AD-080GE
2-CCD Multi-Spectral Camera

AD-080GE

2-CCD multi-spectral camera

- Two 1/3" progressive scan CCD's with 1024 x 768 active pixels. (4.65 μm square pixels).
- Simultaneously imaing of visible and near-IR through a single lens.
- 30 fps with full resolution.
- 24-bit or 30-bit RGB output or Raw Bayer 8-bit or 10-bit output for visible spectrum.
- 8-, 10- or 12-bit output for near-IR spectrum.
- Variable partial scan or vertical binning.
- Sequence trigger mode for on-the-fly change of gain, exposure and ROI.
- Auto-iris lens video output.
- LUT table for gamma correction.
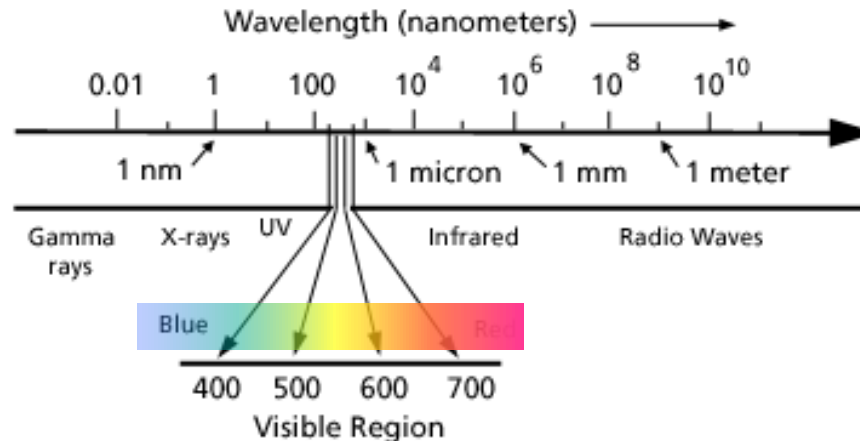- Also available with CL interface

GiGE VISION

GEN<i>CAM

Background

- For the most part, imaging applications can be solved with monochrome cameras working in the visible spectrum, meaning roughly 400 to 700 nm.

- Certain applications, however, make use of other parts of the spectrum
    - Non-visible parts below 400 nm and above 700 nm help enhance details or to see below the surface of organic materials.

Wavelength (nanometers) ⟶

| 0.01 | 1 | 100 | 10^4 | 10^6 | 10^8 | 10^{10} |

1 nm 1 micron 1 mm 1 meter

Gamma rays   X-rays   UV   Infrared   Radio Waves

Blue   Red

400   500   600   700

Visible Region

- The AD-080GE uses a combination of Visible and Near-IR light

Previous Solutions

- Previously, when there was a need to combine information both from the visible and non-visible part of the spectrum, the solution required using *two cameras* that needed to be carefully aligned in order to have the same field of view.

Visible spectrum

Non-visible spectrum
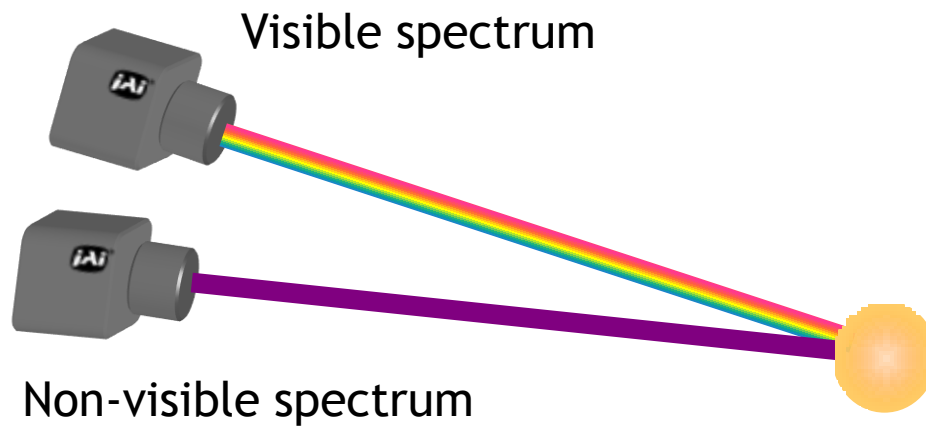
AD-080GE 2-CCD solution

- The AD-080GE (and Camera Link model AD-080CL) use a prism-based design to align visible & NIR sensors to micron-pixel accuracy along the same optical path

New 2-CCD camera with GigE Vision interface
Multi-spectral imaging
Simultaneous imaging of visible and NIR light through a single lens
Color CCD
Prism
NIR CCD
Near Infrared CCD 750-900 nm.
Color 400-700 nm.
See image examples and read more →

- This provides a much higher degree of flexibility (even allowing for customization) and it also has a positive influence on the total cost of the solution
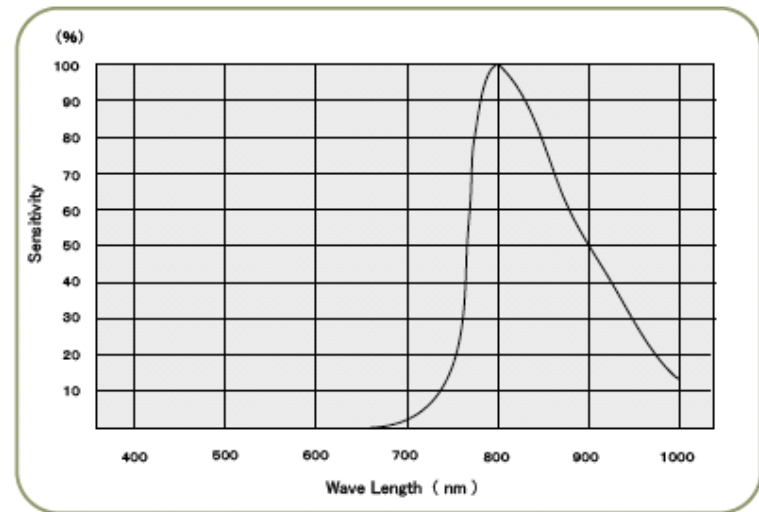
Multi-spectral 2-CCD solution

- The two spectral bands (Visible and NIR) are separated by the coating on the prism surfaces and an additional "trimming" filter
- The curves below show combined response of the sensors and the prism/filters
  - Note: because the wavelengths are different, there is almost no loss of light intensity per channel
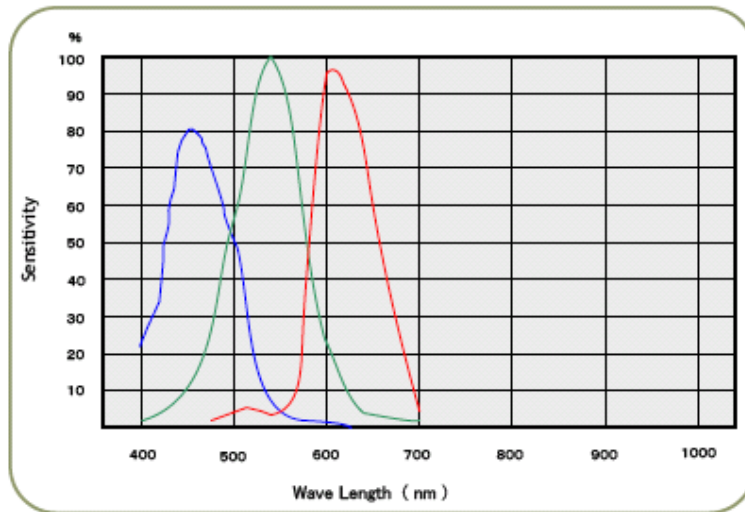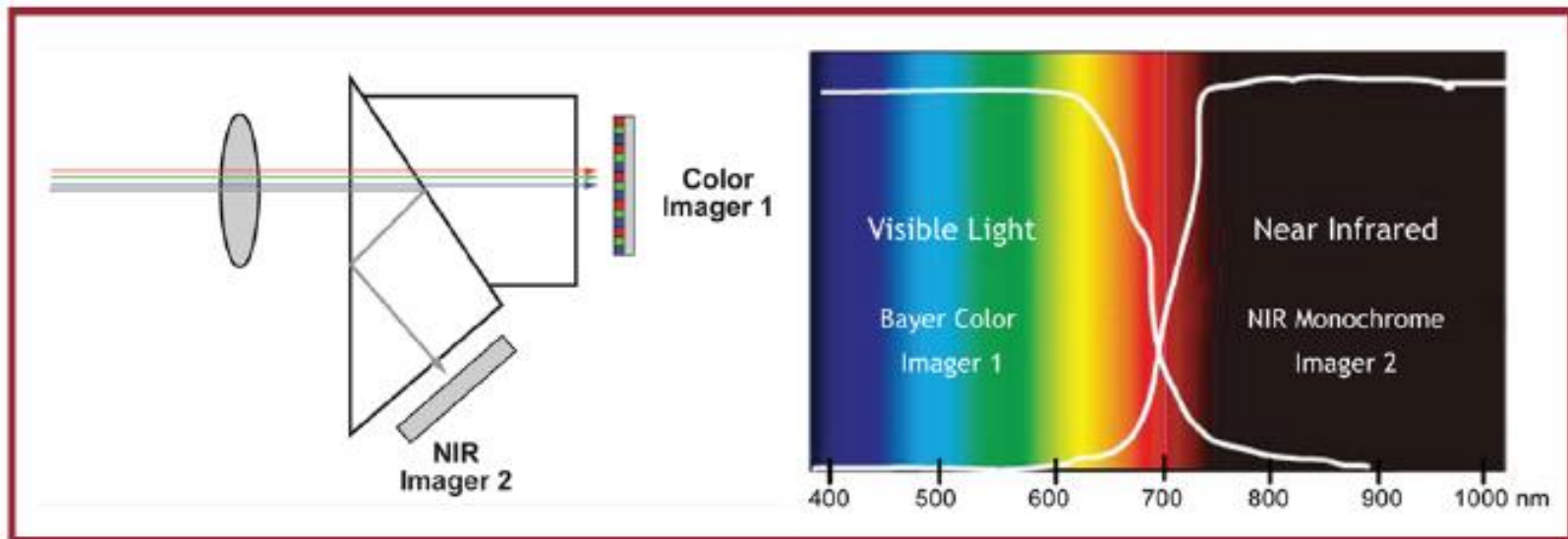

Color Channel   **Near-IR Channel**

Multi-spectral 2-CCD solution

Application cases

- There are many applications that can utilize a multi-spectral combination of Visible and Near-IR.

- These include inspection of:

  - Vegetables
  - Fruit
  - Beans and nuts
  - Meat
 - Pharmaceutical packaging
  - Printing industry

- This approach not only eliminates the alignment issues of a two-camera system, but is easy to deploy and avoids the extra cost of two cameras, lenses, cables, etc.

Food inspection

- When fruit (or vegetables) are exposed to Near-IR light, some of the light is directly reflected on the surface.

- The remaining radiation passes through the surface and is scattered in all directions.

- Some light is absorbed. The amount of absorption depends highly on constituents of the cell structure.

- The process of rotting and decay breaks down the cell structure, resulting in reduced scattering.
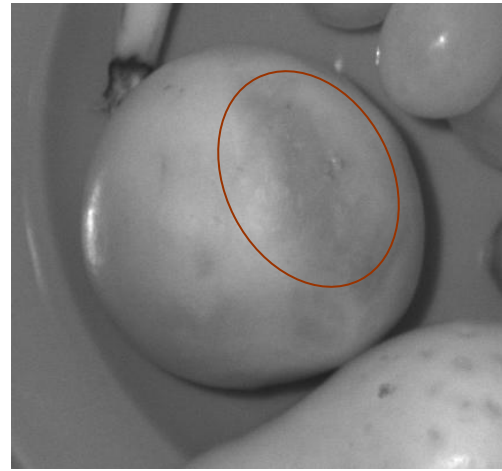
Good

Bad
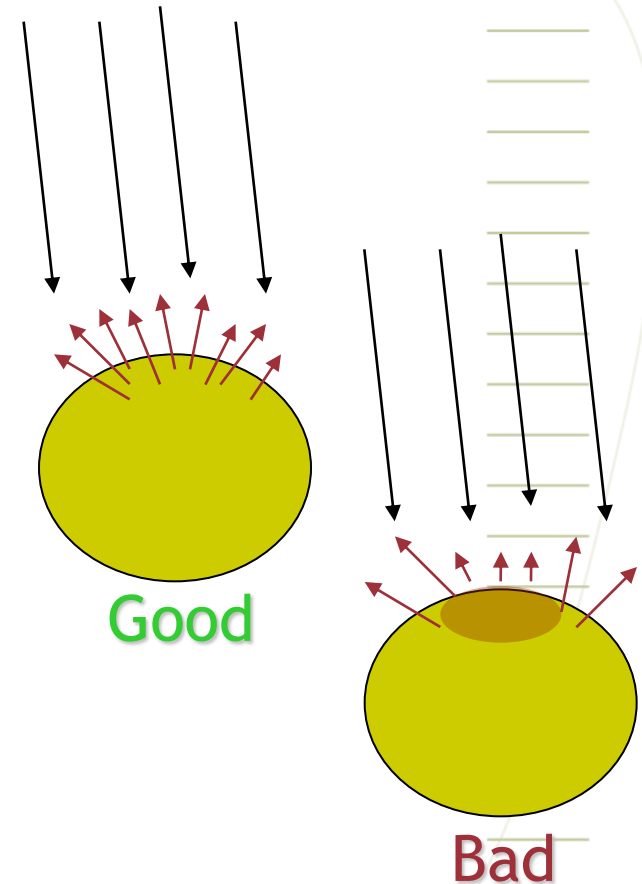
Food inspection example

Fruit

Color - visible

Natural color
variation or sign
of decay?

Near IR

Here is the answer!
The darker patch is an
early sign of decay.

Food inspection - example

Coffee beans

Visible

Try to pick out
the bad one in
this bunch...
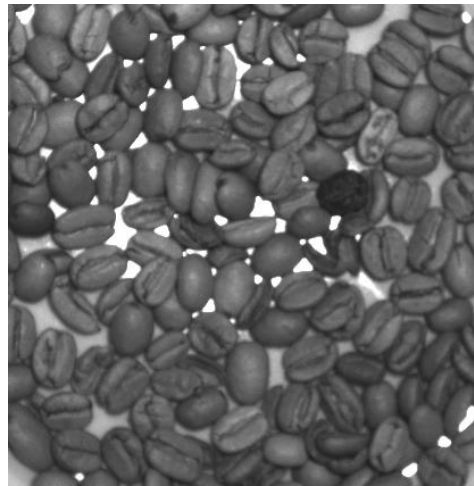
Near IR

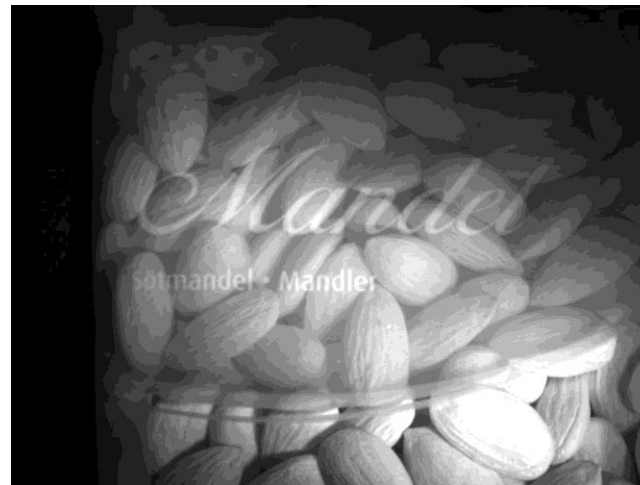Very easy in the
NIR image.

Packaging inspection - example

A bag of almonds

Visible

Near-IR

The visible channel lets you see the printing on the bag, while the NIR channel lets you see through the printing
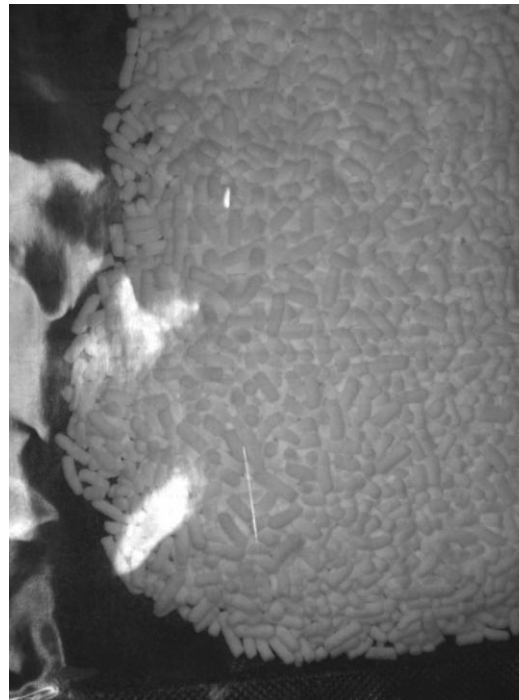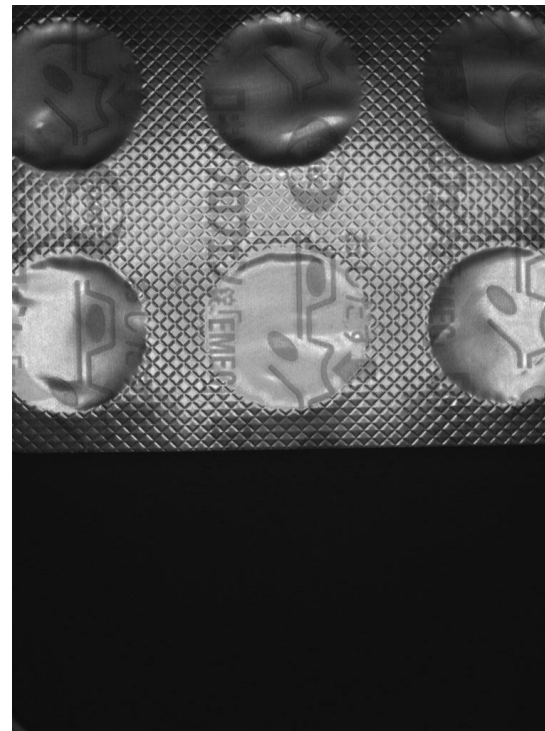
Packaging inspection - example

Box with salt snacks

Visible

Near-IR

The visible channel lets you see the printing on the bag, while the NIR channel lets you see through the printing

Packaging inspection - example

A bag of Japanese sugar

Visible

Near-IR

The visible channel lets you see the printing on the bag, while the NIR channel lets you see what's inside

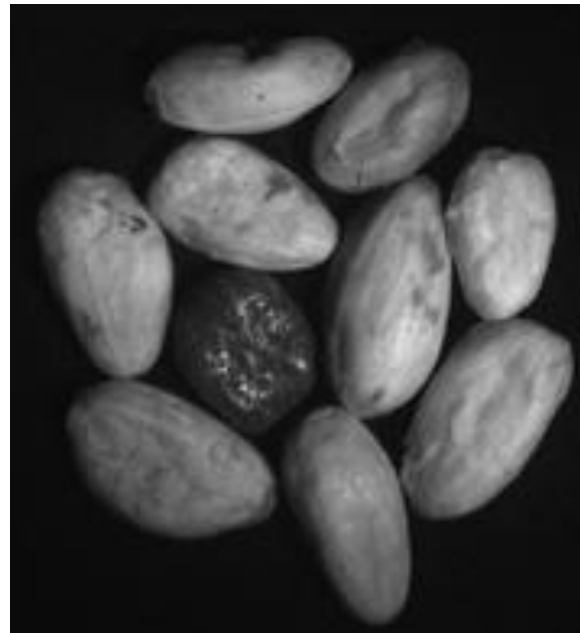# Packaging inspection - example

A blister pack

Visible

Near-IR

The NIR channel lets you see the surface properties

Food inspection - example
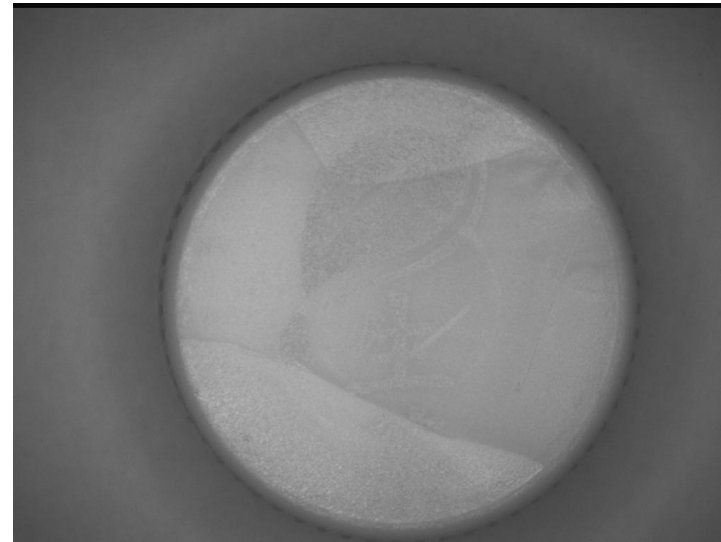
Cocoa beans with an alien element (a stone)

Visible

Near-IR

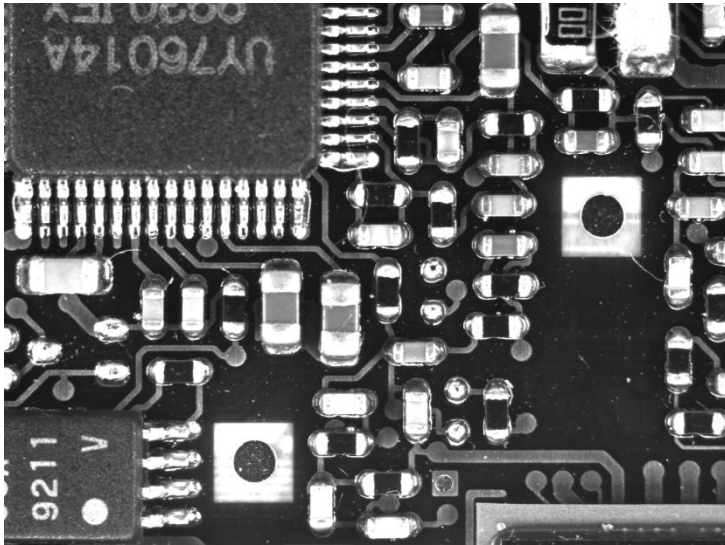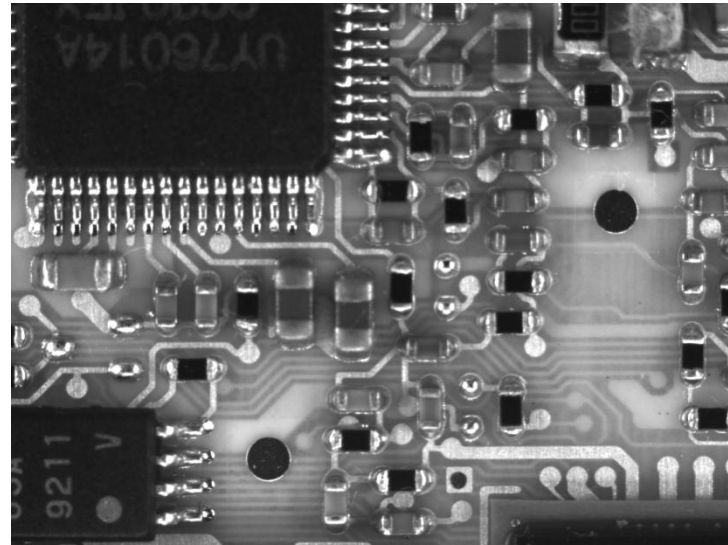# Print/surface inspection - example

Bottle cap

Visible

Near-IR

The color channel allows inspection of the logo print,
while the NIR channel lets you see the surface scratches/defects

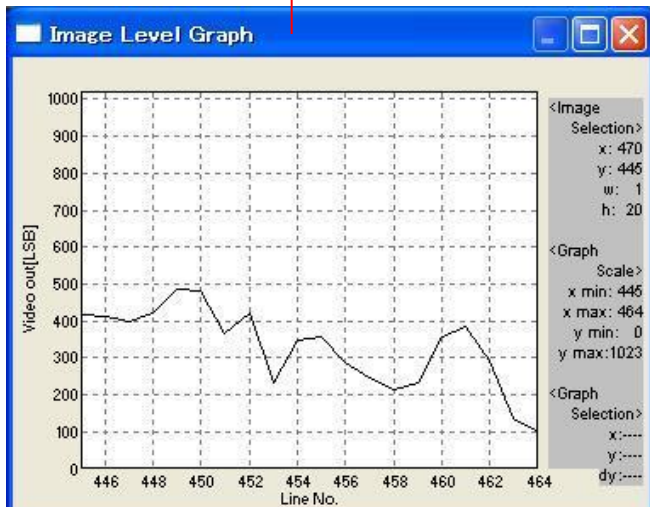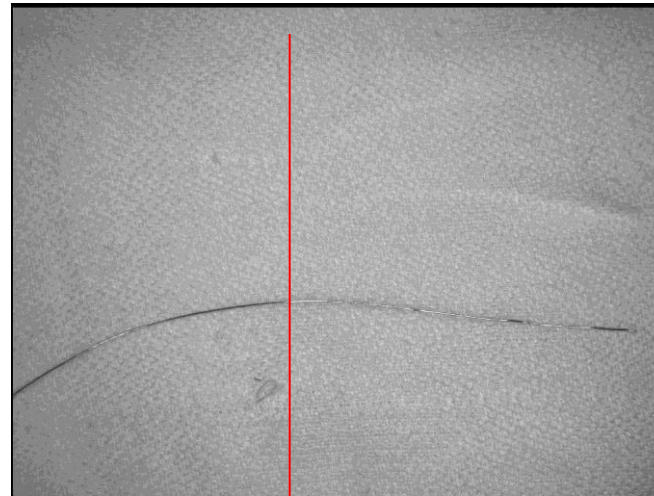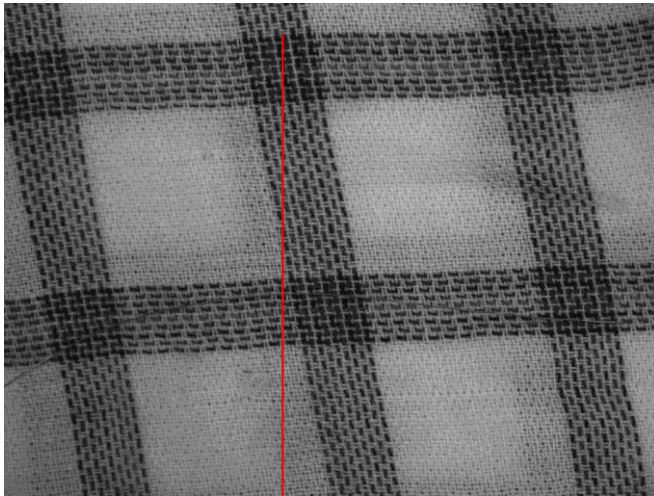# PCB inspection - example

Visible

Near-IR

The visible channel (mono, in this case) shows components on surface, while the NIR channel lets you see traces between PCB layers
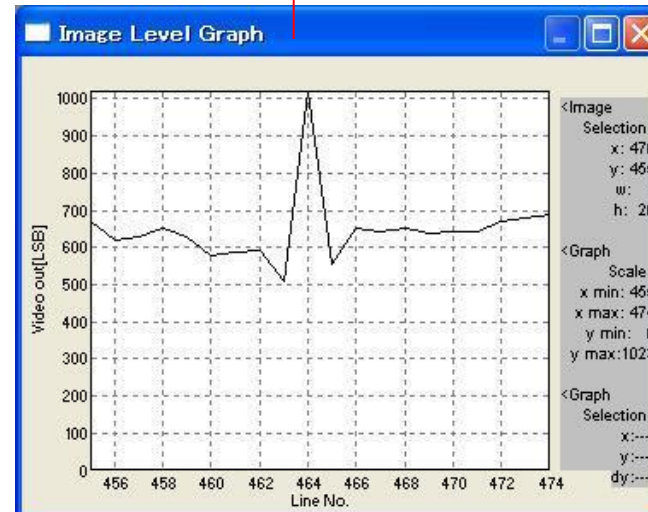
Textile inspection

Pattern inspected in visible vs. foreign thread found in NIR

Visible

Near-IR