Enhancing Strip Steering in Steel Hot Mills Using Interstand Camera-Based Centerline Deviation System

AISTech 2025

May 5, 2025 | Nashville, TN

David Kober

Vice President, Sales & Marketing

Global Gauge Corporation

Agenda

- Background & Motivation
- System Overview
- What’s New to the Industry
- Results & Case Study Highlights
- Future Benefits
- Q&A

Background & Motivation

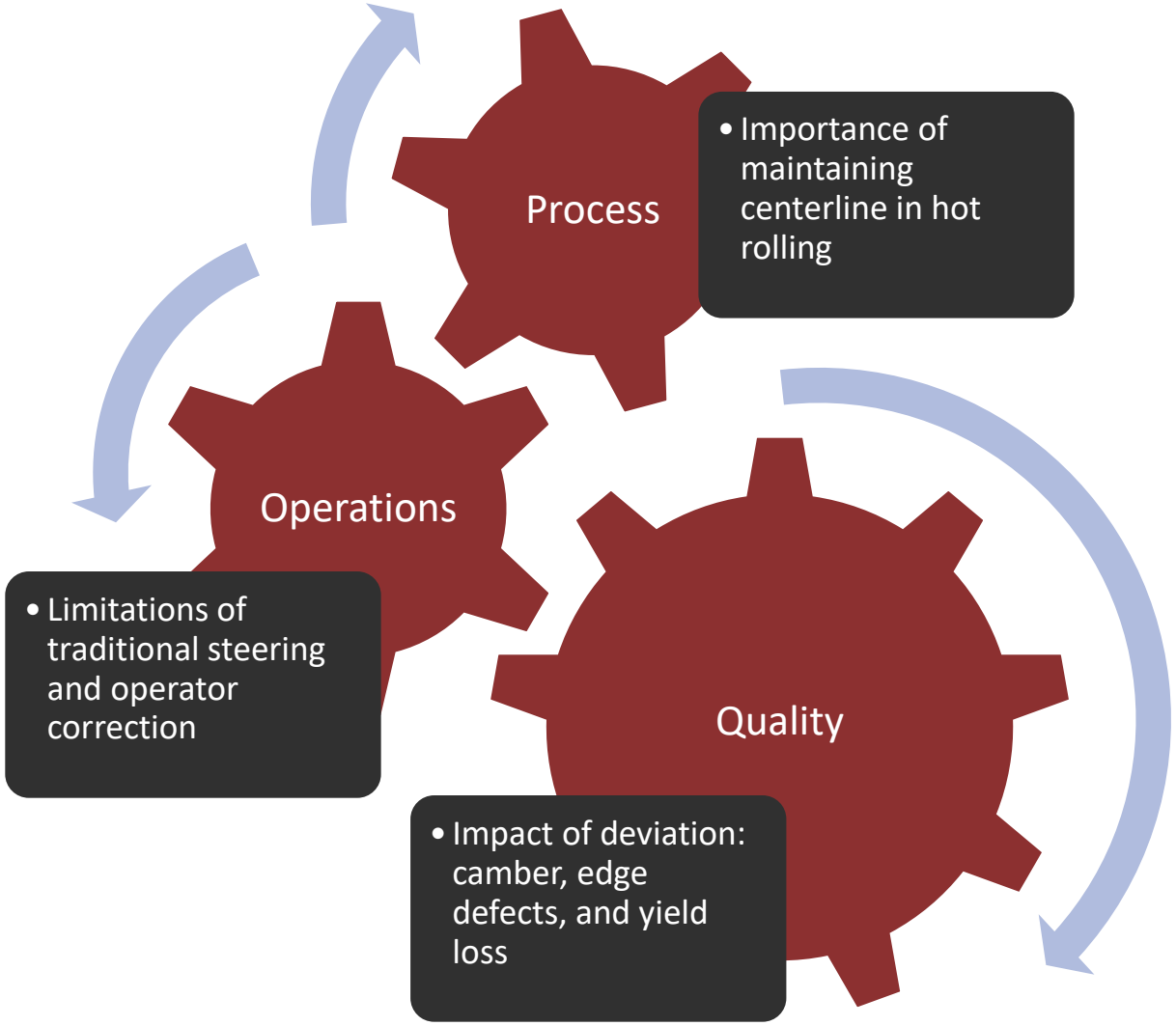
The Challenge

- Hot Mill Finishing
  - Relatively High Temperature
  - Water & Steam
  - Vibration

Each resulting in inconsistent environmental factors that create challenges for visions system solutions.

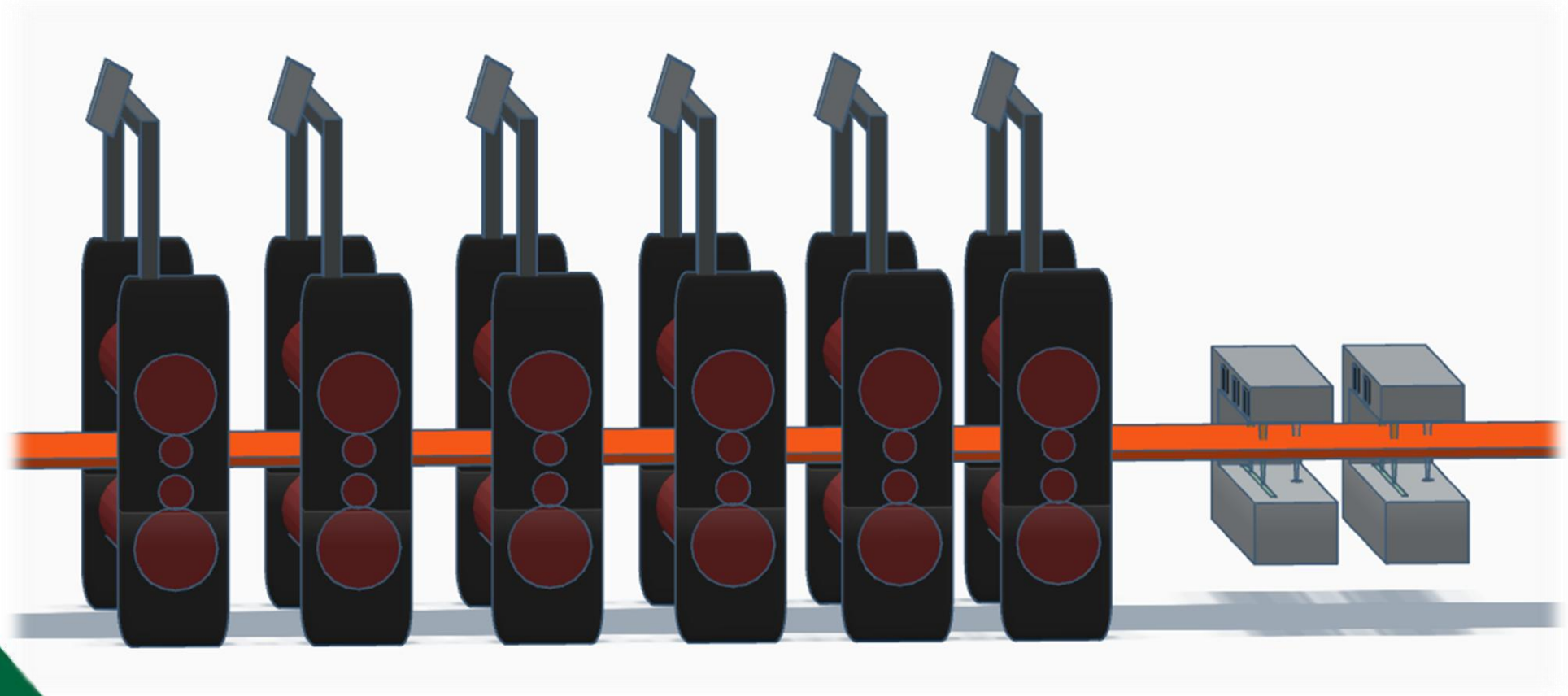
Image by Viktor Mácha / viktormacha.com

The Motivation



The Solution

Interstand Centerline Deviation System (ICDS)



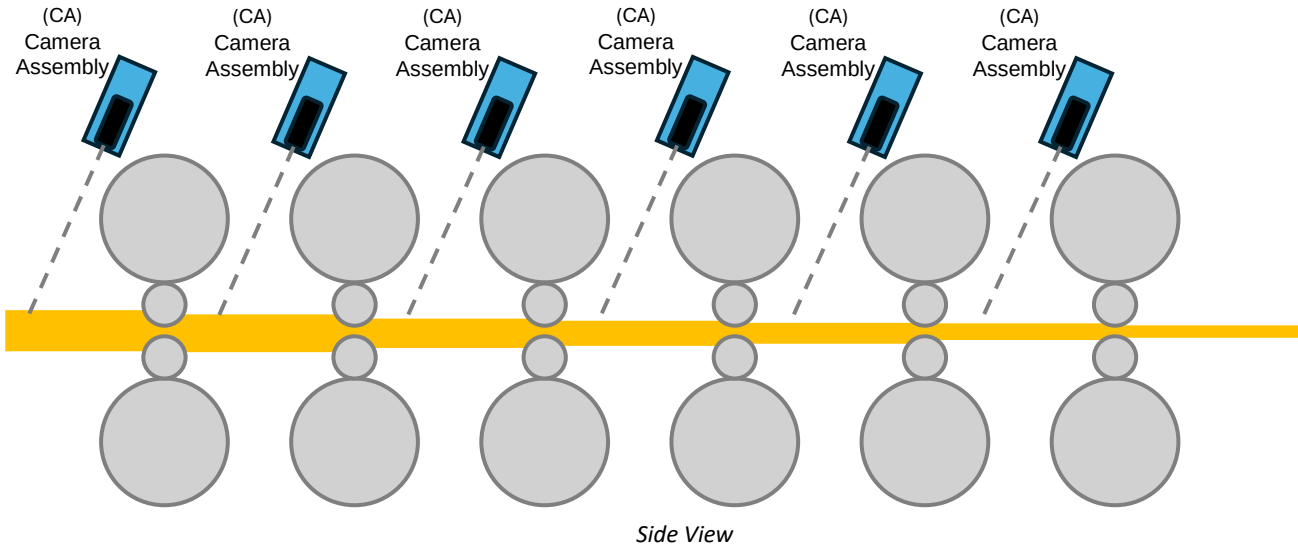
The Solution | Hot Mill Vision System

Interstand Centerline Deviation System (ICDS)

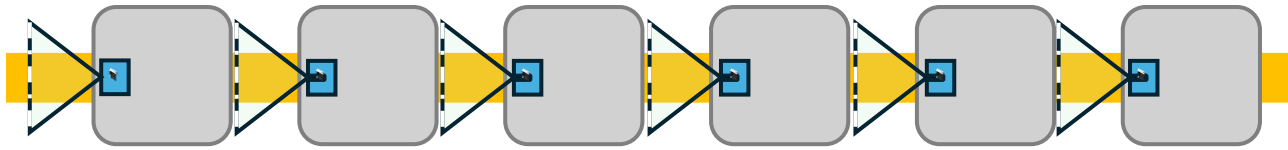
- Camera Assembly
  - Provides millisecond level response to changes in strip centerline deviation
  - Lasers implemented to cross field of view at fixed pixel positions

- Interstand Mill Control Feedback
  - Automatically provide feed-forward and feed-back to control system
  - Feedback can be used as input for control loop to adjust finishing stand cylinders

- Cost-savings from:
  - A reduction in cobbles
  - A reduction in bruised rolls due to tail whip
  - A reduction in maintenance of side guides



Side View



Top View

System Overview

System Architecture

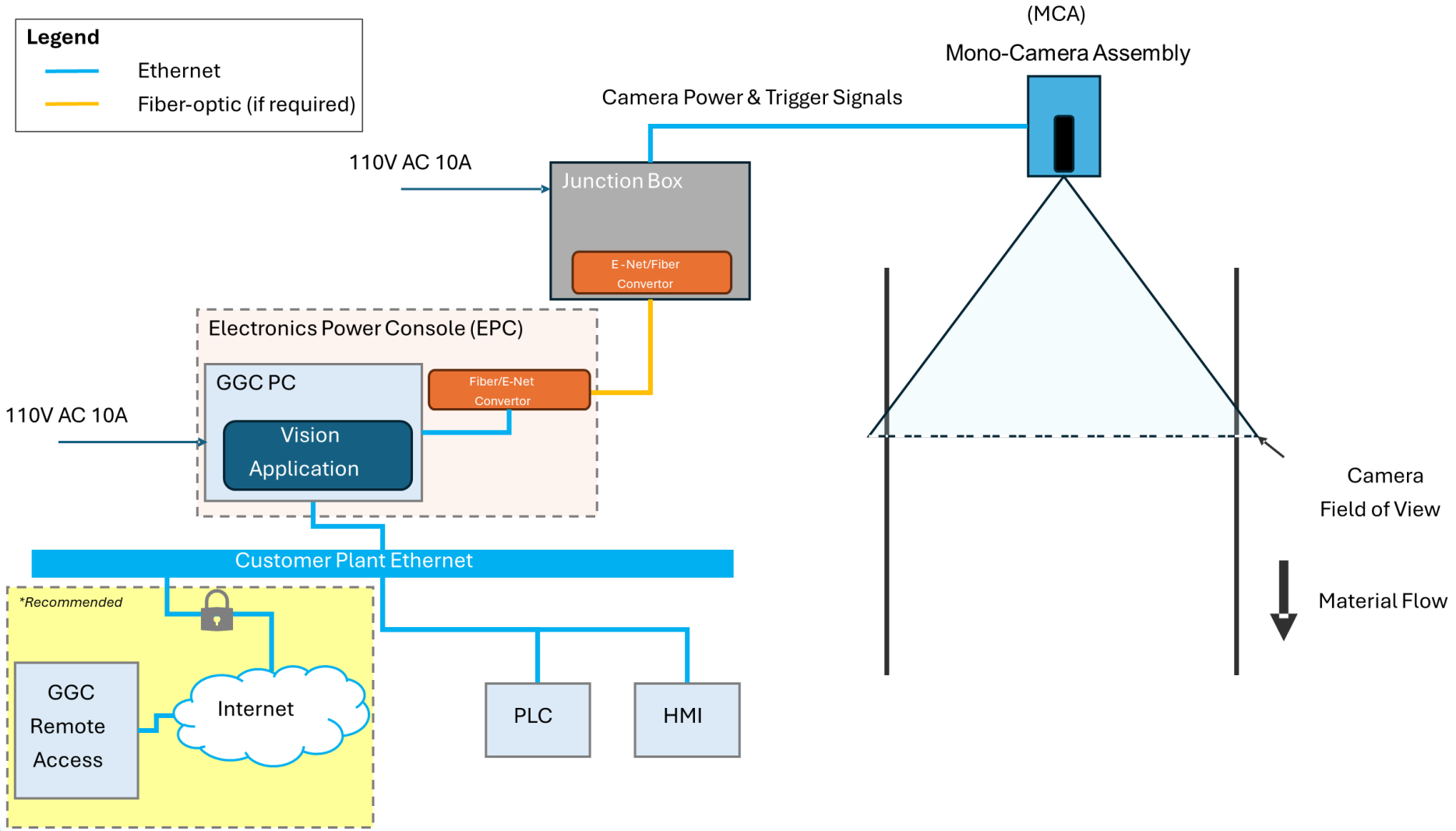


Figure: Centerline Deviation System Basic Block Diagram

System Operation

Control Side Operations

Sensor Side Operations

System Operation

Sensor Side Operations

- As material travels under the camera:
  - The camera continuously captures width images
  - Gauge software processes images to locate material edges on both the operator and drive sides
- Edge positions are used to calculate centerline deviation:
  - Displayed in real-time on a user-friendly HMI screen
- Measurement data is communicated to the customer’s control system:
  - PLC
  - ibaPDA
  - Level 3 (L3) Database

System Operation

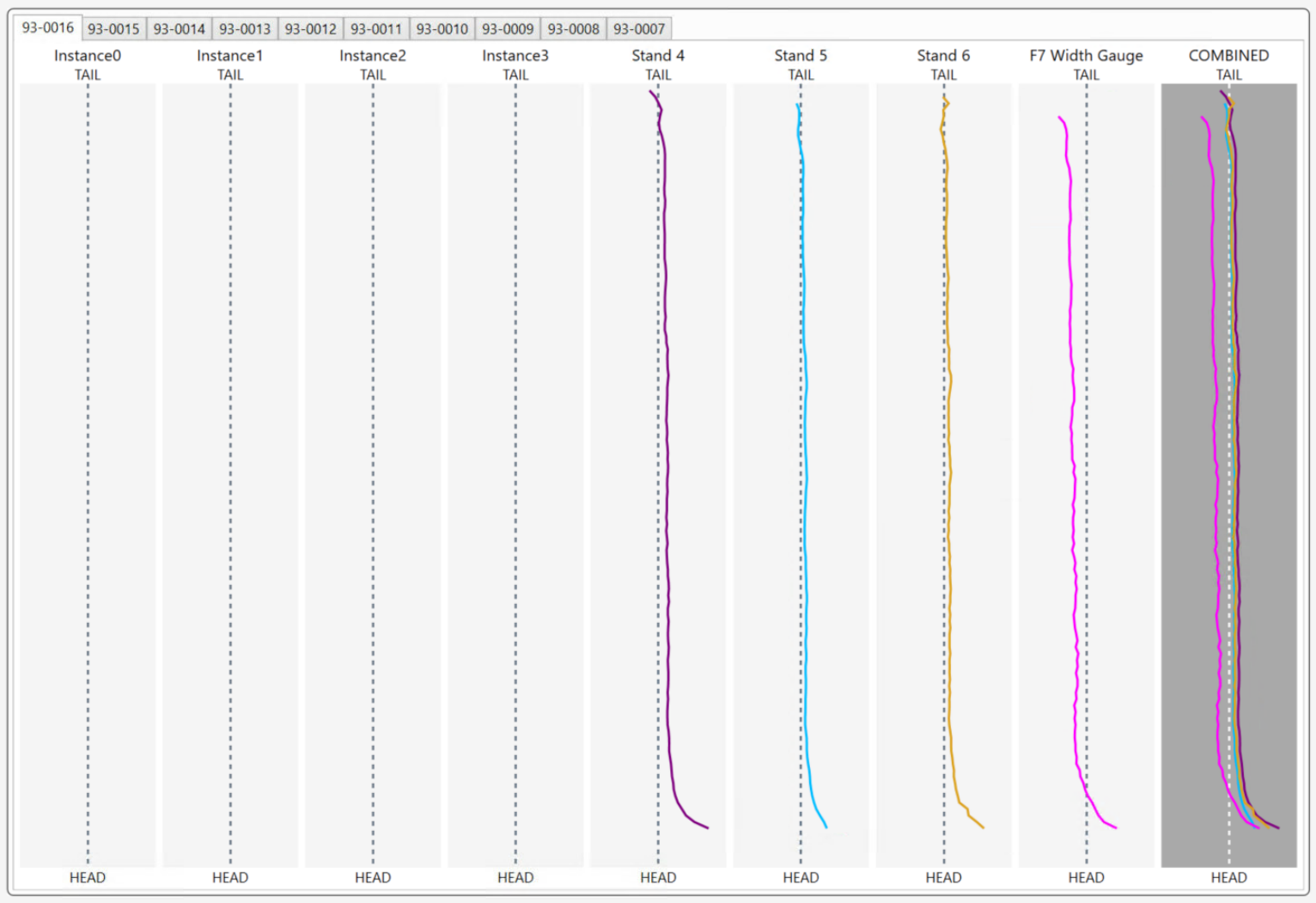
Control Side Operations

- Control initiation begins after receiving the last n healthy readings from the vision system
- The system uses the average of the last n scans as the control input
- This input passes through:
  - Offsets
  - Product-specific adjustments
  - Then through a PID control loop
- Steering adjustments at each mill are based on a combination of:
  - Upstream camera inputs
  - Downstream camera inputs

System Interface | LineTrack Monitor

User Interaction

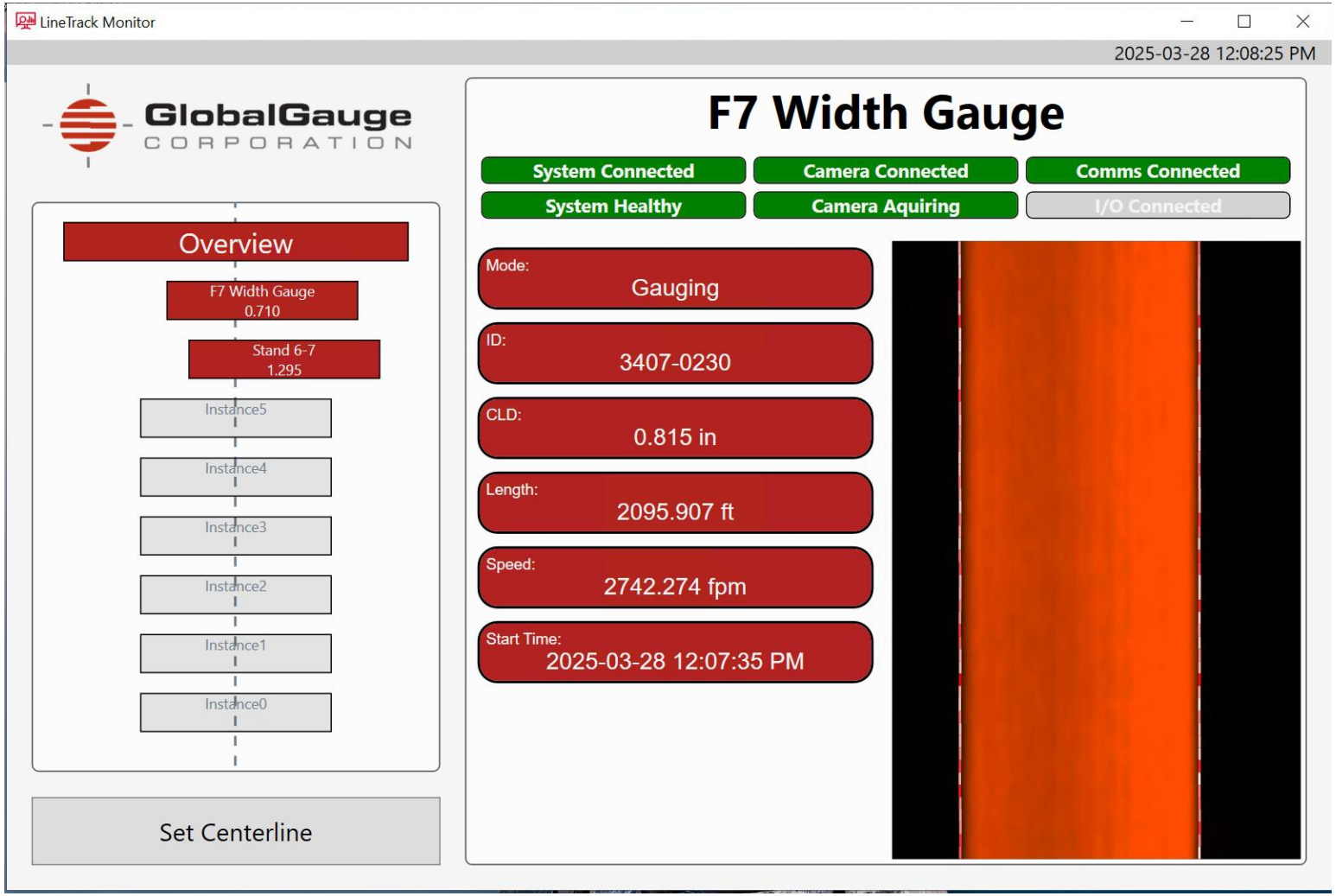
- Full Operator Visibility
- Intuitive Visual Feedback
- Combined Measurement Summary
- Enhanced Decision Support



System Interface | LineTrack Monitor

User Interaction

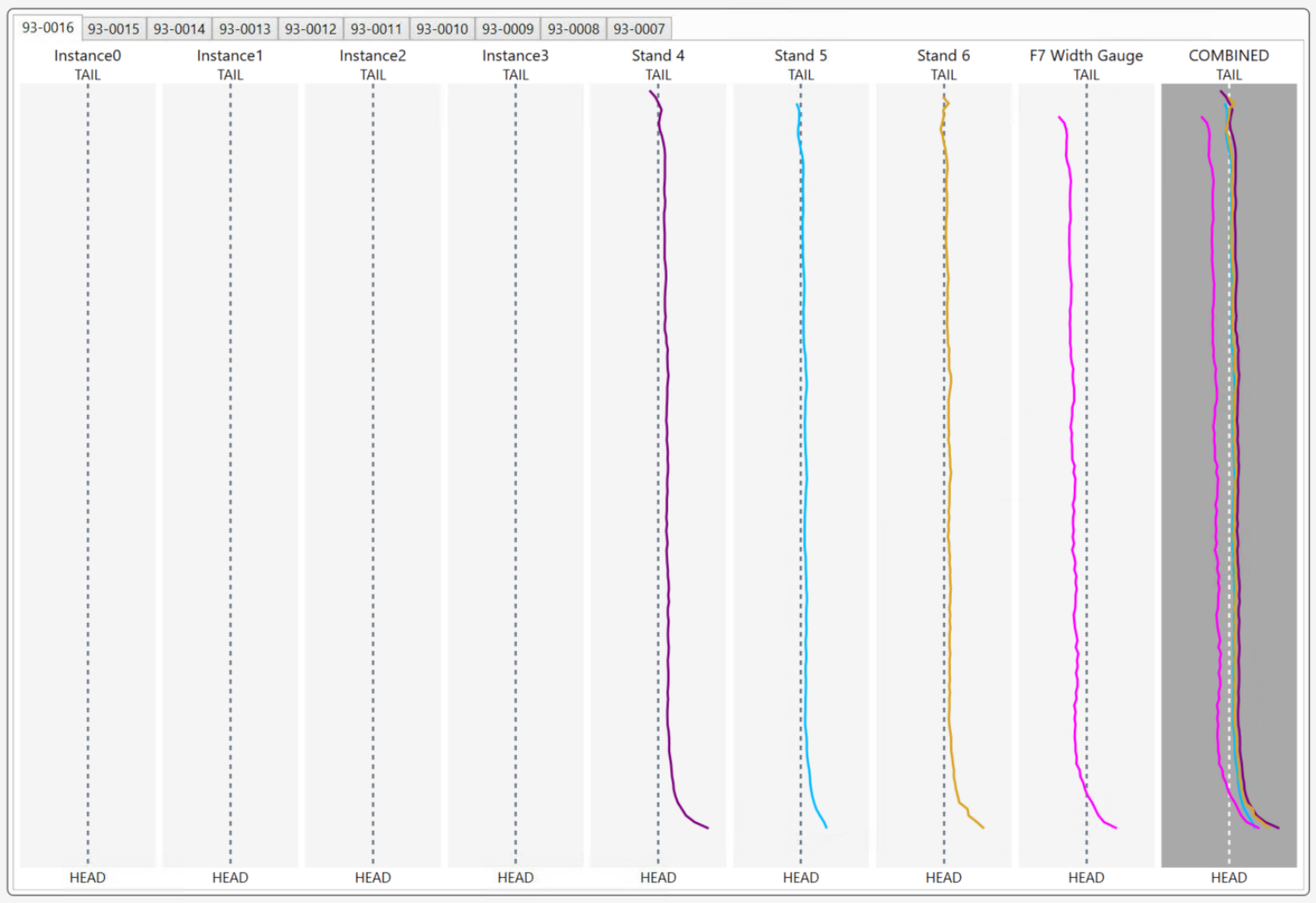
- Real-Time Sensor Monitoring
- Status Mode Display
- Edge Quality Visualization
  - Proactive Maintenance Insights
  - Confidence-Driven Decisions



System Interface | LineTrack Monitor

Data Analysis

- Tab-Based Navigation
- Interactive Bar Visualization
- User-Friendly Archive Browsing
- Export Functionality



What’s New to the Industry

What’s Novel

Advanced Exposure Control

- Understanding and applying different types of exposure control sets apart true experts from those who avoid the effort—proper tuning requires skill and experience.

Mill-Specific Tuning

- Every hot mill presents unique conditions; our system allows tailored tuning that adapts to individual mill characteristics over time.

Superior to Canned Solutions

- Unlike competitor systems with one-size-fits-all algorithms, our solution offers customizable filtering that achieves greater accuracy.

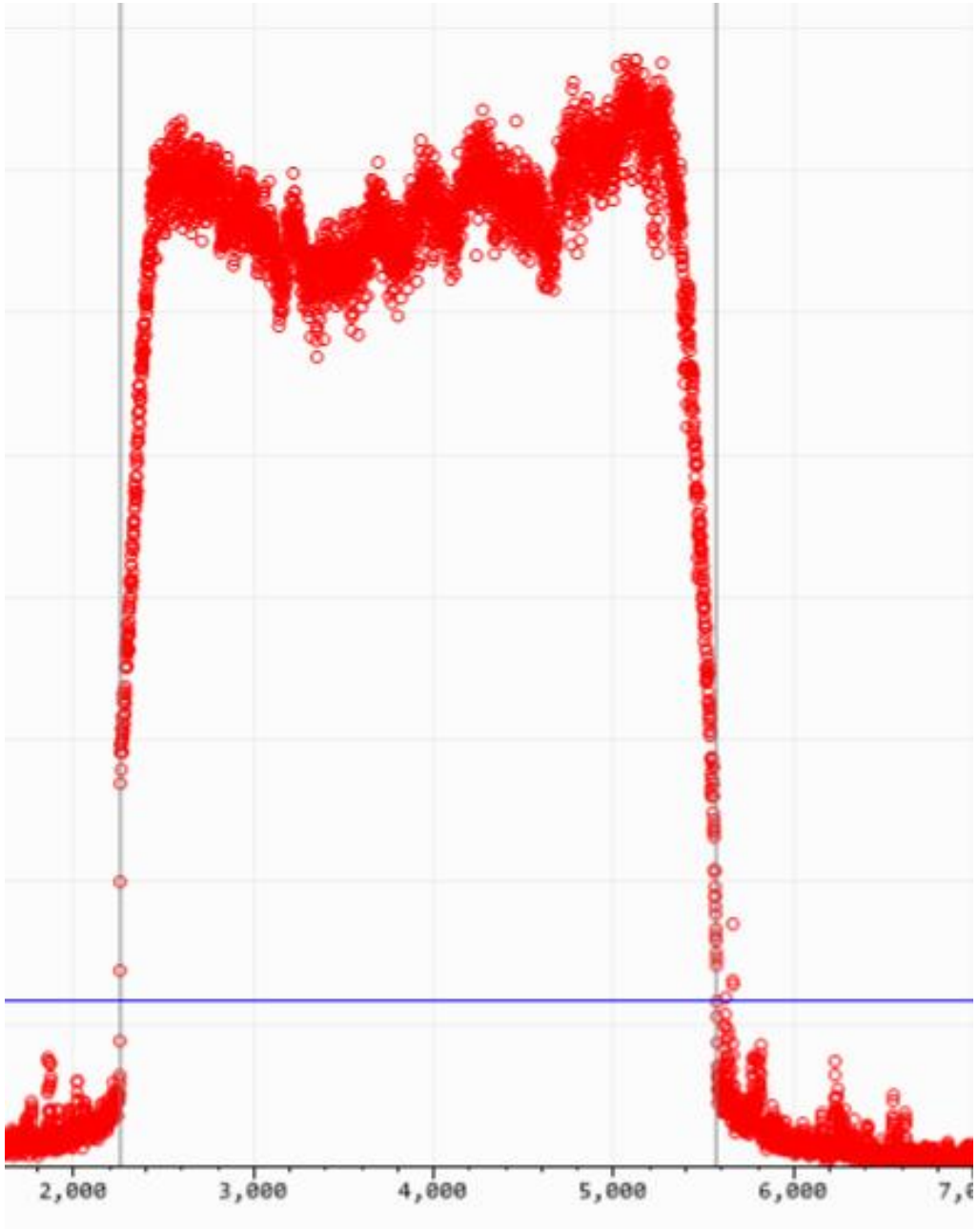
Spike Reduction in Edge Detection

- Pre-filtering and filtering algorithms effectively smooth out erratic or “spikey” sensor feedback, preventing misinterpretation of strip edges.

What's Novel

Real-World Example

- In the example shown, improper filtering could have led to inaccurate detection of the right edge—our algorithms correct and stabilize such anomalies.



Results & Case Study Highlights

Proven Victories & Real-World Results

Positive Operator Feedback
Most operators **actively support and prefer** the system—indicating ease of use and value in daily operation.

✅ **Operator Acceptance**

Pinches Reduced by > 75%
Marked improvement in tail tracking and reduced need for roll changes—especially in stainless applications.
Holes & Gall Reduced by > 75%
In conjunction with improved practices, the system has drastically cut down defects caused by edge rub and misalignment.

📉 **Significant Defect Reductions**

Bearing Failure Prediction
Early detection of mechanical wear through system feedback—enabling **proactive maintenance** and avoiding unplanned downtime.

🛠️ **Predictive Maintenance Capabilities**

AISTech2025

Key Results

Prevention of Cobbles

Poor steering can lead to cobbles, disrupting production and increasing downtime.

Mitigation of Tail Whip

Bad steering can cause tail whip between the final two mill stands, potentially resulting in a violent enough tail whip to create a ‘bruise’ on the rolls.

Reduced Downtime

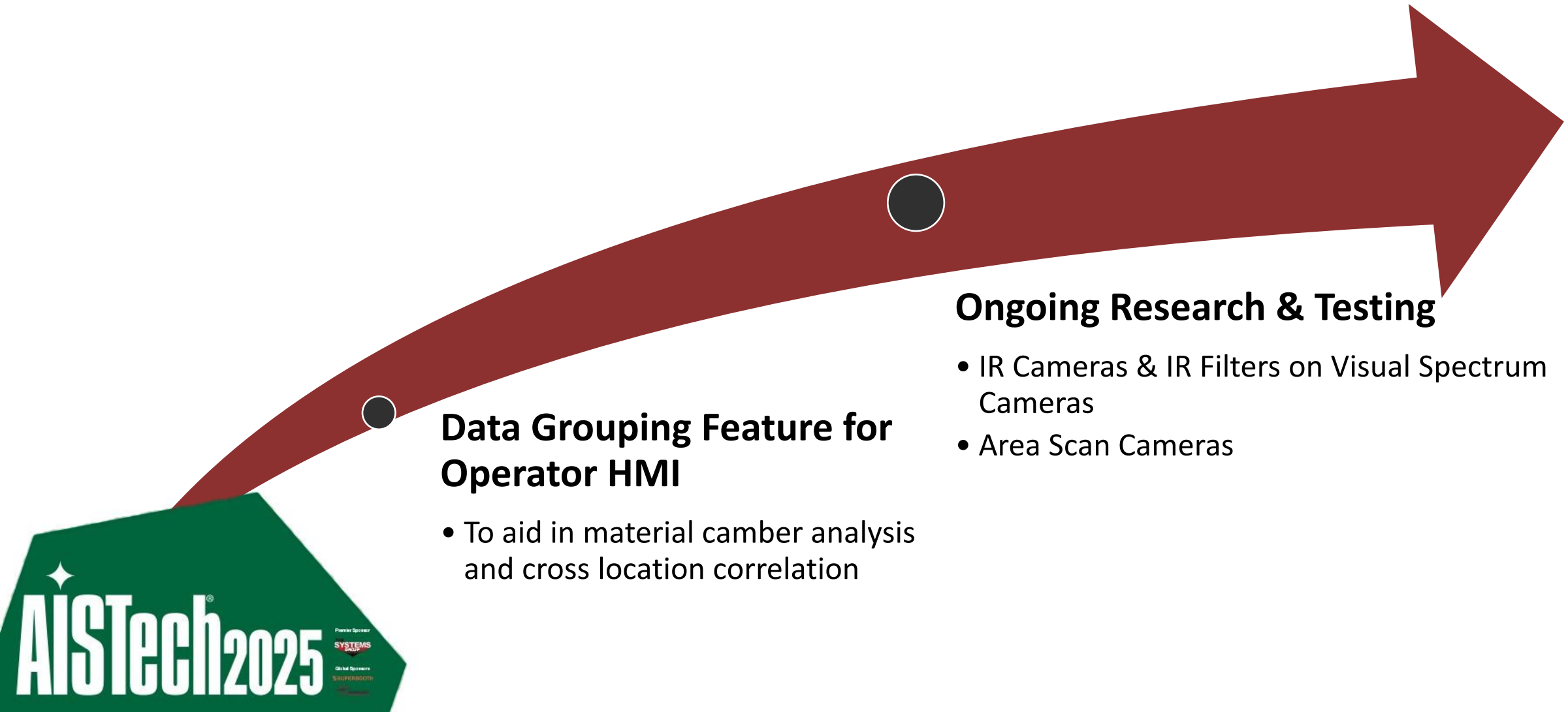
Cobbles and bruised rolls require changing, which can lead to significant downtime. If the roll shop is behind on production, the unavailability of rolls exacerbates this issue.

Long-Term Insights

By analyzing data from the ICDS, manufacturers can uncover root causes of steering issues and predict maintenance needs for wearing or failing components, ultimately enhancing operational reliability.

Future Benefits

Future Applications



Data Grouping Feature for Operator HMI

- To aid in material camber analysis and cross location correlation

Ongoing Research & Testing

- IR Cameras & IR Filters on Visual Spectrum Cameras
- Area Scan Cameras

Q&A

Thank you!

Questions?
Call us at **+1 (937) 254-3500** or
Email me at **d.kober@globalgauge.com**

GlobalGauge CORPORATION

For more info,
visit **www.globalgauge.com**.