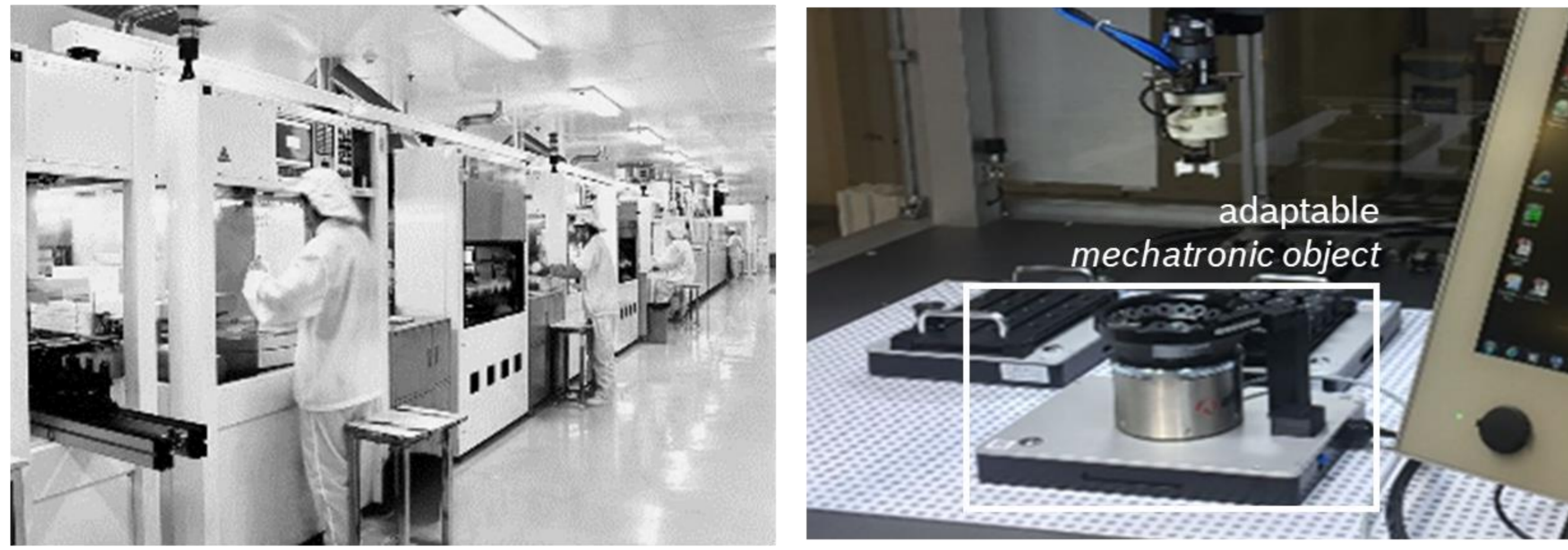# Assisted Safety Assessment and Approval

Safety Assurance for Flexible Production Systems
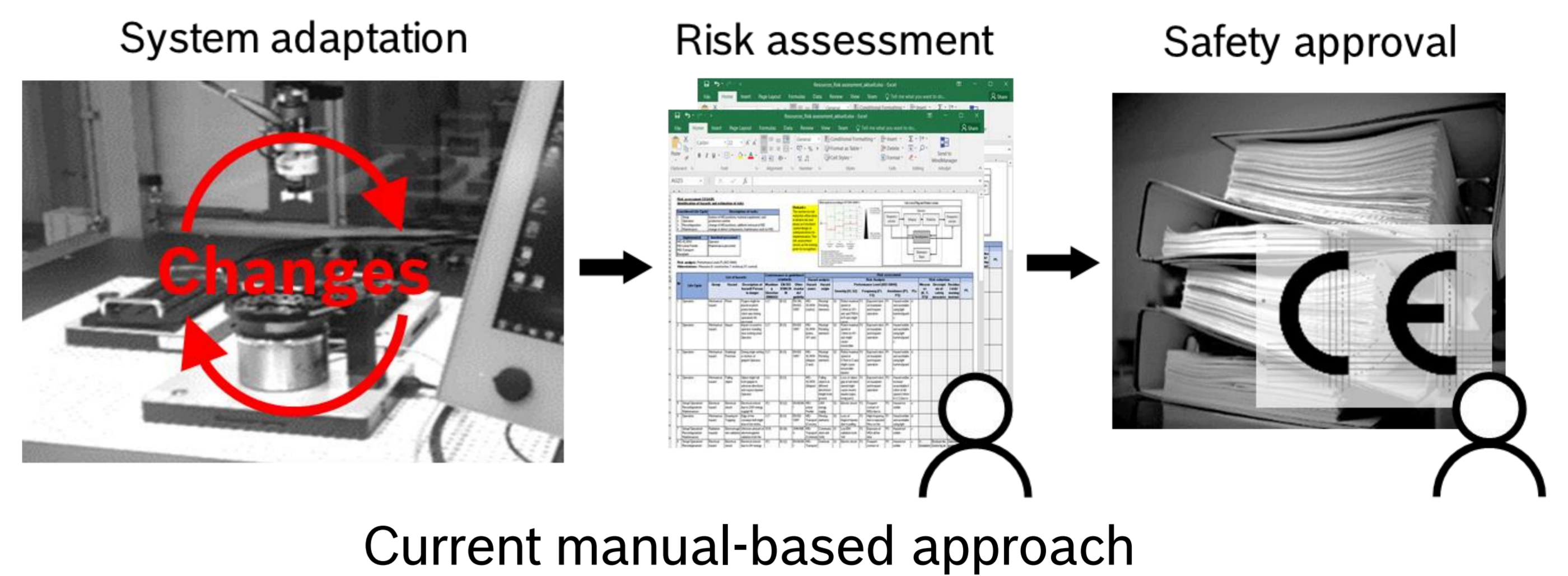
Current Trends

adaptable mechatronic object

rising **adaptability**

↓ lower responsiveness
↓ lower reconfigurability
↓ limited product variations

↑ higher responsiveness
↑ higher reconfigurability
↑ scalable product variations

Problem Statement

System adaptation Risk assessment Safety approval

Changes

CE

Current manual-based approach

| Increased safety **uncertainties** | **Know-how** for safety analysis | Inevitable **legal requirements** |

| Repetitive **manual tasks** | A lot of **paperwork** | **Non-reusable** results |

Assistance through the software-based concept AutoSafety

System adaptations

Digital twins

MO Handling
MO Feeder
MO Tray
ENT MachineCell
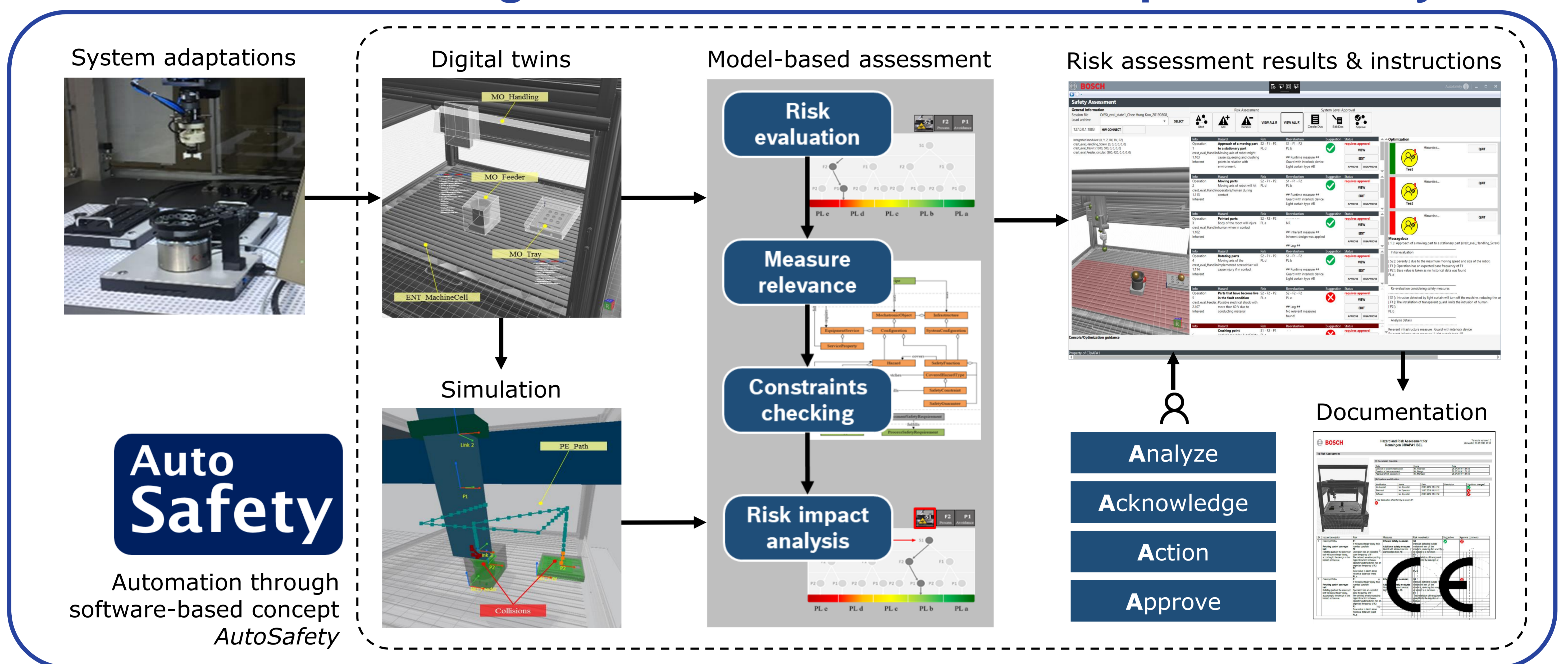
Auto Safety

Automation through software-based concept *AutoSafety*

Simulation

Link 2
PE_Path
Collisions

Model-based assessment

Risk evaluation

PL e   PL d   PL c   PL b   PL a

Measure relevance

Constraints checking

Risk impact analysis

PL e   PL d   PL c   PL b   PL a

Risk assessment results & instructions

Analyze
Acknowledge
Action
Approve

Documentation

CE

Results

Human-in-the-loop Assurance

Digital twins

Checklist for safety-compliant operation

Risk assessment results

Auto Safety

Added Values through AutoSafety

Digital twins
Self-descriptive modules deliver own safety-related information

Reusable information

Simulation
Path simulation checks emergent collision points based on actual system configuration

Checking of **runtime** configuration

Semantic data model
Modeling of relevant data for a model-based safety assessment

Standardized descriptions & semantics

Knowledge base
Software provides data for relevant safety standards and guidance

Know-how for safety analysis

Contact: Chee Hung Koo, Sebastian Schröck, Marian Vorderer
Robert Bosch GmbH, Corporate Sector Research and Advanced Engineering, vorname.name@bosch.com