DETERMINATION OF THE ENERGY SCALE FOR NEUTRON CROSS SECTION MEASUREMENTS EMPLOYING A MONOENERGETIC ACCELERATOR

by

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ABSTRACT

Persistent disparities between the energy scales used for broad spectrum neutron source studies and monoenergetic neutron source studies has prompted an investigation of various factors which affect the determination of an energy scale for monoenergetic accelerators. Yield curves and neutron energy spectra have been calculated for some (p,n) reactions commonly used as neutron sources or for energy calibration purposes. These calculations take into account the energy spread of the incident proton beam and the statistical nature of the proton energy loss. It is shown that when thresholds are observed by detecting the 0 deg. neutron yield the best results are obtained by plotting the square of the yield against the proton energy and extrapolating to zero yield. A linear plot can be in error by 1-2 keV if the energy spread of the proton beam is large.

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* This work was performed under the auspices of the U.S. Energy Research and Development Administration.

These factors also affect the shape of the neutron energy spectrum although the average energy shows little change. A calibration was established for the Argonne Fast Neutron Generator by locating Li-7(p,n)Be-7 threshold (1880.60 ± 0.07 keV) and the B-11(p,n)C-11 threshold (3016.4 ± 1.6 keV). This calibration was confirmed and extended by measuring the location of a carbon resonance (2077 ± 2 keV neutron energy) and by a time-of-flight measurement at 4.466 MeV neutron energy. The energy scale established by this procedure was consistent within experimental error.