Shielding design for the High Brilliance neutron Source (HBS) target station

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Abstract

In recent years, the development of high-current accelerator-based neutron sources (HiCANS) has gained in interest to propose a novel option for the next generation of neutron sources. In HiCANS high neutron yields are achieved by irradiating metal targets with proton beams with energies in the MeV range bellow the spallation threshold and currents of several tens of milliamps. Based on this concept, the High Brilliance neutron Source (HBS) project was developed at Forschungszentrum Jülich to deliver a high flux of neutrons to various scattering, analytics and imaging instruments.

Relying on the experience and challenges of assembling the HBS shielding prototype at Forschungszentrum Jülich, the HBS target station shielding was developed from several layers of lead and borated polyethylene with a suitable stepped support structure. The aim of the shielding is to keep the dose rate in the monitored area well below the radiation protection criteria. The entire target station is modelled for particle transport simulation on the basis of the mechanical design. The dose rate distribution inside the target station as well as on the outside of the bunker walls is calculated during beam operation and also when the beam is switched off. The analysis of neutron and gamma flux and dose rate distribution in the target station from the radiation protection aspects will be presented.

This work is part of the collaboration within ELENA and LENS on the development of HiCANS.