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Russian Nuclear Data Center: History of Creation and Achievements

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Abstract

The article describes the activities of the Russian Nuclear Data Center (Centr Jadernykh Dannykh - CJD) over the period from 1963 to 2014.

Introduction

Nuclear data compilation and evaluation activities started in the Institute for Physics and Power Engineering (IPPE) practically since the time of its creation in 1947, because the work on development of various types of nuclear reactors required reliable nuclear data. At the beginning, a large portion of the data were classified. However, when the first USSR Nuclear Power Plant began operation in 1954 [1], many papers on nuclear data started to be published in international journals. A widely known compilation of such data was the handbook by I.V.Gordeev, A.V.Malishev and D.A.Kardashev, issued in 1959 [2]. The second, updated edition of this handbook was issued in 1963. An important step in the preparation of nuclear data for fast reactor calculations was the creation of "the 26-groups constant system" by I.I.Bondarenko, M.N.Nikolaev, L.P.Abagyan, and N.O.Bazazjanz (the ABBN system) [3]. The ABBN system was published in 1963. Since that time, it had been regularly updated and widely used in fast reactor calculations.

Beginning of international cooperation in the field of nuclear data

Transition from the researches involving low-power critical assemblies to the construction of nuclear power plants invoked stronger requirements for the variety and reliability of nuclear data used in reactor design. The work on the reactor operation and spent fuel utilization issues resulted in additional requirements. These, in turn, resulted in the development of new, high precision nuclear data measurement methods. Another development was the application of theoretical models for quantitative analysis of nuclear reaction cross-sections. New computer systems were developed for processing and long-time storage of nuclear data. These new tasks required new principles of coordinating work of many scientific groups from various institutions.

In the beginning of sixties, the necessity of international coordination of the efforts aimed at providing reliable nuclear data was well recognized. In 1963, the International Expert Group on Nuclear Data was formed under the auspices of the IAEA for coordinating the activities on compilation and evaluation of nuclear data. In 1968, it was renamed to the International Nuclear Data Committee (INDC). The tasks of data compilation, data exchange and development of global databases were given to the international network of regional nuclear data centers. At the beginning, the international nuclear data network consisted of the following four centers:

- The National Nuclear Data Center of the USA (Brookhaven National Laboratory), whose zone of responsibility was the USA and Canada;
- The Nuclear Data Bank (Paris), whose zone of responsibility was Western Europe and Japan,

- The Russian Nuclear Data Center (Obninsk), whose zone of responsibility was the USSR and Eastern Europe; and
- The Nuclear Data Section of the IAEA, whose zone of responsibility covered the remaining countries.

In the subsequent years, the nuclear data center network gradually grew. In 1972, the Center of Nuclear Structure and Reaction Data was established at the Kurchatov Institute (Moscow), mainly specializing on the charged particle data. In 1979, the Center of Photonuclear data was created at the Moscow University and the Nuclear Data Group was established at the Institute of Nuclear Physics (Gatchina). In 1997, the Center of Nuclear Physics Data was organized at VNIIEF (Sarov). The national centers of China and Japan joined the network in seventies. At present time, 13 national and regional centers participate actively in the international nuclear data network.

The INDC and the IAEA Nuclear Data Section, in cooperation with the other centers, had played considerable role in the creation of the international nuclear data libraries EXFOR and CINDA. In addition, they worked on the requirements for nuclear data, on the requirements for data precision, and on the provision of training for specialists from developing countries. Many well-known scientists and specialists from dozens of countries had been involved in this collaboration.

Organization of the nuclear data activities in the USSR

The Information Center of Nuclear Data (ICND) was created at the IPPE in 1963, in order to improve the nuclear data activity. The coordination of the ICDN work was carried out by the Council of the ICND. The first chairman of the Council was O.D. Kazachkovskiy; his deputies were I.V. Gordeev and E.A. Koptelov. In 1965, after the transition of O.D. Kazachkovsky to NIIAR (Dimitrovgrad), L.N. Usachev assumed the position of the Chairman, with A.I. Abramov and E.A. Koptelov being his deputies. Administratively, the ICND was a unit ("gruppa" in Russian) in the theoretical division ("otdel" in Russian) of the IPPE. At those early stages of the ICND establishment, significant contributions to the ICDN activities were made by A.V. Ignatyuk and D.A. Kardashev.

In 1969, the ICND was reorganized into a section ("laboratoriya" in Russian) within the IPPE. It was named Nuclear Data Center (CJD in Russian transcription), and its Council was transformed into the All-union Nuclear Data Commission (NDCom). The main tasks of the NDCom were:

- the coordination of activities on measurement and evaluation of nuclear data,
- the coordination of international cooperation in the field of nuclear data,
- the estimation of nuclear data requirements and
- the coordination of programs related to nuclear data within various institutes of the Ministry of Medium Machine Building (MMMB) and of the USSR Academy of Science.

The head of NDCom was V.A. Kuznetsov, the director of IPPE; his deputy was L.N. Usachev. Later, the heads of NDCom were: O.D. Kazachkovskii, since 1976, M.F. Troyanov, since 1987, and B.D. Kuz'minov, from 1992 to 2006. In 1976 the IPPE was appointed the leading organization of the MMMB on the nuclear data problems.

The NDCom had the following Coordination Counsels:

- Counsel on the nuclear data measurements (Chairman V.I. Mostovoi),

- Counsel on the nuclear data needs (Chairman M.N. Nikolaev),
- Counsel on the non-neutron data (Chairman F.E. Chukreev).

There were also temporary groups on separate problems of nuclear data measurement and evaluation; these were headed by: B.D. Kuz'minov, O.A. Sal`nikov, G.V. Muradyan, C.I. Sukhoruchkin, A.I. Abramov, Yu.S. Zamyatnin, R.D. Vasil`ev, Yu.P. Popov, G. B. Yan`kov.

L.N. Usachev actively participated in the establishment and practical work of the NDCom and the CJD.

The NDCom meetings were carried out annually, usually in one of the leading nuclear institutes of the USSR: IPPE (Obninsk), IAE (Moscow), RI (Leningrad), LIYaF (Gatchina), KhFTI (Kharkov), IYaI (Kiev), IAE (Minsk), VNIIEF (Sarov), ITEF (Moscow), NIIAR (Dimitrovgrad). During these meetings, the participants had good opportunities to familiarize themselves with the research activities of the institutes. As a rule, the meeting programs were focused on the topical needs of data measurements and evaluations. Overall, 34 such meetings were carried out. Active role in the organization of the meetings was played by Yu.V. Adamchuk, the scientific secretary of the NDCom.

The CJD was the "working horse" of the NDCom and had been doing all the practical work to ensure functioning of the whole system. The heads of the CJD were: V.I. Popov (1969-1972), V.N. Manokhin (1972-2006), and A.I. Blokhin (2007- 2014).

The efforts by the NDCom and by the MMMB department responsible for R&D activities resulted in the preparation of the 5-year programs in the nuclear data field. The following research programs were organized and implemented:

- **The 1971-1975 Program** was focused on the measurement of the nuclear constants regarded as the most important ones, and on the enhancement of the general culture of nuclear data analyses. Special attention was paid to the measurements required in order to ensure precise calculation of the breeding coefficient of fast neutron reactors.
- **The 1976-1980 Program** was aimed at the achievement of the level of nuclear data precision sufficient to ensure the calculation of the reactor neutron multiplication coefficient with accuracy about 1% (for initial fuel composition).
- **The 1981-1985 Program** was oriented on nuclear data measurements for the estimation of the minor actinide accumulation in the spent nuclear fuel.
- **The 1988-1995 Program** was focused on the nuclear safety, the nuclear fuel cycle, the radioactive damages of the materials, and the decommissioning of nuclear reactors.
- **The 1996-2005 Program** covered a wide range of works connected with nuclear data for the perspective technologies, such as: the closed fuel cycle, the transmutation of radioactive waste in reactors and in accelerator driven systems, the thermonuclear reactors, the enhanced burn-up of fuel, the nuclear medicine, the space applications, and so on.

The following institutes actively participated in these programs: IPPE (Obninsk), IAE (Moscow), RI (Leningrad), LIYAF (Gatchina), KHFTI (Kharkov), IYAI (Kiev), IAE (Minsk), VNIIEF (Sarov), ITEF (Moscow), NIIAR (Dimitrovgrad), VNIITF (Snezhinsk), VNIIFTRI (Moscow).

More than 60 leading national specialists participated actively in the NDCom Meetings. Large contributions to the organizing and researching work were made by V.I. Mostovoi, Yu.V.

Adamchuk, A.A. Bergman, F.N. Belyaev, M.V. Blinov, V.P. Vertebny, A.P. Vasil`ev, V.Ya. Golovnya, T.V. Golashvli, Yu.S. Zamyatnin, V.A. Kon`shin, A.I. Kal'chenko, S.S. Kovalenko, G.V. Muradyan, V.N. Nefedov, M.V. Pasechnik, K.A. Petrzhak, Yu.P. Popov, A.B. Popov, M.V. Savin, A.I. Saukov, S.I. Sukhoruchkin, P.I. Fedotov, E.F. Fomushkin, F.E. Chukreev, O.A. Shcherbakov, G.B. Yan`kov, V.P. Yaryna. Apologies, if some names are missing. The responsible MMMB staff paid permanent attention to the nuclear data activity. Staff of the scientific and technical management department of the MMMB, in particular I.D. Morokhov, A.K. Kruglov, and E.V. Kulikov, as well as the leading specialists: L.P. Panikov, Yu.G. Klimov, and V.A. Fedorovich participated in ensuring the financial support and organization of this activity.

The Nuclear Data Commission ceased to exist in 2006, after the transformation of the MMMB into the State Corporation of Atomic Energy (SC "Rosatom"). Leading scientists of the IPPE and some other institutes did attempt to create a body similar to the previous NDCom, but those efforts were not successful.

Main directions of the CJD activity

From the beginning of its existence, the CJD had taken part in the international nuclear data exchange, in the technical and scientific activities aimed at the creation of national databases and in the provision of nuclear data to the users. The following tasks were assigned to the CJD:

- Compilation of bibliographic information from the publications on measurement and evaluation of neutron-induced reaction cross-sections for the international catalogue CINDA;
- Compilation of the experimental data on neutron-induced reactions, measured in the USSR and in the East European states, for the international EXFOR database;
- Determination of nuclear data requirements for various applications;
- Organization of data evaluations for the national and international nuclear data libraries;
- Development and maintenance of computer software for nuclear databases, including the search, retrieval, correction, transformation, and graphic presentation of nuclear data;
- Provision of nuclear data to the institutes of the USSR;
- Issuance of journal Voprosy Atomnoi Nauki I Tekhniki (VANT), series: Jadernye Konstanty (Nuclear Constants);
- Exchange of nuclear data with the other nuclear data centers under the aegis of the IAEA.

Since 1966, the CJD had been providing regular compilations of the relevant Russian publications for the CINDA catalogue. In 1969, the technical problem of reading foreign magnetic tapes with nuclear data had been resolved, and in 1970 the first magnetic tape with the Russian nuclear data had been recorded (with the help of the Protvino institute) and transmitted to the other nuclear data centers. In 1971, the CJD commissioned its own computer M-222. Since then, the CJD had been actively participating in the creation and maintenance of the international experimental and bibliographic nuclear data libraries. Since 1969, the CJD has taken part in annual meetings of the international nuclear data centers. The CJD had been answering about 100 nuclear data requests from the national organizations annually.

The important condition of the international data exchange was the compatibility of the computers and software used in the USSR with the computers and software used in the foreign data centers. The resolution of the compatibility problem had taken large efforts from the CJD practically throughout the whole period.

In 1981, a new computer, ES-1033, was installed in the CJD, and the existing software and the data libraries were migrated from the old computer to the new one. In 1994 another computer, the DEC ALFA-3600, was installed. This computer was fully compatible with the hardware and software of the computers used in the other centers of the international network. As a result, the CJD reached the technical level, which enabled the data exchange without technical difficulties.

Important contributions to the scientific developments and to the establishment of the technical processes of the CJD were made by: A.I. Blokhin, Yu.G. Bobkov, N.N. Buleeva, V.M. Bychkov, A.V. Ignatyuk, N.T. Kulagin, C.A. Maev, V.N. Manokhin, M.V. Mikhailyukova, S.M. Nasyrova, O.A. Pakhomova, V.M. Pan`kov, A.B. Pashchenko, N.A. Pervunin, V.P. Platonov, V.I. Popov, V.G. Pronyaev, M.A. Skripova, V.V. Surgutanov, L.S. Tarasko, G.I. Timukhin, V.V. Vozyakov, K.I. Zolotarev. In the publishing activity, the main contribution was made by D.A. Kardashev.

In order to fulfill the tasks assigned to it, the CJD had to establish close cooperation with all the institutions involved in measurement, theoretical analysis and evaluation of nuclear data. The number of the USSR organizations which were involved into the microscopic and integral data measurements, theoretical and evaluation works, estimations of nuclear data needs and various data applications reached 20 during the period from 1970 to 1990.

Within the IPPE, many of the tasks were being solved in close collaboration with the division of theoretical physics and with the section of nuclear reactor constants. Good cooperation was established with the colleagues from the Obninsk Institute of Atomic Energy. As a result, many data evaluation problems were solved successfully, and a considerable number of joint articles was published. A close collaboration with the Institute of Nuclear Energy of the Belorussian Academy of Sciences should be mentioned as well. The evaluation group of that institute made an important contribution to the evaluation of nuclear data for fissionable nuclides.

The close interaction with the State Service of Standard Reference Data (SSSD) should be mentioned too. The SSSD-representatives had taken part in many NDCom Meetings and in their turn, the CJD members regularly attended the SSSD sessions related to the nuclear data.

Through the years, the CJD had collaborated with the Central Institute of Atomic Information (CIAI) and had made significant work on the edition and issuance of the periodic branch journal of "Voprosy Atomoi Nauki i Techniki" (VANT), series: Nuclear Constants. It also contributed to the preparation of the proceedings of the Kiev international conferences on neutron physics. More than 120 issues of the VANT, series Nuclear Constants, 25 annotated releases of "Nuclear investigations in USSR" and the 7 proceedings of the Kiev conferences were issued. These publications were being sent to 20 institutes of the USSR and to many nuclear institutes abroad. The Nuclear Data Section of the IAEA had been translating selected papers into English and distributing them to foreign recipients.

International activity of the CJD

The task of the provision of nuclear data for reactor calculations and for other nuclear applications required joint efforts of the specialists in nuclear theory, experimental physics and data evaluation from many countries. As a result of this international cooperation, the world library of experimental data (EXFOR) and the bibliographic catalogue (CINDA) were created.

At present, the EXFOR library contains practically all the available experimental data on neutron cross sections. The data include information on more than 10000 experimental works. The CJD has compiled the experimental results of more than 1250 measurements from Russia and East European countries. It continues to compile the current Russian measurements and collaborates with the other centers in checking and correcting the earlier compiled works to account for the new codes and dictionaries introduced due to the expansion of the categories of compiled data.

Since 1969, the CJD had taken part in all the meetings of nuclear data centers network and had implemented the decisions and recommendations of these meetings, including the decisions and recommendations of the International Nuclear Data Committee (INDC). In accordance with the adopted schedule, four of the Centers meetings were held in Obninsk. In addition to the main task of the data compilation and exchange, the CJD actively participated in the formation of the data requirements and in the estimation of the required accuracy of data for various applications.

One of the important decisions the NDCcom had taken was the acceptance of the ENDF format for recording and storing the Russian evaluated data. Many data exchange problems had been solved due to this decision, as the CJD got access to a large set of data-processing codes accumulated in foreign centers.

At the beginning, some limitations existed regarding the international exchange of the evaluated data. It is noteworthy that the NDCom and the CJD had been promoting the policy of free exchange of evaluated data. The State Committee of the MMMD supported this policy. The successful solution of the technical problems favored the final decision concerning the free data exchange. As a result, the care of the quality of evaluated data came out of the national frameworks. International cooperation on the development of data evaluation methods had significantly grown through various international forums, the IAEA programs and the direct communication of experts.

In different years and at different levels, the CJD cooperated with foreign institutions, such as the Technical University of Dresden (GDR), the Institute of Nuclear Science and Technology (Cuba), the Institute of Experimental Physics of the Koshut University (Hungary), the Institute of Nuclear Research (Rez, Czech Republic), the Institute of Nuclear Investigations and Nuclear Energy (Sophia, Bulgaria), and the Institute of Radium and Nuclear Investigations (Vienna, Austria).

Within the framework of the Council of Economic Mutual Aid, efforts were made to coordinate the nuclear data activity in the countries of Eastern Europe. In 1982, the corresponding working group was organized, and the first meeting of the group was carried out in Dresden. Subsequent annual meetings of the working group were organized in Kiev (two times), in Varna (Bulgaria), and in Obninsk (Russia). The last meeting was in Dubna (Russia), in March 1989. The CJD participated in all the meetings. The working group ceased its work as a result of the liquidation of the Council of Economic Mutual Aid in 1991.

Main scientific results

From the beginning of its activity, the CJD paid special attention to the development of mathematical methods for data analysis and to the use of nuclear reaction theory to produce evaluated nuclear data. In 1960-ies, the IPPE had already formulated the idea of adjusting the data used in reactor calculations based on results of integral experiments. The CID had developed a new approach to the determination of the permissible uncertainties of nuclear data taking into account the integral experiments [4, 5]. The permissible uncertainties of the main reactor constants, determined under this approach, had been included in the international list of nuclear data requirements, WRENDA.

The CJD, in collaboration with the IPPE theoretical section, developed mathematical method of data parameterization based on the Pade approximation [6], which was widely used in subsequent years in many practical evaluations of nuclear data.

In seventieths, new methods were developed for the description of the statistical properties of excited nuclei [7]. These methods essentially improved the agreement between the nuclear level densities calculations and the experimental results. As the nuclear level density is the dominant components in theoretical calculations of the reaction cross sections, the resulting reliability of such calculations was enhanced. This was of high importance for those ranges of nuclides and neutron energies in which the experimental information is contradictory or absent [8].

In seventies, the CJD was developing the theoretical models for describing the direct processes contribution to inelastic scattering of neutrons. The microscopic description of the inelastic scattering spectrum was investigated to higher order as compared with the traditional distorted wave approximation. It was shown that the excitation of collective states of different polarity mixed with quasi-particle excitations are responsible for the contribution into the hard part of the spectrum. Thus, the importance of taking into account such reaction mechanism for calculating the hard parts of the inelastic scattering spectra was shown [9-12].

Works on the creation of new codes and use of established foreign codes for theoretical cross-section calculations, along with the work on the selection of model parameters, led to the development of several semi-empirical systematics of the threshold reaction cross-sections for the neutron energies ~ 14.5 MeV [13-18].

The publications referenced above represent only a small part of works, performed by the CJD staff. The research assistants of the CJD defended six PhD theses, issued three handbooks [18-20], and published more than 1000 papers, preprints and reports to the national and international conferences.

Libraries of evaluated data

As a result of the CJD work over the period considered, a series of national libraries of evaluated data were created with focus on important practical applications.

The Library of Recommended Evaluated Neutron Data (BROND) contains the most complete neutron data sets needed for detailed calculations of nuclear reactors and other nuclear facilities. The first version of the library (BROND-1), which was created in 1985, contained 65 files for main structural, technological and fission materials of nuclear reactors, including the most important fission products [21]. This library had played an important role in removing the limitations on the international exchange of evaluated nuclear data. Such data exchange had started immediately after the transmission of the BROND-1 library to the IAEA.

The next version, BROND-2, which contained about 120 files, was created in 1992 [22]. During its creation, the previous evaluations for important reactor materials were improved; significant attention had been paid to the evaluation of neutron cross sections for minor actinides and fission products. For the most fissionable nuclei, the evaluations had been made in cooperation with the Institute of Nuclear Energy (Minsk). BROND-2 was included in international catalogues of nuclear data and is now available on the sites of the IAEA, the NEA Data Bank and the NNDC.

During the work on the formation of BROND-3, the attention was paid to the inclusion of the differential neutron cross sections and the gamma ray yields, which were absent in the previous versions [23]. It was originally planned that BROND-3 would be created in 2007 [24], however, as the financial situation had changed, these plans had been changed as well.

The Russian national library of evaluated data (ROSFOND) [25] had been formed by the end of 2006, in cooperation with the Neutron Constants section. The library included most of the files from the BROND-3 library. The ROSFOND library contained 654 files, about two-thirds of which were full files, and about one-third contained neutron activation data files which did not include the differential characteristics of the reaction products. The library versions ROSFOND – 2008 and ROSFOND – 2010 had been upgraded based on the comparison of the evaluated data with the results of integral experiments. These upgraded versions were included in the international catalogues of evaluated nuclear data and are now available on the websites of the IAEA, the NEA Data Bank and the NNDC.

The subsequent work was focused on the evaluation of covariance matrices of uncertainties of the recommended cross sections; such matrices were not included in the previous versions of the Russians evaluated data. Essential progress was made regarding the estimation of the data uncertainties with help of the newly developed strong mathematical method of statistical evaluation, which took into account the so-called “undeclared uncertainties” of experimental data. The application of this method had shown that the real systematic and total uncertainties of many experimental datasets appeared to be considerably higher than the uncertainties declared by the authors. This method was actively used in the evaluation of the uncertainties of important cross sections in the new library version, BROND-3.1 [25].

The library version BROND-3.1 contained 372 files, for nuclides from hydrogen to curium, in the neutron energy range of 10^{-5} eV - 20 MeV. The files for the main fuel, structure and technological materials of nuclear reactors contained covariance matrices for the evaluated data uncertainties. The library was transmitted to the main international nuclear data centers.

Along with the requirements for the calculations of nuclear energy producing facilities, which require the nuclear data considered above, there is a wide range of the needs for data on the activation method of analysis of nuclear transmutations. There is a need for both integral cross section data and for differential data. As a rule, specialized activation nuclear data libraries are created for the activation analysis. The CJD activities aimed at the creation of such libraries are listed below.

Library BOSPOR-80. A large group of threshold reaction evaluations was performed in 1980 with help of the phenomenological systematics [27].

Library of activation data, ADL-3. The library was formed in 1992 for the calculation of the activation of the structure materials in nuclear facilities with high neutron fluxes [28]. The library contained over 20 thousand neutron-induced cross sections in the energy range up to 20 MeV, including targets of radioactive isotopes and isomers with lifetimes longer than one hour.

For most reactions without experimental data, the cross-sections were calculated with help of the theoretical models, the parameters of which were preliminarily verified on the available data for the cross sections of stable isotopes. A considerable number of the ADL evaluations had been included in the international library for thermonuclear reactors, FENDL/2.0 (1997), as well as in the European activation libraries EAF-99 and JEFF-3.1/A.

Library MENDL (the Medium Energy Nuclear Data Library). The library contains neutron and proton induced cross sections for the energy range 1-100 MeV for 500 stable and radioactive nuclei. The library was created on the basis of theoretical calculations. The work was performed in cooperation with the Institute of Atomic Energy (Obninsk) [29].

Library of activation data, ACDAM. It was created in 2009 on the basis of the foreign and the national evaluated data. The library included the computer codes, which could be used for the calculation of activation and transmutation of nuclear isotopes [30].

Activation data library, BROND-3A. was created between 2005 and 2011 on the basis of evaluations of the threshold nuclear reactions for practically all nuclides with the lifetimes more than 3-5 hours. The library contained data for 570 isotopes [31].

Russian dosimetry file, RDF-98. This library was formed in 1992 [32]. It contained the recommended activation cross sections that were widely used in the reactor spectrum dosimetry. Most of these cross sections were included in the international dosimetry file IRDF-2002 available in the IAEA site [33]. The CJD members continued to work actively on increasing the dosimetry reaction list. The corresponding new evaluations were included in the latest version of the library IRDF-2012.

Library of photo-neutron data, BOFOD-90. The library was created in 1992 under the leadership of A.I. Blokhin. Initially, it contained data for 27 elements. On the basis of this library, a system of photo-neutron group constants had been created [34]. In subsequent years, the work on the expansion of BOFOD-90 had continued. The evaluated data from this library had been included into the international library created by the NDS of IAEA[35].

Conclusion

Many years ago, Professor L.N. Usachev was wondering whether the evaluators and the experimentalists could understand each other. The CJD experience has shown that they not only understand each other, but also effectively interact with each other. The libraries of evaluated data available nowadays were produced as a result of the effective international collaboration of the high-level specialists in nuclear theory, measurements, and evaluation.

The nuclear data activity is an example of the well-organized work of nuclear specialists at both the national and the international levels. This work involved dozens of countries; in our country it involved about 20 institutes and organizations. Such cooperation should be maintained as an exemplary one for the future nuclear data activity. For many applications, the accuracy of the available data still is not good enough, and there are many requests for the nuclear data improvements at various branches of nuclear technology.

Intensive development of computers and the creation of Internet in the current century has considerably changed the work with nuclear data. Large computers and data storage on magnetic tapes have disappeared, this resulted in the decrease of the technical personnel involvement for the data request service. The efficiency of the work on nuclear data evaluation has considerably

increased. However, the required data accuracies in certain nuclear applications have not been yet achieved. This means that the main tasks of nuclear data centers remain, and the work should be continued.

Summarizing the CJD history we would like to express our great gratitude to many our colleagues over the world for their cooperation.

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