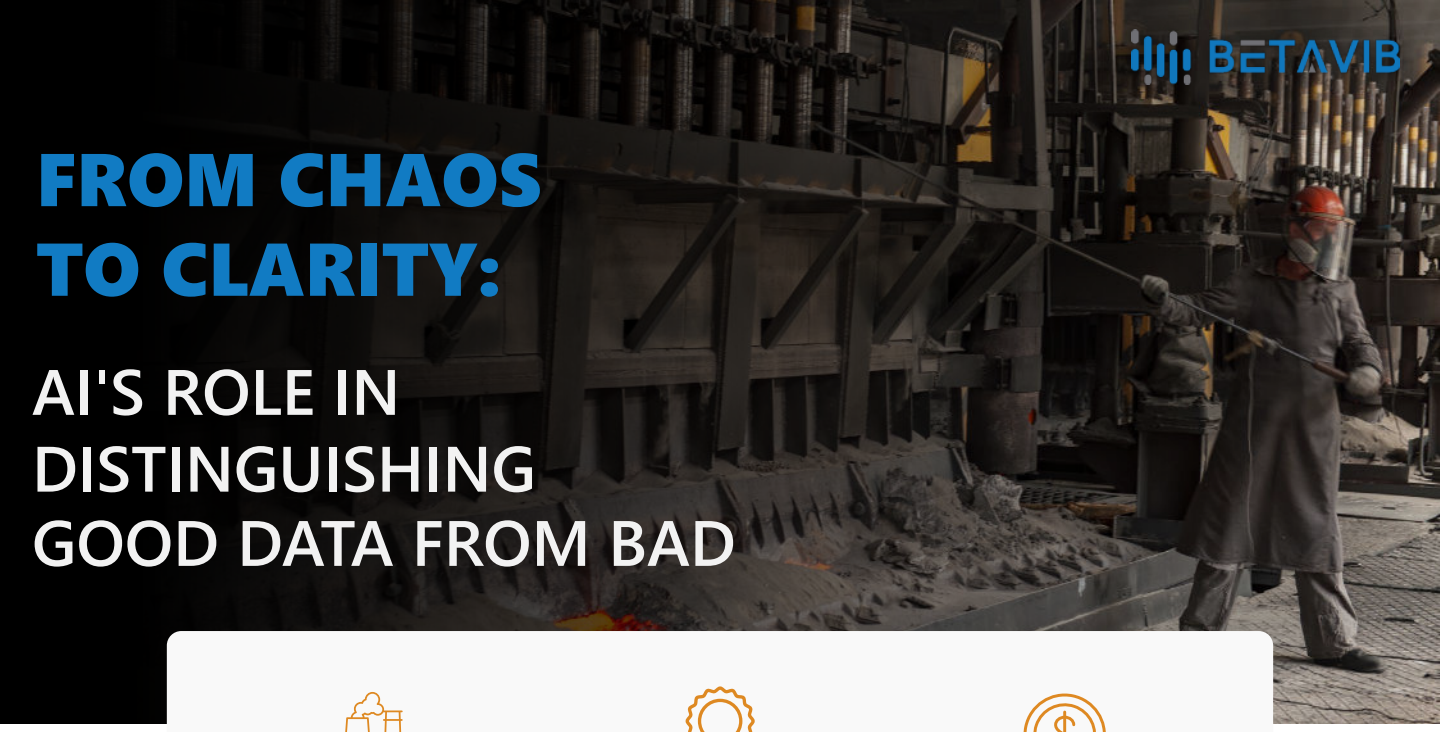


FROM CHAOS TO CLARITY:

AI'S ROLE IN DISTINGUISHING GOOD DATA FROM BAD

287 000 METRIC TONS/YEAR.

2ND LARGEST ALUMINUM PRODUCER

SAVING $1.53 MILLION

BUISNESS CASE

In the aluminum smelting industry, equipment reliability is crucial for maintaining operational efficiency and profitability. BETAVIB, a leader in vibration analysis solutions, partnered with the world's second-largest aluminum producer to address a critical challenge: false alarms and unreliable diagnostics caused by noise in vibration data collected from their crushers. The noise, primarily generated by material dropping into the crusher, obscured true indicators of equipment health, leading to unnecessary shutdowns and maintenance activities.

implementing BETAVIB's AI-powered solution, which includes the Cortex online data collection system and the VibWorks UHDM diagnosis software, the company was able to classify good data from bad effectively. This ensured that diagnostics were accurate and based solely on indicators correlated with asset health. As a result, the plant stands to save millions annually by preventing unplanned shutdowns and optimizing maintenance efforts.

BETAVIB specializes in advanced vibration analysis technologies designed to enhance equipment monitoring and maintenance strategies. The customer, the second-largest aluminum producer globally, operates a smelter with a production capacity of 280,000 tons of aluminum per year, translating to an average daily production of approximately 767 tons. With aluminum priced around $2,000 per ton, the plant generates an estimated $1.53 million in revenue daily.

The crusher is a vital component in the production process, responsible for breaking down raw materials. However, the impact of material dropping into the crusher generates significant noise in the vibration data collected, leading to false alarms and unreliable diagnostics.

CHALLENGES

False Alarms:
Noise-induced false alarms trigger unnecessary inspections and potential shutdowns.

Unreliable Diagnostics:
Blind data collection without proper filtering results in diagnostics that do not accurately reflect equipment condition.

Noisy Vibration Data:
The vibration data is contaminated by noise from material dropping into the crusher, masking true indicators of equipment health.

PROBLEM STATEMENT

Operational Inefficiency:
Frequent false alarms waste resources, as maintenance teams spend time investigating issues caused by material impact noise rather than actual equipment faults.

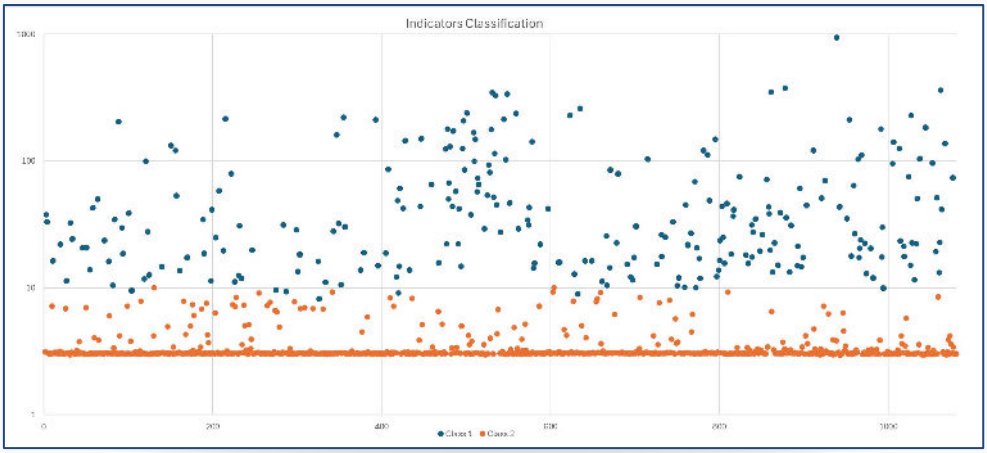
Financial Impact of Crusher Failure:
A one-day shutdown due to crusher failure results in a loss of approximately $1.53 million in revenue, plus additional repair costs.

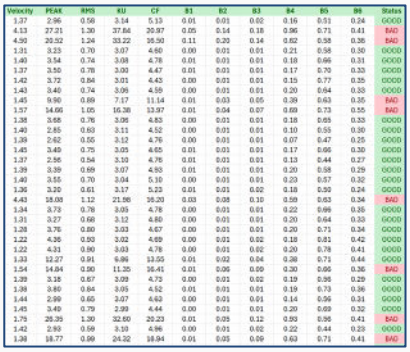
Erosion of Trust:
Repeated false alarms diminish confidence in the monitoring system among staff and management.

Risk of Catastrophic Failure:
Misinterpreting vibration data can lead to undetected faults, causing unexpected breakdowns and extended downtime.

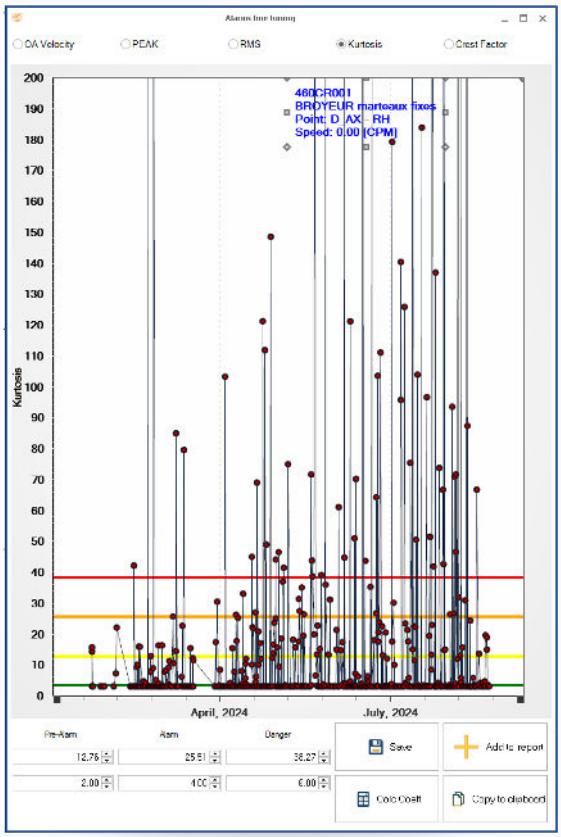
SOLUTION

BETAVIB deployed an AI-based algorithm integrated with its Cortex online data collection system and the VibWorks UHDM diagnosis software to intelligently classify and filter vibration data from the crusher. By training the model on a historical dataset of 500 rows, **the algorithm learned to differentiate between meaningful data indicative of equipment health (Class 02) and irrelevant data caused by the noise of material dropping into the crusher (Class 01).**

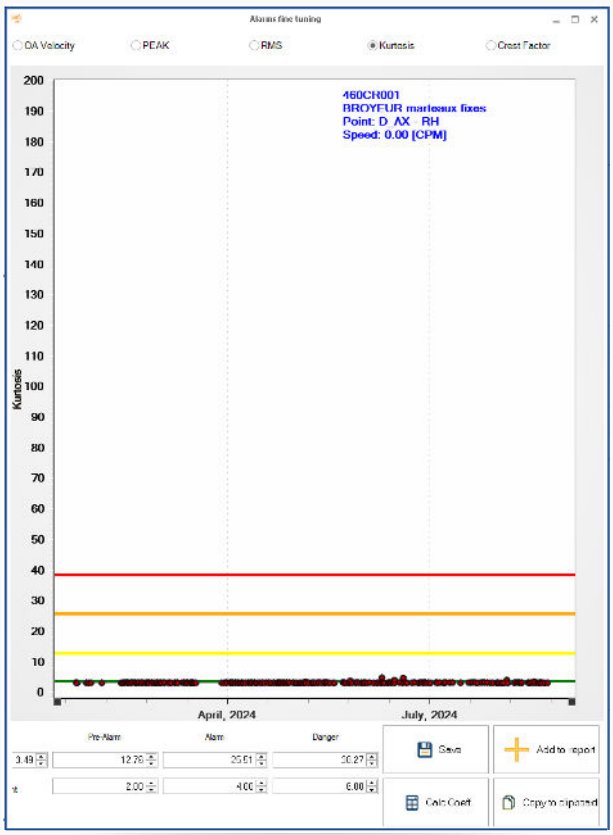




RESULTS



BEFORE

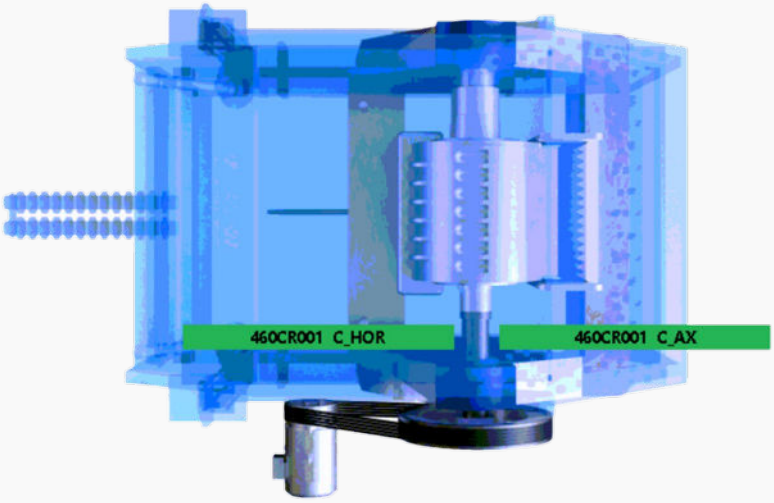


AFTER

IMPLEMENTATION DETAILS

DATA COLLECTION WITH CORTEX

Deployed Cortex, BETAVIB's online data collection system, to gather real-time vibration data from the crusher.
Collected 500 rows of historical data, including periods of normal operation and instances with material dropping.

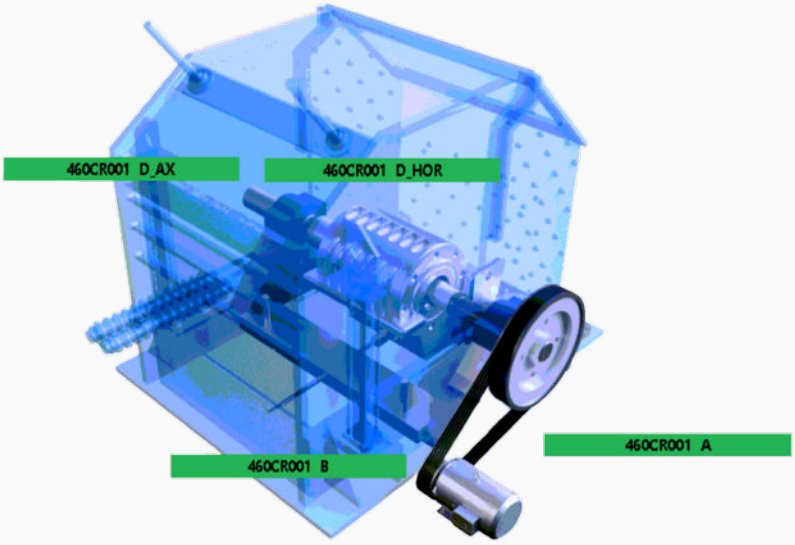


DATA PREPROCESSING

Cleaned and normalized the dataset to standardize different scales and units.
Collaborated with experts to label data as "good" or "bad" based on the presence of material impact noise.

FEATURE EXTRACTION

Identified key features such as frequency components, amplitude variations, and waveform patterns distinguishing normal vibrations from material impact noise.
Applied signal processing techniques to isolate vibration signatures specific to material dropping.



MODEL TRAINING

Utilized machine learning algorithms like Random Forest Classifier and Support Vector Machine (SVM).
Performed cross-validation and hyperparameter tuning to optimize the model's ability to distinguish between equipment health indicators and noise.

INTEGRATION WITH VIBWORKS UHDM

Integrated the AI algorithm into VibWorks UHDM, BETAVIB's advanced diagnosis software.
Enabled real-time analysis and visualization of filtered vibration data for accurate diagnostics.

VALIDATION AND TESTING

Conducted extensive testing under various operational scenarios, including different material dropping rates.
Compared AI-driven diagnostics with traditional methods to assess improvements.

RESULTS

80% REDUCTION
IN FALSE ALARMS

Achieved an 80% decrease in false alarms caused by material impact noise.

70% BOOST
IN DIAGNOSTIC ACCURACY

Enhanced the reliability of equipment health assessments by 70%, enabling timely interventions

20 HOURS/WEEK
FALSE ALARM SAVINGS

Saved approximately 20 hours per week previously spent investigating false alarms.

ANNUAL SAVINGS
$4.8 million

Avoided Shutdowns
Prevented an estimated 3 unplanned shutdowns per year, saving approximately $4.6 million annually (3 days × $1.53 million/day).

Maintenance Cost Savings:
Reduced unnecessary repairs and parts replacements, saving an additional $200,000 annually.

BENEFITS

Financial Gains
Significant cost savings by preventing unplanned shutdowns and optimizing maintenance efforts.

Increased Equipment Reliability
Accurate diagnostics lead to proactive maintenance, reducing the likelihood of catastrophic failures.

Enhanced Productivity:
Minimizing downtime ensures steady production rates, contributing to consistent revenue generation.

Improved Safety
Reliable equipment reduces the risk of accidents and ensures a safer working environment.

Resource Optimization
Maintenance teams can allocate their time and resources more effectively, focusing on genuine issues rather than false alarms.

CONCLUSION

By partnering with BETAVIB and implementing the AI-powered solution incorporating Cortex and VibWorks UHDM, the aluminum producer effectively addressed the challenge of noisy vibration data caused by material dropping into the crusher. The AI algorithm's ability to filter out irrelevant noise has led to more accurate diagnostics, significant cost savings, and enhanced operational efficiency.

This case study demonstrates the transformative impact of integrating advanced AI technologies with specialized hardware and software solutions in industrial settings. BETAVIB's approach has set a new standard for equipment monitoring and maintenance in the aluminum smelting industry.

FUTURE RECOMMENDATIONS

CONTINUOUS IMPROVEMENT

Regularly update the AI algorithm with new data to adapt to changing operational conditions.

TRAINING AND SUPPORT

Provide ongoing training for staff on Cortex and VibWorks UHDM to maximize the benefits of the new system.

INTEGRATION WITH PREDICTIVE MAINTENANCE

Combine AI diagnostics with predictive maintenance strategies for further downtime reduction.

SCALABILITY

Explore opportunities to implement the solution across other facilities within the company or industry-wide

EXPANSION TO OTHER EQUIPMENT

Apply the AI-based monitoring system to other critical assets susceptible to noise contamination.

BETAVIB extends its gratitude to the engineering, maintenance, and data science teams of the aluminum producer for their collaboration. Their expertise was instrumental in successfully deploying the AI-based solution using Cortex and VibWorks UHDM, significantly improving operational efficiency and financial performance. By leveraging BETAVIB's advanced technologies, including Cortex and VibWorks UHDM, to intelligently filter and analyze vibration data, the aluminum producer has enhanced the reliability of its equipment monitoring system. This collaboration showcases how integrating specialized hardware and software solutions with AI can lead to transformative results, setting a new standard for operational excellence in the industry.