PLT Bunk Management
29 July 2025

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PRECISION LIVESTOCK TECHNOLOGIES

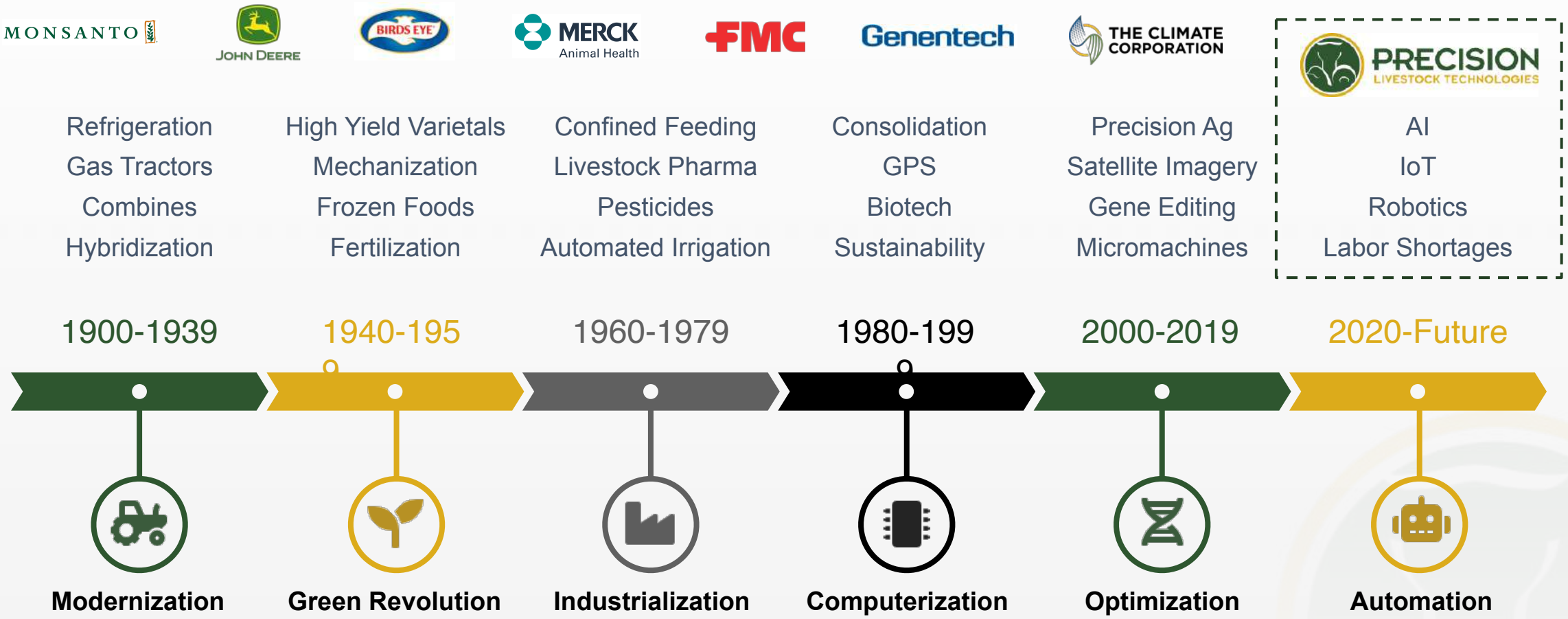
Actionable intelligence to optimize livestock operations

Feeding

Performance

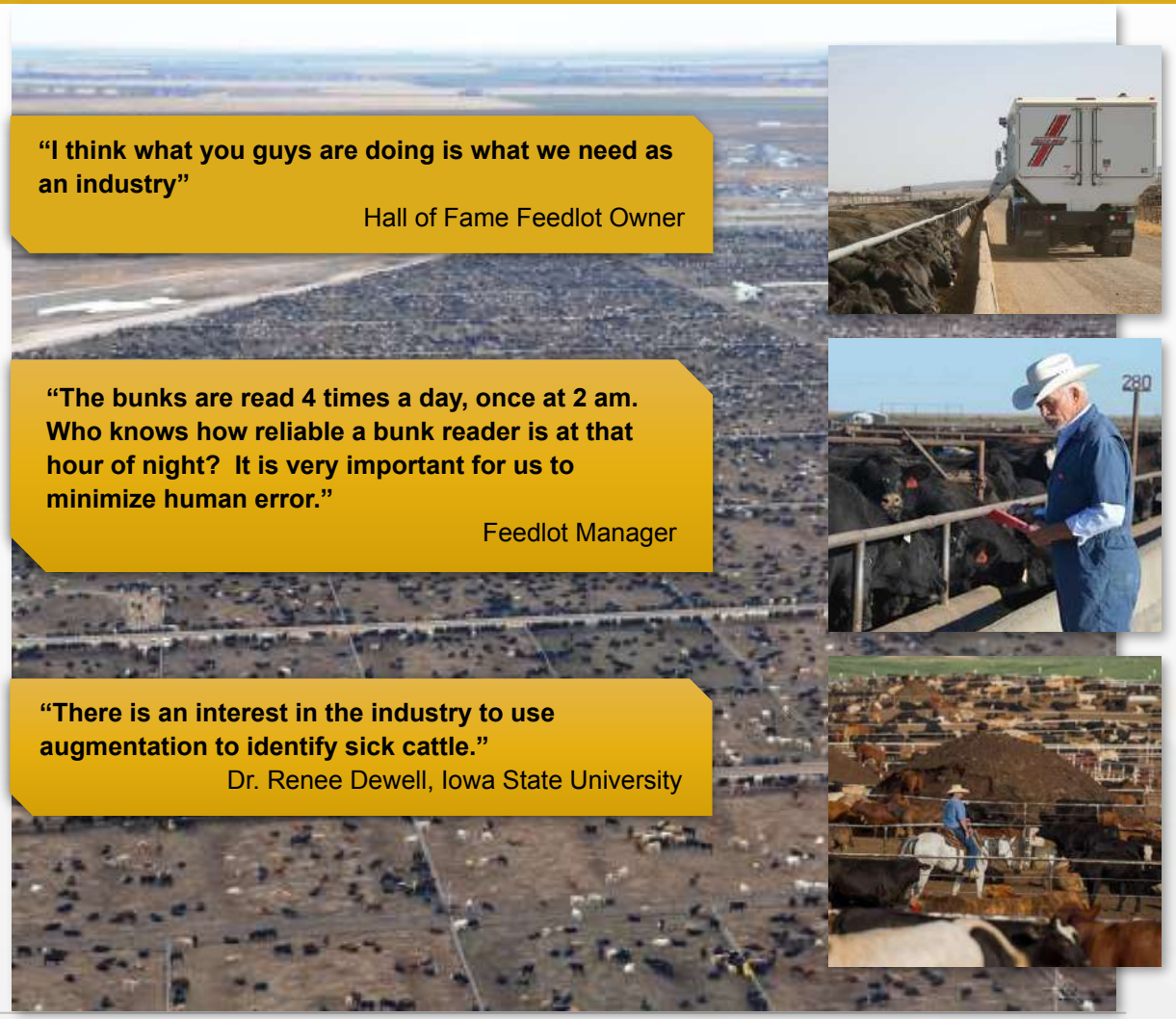
Health

Automation – the Next Wave of AgTech Innovation



A Practical Way to Increase Performance

- **Limitations of Current Methods**
  - Scarce skilled labor, difficult to train and retain
  - Observations vs. objective data
  - Limited ability to reduce volatility and increase performance
- **Powering Improvement with Automation**
  - 24-hour bunk reading
  - Reliable metric on feeding behavior
  - AI-powered feeding recommendations
  - Automated nightly import from management systems



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An Integrated Machine Vision Platform

Administration & Data Integrity

Image Acquisition

Camera & illumination
Control system
Solar power system

Image Data Lake

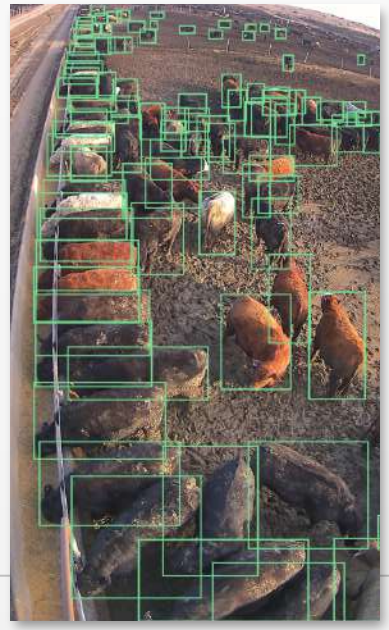
Product Generation

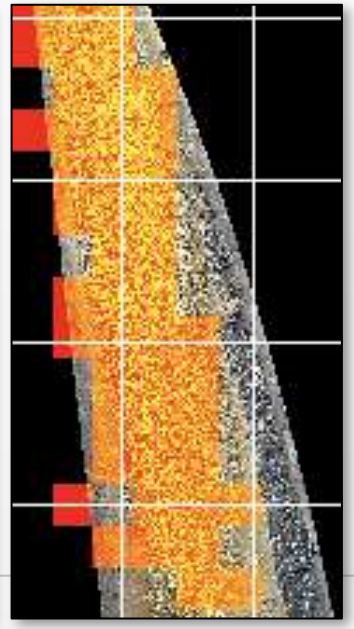
Processing pipeline
Algorithms
System administration

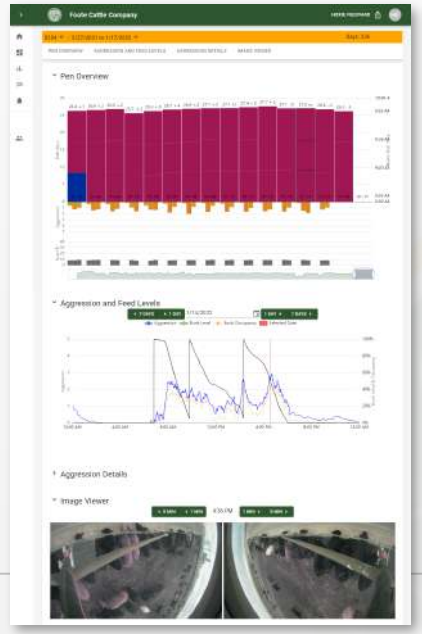
Data Warehouse

Product Delivery

Web interface
Pre-configured reports
User-defined alerts







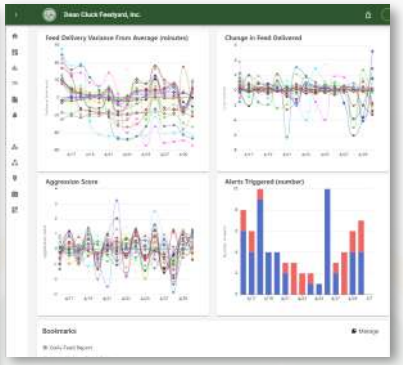


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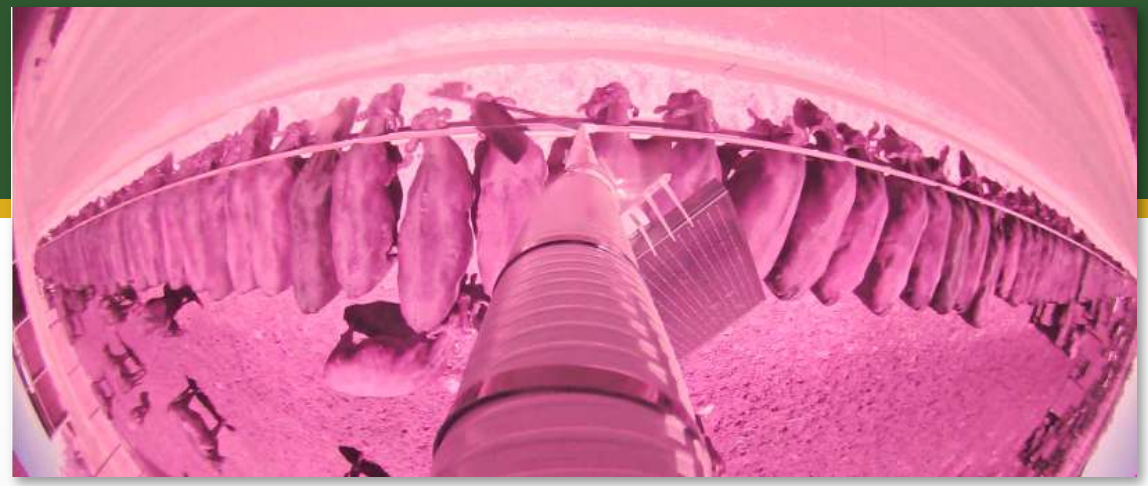
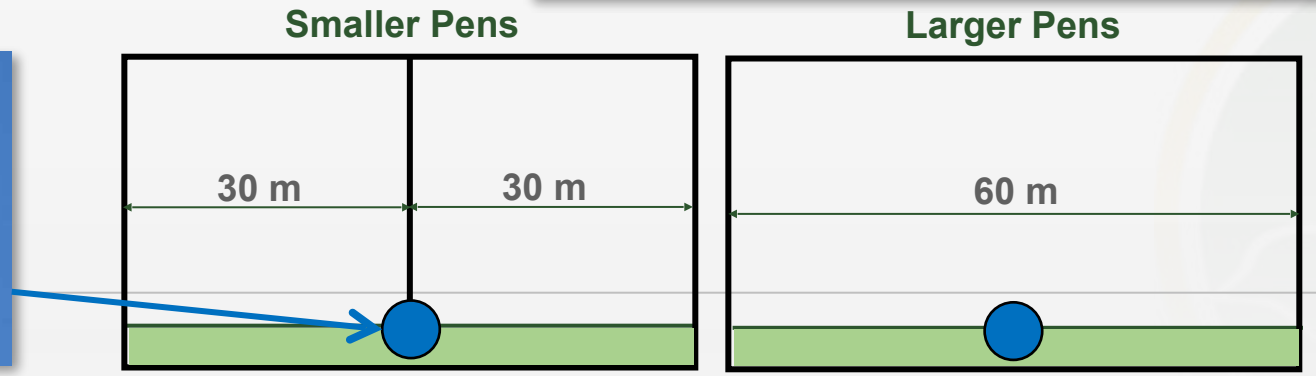
Image Acquisition System

- Covers up to 60 m of bunk line
- Requires 2.4 GHz WiFi network
- Solar-powered or outlet-powered
- Integrated nighttime illumination
- Still images = reasonable bandwidth
- Automated remote updates and diagnostics





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PLT Bunk Management

Problems

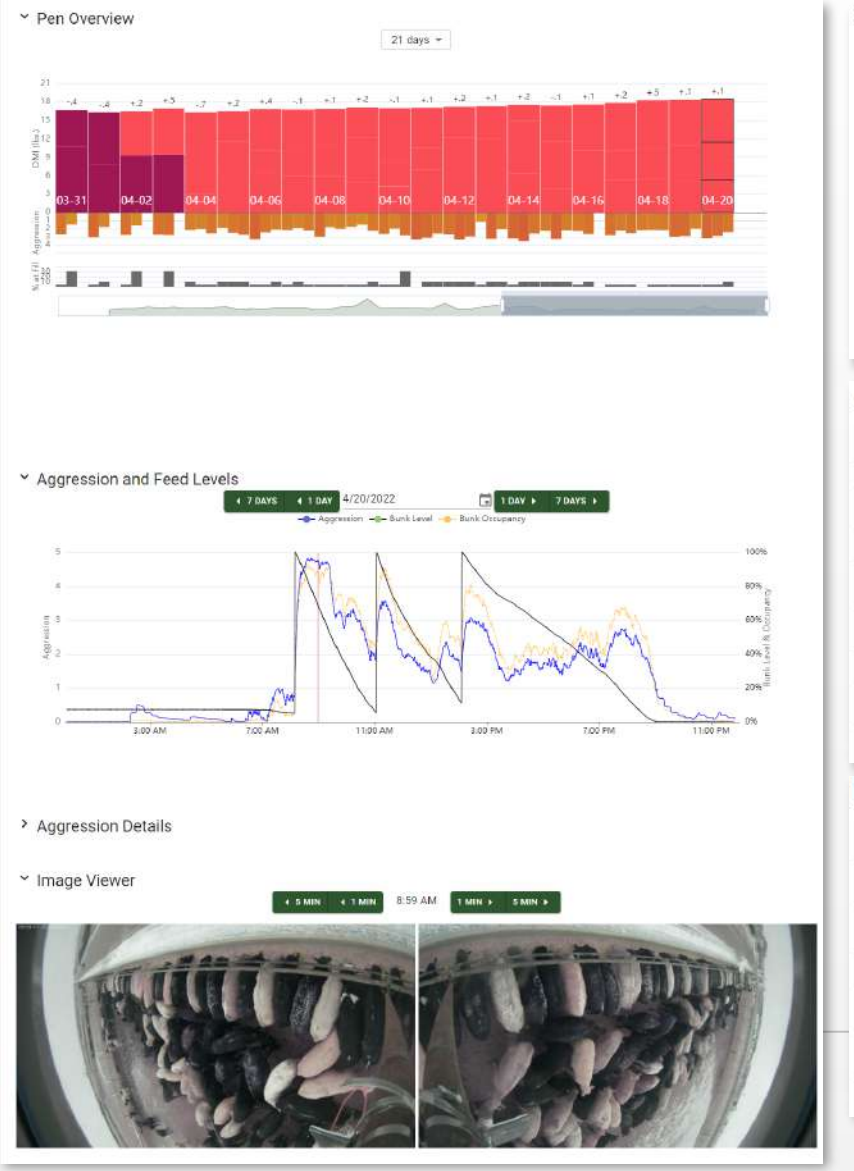
- Subjective data
- Big cuts, slow recoveries
- Staffing and training
- No behavioral insights

Solution

- Automated feed calling
- Continuous monitoring
- Reliable data
- Analytics and alerts

ROI

- Fewer problem pens
- Intake gains
- Adherence to protocols
- Labor savings



Choose a type of alert to create:

Feed Delivery Time
Trigger an alert if feed delivery occurs too far from the average delivery time for the pen

Aggression
Trigger an alert if feed aggression falls outside a specified range

Bunk Level
Trigger an alert if the amount of feed is outside certain precentage range just before refill.

Night Slick
Trigger an alert if the night slick occurs outside a specified time window.

Aggression Score - 1st Feeding - Finish Ration

Score	2/16	2/17	2/18	2/19
315	2.3	3	2.6	2.4
316	3	3	3.2	3.7
317	3.3	4.3	4.4	3.8
318	4.2	3.9	3.8	4.2
319	3.4	3.3	3.8	4
320	4	3.7	4.2	4.1
321	2.6	3.9	4.2	4.5

Night Slick

Slick Time	2/17	2/18	2/19
8	12:03 AM		
9	9:03 PM		8:05 PM
10	1:33 AM		
11	10:18 PM	1:38 AM	7:50 PM
12			
14	2:48 AM	8:34 PM	8:20 PM

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PLT User Interface

Customizable Dashboard

- Easy to create and share to all users
- One-click bookmarks to deeper metrics and reports

Alerts

- Aligned to match feeding program priorities
- Bunk Levels, Night Slick, Behavior, Delivery Time Variance

Tabular Reports

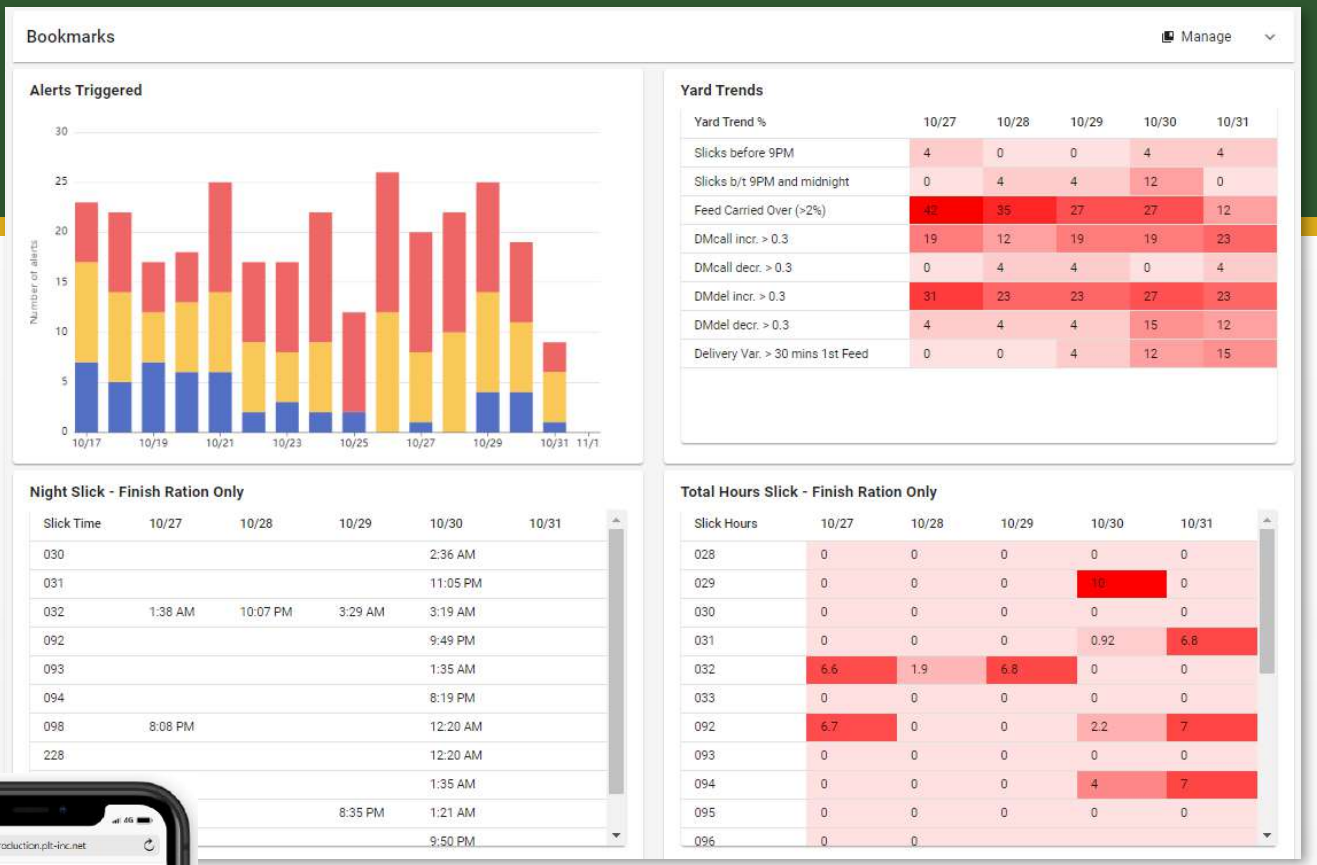
- Action Report, Feeding History, Yard Summary

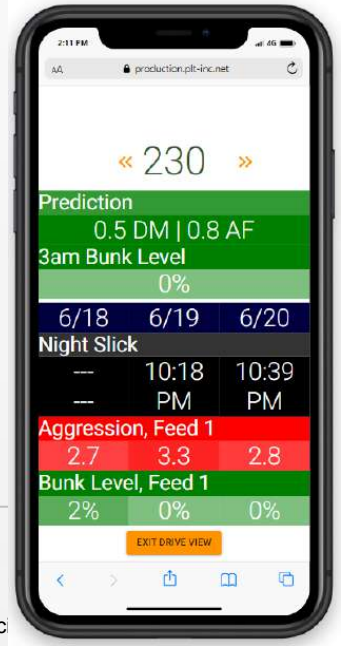
Summary Metrics

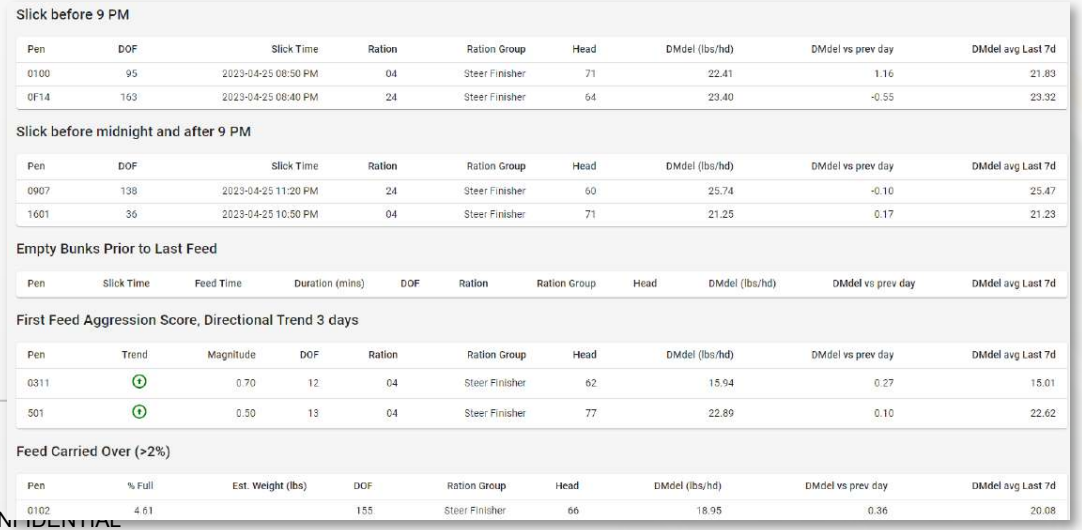
- Reports for bunk levels, night slicks, aggression, etc.
- Filter by pen attributes (DOF, ration category, etc.)

Mobile Drive View

- 3-day summary of prediction, night slicks, bunk levels, feeding behavior







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A Process for Successful Adoption

Phase 1 – Feeding Program Adherence

- Focus on familiar data directly aligned to existing feeding program
- Identify key metrics for outlier identification
- Confirm automated alert settings

Phase 2 – Increased Gain

- Enhance protocols and with new data
- Typically start with aggression and night slicks
- Main goal to increase consistency and reduce volatility

Phase 3 – Feeding Recommendations

- Leverage intake predictions for proactive calls that take advantage of every piece of data

Key Lessons Learned

- Absolutely critical to have buy-in at every level in the organization
- Changing existing processes requires commitment and collaboration

Feed Callers

- Early Morning – Dashboard/Alerts, Drive View, Action Report, Integration
- Late Morning – Review key metrics

Managers

- Daily – Dashboard on key metrics

Nutritionists

- Weekly – Summary reports on program adherence

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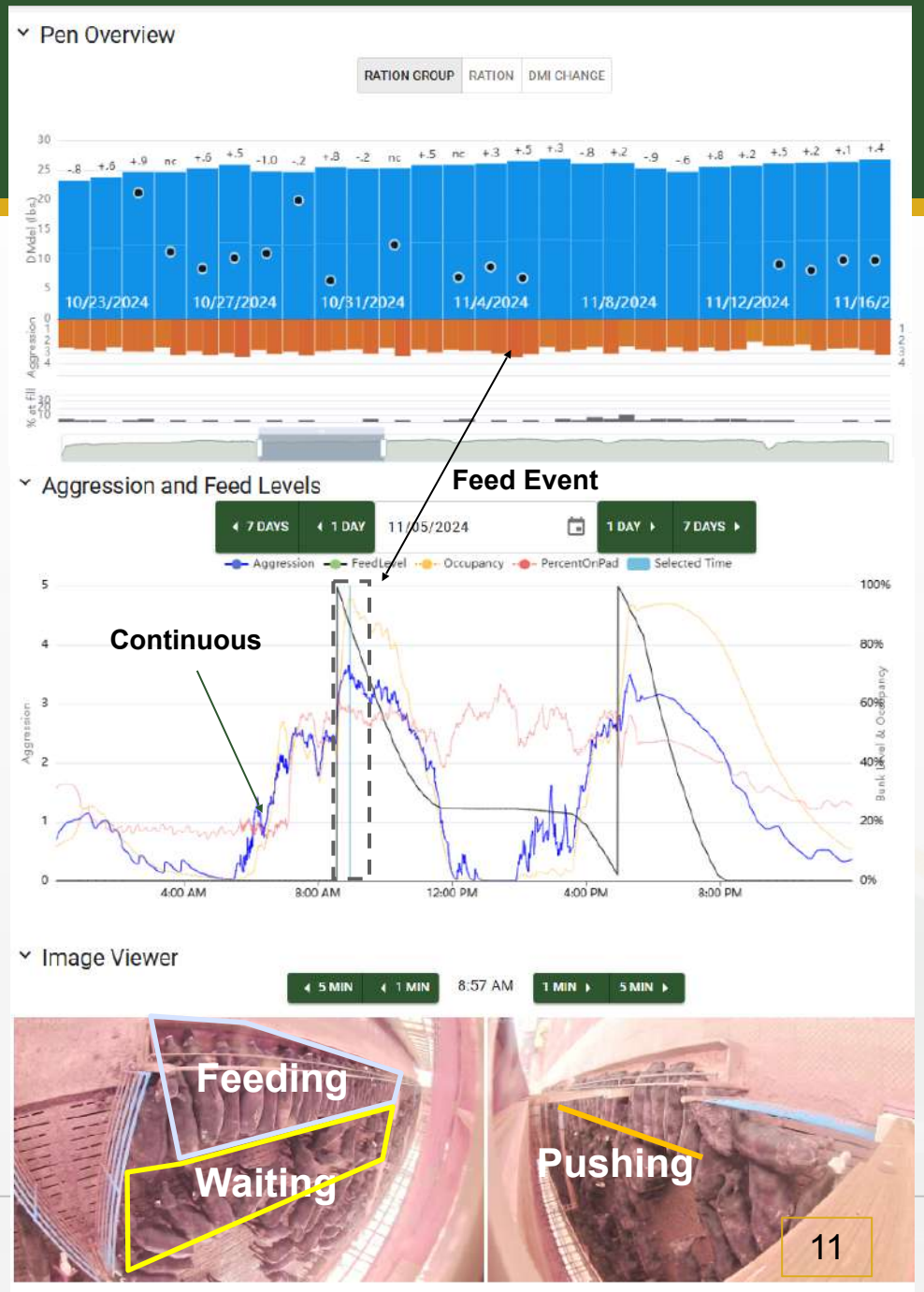
Feeding Behavior and Intake Predictions

Quantifying Feeding Behavior

- **Continuous Measure of Aggression**
  - Feeding, pushing, waiting
  - Scale of 1 to 5
  - 3 = full bunk line, >3 indicates pushing
- **Summarized for Each Feed Event**
  - Average aggression from 10 minutes before to 30 minutes after delivery
  - Weighted towards post-delivery



AI-Powered Intake Predictions

- **Limitations of Current Methods**
  - Long training period
  - Incomplete, periodic, subjective data
  - Reactive calls = big cuts and slow recoveries
- **Advantages of Artificial Intelligence**
  - Proactive calls based on complete data using hundreds of variables over five days
  - Multiple algorithms can be tuned to match feeding program
  - Combined with explanatory notes and warnings to provide context

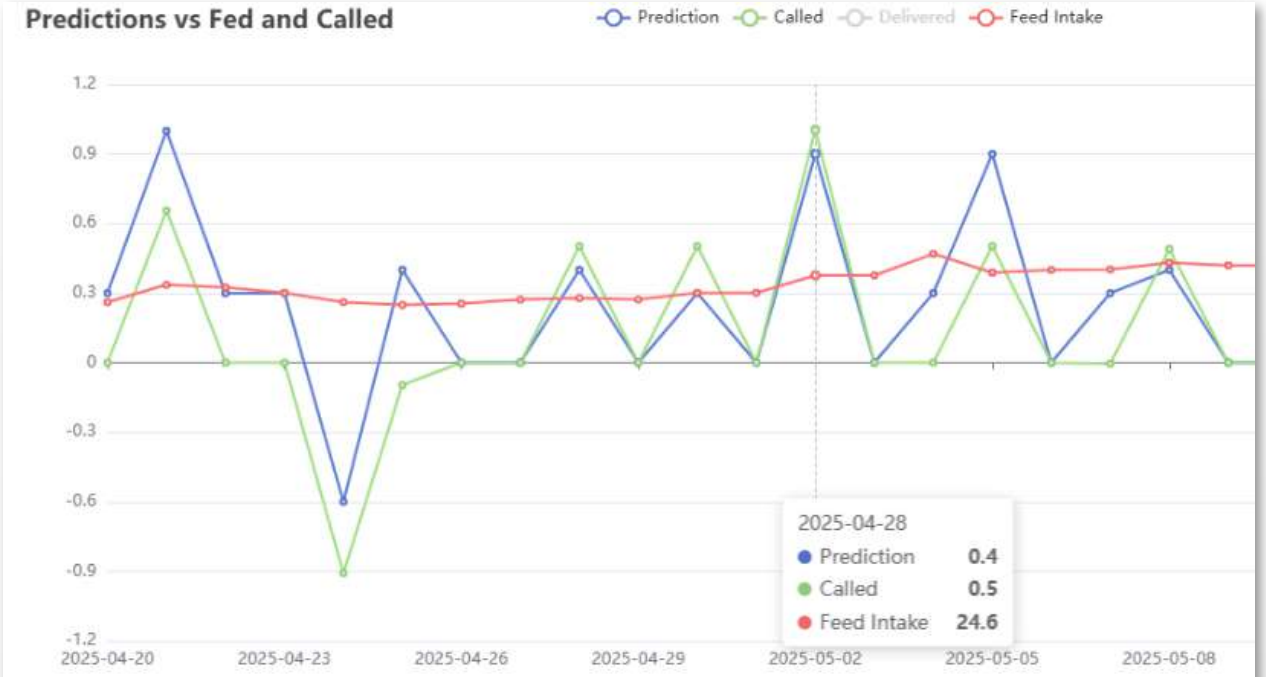
Bunk Levels | Days on Feed | Behavior | Night Slick | Weather

Recommendations and Insights

Daily Recommendations

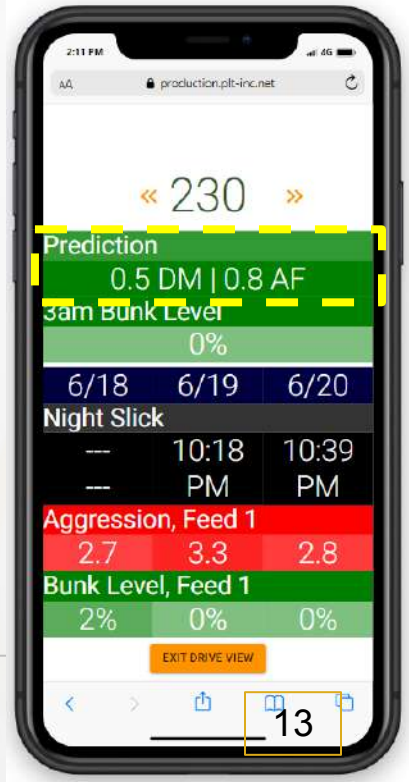
		Change From Yesterday		Trends			
Pen	Ration Group	Per Head (Dry)	Per Head (As Fed)	Overall	Bunk Level	Aggression	Weather
1E	Steer Finisher	0.4	0.6				
1W	Steer Finisher	0.4	0.6				
2E	Steer Finisher	0.0	0.0				
2W	Steer Finisher	-0.8	-1.3	Caution - review trends			
3	Starter	0.9	1.6				
4	Steer Finisher	0.3	0.6				
5E	Steer Finisher	0.2	0.3				
5W	Steer Finisher	0.8	1.3				
6E	Steer Finisher	0.3	0.4				
6W	Steer Finisher	-0.8	-1.3	Caution - review trends			

Detailed Prediction History



	Change From Yesterday			Trends			
Date	Called	Fed	Predicted	Overall	Bunk Level	Aggression	Weather
2025-05-15 (Lot Pardons)			0.3				
2025-05-14 (Lot Pardons)	-0.5	-0.3	-0.3	Caution - review trends			
2025-05-13 (Lot Pardons)	0.0	0.3	0.0	Caution - review trends			
2025-05-12 (Lot Pardons)	0.0	0.0	0.3				
2025-05-11 (Lot Pardons)	0.0	0.0	0.0	Caution - review trends			
2025-05-10 (Lot Pardons)	0.0	0.0	0.0	Caution - review trends			

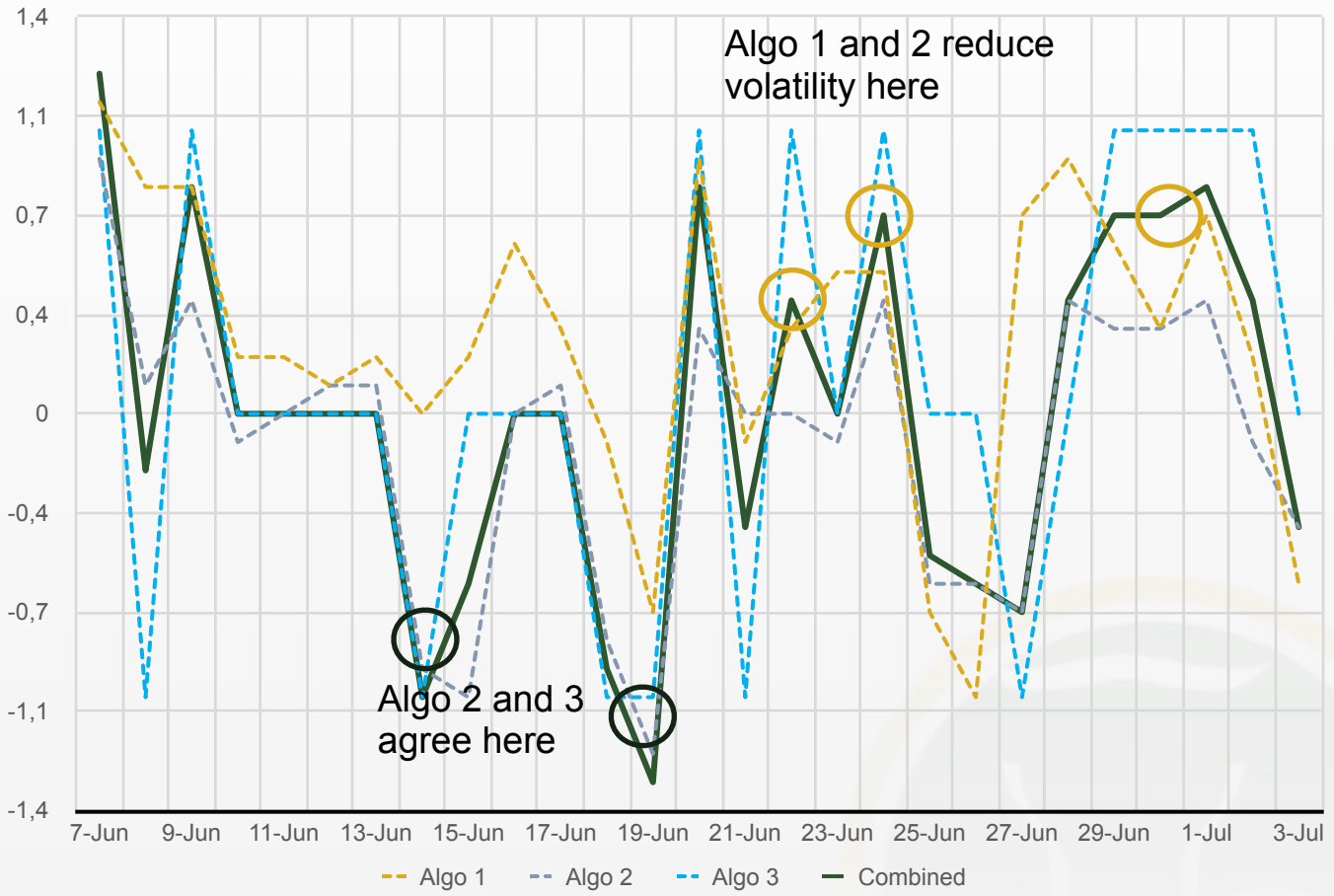
Shows factors behind predictions for training and validation



Accommodating Different Feeding Strategies

We train general algorithms and still provide client-specific results

- Maximize training data by using all client data as inputs
- Combine output of three different types of algorithms to create a **best-fit feeding strategy** for each client
- Depending on the situation, the algorithms can disagree
- We exploit these differences to provide producer-specific solutions



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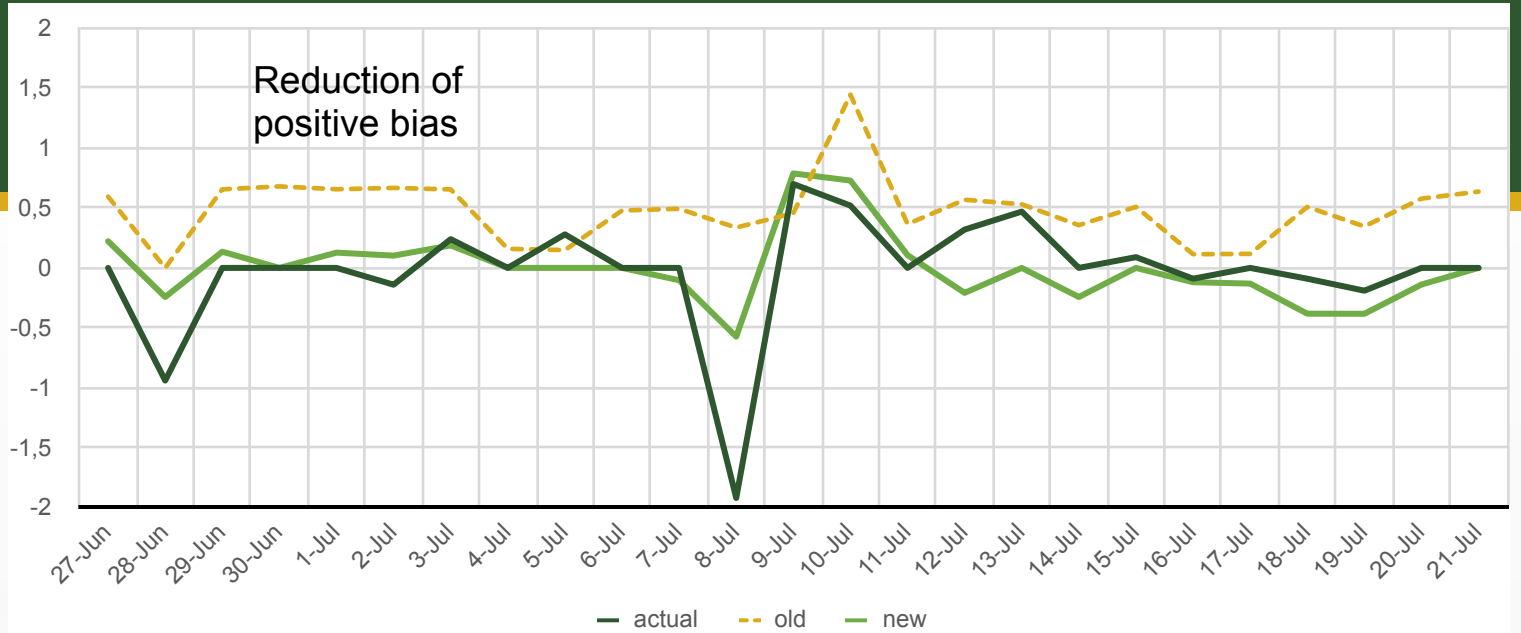
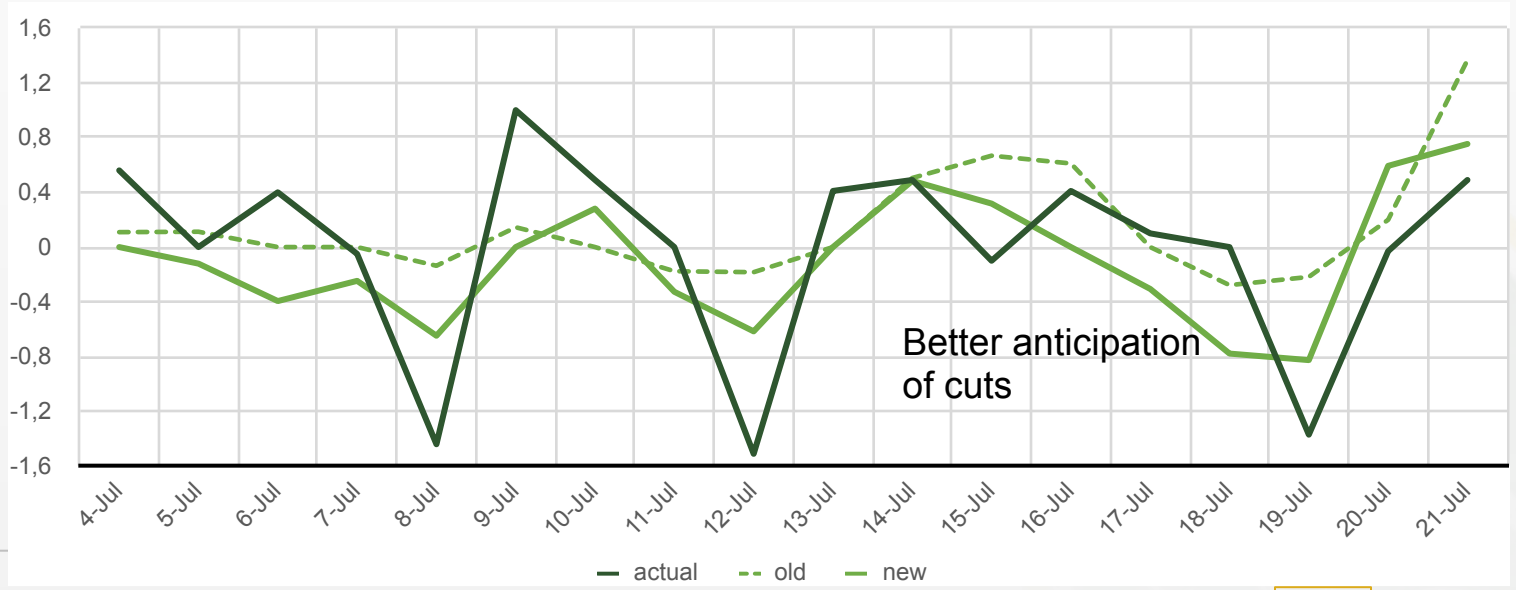
Continuous Improvement

- Algorithms are regularly re-tuned to match feeding strategy
- The fewer pens on the system, the longer it takes to align the output with the strategy
- Graphs here show how major improvements are possible after additional client data has been added to the training dataset





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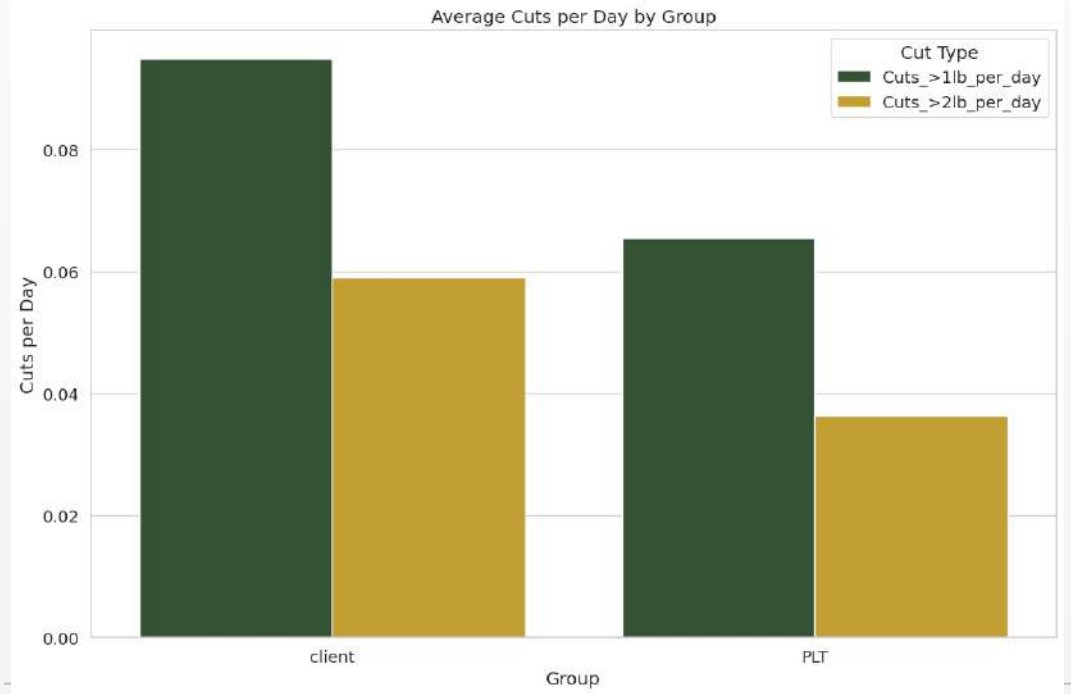
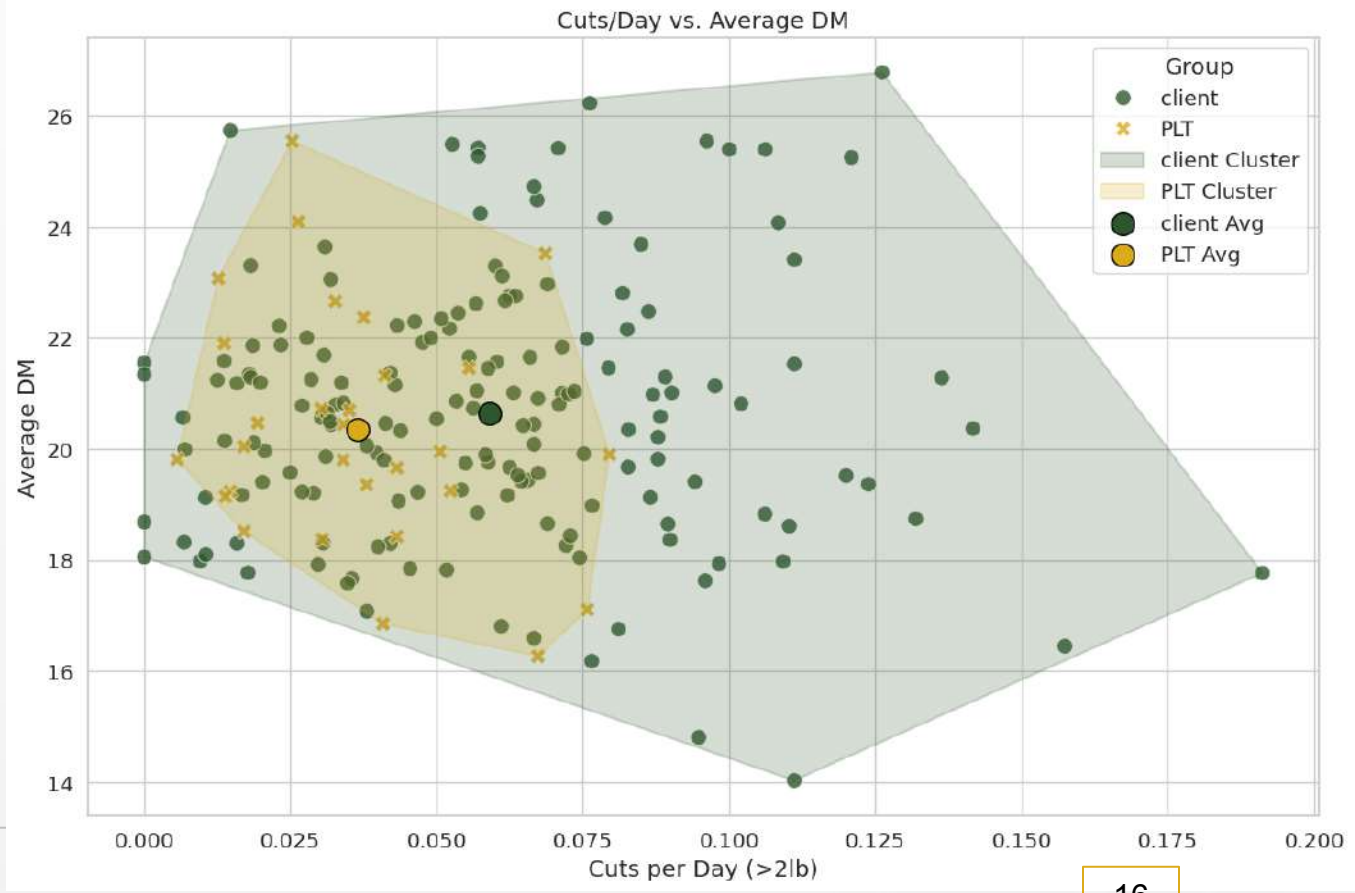
Case Study – 28 Prediction Pens over 7 months

- More consistent intakes and higher conversion
- Fewer large cuts
- Similar DMI with fewer cuts drives positive ROI



More consistency, fewer large cuts



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Case Study – 18,000 Head on PLT System

- Integrated night slick, bunk levels, aggression and intake recommendations into feeding protocol
- The system has led to more consistent intake and better anticipation of cattle
- Yard has improved significantly against its peers in benchmarking done by its nutritionist
- Heavily relying on predictions today

Benchmarking Results		
7-Weights	**Year**	**Rank**
With PLT	**2023**	**3rd out of 15**
Before PLT	2022	11th out of 11
8-Weights	**Year**	**Rank**
With PLT	**2023**	**3rd out of 26**
Before PLT	2022	42nd out of 43

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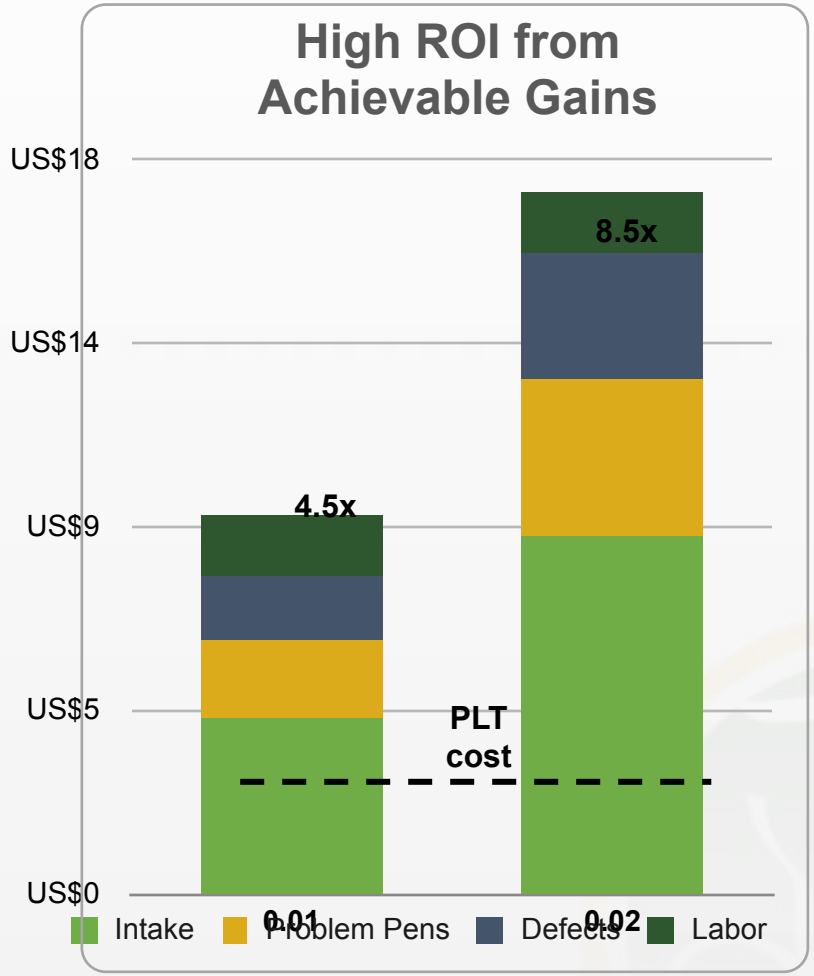
Calculating Return on Investment

- **Profitability is driven by consistent intake over entire feeding period**
  - Large returns from sustained increases
  - One 2kg cut can cost 44 ZAR/head
  - Higher efficiency = fewer days on feed
- **Problem pens are very expensive but often avoidable**
- **Volatility lowers conversion and increases morbidity**
- **Manpower is wasted making manual observations**



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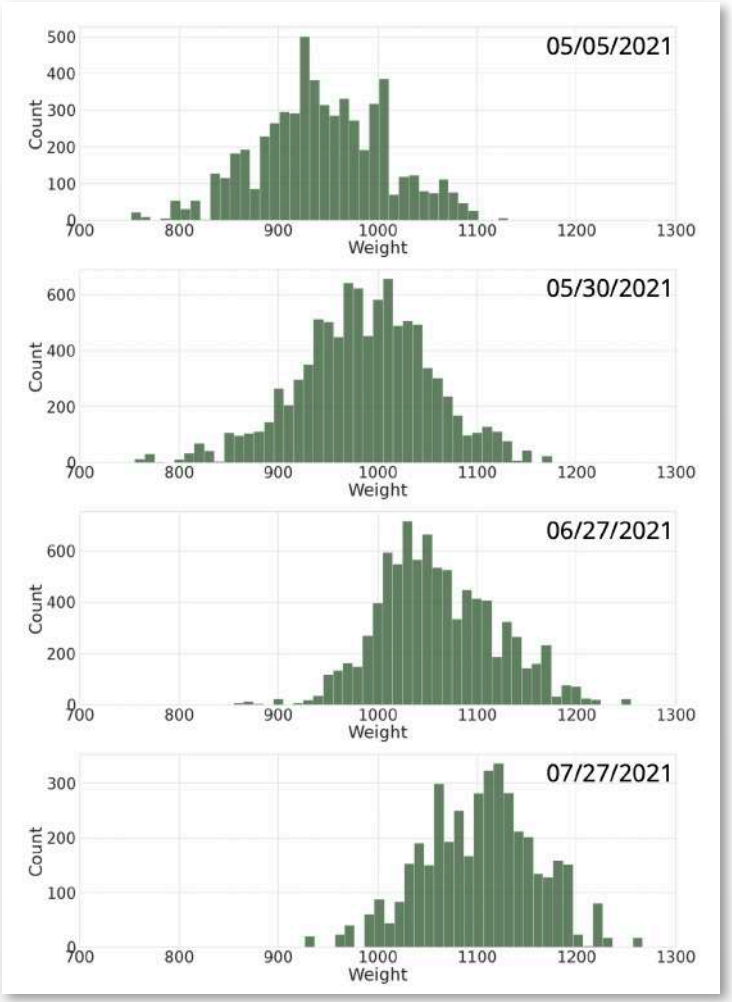
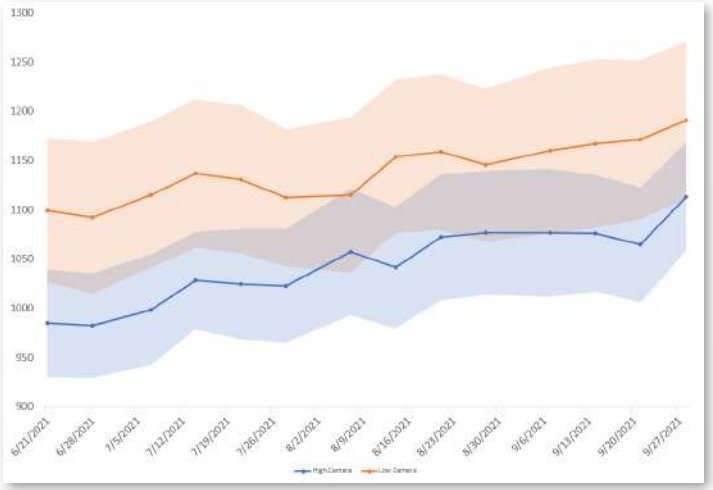
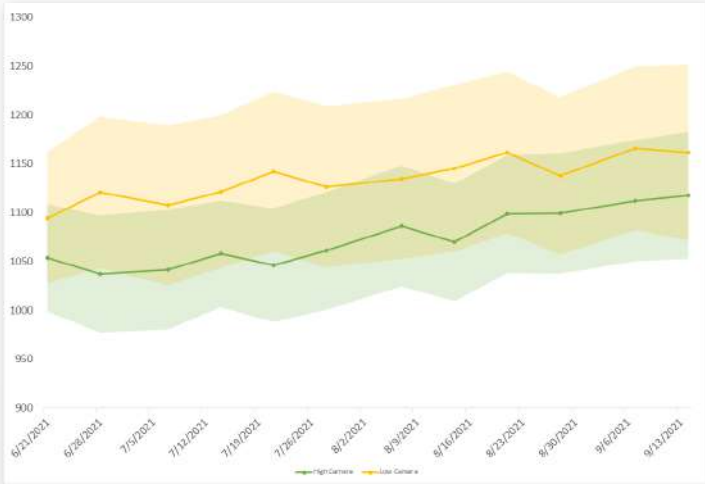
The Future of Performance and Health

Performance Measurement (in development – will have new details by the date of the conference)

Problems	▪ Assumptions-driven ▪ Subjective visual inspections ▪ No data on homogeneity
PLT Solution	▪ Continuous weight data ▪ Harvest optimization ▪ Comparisons between pens and cohorts
ROI	▪ Capture arbitrage between feeding and yardage ▪ Minimize overfeeding ▪ Reduce prediction time horizon (30 vs. 180 days)
Future Expansion	▪ Harvest predictions ▪ Pen conditions

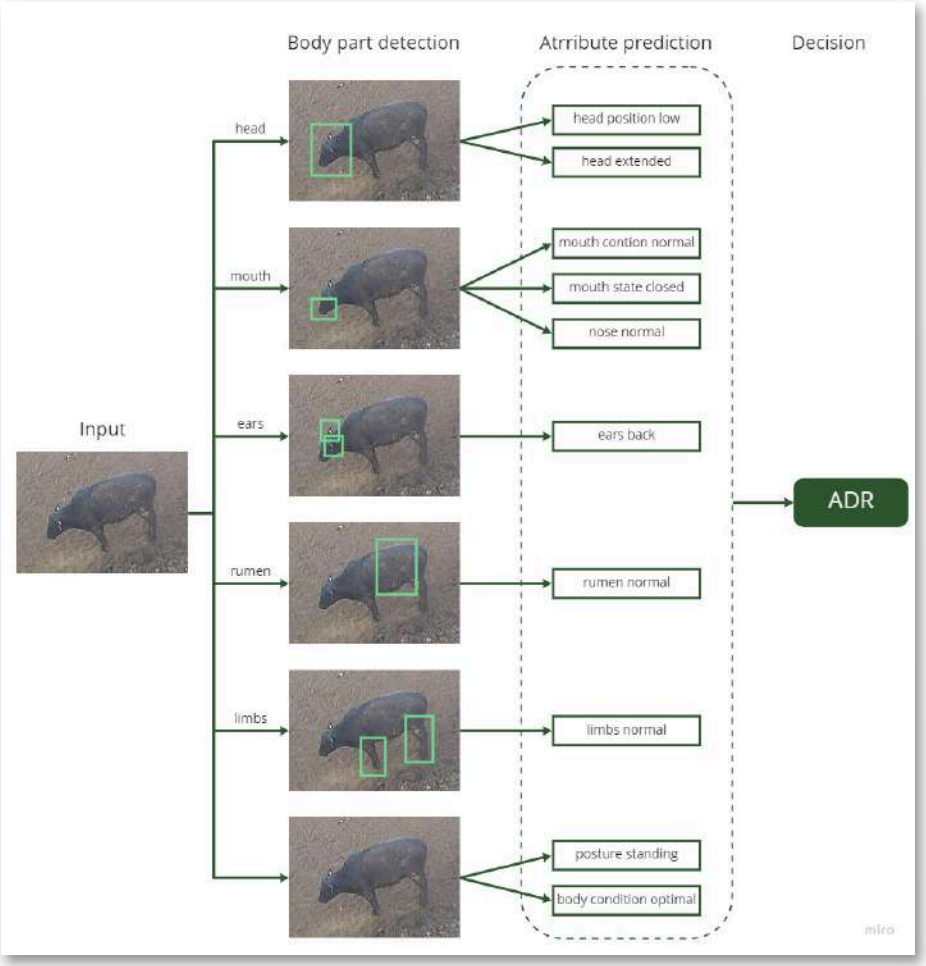






Health Management (experimental – can expand this section)

The Problem	▪ Highly skilled labor required ▪ Notoriously subjective ▪ Prevalence of metaphylaxis
PLT Solution	▪ Continuous monitoring ▪ Early detection ▪ Correlate with eating and behavioral indicators
ROI	▪ Reduce antibiotic usage ▪ Better allocate scarce resources ▪ Increase quality
Future Expansion	▪ Individual animal ID ▪ Telemedicine



FFAR Foundation for Food and Agriculture Research

ICASA A FFAR COLLABORATIVE

$250,000 grant matched by **$380,000** in time and resources from PLT and its research partners

All IP developed owned by PLT

Research Partners

Five Rivers Cattle Feeding

JBS

Veterinary Research & Consulting Services LLC

Iowa State University

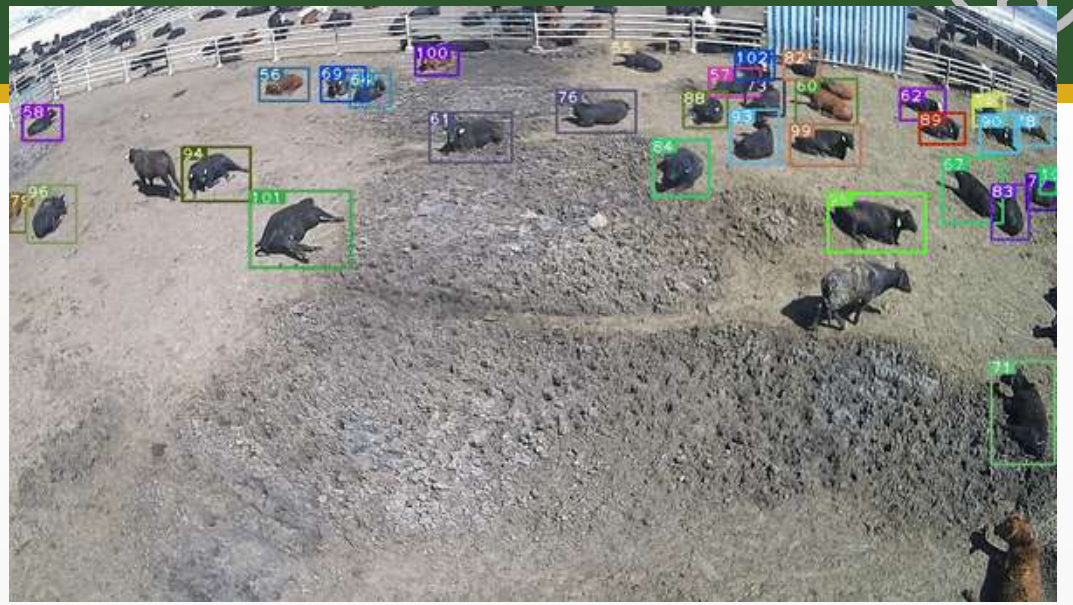
Alltech

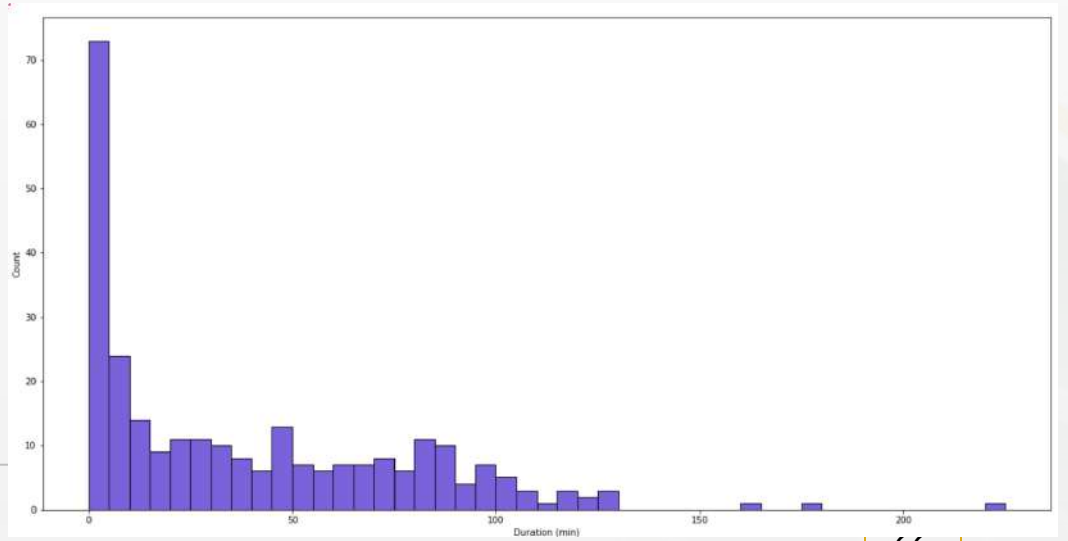
SA Feedlot Association

Precision Livestock Technologies

Health Management – Algorithm Capabilities

- **Animal Detection**
  - Detect animal and isolate within image
- **Location**
  - Understand relative to fixed points in image
- **Body Position**
  - Distinguish between standing and lying and determine postures
- **Duration**
  - Compare image sequences and calculate frequency and durations (eating, drinking, sitting, standing, etc.)
- **Body Part Detection**
  - Recognize body parts (head, limbs, eyes, ears, nose, mouth, rumen)
- **Body Part Classification**
  - Classify and the state of body parts (head position/extension, limb condition, rumen appearance, ear posture, eye condition, mouth condition, nose condition, hair loss and cleanliness/diarrhea)
- **Health Prediction**
  - Classify animal as IDR/ADR (Is/Ain't Doin' Right) based on above





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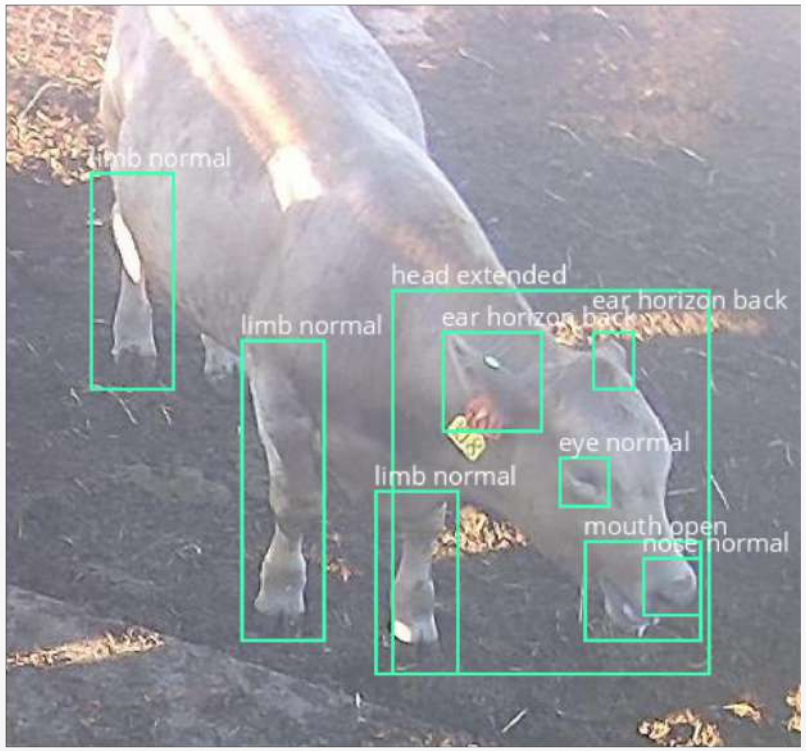
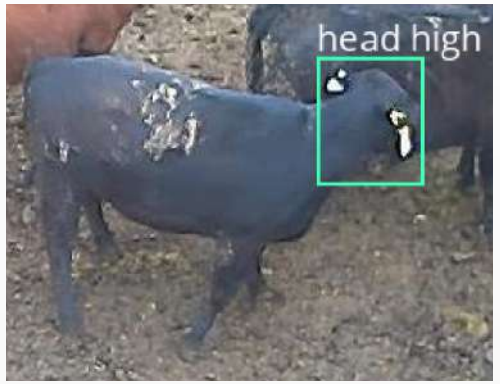
Health Management – Algorithm Examples





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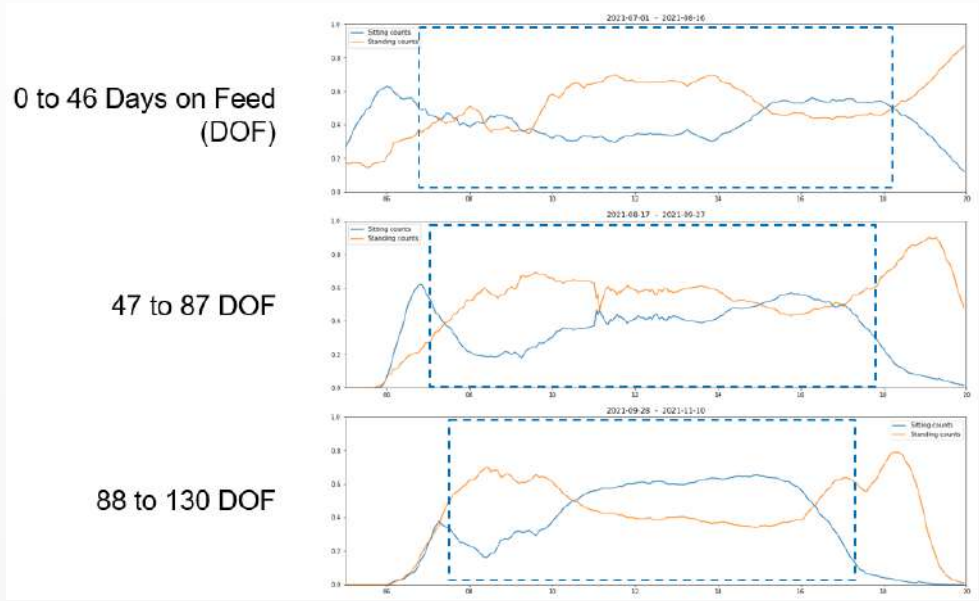
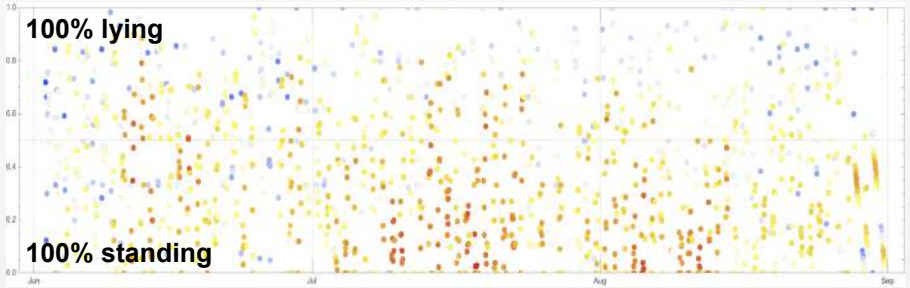
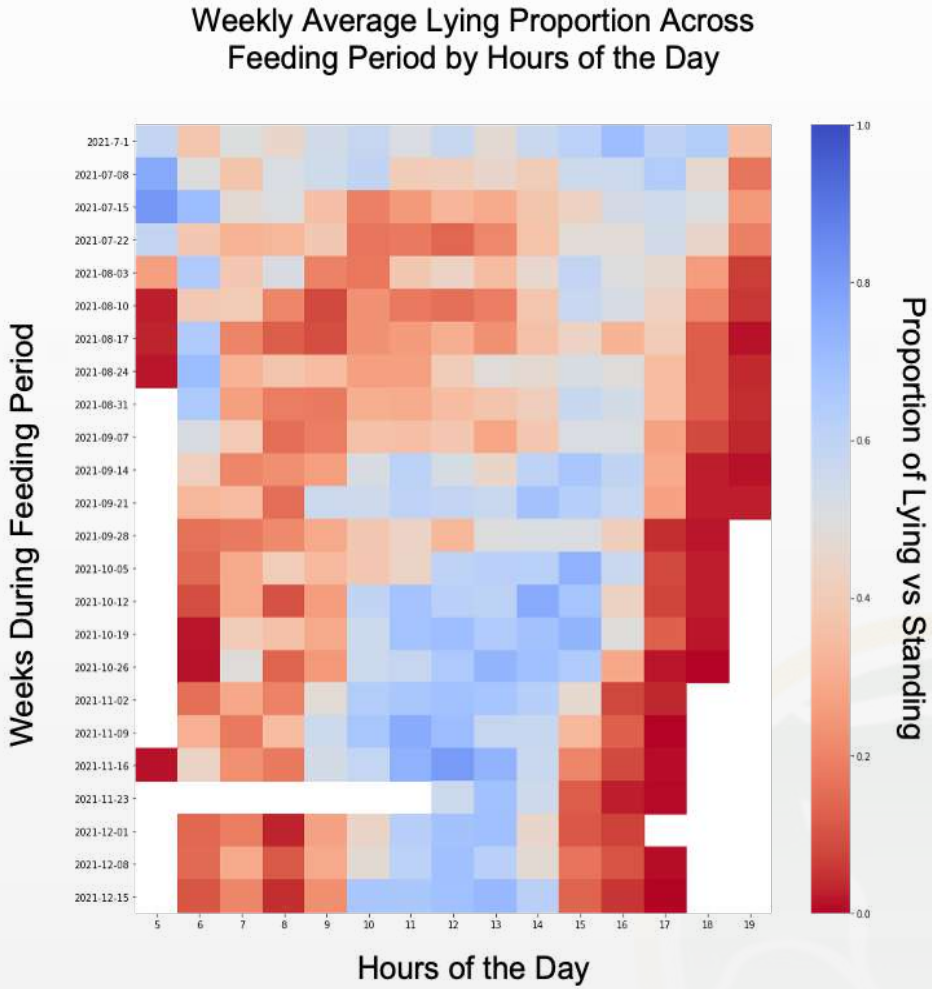
Behavior: Lying/Standing: Pen Level Aggregates

Change Lying/Stading over feeding period



More standing on hotter days (redder dots skewed to bottom of graph)



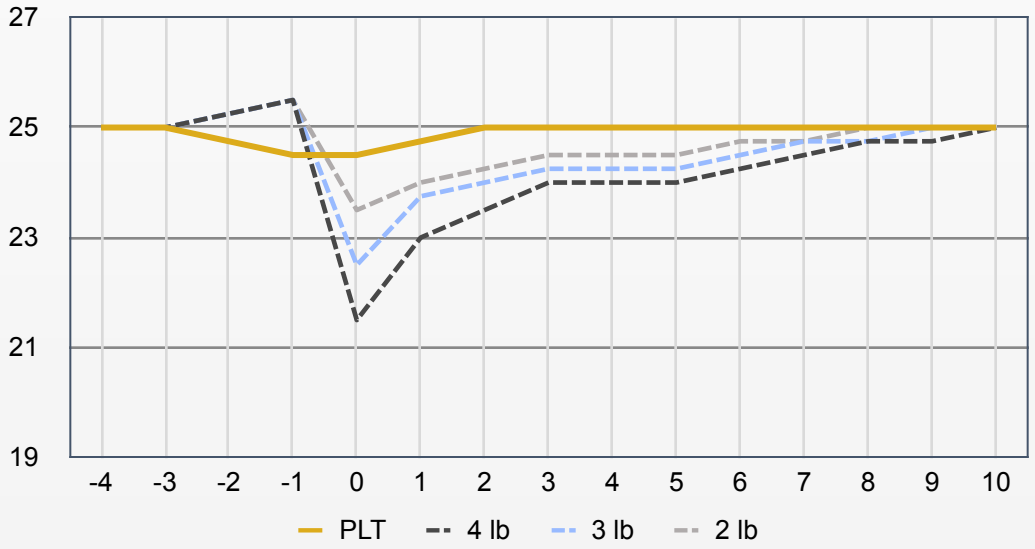


Thank you

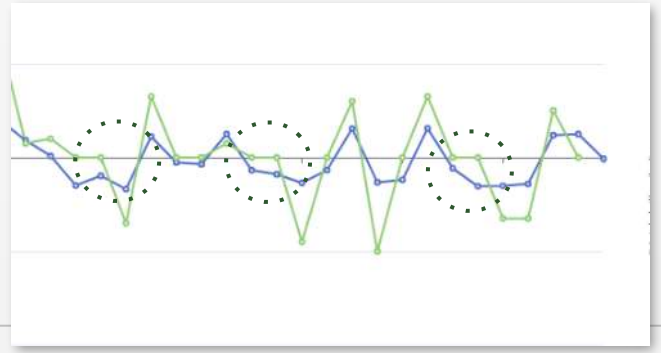
andrew@precision-livestock.com
1.917.596.7224

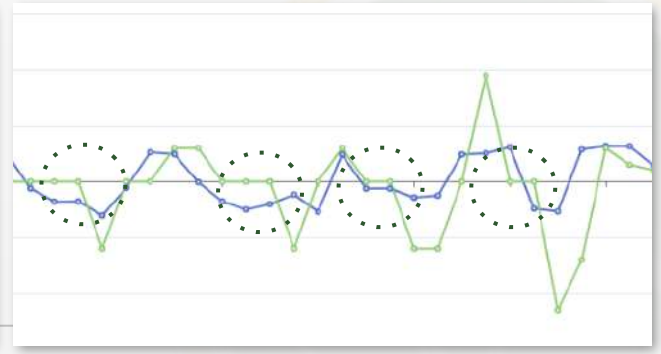
ROI from Proactive Feeding Management

Size of Cut	Intake Lost	Value
4 lb	9.00 lbs	$2.38/head
3 lb	5.50 lbs	$1.44/head
2 lb	2.50 lbs	$0.75/head



26 pens in TX	Jun	Jul	Aug	Sep	Oct	Nov
Predictive Power						
1-2 lbs	75%	71%	73%	67%	61%	69%
2-3 lbs	79%	75%	77%	68%	63%	66%
3-5 lbs	88%	82%	88%	50%	56%	59%
Cuts Predicted						
1-2 lbs	53	72	74	31	31	45
2-3 lbs	34	40	41	21	20	33
3-5 lbs	15	14	15	6	5	16
ROI	**11.1**	**12.6**	**13.1**	**5.8**	**5.4**	**10.8**





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Feed Cost (dry ton)	$450
	$1.6
Sale Price of Gain	0
Feed/Gain	5.5

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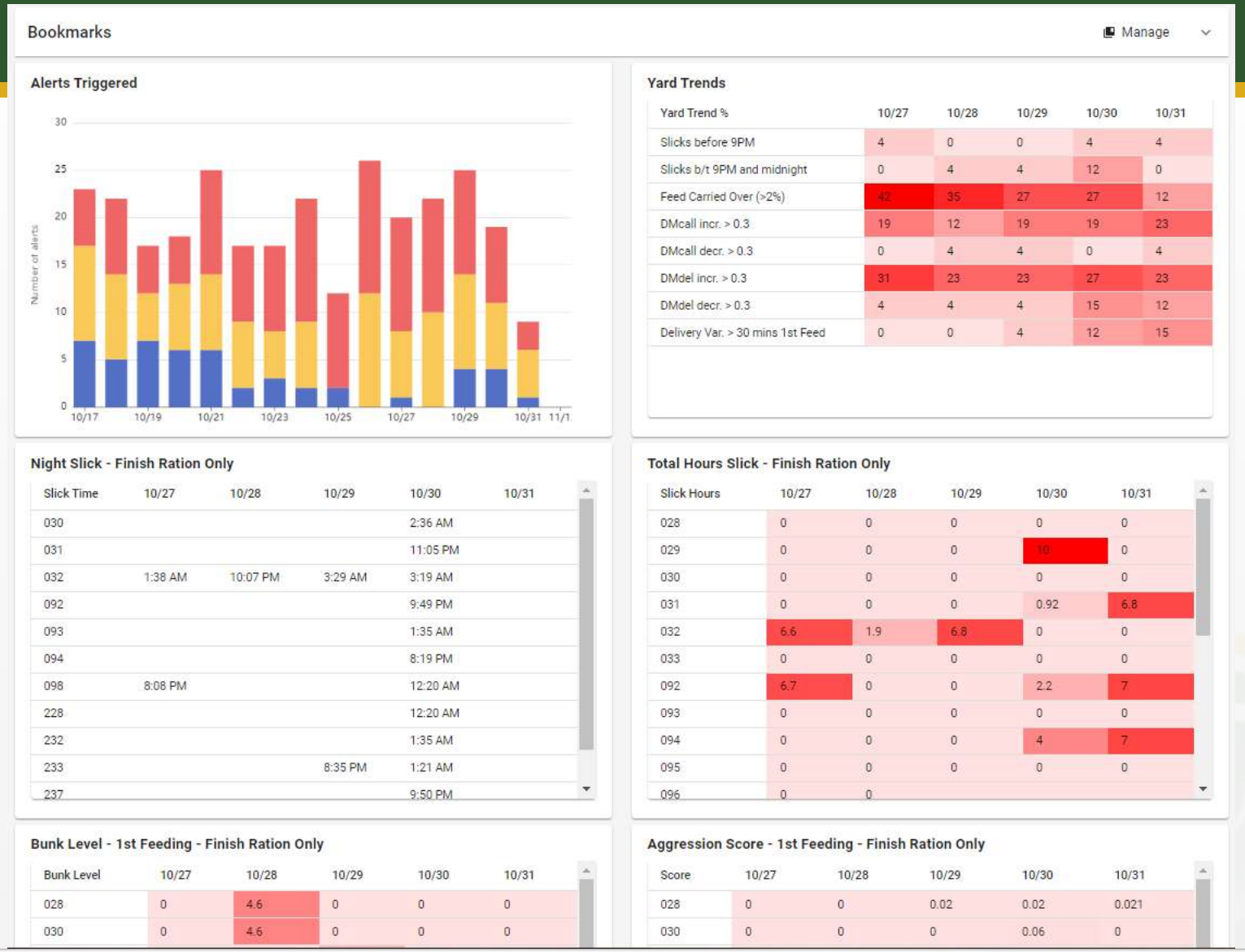
Bunk Management Interface and Reports

Custom Dashboard

Configurable Panels

- Present most relevant information on user homepage
- Easy to create and then share between users
- One-click posting of configured charts from Summary section

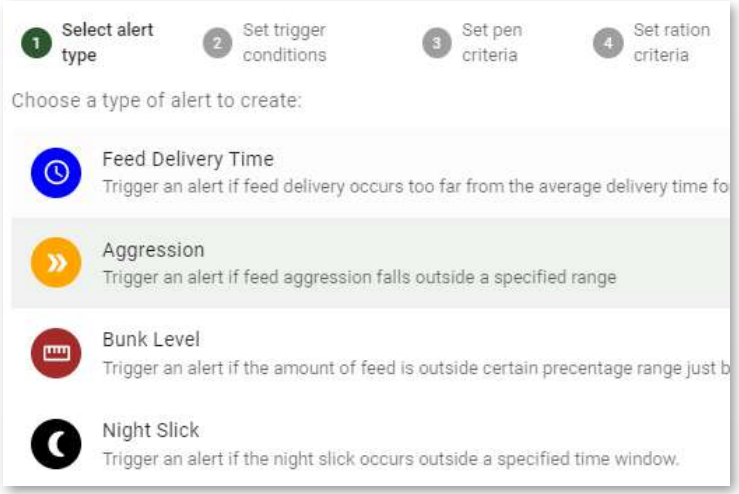


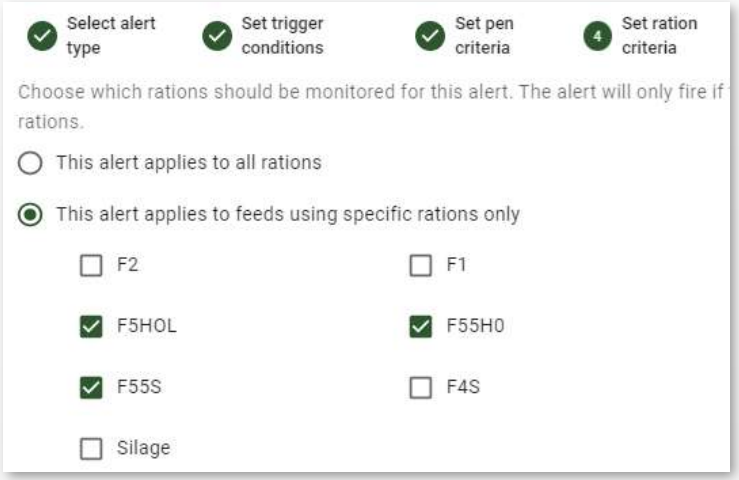
SA FEEDLOT ASSOCIATION

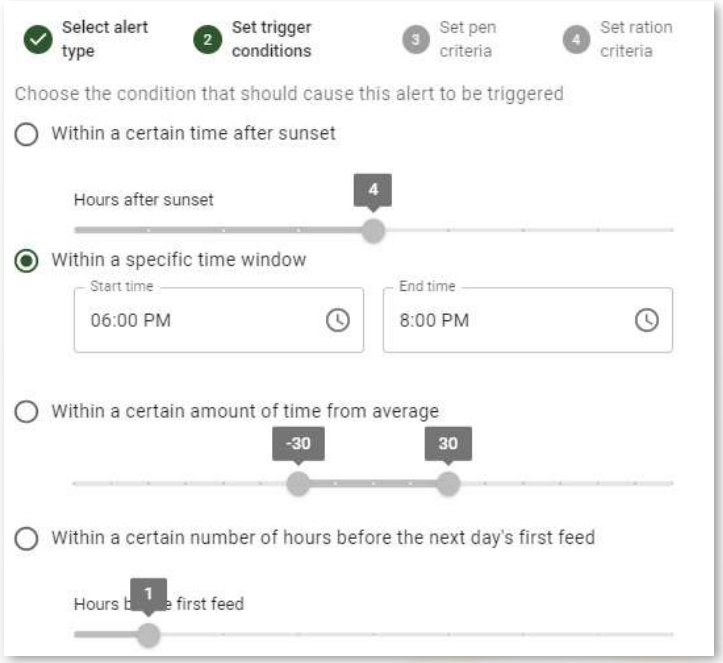
PRECISION LIVESTOCK TECHNOLOGIES

Automated Alerts

- **Capture pens straying outside program**
  - Early/late night slicks
  - Feed carried over to morning
  - Slick bunks between feedings
  - Delivery time variance
  - High/low aggression
- **Uses same filters as analytics**
- **Set who sees alerts**







Instant Reports

Action Report

- Instant access to potential problem pens

Daily Feed History

- Comprehensive data by pen

Pen Summary

- Summary 3-day trend data

Yard Summary

- “Weekly” data on specified metrics

Slick before 9 PM

Pen	DOF	Slick Time	Ration	Ration Group	Head	DMdel (lbs/hd)	DMdel vs prev day	DMdel avg Last 7d
0100	95	2023-04-25 08:50 PM	04	Steer Finisher	71	22.41	1.16	21.83
0F14	163	2023-04-25 08:40 PM	24	Steer Finisher	64	23.40	-0.55	23.32

Slick before midnight and after 9 PM

Pen	DOF	Slick Time	Ration	Ration Group	Head	DMdel (lbs/hd)	DMdel vs prev day	DMdel avg Last 7d
0907	138	2023-04-25 11:20 PM	24	Steer Finisher	60	25.74	-0.10	25.47
1601	36	2023-04-25 10:50 PM	04	Steer Finisher	71	21.25	0.17	21.23

Empty Bunks Prior to Last Feed

Pen	Slick Time	Feed Time	Duration (mins)	DOF	Ration	Ration Group	Head	DMdel (lbs/hd)	DMdel vs prev day	DMdel avg Last 7d

First Feed Aggression Score, Directional Trend 3 days

Pen	Trend	Magnitude	DOF	Ration	Ration Group	Head	DMdel (lbs/hd)	DMdel vs prev day	DMdel avg Last 7d
0311	↑	0.70	12	04	Steer Finisher	62	15.94	0.27	15.01
501	↑	0.50	13	04	Steer Finisher	77	22.89	0.10	22.62

Feed Carried Over (>2%)

Pen	% Full	Est. Weight (lbs)	DOF	Ration Group	Head	DMdel (lbs/hd)	DMdel vs prev day	DMdel avg Last 7d
0102	4.61		155	Steer Finisher	66	18.95	0.36	20.08

Pen	0099	Measure	04-11	04-12	04-13	04-14	04-15	04-16	04-17	04-18	04-19	04-20	04-21	04-22	04-23	04-24	04-25
Head	67	DMdel (lbs/hd)	19.2	19.5	20.2	21.5	21.9	21.5	22.6	22.5	22.3	22.8	22.8	23.0	23.0	23.6	22.4
DOF	69	DMdel Chg	-1.1	0.4	0.7	1.2	0.4	-0.4	1.1	-0.1	-0.2	0.4		0.3	-0.1	0.6	-1.1
BS (in)	14	Agg 1	2.40	2.39	2.49	2.59	2.46	2.68	2.94	2.46	2.55	1.34	2.43	2.42	2.71	2.91	2.35
		Agg 2	1.06	1.10	1.36	2.40	2.22	2.24	2.12	1.21	0.82	1.10	1.24	1.12	2.00	1.85	1.02
		Agg 3	1.23	1.50	1.45	1.07	1.05	1.31	1.41	1.19	1.35	1.34	1.22	1.00	1.57	1.72	1.09
		Slick at 1st feed	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
		Slick at 2nd feed	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	No
		Slick at 3rd feed	No	No	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No
		Night Slick		4:36 AM	10:22 PM	8:30 PM	8:20 PM	7:50 PM	8:15 PM			10:00 PM					

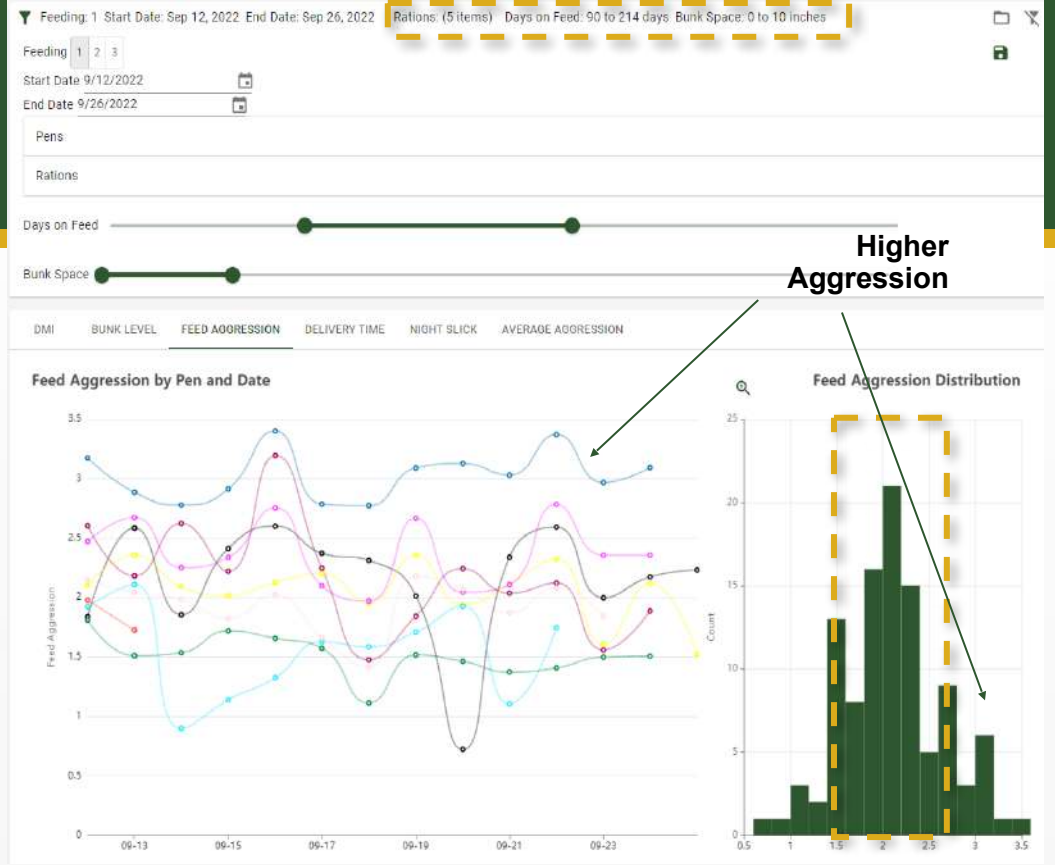
Pen	0100	Measure	04-11	04-12	04-13	04-14	04-15	04-16	04-17	04-18	04-19	04-20	04-21	04-22	04-23	04-24	04-25
Head	71	DMdel (lbs/hd)	21.4	21.5	21.5	22.3	22.5	22.0	23.3	23.0	22.5	23.2	21.2	21.1	21.1	21.3	22.4
DOF	95	DMdel Chg	0.4	0.1		0.7	0.2	-0.5	1.3	-0.3	-0.5	0.7	-2.0	-0.1		0.1	1.2
BS (in)	14	Agg 1	2.18	2.33	2.46	2.64	2.20	2.31	2.91	2.52	2.22	1.78	2.25	2.44	2.59	2.63	2.84
		Agg 2	0.62	1.00	1.50	1.25	1.62	1.54	1.39	1.39	0.55	1.01	0.85	1.05	1.29	0.80	0.63
		Agg 3	1.14	1.15	1.11	1.18	0.98	1.35	1.11	1.03	1.06	0.95	1.24	1.53	1.67	1.31	1.16
		Slick at 1st feed	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes
		Slick at 2nd feed	No	No	Yes	Yes	No	Yes	Yes	No	No	No	No	No	No	Yes	Yes
		Slick at 3rd feed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
		Night Slick		3:52 AM	4:06 AM		10:09 PM	8:40 PM								1:11 AM	8:50 PM

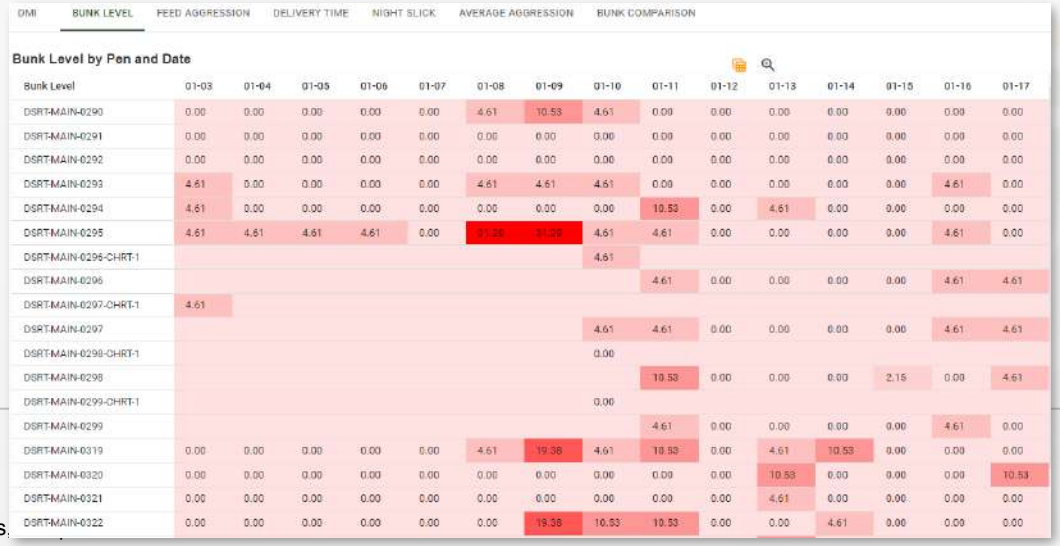
SA FEEDLOT ASSOCIATION

PRECISION LIVESTOCK TECHNOLOGIES

Deep Insights on Key Metrics

- **Filter charts and table for like-for-like comparisons**
  - Feeding, Ration Category, DOF, Bunk Space
- **Save custom filters for quick access**
  - “Finish Ration & more than 90 DOF”
  - “Starter Ration & less than 10” Bunk Space”
- **Bookmark reports with filters applied**
- **Data synced with feed management system**
  - Ration, DOF, head, DM delivered and called





Drive View

- **Navigation**
  - Fast, simple paging through pens
  - Can be based on typical drive order
- **Data Fields**
  - **Prediction** – change per head, on DM and AF.
  - **Night Slick** – prior three nights
  - **Aggression –** prior three days, first feeding
  - **Bunk Level** – prior three days, first feeding