CONCENTRATION OF ^{14}C IN LIQUID SCINTILLATORS

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The main background hindering low-energy ($\lesssim$ 200 keV) neutrino measurements with liquid scintillators comes from the minute remanence of the cosmogenic ^{14}C ($T_{1/2} \simeq 5700$ a) present in the organic oil constituting the bulk of the scintillator. The β-decay endpoint energy of ^{14}C is quite low, $Q = 156$ keV, and the counting rate from ^{14}C is often reduced by threshold settings. However, too high concentration of ^{14}C may results in pile-up pulses. For example, in the Borexino detector at Gran Sasso, Italy, being the most sensitive neutrino detector, the trigger rate is largely dominated by the ^{14}C isotope [1] with the concentration of 2×10^{-18} [2].

It is the lowest ^{14}C concentration value ever measured. There are only a few results available on the ^{14}C concentration. In addition to the one in Ref. [2] there are three other measurements reported in Refs. [3, 4, 5].

Obviously ^{14}C cannot be removed from liquid scintillators by chemical methods, or by other methods in large quantities (liters). In principle, the older is the oil or gas source that the liquid scintillator is made of and the deeper it situates, the smaller the ^{14}C concentration should be. This, however, is not generally the case and it is believed that the ratio depends on the activity (U and Th content) in the environment of the source.

We are performing a series of measurements where the ^{14}C concentration will be measured from several liquid scintillator samples. They need low-background environment and are taking place in two deep underground laboratories: in the new CallioLab laboratory in the Pyhäsalmi mine, Finland, and at the Baksan Neutrino Observatory, Russia, in order to reduce and better understand the systematical uncertainties. Preliminary results will be presented.

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