

Recent Advances in Resonance Region Analyses to Benefit Nuclear Science and Technology: An ORNL Perspective

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For more than 30 years, the Oak Ridge National Laboratory (ORNL) has performed research and development to provide more accurate nuclear cross-section data in the resonance region. The ORNL Nuclear Data (ND) Program consists of four complementary areas of research: (1) cross-section measurements at the Oak Ridge Electron Linear Accelerator (ORELA); (2) resonance analysis methods development with the SAMMY R-matrix analysis software; (3) cross-section evaluation development; and (4) cross-section processing methods development with the AMPX software system. Overall, the ND Program is tightly coupled with nuclear-fuel-cycle analyses and radiation-transport-methods development efforts at ORNL. As a result, resonance region measurements and evaluations are performed in concert with nuclear science and technology needs and requirements. Since the mid-1990s, many of the resonance region advances have been driven by needs within the Nuclear Criticality Safety Program of the U.S. National Nuclear Security Administration. For example, assessments of previous nuclear data measurements and evaluations have revealed deficiencies in nuclear data (e.g., missing resonances and artificially high neutron sensitivity in older capture experiments) that are important for criticality safety applications. As a result, new measurements and evaluations have been performed to address the nuclear data deficiencies. Recent advances in each component of the ORNL ND Program have led to improvements in resonance region measurements, R-matrix analyses, cross-section evaluations, and processing capabilities that directly support radiation transport research and development. Of particular importance are the improvements in cross-section covariance data analysis and evaluation capabilities coupled with covariance processing improvements. The full paper will highlight the resonance region advances with particular emphasis on the nuclear modeling and evaluation capabilities. Specific isotopic examples of resonance region improvements will be given, and the benefit of these advances to nuclear science and technology research and development will be discussed.