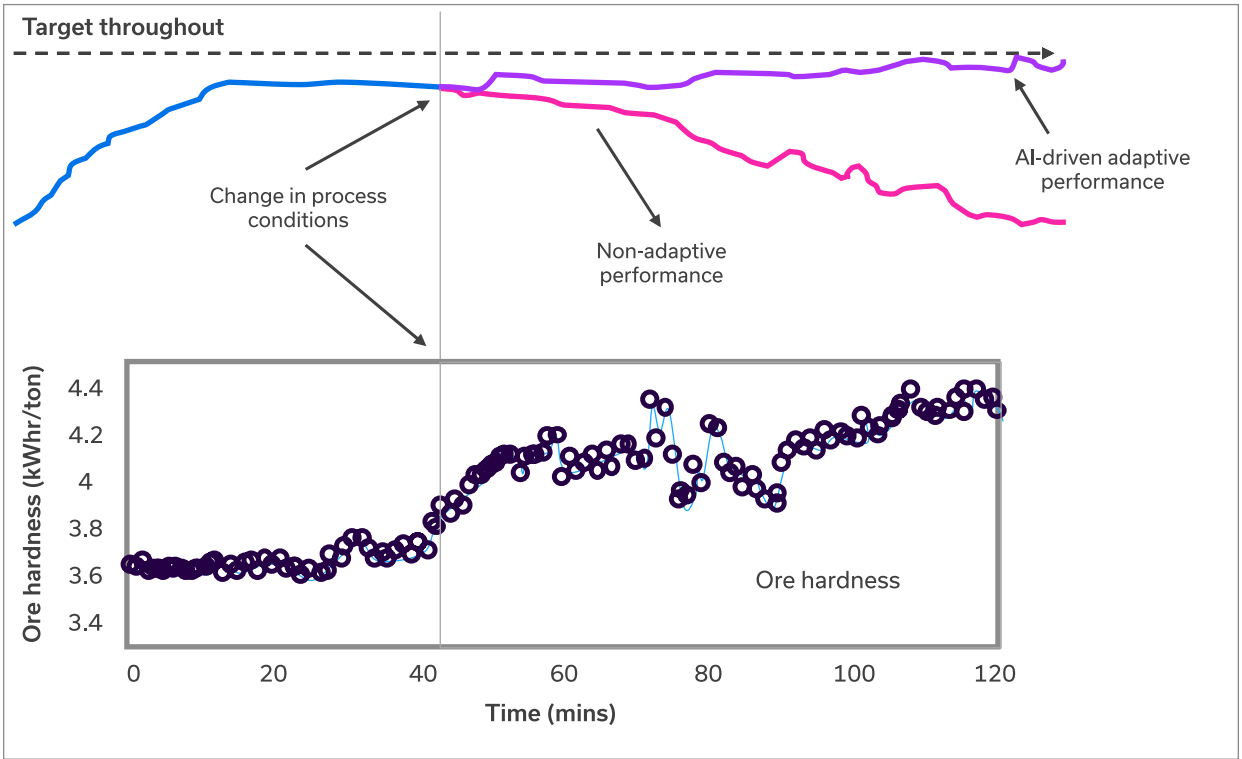
CASE STUDY

Mining and metals

Milling circuit reliability and optimization with Performance 360™

The milling circuit is a critical system that often determines the production capacity of mining, metals, and mineral operations. It handles the grinding of hard ores and is subject to large forces that can damage large, expensive equipment if not controlled appropriately. However, modelling the dynamics of a system such as a ball mill or sag mill is an extremely difficult problem due to its complexity and lack of instrumentation. In addition, constantly varying process conditions such as ore size, shape, and hardness add to the uncertainty in the control of milling circuits and eventually lead to less than optimal throughput. Our customers use Performance 360™'s digital twins to solve these problems and run safe and efficient milling circuits.



As ore hardness increases, AI-driven adaptive performance optimization helps maintain throughput levels without compromising grind quality.

Problem

The grinding mill is one of the largest pieces of equipment used in the mining and mineral industries. It is often used to pulverize hard ores and as a result is subject to large forces that affect its wear, life, and safety. In addition, mills often process ores of variable hardness, shape, and size. This inherent variability is important to account for during the control of mills since there is always a possibility of a build-up of ore inside the mill to an extent that it damages the equipment or causes an overload or runaway condition.

In fact, this dynamic variability of ore-feed along with other process uncertainties create a bottleneck for many mining and mineral operations. Since the mill's advanced process control (APC) system usually lacks the ability to automatically and adaptively deal with the inherent variability and uncertainty, mill operators tend to run conservative control strategies that reduce the chance of overload conditions. However, this also reduces throughput of the mill that eventually impacts business outcomes.

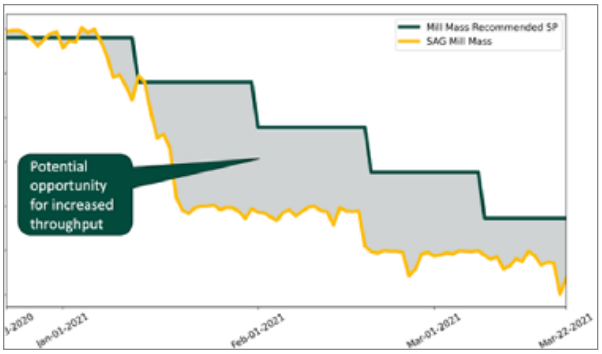
Therefore, there is a need for a system that can monitor the entire grinding circuit and its assets from a reliability perspective as well as from a performance perspective. This wholistic view of the system would then allow us to choose control strategies that can maximize throughput in a safe way.

Solution

SymphonyAI Industrial's Performance 360™ product is a real-time, AI-driven, predictive system that can monitor an entire system like a milling circuit. Its pre-built models can assess machine health, provide real-time monitoring and prescriptions, and recommend predictive maintenance for mills and related grinding circuit assets. It leverages IIoT, AI, and FMEA that provide anomaly detection with automated cause analysis and advisories to ensure increased reliability, uptime, and peak performance of grinding mills.

Performance 360™ runs digital twin models that are trained to capture system dynamics from streams of sensor data. The digital twins do not need explicit system modelling but allow for an injection of physics-based rules if needed. This greatly decreases the time required to train or maintain an AI digital twin; it can be done with just a few clicks.

Once the digital twin is trained, it has the ability to sense process conditions in real time and detect any precursors of anomalous behaviour. By flagging these impending process anomalies early enough, Performance 360™ allows plant operators enough time to mitigate potentially serious issues. Not only does Performance 360™ flag anomalies, but it also has the ability to provide apparent causes for the anomaly and established mitigation or diagnostic steps.



Operation of mill with and without AI-based optimization showing a large amount of opportunity for increased throughput.

In addition, Performance 360™ also has the ability to forecast process evolution into the future. Using this, it then uses dynamic process optimization to recommend control strategies that increase throughput, maintain quality, and reduce the risk of process upsets or overloads.

Performance 360™'s digital twins are also built to be highly performant for real-time use. And they are able to self-tune as new process conditions emerge that need to be taken into account before the control strategy can be recommended.

Outcome and impact

1. Throughput increase of > 1%
2. Energy efficiency gains of > 4%
3. 40-60% reduction of unplanned maintenance events
4. Revenue upside of $5M for a 600TPH gold mining plant