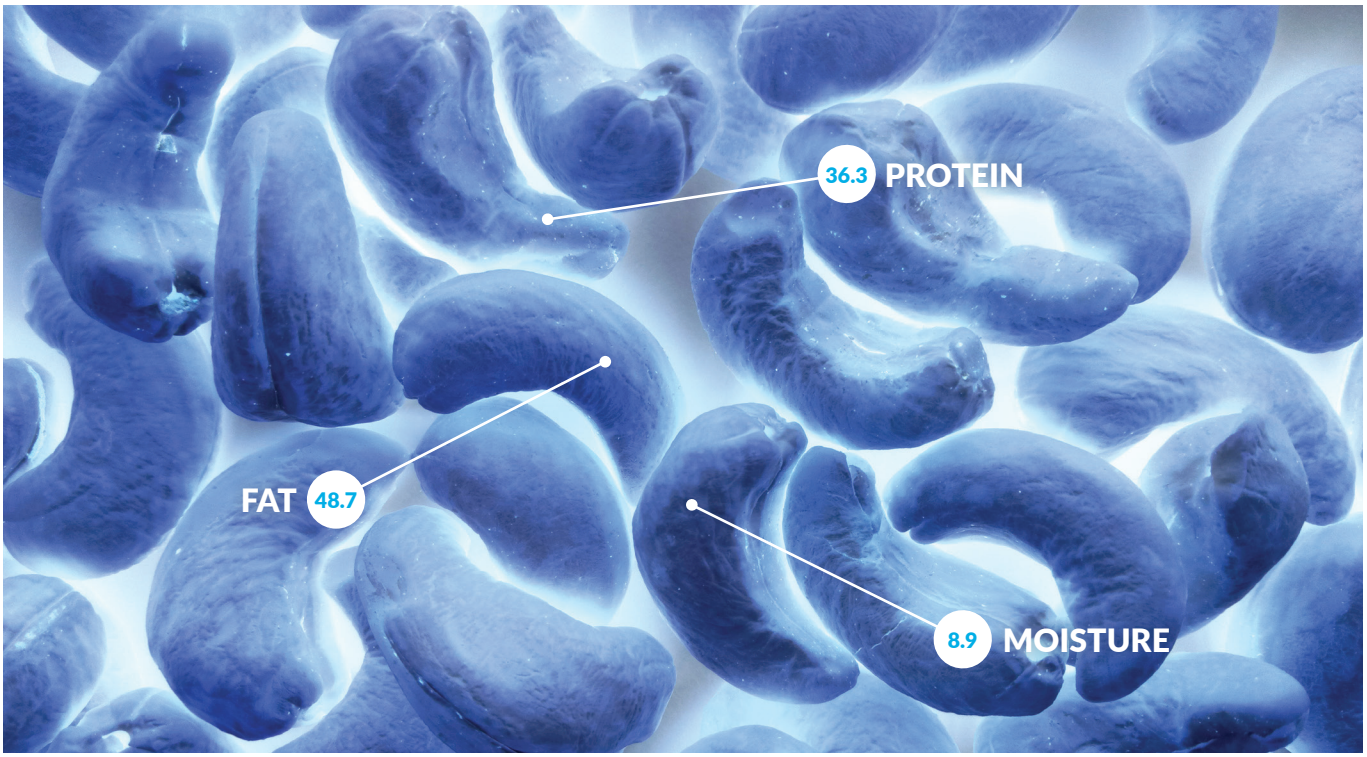
SPECIM
SPECTRAL IMAGING

HSI AND XRAYS
FOR THE FOOD INDUSTRY



A primary concern for food transformers and producers is to ensure the quality of their product. At different steps of the processing chain, food can be contaminated. Also, to provide high quality, the quantification of several parameters, such as, e.g., fat, moisture, sugar, and protein content, is crucial. The presence of contaminants in an end-user package, or if the product does not match with the labeled nutritive properties, would immediately ruin a branding reputation, hardly gained over the years.

Controls are needed to ensure quality. Many use machine vision for this task, but only a few employs hyperspectral cameras. Hyperspectral imaging is a non-destructive and contactless technology, which combines Near InfraRed (NIR) spectroscopy with the spatial distribution. This opens new opportunities for quality control and grading for many types of food products. By utilizing hyperspectral imaging, machine vision systems can reveal much more about meat products than traditional vision methods, mostly on RGB and X-rays sensors.

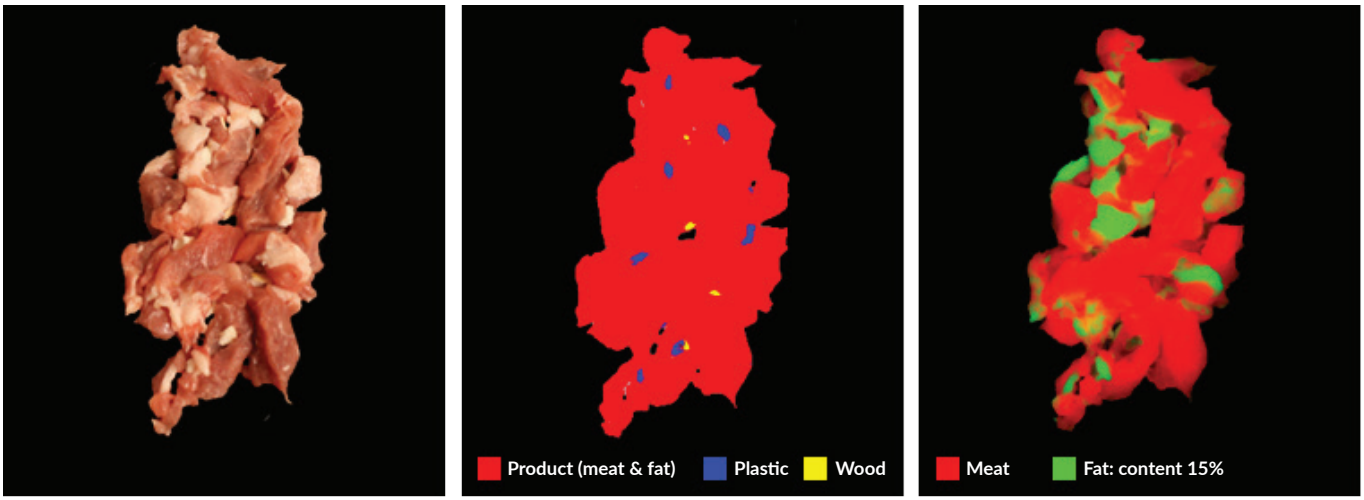
Hyperspectral cameras produce images within which each pixel contains full spectral information. This allows:

1. The detection of contaminants, such as, e.g., plastics, wood, and bones.

2. The quantification of chemical and nutritive properties including, pH, sugar, fat, water, and salt content.

Hyperspectral imaging alone can not solve all issues. But it should be seen as a complementary technology, especially to X-Rays. Hyperspectral imaging can not see through samples, whereas X rays can make them more tangible for detecting contaminants in the middle of the transformed product. However, since they rely on density change detection, they cannot characterize nutritive properties nor detect contaminants whose density is similar to the product.

As an illustrative example, big bones in minced meat could be correctly identified by X-ray, even if it locates in the middle of the product. On the contrary, a hyperspectral camera would not be able to identify it. However, fat and protein could be quantified with the hyperspectral sensor, whereas the X-ray system would not provide relevant data for this task.



Sorting of contaminants and fat based on hyperspectral data.

Data fusion between different types of sensors is the key to ensure robust and accurate quality control. The below table highlights the pros and cons of both technologies within the food quality context.

		X Ray	HSI
Contaminants	Visible on the surface	*	
	Not visible on the surface	*	
Nutritive property	Fat		
	e.g. Sugar, Moisture, Proteins		
Color			

* only if the density of the contaminant is different from the product