COWALERT BY iCEROBOTICS

From accelerometer to useful information – research and practical applications

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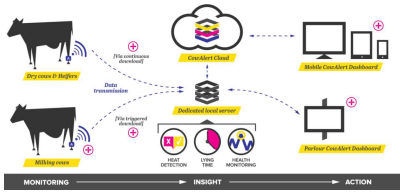
This Presentation

- About IceRobotics
- Introduction to CowAlert
- Research Examples
- Practical Applications
  - Lying Time
  - Lameness
- Future Perspectives
- Summary

IceRobotics Ltd



Company founded

2002

2005

2009

2011

DASIE

2014

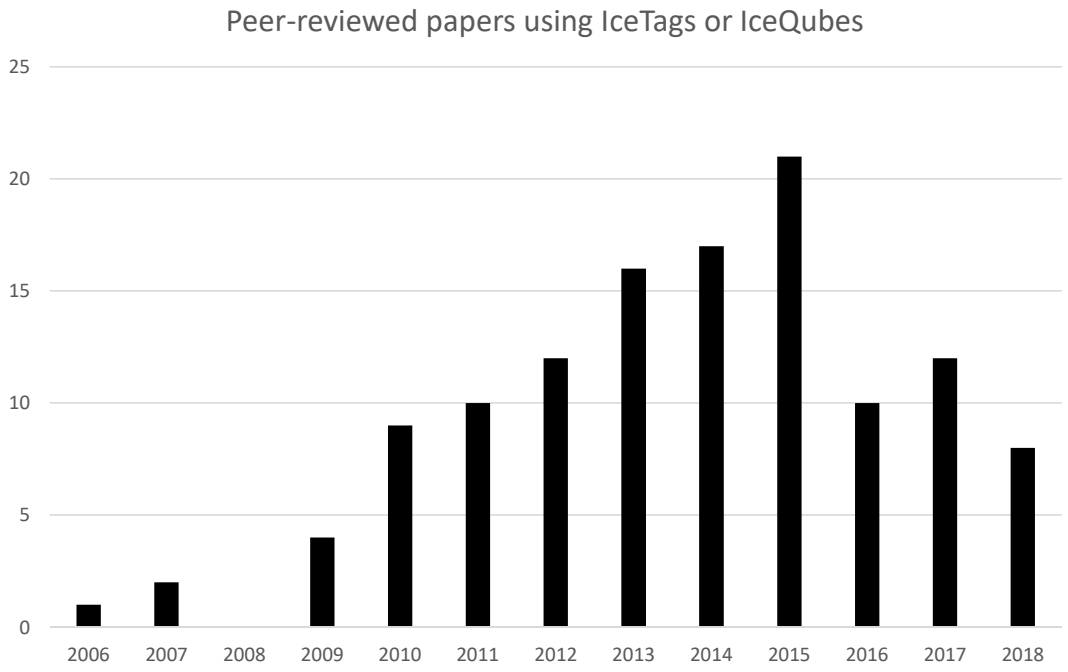
Lameness detection

2017

25 staff, 6 nationalities

2018

IceTags and IceQubes for Science



Species/age groups:

Dairy cattle

Beef cattle

Calves

Yaks

Sheep

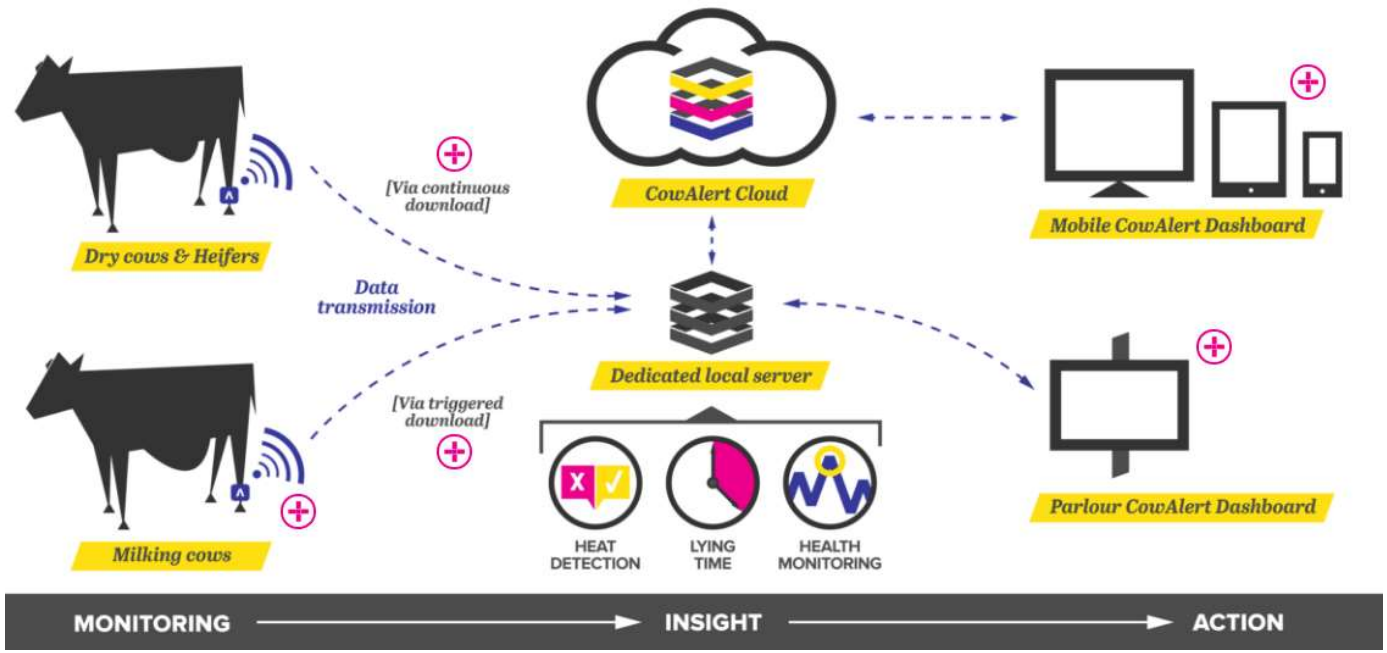
Goats

Horses

Swine *(in prep)*

To date: 122 peer-reviewed papers

Cows in the Cloud



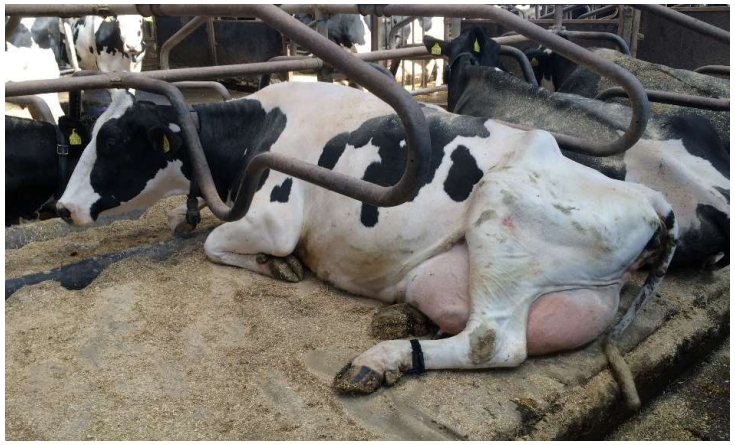
- Launched 2011
- On 200+ commercial farms
- 50+ million “cow days” of data from farms in the UK, Netherlands, Germany, Poland, USA, and Australia
- Cloud storage
- Heat & health issue detection
- Whole herd monitoring
- Dry cow monitoring

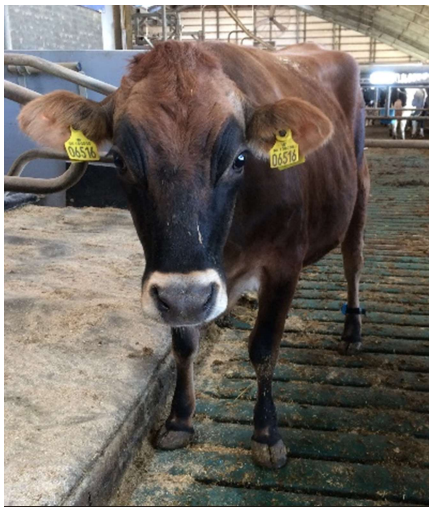
IceQube Output

Motion Index

Lying time ⟷ Standing time (Transitions)

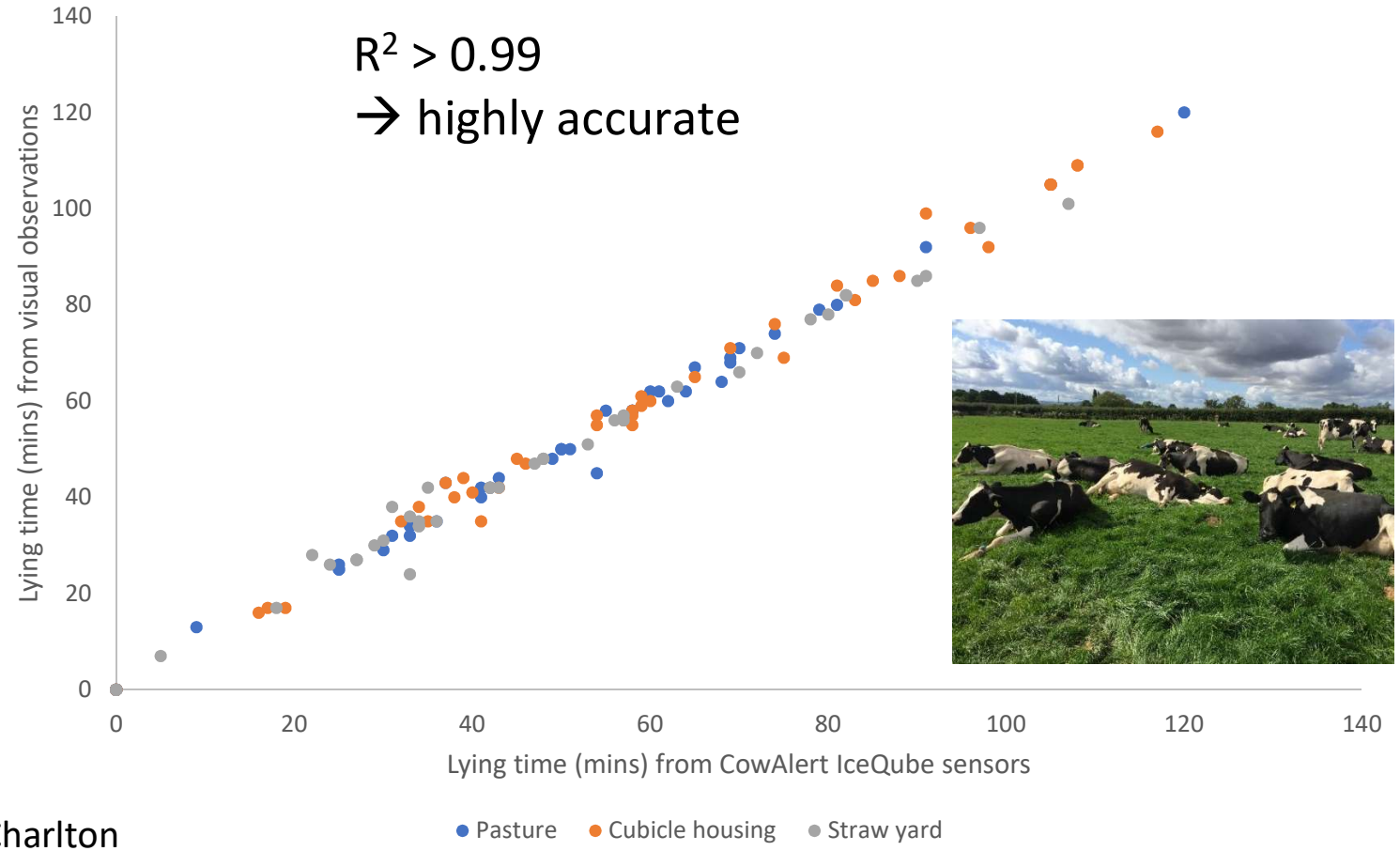
Step count





+ Transition timestamps

Lying Time from IceQubes



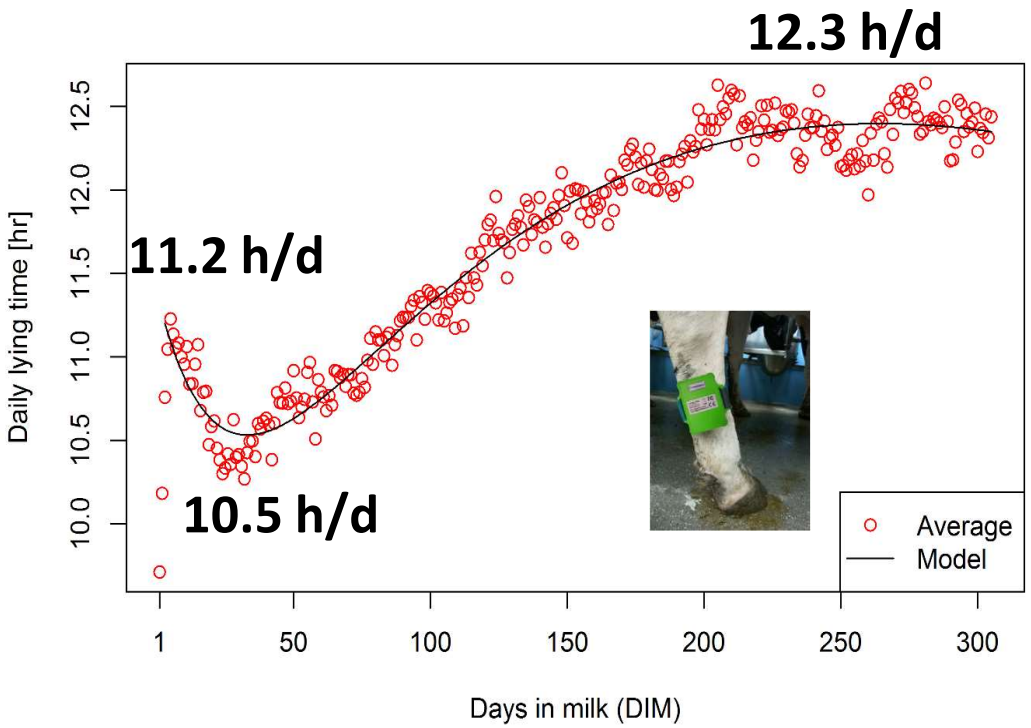
Modified from G. Charlton

Reasons for Low Lying Time

- Overstocking (cubicles & feed space)
- Idle time (waiting to get milked or inseminated)
- Being shut out of lying areas during scraping
- Cubicles too small or uncomfortable
- Long walks
- Heat stress
- Etc

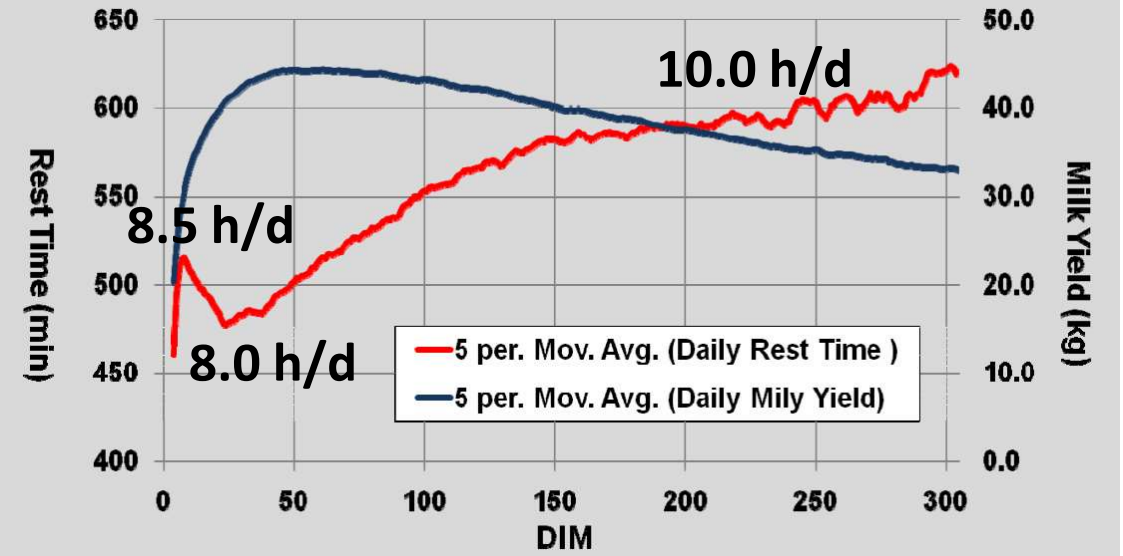
Photo: Nick J Bell, Bos International, UK

Lying Time in Commercial Farms



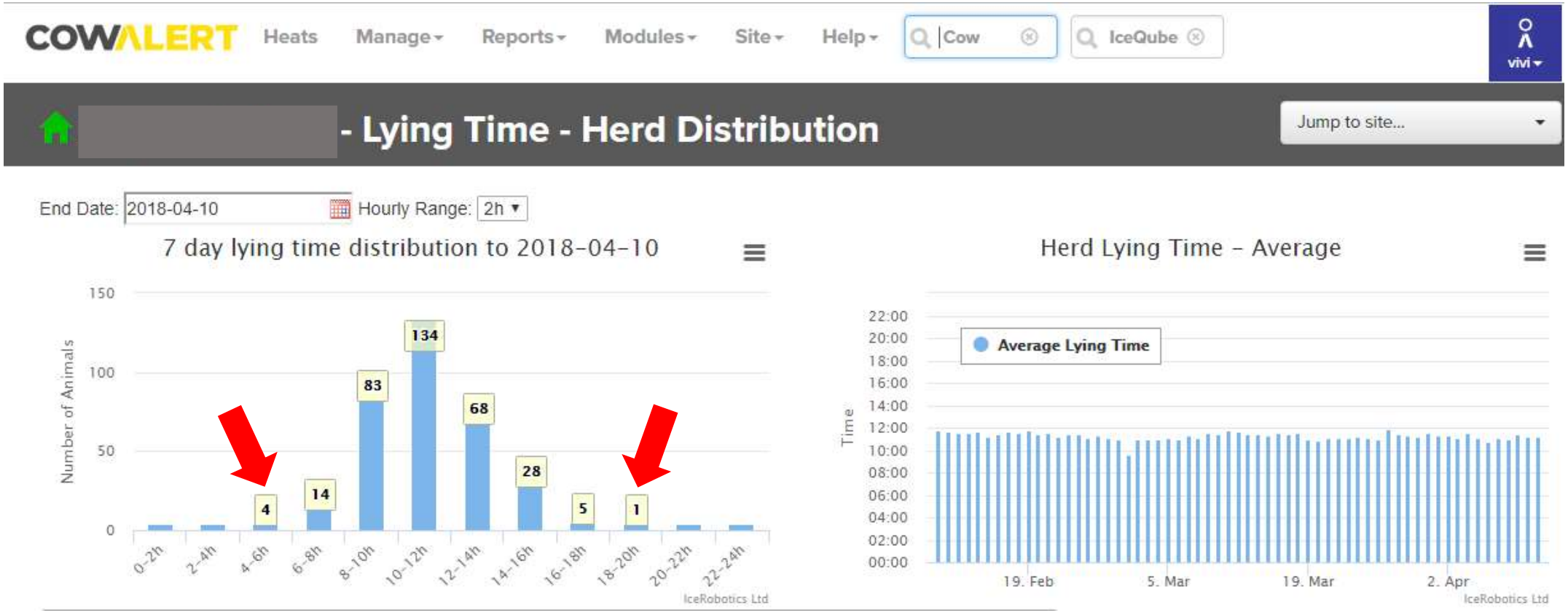
Maselyne et al (2017) Res Vet Sci 110: 1-3:
4 commercial Danish farms, 366 cows, 2 milkings/d

2-3 h/d less lying → effect of 3 milkings/d? Heat stress? A combination?



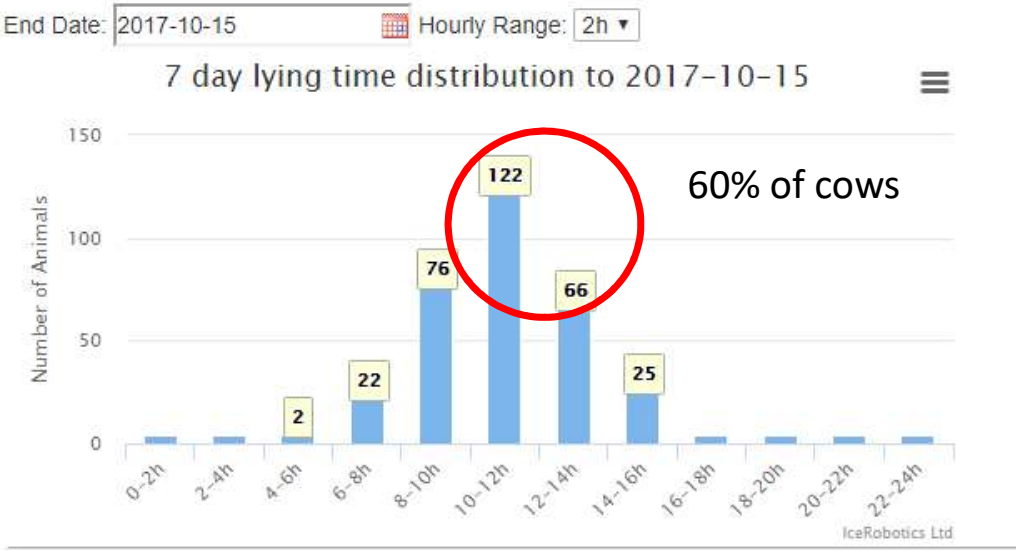
Arazi et al (2010) ICAR presentation:
6 commercial Israelian farms, 1810 cows, 3 milkings/d

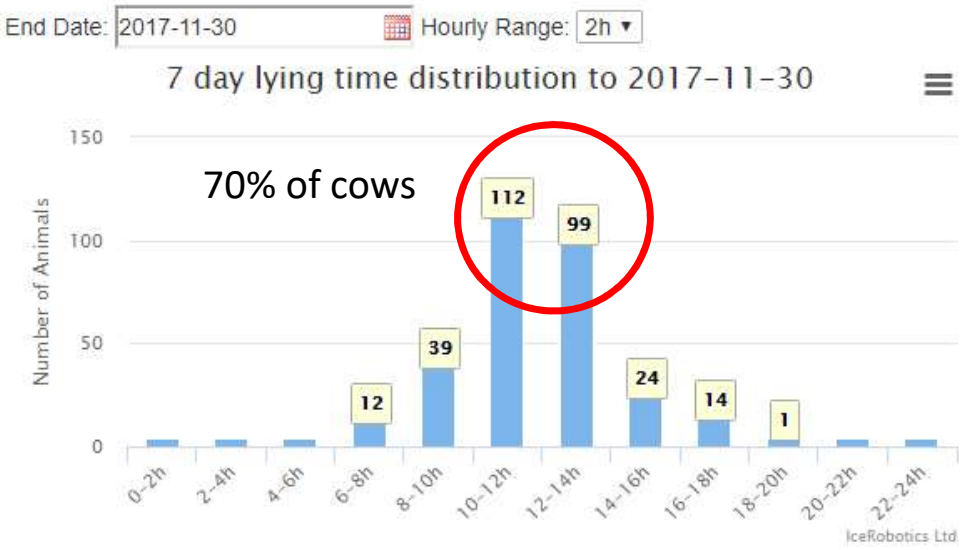
Focus on ‘Outliers’



Benchmarking across Time

Reduction from 3 to 2 milkings/d added 10% cows to optimum lying time of 10-14 h/d





The DASIE Project

Dairy Animal Sensor Integrated Engineering

- August 2014 – 2017
- Budget £1.7 million
- Supported by the UK government
- 4 partners, IceRobotics the lead
- Data from 5 commercial farms and 2 research herds
- 2,240 cows with IceQubes

Why focus on lameness?

1. 25–30% of dairy cows are lame at any one time[1]
2. On average, farmers only notice 1 out of 4-5 lame cows[2]
3. Lame cows are in severe pain for ~3 months[3]

[1] Barker et al (2009) JDS 93: 932-941
[2] Archer et al (2010) In Practice 32: 492-504
[3] Bruijnis et al (2012) Animal 6: 962-970

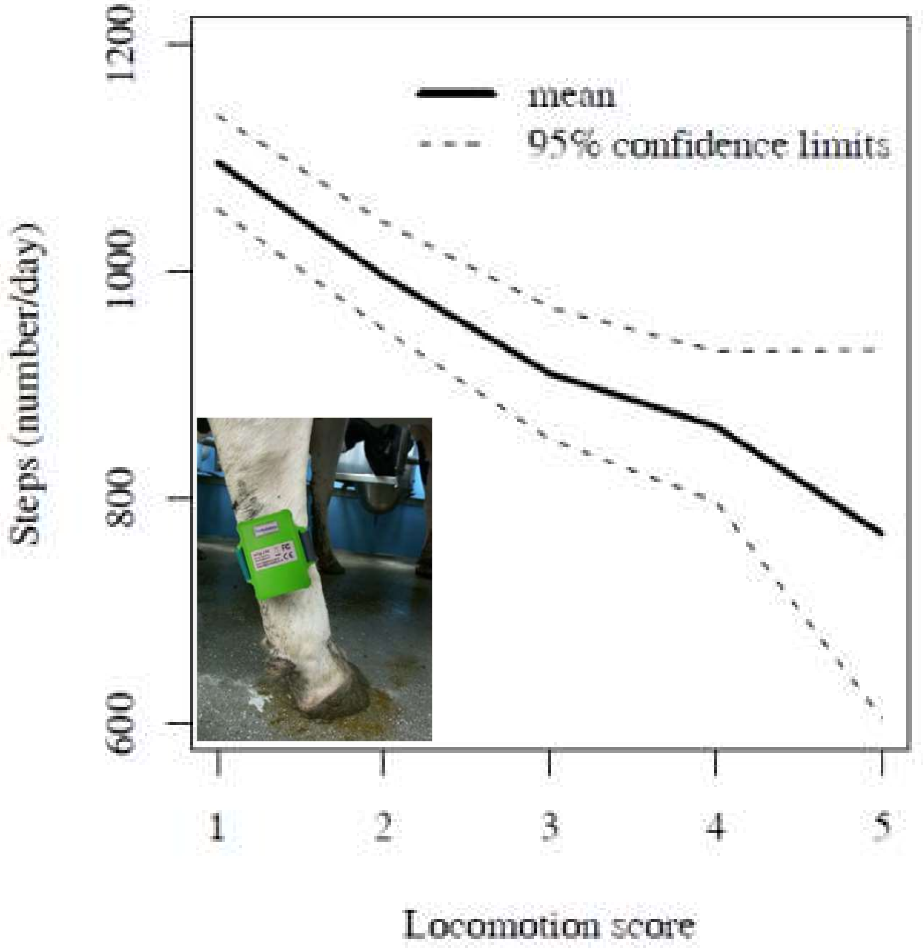
Lameness Reduces

- Yield: 270-857 l milk lost over a lactation
- Oestrus behaviour: mounting period shortened from 5.2 to 1.8 h
- Reproduction: first ovulatory oestrus delayed by 19 days
- Longevity: increased culling risk (HR=1.45 for moderately lame cow, HR=1.74 for very lame cow)

Bicalho et al, 2007 Journal of Dairy Science 90: 4586-91
Huxley, 2013, Livestock Science 156: 64-70
Petersson et al, 2006 Animal Reproduction Science 91: 201-214
Walker et al, 2010 Reproduction in Domestic Animals 45: 109-117

Lameness affects Behaviour

Lying time	119% ↑
Number of steps	95% ↓
Leg activity	80% ↓



And we can monitor behaviour automatically

Blackie et al, 2011 Applied Animal Behavioral Science 134: 85-91
Thorup et al, 2015 Animal 9: 1704-12
Wadsworth et al, 2016 Proc. PDF Conference, Leeuwarden, NL: 315-19

Development of lameness model

- Visual mobility scores used as reference
- 6755 MS on 7 farms in 2016
- 1 of 2 trained observers
- Scale 1-5[1] (1 = perfect, 5 = severely lame)

	Visual mobility score					
	1	2	3	4	5	Total
Number of observations	412	4810	1382	146	5	6755

[1]Chapinal et al, 2009 Journal of Dairy Science 92: 4365–74

Automated Lameness Detection

cow birthdate
& farm KPIs

+

Automated
Lameness
Probability
(ALP)

Lameness Alerts on Farm

Lameness – New Alerts

last 7 days

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	Cow	Estimated Start	Alert Value	Alert Generated	Alert Outcome
1	6282	03 Dec 2017	83.6	04 Dec 2017	Lameness
2	348	03 Dec 2017	85	04 Dec 2017	Lameness
3	795	03 Dec 2017	75.8	04 Dec 2017	Lameness
4	833	03 Dec 2017	81.8	04 Dec 2017	Lameness
5	6334	02 Dec 2017	86.8	03 Dec 2017	Lameness
6	797	02 Dec 2017	81	03 Dec 2017	Lameness
7	226	02 Dec 2017	90.4	03 Dec 2017	Lameness
8	34	02 Dec 2017	89.6	03 Dec 2017	Lameness
9	803	29 Nov 2017	83.8	30 Nov 2017	Lameness
10	689	29 Nov 2017	79	30 Nov 2017	Lameness
11	804	29 Nov 2017	82.6	30 Nov 2017	Lameness
12	542	29 Nov 2017	77.4	30 Nov 2017	Lameness
13	408	29 Nov 2017	77.6	30 Nov 2017	Lameness
14	3737	28 Nov 2017	73.6	29 Nov 2017	Lameness
15	2436	28 Nov 2017	93.6	29 Nov 2017	Lameness

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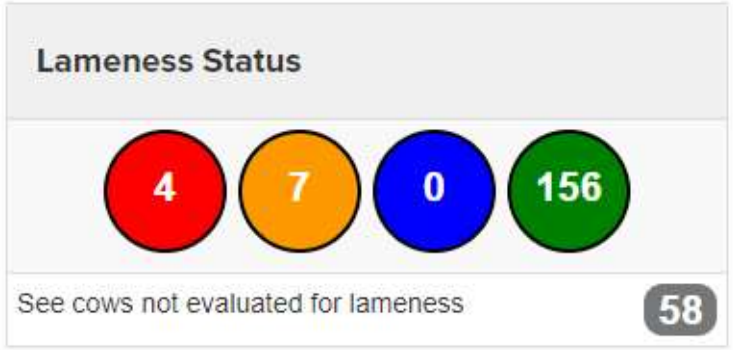
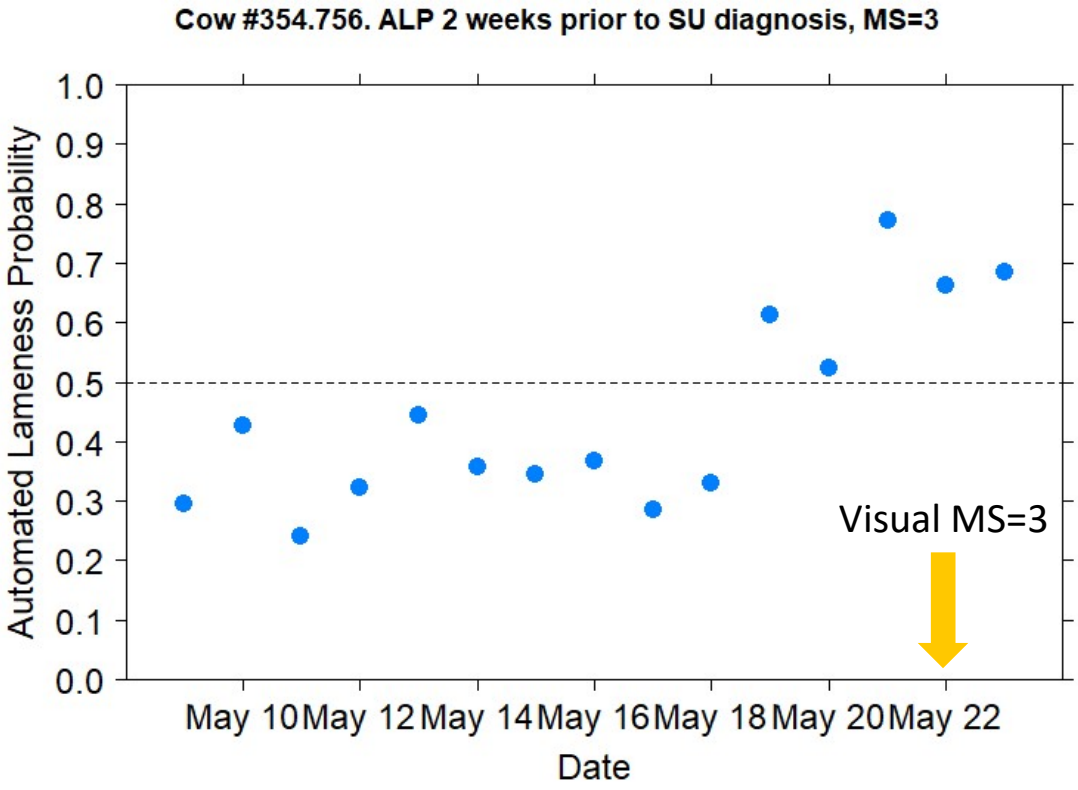


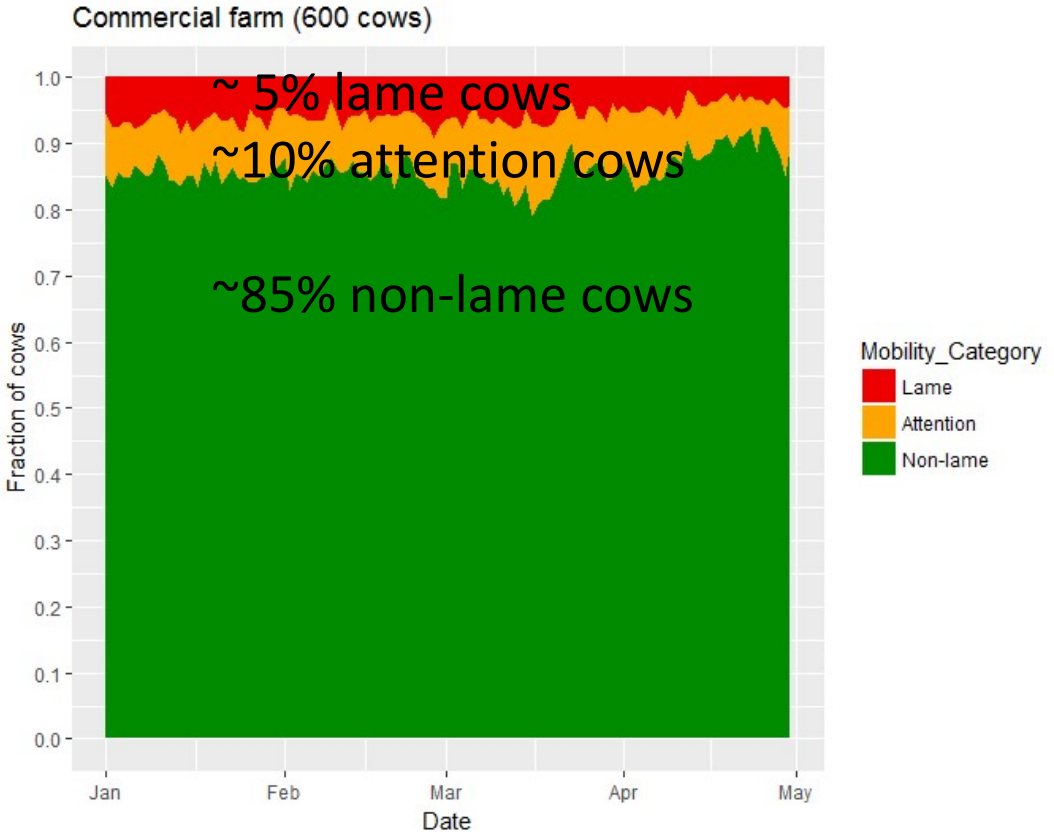
Detection Example (sole ulcer)



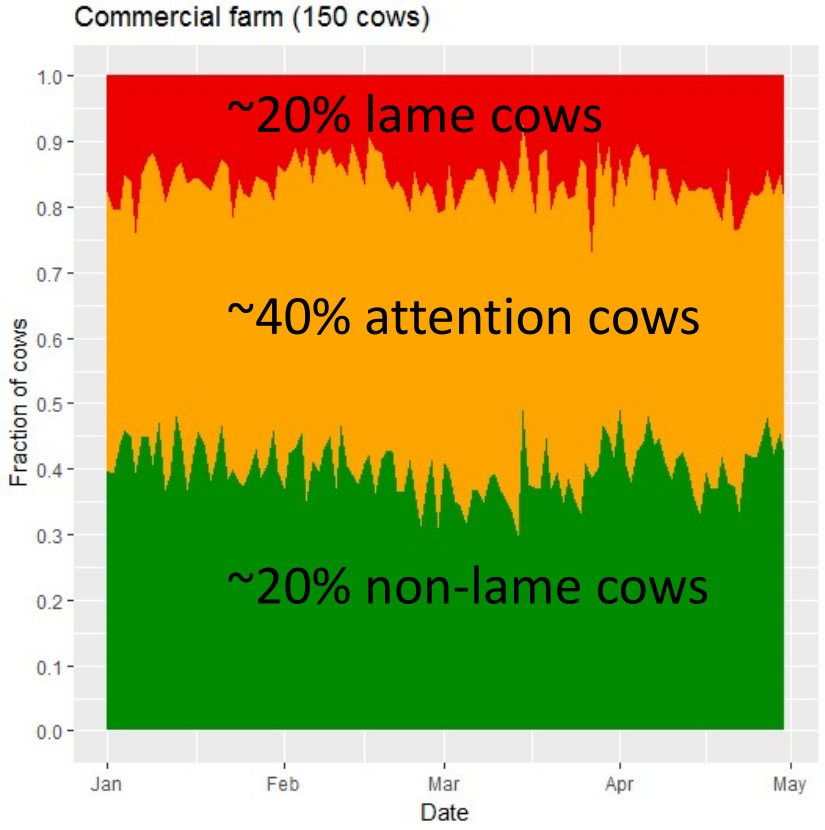
Trim and treat

Herd Mobility Overview

Herd E - good mobility



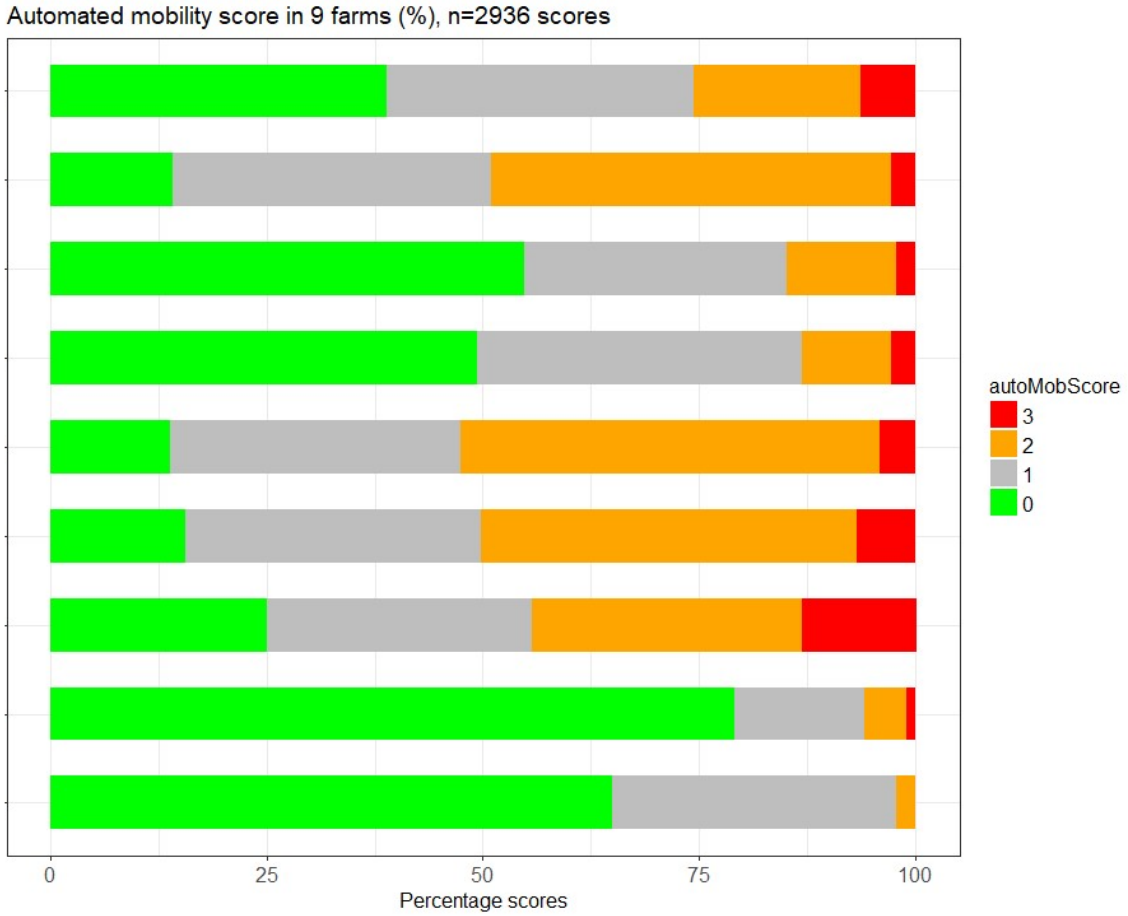
Herd C - severe lameness issues



The Future - Benchmarking

Poor herd mobility

Excellent herd mobility



Summary

- ✓Automated lameness detection is objective and monitors every cow around-the-clock every day
- ✓The ALP is capable of demonstrating beneficial effects of a painkiller on lame cows
- ✓In the future, ALP may enable objective benchmarking across herds

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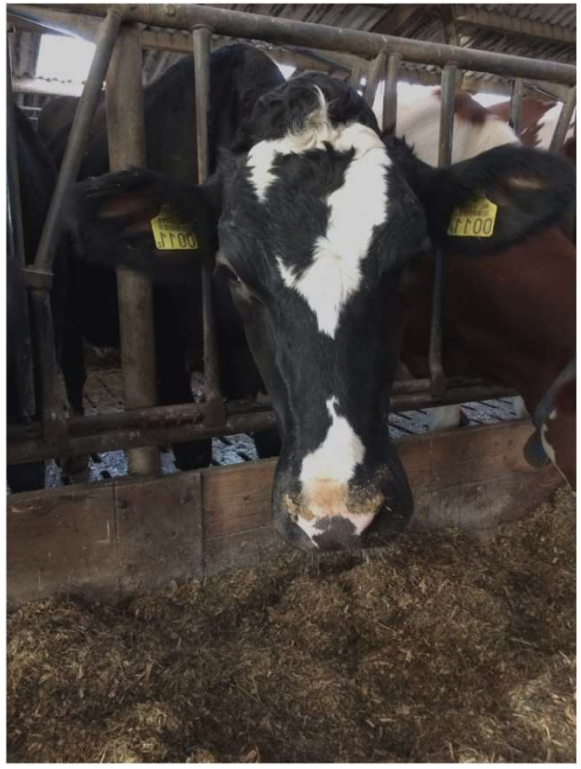
Thanks for listening! Questions?



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