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P1.092 Towards ^{14}C-free liquid scintillator

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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 ½ $\simeq$ 5700 a) present in the organic oil. The β-decay end-point energy of ^{14}C is quite low, Q = 156 keV, and the counting rate due to ^{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 with the concentration of 2 x 10^{-18}. It is the lowest ^{14}C concentration value ever measured. There are only a few other results available on the ^{14}C concentration.

Obviously ^{14}C cannot be removed from liquid scintillators by chemical methods, or by other methods in large quantities. 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 concentration 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 is measured from several samples. They need low-background environment and are taking place in two deep underground laboratories (the depth greater than 4000 mwe), at the 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.