Welcome!

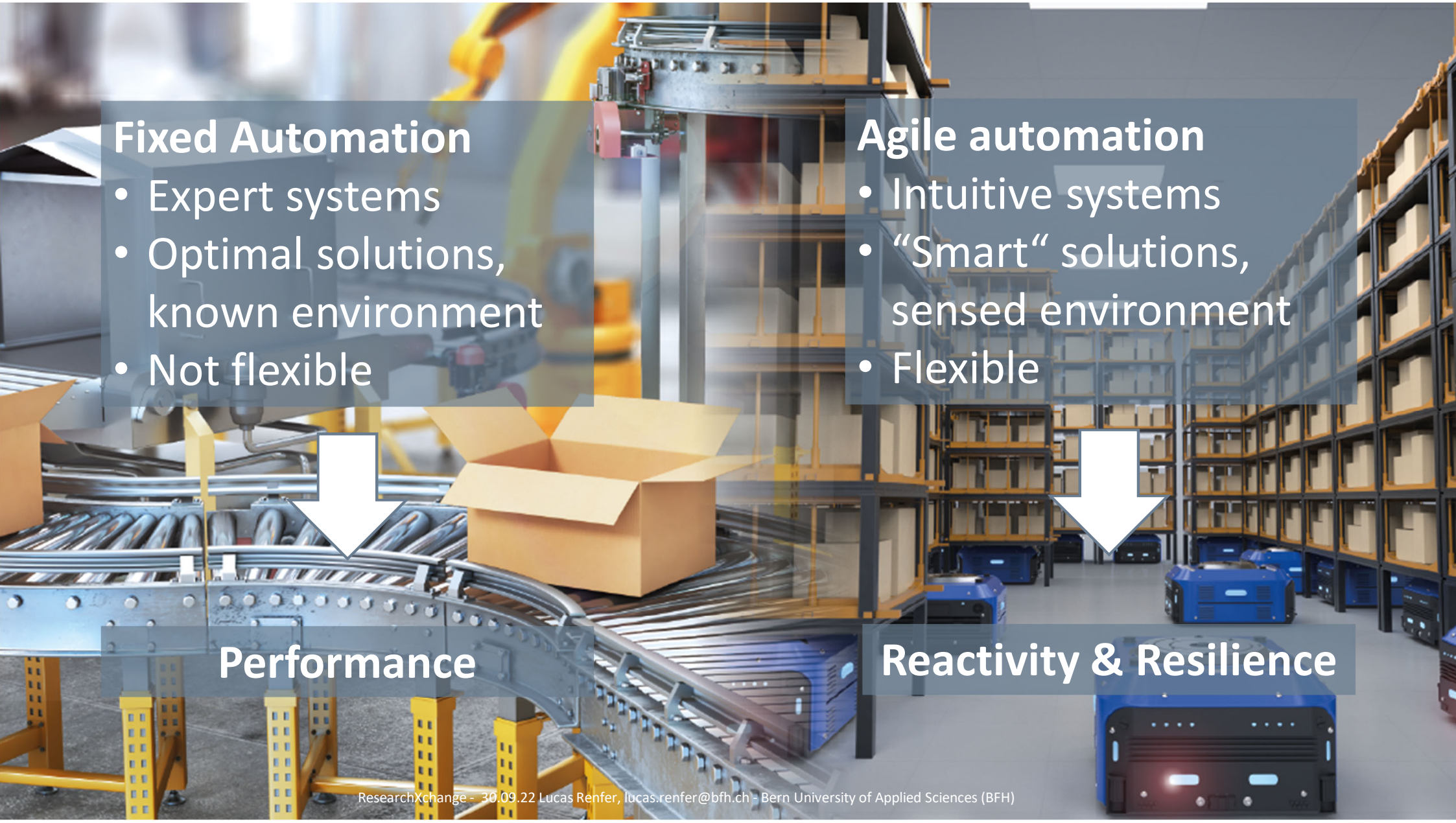
Profitable Automation for High-Mix Small-Volume Production

Lucas Renfer, Scientific assistant, HuCE

STAYING AGILE IN THE INDUSTRY 4.0

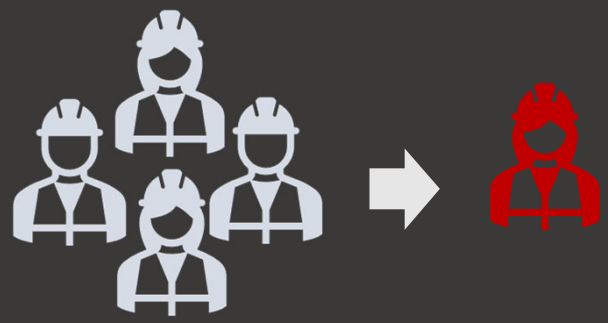
A robot system must be **easily adaptable to changes** in products or processes **without the need to rely on extensively trained employees** in order to be profitable for **small production batches and customized products**.

euRobotics Multi-Annual Roadmap, 2016


Fixed Automation
• Expert systems
• Optimal solutions, known environment
• Not flexible
Agile automation
• Intuitive systems
• “Smart“ solutions, sensed environment
• Flexible
Performance
Reactivity & Resilience

INTERNATIONAL COMPETITION

RECRUITING



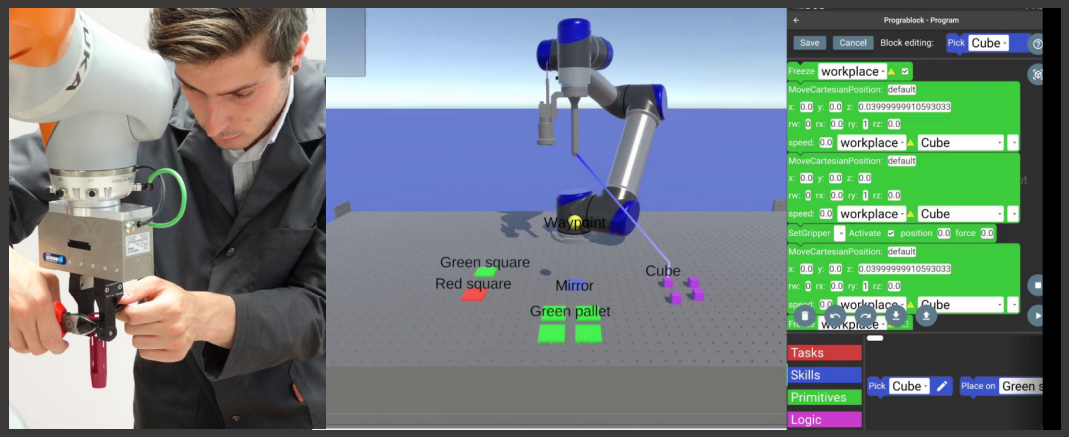
FULL AUTOMATION

FOCUS ON PERFORMANCE

TOO EXPENSIVE FOR LOW VOLUMES!

AGILE AUTOMATION

FOCUS ON FLEXIBILITY AND RESILIENCE,
BUT ALSO ON WORKER UPSKILLING

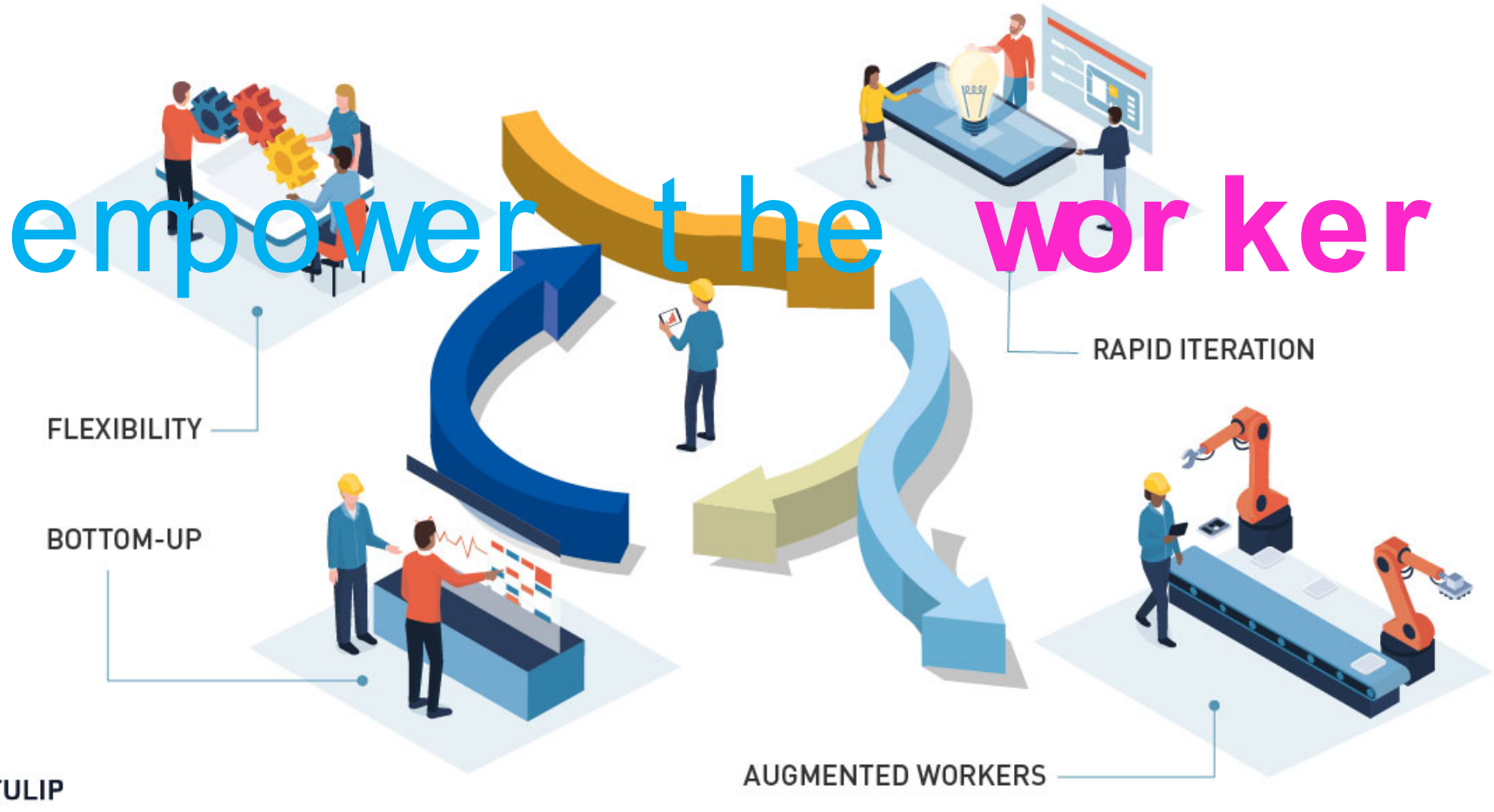


Collaborative robotics, an opportunity for the industry 4.0

WHY ARE COBOTS NOT AGILE ENOUGH?

- Online programming requires fixed environments and is limited to simple tasks
- Intuitive programming apps require a model of the workspace which is too time consuming/complex
- Sensor integration often requires expert knowledge and reduces reactivity/profitability

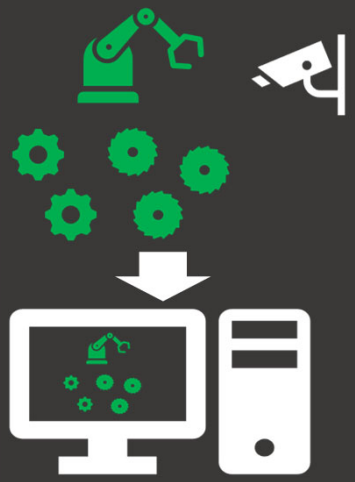
FUNDAMENTAL VALUES OF AGILE MANUFACTURING



INNOVATIONS IN ROBOTICS

FLEXIBLE ROBOTIC CELLS

WITH UNIVERSAL SOFTWARE
FOR ALL HARDWARE



DIGITAL TWIN

INNOVATIONS IN HUMAN MACHINE INTERFACE

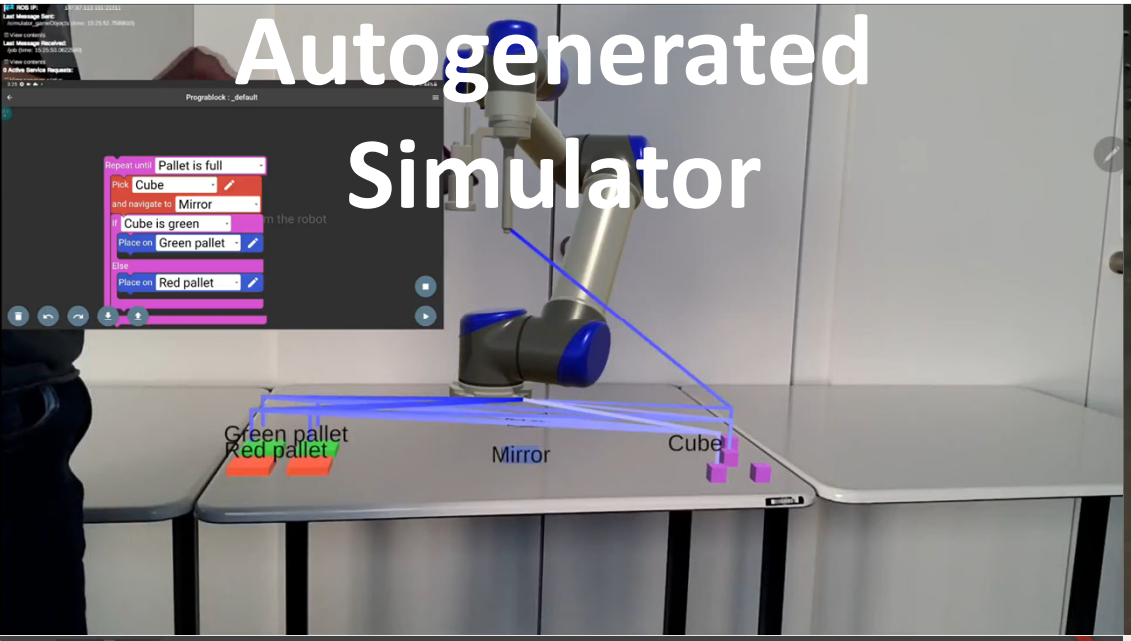
NO-CODE
INTERFACE

USER-CENTERED
DESIGN

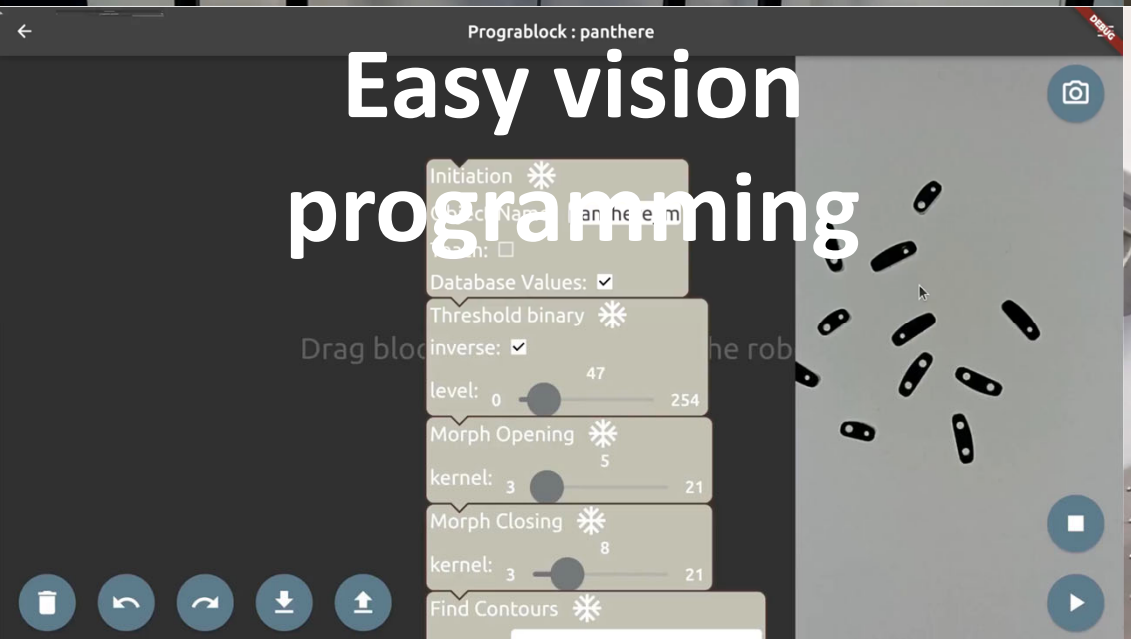
TUTORIALS

AUGMENTED
REALITY

SMART TOOLS

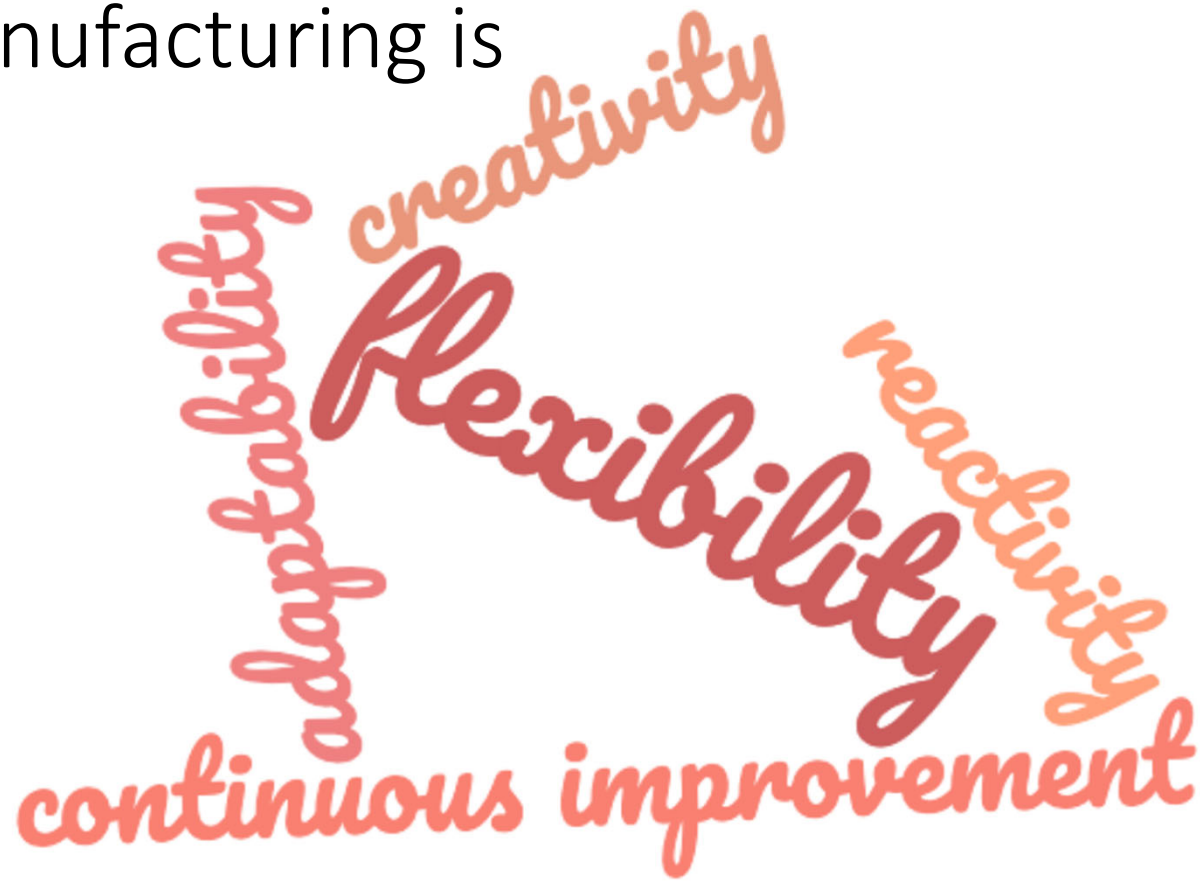

Autogenerated Simulator
Repeat until
Pallet is full
Pick
Cube
and navigate to
Mirror
If
Cube is green
Place on
Green pallet
Else
Place on
Red pallet
Green pallet
Red pallet
Mirror
Cube

Easy Trajectory
F
H


Prograblock : panthere
Easy vision programming
Initiation
Database Values:
Threshold binary
inverse:
level:
0
47
254
Morph Opening
kernel:
3
5
21
Morph Closing
kernel:
3
8
21
Find Contours

Workspace integration
asycube 240

Agile manufacturing is about …



… and that is exactly what humans are good at

One software
One Cell

Universal no-code
programming

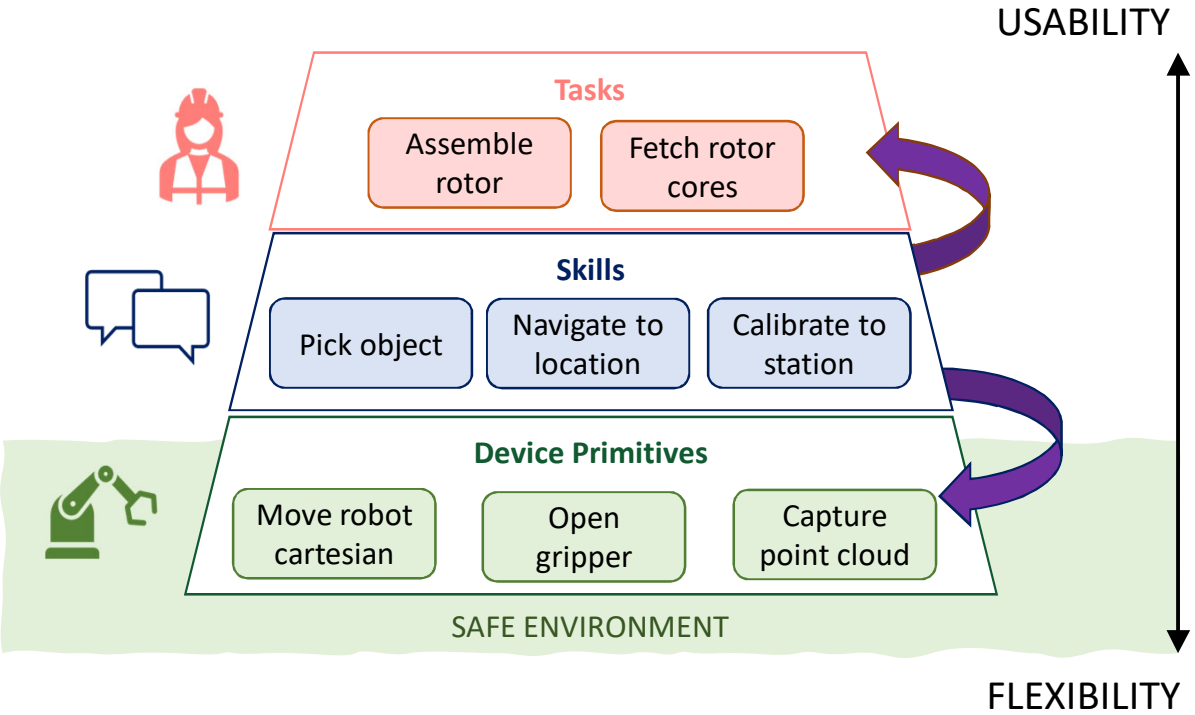
Visual simulation
Virtual - and Augmented Reality

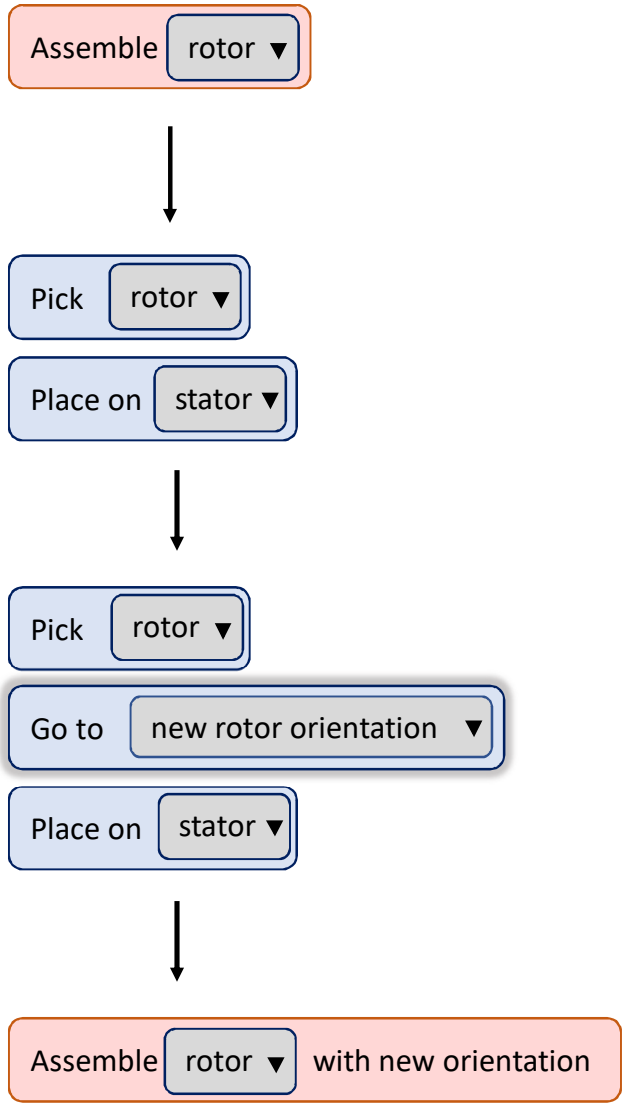
Tutorials
Smart Tools

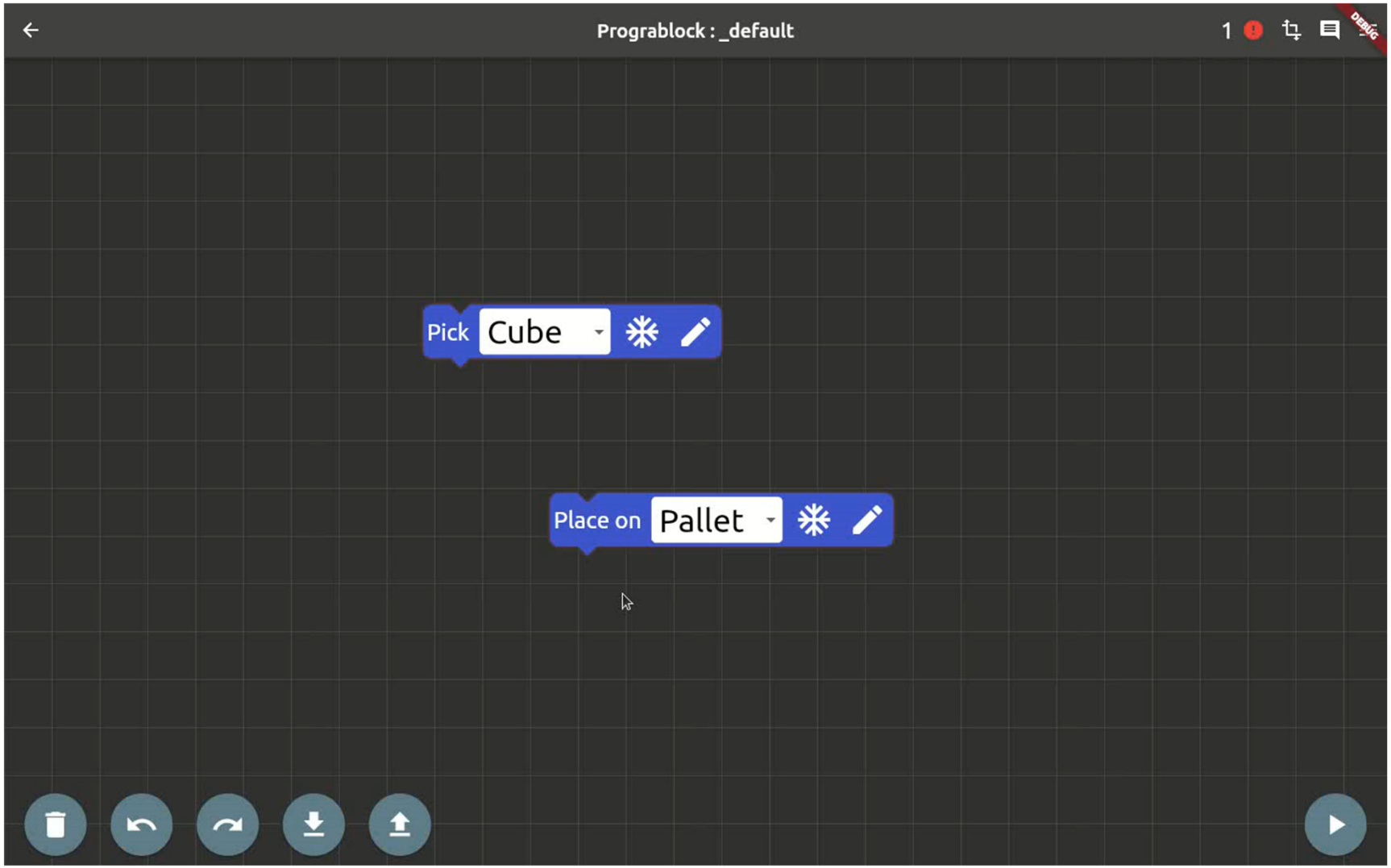
High mix, low volumes
(SME's)

Worker upskilling
for autonomous companies

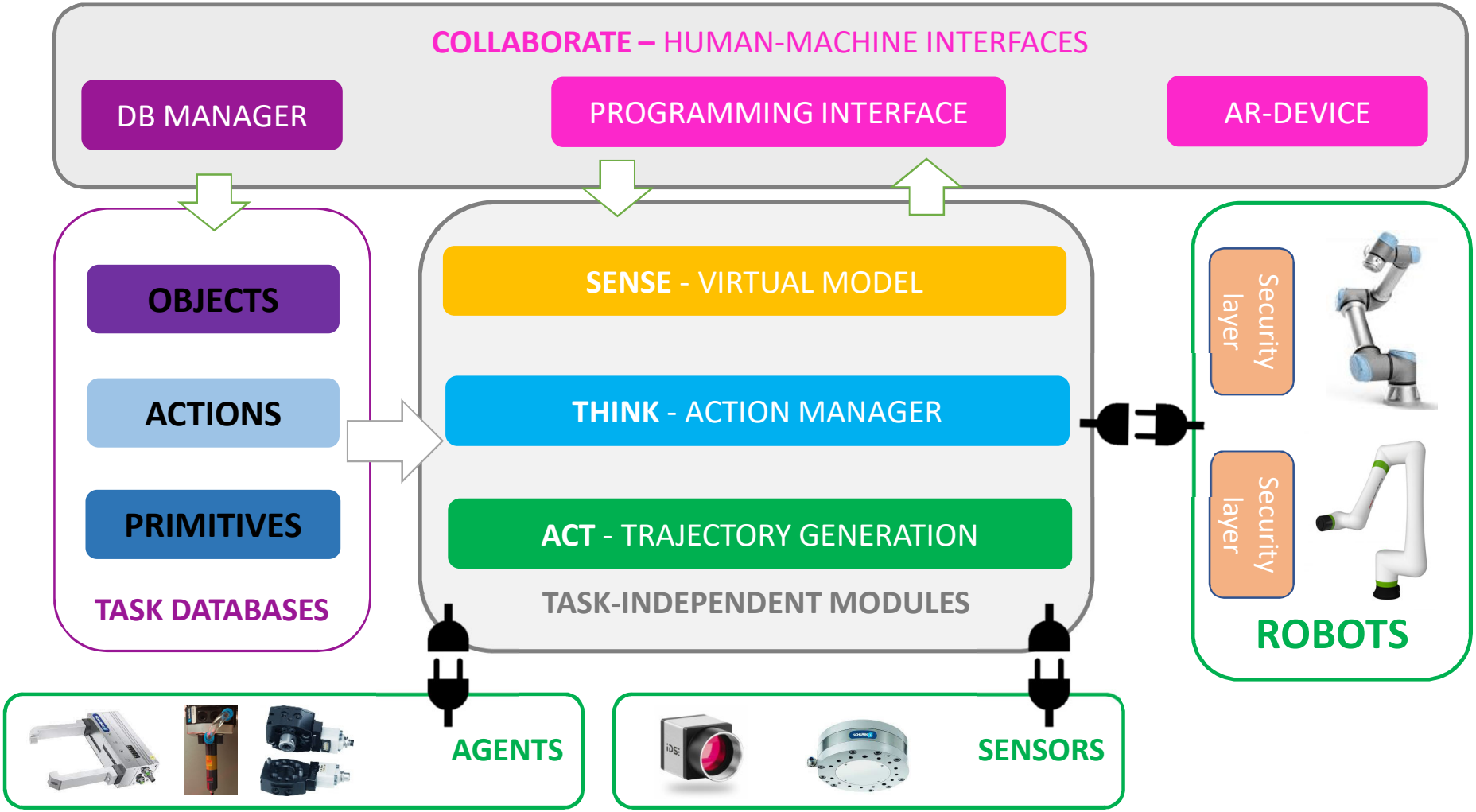
Flexibility – Usability Tradeoff



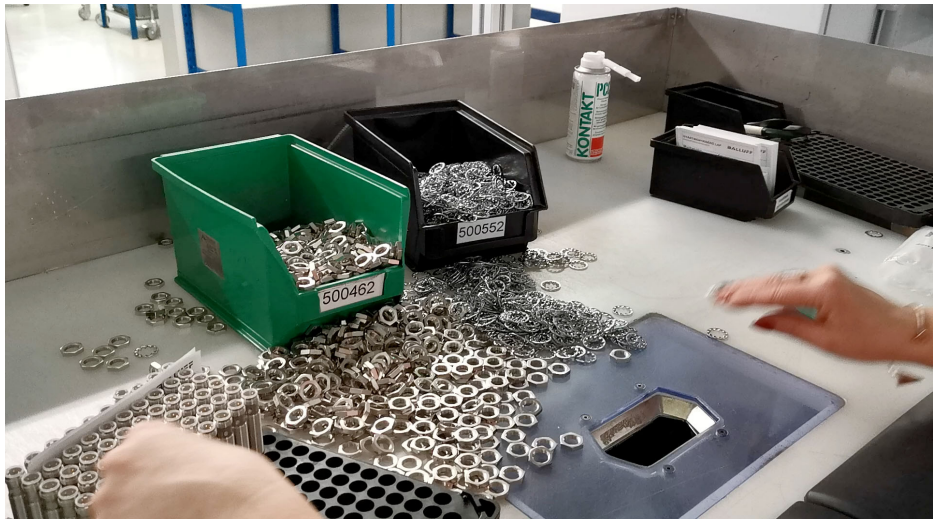


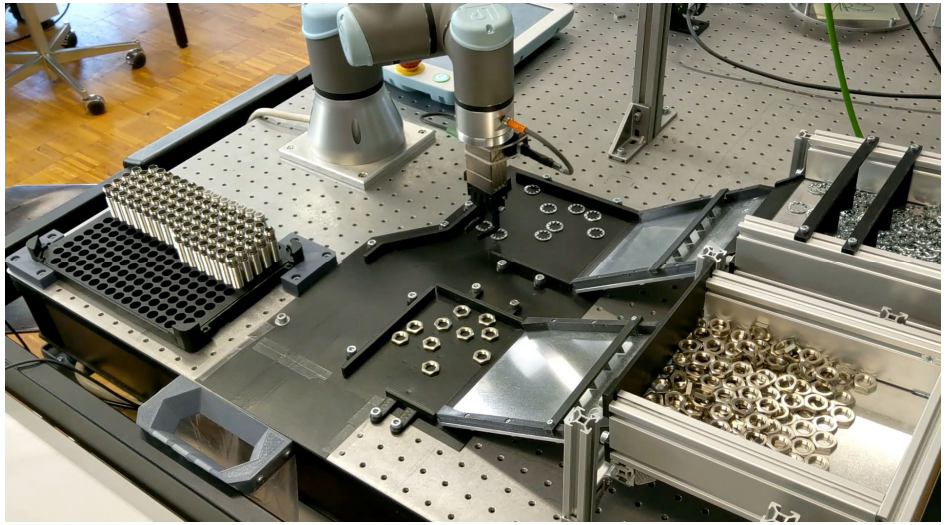

Prograblock : _default
1
DEBUG
Pick
Cube
Place on
Pallet

SOFTWARE ARCHITECTURE

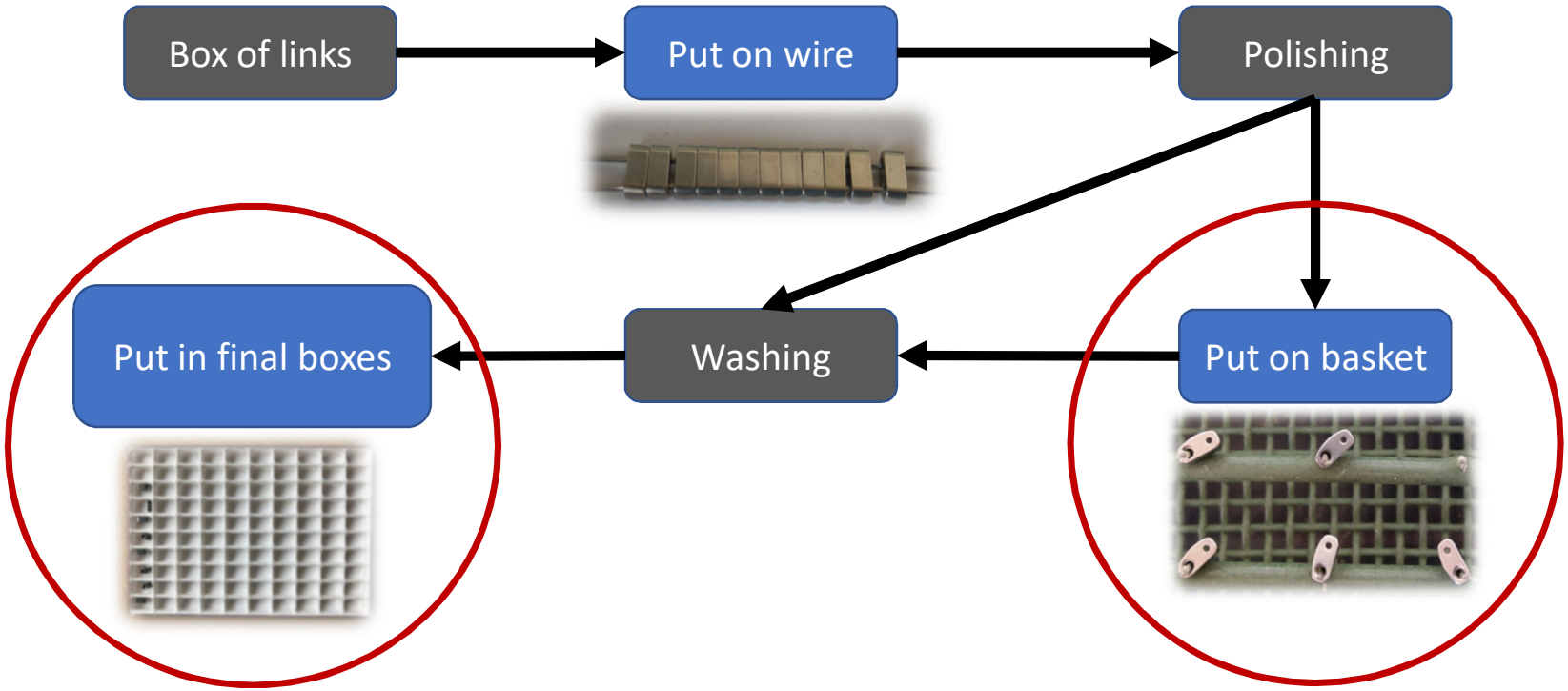


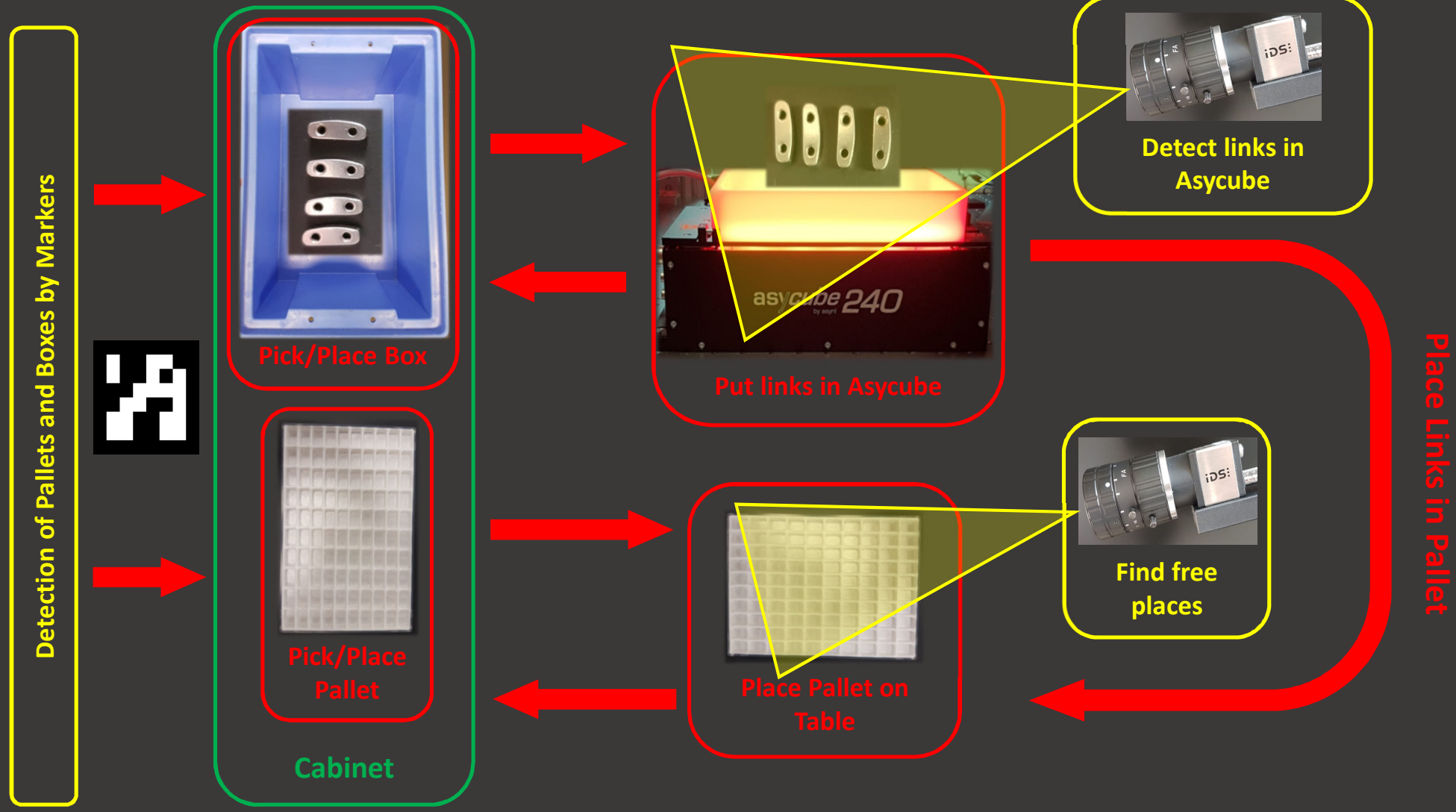
USE CASE : Sensor packaging

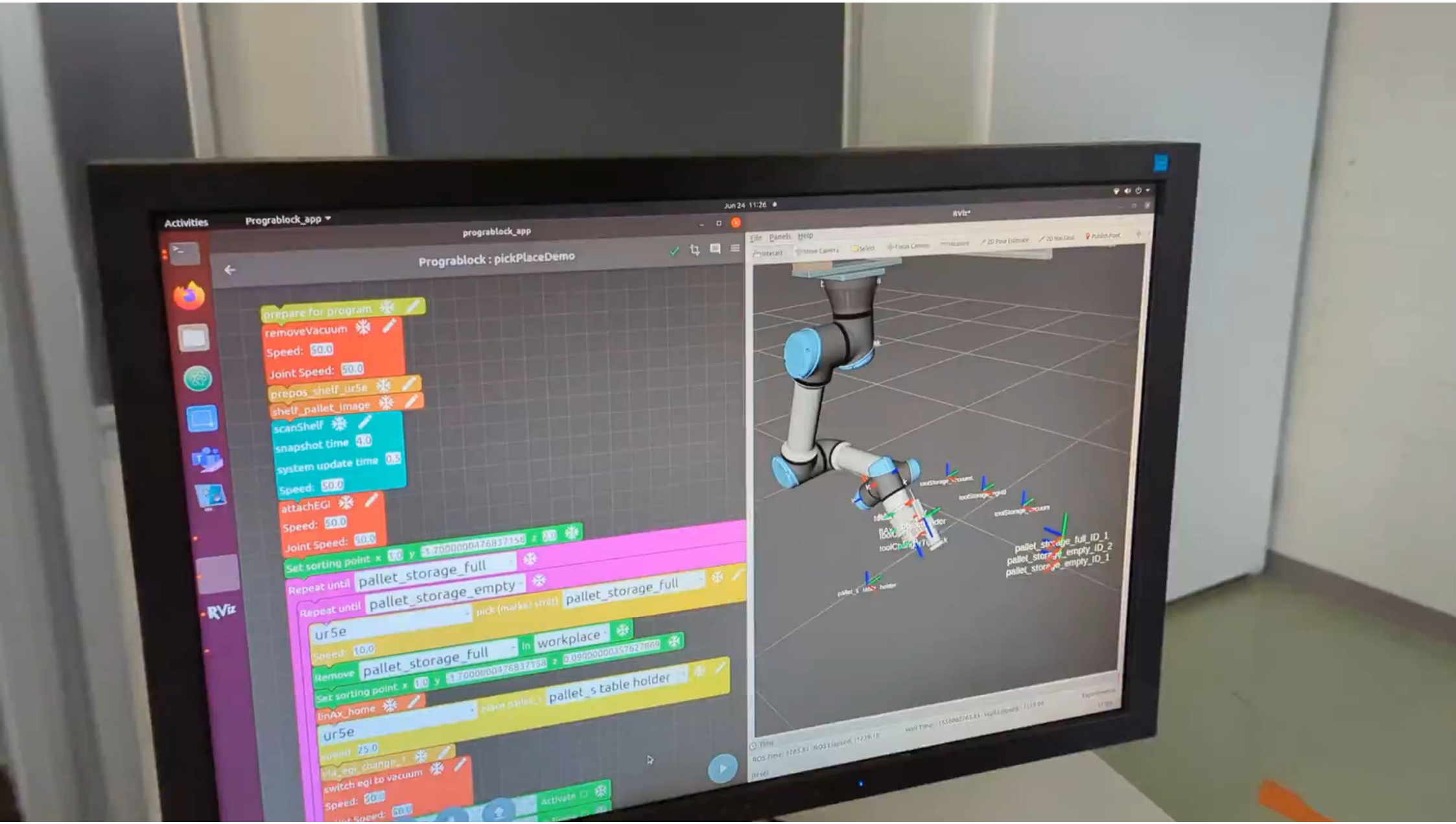




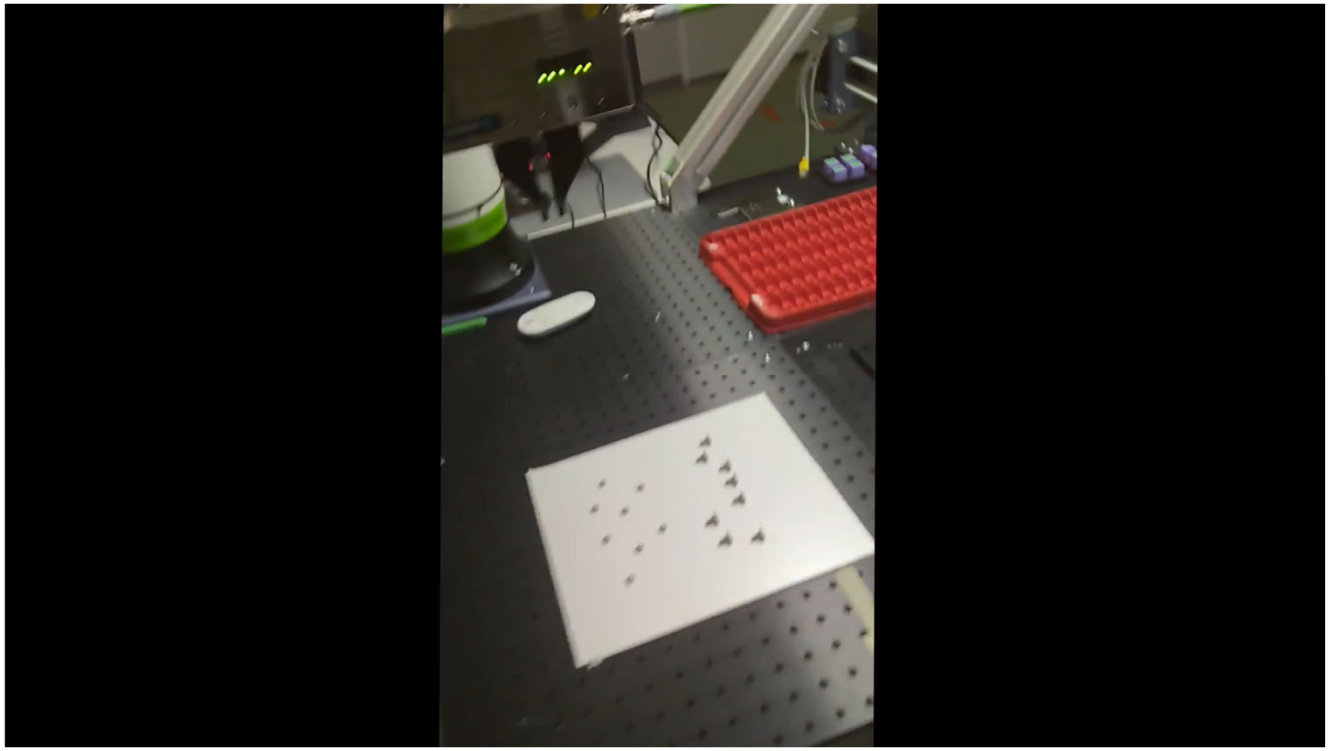
USE CASE : Sorting and palletizing watch links




Detection of Pallets and Boxes by Markers
Pick/Place Box
Pick/Place Pallet
Cabinet
Put links in Asycube
asycube 240
Detect links in Asycube
Place Pallet on Table
Find free places
Place Links in Pallet


Activities
Prograblock_app
prograblock_app
Prograblock : pickPlaceDemo
prepare for program
removeVacuum
Speed: 50.0
Joint Speed: 50.0
prepos_shelf_ur5e
shelf_pallet_image
scanShelf
snapshot time 4.0
system update time 0.5
Speed: 50.0
attachEGI
Speed: 50.0
Joint Speed: 50.0
Set sorting point x 1.0 y 1.700000047683715 z 0.0
Repeat until pallet_storage_full
Repeat until pallet_storage_empty
pick (marker strat) pallet_storage_full
ur5e
Speed: 10.0
Remove pallet_storage_full in workplace
Set sorting point x 1.0 y 1.700000047683715 z 0.099000003576278809
linAx_home
place pallet_s pallet_s table holder
ur5e
Speed: 25.0
via_egi_change_1
switch egi to vacuum
Speed: 50.0
Activate
RViz
Jun 24 11:26
RViz*
File Panels Help
pallet_storage_full_ID_1
pallet_storage_empty_ID_2
pallet_storage_empty_ID_1

USE CASE : Loading a press with various parts



Thank you for your attention!

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With the kind support of:

Berner Fachhochschule
Haute école spécialisée bernoise
Bern University of Applied Sciences

WISSENSCHAFT.
BEWEGEN
GEBERT RÜF STIFTUNG

Next Meetings

Biel/Bienne
Quellgasse 21, Aula

14.10.22 **Pegasus Spine, ein Gerät zur intelligenten Rückenbehandlung** Jan Segessenmann, Wissenschaftlicher Mitarbeiter, Institute for Human Centered Engineering HuCE, BFH-TI

28.10.22 **UAS-Thermaldaten zur Erkennung von Steinen auf landwirtschaftlichen Nutzflächen** Prof. Florian Thürkow, Dozent, Fachbereich Wirtschaftsingenieurwesen, BFH-TI

11.11.22 **The GNU Taler Payment System** Prof. Dr. Christian Grothoff, Professor & CEO, Institute for Cybersecurity and Engineering ICE, BFH-TI & Taler Systems SA

25.11.22 **Experimental heart rate variability characterization** Lars Brockmann, Assistant, Institute for Human Centered Engineering HuCE, BFH-TI

09.12.22 **Parylene-based encapsulation technology for wearable or implantable electronic devices** Dr. Andreas Hogg, CEO, Coat-X AG, La Chaux-de-Fonds

13.01.23 **Care@Home mit technischer Unterstützung** Prof. Dr. Sang-Il Kim, Professor, Institute for Medical Informatics I4MI, BFH-TI

Burgdorf/Berthoud
Pestalozzistrasse 20, E 013

07.10.22 **Tilted washboards and Chaotic Dynamics in a Vintage Rotating Roasting Spit** Prof. Dr. Julio Rodriguez, Dozent, Abteilung MNG Allgemeinbildung, BFH-TI

21.10.22 **Robot Task Model and Notation** Congyu Zhang Sprenger, Wissenschaftliche Mitarbeiterin, Institute for Intelligent Industrial Systems I3S, BFH-TI

04.11.22 **Data Science for Startups** im ZID, Bernapark, Stettlen, Bern Prof. Dr. Erik Graf, Dozent, Institute for Data Applications and Security IDAS, BFH-TI

18.11.22 **Flexible programming of Industrial Robots for Agile Production environments** Laurent Cavazzana, Research scientist, Institute for Intelligent Industrial Systems I3S, BFH-TI

02.12.22 **Wie gefährlich ist ein Unfall mit einem Cabriolet?** Prof. Raphael Murri, Institutsleiter IEM, Institut für Energie- und Mobilitätsforschung IEM, BFH-TI

16.12.22 **Systemtechnologie für die Mikrobearbeitung mit Hochleistungs-UKP-Lasern** Prof. Dr. Beat Neuenschwander, Institutsleiter ALPS, Institute for Applied Laser, Photonics and Surface Technologies ALPS, BFH-TI