

BPSI Spectroscopic Portal Monitor

Building Protection Systems Inc. (BPSI) has employed a relatively new concept for spectroscopic portals. A patented digital conversion technique is used in its spectroscopy systems called Quadratic Compression Conversion (QCC¹). QCC enables the use of detectors in which resolution varies as a function of energy, and other differential non-linearity, to obtain excellent characterization of spectral peaks. This invention uses digital signal processing (DSP) and a fast algorithm for increased sensitivity and response. It is well recognized that sensitivity and response are very important factors in achieving good results in portal monitors. The algorithm used is a fast transfer function to give enhanced real time characterization of the data. Repetitive sub-second sampling of this enhanced spectrum can then give high statistical confidence factors that approach 99.9%. This fast sampling and comparative process is called hysteresis. A 32-bit microprocessor is employed that can present data in time slices as short as 100 ms where effects of background, Compton and Bremsstrahlung are stripped out, greatly aiding the search and analysis. The DSP design operates at 50 MHz and handles a 16K spectrum compression in about 20 nsec. This process combined with large spectroscopic detectors results in accurate identification of radionuclides that are orders of magnitude below ambient background levels.

Even though the inverse square law, background radiation, shielding and movement of cargo can be problematic in this type of application BPSI has been able to obtain excellent results with this technique in their building protection operations with the Building Sentry One product. Critical to this application is the need to make a quick and accurate decision about radioactive threats based on fast repetitive sampling of the spectrum. This technique has greatly reduced the number of false positive or nuisance alarms. In fact the BPSI Building Sentry One system has over 74,000 hours aggregated run time with NO false positives or false negatives.

The forgoing represents a system that is far different than the portal systems employed today, most of which do not identify the radionuclide. Making decisions based on the statistical occurrence of a highly resolved (compressed) peak in the spectrum is certainly more precise (allowing identification) than low resolution systems which utilize very high sensitivity detectors that are subject to large fluctuations in background and other occurrences such as cosmic interaction.

The easy to read and understand data reports from the BPSI system use the ANSI 42.42 format and include identification of ANSI nuclides with a spectrum. Portal monitoring data from many detector systems are exported to a computer and data handling software in real time. Upon finding a radioactive source, acquisition and analysis takes place in about 6 seconds with appropriate alarm indications according to ANSI 42.38. Identification of nuclides is also given with the category of material, namely industrial, medical, SNM and NORM. Data and spectra (up to 10,000) are also stored on a CF card which is conveniently read by a computer for quantitative analysis. The reports can easily be transmitted or emailed to a remote command center or response team.

All systems are auto calibrated and stabilized with K40. K40 is NORM and does not interfere with the detection of radionuclide's including additional K40 that may be present. Since the background is subtracted out rapidly the small amount of K40 used for stabilization is also subtracted. Packaging of the system is in a NEMA 4 enclosure and can be further upgraded to meet ANSI 42.38. The BPSI Spectroscopic Portal Monitor operates on 120 VAC power and requires very little maintenance to provide unparalleled detection and identification of radionuclide threats.