RECONNECT

SYMPOSIUM 2022

KNOWLEDGE • OPTIMIZATION • INNOVATION

Stamicarbon 75 YEARS

Experiences with a digital process monitoring system at Nutrien Borger

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17 May 2022

Jaarbeurs, Utrecht

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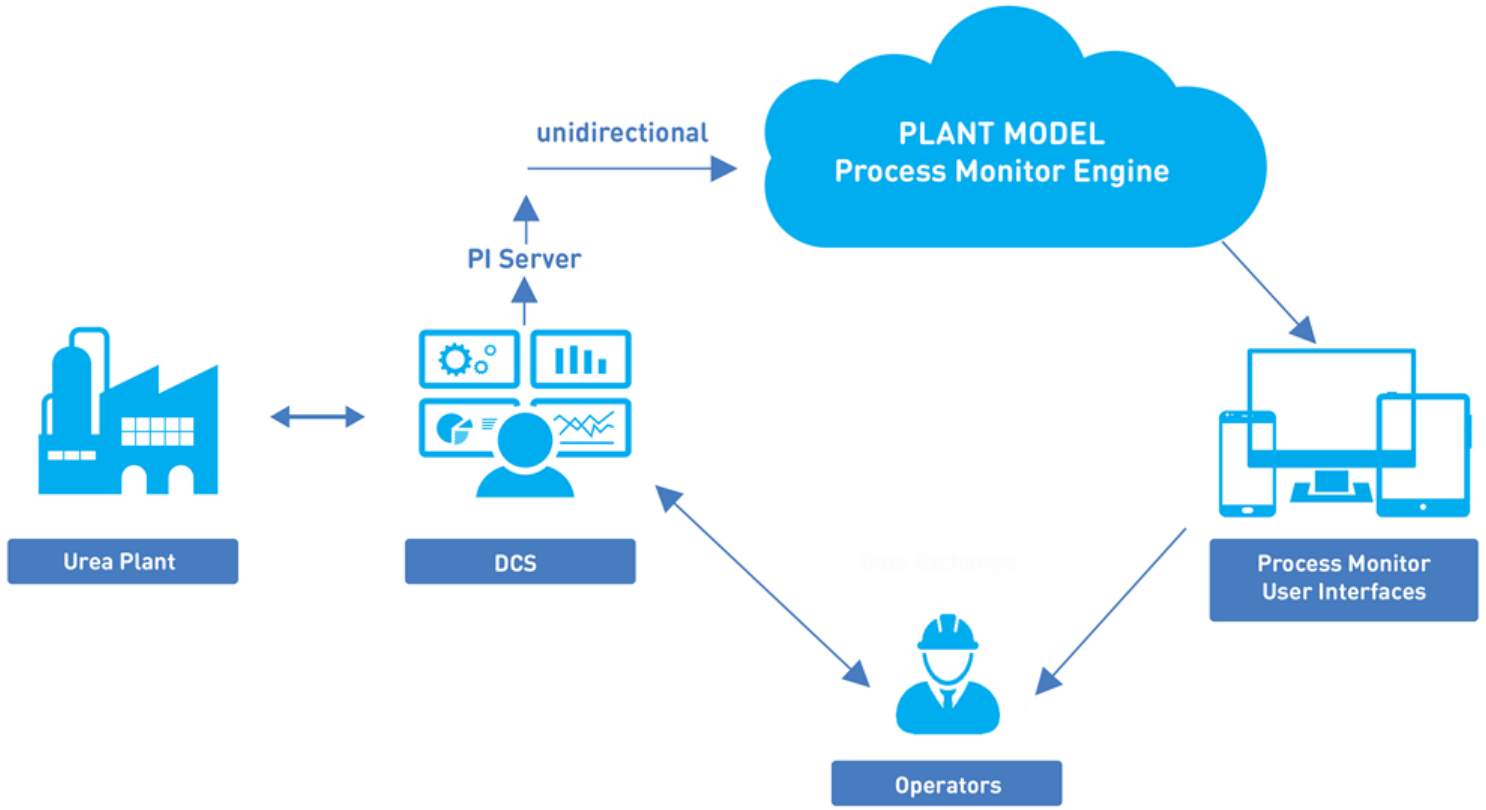
Stami Digital Process Monitor (SDPM) Architecture



Scope of the project

Advance Consult™

- Receive historical data, process through model, create KPI's, KV's
- Analyze performance based on KPI's and KV's
- Discuss findings and propose for improvements
- Next meeting, evaluate results proposed improvements.
- 9 sessions so far
- Achieved 3-4% capacity increase and 3-4% energy consumption reduction

STAMI Digital™ Process Monitor SDPM

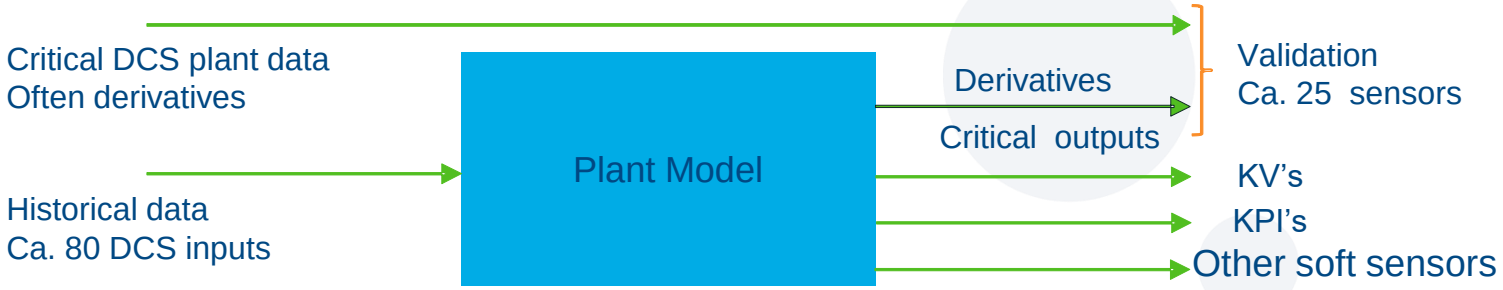
- Cloud communication established Q3 2020
- Beta version issue Q1 2021
- Second issue Q1 2022
- Anticipated new functionality or in progress
  - -Auto reporting
  - -Help functions
  - -Statistical tools
  - -LIMS (Laboratory Information Management System) data in SDPM
  - -Data analysis, perhaps machine learning

The plant model

- Rigorous thermodynamic steady state modeling of urea plant
- Know-how based on 70+ years of research and validation, based on both theoretical and empirical evidences
- ~7000 variables calculated related to ~420 process streams, with a few seconds needed for model calculation and fast one way, secure and encrypted data traffic through Siemens Mindsphere Cloud with ISO 27001 certification.
- Entire process modelled, incl. downstream sections and recycle (so including the kinetics in the pool reactor)

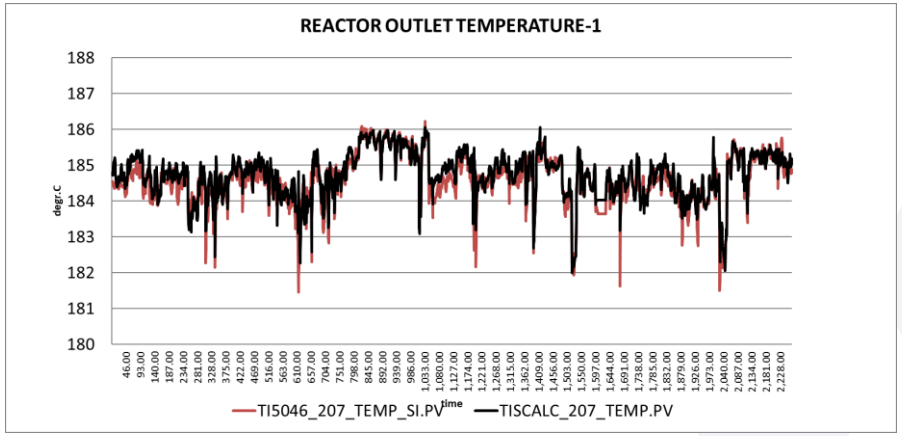
The Process Monitor is the extremely accurate plant model developed by Stamicarbon to push urea plant performance

Validation model during ADVANCE consult™



Validation reactor outlet temperature:

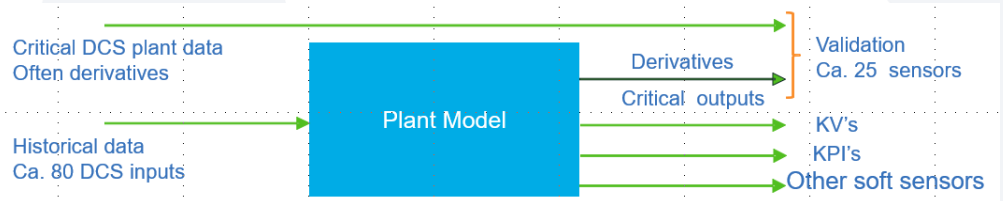
- Black color calculated by model
- Red color measured value
- 2300 data points

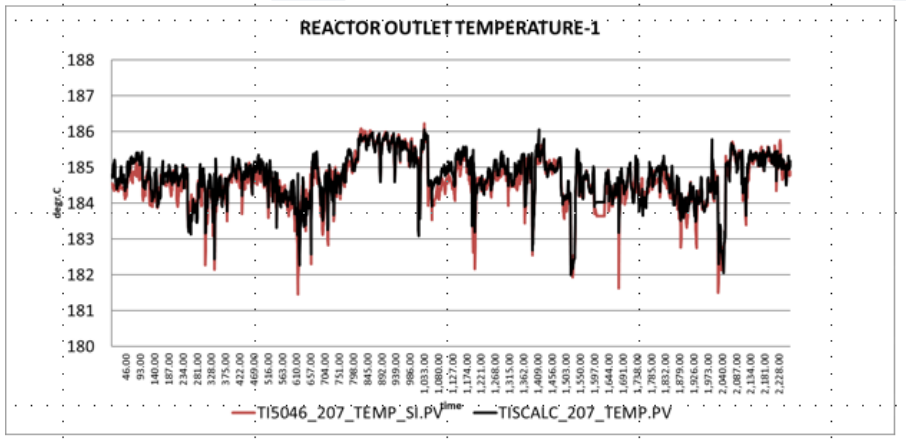


Difference between derivatives and KV's

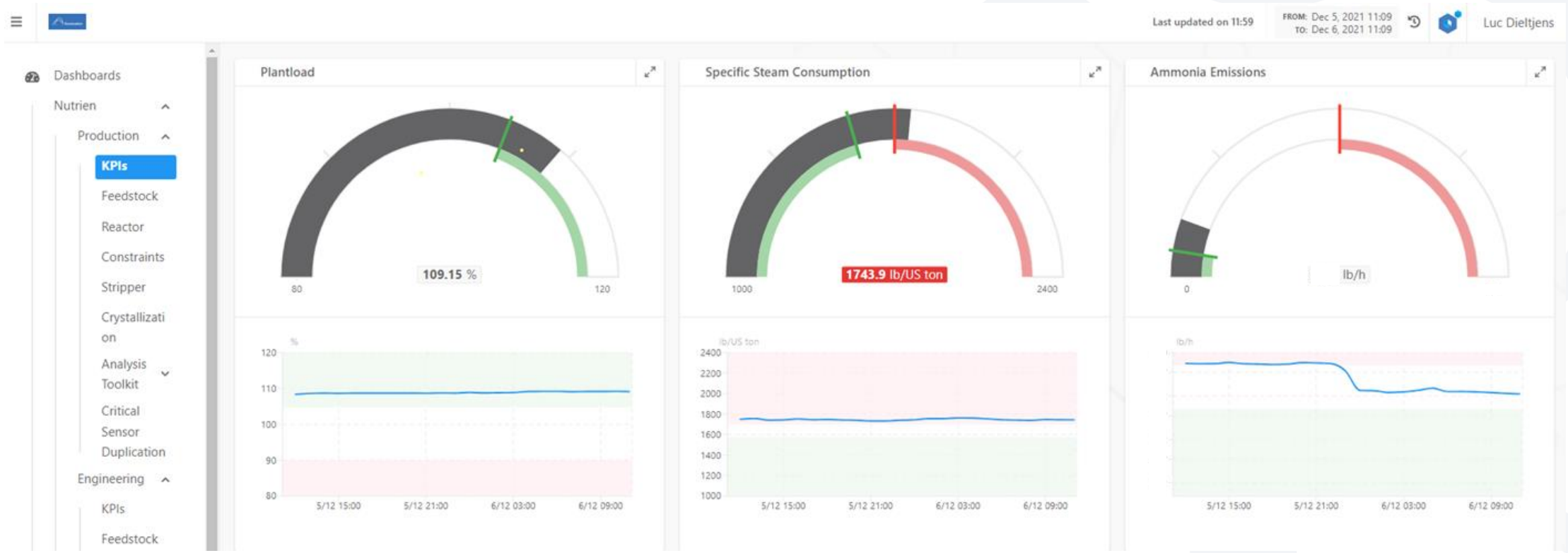
- Derivative variables are often closely observed by operators, e.g. reactor outlet temperature
- Derivatives variables are not conclusive, but subject for interpretation
- KV's are conclusive and set operating points in the plant
- In SDPM evaluate performance by means of KV's and KPI's

- E.g. the urea yield in the reactor is set by the following KV's:
  - N/C
  - H/C
  - System pressure (Total pressure – Inert pressure)
  - Retention time





Main KPI dashboard



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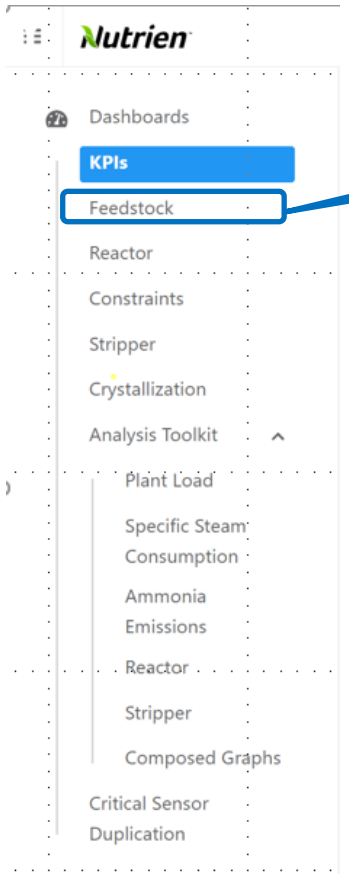
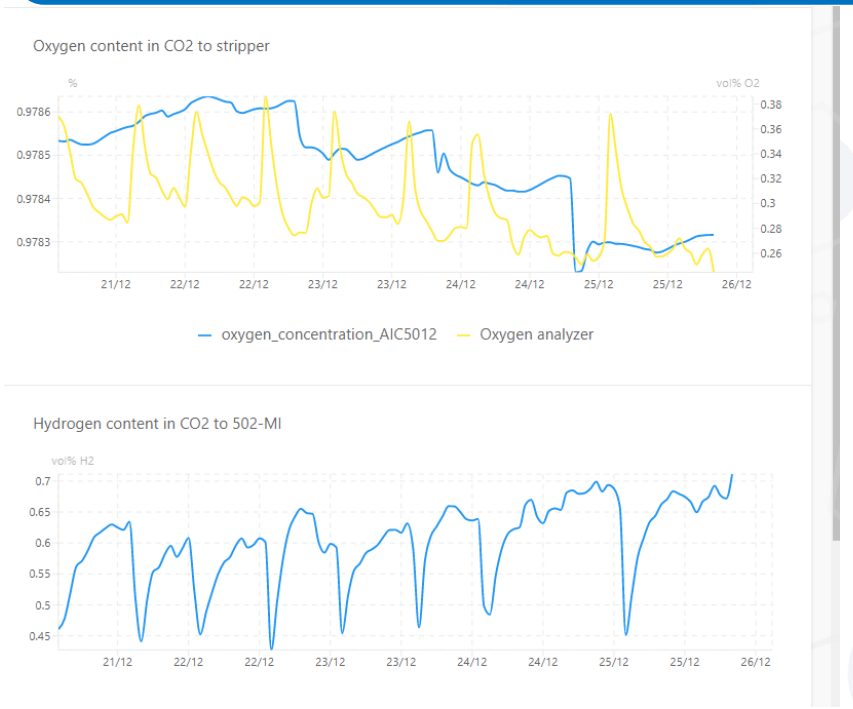
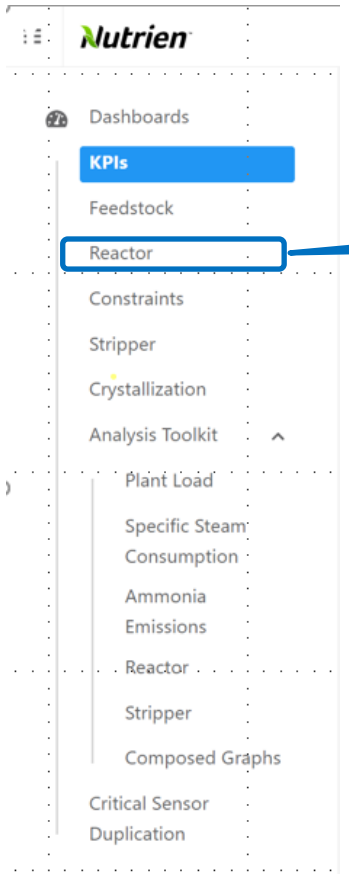
SDPM functionality



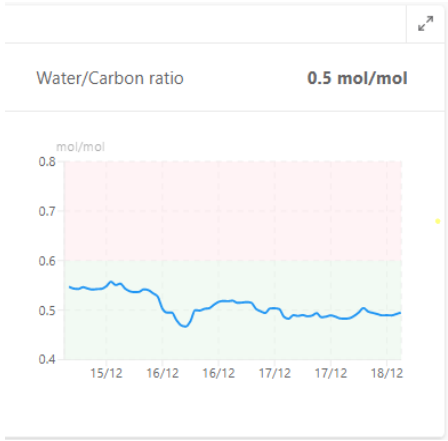
Displays mixture of graphs of KPI's, KV's and DCS sensors related to N/C-control outlet reactor and feedstock conditioning

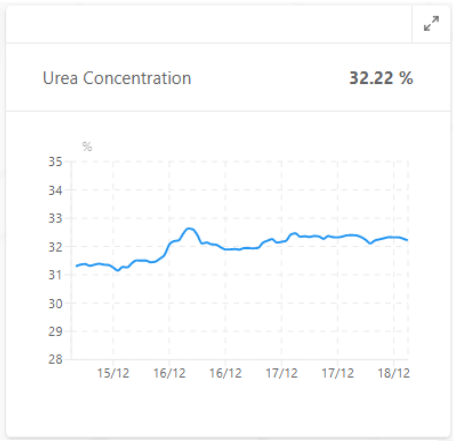


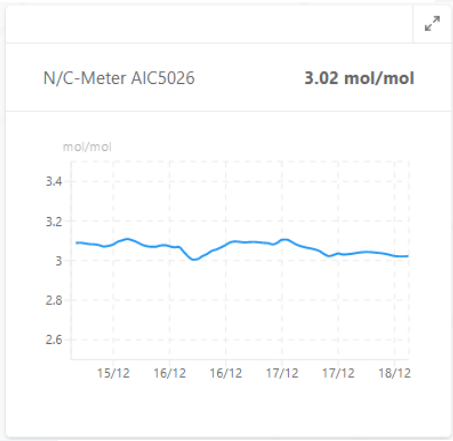
Other SDPM functionality



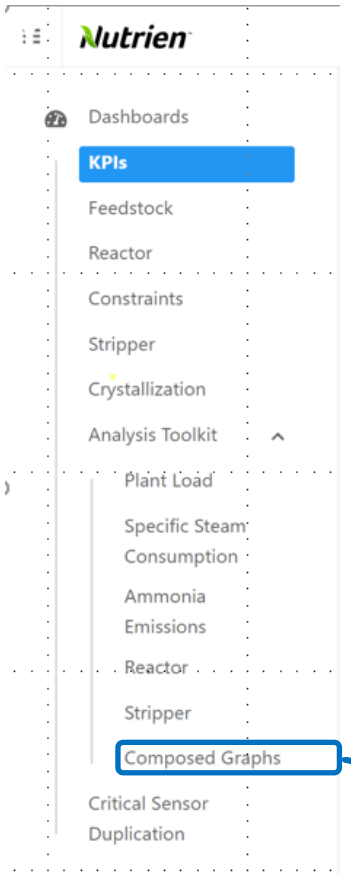
Monitor reactor performance based on KV's

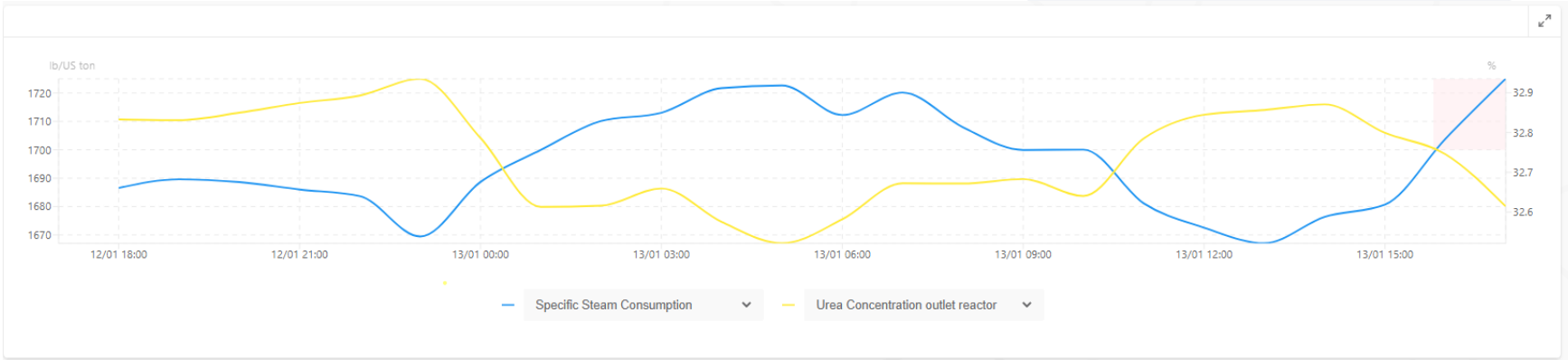


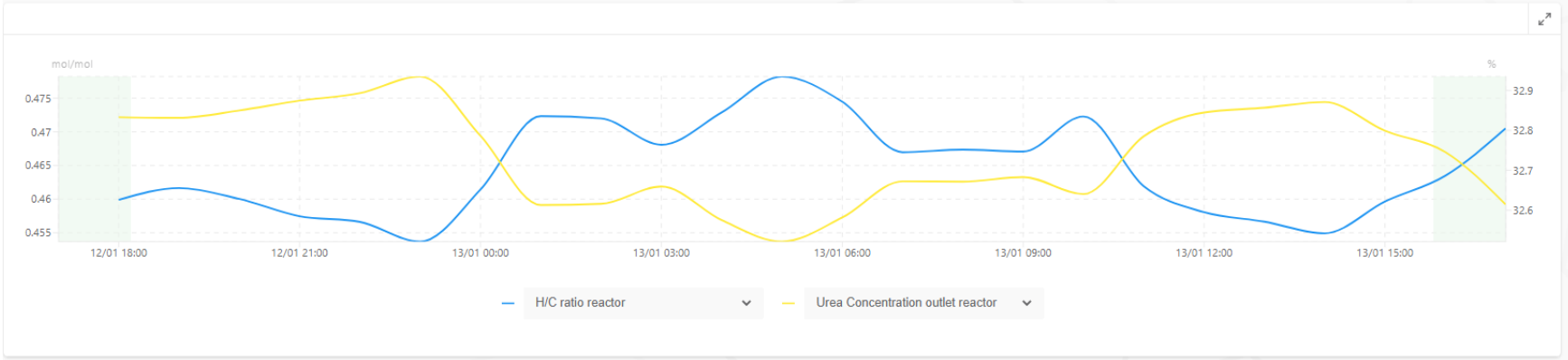




Other SDPM functionality







Compose your own graphs from a selection of KPI's, KV's and DCS sensors.
Powerful tool to analyze the plant!

Summary SDPM

- Real time access to online plant key data (web app and mobile devices), for which a low-bandwidth data connection will be enough
- Custom and variable dashboard setting which is default set by Stamicarbon
- With SDPM, information is spread and shared in the organization from a unique single data source
- Access to direct support of Stamicarbon engineers by means of periodical reports, in combination with telco or video conf. for clarifications, focusing on performance/improvement opportunities
- Access to rapid remote support for troubleshooting
- Model to be developed from actual plant design, then fine-tuned during first 3 months of plant operation to calibrate online data and produce the soft sensors

The Process Monitor brings a wide service package and the feedback and back-up of experts by ADVANCE CONSULT™

Nutrien Stami Digital Process Monitor Pilot Project

Conclusions:

- Three-year Pilot Project started in Q1 2020.
- Advance Consult services were much appreciated by Nutrien, 3-4% capacity increase and energy consumption reduction.
- Plant analysis is done with KPI’s and KV’s instead of derivative variables and other sensors.
- With SDPM, information is spread in the organization from a unique single data source.
- SDPM is a powerful tool to analyze and optimize a urea plant
- Dashboard optimalization is ongoing.
- New functionality is added all the time…

Thank you!

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