

LATEST INNOVATIONS ON GLASS MELTING TECHNOLOGY

SEBASTIAN GALLENBERGER

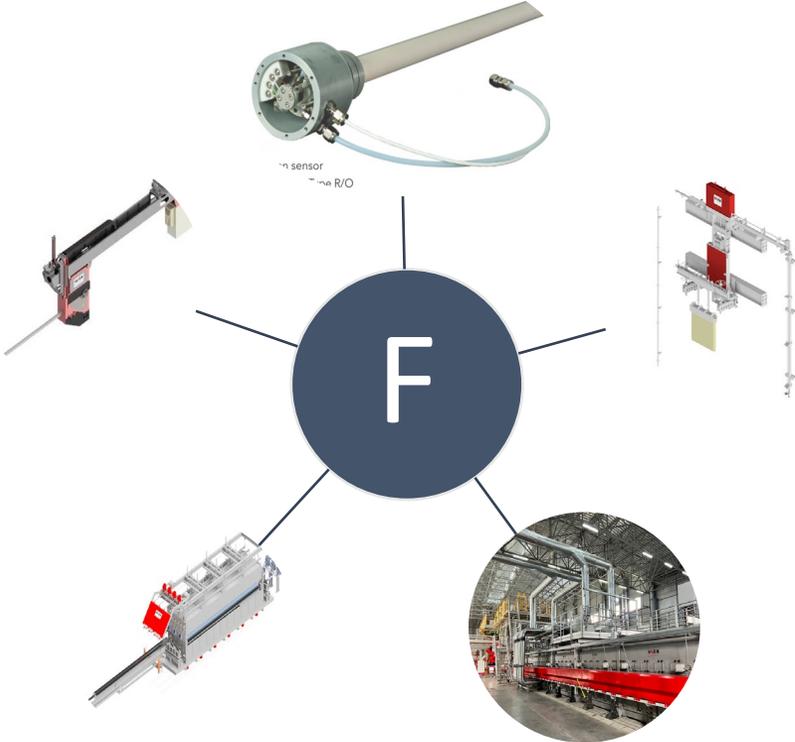
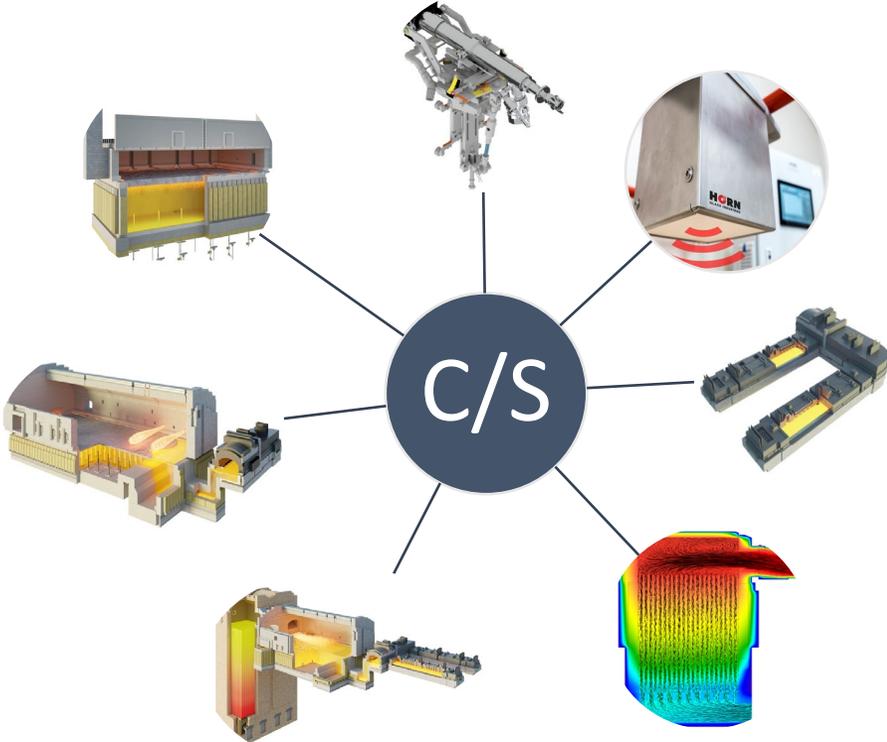
SEPTEMBER 2023

HORN
GLASS INDUSTRIES



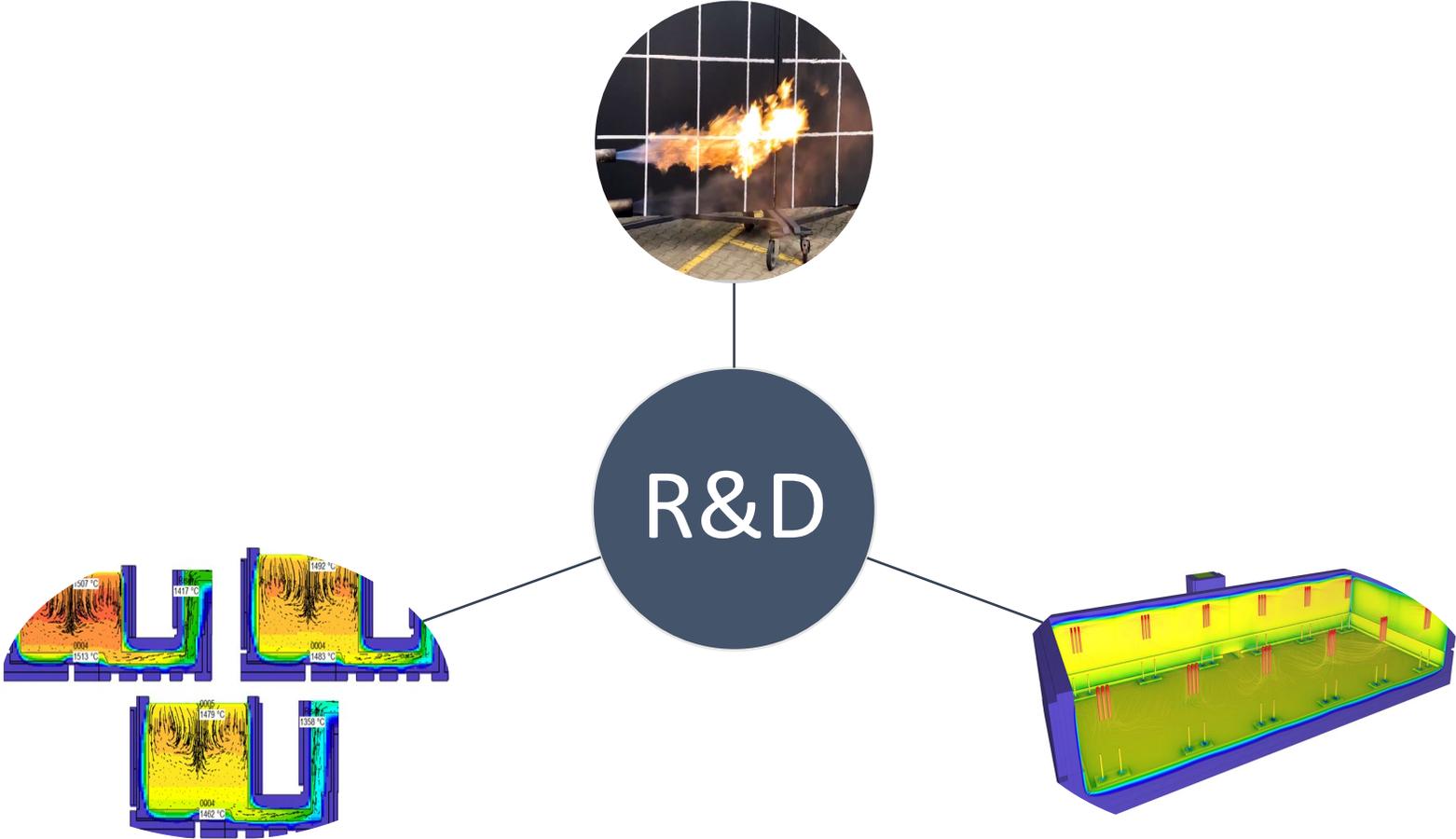
CONTENT

LATEST INNOVATIONS



CONTENT

R&D PROJECTS



WHO WE ARE

HORN is a medium-sized company with many years of experience in **planning, manufacturing and building glass melting furnaces** as well as **turn-key glass plants**.



LATEST INNOVATIONS

HORN RAPID ADJUST BRACKET H-RAB

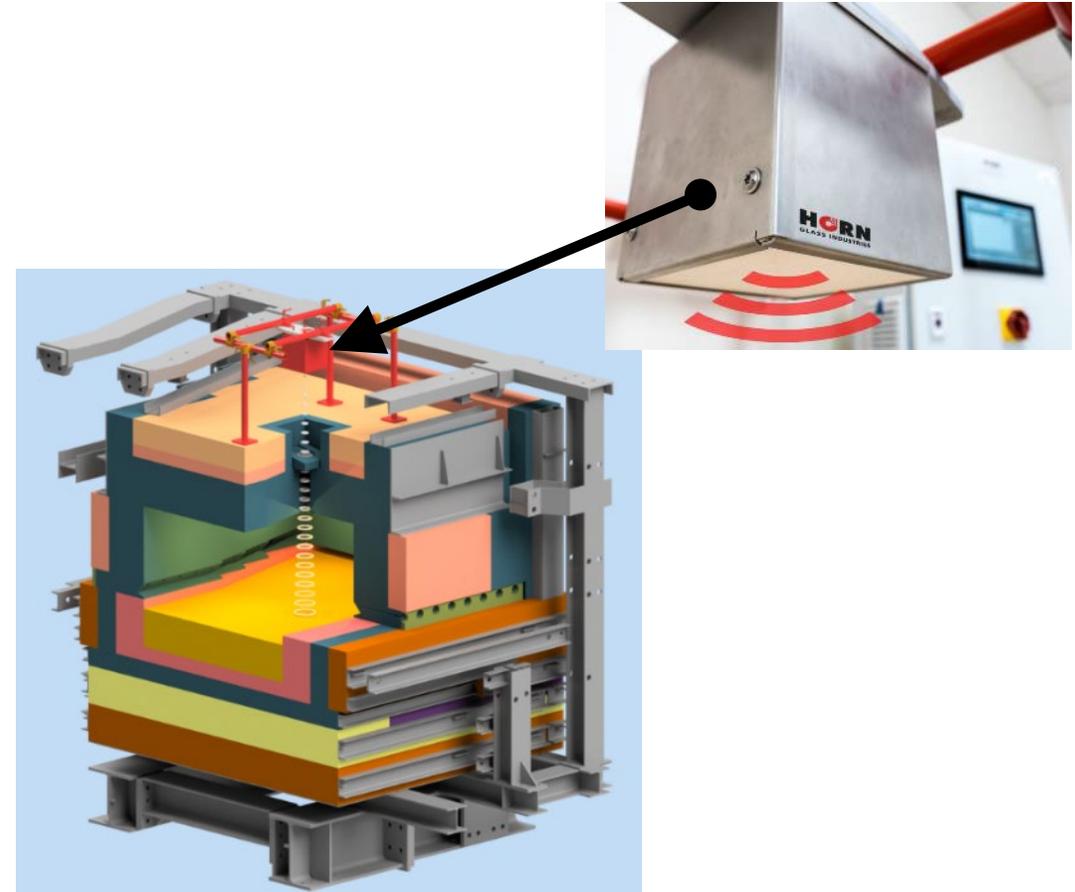
- Adjustment of the horizontal and vertical angle with built-in burner
- The holder forms a unit with the sealing plate which leads to less false air intake
- Time savings of approx. 1 hour per furnace per day due to quick reproducible burner setting after cleaning
- Up to 1.5% energy savings due to quick reproducible burner settings and less false air
- bracket usable on non-HORN furnaces



LATEST INNOVATIONS

NEW CONTACTLESS GLASS LEVEL MEASUREMENT SYSTEM

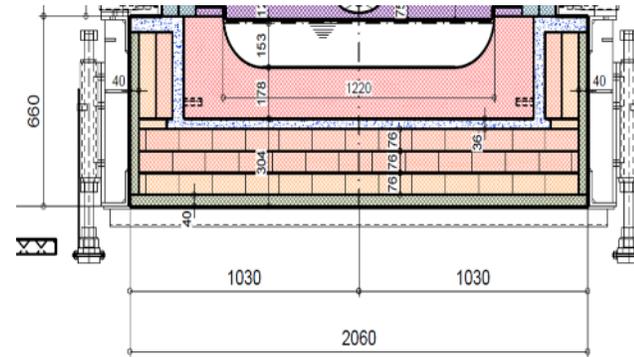
- Works with RADAR waves (60 GHz)
- Distance calculated based on time measurement
- Simple opening for measurement in the distributor crown, closed by a special ceramic tile
- Easy installation of the system; no welding necessary
- Minimum maintenance effort
- No special housing / safety fences etc. necessary (as for radioactive measurement)
- No influence by cooling air



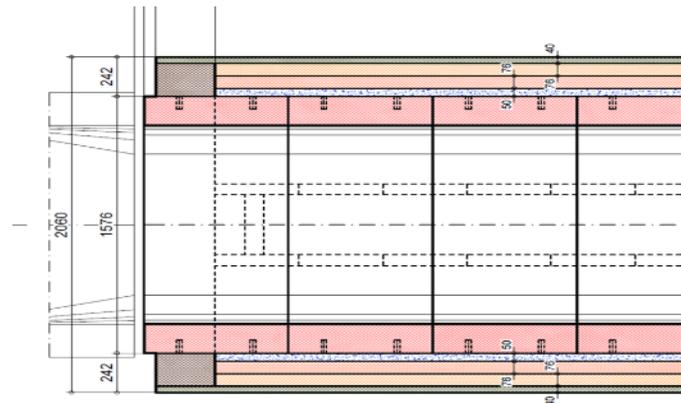
LATEST INNOVATIONS

FOREHEARTH GCS SERIES 301-ADVANCED

 Improved side wall and bottom insulation → reduced heat loss → **Reduced energy consumption + Better THI**



Channel Block
 Ramming Mix
 2x ISO 130 – 0,8
 ISO 125 – 0,5
 Microporous insulation

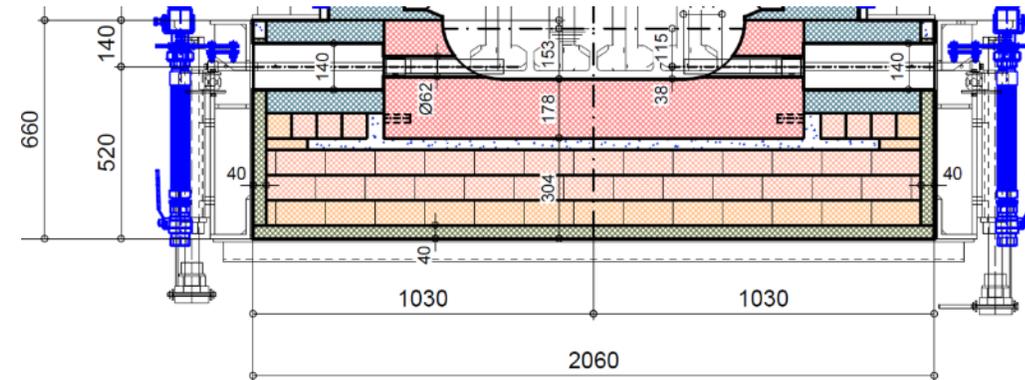


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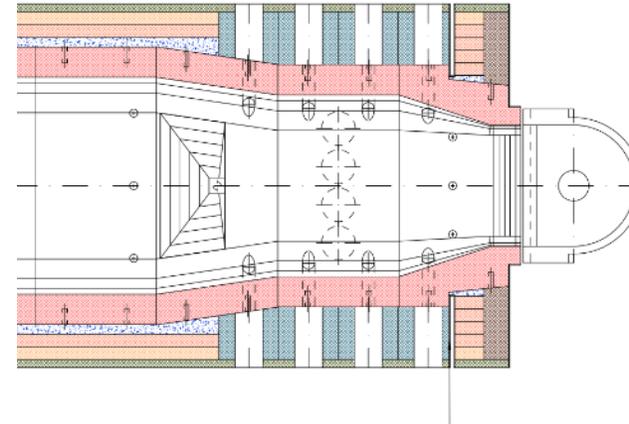
- Improved side wall and bottom insulation → reduced heat loss → **Reduced energy consumption + Better THI**
- Revised position of the electrodes → Better energy input into cold corners → **Better THI**



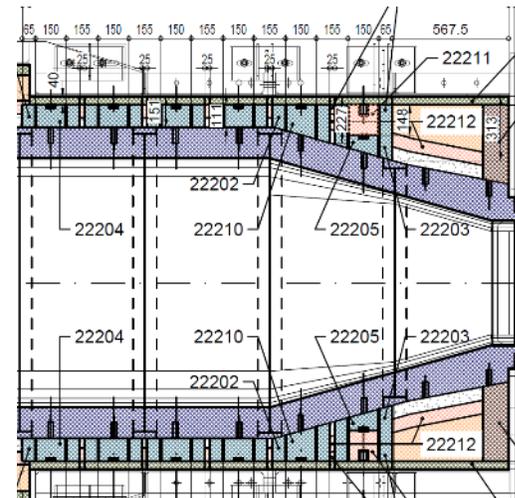
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FOREHEARTH GCS SERIES 301-ADVANCED

- Improved side wall and bottom insulation → reduced heat loss → **Reduced energy consumption + Better THI**
- Revised position of the electrodes → Better energy input into cold corners → **Better THI**
- Improved design of the EQZ channel blocks → Better glass flow → **Better THI**



NEW

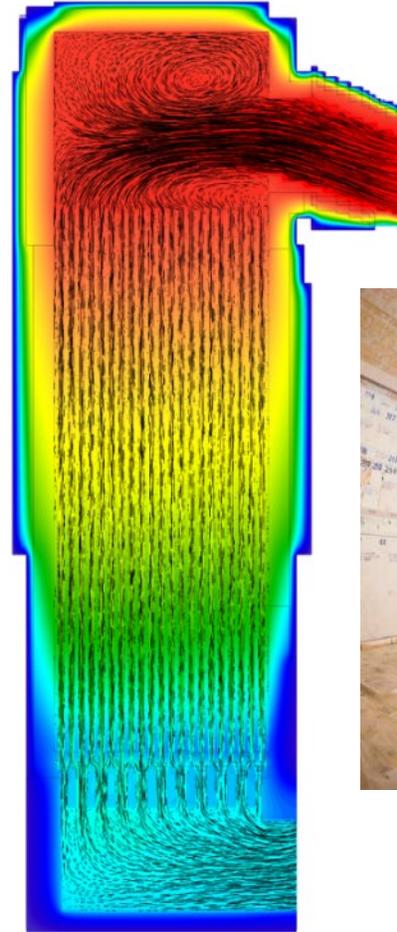


OLD

LATEST INNOVATIONS

ECO END FIRED FURNACES < 3 GJ/TO (<717 KCAL/KG)

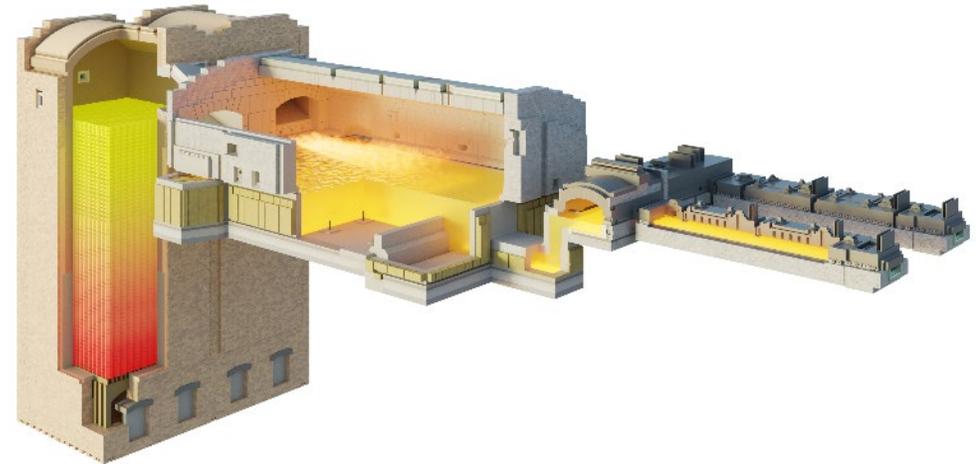
- 🔥 Lowest energy consumption
- 🔥 Cullet share >85%
- 🔥 Bottom boosting >10% with double electrodes
- 🔥 HORN pusher batch charger with semi-closed doghouse and batch pile creation
- 🔥 Advanced insulation concept for furnace/regenerator
- 🔥 Optimized design of regenerator / port neck / superstructure / glass bath



LATEST INNOVATIONS

HYBRID FURNACES – FOSSIL / ELECTRICAL

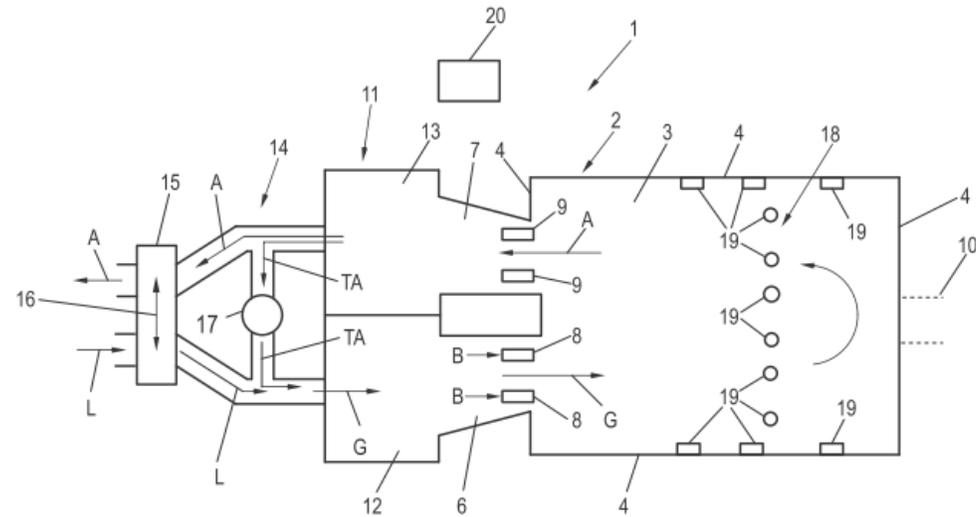
- Based on proven technology
EFF / OXY / RECU
- Security of invest



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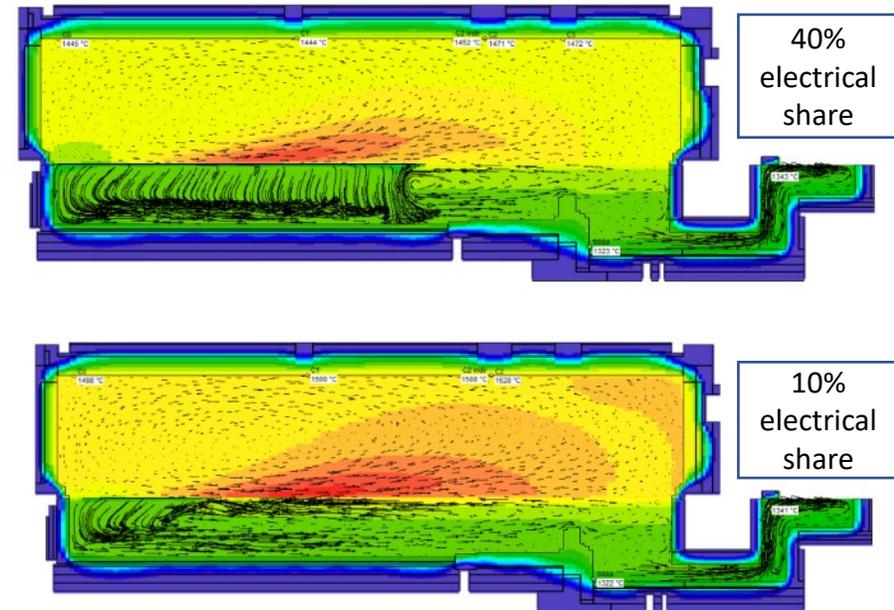
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- Partial recirculation of waste gases into combustion air (about 20% recirculation)
- Recirculation dilutes the air > less flame temperature > less NOx emissions



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temperature > less NOx emissions
- Electric power share 20% up to 40% @ EFF
up to 50% @ OXY /
RECU



LATEST INNOVATIONS

SUPER HYBRID FURNACES – 50 - 80% ELECTRICITY

- 🔥 Cross fired Gas-Oxy or Gas-Air with Recuperator
- 🔥 Electrical share: 50% < > 80%
- 🔥 Electrical share:
 - a) flexible: with one common superstructure
 - b) fix: with two separated superstructures
- 🔥 Pure Silica or Jargal crown



LATEST INNOVATIONS

JSJ - ALL ELECTRIC FURNACES FOR CAPACITY UP TO 200 T/D

- 🔥 Top electrode technology in combination with bottom electrodes
- 🔥 Rectangular furnace:
 - > even distribution of glass convection below the batch layer
 - > higher temperature gradient bottom-top
- 🔥 Easy paving of metal line
- 🔥 Pull flexibility 70-100 %
- 🔥 Cullet content up to 60% (if not fine)
- 🔥 Simple furnace expansion to the sides



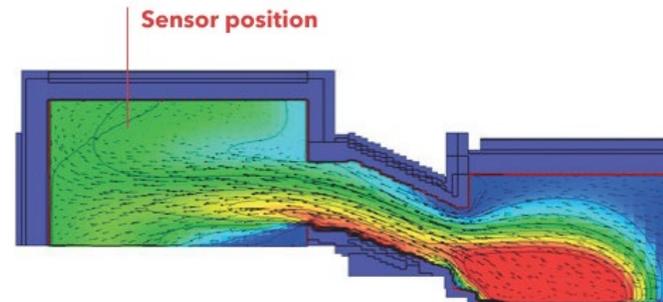
LATEST INNOVATIONS

EUROX – OXYGEN MEASUREMENT SYSTEM

- Direct measurement
- > EFF / CFF / OXY / RECU



Oxygen sensor
Type REG / Type R/O



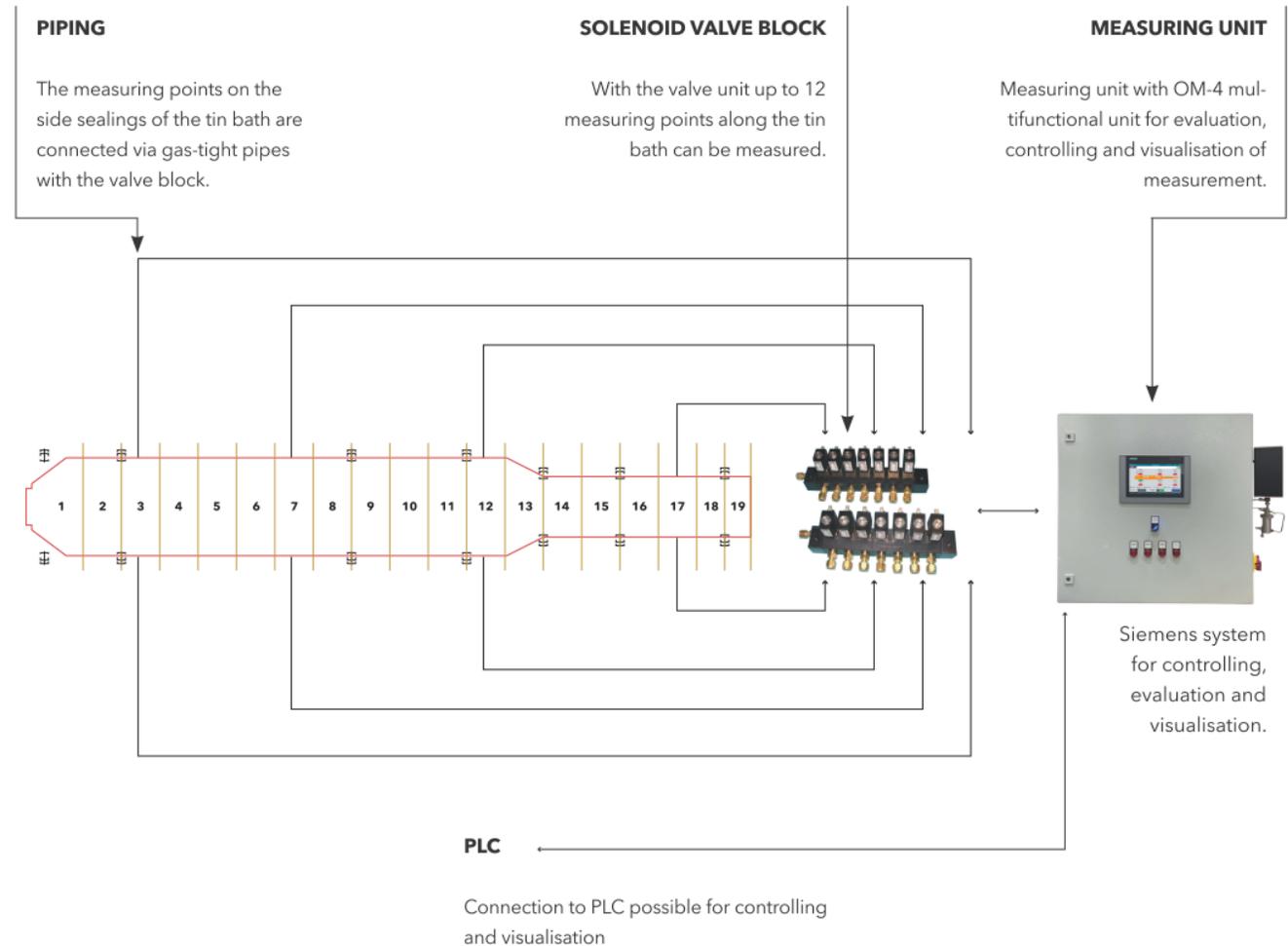
Modelled oxygen distribution in flue gas stream

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 - > EFF / CFF / OXY / RECU

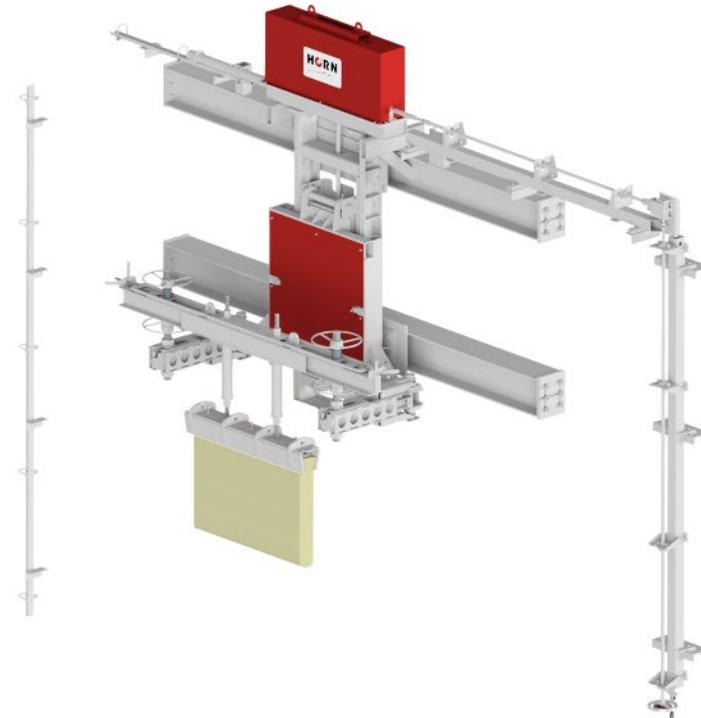
- Extractive indirect measurement
 - > Forehearth atmosphere control
 - > Tin bath atmosphere control



LATEST INNOVATIONS

TIN BATH AND TIN BATH EQUIPMENT

- 🌀 Suspended tveel
 - > suspended from top gives free access to spou



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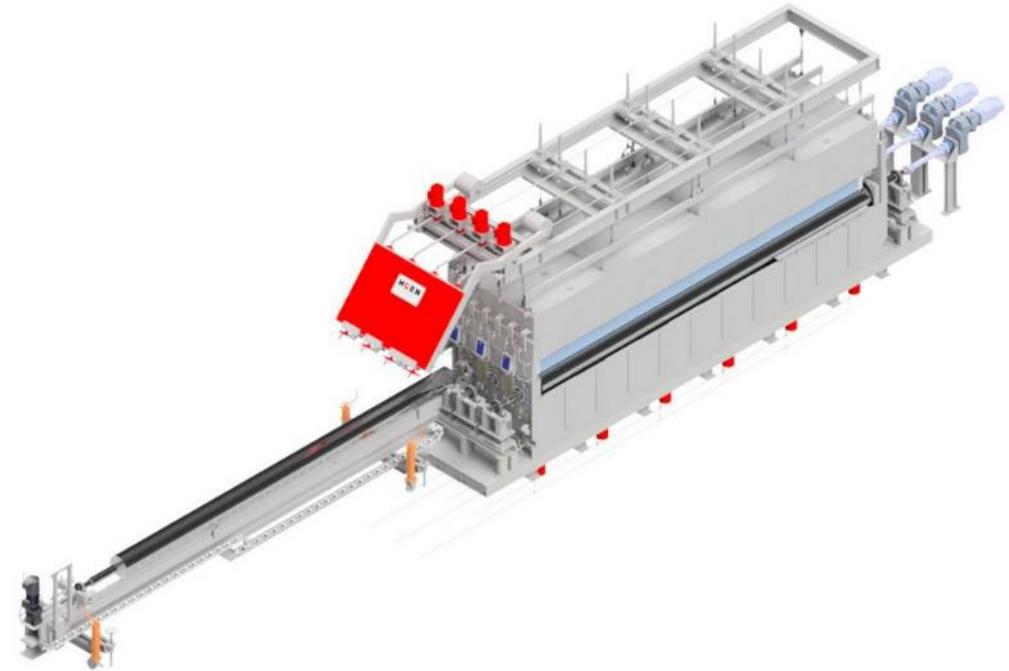
- 🌀 Suspended tweel
 - > suspended from top gives free access to spout lip
- 🌀 Top Roller



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TIN BATH AND TIN BATH EQUIPMENT

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> suspended from top gives free access to spout lip
- 🌀 Top Roller
- 🌀 Drossbox



LATEST INNOVATIONS

ANNEALING LEHR



R&D PROJECTS

HYDROGEN FIRING TECHNOLOGIES

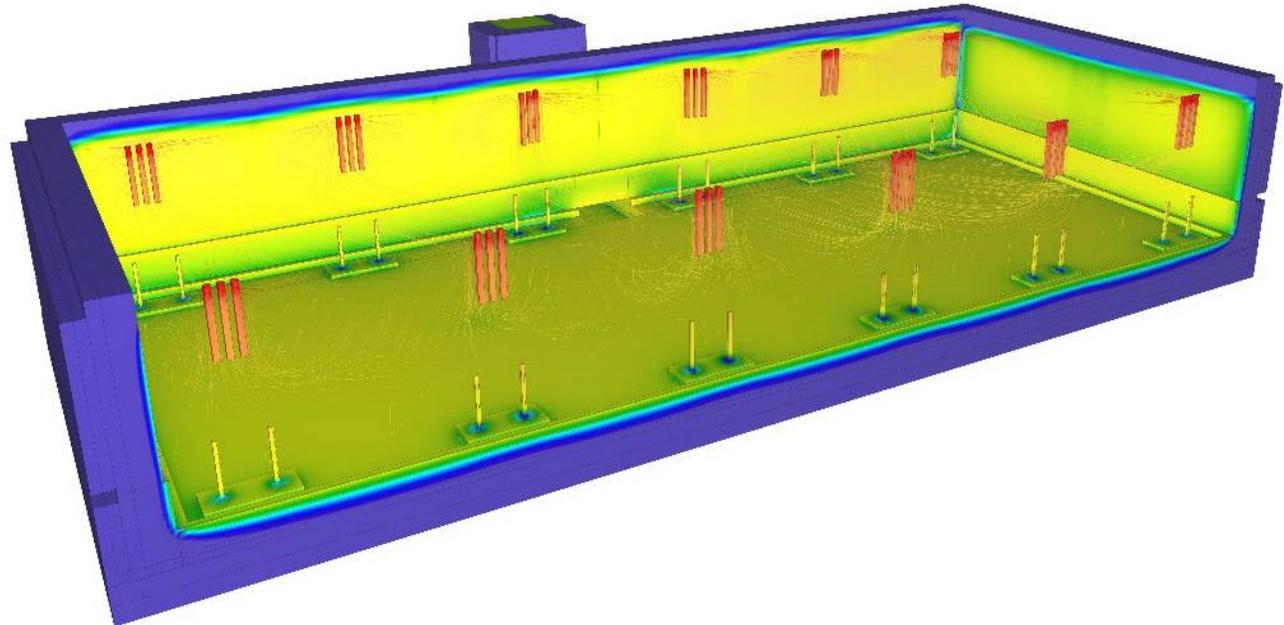
- 🔥 Study covering influences on combustion technology, glass chemistry, refining mechanism, refractories and emissions
- 🔥 Green alternative to electrical heating to reduce CO₂



R&D PROJECTS

ALL-ELECTRIC FURNACES FOR LARGE CAPACITIES >200 T/D

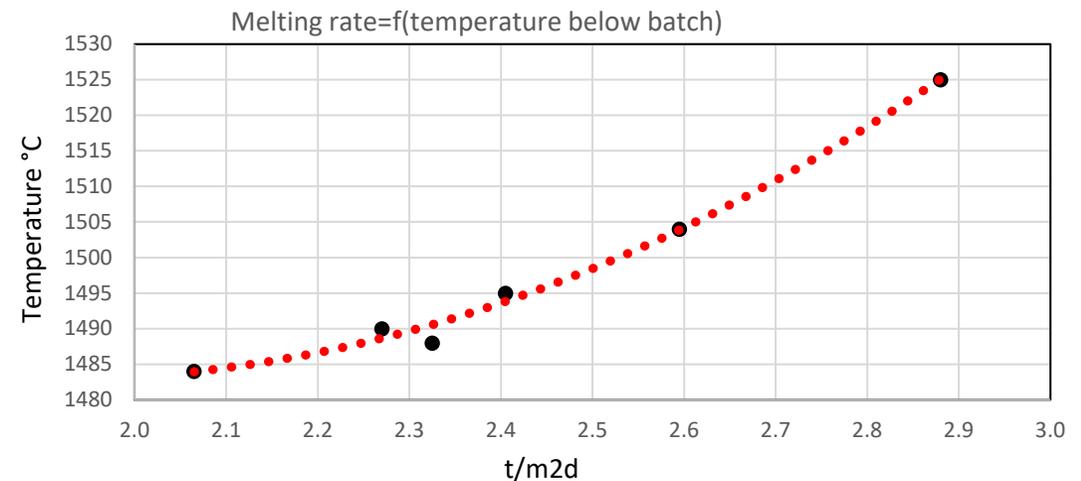
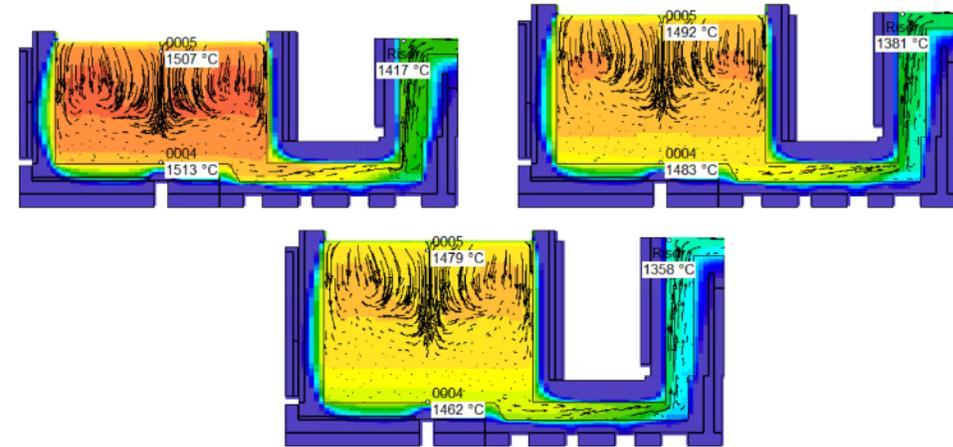
-  Melting Capacity >200 tpd
-  High cullet share >60%
-  Green, Amber



R&D PROJECTS

HIGHLY FLEXIBLE ELECTRIC FURNACE

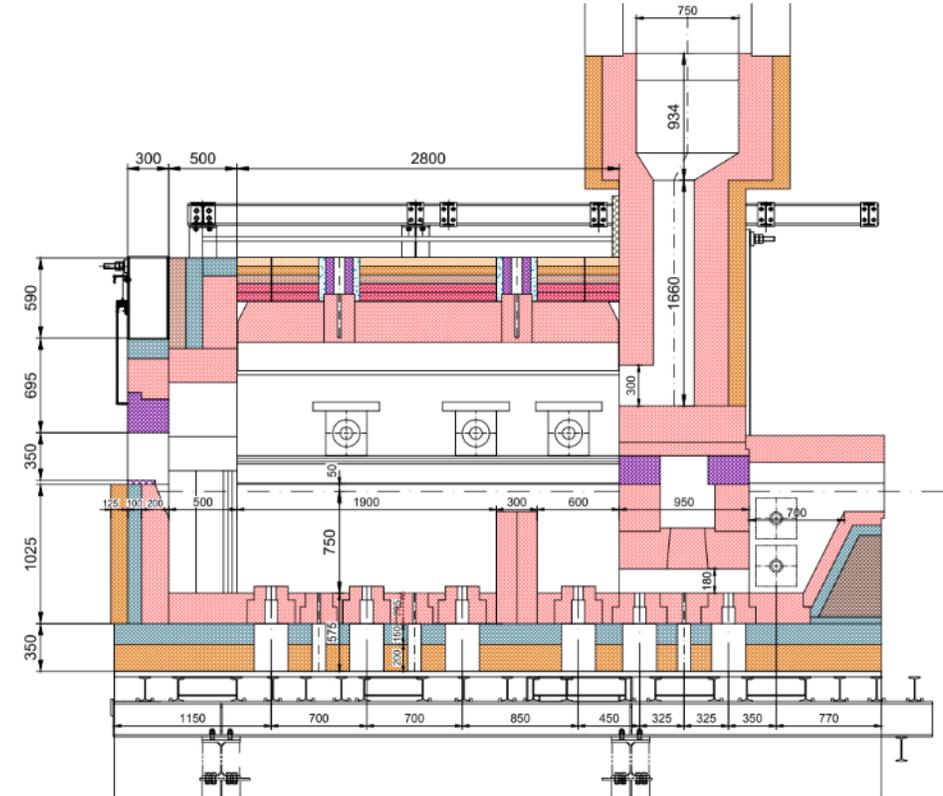
- Flexibility of melting rate up to 50% (now only 30%)
- Increase of lifetime up to 8 years
- Pull change of 10%/day
- Design criteria: critical trajectory is a function of temperature and residence time



R & D WITH UNIVERSITIES

ZERO CO2 - EMISSION FREE GLAS MELTING

- 🔥 H2/O2 heating for furnace and forehearth
- 🔥 Boosting up to 80%
- 🔥 CO2 free raw material
- 🔥 Reduced alkaline content in the glass
- 🔥 Submerged charging
- 🔥 Construction mid 2024 with project partners:



Forschungspartner



Department of Glass and Glass-Ceramic



- Hohe Forschungsexpertise im Bereich der Glas- und Schmelztechnologie
- Enge Verknüpfung Grundlagenforschung und industriellem Anwendungsbezug



Institut für Industrieofenbau und Wärmetechnik



- Hohe Forschungs- und Industrieexpertise im Ofenbau und Wärmeübertrag
- Simulation und Modellierung

Technologiepartner



IPGR @ RWTH Aachen University



- Offizielles An-Institut der RWTH seit 2019, Lehrstuhl für Glas und Glaskeramik
- Forschungsinstitut im Bereich Verpackungsglas, est. 1984
- Koordinator des Projektkonsortiums
- Weltweite Vernetzung

Industriepartner



HORN GLASS INDUSTRIES

- Weltweit einer der führenden Großanlagen-Ofenbauer in allen Bereichen der Glasindustrie
- Technologieträger im Projekt



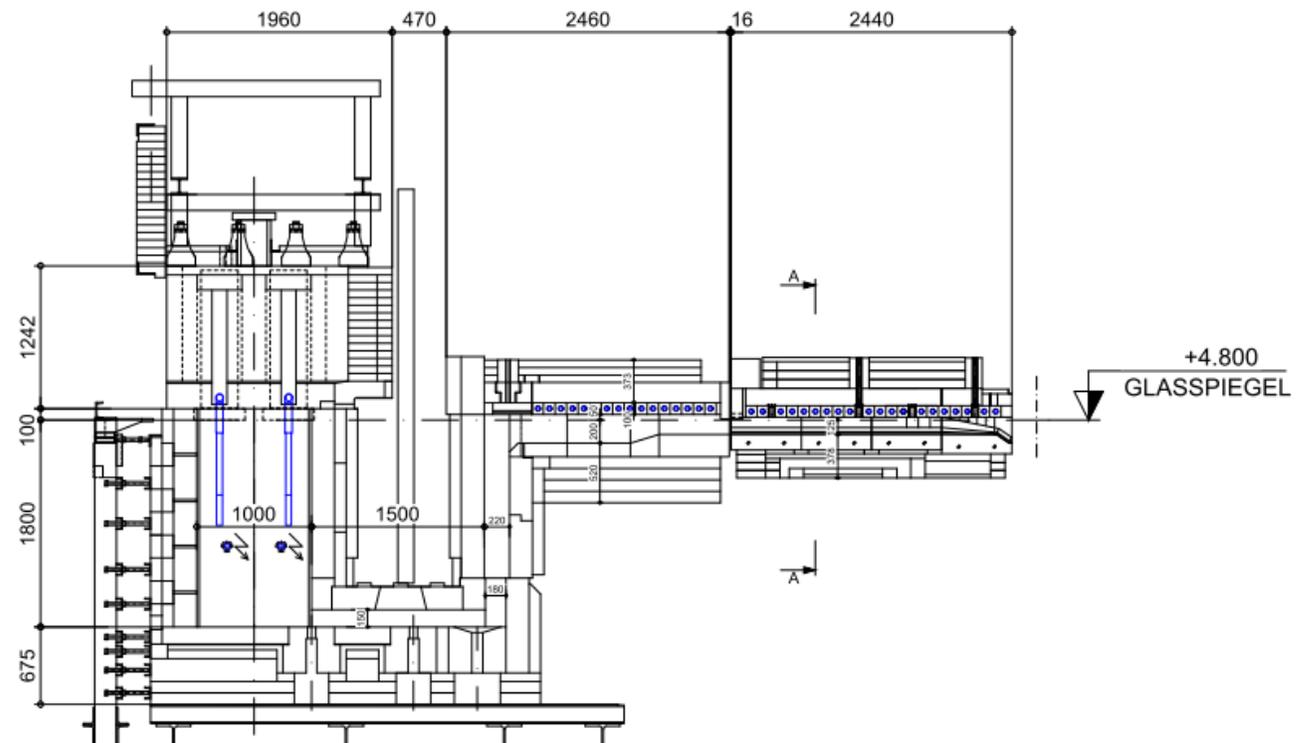
Wiegand-Glas

- D-weit einer der größten Verpackungsglasersteller, > 2,9 Mrd. Flaschen p.a.
- End-Nutzer der Technologie

R&D WITH UNIVERSITIES

GREENGLAS4.0 - HIGHLY FLEXIBLE ELECTRIC FURNACE

- 🔥 Cullet content up to 90%
- 🔥 Melting flexibility >50%
- 🔥 Melting of reducing colours
- 🔥 Increase lifetime
- 🔥 Direct electric forehearth for oxidized glasses
- 🔥 Increase lifetime of Mo electrodes
- 🔥 Construction late 2023 with Universities:
 - TH Deggendorf: Prof. Zimmermann
 - TU Bayreuth: Prof.-Dr. Gerdes
 - TH Nürnberg: Prof.-Dr. Wiltzsch



THANK YOU FOR YOUR
ATTENTION.

HORN
GLASS INDUSTRIES

JSJODEIT 
A MEMBER OF HORN®

