Integrated Manufacturing Layout Design and Optimization

PLM Europe 2018
Uli Rossgoderer, Oct 30th 2018
Line Designer

Plant Simulation & Process Simulate

Point Cloud Data & Virtual Reality available

Teamcenter

Intosite

Plant Virtual Commissioning
Line Designer

Plant Simulation

Teamcenter

Plant Virtual Commissioning
Line Designer
Product Overview

Manufacturing layout solution for Sales and Layout Engineers

Teamcenter managed layout

Managing library of resources not just documents

UX tailored to layout needs

Leveraging NX power, e.g. Visual Reports, Drafting, ST, ...

Production System Engineering with Automation Designer
Virtual Reality available across our tool-set

In this case – Teamcenter Visualization
Communicate your ideas using the Digital Twin
360° Panoramic Photorealistic Rendering (Lightworks)
Line Designer: Utilize the power of NX

Value proposition

- Get more done with less effort
- Use powerful capabilities with ease
  - Simple dialogs and manipulators to modify parametric objects
  - Just use collision detection during positioning
  - Powerful capabilities to derive drawings
  - Realistic visualization
  - And much more …

- Easily manipulate parametric equipment
- Collision Detection
- Point Clouds
- Realistic Visualization
- Drafting Automation
New in Line Designer

**New in 2018 (NX 12.x)**

- Multiple Display Parts Support
- Improved Component Positioning
- Navigation Tree Enhancements
- Filter Plant Navigator
- Find in Navigator
- Occurrence in Plant Navigator
- Parent/Child Compatibility
- 2D Planning View Fit
- Load Collaborative Context
- Study Navigator
- Open PERT from Plant Navigator
- Share attach/mount with Process Simulate
- Kinematics Alignment
- Kinematic support for Joint Dependencies
- Reuse Library Drag and Drop
Kinematics Support in Line Designer

- Support kinematics as part of the reusable equipment in Line Designer
- Provide Use of Kinematics within Line Designer (e.g. Poses, Joint Jog, Robot Jog)
- Kinematics authoring with available Animation Designer launched from Line Designer
- Kinematics imported from Process Simulate
Kinematics Authoring (Role: Library Admin)  
Example: Safety Door
Kinematics Usage (Role: Layout Specialist)
Example: Safety Door
Line Designer
Improved Positioning of Components

- New commands to Align and Distribute Components
Line Designer
Multiple Displayed Parts

- Enabled to open Multiple Layouts and show them e.g. side-by-side
- Enables to open a selected sub-tree (e.g. Station and Line) and open in a new Window
- Window Layouts enable to arrange the different opened graphic views
- Plant Navigator always shows the structure of the active graphic view
Line Designer
Enhanced Plant Navigator

- Capability to freeze columns: makes it easier to keep an overview when working with many columns (scrolling)
- Export current Plant Navigator view to Browser or Spreadsheet, e.g. to make quick calculations in Excel.
- Quick Expand All / Collapse All / Expand Selected / Collapse Selected
Plant Navigator Column now have a new Filtering capability:
Plant Navigator also has a new Find capability, (Preview)
To enable it set the environment variable LINE_DESIGNER_FIND = “1”

Find searches in the selected column → you can search for all attributes that are configured as a column.
Line Designer
2D Planning View Enhancement

Customer default now controls the behavior of “2D Planning View”

Current View

Result after activating 2D Planning View
Line Designer
Load Collaboration Context into Line Designer

• Through embedded Active Workspace you can now load a Collaboration Context into Line Designer
• E.g. search for “Work Packages”
• Line Designer will load and show the Plant Structure contained in the CC
• Teamcenter Preference AWC_NX_OpenSupportedTypes must include MECollaborationContext
Line Designer
Study Navigator

- If TCMA has been installed we want to be able to use Study Manager also for Fixture Planner and Line Designer
- For this we have added a “Study Navigator”
- Enable via customer default

Not yet working with Line Designer!
Virtual Reality in Plant Simulation with more3D

https://www.youtube.com/watch?v=e2_vfc37t3Y
EK Automation – Intralogistics Simulation & Visualization with Plant Simulation - https://www.youtube.com/watch?v=o3NAik2dUUQ

Sansera Engineering (Sansera) is a global engineering company that manufactures complex precision engineered components for automotive and aerospace original equipment manufacturers (OEMs)

Achieved significant operating cost savings due to reducing labor hours

Improved effectiveness of planning and engineering team
Simulation relevant Data managed in Teamcenter Manufacturing

- **Machines/Resources**
  - Availability, energy, cost, recovery time, …

- **Material Handling Systems**
  - Robot, lift, turn table, …

- **Layout**
  - Position, flow connections, …

- **Processes and Operations**
  - Process time, set-up, line balancing,…

- **Products and Variants**
  - Workload, volume, sequences, …
TC Wizard:
Creating 3D Simulation Layout from Line Designer Layout

A new demo toolkit helps/guides Plant Simulation user in setting up 3D simulation models by reusing Line Designer or Teamcenter resource layout.

Benefit:
• Easy start for simulation studies using Line Designer layouts
• Best-practice for working with data from Teamcenter

Achieved technical results:
• Automatic layout rebuild according LD layout (managed in Teamcenter)
• 100% based on standard TC interface
New in Plant Simulation

New in 2018 (V 14.x)

- Automatic Part Routing for lines and machines
- Automatic Part Routing for human’s carrying parts
- Part Destination List
- New Sankey Diagram
- New Gantt Chart
- 3D manipulators
- New 3D conveyor graphic as used in F&B, CPG
- Improved part stacking
- Kinematic poses
- Virtual Commissioning with PLC Sim Advanced 2.0
The automatic part routing offers an easy way to direct parts automatically to a target station.

Route cost attributes can be defined to realize different routes for certain part types.

**Benefit:**
- Fast OOTB and easy-to-use routing strategy
- Reduced need for writing custom SimTalk code for standard part routing tasks
- Easy combination with already existing strategies and custom SimTalk controls

Part Destinations:
- M1
- M2
- M3
- M4
The automatic part routing can also be used with operators carrying parts to their destination. The next destination is defined through the pre-calculated part route on the shop floor.

Customer Benefit:
• New OOTB material routing strategy eliminating a lot of custom SimTalk coding

Achieved technical results:
• Fast and OOTB strategy
• Seamless integration with operators carrying parts on the shop floor

Part destination is the drop place in front of station M3
Version 14.2 Content:

**New Sankey Diagramming Tool**

The Plant Simulation Sankey tool collects and displays part routes on the shop floor.

**Benefit:**
- Easy validation of correct part routing
- Visualize a heat map for heavily used routes and machines
- Enhanced reporting capabilities

**Achieved technical results:**
- Improved Performance (factor 10+)
- Modern and state-of-the-art UI and look & feel
- Better fit to Plant Simulation use cases
- Replacement for outdated SimTalk based Sankey implementation
New embedded Gantt Chart in Plant Simulation

The Plant Simulation Gantt Chart

- collects and displays machine allocation by parts
- Improves validation of part routing
- Shows machine states like “working”, “set-up”, “failed”, …
- Visualize impact of machine states on production performance and part routing

Achieved technical results:
- Improved Performance (factor 10+)
- Modern and state-of-the-art UI and look & feel
- Better fit to Plant Simulation and reporting use cases (tool tip information, 100% integrated)
Gantt Chart:
Embedded to HtmlReport and HTML Export File

Version 14.1 Content:

User Experience Enhancements and Improved Workflows

- 3D manipulators for fast interactive
  - object scaling
  - rotation

- New 3D conveyor graphic as used in Food & Beverage, CPG, …

- The part stacking feature is now used for all simulation objects with part capacity >1:
  → Worker, Place Buffer,…
The Plant Simulation pose editor introduces an easy way for the definition of animated machine modules and equipment.

**Benefit:**

- Easy 3D animation for machines with realistic behaviour
- Impressive technology presentation for customer, management and industry fairs
- Easy usage through SimTalk
  ~._3D.Poses.moveTo("pose") command

**Achieved technical results:**

- Improved ease-of-use for advanced machine animation
- Infrastructure for standardized PL kinematic reuse and exchange

**List of defined poses and pose preview**

**Edit dialog for pose definition and modification** provided by simulation objects
Joint Definition and use in Pose Editor

For graphic objects you can use the new Joint tab in the 3D dialog to define kinematic axes for:

- Translation (Prismatic Joint)
- Rotation (Revolute Joint)

In the pose tab and editor you can create poses with specific settings for joints and reuse them later in SimTalk for animation.
PLCSIM Advanced 2.0 Support and Address Access to PLC I/O

Plant Simulation 14.2 supports the latest virtual PLC version from Siemens. Address based access to PLC I/O is a mandatory data exchange pattern used in automation projects. (i-Device communication, see picture…)

Customer Benefit:

- Ability to use the newest virtual Siemens PLCSIM Advanced 2.0
- Enhanced flexibility in VC projects with more than one PLC

Achieved technical results:

- Support state-of-the-art Siemens technology
- i-Device communication can be used without changing PLC code in VC scenarios.

Each vehicle is mapped to a 40 byte data area in the PLC I/O segment, providing vehicle command parameter.
The company plans to expand capacity in Tianjin by 120,000 units annually with local partner according to a document posted on a local government website. The investment will total 1.76 billion yuan ($258 million), with 110,000 of the vehicles being plug-in hybrids and the remainder EVs, according to the document.
Task: Extend Hybrid Vehicle Production to Electric Vehicle Production Line: Rear Axle

Engineering Challenges

- Rate of New Product Introduction
- Engineering Change Order Cycle Time
- Time to Make Changeovers

Line Planning Solution

- Access to production data and documents
- Collaboration among production planners
- Up to date 3D layouts for decision clarity
- Dedicated Digital tools for layout, optimization, validation, commissioning and collaboration

With China stepping up quotas for Electric Vehicle, and with Hybrids already doing well, Company T is pressing to expand its current Hybrid production to Electric Vehicles.

A new rear axle with an electric drive has been designed. It will require 10 assembly stations. These stations will be added to the Automated Guided Vehicle Hybrid production line. With a tight deadline we are working as a multi-disciplinary team to compress time. No room for errors.
Review As Built Hybrid Production Layout
Tianjin Layout Team - Tianjin, China
Assess AGV Charging Requirement for added 10 EV Stations
Tianjin Inbound Logistics Planner, Automation Specialist – Tianjin, China
Add Charging Extension to Support EV Production

Tianjin Inbound Logistics and Layout Specialists - Tianjin, China
Virtually Commission AGVs Controlled by Siemens SIMOVE
Controls Team – Nuremberg Germany
Line Designer

Plant Simulation & Process Simulate

Point Cloud Data & Virtual Reality available

Teamcenter

Intosite

Plant Virtual Commissioning
Thank You
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