Measuring ^{14}C Content in Liquid Scintillators

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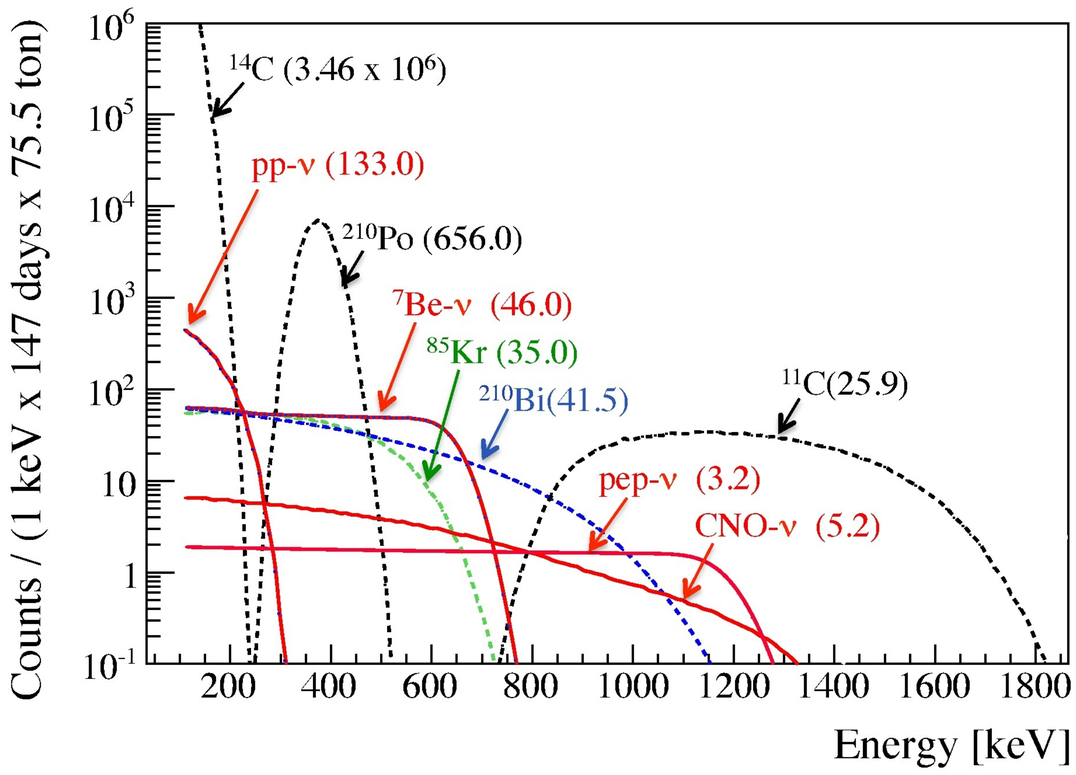
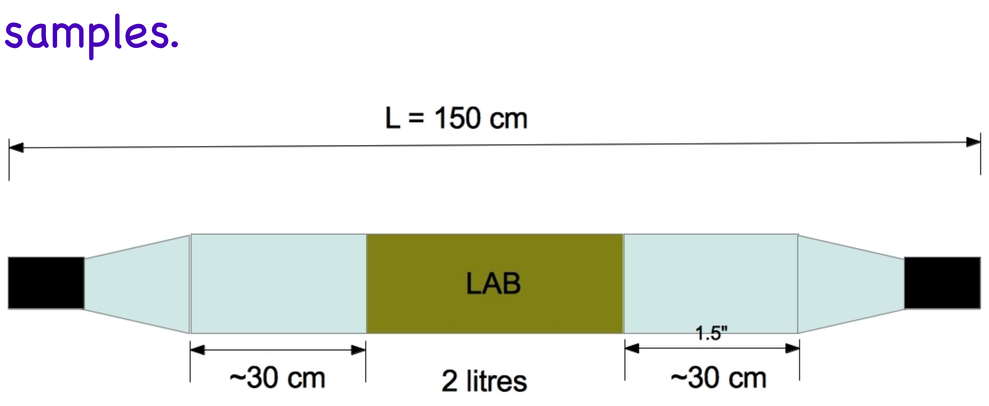
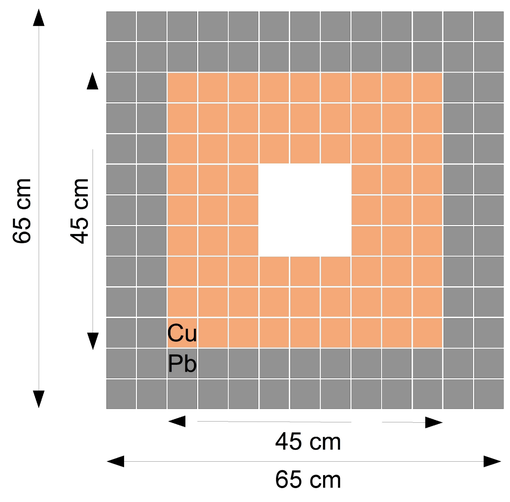
^{14}C intrinsic in the liquid causes the main background at very low energies in liquid scintillation detectors. In high-purity liquid scintillators, the smallest measured concentrations of ^{14}C are close to 2×10^{-18} ($^{14}C/^{12}C$) (see, for example, Refs. [1-3]).

As an example, solar neutrino spectra and the main background components measured by Borexino [4] are shown below.

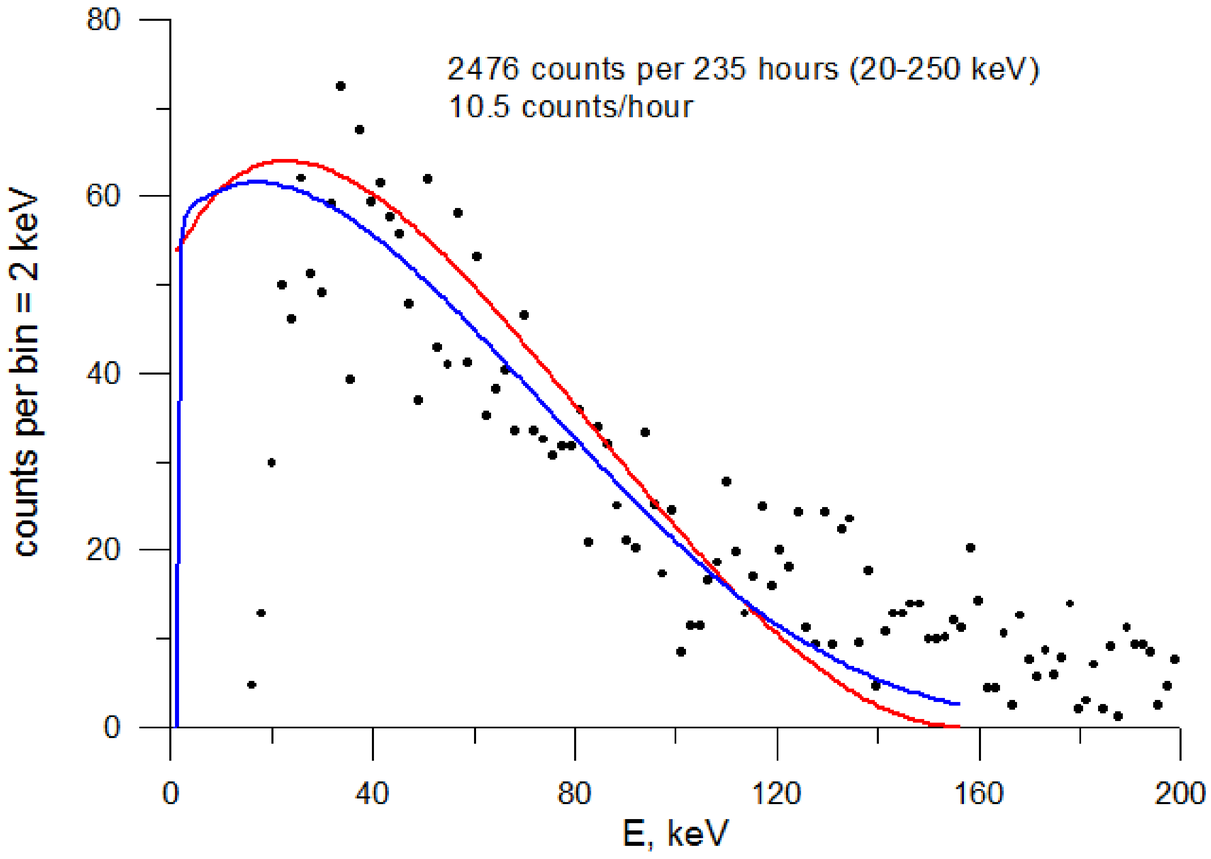


A series of measurements will be carried out in Finland (Pyhäsalmi) and Russia (Baksan) to measure the $^{14}C/^{12}C$ ratio from various liquid scintillator samples.





The detector setup is quite simple. It consists of two low-activity PMTs, two light guides and a vessel of 2 litres of liquid scintillator. In Pyhäsalmi at 4000 mwe they will be covered with a thick layer of copper and lead for shielding gamma-rays from the rock. In Baksan at 4900 mwe, a dedicated low-background laboratory will be used.



Spectrum of ^{14}C from the first measurement after only 10 days performed in Baksan is shown above. The obtained very preliminary concentration of ^{14}C is less than 1×10^{-17}. Measurements in Pyhäsalmi start in the end of 2014.

It will also be studied whether liquid scintillator samples based on coal derivatives would produce lower ^{14}C activity than those based on oil derivatives.

Leverage from the EU 2007–2013
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