D6.6 - PicknPack report

Integration of the adaptive packaging system to the complete PicknPack

Søren Østergaard,

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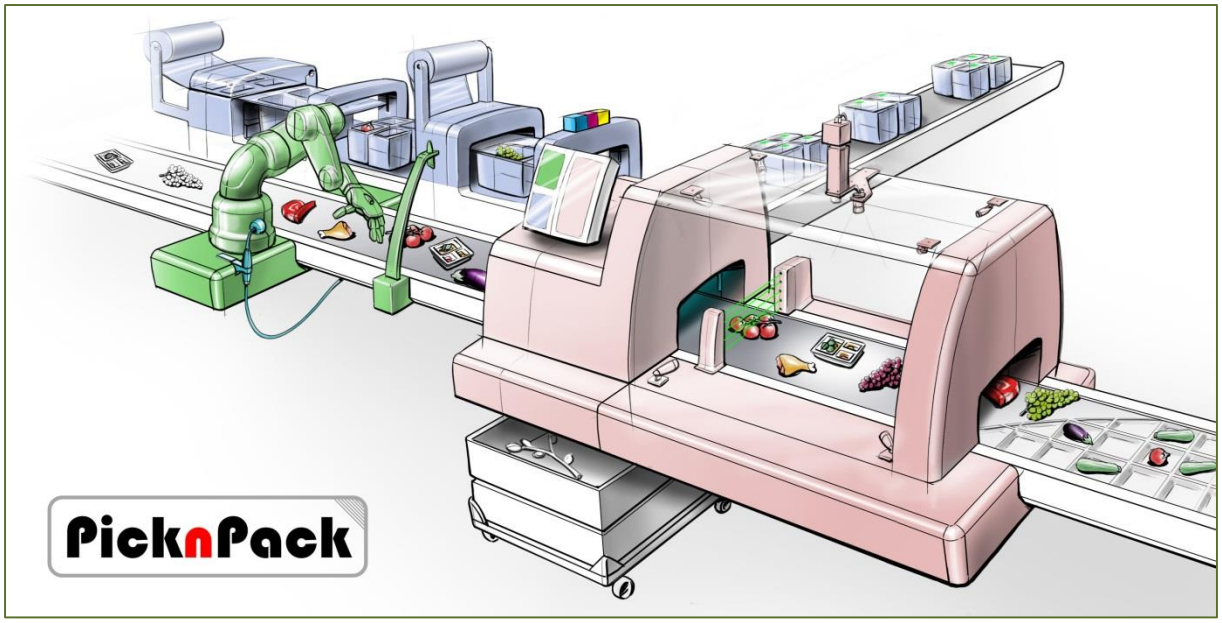

Flexible robotic systems for automated adaptive packaging of fresh and processed food products

Dissemination level		
PU	Public	X
PR	Restricted to other programme participants (including the EC Services)	
RE	Restricted to a group specified by the consortium (including the EC Services)	
CO	Confidential, only for members of the consortium (including the EC Services)	

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1 Introduction

This work package aims to implement WP6 into the PicknPack.

D6.6 is the documentation of the integration of packaging modules from DTI, Cam-Tech, KUL, UM, and DLO to the PicknPack system.

- Assembling the prototype module from the 4 subunits and mounting on a test packaging line
- Production tests
- Evaluation of performance
- Upgrades of subsystems and packaging system

This integration task focus on the in-line demonstration line.

2 Integrated adaptive packaging system

Figure 1 – Photo of the integrated adaptive packaging line

The packaging system was shipped to Wageningen in April 2015 in order to be integrated to a complete working PicknPack system. The WP6 packaging line is running with a few exceptions.

3 Digital mould and flexible mould shift

3.1 Brick mould system

The brick mould system is implemented in two tray heights 35 mm and 75 mm. Bricks are produced in bricks of 40x40 mm and connected together in plates of 240x480 mm.

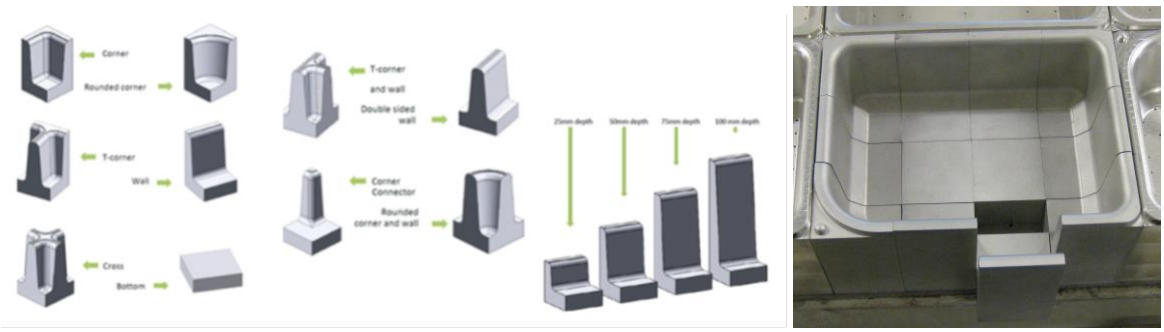

Figure 2 –Brick mould system

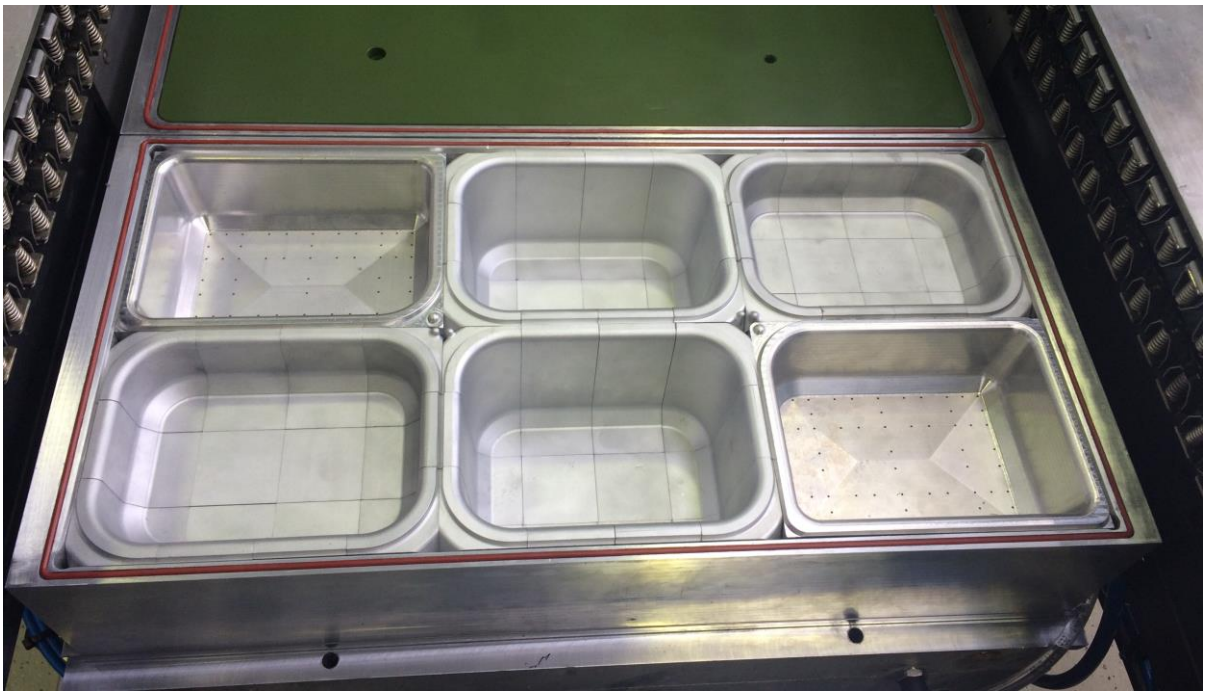

Figure 3 – Brick mould system installed in the thermoformer

The system produces excellent trays as seen on the photo in figure 4. WP6 has designed a fast system with only few minutes lead-time between design and production.

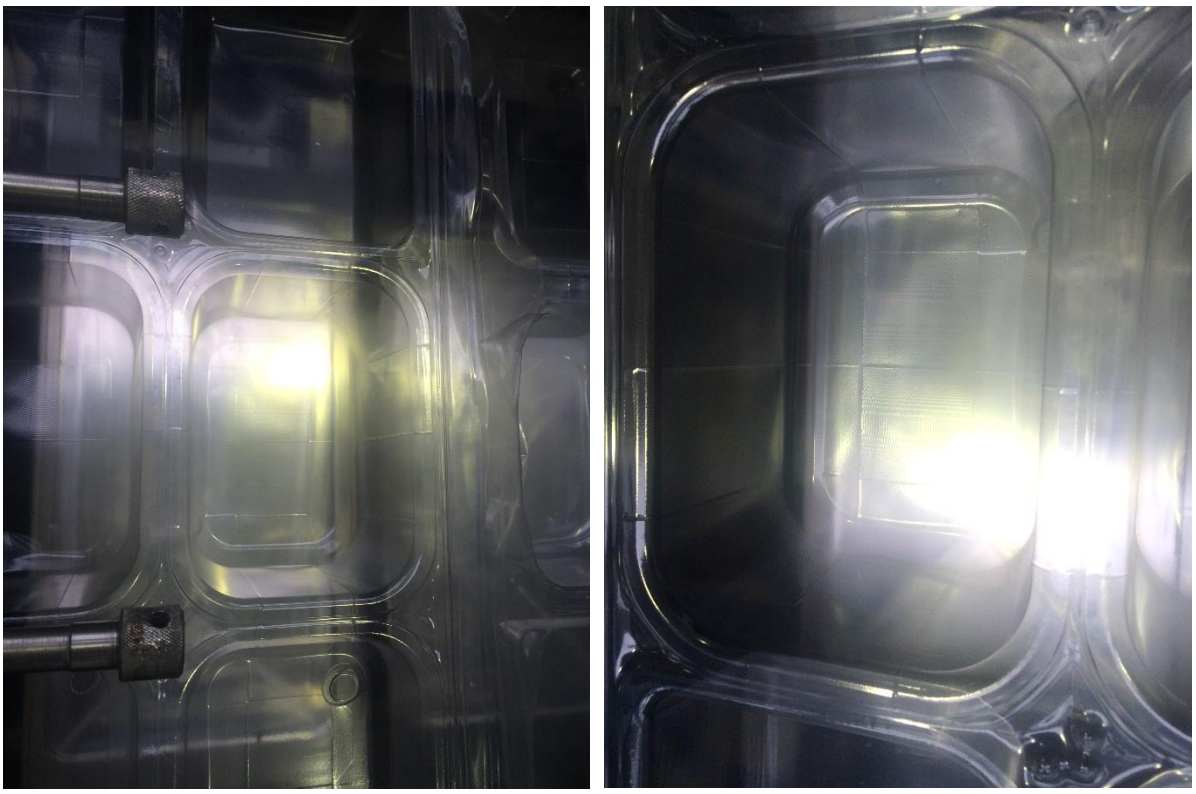

Figure 4 – Plastic trays made from the brick mould system

The thermoformer can form a set of frames in different cycle times. Thin plastic film (200-300µ) in APET and PE can produce a set in about 3-5 seconds. Thicker film will increase production time. Also PP that need a higher forming temperature will need more time. Other modules need a reduced moving speed also reducing capacity.

The final application is running with 600µ APET-PE film is able to operate I cycle time of max. 12 sec or 5 cycle per minutes. With 6 trays a set this is a production capacity of 30 packs per minute.

3.2 Flexible mould shift

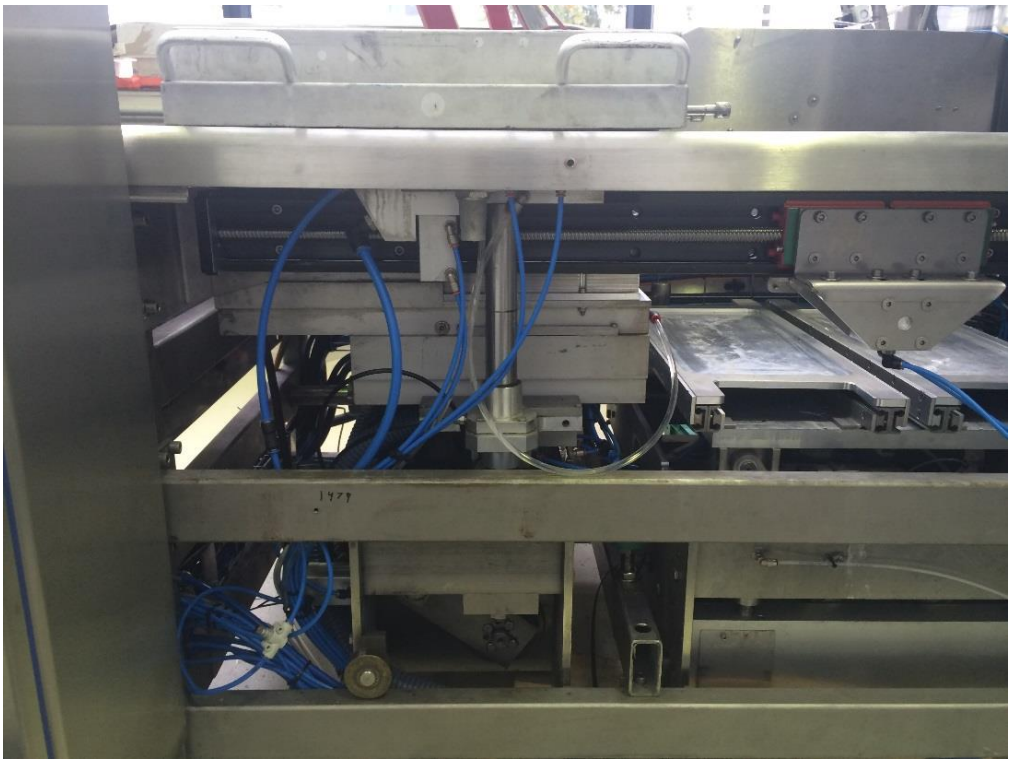

Figure 5 – Photo of the flexible mould shift system in Wageningen

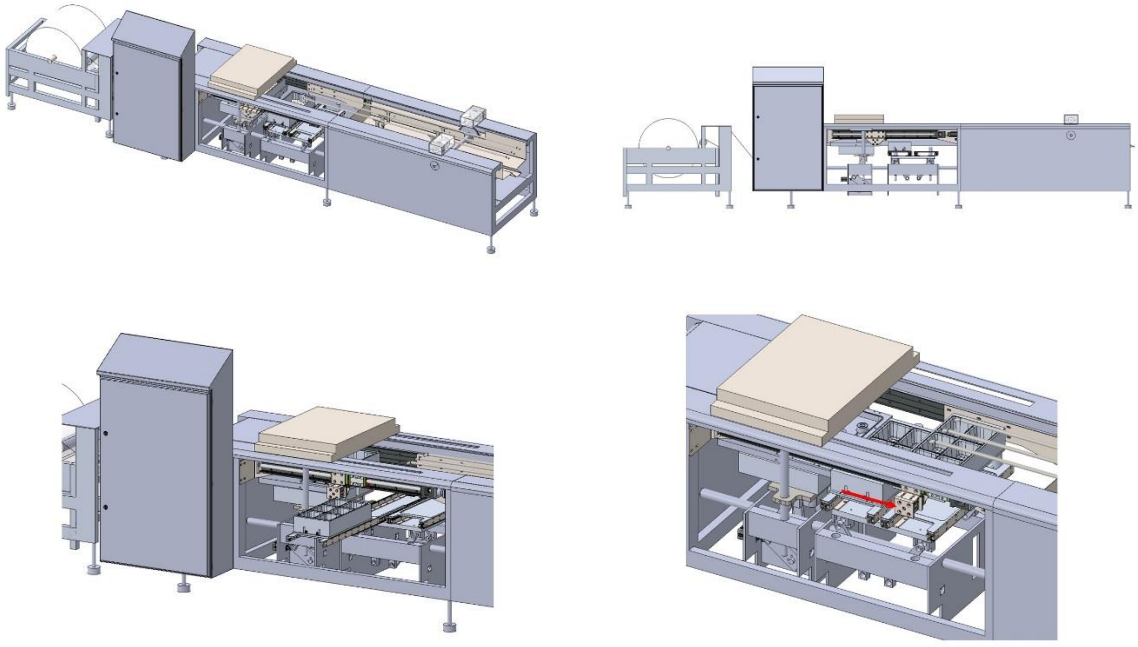

Figure 6 – Drawing of the flexible mould shift system in Wageningen

WP6 has installed a mould shifting system on the thermoformer in Wageningen. The shifting system has two storage plates for mould trays to store each one tray with full mould shots of 480x240 mm. Each mould can be divided into several packaging with the brick mould system. The trays are designed and assembled outside the thermoformer. The mould trays can be slided into the storage. Automated arms move mould trays in and out of the moulding chamber. In this way, the thermoformer can in a few seconds change the production and design.

4 Flexible sealing and cutting

Figure 7 – Laser equipment on top, printer right and cross section.

The laser welder and cutter was planned to be placed in the end of the packaging line after the trays are filled and after the top film is applied. It was planned that the top and the under film to be mechanical locked together at the same level under the laser. The laser seal and cut by a controllable mirror system. See description in D6.5.

We have a serious problem with the laser to weld and cut. When PicknPack started, PP was used for packaging trays, but now almost all packaging is made in APET. The market has changed very fast as APET has a significant lower price and also has a better packaging performance. For this reason, it has been more than difficult to purchase PP for PicknPack. We only have a PP-PE combination that does not work correct in the thermoformer. The option to replace the laser with another type of laser is impossible, as PicknPack has already purchased the laser for PP 2 years ago.

PicknPack Project Board decided on the meeting 29 October 2015:

"*Yesterday in a small group a proposal was discussed on how to proceed now that it appears to be impossible to have the thermoformer produce good trays with PP and the laser/scanner cannot seal and cut PET fast enough. Søren presents the outcome on a flip-over.*

Fraunhofer has a set-up to test the thermoformability of different films and offers help to resolve the thermoformer problem.

The conclusion is that the line will be split in at least two parts: the combination of thermoformer/delta robot/QAS module working with PET; and the combination of cross-sectional module with the laser/scanner, printer and cable robot with RFID applicator.

The problems come together in the laser sealer/cutter. The problems with the laser need to be resolved out of the line. The aim is to demonstrate the second part of the line as an integral system. If we cannot make the laser cut the trays, an additional separation might be necessary between the cross-section and the cable robot.

It is important to still demonstrate that the information of the QAS module can be printed a few seconds later on the package."

The experiences from these tests indicate a problem with having time for both sealing and cutting in the stop time. It is important that the under and over web is perfectly indexed under sealing which need a stop. If the over web is cut under sealing it will be possible to cut under the creeping movement.

The experiments also indicate that the sealing process will be the bottleneck to reduce the stop time.

(First in Mid-November, it has been possible to locate a small leftover web with 700µ 100% PP film. Only about 250 meters is located, so this does not change the decisions made by the Project Board. Another PP web of 530µ was also delivered).

The laser project is still serious delayed. For this reason, the PicknPack Project Board decided on the last meeting 1 March 2016:

- Demonstration will be done as original planned in the project incl. cross-section and printer.
- But the laser and integrity system will be demonstrated separately using either ready-made PP packaging or trays made from the line of the delivered PP films.
- (The cable robot can therefore only demonstrate trays made by the separate laser system.)

5 Integrity system

The integrity checking system has been ready for working in more than a full year as documented in D6.5. But the delays with the laser has postponed the responsible team from KUL. The plan is now together with UM to integrate the laser system and integrity system to a separate demonstration outside the PicknPack line.

KUL has already documented all results up to now in D6.5.

The plan is to have these two systems integrated before 1 April 2016.

6 Flexible decoration

WP6 has done several successful tests decorating plastic films in different colours.

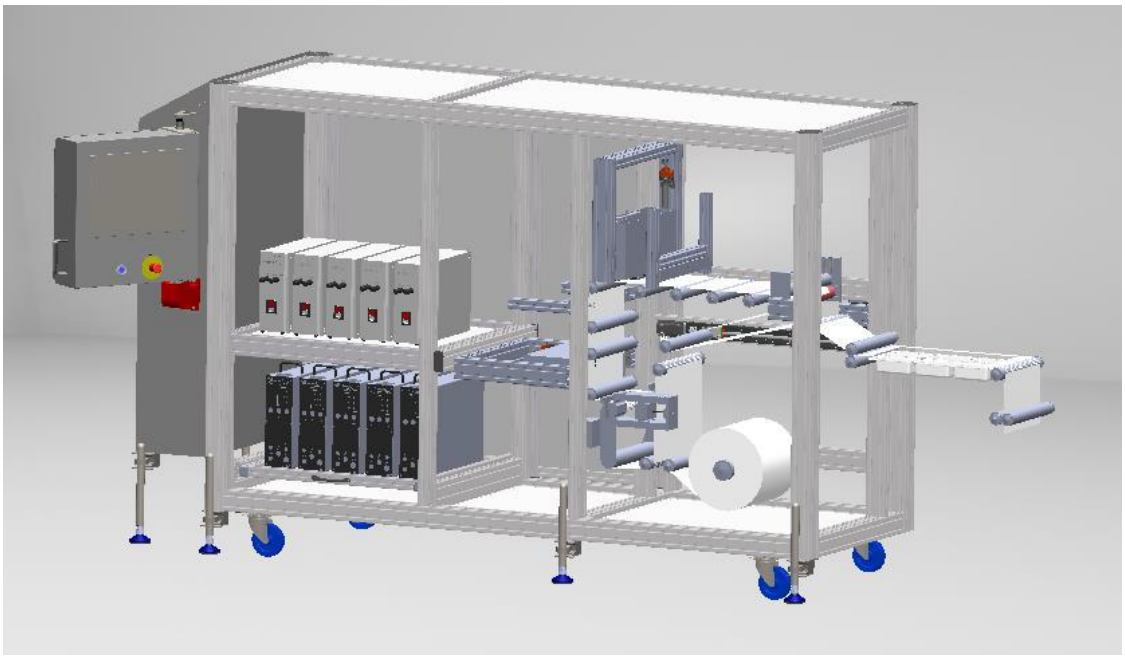

Figure 8 – Printer build together with the cross-section.

It has been decided to decorate in two colours for the demonstration unit, which will give an excellent impression of the opportunities in flexible in-line decoration. Extra colours can be added at extra costs. WP6 has discussed the wish to add more colours on the printer. The printer design is made so it is possible to add several extra colours. As the print equipment for four/five-colour decoration in the full 300 mm web width is too expensive for our limited budget WP6 has selected to demonstrate in two colours in a high quality.

The printing system is designed in a way that individual information and decorations for batch sizes down to single units are printed onto the top-film, before it is sealed onto the tray. Work has also been performed to identify suitable low-migration UV-curable inks for this process, as it is a crucial part of the process that no ink components migrate into the food products. The inkjet print head selected for this process is the Xaar 1002 print head model, which allows to print in a grey-level-mode at 360 dpi, resulting in high apparent resolution and image quality. A unique feature of these print heads is the continuous ink recirculation past the back of the nozzles during jetting, which means that air bubbles or unwanted particles are carried away, resulting in highest printing reliability. These features make the Xaar 1002 the most suitable print head for this type of single-pass printing as employed in PicknPack, where it is important that the printed information like text and barcodes does not contain any defects that makes it unreadable.

Figure 9 – Photo of the printer and laser for welding and cutting in Wageningen. Other modules as sectional frames, scanner and robot is also on the photo.

7 Annexes

Annex 1: Video of WP6 Packaging system in Wageningen

Annex 2: Video of WP6 Printer in Wageningen

Annex 3: Video of WP6 Thermoformer in Wageningen

Annex 4: Video of WP6 Sectional frames in Wageningen