Novus X-Ray LLC

Increasing Quality through X-Ray Technology

Metal in Metal Foil Packages

Contaminant detection in metal foil packaging is a big problem for classical metal detectors.

For many years it has been an industry goal to find and remove small metal particles that find their way into food product. The standard and well practiced method is by means of a magnetometer or normally referred to as a metal detector. Much improvement has been made to such machines to help identify material other than ferrous metal such as stainless steel. This is because most of the machinery in a food processing factory is made from stainless steel and therefore most likely to find its way into the product.

Recent popularity of metallic foil packaging has presented a major problem for detecting small metal contaminants because the magnetometer simply can not see past the foil.

X-Ray inspection technology has promised a solution, but the image processing needed to identify the small objects when contained in a non-homogenizes product has proven very difficult.

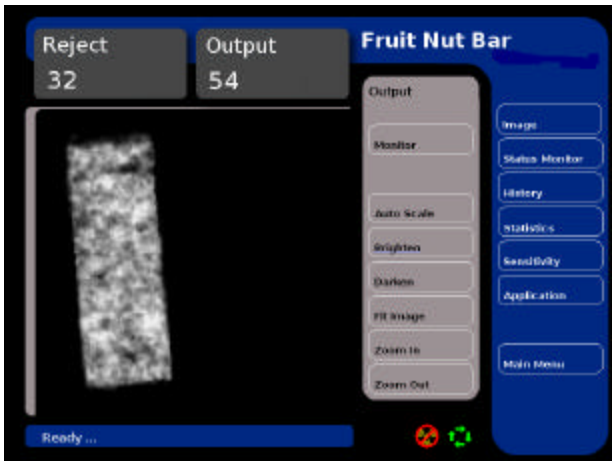

Image of a good raisin and oat cereal bar showing a large variation in product density.

Novus X-Ray's ***Hyper-Switch ™*** processing system has breakthrough technology that can match and even beat the classical metal detector's capability in terms of object size, and can do this when encapsulated in metallic foil packaging.

Contaminant detection is almost always included with an x-ray installation, but its performance is probably the least understood. Its very easy and tempting to simply specify a minimum object size and say "the machine shall be capable of detecting" the object. Without specifying the false rejection rate (FRR) and probability of detection (POD) along with the desired size, the statement is useless.

This customer produces many cereal and energy bars, but the raisin and oat bar is the most challenging in terms of small object detection.

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It is relatively simple to run a few bars through a machine and setup to identify small contaminants, but actual production of this type of product proves very difficult while keeping the POD high and the FRR low.

The ***Hyper-Switch*** ™ platform is capable of detecting 1mm SS contaminant at a POD of 98% and a FRR of 0.1% on this product.

The statistics required to prove the POD and FRR need to be understood, therefore worth mention.

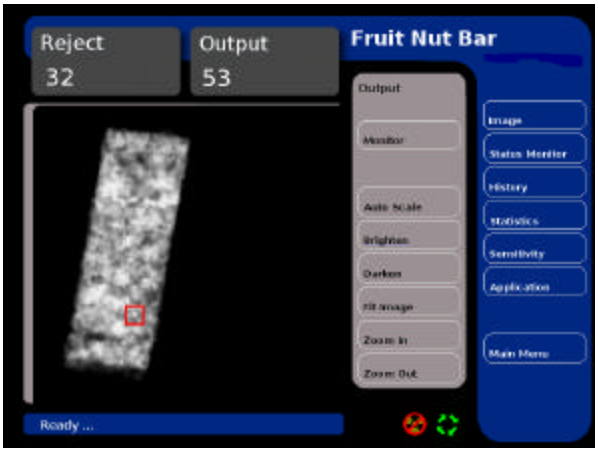
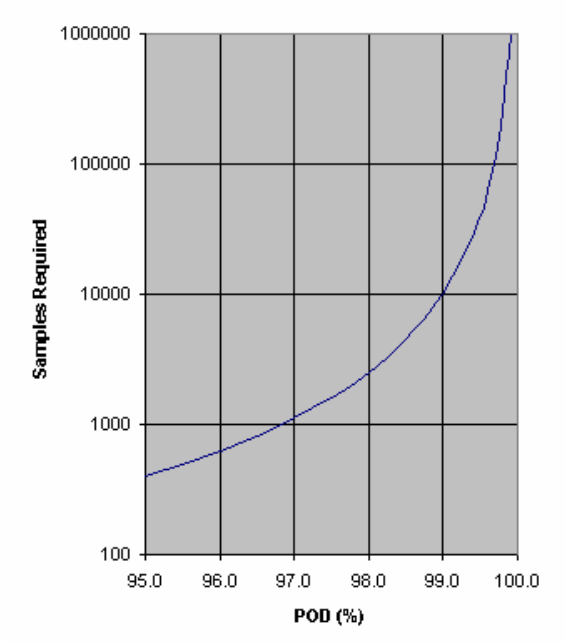


Image of a raisin and oat cereal bar containing a 900um stainless steel sphere.

Contaminant detection statistics are totally independent, therefore the uncertainty of measurement of N number of samples is proportional to the square root of the number of samples. Therefore with a POD of 98% (2:100 or 0.02) the number of samples needed to prove these statistics is one divided by 0.02 squared or 2,500 samples. At a POD of 99%, 10,000 samples are needed.



You can see that the number of samples dramatically increases with higher POD values, therefore much care should be taken when writing these specifications. It is always better to specify a smaller contaminant size with a POD and FRR that are in the range of 95% to 0.2% because they can easily be validated.

Plot showing the relationship of samples needed versus the desired probability of detection.

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