

4D

inca MPC4DISTILLATION

**ONLINE CONTROL
AND OPTIMIZATION SOLUTION
FOR DISTILLATION COLUMNS**

DISTILLATION CONTROL & OPTIMIZATION

Until recently, standard linear Model Predictive controllers (MPC) were the only APC solution for distillation columns. For some columns the performance is however limited or the return on investment is too low.

Non-Linear MPC provides a solution for columns that operate in a very large load, pressure or purity range or consume huge amounts of energy due to the difficult separation of the products. On the other end small and simple columns can benefit from the innovative modeling technology included in INCA MPC4DISTILLATION as well.

WHY MPC4DISTILLATION?

Allows you to operate columns over a very large operating range (load, impurity levels, pressures)

Reduces specific energy consumption beyond what is possible with linear APC systems

Tight quality control (high impurity columns)

Real time monitoring of the column process conditions

Extending common proven linear APC technology for distillation columns towards full range optimization

Standard linear APC solutions have been widely applied on distillation columns. However, for many columns the use of the non-linear APC technology can bring a lot of extra benefits. This potential has now been unlocked by INCA MPC4DISTILLATION:

- **Improved model accuracy leads to better performance.** Non-linear behavior of columns emerges when they are operated over wider load, pressure and impurity ranges. Under these circumstances, linear APC technology is known to have suboptimal performance and sometimes even fails. The INCA MPC4DISTILLATION technology is based on rigorous models taking in account all control- and optimization-relevant physical phenomena that are present inside a column. These non-linear models are much more accurate compared to linear black box models obtained via (automated) step testing around one or more operating points. More accurate models are the prerequisite for better control and optimization if used with a powerful tool like the non-linear INCA MPC engine embedded into INCA MPC4DISTILLATION.
- **No plant tests required.** While standard linear APC needs plant tests to be executed for building black-box models, INCA MPC4DISTILLATION relies on physical insights and historical plant data for building its models. This will reduce the installation time and cost of the APC system significantly, especially for large columns with long settling times. At the same time, the reduced cost will enable the application of APC technology to smaller columns as well.
- **Tackling more difficult to control columns.** Due to its advanced modeling technology, INCA MPC4DISTILLATION allows APC to be applied to more complex and difficult to control columns. High-purity columns with tight composition specifications, azeotropic distillation can also be modeled and optimized efficiently with INCA MPC4DISTILLATION.

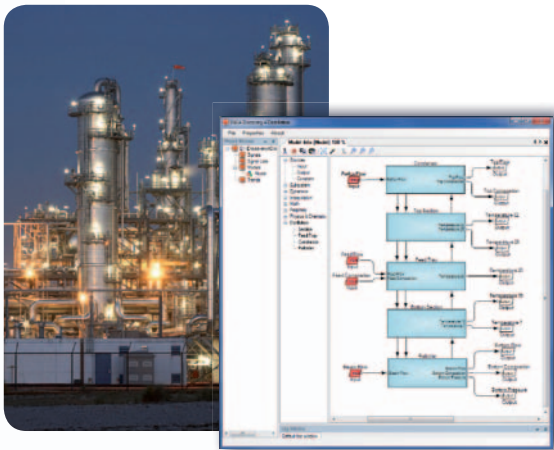
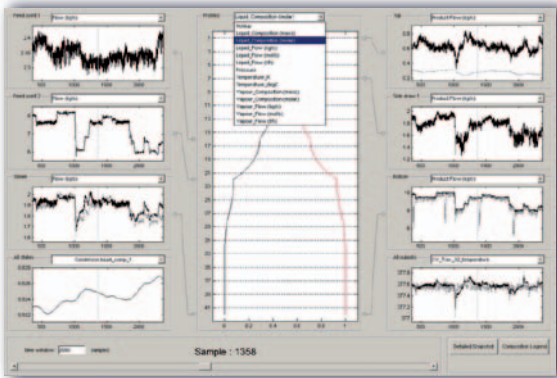




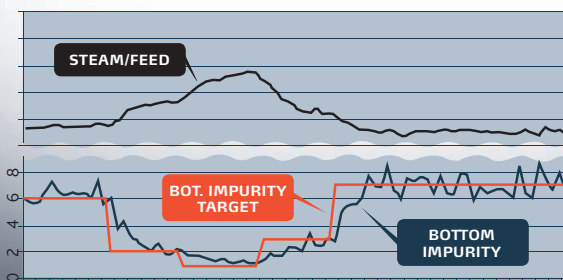
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MPC4DISTILLATION

MPC4DISTILLATION CAPABILITIES:



MPC4DISTILLATION AT WORK:



DISCOVERY4DISTILLATION

Modeling of distillation columns for use within APC must be done sufficiently accurate in order to catch all the important phenomena and non-linearities to be exploited by the controller. Nevertheless it must be done efficiently in order to reduce the implementation cost. INCA MPC4DISTILLATION includes a powerful modeling tool called INCA DISCOVERY4DISTILLATION- that eliminates the need for elaborate plant testing as known in classical linear APC projects by providing a modular, flexible modeling approach that combines physical know-how with parameter identification based on normal (historical) production data. In most cases there will be no or only very limited need for plant testing, resulting in minimal impact on the process.

A built-in observer will take care that the model will stay in line with the real process. Based on existing temperature, pressure and composition measurements the rigorous model will be automatically updated. If only lab data is available MPC4DISTILLATION uses the time stamped lab readings for the updating.

MPC4DISTILLATION Control and Optimization Tool

The model, generated by DISCOVERY4DISTILLATION, is used as the prediction model in the non-linear MPC application. Based on these predictions, the MPC4DISTILLATION controller calculates optimal setpoints (feed, reboilers, reflux, etc.) for the DCS at every control sample. The non-linear Model Predictive Controller is based on a reliable real-time QP optimization solution to make sure that all actual and future dynamic constraints on compositions, pressures and temperatures are satisfied.

MPC4DISTILLATION Results

Real life installations of MPC4DISTILLATION showed the following results:

- Doubled reduction of process variance compared to linear APC systems.
- Increase of the operating range of a linear APC controller by factor 4. This results in a significant increase of the controller uptime.
- Further reduction of steam consumption with 2% compared to linear APC.



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