



AARHUS  
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**Higher milk yield genetically  
correlate to more frequent milking,  
faster flow but less cell count in  
automatically milked cows**

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# The aim of dairy cattle breeding is genetic progress towards:

- More Milk
- Faster milking cows - less time in robot
- Healthy cows - lower somatic cell count

## Tools:

- *"Breeders toolbox" - traits, records and knowledge (= parameter estimates)*
- Adequate management - feeding, traffic, occupation rate, etc ...



Flowrate and milk meters

Milk sampler



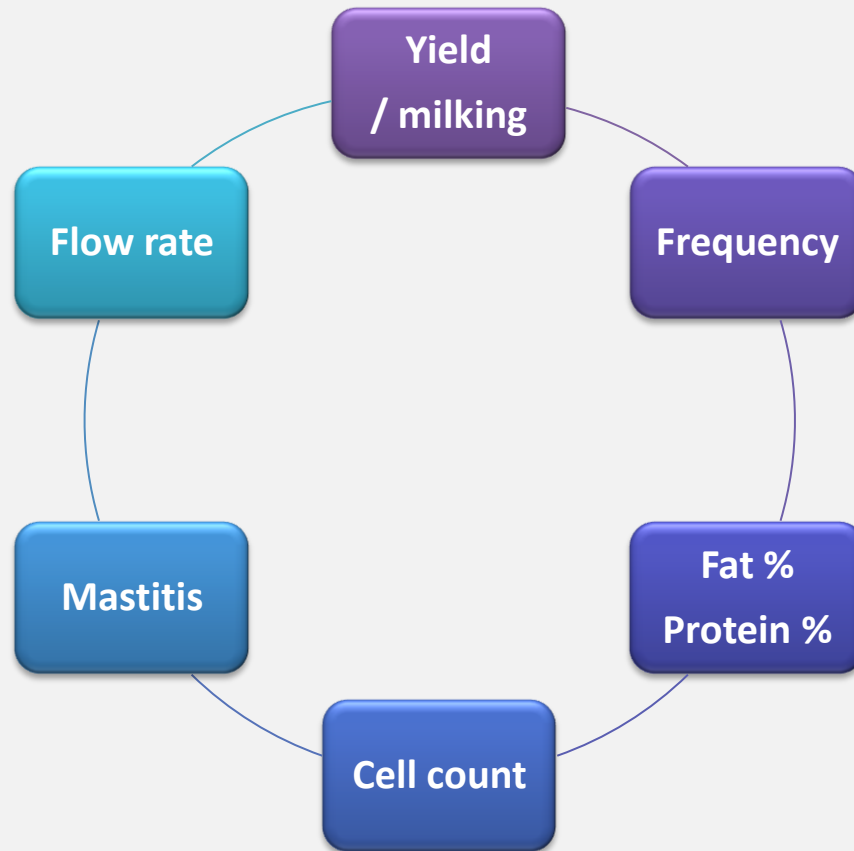
# Automatic milking:

**27% of production in DK, 2010**

## Records affected from:

- Milkings around the clock
- Large variation in
  - Milking intervals
  - Milking variables: yield, composition, flow

# Milking traits and functional traits: How heritable and correlated ?



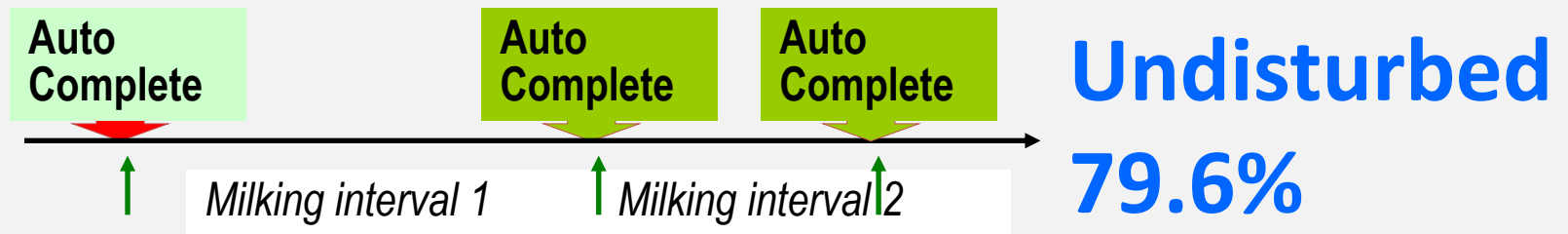
# Experimental herd data

- Holstein, Red Dane, Jersey: 556 cows
- **Parity 1**
- Days in milk: 5 - 305
- 7 years, 3 DeLaval VMS units / cow groups

**280,510** Un-disturbed yield records,  
**146,133** Un-disturbed composition records



# “Un-disturbed” milkings $\Rightarrow$ filtering noisy records out



# Traits – recorded per milking → expressed per 24h

- At every milking - adjust to 24 h basis  
*Curvilinear calibration equation*

$$\text{Yield}_{24} = Y*(0.28 + 0.81MF) + 0.62*MF - 0.17$$

- Yield<sub>24</sub>
- ECM<sub>24</sub>
- Box<sub>time</sub><sub>24</sub>, Milking<sub>time</sub><sub>24</sub>, ...



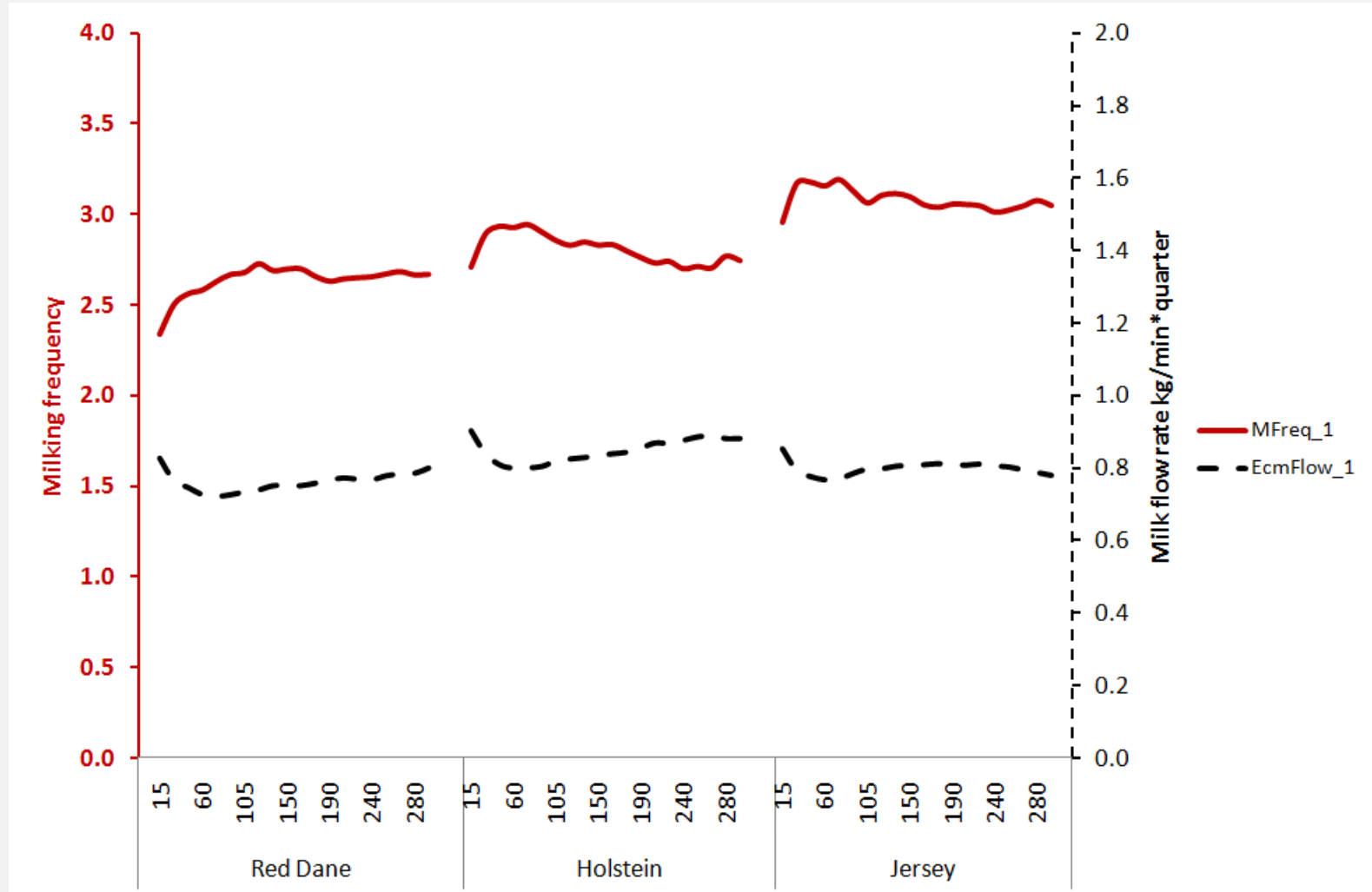
# Analysis of single records – repeatability model

$$Y = Xa + Z_a u_a + Z_p u_p + le$$

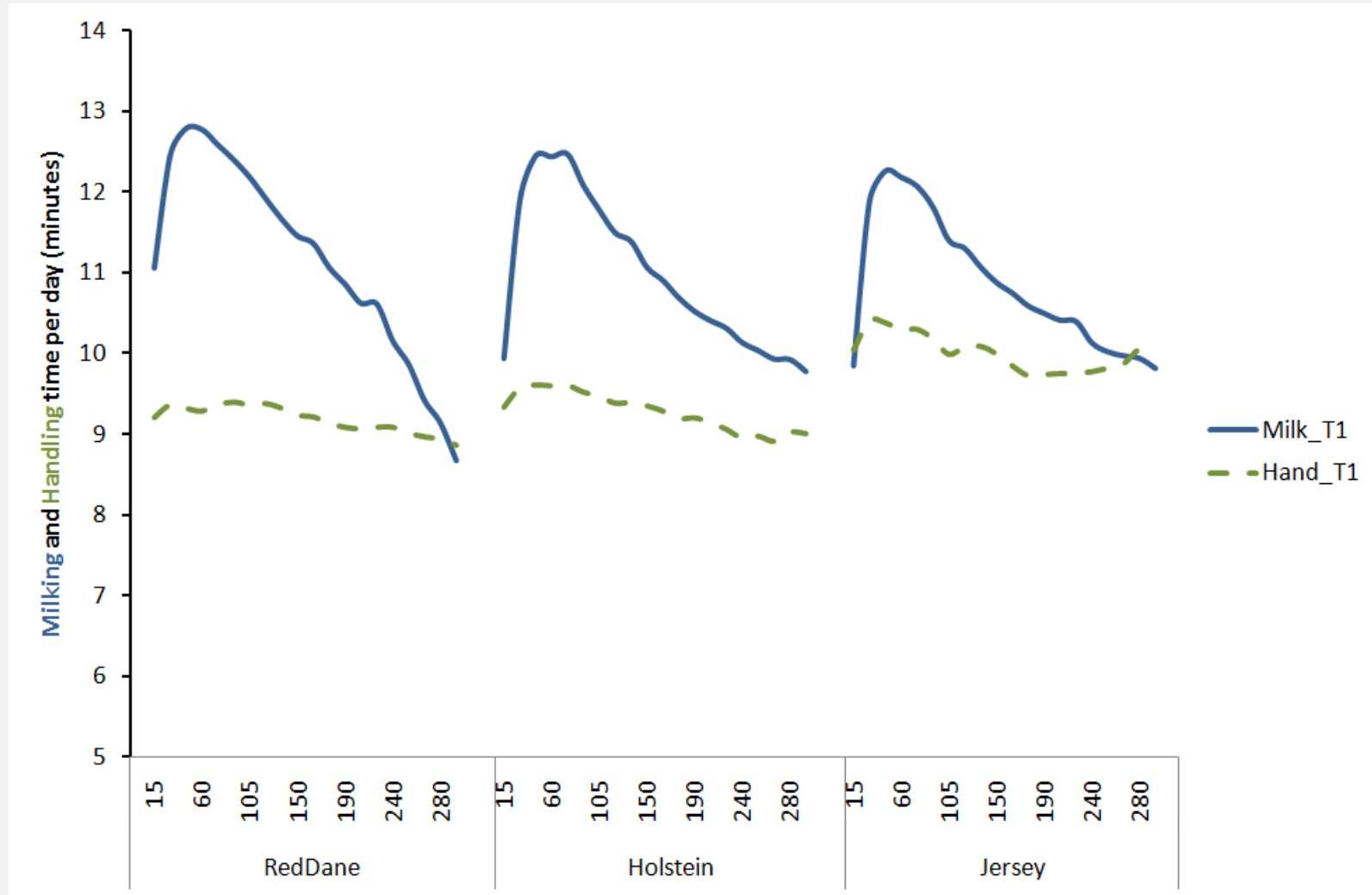
- Systematic effects, a
  - Lactation curves - Wilmink (breed / parity)
  - Diurnal changes - Fourier, order 4
  - Season - Fourier, order 1 within year and breed
- Random effects,
  - Additive genetic
  - Permanent animal
- Residual - constant over the lactation
- SAS + DMU software

# Milking frequency

## Average milk flow rate



# Milking time and Handling time



# Heritabilities

	Heritability
Milking frequency	0.17 ± 0.03
Yield per milking	0.26 ± 0.05
Yield / d	0.49 ± 0.08
ECM_d	0.35 ± 0.07
Somatic Cell Count	0.26 ± 0.06
Flow rate	0.57 ± 0.08
Handling time / milking	0.10 ± 0.03
Milking time / d	0.46 ± 0.07
BoxTime / d	0.30 ± 0.05

# Genetic correlations

	ECM_day	Cells	FlowRate	BoxTime/d
Milking frequency	.56	-.59	-.07	.40
Yield per milking	.66	.22	.36	-.01
Yield / day	.93	-.31	.18	.29
ECM_day		-.27	.23	.28
Somatic Cell Count	-.27		.23	-.10
Flow rate	.23	.23		-.78
Handling time / milking	-.38	.53	-.29	.18
Milking time	.01	.31	-.73	0.80
BoxTime / d	.28	-.10	-.78	

# Correlated response to selection

- **More milkings / day:**  
More milk / d, = Fat %, more ECM, lower SCC
- **More yield ECM kg / day:**  
More milkings, Milk/milking, lower SCC

# Correlated response to selection:

- **Faster milk flow rate**
  - Shorter milking time, shorter handling time
  - Higher SCC
- **Shorter handling time / milking**
  - Shorter total Box-time
  - Shorter milking time
  - Higher milking frequency
  - Lower SCC



# Unresolved issues ...

Restrictions in system

Grazing

Capacity overload

Stage of lactation



# Conclusions

- Cows giving more ECM milk per day are also coming to milking more often and have lower SCC
- To fully exploit the yield potential more robot time is demanded

# Acknowledgement

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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

Thank you ...



# Automatic milking data

## Every milking

- Milking interval
- Yield in kg
- Flow-rate,
- Box-time, Milking time, handling time
- Completeness / Disturbance - code

## Chosen milkings - samples

- Composition: Fat %, Protein %, SCC