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#09-58 Performances of a very high efficiency Imaging Camera for NORM radioactivity detection

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Naturally occurring radioactive materials NORM are materials which may contain any of the primordial radionuclides or radioactive elements as they occur in nature, such as radium, uranium, thorium, potassium and their radioactive decay products, that are undisturbed as a result of human activities. furthermore, the technologically enhanced NORM, TENORM are generated in the form of by-products, residues and wastes, from industrial processes that exploit natural resources such as coal combustion, fertilizers production, processing of metal, oil mineral ores extraction and, generally, many other industrial processing. The management of these materials is receiving more attention compared to the past due to large volumes of generated NORM, low specific activities and very long-lived radionuclides. NORM and TENORM should be evaluated as a pressing environmental hazard and should be monitored and treated with new specific techniques.
We designed a camera for gamma imaging and radionuclide identification based on the coded mask technique. The camera proposed is a compact, self-consistent, with high detection efficiency and good energy resolution in the full range from ^{241}Am up to ^{60}Co, ideal for real-time analysis on the go, with a low power consumption, suitable for industrial process control and ambient monitoring. We built a prototype consisting in 16 CsI(Tl) (3x3x10 cm^3 each) scintillators coupled to photo-multiplier tubes (PMTs) with a digital readout (CAEN digitizer V1725). The scintillators are arranged in a 4x4 matrix and packaged in a metallic frame. We used a 7x7 mask composed by transparent and opaque tiles (3x3 cm^2 for a total size of 21x21 cm^2) to encode radioactive gamma-rays sources image and used a reconstruction algorithm for decoding.
The system was tested in laboratory using free gamma-ray radioactive sources placed at a fixed distance from the mask to measure the camera point spread function (PSF) as function of the acquisition time. we also present the results with a NORM igneous rock sample and a waste drum (typically used in industrial0 nuclear waste management) and we identify the natural radioactive line from its spectrum, and we show the imaging results. We also present the camera minimum detectable activity (MDA) calculated for a source at 15 cm from the camera in a partial lead shielded configuration for different acquisition times, to point out the suitability of the camera in industrial waste monitoring.

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