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PS3-03 Activation of the Neutron Guides Designed for the European Spallation Source

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Different neutron guide materials are selected for the future European Spallation Source under construction in Lund, Sweden. Many charged particle and neutron sources around the globe have never considered the activation of beam material being exposed to the ionizing radiation. When the operation is terminated or refurbishment of beam lines becomes necessary the beam line scientists face the burden of extremely high radiation doses that hampers the “hands-on operation” and results of unnecessary increase of the radioactive waste volume. For this reason the activation of the neutron guide is an important topic because the replacement of the guides is envisaged after a few years use due to radiation damage, mechanical failure or progress in guide technology. The neutron guides are covered by multiple layers (coatings) in order to maximize neutron reflection. In the past mainly glass materials have been manufactured as a substrate of layers, the aluminium substrate is a new and fast developing solution due to its better mechanical properties. In this paper the difference between glass and aluminium guide design will be examined in terms of activation and radiation protection based on Monte Carlo modelling of particle transport and deterministic modelling of the isotopic inventories. The effect of total reflection on the activation is also examined. The results show that the aluminium substrates in terms of activation have better properties than the frequently used Zerodur (lithium aluminosilicate glass-ceramic) that has low thermal expansion.

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