Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3077** Type: **Poster (Non-Student) / Affiche (Non-étudiant(e))**

(POS-34) Optimizing IWCD's Outer Detector using optical simulations

Tuesday 7 June 2022 17:44 (2 minutes)

Water Cherenkov (WC) neutrino detectors, such as Super-Kamiokande (Super-K), employ an outer detector (OD) volume to veto out cosmic muons and other types of background, and to provide passive shielding and identify events that are not contained in the inner detector (ID). The upcoming Hyper-Kamiokande (Hyper-K) experiment, a long-baseline neutrino facility to study oscillations and search for the CP violation in the lepton sector among other physics goals, will follow a similar OD and ID design for its far detector (FD) and for one of its planned near detectors - the Intermediate Water Cherenkov Detector (IWCD). The IWCD will be a sub-kiloton detector to be located at a distance of ˜ 1 km from the J-PARC facility which will be upgraded to deliver a 1.3 MW beam. Due to its shallow depth and smaller size, along with its exposure to the intense neutrino beam, it is expected that background rates and pile-up events in the IWCD will be higher than in the Hyper-K FD. This demands a sophisticated OD veto system to reduce misidentified pile-up events and to improve the reconstruction efficiency for signal events. The IWCD OD walls will be covered with reflective Tyvek material to improve light collection, while a blacksheet layer will optically isolate it from the ID. Building an intelligent veto system would require, among other things, an understanding of the photon distribution in the OD region for different configurations of the reflective Tyvek and the blacksheet. For this purpose, a dedicated Geant4-based simulation was developed to perform a detailed optical simulation of the OD for different optical configurations in order to infer an optimal OD design, wherein we collect enough photon statistics to reconstruct the OD events and, at the same time, keep Cherenkov light localized to improve particle identification. The results of these optimization studies are presented here.

Author: Dr TIWARI, Deepak (Hyper-K, University of Regina & TRIUMF)

Presenter: Dr TIWARI, Deepak (Hyper-K, University of Regina & TRIUMF)

Session Classification: PPD Poster Session & Student Poster Competition (21) | Session d'affiches PPD et concours d'affiches étudiantes (21)

Track Classification: Technical Sessions / Sessions techniques: Particle Physics / Physique des particules (PPD)