Optimizing Manufacturing Systems with Simulation
PLM World 2006, Long Beach
Stefan Linner, UGS
Agenda

1. Tecnomatix Portfolio
2. Tecnomatix Simulation Applications
3. Integrated Planning + Simulation
Tecnomatix Simulation Portfolio

Factory

3D-Layout-planning

Cell

NC-Simulation

Process

Pressline-simulation

Workplace design

Robotic-simulation

PLC-Simulation

Discrete event simulation

Process-Planning

Geometry oriented

Sequence oriented
Agenda

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Tecnomatix Simulation Portfolio
Tecnomatix Plant Simulation

- Tecnomatix Plant Simulation allows for creating a dynamic computer model of a complex system (e.g. production) to explore its characteristics and optimize the performance of the system.

- The computer model enables user to run experiments and what-if scenarios without disturbing an existing production or – used in the planning process – long before the real system is installed.
Principles of material flow simulation

- **Transparent** analysis of complex systems
- Calculation and comparison of real numbers
- Computer supported investment decisions
Benefits of simulation

- Detect and **eliminate problems** that otherwise would have required cost and time consuming correction measures during the production ramp-up
- **Minimize the invest cost** for production lines without jeopardizing the required output
- **Optimize the performance of complex production systems** with many variants
Value

- 3 - 6 % savings on investment (VDI, Association of German Engineers)
- 15 - 20 % productivity increase of existing systems
- 5 - 20 % reduced cost of new systems
- 20 - 60 % decreased throughput time and inventory

Average savings found in European market survey
Tecnomatix Simulation Portfolio

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Geometry oriented
Sequence oriented
Robotics Applications

Arc Welding

Spot Welding

Paint

Laser

Handling

Off-Line Programming

Planning
Cable Simulation
Tecnomatix Portfolio

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Geometry oriented
Sequence oriented

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Today’s situation

Signed OEM Contract

Less Time for Planning
Higher Complexity (e.g. Flexibility)

OEM Changes

Fixed SOP
Fixed Throughput

Mechanical Design

Robotics Simulation + OLP

Effort for Communication

Electrical Design

PLC Programming

Buy, Build

Commissioning

Tecnomatix eM-Workplace
previously: RobCAD

Less Time for Planning

Higher Complexity (e.g. Flexibility)

Time pressure
during commissioning
The Solution: Process Simulate Commissioning

1. 3D Modeling
   - Kinematics
   - Layout
   - Sequence (Simulation)

2. Connecting the Signals (mapping)

3. Virtual Test & Commissioning

E-CAD (e.g. E-Plan)

Step 7 Professional

- Programming
- Debugging

Virtual / Real PLC
Benefits

- Commissioning
  - Identify problems before building the cell
  - Time- and Cost-Reductions due to:
    - Increased program-quality
    - Better preparation
  - Risk-reduction during the commissioning
  - Faster ramp-up

- Production
  - Training of shopfloor-personnel upfront using the virtual line
  - Planning of changes and maintenance work → shorter breakdown-times
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Enhanced CAM Process Chain - NC-Simulation after Post-Processing

**Process Engineering**
- Set-up Planning
- Programming
- Post-Processing
- NC-Simulation

**CAM-System**
- CAD-System
- eM-RealNC

**Machine / CNC Controller**
- On-line Program Test
- Production
- Machine parts
- Change management
- Optimization

**Early Error Recognition**
- Faster Ramp-Up
- Optimized Process

**Shop-floor**
- On-line Program Test
- Production

**Process Engineering**
- Define tool-path
- Select tools
- Define machining parameters
- Create machine-specific NC program (G code)
- Simulation of machine-specific G code program
- Total workspace simulation
- Cycle time optimization
- Program adjustments
- Machine parts
- Change management
- Optimization

**Production**
- On-line Program Test
- Production
- Machine parts
- Change management
- Optimization

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Virtual Controller
NC-Simulation using Siemens 840D VNCK

- Machinemodel (geometric, kinematics)
- Simulation of all peripheral operations such as tool-changer, palet-changer, ...
- Visualization
- Material removal simulation
- Collision Detection
- Virtual Time Management
- Data Viewer VNCK

- Boot Controller with specific machine dataset (including canned cycles)
- Time discrete NC-program execution
- Transmit values to simulation (e.g. joint values)
- Support multi-channel applications
Example: Index Virtual Machine

Siemens 840D VNCK with original HMI of the machine

eM-RealNC Simulation with machine-model
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Deliver Industry based solutions

Value chain

Applications

Industry focused solutions

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Teamcenter Manufacturing Backbone

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Assembly Planning Solution
(Automotive, Aerospace, Heavy Industry)
Summary

► Simulation delivers strong and proven values.

► Simulation e. g. allows for
  ► Verification of planning results.
  ► Optimization of existing production lines.
  ► Smoother ramp-up of production lines.

► Integration with planning applications and data management maximizes the value of Digital Manufacturing.
Thank you