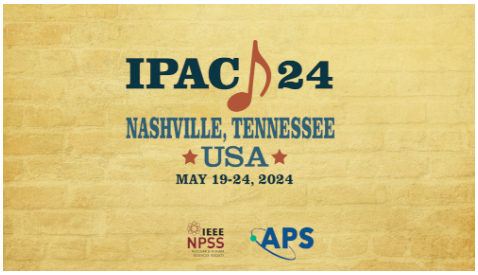

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Effects of delta ray electrons on measurement uncertainties of harp system

Wednesday 22 May 2024 16:00 (2 hours)

A harp system, which is a multi-wire beam profile monitoring (MWPM) system, is planned upstream of the spallation target to make in situ calibration of beam current density configuration on the target along with beam imaging from luminescent coating on the beam entrance window at the Second Target Station (STS) of the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory (ORNL). This beam interception-based beam diagnostics system on the target will be used to ensure that the maximum beam loads on the target are within the design range during neutron production. Current design of the harp consists of three layers of measurement wires each of which is sandwiched between voltage biasing wire planes. The signal obtained from each measurement wire layer is disturbed by secondary electrons (SE) and delta rays produced by beam-matter interactions in neighboring wires and ionization of residual gases in accelerator vacuum. While the backgrounds from SE can be suppressed by voltage biasing, the delta-ray electrons with kinetic energies above keV ranges overcome the electric potential bias. In this paper, we study the effects
of delta-rays on the measurement uncertainties of MWPM using the particle transport simulation code FLUKA. Furthermore, the cases where the harp system is installed in the proximity of a large delta ray sources such as proton beam window or in the core vessel filled with sub-atmospheric gas have been studied.

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