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Plasma and Neutral Beam Injector Guard Wall interaction using MCNP6 and GEANT4

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The choice of elements in structural materials such as stainless-steel can reduce radiation levels due to particle activation. The dose rate to workers and electrical components is managed by the material used for radiation shielding. This work analyses candidate materials used in the ITER neutral beam duct. Quantitative analysis of radiation effects in the Neutral Beam Injection (NBI) section closest to the ITER plasma region was carried out using GEANT4 and MCNP6 simulation.
The materials analyzed includes ferritic martensitic (F-M) steels at different chromium composition (9-25wt %), bainitic (Fe-3Cr-3W), 316L ITER grade Stainless Steel, Nickel base alloy1 (Ni-25Cr-20Fe-12.5W, 0.05C), SS Nickel base alloy2 (Ni-23Cr-18W-0.2C), 316L ITER grade and 304B4 Stainless Steel. GEANT4 and MCNP6 input geometry was developed based on concentric finite cylinders along a common axis of the neutral beam duct. Included in the ITER geometry are the plasma region, outboard blanket and shield, a neutral beam injection (NBI) port with a stainless steel - water layered beam guard, mid-plane port walls, an adjacent toroidal field coil, cryostat and biological shield.
GEANT4 and MCNP6 simulation were used to determine plasma interaction in the heating neutral beam duct closest to the ITER toroidal plasma region.

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