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Implementation of an active muon veto in an existing low-level γ-ray spectrometer at the underground laboratory Felsenkeller

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For low-level gamma-spectrometers situated at medium deep underground laboratories the cosmic radiation still causes a significant contribution to the background count rate. The cosmic component here mainly consists of muons and neutrons produced by muonic reactions. Our investigations were performed in the underground laboratory Felsenkeller, situated at a depth of 138 m.w.e. At this level the total muon intensity is reduced by a factor of 30…40 compared to the earth's surface [1]. The energy-integrated neutron flux amounts to 0.6 … 4.6·10-4 cm-2 s-1, depending on the location and consists mainly of (μ,n) neutrons [2]. Aiming towards continuously decreasing detection limits, the installation of an active muon veto was a logical conclusion under the given circumstances. The original gamma spectrometer is situated in an accessible shielding and was described in detail in [3]. It consists of a state-of-the-art low-level HPGe detector (92% rel. eff.), a low-level lead shield with a copper inner shield and a nitrogen-flushed casing. The active veto consists of three large plastic scintillator plates of 4.5 and 5.0 cm thickness, respectively, arranged around the outer housing of the lead castle. The data processing and adjustment of time relations for the coincidence circuit is implemented by analogue NIM-modules. Optimizations of the electronics was performed with respect to trigger thresholds, coincidence time interval and gate length. Finally, the muon veto improved the integral background count rate (40…2700 keV), normalized to the Ge-crystal mass down to 424 ± 4 d-1 kg-1. This corresponds to a relative reduction of around 85%, exclusively achieved by the active veto. Future investigations will include the analysis of cosmogenic radionuclides in meteorite samples, as well as determining radionuclide contents in low active environmental samples.

[1] Ludwig, F. et al., 2019. The muon intensity in the Felsenkeller shallow underground laboratory. Astropart. Phys. 112 24 –34

[2] Grieger, M. et al., 2020. Neutron flux and spectrum in the Dresden Felsenkeller underground facility studied by moderated 3He counters. Phys. Rev. D 101 123027

[3] Köhler, M. et al., 2009. A new low-level γ-ray spectrometry system for environmental radioactivity at the underground laboratory Felsenkeller. Appl. Rad. Isot. 67 (2009) 736-740

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