

Solutions

- **Created an Arena-based toolbox**
 - Icon driven for quick line set-up
 - Built-in graphic animation
 - Contains specific components and parameters needed to simulate production lines

Results

- **Optimize manufacturing costs and production efficiencies**
- **Optimize operation strategies**
- **Analyze system before bringing operation online**
- **Present visual animation to decision makers**

Sigpack Systems AG (Bosch)

An Arena-driven toolbox aids in the design of a Delta Robot packaging line to optimize production efficiency and maximize profit.



The Company

Sigpack Systems AG (Bosch) is the global leading supplier of packaging systems and machines for piece goods and free-flowing goods. It is concentrated on packaging technology, handling, automation, and process equipment for the pharmaceutical, food products, and confectionery industries.

Recent developments had been focused on Delta Robot packaging lines, which are ideal to perform operations that are monotonous and repetitive, but very demanding in terms of speed, precision, and particularly the sensing of products and pick and place strategies. Examples include online processes with heavy product flow like the loading of cookies into trays and offline processes for the manufacture of mixed packs like assorted pralines and lunchables.

Standard applications feature four to 24 robots that are capable of packing up to 2400 products per minute.

The Challenge

The challenge when designing a Delta Robot packaging line is to optimize efficiency, expressed as “Number of packed products in relation to the required resources.”

At first glance, the calculations seem to be simple. One could assume that the number of products to be packed divided by the number of products each robot is capable of packing equals the number of robots needed. However, there are boundary conditions and external disturbances that prevent designing the packaging line so simply.

Contrary to systems with a constant and evenly distributed product flow, production processes of Delta Robot packaging lines can be very irregular with high fluctuations—especially short-time, high-amplitude variations of the product and the unpredictable behavior of tray flow. Thus, if calculations are based on a rough estimate, the installation of excessive over-capacity

might be necessary in order to guarantee that every product is being packed.

Moreover, as with human beings, the performance of a team of robots can be optimized by not only improving the performance of an individual, but by implementing specific strategies that target optimal distribution of the workload on all robots, called "line balancing." Depending on the task to be fulfilled, different strategies lead to the best result.

Therefore, Arena (a discrete-event simulation tool) was used to simulate Delta Robot packaging lines and answer the following questions:

Questions on system level:

- How many robots are necessary...
 - to pack all products?
 - to compensate for breakdowns or interruptions?
 - to fulfill special boundary conditions (e.g., to convert an uneven incoming product flow to a regular output for downstream machines)?
- What is the optimal work area and position of each robot?
- What is the optimal size and speed of the product presentation band?
- What is the preferred communication strategy between the robots?
- What are the best breakdown handling strategies? Does a buffer, one more robot, a second tray belt, etc., improve the efficiency?

Questions on robot level:

- Pick strategy:
 - Which product should be picked next?
 - Of all products in the pick area of the robot, the selection must be the one product that is most advantageous to the total efficiency.

- Place strategy:
 - Which position in the tray should be filled next?
 - Of all place positions in the place area of the robot, the selection must be the one position that is most advantageous to the total efficiency.

Solutions

SAT Simulations und Automations Technologie GmbH, Freiburg, Germany, created a special Arena-based software toolbox for Delta Robot packaging lines with all the specific components and their describing parameters that are necessary to simulate such lines, including robots, product band, tray band, buffers, pick and place strategies, special control and communication strategies, and costing information.

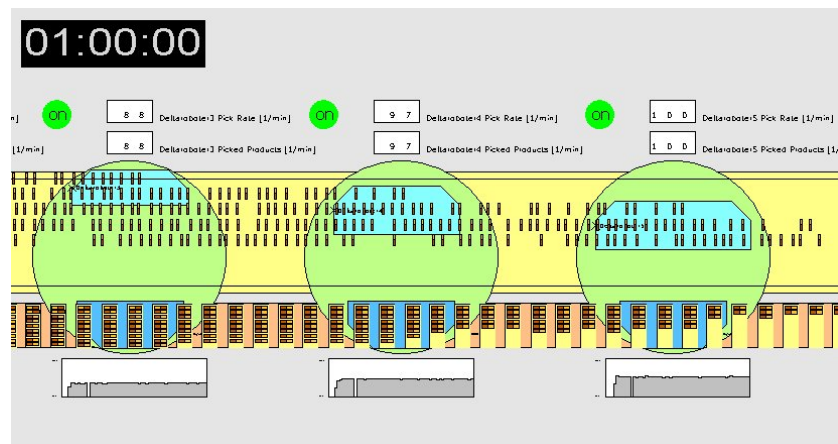
All components of this Delta Line Toolbox are represented by icons that allow the logic of the line to be set up very quickly, functionally, and clearly arranged just by dragging and dropping. Moreover, the built-in online graphic animation is extremely helpful in controlling and understanding the function and behavior of the line.

Results

With the Delta Line Toolbox, it is now possible to get quantitative and comparable results in the very early stages of designing a Delta Line. Different concepts can be evaluated under specific, customer-related conditions. The capability of the Toolbox to answer questions and set up concepts that could not have been solved or would not have been taken into account without the Arena simulation has already been proven in several projects.

Moreover, time and labor costs can be significantly reduced by identifying optimal control strategies before the plant goes into operation.

In addition, having a visual representation of the packaging line in the Arena model is an extremely effective way to present the concepts to the customer. In the case of Sigpack Systems, it helped them to optimize manufacturing costs and profits.



www.rockwellautomation.com

Corporate Headquarters

Rockwell Automation, 777 East Wisconsin Avenue, Suite 1400, Milwaukee, WI, 53202-5302 USA, Tel: (1) 414.212.5200, Fax: (1) 414.212.5201

Headquarters for Allen-Bradley Products, Rockwell Software Products and Global Manufacturing Solutions

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Headquarters for Dodge and Reliance Electric Products

Americas: Rockwell Automation, 6040 Ponders Court, Greenville, SC 29615-4617 USA, Tel: (1) 864.297.4800, Fax: (1) 864.281.2433