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Water assays as a radon monitoring tool for the SNO+ experiment

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The SNO+ experiment is a rare-event search experiment located at SNOLAB with its main goal being the search for neutrinoless double beta decay. This specialized search is highly sensitive, and therefore requires a very stringent radioactive background budget. Going deep underground provides 2km of overhead rock burden allows for very effective shielding from highly energetic cosmic rays that are constantly bombarding the surface of the Earth that would otherwise overwhelm the experiment.

While this shielding is effective, it provides new challenges due to the uranium and thorium that is naturally present in the surrounding rock. The uranium and thorium decay-chain produces radon gas that can emanate and create unwanted background noise within the detector. While there are currently mitigations in place to effectively reduce radon ingress into the ultra-pure water (UPW) shielding surrounding the detector, it is highly crucial to understand, quantify and monitor the radon content. SNO+ utilizes a well established assay system to do this.

Radon assays were developed for the original Sudbury Neutrino Observatory (SNO) experiment that now houses the SNO+ experiment. This assay technique is a unique testing and monitoring tool that separates radon gas from gas volume, and encloses it in a Lucas Cell. This Lucas Cell is specially designed to collect radon atoms. They then can interact in a scintillator surface when an alpha particle interacts with it, gets counted using PMTs, allowing for high accuracy when determining radon atom quantities.

These assays occur on a rotational basis and will continue to provide important information well into the future of the SNO+ experiment. The results from the more recent assays will be discussed as well as plans for trapping radon for the internal detector volume.

Keyword-1

SNO+

Keyword-2

SNOLAB

Keyword-3

Radon

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