NEUTRONICS AND ACTIVATION ANALYSIS OF THE HiPER FACILITY

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The HiPER project is a facility conceived to investigate on the Inertial Fusion Energy. It will operate in a high repetition rate mode (up to 10 detonations per second, 10 Hz). The yields can be about 100 MJ of fusion neutrons, with up to 100 detonations per burst, and a burst every month. With MCNPX code for transport of neutrons and gammas, and with ACAB inventory code and EAF cross-section library for activation we have performed the radiological characterization of the target bay.

The target bay is the space dedicated to host the reaction chamber. A spherical 5 meters radius reaction chamber, 10 cm thick made of a stainless steel is assumed. About 50 optical penetrations are supposed, with disposable lenses facing these penetrations at 8 meters from the center of the reaction chamber. The final optics is placed at 24 meters from the center of the chamber, and it is thought to be shielded against radiation.

In this study we propose a chamber shielding, final optics shielding and a target bay shielding. We also dedicate some specially shielded areas to host the electronics. The possible consequences of the operation regarding with radiation damage are studied for the reaction chamber, the shielding, the disposable lenses and the final optics. We suggest possible maintenance and operation timetables and procedures (hands-on or remote) taking into account the different dose rates derived from the operation of the facility. Finally, we analyze the waste management after 20 years of operation, considering Clearance, Near-surface Burial, and Hands-on or Remote Recycling.

The response functions studied are: Materials Activation, Gas Production (Hydrogen and Helium), Displacement per Atom, Deposited Energy, Prompt and Residual Dose Rates, and Contact Dose Rate, Decay Heat and Clearance and Waste Disposal Rate indexes.

This study can be useful to make decisions on the facility design, the robotics and electronics necessary, the material requirements for the optics and the target bay and likely irradiation scenarios in the facility.