

Application Note 23: Measurement of Whole Milk using the NIT-38 Dairy Analyser



Introduction:

The NIT-38 Dairy Analyser provides a means of analyzing a broad range of dairy products for components, such as, protein, fat and moisture. The NIT-38 is a NIR transmission spectrophotometer based on diode array technology. The analyzer scans the NIR spectrum from 720 to 1100nm. Within this region, C-H (fat), N-H (protein) and O-H (water), absorb NIR energy. The analyzer measures the amount of light absorbed by a sample as the light passes through it. The transmitted light is separated into its frequency domain using a concave holographic grating and a silicon photo diode array detector. Partial Least Squares (PLS) regression techniques are used to correlate the NIR spectra with the concentration of protein, fat and moisture in the samples. Calibration models are then downloaded into the NIT-38 Analyser. Analysis of routine samples is as easy as loading the sample cell, selecting the product type and following the instructions on the screen. Analyses of up to 4 constituents are provided within 60 seconds.

Description:

10 samples of whole milk were scanned in duplicate on the NIT-38 Dairy Analyser using a Liquid Cell with a 5mm pathlength. 3 spectra were collected for each sample scan. The spectra were stored in the analyser's memory and later transferred to a PC. The spectra of several samples of milk are shown below.

Analyses for Fat, Protein and Lactose were provided based on a Foss Milkoscan, were combined with the spectral data in Microsoft Excel. The file was loaded into NTAS(NIR Technology Australia Software) suite and a PLS calibration performed on each constituent.

The same 10 samples were scanned and used as a prediction set.

Results:

The attached four figures shows the prediction data for each constituent.

The following table summarises the prediction set data.

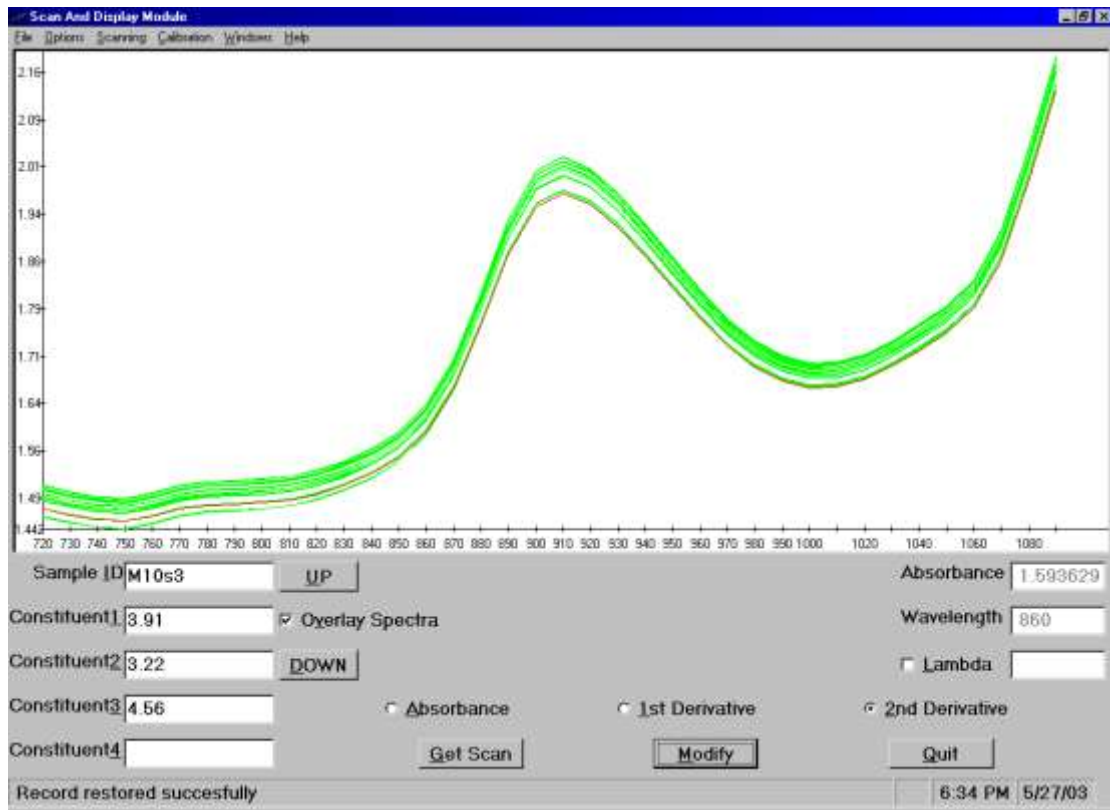
Constituent	Fat	Protein	Lactose
SEC	0.012	0.02	0.016
R ²	0.99	0.96	0.98
SEP	0.027	0.032	0.04

Discussion:

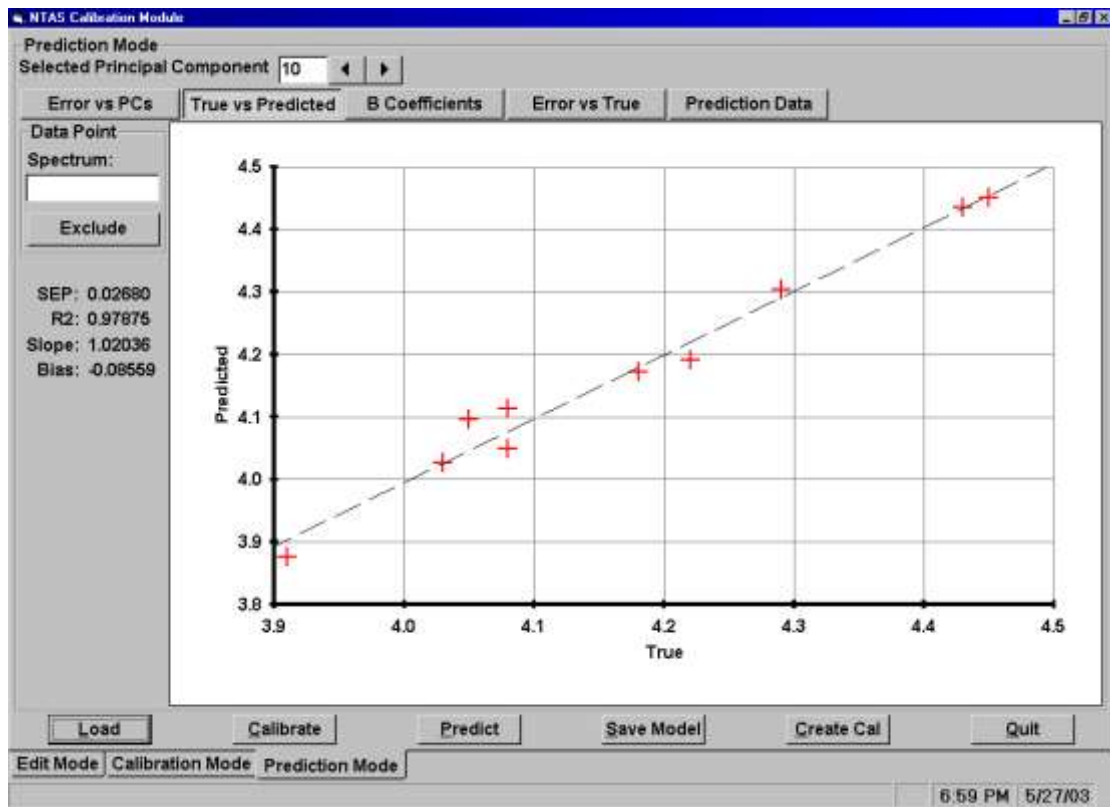
It must be stated that the prediction set is not a valid test of the accuracy of these calibrations, since the set contains the same samples used for calibration. Unfortunately there were insufficient samples provided to make a separate prediction set.

The calibration statistics for fat, protein and lactose show excellent correlation and low errors. The statistics for the prediction set show higher errors. This is considered to be caused by insufficient samples to develop a robust calibration. It is recommended that between 50 and 100 samples of whole milk be scanned with as broad a constituent range as possible. As well, samples covering wider regional selection as well as over many months would be beneficial.

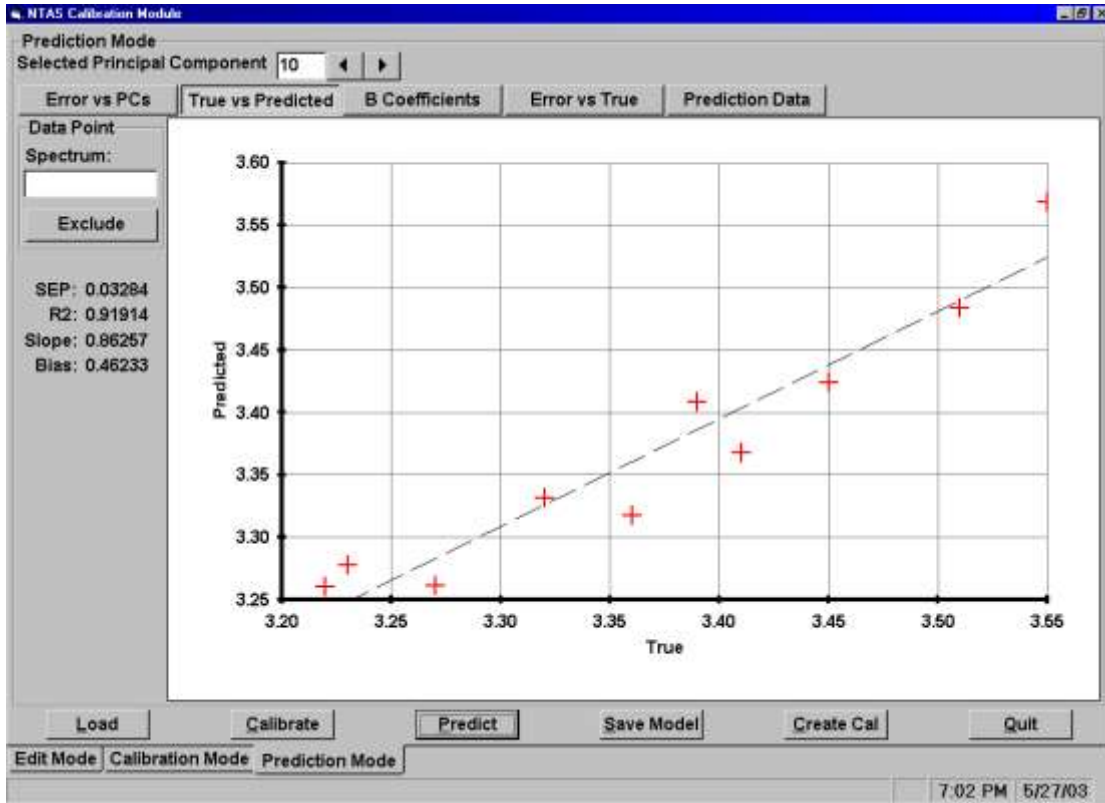
The data presented above demonstrates that the NIT-38 Dairy Analyser is capable of measuring fat, protein and lactose in milk.



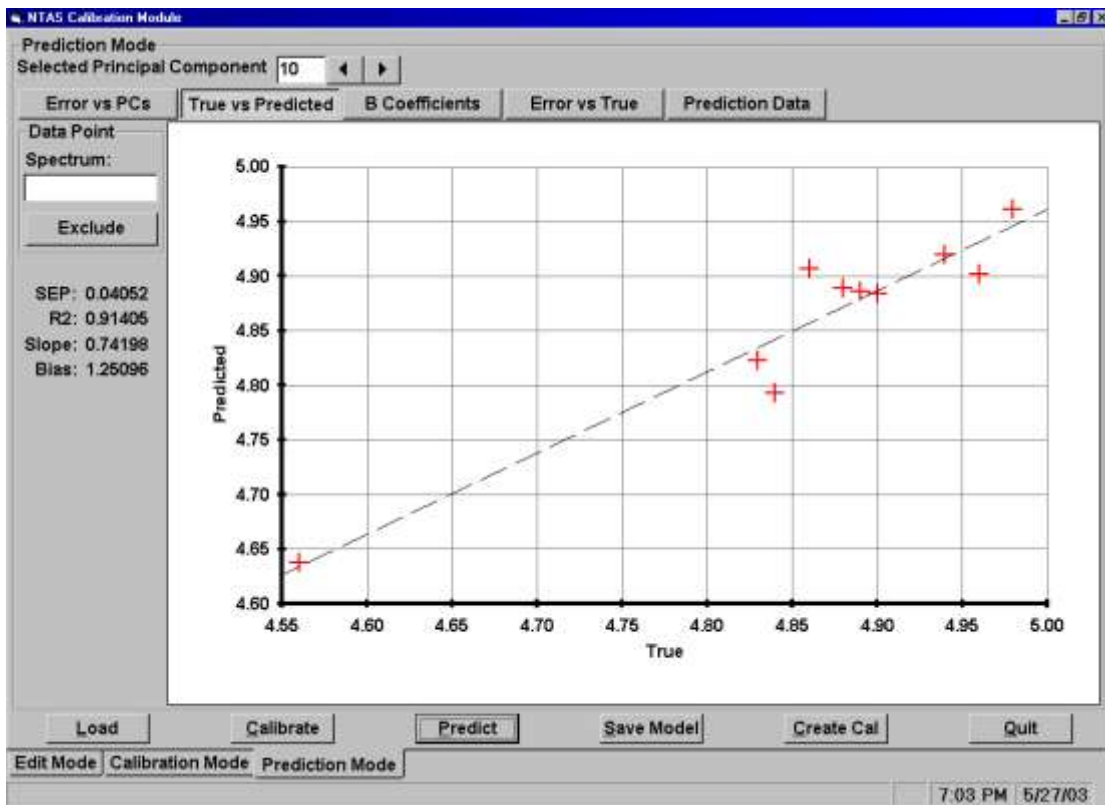
Milk Spectra



Milk Fat Prediction



Milk Protein Prediction



Milk Lactose Prediction