AMERICAN SCIENCE AND ENGINEERING, INC.
WHEN YOU CAN'T AFFORD TO COMPROMISE.

Z BACKSCATTER

ANOTHER AS&E ADVANTAGE

Z® Backscatter technology - only available from AS&E - creates photo-like X-ray images revealing the threats that competitive systems miss, including explosives, plastic weapons, and drugs.

Z Backscatter technology enables the deployment of *simultaneous* Radioactive Threat Detection (RTD) technology. Delivery of the RTD capability relies on the sensor array developed for Z Backscatter scanning.

AS&E systems are safe and effective. "Flying Spot" allows AS&E systems to produce images while emitting a substantially lower radiation dose to both the cargo and the environment than other X-ray inspection systems.

Z Backscatter X-ray

Z Backscatter X-ray

Flying Spot Technology

Z Portal

According to a recent article from the Health Physics Society, "*At this time, no other technologies ...offer the same security benefits of backscatter x-ray security scans...The risk to any individual from frequent backscatter x-ray scans is truly trivial.*"

The ABCs of Z

Proprietary Z Backscatter technology provides the highest clarity - photo-like - images available, allowing accurate and rapid interpretation - unachievable with traditional transmission X-ray images alone.

Z Backscatter is AS&E's signature X-ray technology. Made possible by AS&E's patented Flying Spot, this technology is protected by more than 20 patents and is the proven approach for the discrimination of organic or "low Z" (i.e., low atomic number) materials such as explosives, drugs, cigarettes, and people, especially when hidden within a complex environment. Z Backscatter images reveal the shape and form of objects inside a container, providing context and clarity to expedite inspections. This photographic quality is unachievable with traditional transmission X-ray images alone.

With threats clearly visible in bright white, photo-like Z Backscatter images allow rapid image analysis, high throughput, and enhanced productivity while reducing operator fatigue.

Z Backscatter technology can be used as a Standalone Technology, or in combination with other technologies, including Transmission, Shaped Energy™, and Radioactive Threat Detection.

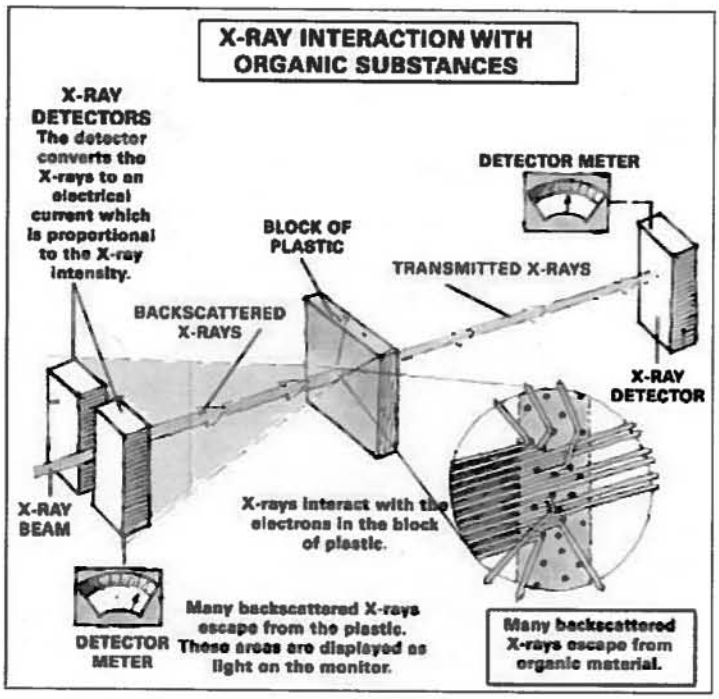
The Compton Scattering Effect

AS&E's Z Backscatter inspection systems use electronically generated X-rays to examine an object. When X-rays interact with matter, they generally do one of three things:

1. They pass through the object.
2. They are absorbed by the object.
3. They are scattered from the object.

Objects with greater density block or absorb more X-rays than objects with lesser density. These dense objects produce the characteristic shadow-like images similar to medical X-rays. These shadowgrams are produced by transmitted X-rays and are referred to as transmission X-ray images.

By comparison, a Z Backscatter image captures data from X-ray photons that are scattered from the object undergoing inspection. This primary scattering effect is known as "Compton Scattering." X-ray photons scatter differently when they encounter different types of materials. Compton scattering is material-dependent, with the lower atomic number materials scattering more strongly than the higher numbered ones. (Higher atomic number elements are more likely to absorb X-rays, either before or after being scattered.)



click to enlarge

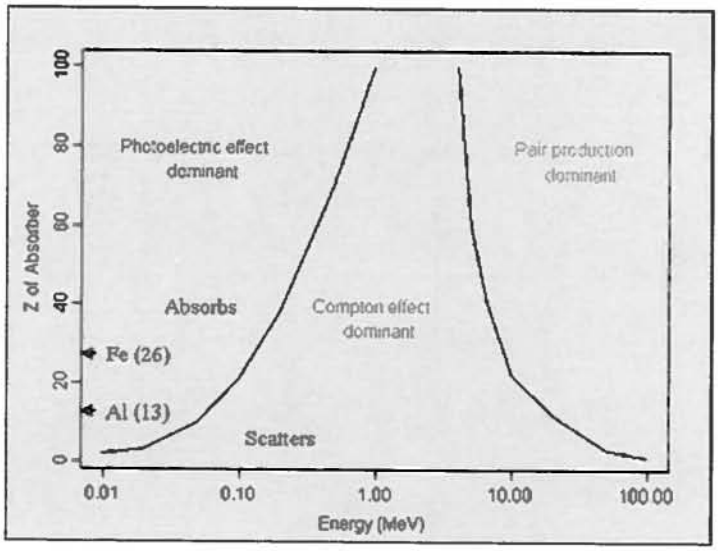
Much organic material is low-density, and does not show up well on traditional transmission X-ray images. Organic matter, specifically explosive material, contains low atomic number (low Z) elements such as carbon, oxygen, hydrogen, and nitrogen. (Please note that there are other low Z materials besides organic matter, including metallic elements. For example, lithium - with an atomic number of 3 - will also produce a strong scatter effect.)

AS&E creates photo-like Z Backscatter images showing organic materials by directing a sweeping beam of X-rays at the object under examination, and then measuring and plotting the intensity of scattered X-rays as a function of the beam position. **Z Backscatter, which utilizes the Compton Scattering Effect, is the most effective X-ray technology for the detection of low Z materials - and only AS&E offers Z Backscatter on all of its Inspection Systems.**

Akin to light reflection, Z Backscatter signals are particularly strong whenever the incident X-rays interact with explosives, plastics, and other biological items, which typically contain low Z materials. Even inorganic objects, such as metals, are given shape and form in

Z Backscatter images - making them easier to interpret than transmission images during X-ray evaluation.

The images created by Z Backscatter detectors are clear, uncluttered, and photo-like. They are much easier to interpret than traditional transmission X-ray images.



AS&E's Flying Spot - The Key to Z Backscatter Technology

ANOTHER AS&E ADVANTAGE

The Flying Spot allows AS&E to deliver Z Backscatter scanning, a proprietary innovation based on the Compton Scattering Effect.

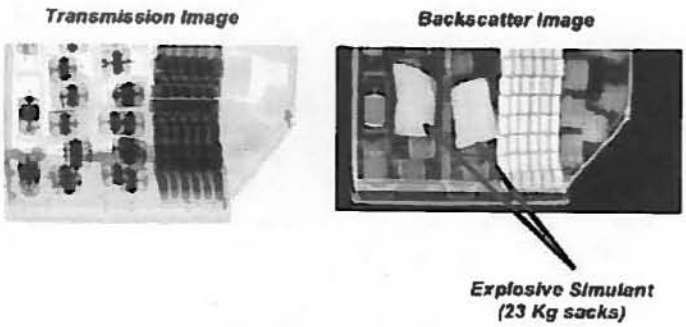
The photo-like images produced by Z Backscatter scanning are made possible by the patented Flying Spot.

With the Flying Spot, AS&E systems can produce images while emitting a substantially lower radiation dose than competing X-ray inspection systems.

It is AS&E's patented Flying Spot technology that makes Z Backscatter scanning possible. Flying Spot technology allows the position of the X-ray beam to be defined at every instant of time, so that any Z Backscatter signal received is easily correlated with the particular region of the cargo undergoing inspection. As described above, Z Backscatter's photo-like images are easy-to-interpret, revealing both the presence and exact position of low Z (organic) components of the cargo. This significantly enhances the ability of operators to quickly understand and interpret scan results.

In these AS&E images, side-by-side transmission and Z Backscatter images of the same LD-3 air cargo container prove the AS&E advantage. Two sacks of explosive simulant are hidden in the container. Note how the Z Backscatter image highlights the organic content of the simulated explosive and presents that image with photo-like clarity.

Images of an LD-3 air cargo container.



Z BACKSCATTER STANDALONE TECHNOLOGY

Mobile and highly effective

Another advantage of AS&E's Z Backscatter scanning is that it can be implemented without the use of boom-mounted receptors. For example, AS&E's Z® Backscatter Van™ (ZBV) is a "backscatter-only" system, which allows for rapid drive-by screening of containers and vehicles in a variety of applications without impeding the flow of commerce. The ZBV can obtain images quickly and without an intrusive presence, since it has no visible components that would indicate that it is a security system. Such covert operation not only can detect hidden threats, but also assist in the apprehension of those responsible for threat and contraband loads.

Multi-View Drive-through Portals

The Z Portal system can be configured with up to three Z Backscatter X-ray detectors to provide maximum screening capability. This allows multiple X-ray views of the vehicles undergoing inspection, including both sides and top-view. The relocatable screening system is available in two sizes - one for large trucks, buses, and cargo vehicles; and a smaller size for passenger vehicles.