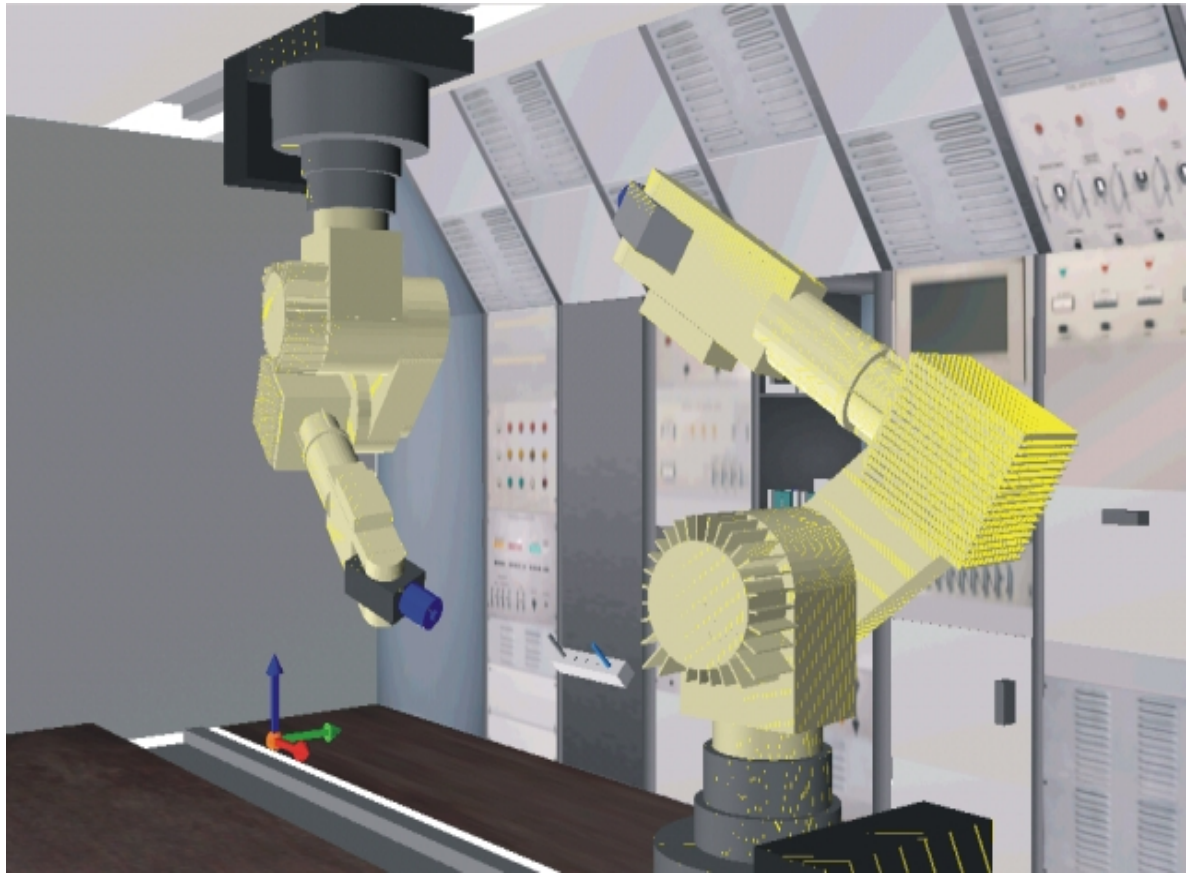
Robotics is spearheading Smart Production – but we need to deliver, too

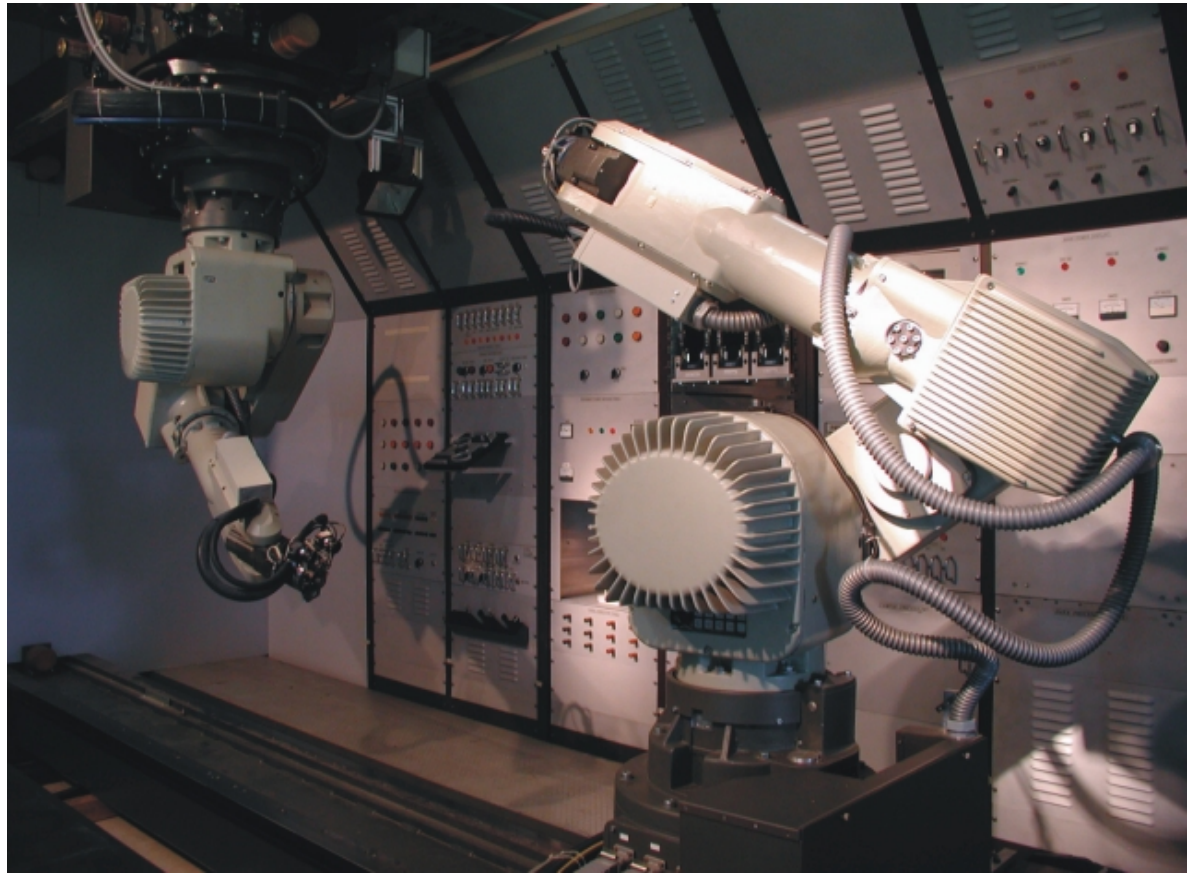
ICINCO 2018
Porto, Portugal
29 – 31 July 2018

Christian Schlette
30 July 2018

Robot simulation and robot control

sigh … my first “digital twin”





Overview

Technologies

From robot control and simulation
to “digital twins” and Smart Production

Transfer, trust and agility

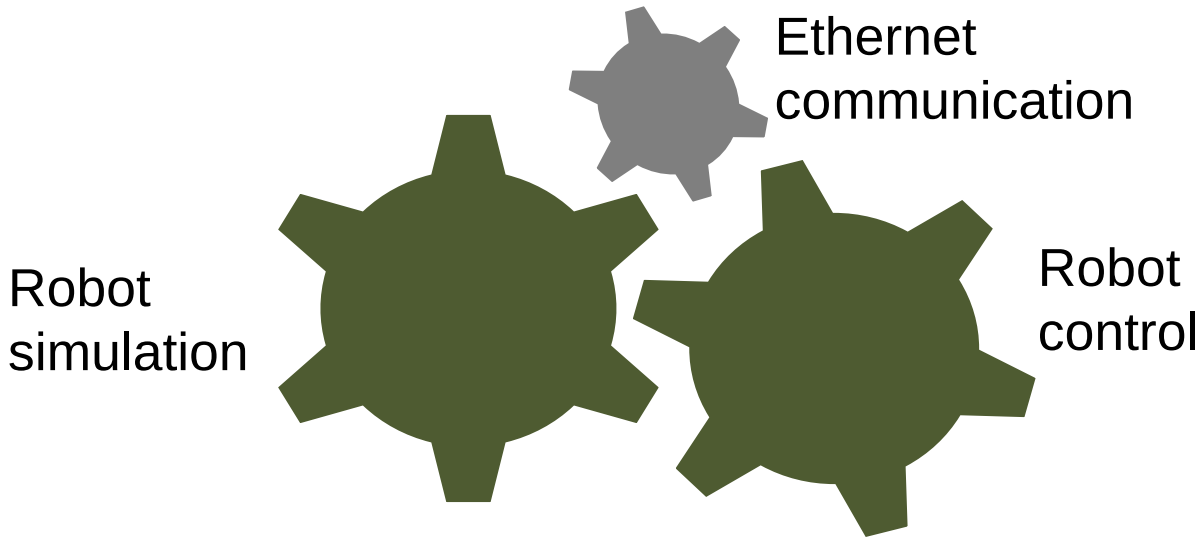
Trying harder to bridge the gap between academia and industry

Technologies

Christian Schlette

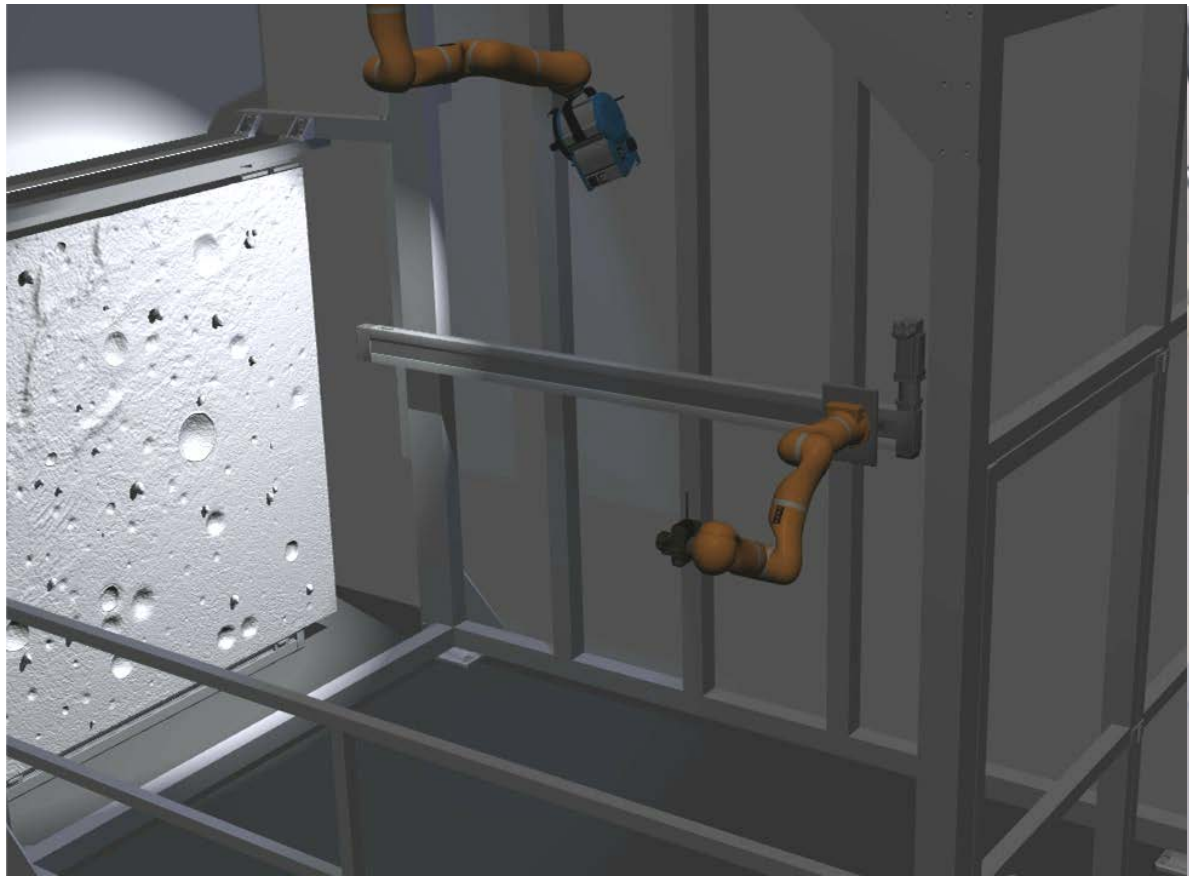
System components

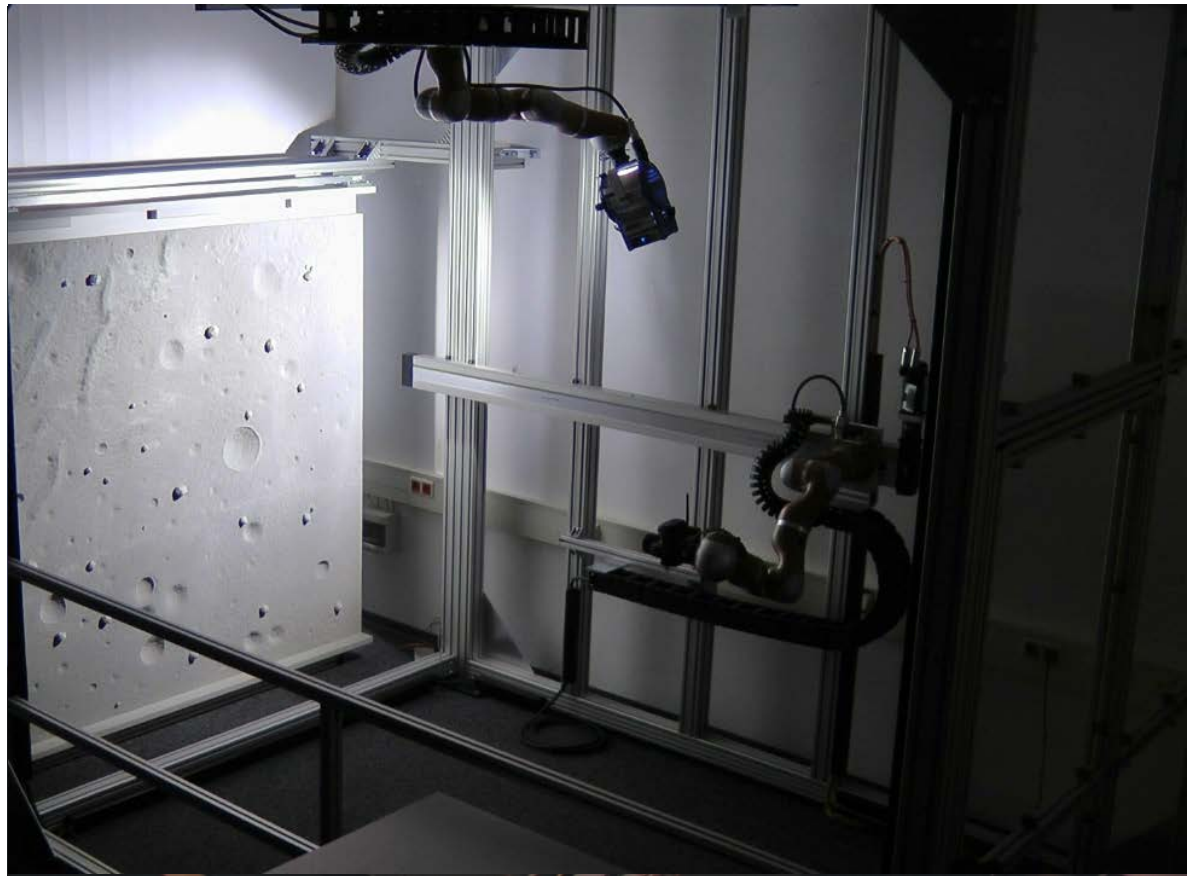
Robot simulation, monitoring and control



Simulation-based system development

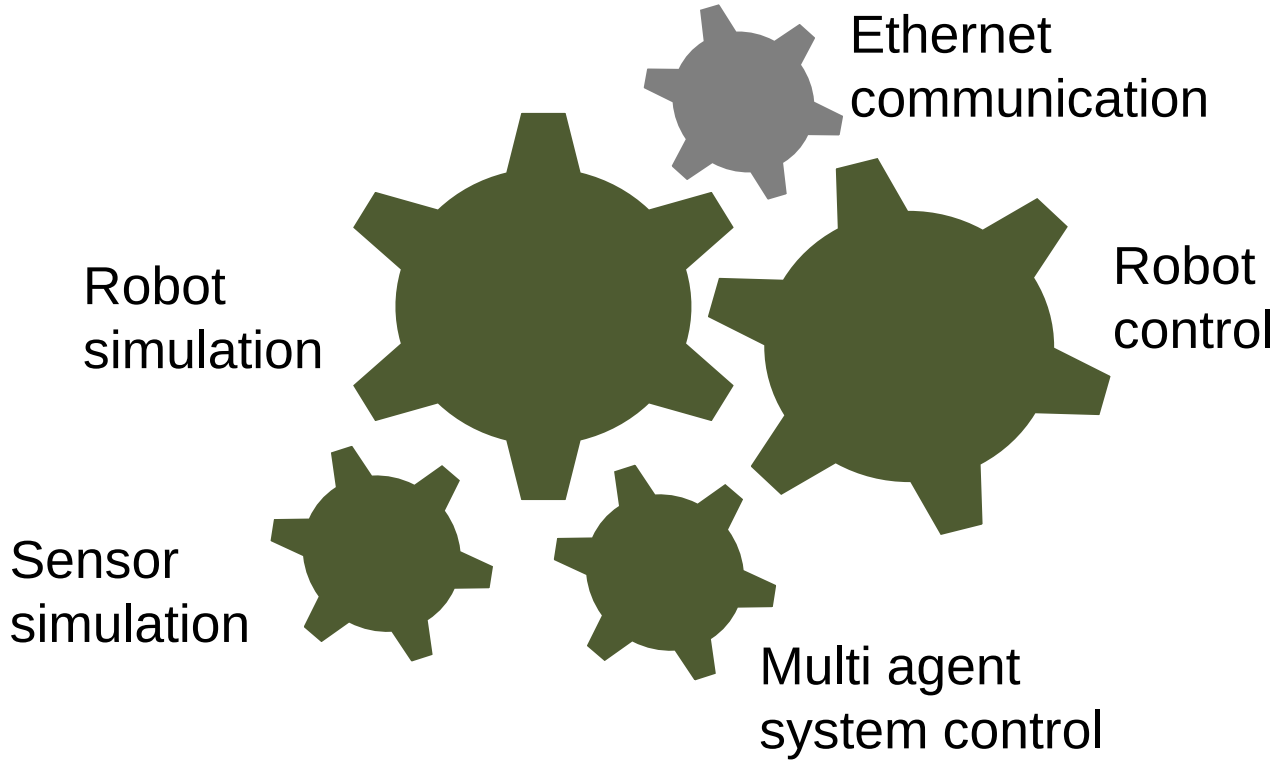
Mockup for optimization of approach trajectories for DLR





System components

…plus sensor simulation and MAS control

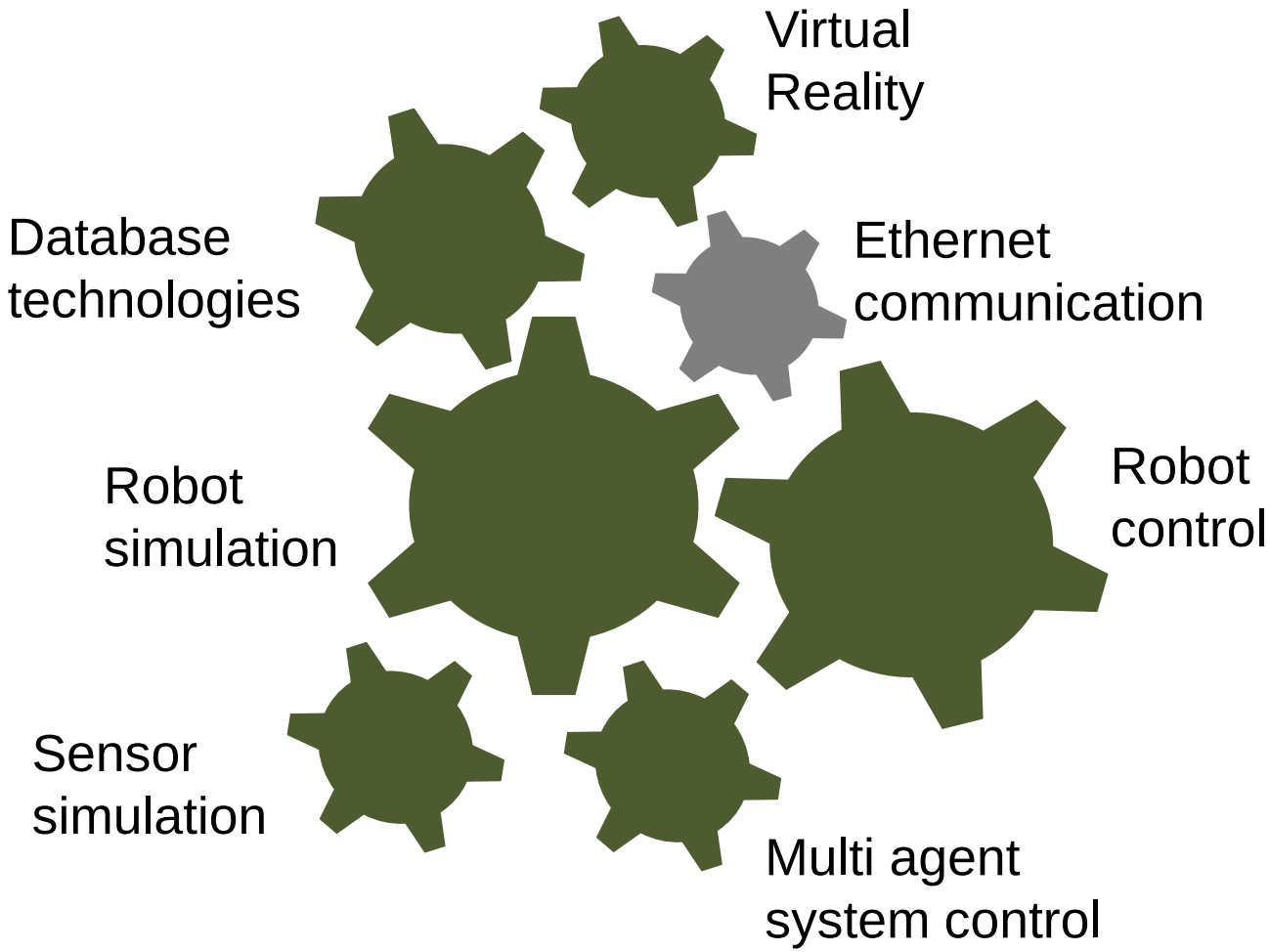


Simulation-based system development

R&D and operator training for the state of North-Rhine Westfalia (NRW)

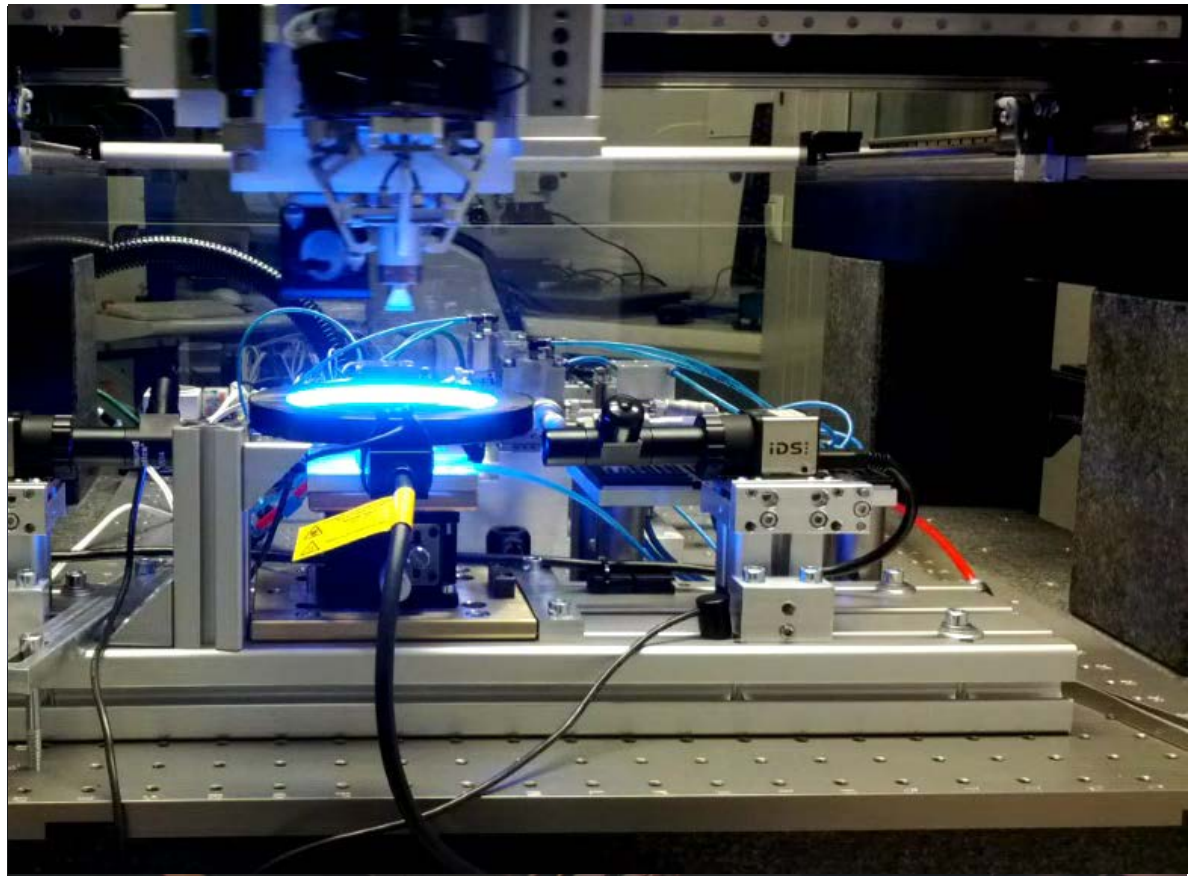
System components

DB technologies and VR to pull in, manage and visualize large environments



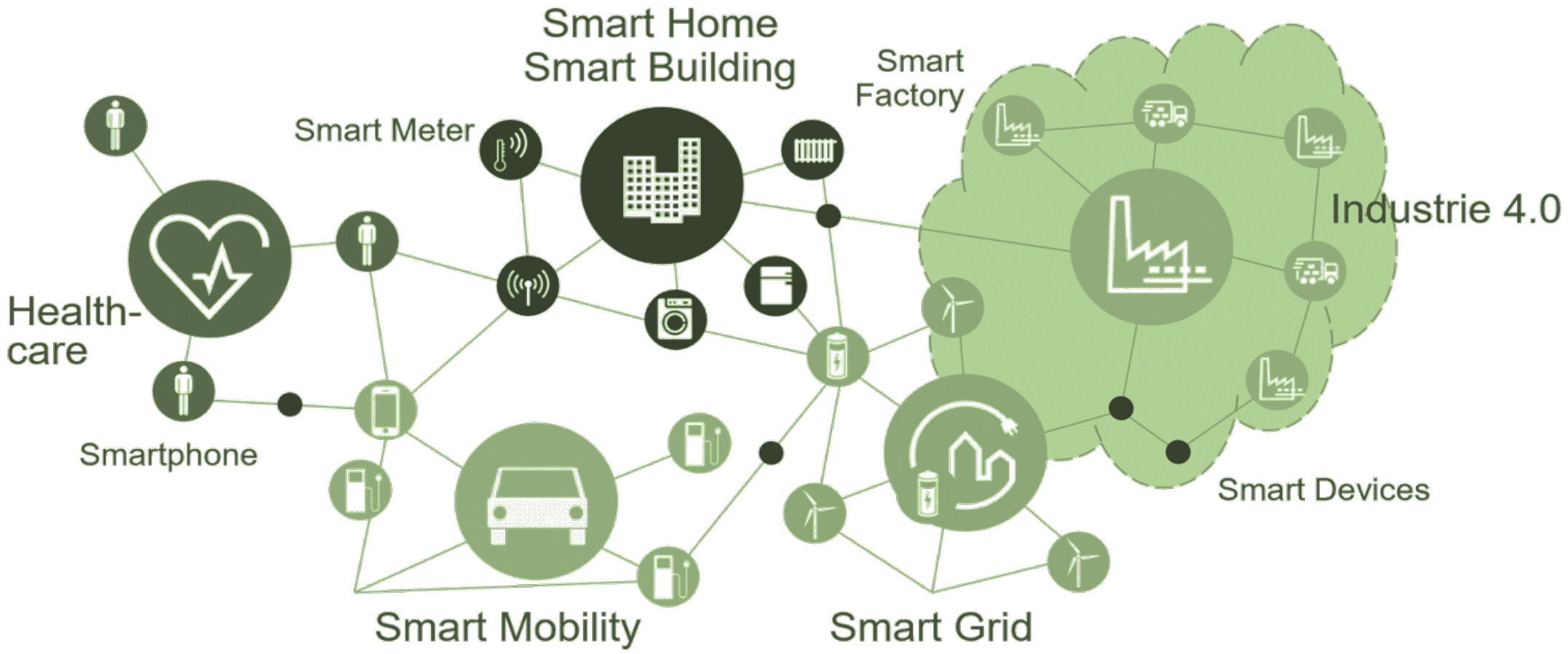
Simulation-based system development

Virtual commissioning for micro-optical assembly stations



Smart Production in context

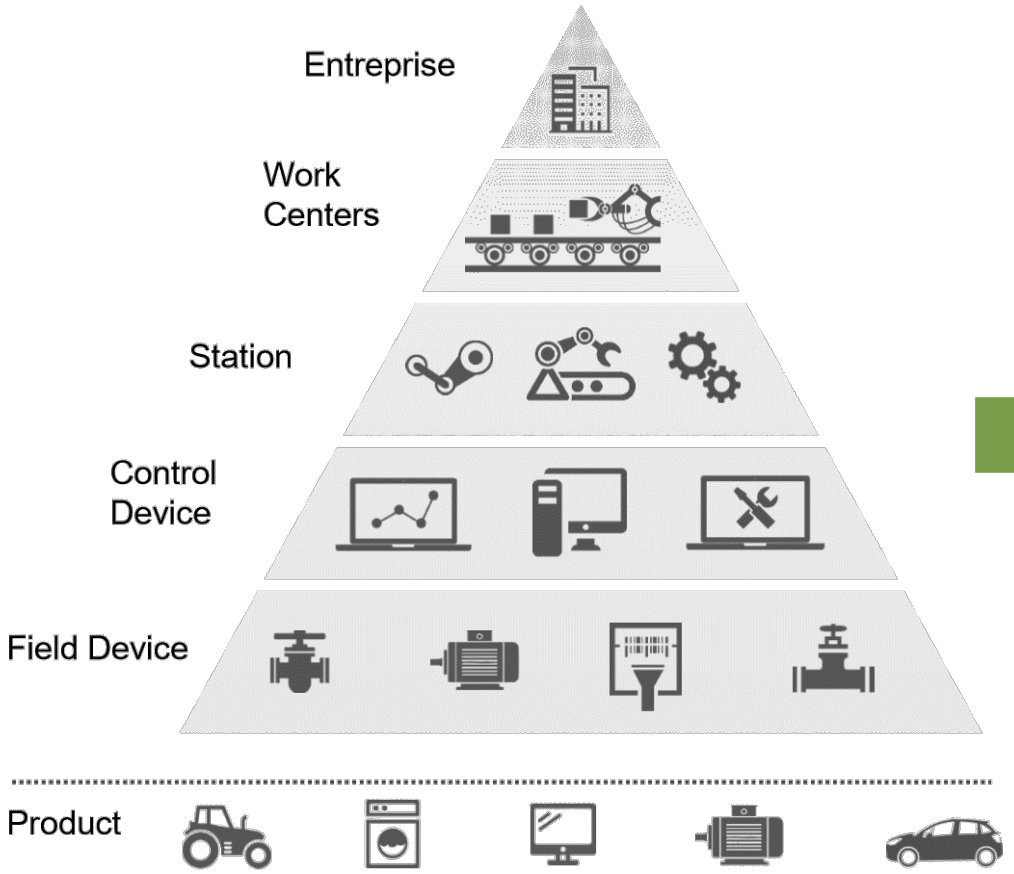
IoT shapes “Smart X”

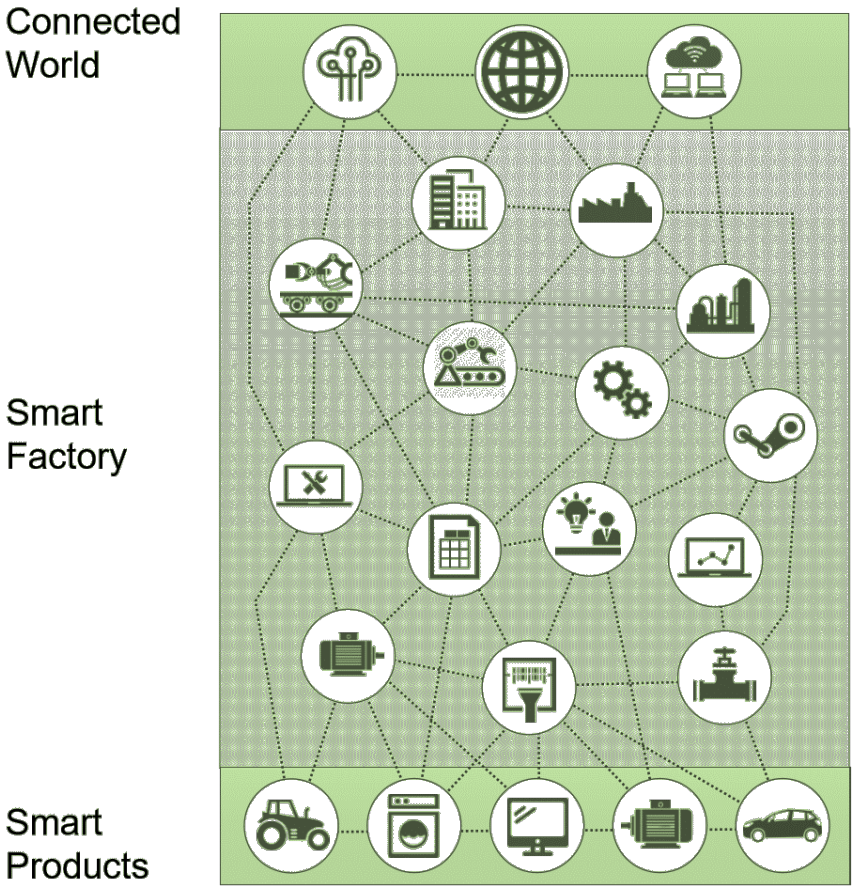


Source: Bosch Rexroth 2016

Breaking existing hierarchies

Smart Production redefines horizontal and vertical integration schemes

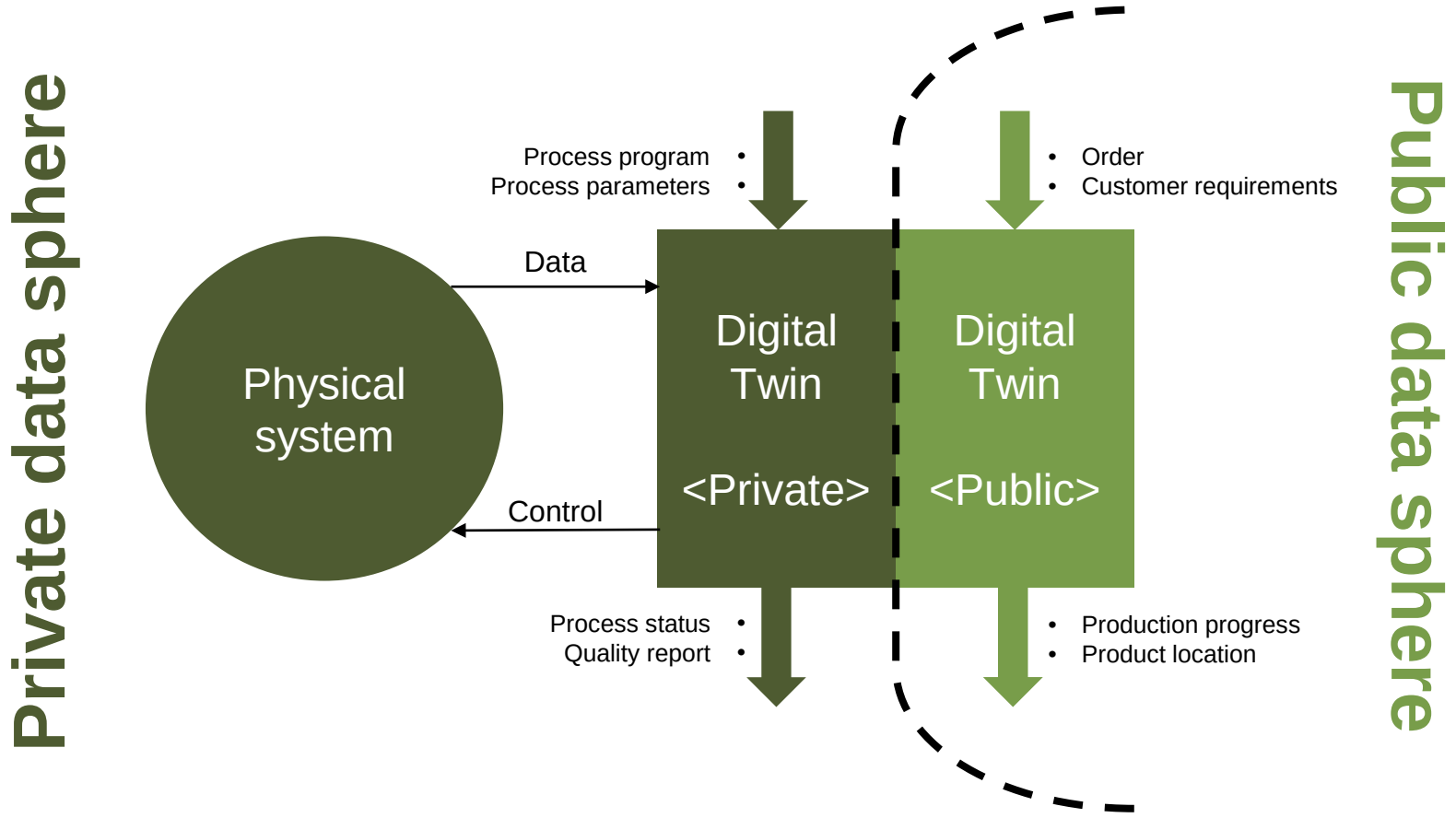




Source: Plattform Industrie 4.0 2016

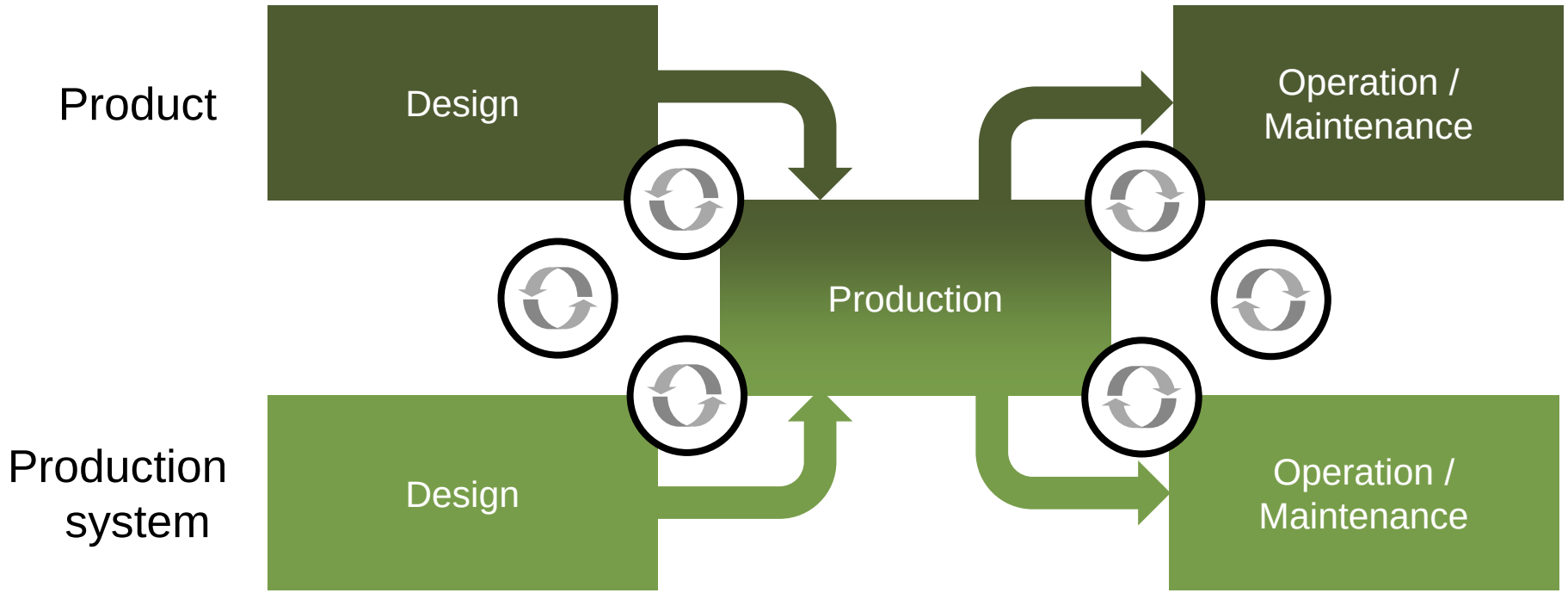
Data-oriented view on digital twins

aka “Administrative shell”



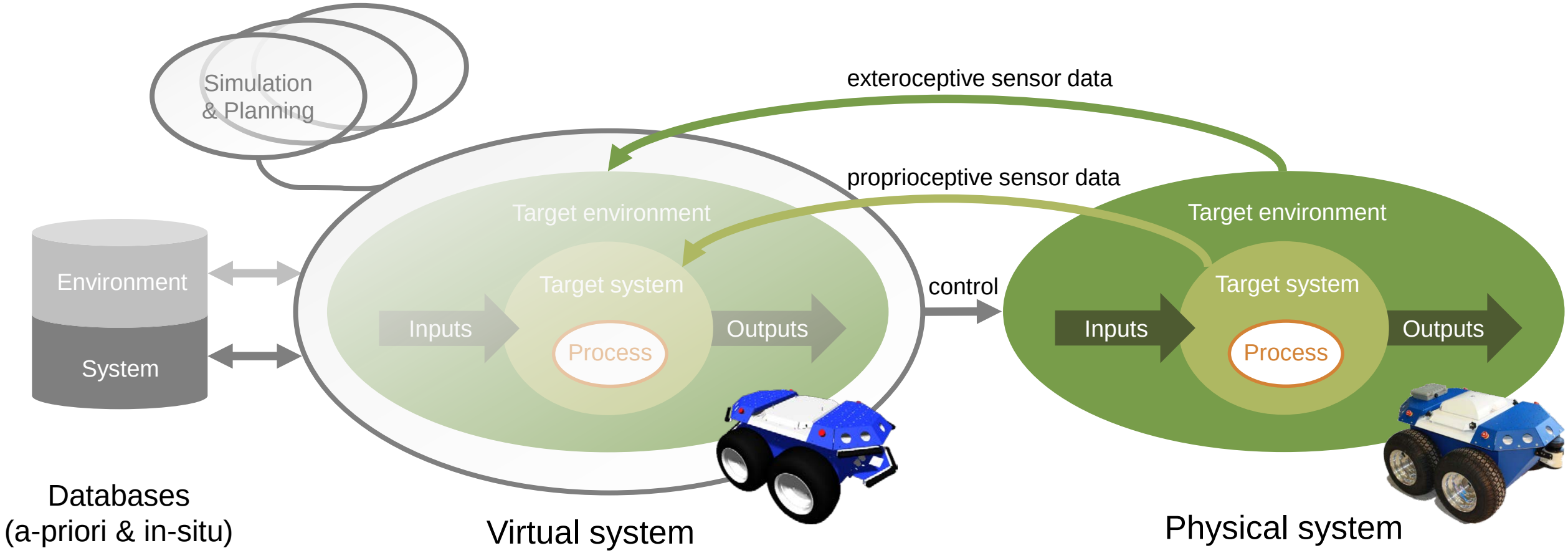
Production-oriented view on digital twins

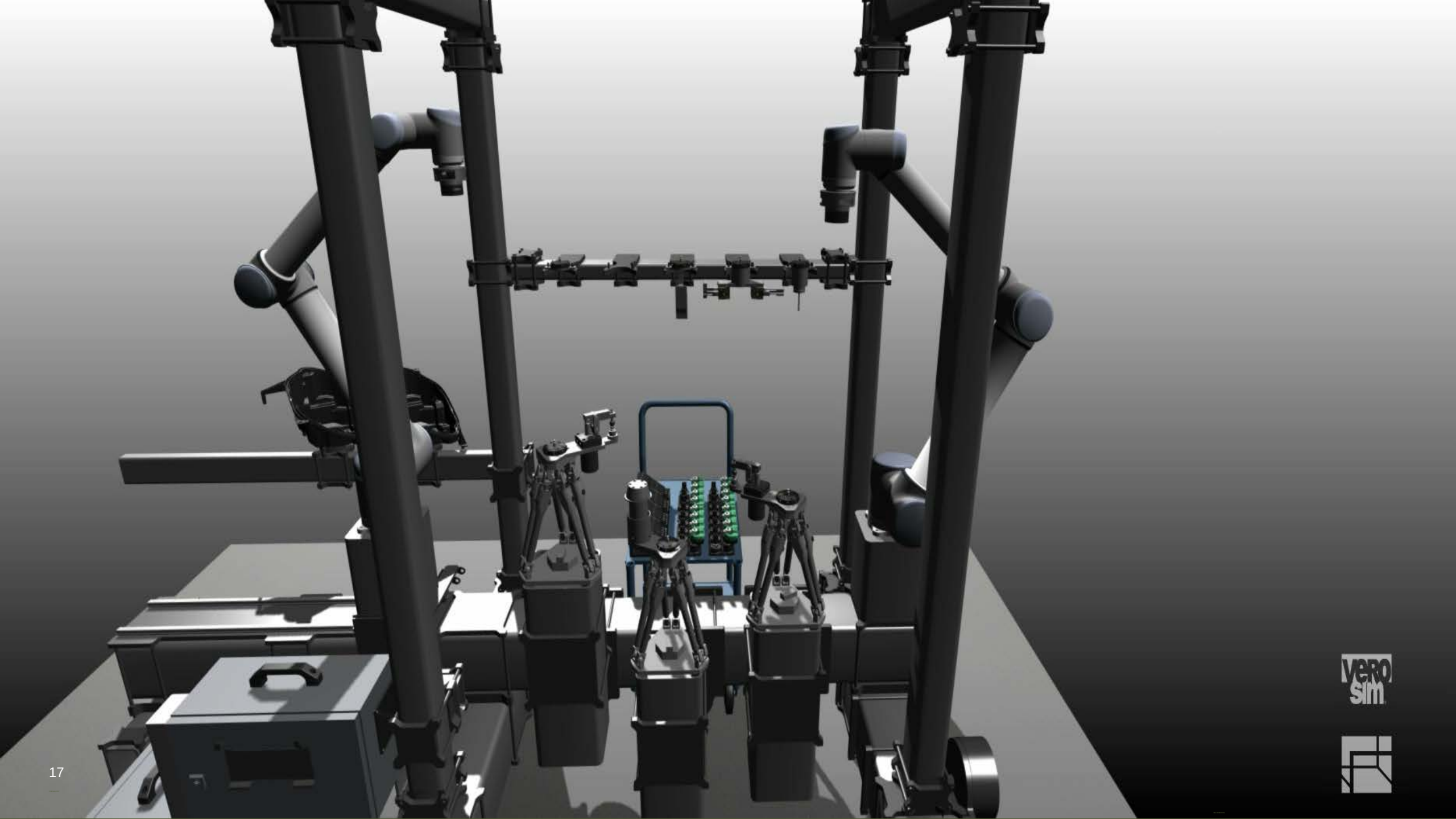
Optimization potentials based on digital twins

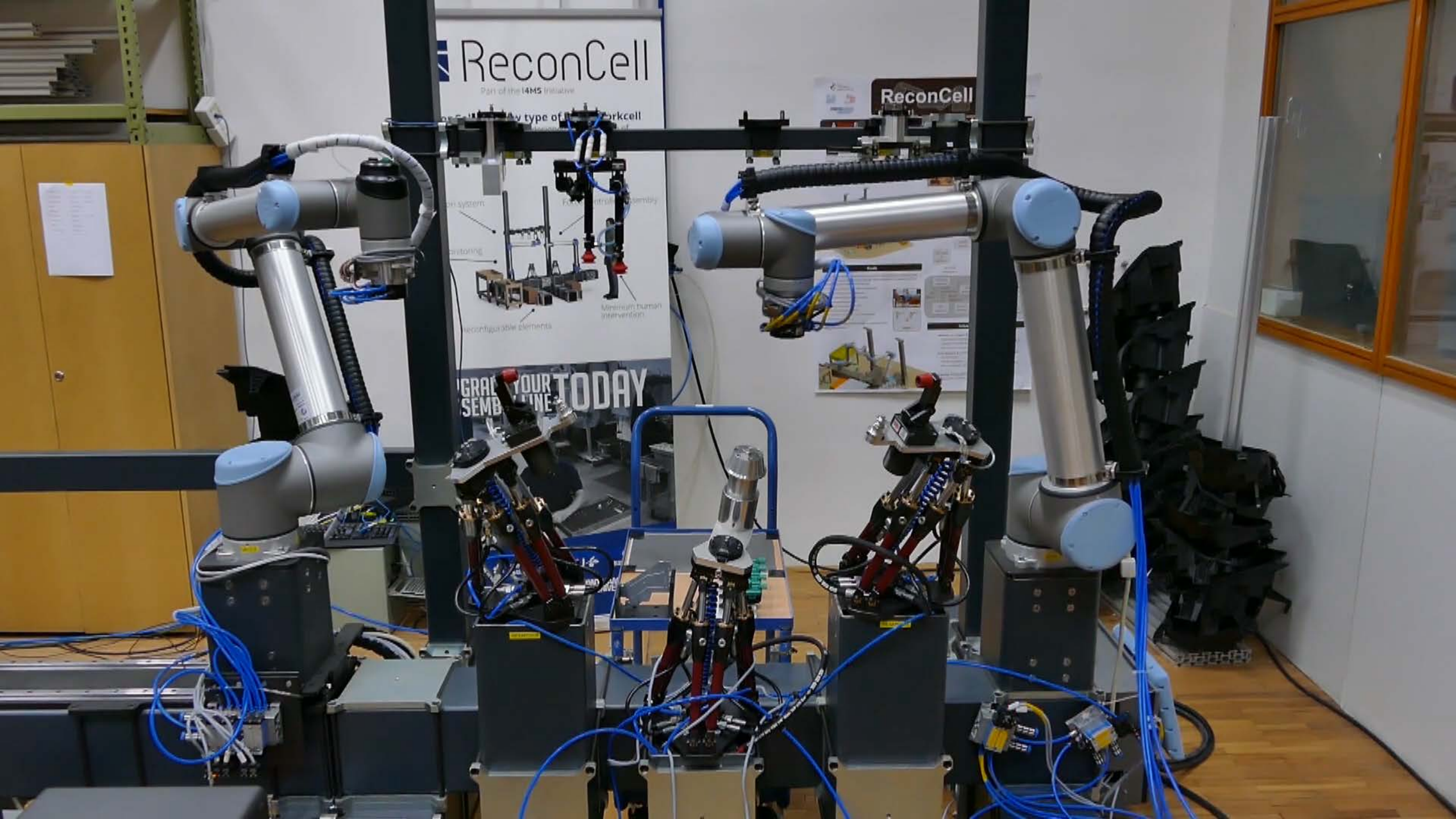


System-oriented view on digital twins

resp. digital twins in robotics

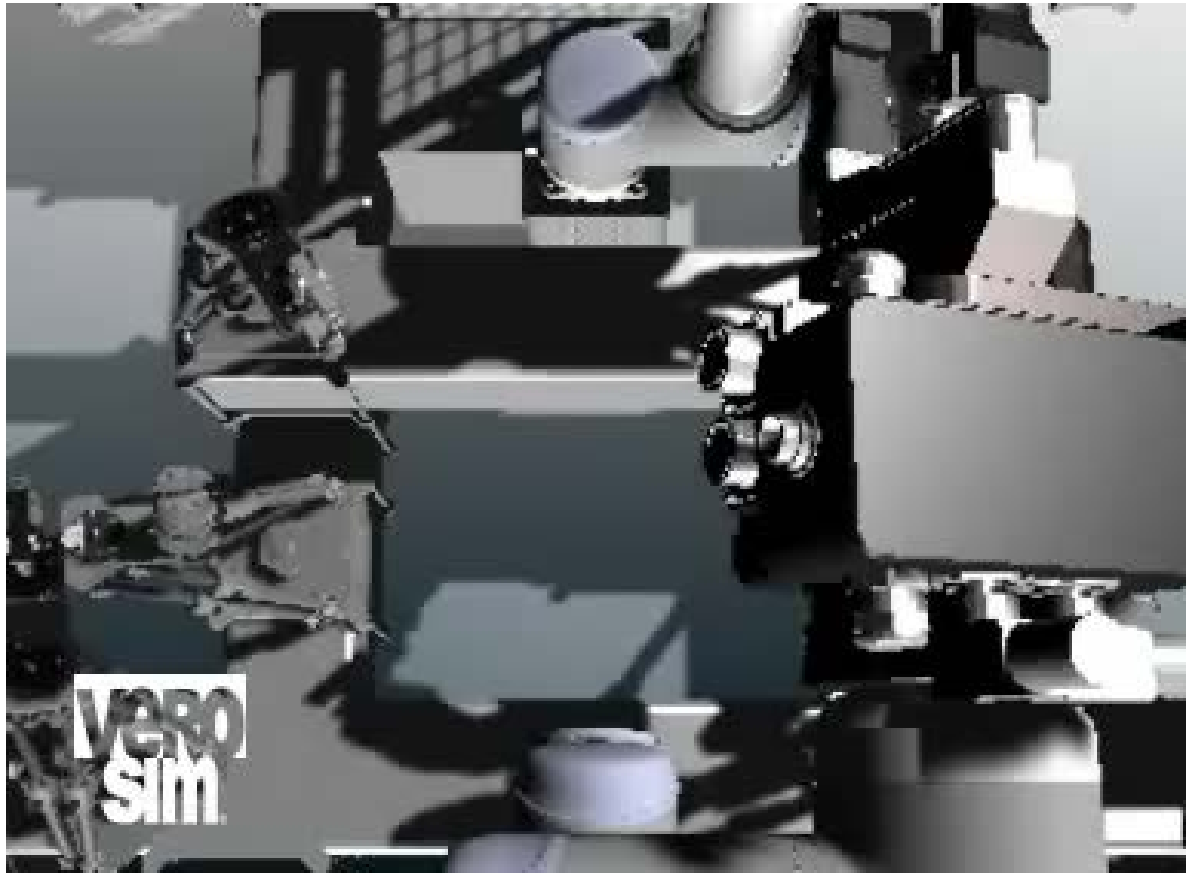


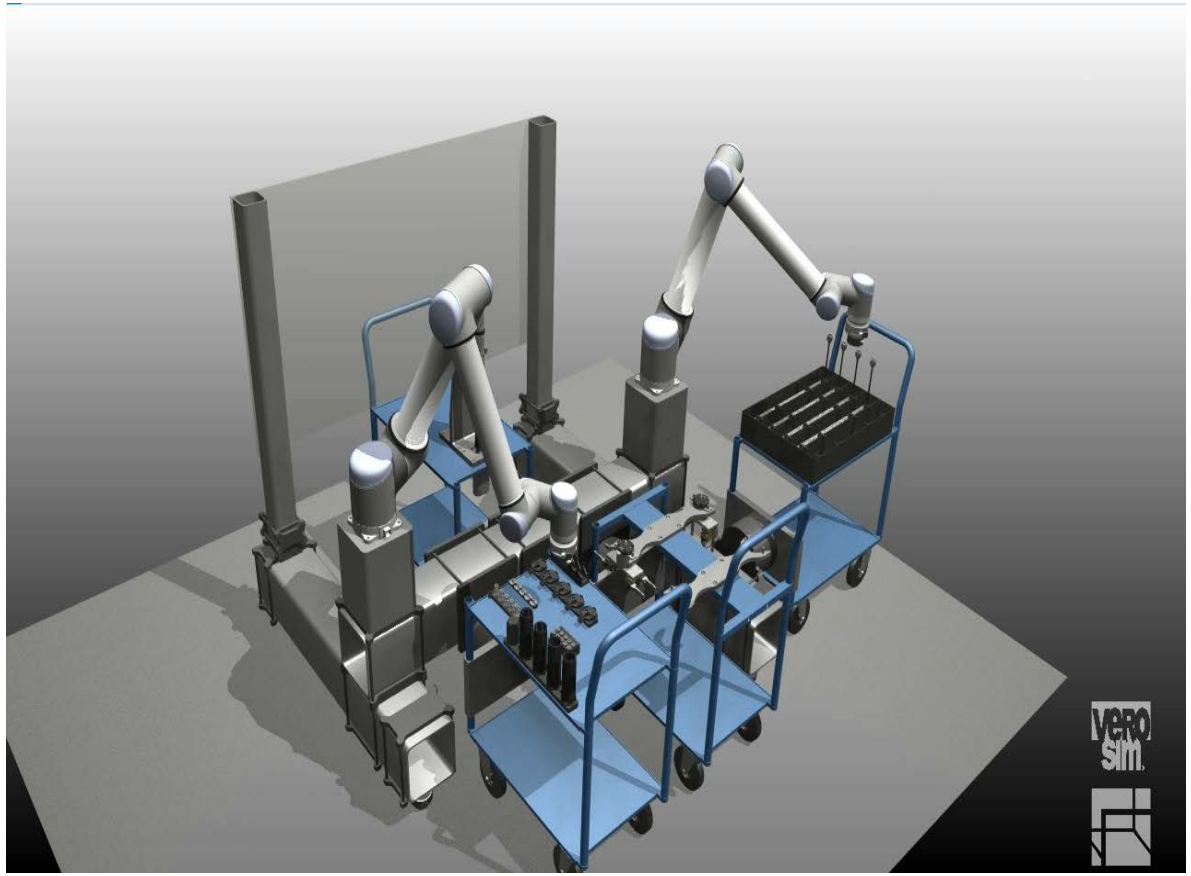


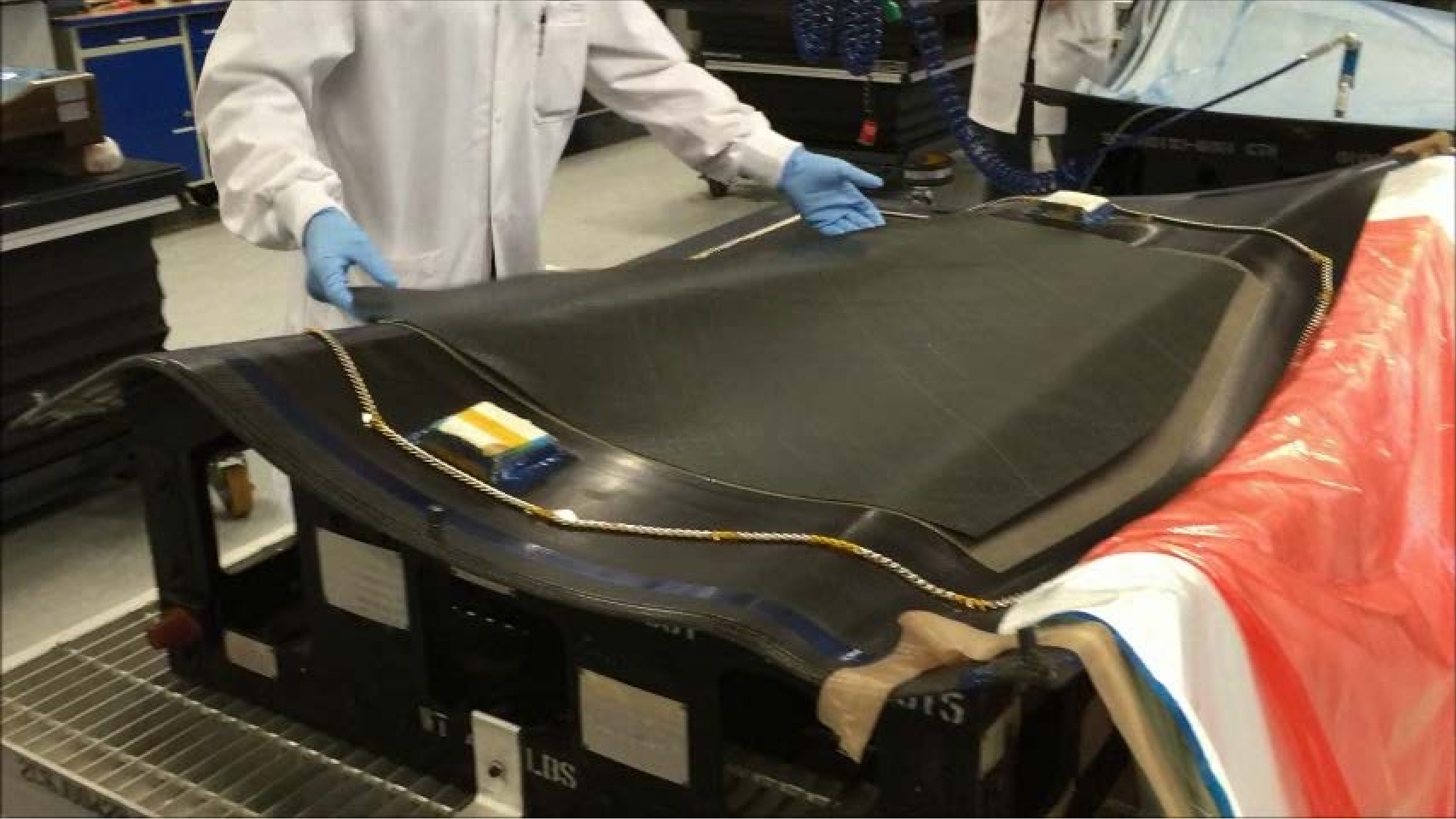

ReconCell
Part of the I4MS Initiative
ReconCell
TODAY

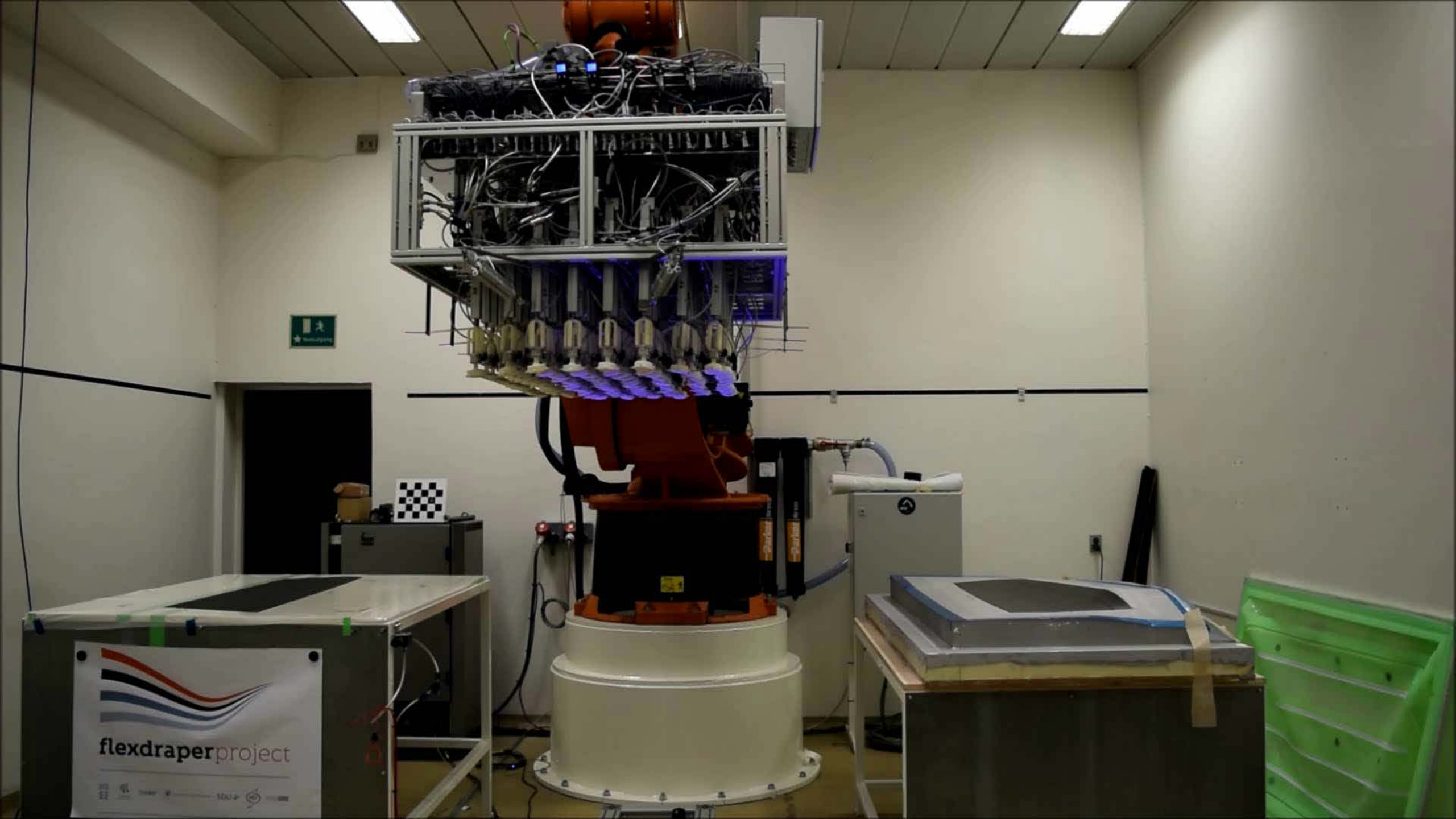
Optimization of equipment poses

e.g. camera and robot positioning in ReconCell



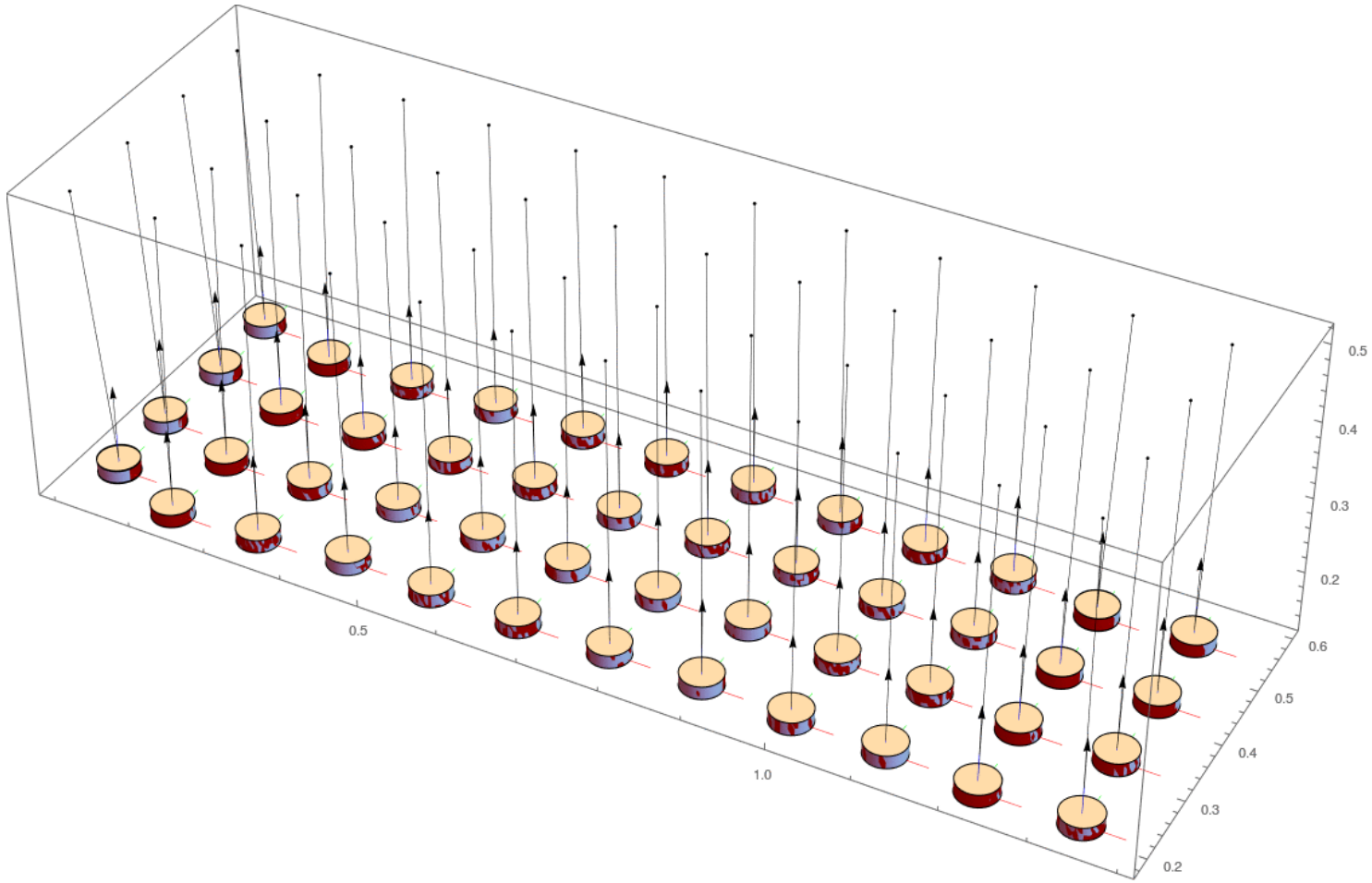





flexdraperproject

Optimization of layup strategies

Piston motion patterns in FlexCell



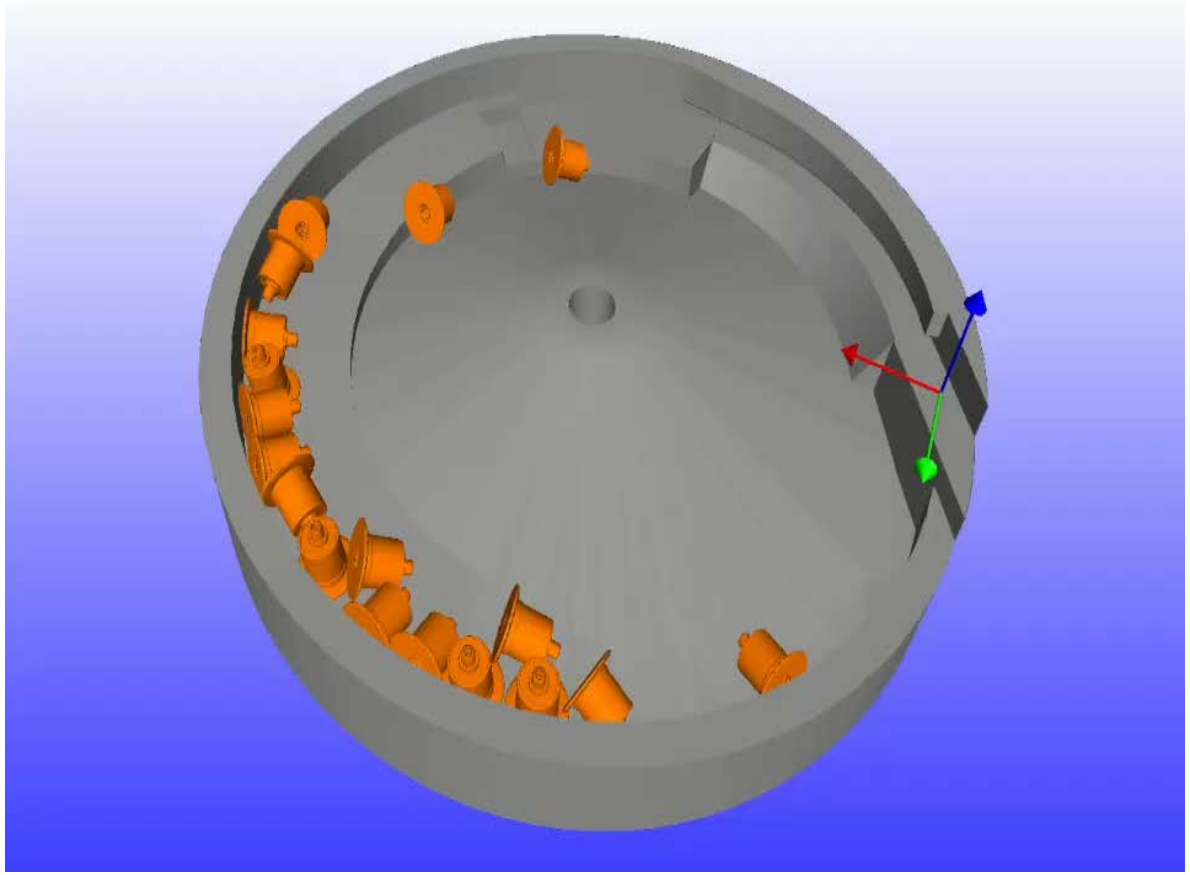
SDU ROBOTICS

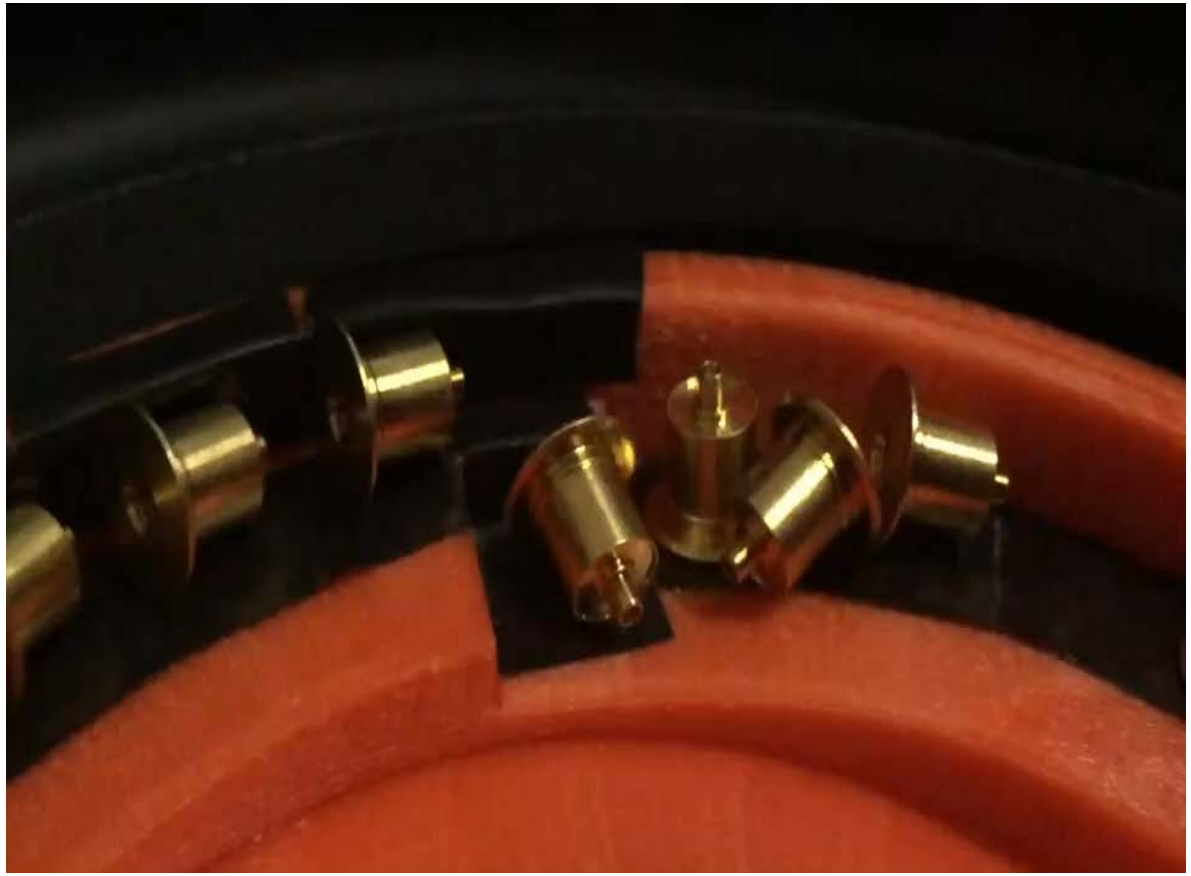
Details on our approach in FlexCell

Ole W. Nielsen, Christian Schlette and Henrik G. Petersen:
Fast and Simple Model for Free Hanging, Pre-impregnated Carbon Fibre Material
Proc. of the 15th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO), Vol. 1, pp. 7, 2018.

Simulation of other automated components

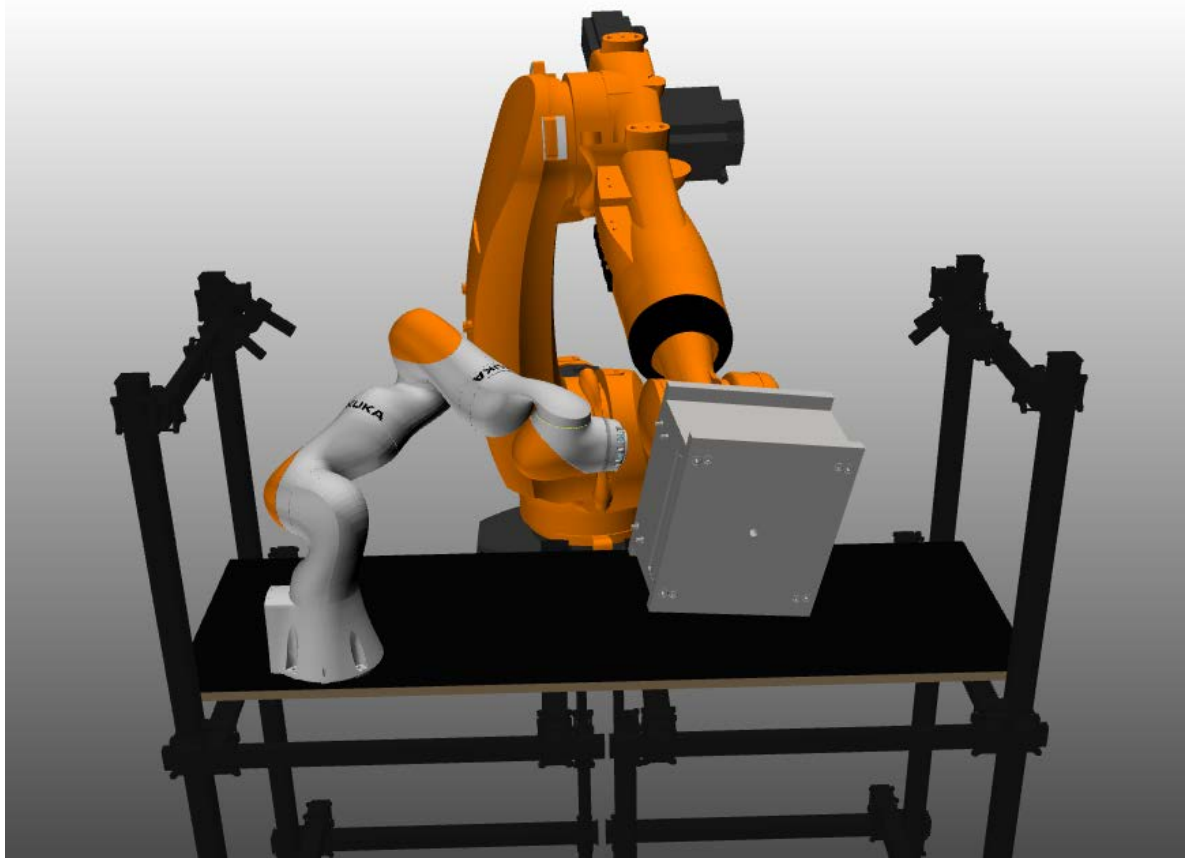
e.g. vibratory bowl feeders





NEW: Human-robot collaboration

e.g. assembly of injection molds for LEGO



Transfer, trust and agility

Christian Schlette

COMPANIES

ABB · AKL Robotics · Anmelo · Arm-Tec Division · AutomationLab · Automation Modules · BCR · bcm transtech as · Bekidan · Berger Neurorobotics · Bila · Bionic Systems Solutions · BIPA A/S · Blue Ocean Robotics · Blue Unit · Boelbjerg Maskinværksted · Bygkontrol · Cabinplant · Ceetec · Core Dynamics · CT Elteknik · Dana Technology · Danish Aerospace · DAN Robotics · Danish Technological Institute · Sabo · Effimat · Ega Matic ApS · Gatec · Elsement · eltraco automation · Enabled Robotics · Fanuc · FarmDroid ApS · FGM A/S · Frontmatec · GEA · GEA · Gibotech · Glunz & Jensen · Hannemann Engineering · HOW · Hydac · ideal-line · inrotech · intego · Invenstar Assembly · Inwatec · JM Engineering A/S · Jørgensen · KEN Hygiene Systems · Kjærgaard · KK-Tech · Kobots · KUBO · KUKA · Laptics Ivs · Lead Robotics ApS · Leica Geosystems · LWT · Lorenz Technology · Lyholm Electric · Martiny Automation · Maskinfabrikken Birlø-Ja · Maskinfabrikken SKN · Maskinsikkerhed · MEL Coo · Micro Technic · MiR · MA Mollerup Automation · MRN roboStacker · Multi Tower · Murr Elektronik · New Icon · Newtec · Nidec – All for dreams · Nord Modules · Nordbo · Odico · on robot · PFCON ApS · PJD Automation – Industriel IT · Polund · Produktionsteknik · Prodena Century · purple robotics · QRS Quality Robot Systems · QuadSAT · Robnor · Robobend · robeman · Robot At Work · Robot Nordic · RobotSort ApS · RobotDoktoren · RV · Sanovo Technology Group · Scan Convert A/S · Scancomp Sensor and Automation · ScanStore · scanvaegt systems · Scape technologies · Life is On Schneider Electric · Schunk · senmatic · sensohive · SG-Tech · SICK Sensor Intelligence. · Skako · Smooth Robotics · DDD Syd Dynamics · Take On Robotics · TEK Projekt · tendo – for people, not symptoms · trendlog.io · TRIVISION Machine Vision – Made Easy · Universal Robots · UVD Robots Infection Prevention · Valcon · Valk Welding · Viggo Hansen A/S · Viking · Viking Software · WallMo · Wamatech · X-drive Robots ApS · Ztove

CLUSTERS AND PARTNERS

CARENET · Dansk Metal · DIRA Danish Robot Network · IDA · Odense Health Innovation & Business · Internationalt RoboCluster · Syddansk Forskerpark · UAS Denmark · WelfareTech · Work in Denmark · South Denmark European Office

PUBLIC SECTOR AND BUSINESS SUPPORT PROVIDERS

Assens Kommune · Developing Fyn · Faaborg-Midtfyn Kommune · Invest in Odense · Nyborg Kommune · Odense Kommune · Region of Southern Denmark · Svendborg Kommune · Væksthus Sydjylland

ODENSE ROBOTICS

FRONTIER FOR ROBOTIC TECHNOLOGIES

POWERED BY DEVELOPING FYN

FINANCING

ScienceVentures · Syddansk Innovation · Vækstfonden · Borean Innovation

ODENSE SEED AND VENTURE

Public Funding	Family Offices	Venture Funding
Crowd Investors	Business Angels (100+)	Loan and Bank Financing

110+ mill. Euros invested in 2016/2017

EDUCATION

SDU University of Southern Denmark

BEng
- Electrical Power Engineering
- Electronics and Computer Engineering
- Global Management and Manufacturing
- Integrated Design
- Manufacturing Engineering and Management
- Mechanical Engineering
- Mechatronics
- Robot Systems
- Software Technology

MSc
- Applied mathematics
- Computer science
- Electronics
- Energy Technology
- Engineering Robot Systems (Advanced Robotics Technology and Drone Technology)
- Information Technology - Product Design
- Learning and Experience Technology
- Mathematics
- Mechanical
- Mechatronics
- Operations Management
- Physics and Technology
- Product Development and Innovation
- Software Engineering
- Welfare Technology

Lillebælt Academy

Academy Profession AP
- Automation Technology
- Computer Science
- IT Technology
- Multimedia Design and Communication
- Production Engineer

Bachelor BA
- E-Concept Development
- PBA Software Development
- Product Development and Technology Integration
- Web Development

Continuing Education
- Academic Education
- Diploma

Syddansk Erhvervsskole

Electricity Automation and IT
- Automatics Electrician
- Data Technician (+EUX)
- Electrician (+EUX)

Metal, Industry and Technology
- Automation Technician (+EUX)
- Industrial Operator
- Industrial Technician (+EUX)
- Sheet Metal Worker (+EUX)
- Technical Designer

SIMAC

Bachelor
- Marine Engineer

OTHERS

University College Lillebælt · Odense Tekniske Gymnasium

RESEARCH, DEVELOPMENT AND INNOVATION

Danish Technological Institute

Disciplines
- Advanced robots
- Co-working robots
- Sensors and robots
- Mobile robots
- Drones (UAS)
- Personal care robots
- Industry 4.0 and data
- Augmented reality
- Artificial intelligence
- Safety

Activities
- Implementation of solutions
- Dissemination, training and education
- Analysis and consultancy

SDU University of Southern Denmark

Faculty of Engineering

TEK Innovation

The Mads Clausen Institute
- SDU Mechatronics
- SDU Innovation and Design Engineering

The Maersk Mc-Kinny Møller Institute
- SDU Robotics
- SDU UAS Centre
- SDU Software Engineering
- SDU Electrical Engineering
- SDU Embodied Systems for Robotics and Learning
- SDU Health Informatics and Technology
- SDU Energy Informatics

Department of Technology and Innovation
- SDU Mechanical Engineering
- SDU Engineering Operations Management

Faculty of Science
- Department of Mathematics and Computer Science (IMADA)

Faculty of Health Sciences
- Department of Sports Science and Clinical Biomechanics
- Department of Clinical Research
- Department of Public Health

SDU Research & Innovation Organisation (RIO)

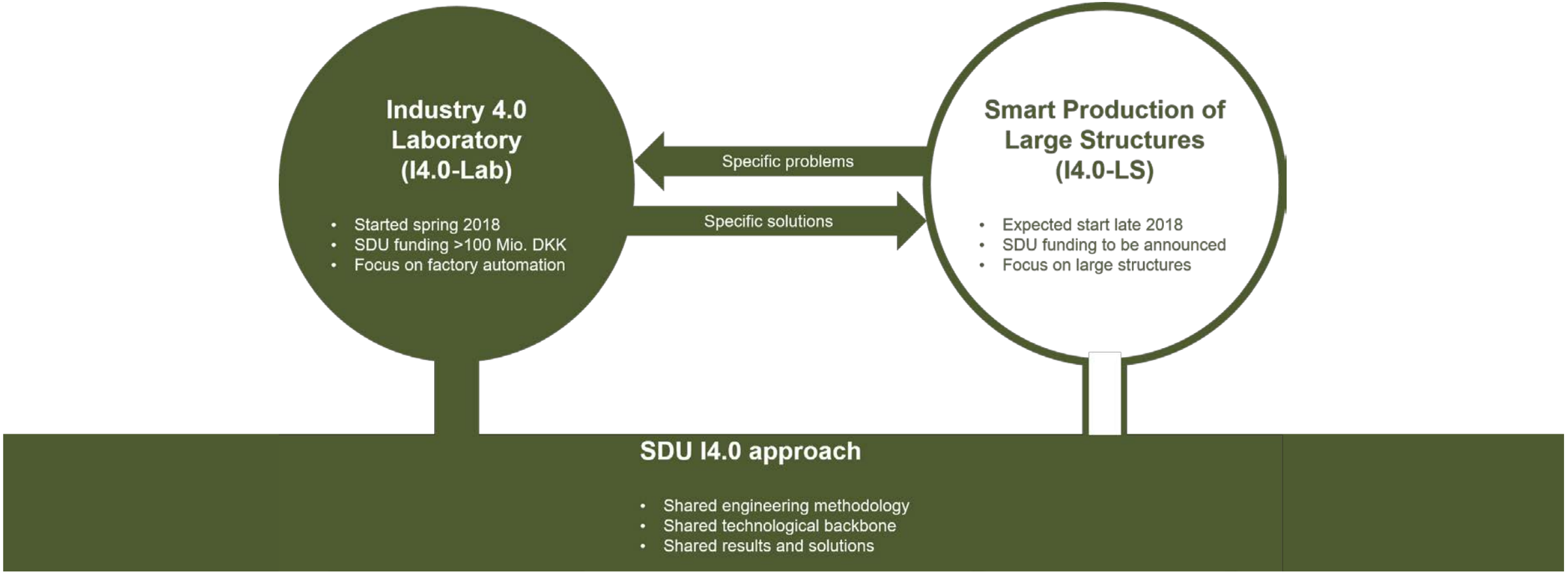
Lillebælt Academy
- Knowledge Center for Automation and Robotic Technology
- Knowledge Center for Health and Welfare Technology

Syddansk Erhvervsskole
- Knowledge Center for Automation and Robotic Technology

OUH Odense University Hospital

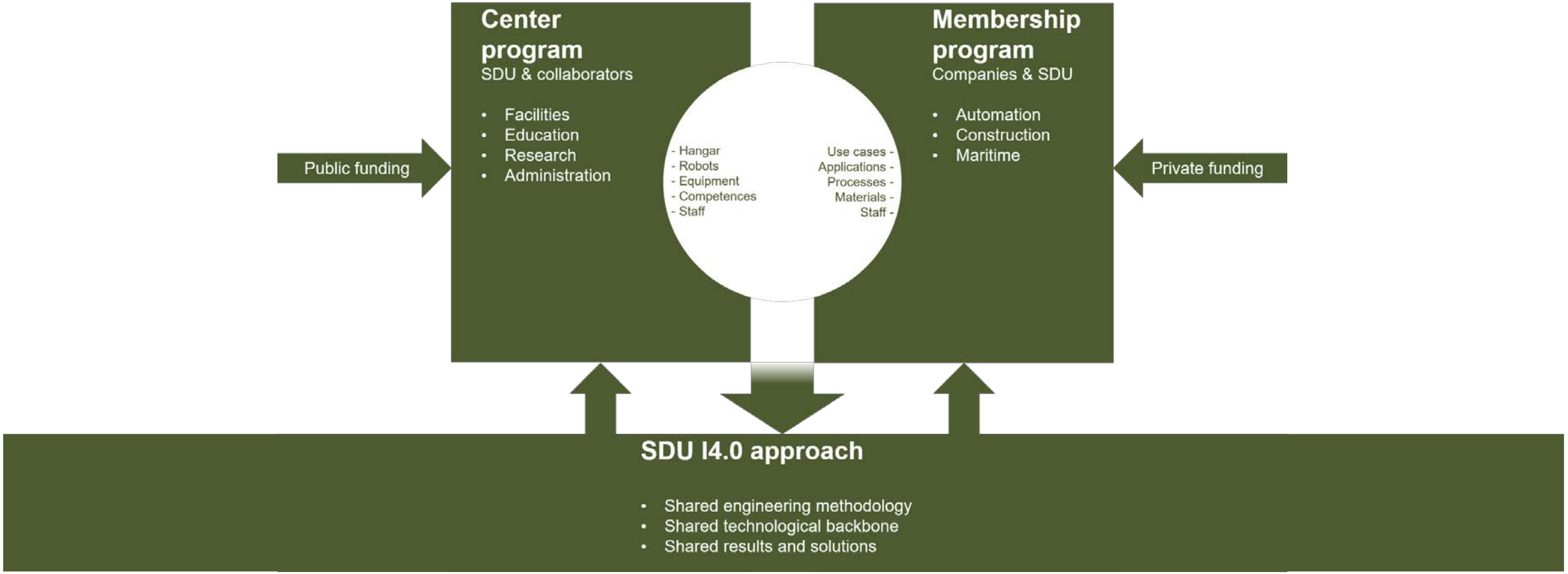
I4.0-Lab and I4.0-LS

Our complementary I4.0 initiatives for different audiences



I4.0-Lab and I4.0-LS

Our initiative to start a “reactor” with companies



We need to improve - trust and agility

- Realistic results and outcomes
- Continuous, reliable partnerships
- Rapid and robust developments
- Clear IPR management
- Clear administrative processes
- Short response times

Thank your for your attention

Christian Schlette
Associate Professor

SDU ROBOTICS
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University of Southern Denmark (SDU)

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