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Sample Analysis Methodology for Telluric Purification

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The SNO+ detector is a multi-tonne liquid scintillator neutrino detector located 2000 m underground near Sudbury, Ontario. In order to search for the proposed neutrinoless double beta decay ($0\nu\beta\beta$), the SNO+ scintillator cocktail will be loaded with tellurium-130. The 130Te will come from telluric acid, which is synthesized with butanediol before being added to the scintillator. The detector is designed to measure extremely sensitive low energy particle interactions. It is necessary then, that the tellurium used is purified extensively, as any contamination with radioactive isotopes will create events that will obscure physics data. To ensure low backgrounds, the telluric acid has been kept underground for multiple years to shield it from cosmogenics and will be purified through an underground plant. Multiple samples from the plant will be taken at different stages of purification during the first "test"batch to better understand the physical processes and to estimate the purification factors prior to tellurium loading. This talk will look at the analysis strategies for these samples and the processes for which the concentrations will be accurately determined. X-ray fluorescence (XRF) will be used to determine the concentrations of telluric acid. UV-Visible Spectroscopy (UV/Vis) will be used to determine the concentration of nitric acid. These will both give a good indication of the chemical interactions during the purification process. Finally, inductive coupled plasma mass spectrometry (ICP-MS) will be used to accurately determine the purity levels through the concentration of uranium and thorium isotopes. Due to the strict SNO+ background budget, it is absolutely vital that these analyses are conducted in a clean, safe, and accurate manner.

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Author: SMITH, James

Presenter: SMITH, James

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