Simcenter Nordic Conference 2018
Industrial Machinery & Heavy Equipment

The Industry is Quickly Evolving

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Massive Complexity

Competitive Pressure

Regulation Pressure

Closing the Loop with the Holistic Digital Twin

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Feed back insights to continuously improve product and production

Innovation in Engineering Process and Solutions
Predictive Engineering Analytics

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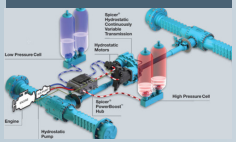
Systems-Driven Product Development

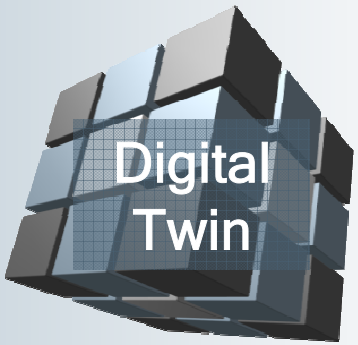
System Mockup

Predictive Engineering Analytics

1D

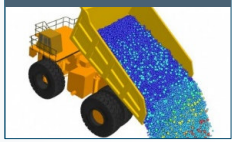


3D



TEST

CFD



Exploration - Analytics - Reporting

Managed in PLM Context - Multi-Domain Traceability, Change and Configuration

Digital Twin

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Simcenter - Solutions Process Overview

Supporting Multi-Attribute Optimization & Performance Engineering

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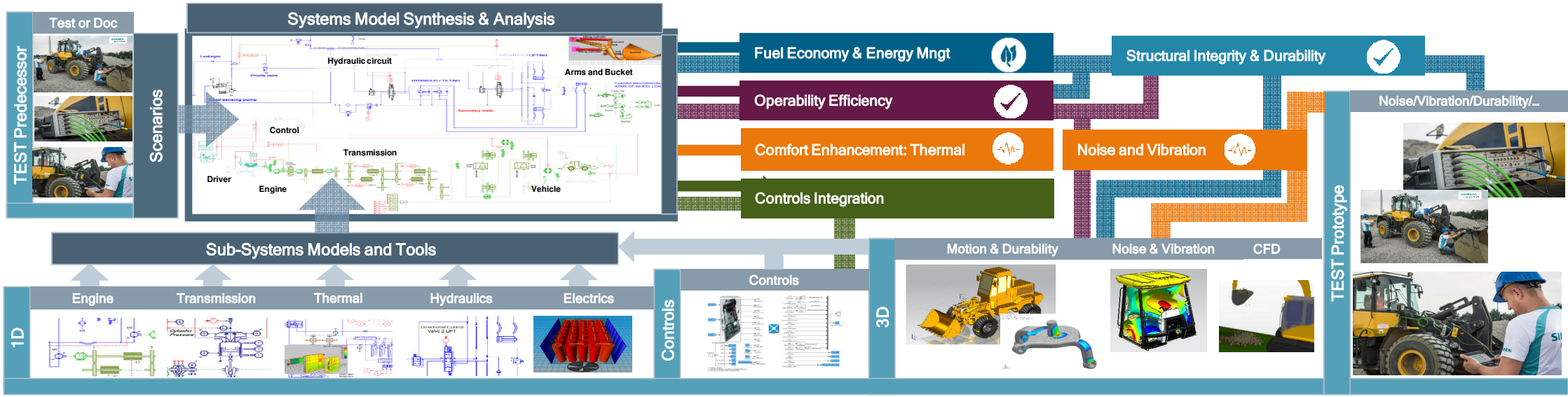

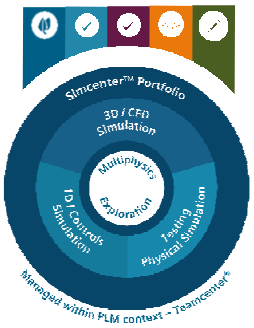

Heavy Equipment Engineering Development

Performance Digital Twin

Performance Physical Twin

Simcenter Portfolio

Engineer innovation for machine performance

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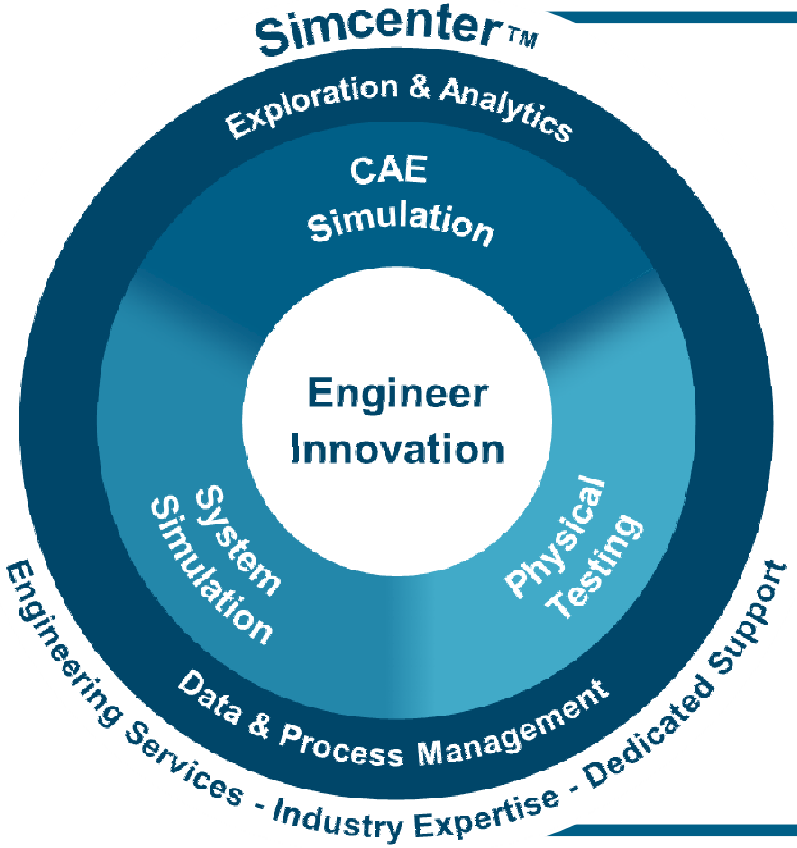

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Engineer innovation for machine performance

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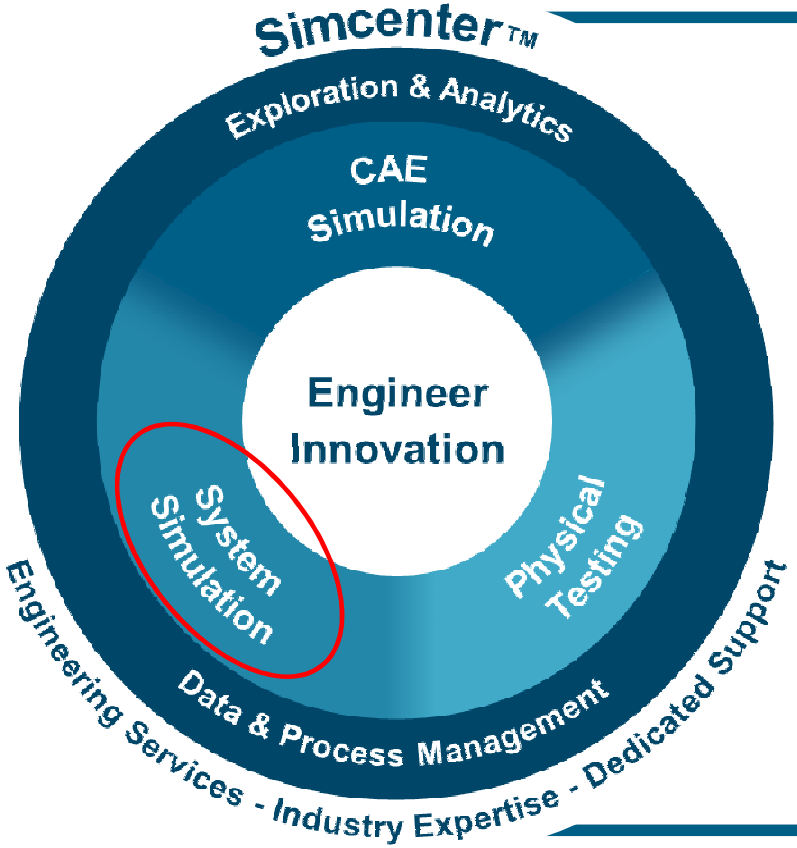

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Picanol
Launching a highly energy-efficient loom

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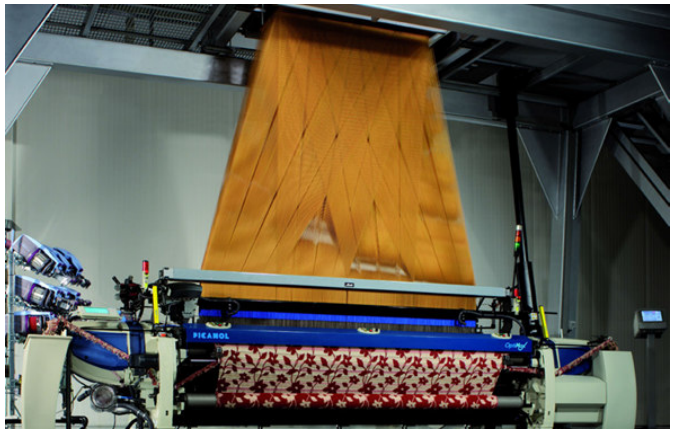
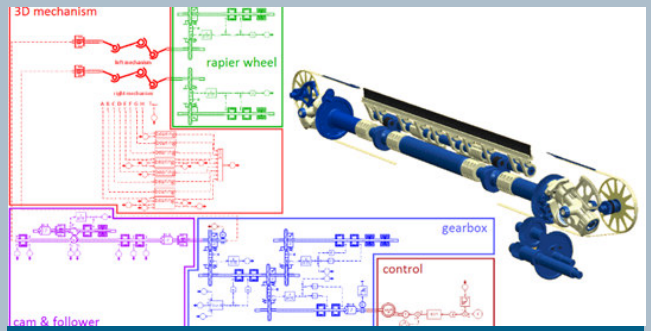
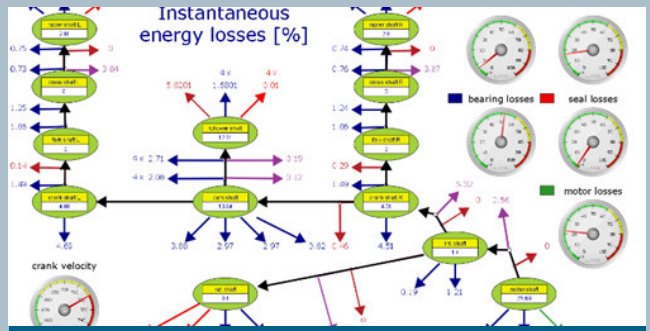


- **Designed the "most energy-efficient weaving looms on the market"**
- **Balanced performance, durability, noise and vibration parameters while minimizing energy consumption**
- **Implemented advanced model-based system engineering**

Optimizing the design towards energy performance



Co-simulation with Simcenter 3D Motion



Flow chart of instantaneous energy losses

- Support the scalable optimization of energy flows thanks to Simcenter Amesim
- Use energy efficiency and total cost of ownership as key performance criteria

"A platform like Simcenter Amesim offers extensive libraries of components that also connect to describe complete multiphysics systems, a prerequisite for advanced model-based system engineering."

Kristof Roelstraete, Manager Research and Development

Cummins
Evaluating energy saving wheel-loader architecture

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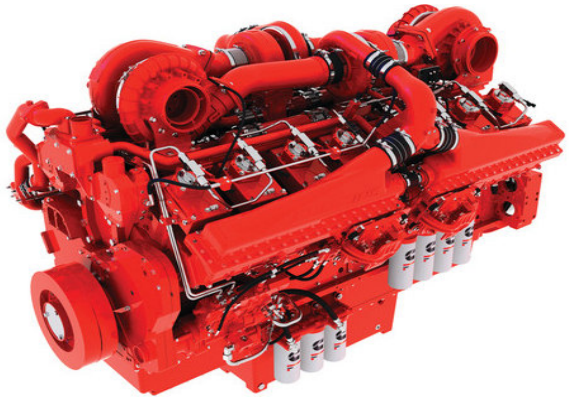
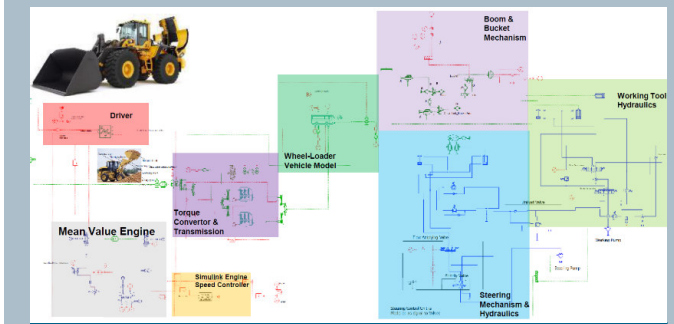
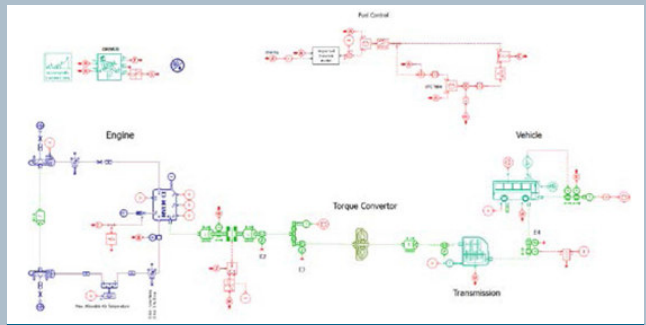


- **Develop a conventional wheel-loader system model that can be used to evaluate the transient response**
- **Identify improvements in potential driveline efficiency and fuel savings opportunities over a conventional wheel-loader**

Predict machine responsiveness and fuel consumption under particular drive cycle



Wheel-Loader LMS Amesim Model



Parallel and series hybrid architecture models of wheel-loader

- Predicted engine speed, machine ground speed and cycle fuel consumption were found to correlate very well with the test results.
- An energy distribution study showed significant power losses in the wheel-loader driveline.

"*Advanced System Simulation Wheel Loader Model for Transient Response and Architecture Studies*", R. Saha, M. Madurai Kumar & L-K. Hwang, L., Cummins Inc.-
N. Zou, C. Yu, Z. Yunfeng and A. Luo, Guangxi Liugong Machinery Co. Ltd.
SAE paper 2015-01-2824

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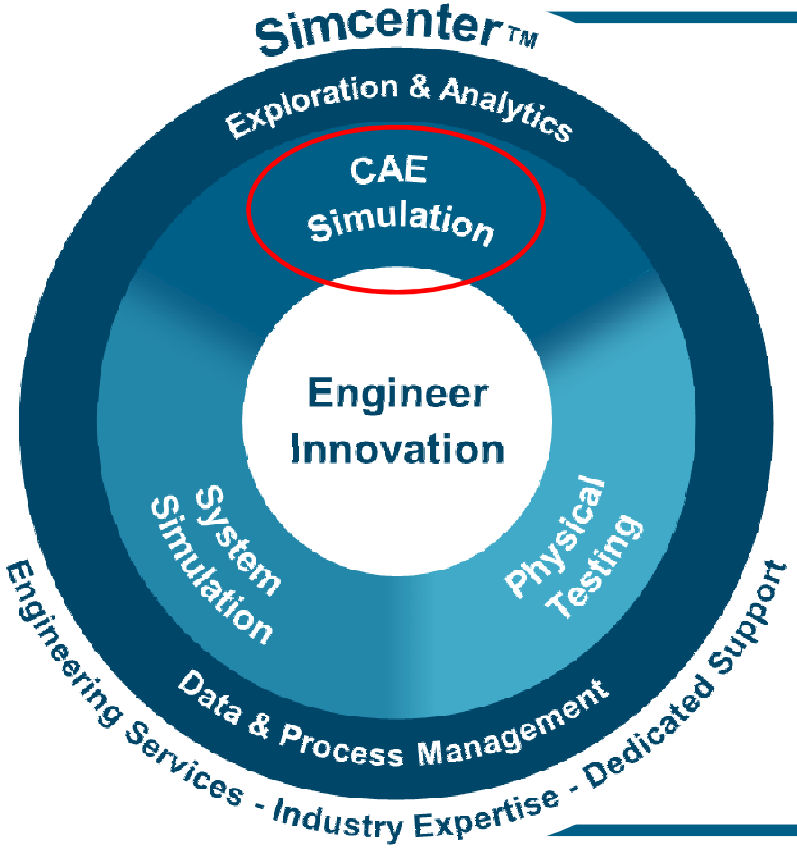

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Shenyang Machine Tool

Reducing simulation time by over 50 percent

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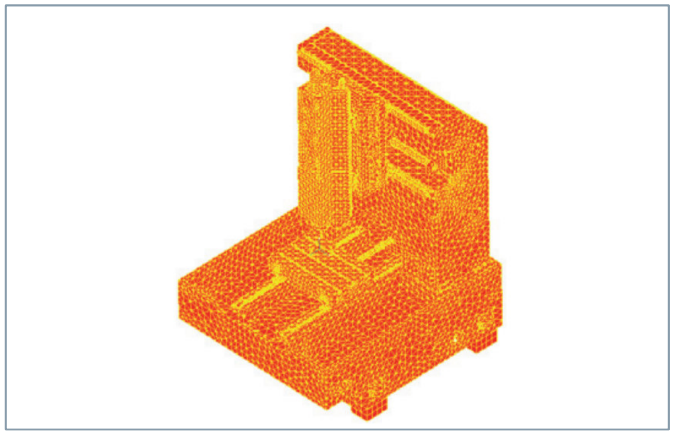
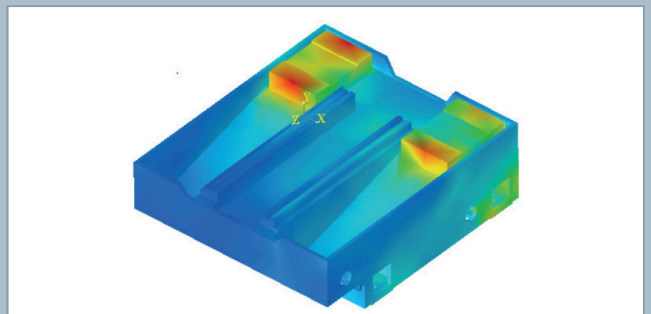
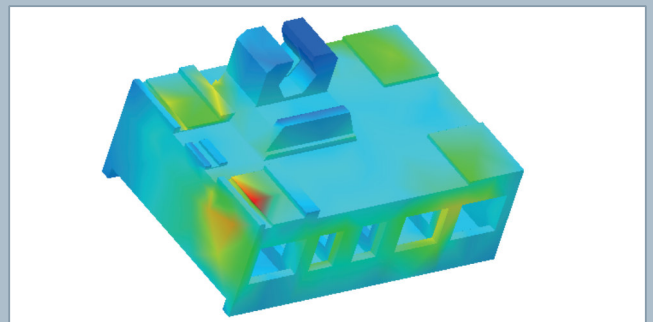


- Reduced simulation time during development by 50 percent
- Optimized the structure for smooth operation
- Implemented a method that can detect potential risks early in the development cycle

NL dynamic analysis to design smooth-operating and robust machines



Advanced finite element analysis with multibody simulation



Efficient capabilities for building the mechanism model

- Analyze component stresses with nonlinear dynamic simulation
- Deploy a solution that can be used to perform coupled electromechanical analysis

"By combining the high-end, nonlinear mechanical solution Simcenter 3D with the electrical simulation in Simcenter Amesim and controls technology, we have all the components in place to help us develop the next-generation machines."

Zhao Feng, Design Engineer Research and Development

John Deere
Using 3D solutions to increase endurance simulations

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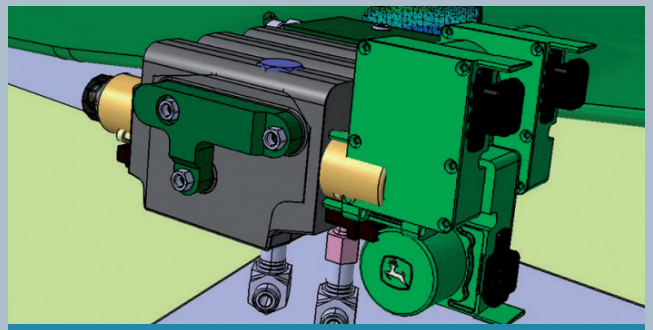
- **Notably increased number of endurance simulations**
- **Enhanced tractor reliability**
- **Reduced physical prototypes**

Structural flexibility of specific tractor components

Better performance, flexibility, comfort, economy and secured reliability



Frontloading durability simulations into our tractor design processes

- Implement complementary simulation strategies
- Leverage multiple simulation approaches to compress tractor development cycles

"The added value of Simcenter 3D on virtual durability investigations performed at John Deere is significant as it serves as the critical backbone of the hybrid approach and increases the efficiency of the mixed approach."

Christian von Holst, Senior Engineer

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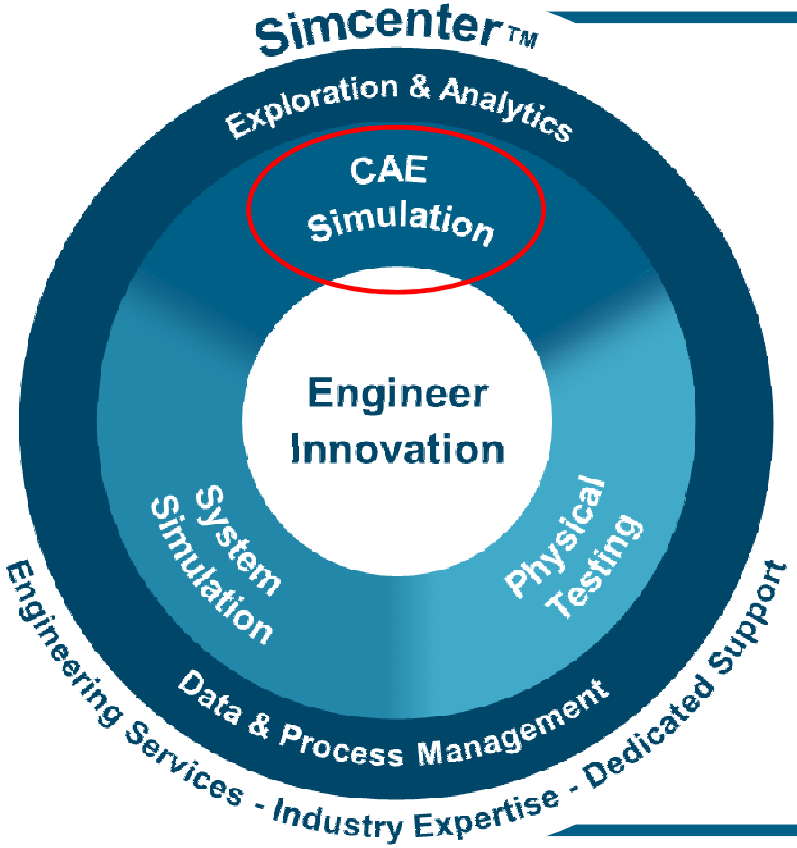

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CNH Industrial

Simulation helps design better off-highway vehicles

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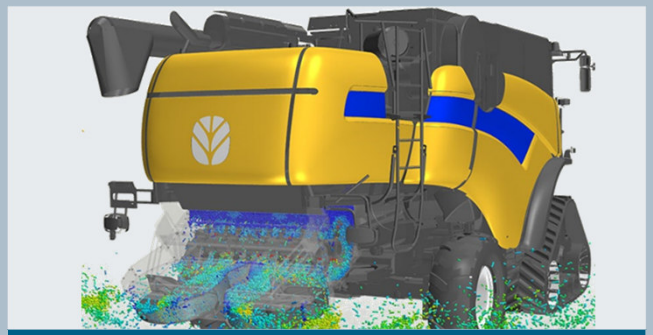
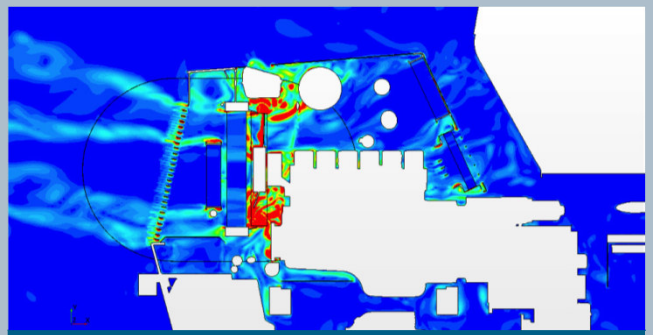
- **Enable direct model of crop processing and management.**
- **Predict and explore thermal cooling performance under different environment/wind conditions**
- **Reduce harmful emissions**

Simulation plays a central role in off-highway vehicle design



DEM looking at spray from back of harvester



Thermal cooling performance

- DEM capability of Simcenter Star CCM+ to enable accurate modeling of crop processing
- Use thermal capabilities to help in the design of more efficient cooling systems

"In the past few years, CFD has become very important to us, especially in helping us to design products that meet and exceed the requirements on new emissions regulations."

Luc Dupon, Senior Design Analysis

AGCO

Shroud design exploration ensures optimal cooling fan performance

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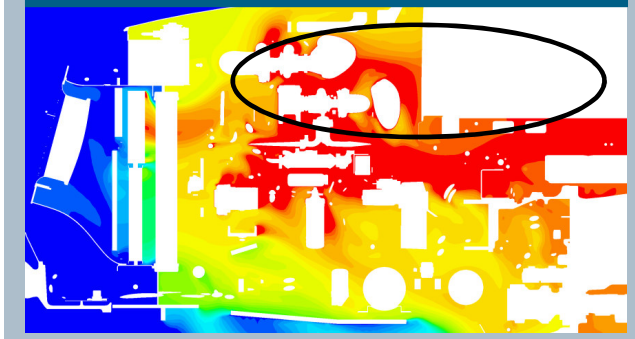
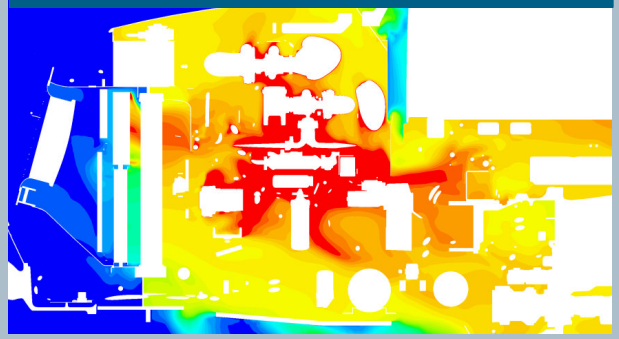
- Reduced design turn-around time
- Reduced peak temperature in engine compartment
- Ensured proper cooling air

Driving innovation through design exploration

Baseline



Improved Thermal Solution



"Simcenter Star CCM+ offered complete CAD-to-mesh process with reduced turn-around time over existing in-house tools. This enabled us to bring in-house the simulation that was previous done by outside consultant allowing us to reduce cost, as well as improve our design."
AGCO

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Engineer innovation for machine performance

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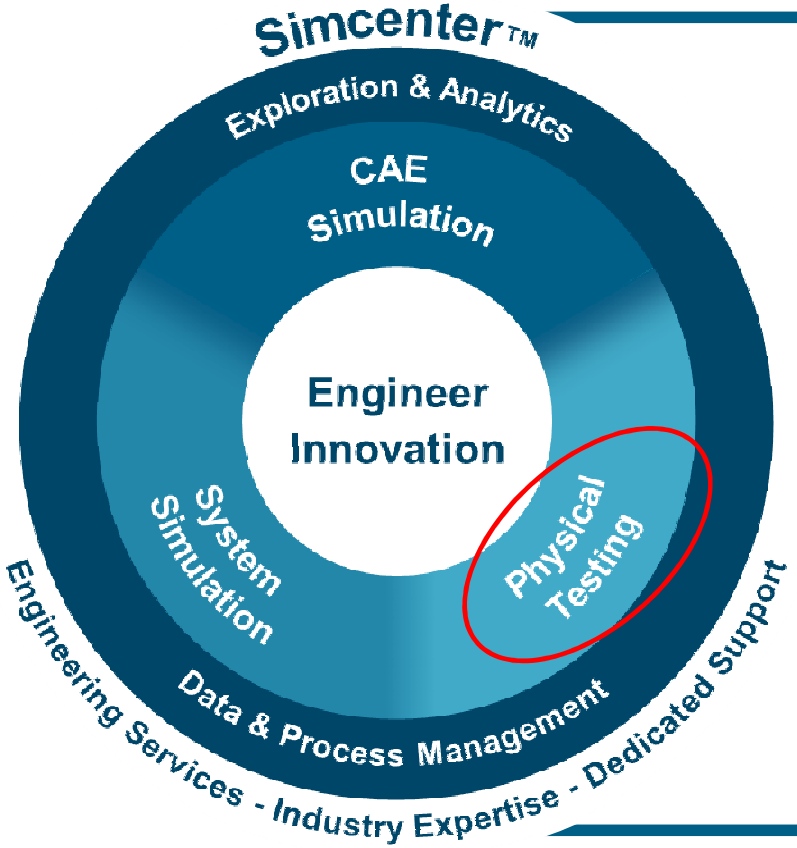

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Agfa Graphics

Reduce vibrations and deliver top-quality printing plates for customers worldwide

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- **Exceptionally fast and easy diagnostics, real-time validation and significantly more efficient troubleshooting**
- **Improved cost and time efficiency through less travel for specialists**
- **Time recordings of various vibration levels at different locations on the machine**

Improving efficiency in detecting vibrations with LMS SCADAS XS

Delivering around-the-world service

Limiting vibration in the production process

- Addressing large numbers of measurements required to identify vibrations for quality control
- Identifying different resonance frequencies to minimize/prevent vibrations

"As a global company, we were immediately attracted by the exceptional mobility and smart functionalities of LMS SCADAS XS which fit our vibration control and troubleshooting needs so well."

Agfa Graphics

John Deere
Enabling resolving excessive cabin noise

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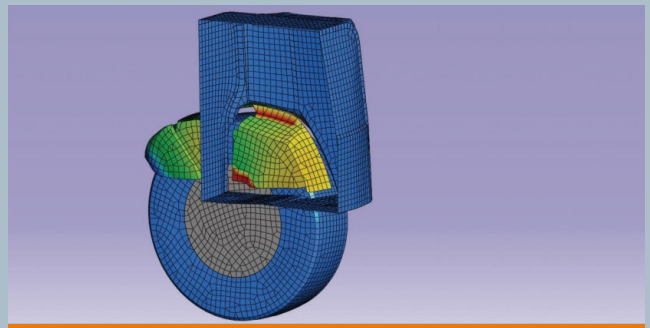
- **Developed approach for addressing acoustic issues early in the development process**
- **Quickly and efficiently identified effects that lead to loud cab noise**
- **Enabled better understanding of the complex acoustic system**

Experimental and numerical acoustic analysis

NVH testing



Acoustics simulation

- Use a combination of experimental and numerical acoustic analysis techniques
- Use Engineering services and Simcenter portfolio to identify and resolve issues

"We were able to identify the sensitivities of the different effects contributing to the cab noise phenomenon much faster and more efficiently through our cooperation with Siemens PLM Engineering services."

Dr. Ing. Christian von Holst, Group Leader, Suspension Systems

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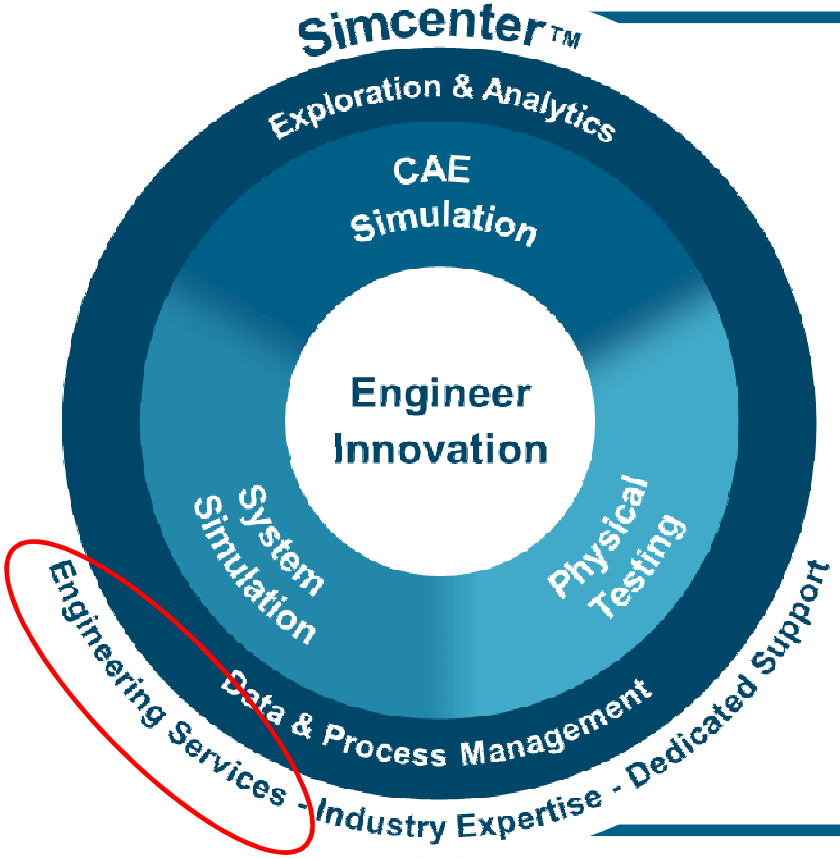

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Engineering and Consulting

Experience and global talent for valued customer partnerships

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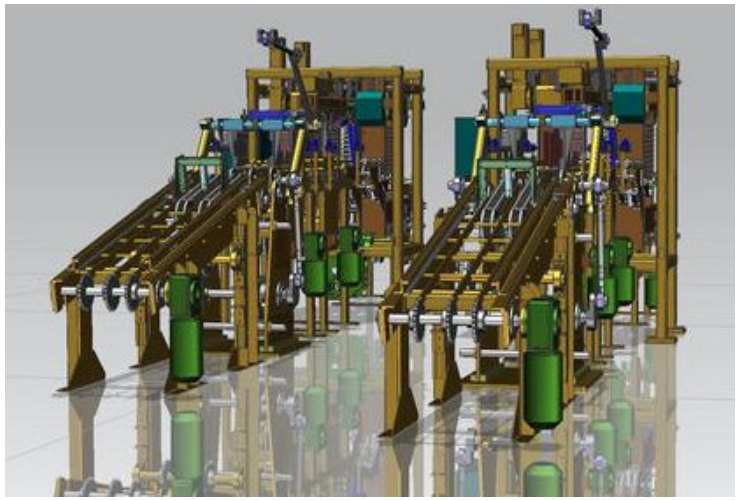
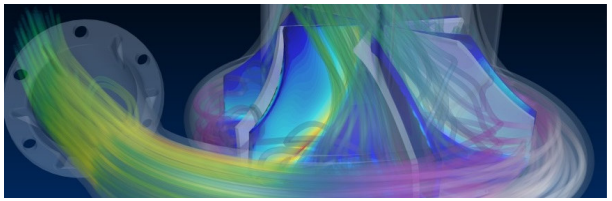
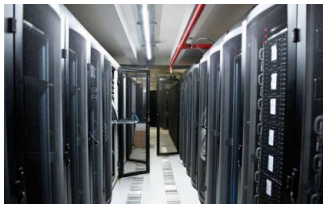
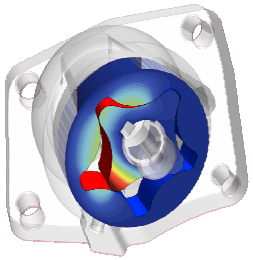
- Troubleshooting
- Co-development
- Technology transfer
- Engineering process transformation



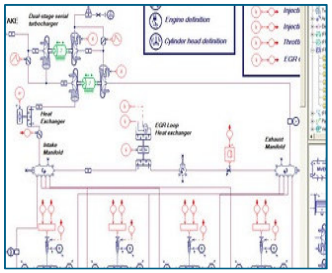


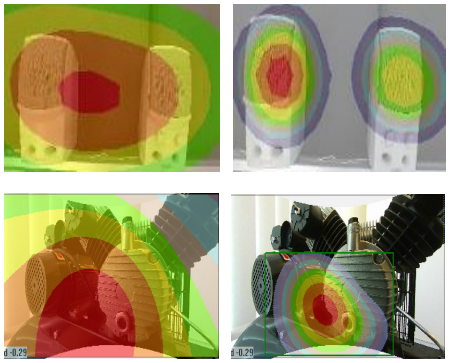


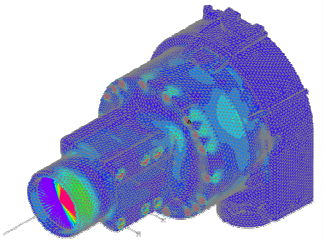


Performance Engineering

- Noise & Vibration
- Durability
- Efficiency
- Speed
- Mechatronics development
- CFD
- Controls







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Engineer innovation

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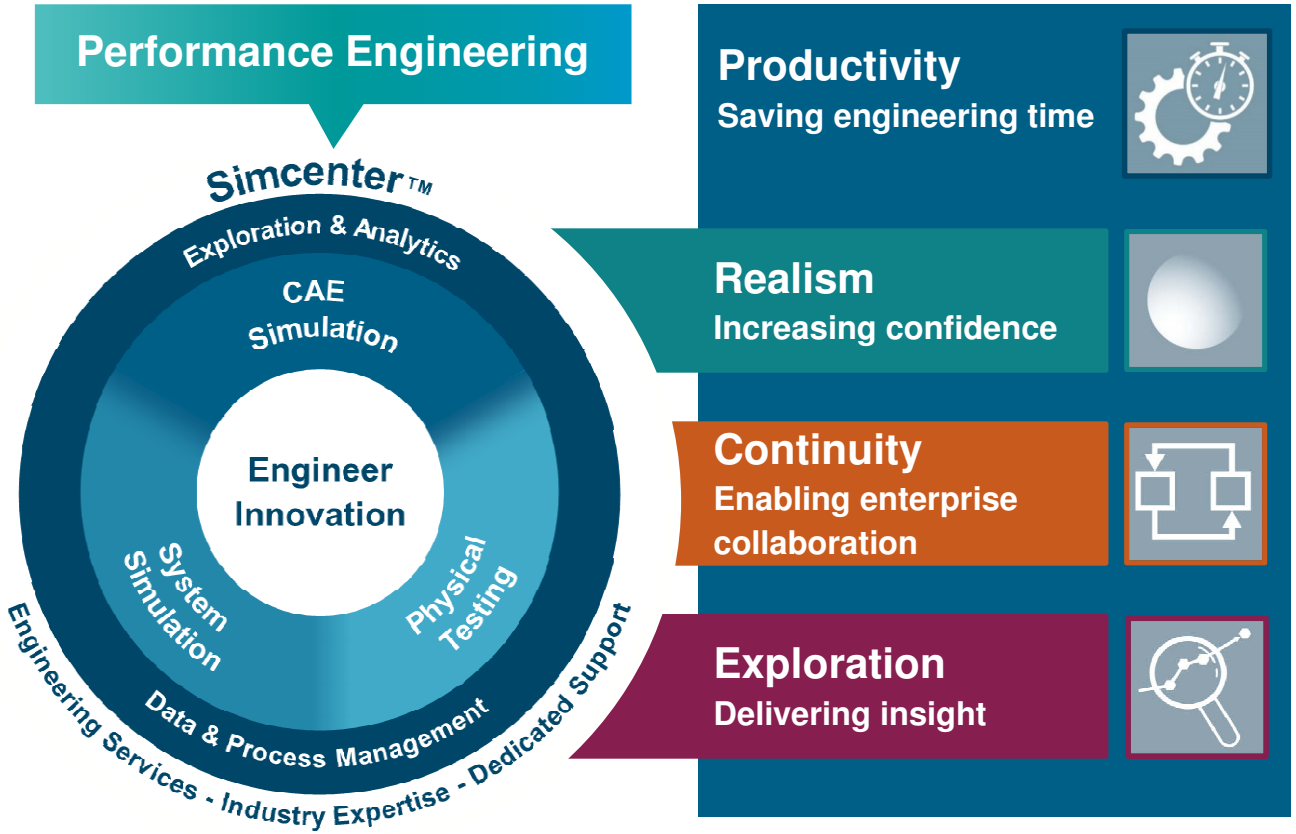

- Innovative solutions
- Faster to market
- Better products
- Lower development cost
- Increased market agility

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Giulio Camauli

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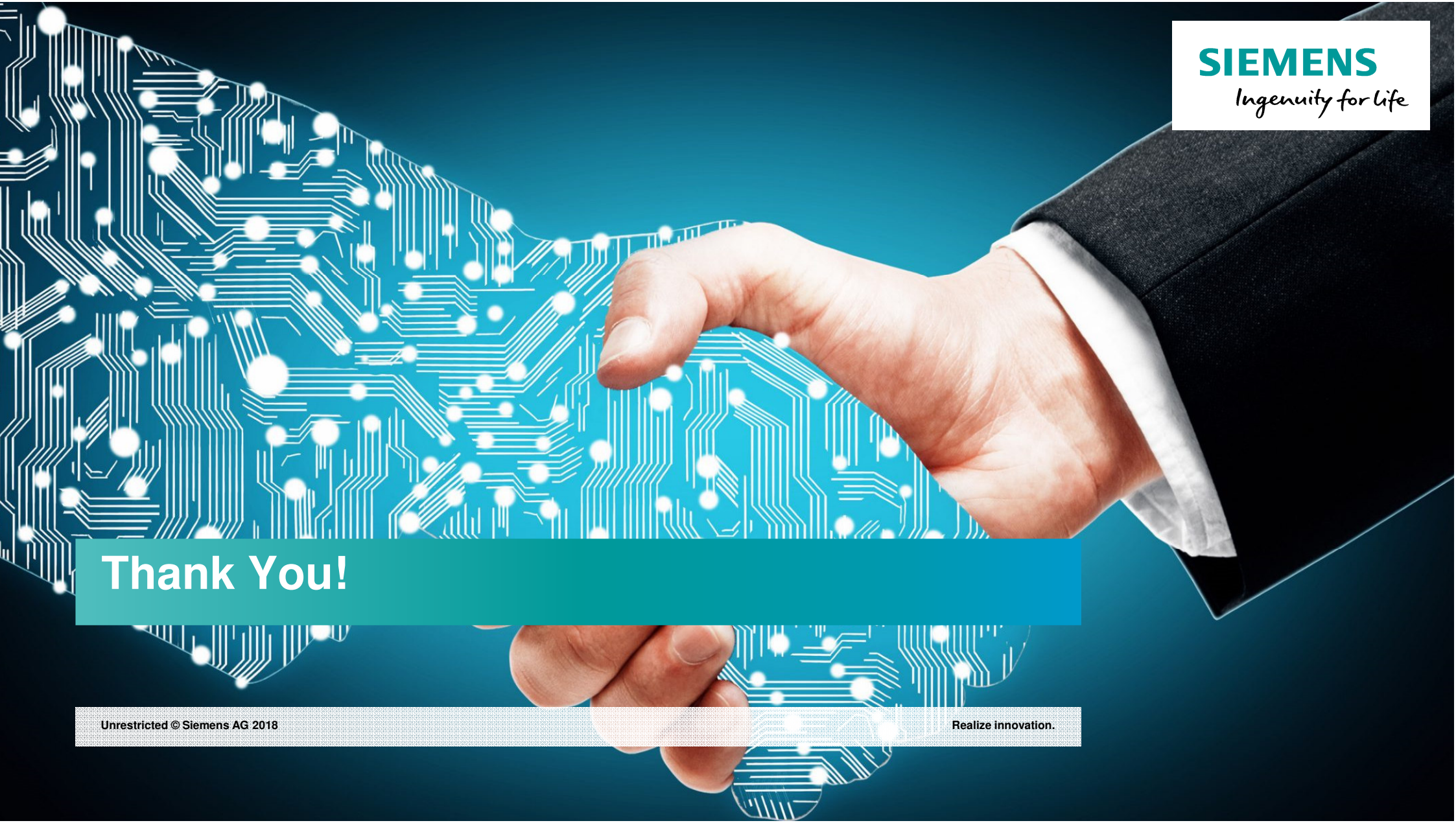

Thank You!