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Activation studies on benefit of the selection of the ESS target concept

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Presently, the ESS project is in the update phase of the conceptual design that has been preliminary defined in 2003 through the joint efforts of several European countries.

According with the baseline of the ESS update design, the linac will deliver 5 MW of 2.5 GeV protons to a single target, in 2 ms long pulses with a 20 Hz repetition rate.

The material activation in such facility is an important aspect that has to be taken into account since the early design phase. In particular the choice of the target material and the design of the target have to consider the following radiation protection issues: i) radiation level received by personnel during maintenance, ii) accident scenarios, iii) the production, handling and disposal of the radioactive wastes.

The aim of this work is to assess the radioactive inventory, decay heat and resulted gamma-ray spectra determining the radiation levels expected during maintenance work and to evaluate the amount of the residual radioactivity to be disposed of after the facility will shut-down for various target concepts under analysis.

In this respect a comparison of the two code systems: i) MCNPX2.6.0 (particle transport) and CINDER'90 (activation) and ii) PHITS (particle transport) and DCHAINSP 2001 (activation) was initially done in order to investigate their predictions and to decide the appropriate simulation tool for the problem.

Results of a sensitivity analysis accounting for various proton beam conditions (energy and profile) are also discussed.

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