

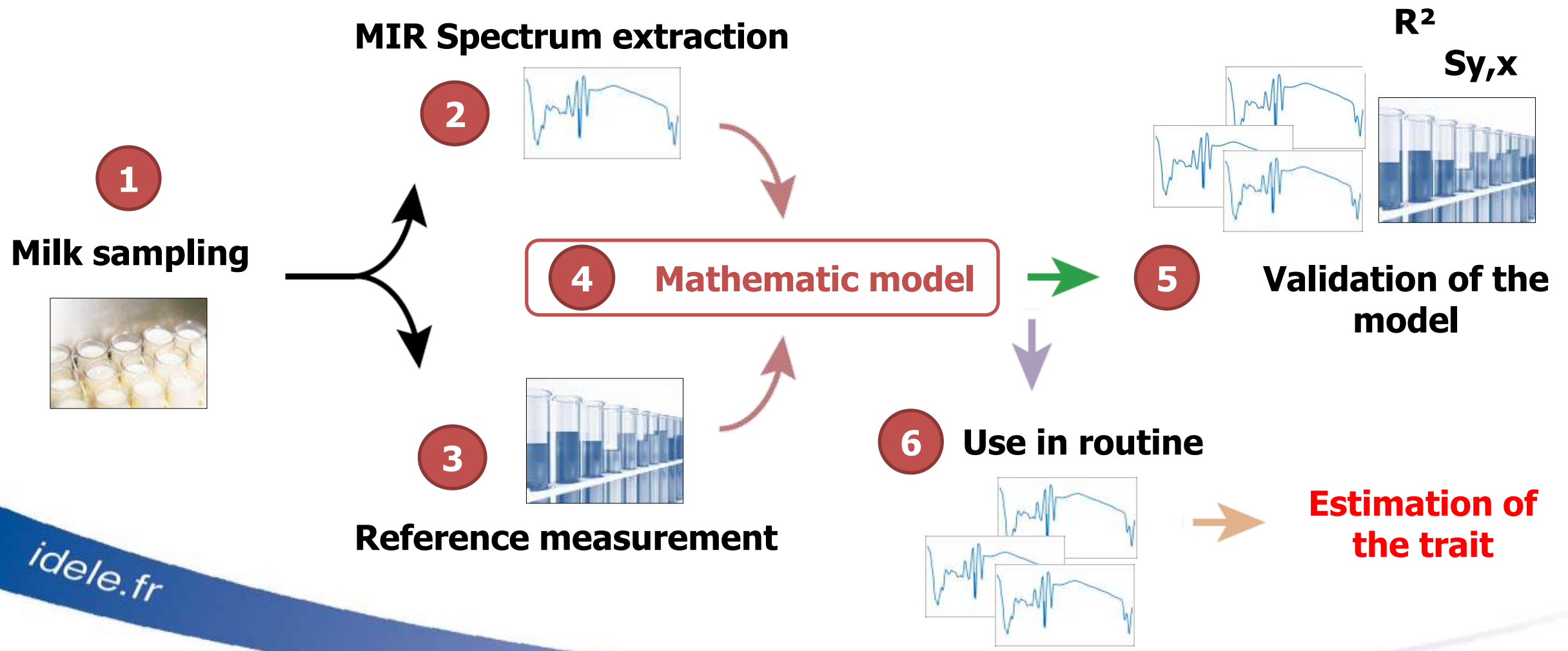
T.S.6 - Milk recording: a tool to improve dairy production.

Phenotyping new traits by mid infrared spectrometry: a way to improve milk quality and dairy cows' management

Marine Gelé (marine.gele@idele.fr)



MIR spectra: a useful material





The French Livestock Institute is involved in several R&D projects using MIR spectra

PhénoFinlait
Un programme R&D pour les filières laitières de demain

FAVACAL

- 
- ▶ Fatty acids
 - ▶ Proteins
 - ▶ Minerals
 - ▶ Ketone bodies
 - ▶ ...

AcID

- 
- ▶ Metabolic status
 - ▶ Health status
 - ▶ ...

- 
- ▶ Lipolysis
 - ▶ Cheese making properties
 - ▶ ...

UREA



An efficient method to estimate milk composition

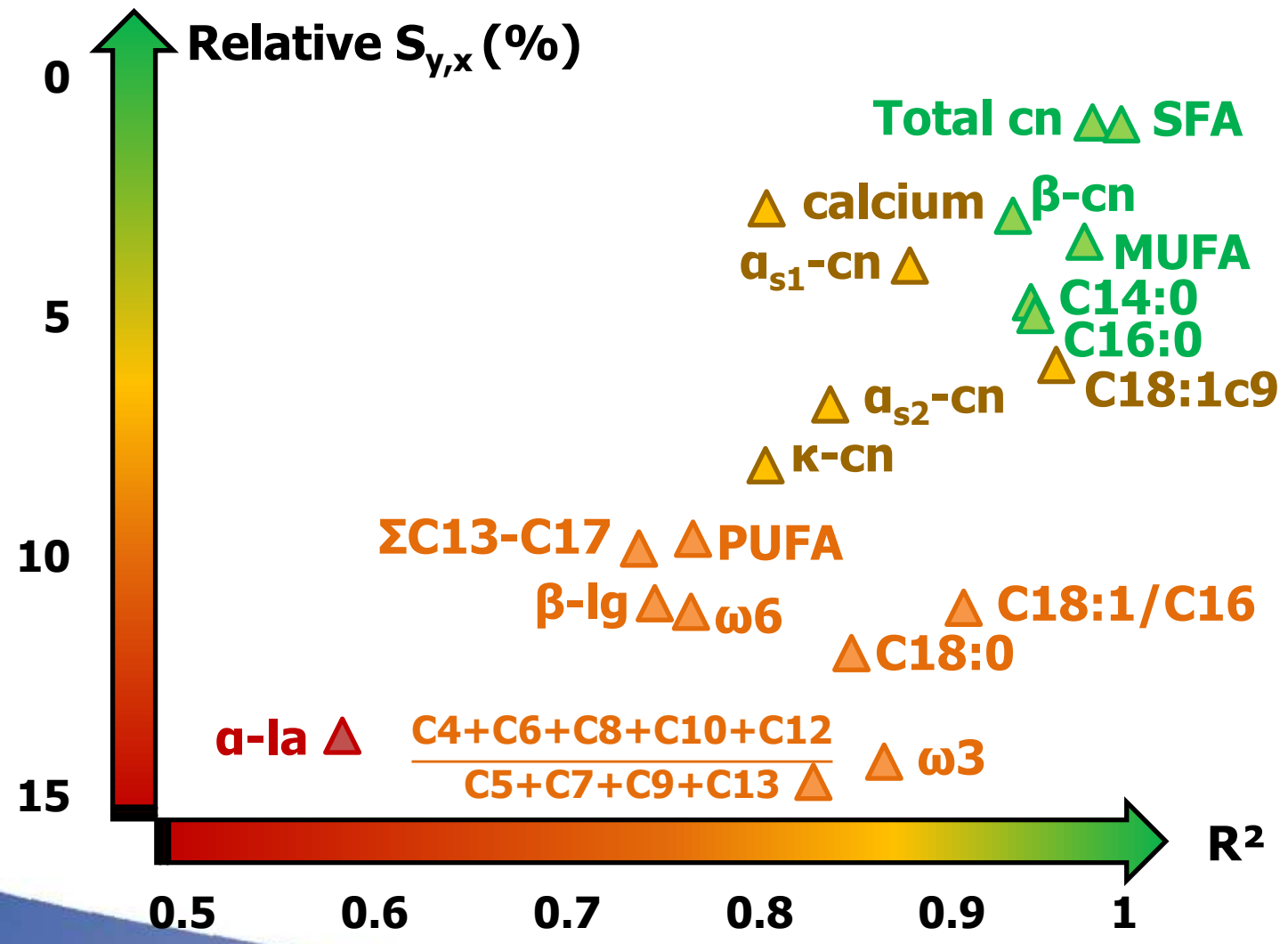


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FAVACAL

AcID

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Possible use

- ☺ Routine, any application
- ☺ Analytic use, quantitative information
- ☹ Screening, high or low levels
- ☹ Not recommended

From milk components to milk quality



Nutritional quality

- ▶ **Fatty acids: neurological system, adiposity...**
- ▶ **Proteins: lysine, tryptophan and sulfur amino acid-rich proteins**
- ▶ **Calcium: constitution of the bones and teeth**



Technological quality

- ▶ **C18:1/C16:0: butter spreadability**
- ▶ **Caseins: curdling and cheese yield**
- ▶ **Calcium: linkage of the casein micelle**



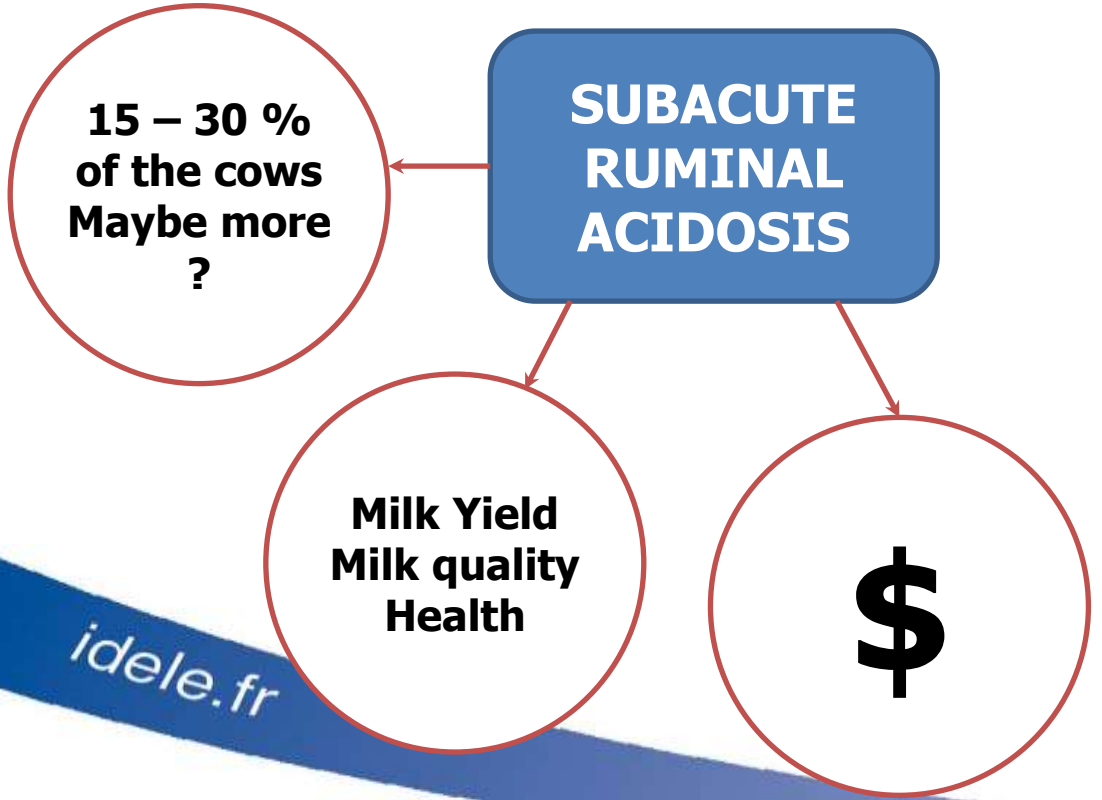
Milk components as biomarkers of nutrition and physiology related traits

Health

Welfare

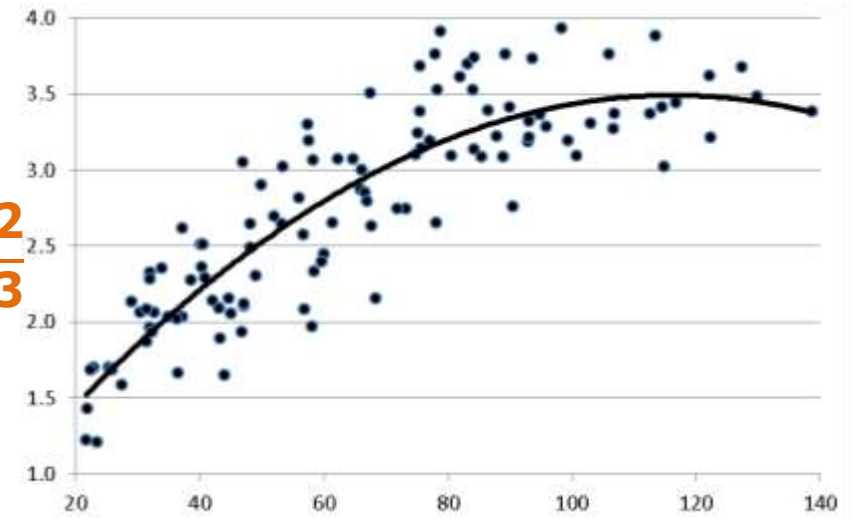
Expression of the potential

without metabolic troubles



AcID project

ruminal $\frac{C2}{C3}$



milk $\frac{C4+C6+C8+C10+C12}{C5+C7+C9+C13}$

➤ An interesting indicator to combine with Fat:Protein ratio for acidosis surveillance



Milk components as biomarkers of nutrition and physiology related traits

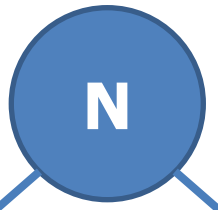
Health

Welfare

Expression of the potential

without metabolic troubles, **with few impact on the environment**

Better estimation



Feeding costs



Environmental impact

UREA project

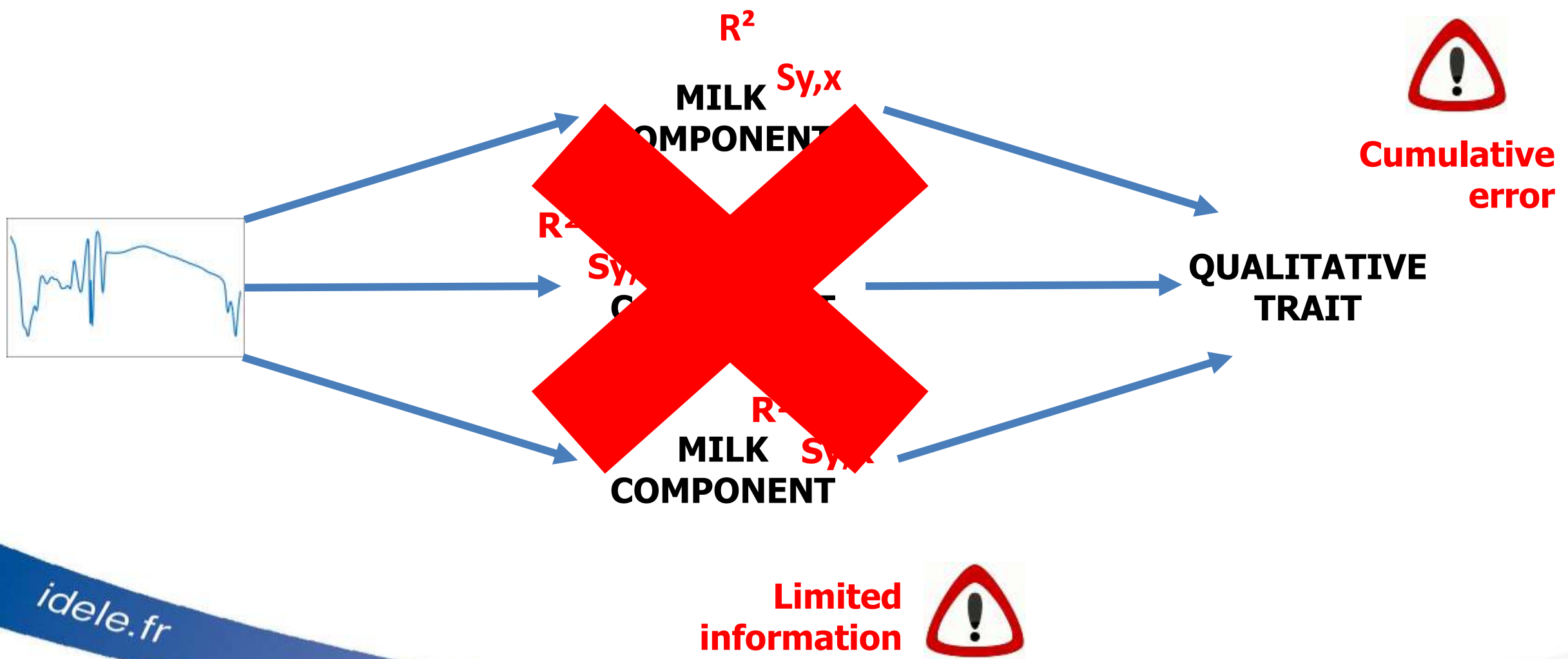
MIR-estimated UREA

Nutrition of the herd

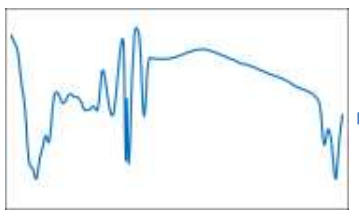


Prediction of nitrogen emissions?

Phenotyping qualitative traits



Phenotyping qualitative traits by using the whole spectrum



Adapted mathematic methods

Sensitivity
Specificity
QUALITATIVE TRAIT

The spectrum reflects the whole milk composition.
→ More information is taken into account
→ Less cumulative error

PPV / NPV

Accuracy

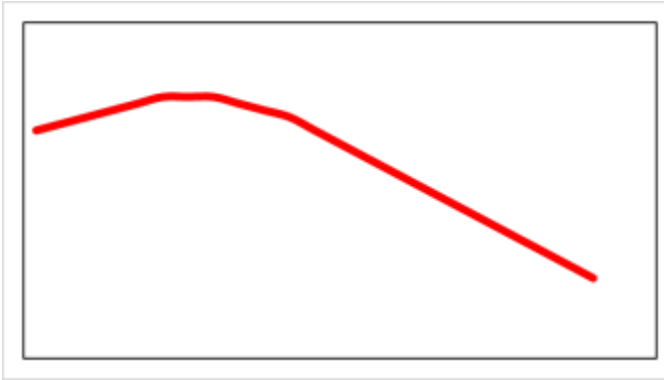


A good way to predict ketosis risk?

KETOSIS



Early Lactation



- Loss of milk yield
- Change in milk composition

- ↗ Metabolic disorders
- ↗ Udder problems
- ↗ Culling rate

Type I

Blood BHB

Milk ketone bodies

LCFA
C18:1c9

Type II

Blood NEFA

Fat:Protein ratio

Citrate



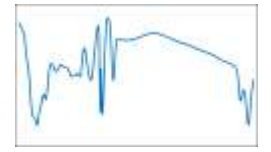


A good way to predict ketosis risk

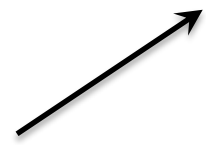
Milk sampling



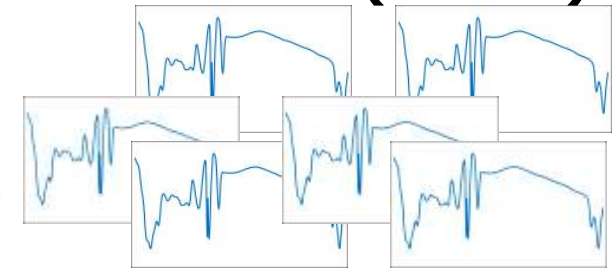
MIR Spectrum extraction



Logistic PLS regression



Cross-validation (n=566)



Sensitivity = 84,5 %
Specificity = 84,2 %

BHB and NEFA in blood



Low Risk vs High Risk Classification



		Prediction	
		Low risk	High risk
Observation	Low risk	234	44
	High risk	43	235

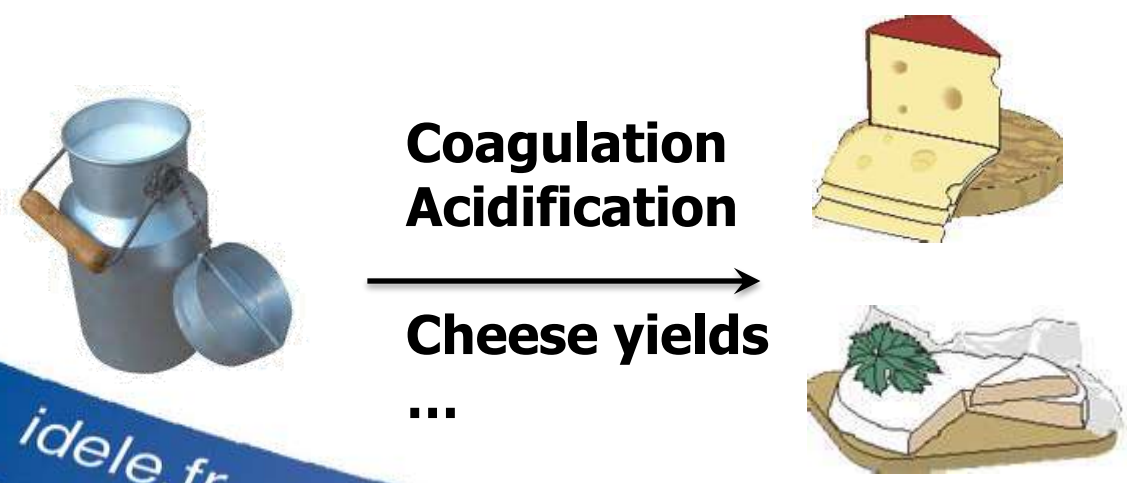
MIR spectrum: a tool to predict cheese making properties of milk ?

- ▶ Is protein content a good predictor cheese making ability of milk?

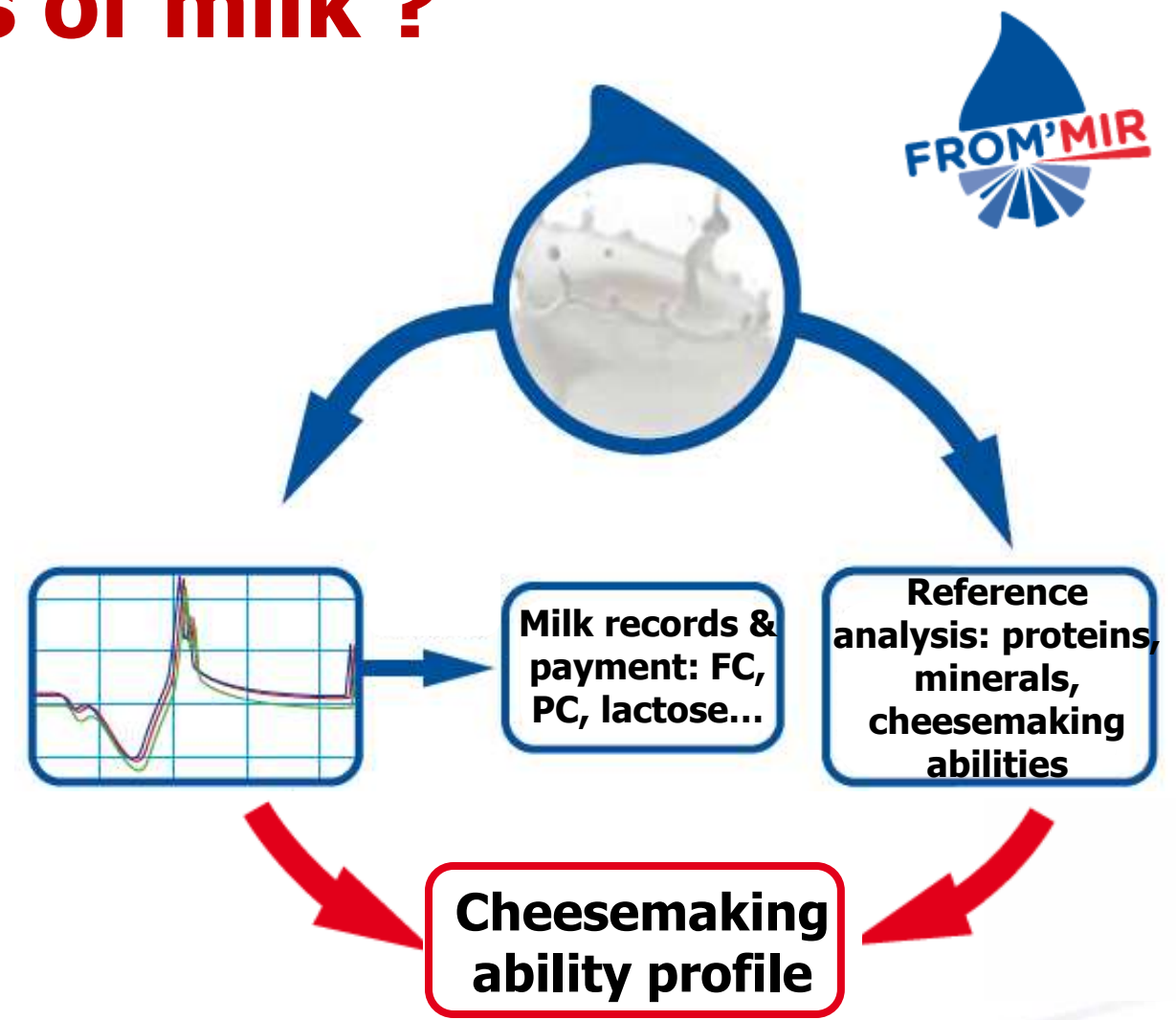
Not always

- ▶ Caseins? Calcium?

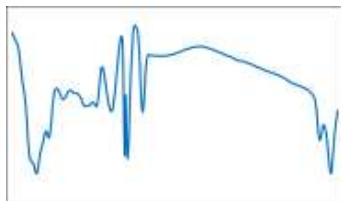
Not only



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Take home messages



- easy-to-get and low-cost material
- very promising to phenotype novel traits
- with many applications



Genetic selection



Herd management



Diseases monitoring



Milk processing

- to meet farmers, dairy processors and consumers demand

Special thanks



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