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New Gamma Camera for Environmental Radioactivity Monitoring

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Abstract: After Fukushima accident, the importance of environmental radiation monitoring has increased many folds for clean and safe nuclear energy. The requirements include quick response, avoid exposure to general public and workers, and finally decontamination of the area. Our approach to accomplish above tasks includes two steps. Firstly the aerial monitoring of affected area by using helicopter to have an estimate of radiation dispersion and finally the scanning of area, with help of crane or vehicle, suspected for high contamination and hot spots. In first case absolute efficiency is preferred while in later both efficiency and spatial resolution have equal importance. We are designing a single gamma camera for area monitoring which consists of CdTe pixelated detector module of 16×16 pixels, pixel size 2.5mm, and two detector thicknesses 5mm and 10mm enclosed in the Tungsten pinhole collimator. In this paper, we present EGS5 simulation results regarding the important parameters like collimator diameter, source to collimator distance, displacement of point source in plane parallel to detector face at fix distance. The collimator diameter is the parameter of prime importance as it makes compromise between efficiency and spatial resolution of the camera. For larger source-collimator distance, as in case of aerial monitoring, the absolute efficiency is small which can be increased with larger collimator and smaller LLW. We studied the different collimator radii with intension to optimize the camera efficiency with acceptable spatial resolution. The preliminary simulation results may be very helpful before actual area monitoring.

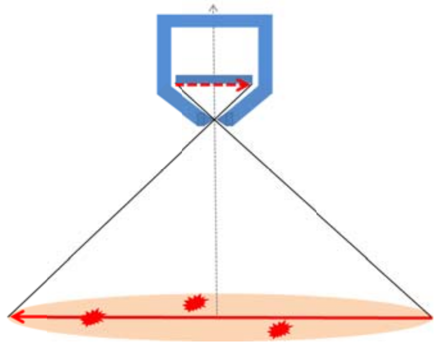

Fig. 1: Gamma camera FOV and hot spots in high background.

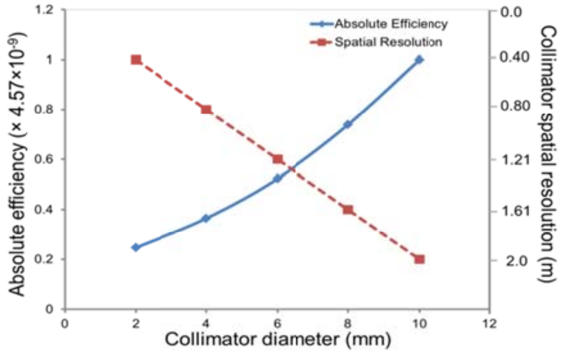

Fig. 2: Trade off between absolute efficiency and collimator spatial resolution with collimator diameter.

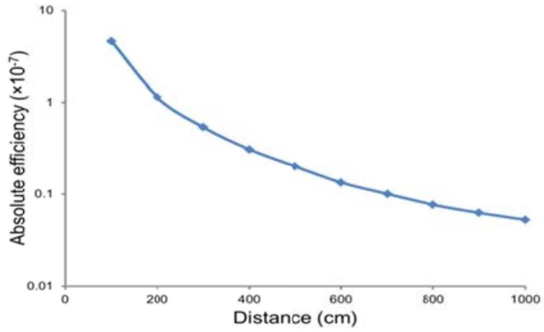

Fig. 3: Absolute efficiency vs source-collimator distance.

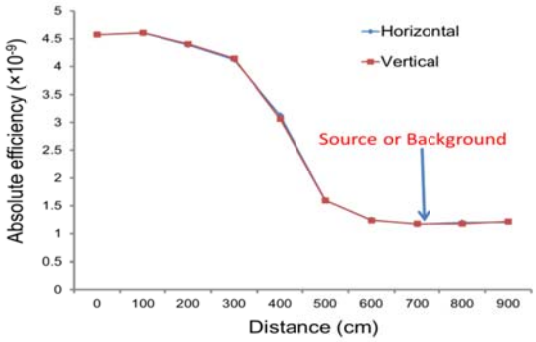

Fig. 4: Absolute efficiency with displacement of point source at 10m in parallel plane for 10mm collimator diameter.