An Overview of Nuclear Data Needs for Nuclear Energy Applications

Nuclear Energy University Programs (NEUP)
Consolidated Innovative Nuclear Research (CINR)
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NUCLEAR DATA NEEDS
FOR NUCLEAR ENERGY APPLICATIONS

- Many nuclear data measurements and evaluations are decades old and updates are needed, especially for new high-fidelity analysis approaches and emerging nuclear energy systems

- Nuclear data measurements are very complex, yet only a few neutron scattering facilities remain, and new capabilities are needed

- Changes in cross section data from one ENDF evaluation to the next can have a significant impact on design, licensing, and operational decisions including:

  - ENDF/B-VII.1 updates to uncertainties in ^{235}U and ^{239}Pu ν change the uncertainty in used fuel systems and affect applicability of benchmark experiments for validation

  - ENDF/B-VII.1 update to ^{35}Cl(n,p) reaction leads to 1000s of pcm reactivity change for fast-spectrum molten chloride salt reactors

  - Missing nuclear data or older evaluations with large uncertainties for materials of interest can be a limiting factor in the design of advanced reactors

  - Pending thermal scattering data for graphite leads to a 900 pcm improvement in reactivity of TREAT with similar effects for HTGR and FHR systems

  - Many other nuclear data needs can be demonstrated through the use of sensitivity/uncertainty methods for relevant applications
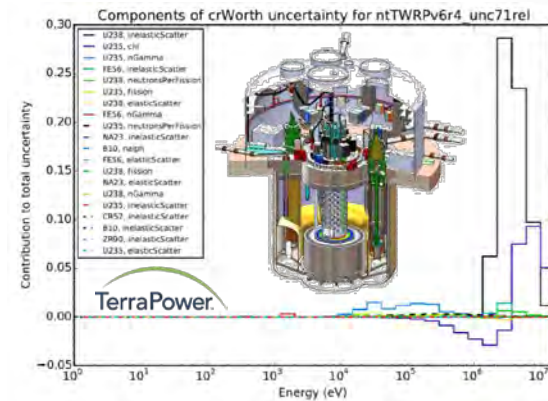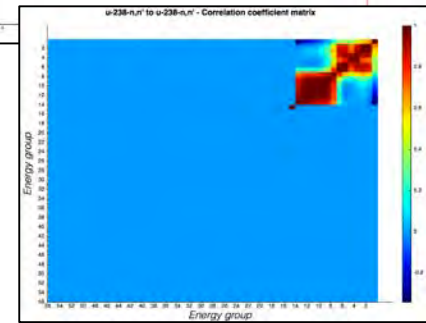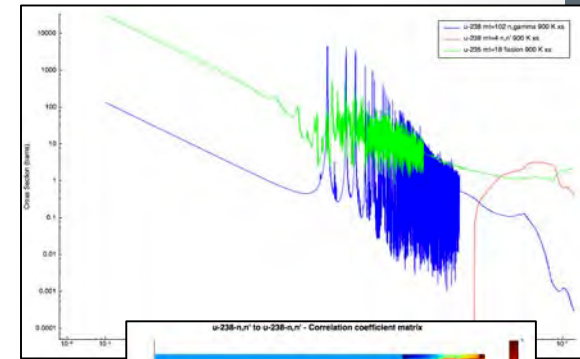
From: N. Touran, "Sensitivities and Uncertainties due to Nuclear Data in a Traveling Wave Reactor", NEA/OECD SG 39 Meeting 2016-05-10

MS-NE-2 – NEUP/CINR
Work-scope Description

- MS-NE-2: Improvements to address nuclear data needs that are clearly demonstrated to be a limiting factor in nuclear fuel and reactor design, analysis, safety, and licensing calculations in NE missions areas. (TPOC – Brad Rearden, reardenb@ornl.gov)

  - Proposals are sought for achieving relevant nuclear data improvements that address one or more stated needs by developing and demonstrating the enhancements through the entire nuclear data pipeline, from:
    - *1) new nuclear data measurements*
    - *2) evaluation in the appropriate format (e.g. ENDF)*
    - *3) inclusion of nuclear data covariances*
    - *4) processing into usable forms for application codes*
    - *5) confirmation of improved predictions and uncertainties through application studies and validation; and*
    - *6) deployment through the National Nuclear Data Center at BNL for inclusion by external users in quality-assured design, analysis, safety, and licensing calculations*

  - Use of sensitivity and uncertainty analysis methods in proposed efforts is encouraged to demonstrate these needs and how they are being met

  - Many nuclear data needs for NE may be found in the NEA Nuclear Data High Priority Request List (HPRL) ([http://www.oecd-nea.org/dbdata/hprl/)](http://www.oecd-nea.org/dbdata/hprl/); also of interest:
    - *continued investigations of thermal scattering data in high-temperature graphite, thermal scattering data for fluorine-based molten salt reactors, and chlorine reactions for fast spectrum molten salt reactors*
    - *documented needs for industry and DOE-NE missions especially as aligned with GAIN (e.g., NEAMS, CASL, ART, TREAT, FCR&D, LWRS)*

  - Partnerships with national laboratories and especially industry are strongly encouraged