



Martin-Luther-University Halle-Wittenberg  
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# Use of accelerometer data for genetic evaluation in dairy cattle

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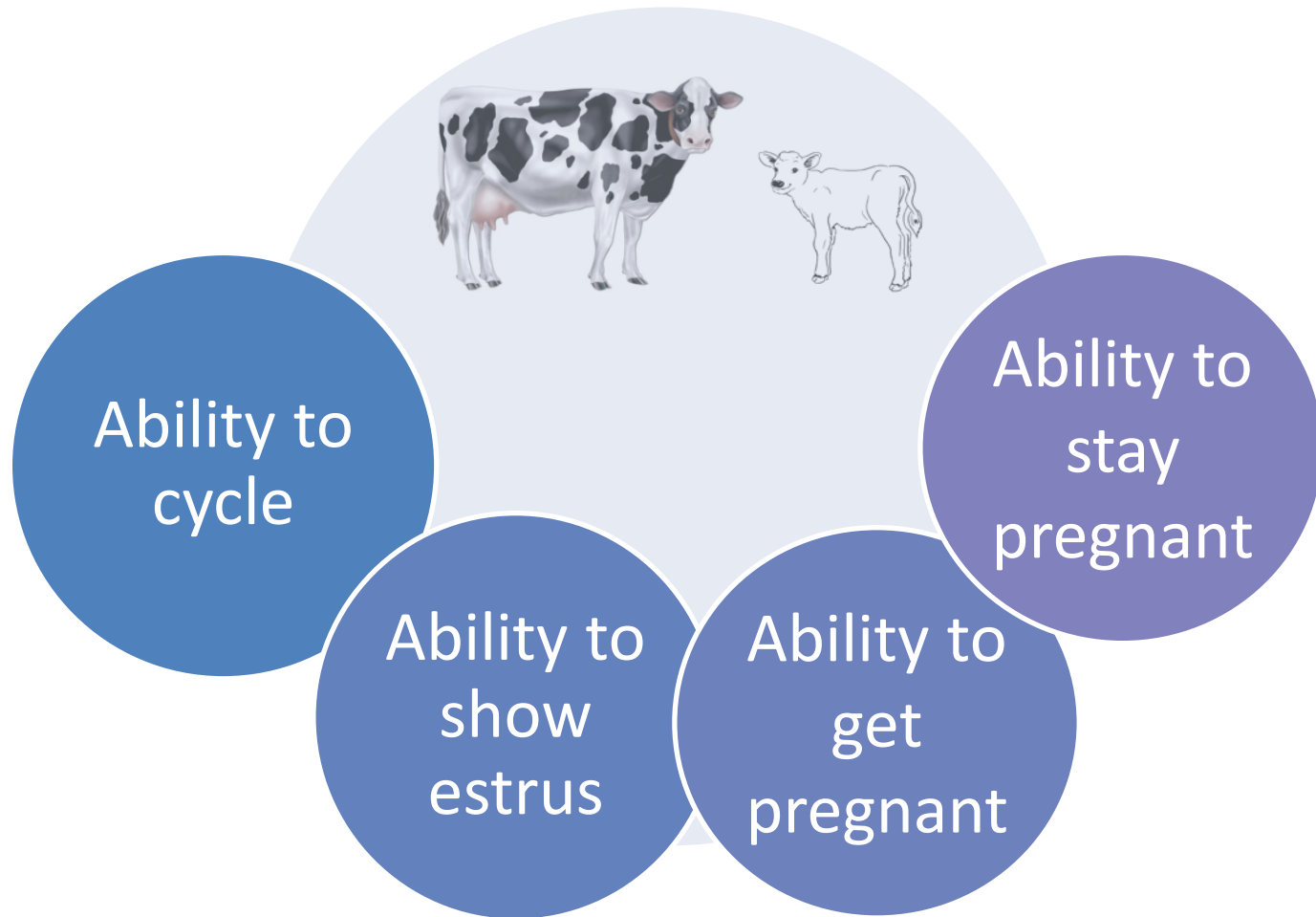


2014 Interbull Open meeting

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# Aspects of female fertility



# Aspects of female fertility



Ability to  
cycle

Ability to  
stay  
pregnant

Ability to  
show  
estrus

Ability to  
get  
pregnant

⇒ Heat detection is  
economical important

⇒ Detectability of estrus

# Methods for estrus detection

- Progesterone measurements
- Farm observations
- Mounting/being mounted (e.g. tail paint)
- Monitor activity (e.g. pedometers)

## Heat strength

= subjectively scored trait

- included in national evaluation in SWE,  $h^2 \approx 0.02/0.03$

Mark et al. 2001  
Mjölks 2001

## Physical activity

- used to describe estrus traits: 1st estrus after calving, regularity, strength, duration of estrus ( $h^2$ : 0.00 - 0.18)

Løvendahl and Chagunda (2009)

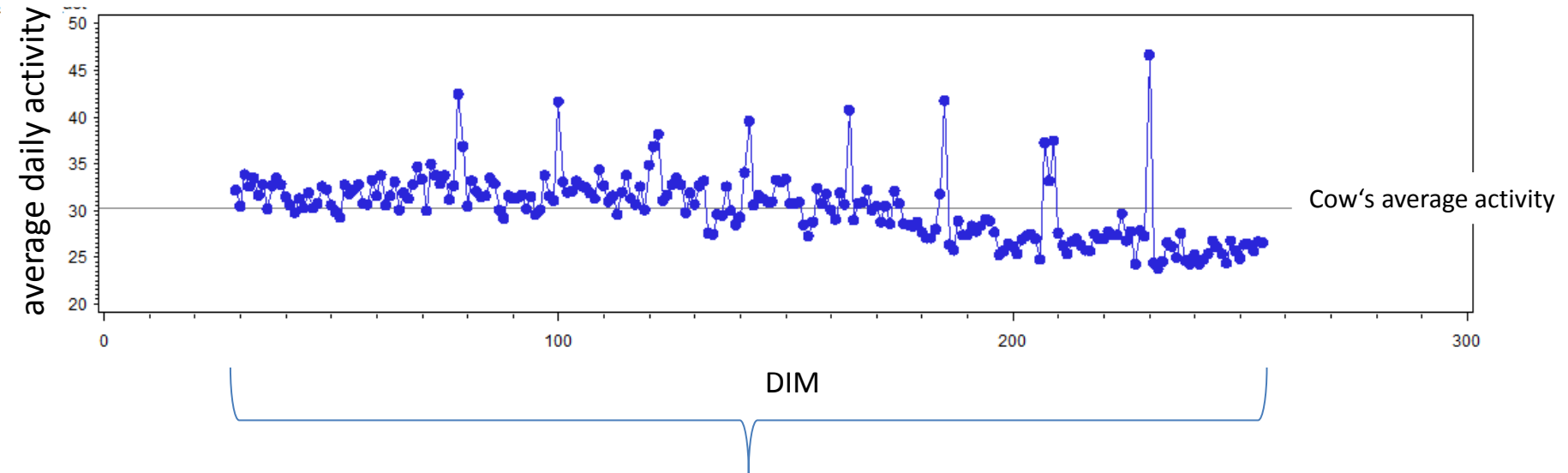
# Data



- 1,172 Holstein cows
- 6 mid-size dairy farms in Israel
- Observation time April 2012 – June 2013
- Activity measurements from neck collars (Heatime<sup>®</sup> HR System, SCR)
- Measurements of 12 two hours blocks per day

# Trait definition

Example of average daily activity of a cow during lactation



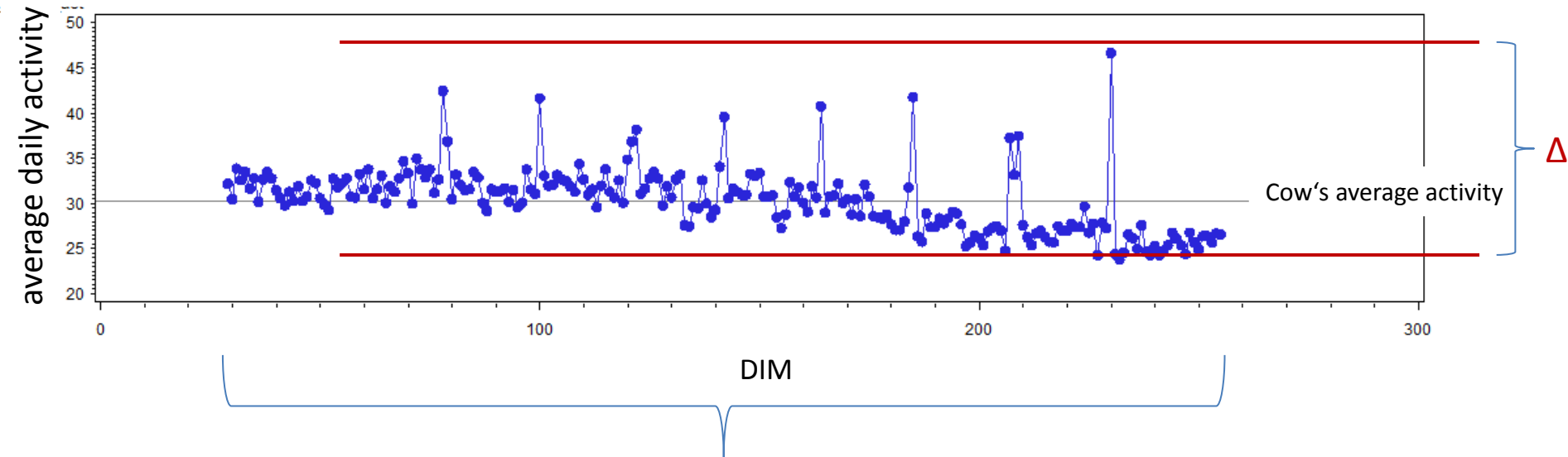
## 1. General level of activity

-> Baseline (Mean of average daily activity, at least 100 rec/cow) → A1

| Trait | N     | Mean | STD | Min  | Max  |
|-------|-------|------|-----|------|------|
| A1    | 1,171 | 37.1 | 6.4 | 17.3 | 71.9 |

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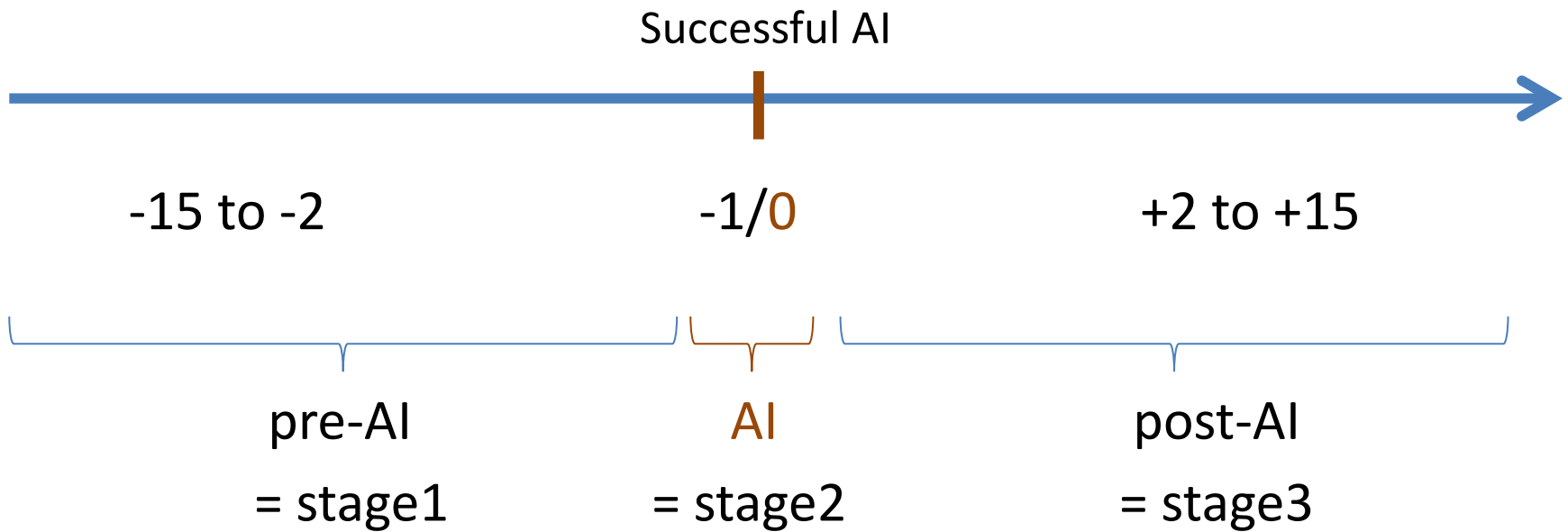
## 2. Deviation from baseline

a) Mean of STD over daily measurements (12 2-hours-blocks) → S1

b) STD over all measurements of a cow (at least 100 rec/cow)

| Trait | N     | Mean | STD | Min  | Max  |
|-------|-------|------|-----|------|------|
| A1    | 1,171 | 37.1 | 6.4 | 17.3 | 71.9 |

# Activity = activity ?



| Trait     | N     | Mean | STD  | Min  | Max  |
|-----------|-------|------|------|------|------|
| A1_Stage1 | 1,008 | 36,4 | 7,1  | 14,9 | 69,2 |
| A1_Stage2 | 1,008 | 47,7 | 10,2 | 21,7 | 88,8 |
| A1_Stage3 | 1,060 | 36,1 | 7,0  | 15,1 | 66,0 |



# Genetic parameters for different stages of activity

Estimated values of heritability (diagonal) and genetic correlations (above diagonal) from multi-trait animal model (systematic effects: hys, lactation, dim), standard errors (Sh<sup>2</sup>) in parantheses

| A1                   | 1              | 2              | 3              |
|----------------------|----------------|----------------|----------------|
| Stage 1<br>(N=1,008) | 0.05<br>(0.04) | 0.96           | 0.98           |
| Stage 2<br>(N=1,008) |                | 0.12<br>(0.05) | 0.99           |
| Stage 3<br>(N=1,060) |                |                | 0.03<br>(0.02) |

SE of genetic correlations between 0.07 and 0.15

| S1                   | 1              | 2              | 3              |
|----------------------|----------------|----------------|----------------|
| Stage<br>(N=1,008)   | 0.15<br>(0.05) | 0.72           | 0.97           |
| Stage 2<br>(N=1,008) |                | 0.11<br>(0.06) | 0.78           |
| Stage 3<br>(N=1,060) |                |                | 0.14<br>(0.05) |

SE of genetic correlations between 0.11 and 0.25

Is the difference between activity during estrus and activity during non-estrus significant ?

$\Delta$  Stage1/3 and 2:

A1:  $h^2 = 0.14$  (absolute value)      0.12 (relative value)

S1:  $h^2 = 0.10$  (absolute value)      0.09 (relative value)

# Conclusion

- Genetic parameters between activity during estrus and non-estrus period are partly different
- Daily variation (STD) seems to be more meaningful than simple mean value
- Values should be varified with larger data
- Physical activity
  - might be an useful (objective and automatical detected) measurement for the ability of a cow to show estrus
  - could be included in evaluation of female fertility



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# Thank you!

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