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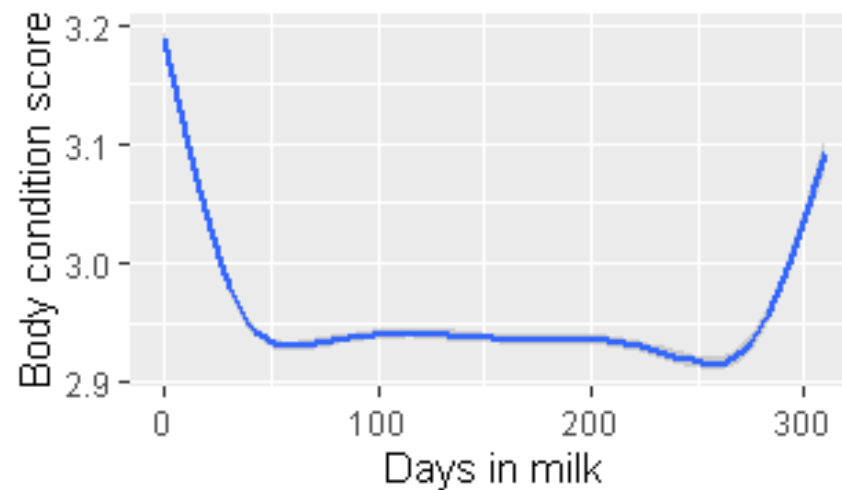


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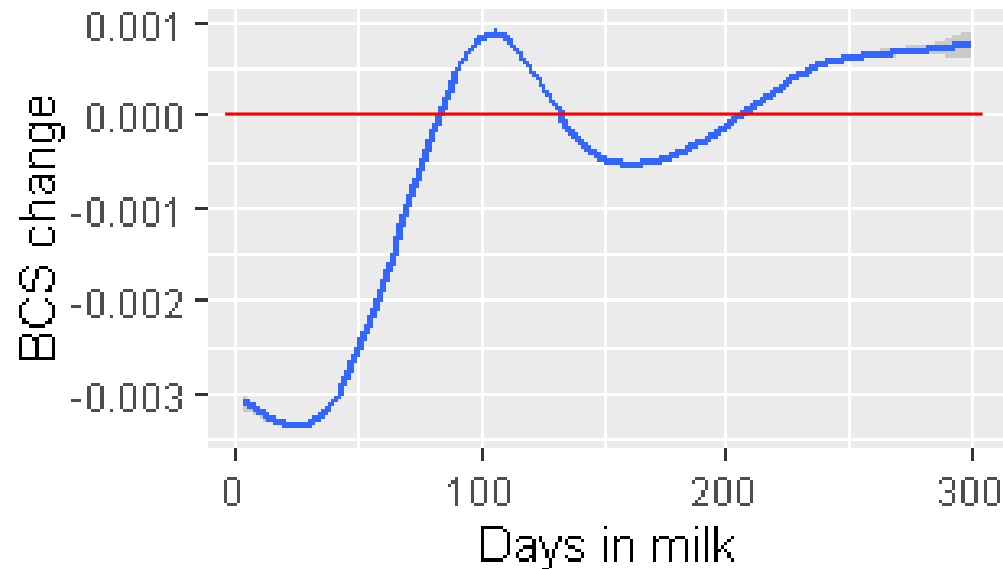
## Body condition score (BCS)

- Metric used to reflect body reserves in mammals
- Assessed by trained scorers and farmers
- Associated with productive, reproductive, and health traits



## Body condition score change

- Useful to identify energy status of the cow
- Associated with productive, reproductive, and health traits

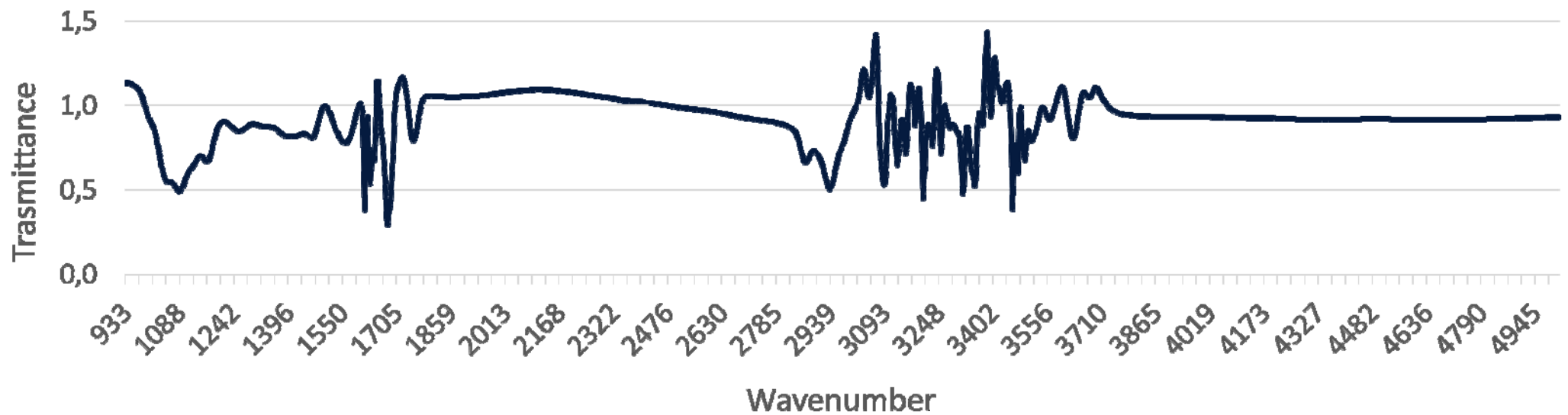


## Effect of body condition score change

- Conception rate to first service (*Butler and Smith, 1989*):
  - Lost >1 BCS unit (5-point scale) post calving → 17% conception rate
  - Lost <1 BCS unit → 53% conception rate
- Somatic cell count (SCC) (*Berry et al., 2007*)
  - Lost more BCS to 60 DIM, or between 60 and 120 DIM → Greater SCC
  - Lost less BCS to nadir → Lower probability of high SCC in early lactation

# Objective

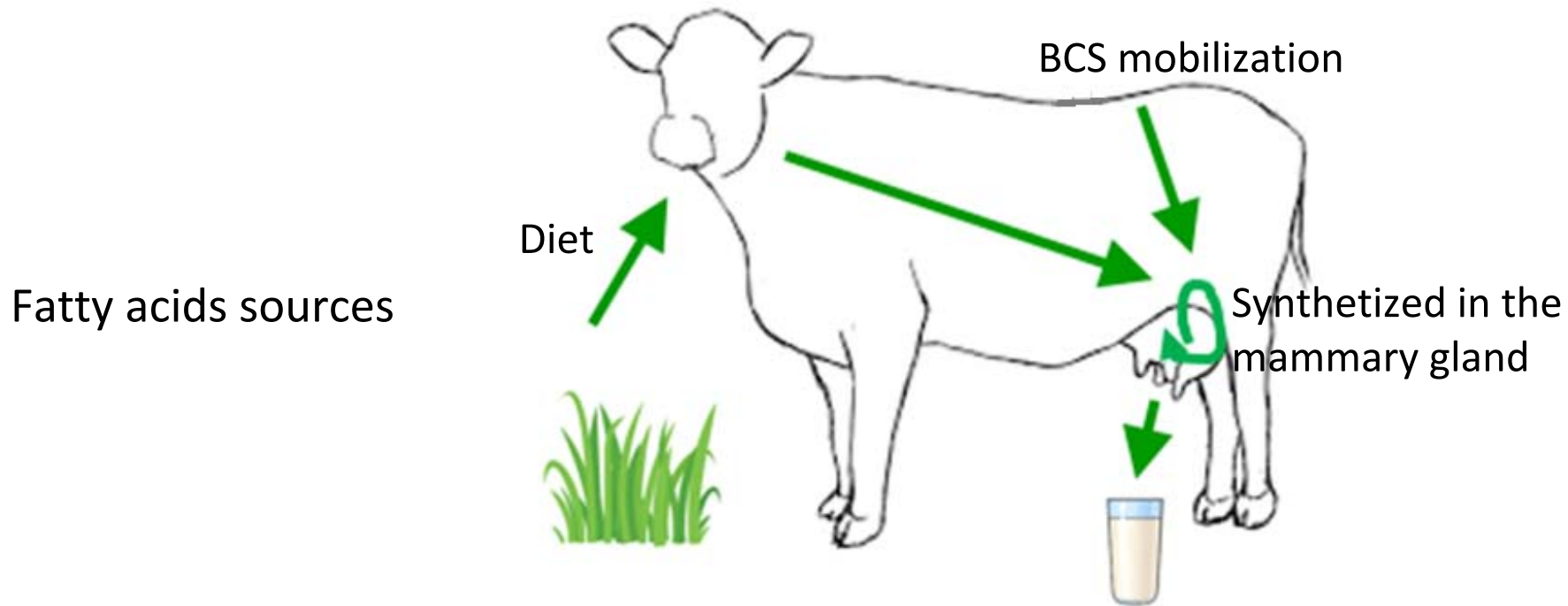
Predict BCS change from milk MIR spectra



Routinely available  
Fast  
No additional costs

# Hypothesis

Fatty acids produced from BCS lost goes into milk



## Data

- 73,193 BCS records from 6,572 cows
  - Only data in first 120 DIM used
- Individual cow BCS lactation profiles
  - Daily BCS change interpolated
- Merged, by week, with MIR spectra

# Analyses

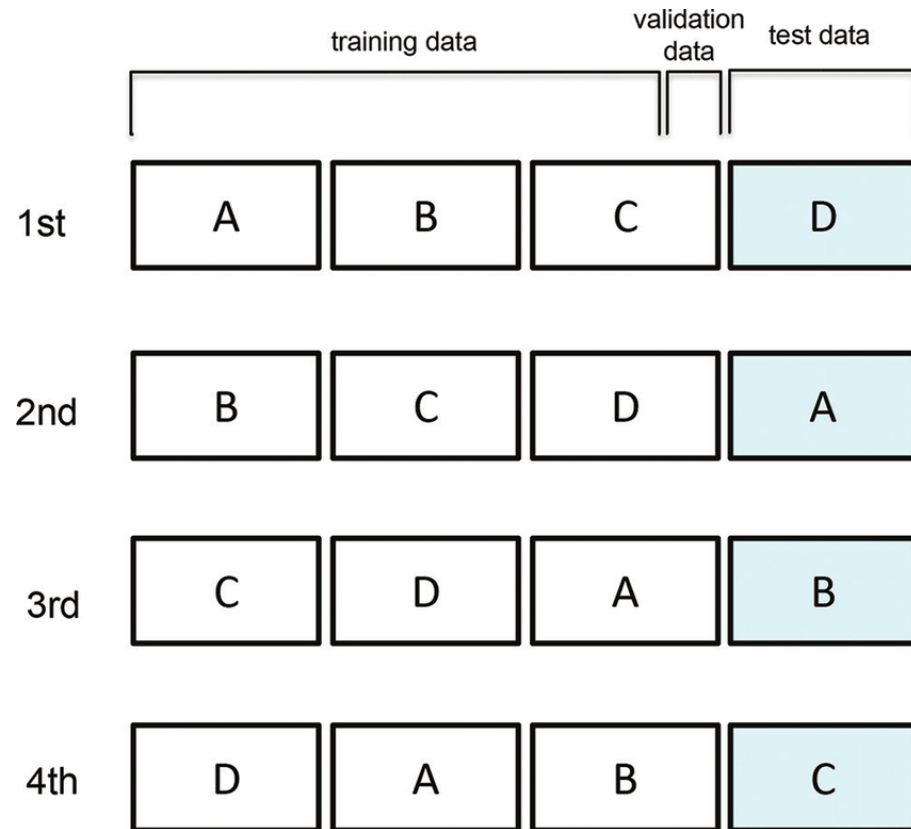
- **3 different methods used**
  - Partial least squares regression (PLSR)
  - Generalized additive mixed model (GAMM)
  - Artificial neural network (NN)
- **Features included in the analyses**
  - PLSR: spectra, days in milk (DIM), DIM<sup>2</sup>, DIM<sup>3</sup>, DIM<sup>4</sup>
  - GAMM: first 20 principal components of the spectra, DIM
  - NN: spectra, DIM



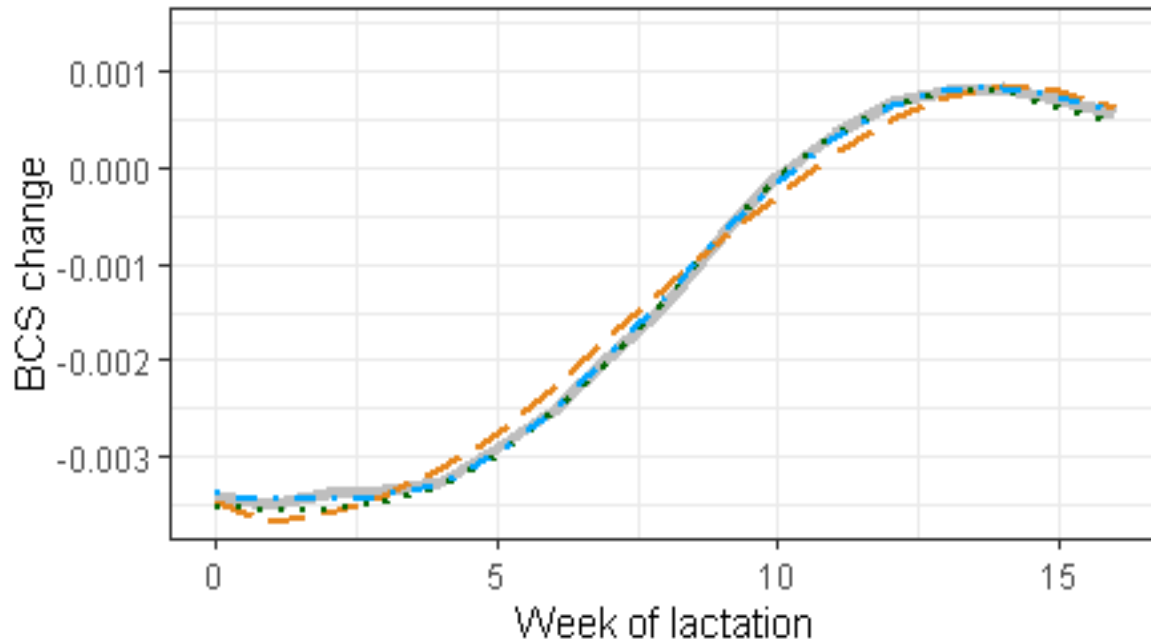
# Validation

- **4 fold cross-validation**

- Dataset divided in 4 sub-datasets
- All records for a given cow lactations in just one sub-dataset
- Iteratively 3 sub-datasets used for training the model, 1 for testing



# Results



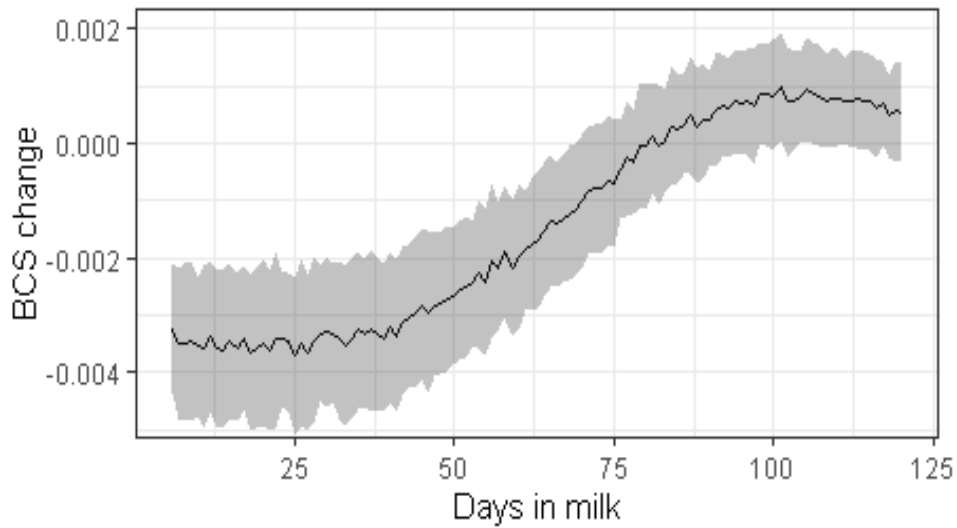
Grey = actual BCS change; orange dashed = PLSR;  
green dots = GAMM; blue dashed = NN

	RMSEV (SD)*	R (SD)
PLSR	1.06 ( $1.0 \cdot 10^{-2}$ )	0.86 (0.004)
GAMM	1.10 ( $1.1 \cdot 10^{-2}$ )	0.84 (0.004)
NN	1.02 ( $1.5 \cdot 10^{-2}$ )	0.87 (0.005)

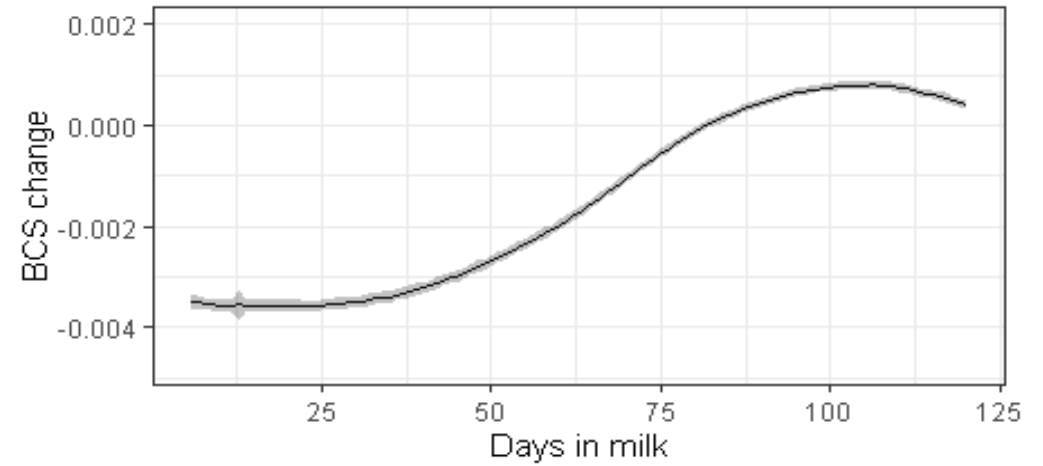
\*Here multiplied by 1,000  
BCS change units

# Variability in the results

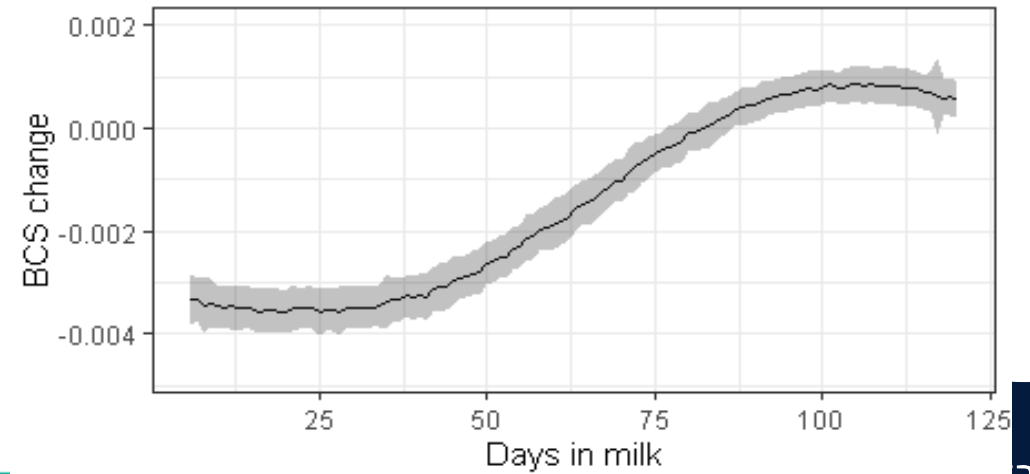
Real BCS change






GAMM



NN



## Conclusions

- Body condition score change can be predicted from MIR spectra 
- Can be used by the farmers to have specific information for each cow
  - Energy balance indicator
  - Decide whether or not inseminate a cow
  - Specific feed requirements
- Provides routine phenotypic information to include in breeding programs 

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# Thanks for your attention

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