

# PROGNOST<sup>®</sup>-NT

Machine Protection and Diagnostics for Predictive Maintenance







## Confidence.

PROGNOST Systems provides the highest level of confidence. Our system is proven reliable and supports many global players in the refining, gas, and petrochemical industry for more than 30 years. Our team of experts is available 24/7 to provide consultations and system support.

# PROGNOST<sup>®</sup>-NT Overview

## **Total Machine Protection and Analysis**

Detect component failures at the earliest possible stage and limit the consequence of serious failures to protect personnel, environment, and assets.





**PROGNOST®-SILver is a signal acquisition system designed for SIL 3 Machine**

**Protection of all Rotating Equipment**

Protection is based on vibration and other critical parameters such as dynamic rod/shaft position and dynamic pressure.

**Signal plausibility checks help prevent false alarms and warnings**

Specialized signal processing avoids false warnings caused by broken wires, loose sensors, and other electrical failures.

**Automatic 10-minute ring buffer for detailed root cause analyses (RCA)**

Continuously recorded uncompressed signal data of all connected sensors (hardwired and DCS connected) are available for detailed root cause analyses. This ring buffer is automatically saved in case of an alarm, at every start/stop, or can be user initiated.

**Early Failure Detection**

PROGNOST®-NT automatically recognizes changing machine operating conditions and adjusts the monitoring thresholds to avoid false warnings caused by variables such as changing pressure, speed, and vibration during different phases of production.

**Reliable and useful piston rod position**

Conventional monitoring methods use piston rod position measurements for wear monitoring purposes only. PROGNOST®-NT uses the dynamic piston rod position for a more reliable rider ring wear calculation and to monitor the mechanical condition of the piston rod, piston and crosshead connections.

**Automated p-V diagram analyses**

PROGNOST®-NT processes the online p-V diagram with dedicated analyses to optimize machinery performance and to detect leaks, such as suction/discharge valves, packing, or piston rings. Further, the system calculates dynamic piston rod loads to provide an early warning of overload.

**Pattern recognition with fully integrated diagnostic database**

Each PROGNOST®-NT system automatically generates and saves new damage patterns when component failures occur. All major failures are analyzed and integrated as failure patterns into the default systems' diagnostic database, along with more than 150 patterns derived from millions of operating hours.

Designed for all your monitoring tasks



PROGNOST®-SILver  
SIL 3 Machine Protection system



- Accurate, intelligent, and powerful machinery analyses and protection based on 30 years of experience
- Proven reliable with installations worldwide on all types of critical rotating equipment
- Global customer support and sales network
- 24/7 customer support capability
- Made in Germany

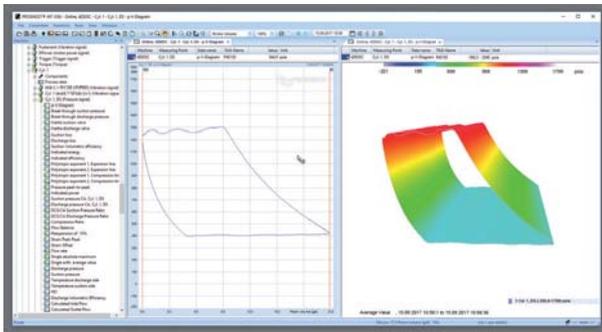


**PROGNOST®-NT system in cabinet**

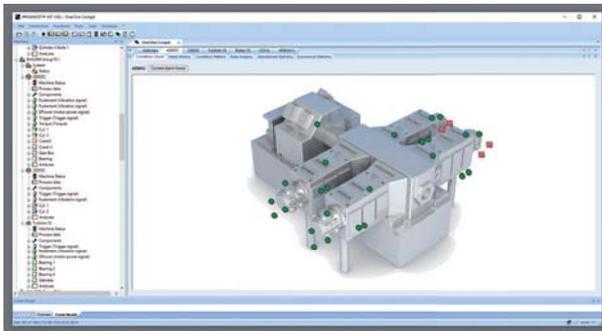
- Online condition monitoring
- SIL 3 machine protection
- Automated diagnostics
- Failure pattern database for clear text messages
- Ring buffer

# RECIPROCATING EQUIPMENT

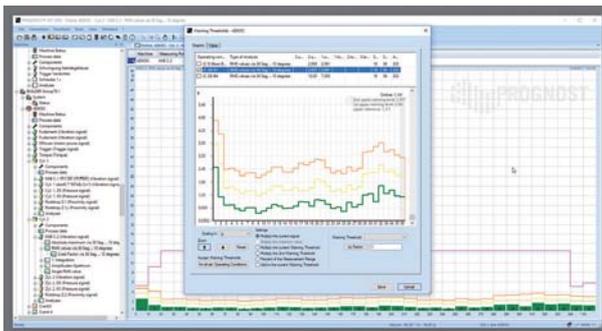
275 analyses and views



Machine tree, p-V diagram, and p-V diagram trend



Machine status with sensor and alarm status



Crosshead vibration threshold setting per segment

PROGNOST® -NT VISU



- Machine
- Process data
- Components
- Trigger (Speed)
- Fundament Velocity
  - RMS 36 segments
  - Absolute Peak 36 segments
  - Single RMS
  - Amplitude spectrum - 180°
    - Turn frequency
    - 0 - 200 Hz
    - 1 - 10 kHz
      - FFT Peak
      - FFT Peak position
    - Turn frequency
      - Non harmonic band RMS
      - Non harmonic band Peak
- 1. Integration
  - RMS
  - Peak to Peak
  - Amplitude spectrum
- Cylinder 1
  - Components
  - Process data
  - Crosshead slide 1
    - Absolute Peak 36 segments
    - RMS 36 segments
    - Crest Factor 36 segments
    - Amplitude spectrum
      - 1,0 x Turn frequency
        - Amplitude
        - RMS
      - 200 - 10 kHz
        - FFT Peak
        - FFT Peak position
  - Vibration
    - Single RMS
    - RMS 36 segments
    - Absolute maximum 36 segments
  - Piston rod position
    - Average 36 segments
    - Rider ring wear
    - Rider ring wear projection
    - Peak to Peak
    - Peak to Peak 8 segments
    - Single position
  - Cylinder 1 head end pressure curve
    - p-V diagram
    - Break through suc/dis pressure
    - Inertia valves
    - Losses
      - Volumetric efficiency
      - Indicated energy and efficiency
      - Polytropic exponents
      - DCS/CA Pressure ratios
      - Indicated power
      - Piston rod load
      - Compression ratio
      - Flow balance



**Process data**

**Components**

**Trigger (Rotation speed)**

**Fundament Velocity**

- RMS 36 segments
- Absolute Peak 36 segments
- Single RMS
- Amplitude spectrum - 180°
  - Turn frequency
  - 0 - 200 Hz
  - 1 - 10 kHz
    - FFT Peak
    - FFT Peak position
- Turn frequency
  - Non harmonic band RMS
  - Non harmonic band Peak

**1. Integration**

- RMS
- Peak to Peak
- Single absolute maximum

**Drive power**

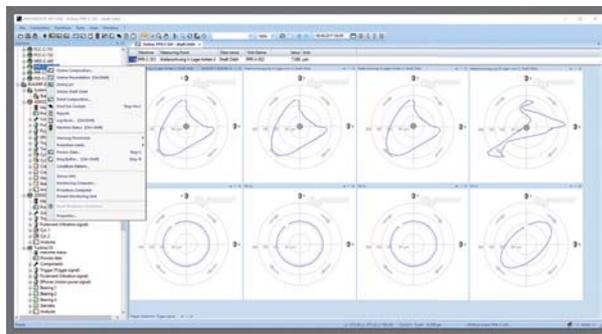
- Peak to Peak
- Single RMS
- Single arith. average

**Bearing 1**

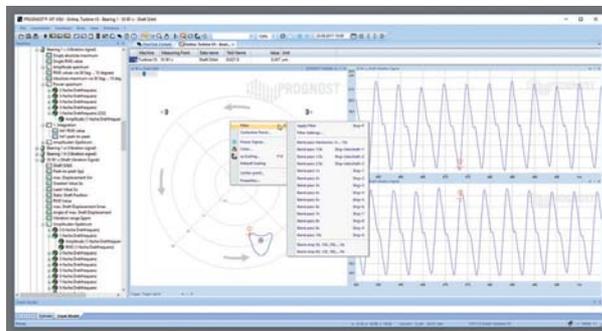
- Components
- Process data
- Shaft vibration Bearing 1
  - Shaft Orbit
  - Peak to Peak
  - Maximum displacement Sm
  - Greatest value So
  - Least value Su
  - Static shaft position
  - RMS
  - Maximum shaft displacement Smax
  - Angle of max. shaft displacement
  - Vibration range Sppm
  - Amplitude spectrum
  - Orbit center displacement
  - Orbit displacement angle
- Bearing 1 vertical vibration
  - Single absolute maximum
  - Single RMS
  - Amplitude spectrum
    - 1 - 10 x Turn frequency
    - 0 - 200 Hz
    - 1 kHz - 10 kHz
      - FFT Peak
      - FFT Peak position
  - Power spectrum
    - 1, Integration
  - Amplitude spectrum
    - 0,5 - 10 x Turn frequency
- Bearing 1 axial vibration
  - Single absolute maximum
  - Single RMS
  - Amplitude spectrum

# CENTRIFUGAL EQUIPMENT

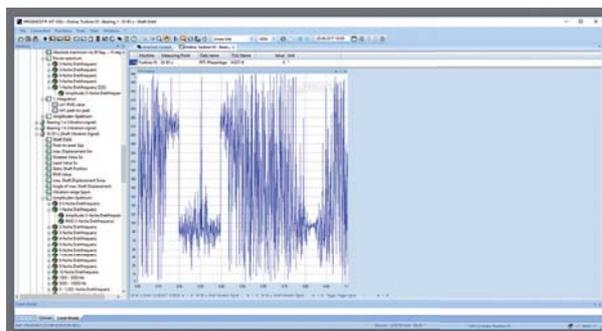
188 analyses and views



Online shaft orbit

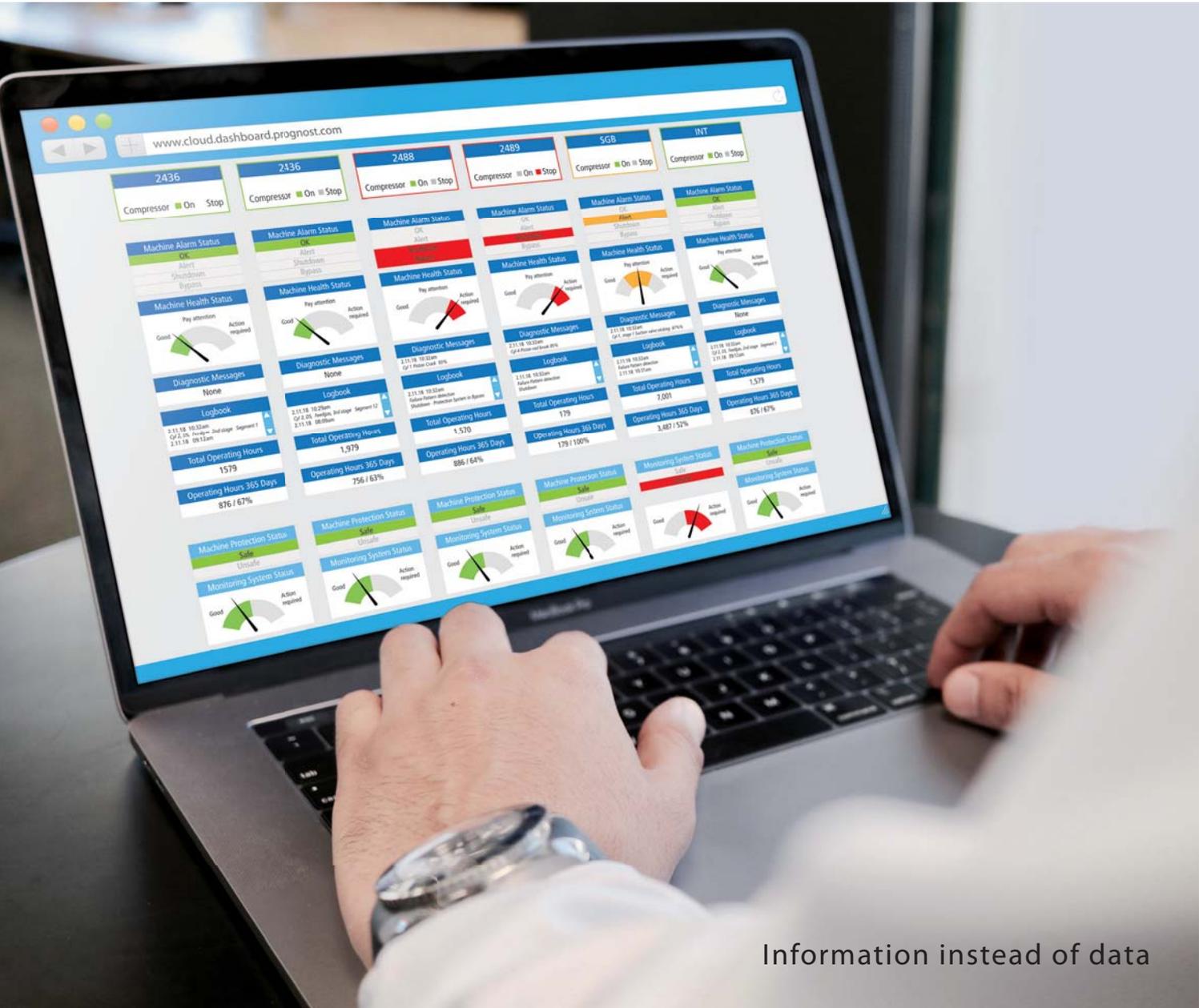


Filtering of shaft orbit

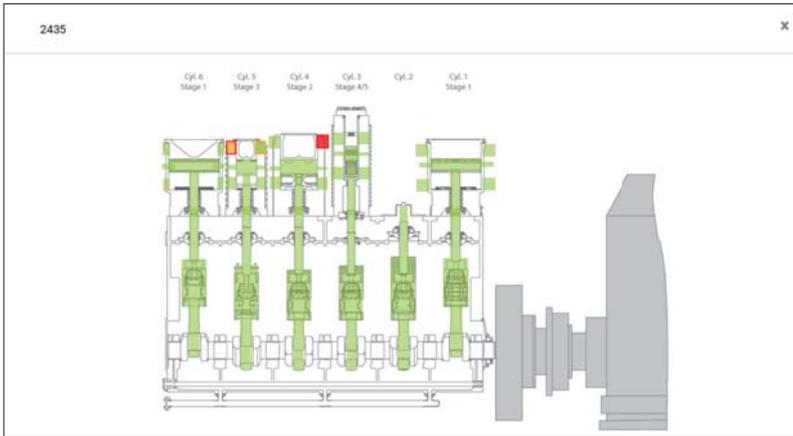


FFT phasing of orbit

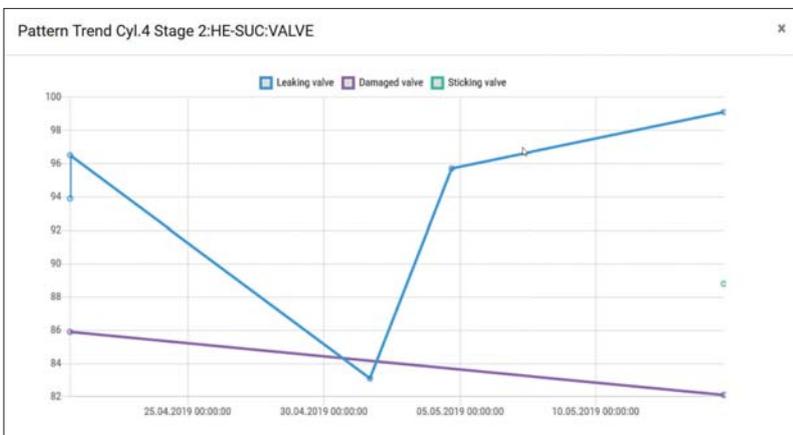
# PROGNOST® Cloud Dashboard



Information instead of data



Machine Status showing affected components via color code (active failure patterns)



Pattern Trend of all related damage patterns

Diagnostic Messages	
14.05.2019 9:53 am	Damage class: Sleeve Bearing, Correlation: 100%
13.05.2019 3:34 pm	Damage class: Sleeve Bearing, Correlation: 91%
13.05.2019 3:32 pm	Damage class: Sleeve Bearing, Correlation: 82%

Diagnostic Messages history for the machine

Logbook	
14.05.2019 11:57 am	Alert - Protection limits violated in the following segment(s) 30
14.05.2019 11:56 am	Alert for Protection limit segment canceled
14.05.2019 11:54 am	Alert - Protection limits violated in the following segment(s) 29

Logbook with alarms, limit violations etc.

Machine Reports	
<a href="#">PROGNOST_semi-annual_report_2019-1_H2435-Rev.2.pdf</a>	
<a href="#">PROGNOST_semi-annual_report_2018-2_H2435-Rev.1.pdf</a>	
<a href="#">PROGNOST_semi-annual_report_2018-1_H2435-Rev.2.pdf</a>	

Library to store all Health Reports and other machine relevant documents

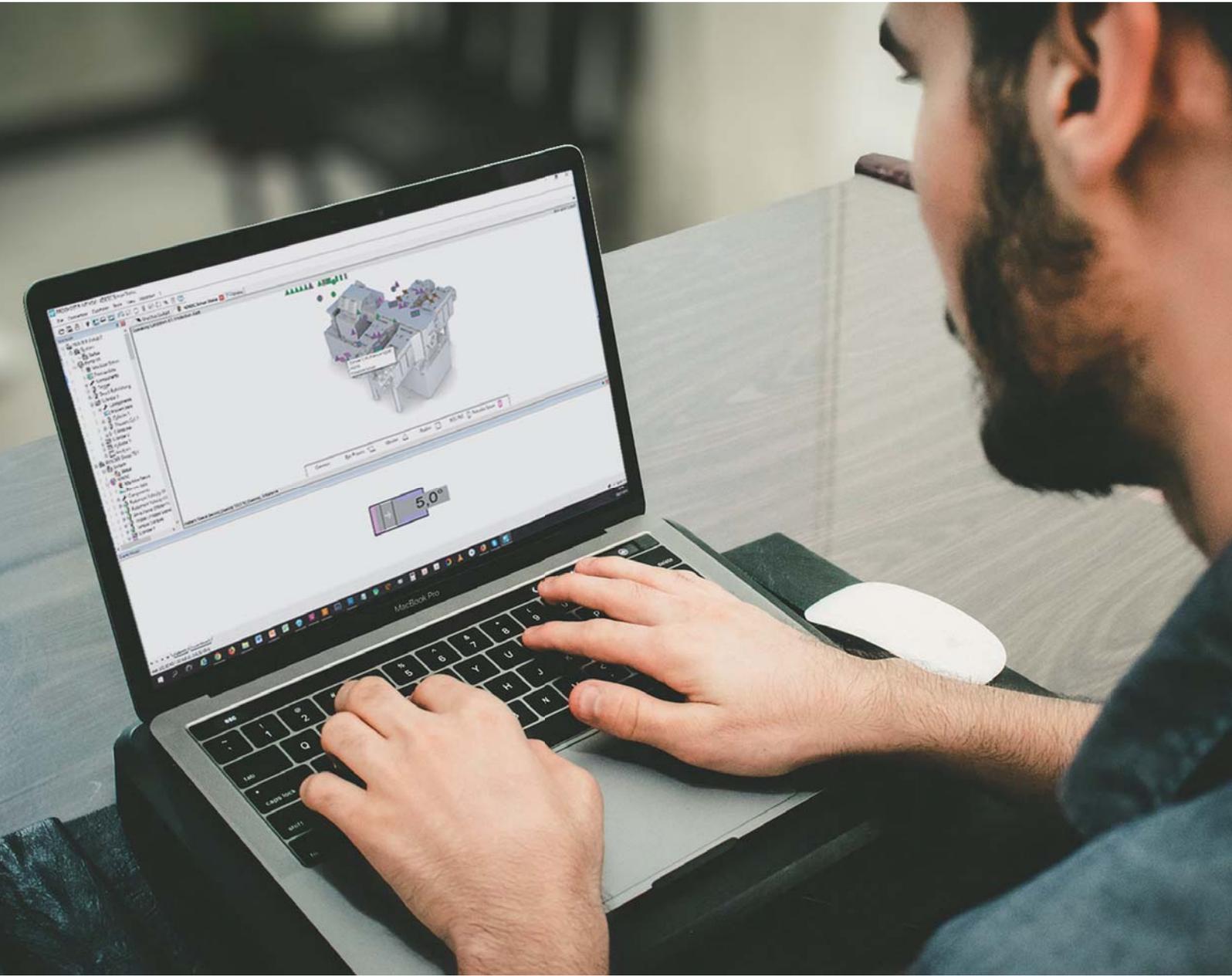
### Let our experience help you!

The PROGNOST® Cloud Dashboard delivers the knowledge of more than 30 years experience in machine monitoring to you.

Benefit from our in-house vibration analyst expertise and the in-depth machinery comprehension demonstrated by our PROGNOST®-NT systems performing hundreds of analyses in realtime.

All this knowledge has been used to create the PROGNOST® Cloud Dashboard. Informative, customizable, worldwide and easy to use.

Modular software for varying degrees of protection and analysis needs



### Protection Analyses

Visualizes and saves online and trend data to provide all information required for precise root cause analyses.

### Early Failure Detection

Detects developing damage at an early stage while accounting for changing operating conditions to avoid false alarms.

### Wear Monitoring

Provides wear trend plots for critical components, such as rider rings or packings.

### Performance Optimization

Evaluates the efficiency of a compressor and its sealing elements with automated p-V diagram analyses.

### Lubrication Monitoring

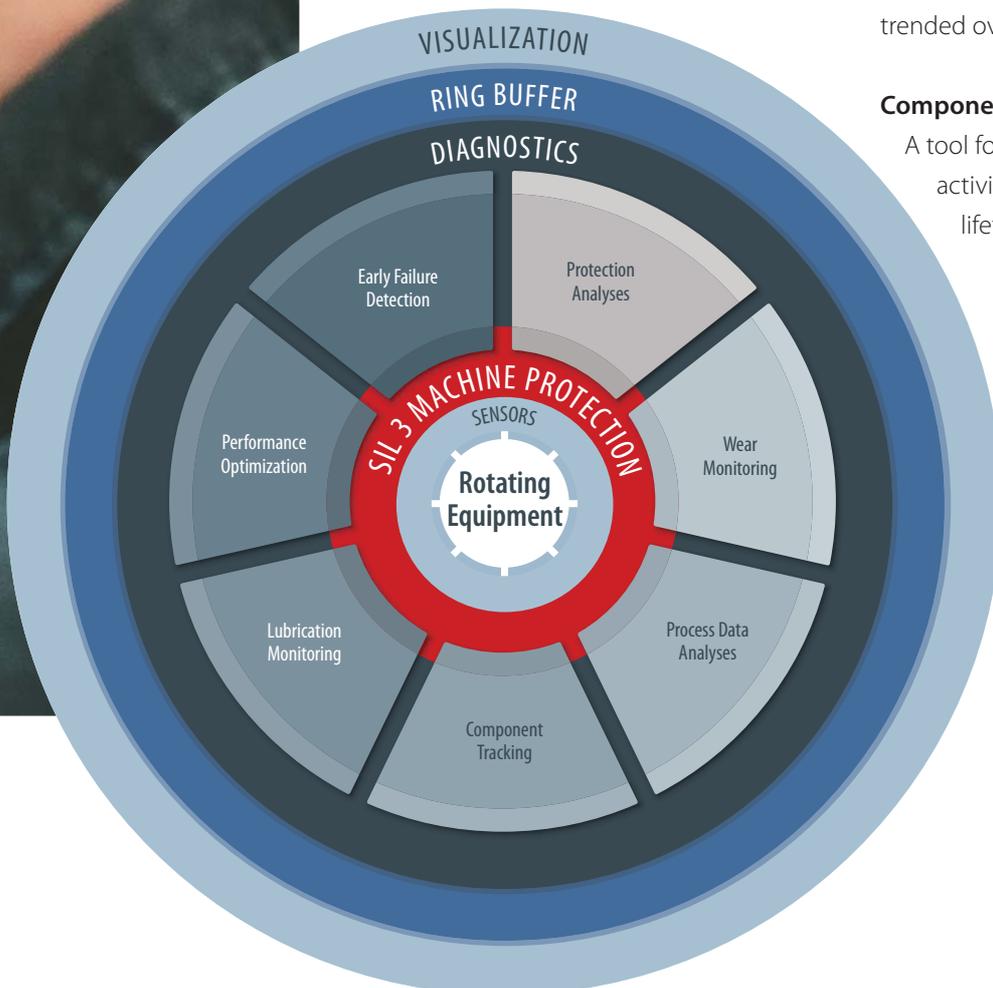
Monitors the flow rate of every individual lubrication point by trend analysis.

### Process Data Analyses

Incorporates both inputs and outputs between the PRONGOST®-NT System and the DCS connection in order to have a comprehensive overview of all machinery values which can be trended over time.

### Component Tracking

A tool for planning and tracking maintenance activities along with real-time component lifetime information.





## **Imprint**

### **Picture Credits:**

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