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Monte Carlo shielding calculations for the SPES target handling system

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The Selective Production of Exotic Species (SPES) is a nuclear facility currently under construction at the National Laboratories of Legnaro (LNL) of the Italian Institute of Nuclear Physics (INFN), aiming at the production of Radioactive Ion Beams.

In the first SPES production phase, low energy and low intensity ion beams are planned to be produced using different targets. A continuous proton beam of 40 MeV of energy and 20 μ A of current will impinge on SiC and UCx targets, whose operational temperature is 2000 °C. The life-cycle of the Target and Ion Source (TIS) unit is 15-day long. After this time, the TIS unit will be removed from the Front-End.

A semi-automatic handling system for this kind of target units is being designed at the SPES laboratories. Such a system picks up the TIS unit and takes it to a temporary storage, where it will be hosted until the final disposal. The system foresees the presence of an operator. Due to the residual activity of the irradiated target, shielding calculations have to be performed based on the frequency and on the duration of the planned operations.

The ambient dose equivalent rate has been calculated with Fluka Monte Carlo code, for the two different target compositions, SiC and UCx, during the TIS removal operations. Different shielding conditions have been analyzed. Shielding calculations performed for both the semi-automatic handling system and for the exhausted target unit temporary storage represent mandatory inputs for the design of the SPES project.

Authors: Dr DONZELLA, Antonietta (University of Brescia); Dr FERRARI, Matteo (University of Brescia); Prof. ZENONI, Aldo (University of Brescia); Dr ANDRIGHETTO, Alberto (INFN-LNL); Dr BALLAN, Michele (INFN); Dr BORGNA, Francesca (INFN-LNL); Dr CORRADETTI, Stefano (INFN - National Institute for Nuclear Physics); Dr D'AGOSTINI, Fabio (INFN-LNL); Dr MANZOLARO, Mattia; Dr MONETTI, Alberto (LNL INFN); Dr ROSSIGNOLI, Massimo (INFN-LNL); Dr SCARPA, Daniele (LNL INFN); Dr TURCATO, Davide (LNL INFN); Mr ZANETTIN, Alberto (LNL)

Presenter: Dr DONZELLA, Antonietta (University of Brescia)

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