

Temperature controlled SNCR for large scaled steam generators

Advantages of NEW Powitec SNCR

SNCR (selective non-catalytic nitrogen oxides reduction) uses Ammonia or Urea based reducing agents to reduce NO and NO₂. The reduction agent is sprayed as aqueous solution in the first draft at different elevations.

Powitec offers the complete SNCR (PiT SNCR) as well as the control system to optimise existing SNCR of other suppliers (PiT Navigator SNCR). To find the optimal spray-amount and -level Powitec uses a new Online-CFD[®] analysis, gaining information about the temperature profile at each spray-elevation.

1. Powitec SNCR Solution:

Advanced Combustion Control + Temperature Controlled SNCR

First Step: Optimised Combustion = Reduced raw-NO_x:

- ◆ Different fuels and different mill/boiler conditions produce different raw-NO_x
- ◆ By analysis and optimised control of the mill-separator-pipe-burner-system the air-/fuel-ratio is optimised and the raw-NO_x is reduced by elevation-staging, fuel-staging, "right" Lambda

Second Step: Advanced SNCR control on basis of temperature distribution information = safe limit compliance at reduced slip and reduced consumption

- ◆ With Online-CFD determination of the local temperatures, speeds, O₂ and raw NO_x
- ◆ Flue gas cleaning through optimal temperature-level- and spray-in-amount control
- ◆ Permanent self learning and adaptive optimisation of the PiT Navigator SNCR (the advanced controller for the SNCR)
- ◆ Optionally downstream SCR (in cooperation with well-known partners) as security catalyst (at higher cross sections and/or lower slip allowances)

2. Powitec analysis of the first draft

Powitec analyses the complete first draft and thus reaches a **high timely and spatial resolution**. For this Powitec offers thermographic analysis with the PiT Multisensor (high speed digital cameras) or heat flux analysis with the PiT FluxStylus (small heat flux measurements from five to nine different directions with one instrument).

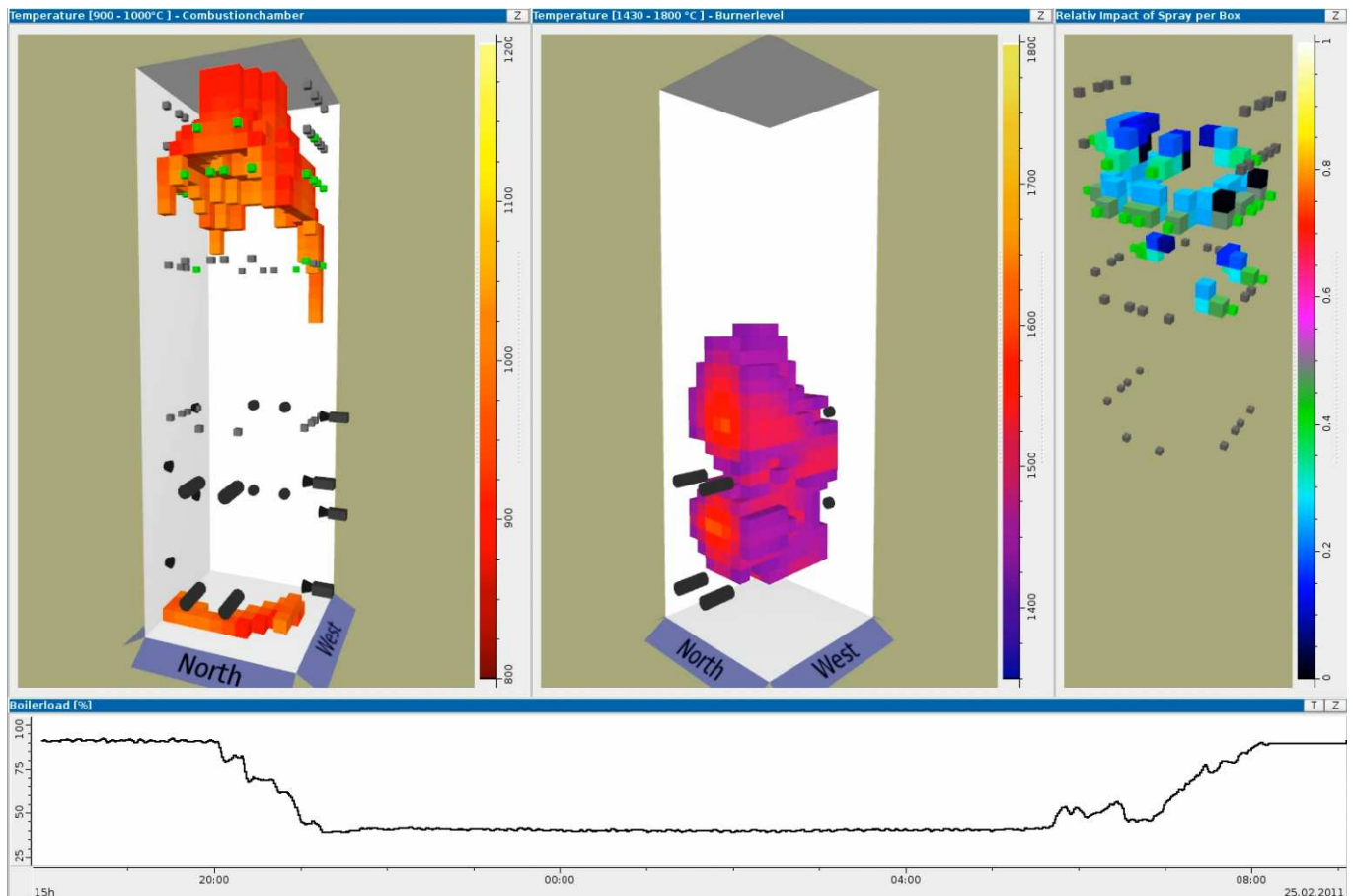
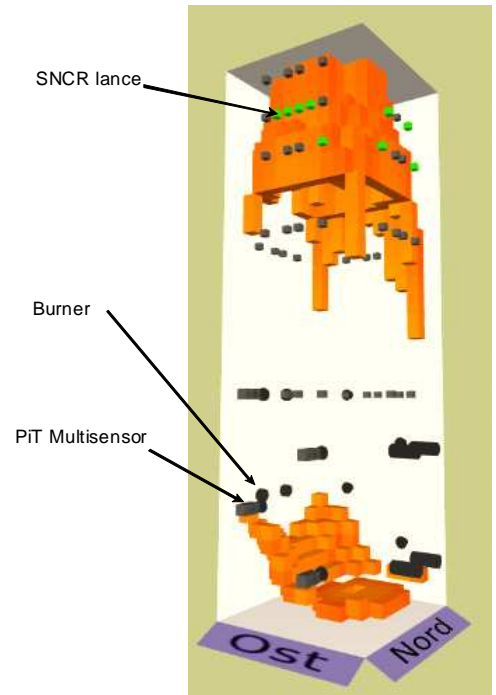
Powitec's new Online-CFD[®] separates the first draft into cubicals and calculates (with the aid of the new information from Powitec sensors) the local temperature distribution (and flue gas speed, O₂ and raw NO_x) in the combustion chamber, equal to a low resolved but permanent CFD (Online-CFD[®]).

The right picture is an example from the **Online-CFD[®]** of a temperature visualisation of the first draft in a shifted boxer fired power boiler only displaying temperatures between 900 and 1000°C, the optimal temperature window for SNCR spraying. The high Online-CFD accuracy was verified over 9 month.

The knowledge about the temperature distribution allows determining the ideal

- ◆ SNCR injection level,
- ◆ injection nozzle,
- ◆ spray amount and
- ◆ optimal spray penetration depth.

Powitec gains for each level of nozzles information about the temperature profile at this elevation with a **very high timely and local resolution**, this enables to spray in the **right amount at the right position**, avoiding slip and reducing the spray amount.



In this screenshot of the Online-CFD the left picture shows locations of temperatures between 900 to 1000°C in the combustion chamber (orange boxes) and the activated lances (small green boxes). The picture in the middle shows the locations of temperatures between 1430 and 1800°C. The right picture shows the locations of relative (0 to 100%) impact of ammonia spray per 1m³ box (cyan and blue boxes). The lower picture shows the boiler load over 24 hours. The load depending changes in temperature distribution and spray amount over the time are shown in the video: http://www.powitec.de/Videos/PiT_OnlineCFD_FlueGas_Flame_Spray.avi

3. Powitec SNCR control

The Powitec SNCR controller PiT Navigator SNCR uses a multidimensional optimizer which is a self learning and adaptive system which can be added to existing SNCR-control systems and to existing combustion controllers. This innovative optimiser is able to adapt itself automatically to changing process (i. e. coal) and plant conditions (plant drift).

Benefits:

- ◆ The combustion is stabilised by controlling the air-/fuel-ratio. This leads to
 - less primary-NO_x development
 - less temperature tilts
 - reduced steam variations
 - less NO_x peaks
- ◆ Determining the speed and temperature of the flue gas which enables to choose the right injection nozzle and additive amount per nozzle. This leads to
 - safe NO_x and slip limit compliance and
 - reduced slip and additive consumption
 - for permanent operation for all load cases and its transients

Further information about the performance of the PiT Navigator SNCR at the 576 t/hr steam generator of the Steag Power Station Fenne can be given by Dr. Neu (Director Plant Fenne) or Mr. Kiehn (Director Production)

4. PiT SNCR

Powitec supplies the complete SNCR including storage tanks, pumps, safety equipment, mixing and measurement modules, distribution modules, pipes, lances and nozzles, as well as engineering and commissioning (turn-key).

Benefits

- Reduced primary NO_x
- Safe limit compliance of NO_x and Slip
- Reduced NO_x-peaks
- Reduced consumption reducing agent and reduced slip
- Better measurement + better control = **reduced costs**

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