Objective carcass measurements to improve lean meat yield and eating quality in Australian beef, sheep and pork

D.J. Brown, D.W. Pethick, P. McGilchrist, C.K. Ruberg ,W.S Pitchford, R. Apps, G.E. Gardner

Speaker: Daniel Brown

Objective Carcass Measurement to Improve Lean Meat Yield and Eating Quality in Australian Beef, Sheep and Pork

Daniel Brown, David Pethick, Peter McGilchrist, Christian Ruberg, Wayne Pitchford, Richard Apps and Graham Gardner

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit programme in partnership with Research and Development Corporations, Commercial Companies, State Departments and Universities.

Precision measurement
from paddock/pen to plate

- Predict quality and amount of final product





Conception — Value — Live Animal — Value — Carcass — Value — Retail Cuts — Value — Cooked Product

Massive variation is quantity and quality of carcasses at all points

Potential Gross Benefit of objective measurements ~$420M/ann by 2030, with 65% LMY <DEXA>, and equally shared between producer / processor.

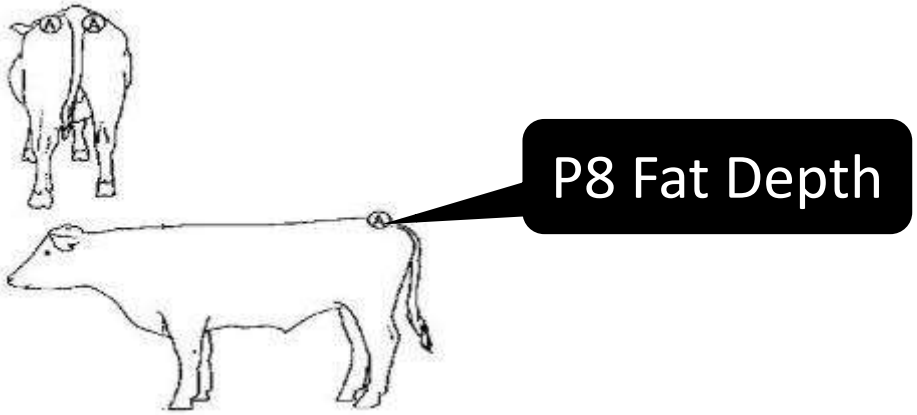
agbu

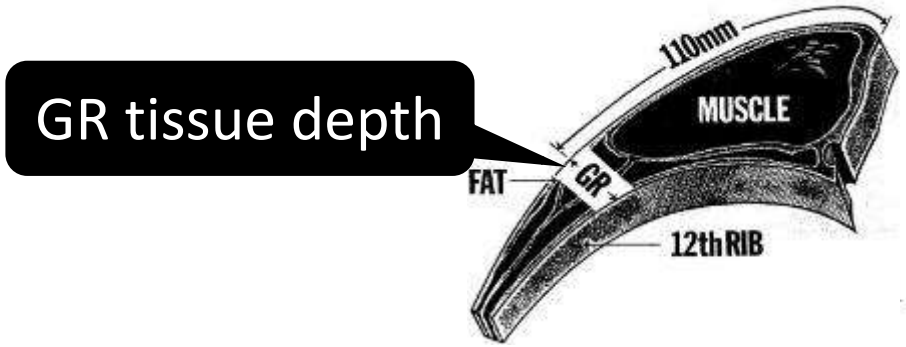
Current trading in beef and lamb

- Traded largely

on carcass weight

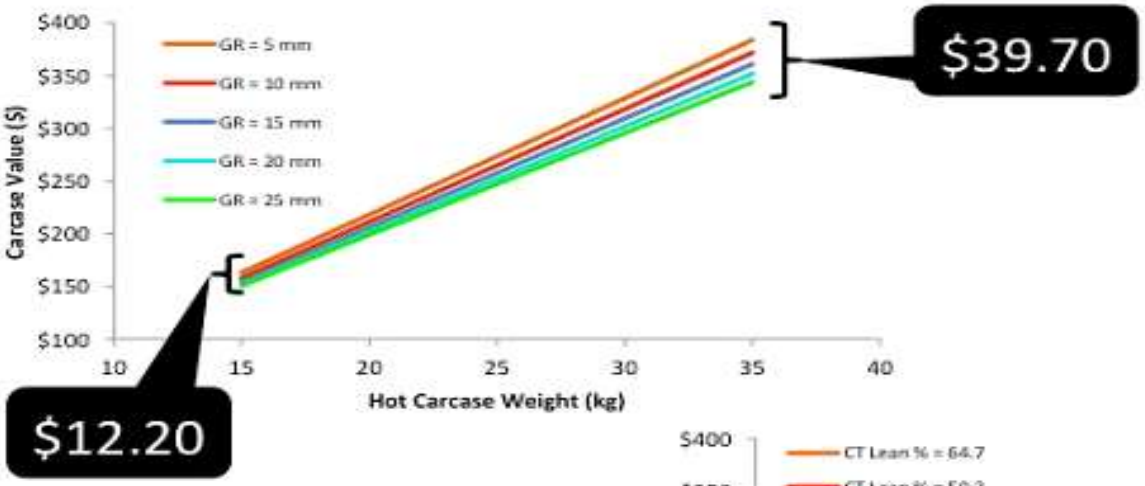
- Fat penalties only at the extremes

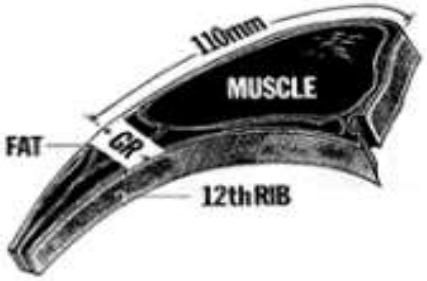


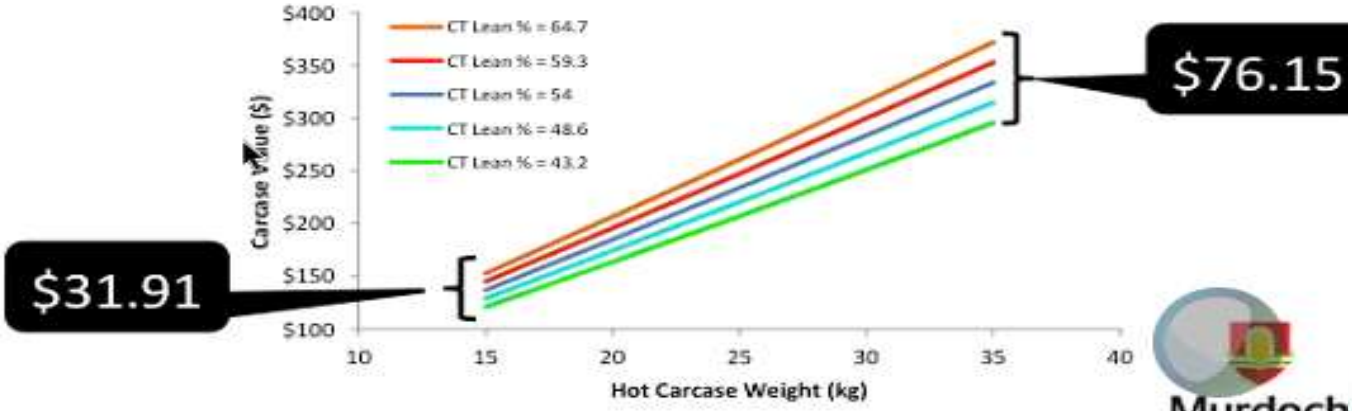


Extra precision gives more accurate (and wider) differentiation of carcase value

What does extra precision mean for the carcase calculator?







Murdoch UNIVERSITY

Trading on Eating Quality

Meat Standards Australia eating quality model

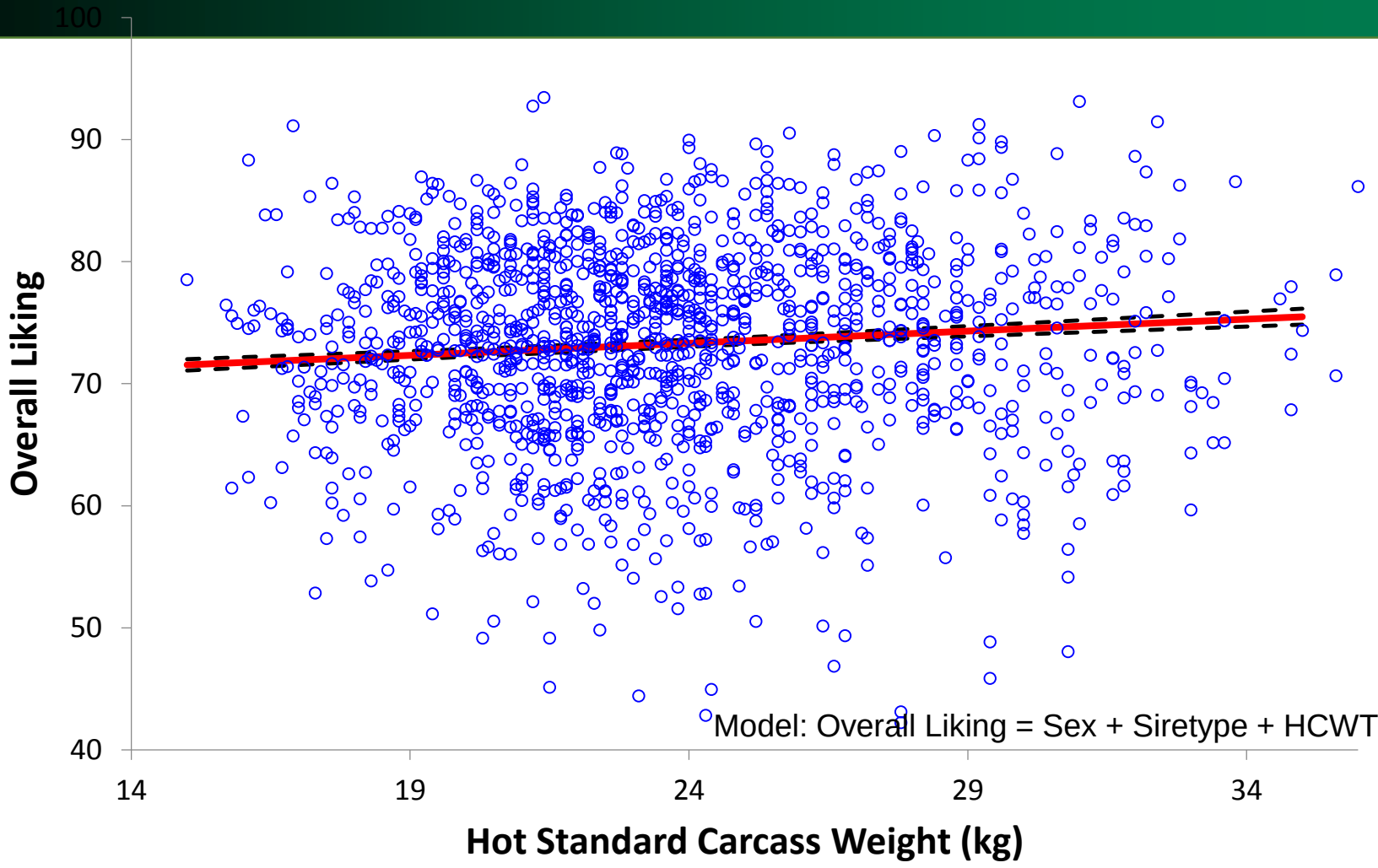
Description	Format	Name	Input	?
Estimated % Bos Indicus	% or X if doubt	EPBI	0	
Animal Sex Type	M/F	Sex	F	
mone Growth Promotent	Y or ? / N	HGP	n	
MilkFedVealer	Y/N	MFV	n	

Aged

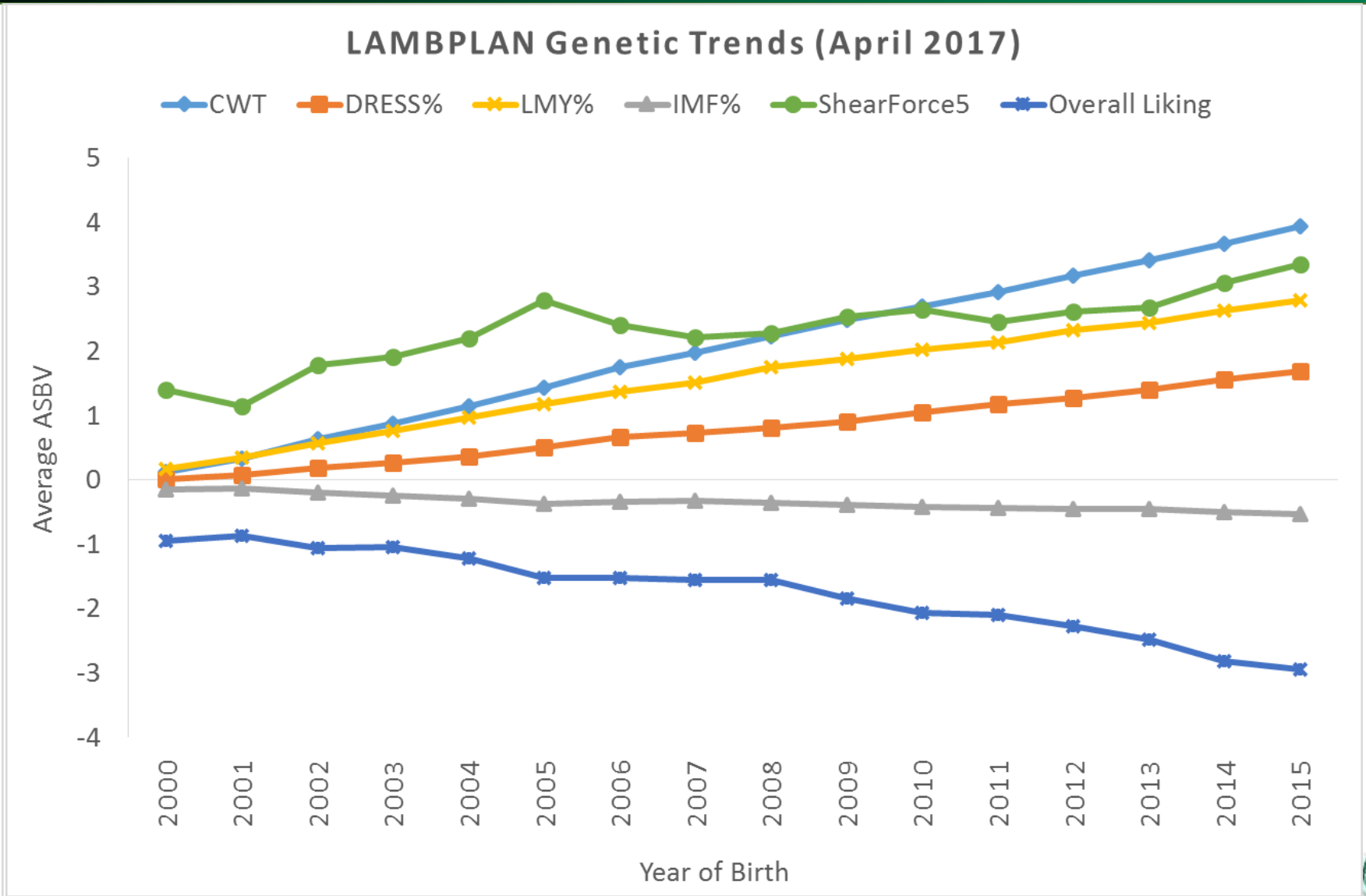
cut	muscle	GRL	RST	SFR	TSL	SCT	CRN
spinalis	SPN081	79	69	79	75		
tenderloin	TDR034	82		76			
tenderloin	TDR062	78	77	80	74		
tenderloin	TDR063	73					
thin-flank	TFL052			67	59	64	
thin-flank	TFL064			61	58	60	
rib-blade	RIB041			48			
brisket	BRI056			44	58	60	38
brisket	BRI057			41	49	64	
shin	FQshin					57	
shin	HQshin					60	
intercostal	INT037			57			

Doesn't exist for lamb!

Loin Eating Quality and HSCW



The Genetics Business Case



Breeding for yield and eating quality: Sheep Genetics

Actively using LMY, SF and IMF data in ASBVs and Indexes

SHEEP GENETICS

Animal performance

Carcass measurements

Consumer eating quality

Resource flocks and ram breeders

Genomic testing

LAMBPLAN ASBV

INTERNATIONAL BEEF RECORDING SCHEME BREEDPLAN

agbu

Australian Government

Department of Agriculture and Water Resources

Rural Research and Development for Profit Programme

Keeping Australian farmers at the cutting edge

Advanced Livestock Measurement Technologies

This project is supported by funding from the Australian Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit programme in partnership with Research & Development Corporations, commercial companies, state departments and universities

AMPC

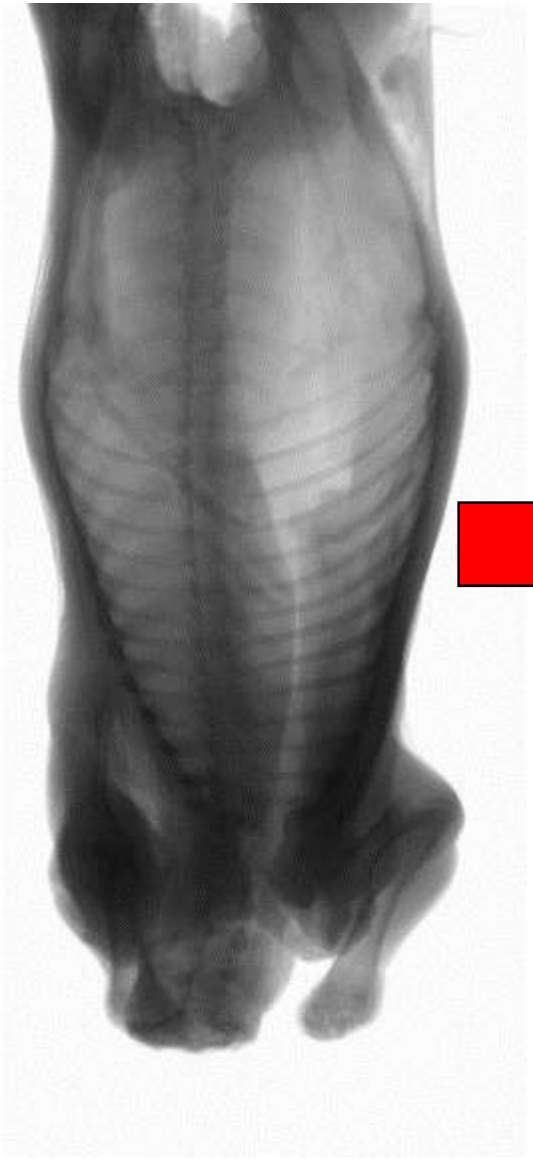
Australian Pork

mla

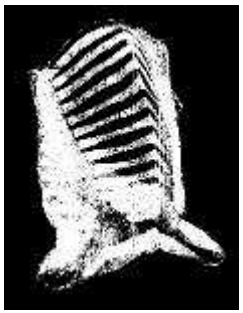
MEAT & LIVESTOCK AUSTRALIA

2D X-Ray for driving robots

Scott Technology

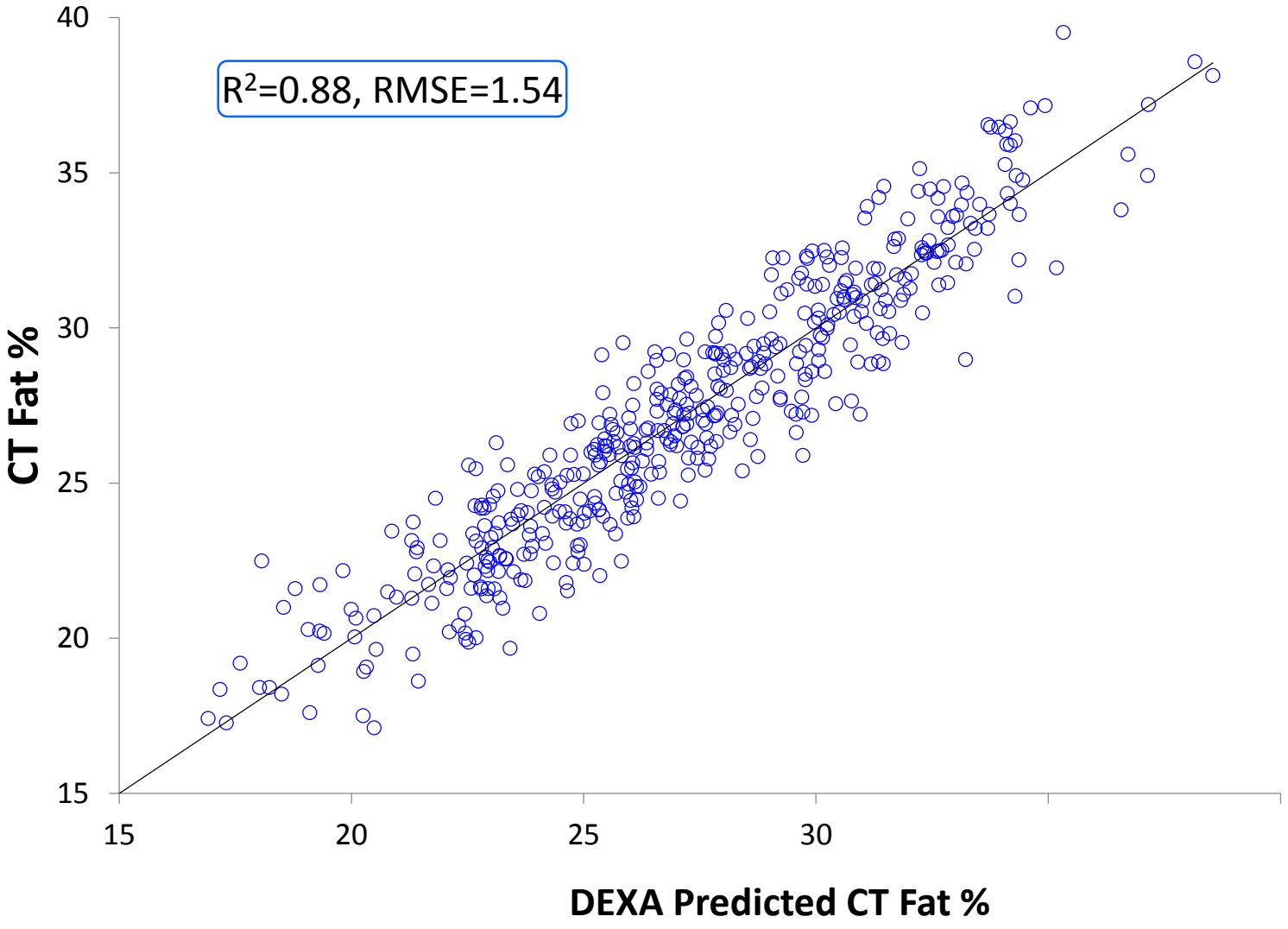


DEXA – Technology, Algorithm and LMY Correlation

		$(x+a)^n = \sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k}$	
Beef	**> 1,500,000 sides**	**104 sides**	**R^2 > 0.88**
		$(x+a)^n = \sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k}$	
Lamb	**> 3,000,000 carcasses**	**600+ carcasses**	**R^2 > 0.90**

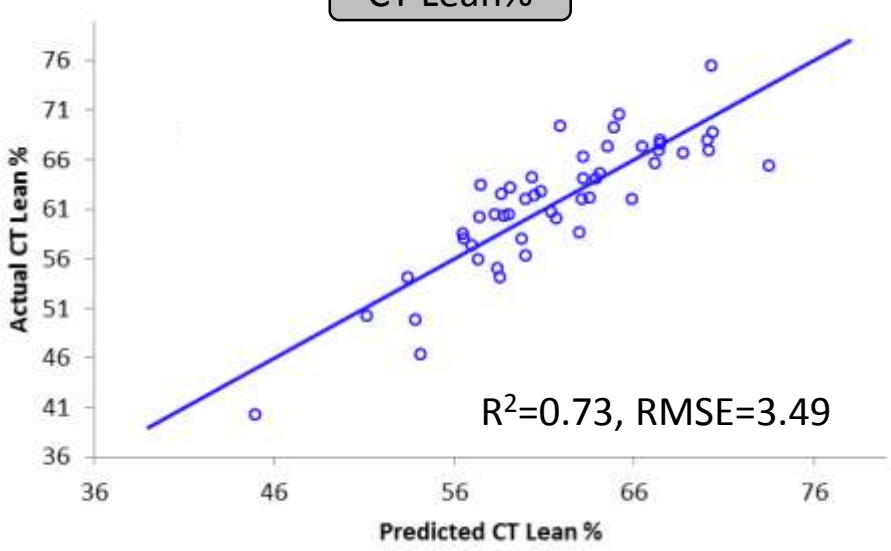
Technology	Algorithm	Correlation

DEXA predicting CT Fat% in lamb

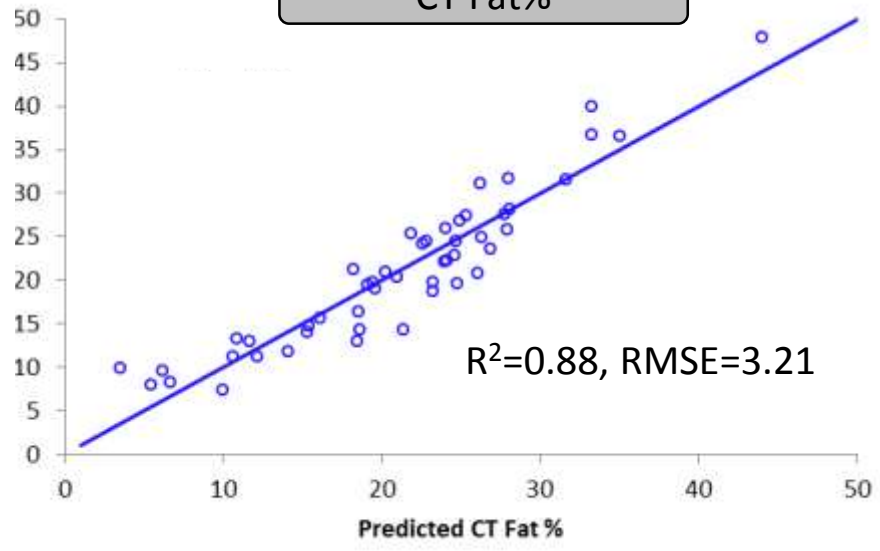


Predicting CT Composition in Beef

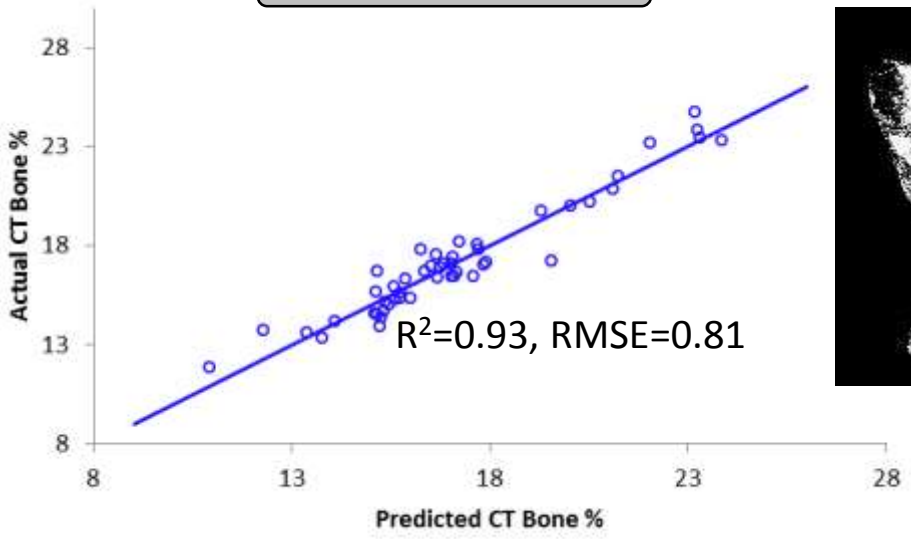
CT Lean%

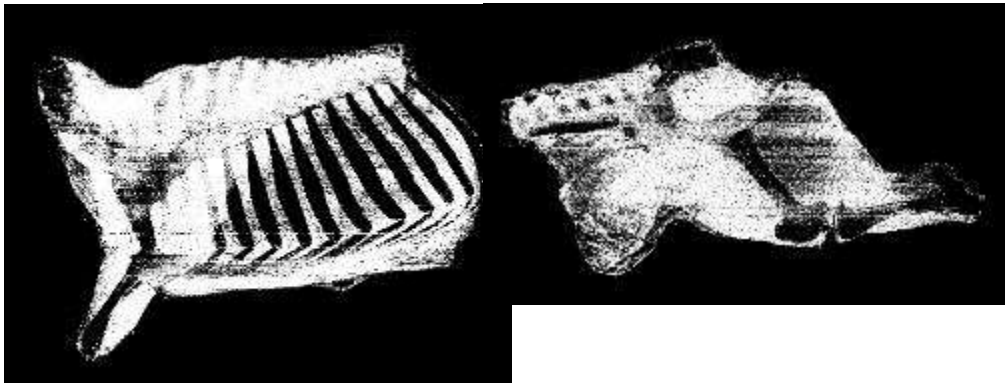


CT Fat%



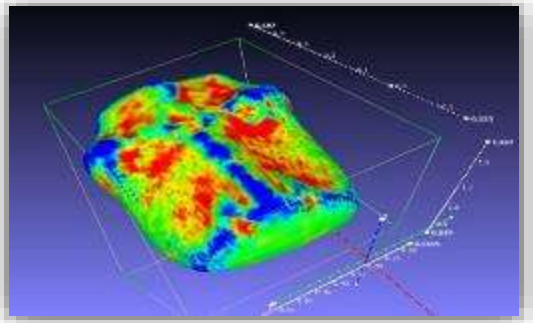
CT Bone%

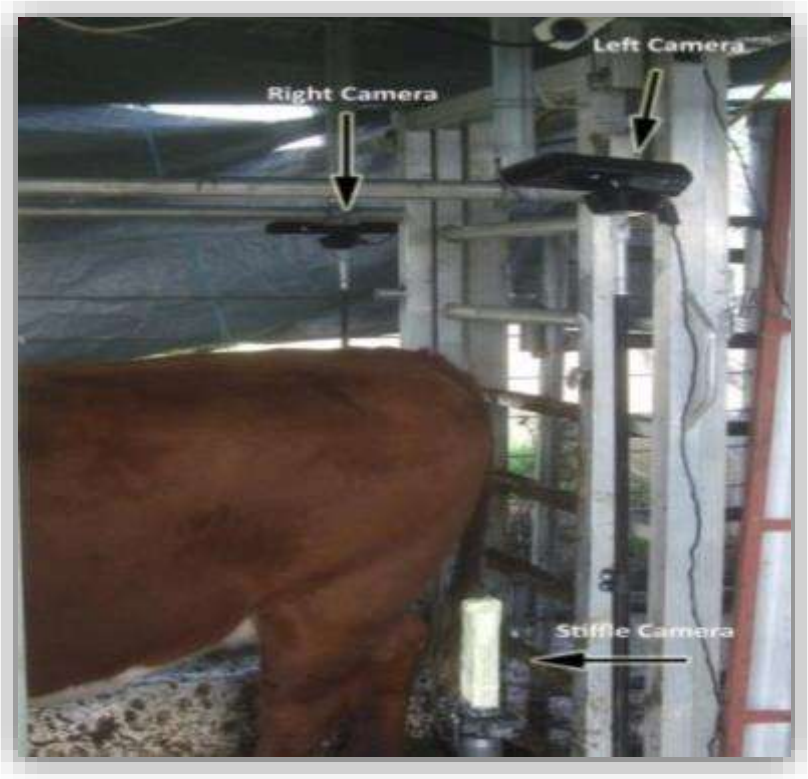




On-Farm Yield Prediction

- 3D Red, Green, Blue, + Depth (RGBD - xbox) camera technology
- Trialed to show great ability to assess body condition score



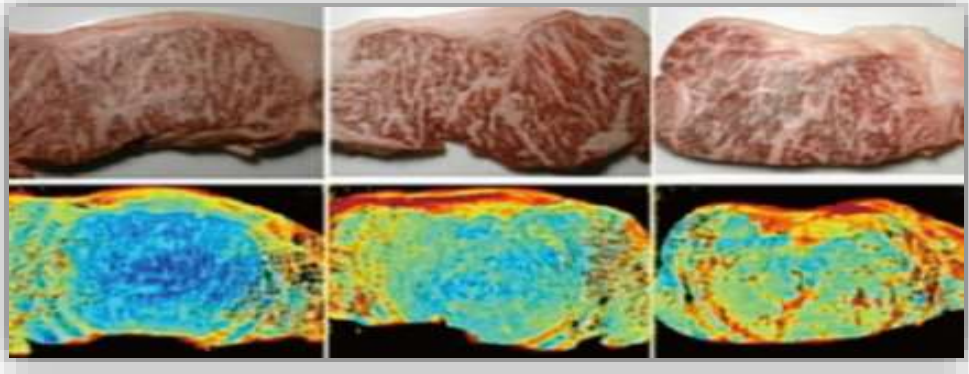


What about quality - Hyper MIJ Camera

What about quality - Hyper spectral imaging

What we think it can grade:

- Eye muscle area
- IMF (marbling scores)
- Meat / Fat colour
- Subcutaneous fat
- Ossification

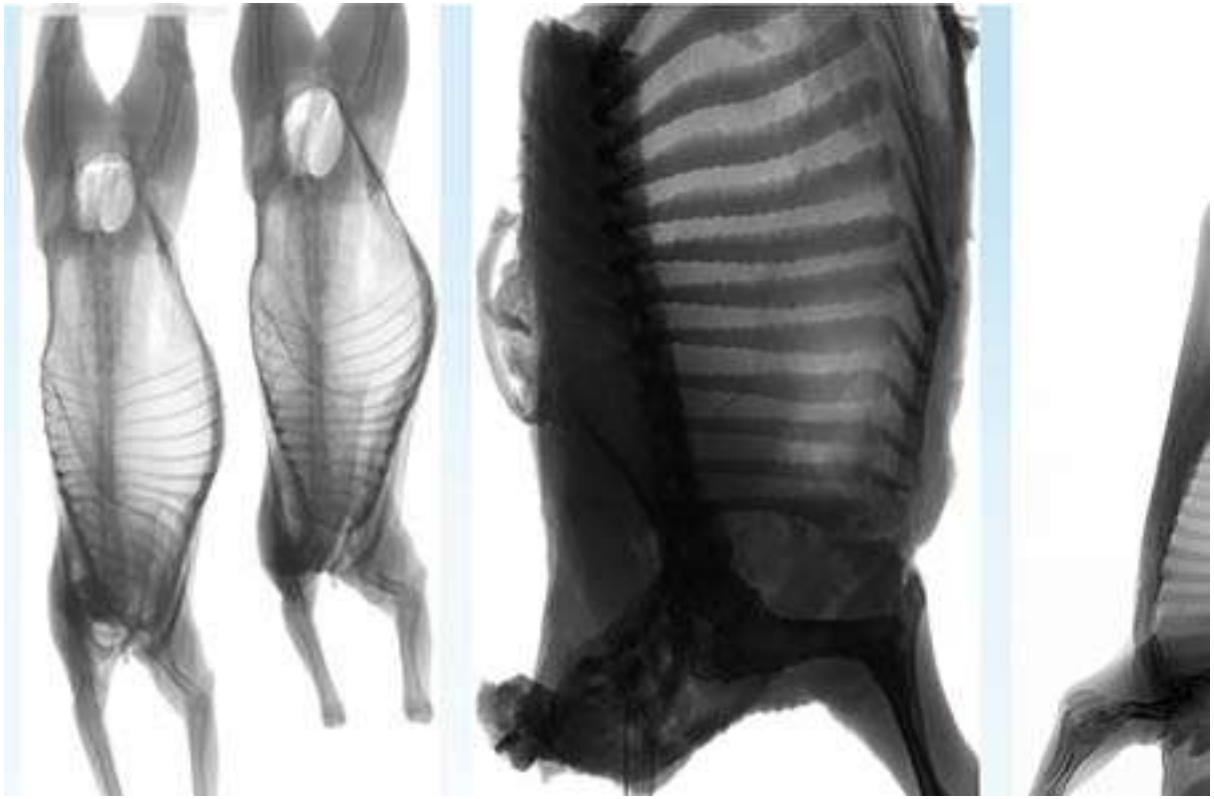


Other Technologies

- NIR
- CT / Cone Beam / Flat Panel CT
- NMR/MRI
- Aviation CT

Others Characteristics

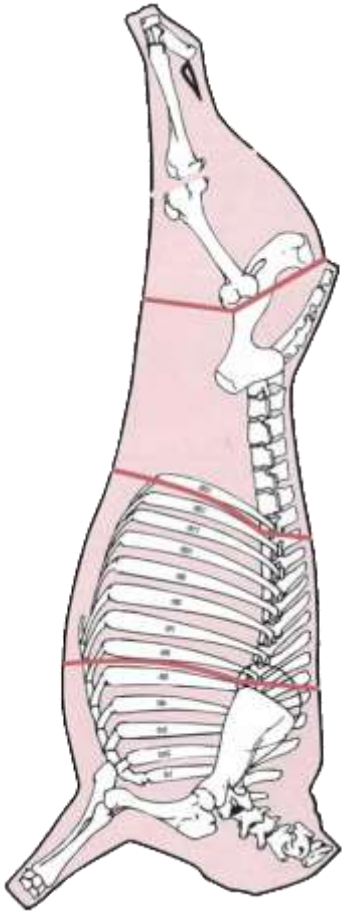
- Rib count
- Dimensions
  - Muscularity
  - Shape
- Age / Maturity



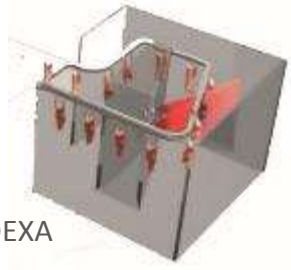
Other Factors being studied

- Slaughter factors
  - Spray chilling
  - Carcass orientation (180 degree turn)
  - Carcass temperature
  - Time post mortem
- Fixed effects
  - Sex, breed, age, finishing system

Producer feedback Meat:Fat:Bone Carcass



Body	RFID	AUS-MEAT FEEDBACK						Carcase Right Side					Carcase Left Side	
		Species	Fat Depth	Dentition	Sex	Bruise Score	Offal Dowgrade	Side Weight (kg)	($/kg)	Meat (%)	Fat (%)	Bone (%)	Side Weight (kg)	($/kg)
1	95494361336	B	15	2	M	2	N	211.0	5.88	55%	14%	31%	213.1	5.85
2	95494354624	B	15	5	M	3	N	226.0	5.86	56%	13%	31%	226.0	5.90
3	95494355548	B	20	0	M	6	N	318.0	5.89	54%	15%	31%	321.2	5.85
4	95494354624	B	21	4	M	8	N	314.0	5.90	55%	14%	31%	314.0	5.89
5	95494362022	B	20	8	M	2	N	218.0	5.85	59%	12%	29%	220.2	5.81
6	95494354624	B	19	4	M	3	N	247.0	5.90	53%	15%	32%	249.5	5.88
7	95494362247	B	16	8	M	9	N	261.0	5.84	56%	15%	29%	258.4	5.89
8	95494354624	B	14	8	M	3	N	269.0	5.90	55%	12%	33%	266.3	5.90
9	95494363697	B	22	3	M	7	N	239.0	5.82	58%	12%	30%	236.6	5.90
10	95494354624	B	12	5	M	9	N	341.0	5.81	53%	16%	31%	337.6	5.83
11	95494360856	B	11	4	M	1	N	194.0	5.88	54%	13%	33%	192.1	5.90
12	95494354624	B	15	1	M	6	N	246.0	5.86	59%	12%	29%	248.5	5.82
13	95494359273	B	16	5	M	3	N	277.0	5.83	55%	14%	31%	279.8	5.81
14	95494354624	B	9	7	M	4	N	197.0	5.87	55%	15%	30%	199.0	5.81
15	95494360585	B	15	4	M	1	N	202.0	5.80	54%	16%	30%	204.0	5.88
16	95494354624	B	21	3	M	1	N	262.0	5.87	52%	15%	33%	259.4	5.86
17	95494360162	B	20	1	M	1	N	206.0	5.86	58%	13%	29%	208.1	5.90
18	95494354624	B	16	8	M	1	N	336.0	5.89	54%	14%	32%	336.0	5.80
19	95494361988	B	15	5	M	6	N	251.0	5.82	54%	16%	30%	253.5	5.87
20	95494354624	B	18	2	M	9	N	330.0	5.80	52%	15%	33%	333.3	5.89



DEXA

Processor utilisation

- Carcass calculators (Beef and Sheep)
  - Retail cut value
  - Value based marketing
- Predict processing costs / wastage
- Optimise carcass usage and market volumes

Optimised profit

AUSMEAT, Calibration & Industry Standardisation

DEXA inside™
(industry standard)

+

$$(x+a)^n = \sum_{k=0}^{n} \binom{n}{k} x^k a^{n-k}$$

Algorithm (Beef & Sheep)
(Industry std. & Industry IP)

+

Calibration block
(industry standard)

+

industry data/trait/identification standards vital

Genetic Carcass Data from Commercial Slaughter

Requirements

- Valid groups (true contemporaries)
- Animals must not been “harvested” from the feedlot pen or grass finished mob
- Must have relevant fixed effects (birth dates, litter size, sex etc?)
- Pedigree (DNA)
- Sires randomly mated
- Effective progeny numbers

Industry data flow

New Devices
- LMY
- IMF
- Health
- Compliance

Supply Chain
- Existing feedback systems

MLA
- LDL
- NLIS

Genetic Evaluation
- BREEDPLAN
- LAMBPLAN

Conclusions

- Existing carcass measurement is poor
- DEXA lamb carcass composition
- Beef DEXA promising
- EQ important but not yet clear
- ALMTech will accelerate development
- Beef, lamb, pork industries
- ICAR guidelines

Supporting partners