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SAC

Genetic variation in milking efficiency – a novel trait for milkability in automatic milking systems

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Danish Cattle Federation

Danish Cattle Research Centre:

- Staff handling many milk samples and keeping robots running

Research Group ”Biosens”

Martin Bjerring, AU-animal science

Automatic milking in DK

- **27% of milk produced in DK (2010)**

- Milkings are by ”voluntary” access
- Anytime – open 24-7
- Traits recorded automatically
- Date-time > intervals
- Yield, flow, time spent in robot ….
- … range of other variables …

Milking efficiency ?

- **Novel trait**
- Automated equivalent to “milkability”
- “yield of **ECM per minute** in milking box”

- Includes time for:
  - Entry, cleaning, attachment, milking, exit, unit cleaning
  - Time difference: Entry – to – closing
  - Expressed at every milking

Why ?

- Alternative to subjective scores of milkability
- Alternative or supplement to flow-rate

- Flow-rate is only fraction of the milking process

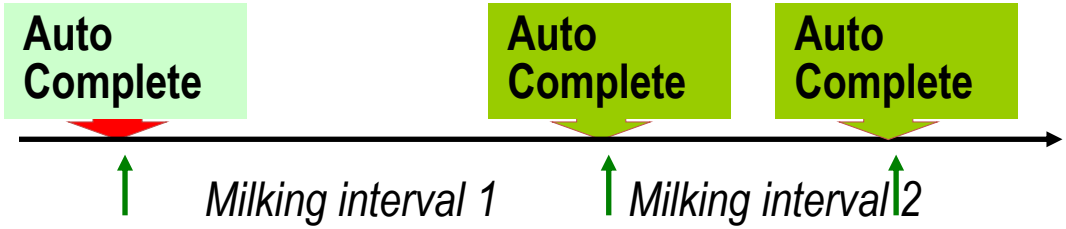
- High (and low) Flow-rates correlates to mastitis risk ... selection for intermediate optimum ...

This experiment

- Intensive experimental station data
- 7 years
- Holstein + Jersey + Red Dane = 556 cows
- 3 DeLaval VMS milking units
- Composition data

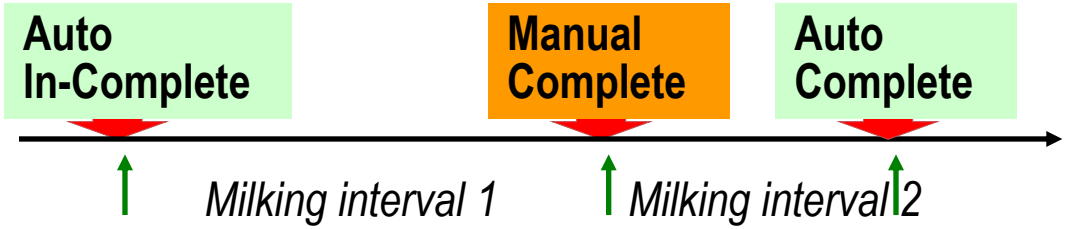
Filtering data

- Milkings are not always completed perfectly



Undisturbed

79.6%



Disturbed

20.4%

Data records – per milking

280,510 Un-disturbed yield records,

Yield per milking

Milking interval

Flow rate, Box_time

Calculate Milking Frequency

146,133 Un-disturbed composition records

Fat, Protein, Lactose, Cells

Calculate ECM/milking

Expressing traits per 24 h

- At every milking – adjust to 24 h basis

  Curvelinear calibration equation

Yield_24 = Y*(0.28 + 0.81MF) + 0.62*MF - 0.17

- Yield_24
- ECM_24

Milking efficiency = ECM / Box_time

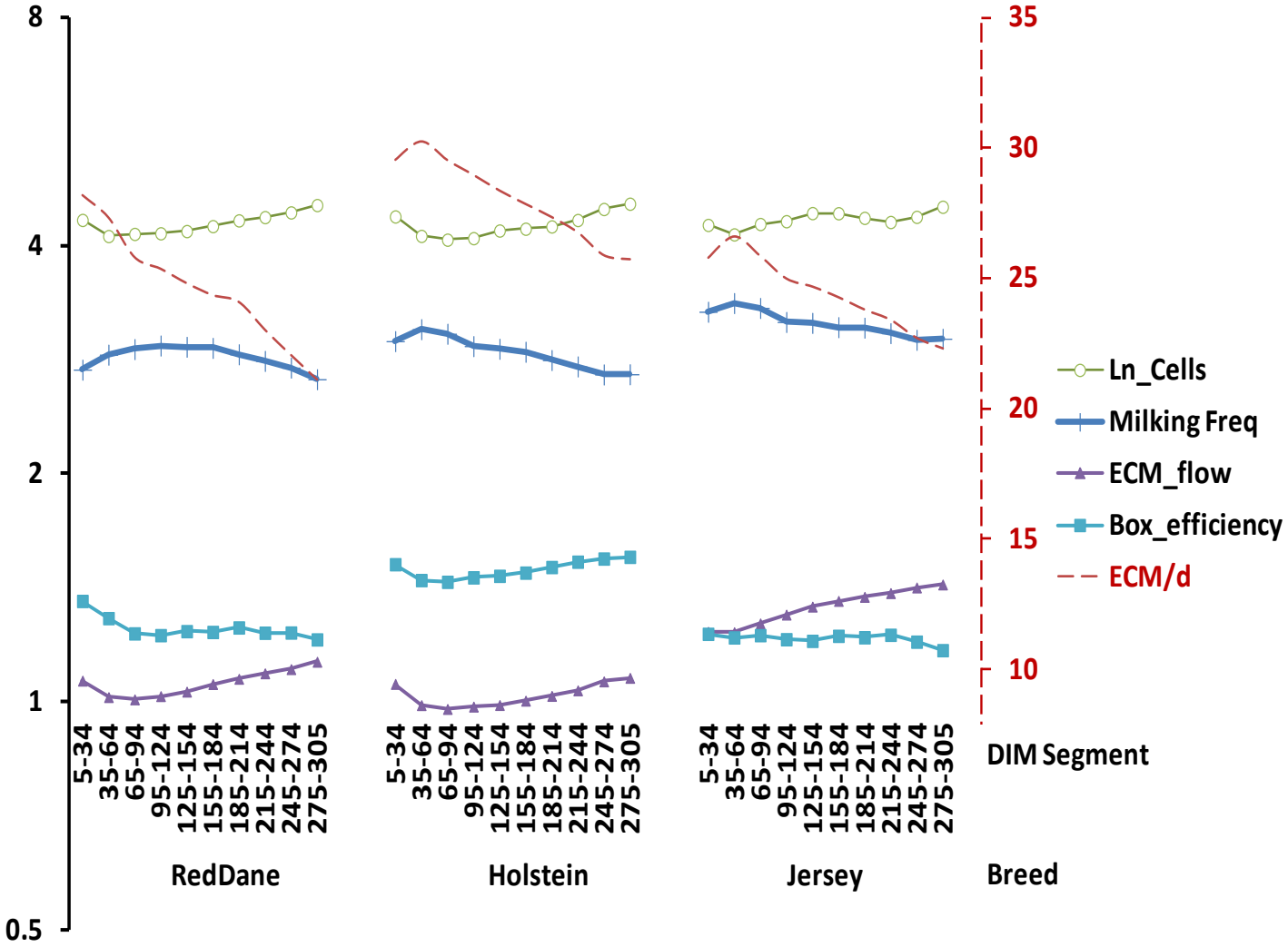
Analysis of lactation segments

- Repeatability model
- 10 segments, dim 5-34, 35-64, ,, 275-305.
- Linear mixed model for each segment
- $\mathbf{Y = Xb + Z_a a + Z_p u_p + Ie}$
- Wilmink lactation curve
- Diurnal variation, Fourier:

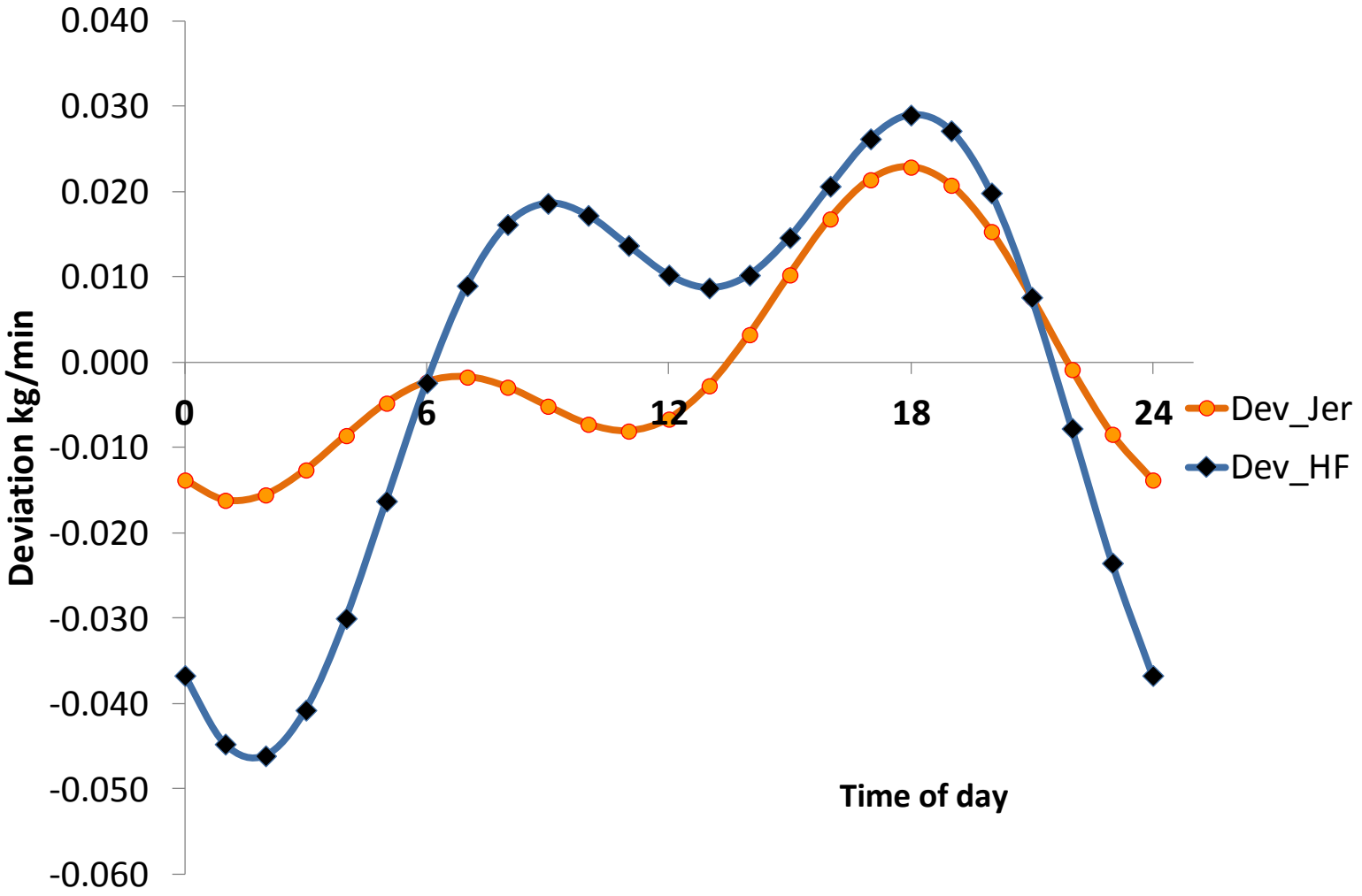
$$y_\theta = \sum_{j=1}^{4} (\cos j\theta 2\pi + \sin j\theta 2\pi)$$

Phenotypic - means

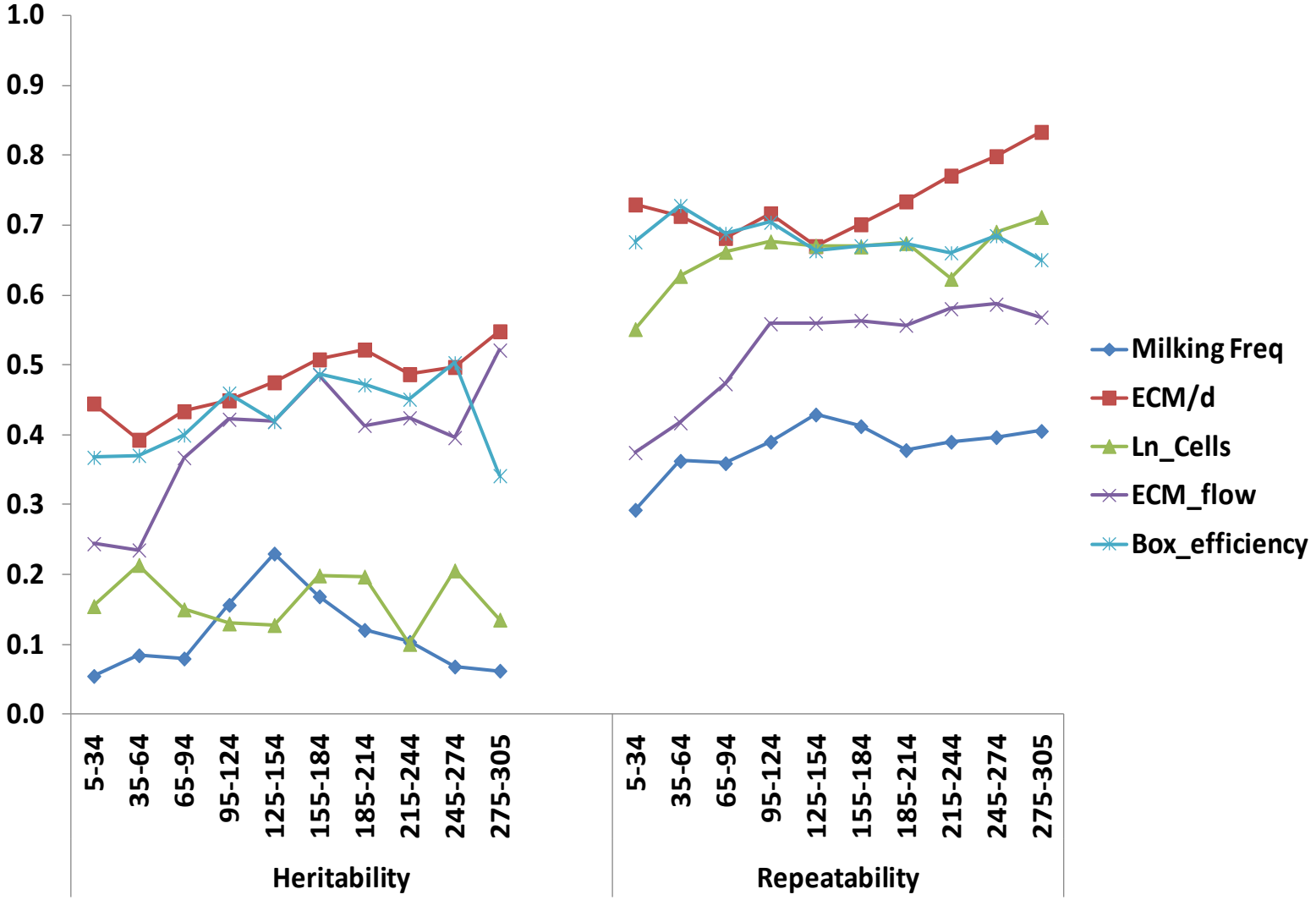
- Segment – breed effects



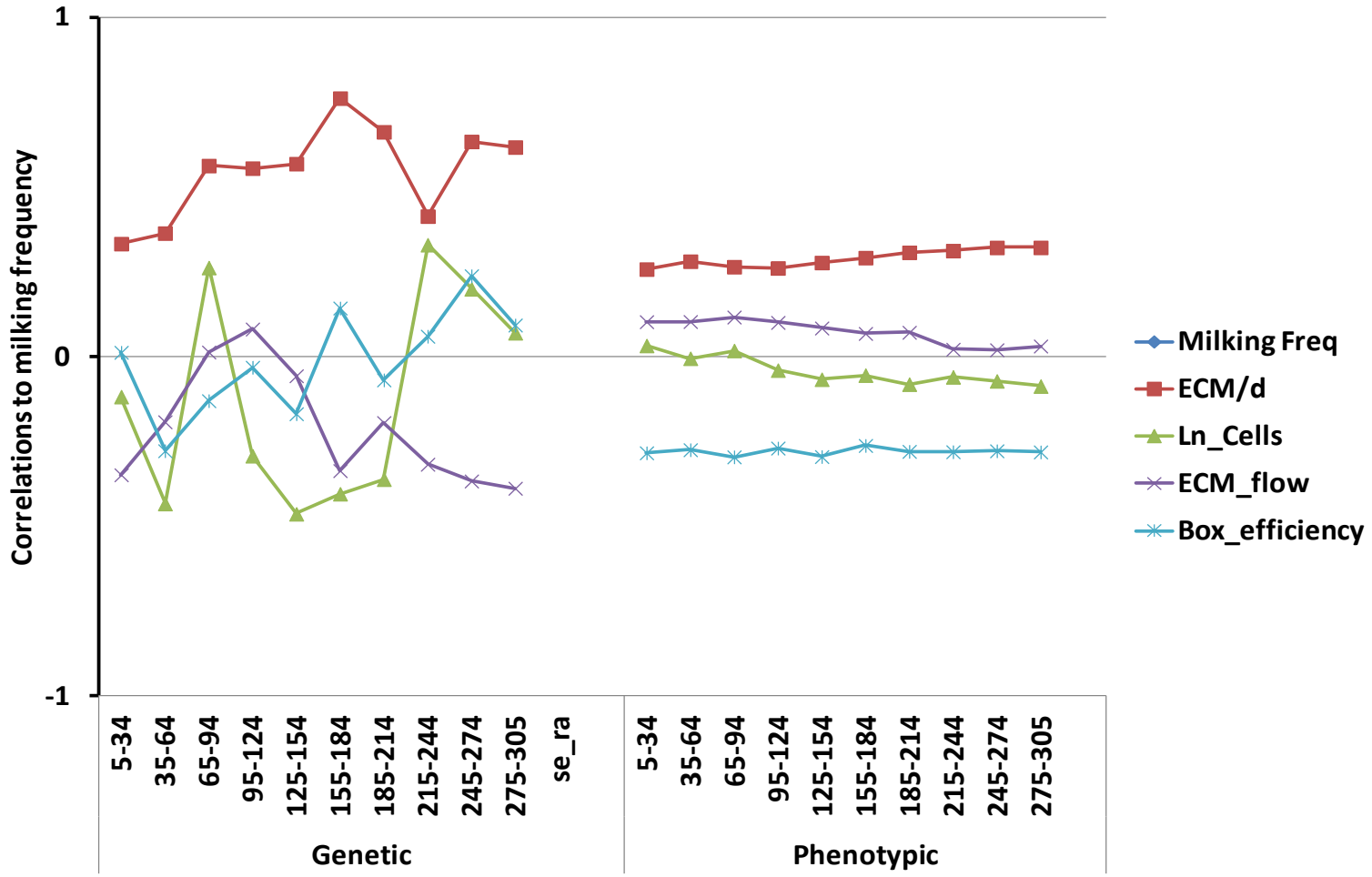
Diurnal effects – sine wave forms



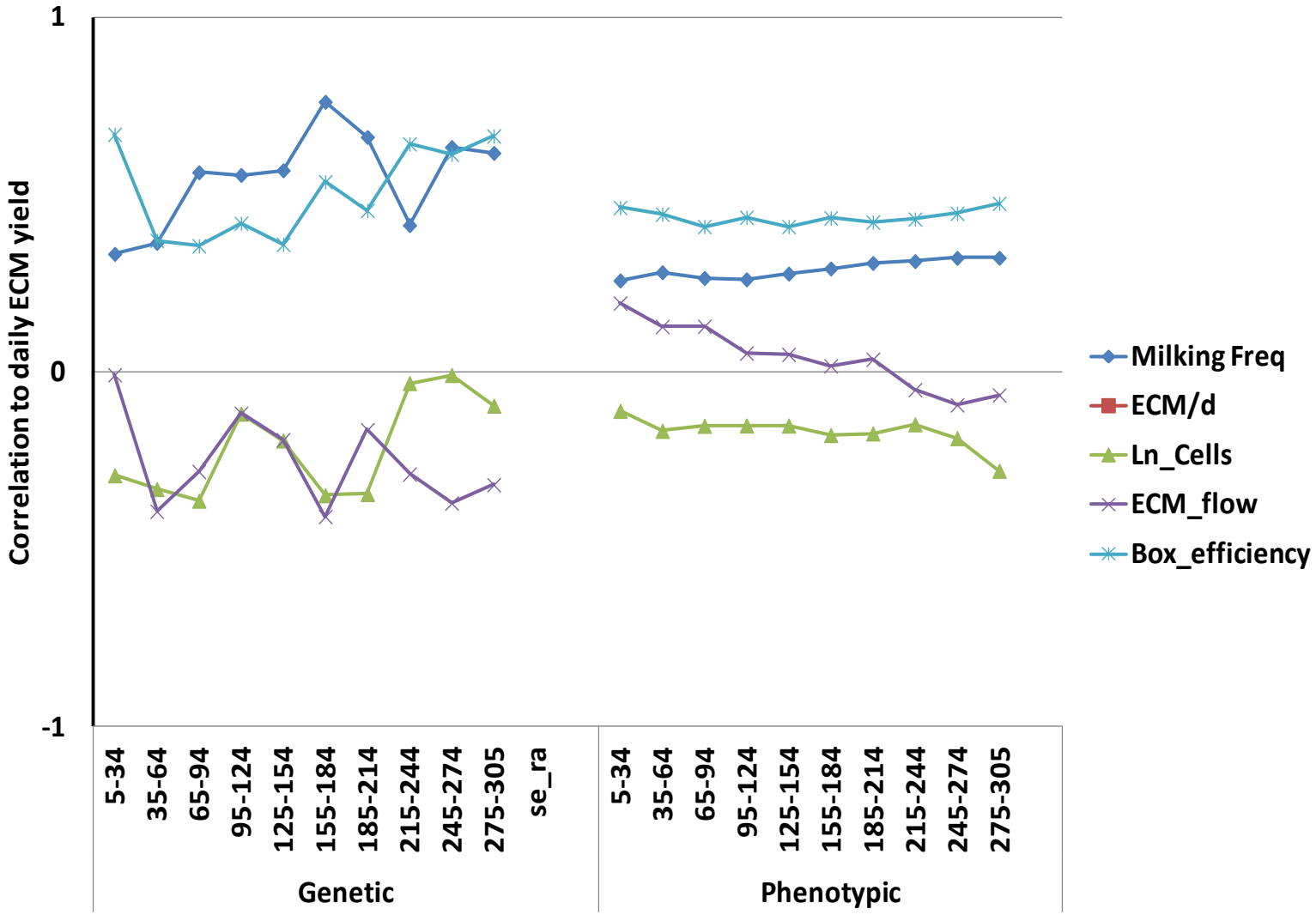
h^2 and repeatability



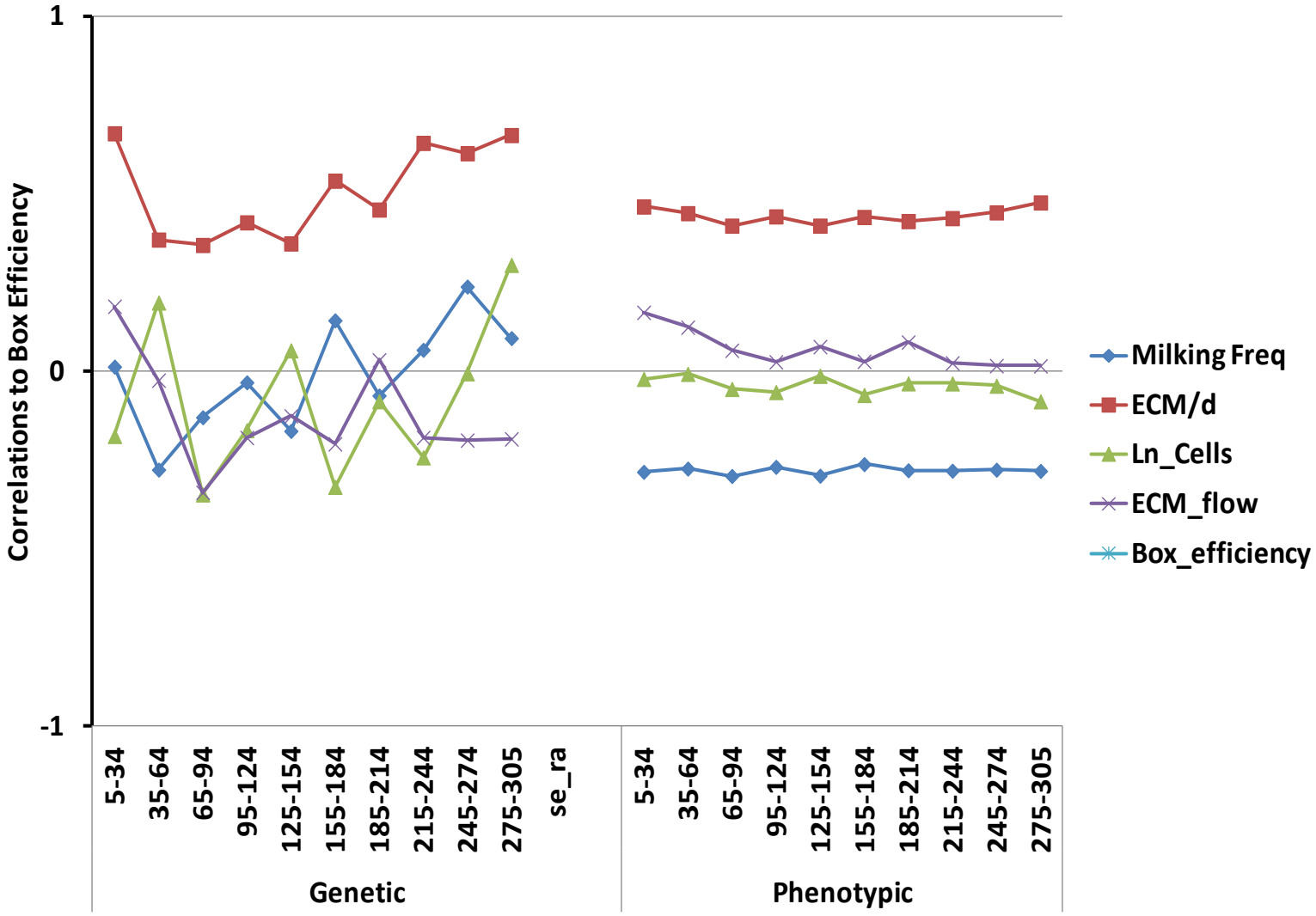
Correlations – Milking frequency



Correlations – ECM yield



Correlations – Milking efficiency



…

- **Cows with higher yield:**
  - Are more effective in using robot time
  - Will demand more robot time per cow
- **Cows with higher milking efficiency:**
  - *Need **not** have higher cell count*
  - *May not have extreme flow rates*


Thank you … → → → Questions ..