# EAAP 2013

# Improvement of a method to predict individual enteric methane emission of cows from milk MIR spectra

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**Walloon Agricultural Research Centre**
***Valorisation of Agricultural Products Department***
***Agricultural Product Technology Unit***
www.cra.wallonie.be

# Context

- World wide, livestock = 37% of anthropogenic $CH_4$ emissions
  → most from enteric fermentation by ruminants (FAO, 2006)

- Sources of variation of $CH_4$ emissions - genetics
  - diet
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- Greenhouse gas + loss of gross energy intake (6 to 12%)

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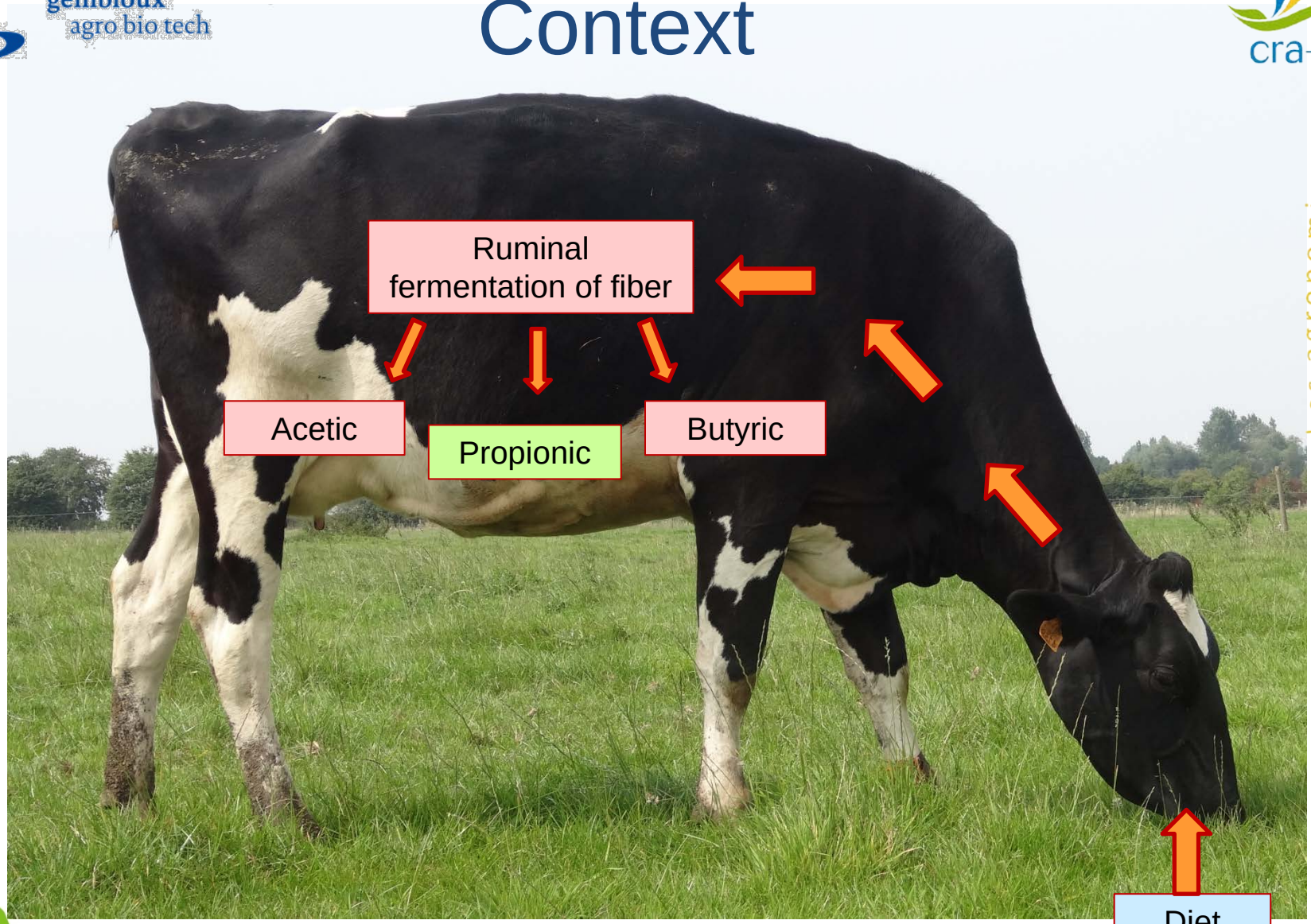
- Greenhouse gas + loss of gross energy intake (6 to 12%)
  - $CH_4$ → 12 years >< $CO_2$ → 100 years
  - $CH_4$ warming potential 20 X $CO_2$

→ Reduce enteric $CH_4$ emissions is particularly interesting in the short and long term

# Context

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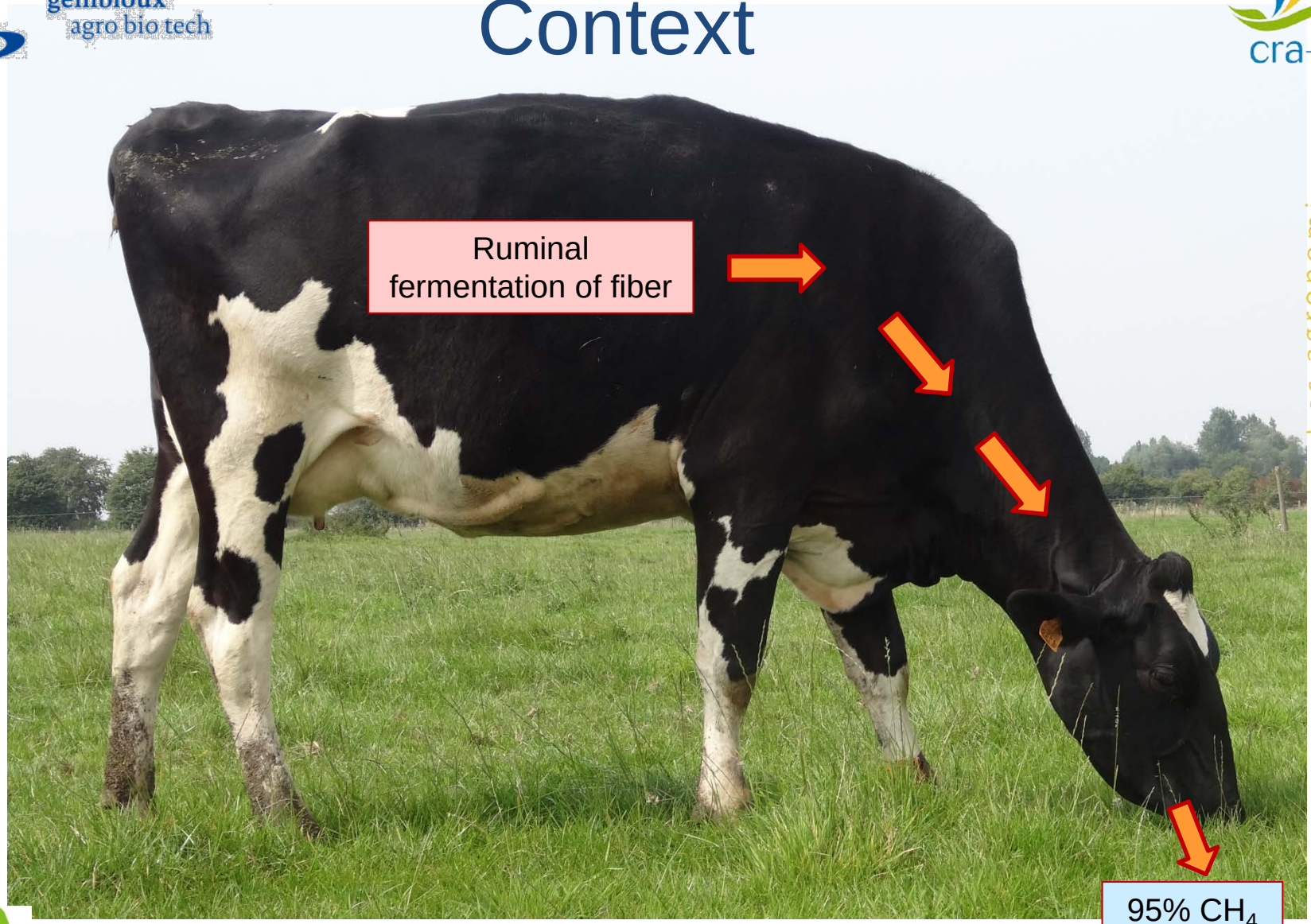

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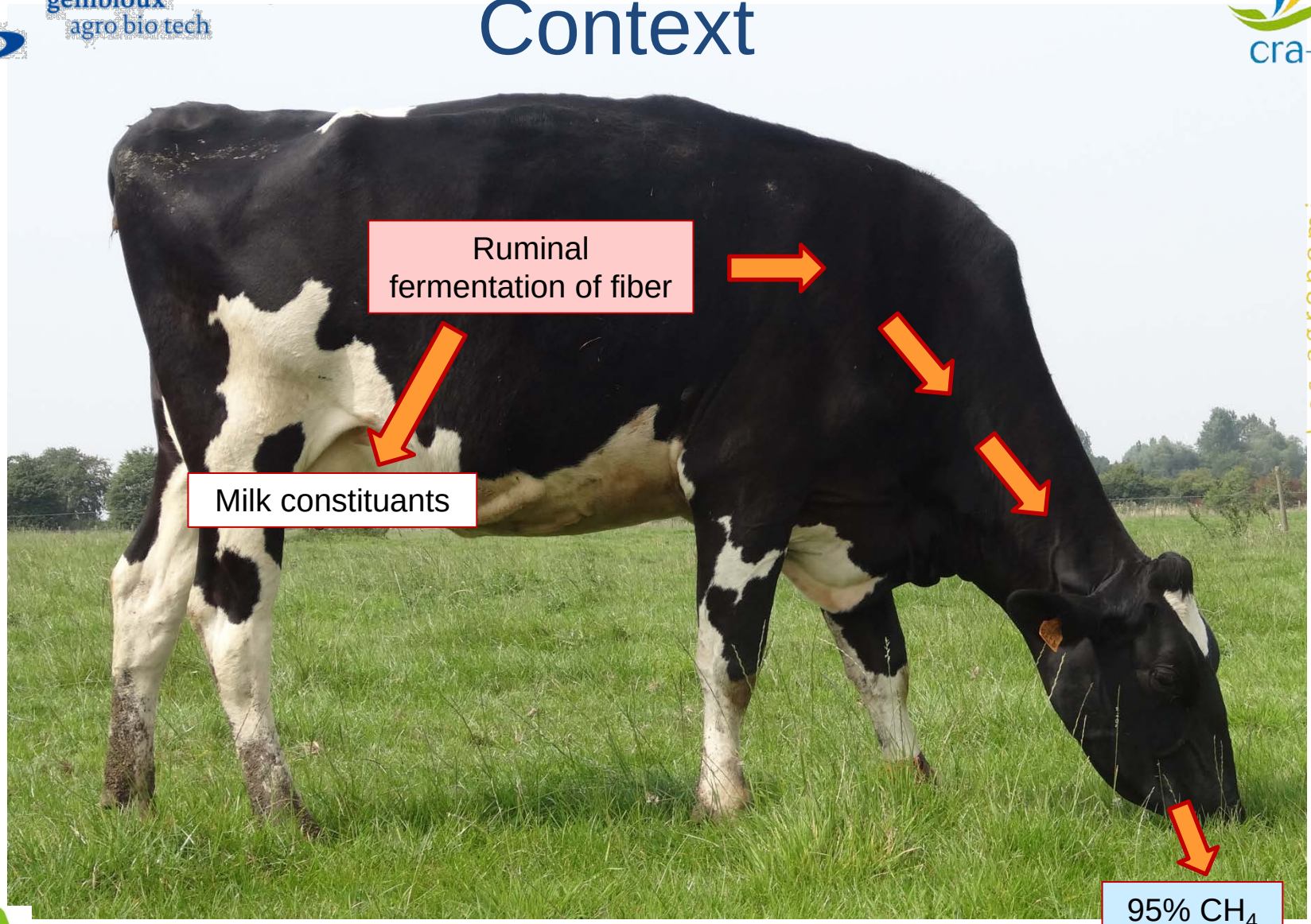

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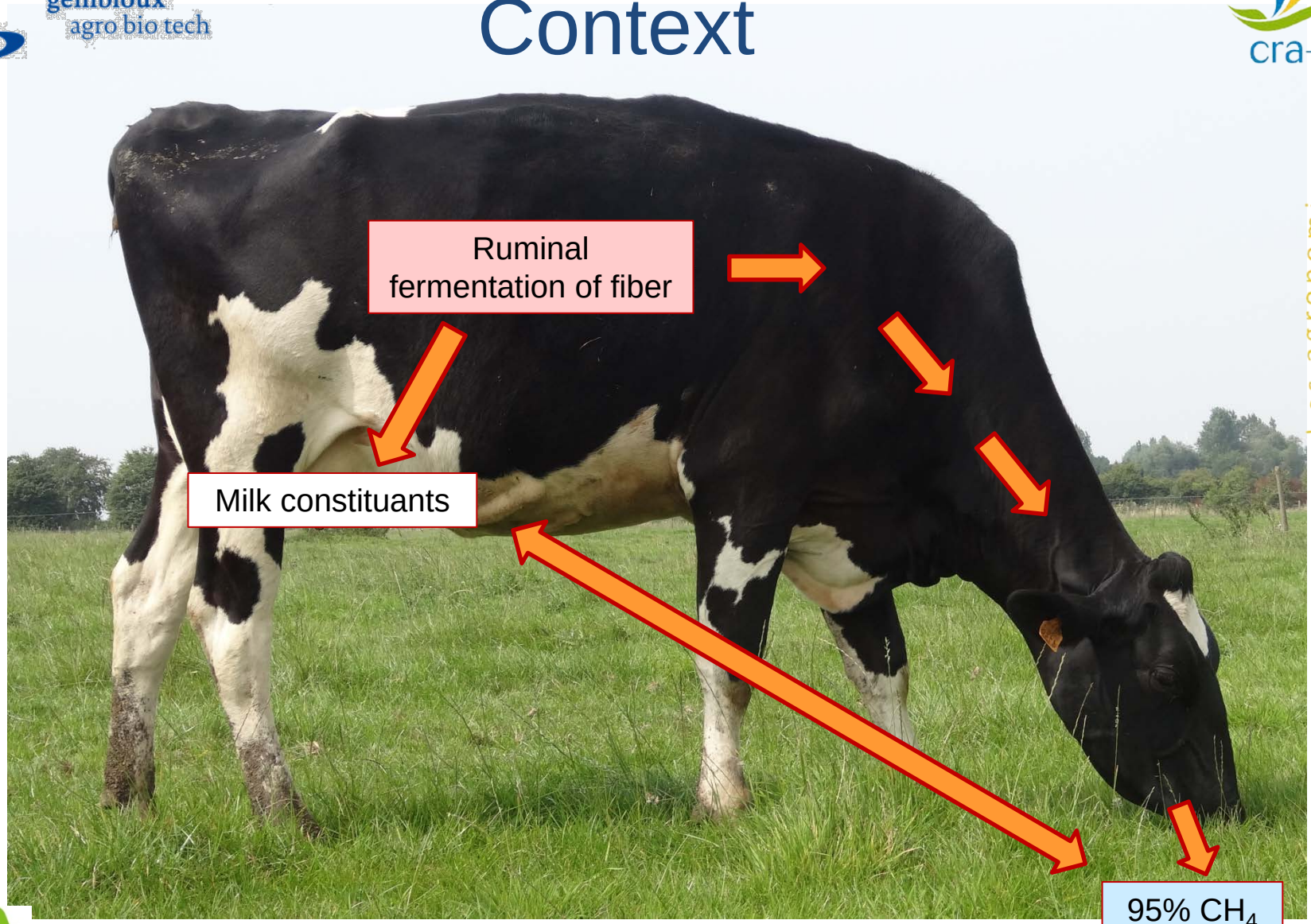


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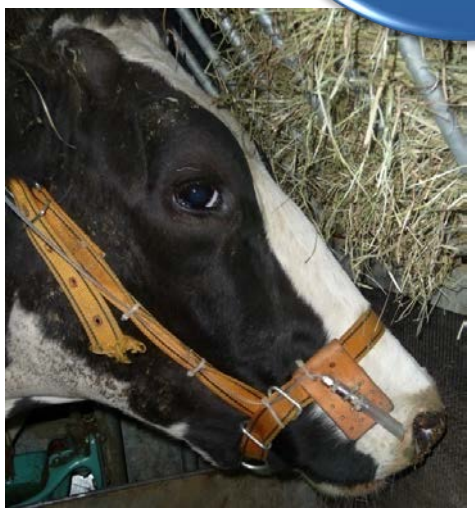
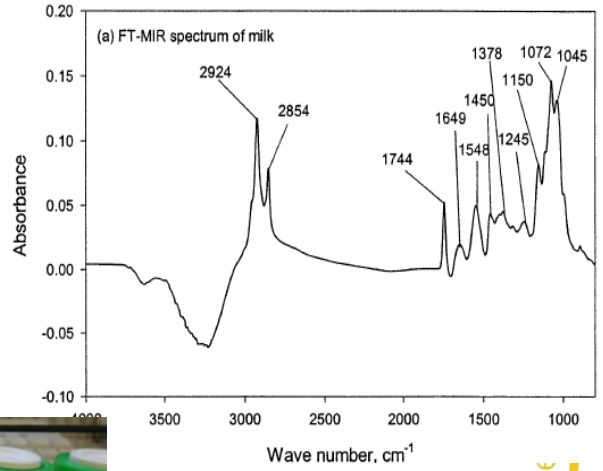
# Objective

Enteric $CH_4$

MIR milk spectra

Equation



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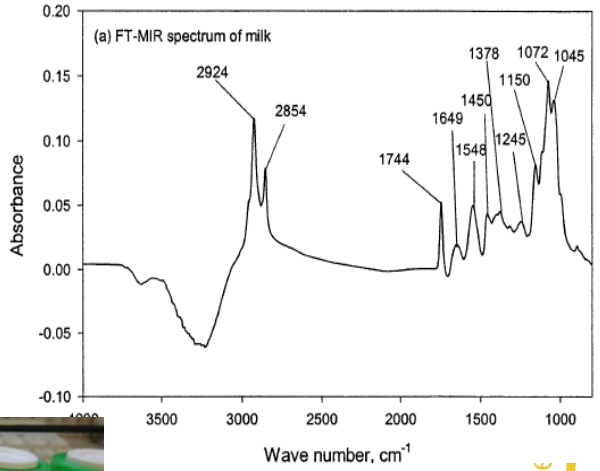


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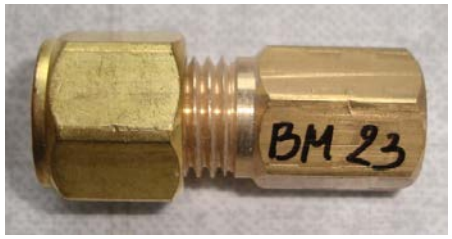
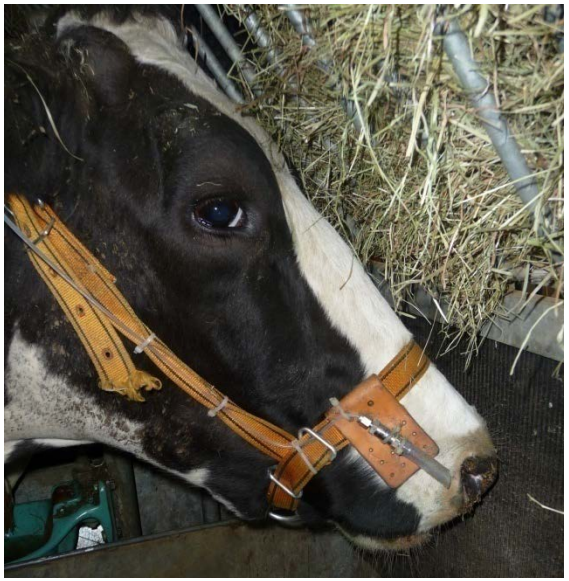
# Material and Methods

- Methane measurements : $SF_6$ technique

# $SF_6$ technique




$$Q_{CH_4} = \frac{C_{CH_4} - C^b_{CH_4}}{C_{SF_6} - C^b_{SF_6}} Q_{SF_6} \frac{MW_{CH_4}}{MW_{SF_6}}$$

# $SF_6$ technique

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- Methane measurements : $SF_6$ technique
- Milk : 40ml of individual milk sample/milking
  - analysed by MIR spectrometry
  - 2 samples / day → 1 $CH_4$ measurement / day

→ average of the 2 MIR spectra (proportionally to milk production)

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  → A maximum variability is needed

  - Belgium (CRA-W) and Ireland (Teagasc – Moorepark)






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# Material and Methods

[a] 452 reference data : MIR milk spectrum // enteric $CH_4$

→ A maximum variability is needed

- Belgium (CRA-W) and Ireland (Teagasc – Moorepark)
- 146 cows
- Lactations : 63 x 1st, 36 x 2nd , 18 x 3rd , 29 x 4th or +
- Holstein, Jersey and Cross-breed (Hol x Jer)
- Different diets : basic diet enriched - in maize
  - fresh grass
  - linseed

  classic total mixed ration

  starch morning, fiber evening

  grassland

# Elaboration of equation

[a] Previous equation (Dehareng et al., 2012. Animal. 6, 1694-1701)

| | N | $R^2c$ | $R^2cv$ | SEC | SECV |
|---|---|---|---|---|---|
| g $CH_4$/day | 77 | 0.85 | 0.72 | 69 | 96 |

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0.06 *vs* 0.13 7 *vs* 27

→ **Robustness increased**

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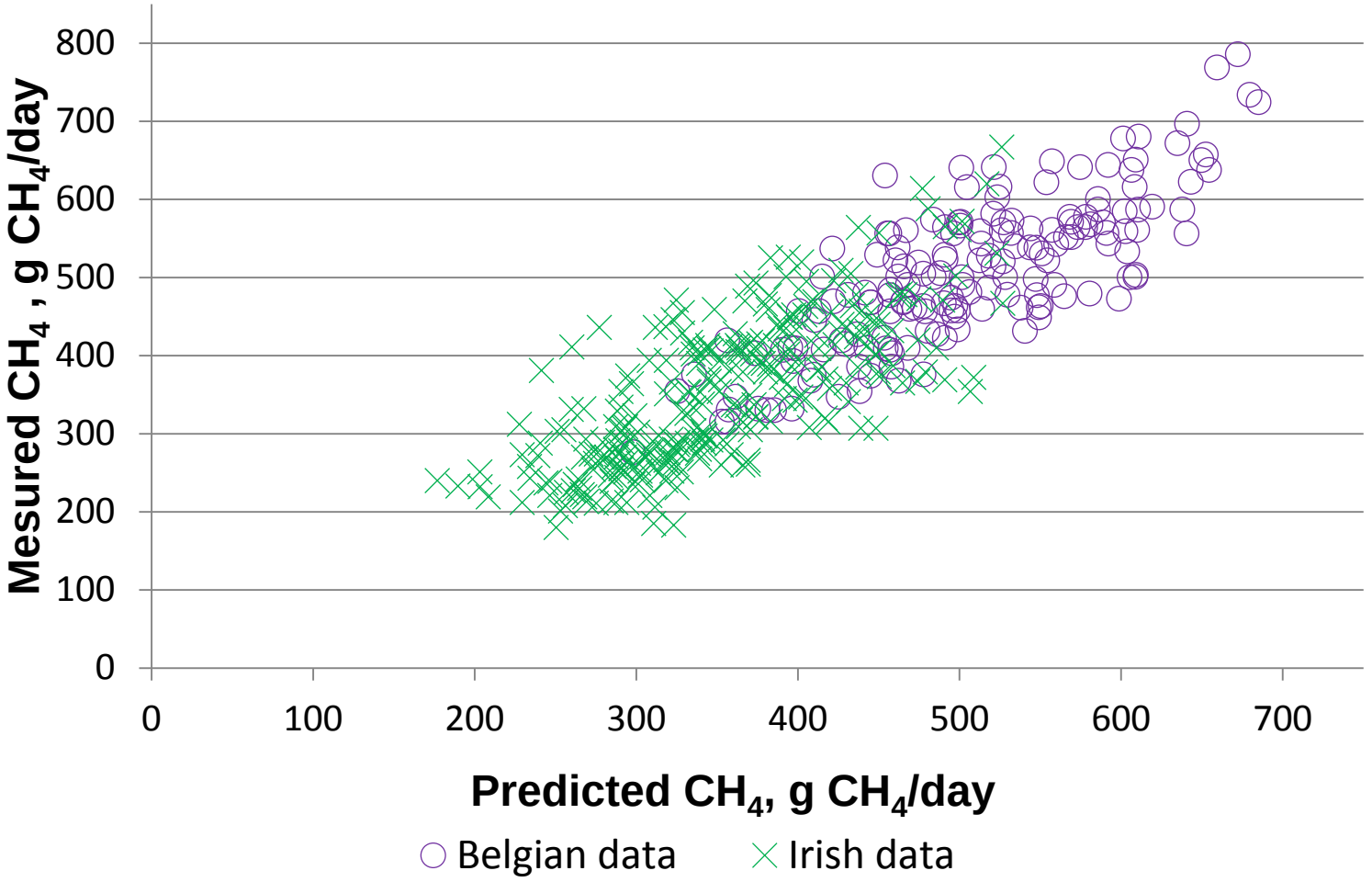


| | N | SD | $R^2c$ | $R^2cv$ | SEC | SECV |
|---|---|---|---|---|---|---|
| g $CH_4$/day | 452 | 126 | 0.76 | 0.70 | 62 | 69 |

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# Conclusions

- Results confirm it is possible to predict enteric $CH_4$ from the milk MIR spectra
- The data set now includes more variability → the robustness of the prediction is improved
- This method will allow large scale studies

→ link enteric $CH_4$ to - genetics,
- diet,
- management,
- geographical location

→ develop tools to mitigate $CH_4$ emissions

*M.-L. Vanrobays : Poster Session 26b (28 August)*

*Theater Session 40 (28 August PM)*

# Improvements

→ More variability is needed

→ Continuity regarding measurement in Belgium

→ External validation

We are open to other national/international collaborations !
Data sets including $CH_4$ and milk MIR spectra

Objective :
Increasing accuracy of prediction and variability in calibration set
→ Be more robust


Thank you!

# Equation

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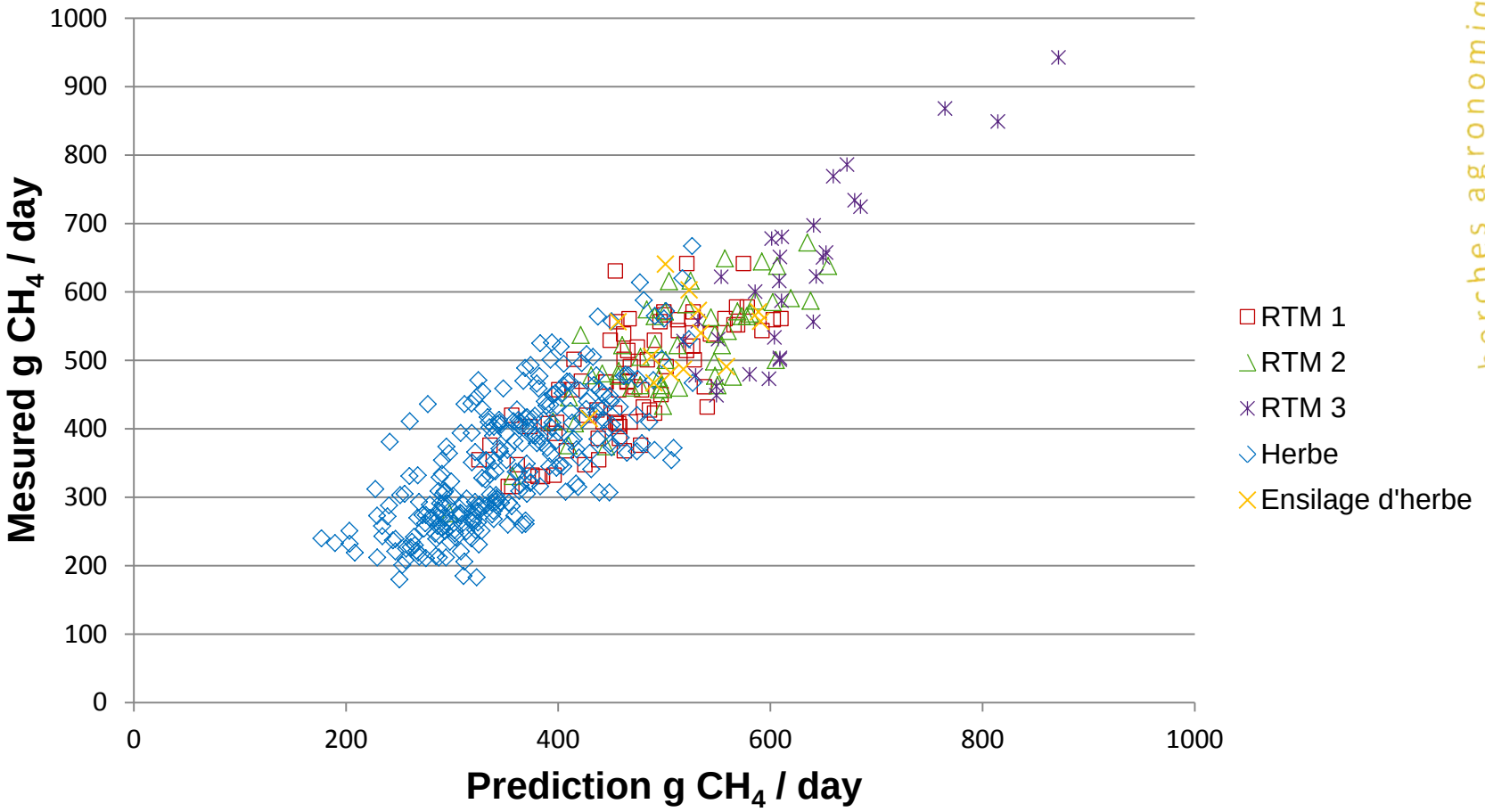


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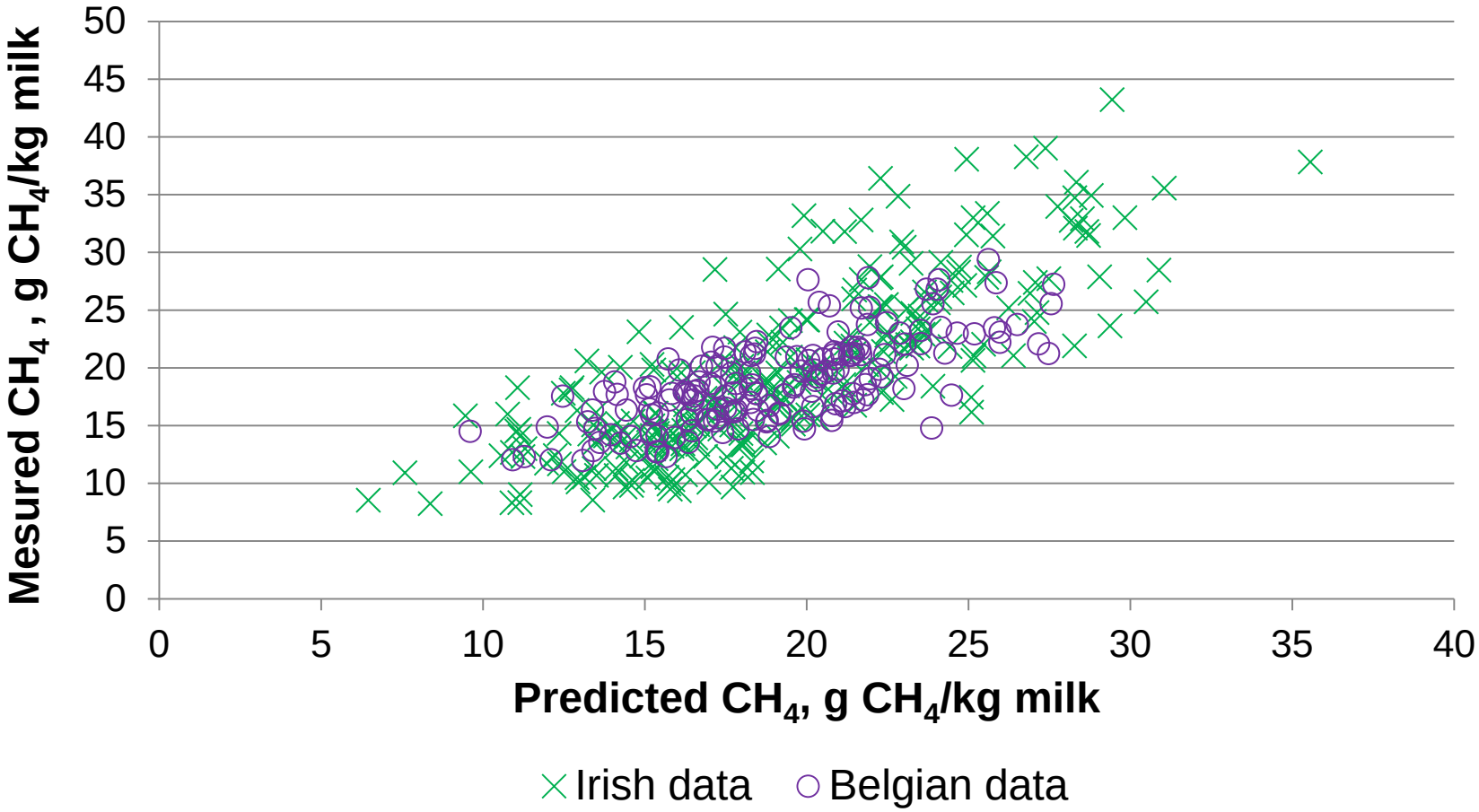


| | N | SD | $R^2c$ | $R^2cv$ | SEC | SECV |
|---|---|---|---|---|---|---|
| g $CH_4$/day | 457 | 5.8 | 0.63 | 0.56 | 3.6 | 3.9 |

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