Calibration of Large Volume Neutron Detector

I. 16. Calibration of Large Volume Neutron Detector

Toyofuku A., Kuzumaki T., Maeda K., Yahata H., Yamaya T., Maruyama K.*,
and Ito S.**

Department of Physics, Graduate School of Science, Tohoku University
Institute for Nuclear Study, Tokyo University*
The Institute of Physical and Chemical Research(RIKEN)**

A large volume liquid-scintillator neutron detector has been developed. The scintillator container is made of an aluminum cylinder of 300mm in length and 200mm in diameter, viewed by a photomultiplier through a plastic light guide. The total volume of NE213 is 9.4ℓ It is intended to measure neutrons in an energy range from 1 MeV to several tens of MeV. We designed it to obtain the optimum power of n-γ discrimination by using a computer simulation. The response function was measured at TOF facilities of the Cyclotron and Radioisotope Center, Tohoku University. The neutrons which have continuous energy spectra have been provided by using a ^{9}Be(p, n) reaction at E_p=30 MeV. The neutron detector was placed at 12 meters far from the target. Neutrons were selected by the pulse shape discriminator method (PSD) and their energies were determined by TOF. Measured response functions were compared with calculations by using the computer code CECIL. The comparisons between the data and the simulations are shown in Fig. 1. At each neutron energy, their agreement was good enough to adopt the calculated result as the neutron detection efficiency. We deduced the neutron detection efficiency shown in Fig. 2.
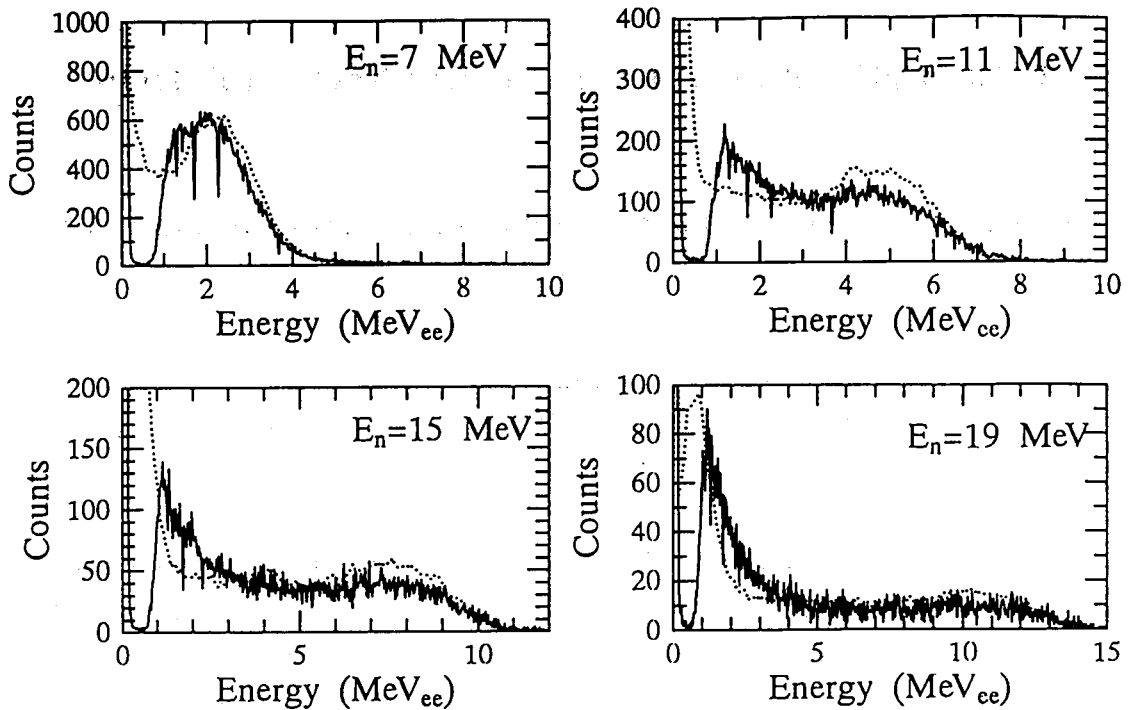
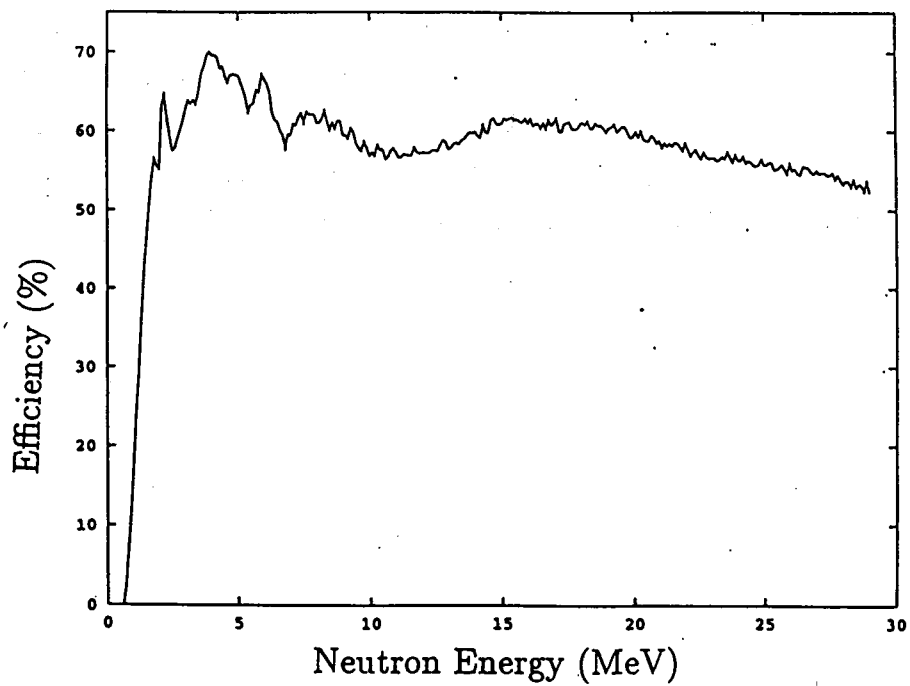Fig. 1. Measured response functions (solid lines) are compared with simulation (dotted lines).

Fig. 2. Neutron detection efficiency. The threshold is 0.5 MeV$_{ee}$