FME AI FOR INDUSTRY JAAREVENT

Toepassing van Digital Twins in de praktijk

7 december 2023

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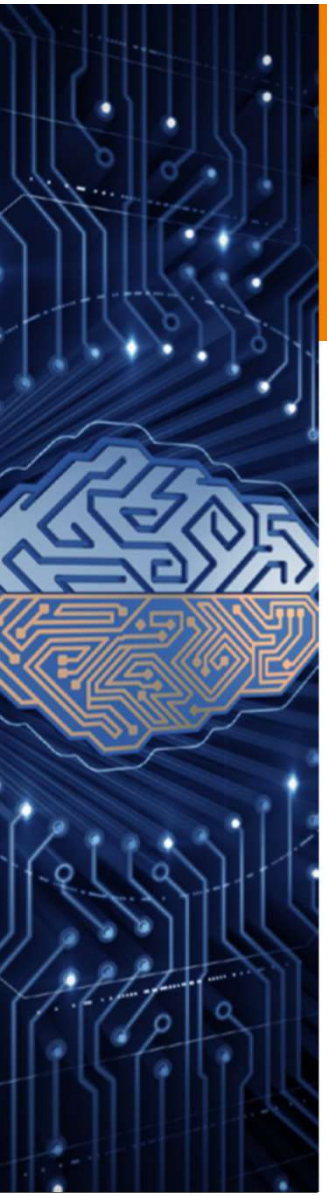

DIGITAL TWINS IN DE PRAKTIJK

Agenda

(45 min.)

Topic	Presenter
• Introduction	Paul
• What is a digital twin?	Paul
• Data – driven Digital Twin	Mark
• Model – driven Digital Twin	Bram
• Demonstration	Bas
• Q & A	All

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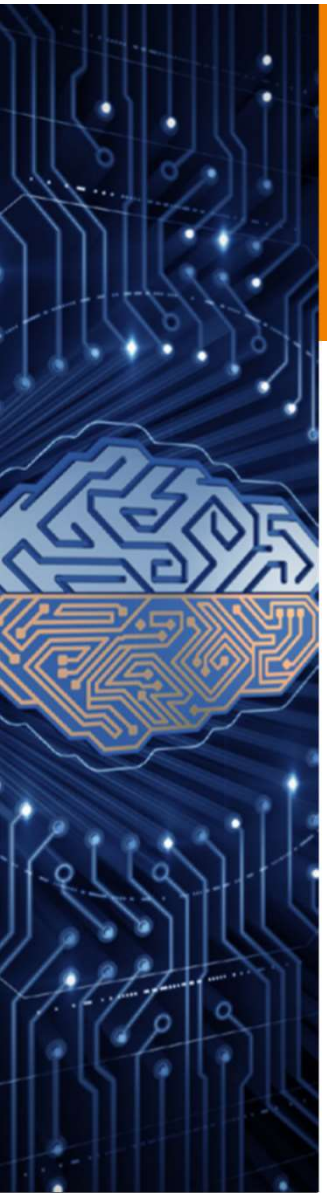

DIGITAL TWINS IN DE PRAKTIJK

Introduction

What is a Digital Twin?

Paul van Ruiten

Siemens Digital Industries

Platform & Tools

Value of Data driven Twin

Mark Roest

VORtech

Models & Algorithms

Why use a Model driven Twin?

Bram de Vrught

QING Mechatronics

Consulting & Innovation

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DIGITAL TWINS IN DE PRAKTIJK

Even voorstellen

Paul van Ruiten

Business Development Manager

SIEMENS

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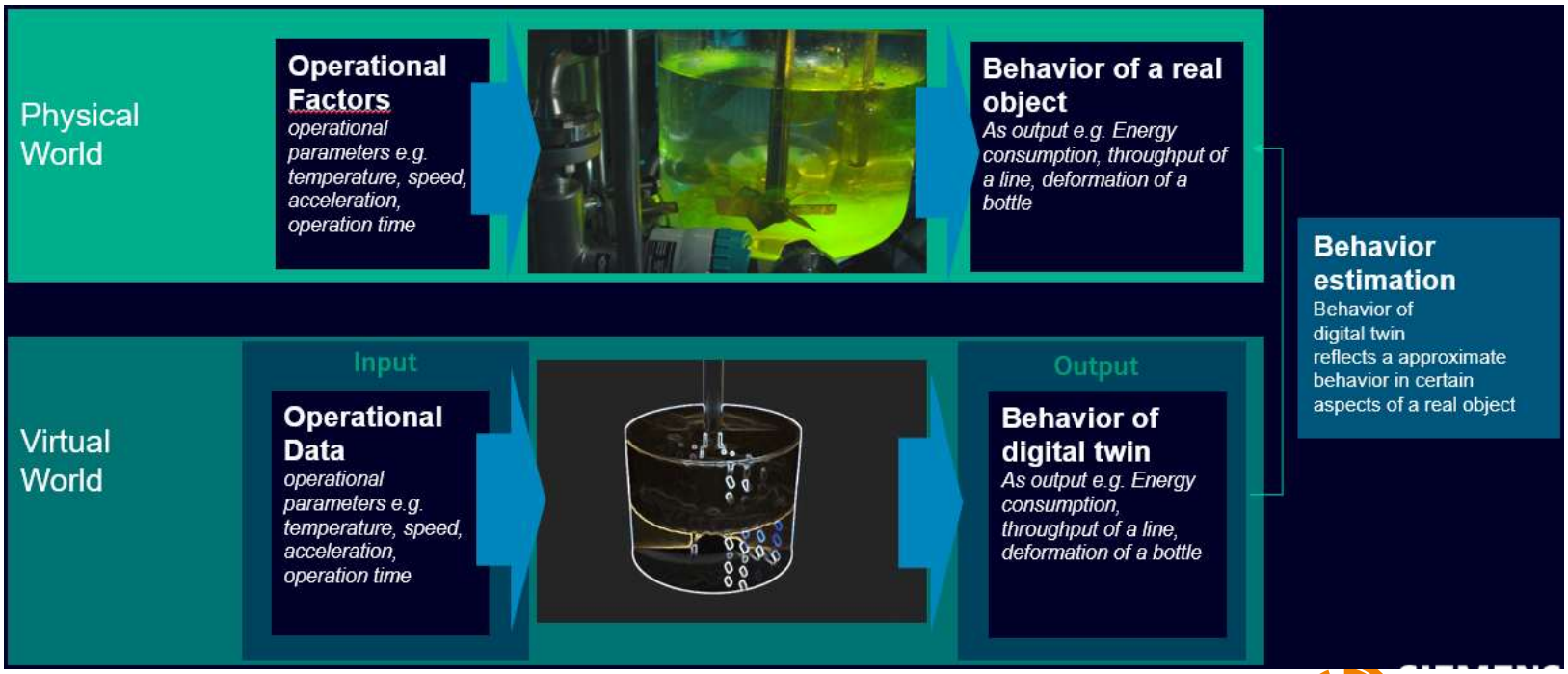
DIGITAL TWINS IN DE PRAKTIJK

What is a digital twin?

A **digital twin** is a virtual representation that serves as the real-time digital counterpart of a physical object or process.



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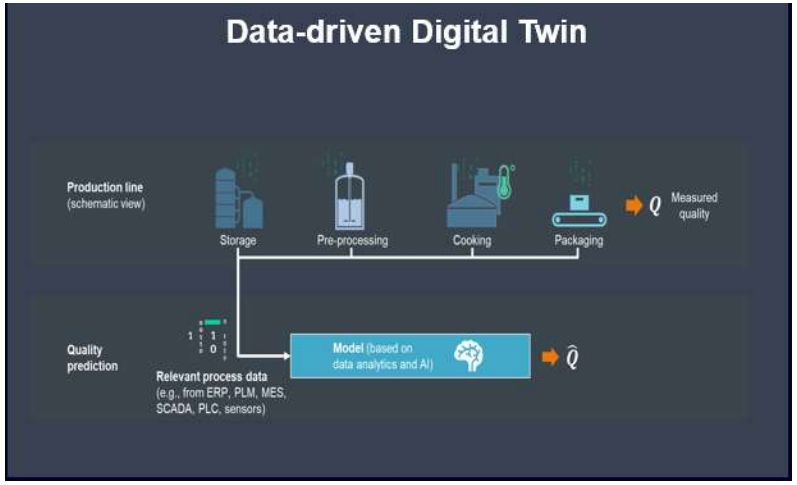
DIGITAL TWINS IN DE PRAKTIJK

Two Types of digital twins



VS

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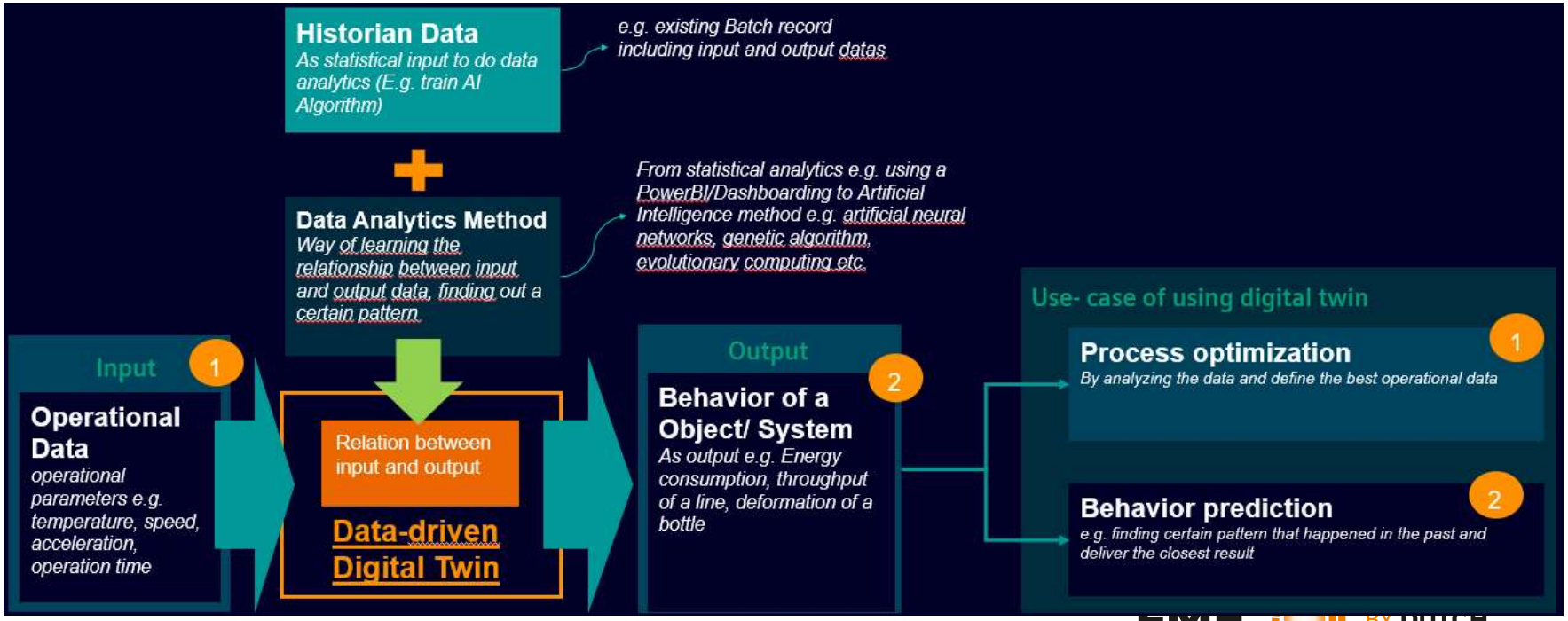
DIGITAL TWINS IN DE PRAKTIJK

Data-driven Digital Twin

A Data-driven Digital Twin is a sorted data sets that reflects the relation between the input and output.



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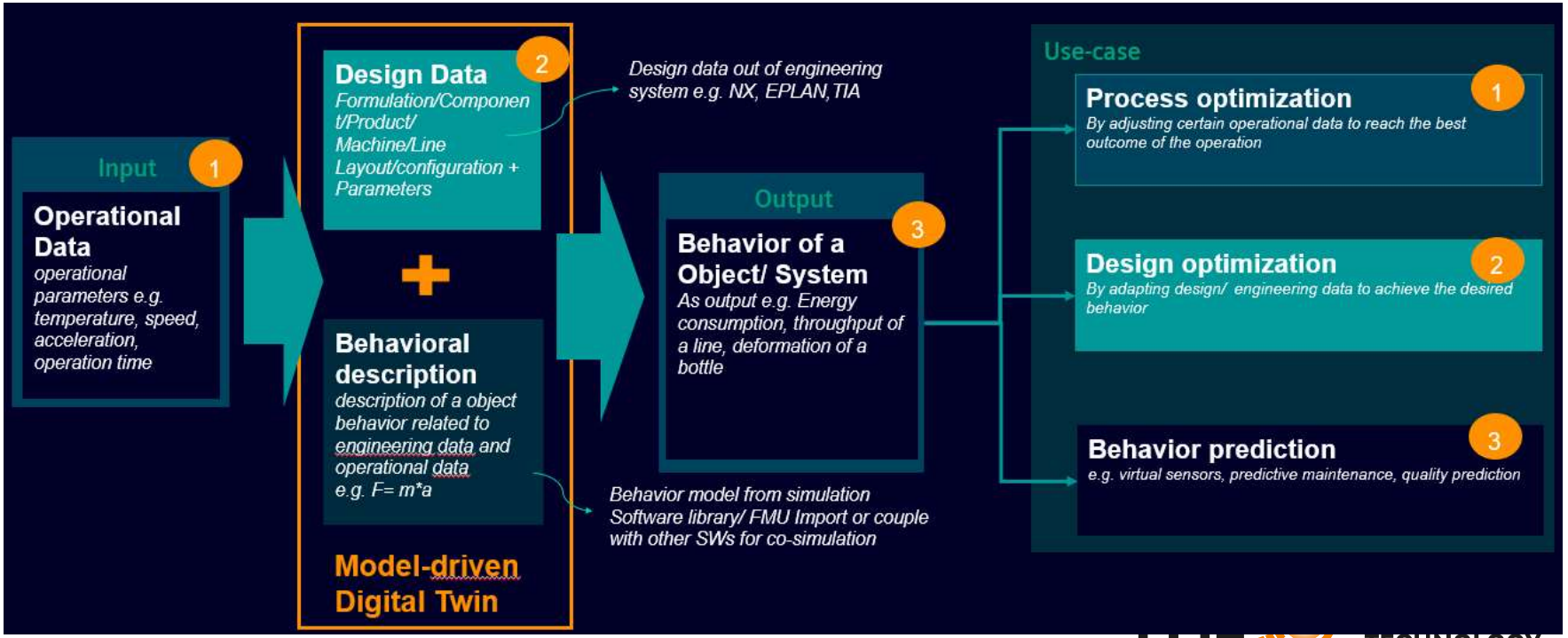
DIGITAL TWINS IN DE PRAKTIJK

Model-driven Digital Twin

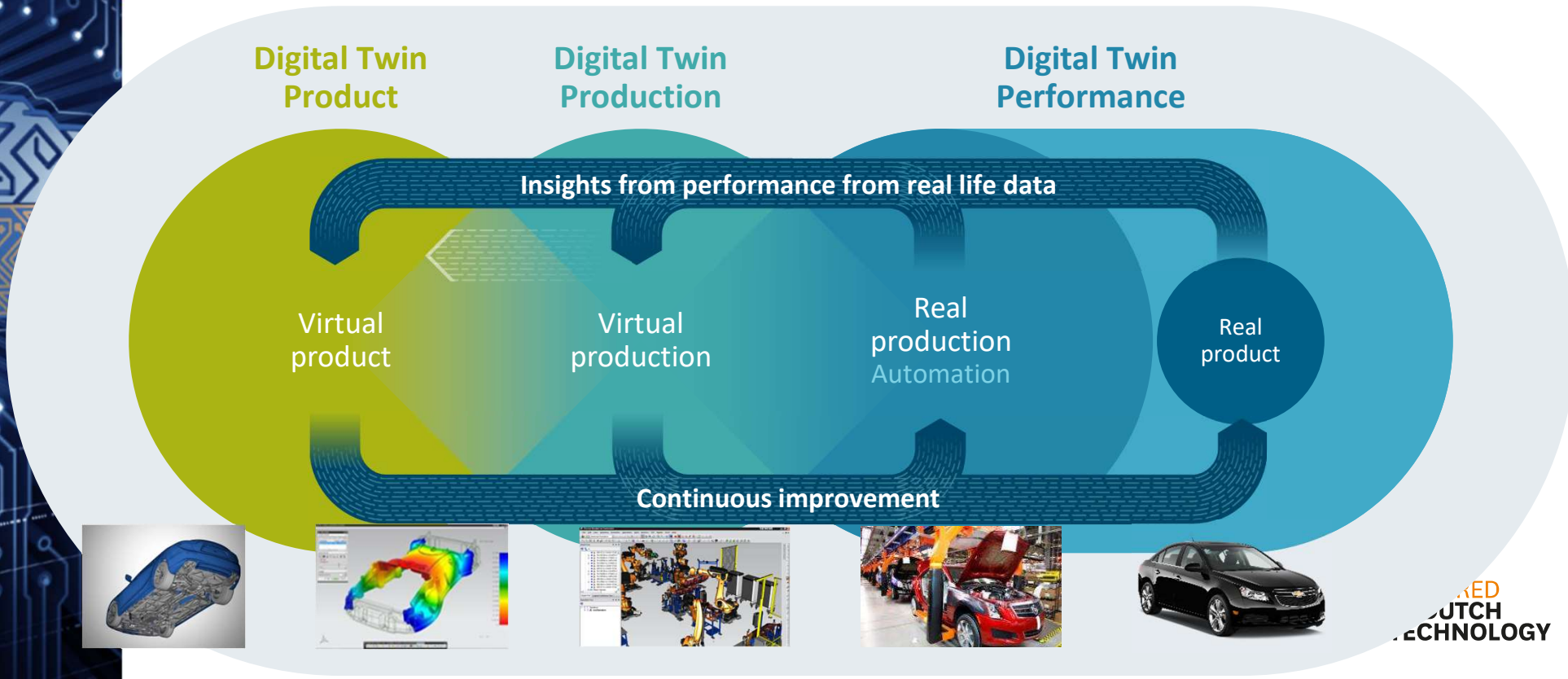
The Model- Digital Twin is the semantically linked collection of the relevant digital artefacts including design data + behavior description.



TECHNOLOGY

DIGITAL TWINS IN DE PRAKTIJK

Life cycle use of digital twin



DATA DRIVEN DIGITAL TWINS

Even voorstellen

Mark Roest

VORTECH

Your development partner for computing and modelling software

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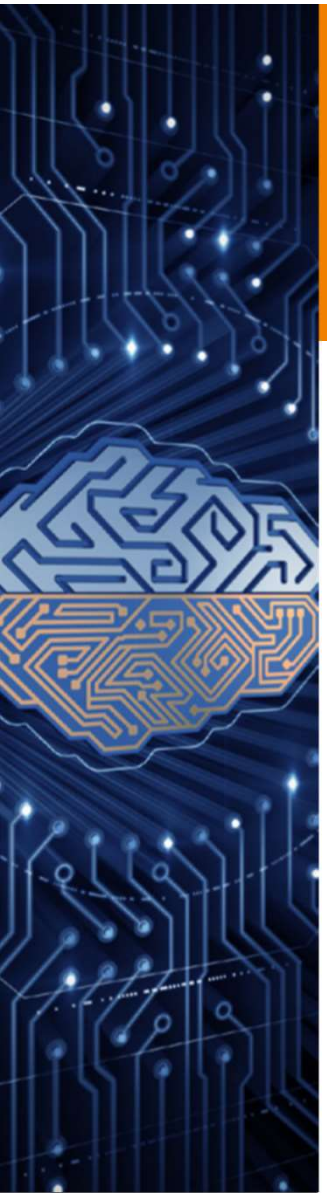
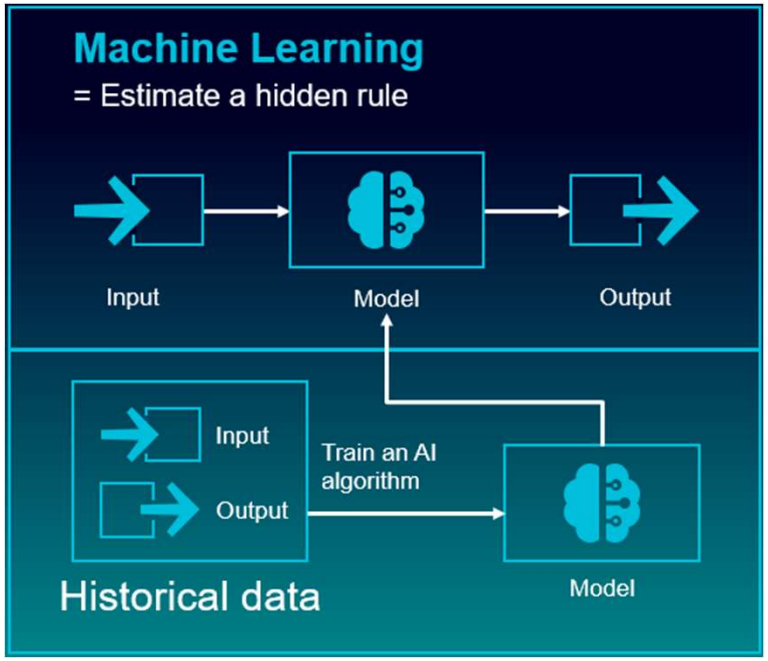


DATA GEDREVEN DIGITAL TWINS

Het principe I



- De input data moet alle voorkomende situaties omvatten.
- Het AI algoritme kan gemaakt worden met
  - Goede oude basis-wiskunde
  - Allerlei moderne technieken zoals
    - Neurale netwerken
    - Regression trees
    - Random forest
    - ...

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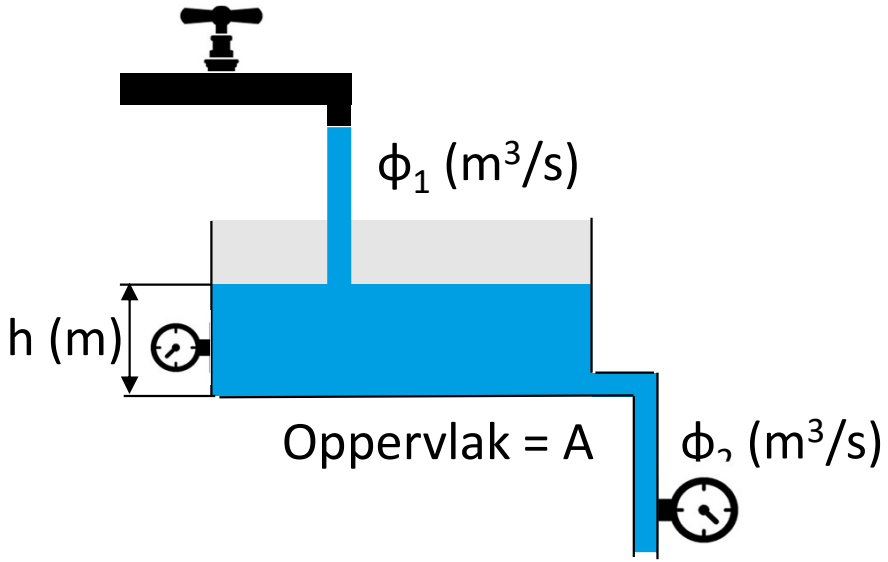
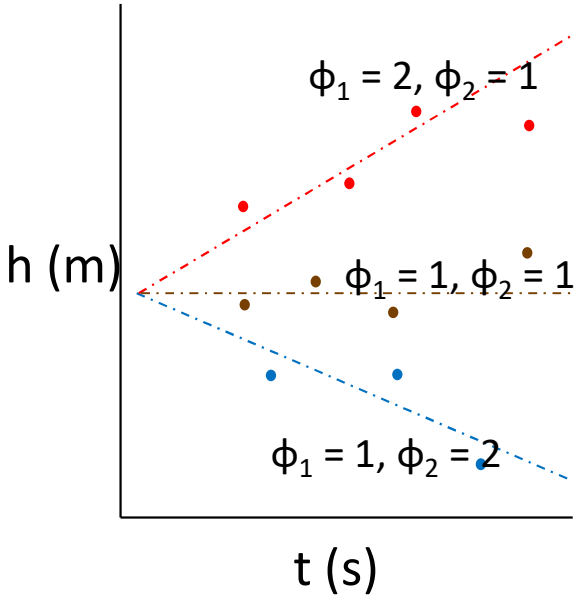
DATA GEDREVEN DIGITAL TWIN

Het principe II





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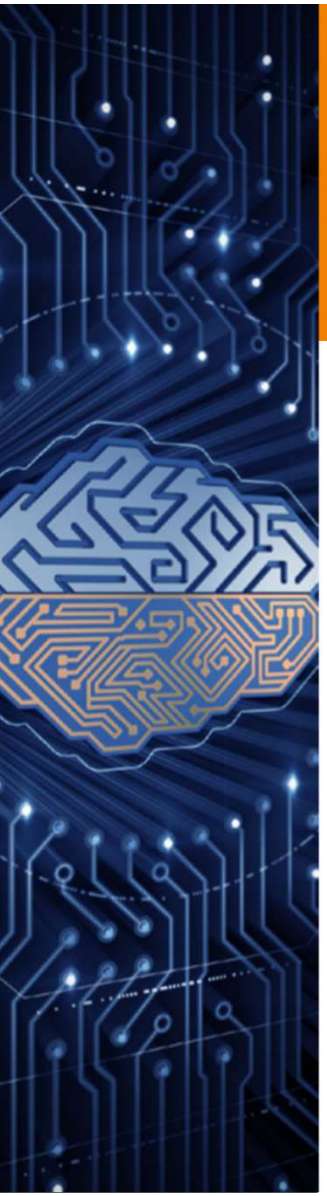
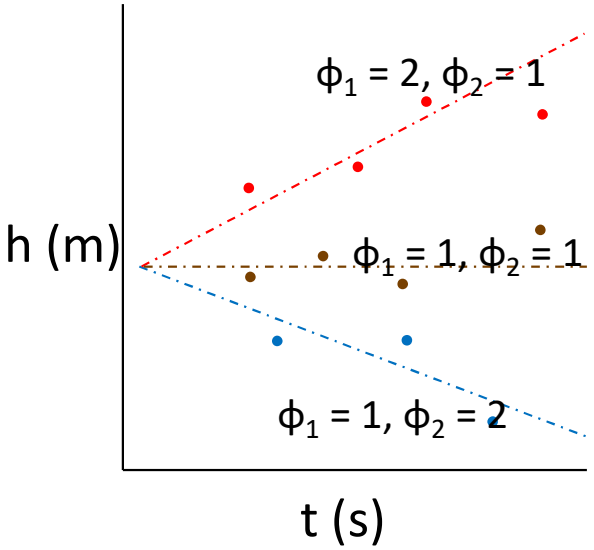


DATA GEDREVEN DIGITAL TWIN

Het principe III

$h\ (t\text{-}t_o) = model\ (\phi_1, \phi_2, h_o)$

```
>>> import numpy as np
>>> from sklearn.linear_model import LinearRegression
>>> model = LinearRegression()
>>> model.fit ( [phi1, phi2, ho], h)
```



python™

R Studio®

Power BI

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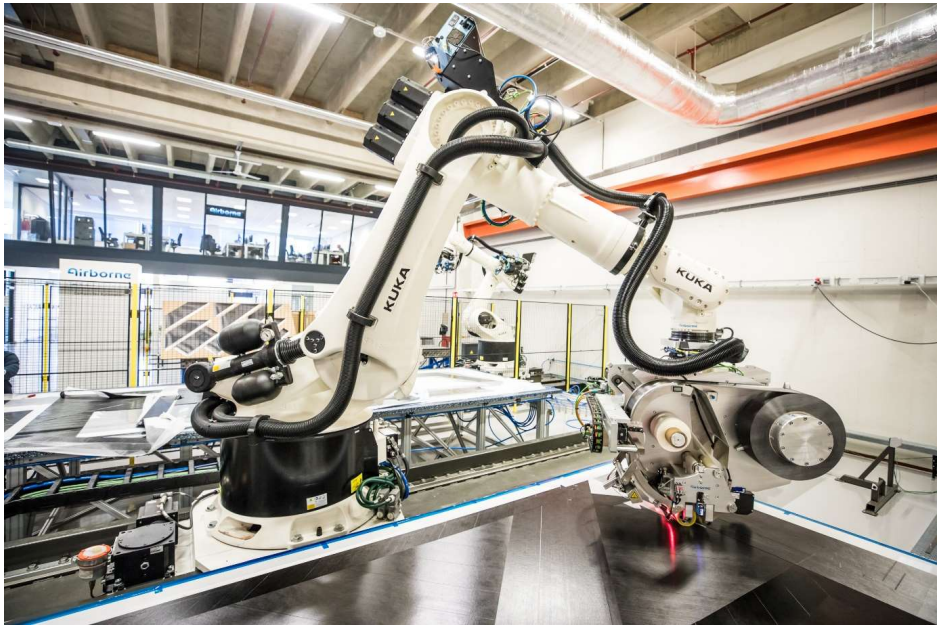
DATA GEDREVEN DIGITAL TWIN

Voorbeeld: snijrobot



- Doel was om een digital twin te maken waarmee vooruit gekeken kan worden naar aankomende afwijkingen bij het snijden.

SMITZH

Airborne VORTECH

UReason

Zie het whitepaper op https://www.vortech.nl/machine-learning-in-de-fabriek/

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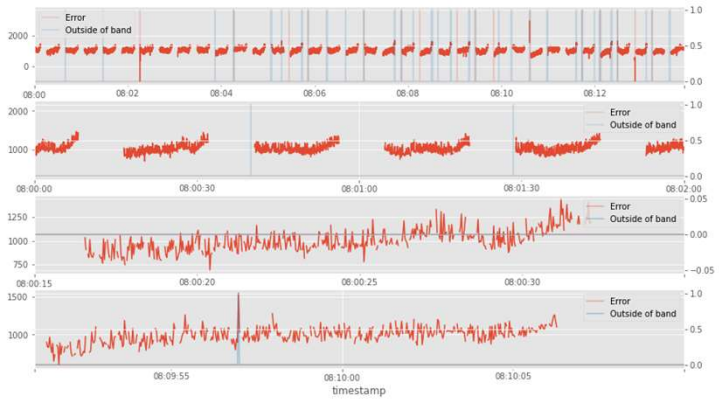
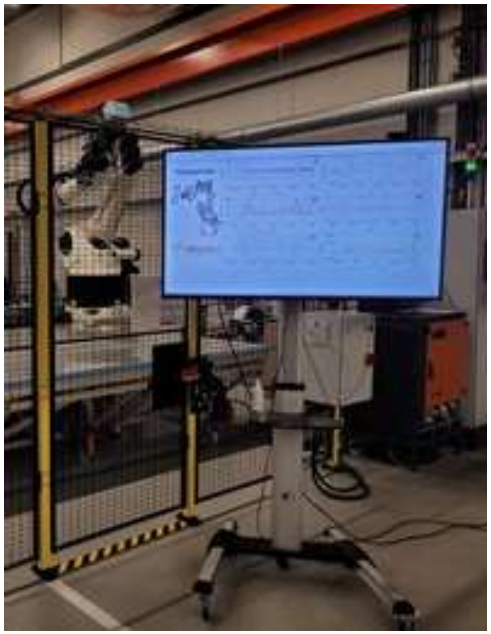
DATA GEDREVEN DIGITAL TWIN

Voorbeeld: snijrobot





PMML
Predictive Model Markup Language

APM Studio

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MODEL DRIVEN DIGITAL TWINS

Even voorstellen

Bram de Vrught

QING forward engineering

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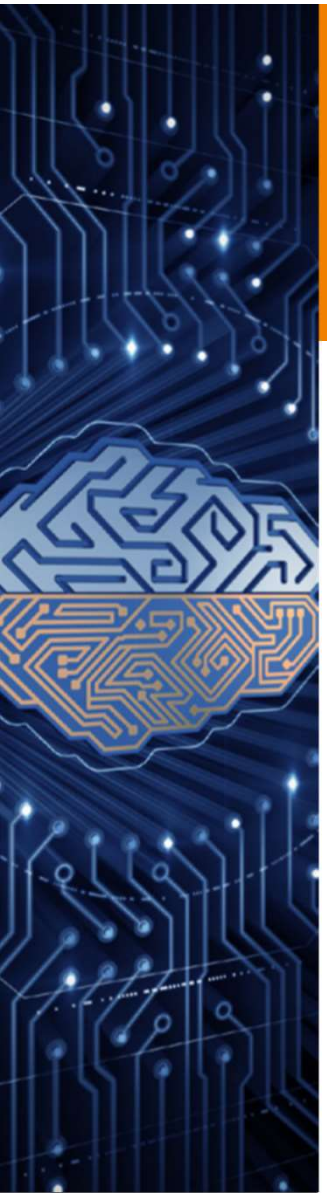

MODEL DRIVEN DIGITAL TWINS

Er is geen zwitsers zakmes in Digital Twinning

Volgens ChatGPT

"A digital twin is like a high-tech mirror image of a physical object or system.

It captures its entire lifecycle, allowing us to simulate, monitor, and analyze its behavior in real-time.

It's essentially a virtual counterpart that helps us understand, predict, and optimize the performance of its physical counterpart.“

Ieder systeem is uniek…

Daarom is de toepassing van Digital Twin ook uniek…

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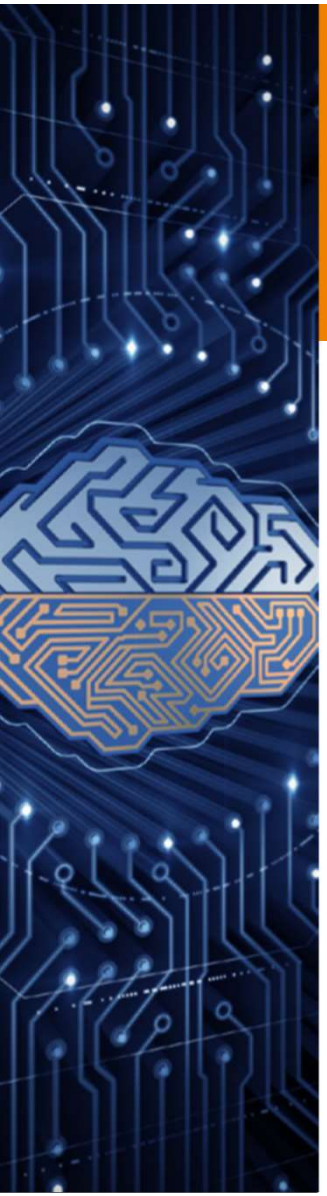

MODEL DRIVEN DIGITAL TWINS

Digital Twin is een Decision Making tool
Hiermee reduceer je zoveel mogelijk risico's

Business Decisions

- Wel of niet investeren?
- De juiste prioriteiten stellen
- Onderbouwing van keuzes op basis van data
- …

Technische beslissingen

- Welke technologie of systemen werken het beste?
- Ga ik de gestelde requirements halen?
- Ga dit passen binnen mijn huidige systeem?
- …

Monitoring en verbeteren

- Hoe kan ik mijn huidige process optimaliseren?
- Welke parameters zijn van invloed op de kwaliteit en output van mijn proces?
- Oorzaak en gevolg?
- …

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MODEL DRIVEN DIGITAL TWINS

Testen en comissioning voor het echte systeem beschikbaar is

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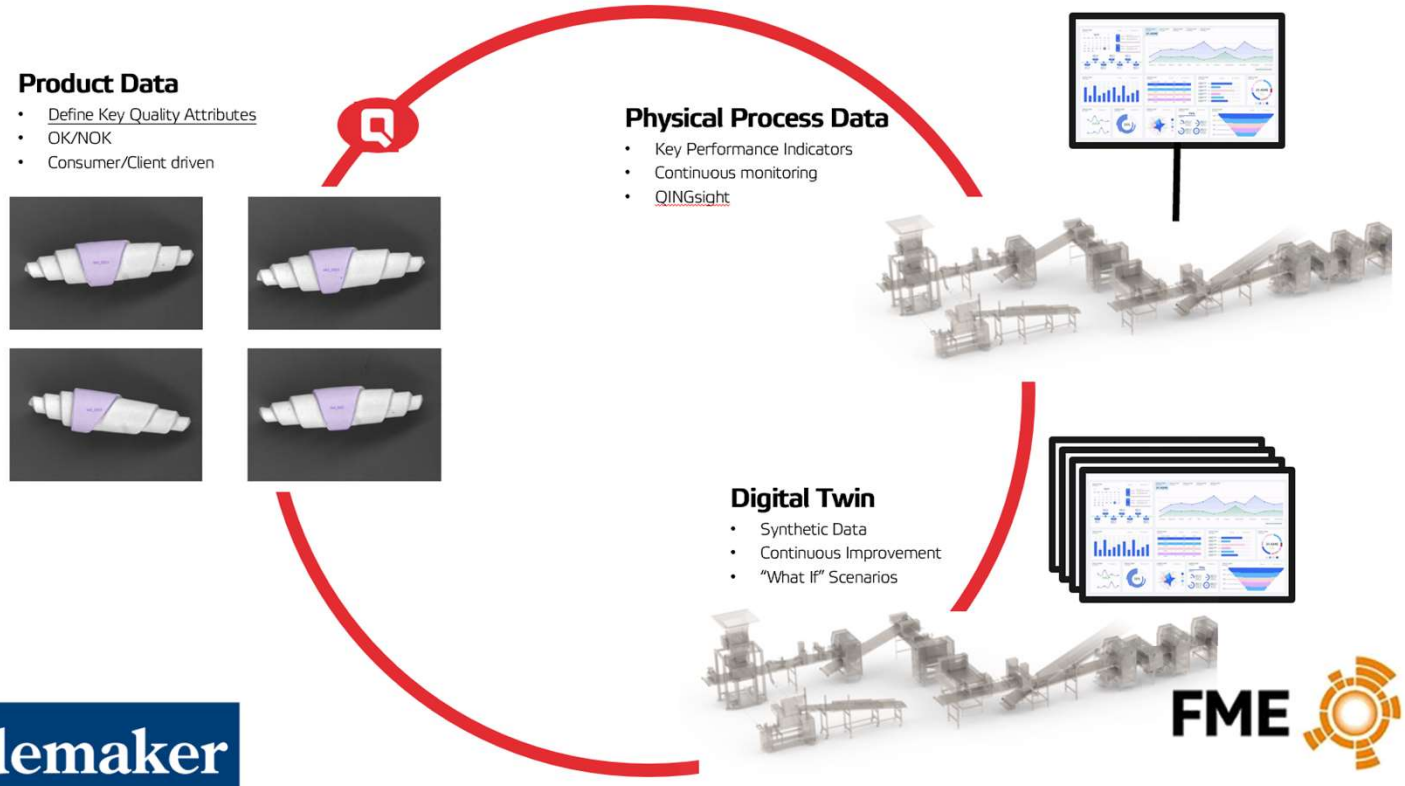
MODEL DRIVEN DIGITAL TWINS

Close the loop
You can only manage what you measure



Rademaker

FME

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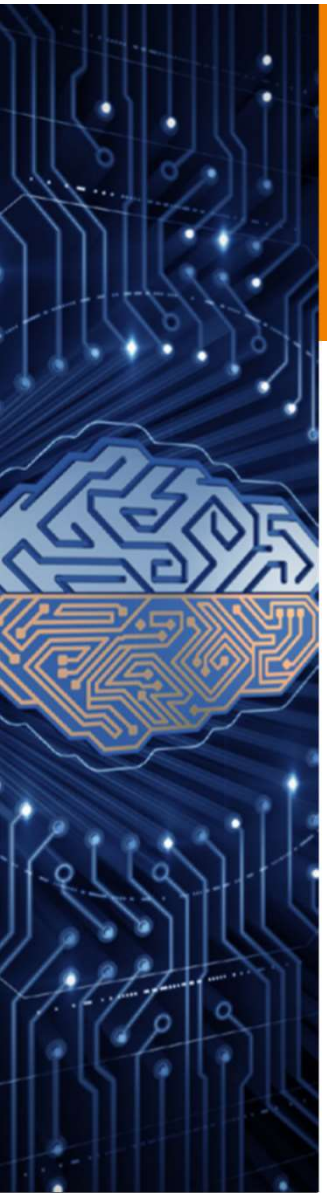

MODEL DRIVEN DIGITAL TWINS

Dit heb je nodig…

Data

- Zorg dat je data van je proces en systemen hebt
- Het maakt niet uit dat het nog niet compleet is

Stel een roadmap op

- Wat wil ik bereiken?
- Welke vragen wil ik graag beantwoorden?
- Waar staan we nu?
- Welke stappen moeten we gaan nemen?

Mindset

- Think big
- Start small
- Scale fast

Werk samen met

- Jouw collega's
- Onderwijs
- Andere bedrijven

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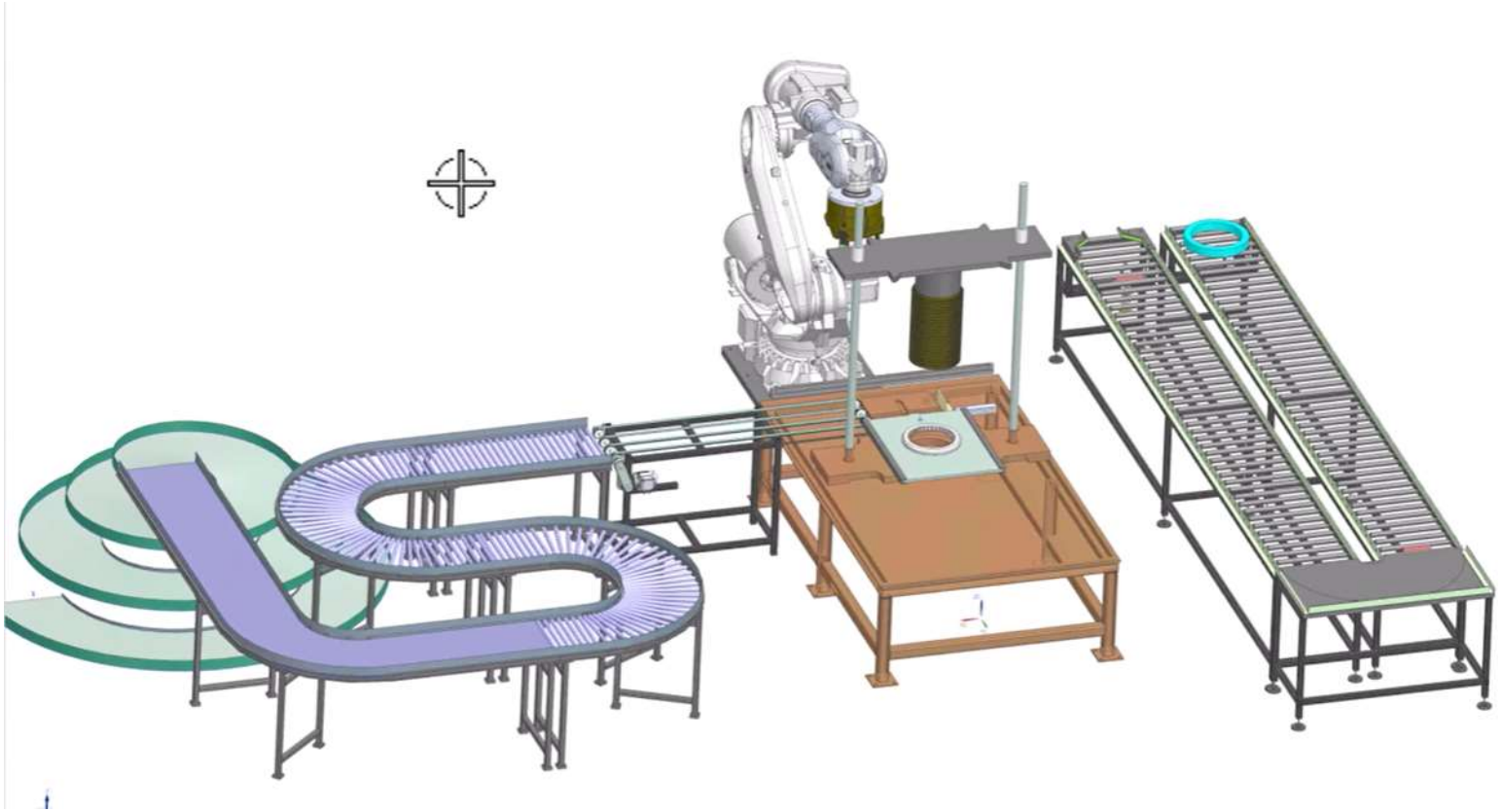
DIGITAL TWINS IN DE PRAKTIJK

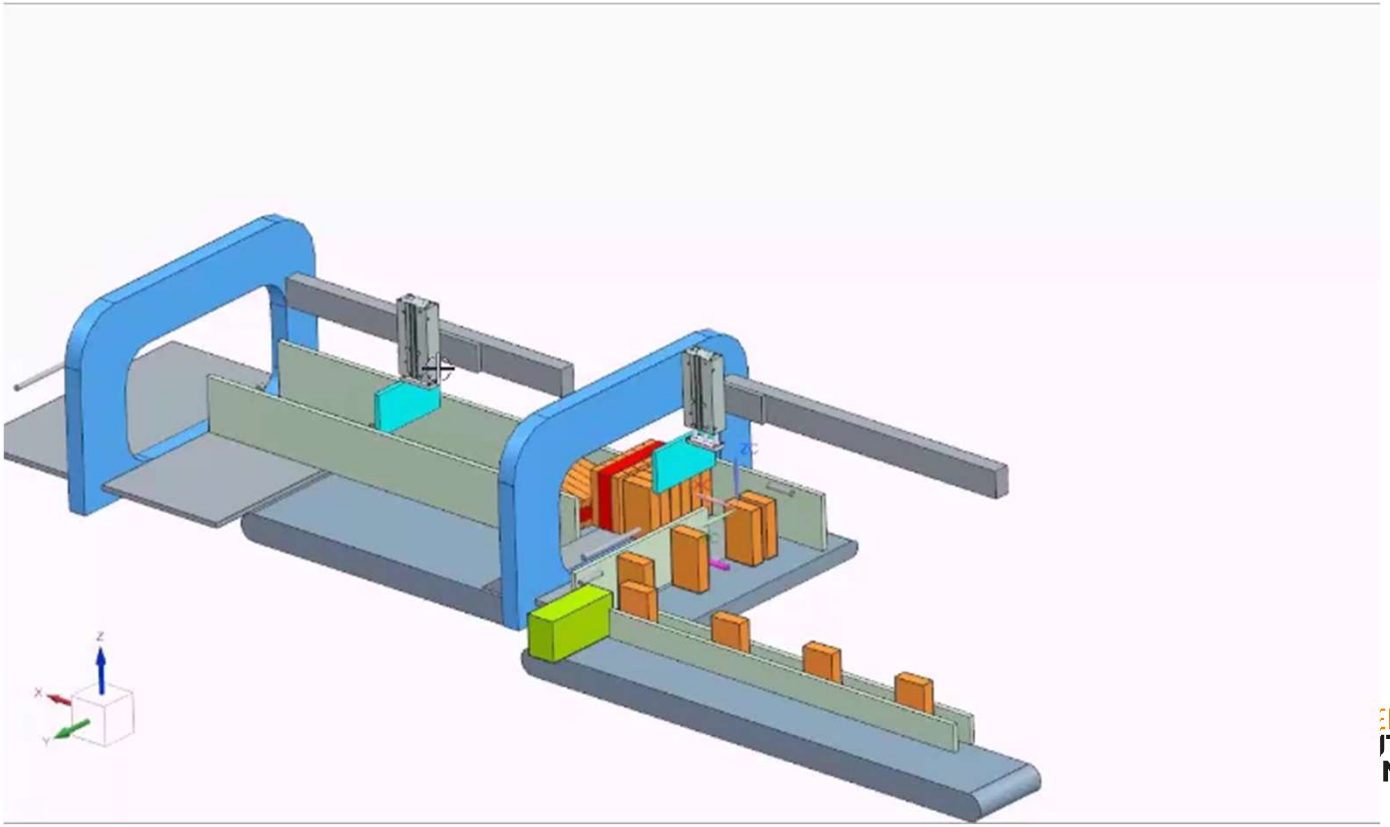
Demonstration – Bas Verschuren

Creating value in minutes



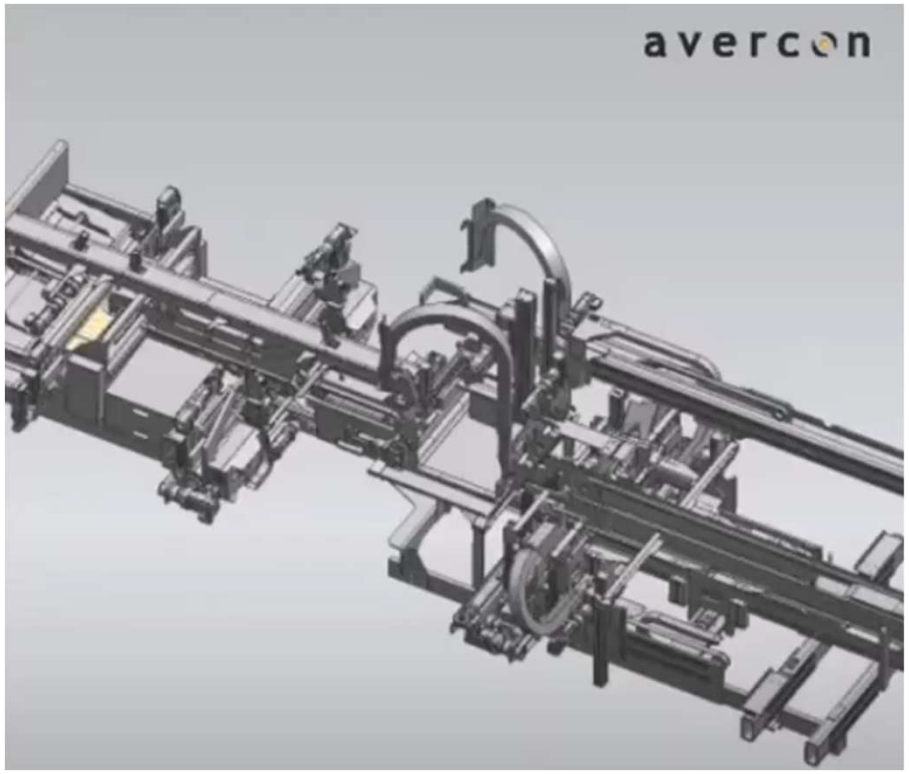
DIGITAL TWINS IN DE PRAKTIJK

Virtual concepts



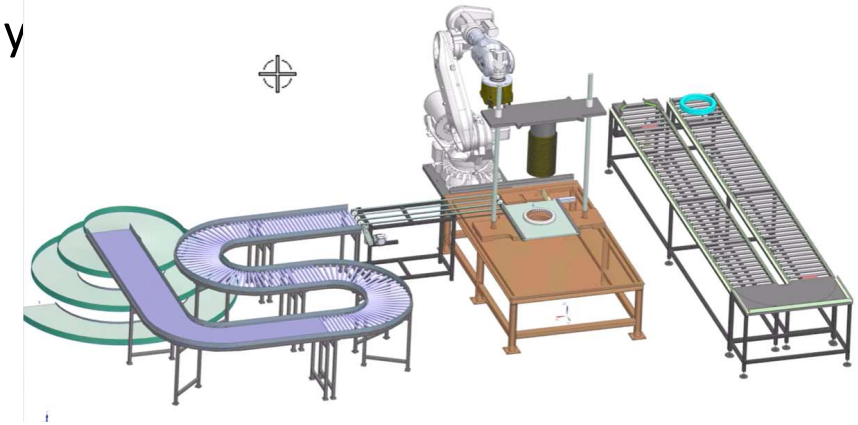
DIGITAL TWINS IN DE PRAKTIJK

Use Case Avercon



Benefits

- ✓ Improves internal (mechanical / electrical / automation) engineering collaboration
- ✓ Share ideas with customer in an early
- ✓ Reduce Prototypes
- ✓ Faster commissioning
- ✓ Operators trained in an early phase
- ✓ Machine upgrades



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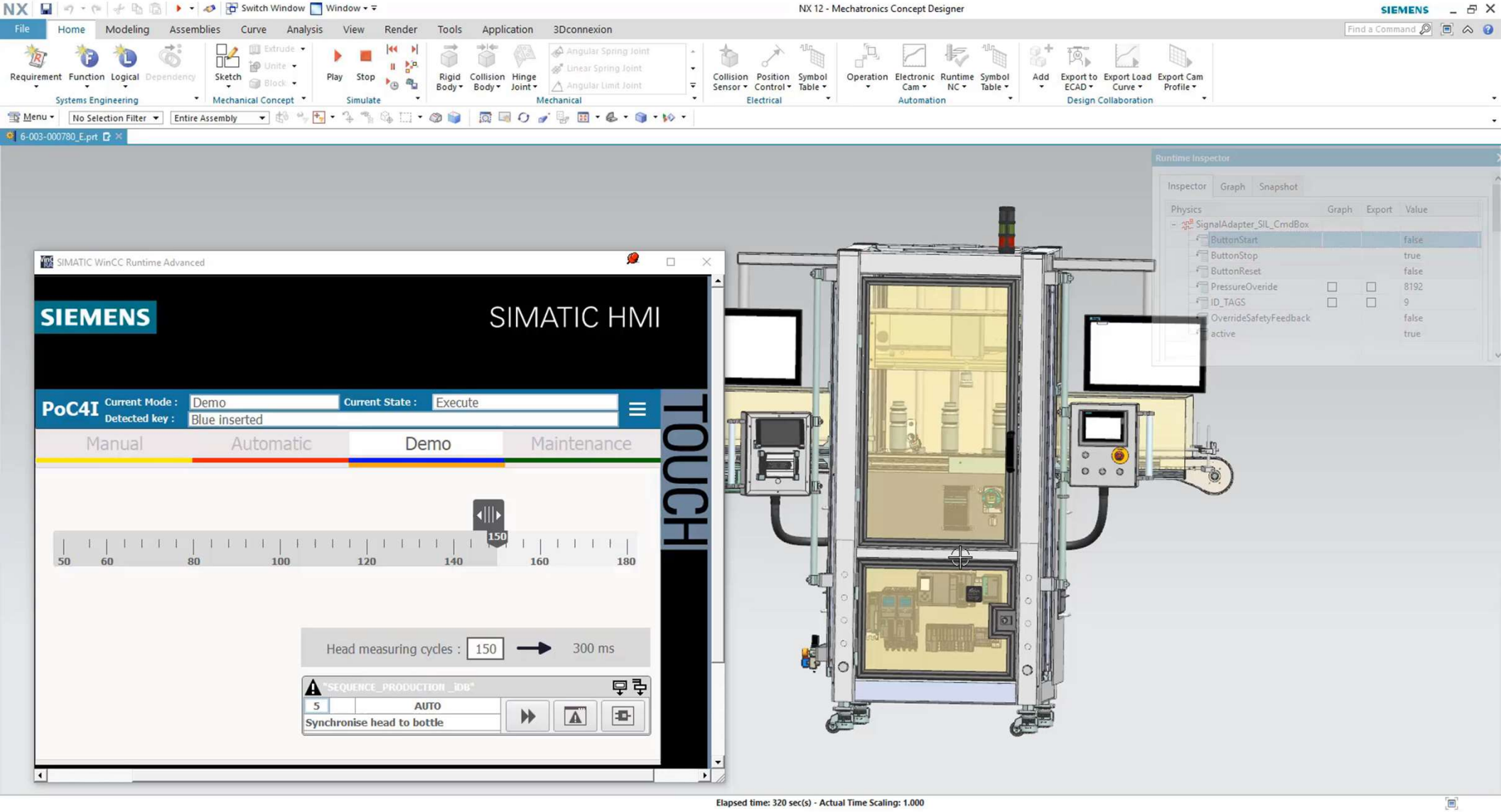
NX 12 - Mechatronics Concept Designer
SIEMENS
File
Home
Modeling
Assemblies
Curve
Analysis
View
Render
Tools
Application
3Dconnexion
Requirement
Function
Logical
Dependency
Systems Engineering
Sketch
Extrude
Unite
Block
Mechanical Concept
Play
Stop
Simulate
Rigid Body
Collision Body
Hinge Joint
Angular Spring Joint
Linear Spring Joint
Angular Limit Joint
Mechanical
Collision Sensor
Position Control
Symbol Table
Electrical
Operation
Electronic Cam
Runtime NC
Automation
Add
Export to ECAD
Export Load Curve
Export Cam Profile
Design Collaboration
6-003-000780_E.prt
Runtime Inspector
Inspector
Graph
Snapshot
Physics
Export
Value
SignalAdapter_SIL_CmdBox
ButtonStart
ButtonStop
ButtonReset
PressureOveride
ID_TAGS
OverrideSafetyFeedback
active
SIMATIC WinCC Runtime Advanced
SIEMENS
SIMATIC HMI
PoC4I
Current Mode :
Demo
Current State :
Execute
Detected key :
Blue inserted
Manual
Automatic
Demo
Maintenance
TOUCH
50
60
80
100
120
140
150
160
180
Head measuring cycles :
150
300 ms
"SEQUENCE_PRODUCTION_IDB"
5
AUTO
Synchronise head to bottle
Elapsed time: 320 sec(s) - Actual Time Scaling: 1.000

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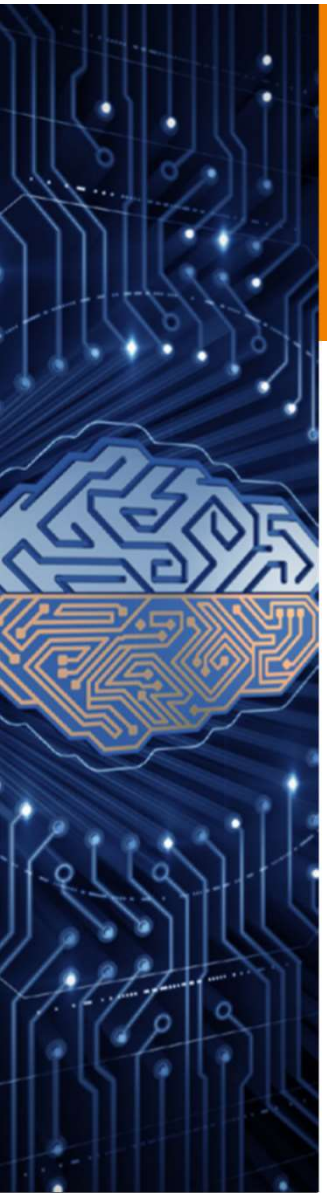
Afsluiting – Aan de slag

Met Digital Twins



DIGITAL TWINS IN DE PRAKTIJK

Aan de slag!

Deep Dive Digital Twin

- Datum wordt ASAP gecommuniceerd.
- Deep dive + Interactieve workshop
- Aanmelden via FME - Patrick Blommerde

Ook interessant:

Deep Dive Aan de Slag met Data – Data Connectivty

Voor meer informatie

- Siemens – Paul van Ruiten: paul.vanruiten@siemens.com
- VORtech – Mark Roest: mark.roest@vortech.nl
- Qing – Bram de Vrught: bdvrught@qing.nl
- FME - Patrick Blommerde: patrick.blommerde@fme.nl

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Bedankt voor je aandacht!

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