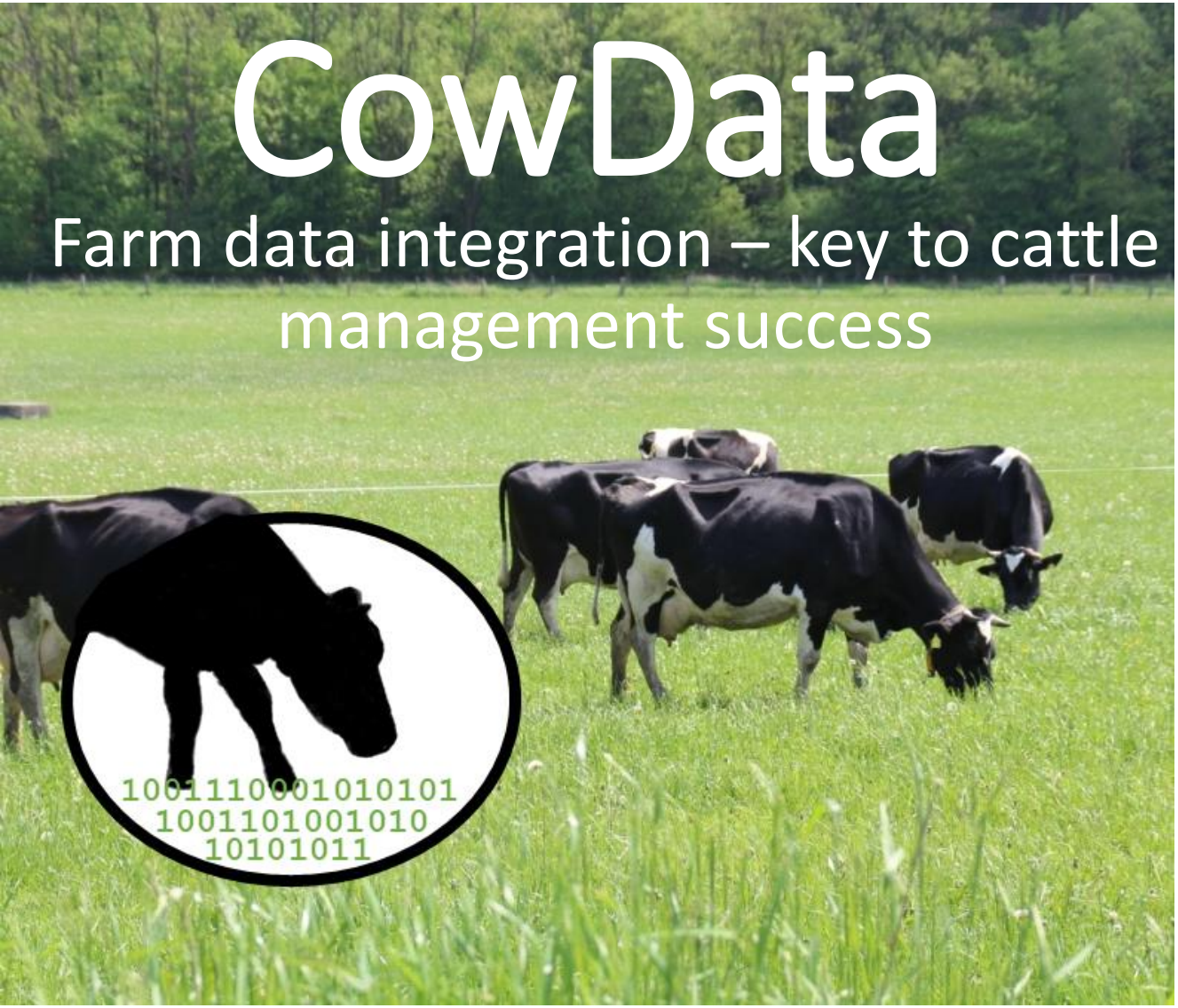
ICT AGRI era-net

ICT and robotics for sustainable agriculture

CowData

Farm data integration – key to cattle management success



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ILVO
Institute for Agricultural and Fisheries Research

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HUMBOLDT-UNIVERSITÄT ZU BERLIN

- Grazing Trial Germany

ILVO
Institute for Agricultural and Fisheries Research

- Database Building

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Agroscope

- Grazing & farm trial Switzerland
- Database implementaion

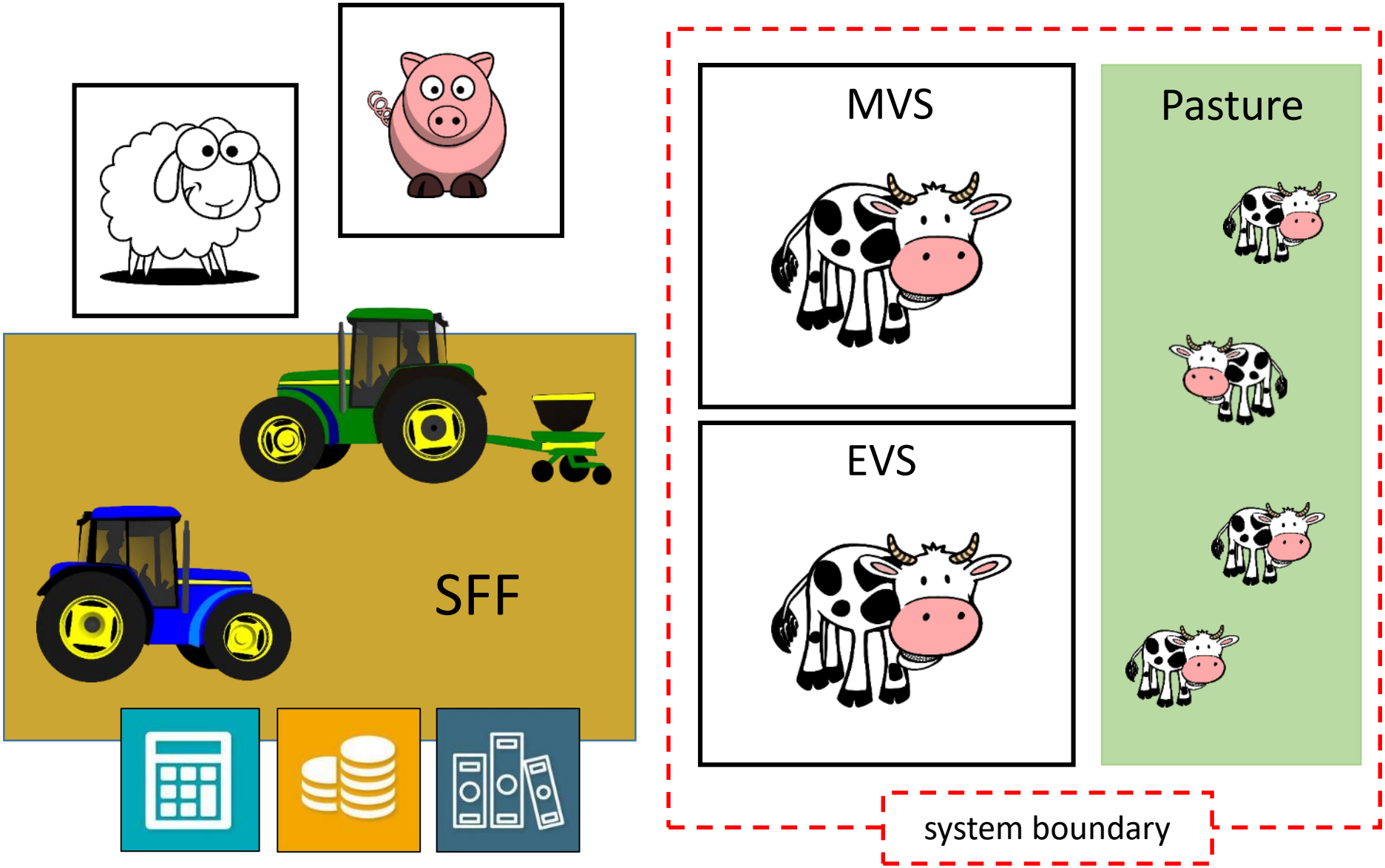
Project Overview

- Database for Farm Data (inTänikon, built by Belgian Partners)
- 2 PhD Projects that serve as use cases (Berlin and Switzerland)

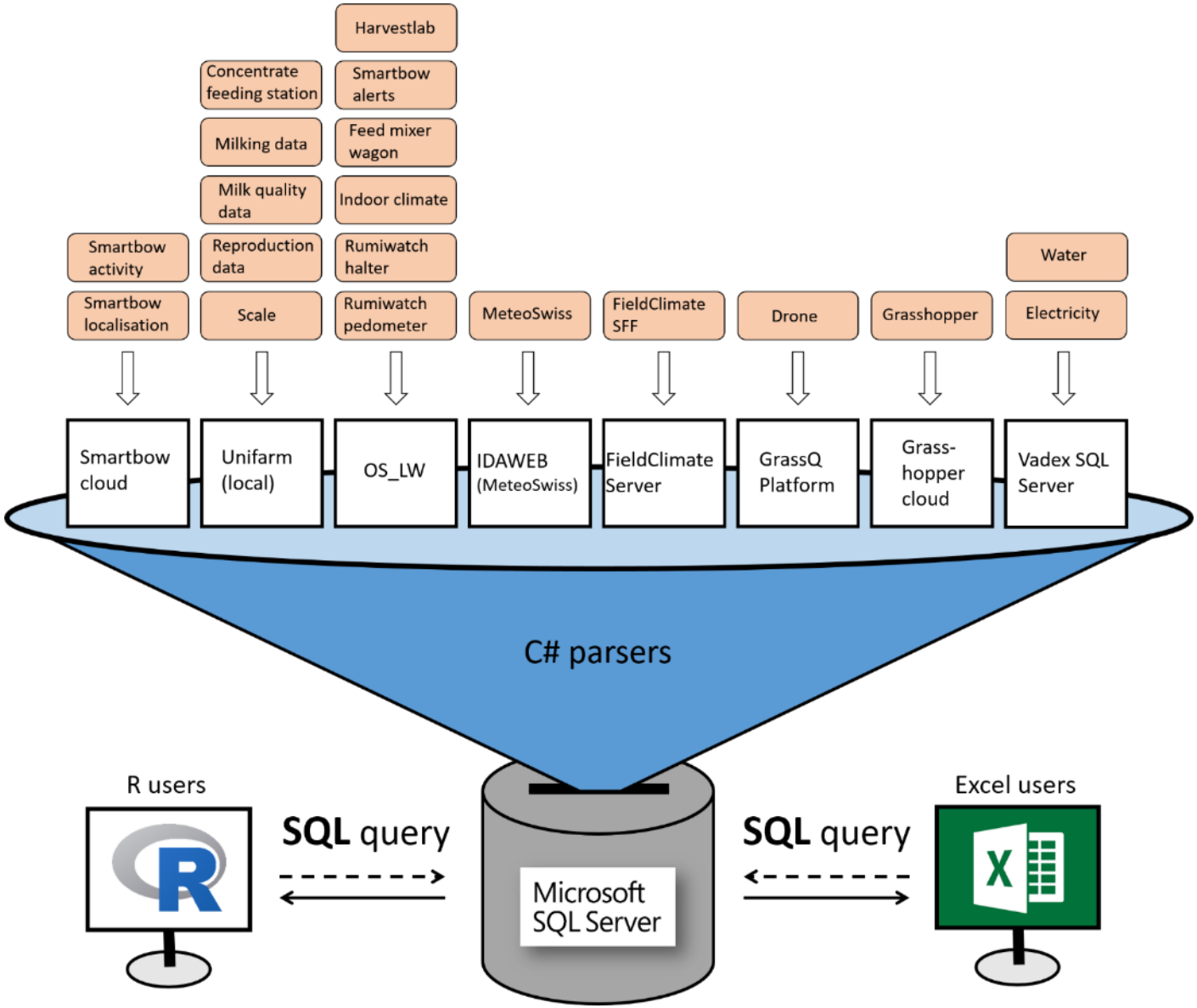
→**Demonstrate the benefit of combining various sensor data to the industry**

Image: Gaëtan Bally, Keystone

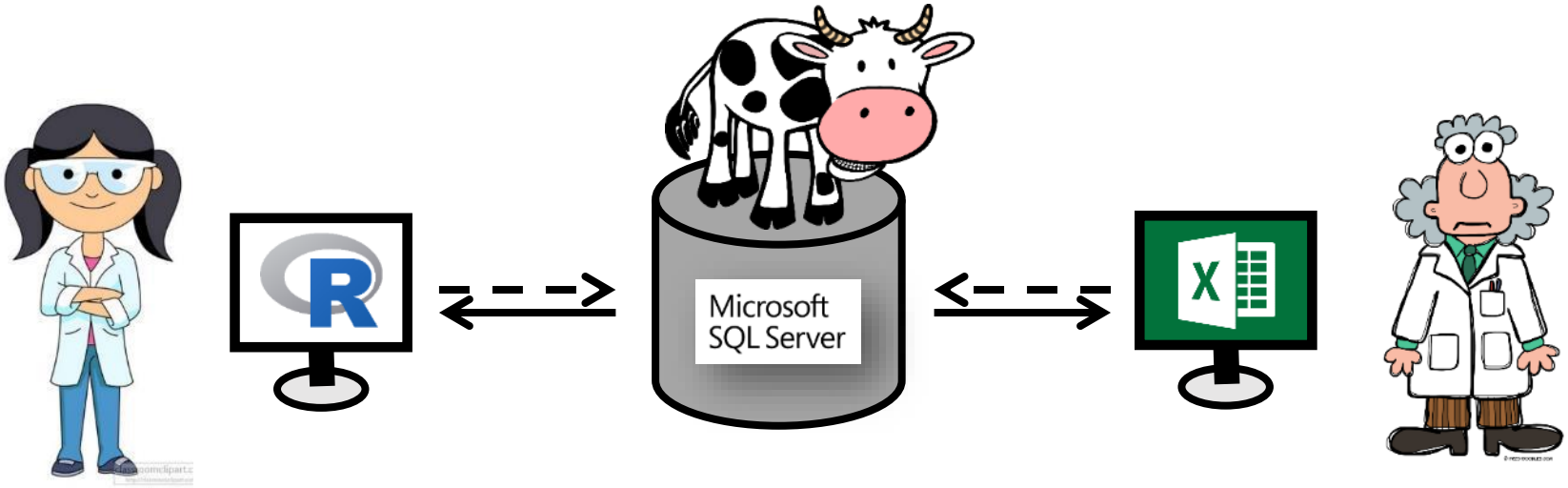
Where does the data come from?



Unifying storage location and data formats - providing SQL interface



CowData Database



Validation of a model to identify insufficient feed allowance based on behavioral responses of grazing cows

Motivation

(1) Improving pasture management

(2) Teaching farmers eyes and develop a decision support system

Can sensors reliably detect behavioral alterations?

Approach

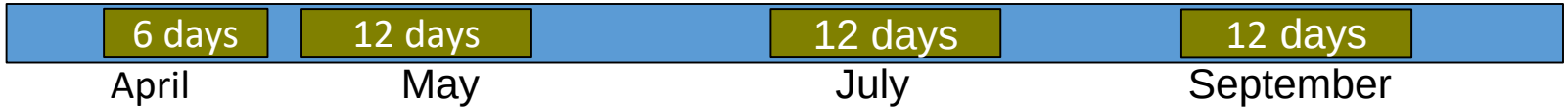
Developing the “Cattle-FeedBack Model”

Identifying the most suitable machine learning approach

Collecting data in a grazing experiment with decreasing feed supply during six days

Validate the model under farm conditions

Experimental Setup



Grazing period (March – October)

Experimental phases

- 20 cows (Braunvieh) in two groups
- 9 hours of grazing per day
- Rotational grazing
- Main pasture area «Waldegg»

Cows pasture covers 80% of feed demand.

«Cattle-FeedBack» Model

- *Identifying low feed intake of spring calving cows: A machine learning approach* (Shaffiullah et al., 2019a)

- *Machine Learning Based Prediction of Insufficient Herbage Allowance with Automated Feeding Behaviour and Activity Data (Shaffiullah et al., 2019b)*

- **Random Forest (*Ho, Tin Kam 1995*) performed best among other suitable machine learning approaches** :
  - K Nearest Neighbour (*Altman, N. S.1992*)
  - Linear Discriminant Analysis (*Fisher, R. A.1936*)
  - Naive Bayes (*Maron, M. E. 1961*)
  - Neural Network (*Hopfield, J. J. 1982*)
  - Support Vector Machine (*Cortes, Corinna; Vapnik, Vladimir N.1995*)
  - Decision Tree (*Quinlan, J. R. 1986*)

→ **Validation under field conditions necessary**

CowData

- Pasture Trial: Behavioural indicators as potential pasture management tool?
- Drying-Off Trial: Behavioural indicators for stress?

Pasture Trial

Research question:

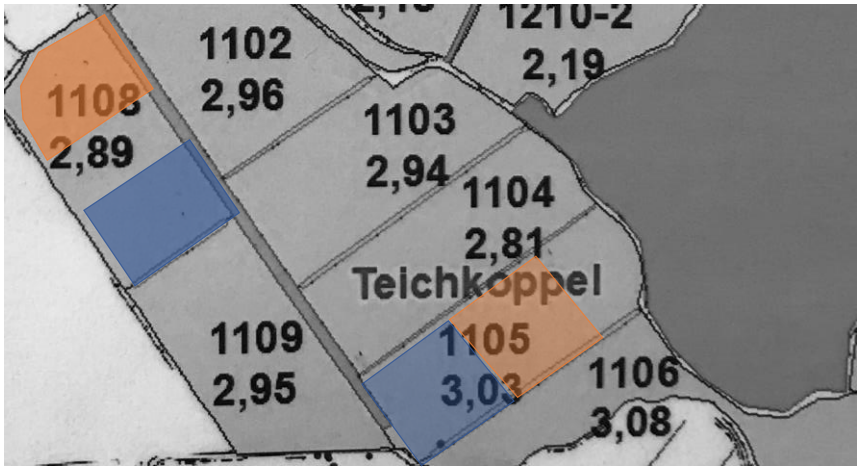
- Does the behaviour of grazing cows change with decreasing sward height?

Aim:

- Detect suitable time to allocate cows to new pasture based on behavioural indicators
  - Optimum utilization of the feed supply
  - Protection of the sod
  - Facilitation of management

Pasture Trial

Example for an experimental period:



1st week

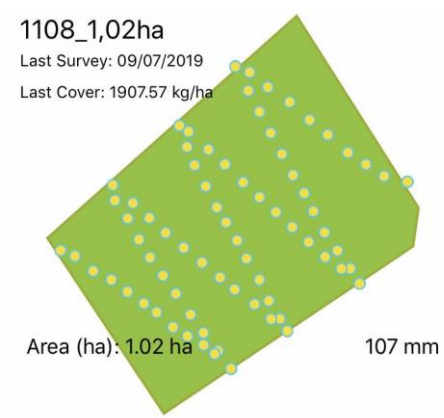
1108: 10,3 cm - herd 1

1105: 7,1cm - herd 2

2nd week

1108: 13,0cm - herd 2

1105: 8,0 cm - herd 1



Data collection:

- Behavior: RumiWatch-halters, IceTag 3D-accelerometers
- Sward height: Grasshopper
- Grass samples, etc.

Drying-Off Trial

Research question:

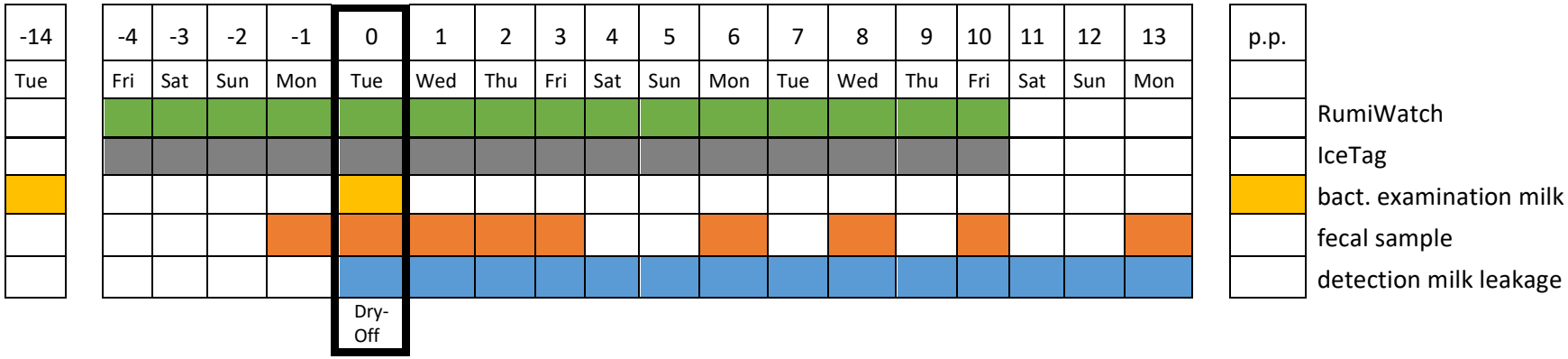
- Can sensor-based behavioural indicators capture the stress by exposure to drying-off and reduce it through grazing?

Background:

- Abrupt omission of milking leads to increased inner udder pressure → can damage tissue → pain *(O'Driscoll et al. 2011, Österman und Redbo 2001, Zobel et al. 2015)*

Experimental procedure for different housing systems:

- Indoor housing vs. pasture



Use of existing farm data

Can animal-specific data show optimization potential in management by combining different data streams?

- Literature review
- Explorative evaluation of the operating data

Early detection of lameness

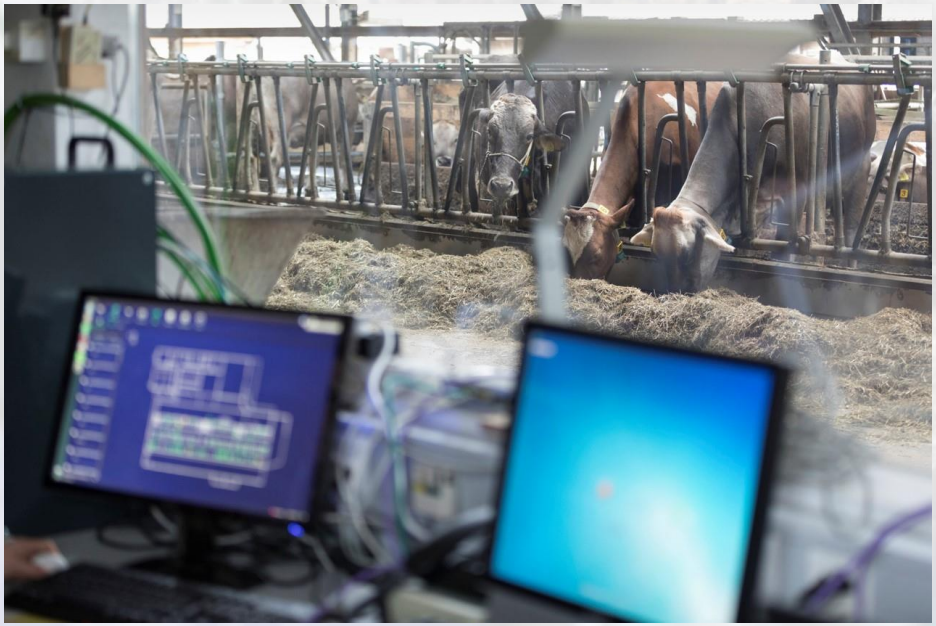
→ Not lame and moderately lame cows differed in specific behaviours (Weigele et al., 2018).

→ Can behavioural changes within an individual be used to detect lameness at an early stage?

→ Can thresholds be defined that have high sensitivity and specificity?

Image: Gaëtan Bally, Keystone

Thank you for your attention!



Your CowData Consortium:

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Belgium: Stephanie van Weyenberg, Brahim AlFarsi

Image: Gaëtan Bally, Keystone