Title: Capture-gated neutron calorimeter using plastic scintillators and 3He drift tubes


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Capture-gated neutron calorimeter using plastic scintillators and 3He drift tubes


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Abstract

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Fast neutron calorimetry is useful in both nuclear fission and fusion environment. We describe a neutron calorimeter with an array of plastic scintillators and low-pressure (200 mbar) He3 drift tubes. Modular design of the detector assembly allows flexibility in setup and operation, so that practical issues, such as energy response, gamma-ray discrimination, and thermal neutron background reduction, can be dealt with effectively. Ideally, fast neutrons deposit their full kinetic energies in the plastic through proton recoil. Thermalized fast neutrons are then detected in the drift tube through the capture reaction 3He(n,p)3H. The drift tubes provide Poisson-distributed neutron-capture gates with a mean about 20 μs for fast neutrons, following their full energy deposition in the scintillators. The detector assembly, including a data acquisition system, is described. Detector characterization and expected performances are also included. (Worked supported by DTRA)