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Extraction of optical parameters in SNO+ with an in-situ optical calibration system

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SNO+ is a multi-purpose neutrino physics experiment investigating neutrinoless double beta decay and neutrino oscillations. The SNO+ detector consists of a 12m diameter acrylic vessel (AV), surrounded by ultra-pure water and approximately 9500 photomultiplier tubes (PMTs) which are positioned on a stainless steel PMT support structure (PSUP). The acrylic vessel will be filled with liquid scintillator. An in-situ optical calibration system based on LEDs and laser sources has been deployed. These optical sources feed light into the detector via optical fibres mounted on the PSUP, resulting in various beams of light. A collimated source will be used to measure the scattering in the liquid scintillator. Data have been taken while the AV was empty to understand the optical properties of the detector. We have analyzed the data to establish properties of the calibration system and to quantify the surface parameters, reflectivity and surface roughness responsible for scattering, as well as various parameters
of the optical calibration system. These parameters will be a valuable input to the position and energy reconstruction algorithms, as well as the simulation, of SNO+.

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