2022 APRIL 27 > 29 in Namur, BE

DAIR'INNOV 22 CONGRESS
Interreg North-West Europe HappyMoo
DDairy
innovations to benefit cow welfare and dairy farming sustainability

Wallonie recherche CRA-W

SmartCow

INRAE

Firsts results about potential use of fecal NIR spectra to estimate daily CH_4 emissions of dairy cows measured with GreenFeed system

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[2] UMR Herbivores, University Clermont Auvergne, INRAE, VetAgro Sup, Saint-Genès-Champanelle, France
[3] Valorization of Agricultural Products Department, CRA-W, Gembloux, Belgium

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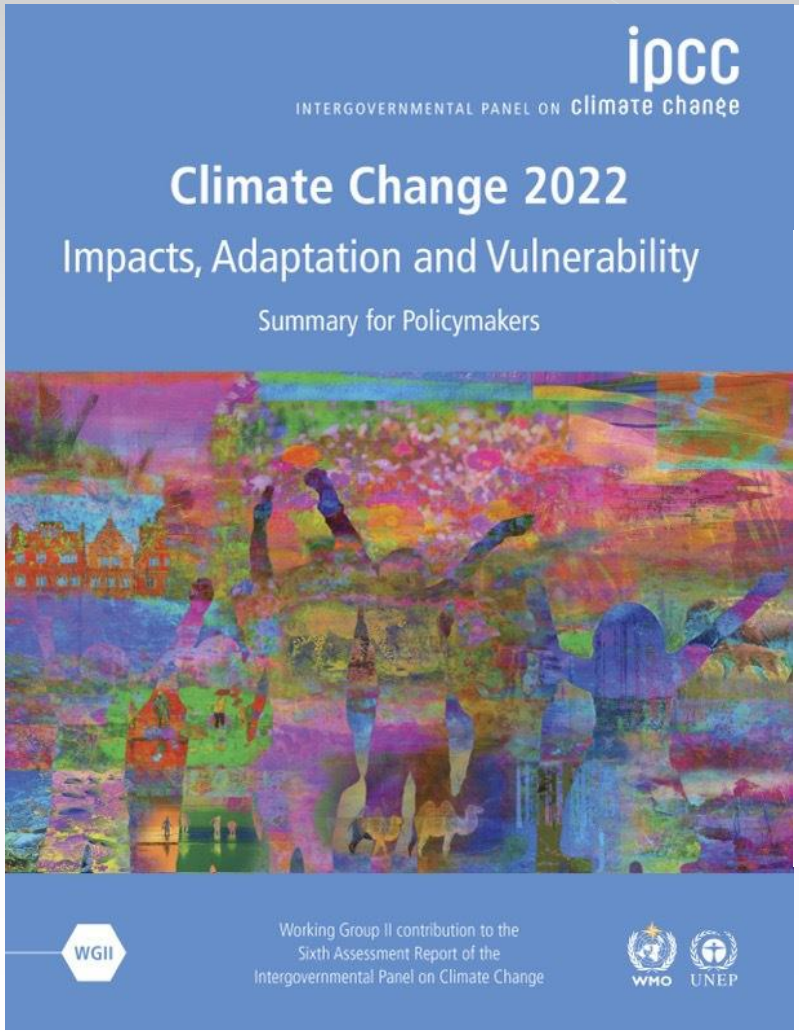
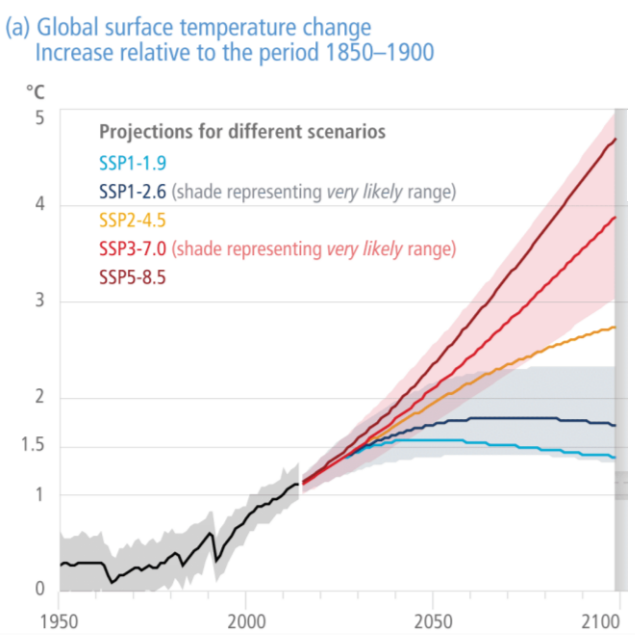
European Commission
Horizon 2020
European Union funding for Research & Innovation

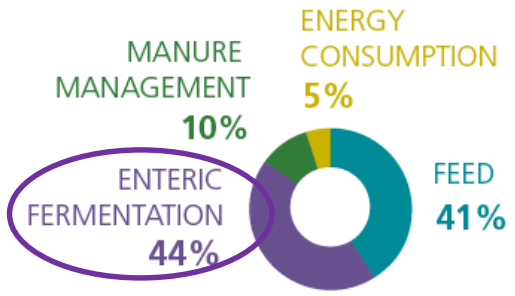


Greenhouse gases and global warming



Efforts from all sectors

What about Breeding?



Source: FAO - GLEAM

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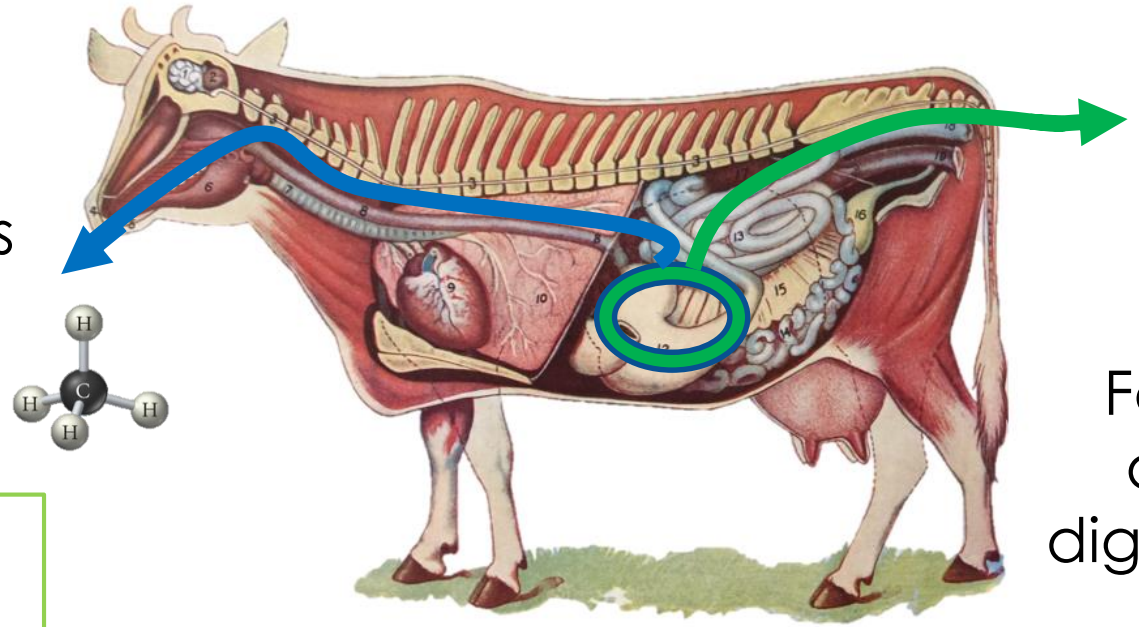
Quantify CH_4 from livestock and realise large scale studies

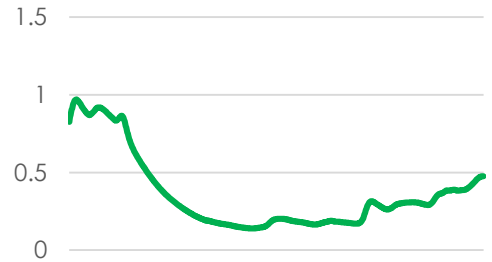
- Models for LCA/inventories – more or less detailed but « fixed »
- Animal effect can be significant → Individual level of CH_4 values
- Reference measurement techniques not for large scale studies
- Great interest to have proxies to quantify individual CH_4 emissions
- Existing for lactating cows (*eg.* milk MIR spectra), but… for others?

Proxy for CH_4 emissions from non-lactating cows?

Eructed methane
//
rumen fermentations



Veterinarial *ex libris* – Internal bovine anatomy - 1920



Feaces NIR spectra directly related to digestibility parameters

Fecal NIR spectra as a proxy for CH_4?

Reference data

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Lactating Holstein cows

Trial	Ref. CH_4	Feaces sampling
1	GF	Spot
2	GF & RC	Weekly
3	GF	Spot
4	GF & SF_6	Spot
5	RC	Weekly
6	SF_6	Weekly
7	RC	Weekly
8	RC	Weekly

GF : Greenfeed ;
RC : Respiration Chambre.

Reference data

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Lactating Holstein cows

Importance of standardized protocols to merge datasets!

Reference data

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Used for first model : - GF values (1 week before fecal sampling)
- Trial n°3 not considered for the moment

Trial	n	Ref. CH_4 (g/day, mean ± SD)	Based diet
1	45	368 ± 68	Grassland or Corn silage
2	19	294 ± 59	Corn silage
4	27	395 ± 103	Corn silage
Total	91	361 ± 86	/

GF : Greenfeed ;
SD : standard deviation.

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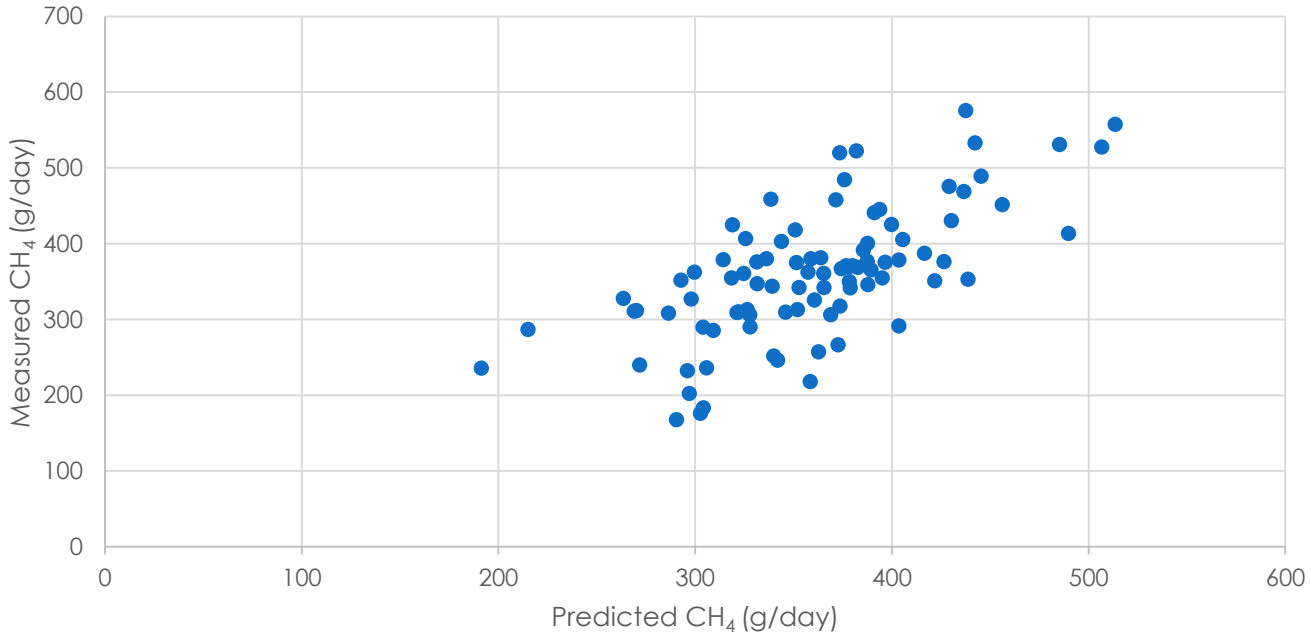
First models to estimate eructated CH_4 from feaces NIR spectra

Modified PLS

n	R^2c	SEc (g CH_4/d)
91	0.43	65



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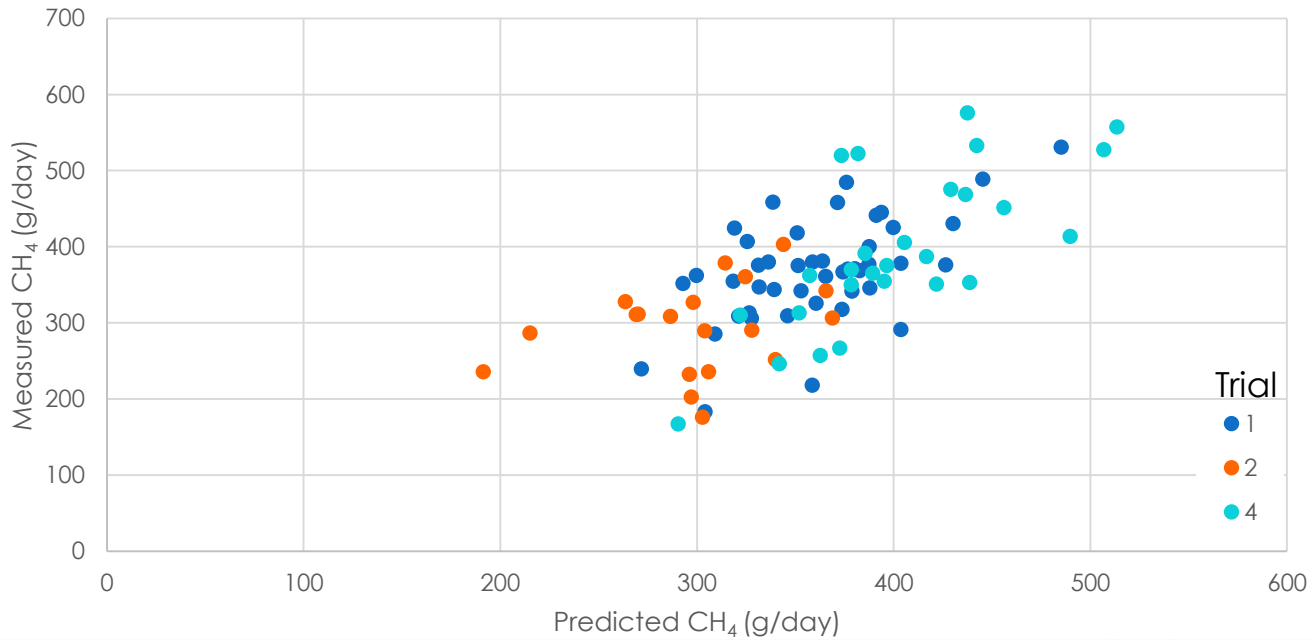

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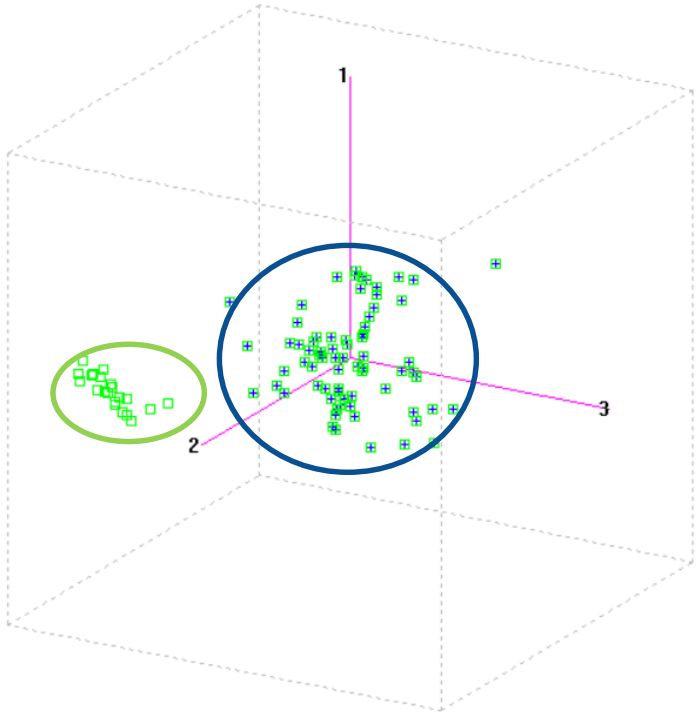

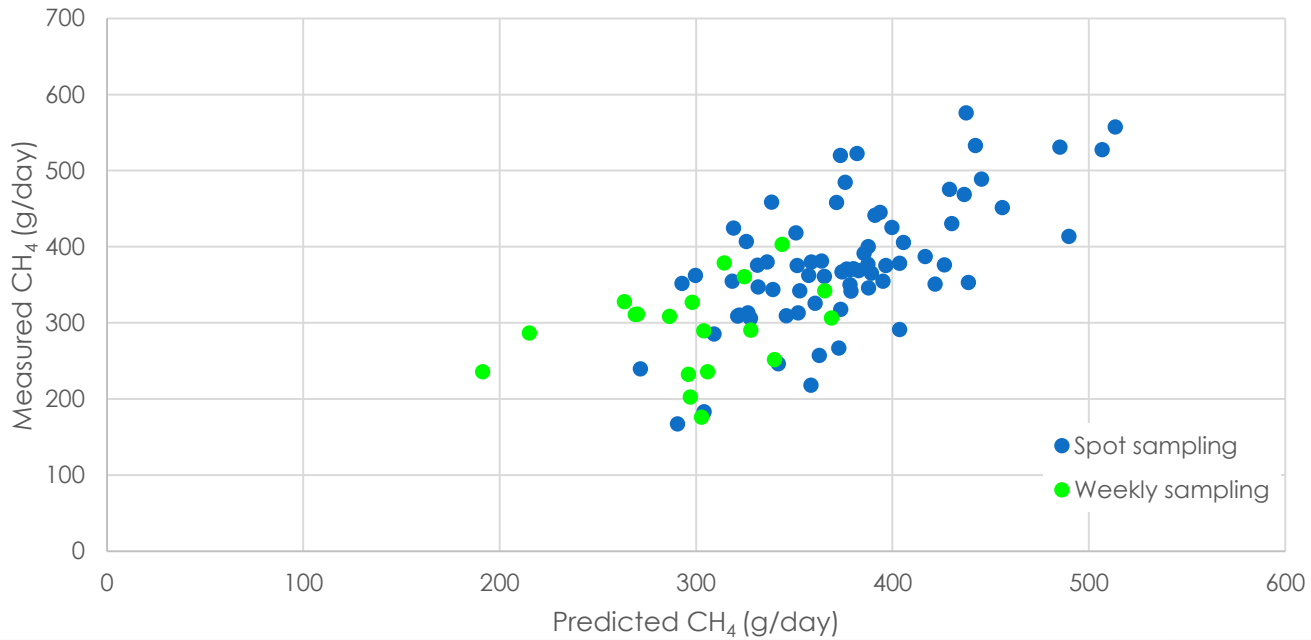

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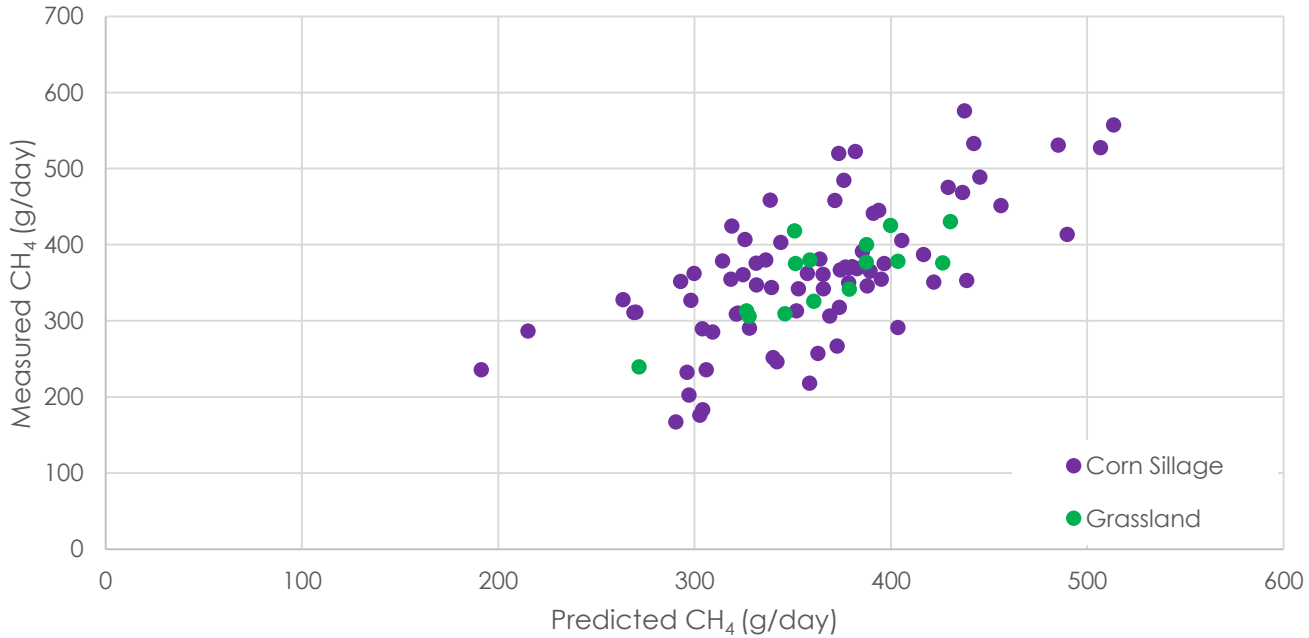
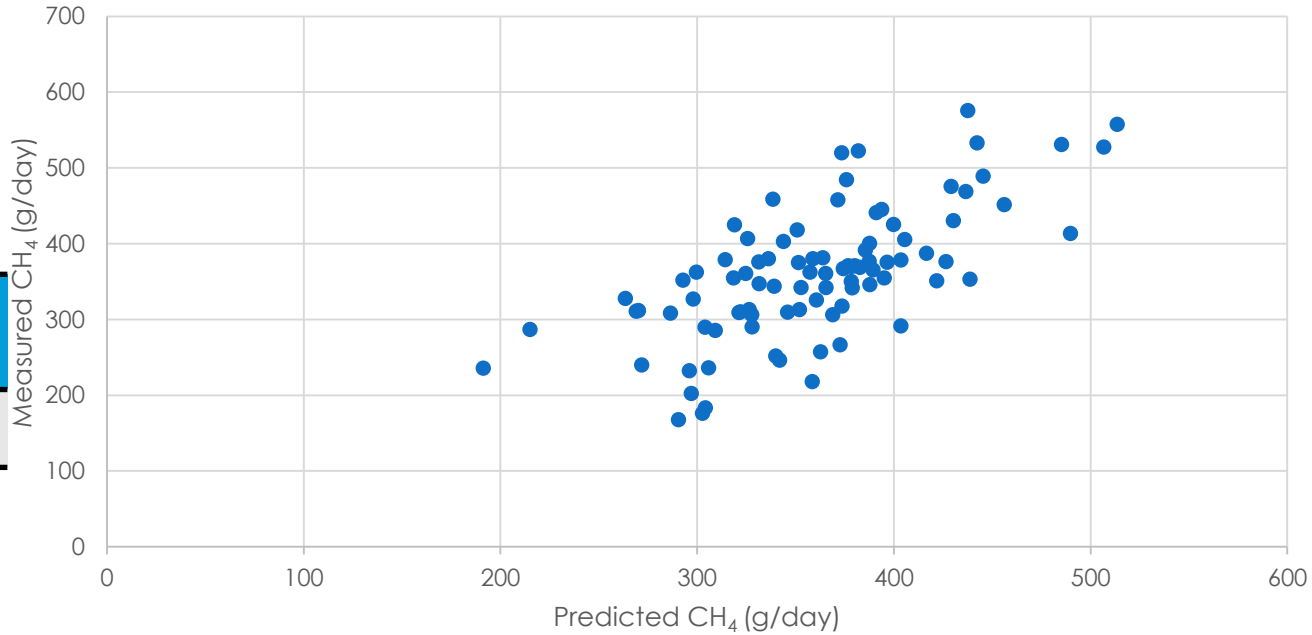


First models to estimate eructated CH_4 from feaces NIR spectra

Modified PLS

4 groups Cross–Validation

n	R^2c	SEc (g CH_4/d)	R^2cv	SEcv (g CH_4/d)
91	0.43	65	0.15	79



First models to estimate eructated CH_4 from feaces NIR spectra

- Interesting
- No robustness based on these datasets
- Low amount of data
- Complementarity of datasets
- For the moment only lactating dairy cows
- Collect data from young cattle, heifers and dry cows

First models to estimate eructated CH_4 from feaces NIR spectra

- Approaches on Beef cattle Greenfeeds
- Greenfeed data and feaces NIR spectra

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N = 83

Calves, reformed cows, suckling cows

Dual purpose Belgian Blue, Belgian Blue

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N = 263

Heifers

Charolais

Diets based on grass, grass silage and/or hay

First models to estimate eructated CH_4 from feaces NIR spectra

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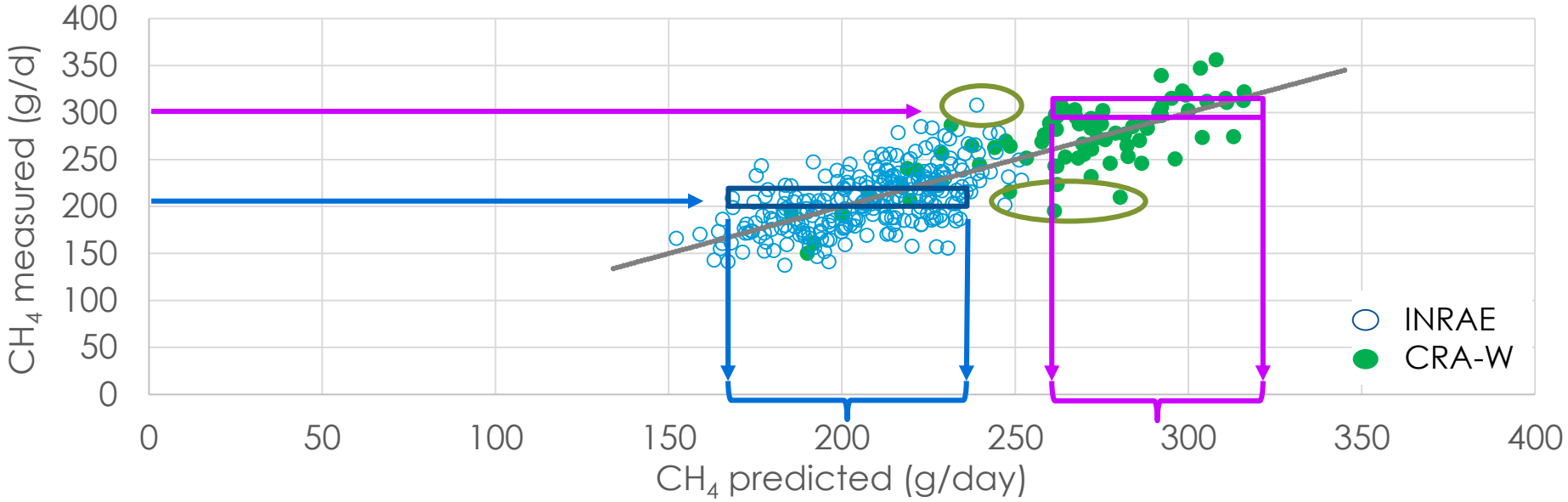

				4 groups	
	N	R^2c	SEc (g CH_4/d)	R^2cv	SEcv (g CH_4/d)
m_21	346	0.62	26	0.55	29

Conclusions & Next steps

- Firsts models estimating CH_4 from feaces NIR spectra showed interesting firsts trends and moderate errors
- Need more reference datasets to conclude about feasability
- Possibility to valorize existing datasets using other sampling protcols?
- Predictive models dedicated to spectific breed/specific diet?
  Or include these information as explanatory variables in an unique model?

Conclusions & Next steps

- → Merge dairy and beef cattle reference datasets?
- → Complementarity between milk MIR spectra and faecal NIR spectra to estimate CH_4? (… And in practice?)
- → Importance of standardized protocols for future data to merge datasets
- → Always consider sampling of milk and/or feaces during trials for IR analyse

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Thank you for your attention

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