ptc LIVEWORX

FESTO

SESSION ID: AL1070B

ALM MEETS PDM: A JOURNEY FROM REQUIREMENTS TO REALIZATION

SPEAKER(s):

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PRESENTERS

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Festo SE & Co. KG

INTRODUCTION FESTO
APPLICATION INTRO
WORKFLOW INTRO
A PRACTICAL EXAMPLE

INTRODUCTION FESTO

Katrin Laschzok

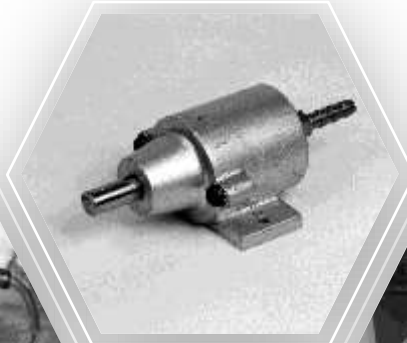
CORPORATE HISTORY – INNOVATIVE SINCE 1925

1925
Gottlieb Stoll, founder

1927
First self constructed tool

1951
Festo develops the first orbital sander

1955
New business area Festo Pneumatic



1956
First own catalogue

1965
Start of Festo Didactic

1987
The world´s first valve terminal

2000
Market launch Fluidic Muscle

2006
Bionic Learning Network

2017
Market launch Festo Motion Terminal

2019
Global Production Center Jinan/China

FESTO AT A GLANCE

After-sales Services in **176** countries

Companies in **61** countries

Over **250** branch offices

Customers Automation **> 300,000**

Employees worldwide: **~ 20,700**

Customers Didactic **> 56,000**

Turnover: **3.36 billion Euro**

OUR BUSINESS SECTORS

Process Automation

Laboratory-Automation

Automation

LifeTech

Factory Automation

Medical Technology

Lifelong Learning

Didactic

Qualification of the workforce

Holistic learning solutions

AUTOMATION – OUR PORTFOLIO

> 30.000
catalogue products

Customer Solutions

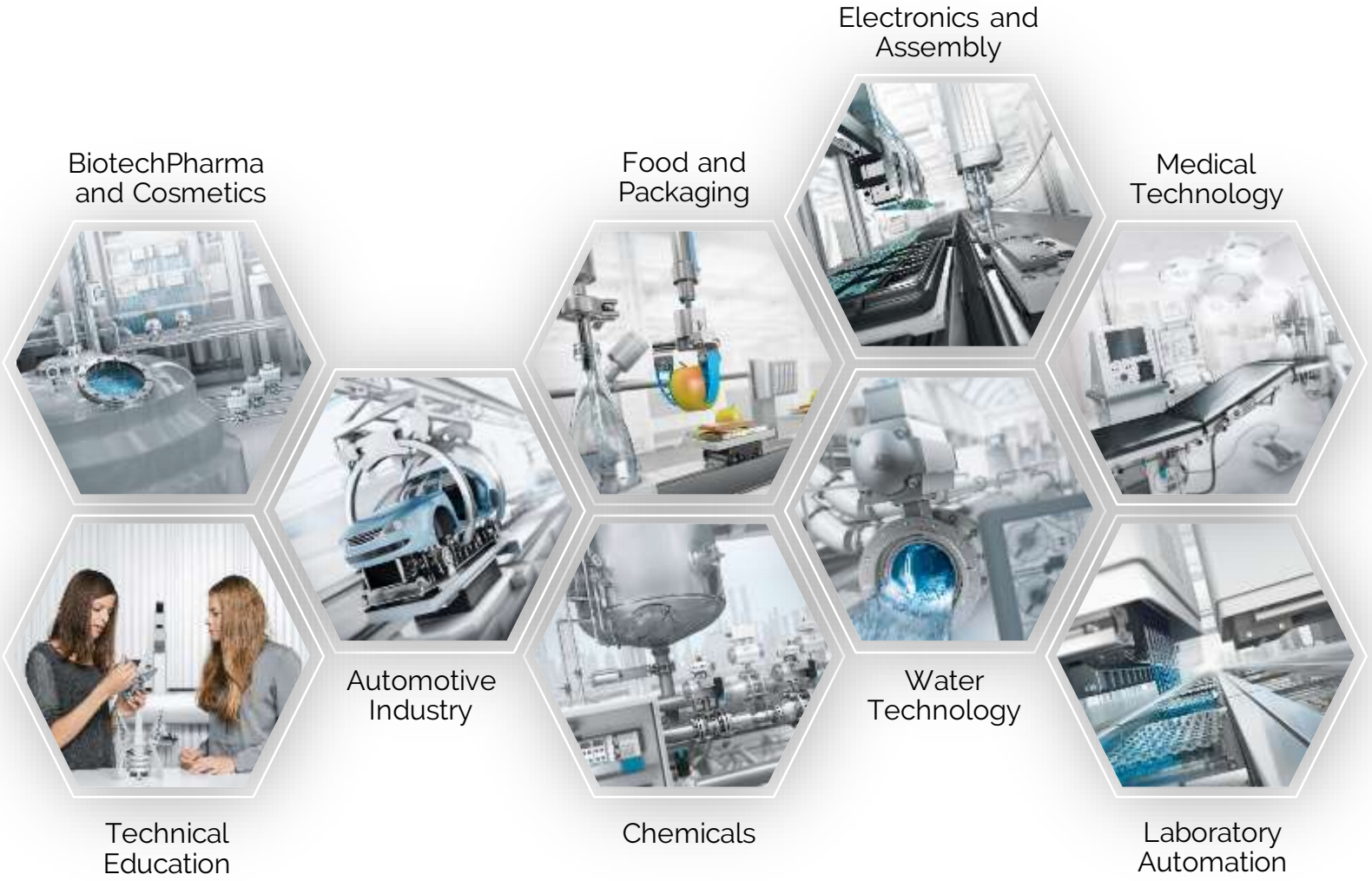
> 10.000
individualised solutions

Electric Automation

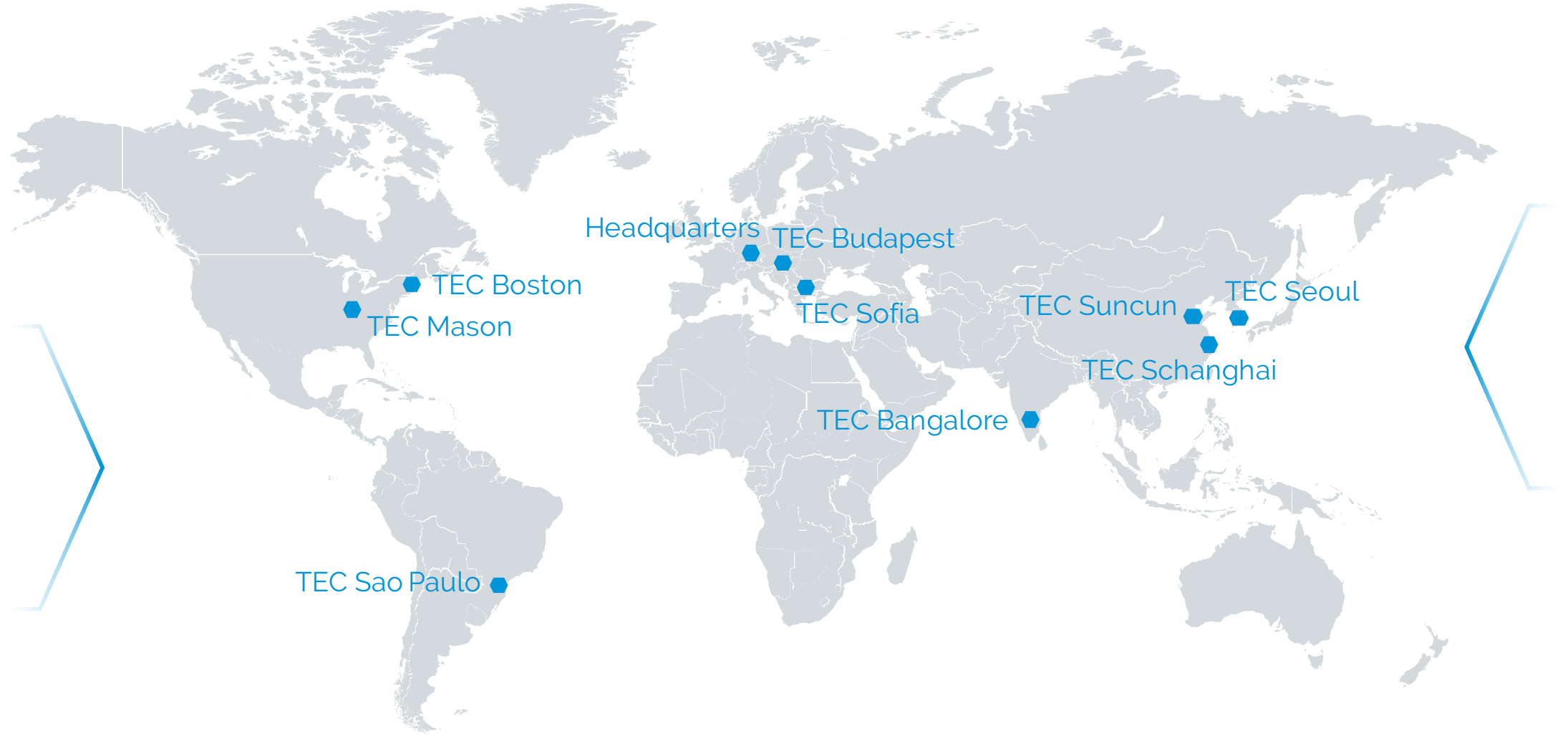
Pneumatic Automation

24 h
delivery service

INDUSTRY SEGMENTS



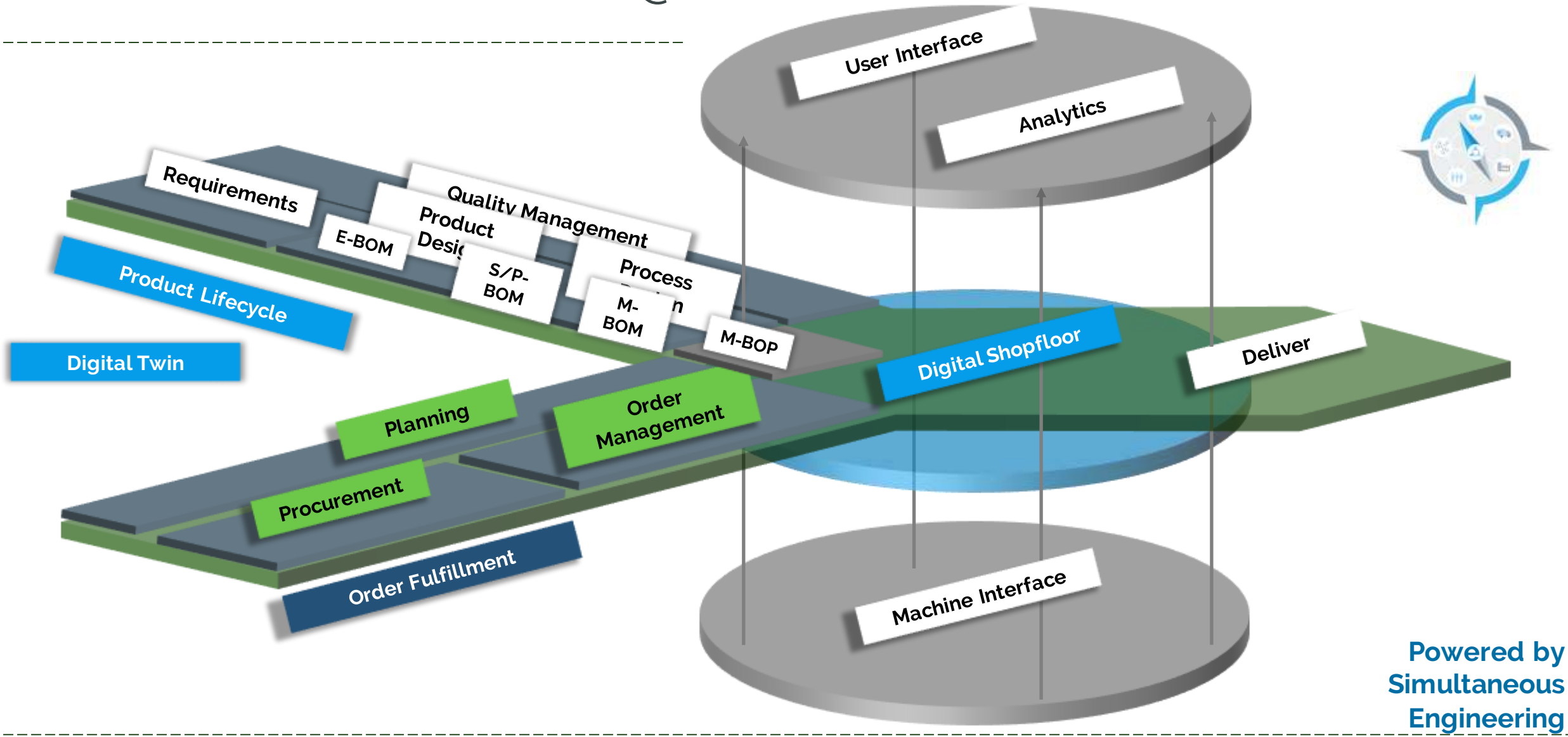
WORLDWIDE RESEARCH AND DEVELOPMENT NETWORK



APPLICATION INTRO

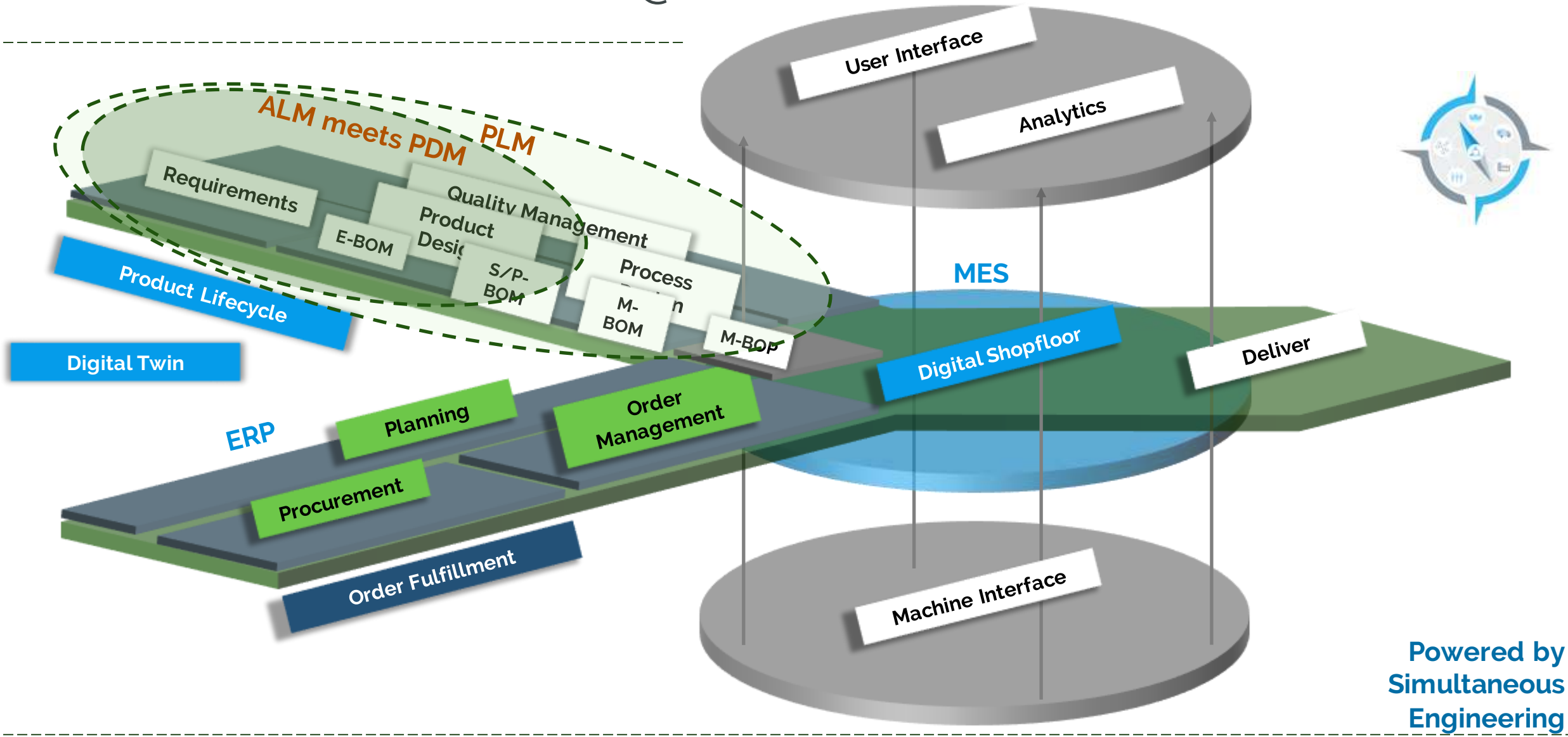
Katrin Laschzok

DIGITALIZATION VISION @FESTO



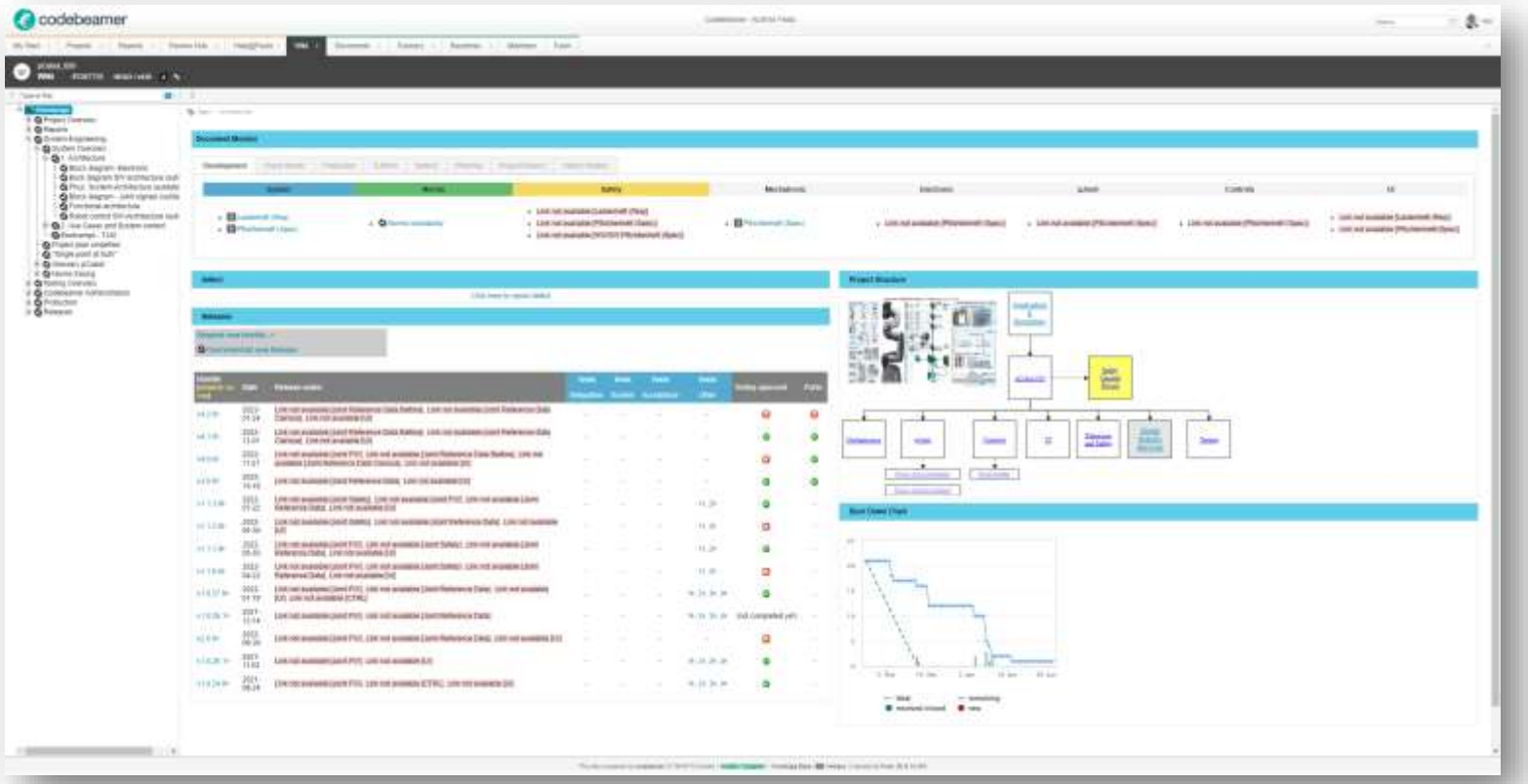
Powered by Simultaneous Engineering

DIGITALIZATION VISION @FESTO



Powered by Simultaneous Engineering

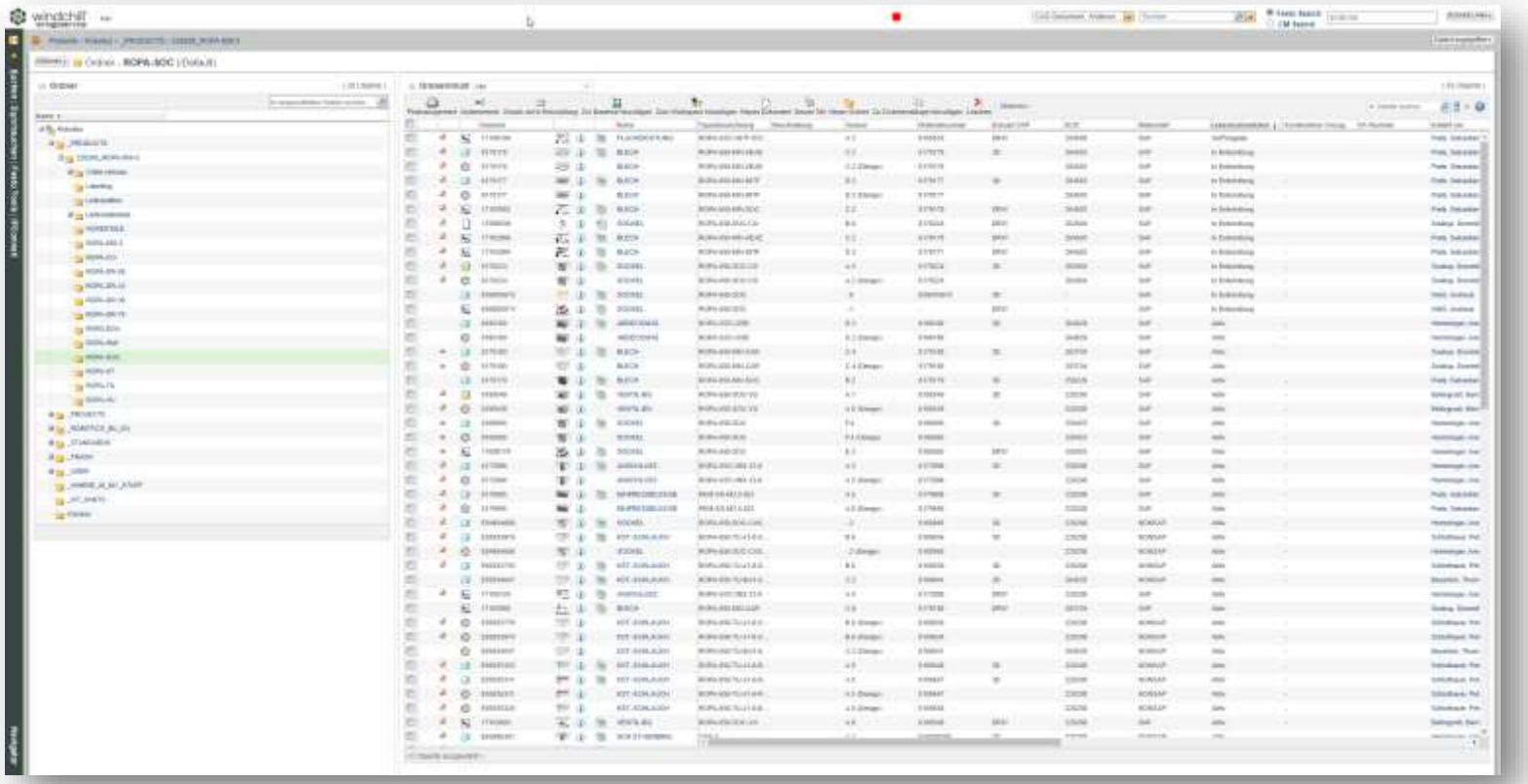
SPECIFICATION MANAGEMENT @ALM CODEBEAMER



Content of Codebeamer

- Technical part of the specifications
- Requirements specification -> Steakholder requirements
- Specification
- Standards (ASME, ISO, DIN)
- Tests

DATA MANAGEMENT @PDM WINDCHILL



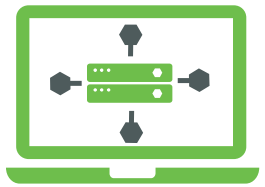
Objects within Windchill

- 3D-CAD-Data / MCAD+ECAD
- 2D-CAD-Data / MCAD+ECAD
- Simulations
- Data sheets
- Attributes of/from all documents
- Viewables of all documents

CODEBEAMER @FESTO

The history and usage of Codebeamer @Festo

Software development



Since 2012

Product development

Since 2018

Since 2019 agile process organization

WORKFLOW INTRO

Katrin Laschzok

CONTENT TO BE CONSIDERED

Codebeamer is a central tool to display and track requirements and specifications. Precise, variant-supported, agile.

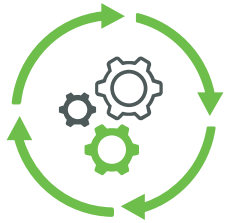
Norms and Standards

All actions in compliance with applicable norms and standards

Components

Mechanics
Pneumatics
Electronics
Software

Development loop



ALM
PDM
Simulation
Testing

Agile release train

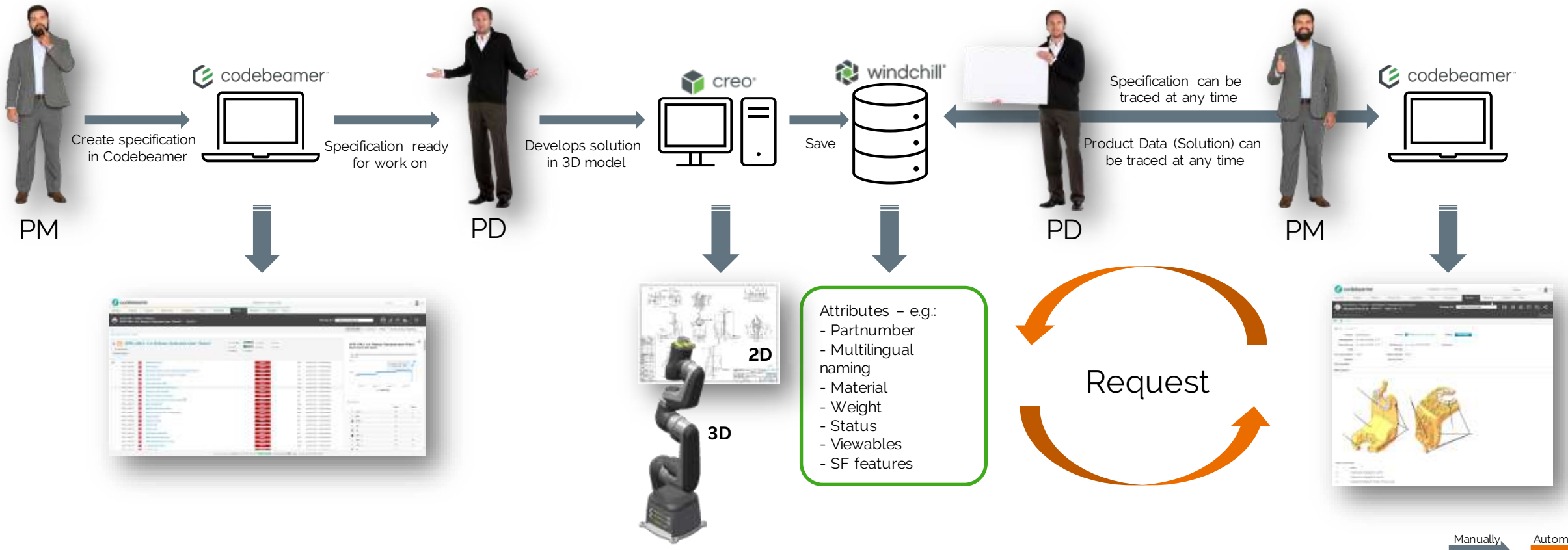
4 PIs in 1 year
4 Sprints in 1 PI

Global development

One single point of truth is needed

WORKFLOW INTRO: ALM MEETS PDM

All actions in compliance with applicable norms and standards



AN EXAMPLE OUT OF OUR PORTFOLIO: THE FESTO COBOT

FESTO COBOT: THE COMPONENTS

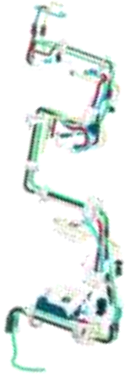
All actions in compliance with applicable norms and standards!

Mechanics

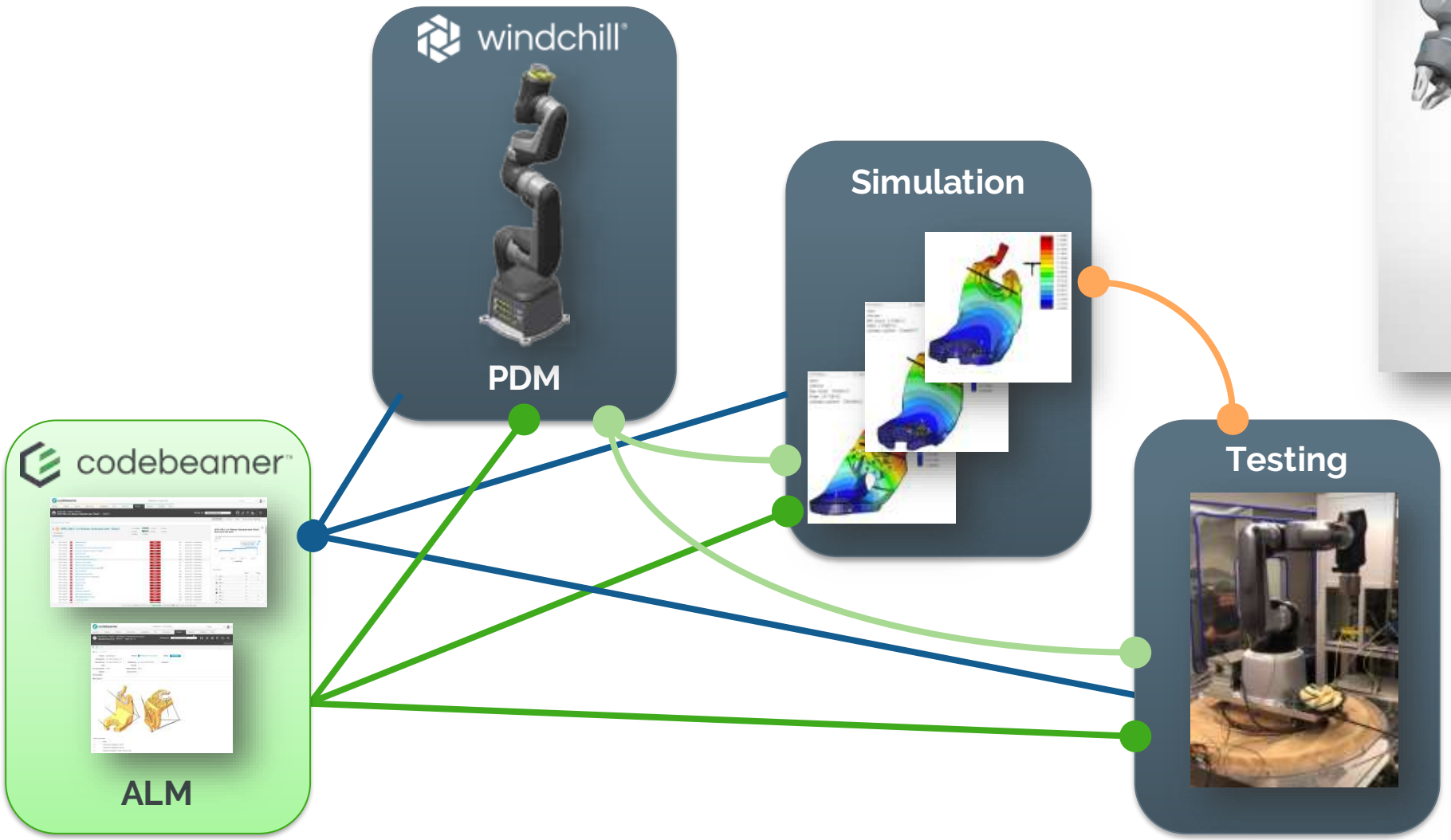
Software

Electronics

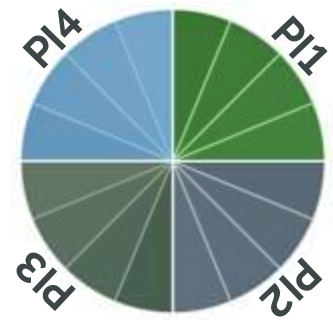
Pneumatics



THE DEVELOPMENT LOOP



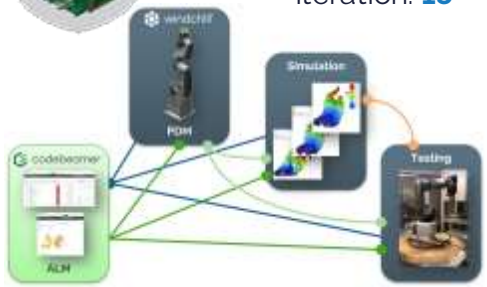
THE AGILE RELEASE TRAIN



Four **PI**s in one year / Four sprints in one **PI**

Design:
Variant: **1**
Version: **–**
Iteration: **36**

Simulation:
Variant: **1**
Version: **–**
Iteration: **15**



Specification
Version: **1**

Testing:
Testrun: **1**

Design:
Variant: **1**
Version: **A**
Iteration: **48**

Simulation:
Variant: **1**
Version: **A**
Iteration: **8**

Specification
Version: **2**

Testing:
Testrun: **2**

Design:
Variant: **2**
Version: **–**
Iteration: **27**

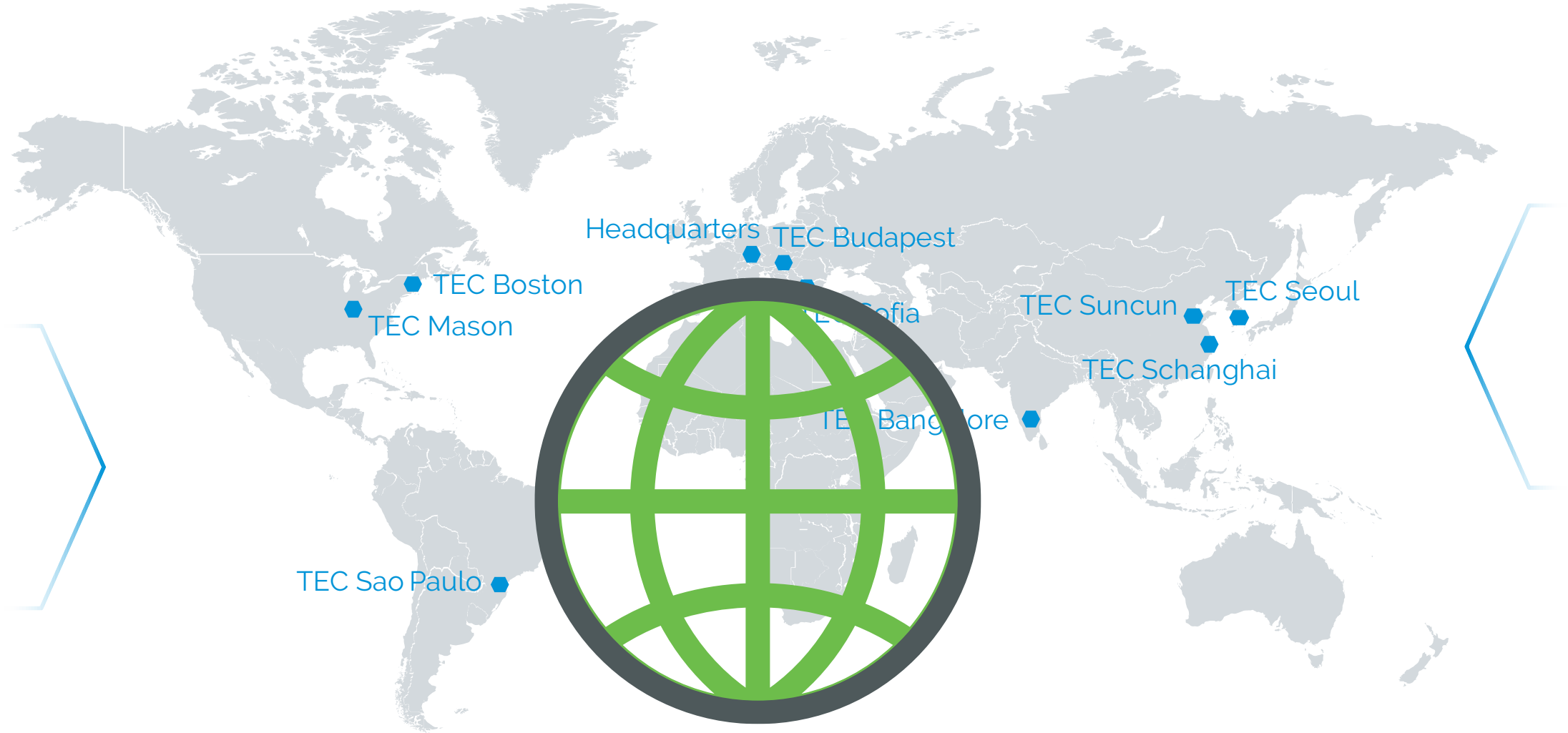
Simulation:
Variant: **2**
Version: **–**
Iteration: **12**

Specification
Version: **3**

Testing:
Testrun: **3**

PI = **P**rogram **I**ncrement

GLOBAL DEVELOPMENT: SINGLE POINT OF TRUTH NEEDED!



A PRACTICAL EXAMPLE

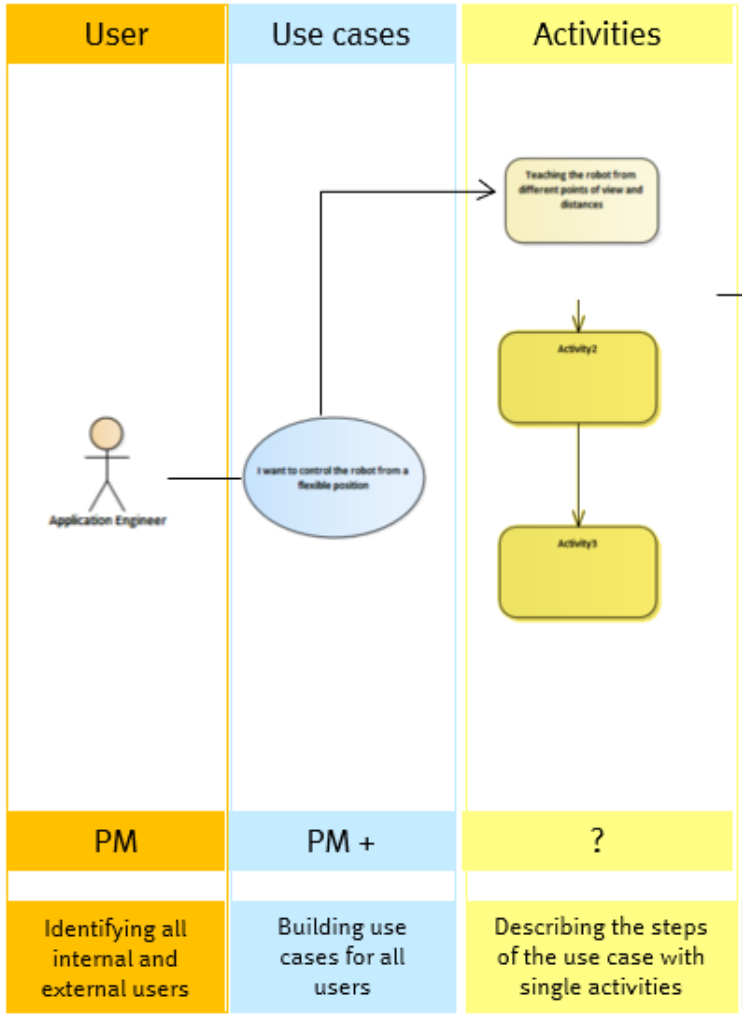
Peter Schlothauer

THE QUESTION ABOUT THE …

CUSTOMER OBSESSED DEVELOPMENT

THE QUESTION ABOUT THE ...

CONNECT THE LINES – THE WAY FORWARD



CONNECT THE LINES – TRACEABILITY

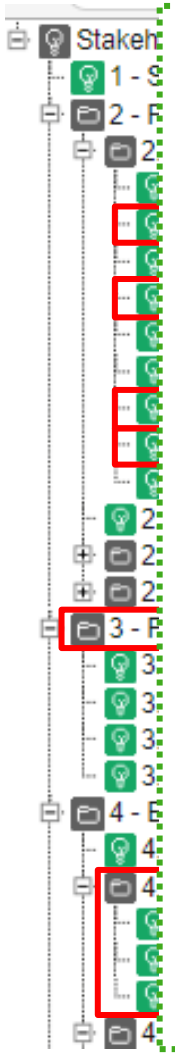
Initial

Summary

- [SR-3488082] Mechanic interface
- [SR-3488081] Mounting cobot arm
- [SR-3488080] Cobot weight
- [SR-3488079] Slim structure/design
- [SR-3488078] Compact system
- [SR-3488077] Compact system design
- [SR-3488076] Start-up time
- [SR-3488075] Easy to start-up
- [SR-3488074] Repeatability
- [SR-3488073] pCobot life time

THE QUESTION ABOUT THE …

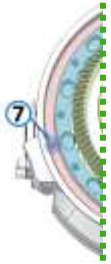
THE PART - OVERVIEW



Sub-

- ge
  sys

- int



Requirements from guidelines and directives

DIN EN ISO 10218-1:2012-01
- 1 - Anwendungsbereich
- 2 - Normative Verweisungen

DIN ISO-TS 15066:2017-04
- 1 - Anwendungsbereich
- 2 - Normative Verweisungen

ISO 9283:1998, *Manipulating industrial robots — Performance criteria and related test methods*

ISO 10218-2, *Robots and robotic devices — Safety requirements for industrial robots — Part 2: Robot systems and integration*

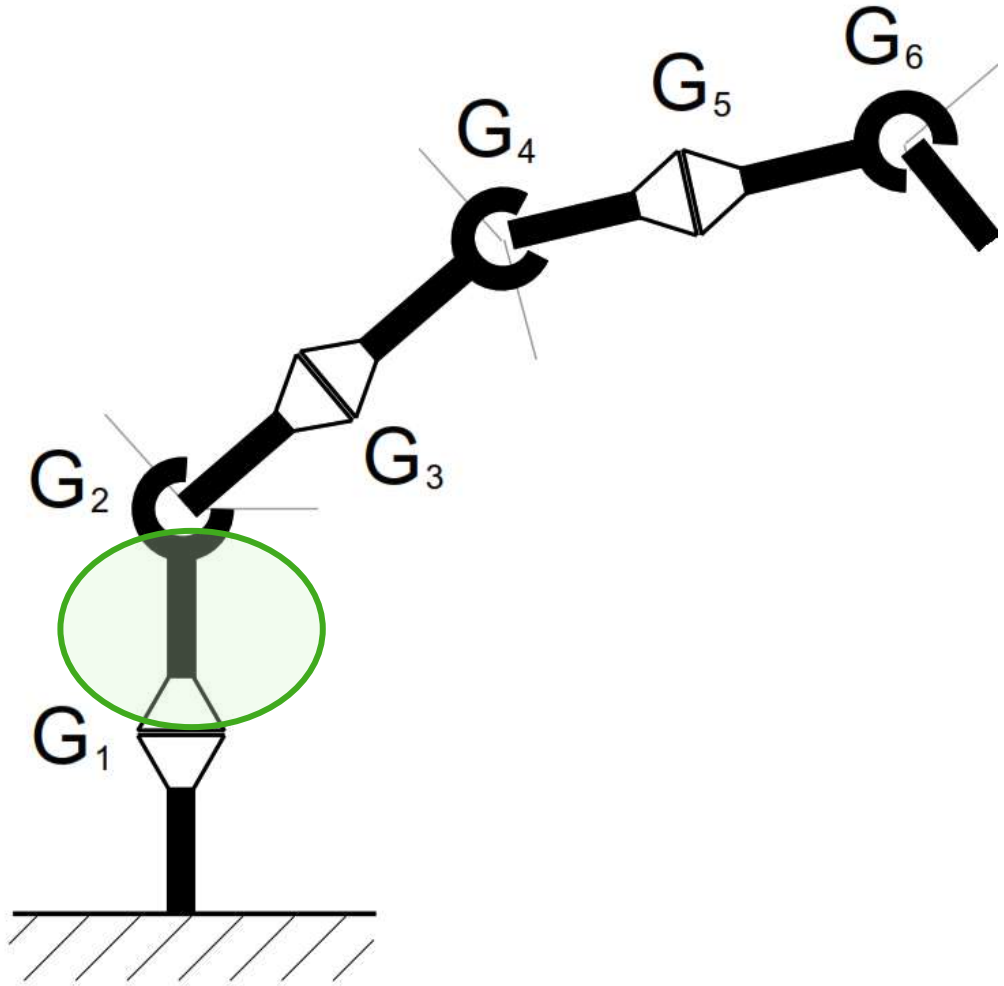
ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850, *Safety of machinery — Emergency stop — Principles for design*

IEC 60204-1, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 62061:2005 *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems*



THE PART – POC (RONJA)

- 2.1.1 - Operating height
- 2.1.2 - Protection class kinematics
- 2.1.6 - Particular resistance
- 2.1.7 - Vibration/shock resistance
- 2.1.8 - Corrosion resistance
- 2.1.9 - Medium temperature
- 2.2 - Human-Robot-Collaboration
- 2.3 - Working space and handled material (4)
- 2.4 - Supply Network (2)
- 3 - Product Performance (4)
- 3.1 - Axis movement: min. speed
- 3.2 - Reference cycle
- 3.3 - pCobot life time
- 3.4 - Repeatability
- 4 - Easy to start-up (15)
- 4.1 - Start-up time
- 4.2 - Compact system design (3)
- 4.2.1 - Compact system
- 4.2.2 - Slim structure/design
- 4.2.3 - Cobot weight
- 4.3 - Mounting cobot arm (2)

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

[SR-3488055] Ambient temperature (operation) <R

[SPEC-3603332] Operating temperature <R

[TESTCASE-3218851] FN 942017-1 - Operating temperature test

5.1.3.2 FN 942017-1 - Operating temperature test

For change temperature tests, the following temperature profile is defined as default:

Temperature levels:	T_{min} and T_{max}
Temperature gradient:	2 K/min
Dwell time per temperature level:	6 h

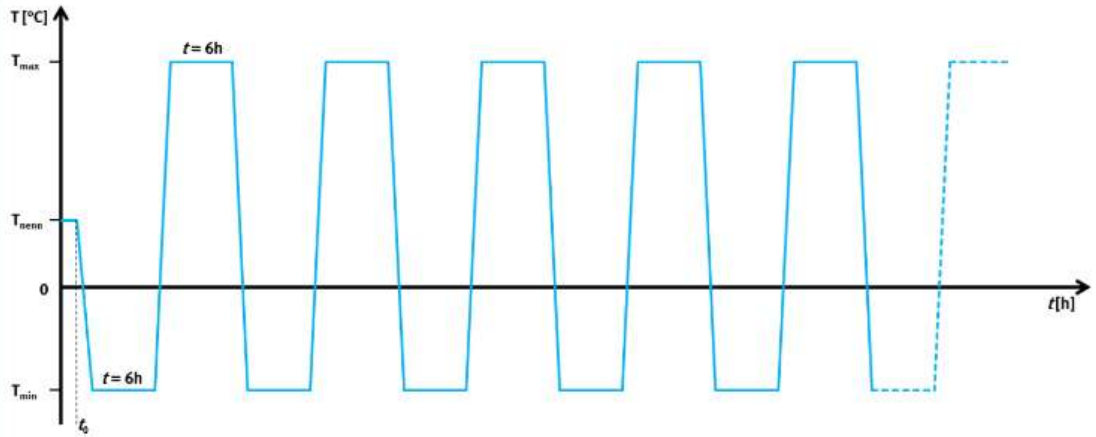


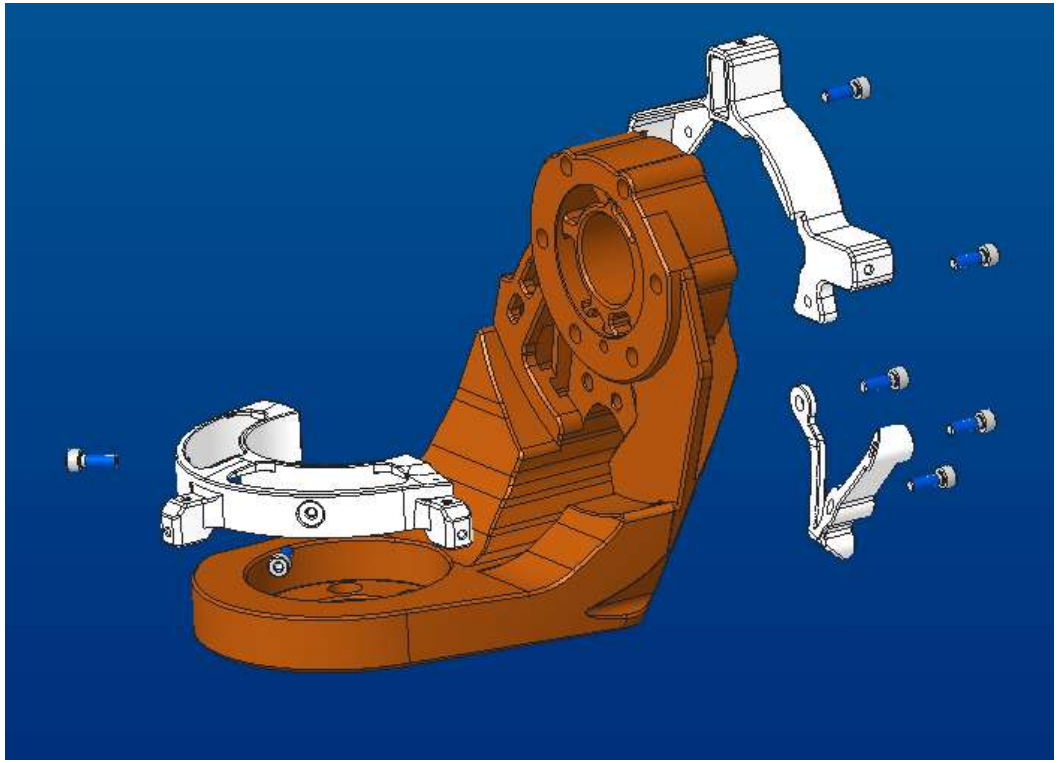
Fig. 1: Alternating temperature tests - temperature profile

1 Test Steps

THE PART – POC (RONJA)

- 2.1.1 - Operating height
- 2.1.2 - Protection class kinematics ✓
- 2.1.3 - Humidity
- 2.1.4 - Ambient temperature (operation) ✓
- 2.1.5 - Storage temperature
- 2.1.6 - Particular resistance
- 2.1.7 - Vibration/shock resistance ?
- 2.1.8 - Corrosion resistance ✓
- 2.1.9 - Medium temperature
- 2.2 - Human-Robot-Collaboration
- 2.3 - Working space and handled material (4)
- 2.4 - Supply Network (2)
- 3 - Product Performance (4) ?
  - 3.1 - Axis movement: min. speed
  - 3.2 - Reference cycle
  - 3.3 - pCobot life time
  - 3.4 - Repeatability
- 4 - Easy to start-up (15)
  - 4.1 - Start-up time
  - 4.2 - Compact system design (3) ? ✗
    - 4.2.1 - Compact system
    - 4.2.2 - Slim structure/design
    - 4.2.3 - Cobot weight
  - 4.3 - Mounting cobot arm (2)

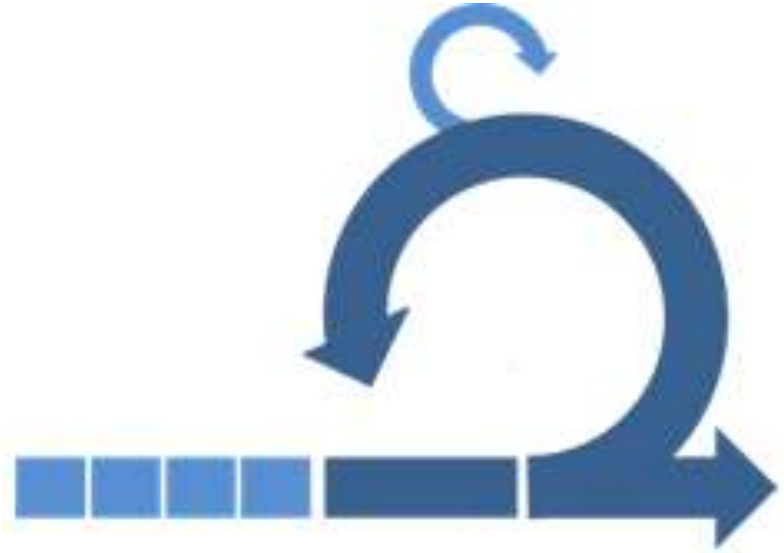
ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design* ?



- machined
- asymmetrical design
- additional parts and screws for assembly of cover and connectivity

weight: 1114 g

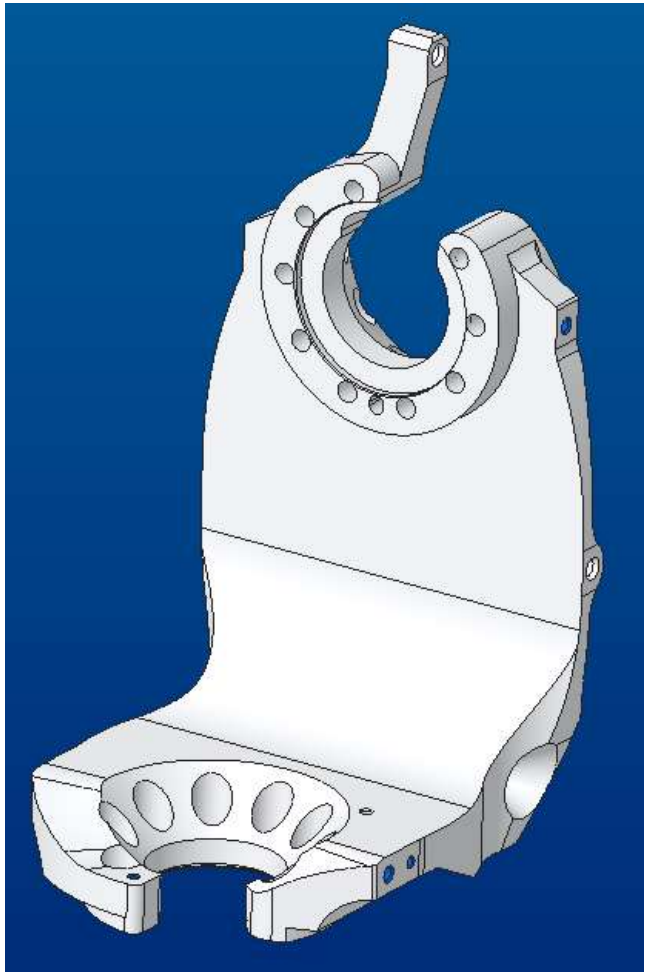
DESIGN LOOP



Focus:

- Lift customer potentials (out of reviewed and iterated specs as learnings from prototype
- Enable for non-cutting manufactoring (Design for Costs)

THE PART – FIRST LOOP (BETTINA)



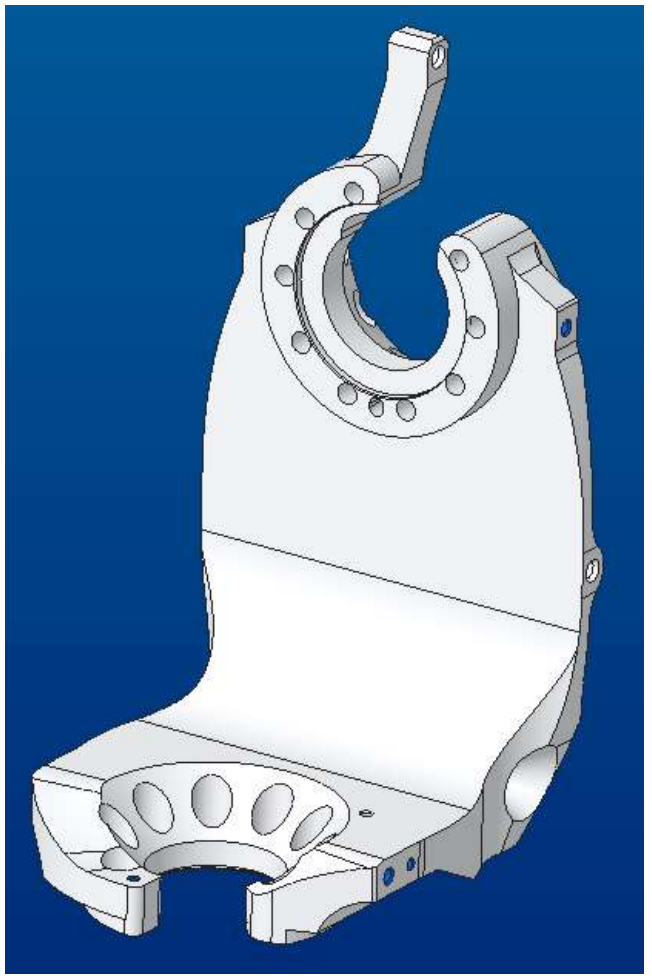
- machined
- symmetrical design
- no additional parts and no screws for cover assembly
- lightweight design: functional integration

weight: 956 g

THE PART – FIRST LOOP (BETTINA)

- 2.1.1 - Operating height
- 2.1.2 - Protection class kinematics ✓
- 2.1.3 - Humidity
- 2.1.4 - Ambient temperature (operation) ✓
- 2.1.5 - Storage temperature
- 2.1.6 - Particular resistance
- 2.1.7 - Vibration/shock resistance ✓
- 2.1.8 - Corrosion resistance ✓
- 2.1.9 - Medium temperature
- 2.2 - Human-Robot-Collaboration
- 2.3 - Working space and handled material (4)
- 2.4 - Supply Network (2)
- 3 - Product Performance (4) ✓
  - 3.1 - Axis movement: min. speed
  - 3.2 - Reference cycle
  - 3.3 - pCobot life time
  - 3.4 - Repeatability
- 4 - Easy to start-up (15)
  - 4.1 - Start-up time
  - 4.2 - Compact system design (3) ? ✓
    - 4.2.1 - Compact system
    - 4.2.2 - Slim structure/design
    - 4.2.3 - Cobot weight
  - 4.3 - Mounting cobot arm (2)

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design* ? ✓



weight: 956 g

- machined
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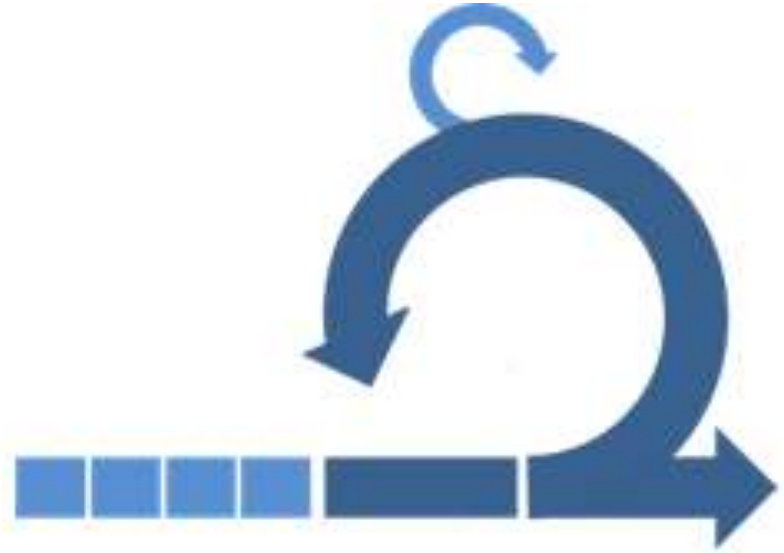
DESIGN LOOP



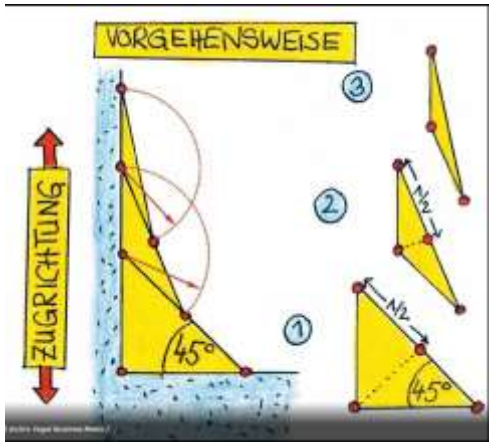
Focus:

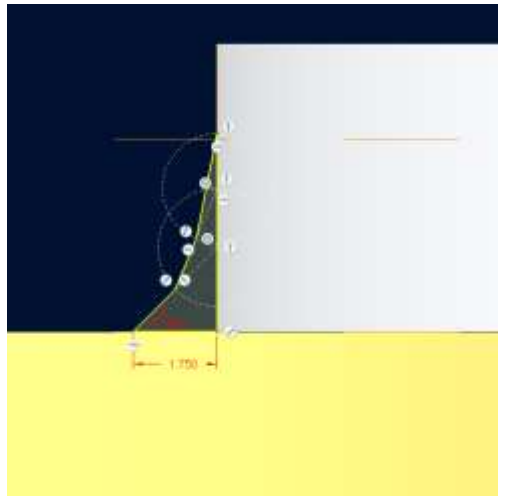
- Realize gravity die casting
- Optimize customer benefits
- Ensure requirement fullfilment

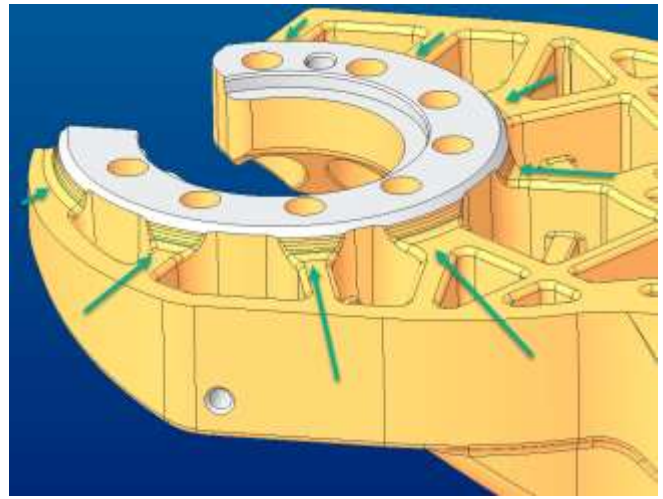
THE PART – FINAL DESIGN (CLARISSA)

- bionical lightweight design

Leaf of the Sea lily – stiffness increase

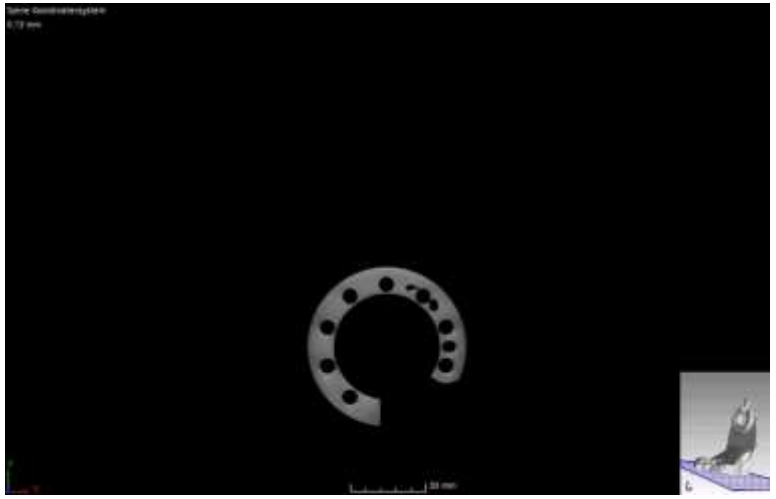


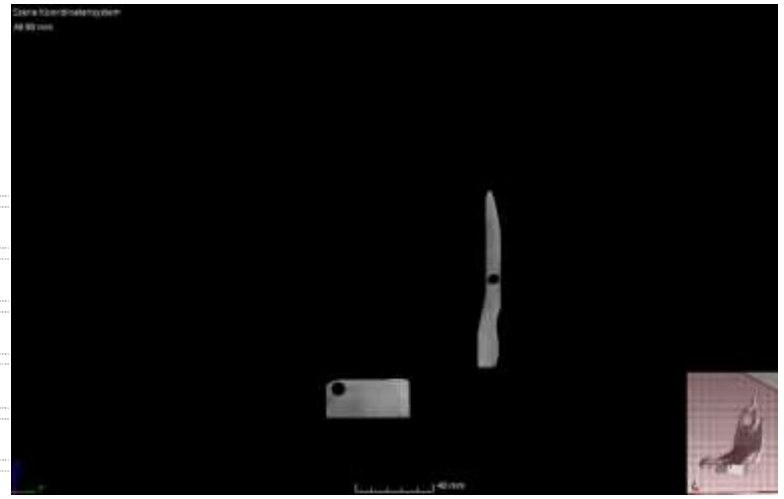


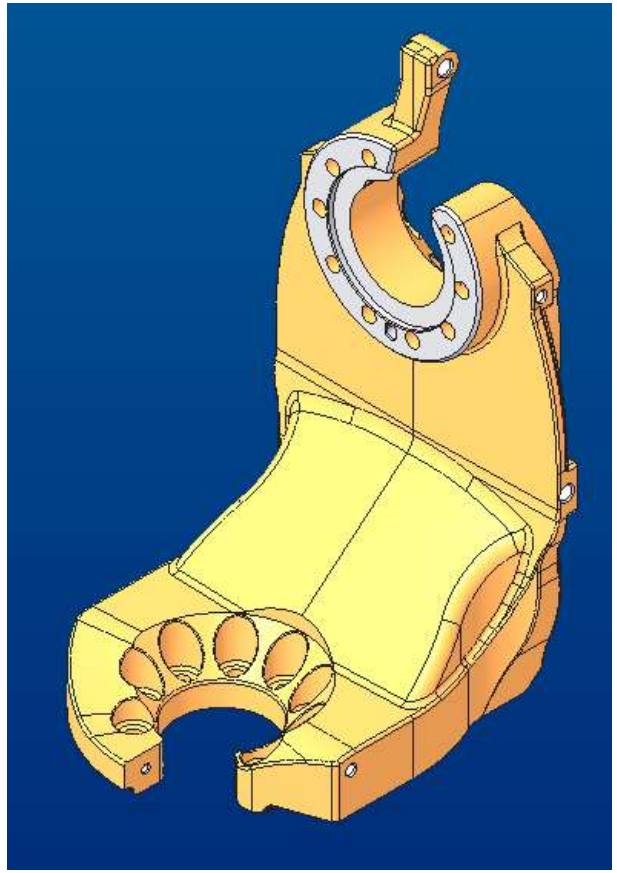


Tree root – tension reduction

THE PART – FINAL DESIGN (CLARISSA)







weight: 939 g

- gravity die casting
- symmetrical design
- no additional parts and no screws for cover assembly
- lightweight design: functional integration & lightweight manufacturing

THE PART – FINAL DESIGN (CLARISSA)

- 2.1.1 - Operating height
- 2.1.2 - Protection class kinematics ✓
- 2.1.3 - Humidity
- 2.1.4 - Ambient temperature (operation) ✓
- 2.1.5 - Storage temperature
- 2.1.6 - Particular resistance
- 2.1.7 - Vibration/shock resistance ✓
- 2.1.8 - Corrosion resistance ✓
- 2.1.9 - Medium temperature
- 2.2 - Human-Robot-Collaboration
- 2.3 - Working space and handled material (4)
- 2.4 - Supply Network (2)
- 3 - Product Performance (4) ✓
- 3.1 - Axis movement: min. speed
- 3.2 - Reference cycle
- 3.3 - pCobot life time
- 3.4 - Repeatability
- 4 - Easy to start-up (15)
- 4.1 - Start-up time
- 4.2 - Compact system design (3) ✓
- 4.2.1 - Compact system
- 4.2.2 - Slim structure/design
- 4.2.3 - Cobot weight
- 4.3 - Mounting cobot arm (2)

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design* ✓

weight: 939 g

- gravity die casting
- symmetrical design
- no additional parts and no screws for cover assembly
- lightweight design: functional integration & lightweight manufacturing

IMAGINE A WORLD

- Where one single point of
- Where enshots are no issu
- Where equirem ed by which Versio software
- Where Impact studies become a „some-clicks-wonder"

ptc **Can make it happen**

VISIT US AT XTROPOLIS!

Katrin Laschzok

Corp. Engineering Data and Applications, Festo

Peter Schlothauer

Head of Development Robotic Kinematics, Festo

Peter Haller

Director Solutions Consulting codebeamer, PTC

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