Objective Carcase Measurement

Transforming carcase grading

Graham Gardner

Murdoch
UNIVERSITY

Outline

- Carcase measurement – the status quo
- Project to accelerate tech development
  - Beef, pork and lamb industries
- How will new tech integrate into MSA?
- Progress towards measuring IMF and LMY

SHEEP CRC

mla donor COMPANY

MEAT & LIVESTOCK AUSTRALIA

AMPC
AUSTRALIAN MEAT PROCESSOR CORPORATION

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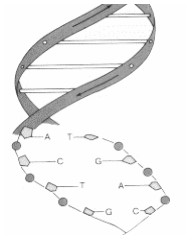
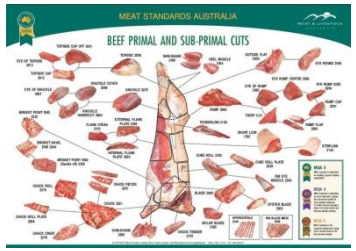
Precision measurement

from paddock/pen to plate

- Predict quality and amount of final product





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

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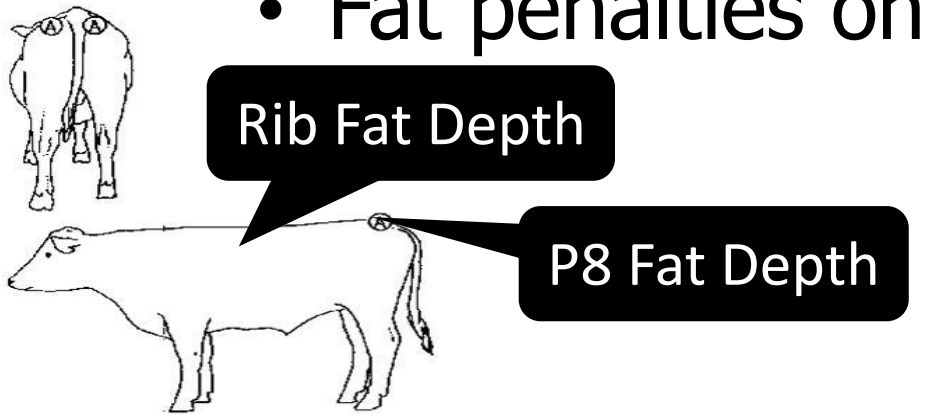
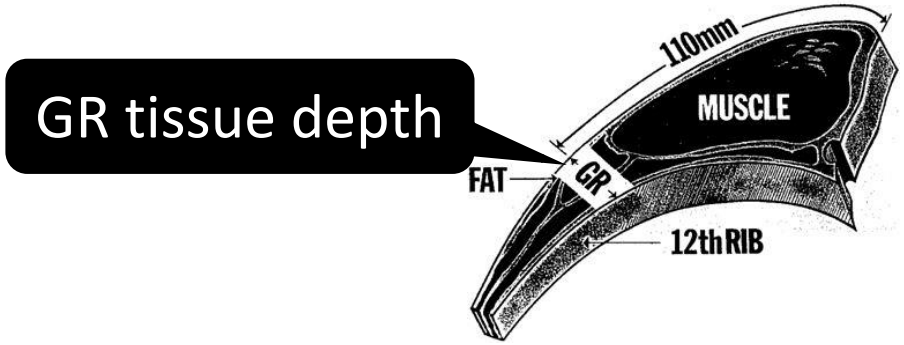
Trading beef and lamb

- Traded largely

on carcase weight

- Fat penalties only at the extremes





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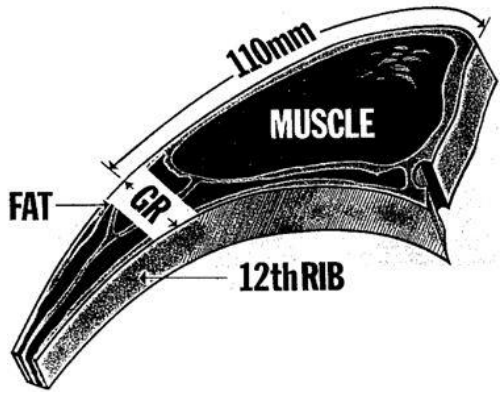
How well do the existing measures work?



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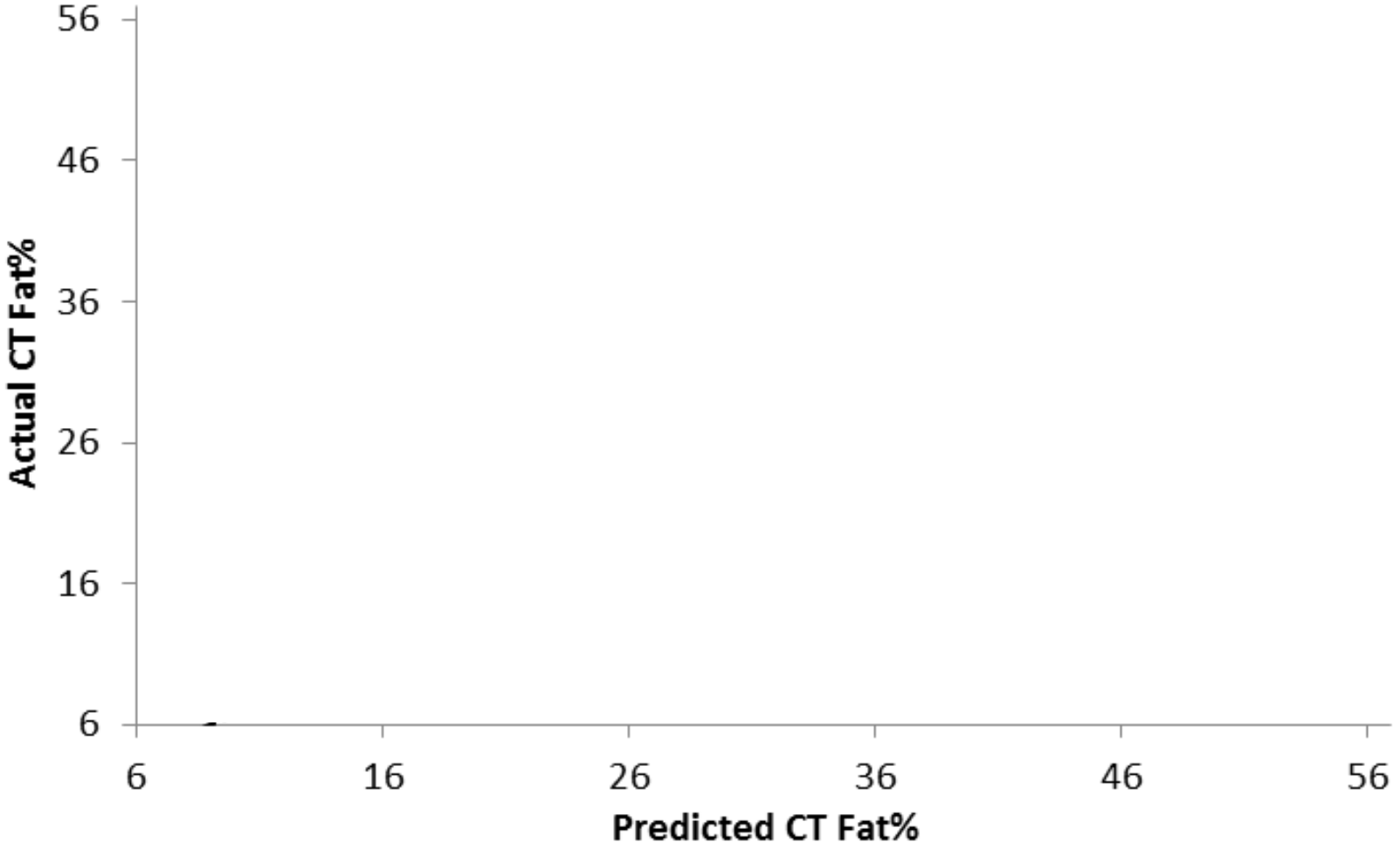
Rib Fat and HSCW

(6 data sets)



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Rib Fat and HSCW

Computed Tomography

"the gold standard"

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Rib Fat and HSCW

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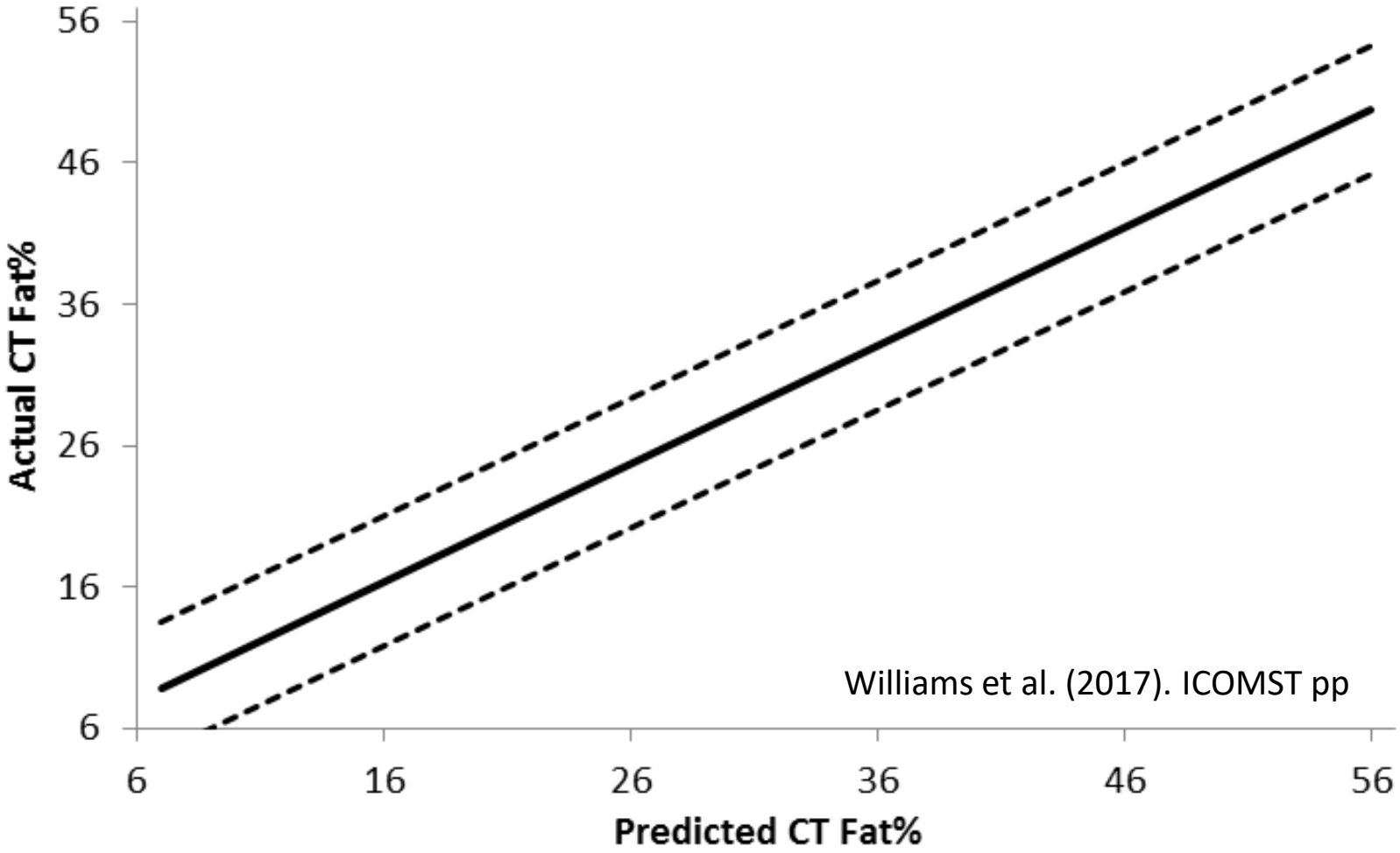

Williams et al. (2017). ICOMST pp

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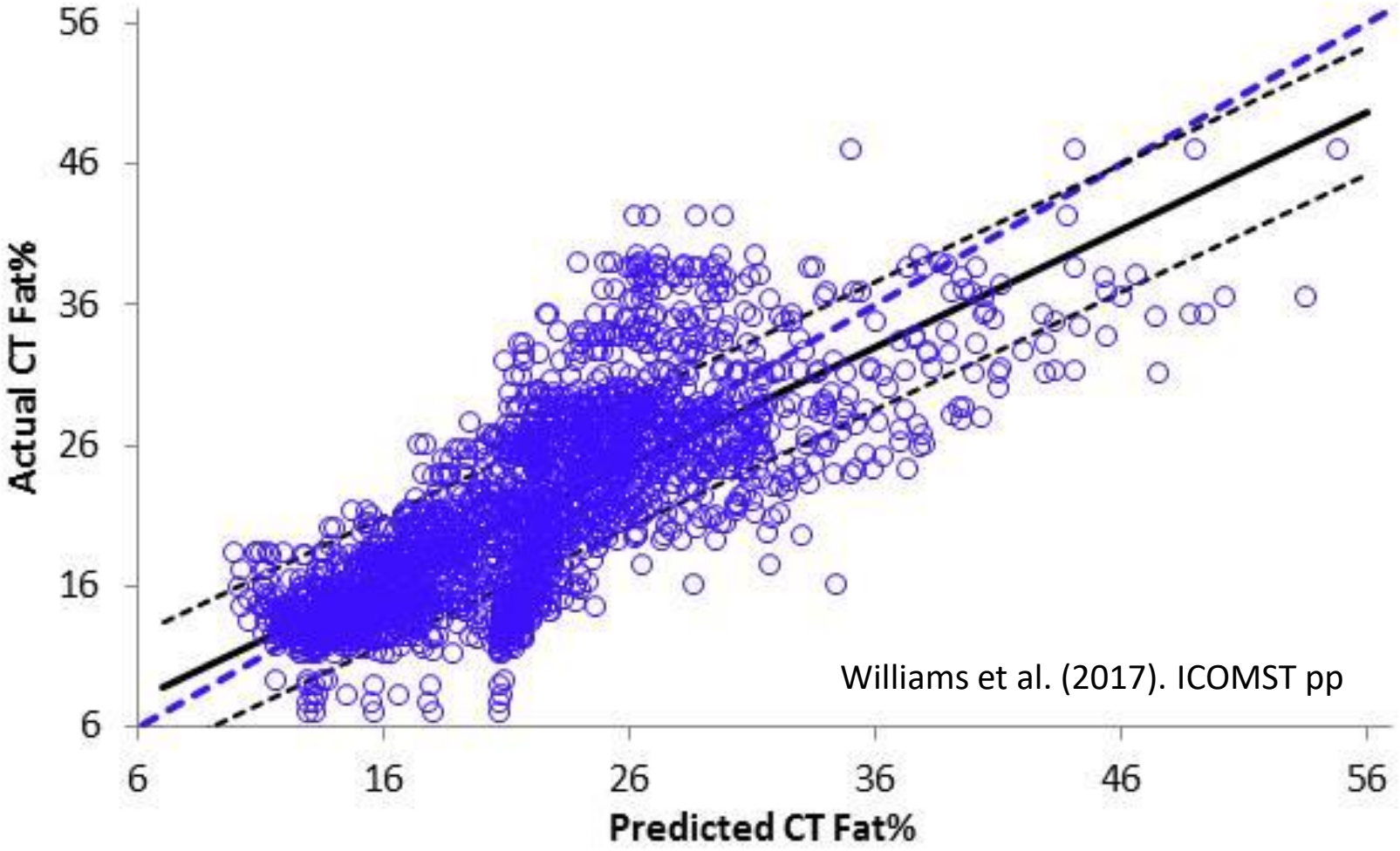

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Rib Fat and HSCW

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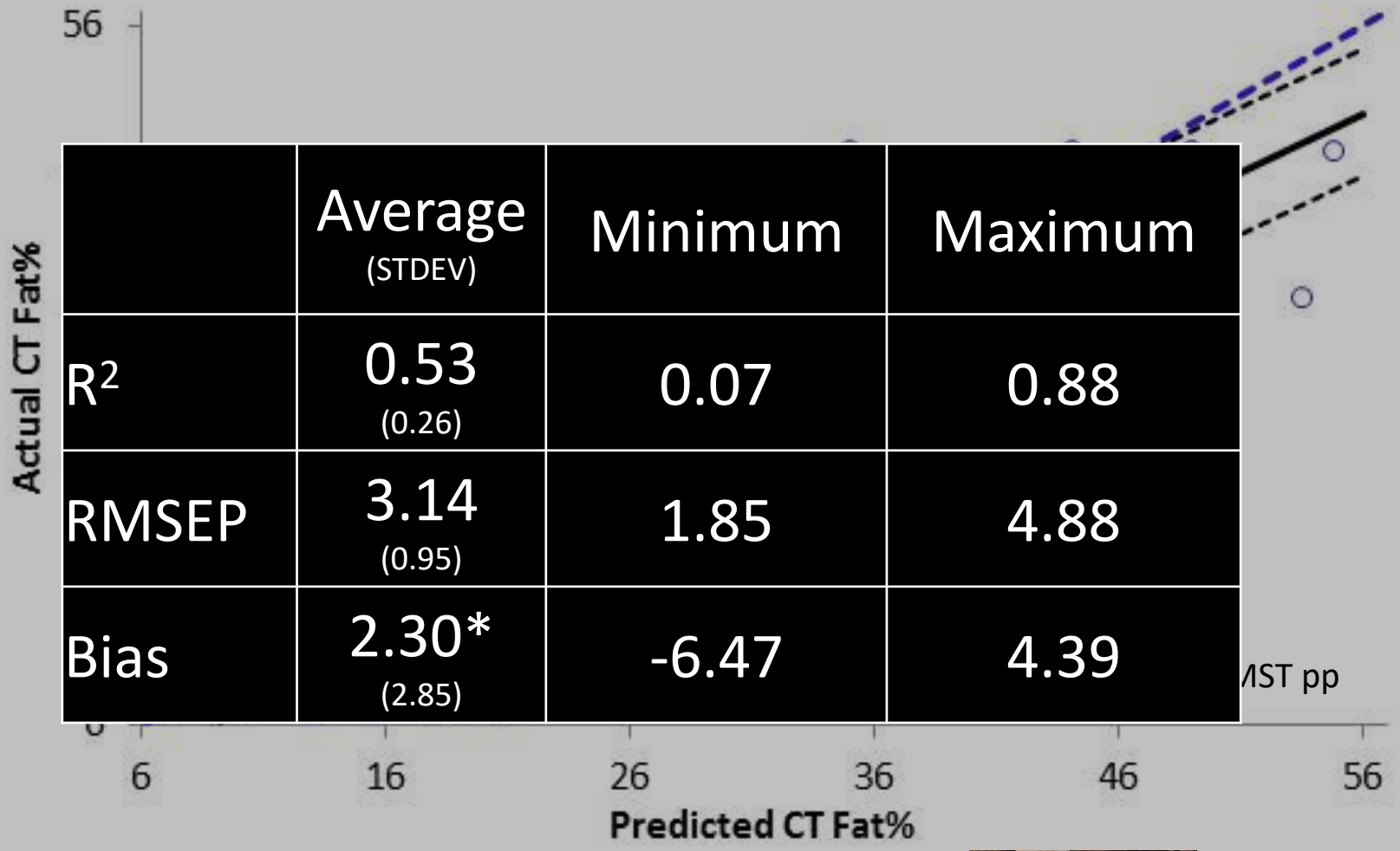
	Average (STDEV)	Minimum	Maximum
R^2	0.53 (0.26)	0.07	0.88
RMSEP	3.14 (0.95)	1.85	4.88
Bias	2.30* (2.85)	-6.47	4.39



*Average of the absolute values of Bias

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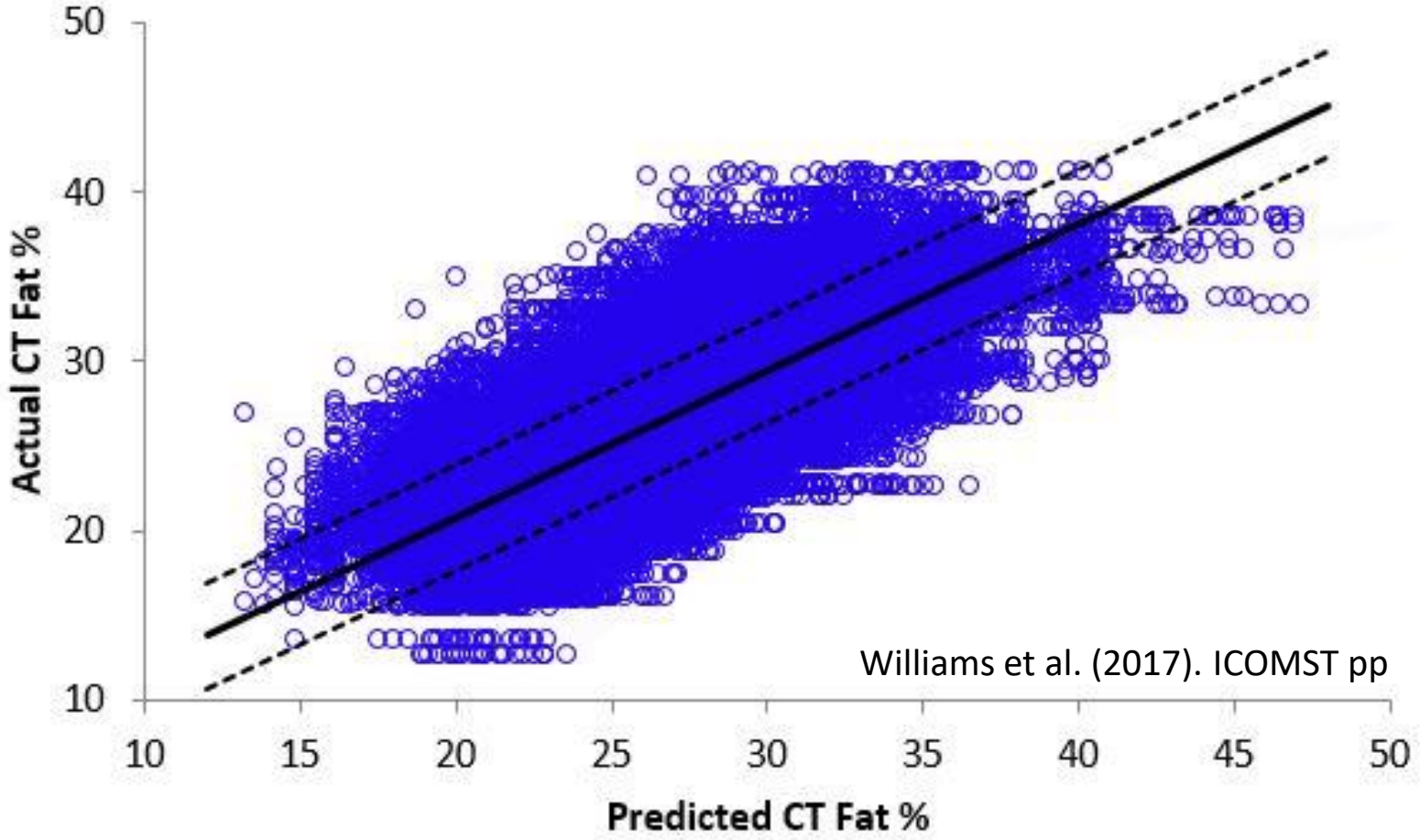
GR and HSCW

(28 data sets)



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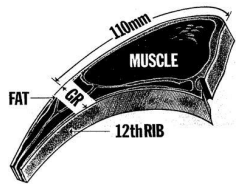

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Eating Quality

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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	
SaleYard	Y/N	SlYrd	n	
Rinse/Flush	Y/N	RnFl	n	
Hot Std Carcase Weight	Weight in Kg	HSCW	350	
HangMethod	T/TS/TL/TC/XT	Hang	at	
Hump Height	mm	Hump	63	
Ossification USDA	USDA measure	uoss	290	
Marbling USDA	USDA measure	umb	300	
RibFat	mm	RbFt	10	
Ulitimate pH	Metered pH	UpH	5.5	
Loin Temp at Grade	Metered Temp C	Utmp	9	
Days of Ageing from Kill	Days Aged	Age	5	

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					
cube roll	CUB045	62	62	62	64		
striploin	STA045	55	56	58	58		
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oyster blade	OYS036	67	64	69	72		
blade	BLD095			43			
blade	BLD096	53	57	58	59	59	
chucktender	CTR085		49	51	53	59	
rump	RMP131	51	59	56	62	54	
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rump	RMP087		52	57	55	56	
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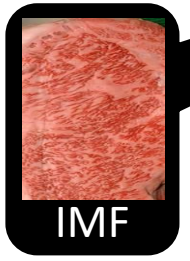
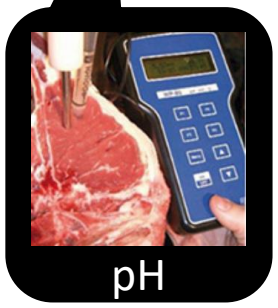
knuckle	KNU098			54	59	56	
knuckle	KNU099	36	47	44	51	52	
knuckle	KNU100			60	62	55	
outside flat	OUT005		40	43	56	59	52
outside flat	OUT029			54	61	55	
eye round	EYE075	40	44	42	45	46	45
topside	TOP001	39		51	53	50	
topside	TOP033	40		53	58	60	
topside	TOP073	34	43	43	56	52	
chuck	CHK068			48	53	65	
chuck	CHK074	63	56	61	67	72	
chuck	CHK078	56	57	58	62	69	
chuck	CHK081			60	64	75	
chuck	CHK082			52	56		
thin-flank	TFL051			58		58	
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			

Trading on Eating Quality





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Aged

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Trading on Eating Quality

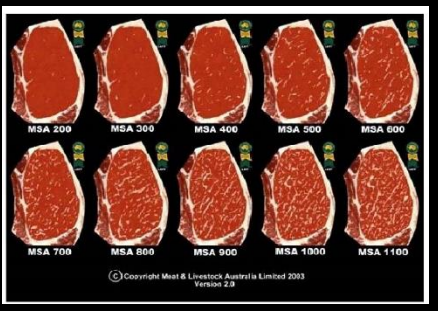
Meat Standards Australia eating quality model

Carcase Wt

Ossification

IMF

Rib Fat Depth



pH

Human estimated scores = error?

chuck	CHK068			48	53	65	
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Doesn't exist for lamb!

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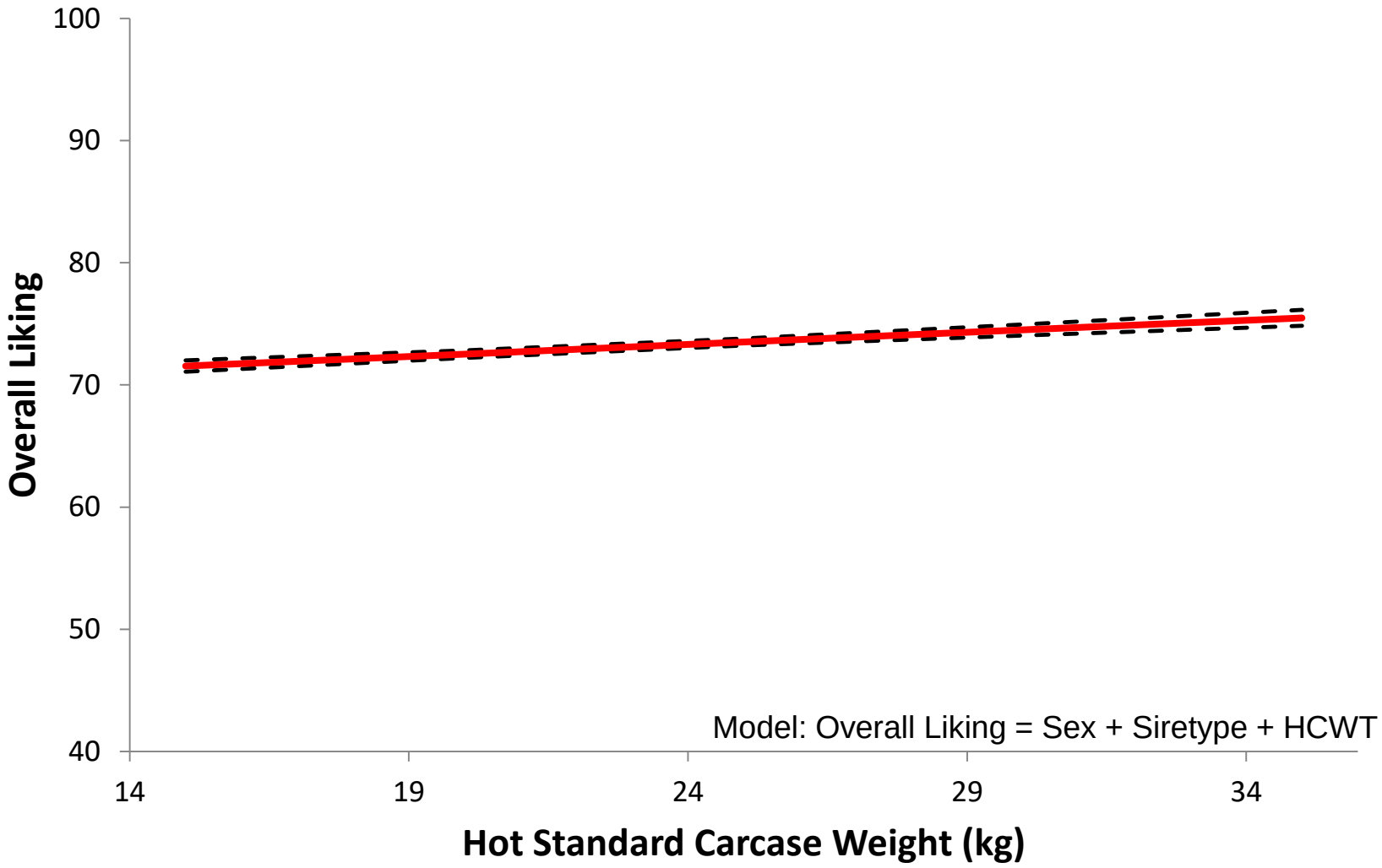
Loin Eating Quality and HSCW



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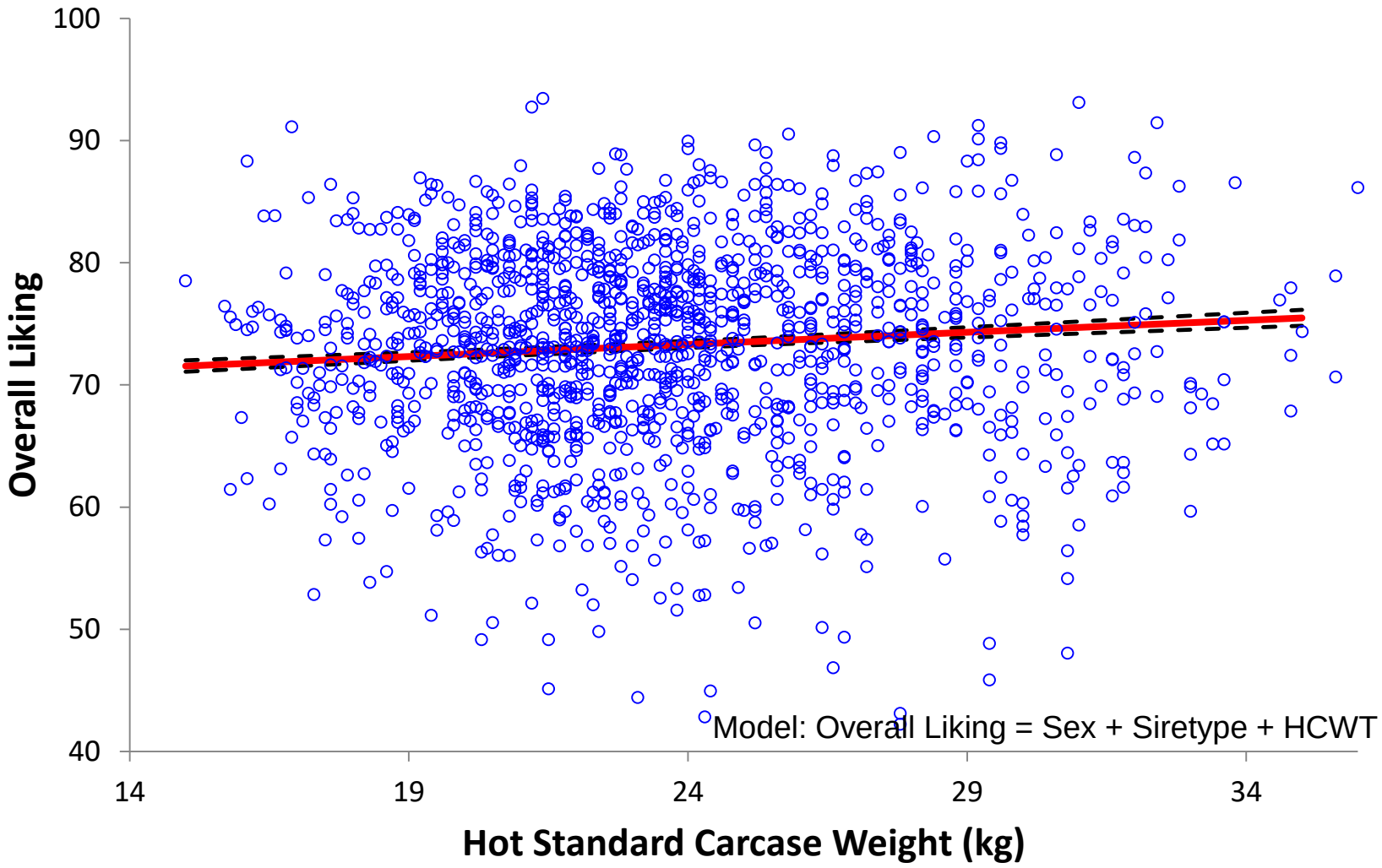
Loin Eating Quality and HSCW



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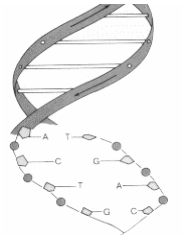
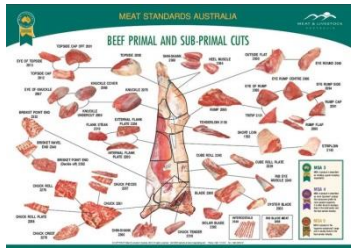
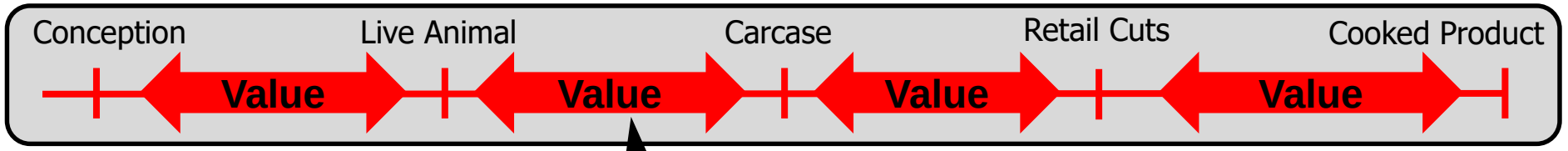
Precision measurement

from paddock/pen to plate

- Predict quality and amount of final product







Trading lacks transparency?

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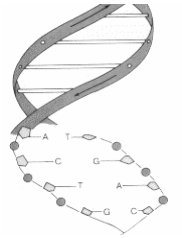
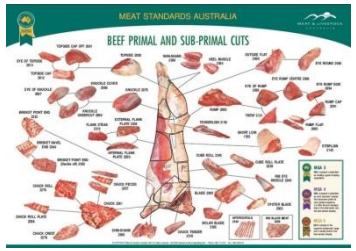
Precision measurement

from paddock/pen to plate

- Predict quality and amount of final product





Conception | Live Animal | Carcase | Retail Cuts | Cooked Product

Value | **Value** | **Value** | **Value**

Senate inquiry

Trading lacks transparency?

= political impetus for change!

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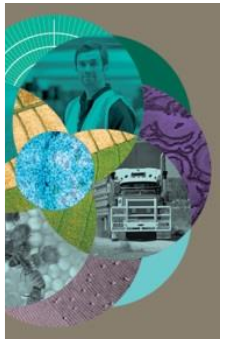
Australian Government

Department of Agriculture and Water Resources



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

MEAT & LIVESTOCK AUSTRALIA

LIVESTOCK AUSTRALIA

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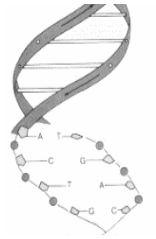

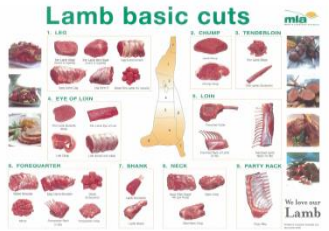

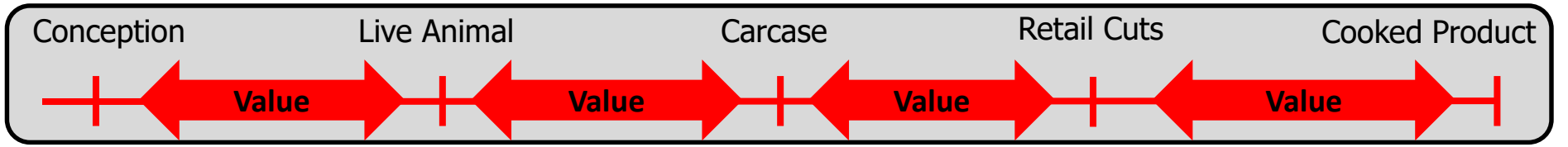

LMY:

3D Imaging

DEXA

3D Imaging

Eating Quality:

Hyperspectral

NIR

Synergy with Automation

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Precision measurement

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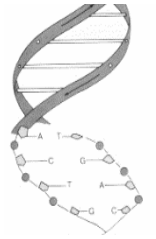

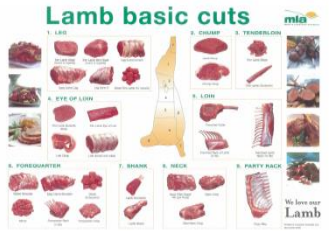

Conception | Live Animal | Carcase | Retail Cuts | Cooked Product

Value | Value | Value | Value

New Breeding Values

Systems to improve compliance

Enhanced Beef MSA

Benchmarking systems

Cut wt prediction systems

Enhanced Producer Feedback

Cuts-based Lamb MSA

Profit functions to optimise carcase use $

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True value of the carcase

Carcase value ($)

=

Wt retail cuts (kg)

X

Value of the cuts ($/kg)

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Eating Quality

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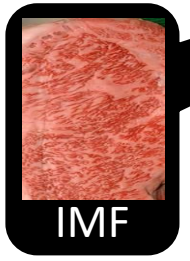
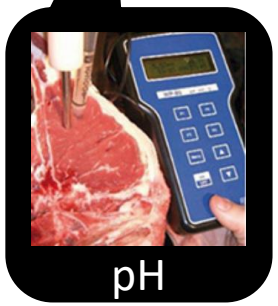
Trading on Eating Quality





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chuck	CHK074	63	56	61	67	72	
chuck	CHK078	56	57	58	62	69	
chuck	CHK081			60	64	75	
chuck	CHK082			52	56		
thin-flank	TFL051			58		58	
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			

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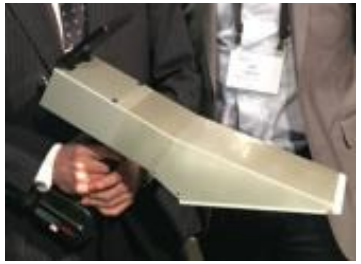
The obvious place to start is IMF!

E+V

Hyperspectral (Frontmatec)



MIJ

MEQ Probe

Halo NIR

Visual grading

CT

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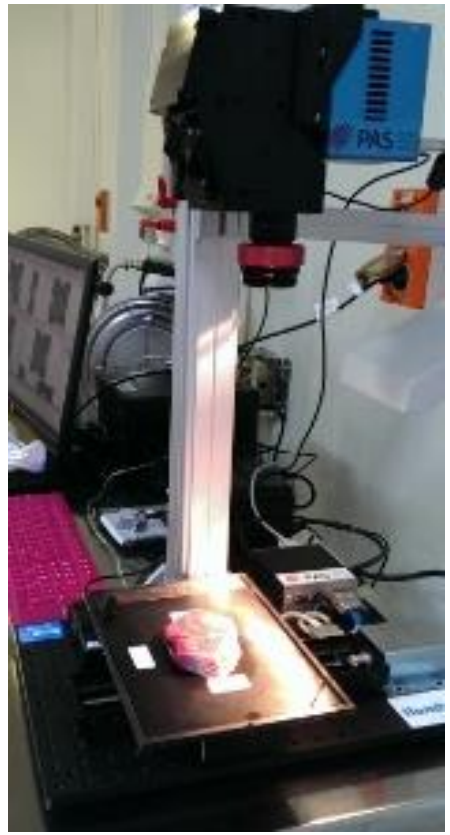
Near Infra-red (NIR) probes

- Used extensively by other industries
- Requires “cut surface”



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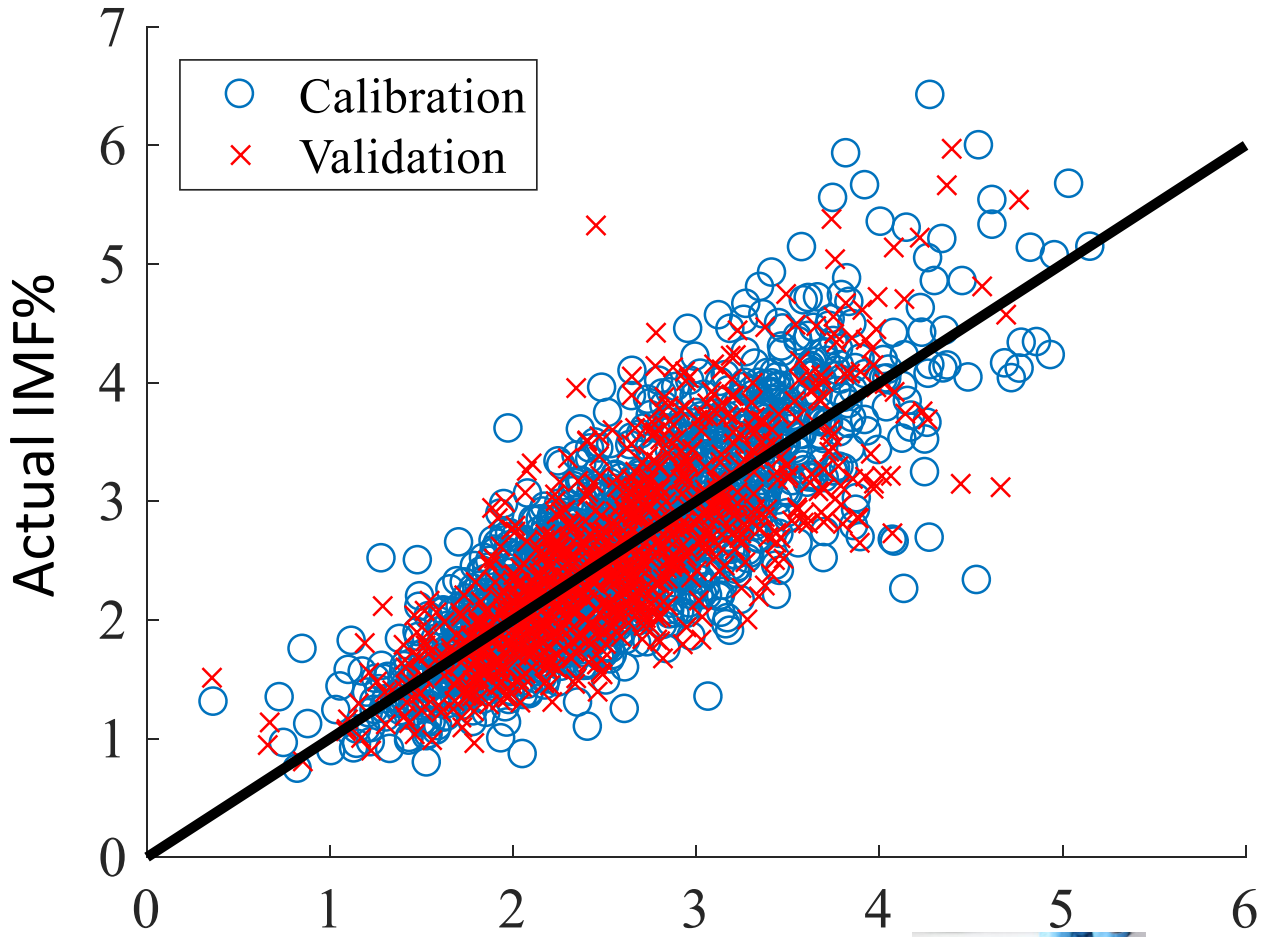
Near Infra-red (NIR) probes



2500 carcasses
RMSEP ~ 0.5%

agresearch
āta mātai, mātai whetū

beef+lamb new zealand GENETICS

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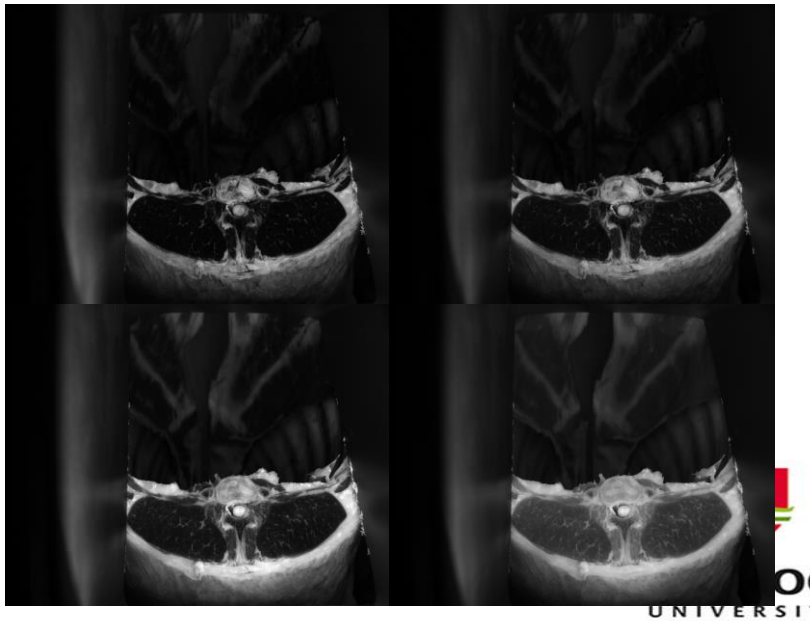
Reis/Craigie et al 2017; Johnson 2018

Frontmatec hyperspectral camera

- Requires cut surface

2 camera lenses

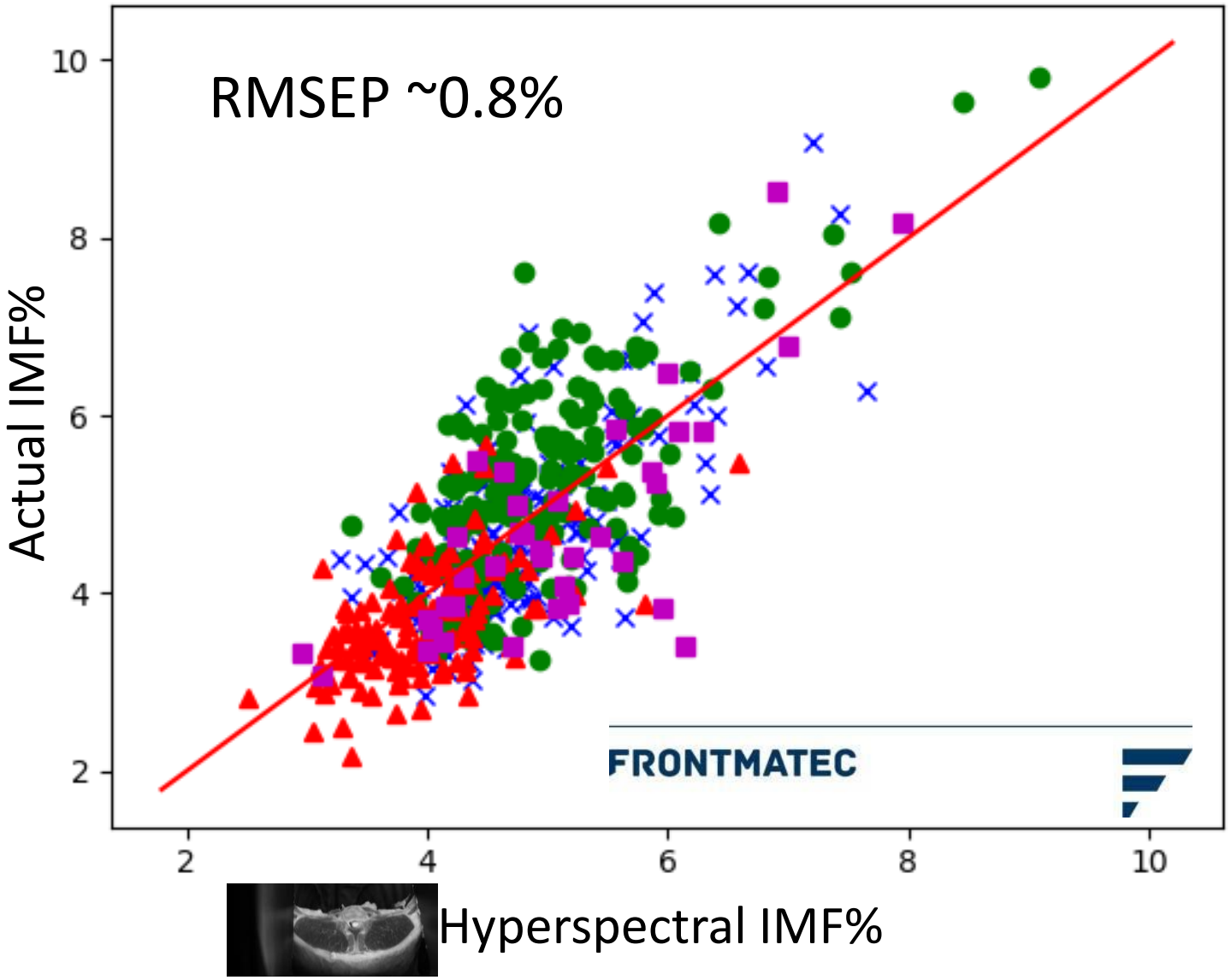
5 LED wavelengths optimised for meat and fat



FRONTMATEC

Frontmatec hyperspectral camera

Lamb



400 carcasses

Cold (24 hrs post mortem)

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Frontmatec hyperspectral camera

Beef

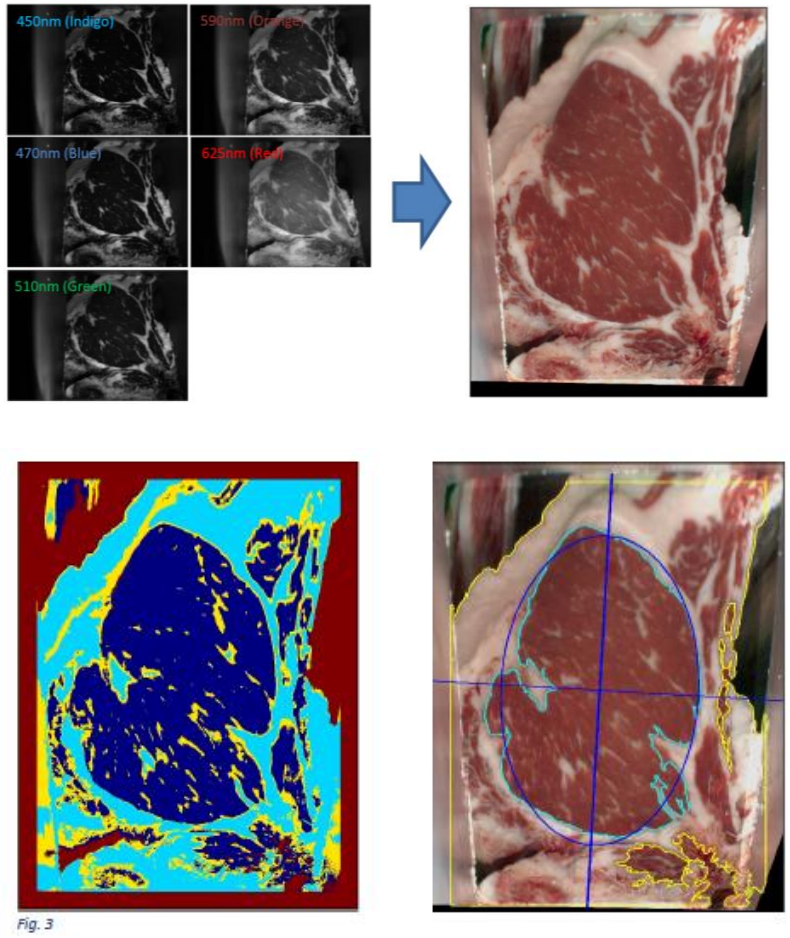

Fig. 3

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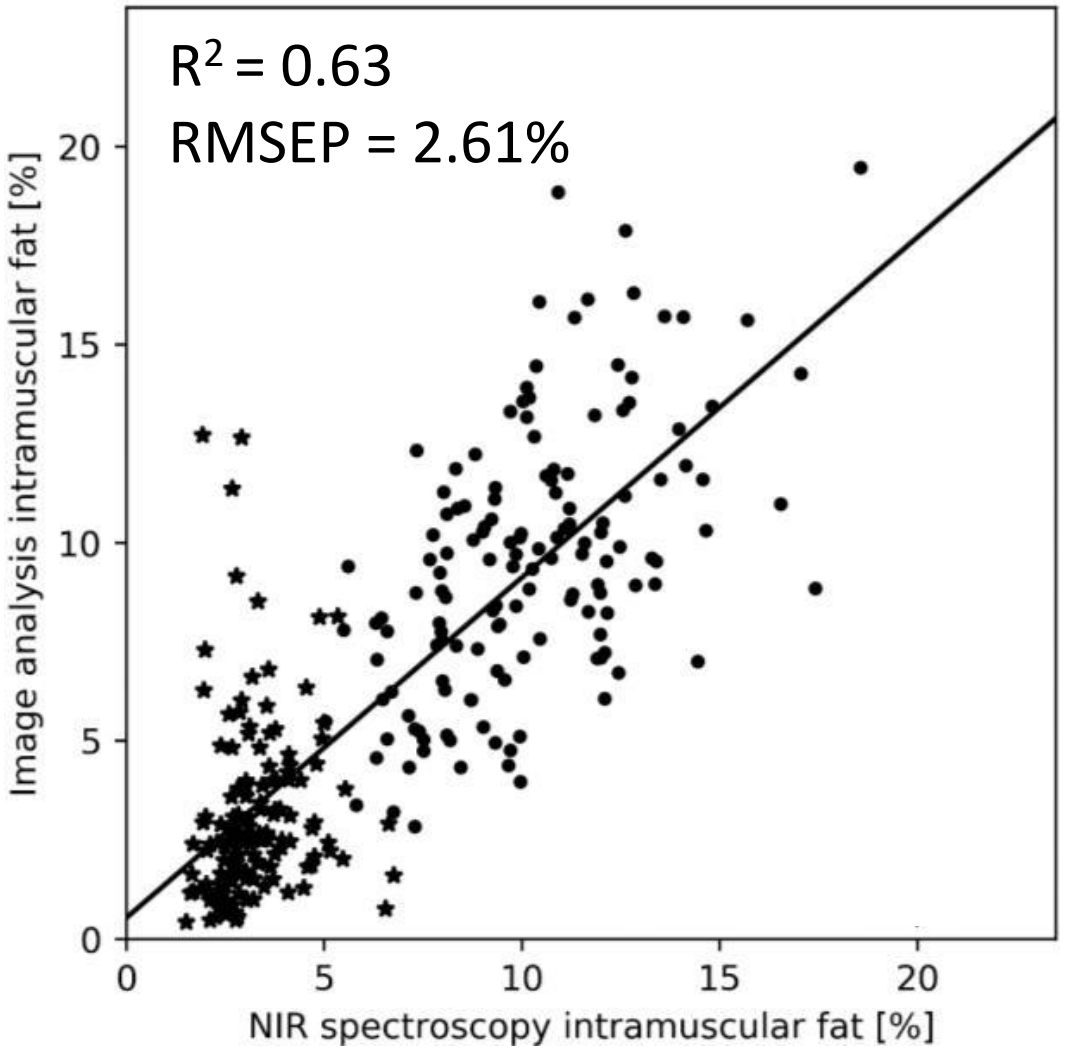
Frontmatec hyperspectral camera

Beef



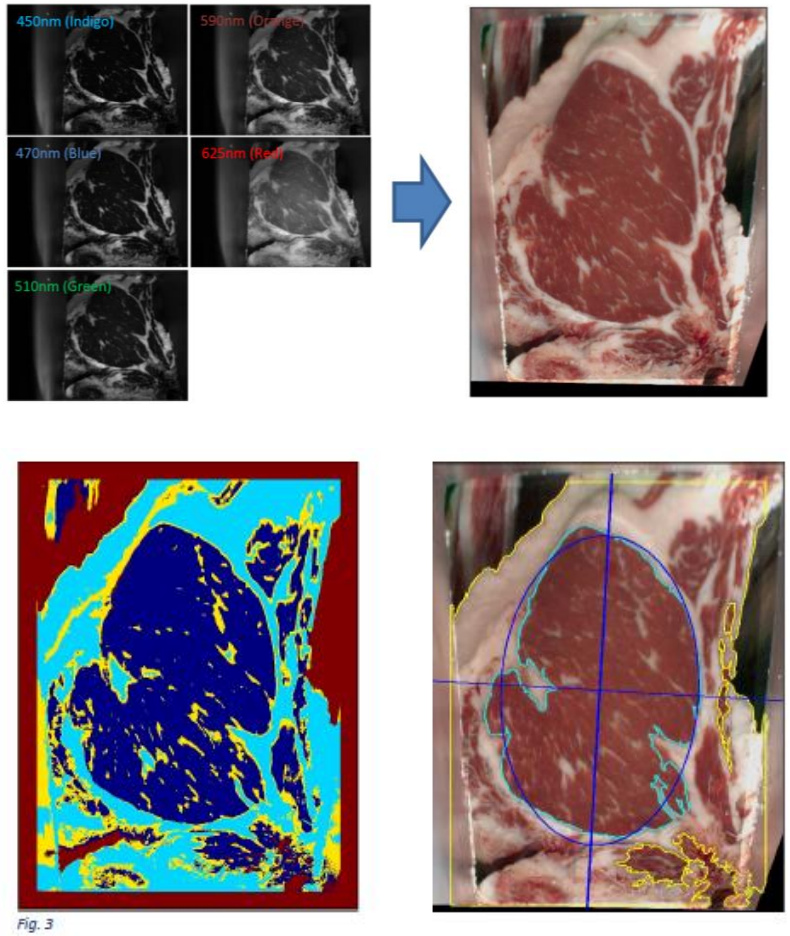


Fig. 3

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Meat Eating Quality (MEQ) probe

- Fibre optic probes with hyperspectral laser
- Requires industry validation
- Potential for:
  - Hot measurement
  - Use at multiple sites
  - Does not require cut surface

MEQ

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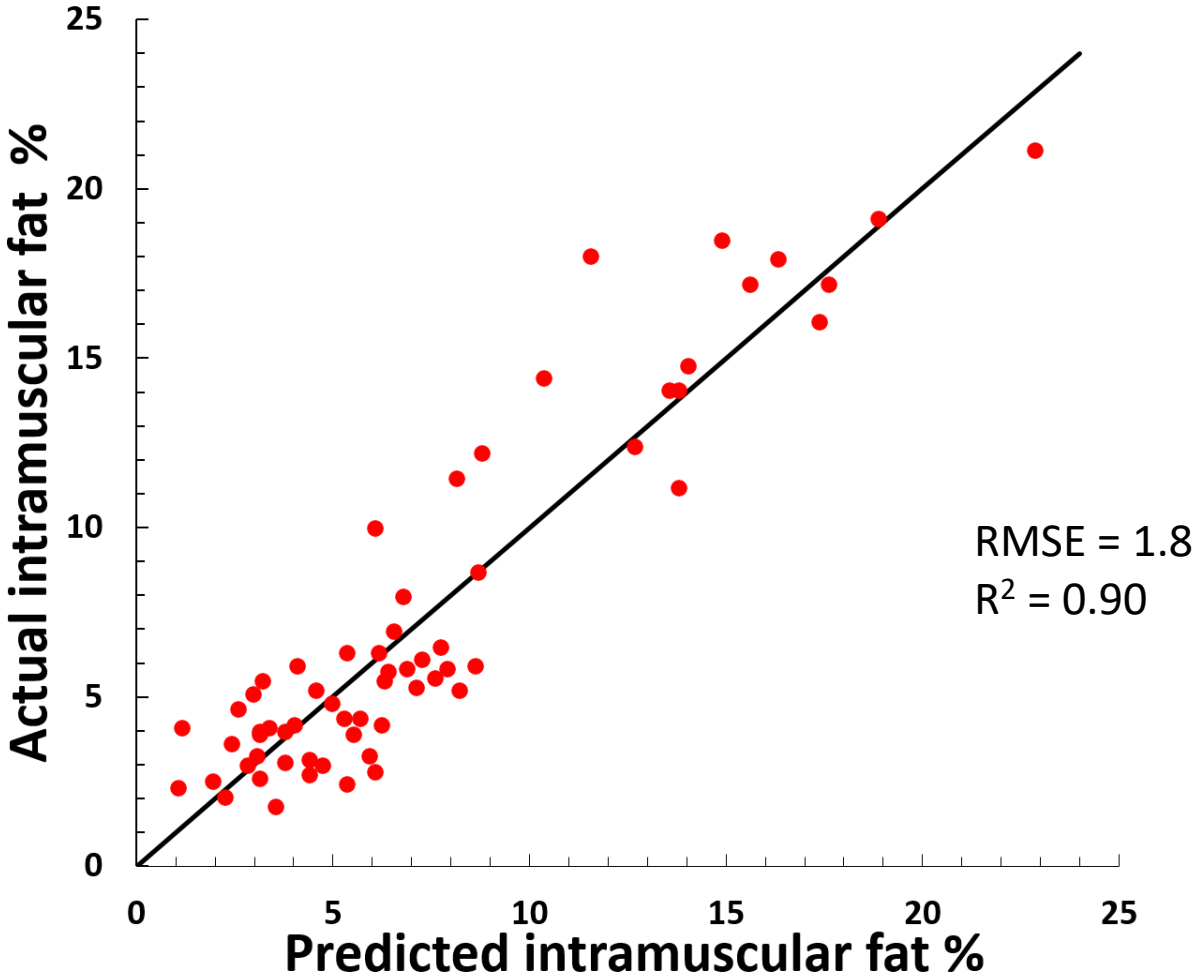
We can predict IMF with CT



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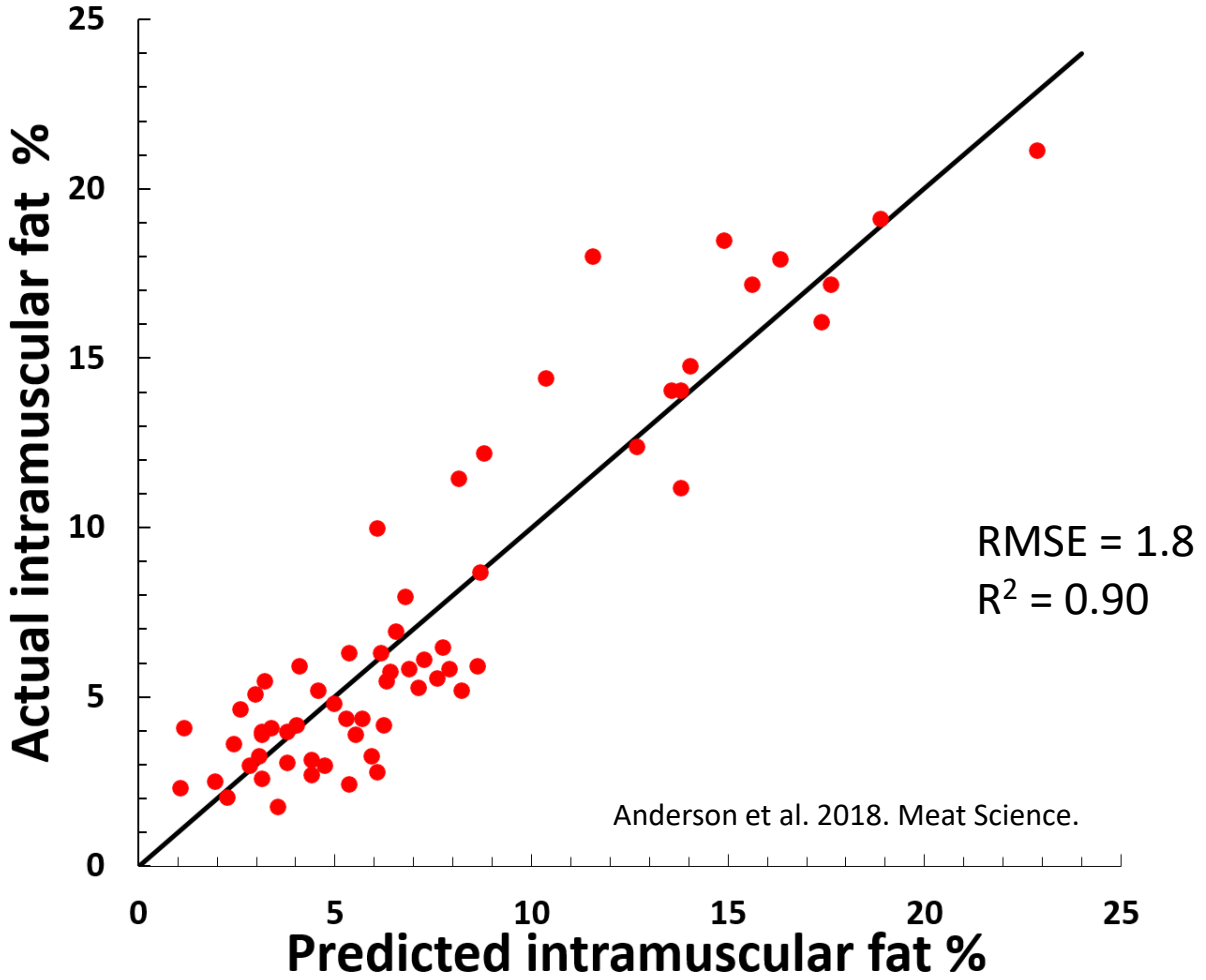
We can predict IMF with CT



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How do we handle new traits?

MSA marbling

Chemical IMF%

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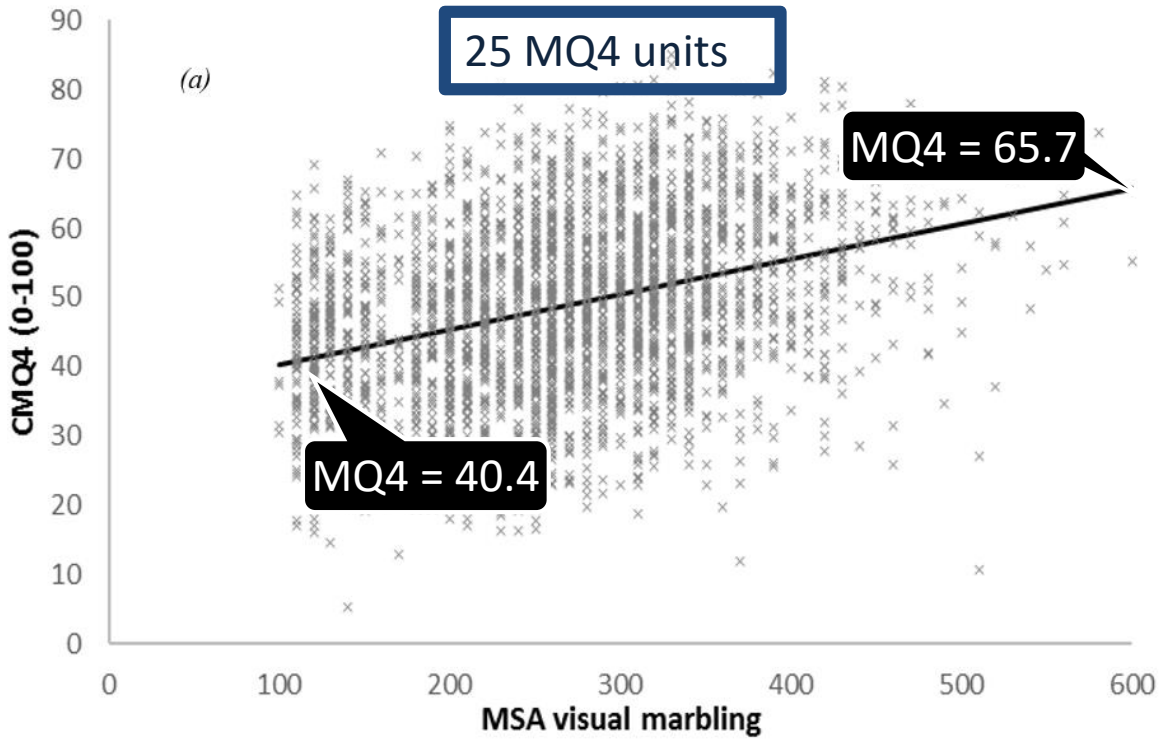
Does IMF predict EQ as well as visual grade



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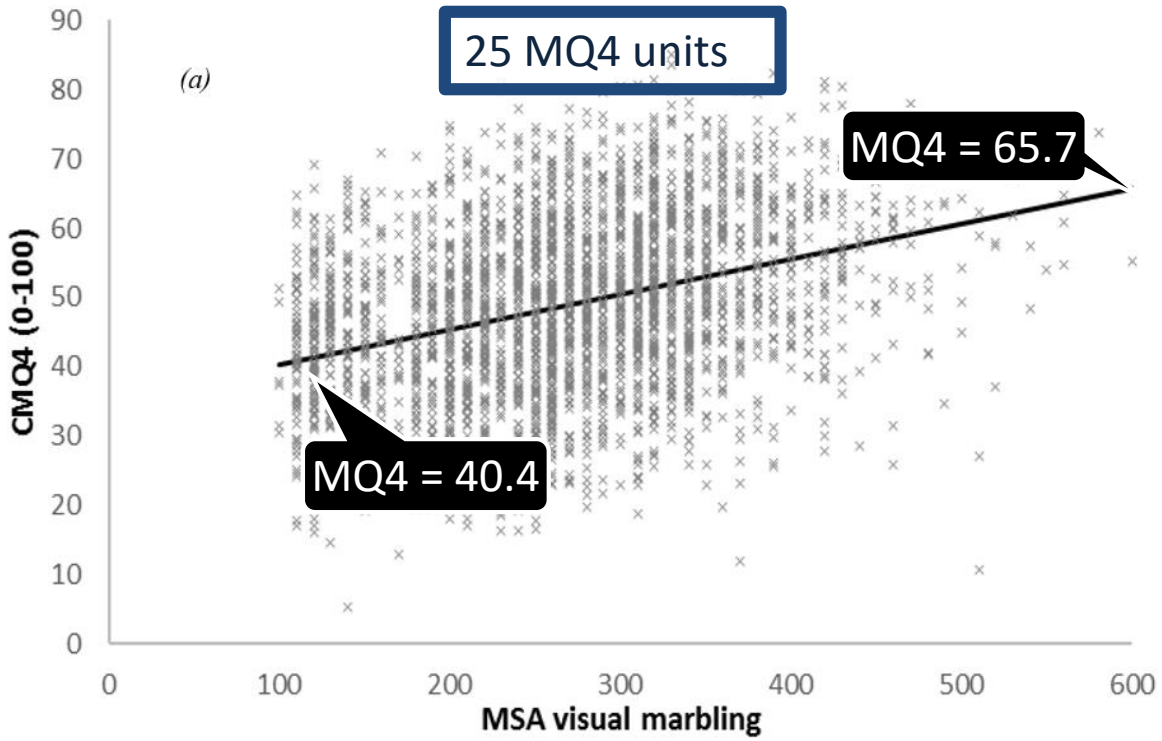
Does IMF predict EQ as well as visual grade



R^2= 0.27

RMSE = 11.898

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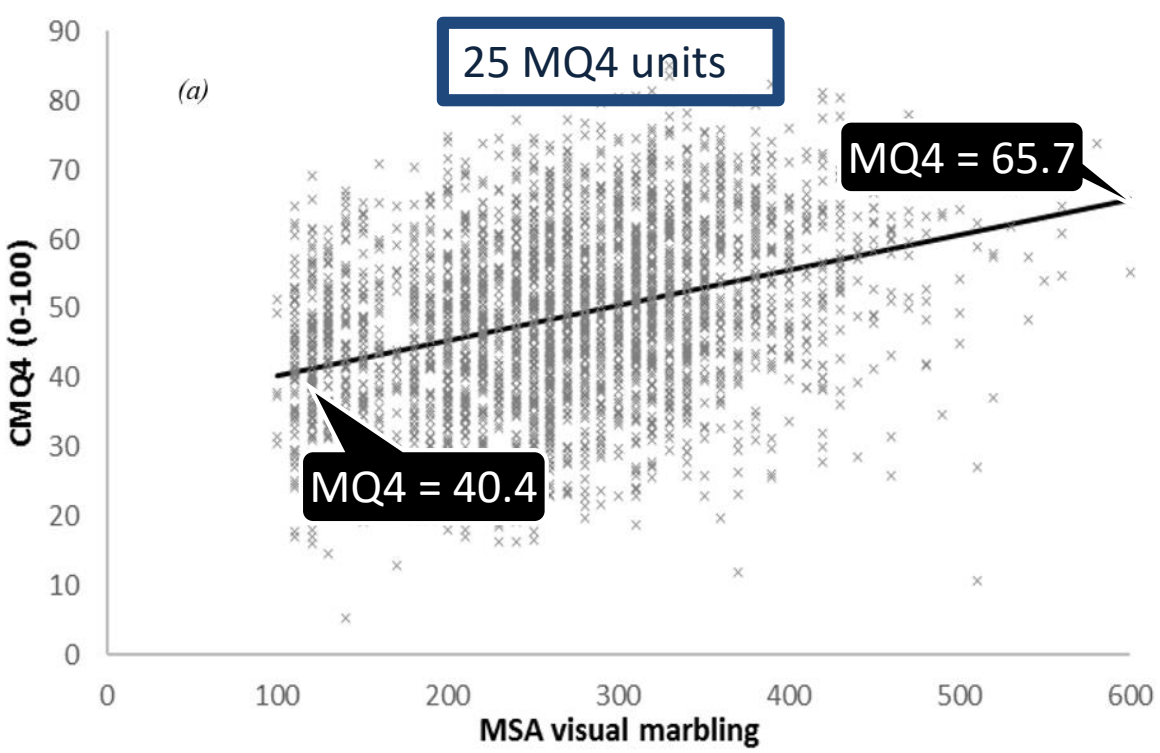
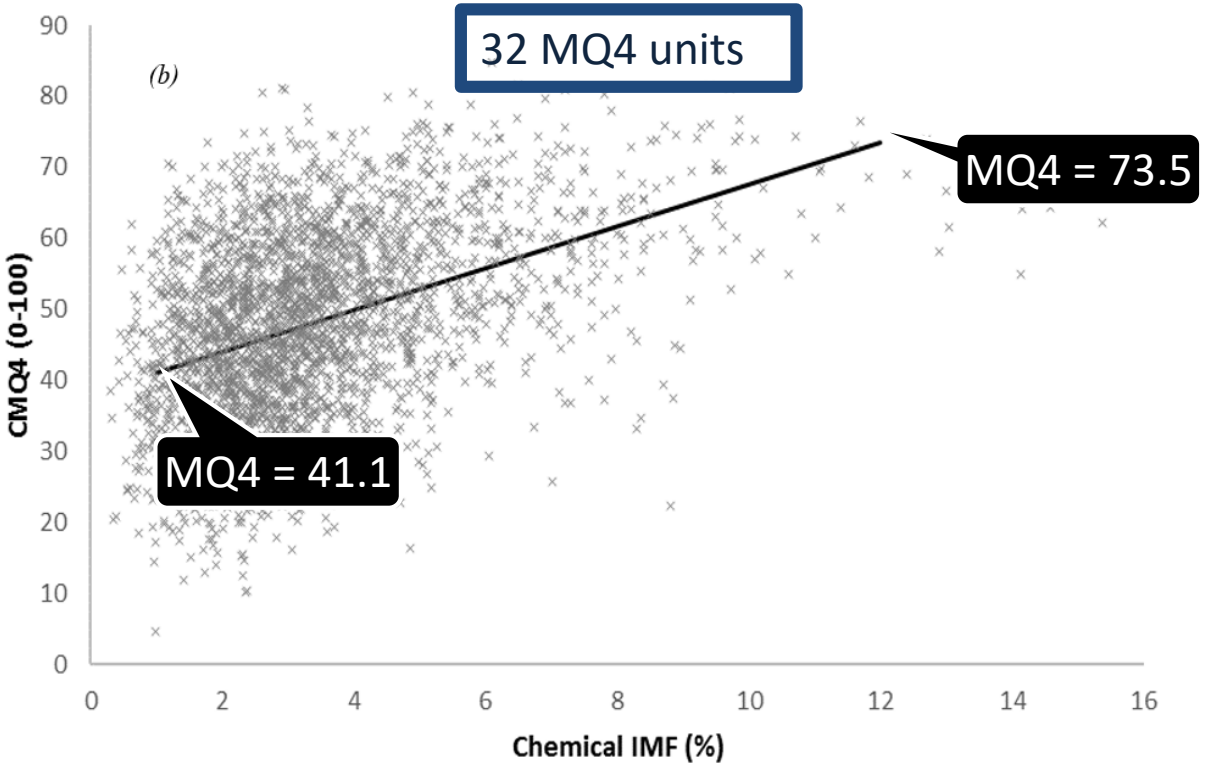
Does IMF predict EQ as well as visual grade



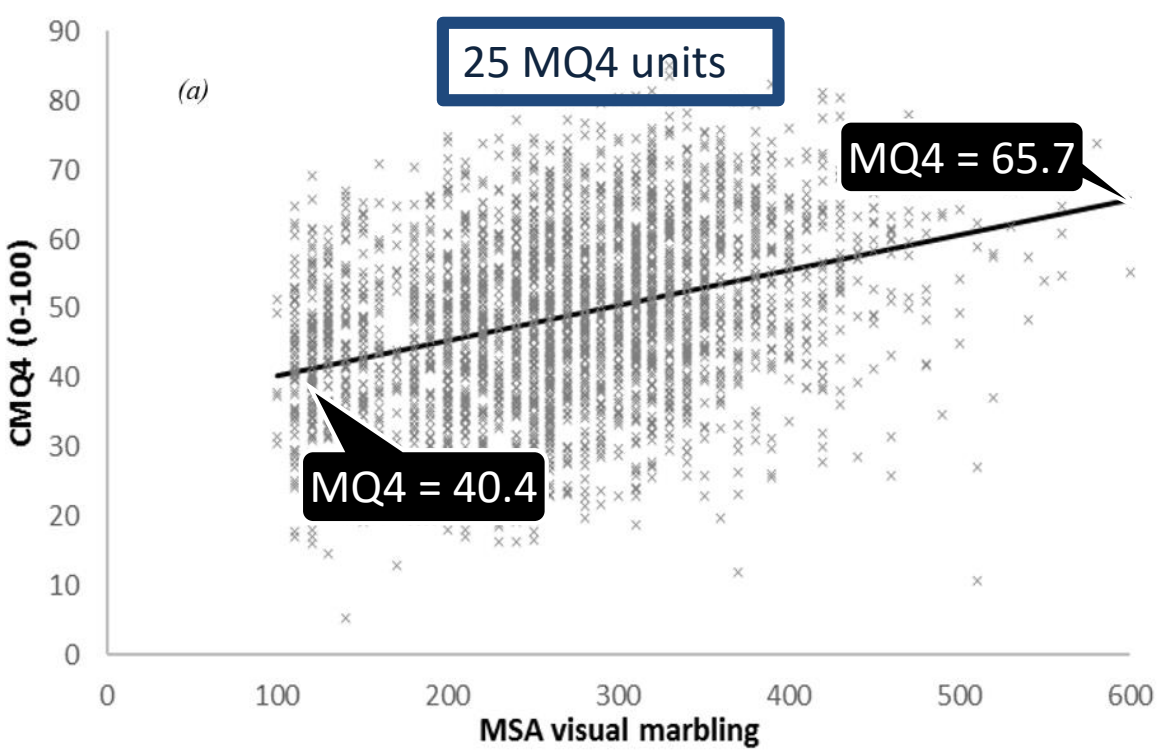


R^2= 0.27

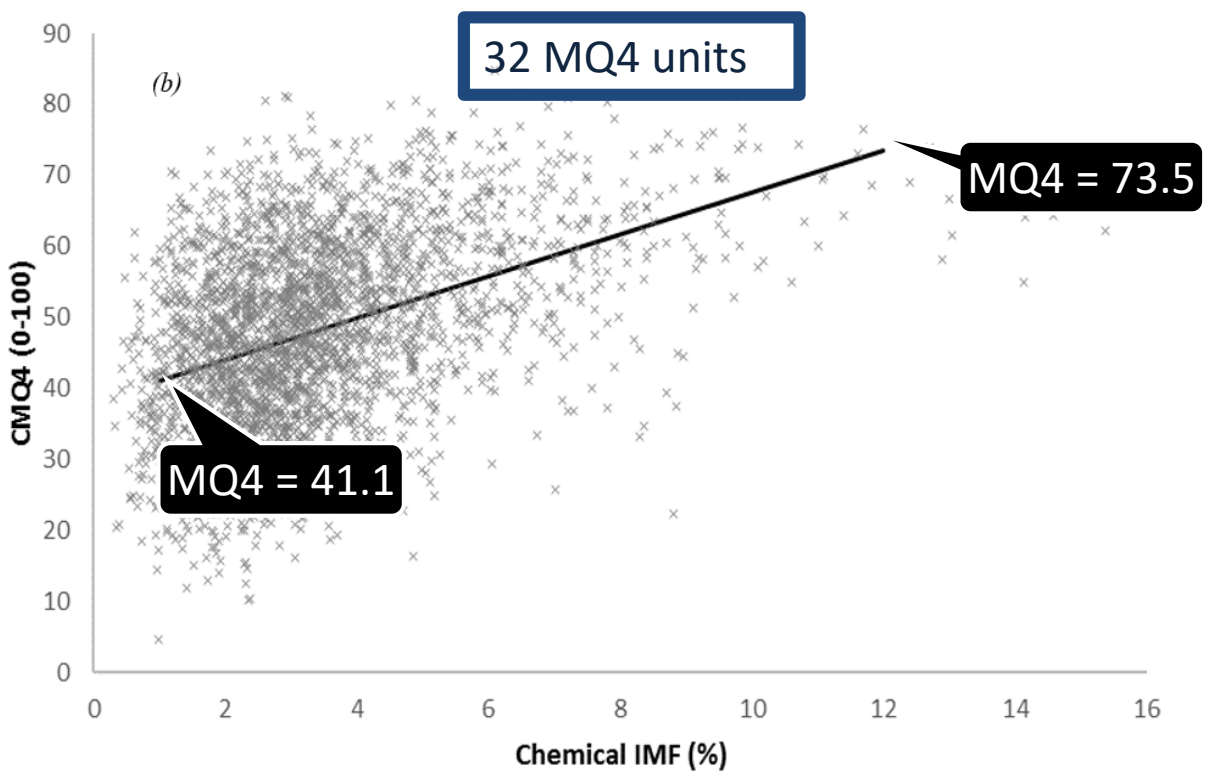
RMSE = 11.898

Murdoch UNIVERSITY

Does IMF predict EQ as well as visual grade



R^2= 0.27
RMSE = 11.898



R^2= 0.32
RMSE = 11.737

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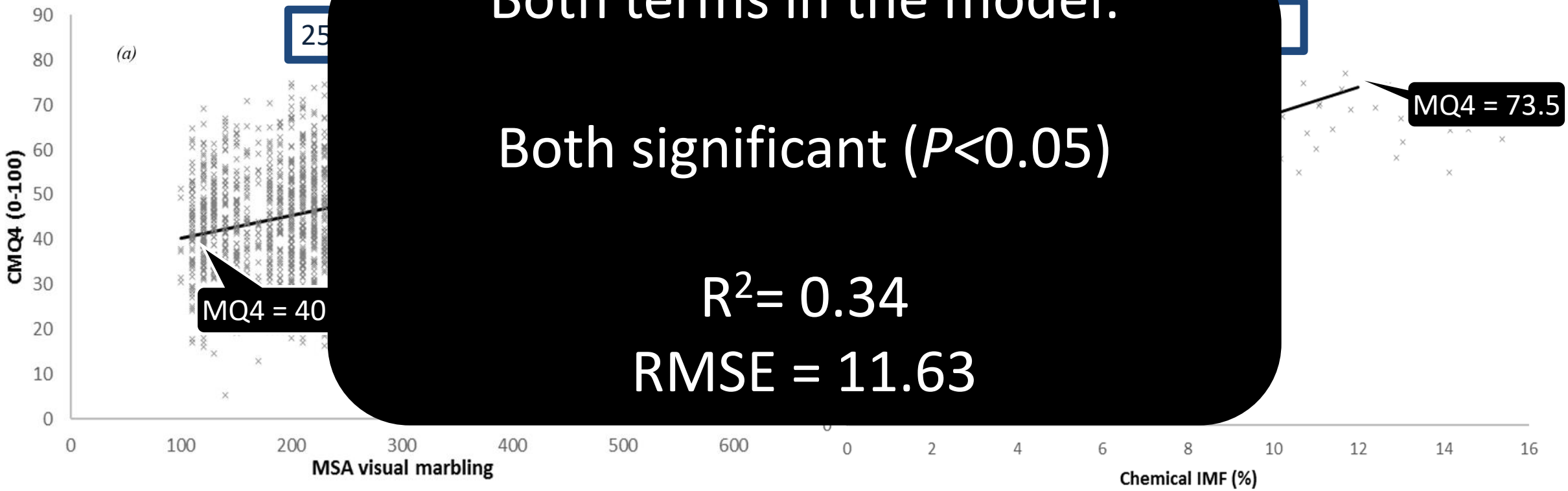
Does IMF predict EQ as well as visual grade



Both terms in the model:

Both significant ($P<0.05$)

$R^2 = 0.34$

RMSE = 11.63

$R^2 = 0.27$

RMSE = 11.898

$R^2 = 0.32$

RMSE = 11.737

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Lean Meat Yield

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Trading on Eating Quality

Carcase Wt

Ossification

IMF

Rib Fat Depth

Meat Standards Australia eating quality model

Description	Format	Name	Input	?
ated % Bos Indicus	% or X if doubt	EPBI	0	
imal Sex Type	M/F	Sex	F	
romotent	Y or ? / N	HGP	n	
aler	Y/N	MFV	n	
	Y/N	SlYrd	n	
Rinse/Flush	Y/N	RnFl	n	
Hot Std Carcase Weight	Weight in Kg	HSCW	350	
HangMethod	T/TS/TL/TC/XT	Hang	at	
	mm	Hump	63	
Ossification USDA	USDA measure	uoss	290	
Marbling USDA	USDA measure	umb	300	
RibFat	mm	RbFt	10	
Ultimate pH	etered pH	UpH	5.5	
Loin Temp	etered Temp C	Utmp	9	
D g from Kill	Day ged	Age	5	

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					
	cube roll	CUB045	62	62	62	64		
	striploin	STA045	55	56	58	58		
	striploin	STP045	53	54	57	57		
	oyster blade	OYS036	67	64	69	72		
	blade	BLD095			43			
	blade	BLD096	53	57	58	59	59	
	chucktender	CTR085		49	51	53	59	
	rump	RMP131	51	59	56	62	54	
	rump	RMP231	54	62	61	60		
	rump	RMP005	59		67	67		
	rump	RMP032			64	68		
	rump	RMP087		52	57	55	56	
	knuckle	KNU066	46	59	54	58	47	
	knuckle	KNU098			54	59	56	
	knuckle	KNU099	36	47	44	51	52	
	knuckle	KNU100			60	62	55	
	outside flat	OUT005		40	43	56	59	52
	outside flat	OUT029			54	61	55	
	eye round	EYE075	40	44	42	45	46	45
	topside	TOP001	39		51	53	50	
	topside	TOP033	40		53	58	60	
	topside	TOP073	34	43	43	56	52	
	chuck	CHK068			48	53	65	
	chuck	CHK074	63	56	61	67	72	
	chuck	CHK078	56	57	58	62	69	
	chuck	CHK081			60	64	75	
	chuck	CHK082			52	56		
	thin-flank	TFL051			58		58	
	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			

Trading on Eating Quality

Computed Tomography
"the gold standard"

Rib Fat Depth

Standards Australia eating quality model

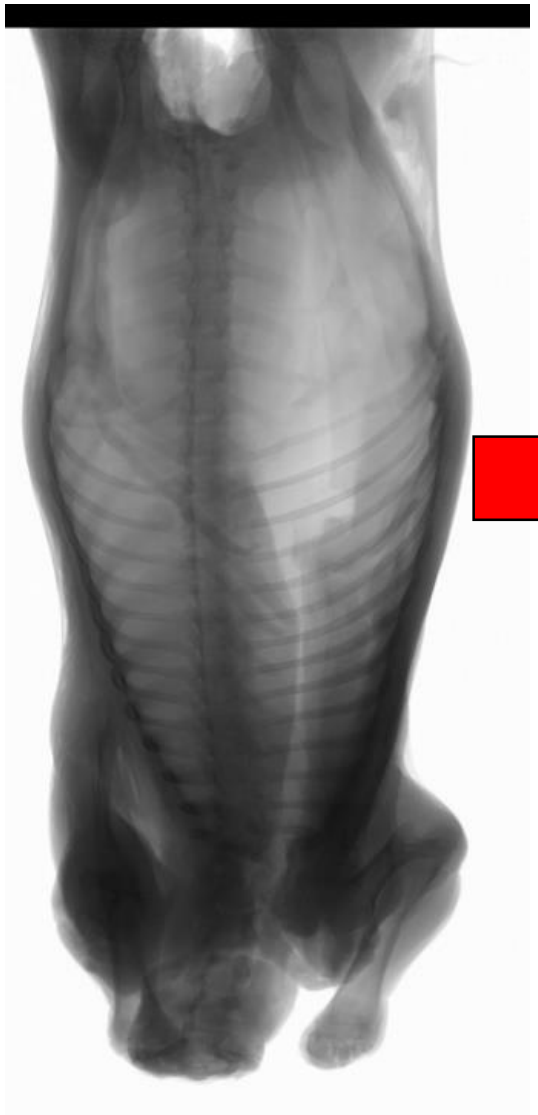
Format	Name	Input	?
if doubt	EPBI	0	
M/F	Sex	F	
N	HGP	n	
	MFV	n	
	?Yrd	n	
		n	
		350	
		at	
	Hump	63	
measure	uoss	290	
measure	umb	300	
mm	RbFt	10	
ured pH	UpH	5.5	
Temp	Utmp	9	
ged	Age	5	

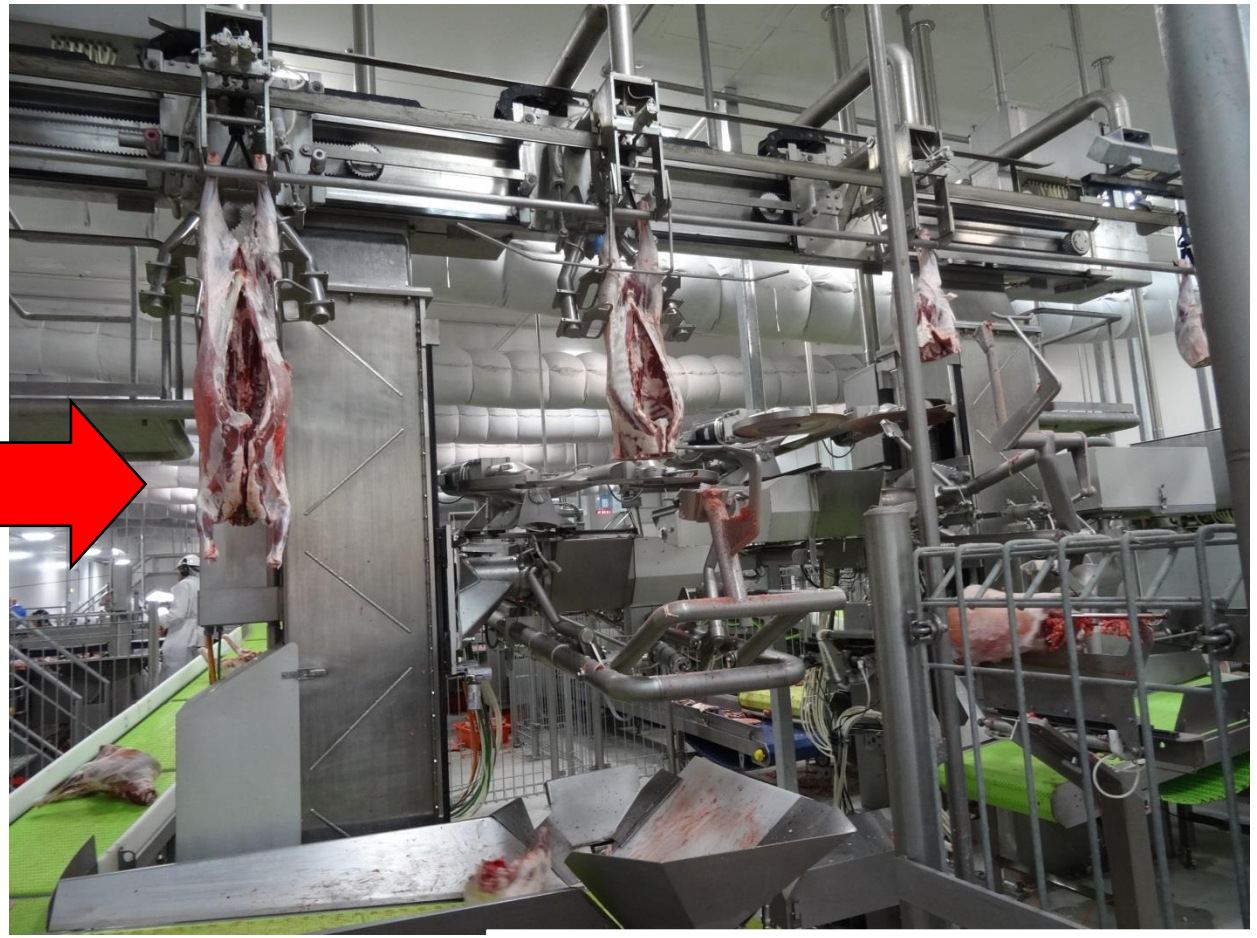
cut	muscle	GRL	RST	SFR	TSL	SCT	CRN
spinalis	SPN081	79	69	79	75		
tenderloin	TDR034	82		76			
tenderloin	TDR062	78	77	80	74		
tenderloin	TDR063	73					
cube roll	CUB045	62	62	62	64		
striploin	STA045	55	56	58	58		
striploin	STP045	53	54	57	57		
oyster blade	OYS036	67	64	69	72		
blade	BLD095			43			
blade	BLD096	53	57	58	59	59	
chucktender	CTR085		49	51	53	59	
rump	RMP131	51	59	56	62	54	
rump	RMP231	54	62	61	60		
rump	RMP005	59		67	67		
rump	RMP032			64	68		
rump	RMP087		52	57	55	56	
knuckle	KNU066	46	59	54	58	47	
knuckle	KNU098			54	59	56	
knuckle	KNU099	36	47	44	51	52	
knuckle	KNU100			60	62	55	
outside flat	OUT005		40	43	56	59	52
outside flat	OUT029			54	61	55	
eye round	EYE075	40	44	42	45	46	45
topside	TOP001	39		51	53	50	
topside	TOP033	40		53	58	60	
topside	TOP073	34	43	43	56	52	
chuck	CHK068			48	53	65	
chuck	CHK074	63	56	61	67	72	
chuck	CHK078	56	57	58	62	69	
chuck	CHK081			60	64	75	
chuck	CHK082			52	56		
thin-flank	TFL051			58		58	
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			

DEXA

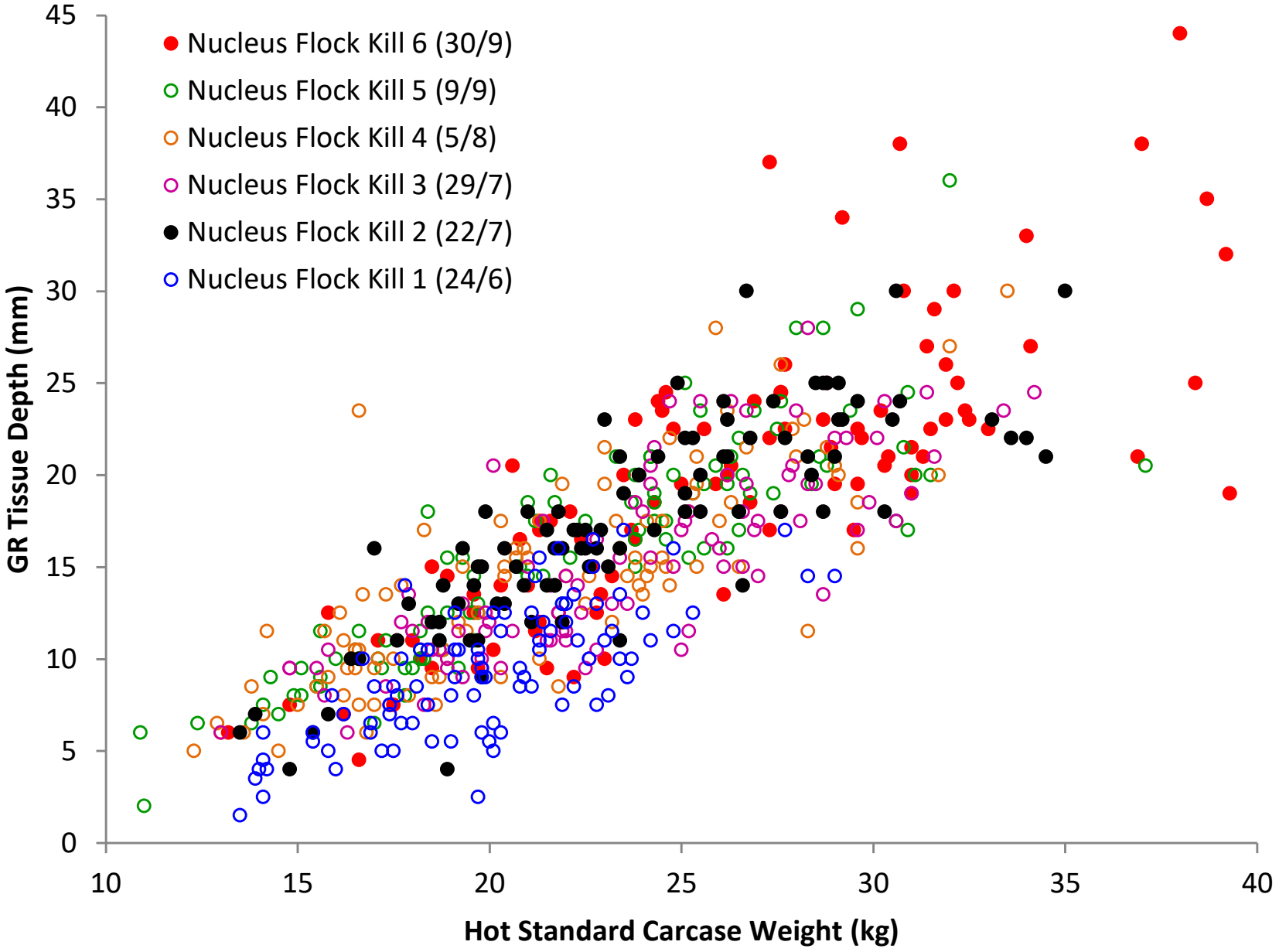
2D X-Ray for driving robots

SCOTT®

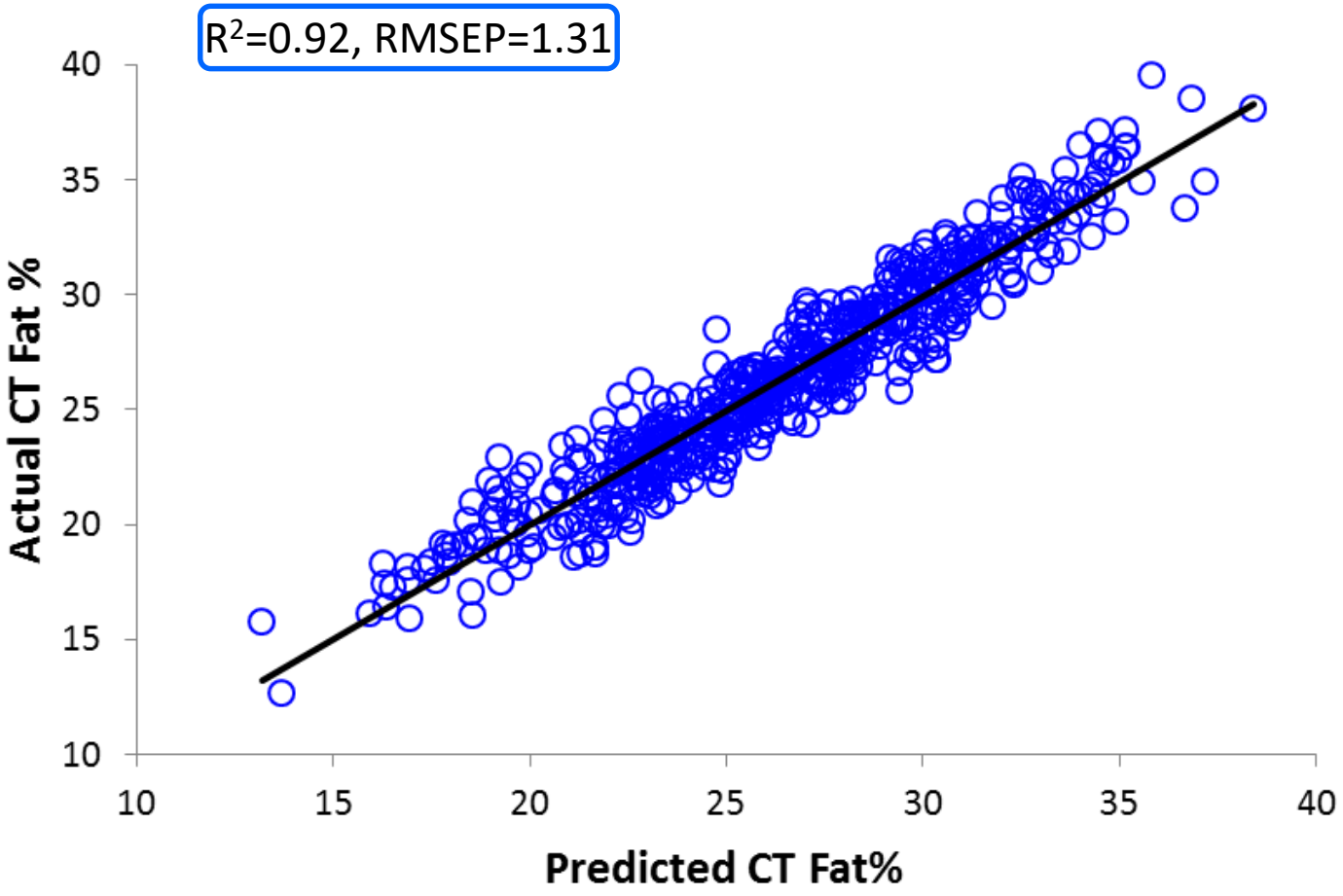




Nucleus Flock to train DEXA



DEXA predicting CT



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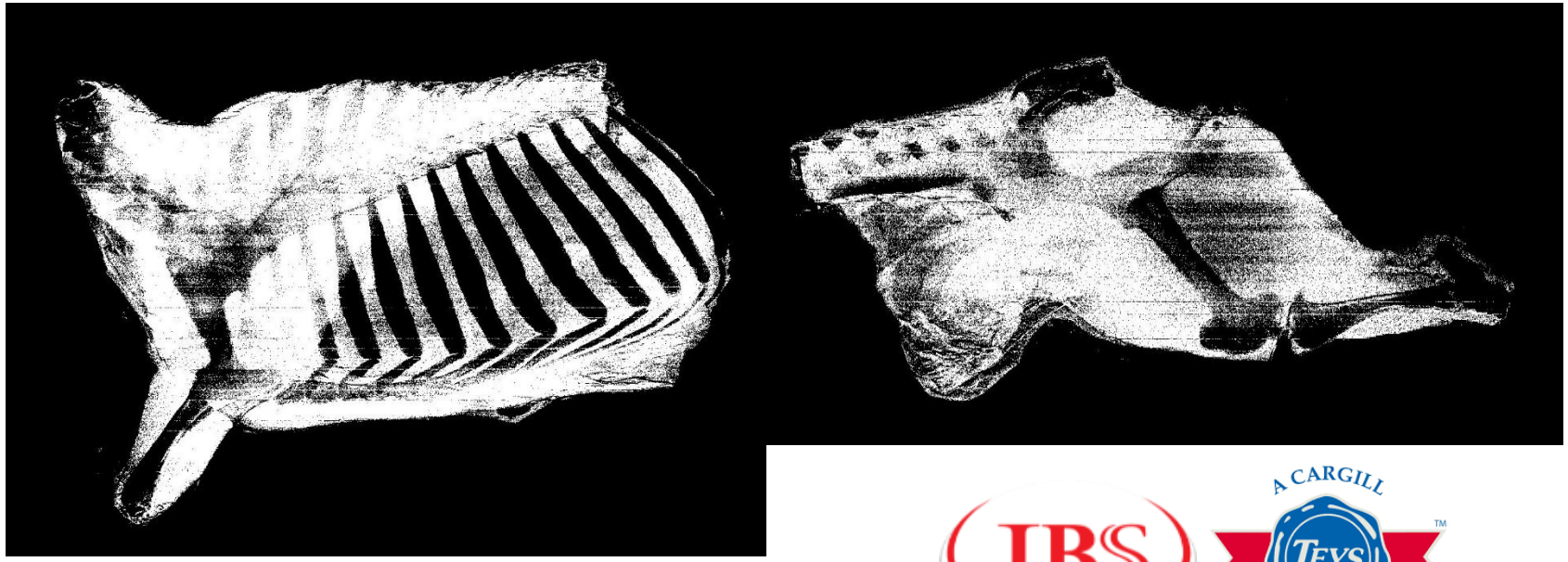
Beef DEXA



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JBS

A CARGILL JOINT VENTURE TEYS AUSTRALIA

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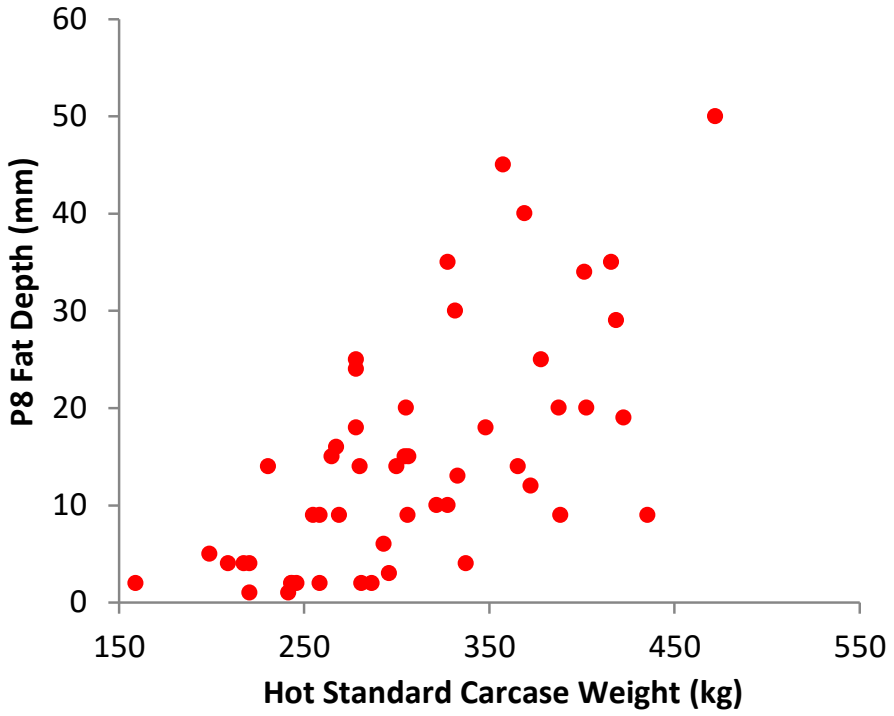
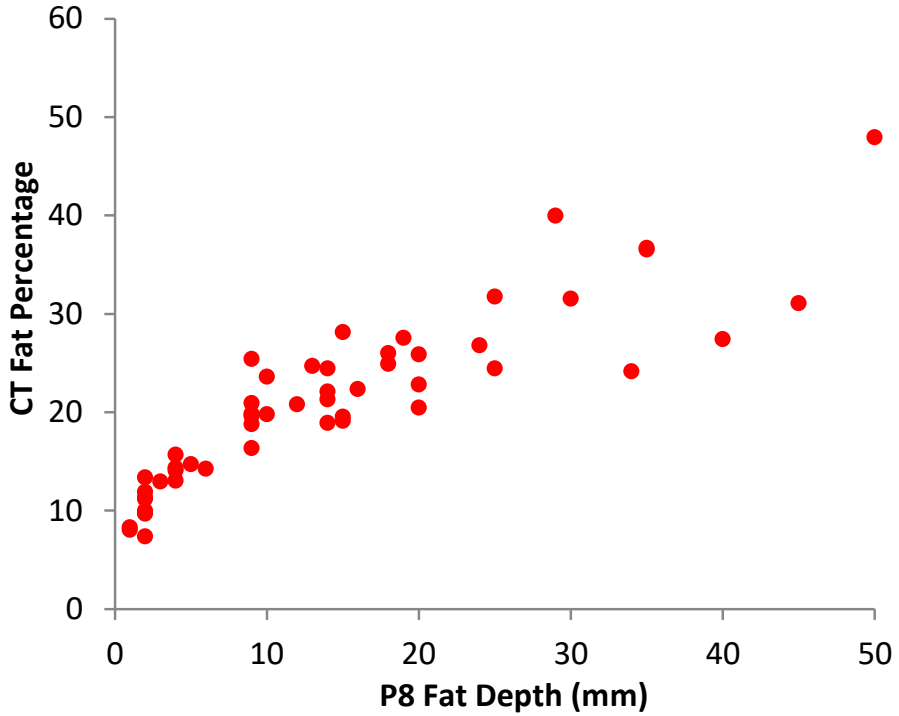
DEXA Results – Carcase Data



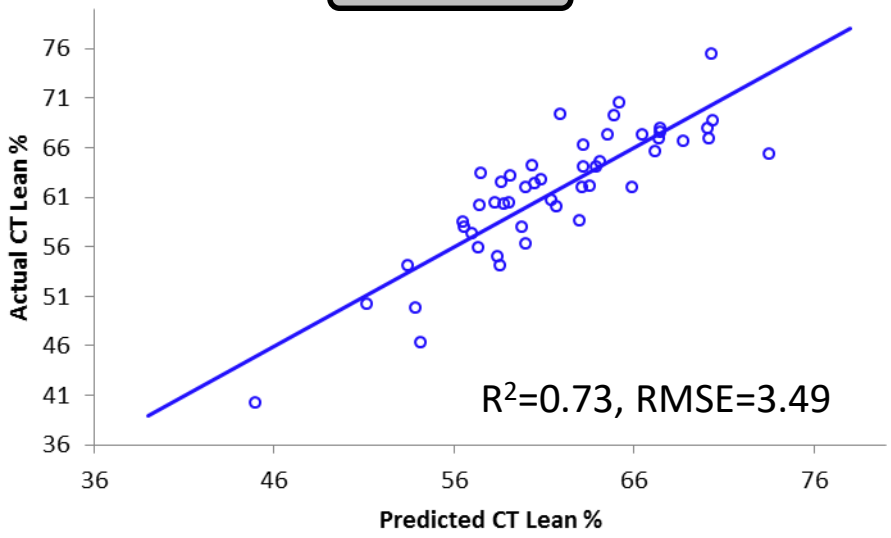


Australian Government
Department of Agriculture and Water Resources

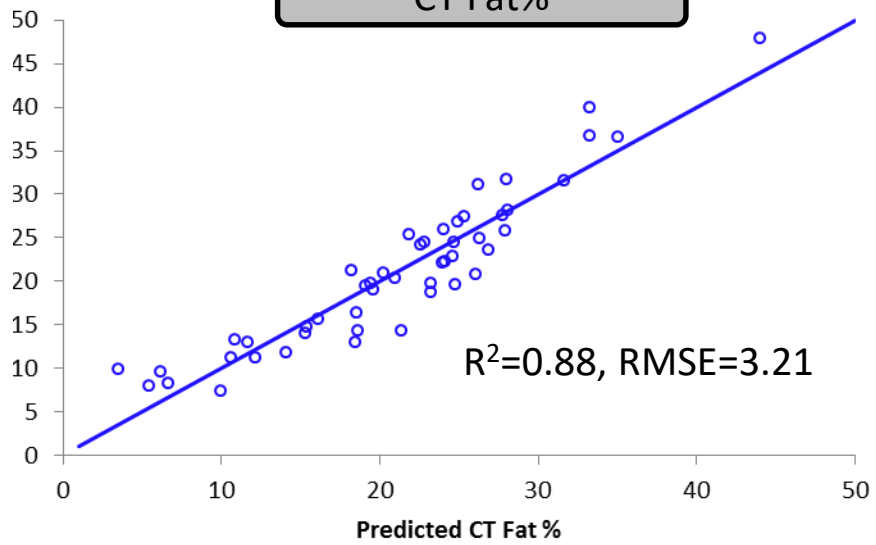
Rural Research and Development for Profit Programme
Keeping Australian farmers at the cutting edge

Predicting CT Composition in Beef

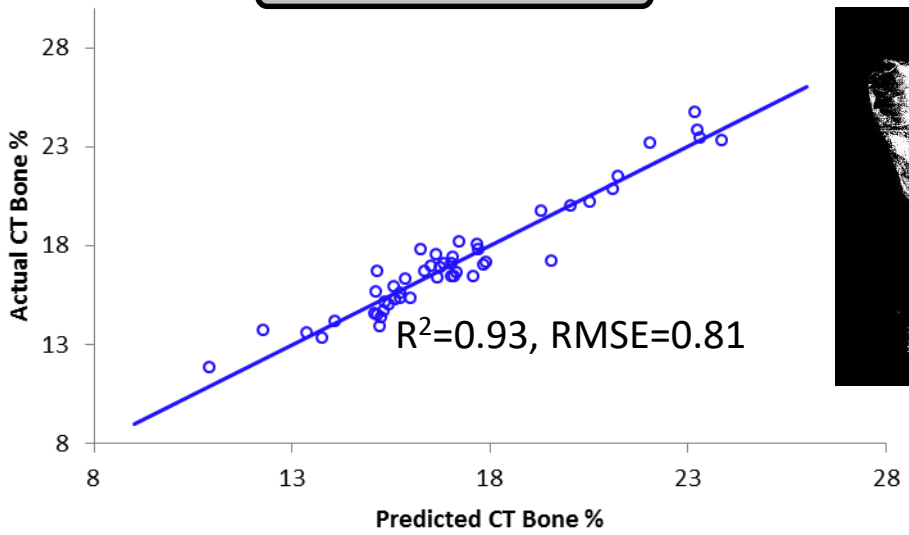
CT Lean%

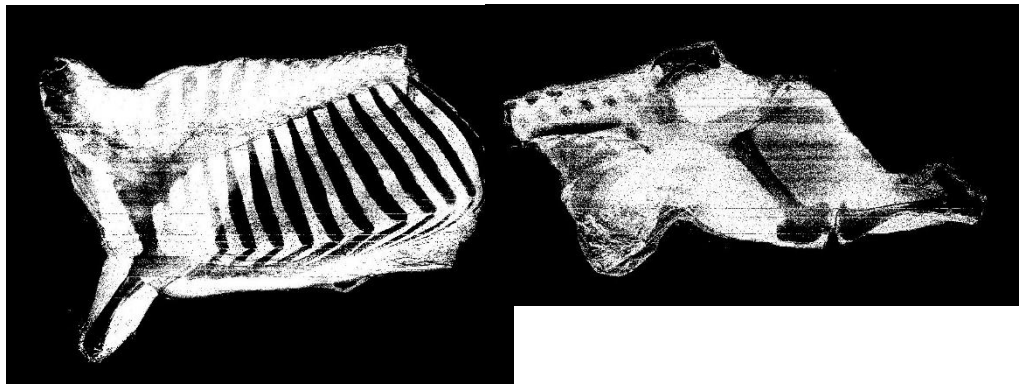


CT Fat%



CT Bone%





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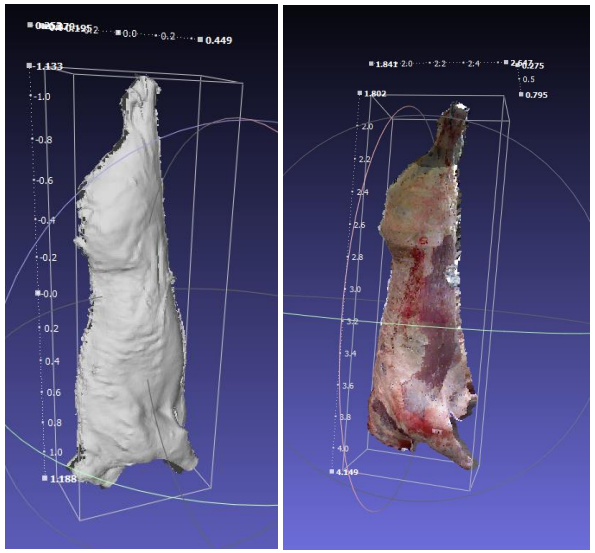
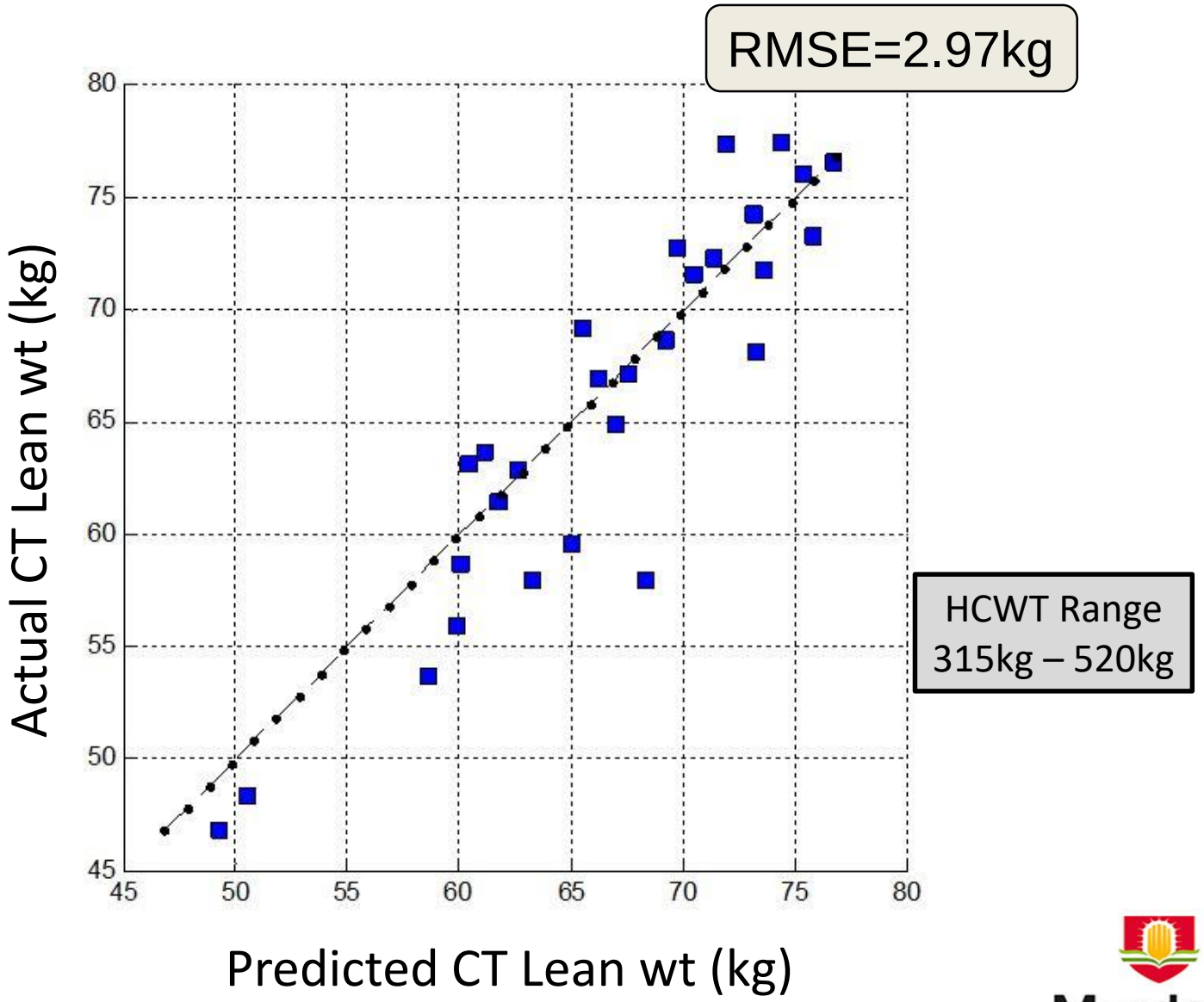
3D imaging for lean meat yield

Uses X-Box RGB cameras





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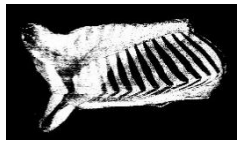
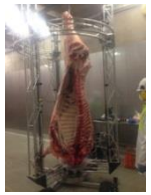
CT as calibrating standard

A common trait for all devices



DEXA

Predict



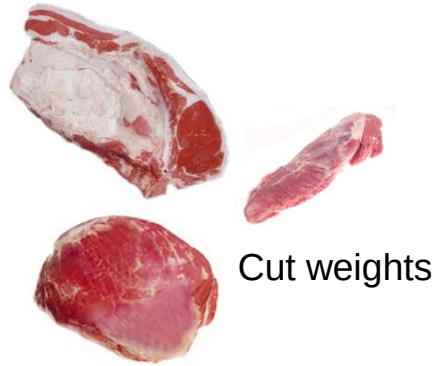
3D imaging

Predict

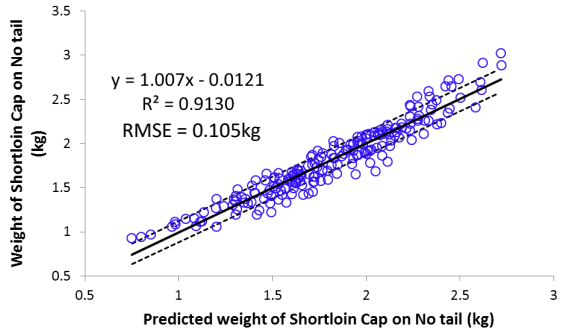
VIAScan

Predict

Validate



Cut weights



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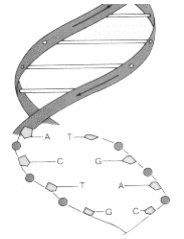
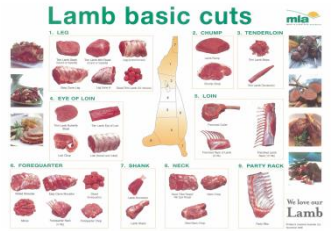
CT as the calibrating standard

- Supply chain information

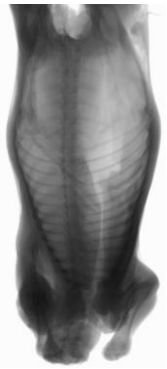




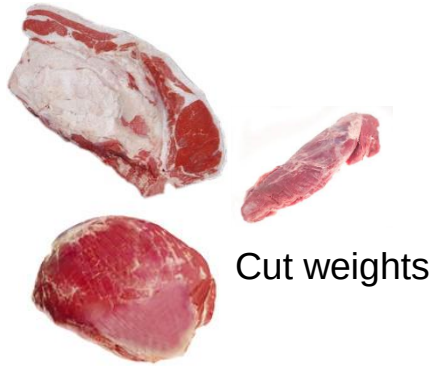
Conception | Live Animal | Carcase | Retail Cuts | Cooked Product

Value | **Value** | **Value** | **Value**

Wt of carcase
bone, muscle, fat



DEXA



Cut weights

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Conclusion

- Existing carcase measurement is poor
- ALMTech will accelerate development
  - Beef, lamb, pork industries
- Upgrade beef MSA inputs / new MSA for lambs
- EQ focused devices – NIR, Hyperspec, CT
- LMY measures also input to MSA

Supporting partners

Australian Government
Department of Agriculture and Water Resources

Statistical analysis

MSA model inputs

Sex
Hot carcass weight
Hump height
Feed type
Hormone Growth promotant status

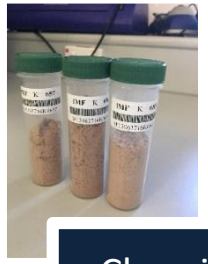
Subcutaneous rib fat depth

Ossification score

Ultimate pH

Covariates

Expert grader MSA marbling



Chemical IMF%

General Linear Models

Palatability scores (MQ4)

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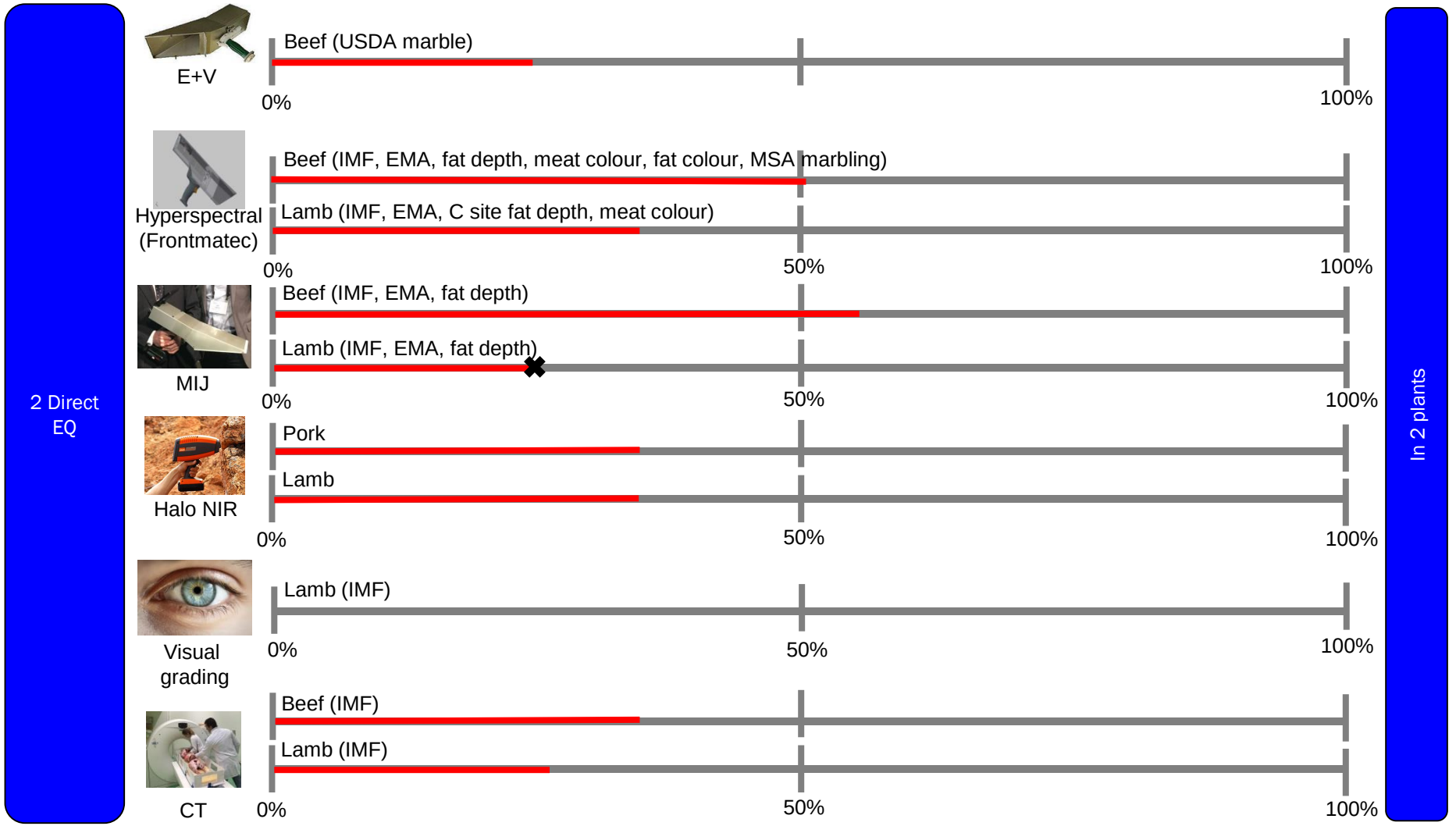
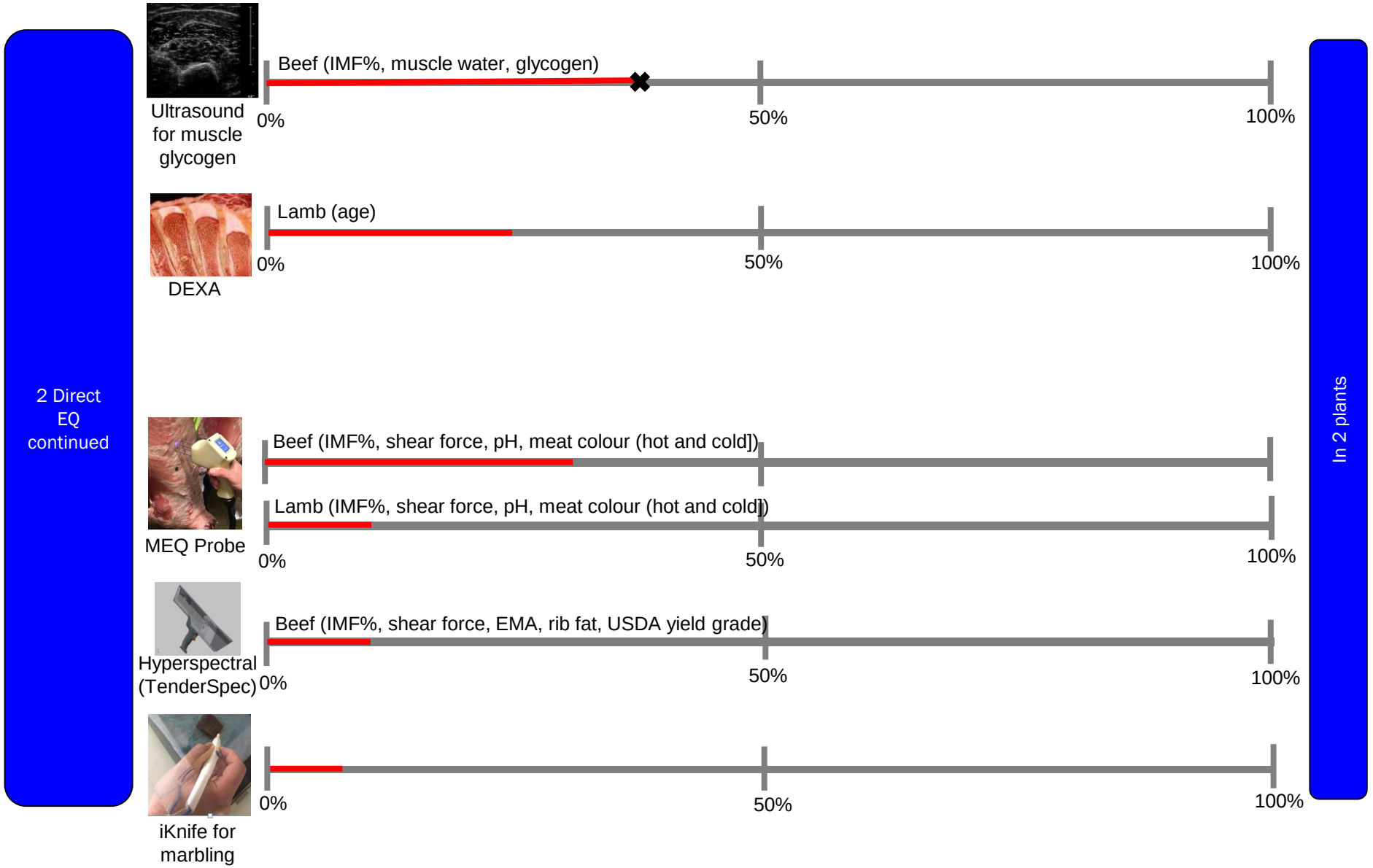
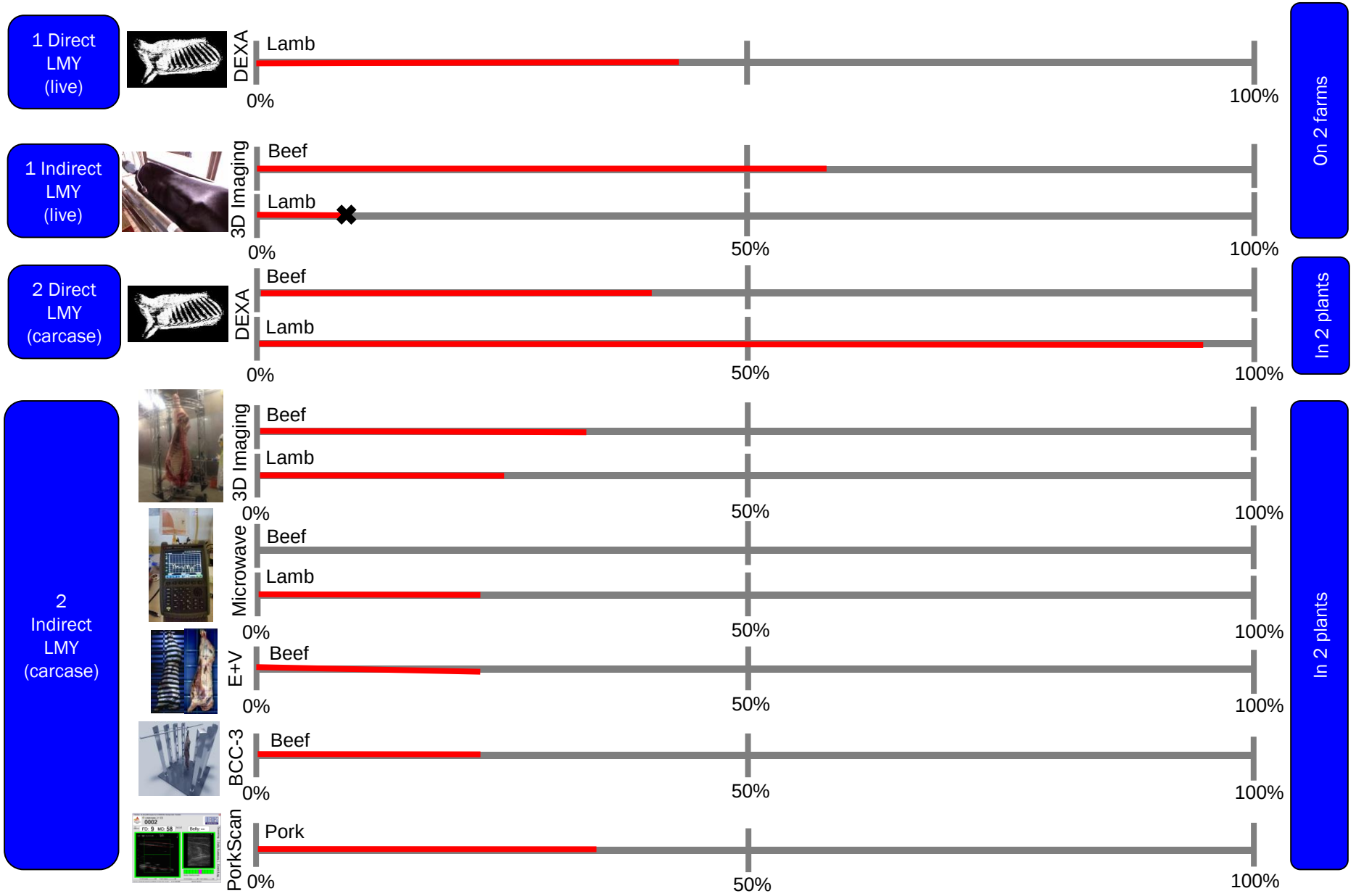
Timeline – EQ devices



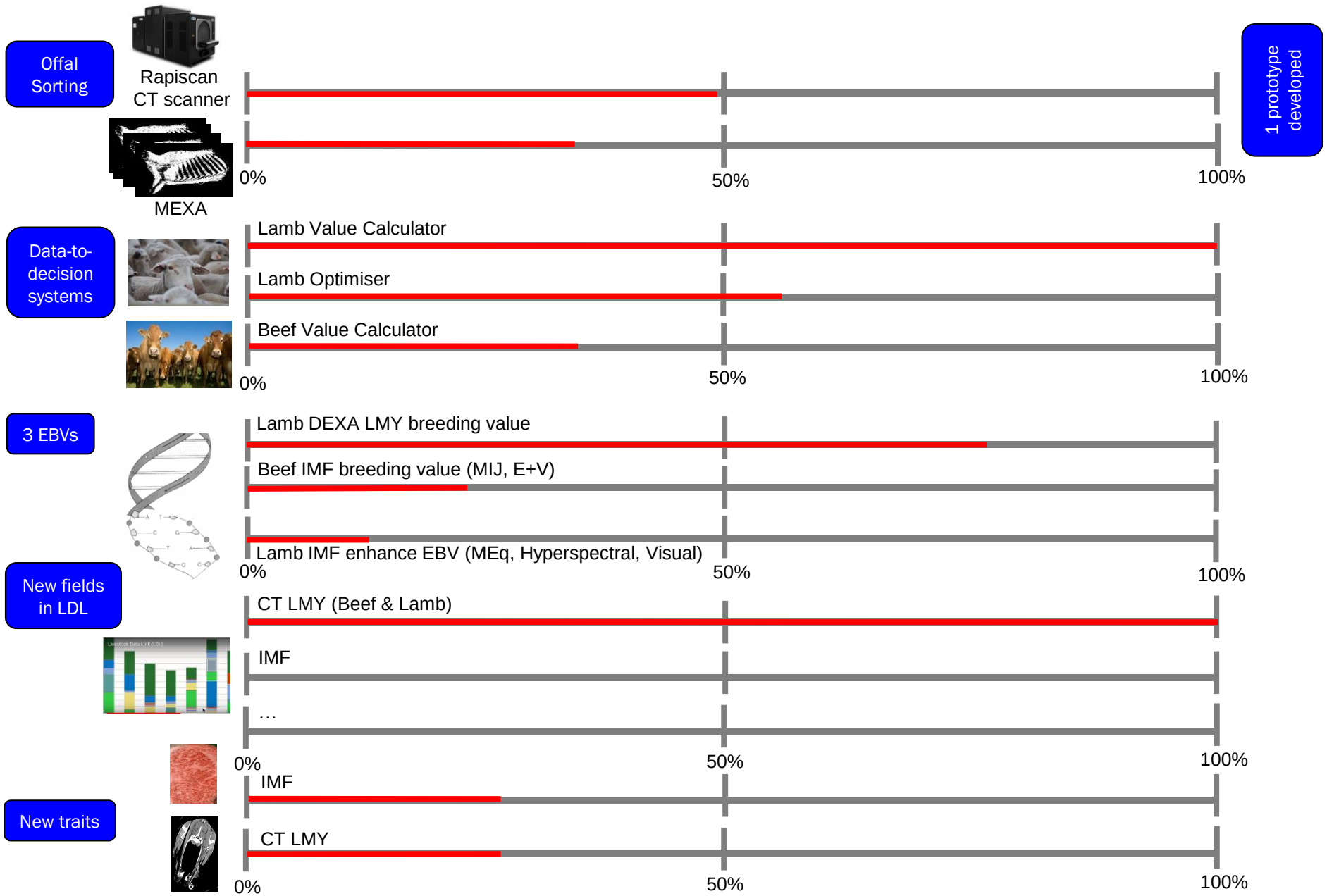
Timeline – EQ devices ctd



Timeline – LMY Devices



Timeline P3 – P5



Estimating cut weight using DEXA

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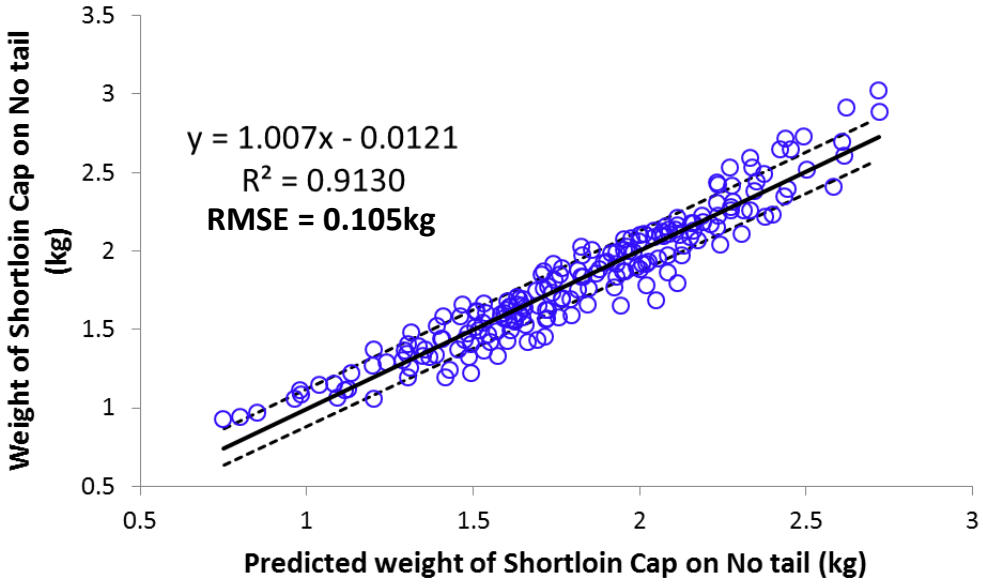
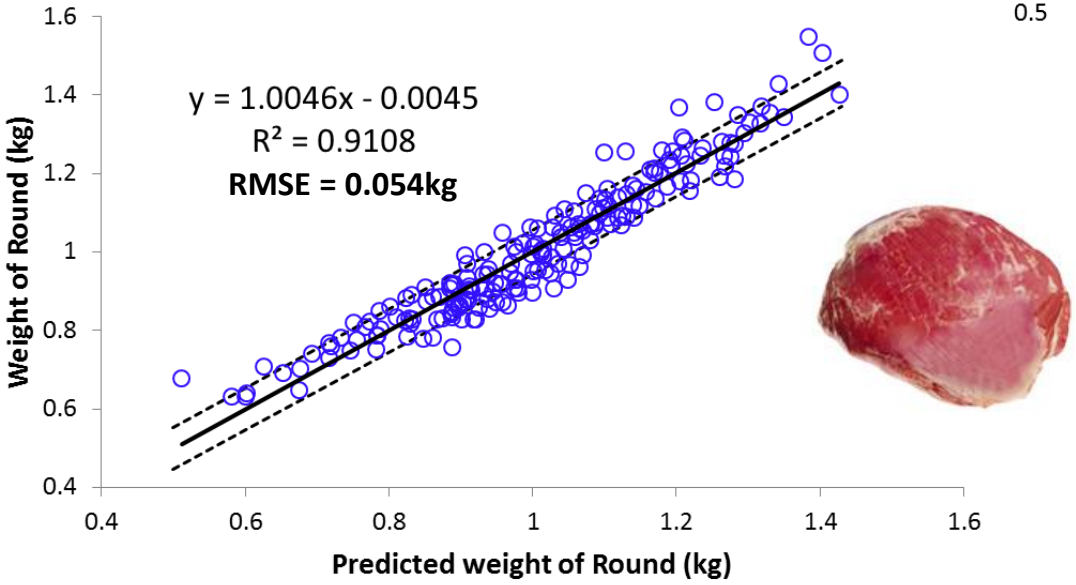
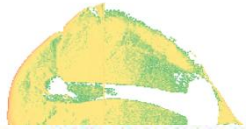
Predicting round & shortloin wt

using HCWT plus DEXAfat value





Carcase Calculator rework



Primal Weight Estimates

Total Retail Valu $221.54

Trade: Over the Hooks. X-Breed Av. GR: 14.1mm Av. HCW: 23 kg Shrinkage: 2.5 %

Carcase Gross Prof $35.55 16.0%

Back to Main Menu

	Weight Kg		Weight Kg		Weight Kg		Weight Kg
Forequarter 4 Rib		Square Cut Shoulder Wholesale		DEXA Lean Value = 52		Eye of Shoulder	0.349
						Bunelesz Shoulder	2.140
		Fore shank not tipped		Fore shank Tipped		Foreshank Trim	0.787
		Breast				Breast Trim	0.197
		Neck		Trimmed Neck		Neck Meat	0.325
Loin		Short Loin		DEXA Lean Value = 48	Short Loin No Tail		Eye of Shortloin 0.726
							Tenderloin Butt 0.165
		Rack (5 Rib) 75 mm tail		Rack Trimmed (6mm trim)	USA Rack Cap Off (5 Rib) Frenched 50mm		Eye of Rack 0.625
		Flap		Bunelesz Flap (untrimmed)			Trimmed Bunelesz Flap 5cl 1.461
Leg		Leg Chump Tipped (6mm		DEXA Lean Value = 59	Bunelesz Leg Chump on Shank Off		Topside 1.254
							Round 0.915
							Silverside 0.897
							Rump 0.524
							Butt Tenderloin 0.119
		Total Lean	0.979		Hind Shank B/I		Hind Shank B/O 0.687

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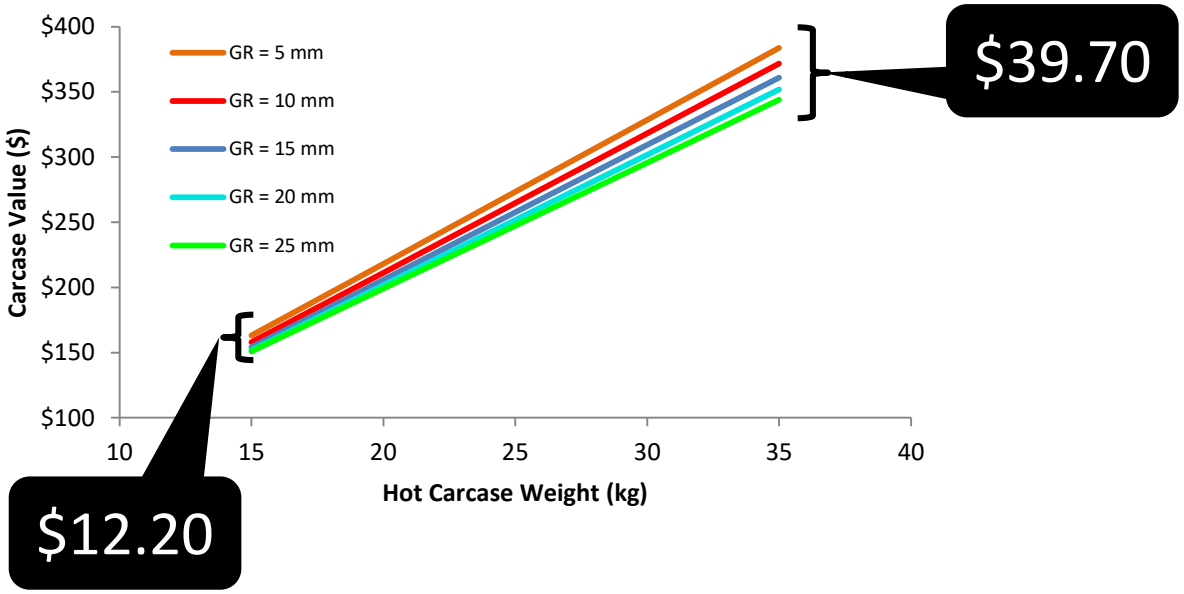
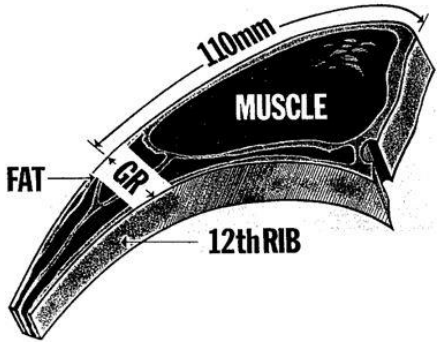
What does extra precision mean for the carcase calculator?





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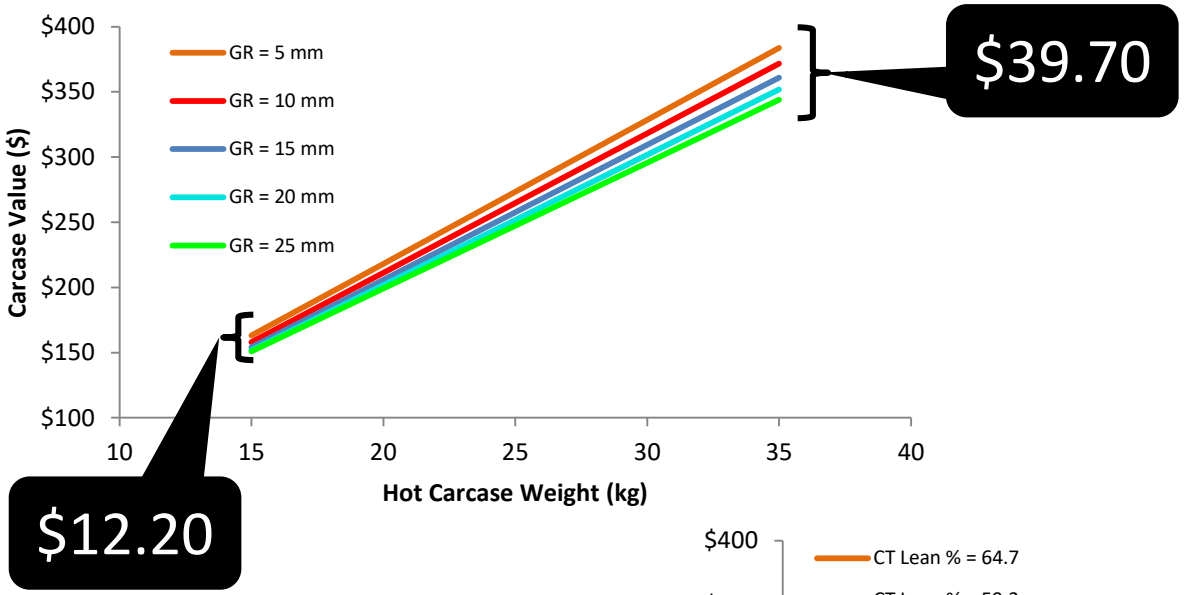

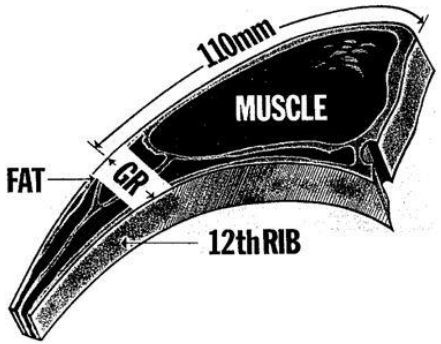

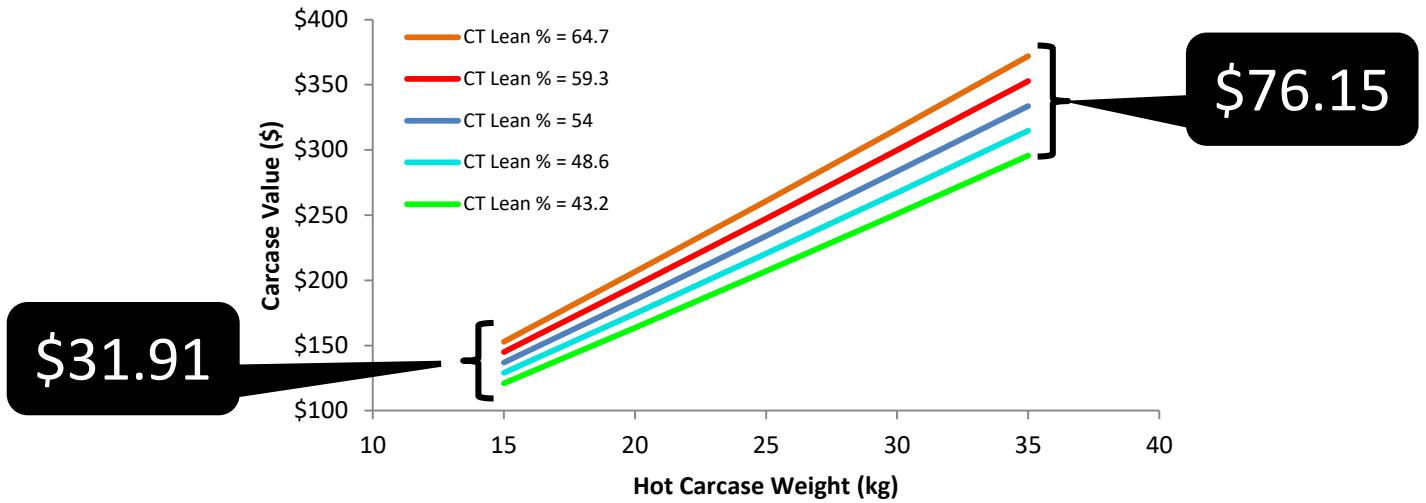

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Optimise carcase usage

Wt & DEXA & EQ

Bone out cost

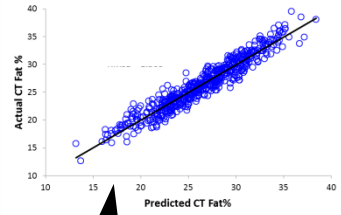
Cut Retail Values

Grid Ref - Week: 7

Valid For Kills: 24/2/14-28/2/14

XB Lambs													
Grade	Fat mm	Dent	-14	14.1-16.0	16.1-18.0	18.1-20.0	20.1-22.0	22.1-24.0	24.1-26.0	26.1-28.0	28.1-30.0	30.1-32.0	32+
S1	0 - 5	0	$1.30	$2.10	$3.30	$4.70	$4.70	$4.70	$4.70	$4.70	$4.70	$4.70	$4.20
S2	6 - 10	0	$1.60	$2.40	$3.60	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$4.50
S3	11 - 15	0	$1.60	$2.40	$3.60	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$4.50
S4	15 - 20	0	$1.60	$2.40	$3.60	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$4.50
S5	20 +	0	$1.60	$2.40	$3.60	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$5.00	$4.50

Cut wt by retail value



Characterise carcase grades

Adj for cut market volume

Optimised profit

Carcase descisions to optimise profit

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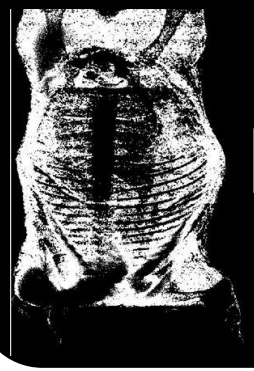
Industry led initiative



MEAT & LIVESTOCK AUSTRALIA

Project 150

DEXA into 90 beef/lamb abattoirs

SHEEPMEAT COUNCIL OF AUSTRALIA

CATTLE COUNCIL OF AUSTRALIA

ALFA AUSTRALIAN LOT FEEDERS' ASSOCIATION

Producer Rep.s

AMIC Australian Meat Industry Council

AMPC

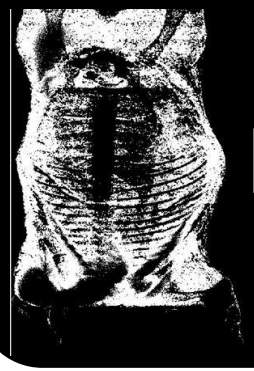
Processor Rep.s

SHEEP CRC

Industry led initiative

Auditor

Regulator



Project 150

DEXA into 90 beef/lamb abattoirs

Industry calibration working group

Objective Measurement Taskforce

Producer Rep.s

Processor Rep.s

Auditing

DEXA

Murdoch UNIVERSITY

Validation/Auditing

Full system Calibration

Sets air attenuation at **4095**

Acquire images

Low energy

High energy

Clearfield

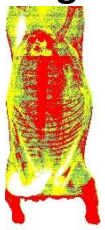
Air_{Atten}

Calc. R values

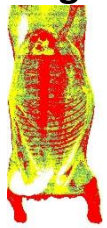
$$R = \frac{\ln(I_{Low}/Air_{Atten})}{\ln(I_{High}/Air_{Atten})}$$

Adjust for Synthetic Phantom

Calibrated Image

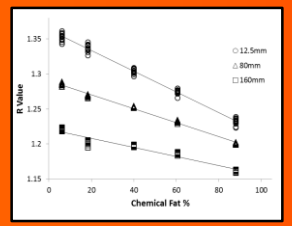


Calibrated Image

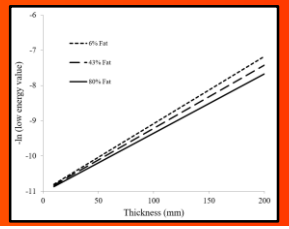


Threshold bone

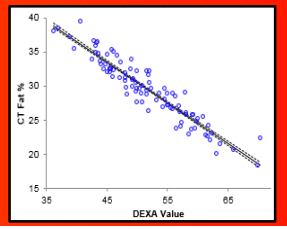
Convert to Tissue%

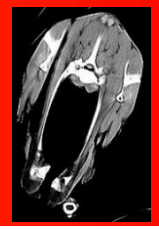


Wt'd pixel depth



Convert to CT lean, fat, bone





Company Specific Algorithm

Murdoch UNIVERSITY

Validation/Auditing

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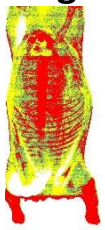


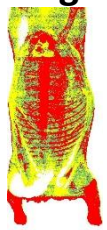
Calibration point

AUS-MEAT Limited Auditor

Synthetic Phantom

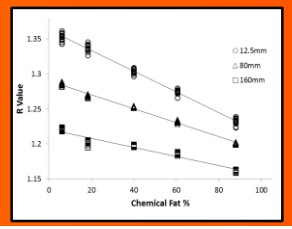
Routine auditing ensures calibrated image

Calibrated Image

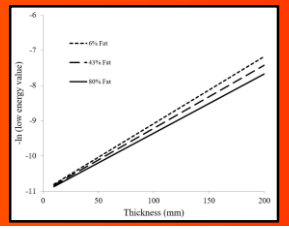


Threshold bone

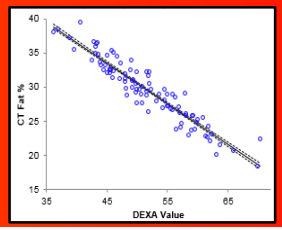
Convert to Tissue%

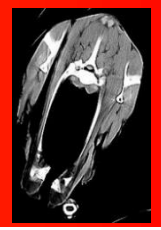


Wt'd pixel depth



Convert to CT lean, fat, bone





Company Specific Algorithm

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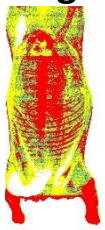
Calibrated Image

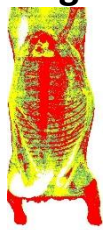


CT validation required when:

1. New DEXA hardware
2. Altered company algorithm
3. Disputes

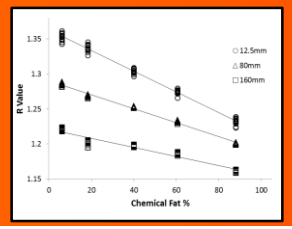
Calibration point

Calibrated Image

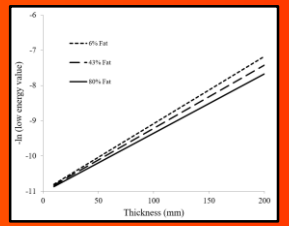


Threshold bone

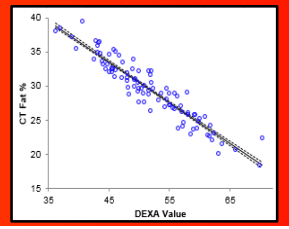
Convert to Tissue%

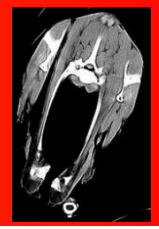


Wt'd pixel depth



Convert to CT lean, fat, bone





Company Specific Algorithm

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CT as calibrating standard

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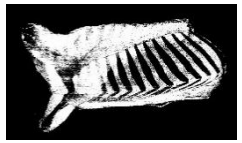
CT as calibrating standard

A common trait for all devices



DEXA

Predict

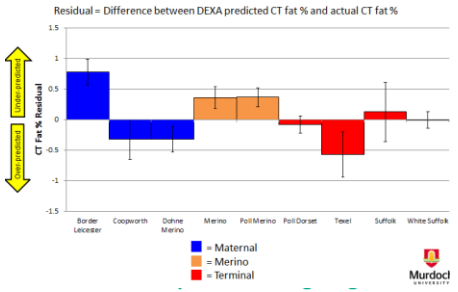
3D imaging

Predict

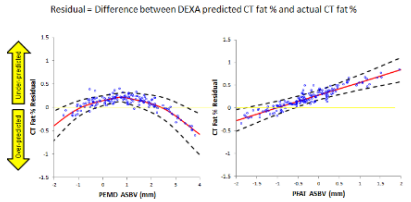
VIAScan

Predict

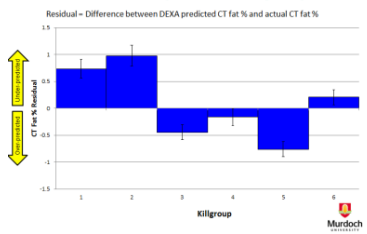
Validate



DEXA accuracy across divergent genetics



DEXA accuracy across kill groups



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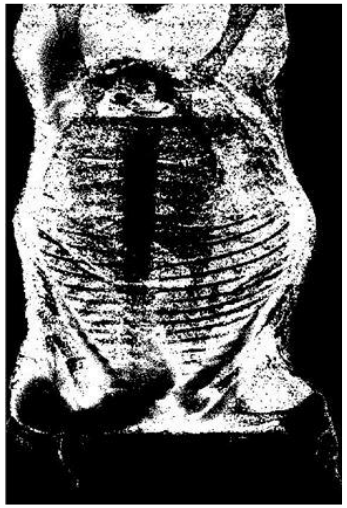
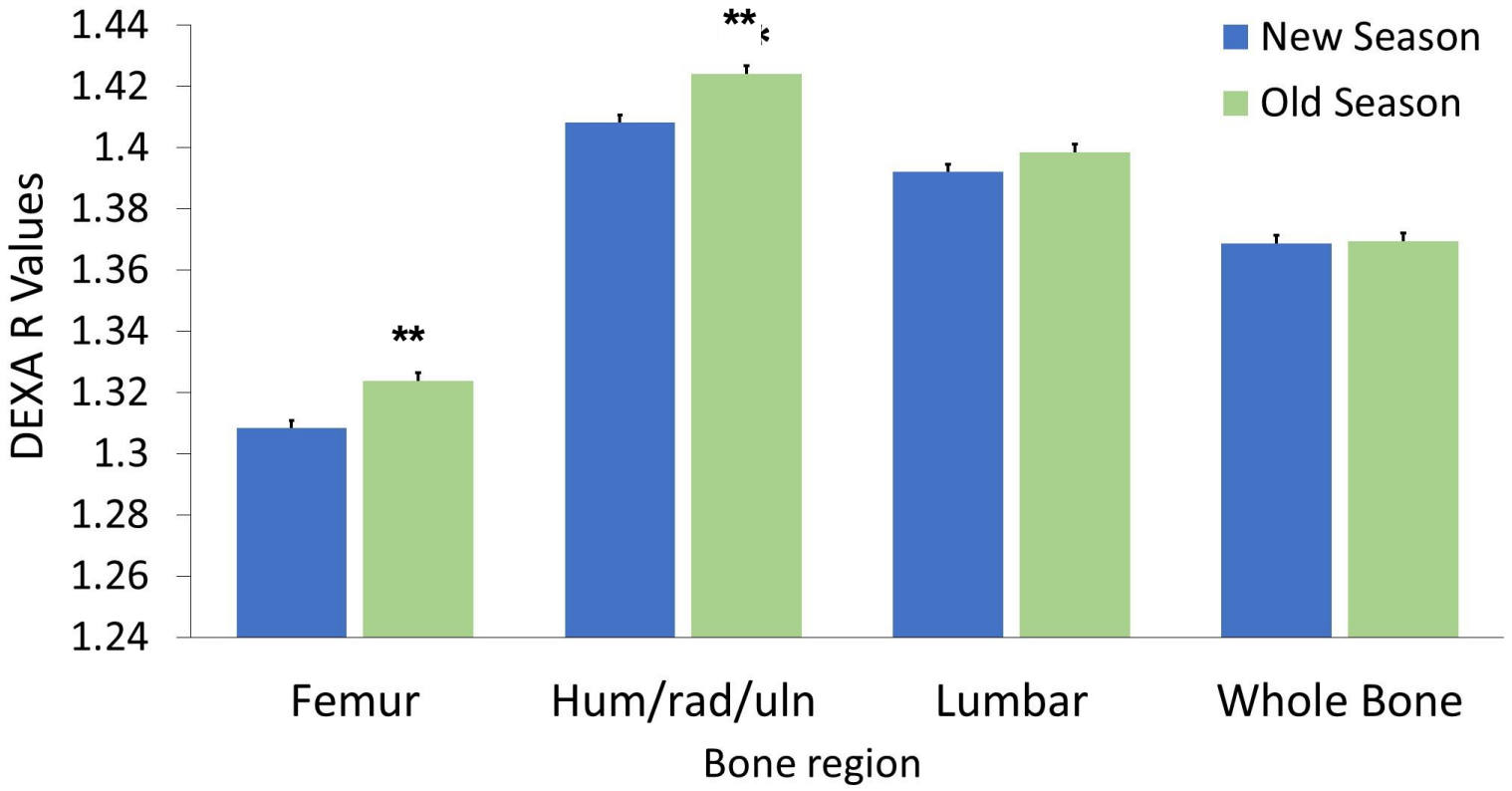
DEXA prediction of age/maturity

DEXA to determine age





Payne et al. (2018). ICOMST pp

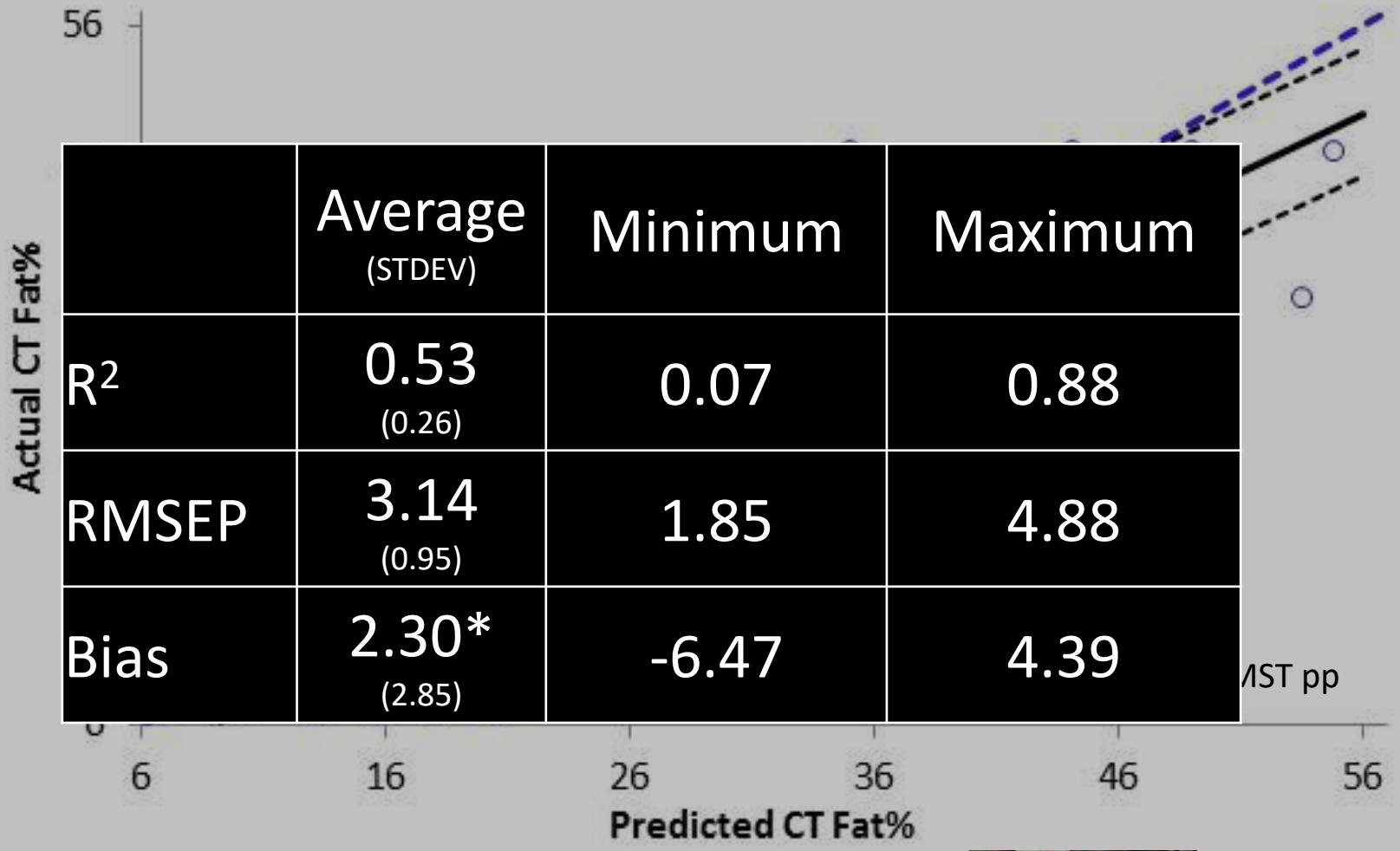
DEXA to determine age

	R-Value
Element	R
Hydrogen	1.0891
Carbon	1.2199
Nitrogen	1.3043
Oxygen	1.4167
Sodium	1.9045
Magnesium	2.0963
Phosphorus	2.7418
Sulfur	2.918
Chlorine	3.151
Potassium	3.4536
Calcium	3.5422

Rib Fat and HSCW

(6 data sets)

	Average (STDEV)	Minimum	Maximum
R^2	0.53 (0.26)	0.07	0.88
RMSEP	3.14 (0.95)	1.85	4.88
Bias	2.30* (2.85)	-6.47	4.39



*Average of the absolute values of Bias

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Near Infra-red (NIR) probes

NIR preliminary results - Topsides (hot)

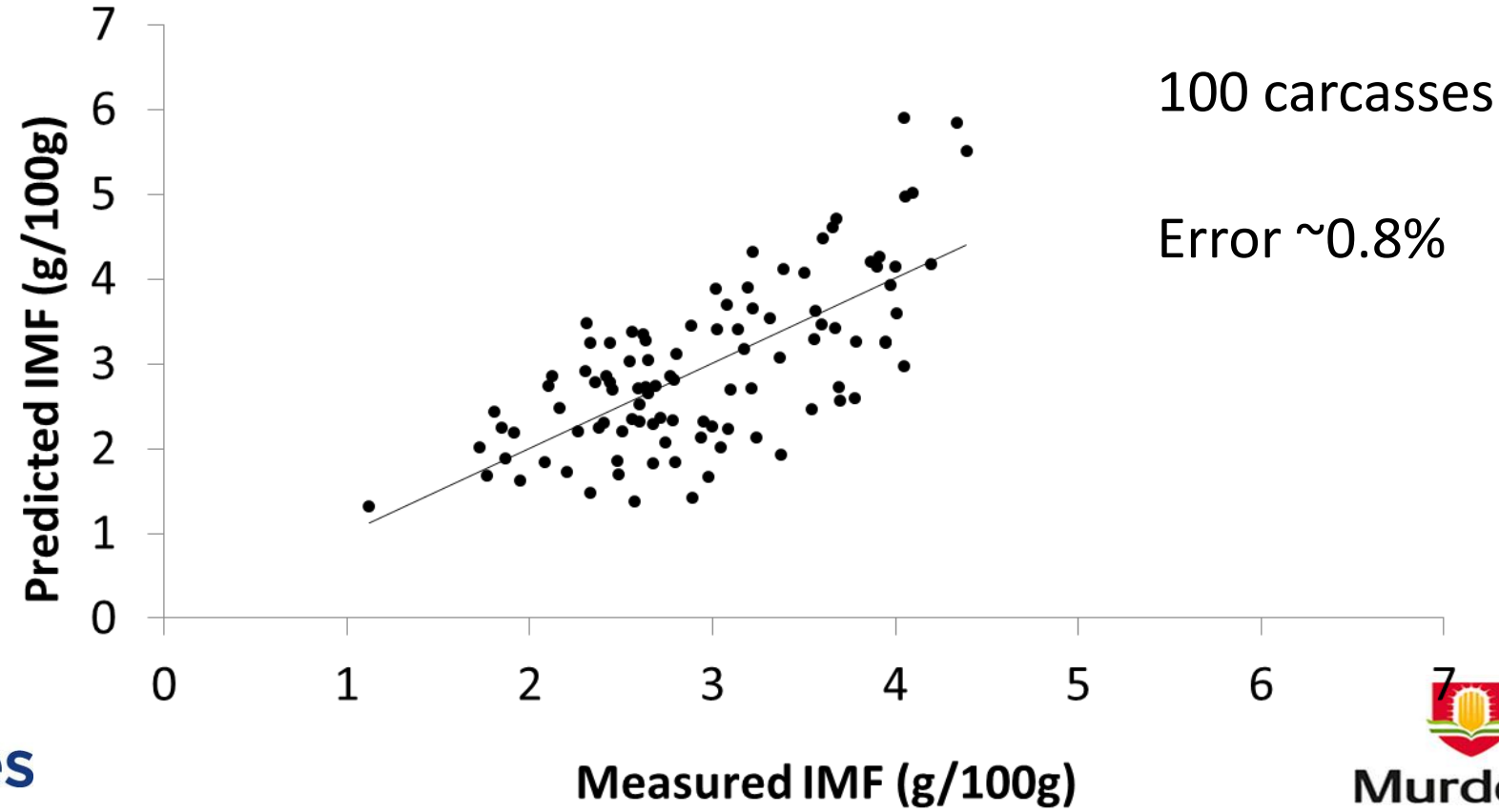
NSW GOVERNMENT Department of Primary Industries

Murdoch UNIVERSITY

Near Infra-red (NIR) probes

NIR preliminary results - Topsides (hot)

Fowler and Hopkins, 2018



100 carcasses

Error ~0.8%

NSW GOVERNMENT Department of Primary Industries

Murdoch UNIVERSITY

Near Infra-red (NIR) probes

NIR preliminary results - Topsides (hot)

Fowler and Hopkins, 2018

Proof of concept ✓

ID primary manufacturer

00 carcasses

rror ~0.8%

6 7

Measured IMF (g/100g)

NSW GOVERNMENT | Dep Primary Industries

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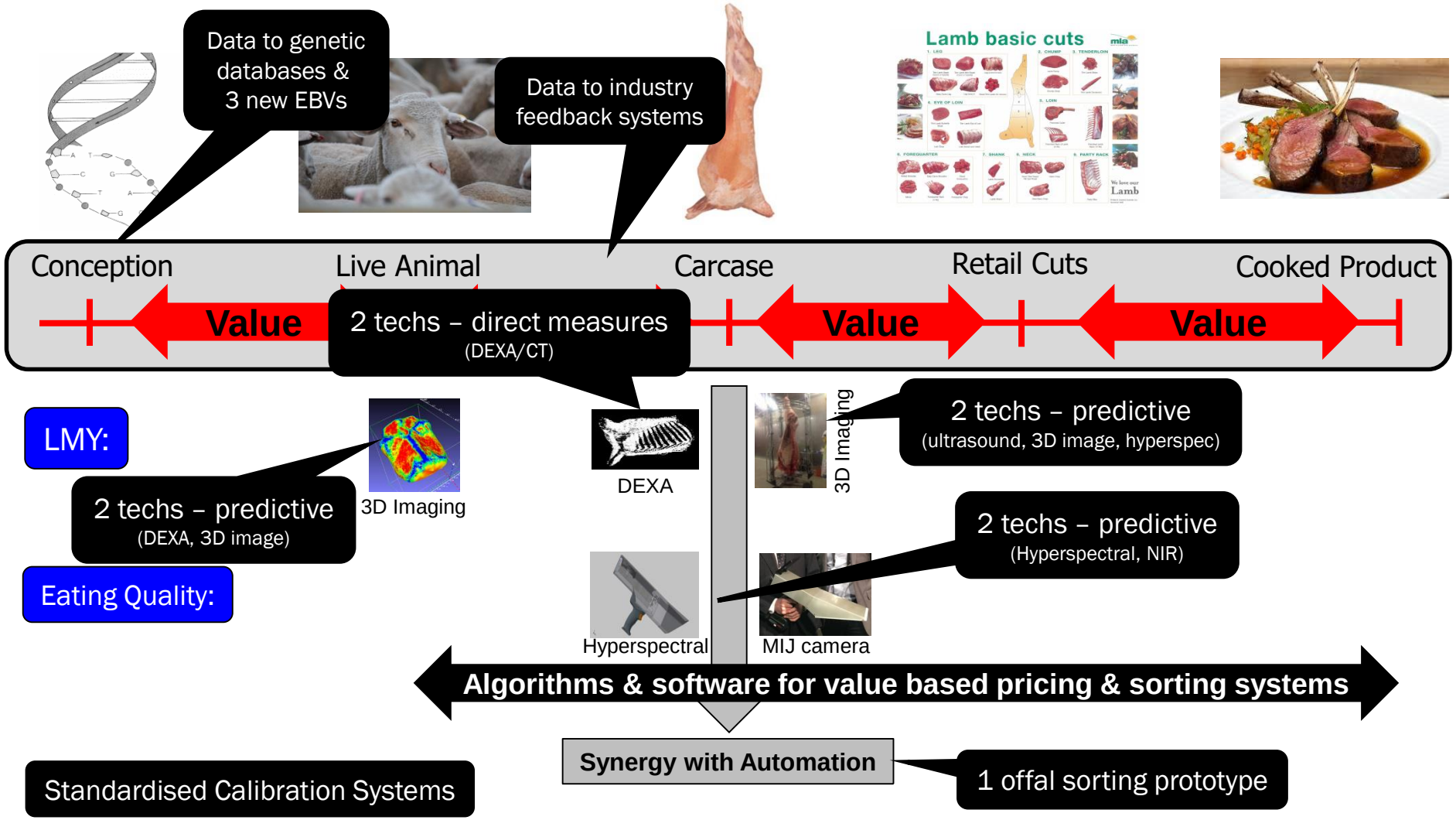
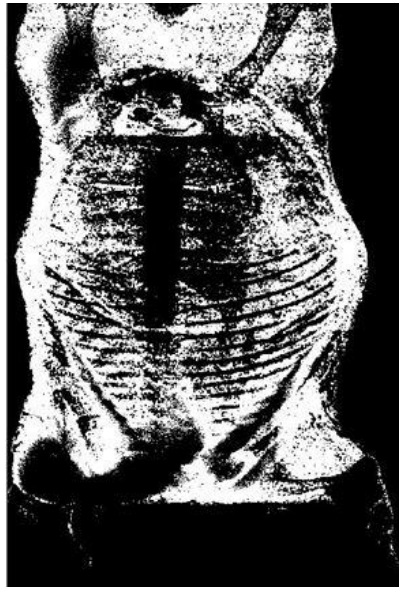
Deliverables!

Predict quality and amount of final product



DEXA Bone analysis



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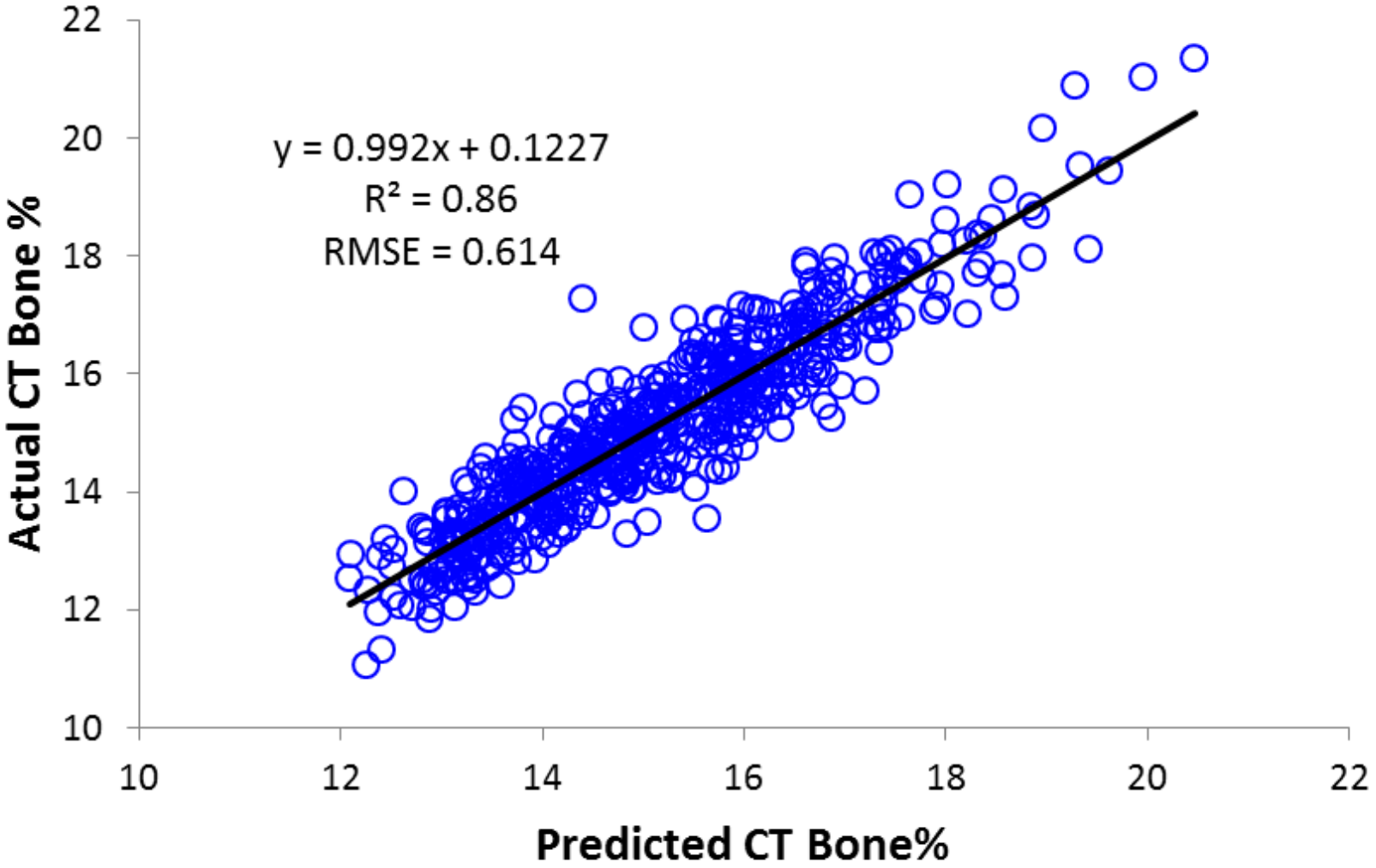
DEXA predicting CT Bone%



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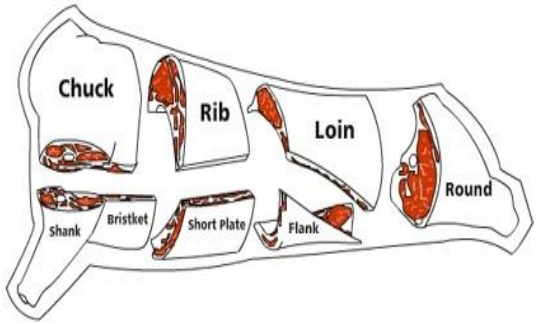
Why CT as the “Gold Standard”?

Traits for calibration

1. Saleable meat yield
   - captures valuable fat & bone
   - cutting specifications differ
   - operator errors
   - slow and expensive (labour)



2. Dissectible LMY
   - less influence of cutting specifications
   - operator errors
   - slow and expensive (destructive

3. CT
   - virtual dissection, thus repeatable
   - no operator error
   - Fast, cheaper (on-sell product)

4. Chemical composition CT
   - no operator error, but difficult to prove repeatability
   - very slow and expensive (destructive)
   - indirect measure of meat yield (consumers don't eat it)

Composition study

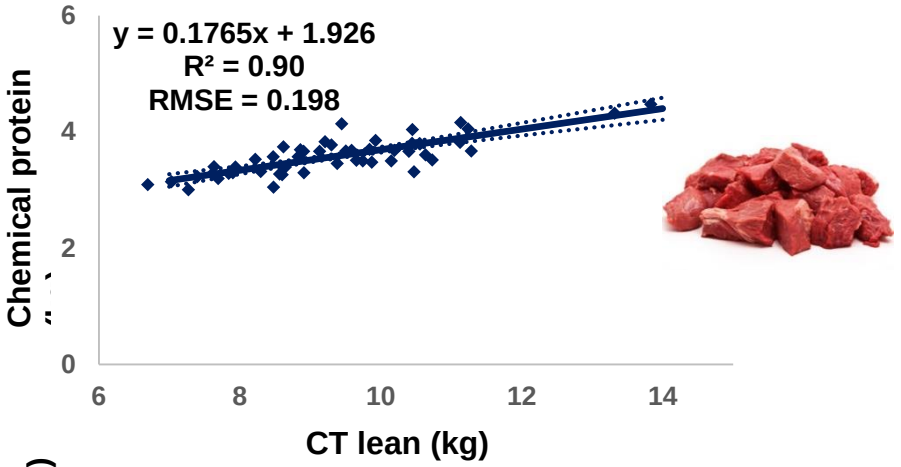
- 50 Merino lambs feedlotted
- Slaughtered at WAMMCO WA
- Carcasses CT scanned at Murdoch
- Trucked to Adelaide for full bone out
- Samples to Murdoch for Chemical analysis

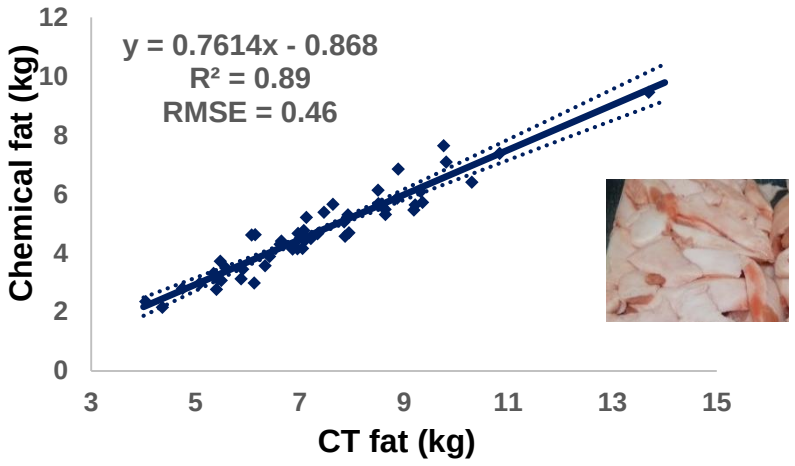
Composition study

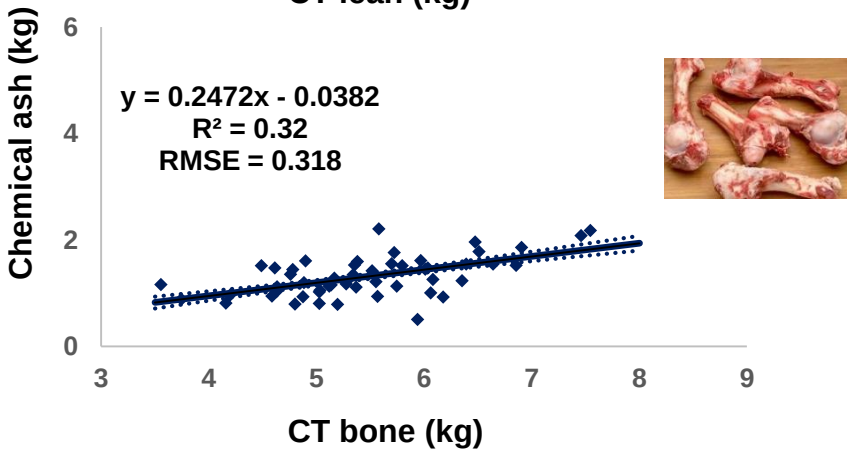
Chemical

vs

CT carcase







Mobile CT Scanner

Needs to be mobile!

1. Prove synthetic phantoms
2. Industry proof of concept data sets
3. Site comparisons
4. Genetic diversity
5. Spot check trouble spots
6. New technologies
7. New boneouts
8. $$$ Keep product in supply chain

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Influence of abattoir factors?

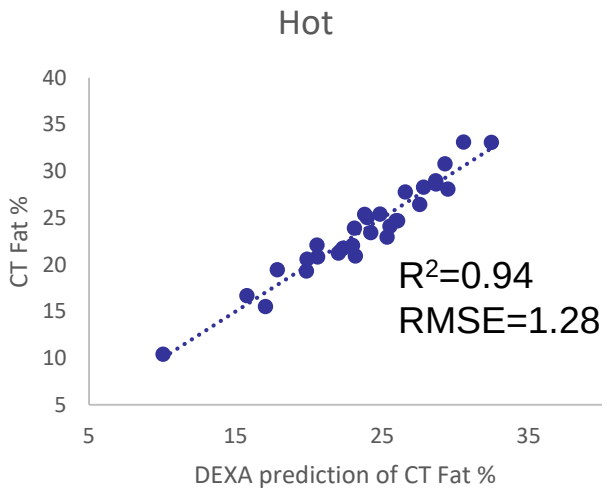
(See FAIM paper)

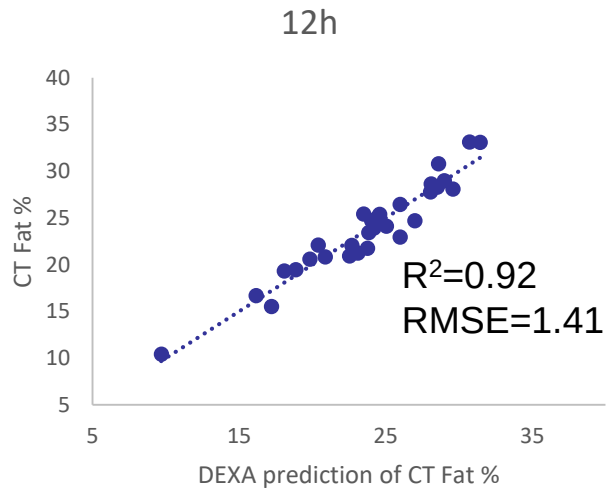
- Spray chilling ✗
- Carcase orientation (180 degree turn) ✓
- Carcase temperature ✗
- Time post mortem ✗ (no Δ in precision)

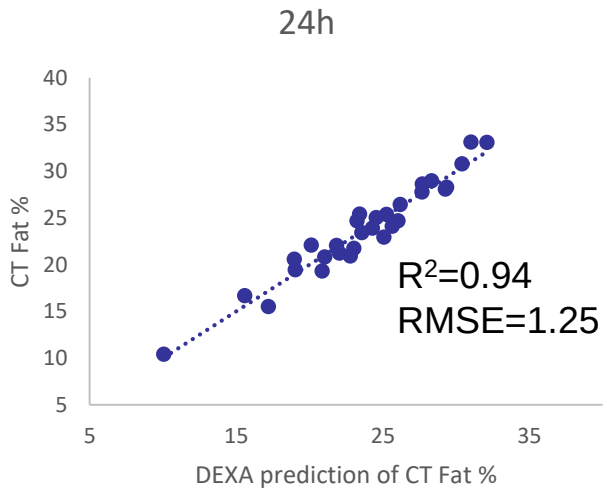
Connaughton et al. (2018). ICOMST pp

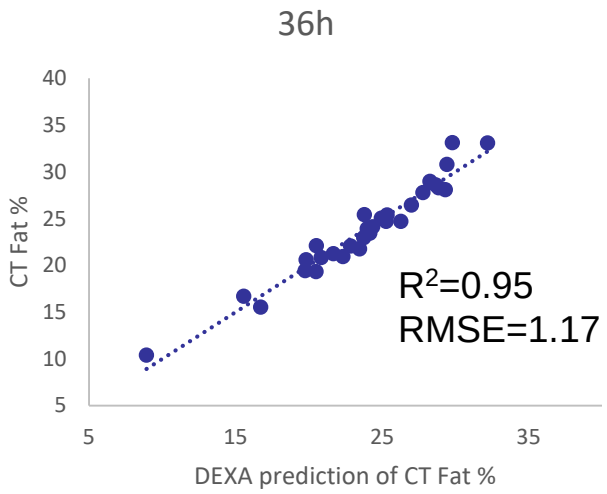
DEXA repeatability

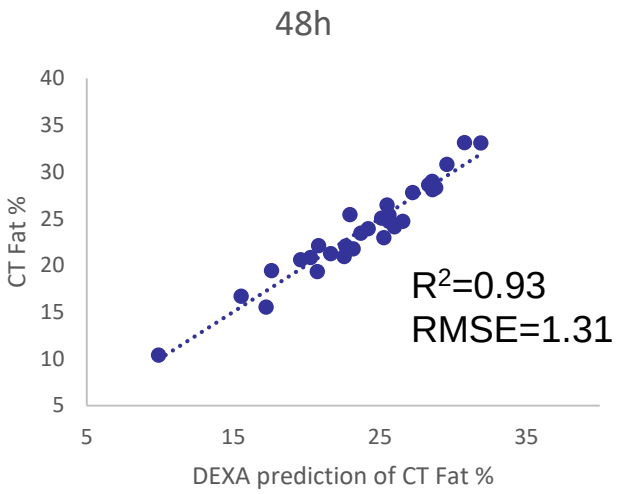
Carcases over time (72h)

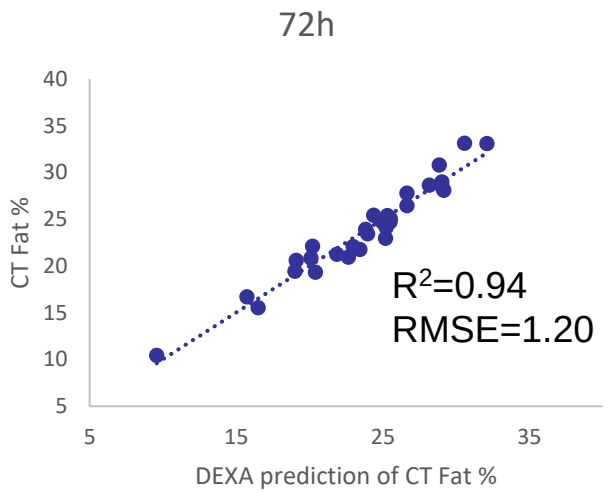












Variability in these traits has a cost!

- Lean meat yield
  - More fat trimmed (labour/waste)
  - Inconsistent retail cut size
- Eating quality
  - Consumer confidence

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This you can't see!

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Variability in these traits has a cost!

- Variability can be managed with…
  - carcase sorting (prior to fabrication)
  - cut sorting for cut size and EQ, assuming its traceable…

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If we can predict it!

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