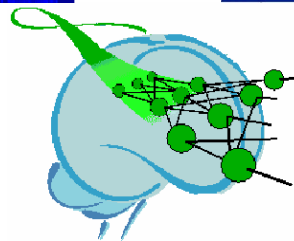
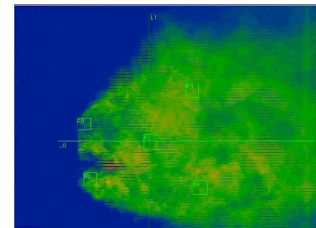
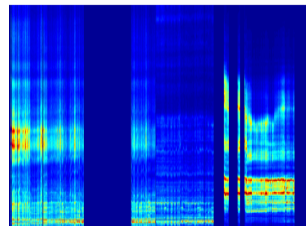


Process Optimisation in coal dust fired Large Power Plants

PiT Navigator



Advanced Combustion Control
for permanent
optimised air/fuel distribution

Challenges:

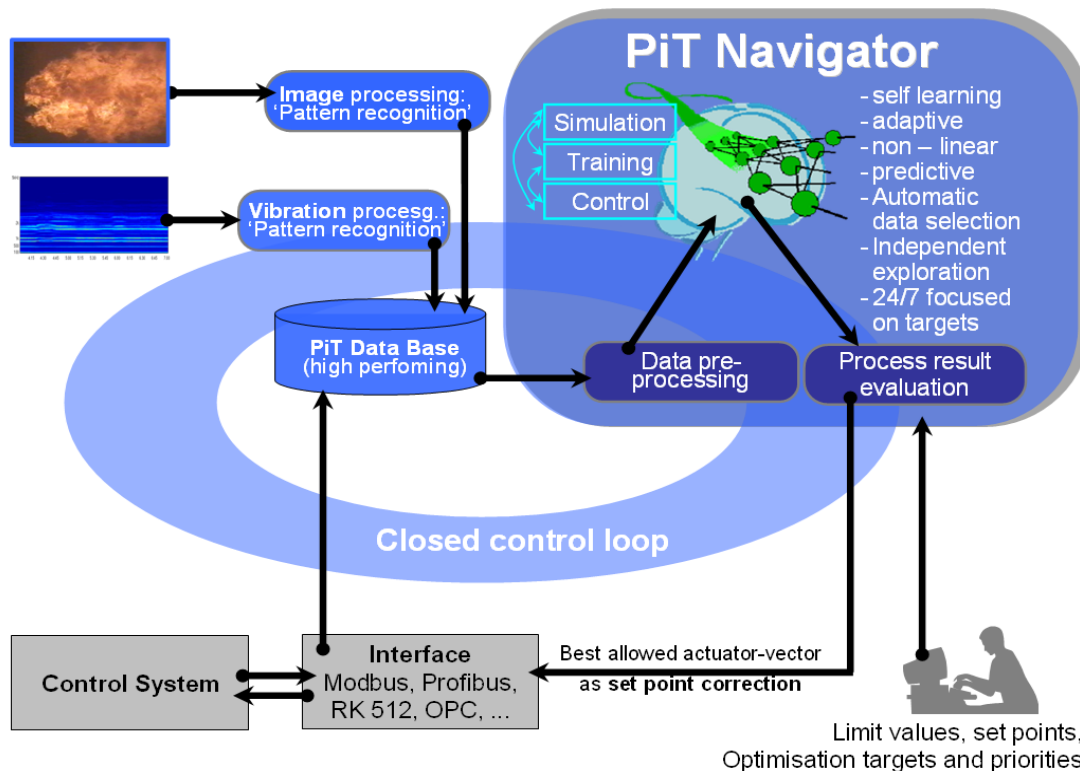
Frequent tasks in coal dust fired large Power Plants are:

1. Optimisation of combustion processes
2. Reduction of emission
3. Varying coal qualities
4. Extension of periods between maintenance outages
5. Reduction of slagging
6. Increase of performance dynamics

Difficulties for each control system arise from the complexity of the process and the constantly changing process conditions:

- fluctuating fuel characteristics
- multiple types of coal
- wear and slagging
- narrow emission limits

Exactly here is where Powitec Intelligent Technologies' (PiT) Optimisation systems come into the picture!



Powitec's Solution: the PiT Navigator

The PiT Navigator is an optimisation package consisting of adaptive software, optical sensors for flame analysis and acoustical sensors for analysis of level of grinding:

1. **High-Speed cameras** observe the combustion chamber and - through a patented pattern recognition process - extract significant features of the ignition-, combustion- and burnout- behaviour.
2. **A vibration pick-up** captures mill vibrations which are being evaluated by a high-performance computer. From these vibration-data, early information on degree of milling and coal quality are derived.
3. The process data from the control and communication system are permanently read on-line via interface. The PiT Navigator correlates these data with the optical and acoustical information through a software based on **neural nets**.

For process modelling too, a system of neural nets is applied, capable of displaying the time-varying dependencies between the values to be optimised and the plant's controlled variables and disturbance variables. A simulation detects all target values and determines the optimal combination of controlled variables. The setpoint corrections calculated by the PiT Navigator are being transferred to the control system over the interface. The improved correcting instructions continuously control towards the optimum. In this way, the PiT Navigator optimises the air/ fuel distribution per burner and over the burner levels.

The PiT Navigator is the **ideal solution** for optimising the process and/or sorting out complex problems (i.e. high slagging, high content of unburned coal in ash, etc.).

Results:

Results through an optimised air/ fuel distribution in the combustion chamber:

1. Homogenised temperature distribution
2. Increased combustion chamber temperature
3. Optimised temperature distribution over the different levels, following acquired conditions
4. Increased efficiency of steam generation
5. Enlargement of varieties of used coal types
6. 30% improvement of performance dynamics
7. Reduction of slagging and soiling at burner mouth and finned wall
8. Increase of availability e.g. through elimination of backfiring
9. Improvement of boiler wall atmosphere
10. Reduction of unburned coal in ash boiler geometries and ash-containing coal.

PiT Navigator = looking + listening autopilot

Reference



Seocheon Thermal Power Plant
PiT Navigator at boiler 1 & 2
2 x 215 MWel basic load,
Hard coal with up to 40% ash content
Slab firing, 40 burners

Results:
Unburned C in ash -0,8% abs. (TPP1)
Unburned C in ash -1,2% abs. (TPP2)



EVONIK Kraftwerk Fenne
1 x 225 MWel, mid load, low grade Saar coal
Front wall fired, 8 burner, 4 mills

Results:
Eta steam generator +0,4%, λ f. 1,25 to 1,18
Axillary consumption -2.000 MWh/a
Unburned Carbon in Ash -0,2% abs.



Vattenfall, Kraftwerk Tiefstack
PiT Navigator at boiler 1 & 2
2 x 252 MWel, up to 12 import coals
Front wall fired, 6 burner, 3 mills

Results:
Eta steam generator +0,3%, λ v. 1,22 to 1,15
CO -12%, NOx -29mg/Nm³
Unburned C in ash -0,5% abs.



E.ON, Kraftwerk Scholven
PiT Navigator at boiler C
Front wall fired, 16 burner, 4 mills
345 MWel, up to 10 import coals

Results:
Reduction of unburned C in ash by 1% abs

Competitive advantages:

Powitec is the only provider worldwide for:

- The complete integration of the results of digital optical and acoustical sensor technology in automatic control
- The most innovative combustion control system worldwide
- Completely self-learning and adaptive controller, which permanently adjusts to changing process conditions
- Advanced Combustion Control through innovative sensor technology and intelligent control

PiT Navigator = + Efficiency + Availability - Emissions

Additional profit:

1. **Increase of boiler efficiency by up to 0,5%** through reduction in fuel consumption by up to 1% and through lowering lambda. At the same time improving the boiler wall atmosphere. CO₂-emissions drop by approx. 1%
2. **Larger primary fuel band**, larger variety of coal types and improvement of co-combustion of secondary fuels
3. **Increased performance dynamics** through reduction of boiler response time through control of the flame centre and the mill system. Therefore, **reduction of the boiler time constant** by approx 30%
4. **Reduction of slagging** and soiling at burner mouth and finned walls through control of burner behaviour, flame position, flame root and -volume, fire expansion within the combustion chamber, therefore **significant availability increase**
5. **Full-automatic permanent optimisation** of the boiler operation towards the management's target and priorities
6. **Improvement of limiting values and emissions** through improvement of air/fuel ratio and distribution, therefore **reduction of unburned coal in ash**, reduction of CO and NO_x by up to 30%

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