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Passive Radiological Inspection of Shipping Containers using a UAV-Mounted Scintillator Detector

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Radiation detectors mounted on unmanned aerial vehicles (UAVs) can be utilised to screen freight passing through a seaport for radioactive material that could be used in radiological dispersal or improvised nuclear explosive devices. Payload and battery life restrictions limit the size of the sensor package that can be deployed on a UAV and as a result a low-cost system is likely to deploy small and lightweight detectors that produce count-starved spectra. To support existing screening infrastructure in place at seaports using drone-based detectors radioactive source identification from these limited spectra is necessary. An established technique for processing count-starved spectra to identify different radioactive isotopes and special nuclear materials uses the ratio of counts in different spectral bins, effectively comparing the shape of different spectra and thus being less susceptible to background. A challenge in the application of this method to screening shipping containers arises from the inherent shielding present; scattering in cargo materials changes the shape of the spectra. This work presents an investigation into the optimum spectral bins required for detecting concealed ^{137}Cs , ^{60}Co and special nuclear materials using the method of spectral comparison ratios. A shift in the optimum bins is seen with 2.5 cm of iron shielding for ^{137}Cs and ^{60}Co sources, while the shielding effect is expected to have less impact for special nuclear materials.

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