final report

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Leap V Upgrading from 2.5 to 5 cpm Oz Development, with improved yield

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Executive Summary

In 2012 Scott concluded the first example prototype of the LEAP V automated bone in forequarter processing cell. Feedback from processors was that the system was excellent in the way that it handled and processed the product however too many cells were required to support a room operating at 10 cpm. This was both a comment based on the required total investment for a 10 cpm processing environment and the footprint required.

This project will take the earlier developed system and develop a 5 cpm system that although will cost slightly more in RRP will ultimately reduce the price for 5 and 10cpm Processors, and reduce the total footprint required.

At the end of this project an Australian Processor will be able to install the system built under this project budget and have the system remain on their site indefinitely.

The design and commissioning of the system has been competed and has included redesign of the robot gripper, use of a custom made horizontal bandsaw along with upgrades in vision and robot software to handle larger Australian product. An IP69K rated robot has been introduced that does not need a cover to protect it from the caustic washdown environment. This robot is on loan from Kuka Robotics and will be installed and closly monitored at ALC when the system is installed at their Colac plant in mid August.

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1 Background

In 2012 Scott concluded the first example prototype of the LEAP V automated bone in forequarter processing cell. Feedback from processors was that the system was excellent in the way that it handled and processed the product however too many cells were required to support a room operating at 10 cpm. This was both a comment based on the required total investment for a 10 cpm processing environment and the footprint required.

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2 Project Objectives

At the conclusion of this project, Scott will have:

1. Revised and redeveloped an automated lamb forequarter system that is smaller in footprint, with increased cycle time and increased yield recovery.
2. Increased the current measured benefit by Greenleaf of the NZ based 2.5 cpm Forequarter system.
3. Developed a system that can either operate standalone or integrate with a Scott x-ray system (the later would increase yield recover and reduce cycle time).

At the conclusion of this project it is expected that an Australian processor (Bordertown, Colac or Tamworth with no x-ray) will then be the host site for the installation of the above unit. It is at this point that at cost benefit analysis can be undertaken to ascertain both the yield and speed improvement and the benefit based on processing Australian stock.

3 Methodology

3.1 System Design

Two parallel paths were undertaken during design phase of the project. Path one was to undertake evaluation experiments with the current 2 cpm system installed at SilverFern Farms Finegand facility to evaluate technology additions and software changes that would result in a 5 cpm target speed being met. The attached video “12.8H Slow Approach” provides a real time demonstration of the Finegand system with improved software and additional hardware to obtain a 5 cpm cut speed.

The second path was to undertake alternative design concepts to ascertain the alternative ways to build the final solution to ensure that it could suit any boning room. Two different design/layout concepts have been developed as depicted below.

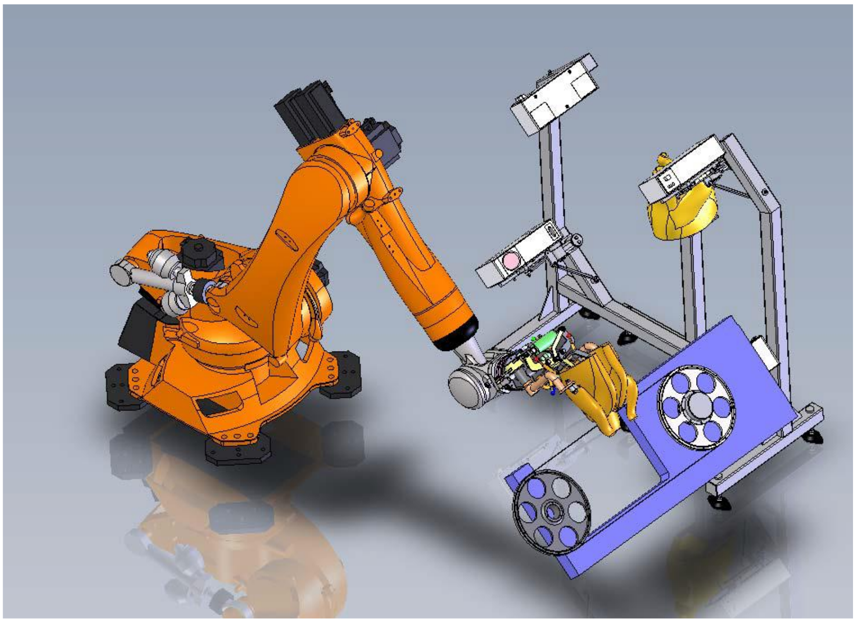

Figure 1: Horizontal Bandsaw Concept

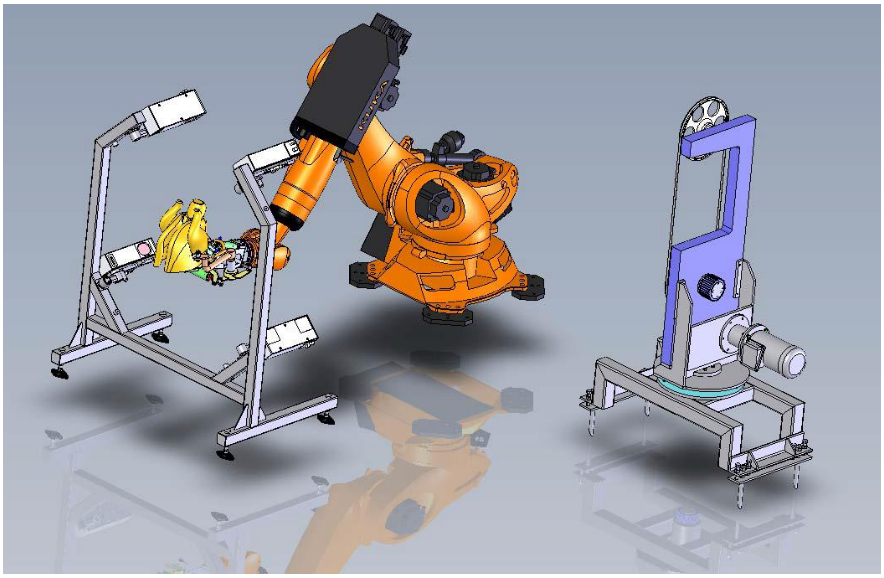

Figure 2: Vertical Rotating Bandsaw Concept

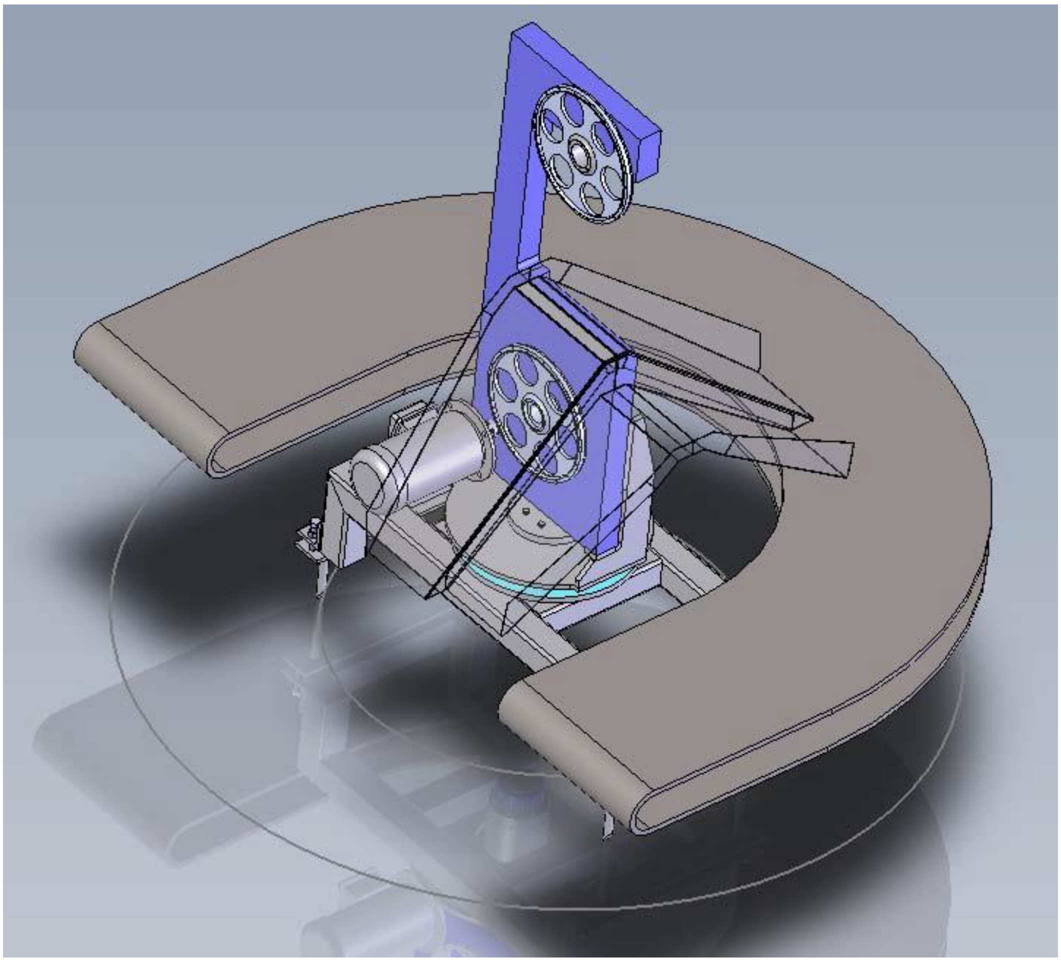

Figure 3: Vertical Rotating Bandsaw Concept (with product discharge belts)

Both of the designs had merit and arguably the only difference in the build cost and bill of materials was the saw frame and the rotating mechanism for the vertical saw. After discussions with AL Colac it appears that the horizontal saw has the advantage that the existing room product conveyor belts may be able to be used (reducing the overall integration costs into an existing Client's room/facility). As such, Scott pursued the horizontal saw design with a view to installing the first 5cpm prototype into AL Colac with a horizontal fixed position bandsaw.

It became evident, however, as the design developed that a fixed position bansaw was not going to be capable of completing all the required cuts. As can be seen in the attached PDF simulation 'MF1101-001-A Robot Positions per Cut ' of the cut paths, the saw needs to vary its position to enable the required cuts to be made. Hence the system was designed with this in mind and a 7th axis servo motor was added to the robot controller to position the saw angle.

3.2 System build

The initial build of the system commenced in Scotts Dunedin Plant in New Zealand.

1) **Robot**
The robot was purchased, a Kuka KR90 with 90kg payload and 2700mm reach with a conroller consisting of the Main controller and the 7th Axis band saw position controller.

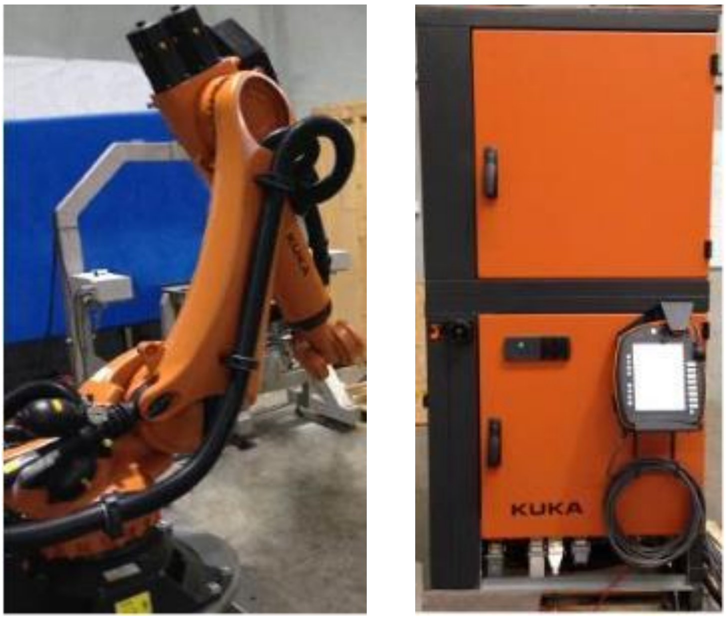

Figure 4: Kuka Robot and Controller

2) **Robot Gripper**
The robot gripper was designed and fabricated. This gripper is a modified version of the original New Zealand LEAP V automated bone in forequarter processing cell. This has been modified to process Australian Stock.

3) **Vision System**
The vision system maps the shape and size of the forequarter as it passes through the laser beams in the robot gripper. There are three laser measuring devices, one each side and one above.

4) **Bandsaw**
After the forequarter is measured by the vision system a bandsaw on a seventh axis cuts the required portions.

The bandsaw has been purpose built. Rotation position (Axis 7) is servo controlled with a range of -40 degrees to 180 degrees. The bandsaw is powered by a 3Kw three phase motor. Speed of the bandsaw blade is variable, controlled by an Allen Bradley PowerFLEX 525 variable speed drive.

5) Main Control Cabinet (MCC)

The MCC houses the robot ancillary equipment. This includes Allen Bradley, Vision industrial PC, Compact Guard Logix PLC, Power Supplies, Variable Speed Drive, Contactors, Overloads, Circuit Breakers and terminal strips.

6) HMI

The Human Machine Interface (HMI) is a 19" NOAX Industrial PC this is used to input and output data to and from the operator, PLC and robot.

Figure 5: HMI screen

Machine control and display options include diagnostics, cut configuration, system speed/cycle time, single cycle, dry cycle, safety system status, part tracking, alarms and faults. Manual control screens include gripper, load table and bandsaw.

4 Results

The system was demonstrated to MLA at Scotts Silverwater work shops on 23/6/16. The original Kuka Robot has been substituted with an IP69K rated robot that does not need a robot bag. This robot is a KRV120 R2100 Nano F Exclusive which has a 120kg pay load and 2100mm reach. This is on loan from Kuka and will be the first time Scott has installed such a robot in a caustic wash down situation. The majority of the robot is coated in a caustic resistant coating with other parts being stainless steel and capable of withstanding caustic conditions. This robot will be routinely monitored following installation on site and can be replaced with the original robot and robot cover should it not with stand the conditions. An image of the new robot is shown below.

5 Discussion/Conclusion

The demonstration showed that the system could successfully grip and cut a forequarter. There are refinements to be made however in the accuracy of the cuts and in cycle time. Scott's will ensure that these issues are addressed prior to the system being shipped to ALC. It is anticipated however that final refinements will be made onsite when a large volume of product is available.

Design of safety fencing and peripheral items such as cable droppers will now be fianlised, ready for installation into ALC's Colac plant in Mid August.

As part of the first milestone for the follow on project, P.PSH.0764 Installation of the Fore Quarter Cell at ALC Colac, discussion have been held with Murray Miller from ALC with regards to the location and integration of the system into their new boning room. The images below show an overall view of its location along with a plan and elevation view of the cell itself.

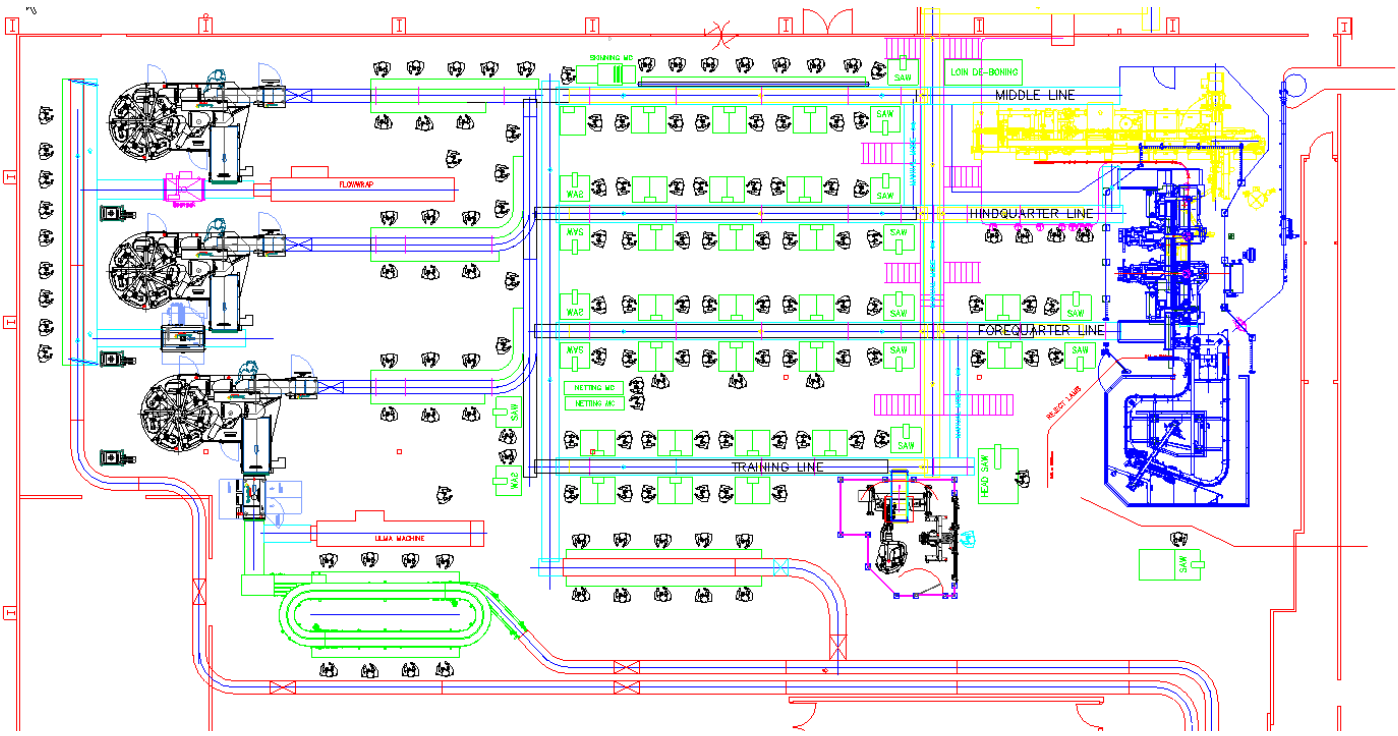

Figure 10: ALC Colac Boning room layout

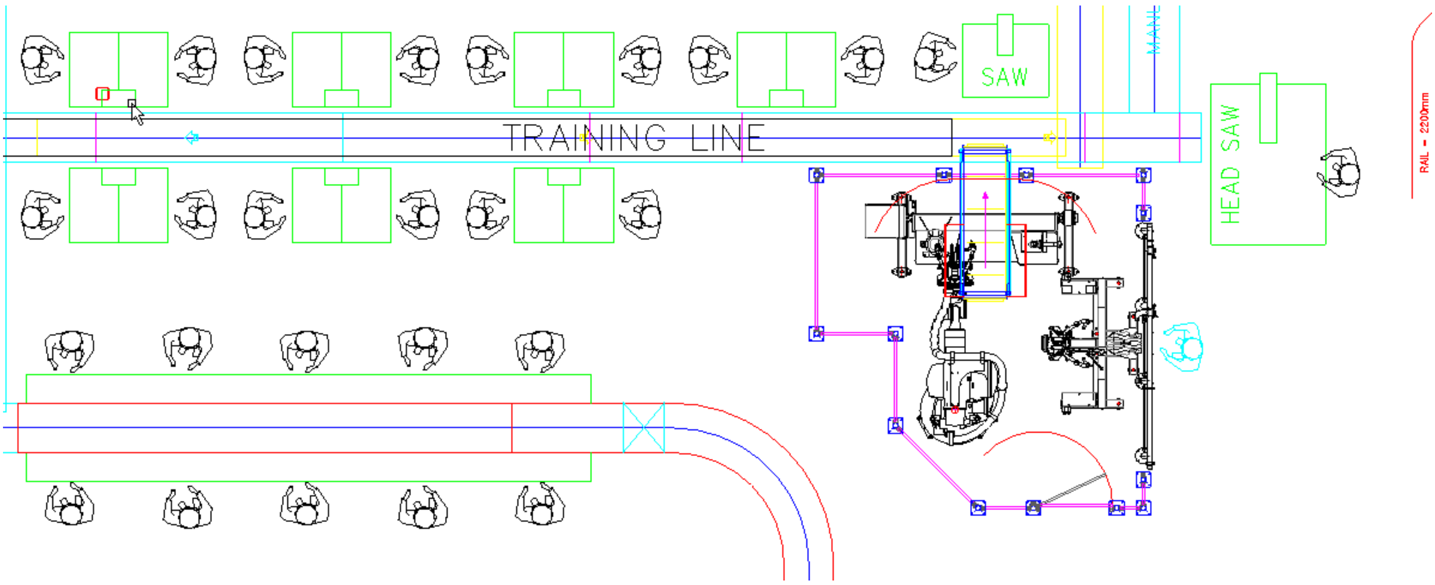

Figure 11: Fore Quarter System located on Colacs Training Line

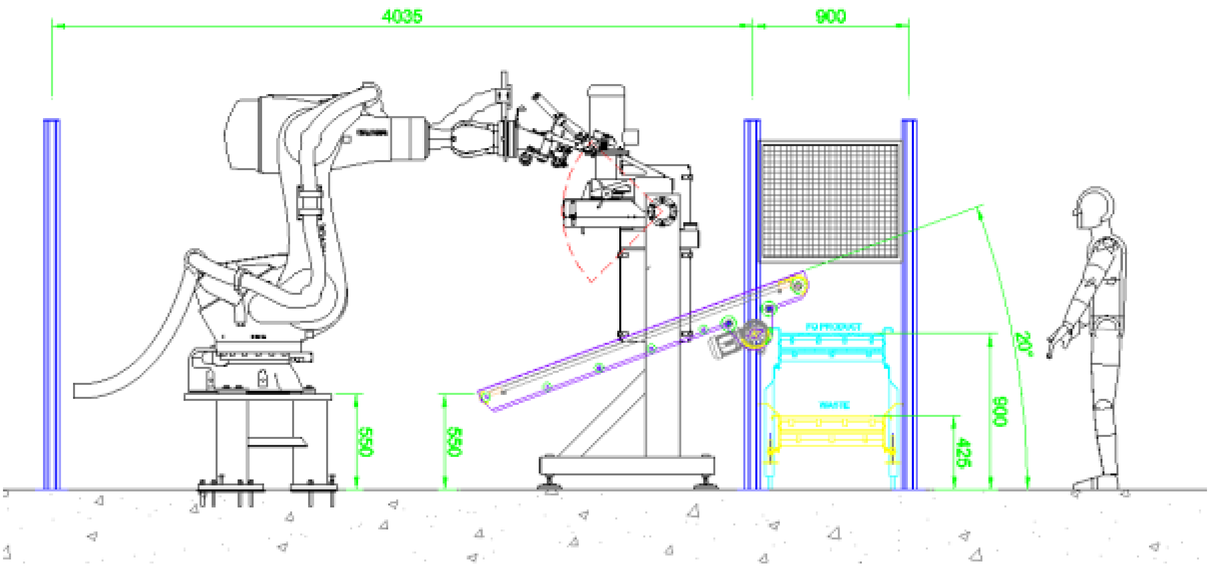

Figure 12: Fore Quarter System elevation view

It can be seen from the above that the system will be located initially on the 'Training Line' in the room. ALC have decided to do this so that the system can be commissioned and brought up to speed without interfering with the production rate of the room.

6 Appendix

The following files have been placed in Scott Box for download. An email will accompany this report with a link to these files.

1) 12.8H Slow Approach
2) MF1101-001-A Robot Positions per Cut
3) 20160623 MLA Demonstration