**P&P Optica**

# Making Sense of Hyperspectral Imaging for Foreign Material Detection

When evaluating vision systems for foreign material detection in your meat processing plant you're bound to come across different solutions making similar claims. Learning how hyperspectral imaging works will help you understand why all vision technologies can't accurately claim to offer the same strengths and capabilities.

## Hyperspectral operates on a different wavelength

Hyperspectral imaging is a form of spectroscopy. You can think of it like a camera, but the similarities end there. A typical camera image only uses three colors (red, green and blue) and even multispectral images only use up to a few dozen colors. In contrast, hyperspectral images split the light reflected off the product into hundreds of continuous colors (or wavelengths). This offers multiple benefits:

- **More precise.** The large number of wavelengths used in hyperspectral imaging allows the technology to capture and use all the available information in a material.
- **More accurate.** Hyperspectral imaging offers more exact detection than other methods.
- **More sensitive.** It also allows the technology to "see" the chemistry of the food it inspects. This helps with finding low-density materials without depending on density, color contrast or size. It also helps with assessing food quality characteristics like lean point.

## Comparing Vision Systems

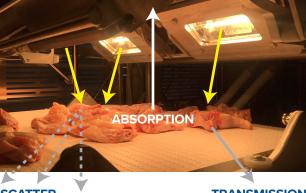|  | Typical Vision | Multispectral Imaging | Hyperspectral Imaging |
|---|---|---|---|
| **# of Light Bands** | Typically 3 | Typically 3-10 | 100's to 1000's |
| **Spectral Resolution** | Low. Broad "colours" | Medium. Can be narrower colours but may be separated by gaps | High. Very fine colour sampling. No gaps. |
| **Information per Pixel** | Very low | Isolated data points only | Full spectrum from each pixel |
| **Identifiable Features** | Visual features only like shapes and high contrast objects | Simple, few components. Identified chemistry only | Complex, multi-component. Known and unknown |
| **Trainability of System** | Low due to very limited Information Per Pixel | Low due to limited data capture | High, due to rich data capture |

## Only PPO Provides True Hyperspectral Imaging In Line

PPO is the market leader in hyperspectral imaging thanks to 20 years of research in high-performance spectroscopy. Here's how the tech comes to life in our Smart Imaging System:

- A set of specialized lamps generates light in both visible and Near Infra-Red (NiR) wavelengths where the spectral signatures are most sensitive to materials like meats, vegetables and plastics.
- Light from these specialized lamps is reflected onto the product being inspected as it moves along the conveyor belt.
- The reflected light is sent through a high-efficiency holographic grating inside our patented spectrometers. The information generated by the reflected light is recorded by a high-speed, high-resolution camera in 500 different continuous wavelengths.
- The reflected and dispersed light contains the chemical signature of anything on the conveyor, including the belt, product and any other materials (like plastic, wood or rubber) present.



**REFLECTANCE**

**ABSORPTION**

**SCATTER**

**TRANSMISSION**

## Translating images into actionable information

Feeding hyperspectral images through PPO's advanced machine learning software allows for highly sensitive inspection of your product as it passes through the Smart Imaging System.

**This information helps to identify foreign objects in real-time, at line speed.**

**+**

**Subtle differences in chemical fingerprints help with measuring fat/ lean content, tenderness, freshness, pH and more.**

**+**

**PPO's models are optimized to get new information from the same spectral data, tailored to our customers' specific requirements.**

### Insist on Hyperspectral Imaging

Other solutions may claim to use spectroscopy or assess chemistry, but only **PPO's patented solution includes true hyperspectral technology:**

- Custom-designed, patented spectrometers and hyperspectral lamps built by our optical designers.
- Machine learning algorithms and AI developed by our in-house software developers.
- Real-time capture and reporting of incidents, using PPO Insights.