Nov 2022

Ugur Tuncer
PI BAM
Metter Toledo Turkiye

Metal Detection, X-ray or Both 'Making the Right Choice'

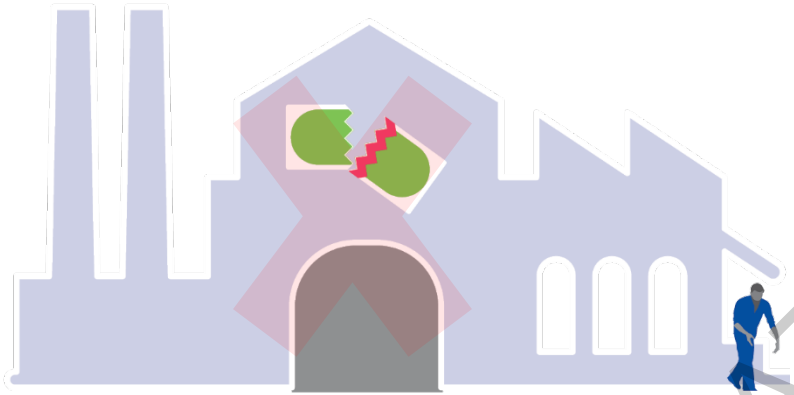
METTLER TOLEDO

Agenda

1	Key Drivers for Installing Metal Detection or X-ray Equipment
2	Basic Principles of Metal Detection
3	Basic Principles of X-ray Inspection
4	Making the Right Choice – Main Considerations

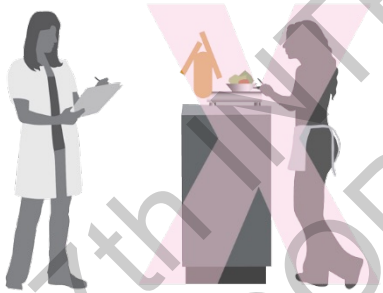
Why Do Our Customers Buy Detection Systems ?

A metal detection or x-ray system is like an insurance policy …

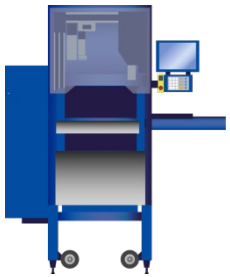


To PROTECT AGAINST irreparable damage to brand reputation

To REDUCE the RISK of contaminated products reaching supermarket shelves and consumers' tables



To help AVOID failed audits or loss of retailer contracts



To PROECT expensive equipment further downstream

Complex Industry Safety Standards

Compliance with global standards, local regulations & retailer requirements

Standards

- Global Food Safety Initiative (GFSI)
  - BRCGS
  - IFS Food
  - SQF Institute — One world. One standard.
  - FSSC 22000

Regulations

- Food Safety Modernization Act (USA)
- Food Standards Act (EU)

Retailer Codes of Practice

- TESCO
- M&S EST. 1884
- Sainsbury's
- ASDA

Metal Contamination Incidents

UK Retailers estimate

50,000

incidents of metal contamination reach the end user every year

Volume of reported Incidents

10%

Investigation results suggest

90%

of metal contaminants found are subsequently **reported as** "**detectable**" by the detector (Metal Detector or X-ray System)

Conclusions

Causes: Procedural, operational and system failure

NOT thought to be linked to performance of the metal detection or x-ray inspection system.

Actions

Increased focus on C.O.P.

Better training

Certification/auditing

Use of greater levels of failsafe monitoring to enhance system functionality

Agenda

1	Key Drivers for Installing Metal Detection or X-ray Equipment
2	Basic Principles of Metal Detection
3	Basic Principles of X-ray Inspection
4	Making the Right Choice – Main Considerations

Metal Detection Portfolio

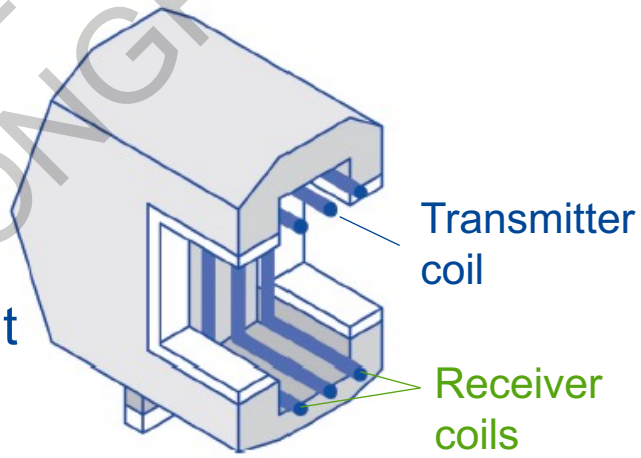
Conveyorized	Gravity Fall	Throats	Pipeline	Pharma
▪ All sectors ▪ Bulk, unpacked and wrapped foods	▪ Flour ▪ Grains ▪ Powders	▪ Potato chips ▪ Confectionary	▪ Soups, sauces, baby food ▪ Pumped sausage meat	▪ Tablets ▪ Capsules ▪ Powders

How Does Metal Detection Technology Work?

Based on magnetic permeability & electrical conductivity

Balanced coil design

- 3 coils wound around a supporting frame
- Creates an electro-magnetic field
- Field is disturbed when metal passes through it



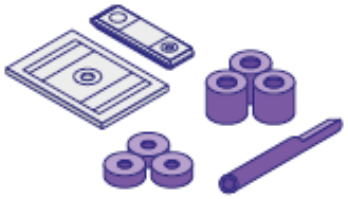
Modern metal detectors can identify all metal types

Best performance requires:

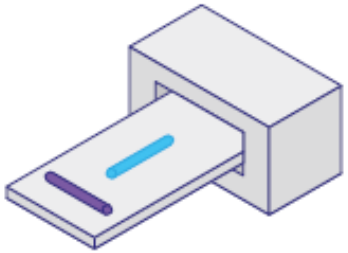
Maximum sensitivity + Stability + Reliability (0 false rejects)

Factors That Contribute to Sensitivity Performance

When measuring the sensitivity of a metal detector, a test piece must be reliably detectable when passed through the center of the aperture.



Metal Type



Orientation Effect

Aperture Size and Product Position

Packaging Material

Environmental Conditions

Product Characteristics

Process Speed

Detector Frequency

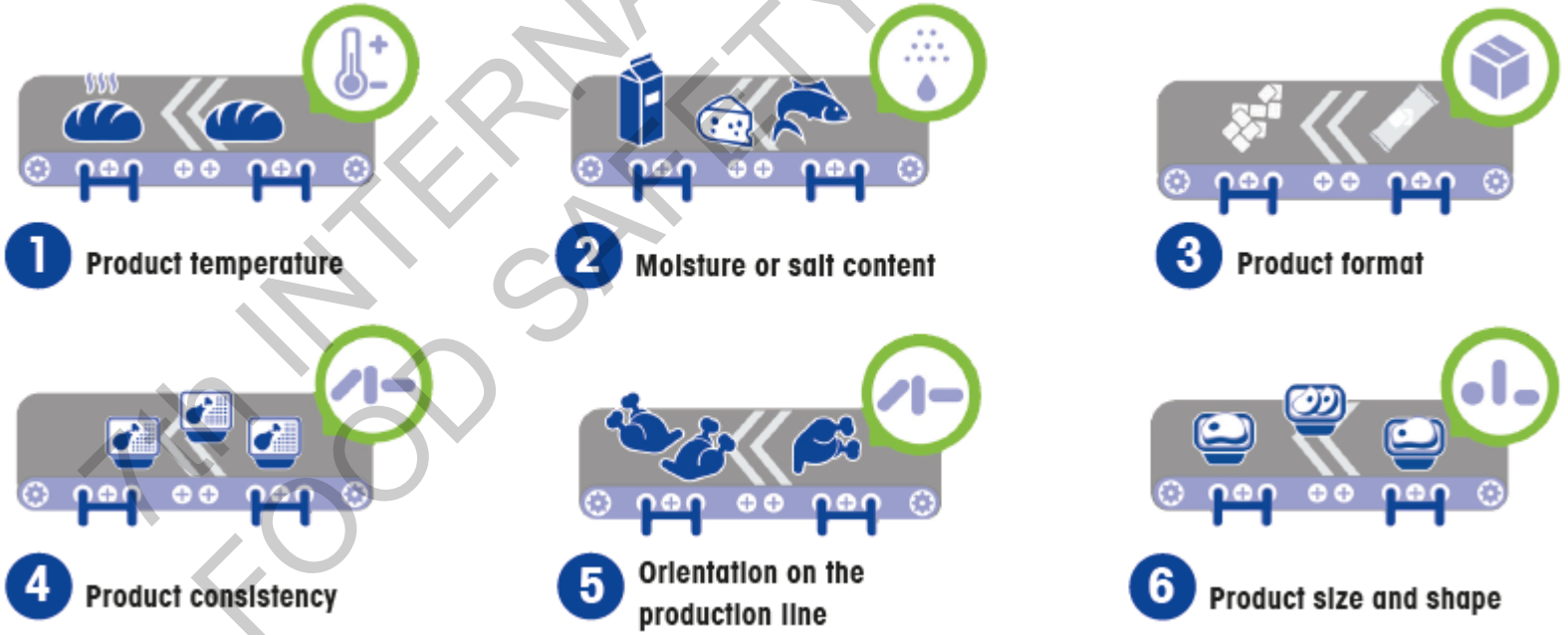
NOTE:
Product Effect is discussed in more detail later in this presentation

Product Effect

Product Effect can lead to high false reject rates

- **Product effect occurs when a product's own characteristics inhibit the inspection device's ability to distinguish between the product being inspected, and a particular contaminant type.**
  - These are often referred to as challenging applications
  - Challenging applications can result in potentially high false reject rates, unless the technology in use is able to overcome product effect

Six key factors that contribute to product effect:



Choosing the Right MD Inspection Technology

Not all metal detectors are created equal for every application…

'Dry' Applications
No product effect impacts

'Wet' Applications
Where product has high salt or moisture content, variable temperture, or is packed in metallized film

Use ultra-high tuned frequency detection technology




Use Multi-Simultaneous Frequency and Product Signal Suppression technology to reduce the active product signal from wet products*



*Or those packaged in metallized film

Agenda

1	Key Drivers for Installing Metal Detection or X-ray Equipment
2	Basic Principles of Metal Detection
3	Basic Principles of X-ray Inspection
4	Making the Right Choice – Main Considerations

How is X-ray Used In The Food Industry?

Choosing the Right X-ray System for the Application…

Vertical Systems

- Sealed Pack Machines

- Bulk-Flow Machines

- Pipeline Machine

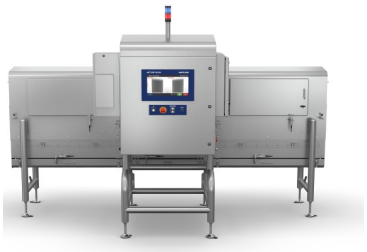
- Large Case Machine

- Loose flow Machine

Horizontal Systems

- Low Absorption Packaging

- Medium Absorption Packaging



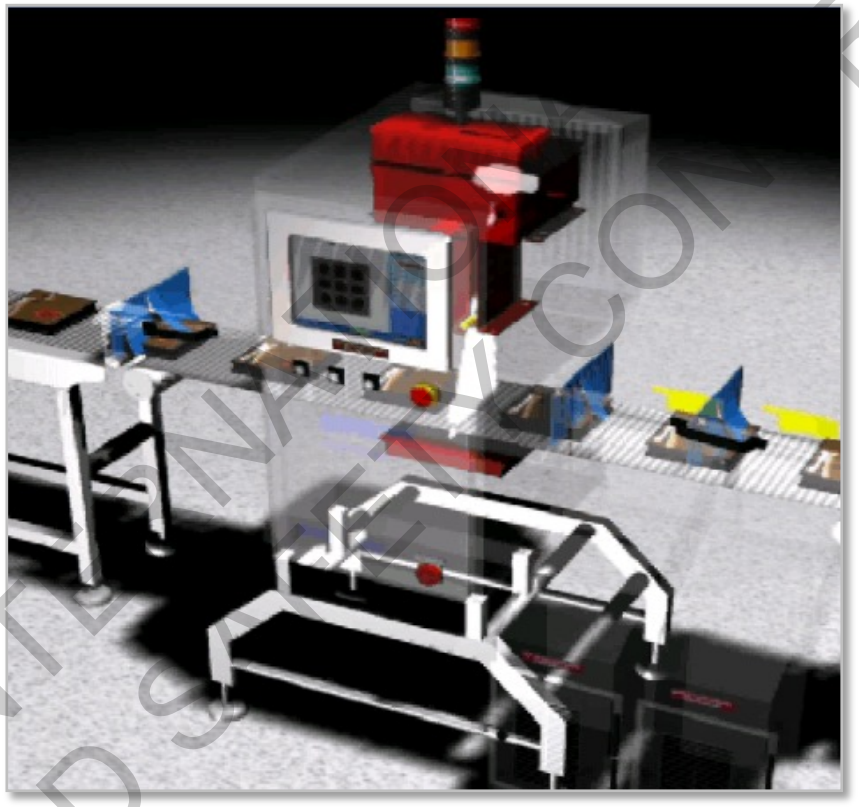
- High Absorption Packaging

Principles of X-ray – How Does It work?

X-Ray generator (red) housing the tube (white)

Computer rebuilds and analyses each image

Detector (red) passes data to the computer



Tube (white) emits beam downwards

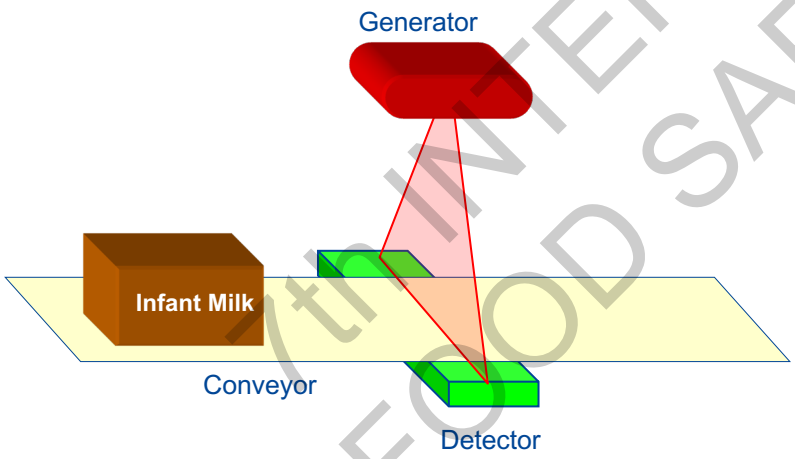
Low energy X-ray beam passes through the product

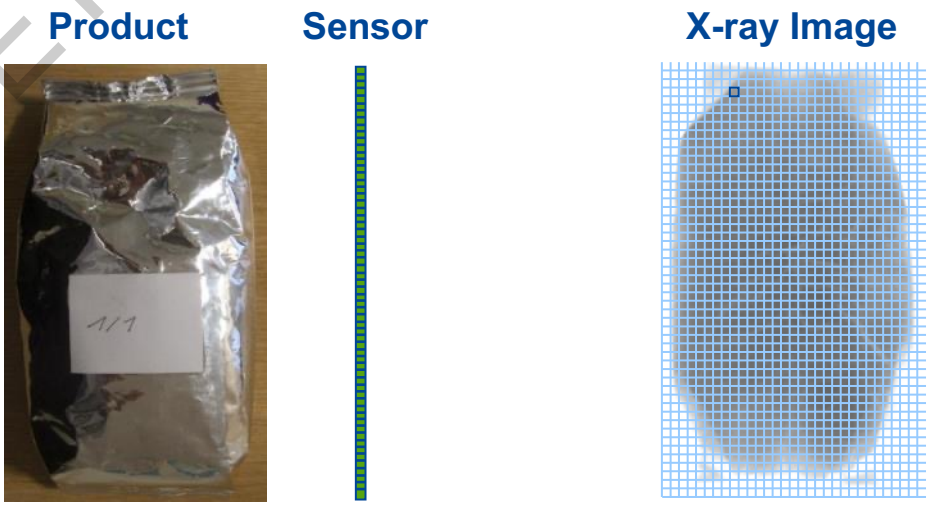
Computer decision initiates rejection of faulty product

How Does an X-ray System Work ?

Example of the technology working

- When a pack passes through the x-ray beam, only the residual energy reaches the detector.
- Measurement of the differences in absorption between product and contaminant (contrast is the basis of x-ray inspection).
- There are three key factors that determine the contaminant detection capability :
  - Product thickness (in the direction of the x-ray beam)
  - Product density to x-rays (e.g. soup is more dense than cereal)
  - Contaminant density to x-rays (e.g. metal is more dense than glass)





Principles of X-ray – "Difference in Absorption"

For the most part, density is used as a benchmark for inspection capabilities
In terms of Specific Gravity, i.e. SG, water has an SG of 1.0

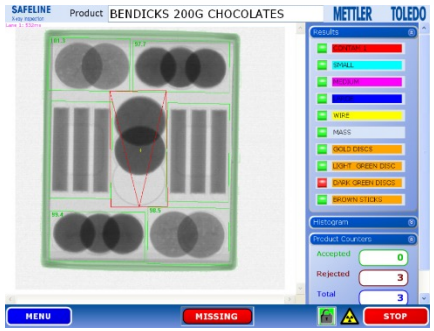
	Typical Food Contaminant	Typical Density g/cm³	Detectability
	Wood, stalks, insects, fruit stones	0.7	Typically not detectable
	Low density plastics	0.9 - 1.2	
	**Water (reference)**	**1.0**	**Typical food density**
	Dense rubber, bone, agglomerates	2.5	Detectable in sizes typically >3mm
	Glass ('low mineral'), ceramics	2.5	
	Aluminium	2.7	Detectable in sizes typically >2mm
	Mineral stone, dense plastics	3.0	Detectable in sizes typically >0.5mm depending on materia and product
	Glass ('high mineral')	6.0	
	Non-ferrous metal	7.5	
	Ferrous metal and stainless steel	7.5 - 8.0	
	Lead	11.30	
	Gold	19.30	

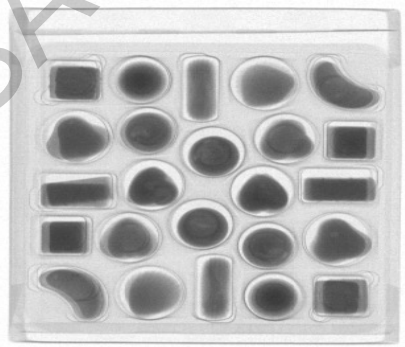
If the contaminant floats on water it is not detectable

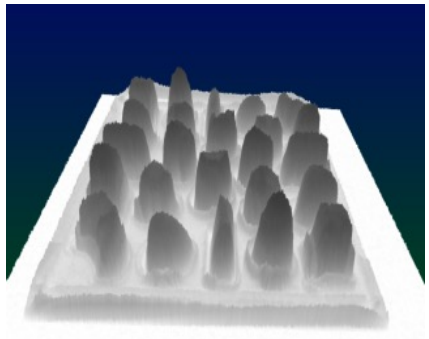
X-ray – More Than Just A Contaminant Detector

Product and Packaging Integrity

- Mass Measurement of overall pack
- Zoned mass for multi compartments
- Fill Level Control
- Damaged Product
- Missing Product
- Product dimension checks
- Insert Inspection (leaflet)
- Product Trapped within the seal
- Caps / Closure in Place
- Consistent Product Quality







Agenda

1	Key Drivers for Installing Metal Detection or X-ray Equipment
2	Basic Principles of Metal Detection
3	Basic Principles of X-ray Inspection
4	Making the Right Choice – Main Considerations

MD, XR or Both? Simplifying The Choice

Metal detection and x-ray inspection offer differing capabilities

Metal detection may be the best choice when:

- Metal is the only likely foreign body contaminant risk
- Aluminum has been identified as a potential risk
- Product must be inspected under gravity-fed conditions, including VFFS applications
- There is a need to protect expensive downstream equipment from metal contaminants

- **X-ray inspection may be the best choice when:**
- Non-metallic contaminants such as glass, mineral stone, calcified bone, or high density rubber or plastics are identified as the contaminant risks
- Product is in metal packaging
- Additional product and packaging checks are required, such as mass measurement, checking for missing or broken products, product in seal inspection or fill level checks

When Both Solutions Should Be Considered

- Different foreign body risks are identified at different CCPs
- Retailer contracts require both
- To achieve peace of mind that all precautionary steps have been taken to minimize the risk of foreign body contamination

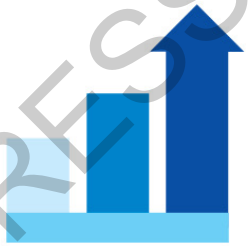
Note

Product testing prior to purchase is highly recommended to establish achievable sensitivity.

Factors to Consider When Choosing a Solution

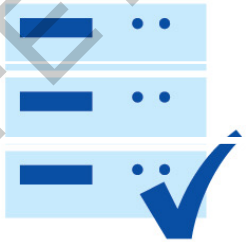
Sensitivity Standards

Hygienic Design



Productivity Targets & OEE

Location of CCPs



Additional Quality Checks

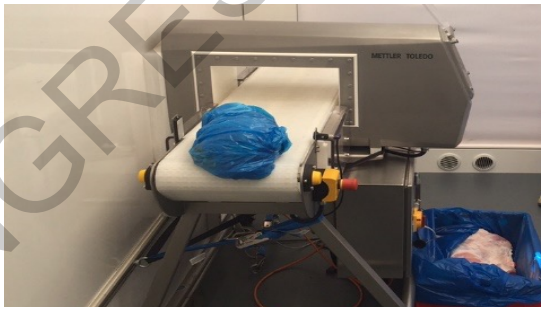
Minimized Product Waste

Product Format

Total Cost of Ownership

How METTLER TOLEDO Can Help

Helping our customers further to make the right choice



On-site Product Demo

We can bring our demo vehicle to you*, so you can put our metal detector to the test and compare results against your current metal detector performance.

eDemo

Product presentation

Show specific machine functions

To demostrate software & solutions

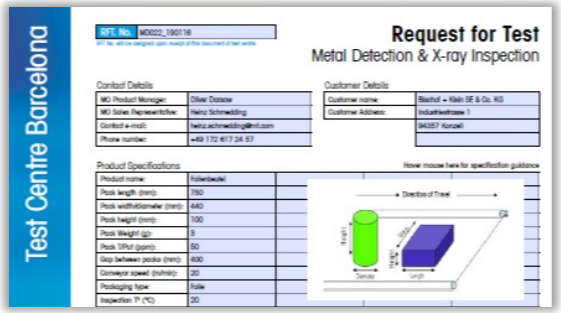
Demostarte product tests

Conduct FAT

Training for Customers

Product Testing

We offer **FREE** product testing at our Global test facilities supported by a full product test report on your individual product(s).



*Availability varies by country

Choosing the Right Supplier

Key Considerations

Choosing the right solution involves more than just physical equipment. A partner who offers **local service support** can help you achieve optimal performance from your product inspection equipment.

Equipment manufacturers who can **offer integrated process solutions including software** for automated data collection and electronic record keeping will make it easier to comply with industry standards and regulations.

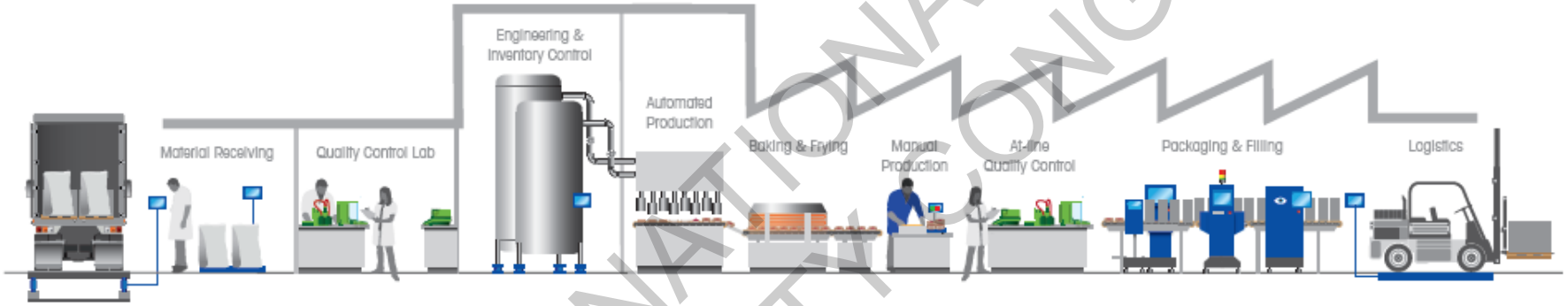
Assurance and Certification
Professional documentation and compliance-related products and services are available for your metal detection and x-ray inspection systems, including certified test samples and Performance Verification.

Equipment Optimization
METTLER TOLEDO can help you achieve optimum equipment performance, from professional start-up support to preventative maintenance and service contracts.

Expert Training and Education
Our modular training programme offers comprehensive guidance to operators, quality assurance staff and maintenance personnel. Additional literature, technical documentation and best practice advice is available to download from our online library. **Visit www.mt.com/library**

Providing Measurement Solutions

Across Our Customers' Value Chain



METTLER TOLEDO offers precision instruments and services for many applications in research and development, quality control, production, logistics and retail to customers around the world.

The Product Inspection Division of METTLER TOLEDO is a leader in the field of automated inspection technology. Our solutions increase process efficiency for manufacturers while supporting compliance with industry standards and regulations. Our systems also deliver improved product quality which helps to protect the welfare of consumers and reputation of manufacturers.

- **www.mt.com/pi-contamination**

Thank you for your time

Download our free whitepaper 'Metal Detection, X-ray or Both - Making the Right Choice' for detailed guidance on choosing the right inspection technology for product safety and quality control.

This document summarizes the pros and cons of each technology and guides you through the decision making process.

4**www.mt.com/md-xr**