Objective carcase measurement

What: **Technologies to measure carcase traits to predict boning cutting lines, lean meat yield, and eating quality**

Who: **MDC, industry and technology partners**

Why: **Increase carcase value, streamline processing, improved producer feedback**

Meat measuring technologies put to the test

Can x-rays and robots deliver objective carcase measurements and processing automation?

It sounds a bit Sci-Fi, but that is the question MLA is answering by investing in new technologies for the Australian red meat processing sector.

Every carcase is different and the ability to measure key carcase characteristics provides the red meat industry with an important opportunity to increase productivity and profitability.

Objective carcase measurement refers to the processes and technologies that have the potential to be used to better measure carcase attributes to predict eating quality, disease or contamination, precise boning cutting lines, and lean meat yield.

Processors are already installing technologies which use skeletal measurements to guide manual and robotic cutting. However, processors still have to estimate (or not measure at all) objective measurements of eating quality characteristics and lean meat yield which can mean lost value.

The ability to fully measure carcase traits would enable producers to:

- Better understand the value drivers of their livestock
- Adjust animal husbandry practices to optimise returns based on accurate carcase feedback
- Improve genetic gain based on more accurate technical feedback
- Use more effective price signals to optimise their livestock offerings,

Fast facts:

- Medical technologies such as CT and x-rays are being used to measure carcase traits
- SEXA, DEXA, NIR and CT offer the greatest potential for red meat processing
- Objective carcase measurement technologies could ‘bolt on’ to other tools such as automated primal cutting systems.

No producer levies are used in MDC projects, instead the MDC attracts investment from commercial partners

And for processors to:

- Better meet customer requirements
- Streamline processing and allow full automation of some manual tasks
- Provide more accurate feedback to producers and the supply chain
- Improve allocation of carcases to most profitable markets
- Ensure maximum yield from each carcase.

Currently, no single commercially available technology has proven to be able to measure all characteristics of a carcase.

So, MLA is driving this area of R&D by investigating a range of technologies that could be applied to red meat processing.

Although some technologies, such as nuclear magnetic resonance or ultrasound, were ruled out due to limitations in image quality, speed or prohibitive cost, others have shown potential.

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These include:

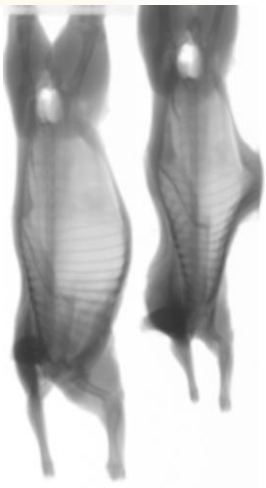
3D x-ray scanning (right): Industrial CT scanning, which a computer-aided tomographic process that uses signal attenuation (usually with x-rays) to produce three-dimensional internal and external representations of the scanned object. It is most commonly used in the medical industry but could be used to estimate lean meat yield, intra-muscular fat, primal weights, and some animal pathologies.

- MLA research reveals that this medical technology could be adapted for the red meat industry to deliver objective measurements of carcase traits.
- CT would deliver economic benefits such as reduced labour costs and more precise cutting lines through automation, and quality assessment earlier in the production process further to save costs through efficencies.
- More accurate measurements to improve supply chain management decisions could also reduce cost or add value to the finished product.

Near-infrared spectroscopy (NIR) (below)**:**
This process enables a prediction highly correlated with chemical analysis in just a few seconds. NIR spectroscopy has been used to analyse fat, moisture, protein content of meat, and other eating quality traits.

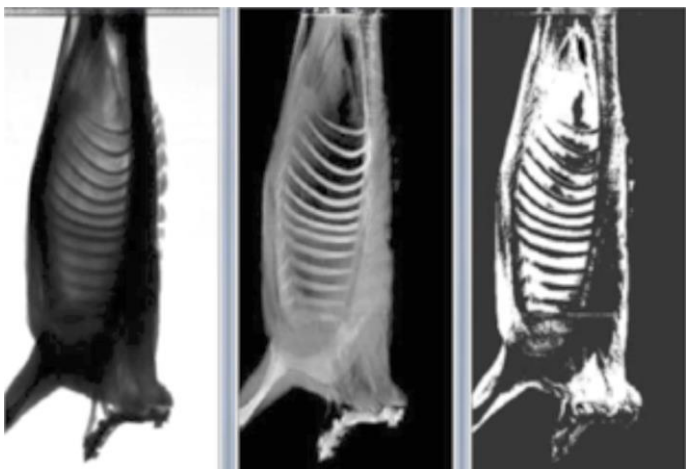
- MLA research produced encouraging results for using NIR to measure carcase traits such as meat colour, ultimate pH, marbling and ossification.
- The benefits of using NIR include cost reduction, improved meat quality, maximum return and reduced variability.

Single source x-ray (right): Two dimensional images are produced using single source x-ray radiation (SEXA). By creating images of the skeletal components this technology can deliver precise automated cutting of carcase primals.

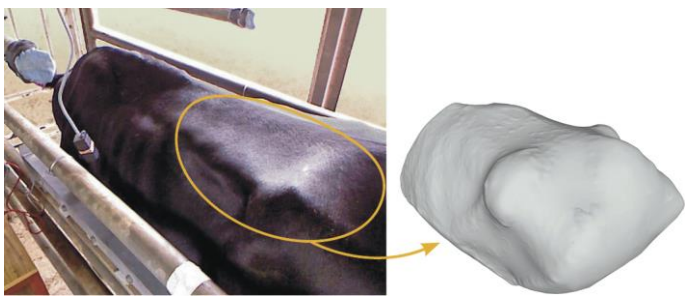


Dual x-ray (below)**:** Dual-energy X-ray absorptiometry (DEXA) utilises two X-ray beams with different energy levels that are projected onto the carcase. DEXA is the most widely used and most thoroughly studied bone density measurement technology, and which can also measure fat and muscle distribution.

Carcase 121806: Low energy image, R value image and threshold R value image.



3D camera (below)**:** Low cost 3D 'Time of Flight' camera technology can take images and provide shape data, which may provide a cost effective trait measurement of livestock on farm, and estimate carcase yield in-plant.



Above: What humans eye can see. Right: What the 3D camera 'sees'.

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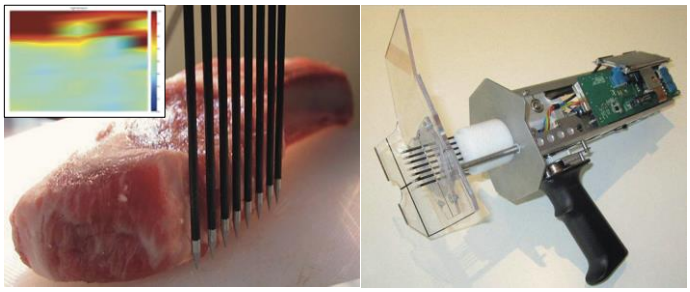
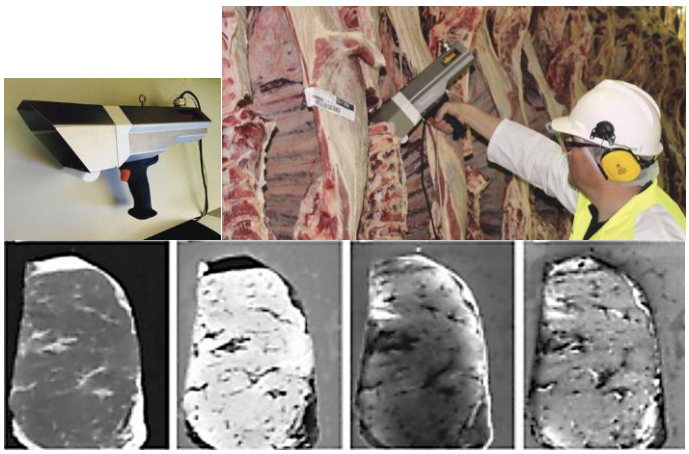
Impedance spectroscopy probe (below)**:** Single point measurements of intra-muscular fat also known as marbling which takes advance of electrical resistance changes through fat and muscle at different frequencies. Good correlations have been found.



Hyperspectral camera (below)**:** Enhanced colour images of loin eye muscles can measure the colour and size of the most valuable carcase products and provide IMF marbling measurements, taking advantage of the different molecular bond responses to excitation light of varying frequency.



MLA has put many carcase measurement technologies through their paces, but SEXA, DEXA, CT scanning, 3D camera, and near-infrared spectroscopy, show the most promise as reliable and cost-effective tools which suit the red meat processing industry.

Objective carcase measurement technologies such as these will deliver significant value to the entire red meat supply chain. For example, feedback to producers about lean meat yields and eating quality traits of their livestock could be used to aid decision making as a management tool. Objective carcase measurements could also be used to create value-based marketing options providing improved market signalling back to producers, and thereby improving long term Australian industry performance and product demand in global markets.

Technology spotlight

MLA is putting objective carcase measurement technologies to the test at line speeds in processing plants, to identify which ones warrant further investment.

MLA is also expanding R&D to see if carcase measurement technologies could be used as front end visioning systems to drive cutting automation, allowing more precise cutting lines and increasing processing efficiency.

For example, at JBS Australia's plant at Bordertown, South Australia, dual-emission x-ray analysis is being used to provide two and three dimensional views of each carcase that passes through the plant's LEAP automated cutting system (pictured below).

This combines lean meat yield predictions with optimum cutting lines for a high degree of accuracy and increasing value.

Further information

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Published by Meat & Livestock Australia Limited ABN 39 081 678 364
May 2015