Introduction:

The Moisture band is the most prominent in the NIR spectral region. As such, it is possible to measure moisture in almost any material, so long as it can be presented to a NIR analyser.

Explosives pose a problem in that measurements must be non destructive and intrinsically safe. NIR offers a rapid means of measuring moisture as well as many other chemical components in explosives. The ability to make the measurement on the propellants without any sample preparation is an obvious advantage over other techniques.

This brief report shows the ability of NIT (Near Infrared Transmission) to measure moisture in propellants.

Description:

9 samples of propellants were scanned using a NIT-38 Near Infrared Transmission Analyser from 720-1100nm. The samples were loaded into a Powder Cell with a 5mm pathlength. The samples were poured into the cell and the excess removed with a spatula to make a flat surface. The cell was loaded into the NIT-38 Sample Transport Module where it was lowered into 10 different positions so that scans could be collected across the entire sample. Each sample was scanned in duplicate. The spectra were stored in the instrument's memory and then uploaded into a PC using NTAS (NIR Technology Analysis Software). A Partial Least Squares regression (PLS) was performed on the sample spectra to develop a calibration for moisture.

Results:

Figure 1. shows the NIT spectra of the 20 spectra collected from the 9 samples. The spectra exhibit large baseline differences due to the fact that there were differences in shapes and sizes of the propellants.

Figure 2. shows the second derivative spectra of these samples. Note that the 2nd derivative spectra lie on the same baseline and that the bands are resolved far more than in the absorbance spectra.

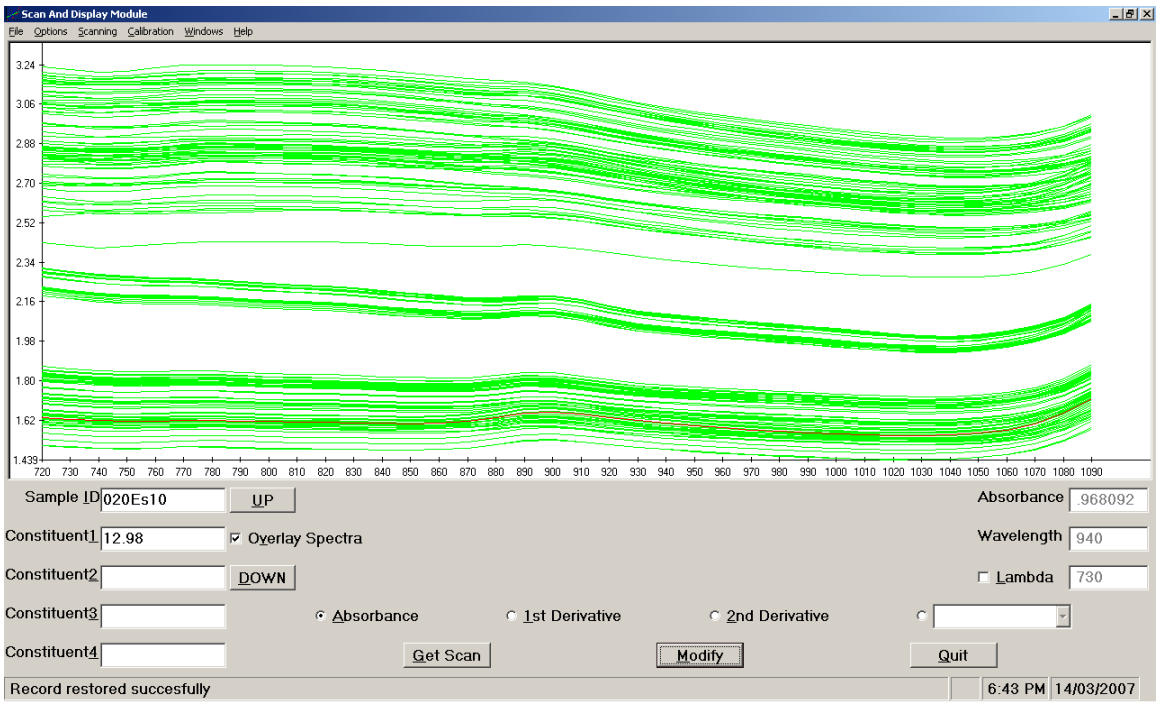Figure 3. shows the PLS regression results for moisture in these samples.

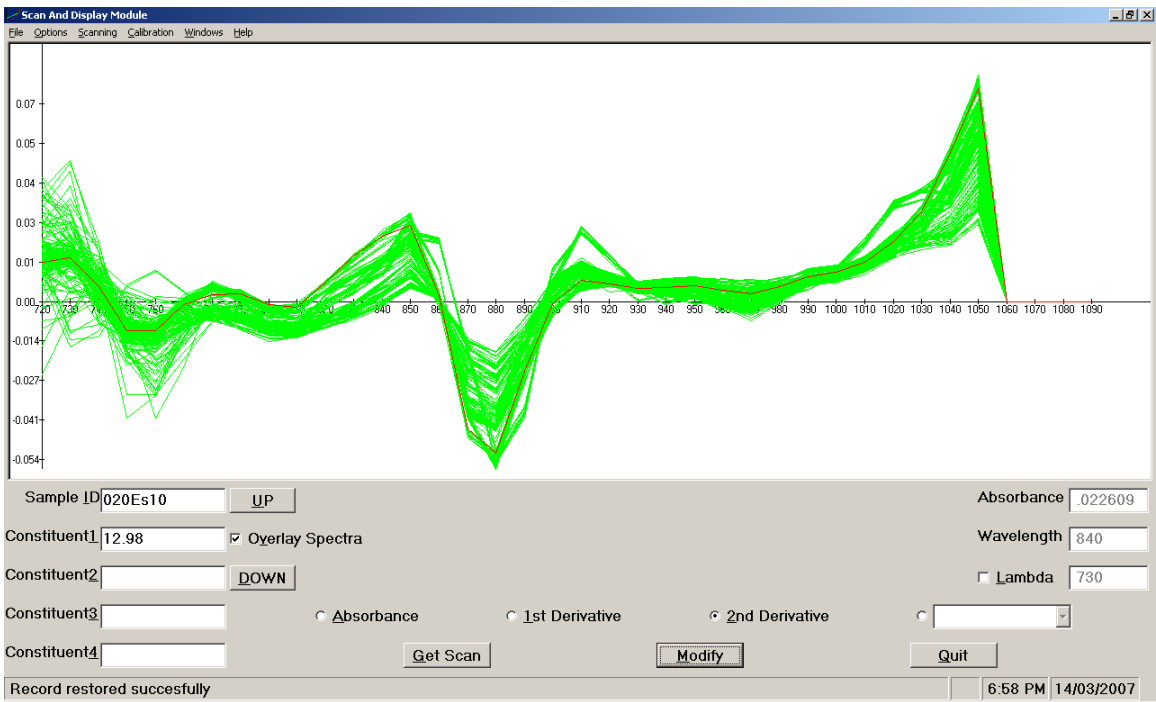Figure 1. NIT Spectra of Various Propellants

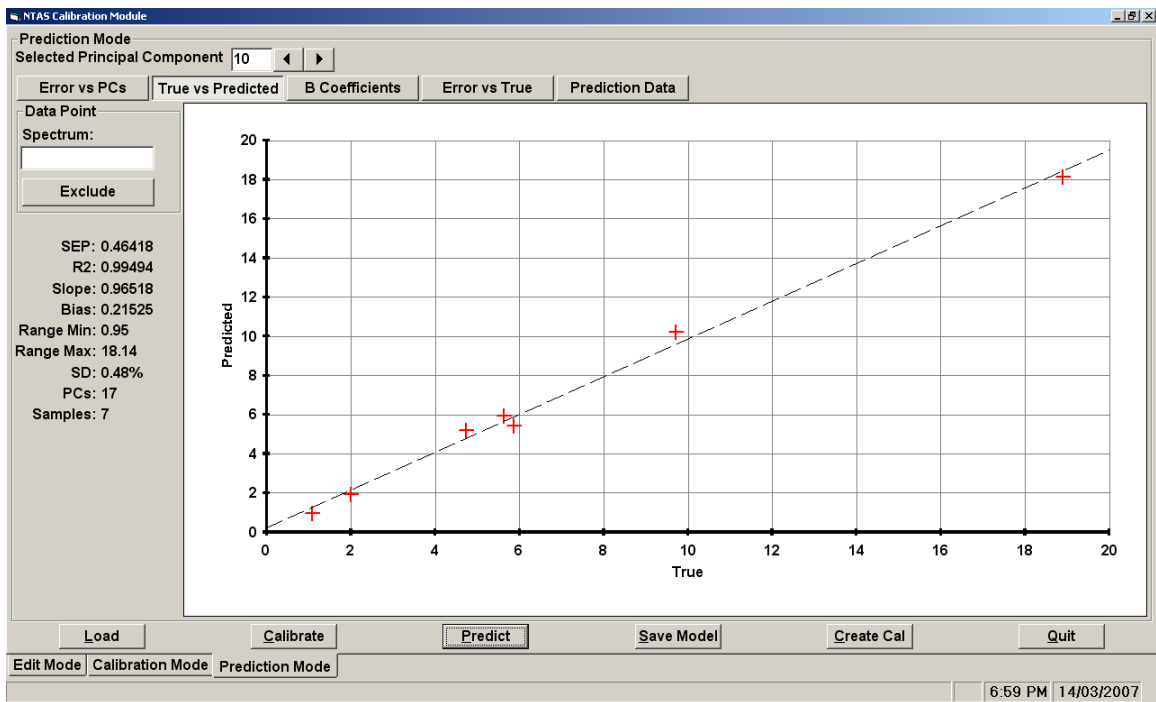Figure 2. 2nd Derivative Spectra of Various Propellants

Figure 3. PLS Regression of the Lab Moistures vs the NIT Spectra

Discussion:

This study is preliminary. Further samples are to be scanned and added to the calibration set, and then a validation study undertaken.

These results illustrate the ability of NIT to measure moisture in complex samples over a wide moisture range.