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Liquid Processing and Assay Systems for the SNO+ Experiment

The SNO+ detector is a renewal of the Sudbury Neutrino Observatory (SNO)heavy water Cherenkov detector in which the heavy water in the detector core is replaced by an organic liquid scintillator (linear alkyl benzene or LAB) for the study of neutrinoless double beta decay, low energy solar neutrinos, geo-neutrinos and other topics. The science program requires extremely low levels of high-energy beta and gamma ray background activities from 214Bi, 212Bi and 210Bi all from the naturally-occurring 238U and 232Th decay chains and from 40K.

The LAB scintillator processing facility, including distillation, water-LAB extraction, functional group metal scavenger columns and nitrogen/steam stripping modules, is currently being installed in the SNOLAB underground laboratory. Ex-situ LAB radio-purity assay procedures have been developed using the metal scavenger columns and gas stripping radon detection methods. Target radio-purities for the LAB are 1.6 x 10^-17 g 238U/g LAB, 6.8 x 10^-18 g 232Th/g LAB and <1.3 x 10^-18 g 40K/g LAB.

The processing and assay systems used for the outer shielding water in the SNO detector have been refurbished. Processing techniques include vacuum degassing and reverse osmosis. Radio-purity assays utilize Ra adsorption on hydrous titanium oxide (HTiO) adsorption filters followed by coincident alpha-beta counting, along with cryogenic deposition and decay counting of Rn. Target radio-purities for the water in the cavity are the same as those achieved for the SNO experiment - 2.06 x 10^-13 g 238U/g H2O and 5.2 x 10^-14 g 232Th/g H2O.

Recent measurements of the efficiency and sensitivity of selected purification and assay techniques are outlined.

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