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Neutron Generator Facility at SFU - GEANT4 Dose Prediction and Verification

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A neutron generator facility under development at Simon Fraser University (SFU) utilizes a commercial deuterium-tritium neutron generator (Thermo Scientific P 385) to produce 14.2 MeV neutrons at a nominal rate of 3×10^8 neutrons/s. The facility will be used to produce radioisotopes to support a research program including nuclear structure studies and neutron activation analysis.

As a prerequisite for regular operation of the facility and as a personnel safety consideration, dose rate predictions for the facility were implemented via the GEANT4 Monte-Carlo framework. Dose rate predictions were compared at two low neutron energy cutoffs: 5 keV and 1 meV, with the latter accounting for low energy thermal neutrons but requiring significantly more computation time. As the SFU facility geometry contains various openings through which thermal neutrons may penetrate, it was necessary to study their contribution to the overall dose rate.

A radiation survey of the facility was performed as part of the commissioning process, consisting of a neutron flux measurement via copper foil activation and dose rate measurements throughout the facility via a ^3He gas filled neutron detector (Thermo Scientific WENDI-2). When using the 1 meV low neutron energy cutoff to account for thermal neutrons in the dose rate predictions, the predictions and survey measurements agree to within a factor of 2 or better in most survey locations.

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