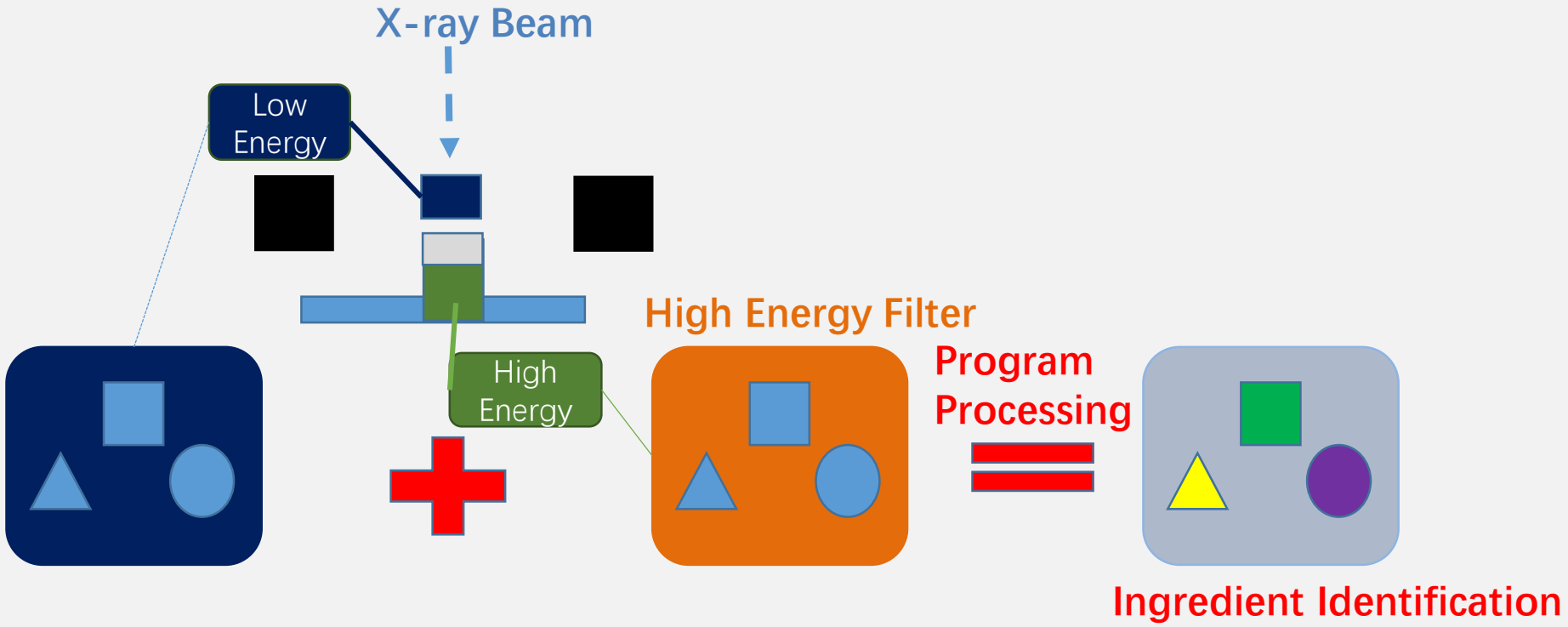
PART 01

Dual Energy Solution

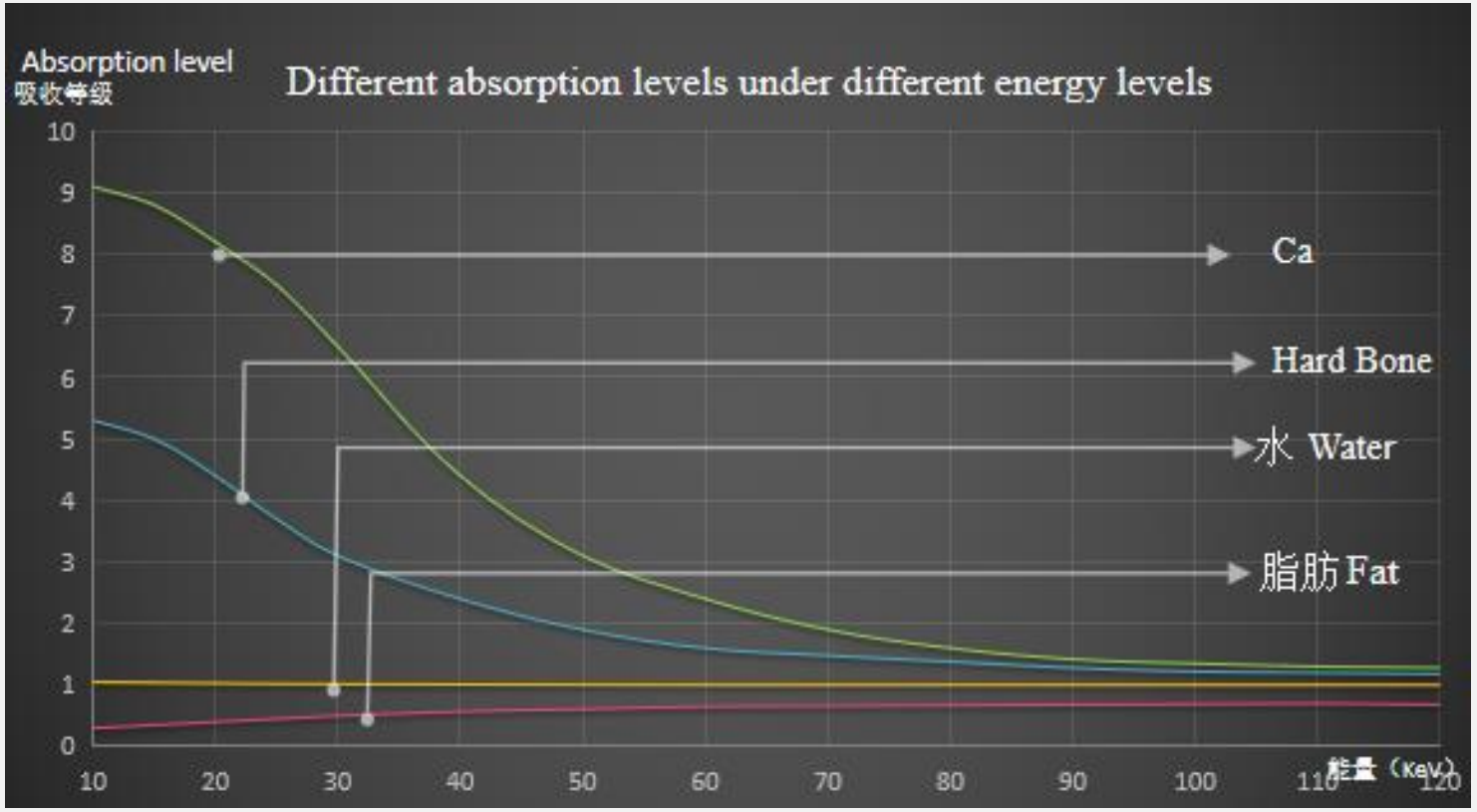
1： Application and Characteristics of Dual Energy Technology



The software automatically compares the high and low energy images, and analyzes whether the foreign matter has atomic number differences through hierarchical algorithm analysis. It detects foreign matter of different components and increases the detection rate of foreign matter.

Effect of Atomic Number on X-ray Absorption

Based on the chemical composition (atomic number) of the product to distinguish, respectively measure the absorption of each chemical element to two non-stop energy X-ray analysis and comparison, obtain high-precision detection results.



2：Application and Characteristics of Dual Energy Technology

太易 TECHIK

Application：

1：Hard Residual Bones in Meat

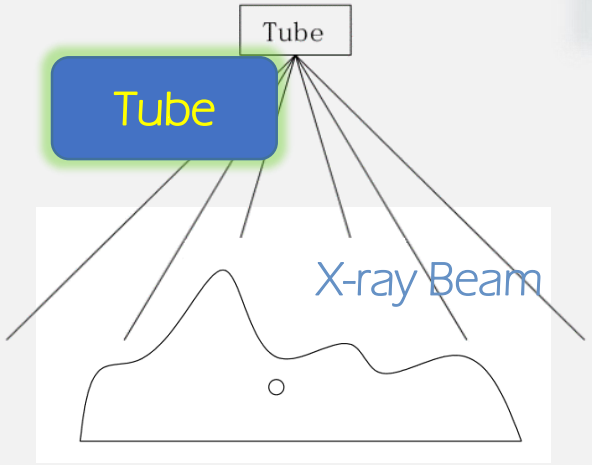
2：Fat Content in Meat

3：Uniform Products with Similar Density Contaminants（flaky glass, organic impurities, etc.）

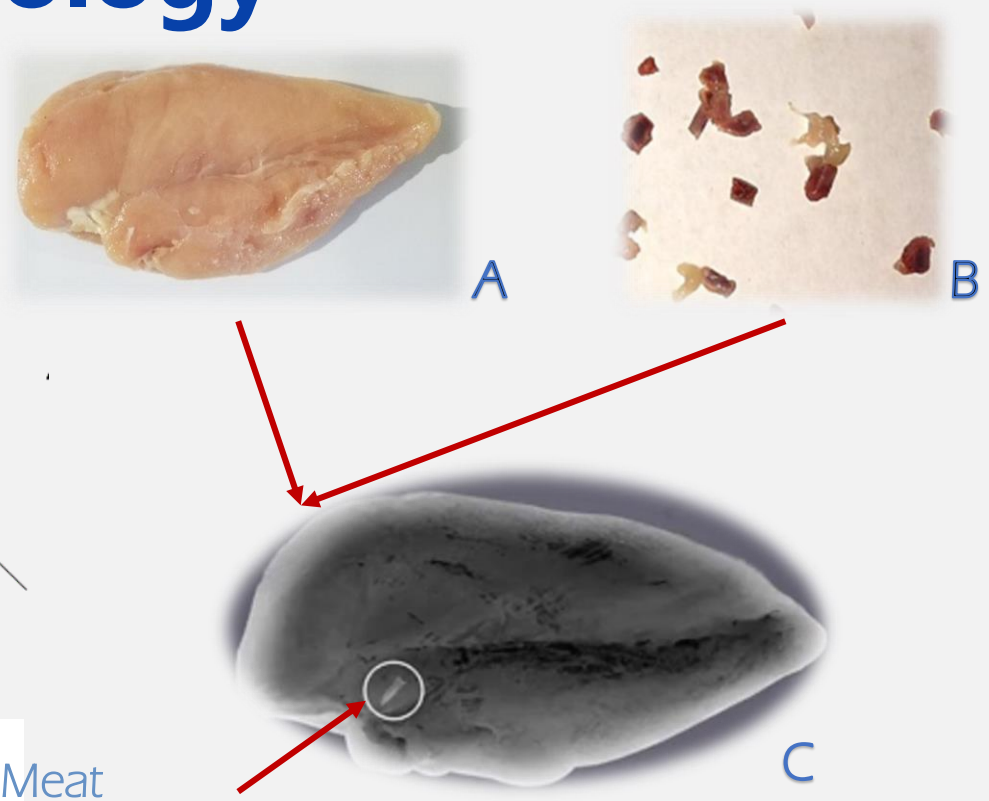
4：Bulk Flow Products (glass, silicon rubber)

2：Application and Characteristics of Dual Energy Technology

1：Hard Bone



图像反映值



Low Density Bone

(1) Even small differences of density between the foreign matter and the product can also be detected.

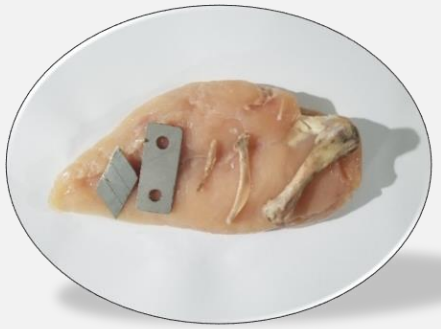
(2) Overlapping makes little difference to detection

(3) Different components can be analyzed to separate out foreign bodies.

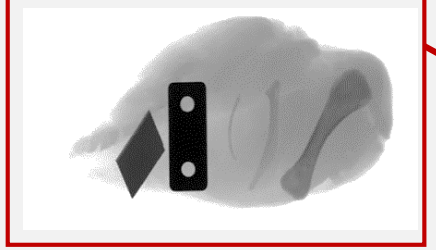
2：Application and Characteristics of Dual Energy Technology

1：Hard Bone

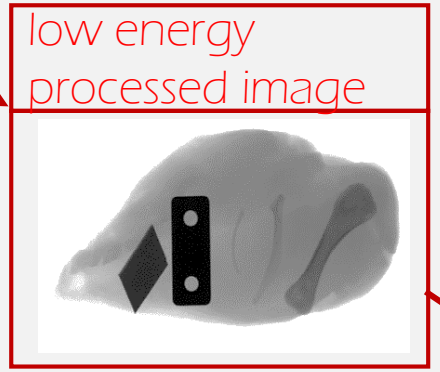
Dual Energy + AI



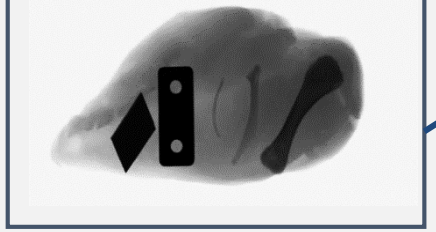
low energy raw image



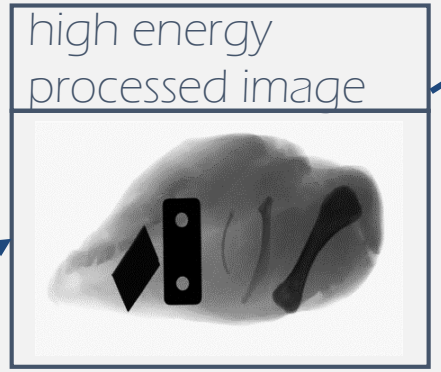
low energy processed image



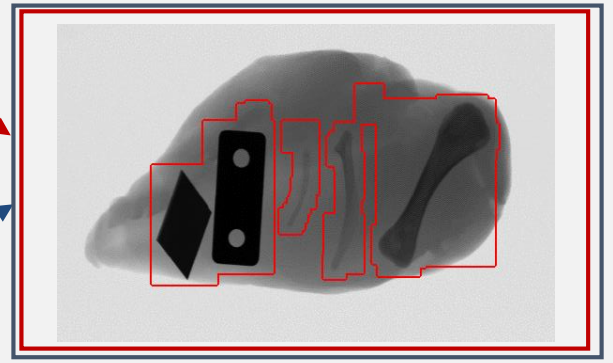
high energy raw image



high energy processed image



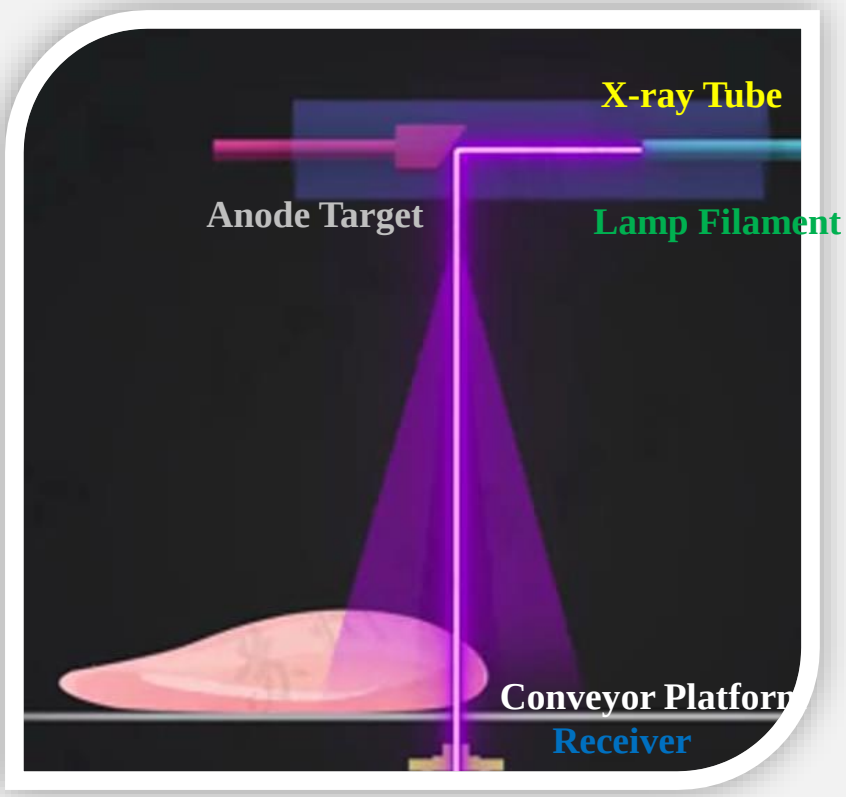
Dual Energy Image

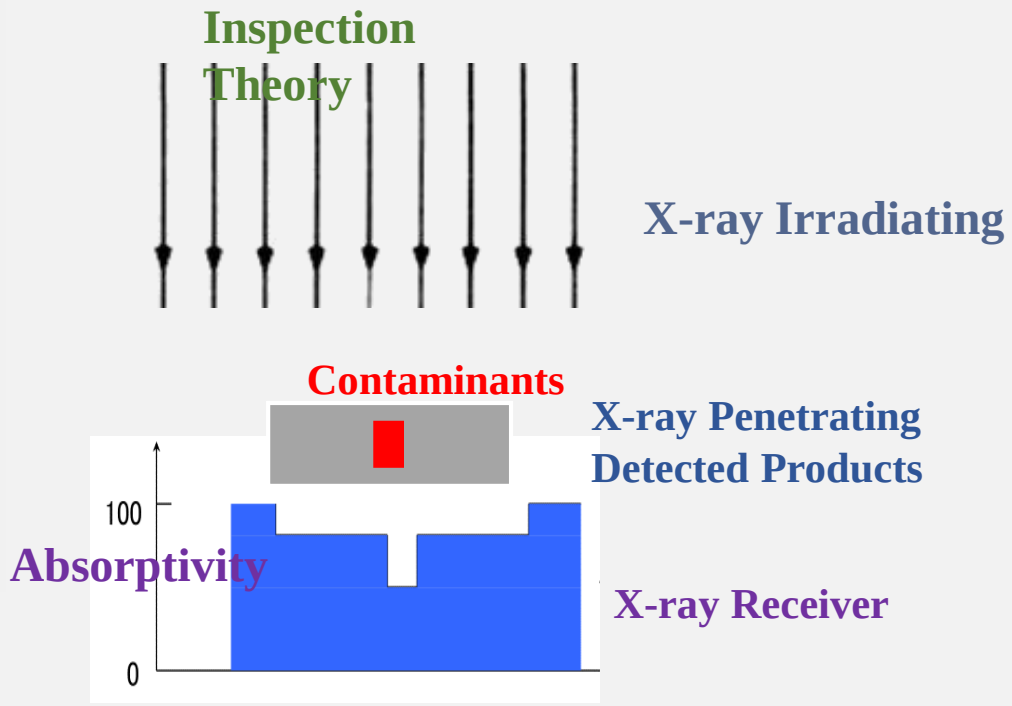


Detects residual low-density bones in chicken

High-sensitivity detection even with overlapping or unevenness

Traditional X-ray Inspection





X-ray has the ability to penetrate. Greater the density of the material is, greater ratio of X-ray absorption, weaker X-ray penetration ability.

Foreign contamiants such as metal, stone, have higher density than food, higher absorption rate to X-ray.

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Traditional X-ray Inspection

Contaminants

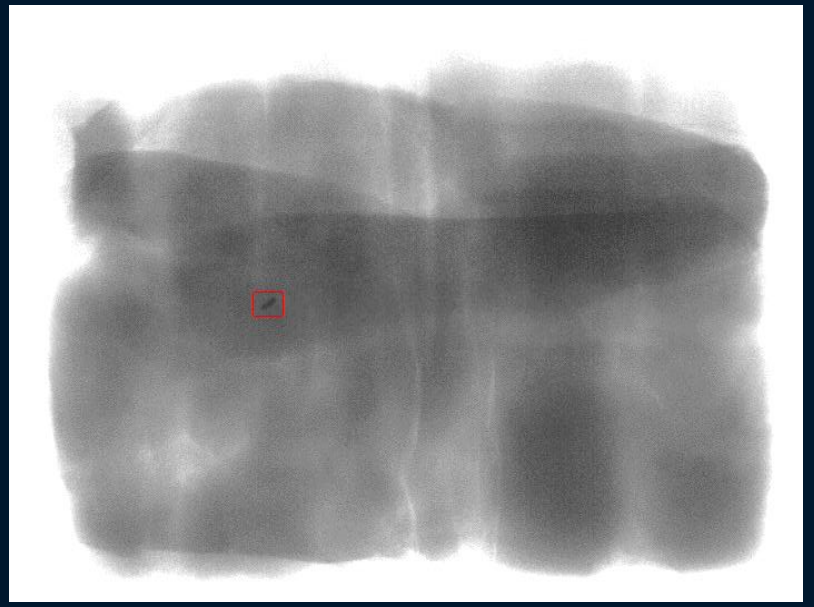
Needle

Hard Bone

Welding Slag/Stone

Broken Blade

Based on density difference between product and foreign contaminants.
Higher density of the contaminants, better sensitivity.



Weakness:

Small density differences, low sensitivity.

Uneven products and overlapping, low density.

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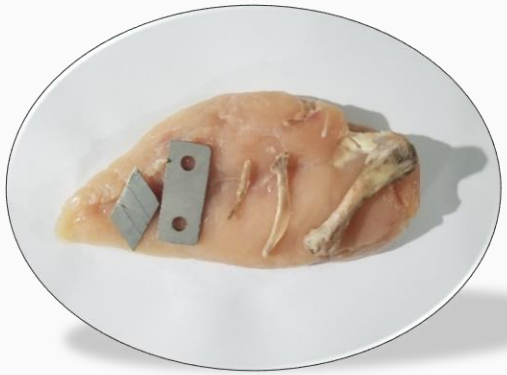
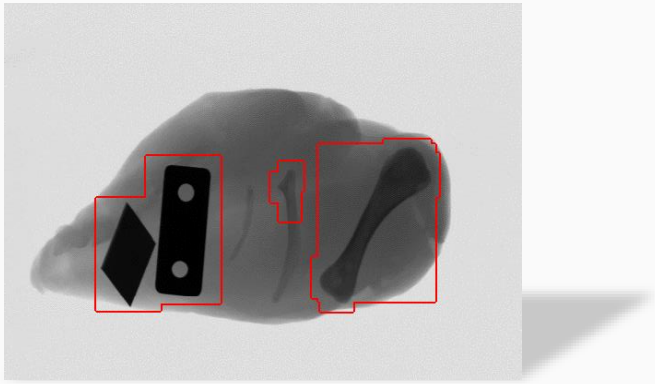
Traditional X-ray Inspection



Dangerous Products



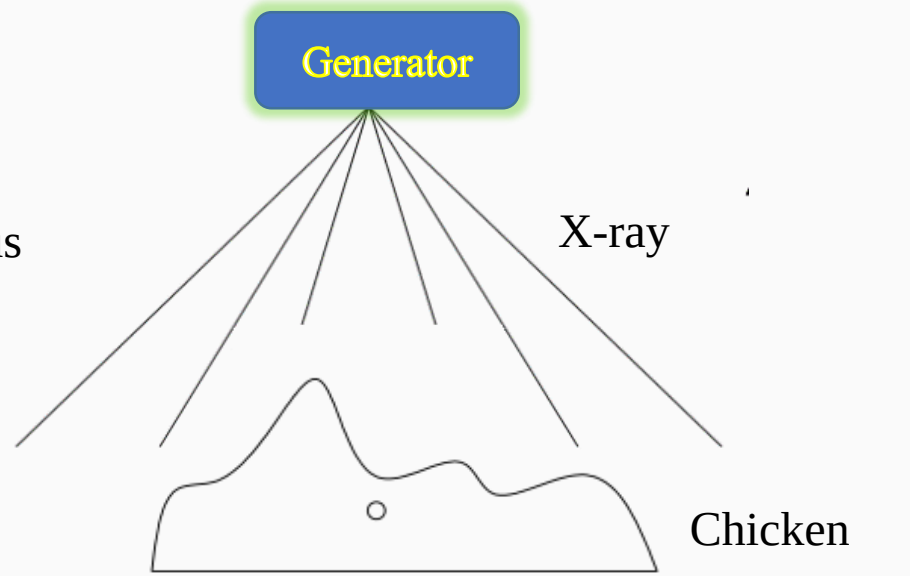


Image reflection value

Metal contaminants, hard bones can be easily found.

Scapula and sternum are difficult to be solved.

TECHIK 太易®

TXR-CB2 Series—Bone Inspection Machine

Model	TXR-CB2-4010 Series
Window Width	400mm
Window Height	100mm
Best Sensitivity (Without Product)	Sus ballΦ0.3mm,Sus wire Φ0.2*2mm,
	Glass/Ceramic Φ1.0mm
Conveyor Speed	10-40m/min
Operation System	Windows 7
Radiation	< 1 μSv/h (CE)
Protection Level	IP66 (Inspection tunnel)
Environment	Temperature：-10~40℃
	Humidity: 30-90%, No condensation
Cooling System	Air Conditioner
Rejecter	Alarm and belt stop/Automatic Rejecter
Air Pressure	0.8 Mpa
Machine Power	2kVA
Main Material	SUS304
Surface Dealing	Matte handle/Sand blasted

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TXR-CB2 Series—Bone Inspection Machine

TIMA Platform

- Hygienic design.
- High resolution imaging system platform.
- Smart algorithm.

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TIMA Platform - Hygienic Design

Hygiene Supervision

- Fully inclined design, no sewage retention.
- No sanitary dead corner, no bacterial breeding area.
- Open design, easy to clean the corners.
- Modular design,one-button quick disassembly the belt, convenient cleaning.

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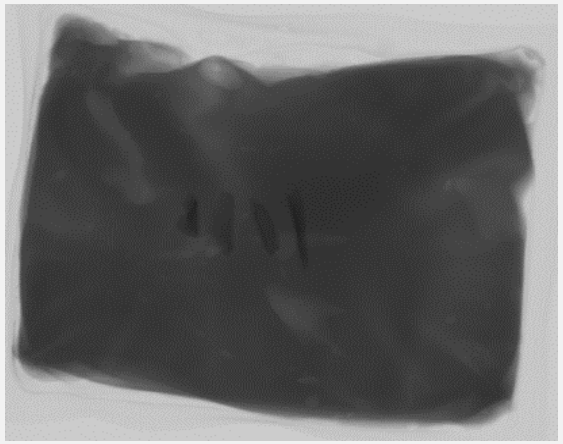
3： Application of Dual Energy Technology

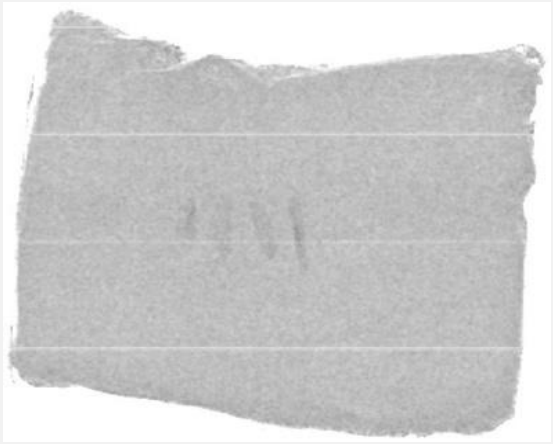
1：1）Hard Bone

1： 19*11*8.28mm
2： 27*12*5.19mm
3： 35*7*3.2mm
4： 26*8*3.2mm

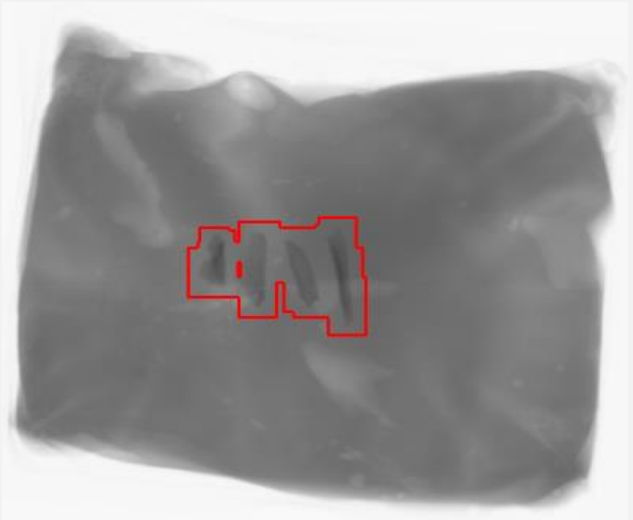
Package Size
240*190*40mm (L*W*H)
1KG



Low Energy Image



Dual Energy Matter Properties Image



Detection Image

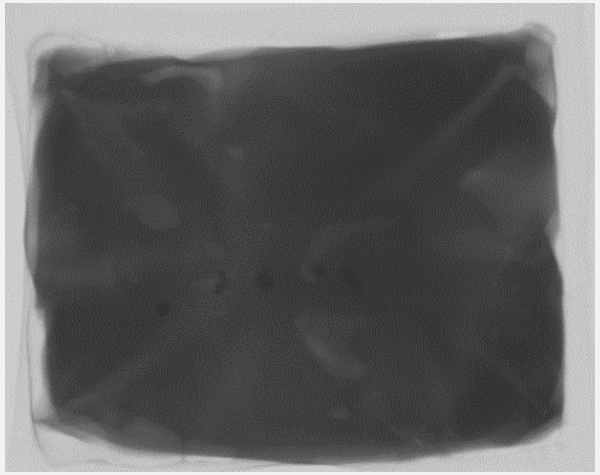
3： Application of Dual Energy Technology

1：2）Hard Bone

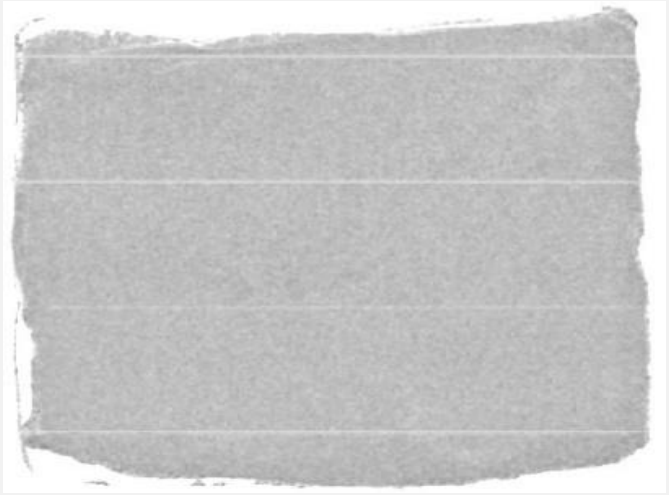
1 2 3 4 5

1： 7*4*3.72mm
2： 9*8*3.23mm
3： 5*5*2.56mm
4： 6*6*2.55mm
5： 13*5*2.2mm

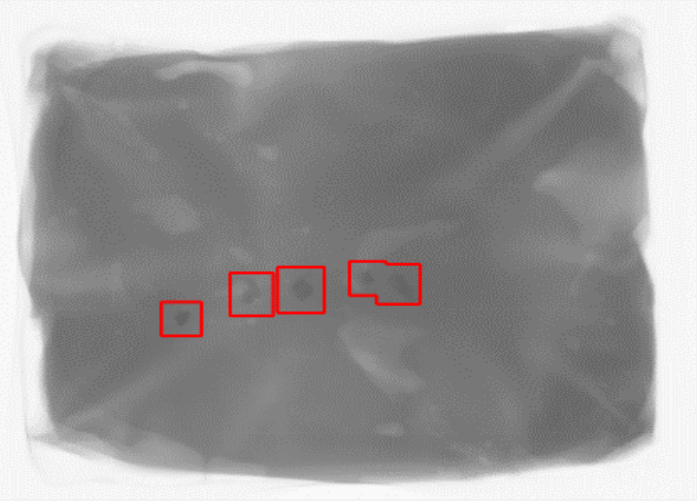
Package Size
240*190*40mm (L*W*H)
1KG



Low Energy Image



Dual Energy Matter Properties Image



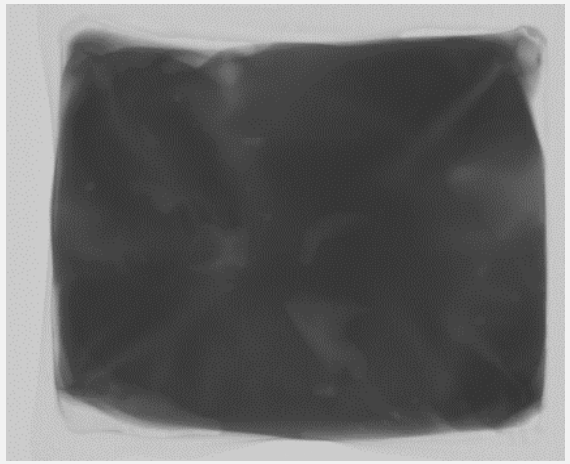
Detection Image

3： Application of Dual Energy Technology

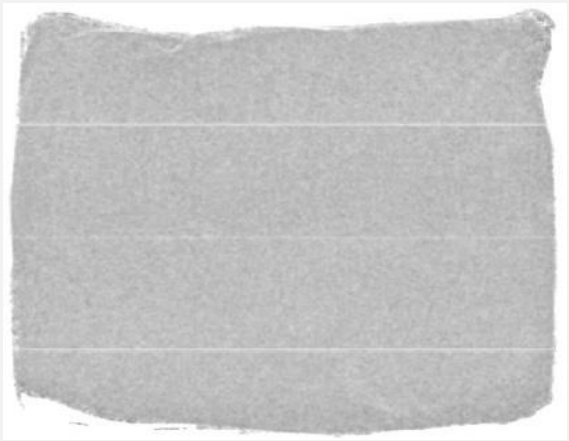
1：3）Soft Bone

Soft Bone

Package Size
240*190*40mm (L*W*H)
1KG



Low Energy Image



Dual Energy Matter Properties Image

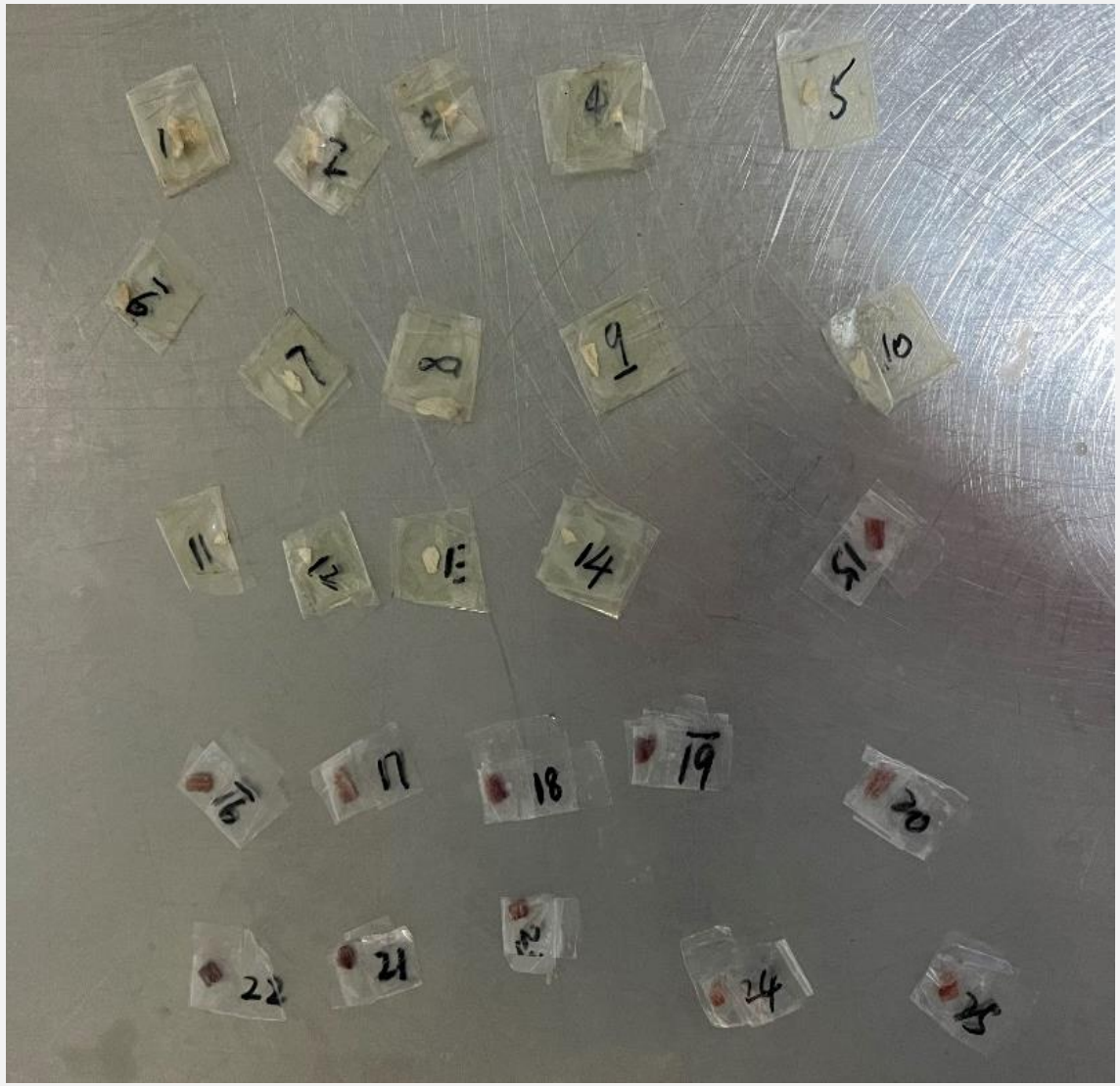
Cannot Detect

4: Application of Dual Energy — On-site Testing

Boneless Chicken Leg：
Size：
100*120*15mm

Chicken Breast：
Szie：
80*30*10mm

4: Application of Dual Energy — On-site Testing



No	Bone Size（L*W*H）	Breast Detected Qty/Total Qty	Leg Detected Qty/Total Qty
1	9.2*4.2*2.1mm	50/50	50/50
2	8*4.1*3.7mm	50/50	50/50
3	4.9*3.6*3.2mm	50/50	50/50
4	5.2*3.3*2.1mm	50/50	50/50
5	6.3*2.8*1.2mm	46/50	36/50
6	6.7*3.5*1.8mm	50/50	50/50
7	6.5*2.6*1.1mm	41/50	38/50
8	10*3.9*1.5mm	50/50	50/50
9	7.6*3.6*1.4mm	50/50	50/50
10	6.1*3.8*0.9mm	32/50	27/50
11	2.8*3.3*1.4mm	50/50	50/50
12	3.6*3.0*0.7mm	19/50	20/50
13	6.1*5.1*0.75mm	24/50	20/50
14	4.3*2.8*1.1mm	41/50	40/50
15	6*3.6*1.12mm	44/50	41/50
16	5.9*3.8*1.3mm	46/50	47/50
17	7.3*3.3*2.4mm	50/50	50/50
18	6.3*4.3*1.5mm	50/50	50/50
19	5.2*5*1.1mm	49/50	48/50
20	6.9*3.8*1.7mm	50/50	50/50
21	4*3.2*1.7mm	50/50	50/50
22	4.7*4*1.6mm	50/50	49/50
23	4.6*3.1*1.3mm	44/50	41/50
24	3.5*3.1*1.0mm	39/50	35/50
25	4.1*3.7*1.35mm	50/50	49/50

4: Application of Dual Energy — On-site Testing

A Bone Detection：Size≥5mm*3mm*1.5mm Hard Bone

Detection No.：1，2，3，4，6，8，9，11，17，18，20，21，22
Detection Rate＞99.5%

B Bone Detection：Size≥4mm*2.5mm＊（1.0mm~1.5mm）Hard Bone

Detection No.：5，7，14，15，16，19，23，25
Detection Rate ＞85%

C Bone Detection：Size≥4mm*2.5mm＊（0.7mm~1.0mm）Hard Bone

Detection No.：10，12，13，24
Detection Rate ＞40%

D Bone Detection：Soft Bone，Brittle Bone

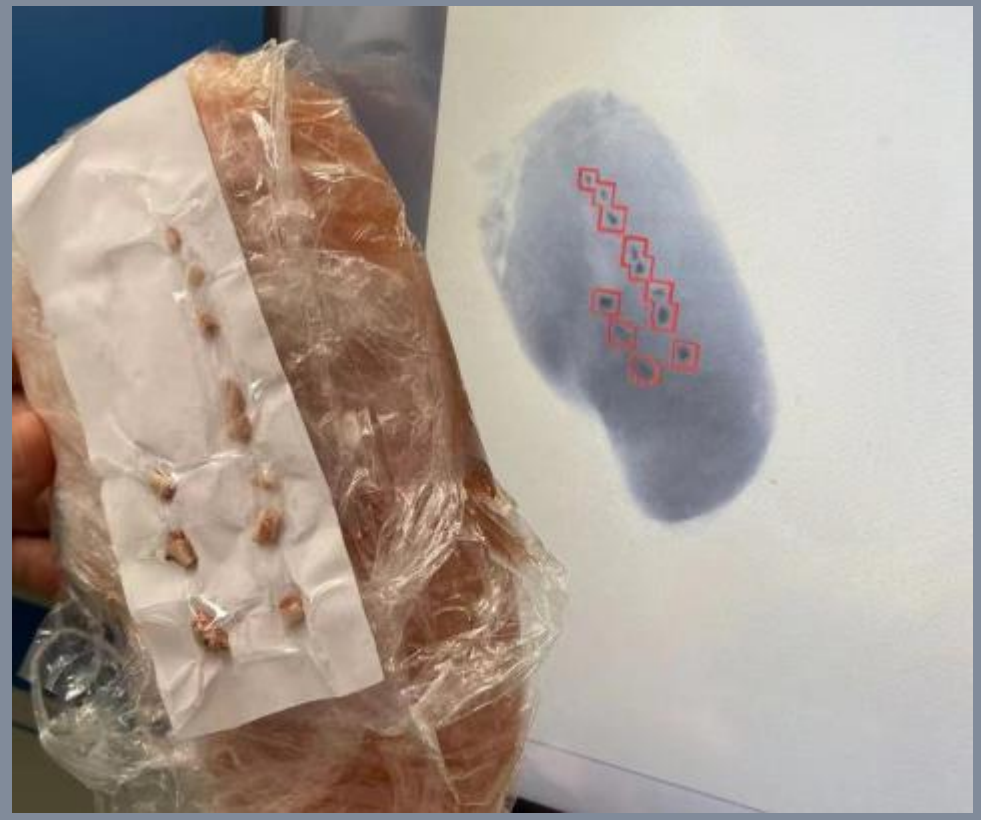
Cannot Detect

Promoting Suggestion

Dual-energy X-ray Advantages

Configuration: dual-energy detector +350w berylium window generator + smart algorithm

- Best solution for bone inspection.
- Higher sensitivity for metal contaminants.
- Fat content inspection.
- Can find out some low density contaminants.
  (PVC, thin glass pieces etc)



TECHIK 杰易®

Dual-energy X-ray Performance --50mm Chicken （Without Smart Algorithm)

Bone Inspection

Sus0.4mm
Glass 1.0mm

TECHIK 杰易

Dual-energy X-ray Performance --50mm Chicken（Without Smart Algorithm)

Thin glass

+

PVC

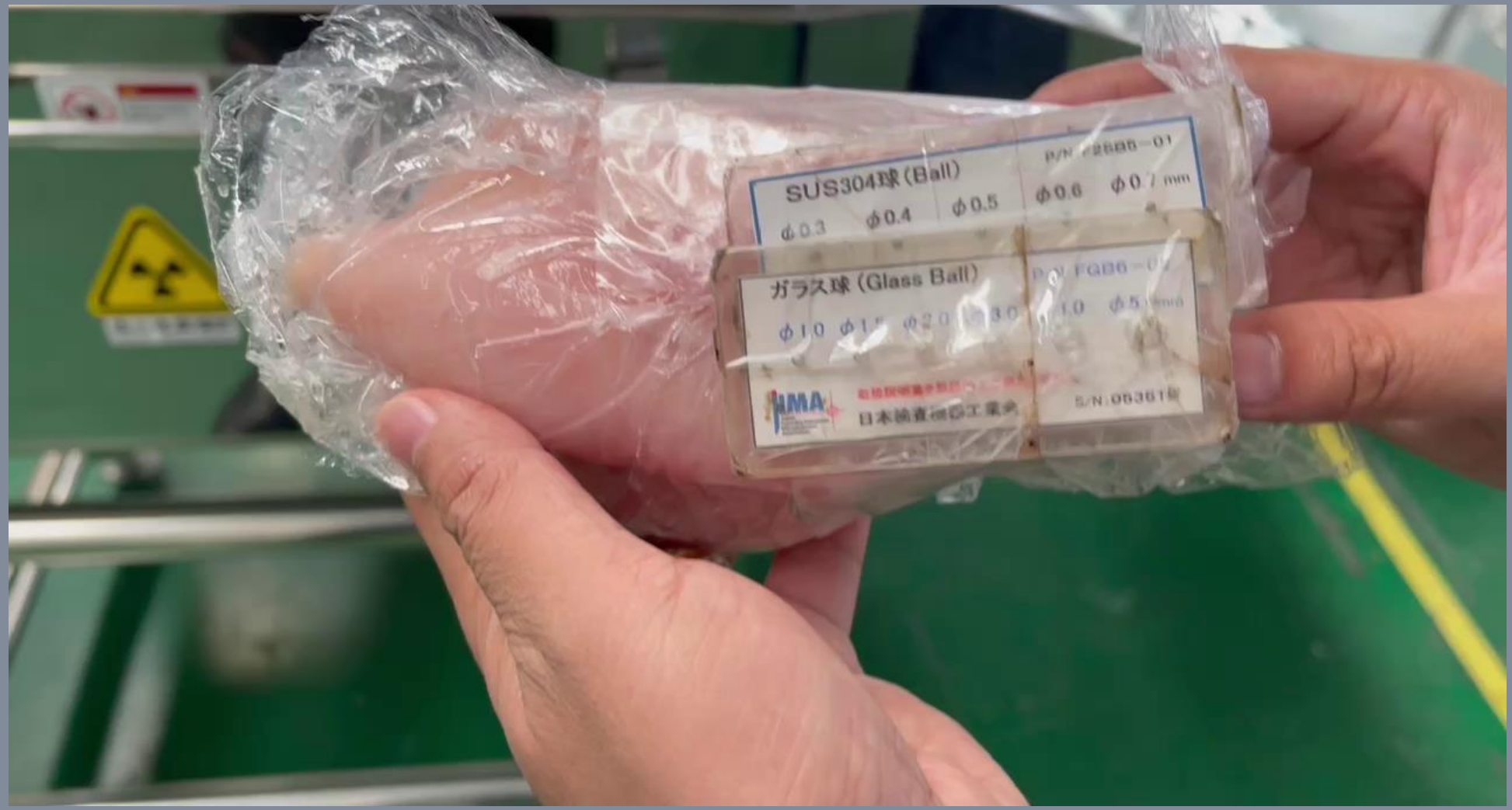
TECHIK 杰易®

Dual-energy X-ray Performance --80mm Chicken （Without Smart Algorithm)

Bone

TECHIK 杰易®

Dual-energy X-ray Performance --80mm Chicken （Without Smart Algorithm)



Sus0.5mm Glass 1.0mm

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5： Application of Dual Energy Technology

2：Fat Content Detection

- Using X-ray to detect a meat sample of known fat content
- Using a photon-counting X-ray detector to receive X-rays passing through the meat sample to obtain images, and to determine high-energy and low-energy signals from the images;
- Then obtain high-energy signal value and low-energy signal value; perform feature calculation on the high- and low-energy signal value to obtain the characteristic value R of the meat sample;
- The same steps are used to detect meat samples with unknown fat content, and the fat content of meat samples with unknown fat content is obtained according to the obtained eigenvalue R and the functional relationship between the fat content of the meat sample and the eigenvalue R.
- The method has short detection time, high precision, simple data processing, low cost, and will not cause damage to meat samples, and can realize large-scale online rapid detection。

重量比= 肥：瘦　重量之间比例

6: Application of Dual Energy –Bulk Flow Detection

Bulk X-ray with Dual Energy for thin Glass Piece

Detection Condition:

Product: Peanut

Capacity: 1.5T/h
400 width Bulk X-ray
350W Beryllium Generator
0.4TDI Detector
Speed 90m/min

Detection Result:

1.1mm Glass Piece→ →All Detected
0.8mm Glass Piece→ →All Detected
0.7mm Glass Piece→ →All Detected
0.6mm Glass Piece→ →70%-80% Detected

Best Solution for Uneven Products

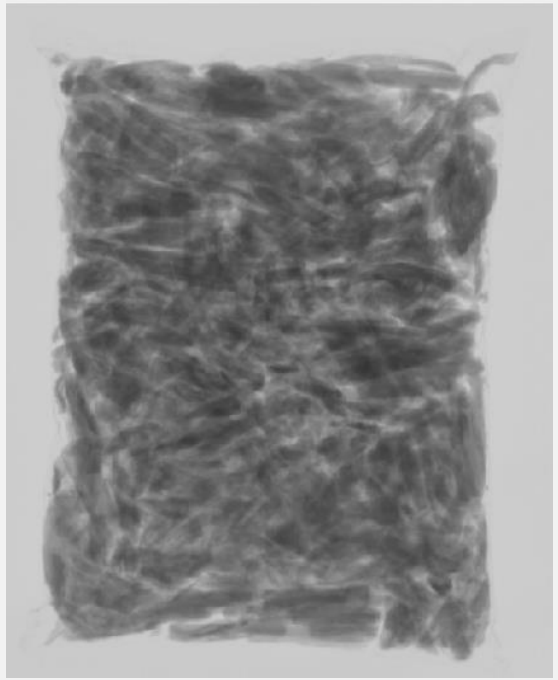
Dual-Energy X-Ray

- Granular products (Chips, Frozen Vegetables, Nuts, etc) that are difficult to detect, with Dual-energy machine, non-organic materials are not affected by the uniformity of the product itself, greatly improving the stability of detection.

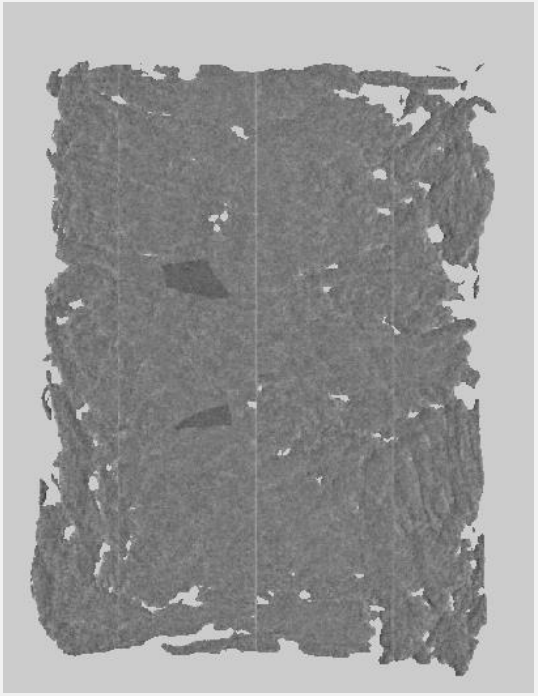
- Due to the overlapping of parts of products when multiple packets pass continuously, false alarms are prone to occur. In this case, Dual Energy can largely ignore the influence of gray scale changes caused by this overlap and achieve better sensitivity and stable detection.



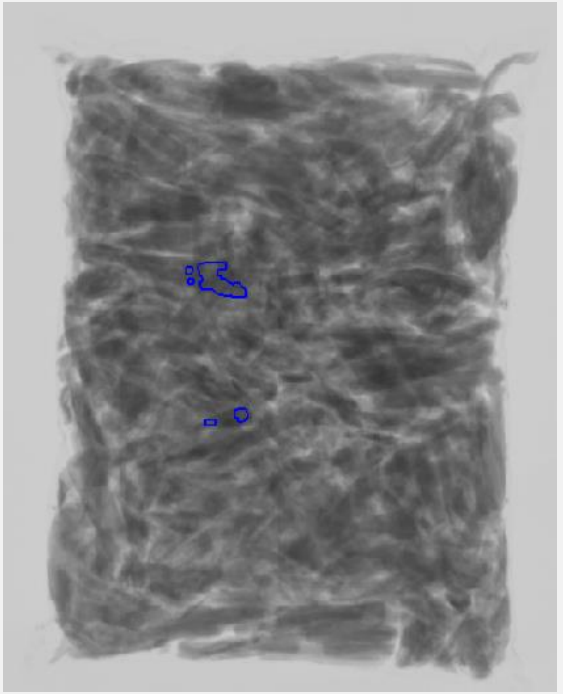

7. Uniform Products with Similar Density Contaminants (Frozen Vegetable/Dried Fruit)



Low Energy



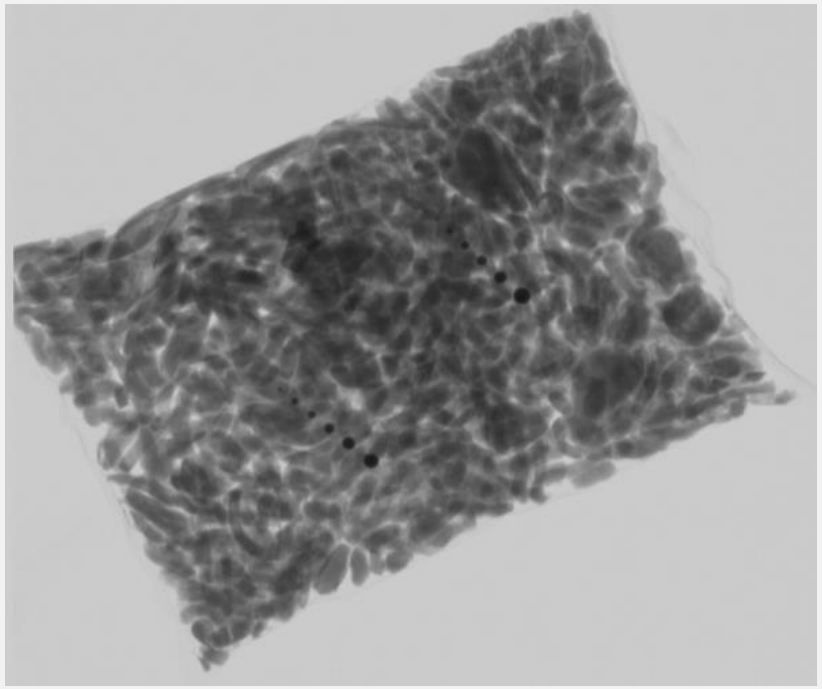
Dual-energy Material Properties Image



Inspection Result

1mm Thickness Glass Pieces

Single-energy X-ray Inspection Results



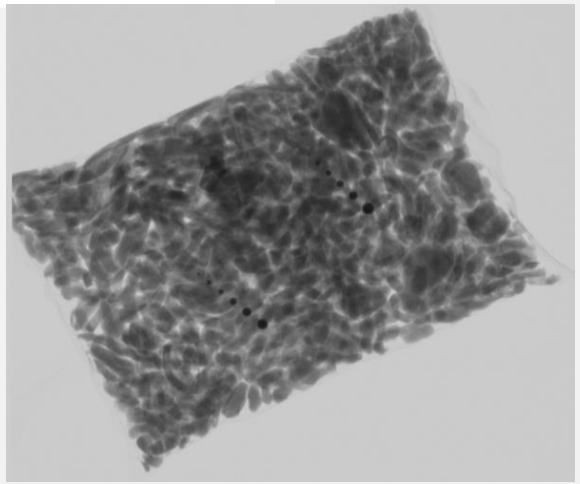
From the image, the product is very uneven.

With single energy,

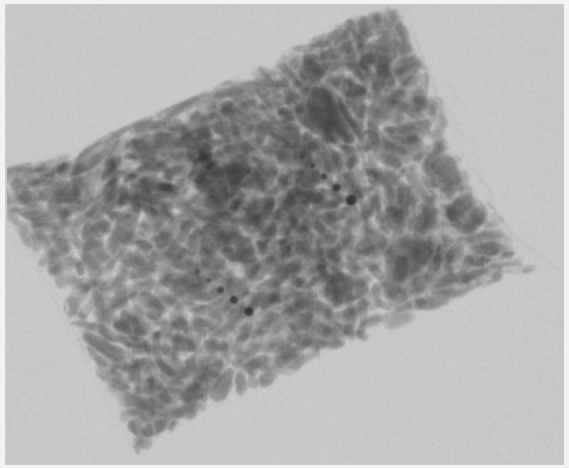
the sensitivity for Glass pieces is around **4.0mm** with product.

Customer wanted to reach better performance for **low density contaminants especially thin Glass pieces.**

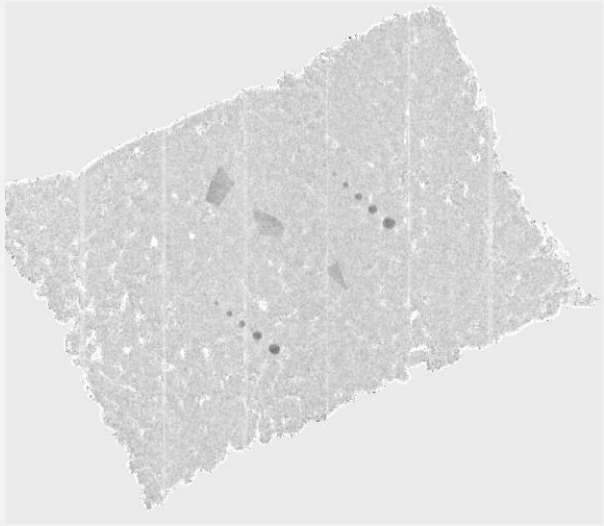
Dual-energy X-ray Inspection Results



Low-enegy Image



High-enegy Image



Final Image

Best Inspection Result:

1mm Thickness Glass Pieces

Dual-energy Inspection Results--Chips

Inspection Results:

Sus Wire: 0.4*2mm

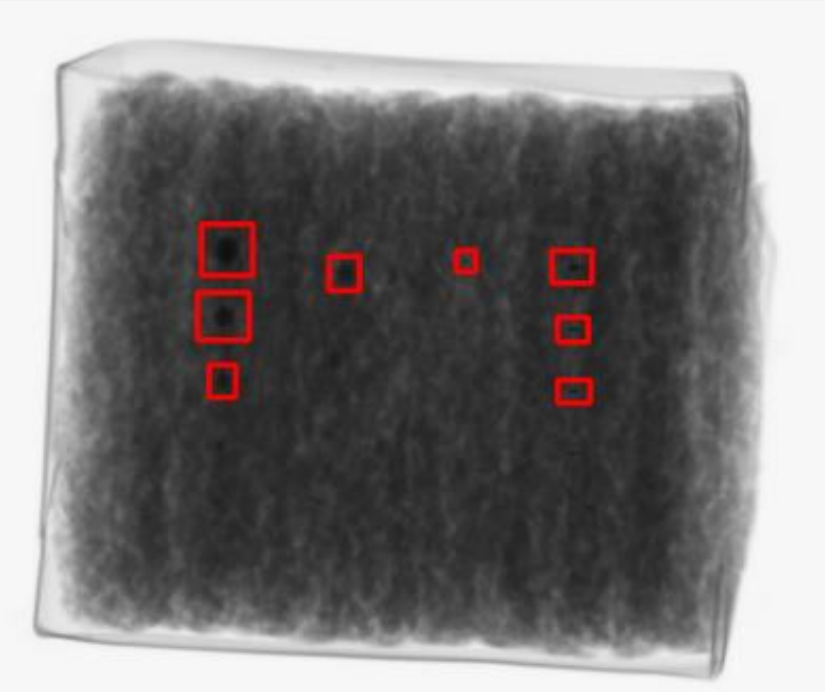
Sus Ball: 0.7mm

Glass Ball: 2.0mm

Quartz Ball: 3.0mm

Dual-energy Inspection Video--Chips

Dual-energy Inspection Results-Pies



Inspection Results:

Sus Wire: 0.5*2mm

Sus Ball: 0.7mm

Glass Ball: 3.0mm

Quartz Ball: 4.0mm

Dual-energy Inspection Video--Pies