# Pooling data for international evaluations for feed intake and efficiency
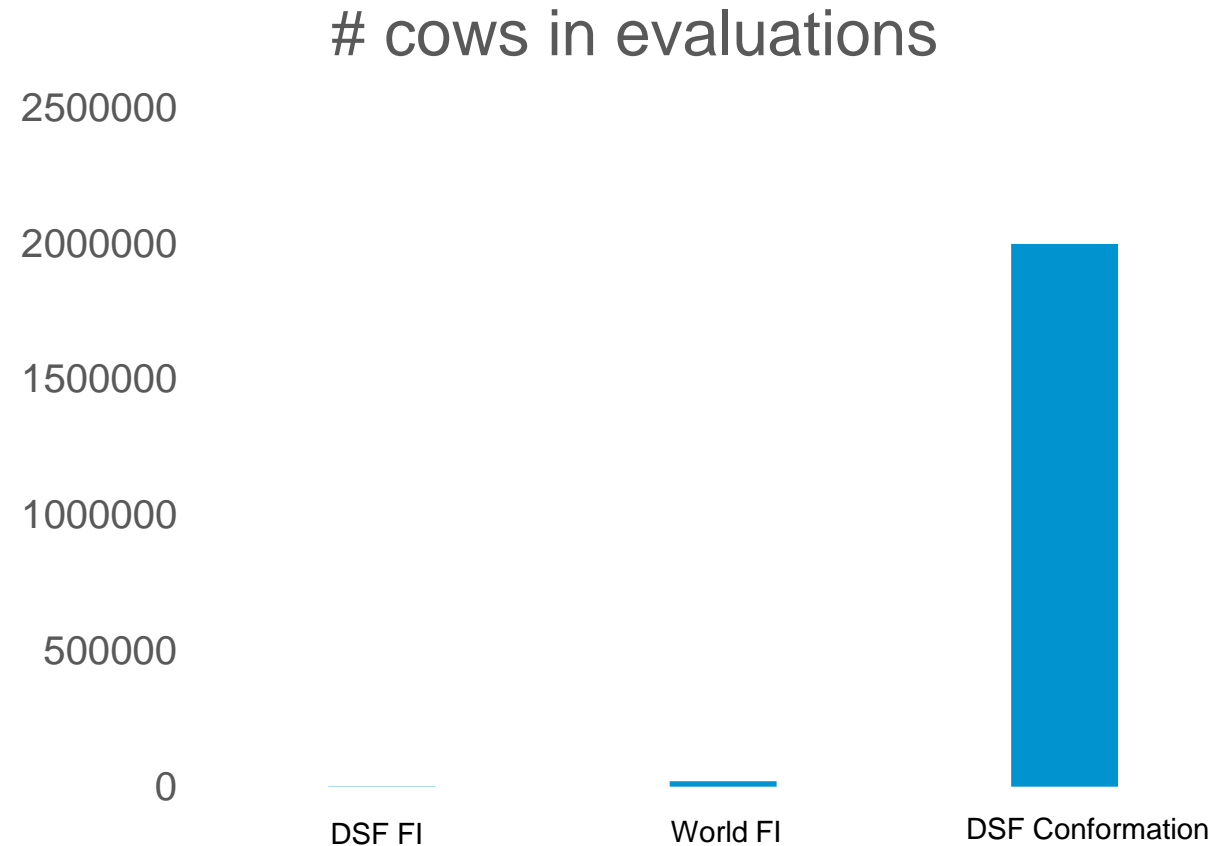
Presented by Jan Lassen

**VIKING**GENETICS®

# The genomics revolution

"With genomic selection we will be able to select for scarsely measured traits such as efficiency."

# cows in evaluations

| | |
|---|---|
| 2500000 | |
| 2000000 | |
| 1500000 | |
| 1000000 | |
| 500000 | |
| 0 | |

DSF FI          World FI          DSF Conformation

www.vikinggenetics.com

# Current status

- VERY limited data all over the world

- Almost all Holstein

- Very complex biology

- Huge interest

# Challenges

- Genetic links between countries

- G * E is probably substantial

- Registrations protocols are different

- Many phenotypes are old

# Data ownership

- Very different from country to country

- Often owned by University or specific researcher

- Very costly registrations
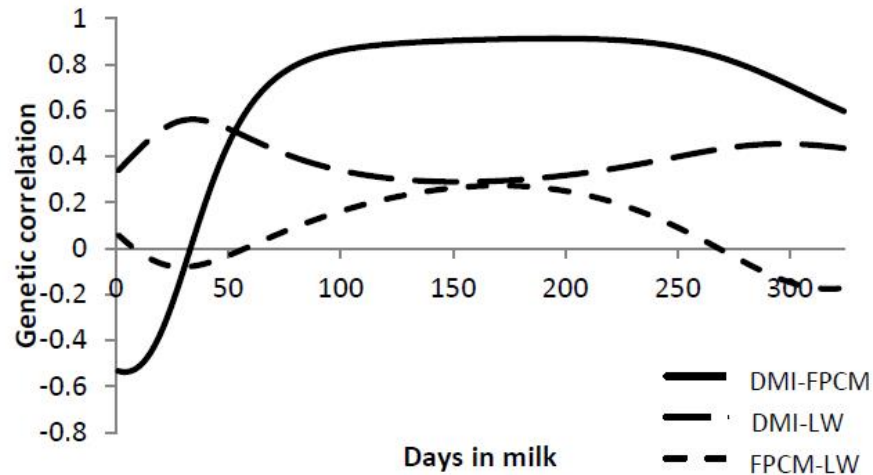
- A challenge for proper collaboration

# RFI models



Figure 2.6 Pairwise genetic correlations when two traits are measured on the same day from 1 to 324 days in milk (DIM) between 1. dry matter intake and fat and protein corrected milk (DMI-FPCM, SE of median=0.06, of $3^{rd}$ quartile=0.09), 2. dry matter intake and live weight (DMI-LW, SE of median=0.11, of $3^{rd}$ quartile=0.10), and 3. fat and protein corrected milk and live weight (FPCM-LW, SE of median=0.12, of $3^{rd}$ quartile=0.13).
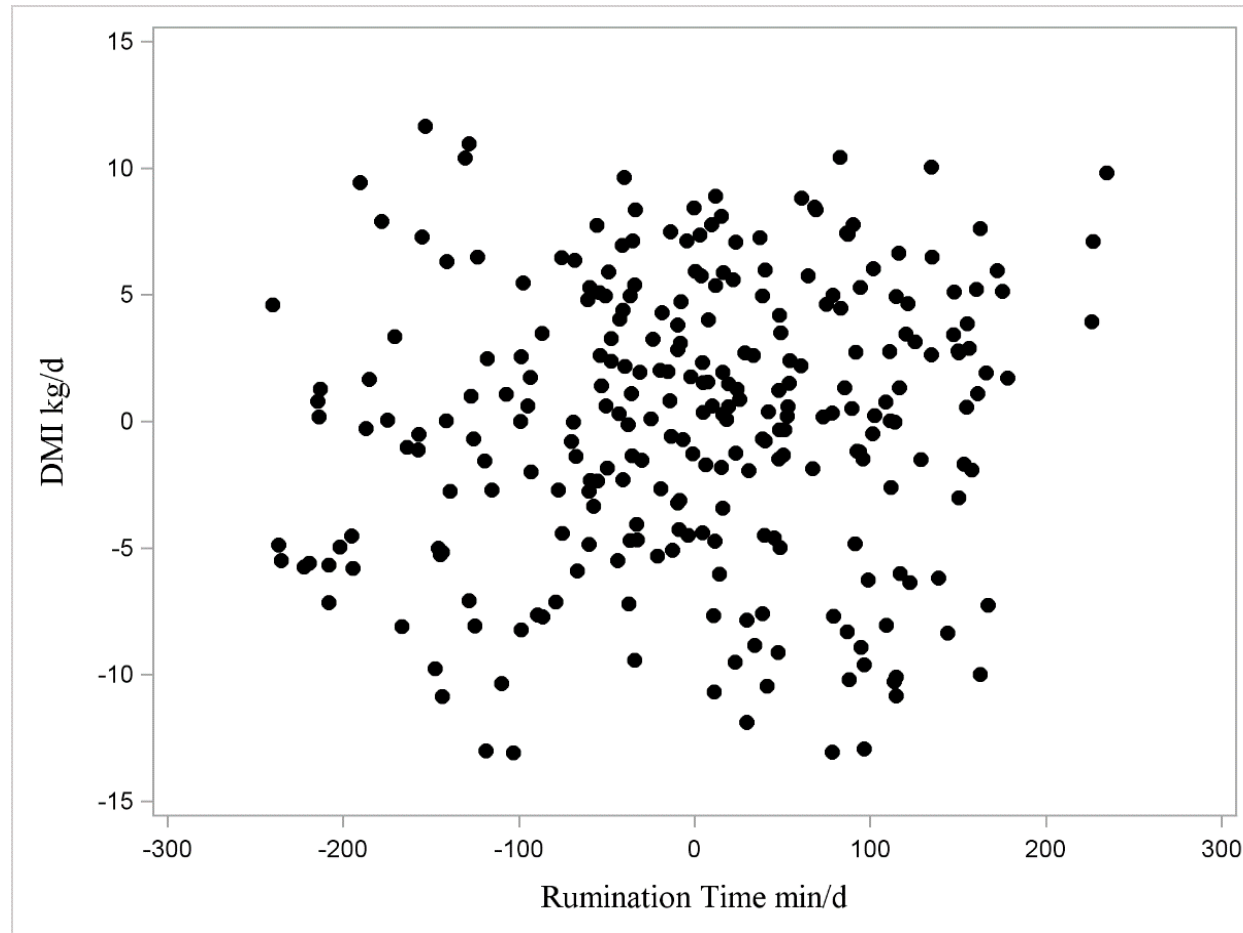
Manzanilla Pech et al., 2016 JDS
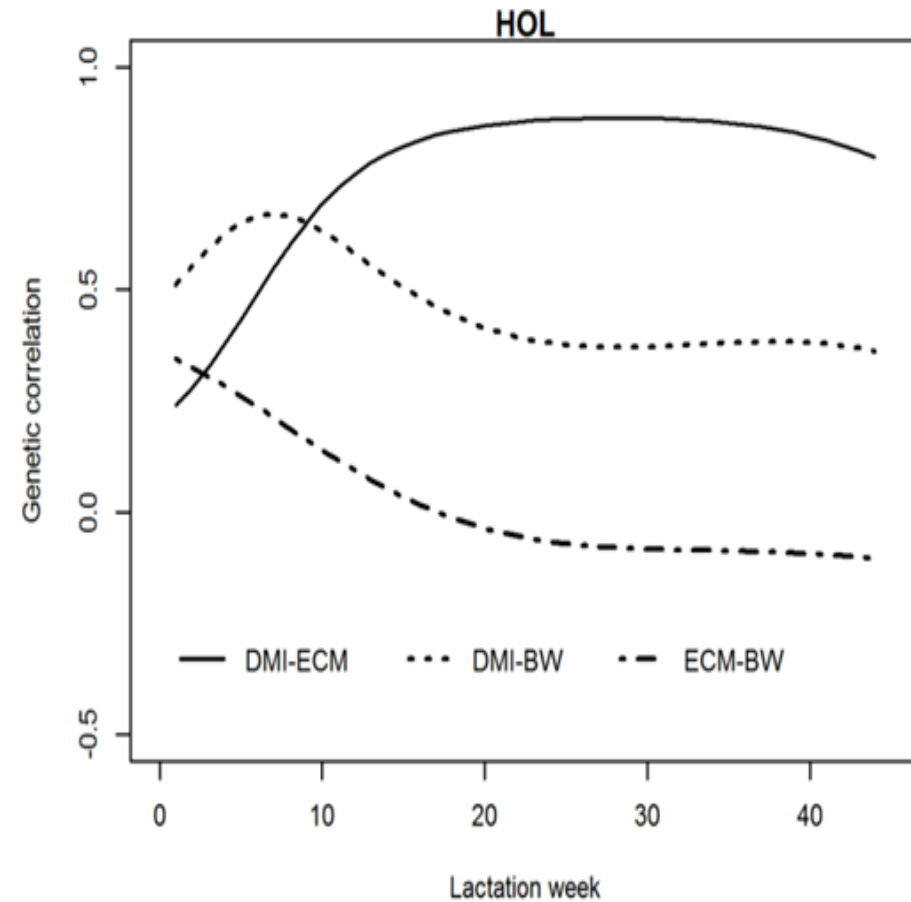
Li et al., 2018 JDS

# Indicators

- Double counting

- No documentation without direct measures

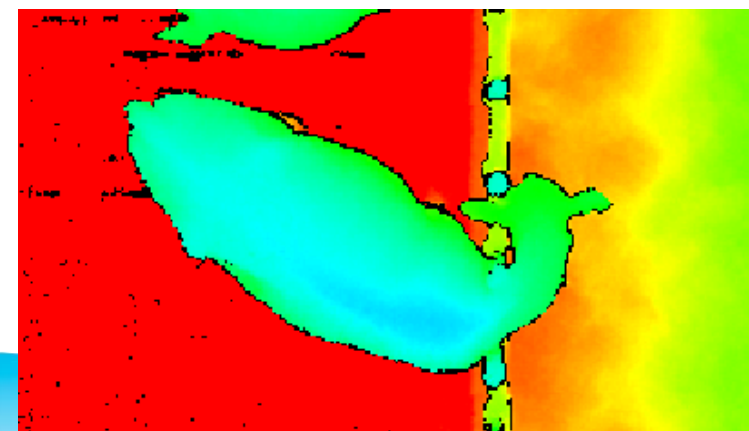- Should be easier and cheaper to measure than the direct trait

# Rumination vs DMI

# Efficiency

- More data is needed

- Not sure indicators will help

- Biology is hardly adequately described

- How to quantify progress

- Direct measures

# Cattle Feed Intake CFIT

Jan Lassen[1], J.R. Thomasen[1], Rikke Hjort Hansen[2], Glenn Gunnar Brink Nielsen[2], Niels Worsøe Hansen[2], Søren Borchersen[1]

[1]VikingGenetics, Denmark

[2]Danish Meat Research Institute, Denmark
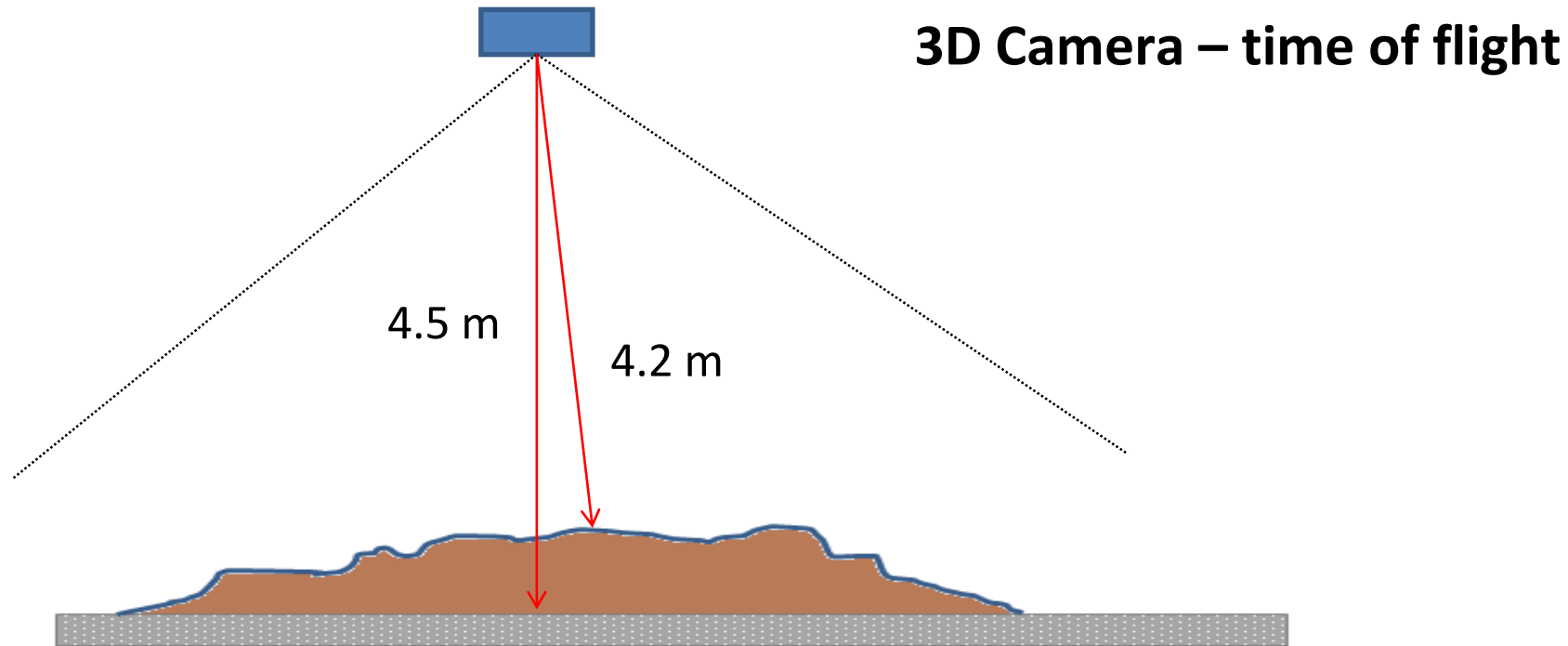
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# Aim and purpose

- To develope a 3D camera system that can measure feed intake at individual cow level at each visit

- May not:
  - Disturb daily routines on farm
  - Disturb cow behaviour

- Should be same system as for identification
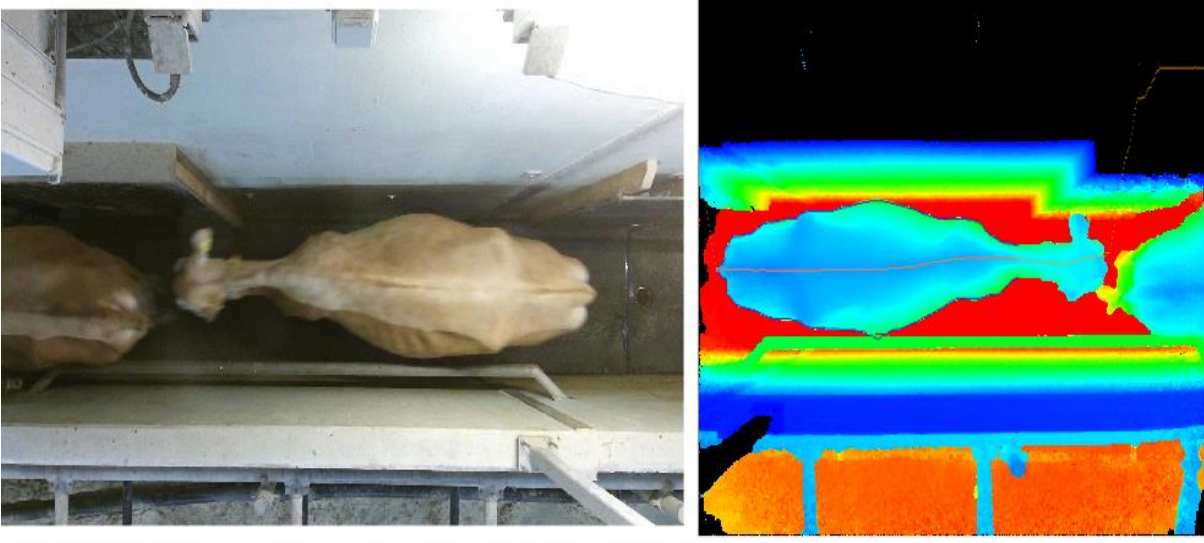
# System setup



3D Camera – time of flight

4.5 m

4.2 m

Zero calibration of floor at each feeding
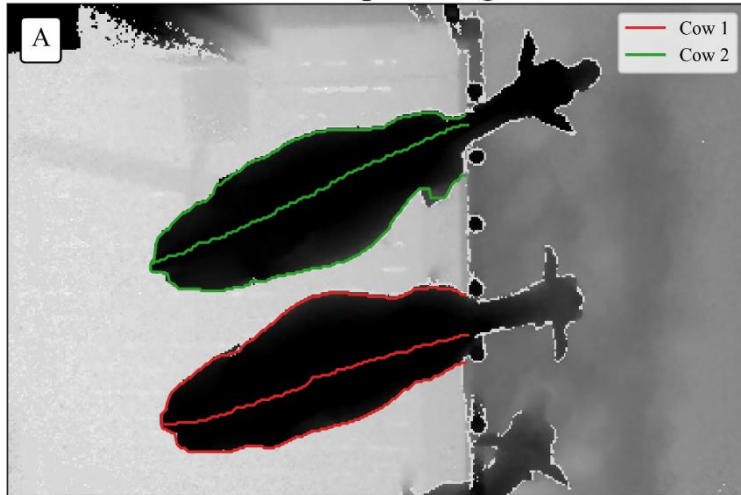
# System setup
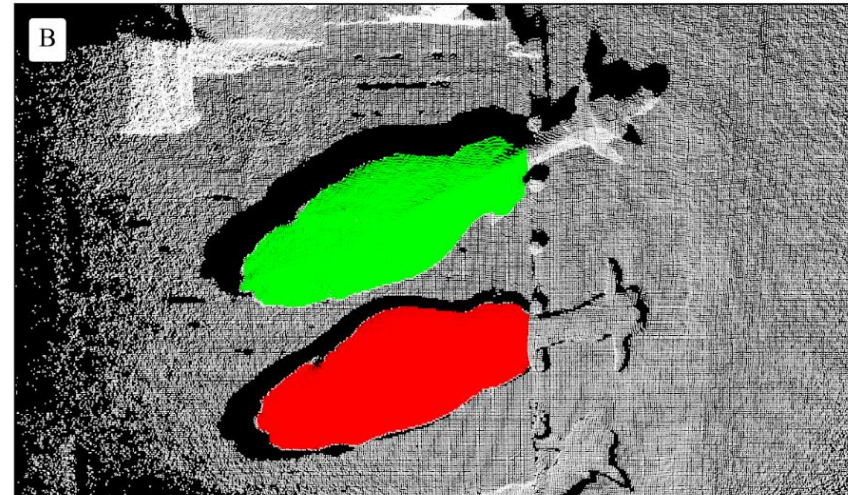
Reference unit

Prediction unit

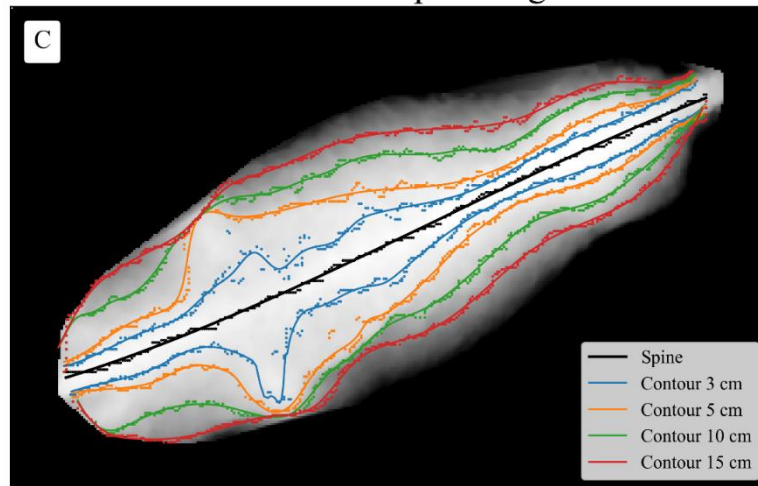# Cow detection and 3D correction



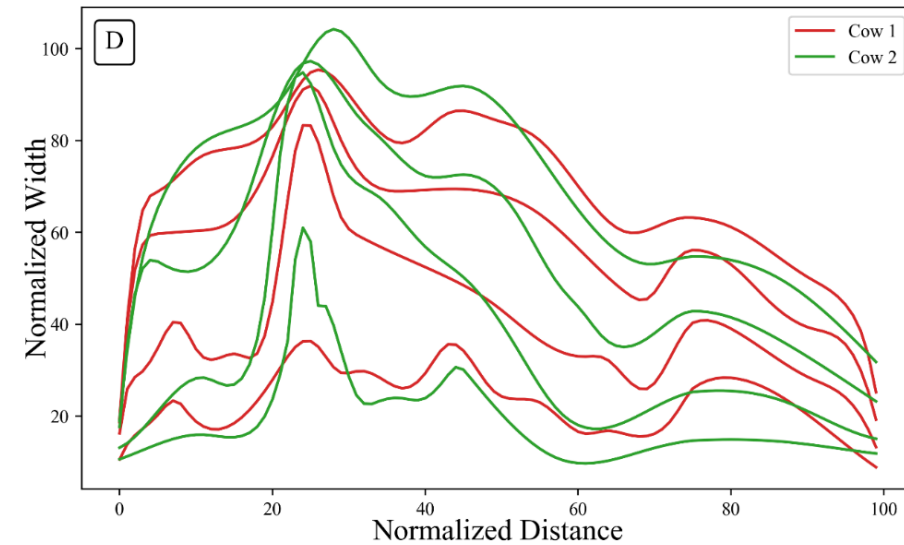Raw Depth Image

Corrected Point Cloud
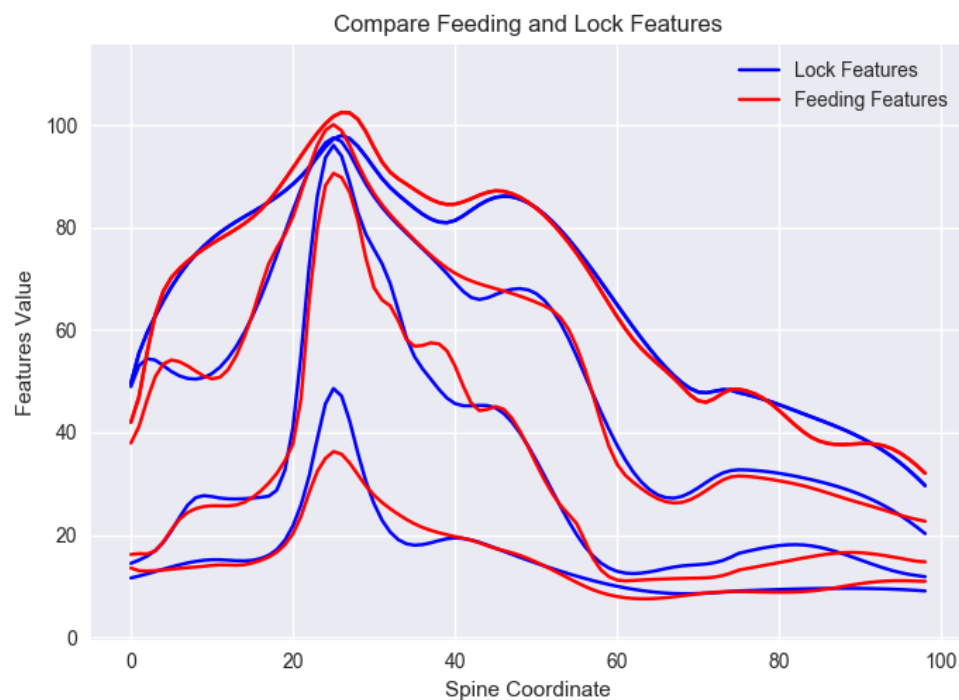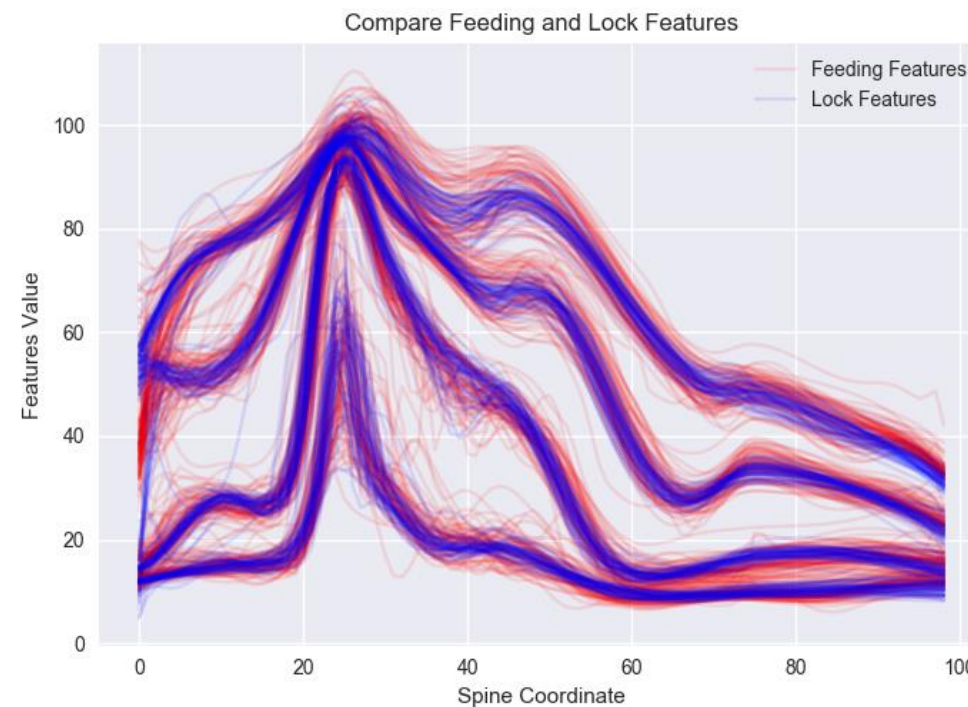
# Feature extraction



Corrected Depth Image

Contour Features

# Match of reference and prediction
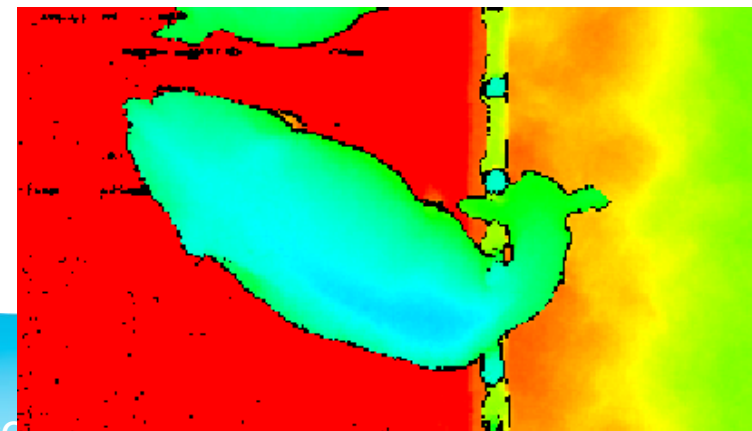


Match of a cow

Variation for one cow - more observations

# Validation of prediction accuracy

- **97 labelled** Jersey cows

- **18 to 50 images** from each cow in the reference unit

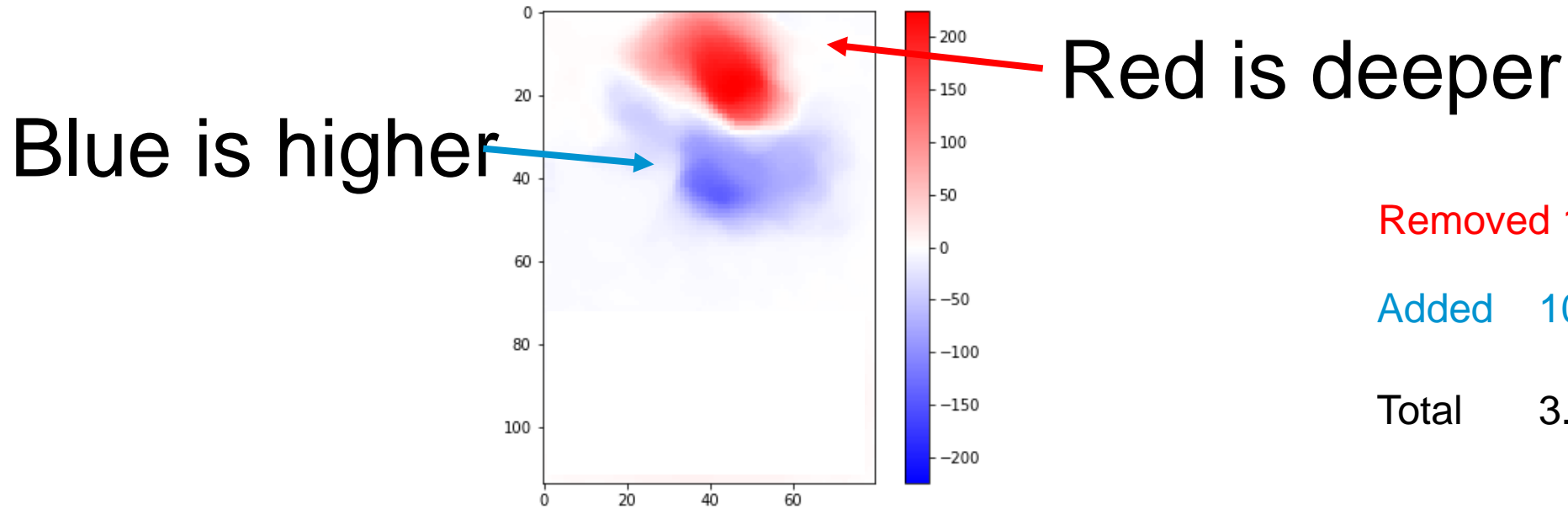- **6357 manually labelled cow visits** at the feeding table over 5 days

# Results of validation

| Sample | Count | Fraction |
|---|---|---|
| Correctly predicted cow-id | 6022 | **95 %** |
| Wrongly predicted cow-id | 335 | 5 % |

# Example of feed intake from a visit



Red is deeper

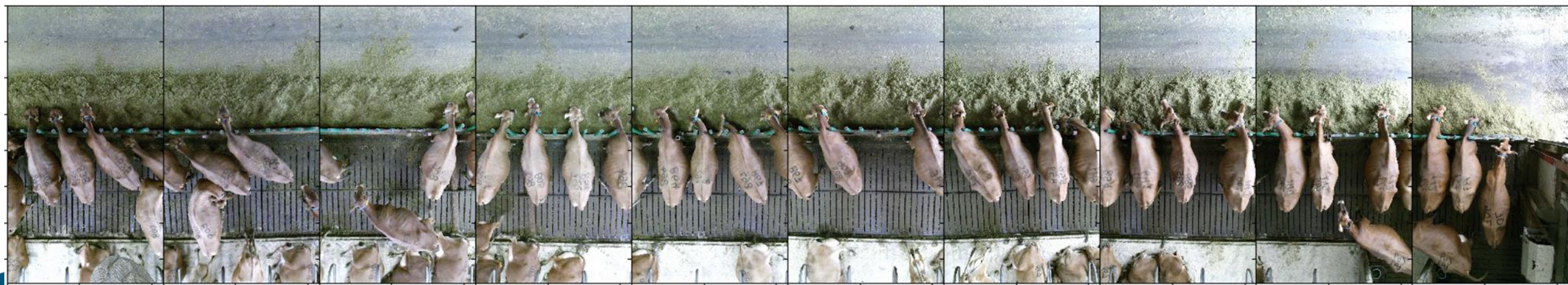Blue is higher

Removed 14.39 l

Added 10.75 l

Total 3.64 l

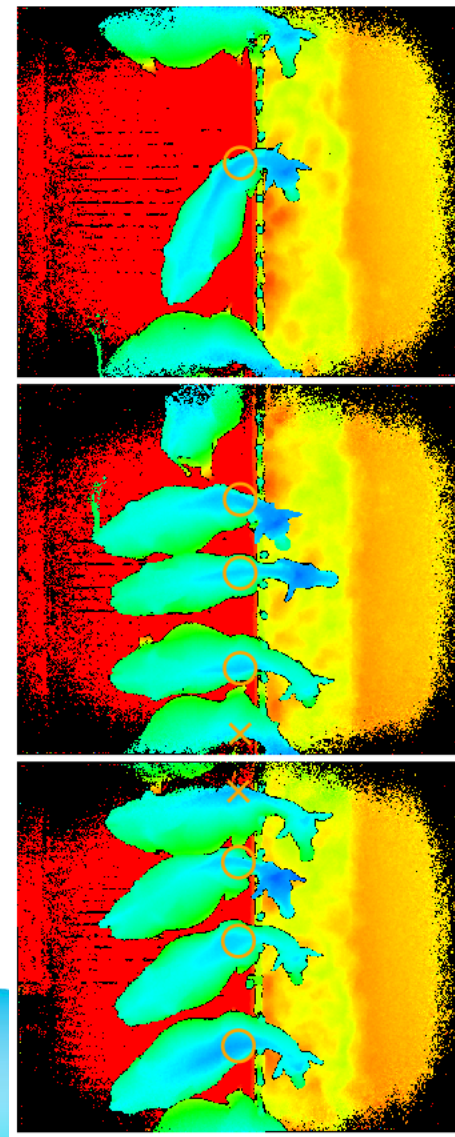Total is difference between red and blue

# Data

- 340 Jersey cows measured for 14 weeks in 2 herds

- Weekly phenotype

- Converted to kilo of feed from density

# Model

$$FI = \mu + wil\ (\beta_1\ dim) \quad \text{fixed reg}$$

$$+ \beta_2\ dim \qquad\qquad \text{fixed reg}$$

$$+ herd \qquad\qquad\quad class$$

$$+ parity \qquad\qquad\ class$$

$$+ animal \qquad\qquad random$$

$$+ res \qquad\qquad\quad\ random$$

# Results

- Repeatability = 0.62

- Corr EKM, FI = 0.50

# Next steps

- All systems up and running on 4 farms
  - + 1000 cows (350 JER, 450 HOL, 250 RDC)

- Data presentation for farmers

- Improvement of identification algorithm

- Improvement of feed intake algorithm

# Sum up

- Pooling of data and collaboration is needed to make evaluations for feed intake

- Identification of cows based on the geometry of their back and patterns can be performed using 3D camera technology

- Feed intake can be measured using 3D camera technology (CFIT)

- Repeatability of 0.62 between weeks (gDMI 0.53)