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Animal variation in methane emission from breath of Danish Red, Holstein and Danish Jersey

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Greenhouse gas emission

- Methane (CH_4) is ~20 times as active a green house gas as Carbon dioxide (CO_2)
- ~15% of total greenhouse effect comes from methane
- Methane from ruminants ~30% of all methane
- ~2-8% of total greenhouse effect comes from ruminants

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Can we select for lower methane emission?

Can we make individual methane measurements on a large scale?

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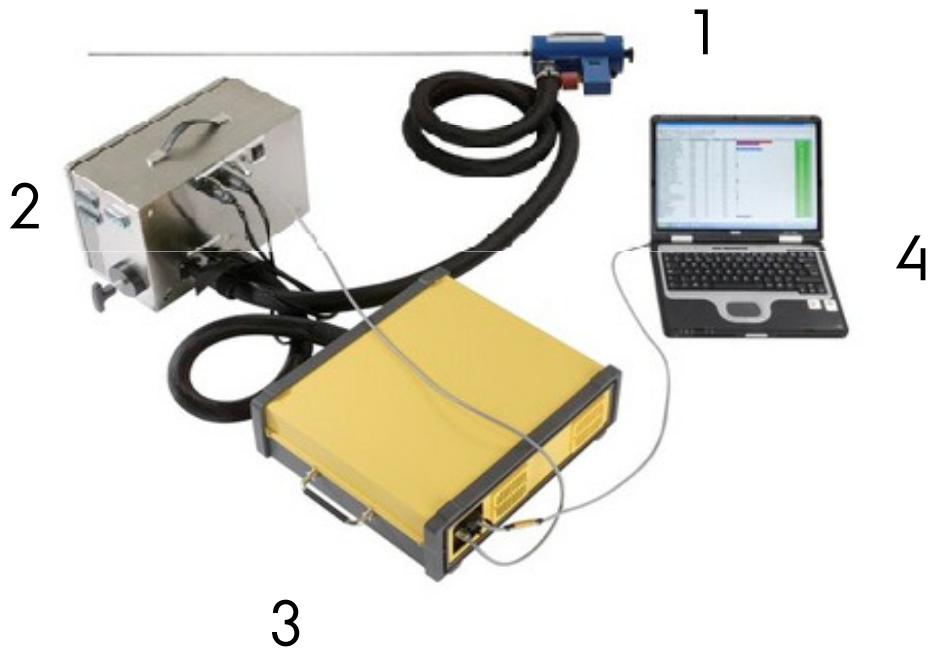
Equipment for measuring in AMS



1. Sampling unit
2. Pump unit
3. Analyser FTIR – (GASMET DX-4000, www.gasmet.fi)
4. Lab top + software

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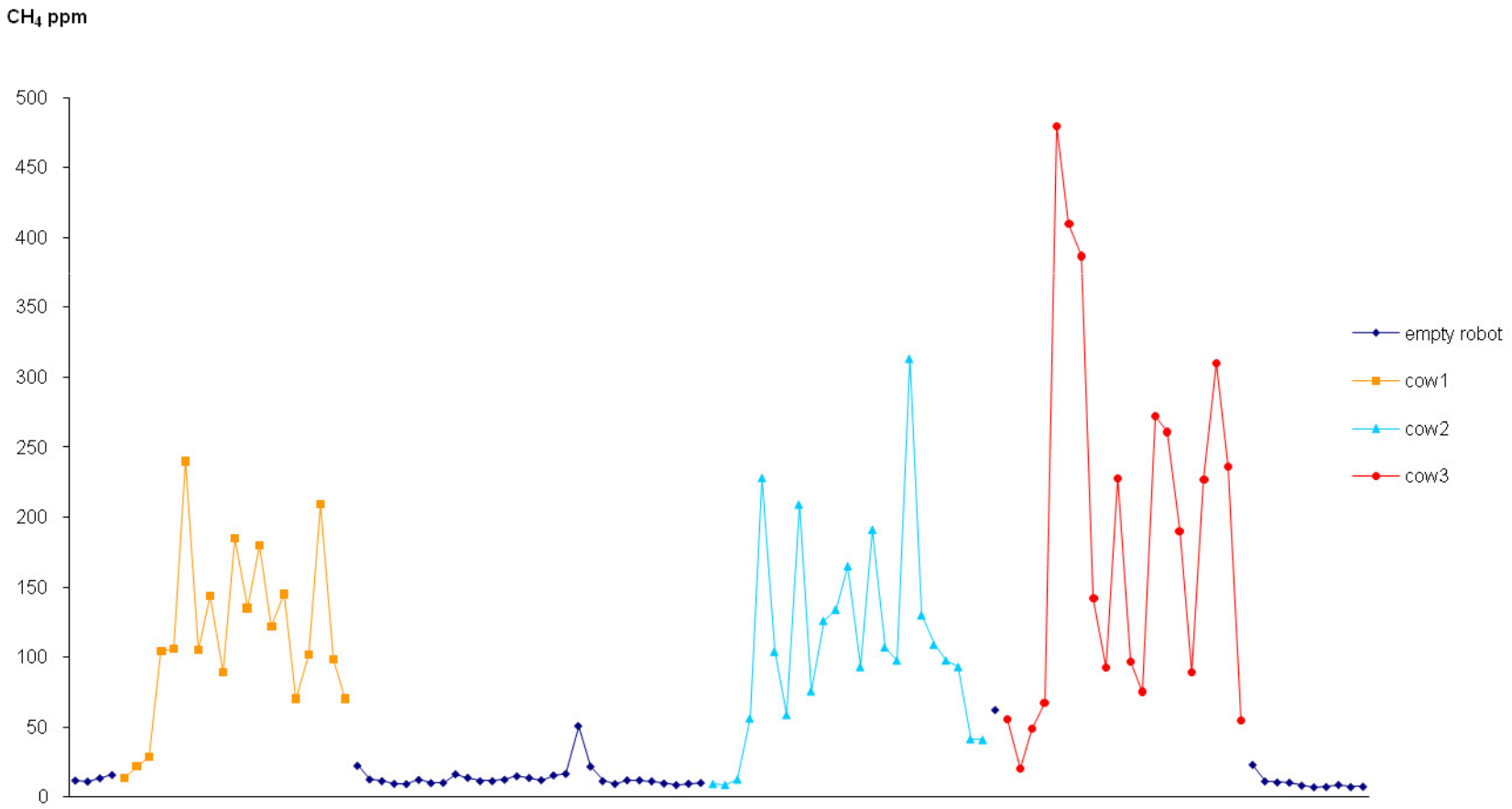
Example of data



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Quantifying Methane production

- Pure measures of methane are relatively unstable
- A CO_2 equivalent can be estimated for each cow
- CH_4/CO_2 is concentration independent and more stable
- Proxy for methane production

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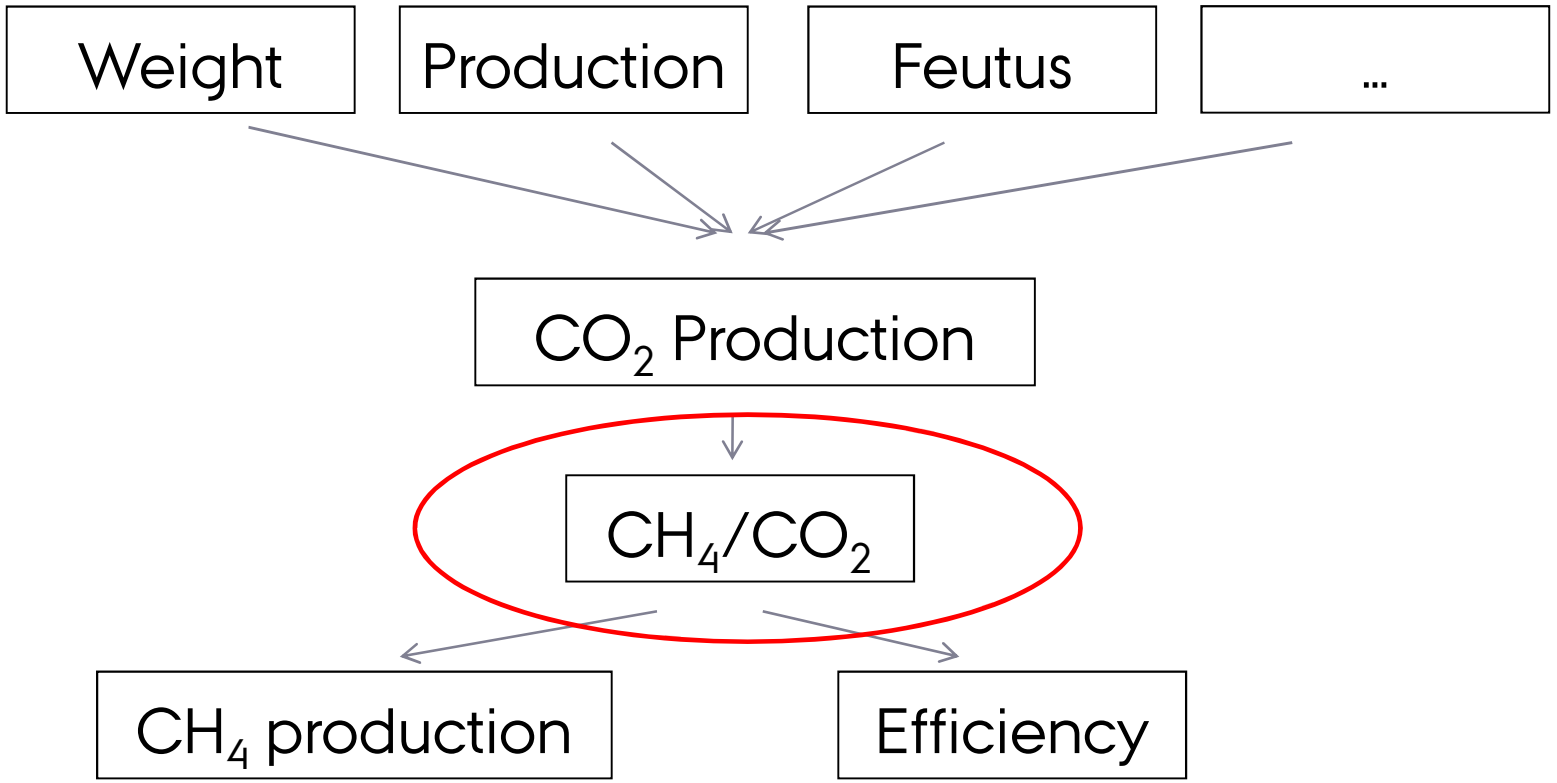
Quantifying methane production



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Data

	Data 1		Data 2
Breed	Holstein	Jersey	Danish Red
Numbers	53	40	273
Days	2	4	7
Visits/cow	2-6	6-12	10-25
Robots	1	1	4
Feed data	Yes	Yes	No
Pedigree	No	No	5726 animals
Phenotypes	2-6	6-12	1

Repeatability

Heritability

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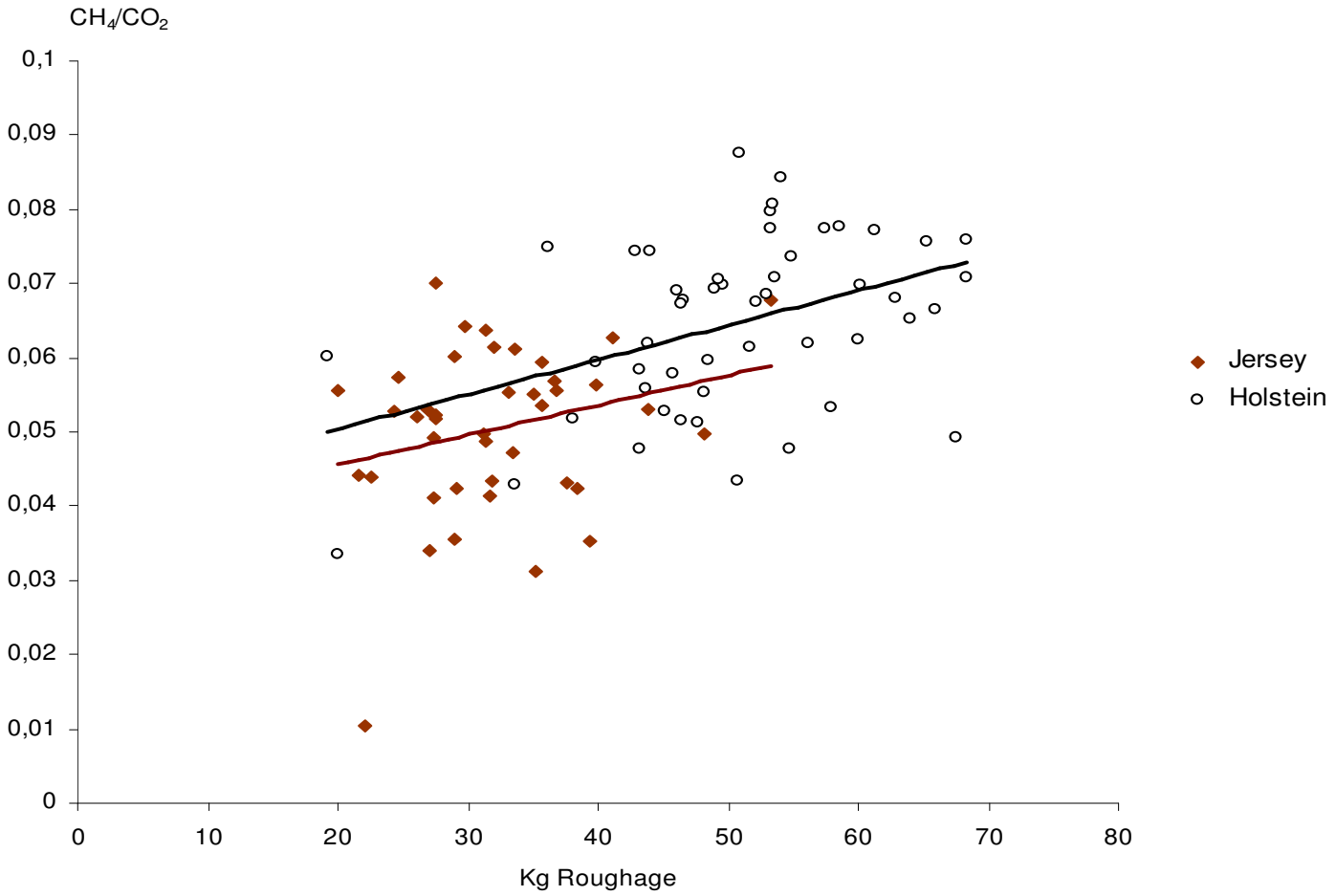
High roughage intake gives high methane prodcution



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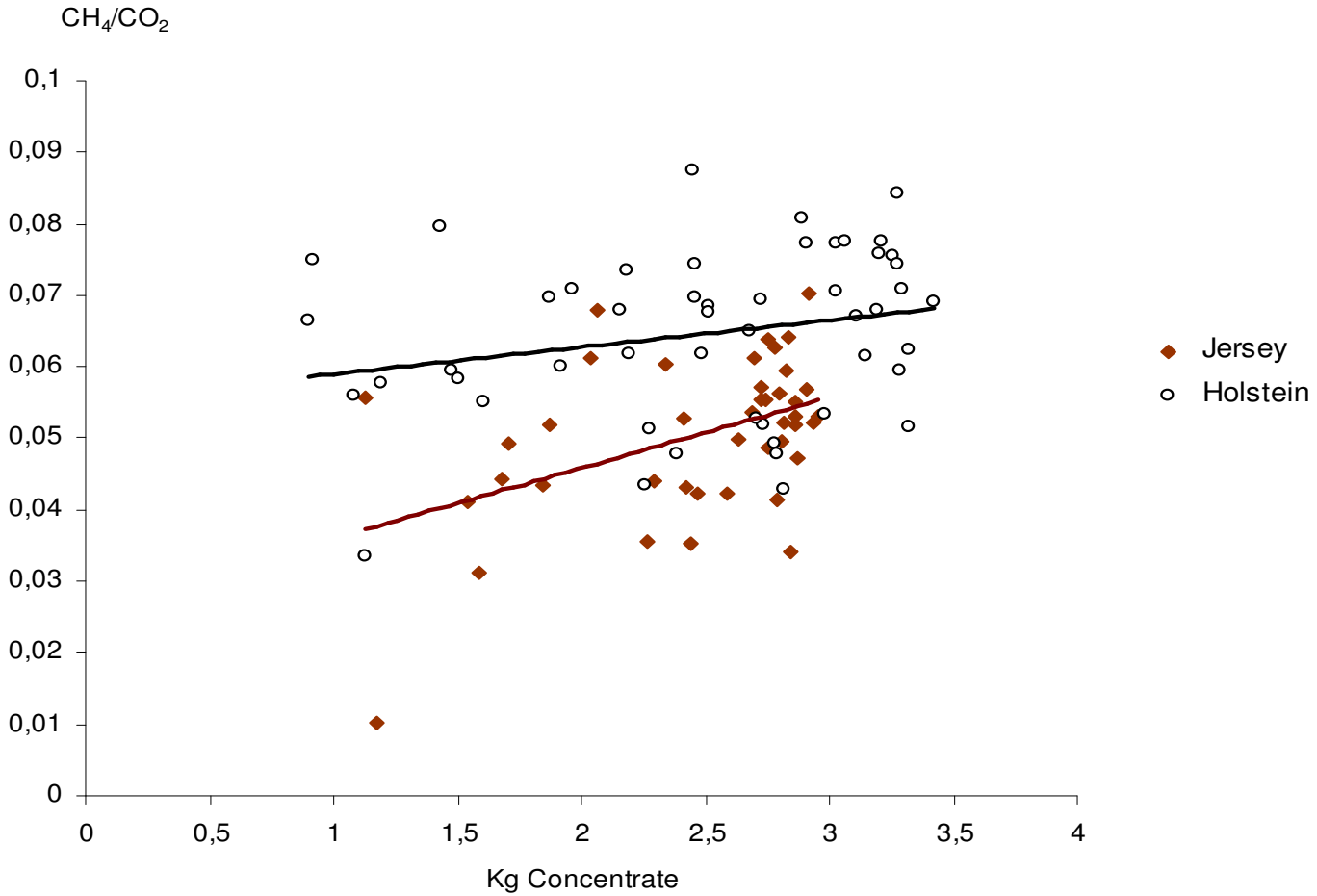
High concentrate intake gives high methane production



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Data 1 statistical model

Mean CH_4/CO_2	=	Mean	
		+ lact nr	Fixed class
		+ DIM	Fixed reg
		+ Concentrate	Fixed reg
		+ Roughage	Fixed reg
		+ sin and cos 24 h waves	Fixed reg
		+ cow	Random
		+ Residual	Random

Repeatability = var (cow)/var (cow) + var(residual)

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Repeatability (between visits)

	CH_4/CO_2
Jersey	0,38
Holstein	0,36

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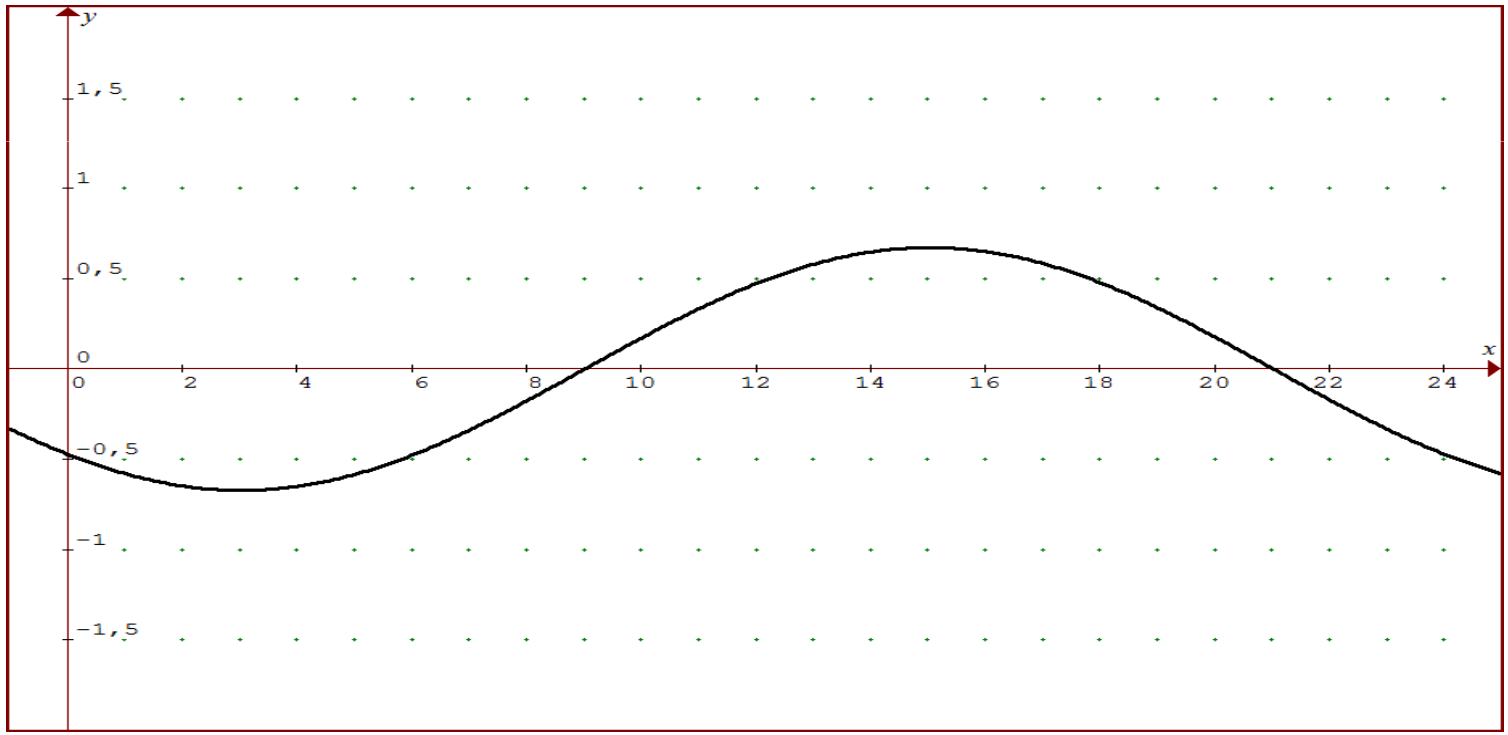
Variation during a day



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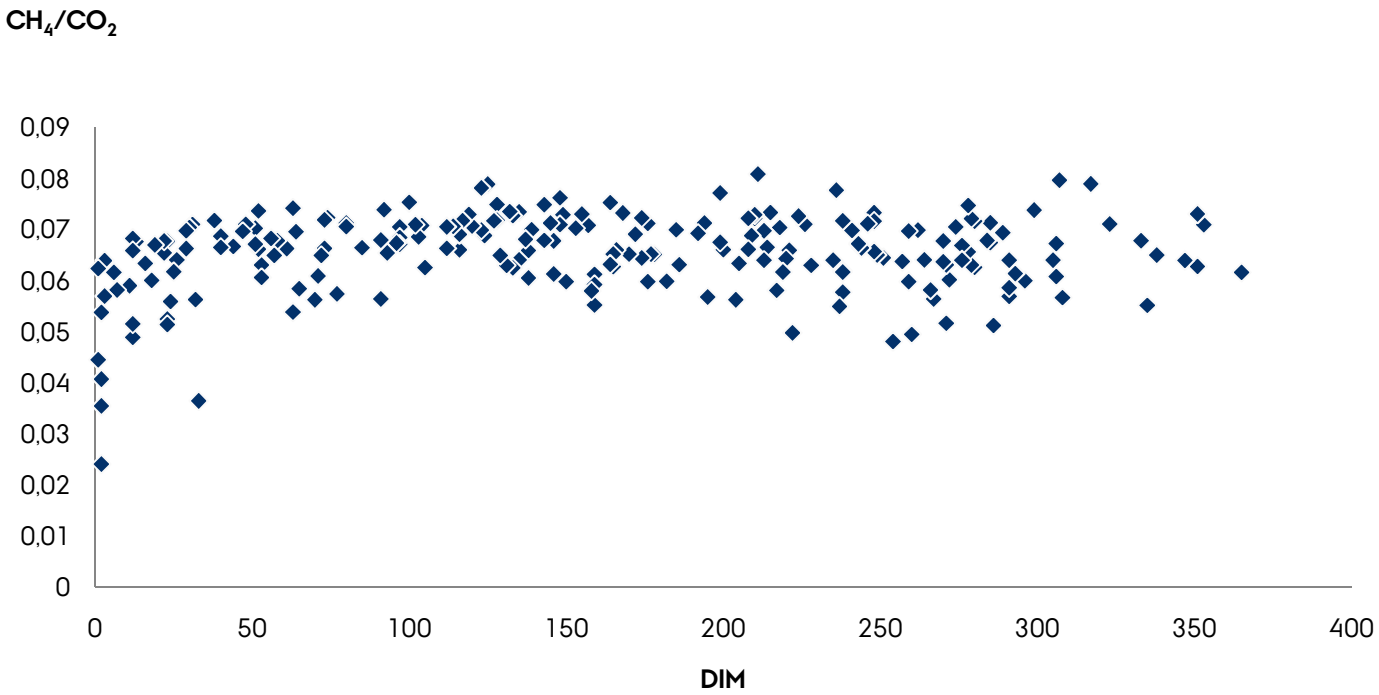
Data 2



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Model data 2

CH_4/CO_2	=	Mean	
		+ Robot	Fixed class
		+ Lact nr	Fixed class
		+ Production	Fixed reg
		+ DIM	Fixed reg
		+ Wilmink DIM	Fixed reg
		+ Animal	Random
		+ Residual	Random

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Heritability estimates for enteric methane emission from dairy cattle

	Mean	Median	1 st Quantile
h^2	0.33	0.29	0.32
SE	0.17	0.17	0.17

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Conclusions

- We measure a repeatable, heritable trait
- The trait relates to
  - roughage intake
  - concentrate intake
  - daily variation
  - days in milk
  - Milk production

  as we would expect methane production to relate to these traits
- We believe we have tools that can measure enteric methane emission from dairy cattle in a large scale.