Lawrence Livermore National Laboratory

LLNL Report

Neil Summers

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344

LLNL-PRES-461523

Workforce

- USNDP funding for FY10 = $145k
- USNDP funded 0.3 FTE Scientific Permanent staff
  - Majority of funding spent on attending USNDP/CSEWG / mini-CSEWG / budget briefing
  - Remaining funding used for coordinating LLNL evaluation work with CSEWG for ENDF releases

- ARRA funded ~0.2 FTE in FY10
  - Project to develop new modern data format
  - project highly leverages ASC/IC funding (~1.25 FTE)

- Funding from other sources
  - ~4 FTE from ASC/PEM, C-4
  - ~1 FTE from NA-22

- New hires:
  - Caleb Mattoon, Sept ‘10, 0.5 FTE (FY11) ARRA funding
  - Nidhi Patel, Oct ‘10, ~0.25 PD (FY11) ARRA funding

LLNL Evaluation work for ENDF/B-VII.1

- 6 LLNL evaluations in ENDF/B-VII.1beta0
  - Kr-78, U-239, Xe-123,4, Re-185,7
- LLNL evaluations for next beta release
  - As-73-5, Ta-180,1

- LLNL recommendations for ENDF/B-VII.1beta0
  - 58 minor actinides from JENDL Actinoid (JENDL-4)
  - Zn elemental evaluations from JENDL-4
  - Am-240 from JENDL-4

- LLNL working on evaluations for ENDF/B-VII.2
  - Proposed new Pu-239 fission neutron spectrum and nubar evaluation

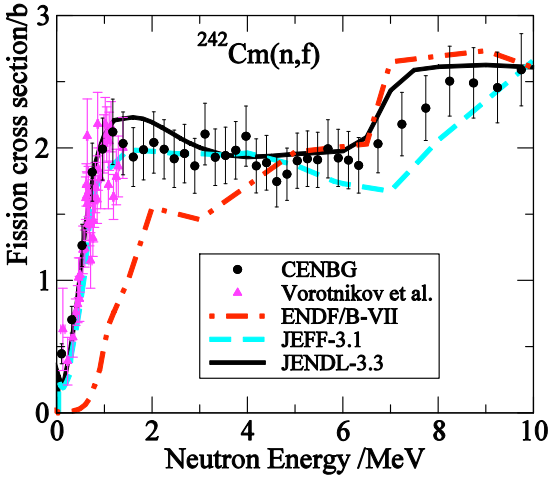
ARRA funded project for new data format

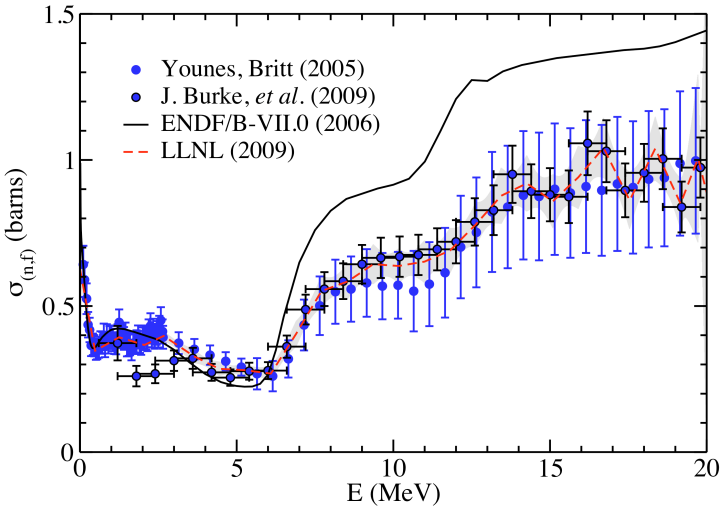
- GND format for nuclear data features an extensible, hierarchic structure
- This defines the **structure** of the new format, which is intended to be portable across file formats and programming languages.

```
<heatedTarget>                          // one target per file
    <styles>…</styles>     // for now, style="evaluated"
    <documentation>…</documentation>
    <particles>…</particles>  // list all particles produced in all channels
    <channel>                           // one 'channel' per reaction
           <crossSection>…</crossSection>
           <product label="n1">
                  <distribution>…</distribution></product></channel>
    <channel>…</channel>
</heatedTarget>
```

- Beta version released soon (available at http://nuclear.llnl.gov)
  - Converting ENDF-6 to python classes
    - Supports writing out to xml or ENDF-6 format
  - XML 'schema' (i.e., xml rules) defining the format
  - Conversion from XML to HDF5
  - Currently supported: cross sections, energy and angular distributions, multiplicities (corresponding to MF 1,3,4-6,8-10).

LLNL leading effort in surrogate reactions providing cross sections on minor actinides

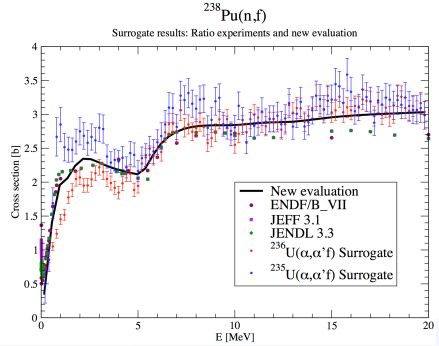




New evaluation of ^{239}U in ENDF/B-VII.1b0 based on LLNL surrogate measurements

For the first time, the 242Cm fission XS has been determined up to the onset of second-chance fission

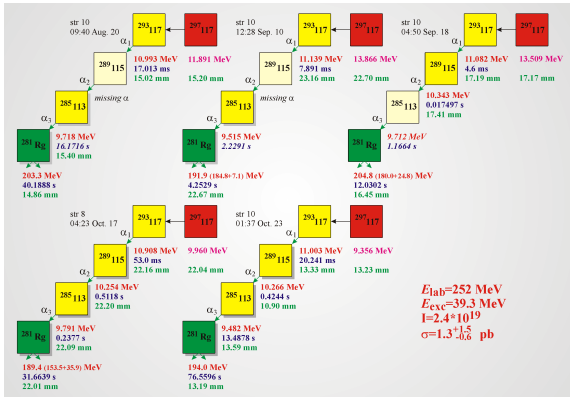
Phys. Lett. B 692, 297 (2010)



New measurements of 238Pu(n,f)
^{238}Pu(n,2n) to follow

LLNL involved in collaboration discovering new element 117.
6 decay chains observed at Dubna from ^{48}Ca + ^{249}Bk reaction.

Phys. Rev. Lett. 104,142502(2010)



LLNL evaluation efforts in FY11 and beyond

- Future efforts in nuclear data evaluation work will focus on covariances
  - Total Monte Carlo – collaboration with TALYS team
    - Inclusion of data and model uncertainties consistently
- Hybrid R-Matrix approach to light ion reaction
  - Using realistic ab-initio reaction (NCSM-RGM) theory as input for R-matrix calculations
- Nuclear theory for surrogate reactions
  - New theory of (d,p) reactions used for surrogates - going beyond Weisskopf-Ewing approximation. Realistic description of spin/parity distribution from direct reaction theory.
- NA-22 funding 2 nuclear data projects in FY11-13
  - New 3 year funding for EGAF (Sleaford - $500k/yr)
  - Modify FREYA for event-by-event modeling in Monte-Carlo codes (Vogt - $420k/yr)