

Branscan

NIR and Image Analysis Systems

Presentation to IAOM Middle East

October 2011

Aytun Erdentug

Multi sensor systems

- NIR Analysis
- Image Analysis
- Colour sensor

NIR Analysis

- NIR spectroscopy is the measurement of the wavelength (800 nm - 2500 nm) and intensity of the absorption of near-infrared light by a sample.
 - NIR spectroscopy is typically used for quantitative measurement of organic functional groups, especially **O-H, N-H, and C-H**.
 - This technology can therefore be used to great effect to measure **Moisture, Fat / Oil, Protein, Ash, Sugar etc**
 - Each wavelength is accurate to +/- 0.2nm, with 1000 wavelengths being scanned, giving good correlation to **Primary Methods** of testing
-

Important Factors

1-Sampling

NIR analysis demands that samples are presented in the **same way each time** to ensure that accuracy, precision and repeatability of results is not impaired by outside factors.

A clean operation is essential as dirt can change the baseline and thus the spectral shape

The procedure for sampling and testing exists to reduce the risk of errors from:

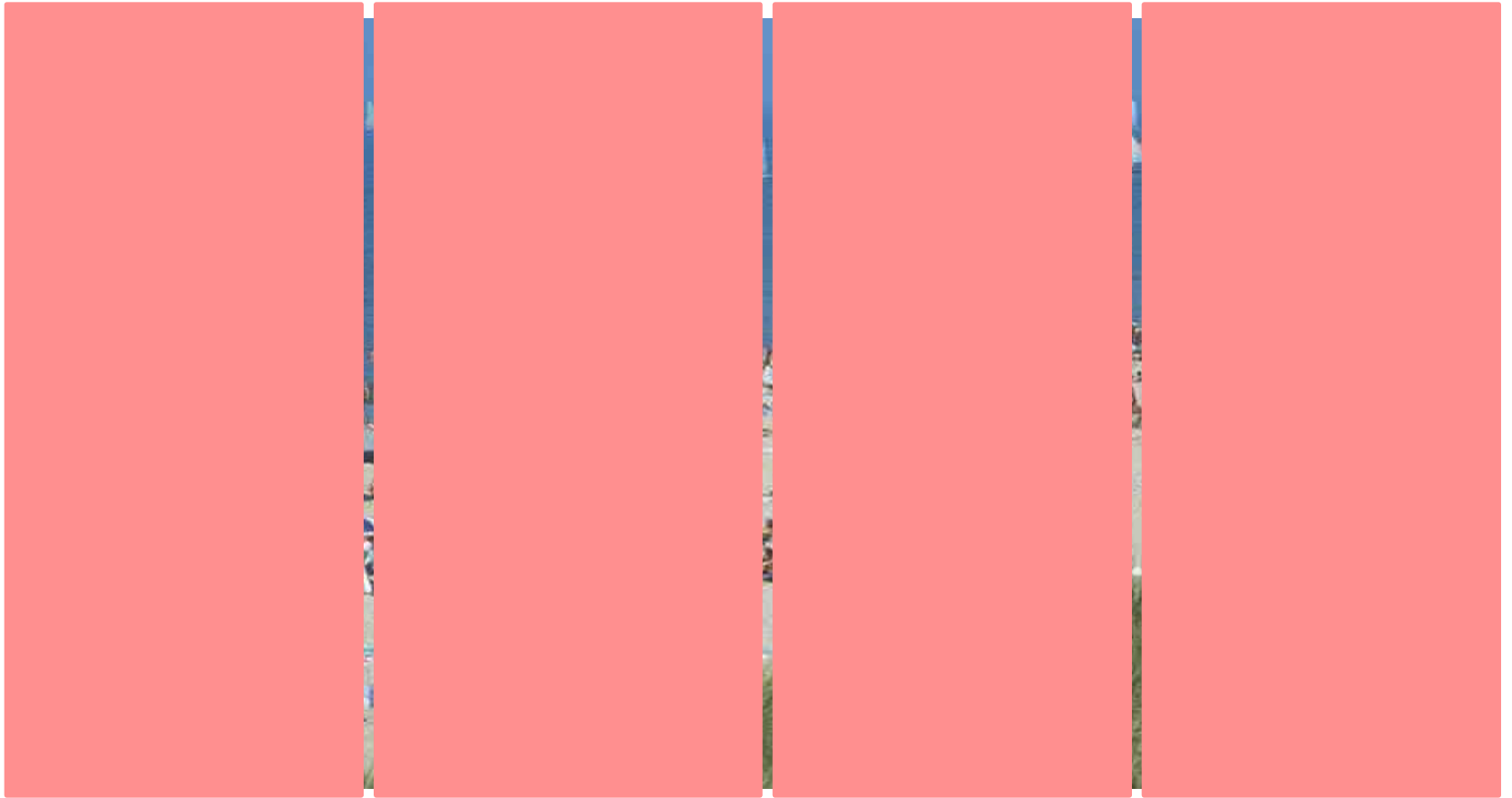
- Temperature
 - Grinding / sample preparation
 - Atmospheric Conditions
 - Uncontrolled tempering / leaving to cool
 - Sample history (route taken / sample point)
-

Important factors 2- Technology

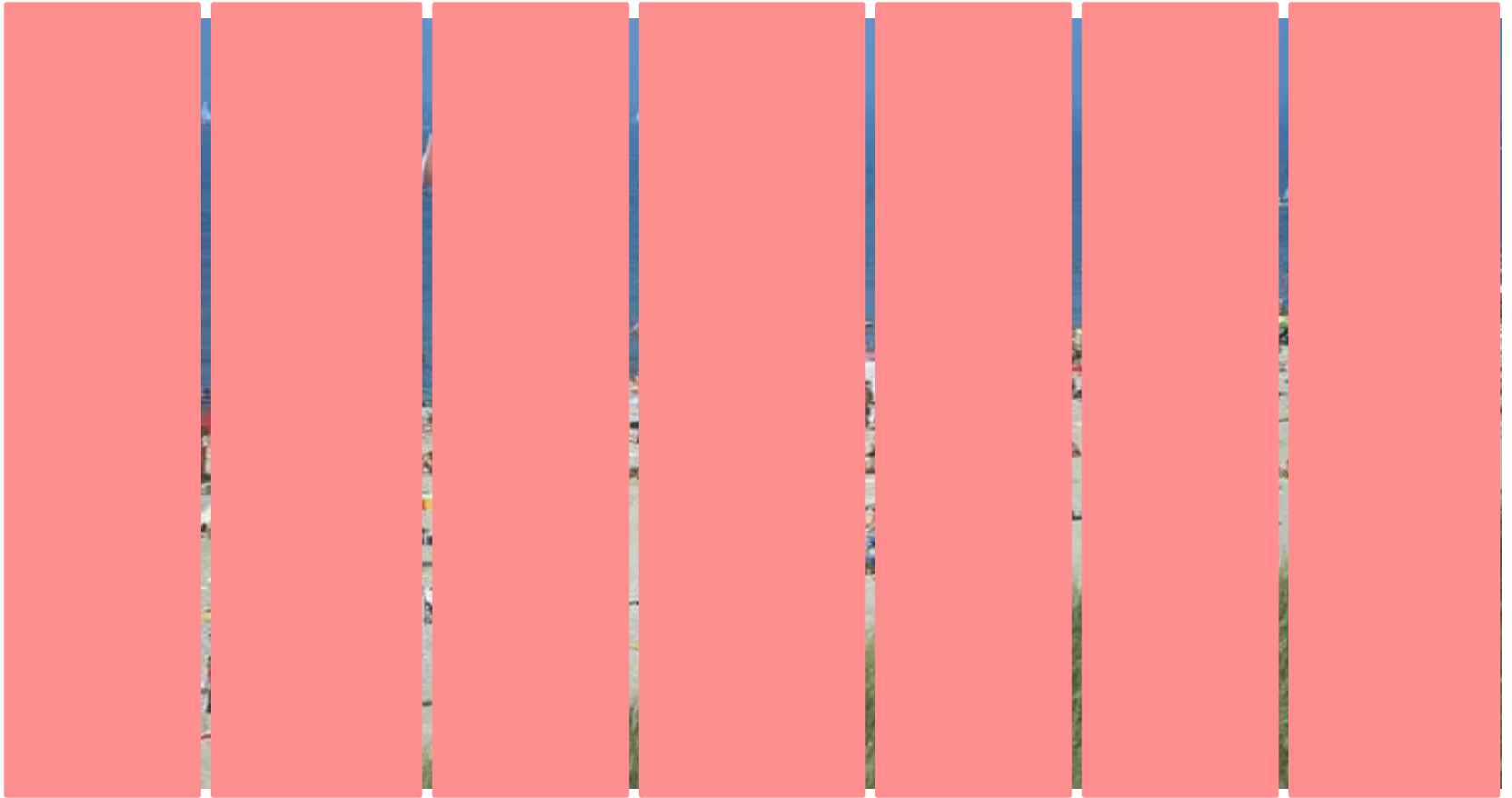
Previous Filter based NIR systems offer 3, 6, 9 or 19 wavelengths for scanning.

**The Branscan Scanning Monochromator /
Diode Array offers 1000 wavelengths**

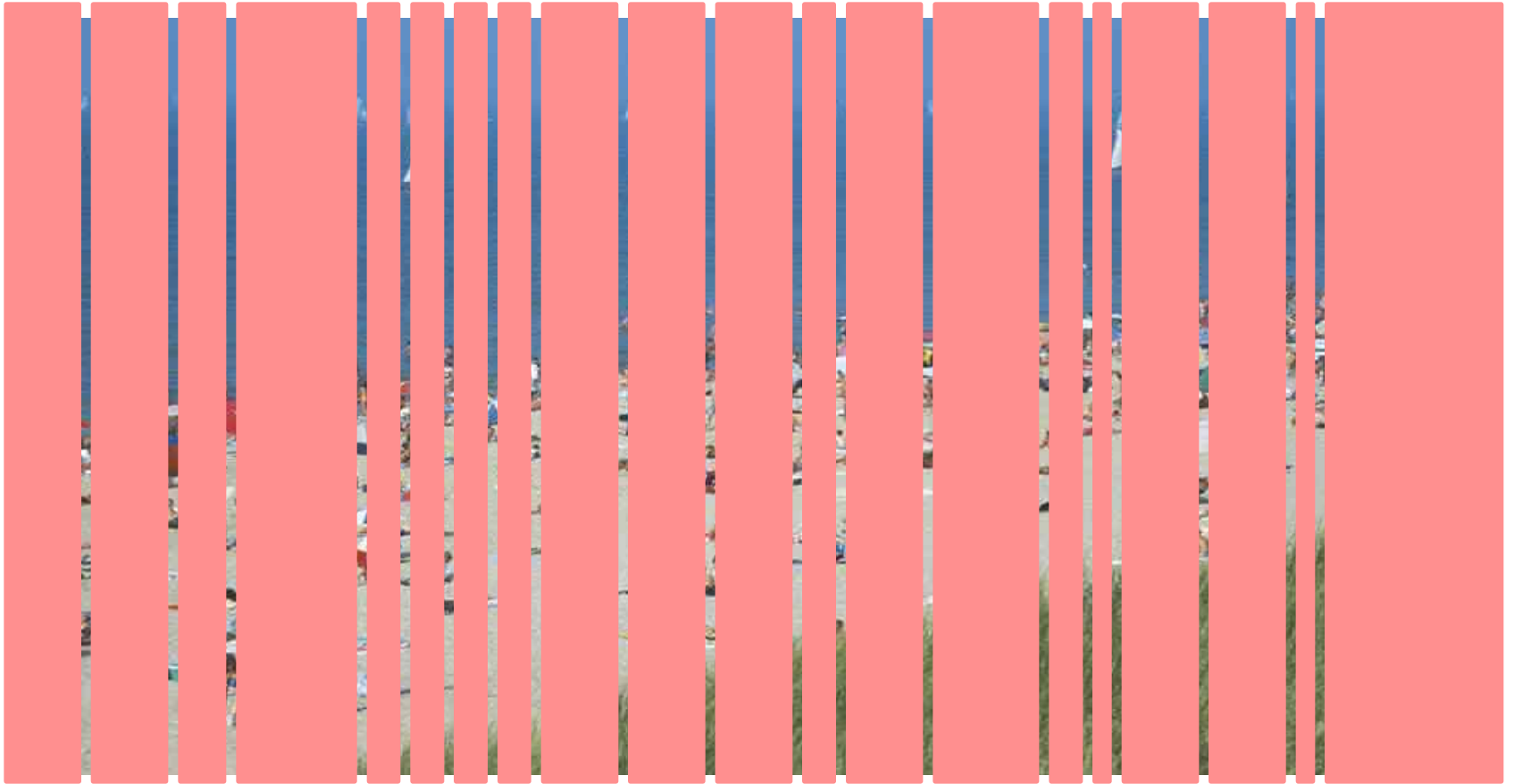
This is the information you see with 3 filters



This is the information you see with 6 filters



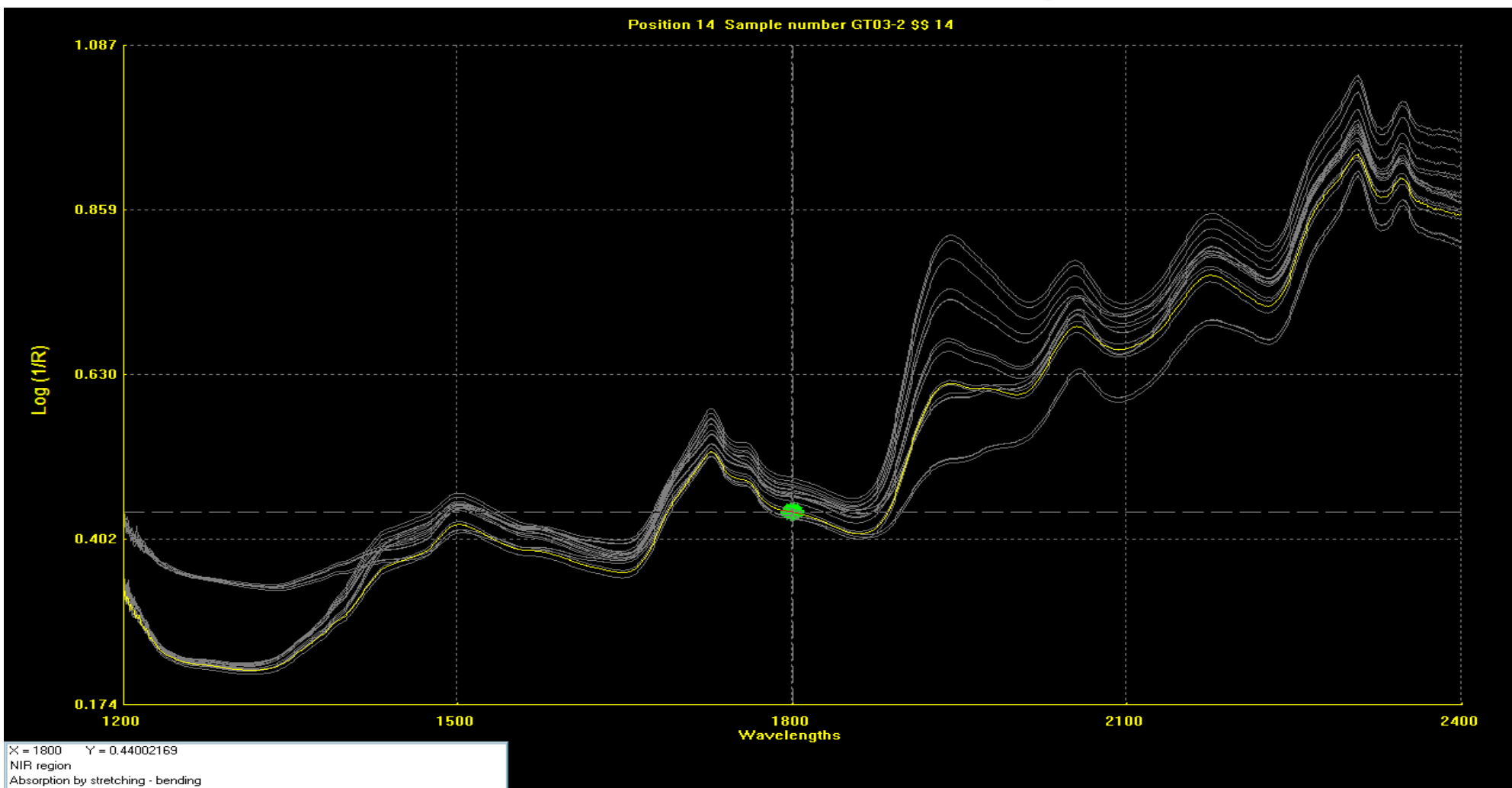
This is the information you see with 19 filters



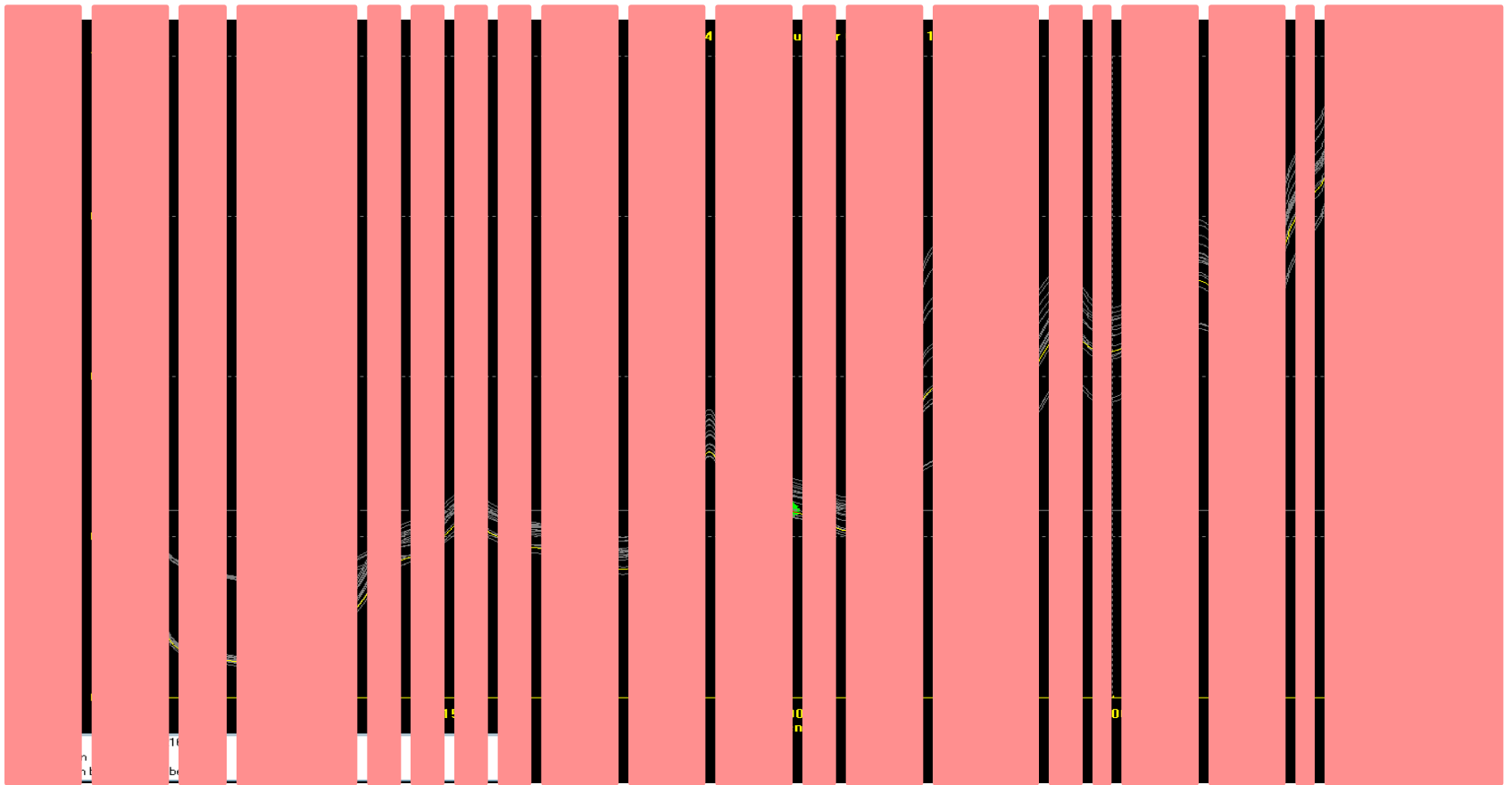
This is the information you see with a Scanning Monochromator / Diode Array



This is the spectra that a Scanning Monochromator / Diode Array would see



**This is the spectra that a filter
Instrument could see**



The figure is a chart showing characteristic infrared absorption bands for various organic compounds, categorized into four regions: 3rd Overtone Region, 2nd Overtone Region, 1st Overtone Region, and Combinations. The x-axis represents Wavelength (μm) from 0.7 to 2.5 and Wavenumber (cm⁻¹) from 14000 to 4000.

3rd Overtone Region (0.7 - 1.1 μm):

- CH 4th Ov:** CH₃ (black), CH₂ (grey), CH (grey).
- NH 3rd Ov:** ArOH (red), RNH₂ (blue), ArCH (brown), RNHR' (blue), ArCH (brown).
- OH 2nd Ov:** H₂O (cyan), ROH (red), ArOH (red), RNH₂ (blue), ArCH (brown).

2nd Overtone Region (1.1 - 1.5 μm):

- CH 2nd Ov:** CH₃ (black), CH₂ (grey), CH (grey).
- NH 2nd Ov:** ArOH (red), RNH₂ (blue), ArCH (brown).
- OH 1st Ov:** H₂O (cyan), ROH (red), ArOH (red), CONH₂ (blue), RNH₂ (blue), CONHR (blue), CH (grey), CH₂ (grey), CH₃ (black).

1st Overtone Region (1.5 - 1.9 μm):

- SH 1st Ov:** ArCH (brown), SH (yellow), CH (grey), CH₂ (grey), CH₃ (black).
- C=O 2nd Ov:** RCOOH (pink), RCOOR (pink), POH (brown), CONH₂ (blue).

Combinations (1.9 - 2.5 μm):

- C=O 1st Ov:** ROH (red), CONH₂(R) (blue), CO (green).
- NH Combo:** RNH₂ (blue), CONH₂(R) (blue), CHO (pink), CC (black).
- CH+CH Combo:** CH (grey), CH₂ (grey), CH₃ (black).
- CH+CC Combo:** CH (grey), CH₂ (grey), CH₃ (black).

FLUORO **SCAN**

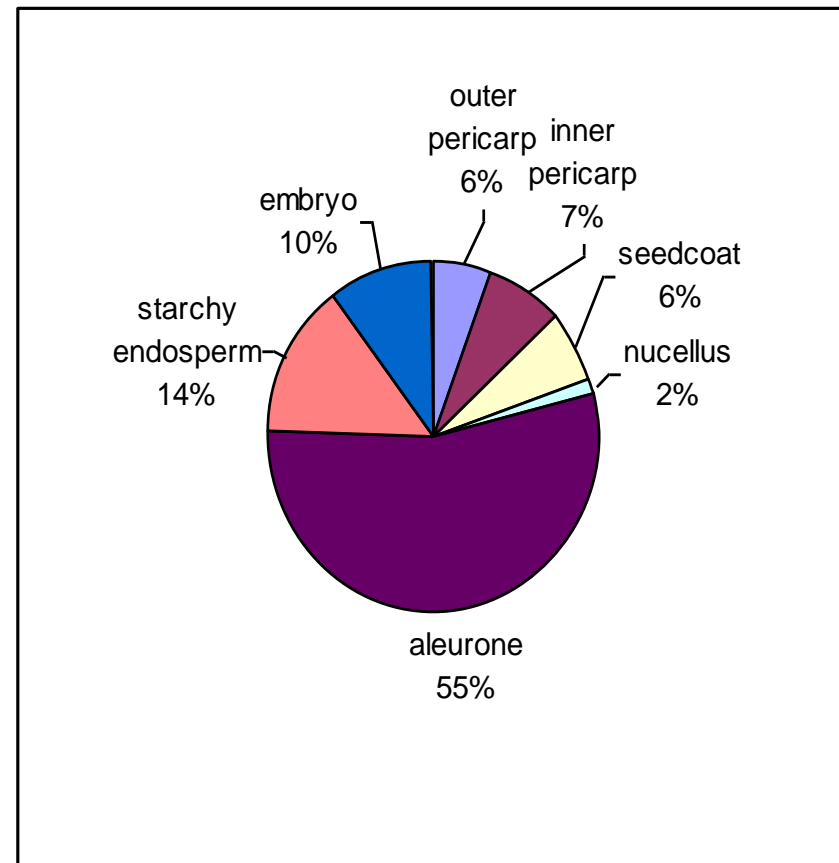
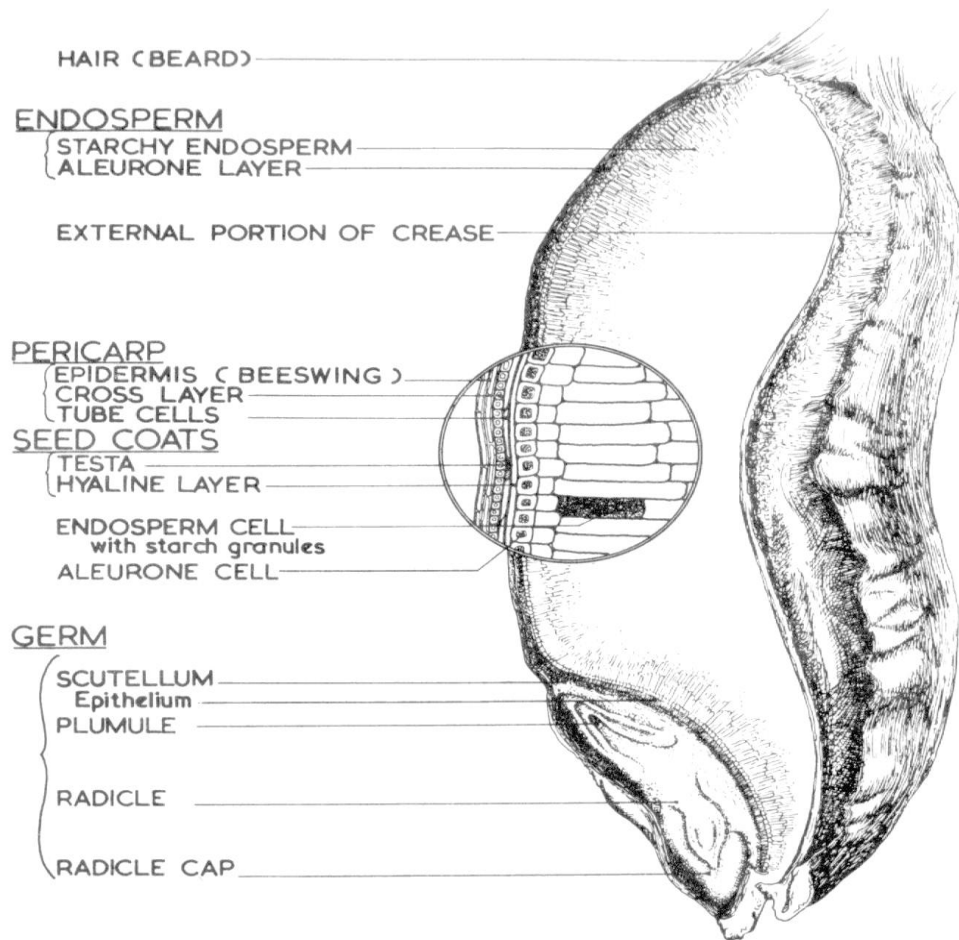
POWDER **SCAN**



IMAGING SYSTEMS

Reliable systems for measuring Specks and
Impurities - Online or Offline

WHAT ARE THE FLOUR IMPURITIES?



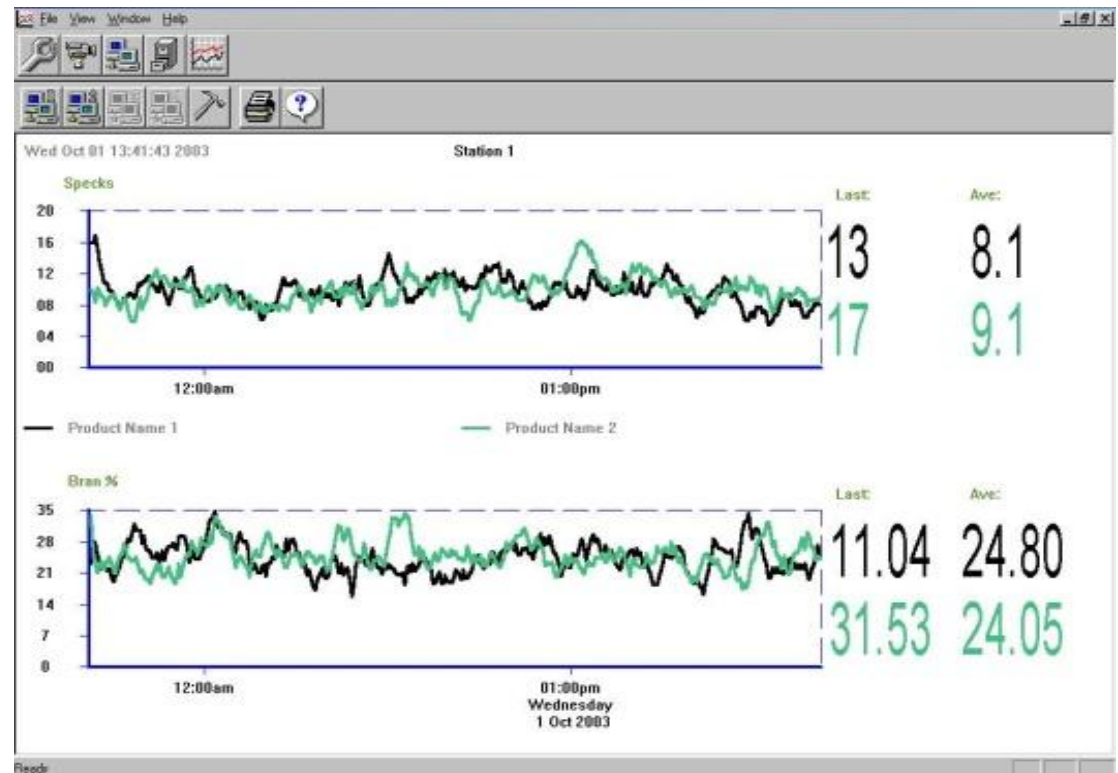
Diagrammatic longitudinal section of wheat grain through crease and germ.

Specks and impurities are a determining factor of the appearance, grade and purity of the product. In some cases impurities can result in the rejection of whole batches.

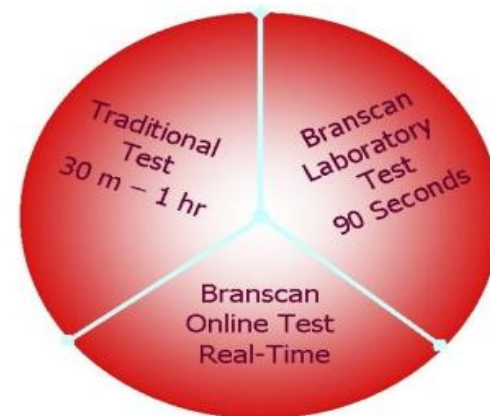
Fluoroscan uses UV light to pick up the yellow specks of fluorescent aleurone and the dark specks of bran in flour products .

Powderscan uses visible light to pick up the specks and impurities in all dried powders and products

Data can be displayed by the software as both aleurone and bran counts and speck percentages, as well as further data such as graphs.



Fluoroscan and **Powderscan** are based on well-established and proven image processing technology which has been used successfully within major manufacturers worldwide for nearly a decade



- Live image and processed image displayed on the screen allowing the user to see the sample analysed in **real-time**. All data can be archived & exported.
 - Ability for Fluoroscan to measure **number and percentage of aleurone and bran** (yellow and brown specks), and report on ash value.
 - Scans at high resolution over a 1cm surface 22 times for **unsurpassed accuracy**
 - Algorithm and lighting system means **daily calibration is not required**.
 - Configurable to give measurements that customers recognise & understand.
-

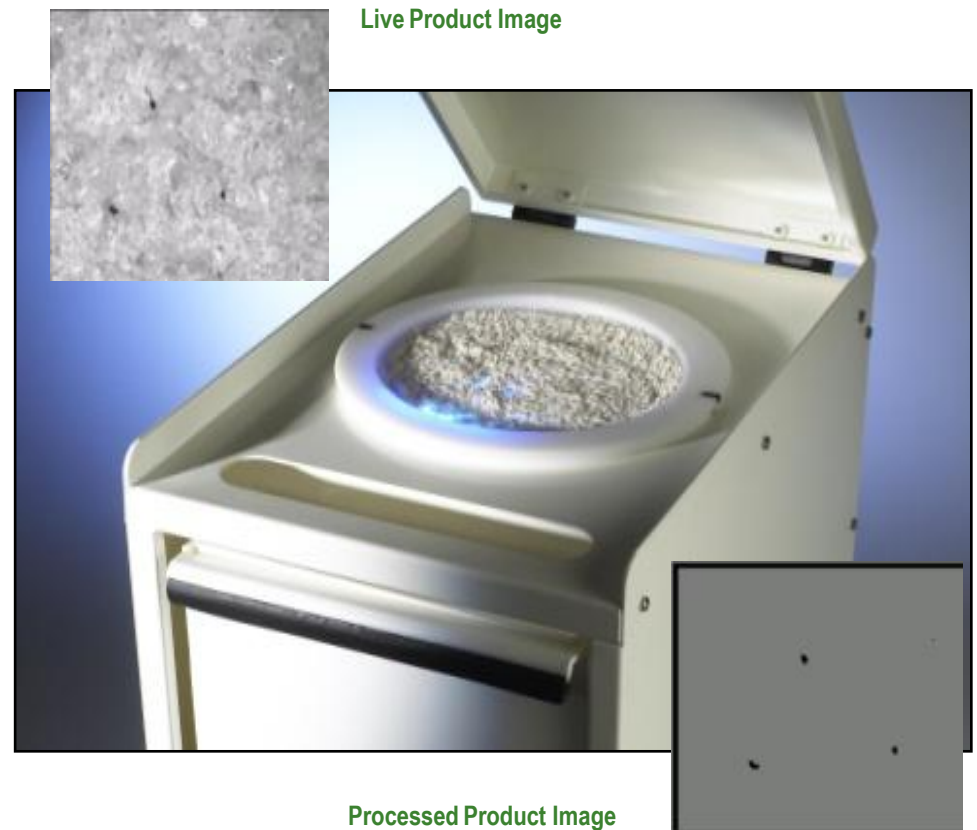


Fluoroscanner Benefits

- Bran levels can be **measured and controlled** via Fluoroscanner.
 - Control via **ASH** reflects measuring a change in minerals, which is therefore a small range (typically 0.55 - 0.65)
 - Bran levels can vary dramatically (typically 0.6 – 1.5), meaning that the range of control is larger, this gives the Miller **better control** over his process.
 - High Bran will affect functionality in terms of: water absorption (bran competing with endosperm for water); damage to the gluten network; hence resulting in low volume of bread
 - Low Bran will result in: added expense for the miller; doughy consistency of product; and larger air bubbles in bread
 - Fluoroscanner provides rapid **detection of sifter bursts**.
 - Fluoroscanner gives control of actual **colour from measurement of “speckiness”**, mimicking the old PECAR test
 - Fluoroscanner can help with **Grist control**, since it measures bran levels from milling different wheat varieties.
 - **Cleanliness of Durum** can be effectively measured from the speckiness of the semolina
-

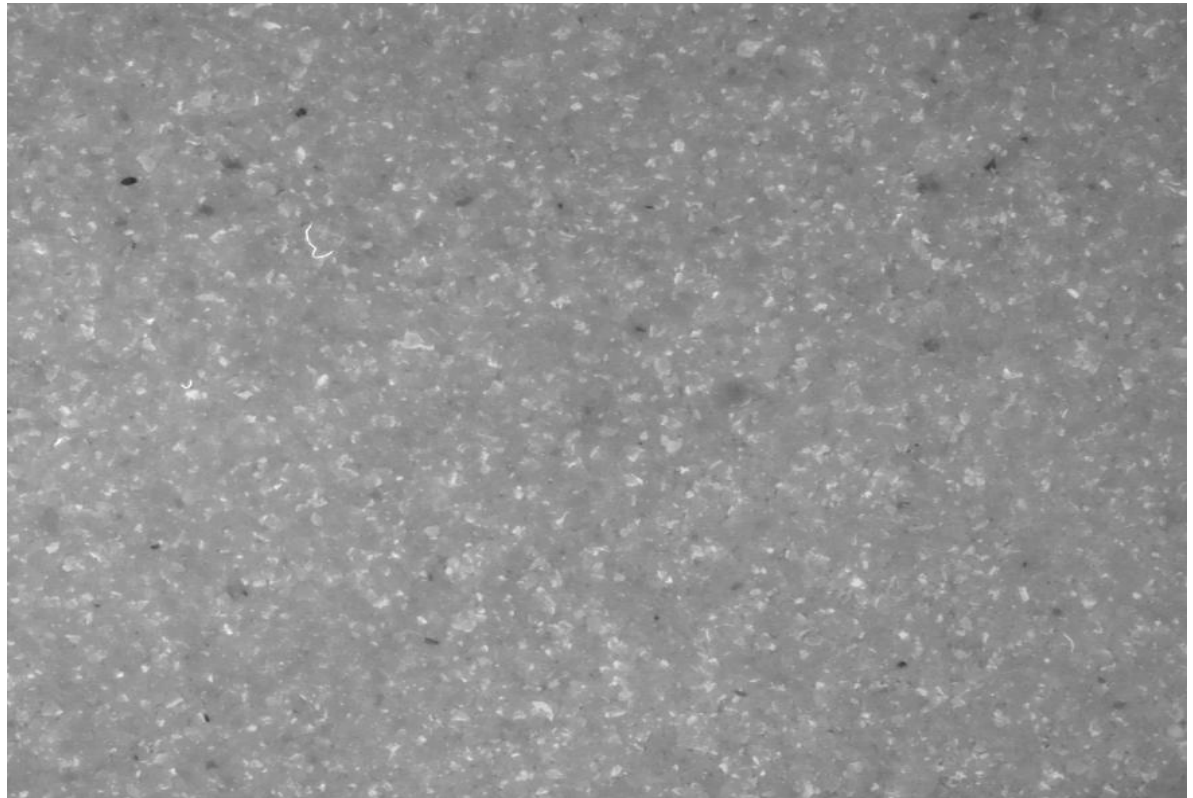
Fluoroscane F2000 Laboratory System

- Portable system weighing 12.5 kg ensuring results can be obtained anywhere they are needed.
- Quickly and easily installed with no need for specialist engineers or sophisticated PC.
- Rapid analytical process, obtaining results in 90 to 120 seconds from a given sample, compared to traditional tests taking anything from 3 to 9 hours.



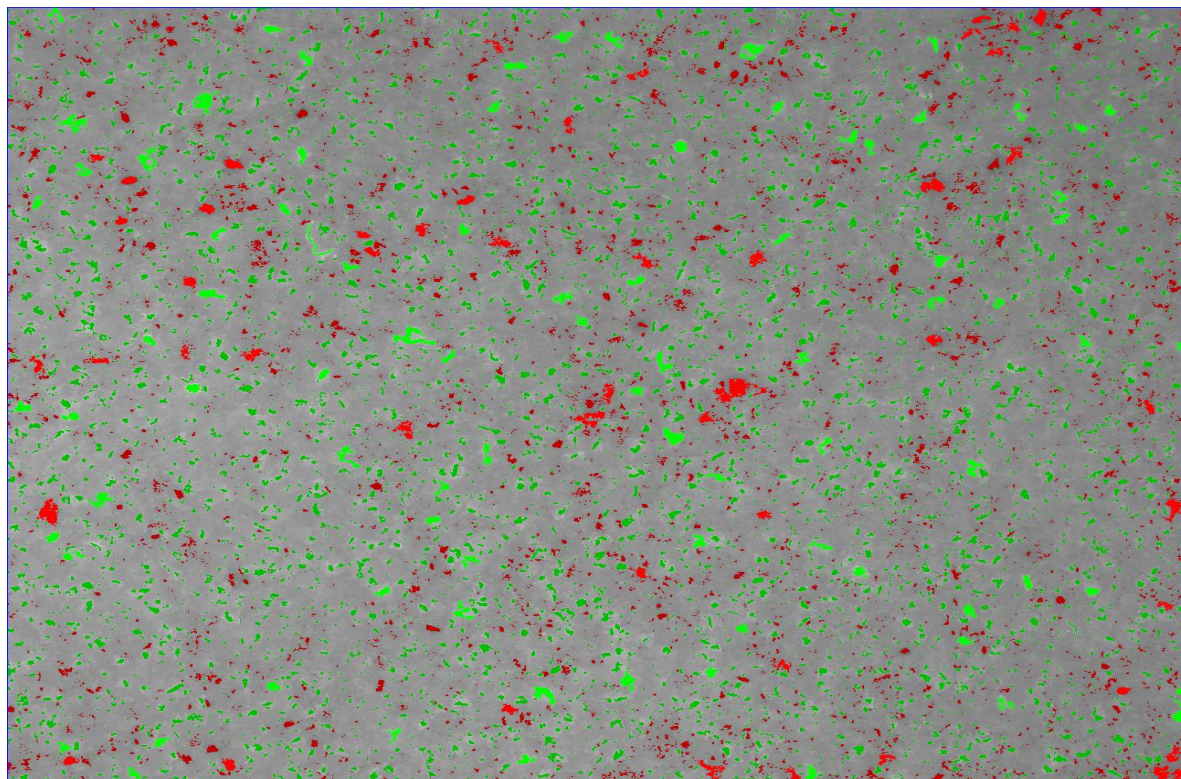
WHAT DOES A **FLUOROSCAN** IMAGE LOOK LIKE?

The image shows a
sample
displayed using the
Fluoroscan lighting
system



WHAT IS PROCESSED AND ANALYSED IN **FLUOROSCAN**?

The Red
(Aleurone) and
Green (Bran)
specks shows
different
constituents of
ASH



Hopperscan can be used to rapidly scan 100% of granular products such as Pellets, Grains and powders passed under its camera.

The sample is then collected for batch auditing or retesting.

A valuable tool when assurance is needed for conformance to specification by quantity



Totalscan analyses 100% of the product and if the quality falls below acceptable levels, **Totalscan** diverts it away from the 'good' product, preventing contamination, waste and loss of profit.

With its flexible scanning area and variable resolution, **Totalscan** can be used anywhere in the production process



Traditionally, Branscan instruments have non destructively tested powders for impurities using image analysis.

The addition of NIR and colour analysis to the online system is a natural progression.

InNIRsCAN is a modular instrument, consisting of up to three measuring sensors:

- **Camera for image analysis**
- **NIR for moisture analysis, etc**
- **Colour Sensor**



Sensor

The **InNIRscan** NIR is a Diode Array scanner in a modular concept:

Sampling-interface, Fibres and spectrometer can be constructed in many possible setups.

A multiplexer makes it possible to extend to multiple channels.

Modular Scanner



InNIRsCAn Benefits

➤ Control of Moisture:

- *Cost effectiveness*
- *The ultimate control measure*
- *Effect on Tempering*

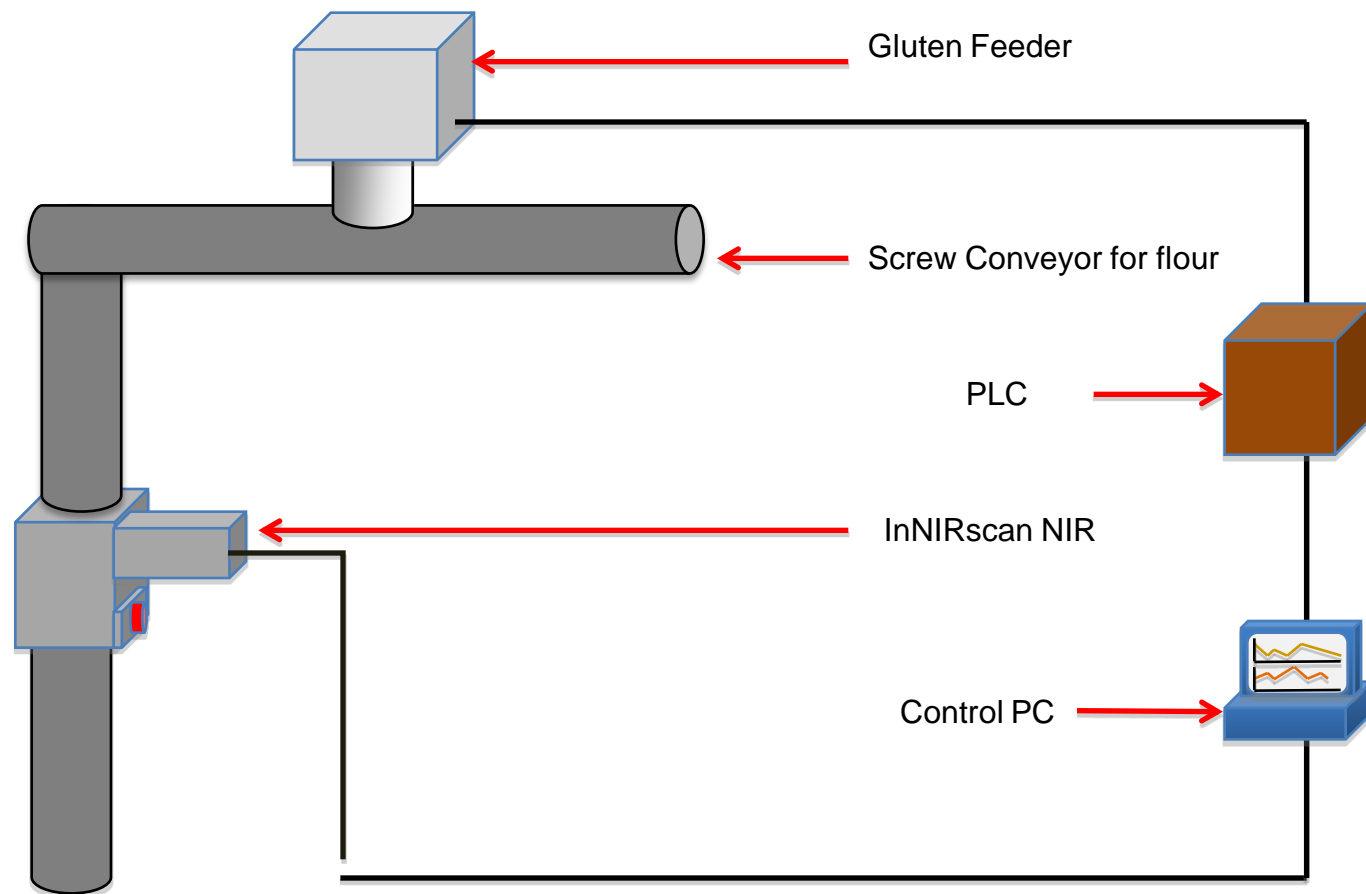
➤ Control of Protein:

- *Control and effect on Grist*
- *Cost reduction through the ability to use cheaper wheat, or utilising a gluten loop*

➤ Secondary measurements for:

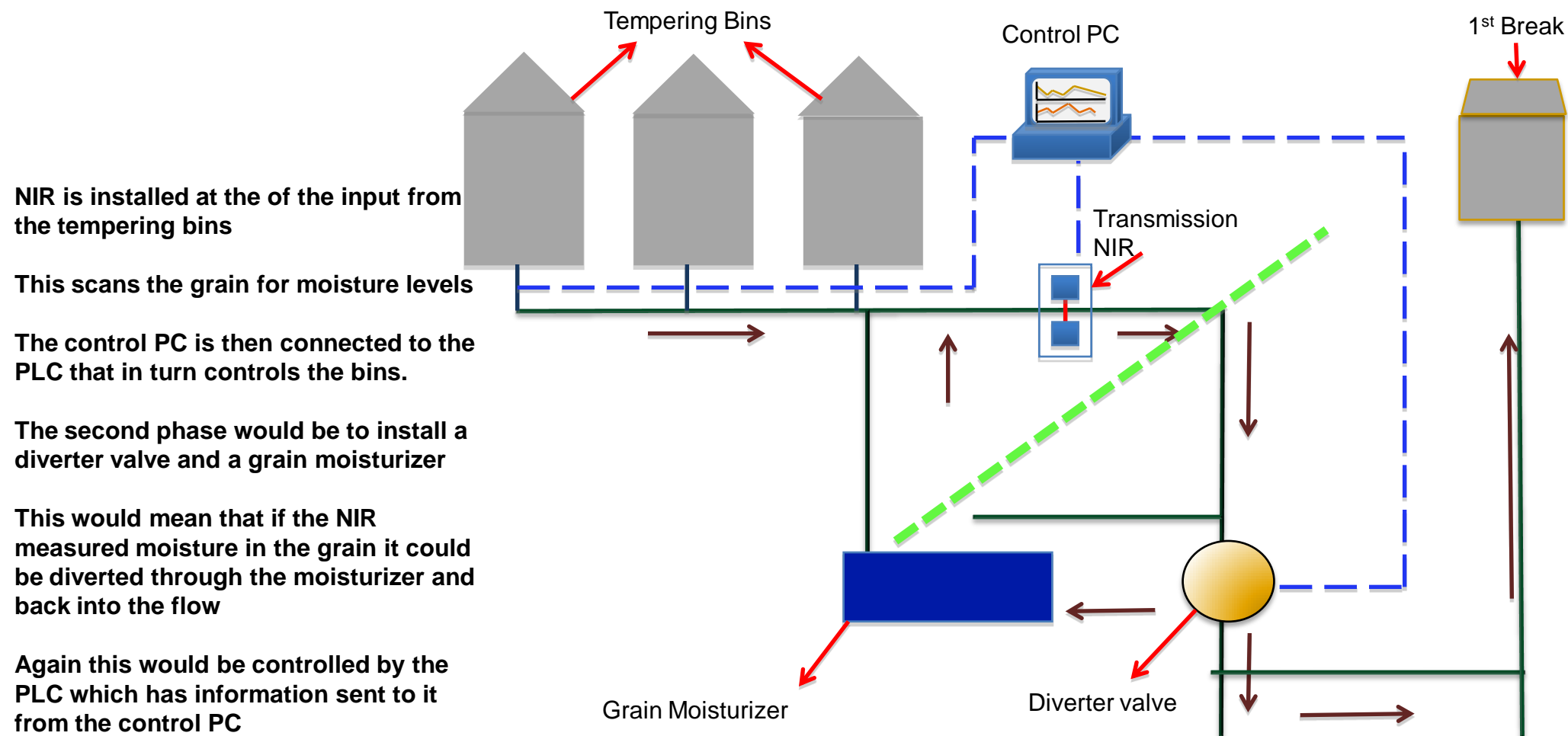
- *Ash, Starch Damage, Water Absorption*
-

InNIRsCAn being used in a Gluten Loop



The InNIRscan is taking readings on average 4 times per minute, the data that is then sent to the Control PC, which in turn is connected to the PLC. The PLC can then ACCURATELY control the feed of Gluten into the flour using the Gluten Feeder.

InNIRsCAN used in a Moisture Loop in 1st or 2nd level wheat conditioning system

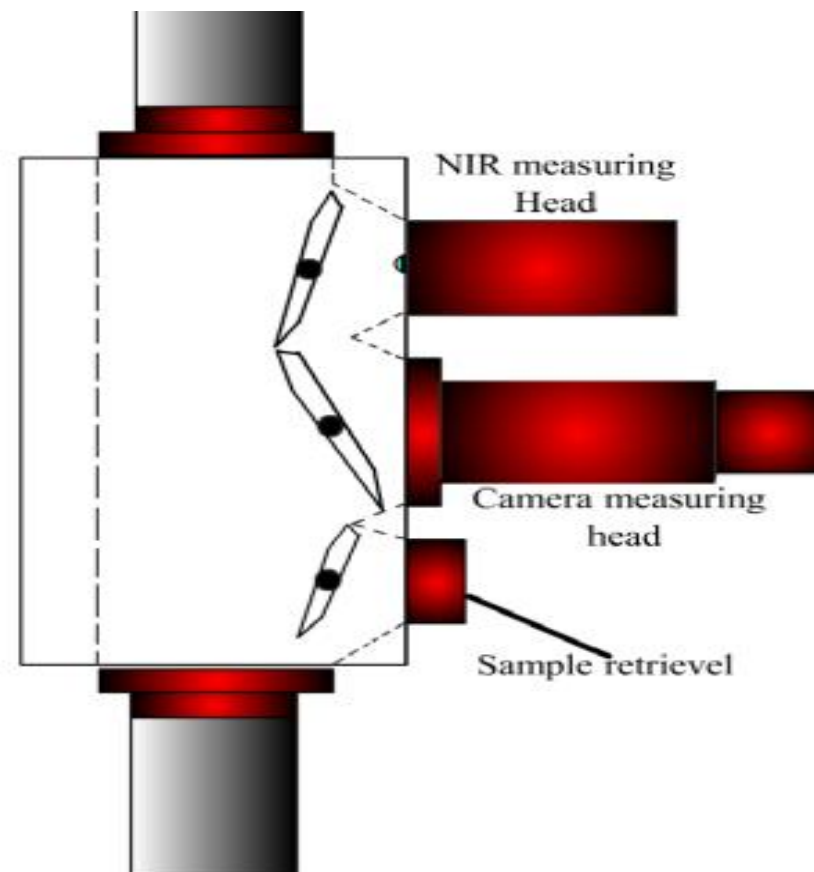




InNIRsCAN may also be run as a multi head system, allowing easy measurement across multiple points in the mill, ideal for monitoring blending or debranning.

The new **sample retrieval** feature means that NIR calibration **validation and verification** has never been more simple.

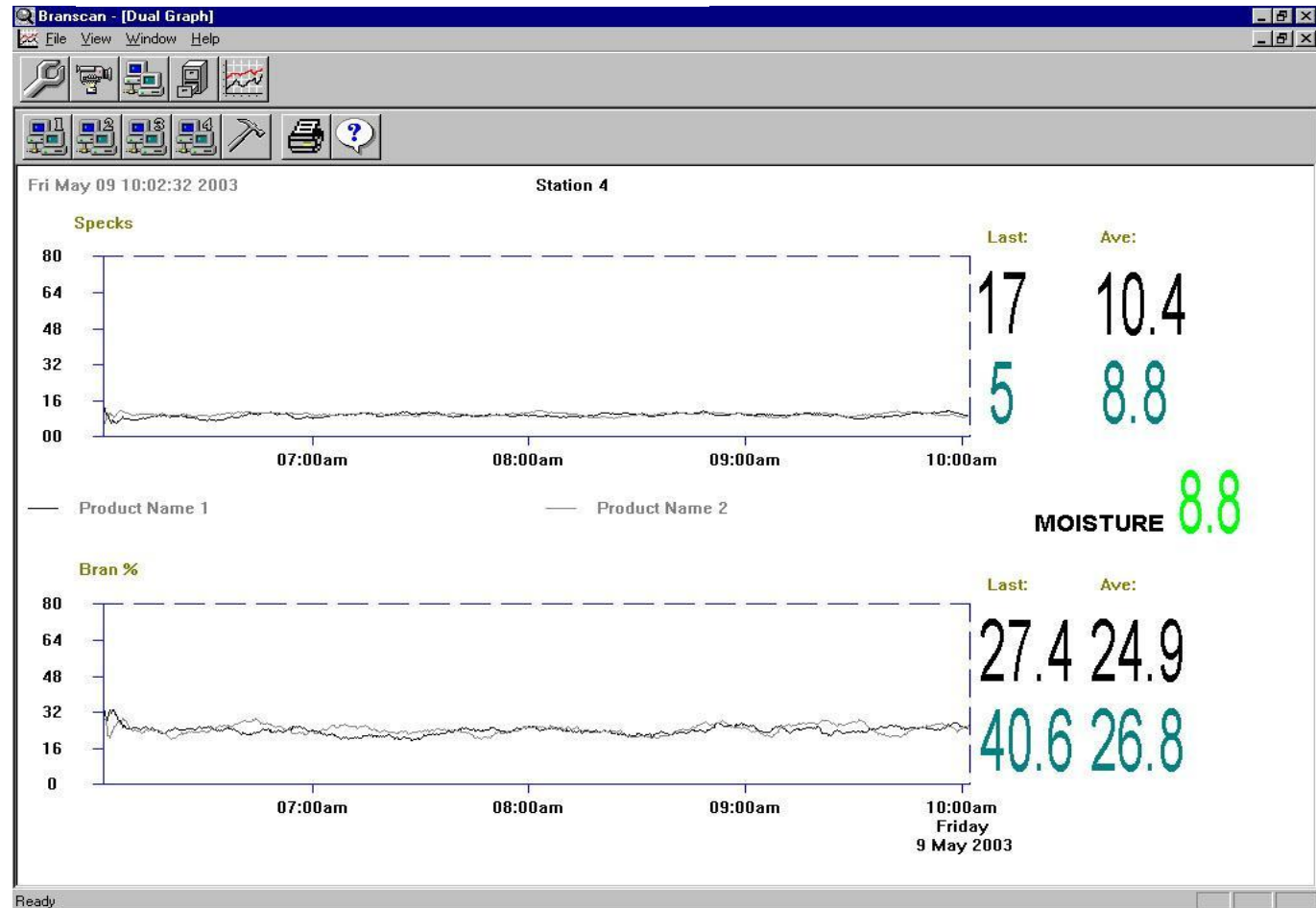
With **InNIRsCAN** installed, laboratory testing is kept to a minimum, which in turn increases productivity and profits.



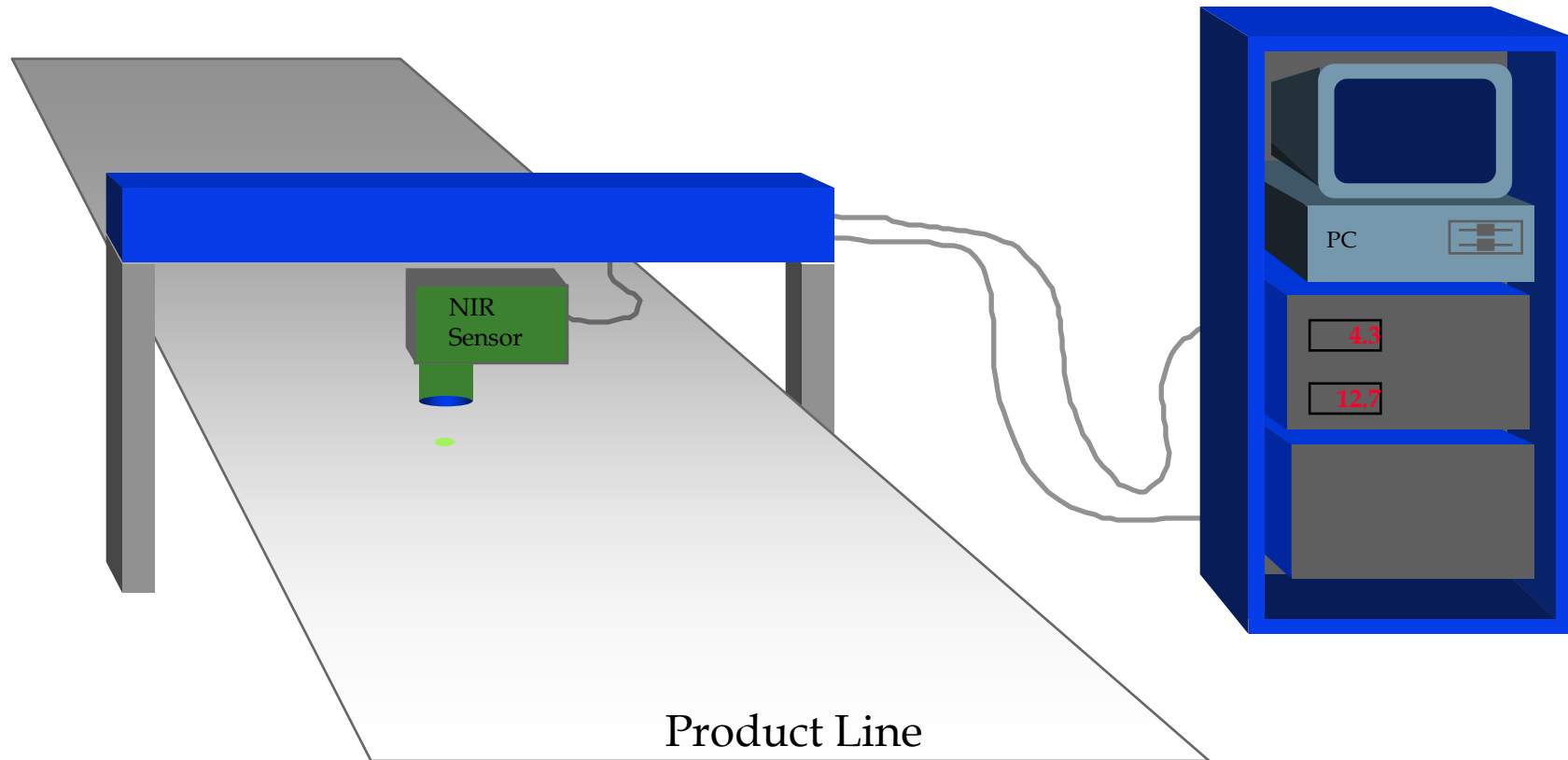


All of the measured values are displayed as both numbers and in a trend graph on the computer screen.

This data can then be automatically stored on a network, sent to a printer or even transmitted to a PLC.



NIR on the production line with moving finished product



NIR on the production line, both at finished product, and bulk intermediate stages

