Homeland Security Taskforce Report

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Homeland Security Taskforce Mandate

- "Task Force on Nuclear Data for Homeland Security provides a mechanism for regular interaction between the U.S. nuclear data and homeland security communities."

- "The Task Force will focus on understanding the current nuclear data needs of homeland security programs and anticipating long-term nuclear data needs as these programs mature. Its most important function will be to help coordinate activities to meet those needs, including redirection of USNDP efforts as appropriate."

- "It is anticipated that the need for improved nuclear data will be driven by Monte Carlo simulation, materials detection, nonproliferation, nuclear interrogation and attribution technologies."

The funders of Homeland Security projects recognize the importance of nuclear data

- "The Task Force uses well-established US nuclear data efforts that integrate resources from various funding agencies, such as DOE Office of Science, NA-22, Nuclear Energy and others. It communicates the value of these efforts to DHS and NNSA, including the production of nuclear data, peer review processes, data testing and quality assurance, along with storage and archival of data for nuclear technology applications."

- It can be difficult to get funders to pay to take the extra step of getting measured/modeled data into data tables
  - energy-time correlations for β-delayed γ's from fission partially paid for with LLNL LDRD funding
  - Evaluated Gamma Activation File (EGAF) data merged with ENDF/B-VII.0 using USNDP funds

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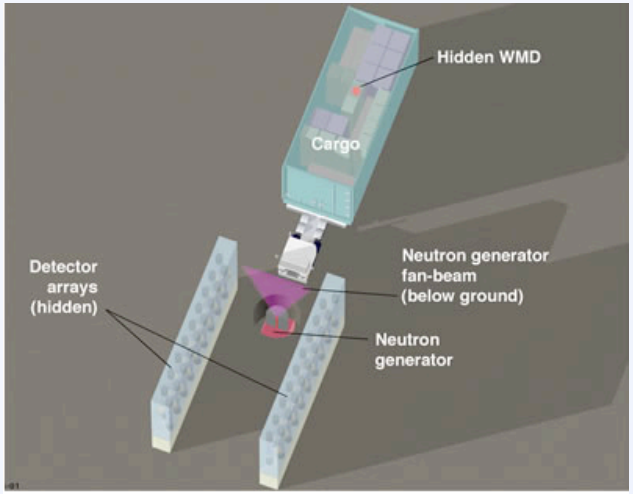
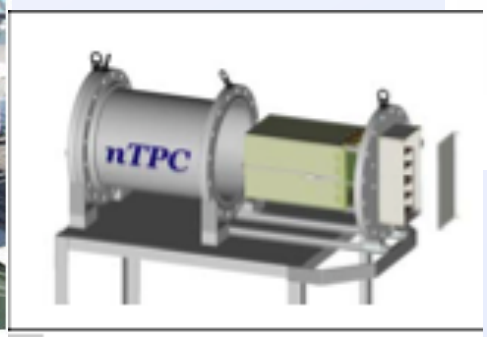
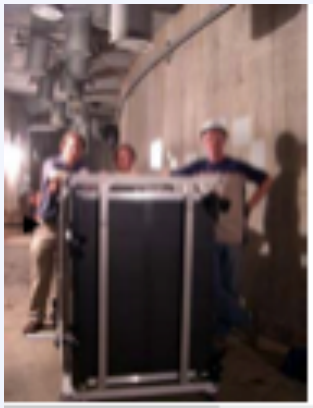
To really help homeland security we have to change our thinking

The Nuclear Carwash

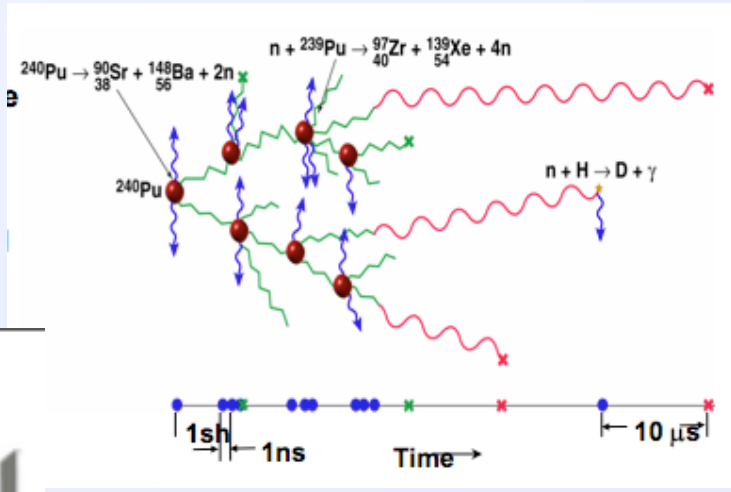






LLNL 0.25 ton *antineutrino* water detector deployed at San Onofre plant August 2007

Fission chains



Data needs for Homeland Security applications do not always neatly fit into ENDF/ENSDF/EXFOR boxes

- Homeland Security applications usually require *correlations* between various particles
  - (γ,γ') data for Nuclear Resonance Fluorescence
  - (n,f) outgoing neutron number-energy correlations for fission chains
  - (n,f) neutron-γ correlations
  - γ's from thermal neutron capture
  - (n,f) β-delayed γ's outgoing time-energy correlations
- But may also require data we consider *exotic*
  - (anti-)neutrino reaction and elastic cross-sections
  - precision anti-neutrino emission spectra from reactors derived from theory and/or beta spectrometer measurements
  - muon reaction and elastic cross-sections for cosmic rays

Correlation data often times is too big for ENDF/ENSDF, publishing models is more appropriate

- (n,f) β-delayed γ's outgoing time-energy correlations were added to ^{235}U and ^{239}Pu in ENDF/B-VII.0
  - 3262 lines in ^{235}U
  - 3129 lines in ^{239}Pu
  - ENDF/B-VII.0 file size of each jumped from 1.35 Mb to 21.5 Mb
- Instead, LLNL publishing codes at http://nuclear.llnl.gov/simulation
  - Fission: discrete neutron and γ-ray emission from the fission
  - RadSrc: intrinsic γ-ray spectrum from nuclear decay of mixture of radioisotopes
  - CRY: correlated cosmic-ray particle showers
- More important to save the data for benchmarking simulation tools

Exotic schemes present new data challenges

- Both ENDF and EXFOR/CSISRS only allow the standard list of incident particles: n, p, d, t, ^{3}He, α, γ
  - need low energy (anti-)neutrino data (< 20 MeV)
  - need intermediate and high energy muon data (>20 MeV)
- ENDF and EXFOR/CSISRS only have limited support for high-energy reaction data
- Low energy transport codes (MCNP, Mercury, AMTRAN, COG) cannot handle these particles, need different tools
  - MCNPX: LANL code
  - GEANT: GPL'd code project led by CERN
  - FLUKA: INFN (Italy) and CERN

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Action items

- Go that extra mile: get funders to pay to get your data into data tables
- Which is more useful: the data you generate or the tools you use to generate it?
- How do we support exotics?
  - New (to us) simulation tools
  - Storing exotic data may require new database effort
- Most importantly: educate funding agencies of need to fund data program