

# Sirius@Max<sup>®</sup> – Optimizing Urea Production

Sirius@Max<sup>®</sup> is a joint solution of Stamicarbon and IPCOS that combines the benefits from the INCA MPC controller with the non-linear optimization capability of Stamicarbon’s urea process modelling tool. This provides urea producers with improved reliability in operation, by ensuring continuous and consistent optimal operation.

IPCOS and Stamicarbon have successfully executed a Sirius@Max<sup>®</sup> project on the urea plant of OCI Nitrogen at the Chemelot industrial area in The Netherlands. This urea plant is highly integrated with 2 melamine and an ammonium nitrate plant providing additional challenges due to its complexity.

With the INCA MPC controller using data driven dynamical models derived from step-testing, the process operation can be stabilized and will be pushed against process limits, e.g. synthesis pressure. The softsensor models provide additional process information which is not or cannot be measured, like stripper tube load and efficiency or ammonia emission. These softsensor values have been included in the INCA MPC design as control objectives. The urea process optimizer provides finally the optimal process settings to truly maximize urea yield based on rigorous modelling which will be realized as targets by the INCA MPC controller.

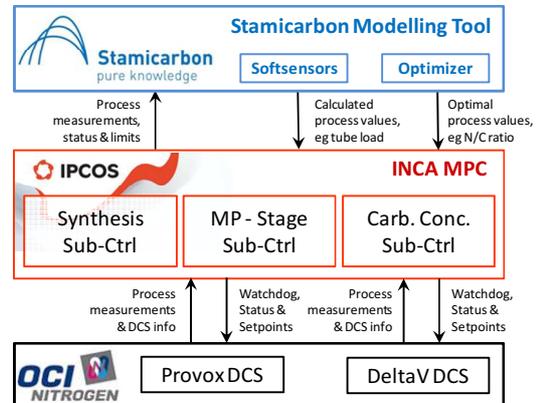


Fig. 1: Setup Sirius@Max<sup>®</sup> consisting of INCA MPC controller with softsensors and optimizer.

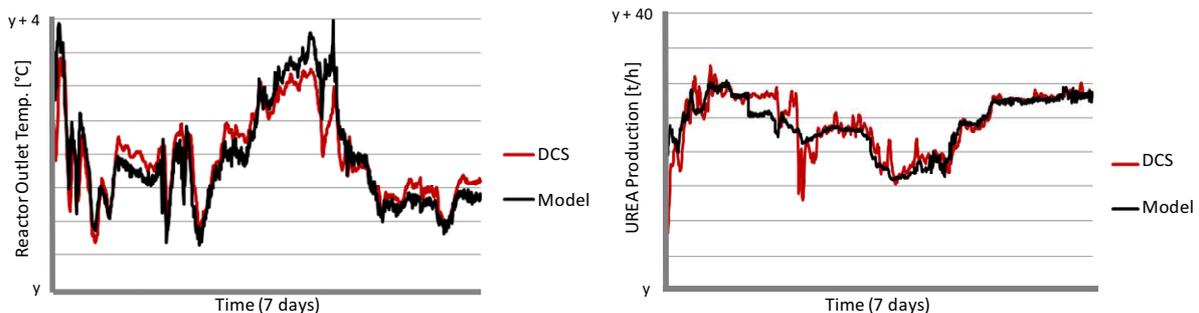


Fig. 2: Validation process models on historic data (7 days) containing all major operational conditions.

A main challenge in this project has been the different operating modes due to the fact that one or more connected processes could be in- or out-of-operation, because the OCI urea process is not a total recycle plant. Therefore switching operational conditions had to be included in the process models. Additional benefits arise from the critical process review during the model validation which can lead to new insight and improvements when matching theoretical models with real-time process data, e.g. on assumed unmeasured process values, like pump recycles or calculated flows, or even possible offsets in important process measurements.

Applying MPC control to production plants provide in general 1% to 3% benefits in production increase and/or energy efficiency by stabilizing process operation and pushing continuously to process limits. With Stamicarbon’s modelling tool providing softsensor and optimization extensions for urea plants the expected MPC benefits can be doubled from the detailed process review and the continuous optimal process operation. This Sirius@Max<sup>®</sup> project at OCI Nitrogen has realized 4.2% benefits clearly exceeding the initial expectations.

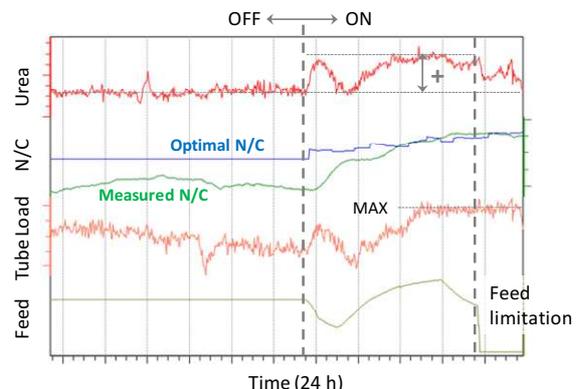


Fig. 3: Operation and benefits Sirius@Max<sup>®</sup>. Optimizing N/C ratio increased conversion rate while at the same time system pressure dropped enabling more feed and operating at tube load constraint.

The core project team consisted of Math Heijnen, Ruud Swarts (OCI Nitrogen), Luc Dieltjens, Klement Riegman (Stamicarbon), Frank de Boer and Heinz Falkus (IPCOS), but gratitude goes to all people who contributed to the success of this Sirius@Max<sup>®</sup> project.