

Low Background CdWO₄ Scintillation Detector

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Researches of rare nuclear processes play an important role in particle and nuclear physics, because they allow to explore properties of the neutrino, to test the Standard Model of particles and properties of the weak interaction. BALOO (BAsement LOw background scintillatiOn setup) was designed and built in the Lepton Physics Department of the Institute for Nuclear Research (Kyiv, Ukraine) to investigate radiopurity level of scintillators and materials screening, to carry out small scale low counting experiments. Cadmium tungstate crystal scintillator (CdWO₄, Ø70×70 mm) is viewed through Ø100×162 mm high purity quartz light guide by a low background photomultiplier tube. The detector is shielded by 6-12 cm of oxygen free high conductivity copper and 15 cm of old lead. A plastic scintillator counter 100×100×12 cm is placed above the set-up to veto cosmic muons, while a home designed electronics allow to reject pile-ups of fast Cherenkov signals in the quartz light guide. The background of the CdWO₄ detector is reduced by 3 orders of magnitude in the energy interval 0.5 – 2.6 MeV and by one order of magnitude above 3 MeV in comparison with unshielded detector at the Earth surface. Advancement of the set-up is progress, particularly by using a transient digitizer to discriminate particles by pulse-shape, and by time-of-events assay to analyze fast decay chains in the uranium and thorium families. Besides, additional plastic scintillation detectors will be installed around the setup to reduce the residual cosmic muons background.