Fero Labs

Industrial Use Case Playbook

Caster Optimization for Surface Defect Reduction

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Introduction

Welcome to the **Industrial Use Case Playbook**, crafted by Fero Labs for the forward-thinking professionals dedicated to enhancing factory production optimization.

Whether you're a Data Scientist, Process or Production Engineer, Quality or Plant Manager, this playbook is tailored to equip you with the strategies, insights, and tools necessary to drive transformative change within your organization.

In today's rapidly evolving industrial landscape, maximizing production efficiency and minimizing operational costs are imperative for maintaining competitiveness and sustainability.

Within each of our industrial playbooks, we present a curated collection of use cases designed to address the specific challenges faced by modern manufacturing facilities. Each use case is meticulously crafted to deliver tangible outcomes, ranging from increased productivity and quality to reduced waste and energy consumption to help achieve sustainability goals.

Featured within these pages is a use case which spotlights **Caster Optimization for Surface Defect Reduction.** This case exemplifies how to tackle complex production optimization challenges head-on, leveraging data-driven approaches to drive measurable improvements in operational efficiency and cost-effectiveness.

As you embark on this journey for operational excellence, we encourage you to approach each Fero Labs use case scenario with curiosity, a willingness to embrace innovation and change.

By harnessing the power of your production data, domain knowledge, and collaborative problem-solving, we believe that you can unlock the full potential of your factory's production capabilities.

Together, let's redefine what's possible in industrial manufacturing and pave the way for a future of unprecedented productivity and sustainability.

Welcome aboard,

Fero Labs

Industry Overview

In the realm of industrial manufacturing, particularly within the steel production sector, optimizing production efficiency holds paramount importance in sustaining competitiveness and driving profitability. Steel plants, characterized by their intricate processes and heavy reliance on energy-intensive operations, face a myriad of challenges ranging from fluctuating market demands to **rising operational costs** and **stringent environmental regulations**.

Steel production stands as a cornerstone of global infrastructure, serving as a fundamental building block for construction, automotive, machinery, and countless other industries. According to industry reports, the global steel production reached over 1.8 billion metric tons in 2020, underscoring its indispensable role in modern society's infrastructure and economic development.

In the steel manufacturing sector, ensuring product quality and minimizing surface defects are paramount for maintaining customer satisfaction, meeting industry standards, and upholding brand reputation. Steel manufacturers operate in a highly competitive and demanding environment, producing a wide range of steel products crucial for various industries, including construction, automotive, and infrastructure.

Surface defects, such as cracks, scratches, and blemishes, can significantly impact the performance and aesthetics of steel products, leading to costly rework, product recalls, and customer dissatisfaction. As such, steel manufacturers are constantly seeking ways to optimize their production processes to reduce surface defects and improve product quality.

One critical aspect of optimizing steel manufacturing processes lies in **Caster Optimization** strategies. The caster is a crucial component in the steelmaking process, responsible for shaping molten steel into solidified slabs or billets. Optimizing caster operations involves enhancing process control, adjusting operating parameters, and implementing advanced technologies to minimize surface defects and improve product quality.

By leveraging real-time process monitoring, predictive analytics, and machine learning algorithms, steel manufacturers can identify potential sources of surface defects and implement corrective actions proactively. This proactive approach not only helps minimize defects but also improves process efficiency and reduces production downtime.

Caster Optimization not only enhances product quality and consistency but also contributes to operational efficiency and cost-effectiveness. By reducing surface defects, manufacturers can minimize material waste, improve yield, and enhance overall process reliability.

Furthermore, as sustainability becomes increasingly important to stakeholders and regulatory agencies, Caster Optimization aligns with broader industry trends towards eco-friendly practices, waste reduction, and resource conservation. At Fero Labs, we refer to this as Profitable Sustainability.

Industry Challenges

In Industry 4.0, the promise of digital transformation often gets stuck in **"pilot purgatory,"** with **70% of initiatives failing to progress beyond testing phases**. McKinsey's research highlights that the choice of use case significantly impacts this phenomenon.

Selecting use cases that lack strategic alignment, clear value propositions, or encounter technical barriers contributes to pilot initiatives' failure.

Pilot purgatory not only wastes resources but also risks eroding confidence in digital transformation efforts. To navigate this challenge, organizations must strategically select use cases closely aligned with their objectives, offering clear pathways to value creation and scalability.

In each **Fero Labs Use Case Playbook**, we explore industrial use cases designed to address modern manufacturing challenges. Leveraging advanced analytics, AI, and machine learning, these use cases aim to drive tangible improvements in operational performance, cost-effectiveness, and sustainability.

By focusing on strategic and transformative use cases, organizations can break free from pilot purgatory and unlock new opportunities for growth and innovation.

Use Case Description

Background

Several steel surface defects, such as longitudinal and off-corner cracks, originate from the continuous casting process. Casting speeds and temperatures, cooling rates, and the chemical composition of different steel grades can contribute to the problem, leading to reworked or even scrapped production.

Problem

Controlling continuous casting to maintain stable production conditions while minimizing surface defects is challenging. The **variability in the chemical composition** of different grades of steel and equipment age, along with **desired casting temperature and speed set points** can lead to increased surface defect rates.

Process engineers and operators in charge of continuous casting processes define set points such as casting temperatures, speeds, mould water flows and pressures to maintain high quality and stable casting of steel into semi-finished products (blooms, ingots, billets, slabs, etc.). These are set based on solidification profiles, tundish temperatures and other process parameters, and rarely reflect variations in chemistry.

Problem Summary

Minimize surface defects during continuous casting by adaptively controlling casting parameters on a batch-by-batch basis in real time.

The current solution involves physics-based models and following historical best practices. These do not capture the full properties of each batch being cast. This approach leads to:

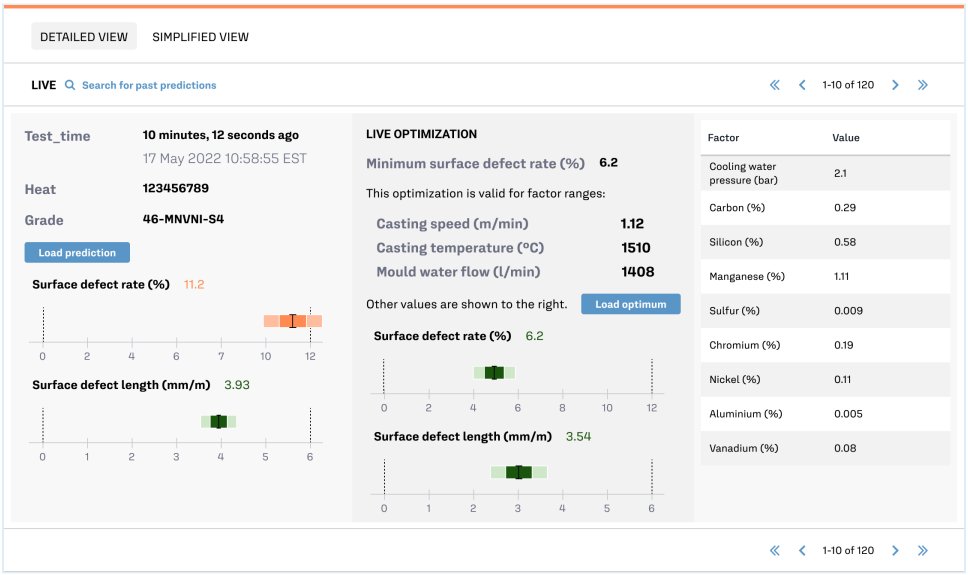
- financial loss due to rework and scrap of products with too many surface defects,
- environmental cost of incurring Scope 1 and 2 emissions due to the unnecessary rework or scrapping of produced steel.

Fero Solution

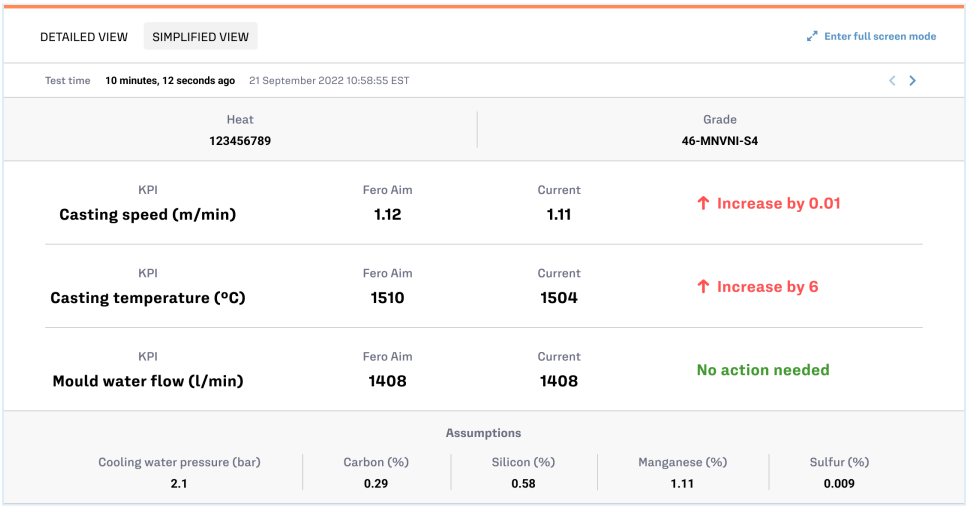
Continuous casting process operators can use Fero Labs software to minimize surface defects by adapting to each batch and learning over time. Operating limits for caster set points can be configured within the software to enable safe recommendations that operators can follow with confidence.

A Live Fero Analysis for this use case presents two screens:

- Detailed View: for **production engineers** to monitor production and direct action plans at any moment.



- Simplified View: for continuous casting process **operators**, with critical information clearly presented.



Process & Business Outcomes

Significant reduction of scrap rates

With Fero Labs providing optimal recommendations for continuous caster parameters, chemistry and caster temperature variability no longer translate to increased surface defects. Since each batch is optimized to safely minimize surface defect rates relative to its specific chemical composition and casting temperature, continuous casters can expect a **18% decrease** in scrap rates.

Decreased severity of surface defects

Fero Labs software not only minimizes the probability of surface defects, but also recommends operational changes that reduce the length of surface defects. With a full adoption of Fero Labs software on the production line, continuous casters can see up to **40% reduction** in average surface crack lengths. Knowing that production will reliably meet its specifications leads to smoother operations.

Measurable cost savings minimizing rework

Static casting operating procedures for product grades lead to unnecessarily high surface defect rates. Some of these products can be reworked, which incurs additional rework costs, both in personnel and in energy. With a full adoption of Fero on the production line, continuous casters can expect up to **15% reduction in rework** of semi-finished products with mild surface defects.

Commensurate Scope 1 and 2 carbon footprint minimization

The minimization of scrapped and reworked product directly translates to a commensurate reduction of Scope 1 and 2 emissions. Since more than half of EAF steelmaking's carbon footprint falls into Scope 1 and 2, a reduction here can reduce the carbon footprint of production by **up to 10%**. Fero can provide reporting capabilities that directly track and account for this reduction.

Fero Labs Adoption Timeline

Continuous casting and rolling mills with specialized teams can collaborate to set up and deploy Fero with ease. Below is a timeline highlighting typical steps. With Fero's easy-to-use, no-code interface, this can be achieved in a matter of weeks, not months or years.

Time	Process & Quality Engineers	Data Scientists / IT	Operators	Management
Week 1	Pull data	Pull data		
Week 1	Upload to Fero			
Week 1	Configure Fero	Configure Fero		
Week 2	Corroborate results	Receive example report showing accuracy		
Week 2	Set up Fero Optimization	Set up Fero Optimization		Receive example report showing savings
Week 3	Live data connection	Live data connection		
Week 3	Live Optimization screen (Detailed view)		Live Optimization screen (Simplified view)	
Going forward	Monitor deployment		Follow Fero Optimization recommendations	Receive regular reports showing savings
Going forward	Run "what-if" scenario simulations, spot check production, run root cause analyses		Follow Fero Optimization recommendations	Receive regular reports showing savings

Use Case Data Requirements

The Fero Labs Platform has convenient integrations into common process information management systems, such as Aveva PI System, AspenTech, Wonderware, and SQL databases, as well as laboratory information management systems, such as SAP, Oracle, and other ERP systems. Initial data exploration can be done either through direct integration into these services, or data file uploads in Excel and CSV data formats.

The data requirements for this use case typically involve the following sources:

End of line surface detection data

- Average rate of rolled semi-finished products with surface defects detected, average length of surface defects

Melt shop production data

- Melt shop chemistry readings for each batch sample, with product grade information

Continuous caster production data

- Historically averaged continuous caster settings and measurements for each batch — ideally for each strand.

Activating This Use Case

Consider our **Industrial Use Case Playbooks** as inspiration and tactical ideas for your team to align on to maximize the efficiencies of your plant. Each Playbook has a matching **Use Case Blueprint** which provides detailed steps to activate each use case within the Fero Labs platform.

If you're curious to see these in action please book a use case demo with our team!

Together, let us continue to push the boundaries of what's possible, driving towards a future where industrial manufacturing is not just efficient and sustainable but truly transformative in its impact on society and the world at large.

Thank you for joining us on this journey, and we look forward to continuing to partner with you in your pursuit of excellence.

Sincerely,

Fero Labs

About Fero Labs

Fero Labs helps factories work better together by bridging the gap between the disconnected goldmine of production data and industrial knowledge inside every plant.

The Fero Labs Profitable Sustainability Platform collects data and knowledge, and augments it with powerful Fero ML so factories can make more confident changes that drive profit and sustainability.

Harnessing Fero Labs, a factory creates an augmented workflow which allows for better use of raw and recycled materials, production time, and energy utilization. Teams can work 90× faster, using Fero's AI powered simulated predictions or live optimizations. They can run root cause analyses in minutes, and make continuous process improvements that drive Profitable Sustainability.

Fero Labs's white-box explainable ML makes decisions clearer by showing the context and confidence levels behind every prediction and recommendation. This expands a plant's production knowledge and drives better production results for manufacturers, all while minimizing emissions. Together we'll build a sustainable tomorrow.