ETH zürich

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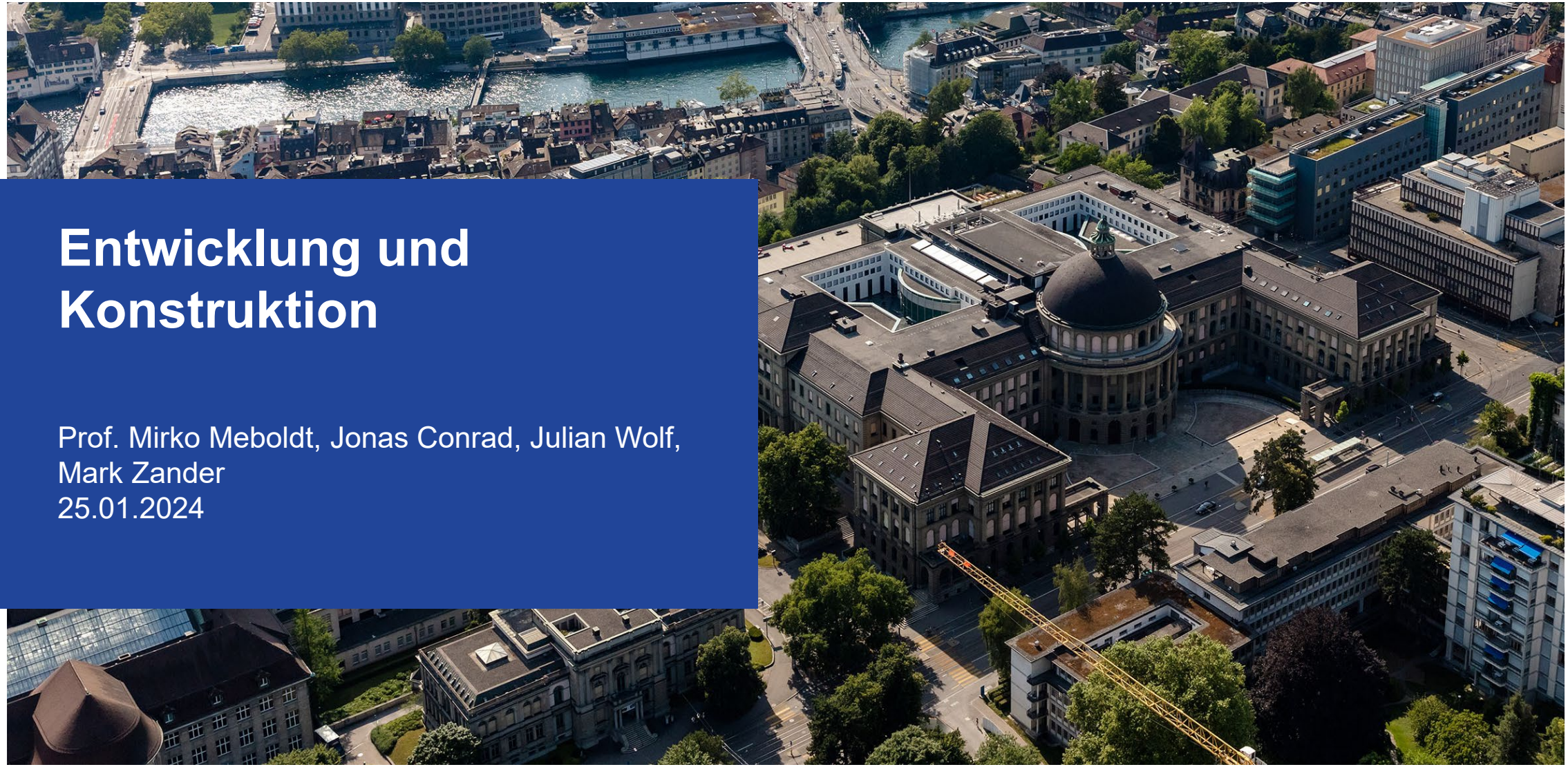
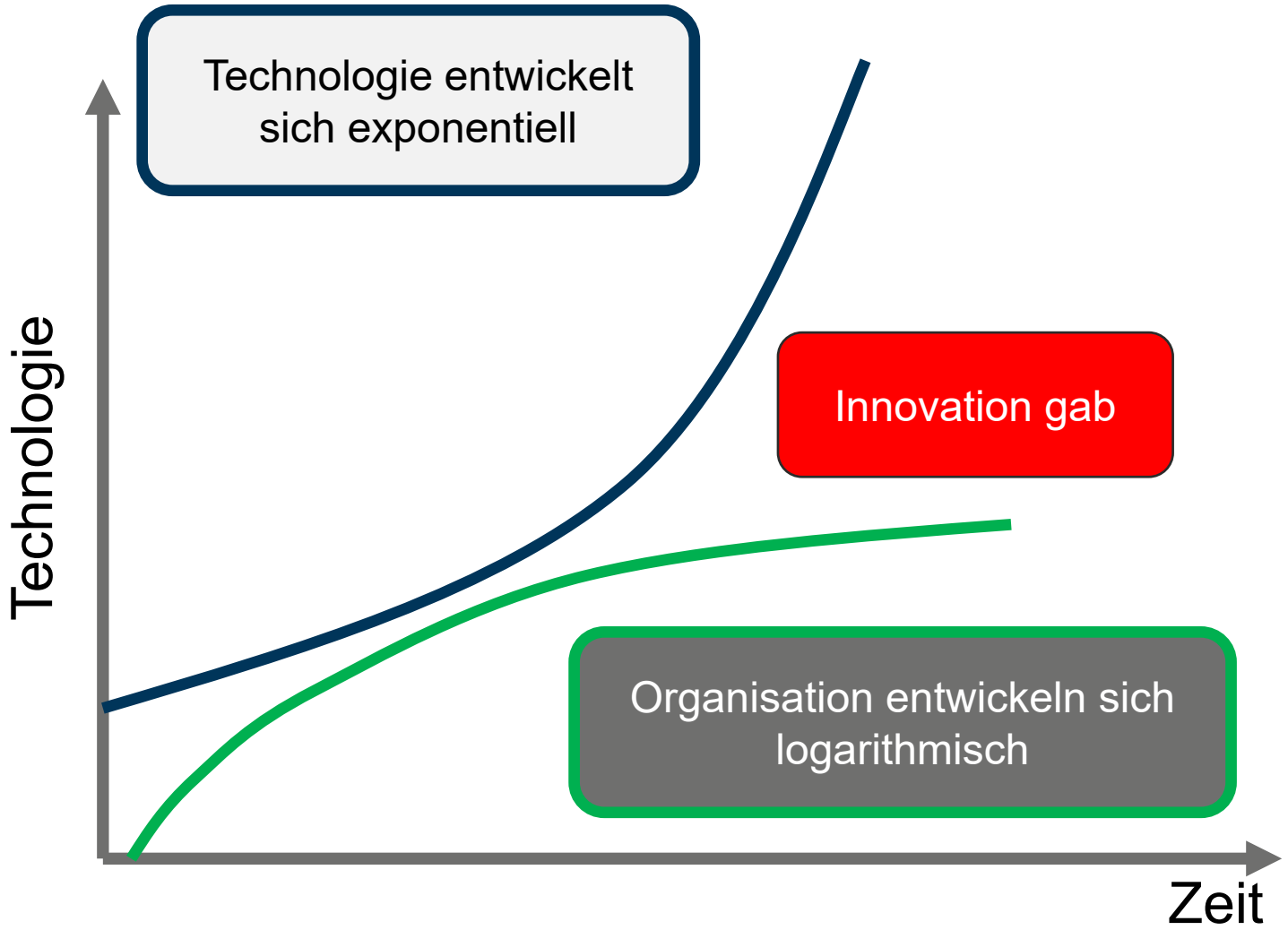
Produktentwicklungsgruppe Zürich



Entwicklung und Konstruktion

Prof. Mirko Meboldt, Jonas Conrad, Julian Wolf,
Mark Zander
25.01.2024

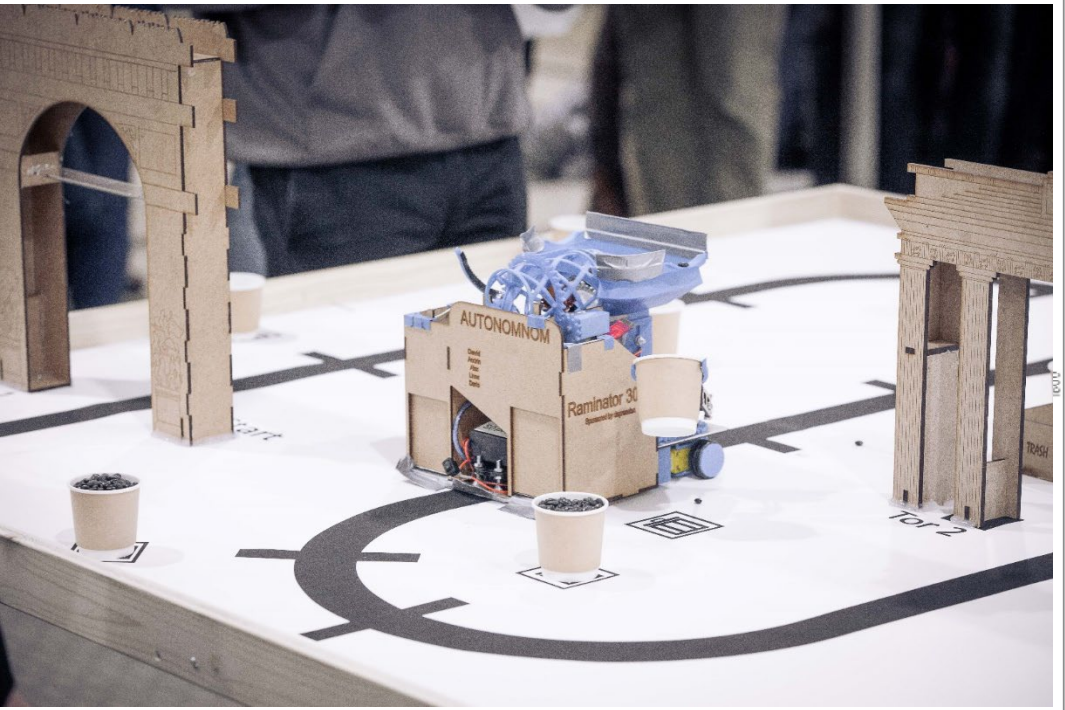
Innovation Gap

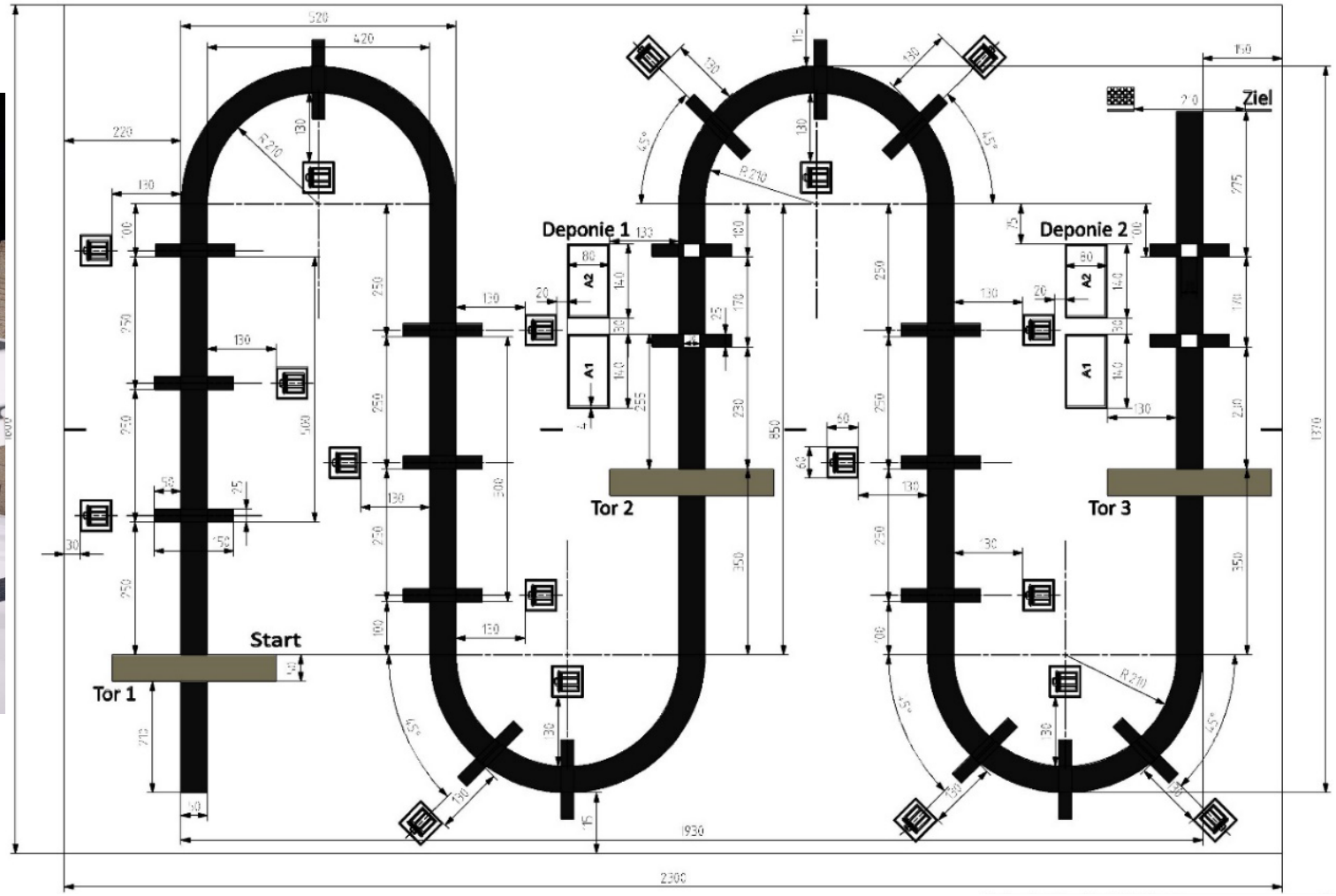


My mission is closing the gab:

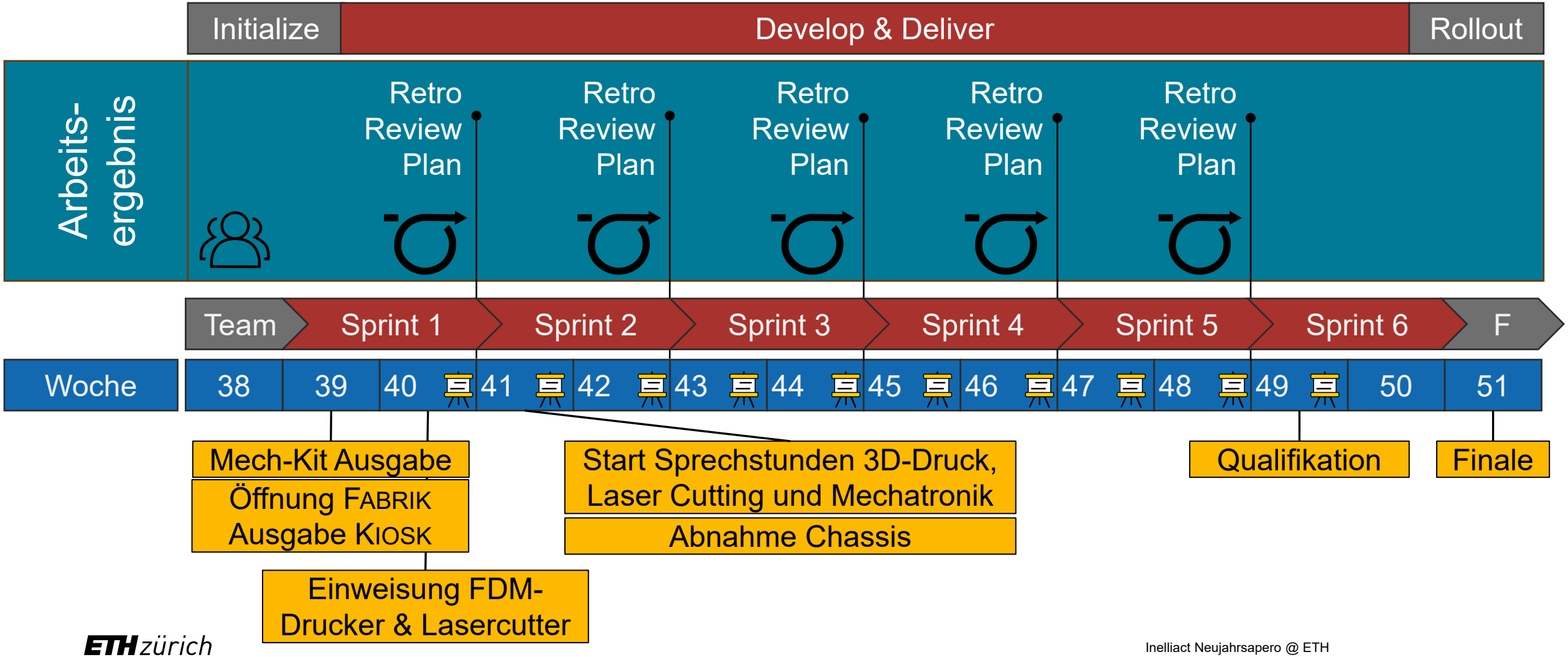
- Education
- Agile Development
- Focus on advanced technologies for engineering

3. Semester ETH: Innovationprojekt

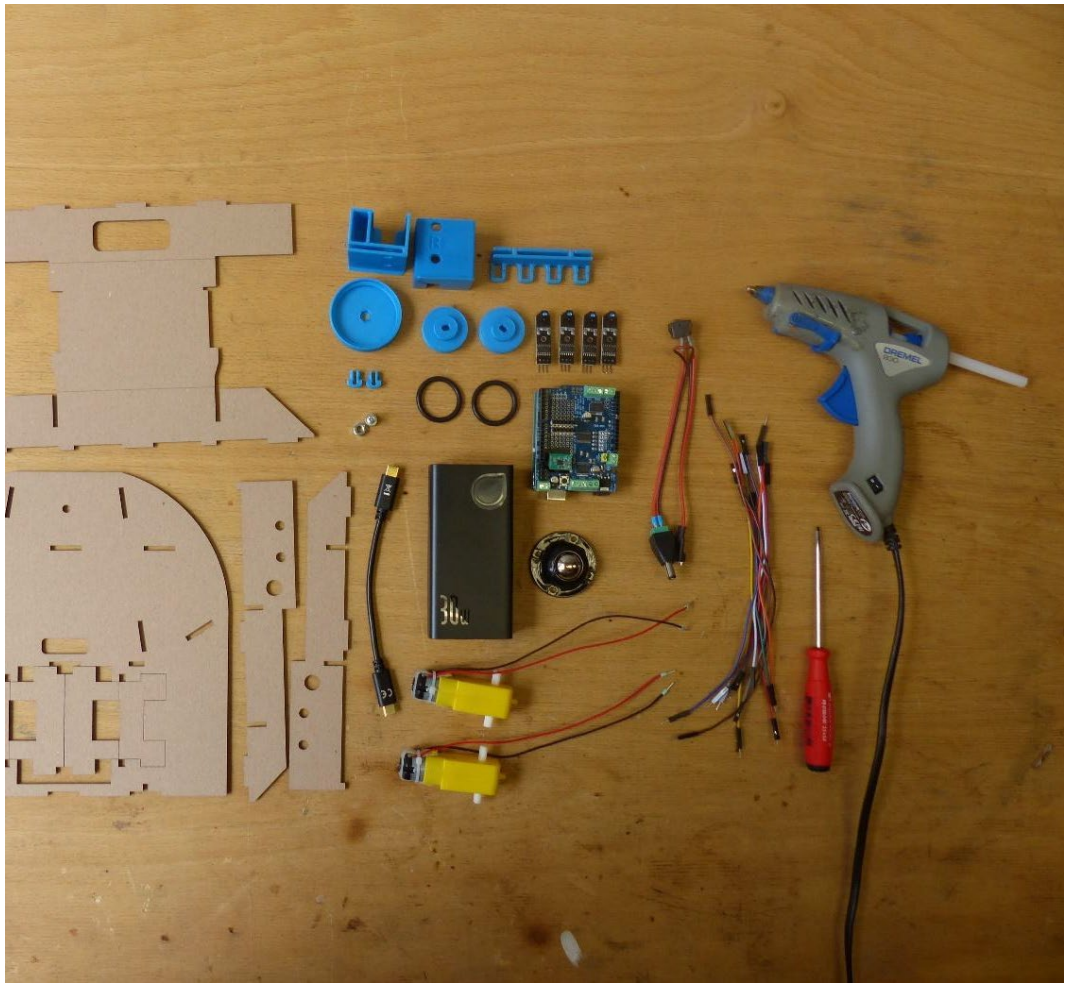


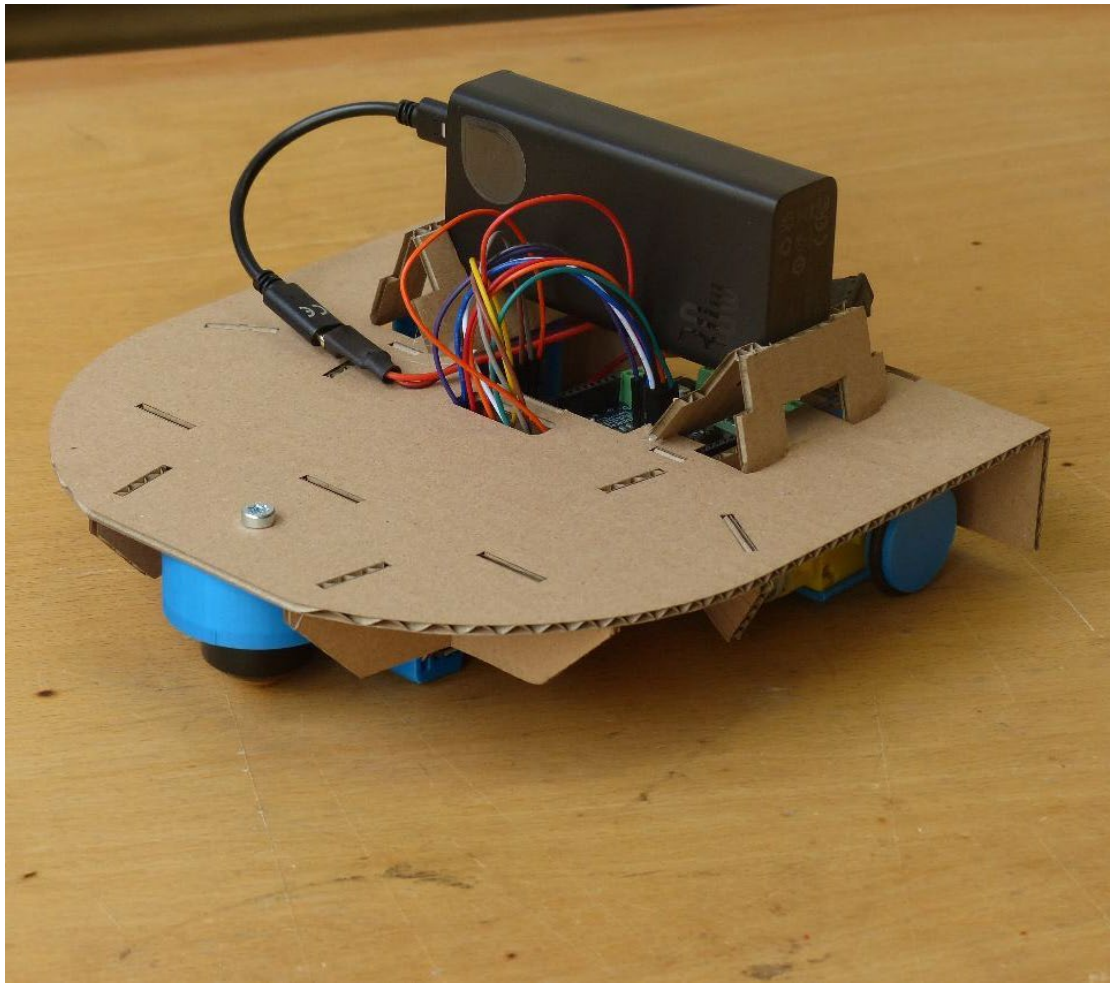


Agile Entwicklung



Arduino als Mechatronik Plattform





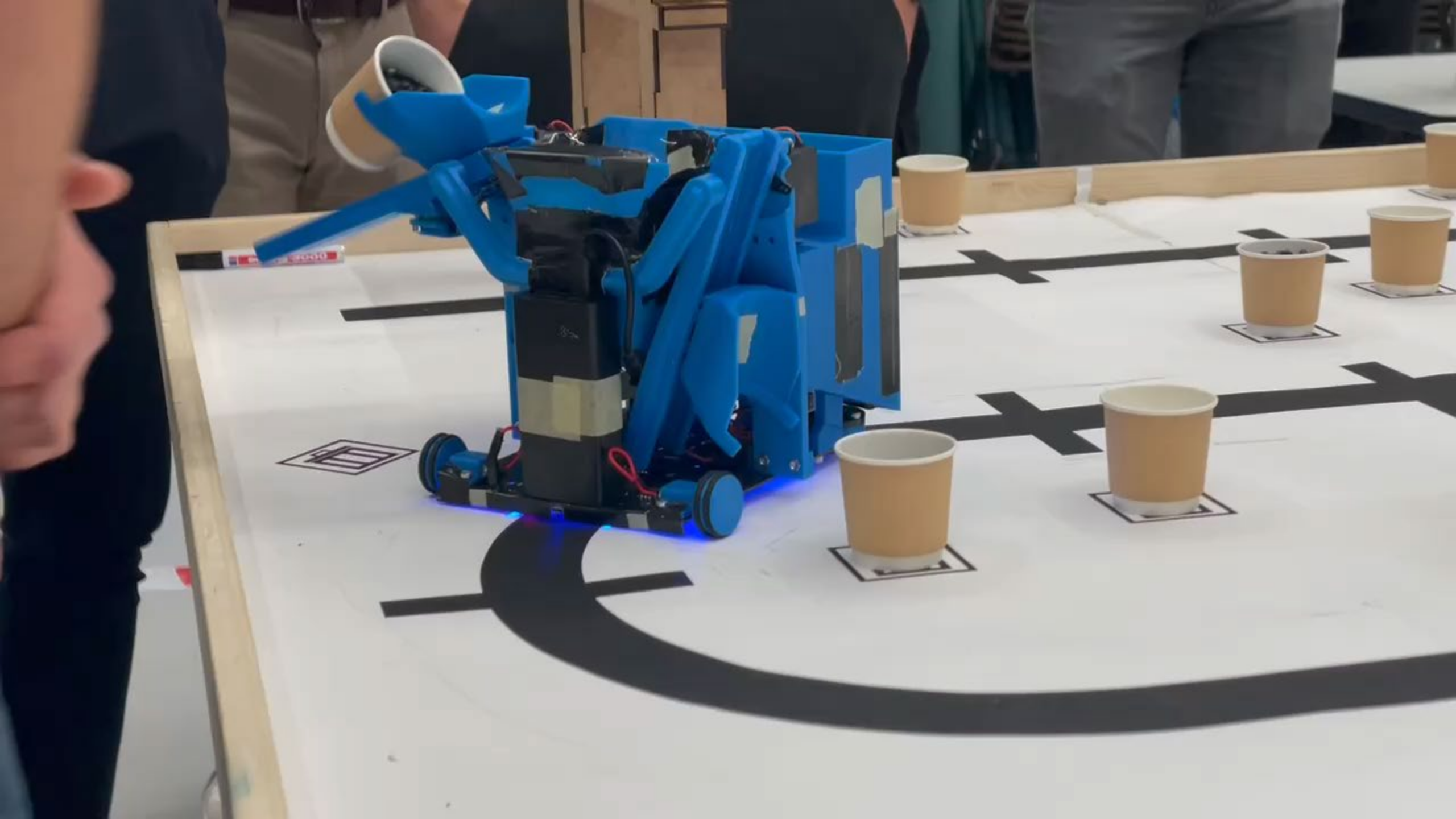
Produktion: 3D-Druck & Lasercutter

Fabrik

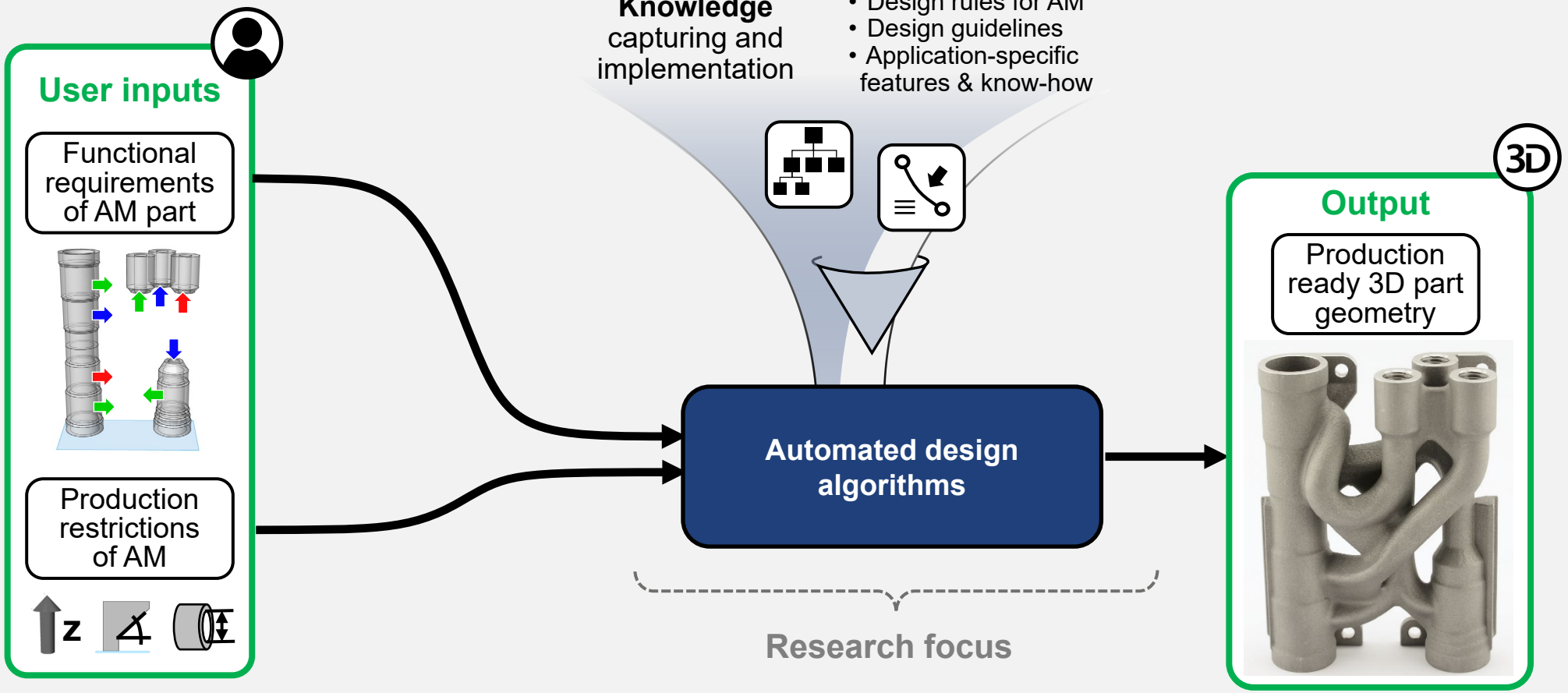
Wettkampf - Qualifikation & Finale

Qualifikation

Finale

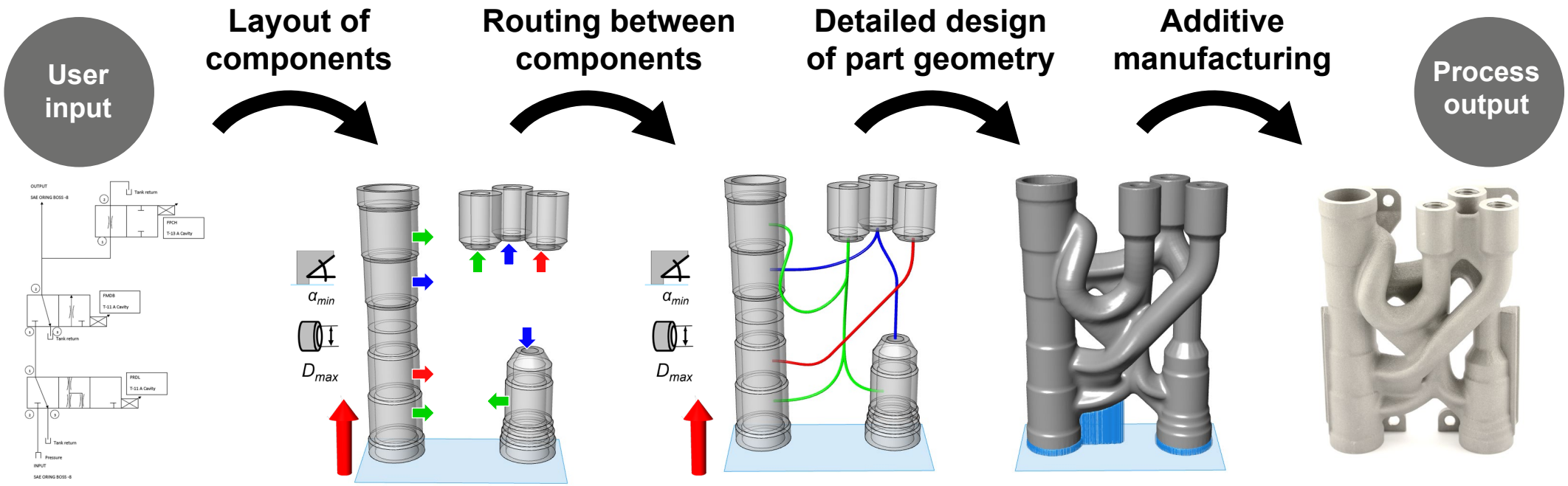


Top-level input by the User – detailed design by the algorithms



Channel routing & support free channels

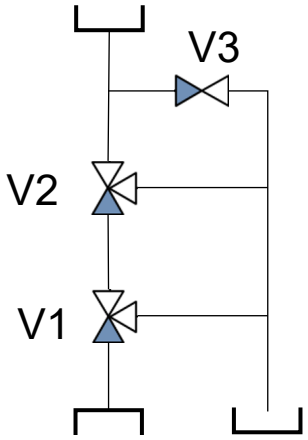
DESIGN AUTOMATION WORKFLOW

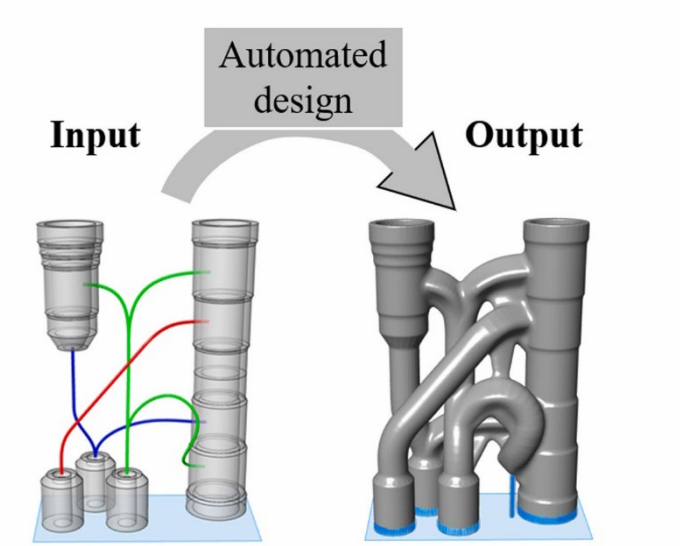


Biedermann, Beutler & Meboldt, 2021, Automated design of additive manufactured flow components with consideration of overhang constraint, Additive Manufacturing Vol. 46

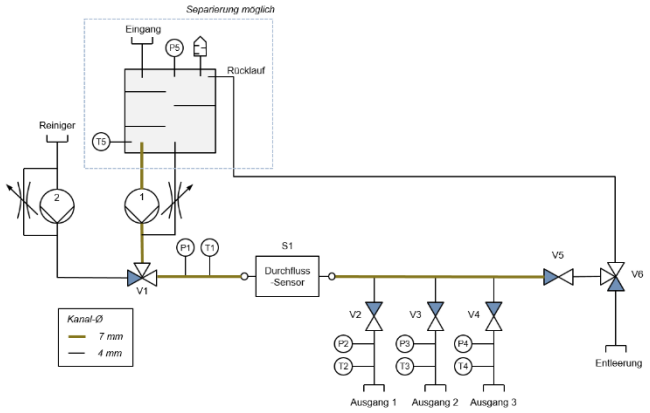
Challenge Passed

academic use case

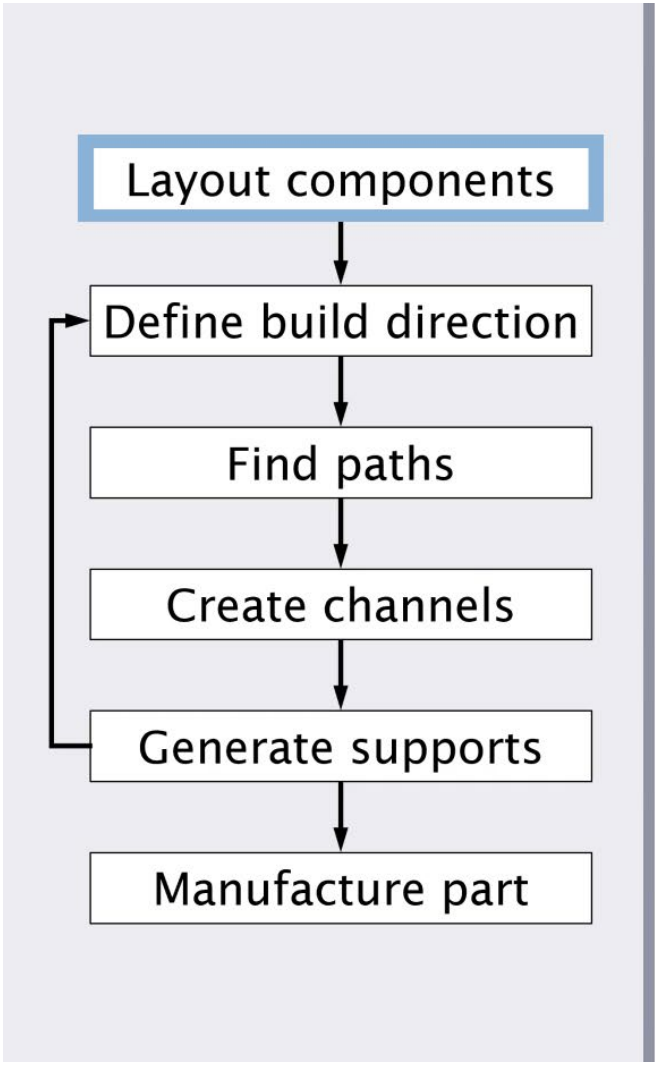


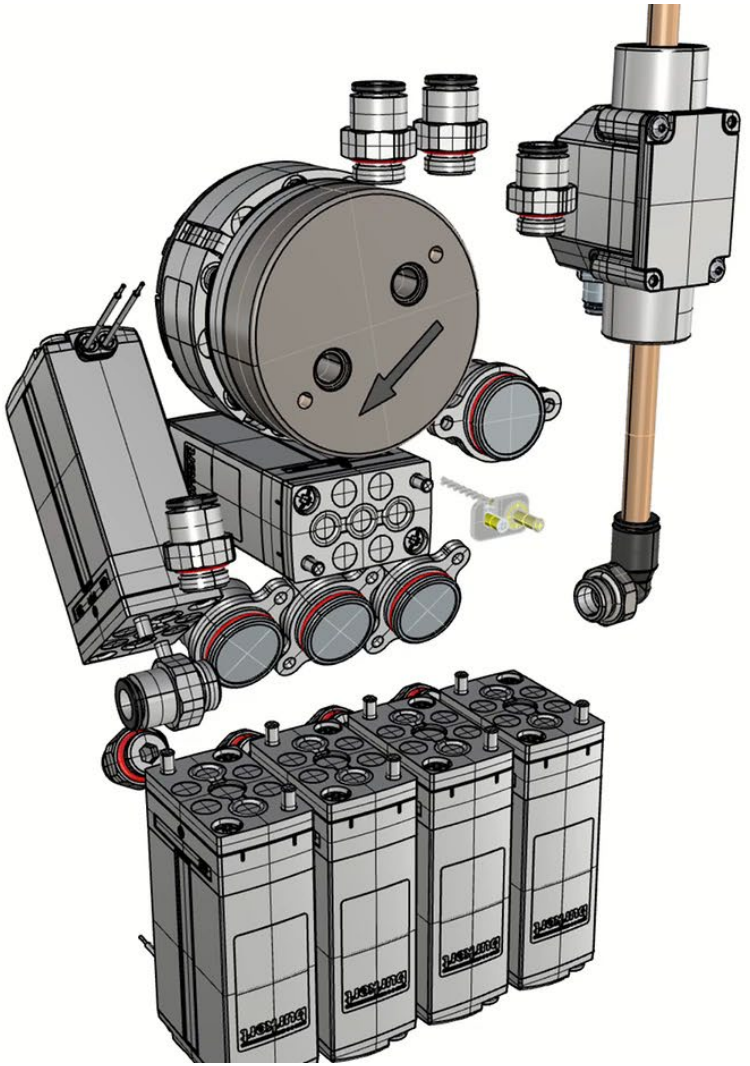


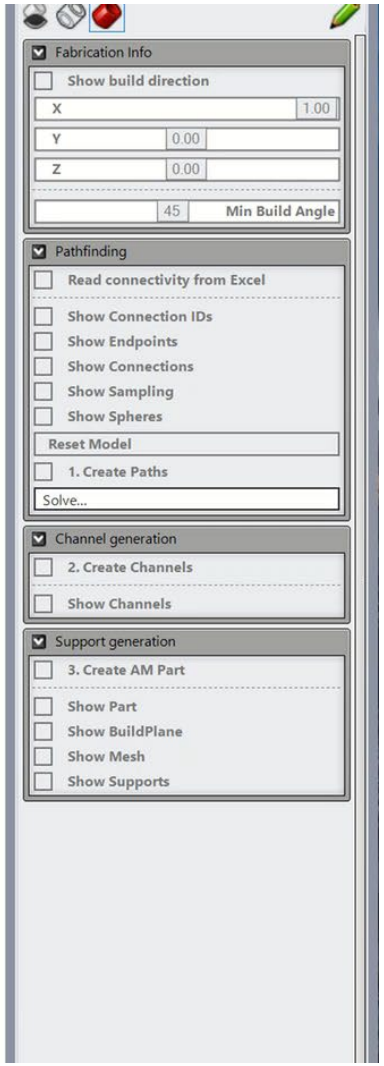
industrial use case



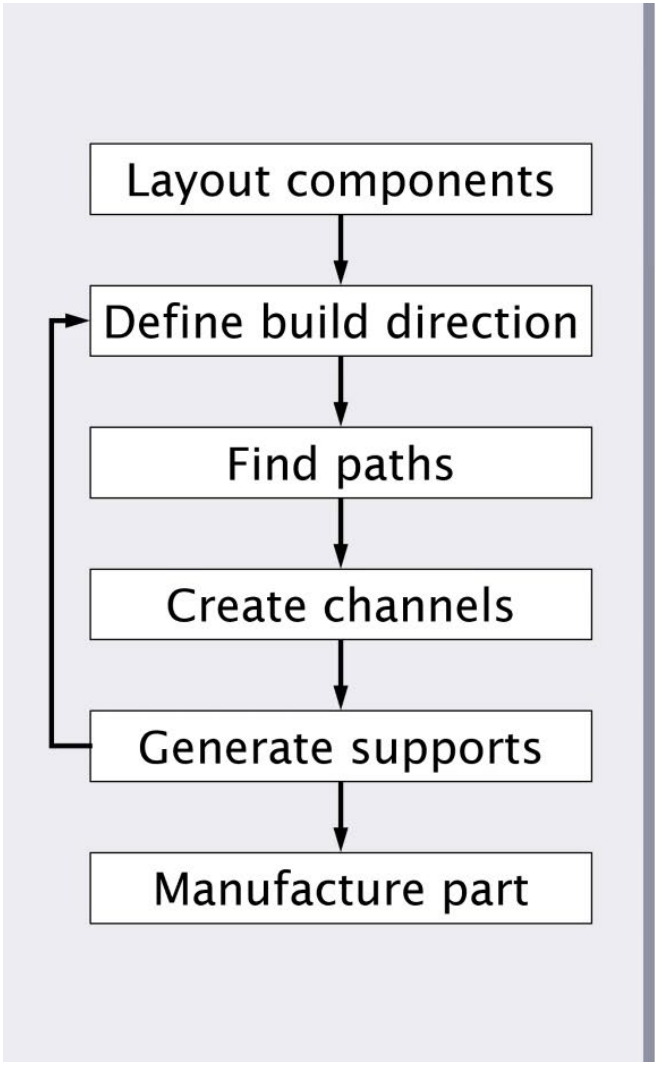
DESIGN PROCESS

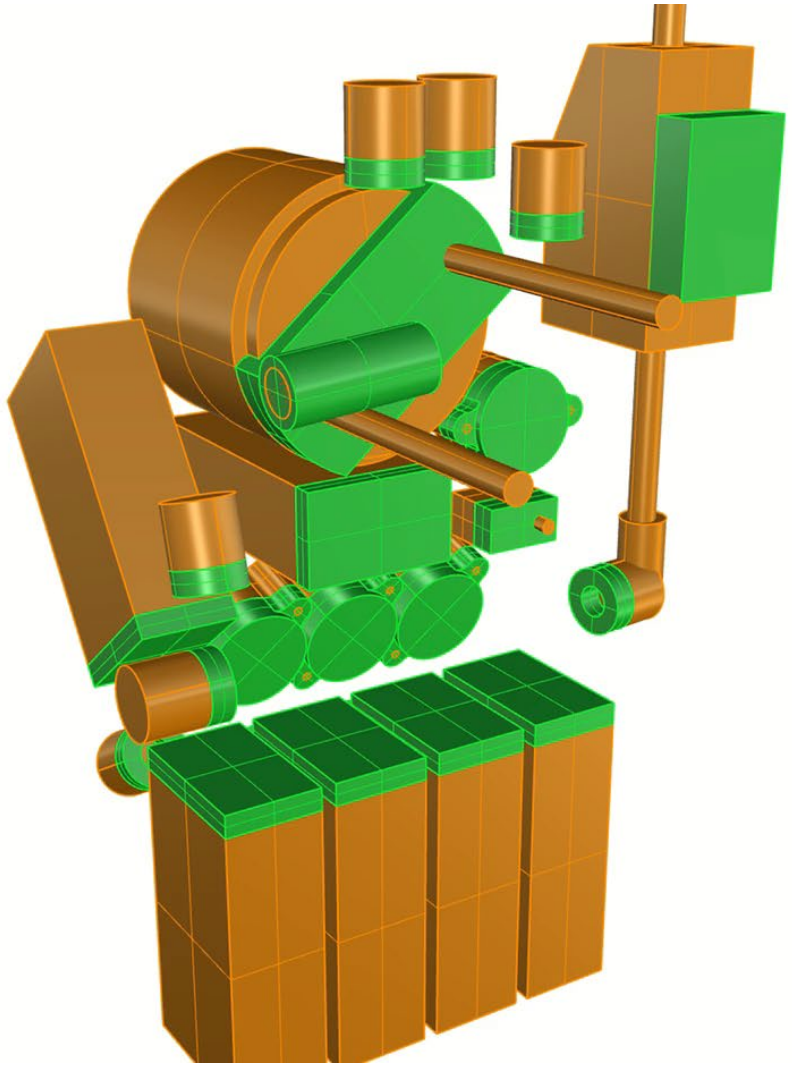


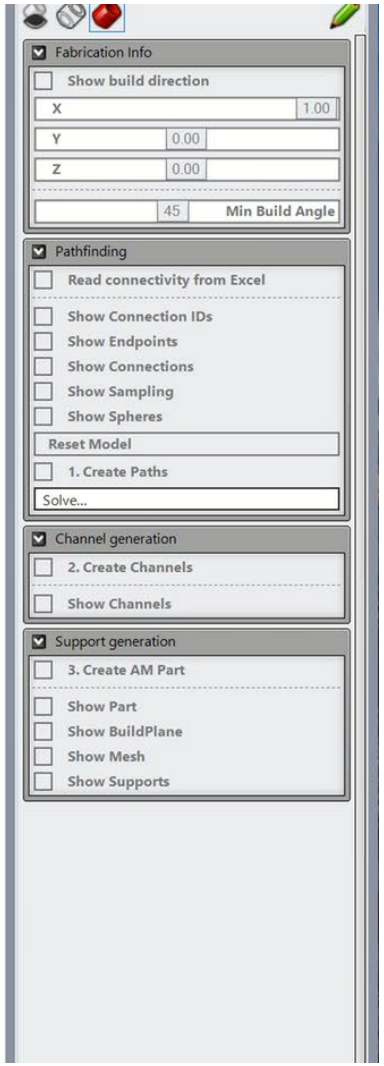




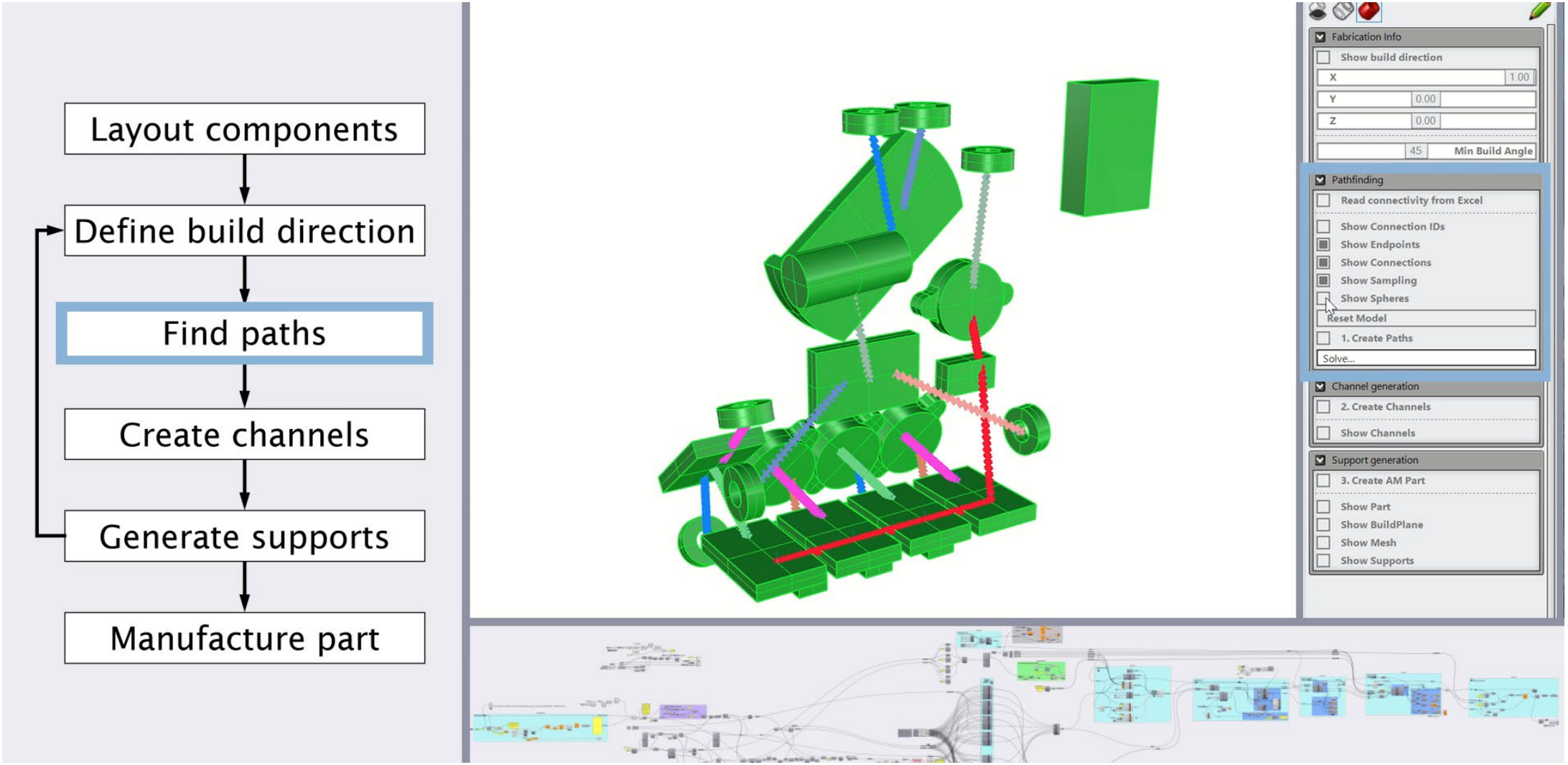
DESIGN PROCESS



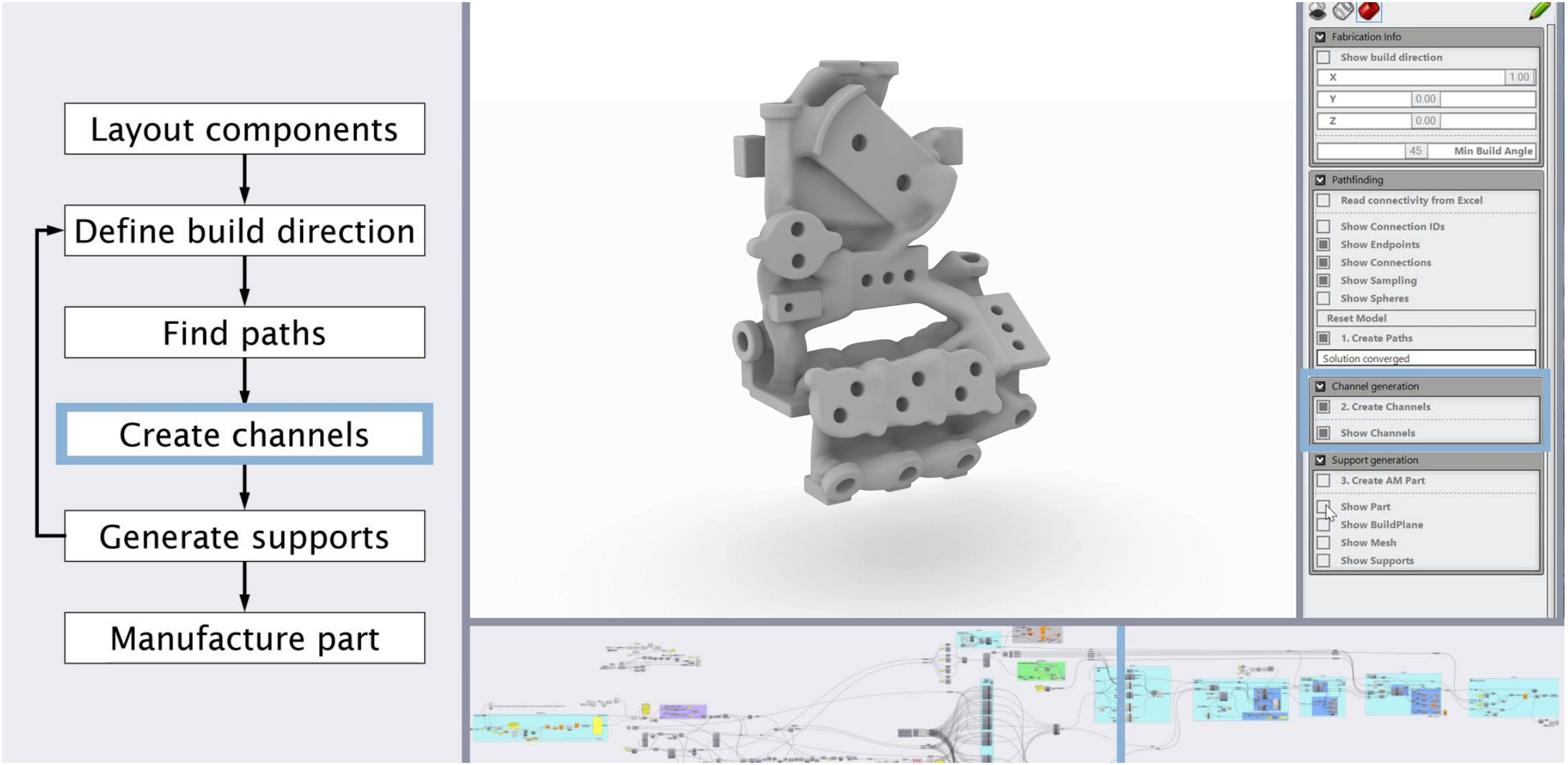




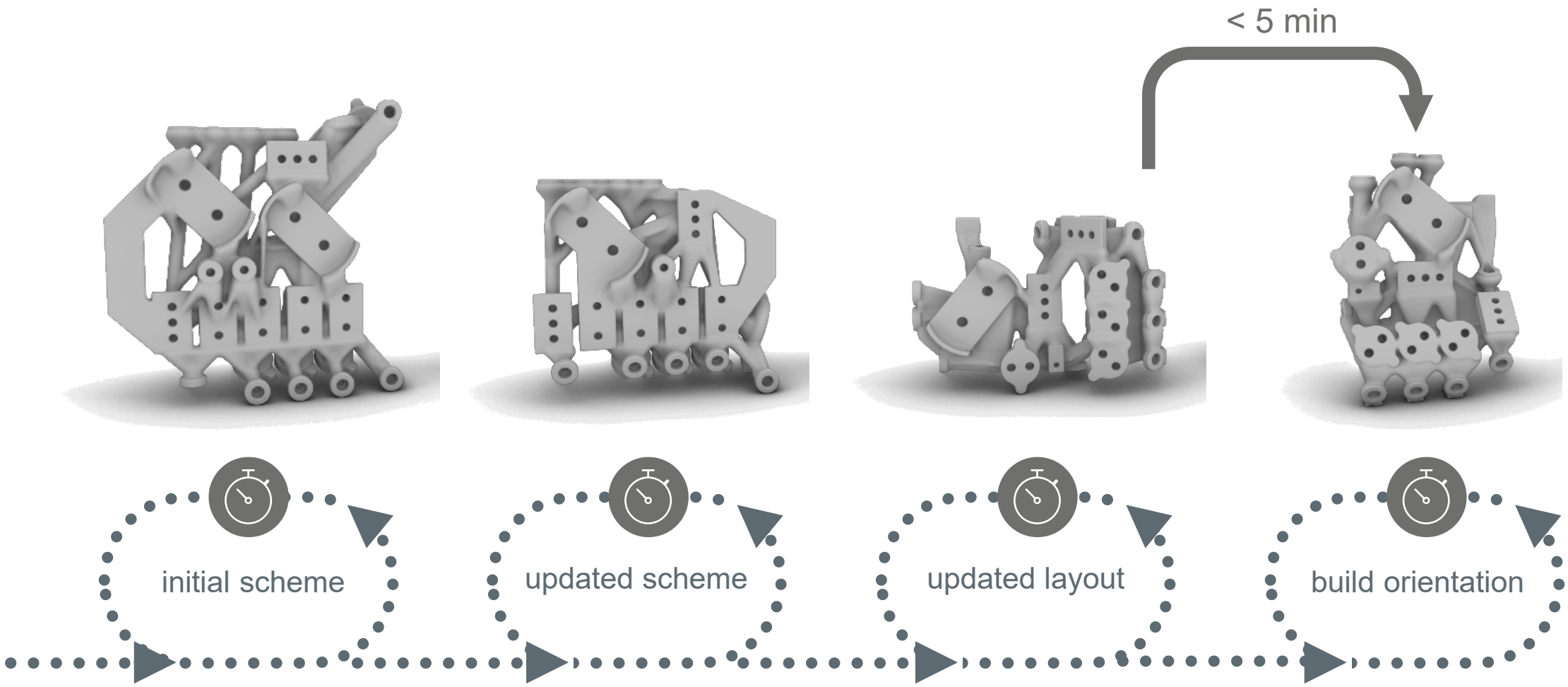
DESIGN PROCESS



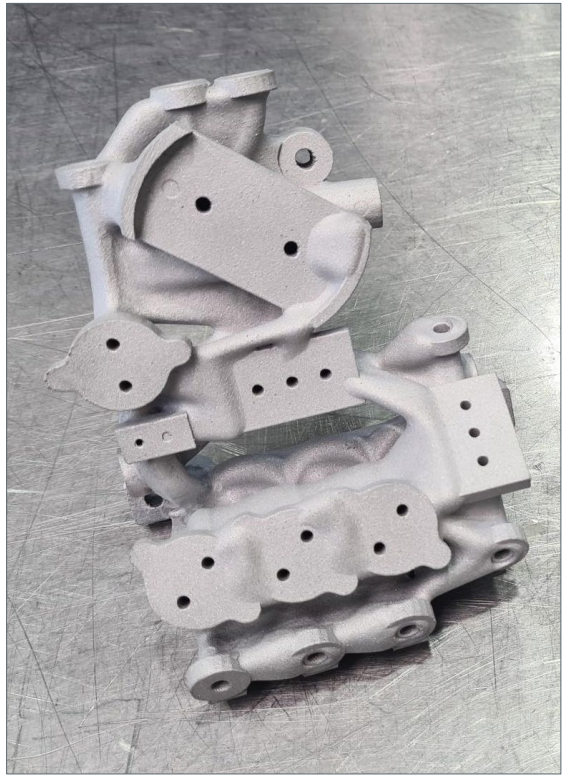
DESIGN PROCESS



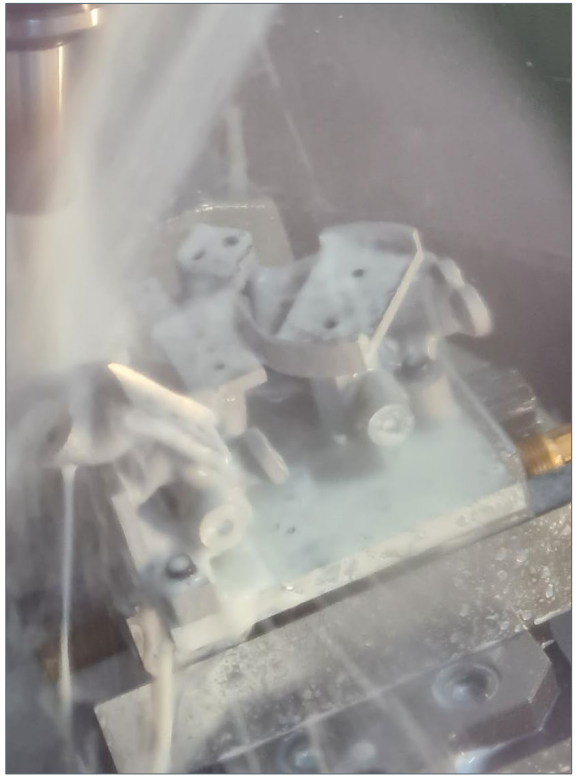
Faster design iterations



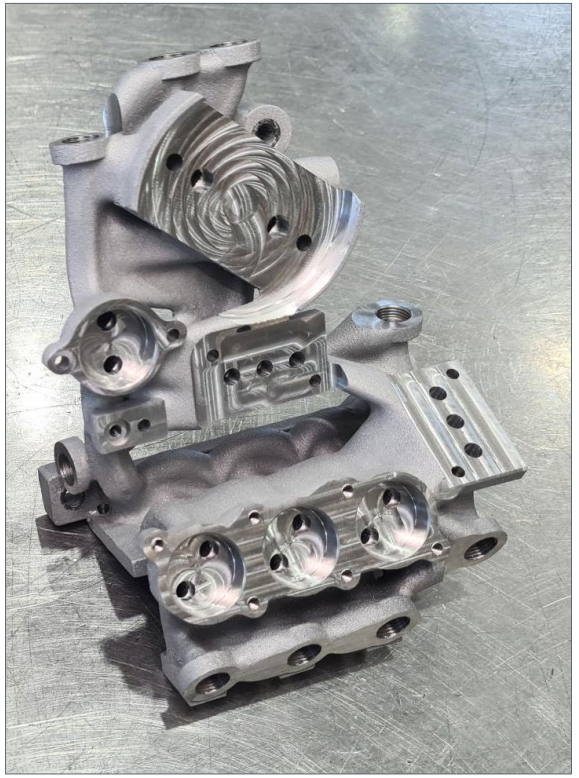
From design to assembly



weight: 518 g



process time: ~ 30 min



weight: 460 g

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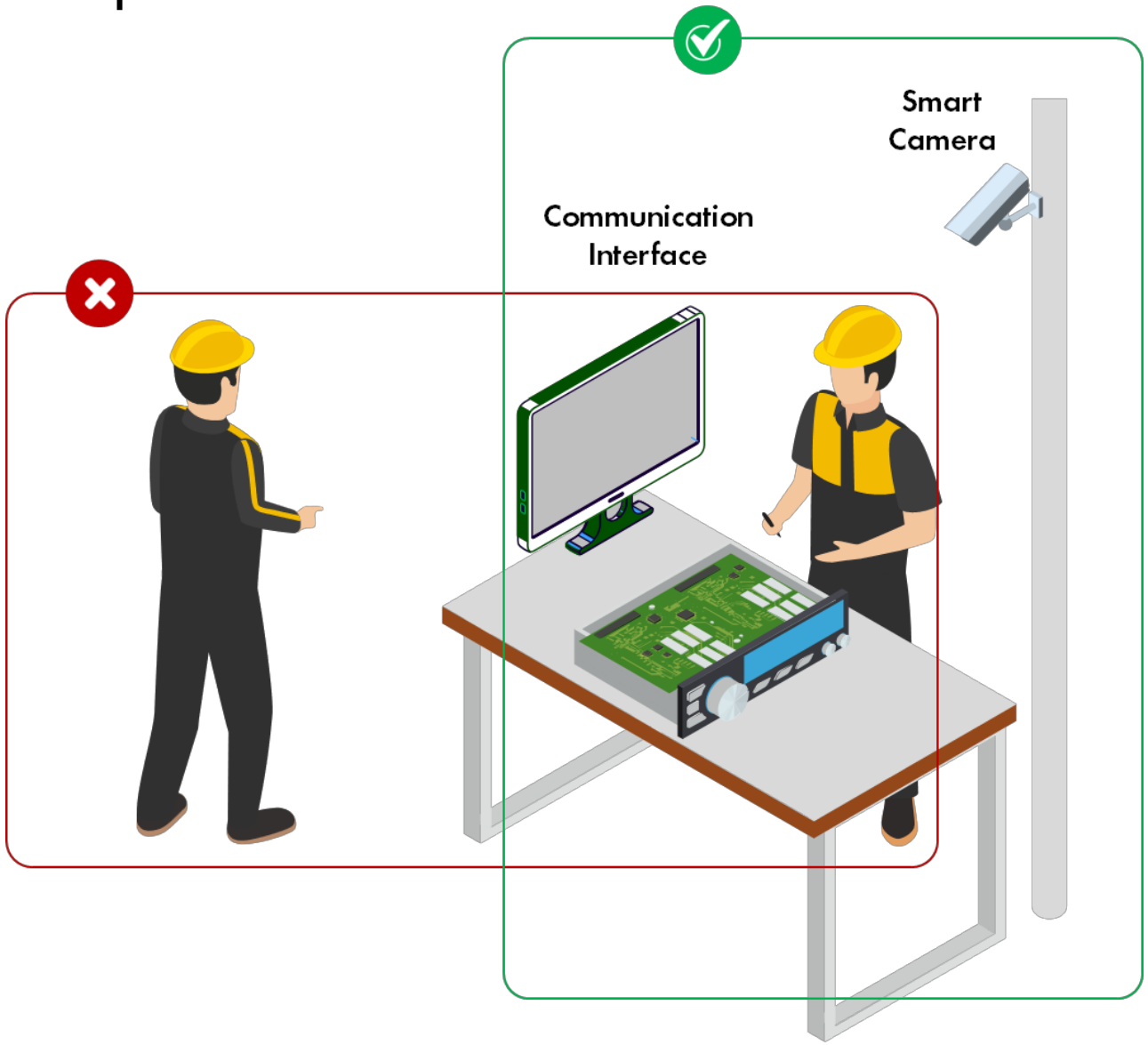
Neujahrsapéro Intelliact
Quality control using smart cameras trained on synthetic data

2024, January 22nd

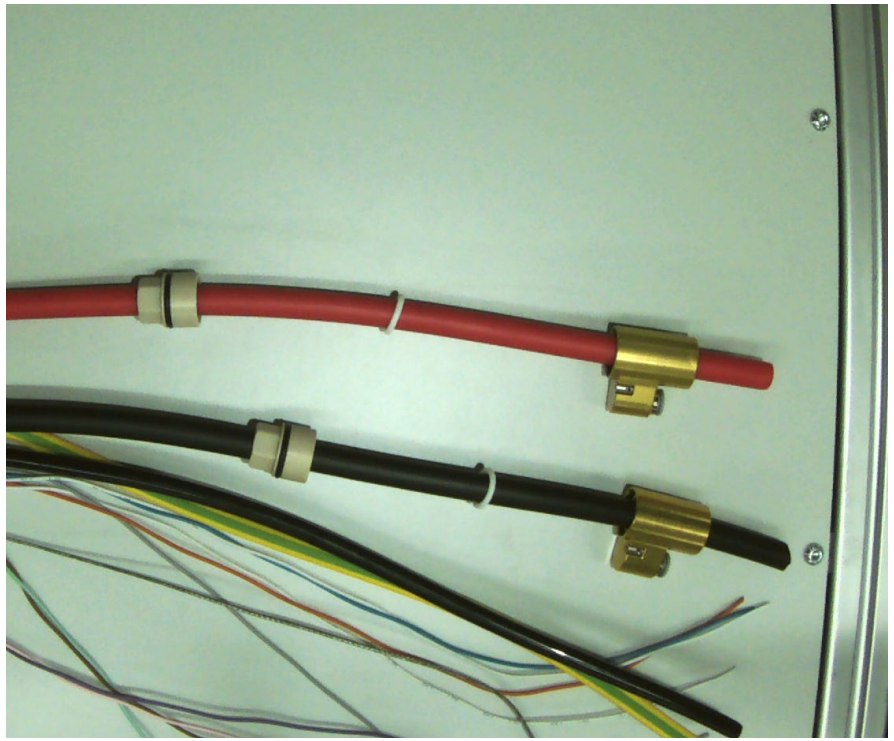
Jonas Conrad

Digital four eye principle

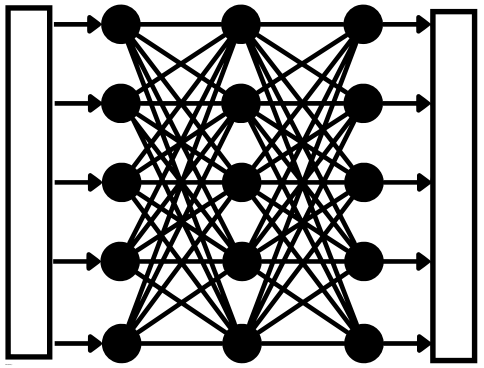


AI-based scene understanding

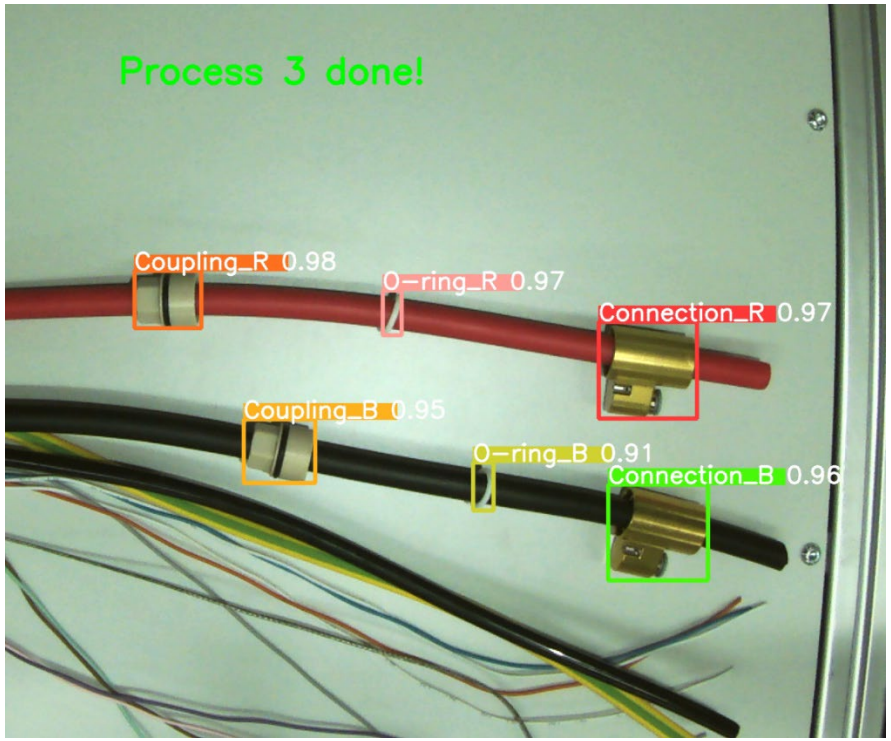
Input



Trained neural network



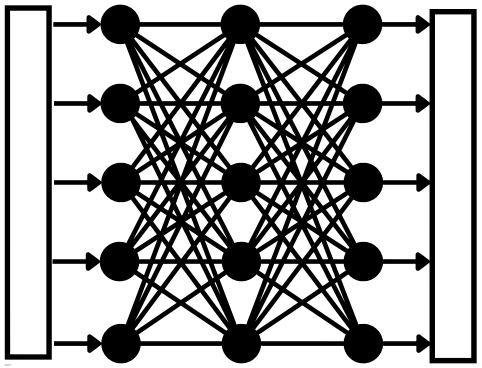
Output

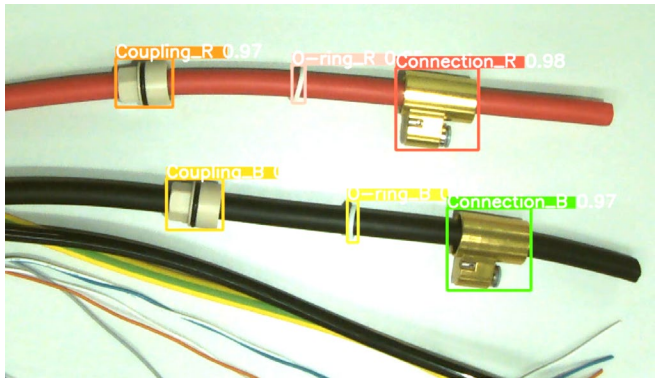


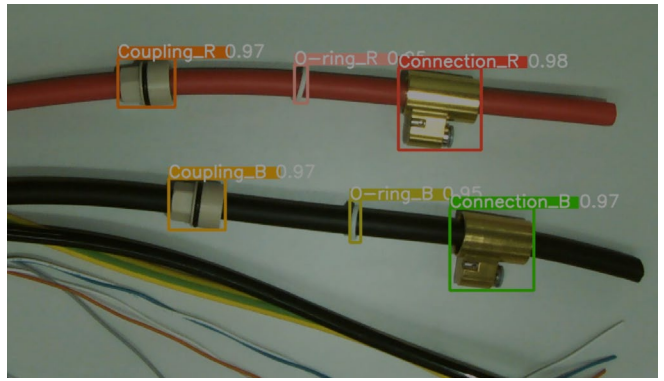
Training data must include the variance of the application.

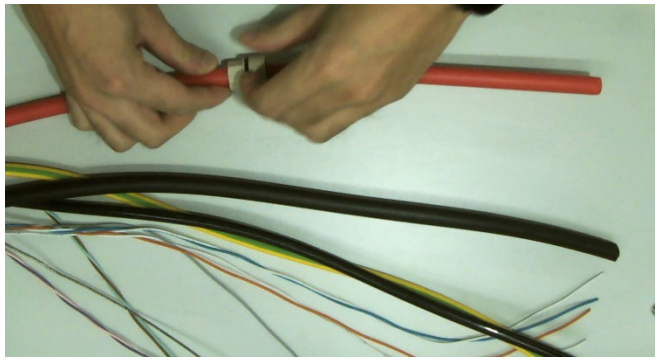
Possible variations during the application scenario:
Background clutter, lighting, occlusion, positions…

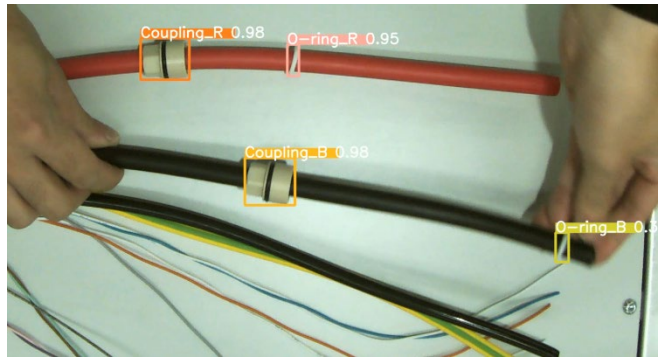
Training data required





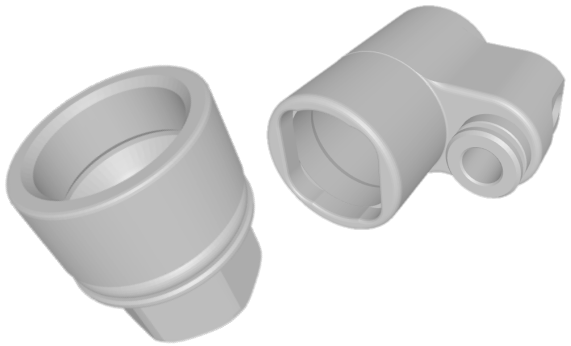




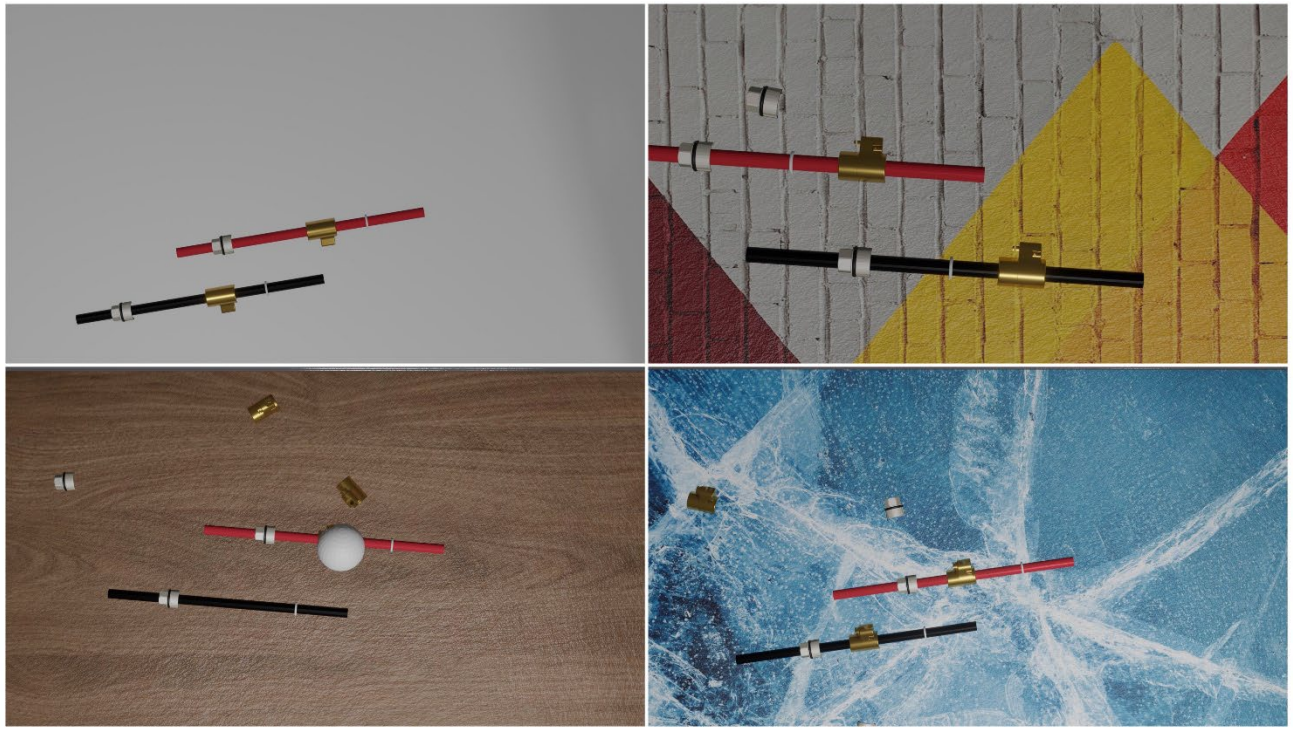


Synthetic training for automated training

Digital part models (CAD)



Automated generation of synthetic images inlcuding variation:
Positions, background, occlusion, lighting, etc.



The useage of synthetic training data allows for easily adaptable model training pipelines.

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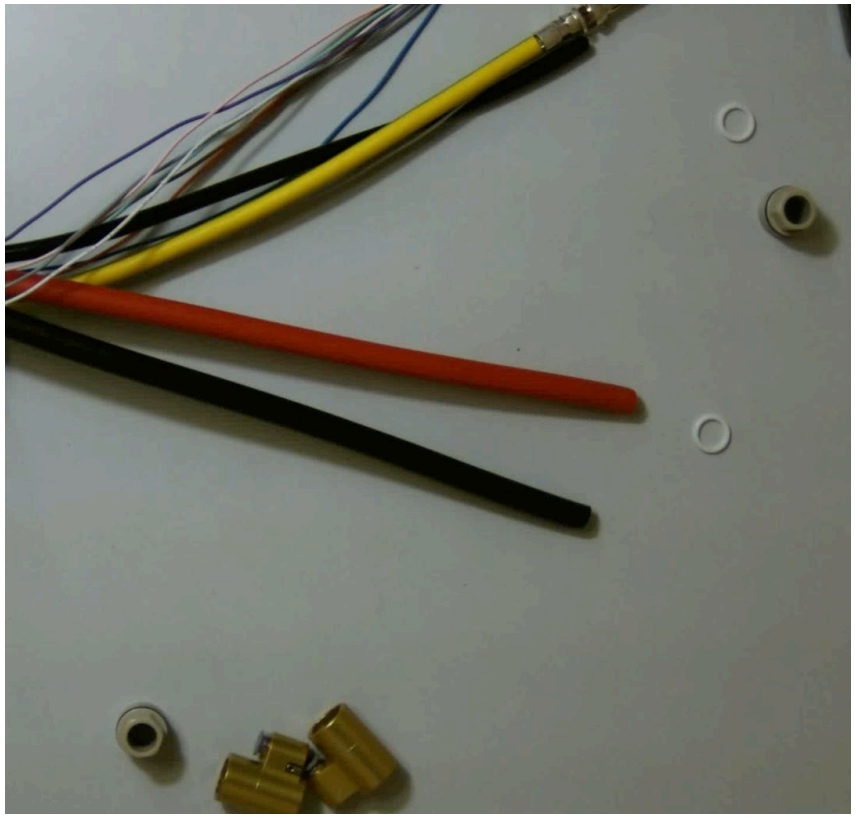
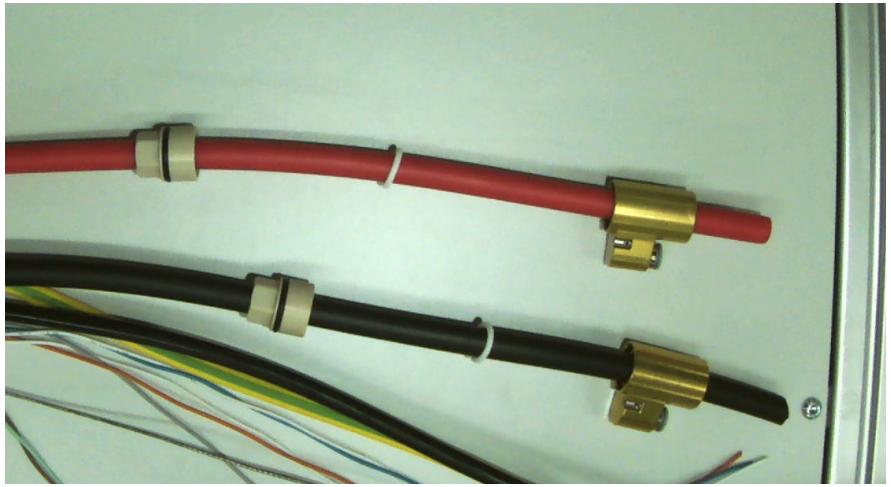
Model useage for assembly step recognition



Your use case can be next!

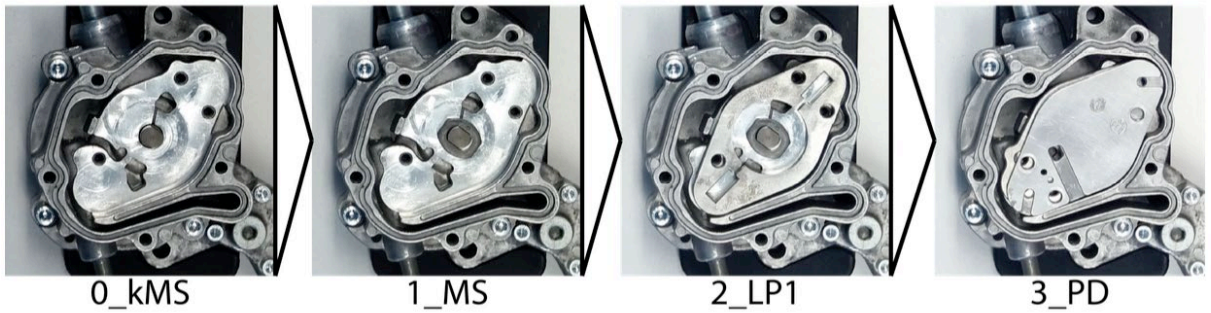
We realize your case:

- Free of charge
- But freedom to publish the case



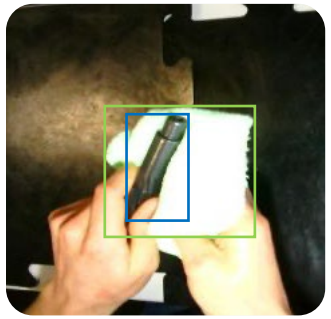
Requirements

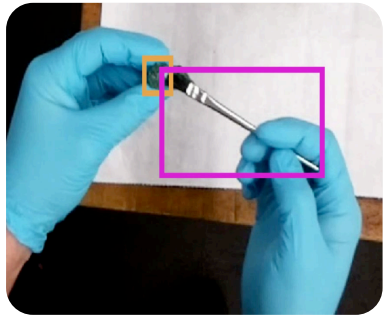
- Hand-held assembly: Parts are handled and visible without specific hardware
- Process confined to one assembly statio
- CAD data is available and publishable
- Examples: Water pump, drill, cable assembly



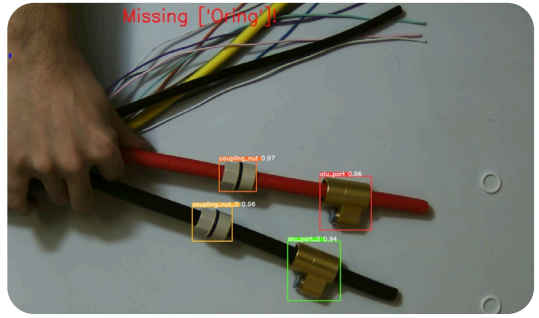
(Application overview)

Assembly action recognition: Liquid (fat, loctite) application, cleaning, fastening screw, etc.





Assembly state recognition: Component assembly, missing components/wrong order



Safety equipment recognition: Present/missing saftey gear

Paper based Maintenance

From SBB

From SBB

Augmented Reality-Based User Guidance

> **“Right information at the Right time in the Right place.”**

- ☑ Significantly less errors in the execution
- ☑ Reduced training and execution times
- ☑ Automatic verification
- ☑ Simplified and semi-automatic documentation
- ☑ Cost advantage

Managing increasing complexity, skill shortage and information overload

SBB | Functional Test of Passenger Emergency Brake

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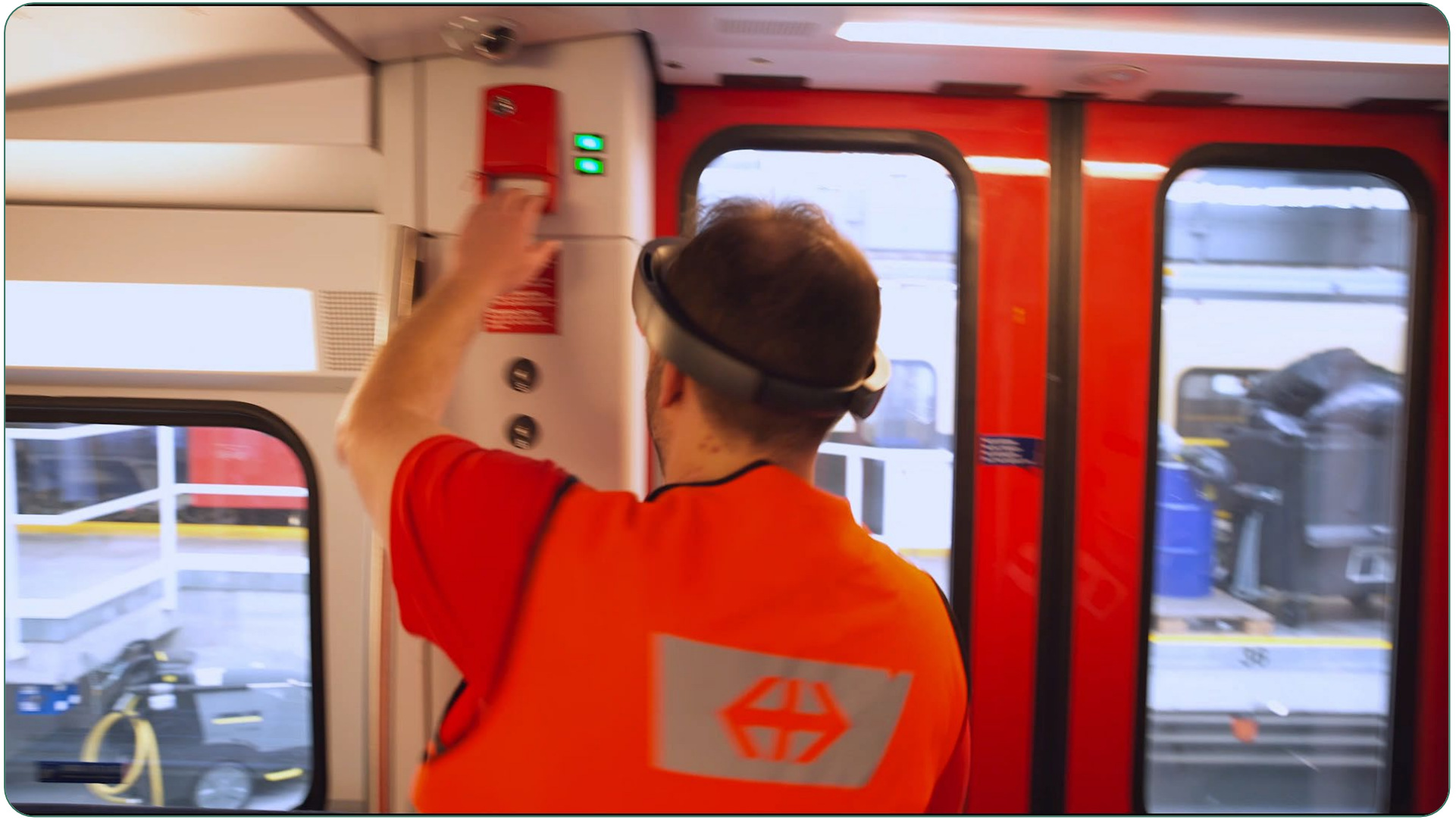
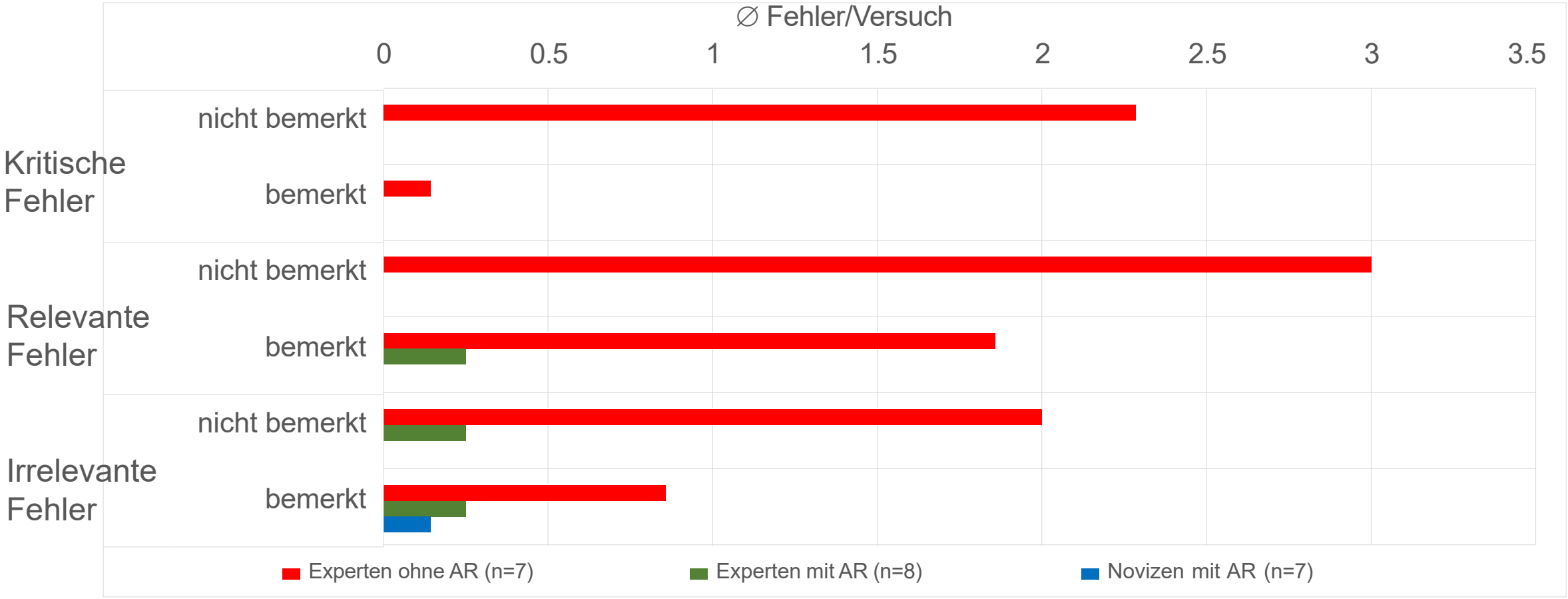
Produktentwicklungsgruppe Zürich

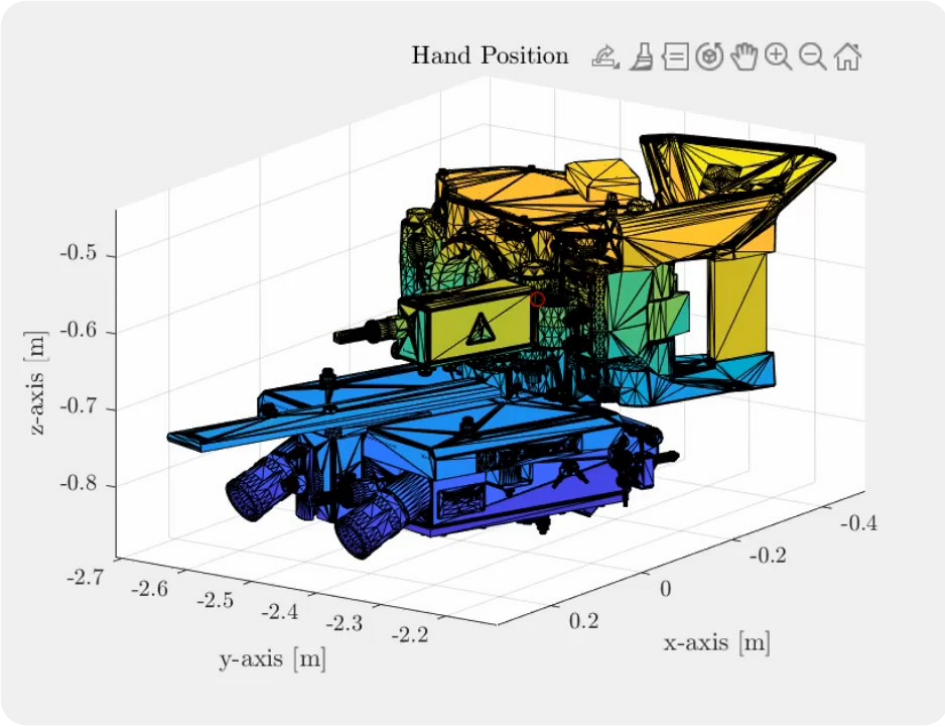
SBB CFF FFS



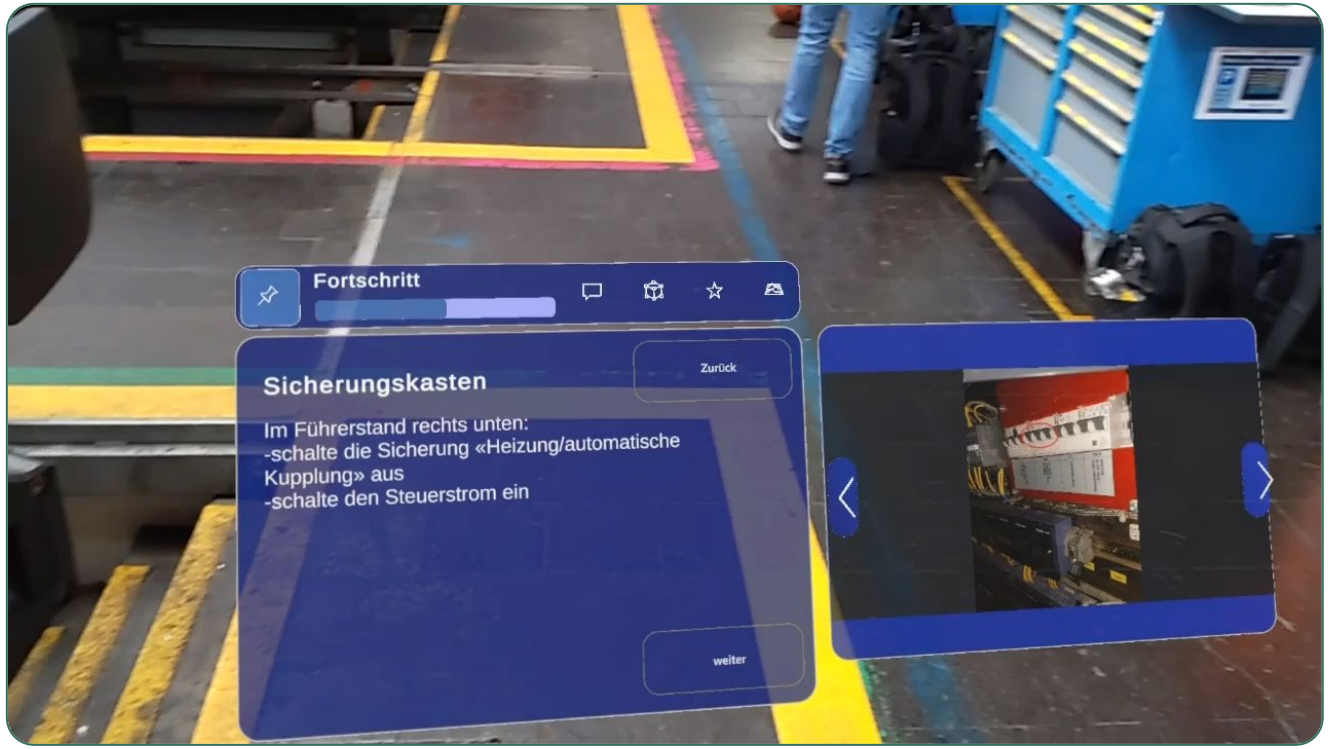
Experten ohne AR vs. Novizen mit AR

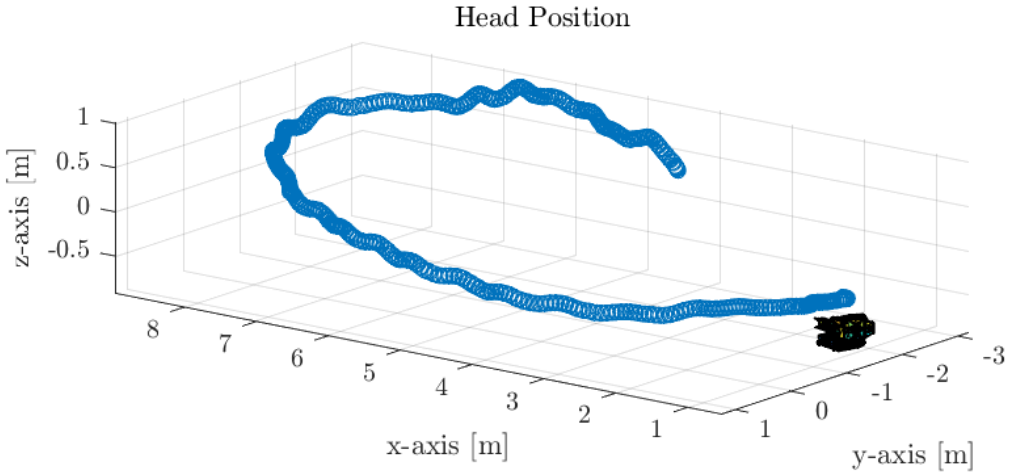


Eye & Hand Tracking



Head Tracking





SBB | Clutch Maintenance → Fuse Warning

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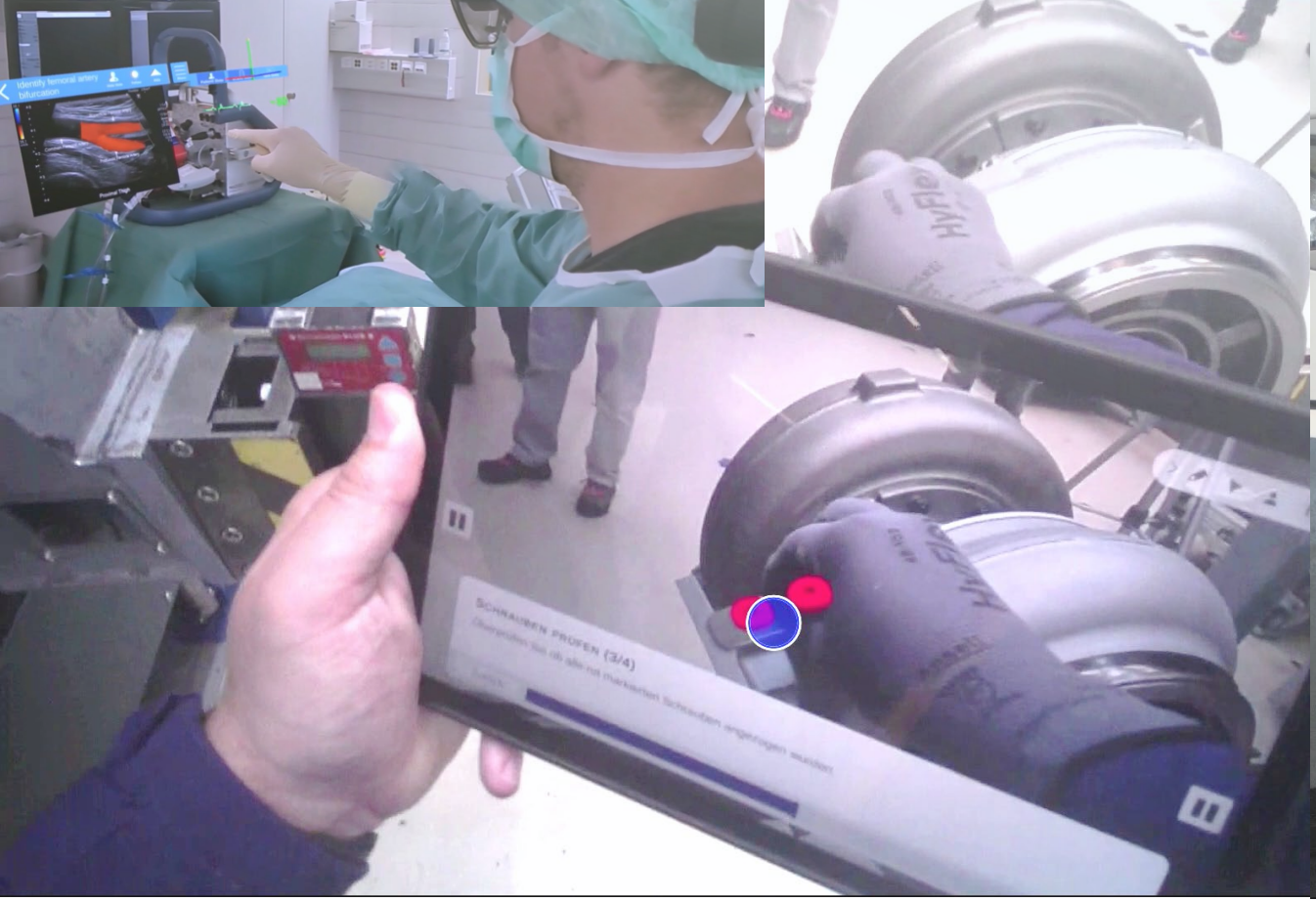
ETH Mobility Initiative in Cooperation with SBB CFF FFS



AR-Based User Guidance with Error Prevention and Know-how Management

Dr. Amir Golshani, Dr. Julian Wolf, Sophokles Ktistakis

Prof. Mirko Meboldt

Gefördert durch:

BRIDGE

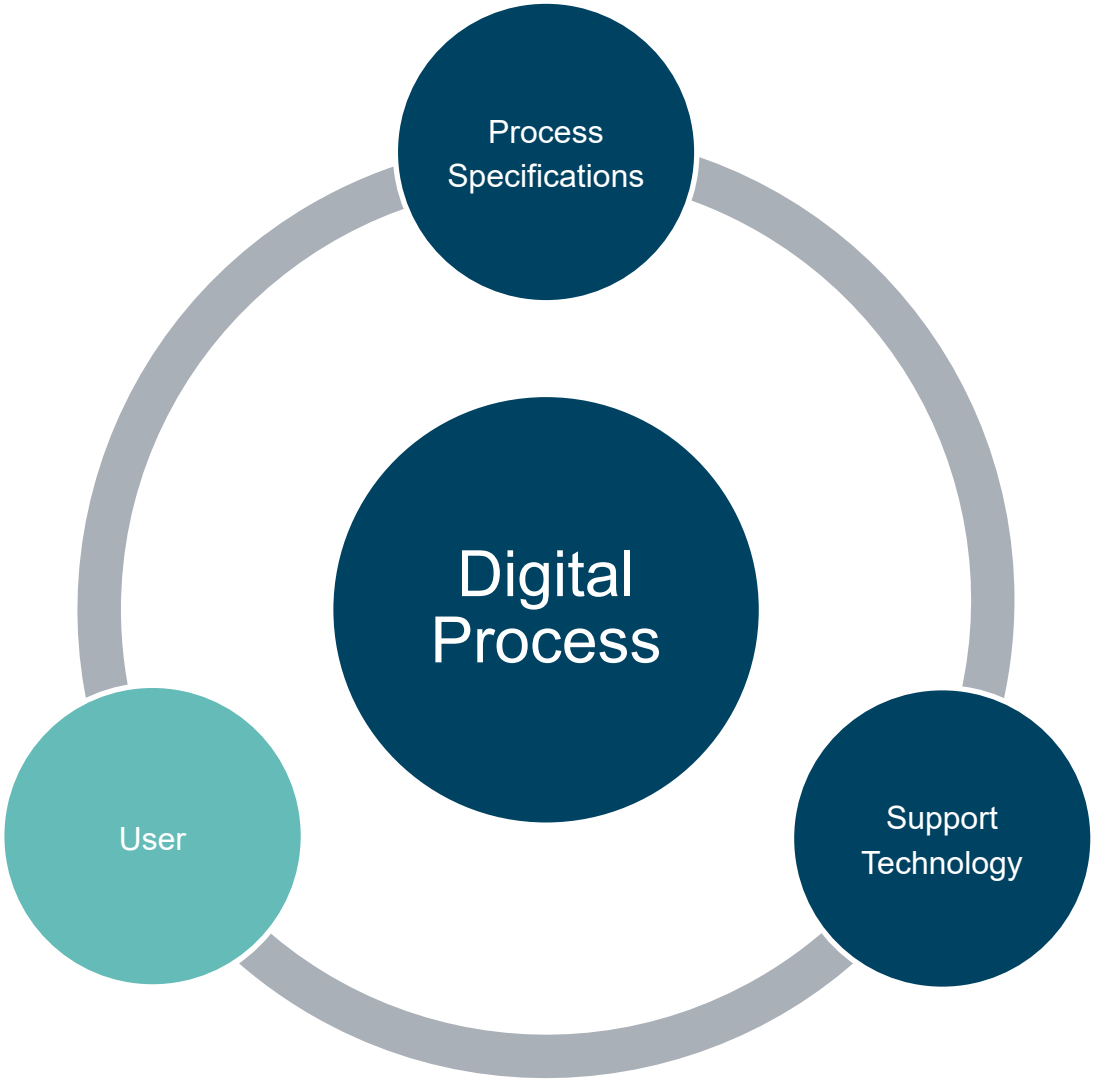
Innosuisse – Schweizerische Agentur für Innovationsförderung

Schweizerischer Nationalfonds

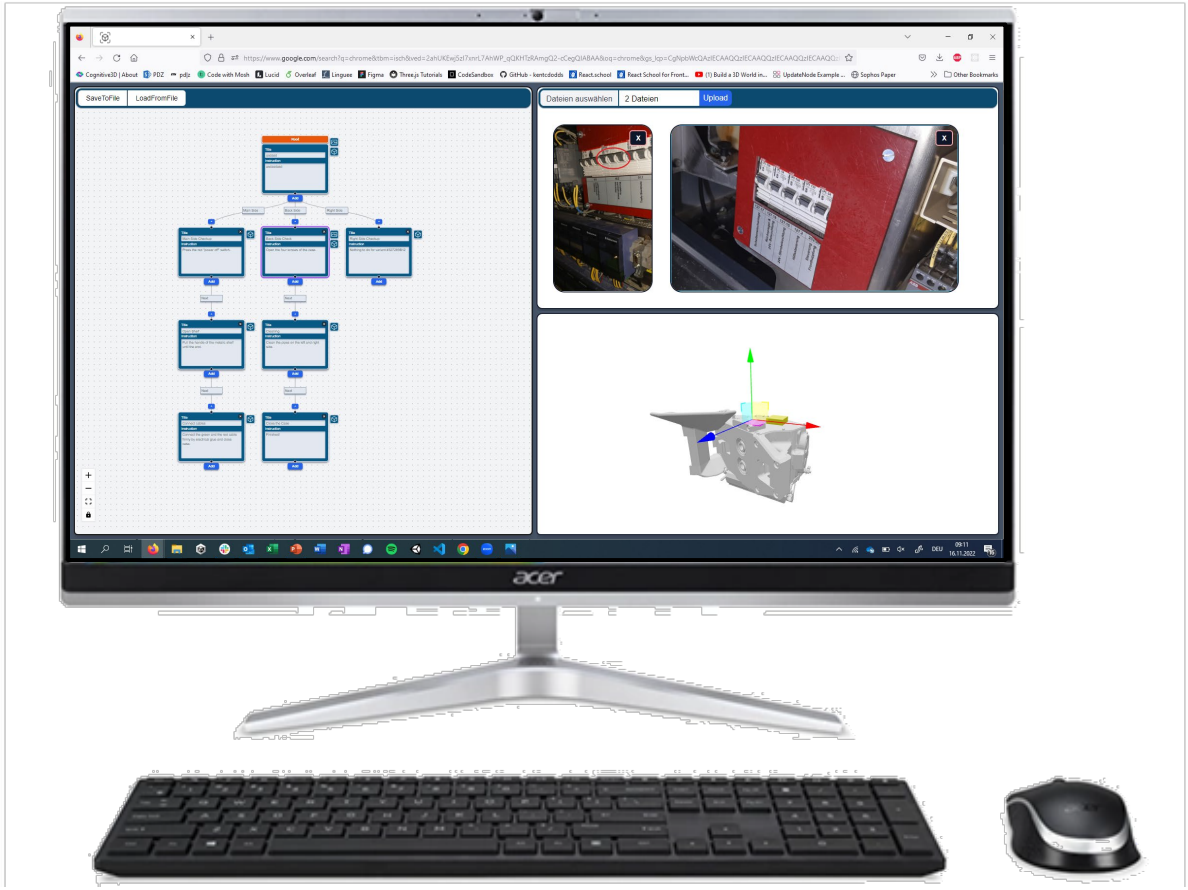
Microsoft for Startups

ucentrics

ucentrics | Focus on the User



Intuitive Creation of Digital Processes



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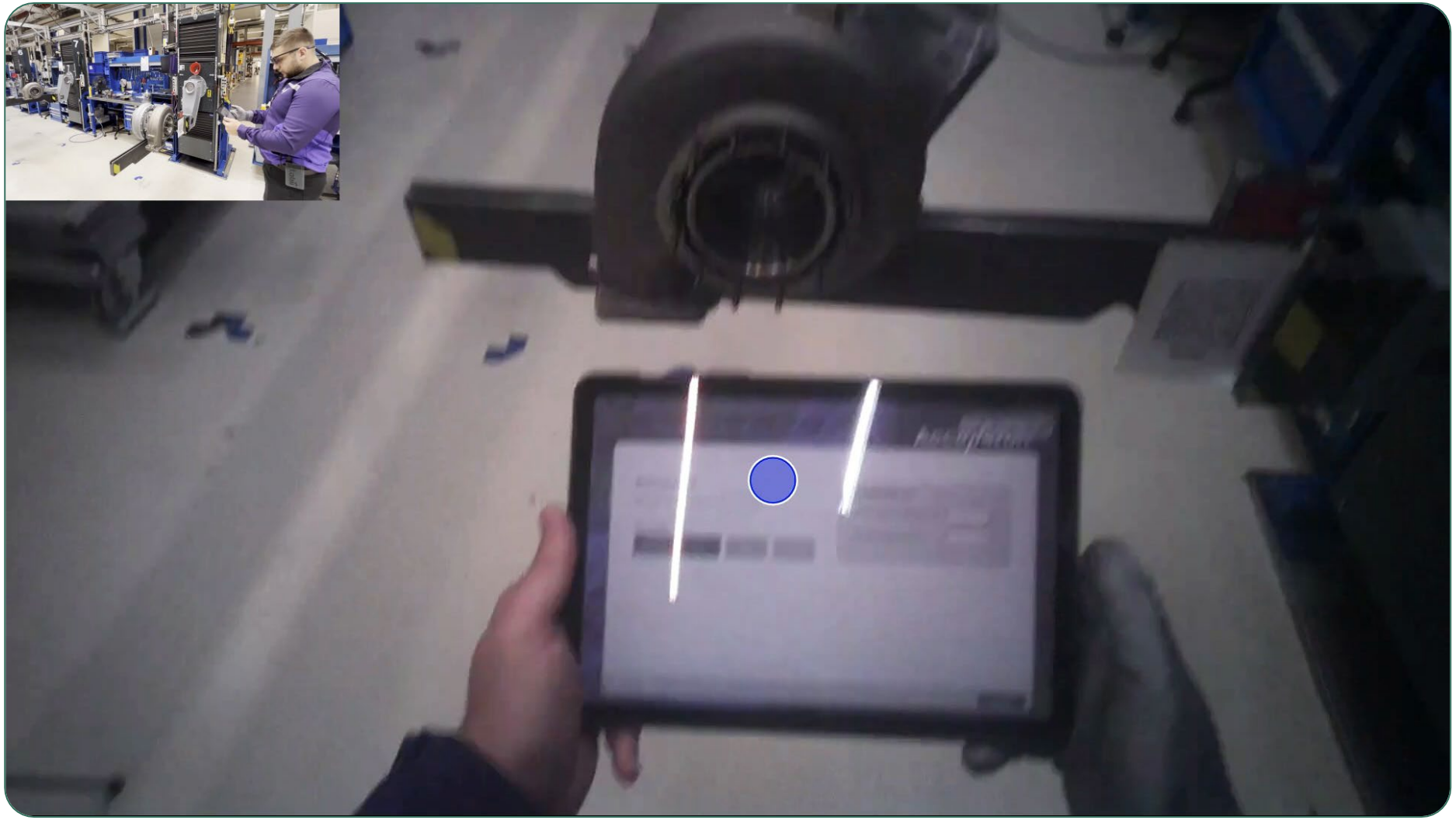
Device Independent Digital User Guidance

Our solution is compatible with popular devices (smart phones, tablets, and AR-Glasses) and can be easily adapted to new device generations.

+ Inexpensive Hardware, high availability		+ Hands free (Gesture & voice control)		+ Next generation compatibility
+ Operated with one hand	+ Complex tasks	+ Demanding environments	+ Complex tasks & Trainings	
			+ Error prevention and real-time feedback	

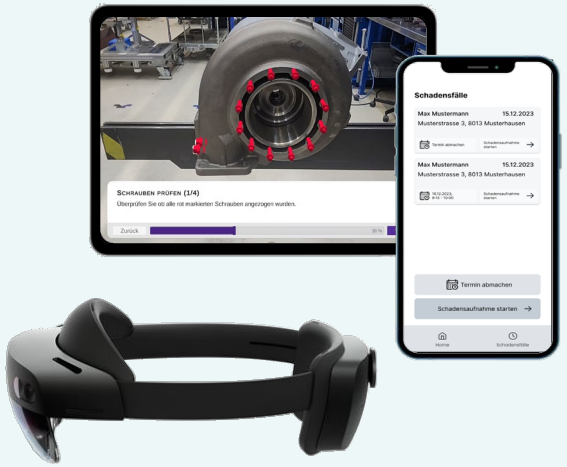
ucentrics

Final Inspection of Turbocharger Assembly

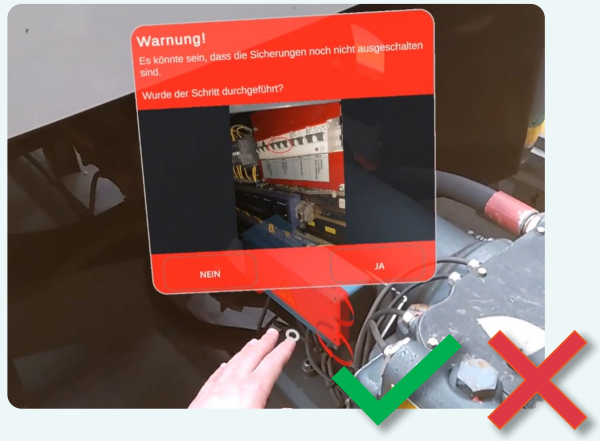


Product and Services

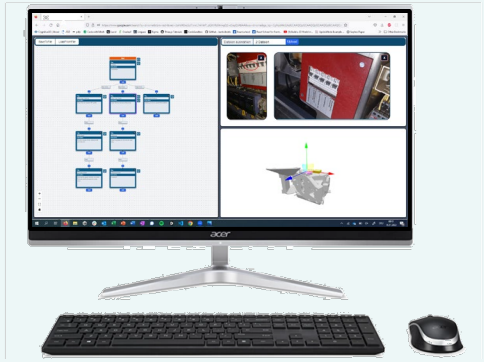
Intuitive Guidance
throughout SOPs and Checklists



Smart Support
- Real-time Feedback
- Automated Step Verification



No-Code Platform
Easily creating and digitizing SOPs and expert knowledge in digital workflows



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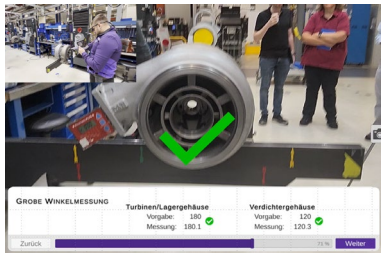
Selected Reference Projects

Acceleron



KSW Kantonsspital Winterthur

SBB CFF FFS

New Green Tec

University of Zurich[UZH]

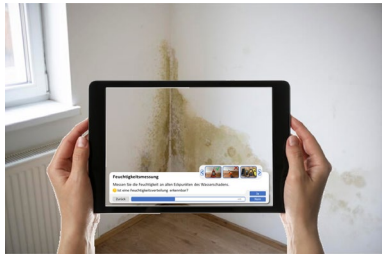
HMZ Award 2022

BELIMO

dormakaba

MEDICAL TEMPLATES AG
Navigate with ease

ipex



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Our Team

Dr. Julian Wolf
Postdoc ETHZ
+6 Year experience with AR-application in Industrial and clinical applications

Dr. Amir Golshani
Experienced C-Level Executive
+ 20 Year experience in High-Tech industries
M&A, Technology & Strategy

Sophokles Ktistakis
Ph.D. Candidate ETHZ
Computer aided human behavior analysis

Prof. Dr.-Ing. Mirko Meboldt
Professor for Product Development (ETHZ)
+15 years experience in industrial innovative product development

pd|z Product Development Group Zurich
Produktentwicklungsgruppe Zürich

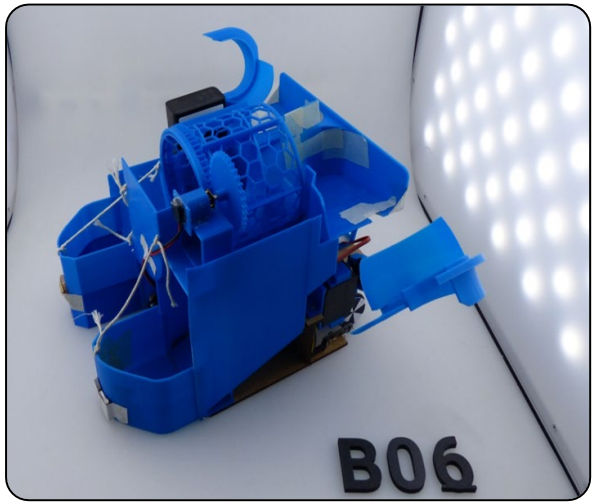
Close cooperation with the pd|z for industrial and research project implementation

Today’s Live-Demonstrations

Final Inspection

Assembly Support Based on Synthetic Training Data

Student Innovationprojects (Hands-on Lecture)



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Programm

17:30 - 18:30 Uhr Live-Demo & Testen der App - in Gruppen

- 17:30 - 17:45: Gruppe 1
- 17:45 - 18:00: Gruppe 2
- 18:00 - 18:15: Gruppe 3
- 18:15 - 18:30: Gruppe 4

  Gruppenzuteilung steht auf Namensschild

- 17:30 Apéro riche und Getränke (parallel zur Live-Demo, direkt neben Apéro-Raum)
- 21/22:00 Uhr: Ende der Veranstaltung