

Implementation and optimization of a home-built cosmic veto system using digital electronics in environmental gamma spectrometry laboratory

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Surface gamma spectrometry laboratories for environmental radioactivity measurements face challenges in measurements of low-level activities due to the background induced by cosmic radiation, mostly from muons. At the Laboratory for Radioecology of the Ruđer Bošković Institute, a modular home-built cosmic veto system with digital electronics was designed and implemented around an existing high purity germanium (HPGe) detector setup. The system consists of three large plastic scintillator plates coupled to photomultiplier tubes surrounding the passive lead shielding. Coincidence events between scintillators and the HPGe detector were identified and vetoed using CAEN DT5781 digitizer with timestamping capabilities. The setup achieved a background reduction factor of 2.4 in the 40–2700 keV range, decreasing the total count rate from 0.58 to 0.27 cps. The signal to noise ratio is increased, introducing the detectability of the present low activity radionuclides while detection limits were improved by up to 50 %.

The setup is modular and customizable which makes it multi-purpose while time stamp mode introduces a powerful tool for a variety of scientific applications in the field of radioactivity and radioactivity measurements.

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