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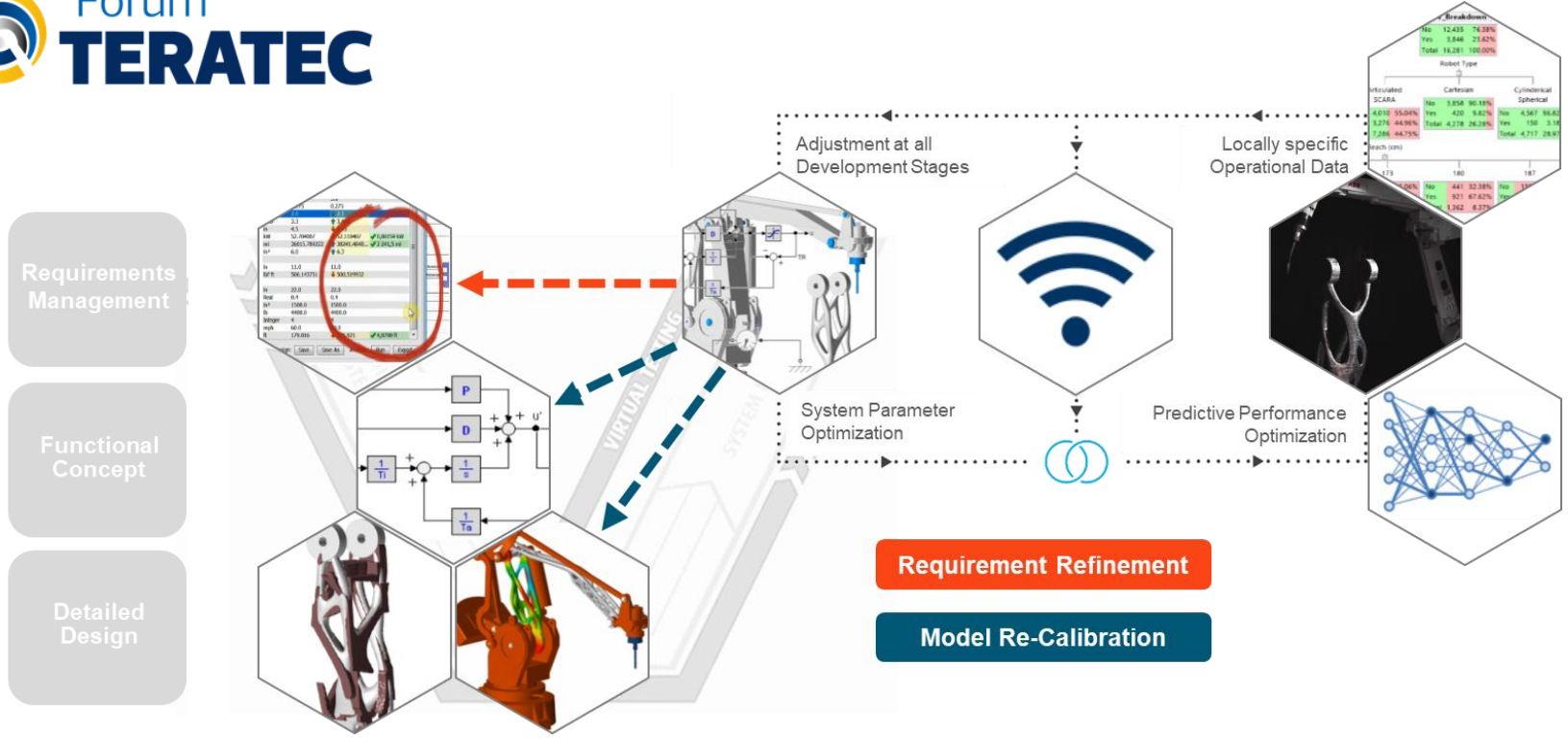

ALTAIR

WORKSHOP – DIGITAL TWINS FOR OPERATIONAL PERFORMANCE ENHANCEMENT

Christian Kehrer / Business Development Director – Systems Integration

Leading Convergence of Computational Science and AI in Engineering

Altair is at the forefront of the evolution toward a smarter, more connected world.

Helping companies use digital twins, intelligent models, and the convergence of simulation, HPC, and AI to predict and optimize system outcomes.

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Altair-at-a-Glance

$572M
FY22 Revenue

74 offices
In 27 Countries

3,000+
Engineers, Scientists, and Creative Thinkers

150+
Altair and Partner Software Products

13,000+
Customers Globally

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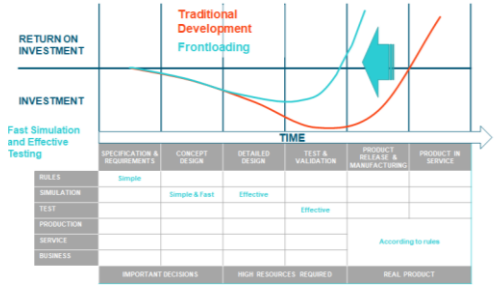
The most valuable Digital Twin makes you benefit from the convergence of simulation and data!

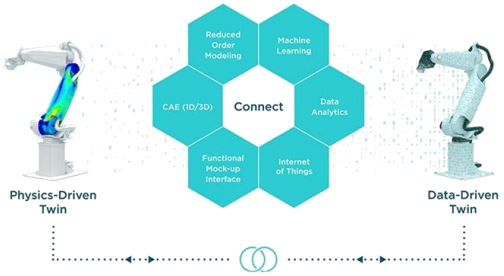
Gaining benefits starts with breaking silos

…by connecting the dots between different departments and engineering disciplines



Frontloading by means of virtualizing tests offers massive, immediate cost saving potential

…by re-use of models and data created during different stages of a product's life cycle



Performance optimization of systems in operation requires convergence of simulation and data

…by enriching measurements with simulation and vice versa

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Altair Digital Twin Platform: Complete & Open

Challenges of Optimizing Products and Process from Design to Operation

1 Productivity

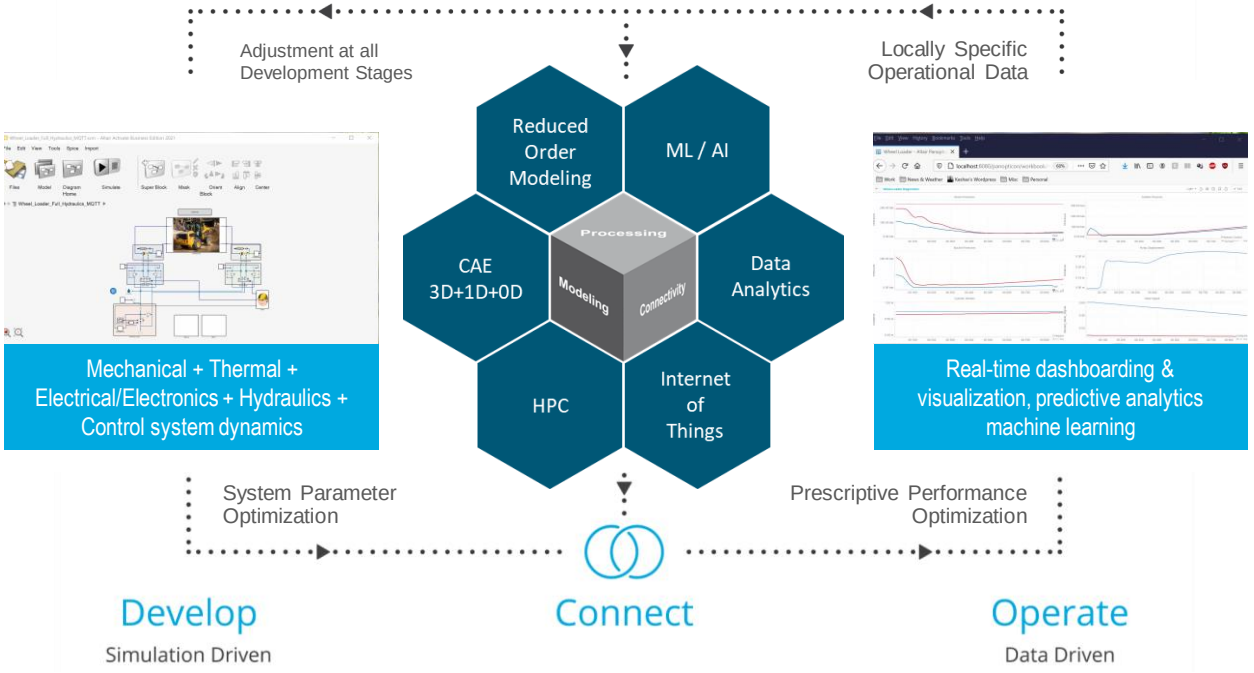
How to break silos, speed-up collaboration and ensure faster time to market?

2 Reliability

How to increase consistency and reliability incl. accurate requirements for device design (structures, motion, controls)?

3 Performance

How to optimize the entire product performance of mechatronic systems incl. all interacting effects?



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SOME NUMBERS…

Businesses are Adopting Digital Twin Technology at Blinding Speeds

71% of businesses began investing in DT within the past year

11% will adopt it within 6 months

More than half will adopt DT in 1-2 years.

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View the Report at: https://www.altair.com/resource/digital-twin-summary-report

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SOME DEFINITIONS…

Definition of a Digital Twin

A digital representation of a product that

- supports **decision making** during the development phase
- helps to **optimize the performance** of the product during operation and
- provides insights for **closing the feedback loop** in the sense of continuous development

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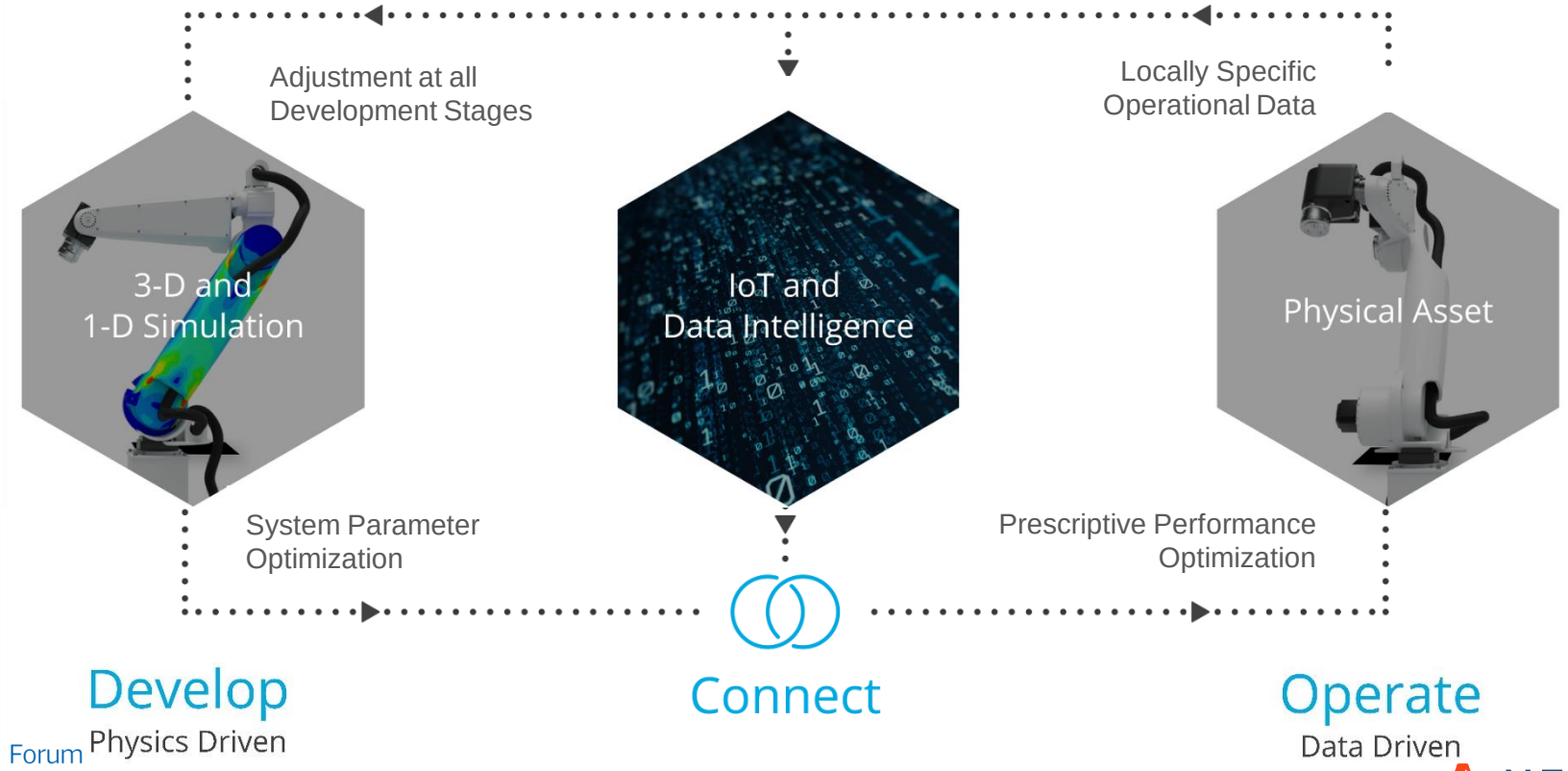
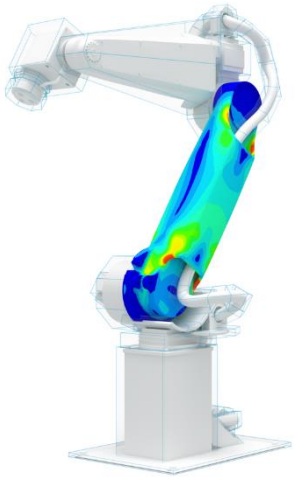
Digital Twins Augmenting Design and Operation



What do you want from your Digital Twin?

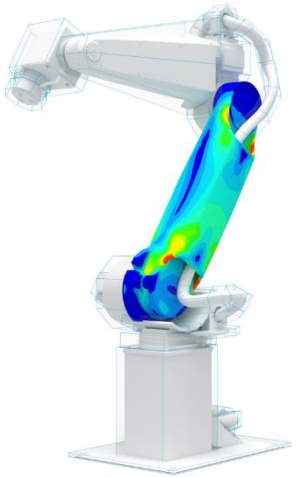
Why you need to ask the right questions



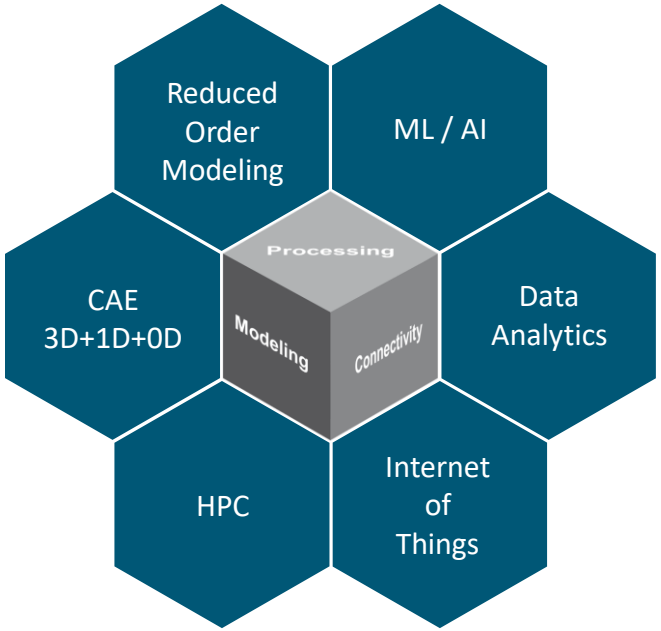
Physics-Driven Twin

Data-Driven Twin

Digital Twin Building Blocks



Physics-Driven Twin



Data-Driven Twin

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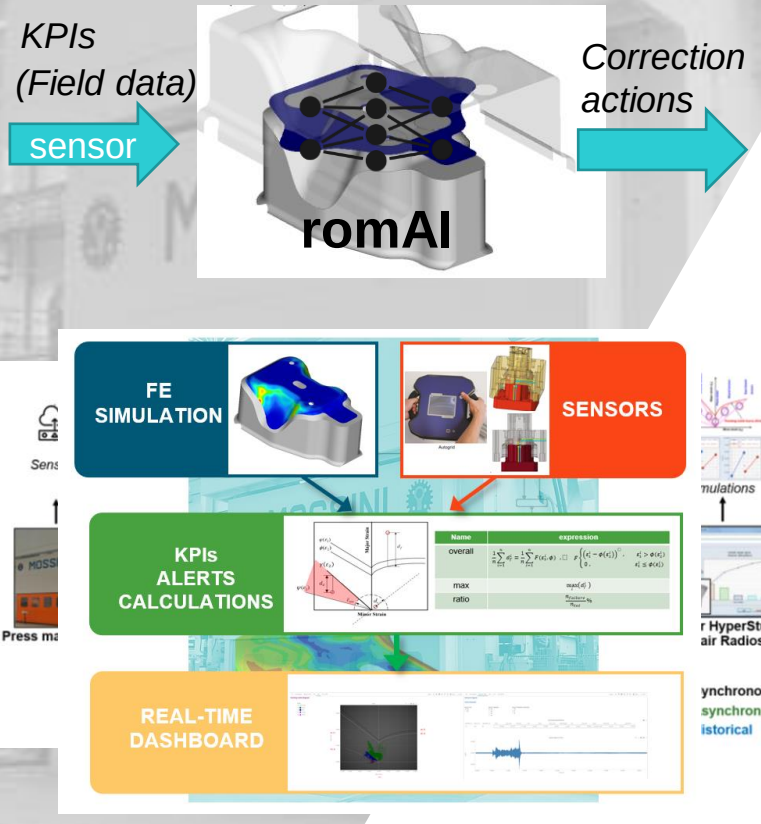
SELECTED USE CASES

A Digital Twin for Improved Process Capabilities in Sheet Metal Forming

Challenge

Accurate monitoring and control of the forming process and its dependency on varying material properties and operating conditions

A Digital Twin for Improved Process Capabilities in Sheet Metal Forming



Challenge

Accurate monitoring and control of the forming process and its dependency on varying material properties and operating conditions

Solution

Smart use of both – measured and simulated data - to better control and improve the process incl.

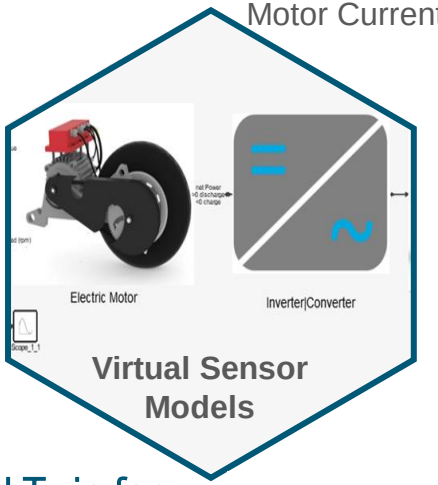
- Accurate and efficient Reduced-Order Models (ROMs) of the forming process
- A comprehensive DT environment incl. FE analysis, DoE and process automation, ROM, system simulation and visualization of KPIs and correction actions on an IoT-based dashboard

Value

- **>15%** reduction of the production waste
- Efficient input parameter variation → run time reduction from hours to seconds
- Comprehensive, accessible and open data processing infrastructure enabling for correction actions and production alerts

E-Powertrain Twin Demonstrator

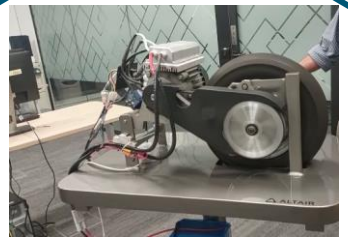
Operational Data
Motor Speed
Motor Current



Virtual Sensor Models

Real time Streaming & Visualization

Operational Data
Motor Speed
Motor Current



Hardware under Test

Digital Twin for Development

physics driven

Simulation Results
Battery SOC
Battery Voltage / Current / Power

Simulation Controlled
Hardware Actuation
ABS controller parameters

Digital Twin for Operation

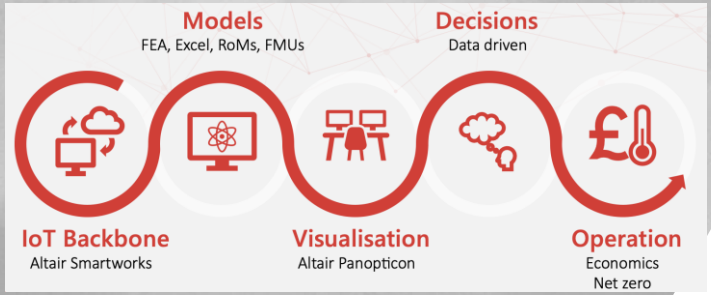
data-driven

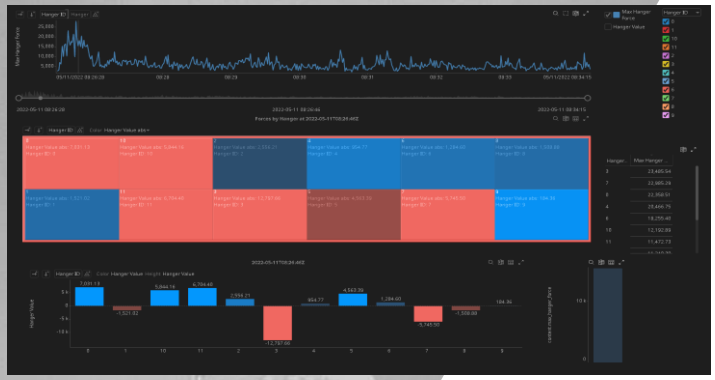
A Physics Based Digital Twin for Nuclear

Challenge

Reduce costs of downtime due to unnecessarily early and often inspections based on worst-case design scenarios

A Physics Based Digital Twin for Nuclear





Panopticon dashboard for:
Real time data visualisation
Data driven decisions

Challenge

Reduce costs of downtime due to unnecessarily early and often inspections based on worst-case design scenarios

Solution

Connect existing verified and validated simulation models to operational data in use of an open and scalable architecture (SmartWorks) for

- Structural integrity models: plasma facing first wall, pressure equipment, cooling water system
- “Virtual sensors” that can’t be instrumented, e.g., fatigue
- IoT backbone for data storage, API exposure and automatic actions

Value

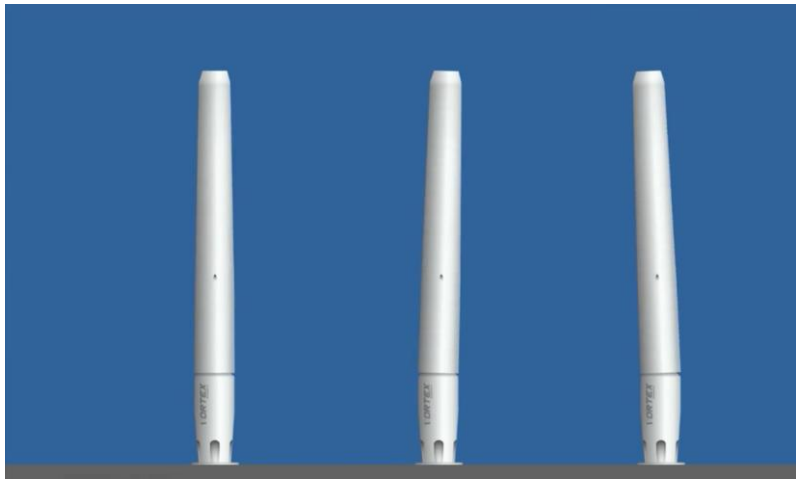
- Extend asset life with real time operational data
- Schedule inspection and maintenance based on actual operation
- New insights and continuous verification

VORTEX Bladeless

Reinventing Wind Power Generation

Challenge

Develop a new innovative wind power technology avoiding current problems of horizontal-axis turbines and design a prototype fast and cost-efficiently



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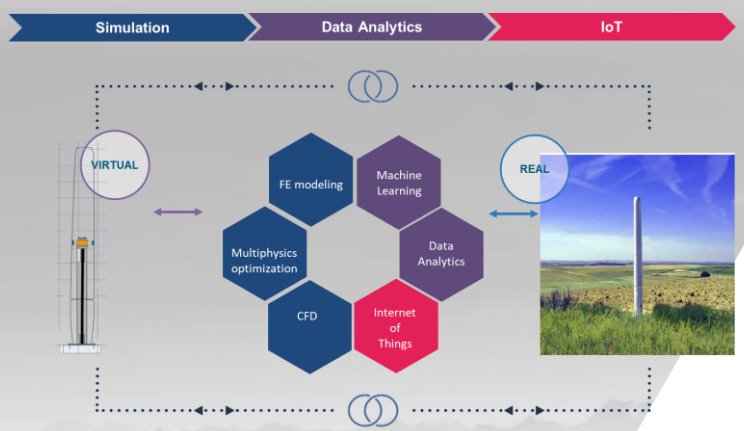

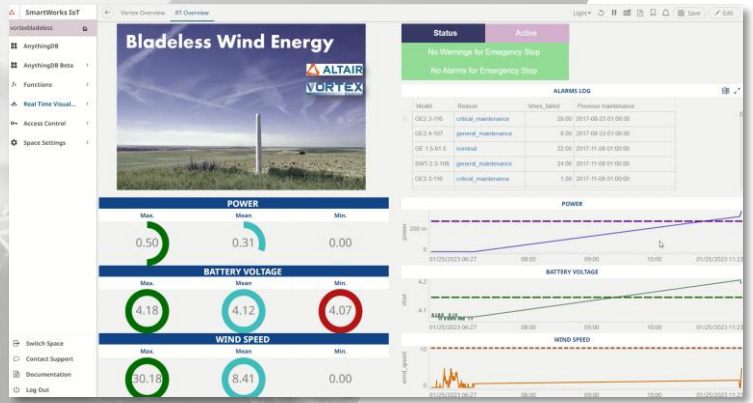

VORTEX Bladeless

Reinventing Wind Power Generation

Challenge

Develop a new innovative wind power technology avoiding current problems of horizontal-axis turbines and design a prototype fast and cost-efficiently

Solution

Established and implemented a comprehensive Digital Twin for development and operation incl.

- Aerodynamic simulation incl. fluid-structure interaction
- Structural evaluation of mechanical movement depending on wind loads and resulting fatigue
- Optimization of electromagnetic flux through the alternator's center coil
- IoT-based real-time dashboard of sensor data (via MQTT)

Value

- Extended lifetime 2x without any mechanical maintenance
- Accelerated development process 5x
- Energetically optimized operation due to real-time insights
- Zero noise and low visual impact

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SUMMARY

Further Digital Twin Resources

Streamlining Product Development by Using Digital Twins with Integrated System Simulation

The Digital Twin concept is broadly applicable to all Altair customer base wanting to develop better products faster. We will explain how to maxim...

Future.Industry 2021

Fireside Chat: Why Engineers will be the key to unlock the digitilization potential at manufacturers

The ever-advancing digitization is being driven by the convergence of simulation, data, and HPC. While virtual methods, interoperable tools...

Future.Industry 2021

Digital Twins

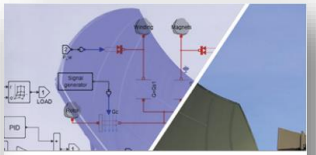
What if you could create 1D simulation models that retain the precision of your 3D analysis while running up to thousands of times fas...

Future.Industry 2021

Panel Discussion: Achieving Digital Twins Through Integrated System Simulations, MBSE, and Reduced-Order Modeling

The term “Digital Twins” can mean different things to different people, and often involves the use of different building-block technologies dependi...

Future.Industry 2021



Leveraging Digital Twins to Increase the Effectiveness of the MBD Approach

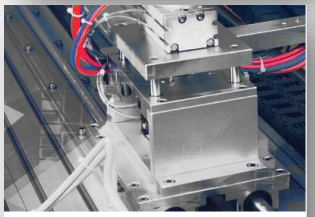
As of today, the “classical” V diagram is very well known among more and more engineers. Nonetheless its usage – even partly – is far away fro...

Technical Document

From Know How to Know Why! - Digital Twin Design...

Development based on experience often means that you know what happens, but you don‘t know why! The use of Digital Twins in development...

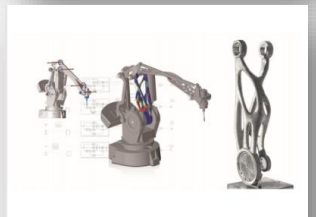
Webinars



Simulation and Digital Twin Adoption in the Industrial...

In 2021, Altair sponsored an SME audience survey to learn more about the adoption of engineering simulation and digital twin initiatives within the...

Brochures



Digital Twin Design Process for Efficient Development...

In a joint project MX3D, ABB, and Altair demonstrated how a 3D printed robot can be improved by using a digital twin process to achieve more precise...

White Papers

Boost Barista Business with Digital Twins Join Gruppo...

Industry Innovator Luca Gatti Luca invites you to a virtual coffee break, to see why it is necessary to model and deeply study the physics behind a cup...

ATCx Industrial Machinery 2021,Conference Presentations

Digital Twin Summary Report

By surveying more than 2,000 professionals around the world, we set out to paint a more complete picture of digital twin technology and its adoption. This...

eGuide

Altair Digital Twin Platform: Complete & Open

Solutions for Optimizing Products and Process from Design to Operation

1 Productivity

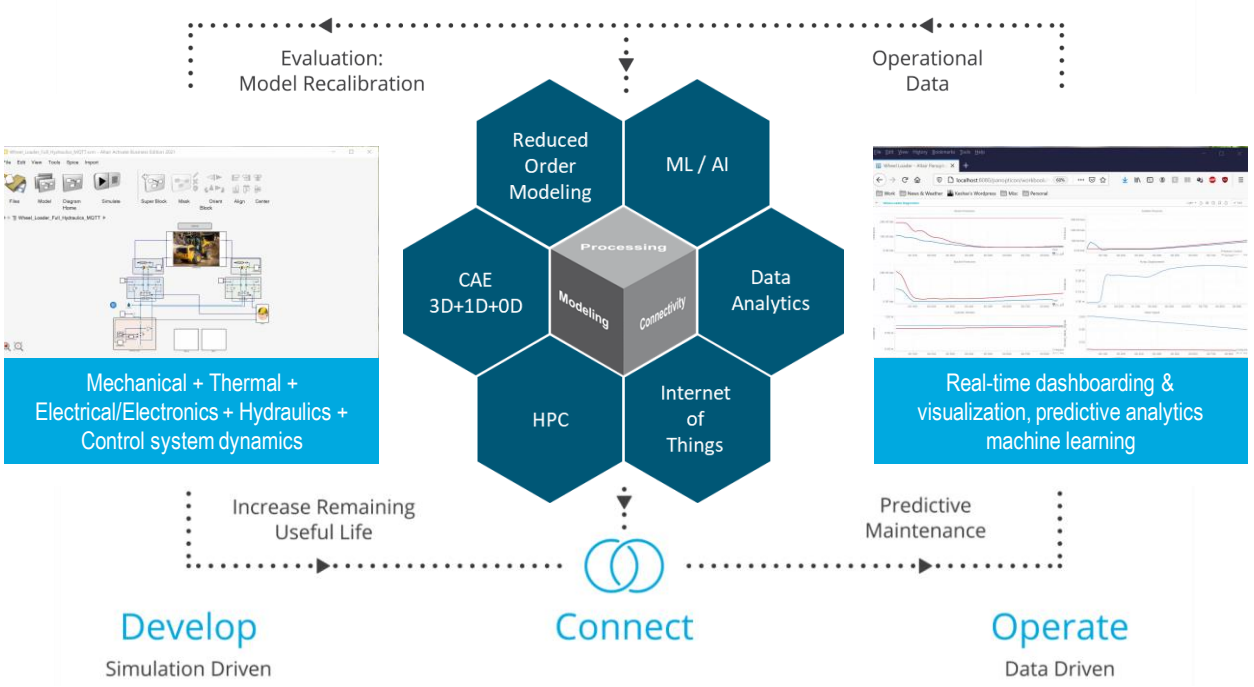
Break silos, speed-up collaboration and ensure faster time to market due to purpose-driven, switchable model-fidelity incl. real-time connection (Operator-in-the-Loop, VR, a.o.)

2 Reliability

Increase consistency and reliability incl. accurate requirements for device design (structures, motion, controls) based on real-world data

3 Performance

Optimize the entire product performance of mechatronic systems incl. all physical domains and their interacting effects



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Altair Digital Twin Offering: Complete & Open Expertise

Technology + Domain Experts for Optimizing Products and Process from Design to Operation

1 Productivity

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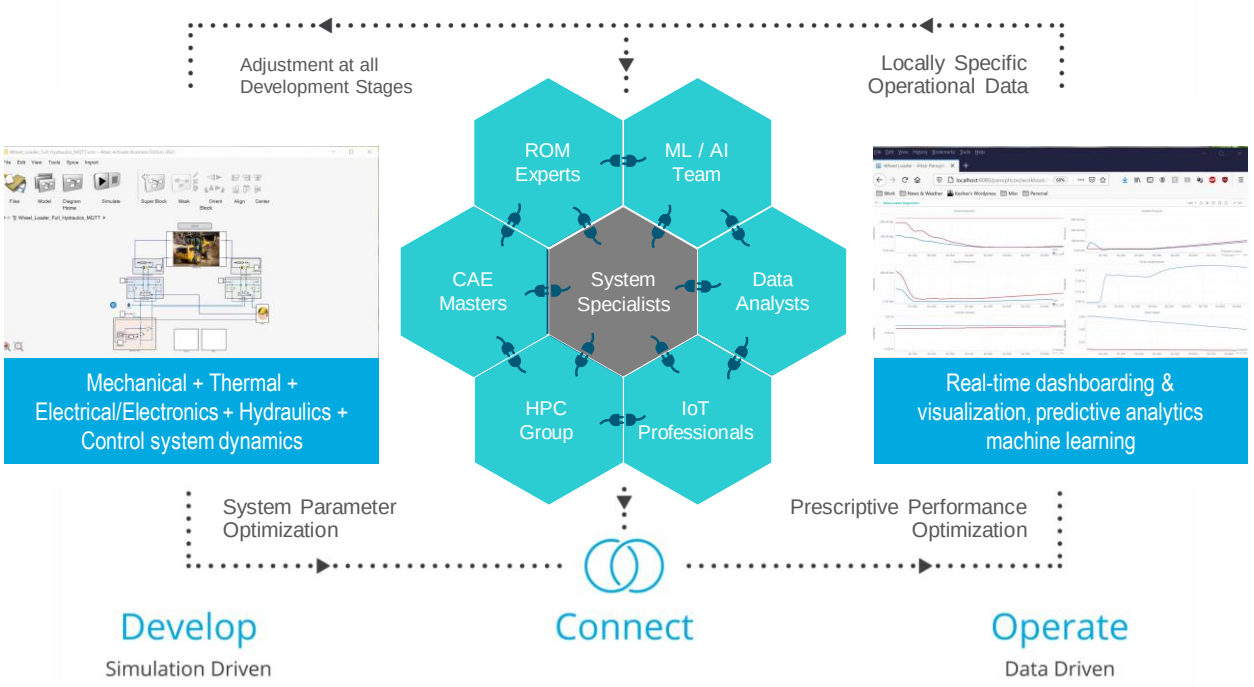

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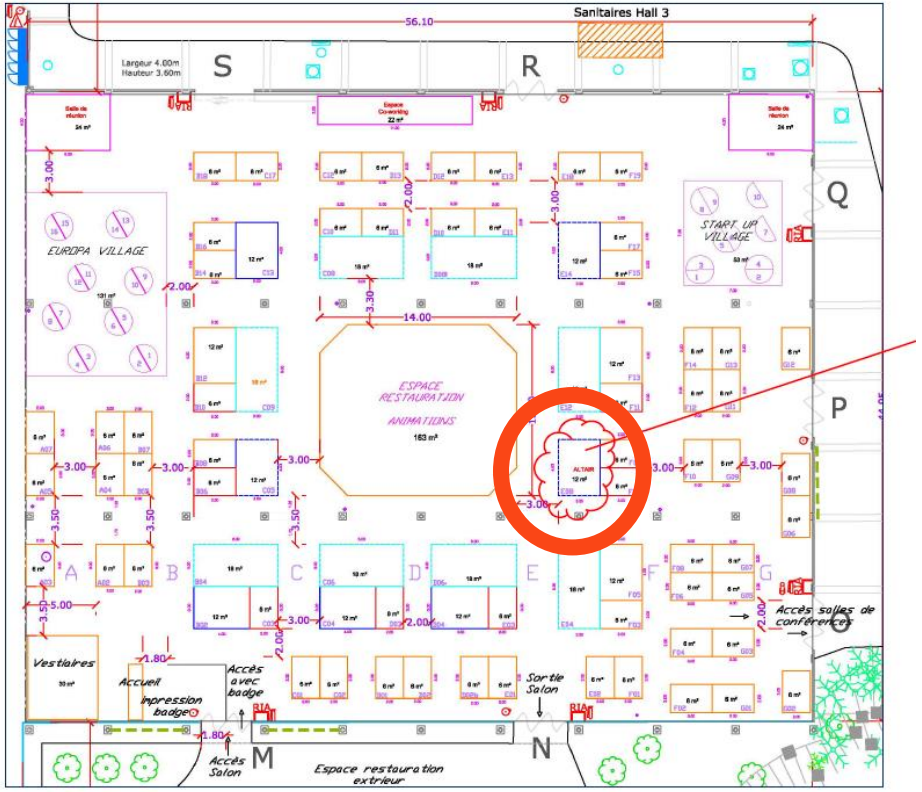
Invitation

Join us at our booth

Nr E08



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