



PHOTONICS SOLUTIONS FOR 2024 **FOOD MANUFACTURING**

The science of light known as photonics is becoming a major player in food manufacturing helping manufacturers and researchers achieve quick and accurate results.

From **spectroscopic** to **hyperspectral infrared** and **X-ray imaging**, discover how our photonic solutions and know-how can transform your operations. Learn about how we can assist you in minimizing waste, maximizing production, and ensuring uncompromising quality standards.

HAMAMATSU
P H O T O N I S O U R B U S I N E S S

Challenges faced by the growing production and quality needs of the increasingly interconnected food industry have pushed certain technologies to the forefront.

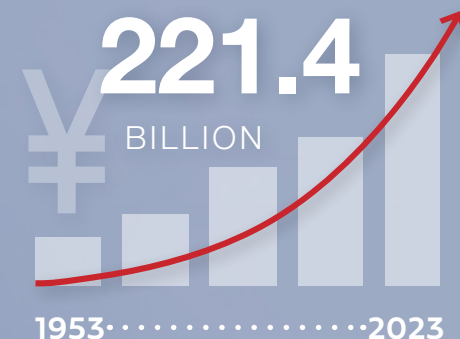
Innovative and full of possibilities, the benefits of using photonics technology are being realized in **quality monitoring, traceability and safety control**.

With close to 70 years in the industry, many of the solutions offered by Hamamatsu Photonics have been designed and customized to fit these demanding applications.

FOOD MANUFACTURING OPENS ITS DOORS TO NEW TECHNOLOGY

AN ESSENTIAL PLAYER IN THE PHOTONICS INDUSTRY

Since 1953, Hamamatsu Photonics has been mastering the development of technologies that capture, measure, and generate light from components to entire optical systems. Passionate about finding new ways to improve our society, we built a series of solutions ideal for **improving food inspection, sorting, safety, and quality** for both industries and researchers.



5,795
EMPLOYEES

10
RESEARCH
& PRODUCTION
FACILITIES

15.000
PRODUCTS

All figures taken in 2023

HAMAMATSU

PROVIDING YOU A SOLUTION AT EVERY STEP

Our photonics solutions provide you opportunities throughout the whole food supply chain from research to the food production process including **pre-processing**, **processing**, **packaging** and **quality control**.

APPLICATION EXAMPLES

INFRARED IMAGING & SPECTROSCOPY



**DETECT THE RIPENESS
OF FRUITS & VEGETABLES**

Apple moisture detection



MEASURE ORGANIC COMPOUNDS

Alcohol concentration estimation in
alcoholic beverages



**DETERMINE THE NUTRITIONAL
INFORMATION OF FRUITS
& VEGETABLES**

Bell pepper nutrition measuring

X-RAY IMAGING



**INSPECT SEAFOOD
QUALITY**

Shellfish in shells identification



**CONTROL BONE CONTAMINATION
IN PACKAGED FISH & MEAT**

Packaged poultry bone detection



**EXAMINE LIQUID LEVEL
CHANGES IN SEALED BOTTLE**

Beer fill level inspection

The application of these methods are
non-destructive, non-contact, in situ
and provide real-time results.

INFRARED IMAGING & SPECTROSCOPY

Infrared, Near-Infrared (NIR) and Short Wavelength Infrared (SWIR) imaging offer high-contrast images, which are ideal for close-up surface details, invisible to the human eye.

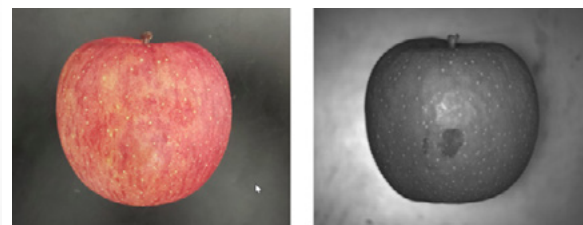
In addition, hyperspectral imaging and spectroscopy provide a long list of information crucial to defining the characteristics of food products.

What can we detect?

Deterioration in food products, for example, is clearly identified to help you sort and remove damaged foods.

INFRARED IMAGING

It reveals details invisible to the human eye through high-contrast imaging.



DETECTING APPLE DEFECTS
THROUGH INFRARED IMAGING

HYPERSPPECTRAL IMAGING

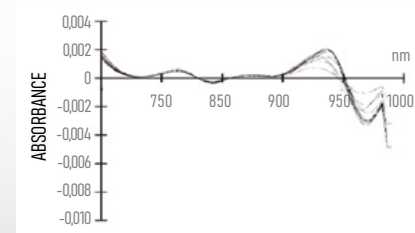
By combining NIR spectroscopy with digital imaging, hyperspectral imaging provides a highly detailed level of information to ensure food quality. It helps us distinguish types of food, their ripeness, their moisture levels, or even the presence of harmful organisms like parasites in water.



MEASUREMENT OF MOISTURE
CONTENT TO MONITOR
CHEESE MATURITY

INFRARED SPECTROSCOPY

Spectroscopy can quickly determine several components in food, including moisture, fat, protein, and carbohydrates.



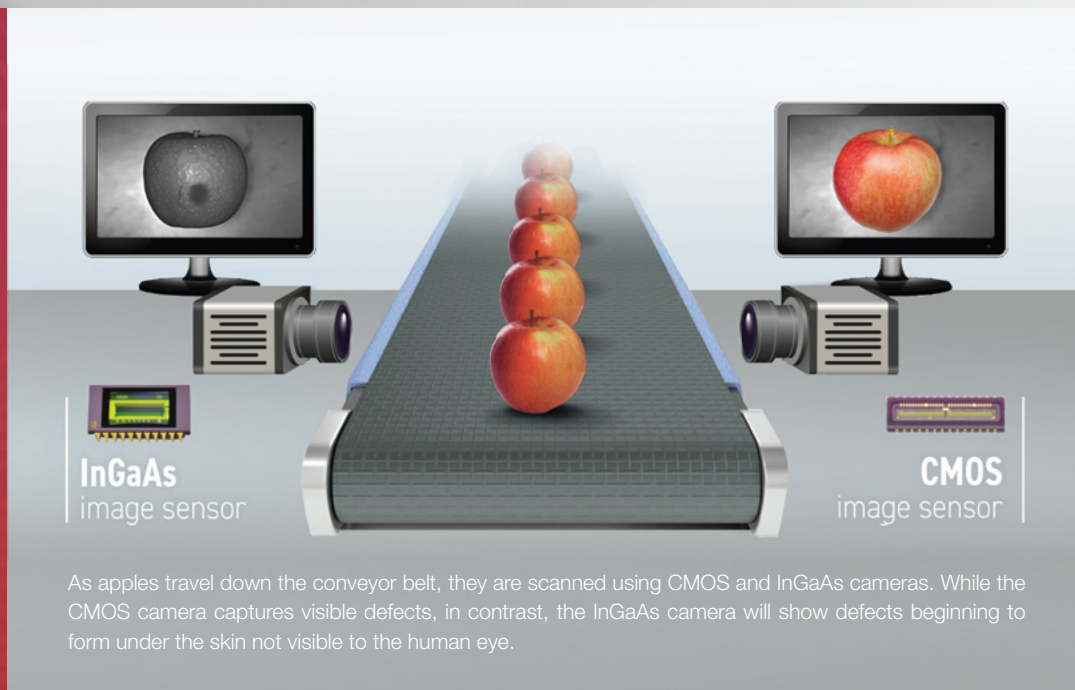
MEASUREMENT OF GLUCOSE FOR
MONITORING PURPOSES

INFRARED IMAGING & SPECTROSCOPY

How can we detect?

The inspection is carried out by moving the object on a conveyor belt while an infrared/SWIR camera is capturing it.

Our highly sensitive camera can detect and visualize even the slightest variations in density of a large variety of product compositions quickly, objectively and reliably. Then, the transmission received by the sensor is converted to electric signals. Finally, an image processing system converts the signals to images so you can easily monitor the quality of your products.

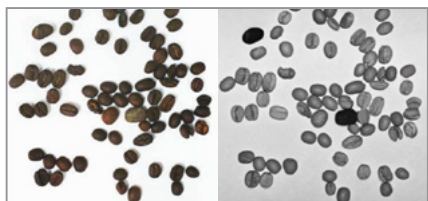


APPLICATION EXAMPLES

SORTING OF COFFEE BEANS & STONES

| VISIBLE IMAGE

| IR IMAGE

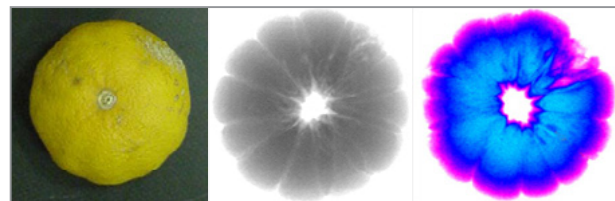


DETECTION OF ALTERATION INSIDE FRUITS

| VISIBLE IMAGE

| IR IMAGE

| PSEUDO COLOR IMAGE

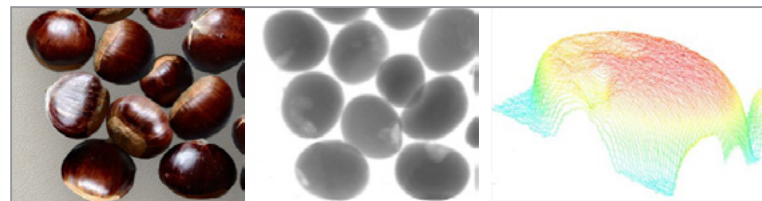


DETECTION OF INSECTS & WORMS IN CHESTNUTS

| VISIBLE IMAGE

| IR IMAGE

| 3D IMAGE



INFRARED IMAGING & SPECTROSCOPY

DISCOVER OUR SELECTION OF INFRARED SOLUTIONS

To discover all our product range
contact us or visit www.hamamatsu.com



NIR & SWIR sensors and modules

Covers the visible (VIS), near-infrared (NIR), and short wavelength infrared (SWIR) regions. Compact and high-speed, they have a built-in CMOS IC, allowing easy operation.

- InGaAs linear image sensor
- InGaAs area image sensor



Infrared spectrometers & Spectrum sensors

Makes in situ real-time measurement possible. Combining image sensing, optical systems and MEMS technology, our compact portable spectrometers come in all shapes and sizes, and cover a broad spectral range.

- Mini-spectrometers
- MEMS-FPI



NIR & SWIR cameras

Bridges the gap between NIR wavelengths, where silicon detectors are no longer sensitive. Our extensive experience with InGaAs sensors allows us to offer excellent image contrast and quality.

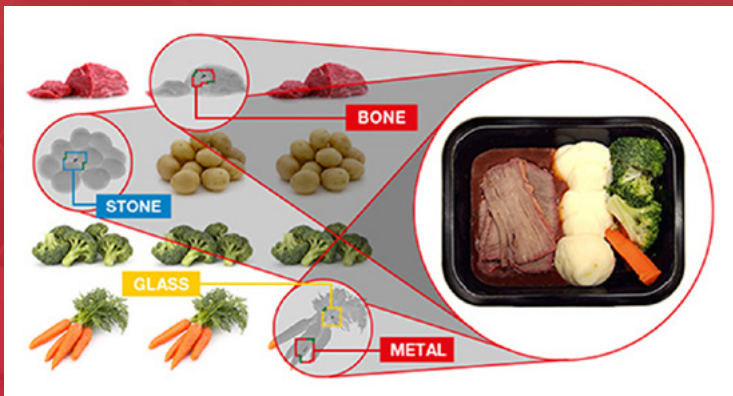
- InGaAs cameras

X-RAY IMAGING

X-ray technology is ideal for the inspection of food products and packaging, as it enables imaging of the internal features without damaging the product and can detect physical defects or contaminants.

What can we detect?

X-ray images can safely capture the inside of any raw produce and packaging, even with uneven surfaces, to identify foreign objects whether these are of the same or different material (eg., glass within glass or metal within glass) and regardless of their shape, size or location within a product.



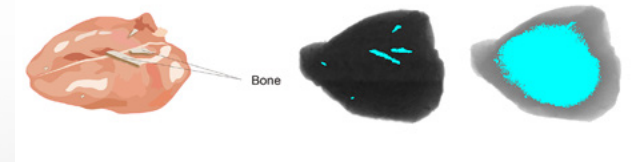
X-RAY SINGLE-ENERGY IMAGES

A conventional technique that involves a product passing through an X-ray beam where only the residual energy reaches the detector. As it passes over the detector, each line of data is added to previous lines, resulting in a complete product image. Ideal for the detection of foreign objects that exhibit an X-ray absorption spike relative to the surrounding product's absorption.



INSPECTION OF PACKAGED FOOD AND WINE BOTTLE CONTAMINANT

X-RAY DUAL-ENERGY IMAGES



CHICKEN BREAST BONE INSPECTION

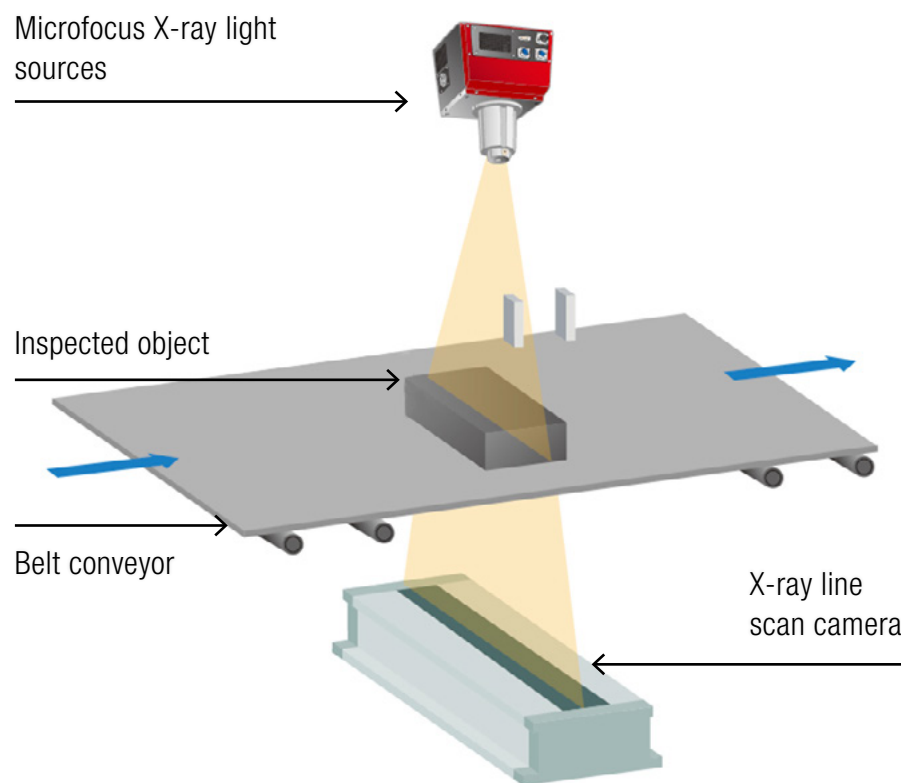
Two separate X-ray energy-generated images using low and high energy X-ray absorption. The image translates the measurement ratio between both energies, ideal for detecting objects that show a small X-ray absorption variation, harder to detect with single X-ray imaging.

X-RAY IMAGING

How can we detect?

The illustration on the right presents an inline X-ray detection operating principle using our combined emission X-ray light source & camera detection solutions.

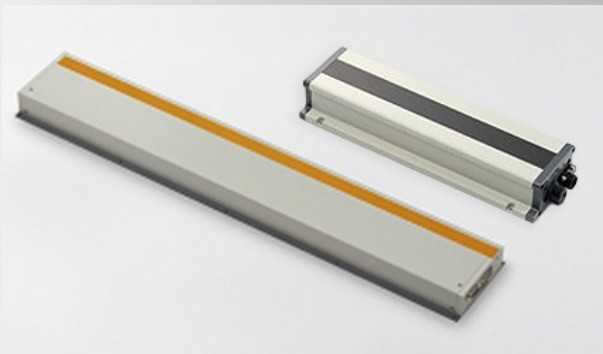
Based on what needs to be uncovered, various solutions exist. X-ray line sensor cameras allow for a clear full visibility of a whole range of foreign objects. Dual-energy cameras will increase the level of contrast by combining high and low energies, allowing density as well as other material characteristics to be determined.



X-RAY IMAGING

DISCOVER OUR SELECTION OF X-RAY SOLUTIONS

To discover all our product range
contact us or visit **www.hamamatsu.com**

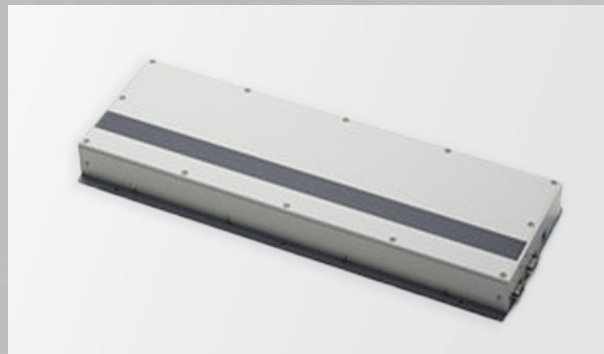


X-ray line scan camera | C14960 & C14300

Delivers high-sensitivity and high-resolution images of moving objects with many options available.

MAIN FEATURES

- Suitable for thin and thick samples
- High dynamic range: low to high X-ray dose detection
- Low noise: high S/N imaging with low X-ray dose
- High speed rates: 4 to 200 m/min



Dual Energy X-ray line scan camera | C10800 series

Performs advanced low density contaminant detection (e.g., chicken bones) and thin density contaminant detection (e.g., glass fragments) which were previously difficult to detect.

MAIN FEATURES

- High dynamic range: extract a target material from multi-energy image data
- 14-bit digital output
- High resolution



X-ray TDI camera | C12300 series

Improves image brightness for enhanced images. Most appropriate for imaging linearly moving objects or where the aspect ratio is significantly asymmetric.

MAIN FEATURES

- Very high/low energy X-ray sensitivity
- High speed line: up to 230 m/min
- High signal to noise ratio: 16 bit output

How can we respond to your needs?



SAMPLE TESTING



PRODUCT DEMOS



LOCAL SERVICE &
MAINTENANCE ADVICE



BEST ENGINEERING
ADVICE



QUALITY PRODUCTS
MANUFACTURED IN-HOUSE

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PHOTONICS SOLUTIONS FOR **FOOD** 2024 **MANUFACTURING**

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THANK YOU!

Any questions?

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