Superior Service

High Energy X-ray Generator Solution

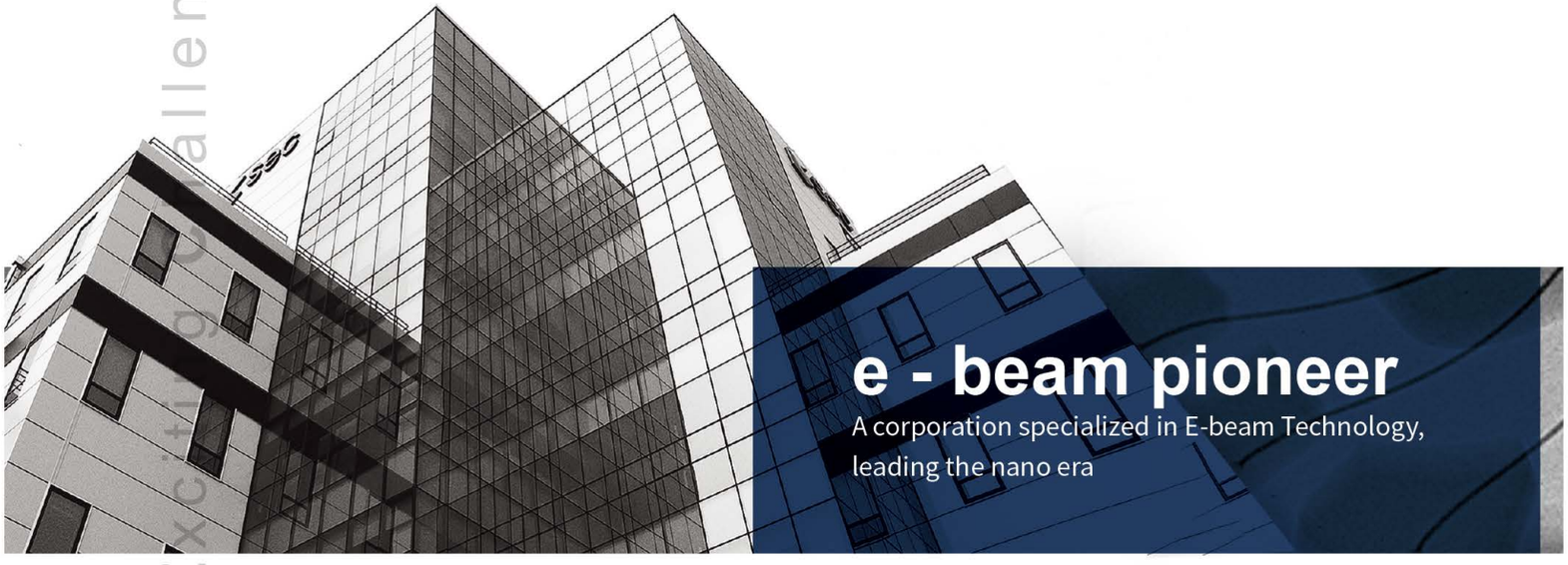
LINASEC

Exciting Challenge!

sec
e-beam pioneer

sec
e-beam pioneer

Superior Service & Exciting Challenge!



e - beam pioneer

A corporation specialized in E-beam Technology, leading the nano era

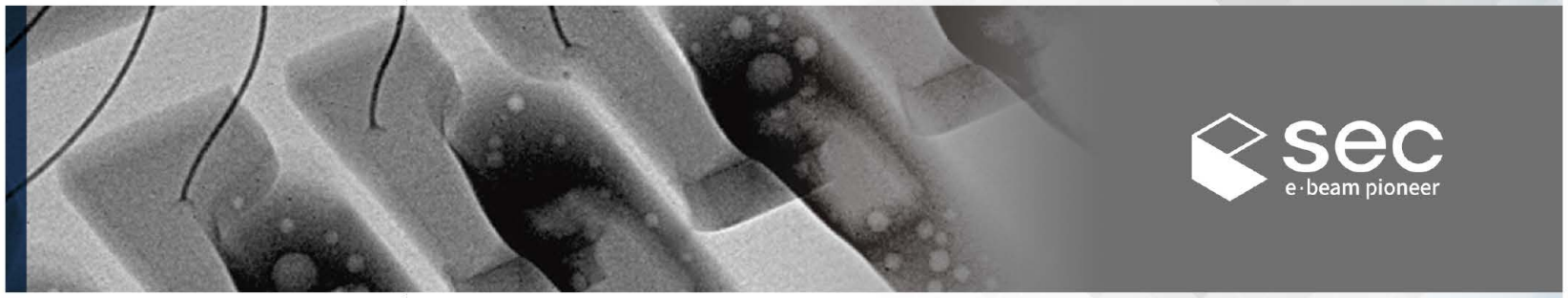
SEC is the best inspection system company developing & selling industrial X-ray inspection system and SEM(Scanning Electron Microscope). We develp and offer linear accelerator and semiconductor packaging system for LCD driver IC as well. Since established in 1991, based on over 29 years of accumulated technical know-how, we have been continuously developing backbone of e-beam inspection equipment in Korea. SEC has its own competitiveness against global companies by continuously localizing X-ray generator and developing new technologies. Also, go through continuous technology development and aware of the current economic and technological environment, we will steadily continue to challenge ourselves to expand business area and move into the future Global Leader.

From 21th century, we build our vision “Superior Service & Exciting Challenge!” that pursue our challenge spirit as well as punctuality.

SEC will strive to keep the principle of providing excellent products with reasonable price at the right time and to satisfy customers with best service.

Superior **S**ervice **&** **E**xciting **C**hallenge!

Be the **Best!** Follow the right **Way!** Keep the **Faith!**



History

10 Million Dollars Tower of Export Awarded

2018 ~ 2019

Shipping the LINAC system (2 MeV, 3 MeV, 6/9 MeV)
Finishing 15 MeV LINAC system Development (Government Funding)
KRISO transfer Container Inspection Technology
Own container inspection facility

2017 ~

Commenced LINAC system and contract
Bidding for Container Inspection System (KOR, Abroad)

2012 ~ 2016

Starting government funded project for LINAC (ATC, ADD)
Sales of beyond 1000 X-ray inspection system
First Hybrid X-ray generator developer in Korea

2009 ~ 2012

Starting LINAC R&D
2D & CT In-line Inspection system development
NANO-Focus tube development

2006 ~

First X-ray tube manufacturer in Korea

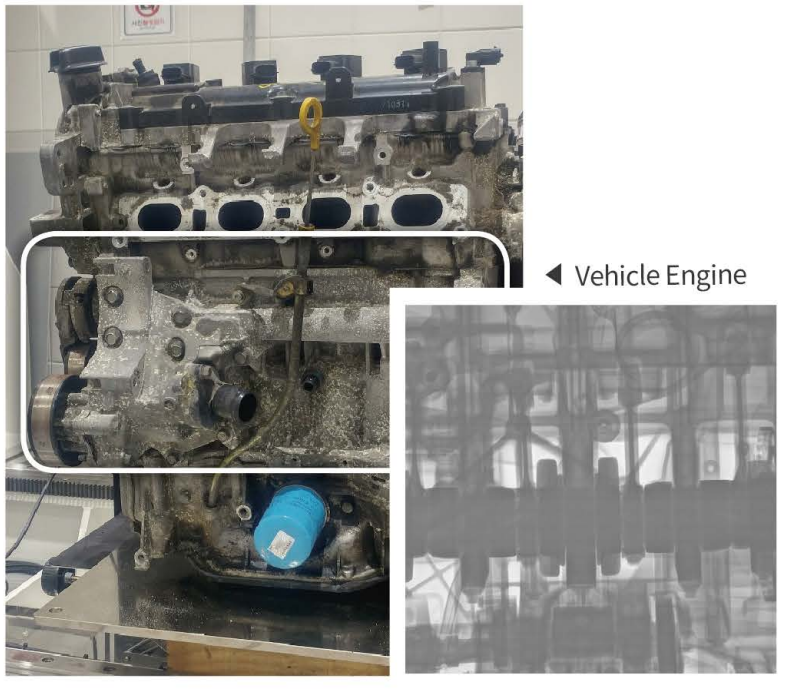
2000 ~ 2005

X-ray inspection system development

1991 ~ 1999

Establishment and growth of SEC

Introduction of LINAC



◀ Vehicle Engine

Applications depending on Energy

kV-Class X-ray generator

Auto-Mobile parts, Cell phone parts
Semiconductors, PCB

MV-Class X-ray generator

Cars, Ships, Engine of Air Plane,
Missile, Rocket Container with truck.

General Information of Accelerators

X-rays are used throughout the production site for quick and accurate quality inspections. For non-destructive testing, the radioactive materials and radiation generators are used to generate X-rays. And for a long time throughout the industry, radiation generators have been applied that can control radiation safely depending on the presence or absence of a power source.

In the radiation-based non-destructive testing, the limit of the object that can be inspected is determined according to the energy. While the existing kV-class radiation generators inspected small parts of automobiles, components of mobile phone, semiconductors, and boards, MV-class radiation generators can inspect cars, ships, aero-engines, missiles, rockets, and tens of tons of containers at once.

Composition of LINASEC Accelerator

Accelerator system that is MV-class radiation generator, is broadly composed of high voltage device, control device and X-ray Head. Accelerator systems produced by SEC are divided into the Separate type in which the X-ray Head and various electric devices are separated, and the All-in-one type in which the X-ray Head and the electric devices are gathered together.

X-ray Head

High voltage Power and Control unit

Chiller

LINASEC Advantage

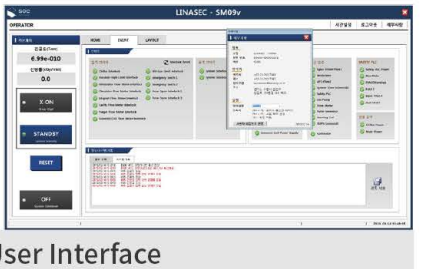
Application of outstanding component parts

X-ray generators manufactured by SEC are adopted the solid state modulators, so it provide semi-permanent usage environment of switching parts. This means that users do not have to manually maintain dangerous high voltage switching parts. X-ray Heads are designed to control dose in a variety of ways using a triode electron gun.

Convenient UI and Continuous Update

The GUI, specially provided by SEC is a program developed by SEC, its own company. It provides a User Interface that sufficiently reflects the needs of users, and provides a continuous updates to customers.

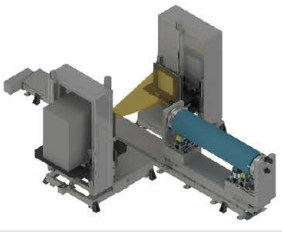
Touch Panel



Convenient User Interface

Application

Accelerators are being applied to a wide range of industry fields, from inspections of large structures such as national defense, engines, ships, and power plant component, to Security fields such as cargo inspection, and food and medical fields related to sterilization. SEC has a variety of solutions for optimum non-destructive testing that customized for the customer's usage environment based on human resources of various fields. SEC was not satisfied with selling generators, and furthermore, tried to provide various services at the customer's eye level. And through that, it has already been able to apply SEC's technology to automatic inspection stand for large structures or container inspection facilities in Gwangyang Port.



Military Area

Container Security

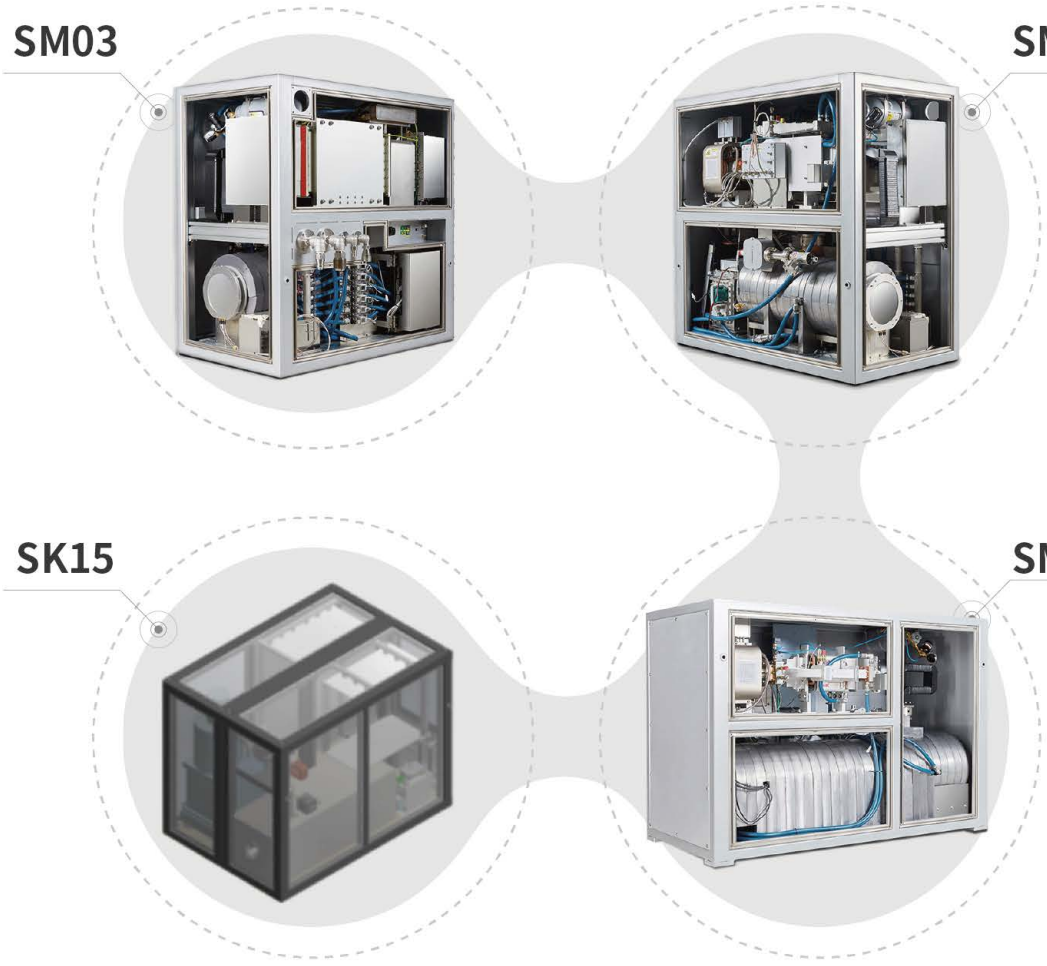
Huge Product

Auto Inspection System

Container Inspection facility at KwangYang Port in Kor

Huge Container Inspection

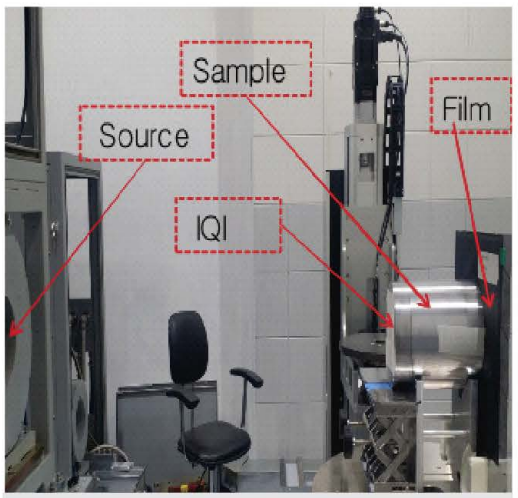
LINASEC Line-Up



Description	SM03	SM06	SM09	SK15
Beam Energy (MeV)	1/2/3	3.5/5/6	5/6/9	Above 9/15
X-ray Beam Dose Rate (Gy/min•m)	0.25 ~ 3	2.5 ~ 10	6 ~ 35	50 ~ 140
X-ray Beam Focal Spot Size	Below 2 mm (FWHM)			
Operating Frequency	2998 MHz (S-band)			2856 MHz
RF Source	Magnetron			Klystron
Beam Pulse Width	1 ~ 3.5 us			
Max. PRF	Up to 300 Hz / sec			250 Hz
Beam Flatness	≥72.5%@±7.5°	≥62%@±7.5°	≥55%@±7.5°	≥45%@±6.0°
Radiographic Quality Range	38 ~ 203mm	51 ~ 254mm	76 ~ 381mm	254 ~ 460mm
Leakage(fraction)	1 x 10-3 (0.1%)			
Electric Power	380VAC 3Φ			
Current	50A/18A (*TCU)			

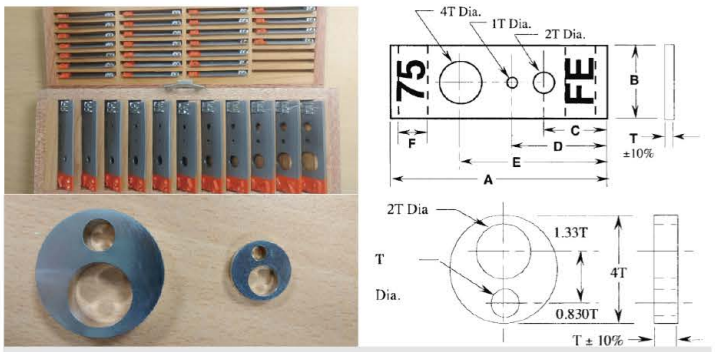
ASTM E94 Standard Hole-type IQI tests

Radiography Quality in accordance with ASTM Standard



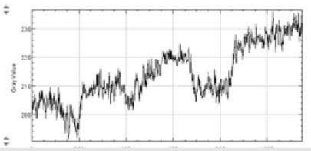
SFD(Source to film Distance) : 2000mm

SEC has conducted the Holes Type Penetrameters test in accordance with ASTM E94. This tests are about 'how minute' defects can be distinguished by the equipment and film only without the help of the software, and basically, you can find the results of 1-2T level have been passed, in the optimal condition.



Holetype IQI Based on ASTM E1025

Hole-Type Image Quality Indicator Results



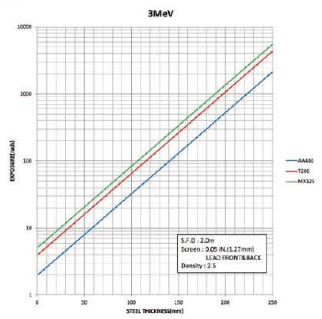
Line Profile of Hole in Film

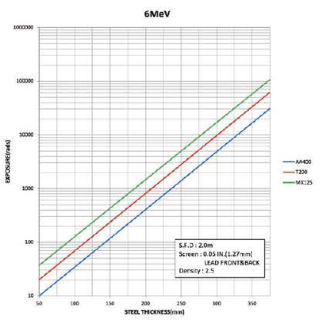
Hole Type Image Quality Inspection Conditions

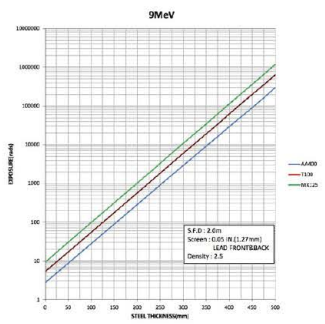
LINASEC SM09V

Energy	Film Type	Thickness	IQI #	Material	Exposure time	Dose rate (@2m)	Result
6	AA400	50	1.8,3.0, 3.5, 4.0	steel	4s	0.1	2-2T
6	AA400	235	4.0, 5.0, 6.0	steel	3m 50s	9.58	1-1T
9	AA400	235	4.0, 5.0, 6.0	steel	50s	6.25	1-2T
6	AA400	286	5.0, 6.0, 7.0	steel	13m 37s	36.18	1-1T
9	AA400	286	5.0, 6.0, 7.0	steel	2m 45s	20.63	1-1T
9	AA400	350	6.0, 7.0, 8.0	steel	12m	90	1-1T
9	AA400	380	6.0, 7.0, 8.0	steel	24m 16s	182	1-1T

Exposure Curve





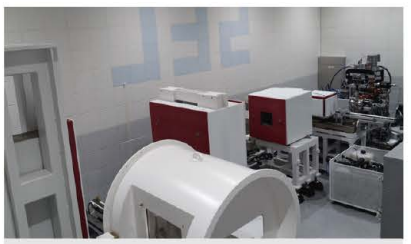


SEC NDT Facilities

Facilities for Non-destructive Testing

SEC is waiting with a test facility in place to show customers all the capabilities that are described so far at any time. In shielding facility that can shield up to 20MV, many users have already tested large samples and are considering purchasing.

CT Inspection Room



Huge Product Inspection Room

Container-Vehicle Security Building

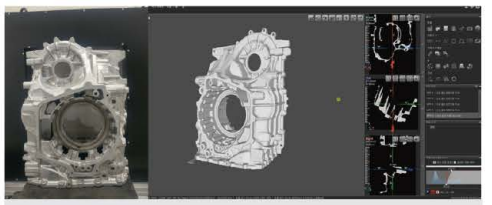
Large Structure Inspection

In the SEC's test facility, non-destructive testing for objects from various customer groups has been performed. As shown in the photos, SEC has inspected from in the field of large structures such as thermal power plants, automotive industry, and national defense, to missiles and rockets of space science field, and these inspections are leading to delivery performance.

Turbine Blade of Power Plant

Vehicle Engine

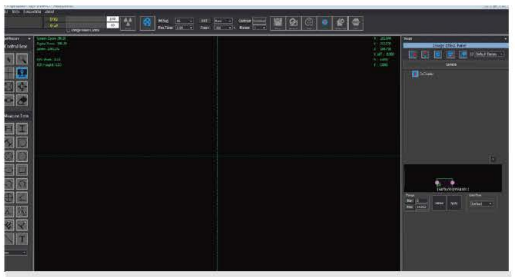
Lead Battery



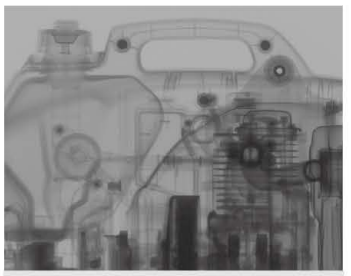
3D CT Scan (Engine Mission)

Software

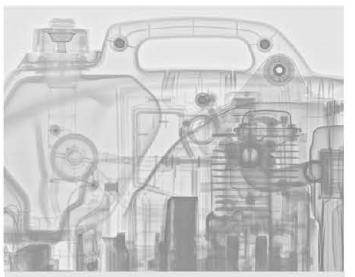
By producing software that is most compatible with SEC hardware control, SEC can supply the NDT environment that enables from hardware control to defect inspection at one-place.
Software is an important factor in operating hardware, which enhances the capabilities of the hardware. The software provided by the SEC enhances the Contrast and Sharpness, extending the range of defect check (such as Void size and foreign substances) that can be inspected.



Total UI Software



Before the Enhancement



After the Enhancement

ANSI N42.46 Standard Results

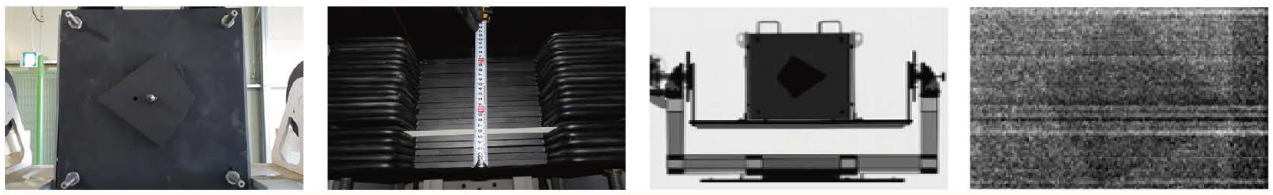
Test results based on the ANSI N42.46 Standard

According to ANSI N42.46 (American National Standard for determination of the Imaging Performance of X-ray and Gamma-Ray Systems for Cargo and Vehicle Security Screening), the Container Security standard, 4 items of which penetration, spatial resolution, wire detection, and contrast sensitivity were measured as follows. The LINASEC-SM09 series is the optimum solution for container screening, providing also the optimum solution for security and logistics business.

Chapter 1

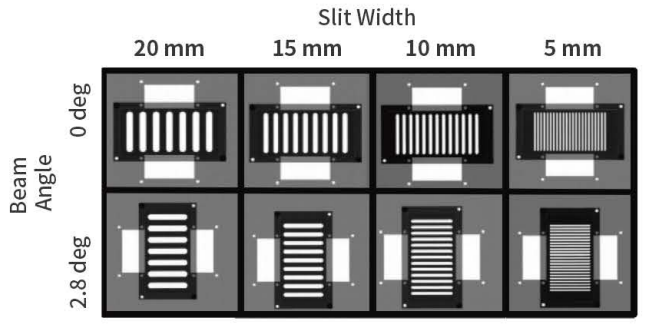
Penetration

Beam Energy	Dose Rate	Max. Penetration	Rhombus Thickness
9MeV	30 Gy/min-m	410mm	80mm



Chapter 2

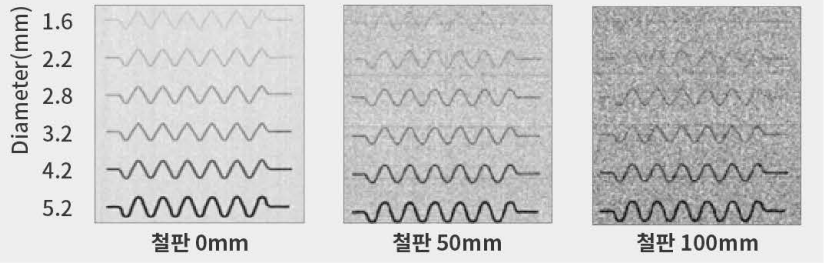
Spatial Resolution



Chapter 3

Wire Detection

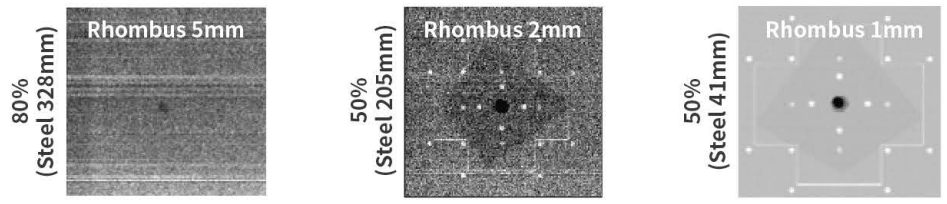
Beam Energy	Dose Rate	Steel Thickness	Rhombus Thickness
9MeV	30 Gy/min-m	0 - 100	80mm



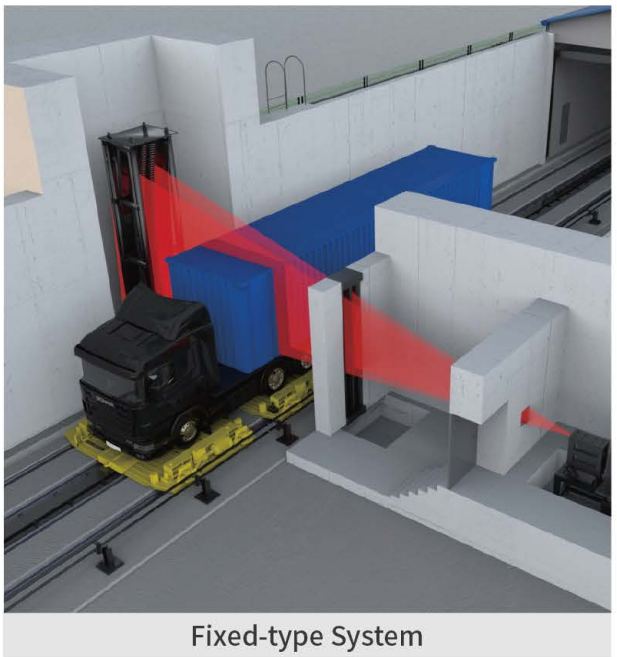
Chapter 4

Contrast Sensitivity

Beam Energy	Dose Rate	Max. Penetration	Contrast Sensitivity
9MeV	30 Gy/min-m	410mm	Not more than 1%



Specification of Container Inspection System



Fixed-type System

Re-Locatable System

Item		Fixed-type	Re-locatable
General Specification	X-ray Generator Model	LINASEC-SM09vi**	LINASEC-SM06vi**
	Nominal Energy(Dual)	9 MeV (6 MeV)	6 MeV (3.5 MeV)
	Scan Method	Driven by container mobile system	Driven by driver
System Specification	Inspection Throughput	12 Vehicles/Hour (Max.)	120 Vehicles/Hour
	Minimum Crew Requirement	1 Image Operator, 1 System Operator & 1 Check in Operator	
	Max. Dose Rate	30.0Gy/min-m(8Gy/min-m)	8.0 Gy/min-m (2.5Gy/min-m)
	Spot Size	≤2 mm	
	Max. Penetration(Steel)	410 mm	250
Detector Specification	Type	Linear Diode Array	
	Vertical Detector Pitch	4.6mm	
	Crystal Type	CdWO4	
	ADC Depth	18bit	
	Vertical Structure	Curved	
Image Processing & Hardware	Image Analysis	Contrast & Edge enhancement, Filters, Marks, Annotations, Histogram Equalization, Review of Image, Image Conversion to standard format, Object measurement, Zoom & window images, Brightness & Contrast change, and etc	
	Data Base Workstation	SQL Database	

* Specifications subject to change without notice.

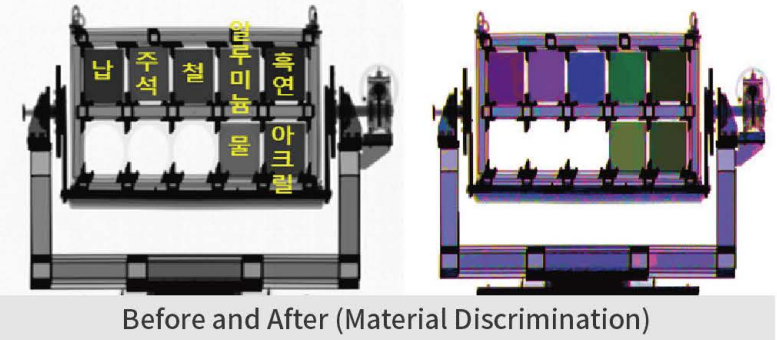
** v : Variable energy (09v : 5~9 MeV / 06v : 3.5~6 MeV)
i : Interlaced mode

Material Discrimination
(Organic-Inorganic materials)

Material discrimination results according to IEC standard

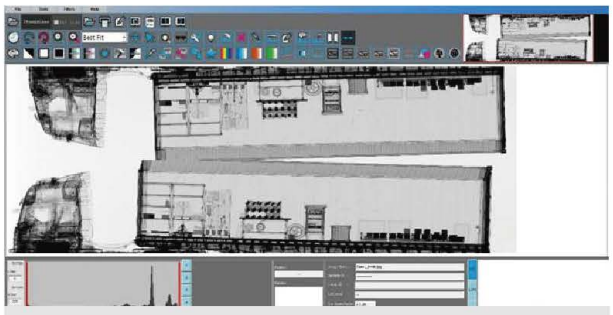
For the field of Container Security, SEC has added a function to easily distinguish explosives and firearms by coating Pseudo Color for discrimination of organic-inorganic matters. The organic-inorganic material discrimination function is tested in accordance with **IEC 62523, Radiation protection instrumentation – Cargo/vehicle radiographic inspection system** standard.

Material Discrimination

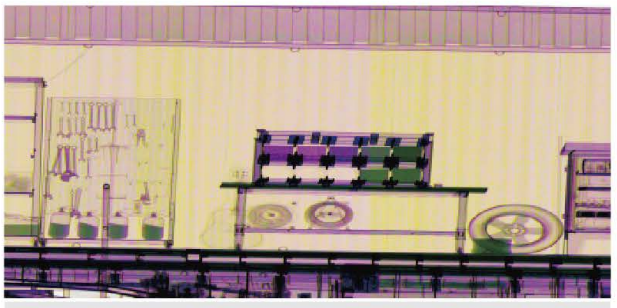


Before and After (Material Discrimination)

Sample Images



Container Security Result



Applied image of material discrimination function

Equipment Images

All-in-One Type

Power-Control Rack Type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Superior & Exciting Service & Challenge!

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