Nuclear Data Developments and Needs
Countering Weapons of Mass Destruction

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CWMD Mission

Enable operational partners to prevent WMD use against the Homeland and promote readiness for chemical, biological, radiological, nuclear, and other health security threats.

CWMD Goals

- **Goal 1: Anticipate, Identify, and Assess Current and Emerging WMD Threats**
- **Goal 2: Strengthen Detection and Disruption of CBRN Threats to the Homeland**
- **Goal 3: Synchronize Homeland Counter-WMD and Health-Security Planning and Execution**

Non-Intrusive Inspection

Background

- Non-Intrusive inspection (NII) systems are deployed to generate images of conveyances and help customs operations officers search for threats without opening containers.
- NII systems need to detect and identify special nuclear material (SNM) in conveyances.

https://www.cbp.gov/sites/default/files/documents/nii_factsheet_2.pdf

Ongoing Development

- Employ active interrogation systems to detect materials using products resulting from x-ray or other interrogating particle reactions.
- Fission and photofission products are of particular interest for uniquely identifying SNM.
- Modelling and simulation is vital for system development. Tools have been developed, but further improvements are required.

Photonuclear Data

Current Research

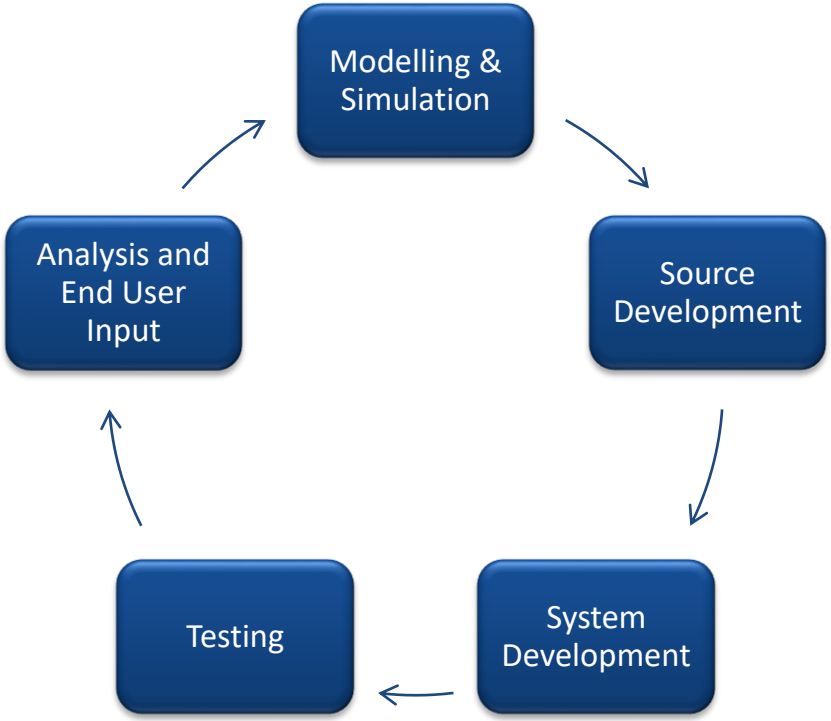
- Improved photonuclear data is required to support more accurate simulations in designing advanced cargo inspection systems.
- Duke University, North Carolina Central University, and Lawrence Livermore National Laboratory are collaborating on a project to produce high precision data in the following areas:

Isotopes	Measured Values	Beam Energy
U^{235}, U^{238}, Pu^{239}	Angle and energy differential yields for prompt neutron emission	$(\gamma, xn)+(\gamma, fn)$: 5.3, 5.5, 6, 7, 8, 10 MeV
		(γ, fn): 11.2 MeV
	Energy spectrum for delayed neutrons and gamma rays from photofission	One energy 8-10 MeV

Photonuclear Data

Future Interests

- Analysis of simulated results using improved photonuclear data, demonstrated in a real-world security-relevant environment.
- Continued testing as systems are developed may unearth discrepancies in photonuclear data, particularly cargo materials.
- Methods are sought for more accurate, more efficient simulations of cargo inspection systems.



Neutron Interaction Data

- Currently investigating neutron interrogation methods for multi-threat detection in cargo.
  - Knowledge of average behavior is sufficient for current development.
- Simulations have been performed of threats in a cargo environment.
  - Measured test results will be compared to look for discrepancies.
- Discrepancies are most expected in materials making up the surroundings and system components:
  - Structural: steel, stainless steel, aluminum
  - Surroundings/Shielding: concrete, boron, polyethylene
  - Detectors
  - High cross-section elements (Gd, Ni)

CWMD Outlook

- Focused firmly on applications, primarily detecting threats in the commercial environment.

- If data deficiencies are identified in relevant areas, improvements to data would benefit modelling and simulation studies.
  - Collaborations often the best avenue for data improvement studies.

Homeland Security