First application of N1S code for calculation of dose due to movement of activated DONES components

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The IFMIF-DONES accelerator will accelerate deuterons up to 40 MeV in order to generate fusion-like neutron fluxes for materials studies. Deuterons will be lost along the beamline, in scrapers and collimators, in the beam dump, and in d-Li reactions at the target. These deuterons and the neutrons produced in reactions may activate materials, particularly in components close to the beamline. These highly activated components, include the high-energy beam transport line (HEBT) scraper, high-flux test module (HFTM) and target assembly (TA). After irradiation in the DONES accelerator, these components will be removed, transported and stored, leading to accumulated dose in different areas of the building. Understanding of these doses is important for the purposes of safety and protection of equipment.

At UKAEA, the Novel 1-Step (N1S) code [1] has been developed for single-step shutdown dose rate (SDDR) calculations in MCNP. In this work, N1S has been modified to account for movement of cells after irradiation. This allows the calculation of accumulated dose around a transport path, accounting for the detailed geometry of the problem as well as parameters of the movement such as movement path and speeds. The N1S method is verified by cross-comparison of the results for DONES HEBT scraper removal scenario against previous calculations using the D1SUNED code [2]. The HFTM and TA scenarios present further detailed applications of the code.

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