Status of Nuclear Data Activity in Korea

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Introduction

As Korea decided to take the nuclear power plant option for supportting its economic growth, it has proceeded in the localization of the nuclear fuel and power plant design technology since 1983. After ten years of the localization efforts, Korea launched a long- and mid-term nuclear development plan in 1994.

The nuclear data activity has been included in the long- and mid-term nuclear development plan since 1997. The main efforts before this time were to generate the multi-group libraries for the lattice neutronics codes such as WIMS-D or CASMO, and the MCNP library from the available evaluated libraries to support the design of a test reactor HANARO, and partially to support the developments of the PWR technology.

Since 1997, the activity includes evaluation and measurement. Since there is no practical nuclear data measurement facility yet, we are supporting people at Korean universities to develop the measurement techniques using foreign facilities.

The NDEL(Nuclear Data Evaluation Laboratory) of KAERI(Korea Atomic Energy Research Institute) has 8 regular staff members and 4 temporal staff members in 2000. Among them, 7 are working for the evaluation, 4 for processing, and 1 for computer maintenance. The main computer facility is a Linux cluster composed of 12 Pentium PCs and three HP-700 series.

Evaluation

Since Korea is experiencing difficulties with the spent fuels produced from 12 pressurized water reactors and 3 CANDU reactors, 13 GW in total, many nuclear development efforts are concerned with the spent fuel. The burnup credit for the spent fuel criticality is a favorite aspect for the transportation and the depository. Current safety regulations permit the partial credit for the minor actinides. So it is necessary to understand the fission product property accurately to receive the credit which is responsible for the 20 - 30 percent of the criticality.

KAERI NDEL has started a re-evaluation of the long-lived fission product nuclides with BNL NNDC. We have re-evaluated the resolved resonance parameters and the average resonance parameters for the unresolved energy region for 19 selected nuclides [1]. We will extend the evaluation up to 20 MeV with a model calculation using ABAREX, ECIS, GNASH, and SUNF.

Intermediate energy data needs in Korea are mainly to support the design of a proton accelerator driven nuclide transmutation system [2]. We have developed a computer code system, ECISPLOT, based on ECIS and GNASH, jointly with JNDC. And we have finished initial work with ECISPLOT [3]. We will continue this work under collaboration with JNDC.

There are several hospitals in Korea which have the medical cyclotron ranging from 30 to 50 MeV. To support the activity in producing the nuclear medicine, and the research in the industry such as thin layer analysis (TLA), we have invited a scientist from CNDC to start evaluation of the charged particle induced reaction cross section [4,5]. After evaluating the production cross section, we are doing a model calculation to estimate the subsidiary unwanted isotope production cross sections [6].

For the feasibility study of constructing a pulsed neutron facility based on an electron linac, we have studied the photoneutron production cross section [7]. We have joined the IAEA CRP on "Compilation and evaluation of photonuclear data for application". This CRP was finished in this year. A TECDOC will be published by IAEA.

Processing

During the design and the construction of a test reactor HANARO, KAERI has developed the libraries for MCNP and WIMS-D based on the evaluated libraries such as ENDF/B-6 and JENDL-3 [8]. KAERI NDEL has been providing various libraries for the lattice neutronics codes WIMS-D, CASMO-3, and HELIOS, to support the nuclear fuel design and development activity in Korea. Also, an ORIGEN-2 library was developed for the test reactor.

Recent efforts in KAERI NDEL processing are focused on the shielding and the material damage calculation of the PWR vessel surveillance problem and the material testing. We are using DOORS and DANTSYS for the analysis [9].

Service

KAERI NDEL is supporting the nuclear data requests inside of the institute as well as in Korea. To supply the data, we are collecting the nuclear data from various sources, such as IAEA/NDS, OECD Databank, etc. Many times we need to interpret the collected data to make it understandable to and usable by the final users who are usually not accustomed with the standard exchange format. A KAERI nuclear data web service(*http://atom.kaeri.re.kr*) was designed to provide the nuclear data for those who need the data but do not have time to study various conventions in the nuclear data society.

The web service is known as "Table of Nuclides" on internet. The table of nuclides provides nuclide-wise information about the mass based on Audi and Wapstra [10], decay property based on NUDAT [11], capture cross section graph based on NGATLAS [12], fission yield table based on ENDF/B-6, and summary of neutron interaction cross section based on JENDL-3.2 [13]. For easy access, we have provided the hypertext link to other nuclides in the decay chain and between natural elements and nuclides. References to the sources of data are provided. A link to the decay diagram is provided based on ENSDF. The decay diagram displays a level diagram and radiation intensity. Another popular feature is the ENDF plot service. The ENDF plot gives interactive plot of the cross section graphs in GIF, EPS, and text form.

To know the usage of the service, we introduced a concept of the valid statistics. Since the web page consists of introductory pages, such as a picture of the nuclides boxes or a form to fill-in user requests for plot, and result pages which display data. We only count the number of the result pages excluding access by the service provider. Last year, the server had a 468,358 hit count, and among them, 72,650 valid ones(about 15.5 %).

Figure 1 displays the valid statistics for the table of nuclides, the ENDF graphs, the decay diagram, the capture cross section and the number of users (or IP addresses). The web service started in 1994, but we did not keep the web log before August 1996. The figure displays a large spread, but it shows an obvious increasing trend. There may be two reason for the increase in users. First is the increase due to the increase in the people who uses the web (netizen). This increase is a natural one. The second is the increase by the introduction of new feature. The rapid increase since 1998 is due to new features, the decay diagram and the neutron capture cross section graph.

Among the 31,020 visitors (based on the number of IP addresses) last year, 9,442 visitors contributed to the valid statistics. The total number of valid statistics was 72,650. So, the average access counts of each user was 7.7. As displayed in Figure 2, the number of users who have accessed many times to get information is inversely proportional to the number of accesses. If we consider the user who accessed more times than the average user access count, as a regular user, we had 1656 regular users last year. (cf. 986 in 1999)

Summary

KAERI NDEL is a user of NRDC for domestic and internet services, evaluation and processing. And KAERI/NDEL will be a potential contributor to international nuclear data by ongoing measurement using either domestic or foreign facilities.

References

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[12] NGATLAS - Atlas of Neutron Capture Cross Sections (Courtesy of IAEA NDS)

[13] XS averaged from JENDL3.2 (Courtesey of T. Nakagawa at JAERI)

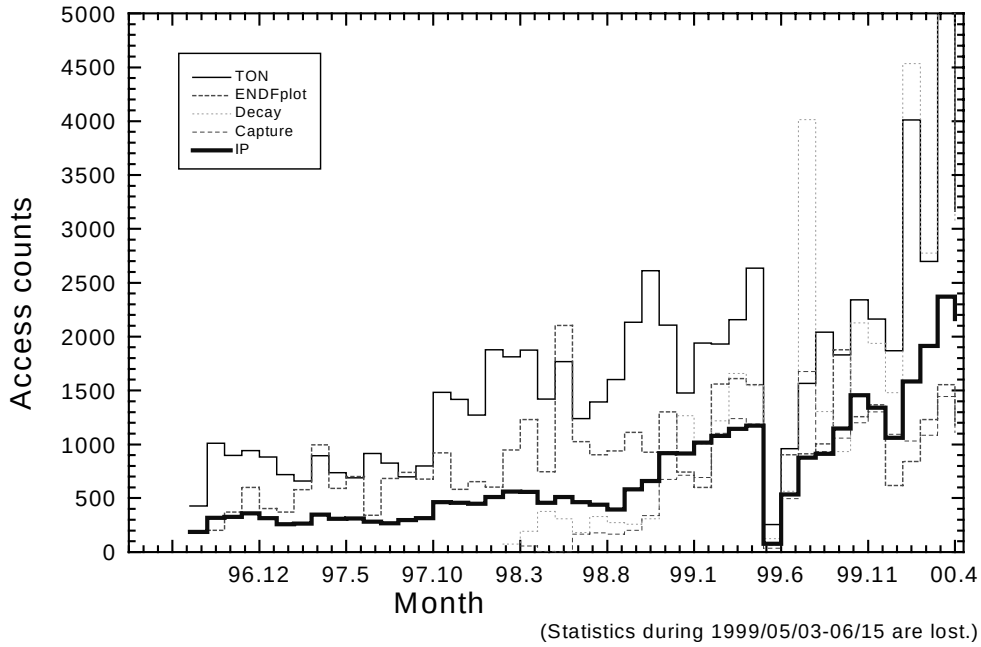

Figure 1. Monthly Usage of KAERI/NDEL web server

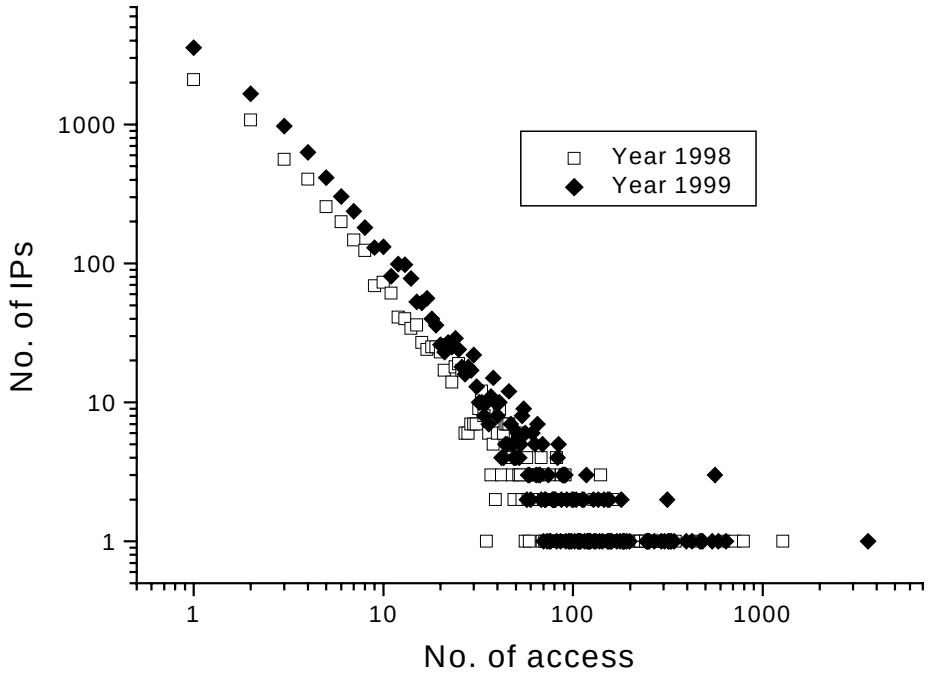

Figure 2. Valid User Statistics