



# Continuously optimizing with the Digital Enterprise

Magnus Edholm

# How?

**With a holistic  
digitalization  
approach**

Variety of drive concepts



Future mobility requirements



Innovative product development

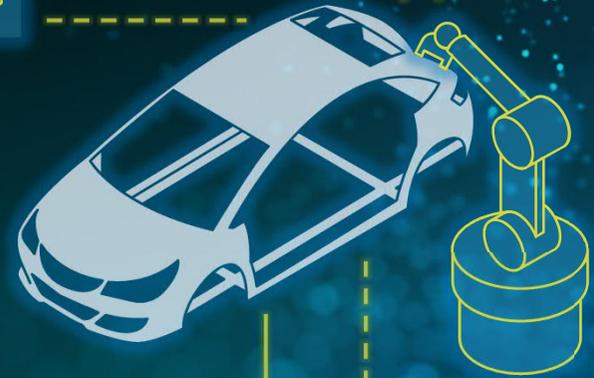


Additive Manufacturing



Automated Guided Vehicles

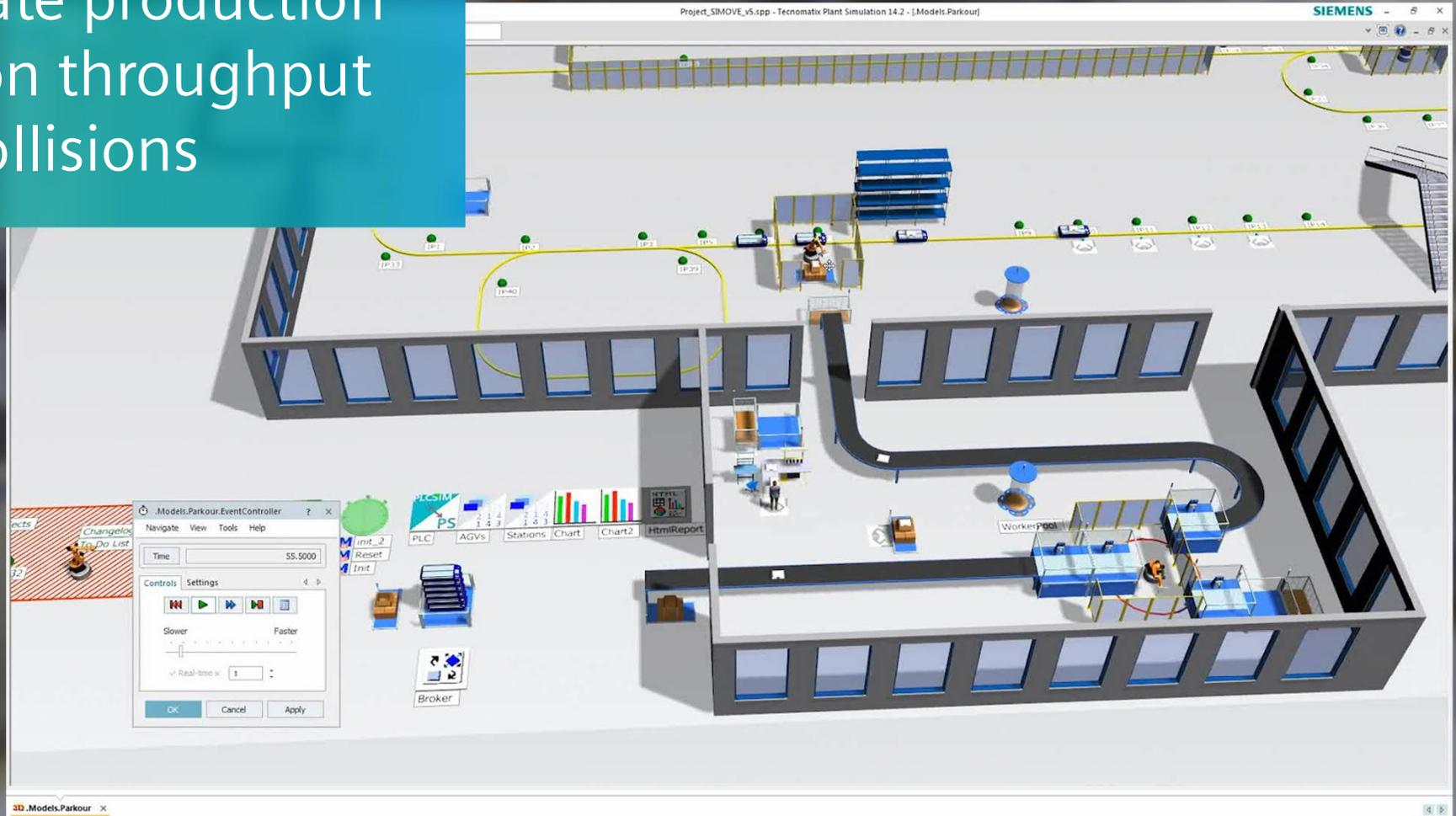
Integration of new value chains



Addressing production complexity  
Flexible production  
concepts with  
Automated Guided  
Vehicles (AGVs)



# Simulate production lines on throughput and collisions



Standardized and open system package  
Complete automation,  
communication, and  
functional safety



## Simulation and flexible production concepts

**Faster  
validation and  
verification**

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**Economic  
manufacturing  
of different car  
models**

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**Easy scalability  
of production  
capacity**

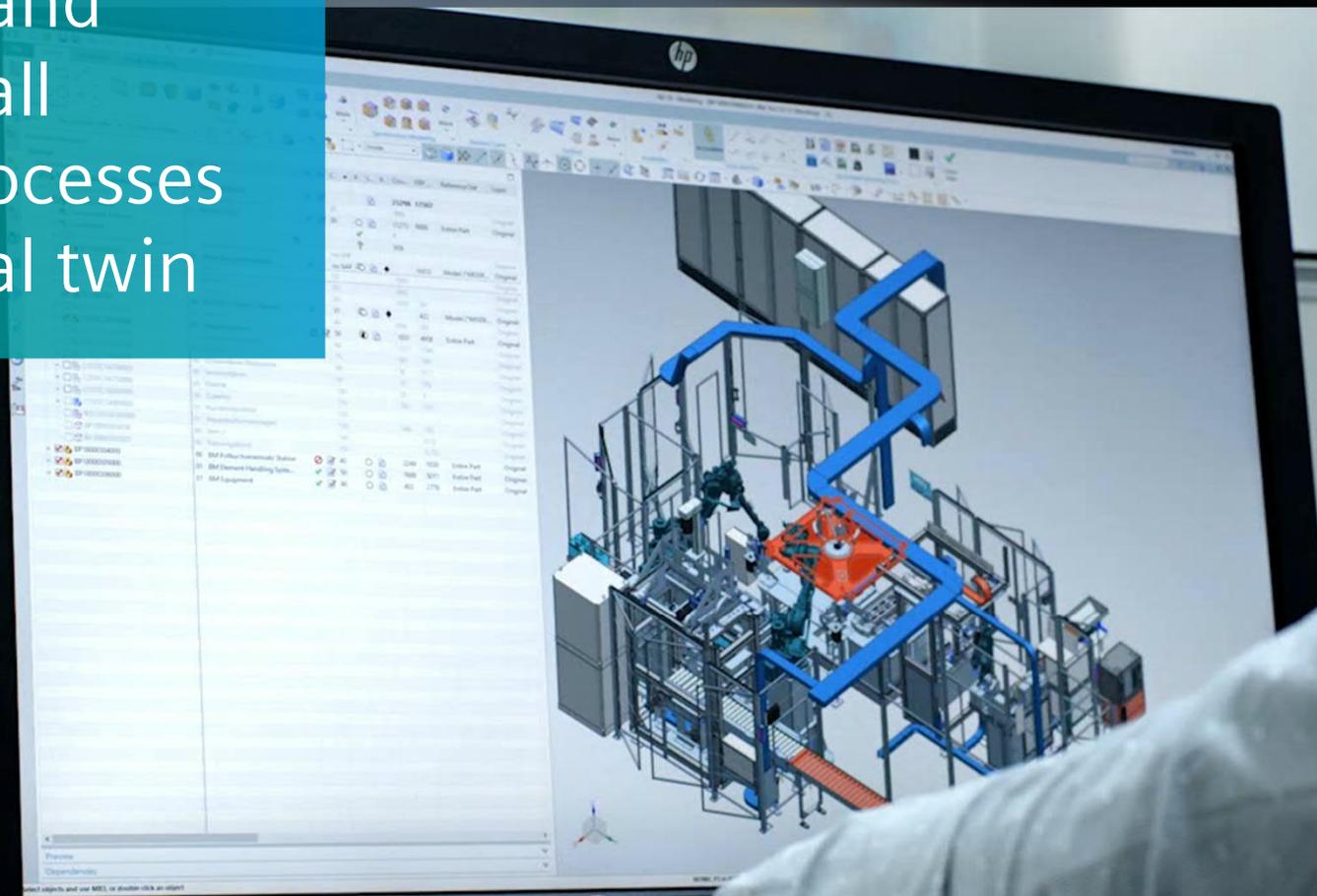
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*For some 30 years, industry believed it had reached the physical limits when casting lead poles for classic lead-acid batteries.*

**Siegfried Altmann**  
CEO Rosendahl Nextrom GmbH

Simulating and  
optimizing all  
machine processes  
with a digital twin





*We achieve a totally new level of output, quality, and performance. None of this would be possible without a digitalized and digitally controlled workflow in the factory.*

**Siegfried Altmann**

CEO Rosendahl Nextrom GmbH



From up to 24 months  
of developing time

down to  
**12**



## The digitalization effect

**50% shorter  
development  
time**

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**95% machine  
efficiency rate**

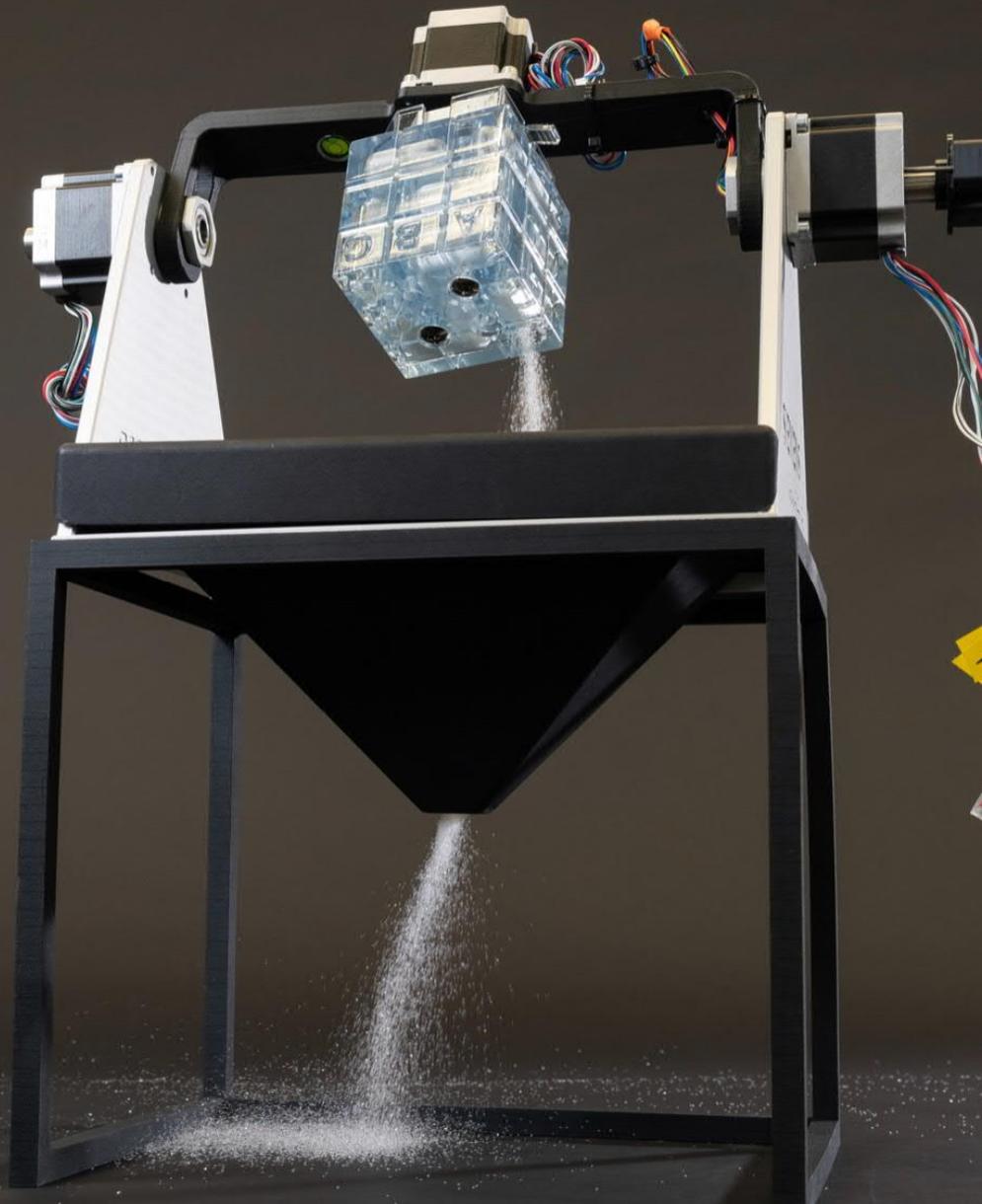
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**25% higher  
production  
output**

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## Non-value-adding-time and waste of resources





Algorithm for  
a depowdering  
chamber

Fully automated  
removal of metal  
powder based on  
algorithms



## Automated depowdering

**No harm for  
human workers**

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**Reusing metal  
powder**

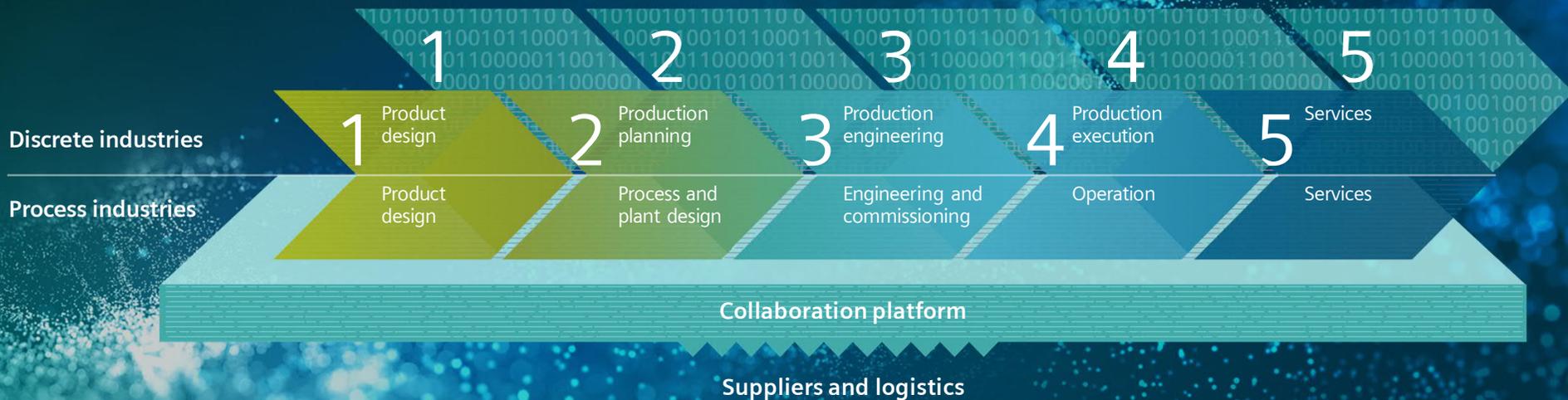
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**Less environ-  
mental impact**

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# Continuous optimization

# Integrating and digitalizing the entire value chain



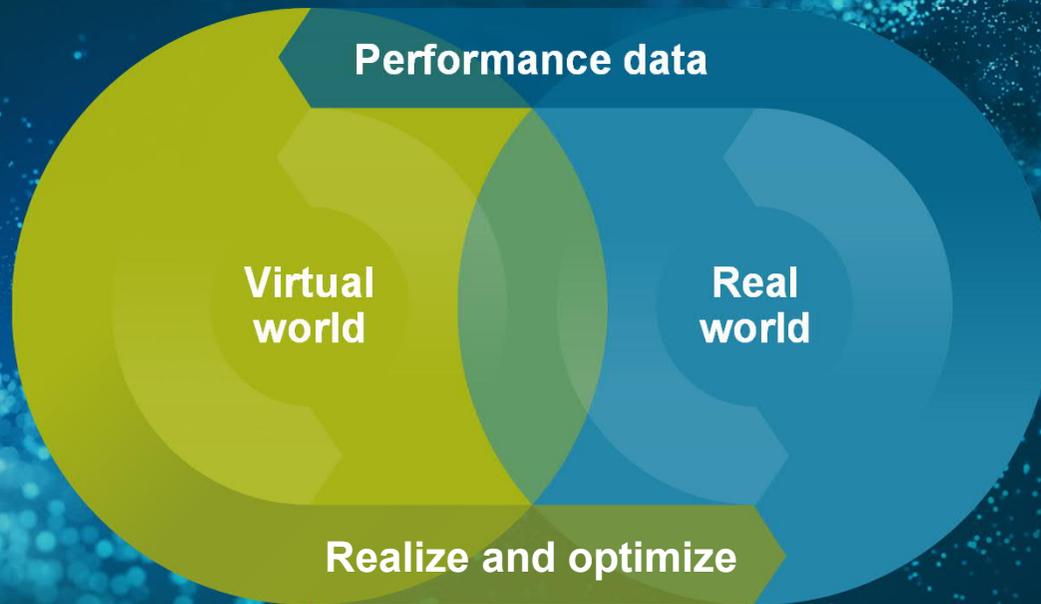
**End-to-end solutions  
for all industries**

**Numerous starting  
possibilities**

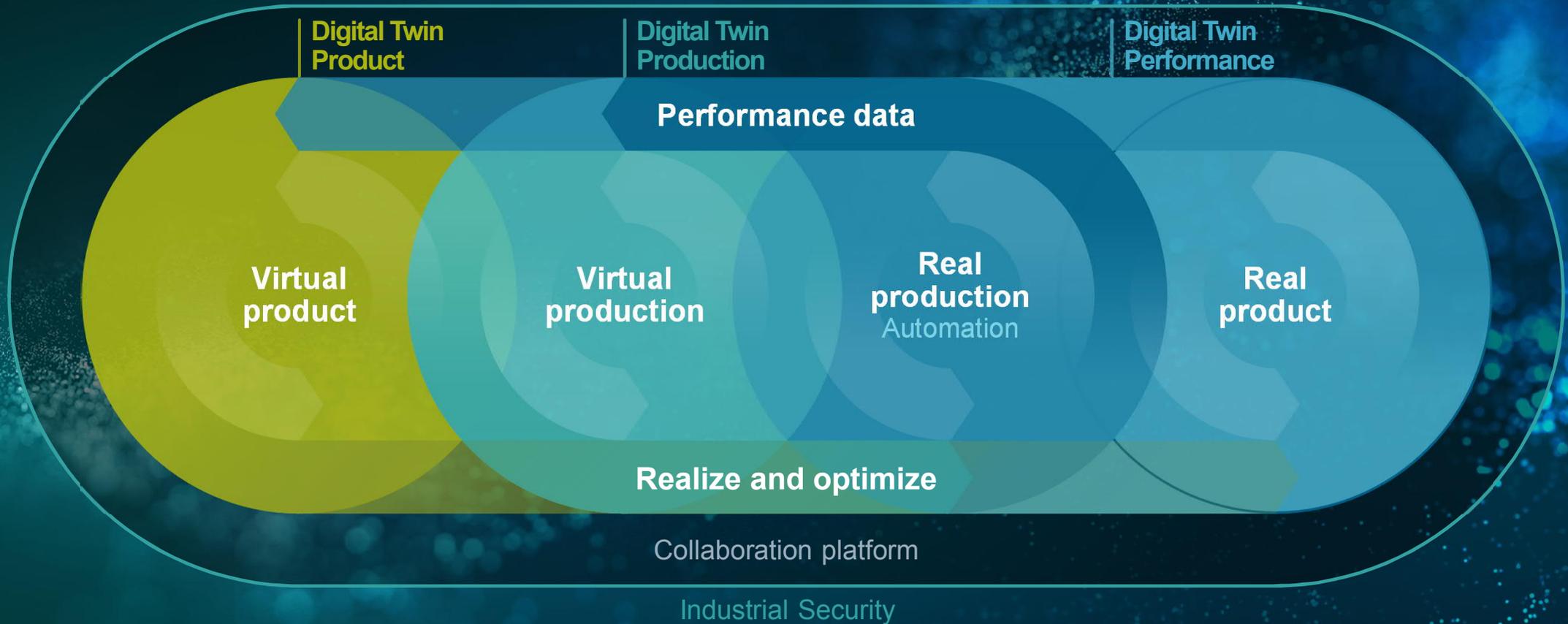
**Brownfield or  
greenfield**

**Standardized and  
open interfaces**

# The basis for continuous optimization



# The basis for continuous optimization



The basis for continuous optimization

# Portfolio

Services for the Digital Enterprise

Consulting

Implementation

Optimization

# Driving the digital transformation in focus industries



## Process Industries

## Hybrid Industries

## Discrete Industries



# Digitalization is key to achieving next-level productivity



 >10bn investment



Virtual world  
Software

Real world  
Automation

1 Cooperation

2007

2019

“With an integrated digital twin platform, we see major potential in speeding up the product development process, reducing prototypes, increasing traceability and thus improving quality and reduce development cost.”

Juha Pankakoski, Executive VP,  
Technology at Konecranes



**KONECRANES®**



“The most important is the competence of the people. We can ask technical questions and they are helping us to solve our challenges, and that makes their systems far more powerful.”

*Olav Tronrud, CEO at Tronrud Engineering*

- Shortened commissioning phase by 20-25%
- Reduced design phase by 10% through parallel working of electronic, mechanical and automation departments



“We have incredible manufacturing flexibility where we can produce specialty paint batches in 1/50th of the size.”

Kevin Worrell,  
Project Director at Dulux Australia

- >50% less time from testing to paint production
- 8x faster production process

**Dulux**<sup>®</sup>

This way they can meet the essential market and customer requirements

**SIEMENS**  
*Ingenuity for life*



**Speed**



**Flexibility**



**Quality**



**Efficiency**

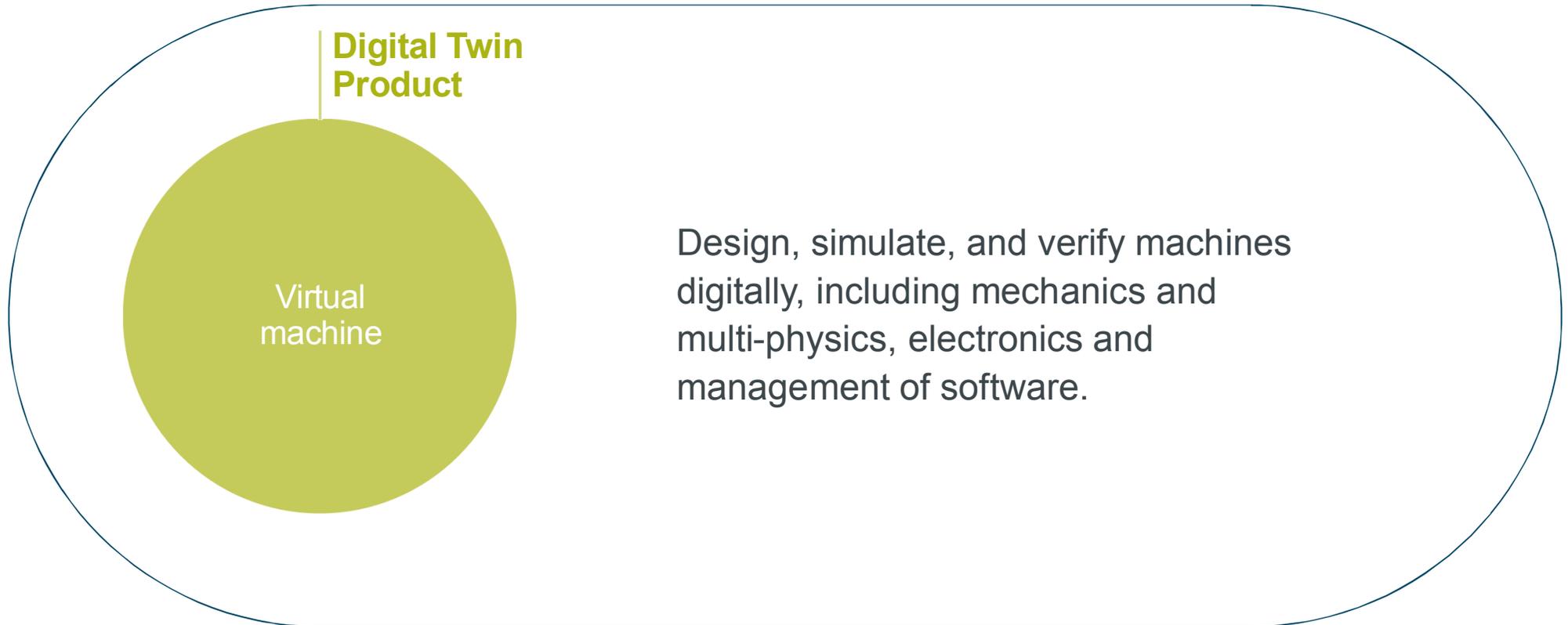


**New business models**



**Security**

# The most holistic Digital Twin

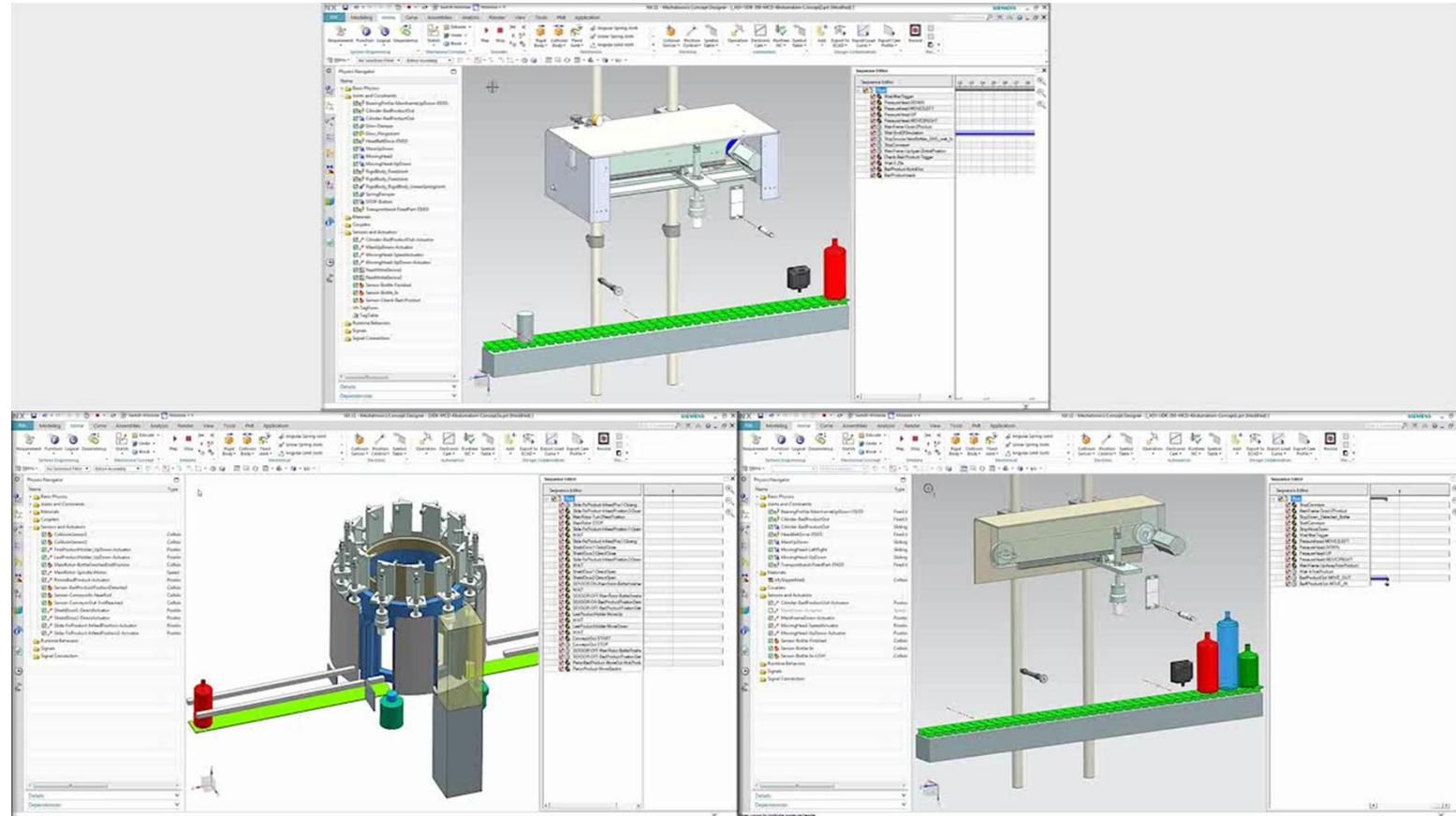


# Digital Twin Product – Virtual machine

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Easy evaluation  
of different  
machine  
concepts

NX Mechatronics Concept  
Designer

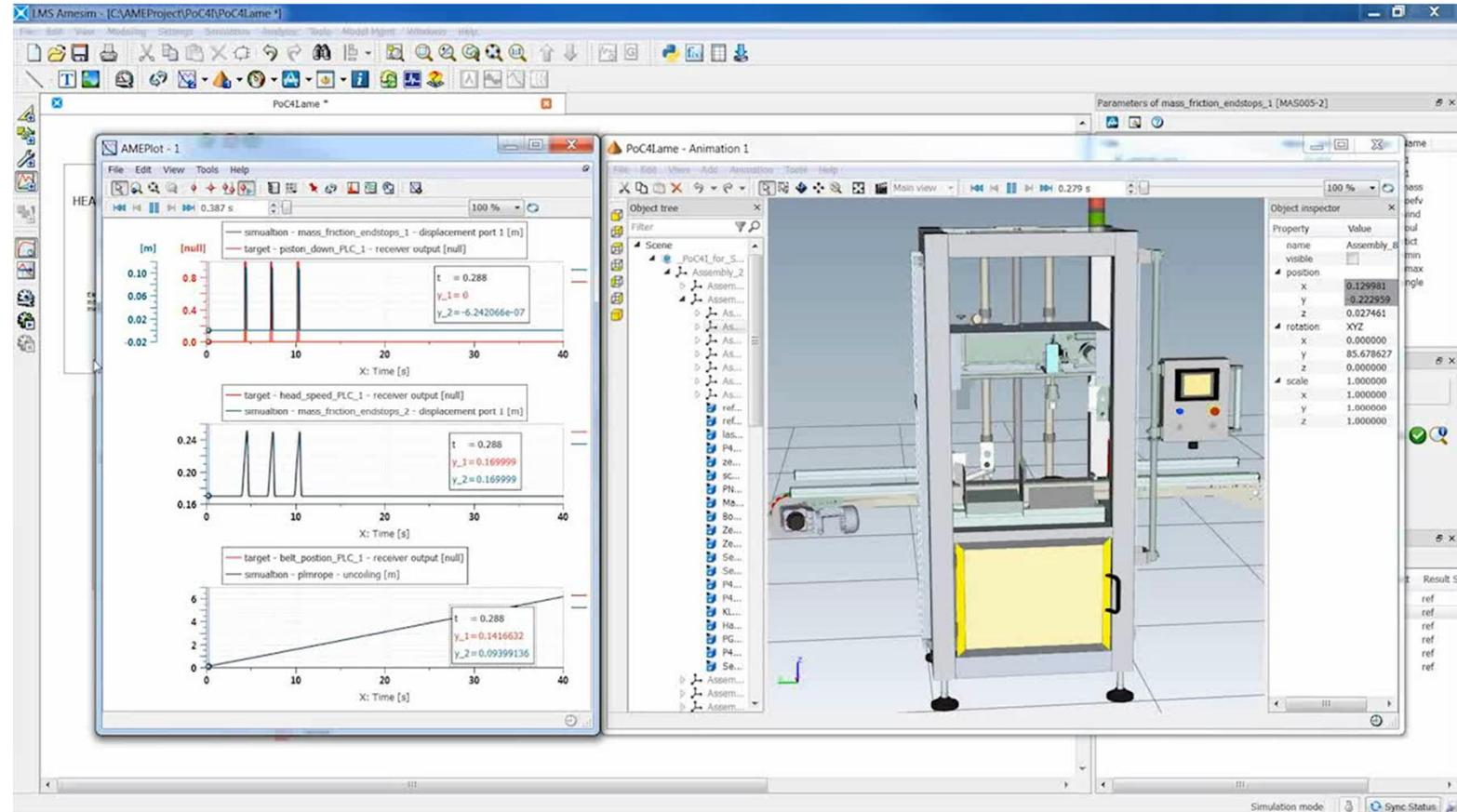


# Digital Twin Product – Virtual machine

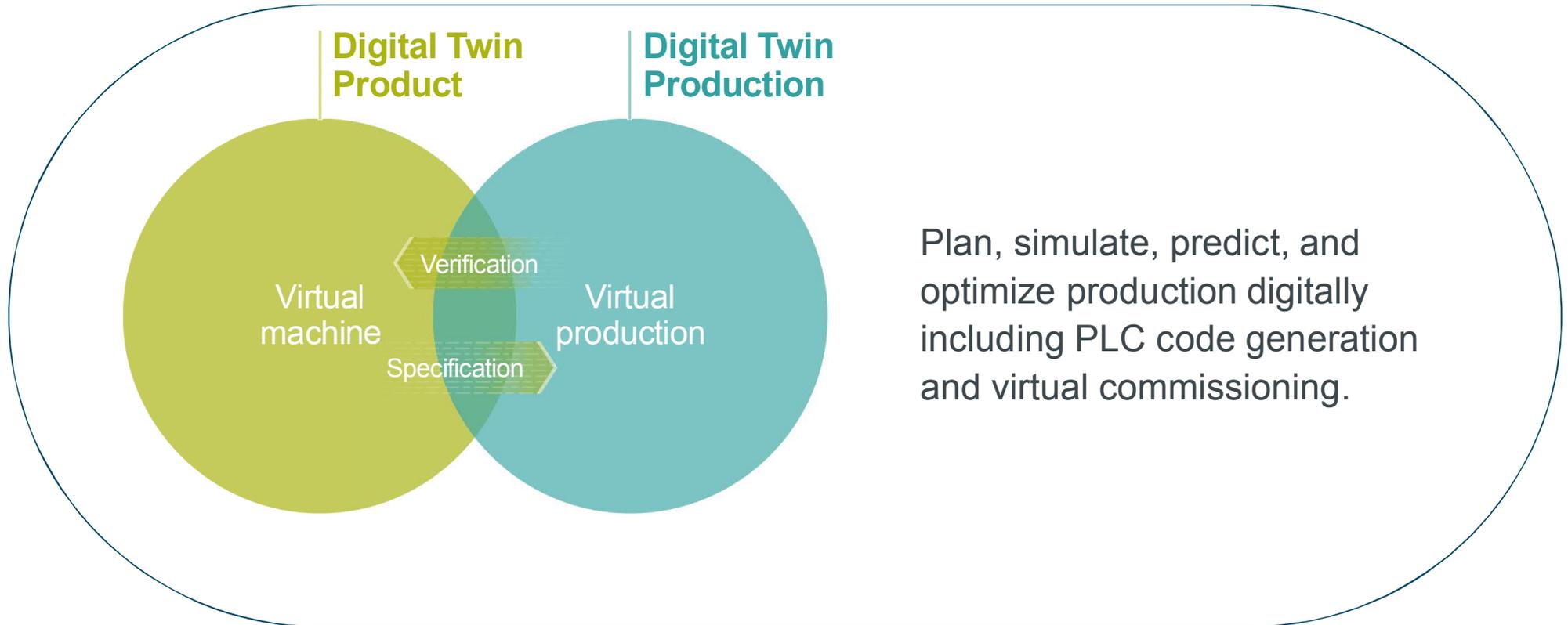
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Validate  
machine  
concepts with  
multi-physics  
simulation

NX Mechatronics Concept  
Designer, Simcenter



# The most holistic Digital Twin

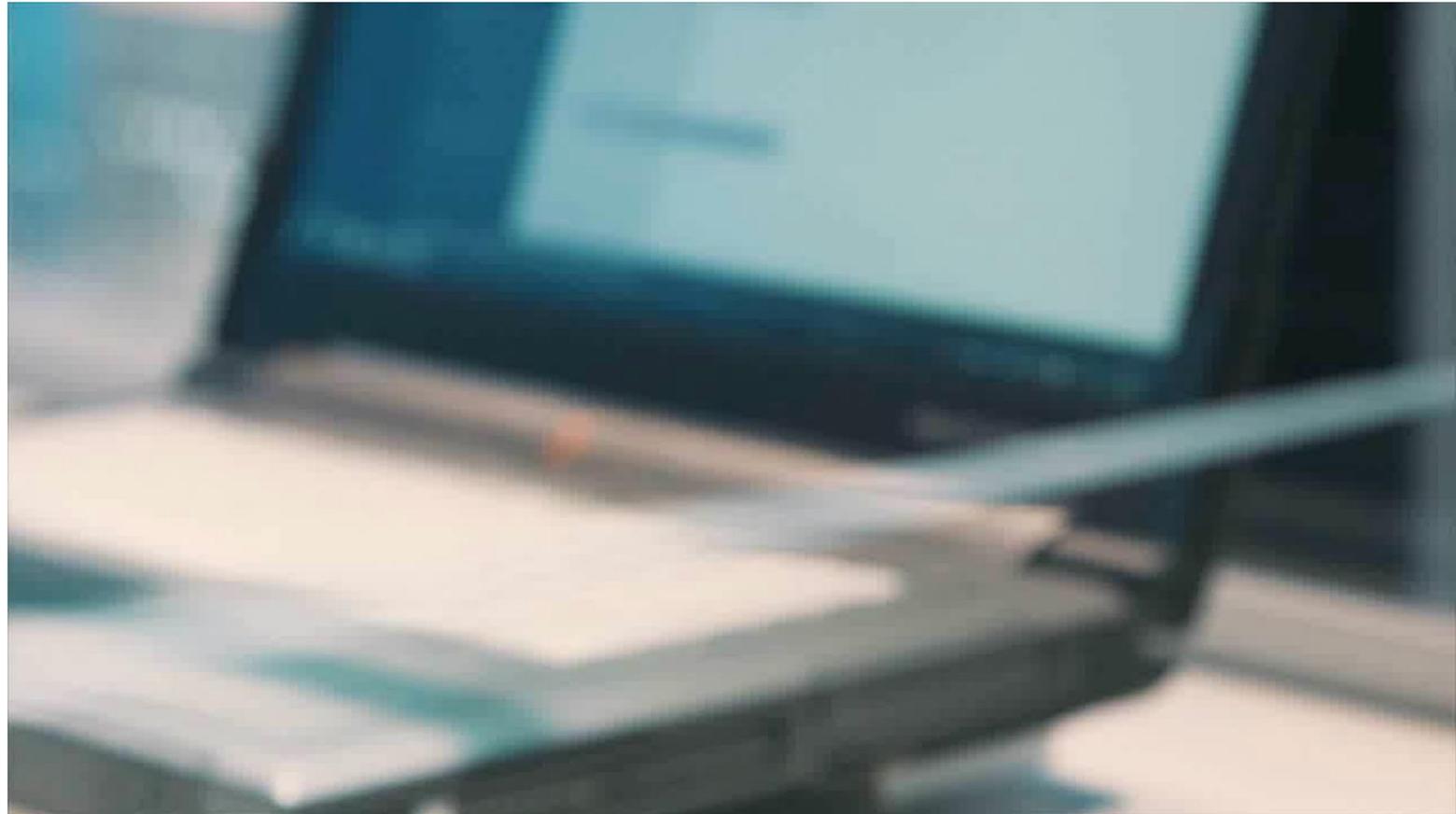


Plan, simulate, predict, and optimize production digitally including PLC code generation and virtual commissioning.



Fast and  
efficient  
engineering and  
commissioning

TIA Portal with  
PLCSim Advanced

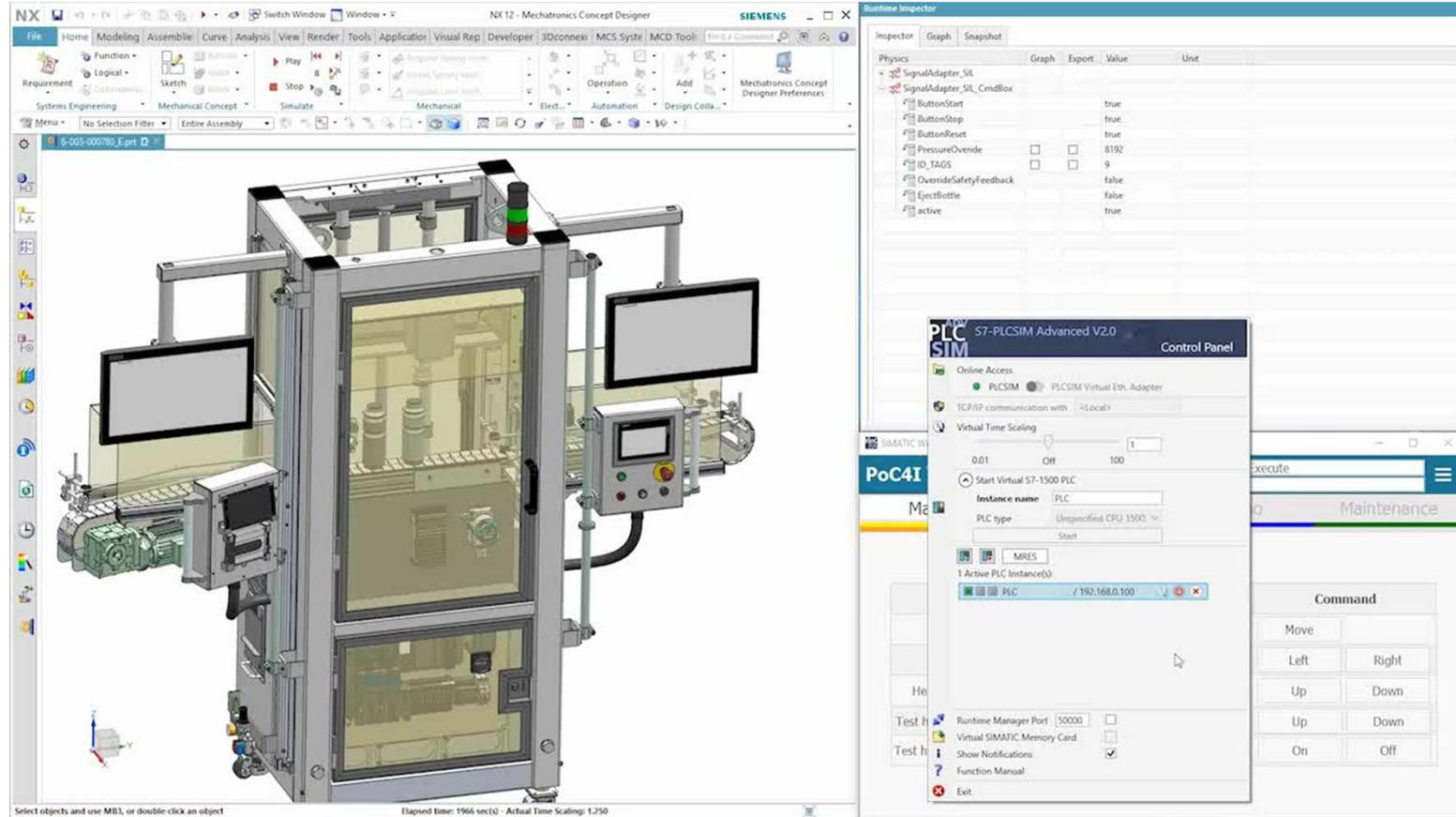


# Digital Twin Production – Virtual production

**SIEMENS**  
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Time-saving  
validation of  
automation code  
and machine in  
the virtual world

NX Mechatronics Concept  
Designer, PLCSim  
Advanced, TIA Portal, SIMATIC

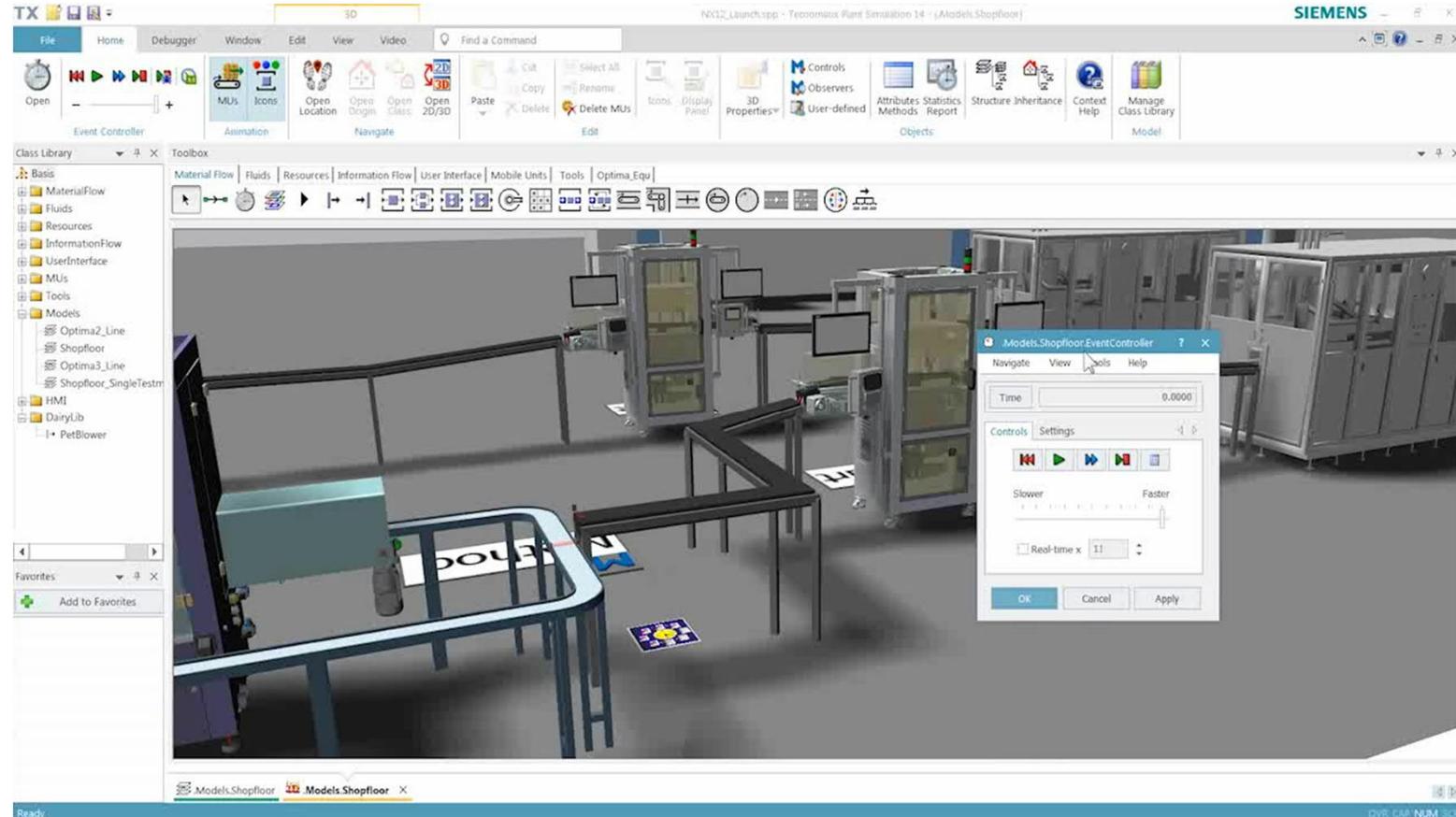


# Digital Twin Production – Virtual production



Simulate production line concept to ensure throughput and avoid bottlenecks

Tecnomatix Plant Simulation



# Digital Twin Production – Virtual production

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Validation of  
G-code in the  
virtual world

NX CAM, SINUMERIK VNCK



LIKS	Position [mm]	T.F.S
X	299.576	T
Y	200.470	
Z	626.289	F 0.000
B	8.000 *	0.000 mm/min 20%
C	8.000 *	S1 0

```
NC/LKS/UNC_SIM/1
N10 DEF REAL_cantolerance#
N20 DEF REAL_F_CUTTING,_F_ENGAGE,_F_RETRACT#
N30 DEF REAL_X_HOME,_Y_HOME,_Z_HOME,_B_HOME,_C_HOME#
N40 _X_HOME=-.1 _Y_HOME=-.1 _Z_HOME=-.1#
N50 _B_HOME=0.0 _C_HOME=0.0#
N60 G40 G17 G710 G90#
N70 CYCLE800(!)#
N80 TRAF00F#
```

Siemens NX - Manufacturing - [test\_setup\_mmm/A1 (Modified)]

Simulation Control Panel

NC Program

Current: Main

NC220 SUPA GO B=\_B\_HOME C=DCL,C\_# GO

NC230 End of Program

NC240 T0

NC250 M6

NC300 M30

Simulation Settings

Show 3D Material Removal

Show Tool Path

Show Tool Trace

Select Path Segment (0)

Show Machine Axis Positions

Analyze

Show Thickness by Color

Simulation Settings

Manage Settings

Animation

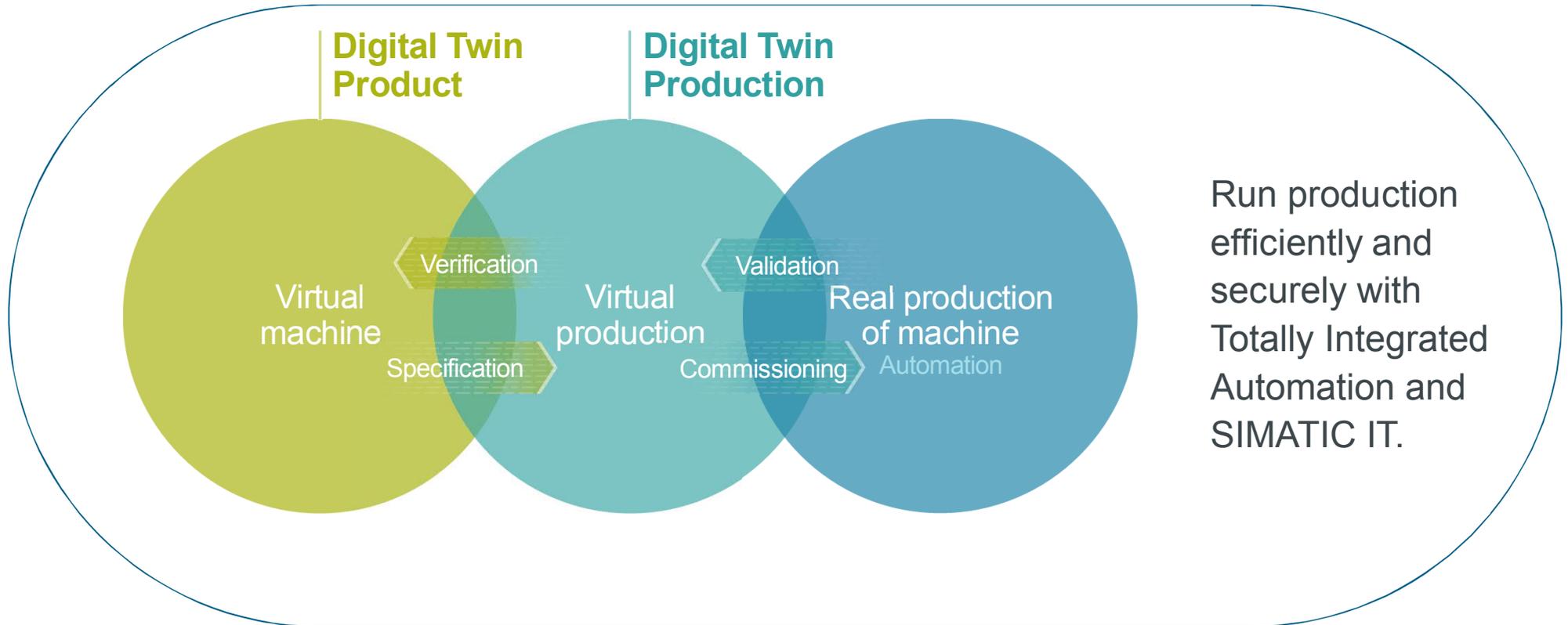
Visualization: Machine Code Simula

Speed: 10

Single Step Mode: Step In

Reset Machine

# The most holistic Digital Twin

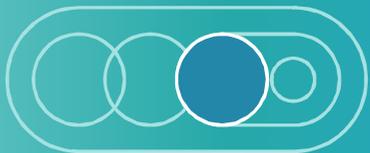


# Digital Twin Performance – Real production of machine (Automation)



Schedule and execute work instructions and quality inspections

SIMATIC IT UA Discrete Manufacturing, QMS Professional, Preactor APS



Segregation Tags Operator

WO\_QTM\_006 Main Frame Assembly Status: Active Work Center: 1010 Main Frame Assembly Active Users/Teams: Operator

Remaining Time: 33:49 S/N: SN\_QM\_20181030\_006 Sequence: 1010/1100 Material: Quality Test Machine.A

Quick Search

- Main Frame Assembly Sequence: 1010
- Mount Machine Foot 4x Sequence: 10
- Get + Place Main Frame from palette Sequence: 20
- Mount Cover cap 4x Sequence: 30
- Mount Cover plate 3x Sequence: 40
- Mount Rear fixed cover plate Sequence: 50
- Mount L Strips 4x Sequence: 60
- Mount Air filter 2x + Ventilator Sequence: 70
- Mount rear cover plate Sequence: 80

**Mount Machine Foot 4x**

**Safety instructions**

- Wear safety glasses
- Wear safety shoes
- Wear safety ear protection

**Work instructions**

- Identify SGR Main Frame
- Identify and mount standard foots (4x)
- Fill the forms in the tab **Tools**.

**Filling the Tool tab:** select the right tool and click the Use Tool button.

- List of additional standard parts

Part-No.	Description	Qty
E-000046	Adjustment tube 90x90x700	4
E-000044	End plate 84x84x8	4
E-000045	Nut M30	4
E-000263	Hexagon bolt M24x130	4
E-000255	Ring 26x44x4	8
E-000256	M22 nut	4

Start

START PAUSE STOP COMPLETE STEP

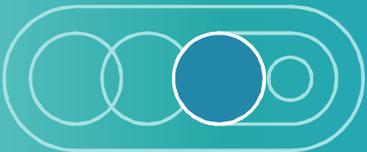
SHOW DETAILS ADD DOCUMENT NOTES DETECTS CHANGE TRAVEL REQUEST LOGISTIC EXECUTION GROUP UNLINK AS BUILT

# Digital Twin Performance – Real production of machine (Automation)

**SIEMENS**  
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Efficient  
and secure  
production  
with Totally  
Integrated  
Automation

SIMATIC, SINUMERIK,  
SIMOTION, SIMOTICS,  
SINAMICS, SIRIUS, TIA Portal

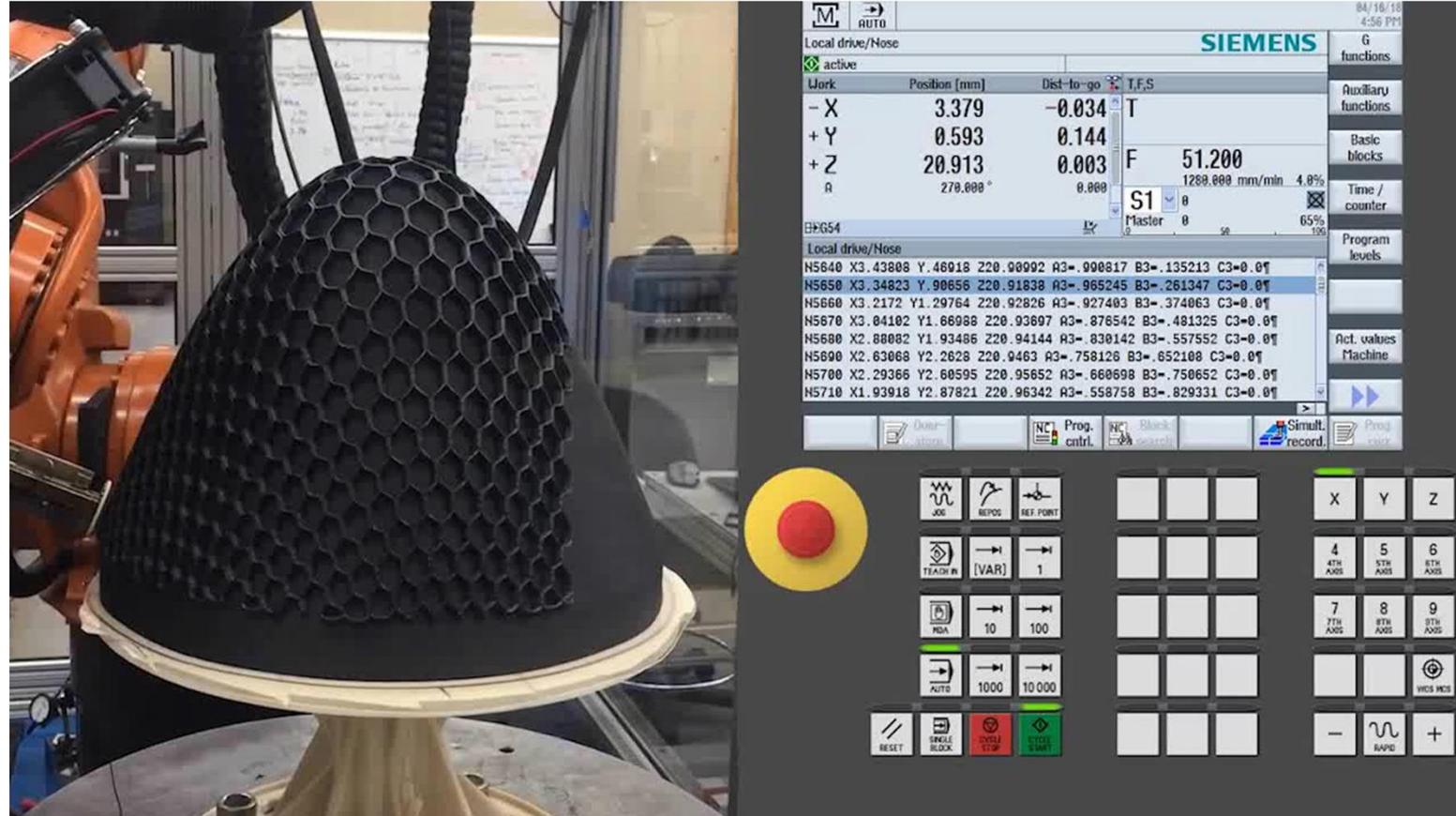


# Digital Twin Performance – Real production of machine (Automation)

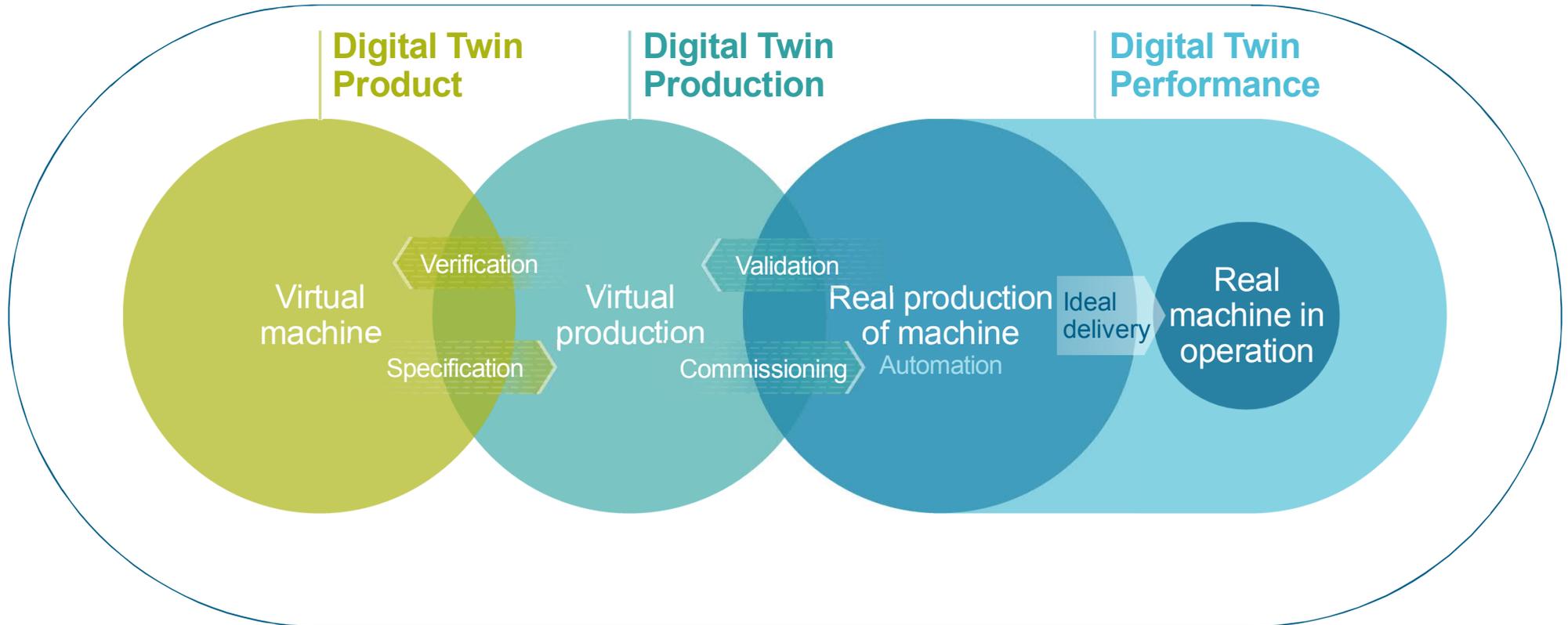
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Realize revolutionary designs with Additive Manufacturing

Robot control with SINUMERIK and SIMATIC

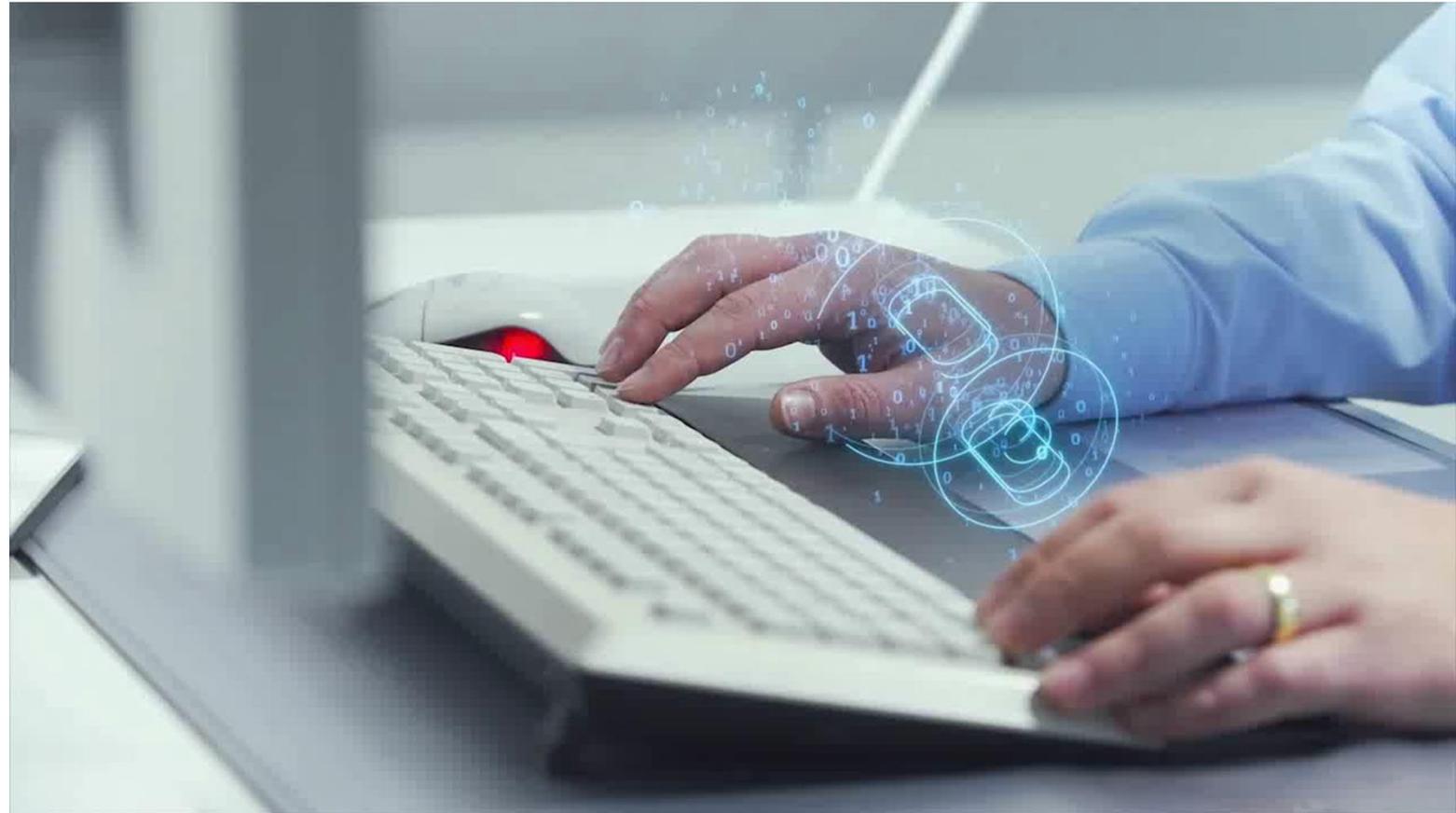


# Continuously improve product and production in the real world



Monitoring of all  
machines –  
everywhere and  
anytime

MindSphere application –  
Manage MyMachines



# Digital Twin Performance – Real machine in operation



Optimize maintenance intervals by tracking machine condition

SIMATIC MindSphere application – Machine Monitor



The screenshot displays the SIMATIC MindSphere Machine Monitor interface. At the top, it shows 'Dashboard' and 'Your Brand' with a 'MindSphere' logo and 'Powered by SIEMENS' text. The main content area is divided into several sections:

- \_Demo:** A large image of a white industrial machine.
- Information:** A table of machine details:

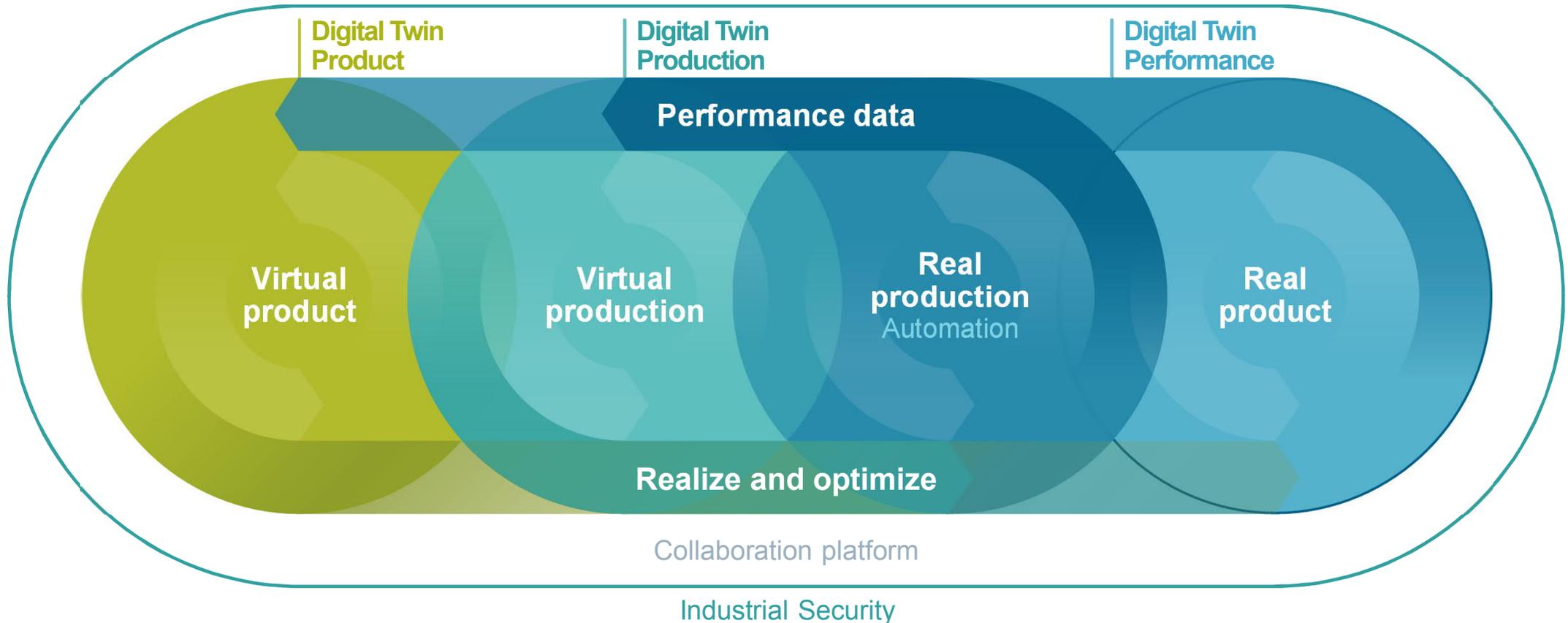
Asset-Type:	pmaacctd.SMM
Description:	TAC
Customer:	pmaacctd
Location:	Germany - 91056 Erlangen Frauenauracher Str. 80
- Current Status:** A summary of the machine's current state:

Current type:	Packaging Units 10x5x3
Amount of products:	40
Last alarm (last 24 h):	Position not possible (Oct 26, 2018, 3:45:12 AM)
- Service Interval:** A list of components and their maintenance status:

8743 of 10000 $\mu$ m	Chain Drive - Increased length	87 %
3276 of 4000 h	Fan - Runtime	82 %
84683 of 80000 mm	Ballscrew - Covered	106 %
- Performance Data:** A summary of production metrics:

Throughput:	85 %	80 of 94 pcs/min
Error-free products:	88 %	146443 of 166413 pcs
- Production:** A line graph showing production levels over time, with a 'Select Time' button and navigation controls (-1H, +1H, -8H, +8H).
- Machine status:** A summary of the machine's overall status, including a 'Select Time' button and navigation controls.

# Continuously improve product and production in the real world



We help our customers beyond portfolio to master their digital transformation

**SIEMENS**  
*Ingenuity for life*

## Consulting

Making sure our customers' way towards digital transformation is the right one

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## Implementation

Helping customers implement and optimize the digital enterprise

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## Optimization

Continuous improvement by analyzing ongoing operations

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## Financing

Supporting customers with smart financing solutions

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# The experts from Digital Enterprise Services





SIEMENS

The future of  
manufacturing  
will be completely  
consumer-centric.



SIEMENS

individual products

fast delivery

best quality

sustainable products

healthy products

traceable origin

A futuristic industrial control room with a robotic arm and a person at a console. The scene is illuminated with blue and white light, featuring a large robotic arm in the foreground and a person in the background interacting with a console. The Siemens logo is visible in the upper right corner.

SIEMENS

Fast delivery

**Systems that  
make decisions  
on their own**

SIEMENS

Individual products

**Produce as  
flexibly as possible,  
anywhere, anytime**



SIEMENS

calculating  
CO<sub>2</sub> footprint

- A
- B
- C

Sustainable products  
**Knowing the exact  
CO<sub>2</sub> footprint of  
anything we build**



SIEMENS

# Human vs. Machine?

The digital  
future starts  
today.