NUCLEAR ENERGY UNIVERSITY PROGRAMS

Improved Fission Neutron Data Base for Active Interrogation of Actinides

PI: Pozzi, Sara – University of Michigan

Project Number: 09-414

Initiative/Campaign: IRR

Collaborators:
Czirr, J. Bart - Photogenics
Haight, Robert - Los Alamos National Laboratory
Kovash, Michael - University of Kentucky
Tsvetkov, Pavel - Texas A&M University

Abstract

This project will develop an innovative neutron detection system for active interrogation measurements. Many active interrogation methods to detect fissionable material are based on the detection of neutrons from fission induced by fast neutrons or high-energy gamma rays. The energy spectrum of the fission neutrons provides data to identify the fissionable isotopes and materials such as shielding between the fissionable material and the detector.

The proposed path for the project is as follows. First, the team will develop new neutron detection systems and algorithms by Monte Carlo simulations and bench-top experiments. Next, They will characterize and calibrate detection systems both with monoenergetic and white neutron sources. Finally, high-fidelity measurements of neutron emission from fissions induced by fast neutrons will be performed. Several existing fission chambers containing U-235, Pu-239, U-238, or Th-232 will be used to measure the neutron-induced fission neutron emission spectra.

The challenge for making confident measurements is the detection of neutrons in the energy ranges of 0.01 – 1 MeV and above 8 MeV, regions where the basic data on the neutron energy spectrum emitted from fission is least well known. In addition, improvements in the specificity of neutron detectors are required throughout the complete energy range: they must be able to clearly distinguish neutrons from other radiations, in particular gamma rays and cosmic rays. The team believes that all of these challenges can be addressed successfully with emerging technologies under development by this collaboration. In particular, the collaboration will address the area of fission neutron emission spectra for isotopes of interest in the advanced fuel cycle initiative (AFCI).