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CALIBRATION OF THE NEUTRON MONITOR and THE ABSOLUTE NEUTRON FLUX MEASURMENT AT THE VAN DE GRAAFF ACCELERATOR

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We have measured the flux of fast neutrons at 4.6 MeV. The twin gridded ionization chamber and two 238U samples in back-to-back geometry have been employed. Experiments were performed at the Van de Graaff accelerator of the Frank Laboratory of Neutron Physics, Joint Institute for Nuclear Research, Dubna, Russia. Fast neutrons were produced through the D(d,n)3He reaction by using a deuterium gas. Cross section at En=4.6 MeV of the 238U(n,f) reaction was used as the standard for the absolute neutron flux determination. The abundance of the 238U isotope in the sample is 99.999%. The working gas of the ionization chamber was Ar+3%CO2. The helium-3 proportional counter employed as a neutron monitor, has components of single helium-3 counter and moderator (polyethylene, paraffin). The helium-3 in this detector is responsible for capturing thermal neutrons that produce tritium and protons in the working gas. Monte Carlo Neutron Particle (MCNP) calculations are necessary to find the detector efficiency due to the helium-3 capture of neutrons, which can then be used for calibration of the detector. In finding the efficiency we used MCNP code to model the detector and find the efficiency as a function of neutron energy. MCNP is a computer code that allows input of the system geometry and materials (moderator and helium3), radiation source and geometry. We had a certain number of neutrons of a given energy aimed at the detector alone and coming from a source. We looked at the number of neutrons that captured in counter out of the total number of neutrons, and plotted the results as a function of energy.

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