Early Stage Safety Planning via Virtual Modelling
The Pros and Cons of using mighty software
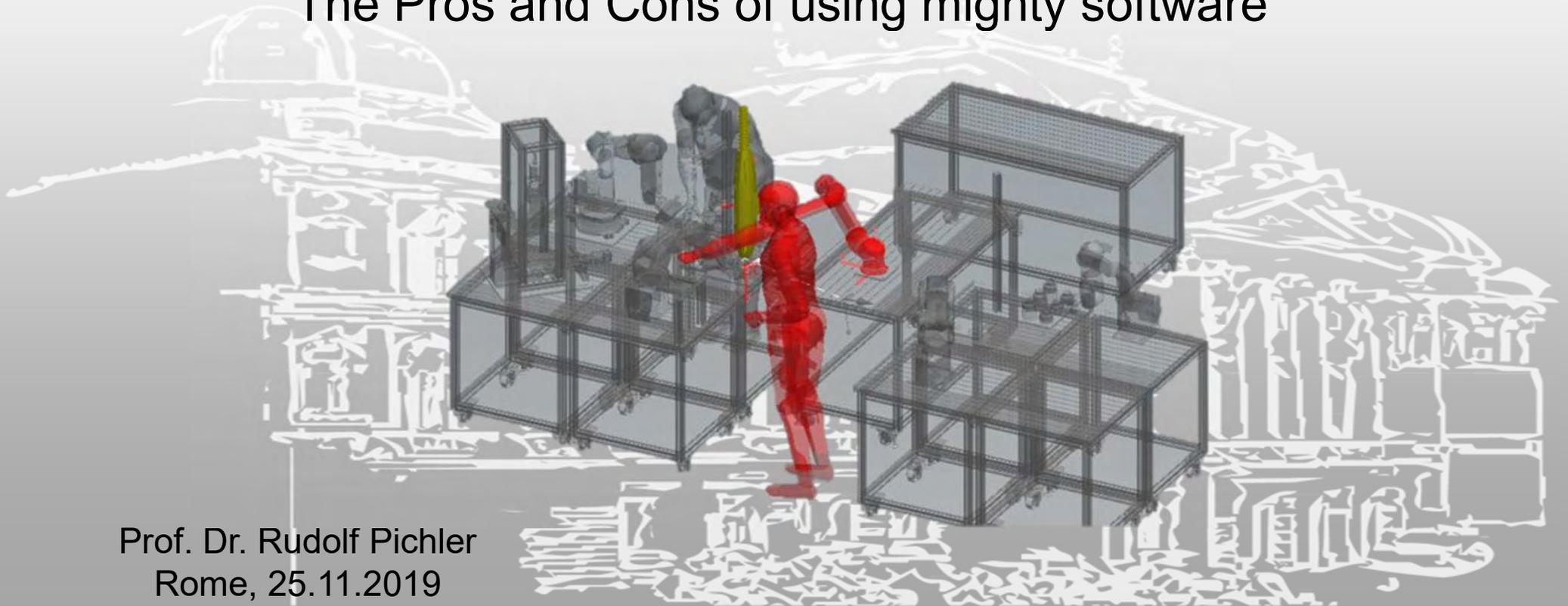
Prof. Dr. Rudolf Pichler
Rome, 25.11.2019

AGENDA

Safety Integrated Simultaneous Engineering
Safety Checks via „Process Simulate Human"
Modell Based Calculation of Safety Reaction Times
Reflections and Summary

Short Ramp Up Periods must also consider the Concerns of Safety!
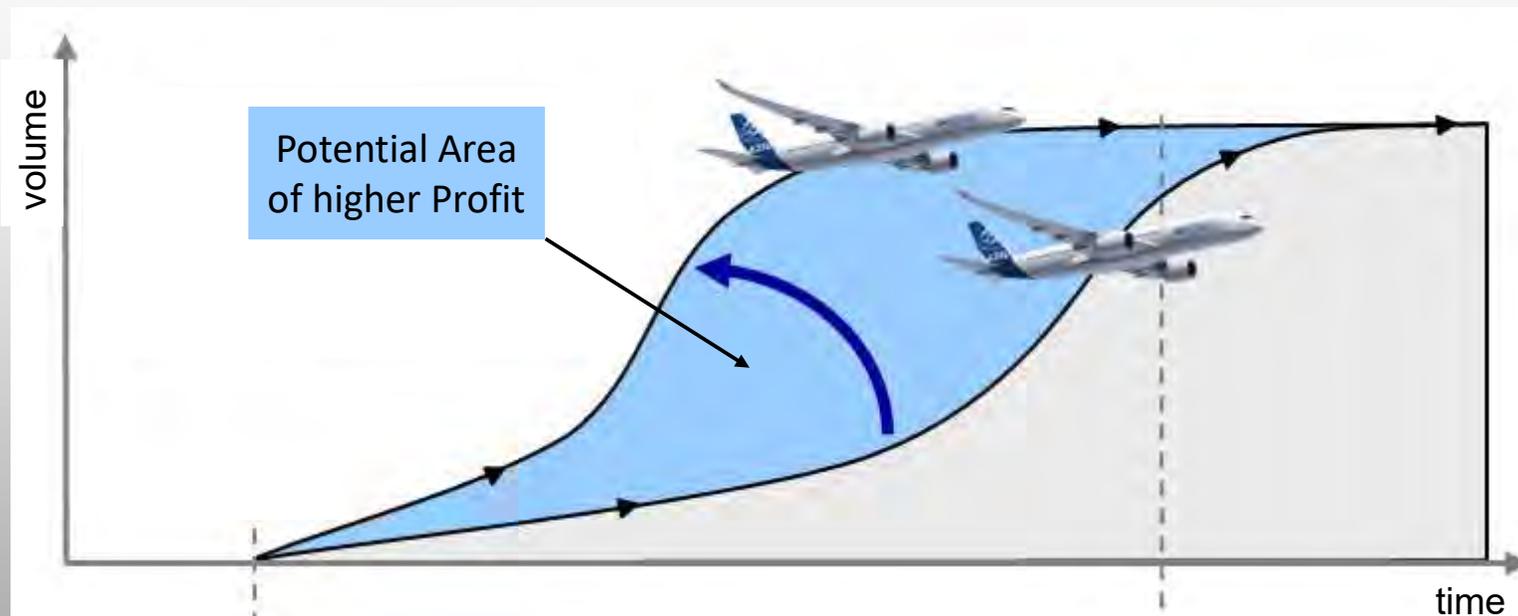
➔ Higher profits and earlier Start of Productions (SOP) need steeper ramp ups

➔ Steeper ramp ups must not forget the finally necessary Safety Acceptance

Safety Planning also has to be a part of Simultanous Engineering

Old School

| Product Development | Process Development | Erection of Machinery | Safety Planning | Safety Approval | **SOP** |

Modern Scheme

| Product Development |
| Process Development |
| Erection of Machinery |
| Safety Planning | S.Appr. | **SOP** |

Benefit

**in Time
in Quality
AND Safety**

Univ.-Prof. Dr. Rudolf Pichler
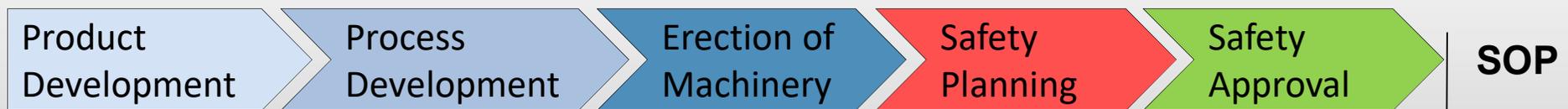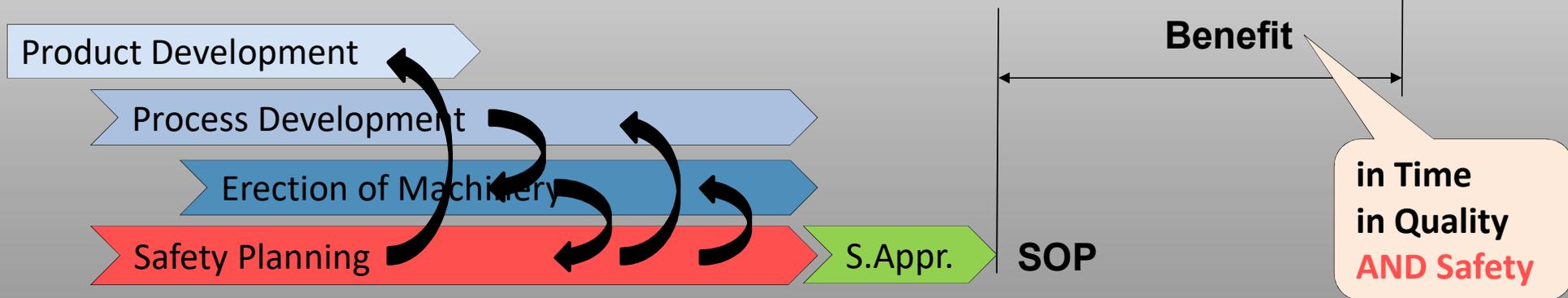
A shared Database and Digital Twins are a Must Have for doing an efficient Simultaneous Safety Engineering
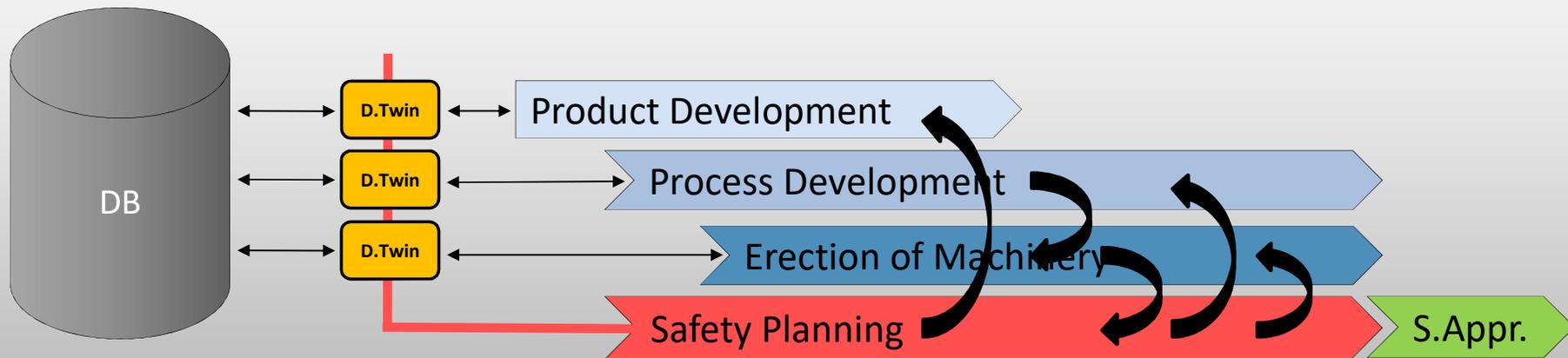
➔ Digital Twins of Products, Processes and Working Environments are essential

➔ Seamless Data Integration is a prerequisite for doing ongoing simulations

➔ The Human Expert cannot be replaced anyhow

The smartfactory@tugraz as a Learning Factory is a splendid research field for data integrated manufacturing

SIEMENS PLM

- ➔ NX CAD
- ➔ NX CAE
- ➔ NX CAM
- ➔ NX MCD
- ➔ TIA Portal
- ➔ SIMIT Simulations Platform
- ➔ Process Simulate Human
- ➔ ....

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LERNFABRIK FÜR AGILE UND DATENSICHERE FERTIGUNG

Source: own representation

Creating Digital Twins of the Workplaces

Real World
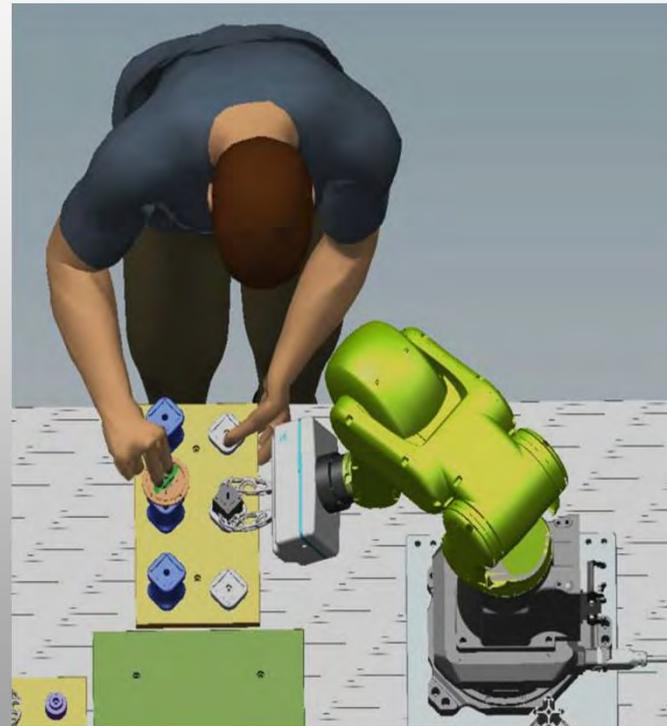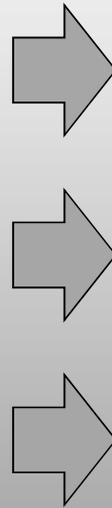
Digital Twin

Creating Digital Twins of the whole Factory

Real World
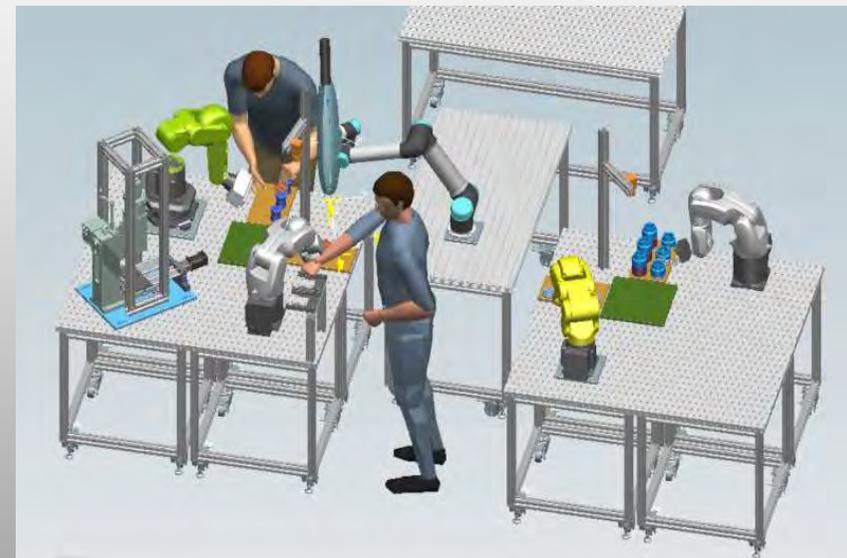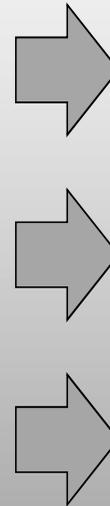
Digital Twin

2 Show Cases in Terms of Modelling Based Safety Planning

Safety and Ergonomic Analysis
via Process Simulate - Human Advanced
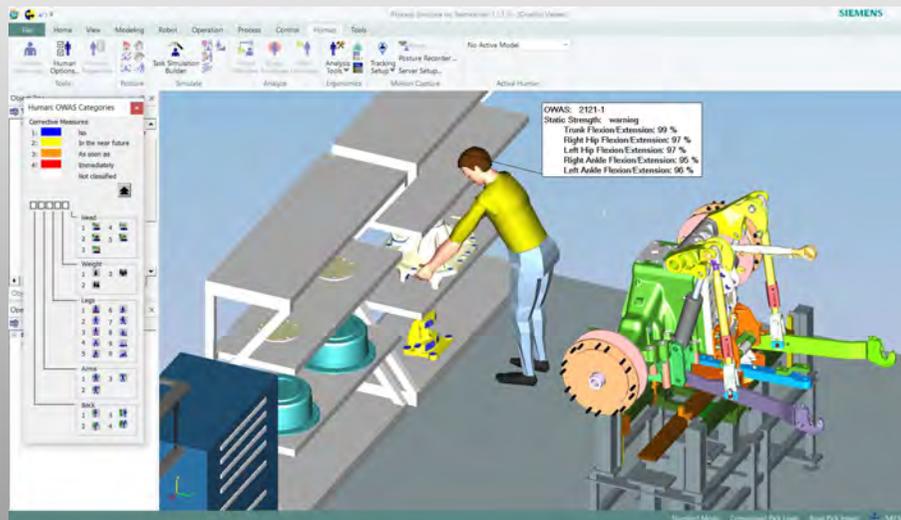
Source: Siemens

Measurement of Safety Reaction Times
via SIMIT Simulation SW
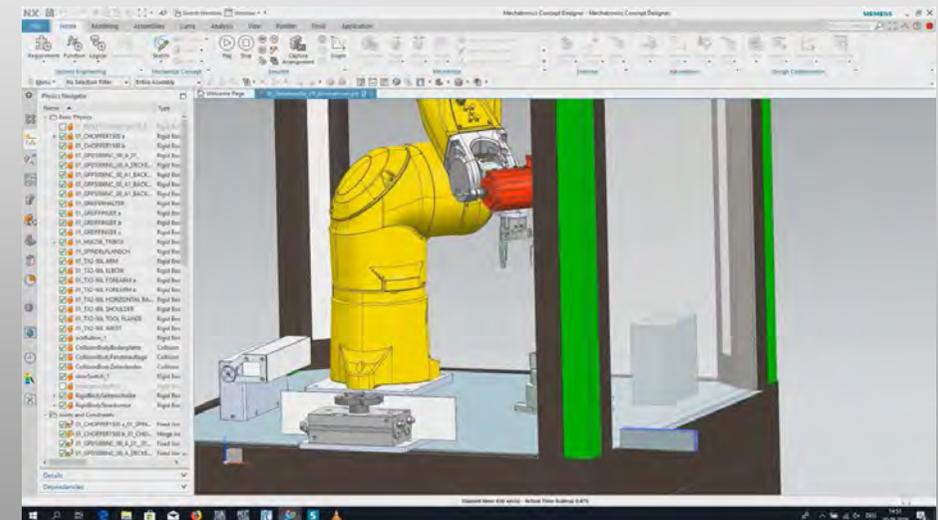
Source: Siemens + IFT

The Simulation examines the Suitability of Safety Precautions

Source: own representation
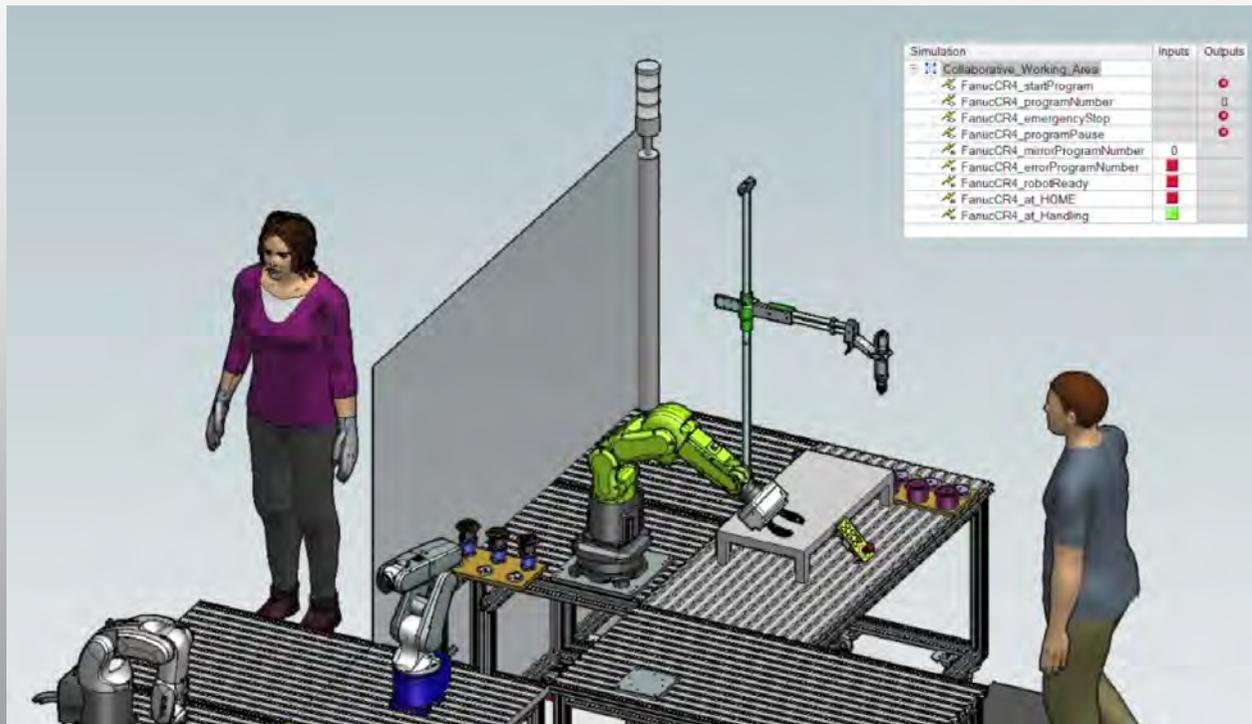
Simulation including folowing Safety Devices:

⇨ Safety Mat
⇨ Safety Curtain
⇨ Indicator Lamps
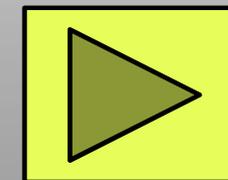
Actual Calculation of Safety Reaction Time
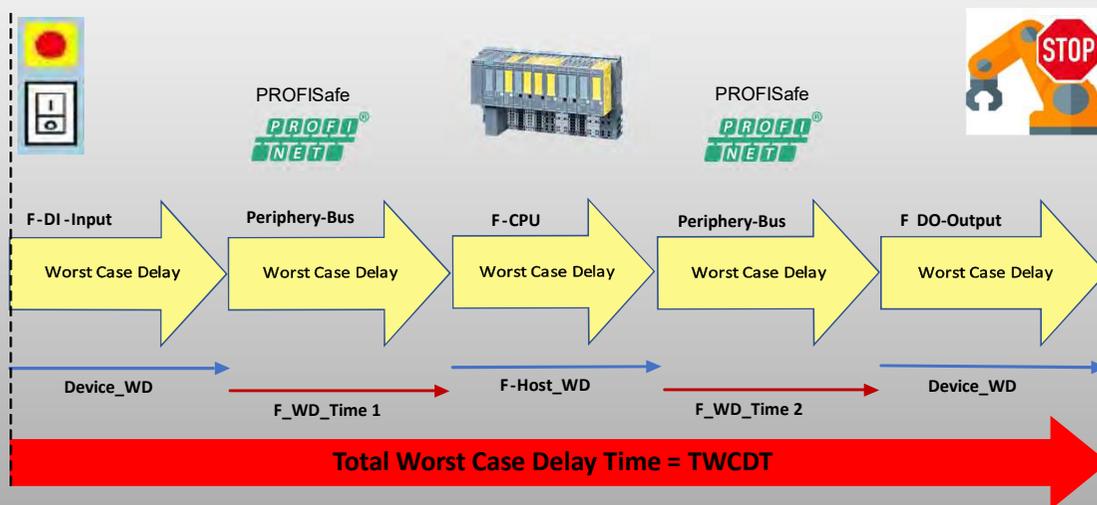
Actual Procedure:

Working with
Time Tables of System Providers

Use of manifold Assumptions
and Expert Recommendations

Model Based Calculation of Safety Reaction Times
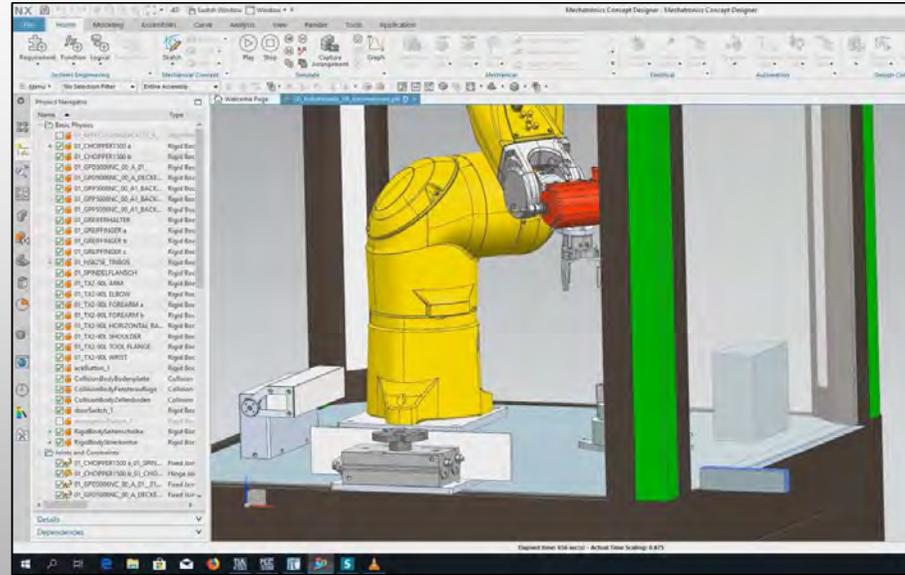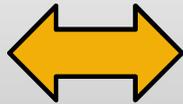
Proprietary Control Unit always remains to be a secret: What is the robot really doing?

➔ Established Simulation is based on the principle „Hardware in the Loop"

➔ Complex Set up of HW and SW- Interfaces is required

Architecture for doing Simulations of the „Stäubli"-Robot Cell
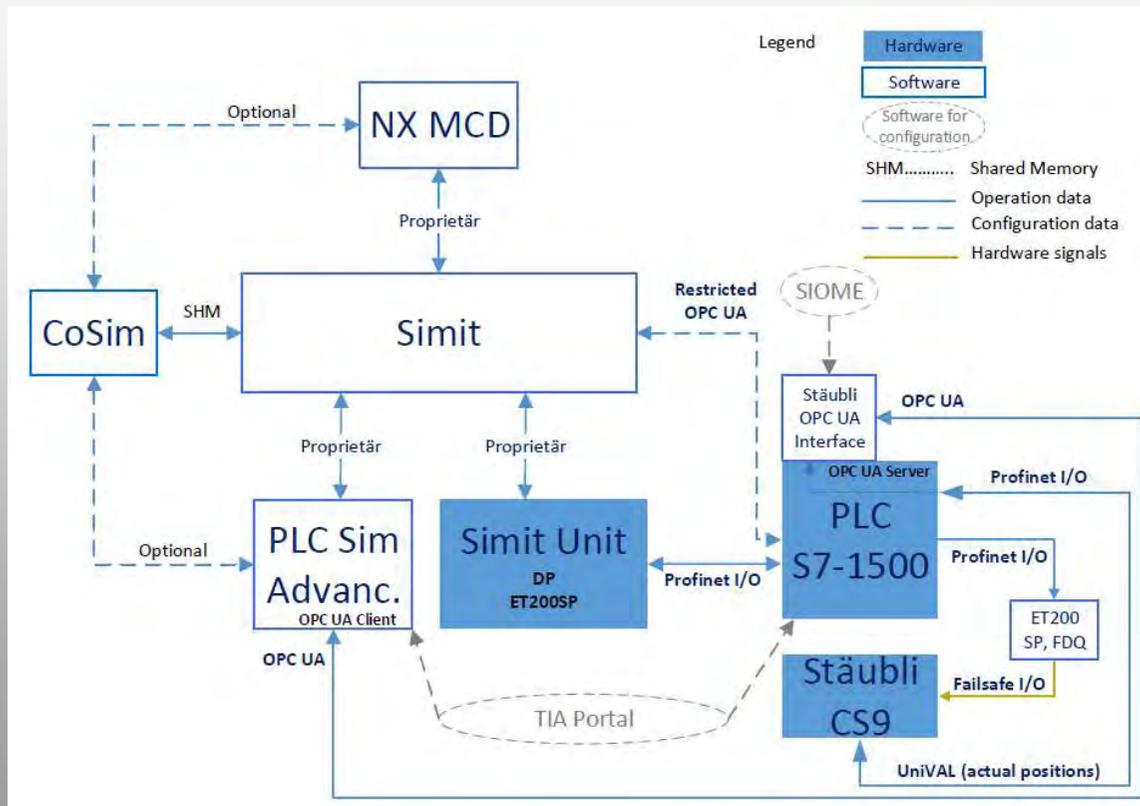
CSi9
Control Unit

On this basis the Simulations definitely follow the commands of the proprietary Control Unit CSi9 of the Stäubli Robot !

Simulation Based Calculation of Safety Reaction Time
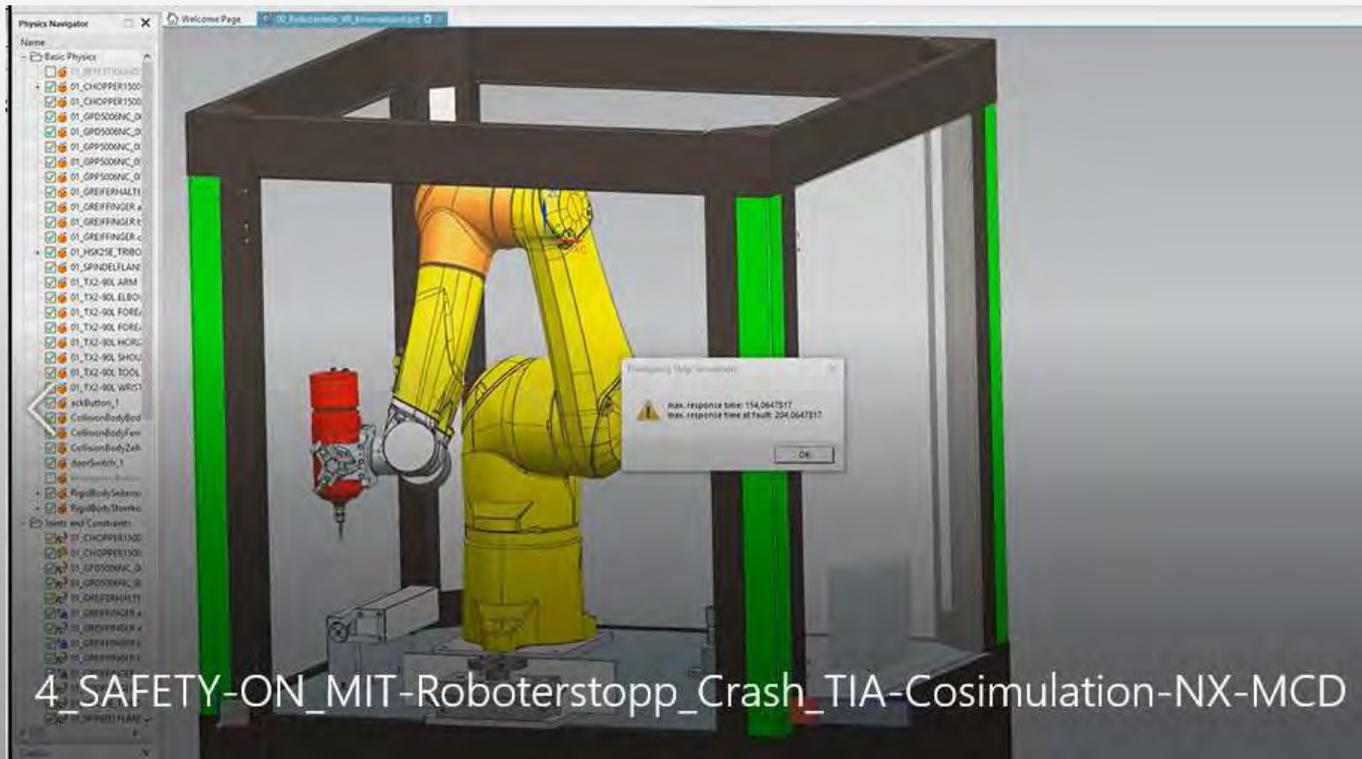
**Reflections on working with Virtual Models and Simulations
in Safety Concerns**

☺ Working with virtual models of new production processe accelerate the
ramp up dramatically. The early inclusion of safety Issues is not only
possible but recommendable.

☺ Such simulations do not only allow the early detection of failures modes
but also give a quick response to engineered alternatives.

💣There are high efforts in the build up and working phase of such virtual
models. Target lead times and target costs could could easily make a stop.

💣Sumulation results are not adequate for passing the Acceptance Tests.
Series of physical measurements have to be done additionally. The
questions of Liability often remain open.

Summary

The Future of Safety Planning

➔ will increasingly be supported by virtual models

➔ will be part of the simultaneous engineering processes

➔ will work with standardized libraries and testing cycles

➔ will still not replace the human expert

START SMALL, BUT START !

Thank you for your Attention!

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