

# Virtual Firing Worlds

## Taking new directions with software simulation

Innovations are not products of chance but based on systematic analyses and their accomplished implementation in practical applications. In this context, computer simulation is rapidly replacing classical methods in research and development as, thanks to ever more powerful computers, the virtual age is now well upon us.

As part of a simulation, a system with all its dynamic processes is reproduced in a model. The aim is to simulate all processes so as to allow the prediction of future events. Applied sensibly, software simulation for innovation processes in industry can save time and money and minimize risks. Kiln specialist **CTB ceramic technology gmbh berlin** has been using appropriate tools for ceramic firing processes for years. These processes can help the operators of industrial firing systems push ahead with the optimization of their firing processes without intervention in production and to identify potential for optimization. Particularly large savings effects can be obtained in the research and development of new ceramic products as here the required empirical firing tests can be reduced considerably.

An existing plant, but also the full functions of new plants can be realistically simulated. The simulation tool is designed to be user friendly and is menu-navigated. In concrete

terms, the simulation covers the representation of:

- all measurement and control devices of a kiln and its peripheral systems
- basic thermodynamic processes in the kiln as well as the influence of every individual regulating device on the various firing-relevant parameters
- the communication between a PLC and the (virtual) plant.

The program is also real-time capable for large projects and suitable for high simulation depths. The simulation software replaces the central I/O periphery and the fieldbus periphery of the plant completely or partly and also works with the most important automation and other fieldbus systems, i.e. "data communication" is always guaranteed. The procedure is essentially as follows: First the I/O signals must be agreed and defined. For this purpose, signal lists can be imported and edited, and the signals can be grouped structurally and technologically and parameterized. This way simple and clearly arranged images of the entire I/O range are quickly formed. Then, depending on the required simulation depth, the signals are linked with simulation elements from pre-generated and extendable libraries. Naturally, all standard functions such as drag & drop, zoom and macro generation can be used.

The required simulations are configured by selecting and linking functional elements that correspond to the devices in the process field. Now the signals are formed by the required simulation parameters and the process states described.

The graphic makes the plant "transparent" and the simulated process easier to understand for all concerned. For this purpose, the graphic representation of the process visualization is imported and displayed on one level, and the functional elements are assigned to the actuators and sensors.

To summarize, CTB simulation programs have the following advantages:

- **Optimized firing conditions**  
Changes in the control software can be tested independently of the real plant and their influence on the firing regime estimated. The effects of the changes to the settings of instruments and control devices can be tested in advance. This reduces costly field tests e.g.
  - in the research and development of new products even with complex geometries. A double effect: software simulations are first performed in research kilns to establish the feasibility of a process and can then be performed in the production plant for optimization of the process.
  - for product changes in an ongoing production operation.
  - when the firing conditions of an existing kiln need to be optimized.
- **Software development and qualification with certifiable quality management**  
The transparent technology-oriented testing environment enables joint software testing with plant suppliers and operators
- **Commissioning**  
Kiln control has already been fully tested prior to commissioning and is instantly functional. With the combination of the simulation and the real plant, step-by-step commissioning and trial operation are supported and logged.
- **Integration of plants or plant components that are connected up- or downstream or through a higher-level control system.**

Fig. 1  
Chart presenting a survey of the I/O structure

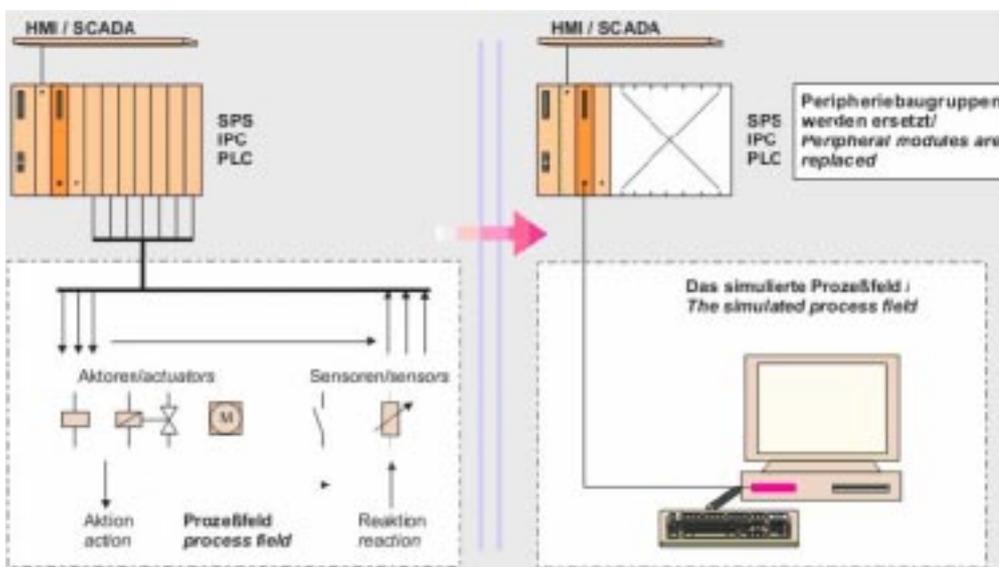
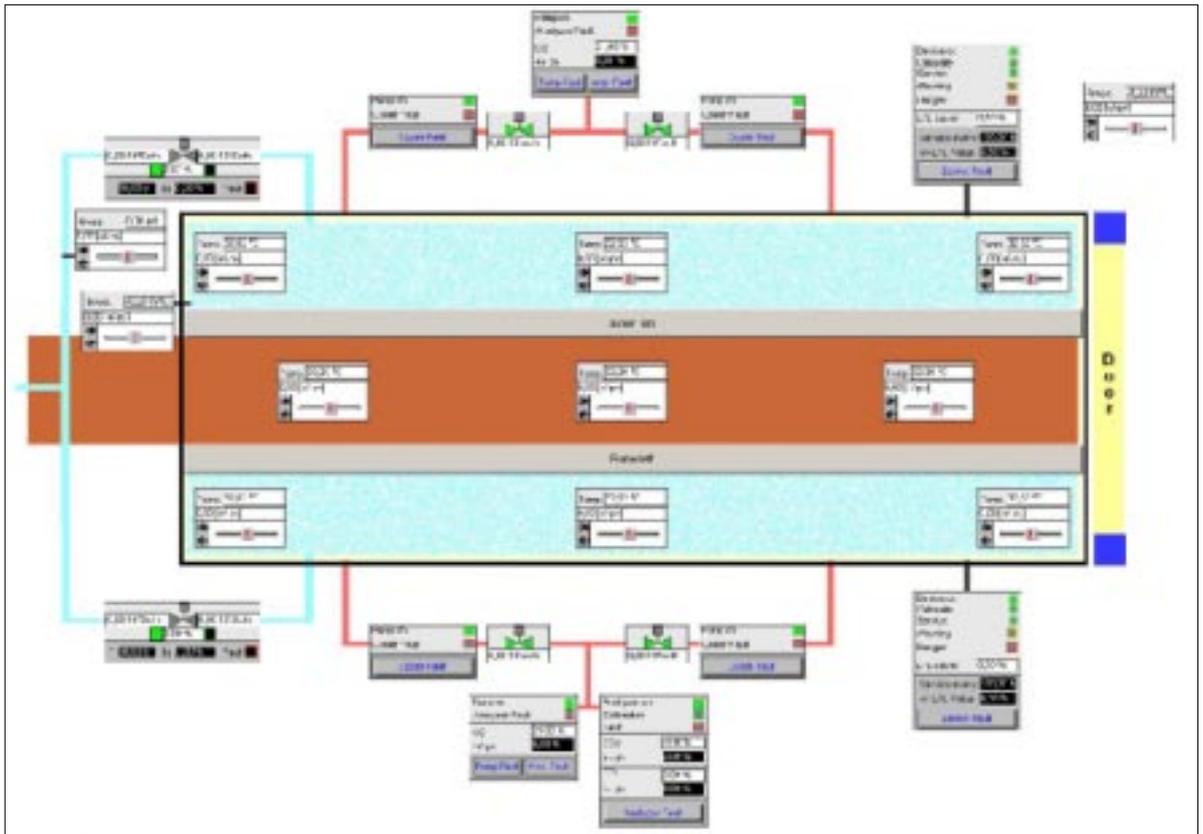


Fig. 2  
Chart giving a survey of a simulation



- Troubleshooting without any production process downtime, instruction and training for employees.

The software simulation and its automation device is used to generate virtual machines and plants. Designated employees can be trained in the operation and servicing of these machines and plants prior to commissioning.

## Summary

With CTB simulation software, the feasibility of changes to the firing regime can be virtually determined in advance, reliably evaluated and optimizations then performed on real existing firing systems. Applied correctly, this tool enables plant operators in the ceramics industry to push ahead with innovations, and at the same time save time and money.

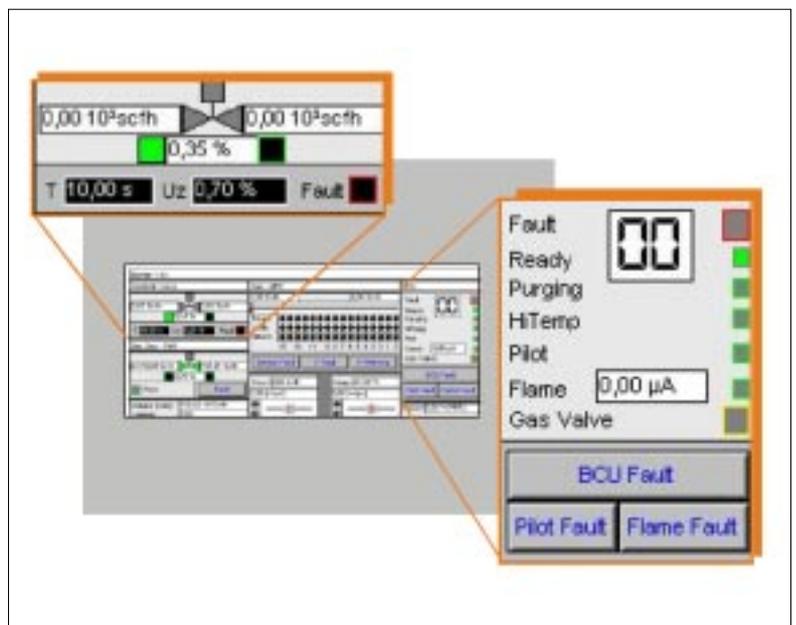


Fig.3 Presentation of single devices in the process field