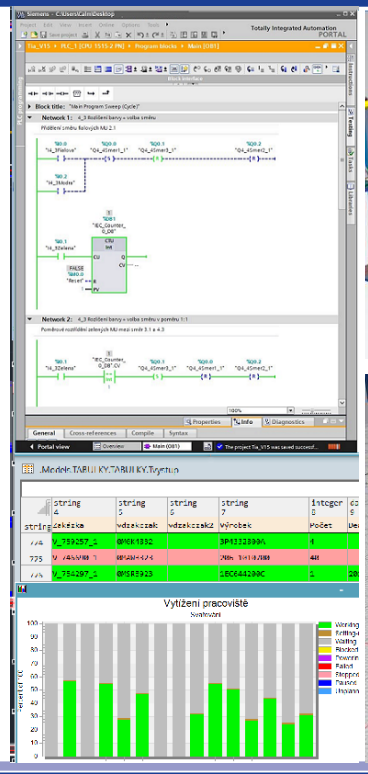
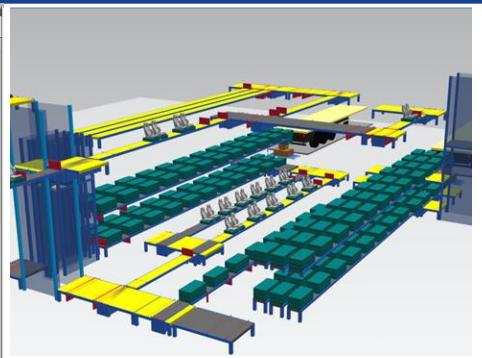
2ND CZECH-GERMAN BUSINESS MEETING

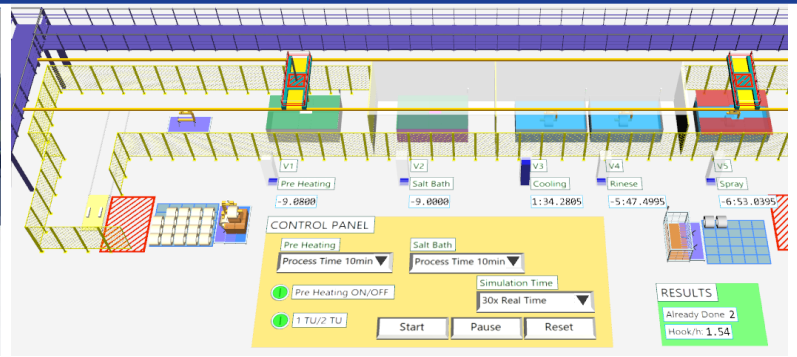
HYBRID DIGITAL TWINS FOR VIRTUAL COMMISSIONING OF PRODUCTION LINES

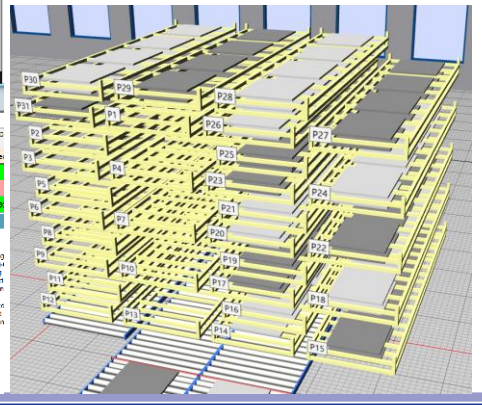
ONDŘEJ KANICH

kanich@taurid.cz







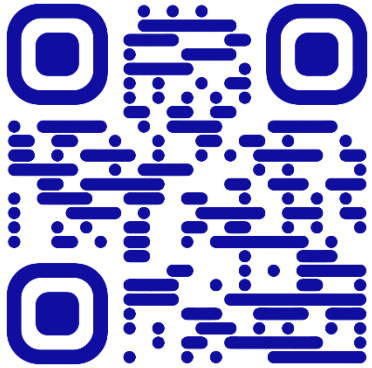


Agenda

- Brief introduction of Taurid Ostrava
- Digital model at Taurid
- Capacitive (performance) simulation
- Virtual commissioning
- Hybrid simulation

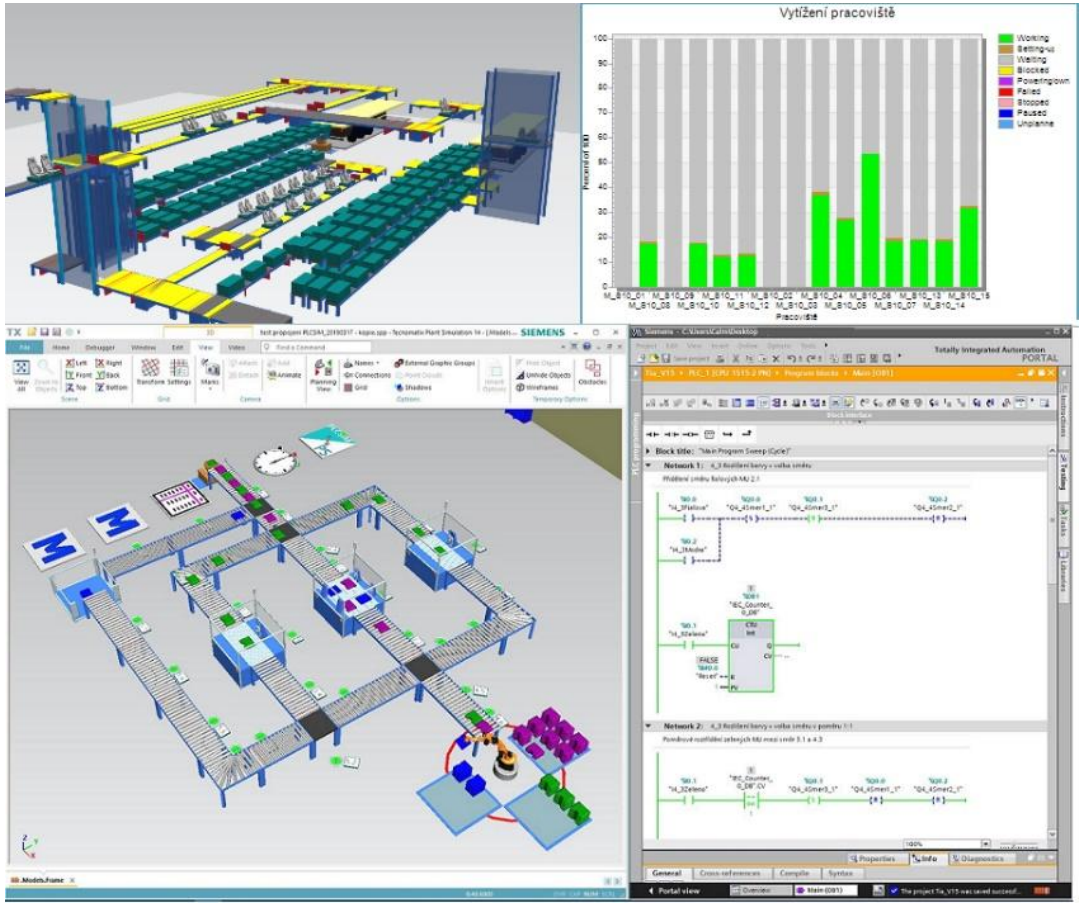
Taurid Ostrava s.r.o.

- Czech company founded in 2003
- Services in the field of automation, robotization and digitalization in industry
- Annual turnover of 5 millions € with 45 employees
- Thousands of realized orders in CZE, EU and world
- Siemens solution partner
- More on our webpage



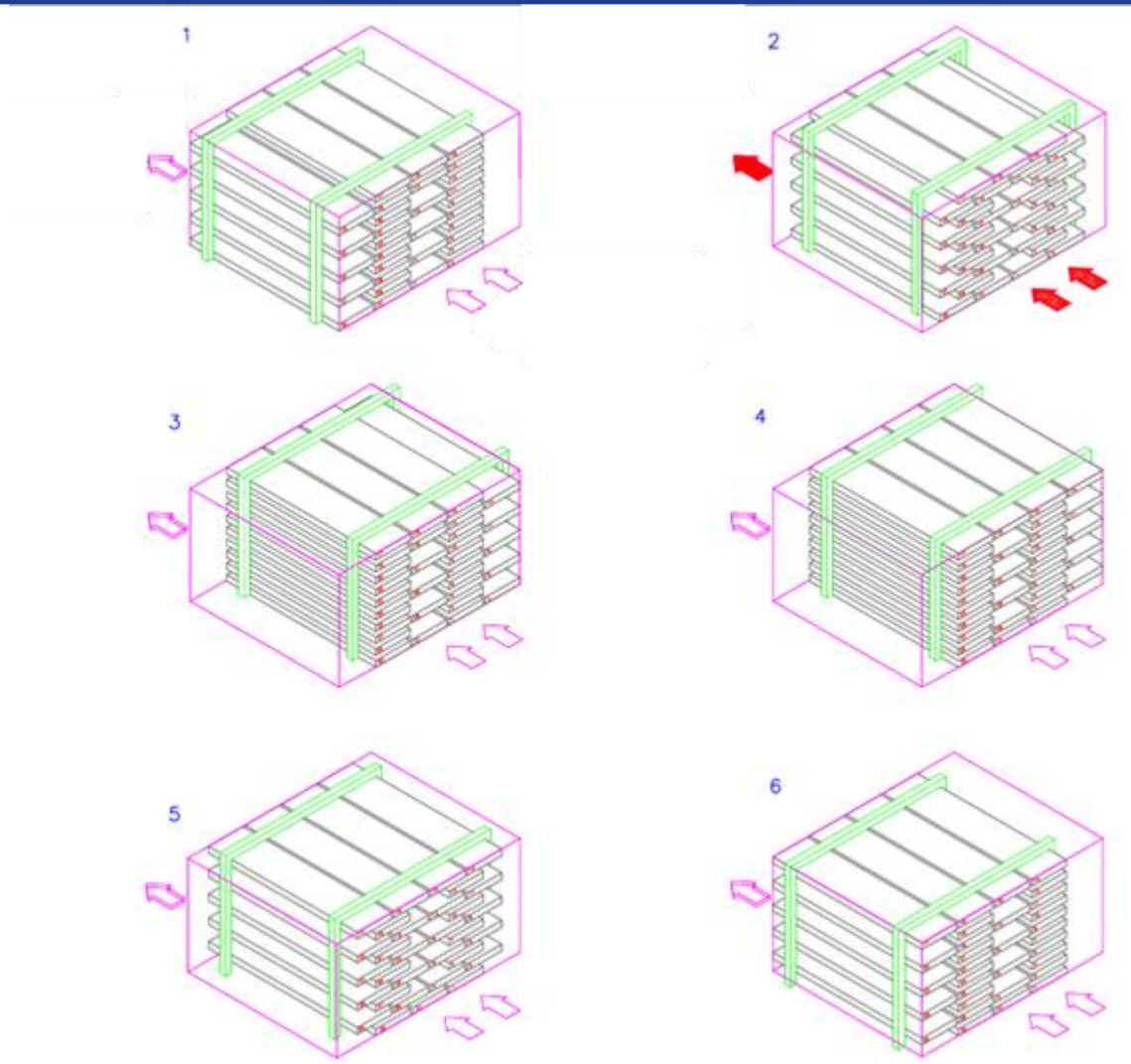
Digital model **at Taurid**

- Customer requirements?
  - Implementation of new production lines or processing equipment
  - Modernization of existing processing equipment (both hardware and software)
- Goal of the digital model?
  - Visualization
  - Safe verification of production capacity
  - Design/verification of layout
  - **Virtual commissioning (VC)**
  - Dynamic production rescheduling

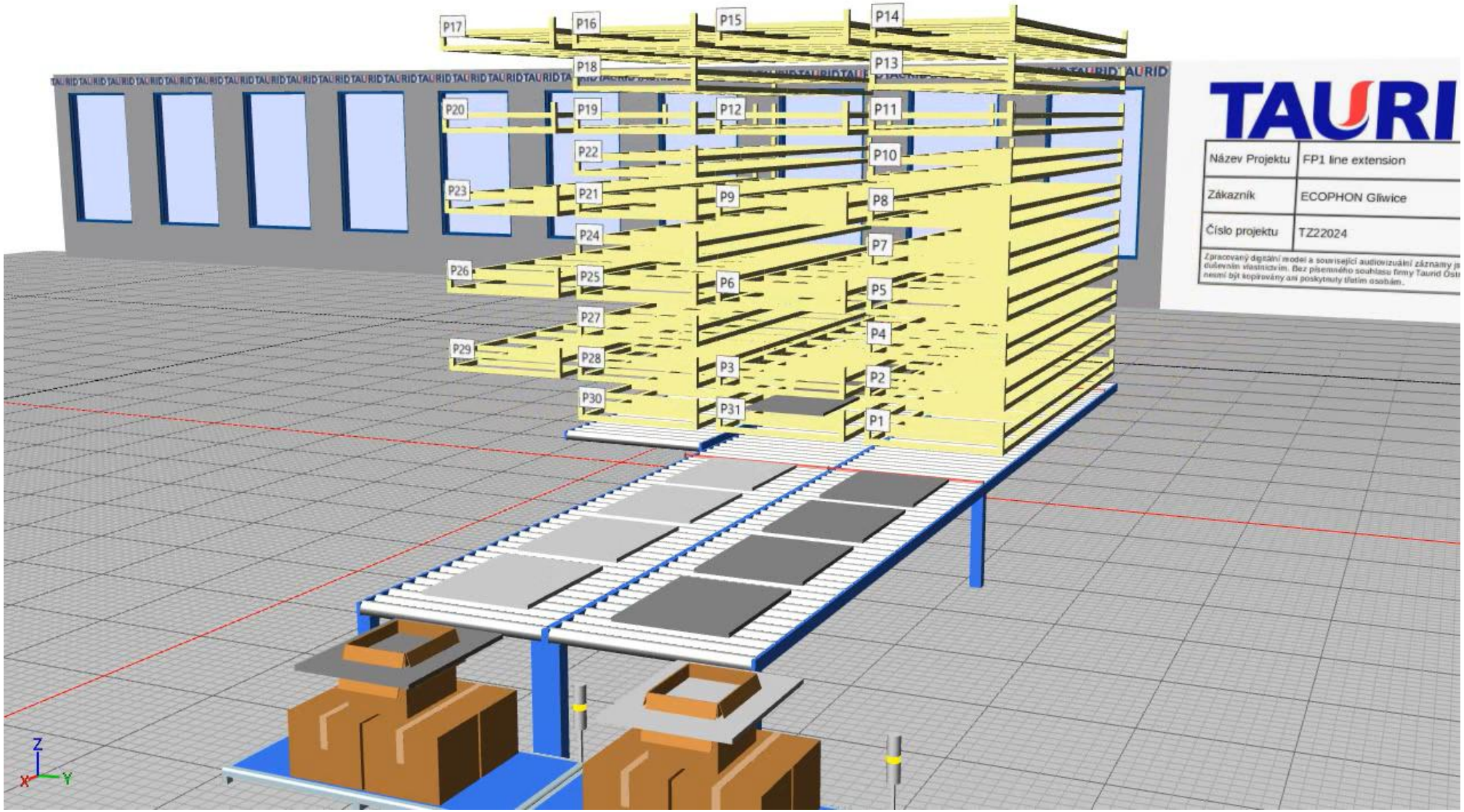


1st use case – step kiln

- A picture is worth a thousand words?
- So, what should happen in each step?
- Do you have an idea?

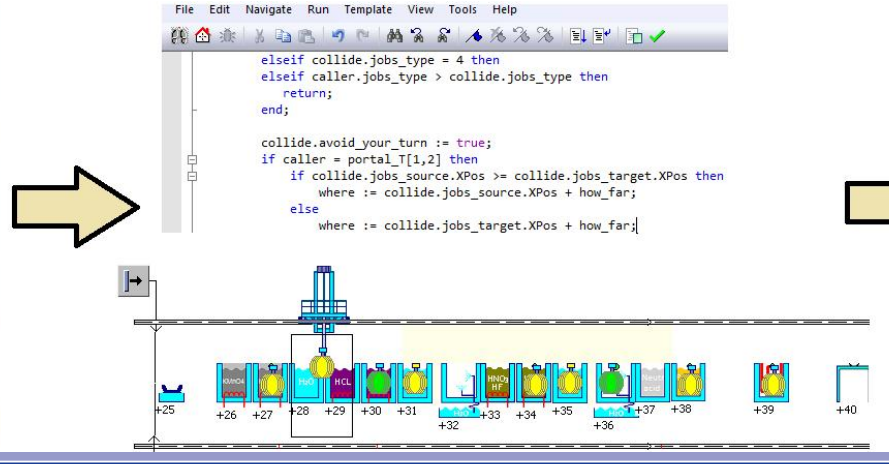


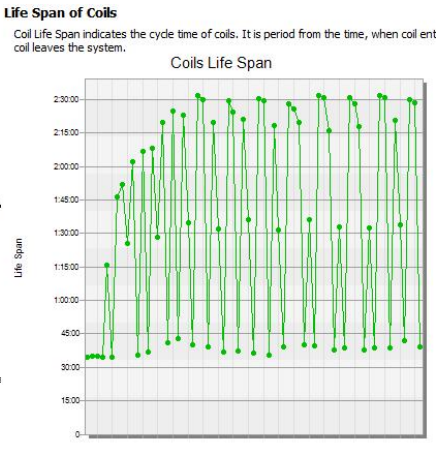
A simulation is worth a thousand pictures



Capacitive (performance) simulation

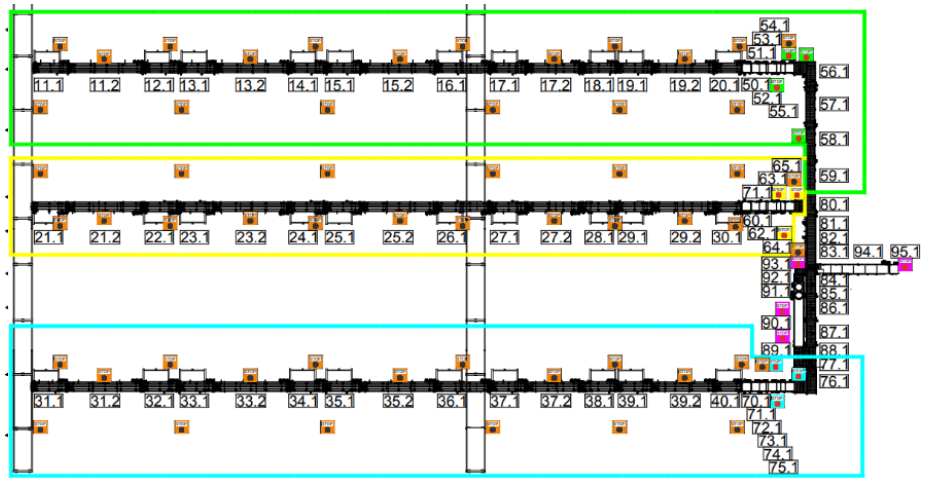
- Design and verification of concepts, parameters and behaviour = reduction of uncertainty
  - Production capacity and flexibility, resource utilisation, transport speeds and capacities, process and set-up times, control logic
- Bottleneck detection and identification of critical scenarios
- 2D/3D animation, results representation (tables, graphs)

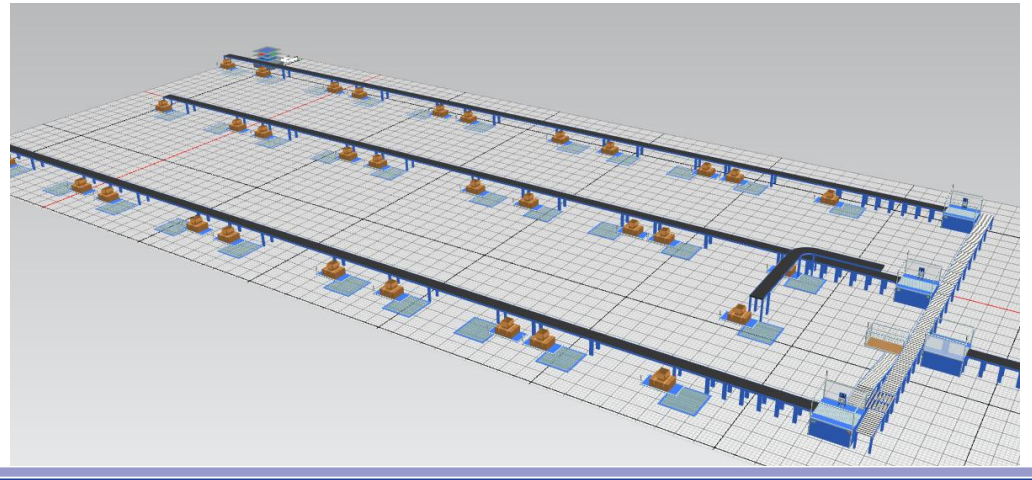




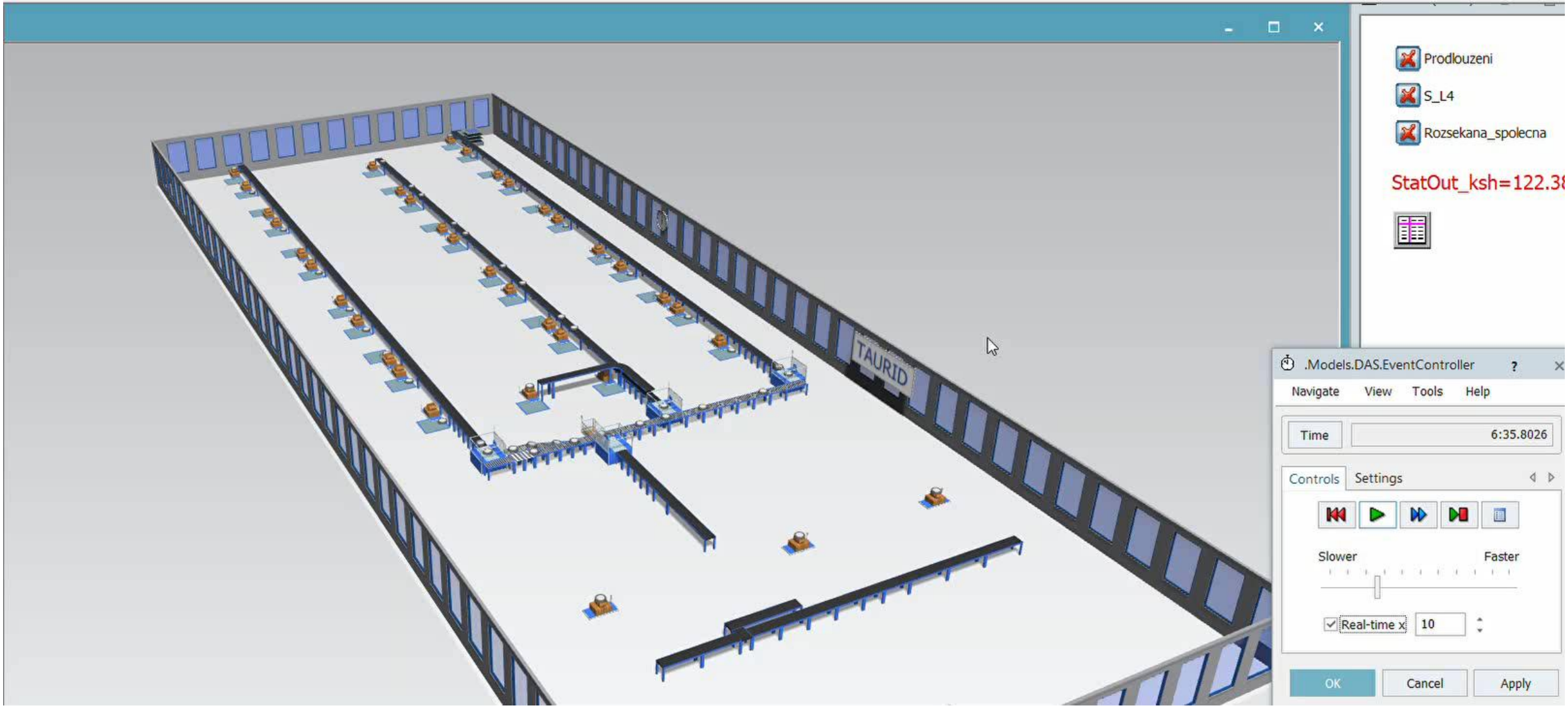
2nd use case – increase production

- 3 lines each have 10 production and 1 processing machine, connected by vertical common line - bottleneck
- How to increase production?
  - Extension of lines and adding new production machines
  - Adding shortened 4th line with new production machines
  - Rework of common line (add more section, more motors)





Video of the final digital model



Virtual commissioning

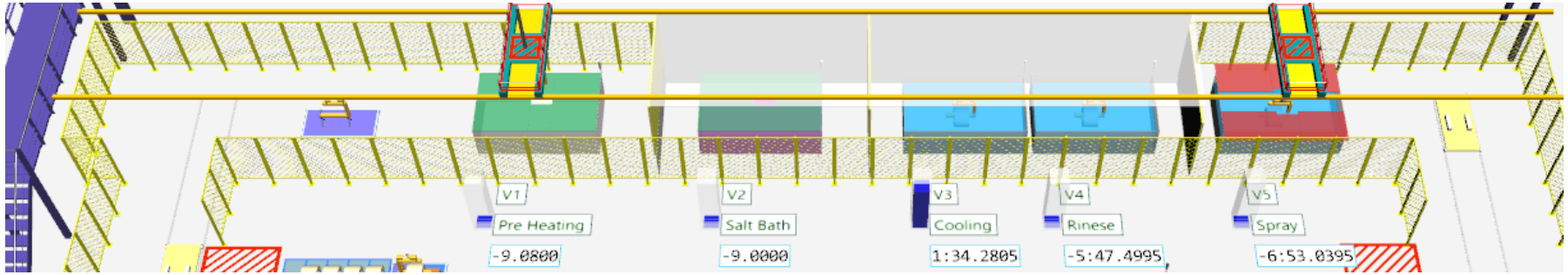
- **Application software** layers = operating modes:
  - Service, manual, automatic (PLC), logistic (MES)
- Logistic layer - processes generated events and assigns so-called jobs (tasks) to transport systems (trolleys, etc.)

- **Taurid** concentrates on the **verification** of the control **algorithm** (= the logistic layer + possible typos)
- **Taurid** focuses on the whole (complex) systems (not one machine)

- **The testing should be done in the office not on site!**

3rd use case – pickling line

- System of **transporting semi-finished products** through several pickling baths
- The prescribed pickling times must be met, but still achieve the highest possible throughput
- The problem is mainly the combination of recipes, having different times, procedures…
- 2in1 model: combines VC and capacitive simulation



Hybrid simulation

- Hybrid model **combines** external and internal control
- Internal control = all logic is in the model file (internal **methods**)
- External control = all logic is done by external source (typically **PLC**)

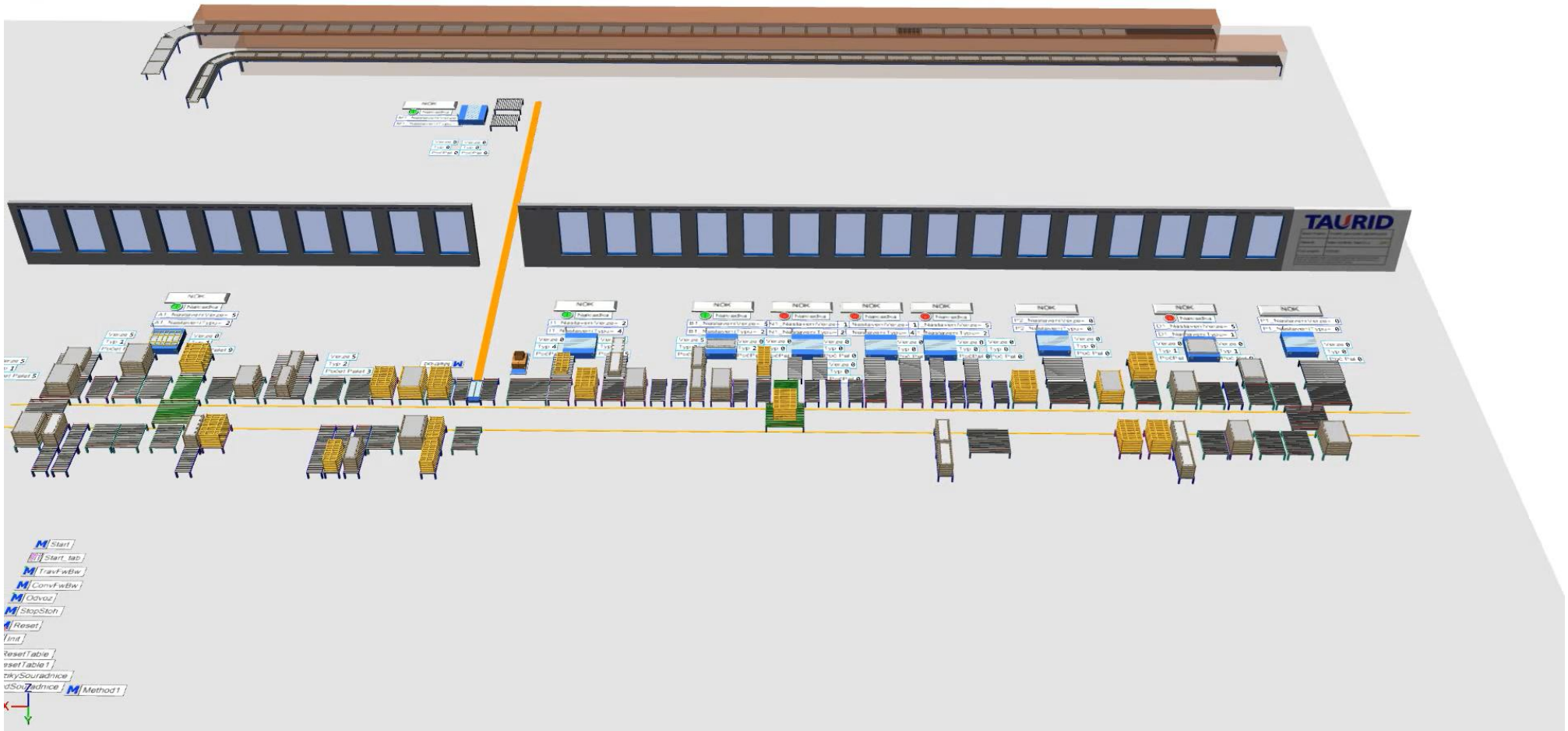
- Both parts communicate and cooperates
- Benefits:
  - Models are faster (created, used, …)
  - No need for detailed VC of existing, tested, unavailable, … parts
  - Internal parts can “cheat” (teleporting pallets, instant set-ups, …)

4th use case - transportation

- System for **preparing** pallets before the process in the soldering furnace
- **Four trolleys** on a common track transport stacks of pallets to conveyors that serve as an intermediate stack (before and after furnace)
- Pallets have different sizes, times – **production mix** plays an important role

- Request was to add another type of pallets
- **Limited time** for installation
- Hybrid simulation (internal furnace, external transport)

Video of the hybrid digital model/twin



When to use hybrid digital twin?

- **Short** implementation **time** at customer site
- Full product portfolio is not available for real testing
- Testing can be accelerated up to **3 times** vs. real time
- **Large number of combinations** are generated
- Customer/contractor want to “see” or “feel” the solution **in advance** of construction
- Possibilities for testing are relatively extensive even with a simple model

Conclusion

- The customer should not play the role of a test rider
  - There is no time for **experiments on the construction** site
- Installation is a stressful job, the pressure to meet deadlines is enormous
  - Programmers as authors of the control algorithm want to reduce stress to a minimum
  - The goal is plug & play solution no plug & pray

THANK YOU FOR YOUR ATTENTION

www.taurid.cz
Starobělská 56
Ostrava 70030
+420 736 602 722

kanich@taurid.cz