(s) temperature mapping
50 poles and 49 interconnectors (left)
One pole 106 sensors (right)