



## **Cruise control for glass furnaces**

Automated furnace control and batch monitoring systems

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Business Development Manager

*Glasspex, September 11<sup>th</sup>, 2025*



# Together we shape a carbon-neutral glass industry, for a brighter future



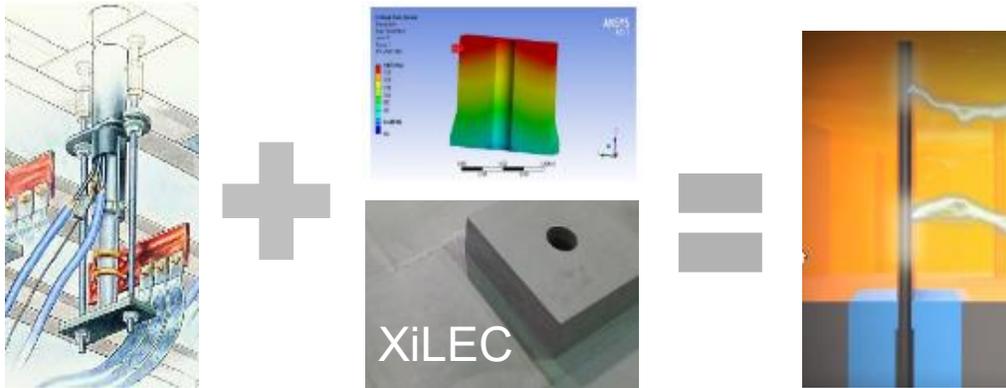
We are continuously supporting you throughout your furnace's life cycle.

Our goal is to propose solutions to improve your furnace performance and contribute to your journey towards decarbonization.

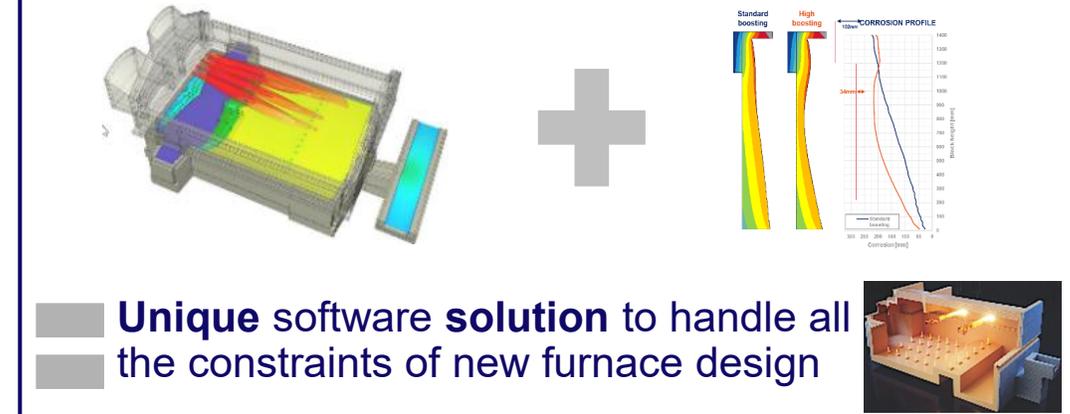


## REFRACTORY SOLUTIONS

Electrode Holder + Block = Electric heating solution



## CORROSION FEATURES IN MODELLING



Unique software solution to handle all the constraints of new furnace design

## SEFPRO GUARD & EXPERT SYSTEM

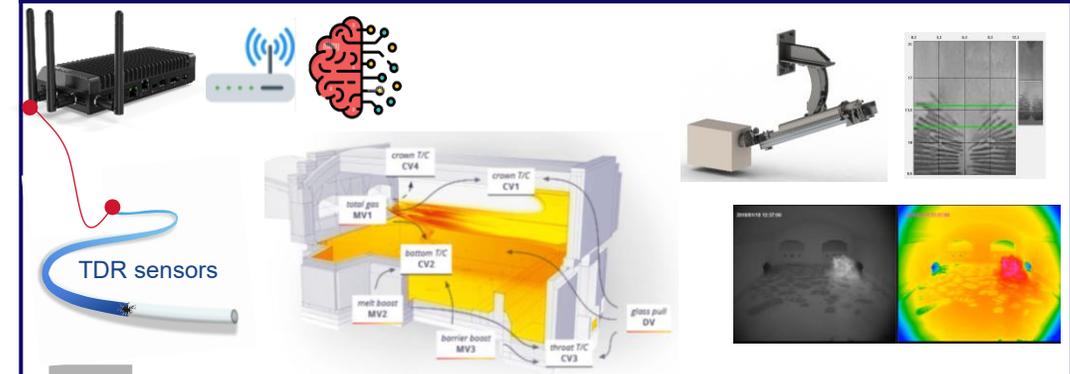


EXPERT SYSTEM **ES III**



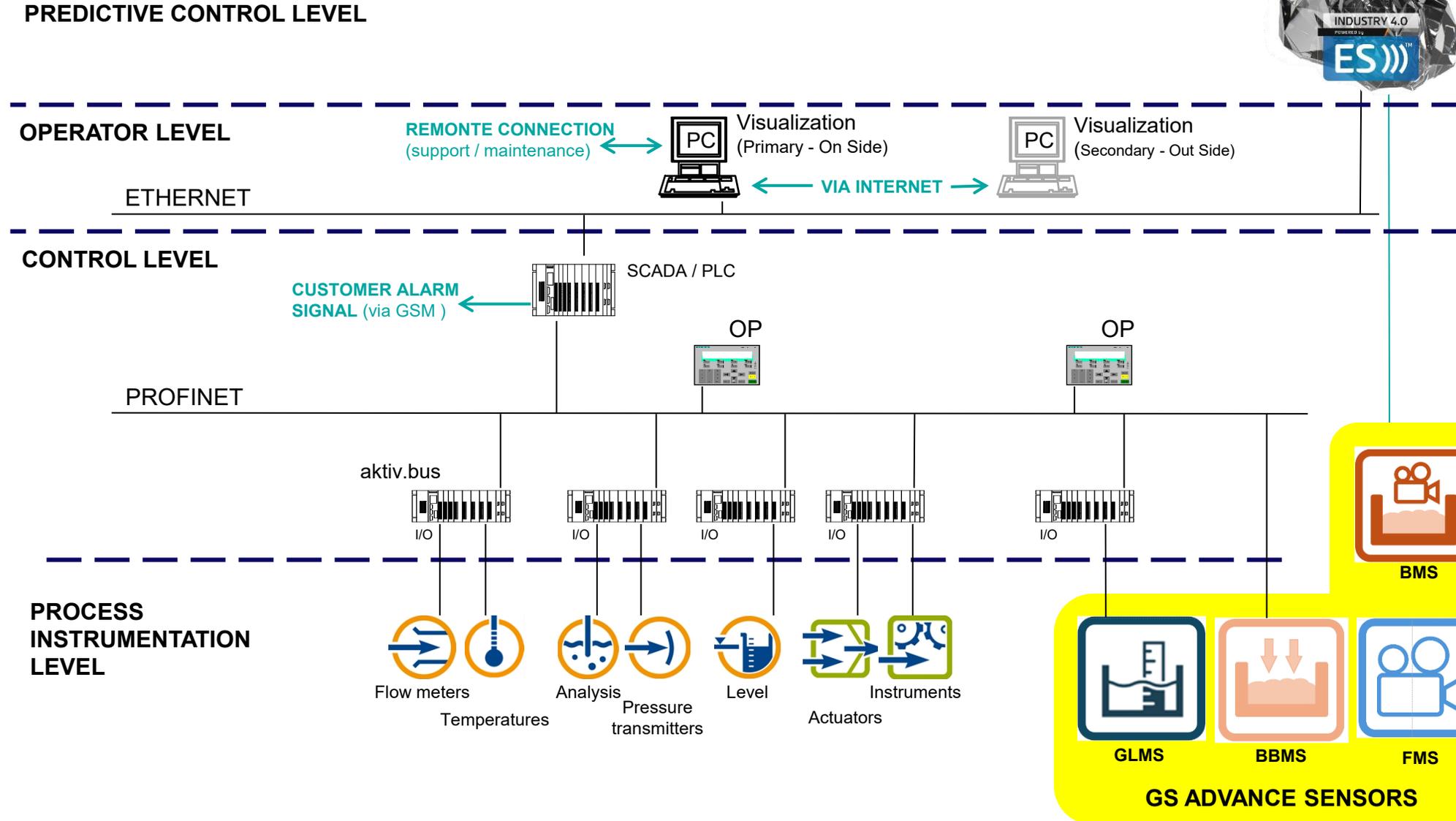
Process control solution with real-time corrosion assessment

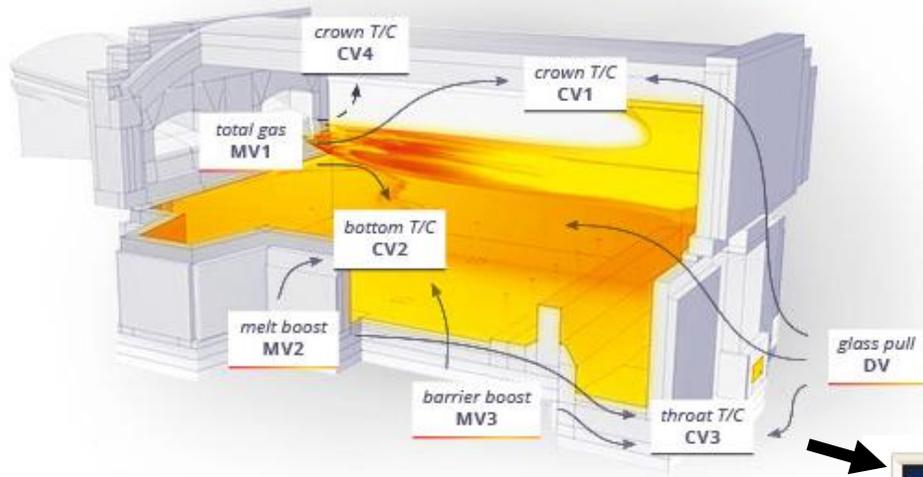
## DIGITAL FACTORY / A.I. / SENSORS



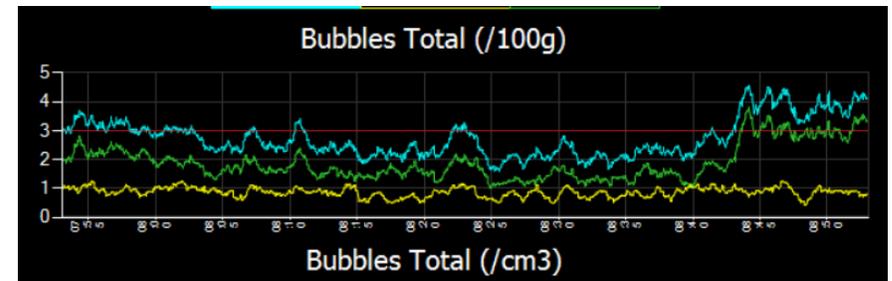
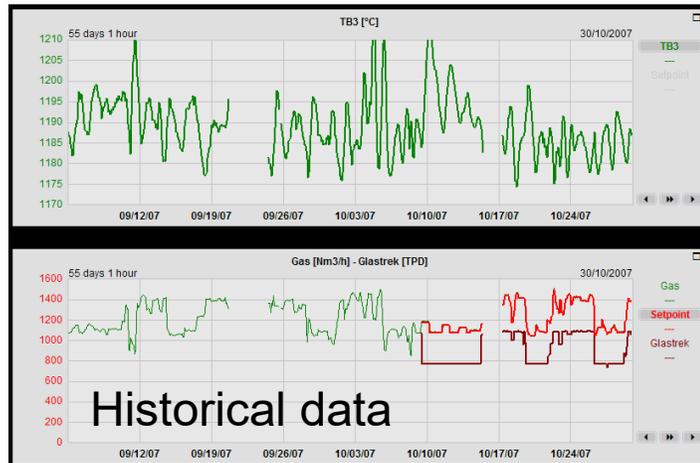
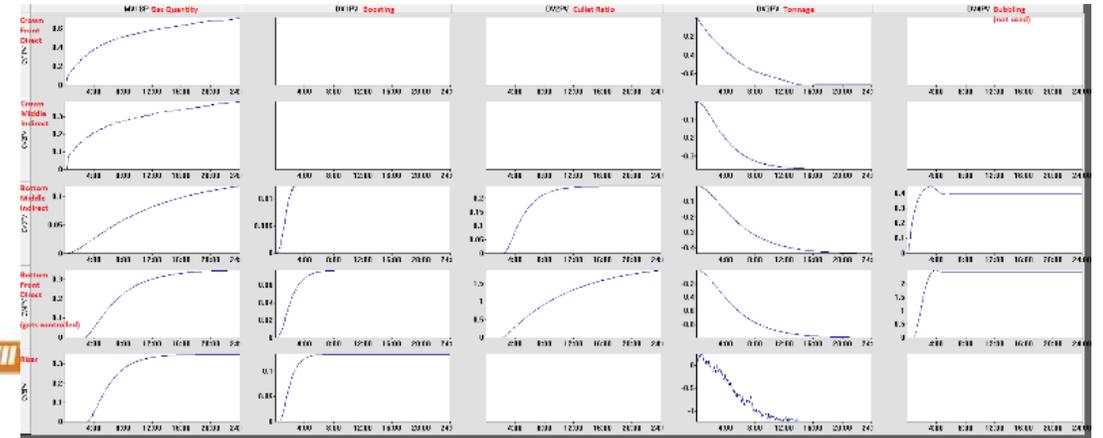
New digital solutions for Smart furnace

# Advanced sensors and furnace control





## MPC Models



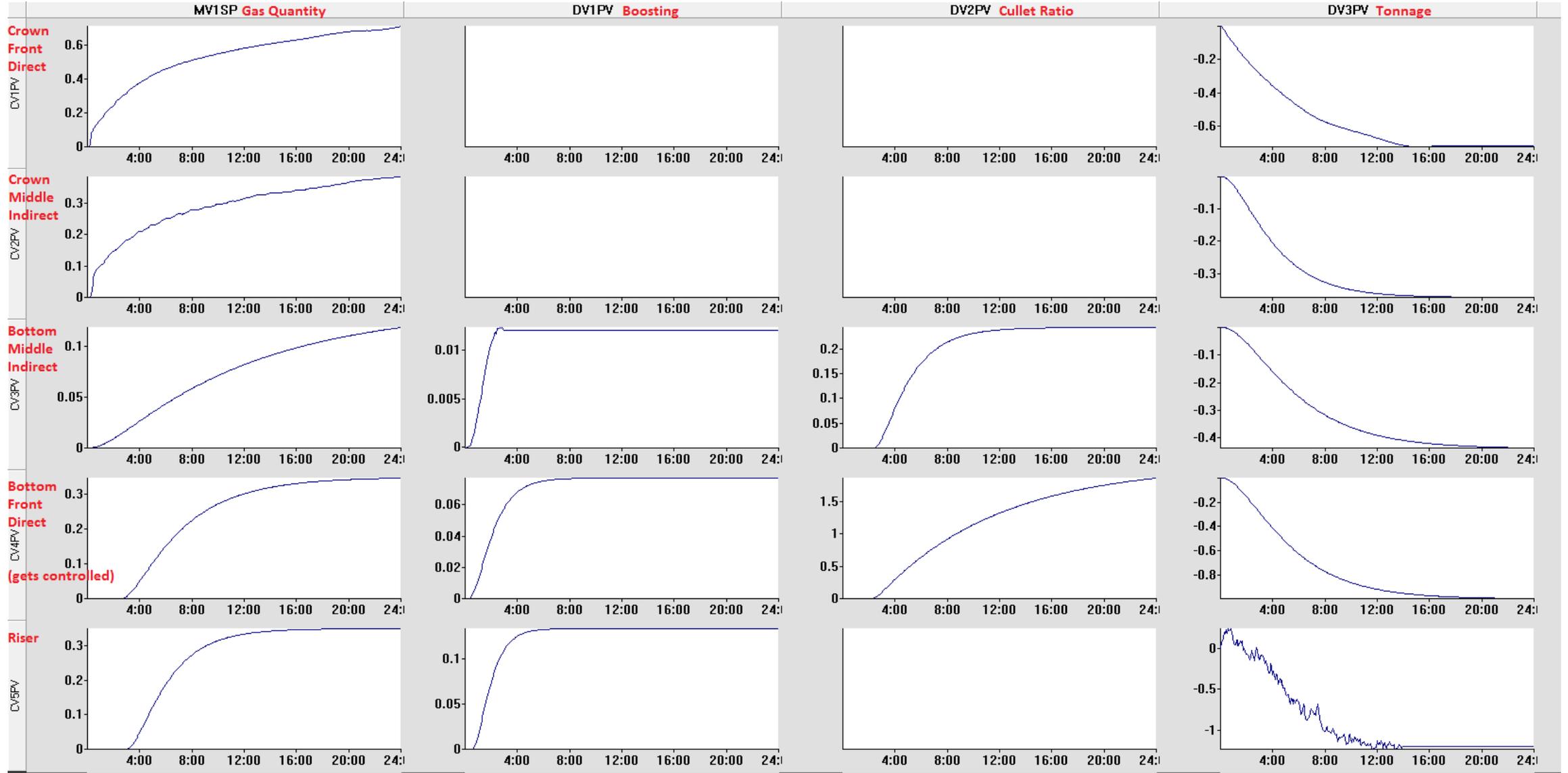
Courtesy of Cortex

## Gas

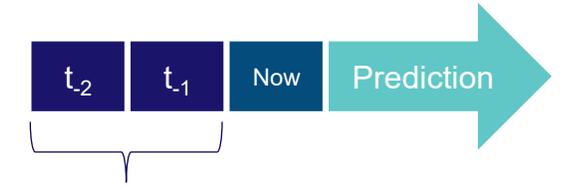
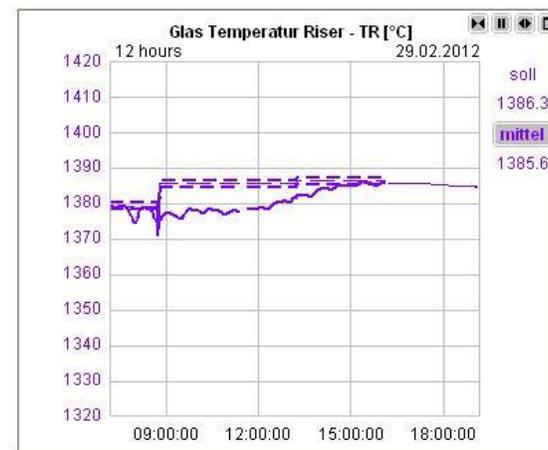
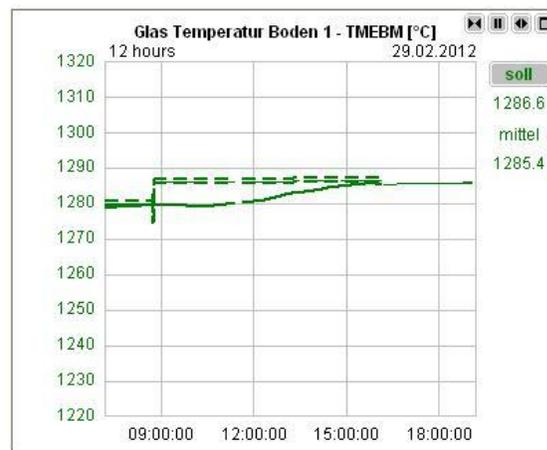
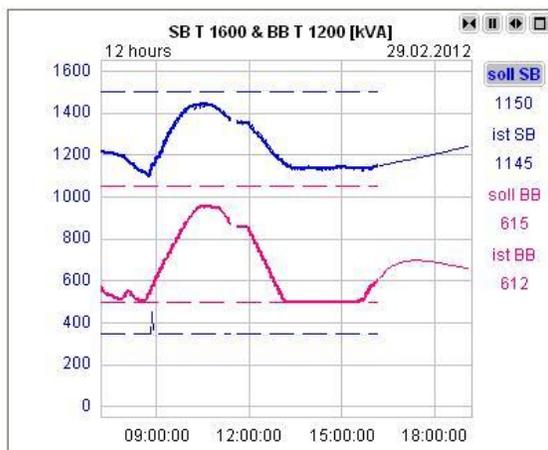
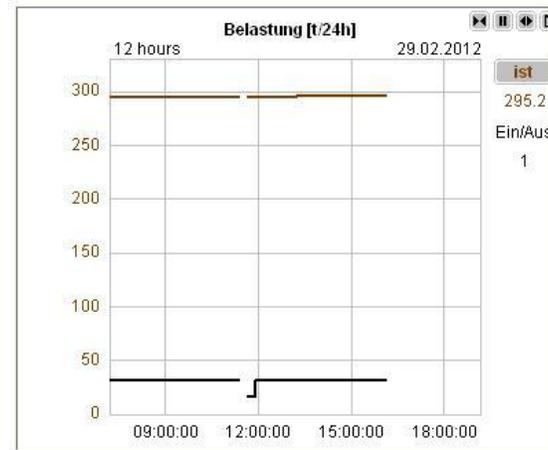
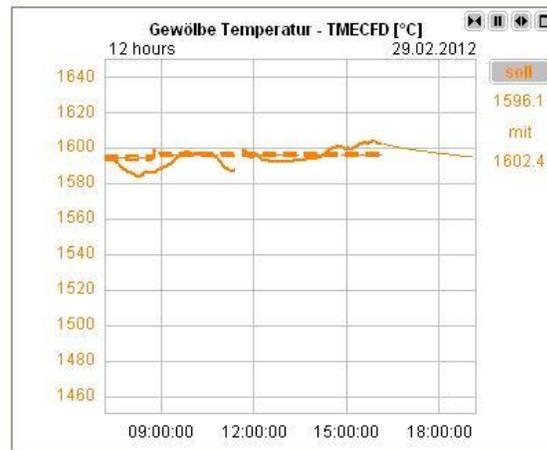
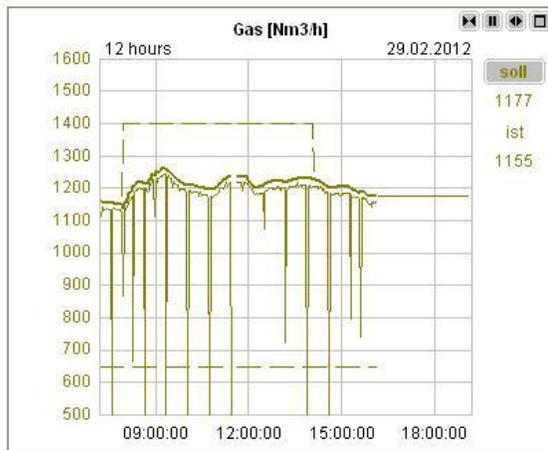
## Boosting

## Cullet Ratio

## Pull



# Model-based predictive control



Past furnace states are included into the calculation

If a prediction doesn't match the set points, input parameters will be changed

## Regelung

|              |       |
|--------------|-------|
| Temperaturen | Aktiv |
| Min. Energie | Aktiv |
| Min. Kosten  | Aktiv |
| Energie OK   |       |

## Einstellungen

|                    |
|--------------------|
| Vorkonditionierung |
| Sollwert           |
| Planung            |

## Sicherheit

|                         |         |
|-------------------------|---------|
| Kontrollersabschaltung  | OK      |
| Sicherheitsabschaltung  | OK      |
| Daten Fehlerabschaltung | OK      |
| Begrenzung              | Meldung |
| Prognose                | Meldung |

## Visualisierung

|                      |
|----------------------|
| Beheizung            |
| Gewölbe Temperaturen |
| Glas Temperaturen    |
| Einstellungen        |
| Überwachung          |

## ESIII Status

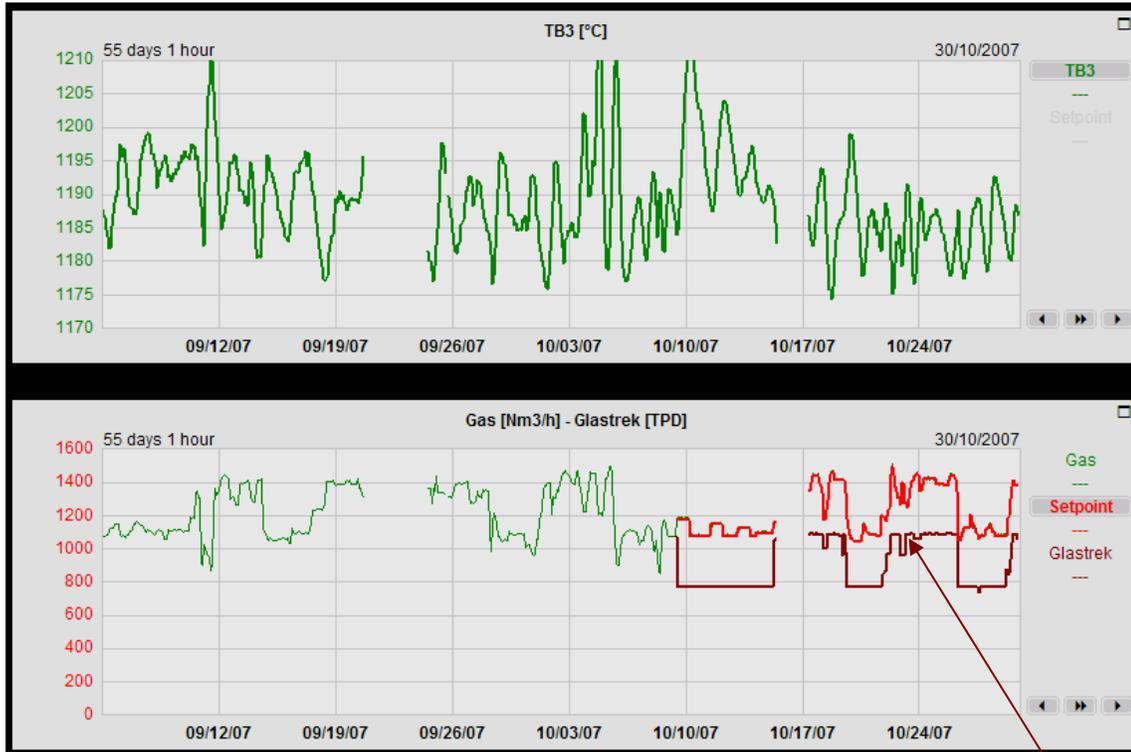
|                  |        |
|------------------|--------|
| Kommunikation    | Aktiv  |
| Komm. Booster    | Aktiv  |
| ESIII System     | Bereit |
| ESIII Regelung   | Ein    |
| Nächster Schritt | 167    |

## Wanne 2

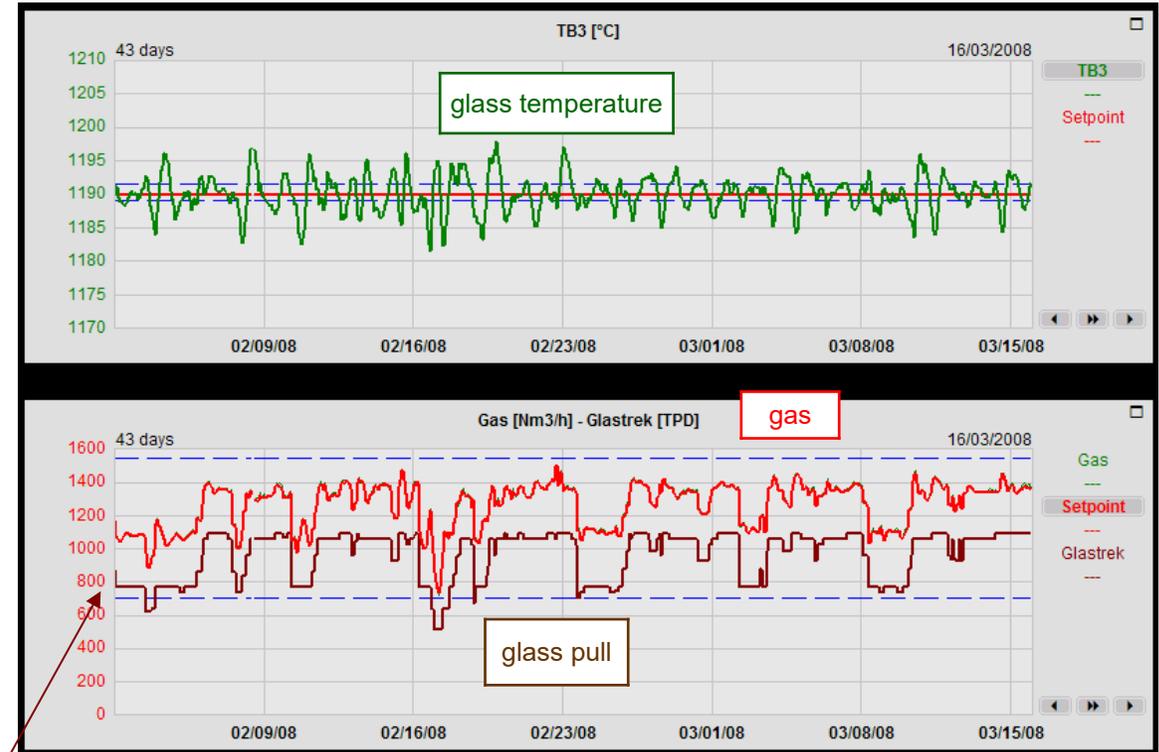
29.02.2012  
16:11:46  
Model 16h

# Expert System III increases the temperature stability

## Operator Control



## ESIII™ Control



Changes in furnace glass pull ('Glastrek')  
Most frequent pulls 144 tpd (line D closed) and 204 tpd (max. pull)

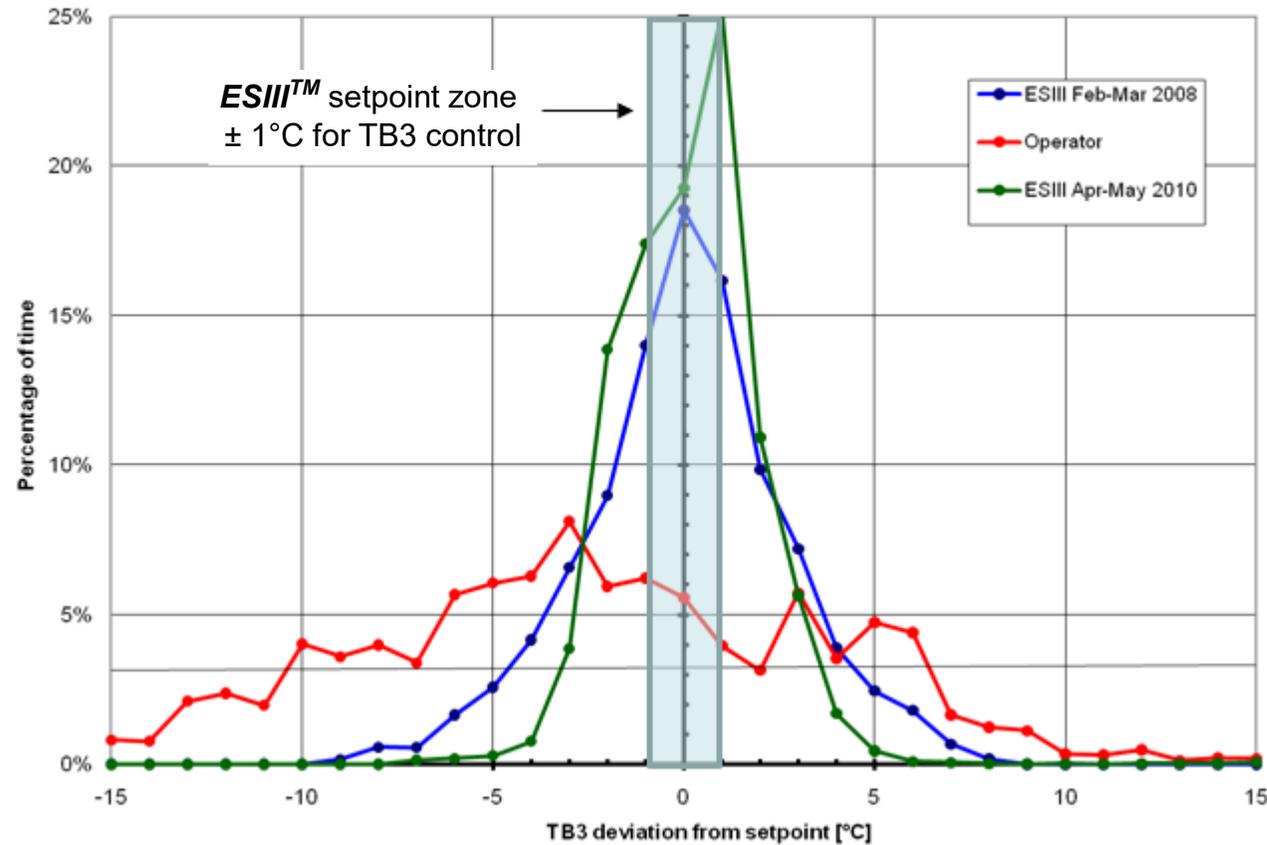
Evaluation period:  
05.09.2007 – 09.10.2007 and 18.10.2007 – 31.10.2007  
(ESIII pretest and missing data periods excluded)

**Total 43 days**

Evaluation period:  
02.02.2008 – 16.03.2008

**Total 43 days**

# Temperature stability



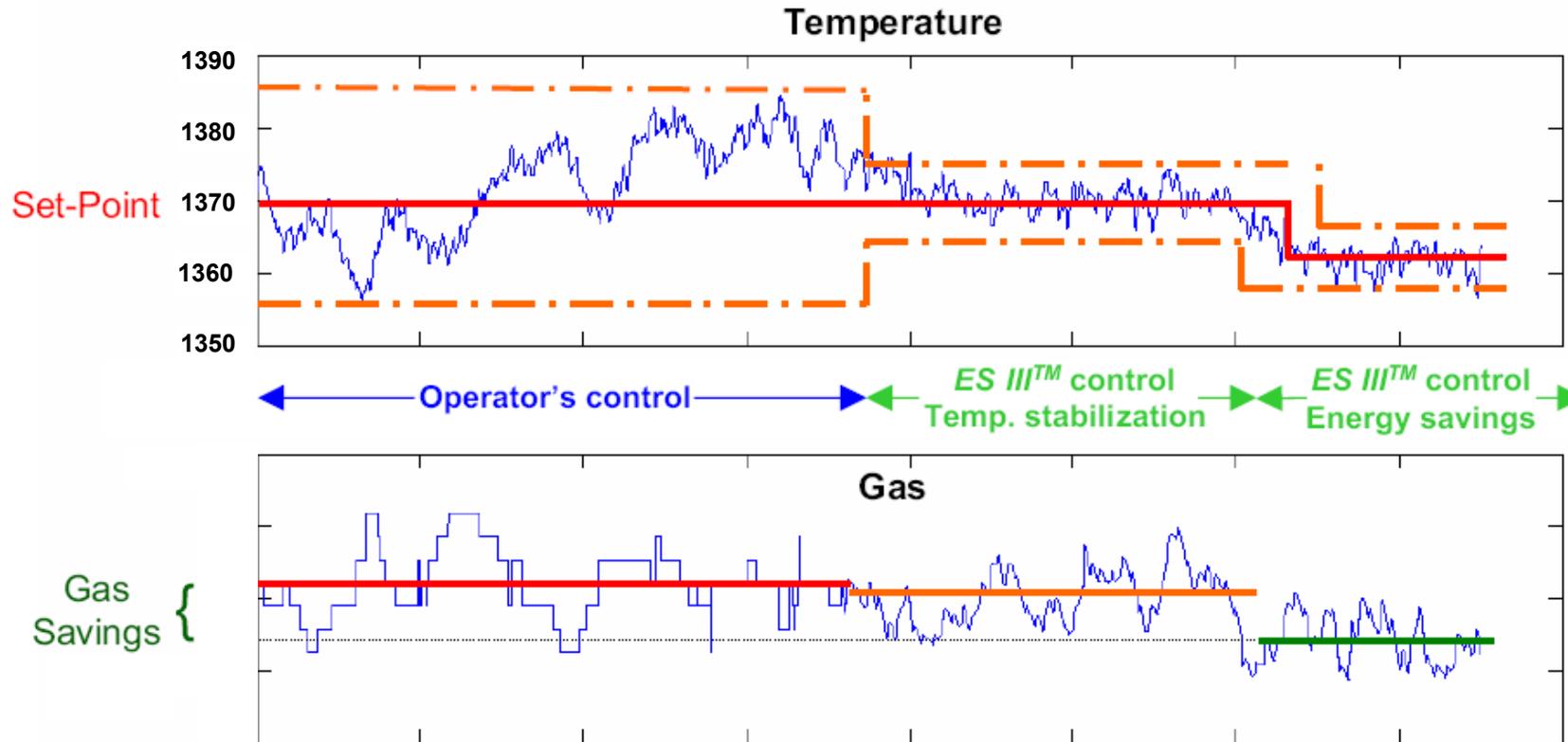
Data sample 2 months

**ESIII™ was in control for 96% of the time**

| TB3 tolerance | Operator | ESIII™ (old furnace) | ESIII™ (new furnace) |
|---------------|----------|----------------------|----------------------|
| ± 2 °C        | 19.6%    | 64.8%                | 74.4%                |
| ± 4 °C        | 44.5%    | 91.6%                | 97.4%                |

Percentage of time TB3 is within tolerances ± 2 °C and ± 4 °C during entire process control, including pull changes

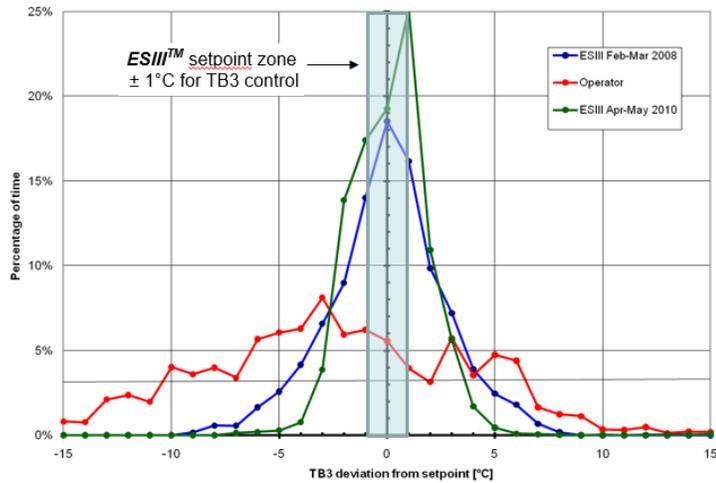
# How to save energy with *ESIII*<sup>TM</sup> process control?



Glass temperature stabilization can be used to save energy by reduction of production temperature setpoint

*Operate furnace at lower temperature, but keep above critical limit to prevent glass defects*

## Temperature Stability



Process stability

## Energy Savings



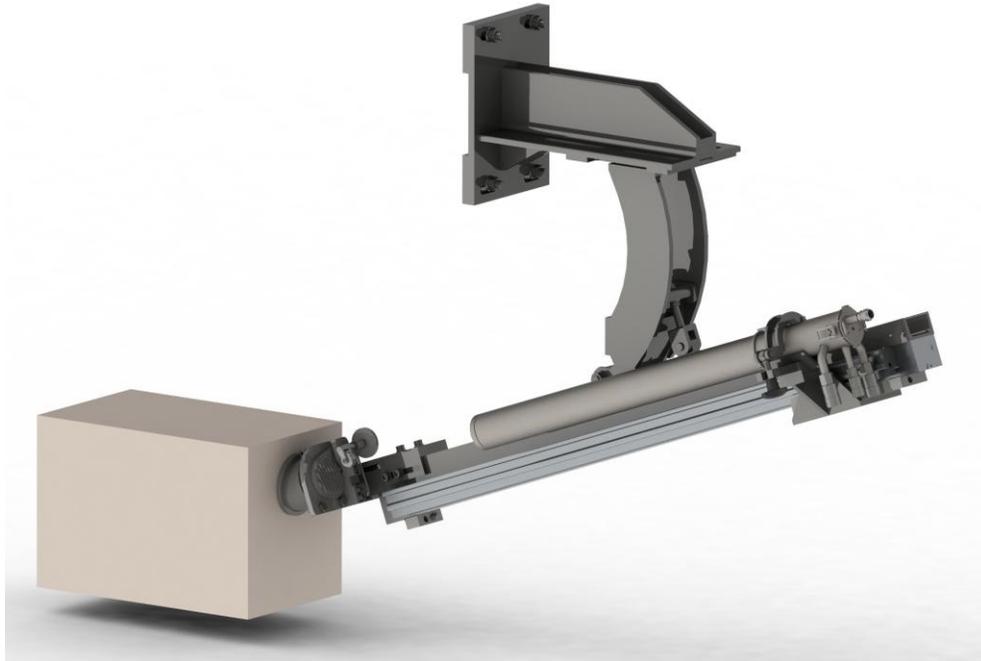
Lower emissions

Savings: 2 – 4% (150k – 400k€)

## 425 Installations

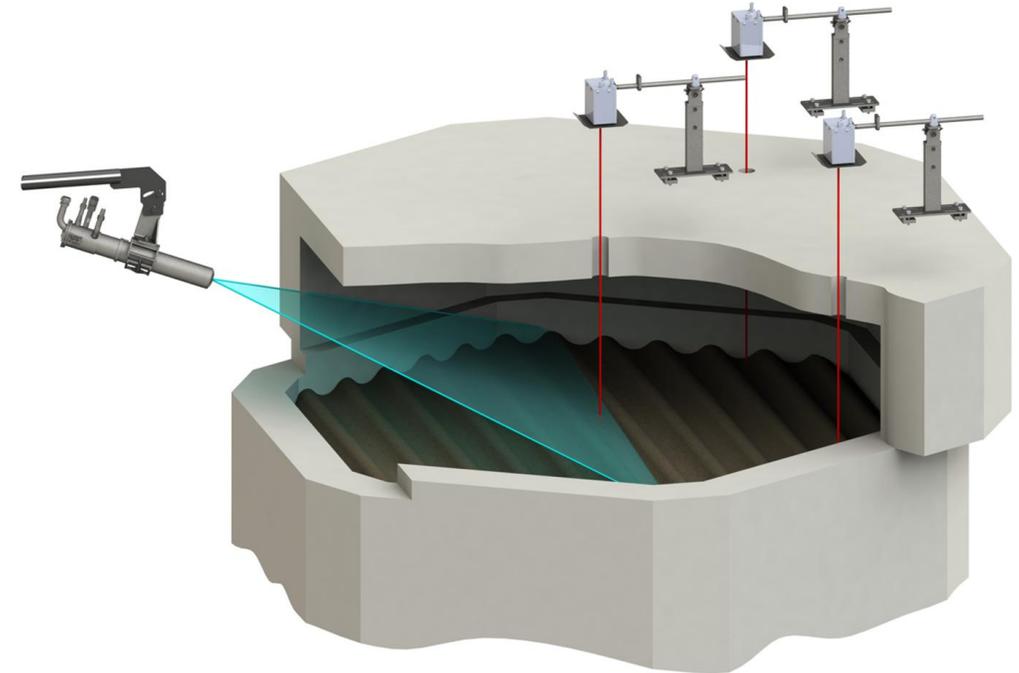


## Furnace Monitoring System



5 MP Near-Infrared Camera  
Temperature Measurements  
AI Batch Monitoring (Coverage, Movement)

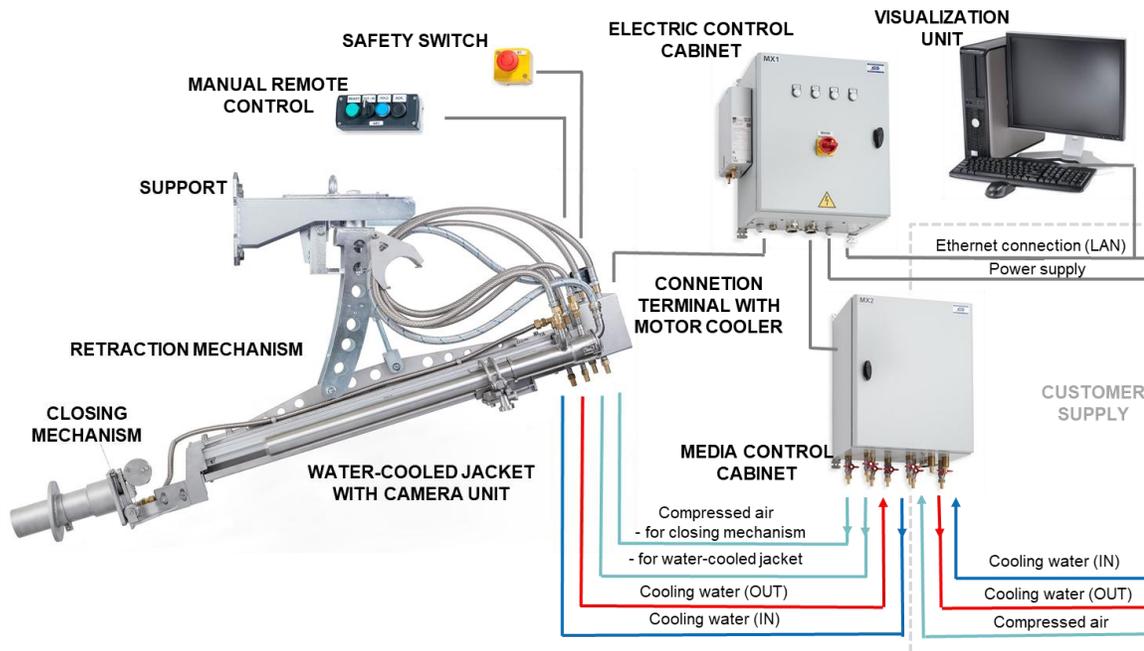
## Batch Blanket Monitoring System



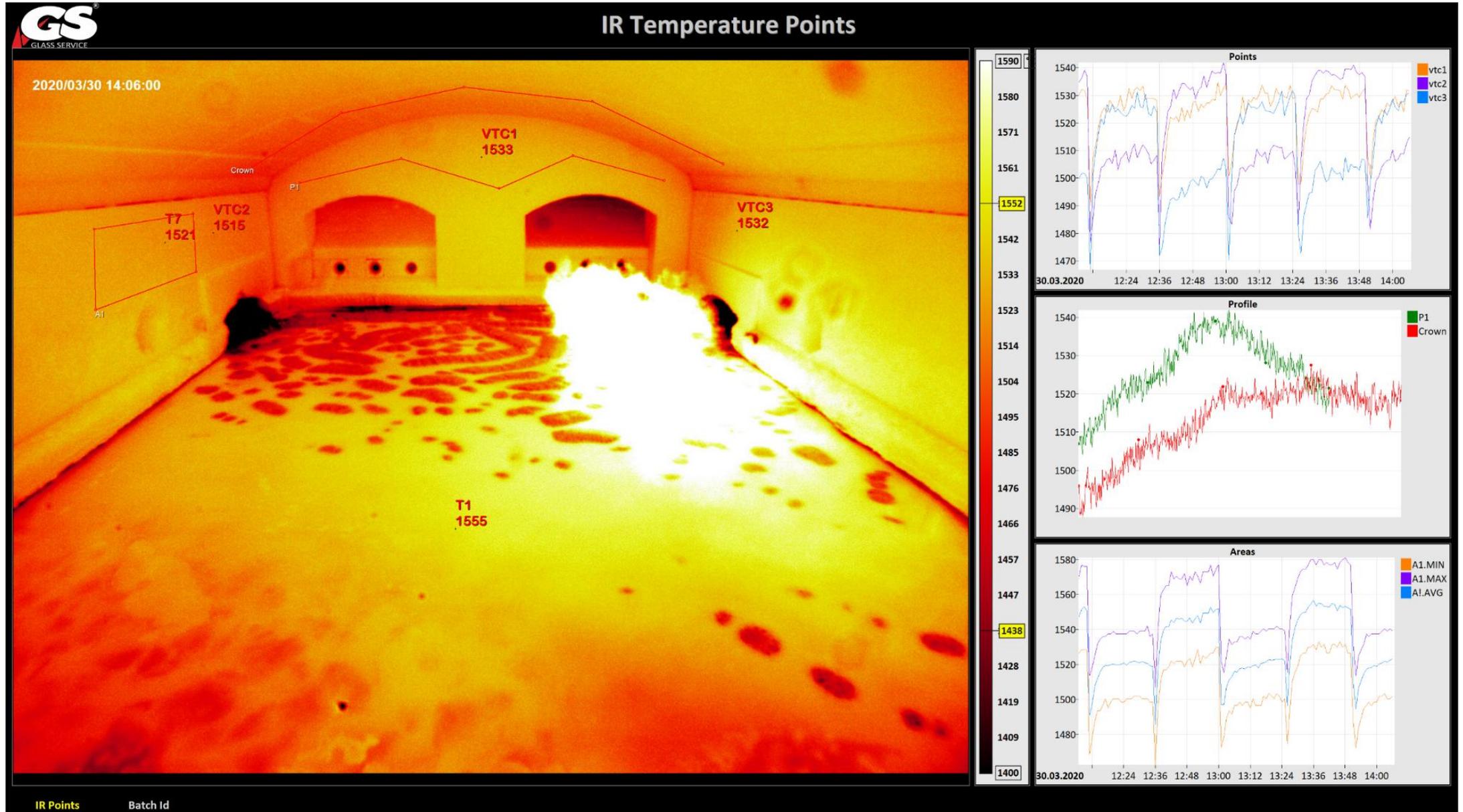
Batch blanket measurement in all-electric furnaces  
Integration into ESIII control

# Near infrared camera (NIR)

- Highest resolution (5 mega pixel) camera for batch monitoring
- Possible to connect to furnace control (PLC / SCADA, **ESIII**)
- High-quality stainless steel jacket construction (1600°C max)
- Lens cleaning by air nozzles at the front of the jacket
- AI (Neural network) Image Software



# Temperature measurement



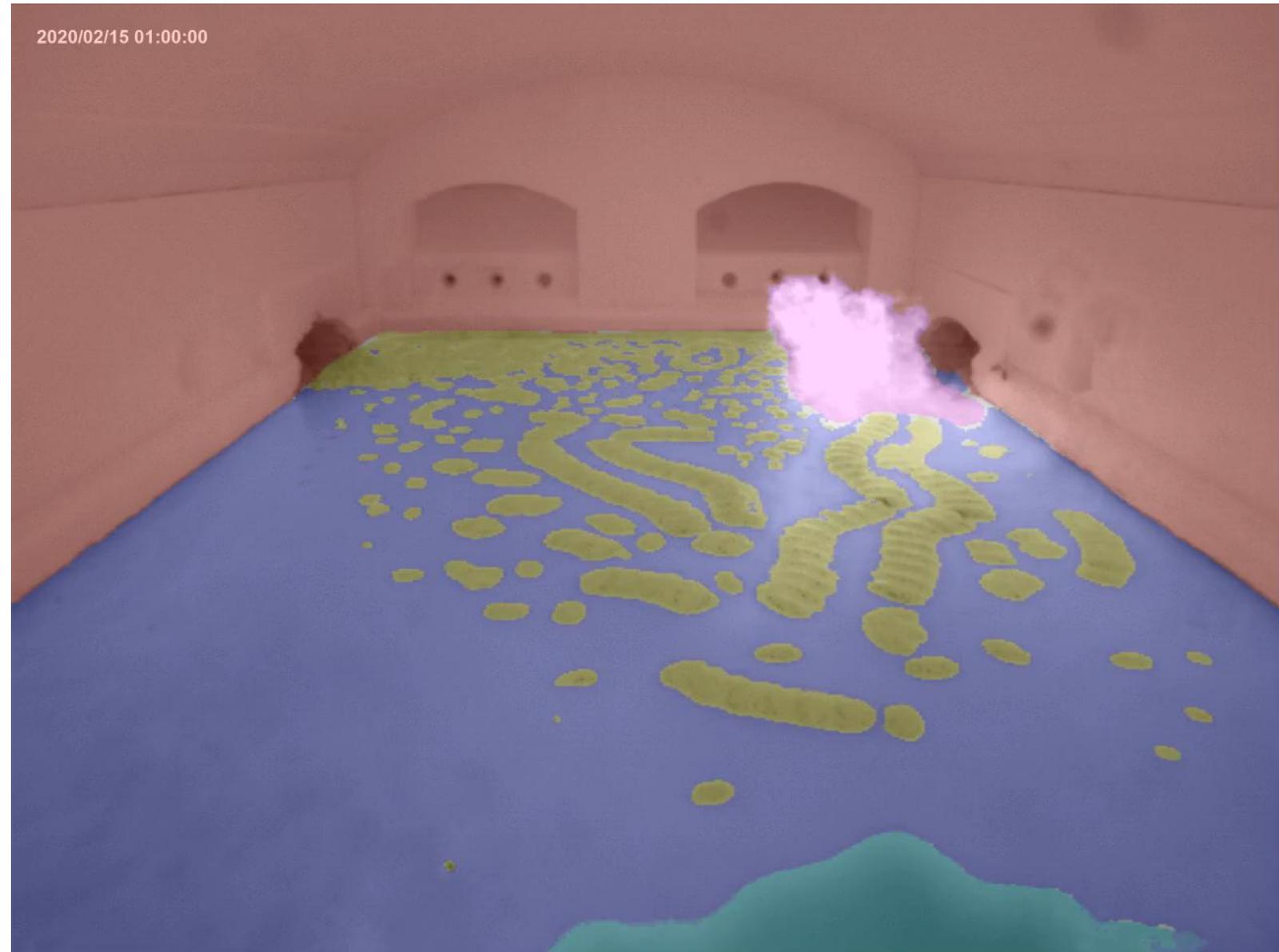
Batch Islands are Identified in yellow

Flame is identified Dynamically

Glass Surface is shown as blue

Refractory show as orange pink

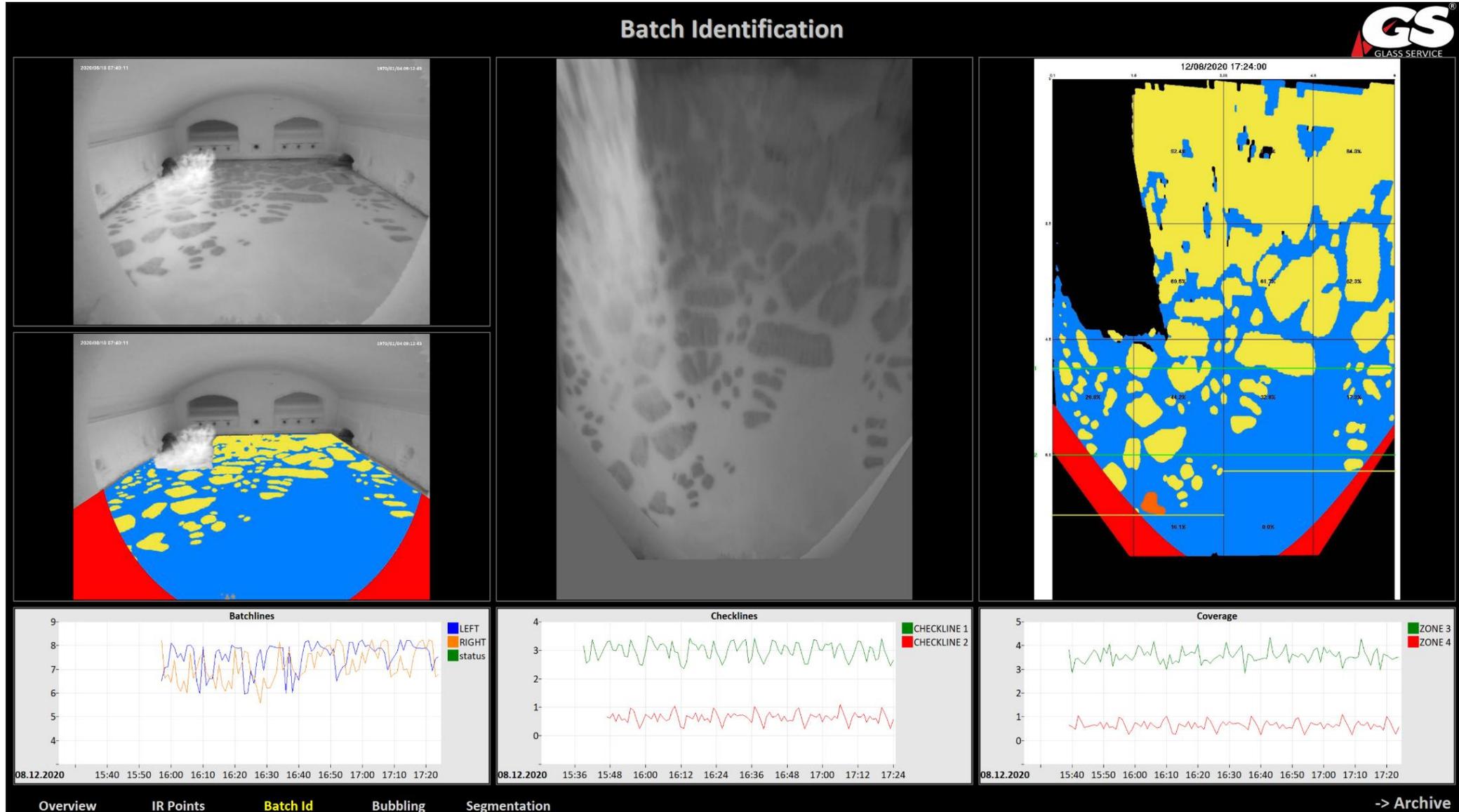
Camera buildup Show in green



# AI Batch Monitoring Module container glass

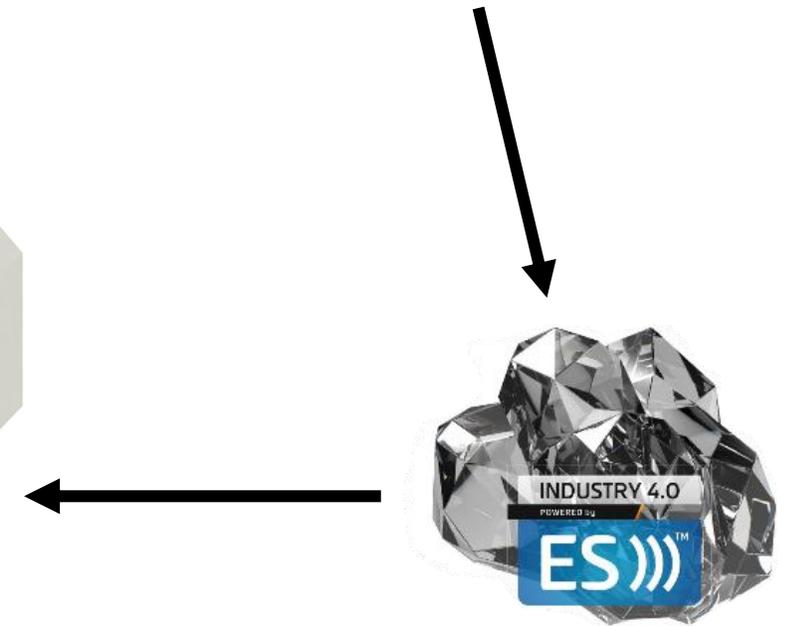
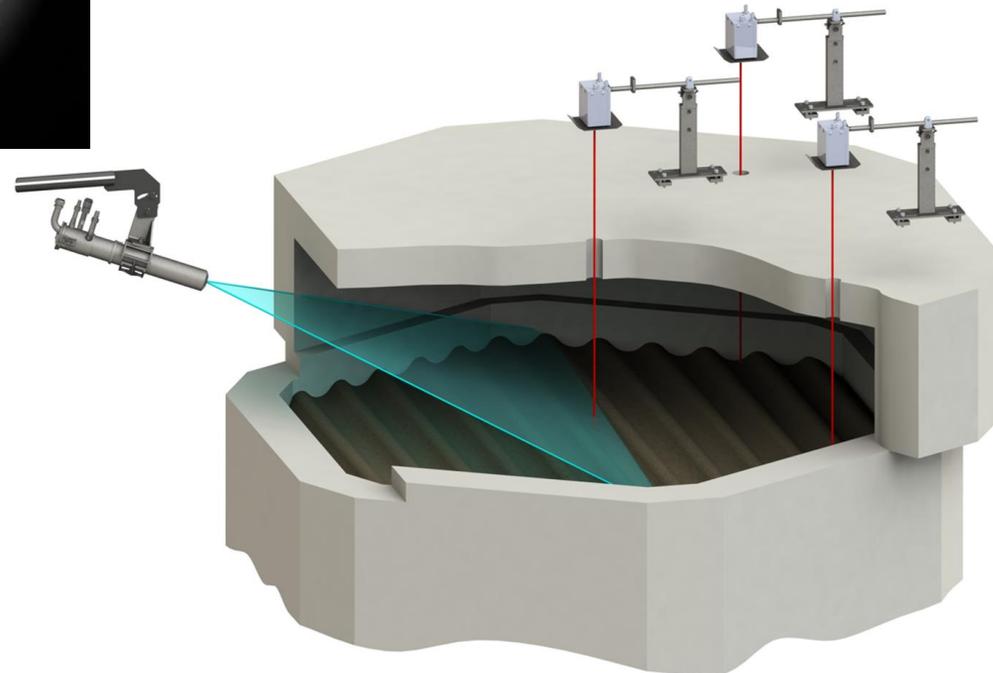
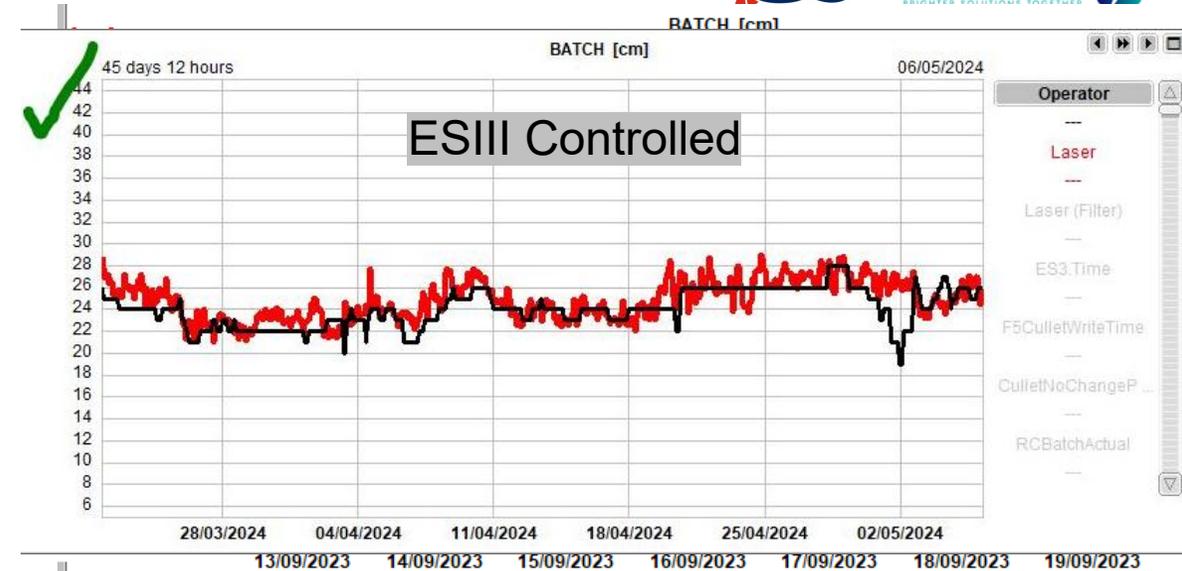


## Glass/Batch Coverage with Historical Trends



# Batch Blanket Monitoring System

Solution for all-electric furnaces



## Take home message



- *ESIII* helps to stabilize the melting process and save energy
- Advanced sensors are crucial to monitor the melting process

# Meet us at Booth D-12





# | Thank you!

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