Next-Gen Mastitis Management with Precision Dairy Technology

Jeffrey Bewley, PhD, PAS

Analytics and Innovation Scientist

Holstein USA, Inc.

U.S. Registered Holsteins FOR MAXIMUM PROFIT

HOLSTEIN ASSOCIATION USA, INC.

WKU SmartHolstein Lab

VISUAL DETECTION AND TREATMENT


FORESTRIPPING

CMT

- Cowside
- Cheap
- Easy
- Simple
- Detects relative cell content
- Does NOT give SCC

COWSIDE TESTS

DHI SCC MONITORING

Mid-South Dairy Records ******* HOT SHEET ******* Page 1
41 samples collected 4-28-10 tested 5-03-10

Index	Barn	Milk	Fat	Pro	SNF	MUN	SCC	Count	DIM	Lac	CAR	B#
Avg	41 cows	59.8	3.9	3.3	9.0		3.6		140			

Highest 20 SCC Cows Weighted Average SCC: 492

Index	Barn	Milk	Fat	Pro	SNF	MUN	SCC	Count	DIM	Lac	CAR	W/O	%
7	7SWISS	42.1	4.7	4.0	8.8		9.2	7352	12	1		373	25.6
56	56	30.2	5.3	4.6	8.3		9.0	6400	180	3		297	15.9
54	TESSY	81.5	3.6	3.2	8.7		6.9	1493	12	2		254	10.1
302	GLITTER	83.1	3.3	3.0	8.2		6.3	985	47	3		226	6.8
14	IZZIE	62.7	3.6	3.3	9.1		6.5	1131	145	5		200	5.9
457	NIKKI	81.4	3.2	2.9	8.1		5.9	746	34	2		179	5.0
554	AIDA	44.8	4.3	3.4	9.2		6.3	985	150	1		161	3.7
289	WHITCHA	61.7	3.2	3.2	9.0		5.4	528	308	4		149	2.7
68	5639556	85.1	4.0	3.0	8.8		4.9	373	15	1		139	2.6
17	M17	47.2	2.9	3.0	8.8		5.6	606	41	1		127	2.4
608	ELIZABE	36.1	4.1	3.2	8.9		5.8	696	107	2		116	2.1
47	PEYTON	68.2	4.8	3.3	9.0		4.8	348	117	6		106	2.0
35	SQUIRRE	58.0	3.8	3.4	9.3		4.7	325	50	1		99	1.6
119	BGEORGE	66.2	3.0	3.1	8.7		4.4	264	162	2		92	1.4
113	BETH	72.4	3.4	3.4	9.0		4.1	214	316	3		86	1.3
4	GRACEFU	56.9	6.0	3.7	9.3		4.4	264	204	4		80	1.2
285	ANN	60.5	4.2	3.7	9.2		4.3	246	210	4		72	1.2
42	42	76.0	3.6	3.3	9.1		3.7	162	28	1		67	1.0
86	86	65.3	2.4	3.1	8.9		3.9	187	26	1		61	1.0
282	WITCHIE	68.1	3.9	3.1	8.6		3.7	162	137	3		55	0.9

A ROAD PAVED WITH TECHNOLOGY

Rapid,
continuous
measurements


Deloitte University Press
Deloitte Review
FROM DIRT TO DATA
The second green revolution and the Internet of Things
#DeloitteReview

WHITE REVOLUTION

DETECTION NEEDS VERY DIFFERENT

FOUR DIFFERENT SCENARIOS

- Cows with severe clinical mastitis needing immediate attention
- Cows with subclinical mastitis, mild or mild, or moderate clinical mastitis not needing immediate attention
- Cows needing attention at drying off
- Monitoring of udder health at the herd level

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Novel ways to use sensor data to improve mastitis management

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MASTITIS DETECTION BENEFITS

- Reduced labor
- Separate abnormal milk
- Early treatment and intervention
  - NSAID administration?
  - Supportive therapy/probiotics?
  - Pathogen-specific approach?
- Increase in bacteriological cure
  - Fewer chronic cases?
- Reduced chronic cases
  - Faster more appropriate treatment regimes
  - Reduced mastitis transmission
  - Contagious animals separated sooner
- Increase in well-being
  - Fewer severe cases
  - Pain relief

MASTITIS DETECTION PLUS CULTURING MAGNIFIES VALUE

DRYING OFF

- Abrupt cessation is US industry norm
- Milk leakage and discomfort are concern
- Increase risk of IMI Primiparous animals show reduced risk of IMI with gradual cessation
- Role in tailoring drying off approach
- Selective dry cow therapy

Dairy Farm Tech 2.0

Created by: PROGRESSIVE DAIRY · IFCN Dairy Data · Knowledge · Inspiration

SMALL

Small companies are defined as technology start-ups whose innovation is touching fewer than 100,000 cows.

ADIS, AgriCair, agricam, AgriGates, AIMER, Animall.in, AREETE, ArkeaBio, ARMENTA BeCowse We Care, Athian, bankbarn, Bezoar Laboratories, BINCONNECT, BINSENTRY, BIOFILTRO, Blue Ocean Barns, brainwired, BROLIS HERDLINE, Cattle Eye, CATTLE SCAN, Cattle Guru, CERES TAG, CHIMERTECH, chordata, CisGEN, Concept Dairy, COWEALTHY, COWOW, Dairycs, DairyLight Proven Science, DairyOffice, deLmos, DVARA Holdings, eCow, eio diagnostics, EMGENISYS, ExciPlex, Farm Health Guardian, Farmnote, Farm Tree, FaunaTech, Figured, FodderTech, FYTO, Grassa, HATO agricultural lighting, Healthy Cow, hydrogreen, INSYLO, Isomark Health, Krimanshi, KUHdo, Labby, Lasso, LEMNA, LUCI, MarginSmart, Midwest Grazing Exchange, Mileutis, Milkvilla, miRobot, MooMa, moonsyst, mooofarm, mootral, myaniml, Nano Discovery, Nofence, OmniEye, ONFARM, OneCup AI, Pastoral, PastureMap, peoplecor, Pharm Robotics, RenaissanceAg, ROVIBEC Agrisolutions, Rumin8, SomaDetect, Smart Soaker, TDLogix, TEC2FIT, The Lab 004, TJ Hoof Hub, TurboCow, VeriSeal, viehworld, VOLTA Greentech, wicow, Zeddy, zelp

MEDIUM

Medium companies are defined as early adoption companies who are touching between 100,000 and 1,000,000 cows.

Accu-trim, Acumen Detection, agolin, Agrimesh, AHV, All 4 Hooves, ams Galaxy USA, anitra, AOTOSO, automed, Axiota, Biolectric, BoviSync, cainthus by Ever.Ag, cynomys, Cattle Care, C-Lock Inc., Connecterra, Dairy Enteligen Forecast, Dairy Health & Management Services, Dairy Margin Tracker, dpn, ENGS Systems Innovative Dairy Solutions, FarmChamps, FarmLife, FBN, Feedlync, FERA, 丰顿科技 Foen Technology, FOSS, Green Source Automation LLC, HALTER, HANSKAMP, HerdStrong, Hokofarm Group, Hoofcount, Grand River Robotics, inBarn, iYOTAH, Kingswood Computing, LWR, MIMIRO, Mastatest, MilkingCloud, MILKTECHNZ, milk moovement, MmmooOgle, Moocall, MooMe, My Dairy Dashboard, native, Pasture.io, Peacock Technology, PROTEKTA, SCIO by Consumer Physics, smaXtec, TERRA NutriTECH, UniDairy 和牧兴邦, Valmetal, Vytelle, stellapps, VYLA

LARGE

Large companies are defined as those working with technology (research, development or acquisition) whose products touch more than 1,000,000 cows.

AAD Advanced Animal Diagnostics, ADISSEO, afimilk, Ajinomoto, Alltech, amelicor, balchem, BinMaster, BouMatic, Cargill, Ceva, 科湃腾 Copartner, Cowmanager, DDW, Dairymaster, DRMS, DATAMARS, DeLaval, DSM, Elanco, Ever.Ag, FarmTrace, fodjan, Förster Technik, Fullwood JOZ, FutureCow, Gallagher, GEA, Genus, GOHE 国科农牧, HALO Systems, herdwatch, Holm & Laue, iDDEN, Intellync, KEENAN an Alltech company, KEMIN, LELY, levno, LIC Automation, MADCAP Dairy Supply Chain Software, Madero Dairy Systems, MERCK Animal Health, Micro Technologies AmerisourceBergen, milc group, MILKLINE, milkrite InterPuls, Mtech, nedap, nutreco, PARNELL, prompt, Pearson Milking Technology, Rock River Laboratory, Inc. Agricultural Analysis, SenseHub, STgenetics, Teatwand, TOPCON Agriculture, Trans Ova Genetics, uniform agri, Urban, URUS, vas, VES-Artex, WAIKATO Milking Systems, 新牛智能 Xinniu Intelligent, ZISK, zoetis

This poster tracks companies developing and deploying 21st Century technology advancements for use in handling, milking or managing cows or youngstock on dairy farms globally. Technologies that offer solutions for use in farming applications or in the dairy supply chain are not included. Manure-handling technologies are not part of the scope of this project. However, technologies for the management of enteric methane and a farm's carbon footprint are included.

Companies displayed on the map are startups or may be partially / fully owned by other companies. Companies owning or investing in these new technology brands may also be included. Companies that solely distribute technology owned by others are not included.

Disclaimer: This poster is meant to be inclusive. If you feel your technology company has been inadvertently left off or inaccurately categorized, please email the poster's creators to be added to future versions. Follow linkedin.com/groups/12742633/ for updates.

For feedback contact: Torsten.hemme@ifcndairy.org; walt.cooley@agproud.com
Date updated: January 17, 2024

WKU SmartHolstein Lab Daily Data

Production

75.8 lbs milk	83.8 energy-corrected milk	5:52 milking time min:ss
4.3 fat %	3.3 protein %	4.4 lactose %
9.2 conductivity	177,000 test day SCC cells/ml	102.5 rumen temperature

Behavior

138 steps/hr	10:26 rest time hr/d	9.7 rest bouts/d
3:06 eating time hr/d	4:05 active time hr/d	8:01 rumination hr/d
4:36 time at feedbunk hr/d	5:48 standing time hr/d	1:54 time out of pen hr/d
87.2 cow comfort index		

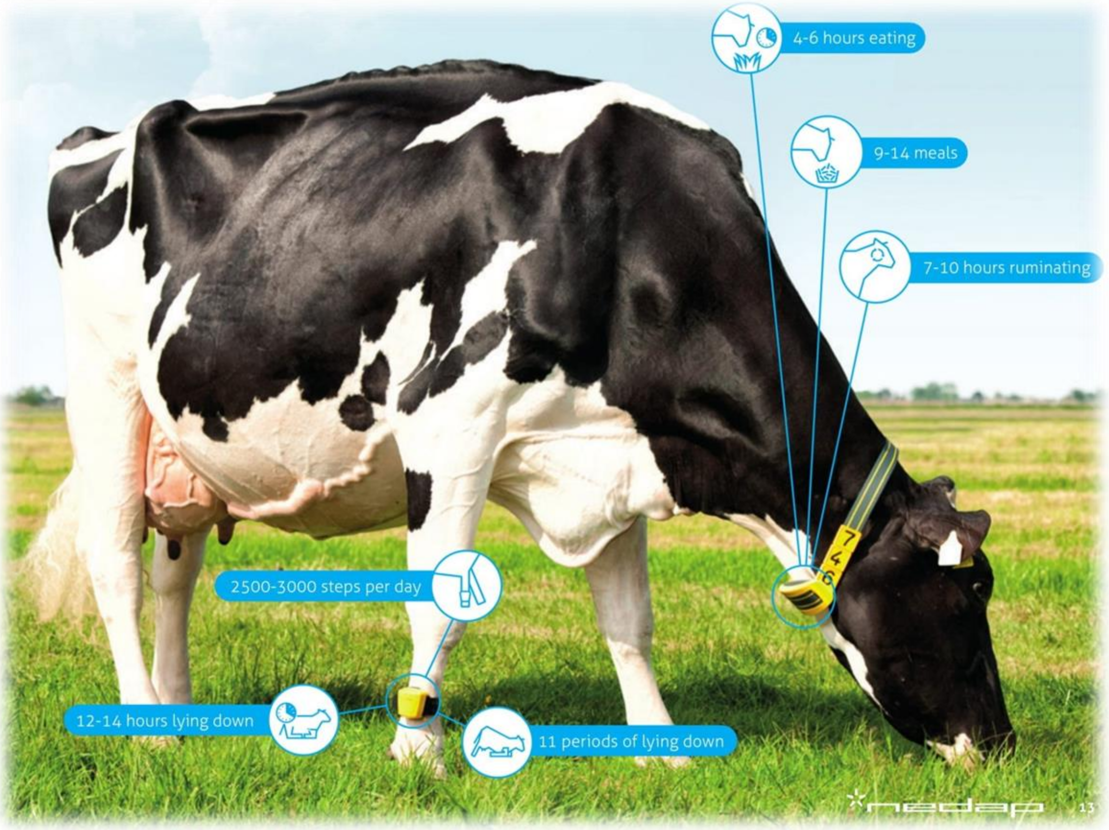
Environment

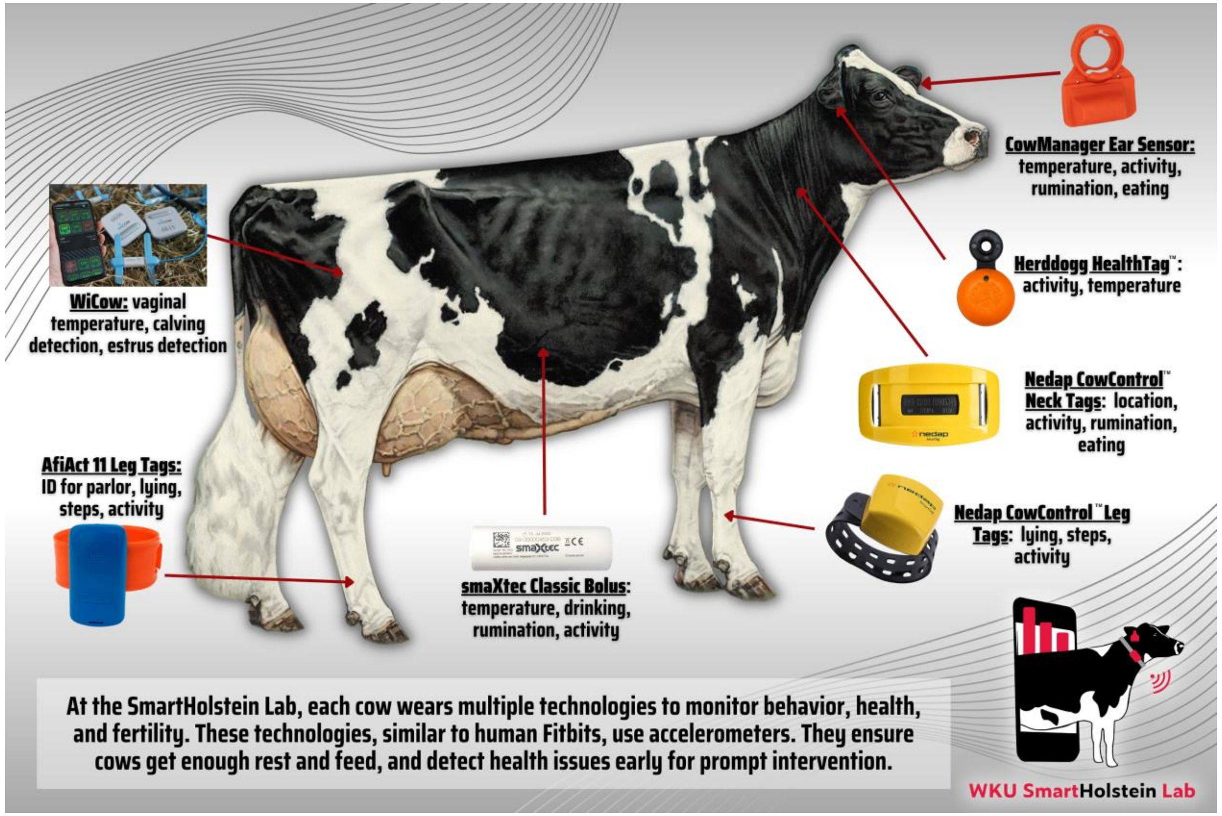
58.8 THI	0.1 rain (in.)	1.1 ammonia (ppm)
0.6 methane (ppm)	21.1 TVOC (ppm)	225.2 light (lux)

Nutrition

1.1 deliveries/day	7.4 pushups/day	0.9 cleanouts/day
4:03 low feed hr/d	6.2 rumen pH	

Wearable Sensors





ChordataDairy™

First health microchip optimized for dairy

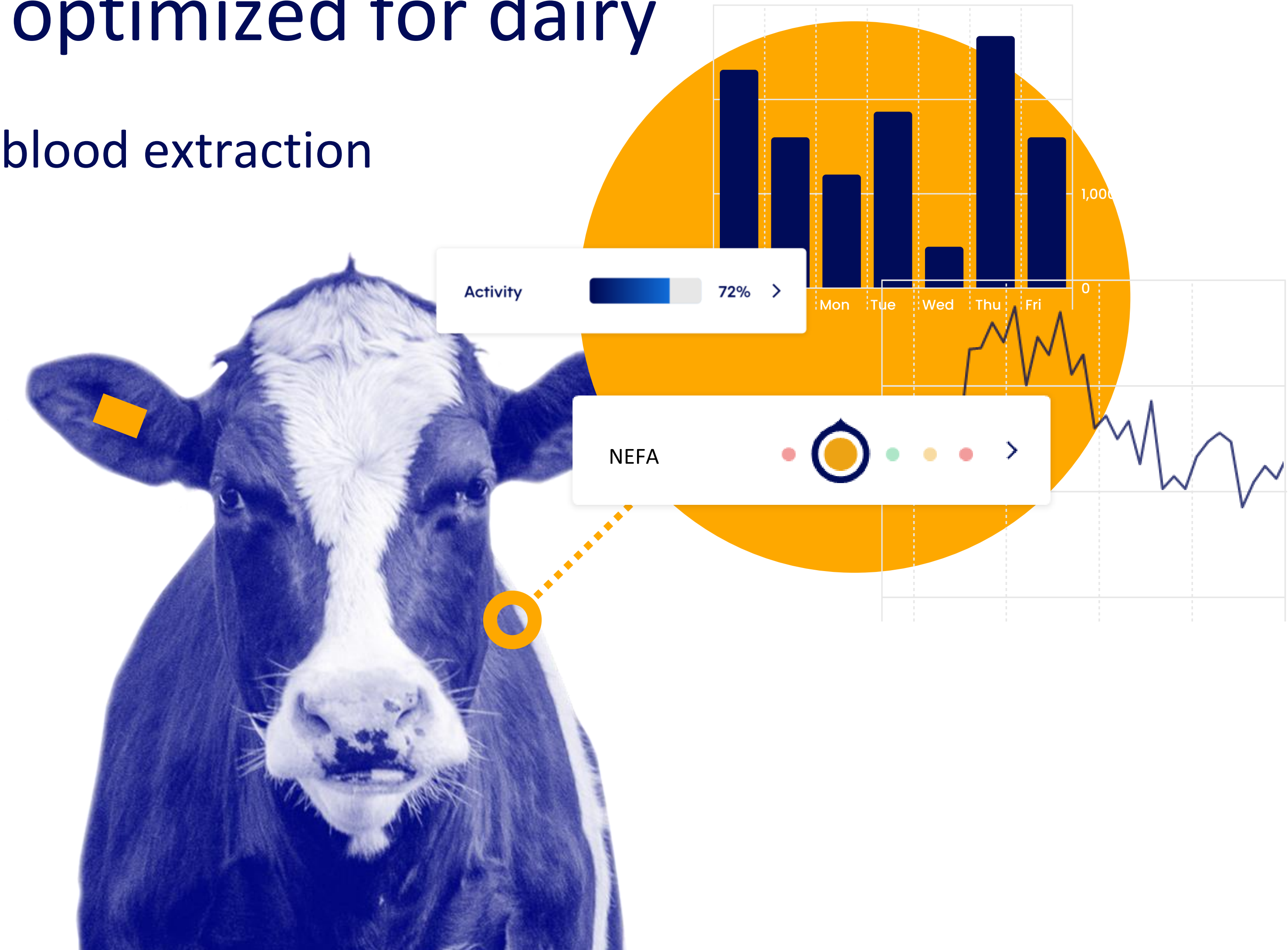
Real-time measurement without blood extraction

- ✓ Progesterone for Fertility
- ✓ BUN, BHB and NEFA for energy status
- ✓ Body temperature

With a smart ear tag monitoring

- ✓ Lameness
- ✓ Movement
- ✓ Behaviour

And API data integration from other technologies



connecterra

Decision support

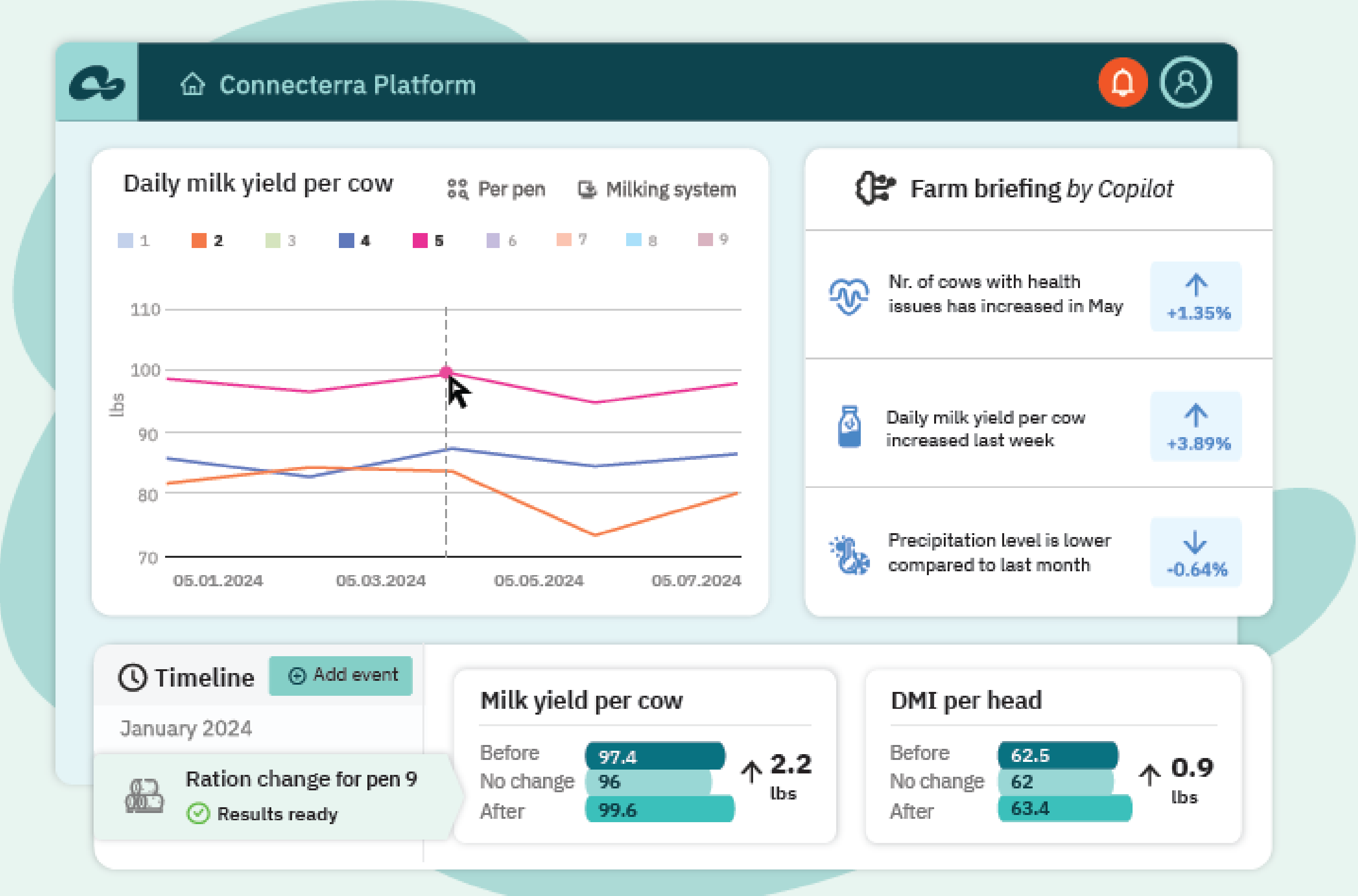
Quantify the impact of your interventions and make data-driven decisions

- Keep a centralized record of changes and events
- Understand the impact of changes you make
- Make better decisions for your herd and operations

Copilot

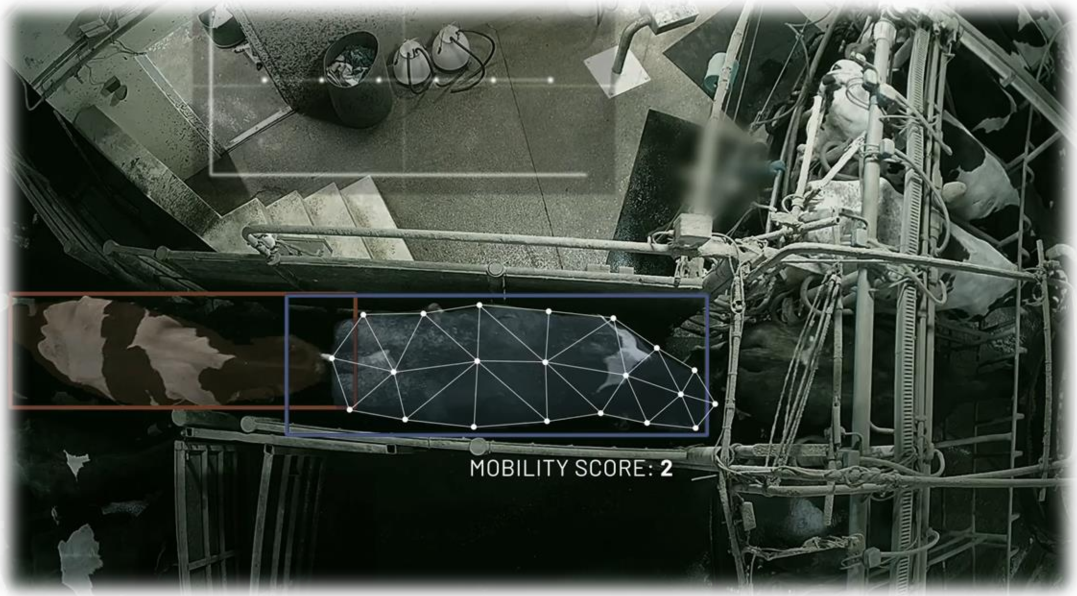
AI-powered Copilot automates data analysis and sends key insights to your inbox

- Save time spent browsing through data
- Get a weekly summary of key changes and outliers
- Identify hard-to-spot issues with advanced AI



connecterra

Machine Vision Technologies



CATTLE EYE

BOVICA²IR

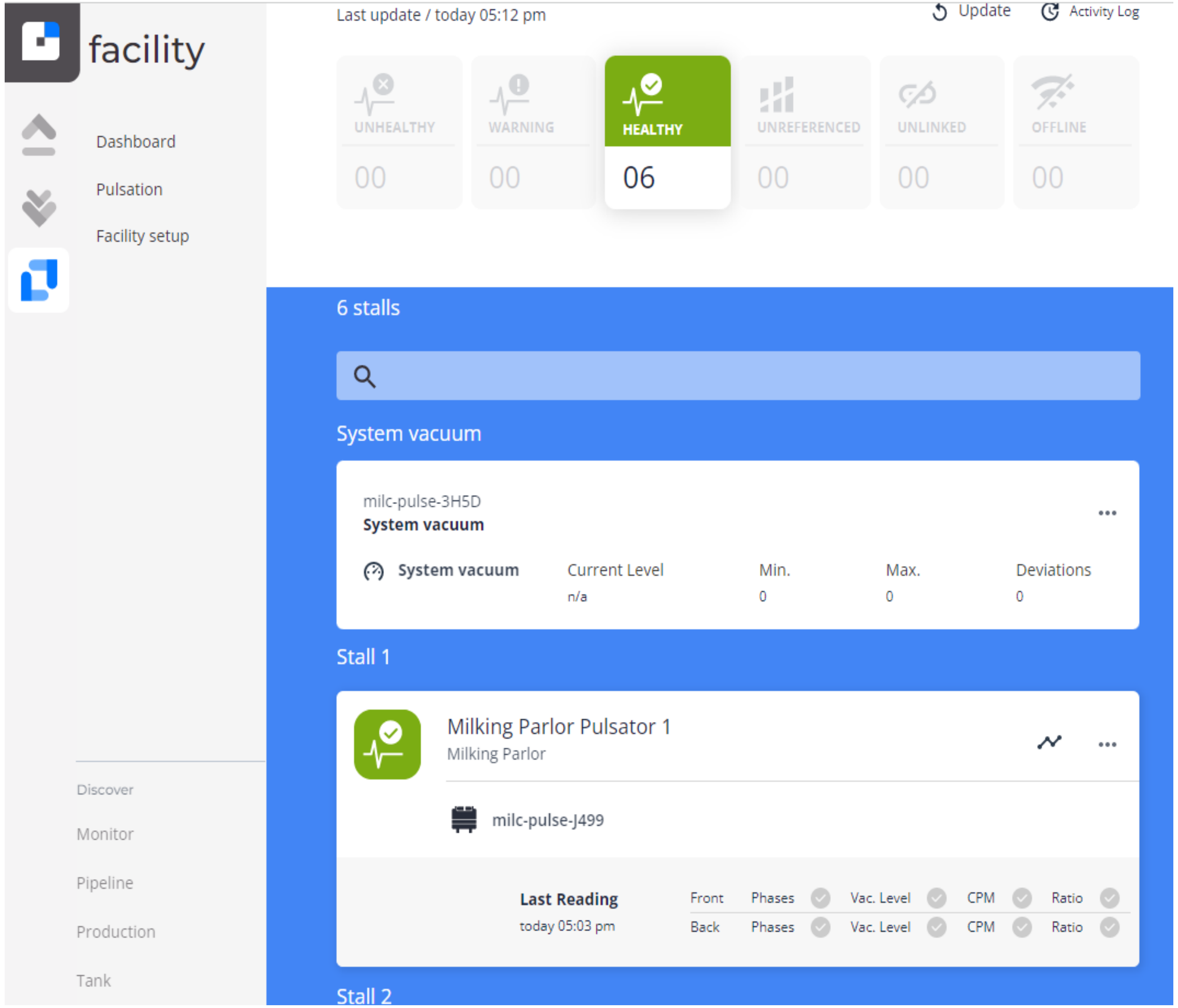
Cattle Care

Missed Post Dip Event

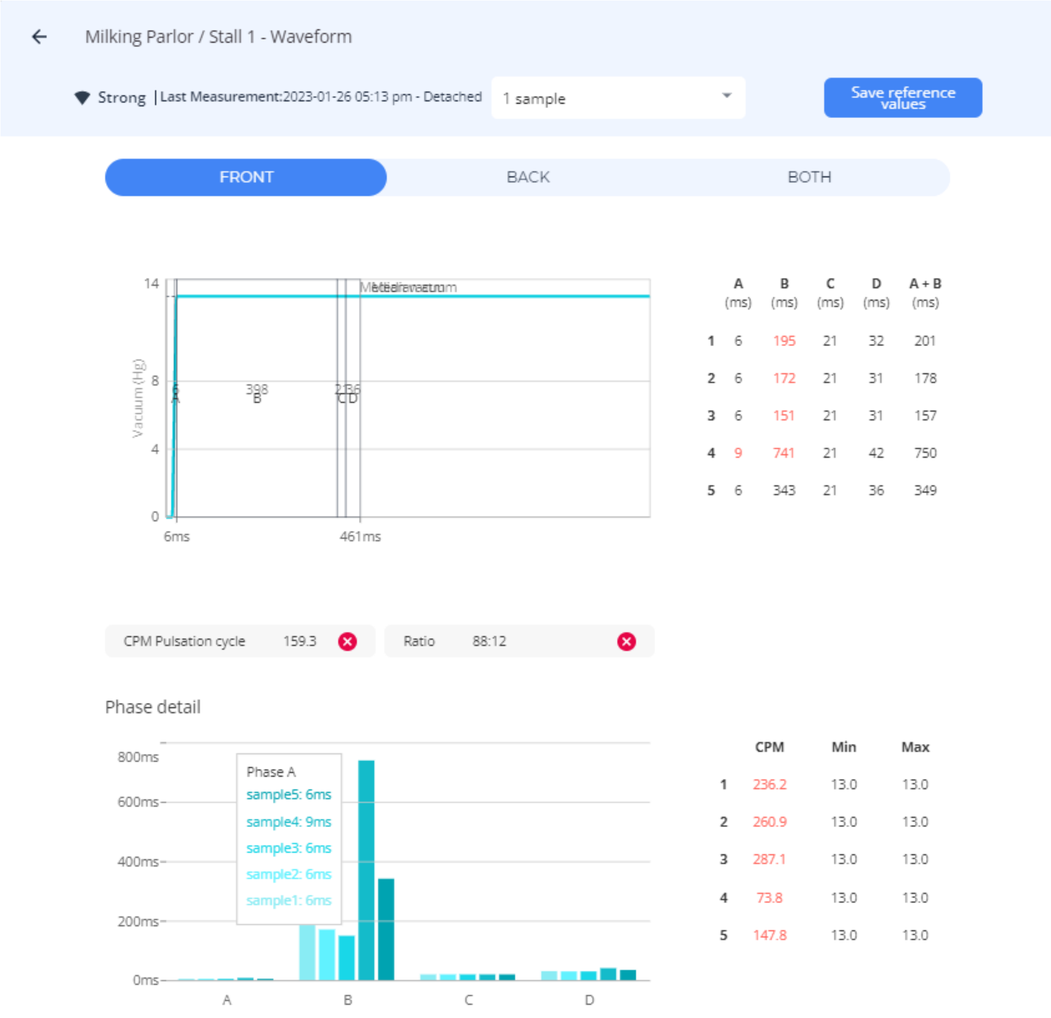
Phone Time

milc group

milc pulse



facility
Last update / today 05:12 pm
Update
Activity Log
UNHEALTHY
00
WARNING
00
HEALTHY
06
UNREFERENCED
00
UNLINKED
00
OFFLINE
00
Dashboard
Pulsation
Facility setup
6 stalls
System vacuum
milc-pulse-3H5D
System vacuum
System vacuum
Current Level
n/a
Min.
0
Max.
0
Deviations
0
Stall 1
Milking Parlor Pulsator 1
Milking Parlor
milc-pulse-J499
Last Reading
today 05:03 pm
Front
Back
Phases
Vac. Level
CPM
Ratio
Discover
Monitor
Pipeline
Production
Tank
Stall 2



Milking Parlor / Stall 1 - Waveform
Strong
Last Measurement:2023-01-26 05:13 pm - Detached
1 sample
Save reference values
FRONT
BACK
BOTH
6ms
461ms
A (ms)
B (ms)
C (ms)
D (ms)
A + B (ms)
1 6 195 21 32 201
2 6 172 21 31 178
3 6 151 21 31 157
4 9 741 21 42 750
5 6 343 21 36 349
CPM Pulsation cycle 159.3
Ratio 88:12
Phase detail
Phase A
sample5: 6ms
sample4: 9ms
sample3: 6ms
sample2: 6ms
sample1: 6ms
800ms
600ms
400ms
200ms
0ms
A
B
C
D
CPM
Min
Max
1 236.2 13.0 13.0
2 260.9 13.0 13.0
3 287.1 13.0 13.0
4 73.8 13.0 13.0
5 147.8 13.0 13.0

Labby
Optical intelligence for milk

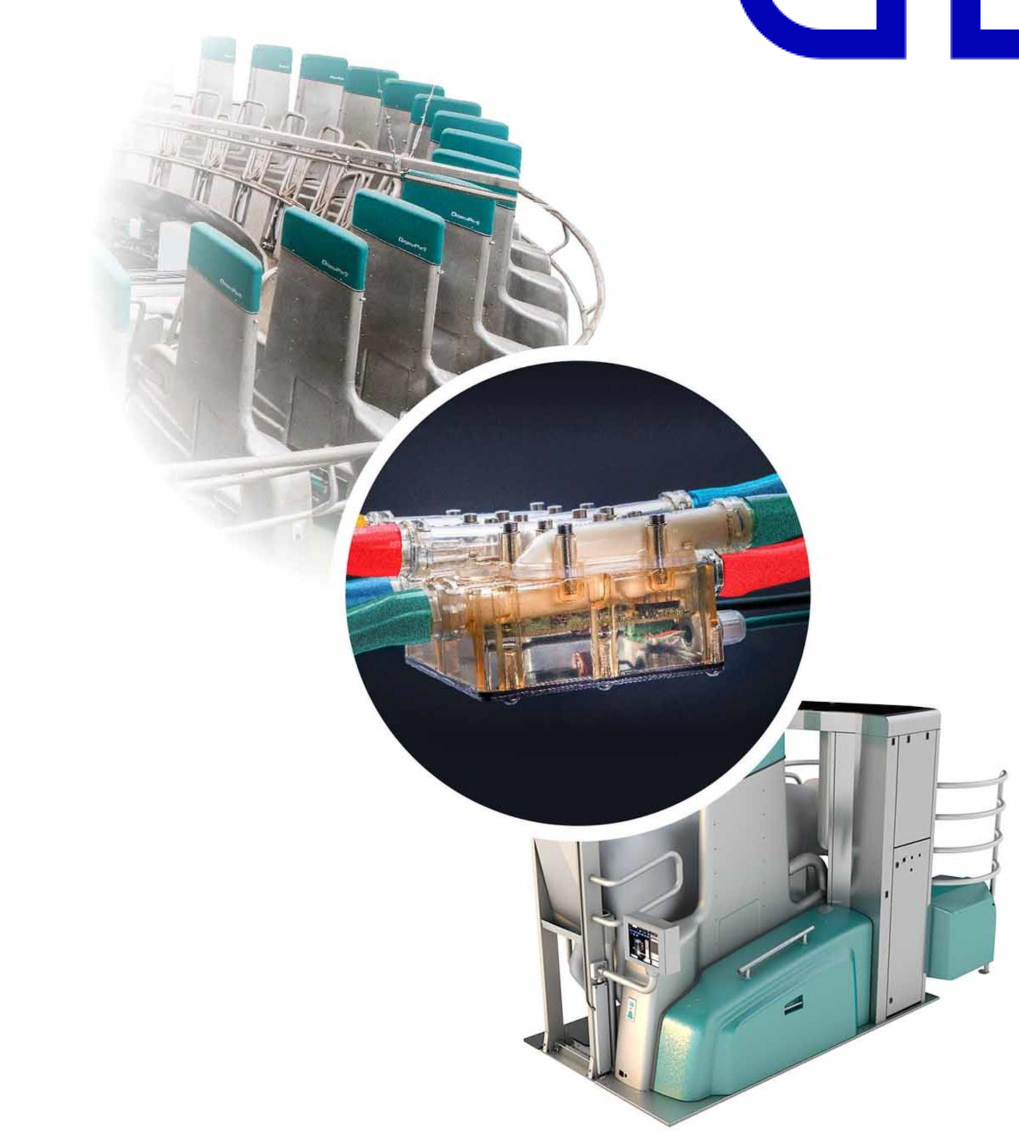
GEA

Inline Somatic Cell Count

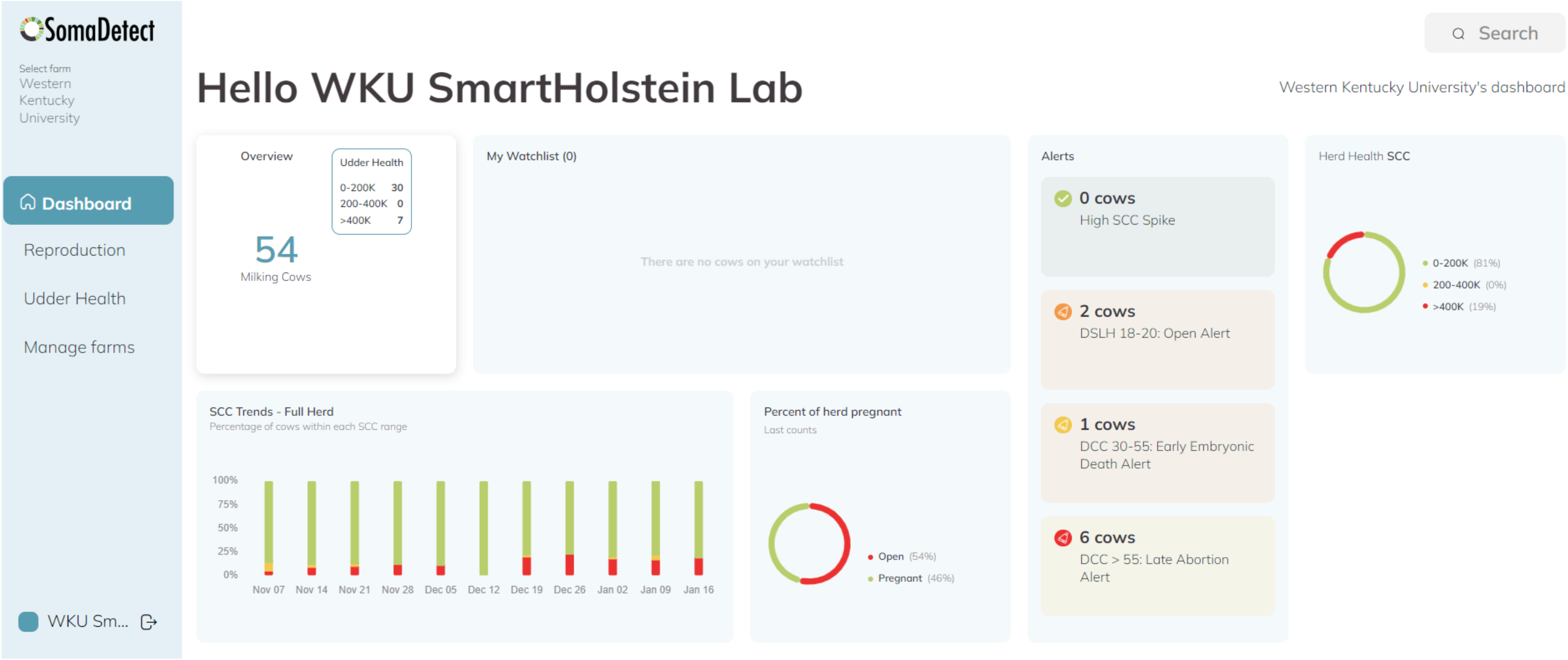
SomaDetect

GEA'S DAIRYMILK M6850

- First somatic cell count system focus on each udder quarter individually
- Works with DairyRobot R9500, former Monobox or DairyProQ
- Uses Electrical Permittivity Threshold (EPT) technology, a patented, physical method to measure somatic cell counts in milk, with no resources or reagents

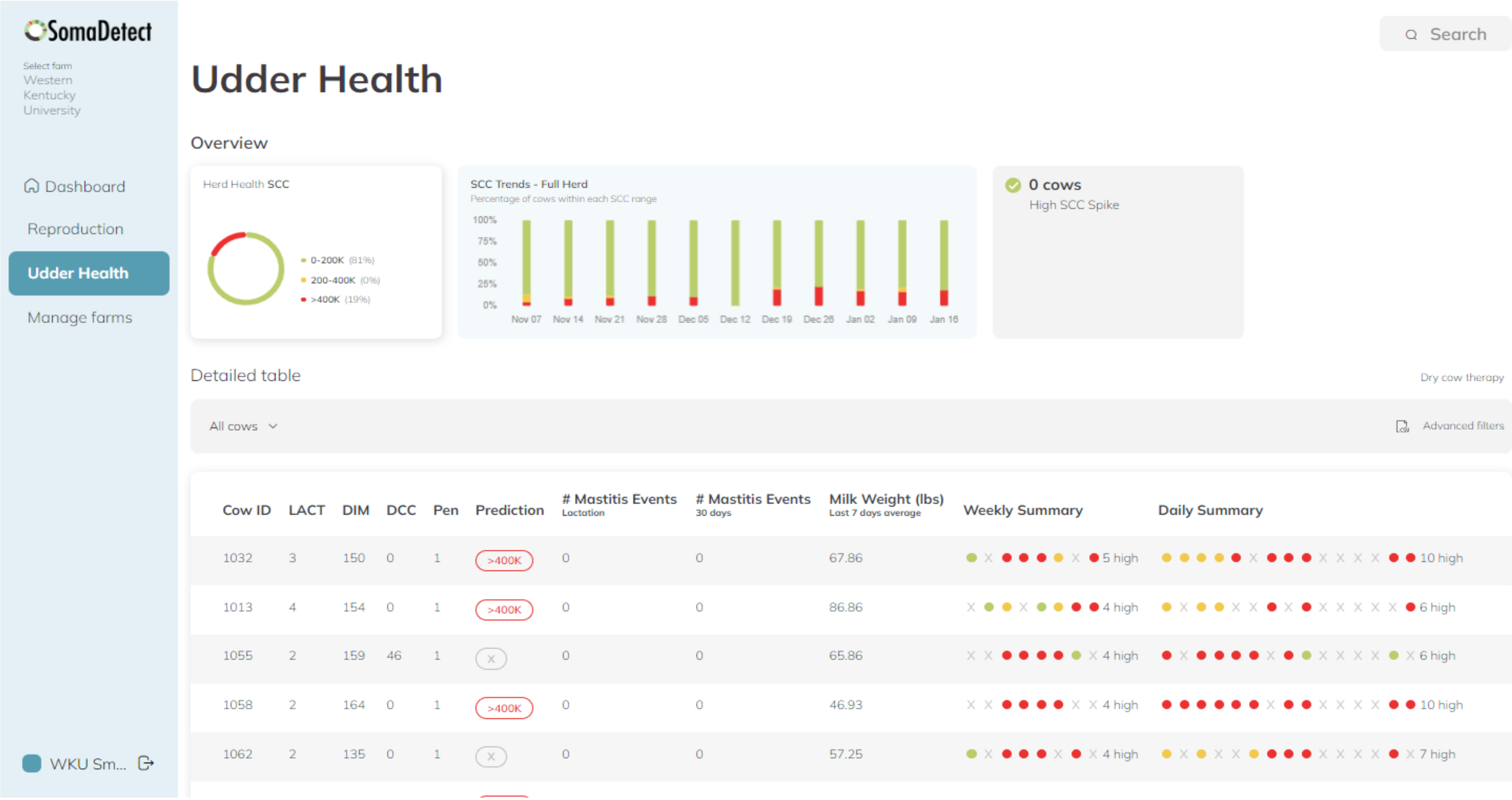


SomaDetect



SomaDetect
Select farm
Western Kentucky University
Dashboard
Reproduction
Udder Health
Manage farms
WKU Sm...
Search
Hello WKU SmartHolstein Lab
Western Kentucky University's dashboard
Overview
Udder Health
0-200K 30
200-400K 0
>400K 7
54
Milking Cows
My Watchlist (0)
There are no cows on your watchlist
Alerts
0 cows
High SCC Spike
2 cows
DSLH 18-20: Open Alert
1 cows
DCC 30-55: Early Embryonic Death Alert
6 cows
DCC > 55: Late Abortion Alert
Herd Health SCC
0-200K (81%)
200-400K (0%)
>400K (19%)
SCC Trends - Full Herd
Percentage of cows within each SCC range
100%
75%
50%
25%
0%
Nov 07
Nov 14
Nov 21
Nov 28
Dec 05
Dec 12
Dec 19
Dec 26
Jan 02
Jan 09
Jan 16
Percent of herd pregnant
Last counts
Open (54%)
Pregnant (46%)

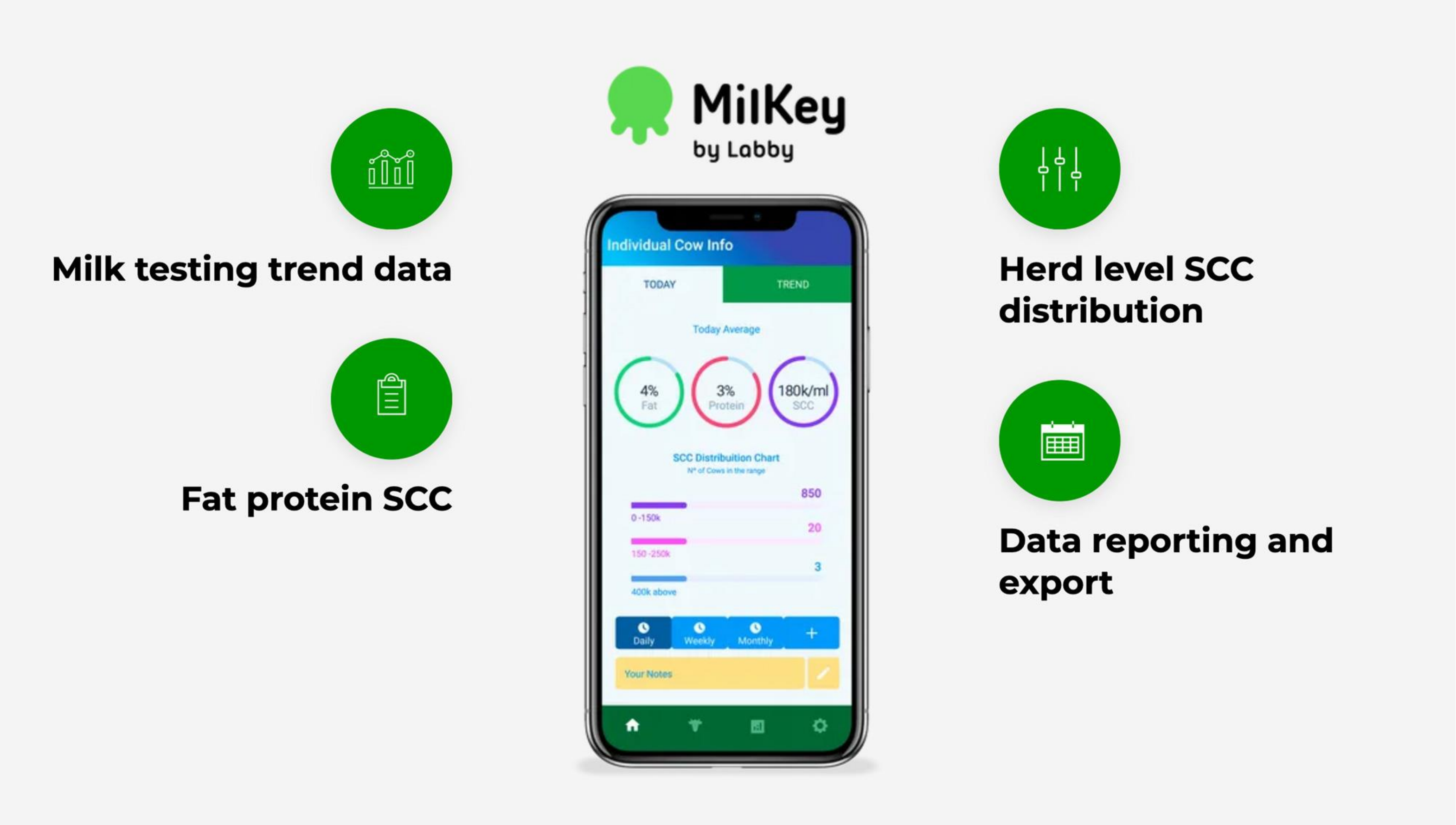
SomaDetect


SomaDetect
Select farm
Western Kentucky University
Dashboard
Reproduction
Udder Health
Manage farms
WKU Sm...
Search
Udder Health
Overview
Herd Health SCC
0-200K (81%)
200-400K (0%)
>400K (19%)
SCC Trends - Full Herd
Percentage of cows within each SCC range
100%
75%
50%
25%
0%
Nov 07
Nov 14
Nov 21
Nov 28
Dec 05
Dec 12
Dec 19
Dec 26
Jan 02
Jan 09
Jan 16
0 cows
High SCC Spike
Detailed table
Dry cow therapy
All cows
Advanced filters
Cow ID
LACT
DIM
DCC
Pen
Prediction
Mastitis Events Lactation
Mastitis Events 30 days
Milk Weight (lbs) Last 7 days average
Weekly Summary
Daily Summary
1032 3 150 0 1 >400K 0 0 67.86 5 high 10 high
1013 4 154 0 1 >400K 0 0 86.86 4 high 6 high
1055 2 159 46 1 X 0 0 65.86 4 high 6 high
1058 2 164 0 1 >400K 0 0 46.93 4 high 10 high
1062 2 135 0 1 X 0 0 57.25 4 high 7 high

Labby

Optical intelligence for milk

- Light scattering, absorption and fluorescence to simultaneously determine milk composition
- In-line and handheld devices



ELECTRICAL CONDUCTIVITY

- Ion concentration of milk changes, increasing electrical conductivity
- Inexpensive and simple equipment
- Wide range of sensitivity and specificity reported
- Results improve with quarter level sensors
- Improved results with recent algorithms
- Most useful combined with other metrics

MILK COLOR

- Color variation (red, blue, and green) sensors in some automatic milking systems
- Reddish color indicates blood (Ordolff, 2003)
- Clinical mastitis may change color patterns for three colors (red, green and blue)
- Specificity may be limited

THE POWER WITHIN

Core body temperature monitoring has promise as a mastitis detection tool.

BY KIM SCHOONMAKER

Temperature

- Not all cases of mastitis result in a temperature response
- Best location to collect temperature?
- Noise from other physiological impacts

J. Dairy Sci. 94:3568–3574
doi:10.3168/jds.2010-3944

The use of a radiotelemetric ruminal bolus to detect body temperature changes in lactating dairy cattle

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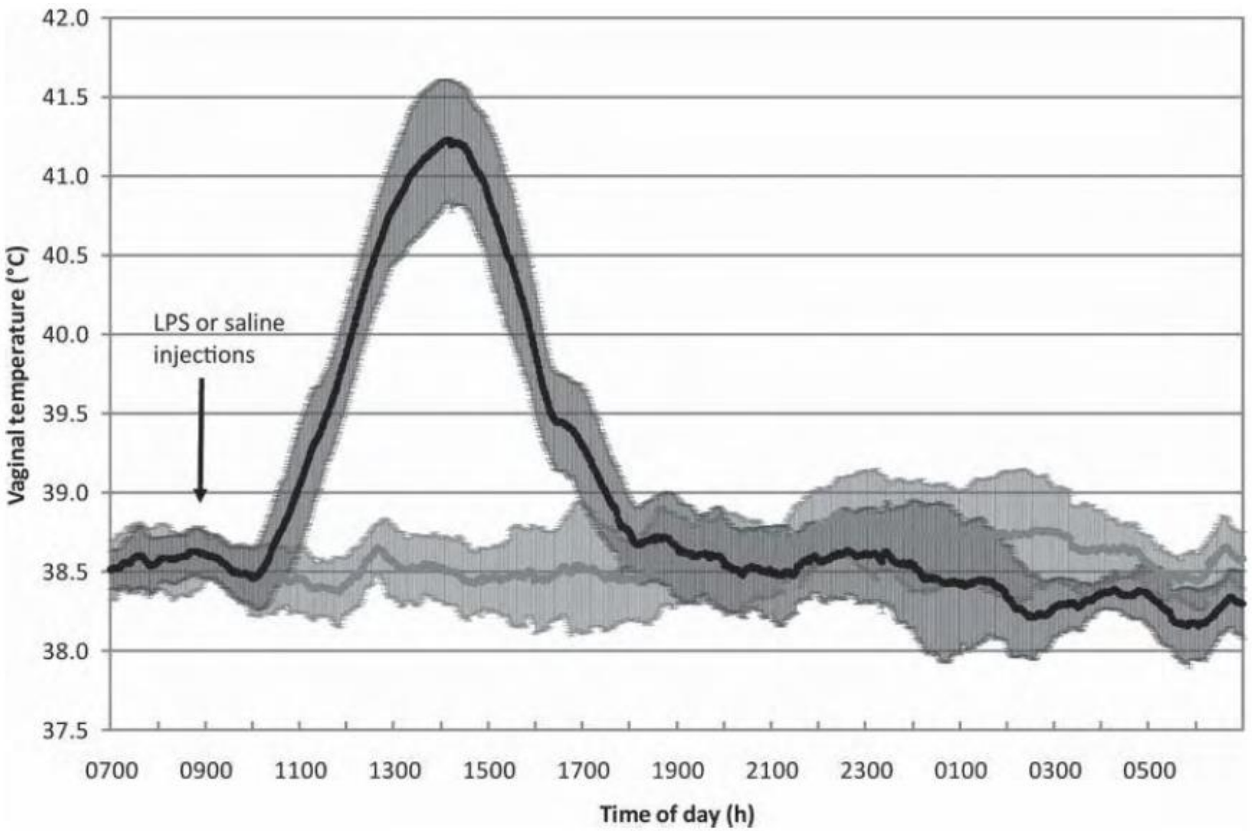

Figure 1. Twenty-four-hour recording of vaginal temperature during d 21 of cows received intramammary injection of LPS (black marker) or saline (gray marker). Each point (n = 16) represents average vaginal temperature recorded during a given minute. The error bars represent standard deviation. Lipopolysaccharide or saline injections were administered at 0900 h, as depicted by the arrow.

J. Dairy Sci. 106:1360–1369
https://doi.org/10.3168/jds.2022-22421

Evaluation of reticuloruminal temperature for the prediction of clinical mastitis in dairy cows challenged with *Streptococcus uberis*

Zelmar Rodriguez,[1*] Quinn K. Kolar,[2] Kirby C. Krogstad,[2] Turner H. Swartz,[2] Ilkyu Yoon,[3] Barry J. Bradford,[2] and Pamela L. Ruegg[1]
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[3]Diamond V, Cedar Rapids, IA 52404

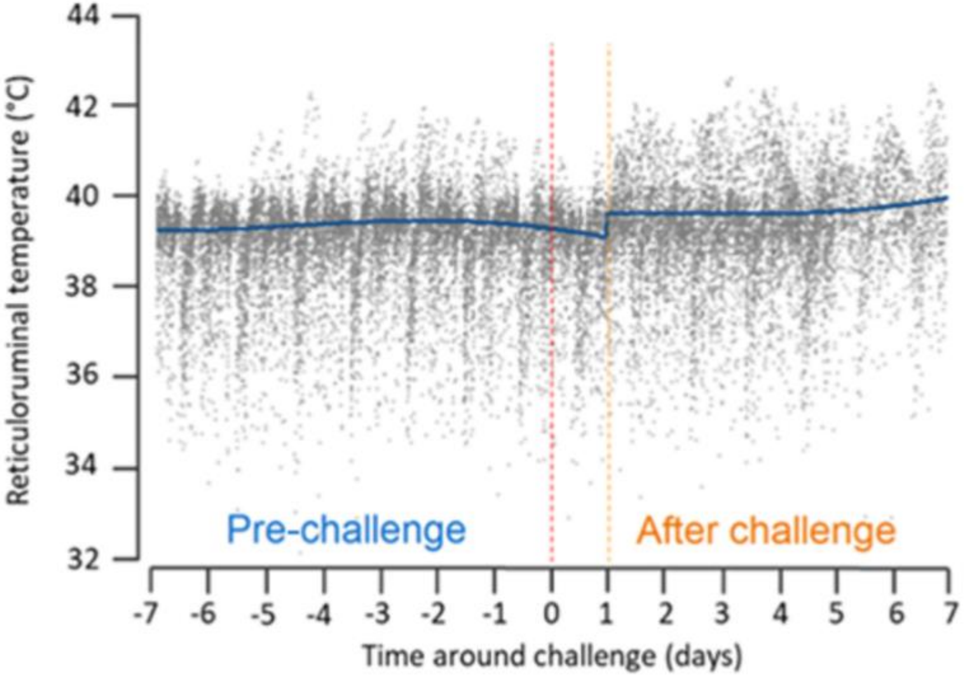

Figure 2. Interrupted time series model with a 1-d delay for reticuloruminal temperature (RRT) variation based on the day of intramammary challenge with *Streptococcus uberis* in 37 Holstein dairy cows. Cohorts 1 and 2 (n = 17) were followed until d 7, whereas cohorts 3 and 4 (n = 20) were followed until d 5. Days are relative to intramammary challenge with *Strep. uberis* (d 0). The red dashed line marks the day of the challenge, whereas the orange dashed line (right side) marks the day on which variation in RRT was observed. Results indicate that IMI induced an increase in RRT of 0.54°C (95% CI: 0.41, 0.66; $P < 0.001$) 24 h after intramammary challenge with *Strep. uberis*.

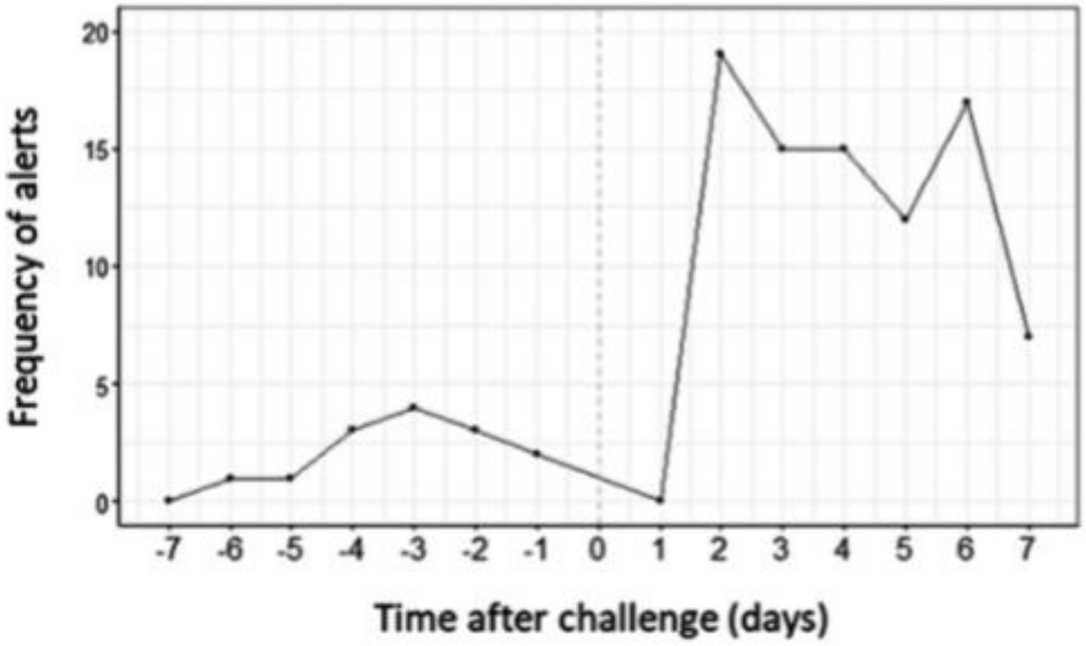

Figure 3. Frequency of health-related alerts based on the time of intramammary challenge. Day 0 represents the day of the intramammary challenge with *Streptococcus uberis*. During the week before the challenge, 13.6% of the alerts were recorded, whereas 86.4% were recorded after the challenge.

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Table 1. Performance of the reticuloruminal temperature (RRT) alerts to predict clinical mastitis (CM) in cows challenged with *Streptococcus uberis*[1]

CM severity score	Test characteristic	Ability to predict CM at least 24 h before onset of clinical signs, % (95% CI)
Mild (severity 1)	Se[2]	90.9 (58.7, 99.8)
	Sp[3]	90.9 (58.7, 99.8)
	PPV[4]	90.9 (58.7, 99.8)
	NPV[5]	90.9 (58.7, 99.8)
	Accuracy[6]	90.9 (70.8, 98.9)
Moderate (severity 2)	Se	77.8 (57.7, 91.4)
	Sp	92.6 (75.7, 99.1)
	PPV	91.3 (72.0, 98.9)
	NPV	80.6 (62.5, 92.5)
	Accuracy	85.2 (72.9, 93.4)
Severe (severity 3)	Se	100 (59.0, 100)
	Sp	85.7 (42.1, 99.6)
	PPV	87.5 (47.3, 99.7)
	NPV	100 (54.1, 100)
	Accuracy	92.9 (66.1, 99.8)

[1]Based on severity score at least 24 h before the occurrence of clinical signs of a given severity in 37 Holstein dairy cows.

[2]Se = sensitivity: correct prediction of a CM status based on a generated RRT alert.

[3]Sp = specificity: correct prediction of a CM absence status based on the lack of an RRT alert.

[4]PPV = positive predictive value: probability that, given an RRT alert, the cow will develop CM of a given severity.

[5]NPV = negative predictive value: probability that, given a lack of an RRT alert, the cow will not develop CM of a given severity.

[6]Accuracy includes 22 observations for mild severity, 54 for moderate, and 14 for severe severity.

ADVANCED IMAGING & MACHINE LEARNING

We automate mastitis detection without touching the cow or milk.

- Camera installed on rotary parlor
- Infrared image analysis at every milking
- In-barn, "edge", data processing
- Real-time signal to workers
- Integrates with other farm software systems

Thermography

May be limited because not all cases of mastitis result in a temperature response

Difficulties in collecting images

Before Infection   After Infection

Animal 16 (2022) 100646

Contents lists available at ScienceDirect

Animal

The international journal of animal biosciences

Accurate detection of dairy cow mastitis with deep learning technology: a new and comprehensive detection method based on infrared thermal images

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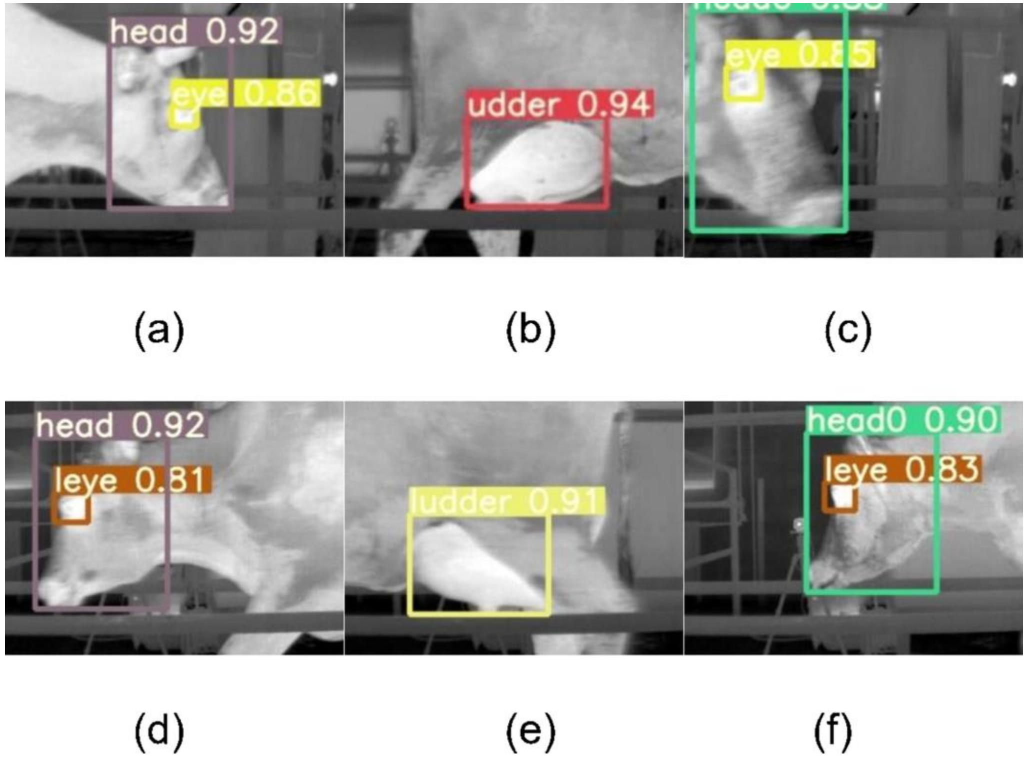


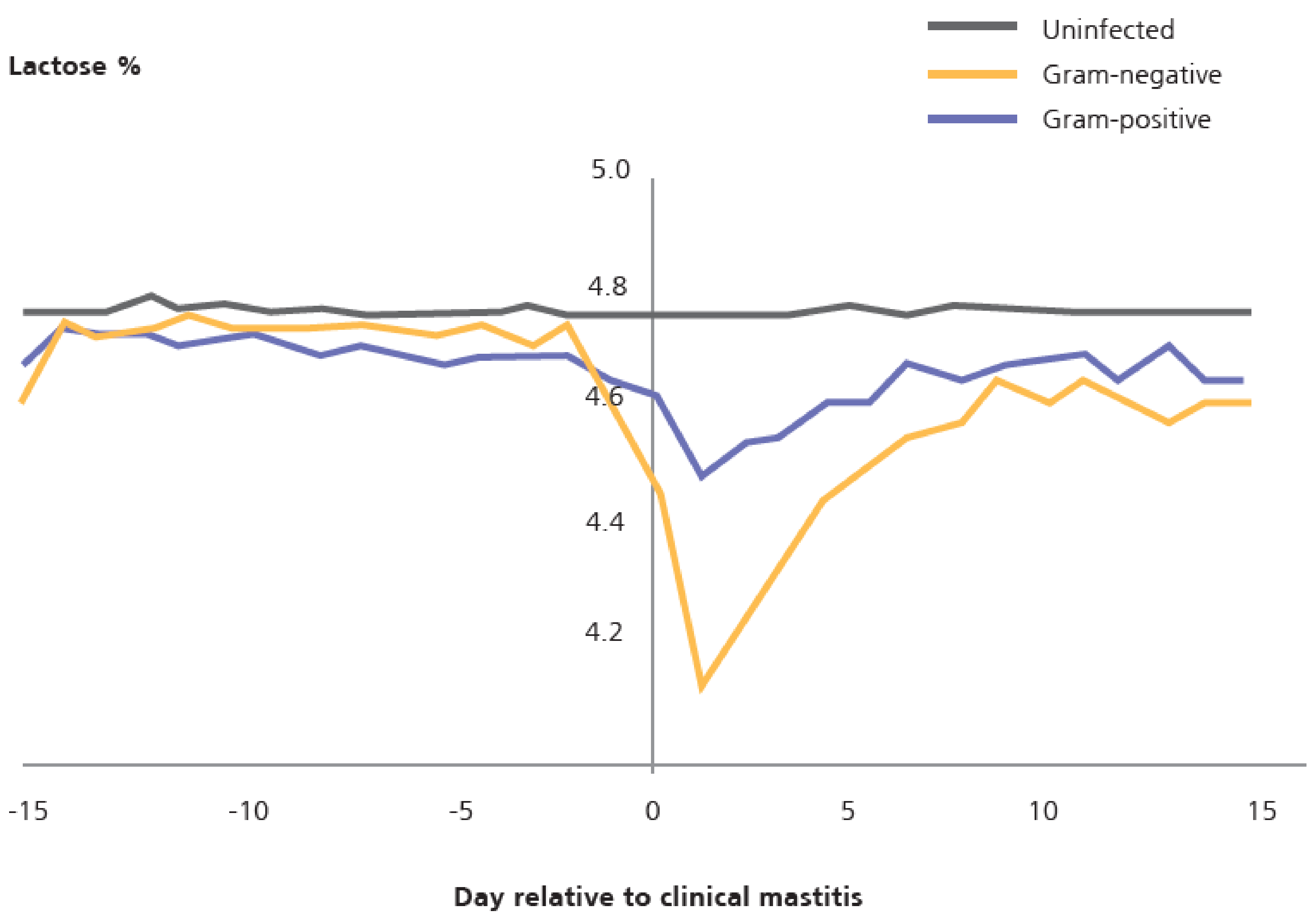
Table 2
Detection results of three methods for 105 Holstein cows mastitis.

Detection method	Specificity (%)	Sensitivity (%)	Accuracy (%)
Left and right USST difference method	97.44	33.33	80.95
OST and USST difference method	58.97	96.30	68.57
New and comprehensive method	84.62	96.30	87.62

Abbreviations: USST = udder skin surface temperature; OST = ocular surface temperature.

Spectroscopy

- Visible, near-infrared, mid-infrared, or radio frequency
- Indirect identification through changes in milk composition
- AfiLab uses near infrared
  - Fat, protein, lactose



Steele and Petersson-Wolfe, unpublished

J. Dairy Sci. 102:11233–11249
https://doi.org/10.3168/jds.2019-16549

The effect of J5 bacterins on clinical, behavioral, and antibody response following an *Escherichia coli* intramammary challenge in dairy cows at peak lactation

N. M. Steele,[1,2*] T. H. Swartz,[1] K. M. Enger,[3] H. Schramm,[4] R. R. Cockrum,[1] S. J. Lacy-Hulbert,[2] R. R. White,[5] J. Hogan,[3] and C. S. Petersson-Wolfe[1]
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[2]DairyNZ Ltd., Private Bag 3221, Hamilton 3240, New Zealand
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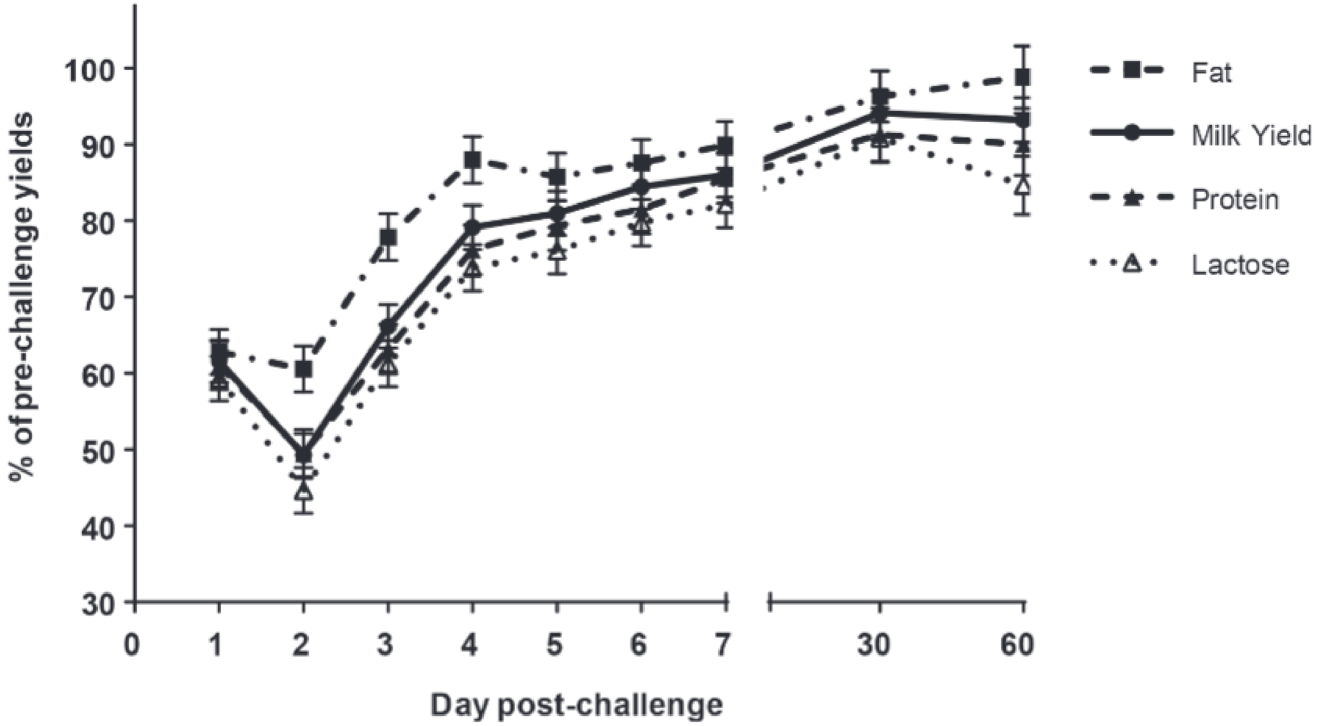
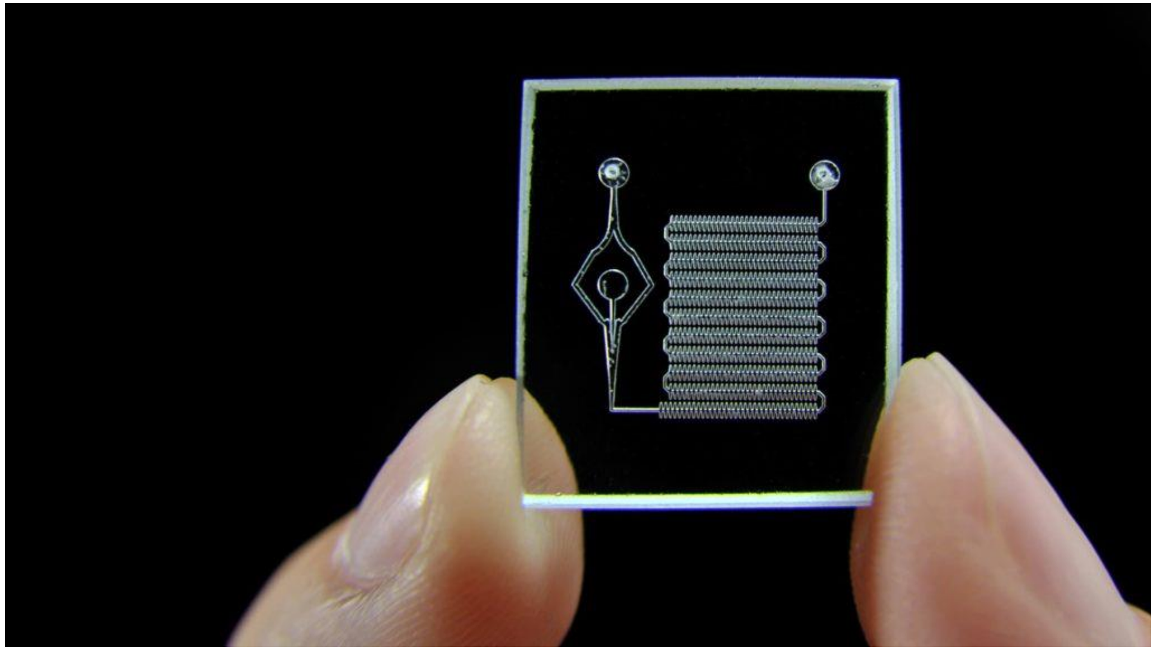
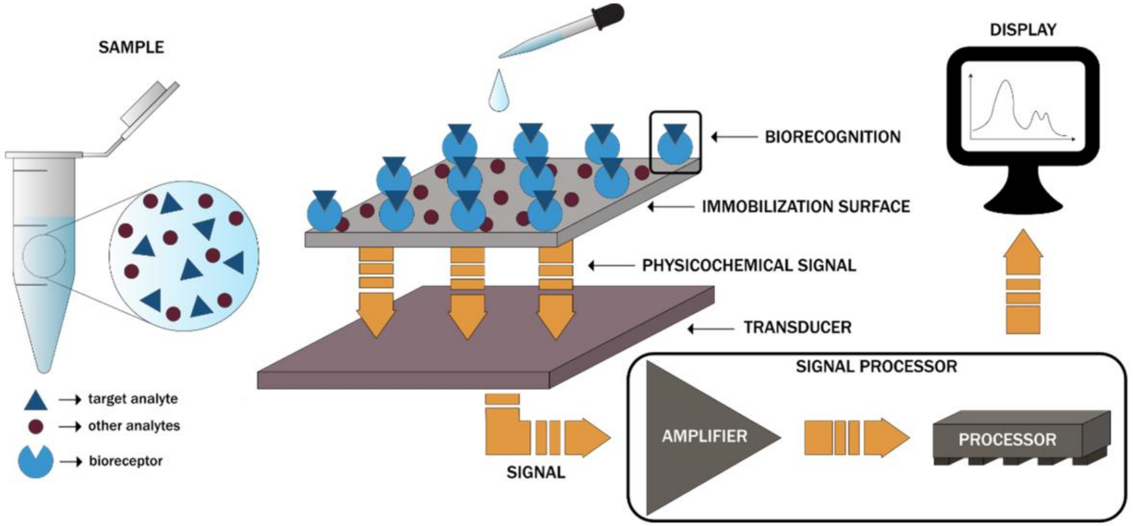


Figure 3. Least squares means (±SEM) of the percent of pre-challenge yields (kg) for milk yield, milk fat, milk protein, and milk lactose in the 60 d following an intramammary challenge with *Escherichia coli*. No significant differences were found between treatments ($P > 0.05$).

Lab on a Chip



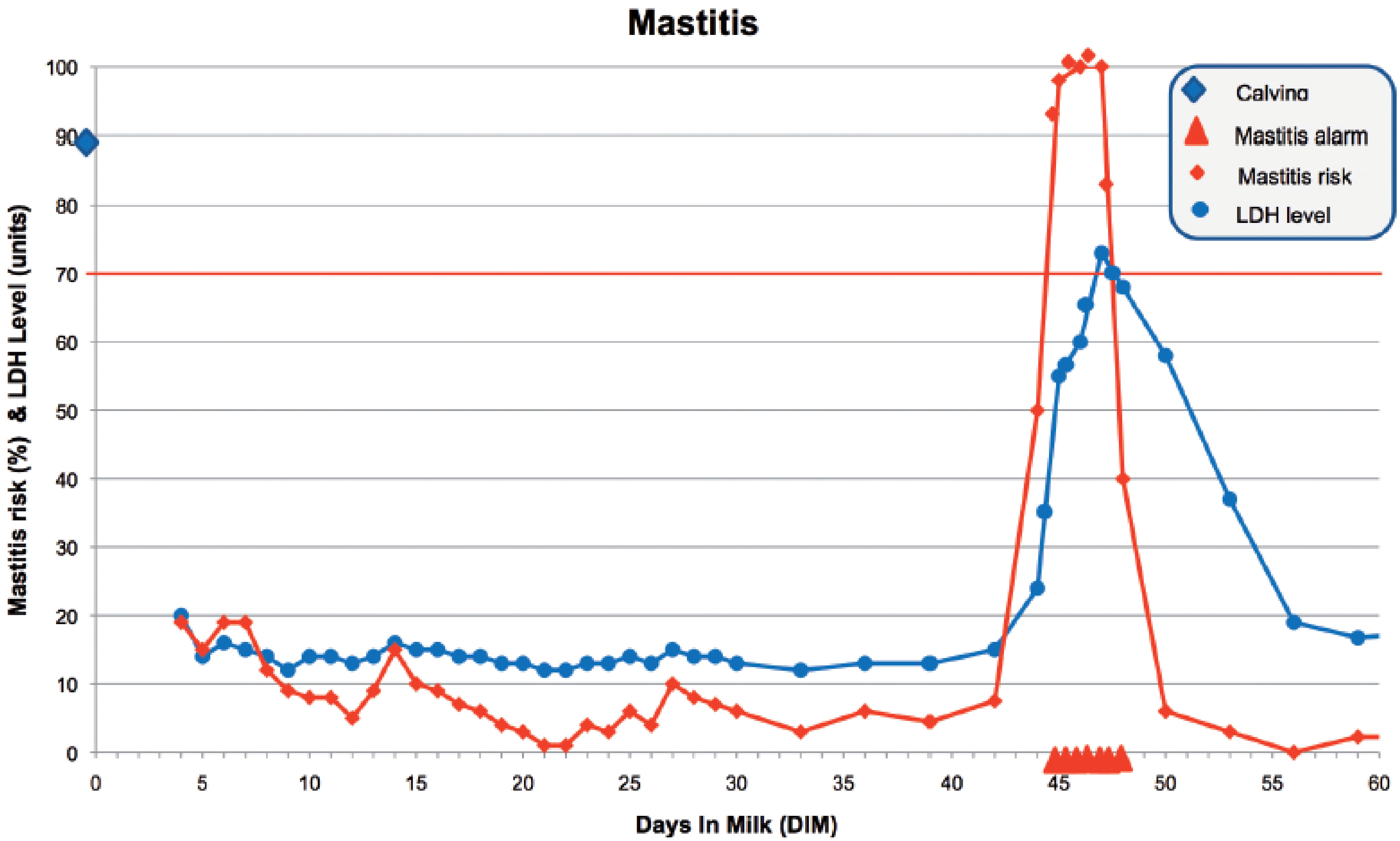

SAMPLE
DISPLAY
BIORECOGNITION
IMMOBILIZATION SURFACE
PHYSICOCHEMICAL SIGNAL
TRANSDUCER
SIGNAL PROCESSOR
AMPLIFIER
PROCESSOR
SIGNAL
target analyte
other analytes
bioreceptor

Biosensors and Chemical Sensors

- Biological components (enzymes, antibodies, or microorganism)
- Enzyme, L-Lactate dehydrogenase (LDH), is released because of the immune response and changes in cellular membrane chemistry
- Chemical sensors: changes in chloride, potassium, and sodium ions, volatile metabolites resulting from mastitis, haptoglobin, and hemoglobin (Hogeveen, 2011)

Herd Navigator

- Progesterone
  - Heat detection
  - Pregnancy detection
- LDH enzyme
  - Early mastitis detection
- BHBA
  - Indicator of subclinical ketosis
- Urea
  - Protein status



Mastitis
Calving
Mastitis alarm
Mastitis risk
LDH level
Mastitis risk (%) & LDH Level (units)
Days In Milk (DIM)
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20
25
30
35
40
45
50
55
60

Individual Cow SCC from a Bulk Tank Sample

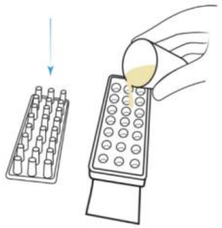
On-Farm PCR Pathogen Detection

Acumen DETECTION

1

Load cartridge

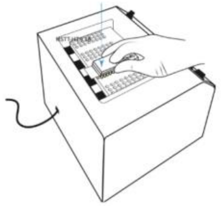
Add milk sample to Mastatest cartidge, then replace the lid. Firmly tap cartridge to dislodge any bubbles.



2

Place in Lapbox

Place Mastatest cartridge into the Lapbox™, enter cow number, then start the test.



3

Results in 24 hours

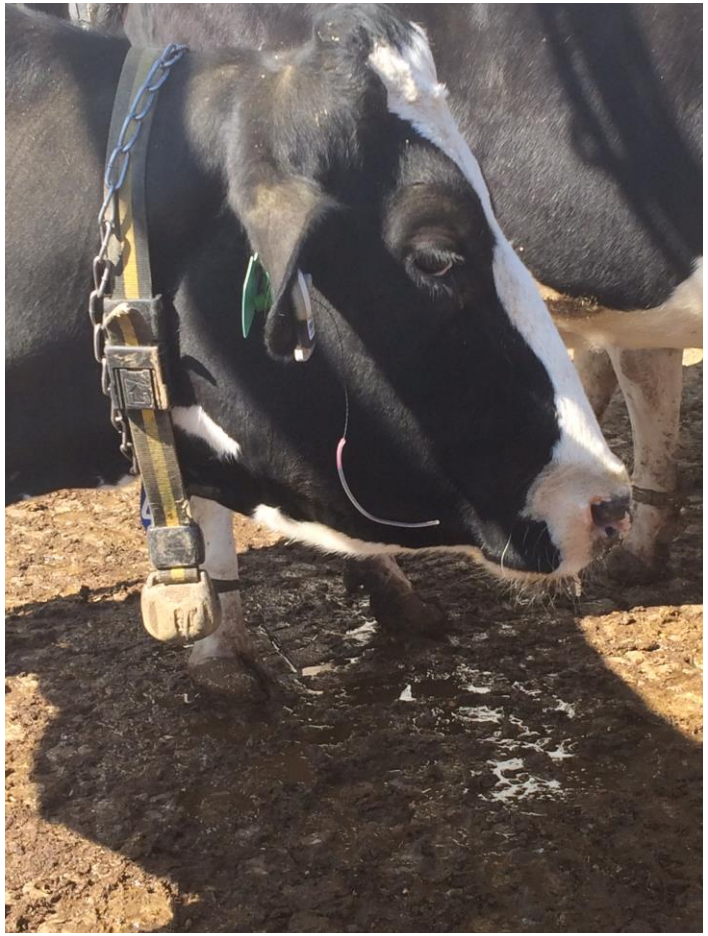
Fully interpreted test results will be emailed to you within 24 hours.

Mastatest

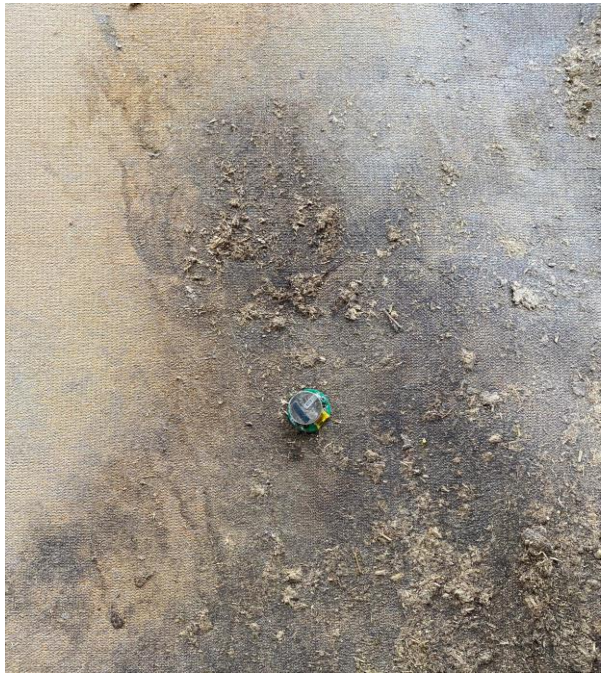
What Lessons Can be Learned from the Technology Graveyard?

Nobody on Team that Knows Cows

Physical Form Problems



Device Integrity

Identifying, fixing, or replacing broken, misfitting, or malfunctioning devices

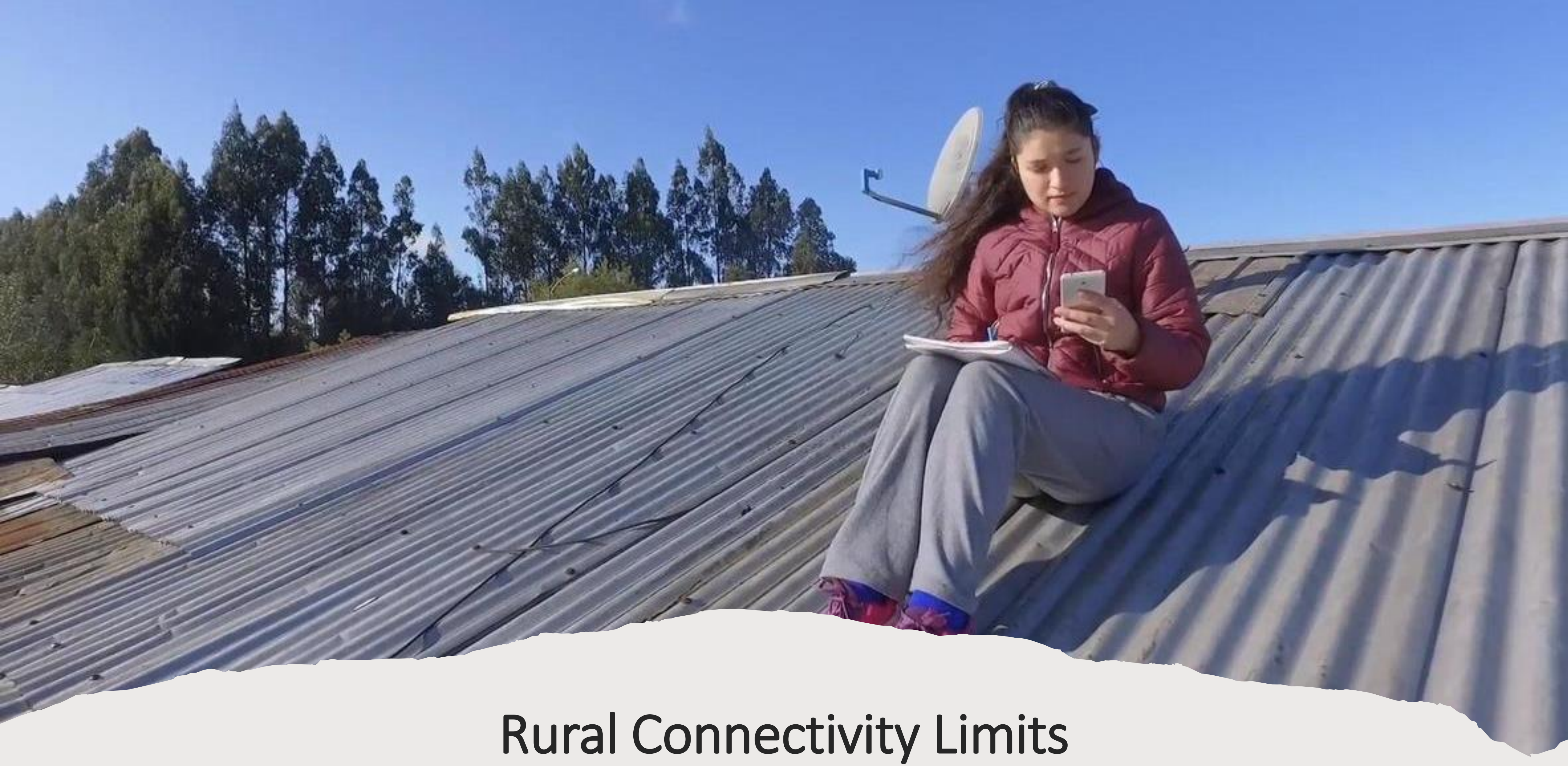
Cow ID issues? Right data from the right cow?

Too Much Infrastructure Needed

Plug and Play Has Different Meanings for Different People

Rodents and Other Farm Realities

Lightning Strikes Twice



Rural Connectivity Limits

Focus on Technology, Rather than Information

Some Data Interesting but Not Useful

How Much Data Do We Really Need?

- Clinical or subclinical
- SCC
- Human detection of clinical signs
- Bacteria presence
- Time window

Mastitis Challenges

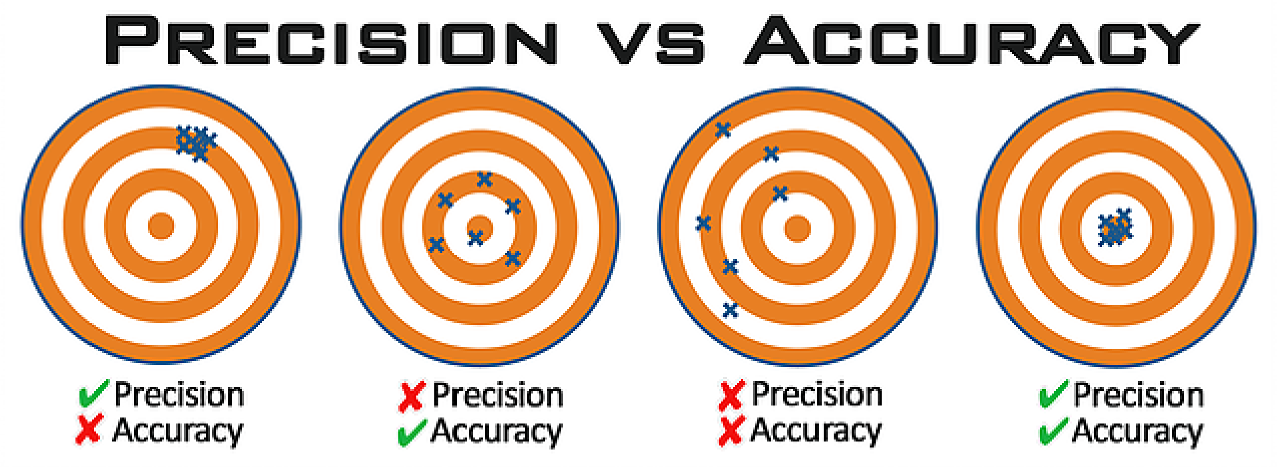
- DYNAMICS OF CLINICAL AND SUBCLINICAL MASTITIS
- POTENTIAL FOR OVERTREATMENT
- EMPLOYEE EDUCATION
- WHAT ACTION TO TAKE?

Mastitis Challenges

- CALIBRATION ACROSS TIME
- AUTOMATIC DIVERSION OR ALERT
- PATHOGEN DIFFERENCES
- FARM DIFFERENCES

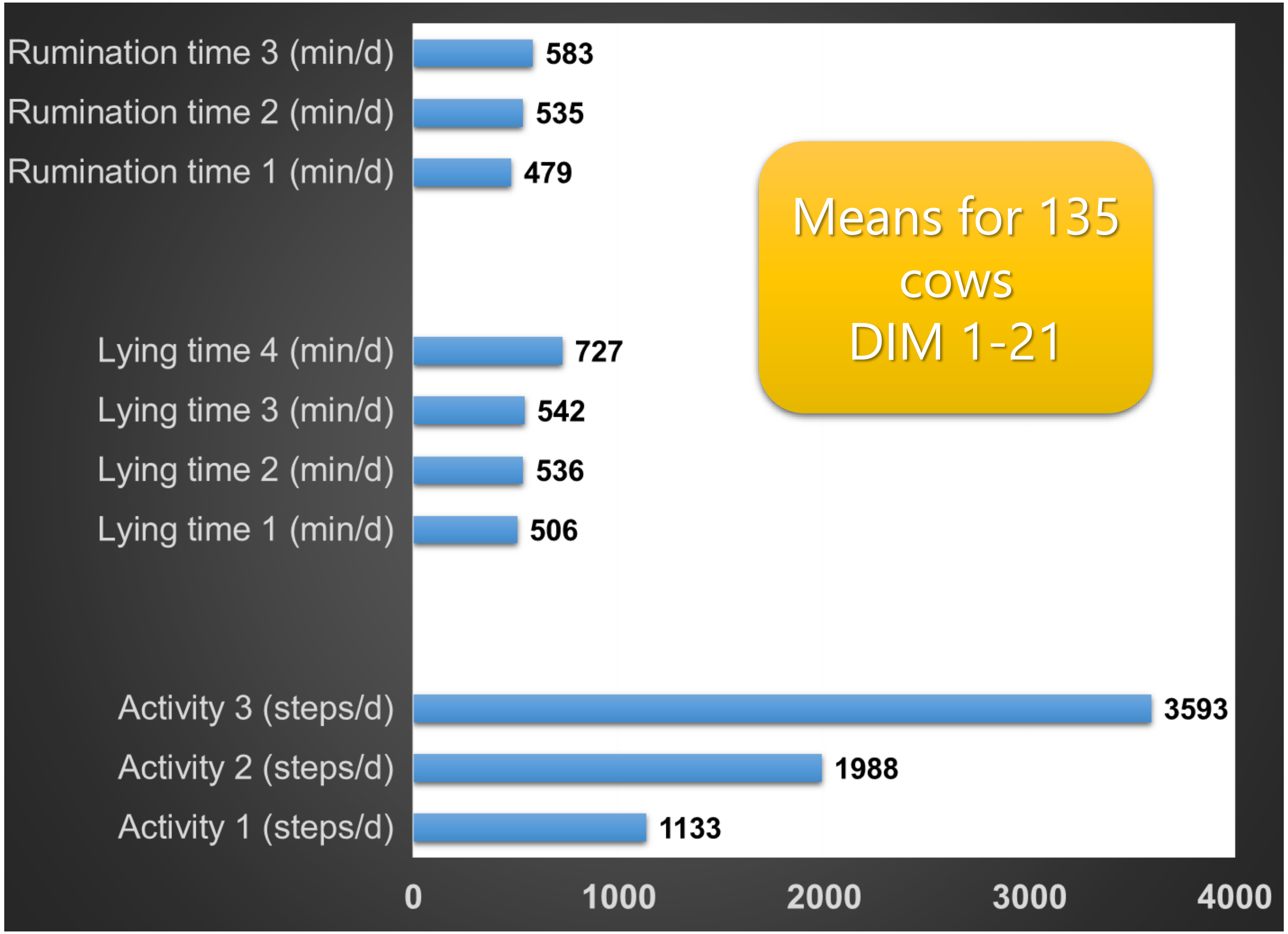
Are we focused too heavily on disease detection?

Are we measuring the targets we intend to?



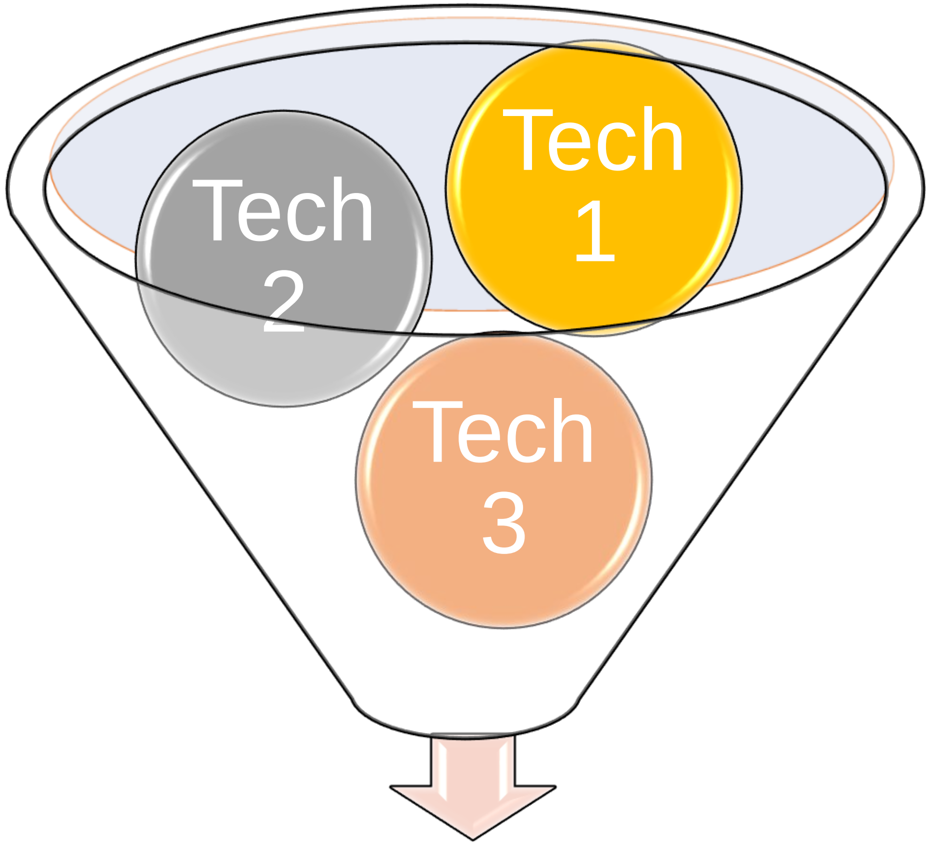
Can’t forget the need for third party validations

X ≠ X and Y ≠ Y



Jones et al., 2020

Disappearing Data



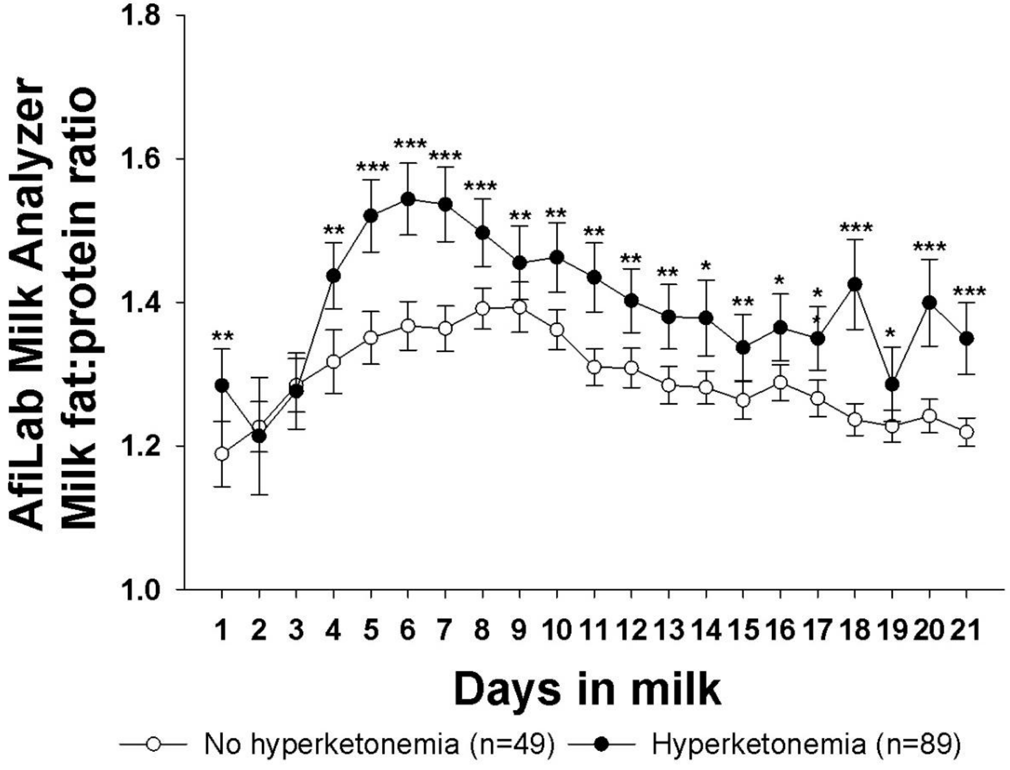
847 cow days (29%) out of possible 2898

- **138 cows**
- **DIM 1 to 21**
- **2898 cow days**
- **7 technologies**

Tsai et al., 2020

How good are we at finding events of interest?

The Full Story

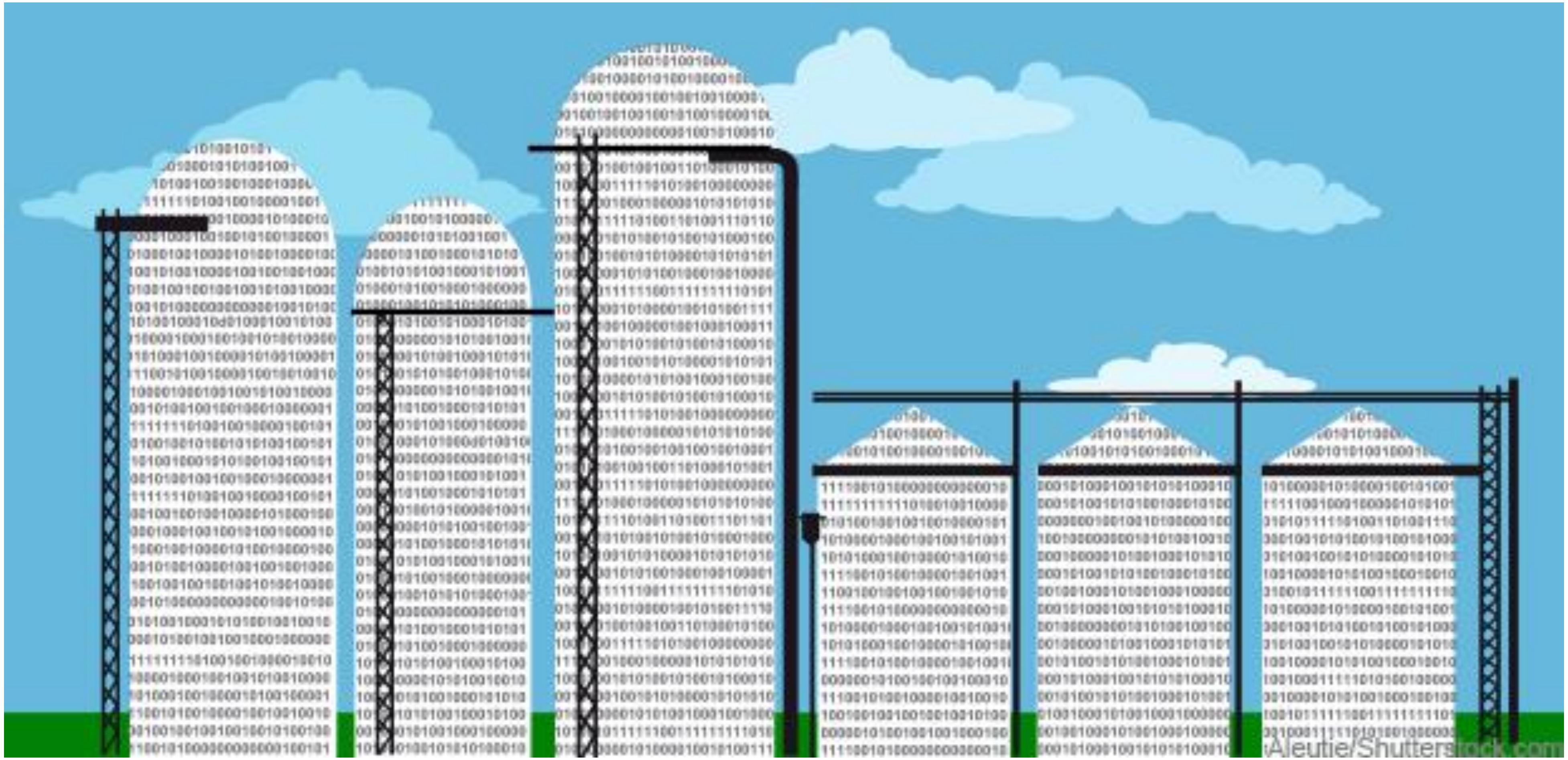


† $P < 0.1$, * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Technology	Disease	
	Detection Rate (%)	False Positive Rate (%)
System 1	80	15
System 2	80	19
System 3	70	23
System 4	78	18
System 5	76	20
System 6	46	12
System 7	60	15

Tsai et al. 2020

Data Silos



DHIA | Sensors | Genetics | Milk Buyer | Nutrition | Financial

Data Integrators

iYOTAH SOLUTIONS

AgriGates

VYLA

dpn

MmmooOgle

bovcontrol

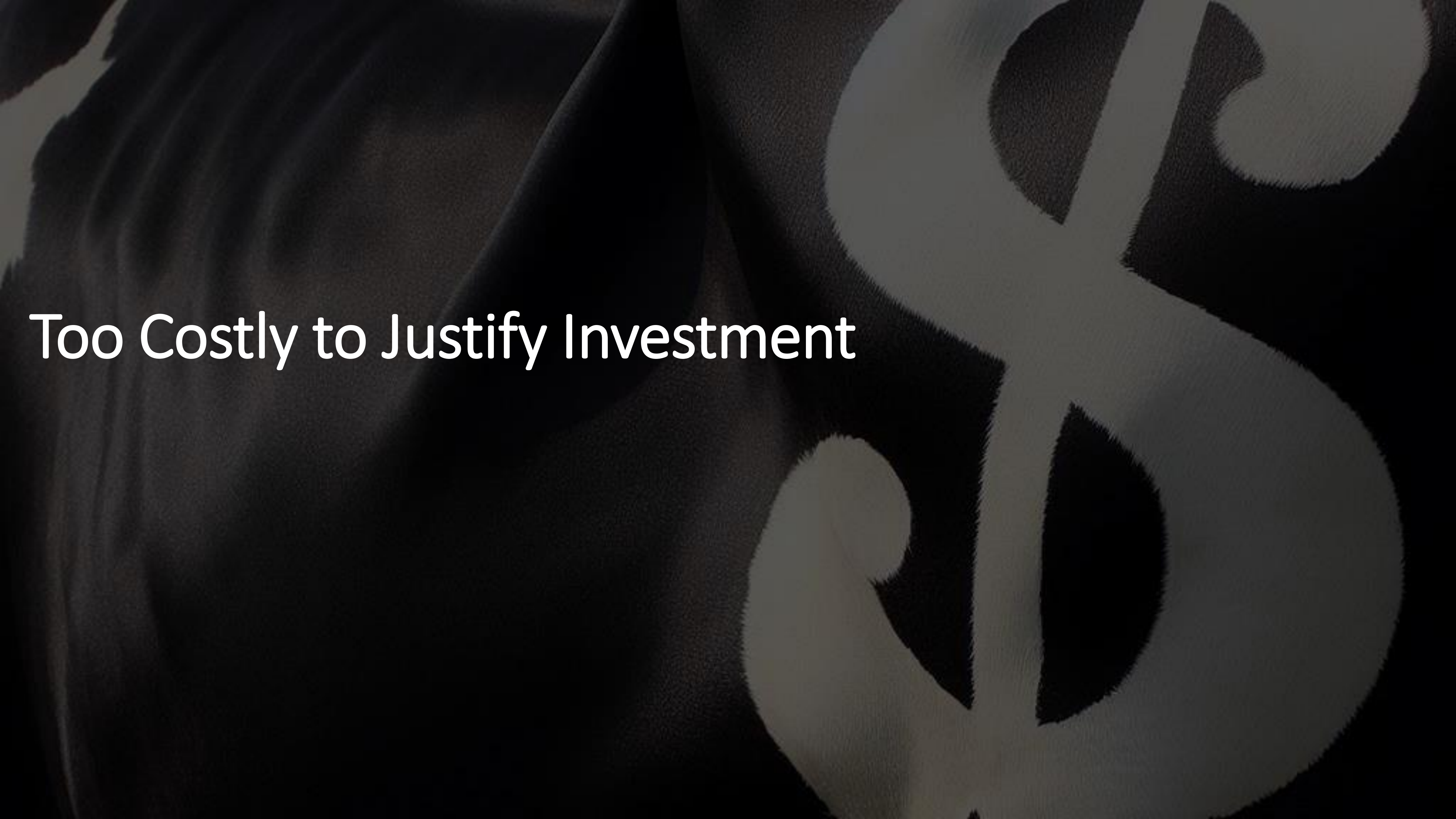
Agrimetrics
THE CATALYST FOR CHANGE

Proagrica

AIMS

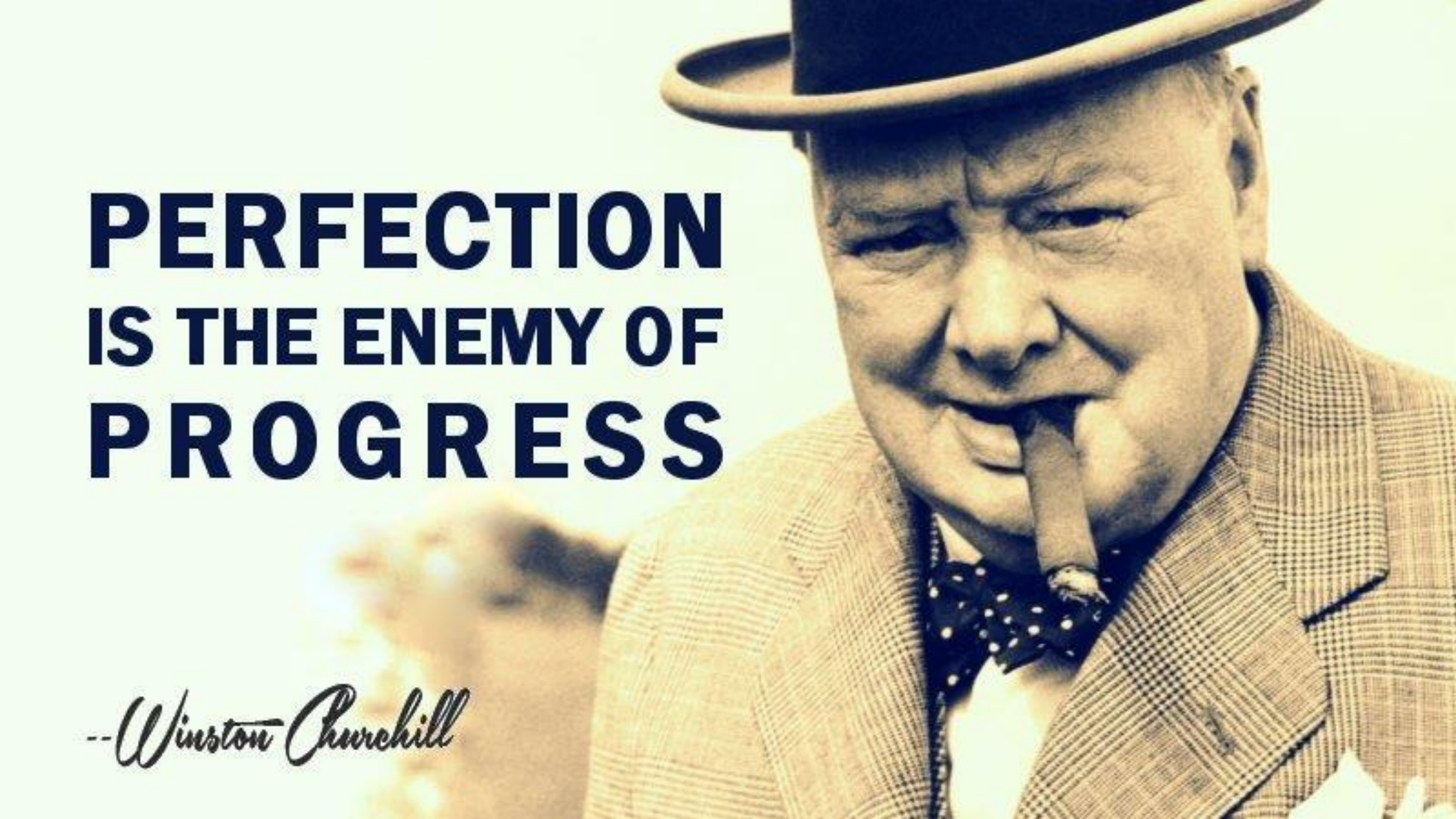
DDW
BIG data for dairy

Too Costly to Justify Investment



Economic Considerations

- Initial investment
- Ongoing, variable costs
- Only reducing, not eliminating case cost
- Compare detection versus prevention investment
- Consider cost of intervention
- Intervention success likelihood
- Is the information used or ignored?


PERFECTION
IS THE ENEMY OF
PROGRESS
--Winston Churchill

Never Lose Sight Of the Cow

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