In-plant measurement of Intramuscular fat (IMF)

Cameron Craigie,
Science Impact leader – Meat products & Supply, AgResearch

Project Team

AgResearch

Tricia Johnson, Kathryn McRae, Marlon Reis, Kevin Taukiri, Michelle Challies, Paul Shorten & Adam Stuart

Alliance Group Limited

Sonja Lindsay, Johanna Phillips, Gemma Milne, Gary Maclennan, Mike Tate

Other partners

Neville Jopson (Abacusbio), Paul Muir (On-Farm Research) Chris Logan (Lincoln University)

Format

- Overview of IMF
- Overview of Beef and Lamb NZ Genetics project and results to date
- Demo of ASD Trek instrument
- Q&A

(A Workshop is interactive so please ask questions)

Types of fat

- Removed from the carcass during processing:

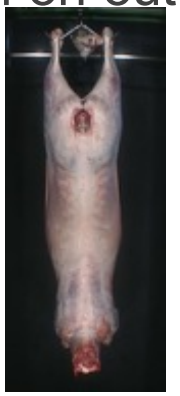
Internal

e.g. kidney fat

- Remains with the carcass during processing:

Subcutaneous

Seen on outside



***Inter*-muscular**

Between muscles

***Intra*-muscular**

Within the muscle

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Fat is influenced by

- Sex of lamb
  - Will be lower in entire males – less overall fat
- Age at slaughter – maturity
  - Late developing depot
- Slaughter weight
  - Relates to maturity
- Genetics
  - Has been shown to be highly heritable
  - Identified as research priority by Beef + Lamb New Zealand Genetics

Why are we interested in IMF?

- Key driver of meat palatability, directly linked to:
  - Flavor (fat soluble compounds and fat composition)
  - Tenderness
  - Juiciness
- IMF also key trait for resilience (as an energy reserve)

But…

Selection for lean meat yield using BVs for post-weaning growth, eye muscle depth and back fat is reducing IMF across the lamb carcass

(Anderson et al. 2015 Animal 9:6 1081-1090)

RISK: Going too lean and reducing palatability

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So how can we measure it?

Beef and Lamb NZ Genetics project with Alliance Group Limited has been running for 18 months:

Aim: To investigate the feasibility for real-time non-destructive prediction of meat tenderness, pH, colour, intramuscular fat content as of lamb loins at 24 hours post mortem in two commercial meat processing plants

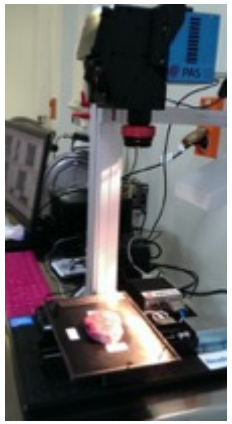
- Proof-of-concept. HSI (a new technology) and NIRS (an existing technology).
- Test the performance and suitability of HSI and NIRS for the purposes of developing a meat-quality based decision support system.
- Develop prediction equations to convert spectral data into meat quality information (tenderness, IMF%, colour stability and pH).

Sampling

Imaging systems

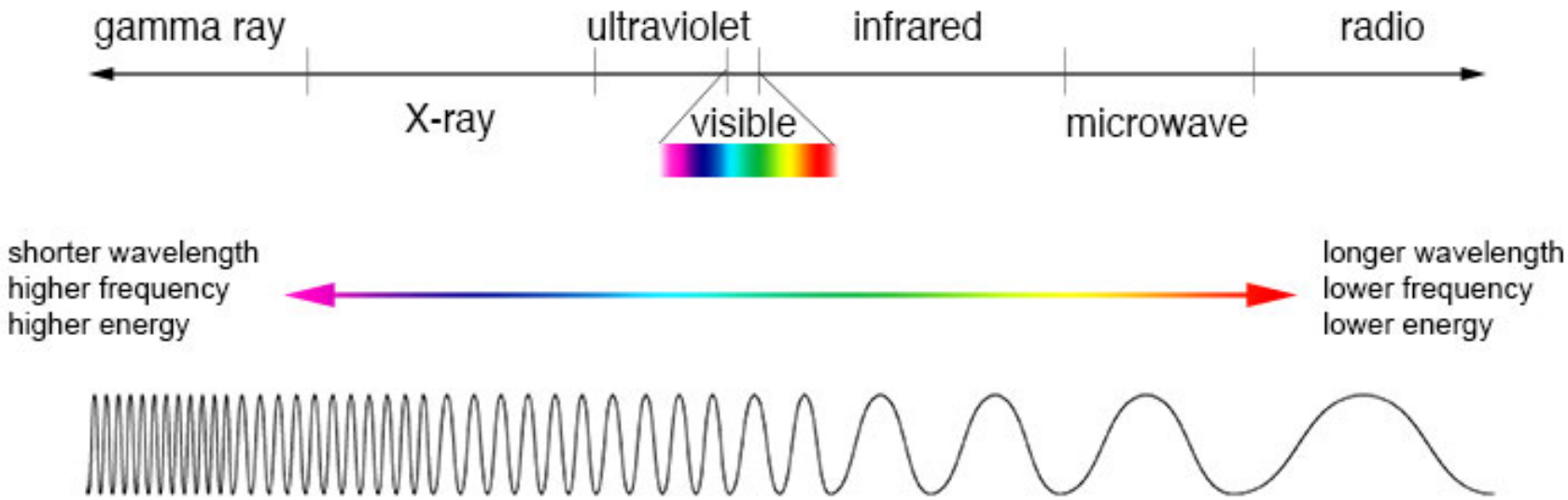
- Visible-Near Infrared spectroscopy (NIRS) spectral range 350-2500 nm
- AgR instrument + Halo

- Hyperspectral imaging (HSI) spectral range 550-1650 nm. – similar principle to NIRS, but added advantage of a spatial dimension.



Imaging systems

- Visible-Near Infrared spectroscopy (NIRS) spectral



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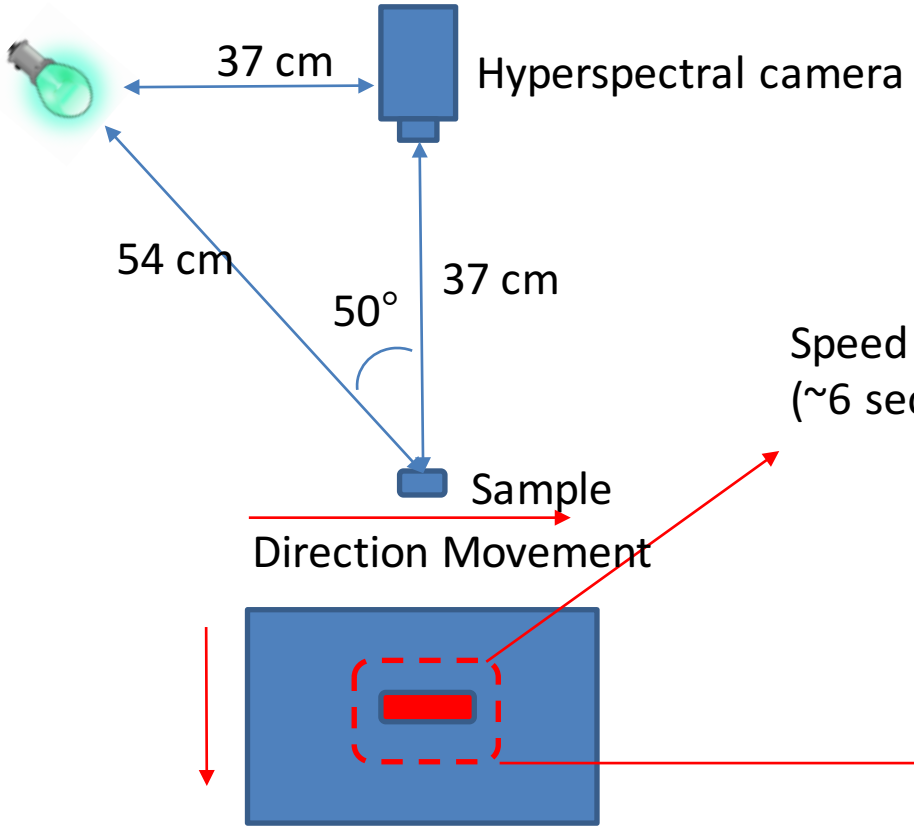
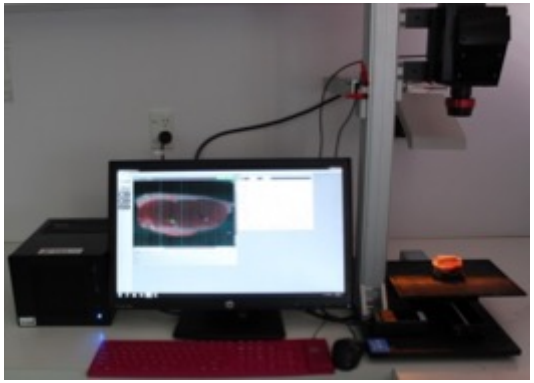
Hyperspectral imaging





Detector

Light source

Speed (mm/s) = 11.1
(~6 seconds to collect the following image)

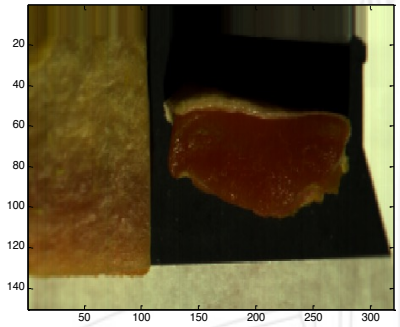
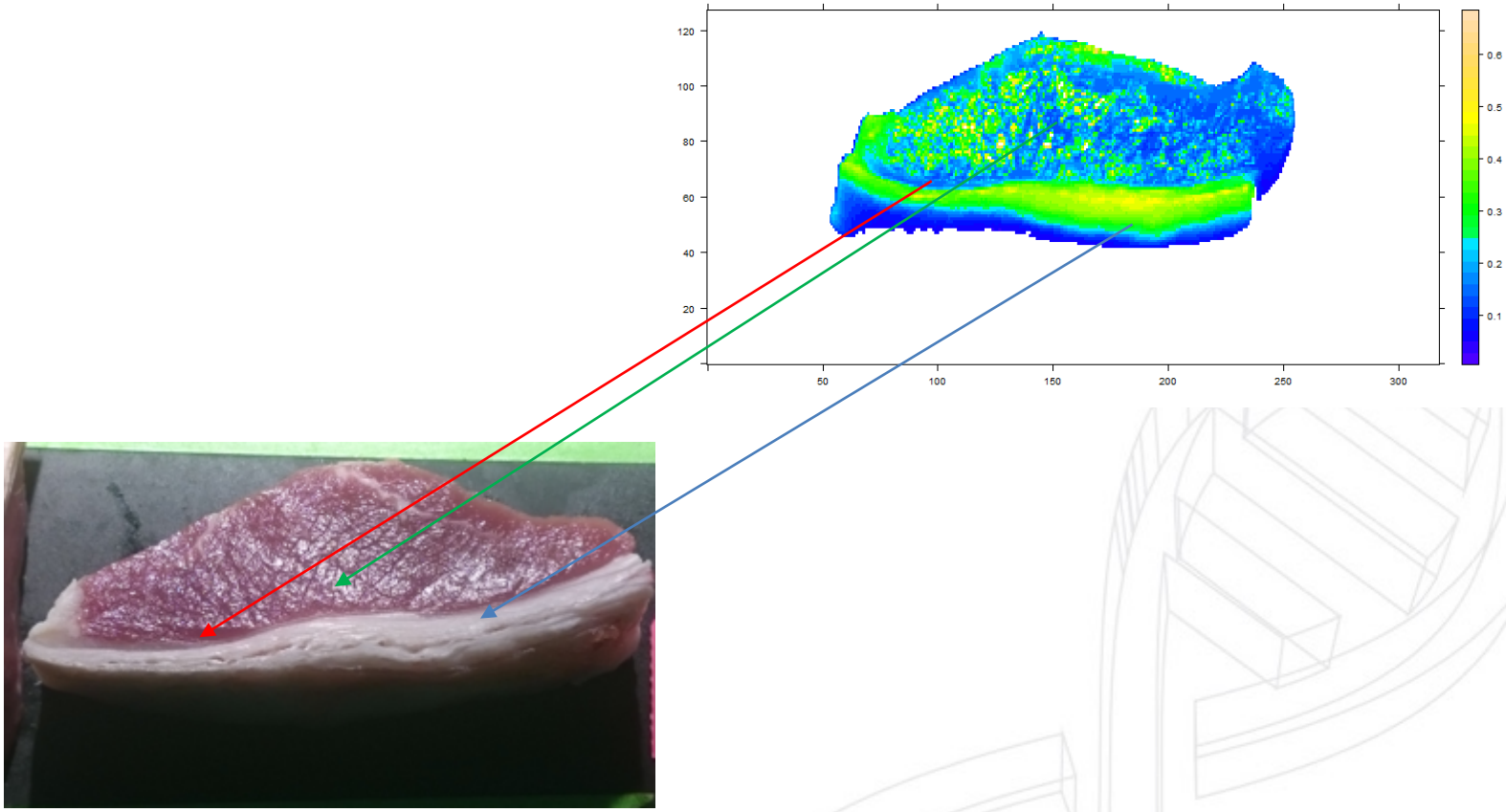
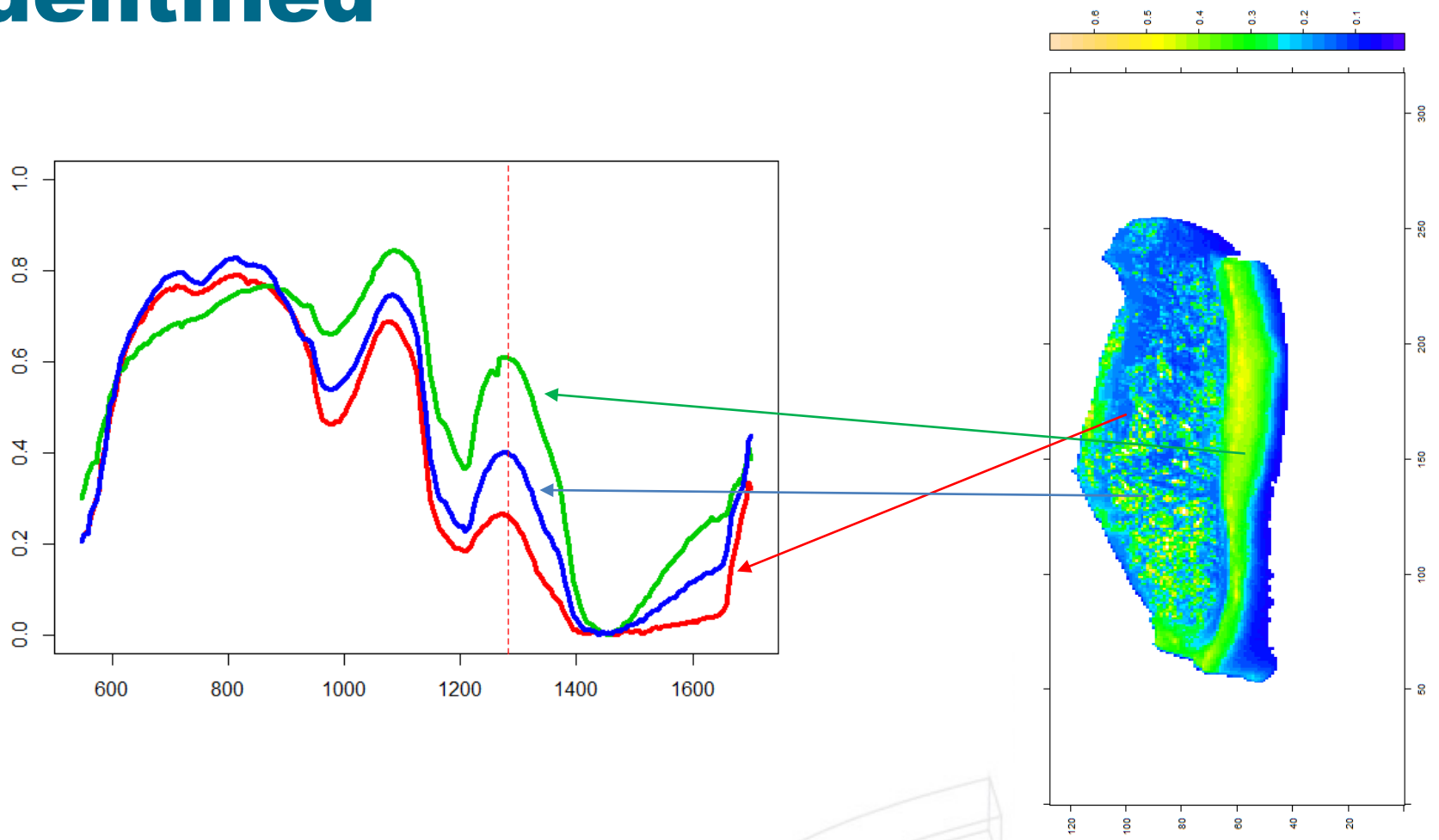


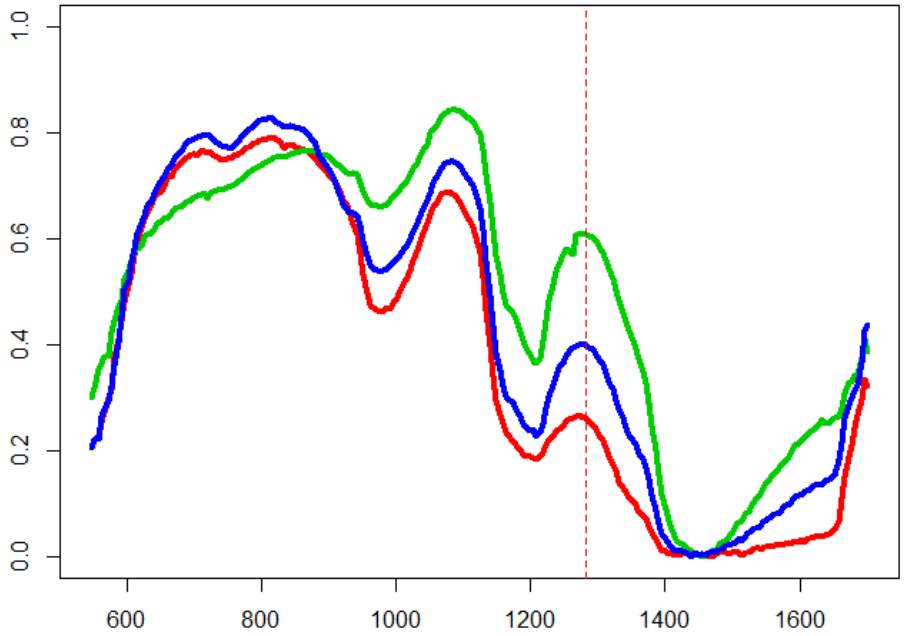
Image processing



Meat spectra of tissue types identified



Process Spectra using an Multivariate calibration algorithm



Convert spectral data to predictions of IMF

Summary of the MQ data in BLG spectral project

Spectral data + Meat Quality reference readings

Trait	2014-born	2015-born	Total
pH	2517	2183	4700
IMF	**1678**	**218**	**1896**
Tenderness	1716	-	
Colour	1830	-	
MBS	906	-	

Largest dataset of its kind ever collected

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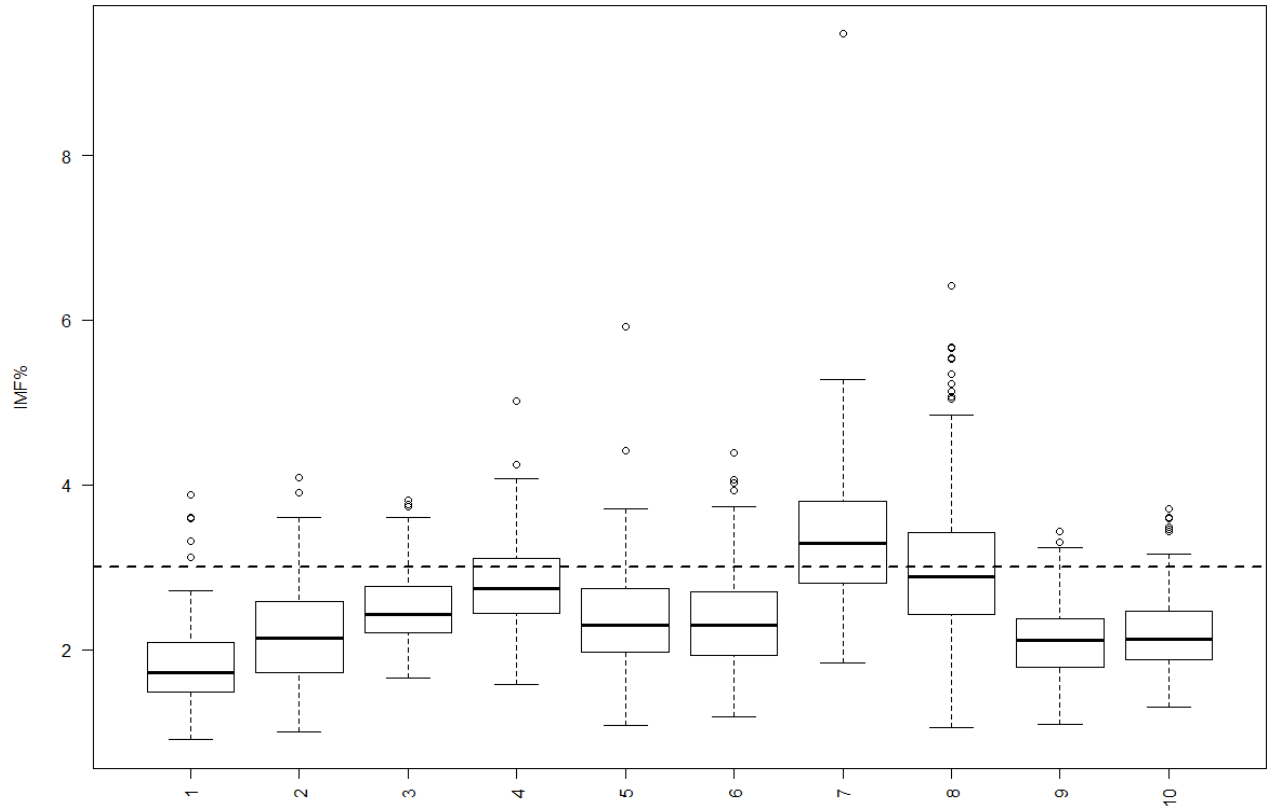
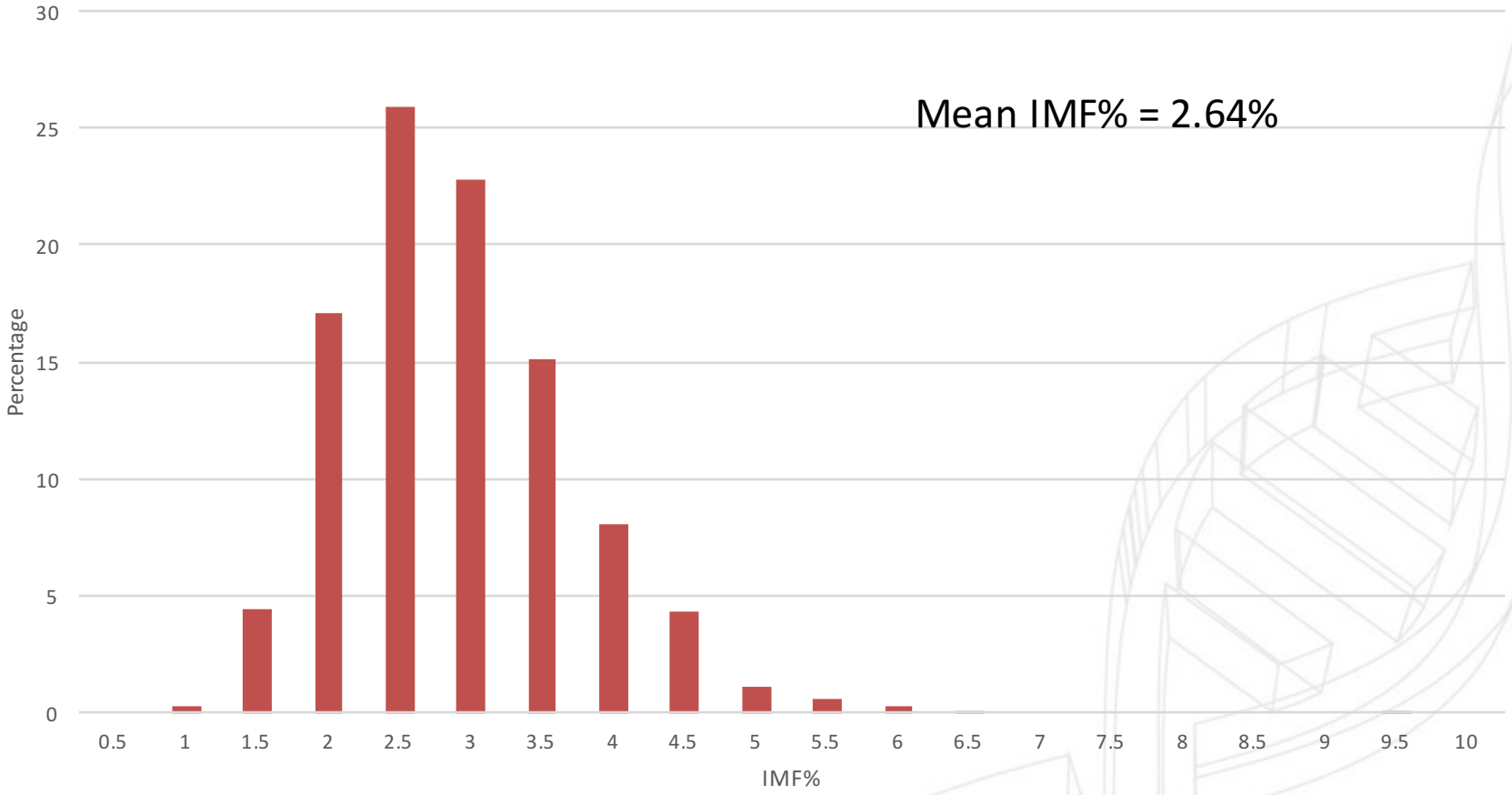
Results to date

Distribution of IMF in 2014-born lambs



Distribution of IMF% from 2014-born lambs (n = 1678)



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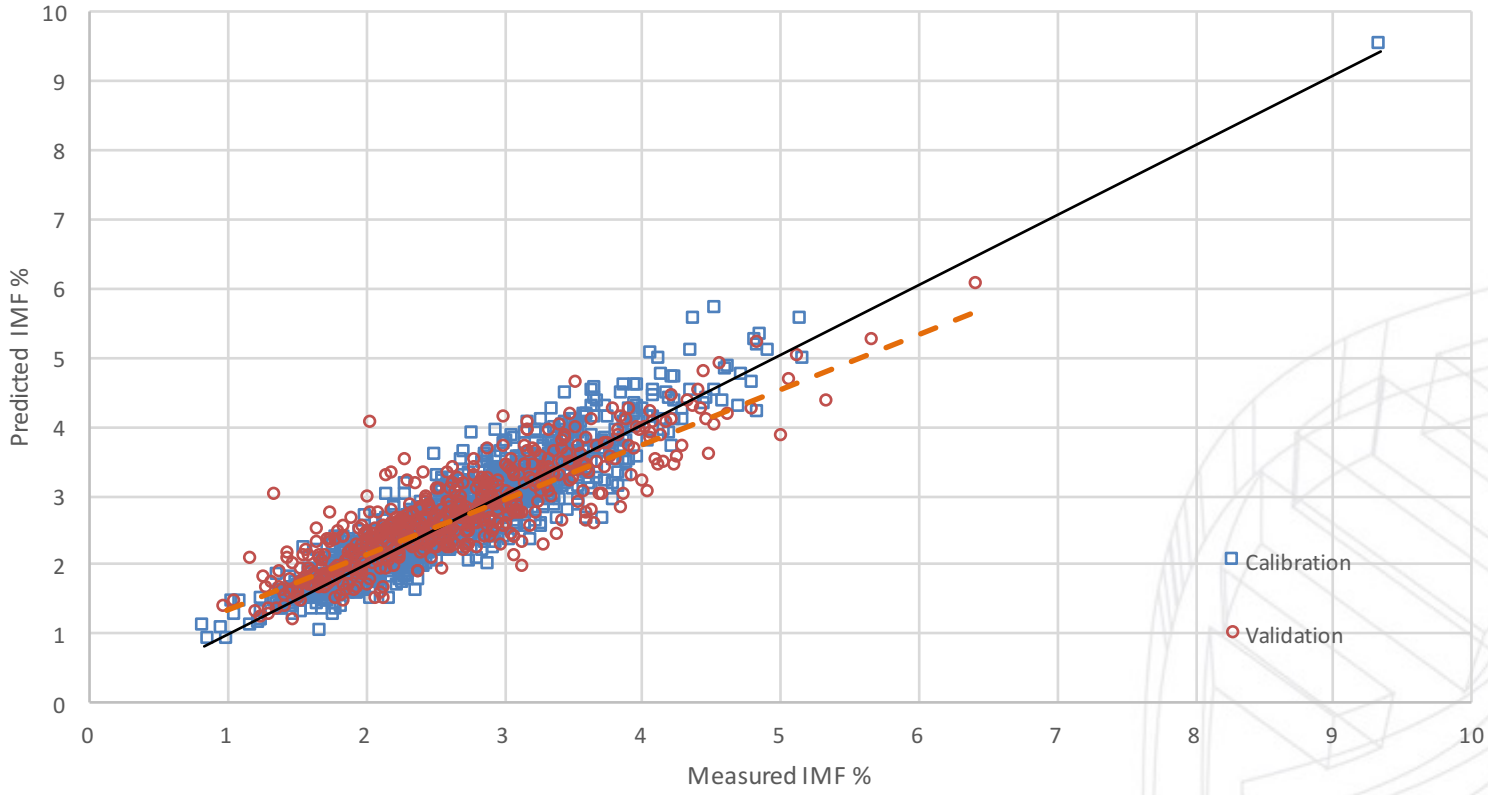
Predicting IMF% using Hyperspectral imaging



The validation data gives an R^2 value of 0.75 and an RMSE of 0.407%

Progress to date

- Initial indications are that NIR and Hyperspectral Imaging work for predicting IMF (and pH)
- We have proven the concept – We can measure IMF objectively and accurately

- Still to do: Technical challenges of implementing these technologies and integrating predicted meat quality results into value chain (e.g. SIL and other databases).

- So we are not there yet with in-plant measures, but it will happen.

Demo of new hand-held instrument

ASD Trek

Currently being evaluated by AgResearch

Potential applications as an in-plant (or in-market) tool for non-invasive meat quality measurement

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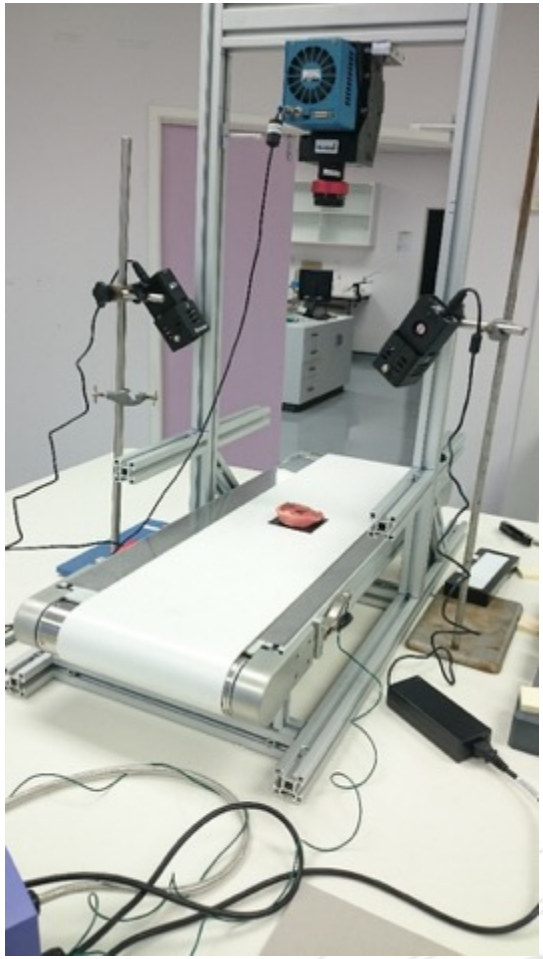
Q&A



Thank you.

Cameron Craigie, PhD
Science impact leader - AgResearch
021 289 9063
07 838 5152
cameron.craigie@agresearch.co.nz