U.S. Experimental Activities Report

WPEC Meeting, 13-15 May 2002

by

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on behalf of the

CSEWG
Measurements and Basic Physics Committee

Introduction

- This presentation summarizes the CSEWG Measurement & Basic Physics Committee meeting that took place at BNL on 5 November 2002.

- Detailed texts, plots, and tables are available in the CSEWG 2002 Annual Report.

- Be aware that the U.S. effort in low-energy nuclear physics is large, broad in scope, and quite de-centralized, both in location and sponsorship. Much of the current work in this country is carried out at universities, and it tends to focus on non-applied areas such as astrophysics and fundamental nuclear structure issues of rather limited relevance to the interest of both CSEWG and WPEC. These topics will not be addressed here.

CSEWG Measurements and Basic Physics Committee Meeting Agenda

- Laboratory experimental reports
  - RPI (Danon)
  - ANL (Kondev)
  - LANL (Haight)
  - NIST (Carlson)
  - Ohio University (Smith, for OU staff)

- Reports on special topics
  - Dresden fast-neutron workshop (Cheng)
  - Standards measurements worldwide (Carlson)
  - Large errors and confidence intervals (Smith)
  - Experimental resources website (Smith)
  - Evaluator requests for nuclear data website (Smith)
  - WPEC 2003 Meeting (Smith/Cheng)
  - IRMM activation workshop (Smith)
  - ND-2004 Conference, Santa Fe (Haight)

Laboratory Experimental Reports

- Contributions are voluntary and the report format is at discretion of contributors. They are collected into a single PDF document.

- Difficult to solicit reports for CSEWG:
  - Not a requirement of the sponsors.
  - Researchers are busy and over-burdened with a plethora of mandated progress reports, budget issues, and many other required administrative responsibilities.
  - Limited travel budgets often discourages attendance at CSEWG meetings.
  - Jurisdictional boundaries between CSEWG and the USNDP (DoE/DNP sponsored work) are sometimes fuzzy.

- The contributions submitted to the CSEWG Measurement and Basic Physics Committee serve to give a flavor of recent experimental activity in the applied nuclear data area.

Rensselaer Polytechnic Institute
(Gaerttner Laboratory, Linac facility)

- Presented by Y. Danon.
- Neutron transmission and capture experiments on Cd, Rh, ^{236}U, and ^{238}U were mentioned.
- Progress on data analysis for measurements on Gd, Hf, Nd, Nb, Mo, Cs, Cd, and ^{236}U was discussed.
- Development of an experimental capability to simultaneously measure fission cross-sections and fragment energy, angle, and charge distributions using a double-gridded chamber was described.
- Work is in progress on the determination of experimental resolution functions and the development of an approach for using the RPI multiplicity detector to measure alpha.
- There is an ongoing effort to upgrade the RPI Linac facility. Improvements were made on the injector during 2002.

Argonne National Laboratory

- Presented by F. Kondev.
- D. Smith continued collaboration with IRMM on the WPEC Subgroup 19 neutron activation project. ANL contributions: i) prepared EXFOR data files; ii) joined in an experiment to characterize neutron sources (along with Ohio University).
- F. Kondev collaborated with the ANL Physics division on several nuclear structure measurements at ATLAS and on the development of methods for applying AMS techniques to studies of heavy nuclei. This work included measurements on ^{244}Pu using the AMS technique.
- D. Smith continued a study of methods for dealing with large errors in measured and evaluated physical quantities in collaboration with ORNL. Emphasis this year was on the role played by statistical confidence intervals (to be mentioned later).

Los Alamos National Laboratory

- Presented by R. Haight.
- Reviewed the extensive experimental nuclear data studies carried out during the past year at Los Alamos.
- Most experiments were performed at the FIGARO, GEANIE, and DANCE facilities.
- Spallation-target neutron yields were measured in support of the ATW project.
- FIGARO is a combined γ-ray and neutron detector facility. Facility commissioning studies involved measurements of neutron emission spectra from ^{12}C, ^{28}Si, and ^{56}Fe neutron inelastic scattering. Fission neutron spectra from $^{235,238}U$ were also measured.
- GEANIE consists of 26 HPGe detectors. Recent measurements of neutron-induced processes that emit γ-rays in the neutron-energy range 1-400 MeV used targets of ^{11}B, ^{18}O, ^{48}Ti, ^{52}Cr, ^{56}Fe, ^{75}As, ^{89}Y, ^{90}Zr, ^{150}Sm, ^{151}Eu, $^{191,193}Ir$, ^{209}Bi, $^{233, 235,238}U$, and ^{232}Th.
- DANCE consists of 159 BaF_2 scintillators arranged in a 4-pi configuration. It is used for neutron capture measurements with small samples of rare or radioactive material at neutron energies up to several hundred keV. During the past year measurements were made on ^{151}Sm, ^{171}Tm, and $^{234,238}U$. Upgrades to this facility are planned.
- All LANL neutron physics measurements involved utilization of the WNR (fast neutron) and MLNSC (moderated neutron) sources at LANSCE. These facilities are currently operational for more than 6 months out of the year with optimal performance.

National Institute of Standards and Technology

- Presented by A. Carlson.
- Very accurate scattering angular distribution measurements on H(n,n)H at 10 MeV, carried out in collaboration with Ohio University and LANL, were completed and plans were established to perform the same type of experiment at OU at 15 MeV.
- A new cryogenic calorimeter built at NIST for use in very accurate neutron fluence measurements was described. Accuracies on the order of 0.1% are sought. This facility was employed to measure the $^{6}Li(n,t)$ cross section at ≈4 meV.
- Spherical-shell transmission measurements on Fe were performed in collaboration with Ohio University and University of Florida.

Ohio University

- D. Smith presented this report since no representative from OU was able to attend the CSEWG meeting.
- The H(n,n)H scattering experiment was mentioned (see NIST report).
- Additional experimental studies of the $^{9}Be(p,n)$ and $^{9}Be(d,n)$ reactions have been carried out.
- A survey of nuclear level densities in the mass range A=20-70 was undertaken, and it has been shown that the nuclear level density drops for a fixed nuclear mass number as one progresses farther away from the line of beta stability.
- OU joined with ANL and IRMM in a study by TOF of neutron spectra from deuteron bombardment of metal tritide targets and blank substrates. The goal is to characterize this source precisely for use in neutron cross section experiments.

Special Reports

- Following tradition, several special reports of general interest to CSEWG were presented during the meeting of this CSEWG committee.

- These diverse presentations addressed technical topics, meetings, and information dissemination issues.

Dresden Fast Neutron Workshop

- E. Cheng gave a presentation on the International Fast Neutron Physics Workshop that took place on 5-7 September, 2002.
- This meeting was held at Technical University Dresden, Dresden, Germany, and it was organized by the Institute of Nuclear and Particle Physics at TU-Dresden.
- The conference was attended by 47 participants in spite of the threat posed by severe flooding in that region. They represented a wide range of countries in Europe as well as Japan, Russia, and the U.S.
- Cheng also reported on an international workshop on fusion neutronics that was held in conjunction with the main meeting.

Standards Measurements Worldwide

- Presented by A. Carlson.
- Carlson is coordinating the efforts of CSEWG in the area of the neutron cross-section standards. He also leads an international activity on standards under the auspices of the IAEA. He reports on this activity at the present meeting.

Large Errors and Confidence Intervals

- D. Smith described ongoing studies carried out at ANL, in collaboration with ORNL, on how to handle large errors in nuclear data.
- The conclusions from this work suggest the need for a probabilistic approach in which the parameters of probability distributions are specified, not just the recommended values and errors as is currently done. This may have a significant long-term impact on evaluated file content and formats.

Experimental Resources Website

- Presented by D. Smith.
- ANL maintains a website for CSEWG and the USNDP that is devoted to listing the U.S. facilities where nuclear data studies are being carried out or could be carried out:
  http://www.td.anl.gov/nrs/index.html
- This website is maintained current and includes direct links to the Internet sites of the listed laboratories.

- Since there is no "hit counter", it is not clear to what extent this website is of significant value to the nuclear data community.

Evaluator Data Requests Website

- Presented by D. Smith.
- A website devoted to U.S. evaluator requests for new experimental data has been in operation for a year with little success in soliciting requests. Thus, it will probably be abandoned as an "unsuccessful experiment".

WPEC 2003 Meeting

- Presented by D. Smith and E. Cheng.
- A preview of the 2003 WPEC meeting in Coronado, California, was presented to CSEWG.

IRMM Neutron Activation Workshop

- Presented by D. Smith.
- A preview was given of a WPEC Subgroup 19 of WPEC workshop in Geel, Belgium (13-14 January 2003).
- A. Plompen is presenting a summary of the Geel meeting at the present meeting.

ND-2004

- Presented by R. Haight.
- A preview was given of plans being made for the next major international conference in Santa Fe, NM, with LANL as host.