



Ladle SandMan® and LaCam®

A  **BSE** and **FERROTRON**
A **MINTEQ** DIVISION

LADLE SANDMAN® MEETS LACAM® SYSTEM

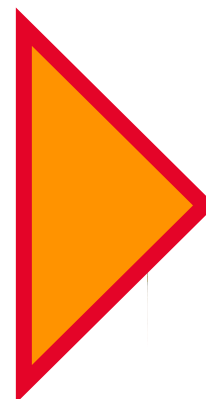
MINTEQ



Automatic Filling
& Monitoring



Precise Laser
Measurement



Automatic Sanding
System Including
Quality Control



GENERAL

How do you fill 17.000 ladles per year safely ?

PRACTICES

Funnel/Chute Systems + Throwing Bags

- Involve Manual Handling
- Sand segregation

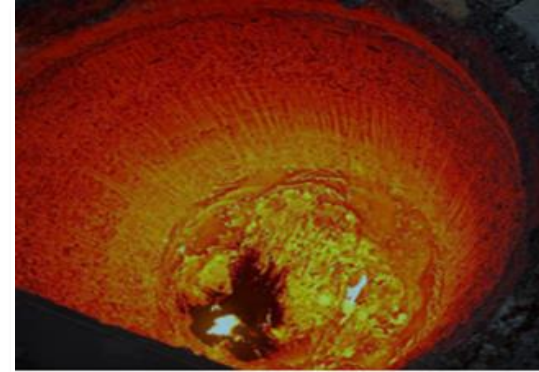


Crane-Based Container Discharge

- Requires operator positioning
- Time-consuming
- Reliance on operator precision

No Integrated Monitoring

- **Root cause analysis** difficult without proper data.
- No detection of slag or block obstructions

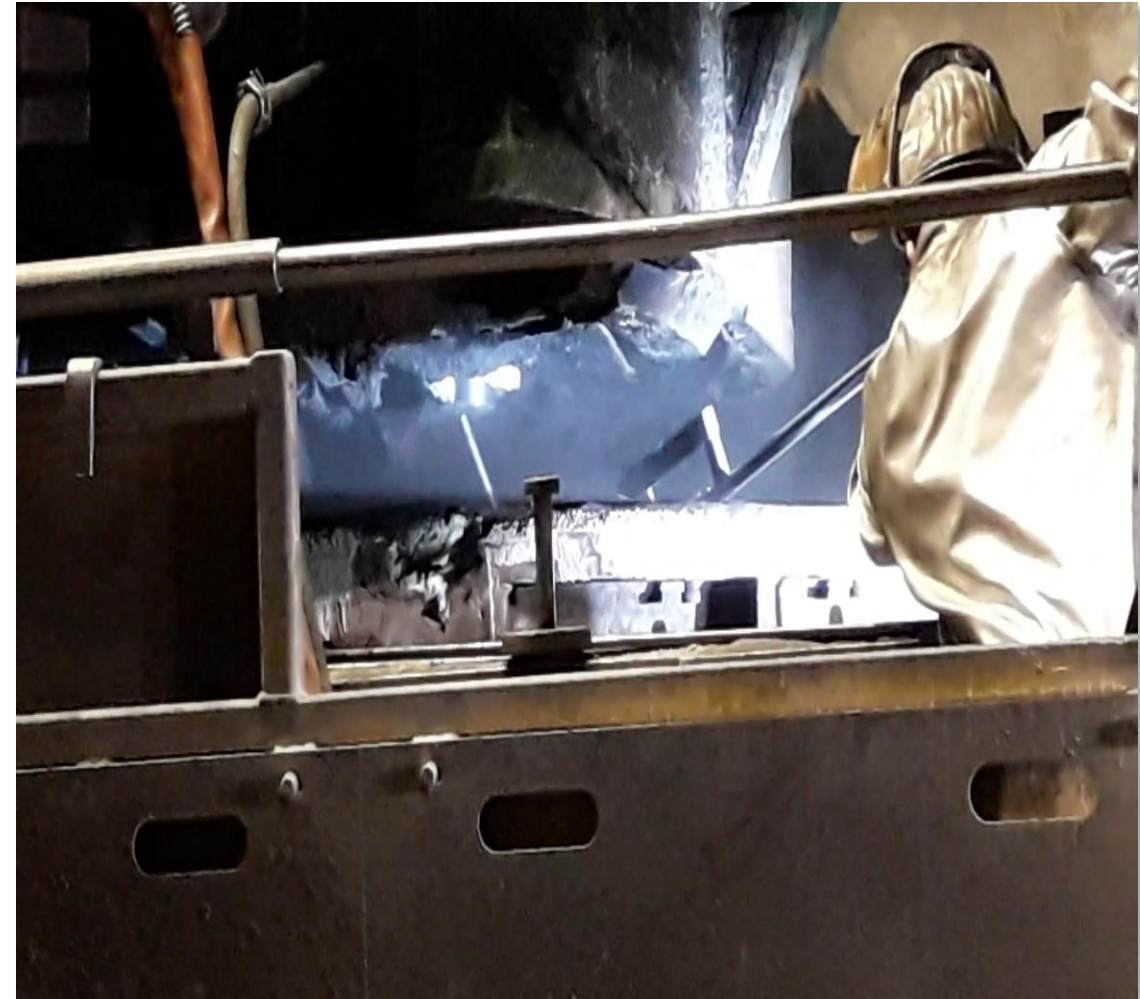


Safety Hazards

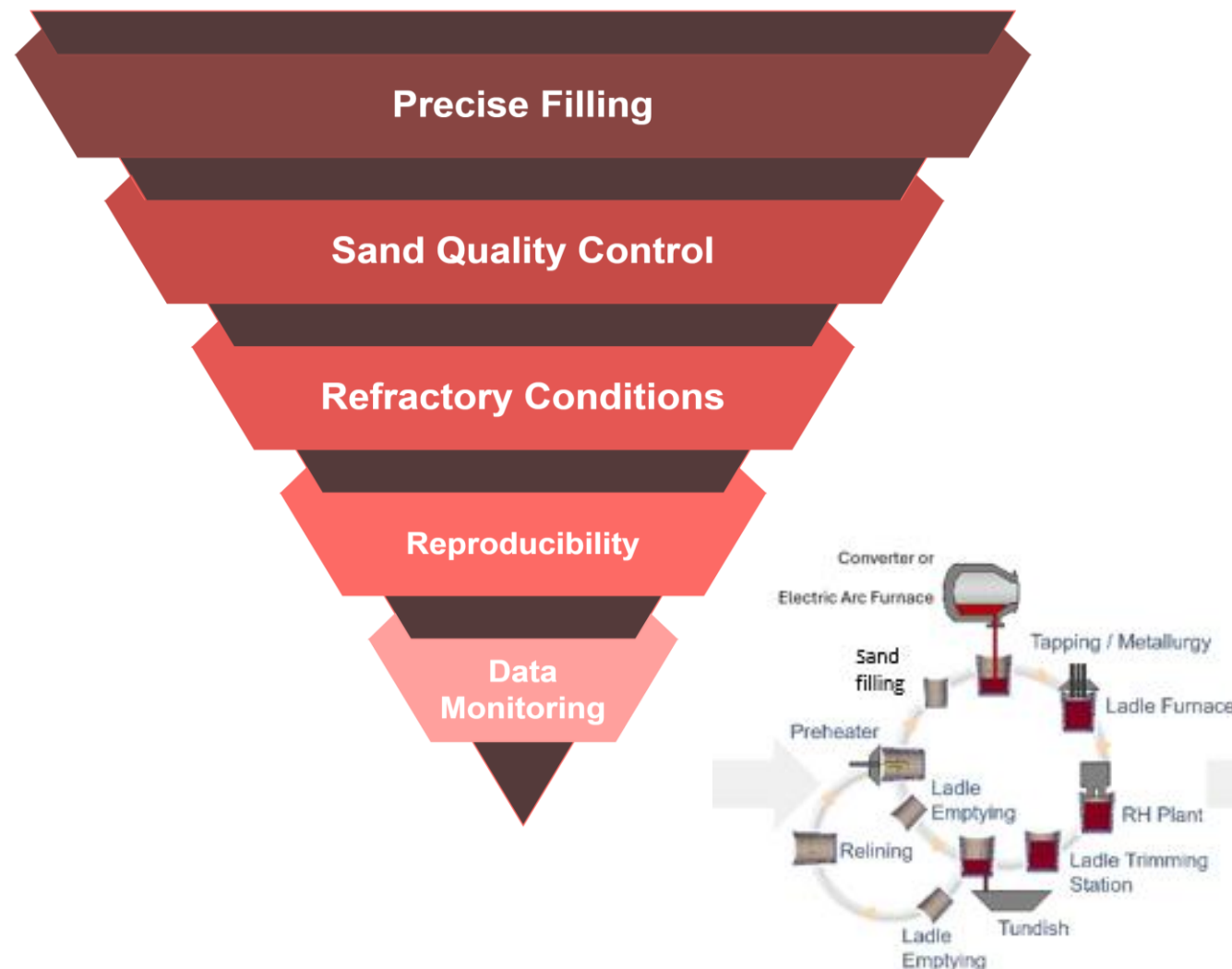
- Emergency opening procedures expose workers to **hot zones**, oxygen flames, and high stress.
- Increases the **risk of accidents** in already hazardous environments
- Repetitive lifting of heavy sandbags, often at height, in high-temp zones

Quality Downgrades

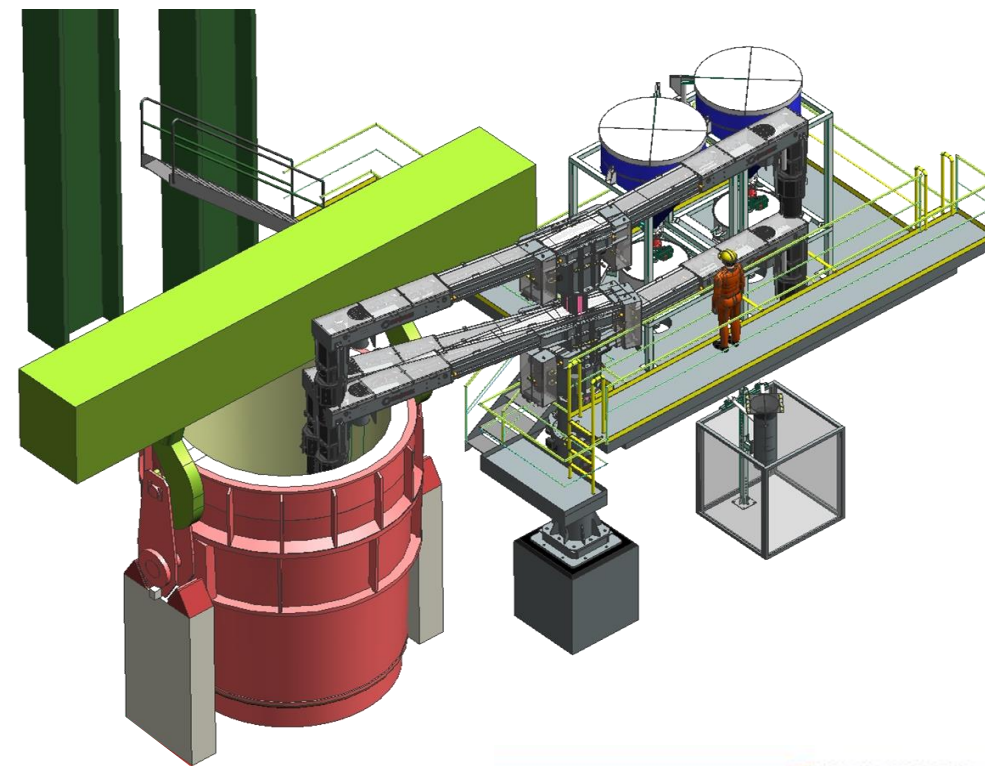
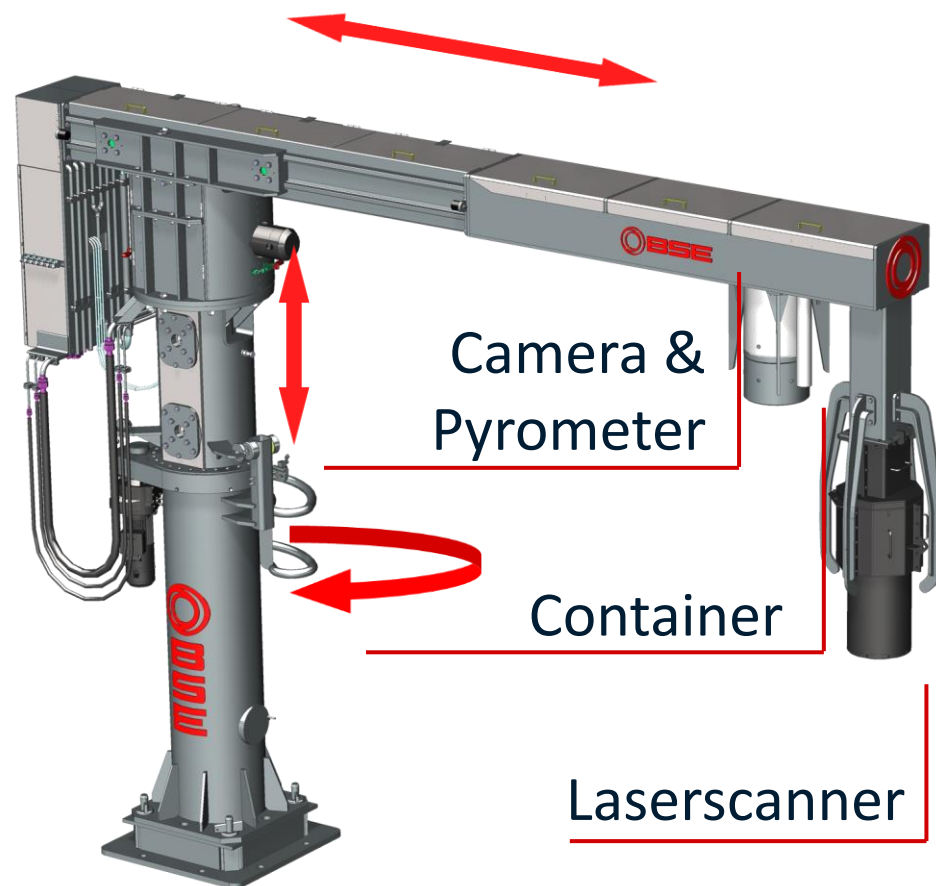
- Manual **oxygen lancing** introduces O₂ into the melt
- **Downgrade entire heats**, especially critical in high-grade steel production



- **Repeatable accuracy** per filling to avoid over- and underfilling
- Integrated silo ensures **dust-free, moisture-protected storage and filling**—stable sand quality, minimal losses
- Precise placement **directly into the well block**, even when the ladle is suspended
- No sand losses from misalignment or funnel-based segregation
- Operator stays in **safe, remote location** during entire process
- Visual and thermal data for **process traceability and root cause analysis**.
- Great position in thermal cycle for heat-saturation measurement.



Safe and reproduceable Well Block Filling meets Smart Refractory Scanning

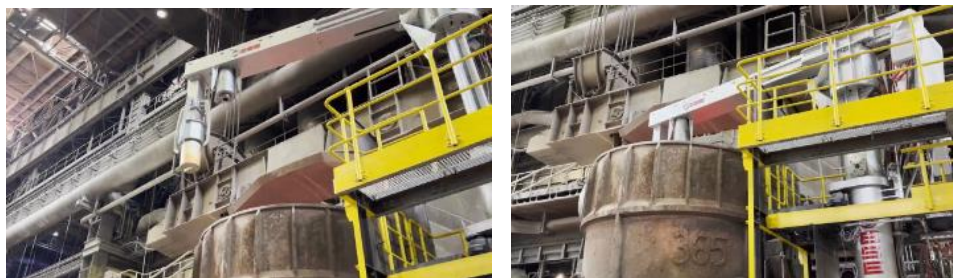


FERROTRON
A **MiNTEQ** DIVISION

THE SOLUTION: LADLE SANDMAN[®]+: OPERATIONAL CYCLE

MiNTEQ

1. Positioning & first ladle positioning scan



2. Second scan for positioning of sand



Laser



Sand container

3. Filling of ladle well & lifting of sand, 3rd scan for cone quality



Sand container



Cone

4. Park position & re-filling of sand



Moving out



into park

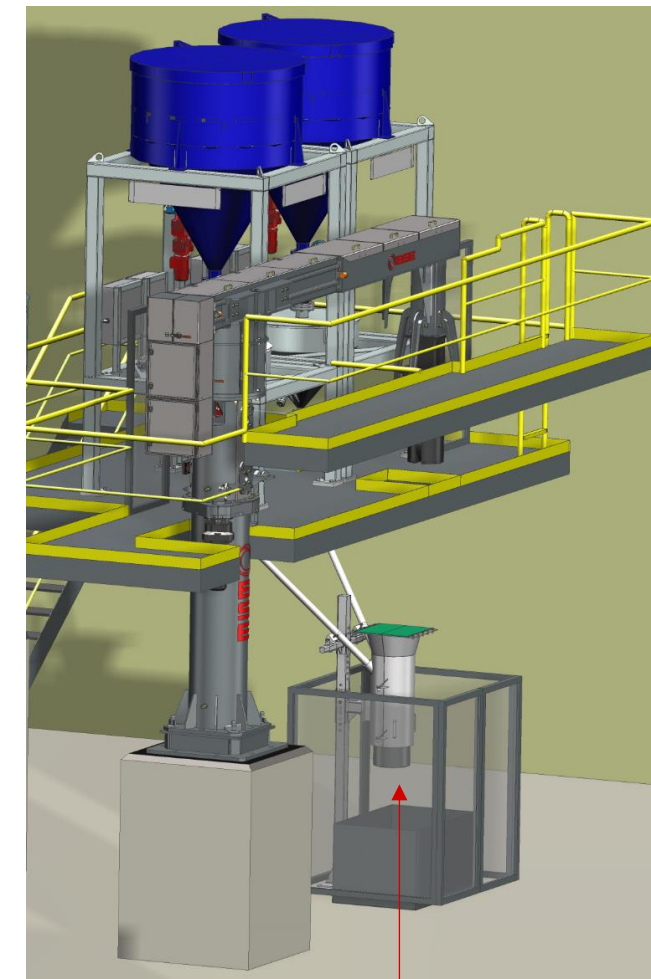
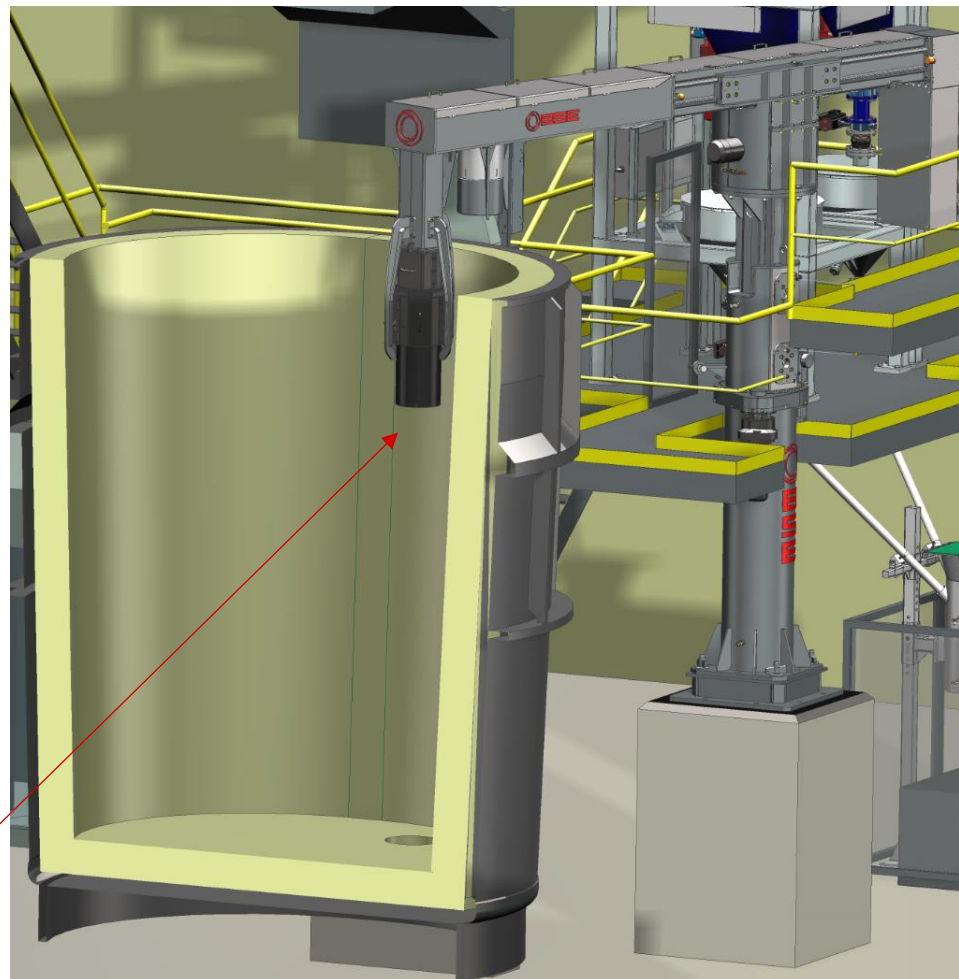
THE SOLUTION: LADLE SANDMAN®+: OPERATIONAL CYCLE, SCANNING

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- Lack of space because of lifting beam of crane and Sandman®+ arm
- Lifting column with emergency recovery function
- Flange connection and utilities supply of LaCam® system
- Two hoppers to supply sand to container
- Full automation by PLC integration

Situation in picture:

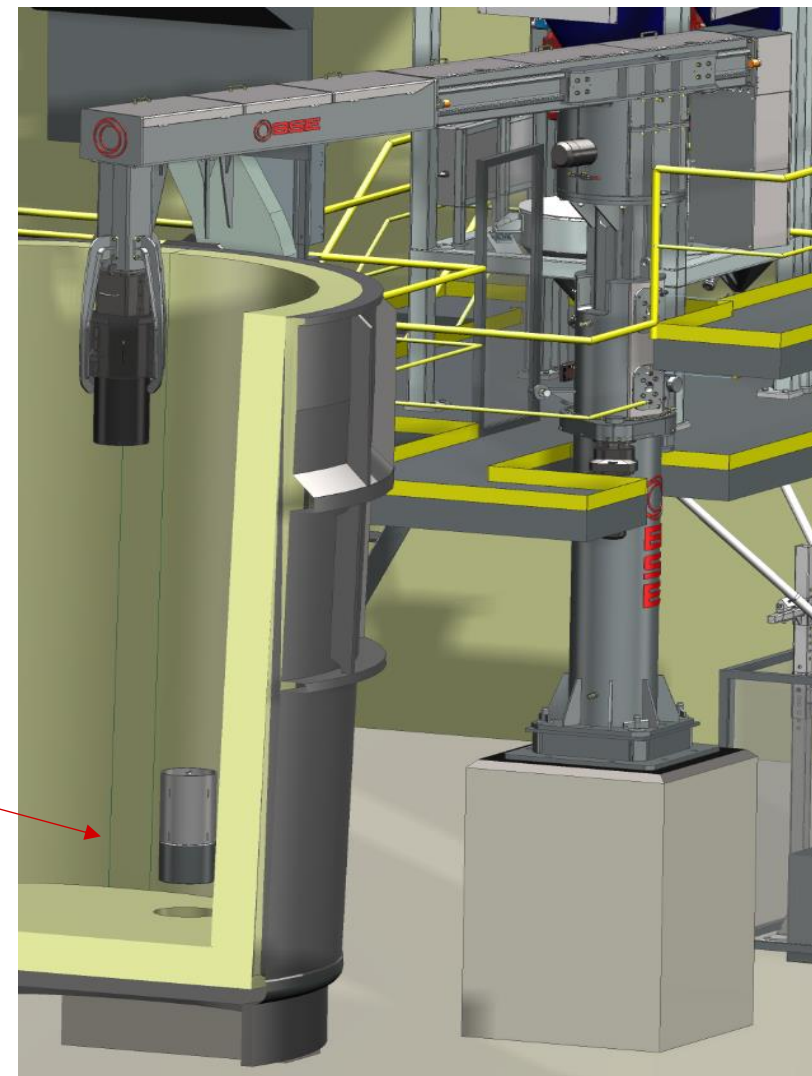
- **Laser in position for first scan of tap-hole (well filler block)**



Sand filling station for sand container
Sandman+ in parking position

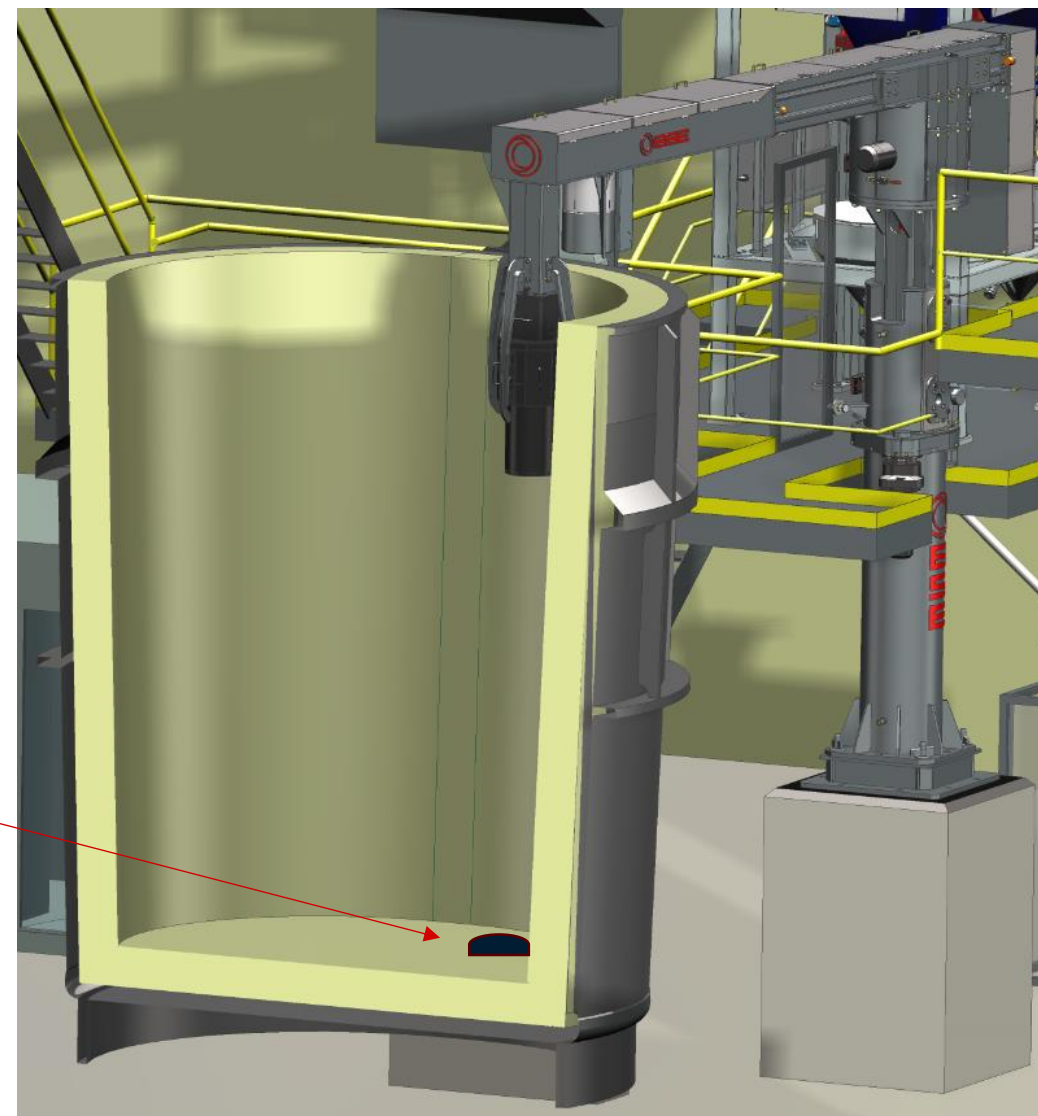
Situation in picture:

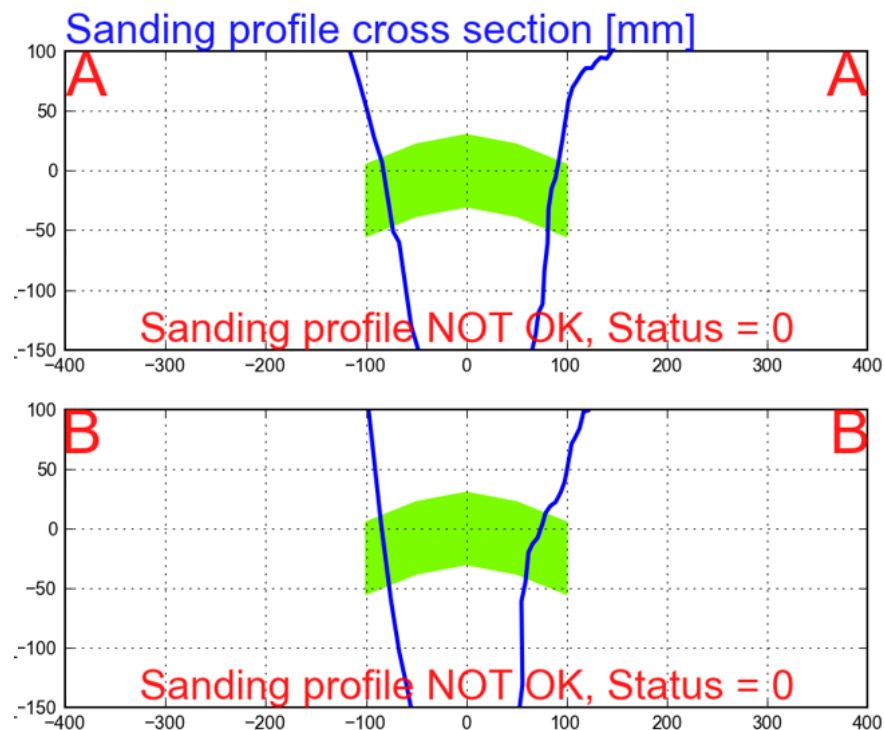
- Laser measurement to assess exact position of well block
- The sand container with the tap-hole filling material is placed directly above the well-block
- Delivery of exact quantity of sand into the tap-hole for highly reproduceable tap-hole filling and opening results



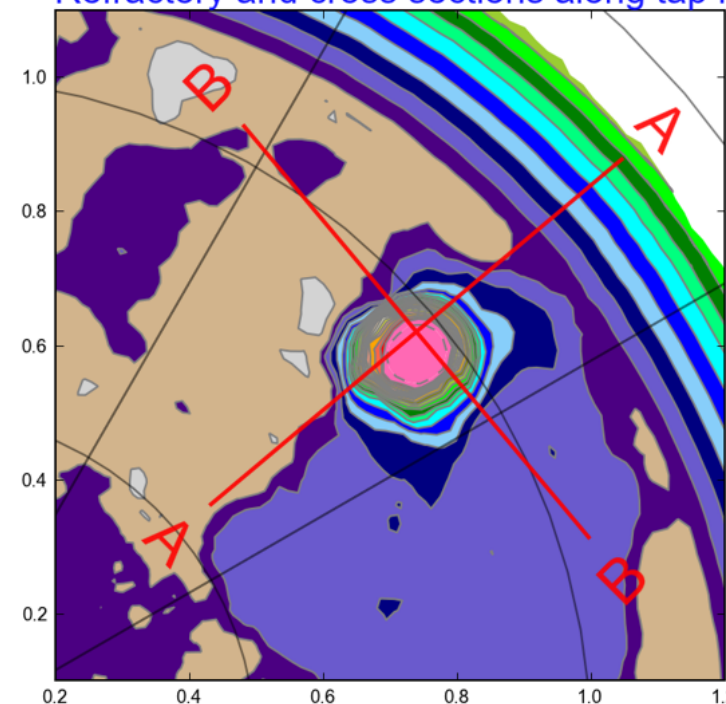
Situation in picture:

- Sand dropping and filling of the tap-hole completed
- A defined cone of material on top of the tap-hole is measured for quality assurance
- Reproduceable process ensures high tap-hole opening rates





Refractory and cross sections along tap hole [m]



Sand calc. [kg]:
20.4



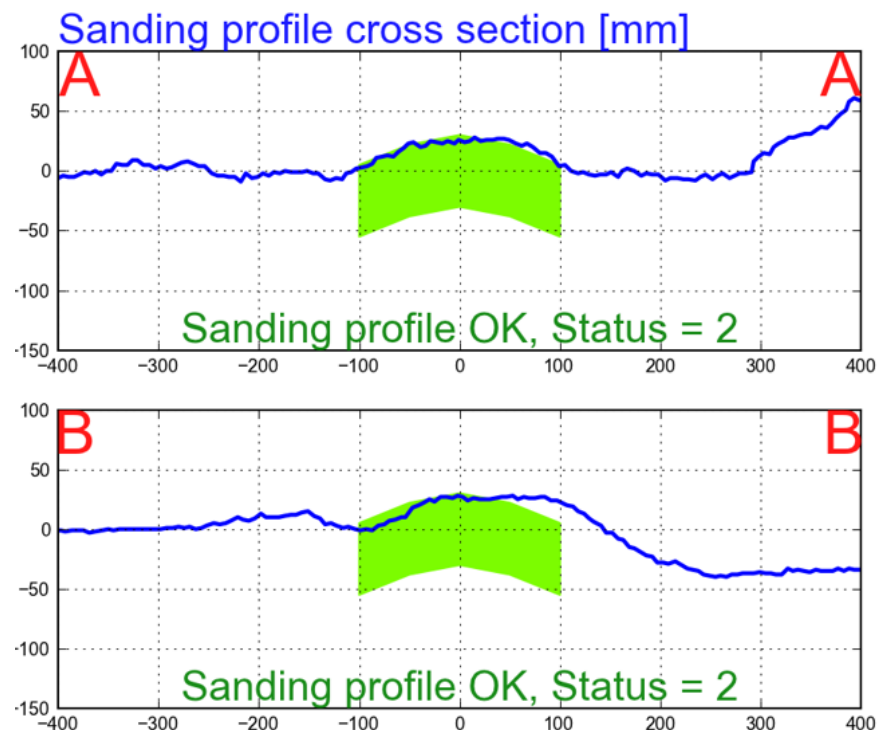
Analysis of Vessel: Ladle

Selected area to analyse: Bottom

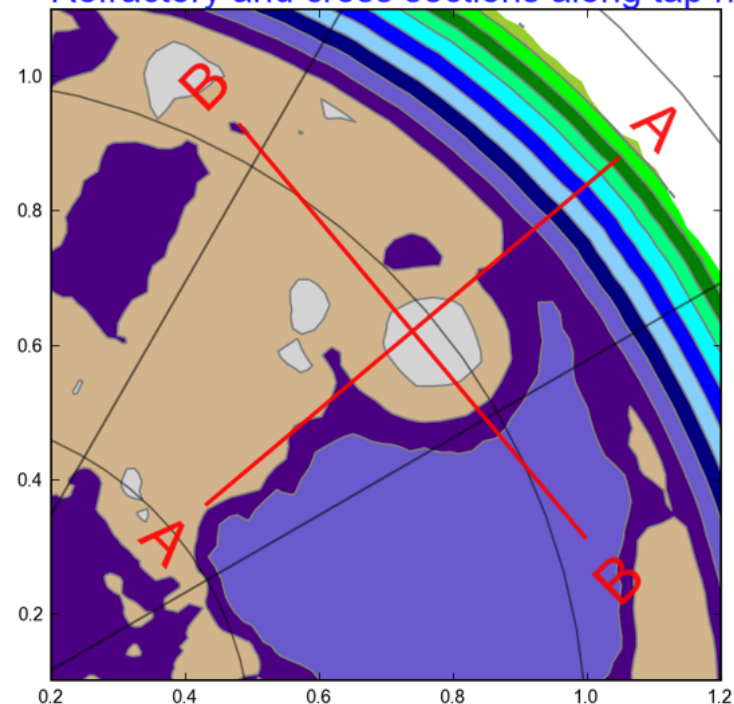
Cross sections A / B show opening condition → Needs to be filled with sand.

Volume projection calculated for optimized tap hole opening rate

THE SOLUTION: LADLE SANDMAN[®]+: QUALITY CONTROL



Refractory and cross sections along tap hole [m]



Analysis of Vessel: Ladle

Selected area to analyse: Bottom

Cross sections A / B analysed and within specified boundaries → pass.

Optimized tap hole filling volume applied and checked to secure **very high opening rates**

Filler sand savings

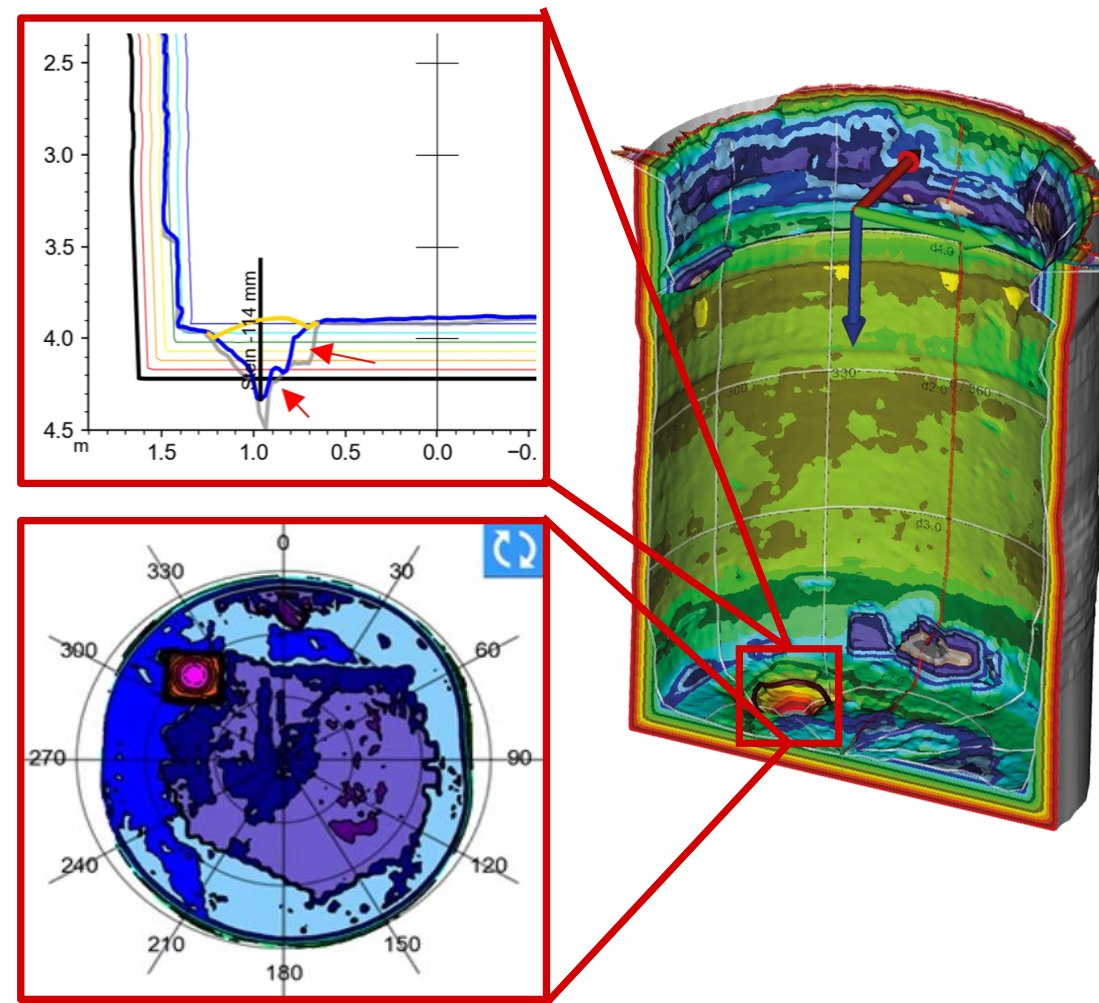
- 40% less consumption
- Increase in ladle opening rate by 4% for free-cutting steel grades
- Shift from “burn-on” to “short probing” in standard grades

Advanced Refractory Monitoring

- High-resolution 360° laser scans reveal wear zones undetectable by eye

Short Cycle Time, High Availability

- Sand filling in ~3 minutes
- Laser scan + filling completed in <6 minutes
- System availability >97%



Operator Assistance

- Assists operators in deciding whether the ladle is fit for the next heat

Material Development 4.0

- Real-world wear data accelerates refractory trials and supplier evaluations

Predictive Maintenance

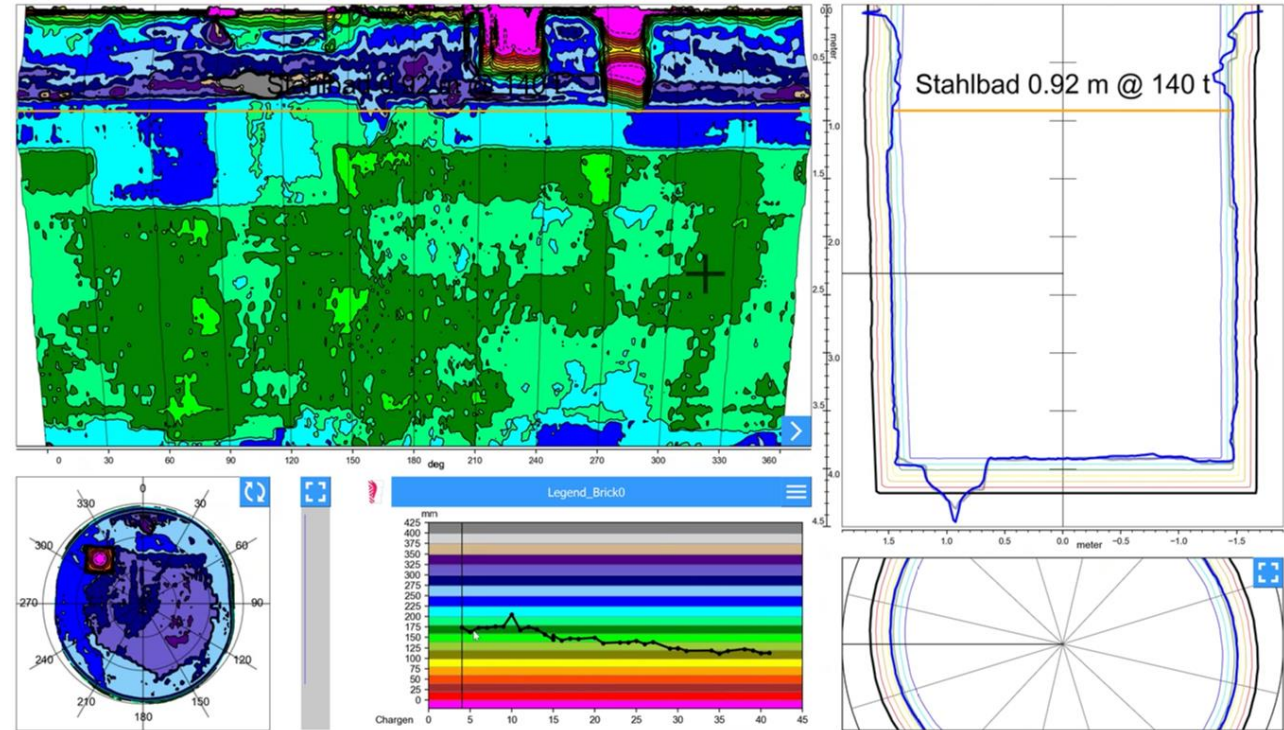
- AI-driven wear forecasting based on laserscans, temperature profiles and ladle history

Fully Traceable Operations

- Every fill linked to heat, ladle ID, and condition

Autonomous Decision-Making

- Data-based of filler sand quantity based on real time wear patterns



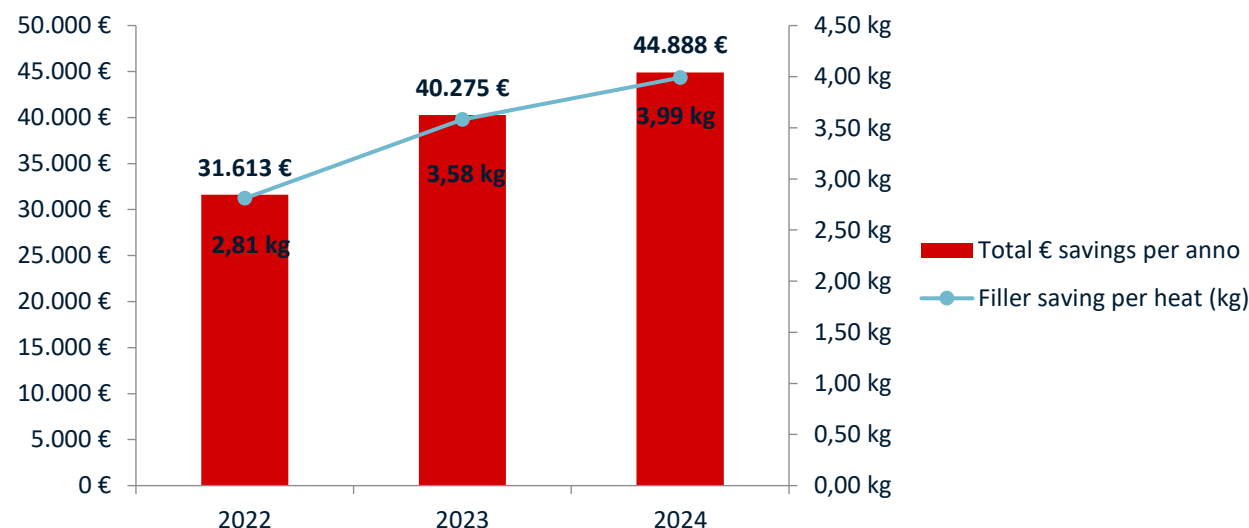
Improved Opening Rate and Reduced Sand Consumption

- Increase in ladle opening rate from 93.5 % to 99.1 %
 - 86% reduction of non-free opening ladles
- Reducing of filler sand consumption from 20 to 16 kg
 - with a ± 0.3 kg accuracy per fill, eliminates over- or underdosing, ensures uniform well-block filling
- Hands-off and safe
 - No manual handling, no exposure to heat or height
 - Up to 80 manual operations eliminated per day
- Image-based documentation
 - Visual traceability before & after every cycle
 - Pyrometer ensures refractory is in optimal condition

Modus	Daily heats	Non-Opening rate	Daily blocked ladles
SandMan	79	0,90%	0,7
Manual	79	6,50%	5,1



Annual Savings with SandMan(€)





ERGONOMICS

- No sandbag dragging, no ladder climbing
- Operation from pulpit
- Temperature and camera visualization
- Operator safety



OPERATIONS

- Reproducible well filling
- Standardized/robust process
- Lower sand consumption
- Higher ladle opening rate



MONITORING

- Laser and pyrometric scan
- Ladle identification
- Refractory and well examination
- Alarm limits
- Data supply



QUALITY & BIG DATA

Potential for:

- Predictive refractory maintenance
- Refractory R&D studies
- Technological progress
- Optimization of thermal cycle of ladles

EQUIPMENT SUPPLIED BY BSE; LASER SCANNER BY FERROTRON

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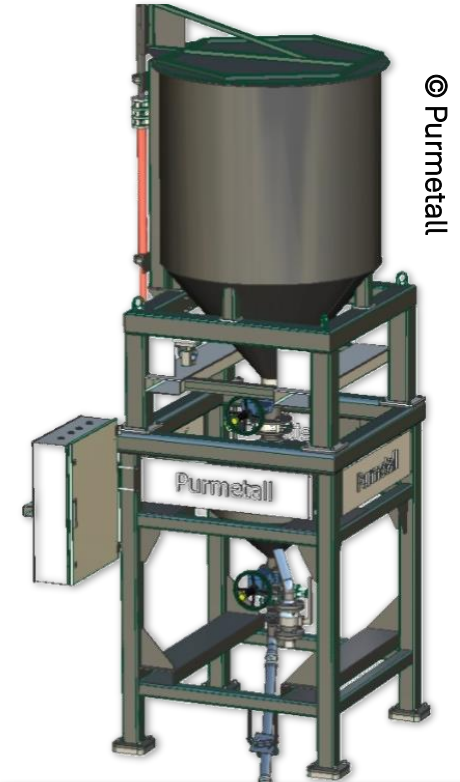
Control panel with HMI
& camera screen



Camera screen
&
HMI screen surface



Hydraulic unit with
emergency buffer



Dosing station for well
filler sand

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