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Analysis of Alpha Particle Quenching in SNO+ Scintillator Using Internal Polonium Backgrounds

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The SNO+ experiment is a multipurpose neutrino detector located 2 km underground at SNOLAB in Sudbury, Ontario. The goal of the experiment is to search for neutrinoless double beta decay ($0\nu\beta\beta$) in liquid scintillator loaded with ^{130}Te in a low-background environment, thus necessitating the study of radioactive background contaminants. A sound understanding of the backgrounds can greatly improve calibrations and characterization of the light yield in the detector by comparing the light response to the results produced in simulation. One of the aspects of characterizing the light yield of the detector is the study of quenching sources, which refers to any process that reduces the quantum light yield of the scintillator. In this talk, analysis of α-particle quenching in scintillator from the decays of ^{210}Po, ^{212}Po and ^{214}Po is presented. Selections are made to data and Monte Carlo (MC) simulation based on detector geometry, scintillator levels in the partial fill phase and timing characteristics of the decays. The emission spectra in both data and simulation can be modelled effectively with exponentially modified Gaussian distributions due to the mono-energetic nature of the decays. Taking the mean value of the models to be the emitted energy of the decays, these parameters can be compared to their respective Q-values. The goal of this analysis is to fit an integrated light yield curve through the points to obtain the Birks' parameters S and k_B.

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