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Test of materials for rare event experiments in Korea by using a commercial gas ionization alpha counter

Content

A few different rare event experiments searching for weakly interacting massive particles (WIMPs) and neutrino-less double beta decays have been being prepared, constructed and operated at an underground laboratory located in Yangyang, Korea. Screening very low back ground level materials are very critical requirements for such experiments to achieve good enough sensitivities to detect such rare events. For the screening, some number of alpha and gamma detectors have been investigated for detection of isotopes which can mimic the signals from the rare events which we are interested in observing. Out of the investigation, a commercial gas ionization alpha counter (UltraLo-1800 from XIA Co.) was purchased and installed at the Yangyang underground laboratory (Y2L) in June 2015. The alpha counter is an ionization chamber using Argon gas to ionize alpha particles in a given electric field to measure the energies and rise times of alpha particles. By combining the rise times and energies, the counter can also separate the alpha particles from the places in the chamber where the test samples are not located. This discrimination method is very powerful to achieve better than 1x10ˆ-4 counts/hr/cmˆ2 level of background depending on the material and the measurement time. After confirming the counter performance with an Am-241 source and a low background copper disk from the XIA (Originally from Pacific Northwest National Laboratory (PNNL)), quite number of different materials have been tested. In this presentation, we are going to show the performance of the counter in background levels from those samples such as lead blocks and Teflon sheets. For a lead block, we have observed contaminations from the bulk and the surface of the lead in the energy spectrum by comparing with a simulation data. For a Teflon sheet, we could observe a similar level of low background (2x10ˆ-4 counts/hr/cmˆ2) as the low background copper disk from the PNNL. This counter confirmed to be an essential screening device for selecting low background materials for the coming experiments being prepared.

About the Presenter

The presenter has been working in the elementary particle physics experiment field for about 29 years. His interest has been in the development, construction, and operation of particle, astro particle, and nuclear detectors to be used in accelerator based experiments, balloon flight experiments in the Antarctica, and rare event experiments at an underground laboratory. Various detectors such as gas filled drift tube detector, CsI(Tl) crystal detector, Tungsten and scintillating fiber sampling calorimeter, and silicon pixel detectors are what he has been mainly experienced so far. Recently he has been working in the low background detector development using scintillation crystals in room or low temperature. To achieve the low background experiment, a few different alpha and gamma detectors were investigated and being used for screening of detector component materials.

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