

SATAKE



BELTUZA  
**SPECTRA**

X-Ray Technology

Belt-Type Sorter  
**CSX600BW**

# X-ray & Artificial Intelligence

Combining optics and AI for the future

Beltuza Spectra uses X-ray and advanced shape-finding technology to sort by perimeter and circularity sorting.



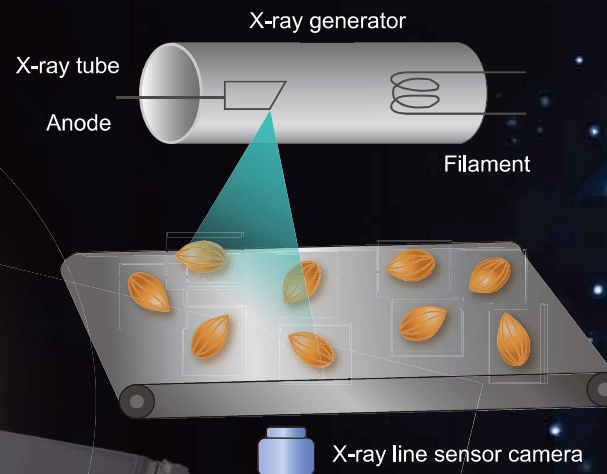
**Internal, External, and Material characteristics inspection.**

**Made possible in a single unit.**

Spectra utilizes six optical wavelengths (Red, Green, Blue, IR1, IR2, X-Ray) and advanced shape sorting. The combination of these enables inspection of the external and internal properties of the product.

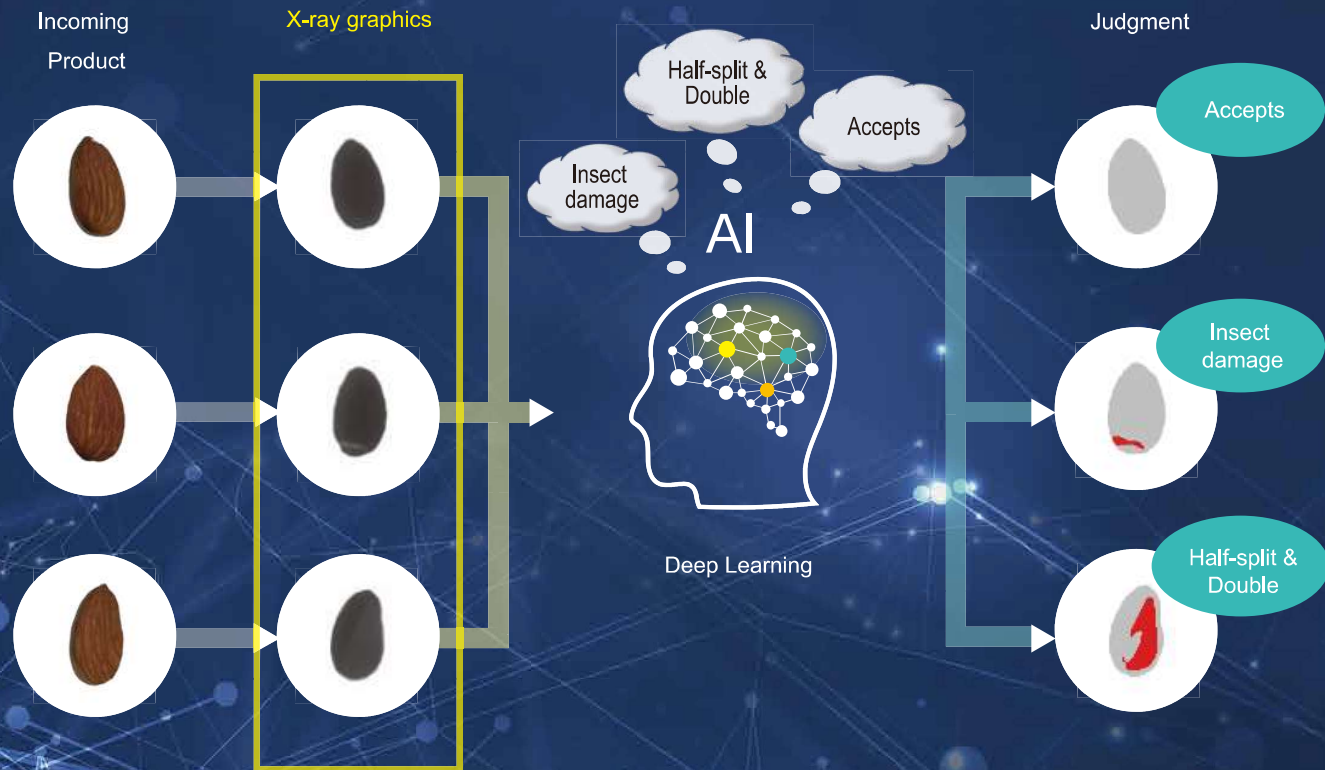
# Results only achievable with X-ray and AI

## How X-ray works



X-rays emitted from the X-ray generator penetrate the object to be sorted and are captured by the X-ray line sensor camera. The denser and thicker the object is, the more X-rays it absorbs and the darker it appears. In the case of internal defects, such as insect damage, the thickness of the defective area is thinner than the surrounding area, so it appears brighter.

# AI distinguishes the subtle differences between product variation and defects



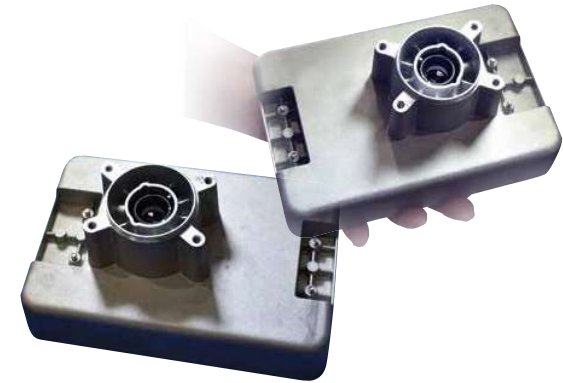
X-rays can be used to visualize holes in the interior due to insect damage, as well as chipped or deformed areas on the exterior.

The AI, which learns the characteristics by deep learning, identifies accept, insect damage, half-split or double. In addition, the user can select "insect damage" or "half-split or double" as defective products.

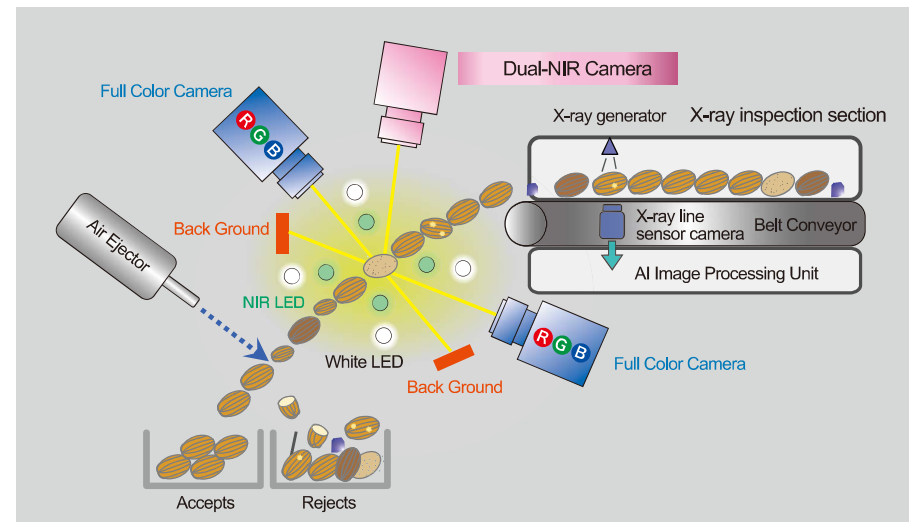
# Optimal sensitivity setting by combination of RGB wavelengths and two NIR wavelengths - **MIX sensitivity**

Patent pending

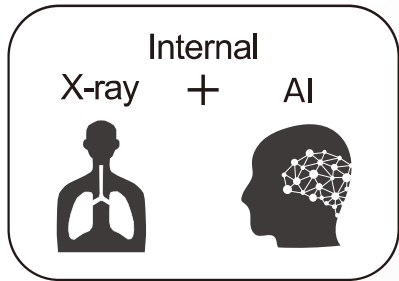
The upgraded Satake 3S system evaluates the product application and automatically creates the sensitivity for accurate defect removal.



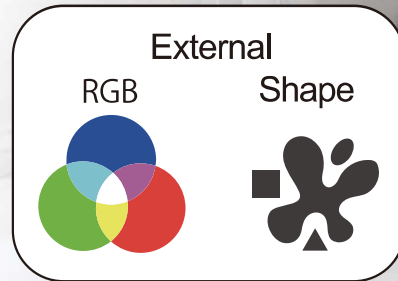
## ■ Sorting Mechanism



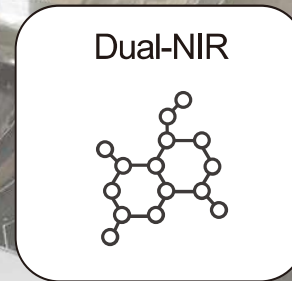
# Internal, External, all covered.



By building an AI-based separation model Satake has made it possible to detect complex internal defects such as insect damage and half-split grains, which cannot be sorted by conventional optical sorters.



In addition to rejecting products based on shape and size, the Spectra also detects subtle color differences using advanced RGB cameras.



Cracks and chips



Peeled



Insect damage



Discolored



Sorting sample: Almond

	Accepts	Internal Damage	Shape Defects	Discolored	Shell	Metals, etc.
X-ray + AI		A+	A	NG	NG	A+
X-ray		A	NG	NG	NG	A+
Dual-NIR		NG	NG	NG	A+	A+
Shape		NG	A+	NG	NG	NG
RGB		NG	A	A+	A	A
All combined		A+	A+	A+	A+	A+

\* Results may vary depends on the conditions of incoming products.

# Function

Using advanced image processing technology and exclusive software, Satake Spectra automatically creates optimal sensitivity to achieve the ultimate sort.



**3S system  
(Automatic sensitivity creation)**

Satake's proven 3S system automatically creates an optimal sensitivity setting from the captured images of accepts and defective products.



**Shape sorting**

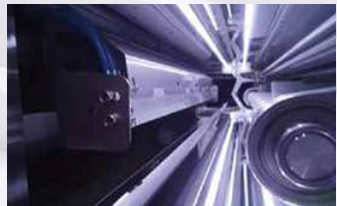
The Spectra enables the user to easily select the optimum shape settings for their product.



# Components



Allows users to scroll through images just like a smart phone. The design has excellent visual appeal and operation



White LED, full-color and NIR cameras, image processing systems, 5mm ejectors, are the heart of Beltuza Spectra.

Accepts discharge

It is designed to prevent damage to the product.

X-ray section

The X-ray images obtained by high-speed X-ray line sensor are identified by the latest image processing system including AI.



Feed material to the conveyor through the slider. The volume can be adjusted.



The belt speed of 1.9m/s enables stable feeding of various materials to the optical section.



# Safety Design

## Safety of X-rays

Safety is our top priority. A variety of safety measures have been implemented.

### Safety for Humans

- X-ray leakage of Beltuza Spectra is less than  $1\mu\text{Sv/h}$

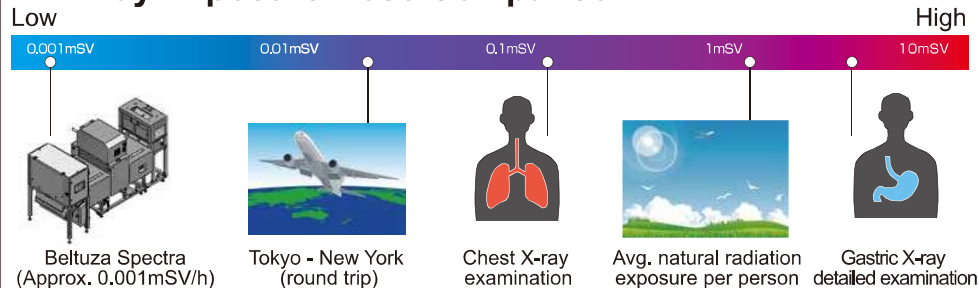
### Safety for foods

- The maximum X-ray dose to food (inspected product) is 0.0001 Gy, which is significantly lower than the standard value of CODEX Committee (FAO/WHO)

\* CODEX Standard: 10 kGy or less (2003 CODEX STAN 106-1983, REV.1-2003)

**IMPORTANT:** Before installing and using the product, you may be required to notify local authorities, obtain an appropriate license, appoint a person in charge of the work, and measure the amount of leakage. Please check the laws and regulations of your country or region in advance.

### X-ray Exposure Dose Comparison



Safety interlock switches

With these 9 switches, if the cover is opened during operation, X-ray generator, conveyor motor, and machine operation will be stopped.



Safety cover

The X-ray generator and the X-ray inspection section are covered with a safety cover and shielded to protect against X-ray leakage.



Pilot lamp

The pilot lamp lights up to allow easy identification of X-ray irradiation.

Key Switch

Allows the administrator to control the operation.



Emergency stop switch

When the switch is pressed, X-ray irradiation stops. At the same time, the power to the conveyor motor is immediately cut off.

# Specifications

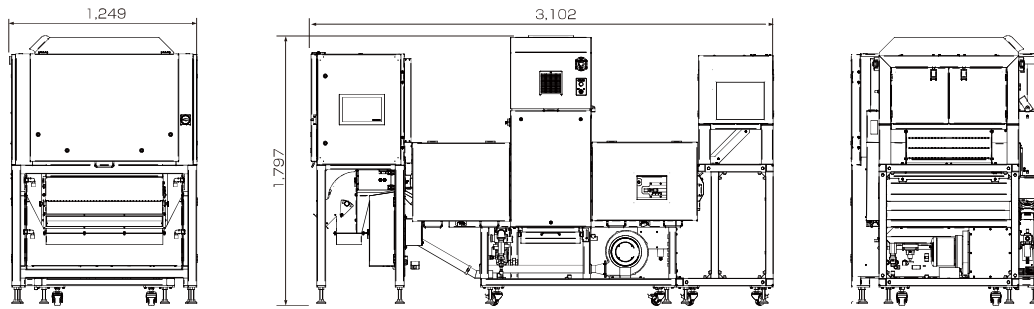
Model		CSX600BW
Applications <sup>※1</sup>		Almonds and other products <sup>※2</sup>
Output Capacity <sup>※3</sup>		Maximum 10.0t/h (Almond kernel)
Feeding Mechanism		Electromagnetic Feeder
Belt		Surface material: Polyurethane, Effective width: 580mm
X-ray section	Camera	X-ray Line sensor camera x 1
	X-ray leakage	≤ 1μSv/h
Optics section	Camera	Full Color CCD Camera x 4, NIR Camera x 2
	Light Source	White LED x 6, NIR LED x 4
Ejector Valve		5mm pitch x 136
Cleaning Device		Wiper, Sweeper, Blower
Net Weight		1,100 kg
Power Supply		Main Unit: Single Phase AC200 - 220V Max. 3.2kW AI Image Processing Unit: Single Phase AC100 - 240V Max. 0.05kW
Required Air		Beltuza Spectra: 1,000 - 1,500 NI/min AC Unit: 700NI/min
Air for Dust Collection		10m <sup>3</sup> /min
Body Construction		SUS304

※1 May not be able to sort due to the characteristics of product.

※2 Products other than almonds may require additional time for AI development.

※3 Processing capacity varies depending on variety and contamination of material.

# Dimensions (mm)



For more information, please contact your nearest Satake.

<https://satake-group.com>



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