

# Present Status of CENDL Project

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## 1 General

Chinese Nuclear Data Committee assumes responsibility the management of CENDL project. Committee meetings are generally held once per year. The follows is the organization of committee:

Committee Chair: Prof. Zhao Zhixiang, CIAE

Technical working party: Evaluation Working Party  
Measurements Working Party.  
Benchmark Working Party.

CENDL is carried out by China Nuclear Data Center and China Nuclear Data Network, the follows are the including of the network:

China Nuclear Data Network: China Institute of Atomic Energy.  
Peking University,  
Sichuan University.  
Lanzhou University.  
Tsinghua University  
Nankai University,  
Jilin University  
Zhenzhou University ,  
Northwest University and et al

## 2 General purpose file

### • CENDL-3.1

The evaluated activities of CENDL-3.0 were started in 1995 and finished in 2000. The library includes comprehensive data evaluations for all neutron reactions in the energy range from  $10^{-5}$ eV to 20MeV for 200 nuclides, among them, 133 nuclides are newly evaluated, and 67 nuclides are taken from CENDL-2.1. The ENDF-6 format is adopted, the files 1, 2, 3, 4, 6, 12~15 are included for major fissile nuclide, structure material and light nuclide, files 1, 2, 3, 4, 5 are given for minor fissile and fission production nuclides.

CENDL-3.0 was distributed inside of China as an internal test version in 2001.

The criticality benchmark testing of CENDL-3.0 had been carried out for various types of fast and thermal reactors and neutron leakage spectra experiments by Integral Test Working Group in CNDC. After that some feedback information from benchmark testing and users has been received. These were considered in the re-evaluations for improving the data of the important nuclides, especially for the uranium and plutonium isotopes when the improvement is completed, CENDL-3.1 is the new version of CENDL-3.0.

#### • New evaluations

Evaluation is in progress for developing the CENDL neutron general purpose library. 24 new neutron data evaluations have been performed in CNDC cooperated with CNDN:  $^{12}\text{C}$ ,  $^{16}\text{O}$ ,  $^{23}\text{Na}$ ,  $^{24, 25, 26}\text{Mg}$ ,  $^{63,65,\text{nat}}\text{Cu}$ ,  $^{85}\text{Y}$ ,  $^{95}\text{Zr}$ ,  $^{99}\text{Mo}$ ,  $^{129, 131, 132, 134}\text{Xe}$ ,  $^{136,138,140,142}\text{Ce}$ ,  $^{169}\text{Tm}$ ,  $^{185,187}\text{Re}$ ,  $^{240}\text{Pu}$ . (e.g Fig 1-4). The evaluations for  $^{16}\text{C}$ ,  $^{16}\text{O}$  have been extended to 30 MeV. The new evaluations were based on the updated model codes (LUNF, UNF, FUNF, TALYS and EMPIRE et al) calculation and the new experimental data. The new evaluations will be collected by CENDL future edition.

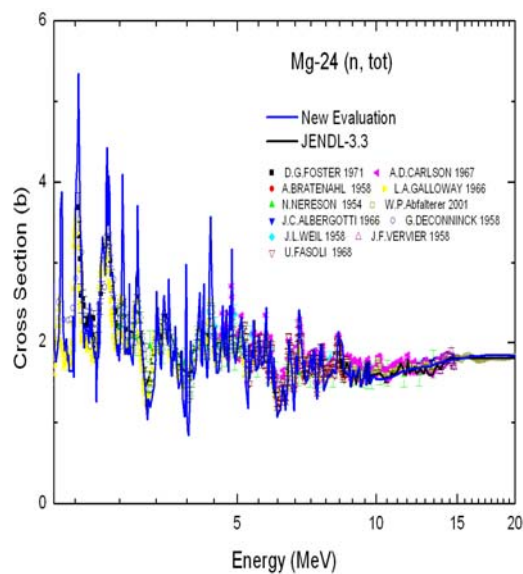


Fig.1  $n+^{24}\text{Mg}$  total cross sections

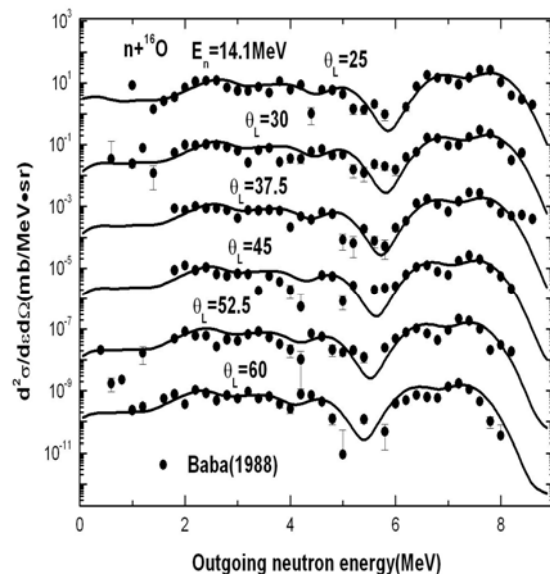


Fig 2. Double-differential cross sections of  $n+^{16}\text{O}$

### 3. Fission yield

#### • Semi-empirical model study for $n+^{235}\text{U}$ fission

A semi-empirical model (simplified theoretical model) was utilized to study the fission of  $n+^{235}\text{U}$ , which had 11 parameters determined by fitting the experimental data. The result shows, within the incident energy range of 0 ~ 20 MeV, the model

could well describe the energy-yield relations of the most of the products (e.g Fig 5-6).

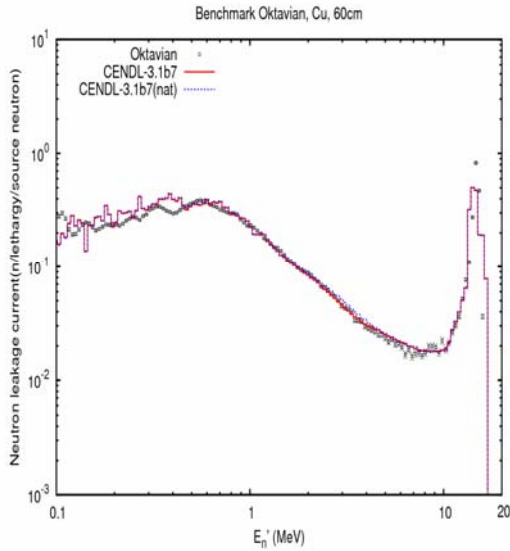


Fig.3 Neutron leakage spectrum for Cu benchmark

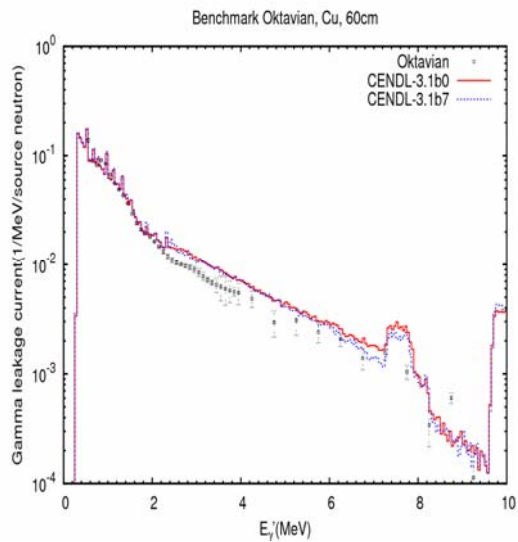


Fig. 4. Photon leakage spectrum for Cu benchmark

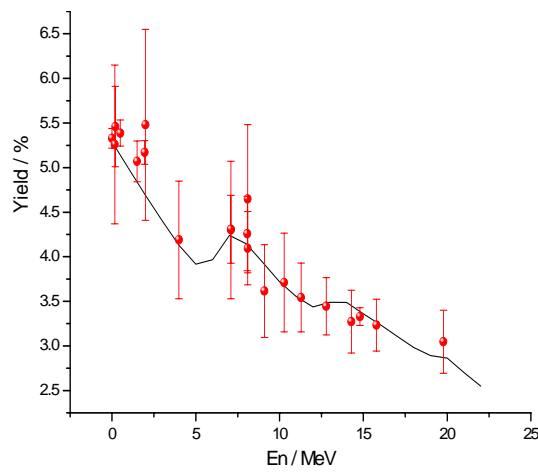


Fig 5.  $^{144}\text{Ce}$  cumulative yield of  $\text{U}235+n$ .

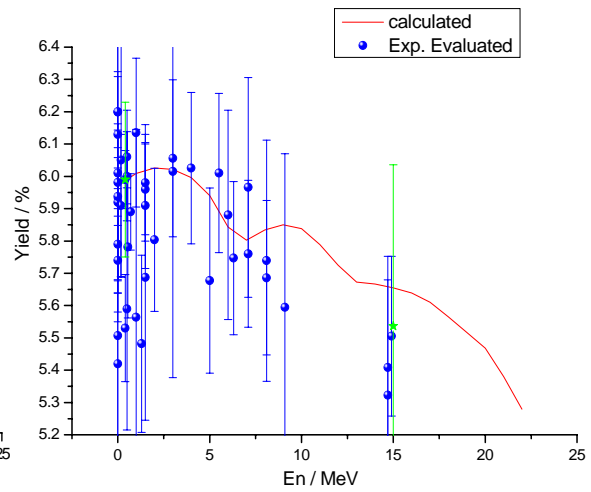


Fig 6  $^{97}\text{Mo}$  Yield of  $\text{U}235+n$

### • Systematics on Mass Distribution Data and Independent Yield

Based on the experimental data, the systematics on mass distribution of fission product nuclides and independent yield were studied, the systematics code was developed and the parameters were determined by fitting experimental data.

## 4 Structure and decay data

### • Structure Data

The nuclear structure and decay data evaluations in CNDC and CNDN has permanent responsibility for evaluating and updating NSDD for A=51, and 195-198. In the past year, the mass chain A=198 have been revised using available experimental decay and reaction data.. Now A=195 is being updated.

### • Decay Data

The new decay data evaluations of  $^{85m}\text{Kr}$ ,  $^{97}\text{Zr}$  and  $^{109}\text{Cd}$  have been performed. These evaluations included the half-life,  $\gamma$  -ray intensity, branch ratio and decay schemes et.al. Two evaluation methods ENSDF and DDEP were used in our new evaluations.

## 5 Nuclear data work for ADS project

The nuclear data and related research work for ADS project has been done in China Institute of Atomic Energy.

- The theoretical model code MEND of nucleon-induced reaction has been improved. In the new version of MEND code, the gamma-production cross sections and ENDF format are included.
- The calculation and evaluation of n and  $p+^{54,56,57,58}\text{Fe}$  (e.g Fig 7). and  $p+^{58}\text{Ni}$  reactions for incident nucleon energy below 250 MeV were carried out based on the new MEND code.
- Based on the proposed benchmarks of the CRP, preliminary testing calculations for YALINA-Booster were carried out using IAEA ADS library and the data from LA150 with Monte Carlo code.

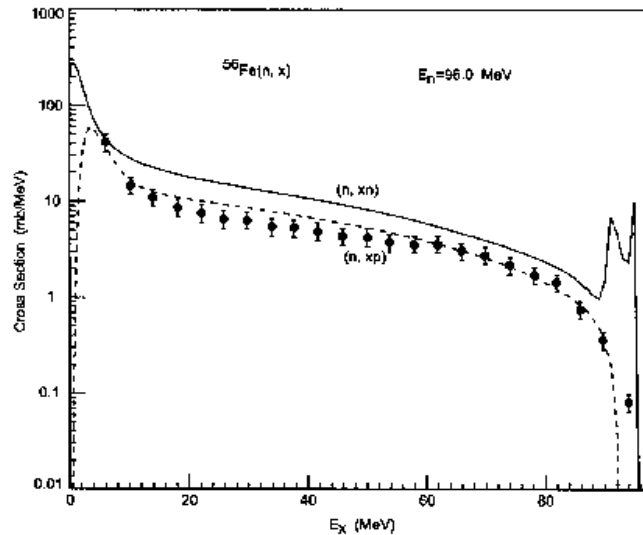


Fig. 7 Calculated energy spectra of neutron (solid line) and proton emission (dash line) compared with proton emission experimental data (symbols) for  $n+^{56}\text{Fe}$  reaction.

## 6 International Co-operation:

At present, The scientists of CNDC participate in two IAEA Coordinated Research Projects:

- Minor Actinide Neutron Reaction Data
- Updated Decay Data Library for Actinides.

## 7 The meeting and symposium

- The symposium on Nuclear Data Future needed, 16 Dec. 2008, Beijing
- The Technical Meeting of fission yield, May 15-18, 2009, Guilin
- The Meetings of China Nuclear Data Committee, 14 May. 2009, Beijing