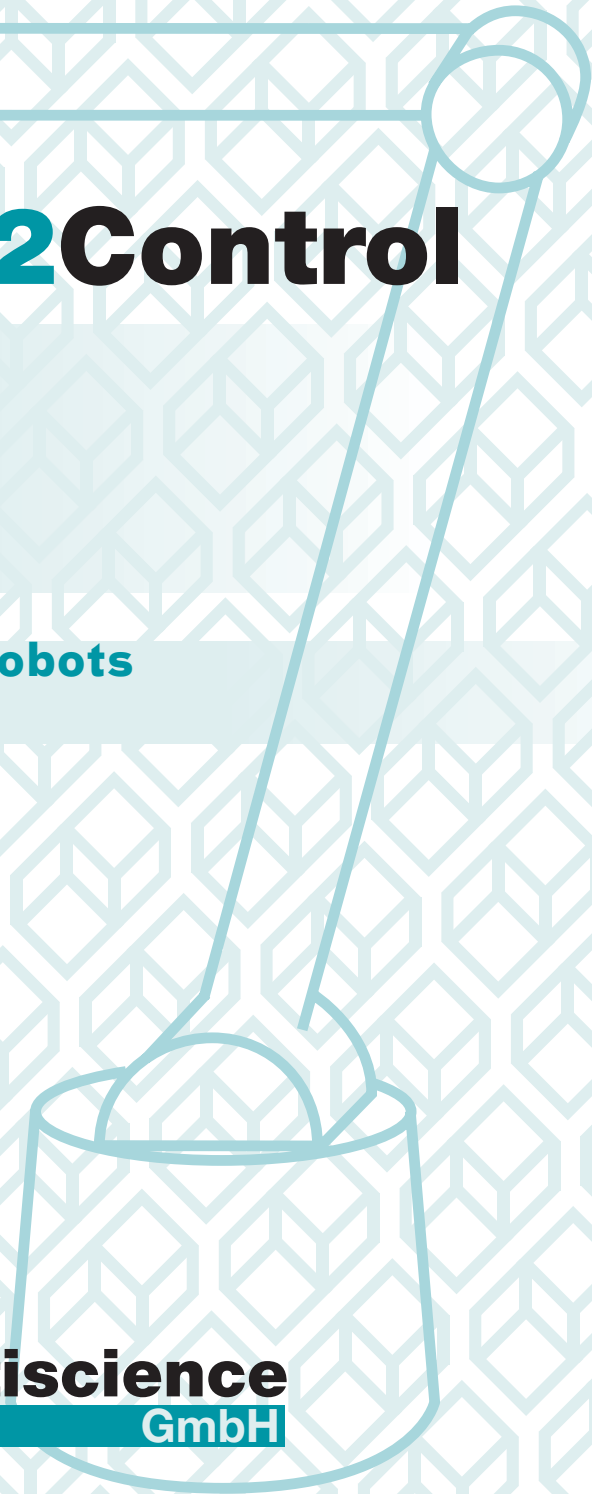
# Multi2Control

... teaches robots
how to pack



Multiscience
GmbH

# Multi2Control - control of automatic packing systems with MultiPack & MultiMix

**Multiscience GmbH** has been founded in 1986. The company's field of activity is the development and sale of MultiPack software systems for loading optimisation with equal-sized products, and of MultiMix for packing heterogeneous items.

Over the years since 1995, variants of the MultiPack program were developed for numerous manufacturers of palletising systems. These enable robots or layer palletisers to be automatically programmed via special interfaces.

This is significantly more efficient than a time-consuming teach-in of the palletising pattern, particularly with frequent product changes.

Increasingly, since 2000, MultiMix-based applications have also been implemented for automatically generating robot control data for picking heterogeneous customer orders.

The next few pages will give you an overview of the possibilities of controlling automatic packing systems with MultiPack and MultiMix.

## MultiPack for robots

In recent years, a large number of individual variants of the MultiPack program have been created, in cooperation with a number of eminent robot manufacturers, both at home and abroad, but even more so as a result of the wealth of ideas and the diverse requirements of many highly-specialised systems houses.

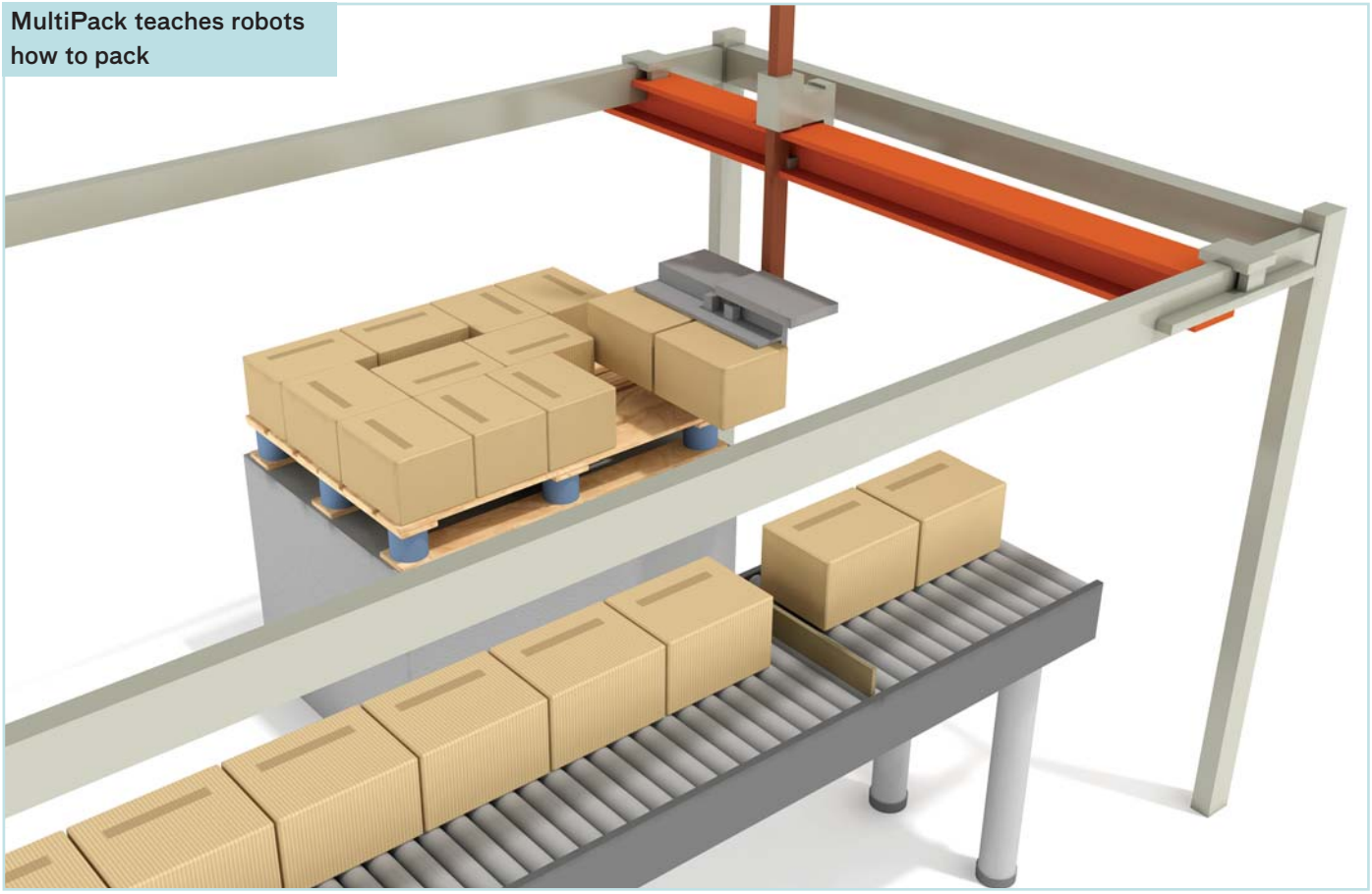
These programs are used in-house by robot system vendors for programming packing patterns, and are also often supplied to the end customer – along with the robot hardware – to facilitate fast, simple programming of a new packing pattern. Many suppliers sell MultiPack for Robots under their own product name, which creates a reference to the company name, for example. MultiPack for Robots uses the proven MultiPack algorithms to calculate the packing pattern for square, round and oval products.

In individual projects, non-layerwise palletising systems have also been implemented, e.g. for cardboard boxes with rolls of wallpaper, or cartons of cigarettes. MultiPack for Robots supports clamping grippers, fork grippers and vacuum grippers for single and multiple gripping tasks as standard. For vacuum grippers with several separate vacuum groups, MultiPick/SinglePlace palletising can be calculated (placement of several products individually, or in smaller groups).

For some customers, split clamping grippers and fork grippers with two or more segments, the 2-chamber grippers customary in the printing sector, and carton grippers, are integrated as well. For generating the layer pattern, it is irrelevant whether SCARA or portal robots are used. What is important, however, is that all placement points lie within the working area of the respective robot that can be specified in MultiPack. In addition, when generating



MultiPack teaches robots how to pack



the gripper cycle, the constricting contours of the palletising area (e.g. safety barriers) and the maximum outline of the gripper are taken into account.

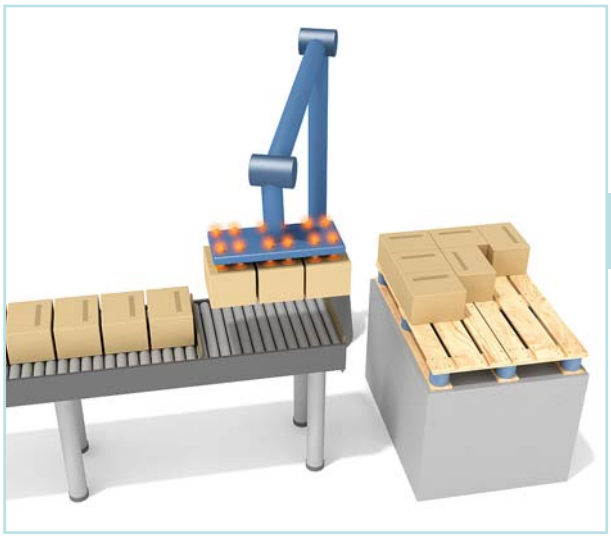
To maximise robot performance, MultiPack calculates the minimum-time gripper cycle combination and sequence for each layer pattern.

## TCP-referenced control data

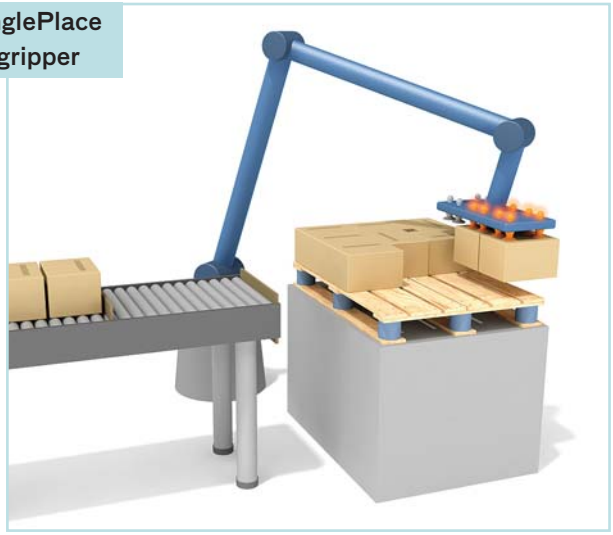
The vast majority of robot system vendors cannot transmit the product positions on the pallet from MultiPack for Robots, from which the pick up and placement coordinates to be approached are then calculated – by lengthy calculations – within the robot controller.

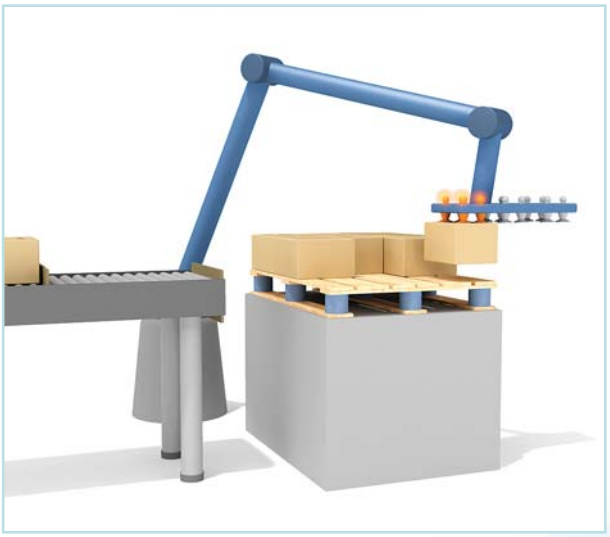
Instead, the coordinates of the robot TCP, resulting from the gripper design and referenced to the pick up station and the target pallet are imported, which can be directly approached by the robot. As the associated robot frames can normally be freely calibrated, MultiPack for Robots does not need to be customised to the particular system configuration installed.

In addition to the TCP coordinates, the angle of the gripper at pick up and placement, and the gripper control data are calculated for each robot cycle. Which vacuum group must be activated or deactivated, which clamping gripper flap valves must be opened, and what pressure the clamping gripper must exert are all taken into account here. In addi-



MultiPick/SinglePlace
with vacuum gripper





tion, the direction from which the pick up and placement points are to be approached is also specified.

The palletising sequence can be visualised in 2-D and 3-D, and even step-by-step. The cycle formation and sequence automatically determined by MultiPack for Robots can be changed manually, taking account of the restrictions mentioned above.

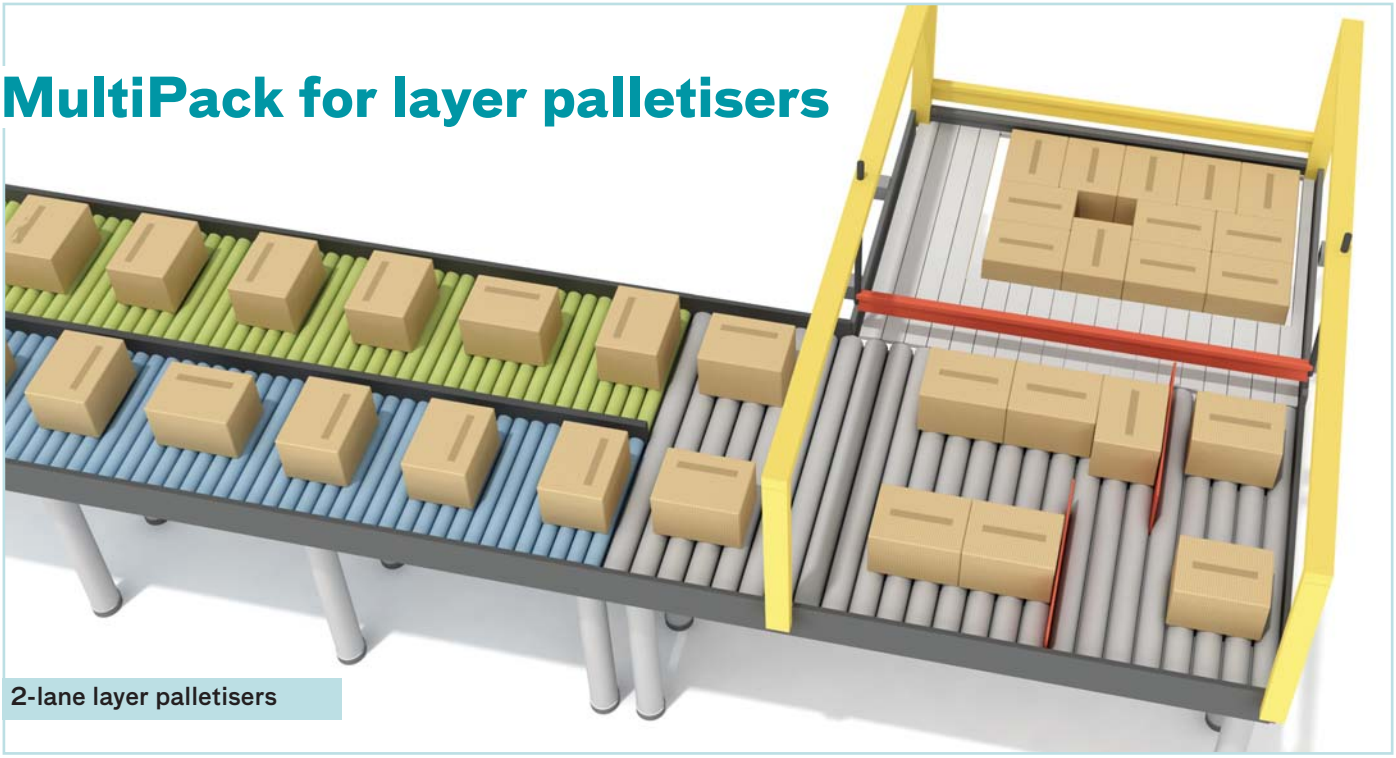
The performance of the system for packing patterns specified by the client can be analysed back at the design stage of a robot packing system: the minimum number of robot cycles per layer is easily determined and alternative gripper designs can be compared.

## Connection to the robot controller

Multiscience has already implemented a wide variety of alternative concepts for transmitting the control data to the robot, from the output of ASCII files, to direct access to the memory chips of the robot controller, using S5 or S7 interfaces, for example.

The current target state of the pallet loading can be visualised on the robot's user interface, using the MP-View tool supplied. If MultiPack for Robots is used to palletise order-related or even subsets of a complete loading, palletising with commencement layers can be calculated for this online. The special versions of MultiPack for Robots are supplied exclusively to the respective systems houses. Of course, user support is also provided directly by Multiscience if required.

# MultiPack for layer palletisers



2-lane layer palletisers

MultiPack for Layer Palletisers is also based on the proven MultiPack software and was developed in cooperation with eminent layer palletiser manufacturers.

MultiPack for Layer Palletisers depicts the standard system configurations with up to 4 feed lanes, where both systems with fixed or adjustable stoppers, and systems without stoppers (i.e. with synchronised conveyor operation) can be defined.

For the selected layer pattern, MultiPack determines the distribution of the products on the feed conveyors and the pushing-off operations, as well as the stopping positions of the individual products, which can be modified interactively. The pushing-off operation and the layer image on the pallet resulting from pushing the products together and opening the layer table are visualised 2- and 3-dimensionally.

If the customer's requirements only envisage a limited number of packing patterns to be generated on the palletiser, MultiPack can be used back at the project design stage to investigate which stoppers actually have to be fitted. MultiPack outputs an overview of all the stoppers required for the packing pattern, so that – for rarely used stopper positions – investigations can be made into whether the packing pattern concerned could also be generated with alternative stopper arrangements. As a result, the number of stoppers to be fitted, and hence the price of the system, can be kept to a minimum.

MultiPack is also used directly to generate control data, allowing fast programming of the palletiser without knowledge of the control system. Fast, simple reprogramming of the palletiser is very important in import warehouses, for the constantly changing promotional goods carried by many chain stores. The available data includes the sequence of the products per feed lane (lengthways or sideways, according to the label position on palletisers with 0° - 270° turning station), the stopping position for each product, the target position for each pushing-off operation, and the target values for centring the layers.

# MultiMix for Robots

## Planned automatic order picking

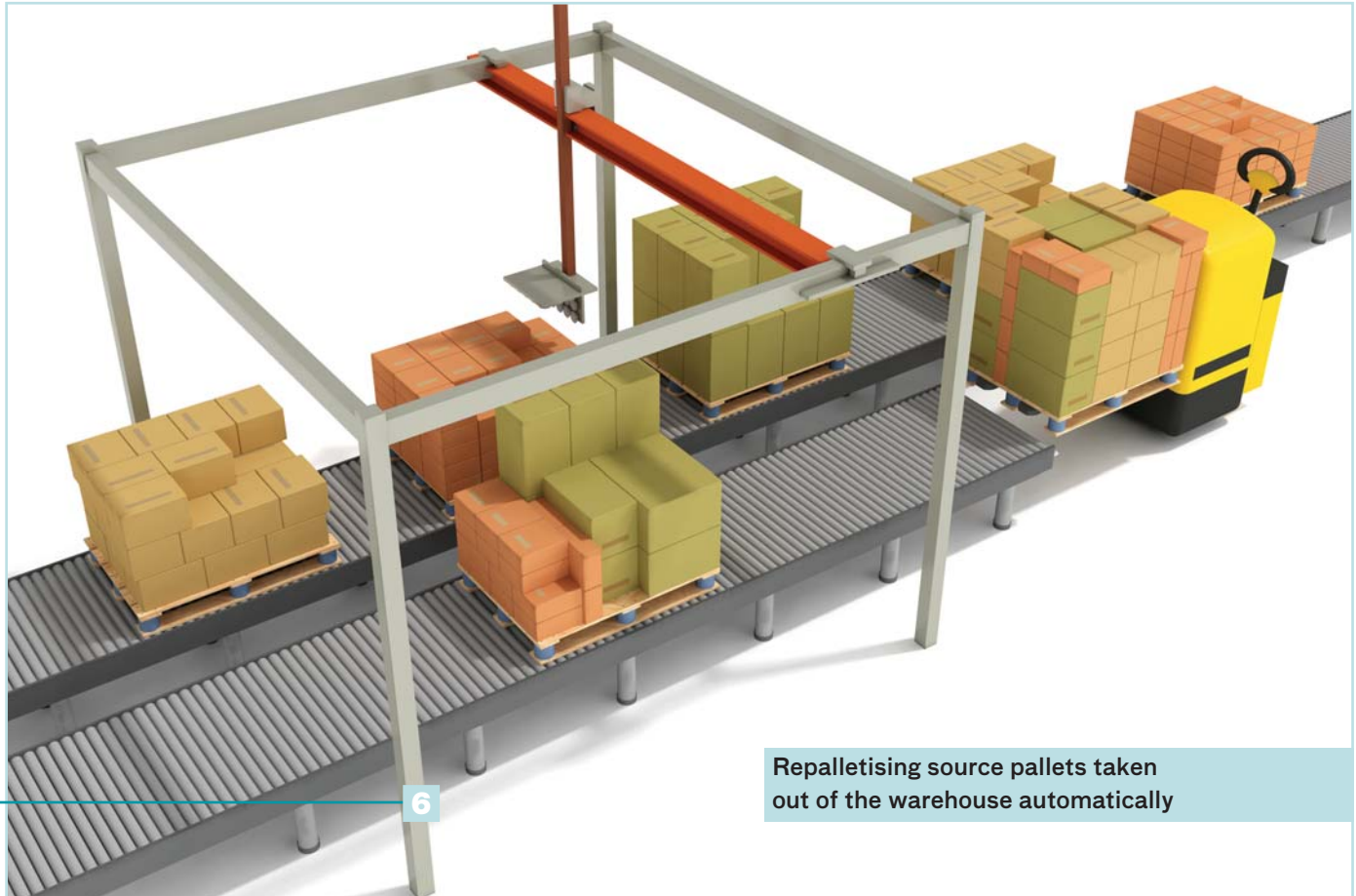
Automatic palletising of picked customer orders presents a major challenge for the future. Very few automatic order picking systems are currently in service. However, the demand for appropriate solutions has risen in leaps and bounds in recent years.

Various systems houses have developed the most widely different concepts based on MultiMix, and in some cases have already implemented them. From the robot control point of view, there is not much difference between single-variety and mixed palletising, i.e. essentially, the different versions are applicable to MultiPack for Robots. However, whereas with single-variety palletising, the palletising patterns are only selected and transmitted to the robots once per product format, with order picking of heterogeneous goods – which differ in make-up from one order to another – stable pallet loadings have to be automatically calculated for each order.

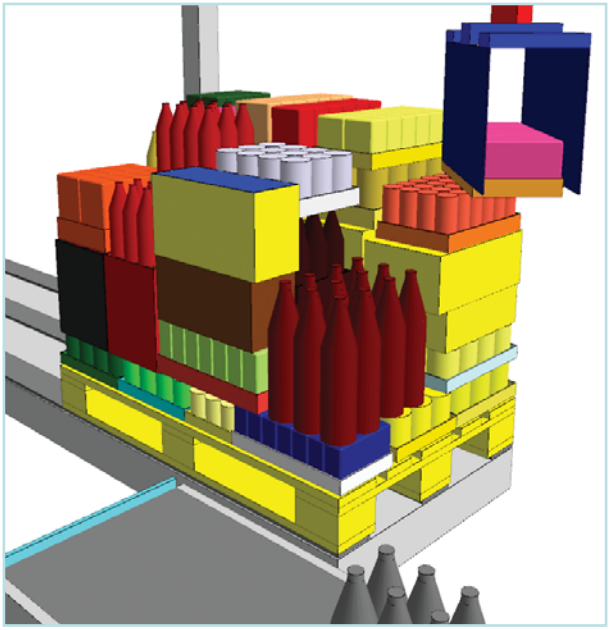
Consequently, MultiMix has to be connected to the order processing software, to break down the orders into pallet-compatible subsets, which can then be either fully packed by the robots or even, in some cases, manually packed, where the products cannot be handled by the robots.

Extremely diverse configurations for the loading sequence are possible here:

- The sequence is rigidly specified by a planned production sequence, for example.
- The sequence is rigidly specified, a limited number of products can be buffered temporarily.
- The sequence can be specified item-wise by MultiMix, the same items must be palletised successively, because, for example, the source pallets are taken out of the warehouse sequentially.
- The sequence can be specified by MultiMix at product level.



Repalletising source pallets taken out of the warehouse automatically




Order picking pallets planned with MultiMix

In addition, product groups may have to be kept together, or heavy products positioned as far down as possible on the pallet. With increasing degrees of freedom in relation to the sequence entry, higher stowage space utilisations and more stable loadings can be generated.

Pallet loadings set up by MultiMix can be handled sequentially or even in parallel by various robots. As with pallets, other containers (e.g. roll containers, pallet boxes or returnable containers) can be loaded or filled too. In this case, the requirements imposed for stability of the loading are normally not as stringent as with loading pallets.

At the project design stage of palletising systems, Multiscience offers the option – based on MultiMix – of calculating the optimal loadings in each case for real order data, and of creating a visualisation for the presentation to the end customer.

## Chaotic palletising

Chaotic palletising means the loading of products arriving at the packing space in a random sequence, where there is only a very limited preview of the next product, and where no, or very few, products can be buffered temporarily. Configurations such as this are found, for example, when loading baggage into ULDs or when packing heterogeneous parcels at parcel service companies.

In contrast to manual palletising, with robot-aided palletising, there is no possibility of moving a product later on, if its position proves to be unfavourable. That is why better stowage space utilisation can normally be achieved with manual packing. Experience shows that good loading arrangements can only be achieved if the stowage space has supporting walls on all sides, or if the products are modular, i.e. the individual product formats fit together like building blocks. Whether or not sufficiently high utilisation factors and stable loadings can be achieved with such scenarios can be investigated with MultiMix as part of the project design, by means of a packing simulation, based on real data.

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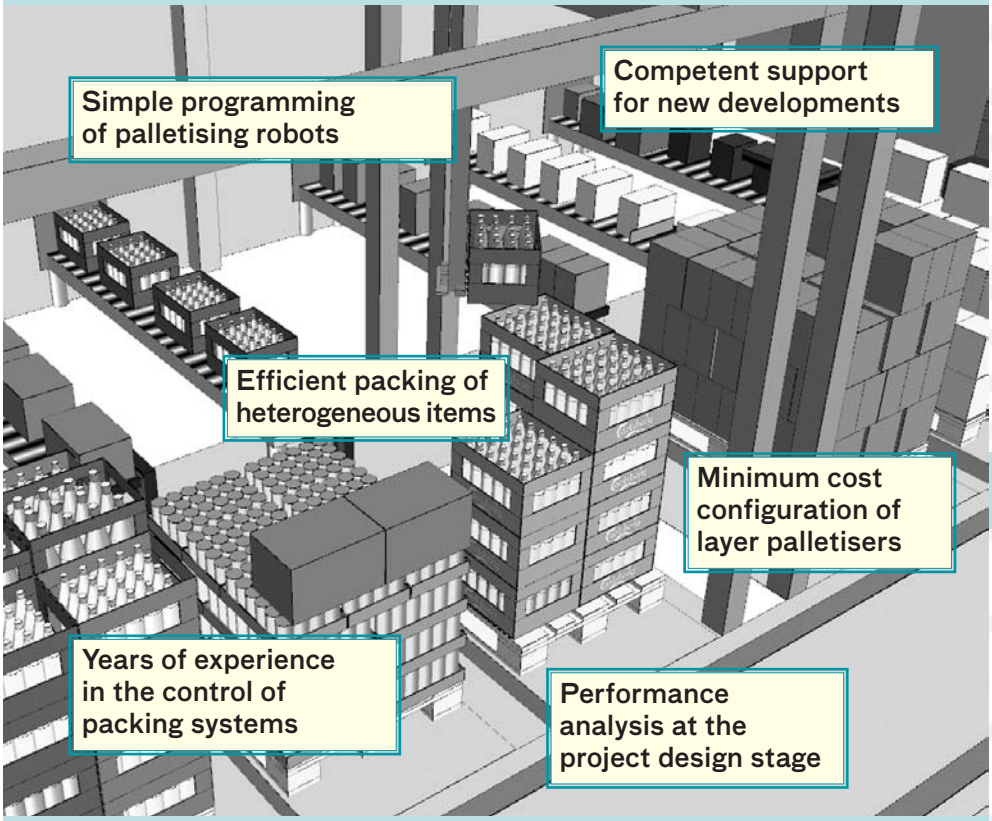


# Multi2Control

**Efficient programming of palletising systems with MultiPack & MultiMix**

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