C04 BIM

Integrating Digital Design and Additive Manufacturing through BIM-Based Decision Support and Digital Twin Methods

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Project aims of 2nd funding period

- Utilising **tacit knowledge** in the early design stage
- Integrate the **case-based reasoning (CBR)** method
- Extend the **Fabrication Information Modeling (FIM)** framework to support **multi-stage manufacturing**
- Realization of FIM as **Cyber Physical Systems (CPS)** by enabling automated sensor data interpretation
- Implementation of the **Learning-by-Printing (LbP)** concept by integrating machine learning methods into the early design stage

Key collaborations in 2nd funding period
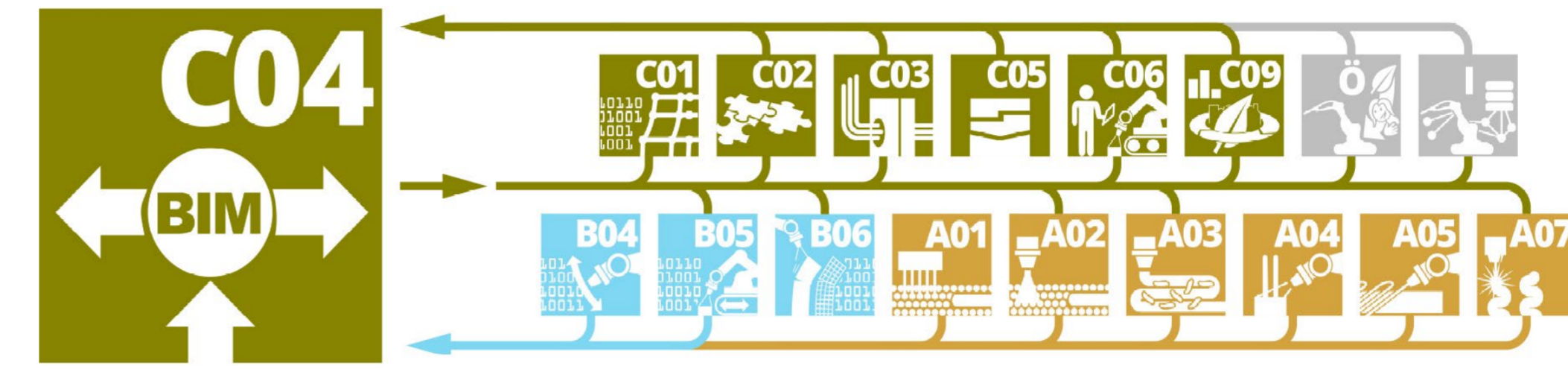
- **C06** for automated quality control integration into FIM, CPS investigations, and integration of construction planning into the early design stage
- **A03** for full-scale validation of the CPS implementations and evaluation of transfer learning methods for Learning-by-Printing
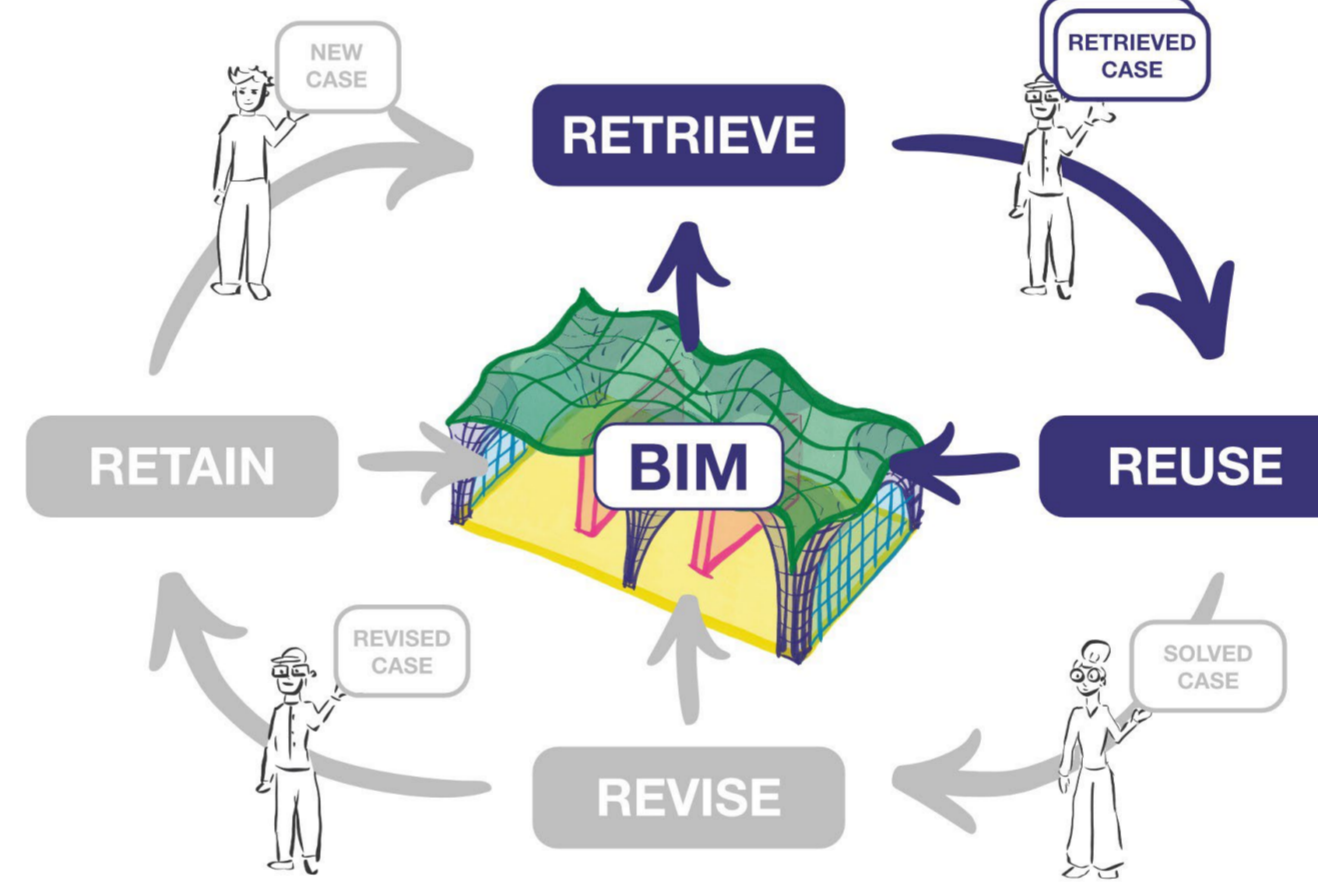- **A04** verification of transfer learning methods for Learning-by-Printing

Methods

Utilising tacit knowledge for DDSS
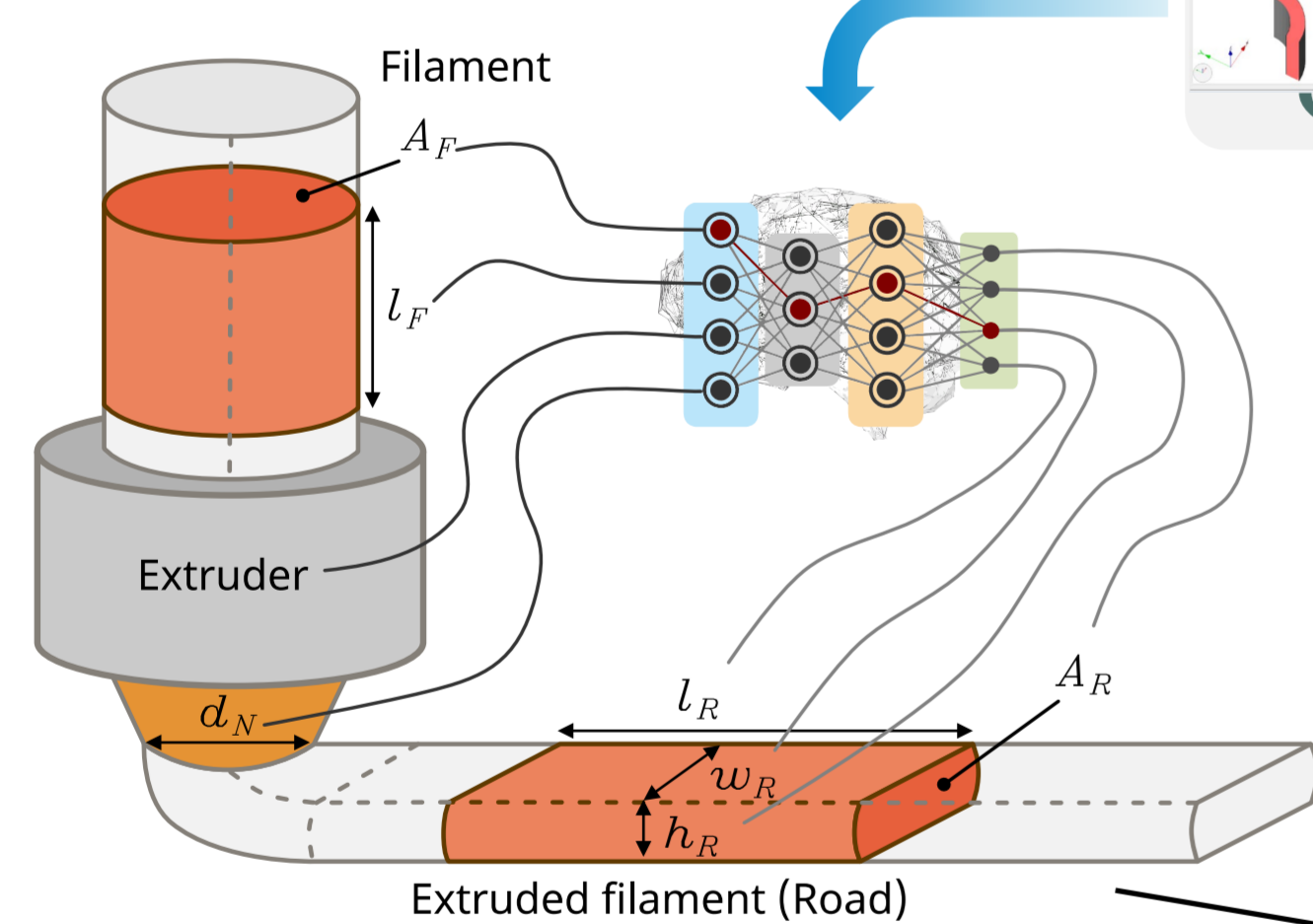- Pipeline of tacit knowledge acquisition and reuse
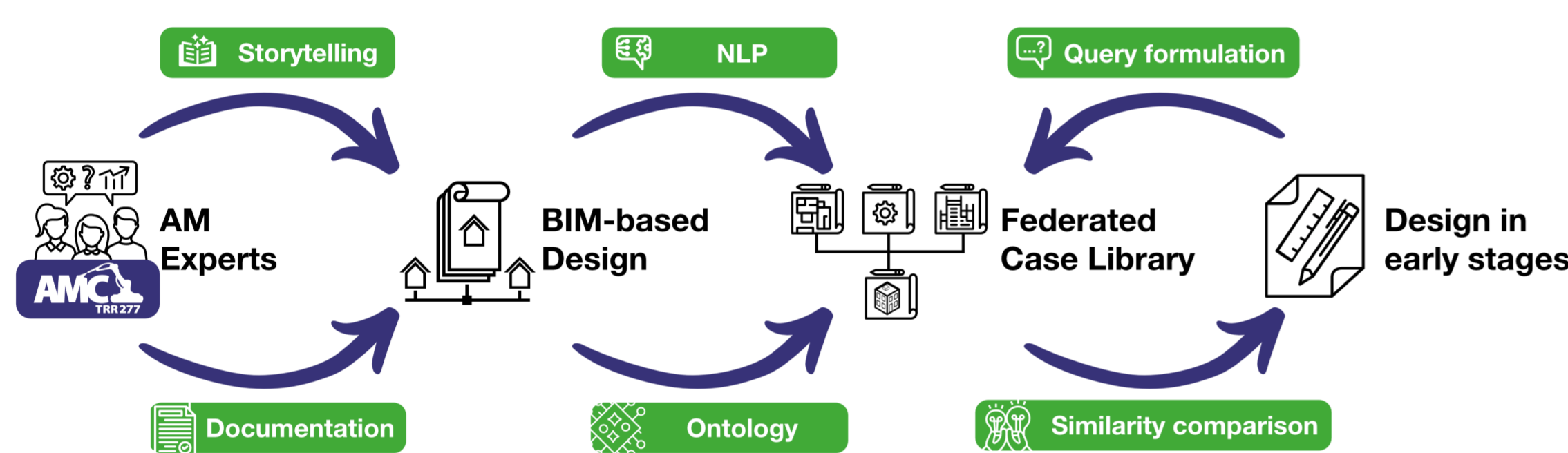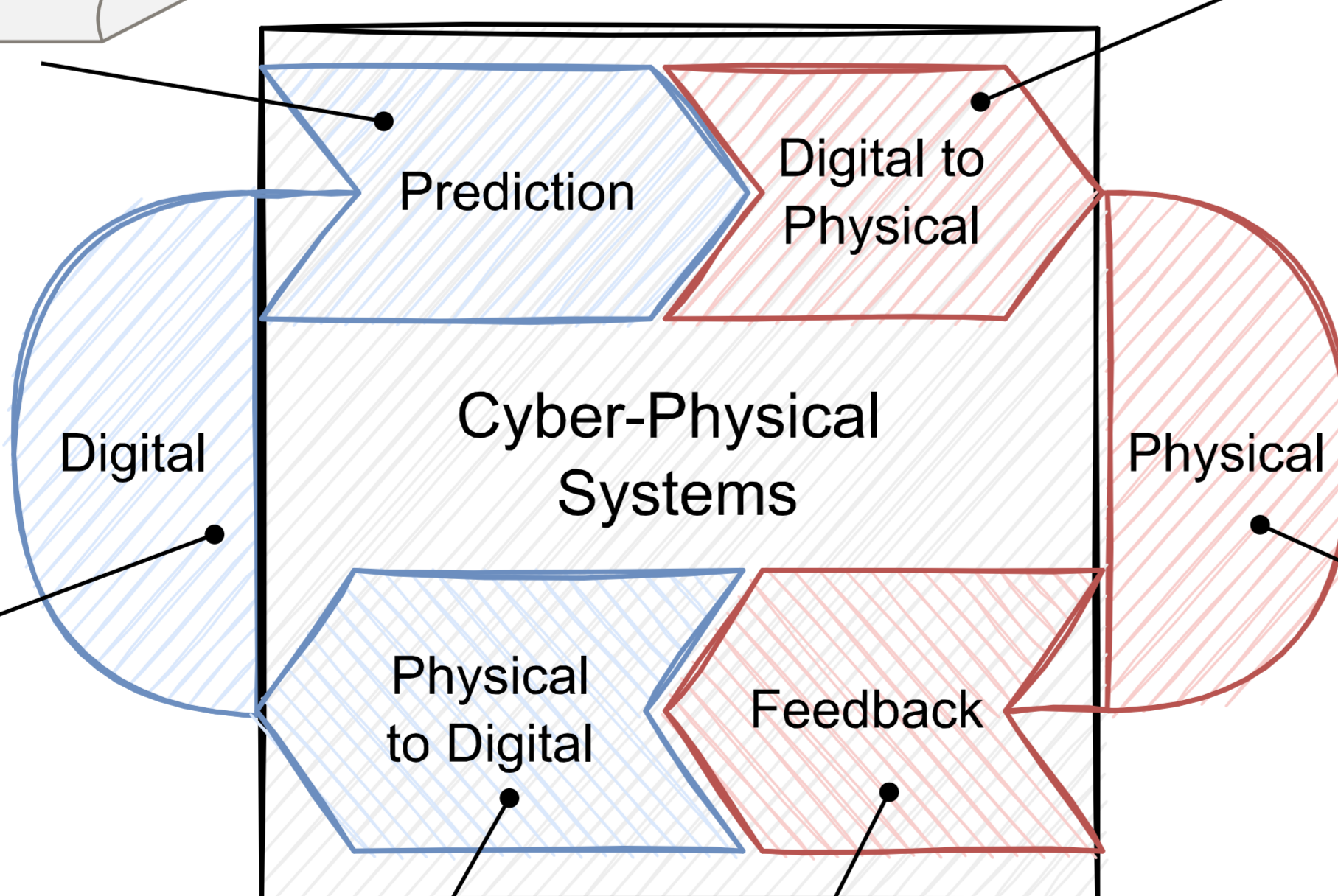

- CBR with focus of retrieve and reuse

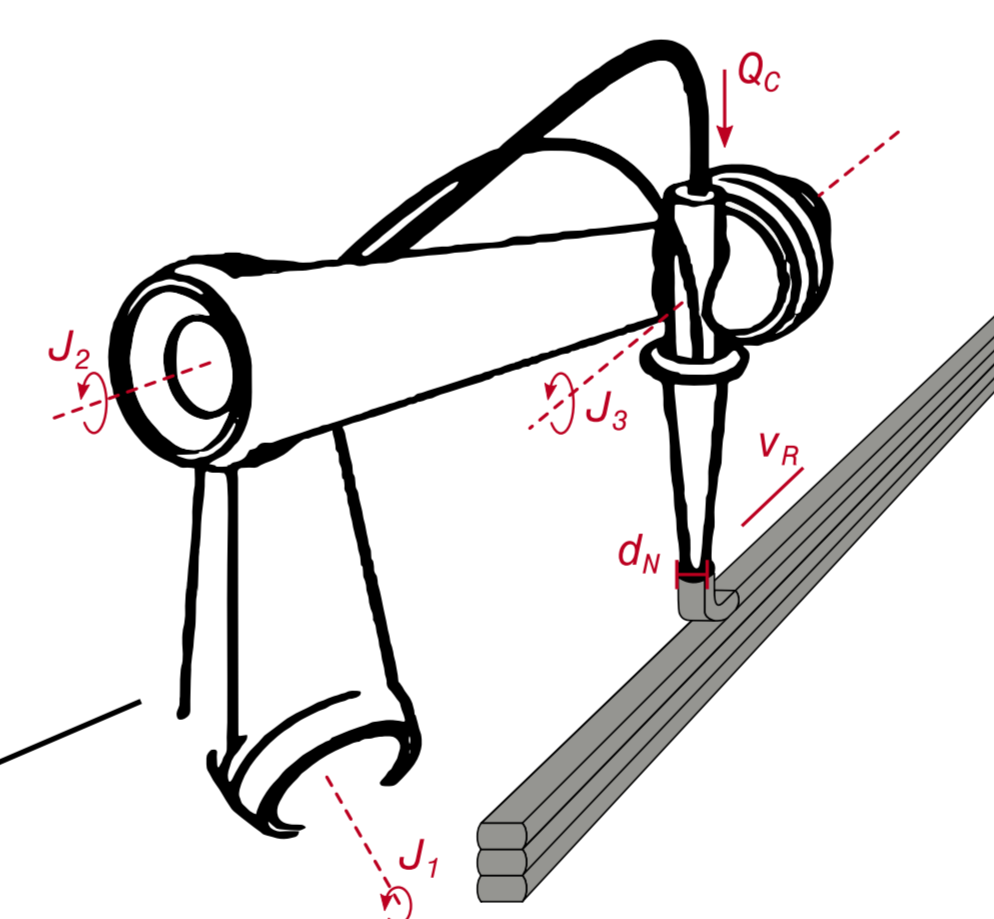### Learning by printing for FIM
- Fast design variant evaluation

Neuronal Network training
- Automated training experiments based on FIM data

Realization of FIM as CPS
- Increasing level of automation
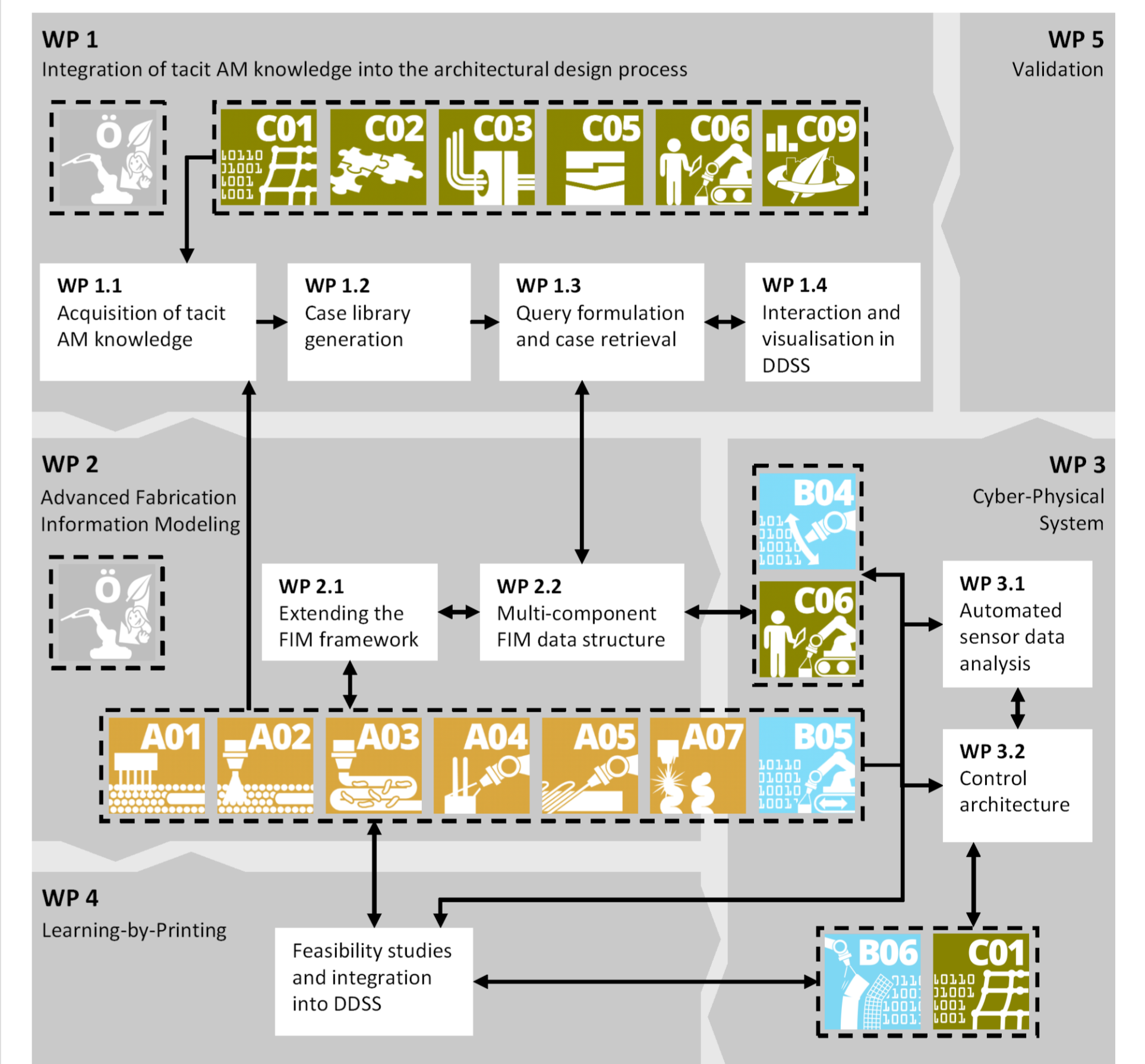- Fully synchronized digital and physical counterparts

FIM model

Cyber-Physical Systems — Digital, Prediction, Digital to Physical, Physical, Physical to Digital, Feedback
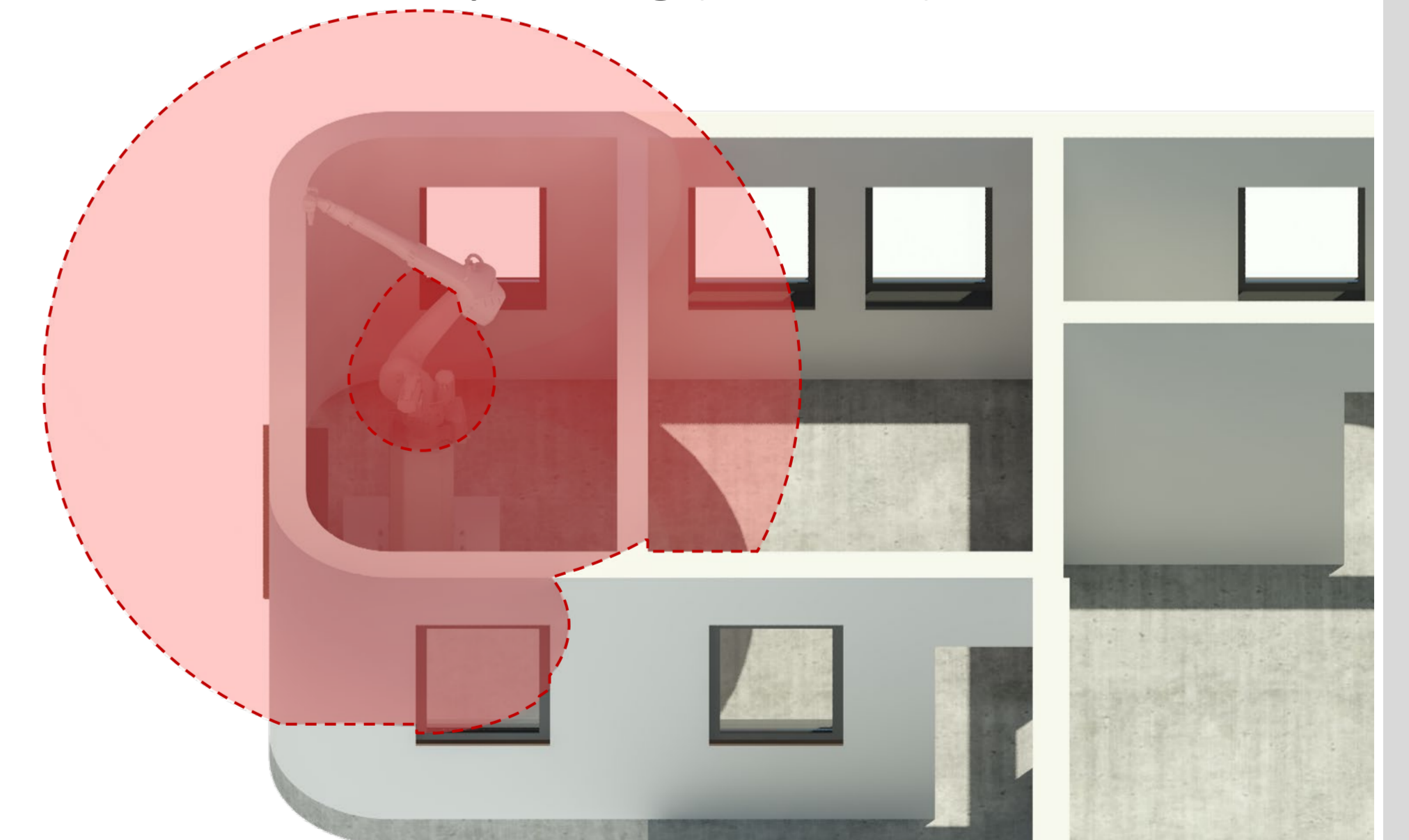
Automated sensor analysis
- Integrated quality control
- Direct data feedback to FIM model
- Integration of control loops

Work programme

Extended FIM-based robot simulation
- Multi-component FIM
- Construction planning (with C06)

Outlook 3rd funding period

- Integration of reinforcement learning, trained chatbot and event-driven simulation tools
- Increased level of automation of the implemented methods and frameworks
- Extension of FIM to enable process simulations across different temporal and spatial scales