NUCLEAR ENERGY RESEARCH INITIATIVE

An Innovative Approach to Precision Fission Measurements Using a Time Projection Chamber

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Program Area: Advanced Fuel Cycle R&D

Collaborators:
Abilene Christian University
California Polytechnic State University
Colorado School of Mines
Los Alamos National Laboratory
Lawrence Livermore National Laboratory
Idaho National Laboratory
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Project Description

The principal objective of this project is to initiate a fission cross section measurement program to provide fission data with unprecedented precision needed for the Global Nuclear Energy Partnership (GNEP) initiative and Generation IV reactor designs. The research consortium will construct, install, and test a prototype of a three-dimensional time projection chamber (TPC) that will carry out fission physics measurements. This will establish the necessary infrastructure for a world-class fission measurement campaign that meets the nuclear data needs required for planning, modeling, designing, and executing the GNEP program.

In addition to providing high-quality fission cross section data, the TPC will generate a rich basic physics dataset of various parameters as a function of neutron energy, including the kinematics and angular distribution of fission products, ternary fission cross sections for light isotopes, and fission product identification. A well-calibrated and tested TPC would reduce fission cross section uncertainty measurements below one percent.

The experimental apparatus will provide precise data on the fission cross sections of key actinides. This will impact the design of actinide-burning targets and reactor designs for GNEP activities as well as the proliferation resistance of potential new fuel cycles. These new data will reduce margins, thus reducing construction and operating costs, and provide the required precision data during the current engineering/selection phase. In addition, the project will train graduate students and post-doctoral students in experimental nuclear physics and radiation physics, thereby assisting in restoring a much-needed human resource for the anticipated renaissance of nuclear power.