LA-UR- 11-00745

Approved for public release; distribution is unlimited.

Title: HIGH-PRESSURE HE-4 NEUTRON SPECTROMETER

Author(s): ZHEHUI WANG, C. L. MORRIS, E. C. MILNER, JEFFREY BACON, MICHAEL BROCKWELL, KIWHAN CHUNG, F. E. GRAY1, S. J. GREENE, GARY HOGAN, P. L. MCGAUGHEY, MARK MAKELA, FESSEHA MARIAM, MATTHEW MURRAY, J. C. RAMSEY, ALEXANDER SAUNDERS, AND RANDY SPAULDING

Intended for: 52nd INMM Annual Meeting, Palm Desert, CA, July 17-21, 2011

Los Alamos
NATIONAL LABORATORY
EST. 1943

Los Alamos National Laboratory, an affirmative action/equal opportunity employer, is operated by the Los Alamos National Security, LLC for the National Nuclear Security Administration of the U.S. Department of Energy under contract DE-AC52-06NA25396. By acceptance of this article, the publisher recognizes that the U.S. Government retains a nonexclusive, royalty-free license to publish or reproduce the published form of this contribution, or to allow others to do so, for U.S. Government purposes. Los Alamos National Laboratory requests that the publisher identify this article as work performed under the auspices of the U.S. Department of Energy. Los Alamos National Laboratory strongly supports academic freedom and a researcher's right to publish; as an institution, however, the Laboratory does not endorse the viewpoint of a publication or guarantee its technical correctness.

Form 836 (7/06)

HIGH-PRESSURE HE-4 NEUTRON SPECTROMETER

ZHEHUI WANG, C. L. MORRIS, E. C. MILNER, JEFFREY BACON, MICHAEL BROCKWELL, KIWHAN CHUNG, F. E. GRAY[1], S. J. GREENE, GARY HOGAN, P. L. MCGAUGHEY, MARK MAKELA, FESSEHA MARIAM, MATTHEW MURRAY, J. C. RAMSEY, ALEXANDER SAUNDERS, AND RANDY SPAULDING

LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, NM 87544

[1]REGIS UNIVERSITY, DENVER CO 80221

(FOR 52ND INMM Annual Meeting, Palm Desert, CA, July 17-21, 2011)

ABSTRACT:

We describe the use of high-pressure He-4 drift tubes for MeV neutron spectroscopy. He-4 has one of the largest collision cross sections with fast neutrons in the 0.4 to 10 MeV range. Even for mono-energetic neutrons, however, the energy distribution of recoil alpha particles is a continuum with an upper limit corresponding to 64% of the incident neutron energy. The fraction of low-energy recoil alpha is significantly higher than the high-energy recoils near the upper limit. Therefore, discrimination of alpha particle signals from Compton electron signals with comparable amplitudes is essential for good efficiency and energy resolution. Measurements using 10-bar He-4 detectors show that neutron/gamma discrimination using pulse-shape discrimination is feasible. Energy spectrum from beta-delayed neutrons of N-17 is compared with that from an AmBe source. Dependence of efficiency and energy resolution on the He-4 pressure is discussed. The design and expected performance of a spectrometer based on an array of high-pressure He-4 drift tubes are also included.

This work was supported by Defense Threat Reduction Agency (DTRA).