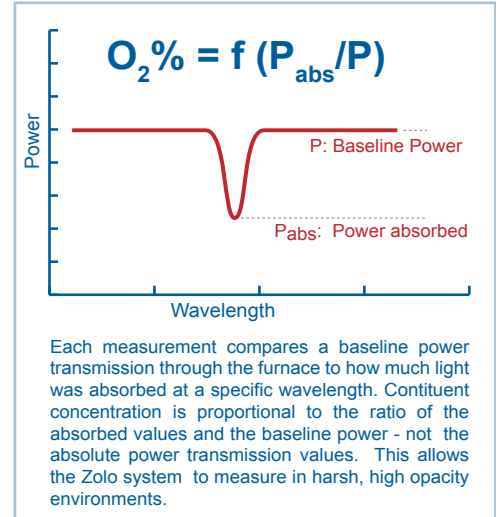


Combustion Diagnostic System

The Zolo Technologies' Zolo**SCAN-GLS** is an innovative laser-based combustion diagnostic system which simultaneously measures temperature, O₂, CO and H₂O in real-time, directly in a glass melting furnace along multiple laser paths set in critical areas of the furnace. There are no probes to insert, no sensitive electronics near the furnace and no calibration required. Only small port openings and a clear line of sight across the furnace are required for each laser path. Zolo**SCAN-ETH** measurements provide a more accurate and reliable representation of the furnace than traditional single-point thermocouples and ZrO₂ sensors.

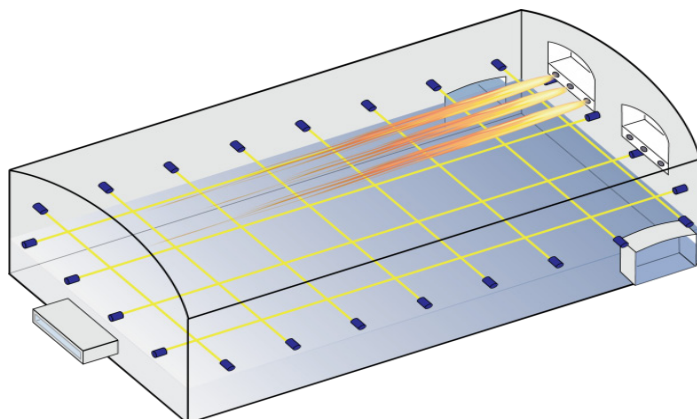


Proven Technology

Zolo systems utilize a well-proven technique known as Tunable Diode Laser Absorption Spectroscopy (TDLAS). Developed in collaboration with Stanford University, Zolo's TDLAS uses multiple lasers each tuned to the unique absorption wavelengths for a specific constituent. Zolo systems are designed for ultra-harsh combustion environments such as a steel plant and have been successfully installed on over 50 industrial process, refinery applications and coal-fired boilers around the world. The Zolo**SCAN-GLS** system is built for 24/7 operation in an ethylene cracking furnace environment - it is reliable, robust and low maintenance.

Multiple Paths Provide Real-time Combustion Profiles

The Zolo**SCAN-GLS** combines multiple lasers onto a single optical fiber. Pairs of SensAlign™ heads are installed in strategic locations along the furnace walls to send (pitch) and receive (catch) the laser signals. The combined light is sequentially transmitted to each of the paths where a pitch head sends the laser light across the furnace. Light is collected by a catch head and routed back to the control rack via optical fiber. In the control rack the combined laser light is separated so that the light absorbed by each gas is measured to determine its average concentration of O₂, CO and H₂O and temperature along each laser path. Multiple paths are arranged to provide combustion information corresponding to the burner control parameters for each zone in the furnace.

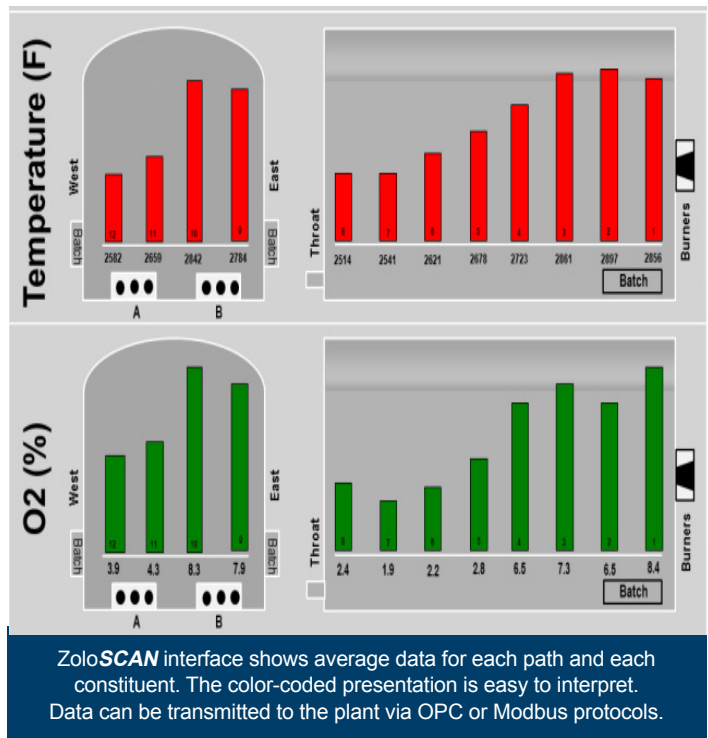


ZoloSCAN-GLS Layout

Multiple paths arranged around the furnace provide profiles for temperature, CO and O₂ that can be used to balance and optimize combustion. Path layout will be determined by burner configuration and zone design.

Actionable Information

The Zolo**SCAN-GLS** control rack (NEC Class 1, Div 2 compliant) is located away from the furnace and houses all of the sensitive electronics such as the lasers, detectors and computer. The interface provides real-time balance information for each measurement path across the cracking furnace. For a typical system, a complete profile of the furnace is updated every few minutes. Operators can use the Zolo**SCAN-GLS** interface to make adjustments to the air/fuel ratio or to the burners to improve the temperature and oxygen balance in the furnace. The real-time measurements can also be integrated directly into the control system in order to achieve the greater benefits available with automated control.



Benefits of ZoloSCAN-GLS

- ▶ Increase Productivity
 - ▶ Heat transfer optimization/heat flux profiles
 - ▶ Uniform temperature profiles across furnace
 - ▶ Improved stirring
- ▶ Fuel Savings
 - ▶ Lower excess O₂
 - ▶ Optimize air/fuel ratio
- ▶ Product Quality
 - ▶ Maintain uniform temperature profiles
 - ▶ Eliminate localized hot spots
 - ▶ Minimize seed count
- ▶ Lower Emissions
 - ▶ Reduced NO_x, CO and CO₂
- ▶ Safety/Sentry
 - ▶ Alarms for high CO



ZoloSCAN SensAlign heads mounted on the side of the furnace wall (above). The heads automatically realign as necessary to ensure optimum power transmission.



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