

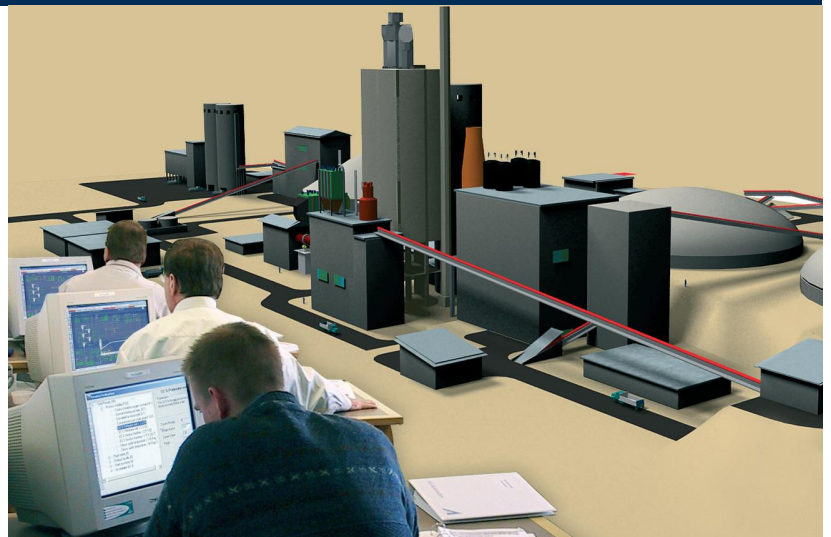


Could we have avoided the last shut-down if the operator knew how to handle...?

# ECS/CEMulator®

– the most realistic environment for operator training in the cement industry

- ..... Measurement Noise
- ☒..... Input Point Disturbances
- ☒..... Equipment Disturbances
  - ☒..... Motor Disturbances
- ..... Klin ring formation
- ☒..... Lining hole
- ☒..... Damper Failure
- ☒..... Splitter/Gate Failure
- ..... Cyclone Jam
- ☒..... Controller Failure



### Application

ECS/CEMulator is a high technological breakthrough in development of an advanced environment for training of process operators and engineers in the cement industry. Combining decades of process design and operation experience of FLSmidth, an extensive theoretical insight on process dynamics, and the latest software technology, FLSmidth Automations has developed an absolute realistic simulator of cement plant processes.

### Background

Contrary to most cement process simulators, ECS/CEMulator is developed on a full functional control systems platform enabling the complete set of functions and features of a modern control system environment for the users.

Having a skilled team of operators plays a crucial role in beneficial and safe operation of industrial plants. Especially in the cement industry, with the significant high cost of investment, practical knowledge and experience of plant operation have a direct effect on production economy.

Insufficient insight in process dynamics and interactions, high stress factors in real time operation conditions, and lack of adequate experience in utilizing the existing control system are

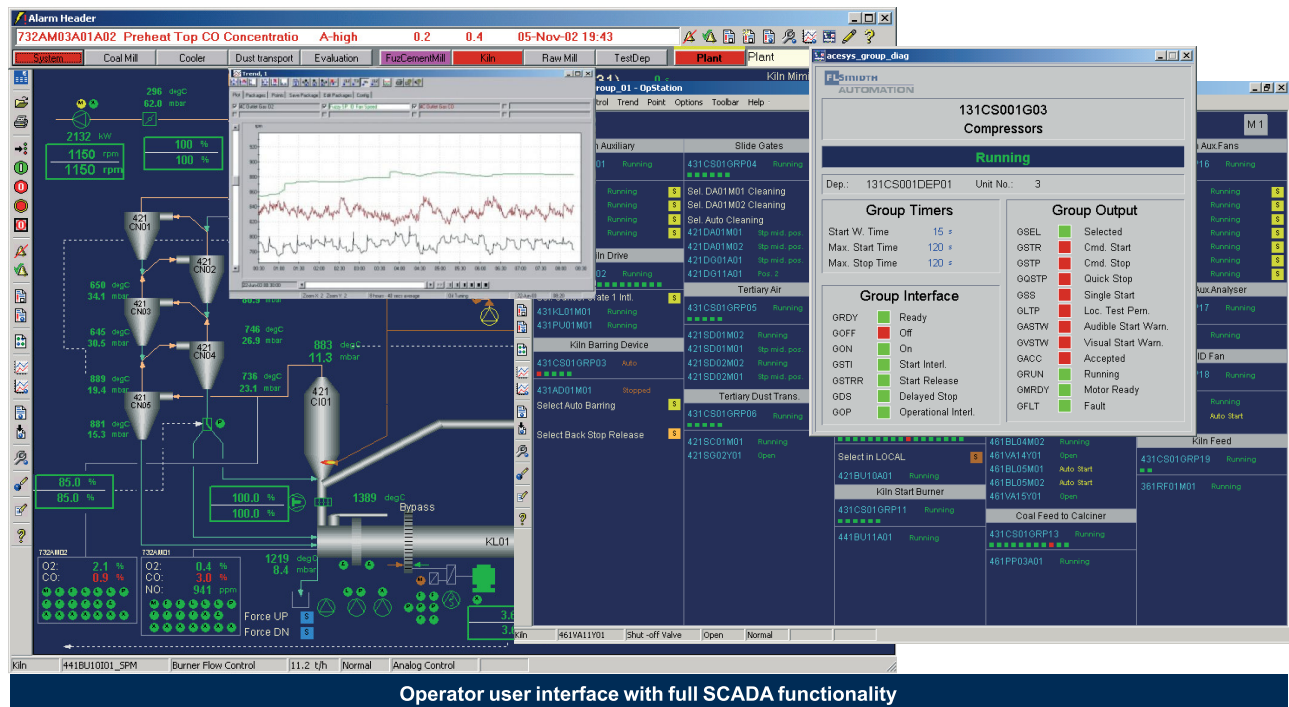
typical reasons for incorrect operator actions. The consequences of this may result in low production quality, production interrupts, and equipment damage, in worst case risk on human safety.

The increasing demand on production sustainability in the recent years has resulted in requirements of which the degree of fulfillment is effected by the level of skills of plant operators and engineers.

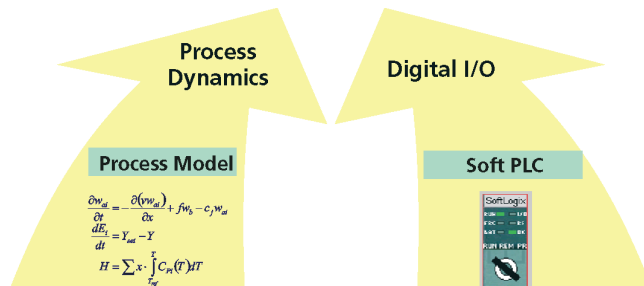
### Benefits

ECS/CEMulator is an advanced and user-friendly cement process simulator which aims at:

- Process operator training in an absolutely realistic and risk-free environment
- Increasing operator skills in reaching pre-defined production quantity and quality targets
- Operator performance evaluation
- Increasing operator skills for optimal utilisation of a modern control system
- Enabling process engineers and designers to test their ideas before practical implementations

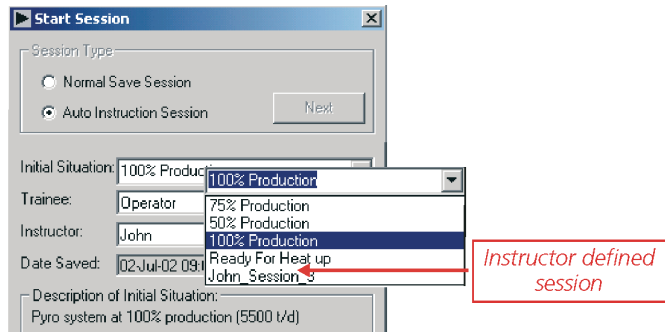


Operator user interface with full SCADA functionality



ECS/CEMulator combines two main data-engines for complete process unit simulation:

I) thousands of mathematical model equation are solved to visualize the process dynamics and evolutions, and II) an actual Soft PLC containing a complete process unit PLC program is utilized to enable full digital I/O and sequence control and interlocking in the various groups of the process unit.

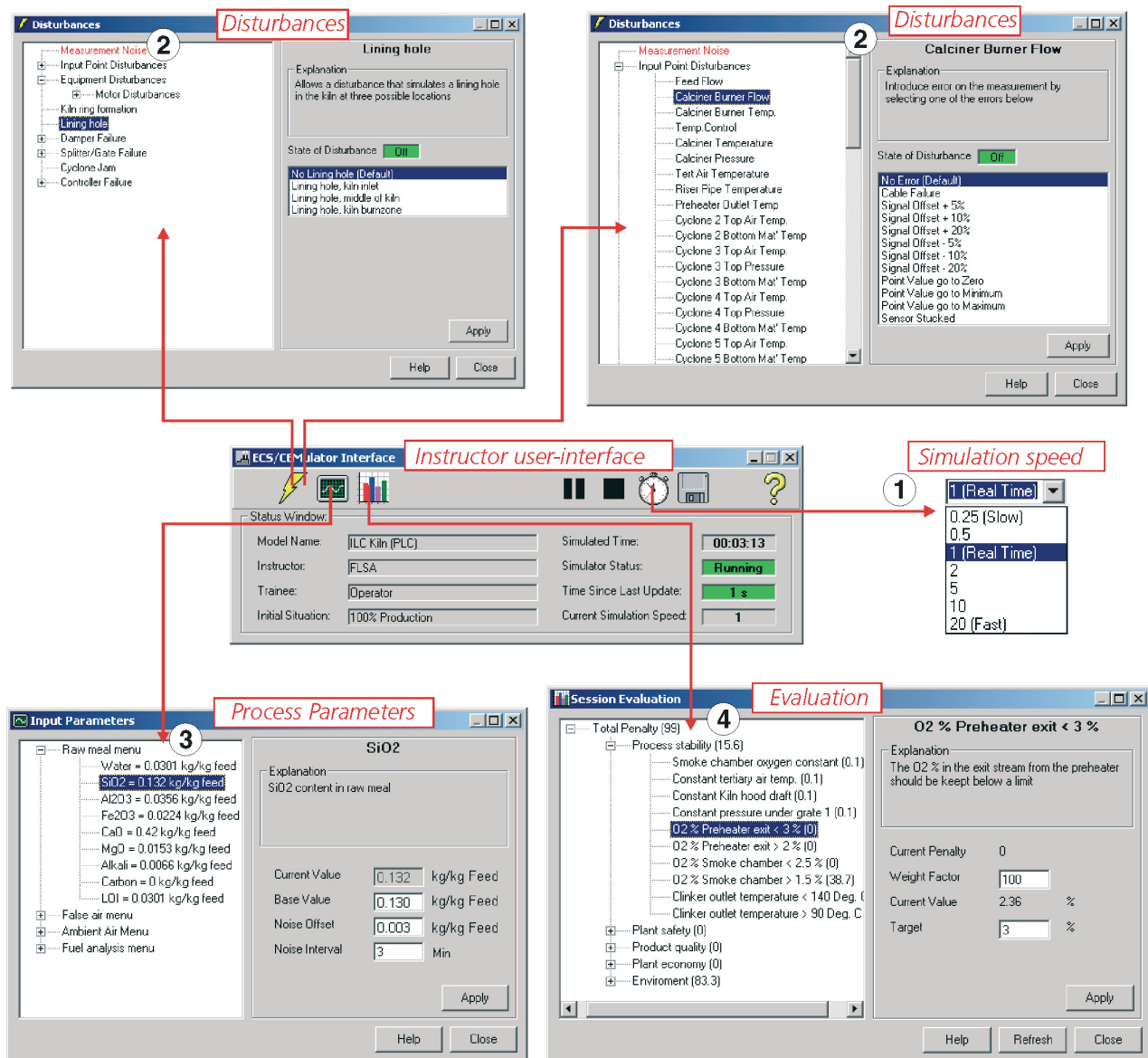


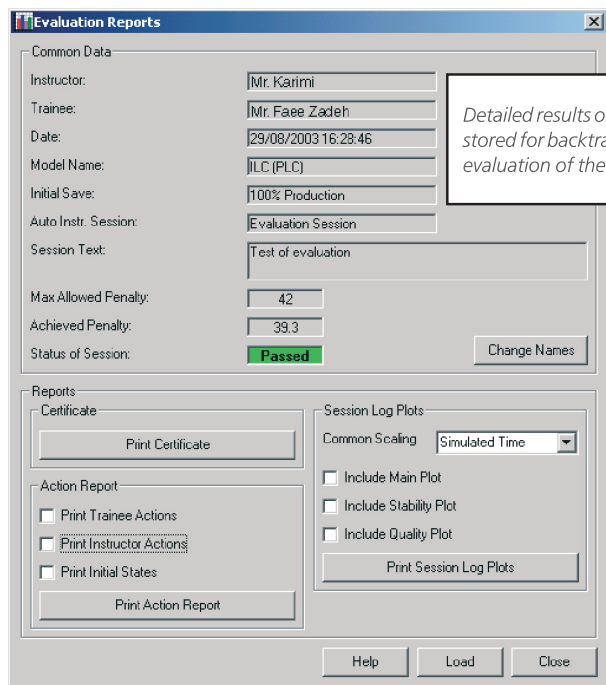
The initial conditions of a training sessions is selected among some pre-defined conditions designed by the instructor. This means that the operators can be trained in various levels of skills in the same process unit. Here an initial condition could be that the "kiln is in 80% production with some problems in the draft".

With an "Auto Instruction Session" the operator will automatically be confronted with process disturbances and condition changes during the training. A robotic instructor will basically control the session.

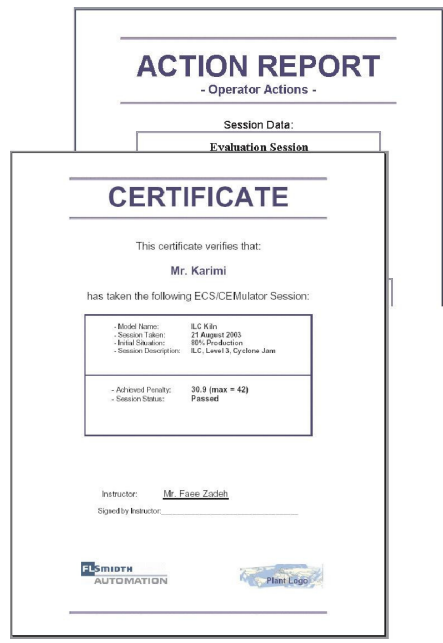
While a training session is running, the following options are available for the instructor:

- 1 The simulation speed can be changed on-the-fly, e.g. to "accelerate" the process reaction upon a control action.
- 2 Various type of disturbances, e.g. equipment failure or measurement errors or other, process specific, frequent occurring conditions can be introduced.
- 3 Operation input parameters such as flow or material conditions can be changed.
- 4 The mission in the training as pre-defined production, quality and emission target values and the associated weight factors can be modified.

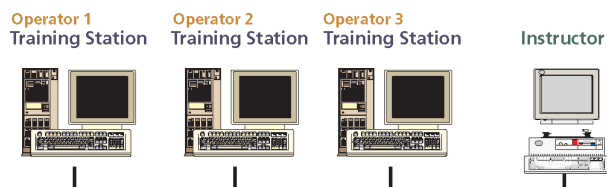




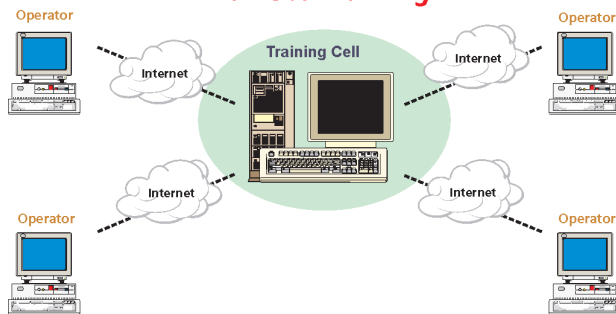
Detailed results of all training sessions are stored for backtracking and performance evaluation of the individual trainees.



The configuration of a training cell can be as simple as one instructor station with 1 training station. In a classroom configuration, the training stations always run simulations independent from each other. The instructor has full control and supervision of all trainee stations at the same time.



### Remote Training



Being a training centre for a number of plants, the corporate technical offices can offer training of operators at different levels of skill.

Since the training sessions are physically executed at the training stations with full support for remote access, no special software installation is required at plant operator stations. The operator stations can be any kind of PC with MS-Windows 9x, NT, or 2000 operating system.

### Available Standard Models

Depending on the actual needs, a specific set of models can be selected among various types of kilns including preheater and cooler section, raw mills, cement mills, and coal mills. All standard models include process specific mimics, Soft PLC-based group start/stop control with object oriented faceplate support, process-specific disturbance options, process parameter change options and evaluation criterion.

Please refer to the model-specific data sheet for detail information on the individual models.

### Optional Model Customization

Based on the standard models, a wide range of customization can be supplied to meet the specific customer requirements for the actual plant. The following are some examples of model customisation:

- Graphical mimic diagrams
- PLC program
- Modification of process units
- Complete new model development

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