

INVESTIGATION OF HEAVY WATER LOADING IN NEUTRON BEAM CHANNEL OF TEHRAN RESEARCH REACTOR TO DECREASE FAST NEUTRON BACKGROUND AT DIFFRACTION TABLE

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Abstract : To obtain very sharp neutron diffraction pattern using the diffractometer facilities in research reactors, high-efficiency detectors, low fast neutron backgrounds, and high intensity neutron beam in the range of analysis are important factors. To improve the old diffraction system of Tehran Research Reactor, some reformation were investigated to decrease the fast neutron backgrounds at the diffraction table. However, crystalline neutron filters could obtain this aim easily, the homemade high-purity heavy water accessibility in TRR caused the cheap procedure is investigated in the present study. Hence, heavy water usage inside the horizontal channel of TRR was investigated using MCNPX code simulation. The obtained results showed about 10 litres heavy water loading inside the channel would reduce the fast neutrons with $E_n > 1$ MeV about 124 times but the thermal neutron in the range of analysis ($0.02 \text{ eV} < E_n < 0.33 \text{ eV}$) would be reduced about 7.5 times. The calculations showed a donut-shaped heavy water cylinder would allow the thermal neutron reduction is not noticeable (about 21%) while the fast neutron reduction is 1.83 times.

Keywords: *Heavy water, Fast neutron shielding, Neutron diffraction, Tehran Research Reactor*