International Atomic Energy Agency

INDC(NDS)-375
Distrib.: G+RP

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

Summary Report of the Third Research Co-ordination Meeting on Measurement, Calculation and Evaluation of Photon Production Data

Bled near Ljubljana, Slovenia
29 September to 3 October 1997

Prepared by

Pavel OBLOŽINSKÝ
IAEA Nuclear Data Section
Vienna, Austria

January 1998

IAEA NUCLEAR DATA SECTION, WAGRAMERSTRASSE 5, A-1400 VIENNA

Reproduced by the IAEA in Austria
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Abstract

The present report contains the account of the last meeting of the Co-ordinated Research Project on "Measurement, Calculation and Evaluation of Photon Production Data". In addition to the summary of the meeting, the overall results achieved under the project in 1994-1997 are summarized, including the list of publications. The status of work on the Final Report of the project is also given.

January 1998

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1 Summary of the Meeting

1.1 Objectives and Participation

The 3rd Research Co-ordination Meeting (RCM) on "Measurement, Calculation and Evaluation of Photon Production Data" was held in Bled near Ljubljana, from 29 September to 3 October 1997. The local host of the meeting was Prof. F. Cvelbar, Institute Jožef Stefan, Ljubljana. F.S. Dietrich, LLNL, Livermore, U.S.A. served as a chairman of the meeting. The scientific secretary was P. Obložinský, Nuclear Data Section, IAEA, Vienna.

The purpose of the meeting was to review the work performed under the Co-ordinated Research Project (CRP) since the 2nd RCM, particularly to review the draft of the Final Report of the CRP. The detailed Agenda is attached (see Appendix 1).

The meeting was attended by the chief scientific investigators or by their representatives of all 10 laboratories participating in the project, and by 2 cost-free observers. The participating laboratories were represented by E. Běták (IP SAS, Bratislava, Slovakia), F. Cvelbar (IJS, Ljubljana, Slovenia), J.K. Dickens (ORNL, Oak Ridge, U.S.A.), F.S. Dietrich (LLNL, Livermore, U.S.A.), J. Kopecky (JUKO, Alkmaar, The Netherlands), A. Mengoni (ENEA, Bologna, Italy), A. Pavlik (IRK, Vienna, Austria), K. Shibata (JAERI, Tokai-mura, Japan), S.P. Simakov (IPPE, Obninsk, Russia) and S. Unholzer (TU, Dresden, Germany). In addition, A. Likar and T. Vidmar (both IJS, Ljubljana, Slovenia) attended as observers. The full list including affiliations is attached (see Appendix 2).

1.2 Progress since the 2nd RCM

Progress reports were delivered by all CRP participants. The following results were achieved:

* A. Pavlik/H. Vonach (Austria, IRK Vienna): measurements of photon data for reactions with energetic neutrons and protons were completed;
* S. Unholzer (Germany, TU Dresden): benchmark data for slab experiment and mockup experiment of the ITER design were completed;
* A. Mengoni (Italy, ENEA Bologna): evaluation of gamma production for ^{7}Li was completed;
* K. Shibata (Japan, JAERI Tokai-mura): benchmark data for sphere and cylinder data were documented, evaluation of Fe and Ni was documented;
* J. Kopecky (Netherlands, JUKO Alkmaar): NGATLAS was completed, file of gamma ray strength functions was completed;
* S.P. Simakov (Russia, IPPE Obninsk): compilation of discrete gamma rays at 14 MeV was completed;
* E. Běták/S. Hlaváč (Slovakia, IP SAS Bratislava): comparison of preequilibrium calculations with GNASH was performed, measurements at 14 MeV were completed;
* F. Cvelbar/A. Likar (Slovenia, IJS Ljubljana): compilation and assessment of DSD codes were completed;

* J.K. Dickens (U.S.A., ORNL Oak Ridge): review of photon production codes was completed;
* F.S. Dietrich (U.S.A., LLNL Livermore): review of capture above 10 MeV was completed.

In addition to these presentations, actions from the previous meeting (2nd RCM held in Vienna, 21-24 May 1996, see Report INDC(NDS)-357) were specifically reviewed. It was found that 13 out 16 actions were successfully completed. Uncompleted remained the precise measurement of 847 keV gamma rays from ^{56}Fe, compilation of gamma ray production at neutron energies above 14 MeV, and the study on level densities for gamma production.

As a major common result since the last meeting, the draft of the Final Report of the CRP was prepared (see next Chapter for more details). As a consequence, partial progress reports are not included into the present document since all the results will be duly reflected in the Final Report of the CRP.

1.3 Main Conclusions

The meeting resulted in 3 main accomplishments, described in more detail in the following Chapters and summarized briefly below:

a. An assessment of how well the objective of the CRP were met. It was concluded that the CRP objectives were largely met (see Chapter 2 for more details). In particular, the CRP assessed the status of photon production data for applications, produced several useful compilations, measured new microscopic data and integral benchmarks, improved calculational procedures particularly in describing neutron capture, and produced recommendations for future evaluations.

b. Establishment of procedures for completing the Final Report. The Final Report of the CRP should be published as an IAEA TECDOC. A. Mengoni (Italy, ENEA Bologna) will serve as an editor of the report. The first draft of this report was reviewed in the present meeting, a number of corrections were proposed and a detailed procedure for final revisions was agreed upon (see Chapter 3). It is understood that the final reviewing and formatting of the document needs appreciable time and attention of the editor. It is planned that the revised draft will be prepared for submittal to the IAEA Publication Committee in March 1998.

c. Proposal for a Workshop. It was concluded that the subject of photon production data, particularly the evaluation methodology, requires further attention and improvements. This is largely due to new emerging non-energy applications that are concerned with nuclear processes well outside the scope of data needed for power reactors, such as medical applications, transmutation, and accelerator driven systems. To this end, the participants recommended to organize a specialized Workshop on Photon Evaluation Methodology (see Chapter 4 for details).

2 Summary of the CRP Results

The goal of the CRP was to examine the current status of measurements, calculations and evaluations of photon production data with emphasis on neutron induced reactions, work out procedures and methods to be recommended for future evaluations, and improve selected photon production cross sections in internationally recognized general purpose data libraries. These problems were addressed by the CRP during 1994-1997, with 3 research co-ordination meetings held in Bologna 1994, Vienna 1996 and Bled 1997. The results can be summarized as follows:

2.1 Measurements

Experimental developments were primarily concerned with measurements of discrete gamma-ray production cross sections. Precision measurement of the production of 847-keV gamma-rays from ^{56}Fe in the 1-4 MeV neutron energy range was motivated by the pressure vessel surveillance dosimetry (measurements are currently under completion). Careful measurements on 8 medium-heavy nuclei (Na, Al, Si, P, K, V, Mn, Mo), motivated mostly by fusion applications, were done at the 14-MeV neutron facility in Bratislava. Measurements at the Los Alamos WNR facility of gamma production induced by a white neutron source up to 200-400 MeV, done in collaboration with IRK Vienna, provided data for a sensitive test of nuclear reaction model calculations, of importance for transmutation applications. Of special interest is a new multidetector array (GEANIE) for continuing these measurements. In addition, an extensive set of integral measurements with 14 MeV neutrons was performed partly in JAERI and partly in Dresden, of importance for quality assurance procedures for evaluated nuclear data libraries.

2.2 Calculations

New developments in the calculations were largely concerned with two open problems in modelling photon production, namely the unsatisfactory situation in various aspects of radiative capture and inconsistencies in the use of preequilibrium models.

Thus, the direct radiative capture model was successfully applied to produce much improved photon production on C, O and Li for $E_n < 1$ MeV, with results already included into the Japanese Evaluated Nuclear Data Library JENDL-3.2. Next, modelling of high energy (above 10 MeV) gamma rays was addressed, partially motivated be the needs to improve shielding calculations. These developments include an extension of the direct-semidirect (DSD) model to treat unbound final states that was successfully tested on a data set of 34-MeV proton capture. Also, of interest are attempts to understand the origin of the imaginary coupling in the semidirect form factor and the phenomenological separation of the DSD from multistep mechanisms. Finally, a consistent preequilibrium exciton model that includes spin effects was tested against (n,xgamma) data and successfully compared with the recommended code GNASH.

2.3 Compilations, Evaluations and Benchmarking

Completed was a comprehensive Atlas of Neutron Capture Cross Sections comprising 737 target nuclei for neutrons up to 20 MeV. An update of the status of gamma-ray strength functions was made and a file of recommended strength functions was prepared. A compilation of discrete gamma ray production for all practically important elements with 14 MeV neutrons was prepared. Also, a compilation of experimental results on capture gamma rays for neutrons above 10 MeV was completed. New evaluations of photon production for light materials C, O and Li, and for constructional materials Ni and Fe were completed. Benchmark tests of gamma production were performed for a number of materials for the evaluated libraries JENDL-3.2, JENDL Fusion File and FENDL-1, providing an important assessment of the quality of these files. A specific effort was devoted to an integral test of neutron-induced photon production for Fe and comparison with Monte Carlo calculations using the EFF-2 library.

2.4 Output and Publications

The output of the CRP includes several stand alone databases and compilations, 5 new evaluations, new measurements of discrete gamma rays and integral experiments, and new calculations. These results are freely available, they are described in a number of publications, and summarized in the approximately 250 pages of the Final Report of the CRP (under preparation). It is furthermore expected that JAERI and Dresden will submit their photon benchmark data for inclusion into the IAEA fusion benchmarks file which is a part of the FENDL library.

Databases and compilations:

- Neutron Capture Gamma Ray Atlas (NGATLAS). Available on the IAEA Nuclear Data Section Web server (http://www.iaea-nds.or.at/ngatlas).
- File of gamma ray strength functions needed for evaluation of photon production data by theoretical methods. Included into the IAEA Reference Input Parameter Library. Available on the IAEA Nuclear Data Section Web server (http://www.iaea-nds.or.at/ripl).
- Compilation of codes for photon production data. Available as electronic publication ORNL/RSIC-57 (Oak Ridge 1997) on the ORNL Web server (details to be specified).
- Critical compilation of discrete gamma rays in reactions with 14 MeV neutrons, motivated by fusion applications. Available as a part of the CRP Final Report.
- Data for integral benchmarking of photon production, needed by the quality assurance process of evaluated data libraries. Available as a part of the CRP Final Report.

Evaluations:

- Light nuclei C, O and Li. Available through the JENDL-3.2 file.
- Constructional materials Fe and Ni. Available through the JENDL-FF file.

Publications:

Specifically mentioned should be 3 extensive publications, a comprehensive atlas of neutron capture cross sections, a summary of computer programs for photon data, and atlas of energy-angular distributions of gamma rays:

* J. Kopecky et al. "Atlas of Neutron Capture Cross Sections (NGATLAS)", Report INDC(NDS)-362 (IAEA, Vienna, April 1997), 369 pages;
* J. White et al. "Computer Programs and Data Libraries Pertaining to Photon Production Data", Report ORNL/RSIC-57, available electronically, 160 pages;
* A.I. Blokhin et al. "Atlas of Energy-Angular Distribution of Gamma Rays Produced in Neutron Reactions", Report INDC(CCP)-387 (IAEA, Vienna, February 1996), 140 pages.

In addition, the Final Report of the CRP will be published in 1998, and more than 80 individual scientific and technical papers were published (see Appendix 3 for the full list).

2.5 Performance Criteria for Satisfying the CRP Objectives

The CRP adopted several procedures towards meeting its objectives. First, tasks for each CRP member were precisely formulated and deadlines specified. Results were reported and reviewed at each RCM. Second, results of the CRP were reported in the major international meetings (Capture Conference in Budapest 1996, and Nuclear Data Conference in Trieste 1997). Third, a number of papers were published in scientific journals, subject to the peer review system.

3 Final Report of the CRP

The draft of the Final Report, prepared before the present meeting, was discussed in detail at the meeting. It was agreed that the Final Report will be produced in the form of the IAEA TECDOC. It is understood that the Final Report is not meant as a collection of individual papers. Rather it puts the results of the CRP into the context of the CRP objectives, and provides a set of recommendations for evaluators of photon production data, including measurements.

The revised outline of the Final Report, specific actions, including procedures and deadlines for its completion are summarized below.

3.1 Outline

The title of the TECDOC will be "Measurement, Calculation and Evaluation of Photon Production Data" with the subtitle "Final Report of the Co-ordinated Research Project". Given below is the shortened version of the revised outline (for the full version see Appendix 4).

3.2 Specific Actions

The status of the various contributions to the Final Report, individuals responsible for each contribution, and the deadline for receiving the completed version are summarized in Appendix 4.

3.3 Procedures and Deadlines

The revised version of each individual contribution to the Final Report will be collected by F.S. Dietrich (LLNL Livermore). He will transfer the whole document to A. Mengoni (ENEA Bologna) who will serve as the editor of the report. It is understood that the reviewing and formating of the revised document needs appreciable time and attention of the editor. The goal is to prepare the report for the submittal to the IAEA Publication by the end of March 1998.

Summary of actions and deadlines:
- Submittal of revised and missing contributions to F.S. Dietrich before 27 October 1997 or as otherwise indicated in Appendix 4 (action: all CRP participants).
- Completion of the revised draft (action: A. Mengoni, 31 December 1997).
- Distribution of the revised draft to all CRP participants for comments (action: P. Obložinský, 31 January 1998).
- Collection of comments from the CRP participants (action: P. Obložinský, 28 February 1998).
- Submittal of the Final Report to the IAEA Publication Committee (action: P. Obložinský, 31 March 1998).

4 Proposal for a Workshop

The work performed in this CRP showed that integral benchmarking is extremely important for checking the accuracy of evaluated data files. As an example, Fe and Ni evaluations were revised because of the large discrepancies that were revealed by testing against integral data.

This is one of the arguments why evaluation methodology requires further attention and continuing improvement. This finding is particularly applicable to newly emerging non-energy applications that are concerned with nuclear processes well outside the scope of data needed for power reactors. These include medical applications, transmutation, and accelerator driven systems. It should be noted that in these applications one faces a massive amount of photons produced by nuclear interactions. Consequences of this are the increased shielding requirements and the additional release of nuclear heat caused by subsequent interactions of photons with matter.

In response to this situation, the participants in the present CRP recommend the organization of a specialized Workshop on Photon Evaluation Methodology. This Workshop would provide a broad forum for exchange of ideas and experiences on both model development and evaluation methods. However, this Workshop should be different from the 1994 NEA Specialists' Meeting on Photon Production Data in the sense that the principal emphasis should be placed on evaluation methodology.

Appendix 1

3rd Research Co-ordination Meeting on
"Measurement, Calculation and Evaluation of Photon Production Data"
Villa Plemelj, Presernova 39, Bled, Slovenia
29 September to 3 October 1997

AGENDA

*** Monday, 29 September 1997**

09:00-09:30 **Opening** (Local Host, IAEA Representative)
- Adoption of Agenda
- Announcements

09:30-12:30 **Review of Actions from the 2nd Meeting** (P. Obložinský)
Progress Reports (15' each)
1. A. Pavlik (Includes also H.K. Vonach)
2. S. Unholzer
3. A. Mengoni
4. K. Shibata
5. J. Kopecky
6. S.P. Simakov
7. E. Běták (includes also S. Hlaváč)
8. F. Cvelbar and A. Likar
9. J.K. Dickens
10. F.S. Dietrich

Notes: *Progress Reports should be kept short and informative, each reporter should give a brief overview, in 15', of the work done after the 2nd Meeting. More detailed reports may be useful later when reviewing the draft of the Final Report.*

12:30-14:00 Lunch break

14:00-18:00 **Review of the Draft of the Final Report**
- Comments from the Editor (F.S. Dietrich)
- Comments from Participants
- General Discussion
  * Outline and Scope
  * Style and Format
  * Procedures
- Creation of Working Groups for a detailed Review

*** Tuesday, 30 September 1997**

09:00-12:30 Review of the Draft of the Final Report continued
- Detailed Review by the Working Groups

12:30-14:00 Lunch break

14:00-18:00 Review of the Draft of the Final Report continued
- Detailed Review by the Working Groups

19:00- Dinner

*** Wednesday, 1 October 1997**

09:00-12:00 Review of the Draft of the Final Report continued
- Plenary: Reports from the Working Groups

12:00-13:00 Lunch break

13:00- Excursion to the Institute Jožef Stefan followed by the Meeting Dinner
(Details to be specified by the Local Host)

*** Thursday, 2 October 1997**

09:00-12:30 Updating of the Draft of the Final Report
- All Participants: Updating of the Contributions

12:30-14:00 Lunch break

14:00-16:00 Updating of the Draft of the Final Report continued
- Plenary: Concluding Discussion

16:00-18:00 Drafting of the Meeting Report
- Summary of the CRP Results
- Status of the CRP Final Report

19:00- Dinner

*** Friday, 3 October 1997**

09:00-12:30 Drafting of the Meeting Report continued
- Conclusions and Recommendations
- Procedures for completing the Final Report
- Follow-up Actions

12:30-14:00 Lunch break

14:00-16:00 Adoption of the Meeting Report
Concluding Statements
Adjournment

334-F4-RC-571.3 **Appendix 2**

INTERNATIONAL ATOMIC ENERGY AGENCY

Third Research Co-ordination Meeting on
"Measurement, Calculation and Evaluation of Photon Production Data"

Bled near Ljubljana, Slovenia
29 September to 3 October 1997

Scientific Secretary: Pavel OBLOŽINSKÝ

LIST OF PARTICIPANTS

CRP Participants:

1. Dr. Andreas PAVLIK
[will attend the meeting for
Dr. Herbert K. VONACH]
Institut für Radiumforschung
und Kernphysik der Universität Wien
Boltzmanngasse 3
A-1090 Vienna
AUSTRIA

Res. Agreement No. 8026/CF

Fax: +43-1-31367-3502
Phone: +43-1-31367-3515
Net: pavlik@pap.univie.ac.at

2. Dr. Siegfried UNHOLZER
Institut für Kern- und Teilchenphysik
Fakultät für Naturwissenschaften
und Mathematik
Technische Universität Dresden
Mommsenstraße 13
D-01069 Dresden
GERMANY

Res. Agreement No. 8208/CF

Fax: +49-351-463-7292
Phone: +49-351-463-3166
Net:
unholzer@pktw11.phy.tu-dresden.de

3. Dr. Alberto MENGONI
Dipartimento Innovazione
Settore Fisica Applicata
ENEA
- Ente per le Nuove tecnologie,
l'Energia e l'Ambiente
Viale G.B. Ercolani, 8
I-40138 Bologna
ITALY

Res. Agreement No. 8596/CF

Fax: +39-51-6098-359
Phone: +39-51-6098-318
Net: #balme1@iboenea.bologna.enea.it
Net: mengoni@rikvax.riken.go.jp

4. Dr. Keiichi SHIBATA
Department of Reactor Engineering
Nuclear Data Center
Japan Atomic Energy Research Institute
Tokai-mura, Naka-gun
Ibaraki-ken 319-11
JAPAN

Res. Agreement No. 8107/CF

Fax: +81-29-282-6122
Phone: +81-29-282-5907
Net: shibata@cracker.tokai.jaeri.go.jp

5. Dr. Jura KOPECKY
Kalmanstraat 4
NL-1817 HX Alkmaar
THE NETHERLANDS

Res. Agreement No. 7911/CF

Fax:
Phone: +31-72-5114054
Net: research1@pi.net

6. Dr. Stanislav P. SIMAKOV
Department of Nuclear Physics
Institute of Physics
and Power Engineering
Ploschad Bondarenko
249020 Obninsk, Kaluga Region
RUSSIA

Res. Contract No. 7809/RB

Fax: +7-095-2302326
Fax: +7-095-8833112
Phone: +7-08439-98272
Net: simakov@ippe.rssi.ru

7. Dr. Emil BĚTÁK
Department of Nuclear Physics
Institute of Physics
Slovak Academy of Sciences
Dúbravská cesta 9
SK-842 28 Bratislava
SLOVAKIA

Res. Contract No. 7811/RB

Fax: +421-7-376085
Phone: +421-7-3782715
Phone: +421-7-3782925
Net: betak@savba.sk

8. Dr. Franc CVELBAR
Department for Low and Medium
Energy Physics
Institute "Jožef Stefan"
Jamova 39
P.O. Box 100
1111 Ljubljana
SLOVENIA

Res. Contract No. 7810/RB

Fax: +386-61-219385
Phone: +386-61-1766-500
Phone: +386-61-1773-325
Net: franc.cvelbar@ijs.si

9. Dr. J. Kirk DICKENS
Oak Ridge Electron Linear Accelerator (ORELA)
Joint Institute for Heavy Ion Research
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, TN 37831-6354
U.S.A.

Res. Agreement No. 7913/CF

Fax: +1-423-576-8746
Phone: +1-423-574-4489
Net: jkd@astrov.phy.ornl.gov

10. Dr. Frank S. DIETRICH
Lawrence Livermore National Laboratory
7000 Avenue
P.O. Box 808, MS L-028
Livermore, CA 94551
U.S.A.

Res. Agreement No. 7912/CF

Fax: +1-510-423-3371
Phone: +1-510-422-4521
Net: dietrich2@llnl.gov

Observer:

11. Dr. Andrej LIKAR
Department for Low and Medium Energy Physics
Institute "Jožef Stefan"
Jamova 39
P.O. Box 100
1111 Ljubljana
SLOVENIA

Fax: +386-61-219385
Phone: +386-61-1766-500
Net: andrej.likar@ijs.si

12. Dr. Tim VIDMAR
Department for Low and Medium Energy Physics
Institute "Jožef Stefan"
Jamova 39
P.O. Box 100
1111 Ljubljana
SLOVENIA

Fax: +386-61-219385
Phone: +386-61-1766-500
Net: franc.cvelbar@ijs.si

Scientific Secretary:

13. Dr. Pavel OBLOŽINSKÝ (Scientific Secretary of the Meeting)
IAEA Nuclear Data Section
Wagramerstrasse 5
P.O. Box 100
A-1400 Vienna
AUSTRIA

Fax: +43-1-20607
Phone: +43-1-2060-21712
Net: oblozinsky@iaeand.iaea.or.at

Appendix 3

List of Publications produced by the CRP

Given below is a list of 82 technical and scientific papers and reports published by the CRP participants as a result of their activity in the framework of the present CRP in 1994-1997. The publications are arranged along the individual laboratories, common papers are listed only once (under the laboratory of its first author).

• Austria, IRK Vienna

1. H. Vonach et al. "^{207,208}Pb(n,xnγ) reactions for neutron energies from 3 to 200 MeV". Phys. Rev. C 50 (1994) 1952.

2. A. Pavlik et al. "^{207,208}Pb(n,xnγ) reactions for neutron energies up to 200 MeV" in J.K. Dickens, ed., Proc. Int. Conf. Nuclear Data for Science and Technology, Gatlinburg, USA, 9-13 May 1994 (American Nuclear Society, La Grange Park, IL 1994) Vol. 1, p. 363.

3. H. Hitzenberger et al. "Study of ^{27}Al(n,xγ) up to E_n=400 MeV" in J.K. Dickens, ed., Proc. Int. Conf. Nuclear Data for Science and Technology, Gatlinburg, USA, 9-13 May 1994 (American Nuclear Society, La Grange Park, IL 1994) Vol. 1, p. 367.

4. A. Pavlik et al. "Measurement of gamma-ray production cross sections in neutron induced reactions for Al and Pb" in C. Coceva et al., eds., Proc. Specialists' Meeting on Measurement, Calculation and Evaluation of Photon Production Data, Bologna, Italy, 9-11 Nov. 1994, Report NEA/NSC/DOC(95)1 (ENEA, Bologna 1995) p. 33.

5. A. Pavlik et al. "^{208}Pb(n,pxnγ) reactions for neutron energies up to 200 MeV" in P. Obložinský, ed., Measurement, Calculation and Evaluation of Photon Production Data, (text of papers presented at the first research co-ordination meeting, Bologna, Italy, 14-17 Nov. 1994), Report INDC(NDS)-334 (IAEA, Vienna 1995) p. 39.

6. H. Vonach et al. "Spallation reactions in ^{27}Al and ^{56}Fe by 800 MeV protons" Phys. Rev. C 55 (1997) 2458.

7. A. Pavlik et al. "^{27}Al(n,xγ) reactions for neutron energies from 3 to 400 MeV" submitted to Phys. Rev. C.

8. H. Vonach et al. "Spallation reactions in ^{27}Al and ^{56}Fe induced by 800 MeV protons". Proc. Int. Conf. Nuclear Data for Science and Technology, Trieste, 19-24 May 1997, in press.

• Germany, TU Dresden

1. H. Freiesleben et al. "An integral test of neutron-induced photon production data for iron". In Report INDC(NDS)-334 (IAEA, Vienna 1995) pp. 137-138.

2. W. Hansen et al. "Test of neutron and photon data in an iron benchmark experiment with 14 MeV neutrons". Proc. Int. Conf. on Nuclear Data, Gatlinburg (USA), 9-15 May 1994 (ed. J.K. Dickens) p. 913.

3. W. Hansen et al. "Gap influence on neutron and photon penetration of an Fe-shield irradiated with 14 MeV neutrons". Proc. Int. Conf. on Nuclear Data, Gatlinburg (USA), 9-15 May 1994 (ed. J.K. Dickens) p. 910.

4. H. Freiesleben et al. "Investigation of neutron and photon fluxes penetrating an iron shield assembly". Proc. 18th Symp. on Fusion Technology, Karlsruhe (Germany), 22-26 Aug. 1994 (ed. K. Herschbach et al.) p. 1365.

5. H. Freiesleben et al. "Experimental investigation of neutron and photon penetration and streaming through iron assemblies". Fusion engineering and design 28 (1955) pp. 545-550.

6. H. Freiesleben et al. "Report on detailed design of neutron and gamma spectra measurements". Report TUD-IKTP/95-02 (Dresden, April 1995).

7. S. Guldbakke et al. "Response matrices of NE-213 scintillation detectors for neutrons". ASTM STP 1228, American Society for Testing Materials, Philadelphia, 1995 (ed. H. Farrar et al.) pp. 310-322.

8. H. Freiesleben et al. "Measurement and analysis of spectral neutron and photon fluxes in an ITER shield mock-up". Proc. 19th Symp. on Fusion Technology, Lisbon (Portugal), 16-20 Sept. 1996 (ed. C. Varandas et al.) p. 1571.

9. H. Freiesleben et al. "Test of photon production data in integral experiments with 14 MeV neutrons". In Report INDC(NDS)-357 (IAEA, Vienna 1996) p. 51.

10. U. Fischer et al. "Test of evaluated data from libraries for fusion applications in an ITER shield mock-up experiment". Proc. Int. Conf. on Nuclear Data, Trieste, 19-24 May 1997, in press.

11. U. Fischer et al. "Improved neutron cross-section data for Fe^{56} and application to an integral fusion neutronics experiment". Proc. Int. Conf. on Nuclear Data, Trieste, 19-24 May 1997, in press.

• Italy, ENEA Bologna

1. A. Mengoni et al. "Electromagnetic transitions in halo nuclei" Proc. Int. Conf. on Nuclear Data for Science and Technology, Trieste, 19-24 May 1997, in press (1997).

2. T. Nakamura et al. "Coulomb excitation of ^{11}Be", Physics Letters B 394 (1997), p. 11.

3. A. Mengoni et al. "Coulomb dissociation processes and capture reaction rates of unstable nuclei". Proc. Workshop on Nuclear Astrophysics. C. Spitaleri, ed., INFN-LNS Report, in press (1997).

4. A. Mengoni et al. "Neutron capture and neutron halos". Proc. Int. Symp. on Capture Gamma-ray and Related Topics. G. Molnár, ed., Springer Verlag, in press (1997).

5. A. Mengoni et al. "Exotic structure of light nuclei and their neutron capture reaction rates". Proc. Int. Conf. "Nuclei in the Cosmos". University of Notre Dame, 20-27 June 1996, Nucl. Phys., A621 (1997) p. 323c.

6. A. Mengoni et al. "Exotic properties of light nuclei and their neutron capture cross sections". Proc. Int. Seminar on Interaction of Neutrons with Nuclei, Dubna (Russia), 27-30 April 1996. W.I. Furman, ed., Report E3-96-336 (1996) p. 165.

7. A. Mengoni "New aspects of the neutron capture of light nuclei". 1st Int. Internet Symp. on Nuclear Data, 1996.

8. A. Mengoni et al. "Exotic properties of light nuclei and their neutron capture reaction rates". In "origin of matter and evolution of galaxies". T. Kajino et al., eds., World Scientific, Singapore (1996), p. 264.

9. F. Käppeler et al. "Neutron capture cross sections of the cerium isotopes for the s- and p-process studies". Physical Review C 53 (1996) 1397.

10. A. Mengoni et al. "Direct radiative capture of p-wave neutrons". Physical Review C 52 (1995) R2334.

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Title: Measurement, Calculation, and Evaluation of Photon Production Data
Final report of a coordinated research project

Responsibility				Status	Deadline
Oblozinsky	---	FORWARD		not yet written	15 Nov
Oblozinsky	---	CONTENTS		not yet written	15 Nov
	1	INTRODUCTION			
Oblozinsky		1.1	Background and scope of the CRP	first draft available, needs revision	15 Nov
Oblozinsky		1.2	Overview of the topics covered	first draft available, needs revision	15 Nov
Oblozinsky		1.3	Specific accomplishments of the CRP	first draft available, needs revision	15 Nov
		---	References		
	2	MEASUREMENTS			
Dickens		2.1	Introduction	from relevant abstracts + handwritten version	27 Oct
Dickens		2.2	Precision measurements of discrete gammas	on hold pending result of expt	27 Oct
Hlavac		2.3	Discrete gamma measurements at 14 MeV	revised version to Hlavac via Betak for review	27 Oct
		2.4	Gammas from medium and high energy reactions		
Dickens			2.4.1 Overview, medium and high energies	abstracts from Pavlik	27 Oct
Pavlik			2.4.2 Incident neutrons	complete	
Vonach			2.4.3 Incident protons	complete	
		---	References		
	3	INTEGRAL EXPERIMENTS AND BENCHMARK ANALYSES			
Dickens		3.1	Introduction	abstracts from Shibata and Unholzer	27 Oct
Shibata		3.2	Sphere experiments	new version expected	27 Oct
Shibata		3.3	Cylinder experiments	new version expected	27 Oct
Unholzer		3.4	Slab experiments	new figures and text modifications needed	27 Oct
Unholzer		3.5	ITER mockup experiments	complete	
		---	References		
	4	CALCULATIONS			
Dietrich		4.1	Introduction	not yet written	15 Nov
Cvelbar		4.2	Modeling 14-MeV neutron capture: overview	significant additions expected	15 Nov
Betak		4.3	Preequilibrium and GNASH calculations	complete	
		4.4	Direct-Semidirect calculations		
Dietrich			4.4.1 Overview of DSD calculations	from Dietrich/Likar abstracts	27 Oct
Dietrich			4.4.2 Extensions of DSD model	minor changes needed in 1 fig. and 1 ref.	27 Oct
Likar			4.4.3 Consistent DSD; imaginary form factor	complete	
Mengoni		4.5	Photon production in light nuclei	minor changes needed	27 Oct
		---	References		
	5	COMPILATIONS			
Dickens		5.1	Introduction	handwritten version	
		5.2	Gamma production		
Dickens			5.2.1 Overview of gamma production compilations	handwritten version	
Dickens			5.2.2 Gammas for neutrons from threshold to 13 MeV	new version; need to type	

Simakov			5.2.3	Discrete gammas at 14 MeV	revised; need electronic version	27 Oct
Vonach			5.2.4	Gammas for neutrons above 20 MeV	Dietrich/Oblozinsky to contact Vonach	?
		5.3	Radiative capture			
Kopecky			5.3.1	Overview of compilations relevant to capture	material from submitted abstracts	27 Oct
Kopecky			5.3.2	Atlas of neutron capture cross sections	complete	
Dietrich			5.3.3	Capture spectra for neutrons above 10 MeV	Cvelbar will provide additional matl.	27 Oct
Mengoni			5.3.4	Capture in light nuclei	text complete; figures needed	27 Oct
Kopecky		5.4	Experimental data base for gamma ray strength functions		text complete; table will be revised	27 Oct
		—	References			
	6	EVALUATIONS				
Dickens		6.1	Introduction		material from submitted abstracts	27 Oct
Mengoni		6.2	Evaluations for 7Li, 12C, 13C and O		minor changes needed	27 Oct
Shibata		6.3	Evaluations for Fe and Ni		text complete; figures needed	27 Oct
Dickens		6.4	Assessment of evaluations for Li, Cr, and Ni		not yet written	27 Oct
		—	References			
	7	CODES				
Dickens		7.1	Introduction		material from submitted abstracts	27 Oct
Dickens		7.2	General photon production codes		complete	
Betak		7.3	Preequilibrium codes		minor changes needed	27 Oct
Cvelbar		7.4	Direct-semidirect codes		documentation of Kitazawa code expected	27 Oct
		—	References			
	8	RECOMMENDED PROCEDURES AND INPUT PARAMETERS				
Dietrich		8.1	Introduction		material from submitted abstracts	15 Nov
Mengoni		8.2	Level densities		not yet written	27 Oct
Kopecky		8.3	Recommended strength functions		text complete; figures must be redrawn	15 Nov
Betak		8.4	Recommendations for preequilibrium calculations		minor changes needed	27 Oct
Cvelbar		8.5	Recommendations for DSD calculations		section on recommended pars expected	27 Oct
Mengoni		8.6	Recommendations for capture in light nuclei		complete	
		—	References			
	9	SUGGESTED EXPERIMENTS				
Dietrich		9.1	Introduction		to be written from discussion notes	15 Nov
Dietrich		9.2	Cross section measurements		to be written from discussion notes	15 Nov
Dietrich		9.3	Integral benchmark experiments		to be written from discussion notes	15 Nov
		—	References			
Oblozinsky	—	CRP PARTICIPANTS AND OTHER CONTRIBUTORS			not yet written	15 Nov
Oblozinsky	A	PUBLICATIONS ASSOCIATED WITH THIS CRP			needs to be completed; minor changes	15 Nov

Nuclear Data Section
International Atomic Energy Agency
P.O. Box 100
A-1400 Vienna
Austria

e-mail: services@iaeand.iaea.or.at
fax: (43-1)20607
cable: INATOM VIENNA
telex: 1-12645 atom a
telephone: (43-1)2060-21710

online: TELNET or FTP: iaeand.iaea.or.at
username: IAEANDS for interactive Nuclear Data Information System
username: ANONYMOUS for FTP file transfer
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