SIEMENS
Ingenuity for life

Siemens Industry Software
Kick-Off 10'

Realize innovation.

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Agenda:

Introduction

Today's Challenges

Siemens for Controls and Embedded SW

Ongoing projects

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Agenda:

Introduction

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Siemens Industry Software
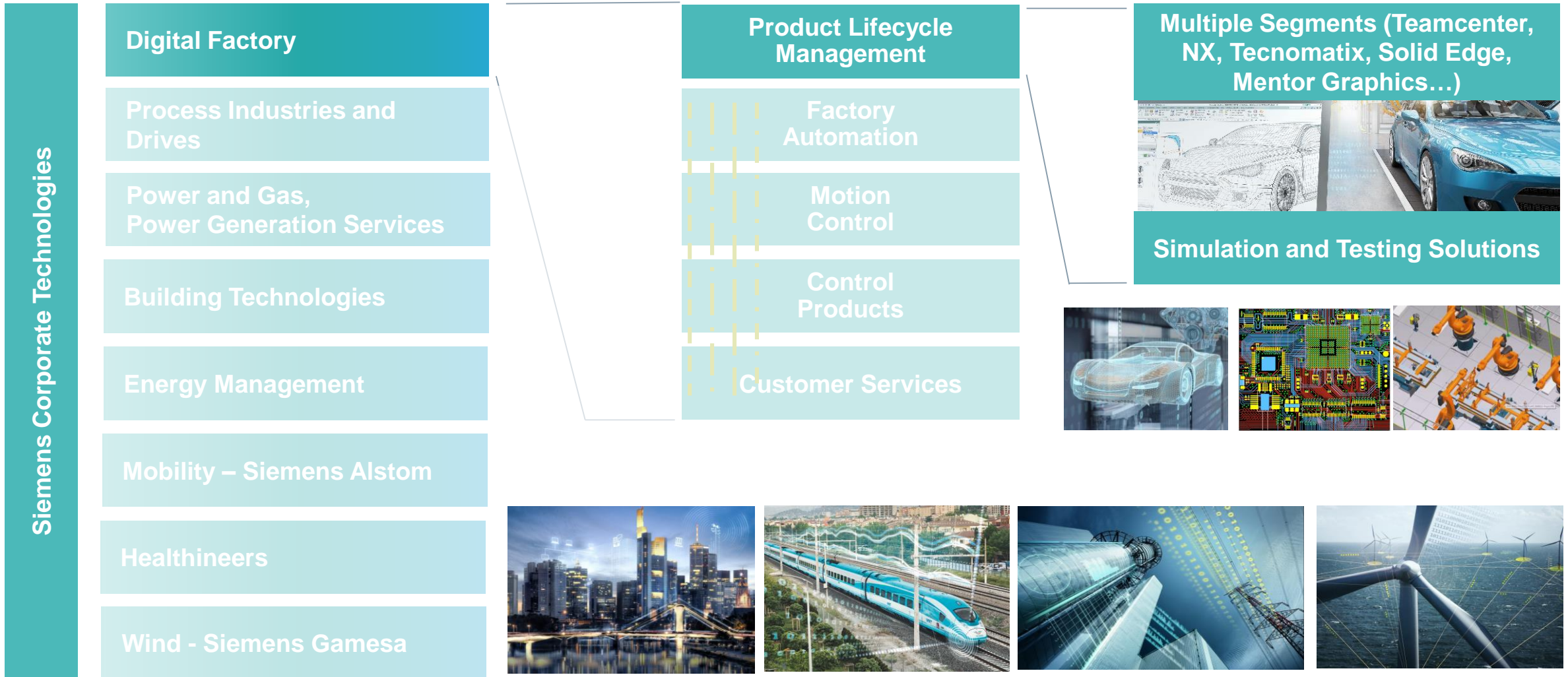# Siemens PLM Simulation and Testing Solutions

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- **Spin-off** from KU Leuven, 1980, as *LMS International*

- Partner in engineering innovation in the mechanical and mechatronic industries: **software, systems and services**

- **B2B** company selling to leading **R&D labs of major industries**

- Addressing **critical product performances** and supporting the design of green and safe products

- Committed to innovation: **> 20% of budget in R&D**

- More than **5.000 manufacturing** companies actively use LMS Products and Services (75% auto & aero)

- Acquired by **Siemens in 2013**, LMS now is the HQ of the **"Simulation and Test"** segment of **Siemens PLM,** part of the **Digital Factory Division**

- Belgian Legal Entity: **Siemens Industry Software NV**

- Product brand "**Simcenter**"

Siemens PLM Software
Simulation and Testing Solutions – SISW

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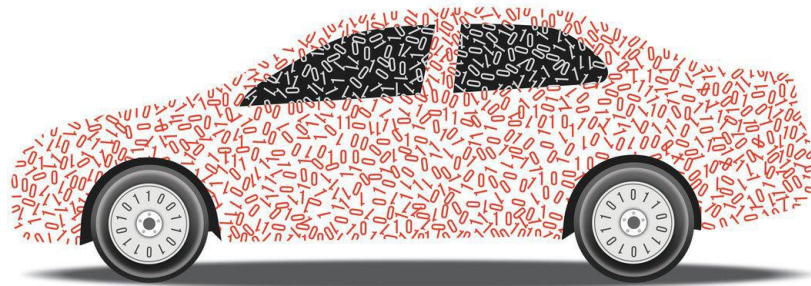**Siemens Corporate Technologies**

Digital Factory
Process Industries and Drives
Power and Gas, Power Generation Services
Building Technologies
Energy Management
Mobility – Siemens Alstom
Healthineers
Wind - Siemens Gamesa

Product Lifecycle Management

- Factory Automation
- Motion Control
- Control Products
- Customer Services

Multiple Segments (Teamcenter, NX, Tecnomatix, Solid Edge, Mentor Graphics…)

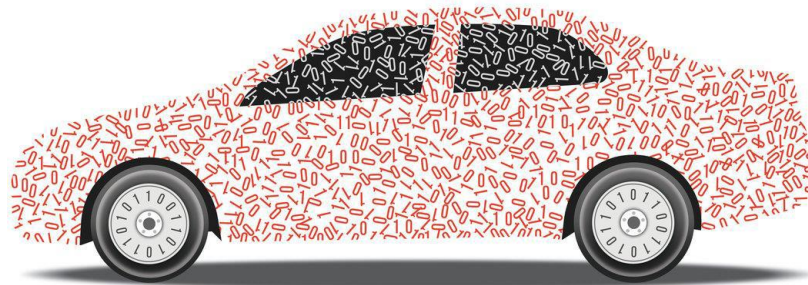**Simulation and Testing Solutions**
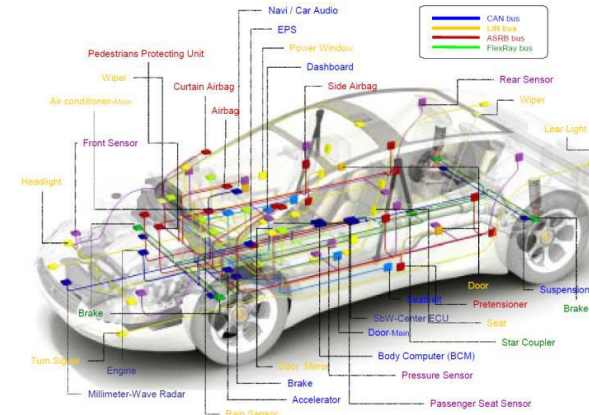
Agenda:

Industry challenges

Today's car, aircraft, ship or factory is a software-intensive mechatronic system
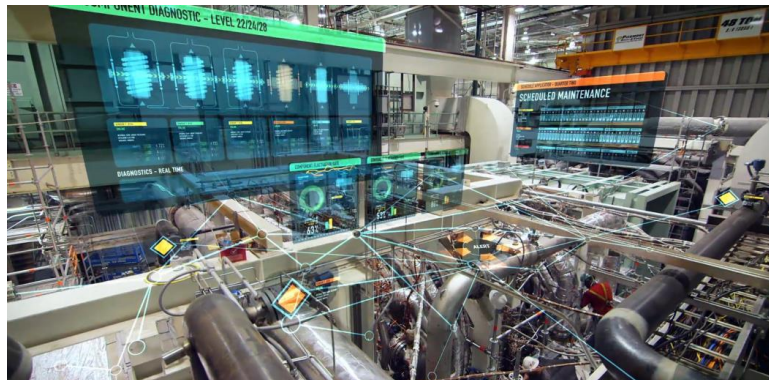
Industry challenges

A modern car realizes + 100's of vehicle functions..

..distributed over several ECU's and connected through multiple busses..

…with increased algorithm complexity and tight constraint requirements..

…Programmed in million lines of software code…

Industry challenges

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Each vehicle function needs to be validated and calibrated..

..at reduced development time and cost..

.. is developed in a large ecosystem of companies..
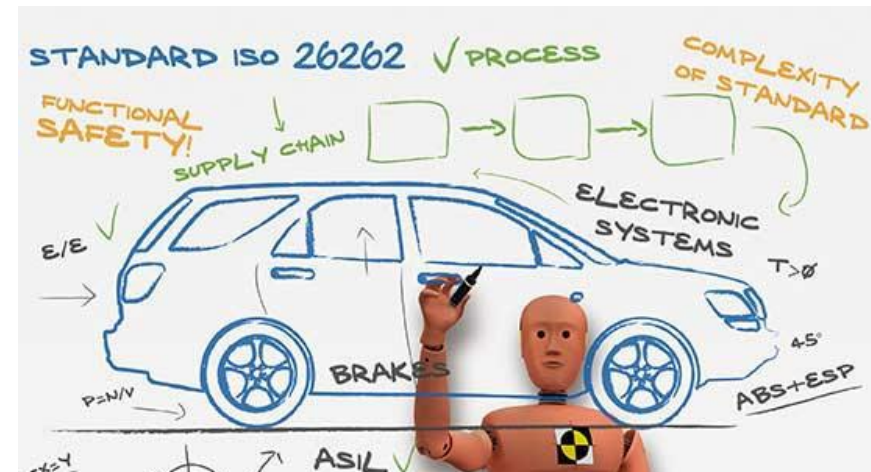
.. And needs to be certified before going in production!

Industry challenges
Car recalls can become a costly affair…

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Ford Failure-to-Park

(Failed safety catch automatic transmission)
- **98 people killed**
- 21 million vehicles recalled
- $ 1.7 billion
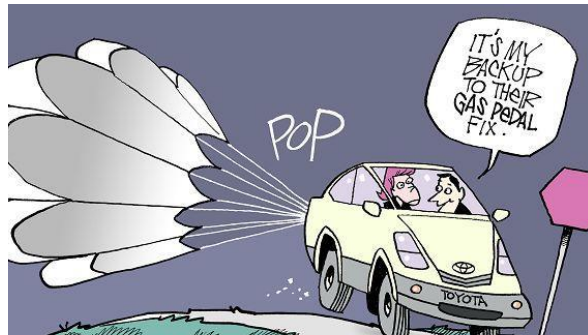
Toyota Out-of-Control Gas Pedals
(Drive-by-wire Throttle system)
- **89 people killed**
- 9 million vehicles recalled
- $ 5 billion

Takata Airbag Explosion
(Spontaneous explosion)
- **19 people killed**
- 70 million vehicles recalled£
- Estimated $ 24 billion

Industry challenges
Need for improvement

- Exponential increasing number of software lines

- High risk of detecting errors at the end of the design process

- Integration validation late in the design process

- Higher number of employees at different locations

- High demands for safety and certification
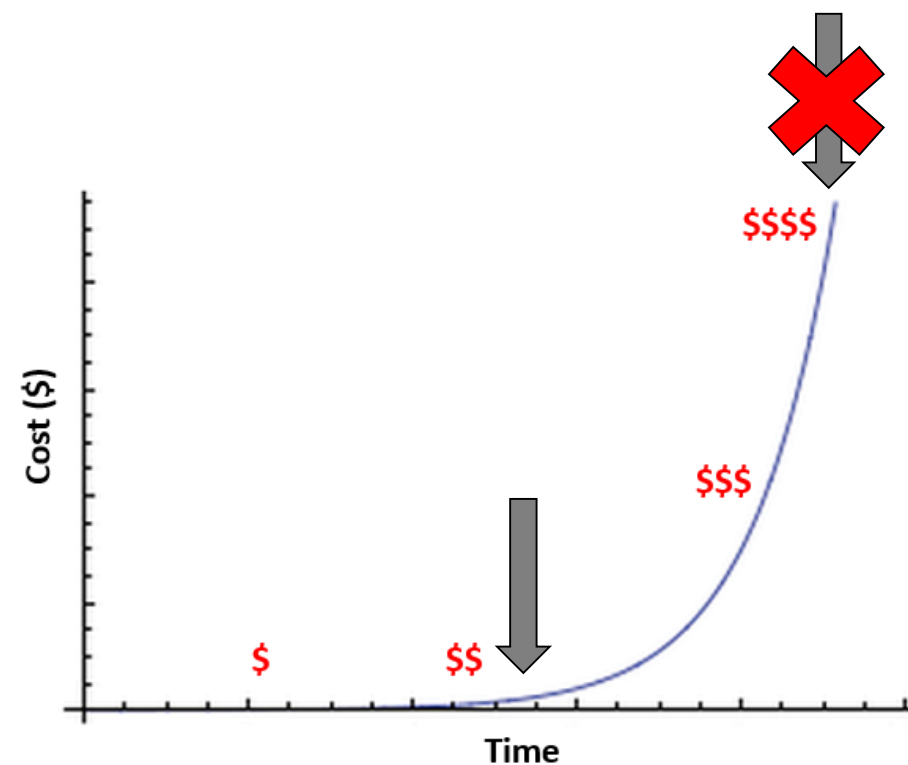
How can we make safe and correct mechatronic systems in a multidisciplinary environment?

Agenda:

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The Digital Twin for software-intensive mechatronic systems
Vertical know-how for solutions tailored to individual domain

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Digital Twin
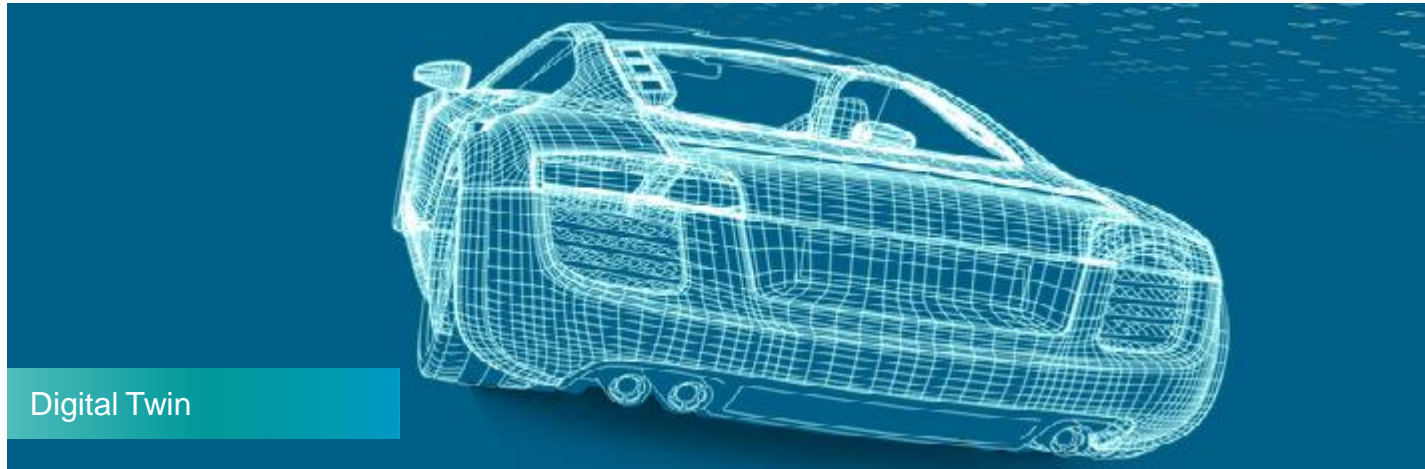
Why?

- Enable a **concurrent mechanical, software and E/E hardware design process**

- Replace expensive and time-consuming physical tests with **early virtual evaluation and validation**
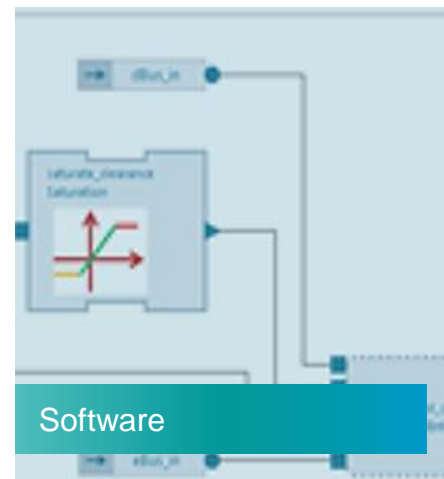
Mechanical

Electrical

Software

Physics

Environment
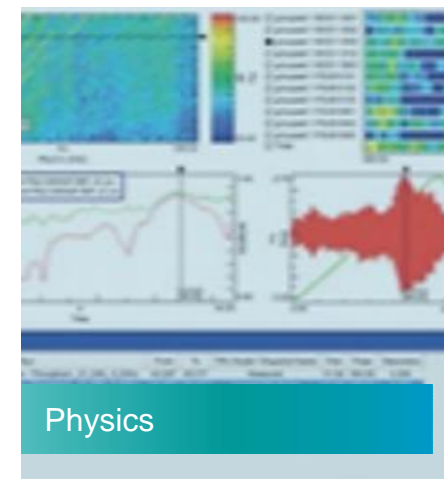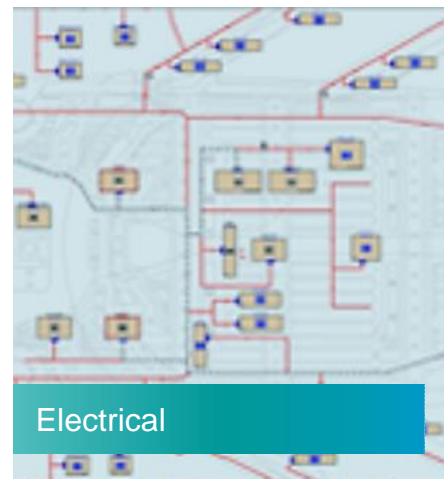
Simcenter/Siemens for Mechatronic Systems Development
Background - Plant models in support of controls for XIL testing

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Architecture choice
Understanding of physics
Definition of sensor / actuator
(Dys)functional analysis
Reliability & safety

Requirements for control
Functional / Dysfunctional

Control synthesis
Virtual sensors
Executable specifications
MIL validation
First settings

Functional MiL validation
Simulation module or complete controls

Scalable Behavioral Models

Intake Manifold

Engine Rotary Velocity

Automatic code generation

Tuning support
Final calibration

Tuning level 1
First calibration step

HIL validation
Verification & Validation

One platform needed across full development cycle

Multi-Physics Modeling

Siemens PLM Software

Simcenter/Siemens for Mechatronic Systems Development
Towards an integrated portfolio of multi-domain solutions

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Teamcenter Polarion

Mentor

System completion

Customer demand

Requirements Engineer

System Architect

Hardware

Project Management

IT manager

Safety/QA Engineer

Simcenter

Simcenter bringing simulation and testing capability for physical systems, control algorithms and embedded software

Mentor bringing solutions in the E/E and software engineering domain

solution for the PLM-ALM orchestration and industry compliant certification

Siemens PLM Software

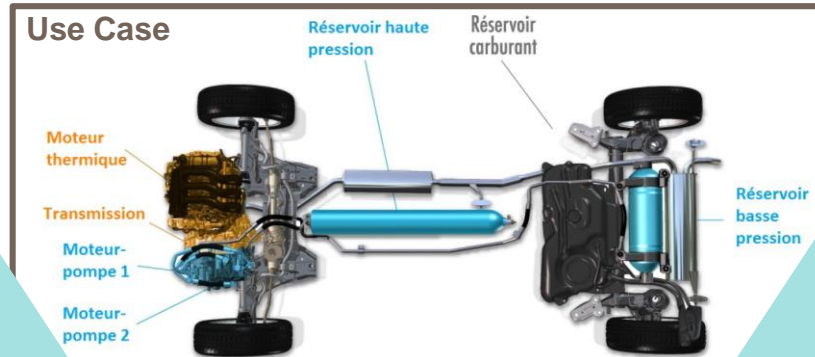# The Portfolio Applied – Demonstrator in Co-Operation with UAntwerp
Development of a Hydraulic Hybrid Drivetrain controller

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Polarion ALM

- Requirements
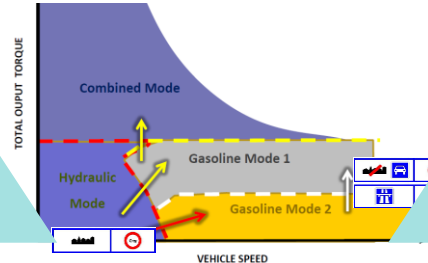- Test Cases
- Planning

Engineering Process Optimization

Use Case

Simcenter – Digital Twin
- Amesim RT
- Plant Model
- Break-out Box
- ECU

HiL

Mentor Graphics
- VSB
- AUTOSAR Architecture

Software Architecture Design and Analysis

Target Deployment

Mentor Graphics
- Volcano Reference Board
- VSTAR

Software Detailed Design

SiL B2B

MiL

External – Controls Development Environment
- Modelling Patterns
- Guideline Checks

HEEDS
- Controls Design Optimization

External Environment
- Simulink
- Unit Testing
- Closed Loop Co-Simulation

Simcenter – Digital Twin
- Amesim

Software Integration

Agenda:
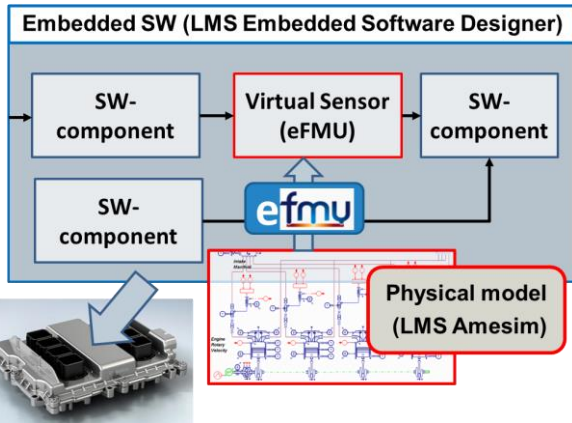
Dedicated Collaboration with the University of Antwerp
Ongoing Projects

EMPHYSIS: 11/2017, 3 years

Definition of a new standard [eFMI] facilitating integration of physical models into embedded software
Proof of concept realization for multiple applications:
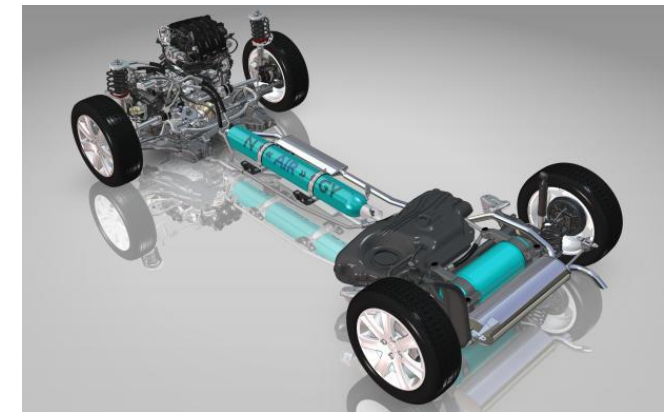MPC, 1D or 3D virtual sensing, MBST, ...

SISW SAS, Dana, **University of Antwerp**, … as main partners
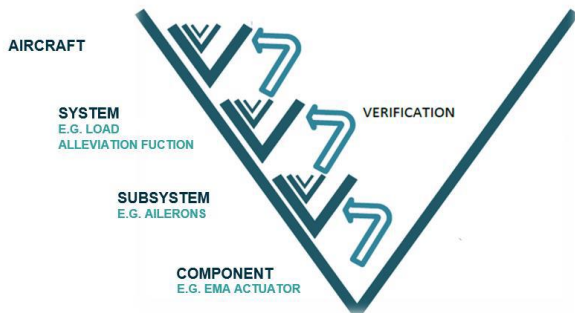
ENPOWER: 01/2017, 2 years

Controls and Software development according to the ISO 26262 standard for functional safety in automotive

Industrial Solution : Industry compliant V&V workflow with Siemens solutions

Dana, Flanders Make, **University of Antwerp**, … as main partners

INES: 09/2017, 2 years

Development of a realistic, innovative and implementable MBSE process for avionics systems and software design

Identification of a series of software tool innovations covering the complete development and life cycle of avionics systems

Boeing, **University of Antwerp**, … as main partners

Thank you.