

Accuracy and potential of in-line milk composition analysis with near infrared spectroscopy (NIRS)

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Competence
centre

Milk


Agricultural Science
Schleswig-Holstein



SensoLogic
Software + Sensor Systeme

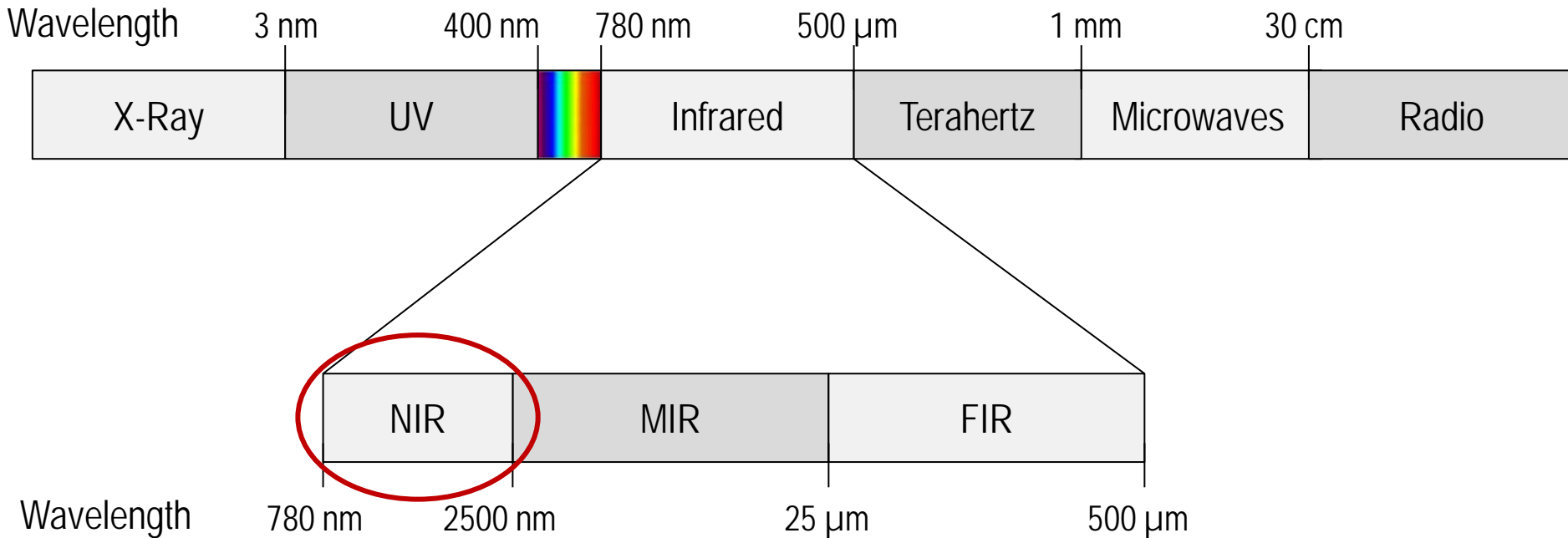


ZUKUNFTSprogramm
Wirtschaft

Investition in Ihre Zukunft

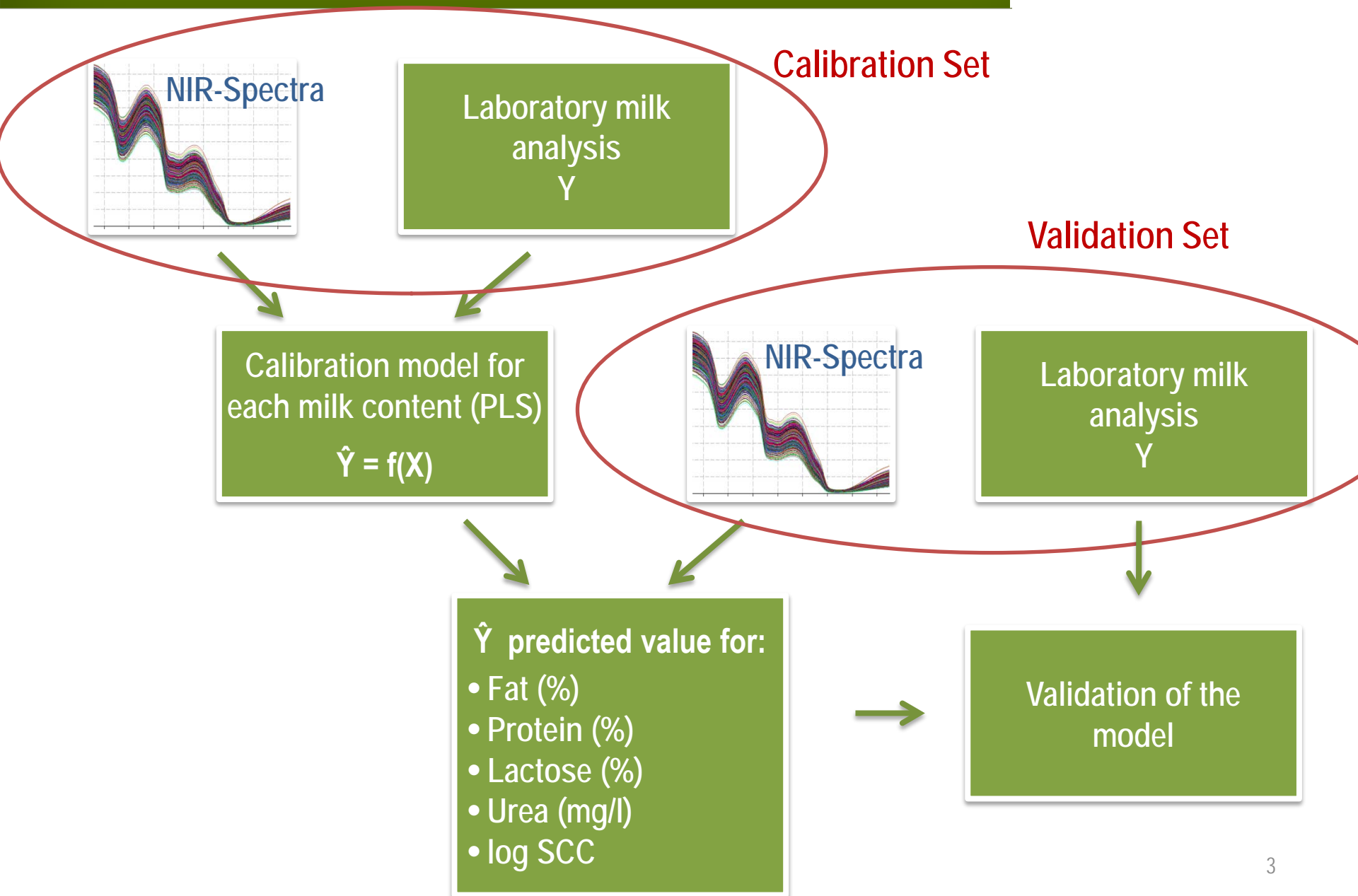
financed by the European Union,
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Near-infrared spectroscopy (NIRS)

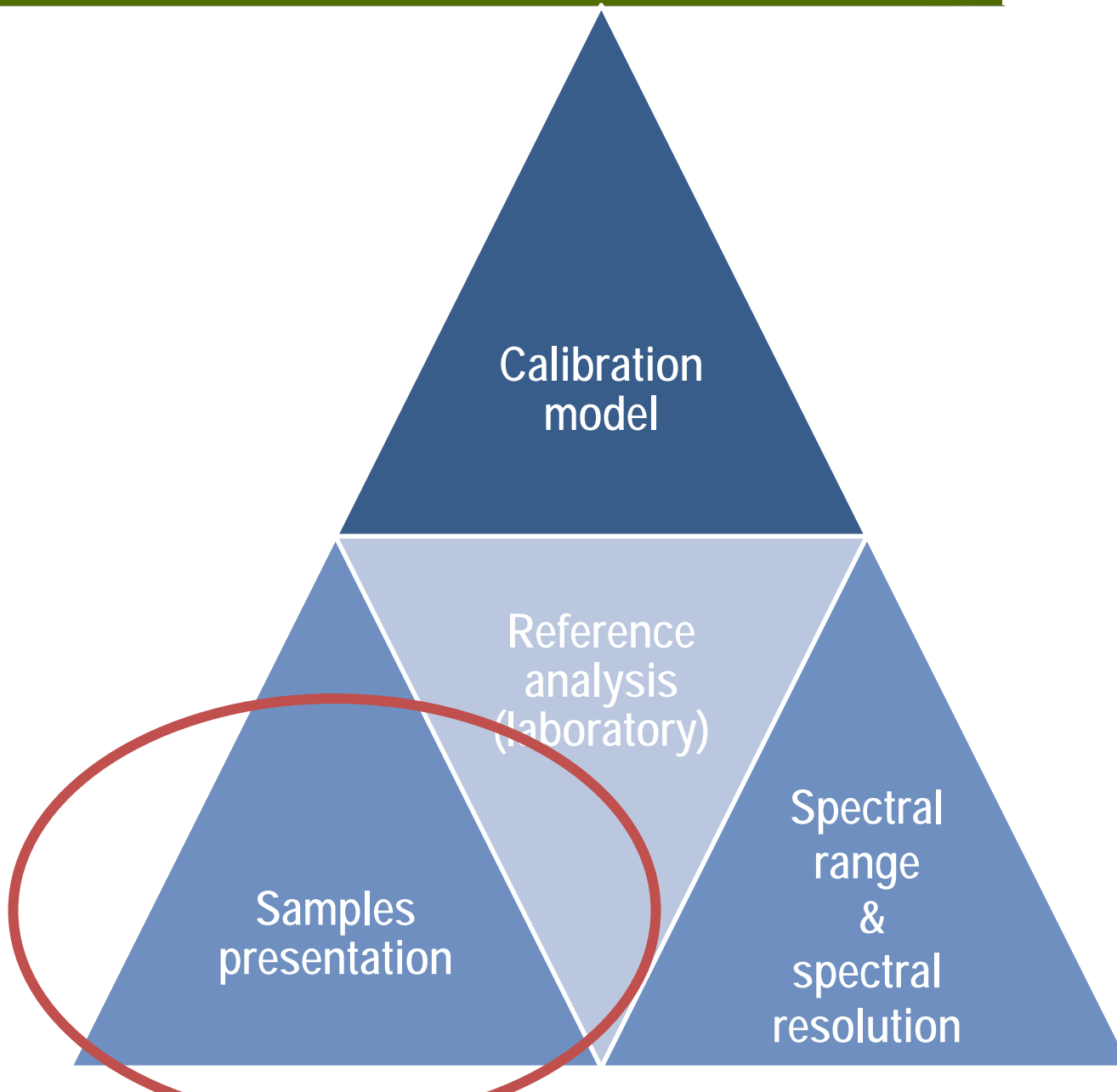


Infrared region: The incident light is absorbed by functional groups and causes a change in the vibration state (molecular vibrations)

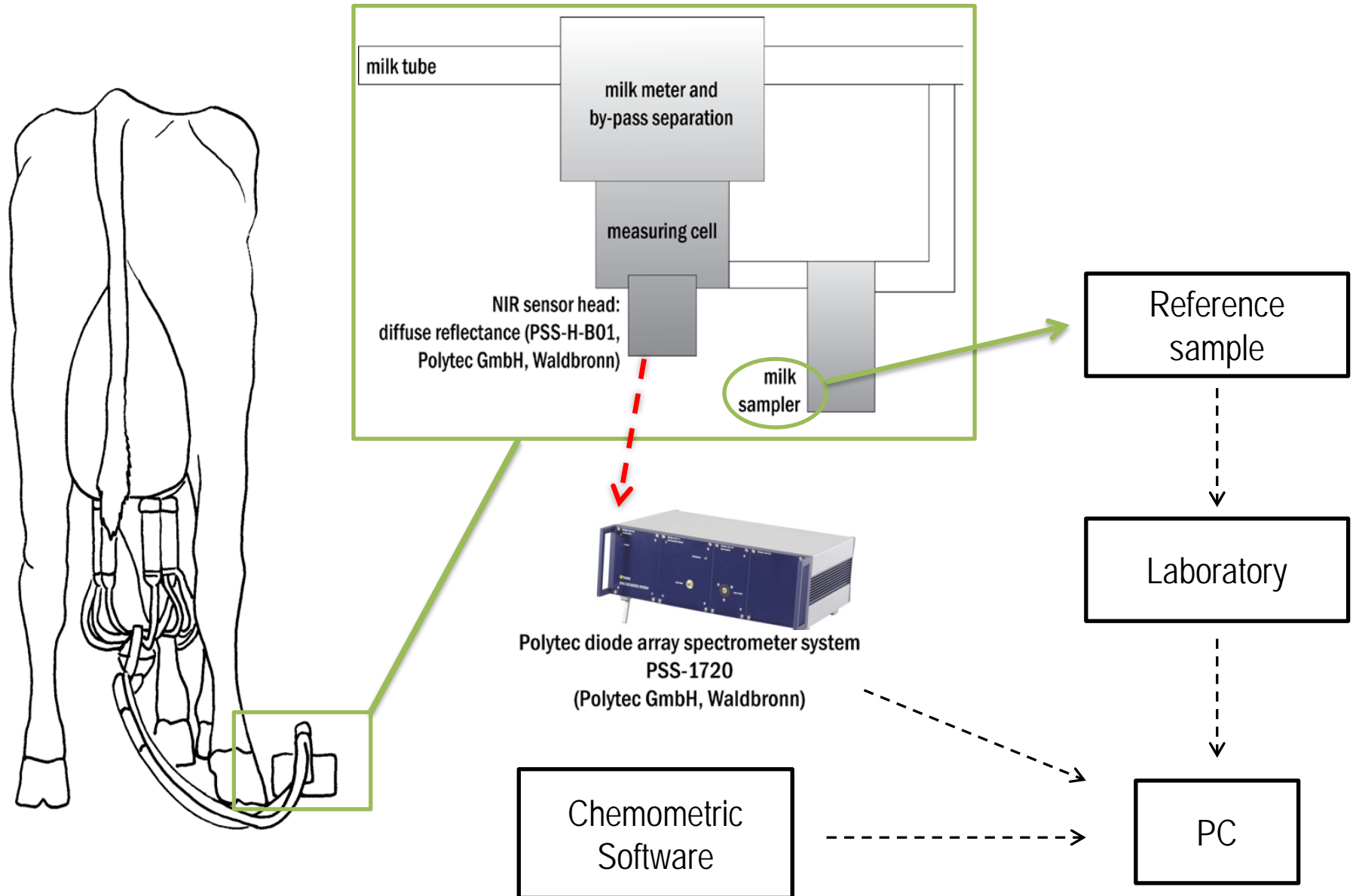
→ NIR region: Detection of overtones and combinations of different vibrations occurring from the fundamental vibrations → possibility to detect molecules that consist of these functional groups



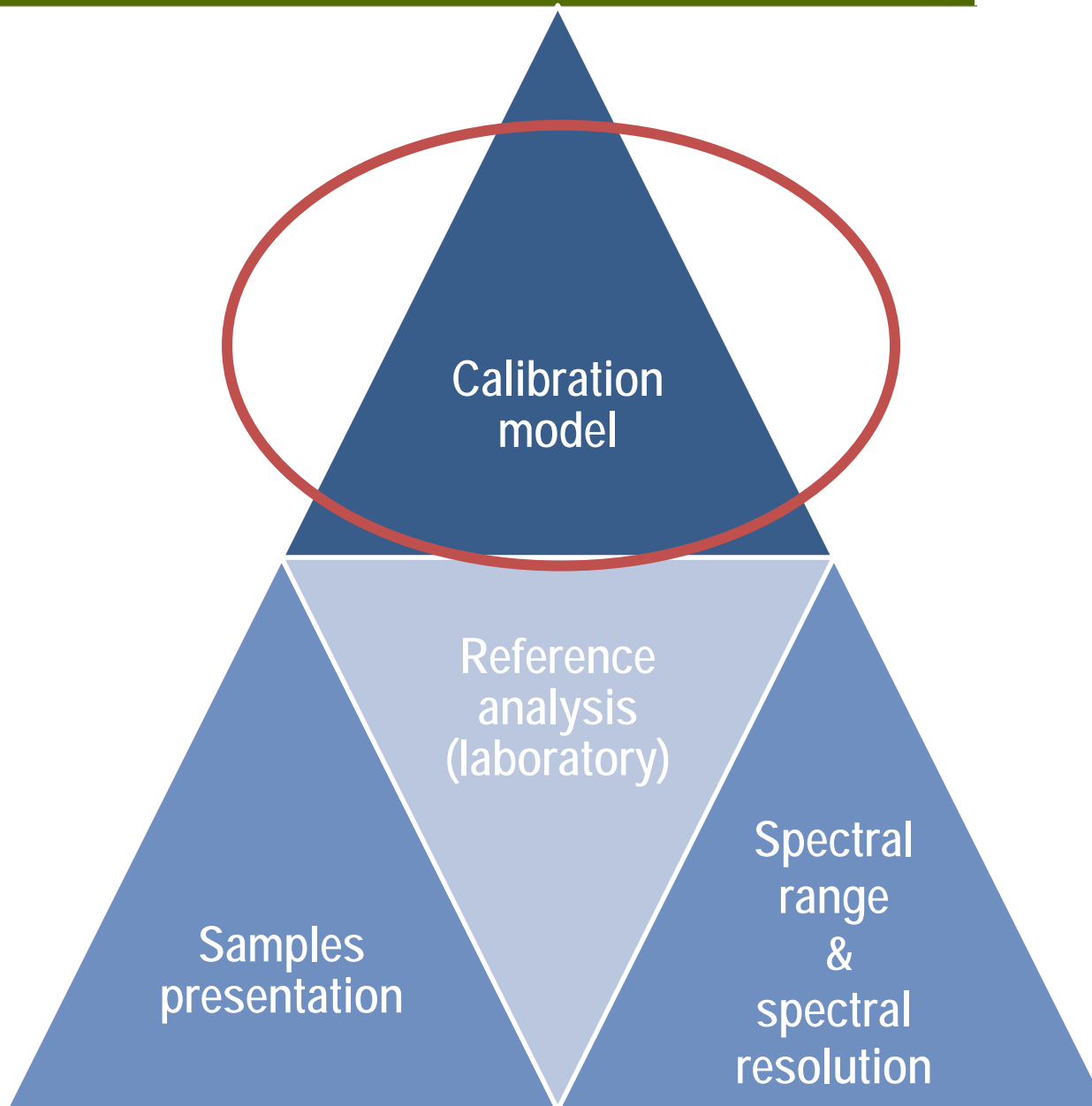
Premises for accurate prediction results



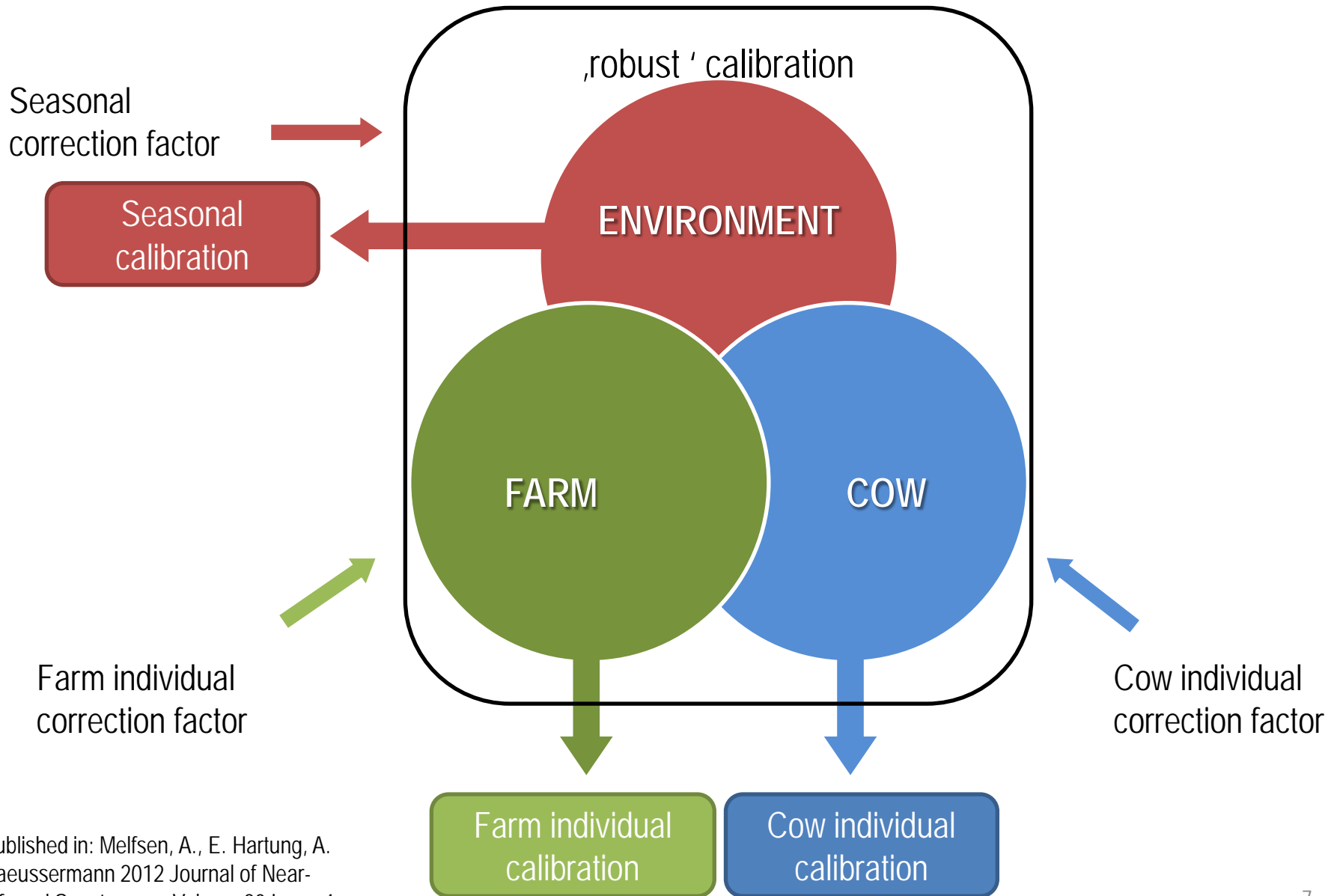
Setup of the in-line analysis



Premises for accurate prediction results



Influences on NIR milk composition analysis



Sampling in-line setup

Farm ME
n = 1313

(a₁) n=209

(a₂) n=275

(b₁) n=192

(b₂) n=203

(c₁) n=205

(c₂) n=229

Farm SB
n = 937

(a) n=338

(b) n=323

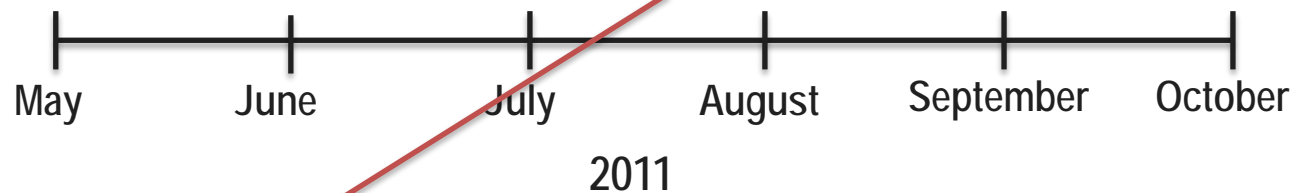
(c) n=276

Farm FK
n = 869

(a) n=279

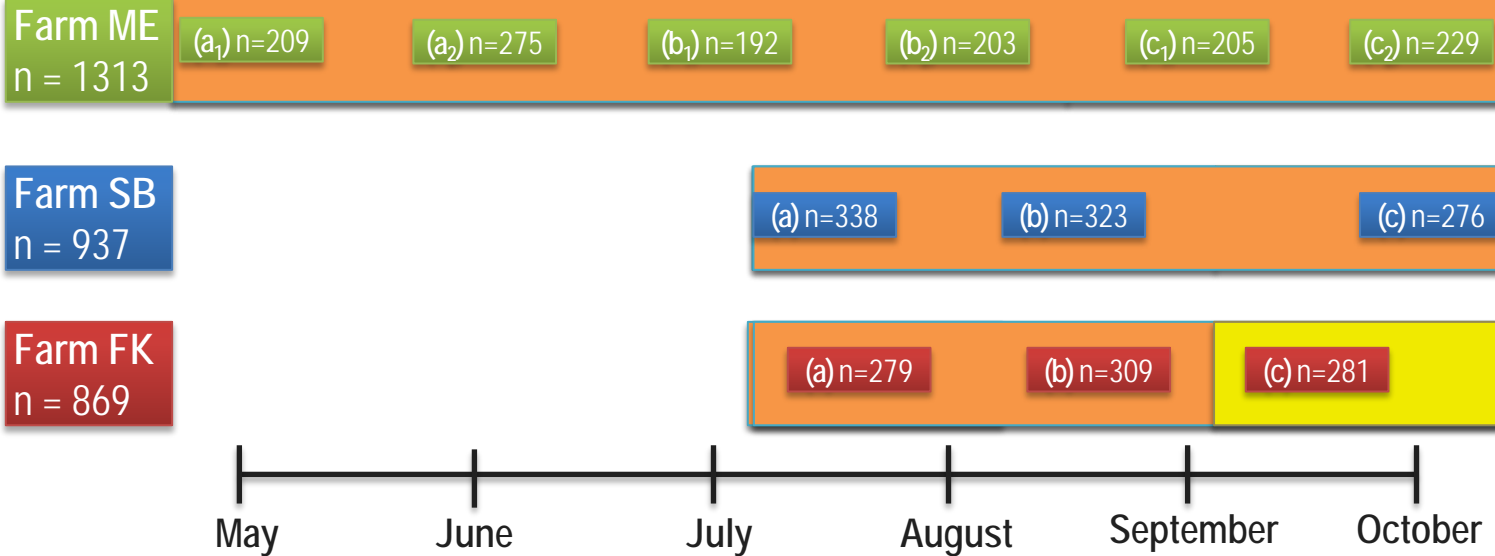
(b) n=309

(c) n=281



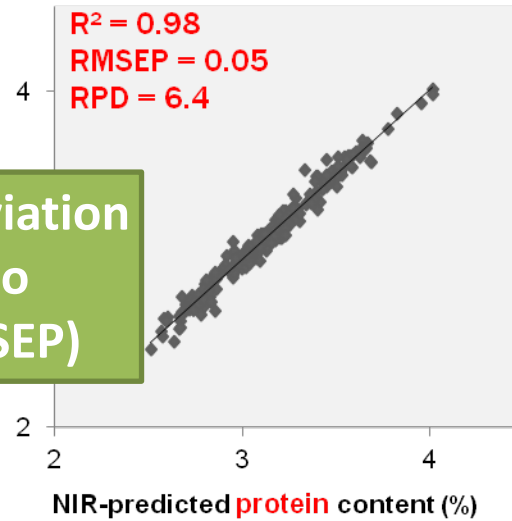
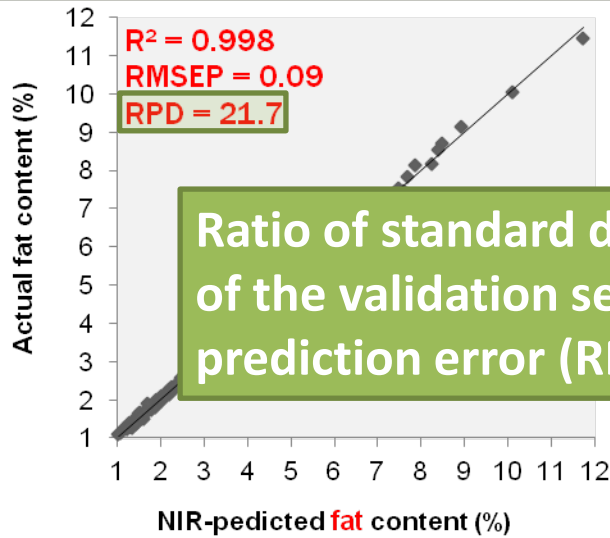
- Each measuring date representing four consecutive milking sessions
- Installation of the in-line measuring setup on one milking place
- Sampling of subsamples from total cow milking for reference analysis

NIR Analyse in-line

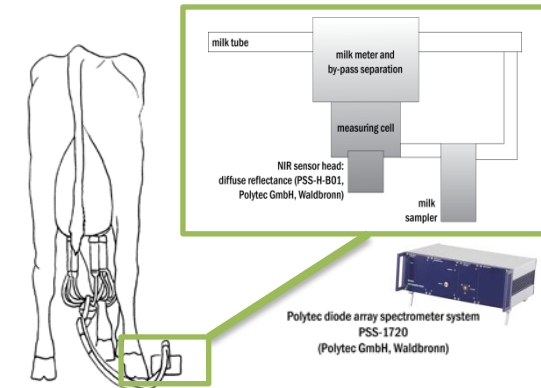


	Calibration-Set	Validation-Set
	Potential of NIR analysis; randomly created validation-sets (RDM) 2/3 spectra	1/3 spectra
	Farm-individual Calibration (INT) Measuring date a + b	Measuring date c
	External Calibration (EXT) Farm 1 & 2	Farm 3 measuring date c
	Extended external Calibration (EXT+1/3 & EXT+2/3) Farm 1 & 2 + Farm 3 measuring date a Farm 1 & 2 + Farm 3 measuring date a + b	Farm 3 measuring date c Farm 3 measuring date c

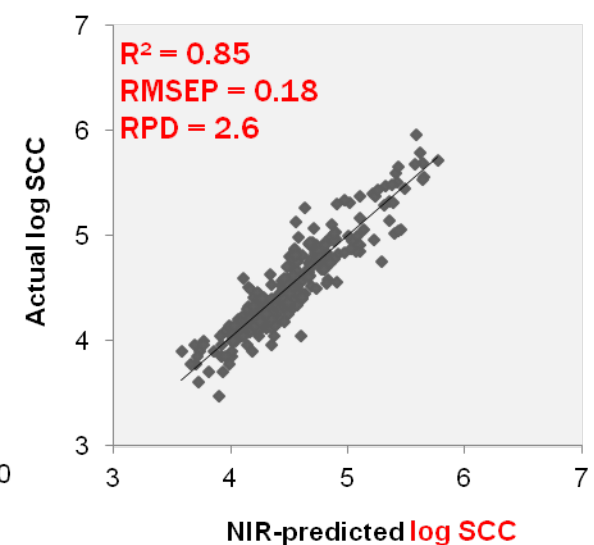
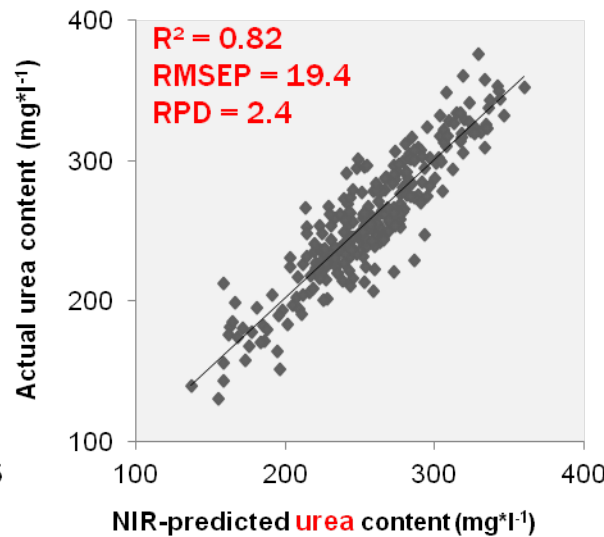
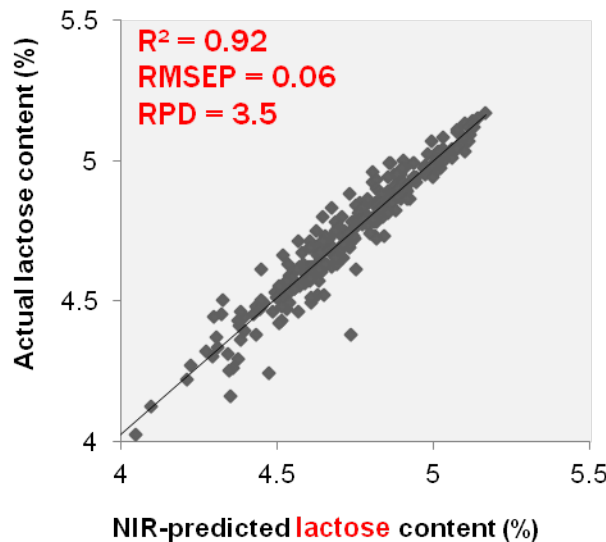
Potential in-line setup (random dataset)



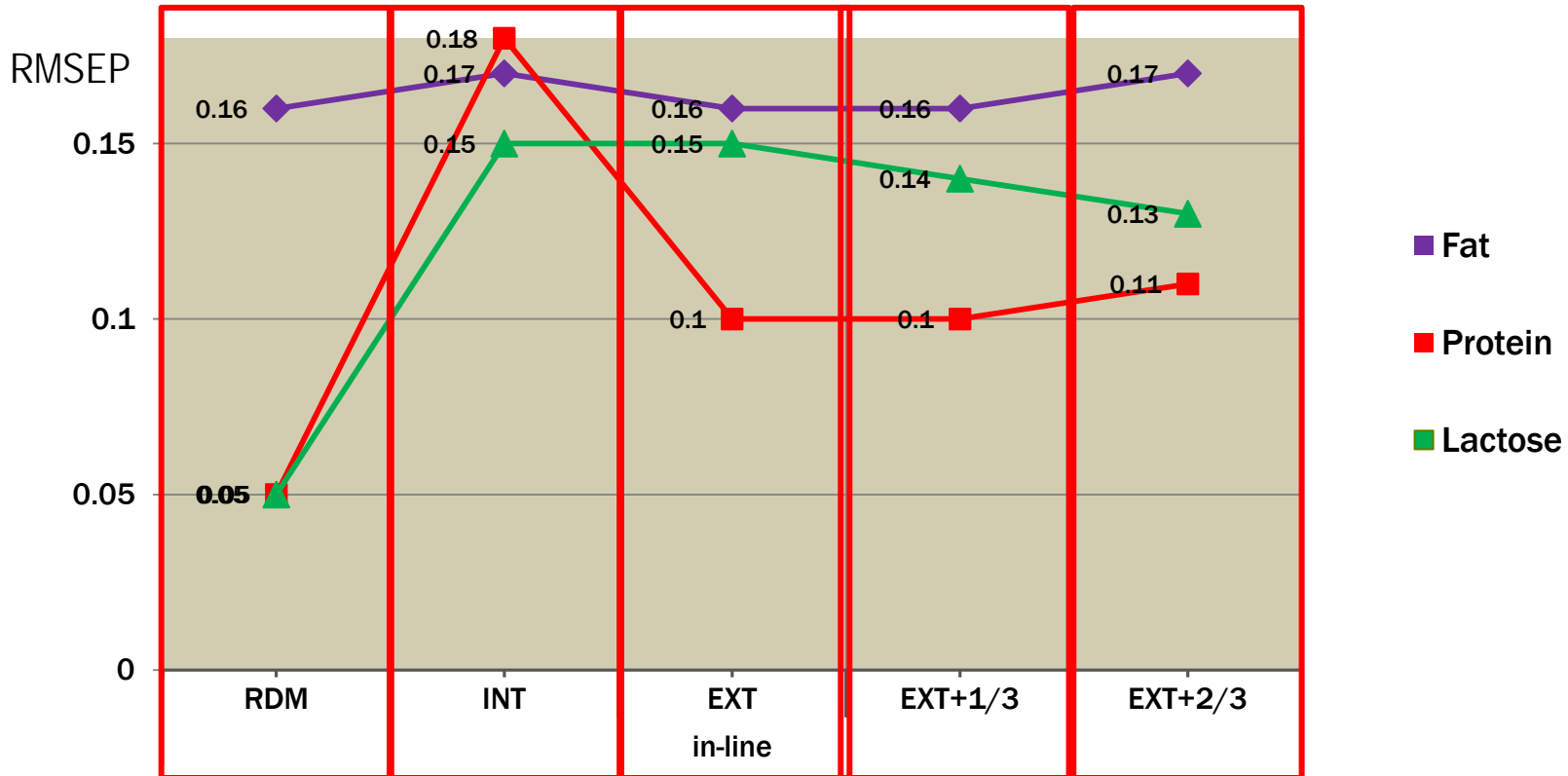
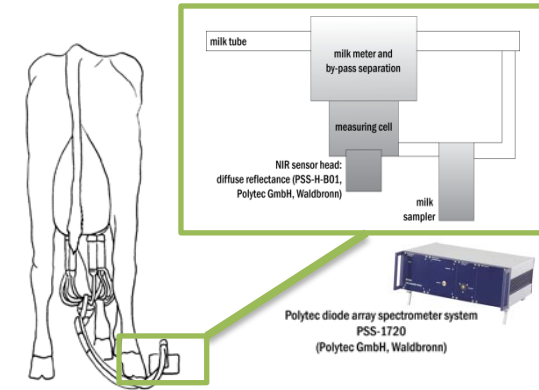
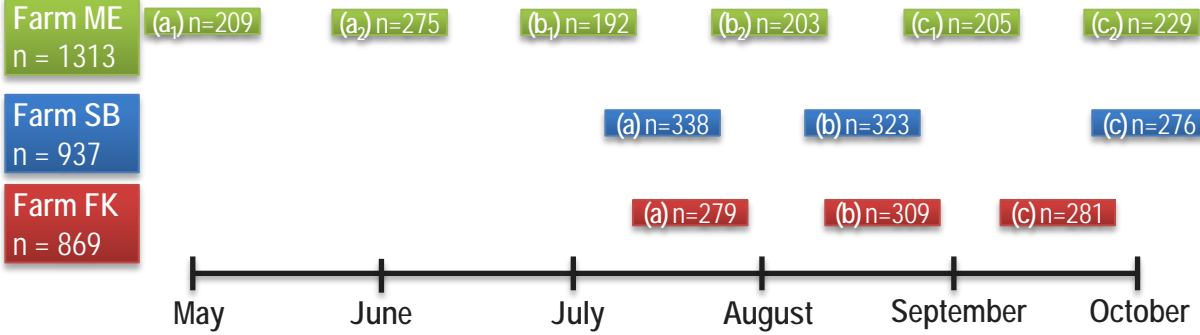
Ratio of standard deviation of the validation set to prediction error (RMSEP)



n=785 subsamples of 84 cow milkings occurring from 43 different cows (July-Sept 2011)



Robustness of calibration models



NIRS has the potential to analyze milk contents during the milking process with a high temporary frequency

- measuring principle and in-line setup

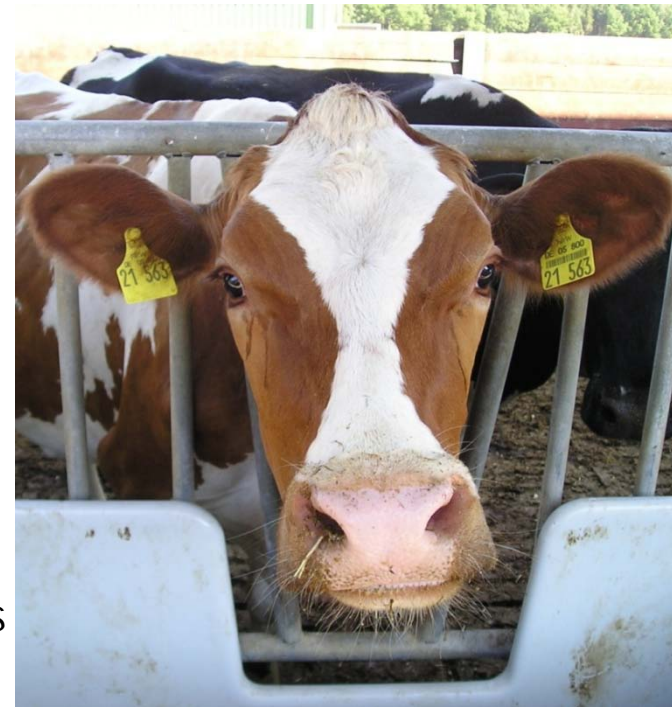
- Measuring principle are useful for practical implementations
- In-line sample presentation can be used in different milking parlor types

- Potential (fully randomized calibration and validation sets)

- Excellent to good prediction results were achieved for fat (%), protein (%) and lactose (%) content with fully randomized calibrations

- Robustness of NIR calibration models

- Farm individual calibration models do not represent the variability of future milk spectra
- Compared with farm individual models, external calibration models achieve better accuracy results
- An individual cow scatter correction can additionally improve the accuracy results



Thank you for your attention



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