

Increasing Efficiency - Advanced Processes and Digitization

Chemical Industry Contribution to Reduce Energy
Consumption and Greenhouse Gas Emissions



© Mimi Potter

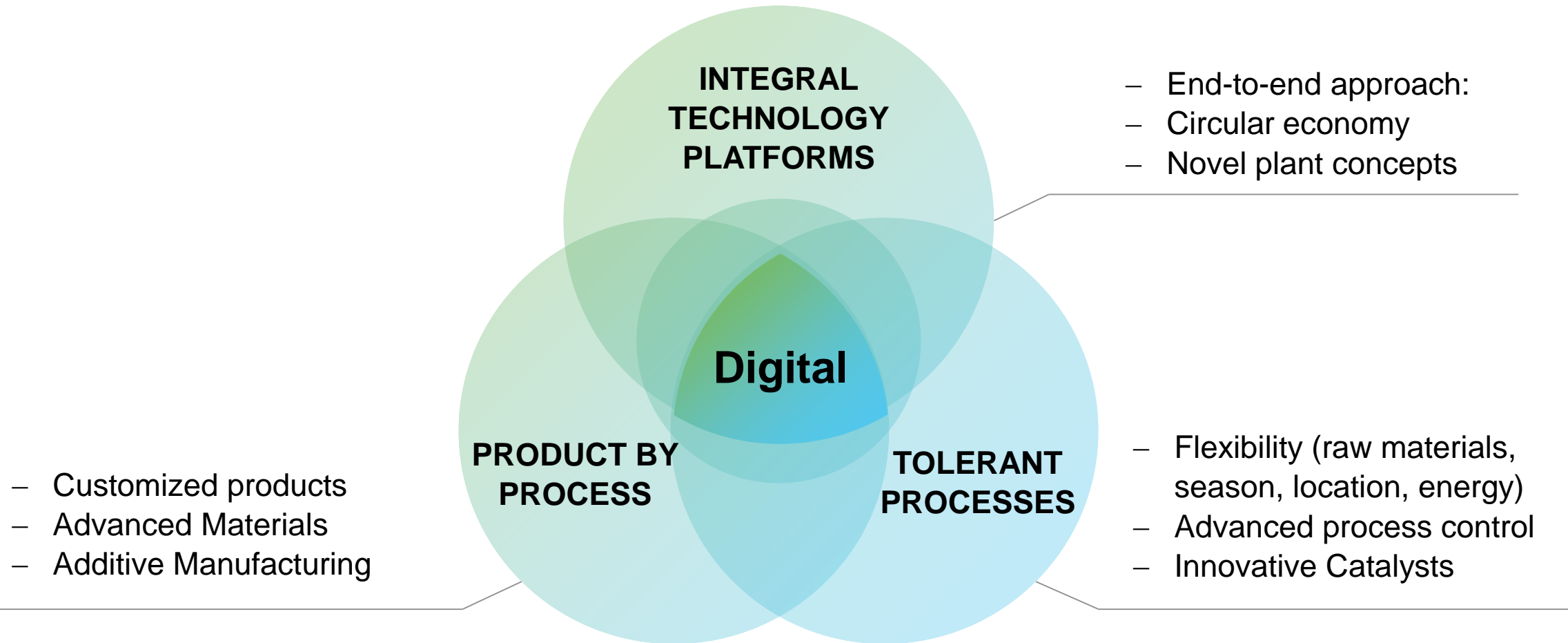
Public

Olaf Wachsen
Group Technology & Innovation
Group Process Technology
14.03.2017

what is precious to you?

The next dimension in process innovation

creates solutions for energy demand and CO₂ emissions reduction in raw material supply, production and application



Digitization transforms the chemical industry rapidly

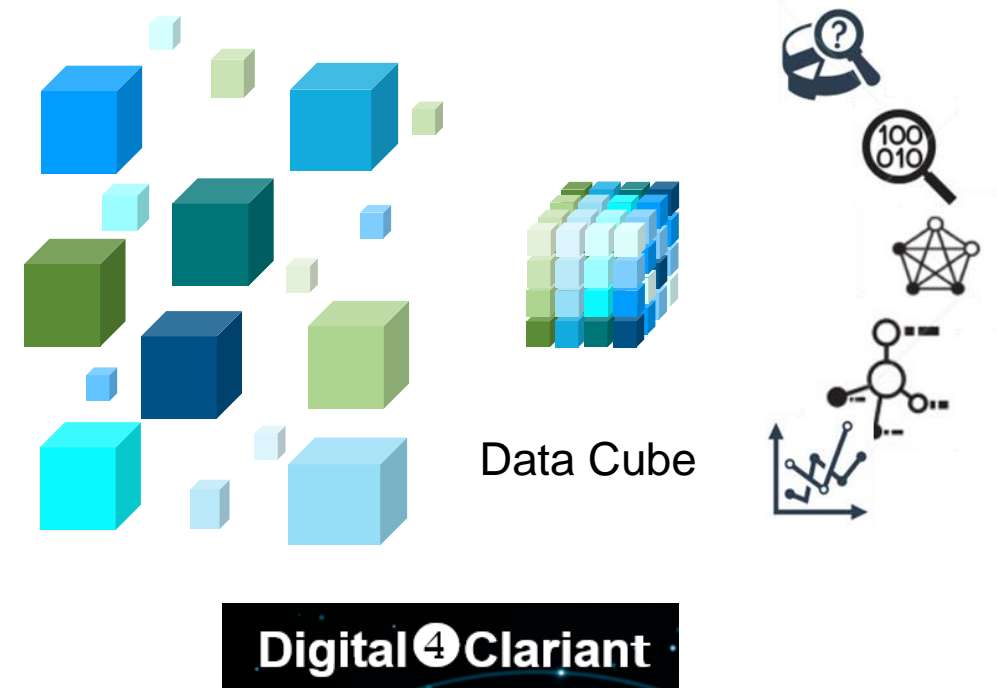
DATA MANAGEMENT AND ANALYSIS

Key enablers in all fields of Process Industry



DISCOVER VALUE OUT OF BIG DATA

Novel methods are required to capture relevant information from many independent data sources



Modular plant design enables flexible & sustainable production concepts



Mission

Advance the production of high-value products that meet high quality demands in **flexible intensified continuous plants** by introducing novel online sensors & closed-loop control methods.

Characteristics

- Miniaturized equipment
- Intensified heat & mass transfer
- Possibly modular setup



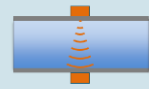
Containerized modular plant from F³ Factory project

Benefits

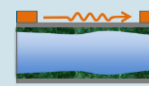
- Product uniformity
- Sustainability
- Fast adaption to market demand
- Innovative products

Novel sensors

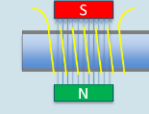
Ultrasound (across pipe)



Ultrasound (along pipe)



Low field NMR spectroscopy (permanent magnet)



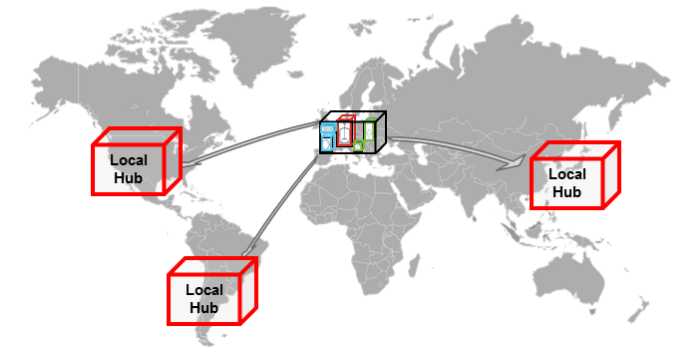
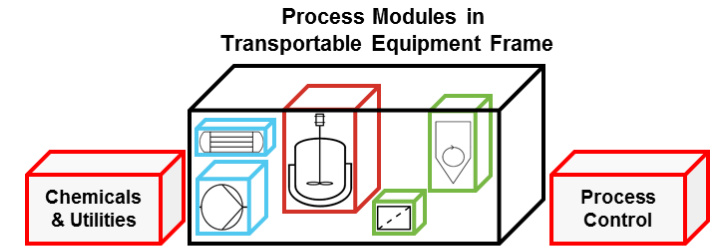
Novel control concepts

Model-based control

Online state & parameter estimation

Sensor failure detection & correction

Online performance monitoring

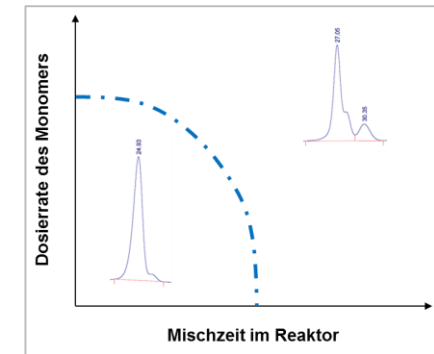
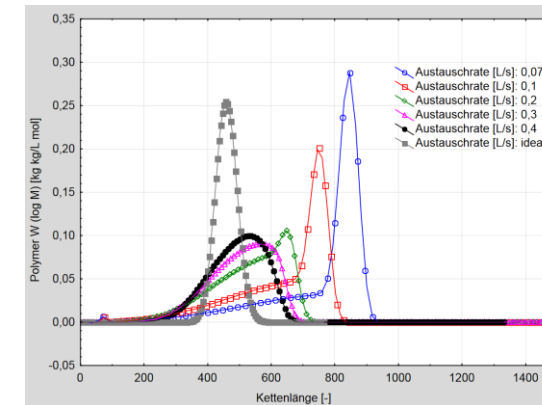
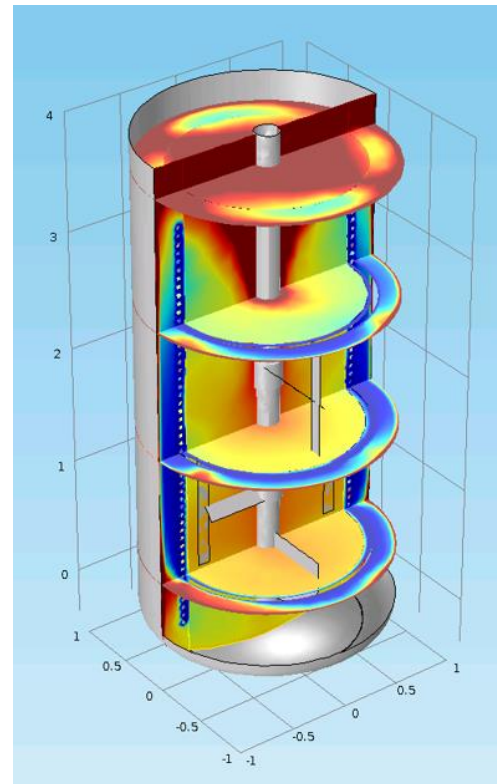
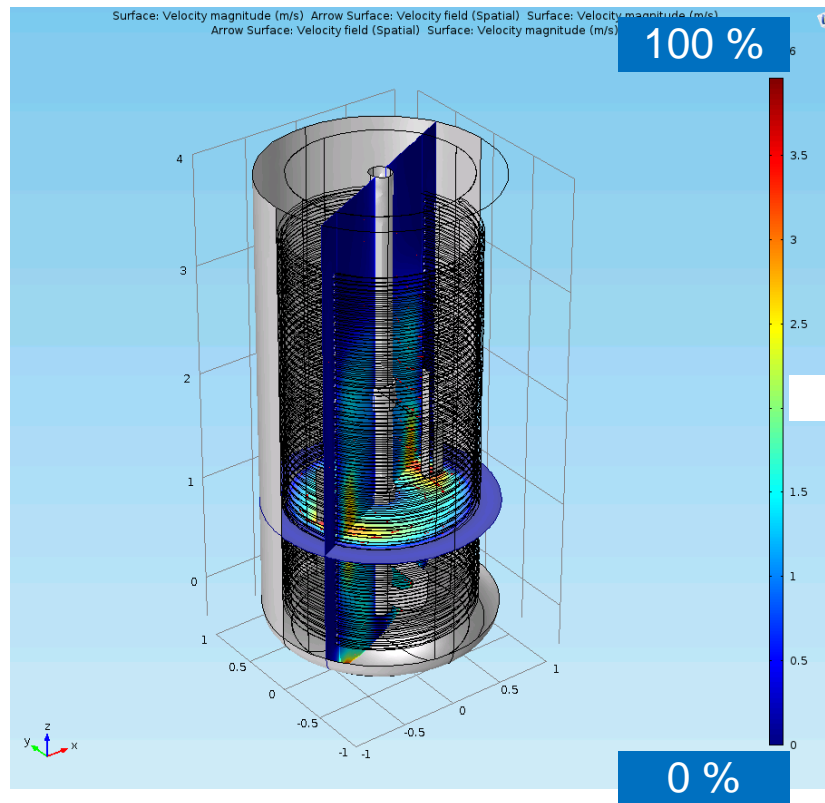


Requirements:

- Robust software systems
- Industrialized novel sensor technologies
- Modular process control elements
- System wide optimization
- Safe remote control
- Health monitoring, failure detection
- Data driven predictive maintenance

Product by process supported through multi scale simulations – from process details to product performance

- Effect of process conditions on polymer chain length distribution, which determines product performance



Requirements:

- Models for product behavior in application
- Hybrid modelling (multi scale, multi method)
- Automated optimization

Conclusions

- ✓ **Chemical production** uses more and more **digital innovations** such as novel sensors, data-capturing, planning and control, modeling and simulation (materials, processes, infrastructure), cloud computing and (big-) data analytics
- ✓ New **modular continuous plant processes** are more economic and sustainable than current batch operations and only possible by new type of equipment design, **advanced digital process control and online process analytics**
- ✓ If further applied in the chemical industry, the **impact of process control and new processing technologies** could result in **significant reduction of CO₂ emissions**, less consumption of solvents and in acceleration in the development of new products (2x faster additional innovations and 2x shorter times-to-markets)
- ✓ **Digital transformation projects to transform existing chemical plants** implementing latest process innovation could lead to significant efficiency gains in manufacturing (retrofit)
- ✓ The total **typical budget required** per project including the construction of **first of its kind modular plant** also for **circular economy cases** is estimated to be in the **20 – 50M €** range
- ✓ Tailored **new materials based on digital manufacturing technologies** will enable significantly increased impact on resource & energy efficiency down the value chain, e.g. in transport or housing

CLARIANT 

Disclaimer

- This presentation contains certain statements that are neither reported financial results nor other historical information. This presentation also includes forward-looking statements.
- Because these forward-looking statements are subject to risks and uncertainties, actual future results may differ materially from those expressed in or implied by the statements. Many of these risks and uncertainties relate to factors that are beyond Clariant's ability to control or estimate precisely, such as future market conditions, currency fluctuations, the behavior of other market participants, the actions of governmental regulators and other risk factors such as: the timing and strength of new product offerings; pricing strategies of competitors; the Company's ability to continue to receive adequate products
- from its vendors on acceptable terms, or at all, and to continue to obtain sufficient financing to meet its liquidity needs; and changes in the political, social and regulatory framework in which the Company operates or in economic or technological trends or conditions, including currency fluctuations, inflation and consumer confidence, on a global, regional or national basis.
- Readers are cautioned not to place undue reliance on these forward-looking statements, which speak only as of the date of this document. Clariant does not undertake any obligation to publicly release any revisions to these forward-looking statements to reflect events or circumstances after the date of these materials.