

## Lactation model

*An accurate machine learning approach to predict fat, protein, and milk yield before and during lactation from test-day records*

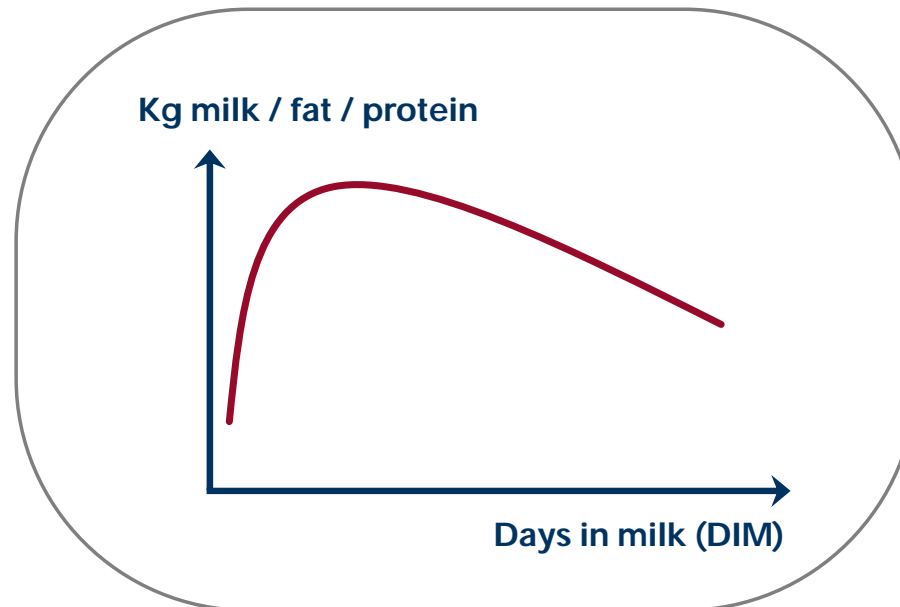
**Ines Adriaens | June 4 | 11:00 – 13:00**  
**CRV BV**



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TS6: Milk Recording in a Technology World: Providing Value Added Services and Data Exchange solutions for Farms with Robots and Sensors

## Why *another* lactation model?



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key figures, management decisions and performance targets

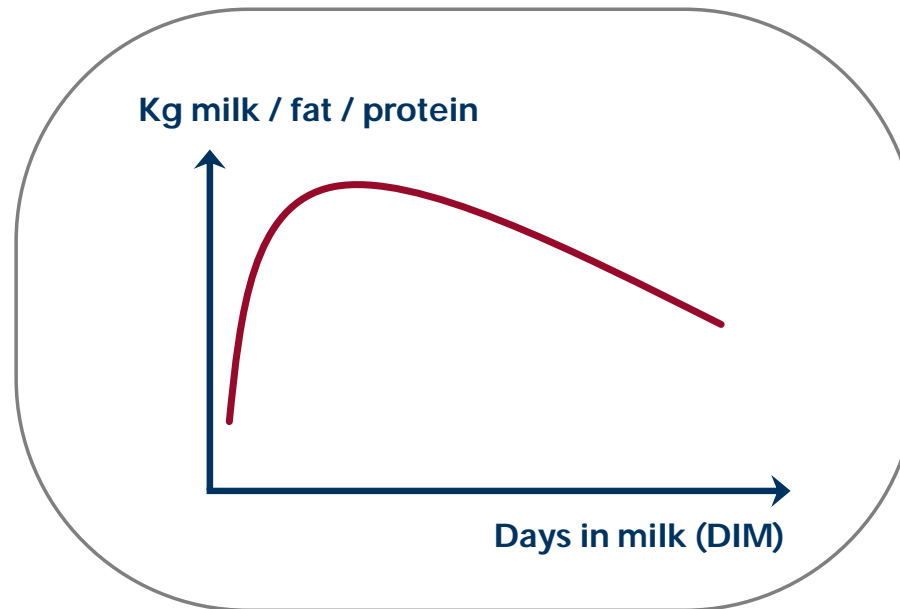
$$P = G + E$$

management assessment (genetic) benchmarking

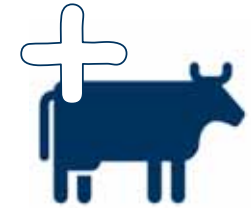


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## Why a lactation model @ CRV?



...



cow health monitoring

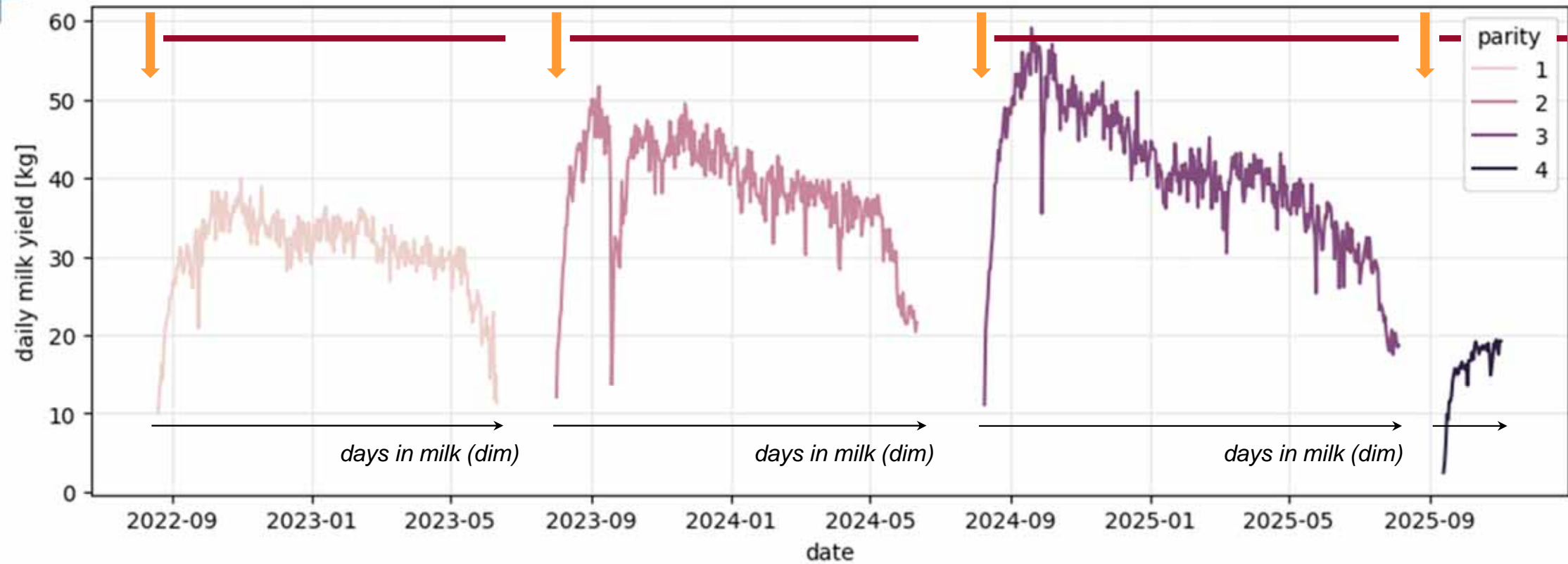


herd performance monitoring and prediction (e.g. mineral excretion)

Goal: predict **milk**, **fat**, and **protein** yield

before lactation started (day-0)

for ongoing lactations (day-n)



## Herd milk recording + studbook data

- 9000 farms
- 1.1 million animals
- 1.7 million lactations



**dataset**

## Available variables

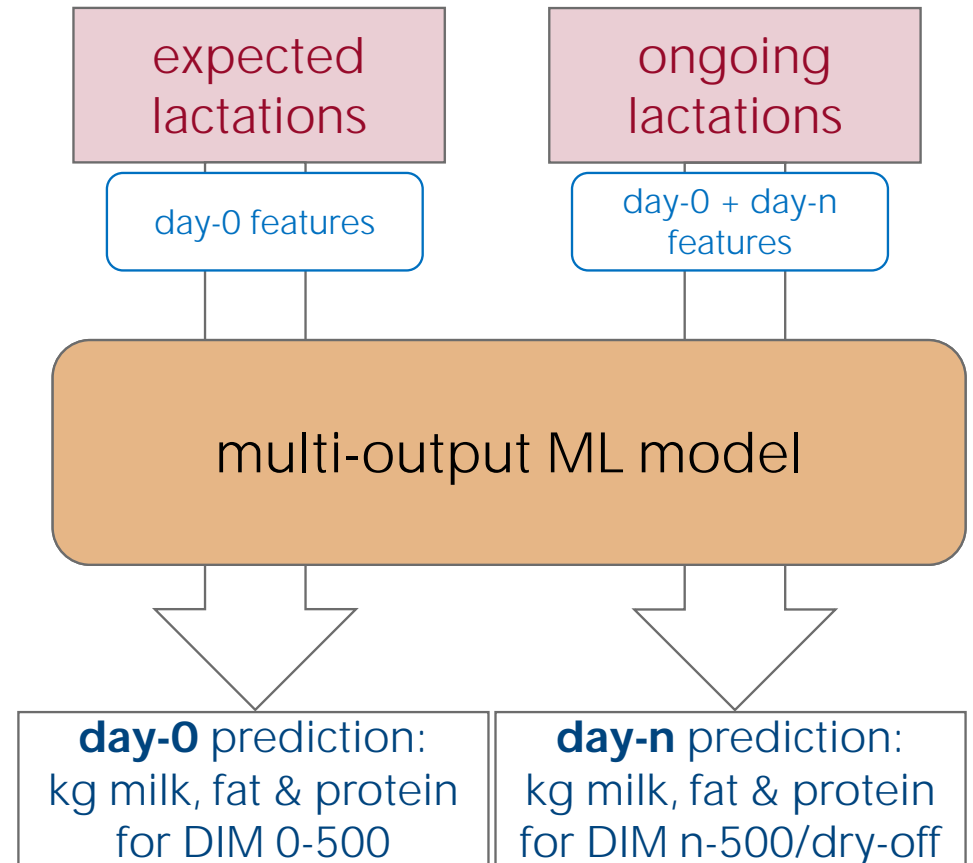
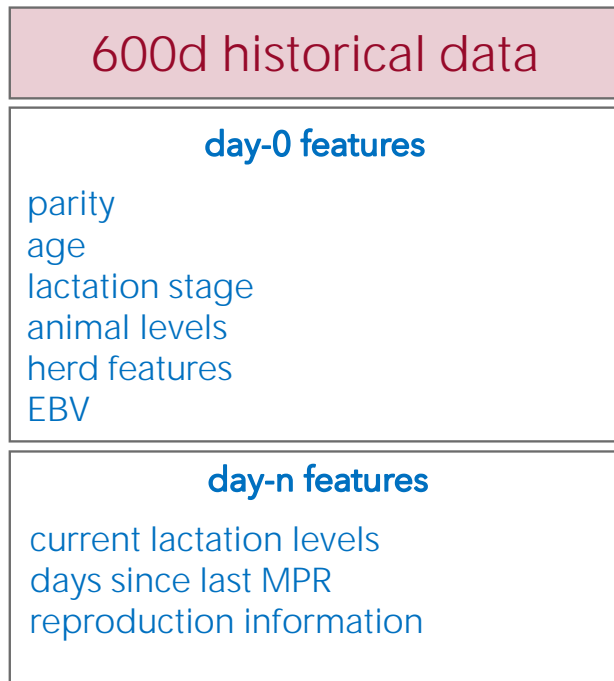
- reproduction data
- herd milk recording (test-day) data
- genetic information (estimated breeding values, EBV)



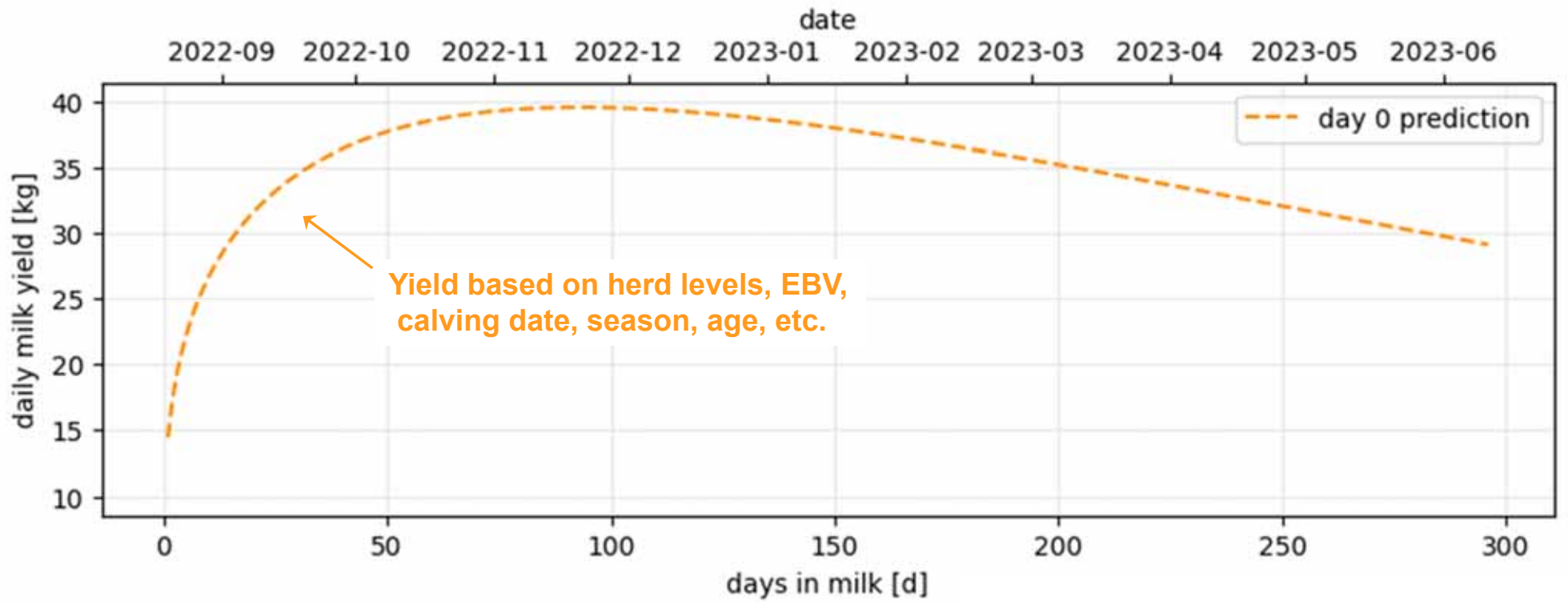
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# TRAINING, VALIDATION, TEST

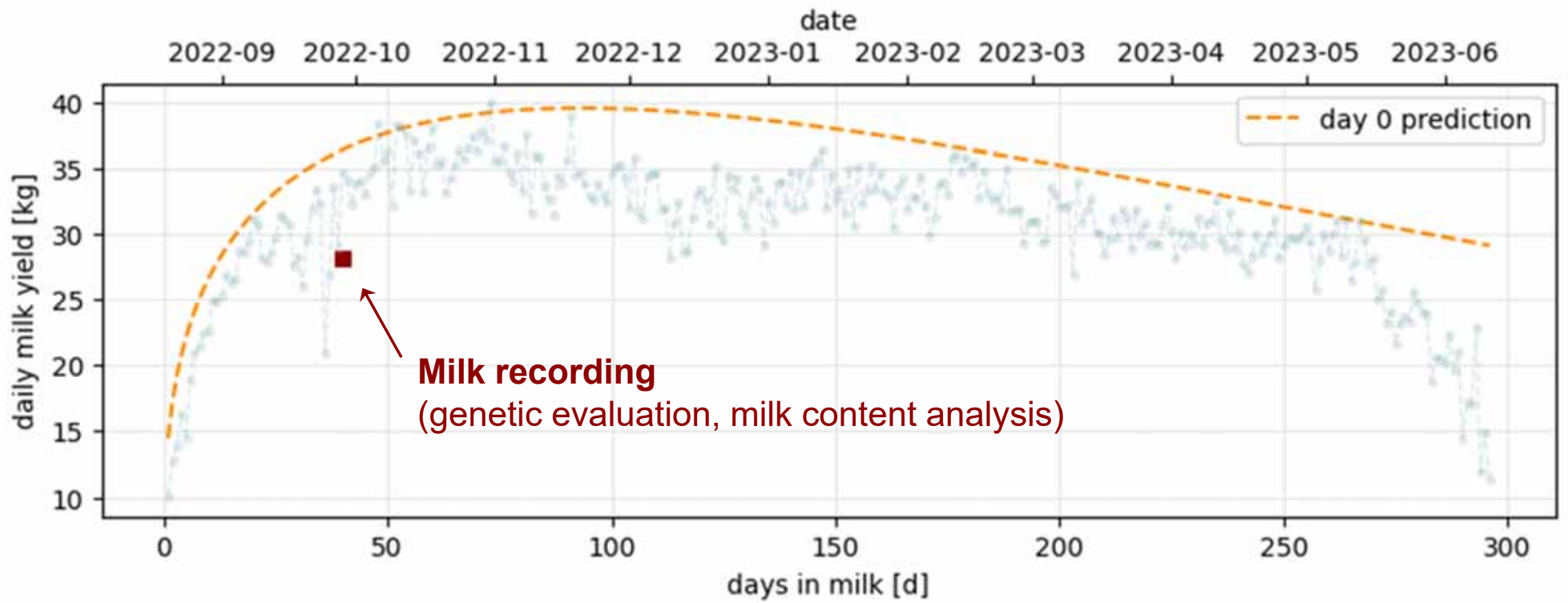
# PREDICTION



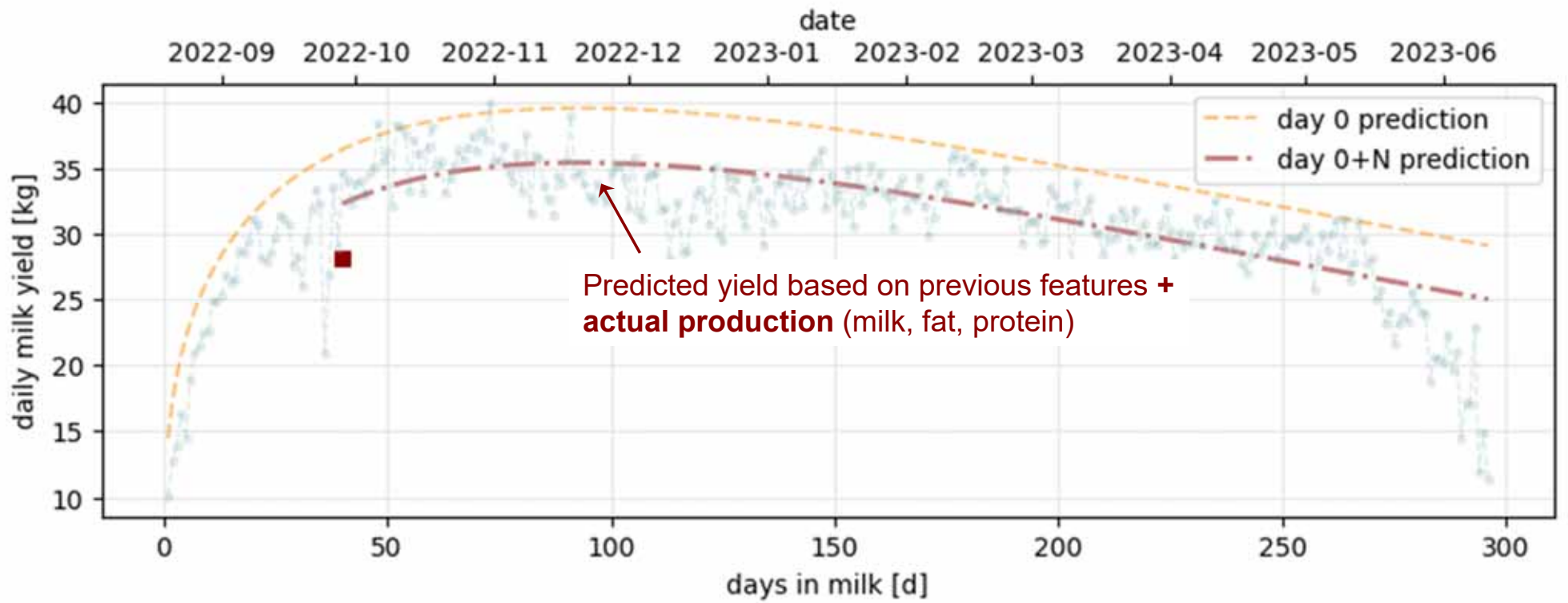
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# How good are the predictions on test set?

MEDAE   MAPE
Day 0
Day n

**MEDAE:** median absolute error [*kg*]

**MAPE:** mean average percentage error [%]

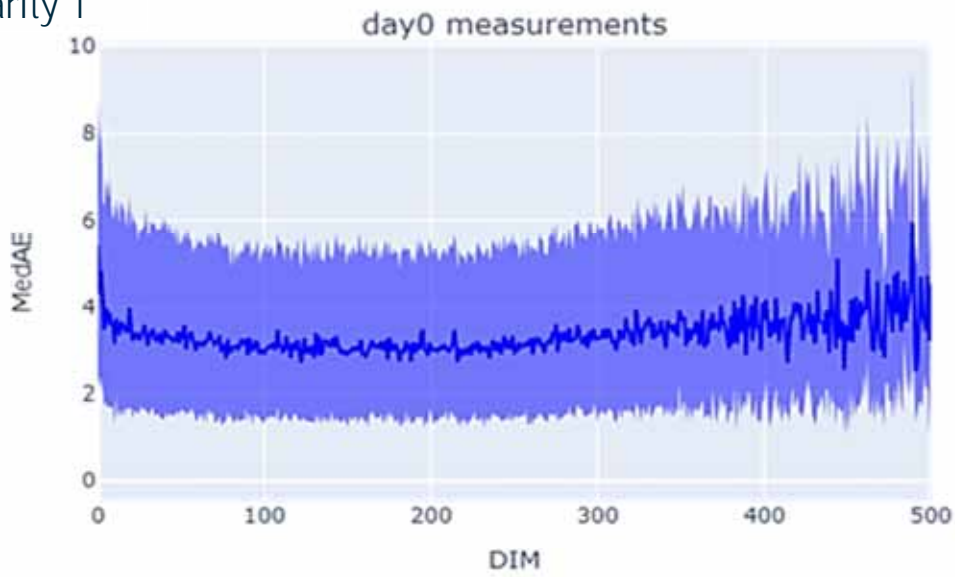
**FPCM\*** (kg) = milk yield (kg) × [0.1226 × fat (%) + 0.0776 × protein (%) + 0.2534]



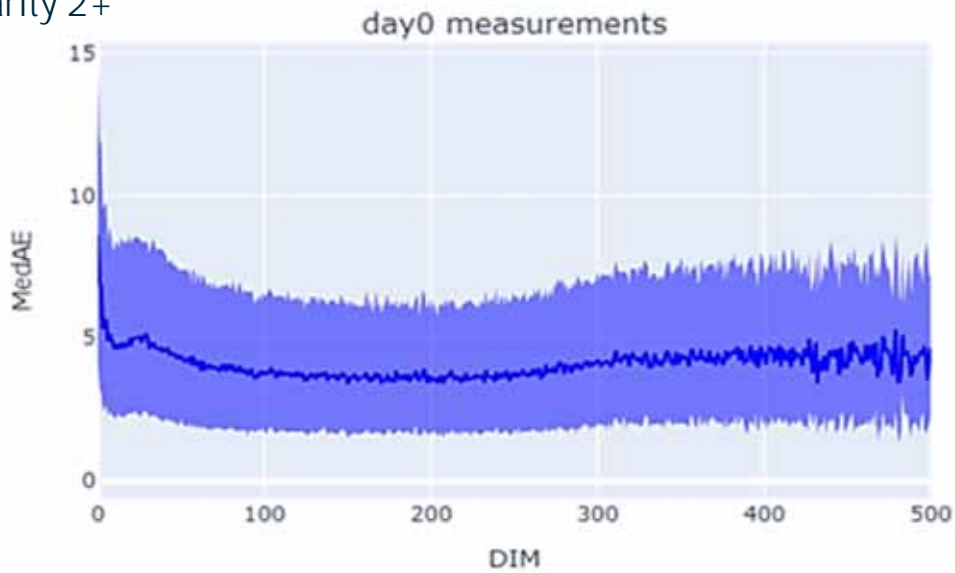
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MedAE of fpcm over DIM with the interquartile range

Parity 1

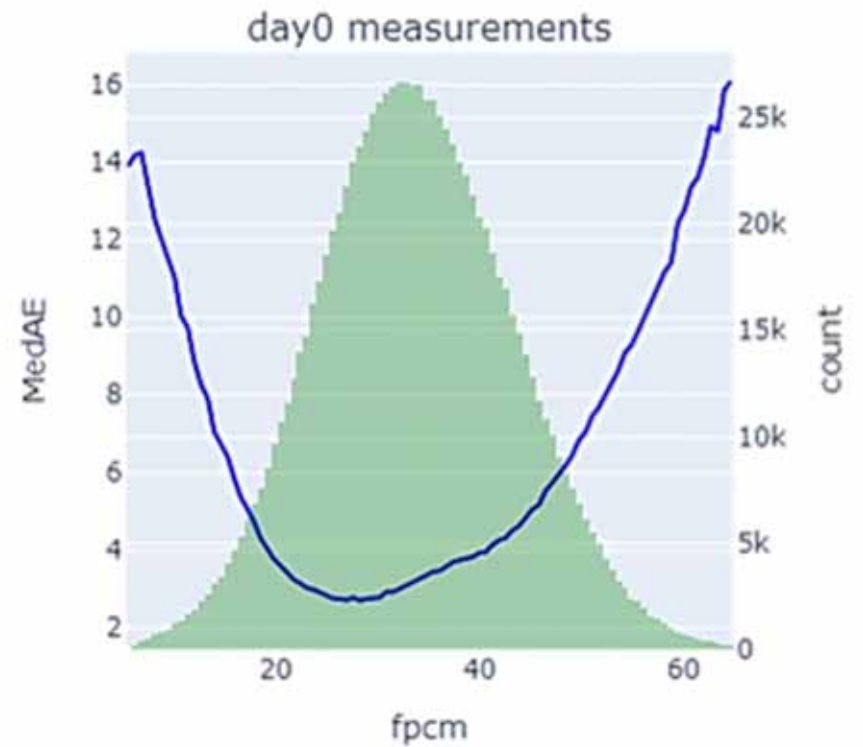


Parity 2+

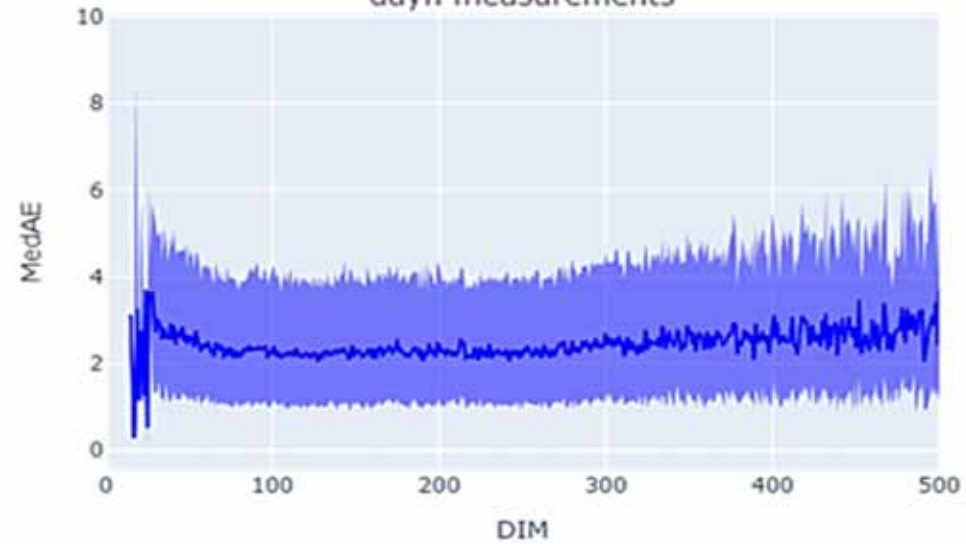


## FPCM - day 0 predictions

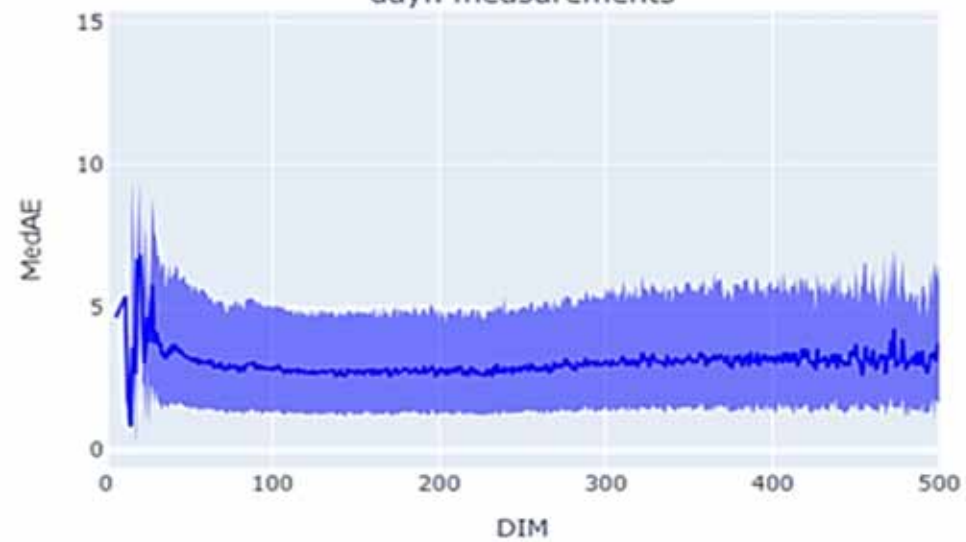
- Median error: 3.71 kg
- Mean average error: 14.2%



Parity 1  
 MedAE of fpcm over DIM with the interquartile range  
 dayn measurements

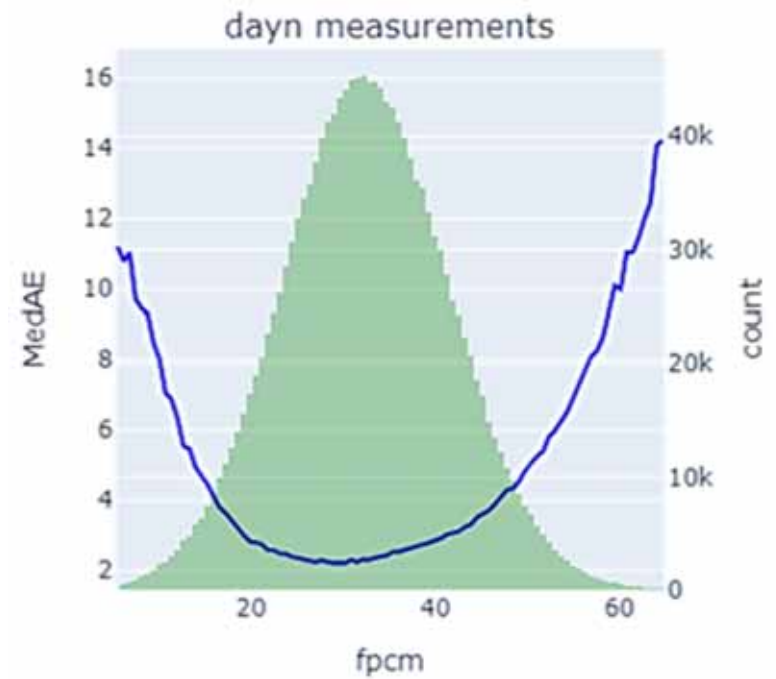


Parity 2+  
 dayn measurements



## FPCM - day n predictions

- Median error: 2.69 kg
- Mean average error: 11.0%





## Take home messages

- Machine learning provides new methods to train and predict milk, protein, and fat yield from large datasets
- Highly accurate prediction can be done both at the start of a lactation and upon new data coming in
- Predictions can serve a variety of applications such as individual and group-level monitoring, decision support, and performance targets



Thank you!



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