Application Note 44: Analysis of Cheese and Cheese Slices

Introduction:

In the NIR region there are three major chemical entities measured, C-H = fat, N-H = protein, O-H = water and C-O-H = sugar. These happen to be the major components of dairy, food and agricultural products. As such analysis of fat, protein, water and sugars in milk and cheese are well established. NIT, Near Infrared Transmission spectroscopy, measures fat, protein and water in cheese by passing light through a 10mm thick sample of the cheese. NIT offers the advantage over NIR reflectance measurements, in that the spectra are collected through the sample and not just the surface.

This study looks at the ability to develop NIT calibrations for pH and Moisture in Cheese Slices and the bulk cheese used in the preparation of the slices. pH is not measured directly in the NIR region, however the pH of the sample affects the water peak and this can be used to calibrate for pH.

Data was also provided for Fat and Salt, however there were too few samples to draw any real conclusions. Nonetheless calibration plots are shown. If more data can be provided for fat and salt in these samples, then these parameters can be explored further.

Description:

15 samples of Cheese Slices and 12 samples of Bulk Cheese were provided. Various composition levels for ph, moisture, fat and salt were provided. There was no reference to the nature of the laboratory tests used to make the measurements.

Samples of bulk cheese were placed into a Squeeze Cell with a 10mm pathlength. The cell was closed and the sample was compressed to fill the sample cell. The cell was placed into the NIT-38 Dairy Analyser and 5 scans were collected as the sample cell moved in front of the light beam. The samples were each scanned induplicate with the sample being replaced between scans.

For the Sliced Cheese, 6 slices were removed from their plastic sleeves and laid on top of each other. A knife was used to trim the stack of slices so that they could be placed into the Squeeze Cell. The cell was closed and the slices compressed between the two windows. 5 scans for each sample were collected, however the scans were not repeated in duplicate as there was only enough sample to make one measurement.

No cleaning was done between scans as there was little carry over from any sample.

The scans were uploaded from the NIT-38 Dairy Analyser and brought into Microsoft Excel. The reference data for pH, moisture, fat and salt were entered into the appropriate columns in the Excel spreadsheet. The sets of five scans were averaged to form a single scan for each set. The resulting spectral file was loaded into NTAS, NIR Technology Australia Software, to perform Partial least Squares regression between the reference data and the NIT spectra.

Results:

Figures 1, 2 and 3, show the NIT spectra of the bulk cheese, cheese slices and both sets together. The large peak at 920nm is the moisture band. The shoulder peak at 860nm is the fat band. Protein which would also be present absorbs around 1020nm.

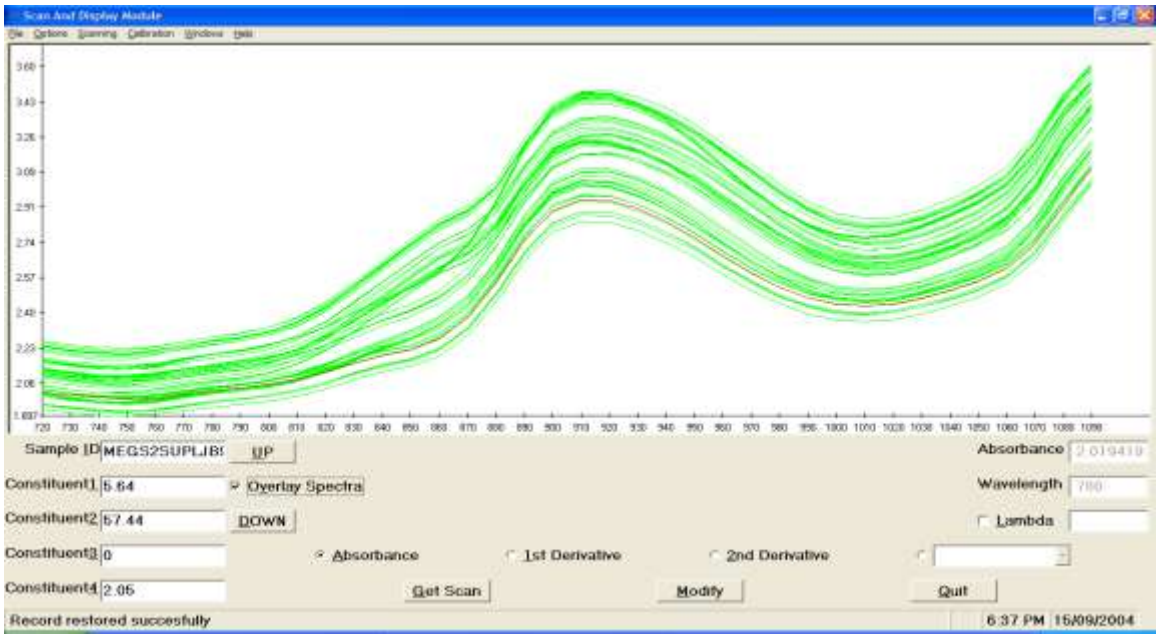

Fig 1. NIT Spectra of Cheese Slices

It can be seen that there are slight differences in the consistency of the spectra of the bulk cheese as compared with the sliced cheese. This reflects the difficulty in loading the bulk cheese samples. It may be better to process the bulk cheese in some form of blender prior to loading in the sample cell, or to heat the sample slightly so that it is more malleable.

The Cheese Slices were very easy to prepare and the NIT spectra shows the consistency of the product.

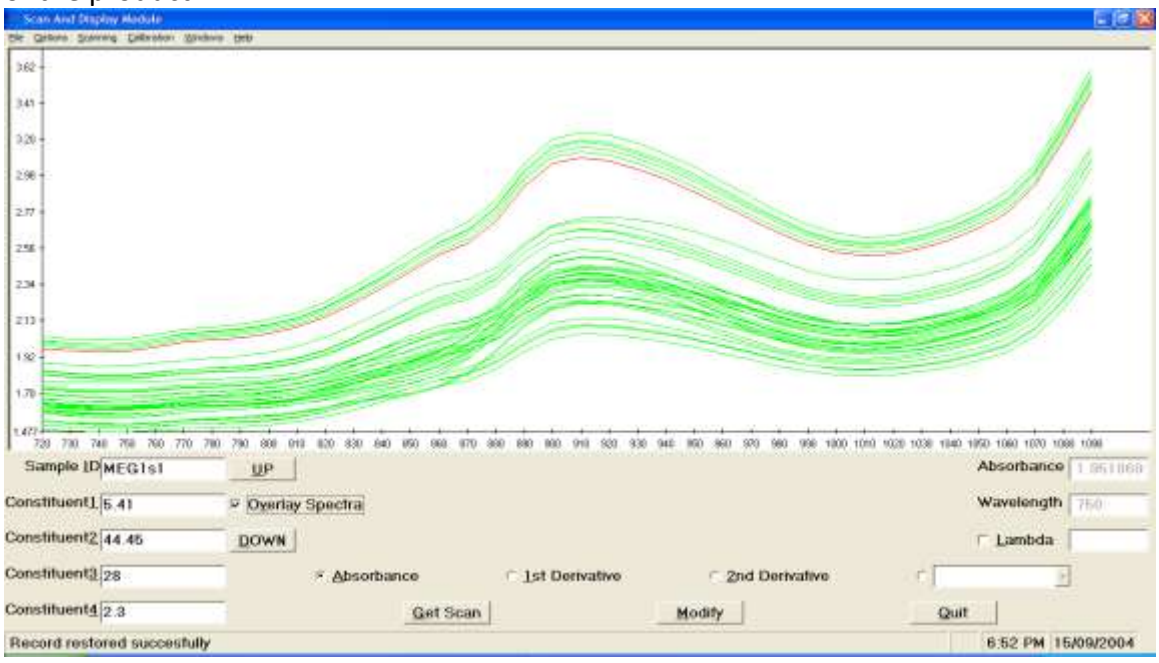

Fig 2. NIT Spectra of Bulk Cheese

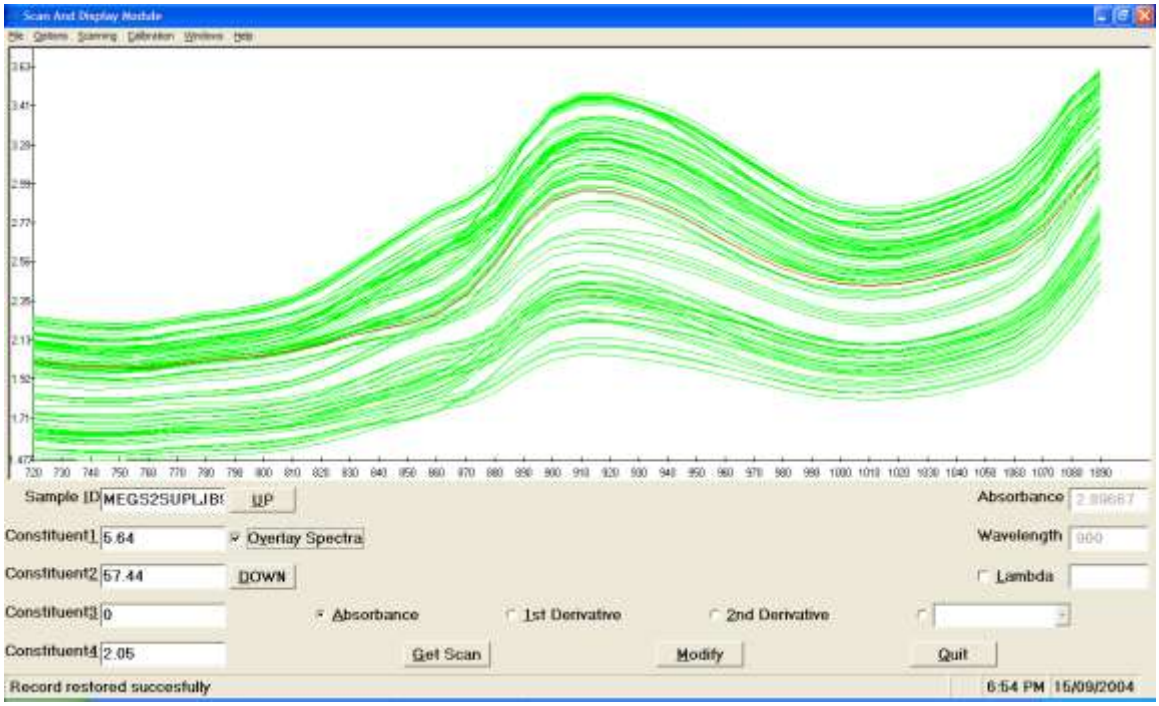

Fig 3. NIT Spectra of Bulk Cheese and Cheese Slices

Figures 4 through 11 show the calibration plots for the various components in each type of cheese. It can be seen that by separating the spectra into Cheese Slices and Bulk Cheese, the calibration plots are far superior. This reflects that there are significant differences between the two types of cheese and as such two separate calibrations should be used.

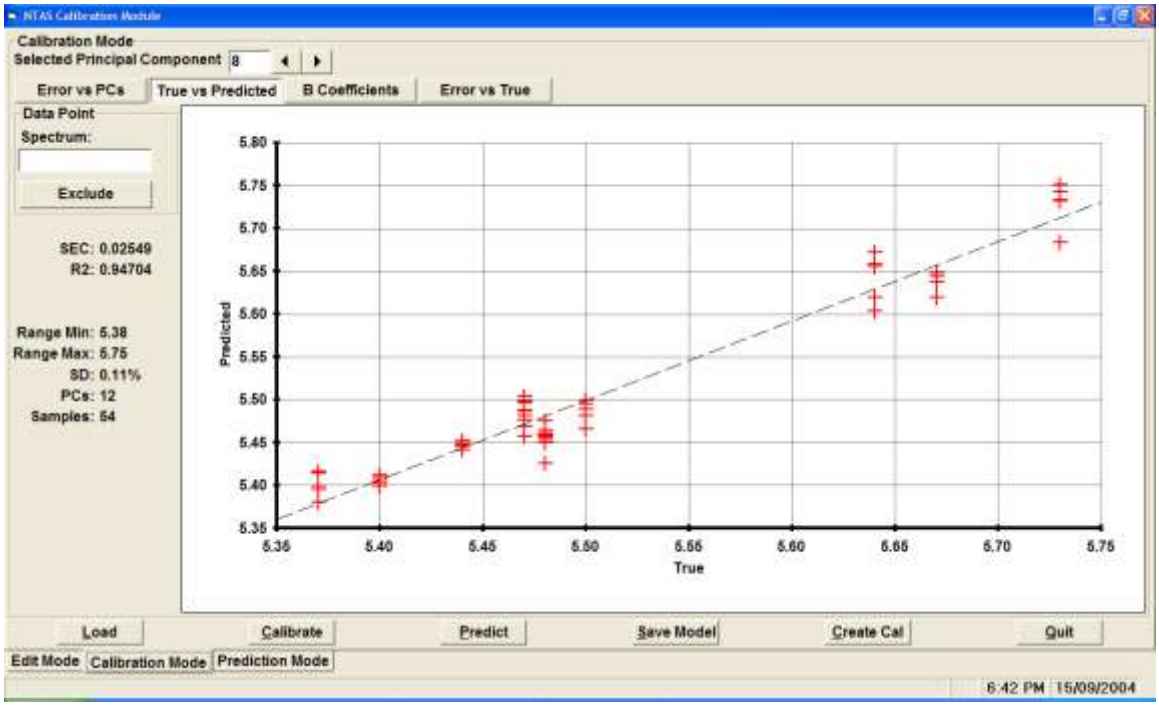

Fig 4. Calibration Plot for pH in Cheese Slices.

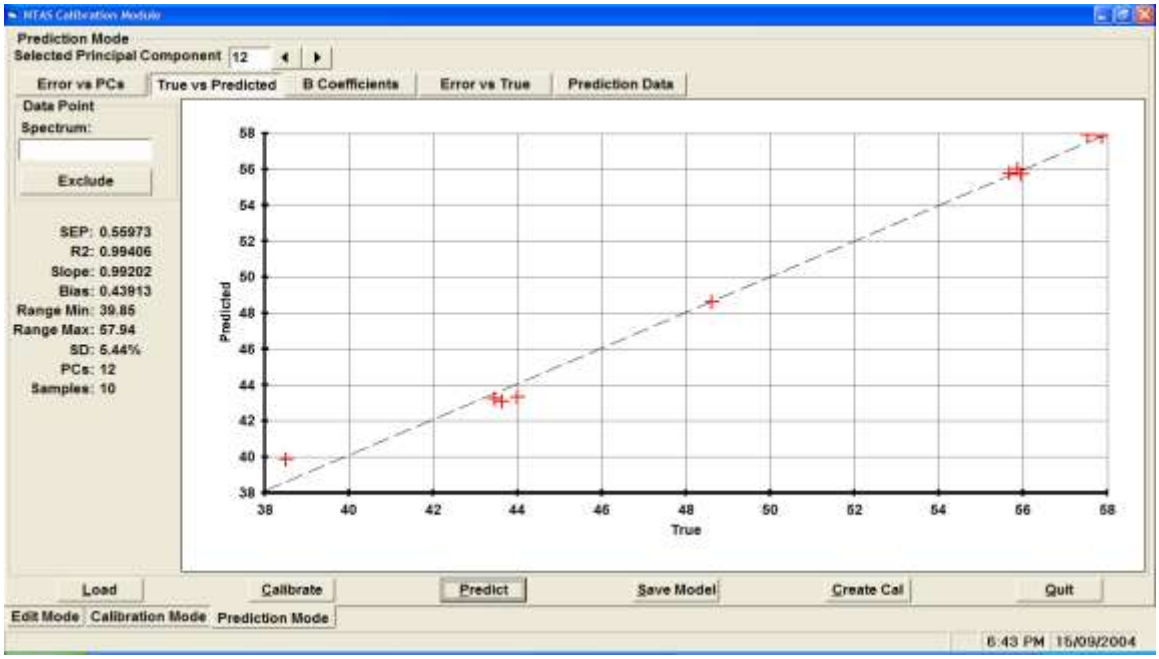

Fig 5. Calibration Plot, Moisture in Cheese Slices

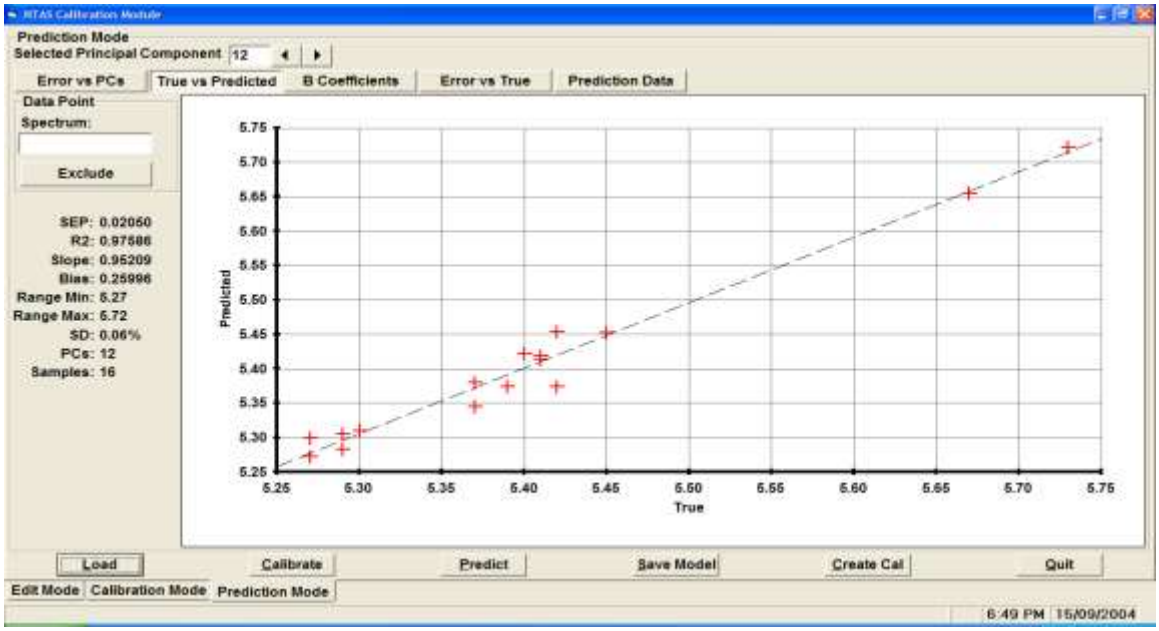

Fig 6. Calibration Plot for pH in Bulk Cheese.

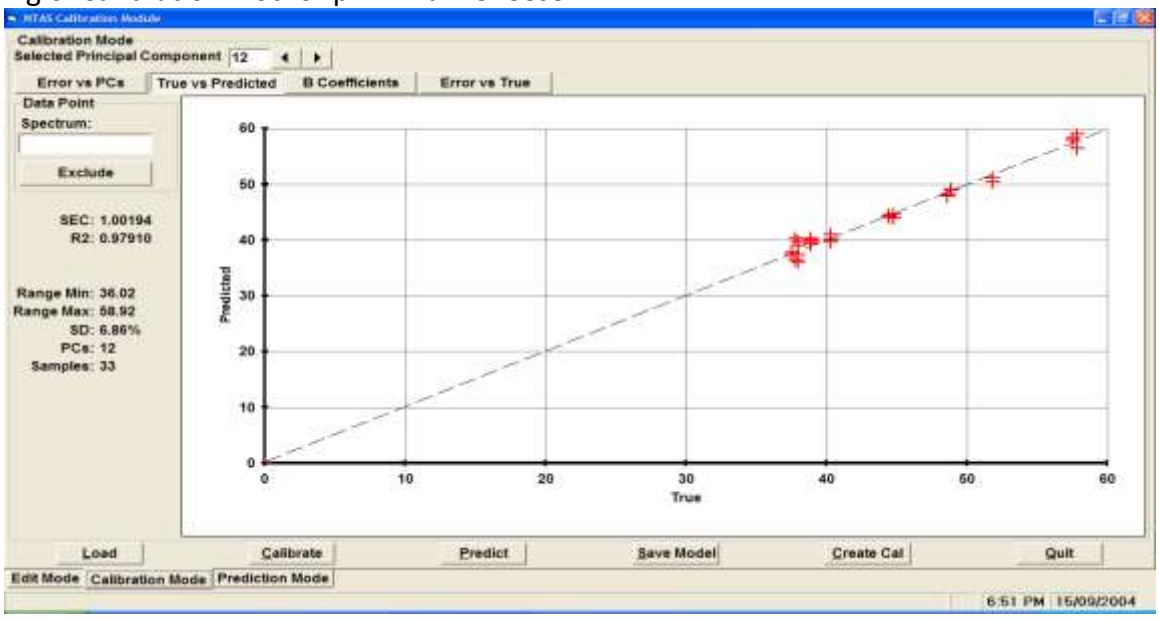

Fig 7. Calibration Plot for Moisture in Bulk Cheese

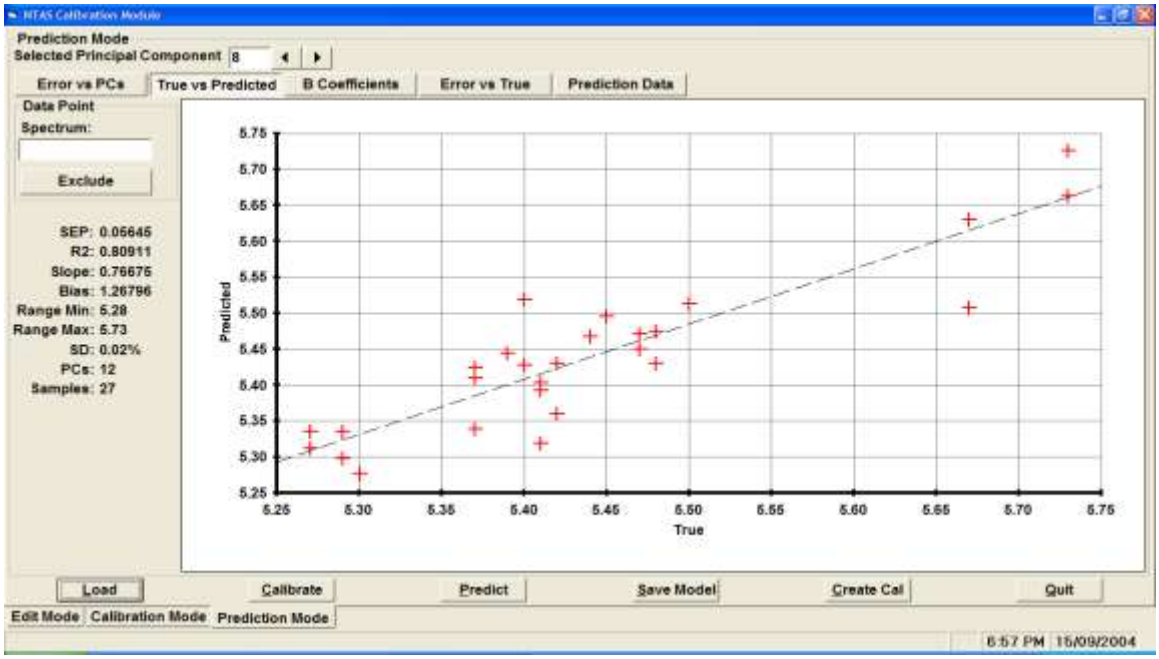

Fig 8. Calibration Plot of pH in Bulk Cheese and Cheese Slices

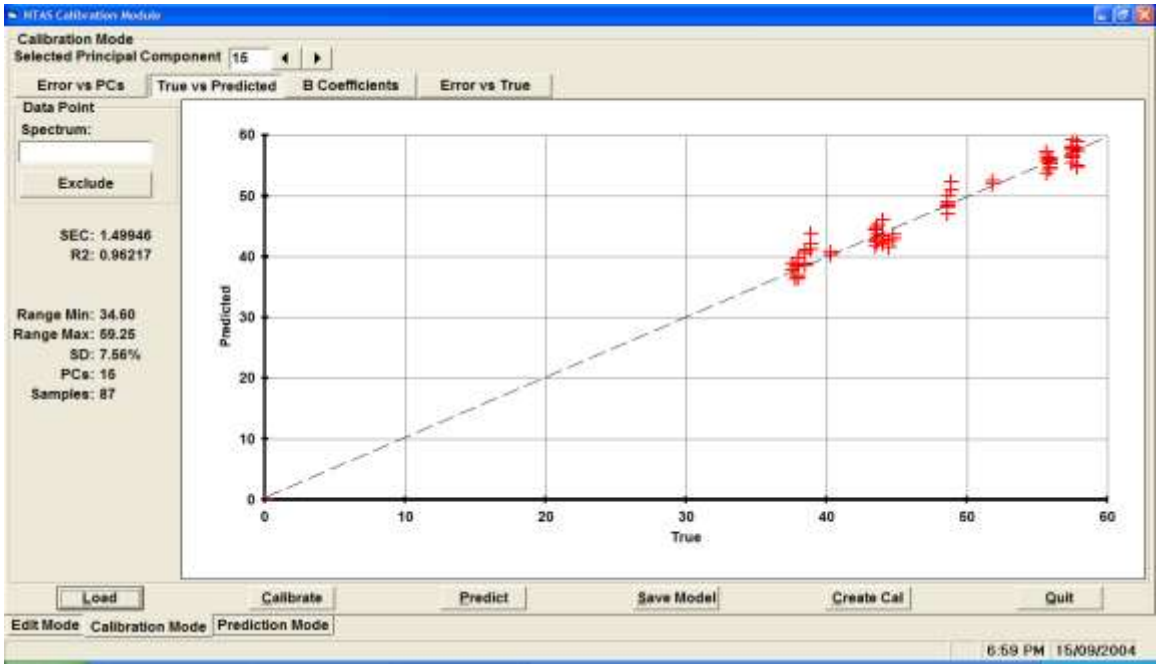

Fig 9. Calibration Plot for Moisture in Bulk Cheese and Cheese Slices

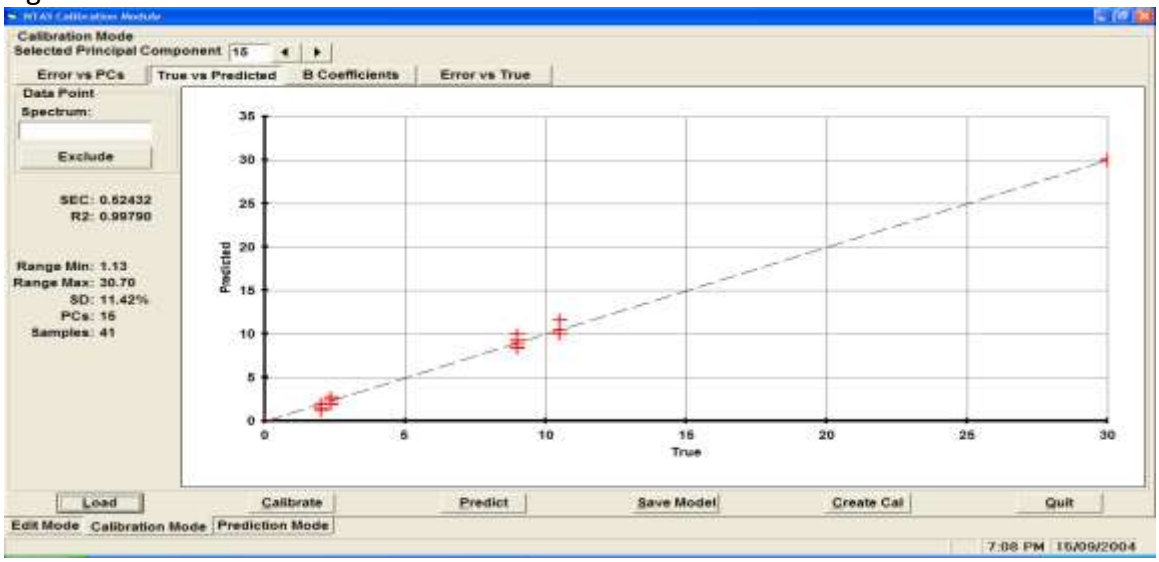

Fig 10. Calibration Plot for Fat in Bulk Cheese and Cheese Slices

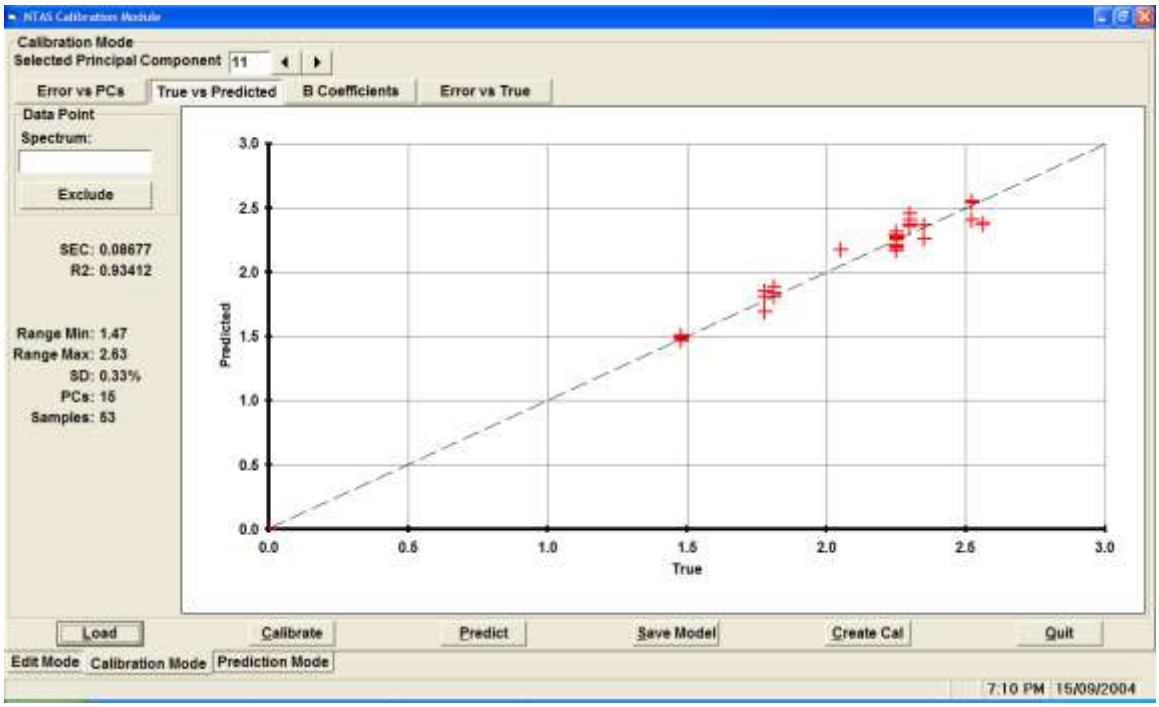

Fig 11. Calibration Plot for Salt in Bulk Cheese and Cheese Slices

The calibrations for pH and Moisture in both Bulk Cheese and Cheese Slices are considered to be acceptable, considering the limited number of samples provided. As for the Fat and Salt calibrations, it is considered that the data illustrates the feasibility of developing NIT calibrations for these components.

Conclusion:

This is a preliminary study that shows that the NIT-38 Dairy Analyser can measure pH and Moisture in cheese. Approximately 30-50 samples for both Bulk Cheese and Cheese Slices would be required to develop a more accurate and robust calibration, however the calibrations developed with these samples can be used as a starter calibration to which more spectra can be added.

NIR Technology Systems
366 Edgar Street, Condell Park, NSW, 2200, Australia
Tel: 612 9708 5068, Fax: 612 9708 5537
Email: nirtech@nirtech.net, Web: www.nirtech.net