PORTFOLIO DYNAMOX:

Belt conveyors



About

The Dynamox Solution provides continuous online monitoring of the **condition and performance** of vibrating screens to **prevent failures** and **increase the reliability** of these assets.

In this document you will learn more about the solution and how it is fundamental to increasing the **safety** and **availability** levels of industrial plants.

Scan this and download the Belt conveyor portfolio

03 Belt conveyors

Learn more about this asset and how the Dynamox Solution helps monitor its condition.

13 DynaDetect

Automated detection and diagnosis tool supported by artificial intelligence algorithms.

20 DynaSens

Tool for making reliable and traceable records of inspection routines.

25 DynaNeo

Dashboard to support maintenance management with a unified view of the condition of assets and workflows.

28 Asset Pro

Specialist dashboard for monitoring the structural health and performance of belt conveyors.

32 Integrations

Data and alert integration service from the Dynamox Platform to third-party systems.

33 Success cases

Cases of clients who have achieved impactful results using the Dynamox Solution.

36 Benefits

Discover the benefits of the Dynamox Solution for managers, vibration analysts and maintenance technicians.

Challenges in monitoring this asset

- **Asset size:** can reach kilometers, requiring an efficient monitoring system;
- **Installation area:** it can be difficult to obtain data when the asset is underground or in protected areas;
- **Height:** its location in high places makes it difficult to access its components.
- **Enclosure:** asset safety protection can become a major challenge for monitoring, requiring efficient, autonomous and continuous data collection solutions.



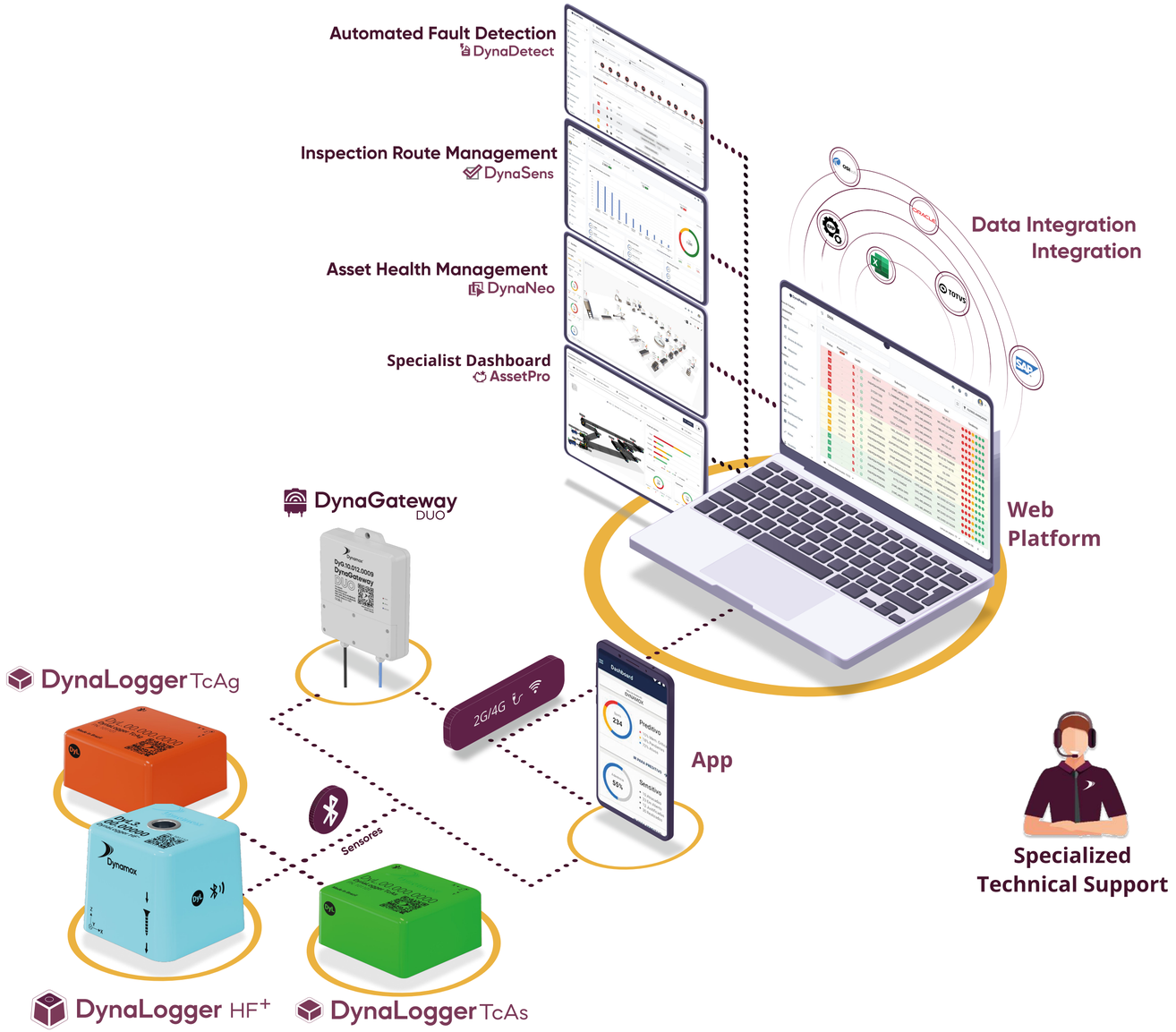
Belt conveyor for ore

Check out how the Dynamox Solution works to identify faults in the various components of this asset.

Dynamox Solution

Rely on the Dynamox ecosystem to monitor the health and performance of belt conveyors combined with data intelligence tools.

DynaLogger HF +S	Drive, lubrication fault, early-stage bearing faults
DynaLogger TcAs	Drum bearing faults, more severe lubrication faults, chute coating, looseness, electrical faults, gear faults
DynaLogger TcAg	Load, impact and return rollers, brakes, electrical panels and more





Dynamox application

Vibration and temperature monitoring
Drive subsets, pulleys, rollers and others

Fault diagnosis tools
Including 3D spectral waterfalls

DynaSens
Checklists and digital routes for sensitive Inspection

DynaDetect
Automated fault detection supported by artificial intelligence

Asset Pro
Specialist dashboard for condition monitoring

DynaNeo
Customizable dashboard for visual plant health management

Integration
Customized data integration

Technical support
Personalized service

Field installation

Check out photos of the application of sensors and Gateways in belt conveyor installations.



Load rollers



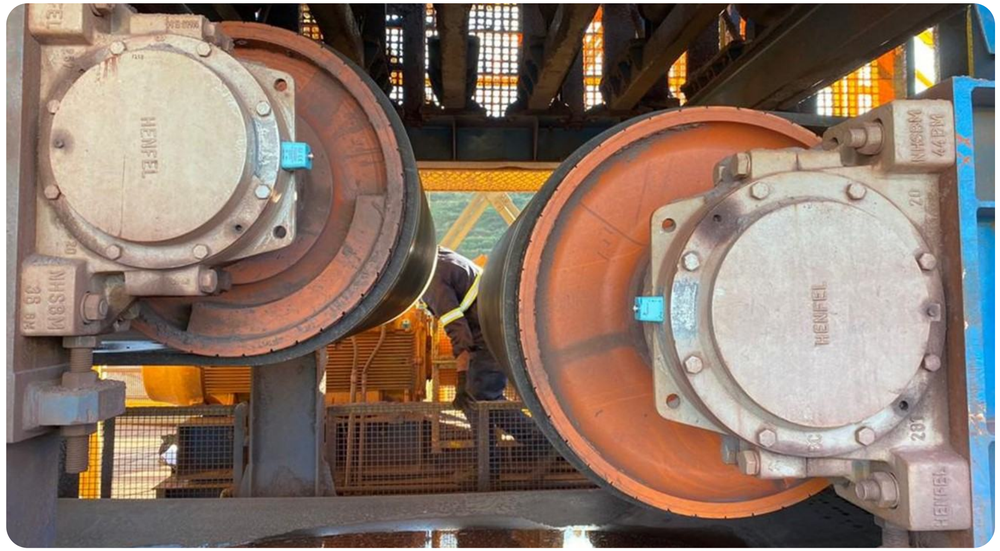
Drum bearing



Drive mechanism



Drive mechanism



Pulleys



Rollers



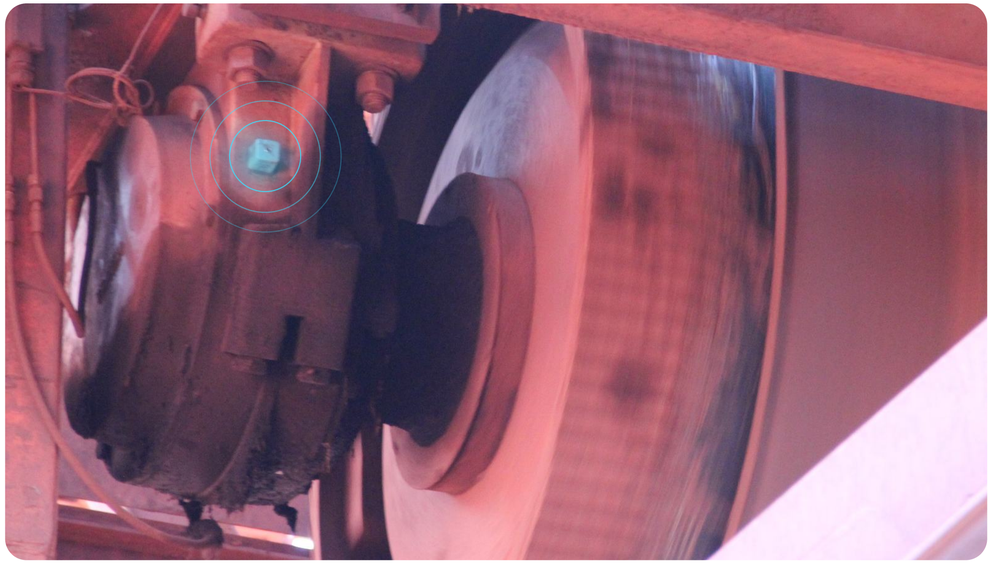
Drive structure



Hydraulic coupling



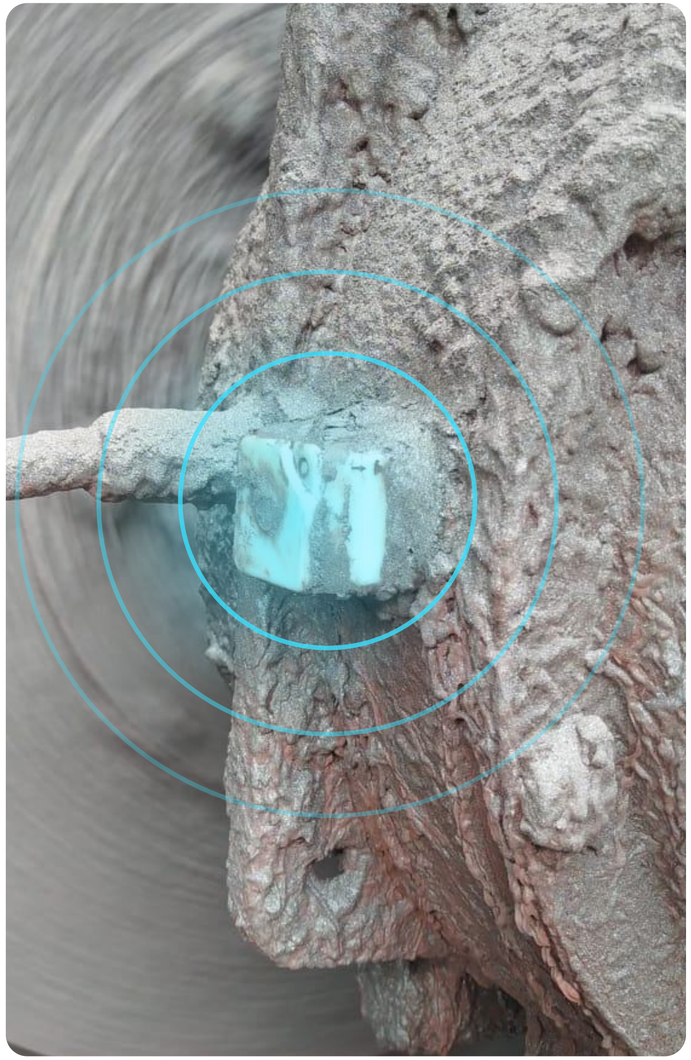
Drive assembly



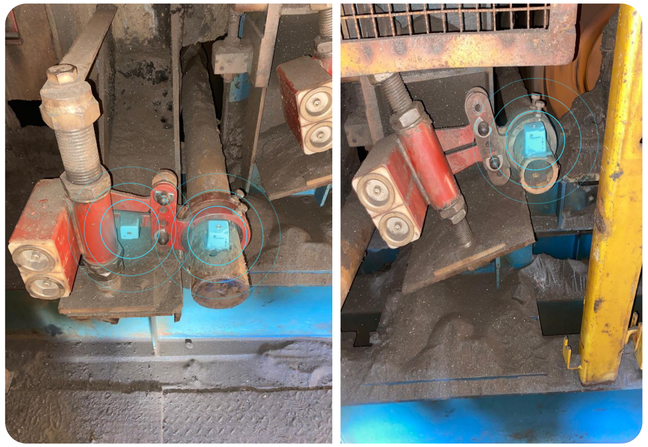
High places



Enclosure



High level of contamination



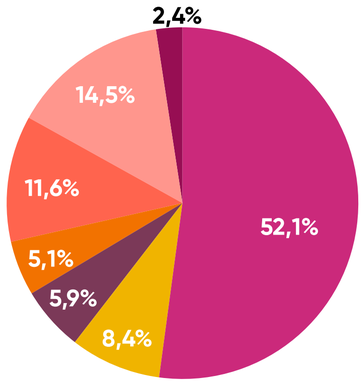
Sensors applied to primary and secondary scrapers



Chute structure

Failure modes detectable with the Dynamox Solution

The most common faults in BC:



Source: Dynamox predictive report data

Legend:

- **Bearing looseness**
- **Wear**
- **Beating**
- **Misalignment**
- **Gear failure**
- **Others**
- **Bearing wear**

		Vibration and temperature	Sensitive inspection	Current and voltage[2]
Electric Motor	Partial discharges	⊗	⊗	✓
	Bad contact	⊗	⊗	✓
	Short circuit between turns	✓[1]	⊗	✓
	Poor insulation	⊗	⊗	✓
	Electrical unbalance	✓[1]	⊗	✓
	Cracked/broken cage	✓[1]	✓	✓
	Overcurrent	✓[1]	✓	✓
	Overheating	✓	✓	⊗
	Bearing fault (Wear/Crack)	✓	⊗	⊗
Frequency inverters	Panel heating	✓	✓[1]	⊗
	Electronic components burnout	✓[1]	✓	✓
	Motor heating	✓	✓[1]	✓
	Motor burnout (stator)/ spot in stator wire	⊗	⊗	✓
Interconnecting element	Wear on the static element	✓[1]	✓	
	Looseness	✓	✓	
	Eccentricity	✓	⊗	
	Misalignment	✓	⊗	
	Unbalance	✓	⊗	
	Slippage between pulleys	✓	✓	
	Friction/Rubbing	✓	✓[1]	

[1] Partial coverage

[2] Enging Solution | Predictive maintenance and fault detection for electrical assets. Find out more at www.enging.pt

Belt conveyor

		Vibration and temperature	Sensitive inspection
Gearbox	Bearing fault (wear/cracks)	✓	✓[1]
	Inadequate lubrication	✓	⊗
	Looseness of adjustments, housings, bushings and shafts	✓	✓[1]
	Mechanical stress	✓	⊗
	Lack of parallelism between housings	✓	⊗
	Inadequate contact between gear teeth	✓	⊗
	Cracked/broken teeth	✓	⊗
	Pitted teeth	✓	⊗
	Cracked shaft	✓	⊗
	Oil leak	⊗	✓

		Vibration and temperature	Sensitive inspection
Flywheel bearings	Inadequate lubrication	✓	⊗
	Bearing fault (Wear/Cracks)	✓[1]	⊗
	Looseness of adjustments, housings, bushings and shafts	✓	⊗
	Mechanical looseness	✓	⊗
	Mechanical stress	✓[1]	⊗
Hydraulic drive	High rigidity	✓	⊗
	Drainage	✓	⊗
	Oil leak	⊗	✓
Belt	Uneven wear	⊗	✓
	Tear	⊗	✓
	Structural friction	⊗	✓
	Misalignment	⊗	✓

[1] Partial coverage

[2] Enging Solution | Predictive maintenance and fault detection for electrical assets. Find out more at www.enging.pt

Belt conveyor

		Vibration and temperature	Sensitive inspection
Pulley	Coating wear	✓	✓[1]
	Sheet metal wear	⊗	✓[1]
	Crack in the mirror	✓	✓[1]
	Bearing bushing loosening	✓	⊗
	Tensor ring fixation	✓	⊗
	Inadequate lubrication	✓	✓
	Bearing wear	✓	✓
Scraper	Wear	✓	✓
	Fixation	✓	✓
	Improper adjustment	✓	✓
	Break	✓	✓

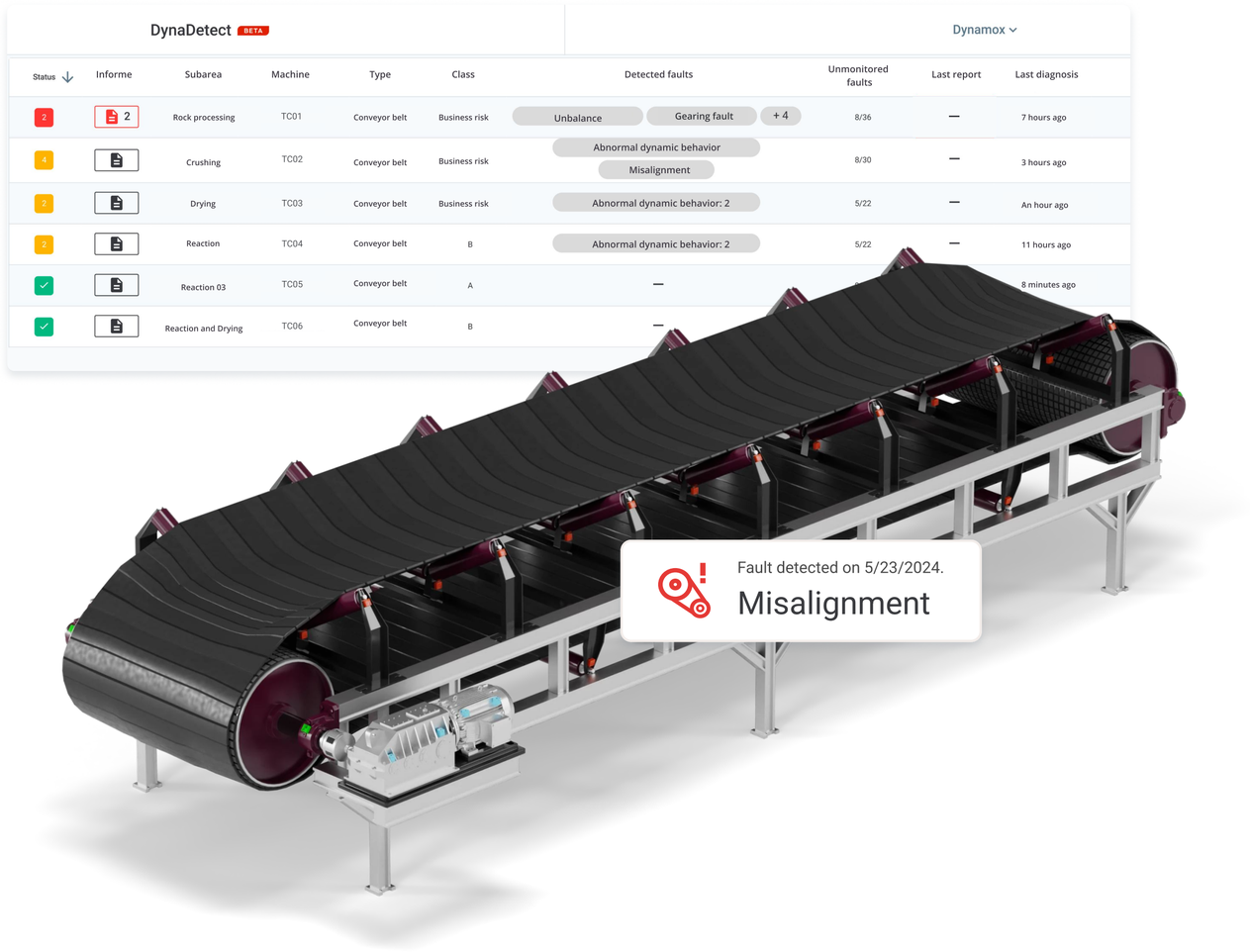
		Vibration and temperature	Sensitive inspection
Rollers	Bearing breakage	✓	✓
	Roller breakage	✓	✓
	Roller fixation	✓	✓
	Shaft breakage	✓	✓
	Lack of lubricant	✓	⊗
	Coating detachment	✓	✓
	Stop/Lock	✓	✓
	External contamination	✓	✓
Transfer chute	Coating wear	✓	✓
	Clogging	✓[1]	✓
	Loosening of wear plate screws	✓	✓
	Crack in the structure	⊗	✓
	Loosening of structure fixation	✓[1]	✓
	Material decentralization	⊗	✓

[1] Partial coverage

[2] Enging Solution | Predictive maintenance and fault detection for electrical assets. Find out more at www.enging.pt

Automated Detection

DynaDetect is an AI-supported tool designed to automatically analyze vibration and temperature data, revealing trends and offering agile diagnosis for possible faults at an early stage.



Identifying faults

In addition to the **belt**, the **drive assembly**, **rollers**, **pulleys**, **chutes**, **frame** and **scrapers** are also fundamental components. For each of these, Dynamox's detection tool carries out automated diagnoses for the following faults:

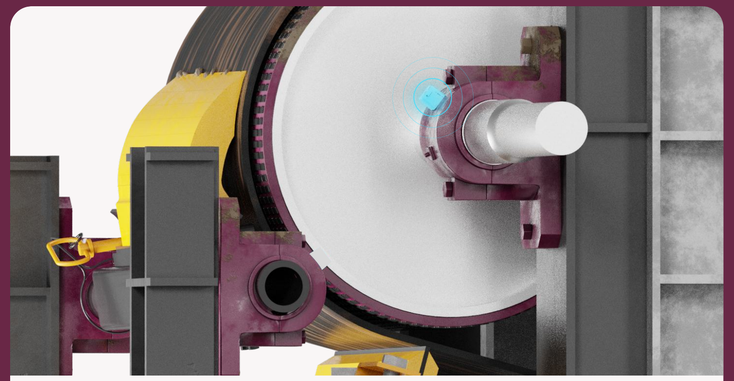
Mechanical faults

- Lack of rigidity
- Bearing wear
- Unbalanced pulley
- Abnormal dynamic behavior
- Gearing fault
- Misalignment
- Structural looseness
- Rotating looseness
- Structural unbalance
- Misaligned pulley
- Lack of lubrication

Electrical faults

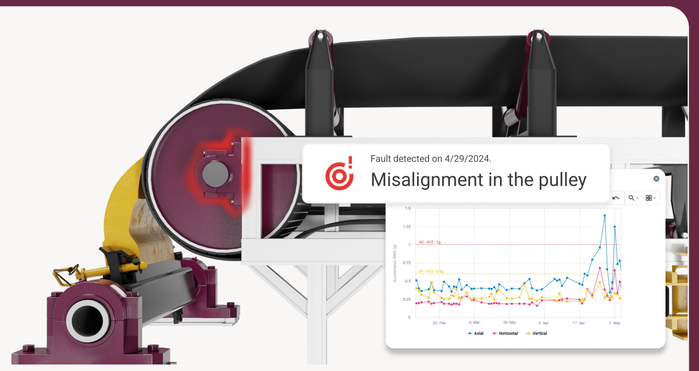
- Stator fault
- Rotor bar fault
- Electrical fault

DynaDetect: A predictive analysis tool



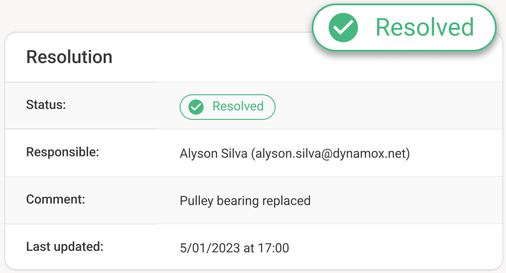
1. Data collection

Vibration and temperature data are collected continuously during the asset's operation.



2. AI analysis and detection

The artificial intelligence model specializing in conveyors analyses the data and draws up the diagnosis.



3. Report automation

DynaDetect helps prepare reports so that the maintenance team can act assertively on the alarmed asset.

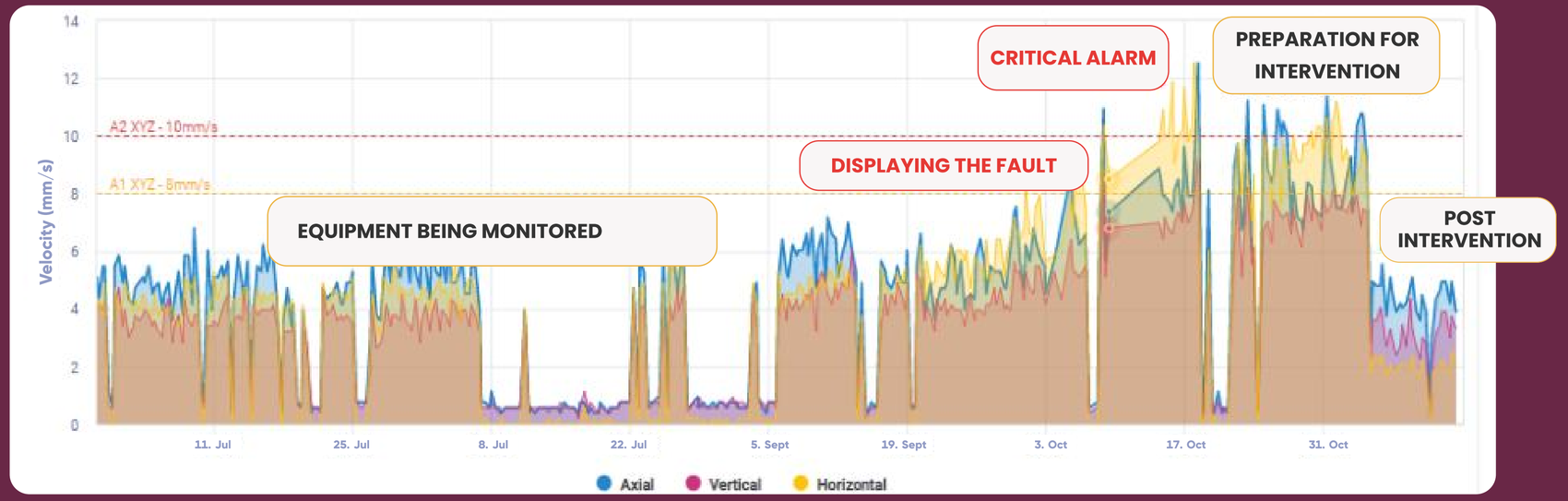
DynaDetect success case:

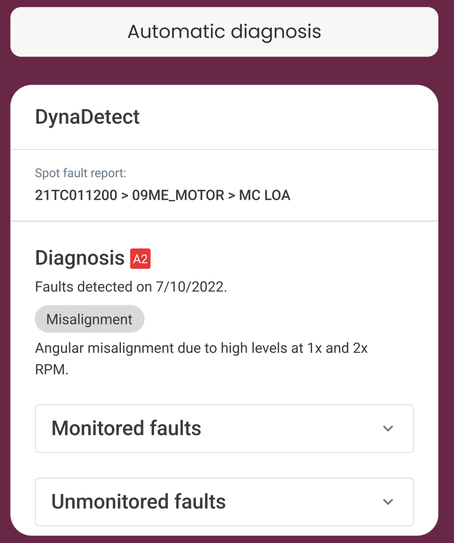
Potential fault detection in the Belt conveyor drive motor

Belt conveyors are crucial for material transportation, and any downtime directly affects production. Therefore, condition monitoring is vital.

However, this task is challenging due to the conveyor's length and difficult access.

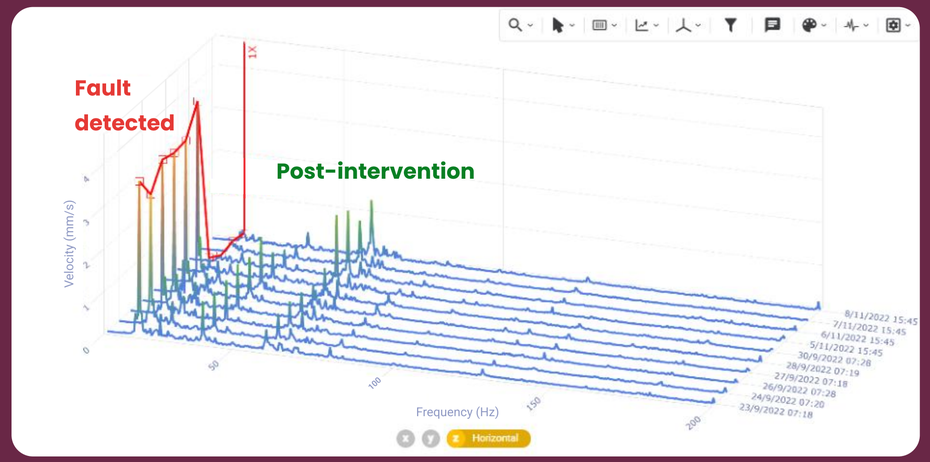
Fortunately, Dynamox provides a solution that addresses these challenges, helping to prevent failures and enhance the reliability of belt conveyors!





In this instance, analysts received a diagnostic alert for motor misalignment, which escalated and triggered an A2 alert, indicating a critical level. A field inspection confirmed the issue in the high-speed coupling (see photo)

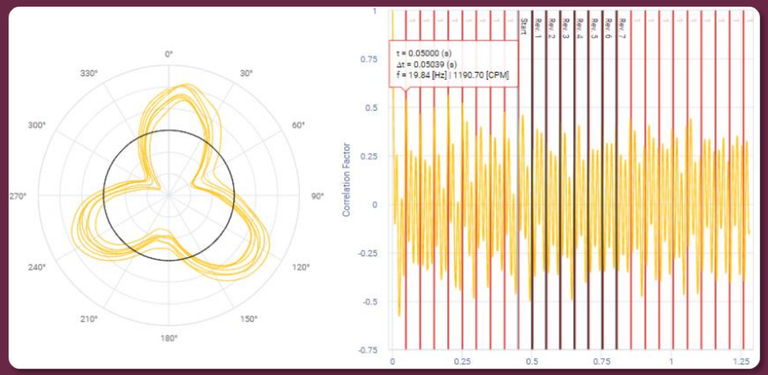




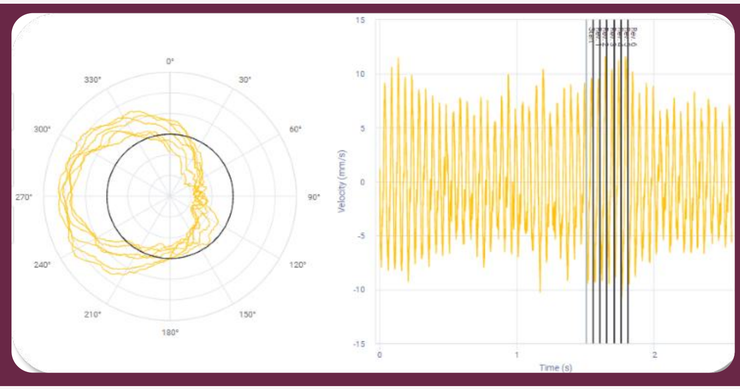
The spectral waterfall indicates the machine's rotation frequency (approximately 20Hz or 1200 RPM). Additionally, there is a threefold increase in the rotation frequency, which characterizes misalignment.

The analysis corroborates this diagnosis, with a low residual misalignment visible in the autocorrelation graph (figure opposite).

The analysis supports this diagnosis, showing a low residual misalignment in the autocorrelation graph (see figure).



The figure above, featuring the circular view of autocorrelation, illustrates the residual presence.



Cepstrum graph with BPFI rahmonics in evidence.

Learnings from the case

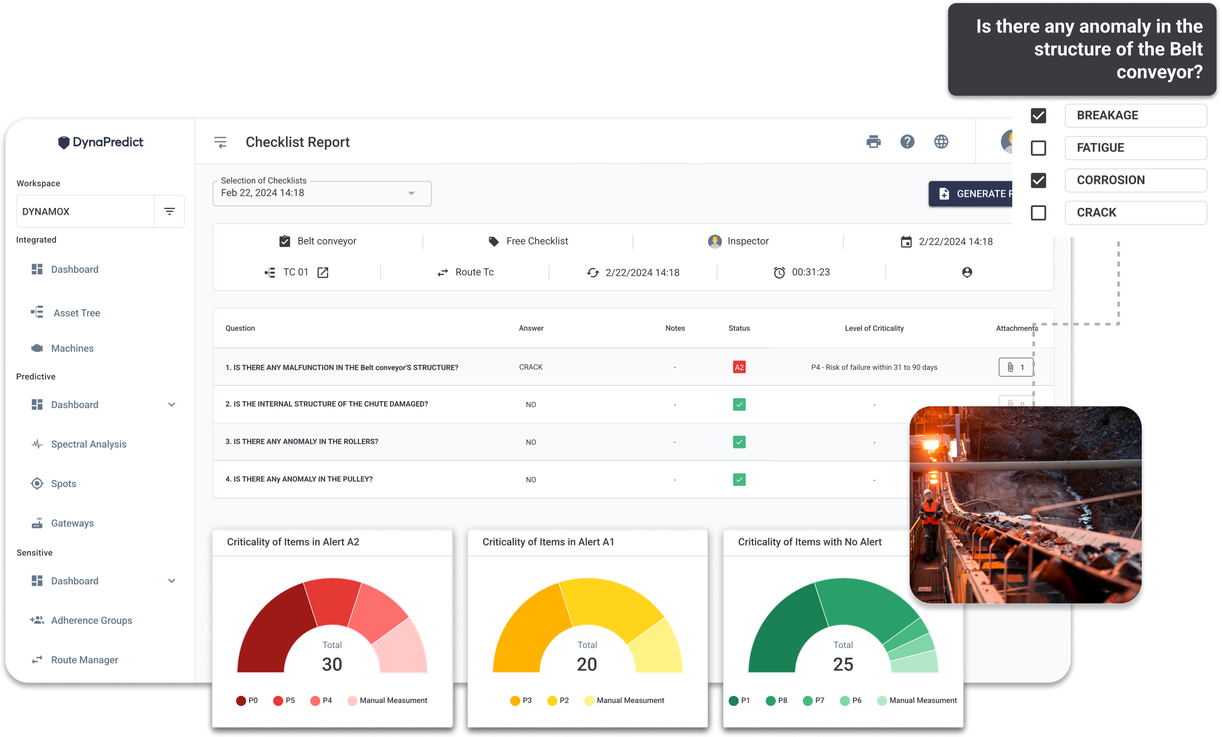
Continuous monitoring of a Belt conveyor, combined with automated detection, enabled the rapid diagnosis of a problem at an early stage that could have turned into an unplanned stoppage with major production impact.

This case illustrates how the Dynamox Solution helped to prevent a problem from worsening, extending the life of the equipment and ensuring the efficiency of the operation. Technology has therefore proved essential for predictive maintenance, guaranteeing that the production line continues to run safely and efficiently.

Watch now!

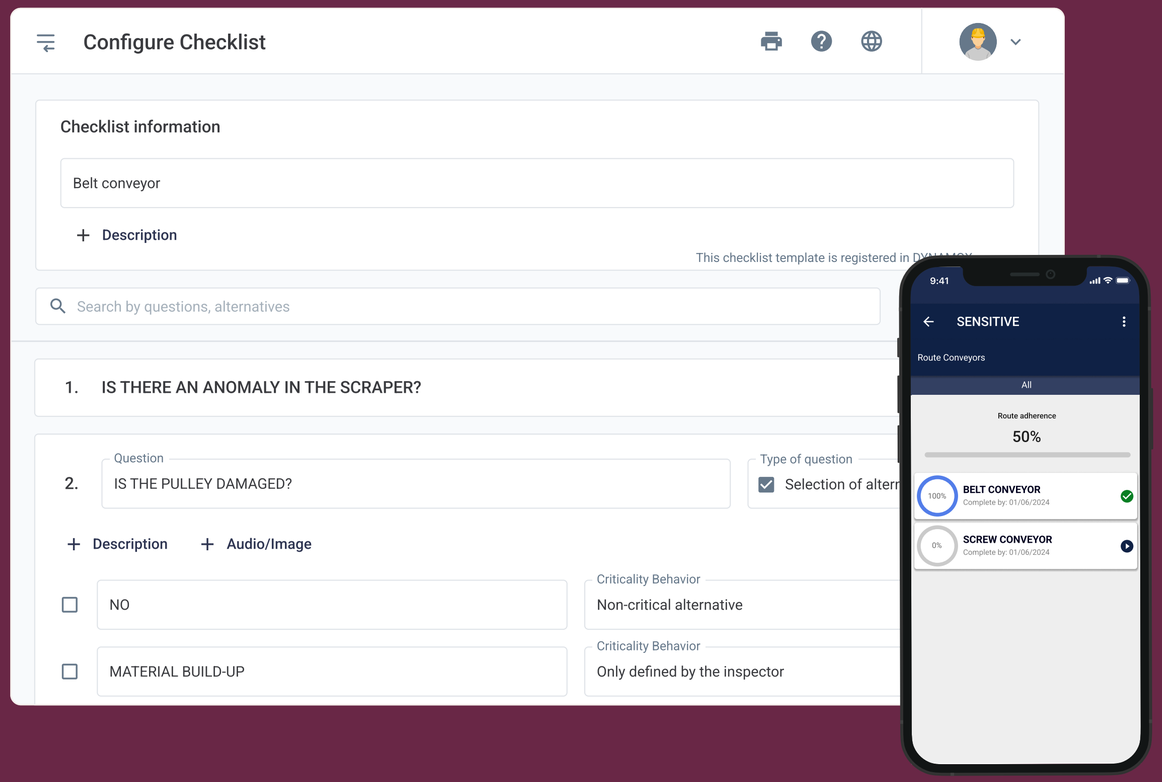
Sensitive inspection

DynaSens is a tool that, when combined with monitoring via wireless sensors, creates reliable and traceable records of inspection routines. This transforms field-collected data into an accurate source for making informed maintenance decisions.



Integrations

Creation of work orders integrated with ERP software



Checklists

Create or use standard checklist templates for belt conveyors that can be integrated into inspection routes.

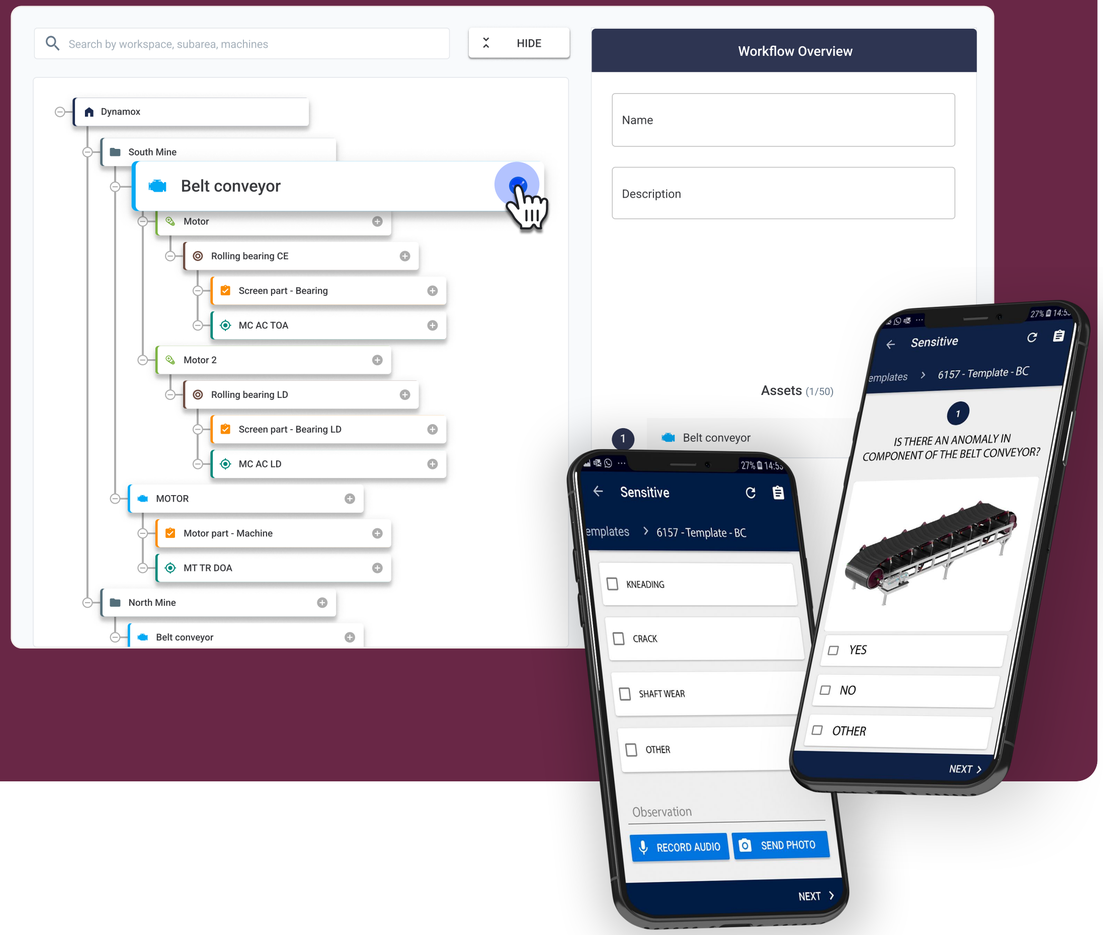
Routes

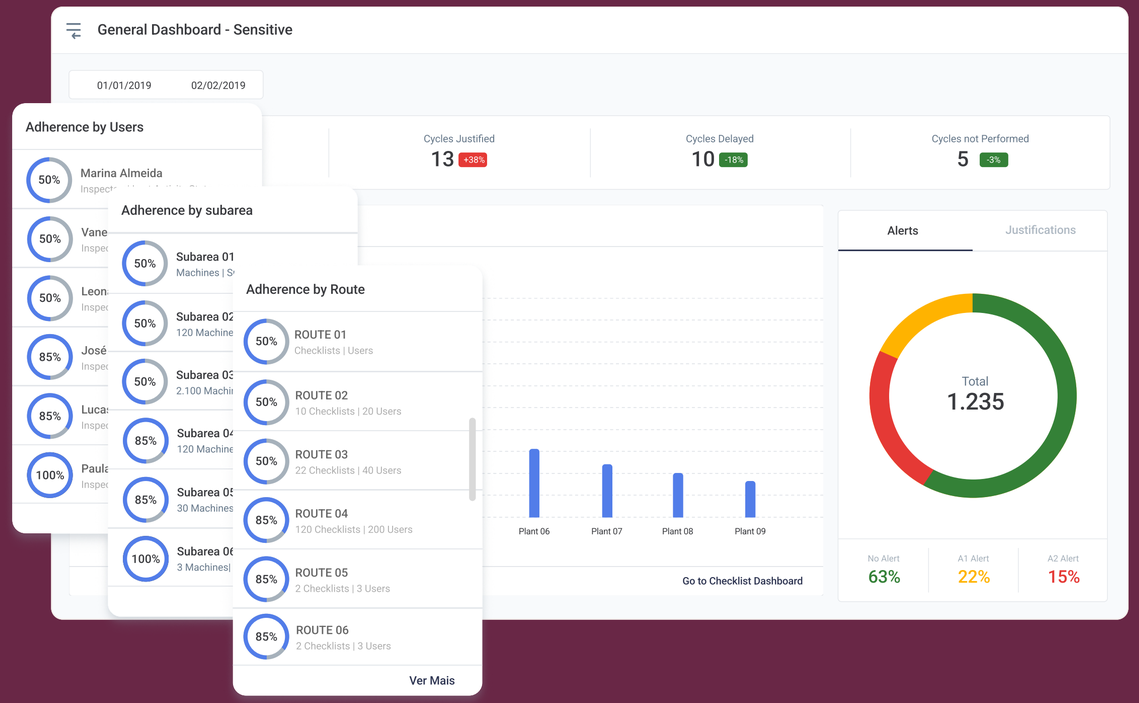
Create inspection routes with customizable cycles, execution tolerances, and configurations for inspectors.

When running routes via the app, the checklist is displayed according to the template created on the platform with the questions, descriptions and alternatives registered.

Execution via App

- Offline execution
- Geolocation recording
- Comments with image and audio





Analysis

Analyze field-generated reports using dashboards. These dashboards offer an overview of the plant's health, organized by location, occurrences, and triggered alerts.

Monitor inspector adherence by evaluating the areas covered during inspections, the percentage of routes completed, and whether any routes were justified or not carried out.

Use case

Check out a use case of the checklist functionality for Belt conveyors

Checklist:	CHECKLIST TC
Type:	Checklist Livre
User:	inspector01@dynamox.net
Location in the Asset Tree:	Belt conveyors
Route:	WEEKLY MECHANICAL INSPECTION ROUTE
Answer date:	12/05/2023 13:23
Synchronization:	12/05/2023 14:04
Aprox. Time Used:	00:06:04
Geolocation:	-20.1915 -43.4897

Question 1:	IS THE PULLEY DAMAGED?
Answer:	MATERIAL BUILD-UP
Notes:	-
Criticality Level:	P0 - ACT / RISK OF FAILURE LESS THAN 15 DAYS
Attachments	

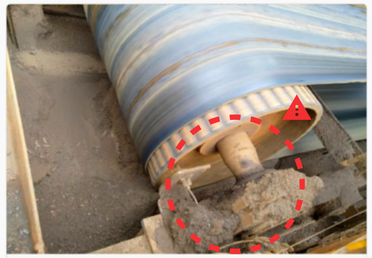


Imagem em 12-05-2023 11:29.jpg

Question 2:	IS THE CHUTE'S INTERNAL STRUCTURE DAMAGED?
Answer:	YES
Notes:	NEED TO CHECK CHUTE DUE TO INTERNAL COATING WEAR
Criticality Level:	P0 - ACT / RISK OF FAILURE LESS THAN 15 DAYS
Attachments	

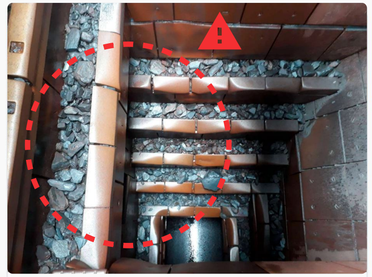
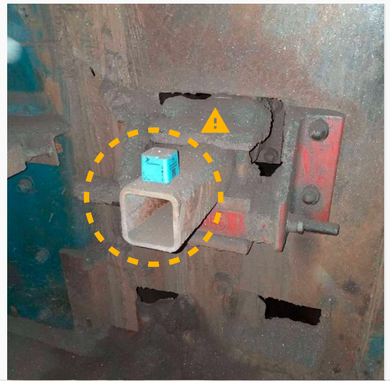


Imagem em 12-05-2023 11:29.jpg

Question 3:	IS THERE ANY ANOMALY IN THE SCRAPER?
Answer:	NO
Notes:	-
Criticality Level:	P3 - Risck of fdailure within 91 to 120 days.
Attachments	



Question 4:	IS THE STRUCTURE FAULTY?
Answer:	YES

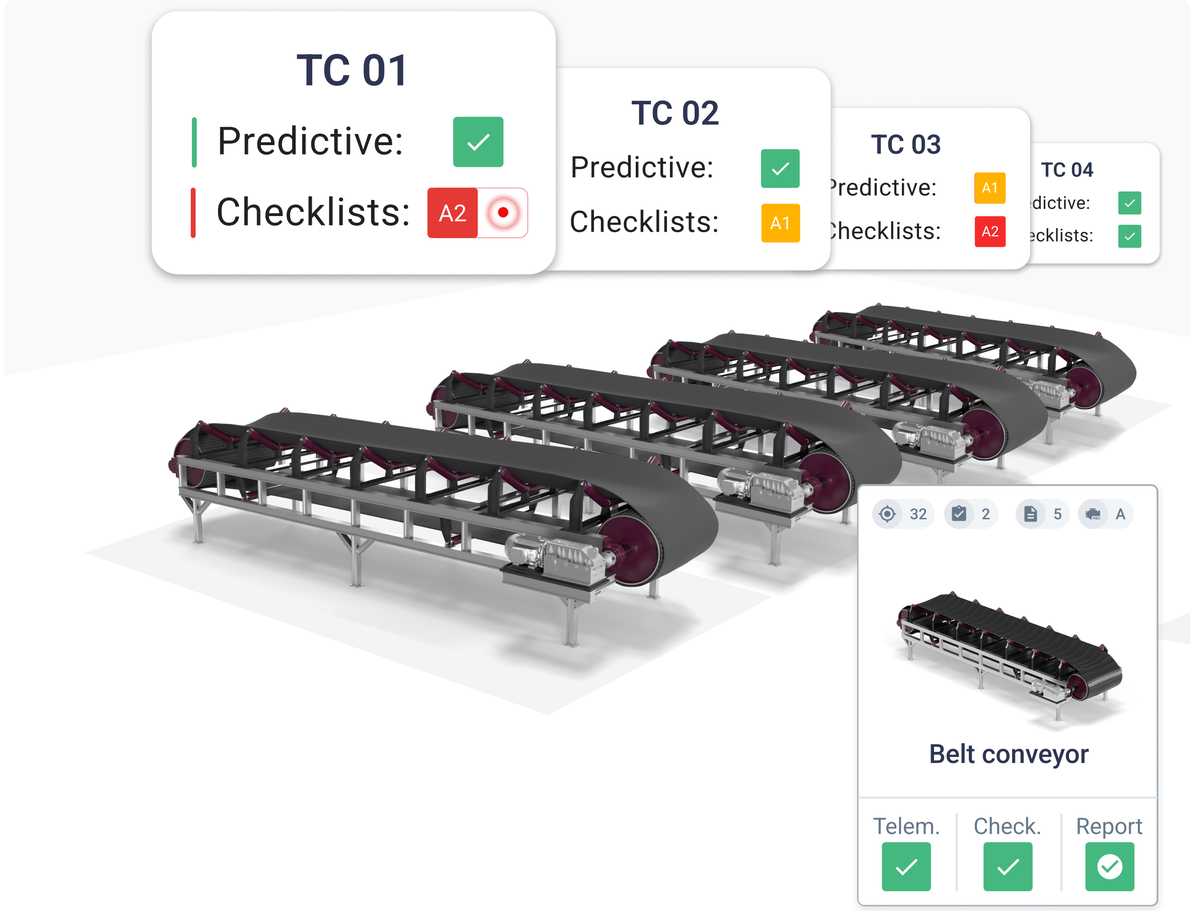
Question 4.1:	SPECIFY THE DAMAGE
Answer:	DAMAGED COATING
Notes:	-
Criticality Level:	P4 - RISK OF FAILURE WITHIN 31 TO 90 DAYS
Attachments	



Visual Asset Management

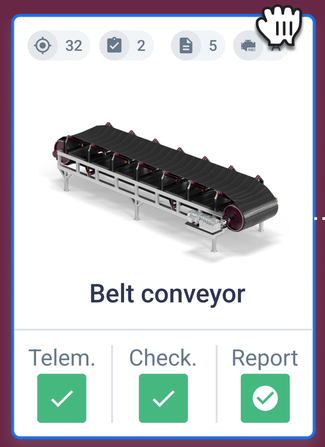
DynaNeo centralizes and visualizes management data, including temperature and vibration criticality alerts, sensitive inspection checklists, and equipment-issued reports.

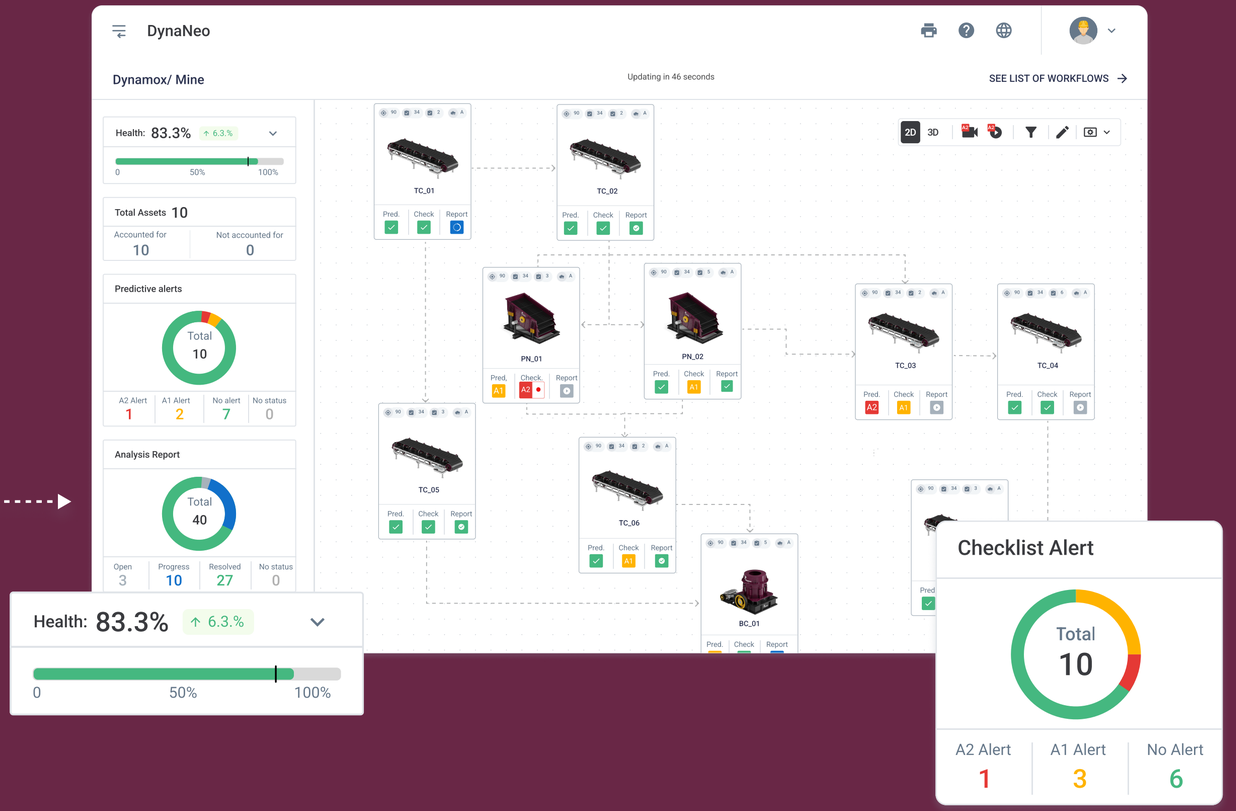
With this information readily available, establishing and directing maintenance priorities becomes more effective.



Workflows

Select the assets and indicators relevant to your production process and configure your workflow according to your preferences.

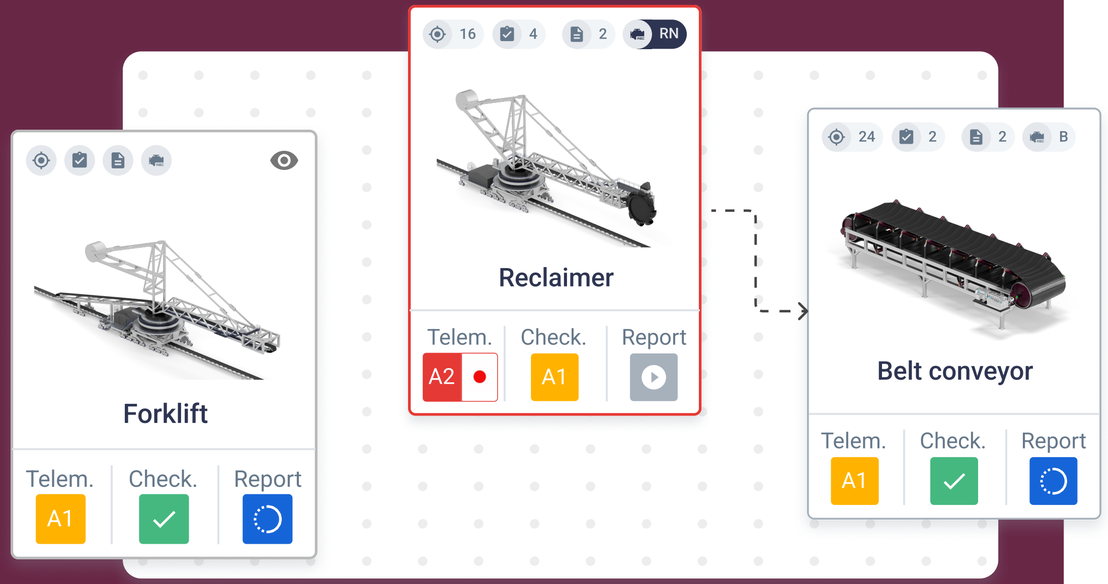




Process

Use drag and drop to effortlessly connect assets on the board and set up your workflow.

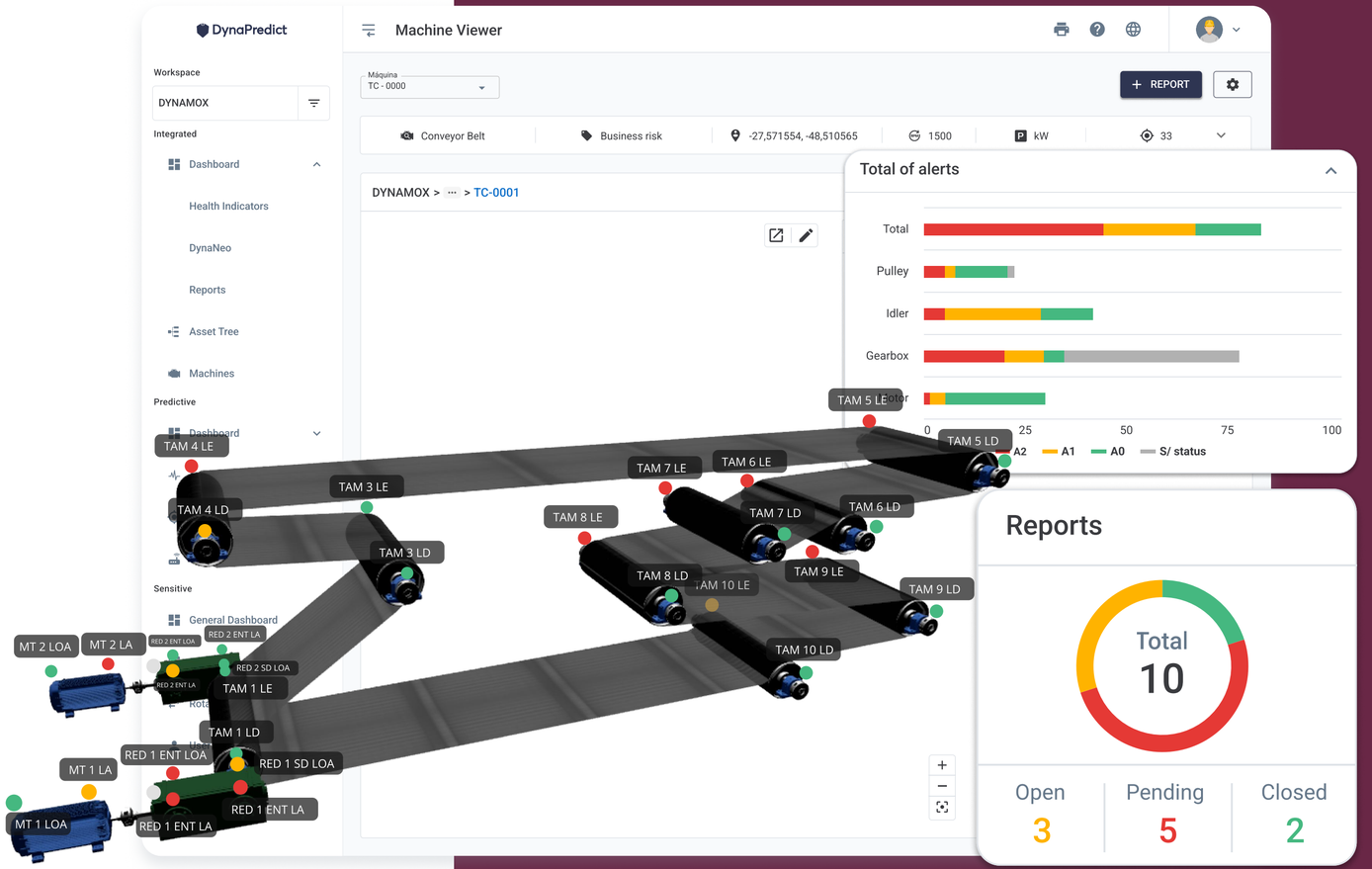
The tool enables you to visualize the impact of breakdowns or maintenance on the process, quickly identifying alarmed assets.



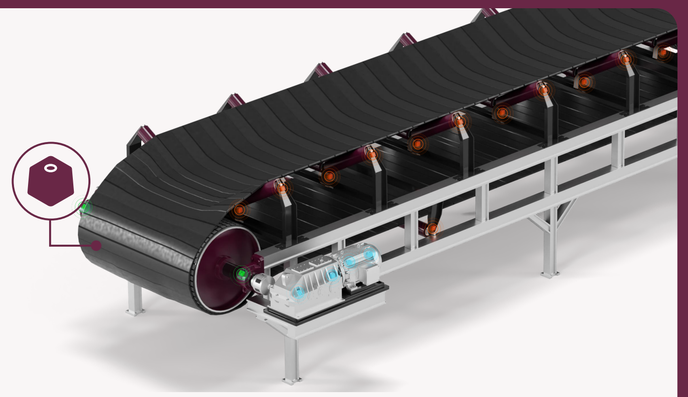
Specialist Dashboard

Asset Pro is a resource that combines a comprehensive view of diverse information on complex assets such as Belt conveyors.

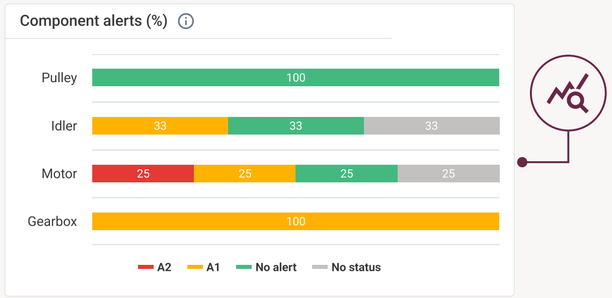
The feature allows you to view reports, condition indicators, automated detection diagnoses and specific metrics, making it a powerful ally in efficient asset management.



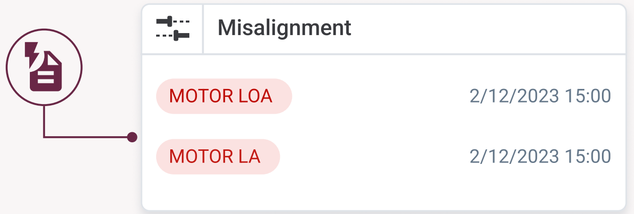
More efficiency, availability and performance for your plant



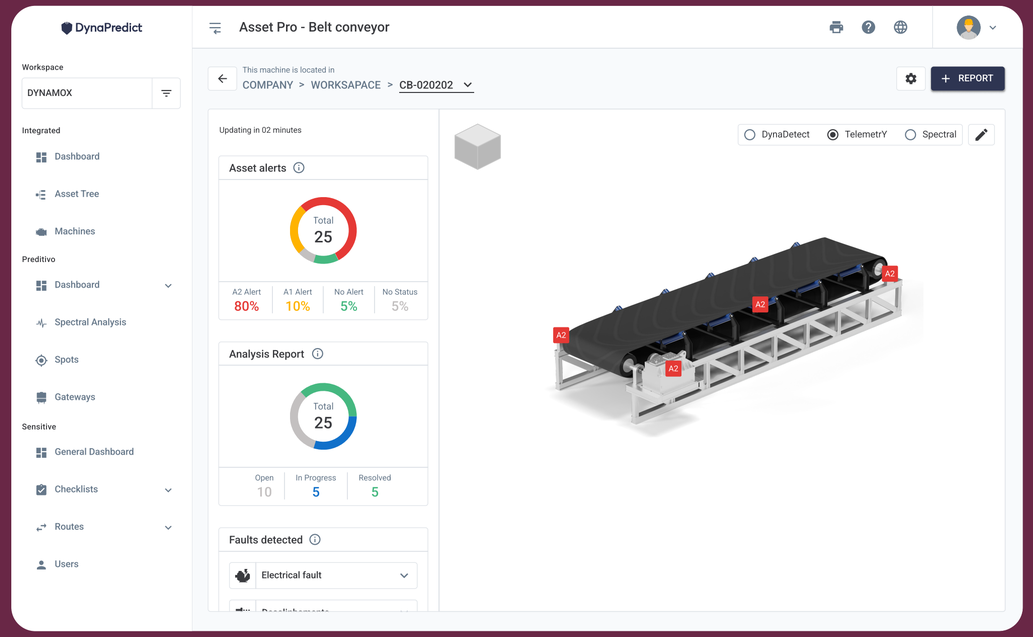
1. Digitize your assets and associate monitoring points



2. Monitor condition and performance indicators



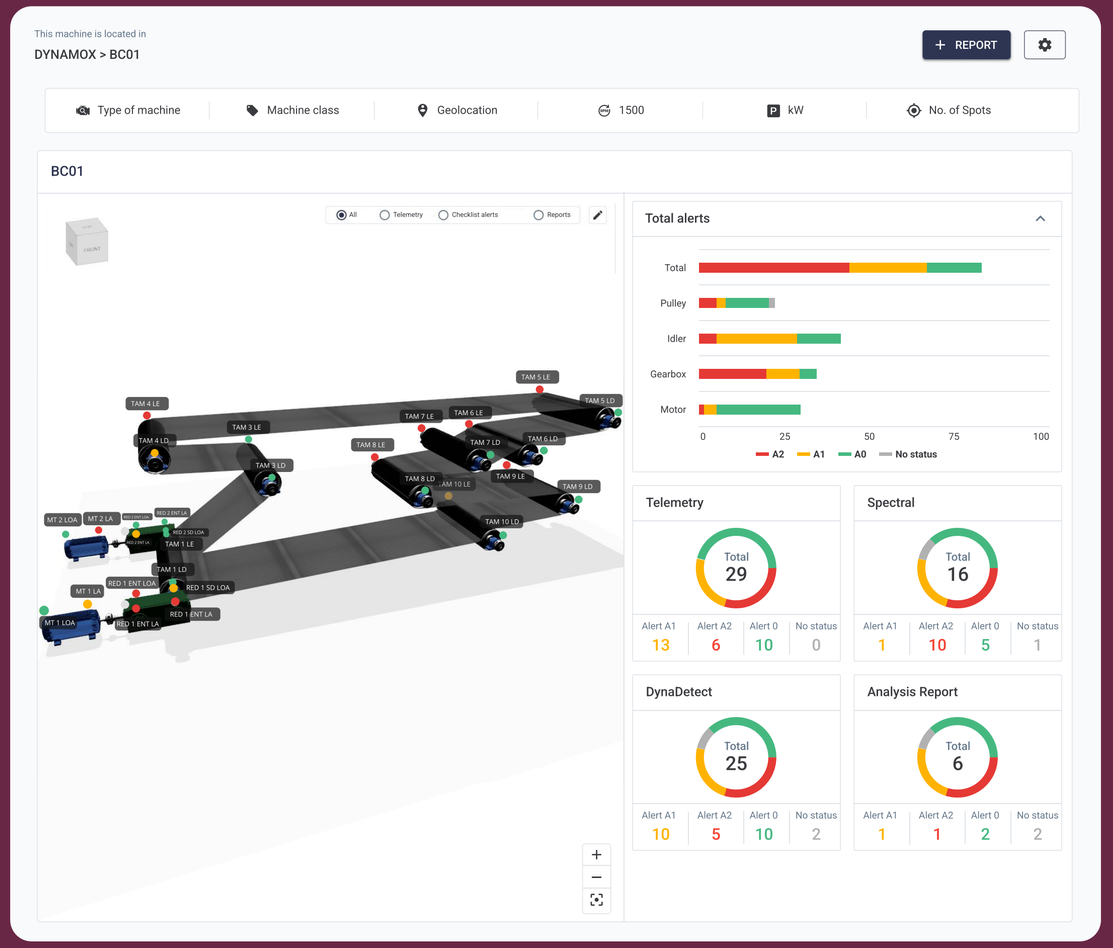
3. Have automated fault diagnostics supported by AI.



Centralized information

The feature enables you to monitor the overall condition of the belt conveyor, quickly identifying any factors that could interfere with its operation.

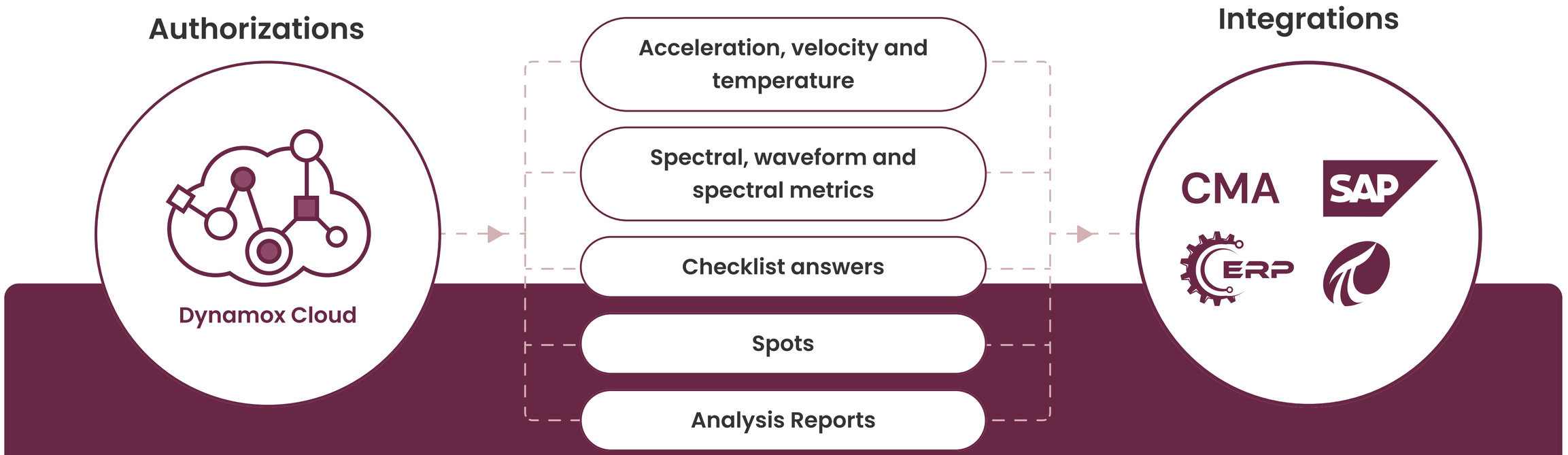
Additionally, the dashboard provides visibility into telemetry data, spectral data, and automated detection, indicating when a fault has been detected.



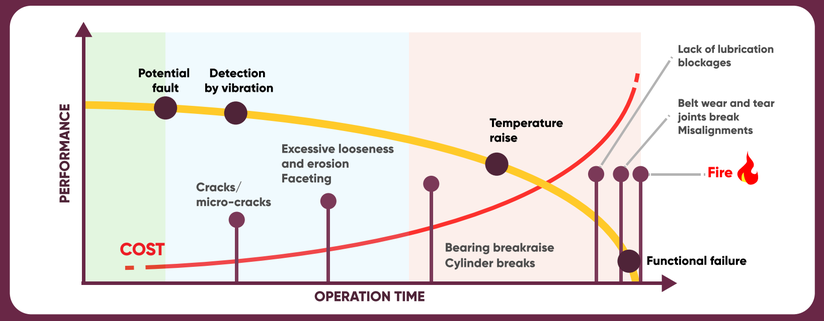
Asset digitalization

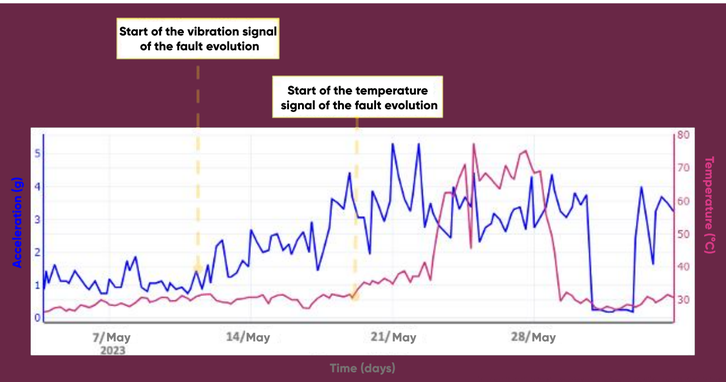
Asset Pro enables the creation of digital versions of assets, allowing for the association of monitoring points and providing near real-time data monitoring.

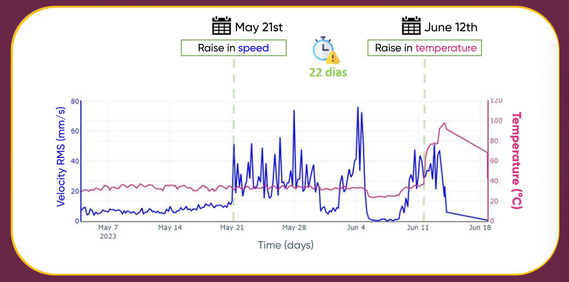
Integrations



Dynamox Cloud allows data and alerts from the Dynamox Platform to be integrated with other systems. It is thus possible to receive measurements, reports and create recommendations, allowing information to be correlated and alerts to be configured from your operations or process environment.









Case study:

Why not just monitor roller temperature?

Rollers support the belt and facilitate its movement, bearing loads along the conveyor. These assets are numerous along a belt conveyor, and depending on the severity of their failure, they can cause critical damage. Typically, rollers are monitored only by temperature; however:

The curve in the first graph clearly illustrates the relationship between fault detection and maintenance costs: the later defects are identified, the more expensive the repairs. In the real case shown opposite, the fault first appears in the vibration signal 8 days before any change is detected in the temperature signal.

A significant increase in the temperature signal is only observed when the fault is already advanced. In contrast, the vibration signal allows for tracking the fault's progression over time.

Success case:

Roller fault detected with Dynamox technology

Wireless vibration and temperature monitoring allows for the early detection of anomalies, such as component wear or overheating, which require immediate or scheduled maintenance. To reduce working hours and avoid a manual process that does not comply with NR 12, wireless sensors were installed on the belt conveyor idlers (see images opposite).

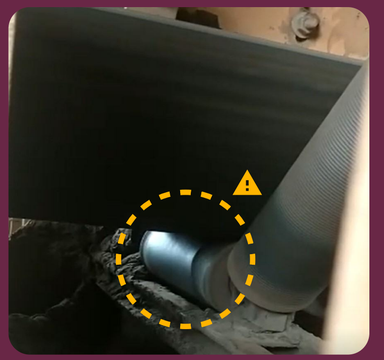
The system detected, diagnosed, and communicated the anomaly alert via email. Scan the QR code opposite to watch the video of the case.

Anomaly found on the CB Load Roller





Watch now!



Learnings from the case

During the investigation, professionals identified wear on the central roller, which was the cause of the system alert.

An intervention was scheduled to replace the defective roller before a more serious incident could occur, potentially compromising the asset and impacting production.

Thanks to remote predictive monitoring with wireless vibration and temperature sensors, the risk of production interruptions due to unexpected and catastrophic failures, such as fires, was avoided.

Benefits

Plant Manager

Management tools enable quick and centralized access to plant or production process health information, allowing for report generation and ensuring predictability.

- **Get your KPIs in an automated way**
- **Increase plant reliability and availability**
- **Avoid corrective maintenance costs**

Vibration Analyst

Vibration analysis and AI-assisted fault detection tools enable analysts to identify and prioritize maintenance actions for faults at various stages.

- **Increase asset efficiency and productivity**
- **View assertive and complete diagnoses**
- **Monitor the plant minute by minute remotely**

Maintenance Technician

The data obtained from Dynamox Solution makes the maintenance technician’s work more agile and efficient, ensuring comprehensive coverage of all the plant’s assets.

- **Take targeted and assertive maintenance actions based on diagnoses and reports**
- **Increase asset productivity and efficiency**

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