

MASTERING THE CHANGE: NAVIGATING THE DIGITAL TRANSFORMATION OF OUR INNOVATION CHAIN



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YOUR TWINS IN INDUSTRIAL EQUIPMENT



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3DEXPERIENCE®



Virtual Twins along Product Life cycle in one Platform

Engineering | Marketing | Sales | Manufacturing | Service



Project and Requirement Management

Change and Configuration Management

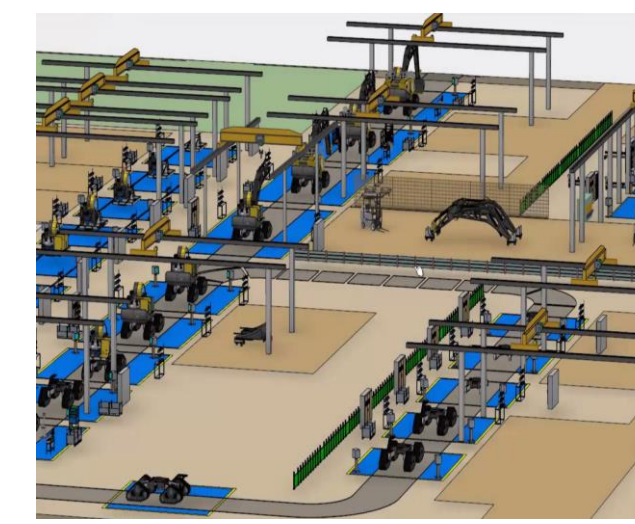
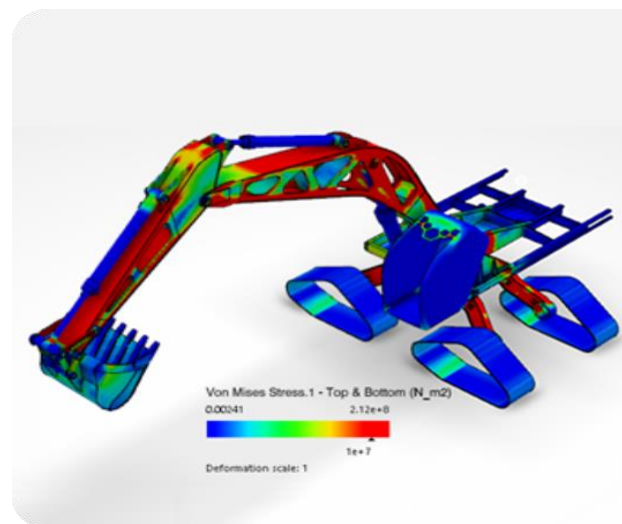
Engineering & Simulation
Twin

Marketing
Twin

Sales
Twin

Manufacturing
Twin

Service
Twin



Industrial Equipment Solutions for Virtual Twin Experiences along the Life Cycle

Generic Virtual Twins

Specific twins

Customer Opportunity

Purchase Order

Site Acceptance Test

New Product Development

Product Marketing assets

Quoting & Selling

Detailed Design & Manufacturing

Field Service

Generic Configurable Virtual Twins

- Engineering model
- Manufacturing model
- Service model
- Simulations

Generic marketing twins

- Simplified
- Beautified

Quote Specific Virtual Twin

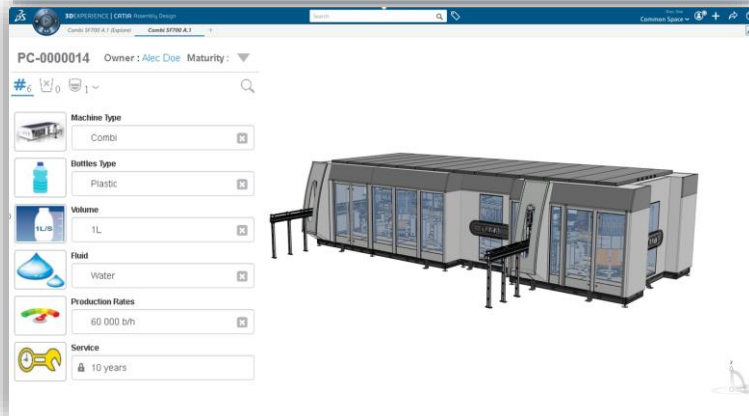
- Sales model
- Engineering model
- Simplified/Beautified
- Simulations

Order Fulfilment Serialized Virtual Twins

- Engineering model
- Manufacturing model

In Operation Serialized Virtual Twins

- Service model
- Engineering model
- Simulations



Plant Twin



Field Twin updates

Single Source for Speed
Simplified Smart Equipment

Instant Equipment
Showcase

Instant Equipment
Showcase

Ready to Make

Keep them Running

First things first: New Product Development

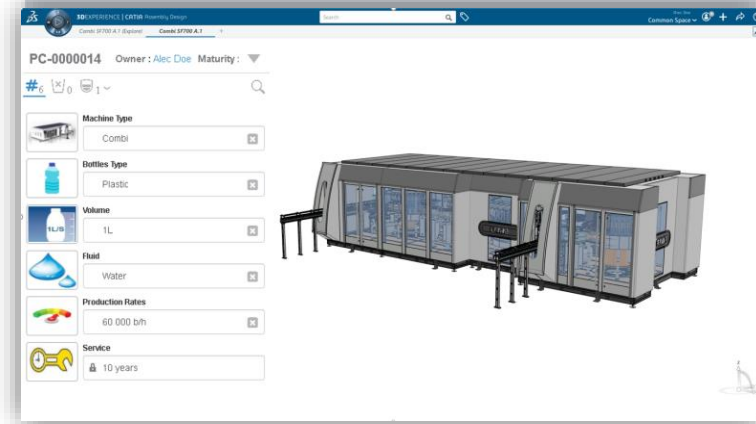
Generic Virtual Twins

In ONE Platform:

New Product Development

Generic Configurable Virtual Twins

- Engineering model
- Manufacturing model
- Service model
- Simulations



- Engineering disciplines + all types of simulations
- PLM including product release, product change management, configuration, EBOM to MBOM, EBOM to SBOM

Single Source for Speed
Simplified Smart Equipment

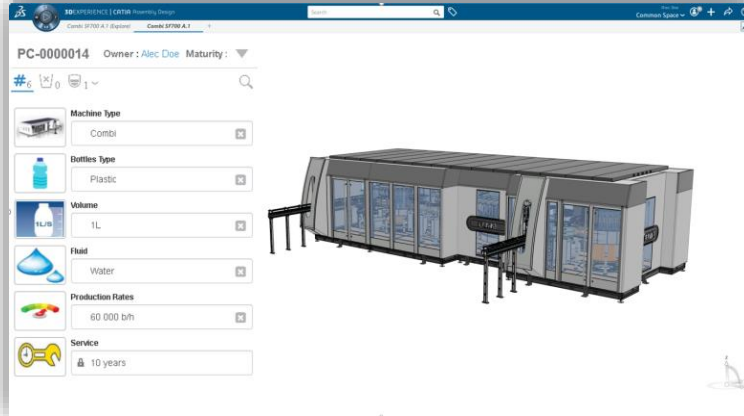
First things first: New Product Development

Generic Virtual Twins

New Product Development

Generic Configurable Virtual Twins

- Engineering model
- Manufacturing model
- Service model
- Simulations



The screenshot shows a software interface for a virtual twin. On the left, there is a list of parameters: Machine Type (Combi), Buffer Type (Plastic), Volume (1L), Fluid (Water), Production Rates (60 000 b/h), and Service (10 years). On the right, there is a 3D model of a machine with a conveyor belt and a hopper.

In ONE Platform: Engineering disciplines with simulations

- Mechanical 3D
 - CATIA and SOLIDWORKS AI assisted Modeling & Simulation (MODSIM)
- Fluidic 2D (schematics) and 3D
 - Pneumatics within the platform leading to single BOM
- Electrical 2D (schematics) and 3D:
 - For harness design
 - For cable and electric cabinet design
 - Single BOM
- Electronics:
 - We partner with established leaders
- Software
 - We partner with French Agile ALM Tuleap offering easy to use links to 3DX platform
 - Executable code object in the EBOM

Single Source for Speed
Simplified Smart Equipment

First things first: New Product Development

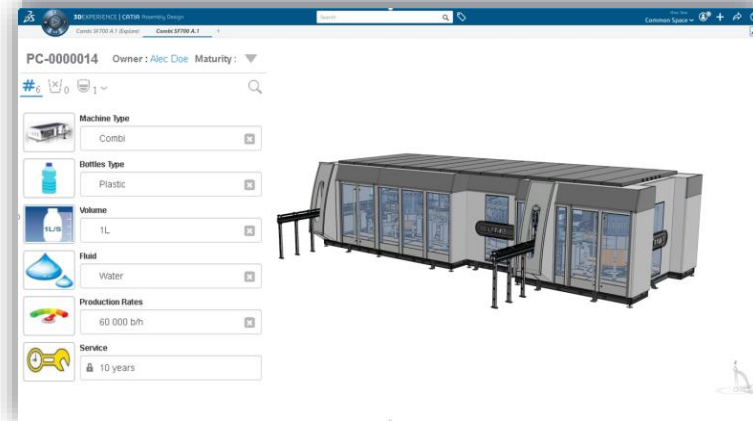
In ONE Platform: PLM

Generic Virtual Twins

New Product Development

Generic Configurable Virtual Twins

- Engineering model
- Manufacturing model
- Service model
- Simulations



- One EBOM including CAD or with link to CAD
 - CATIA
 - SOLIDWORKS
 - Electrical schematics
 - Fluidic schematics
 - Equipment software
- EBOM to MBOM and EBOM to SBOM
 - Better orchestrated in the product platform than in ERP
- Product Release and Product Change
 - Better orchestrated in the product platform than in ERP
- Configuration: towards full CTO Configure To Order
 - Better orchestrated in the product platform than in ERP
- Product Portfolio
 - Better orchestrated in the product platform than in ERP

Single Source for Speed
Simplified Smart Equipment

NOT « AI FOR AI », BUT AI APPLICABLE IN BUSINESS CONTEXT

Purposeful AI



AI to augment People to imagine, create, produce and operate better Products & services



Sustainable: benefit of AI > cost of AI

Relevant for Industry

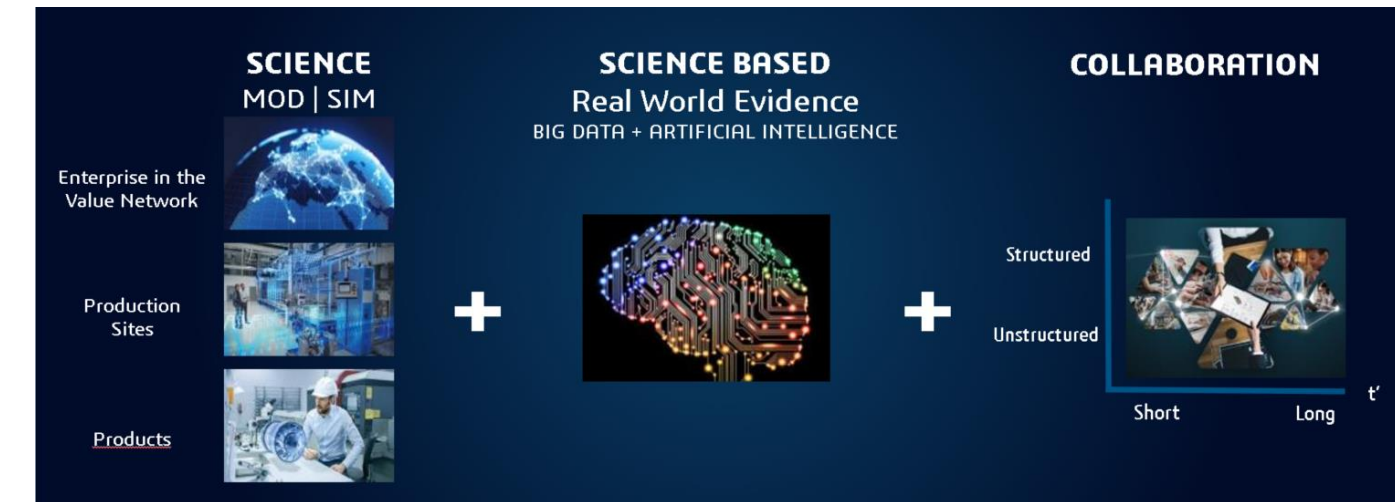


Leveraging **Industry Knowledge and Know-how**



Hybrid: mixing Generative AI and Science-based AI

Unique Approach



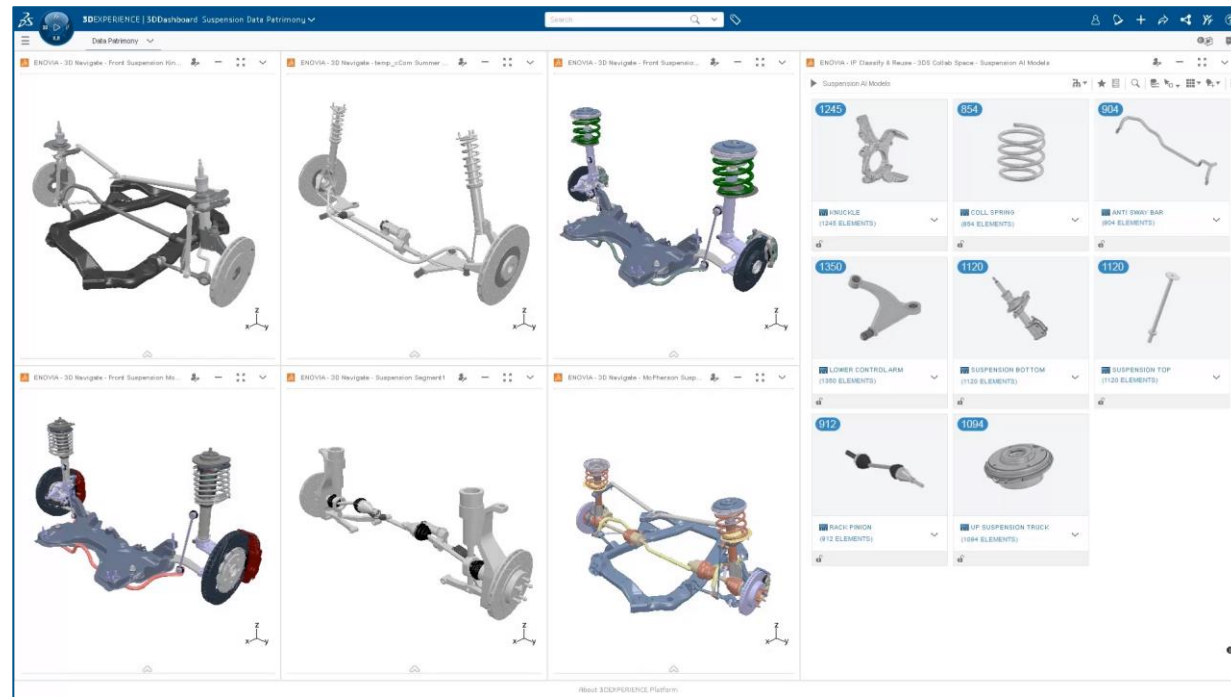
Always put **in Context** thanks to Models & Ontologies



Always **Actionable:** not only AI to be informed, but AI to directly act

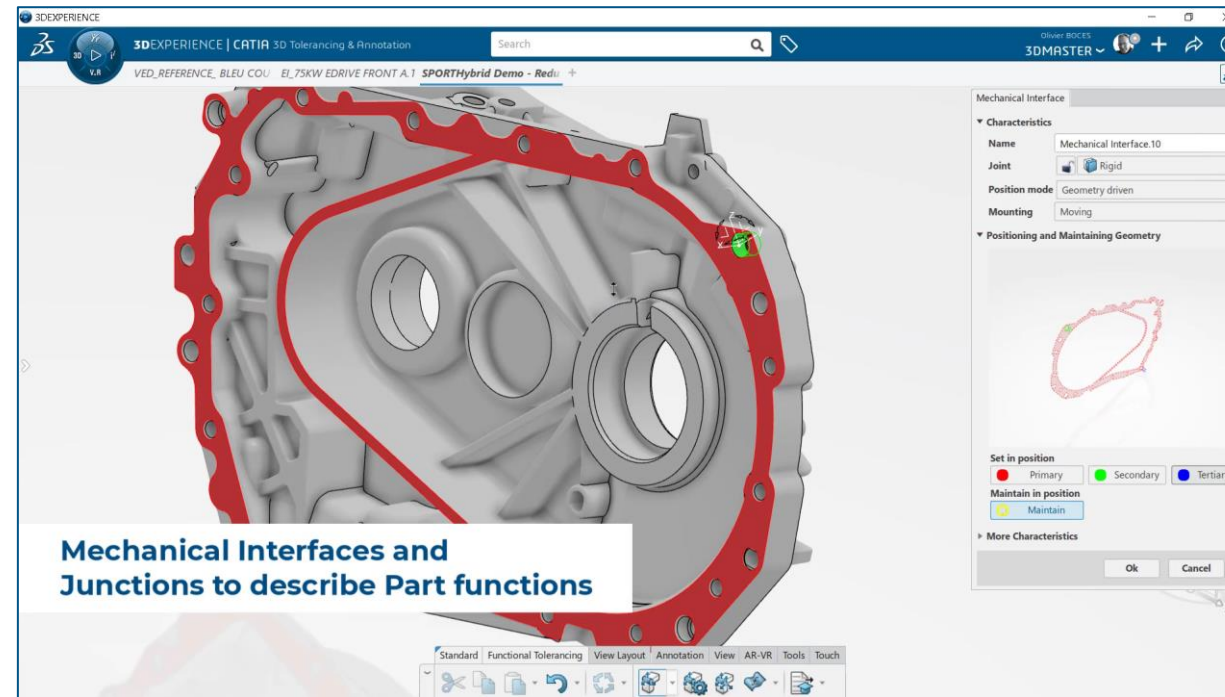
GENERATIVE EXPERIENCES | MECHANICAL DESIGN

Generative Assembly & Kinematic



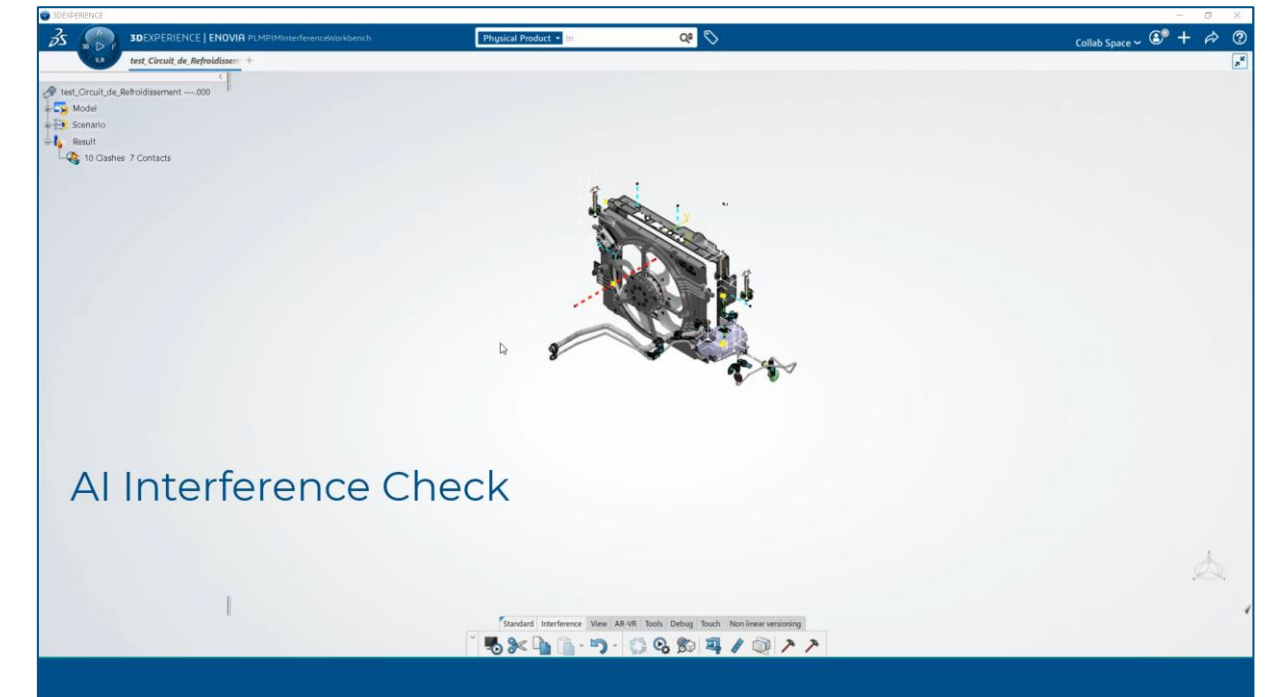
Generate the most optimal assembly from product definition functional description, based on existing list of parts and select the best alternatives, on target, with performance objectives.

Generative Tolerancing



Generate Tolerancing diagrams from Product Mechanical interfaces to convey manufacturing informations fully compliant to standards (ISO, ANSI, ASME)

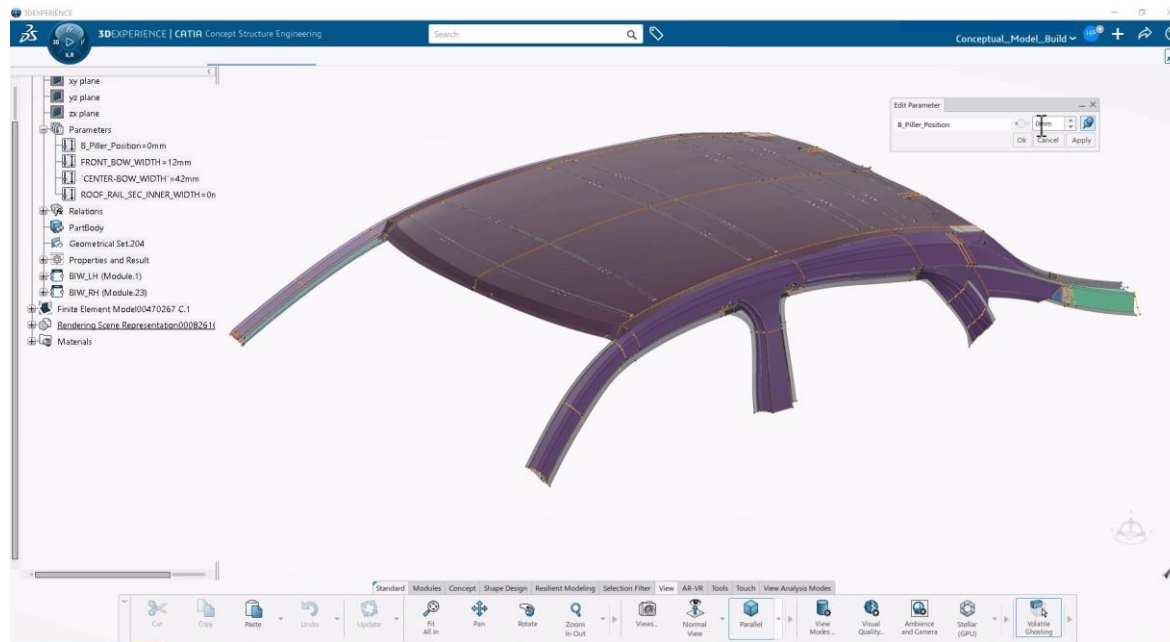
Interference Check Prediction



Automate Interference classification leveraging past vehicle programs to drastically improve mechanical part clash analysis moving from hours to minutes.

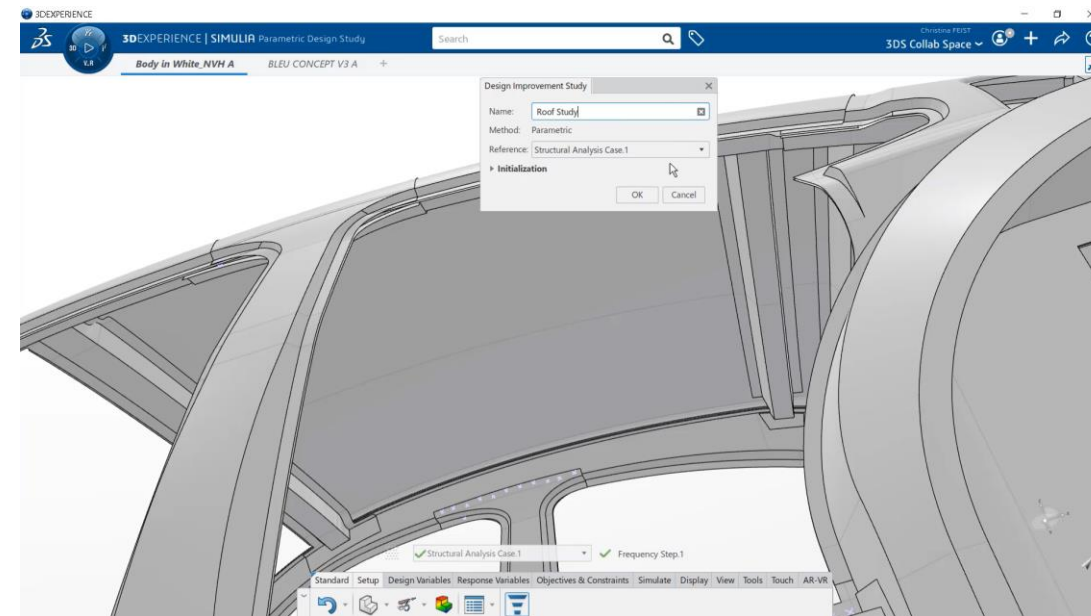
GENERATIVE EXPERIENCES | DESIGN EXPLORATION & VALIDATION

MODSIM Definition



Seamless continuity from resilient
concept modeling to simulation model
(mesh + connections)

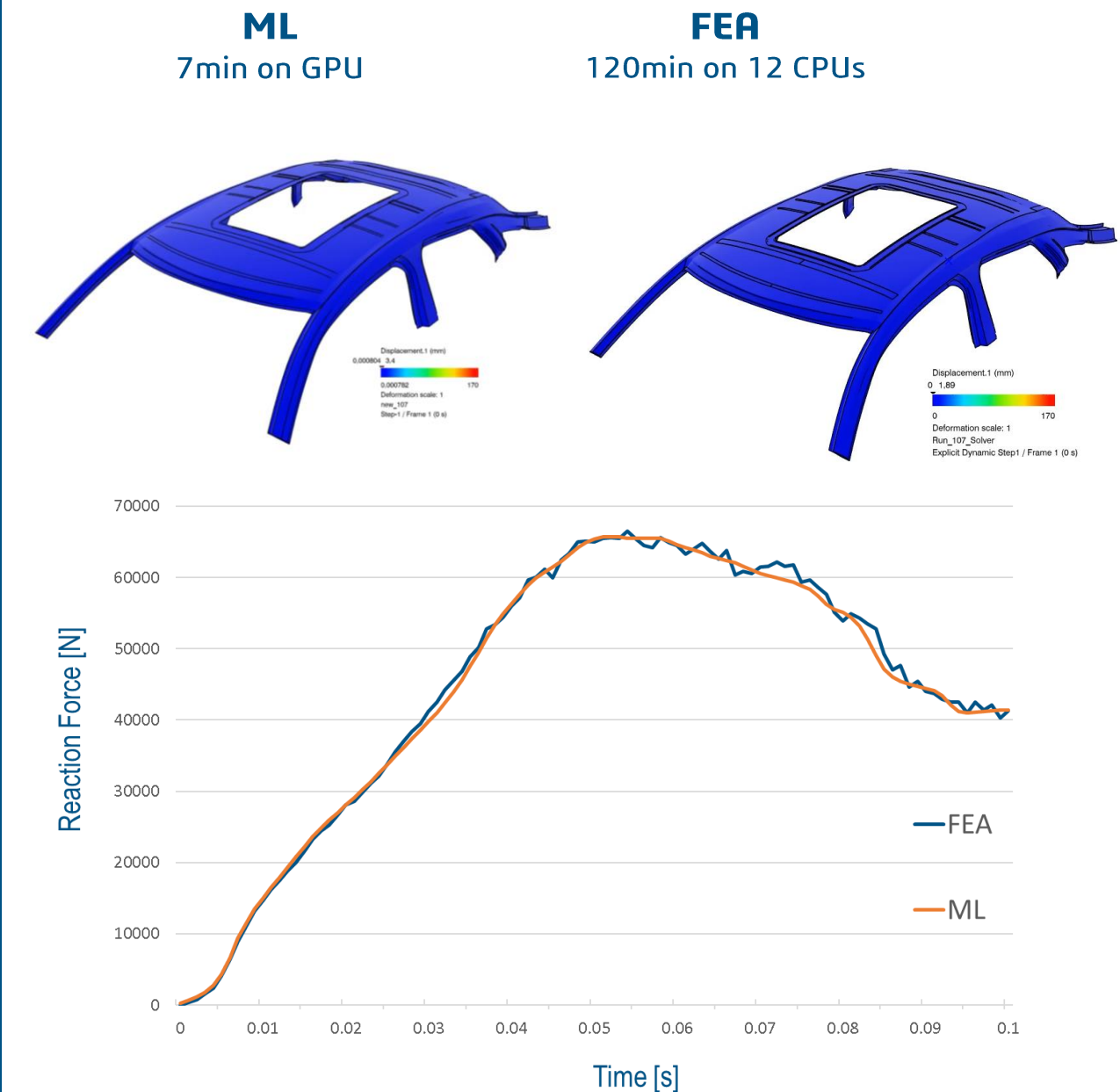
MODSIM Exploration



Full Automatic design space exploration
from parametric model variations to
simulation results

This creates the baseline synthetic data for
ML training on physics behavior

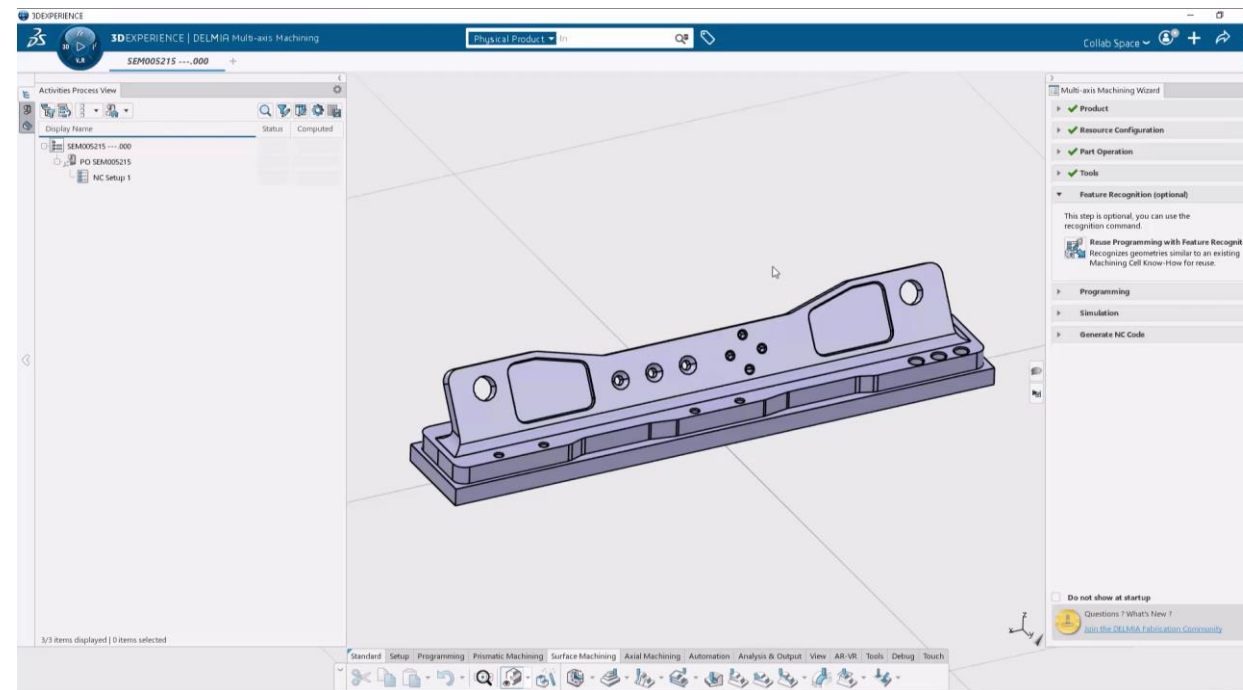
PHYSIC BEHAVIOUR Prediction



Instant Simulation Result Exploration
for Designers

GENERATIVE EXPERIENCES | INDUSTRIAL ENGINEERING

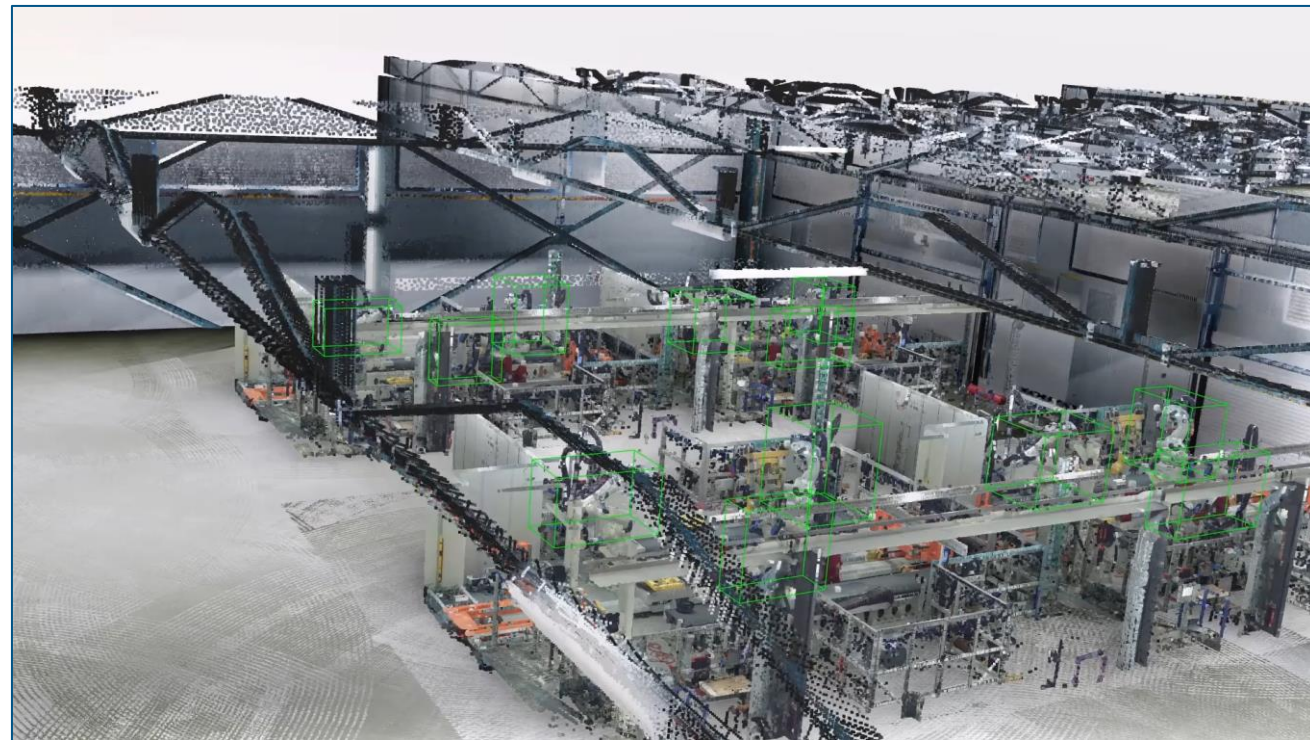
AI Assistant for NC Programmers



Improve productivity of inexperienced NC programmers by automatically proposing a type of toolpath based on the geometry features selected on the 3D models

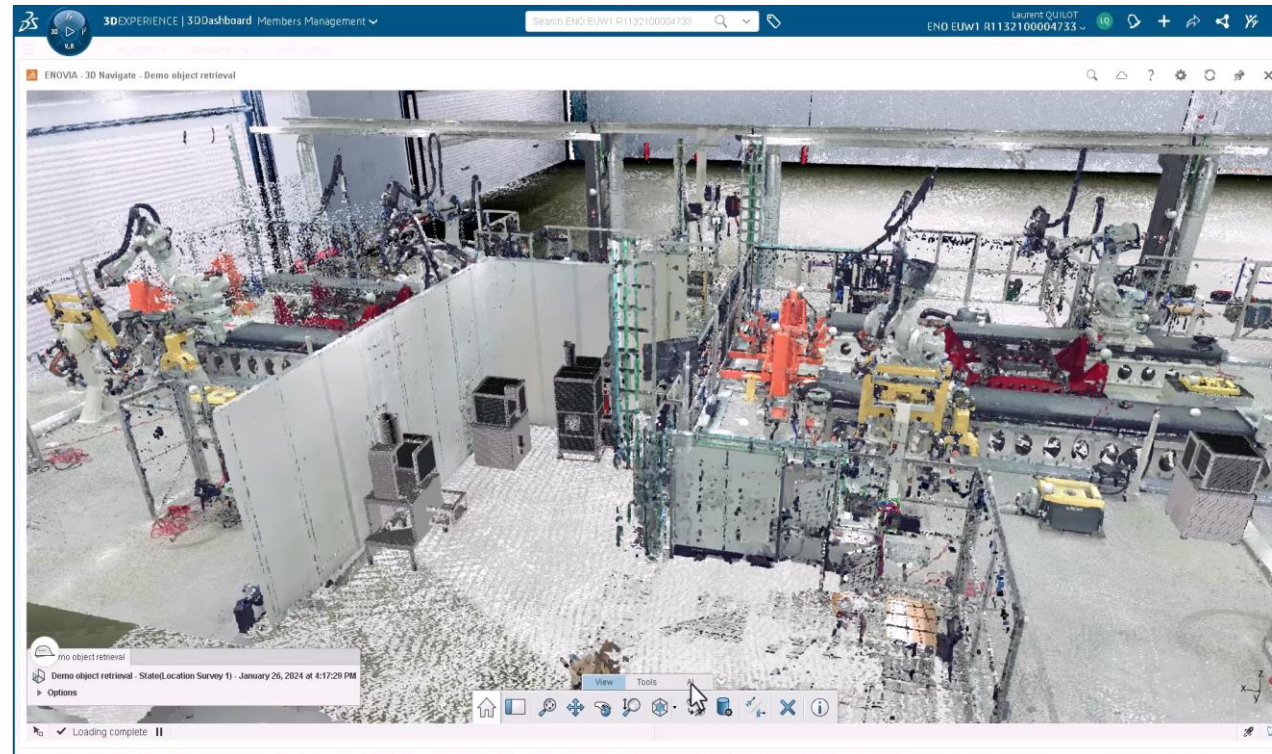
GENERATIVE EXPERIENCES | VIRTUAL TWIN GENERATION

Point Cloud Object Retrieval



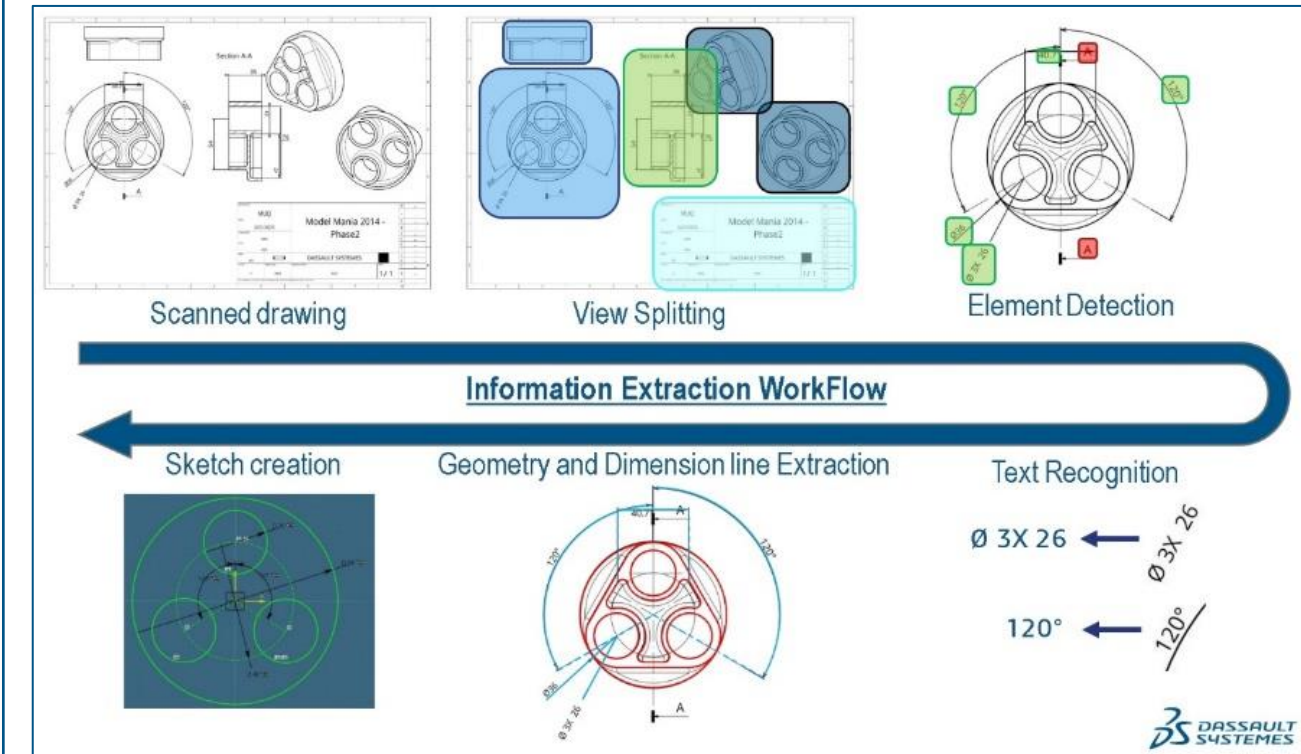
Retrieve objects such as Robot, Pipe, or equipment lines in a large point cloud objects

Point Cloud Object Instantiation



Recognize similar assets into a point cloud and replace them by Virtual Twins.

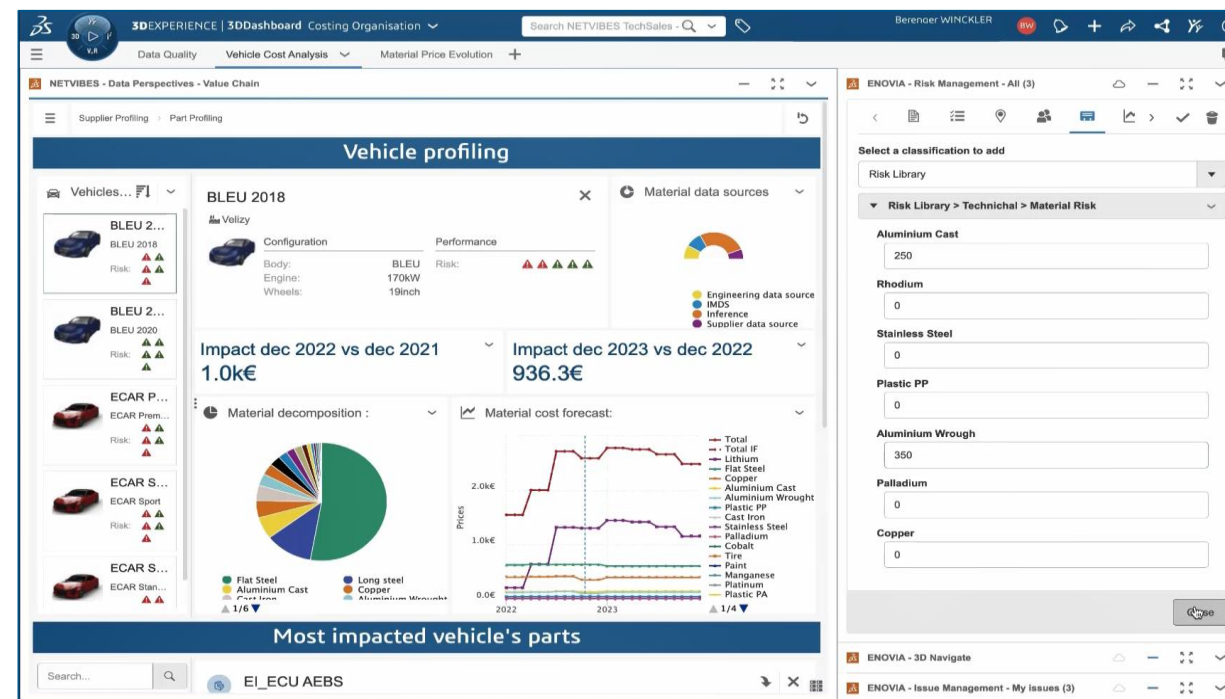
Drawing to 3D



Leverage existing drawing patrimony and AI models in order to extract information and guide designer during the Mechanical Part Reconstruction Process

GENERATIVE VIRTUAL TWIN EXPERIENCES | RAW MATERIAL FLUCTUATIONS

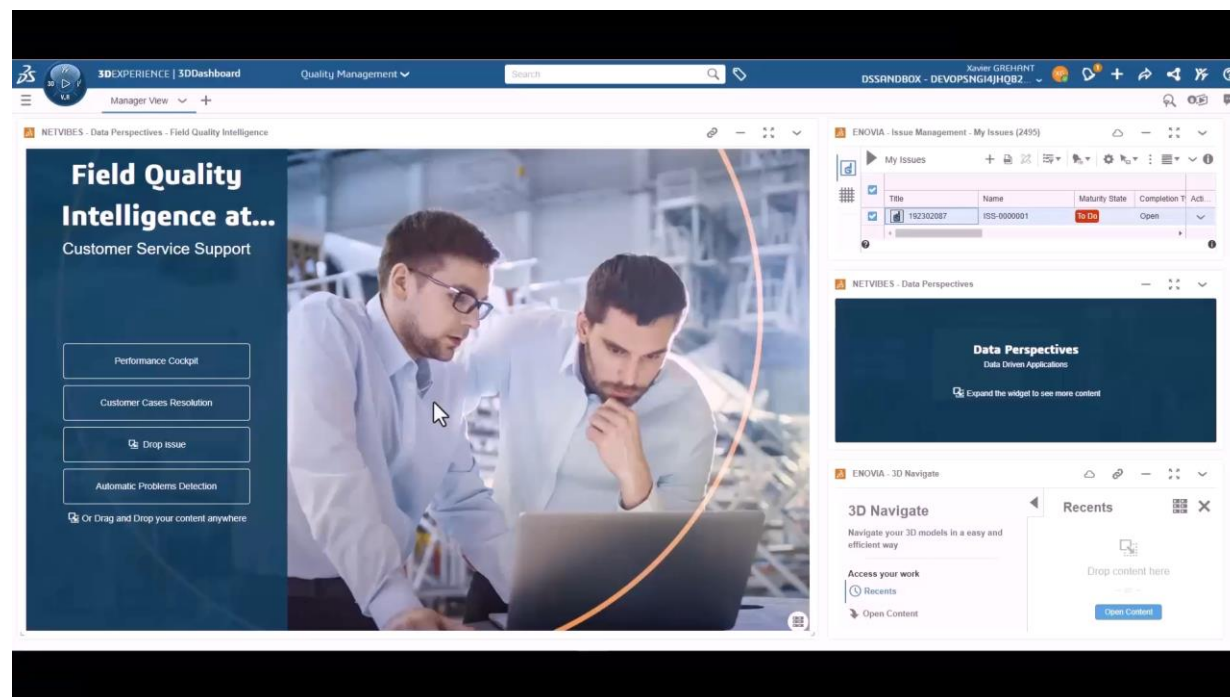
Supply Chain Volatility Intelligence



Break the silos between engineering, finance & suppliers to know instantly how prices fluctuations impact your business, reveal and launch the best course of action

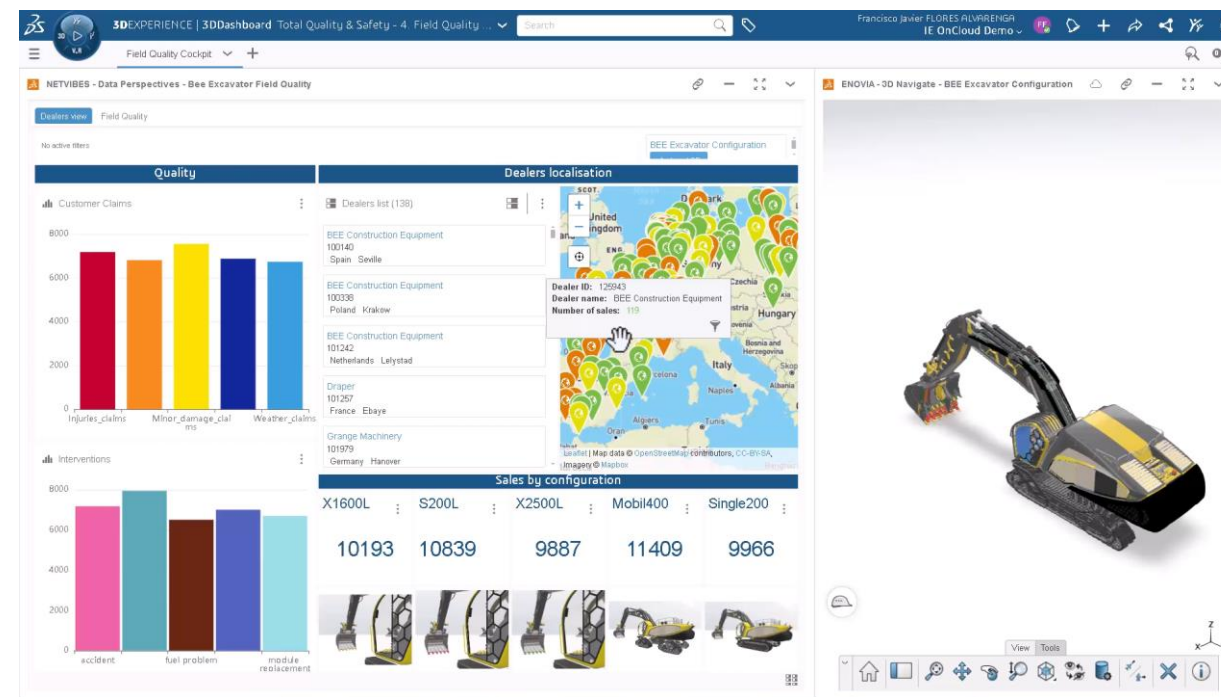
GENERATIVE VIRTUAL TWIN EXPERIENCES | AFTERSALES

Field Technician Report Structuring



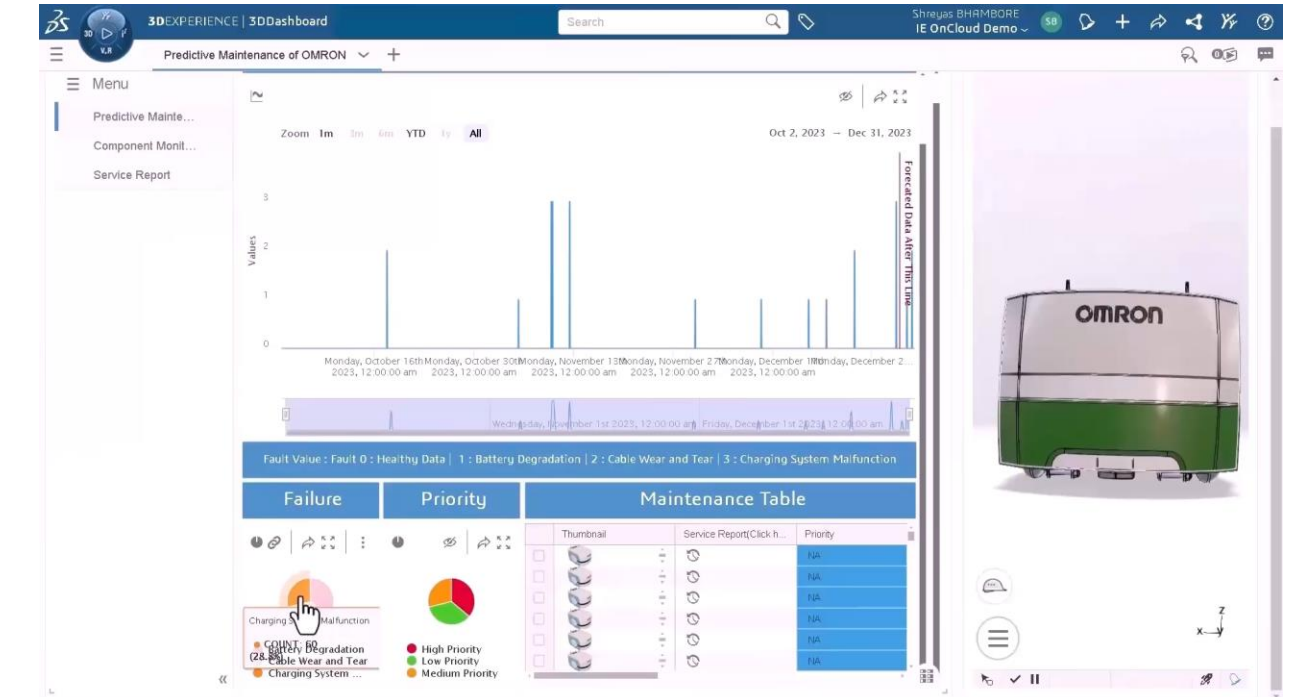
Automated natural text structuring and semantic analysis for streamlined root cause identification

Field Quality Intelligence



For Service Managers to know their customers priorities and handle short-term resolutions for reactive maintenance.
For Product Quality managers to reveal groups of similar, recurrent issues that could be solved by coming back to design decisions.

Predictive Maintenance



Leverage operational data to create Data Perspectives, tailor-made for predictive maintenance

- Visualize data coming from the field on a Data Analytics Cockpit
- Use Machine Learning on that data to predict future equipment failure and act before it happens

AI powered Virtual Twins along Product Life in one Platform

Engineering | Marketing | Sales | Manufacturing | Service



Project and Requirement Management

Change and Configuration Management

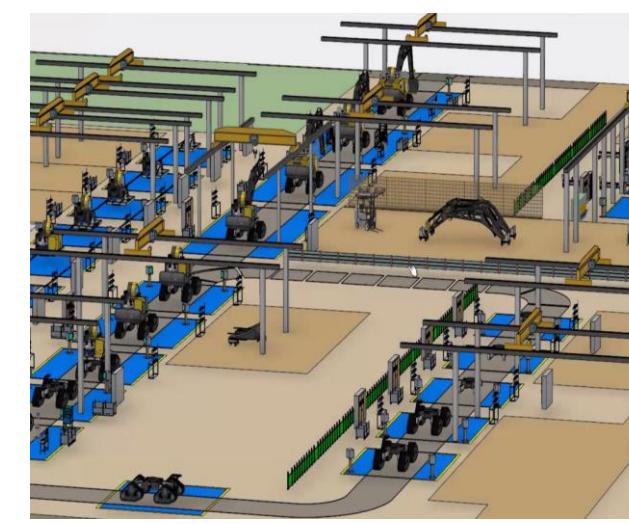
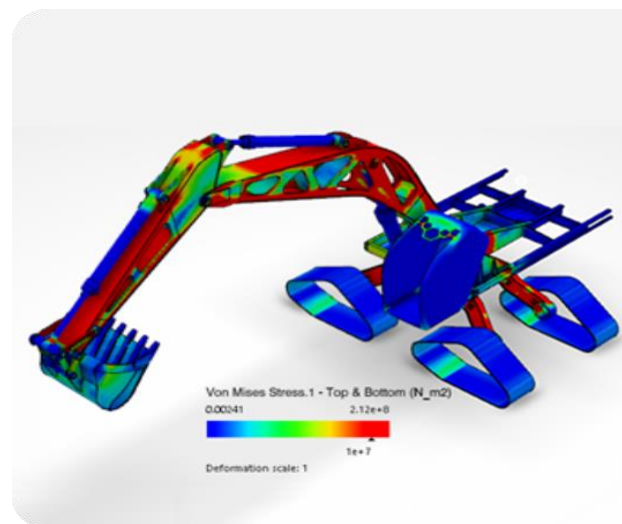
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Innovate Smartly!

Mastering the *Change*

Navigating the digital transformation of
our innovation chain



**“Never before have so many people from
Pepperl+Fuchs’ Innovation Area
worked together on a project like this.”**

Dr. Gunter Kegel, CEO Pepperl+Fuchs SE



PEPPERL+FUCHS

6,850

EMPLOYEES

around the world
to assist with all
your needs

6

MANUFACTURING
LOCATIONS

50,000

PRODUCTS

available to solve
all your application
needs

3

HEADQUARTERS

in Europe,
the USA, and Asia

930

MILLION €

Revenue

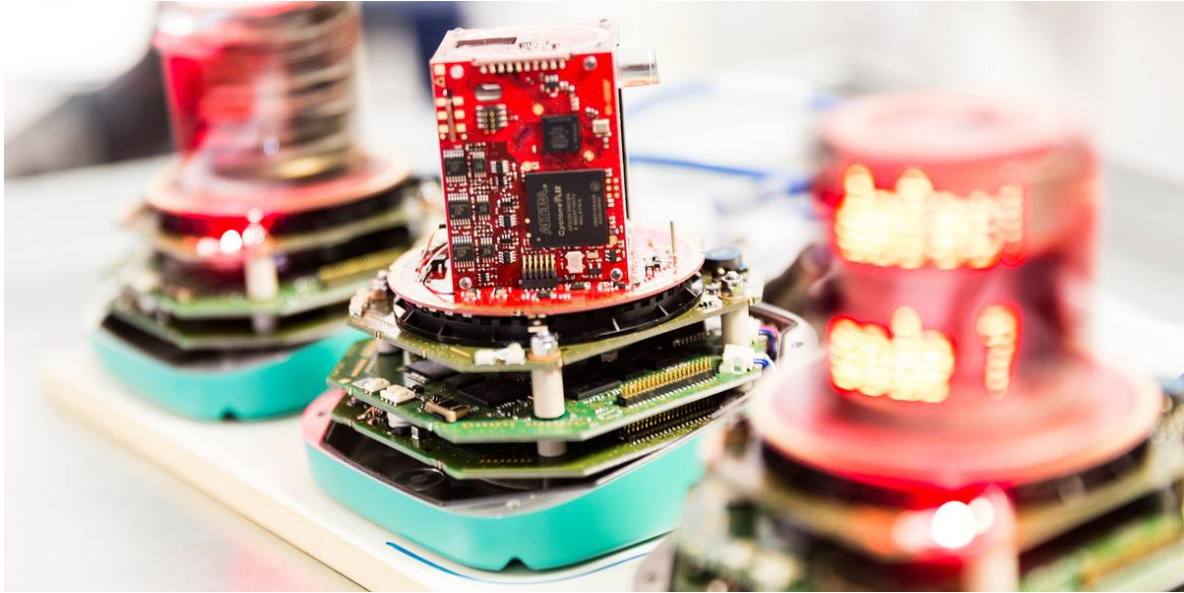
2

FOUNDER
FAMILIES

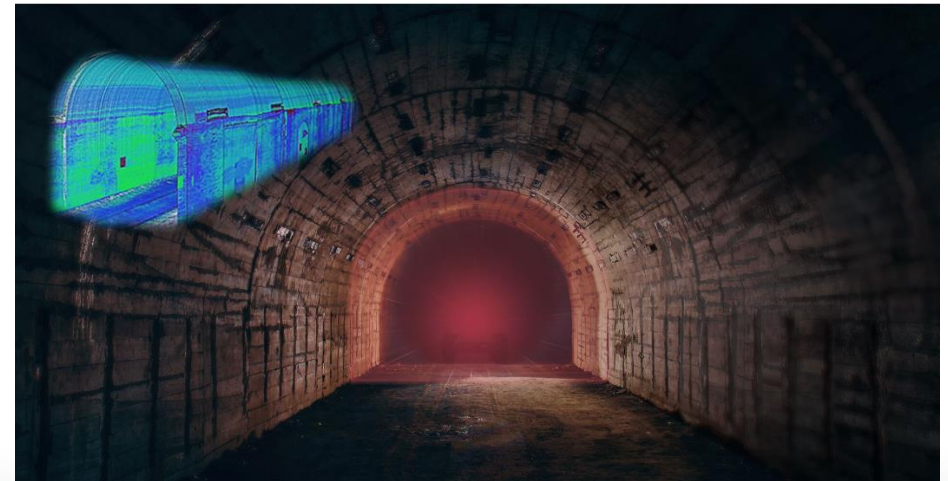
privately own 100 %
of the company

Pepperl+Fuchs SE is
a leading global
provider of **factory
and process
automation,**
specializing in
**sensor technology
and intrinsic safety**

Pepperl+Fuchs SE | Factory and Process Automation



R2000 Series 2-D Laser Scanner



Product Lifecycle Management (PLM)

What is our strategic focus?

The future is data-driven!



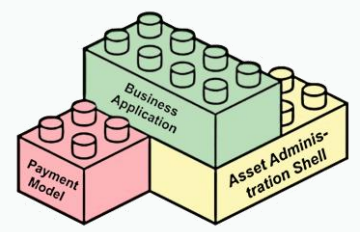
We live
Digitalization:
Business processes
and information flows
are aligned

Short-term



We are part of a
Data-Ecosystem:
Data-driven cooperation
with suppliers, partners
and customers

Intermediate-term



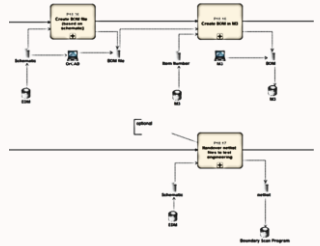
We are part of a
Data-Economy:
Data-driven business
models

Long-term

Product Lifecycle Management (PLM)

What is our strategic focus?

PLM-Program
started 2022



We live

Digitalization:

Business processes
and information flows
are aligned

Better digitalization of existing lifecycle workflow
Gaining efficiency, transparency and quality along the product lifecycle

Supporting new, digital, data-driven business models
Generating and using lifecycle relevant data in standardized open data
models used in next generation data rooms

Product Lifecycle Management (PLM)

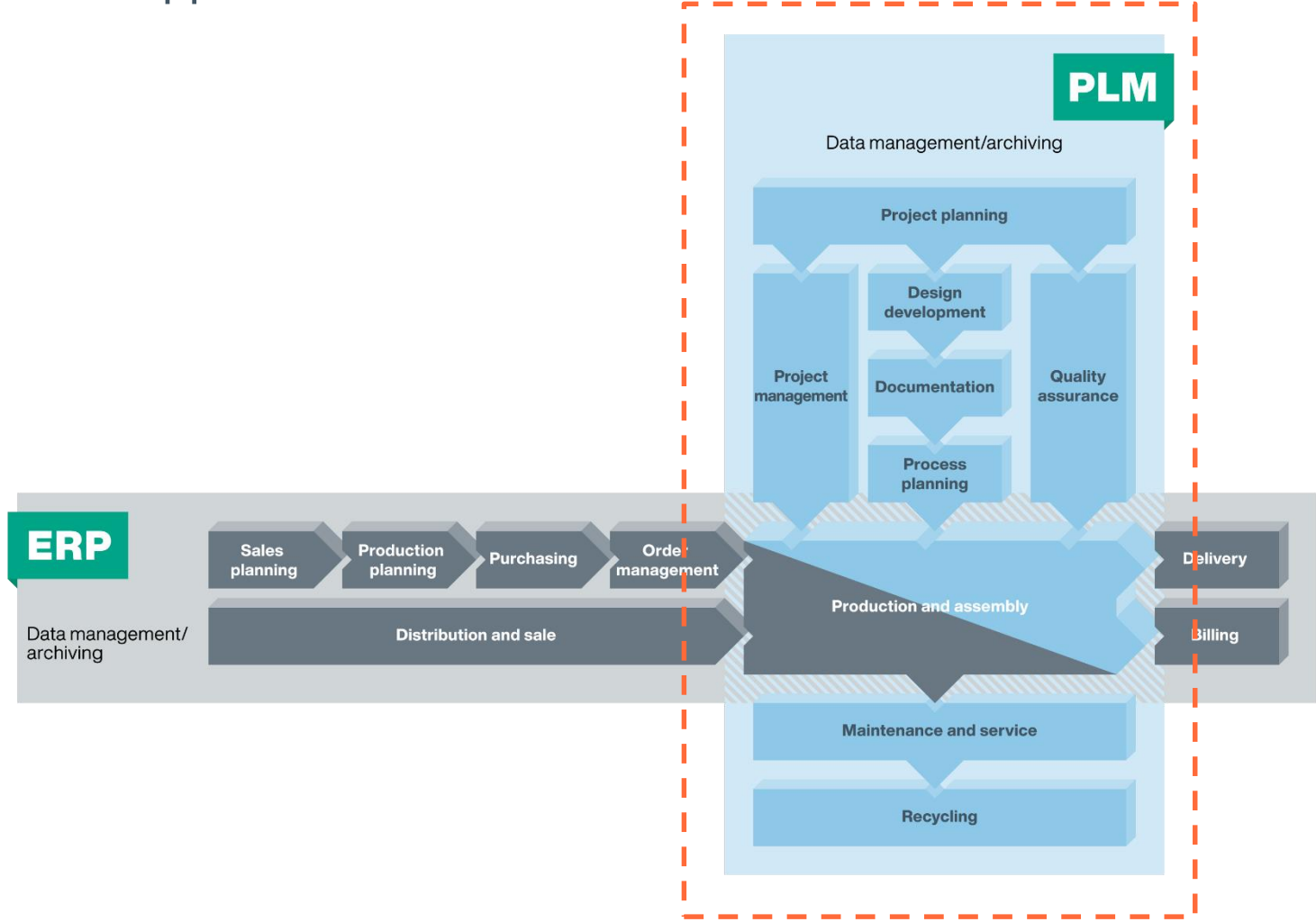
Will PLM become just another software we are supposed to use? No...

It is a management approach that

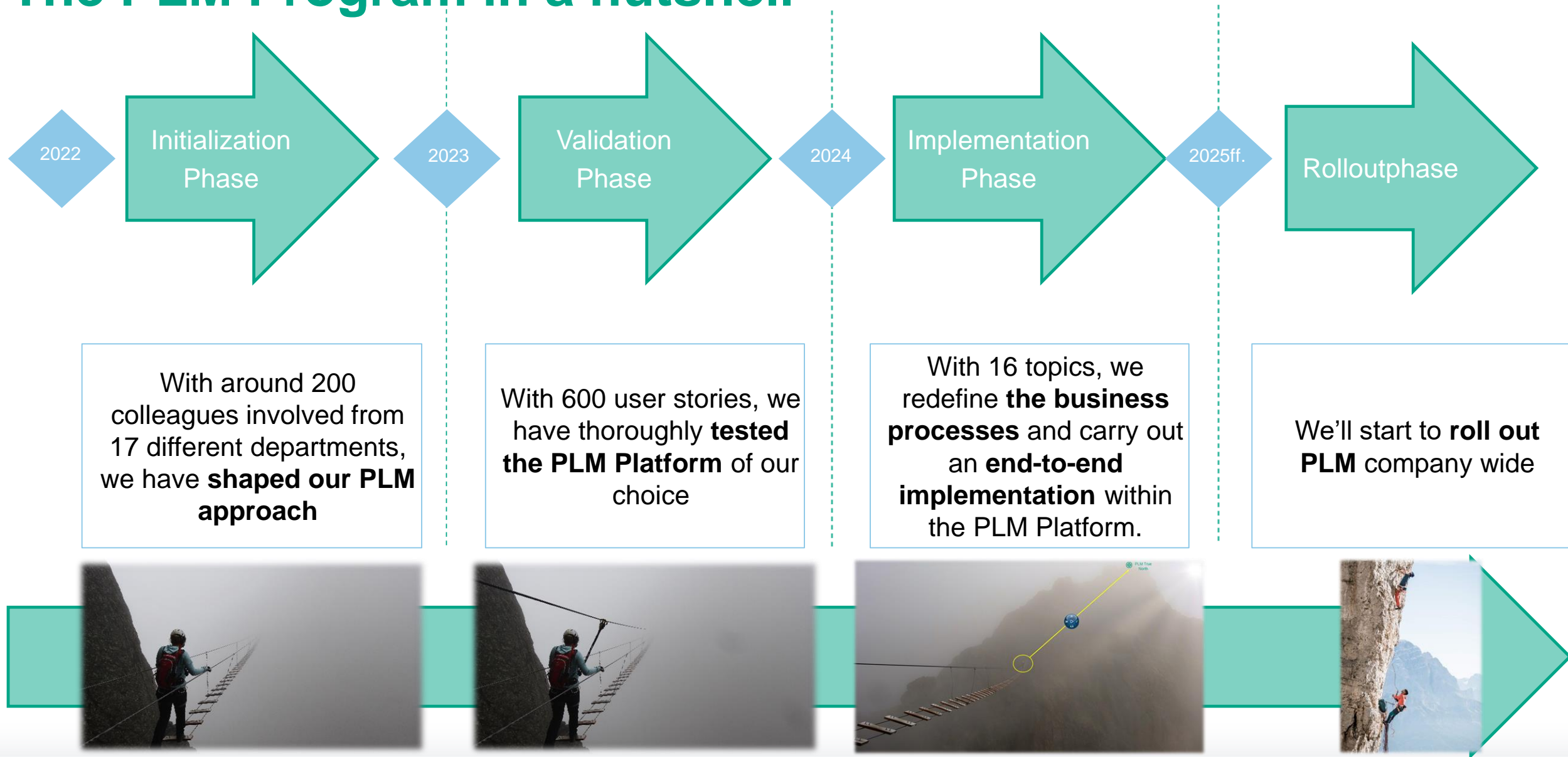
INTEGRATES people, processes, product data and systems to

MANAGE the product throughout the whole life cycle and effectively

SHARE this data with other stakeholders along the innovation chain.



The PLM Program in a nutshell



The PLM Program in a nutshell

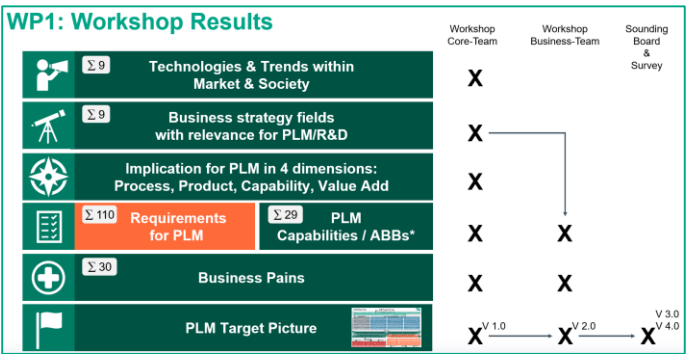


Initialization Year - Scope definition

Overview of first three work packages (WP) of PLM initialization year



WP1: Definition of scope, target picture, PLM strategy



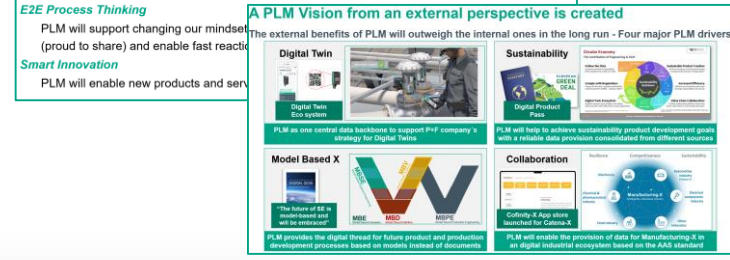
Our True North describes...
...the purpose of the PLM and should be a guideline for every decision to make

Manage the complexity
PLM will enable us to master the Product Lifecycle process from product idea, engineering, production, returns/repairs to discontinuation.

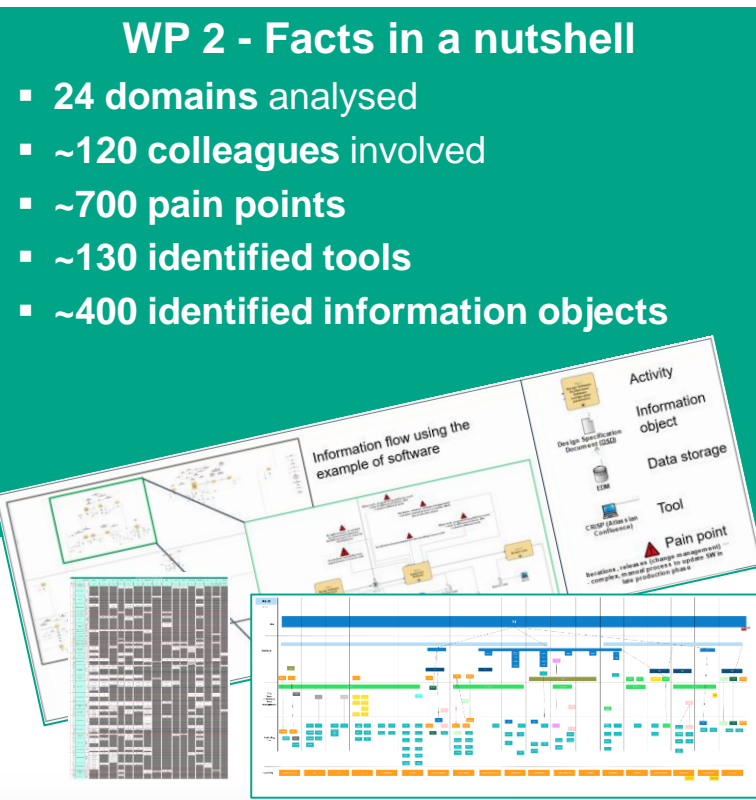
Full traceability
PLM will ensure traceability between project, product type (Digital Master) and product instance data (Digital Twin).

E2E Process Thinking
PLM will support changing our mindset (proud to share) and enable fast reaction.

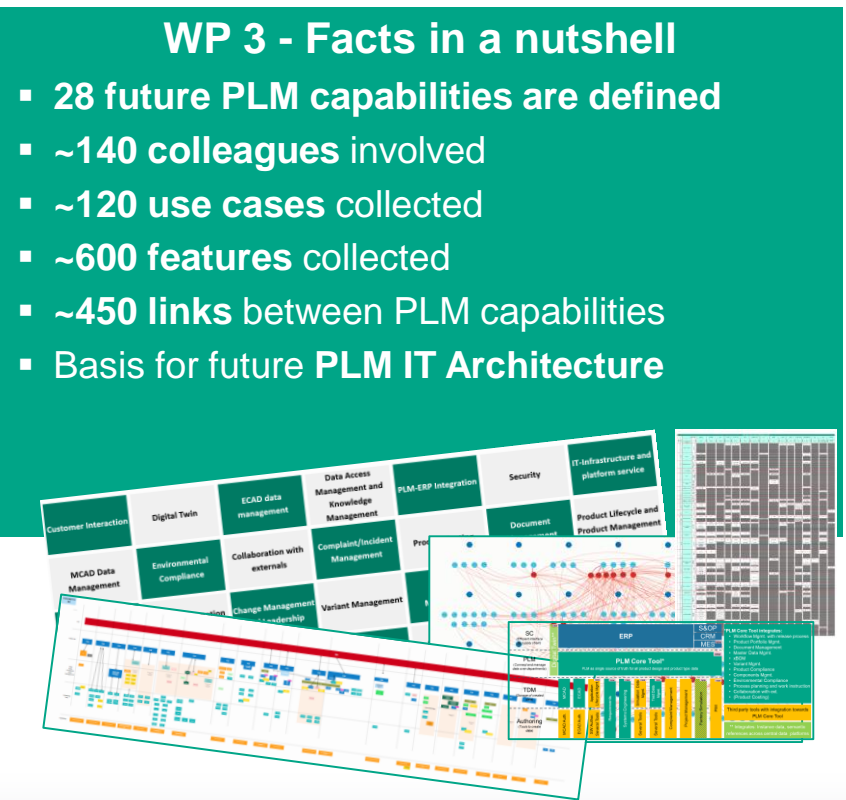
Smart Innovation
PLM will enable new products and services.



WP2: Analysis of the current state (processes, tools, IT-landscapes)

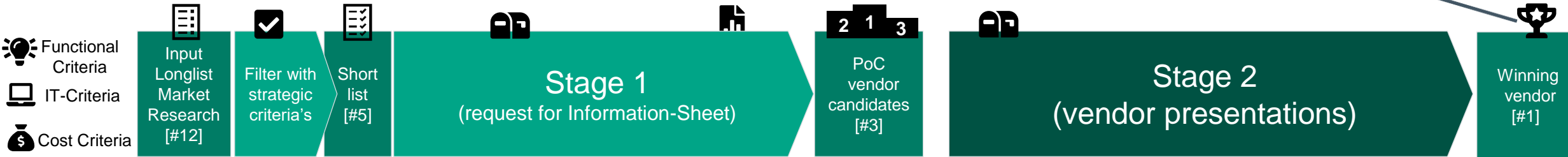


WP3: Development of technical concept (PLM-Vendor independent)



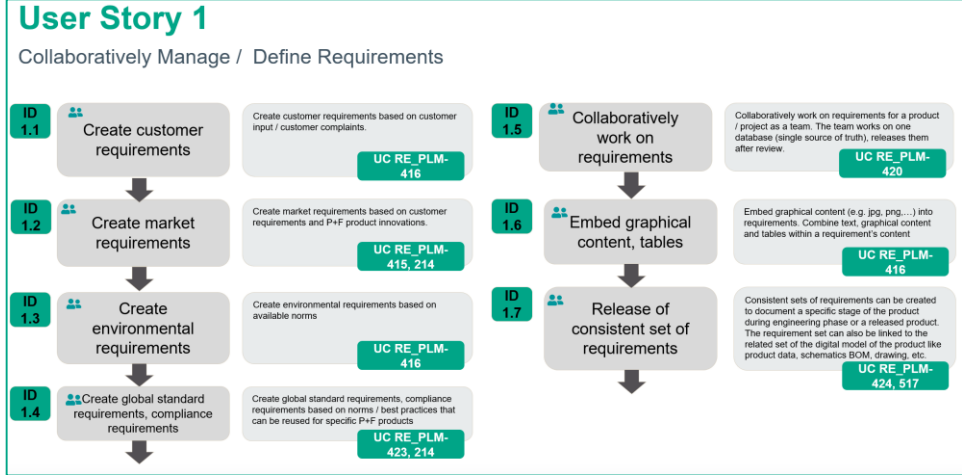
Initialization Year - Selection of PLM vendor

Two-stage procedure to identify the right PLM vendor



Stage 2: 27 user stories (US) as basis for the functional PLM Vendor selection

- US01 Collaboratively Manage / Define Requirements
- US02 Define System / Sub Systems (Architecture)
- US03 Product Portfolio Planning
- US04 Variant Management *
- US05 Project Management
- US06 Mechanical Data Management *
- US07 Electrical Data Management *
- US08 Software Data Management *
- US09 EBOM Management *
- US10 MBOM Management *
- US11 Service BOM Management
- US12 Component Management *
- US13 Knowledge Management *
- US14 Product Lifecycle *
- US15 Document Management *
- US16 Collaboration / Customer Interaction *
- US17 Product Costing
- US18 Process Planning *
- US19 Verification & Validation Testing
- US20 Verification & Validation Simulation
- US21 Environmental Compliance *
- US22 Complaint Management
- US23 Engineering Change Management *
- US24 Product Compliance
- US25 Product Information Management (PIM)
- US26 Digital Twin
- US27 Workflow Management *



Rfl: Request for information

The PLM Program in a nutshell



Validation Phase in a nutshell

Functional validation of the selected PLM Platform

Functional validation of the PLM Platform by key users from departments

600 user stories were validated over 8 months using 8 workstreams (~200 colleagues within core team)

Requirements Mgmt

ECAD Data Mgmt

Product Portfolio Mgmt

Product Structure

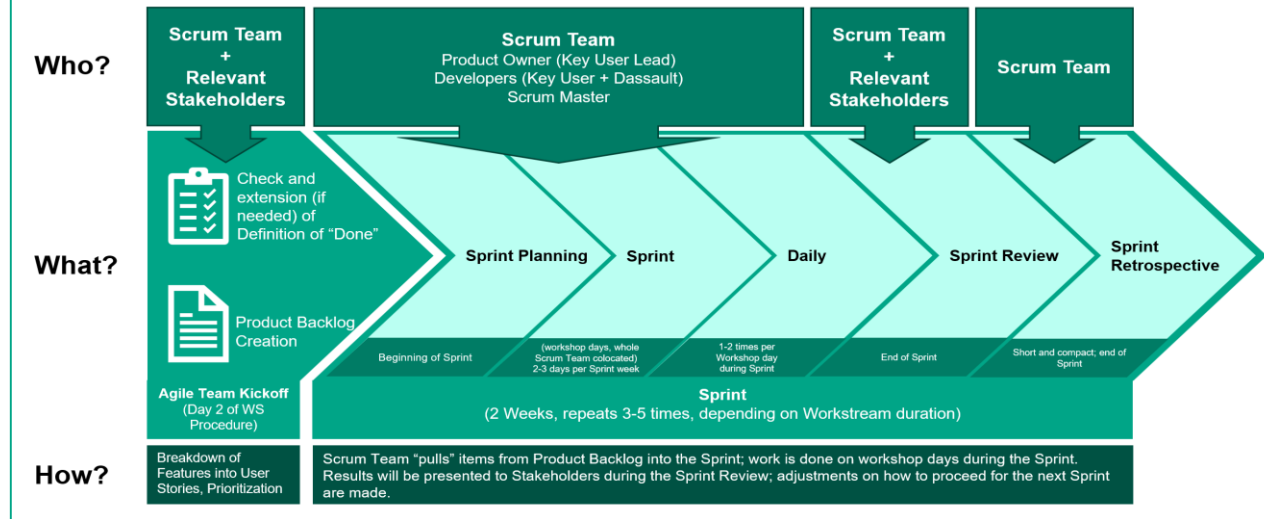
MCAD Data Mgmt

Document Mgmt

Industrial Mgmt

Workflow Mgmt

Agile Workstream Setup



Goal Management + Progress Measurement

OKR (Objectives, Key Results) as methodology and adaptation to our PLM program

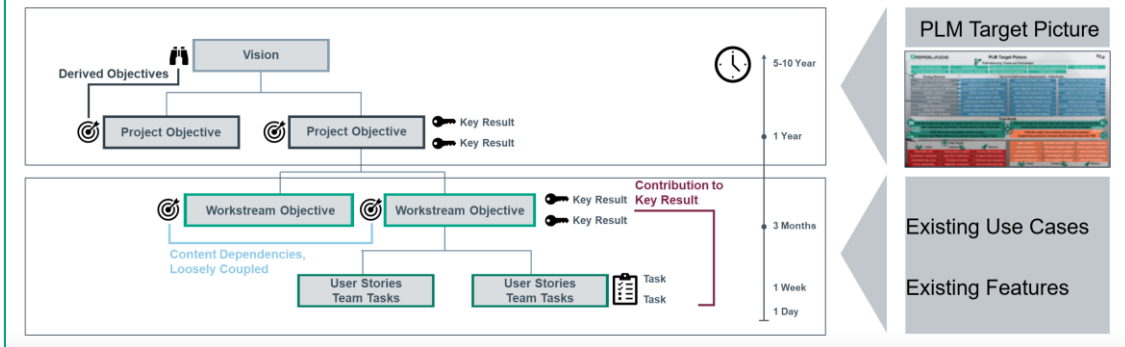


The Objective tells you where to go



Key Results tell you how to get there

O (Objectives)
KR (Key Results)



Cloud as future-oriented infrastructure

External collaboration as key enabler of data driven business models

3DS is a leading cloud provider in the PLM sector offers investment security

Fast deployment and global scalability in accordance with local legislation

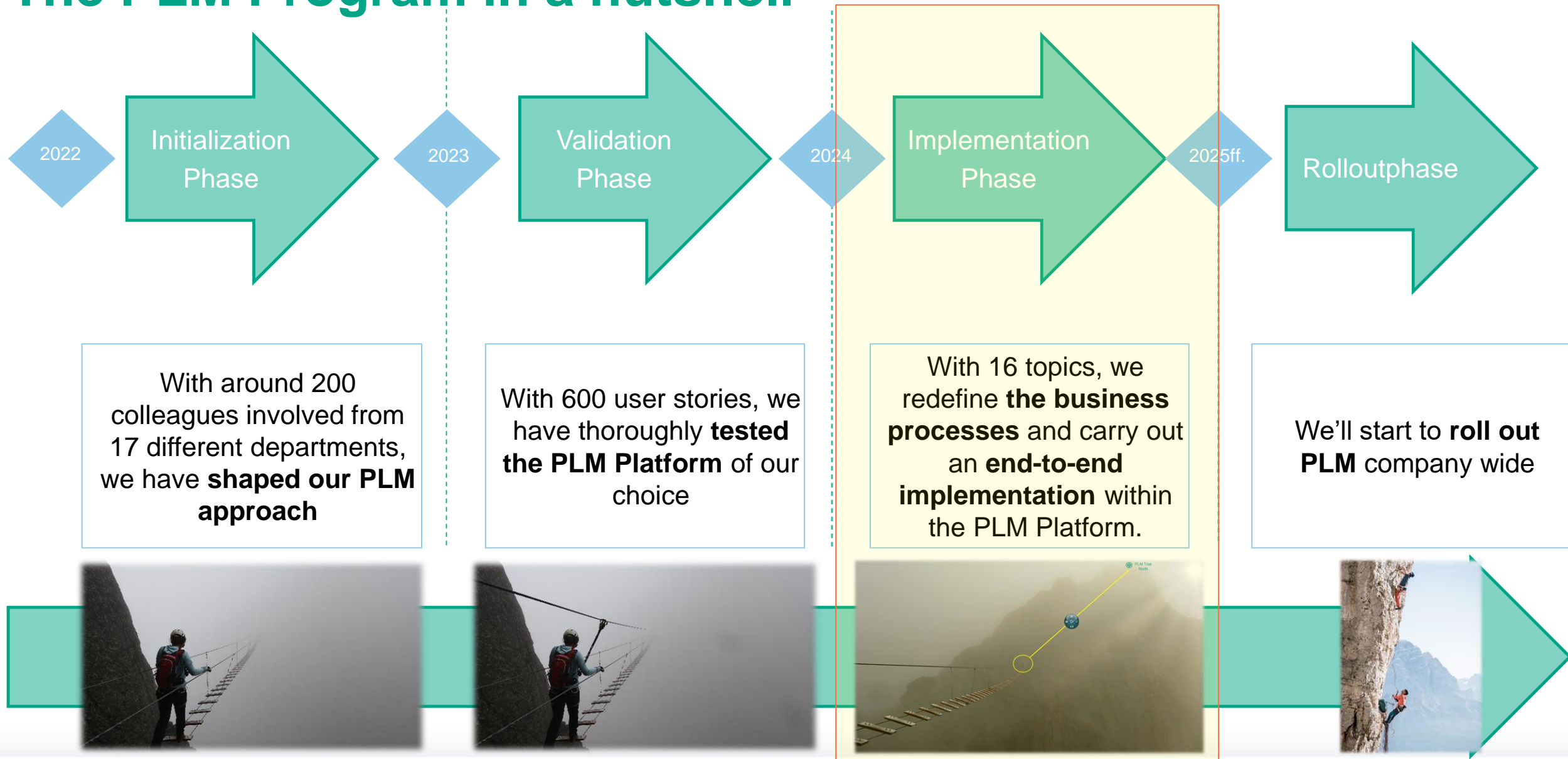
Use of OOTB functionalities in the cloud **reduces complexity and guarantees updates/future viability**

Collaboration with externals as a key driver for future success and cloud as enabler

Cloud as enabler for future **AI applications**

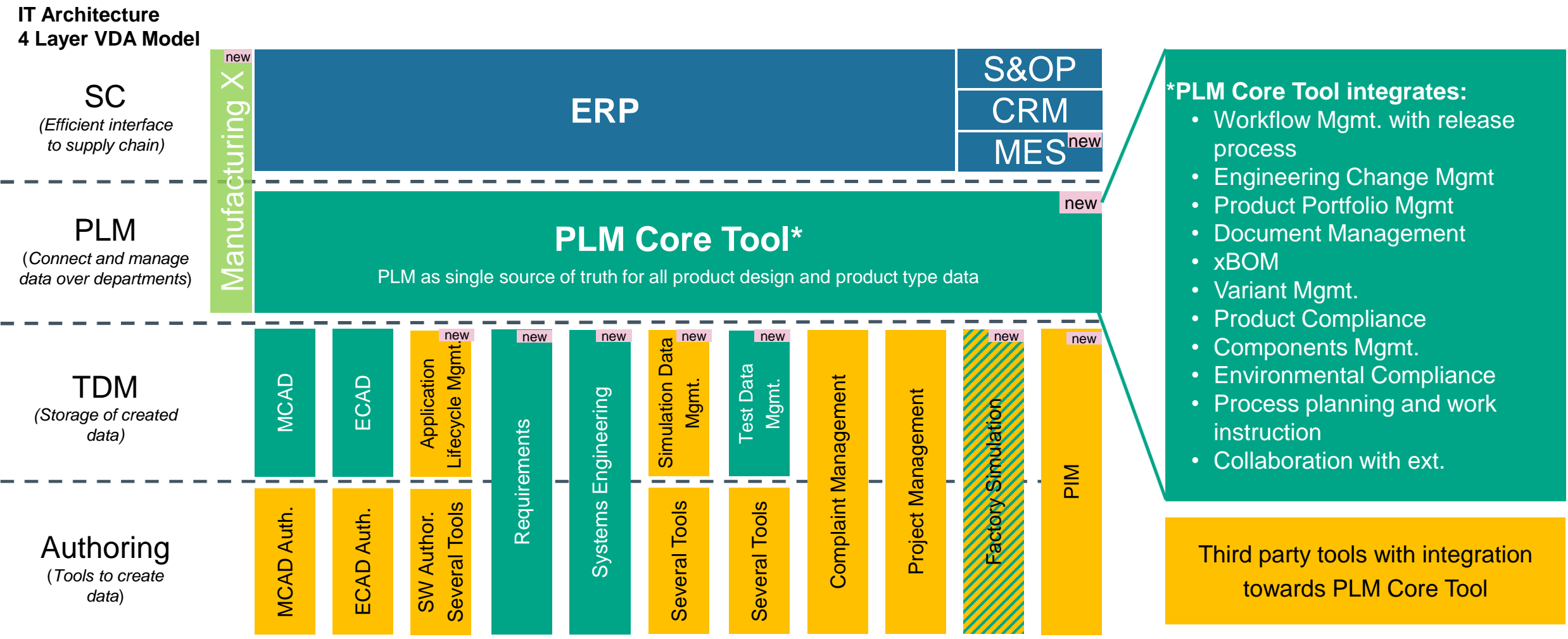
The cloud offers earlier and more **exclusive access to new and existing functions**

The PLM Program in a nutshell



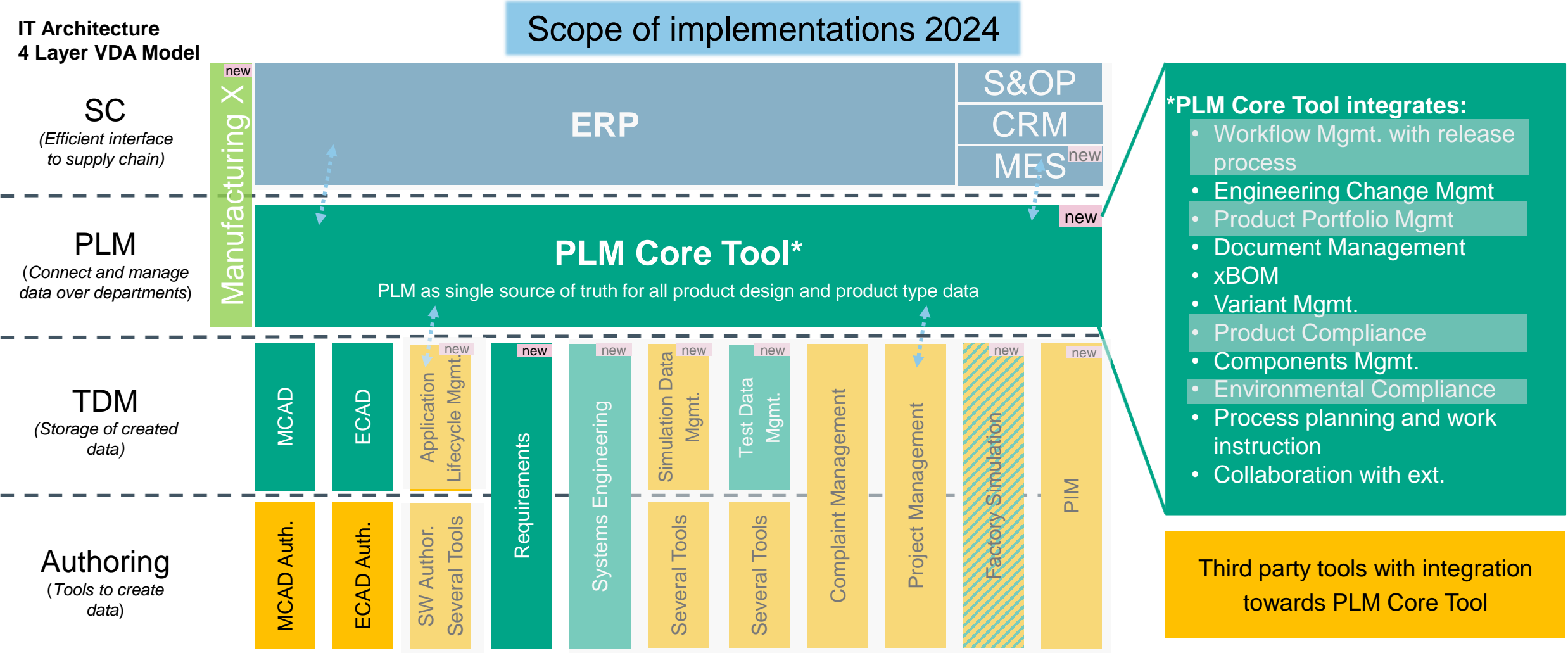
PLM is not only the PLM Platform itself....

It is about a seamless tool chain by integrating tools into a comprehensive PLM IT architecture



PLM is not only the PLM Platform itself....

It is about a seamless tool chain by integrating tools into a comprehensive PLM IT architecture



Planning 2024

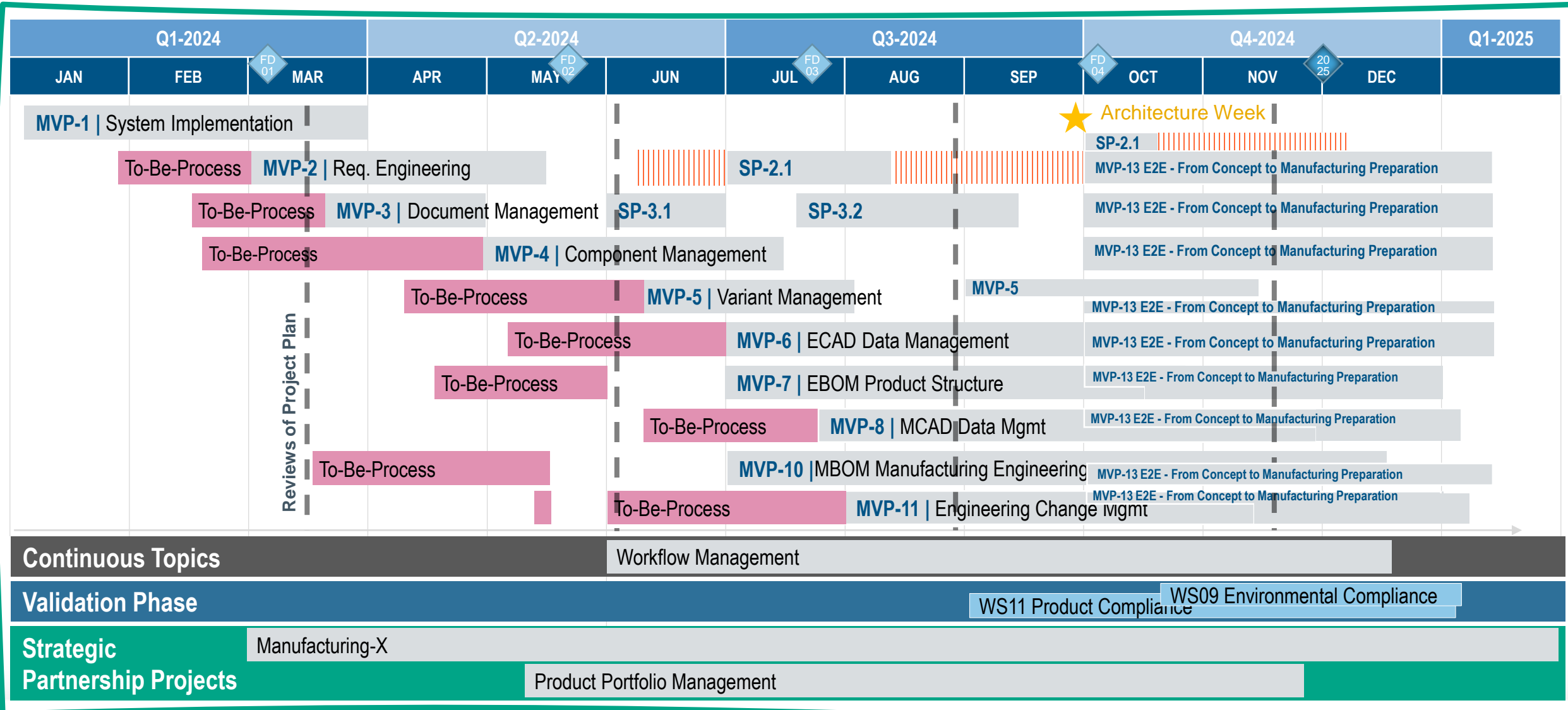
MVP = Minimum viable Product
 SP = Solution Phase
 WS = Workstream
 P = Pilot Project

Living Document

V32
 September
 2024

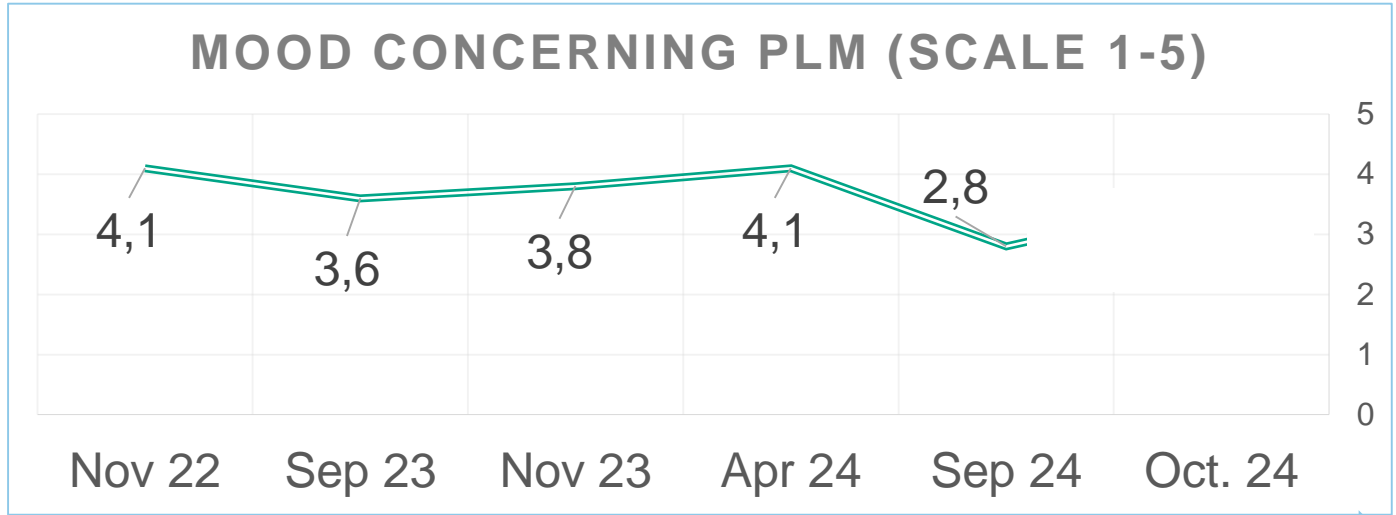
Project Management – Start and Duration of each first MVP

Pilot Project Live



Mood Barometer Topic Leads concerning PLM Program

Complexity and dependencies as a burdensome factor



Multitude of possibilities and dependencies led to disorientation

Necessity to create target picture

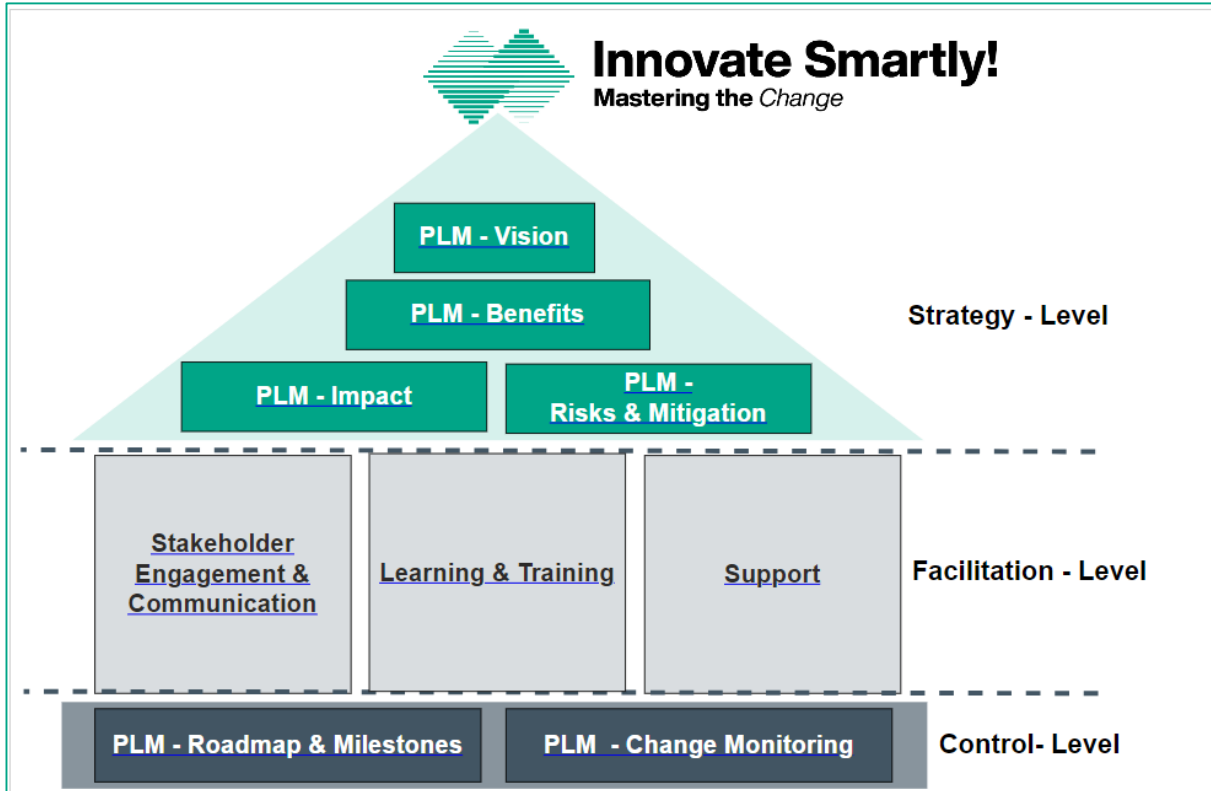
~70 decisions within an architecture week (~30 colleagues)

Transitioning open issues into decisions

Uncertainty too high?
Working hypothesis with action item.
„Fail fast“ and „start before you are ready“

Target picture as enabler for org. change management

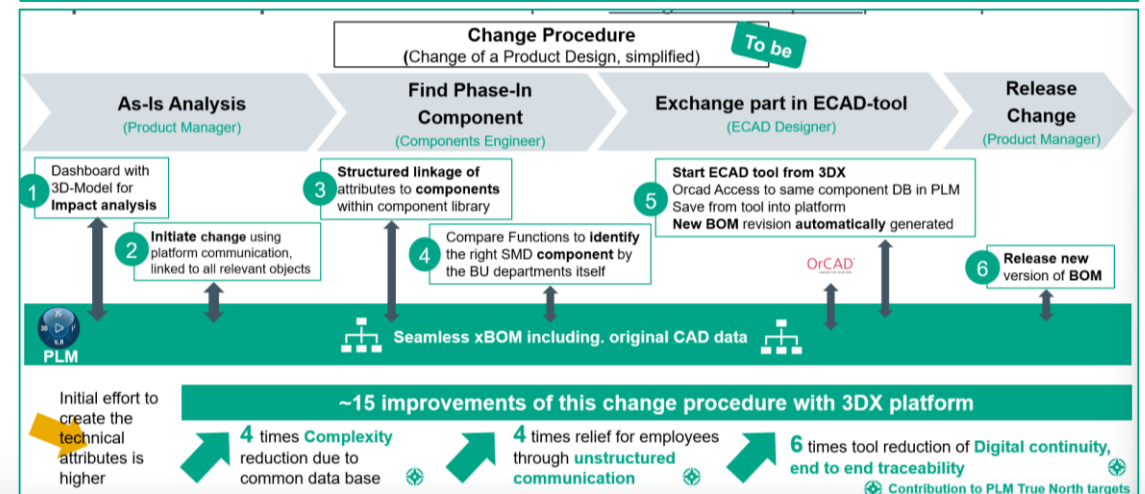
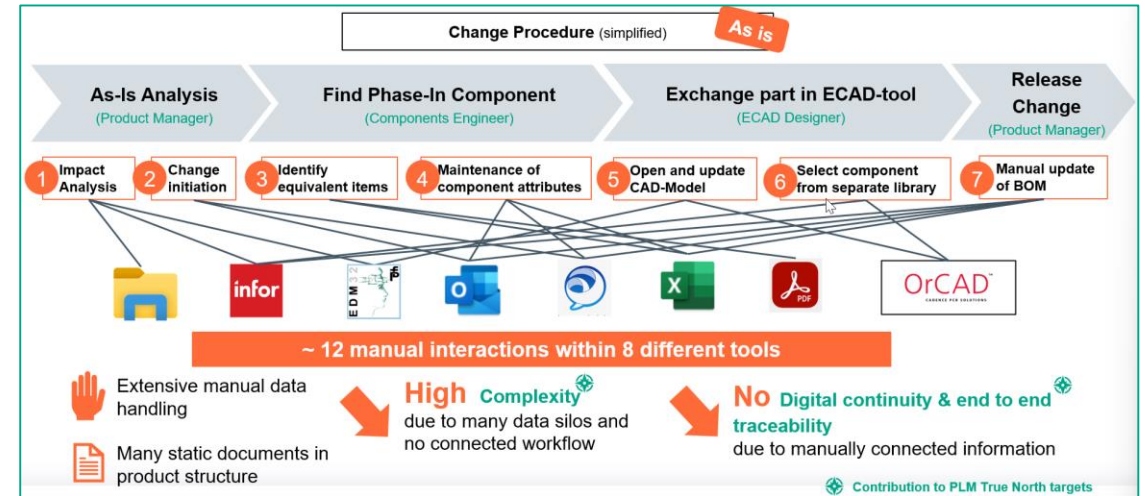
Demonstrating PLM Benefits



"Change Management is like the background music in a movie - it helps emphasizing what's important while being barely noticeable itself."

Use Case Description

"I want to replace a THT with a SMD component during the development phase of a product"

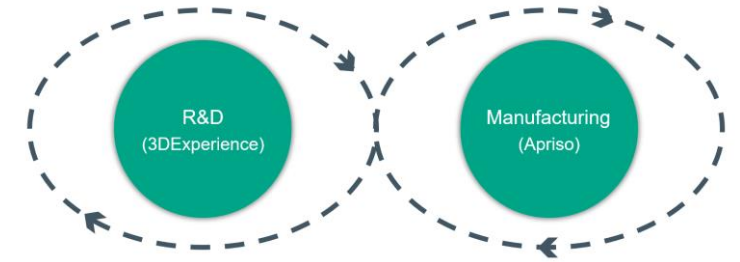


The PLM Program in a nutshell



Rolloutphase 2025 onwards

How do we proceed?



1. All-at-once-rollouts: Obtaining a target picture considering real conditions

Deploy the PLM platform *across all departments simultaneously*, ensuring full integration and collaboration from the start for one pilot product („From Concept to Manufacturing“)

2. Step-by-step rollouts: Populate the data management within 3DX

A phased approach, *where each department or topic is implemented gradually*, making the process more manageable while addressing issues incrementally (Requirements, ECAD, MCAD, Components)

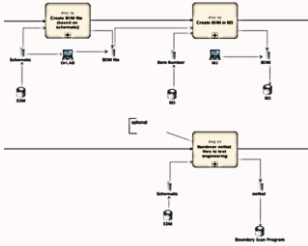
3. 2026ff. Scaling the platform: Value-driven rollouts per product groups

Transition the Bill of Materials (BOM) single source of truth from ERP to PLM using a product group specific, value driven, step-by-step approach (Variant Mgmt + EBOM + MBOM + ECM)

Product Lifecycle Management (PLM)

What is our strategic focus?

PLM-Program
started 2022



We live

Digitalization:

Business processes
and information flows
are aligned



Innovate Smartly!
Mastering the Change

Better digitalization of existing lifecycle workflow

Gaining efficiency, transparency and quality along the product lifecycle

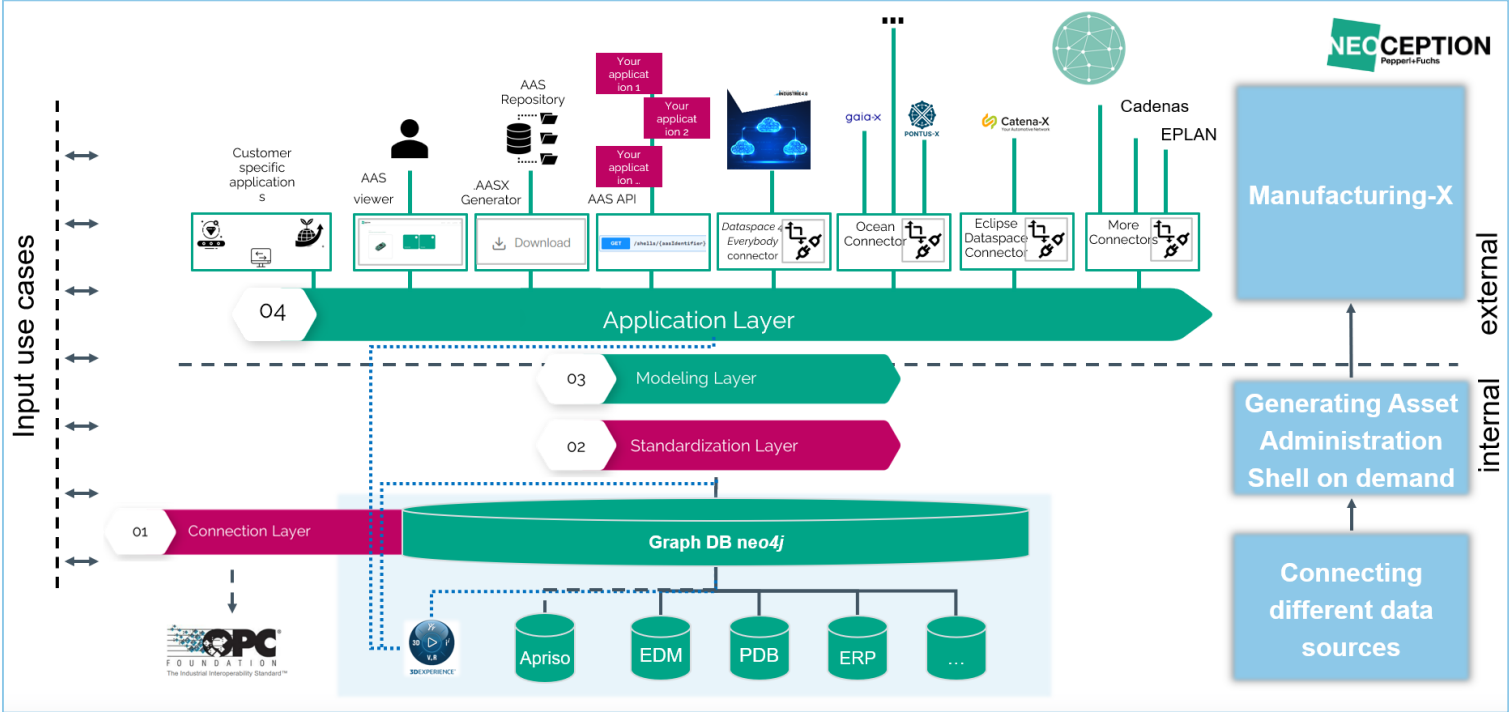
Supporting new, digital, data-driven business models

Generating and using lifecycle relevant data in standardized open data models used in next generation data rooms

Supporting new, digital, data-driven business models

First basis Use Case: Digital Nameplate (afterwards scaling to further use cases)

- **Blueprint** *how* to implement data-driven use cases
- Live implementation to **build-up an aligned IT-infrastructure with the ability to scale further use cases** without major integration costs
- Clarification of how the **3DExperience Platform** will be integrated



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Your automation, our passion.



THANK YOU FOR YOUR INTEREST

