Slide 1

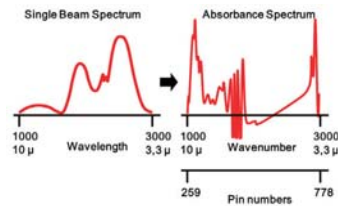**液態及固態乳製品檢測新科技**

New Analytical Technology for Liquid and Solid Dairy Products

孫丕忠 Terence Sun

August 26th 2020, Taoyuan, Taiwan

**Slide 2**

乳製品 品質 Quality of Dairy Products   **FOSS**

液態乳製品快速檢測技術

Rapid Method for The Quality of Liquid Dairy Products

**Slide 3**

FTIR 檢測技術之應用 What Can FTIR Offer Us Today?   **FOSS**

- 自1970年代以來，中紅外線(MIR)光譜分析儀，已成為例行檢測牛奶中主要成分 (脂肪、蛋白質、碳水化合物) 的快速方法
  Mid-Infrared (MIR) spectroscopy has been available since the 1970's as a rapid method for routine measurements of the main constituents in milk (fat, protein, carbohydrates)

- 傅立葉轉換式紅外光譜 (FTIR) 是獲取 MIR 光譜分析的最新方法
  Fourier Transform Infrared (FTIR) spectroscopy is the state-of-the-art method for acquiring MIR spectra analyzing
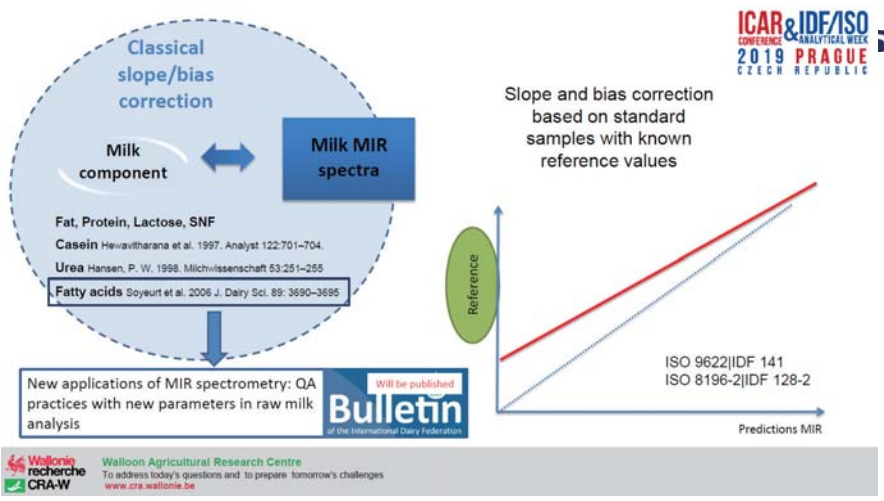

Slide 4
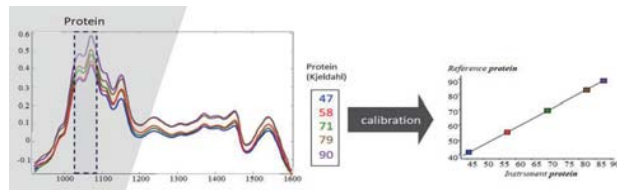
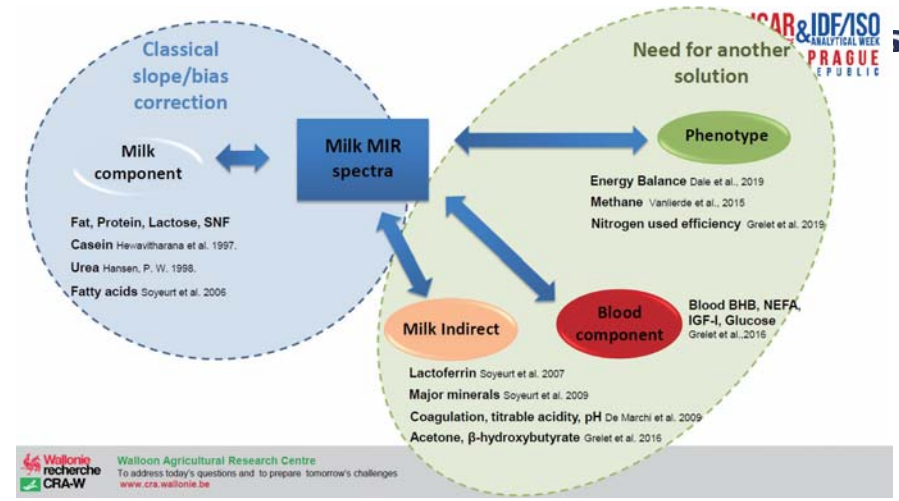**液態乳 MIR 光譜** Mid IR Spectra of Liquid Milk   **FOSS**
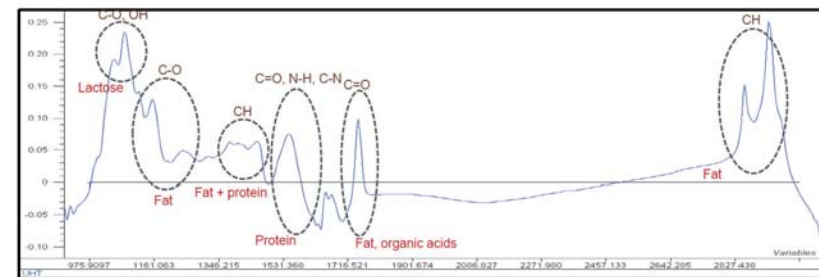
- Position of the peaks → Qualitative analysis
- Intensity of the peaks → Quantitative analysis

※ Frédéric Dehareng & Clément Grelet, ICAR 2019 Conference, Technical session 7: Challenges in Creating Additional Value from Milk Analysis

Slide 1 (top-left)

Classical slope/bias correction

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

Slope and bias correction based on standard samples with known reference values

Reference

ISO 9622|IDF 141
ISO 8196-2|IDF 128-2

Predictions MIR

New applications of MIR spectrometry: QA practices with new parameters in raw milk analysis

Will be published **Bulletin** of the International Dairy Federation

Wallonie recherche CRA-W — Walloon Agricultural Research Centre
To address today's questions and to prepare tomorrow's challenges
www.cra.wallonie.be

※ Frédéric Dehareng & Clément Grelet, ICAR 2019 Conference, Technical session 7: Challenges in Creating Additional Value from Milk Analysis

Slide 2 (top-right)

Classical slope/bias correction

Milk component ↔ Milk MIR spectra

Fat, Protein, Lactose, SNF
Casein Hewavitharana et al. 1997.
Urea Hansen, P. W. 1998.
Fatty acids Soyeurt et al. 2006

Need for another solution

Phenotype
Energy Balance Dale et al., 2019
Methane Vanlierde et al., 2015
Nitrogen used efficiency Grelet et al. 2019

Milk Indirect
Blood component — Blood BHB, NEFA, IGF-I, Glucose Grelet et al., 2016

Lactoferrin Soyeurt et al. 2007
Major minerals Soyeurt et al. 2009
Coagulation, titrable acidity, pH De Marchi et al. 2009
Acetone, β-hydroxybutyrate Grelet et al. 2016

Wallonie recherche CRA-W — Walloon Agricultural Research Centre
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※ Frédéric Dehareng & Clément Grelet, ICAR 2019 Conference, Technical session 7: Challenges in Creating Additional Value from Milk Analysis

Slide 3 (bottom-left)

ICAR 2019 會議 – FTIR 新的檢測模式
ICAR 2019 Conference – Focus on New Tools

FOSS

Hall Panorama

Time	Session
8:30-10:30	**Technical Session 7** — **Challenges in Creating Additional Value from Milk Analysis** — Chairpersons: Silvia Orlandini and Jere High
8:30-8:50	S07(T)-OP-1 **Additional value of cell differentiation in the course of DHI testing** — Folkert Onken
8:50-9:10	S07(T)-OP-2 **Pregnancy testing in dairy cows using a PAG test in milk samples: Different thresholds for different stages of the pregnancy** — Daniel M. Lefebvre
9:10-9:30	S07(T)-OP-3 **New quality assurance challenges with recent mid-infrared models** — Frédéric Dehareng
9:30-9:50	S07(T)-OP-4 **Implementation of a routine Fourier-transform infrared procedure for fatty acid analysis in milk** — Daniel M. Lefebvre
9:50-10:10	S07(T)-OP-5 **Routine infrared phosphorous determination in ex-farm milk giving better insight in the phosphorous cycle on dairy farms** — Harrie van den Bijgaart
10:10-10:30	Question and Discussion

Slide 4 (bottom-right)

ICAR 2019 會議 – FTIR 新的檢測模式
### ICAR 2019 Conference – Focus on New Tools

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Electronic posters

S07(T)-PP-01 „MastiMIR" - A mastitis early warning system based on MIR spectra — Laura Monica Dale

S07(T)-PP-02 Prediction of evaluated energy balance (NEL and ME) in dairy cows by milk mid-infrared (MIR) spectra — Laura Monica Dale

S07(T)-PP-03 „KetoMIR2" - Modelling of ketosis risk using vets diagnosis and MIR spectra for dairy cows in early lactation — Laura Monica Dale

S07(T)-PP-04 The use of fatty acid profiles from milk recording samples to predict body weight change of dairy cows in early lactation in commercial dairy farms — Franziska Dettmann

S07(T)-PP-05 Large scale dataset to improve and validate the prediction of lactoferrin content using milk mid-infrared spectrometry — Hélène Soyeurt

S07(T)-PP-06 A first approach to predict nitrogen efficiency of dairy cows through milk FT-MIR spectra — Clément Grelet

S07(T)-PP-07 From new milk-testing parameters to new DHI services – The view of an instrument manufacturer — Daniel Schwarz
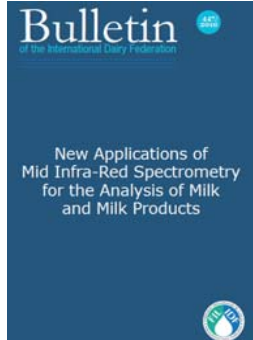
Slide 1:
國際乳業聯盟(IDF) 公告
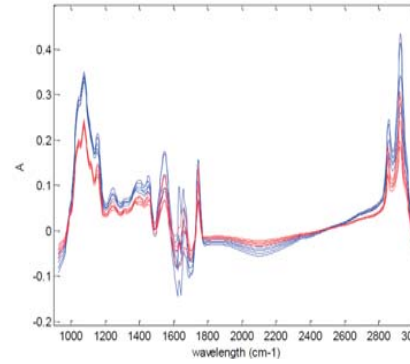Bulletin-International Dairy Federation, IDF
IDF 447 Published 2010
IDF 504 Published 2020

Slide 2:
FTIR 檢測模式-品質確保的新挑戰
New Quality Assurance Challenges with FTIR Models

Slide 3:
FTIR 檢測模式-品質確保的新挑戰
New Quality Assurance Challenges with FTIR Models
解決方案 → 光譜標準化
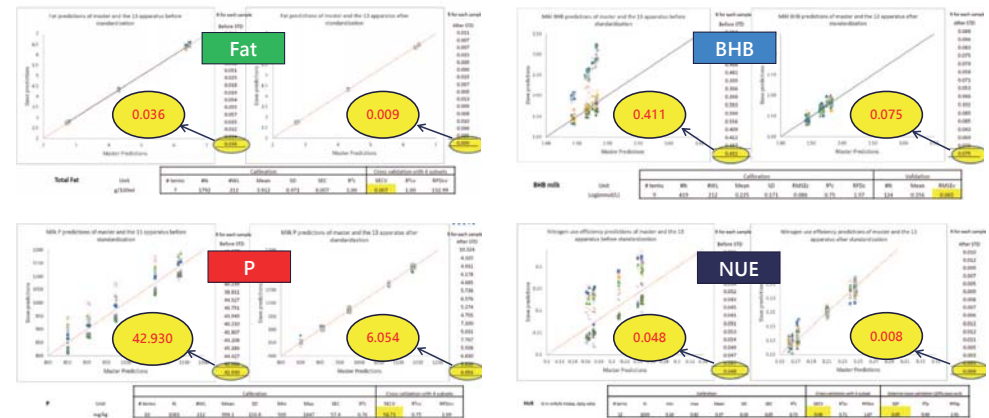IDF 490 Published 2017

Slide 4:
5 個生乳樣品 - Fat, BHB, Phosphorous, Nitrogen use efficiency
6 台 MilkoScan FT+ (法國) & 7 台 MilkoScan FT 6000 (瑞士)

MilkoScan™ FT3
**The World's First**
Intelligent Milk Analyser

專利光譜標準化技術-預防儀器漂移
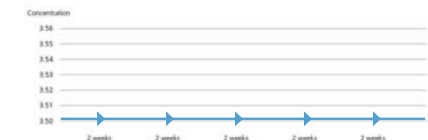### Always Standardised-No More Instrument Drift

FOSS

- MilkoScan™FT3 導入FOSS新取得專利之光譜自動標準化技術，此技術無需人工干預，亦不需使用FTIR標準液

- 隨著光譜自動標準化技術新專利的推出，儀器之間不再存在漂移和結果變化的情況

- MilkoScan FT3 每兩小時自動執行光譜標準化一次，消除儀器漂移，使檢測結果持續維持穩定的一致性

- 光譜自動標準化技術，不僅可以年復一年地實現檢測設備穩定的高性能，不再需要執行耗時的標準化檢查，大幅減少高成本的傳統分析校正，同時還提供了提高利潤和優化成本的機會。。

現行方式光譜標準化 | MilkoScan™ FT3 自動光譜標準化
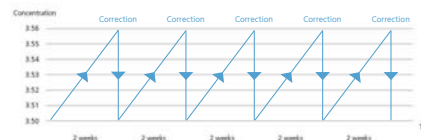
自我診斷功能-確保儀器正常運作
Instrument Self-Diagnostic Ensure High Up-Time

FOSS

提供超過100個解決方案提示

Warning

內建 20個 ID Chips

檢測產品種類及項目
Full Coverage Robust Calibrations

FOSS

Milk
Fat, Protein, Casein, Lactose, Low Lactose, Glucose, Galactose, Total Solids, Solids Non Fat, Density, Citric Acid, Urea, Free Fatty Acids, Titratable Acidity and Freezing Point

Cream
Fat, Protein, Lactose, Total Solids and Solids Non Fat and Freezing Point

Whey
Fat, Protein, Lactose, Total Solids, Solids Non Fat and Titratable Acidity

Yoghurt & fermented application
Fat, Protein, Lactose, Total Solids, Solids Non Fat, Glucose, Fructose, Sucrose, Total Sugars and Lactic Acid

Dessert & ice cream application
Fat, Protein, Lactose, Total Solids, Solids Non Fat, Glucose, Fructose, Sucrose, Total Sugars and Lactic Acid

Concentrated & fortified milk
(Conc. Milk, Baby Milk, Infant formula, infant formula powder, Evaporated Milk, Sweetened Condensed Milk)
Fat, Protein, Lactose, Total Solids and Solids Non Fat

Whey concentrates & permeate
(WPC, WPI and concentrated permeate)
Fat, Protein, Lactose, Total Solids, Solids Non Fat and Titratable Acidity

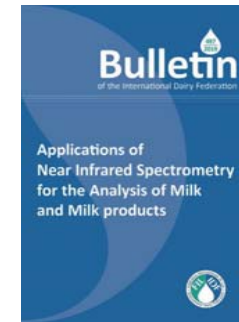**Other Applications**

Juice, Soy Sauce.......

- MilkoScan FT3 允許對分析樣品的粘度進行自動調整，因此可對高固體含量的WPC進行可靠的分析

乳製品 品質 Quality of Dairy Products

固態及半固態乳製品快速檢測技術
Rapid Method for The Quality of Solid and Semi-solid Dairy Products

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國際乳業聯盟(IDF) 公告
Bulletin-International Dairy Federation, IDF

IDF 497 Published 2019

固態及半固態乳製品快速分析儀
FoodScan™ 2 for Solid and Semi-Solid Dairy Products Analysis

FoodScan™ 2
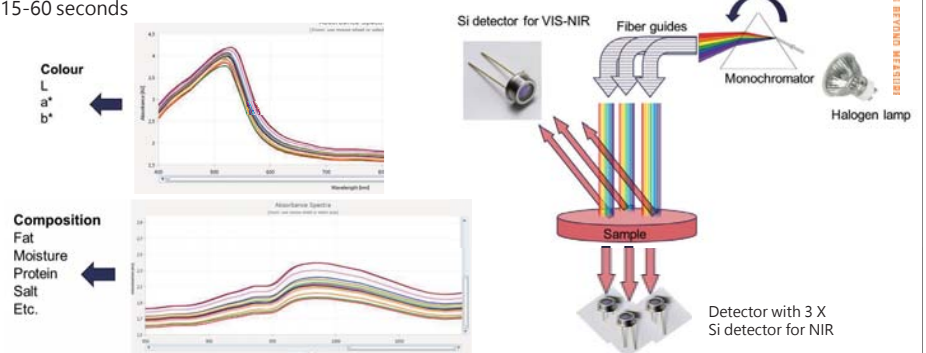### A VARIANT TO SUIT YOUR NEEDS

FoodScan™ 2

採用 近紅外光穿透式技術 **(NIR transmission)** 檢測固態及半固態乳製品

例如：butter and spreads, cheese, yoghurt, quark...等

亦可應用於肉製品檢測 (牛肉、羊肉、雞肉、魚肉...)

檢測原理 FoodScan - Operating Principle

- NIR Transmittance 400-1100 nm on a rotating sample +1 reflectance detector, enabling color analysis
- 3 spot transmission, 3 times the volume analysed, with less rotations
- 15-60 seconds

Colour
L
a*
b*

Composition
Fat
Moisture
Protein
Salt
Etc.

Si detector for VIS-NIR
Fiber guides
Monochromator
Halogen lamp
Sample
Detector with 3 X
Si detector for NIR

Slide 1 (top left)

1 登錄樣品資訊
↓
2 檢測
↓
3 得到結果

可同時測得樣品
色度 (CIE L* a* b standard)

FOSS

15 sec.

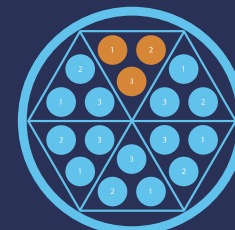NATIONAL CHEESE INSTITUTE CHEESE COLOR STANDARDS

Slide 2 (top right)

大幅降低樣品前處理的時間

可獲得樣品更多的資訊

Accurate results every time because:

- With 3 sub-scans an even larger share of the sample is measured, which make you less dependent on the homogenisation step
- FoodScan™ 2 is a major step forward in NIR transmission technology

Slide 3 (bottom left)

人工神經網路 (ANN) 技術檢量線

原物料的改變、生產製程的變化及消費者喜好的改變而產生新產品是不可避免的趨勢

以人工神經網路 (ANN) 技術建立的檢量線，具有智能性及穩固性，可確保具備處理所有問題的能力

如果所需要檢測的樣品種類或檢測項目，未涵蓋在ANN檢量線中，FOSS可提供支援協助客戶，進行客製化的服務

FOSS

ANN Artificial Neural Networks

收集超過30,000筆樣品資訊建立ANN檢量線

檢量線範圍涵蓋絕大多數的固態及半固態乳製品

↓

CHEESE
BUTTER
SPREADS
CULTURED AND FERMENTED PRODUCTS
WHEY POWDER

Slide 4 (bottom right)

優良食品安全之願景
GoodProduct – A Strong Vision

FOSS

GoodProduct™

Tools to secure an effective and safe supply chain