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Neutron yield measurements for Be, V and Ta targets from 22-42 MeV proton beams

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The High Brilliance neutron Source (HBS) project aims to develop a scalable Compact Accelerator-driven Neutron Source (CANS) enabling neutron fluxes at the corresponding instruments comparable to medium-flux fission-based research reactors. For scalable CANS, the target material providing the largest neutron yield depends on the energy of the sub-100 MeV primary proton beam. Simulations based on the TENDL database suggest that low-Z materials, e.g. Beryllium and Vanadium, generate more neutrons at proton beam energies below 20 MeV while high-Z materials, e.g. Tantalum, generate more neutrons at proton beam energies above 20 MeV. In order to improve the reliability of the underlying databases, the neutron yield of $\mathrm{p}+\mathrm{Be}$, $\mathrm{p}+\mathrm{V}$ and $\mathrm{p}+\mathrm{Ta}$ for 22, 27, 33 and 42 MeV protons is indirectly determined by a novel method through the measurement of the 2.23 MeV gamma ray of hydrogen induced by thermal neutron capture in a polyethylene moderator. The neutron to gamma conversion rate is measured with an AmBe calibration neutron source. Corrections for escaped neutrons are applied via an MCNP simulation of the experiment. This contribution presents the experimental results and a comparison with the neutron yield obtained from simulations.

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