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Critical and Subcritical Measurements
Team Advanced Nuclear Technology
(NEN-2) Group
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Project Title

Advanced Subcritical Measurements for Computational Methods and Nuclear Data Validation

Project Objective

Perform advanced subcritical measurements, compare measured and simulated results, and influence future nuclear data evaluations.

Project Description

LANL has performed many subcritical measurements with bare and reflected BeRP ball configurations. Measurements on more complex systems, such as research reactors, are the next step in advanced subcritical experiments. Correlated neutron data from the measurements are used to validate Monte Carlo (MC) predictive simulation capabilities. This comparison between simulated and measured data is used to develop a toolkit for influencing future nuclear data evaluations. The Critical and Subcritical 0-Power Experiment at Rensselaer (CaSPER) and the Subcritical Copper-Reflected - Phase Plutonium (SCR - P) measurement were completed in July and December of 2016, respectively.

Project Relevance to Nuclear Nonproliferation

MC simulations of special nuclear material (SNM) are extensively used in the field of nuclear nonproliferation for applications such as SNM identification and characterization, experiment planning, and detection system development. Both reliable MC simulation codes and accurate nuclear data knowledge are necessary in order to precisely predict the results of SNM measurements.

Products and Outcomes of Project

The short-term outcome of this project will be a journal paper describing the simulated and measured results of the CaSPER measurement. A detailed benchmark model of the SCR P measurement will also be produced. Progress will be made towards a journal paper comparing the performance of various MC codes that take into account the correlated physics of fission, as applied to previous LANL BeRP benchmarks.



Publications and Reports

R. BAHRAN, J. HUTCHINSON, J. ARTHUR, et al., "Development of a Research Reactor Protocol for Neutron Multiplication Measurements," *ANS Winter Meeting and Nuclear Technology Expo*, Las Vegas, NV, Nov. 6-10, 2016, LA-UR-16-24665.

J. ARTHUR, R. BAHRAN, J. HUTCHINSON, et al., "Comparison of the Performance of Various Correlated Fission Multiplicity Monte Carlo Codes," *ANS Winter Meeting and Nuclear Technology Expo*, Las Vegas, NV, Nov. 6-10, 2016, LA-UR-16-24512.

J. ARTHUR, R. BAHRAN, J. HUTCHINSON, "Analysis of the July 2016 Critical and Sub-critical 0-Power Experiment at Rensselaer (CaSPER) Measurement Campaign," Memo NEN-2: 17-001, LA-UR-17-20881 (Jan. 20, 2017).

J. HUTCHINSON, R. BAHRAN, T. CUTLER, et al., "Subcritical Copper-Reflected \square phase Plutonium (SCR \square) Measurements and Simulations," *International Conference on Mathematics and Computational Methods Applied to Nuclear Science and Engineering*, Jeju, South Korea, April 16-20, 2017, LA-UR-17-20621.