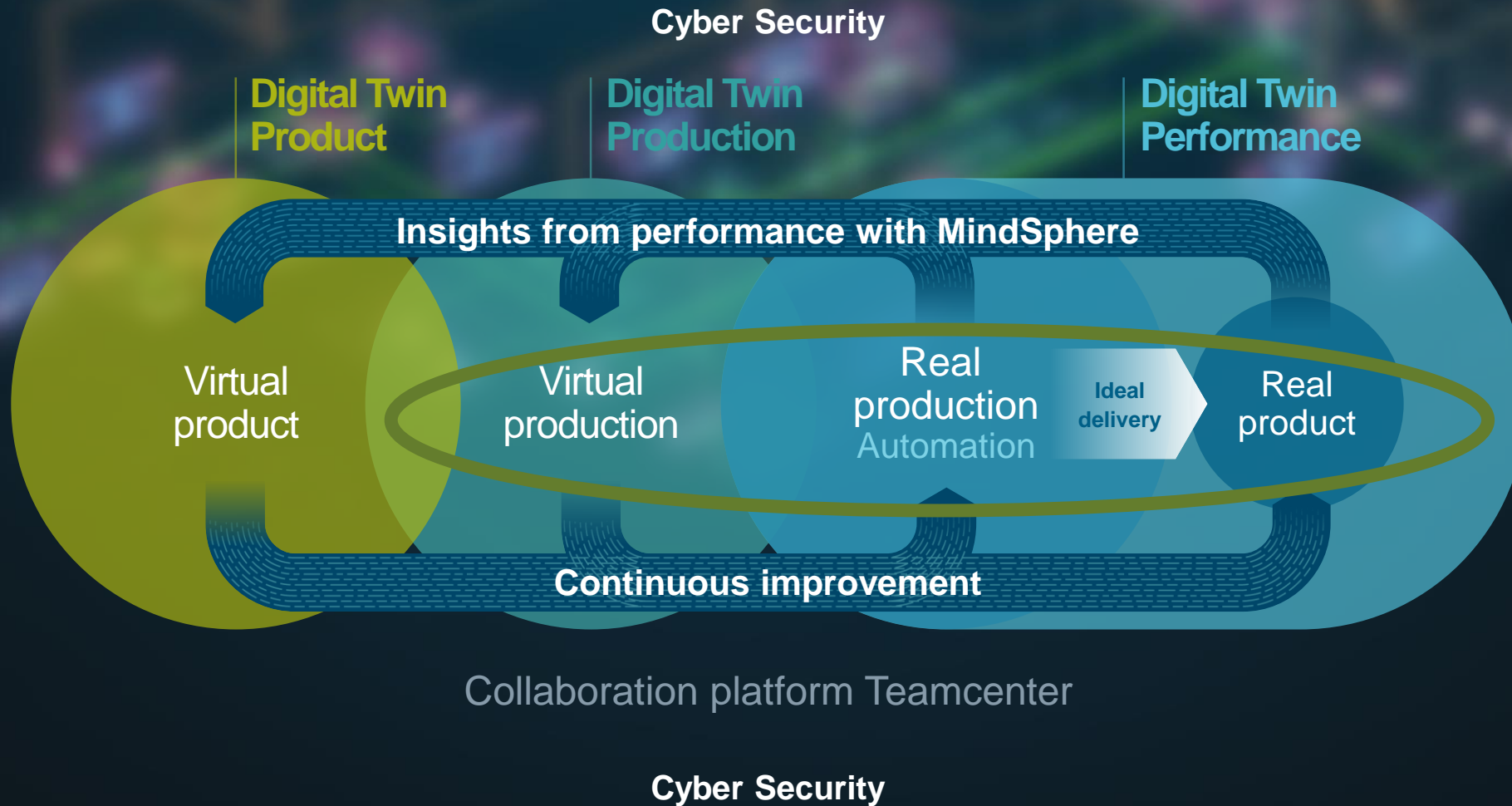


Digital Twins Production Equipment (and the Product in mind...)

The Digital Enterprise – an integrated solution



What is a Digital Twin?

Your Company, Organization, Discipline May has Different Needs

Digital Twin & Workflow!



Define



Purpose Insights Whom When

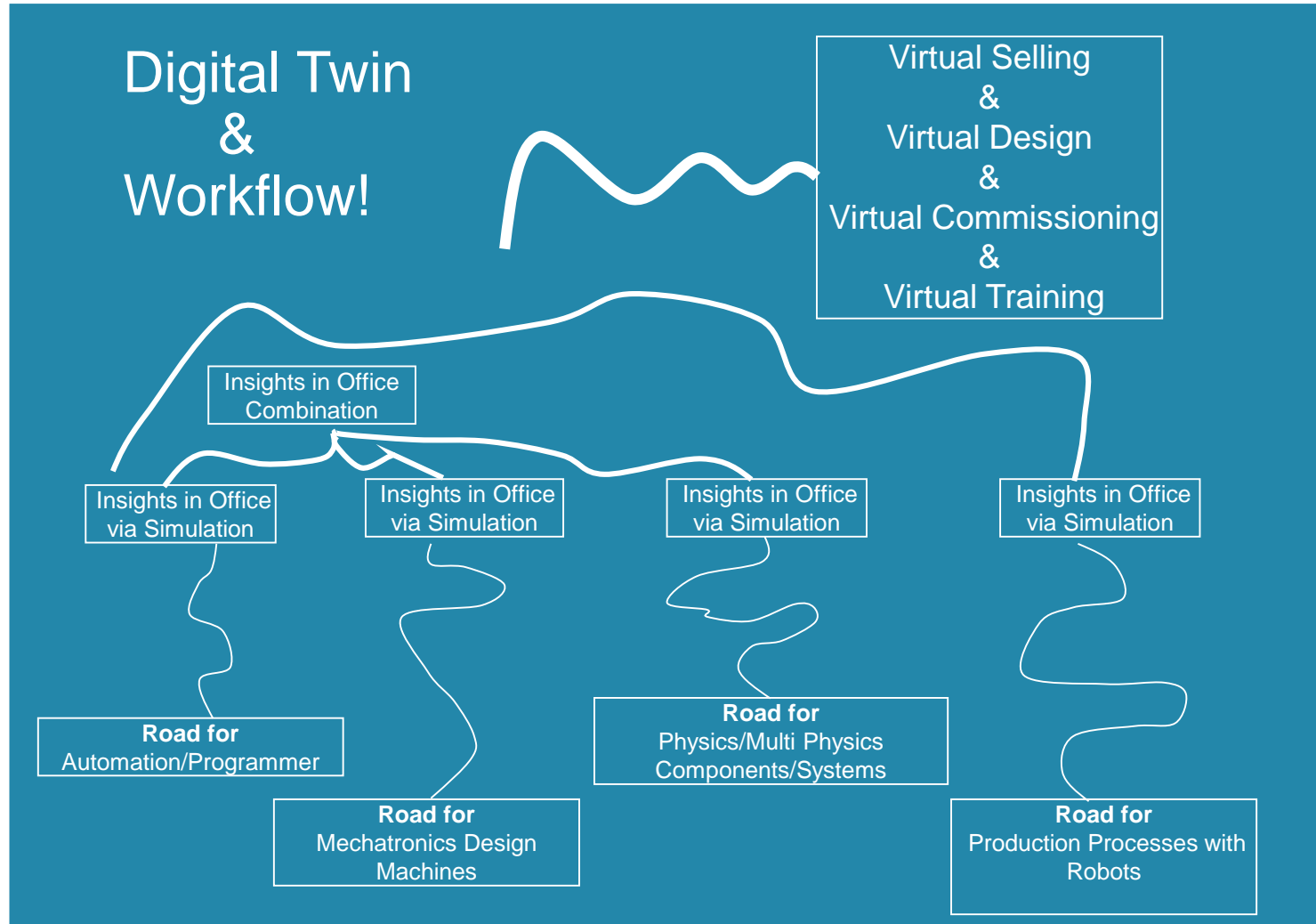


Step Wise Journey



What is a Digital Twin?

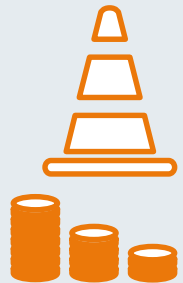
Your Company, Organization, Disciplines May have Different Needs



Production Equipment

- How Digital Twins generate Values

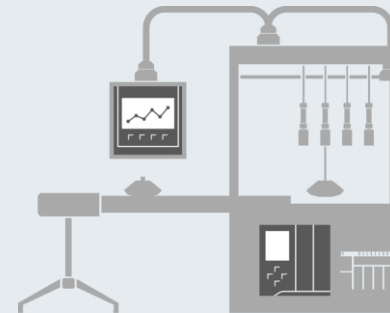
SIEMENS
Ingenuity for life



Risk & Cost



**Attract
Employees**

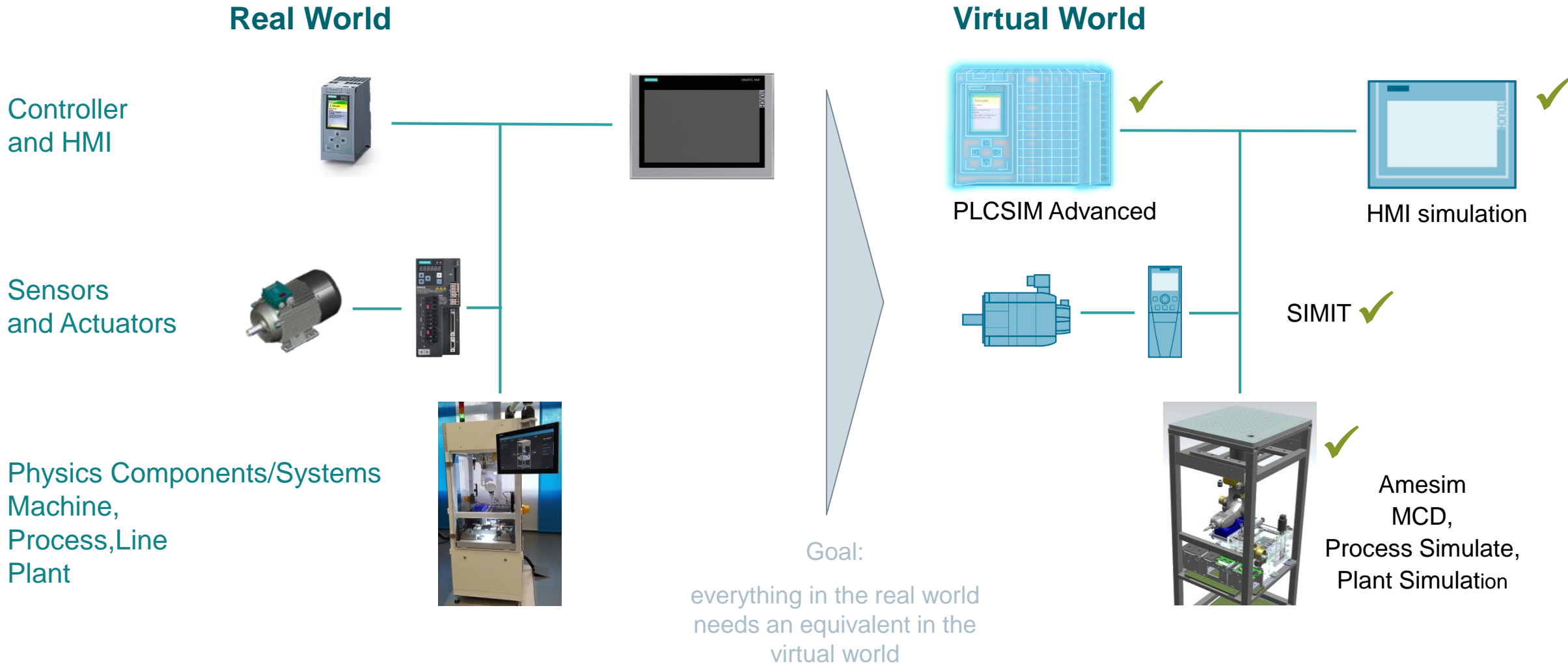


Product



**Time to
Market**

Behavior Simulation with SIMIT to fill the gap in between Automation and PLM



Digital Twins and interaction with each other

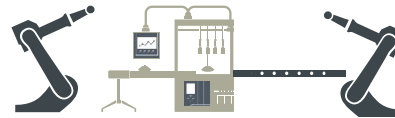
- **Production Line**



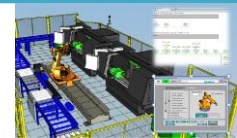
**Tecnomatix
Plant Simulation**



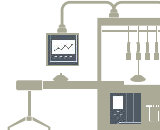
- **Robotic Cell**



**Tecnomatix
Process Simulate**



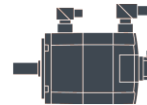
- **Production Machine**



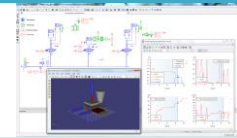
**NX Mechatronic Concept
Designer**



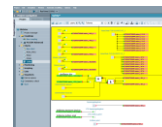
- **Component/System Physics**



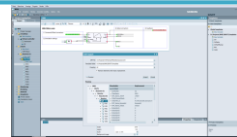
Simcenter Amesim



- **Component/Functional Behavior**



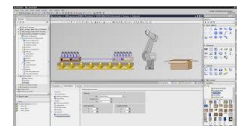
**SIMIT (SiL / HiL)
Simit Unit (HiL)**



- **Automation**

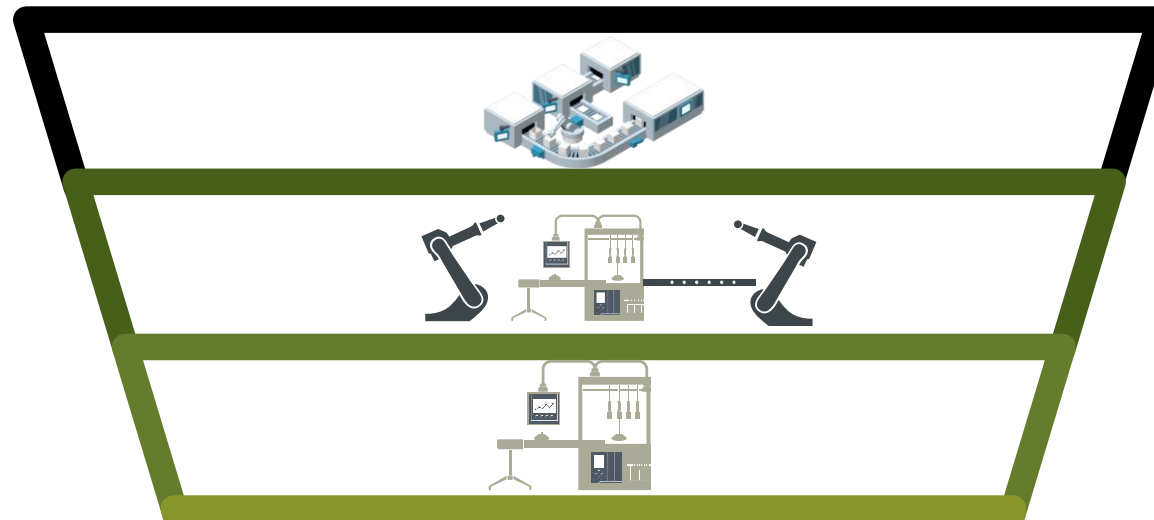


**Simatic
Sinumerik
Simotion**

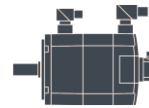


• **Quality & MES - Interface**

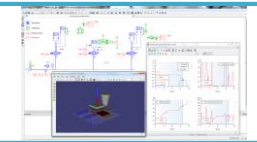
Digital Twins and interaction with each other



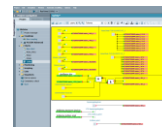
- **Component/System Physics**



Simcenter Amesim



- **Component/Functional Behavior**



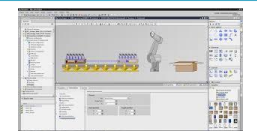
SIMIT (SiL / HiL)
Simit Unit (HiL)



- **Automation**



Simatic
Sinumerik
Simotion



• **Quality & MES - Interface**

Simcenter Amesim

Physics of Components and System

SIEMENS
Ingenuity for life

The screenshot displays the Simcenter Amesim software interface, which is used for multi-physics simulation. The main workspace shows a 3D model of a hydraulic press system, including a pump, valves, and a cylinder. The interface is divided into several panes:

- Top Bar:** Contains tabs for File, Edit, Sketch, Configure, Simulate, Interfaces, Tools, and Help. Below these are buttons for SKETCH, SUBMODEL, PARAMETER, and SIMULATION.
- Left Panel:** Shows a tree view of the model components, including 'CheckValve.ame', 'Hydraulic_press_step1.ame', 'Hydraulic_press_step2.ame', 'Hydraulic_press_step3.ame', 'Loader_crane_15_step1.ame', and 'Ch2_ex3a_waste_collection_truck_TM_step1.ame'.
- Right Panel:** Displays a 'Library tree' with various components categorized under 'Hydraulic Component Design'. Categories include Fixed Body, Moving Body, Pumps, Specific components, Hydraulic Resistance, Filling, Thermal, Thermal Hydraulic, Thermal Hydraulic Resistance, Thermal Hydraulic Component Design, Cooling System, Two-Phase Flow, Air-Conditioning, HEAT, Pneumatic, Pneumatic Component Design, Gas Mixture, Moist Air, electrochemistry, Fuel Cell, Powertrain, and 3D Mechanical.
- Bottom Panel:** Contains a 'Post processing' table and a 'Parameters of end_TableMachine [EMDT]' table.

Post processing table:

Name	Title	Expression	Default Result Set	Value
A1	Pump flow rate	-Q1@pump01	ref	
A2	Electric motor po...	{U}@end_Table...	ref	
A3	Electric motor en...	integ(A2)	ref	
A4	Oil valve pressu...	{p}@valve02@...	ref	
A5	Relief valve ene...	energy@valve@...	ref	
A6	Oil valve energy	{energy}@valve...	ref	

Parameters of end_TableMachine [EMDT] table:

Title	Value	Unit	Tags
torque	0	Nm	
characterization t...	simple		
constant efficiency	0.8855	null	
maximum torque	300	Nm	
maximum power	30000	W	
maximum rotor rel...	3000	rev/min	
torque time const...	0.01	s	
numerical par...			
power, energ...			

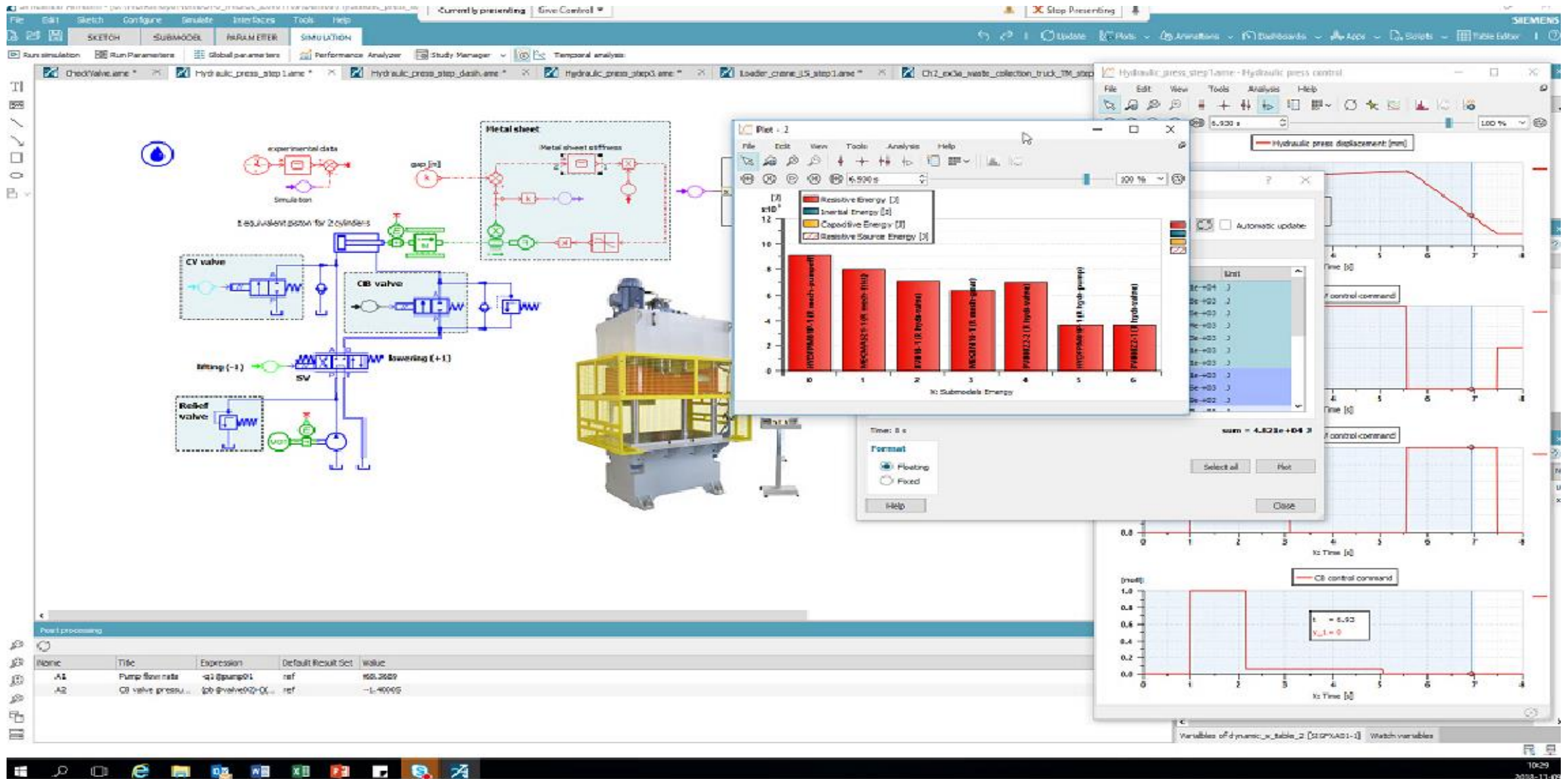
Variables of end_TableMachine [EMDT] table:

Title	Value	Unit	Save
current at port 1	-54e-07	A	
current at port 2	-54e-07	A	
input voltage	400	V	
input current	-54e-07	A	
rotor relative speed	1.23046	rev/min	
torque	-148563	Nm	
maximum torque	300	Nm	
minimum torque	-300	Nm	
variables at p...			
power, energ...			

Simcenter Amesim

Application example – Energy optimization of hydraulic system

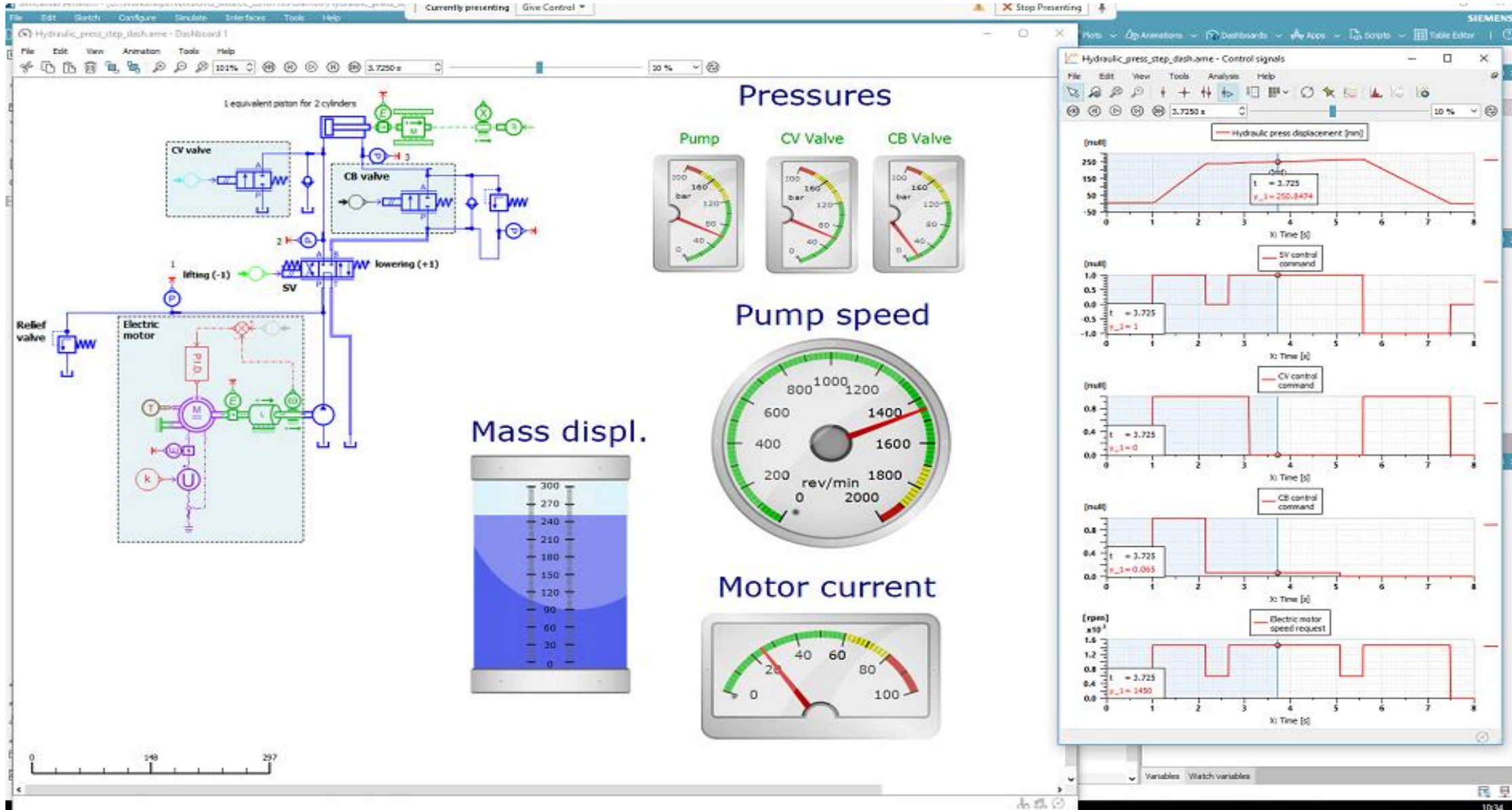
SIEMENS
Ingenuity for life



Simcenter Amesim

Application example – Pressure measurement in 3 points

SIEMENS
Ingenuity for life



Öhlins Racing - Boosting suspension performance with Simcenter Amesim



Boosting suspension performance

Understanding dynamics
with LMS Imagine.Lab
Amesim

Simcenter Amesim

Interfaces to Automation and NX MCD



Features

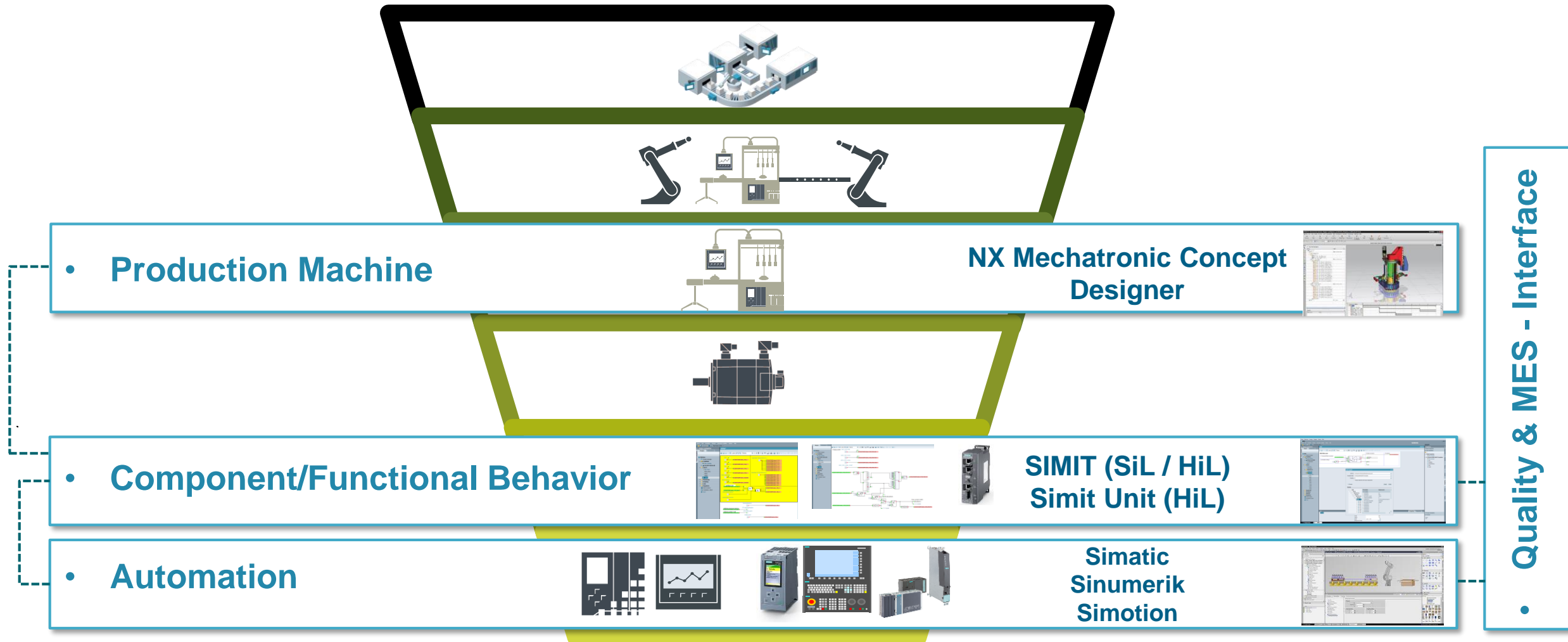
- Can be used with real automation and drive controllers, including SIMATIC PLCs, SIMOTION and SINUMERIK for hardware-in-the-loop
- Support of PROFINET or PROFIBUS communications through a Siemens SIMIT Unit hardware gateway
- Interface with SIMIT FRAMEWORK (ULTIMATE) and PLCSIM Advanced for software-in-the-loop
- OPC UA client available and all provided interface connectors can be used simultaneously
- Time synchronization with Simcenter Amesim, SIMIT and PLCSIM Advanced (the latter based on the main PLC cycle)
- Connected to NX Mechatronic Concept Designer to control or directly interact with CAD models

The screenshot shows the 'Automation Connect' window with the 'Variable mapping' tab selected. The 'NX MCD' tab is highlighted with a red circle. The 'PLCSIM Adv' tab is also highlighted with a red circle. The 'SIMIT' and 'Simulation Unit' tabs are also highlighted with red circles. The table displays the following data:

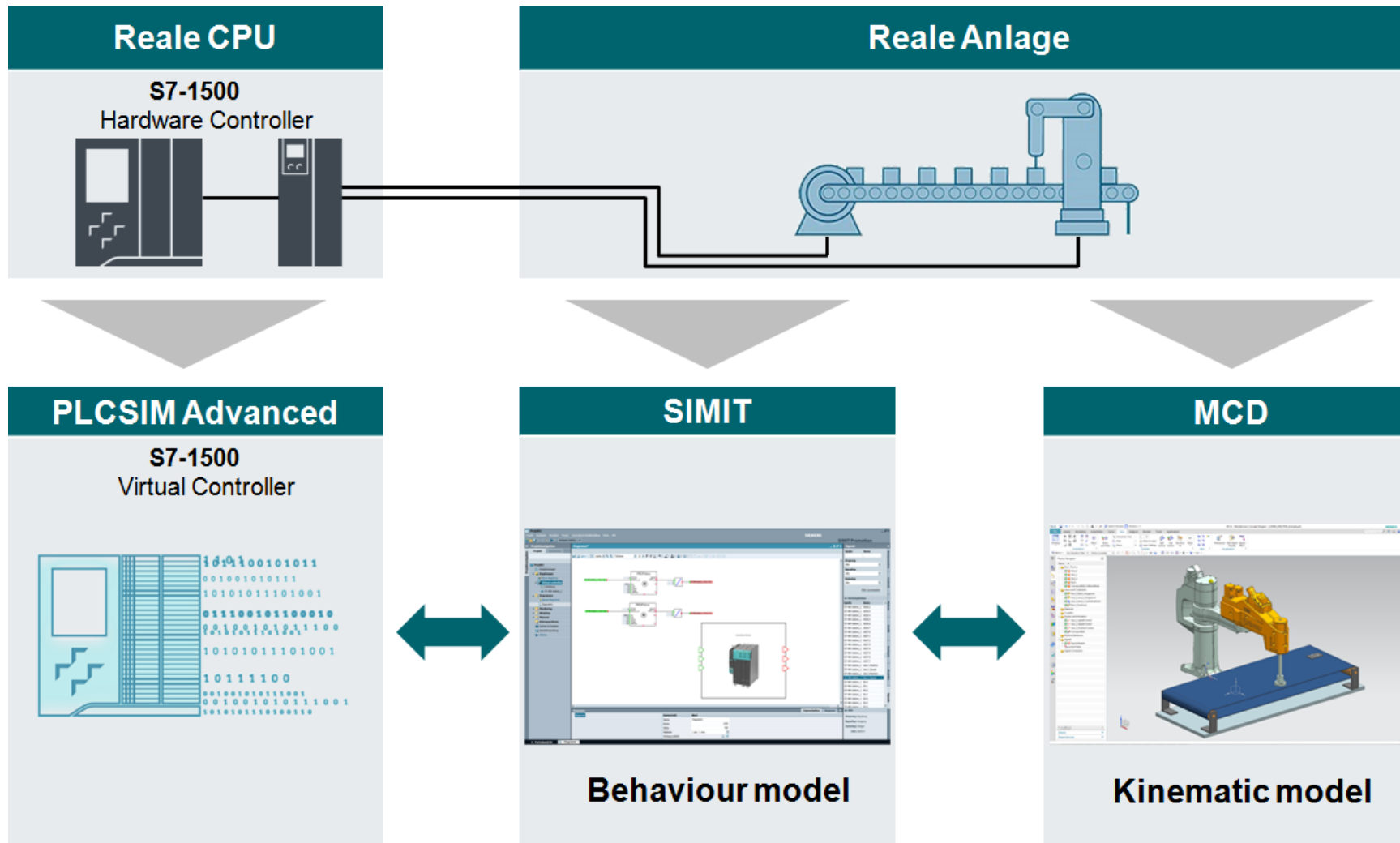
Connector	Name	Type	Address
Simcenter_A...	Cyl1PVPress	LREAL	Q70
PLCSIM_Adv	CMD_Cyl2Valv...	REAL	QF17
PLCSIM_Adv	CMD_Cyl2Valv...	BOOL	Q0.3
PLCSIM_Adv	CMD_Cyl2Valv...	BOOL	Q0.2
PLCSIM_Adv	SoilForce	REAL	QF13
PLCSIM_Adv	CMD_Cyl1Valv...	REAL	QF1
PLCSIM_Adv	CMD_Cyl1Valv...	BOOL	Q0.1
PLCSIM_Adv	CMD_Cyl1Valv...	BOOL	Q0.0
PLCSIM_Adv	Cyl2PressPIDOut	REAL	QF21
PLCSIM_Adv	Cyl1SpeedPID...	REAL	QF9
Simcenter_A...	Cyl2PVSpeed	LREAL	Q740
Simcenter_A...	Cyl2PVDispl	LREAL	Q732
Simcenter_A...	Cyl2PVPress	LREAL	Q724
Simcenter_A...	Cyl1PVSpeed	LREAL	Q716
Simcenter_A...	Cyl1PVDispl	LREAL	Q78
PLCSIM_Adv	Cyl1PressPIDOut	REAL	QF5

Connector	Name	Type	Address
PLCSIM_Adv	Cyl1Press	REAL	IF2
Simcenter_A...	Cyl2Valve1	LREAL	I748
Simcenter_A...	Cyl2Valve3	LREAL	I764
Simcenter_A...	Cyl2Valve2	LREAL	I756
Simcenter_A...	Soil_Force	LREAL	I740
Simcenter_A...	Cyl1Valve1	LREAL	I70
Simcenter_A...	Cyl1Valve3	LREAL	I716
Simcenter_A...	Cyl1Valve2	LREAL	I78
Simcenter_A...	Cyl2PIDOutPress	LREAL	I780
Simcenter_A...	Cyl1PIDOutSpe...	LREAL	I724
PLCSIM_Adv	Cyl2Speed	REAL	IF18
PLCSIM_Adv	Cyl2Displ	REAL	IF22
PLCSIM_Adv	Cyl2Press	REAL	IF14
PLCSIM_Adv	Cyl1Speed	REAL	IF6
PLCSIM_Adv	Cyl1Displ	REAL	IF10
Simcenter_A...	Cyl1PIDOutPress	LREAL	I732

Digital Twins and interaction with each other



SIMATIC Machine Simulator: Software in the Loop

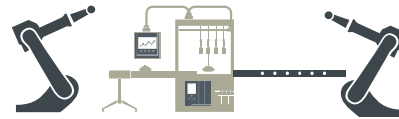




Simulation at every level

Our customers have specific challenges

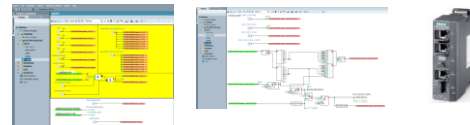
- **Robotic Cell**



**Tecnomatix
Process Simulate**



- **Component and periphery Behavior**



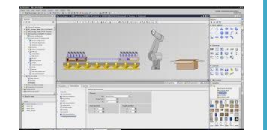
**SIMIT (SiL / HiL)
Simit Unit (HiL)**



- **Automation**



**Simatic
Sinumerik
Simotion**



• **Quality Assurance - & MES - Interface**

Brownfield and Greenfield – Automotive

- Follow Customers Globally
- Flexibility
- Time Savings
- Secure Quality
- Fixed Price



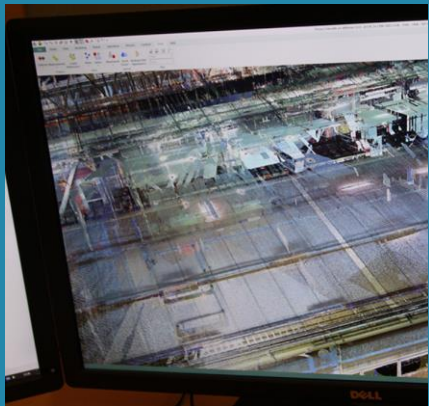
"It is wonderful that there are smart tools also for automation engineers."

Paul Jarnehäll, Market Area Manager, ÅF

ÅF-Industry, Advanced Manufacturing

Focus : Implementing Industrie 4.0 and a digital factory.

SIEMENS
Ingenuity for life



Point Cloud



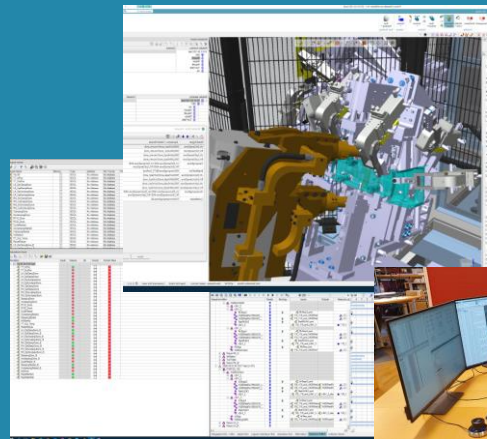
Mechanics Kinematics



Robot Reachability



OLP Robots



Line Simulation



Internal logic, event-based simulation



Realistic cycle times for Automation



Project/Automation Engineer



Defines and Integrate Behavior from Automation Perspective in Simit & Process Simulate



PLC Programmer work towards Simit

Elias Tekniksprångare hos Siemens



Automation Projekt
with Simit
+
Installation Guide



How think when programming
Production Equipment
-> Plant Data Interface
=> OMAC PackML

OMAC PackML
A novice's perspective

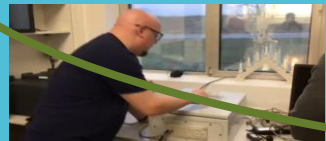
Robot i TIA Portal



Simit @ 1 Day ws
Be the teacher for the basics

- Machine Safety
focus Software/Hardware
- Drives-
Simatic Machine Simulator

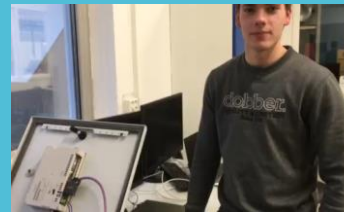
Automation Project
Wednesday = FAT 15:00



Automation Project
Tuesday

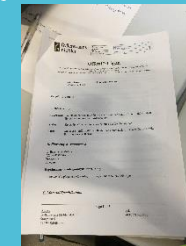


Automation Project
Monday



Automation Project
FAT Wednesday 16:00

(Automationssimulering
Simit....)



Understanding
Automation hardware
in combination with software
& how to choose I/O
from technical and diagnostics
point of view

Learned basic Automation
via Sitrain Web Trainings

Visited End Customer
to get a feeling about
a production
site
– from Producer/ End Customer
Perspective

Sitrain
Programming 1 Course