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Thermo Fisher Scientific

## Developing detection strategies

‘Good is not good enough’ when  
it comes to metal detection

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**F**ood safety is a topic that grabs headlines around the world. From bacterial to metal and foreign object contamination in food, incidents involving accidental food contamination has caused increasing consumer concern about the food-supply chain.

### Meat and poultry are among the most difficult metal-detection applications.

Progressive processors are stepping up efforts to improve processes and procedures when it comes to prevention and detection of foreign objects. Good is not good enough anymore.

Protecting products such as meat and poultry from foreign objects requires careful thought. Metal detection technology has been around for more

than 30 years, but some real-world challenges have withstood the test of time and technology. Reliable and easy to use, metal-detection technology is the standard bearer for identifying foreign objects in virtually thousands of types of products. The technology is especially easy to apply in the production of dry, lightweight products.

Meat and poultry present different challenges. Product characteristics like wetness, density, size, salt content and the wide range of possible metal contaminants make working with it more difficult. In addition, processors that work with meat and poultry must follow specific handling and sanitation procedures to avoid pathogen contamination and ensure total safety and brand protection. Meat and poultry are among the most difficult metal-detection applications.

### The ‘product effect’

All metals have properties that make them discernible to metal detectors. Non-ferrous, stainless-steel and ferrous metals emit X (magnetic) and R (resistive) signals. Most metal detectors work by balancing a transmitted radio frequency signal between two receivers. When the signals are in balance, the product is free from metal contaminants. Metal objects coming through a detector emit X and R signals, which distort the receiver signals. A change in the balance of the signals usually means metal is present, usually, but not always. Wet, partially frozen or salty products also emit X and R signals. When these products go through metal detectors, they produce a false positive. This is known as the “product effect.”

Traditional metal detectors distinguish the difference between product and metal by “reading” the product’s X and R signals and creating a normal range for these signals. The ratio of the two effects is called the phase angle. Any readings close to the phase angle are considered normal. For many years, this has been a cost-efficient, reliable and safe way to ensure product quality. But this “best effort” sometimes just isn’t good enough.

Small metal objects – often smaller than 2mm – can fall within a product’s phase angle and be “phased out.” This can be dangerous because

it often means the metal detector isn't detecting all the metal.

In today's challenging economy, manufacturers from both the food-processing industry and product-inspection businesses are willing to take extra steps to protect consumers

while preserving brand equity. Investments in new metal-detection technology focused on eliminating the phase out effect, detecting smaller pieces of metal and providing better protection for manufacturers and consumers are becoming more common.

### Product size matters

When it comes to processing meat, large products can mean big problems. Meat and poultry are often processed in large, bulky packages. To adequately inspect these packages, metal detectors need large apertures, which can reduce sensitivity. Some metal detection systems designed for these applications offer a multi-coil design to increase metal signals by up to two times more than traditional three coil schemes, which improves sensitivity in large areas. For larger pieces of meat, multi-coil designs help ensure detection systems can meet uncompromising standards for detecting metal.

Metal detection in ground meat presents its own set of problems.

### Protecting products from foreign objects takes some careful thought.

Although the small aperture of the pipeline system provides the best sensitivity, unfortunately, it also precludes an accurate audit of the system. The closed nature of the system will not allow audits with a test stick or card, making it difficult to assess performance standards.

To ensure the sensitivity of the metal detector is continuously monitored, processors incorporate auditing systems to ensure the metal detector is operating properly. Some systems, such as Thermo Scientific's AuditCheck, automatically pass an air-driven test shuttle through the metal detector and compares both the magnetic (X) and resistive (R) signals to calibrated levels. This operation goes beyond a simple go/no-go test. Because signal levels are measured and compared to acceptable levels, AuditCheck can identify problems before they occur, eliminating costly recalls. If full traceability is needed, a complete record of all tests is available.

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## Keep it clean

Federal Regulations 21CFR110 Subpart E explicitly states that “all reasonable precautions shall be taken to ensure that production procedures do not contribute to contamination from any source.” To that end, metal detectors used in meat and poultry plants must meet special sanitation requirements. Quick assembly and disassembly and capability for clean-in-place (CIP) applications go a long way toward meeting these requirements.

Frequent equipment washdowns mean constant exposure to high water pressure, high temperatures and harsh cleaning solutions. In order to withstand this, a metal-detection system must be designed to resist corrosion, water ingress, thermal shock and other severe conditions.

To address cleaning and sanitation

challenges, more progressive metal-detection systems are made from stainless steel to prevent corrosion. Internally, the metal-detector head is filled with epoxy to prevent water ingress in the equipment. Temperature-tested epoxy liners, as well as food-grade ABS plastic front panels without buttons or switches also help protect equipment in harsh processing environments.

Equally important in designing an effective metal detection system is using a U.S. Dept. of Agriculture-approved conveyor design. While these belts may add as much as 30 percent to the cost of the equipment, it adds priceless benefits in safety, reliability and durability to a system.

Meat and poultry contaminant events are common and can be extremely costly. The closer the product gets to the consumer, the higher

the cost of failure. Evaluate vendors with high-performance products and extensive experience in these applications. Choose a system that will thrive, not just survive. Then install, audit and maintain it for the best value over the system's life. ■

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*Bob Ries is the Product Manager at Thermo Fisher Scientific. He has more than 20 years of*



*technical experience related to instrumentation, measurement and inspection technologies. Ries is responsible for developing and introducing what is billed as the world's most-sensitive metal detector using a new concept in entry level x-ray systems, and a high-end family of x-ray systems offered in partnership with a European pioneer in x-ray technology.*

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