Low-Background γ-Spectroscopy at the New Underground Laboratory ◇

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During the last year we moved the three HPGe detectors, which were located at the Physik Department so far, to the newly erected underground laboratory of the Beschleunigerlaboratorium in Garching. This laboratory has an overburden of about 1500 g/cm^2 cutting off the main part of the hadronic component of the cosmic radiation. This reduces the excitation rates caused by neutrons penetrating the lead shield of the detector by roughly one order of magnitude.

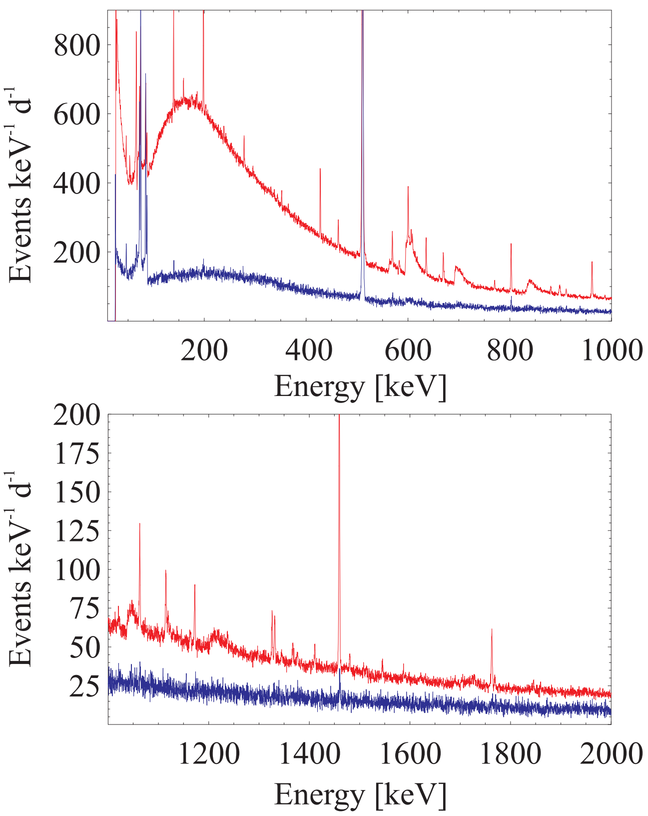

Fig. 1: Background reduction of the 152%-detector at the new underground laboratory, compared to the spectrum in the laboratory formerly used (without μ-veto).

At the moment five detectors are operated in the laboratory, three of which are fabricated of ultra low activity materials. The p-type detector of 152% relative efficiency is mainly used for the detection of γ-rays above 300keV whereas the two LOAx configurated detectors are used for the detection of γ-activities in the energy window below 500keV. [1]

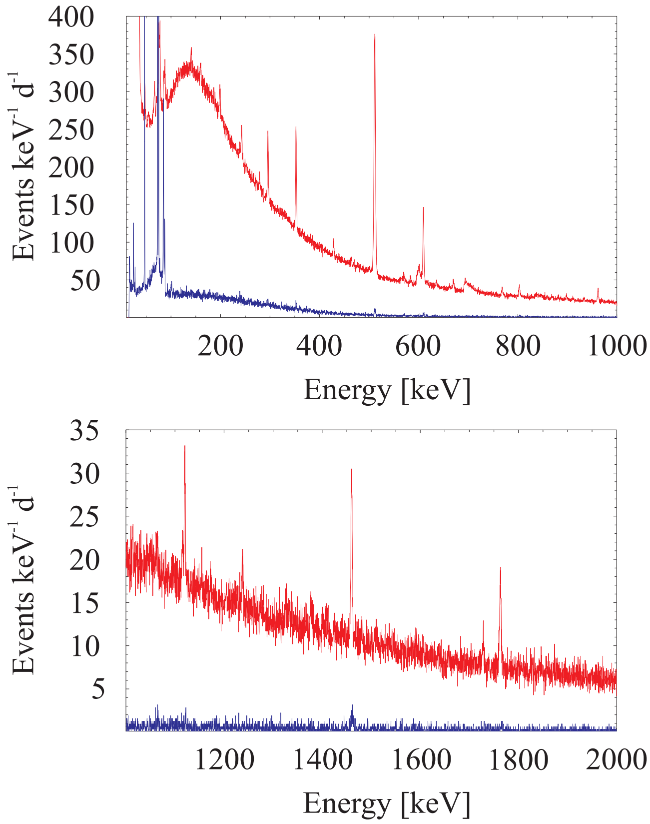

Fig. 2: Background reduction of the LOAX-detector at the new underground laboratory, compared to the spectrum in the laboratory formerly used (with μ-veto).

For the reduction of the photon flux within the detectors they are equipped with a low radioactivity lead shield of 150mm thickness. The inner layer consists of 50mm high purity lead which has a specific ^{210}Pb activity of 27mBq/g. On the outside the detectors are surrounded by 2" plastic scintillators which serve as an active veto against muons, suppressing bremsstrahlungs effects of througoing muons and short lived muon induced excitations. [2]

The combined improvements in the background rates opened new fields to the spectroscopy of low primordial activities. In the forecoming weeks a NaI anticompton detector will be set into joined operation with the p-type detector leading to the detection of lowest activities by the use of γ-γ coincidences and anticoincidences. The detection mode can be adapted to the decay of the investigated nuclide and can be used for a significant background suppression of neutron activated samples.

References

[1] R. v. Hentig *et al.*, Determination of Radioactive Trace Elements in Ultra Low Background Detectors by Means of Neutron Activation Analysis, Czech. J. Phys., to be published

[2] R. v. Hentig *et al.*, Records in Ultra Low Measurements with Neutron Activation Analysis, Proc. of International Conference on Advanced Technology and Particle Physics, Como, 1998

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