

## **Radiological Inventory and Associated Activity Analyses Towards Decommissioning of a 40 MeV Medical Cyclotron VUB**

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This research focuses on using the MCNP6.2 Monte Carlo code to calculate particle fluxes and spectra with associated cross-section libraries on the precisely modelled geometry of the 40 MeV cyclotron and to be used further for depletion calculations. This cyclotron, a variable-energy, multi-particle accelerator, has been operational for 35 years at the Vrije Universiteit Brussel (VUB), Belgium health campus. The study includes neutron dose rate validation, sensitivity analyses of proton beam distribution, and depletion calculations with the ALEPH2 code, which was developed at SCK CEN. Overall, these analyses aim to determine the induced activities of specific nuclides in the areas of interest within the cyclotron components for validation purposes and to assess the radionuclide inventories at the end of the cyclotron's lifecycle. Additional analyses were also conducted on the cyclotron components over decay time. The results will either be validated against experimental values where applicable or used to gain insights into the activation profile in the absence of experimental values. The observation of radionuclide decay trends will help define the characterization of radiological waste according to the clearance levels declared by Belgian laws. Finally, the goal is to identify the best possible decommissioning scenarios that allow for the maximum reuse of dismantled components, supporting the sustainable development of accelerator installations.

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