



U.S. DEPARTMENT OF
ENERGY

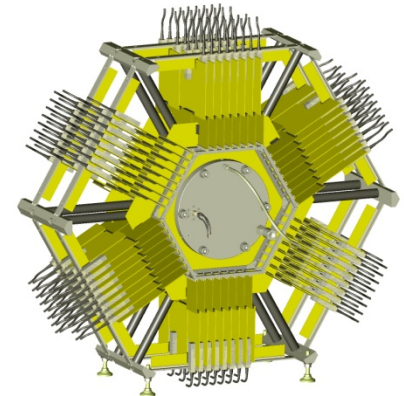
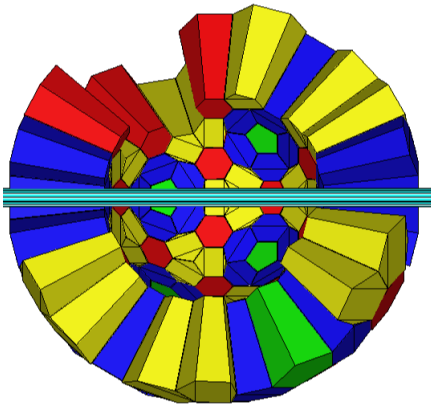
Nuclear Energy

Nuclear Energy University Programs (NEUP) Fiscal Year (FY) 2013 Annual Planning Webinar

Nuclear Data and Measurement Techniques

Daniel A Vega
Federal Program Manager

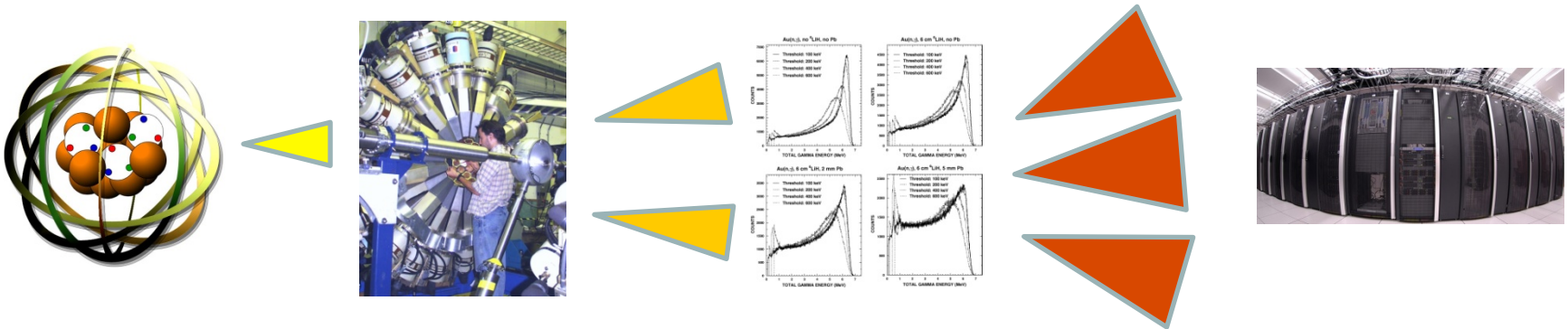
August 2012





Nuclear Data Mission

- Provide high fidelity and reliable nuclear data for Particle Transport and Nuclear Physics Calculations



- DOE-NE's Nuclear Data Program investigates advanced methods to produce high fidelity nuclear physics data – spanning all phases of the nuclear fuel cycle
 - Power and waste production source terms
 - Neutron Scattering, absorption, fission and multiplicity data
 - Advanced Covariance, Uncertainty, and sensitivity analysis

Nuclear Data Goals and Objectives

- ***Near-term goals* are to support near term specific data needs for high priority isotopes and energy regions**
 - Sensitivity analyses to prioritize high-reward experiments
 - Nuclear parameters and cross-section evaluations for current transport models in FCRD and ARC

- ***Long term goal* is to develop a consistent and predictive model of fission data that includes all physically meaningful correlations**
 - cross sections, fission fragment yields, prompt fission neutrons and gamma rays, beta-delayed neutrons and gamma rays, etc.
 - “Nuclear Modeling” and Reliable Predictive capability for assessing nuclear interactions amongst entire actinide series

Research Needs: Advanced Detector Development for High-precision Nuclear Data

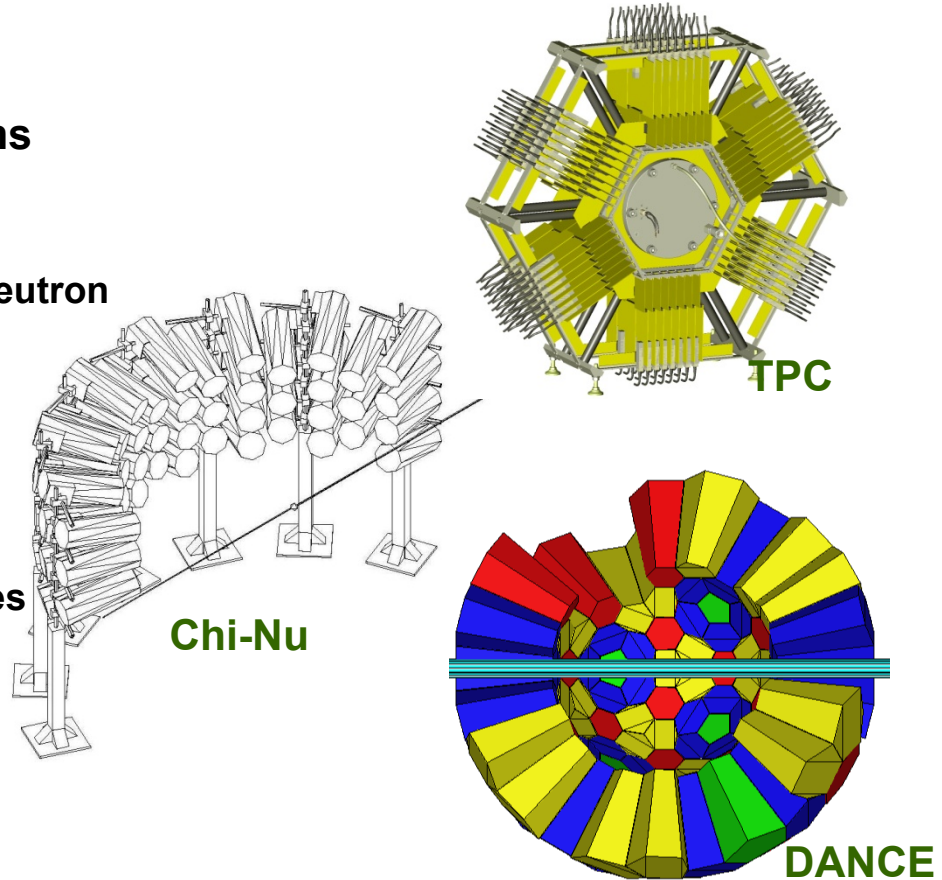
Many of the nuclear data needs identified in sensitivity calculations require data far beyond current capabilities

■ Power and Waste production source terms

- Sub-percentage fission measurements
 - Time Projection Chamber
- Fission fragment production vs incident neutron energy
 - SPYDER (Los Alamos LDRD)

■ Neutron spectra and economy

- Elastic scattering
 - Structural materials and actinides (NEUP)
- Capture data on highly-radioactive isotopes
 - DANCE development (Los Alamos + NEUP)
- Prompt Fission Neutron Spectra
 - Chi-Nu (Los Alamos + NEUP)





Nucleus modeling tools provide low-cost, timely estimates for nuclear codes

- **There are a large number of cross sections and production cross sections that cannot be measured – some impossible, some too hard (expensive)**
- **Fission neutron spectrum calculations developed for broad range of actinides and fission fragments, as a function of incident neutron energy**
 - Hard to measure the full spectrum, time-consuming measurements, some impossible
 - World's first calculations for PFNS for a entire isotopic suite, including all correlations developed
- **Nucleus modeling providing estimates for fission product yields**
 - Large phase space, most are hard to measure, many impossible

Nuclear Data Program Structure

- **DOE Headquarters Oversight – \$4.5 Million effort**
 - ~60% Fuel Cycle Technologies(FCT)
 - ~40% Advanced Reactor Concepts (ARC)
- **INL/ISU Technical Director (Tony Hill)**
- **Working group structure is embedded in broader nuclear physics community (DOE-SC)**
- **Highly comingled University and Laboratory researchers**
- **~ \$4.5 Million effort, co-funded by Fuel Cycle Technologies (FCT) and Advanced Reactor Concepts (ARC)**

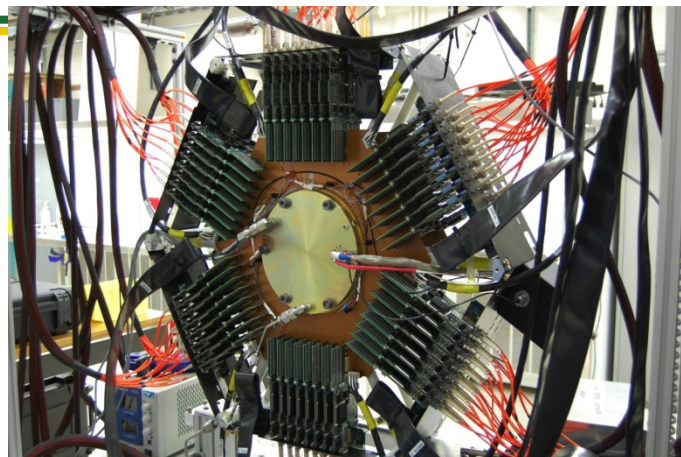
Nuclear Data and Measurement Techniques (MS-FC2)

“ advanced measurement techniques that could complement the ongoing measurement program. Such a topic includes Innovative ideas for detector development and testing to collect high fidelity data for improvements in cross section evaluations, covariance data, multiplicity, and spectrum information for candidate fuel and structural materials. In addition, robust sensitivity analyses are required to prioritize high value data ”*

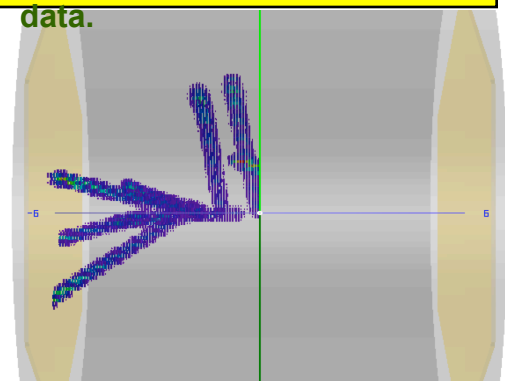
*NEUP Draft R&D Workslope Descriptions

Current Activities - The Fission Time Projection Chamber

- 10 papers and contributions, over 20 presentations (domestic and international), 14 student presentations, 18 posters (all in the last two years)
- Students have received 10 awards for talks and posters at several national meetings
- Summer ANS 2011 (Hollywood, FL) included special session for TPC
 - Students, PIs presented



Half instrumented TPC on the LLNL test stand before being shipped to Los Alamos to collect beam induced data.



High-rate alpha source used to demonstrate the reconstruction capabilities of the TPC.