Nuclear Data for Homeland Security

Monte Carlo Simulations

Simulation code. A typical use of nuclear data for Homeland Security involves Monte Carlo simulation calculations needed to develop and/or assess variety of devices and tools to detect and identify nuclear materials and radioactive materials. For this purpose one usually employs LANL nuclear transport code MCNP (Monte Carlo N-Particle), *www-xdiv.lanl.gov/x5/MCNP/*. This code is the U.S. workhorse for neutronics calculations, developed for a broad range of nuclear technology applications, including national security, energy, homeland security, criticality safety and many others (medical, dosimetry, shielding, accelerator target design, nuclear waste, …).

Nuclear data. MCNP code is supplied with processed cross sections from the ENDF library maintained by the U.S. Nuclear Data Program. Use of nuclear data can be thus estimated from MCNP licenses by the Radiation Safety Information Computational Center, *www-rsicc.ornl.gov,* giving:

- ❑ 2,469 site licenses of MCNP4, with ~7,500 individual users (~3 per license)
- ❑ ~1,300 site licenses of MCNP5 (latest version released in April 2003), with:
    - ❑ Estimated 10 % licenses (~400 users) for DHS applications, and with
    - ❑ 175 pages of links from *Google* search for *MCNP Homeland Security*

Examples. Specific nuclear data needs of MCNP users addresses the Task Force for Homeland Security of the U.S. Nuclear Data Program. Examples are shown on next page (active interrogation – LANL, attribution – LLNL, detection of explosives – BNL).

Properties of Radioactive Nuclei

Decay information for nuclides with half-life longer than 1 hour. 5000 copies printed, distributed to 100+ organizations, including the 50 states' Emergency Preparedness departments as well as many Police and Fire departments. Available in PDA format.

"*Might I add that I have used the Wallet cards now for 7 years. Both as a Health Physics Tech in the US Air Force and as a Radiological Coordinator for the State of California. In many emergency applications (transportation, facility, and terrorism planning) we have found the Cards to be essential in our response and in planning for the response.*"

Bill Potter, Coordinator (Radiological), Governor's Office of Emergency Services, Radiological Preparedness Unit.

"*Thank you for your prompt response to my query about the Wallet Cards and DOE. As a part of DOE, the Naval Reactors Program has an obvious interest in this subject.*"

Albert (Skip) Kahler, Bechtel Bettis.

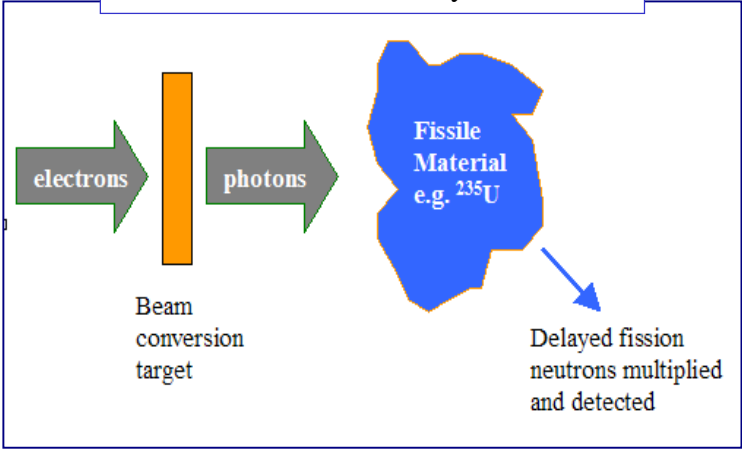Testimonials

Nuclear Wallet Cards for Radioactive Nuclei

March 2004

Jagdish K. Tuli
National Nuclear Data Center

(*www.nndc.bnl.gov*)

Brookhaven National Laboratory
P.O.Box 5000
Upton, NY 11973-5000
USA

Examples of Monte Carlo Simulations for Homeland Security

MCNP simulation of delayed neutrons

Active Interrogation - LANL

❑ Fissile material, such as ^{235}U and ^{239}Pu, can be hidden in containers with a shielding thick enough to remain undetected.

❑ Active interrogation based on photo-fission and delayed neutrons reveals the presence of these materials.

❑ Simulation used to optimize experimental detection technology development.
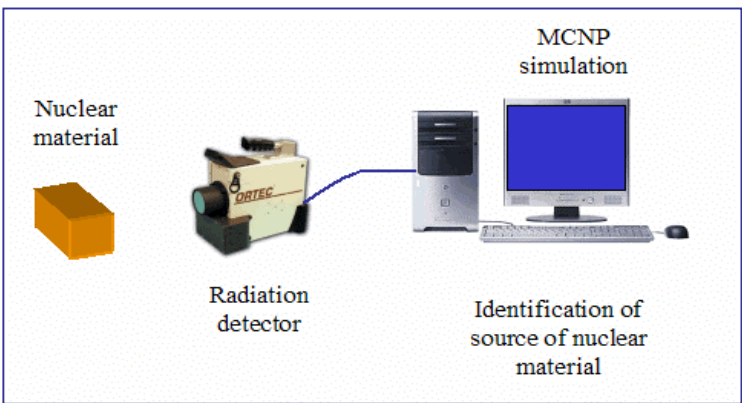

Attribution - LLNL

❑ Use of radiation signatures to detect nuclear material (weapon-usable or radiological) and identify its source.

❑ Allows forensic capability for post-nuclear-event attribution.

❑ Simulation used to determine source of nuclear material.
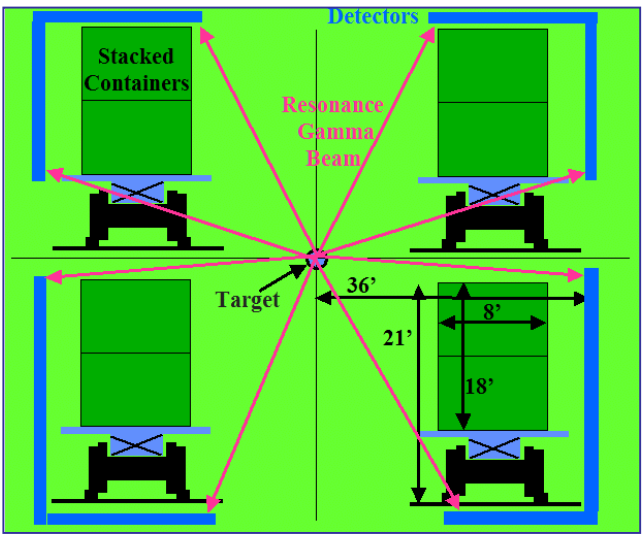
Detection of Explosives - BNL

❑ Detection of Nitrogen in explosives using Gamma Resonance Technique.

❑ Absorption of 9.17 MeV photons by ^{14}N.

MCNP simulation of detected gamma rays
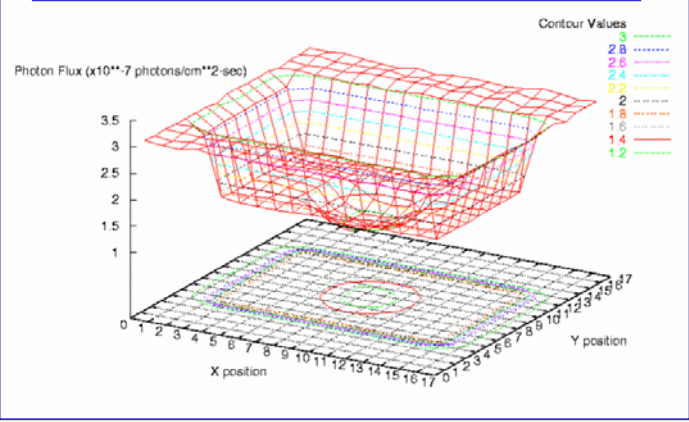
❑ Proposal to use Gamma Resonance Technique for detection of improvised explosive devices in Iraq is currently being assessed by Naval Surface Warfare Center (Dahlgren, VA).