# DIGITAL TWIN FOR EDUCATION

CARL-BENZ-SCHULE
GAGGENAU

Mercantec

software requirements and
examples of digital twins

## Module 1

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# Software requirements

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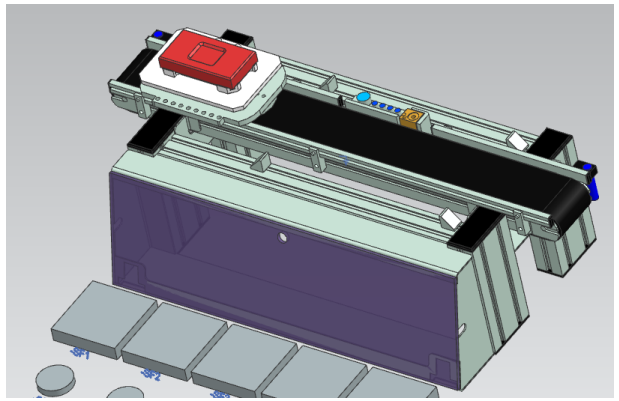
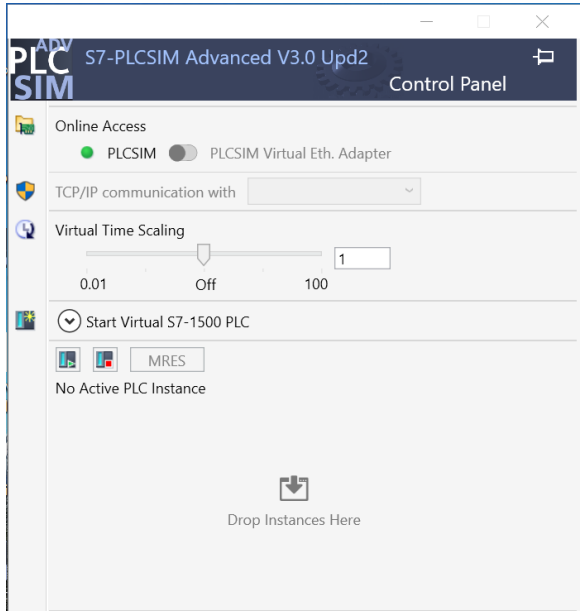
NX Mechatronics Concept Designer
SIEMENS

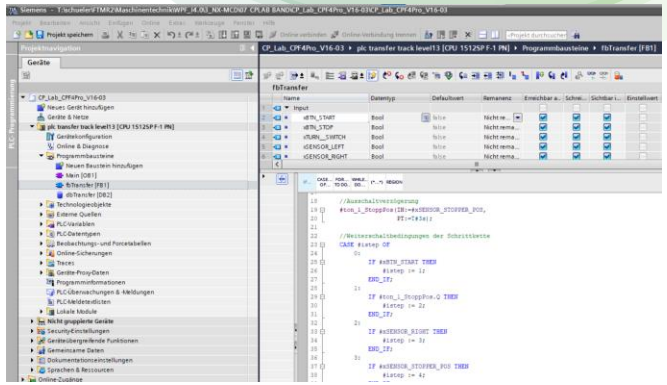
Simulation Software Siemens NX MCD



Simulation Tool PLC SIM Adv.




Creating a Soft-PLC as a connector between MCD and TIA Portal



PLC Programming Software Siemens TIA-Portal

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# Examples of digital twins

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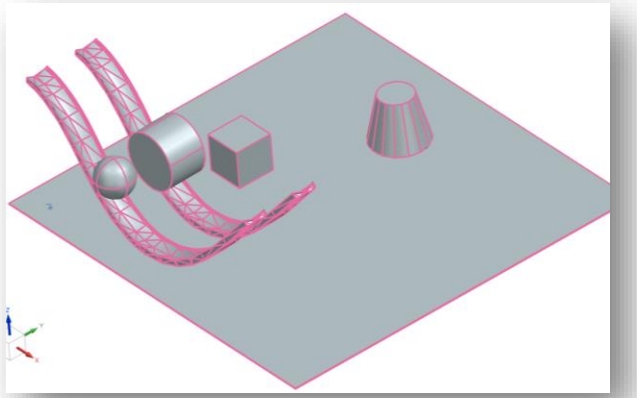

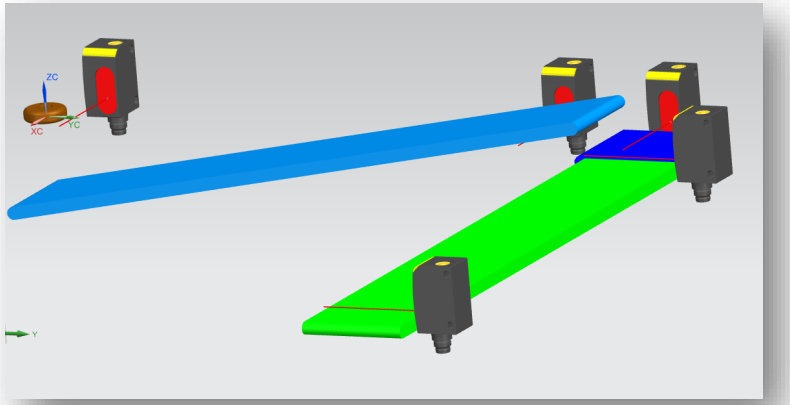

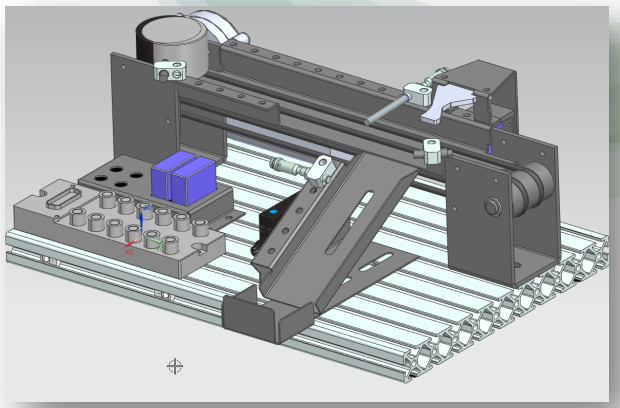

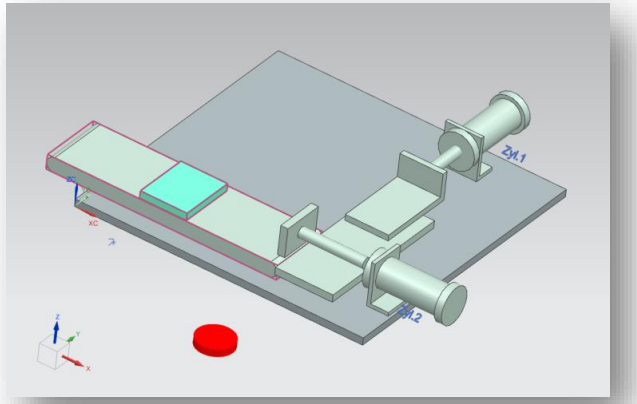


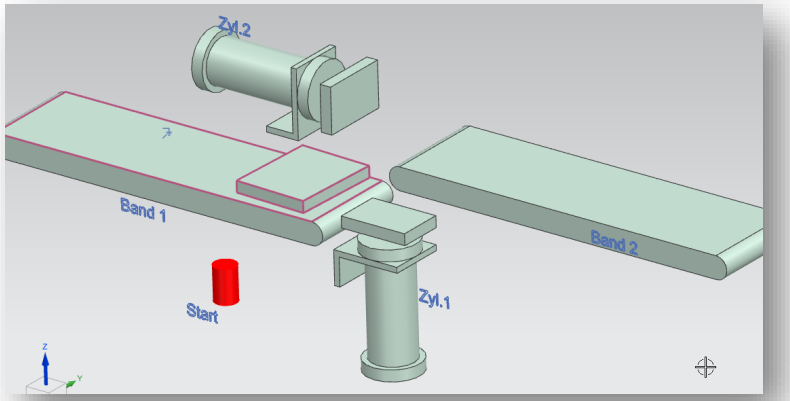


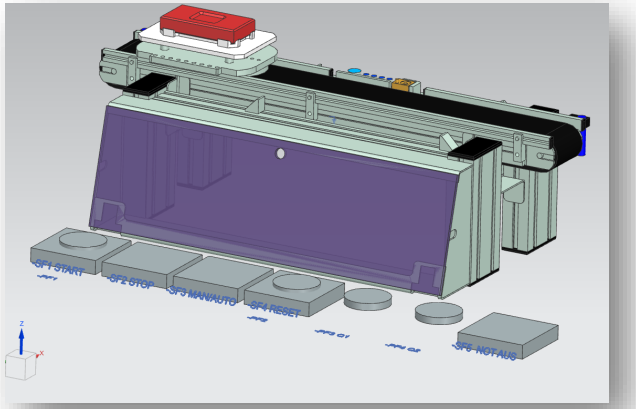

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# Examples of digital twins

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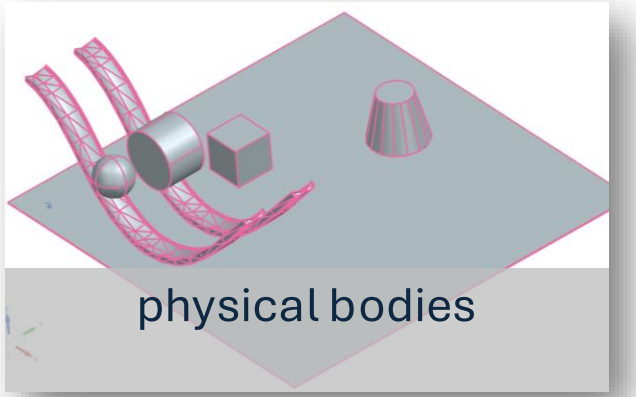
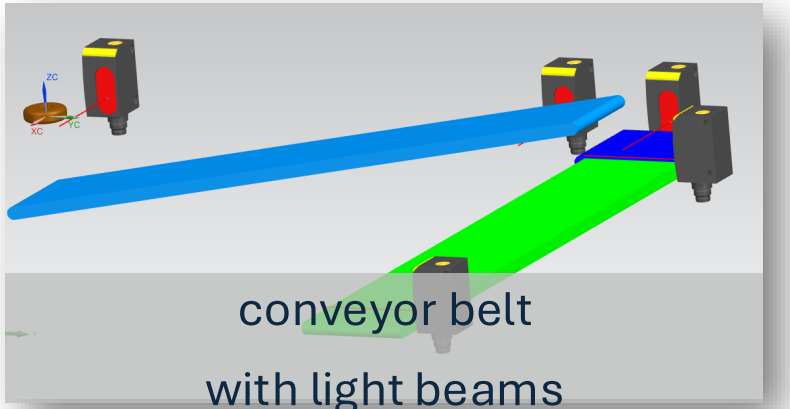
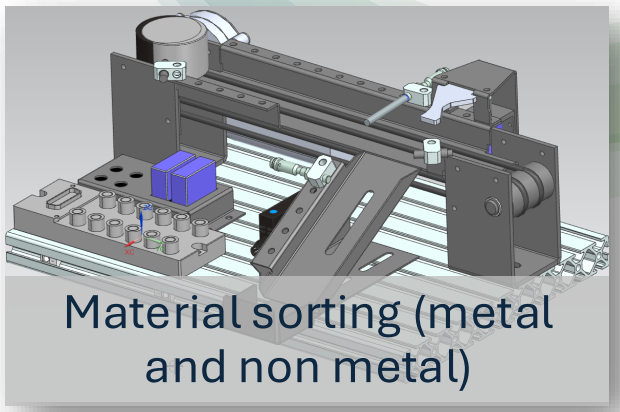


physical bodies

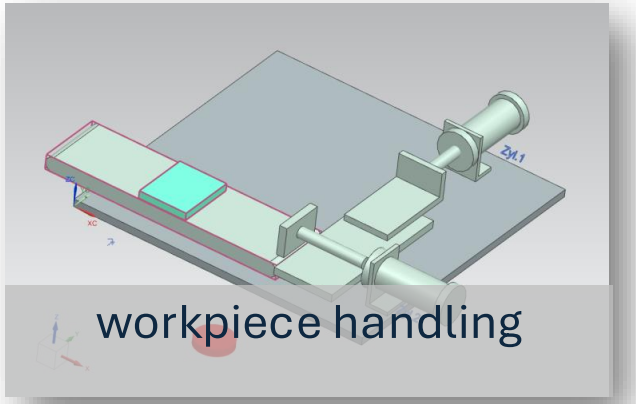


conveyor belt

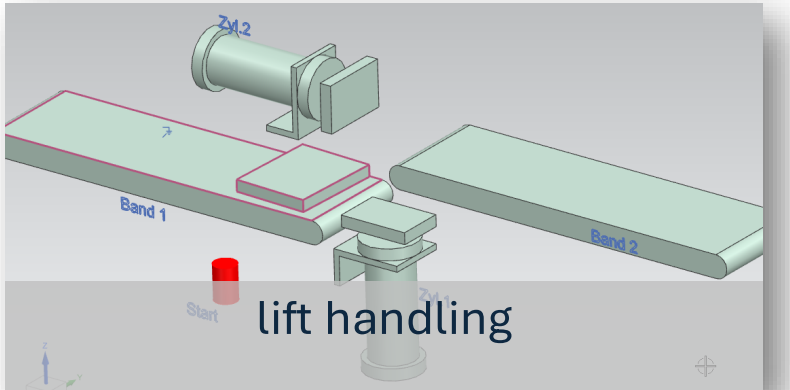
with light beams



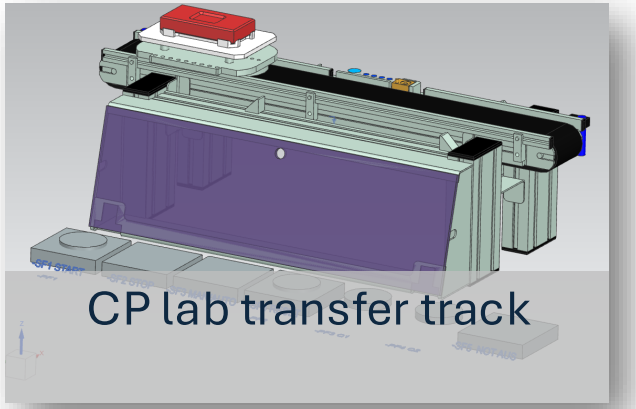
Material sorting (metal and non metal)




workpiece handling




lift handling



CP lab transfer track

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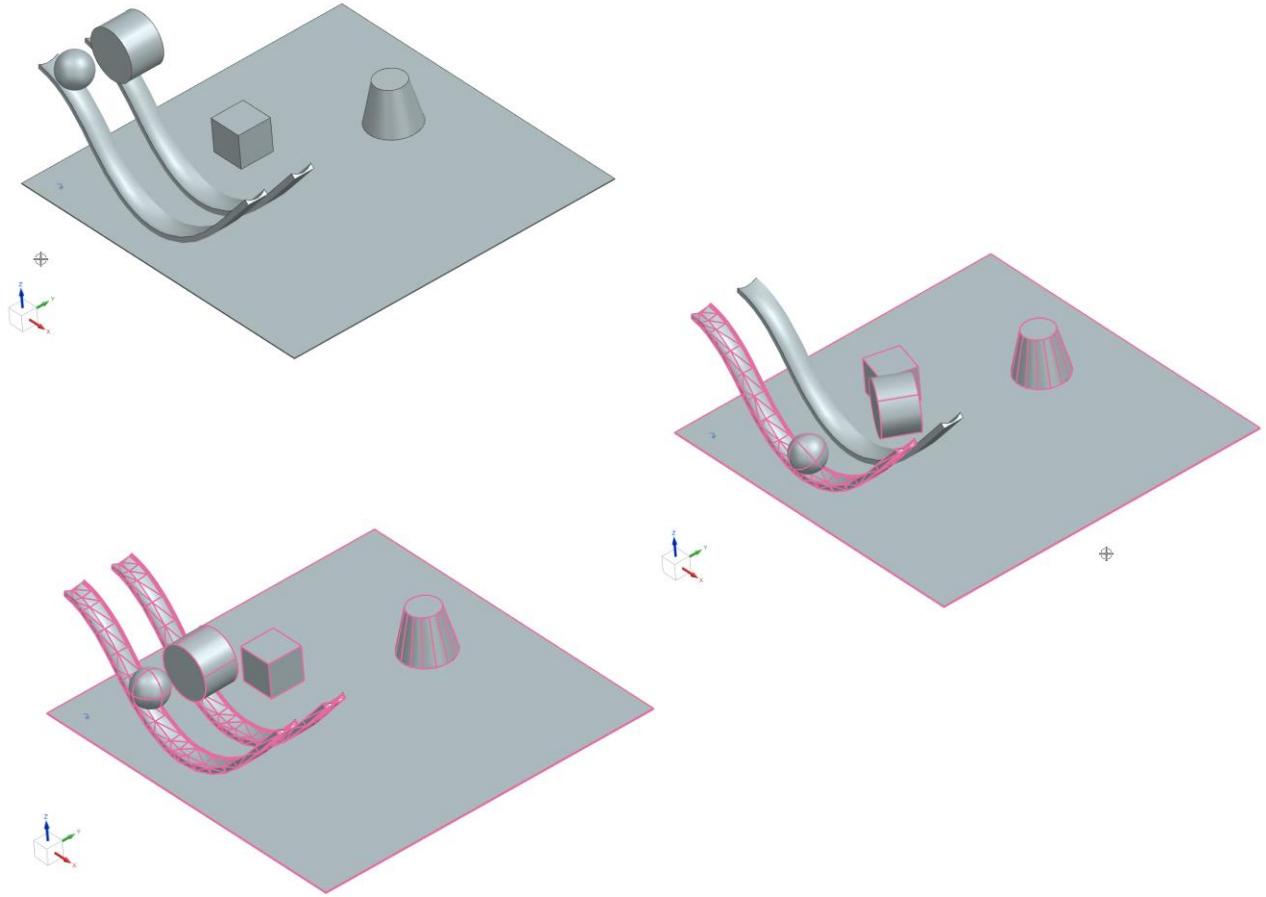
# Physical bodies



The digital models can be given physical properties (e.g. density, friction, ...). Thus, the model behavior corresponds to the real behavior. The bodies roll down the ramp at different speeds. Also bodies can leave the ramp.

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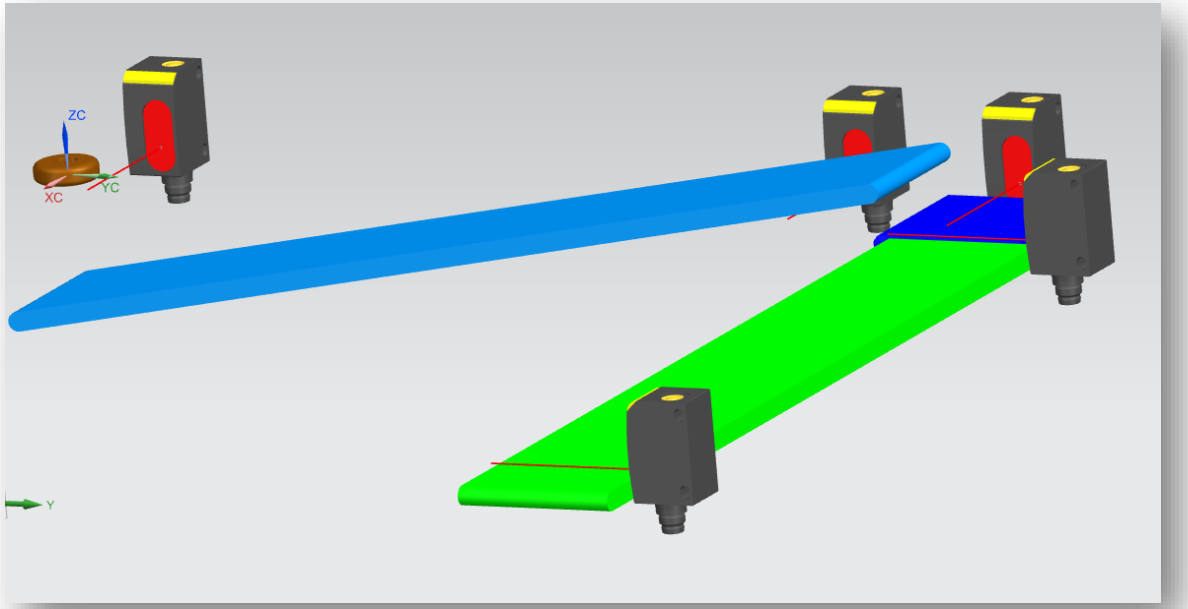
# Conveyor belt with light beams




Different bodies can be transported on the belt. Modelled light barriers give signals (e.g. to a controller) that can be further processed.

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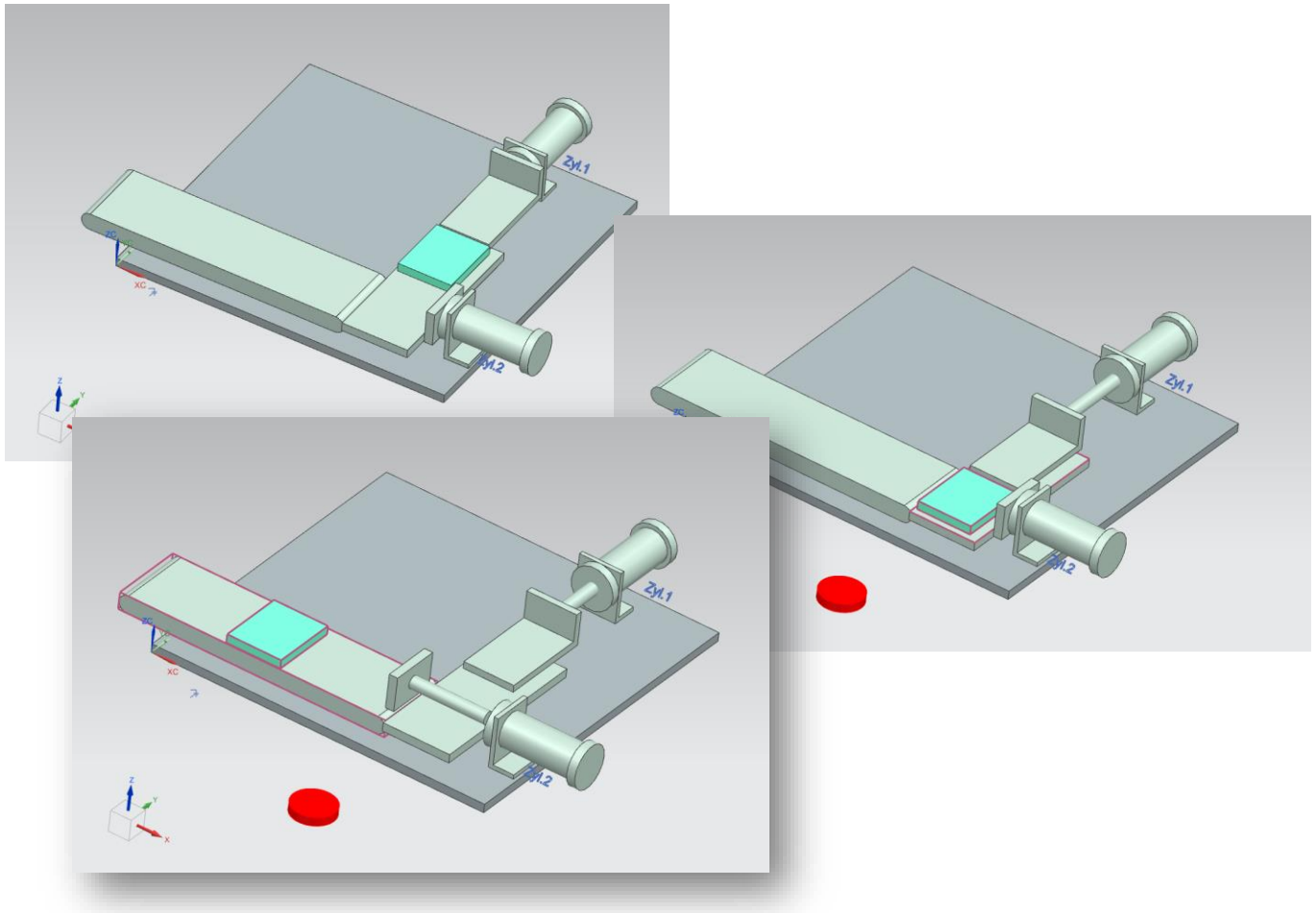
# Workpiece handling



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Digital pneumatic cylinders extend and transmit a force to the workpieces so that they reach the next conveyor belt. The cylinders can be integrated into PLC programming and controlled.

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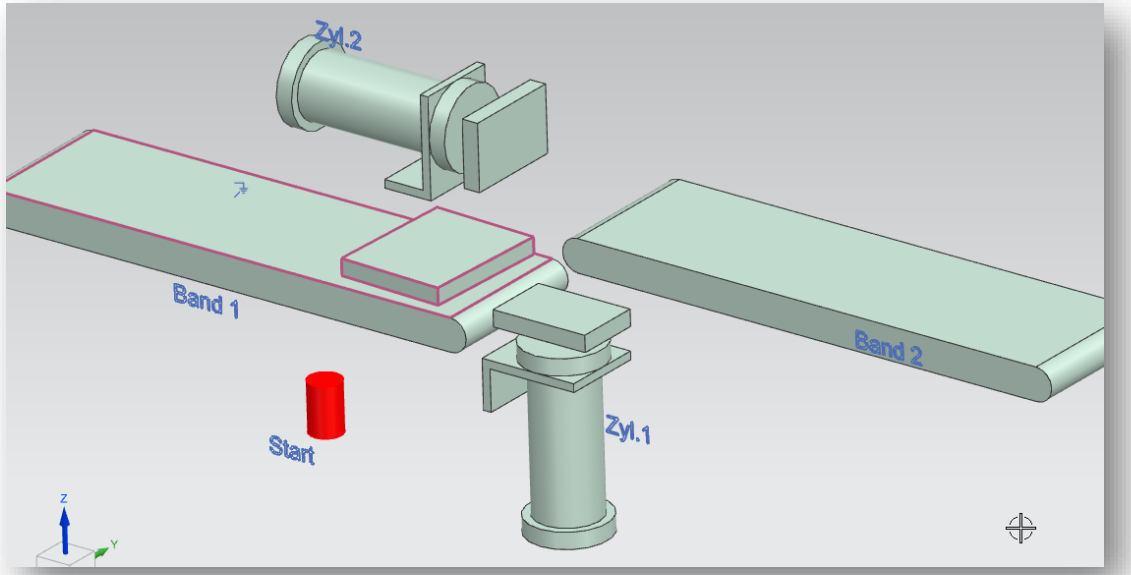
# Lift handling




Similarly, a vertical production line can also be simulated using the physical properties. In this example, one cylinder is used as a lifting cylinder and the other as an extension cylinder. Both are controlled by a PLC.

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# Sorting station

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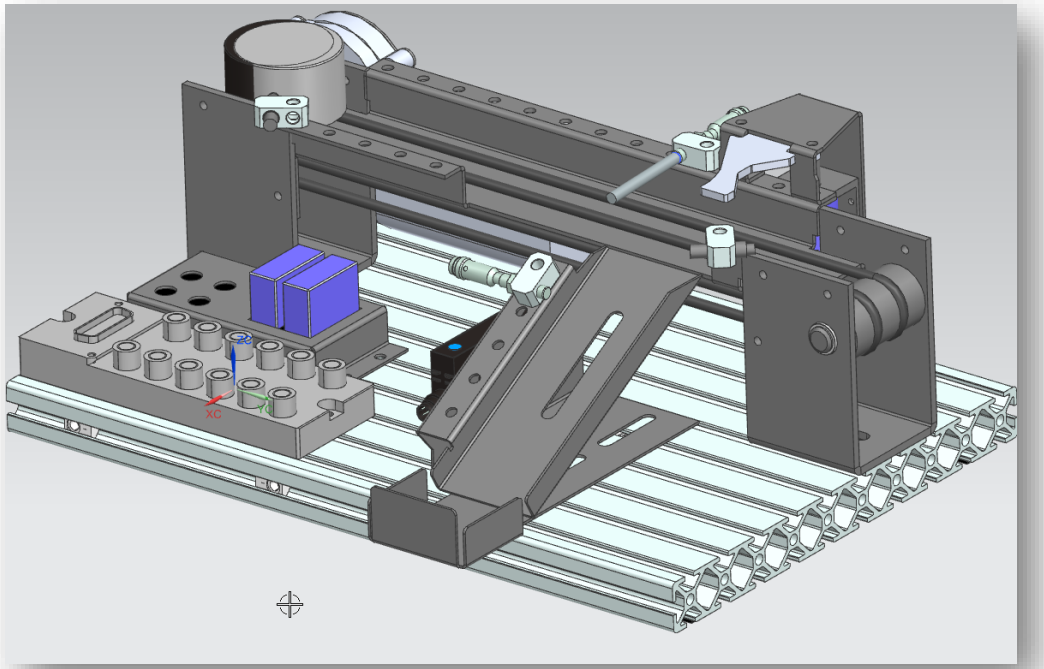

In the material sorting system, a distinction is made between metallic and non-metallic workpieces. The material properties are given to the workpieces as part of the creation of a digital twin. The system can sort out metallic or non-metallic workpieces on the basis of PLC programming.

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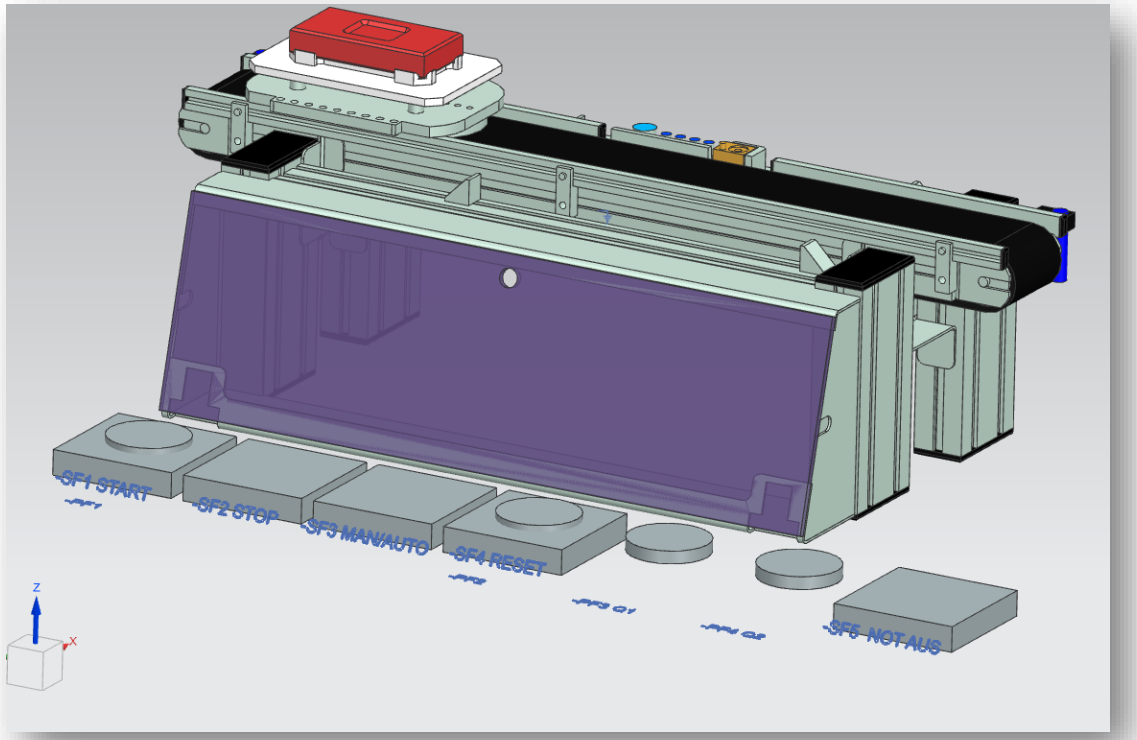
# CP Lab transfer track




Here you can see the digital twin of the transfer track of a production plant. A workpiece (red) is transported through the production line on the belt with the help of a workpiece carrier. The transfer belt is controlled by a PLC. It has several sensors at the respective ends and in the middle. There is also a stopper in the middle. This allows the movements that are crucial for production to be realized.

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# CP Lab transfer with turning application

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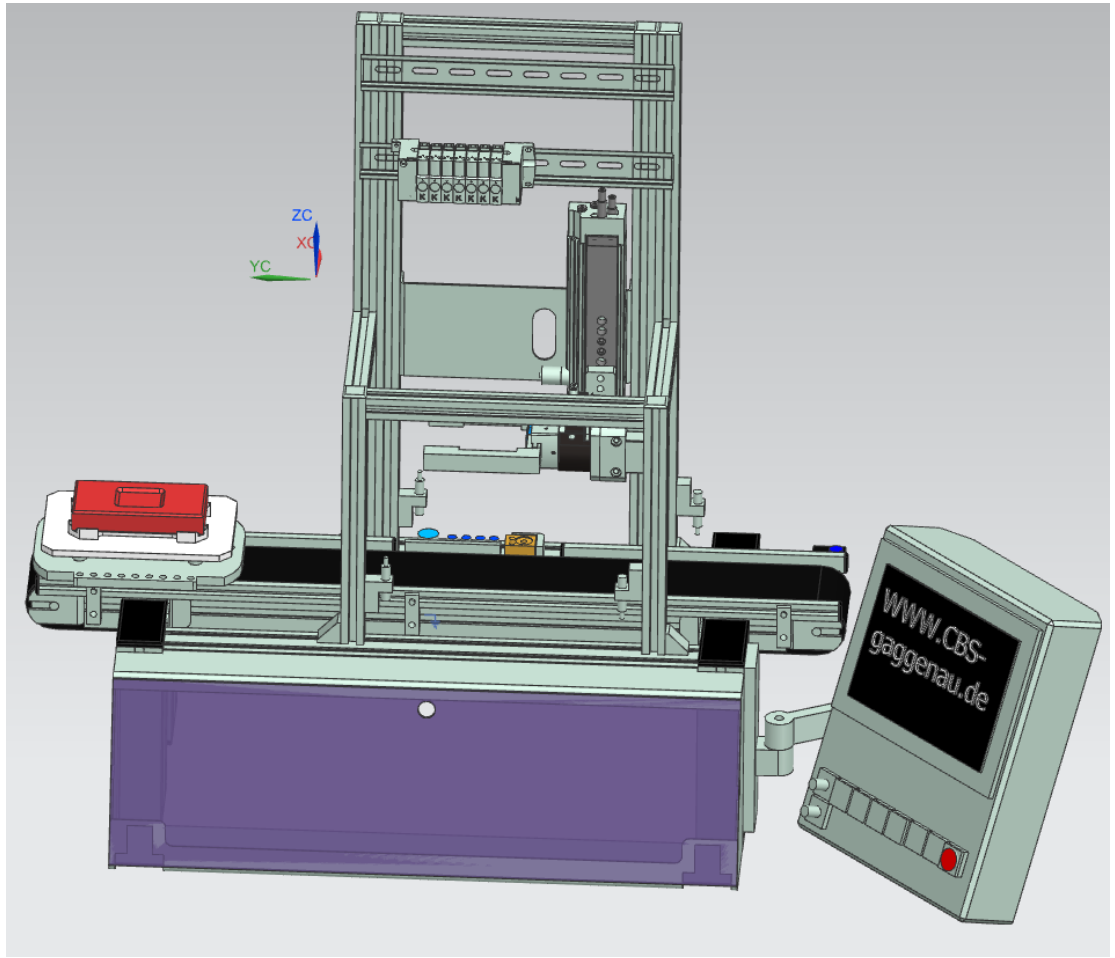


Here you can see the digital twin of the transfer track with the turning application on top.

This is the master piece of our digital twin. With this simulation tool a hole class can create plc programs in the same time and test their solutions directly.

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