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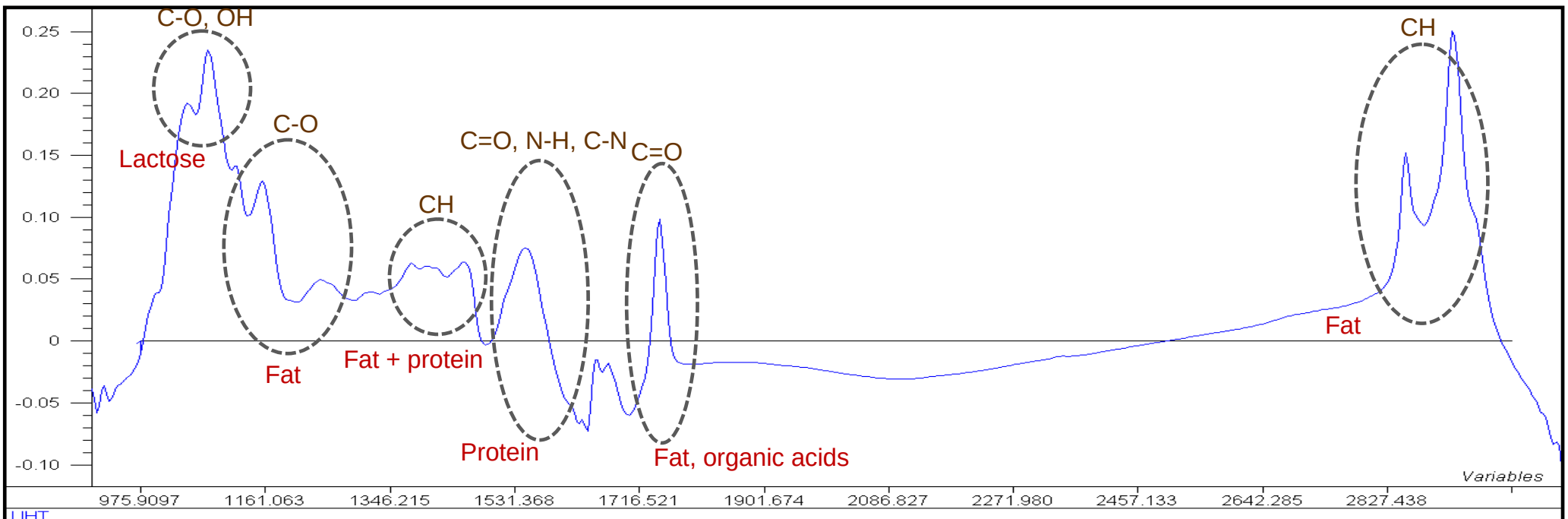
ICAR THE GLOBAL STANDARD FOR LIVESTOCK DATA
Annual Conference
ICAR2018.NZ

7 – 11 February 2018
Aotea Centre
Auckland,
New Zealand

Presentation of a new system to monitor and stabilize mid infrared spectral data

Clément Grelet, Vincent Baeten, Pierre Dardenne, Juan Antonio Fernandez Garcia, Ouissam Abbas, &
Frédéric Dehareng

Walloon Agricultural Research Centre, Belgium



- **Position** of the peaks → **Qualitative** analysis
- **Intensity** of the peaks → **Quantitative** analysis

But…

Spectra of a same milk could differ:

- between different brands apparatus
- between different models apparatus of the same brand
- between apparatus of the same model of the same brand

Moreover, even with the same instrument, the spectra could be different for the same milk. It's not stable in time !

-T°/humidity in the lab
-Piece replacement
-Maintenance operation
-Use/wear

Milk component ⟺ Milk MIR spectra

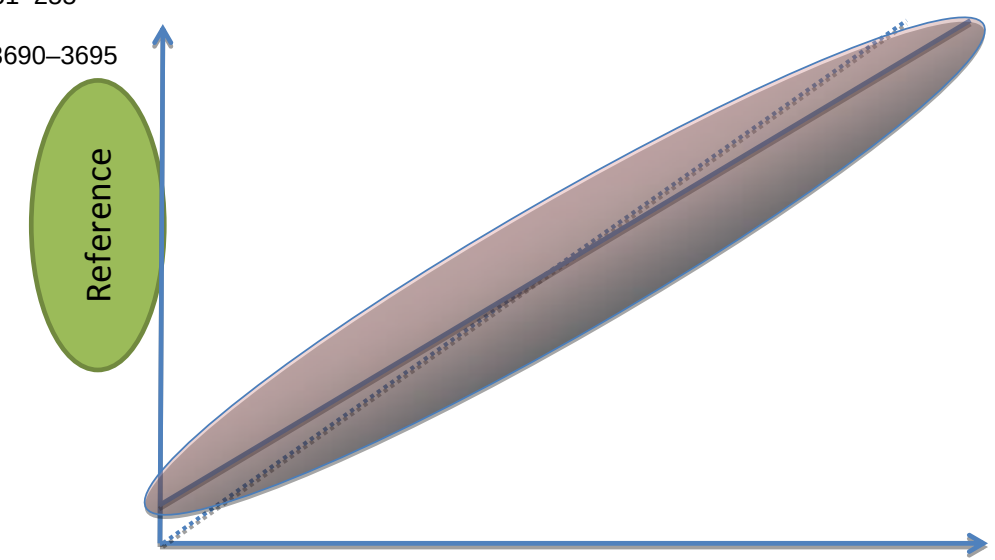
Fat, Protein, Lactose, SNF

Casein Hewavitharana et al. 1997. Analyst 122:701–704.

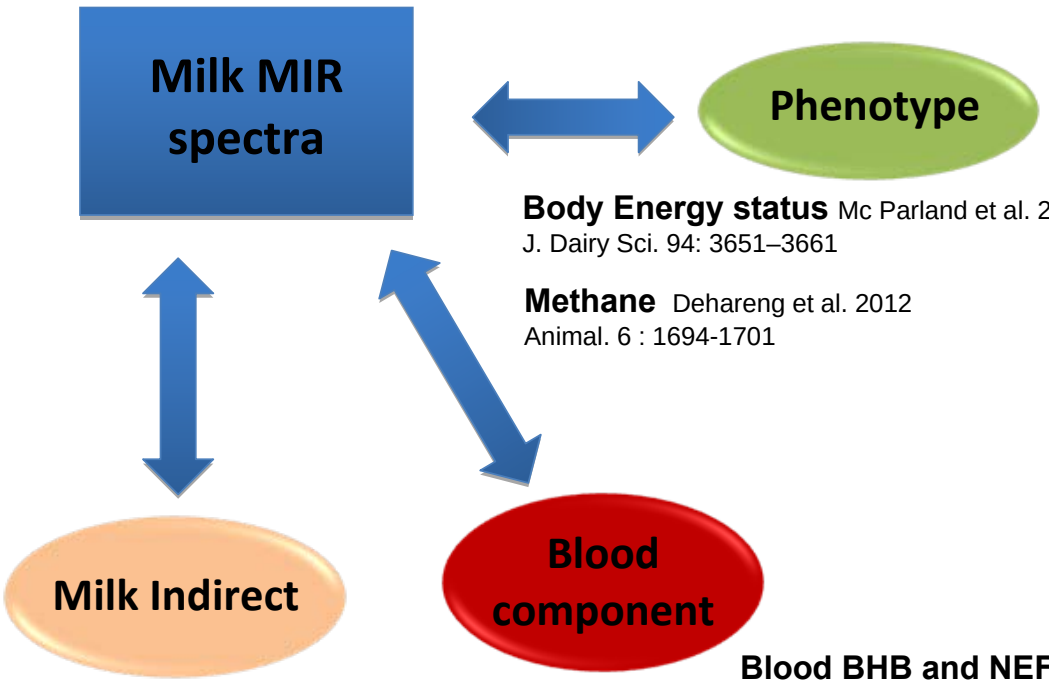
Urea Hansen, P. W. 1998. Milchwissenschaft 53:251–255

Fatty acids Soyeurt et al. 2006 J. Dairy Sci. 89: 3690–3695

Classical slope/bias correction



Spectral Standardization



Body Energy status Mc Parland et al. 2011
J. Dairy Sci. 94: 3651–3661

Methane Dehareng et al. 2012
Animal. 6 : 1694-1701

Blood BHB and NEFA
M. Gelé et al. 2015, ICAR

Lactoferrin Soyeurt et al. 2007 J. Dairy Sci. 90: 4443–4450

Major minerals Soyeurt et al. 2009 J. Dairy Sci. 92: 2444–2454

Coagulation, titrable acidity, pH De Marchi et al. 2009 J. Dairy Sci. 92: 423-432

Acetone, β-hydroxybutyrate, and citrate Grelet et al. 2016 J. Dairy Sci. 99 : 4816–4825

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QUALITY ASSURANCE TOOLS FOR MID INFRARED SPECTROMETRY IN DAIRY LABORATORIES – PART 1

Bulletin 490 2017
of the International Dairy Federation

Standardization of FT-MIR instruments for milk analysis

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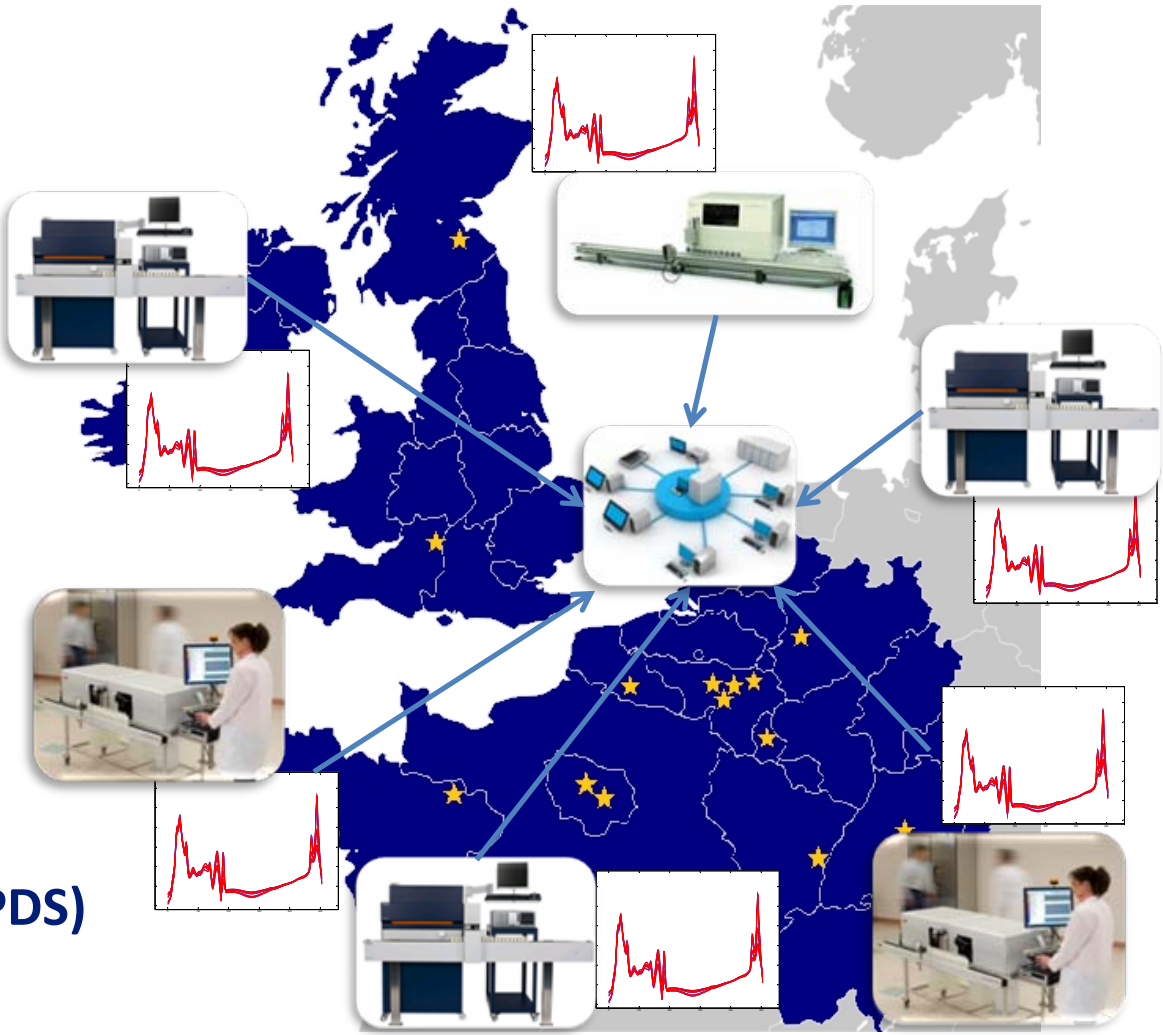
OptiMIR

Project :2011-2015

Develop MIR models predicting cow status



PIECE-WISE DIRECT STANDARDIZATION (PDS)

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PDS Standardization is a solution to solve these problems

J. Dairy Sci. 98:2150–2160
http://dx.doi.org/10.3168/jds.2014-8764

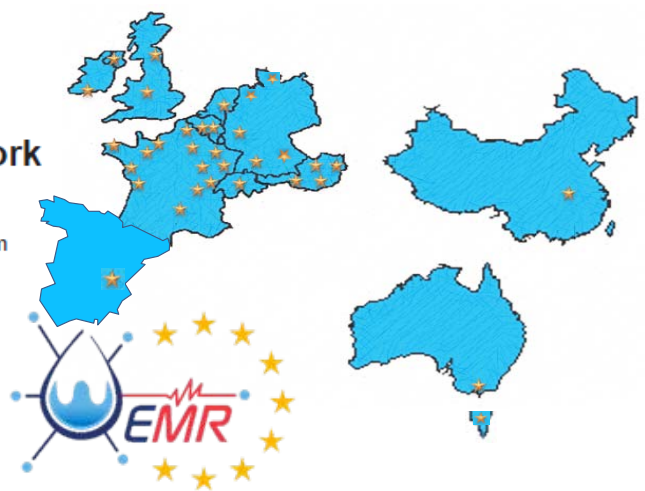
Standardization of milk mid-infrared spectra from a European dairy network

C. Grelet,[1] J. A. Fernández Pierna,[1] P. Dardenne, V. Baeten, and F. Dehareng[2]
Walloon Agricultural Research Center, Valorisation of Agricultural Products Department, 24 Chaussée de Namur, 5030 Gembloux, Belgium

J. Dairy Sci. 100:7910–7921
https://doi.org/10.3168/jds.2017-12720

Standardization of milk mid-infrared spectrometers for the transfer and use of multiple models

C. Grelet,* J. A. Fernández Pierna,* P. Dardenne,* H. Soyeurt,† A. Vanlierde,* F. Colinet,† C. Bastin,‡ N. Gengler,† V. Baeten,* and F. Dehareng*[1]
*Valorization of Agricultural Products Department, Walloon Agricultural Research Center, 5030 Gembloux, Belgium
†Agriculture, Bio-Engineering, and Chemistry Department, University of Liège, Gembloux Agro-Bio Tech, 5030 Gembloux, Belgium
‡Walloon Breeding Association, B-5590 Ciney, Belgium



100 machines
3 continents
13 countries
40 labs

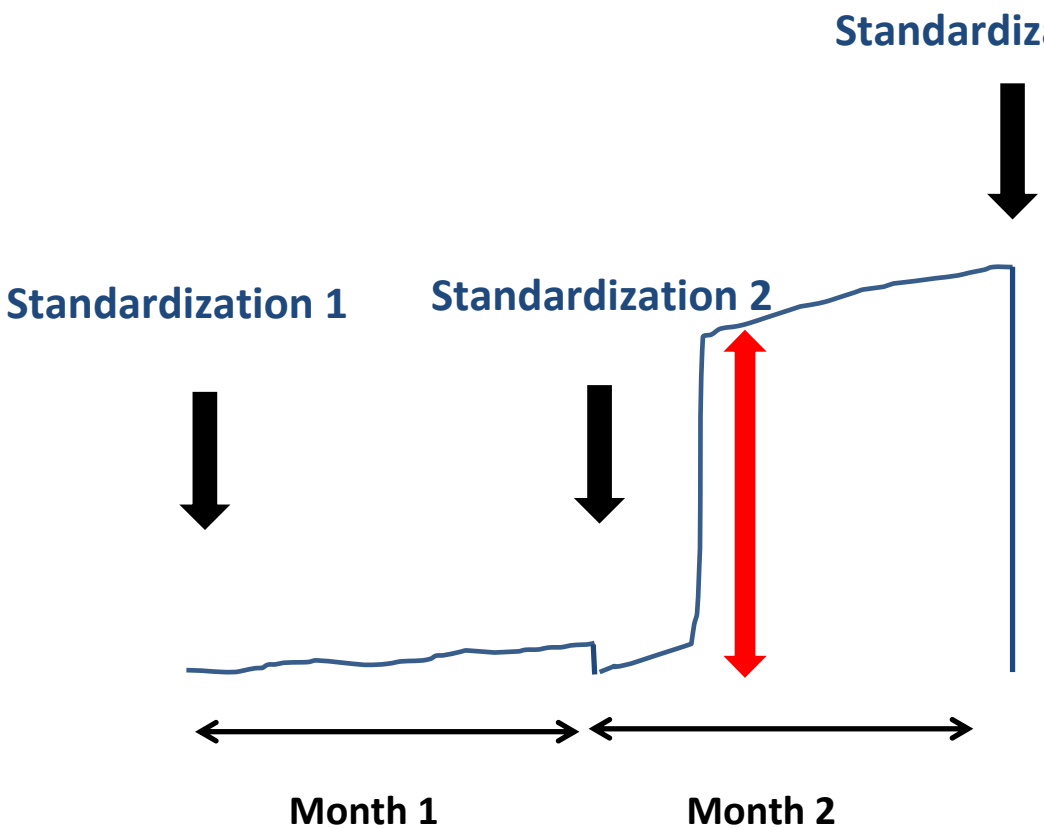
- ✓Creation of common models, more robust
- ✓Use of models on all instruments
- ✓Sharing of data/models
- ✓Creation of spectral database

Daily Monitoring and Stabilization of spectra

1. Monitoring of the stability between 2 PDS standardization
2. If needed, realization of a stabilization procedure

Dailycheck

Monitoring of the stability in time



Strong perturbation

↓

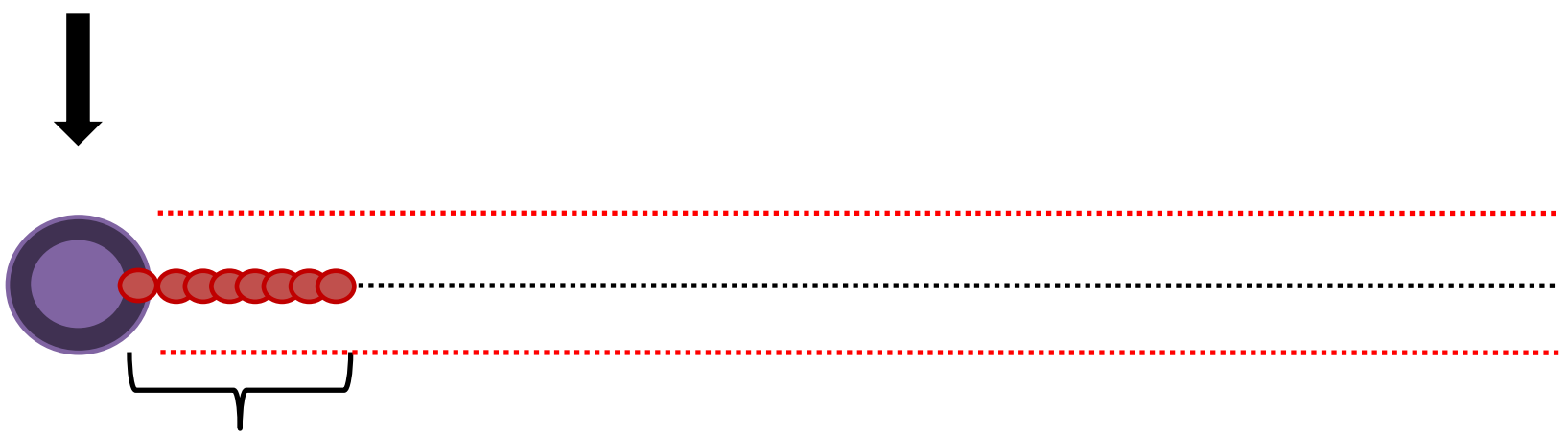
biased predictions

Creation of an alert system for the labs

Dailycheck

Monitoring of the stability in time

Standardization 1



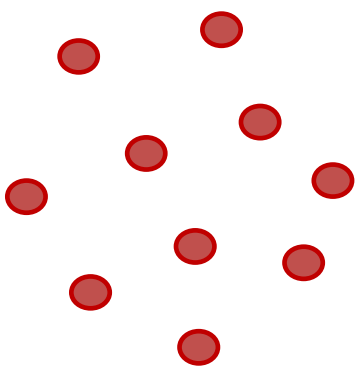
Just after the standardization: 10 UHT milks constituting the stability reference

Dailycheck

Monitoring of the stability in time

- Based on the GH (Global H) which is the standardised Mahalanobis distance

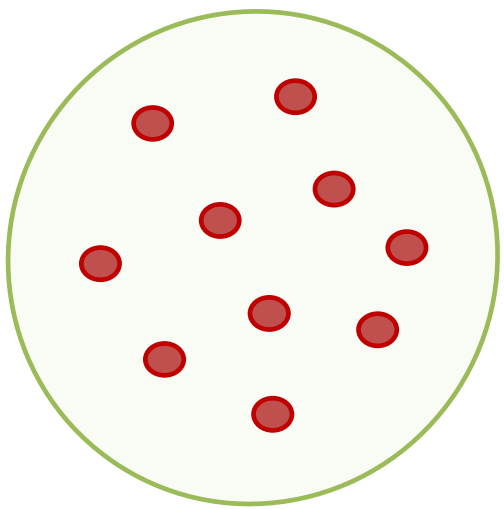
10 UHT milks constituting the stability reference



Dailycheck

Monitoring of the stability in time

- Based on the GH (Global H) which is the standardised Mahalanobis distance



10 UHT milks constituting the stability reference

Variability covered by the stability reference

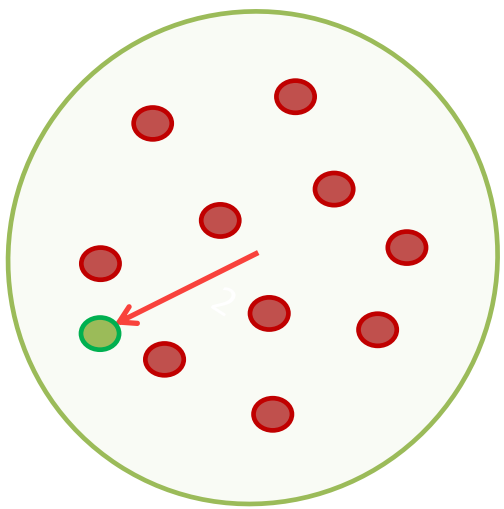
New daily-check sample

Dailycheck

Monitoring of the stability in time

- Based on the GH (Global H) which is the standardised Mahalanobis distance

GH = 2 → OK



10 UHT milks constituting the stability reference

Variability covered by the stability reference

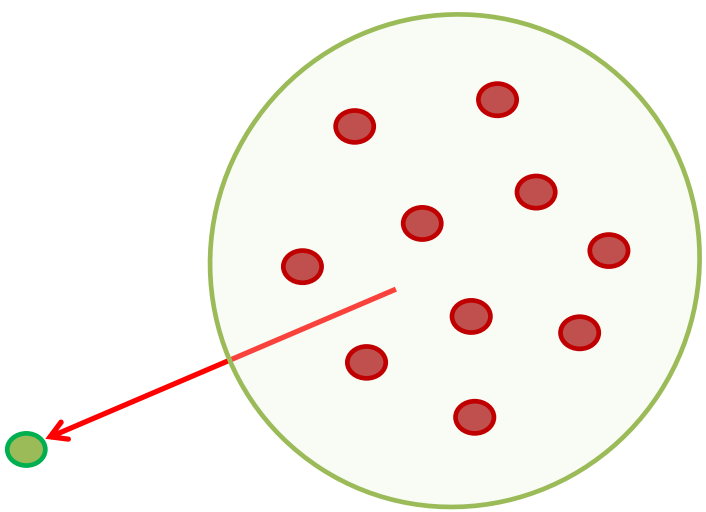
New daily-check sample

Dailycheck

Monitoring of the stability in time

- Based on the GH (Global H) which is the standardised Mahalanobis distance

GH = 20



10 UHT milks constituting the stability reference

Variability covered by the stability reference

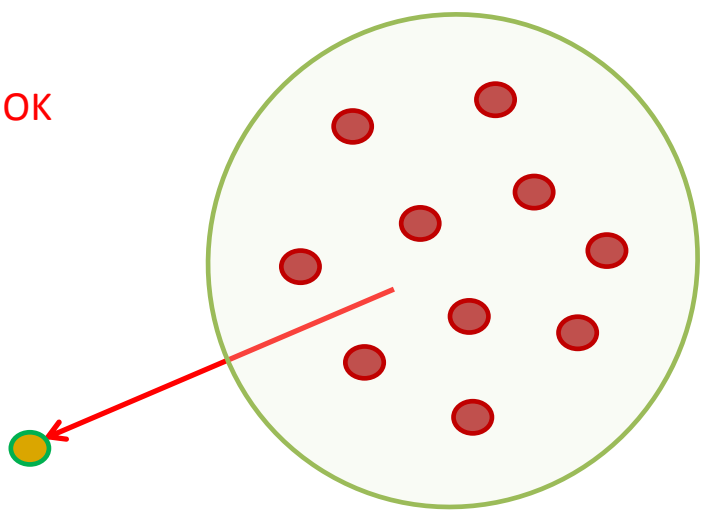
New daily-check sample

Dailycheck

Monitoring of the stability in time

- Based on the GH (Global H) which is the standardised Mahalanobis distance

GH = 20 → NOT OK



10 UHT milks constituting the stability reference

Variability covered by the stability reference

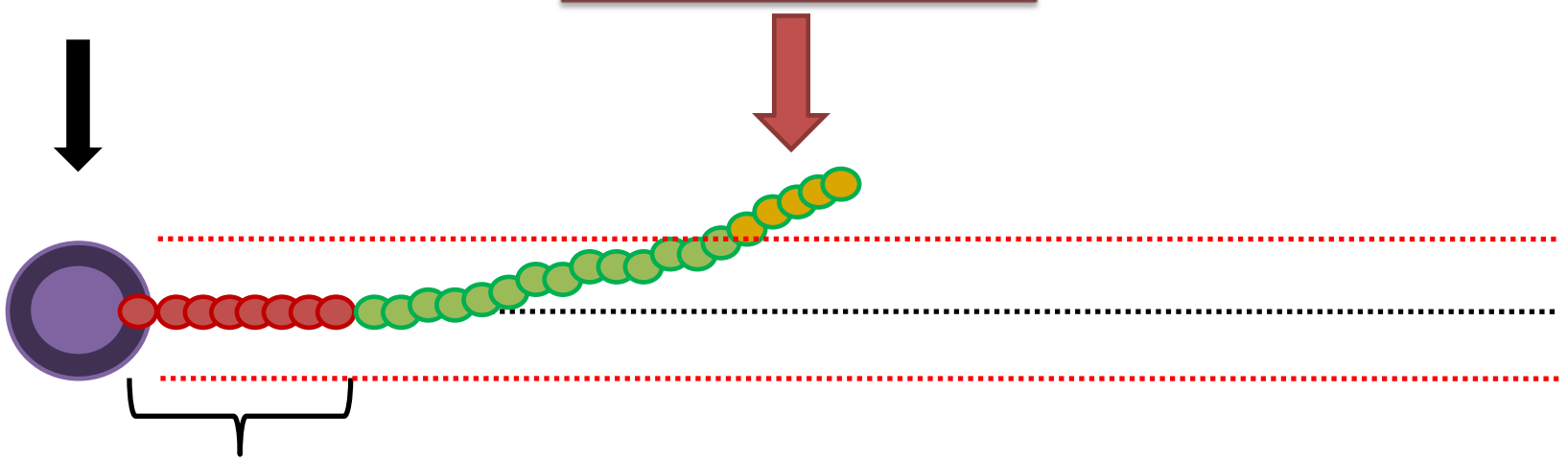
New daily-check sample

Dailycheck

Monitoring of the stability in time

Standardization 1

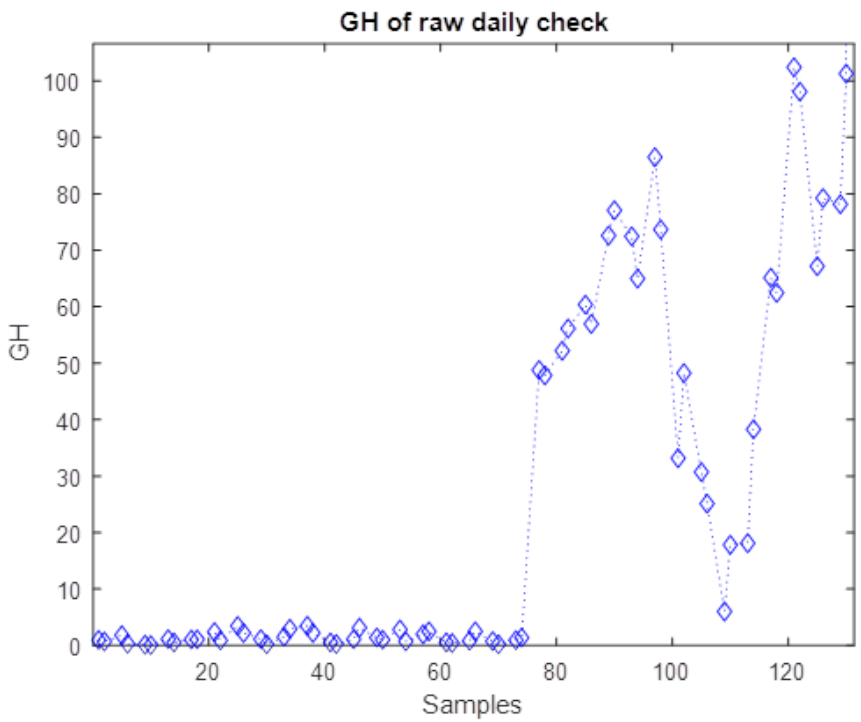
After n samples out:
Alert !



Just after the standardization: 10 UHT milks constituting the stability reference

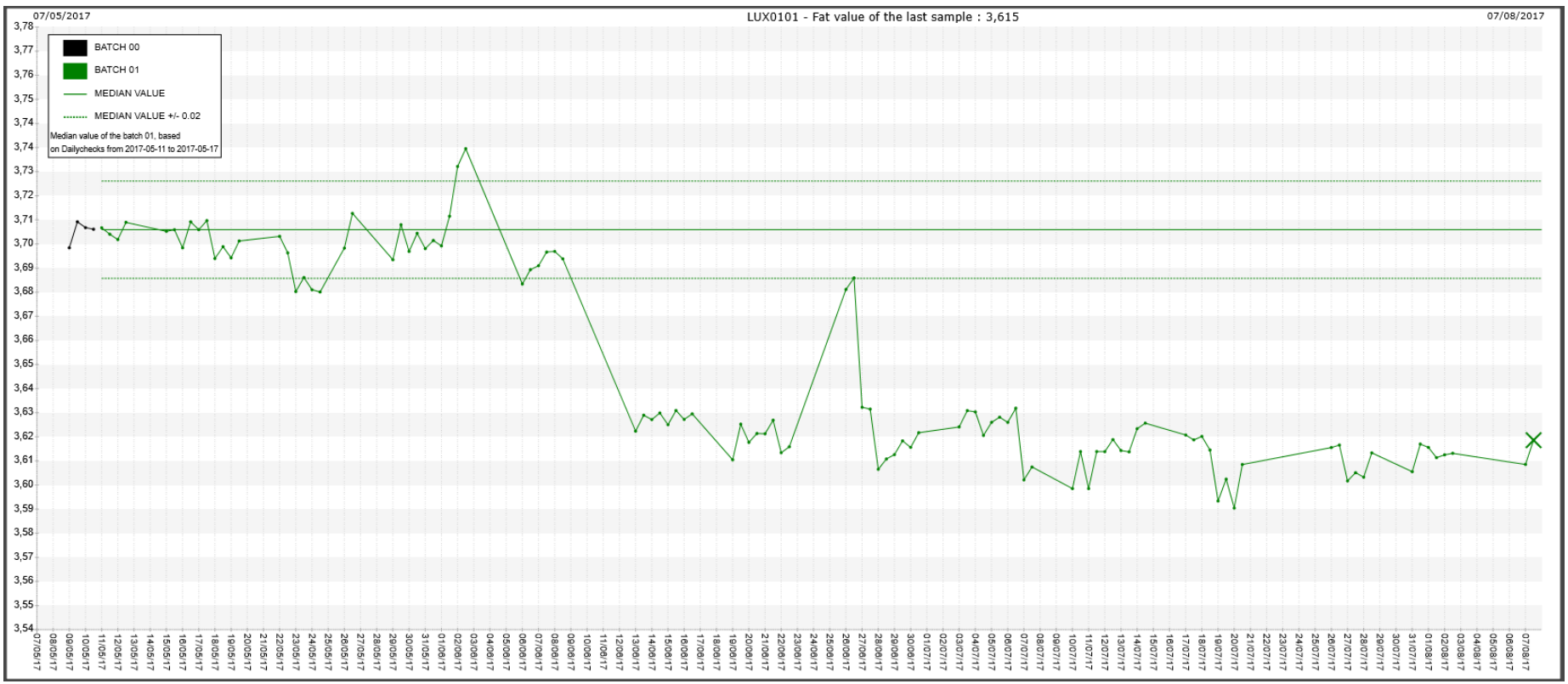
Dailycheck

Monitoring of the stability in time



Dailycheck

Monitoring of the stability in time



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Dailycheck

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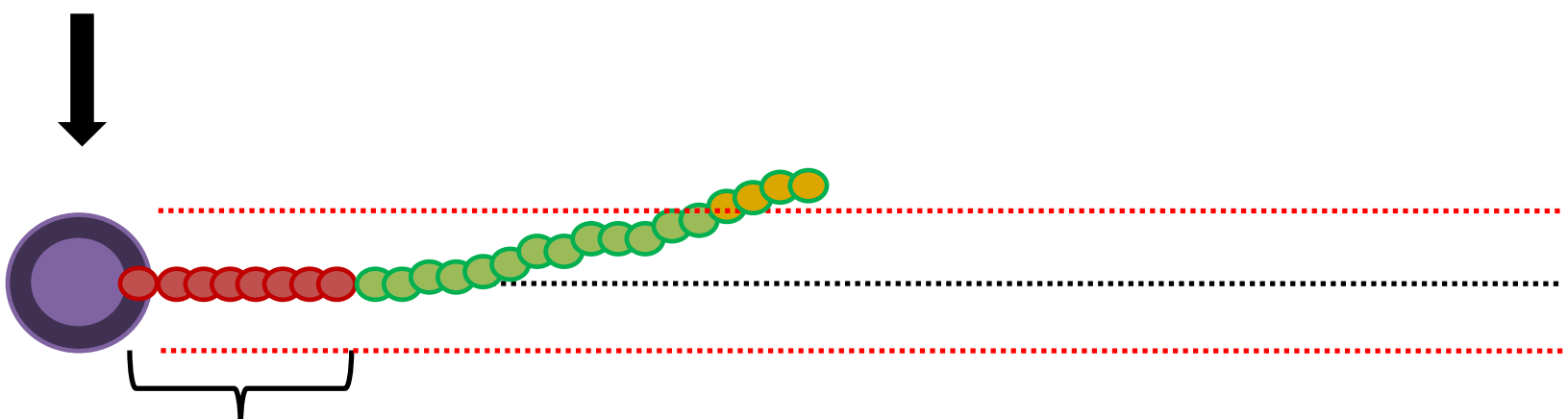
Monitoring of the stability in time

Alert System

Standardization



Just after the standardization: 10 UHT milks constituting the stability reference

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Dailycheck

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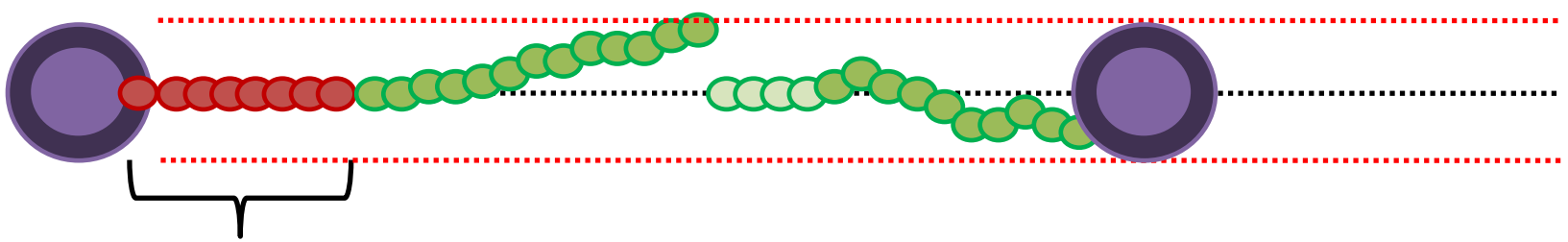
Monitoring of the stability in time

Alert System

Standardization

Stabilization

Standardization



Just after the standardization: 10 UHT milks constituting the stability reference

Stabilization

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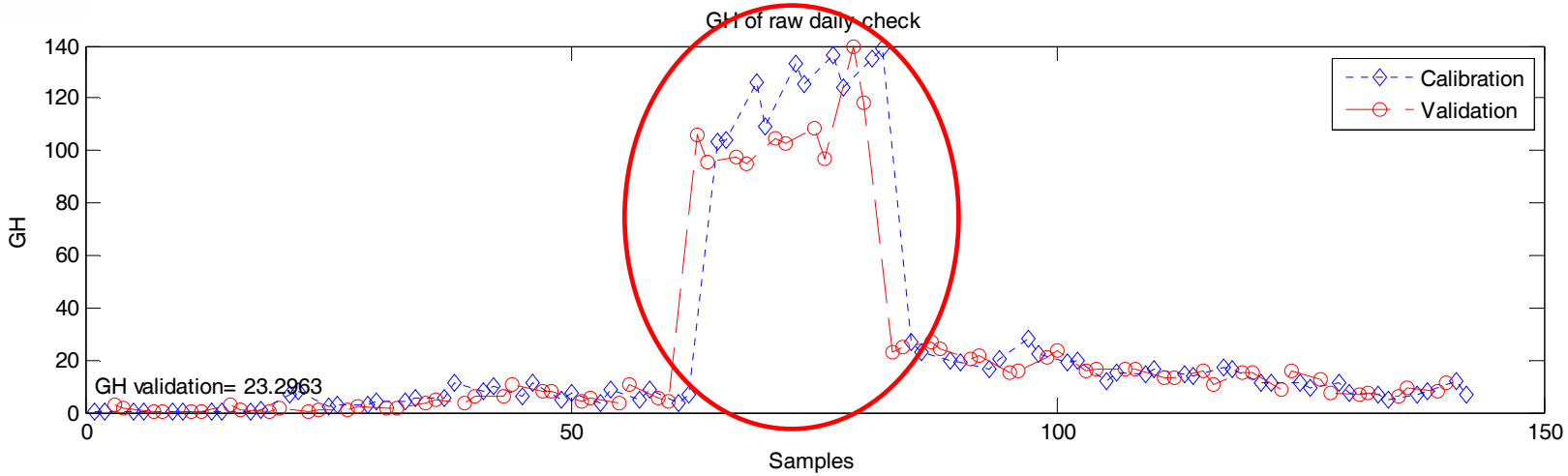
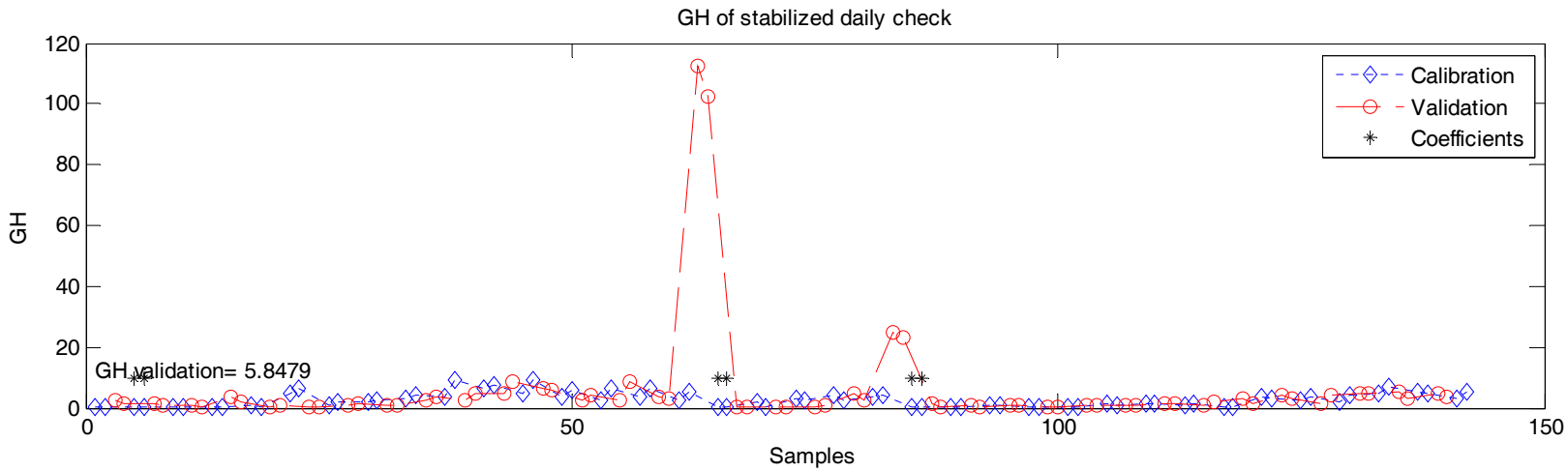
Impact on GH

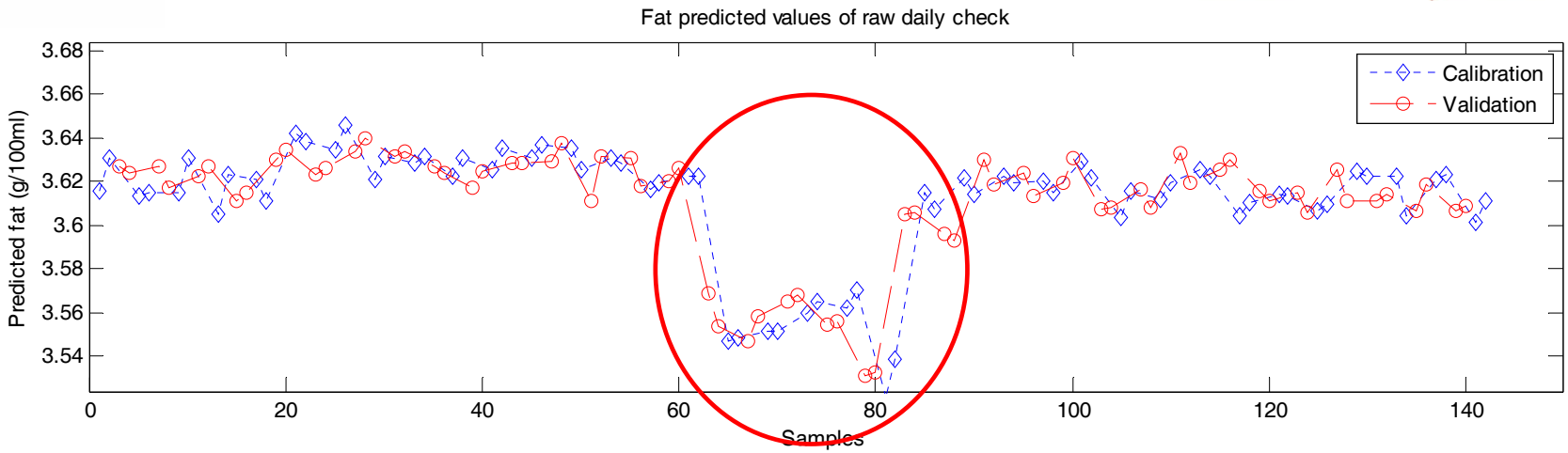


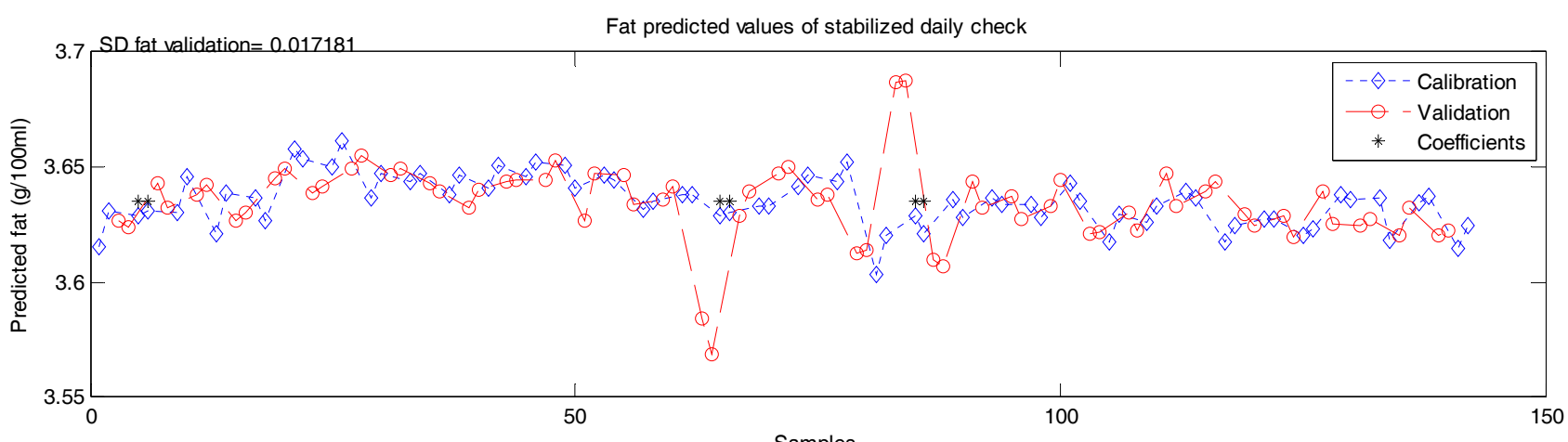


Stabilization

Impact on Fat

SD fat validation= 0.025834





Conclusion:

- Routine standardization:
  - ✓ Creation of common models, more robust
  - ✓ Use of models on all instruments
  - ✓ Sharing of data/models
  - ✓ Creation of spectral database

- Alert detection:
  - ✓ Detection of all deviations/perturbations between 2 monthly ring test based on GH and/or Parameter measurements

- Stabilization:
  - ✓ Potential to use models in routine