International Atomic Energy Agency

INDC(NDS)-222
Distr. G+P

INDC

INTERNATIONAL NUCLEAR DATA COMMITTEE

PROGRESS

IN

FISSION PRODUCT NUCLEAR DATA

Information about

activities and requirements

in the field of measurements and compilations/evaluations

of fission product nuclear data (FPND)

collected

by

M. Lammer

Nuclear Data Section
International Atomic Energy Agency
Vienna, Austria

No. 13
1990

INDC(NDS)-222
Distr. G+P

PROGRESS

IN

FISSION PRODUCT NUCLEAR DATA

Information about

activities and requirements

in the field of measurements and compilations/evaluations

of fission product nuclear data (FPND)

collected

by

M. Lammer

Nuclear Data Section
International Atomic Energy Agency
Vienna, Austria

No. 13
1990

NOT FOR PUBLICATION

Reproduced by the IAEA in Austria
November 1990

90-05668

FOREWORD

This is the 13th issue of a report series on Fission Product Nuclear Data (FPND) which is published by the Nuclear Data Section (NDS) of the International Atomic Energy Agency (IAEA). The purpose of this series is to inform scientists working on FPND, or using such data, about all activities in this field which are planned, ongoing, or have recently been completed.

The types of activities included in this report are measurements, compilations and evaluations of:

Fission product yields (neutron induced and spontaneous fission);
Neutron reaction cross sections of fission products;
Data related to the radioactive decay of fission products;
Delayed neutron data of fission products; and
Lumped fission product data (decay heat, absorption etc.).

The first part of this report consists of unaltered original contributions which the authors have sent to IAEA/NDS. Therefore, the IAEA cannot be held responsible for the information contained nor for any consequences resulting from the use of this information. Contributions containing information on the data types given above are accepted. Contributions on experimental work can usually be included repeatedly until the final publication is presented. Contributions on evaluations continue to be included as long as the data or files are not superseded.

The second part contains some recent references relative to fission product nuclear data, which were not covered by the contributions submitted, and selected papers from conferences. However, completeness of literature citations in this part is not attempted.

NOTE:

Part 3 contains requirements for further FPND measurements (see also "note to measurers" on page ix), which were recommended by specialists' meetings or Coordinated Research Programmes on FPND.

The 12th issue of this series has been published in January 1988 as as INDC(NDS)-191. The present issue includes contributions which were received by NDS between 1 January 1988 and 1 March 1990.

The next issue of this report series is envisaged to be published in spring 1992.

TABLE OF CONTENTS

Page numbers in brackets refer to collaborations, which are not listed under "Laboratory and Address".

	PTB Braunschweig	21,22
	Techn. Univ. Braunschweig	22
	Techn. Univ. Muenchen	23
	Univ. Goettingen	(23)
	Univ. Mainz	17,18,23,24,25
Hungary :	Kossuth Univ., Debrecen	25
	KFKI Budapest	2
India :	Andhra Univ.	26
	BARC, Trombay	27,28,29,30,31
	Panjab Univ., Chandigarh	32,33
Israel :	Negev Nucl. Res. Centre, Beersheba	(44)
Japan :	JAERI	34
	Kyoto Univ.	35
	Nagoya Univ.	36
Korea :	Mokwon Univ.	(36)
	Univ. of Yonsei, Seoul	36
Norway :	Univ. of Oslo	(37),(38),(39),(40)
Sweden :	Chalmers U. of Technol.,Goeteborg	(37),(38),(39),(40)
	U.Uppsala,Studsvik Neutron Res.Lab.	37,38,39,40
Taiwan :	Inst.Phys., A.S., Nankang, Taipeh	41
	Nat'l Tsing Hua Univ., Hsinchu . .	42
United Kingdom :	Imp. College Reactor Centre, Ascot	42
	Univ. of Birmingham	43,44
U.S.A. :	Ames Lab., Iowa State Univ. . . .	44
	ANL, Argonne	45
	BNL, Brookhaven	(44),46
	Clark Univ.	(44)
	Drexel Univ., Philadelphia, Penn.	(44)
	INEL, EG+G Idaho	46,47
	LLNL, Livermore	(44)
	ORNL, Oak Ridge	47,48
	Univ. of Idaho	(46)
	Univ. of Lowell, Mass.	49
	Univ. of Oklahoma	(44)
U.S.S.R. :	FEI, Obninsk	49,50,51
	Inst.Nucl.Phys., Kaz.SSR, Alma Ata	52
	Khlopin Radium Inst., Leningrad .	53
	Lensovjet Inst.Technol.,Leningrad	53
	Moscow Phys. Engineering Inst. . .	50
Yugoslavia :	Univ. of Zagreb	18

NOTE TO MEASURERS

The Consultants' Meeting on the "Compilation and Evaluation of Fission Yield Nuclear Data", Vienna, Austria, 27 - 29 September 1989, (see meeting summary on page 87) issued several recommendations and requests of relevance to measurers, which are summarized below:

1) EXFOR (EXchange FORmat) will be commonly used as the format and data base for the compilation and exchange of experimental fission yield data. It provides for the inclusion of detailed information on the experimental conditions and data analysis.
   Authors of papers which are compiled into EXFOR receive copies of the entries for proof-reading, which makes an EXFOR entry a publication which can be cited. Therefore it is essential that measurers respond to author proofs and exprimental details requested by the compiler.

2) Independent yield measurements are important for the improvement of semiempirical models and the prediction of decay heat via summation calculations.
   Special care should be taken by measurers to take into account isomeric yields and branching fractions for decay and delayed neutron emission, and the numerical values used should be given. It should be clearly stated whether the data are before or after delayed neutron emission. Measurers are urgently requested to publish sufficient details on the method used, and how these data were used in the analysis.

3) Publication of uncertainties and experimental details:
   Measurers should publish all contributions to the overall uncertainty in detail, i.e.: statistical error, systematic error contributions (determined or estimated), correlations and covariances (or at least estimates of correlation coefficients). Furthermore, sufficient details on the experiments, results, data and error analyses should be given which are pertinent for the data evaluation.
   If journal editors do not accept such lengthy descriptions of the experiments, the relevant details can be either
   - published in a laboratory report, or
   - communicated directly to evaluators. In any case should they be
   - provided to the EXFOR compiler for inclusion in the entry.

   This should also be done if errors in the data are detected or data are withdrawn by measurers.

4) Further measurements of fission yields are still needed. They are listed in detail in Part 3 of this issue. In summary, the following types of data are requested:
   - independent yields (isobaric, isotopic),
   - isomeric yields and yield ratios,
   - direct measurements of pairing effects,
   - measurements over fragment ionic charge states and kinetic energy,
   - all types of yields in the symmetric region,
   - ternary fission yields, also as a function of neutron energy,
   - chain yields, for which no measurement, only one measurement, or discrepant measurements exist.

   Regarding the last point, measurers are asked to look at the tables of discrepancies at the end of this issue, look at their own measurements and analyse the data.

SUBMITTING CONTRIBUTIONS

The next issue is expected to be publised in July 1989. All scientists who are presently working - or have recently completed work - in the field of FPND and who want to contribute to the next issue of this series are kindly asked to send contributions to me between now and 1 October 1991, so that they reach NDS before 15 October 1991.

Those scientists or groups who have already contributed to the present issue and who want to leave their contribution(s) unchanged or who wish to suggest only slight changes, should inform me accordingly before the above deadline.

FORMAT:

The size of one contribution should preferably not exceed one page. Of course, the number of contributions per working group or laboratory is not restricted. Similar experiments (calculations, compilations, evaluations) performed by one person or group should preferably be combined into one contribution, if this is possible without loss of clarity.

The headings suggested for the 3 types of contributions are shown on the following page. For the sake of consistency it is requested that the suggested headings be used as far as appropriate.

COMPILATIONS and EVALUATIONS: If applicable, the availability of numerical data from computer files could be indicated either under the heading "Computer files ..." or under a separate heading "Availability".

CONTACT: If desired, the name of the person to be contacted for further information or numerical data, or customer services in the case of data files, can be given.

EDITING: Since contributions received are generally used directly for publication, it is important that typed ORIGINALS are sent and not just carbon- or photocopies. It would be a great help for producing an edited report if a margin of 2 cm (or 1 inch for North American paper format) is left on each side of the text, and a 5 cm space is left at the top of each page (or 3 cm if the name of the country is included).

COMMENTS or SUGGESTIONS concerning the format, contents and layout of this report series are most welcome and should be directed to me in time before the next issue.

I would like to thank the contributors for their cooperation.

Meinhart Lammer

Suggested headings for:

Measurements:	Compilations:	Evaluations:
Laboratory and address:	Laboratory and address:	Laboratory and address:
Names:	Names:	Names:
Facilities:		
EXPERIMENT:	COMPILATION:	EVALUATION:
Method:		Method:
Completion date:	Major sources of information:	Major sources of information:
Discrepances to other reported data:	Deadline of literature coverage:	Deadline of literature coverage:
Publications:	Cooperation:	Status:
Contact:	Other relevant details:	Cooperation:
	Computer file:	Other relevant details:
	Availability:	Computer file of compiled data:
	Completion date:	Computer file of evaluated data:
	Publications:	Availability:
	Contact:	Discrepancies encountered:
		Completion date:
		Publications:
		Contact:

SUBJECT INDEX

With respect to the earlier issues, underlined page numbers refer to new work, page numbers in brackets refer to unchanged contributions, and others refer to revised contributions.

1. MEASUREMENTS

1.1. Fission yields

1.1. Fission yields (cont'd)

1.1. Fission yields (cont'd)

1.2. Neutron reaction cross sections

1.2. Neutron reaction cross sections (cont'd)

1.2. Neutron reaction cross sections (cont'd)

nuclide	neutron energy	reaction	page
Gd-157	1.1-235 keV	average (n,γ), S0, S1, γ-width	34
	1.1-235 keV	average (n,γ), S0, S1, γ-width	34
	3-500 keV	(n,γ),excitation function	47
Gd-160	14 MeV	(n,α), (n,γ)	5
Tb-159	0.4-1.6 MeV	capture	10
Dy-162	unspecified	capture γs, Dy-163 level structure	23
Dy-163	unspecified	inelastic γs, Dy-163 level structure	23
Many	thermal	(n,γ): σ_0 and resonance integrals	2
	thermal	(n,α), (n,p) systematic study	3
	epicadmium	system. study of varying Cd-thickness	12

FProd= gross FP-mixtures

Many= several nuclides not specified in detail

1.3. Decay data

nuclide	data type	page
Ni- 70	identification,T1/2	15
Ni- 71	identification,T1/2	15
Ni- 72	identification,T1/2	15
Ni- 73	identification,T1/2	15
Ni- 74	identification,T1/2	15
Cu- 74	identification,T1/2	15
	β-γ spectroscopy	44
Cu- 75	identification,T1/2	15
Cu- 76	identification,T1/2	15
	β-γ spectroscopy	44
Cu- 77	identification,T1/2	15
Zn- 80	β-γ spectroscopy	44
Ga- 72	T1/2	15
Ge- 83	β-γ spectroscopy	44
As- 76	T1/2	15
Se- 79m	T1/2	15
	β-branching, log ft	19
Se- 81m	T1/2	15
Br- 82	T1/2	15
	β-decay study	41
Br- 90	$Q\beta$ value	22
Br- 91	$E\beta$,$Q\beta$	22
Kr- 91	$E\beta$,$Q\beta$	22
Kr- 92	$E\beta$,$Q\beta$	22
Br- 92	$E\beta$,$Q\beta$	22
Kr- 85	T1/2	(21)
Kr- 93	level studies	18
Kr- 94	level studies	18
Rb- 88	T1/2	15
Rb- 97	shape coexistence	17
Rb- 98	β-γ spectroscopy	44
Rb- 99	β-γ spectroscopy	44
Sr- 89	γ-emission probability	21
Sr- 90	T1/2	6
	T1/2	(21)
Sr- 99	β-γ spectroscopy	44
Sr-100	β-γ spectroscopy	44
Sr-101	β-γ spectroscopy	44
Y - 90m	conversion coefficient	26
Y - 96	level studies	17
	level lifetimes	18

1.3. Decay data (cont'd)

1.3. Decay data (cont'd)

1.3. Decay data (cont'd)

nuclide	data type	page
Nd-155	decay properties	46
Nd-156	decay properties	46
	T1/2, X-, γ-rays	35
Pm-147	γ-emission probability	21
Pm-152	decay properties	46
Pm-153	decay properties	46
Pm-154	decay properties	46
Pm-155	decay properties	46
Pm-156	decay properties	46
	T1/2, X-, γ-rays	35
	nucl.spectroscopy	39
Pm-157	decay properties	46
Pm-158	decay properties	46
Sm-153	T1/2	15
	γ-ray measurements	10
Sm-157	decay properties	46
Sm-158	decay properties	46
Sm-159	decay properties	46
Sm-160	decay properties	46
Eu-152	T1/2	(6)
	T1/2	(21)

nuclide	data type	page
Eu-152m	conversion electrons	52
Eu-152	conversion electrons	52
Eu-154	T1/2	(21)
	β-decay study	41
	rel. γ-ray intensities	9
Eu-155	T1/2	(21)
Eu-156	γ-ray measurements	10
Eu-161	decay properties	46
Eu-162	decay properties	46
Gd-159	T1/2	15
Gd-164	decay properties	46
Tb-160	γ-ray measurements	10
Tb-161	T1/2	15
Dy-165	T1/2	15
Ho-166	T1/2	15
Many	decay scheme studies	(5)
	A=100-120: isomerism study	13
	antineutrino-,β-spec.	39
	average β-decay energies	40

A= several nuclides within the mass chain given

Many= several nuclides not specified in detail

1.4. Delayed neutron (=dn) data

nuclide	data type	page
Br- 87	E-spectrum	47
Br- 88	E-spectrum	47
Br- 89	E-spectrum	47
Br- 90	E-spectrum	47
Br- 91	E-spectrum	47
Br- 92	E-spectrum	47
Rb- 93	E-spectrum	47
Rb- 94	E-spectrum	47
Rb- 95	E-spectrum	47
Rb- 96	E-spectrum	47

nuclide	data type	page
Rb- 97	E-spectrum	47
I -137	E-spectrum	47
I -138	E-spectrum	47
I -139	E-spectrum	47
I -140	E-spectrum	47
I -141	E-spectrum	47
Cs-143	E-spectrum	47
Cs-144	E-spectrum	47
Cs-145	E-spectrum	47
Many	Pn	37

1.4. Delayed neutron (=dn) data (cont'd)

nuclide	neutron energy	data type	page
U	fast	total and group yield	43
U -235	thermal	delayed neutron fraction	34
	thermal	energy spec.(time)	49
	fast	energy spec.(time)	49
	0.5-2 MeV	energy spectra	43
U -238	fast	energy spec.(time)	49
Pu-239	thermal	energy spec.(time)	49
	thermal	groups+precursors: time+e	51
	fast	energy spectra	43

2. COMPILATIONS AND EVALUATIONS

data category	further specifications	page
fission yields	compil.+eval.,10 fission systems complet	56
	charge distr.,U-236,Cf-252 spont. fissio	59
	compilation (JNDC) for decay heat calc.	61
	fitted mass yields, 20 fissioning system	62
	evaluation:indep. yields, Pu-235 thermal	63
	complete eval., indep.+ cumul. yields	63
	eval. file (ENDF/B-VI), 50 yield sets	66
	indep. yields, charge distribution	68
	fragment mass distribution, Ac to Fm	69
cross sections	eval.: (n,γ): σ_0, I_0, γ-intensities	57
	eval.: nuclear data for k_0 factors	57
	evaluation: 172 FP (Z=33-65) for JENDL-3	60
	integral test of JENDL FP libraries	60
	compilation,few group + multigroup data	66
decay data	Nuclear Data Sheets,6 A-Chains:A=102-112	56
	compil.+eval., all data, French file	58
	T1/2, radiation data, decay scheme data	58
	compil.+eval. (JNDC) for decay heat calc	61
	half lives of Sr-90 and Cs-137	64
	complete file UKFPDD2 (UK working group)	64
	all data,compilation for ENDF/B-VI	66
	eval. file in ENDF/B-VI format,755 nucl.	66
delayed neutrons	compilation (JNDC) for decay heat calc.	61
	Pn-values for 86 precursors	62
	eval.,equilibrium spectra	(65)
	energy spectra for individual precursors	66
	eval.: Pn, precursor+aggregate spectra	66
decay heat	summation calculation,JNDC working group	61
	data base for decay heat code FISP6	64
	total decay power based on ENDF/B-V data	(66)

PART 1: ORIGINAL CONTRIBUTIONS

1.1 MEASUREMENTS

Laboratory and address : Nuclear Physics Laboratory
Proeftuinstraat 86
B-9000 Gent, Belgium

Names : E.Jacobs, D.De Frenne, A.De Clercq, S.Pommé, K.Persijn

Facilities : Linear Electron Accelerator

Experiments : Emission of light charged particles in the photofission of $^{230,232}Th$, $^{233,234,235,238}U$, ^{237}Np and ^{242}Pu.
Mass, kinetic energy and charge distributions for the photofission of ^{232}Th and ^{238}U
Fragment angular distributions for electrofission of ^{232}Th

Method : Measured : light charged particles (^3H, ^4He, ^6He) emitted in the photofission of $^{230,232}Th$, $^{233,234,235,238}U$, ^{237}Np and ^{242}Pu, using ΔE-E detectortelescope particle identification system; deduced : B/^{4}He, ^{3}H/^{4}He, $<E_{4_{He}}>$, $<E_{3_H}>$ and FWHM of the kinetic energy distributions.
Measured : catcherfoil γ-ray spectra and kinetic energies of the two fragments for ^{232}Th and ^{238}U photofission with 6.4-14 MeV bremsstrahlung; deduced : kinetic energy distributions, post- and pre-neutron mass distributions, neutron emission curves, range of ^{232}Th photofission products in Th.
Measured : angular distributions of fragments for $^{232}Th(e,f)$, 4.5 MeV $<Ee<$ 7MeV, mika-foils

Publications :
- M.Plessens, E.Jacobs, D.De Frenne, S.Pommé and A.De Clercq
  Proceedings of the Conf. "50 Years with Nuclear Fission", Gaitherburg, Maryland 1989, Am.Nucl.Soc., Lagrange Park, Ill., p.673
- J.D.T.Arruda-Neto, E.Jacobs, D.De Frenne and S.Pommé
  Proceedings of the Internat. Nucl. Phys. Conf., Sao Paulo, Brasil 1989, p.33.

Laboratory and address	:	Institute for Nuclear Sciences, Proeftuinstraat 86, B-9000 Gent, Belgium * Central Research Institute for Physics, H-1525 Budapest 114, P.O.Box 49, Hungary
Names	:	F.De Corte, A.Simonits *
Facilities	:	Reactors THETIS(Gent, Belgium) and WWR-M (Budapest, Hungary)[+ occasionally DR-3 (Risø, Denmark)]
Experiment	:	Determination of 2200 ms-1 cross-sections (σ_0), resonance integral to 2200 ms^{-1} cross-section ratios (I_0/σ_0) and resonance integrals (I_0) for (n,γ) reactions of interest in reactor neutron activation analysis [many of the radionuclides considered are fission products].
Method	:	Cooperative but independent experimental work in Gent and Budapest: activation method, with gamma spectrometry on a Ge-detector, for σ_0-determination [with careful selection of literature data for the input parameters (absolute gamma-intensity, isotopic abundance, half-life)]; cadmium-ratio method for I_0/σ_0-determination [with correction for a non-1/E epithermal neutron flux distribution].
Accuracy	:	σ_0 : total uncertainties are obtained by quadratic combination of random (experimental) ones - not exceeding 2% - with uncertainties originating from the input data ; I_0/σ_0 : of the order of 3%, on the average.
Completion date	:	Work is in progress [Status 1989 : σ_0 for 83 (n,γ) reactions (+ 18 tentative values) ; I_0/σ_0 for 53 (n,γ) reactions (+ 53 tentative values)].
Discrepancies to other data	:	A critical comparison is made with previously measured and evaluated data (included in Publications 1., 2. and 4. below).
Publications	:	1. F.De Corte, A.Simonits, Nuclear Data for Science and Technology (May 30-June 3, 1988, Mito, Japan; S.Igarasi, Editor ; Saikon Publ.Co.) (1988) 583 2. F.De Corte, A.Simonits, A.De Wispelaere, J.Radioanal.Nucl.Chem., 133(1) (1989) 131 3. F.De Corte, A.Simonits, A.De Wispelaere, A.Elek, J.Radioanal.Nucl.Chem., 133(1) (1989) 3 4. F.De Corte, A.Simonits, J.Radioanal.Nucl. Chem., 133(1) (1989) 43

BELGIUM

Laboratory and address : Nuclear Physics Laboratory,
Proeftuinstraat 86, B-9000 Gent, Belgium
SCK/CEN, B-2400 Mol, Belgium

Institut Laue-Langevin, B.P. N°156 X, 38042
Grenoble, France

Names : C. Wagemans, P. Schillebeeckx, J.P. Bocquet

Facilities : High Flux Reactor, Institut Laue-Langevin, Grenoble

Experiments : Thermal neutron induced (n,α) and (n,p) reactions on fission products.

Method : Charged particle detection with surface barrier detectors.

Completion date : Systematic study in progress.

Publications :

1) C. Wagemans, Proc. 4th Int. Conf. on Neutron Induced Reactions, Smolenice (Czechoslovakia) 1985, p. 344.
2) C. Wagemans, Proc. IAEA-INDC Conf. on Heavy Ion Targets and Related Phenomena, Darmstadt (FRG) 1988, in print

BELGIUM

Laboratory and address : Nuclear Physics Laboratory,
Proeftuinstraat 86, B-9000 Gent, Belgium
SCK/CEN, B-2400 Mol, Belgium

Institut Laue-Langevin, B.P. N°156 X, 38042
Grenoble, France

Names : C. Wagemans, P. Schillebeeckx, J.P. Bocquet

Facilities : High Flux Reactor, Institut Laue-Langevin, Grenoble

Experiments : Absolute yields and energy distributions of the charged light particles emitted during the thermal neutron induced fission of ^{229}Th, ^{233}U, ^{235}U, ^{237}Np, ^{241}Pu, ^{239}Pu, ^{241}Am and ^{243}Am

Method : The charged particles are identified with surface barrier (ΔE-E) telescope detectors.

Completion date : ^{235}U completed; other isotopes in progress.

Publications :

1) C. Wagemans et al., Phys. Rev. C33 (1986) 943
2) C. Wagemans, "Light particle accompanied fission" in Particle emission from nuclei, Vol. III, Chapter 3, p. 63-97, CRC Press (USA), D. Poenaru and M. Ivascu (editors), 1988.

E.E.C. BELGIUM

Laboratory and addresses : CEC-JRC, Central Bureau for Nuclear Measurements, B-2440 Geel, Belgium
SCK/CEN, B-2400 Mol, Belgium

Names : C. Wagemans, P. Schillebeeckx, A.J. Deruytter

Facilities : Neutron time-of-flight spectrometer at the 150 MeV Linac. Thermal neutron beam at the Reactor BR1.

Experiments : Fission fragment kinetic energy and mass distribution for ^{236}Pu (s.f.), ^{238}Pu (s.f.), ^{239}Pu (n_{th},f), ^{240}Pu(s.f.), ^{241}Pu(s.f.) and ^{244}Pu(s.f.)

Method : Coincident fission fragments detected with surface barrier detectors. Deduced fragment mass and energy distributions.

Publications : 1) C. Wagemans et al., Proc. Int. Conf. Fifty Years Research in Nuclear Fission, Berlin (FRG) 1989.

BELGIUM

Laboratory and address : CEC-JRC, Central Bureau for Nuclear Measurements, B-2440 Geel, Belgium.

1) Names : F.-J. Hambsch, H.-H. Knitter, C. Budtz-Jørgensen.

Facilities : Neutron time-of-flight spectrometer GELINA, 7 MV and 3.7 MV Van de Graaff.

Experiment : Fission fragment total kinetic energy and mass distribution for ^{235}U (n, f) in the resonance region.

Method : Twin Frisch gridded ionization chamber for coincident fission fragment detection.

Accuracy : Fragment mass resolution about 2 u. Fragment energy resolution about 2 MeV, 10^7 coincident events recorded.

Completion date : 1987.

Publications :
1) F.-J. Hambsch, Ph.-D Thesis June 1987;
2) H.-H. Knitter et al., Proc. of Int. Conf. on Neutron Physics, Kiev, SU, 1987, p. 22;
3) F.-J. Hambsch et al., Nucl. Data for Science and Technology, Mito, Japan, 1988, p. 407;
4) F.-J. Hambsch et al., IAEA Consultants Meeting on physics of neutron emission in fission, Mito, Japan, 1988, INDC(NDS)-220 p. 129
5) F.-J. Hambsch et al., Nucl. Phys. A 491 (1989) 56.

2) Names : F.-J. Hambsch, H.-H. Knitter, C. Budtz-Jørgensen.

Facilities : Neutron time-of-flight spectrometer GELINA, 7 MV and 3.7 MV Van de Graaff.

Experiment : Fission fragment total kinetic energy, mass and angular distributions of $^{252}Cf(sf)$ in correlation with prompt neutron emission.

Method : Twin Frisch gridded ionization chamber for coincident fission fragment detection. Neutron time of flight detection with NE213 scintillator.

Accuracy : Fragment mass resolution better than 1 u. Fragment energy resolution about 0.5 MeV, 4.10^7 fission events without and 3.10^6 fission events with neutron coincidence recorded.

Completion date : Data evaluation as well as data acquisition still ongoing.

Publications :
1) C. Budtz-Jørgensen et al., NIM A 258 (1987) 209;
2) C. Budtz-Jørgensen et al., Nucl. Phys. A 490 (1988) 307.

BRAZIL

Laboratory and address: Instituto de Engenharia Nuclear
Comissão Nacional de Energia Nuclear
Caixa Postal 2186
20001 - Rio de Janeiro - RJ - BRASIL

Names: A.V. Bellido, S.C. Cabral

Facilities: CV-28 Variable Energy Cyclotron
Helium Jet Transport System.

Experiment: Fission yield determinations and decay scheme investigations on short-lived fission products from actinides fissioned by charged particles.

Method: Quick transport by a helium jet of the recoiling fission products from the irradiation chamber to the collection chamber (at 15 m distance) and then to the counting station situated just in front of a high resolution Ge(Li) detector. Identification and measurement of the fission products by gamma-ray spectrometry.

Accuracy: Better than 10 %.

Completion date: October 1990

BULGARIA

Laboratory and address: University of Sofia, Faculty of Physics ,
Department of Atomic Physics, 1126 Sofia,

Names : N.Nenoff
Hr.Venkov (Institute of plant protection, Kostinbrod)

Experiment : Determination of 14 MeV neutron reaction cross section for :

$^{152}Sm(n,p)\ ^{152m,g}Pm$, ; $^{160}Gd\ (n,\gamma)$; (n,α)

Method : Activation technique

Completion date: July 1989

Publications : Determination of the effective cross-section of (n,p) -reactions with 14-15 MeV neutrons
N.Nenoff, D.Kolev, R. Korea, St.Gabrakov, Hr.Gountchev, I.Penev
Annu. Univ. Sofia , v. 78, (1984) 35

CANADA

Laboratory and Address: Atomic Energy of Canada Limited Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario, Canada K0J 1J0

Names: J.G.V. Taylor and R.H. Martin

Facilities:
1) 4πγ ionization chamber
2) 4πβ gas flow proportional counter
3) 4πβ-γ coincidence system
4) scintillation spectrometer
5) Ge detector
6) Radioisotope standardization laboratory

Experiment: Half-lives of ^{109}Cd, ^{133}Ba and ^{152}Eu

Method: 4πγ ionization chamber.

Accuracy: <0.1%

Completion Date: Continuing and undetermined at present.

Discrepancies to other data: None at present.

Publication: None at present.

CANADA

Laboratory and Address: Atomic Energy of Canada Limited Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario, Canada K0J 1J0

Names: J.G.V. Taylor and R.H. Martin

Facilities:
1) 4πγ ionization chamber
2) 4πβ gas flow proportional counter
3) 4πβ-γ coincidence system
4) scintillation spectrometer
5) Ge detector
6) Radioisotope standardization laboratory

Experiment: The half-life of ^{90}Sr was determined at 28.92 years.

Method: 4πβ gas flow proportional counter

Accuracy: ± 0.03 years (0.1%).

Completion Date: Completed. A full report is to be published in the near future.

Discrepancies to data: The range of eight selected published values for this half-life is 27.7 to 29.7 years. The weighted mean of these determinations is 28.87 ± 0.17 (external error) years with a reduced chi-squared of 3.2. Within the combined uncertainties so calculated, the present result agrees with the average of previous measurements.

Publication: Martin R.H. and Taylor J.G.V. (1985) The half-life of ^{90}Sr. In progress report, Physics Division, 1985 July 01 - December 31, PR-P-142, Atomic Energy of Canada Limited, report AECL-9103.

CANADA

Laboratory and Address: Atomic Energy of Canada Limited Research Company, Chalk River Nuclear Laboratories, Chalk River, Ontario, Canada K0J 1J0

Names: J.G.V. Taylor and R.H. Martin

Facilities:
1) $4\pi\gamma$ ionization chamber
2) $4\pi\beta$ gas flow proportional counter
3) $4\pi\beta$-γ coincidence system
4) scintillation spectrometer
5) Ge detector
6) Radioisotope standardization laboratory

Experiment: The half-life of ^{137}Cs has been found to be 10967.8 days. A purified source of ^{137}Cs was measured in an ionization chamber for eight years relative to three ^{226}Ra reference sources. Allowance was made in the least squares fitting procedure for a small contribution from ^{134}Cs (0.027% initially) and for ^{210}Bi growing towards equilibrium in the reference sources.

Method: $4\pi\gamma$ ionization chamber.

Accuracy: ± 4.5 days (0.04%). This uncertainty combines Type A and Type B components equivalent to one standard deviation.

Completion Date: Completed.

Discrepancies to other data: More than 20 measurements of the ^{137}Cs half-life have been reported since its discovery. Twenty-one values range from 9715 to 12053 days. The weighted mean of these 21 values is 10988 ± 22 (external error) days with a reduced chi-squared of 13. Within the uncertainties so calculated, this new result agrees with the average of previously reported values.

Publication: Accepted for publication in a future issue of Nuclear Instruments & Methods as part of the proceedings of the 1989 ICRM International Symposium on Nuclear Decay Data.

C H I N A

Laboratory And Address: Laboratory of Neutron Physics
Institute of Atomic Energy
P.O. Box 275-46, Beijing 102413, China

Names: Jing Kexing, Li Ze, Liu Conggui, Liu Yonghui, Su Shuxin and Huang Shengnian

Facilities: The swimming pool reactor, 130 c.c. Ge(Li) detector coupled with 4K analyzer

Experiment: 13 cummulative yields and 10 mass chain yields from Kr-87 to Ce-143 were determined absolutely for the fission of Th-232 induced by 7.64 MeV monochromatic gamma rays. The gamma photons were abtained from the thermal neutron capture gamma sourse installed at the swimming pool reactor of IAE, by using Fe radiator. The samples used were Th metal disks which were sandwiched between two thin Th foils during irradiation. The fission events of the thin foils were detected by solid state nuclear track detectors. In this way the fission rate was determined absolutely. The fission product activities of irradiated samples were measured by Ge(Li) gamma ray spectrometry.

Method: Direct Ge(Li) gamma ray spectroscopy

Accuracy: 4.2---10.1%

Completion Date: June 1985

Descrepancies to other reported data: No other data has been reported.

Publication: Chinese J. of Nuclear Physics, Vol.10, No.3, (1988) 244
Nuclear Data for Science and Technology (1988 MITO) 1151

Laboratory And Address: Laboratory of Nuclear Chemistry
Institute of Atomic Energy
P.O. Box 275, Beijing 102413, China

Names: Qi Linkun, Liu Conggui, Su Shuxin, Liu Yonghui, Li Ze, Cui Anzhi, Guo Jingru.

Facilities: Heavy Water Research Reactor,
High resolution Ge(Li) gamma-ray Spectrometric System,
Low background Measurement system.

Experiment: The mass distribution of fission of U-235 and U-238 induced by the fision spectrum neutrons.

Methods: Radiochemical method and Ge(Li) gamma ray spectroscopy

Accuracy: 3--50% for U-235
3--30% for U-238

Completion Date: July 1986 (U-235)
July 1988 (U-238)

Publications:

1. Qi Linkun, Liu Conggui, Li Ze, Wang Xiuzhi, Zhang Sujing, Liu Yonghui, Liu Daming, Ju Changxin, Lu Huijun, Zhu Jiaxian, Guo Jingru, The Mass Distribution in Fission Spectrum Neutron Induced Fission of U-235,Proceedings of the International Conference "Nuclear Data for Science and Technology", May 30--June 3, 1988, Mito, Japan, P.967.
2. Su Shuxin, Liu Yonghui, Zhang Sujing, Liu Conggui, Wang Xiuzhi, Qi Dahai, Tang Peijia, Cui Anzhi, Liu Daming, Zhu Jiaxuan, Qi Linkun, Li Daming, Zhang Chunhua, Jing Kexing, Ju Changxin, Li Ze, Guo Jingru, The Mass Distribution in Fission Spetrum Neutron Induced Fission of U-238, Chin. J. of Nuclear and Radiochemistry, to be published.

Laboratory And Address: Laboratory of Nuclear Chemistry
Institute of Atomic Energy
P.O. Box 275-85, Beijing 102413, China

Names: Chen Qingjiang, Su Shuxin, Yang Jingxia, Chen Yundong, Li Xueliang, Zhang Hongdi, Lin Fa, Guo Jingru

Facilities: Cf-252 source, low background 2 pi gas-flow proportional counter, plastic scintillation counter, and well type Na(Tl) detecter.

Experiment: Absolute yields of fission products representing 35 mass chains from Cf-252 spontaneous fission have been determined. The mass distribution curve has been abtained.

Method: Radiochemical seperation and beta or gamma counting.

Accuracy: 3--5% for Nuclides on the peaks of mass distribution curve and 10--17% for the valley and the wings of the distribution.

Completion Date: December 1985

Publications:

"Absolute determination of the spontaneous fission yields of Cf-252 by radiochemical method", Atomic Energy Science and Technology (China), Vol.20, 161(1986).
J. Radioanal. Nucl. Chem., Articles, Vol.111, 63(1987).

CHINA

Laboratori and Address: Institute of Atomic Energy
P.O.Box 275 (20) Beijing,
P.R.of China

(1) Name: Wang Xin Lin, Li Xiaodi, Du Hongshan

Experiment: Determination of relative intensities of gamma-rays from the decay of ^{125}Sb, ^{154}Eu and ^{182}Ta.

Method: Measurements were perfomed with calibrated Ge(Li) and coaxial Ge detector.

Accuracy: 1.0---2.0%

Completion Dates: June 1985.

Publication: Chinese Journal of Nuclear Physics 8 (1986) 371

(2) Name: Wang Xin Lin, Li Xiaodi, Lu Xiang

Experiment: Intercomparison measurements of emission rate of gamma-rays.

Method: A home intercomparison measurements of emission rate of gamma-rays were performed by means of Ge(Li) detector and ^{152}Eu source.*)

Accuracy: 2.0%

Publication: Atomic Energy Science and Technology 20 (1986) 222

*) including: Cs-134, Cs-137

CHINA

Laboratory and address: Institute of Modern Physics
Academia Sinica
P.O.Box 31
Lanzhou, China

Names: Li Wenxin, Sun Tongyu, Sun Xiangfu
Zhao Zhizheng and Guo Yingxiang

Facilities: Cockcroft-Walton accelerator
He-jet system
HPGe detectors
γ-γ coincidence system
Radiochemical laboratory

Experiment: Mass and charge distributions for the fission of ^{232}Th and ^{237}Np with 14MeV neutrons.
Measurement of decay properties for fission products is planned.

Method: γ-spectrometry and chemical separation followed by γ-spectrometry

Accuracy: ~5-15% for CFY

Completion date: Feb. 1989

Discrepancies to other reported data: In the fission of ^{232}Th 6 IFY in the symmetric region and 12 of measured 57 CFY were determined for the first time.

Publications:
1) Li Wenxin et al., "Charge Distribution in the 14.7 MeV-Neutron-Induced Fission of ^{232}Th: Independent Yields of Isotopes of Rh,Ag,In and Sb", High Energy Physics and Nuclear Physics, 11(1987) 376(in Chinese).
2) Sun Tongyu et al., "Mass Distribution in the 14.7 MeV Neutron-Induced Fission of ^{232}Th", High Energy Physics & Nuclear Physics, 12(1988) 221.

Laboratory and address:	Nuclear Physics Laboratory, Physics Department, Jilin University,Changchun 130023, P.R of China
Names:	Liu Yunzuo, Hu Dailing, Sun Huibin, Huo Junde, Zhou Jiewen, Ding Zhaozhong, Hu Baohua, Ma Chunhui, Wu Yuedong, Liu Yabo, You Jianming, Jin Changwen, and Li Yuan
Facilities:	Coaxial Ge(Li) detectors of 105 cm^3 and 110 cm^3, coaxial HpGe detector of 114 cm^3, planar HpGe detector of 1 cm^2X1 cm and 10 cm^2X 1.5 cm, Si(Li) detector of 1 cm^2X 1cm. 4k and 8k multichannel analyzers, multiparameter system, angular correlation set-up, fast-slow coincidence system, PDP11/23 and PDP11/44 computer systems.
Experiment:	Studies on levels populated in beta-decay of various nuclides at higher resolution and improved counting statistics; Measurements of energies and intensities of gamma rays emitted by nuclides related to nuclear energy utilization.
Method:	Gamma singles and gamma-gamma coincidence measurements.
Completion date:	Published: decays of ^{147}Nd, ^{140}La, ^{124} Te and ^{192}Ir. Published in short notes without detailed data: decays of ^{182}Ta, ^{153}Sm and ^{131}Ba. Analysis in progress: ^{156}Eu, ^{188}Re, ^{160}Tb and ^{169}Yb.

publications:

1. Study on the Decay scheme of ^{147}Nd
   Chinese Journal of Nuclear Physics, 5, 313(1983)
2. Level Structure of ^{140}Ce from the Decay of ^{140}La
   Chinese Phys. Lett., 2, 265(1985)
3. Level Structure of ^{131}Cs Populated in the Decay of ^{131}Ba
   Proc. of International Nuclear Physics Conference, August 25-30, 1986, HARROGATE, ENGLAND.
4. Levels in ^{153}Eu Populated in the Decay of ^{153}Sm
   ibid.
5. A Discussion on the newly proposed Levels in ^{182}W
   ibid.
6. Studies on the Low-Lying Levels in ^{192}Pt and ^{192}Os Populated in ^{192}Ir Decay.
   Z. Phys. A - Atomic Nuclei, 329, 307-317(1988)
7. Levels in ^{124}Te Populated in the Decay of ^{124}Sb
   Z. Phys. A - Atomic Nuclei, 331, 391-400(1988)

Laboratory and address:
Institute of Nuclear Science and Technology of Sichuan Univ.
P.O.Box 390-1 Chengdu , P.R. of China

Name:
Xu Haishan Xiang Zhengyu Mu Yunshan Li Yexiang
Wang Shiming Chen Yaoshun Liu Jinrong

Facilities:
Pulsed 2.5 MeV Van de Graaff,
Large-liquid-scintillator tank.

Research:
We have measured the fast neutron capture cross sections, using a prompt detection technique, for fission products Ag, Nd, Sm, Eu, Gd, Tb, Dy, and Er in the 0.4-1.6 Mev neutron energy range. Relative cross sections have been determined by Au-197 as a standard sample.

Accuracy:
10-12%

Completion date:
1984-1986

Published:
Chinese Journal of Nuclear Techniques, 9, 9 (1986)
Chinese Journal of Nuclear Physics, 9, 2, 39 (1987)
Chinese Journal of Nuclear Physics, 10, 3, 233 (1988)
Chinese Journal of Nuclear Techniques,12, 4,237(1989)

China

Laboratory and address:
Institute of Nuclear Science and Technology of Sichuan Univ.
P.O.Box 390-1 Chengdu , P.R. of China

Name:
Mu Yunshan Xu Haishan Xiang Zhengyu Li Yexiang Wang Shiming

Facilities:
Pulsed 2.5 MeV Van de Graaff,
Large-liquid-scintillator tank.

Research:
We have measured the fast neutron capture cross sections of fission products Nb and Mo,using the technique of detection of prompt gamma rays in the 0.7-1.4 MeV neutron energy range.Relative cross sections have been determined by Au-197 as a standard sample.

Accuracy:
11-12%

Completion date:
1989

Published:
In plan

CZECHOSLOVAKIA

Laboratory and addres: Institute of Physics of the Electro-Physical Research Centre, Slovak Academy of Sciences
Dubravska cesta
84228 Bratislava, Czechoslovakia

Names: J. Krištiak, J. Kliman, V. Polhorsky

Facilities: JINR Dubna (USSR); IBR-30 reactor, flight-path, fission chambers, Ge(Li) detectors, BGO detectors, neutron detectors.

Experiment: The measurement of prompt gamma-rays from primary fission fragments.
Determination of independent yields from resonance neutron induced fission of ^{235}U and ^{239}Pu.
Determination of the total gamma-ray spectra of fission products from the resonance neutron fission of ^{235}U.

Method: in-beam gamma-ray spectroscopy.

Accuracy: statistical errors greater as 4%.

Completion data: the end of 1989 for ^{235}U fission and the end of 1990 for ^{239}Pu.

Discrepancies to other reported data:
There are no principal discrepancies with the data compiled by Rider and Meek for thermal neutrons. Up to now there are no data for resonance neutrons.

Publications:
1) N.A. Gundorin, A. Duka-Zolyomi, J.Kliman, J. Krištiak, Atomnaja energia 66(1989) 394
2) A.A. Bogdzel, N.A. Gundorin, A. Duka-Zolyomi, J. Kliman, J. Krištiak, Comm. JINR, P15-88-385
3) N.A. Gundorin, A. Duka-Zolyomi, J. Kliman J. Krištiak, Comm. JINR P15-88-386

CZECHOSLOVAKIA

(contd.)

4) A.A. Bogdzel, N.A. Gundorin, A. Ouka-Zolyomi, J. Kliman, J. Krištiak, Fifty years with nuclear fission, International Conference, April 26-28, 1989, Gaithersburg

5) J. Kliman, A.A. Bogdzel, N.A. Gundorin, A. Ouka-Zolyomi, J. Krištiak, Investigation of the prompt gamma-rays from the neutron fission of ^{235}U and the independent yields of primary fission fragments (to be published)

EGYPT

Laboratory and address: Physics Department
Faculty of Science
Tanta University
Tanta ,Egypt

Names : T.Elnimr ,F.M.Ela-assaly

Facilities :ET -RR -1 Reactor

Experiment : Determination of the attenuation of epicadmium neutrons using the method of varying Cd-thickness

Method : Activation technique

Accuracy : better than 2 %

Completion dates : Systematic study in progress

Publications : T.Elnimr et al J.Radioanal.Nucl.Chem. 109 No.1 (1987)3
T.Elnimr et al Proc. Math. Phys. Soc.Egypt 58 (July, 1984) 93

Laboratory and Address:	Department of Physics University of Jyväskylä (JYFL) Seminaarinkatu 15, SF-40100 Jyväskylä
Names:	J.H. Äystö, P. Jauho, A. Jokinen, J.M. Parmonen and H. Penttilä, University of Jyväskylä; K. Eskola and M.E. Leino, University of Helsinki
Facilities:	On-line mass separator IGISOL, which consists of 55 degree scandinavian type magnet and ion guide, connected on-line with the mc-20 cyclotron of JYFL.
1. Experiment:	β-decay half-lives, β-decay energies and β strength distribution of neutron rich nuclei produced in 20 MeV proton induced symmetric fission of ^{238}U. Observed new isotopes ^{111}Tc, ^{112}Ru, ^{113}Ru, ^{113}Rh, ^{114}Ru, ^{115}Rh, ^{116}Rh, ^{118}Pd, ^{119}Pd.
Method:	γ-X, γ-γ and γ-β coincidence measurements of mass separated fission products. Multiscaling method for the half-life measurements.
Completion date:	The project is expected to continue at least to 1991.
Publications:	J.H. Äystö et al., Levels in $^{110,112,114,116}Pd$ from the β decay of the on-line mass separated Rh isotopes, Nucl. Phys. A480 (1988) 104-124; J.H. Äystö et al., Identification and decay of new neutron-rich isotopes ^{115}Rh and ^{116}Rh, Phys. Lett. B201 (1988) 211-214; H. Penttilä et al., Half-life measurements for neutron rich Tc, Ru, Rh and Pd isotopes, Phys. Rev. C38 (1988) 931-934; V. Koponen et al., Gamow-Teller decay of ^{118}Pd and neighbouring even isotopes of palladium, Z. Phys. A333 (1989) 339-348.

2. Experiment:	Isomerism in neutron rich nuclei in mass area A = 100 - 120.
Method:	Recently built electron lens allows high accuracy conversion electron measurements at energy range from 30 keV to 1 MeV. Coincidence measurements with γ and X-rays and β-electrons are possible. First measurements have been performed in November 1989. Preliminary results have been reached with γ-ray experiments.
Publications:	H. Penttilä et al., New neutron-rich nuclei and isomers produced in symmetric fission, to be published in Physica Scripta.
3. Experiment:	Charge dispersion of proton induced symmetric fission of ^{238}U.
Method:	The efficiency of the ion source of the IGISOL-facility is independent of the element of the radioactive nucleus. The independent yield can be deduced from measured γ spectra and deduced level schemes.
Publications:	M.E. Leino et al., Charge dispersion in symmetric fission induced by 20 MeV protons on ^{238}U. To be published.

FRANCE

Laboratory and address : CENTRE D'ETUDES NUCLEAIRES DE GRENOBLE
DRF/SERVICE DE PHYSIQUE
M.D.I.H.
85X - F 38041 Grenoble Cedex

Names : J. BLACHOT, J.CRANCON, Ch. HAMELIN, G. LHOSPICE

Facilities : Melusine reactor (thermal neutron and caramel system for fast neutrons) 3 Mev neutrons generators and high flux reactor of I.L.L.

Cooperation : C.S.T.N. Alger
M. HADDAD, M. ASGHAR

Experiment : The mass yields have been measured for :

232U(Nth,F) 238PU(Nth,F) 229Th(Nth,F)

Method : Direct growth and decay activities are measured with a Ge/Li detector and record in a multispectrum mode by a 4k multichannel analyser.

Accuracy : The average relative uncertainty of our measurements is between 5 and 10%.

Completion Date : The measurements are completed.

Publications : See previous reports No 12.

Radiochimica 42, 165 (1987)
" 46, 23 -24 (1989)
Nucl. Data Sc. & Tech. MITO p 979 (1988)
Nucl. Phys. A481, 333 (1988)
Nucl. Data Sc. & Tech. MITO p 943 (1988)

FRANCE

Laboratory and address: Institut Laue-Langevin
156X
F-38042 Grenoble

Names: M.Asghar, J.P.Bocquet, R.Brissot, J.Crancon, M.Djebarra, D.Engelhart, Ch.Ristori, B.Wilkins.

Facilities: Mass spectrometer LOHENGRIN on an internal beam of the reactor.
Neutron flux: 5.10^{14} n.cm^{-2}.s^{-1}.
Fission fragments analyzed by their mass, ionic charge and energy

Experiment: Nuclear charge distribution of fission fragments from ^{249}Cf(n,f).

Method: Lohengrin and large ionization chamber for nuclear charge identification.

Accuracy: 3 to 10%.

Completion date: 1987

Discrepancies to other reported data: No other data available for nuclear charge distribution.

Publications: Nucl. Phys. A496 (1989) 346
Proc. Conf. Nuclear Data for Science and Technology, Mito, Japan (1988), p. 963.

FRANCE

Laboratory and address:	Institut Laue-Langevin 156X F-38042 Grenoble
Names:	P.Armbruster, M.Bernas, J.P.Bocquet, R.Brissot, H.Faust, P.Roussel.
Facilities:	Mass spectrometer LOHENGRIN on an internal beam of the reactor. Neutron flux: 5.10^{14} $n.cm^{-2}.s^{-1}$. Fission fragments analyzed by their mass, ionic charge and energy
Experiment:	Identification of new isotopes of Ni and Cu.
Method:	Ionization chamber of improved performance (for contaminants rejection) and Lohengrin. Several new isotopes have been identified : $^{70-74}Ni$ and $^{74-77}Cu$.
Accuracy:	
Completion date:	Work will go on with half-life measurement.
Discrepancies to other reported data:	
Publications:	Europhysics Letters 4 (1987) 793.

FRANCE

Laboratory and Address:	Centre de Recherches Nucléaires IN_2P_3 - CNRS Université Louis Pasteur - BP20 Cro F-67037 Strasbourg Cedex, France
Names:	A. Abzouzi (Institut de Physique, Université Houari Boumedienne, Alger, Algeria) M.S. Antony, J.B. Bueb (Centre de Recherches Nucléaires, Strasbourg) and V.B. Ndocko-Ndongué (I.U.T., Université de Haute Alsace, 68093 Mulhouse Cedex)
Facilities:	On-campus University Research Reactor. Fast transfer system Neutron flux of 1.1 x $10^{12}n/cm^2/s$ 120 cc Ge(Li) and 10 cm diameter Na(Tl) detectors coupled with 4K multichannel analyser.
Experiment:	Precise measurement of half-lives of 39 nuclides including several fission products listed below.
Method:	Counting of the most intense γ-rays following the β^- of the β^+ decay of the nuclides produced by thermal neutron absorption of target nuclei
Results:	Refer to Table I
Accuracy:	Quoted in parenthesis
Publications:	1. "Precision Measurement of the Half-life of ^{38}Cl", M.S. Antony, J.B. Bueb, W. Harrmann and V.B. Ndocko Ndongué, J. Radioanal. and Nucl. Chem. Letters 126 (1988), 295-300. 2. "Precision Measurement of the Half-lives of Nuclides", A. Abzouzi, M.S. Antony and V.B. Ndocko Ndongué, J. Radioanal. and Nucl. Chem. Letters 135 (1989), 1-7. 3. "Reevaluation of the Half-lives of Several Nuclides", A. Abzouzi, M.S. Antony and V.B. Ndocko Ndongué, J. Radioanal. and Nucl. Chem. Letters 135 (1989) 455-460. 4. "Nuclear Spectroscopy at the Stransbourg Research Reactor", A. Abzouzi, M.S. Antony and V.B. Ndocko Ndongué, Internal Report CRN-PN 18/88, Centre de Recherches Nucléaires, Strasbourg.

FRANCE
(cont'd)

5. "Improved Values of Half-lives of Several Nuclides", A. Abzouzi, M.S. Antony and V.B. Ndocko Ndongué, J. Radioanal. and Nucl. Chem. Letters 137 (1989) 381.

Table I. Results of half-lives of nuclides investigated in this work

Nuclide	E_γ analysed (keV)	Half-lives deduced
^{72}Ga	834.1	14.095 (3)h
^{76}As	559.1	26.321 (1)h
^{79m}Se	95.7	3.92 (1)m
^{81m}Se	103.0	57.28 (2)m
^{82}Br	554.4	35.281 (6)h
^{88}Rb	898.1	17.773(11)m
^{104m}Rh	51.4	4.37 (1)m
^{116m}In	1293.6	54.11 (3)m
^{128}I	442.9 + 526.6	24.991 (8)m
^{139}Ba	165.9	84.547(15)m
^{140}La	1596.5	1.6785(2)d
^{142}Pr	1575.5	19.140 (2)h
^{143}Ce	293.3	33.039 (6)h
^{149}Nd	211.3	1.728 (1)h
^{153}Sm	103.2	46.70 (5)h
^{159}Gd	363.5	18.479 (4)h
^{161}Tb	25.7	6.8985(5)d
	48.9	
	74.6	
^{165}Dy	94.7	2.334 (1)h
^{166}Ho	80.6	26.827 (5)h

GERMAN DEMOCRATIC REPUBLIC

Laboratory and adress: Zentralinstitut für Kernforschung Rossendorf
DDR - 8051 Dresden, Postfach 19

Names: K. Dietze, H. Kumpf, B. Böhmer

Facilities: Fast-thermal coupled systems RRR/SEG-IV, -V and -VII characterized by an energy-independent adjoint flux

Experiment: Integral test of FPND by C/E-ratios

Method: Measurements of central reactivity worths of isolated and mixed fission products by means of pile-oscillator technique
Measurements of mass dependence and extrapolation to infinitely small mass values
Determination of flux-weighted effective absorption cross sections relative to ^{10}B
Generation of ABBN-group data
Integral test of the absorption data by C/E-ratios, especially of resonance self-shielding factors,
Comparison of different FPND

Samples: Natural mixtures of Mo, Cd
Isolated isotopes ^{93}Nb, 95, 97, 98, ^{100}Mo, ^{103}Rh, ^{105}Pd, ^{109}Ag, ^{133}Cs, 143, ^{145}Nd, ^{149}Sm, ^{153}Eu

Accuracy: $\Delta k/k \approx 10^{-8}$, ± 8 - 15% in C/E-ratios

Completion: RRR/SEG-IV and -V: completed
Further, improved investigations are planned 1990/91 at the facility RRR/SEG-VII characterized by an extremly soft spectrum, an energy-independent adjoint flux and K_∞ near 1

Discrepancies to other reported data:
Discrepancies have been stated for different materials and data sets

Publications:
K. Dietze et al., Kernenergie 28 (1985) p. 75
K. Dietze et al., Kernenergie 29 (1986) p. 401
V. I. Golubev et al., Yadernye Konstanty 1 (1986) 68
B. Böhmer et al., Int. Conf. on Neutron Physics, Kiev, Sept. 1987, Proc. (1988) Vol. I, p. 342
E. Lehmann et al., Kernenergie 29 (1986) p. 30
E. Lehmann et al., ZfK-656, 1988
K. Dietze et al., Kerntechnik 53/2 (1988) p. 143
S. M. Bednjakov et al., Atomnaya Energiya (in press)
K. Dietze, H. Kumpf, Kernenergie (in press)

Germany, Fed. Rep.

Laboratory:	Kernforschungsanlage Jülich, Institut für Kernphysik, Postfach 1913, D–5170 Jülich
Names:	M.L. Stolzenwald, G. Lhersonneau, S. Brant, G. Menzen, K. Sistemich
Facilities:	Fission product separator JOSEF (Reactor DIDO, Jülich)
Experiment:	Identification of an 8^+ state in ^{96}Zr with the probable configuration $\pi g^2_{9/2}$ and assignment of spin and parity 8^+ to the ß decaying isomer in ^{96}Y.
Method:	Separation of the fission products according to their masses and nuclear charges. Measurements of γ–γ coincidences and angular correlations.
Accuracy:	——
Completion:	completed
Publication:	Z. Physik A–Atomic Nuclei 327 (1987) 359

Germany, Fed. Rep.

Laboratory:	Universität Mainz, Institut für Kernchemie, Postfach 3980, D–6500 Mainz Kernforschungsanlage Jülich, Institut für Kernphysik, Postfach 1913, D–5170 Jülich
Names:	G. Lhersonneau, B. Pfeiffer, K.–L. Kratz, H. Ohm, K. Sistemich
Facilities:	Fission product separator OSTIS (High Flux Reactor, Grenoble)
Experiment:	Discovery of shape coexistence in ^{97}Sr through the identification of a rotational band built on an excited state at 585 keV.
Method:	Separation of fission products according to their mass. Measurement of γ–γ–time coincidences
Accuracy:	——
Completion:	completed
Publication:	Z. Physik A–Atomic Nuclei 330 (1988) 347

Laboratory:	Kernforschungsanlage Jülich, Institut für Kernphysik, Postfach 1913, D–5170 Jülich
Names:	G. Molnár (on leave of absence from the Institute of Isotopes, Budapest/Hungary), H. Ohm, G. Lhersonneau, K. Sistemich
Facilities:	Fission product separator JOSEF (Reactor DIDO, Jülich)
Experiment:	Determination of the lifetimes of the 3_1^- state at 1897 keV in ^{96}Zr. Evidence for unusual collectivity of the $3_1^- \rightarrow 0_1^+$ transition and for doubly magic character of this nucleus.
Method:	Separation of the fission products according to their masses and nuclear charges. Measurements of delayed γ–γ coincidences with Ge–detectors.
Accuracy:	50 %
Completion:	completed
Publication:	Z. Physik A–Atomic Nuclei 331 (1988) 97

Laboratory:	Universität Mainz, Institut für Kernchemie, Postfach 3980, D–6500 Mainz University of Zagreb, Prirodoslovno–matematicki facultet, Marulicev trg. 19, YU–41000 Zagreb/Yugoslavia Kernforschungsanlage Jülich, Institut für Kernphysik, Postfach 1913, D–5170 Jülich
Names:	G. Lhersonneau, S. Brant, H. Ohm, V. Paar, K. Sistemich, D. Weiler
Facilities:	Fission product separator JOSEF (Reactor DIDO, Jülich)
Experiment:	Study of the level structure of $^{93/94}$Rb through γ–γ coincidences and IBFM/IBFFM calculations.
Method:	Separation of the fission products according to their masses and nuclear charges. Calculations using ^{94}Sr as IBM core and parameters developed through extensive study of the $A \sim 100$ region.
Accuracy:	——
Completion:	completed
Publication:	Z. Physik A–Atomic Nuclei 333 (1989) 1 Z. Physik A–Atomic Nuclei 334 (1989) 259

LABORATORY: Kernforschungszentrum Karlsruhe GmbH
Institut für Kernphysik
Postfach 3640
D-7500 Karlsruhe
Federal Republic of Germany

1. NAMES: N. Klay, F. Käppeler

FACILITIES: High Flux Reactor, ILL, Grenoble

EXPERIMENT: Measurement of beta branch in the decay of the isomer ^{79m}Se.

Method: Production of ^{79m}Se by irradiation of ultraclean ^{78}Se sample in high flux reactor; detection of electrons from beta decay via mini-orange spectrometer; deduced log ft for beta decay of ^{79m}Se.

ACCURACY: ± 2% for log ft value

COMPLETION DATE: December 1987

DISCREPANCIES TO OTHER REPORTED DATA: No other data available.

PUBLICATIONS: N. Klay, F. Käppeler, Phys. Rev. C38 (1988) 295

2. NAMES: F. Käppeler, W.R. Zhao, H. Beer, U. Ratzel

FACILITIES: 3.75 MV van de Graaff

EXPERIMENT: Measurement of the Maxwellian Average Neutron Capture Cross Sections of ^{88}Sr and ^{89}Y at kT = 25 keV.

Method: Activation of thin samples in quasi Maxwellian neutron spectrum of kT = 25 keV; counting of induced activities via electrons from beta decay in a 4πSi(Li) spectrometer; neutron flux determined by simultaneous activation of ^{197}Au samples.

ACCURACY: 3.0 and 3.2% for the cross section of ^{88}Sr and ^{89}Y, respectively.

COMPLETION DATE: May 1989

DISCREPANCIES TO OTHER REPORTED DATA: No serious discrepancies to existing data, but uncertainties reduced by factors of ~ 3 to 5.

PUBLICATIONS: Submitted to the Astrophysical Journal

3. NAMES: K.A. Toukan, F. Käppeler

FACILITIES: 3.75 MV Van de Graaff

EXPERIMENT: Measurement of the Maxwellian Average Neutron Capture Cross Sections of ^{94}Zr and ^{96}Zr at kT = 25 keV.

Method: Activation of metal foils in quasi Maxwellian Neutron Spectrum of kT = 25 keV; counting of induced activities via characteristic gamma-rays; neutron flux determined by simultaneous activation of ^{197}Au foils.

ACCURACY: 3.8 and 4.7% for ^{94}Zr and ^{96}Zr, respectively.

COMPLETION DATE: March 1989

DISCREPANCIES TO OTHER REPORTED DATA: No serious discrepancies for ^{94}Zr but up to a factor of 4 in case of ^{96}Zr; uncertainties reduced by factors 2 to 5.

PUBLICATIONS: K.A. Toukan, F. Käppeler
The Astrophysical Journal (in press)

GERMANY, FED. REP.

(cont'd)

4. NAMES: K. Wisshak, F. Voß, F. Käppeler, G. Reffo

FACILITIES: Pulsed 3.75 MV Van de Graaff

EXPERIMENT: Neutron Capture Cross Section Measurements of ^{93}Nb and ^{103}Rh in the Energy Range from 3 to 200 keV.

Method: Continuous neutron spectrum produced via $^{7}Li(p,n)$ reaction. Time of flight determination of neutron energy (flight path 77 cm). Capture events are detected by a 4π BaF_2 detector with ~ 100% efficiency for gamma-rays up to 10 MeV, 7% energy resolution at 2.5 MeV, and 500 ps time resolution. Measurements are performed relative to a gold standard.

ACCURACY: Statistical accuracy ~ 1% for 20 keV wide energy bins, systematic uncertainty ~ 0.8% for the cross section ratio.

COMPLETION DATE: Data evaluation completed

DISCREPANCIES TO OTHER REPORTED DATA: 15 and 25% difference to the ^{93}Nb and ^{103}Rh cross section reported by Macklin (Nucl. Sci. Eng. **59** (1976) 12), and Macklin and Halperin (Nucl. Sci. Eng. **73** (1980) 174), respectively.

PUBLICATIONS: in preparation

GERMANY, FED. REP.

(cont'd)

5. NAMES:	H. Beer, G. Walter, F. Käppeler
FACILITIES:	3.75 MV Van de Graaff
EXPERIMENT:	Measurement of the ^{116}Sn capture cross section between 3 and 200 keV.
Method:	Continuous neutron energy spectrum from the $^{7}Li(p,n)$ reaction. Enriched ^{116}Sn (98%) metal sample. Capture events detected by 2 C_6D_6 detectors of 1 ℓ volume with pulse height weighting. Neutron energy determination by time-of-flight, 1.5 ns/m resolution; ^{197}Au sample used as standard.
ACCURACY:	5.4% for Maxwellian average at kT = 30 keV.
COMPLETION DATE:	1988
DISCREPANCIES TO OTHER REPORTED DATA:	Good agreement with previous measurement by Macklin and Gibbons 1967, Phys. Rev. **159**, 1007, but uncertainty reduced by factor 4.
PUBLICATIONS:	Astron. & Astrophys. **211**, 245 (1989)

GERMANY, FED. REP.

Laboratory and address:	Physikalisch-Technische Bundesanstalt Bundesallee 100, D-3300 Braunschweig
Names:	K. Debertin, H. Schrader, K. F. Walz
Facilities:	Ionization chamber; Ge(Li) spectrometer
Experiment:	Determination of half-lives of ^{85}Kr, ^{90}Sr, ^{99}Mo, $^{99}Tc^{m}$, ^{125}Sb, ^{131}I, ^{133}Xe, ^{140}Ba, ^{140}La, ^{144}Ce, ^{152}Eu, ^{154}Eu, ^{155}Eu.
Method:	The decay of the radioactive substance in a source is followed over a period of several half-lives.
Accuracy:	0.1% to 0.01% (1 σ)
Completion date:	partly completed, partly ongoing
Publication:	K. F. Walz, K. Debertin and H. Schrader: Half-Life Measurements at the PTB. Intern. J. Appl. Rad. Isotopes 34 (1983) 1191 - 1199

Laboratory and address:	Physikalisch-Technische Bundesanstalt Bundesallee 100, D-3300 Braunschweig
Names:	U. Schötzig
Facilities:	Ge(Li), HPGe and Si(Li) detectors carefully efficiency-calibrated.
Experiment:	Determination of the photon-emission probabilities per decay of ^{89}Sr and ^{147}Pm (and of other non-fission product nuclides)
Method:	Measurement of photon emission rates of sources, whose activities have been determined with absolute methods.
Accuracy:	1.4% to 7% (for very weak transitions)
Completion date:	Completed
Publication:	U. Schötzig: Photon emission probabilities of ^{44}Ti, ^{65}Zn, ^{88}Y, ^{89}Sr, ^{147}Pm, ^{204}Tl and ^{210}Pb; Nucl. Instr. Meth. Phys. Res. A 286 (1990) 523

Laboratory and address:	Physikalisch-Technische Bundesanstalt Bundesallee 100, D-3300 Braunschweig
Names:	H. Schrader
Facilities:	Two photon detectors with thin NaI(Tl) crystals connected to coincidence electronics
Experiment:	Standardization of ^{129}I by a tracer method with poton-photon coincidences from the decay of ^{125}I
Method:	A tracer method for activity measurements has been elaborated using mixed samples of ^{129}I and ^{125}I, both radionuclides emitting photons with rather similar energies from about 27 to 40 keV.
Accuracy:	2 % (estimated relative standard deviation for the activity, mainly due to systematic uncertainties)
Completion date:	Method completed, several standardizations ongoing
Publication:	H. Schrader: Standardization of ^{129}I by a Tracer Method with Photon-Photon Coincidences from the Decay of ^{125}I. To be published in Appl. Rad. Isot. (1989/90)

Laboratory and Address: Institut für Metallphysik und Nukleare Festkörperphysik
Technische Universität Braunschweig
Mendelssohnstr. 3
D-3300 Braunschweig

Names: U. Keyser, F. Münnich

Facilities: On-line mass separators LOHENGRIN and OSTIS, installed at the high-flux reactor of the ILL, Grenoble, France and CERN-ISOLDE II, Geneva, Switzerland

Experiments: 1) Determination of β-decay energies of very neutron rich isotopes available from fission and spallations of ^{235}U and ^{239}Pu

Method: βγ-Coincidence measurements with a plastic-scintillator telescope.

Accuracy: ΔE between 50 keV and 150 keV, depending upon the complexity of the decay scheme.

Completion date: Systematic investigation

Publications:

Experimental β-Decay Energies of Very Neutron-Rich Light Fission Products; Proc. Int. Conf. Nucl. Data Basic and Applied Science, Eds. P.G. Young et al., Vol.1, 713 (1985) +)

β-Decay Energies of Neutron-Rich Nuclei in the Mass Region 142≤A≤150; Z. Physik A324, 15 (1986) #)

Nuclear Structure Effects in the Mass Region Around A=100, Derived from Experimental Q_β-Values; Z. Physik A327, 383 (1987) +)

β-Decay Energies and Systematics of Nuclear Structure Effects; 5th Internat. Conf. on Nuclei Far from Stability; Eds. I.S. Tower, AIP Conf. Proceeding 164, 30 (1988)

Experimental β-Decay Energies of $^{91,92}Br$; Nucl. Phys. A491, 373 (1988) **)

Experimental β-Decay Energies of Very Neutron-Rich Fission Products with 107≤A≤109; Z. Physik A334, 239 (1989) ++)

+) ^{90}Br, $^{101-103}Zr$, $^{101-105}Nb$, $^{103-106}Mo$, $^{104-106}Tc$

#) ^{146}Cs, $^{146,147}Ba$, $^{146,147}La$, ^{147}Ce

**) $^{91,92}Br$, $^{91,92}Kr$

++) ^{107}Mo, $^{107-109}Tc$, $^{107-109}Ru$, ^{108}Rh

Laboratory and address: Physik-Department
Technische Universität München
D 8046 Garching

Names: T. von Egidy, J. Klora, H. Lindner, U. Mayerhofer
collaboration with ILL, Grenoble, University of Göttingen and others

Facilities: Q3D spectrograph at the Munich Tandem Accelerator
(n,γ) facilities at the ILL, Grenoble

Experiments: (n,γ), (d,p), (d,t)

Publications:

1) M. Bogdanovic, R. Brissot, G. Barreau, K. Schreckenbach, S. Kerr, H.G. Börner, I.A. Kondurov, Yu. E. Loginov, V.V. Martynov, P.A. Sushkov, T. von Egidy, P. Hungerford, H.H. Schmidt, H.J. Scheerer, A. Chalupka, W. Kane, G. Alaga
Nucl. Phys. A470 (1987) 13
The level scheme of ^{134}Cs

2) Ch. Winter, B. Krusche, K.P. Lieb, T. Weber, G. Hlawatsch, T. von Egidy, F. Hoyler
Nucl. Phys. A 473 (1987) 129
Spectroscopy of ^{88}Sr with the ^{87}Sr (n,γ) and ^{87}(d,p) reactions

3) Ch. Winter, B. Krusche, K.P. Lieb, S. Michaelsen, G. Hlawatsch, H. Lindner, T. von Egidy, F. Hoyler, R.F. Casen
Nucl. Phys. A 491 (1989) 395
Level structure of ^{89}Sr investigated with thermal and fast neutron capture and the (d,p) reaction

4) S.L. Sakharov, I.A. Kondurov, Yu. E. Loginov, V.V. Martynov, A.A. Rodinov, P.A. Sushkov, Yu. L. Khazov, A.I. Egorov, V.K. Isupov, H.G. Börner, F. Hoyler, S.A. Kerr, K. Schreckenbach, G. Hlawatsch, T. von Egidy, H. Lindner
Nucl. Phys. A 494 (1989) 36
Low-lying ^{130}I excited states from the (n,γ) reactions

5) H.H. Schmidt, P. Hungerford, T. von Egidy, H.J. Scheerer, H.G. Börne S.A. Kerr, K. Schreckenbach, F. Hoyler, G.G. Colvin, A.M. Bruce, R.F. Casten, D.D. Warner, I.L. Kugava, V.A. Bondarenko, N.D. Kramer, P.T. Prokofjev, A. Chalupka
Nucl. Phys. A, 504 (1989) 1
Nuclear Structure of ^{163}Dy studied with (n,γ),(n,n'γ),(d,p) and (d,t) reactions

Laboratory: Institut für Kernchemie
Universität Mainz
Postfach 3980, D-6500 Mainz, Germany
Tel.: 06131-395879, Fax: 06131-395253
EARN: DENSCHLA at DMZNAT51

1.

Names: A. Srivastava, H. O. Denschlag
Facilities: TRIGA Reactor, this institute
<u>Experiment:</u> Nuclear charge distribution in the reactor induced fission of ^{232}Th: Fractional cumulative yields of the isotopes of krypton and xenon
Method: Emanation method of fission rare gases through a layer of Mg-stearate into an evacuated volume during reactor irradiation followed by radiochemical isolation of the descendents.
Accuracy: 5 %
Completion: Completed
Publication: Radiochimica Acta <u>46</u>, 17-21 (1989)

2.

Names: R. Hentzschel, H. O. Denschlag
Facilities: TRIGA Reactor, this institute
<u>Experiment:</u> Isomeric yield ratios of ^{134}I and ^{136}I and independent fractional yields of some halogen isotopes in the fission of ^{232}Th with reactor neutrons
Method: Rapid chemical separation of the fission iodine and - bromine from precursors and from other fission products
Accuracy: 5 %
Completion: Completed
Publication: R. Hentzschel, Diplomarbeit, Mainz (1989), submitted to Radiochimica Acta

---

3.

Names: U. Güttler, P. Stumpf, H. O. Denschlag (Univ. Mainz), and H. Faust (ILL, Grenoble)
Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble
<u>Experiment:</u> Determination of mass yields and charge distribution of very light fission products in the reaction ^{241}Am(2n,f) and of mass yields in the symmetric region of this reaction at various kinetic energies of the fission fragments.
Method: Mass separated fission products are stopped in a large ionization chamber that provides a signal of the total fragment energy and - in the case of Z identification - of the specific energy loss.
Accuracy: A few percent
Completion: Experimentally completed
Publication: Two PhD-theses in preparation (U. Güttler and P. Stumpf), publication planned.

4.

Names: W. Ditz, H. O. Denschlag (Univ. Mainz), and H. Faust (ILL, Grenoble)
Facilities: LOHENGRIN mass separator for unslowed fission products at the Institut Laue-Langevin, Grenoble
<u>Experiment:</u> Determination of mass yields and charge distribution of very light fission products in the reaction ^{239}Pu(n_{th},f) at various kinetic energies of the fission fragments.
Method: See above (Experiment No. 3)
Accuracy: A few percent
Completion: To be experimentally completed in 1989
Publication: -

---

5. Names: C. Lietz, H. O. Denschlag, W. Ditz, U. Güttler, B. Sohnius, P. Stumpf (Univ. Mainz) and H. Faust (ILL, Grenoble)

Facilities: LOHENGRIN Mass separator for unslowed fission products at Institut Laue - Langevin, Grenoble

Experiment: Fission yields and isomeric ratios in 12 mass chains of $^{233}U(n_{th},f)$ have been measured at various well defined energies of the fission fragments

Method: Fission fragments separated according to mass (resolution $M/\Delta M = 400$) and kinetic energy (resolution 2 MeV) are intercepted on a moving transport tape, carried continuously or discontinuously in front of a Ge(Li) γ-ray detector, and counted via the γ-rays emitted in their β-decay.

Accuracy: 10 %

Completion: Experimentally completed

Publication: C. Lietz, Diplomarbeit, Mainz (1985); Preliminary results in "Jahresbericht 1985" this institute and Report NEANDC(E)-272 U Vol. V, p. 33 and 36 (1986); publication planned.

---

6. Names: A. Srivastava, H.O. Denschlag, W. Ditz, U. Güttler, P. Stumpf (Univ. Mainz) and H. Faust (ILL, Grenoble)

Facilities: LOHENGRIN Mass separator for unslowed fission products at Institut Laue - Langevin, Grenoble

Experiment: The isomeric yield ratios of ^{97}Y and ^{134}I in the reaction $^{239}Pu(n_{th},f)$ at various kinetic energies of the fission fragments were determined

Method: Mass separation (see contribution No. 1, above)

Accuracy: 10 %

Completion: Experimentally completed

Publication: Jahresbericht 1986, this institute

7.

Names: St. Hörner, H.O. Denschlag, H. Gabelmann, K.L. Kratz, B. Pfeiffer (Univ. Mainz), and H. Stöhlker (ILL, Grenoble)

Facilities: OSTIS mass separator, ILL (Grenoble)

Experiment: The fission yields and isomeric formation ratios of the Indium isotopes 123-129 from $^{235}U(n_{th},f)$ were determined

Method: γ-ray spectrometry after mass separation

Completion: experimentally completed

Publication: St. Hörner, Diplomarbeit, Mainz (1985); Preliminary results in "Jahresbericht 1984" this institute and Report NEANDC(E)-262 U Vol. V, p. 43 (1985); publication planned.

8.

Names: St. Hörner, H.O. Denschlag, W. Ditz, U. Güttler, B. Sohnius, P. Stumpf (Univ. Mainz), H. Faust (ILL, Grenoble)

Facilities: LOHENGRIN Mass separator for unslowed fission products at Institut Laue - Langevin, Grenoble

Experiment: Isomeric formation ratios of ^{96}Y, ^{97}Y, and ^{98}Y in $^{235}U(n_{th},f)$ were determined at various kinetic energies of the fission fragments.

Method: Mass separation (see contribution No. 1, above)

Accuracy: 10 %

Completion: Experimentally completed

Publication: St. Hörner, Diplomarbeit, Mainz (1985); Preliminary results in "Jahresbericht 1984" this institute and Report NEANDC(E)-262 U Vol. V, p. 41 (1985); publication planned.

HUNGARY

Laboratory and address: Institute of Experimental Physics
Kossuth University
P.O. Box 105
4001, Debrecen
Hungary

Names: S. Quichaoui, S. Juhász, M. Várnagy and J. Csikai

Facilities: Cockcroft-Walton generator

Experiment: Measurement of the angular distribution of fission fragments from the fast neutron induced fission of ^{235}U, ^{238}U and ^{237}Np near the (n,2nf) threshold. The anisotropy parameters were determined around 14 MeV.

Method: Polycarbonate nuclear track detector and Jumping Spark Counter

Accuracy: Refer to the table

States: Completed

Table:

Nuclide	E(MeV)	Experimental anisotropy
^{235}U	14.12±0.08	1.441±0.056
	14.80±0.17	1.333±0.021
^{238}U	14.12±0.08	1.528±0.055
	14.45±0.12	1.499±0.040
	14.80±0.17	1.421±0.037
^{237}Np	14.12±0.08	1.375±0.025
	14.45±0.12	1.276±0.026
	14.80±0.17	1.232±0.020

Publications: S. Quichaoui, S. Juhász, M. Várnagy and J. Csikai
INDC /NDS/-146, <u>249</u> /1983/

S. Quichaoui, S. Juhász, M. Várnagy and J. Csikai
Acta Physica Hungarica
<u>64</u>, 209-218 /1988/.

INDIA

LABORATORY AND ADDRESS : Swami Jnanananda Laboratories for Nuclear Research, Andhra University, VISAKHAPATNAM – 530 003, INDIA.

NAMES : M.V.S. Chandrasekhar Rao, N. Ven kateswara Rao, S. Bhuloka Reddy, G. Satyanarayana, D.L. Sastry, M.R. Iyer and S.G. Sahasrabudhe

FACILITIES : CIRUS reactor, Bhabha Atomic Research centre, Bombay and HpGe detector with a 4K microprocessor based MCA

EXPERIMENT : Measurement of anomalous conversion of 127 keV E3 transition in ^{134m}Cs

METHOD : ^{134m}Cs was produced via ^{133}Cs (n,γ) ^{134m}Cs reaction. The α_K and of the 127.49 keV $(8^- \longrightarrow 5^+)$ E3 transition in ^{134m}Cs was determined using the K X- ray peak to gamma peak and Intensity Balance methods, respectively.

ACCURACY : Refer to the Table

STATUS : Completed

TABLE :

α_K(exp.) = 2.24 ± 0.04	α_T(exp.) = 5.84±0.47
α_K(Th.) = 1735	α_T(Th.) = 6.96
Deviation from Theory =(17.6±1.4)%	Deviation from Theory =(16.1±6.7)%

PUBLICATION : Z. Phys. A330 (1988) 161

LABORATORY AND ADDRESS : Swami Jnanananda Laboratories for Nuclear Research, Andhra University, VISAKHAPATNAM - 530 003, INDIA.

NAMES : G. Sree Krishna Murty, M.V.S. Chandrasekhar Rao, N. Venkateswara Rao, S. Bhuloka Reddy, G. Satyanarayana, D.L. Sastry, M.R. Iyer and S.G. Sahasrabudhe

FACILITIES : CIRUS reactor, Bhabha Atomic Research centre, Bombay and HpGe detector with a 4K microprocessor based MCA

EXPERIMENT : Measurement of 479.53 keV M4 transition in ^{90m}Y

METHOD : ^{90m}Y was produced via ^{89}Y (n,γ) ^{90m}Y reaction. The total conversion coefficient of the 479.53 keV $(7^+ \longrightarrow 3^-)$ M4 transition in was determined using the Intensity Balance method.

ACCURACY : Refer to the Table

STATUS : Completed

TABLE :

α_T(exp.)	= 0.099 ± 0.0013
α_T(Th.)	= 0.098
Deviation from Theory	= (1.02 ± 1.32)%
Hindrance	= 10.29

PUBLICATION : J. Physics G 15 (1989) 1769

INDIA

LABORATORY AND ADDRESS
Radiochemistry Division
Bhabha Atomic Research Centre
Trombay, BOMBAY-400085, INDIA

NAMES
T. Datta, S.P. Dange, S.K. Das, H. Naik, A.V.R. Reddy, B.S. Tomar, A. Goswami, Satya Prakash and M.V. Ramaniah

FACILITIES
1. Class A Laboratory
2. HPGe detector and Multichannel Analyser

EXPERIMENT
Investigation of the influence of fragment nuclear structure and deformed shell effect on the scission configuration using angular momenta of fission fragments

METHOD
Fragment angular momenta have been deduced from radiochemically determined independent isomeric yield ratios of the fission products in thermal neutron fission of actinides and in SF of ^{252}Cf.

ACCURACY
± 10% on angular momenta

STATUS
The work is completed.

PUBLICATIONS

1. Dependence of the angular momenta of fission fragments on their nuclear structure, Radiochimica Acta 39, 127-130 (1986).
2. Influence of fission fragment nuclear structure on scission configuration in $^{252}Cf(SF)$, Z. Physik A. Atomic Nuclei 324, 81-85 (1986).
3. Effect of shell closure proximity on fragment angular momenta in $^{241}Pu(n_{th},f)$, J. Radioanal. Nuclear Chem.Letters 108(1986) 269
4. Fragment angular momentum in low and medium energy fission of ^{242}Pu, Z. Physik A. 327 (1987) 225.

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic Research Centre Trombay, BOMBAY-400085, INDIA
NAMES	A.G.C. Nair, A. Srivastava, A. Goswami, B.K. Srivastava, S.K. Das, B.S. Tomar and Satya Prakash
FACILITIES	1. Class A Radiochemical Laboratory 2. HPGe detector and Multichannel Analyser
EXPERIMENT	Cumulative yield determination of Ru isotopes in fission of actinides
METHOD	Cumulative yields of short-lived Ruthenium isotopes in the thermal neutron induced fission of ^{233}U, ^{235}U, ^{239}Pu and ^{241}Pu have been determined using a fast radio-chemical separation technique.
ACCURACY	± 10% on the yields
STATUS	The work is completed.
PUBLICATIONS	1. Cumulative yields of short-lived Ruthenium isotopes in the thermal neutron induced fission of ^{233}U, ^{235}U and ^{239}Pu, J. Radioanal. Nucl. Chem. Articles 91/1 (1985) 73-79. 2. Cumulative yields of short-lived Ruthenium isotopes in the thermal neutron induced Fission of ^{241}Pu, Radiochimica Acta 42, 7 (1988).

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic Research Centre Trombay, BOMBAY-400 085, INDIA
NAMES	A. Ramaswami, N. Chakravarty, S.S. Rattan, R.J. Singh, Satya Prakash and M.V. Ramaniah
FACILITIES	1. Class A Radiochemical Laboratory 2. HP Ge Detector and Multichannel Analyser
EXPERIMENT	Nuclear charge distribution studies, Fractional cumulative yields in reactor neutron induced fission of ^{237}Np and Thermal neutron induced fission of ^{241}Pu.
METHOD	Fast radiochemical separation and gamma-ray spectrometry
ACCURACY	10 - 12% on the yields.
STATUS	Work on charge distribution study of ^{237}Np completed and of ^{241}Pu is likely to be completed by end of 1987.
PUBLICATIONS	1. Charge distribution studies in the reactor neutron induced fission of ^{237}Np, DAE Radiochemistry and Radiation Chemistry Symposium, IIT, Kanpur, India (1985). 2. Charge distribution studies in the neutron induced fission of ^{237}Np: Fractional cumulative yields of ^{134}Te, ^{135}I and ^{138}Xe, Radiochimica Acta 41 (1987) 9.

LABORATORY AND ADDRESS

Radiochemistry Division,
Bhabha Atomic Research Centre,
Trombay, BOMBAY-400085, INDIA

NAMES

A.V.R. Reddy, S.B. Manohar,
S.M. Deshmukh, T. Datta, P.P. Burte,
Satya Prakash and M.V. Ramaniah

FACILITIES

1. Class A Radiochemical Laboratory
2. 8% HP-Ge Detector
   Multichannel analyser

EXPERIMENT

Isotopic yield distribution in the low energy fission of $^{252}Cf(SF)$, $^{241}Pu(n_{th},f)$, $^{245}Cm(n_{th},f)$, $^{241}Am(n,f)$, $^{232}Th(n,f)$, $^{238}U(n,f)$, $^{229}Th(n_{th},f)$

Independent yields of Iodine isotopes are determined γ-spectrometrically after performing radiochemical separations.

ACCURACY

10 – 12% on the yields

STATUS

The work in $^{252}Cf(SF)$, $^{241}Pu(n_{th},f)$, $^{241}Am(n,f)$, $^{229}Th(n_{th},f)$ and $^{245}Cm(n_{th},f)$ is completed.

Work in ^{232}Th and ^{238}U is in progress.

PUBLICATIONS

1. Part of the work on iodine yields in $^{252}Cf(SF)$ was presented in the Symp. "Nuclear and Radiochemistry", B.H.U., Banaras, India (1981).
2. Isotopic yield distribution of iodine in thermal neutron induced fission of ^{241}Pu, International Symposium on Artificial Radioactivity, University of Poona, Pune, India (Jan. 1985).
3. Isotopic yield distribution of iodine in the reactor neutron induced fission of ^{241}Am, DAE Radiochemistry and Radiation Chemistry Symposium, IIT Kanpur (1985).
4. Isotopic yield distribution of iodine in thermal neutron induced fission of ^{245}Cm, DAE Symposium on Radiochemistry and Radiation Chemistry, Tirupati, India (1986).

LABORATORY AND ADDRESS

Radiochemistry Division
Bhabha Atomic Research Centre
Trombay, BOMBAY-400085, INDIA

NAMES

S.B. Manohar, A. Ramaswami,
B.K. Srivastava, A.V.R. Reddy,
A.G.C. Nair, G.K. Gubbi,
A. Srivastava, S.S. Rattan and
Satya Prakash

FACILITIES

Class A Radiochemical Laboratory
HPGe detector and Multichannel Analyzer
Variable Energy Cyclotron

EXPERIMENT

Charge distribution studies: Determination of fractional cumulative yields of xenon, barium and cerium isotopes in low and medium energy fission

METHOD

The fractional cumulative yields of $^{137,138,139}Xe$, $^{139,140,141,142}Ba$ and $^{146,147}Ce$ in spontaneous fission of ^{252}Cf and of ^{92}Sr, ^{134}Te and ^{135}I in $^{238}U(\alpha, f)$ have been determined using radiochemical separation and gamma spectrometric techniques.

ACCURACY

± 10% on yield values

STATUS

Work is completed

PUBLICATIONS

1. Nuclear charge distribution in spontaneous fission of ^{252}Cf, International Conference: Fifty years Research in Nuclear Fission, Berlin, Germany (1989).
2. Charge distribution study in alpha induced fission of ^{238}U, Radiochemistry and Radiation Chemistry Symposium, IGCAR, Kalpakkam (1989)
3. Cumulative yields of short-lived isotopes of Barium in the spontaneous fission of ^{252}Cf, J. Radioanal. & Nucl. Chem. Articles 125, 85 (1988)

LABORATORY AND ADDRESS
Radiochemistry Division
Bhabha Atomic Research Centre
Trombay, BOMBAY-400085, INDIA

NAMES
T. Datta, S.P. Dange, H. Naik, P.K. Pujari, B.S. Tomar, A. Goswami, S.K. Das, B.K. Srivastava, R. Guin, S.M. Sahakundu and Satya Prakash

FACILITIES
Class A Laboratory
HPGe detector, Multiparameter/Multichannel Analyzer
Variable Energy Cyclotron

EXPERIMENT
Investigationa on the influence of fragment nuclear structure, deformed shell effect on scission configuration and the effect of excitation energy as well as the fissioning nucleus on fragment angular momentum were carried out.

METHOD
Fragment angular momenta have been deduced from the radiochemically determined independent isomer yield ratios of the fission products in the thermal neutron induced fission of ^{235}U, ^{239}Pu, ^{245}Cm, SF of ^{252}Cf and in the alpha induced fission of ^{238}U at various alpha energies.

ACCURACY
± 10% on angular momentum values

STATUS
The work is completed.

PUBLICATIONS

1. Effect of shell closure proximity on fragment angular momenta in $^{241}Pu(n_{th}, f)$, J. Radioanal. Nucl. Chem. Letters, 108, 269 (1987)
2. Correlations of fission fragment angular momentum with collective and intrinsic degrees of freedom, Z. Physik A. 331, 335 (1988)
3. Influence of collective rotational degrees of freedom in medium energy fission, Z. Physik A 330, 103 (1988)
4. Fragment angular momenta in alpha induced fission of ^{238}U, Phys. Rev. C 38, 1787 (1988).
5. Effect of excitation energy on fission fragment angular momentum, Radiochemistry and Radiation Chemistry Symposium, IGCAR, Kalpakkam (1989)

LABORATORY AND ADDRESS
Radiochemistry Division
Bhabha Atomic Research Centre
Trombay, BOMBAY 400085, INDIA

NAMES
T. Datta, P.K. Pujari, B.S. Tomar, S.K. Das, A. Goswami, S.B. Manohar, H. Naik and Satya Prakash

FACILITIES
Class A. Laboratory, Surface barrier detectors, Multichannel Analyzer

EXPERIMENT
Elemental yields of the fragments have been determined in $^{252}Cf(SF)$

METHOD
Coincidence kinetic energy measurements have been determined using a pair of surface barrier detectors coupled to a multiparameter system. A model independent mass charge correlation parameter was used to get the elemental yields of the fission fragments.

ACCURACY
10-12% on yield values

STATUS
Work is completed.

PUBLICATION
A new approach to determine elemental yield, charge polarization and odd-even effects in fission, International Symposium on Nuclear Physics, Physics and Chemistry of Fission, Gaussig, GDR (1988).

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic Research Centre Trombay, BOMBAY-400085, INDIA
NAMES	Satya Prakash, S.B. Manohar, T. Datta, A. Goswami and S.P. Dange
FACILITIES	Class A Laboratory HPGe Detector, Multichannel Analyzer, Variable Energy Cyclotron
EXPERIMENT	Angular distribution studies on the fission products have been carried out as a function of their masses in alpha induced fission of actinides.
METHOD	Angular distribution of fission fragments has been measured in varying energy alpha induced fission of ^{232}Th, ^{238}U and ^{233}U using recoil catcher and gamma spectrometric technique
ACCURACY	± 10% on anisotropy values
STATUS	The work is in progress.
PUBLICATIONS	1. Radiochemical investigation on mass resolved angular distribution of fragments in medium energy fission, International Symposium on Nuclear Physics; Physics and Chemistry of Fission, Gaussig, GDR, 1988. 2. Mass resolved fragment angular distribution in alpha induced fission of ^{238}U, Radiochemistry and Radiation Chemistry Symposium, IGCAR, Kalpakkam, 1989.

INDIA

LABORATORY AND ADDRESS	Radiochemistry Division Bhabha Atomic Research Centre Trombay, BOMBAY-400085, INDIA
NAMES	V.K. Bhargava, M.S. Oak, A. Ramaswami and Satya Prakash
FACILITIES	Class A Laboratory, HPGe Detector, Multichannel Analyzer
EXPERIMENT	Absolute yield determination of ^{99}Mo and ^{132}Te in spontaneous fission of ^{252}Cf
METHOD	Absolute yields of ^{99}Mo and ^{132}Te have been determined in the spontaneous fission of ^{252}Cf using solid state track detector cum gamma spectrometric technique
ACCURACY	± 10% on yield
STATUS	Work completed
PUBLICATIONS	1. Absolute yields of fission products ^{99}Mo and ^{132}Te in SF of ^{252}Cf, Radiochemistry and Radiation Chemistry Symposium, Bombay (1988) 2. Absolute yields of ^{99}Mo and ^{132}Te in spontaneous fission of ^{252}Cf, Radiochimica Acta 46, 177 (1989)

Laboratory and Address: Department of Physics, Panjab University, Chandigarh-160014, INDIA.

Names: Devinder Mehta, Surinder Singh, Harpal Kaur, Bakhshish Chand, M.L.Garg, H.R.Verma, Nirmal Singh, T.S.Cheema and P.N.Trehan.

Facilities: A 28.27 mm^2 x 5.0 mm planar HPGe detector and a 28.27 mm^2 x 5.5 mm planar Si(Li) detector.

Experiment 1: Precision measurements of X-ray and Gamma ray intensities in the decay of ^{137}Cs, ^{141}Ce, ^{170}Tm, ^{203}Hg.

Method: K and L X-rays and gamma rays were measured using a coaxial HPGe detector (FWHM = 1.8 keV at 1332 keV used in energy region 80–1400 keV) a planar HPGe detector (FWHM 459 eV at 122 keV, used in energy region 20–400 keV) and a Si(Li) detector (FWHM 170 eV at 5.9 keV, used in energy region 4–90 keV). Efficiency calibration of these detectors was done using radioactive standard sources. Below 15 keV, efficiency of Si(Li) detector in a special annular source geömetry was also determined by measuring the K X-ray fluorescence yield from thin metallic foils of Ti, Cu, Se, Ge and Y excited by 22.6 keV photons and from the knowledge of K X-ray fluorescence cross-sections. Gamma ray intensities were corrected for summing.

Accuracy: Errors are quoted in parantheses. (Table 1)

Completion date: November 1986.

Discrepancies: Different components of K and L X-rays in ^{141}Ce, ^{170}Tm decays and only L X-rays in ^{137}Cs, ^{203}Hg decays have been measured for the first time. The X-ray and gamma ray intensities have been measured with much better precision as compared to the earlier measured ones.

Publications:

1. Devinder Mehta, Harpal Kaur, M.L.Garg, H.R.Verma, Nirmal Singh, T.S.Cheema and P.N.Trehan, Nucl. Instr. and Meth. A242 (1985) 149.

2. Devinder Mehta, Surinder Singh, H.R.Verma, Nirmal Singh and P.N.Trehan, Nucl. Instr. and Meth. A254 (1987) 578.

3. Devinder MEHTA, Bakhshish CHAND, Surinder SINGH, M.L. GARG, Nirmal SINGH, T.S. CHEEMA and P.N. TREHAN Nuclear Instruments and Methods in Physics Research A260 (1987) 157–159

(cont'd)

Table 1: Relative intensities of X-rays and gamma ray in the decay of ^{137}Cs, ^{170}Tm, ^{141}Ce and ^{203}Hg.

	Energy (keV)	Radiation	Relative intensity (%)		Energy (keV)	Radiation	Relative intensity (%)
^{137}Cs	3.956	L_ℓ	0.0160(14)	^{141}Ce	5.03	$L_{\alpha,\eta}$	1.54(5)
	4.466	$L_{\alpha,\eta}$	0.558(22)		5.52	$L_{\beta_{1,3,4}}$	1.17(4)
	4.829	L_β	0.449(18)		5.85	L_{β_2}	0.21(1)
	5.531	L_γ	0.055(3)		6.33	L_γ	0.24(1)
	32.006	$K_{\alpha_{1,2}}$	6.85(11)		35.55	K_{α_2}	25.4(4)
	36.343	$K_{\beta_1'}$	1.31(2)		36.03	K_{α_1}	
	37.255	$K_{\beta_2'}$	0.321(7)		40.70	$K_{\beta_1'}$	4.87(9)
	661.7	γ	100.0(10)		41.80	$K_{\beta_2'}$	1.19(2)
					145.5	γ	100.0(10)
^{170}Tm	6.49	L_ℓ	2.38(7)*	^{203}Hg	8.952	L_ℓ	0.162(8)
	7.35	$L_{\alpha,\eta}$	57.3(17)*		10.257	L_α	3.31(13)
	8.44	L_β	60.3(18)*		10.993	L_η	0.0519(24)
	9.73	L_γ	9.74(31)*		12.212	L_β	3.45(13)
	48.83	Er-$K_{\alpha_{1,2}}$	2.84(6)		14.290	L_γ	0.685(27)
	55.60	Er-K_{β_1}	0.63(2)		70.833	K_{α_2}	4.69(7)
	57.20	Er-K_{β_2}	0.145(6)		72.874	K_{α_1}	7.92(12)
	51.35	Yb-K_{α_2}	37.7(9)		82.344	$K_{\beta_1'}$	2.71(6)
	52.39	Yb-K_{α_1}	68.0(17)		84.865	$K_{\beta_2'}$	0.776(16)
	59.30	Yb-K_{β_1}	21.45(32)		279.2	γ	100.0(12)
	60.98	Yb-K_{β_2}	5.33(9)				
	78.59	Er-γ	0.150(20)				
	84.25	Yb-γ	100.0(10)				

* These results also include L X-ray of Er whose contribution is expected to be less than 1%.

Names: Bakhshish Chand, Jatinder Goswamy, Devinder Mehta, Surinder Singh, M. L. Garg, Nirmal Singh and P. N. Trehan.

Facilities: A 96.0cc coaxial HPGe, a 28.27mm x 5.0mm vertical planar HPGe and a 28.27mm x 5.5mm Si(Li) detectors.

Experiment 2: Precision measurements of K X-rays and Gamma ray intensities in Ru-103, Ba-131, Cs-134 and Ho-166m decays.

Method: Same as described in experiment 1.

Accuracy: *Errors as quoted in parantheses* (Table 2)

Completion date: December 1987.

Descrepancies: The intensities of different components of K X-rays in Ru-103, Ba-131, Cs-134 and Ho-166m decays have been measure for the first time. The gamma ray intensities have been measured with much better precision as compared to the earlier measured values.

Publication: Bakhshish Chand, Jatinder GOswamy, Devinder Mehta, Surinder Singh, M. L. Garg, Nirmal singh and P. N. Trehan.
Nucl. Instr. and Meths. A273 (1988) 310.

Table 2: Relative intensities of K X- and gamma rays of Ru-103 and Cs-134

Ru-103

Energy [keV]	Relative intensities Experimental (present)
20.17 (K_α)	9.35(20)
22.78 (K_β)	1.92(4)
39.73	0.098(9)
42.6	0.0057(6)
53.29	0.487(11)
113.25	0.0039(8)
114.97	0.0081(5)
241.9	0.0198(14)
292.7	0.0063(19)
294.98	0.333(5)
317.8	0.021(10)
357.4	0.0103(6)
443.8	0.379(4)
497.1	100.0(11)
514.6	0.0125(16)
557.1	0.954(11)
567.9	0.0031(1)
610.3	6.33(5)
612.02	0.118(3)
651.7	0.0076(25)

Cs-134

Energy [keV]	Relative intensities Experimental (present)
32.06 (K_α)	0.740(15)
36.38 (K'_{β_1})	0.142(4)
37.25 (K'_{β_2})	0.032(4)
242.9	0.0294(20)
326.4	0.0170(17)
475.4	1.52(2)
563.3	8.54(7)
569.3	15.75(3)
604.7	100.0(7)

Names: Bakhshish Chand, Jatinder Goswamy, Devinder Mehta Nirmal Singh and P. N. Trehan.

Facilities: Two 96.0cc and 57.0cc coaxial HPGE detectors, a 28.27mm x5.0mm vertical planar detector and two 28.27mm x5.5mm planar Si(Li) detectors.

Experiment 3: X-ray and gamma ray intensity measurements in I-131, Ho-166, Au-198 and Au-199 decays.

Method: Same as described in experiment 1.

Accuracy: *Errors as quoted in parantheses* (Table)

Completion date: January, 1989.

Discrepancies: The intensities of K and L X-rays in I-131 Ho-166, Au-198, and Au-199 decays have been measured for the first time. The Gamma ray intensities have been determined with much better precision than the earlier measured values.

Publication: Bakhshish CHAND, Jatinder GOSWAMY, Devinder MEHTA, Nirmal SINGH and P.N. TREHAN

Nuclear Instruments and Methods in Physics Research A284 (1989) 393–398

Table
Relative intensities of X- and gamma rays emitted in ^{131}I decay

Energy [keV]	Radiation	Relative intensities Present
3.639	L_l	0.014 (2)
4.109	L_α	0.362 (22)
4.416	L_β	0.287 (18)
5.039	L_γ	0.036 (3)
29.667	$\overline{K}_\alpha$	5.15 (15)
33.625	K'_{β_1}	0.913 (30)
34.41	K'_{β_2}	0.210 (6)
80.2	γ	3.26 (7)
177.2	γ	0.334 (6)
232.2	γ	0.0039 (5)
272.5	γ	0.0735 (18)
284.3	γ	7.56 (8)
295.8	γ	0.0022 (10)
302.4	γ	0.0057 (8)
318.1	γ	0.096 (2)
324.8	γ	0.025 (3)
325.4	γ	0.361 (5)
358.4	γ	0.0304 (11)
364.5	γ	100.0 (7)
404.8	γ	0.066(2)
502.9	γ	0.438 (5)
636.9	γ	8.75 (9)
642.7	γ	0.269 (5)
722.9	γ	2.19 (2)

Laboratory and Address:	Linac Laboratory Japan Atomic Energy Research Institute Tokai-mura, Naka-gun, Ibaraki-ken, Japan
Names:	M. Mizumoto, M. Ohkubo, Y. Nakajima M. Sugimoto, Y. Kawarasaki (JAERI)
Facilities:	Neutron time-of-flight spectrometer at the 120 MeV electron linear accelerator
Experiment:	Average neutron capture cross section measurements in keV region and resonance parameter measurements.
Detectors:	500 l liquid scintillator tank and Moxon-Rae detector; Li-6-glass and B-Na I detectors for neutron flux and transmission measurements.
Flight paths:	47 m and 52 m for capture measurements 47 m, 56 m, 100 m and 190 m for flux and transmission measurements.
Resonance analysis:	The Atta-Harvey area analysis code and the multi-level Breit-Wigner code SIOB Monte Carlo code CAFIT, TACASI and FANAC
(1) Samples:	Ba-135, Ba-137 and Ba-138 (nitrate and carbonate powder enriched to 79.04, 81.90 and 99.67%, respectively)
Energy region:	less than 300 keV
Completion date:	Measurements are completed
Publications:	M. Mizumoto et al., Int. Conf. Nuclear Data for Basic and Applied Science, Santa Fé, New Mexico, May 1985 M. Mizumoto et al., J. Nucl. Sci. Technol. 25 (1988) 757
(2) Sample:	Sn-122 (Oxide powder enriched to 92.20%) Resonance parameters, D0, S0 and R'
Energy Region:	from 1.5 up to 30 keV
Completion date:	Completed
Publications:	Y. Nakajima et al., Int. Conf. Nuclear Data for Basic and Applied Science, Santa Fé, New Mexico, May, 1985; Y. Nakajima et al., Annals of Nuclear Energy 17(1990)95
(3) Sample:	Gd-155 and Gd-157 (Oxide powder enriched to 91.77 and 88.63%, respectively)
1) Average capture cross sections :	S0, S1 and $\Gamma\gamma$
Energy region:	1.1 to 235 keV
Accuracy:	6 to 9%
2) Publication	Y. Nakajima et al., Annals of Nuclear Energy 16(1989)589
(4) Analysis:	
Publication:	M. Mizumoto and M. Sugimoto The influence of water absorption in samples for neutron capture cross section measurements, Nucl. Instrum. Methods. A282 (1989) 324

Laboratory and address:

Japan Atomic Energy Research Institute

Tokai-mura,Naka-gun,Ibaraki-ken 319-11,Japan

Names: Yoshihiko Kaneko,Fujiyoshi Akino and Tsuyoshi Yamane

Facility:

Semi-Homogeneous Experiment Critical Assembly(SHE).

Experiment:

Method: The delayed neutron data for thermal fission of ^{235}U was evaluated through an indirect method based on the comparison between measured and calculated values on the following three integral quantities for the SHE.

Data 1:Inverse kinetic parameter,Λ/β_{eff}.

Data 2:Central reactivity worths of Thorium, Natural uranium, and SHE fuel rods,ρ/β_{eff}.

Data 3:Central reactivity worths of burnable poison rods, ρ/β_{eff}.

The most probable values for both of the effective delayed neutron fraction β_{eff} and the decay constants λ's of delayed neutron precursors were determined from the condition that the sum of the squared deviations of the ratios of calculated to measured values from unity was minimized for the integral quantities.

Accuracy:Delayed neutron fraction,

β=0.00677±0.00008

Under the assumption that the Keepin's energy spectra had not so large uncertainties that the resulting errors in β_{eff} were negligibly small.

Completion date: February,1988

Descrepancies to other reported data:The evaluated value of β should be 4.2% higher than value of Keepin's delayed neutron data. The most probable λ values were not away from those for thermal fission filed in the Keepin's delayed neutron data set.

Publication:

"Evaluation of Delayed Neutron Data for Thermal Fission of U-235 based on Integral Experiments at Semi-Homogeneous Experiment", J.Nucl.Sci.Technol.,Vol.25,No.9,p673(1988)

JAPAN

Laboratory and address:	Research Reactor Institute, Kyoto University Kumatori-cho, Sennan-gun, Osaka, Japan
Names:	K. Okano and Y. Kawase
Facilities:	On-line mass separator(KUR-ISOL) installed at 5 MW Kyoto University Reactor.
Experiment:	Gamma-rays and half-lives of ^{156}Pm and ^{156}Nd
Method:	Gamma-rays and X-rays from mass separated isotopes were measured with a Ge(Li) and LEPS spectrometer.
Accuracy:	Estimated errors of γ-ray energies are 0.1-0.3 keV. Errors of half-lives are 1-2%.
Completion date:	Measurements of singles spectra are completed.
Publications:	Annu. Rep. Res. Reactor Inst., Kyoto Univ., 22(1989)92

JAPAN

Laboratory and address:	Research Reactor Institute, Kyoto University Kumatori-cho, Sennan-gun, Osaka, Japan
Names:	Y. Kawase and K. Okano
Facilities:	On-line isotope separator(KUR-ISOL) installed at 5 MW Kyoto University Reactor.
Experiment:	Identification of a new isotope ^{154}Pr
Method:	Gamma-rays and X-rays from mass separated isotopes were measured with a Ge(Li) and LEPS spectrometers. A new isotope ^{154}Pr has been identified by the mass number and γ-ray and X-ray energies of the relevant activity.
Accuracy:	Estimated errors are about 5 %.
Completion date:	The measurements of singles spectra are completed. Decay scheme studies are planned.
Publications:	Z. Phys. A-Atomic Nuclei, 330(1988)231

JAPAN

Laboratory and address:	Department of Nuclear Engineering Nagoya University, Furo-cho, Chikusa-ku, Nagoya, 464-01 JAPAN
Names:	M. Shibata, H. Yamamoto, M. Miyachi, K. Kawade, T. Katoh, T. Tamai, S. Nishikawa, J. Ruan
Facility:	A 5 MW Kyoto University Reactor
Experiments:	Decay of Nd-152
Method:	The decay of 11.6 min Nd-152 to levels of odd-odd Pm-152 has been studied with HpGe, Ge(Li), LEPS and plastic scintillation detectors. Sources were prepared by the rapid chemical separation, called a radio ion chromatography from the fission products of U-235. Intensities of gamma-rays and half-lives of excite levels were determined. A new decay scheme is proposed.
Accuracy:	Errors are less than 15 % for strong gamma-ray intensities and 30 % for weak ones. Errors of half-life is about 1 ns.
Completion date:	April 1989
Publication:	to be published in J. Phys. Soc. Japan

KOREA

Laboratory and Address:	University of Yonsei Department of Physics 134 Shinohon-dong, Sudaemoon-gu Seoul 120, Korea
Names:	W.M. Chung, J.K. Hwang, H.Y. Hwang +) +) Mokwon University
Facilities:	Two HPGe detectors connected with the 2k M.C.A. and Cyber computer
Experiment:	Determination of the multipole mixing ratios in the ^{192}Os, ^{192}Pt and ^{134}Ba by γ-γ angular correlation system
Method:	The γ-rays of ^{192}Os, ^{192}Pt and ^{134}Ba following the β-decay of ^{192}Ir and ^{134}Cs were precisely measured by two HPGe detectors. And by these data and γ-γ angular correlation method the many multipole mixing ratios - and B(E2) - values of these three nuclei were determined.
Completion date:	1987
Publications:	1) W.M. Chung and H.Y. Hwang, J. Korean Phys. Soc. 22, 294 (1989) 2) W.M. Chung, H.Y. Hwang, J.K. Hwang, K.K. Kwon and K.S. Joo, J. Korean Phys. Soc. 20, 166 (1987) 3) W.M. Chung, H.Y. Hwang, J.K. Hwang and G.H. Lee, J. Korean Phys. Soc. 20, 260 (1987)

SWEDEN

Laboratory and address: University of Uppsala
The Studsvik Neutron Research Laboratory,
S-61182 NYKÖPING, Sweden

Names: K Aleklett, B Ekström, B Fogelberg, L Jacobsson, P-I Johansson, E Lund, G Rudstam, L Sihver, and L Spanier (University of Uppsala)

P Hoff and J Omtvedt (University of Oslo)

G Skarnemark and O Tengblad (Chalmers University of Technology, Göteborg)

Facility: The OSIRIS on line mass separator is used to extract selected nuclei from thermally fissioned ^{235}U. A complete redesign of the ion source has been made in order to reach higher temperatures and thereby shorter delay times for the released fission products. The new design has increased the production yields of many short-lived isotopes with factors of 10^2-10^3.

1. Experiment: Characterization of and P_n values for delayed neutron precursors.

Method: Simultaneous measurement of neutron and beta activities and a multiscaling mode.

Completion date: Indefinite for the P_n studies as such.

SWEDEN
(cont'd)

2. Experiment: Total beta decay energies and atomic masses.

Method: Beta particles are recorded in coincidence with gamma rays depopulating known levels in the daughter nucleus. The end-point energies of the beta spectra are determined, and by adding the level energy the total beta-decay energies are obtained. The beta-particles are recorded in a planar HPGe detector and the gamma rays in a standard coaxial HPGe detector. Recent results include data on $^{130-132}In$, $^{129-134}Sn$, $^{130-135}Sb$ and $^{133-135}Te$.

Completion date: Indefinite for the experiment as such.

Publications: B Fogelberg, Y Zongyuan, and L Spanier, Phys. Lett. 209B (1988) 173.

L Spanier, K Aleklett, B Ekström, and B Fogelberg, Nucl. Phys. A474 (1987) 359.

SWEDEN
(cont'd)

3. Experiment: Yields of products from thermal neutron-induced fission of ^{235}U.

Method: The activity of a fission product is determined by means of gamma spectroscopy and neutron counting of mass-separated samples. After correction for delay, counting efficiency, branching ratio and reactor power the result will be a product of the fission yield and the overall separation efficiency. The latter factor is nearly the same for all isotopes of a given element. Thus relative yields are directly obtainable and have to be normalized against the yield of one of the isotopes determined absolutely by any other technique. The new target and ion source system has had a considerable impact on the fission yield determinations and a rather comprehensive set of measurements has been made for the mass region A=75-158, providing improved data for a large number of short-lived fission products.

Completion date: The experiment is finished.

Publications:

G Rudstam, B Ekström, and E Lund, "Independent Yield Pattern in Thermal Neutron-Induced Fission of ^{235}U, Contribution to the conference "Fifty Years with Nuclear Fission", April 25-28, 1989, Gaithersburg.

G Rudstam, P Aagaard, B Ekström, E Lund, H Göktürk, and H U Zwicky, "Yields of Products from Thermal Neutron-Induced Fission of ^{235}U, Submitted to Radiochimica Acta.

SWEDEN
(cont'd)

4. Experiment Yields of fission products from fast fission of ^{238}U.

Method: The Van de Graaff accelerator at Studsvik was used for the experiments which involve irradiation of ^{238}U samples by fast neutrons and subsequent gamma-ray spectroscopy. Fast monoenergetic neutrons (2.3 ± 0.1 MeV) were obtained by bombardment of a tritium target with protons.
Cumulative fission yields have so far been measured for 44 nuclides representing 24 mass chains in the mass regions 89-105 and 129-151. The next phase of the experiment will consist of the determination of independent yields using the OSIRIS isotope separator.

Completion date: Indefinite for the experiment as such.

5. Experiment: Gamma branching ratios for fission products.

Method: Gamma branching ratios for products induced in thermal-neutron fission of ^{235}U have been determined by simultaneous measurements of the beta and gamma activities. Measurements have been extended to include Pd isotopes with A=113-116, and Cd and In isotopes with A=119-132.

Completion date: Indefinite for the experiment as such.

Publications: B Fogelberg, Proceedings of the International conference on Nuclear Data for Science and Technology, Mito 1988 (ed. S Igarasi) p. 837.

6. Experiment: Nuclear spectroscopic studies of the decays of short lived fission products. Recent or current studies concern the decays of $^{113-116}Pd$, $^{113m,115m}Ag$, ^{134}Sn, ^{135}Sb, and ^{156}Pm.

Publications: B Fogelberg, E Lund, Y Zongyuan, and B Ekström, AIP Proceedings 164, ed. I S Towner (1988) p. 296.

E Lund, B Ekström, B Fogelberg, and G Rudstam, ibid, p. 578.

P Hoff, B Ekström, and B Fogelberg, Z Phys. A332 (1989) 407.

SWEDEN
(cont'd)

7. Experiment: Study of the antineutrino energy spectrum in the vicinity of a nuclear reactor.

Method: The aim of this investigation is to provide an experimental basis for the evaluation of the high-energy part of the antineutrino spectrum. The procedure is to choose those fission products which give the largest contributions to the antineutrino spectra in the range above 5 MeV for a measurement of the continuous beta spectrum from as low energy as possible up to the end-point. The beta spectra are then converted to antineutrino spectra.
The technique is to measure an isotope separated sample with a telescope consisting of a thin plastic detector and a planar HPGe detector. The beta spectrum is recorded when the telescope components are in coincidence mode and the gamma spectrum when they are in anticoincidence mode. Peaks in the gamma spectrum are used to evaluate the sample composition at any time.
The first experimental phase of this project has been carried out at the isotope-separator-on-line facility ISOLDE at CERN. The second phase has been carried out at OSIRIS using the conventional plasma ion-source and the third phase using the new high-temperature ion-source.
As a byproduct of the antineutrino project the average beta energy is obtained for individual nuclides. These data are extremely important for evaluation of the

decay heat in nuclear fuel, and also useful for a systematic study of the behaviour of the beta strength function far away from stability.

Completion date: 1988.

Publications: O Tengblad, K Aleklett, R von Dincklage, E Lund, G Nyman, and G Rudstam, "Integral $\bar{\nu}$-Spectra Derived from Experimental ß-Spectra of Individual Fission Products", Nucl. Phys. A 503 (1989) 136

SWEDEN
(cont'd)

8. Experiment: Determination of gamma spectra and average gamma energies for fission products.

Method: Gamma spectra have been measured for short-lived fission products using a large NaI(Tl)-spectrometer. The samples were produced with the OSIRIS isotope separator. The abundances of the various isobars in the sample were determined by means of gamma peaks recorded with a Ge(Li)-spectrometer. Average gamma energies were deduced from the spectra.

Completion date: The experiment is finished (1989).

Publications: G Rudstam, K Aleklett, E Lund, O Tengblad, B Jonson, G Nyman, R von Dincklage, and P Hoff, "Average Beta Energies of Fission Products and their Use for Decay Heat Predictions", Contribution to the Specialists' Meeting on Data for Decay Heat Predictions, Studsvik, Sweden, 7th to 10th September, 1987 (1987).

G Rudstam, P Aagaard, K Aleklett, O Tengblad, B Jonson, G Nyman, R von Dincklage, and P Hoff, "Experimental Determinations of Average Beta and Gamma Energies and their Use for Decay Heat Predictions", Proceedings of the International Conference on Nuclear Data for Science and Technology, May 30 - June 3, 1988, Mito, Japan (1988) p. 867.

SWEDEN
(cont'd)

G Rudstam, P-I Johansson, P Aagaard, and J Eriksen, "Average Gamma Energies Emitted per Decay of Individual Fission Products", The Studsvik Neutron Research Laboratory Report NFL-59 (1989).

G Rudstam, P-I Johansson, O Tengblad, P Aagaard, and J Eriksen, "Beta and Gamma Spectra of Short-Lived Fission Products", submitted to Atomic Data and Nuclear Data Tables (1989).

TAIWAN

Laboratory and Address:	Institute of Physics Academia Sinica Nankang, Taipei 11529 Taiwan, R.O.C.
Names:	G.C. Kiang, L.L. Kiang (Nat'l. Tsing-Hua University), E.K. Lin, P.K. Teng, C.W. Wang.
Facilities:	3 MV NSC 9SDH-2 Pelletron, Anti-Compton γ-ray spectrometer, micro Vax II + CAMAC + Fast NIM data acquisition system, HpGe detectors, NaI(Tl) and Plastic crystals
Experiments:	In-beam γ-ray spectroscopy, Radioactivity
Methods:	The (p,γ), (d,pγ) and (n,γ) reactions are detected by HPGe, detector HPGe HPGe coincidence spectrometer, and HPGe NaI(Tl) anti-Compton spectrometer. Singles, coincidence spectra and directional correlation function are measure. The lifetime of excited states are measured by DSAM. To measure the γ-decay of the radioactive samples which are neutron-irradiated at Tsing-Hua University 1 MW Reactor.
Accuracy:	Typically, the total error is under 8%.
Publications:	1) G.C. Kiang, L.L. Kiang, P.K. Teng, G.C. Jon, T.H. Yuan and Y.M. Hsu, "The Structure of ^{154}Gd via the β-decay of ^{154}Eu Nucleus", Capture Gamma-ray Sepctroscopy 1987, p. 520, Proceedings of the Sixth Conference on Gamma-ray Spectroscopy held at Leuven, Belgium, from 31 August to 4 September 1987, Ed. by K. Abrahams and P. Van Assche. 2) L.L. Kiang, G.C. Kiang, P.K. Teng, G.C. Jon, T.H. Yuan and Y.M. Hsu, "Studies on the Level Structure of ^{154}Gd via the β-decay of ^{154}Eu Nucleus", Z. Phys. A-Atomic Nuclei 333, 19 (1989). 3) L.L. Kiang, G.C. Kiang, P.K. Teng, E.K. Lin, T.H. Yuan, C.W. Wang, L.J. Lo and B. Chen, "Experimental Studies on the Excited States of ^{82}Kr Populated by the β-decay of 35h ^{82}Br", Nucl. Sci. J. 26 (1), 10 (1989). 4) D. Wang, E.K. Lin, G.C. Jon and C.W. Wang, "Gamma Transitions in ^{124}Te Following the β-decay of ^{124}Sb", Proc. Natl. Sci. Counc. ROC (A), Vol. 8, No. 4, 240 (1984).

TAIWAN

Measurements:

Laboratory and address:	Institute of Nuclear Science National Tsing Hua University Hsinchu 30043, TAIWAN R.O.C.
Names:	Prof. Dr. Chien CHUNG
Facilities:	1 MW Tsing Hua Open-pool Reactor
EXPERIMENT:	CFY in $^{232}U(n_{th},f)$
Method:	Direct, rapid multi-scaling gamma spectrometry
Completion date:	1989.08.
Discrepances to other reported data:	12 CFY measured the first time
Publications:	Radiochimica Acta 49 (1990) 113
Contact:	Prof. Dr. Chien Chung Institute of Nuclear Science National Tsing Hua University Hsinchu 30043, TAIWAN R.O.C.

UNITED KINGDOM

Laboratory:	IMPERIAL COLLEGE REACTOR CENTRE Silwood Park, Ascot, Berkshire SL5 TE, England Telephone: 44-990-294290. Fax: 44-990-24931
Names:	T.D. MAC MAHON, F. TAKRURI, M. HAMMED
Experiment:	Neutron capture gamma ray spectroscopy of ^{100}Tc, ^{104}Rh and ^{110}Ag
Method:	Capture gamma rays and conversion electrons emitted in the $^{99}Tc(n,\gamma)^{100}Tc$, $^{103}Rh(n,\gamma)^{104}Rh$ and $^{109}Ag(n,\gamma)^{110}Ag$ reactions with thermal neutrons are studied using the BILL and GAMS spectrometers at the Insitut Laue-Langevin, Grenoble. Work carried out in collaboration with Leningrad Nuclear Physics Institute and KFA Julich. Data from several experiments are combined to produce detailed lebel schemes up to about 1 MEV excitation in each nucleus.
Publications:	I.A. Kondurov, Yu.E. Loginov, T.D. Mac Mahon, A. Osuma, P.A. Sushkov, "Internal electron conversion in the reaction $^{103}Rh(n,\gamma e)$", Proc. XXXVIII Conf. on Nuclear Spectroscopy and Structure of Atomic Nuclei, Baku, U.S.S.R., April 1988. P.A. Sushkov, T.D. Mac Mahon, "Precise determination of the energies and intensities of transitions from internal conversion electron data", Proc. Seminar on Questions of Precision in Nuclear Spectroscopy, Vilnius, U.S.S.R., May 1988.

Laboratory and Address: Physics Department Radiation Center
University of Birmingham
P.O. Box 363
Birmingham B15 2TT

Names: D.R. Weaver, J.G. Owen

Facilities: 3MV Dynamitron

Experiment: Fast neutron induced delayed neutron yield and spectra measurements.

Method: 3-He spectrometers. Yield measurements use a precision long counter.

Accuracy: A full covariance matrix is calculated.

Publication: Proceedings of the Specialists' Meeting on Delayed Neutron Properties, Birmingham, September 1986, page 165 *)

International Conf. on Nuclear Data for Science and Technology, Mito, Japan, 30 May-3 June 1988. Proceedings, page 861. +)

*) U-235 (En = 0.5 - 2 MeV)

+) nat. U (dn total and group yield)
Pu-239 (energy spectrum)

Laboratory and Address: Physics Department Radiation Center
University of Birmingham
P.O. Box 363
Birmingham B15 2TT

Names: H. Afarideh, K. Randle

Facilities: 3MV Dynamitron accelerator

1. Experiment: Determination of fission yields following fast neutron fission in ^{238}U. Cumulative fission yields have been measured by direct gamma-ray counting using a hyperpure Ge detector at neutron energies in the range 1.7 to 6 MeV. Neutron fluences were measured absolutely with a ^{238}U fission chamber of special design.

Completion Date: Some work was completed in 1988. Further analysis of results in the 14MeV range is still in progress.

Publication: Int. Conf. on Nuclear Data for Science and Technology, Mito, Japan, 30 May-3 June 1988. Proceedings, page 987.

2. Experiment: Investigation of triton production in the ternary fission of ^{238}U using monoenergetic neutrons. Tritons (and alpha particles) are detected in a ΔE-E telescope arrangement and three-dimensional mass-energy spectra are produced via a Particle Identification Unit. Neutron energies in the range 2-4.5 MeV. Total fissions measured with a calibrated surface barrier detector. Applications for funding for a further phase are in hand.

Accuracy: Presently $\pm$ 25%.

Completion Date: The work for the initial phase was completed in 1988.

Publications: Int. Conf. on Nuclear Data for Science and Technology, Mito, Japan, 30 May-3 June 1988. Proceedings, page 987.

Ann. nucl. Energy 16 (1989) 313

UNITED KINGDOM

Laboratory and Address: Physics Department Radiation Center
University of Birmingham
P.O. Box 363
Birmingham B15 2TT

Names: H. Afarideh, K. Randle, S.A. Durrani

Experiment: Investigation of triton and α-particle production in the spontaneous fission of ^{252}Cf.

Method: The energy spectrum of α-particles in the ternary fission of ^{252}Cf has been determined by two independent methods and that of tritons by just one. In the first method, long range alpha (LRA) particles and tritons were identified by a ΔE-E telescope, which consisted of two surface barrier detectors mounted in front of a ^{252}Cf source. Here, the energy spectrum and the emission probability of both tritons and α-particles were determined. In the second, combinations of the cellulose nitrate plastic LR115 and various thicknesses of Al foil were used to measure the energy spectrum of LRA particles down to a 2 MeV cut-off.

Completion Date: The work is completed.

Publication: Ann. Nucl. En. 15 (1988) 201

U.S.A.

Labroratory and address: Ames Laboratory-USDOE
Iowa State University
Ames, Iowa 50011

Names: F.K. Wohn, John C. Hill, J.A. Winger and D.D. Schwellenbach. (Contact person: Wohn)

Facilities: mass separator TRISTAN on-line to High Flux Beam Reactor at Brookhaven National Laboratory (see also BNL contribution).

Experiments: β and γ spectroscopy of decays of the fission products: ^{74,76}Cu, ^{80}Zn, ^{83}Ge, ^{98,99}Rb, $^{99-101}$Sr, $^{98,100-102}$Y, ^{101}Zr, ^{101}Nb, ^{116,118,120}Ag, ^{146}La, ^{150}Ce, ^{150}Pr.

Methods: β, γ, and e^- spectroscopy: β, γ and e^- singles; γ and e^- multiscaling; $\beta\gamma$ and $\gamma\gamma$ coincidences; $\gamma\gamma$ angular and perturbed angular correlations; $\beta\gamma\gamma$ delayed coincidences. Detectors: HpGe, LEPS and Ge(Li) for γ; HpGe and plastic for β; Si(Li) for e^-; plastic, BaF_2 and HpGe for $\beta\gamma\gamma$.

Accuracy: γ and e^- energies to 50-200 eV; γ intensities (relative or absolute) to 3-10%; β-decay lifetimes (by γ multiscaling) to 2-10%; level lifetimes (by delayed coin.) to $\leq$10 ps.

Completion date:
1: published since Progress in Fission Product Nuclear Data No. 12: listed below.
2: nearing completion: decays of ^{76}Cu, ^{101}Zr, ^{102}Y; level lifetimes in A$\approx$100 nuclei.
3: analysis in progress: decays of ^{99}Rb, ^{101}Y, ^{101}Nb.

Publications:*

1. "Decay of ^{80}Zn: Implications for Shell Structure and r-Process Nucleosynthesis," Winger, Hill, Wohn, Moreh, Gill, Casten, Warner Piotrowski and Mach, Phys. Rev. C 36, 758 (1987).

2. "Decay of ^{100}Sr and a 'Pairing-Free' K^{π}=1$^+$ Rotational Band in Odd-Odd ^{100}Y," Wohn, Hill, Winger, Petry, Goulden, Gill, Piotrowski, and Mach, Phys. Rev. C 36, 1118 (1987).

3. "Rotational Structure of Highly Deformed ^{99}Y: the 536-keV Band," Wohn, Phys. Rev. C 36, 1204 (1987).

4. "Decay of ^{101}Sr and the Rotational Structure of ^{101}Y," Petry, Goulden, Wohn, Hill, Gill and Piotrowski, Phys. Rev. C 37, 2704 (1988).

5. "Systematics of g Factors in Neutron-Rich ^{142,144,146}Ba Isotopes," Wolf, Gill, Mach, Casten and Winger, Phys. Rev. C 37, 1253 (1988).

6. "TRISTAN Research on Neutron-Rich Nuclei: Magnetic Moments and Nuclear Structure," Wolf, Casten, Gill, Brenner, Mach, Hill, Wohn and Winger, in Nuclei Far from Stability, ed. I.S. Towner, AIP Conference Proceedings No. 164, p. 174 (1988).

7. "Is the Region above ^{78}Ni Doubly Magic," Hill, Winger, Wohn, Gill, Piotrowski, Ji and Wildenthal, ibid., p. 375.

8. "Test of the Singly Magic Character of the N=50 Isotone ^{83}As Populated in ^{83}Ge Decay," Winger Hill, Wohn, Gill, Ji and Wildenthal, Phys. Rev. C 38, 285 (1988).

9. "Shape Coexistence and Mixing of Spherical and Deformed Shapes in the N=60 Isotones," Hill, Wohn, Petry, Gill, Mach and Moszynski, in Nuclear Structure of the Zirconium Isotopes, ed. by J. Eberth, R.A. Meyer and K. Sistemich, Springer-Verlag, p. 64 (1988).

10. "Large Inertial Moments, Pairing Reduction and the Effects of Coriolis Mixing on Rotational Bands in Odd-Z Deformed A=100 Nuclei," Wohn, Hill, Petry and Gill, ibid., p. 343.

11. "Structure of Neutron-rich ^{74}Zn from ^{74}Cu Decay and Shell-Model Calculations for Even-A Nuclei," Winger, Hill, Wohn, Warburton, Gill, Piotrowski and Brenner, Phys. Rev. C 39, 1976 (1989).

12. "Picosecond Lifetime Measurements in ^{116,118,120}Cd and Structure of Normal and Intruder States," Mach, Moszynski, Casten, Gill, Brenner, Winger, Krips, Wesselborg, Buescher, Wohn, Aprahamian, Alburger, Gelberg and Piotrowski, Phys. Rev. Lett. 63, 143 (1989).

13. "Magnetic Moment of the 2_1^+ State in ^{98}Sr," Wolf, Sistemich, Mach, Gill, Casten and Winger, Phys. Rev. C 40, 932 (1989).

14. "Structure of Odd-Odd ^{74}Ga from the Decay of Neutron-Rich ^{74}Zn," Winger, Hill, Wohn and Brenner, Phys. Rev. C 40, 1061 (1989).

*Colleagues involved with the Ames group in TRISTAN studies listed above, with their institutional affiliation at the time of these studies.
Brookhaven National Laboratory, staff: D. Alburger, R.F. Casten, R.L. Gill, H. Mach, E.W. Warburton, C. Wesselborg
Brookhaven National Laboratory, visitors: A. Gelberg, W. Krips, M. Moszynski, A. Piotrowski
Clark University: D.S. Brenner, R. Schuhmann
Drexel University: X. Ji, B.H. Wildenthal
Kernforschungsanalge Jülich: M. Büscher, G. Molnar, K. Sistemich
Lawrence Livermore National Laboratory: A. Aprahamian
Negev Research Centre: Z. Berant, R. Moreh, A. Wolf
University of Oklahoma: J.D. Goulden, R.F. Petry

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60439
U.S.A.

Authors: A. B. Smith, P. T. Guenther and S. Chiba*+

Facilities: Argonne National Laboratory 8 MeV tandem and associated time–of–flight facilities.

Experiment: Differential elastic– and inelastic–scattering cross sections of palladium were measured to incident neutron energies of 8 MeV. The results, with associated interpretations, indicate that the inelastic–scattering cross sections of the even–isotopes of palladium fission products, as given in prominent fission–product files, are too small by significant amounts. However, the inelastic scattering is predominantly due to statistical processes at energies of importance in fission–reactor applications.

Publication: A detailed description of the work is given in the report ANL/NDM–112, and a manuscript has been accepted for publication in Ann. Nucl. Energy.

*Permanent address: Japan Atomic Energy Research Institute, Tokai, Ibaraki, Japan.

+This work supported by the U.S. Department of Energy under Contract No. W–31–109–Eng–38.

Laboratory and address: Brookhaven National Laboratory
Upton, New York 11973
U.S.A.

Names: G. Wang, D. E. Alburger, and E. K. Warburton

Facilities: High-flux reactor
Ge(Li) γ-ray spectrometer

Experiment: Measurement of precision energies and relative intensity of γ rays in decay of ^{134}Cs. Self-consistent decay scheme developed.

Method: ^{134}Cs γ rays compared with ^{192}Ir, ^{228}Th, ^{137}Cs, ^{110m}Ag, ^{60}Co, and ^{207}Bi γ-ray standards.

Accuracy: γ energies 3-13 eV; relative γ intensities 0.7-8%.

Completion date: Completed

Discrepencies to other reported data: No major discrepencies

Publications: G. Wang, D. E. Alburger, and E. K. Warburton, Nucl. Instr. and Methods A260, 413 (1987).

Laboratory and address: Idaho National Engineering Laboratory
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, Idaho 83415 USA

Names: R. C. Greenwood, R. A. Anderl, R. G. Helmer, C. W. Reich, K. D. Watts, H. Willmes (U.Idaho)

Experiment: Nuclear decay properties ($T_{1/2}$, average β and γ decay energies, β-strength functions, β-branching, γ-branching) of short-lived fission products.

Facility: Two 600-μg ^{252}Cf spontaneous-fission sources coupled via He gas-jet transport to an on-line isotope separator.

Method: On-line mass separations followed by γ- and β-ray measurements.

Measurements Completed: Gamma-ray spectral measurements and half-life determinations for $^{151-153}Pr$, $^{153-156}Nd$, $^{152-158}Pm$, $^{157-160}Sm$, $^{161,162}Eu$ and ^{164}Gd.
Gamma-gamma coincidence measurements for ^{151}Pr, $^{152-157}Pm$, $^{157,158}Sm$.

Publications: H. Willmes, R. A. Anderl, J. D. Cole, R. C. Greenwood and C. W. Reich, "Level Structure of ^{159}Eu from the β^- *Decay of the Recently* Discovered Isotope ^{159}Sm," Phys. Rev. C 36, 1540 (1987).

R. C. Greenwood, M. A. Lee and R. A. Anderl, "Identification of a New Isotope, ^{164}Gd," Radiochimica Acta 43, 129 (1988).

"Identification of New Neutron-Rich Rare-Earth Isotopes Produced in ^{252}Cf Spontaneous Fission," R. C. Greenwood, R. A. Anderl, J. D. Cole, M. A. Lee and H. Willmes, in Nuclei Far From Stability, 5th International Conference, Rosseau Lake, Ontario, Canada, 1987, AIP Conference Proceedings 164 (New York, 1988) p. 782.

"Nuclear Data Measurements of Neutron-Rich Nuclides Produced in Fission using On-Line Isotope Separation," R. C. Greenwood, A. J. Caffrey, J. D. Cole, M. S. Drigert, R. G. Helmer, M. A. Lee, C. W. Reich and D. A. Struttmann, in Proceedings of the International Conference on Nuclear Data for Science and Technology, Mito, Japan, 1988, edited by S. Igarasi (Saiken Publishing Co., 1988) p. 359.

U.S.A.

Laboratory and Address: Idaho National Engineering Laboratory
EG&G Idaho, Inc.
P. O. Box 1625
Idaho Falls, ID 83415 USA

Names: R. C. Greenwood, A. J. Caffrey

Experiment: Delayed-neutron energy spectral measurements of fission-product isotopes.

Facility: TRISTAN ISOL system at Brookhaven National Laboratory

Method: Isotope separation on line with gas-filled proton-recoil proportional counters and liquid scintillation detectors used to measure delayed-neutron spectra.

Measurements: $^{93-97}Rb$ and $^{143-145}Cs$ conpleted, measurements on $^{87-92}Br$ and $^{137-141}I$ approved by program committee.

Publications: "Nuclear Data Measurements of Neutron-Rich Nuclides Produced in Fission using On-Line Isotope Separation," R. C. Greenwood, A. J. Caffrey, J. D. Cole, M. S. Drigert, R. G. Helmer, M. A. Lee, C. W. Reich and D. A. Struttmann, in Proceedings of the International Conference on Nuclear Data for Science and Technology, Mito, Japan, 1988, edited by S. Igarasi (Saiken Publishing Co., 1988) p. 359.

R. C. Greenwood and A. J. Caffrey, "Further Measurements of the Delayed Neutron Spectra of $^{93-97}Rb$ and $^{143-145}Cs$", Proceedings of the Specialists Meeting on Delayed Neutrons, University of Birmingham, England, September 1986, page 199.

U.S.A.

Laboratory: Oak Ridge National Laboratory, P. O. Box 2008
Oak Ridge, Tennessee 37831-6354

Name: R. L. Macklin

Facility: Oak Ridge Electron Linear Accelerator (ORELA)

Experiment: Neutron Capture Cross Sections

Method: Neutron Time-of-Flight; prompt gamma cascade energy by liquid scintillator pulse height weighting

Accuracy: Estimated 5% or less

Completion Date: As noted

Publications: R. L. Macklin, "Neutron Capture by ^{79}Br, ^{81}Br, and ^{75}As," *Nucl. Sci. Eng.* **99**, 133 (1988).

The excitation functions for the reactions $^{152,154,155,157}Gd(n,\gamma)$ have been measured over the neutron energy range of 3 keV to 500 keV and are reported in: H. Beer and R. L. Macklin, "The ^{151}Sm Branching, a Probe for the Irradiation Time Scale of the s-Process," *The Astrophysical Journal* **331**, 1047 (1988).

H. Beer and R. L. Macklin, "Measurement of the ^{85}Rb and ^{87}Rb Capture Cross Sections for s-Process Studies," *The Astrophysical Journal* **339**, 962-977, (1989).

R. L. Macklin, *Search for ^{136}Xe Resonance Neutron Capture*, Oak Ridge National Laboratory Report ORNL/TM-10766, (May 1988).

R. L. Macklin and R. R. Winters, *Neutron Capture of ^{122}Te, ^{123}Te, ^{124}Te, ^{125}Te, and ^{126}Te*, Oak Ridge National Laboratory Report ORNL-6561 (July 1989).

Neutron capture up to 700 keV was measured for $^{147,148,149,150}Sm$. Resonance parameters were fitted for $^{148,150}Sm$ from 0.2–5 keV. Average capture cross sections at higher energies are being analyzed.

$^{86}Sr(n,\gamma)$ resonances were analyzed from 2.6 to 90 keV, $^{87}Sr(n,\gamma)$ resonances 2.6 to 50 keV, and average capture to 700 keV, and $^{88}Sr(n,\gamma)$ resonances from 2.6 to 385 keV. A draft report is in preparation (1989) by R. L. Macklin and R. R. Winters.

U.S.A.

Laboratory and Address: Oak Ridge National Laboratory
P. O. Box 2008, MS6356
Oak Ridge, Tennessee 37831-6356, USA

Names: J. K. Dickens, S. Raman, and B. L. Broadhead

Facilities: Dounreay Prototype Fast Reactor (PFR)

Experiment: Three specially prepared rods, each containing 24 actinide samples, each of ~1-mg mass, were irradiated at the Dounreay PFR. Two of the rods were irradiated over a 1-yr period, each for a total of fast-neutron fluence equivalent to ~63 full power days. The third rod was irradiated over a period of about 4 yrs for a total neutron fluence of ~400 full power days. Principal isotopes of these samples were ^{230,232}Th, ^{231}Pa, $^{233-236,238}$U, ^{237}Np, $^{238-242,244}$Pu, ^{241,243}Am, ^{243,244,246,248}Cm.

Nine months following the end of the irradiation of the first fuel pin (FP-1) portions of each sample were prepared for high-resolution gamma-ray assay, and measurements of gamma rays corresponding to decay of longer-lived fission products were carried out for a period of ~1 yr. Fission products identified were ^{91}Y, ^{95}Zr, ^{95}Nb, ^{103}Ru, ^{106}Rh (following decay of ^{106}Ru), ^{110m}Ag, ^{125}Sb, ^{134}Cs, ^{137}Cs, ^{141}Ce, ^{144}Ce, ^{144}Pr, and ^{155}Eu. Relative yields of these fission products were determined.

Study of the samples for the fuel pin FP-2 was initiated in 1988. FP-2 was irradiated concurrently with FP-1, and so had cooled ~5 years. This experiment concentrated on determinations of absolute yields of ^{137}Cs. Data from cobalt-copper dosimeters in FP-2 were also analyzed. Calculations using ORIGEN for comparisons with results from both FP-1 and FP-2 have been completed and a report is in preparation.

The irradiation of the third fuel pin ended in June 1988. Sample dissolutions are now underway.

Accuracy: For FP-1: between 4% and 60% (1σ), the larger values due to uncertainties in peak extractions.

For FP-2: Between 3% and 15% (1σ).

Completion Date: March 1986 for FP-1; January 1989 for FP-2.

U.S.A.

(cont'd)

Discrepancies to Other Reported Data: For FP-1 the relative yield data were compared with presently existing evaluated data. The comparisons are generally favorable; however, discrepancies exist for some of the ^{103}Ru and ^{106}Rh-^{106}Ru data which we are not able to explain. For FP-2 the absolute ^{137}Cs yield compare reasonably well with calculated values; at least as well as the measured dosimeter yields agree with calculated yields.

Publication: FP-1 Data: J. K. Dickens and S. Raman, "Fission-Product Yield Data from the US/UK Joint Experiment in the Dounreay Prototype Fast Reactor," ORNL-6266 (1986).

J. K. Dickens, "Fission-Product Yields for Fast Neutron Fission of ^{243,244,246,248}Cm," *Nuclear Science and Engineering* **96**, 8 (1987).

FP-2 Data: In preparation.

U.S.A.

Laboratory and Address: University of Lowell
Lowell, Mass. 01854

Names: G. Couchell, W. Schier

Facilities: 5.5-MV Van de Graaff, 1-MW swimming pool reactor, helium jet, tape transport system, beta-neutron time-of-flight spectrometer.

Experiment: Delayed-neutron energy spectra as a function of time following fission of U235, Pu239 and U238.

Method: Beta-neutron time-of-flight method using helium jet and tape transport system together with Pilot U plastic, BC501 (PSD liquid) and Li6-glass scintillators. Reactor or accelerator neutrons are used for thermal and fast fission.

Status: Composite spectra spanning an energy range, 0.01 to 2.00 MeV, have been measured for eight delay-time intervals ranging from 0.17 to 85.5 s following both thermal and fast fission of U235. Energy spectra from 0.01 to 4.00 MeV have been measured at seven delay-time intervals ranging from 0.17 to 29.0 s following thermal neutron fission of Pu239. Fast fission studies of U238 are now in progress.

Publication: R.S. Tanczyn et al., Composite Delay Neutron Energy Spectra for Thermal Fission of U235, Nucl. Sci. Eng. 94 (1986) 353.

Q. Sharfuddin et al., Search for an Energy Dependence in U235 Delayed Neutron Spectra, Nucl. Sci. Eng. 98 (1988) 341.

G.P. Couchell et al., Measurements of Delayed Neutron Energy Spectra for U235, U238 and Pu239, Proc. 1988 International Reactor Conf., Jackson Hole, Wyoming (1988) vol. III, 243.

(See also Int. Conf. Nuclear Data for Science and Technology, Mito, Japan, 1988, pp. 853, 905; at the end of this report).

U S S R

Laboratory and adress Institute of Physics and Power Engineering
Obninsk, Kaluga Region, 249 020

Names : A.A.Goverdovsky, B.D.Kuz'minov, V.F. Mitrofanov, A.I.Sergachev

Facility : 3-MeV VG-accelerator IPPE, Obninsk

Experiment : Peculiarities of the energy balance of the nuclear fission are observed and discussed. The most remarkable effect is a systematic decrease of mean total kinetic energy TKE of fragments in fission through vibrational resonances. The most important properties of the phenomenon are investigated for fissioning systems : Th-231,233 , U-234,235, 237,239 , Pu-240. To evaluate the true value of TKE-decrease, a contribution of non-resonance nature sub-barrier fission should be taken into account as well as an effect of experimental energy resolution of bombarding neutrons. In that case TKE-variations (δ TKE) are 2 - 3 MeV for all resonances investigated. It was shown, that the δ TKE-value is in good agreement correlation with the δE_{vibr} - level of the corresponding vibrational resonances relative to bottom of the intermediate well of fission barrier.

Method : 2-E method, semiconductor detectors ; U-235thermal - calibration.

Accuracy : TKE = 50 - 200 keV ; M = 3 - 4 a.m.u.

U S S R
(cont'd)

Completion date: First series of measurements are finished.

Publications :

1. Goverdovsky A.A. et.al. - Proc. Int. Conf. "FIFTIETH ANNIVERSARY OF NUCLEAR FISSION", Leningrad, Oct. 16-20, 1989 .
2. Goverdovsky A.A. et.al. - Nucl.Phys. (SOV). 1986. V.44(1). P.287; 1987.V.46 (3). P.706. 1988. V.48. P.1251.
3. Goverdovsky A.A. et.al. - J. Atomic En. (SOV). 1988. V.64(6). P.425.
4. Goverdovsky A.A.- Thesis. 1988. IPPE. Obninsk. USSR.

U S S R

Laboratory and adress :

Institute of Physics and Power Engineering
Ploshad Bondarenko - 1
Obninsk
Kaluga Region , 249 020

Moscow Physical Engineering Institute
Moscow 115409

Names : A.A.Alexandrov, A.A.Goverdovsky, N.N.Demidobich, Yu.A.Korzhuk, S.I.Sitnikov, A.I. Sljusarenko, Yu.F.Pevchev, S.L.Podshibjakin, Yu.V.Pjatkov, S.L.Sharov, A.N.Shemetov, R.A.Shehmametiev, I.A.Shljapina.

Facility : Moscow Engineering Physical Institute reactor ; $4 * 10^{10}$ n/cm^2*s thermal neutrons.

Experiment : The measurements of mass-energy spectrum of thermal neutron-induced ^{242m}Am fission fragments have been made.

Mehtod : Time-of-flight spectrometer. The velocity and energy of fission fragments were measured by means of two channel-plate detectors (overall resolution 120 ps) and surface-barrier detectors, respectively. About $3,4*10^6$ events were recorded. The calibration procedure for detectors was performed on $^{235}U_{th}$ fission fragments measurements.

Publication : A.A.Alexandrov et.al. "Mass-energy spectrum of thermal neutron-induced ^{242m}Am fission fragments" - Proc. Int. Symp. Nucl. Fiasion, Gaussig, GDR, 1988.

U S S R

Laboratory and adress	Institute of Physics and Power Engineering Ploshad Bondarenko - 1 Obninsk Kaluga Region
Names :	S.V.Ignatjev, B.P.Maksjutenko, Yu.F. Balakshev, N.N.Gonin
Facility :	3-MeV VG-accelerator IPPE, Obninsk
Experiment :	From experimental data the different kinds of delayed neutrons spectra were reconstructed : quasi-equilibrium spectra, spectra of the groups and precursors of delayed neutrons, integral spectra for different time after switching of the source the neutrons inducing the fission.
Method :	Experimental data were obtained by means of twodimensional method with the help of ^{3}He-spectrometer on-line with the computer.
Publication :	S.V.Ignatjev et.al. "Time and energy partitions of delayed neutrons in thermal neutron fission of plutonium-239"- Proc. Int. Symp. "FIFTIES ANNIVERSARY OF NUCLEAR FISSION", Leningrad, USSR, Oct. 1989.

U S S R

Laboratory and adress	Institute of Physics and Power Engineering Ploshad Bondarenko - 1 Obninsk Kaluga Region
Names :	Khrjachkov V.A., Kuz'minov B.D., Sergachev A.I., Sljusarenko A.I.
Facility :	3-MeV VG-accelerator IPPE, Obninsk
Experiment :	Fission fragments mass distributions for U-235 cold fragmentation by thermal and fast neutrons.
Mehtod :	Twin gridded ionization fission chamber ; thin active layer (50Al-40^{235}U-30Au) μG/cm^2.
Accuracy:	FWHM(E_k) = 2,0 MeV, FWHM(M_{cold}) = 2 a.m.u. Total stat. = $3 \cdot 10^{6}$ events (total spect.)
Publication :	(Names) - Proc. Int. Symp. "Nuclear Fission-50", Leningrad, USSR, 1989.

U.S.S.R.

Laboratory and adress: Institute for Nuclear Physics, Kaz. SSR Academy of Sciences, Alma-Ata 82, 480082, USSR.

Names: V.M.Kartashov, A.I.Oborovskiy, A.G.Troitskaya

Facilities: Nuclear Reactor WWR-K, Alma-Ata, 50 cm iron double focusing β-spectrometer.

Experiment: Study of decays of ^{I52}Eu ($T_{I/2} \simeq$ I3 y) and ^{I52m}Eu ($T_{I/2}$ = 9,3 h).
The experimental ratios of conversion line intensities in the energy region from 70 keV to I500 keV, the experimental intrinsic conversion coefficients for twenty three transitions in ^{I52}Sm and eleven transitions in ^{I52}Gd have been obtained. Multipolarities, E0-transition parameter values, penetration parameter values have been estimated for these nuclei.

Method: β-spectrometric measurements of conversion electrons with a set resolution 0,02÷0,03%. The sources have been produced by scattering of Eu_2O_3, enriched to about 98% in ^{I5I}Eu, onto Al-foil backing in vacuum after irradiation of this oxide in the reactor.

Accuracy: Between I% and 30% for conversion line intensities over the range of relative intensities I÷IO^{-5}. The conversion coefficients of the most intense lines have been determined with the uncertainties I,5÷2,0%.

Complection Date: Work has been completed.

Discripancies to Other Report Date: Comparisons of experimental conversion coefficients, multipolarities, penetration parameters and E0-transition parameters with computed ones and the same, obtained from the priar measurements of other authors, are given in Ref.s 3÷5.

U.S.S.R.
(con'd)

Publications:

I. V.M.Kartashov, A.G.Troitskaya "Characteristics of ^{I52}Eu- and ^{I82}Ta-decay transitions", in Proceeding of XXXV Conf. on Nuclear Spectroscopy and Nuclear Structure, April I985, Leningrad, USSR, p. I00.

2. V.M.Kartashov, A.I.Oborovskiy, A.G.Troitskaya "Electric monopole transitions in the nuclei ^{I52}Sm, ^{I52}Gd and ^{I82}W", Izv. Acad. Nauk Kaz. SSR, Ser. Fiz.-Mat., N. 4, I986, p. 43-48.

3. V.M.Kartashov, A.I.Oborovskiy, A.G.Troitskaya "Date about multipolarity of nuclear transitions in ^{I06}Pd, ^{I52}Sm and ^{I52}Gd, obtained by different methods", in "Voprocy tochnosty v yadernoy spectroscopiy". Part I. Institute of Physics Lit. SSR, Vilnus, USSR, I986, p. I28-I35.

4. V.M.Kartashov, A.I.Oborovskiy, A.G.Troitskaya "Multipole compound of $I_\gamma \rightarrow I_g$ transitions in ^{I52}Eu and ^{I82}Ta decays", in Proceeding of XXXVII Conf. on Nuclear Spectroscopy and Nuclear Structure, April I987, Yurmala, USSR, p. II2.

5. V.M.Kartashov, A.I.Oborovskiy, A.G.Troitskaya "Interband transitions in the nuclei ^{I06}Pd, ^{I52}Sm, ^{I52}Gd, ^{I82}W", Izv. Acad. Nauk SSSR, Ser. Fiz., 53, 2462 (I989).

USSR

Laboratory and Address: V.G.Khlopin Radium Institute,
Roentgena str. 1,
197022, Leningrad, USSR.

Names: I.D. Alkhazov, A.V. Kuznetsov, V.I.Shpakov

Facilities: Twin gadolinium loaded large liquid scintillator counter
Twin parallel plate ionization chamber with detectors for long range particles.

Experiment: Two dimensional neutron multiplicity distributions as a function of fragment mass and kinetic energy and long range particle energies in binary and ternary fission of 252Cf. Fragment mass distributions for fixed combinations of numbers of neutrons emitted by the complementary fragments.

Method: Simultaneous measurements of five parameters for each fission events. Reconstruction of the initial two-dimensional neutron multiplicity distributions

Accuracy: 5% to 80% depending on the yield level.

Completion Date: Partialy completed. The work will go on.

Publications: I.D. Alkhazov et al. Phys. of Neutr. Emission in Fission. Proc. of a Cons. Meeting, Mito, Japan, 1988, INDC (NDS)-220, p. 139
I.D. Alkhazov et al. Proc. of Internat. Conference Fifteth Anivers. of Nuclear Fission, Leningrad, USSR, Oct. 1989.

Descrepancies to other reported data: No such data available.

USSR

Laboratory and address: Lensovet Institut of Technology,
Leningrad, 198013, USSR

1.Names: V.F.Teplykh, E.V.Platygina, K.A.Petrzhak,
A.A.Solonkin, A.W.Mossesov

Facilities: Reseach reactor WWR-M, mass-spectrometr MI-1201, Ge(Li) γ-spectrometr

Experiment; Measurement of heavy product yields for the fission of ^{238}Np by thermal neutrons

Method: After irradiation of $^{237}NpO_2$ in Be-reflector channal of WWR with cadmium ratio ~30 at neutron flux $\sim 10^{14}$ $sm^{-2}s^{-1}$ for 5 - 18 days in targets were produced mainly the products of reaction $^{238}Np(n_{th},f)$.
Relative cumulative yields of stable and long-lived nuclides (Xe, Cs, Ce, Nd, Sm, Eu isotops) were determined using mass-spectrum analyses data for samples which were obtained after complete or partial radiochemical separation of fission products. The neutron capture processes, pile-up and decay during irradiation and cooling time were accounted for.
Absolut yields are based on the normalization to 100 % of heavy product relative yield sum.

Results: The values of 24 ^{238}Np fission relativ and absolute yields are obtained.

Accuracy: Relative yields were determined with the relative accuracy better that 1 % except for ^{135}Xe, ^{137}Cs, ^{151}Sm, ^{152}Sm, ^{154}Sm, ^{153}Eu and ^{135}Cs the accurasy being 3%, 3.7%, 3.2%, 5.2%, 1.4%, 13% and 40% respectively.

USSR
(cont'd)

Discrepancies to other reported data:	Measured yields values for xenon isotopes agree within the error range with the earlier reported data.
Completion date:	Apr. 1986
Publications:	Part of resultes were published in Proceeding of Conf. on Neutron Physics, Okt.,1983, Kiev, USSR. V.F.Teplykh, et al.,"Measurement of ^{135}Xe yields for fission of isotops uranium, ^{238}Np and ^{239}Pu", 1984, 2, p.251-253. A.A. Solonkin et.al., Atomn. Energ. 64 (1988) 435 (English: Soviet At. En. 64 (1988) 497

1.2 COMPILATIONS AND EVALUATIONS

BELGIUM

Laboratory and address : Nuclear Physics Laboratory
Proeftuinstraat 86
B-9000 Gent, Belgium

Names : D.De Frenne, E.Jacobs

Evaluation : Nuclear Data Sheets for A = 102, 103, 105, 106, 110 and 112

Purpose : to give a critical survey of all available information concerning A = 102, 103, 105, 106, 110 and 112 nuclei, and derivation of consistent best or preferred values with their uncertainties.

Method : Cfr. Nuclear Data Project

Major sources of information : Recent References of NDP

Deadline of literature coverage : 102 : probably beginning 1990
103 : June 1984
105 : February 1985
106 : January 1987
110 : October 1982
112 : June 1988

Computer file of available data : ENSDF

Completion date : 102 : probably beginning 1990
103 : September 1984
105 : March 1985
106 : February 1987
110 : December 1982
112 : July 1988

Publications :
- P.De Gelder, D.De Frenne, E.Jacobs, Nucl.Data Sheets 35, 443 (1982)
- P.De Gelder, E.Jacobs, D.De Frenne, Nucl.Data Sheets 38, 545 (1983)
- D.De Frenne, E.Jacobs, M.Verboven, Nucl.Data Sheets 45, 363 (1985)
- D.De Frenne, E.Jacobs, M.Verboven and P.De Gelder, Nuclear Data Sheets 47, 261 (1986)
- D.De Frenne, E.Jacobs, M.Verboven and G.De Smet, Nuclear Data Sheets 53, 73 (1988)
- D.De Frenne, E.Jacobs, and M.Verboven, Nuclear Data Sheets 57, 443 (1989)

CHINA

Laboratory and Address:	Chinese Nuclear Data Centre Institute of Atomic Energy P. O. Box 275(41) Beijing 102413, China
Cooperation:	Chinese Nuclear Data Coordination Network, and the other contributors in the world.
Names:	Wang Dao, Zhou Delin, Cai Dunjiu
Purpose:	To provide fission yield data for decay heat predictions
Evaluation:	Preliminary evaluations for 10 yield sets have been made. An effort to update the old evaluations is carrying out. Covariance technique is to be introduced into the evaluation for production of evaluated experimental data.
Compilation:	Based on the international EXFOR fission yield base which is being completed and checked up, compile experimental data files according to 3 different types of measurements, namely, absolute, relative, and R-value measurements.
Calculation:	Decay heat of fission products for testing the recommended values of fission yields thru comparing calculated decay heat data with measured ones.
Status:	Under work
Computer file of evaluated data:	The evaluated 10 yield sets in ENDF/B-V format are available from the IAEA Nuclear Data Section.
Contact:	Any comments are invited. To: Wang Dao

EGYPT

Laboratory and address: Physics Department
Faculty of Science
Tanta University
Tanta ,Egypt

Names : T.Elnimr et al

Evaluation : Reactor thermal and epithermal (n,γ) cross - sections and absolute gamma intensities

Purpose : Preparation of a document providing recommended values of the (n,γ) activation cross - section and for absolut gamma intensities

Method : K_0- factors (activation techniques)

Major sources of information: Recent References

Status : Completed, for thrity eight isotopes

Contact : Comments , suggestions and corrections to the data are invited
To : Tarek Elnimr

Publication: T.Elnimr and F.A.El- Hussiny J.Phys.D:Appl.Phys 18 (1985)1967
T.Elnimr and I.I.Bondouk J.Phys.D:Appl.Phys 16 (1983) 1407

EGYPT

Laboratory and address: Physics Department
Faculty of Science
Tanta University
Tanta ,Egypt

Names : T.Elnimr

Evaluation : Nuclear Data

Purpose : Preparation of a document providing recommended values of the (n,γ) activation cross - section and for absolut gamma intensities

Method : K_0- factors (activation techniques) determined by the cadmium subtraction method

Major sources of information: Recent References

Status : Completed, for thrity six isotopes

Contact : Comments , suggestions and corrections to the data are invited
To : Tarek Elnimr

Publication: T.Elnimr, The Arabian Journal for Science and Engineering 14 No. 1(1989) 141
T.Elnimr , The Arabian Journal for Science and Engineering 10 No.2 (1985) 139

FRANCE

Laboratory and address :	CENTRE D'ETUDES NUCLEAIRES DE GRENOBLE DRF/SERVICE DE PHYSIQUE M.D.I.H. 85X - F 38041 Grenoble Cedex
Name :	J. BLACHOT
Cooperation :	DEMT/SERMA/LEPP Saclay J.C NIMAL, B.NIMAL, C.DIOP
Compilation and Evaluation :	Radionuclide decay data : - to provide a comprehensive data bank of radioactive decay with : half lives, Q-values, branching ratios, nuclear and spectra alpha, beta, gamma, energies and intensities with associated uncertainties.
Purpose :	- Decay data file for summation calculation of decay heat (Pepin code). - Data bank for all people using decay data parameters.
Sources :	ENSDF file mostly and new recent works on short lived F.P. not yet evaluated in ENSDF.
Computer file and programs :	- Preparation of JEF2. - Magnetic tape available on line for those using the French CISI Network. - Off line from the NEA Data bank (Saclay);
Publication :	- MITO (1988) p 901 - Data for Decay heat predictions - STUDSVIK (1987) - NEACRP-302 'L' - NEANDC-245 'V'

FRANCE

Laboratory and adress	Laboratoire de Métrologie des Rayonnements Ionisants C.E.N. Saclay B.P. 6, F91192 Gif sur Yvette Cedex
Names:	N. Coursol, B. Duchemin, J. Legrand, F. Lagoutine*
Evaluation:	Radionuclide decay data
Purpose;	Preparation of a document providing recommended value of the principal decay scheme parameters: half-life, energies and intensities of various nuclear and atomic radiations emitted (e.g. Beta, Gamma, Conversion-Electrons, X-rays ...)
Method:	- critical analysis of published results - determination of mean values and associated uncertainties
Source of information:	Nuclear Data Sheet, INIS-Atomindex other recent publications
Publications:	Table des radionucléides, édition CEA-LMRI, containing among other radionuclides, the following fission and reactor products -Vol. 1: Kr-85, Mo-99, Tc-99, Ru-103 + Rh-103m, Sb-125 + Te-125m, Xe-133, Xe-133m, Ce-144 + Pr-144 (updated publication available) -Vol. 2: Rb-86, Rb-88, Sr-89, Sr-90 + Y-90, Y-91, Ru-106 + Rh-106, Te-127m + Te-127, I-129, Te-131m + Te-131, Xe-131m, Ba-140 + La-140, Pr-143, Zr-95 + Nb-95, Nb-95m, I-131, Cs-137 + Ba-137m, Ce-141 (updated publication available) -Vol. 3: Y-88, Sr-92, Y-92, Sb-122, Sb-124, Xe-127, Nd-147, Pm-147, Sm-151, Ho-166m, Ra-226 + decay-chain, Pu-238, Pu-239, Pu-240, Pu241, U-237, Cm-244 (publication available) -Vol. 4: Nb-93m, Te-133, Te-133m, Te-134, Eu-152, Th-228 + decay-chain, U-236, Np-237, Cm-242, Pu-242, Cm-246 (publication available) -Vol. 5: In-114, In-114m, Gd-153, Np-239, U-238 + decay-chain,Th-232 + decay-chain (in preparation)

*(retired)

Laboratory and address: Department of Physics, Panjab University, Chandigarh-160014 (India).

Names: S. S. Malik, S. Kumar, R. K. Puri, S. Singh, and R. K. Gupta.

Evalution: (i) Charge distribution yields in spontaneous fission of U-236 and Cf-252 nuclei. (ii) Correlation of charge and mass distributions in the spontaneous fission of U-236. (iii) New cluster radioactivity as a cluster emission vs. fission process.

Purpose: To predict and study the fine structure of the charge distribution yields, correlation of charge and mass distributions in the fission process and the exotic cluster emission as a cluster decay process or the fission process.

Method:

i) Charge distribution yields are obtained by solving a stationary Schrodinger equation numerically as well as analytically. The width of distribution, the most probable charge and the odd-even proton effects are also calculated.

ii) Time dependent Schrodinger equation in charge as well as in coupled charge and mass asymmetry and relative separation coordinates are solved analytically to obtain, respectively, the charge distribution yield and to study the time evolution of mean values(centroids), variances (widths) and their correlation coefficient in the spontaneous fission of U-236.

iii) A dynamical model of new cluster radioactivity is proposed, where the cluster formation probability is calculated as the quantum mechanical formation probability of clusters inside the nucleus.

Major sources of information: Journals and reports at national/international conferences.

Deadline of literature coverage: October 1989.

Status:

(i) Fine structure effects in charge distribution yields of light mass products(A=97-104) of U-236 are observed to give rise strong proton odd-even effects, which are shown to be due to the shell effects in both potential and masses.

(ii) Additional proton odd-even effect due to coupling of charge asymmetry coordinate to the relative

separation coordinate is observed in the charge distribution yields of U-236.

(iii) The degree of neutron-proton correlation in the spontaneous fission of U-236 is found to be dependent strongly on time. At very small times the neutron-proton motion is found uncorrelated, which become correlated at larger times.

(iv) Cluster formation in radioactive nuclei is a quantum mechanical fragmentation process, like the normal fission.

(v) The heavier clusters, like Ca-48 observed in decay of Cf-252, follows the super-asymmetric fission process better rather than the cluster emission process.

Publications:

1. D. R. Saroha, R. Aroumougame and R. K. Gupta, Phys. Rev. C27 (1983) 2720.
2. D. R. Saroha and R. K. Gupta, Phys. Rev. C29 (1984)1101.
3. R. K. Gupta and D. R. Saroha, Phys, Rev. C30 (1984)395.
4. R. K. Gupta, D. R. Saroha and N. Malhotra, J.de Physique colloque 45 (1984)C6-477.
5. D. R. Saroha and R. K. Gupta, J. Phys. G: Nucl. Phys. 12 (1986)1265.
6. R. K. Gupta, S. Gulati, S. S. Malik and R. Sultana, J. Phys. G: Nucl. Phys. 13 (1987)L27.
7. R. K. Gupta, S. S. Malik and R. Sultana, Fizika 19 (1987)23 (Supplement 1)
8. S. S. Malik, S. Singh, R. K. Puri, S. Kumar and R. K. Gupta, Pramana J. Phys. 32 (1989) 419.
9. S. S. Malik and R. K. Gupta, Phys. Rev. C39 (1989)1992.
10. R. K. Puri, S. S. Malik and R. K. Gupta, Europhys. Lett. 9 (1989)767.
11. R. K. Gupta , S. Kumar ,S. S. Malik, R. K. Puri and S. Singh, Proc. 50 years with Nucl. Fission, Gaithersburg, Maryland, U.S.A. April 25-28 (1989).
12. S. Kumar and R. K. Gupta, Contr. Int. Nucl. Phys. Conf. Sao Paulo, Brasil, August 20-26(1989).

Laboratory and addres : Japanese Nuclear Data Committee/FPND S.W.G., Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki 319-11, Japan

Name : S. Iijima, M. Kawai (group leader) (i)
T. Nakagawa, Y. Nakajima, T. Sugi (ii)
H. Matsunobu (iii), A. Zukeran (iv),
T. Watanabe (v) and M. Sasaki (vi)

Evaluation : (1) JENDL-3 FP Library containing neutron cross sections for the following 172 FP nuclides. :

As- 75,
Se- 74, 76, 77, 78, 79, 80, 82
Br- 79, 81,
Kr- 78, 80, 82, 83, 84, 85, 86,
Rb- 85, 87,
Sr- 86, 87, 88, 89, 90,
Y- 89, 91,
Zr- 90, 91, 92, 93, 94, 95, 96,
Nb- 93*, 94, 95,
Mo- 92, 94, 95, 96, 97, 98, 99, 100,
Tc- 99,
Ru- 96, 98, 99, 100, 101, 102, 103, 104, 106,
Rh-103, 105,
Pd-102, 104, 105, 106, 107, 108, 110,
Ag-107*, 109*, 110m,
Cd-106, 108, 110, 111, 112, 113, 114, 116,
In-113, 115,
Sn-112, 114, 115, 116, 117, 118, 119, 120, 122,
Sn-123, 124, 126,
Sb-121, 123, 124, 125,
Te-120, 122, 123, 124, 125, 126, 127m, 128,
Te-129m, 130,
I- 127, 129, 131,
Xe-124, 126, 128, 129, 130, 131, 132, 133, 134,
Xe-135, 136
Cs-133, 134, 135, 136, 137,
Ba-130, 132, 134, 135, 136, 137, 138, 140,
La-138, 139,
Ce-140, 141, 142, 144,
Pr-141, 143,
Nd-142, 143, 144, 145, 146, 147, 148, 150,
Pm-147, 148g, 148m, 149
Sm-144, 147, 148, 149, 150, 151, 152, 153, 154,
Eu-151, 152, 153, 154, 155, 156,
Gd-152, 154, 155, 156, 157, 158, 160,
Tb-159.

N.B. 1) The underlin denotes a nuclides newly added to JENDL-2 as a JENDL-3 FP nuclide.
2) An asterisc indicates the nuclide contained in the general purpose file of JENDL-3.

(2) Integral test of JENDL FP Libraries.

Purpose : Reactor burnup calculation, dosimetry, activation, radiation damage, nuclide transmutation and detonation.

Method : (1) Calculation of capture, elastic and inelasic scattering and total cross sections with spherical optical model and statistical theory. Multi-level BW formula in thermal and resonance regions. Negative resonances were introduced to reproduce the thermal cross sections. Unassigned neutron angular momentum and spin state were determined with Bayesian theorem according to resonance level statistics. Strengh function model

was employed in unresolved resonance region up to 100 keV. Optical model parameters were determined. Level density parameters were reevaluated, deriving systematics of parameters. Gamma-ray strength function were studied in detail.

(2) For higher neutron energies, (n,2n), (n,p), (n,a), (n,np) and (n,na) cross sections evaluated by using the simple evaporation and preequilibrium model calculation code PEGASUS. Direct inelastic scattering cross section calculated by DWBA theory, for weak absorbing nuclei. Semidirect and direct capture contribution was added. Evaluation based on the experimental data for capture and threshold reaction cross sections up to 1988. The results of integral tests on JENDL-2 FP data are taken into account in the evaluation.

(3) Integral test using JAERI-FAST type 70-group cross sections with resonance self-shielding factors, and the neutron spectrum data for STEK, CFRMF and EBR-II. Covariances of flux and cross sections are considered.

Major sources of information : EXFOR Library, CINDA, BNL-325 and recent literature. Integral data from STEK, CFRMF and EBR-II.

Status : (1) JENDL-2 FP Library has been released to the NEA Data Bank in December 1985.

(2) Data evaluation for JENDL-3 FP Library has been completed and their compilation is on final stage. The evaluated results are being compared with JENDL-2 and the experimental data.

(3) Code system for integral test, containing calculation of covarince matrices and cross-section-adjustment based on integral data, was developed. The applicabilty of cross section adjustment to data evaluation was investigated, by considering flux depression effects for strongly absorbing FP nuclides and mehod uncertainties.

Computer file of evaluated data : JENDL-3 (ENDF/B-V Format).

Expected completion date : File completion March of 1990, Integral test will follow.

Publications: (1) M. Kawai and FPND Sub-working Group, "Evaluation of FP Cross Sections for JENDL-3", JAERI-M 88-065, p. 57 (1988).

(2) T. Watanabe, et al., "Fission-Product Cross Section Integral Tests and Adjustment Based on Integral Data", ibid. p.148 (1988).

(3) M. Kawai, et al., "Evaluation and Integral Tests of FP Nuclear Data for JENDL-3", Proc. Int. Conf. on Nuclear Data for Science and Technology, May 1988, Mito, p. 569, (1988).

(i) Toshiba Corporaton. (ii) JAERI. (iii) Sumitomo Atomic Energy Industries, Ltd. (iv) Hitachi Ltd. (v) Kawasaki Heavy Industries (vii) Mitsubishi Atomic Power Industries, Inc.

JAPAN

Laboratory and address:
Japanese Nuclear Data Committee
Decay Heat Evaluation Working Group
c/o Nuclear Data Center
Japan Atomic Energy Research Laboratory
Tokai-mura, Naka-gun, Ibaraki-ken 319-11
Japan

Members:
R.Nakasima (Hosei University), T.Tachibana, M.Yamada (Waseda University)
T.Yoshida, S.Iijima, T.Murata (Toshiba), I.Otake (Data Eng. Inc.)
A.Zukeran (Hitachi), T.Hojuyama (MAPI), T.Tamai (Kyoto University)
H.Ihara, J.Katakura, K.Tasaka, K.Umezawa (JAERI)

Compilation:
Decay data, delayed neutron data and fission yields

Purpose:
To construct a user-oriented FP decay data library mainly aiming at decay heat calculations and to establish recommended decay heat curves. (For the latter purpose cooperation is being done with the Decay Heat Standard Research Committee of the Atomic Energy Society of Japan.)

Major Source of Information:
Journals, Nuclear Data Sheets, ENSDF and theoretical calculations

Status of the Data Evaluation:
JNDC FP Decay Data Library Version 2 was completed in 1989. Summary reports are now being prepared for publication. The library contains decay and yield data for 1200 fission product nuclides relevant to summation calculations of reactor decay heat. The second version has capability of delayed-gamma energy spectrum calculations. The calculated decay heat based on this version is easily reproduced with the aid of 32-term fitting formula.

Availability of the Data:
Contact Dr. Y.Kikuchi
Nuclear Data Center
Japan Atomic Energy Research Institute
Tokai-mura, Ibaraki-ken 319-11, Japan

Publications:

1. K.Tasaka and S.Iijima, J. Nucl. Sci. Technol., **23**, 914 (1986)
2. J.Katakura and T.Yoshida, "Gamma-Ray Spectrum Data Library of Fission Product Nuclides and Its Assessment," JAERI 1311 (1988)
3. K.Tasaka, J.Katakura and T.Yoshida, "Reviw of Decay Heat Calculations," Proc. Int. Conf. on Nucl. Data for Sci. and Technol., (Mito, 1988) p.819
4. M.Yamada, "Recent Progress in the Gross Theory of Beta Decay," ibid., p.841

5. J.Katakura, "Calculation of Gamma-Ray Spectrum of Aggregate Fission Product Nuclides and Fitting of the Gamma-ray Spectrum," ibid. p.881
6. T.Tachibana, "Estimation of Delayed Neutron Emission Probability and Delayed Neutron Yield," ibid. p.885
7. T.Yoshida et al., "The Overview of the JNDC FP Decay Data Library Version 2," ibid. p.889
8. T.Yoshida, J.Katakura and H.Ihara, "Calculation of the Delayed Fission Gamma-Ray Spectra from U-235, -238, Pu-239, -240 and Pu-241; Tabular Data," JAERI-M 89-037
9. H.Ihara, editor, "Tables and Figures from JNDC Nuclear Data Library of Fission Products, Version 2," JEARI-M report, to be published
10. K.Tasaka, "JNDC FP Nuclear Data Library Version 2," preparing for publication as a JAERI report.

JAPAN

Laboratory and Address: Tokyo Metropolitan University
Setagaya ku, Tokyo 158

Names: H. Nakahara, T. Ohtsuki, Y. Hamajima, and K. Sueki

Evaluation:

Purpose: Systematic Study of Mass Division Mechanism in Low-Energy Nuclear Fission

Method: Asymmetric mass yield curves reported in literature have been fitted by two Gaussians for 13 thermal-neutron induced fission reactions (^{227}Th through ^{254}Fm) and for 7 spontaneously fissioning nuclei (^{242}Cm through ^{256}Fm). Variation of Gaussian parameters, peak position, width and peak height, are discussed as a function of the fissioning mass.

Major source of information: E.A.C. Crouch, Nucl. Data Tables 19, 343 (1977)

Publication: Radiochimica Acta 43, 77-81 (1988)

SWEDEN

Laboratory and address: University of Uppsala, The Studsvik Neutron Research Laboratory, S-61182 NYKÖPING, Sweden

Names: E Lund and G Rudstam.

Evaluation: Delayed Neutron Branching Ratios.

Purpose: To provide evaluated P_n-values for the JEF-II file.

Method and source of information: Data on delayed neutron branching ratios published or given as private communication before the end of 1987 are included.

Discrepancies: Among the 86 delayed neutron precursors included in the evaluation there are many cases with only one experimental result available or for which the reported data are inconsistent. Therefore, measurements are recommended for 39 precursors.

Publication: E Lund and G Rudstam, "Delayed-Neutron Branching Ratios of Fission Products", The Studsvik Neutron Research Laboratory Report NFL-60 (1989).

TAIWAN

Laboratory and address:	Institute of Nuclear Science National Tsing Hua University Hsinchu 30043, TAIWAN R.O.C.
Names:	Prof. Dr. Chien CHUNG
EVALUATION:	IFY in $^{239}Pu(n_{th},f)$
Method:	Least-square fit of Gaussian distribution of all data
Major sources of information:	published data available from literatures
Deadline of literature coverage:	1988.01
Status:	Completed
Cooperation:	None
Other relevant details:	None
Computer file of compiled data:	IBM PC disk
Computer file of evaluated data:	IBM PC disk
Availability:	on request
Discrepancies encountered:	large for IFY far from stability line
Completion date:	1989.08
Publications:	submitted for review in the Journal of Radioanalytical and Nuclear Chemistry, Articles
Contact:	Prof. Dr. Chien Chung Institute of Nuclear Science National Tsing Hua University Hsinchu 30043, TAIWAN R.O.C.

UNITED KINGDOM

Laboratory and address:	Atomic Energy Establishment Winfrith, Dorchester, Dorset DT2 8HD, United Kingdom, Europe.
Names:	M.F. James, R.W.Mills and D.R.Weaver (Birmingham University).
Compilation and Evaluation:	Fission Product Yields for spontaneous and neutron induced fission for UKFY2 evaluation.
Purpose:	To compile experimental Fission Product Yield data, and evaluate this data to produce a set of libraries, currently in ENDF/B-VI format.
Method:	Weighted averaging of experimental data, fitting data to various models for chain and fractional independent yields, adjustment for physical constraints, isomeric splitting from experimental data or Madland and England model and production of ENDF/B-VI formatted libraries.
Fissile materials considered:	Database contains spontaneous(S) and neutron induced fission yield data for all fissile materials in compilation. Neutron energies; thermal(T), fast(F), High(H) and monoenergetic. Libraries contain complete yield sets for Th232FH, U233TFH, U234F, U235FTH, U236F, U238FH, Np237TF, Np238TF, Pu238TF, Pu239TF, Pu240F, Pu241TF, Pu242F, Am241TF, Am242mTF, Am243TF, Cm242S, Cm243TF, Cm244TFS Cm245TF, and Cf252S.
Major sources of data:	Compilations from Crouch(1), data within EXFOR and searches of the open literature. Complete upto mid-1989.
Status:	Adjusted Independent libraries completion due December 1989, cumulative libraries to follow early 1990.
Compilation:	Tables of data and discrepancies will be published for chain and fractional independent yields.
Evaluated files:	UKFY2 available from authors early 1990.
References:	1. E.A.Crouch, " Fission-Product Yields from neutron-induced fission." Atomic and Nuclear Data sheets Vol 19, No.5, May 1977.
Contacts:	M.F.James, office 211/B21 or R.Mills office 204A/B20 at AEE Winfrith. Telephone England (0305)251888 Ext 2939 or 2503.

Laboratory: IMPERIAL COLLEGE REACTOR CENTRE
Silwood Park, Ascot, Berkshire
SL5 TE, England
Telephone: 44-990-294290.
Fax: 44-990-24931

Names: M.U. RAJPUT, T.D. MAC MAHON

Evaluation: Half-lives of ^{90}Sr and ^{137}Cs

Purpose: To provide recommended values for the half-lives (and associated uncertainties) for ^{90}Sr and ^{137}Cs from the inconsistent sets of experimental values reported in the literature.

Method: 9 experimental values of the ^{90}Sr half-life reported in the literature between 1955 and 1987, and 18 values of the ^{137}Cs half-life reported between 1955 and 1989, have been considered. Each set of data exhibits large inconsistencies.

The inconsistencies have been treated by firstly increasing very small quoted uncertainties to a minimum of 0.2 years in the case of ^{90}Sr and 0.1 years in the case of ^{137}Cs, and secondly a subsequent inflation of all uncertainties to make the value of chi-squared per degree of freedom equal to unity.

Recommended values are:-

^{90}Sr : 28.67 ± 0.18y (10473 ± 66d)

^{137}Cs : 30.11 ± 0.08y (10996 ± 30d)

References:

M.U. Rajput, T.D. Mac Mahon "Discrepancies in the half-lives of ^{90}Sr, ^{137}Cs and ^{252}Cf" Imperial College Reactor Centre Research Report ICRC/88/1, June 1988.

P.W. Gray, T.D. Mac Mahon, M.U. Rajput, "Objective data evaluation procedures", Nucl. Instr. & Meths. (to be published).

Laboratory and Address: National Power
Berkeley Nuclear Laboratories
Berkeley
Gloucestershire GL13 9PB
United Kingdom

Working Group:

A. Tobias	National Power, BNL
P. Robb	AEA Technology, Winfrith
M.F. James	AEA Technology, Winfrith
A.J. Fudge	AEA Technology, Winfrith
A. Whittaker	BNFL Sellafield
D.R. Weaver	University of Birmingham
R.W. Mills	University of Birmingham
T.D. MacMahon	Imperial College Reactor Centre

Evaluation: Radionuclide Decay Data

Purpose: To provide a comprehensive, up-to-date library of radioactive decay data including half-lives, Q-values, branching fractions, alpha, beta and gamma energies and emission probabilities and corresponding uncertainties.

Status:

1. The current UK Fission product decay data library is UKFPDD-2 which was released in 1980/81. It contains data for 855 nuclides of which 736 are radioactive and 390 have spectral data. The JEF1 decay data file is also available for use in the U.K.
2. The spectral data of UKFPDD-2 are available as an additional data base for the inventory/decay heat code FISP6, permitting the calculation of detailed radiation spectra from irradiated fuel.
3. A spectral data retrieval system is available for use with ENDF/B format decay data files. Catalogues of spectral data are available as functions of nuclide or radiation energy with a variety of editing options.

Progress: Efforts are aimed largely towards JEF construction and testing. The JEF1 decay data and fission yield data libraries have been used in decay heat calculations and the results compared with predictions from UK data files and measured values. Comparisons between JEF1 predictions and a least squares fit to measured data have been used in an attempt to identify nuclides for which available decay data may be erroreous. Proposed improvements and extensions in decay data for JEF2 have been formulated.

Publications:

1. "UKFPDD-2: A Revised Fission Product Decay Data File in ENDF/B-IV Format" by A. Tobias and B.S.J. Davies, 1980, CEGB Report RD/B/N4942.

2. "FISP6 - An Enhanced Code for the Evaluation of Fission Product Inventories and Decay Heat" by A. Tobias, 1982, CEGB Report TPRD/B/0097/N82.

3. "A Retrieval System for Spectral Data from ENDF/B Format Decay Data Files" by A. Tobias 1981, CEGB Report RD/B/5170N81.

4. "The UKCNDC Radioactive Decay Data Libraries" by A. Tobias, B.S.J. Davies, A.L. Nichols and M.F. James, 1983, Nuc. Energy, Vol. 22 No. 6, pp 445-552.

5. "Evaluated Decay Data for Reactor Applications: The UKCNDC Data Libraries" by A.L. Nichols and A. Tobias, 1984, Nuc. Inst. Methods, Vol. 223, pp 487-491.

6. "Decay Heat Predictions Using JEF1" by A. Tobias, 1986, CEGB Report TPRD/B/0863/R86.

7. "Uncertainties in JEF1 Integral Decay Heat Predictions Estimated from Comparisons with a Least Squares Fit to Measured Data", A. Tobias, 1987, presented at Specialists' Meeting on Data for Decay Heat Predictions, Studsvik, Sweden, Sept. 1987.

Laboratory and Address:	Physics Department Radiation Center University of Birmingham P.O. Box 363 Birmingham B15 2TT
Names:	D.R. Weaver, M.F. James (UKAEA Winfrith, Dorset)
Evaluation:	Delayed neutron properties
Purpose:	For reactor physics calculations
Major Sources of information:	1. Scientific journals; 2. Laboratory reports containing accounts of completed work which are unlikely to be published in the open literature.
Deadline of literature coverage:	Continuous
Status:	In progress

U.S.A.

Laboratory and address:	Idaho National Engineering Laboratory EG&G Idaho, Inc. P. O. Box 1625 Idaho Falls, ID 83415 USA
Names:	C. W. Reich, M. H. Putnam
Compilation:	Decay data for fission products. Quantities treated include: $T_{½}$; $Q\beta$; branching fractions for the various decay modes; energies and intensities of all emitted radiations (e.g., β, γ, c.e., x-ray); K-, L- and total ICC; delayed-neutron energy spectra for individual precursors; uncertainties in all measured values.
Purpose:	Decay data file for ENDF/B.
Major source of Information:	Nuclear Data Sheets, Table of Radioactive Isotopes, recently published papers, preprints of recent work.
Deadline of literature Coverage:	Ongoing. Evaluation of decay data for inclusion in Version VI of ENDF/B is nearing completion.
Computer File:	Decay data will be included in ENDF/B Fission Product File. Tapes available through normal ENDF/B procedures. Evaluated decay data sets for 510 fission-product nuclides (and isomeric states) have been prepared for inclusion in the ENDF/B-VI Fission-Product File.
Publications:	C. W. Reich, "Review of Nuclear Data of Relevance for the Decay Heat Problem," in <u>Proceedings of a Specialists' Meeting on Data for Decay Heat Predictions</u>, Studsvik, Sweden, 7-10 September 1987, (Nuclear Engergy Agency, Paris, 1987), p. 107.

U.S.A.

Laboratory and Address:	Los Alamos National Laboratory, P.O. Box 1663 Los Alamos, New Mexico 87545 U.S.A.
Names:	T.R. England, R.J. LaBauve, W.B. Wilson, D.C. George, B.F. Rider, C.W. Reich (INEL), R.E. Schenter (HEDL), F.M. Mann (HEDL), J.-I. Katakura (JAERI), A.C. Wahl (Washington Univ.)
Cooperation:	HEDL, INEL, BNL, and ENDF/B sub-committees, plus other worldwide contributors.
Purpose:	To provide evaluations and compilations for ENDF/B and processed libraries based on ENDF/B files.

Evaluations:

A. <u>Decay Data</u>

Preliminary file in an ENDF/B-VI format for 891 nuclides was completed for testing in November, 1989. Of the 755 unstable nuclides, we have essentially complete spectra for beta, gamma, x-ray, discrete electrons, etc. for 736 nuclides. 510 have measured spectra or total decay energies; 115 of these are supplemented with model calcula- tions, and nuclear models are used for most of the remaining unstable nuclides. The decay data include the delayed neutron emission spectra. These data are now being tested using integral experiments and for proper ENDF/B-VI format rules. Data should be available for distribution in early 1990.

B. <u>Yield Data</u>

A preliminary evaluation for neutron or spontaneous fission yields for 36 fissioning systems at one or more neutron energies (60 yield sets) is complete. This contains direct yields before delayed neutron emission and cumulative yields after delayed neutron emission.

The entire evaluation will be redone using improved distribution parameters discussed at the Sept. 1989 IAEA CRP meeting.

C. <u>Delayed Neutrons</u>

The evaluation for 271 delayed emission spectra, supplemented with models, and precursor emission probabilities is complete. These data will be incorporated in the decay files for ENDF/B-VI.

Using a preliminary set of fission product yields evaluated for ENDF/B-VI, we have calculated the aggregate spectra from fission pulses for 43 fissioning systems. These have been approximated using the usual six time-groups, including corresponding spectra in 10 keV energy bins per group to 3 MeV. Twenty-eight sets of such data are being incorporated into ENDF/B-VI (ENDF/B-V contains data for only six fissioning nuclides and spectra in only 28 groups to 1.2 MeV).

Compilations/ Libraries:

A. A summary report containing all ENDF/B-V total decay parameters, halflives, few-group processed cross sections, mass chain yields, schematics of coupled nuclides, supplementary data, and a listing of questionable data has been completed. This report will serve as a reference document for ENDF/B-V data (Ref. 2).

B. Processed multigroup cross sections (154 groups) for all ENDF/B-V fission products and actinide cross sections are available along with a collapsing code in Ref. 3.

C. Multigroup decay spectra (158 groups) for $\beta^{\pm}$, γ, α, discrete electrons and neutrinos based on ENDF/B-V decay data have been generated using the SPEC5 Code (Ref. 4). These are available, but not published.

D. Few-group β and γ spectra, curies, and total decay power analytical fits based on ENDF/B-V data (and modified by experiments in which such integral data were available) are included in the library for the DKPOWR Code (Ref. 5).

All processed libraries based on a released version or modifications of ENDF/B are available. Several libraries for codes such as the various versions of CINDER are also available. Current references are based on ENDF/B-V or subsequent work.

References:

1. General Electric (Vallecitos Nuclear Center) report series, "Compilation of Fission Product Yields:" M.E. Meek and B.F. Rider, NEDOR-2154 (1972): B.F. Rider and M.E. Meek, NEDO 2154-1 (1978): B.F. Rider, NEDO-2154-3(B), [ENDF-292] (1980); and B.F. Rider, NEDO-2154-3(C) [ENDF-322] (1981).

2. T.R. England, W.B. Wilson, R.E. Schenter, and F.M. Mann, "ENDF/B-V Summary Data for Fission Products and Actinides," Los Alamos informal document LA-UR-83-1285 (May 1984) (ENDF 322). Electric Power Research Inst. report NP-3787, December 1984.

3. W.B. Wilson, T.R. England, R.J. LaBauve, and R.M. Boicourt, "The TOAFEW-V Multigroup Cross-Section Collapsing Code and Library of 154-Group Processed ENDF/B-V Fission-Product and Actinide Cross Sections," Electric Power Research Inst. report EPRI NP-2345. [Los Alamos Nat. Lab. informal document LA-UR-81-1762 Rev (April 1982).]

4. T.R. England, R.J. LaBauve, W.B. Wilson, and N.L. Whittemore, "SPEC5: Code to Produce Multigroup Spectra," in Applied Nuclear Data Research and Development Quarterly Progress Report, Jan. 1 - March 31, 1981," C. Baxman and P. Young, Comps., Los Alamos Scientific Laboratory report LA-8874-PR (July 1981), p. 50.

5. W.B. Wilson, T.R. England, R.J. LaBauve, and D.C. George, "DKPOWR: A Code for Calculating Decay Power, Energy, Activity, and $\beta + \gamma$ Spectra in LWR Fuel Using Fission Pulse Functions," prepared for publication by the Electric Power Research Institute, May 1984. [Los Alamos informal document LA-UR-85-157 (January 1985.)]

6. T.R. England, E.D. Arthur, M.C. Brady, and R.J. LaBauve, "Background Radiation from Fission Pulses," Los Alamos National Laboratory report, LA-11151-MS, (Sept. 1987)

7. W.B. Wilson, T.R. England, R.J. LaBauve and J.A. Mitchell, "Calculated Radionuclide Inventories of High-Exposure Fuels". Nuclear Safety, Vol. 29, No. 2, April-June, 1988

8. T.R. England and J. Blachot, "Status of Fission Yield Data," invited paper for the International Conference on Nuclear Data for Science and Technology, May 30 - June 3, 1988, in Mito, Japan. Ed. S. Igarasi, JAERI, [LA-UR-88-1696]

U.S.A.
(cont'd)

9. T.R. England and M.C. Brady, "Delayed Neutron Spectra by Decay Group for Fissioning Systems from Th-227 through FM-255," invited paper for the 1988 International Reactor Physics Conference in Jackson Hole, Wyoming, Sept. 18-21, 1988 [Summary LA-UR-88-626, Feb. 1988, Final Paper, LA-UR-88-2140, June 1988]

10. M.C. Brady and T.R. England, "Delayed Neutron Data and Group Parameters for 43 Fissioning Systems," Nucl. Sci. and Eng., 103, pp. 129-149, (October, 1989) [LA-UR-88-4118]

11. T.R. England and B.F. Rider, "Evaluation and compilation of Fission Product Yields, 1989," ENDF-349 (Draft to be published as a laboratory report - this will be the primary documentation for ENDF/B-VI)

12. T.R. England, F.M. Mann, C.W. Reich, and R.E. Schenter, "ENDF/B-VI Radioactive Decay and Yield Libraries," invited paper for the ANS Meeting, Nov. 26-30, 1989 [LA-UR-89-2174]

13. T.R. England and M.C. Brady, "ENDF/B-VI Six-Group Delayed Neutron Data," invited paper for the ANS Meeting, Nov. 26-30, 1989, LA-UR-89-2207

U.S.A.

Laboratory and address
Washington University, Department of Chemistry, St. Louis, MO 63130, U.S.A.

Name
A. C. Wahl

Compilation and evaluation
Independent yields and other data related to nuclear-charge distribution in fission are compiled and evaluated for low-energy fission reactions (excitation energies up to ~ 20 MeV). The current compilation includes data for thermal-neutron-induced fission of ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu, for spontaneous fission of ^{252}Cf, for fission-spectrum-induced fission of ^{238}U and ^{232}Th, and for 14-MeV-neutron-induced fission of ^{238}U. Data for other fission reactions will be added.

Purpose
Systematic trends in independent yields (IN) are derived from the data by use of empirical models, which allow estimates to be made of independent yields for all fission products and contribute to the understanding of fission-reaction mechanisms.

Sources of information
Journals, reports, preprints, other compilations, and personal communcations.

Method
Original values of experimental data and uncertainties are maintained in a file, and average values are calculated and normalized for each A, when sufficient data exist, so that the sum of fractional independent yields (FI) is unity. The set of FI values for each fission reaction, or IN values derived from them, are treated by the method of least squares to derive systematic trends in the yields described by the Z_P and A'_P empirical models.

Cooperation
We are prepared to exchange files with other groups.

Computer files
Information is held in computer files.

Completions
Compilation is continuous; evaluations and redetermination of parameters for models occurs periodically. Recent reports of data, evaluations, and model-estimated yields and uncertainties are given in references 1 and 2.

U.S.A.

(cont'd)

Publications

1. A.C. Wahl, "Nuclear-Charge Distribution and Delayed-neutron Yields for Thermal-neutron-induced Fission of ^{235}U, ^{233}U, and ^{239}Pu and for Spontaneous Fission of ^{252}Cf", *Atomic Data and Nuclear Data Tables* 39, 1-156 (1988).
2. A.C. Wahl, "Nuclear-Charge and Mass Distribution from Fission", presented at the Conference on 50 Years with Nuclear Fission, Washington, D.C., April 28, 1989; to be published in the Conference Proceedings.
3. A.C. Wahl, "Nuclear-Charge Distribution and Delayed-neutron Yields for Thermal-neutron-induced Fission of ^{235}U, ^{233}U, ^{239}Pu and ^{241}Pu and for Fast-neutron-induced Fission of ^{238}U", Proceedings of a Specialists' Meeting on Data for Decay Heat Predictions, held in Studsvik, Sweden, Sept., 1987. Reports NEACRP-302 'L', NEANOC-245 'U' (1987).
4. A.C. Wahl, "Nuclear-Charge Distribution Near Symmetry for Thermal-Neutron-Induced Fission of ^{235}U", *Phys. Rev. C* **32**, 184 (1985).
5. A.C. Wahl, "Nuclear Charge Distribution in Fission", in *New Directions in Physics, The Los Alamos 40th Anniversary Volume*, edited by N. Metropolis and G.-C. Rota, Academic Press, N.Y., 1987, pp. 163-189.
6. A.C. Wahl, "Systematics of Nuclear Charge Distribution in Fission. The Z_P Model", *J. Radioanal. Chem.* 55, 111 (1980).

U S S R

Laboratory and adress	Institute of Physics and Power Engineering Ploshad Bondarenko - 1 Obninsk Kaluga Region
Names :	Goverdovsky A.A., Ignatjuk A.V.
Evaluation :	Fission fragment mass distribution dispersions as a function of Z^2/A - parameter.
Results :	Fissioning systems from Ac to Fm ; dissipation energy evaluation for different deformations between the saddle point and scission one.
Publication :	A.A.Goverdovsky, A.V.Ignatjuk. "Statistical and dynamical aspects for nuclear fission"- Proc. Int. Symp. Nucl. Fission, Gaussig,GDR, 1988.

PART 2: RECENT PUBLICATIONS RELATED TO FPND

(Completeness of this section has not been attempted)

2.1. Publications not covered by contributions

The publications listed below refer to activities related to FPND which are not covered by the contributions contained in this issue. They are sorted according to:

2.1.1 Fission yields and charge distribution

2.1.2 Neutron reaction cross sections

2.1.3 Decay data

2.1.4 Delayed neutron data

2.1.5 FP decay heat

2.1.6 Reviews and summaries

For papers presented at meetings see section 2.2.

2.1.1 Fission yields and charge distribution

Characteristics of mass and nuclear charge distributions of $^{229}Th(n_{th},f)$. Implications for fission dynamics
J.P. Bocquet, R. Brissot, H.R. Faust, M. Fowler, J. Wilhelmy, M. Asghar, M. Djebara
Z. Phys. A 335(1990)41

Differences between angular distributions of fission fragments of unequal mass
B.M. Gokhberg, L.D. Kozlov, S.K. Lisin, L.N. Morozov, V.A. Pchelin, L.V. Chistyakov, V.A. Shigin, V.M. Shubko, Yu.A. Yashin
Yad. Fiz. 47(1988)320 (English: Sov. J. Nucl. Phys. 47(1988)201)
(including: Th-232, U-236,238)

Application de la technique d'activation a l'étude des distributions en masse et en charge nucléaire de $^{238}U(n,f)$ et $^{232}Th(n,f)$ induites par les neutrons de 3 MeV et 14 MeV
K. Embarch
Thesis: Unviersité Mohammed V, Rabat, Morocco

Nuclide yields of light fission products from thermal-neutron induced fission of ^{233}U at different kinetic energies
U. Quade, K. Rudolph, S. Skorka, P. Armbruster, H.-G. Clerc, W. Lang, M. Mutterer, C. Schmitt, J.P. Theobald, F. Gönnenwein, J. Pannicke, H. Schrader, G. Siegert, D. Engelhardt
Nucl. Phys. A 487(1988)1

Isomeric yield ratio of ^{146}La and ^{84}Br in the thermal neutron induced fission of ^{235}U
C.H. Lee, L.T. Hwang, Y.S. Lin, Y.W. Yu
J. Radioanal. Nucl. Chem., Letters 119(1987)101

Measurement of the yield of fission products of ^{235}U and ^{239}Pu by the method of semiconductor gamma spectrometry
A.M. Gudkov, V.M. Zhivun, A.B. Koldobskii, S.V. Krivasheev, V.G. Nesterov, N.S. Piven, E.V. Semenova, G.N. Smirenkin
At. En. 65(1988)208 (English: Soviet At. En. 65(1989)765)

The double-torus ionization chamber DIOGENES for the investigation of charged particle associated nuclear fission
P. Heeg, J. Pannicke, M. Mutterer, P. Schall, J.P. Theobald, K. Weingärtner, K.F. Hoffmann, K. Scheele, P. Zöller, G. Barreau, B. Leroux, F. Gönnenwein
Nucl. Instr. Meth. Phys. Res. A 278(1989)452
(including: $^{235}U(n_{th},f)$, $^{239}Pu(n_{th},f)$ and $^{252}Cf(sf)$)

Mass distributions in different fissioning nuclei
A. Osman, M. Zaky, S.A. Saleh
Nuovo Cimento A 102(1989)1223
(calculation for: U-236,238)

Isobaric and isotopic distributions of heavy fission products from the $^{238}U(n_f,f)$ and $^{232}Th(\alpha,f)$ reactions
E. Dobreva, N. Nenoff
Bulg. J. Phys. 15(1988)211

Ternary fission of the spontaneously fissioning isomer ^{238}U
V.E. Makarenko, Yu.D. Molchanov, G.A. Otroshchenko, G.B. Yan'kov
Pis'ma Zh. Eksp. Teor, Fiz. 47(1988)489
(English: JETP Letters 47(1988)573)

Angular distribution of fragments from the fission of ^{238}U induced by neutrons in the energy range 1-18 MeV
H. Afarideh, S.A. Durrani, K. Randle
Ann. Nucl. Energy 17(1990)143
(see also contribution on page 43)

Mass and energy characteristics of products of thermal-neutron fission of $^{239,241}Pu$
A.D. Belyaev, Z.S. Bikbova, V.L. Gaishan, T.L. Gurvich, V.I. Kogan, V.P. Pikul, A.M. Usmandiyarov, P.K. Khabibullaev
Yad. Fiz. 48(1988)324 (English: Sov. J. Nucl. Phys. 48(1988)204)

P-odd asymmetry in emission of fragments from ternary fission of ^{239}Pu by polarized thermal neutrons
A.V. Belozerov, B.D. Vodennikov, G.V. Danilyan, E.I. Korobkina, V.S. Pavlov, Yu.F. Pevchev, A.G. Sadchikov, S.M. Solov'ev, A.K. Churakov
Yad. Fiz. 49(1989)326 (English: Sov. J. Nucl. Phys. 49(1989)201

Some peculiarities in ionic charge distributions of $^{241}Pu(n_{th},f)$ fission products
A.D. Belyaev, Z.S. Bikbova, V.L. Gaishan, T.L. Gurvich, V.I. Kogan, V.P. Pikul, A.M. Usmandiyarov
Nucl. Inst. Meth. Phys. Res. B 43(1989)5

Angular anisotropy of fragments from fission of ^{242}Pu and ^{233}U by neutrons with energy 3.80-6.30 MeV
D.L. Shpak, G.G. Korolev, Kh.D. Androsenko
Yad. Fiz. 49(1989)928 (English: Sov. J. Nucl. Phys. 49(1989)577)

Cold compact and cold deformed spontaneous fission of ^{252}Cf
I.D. Alkhazov, A.V. Kuznetsov, S.S. Kovalenko, B.F. Petrov, V.I. Shpakov
Yad. Fiz. 48(1988)655 (English: Sov. J. Nucl. Phys. 48(1988)420)

Spontaneous fission properties of ^{258}Fm, ^{259}Md, ^{260}Md, ^{258}No, and $^{260}[104]$: biomodal fission
E.K. Hulet, J.F. Wild, R.J. Dougan, R.W. Lougheed, J.H. Landrum, A.D. Dougan, P.A. Baisden, C.M. Henderson, R.J. Dupzyk, R.L. Hahn, M. Schädel, K. Sümmerer, G.R. Bethune
Phys. Rev. C 40(1989)770

Spontaneous emission of light fragments (decay/fission)

Heavy-fragment radioactivity of ^{234}U
K.J. Moody, E.K. Hulet, Shicheng Wang, P.B. Price
Phys. Rev. C 39(1989)2445

Observation of nucleon clusters in the spontaneous decay of ^{234}U
S.P. Tretyakova, Yu.S. Zamyatnin, V.N. Kovantsev, Yu.S. Korotkin, V.L. Mikheev, G.A. Timofeev
Z. Phys. A 333(1989)349

Detection of radioactive ^{236}Pu decay with emission of ^{28}Mg nuclei
A.A. Ogloblin, N.I. Venikov, S.K. Lisin, S.V. Pirozhkov, V.A. Pchelin, Yu.F. Rodionov, V.M. Semochkin, V.A. Shabrov, I.K. Shvetsov, V.M. Shubko, S.P. Tretyakova, V.L. Mikheev
Phys. Lett. B 235(1990)35

Heavy-fragment radioactivity of ^{238}Pu: Si and Mg emission
Shicheng Wang, D. Snowden-Ifft, P.B. Price, K.J. Moody, E.K. Hulet
Phys. Rev. C 39(1989)1647

2.1.2 Neutron reaction cross sections

Total cross section and resonance spectroscopy for $n+^{86}Kr$
R.F. Carlton, R.R. Winters, C.H. Johnson, N.W. Hill, J.A. Harvey
Phys. Rev. C 38(1988)1605

Measurement of the cross sections for the reactions $^{52}Cr(n,2n)^{51}Cr$, $^{66}Zn(n,2n)^{65}Zn$, $^{89}Y(n,2n)^{88}Y$ and $^{96}Zr(n,2n)^{95}Zr$ from 13.5 to 14.8 MeV
M. Wagner, G. Winkler, H. Vonach, Cs.M. Buczko, J. Csikai
Ann. Nucl. En. 16(1989)623

^{89}Y+n resonances for E = 10-740 keV and intermediate structure
H.M. Agrawal, J.B. Garg, J.A. Harvey
Nucl. Phys. A 501(1989)18

Measurement of the cross section for the reaction $^{93}Nb(n,n')^{93m}Nb$ at 2.8 MeV
M. Wagner, G. Winkler, H. Vonach, G. Petö
Ann. Nucl. En. 15(1988)363

Excitation functions of ^{93}Nb(n,2n)^{92m}Nb, ^{93}Nb(n,α)^{90m,g}Y, ^{139}La(n,α)^{136}Cs and ^{181}Ta(n,p)^{181}Hf reactions in the energy range of 12.5-19.6 MeV
R. Wolfle, A. Mannan, S.M. Qaim, H. Liskien, R. Widera
Appl. Radiat. Isot. 39(1988)407

Activation cross section and isomeric cross-section ratio for the ^{93}Nb(n,α)^{90}Y^{m,g} process
A. Mannan, S.M. Qaim
Phys. Rev. C 38(1988)630

A study of the level and decay scheme of ^{97}Mo via the (n,n'γ) reaction
F. Demanins, U. Abbondanno, F. Raicich
Nuovo Cimento A 98(1987)133

A study of the ^{97}Mo(n,n'γ)^{97}Mo reaction
U. Abbondanno, F. Demanins, F. Raicich
Nuovo Cimento A 102(1989)1533

^{100}Ru studied by thermal neutron capture
G.G. Colvin, S.J. Robinson, F. Hoyler
J. Phys. G 14(1988)1411

Measurement of the resonance integral and evaluation of the absorption cross section for thermal neutrons for radioactive ^{109}Cd
M.P. Anikina, A.G. Beda, A.V. Davydov, M.M. Korotkov, G.M. Kukavadze, L.Ya. Memelova
At. En. 62(1987)415 (English: Sov. At. En. 62(1987)483)

Refining the capture cross sections of ^{103}Rh, ^{105}Pd, ^{109}Ag, and ^{153}Eu
S.M. Bednyakov, M.V. Bokhovko, G.N. Manturov, K. Dietze
At. En. 67(1989)199 (English: Sov. At. En. 67(1990)675)

A study of the ^{127}I(n,γ)^{128}I reaction
M.A. Islam, T.J. Kennett, W.V. Prestwich
Z. Phys. A 335(1990)173

Low-lying ^{130}I excited states from the (n,γ) reaction
S.L. Sakharov, I.A. Kondurov, Yu.E. Loginov, V.V. Martynov, A.A. Rodionov, P.A. Sushkov, Yu.L. Khazov, A.I. Egorov, V.K. Isupov, H.G. Börner, F. Hoyler, S. Kerr, K. Schreckenbach, G. Hlawatsch, T. von Egidy, H. Lindner
Nucl. Phys. A 494(1989)36

A study of the ^{139}La(n,n'γ)^{139}La reaction
U. Abbondanno, A. Boiti, F. Demanins
Nuovo Cimento A 97(1987)647

Fast neutron capture cross sections of Europium
Xiang Zhengyu, Xu Haishan, Li Yexiang, Mu Yunshan, Wang Shiming, Liu Jianfeng
Nucl. Sci. Eng. 104(1990)277
(see contribution on page 10)

2.1.3 Decay data

Energy of the 32 keV transition of $^{83}Kr^{m}$ and the atomic mass difference between ^{3}H and ^{3}He
S.T. Staggs, R.G.H. Robertson, D.L. Wark, P.P. Nguyen, J.F. Wilkerson, T.J. Bowles
Phys. Rev. C 39(1989)1503

Absolute gamma intensities in the A=98 transitional nuclei and shape coexistence in ^{98}Y
H. Mach, R.L. Gill
Phys. Rev. C 36(1987)2721
(see also contribution on page 44)

Intruder state collectivity at a double subshell closure from the beta decay of 0^{-} $^{96}Y^{g}$ to the levels of ^{96}Zr
H. Mach, G. Molnár, S.W. Yates, R.L. Gill, A. Aprahamian, R.A. Meyer
Phys. Rev. C 37(1988)254
(cf. contribution on page 44)

Double gamma decay in ^{90}Zr
E.R. Mucciolo, O. Helene
Phys. Rev. C 40(1989)2403

Intensity and angular correlation measurements of ^{103}Ru
S.M. Darwish, S. Abdel-Malak, M.A. Abou-Leila, N. Walley-Eldin, A.M. Hassan
Hadronic J. 10(1987)1

^{109}Pd and ^{109}Cd activity standardization and decay data
C. Ballaux, B.M. Coursey, D.D. Hoppes
Appl. Radiat. Isot. 39(1988)1131

Gamma-ray angular correlations in the decays of ^{109}Pd and ^{111}Pd
D.E. Brown, K.S. Krane
Nucl. Phys. A 489(1988)100

Precision measurement of the total ICC for M4 transitions in ^{117}In, ^{117}Sn, ^{197}Pt, and ^{197}Hg
I.N. Vishnevskii, V.A. Zheltonozhskii, M.A. Ukhin
Izv. Akad. Nauk CCCP, Ser. Fiz. 51(1987)863 (English: Bull. Acad. Sci. USSR, Phys. Ser., 51(1987) no.5, page 23)

Decays of ^{118}In, ^{120}In, and ^{122}In isomers to levels in ^{118}Sn, ^{120}Sn, and ^{122}Sn
S. Raman, T.A. Walkiewicz, L.G. Multhauf, K.G. Tirsell, G. Bonsignori, K. Allaart
Phys. Rev. C 37(1988)1203

Selected gamma-ray energies and emission probabilities for the decay of ^{125}Sb and ^{154}Eu
R.G. Helmer
Appl. Radiat. Isot. 41(1990)75

Measurement of nuclear-physical characteristics of radionuclides
A.M. Geidel'man, Yu.S. Egorov, V.G. Nedovesov, G.E. Shchukin
Izmer Tekh. 30, no.3(1987)49 (English: Meas. Tech. 30 (1987)289)
(including: Sn-119m, Te-125m)

γ-γ angular correlations in ^{131}Xe
Seung Ai Shin, Ho Sik Kang
New Phys. (South Korea), 28(1988)678
(in Korean)

Decay of a new 16.7 min isomer of ^{131}Sb
A. Goswami, S.K. Das, B.S. Tomar, A.G.C. Nair, R. Guin, S.B. Manohar, S.M. Sahakundu, Satya Prakash
Phys. Rev. C 38(1988)1513

Structure of odd-odd ^{132}Sb
C.A. Stone, S.H. Feller, W.B. Walters
Phys. Rev. C 39(1989)1963

Decay of $^{139,141,143}Xe$ to levels of $^{139,141,143}Cs$
S.H. Faller, P.F. Mantica,Jr., E.M. Baum, Chien Chung, J.D. Robertson, C.A. Stone, W.B. Walters
Phys. Rev. C 38(1988)905

Directional correlations of γ transitions in ^{142}Ce
A.L. Lapolli, C.B. Zamboni, R.N. Saxena
Phys. Rev. C 41(1990)2312

Search for reflection asymmetric structures in the A=145 mass region: decays of 1.8-s ^{143}Cs to levels of ^{143}Ba and 4.1-s ^{147}La to levels of ^{147}Ce
J.D. Robertson, P.F. Mantica,Jr., S.H. Faller, C.A. Stone, E.M. Baum, W.B. Walters
Phys. Rev. C 40(1989)2804

Decay of ^{143}Ba to levels of the odd-proton N=86 nuclide ^{143}La
S.H. Faller, J.D. Robertson, E.M. Baum, Chien Chung, C.A. Stone, W.B. Walters
Phys. Rev. C 38(1988)307

Level structure of the odd mass Pr isotopes: levels of ^{143}Pr populated in the beta decay of ^{143}Ce
D.F. Kusnezov, D.R. Nethaway, R.A. Meyer
Phys. Rev. C 40(1989)924

Level structure of odd-mass Pr isotopes: decay of 3.0-min ^{145}Ce to levels of ^{145}Pr
E.M. Baum, J.D. Robertson, P.F. Mantica,Jr., S.H. Faller, C.A. Stone, W.B. Walters, R.A. Meyer, D.F. Kusnezov
Phys. Rev. C 39(1989)1514

Beta-decay of $^{148,150,152}Pr$ into levels of $^{148,150,152}Nd$
T. Karlewski, N. Hildebrand, M. Brügger, N. Kaffrell, N. Trautmann, G. Herrmann
Z. Phys. A 330(1988)55

K-capture probabilities and some B(E2) ratios in the decay of ^{152}Eu
S.S. Ghumman, H.S. Binarh, H.S. Sahota, T. Iwashita
J. Phys. Soc. Japan 58(1989)3921

Levels in ^{152}Gd and ^{152}Sm populated by the decay of ^{152}Eu
N.M. Stewart, E. Eid, M.S.S. El-Daghmah, J.K. Jabber
Z. Phys. A 335(1990)13

2.1.4 Delayed neutron data

The analysis of delayed neutron energy spectra recorded with ^{3}He ionization chambers
H. Ohm, K.-L. Kratz, S.G. Prussin
Nucl. Instr. Meth. Phys. Res. A 256(1987)76

Yields of delayed-neutron groups in thermal-neutron fission of ^{229}Th
A.N. Gudkov, A.B. Koldobskii, S.V. Krivasheev, N.A. Lebedev, V.A. Pchelin
Yad. Fiz. 49(1989)1551 (English: Sov. J. Nucl. Phys. 49(1989)960)

Measurement of the delayed-neutron yields in the fission of ^{233}U, ^{236}U, ^{237}Np, ^{240}Pu, and ^{241}Pu by neutrons from the spectrum of a fast reactor
A.N. Gudkov, V.M. Zhivun, A.V. Zvonarev, V.V. Kovalenko, A.B. Koldobskii, Yu.F. Koleganov, S.V. Krivasheev, V.B. Pavlovich, N.S. Piven, E.V. Semenova
At. En. 66(1989)100 (English: Sov. At. En. 66(1989)115)

Determining delayed-neutron group yields for fast neutron ^{235}U and ^{241}Am fission
A.N. Gudkov, S.V. Krivasheev, A.B. Koldobskii, E.Yu. Bobkov, Yu.F. Koleganov, A.V. Zvonarev, V.B. Pavlovich
At. En. 67(1989)218 (English: Sov. At. En. 67(1990)702)

Prediction of the delayed neutron yields for actinide nuclides
Y. Ronen
Ann. Nucl. Energy 16(1989)647

2.1.5 FP decay heat

Measured data of delayed gamma-ray spectra from fissions of ^{232}Th, ^{233}U, ^{235}U, ^{238}U and ^{239}Pu by fast neutrons; tabular data
M. Akiyama, J. Katakura
JAERI-M-88-252(1988)

2.1.6 Reviews and summaries

Progress on the nuclear charge distribution in fission in the last decade
Li Xueliang
J. Nucl. Radiochemistry 11(1989)194
(in Chinese)

Even-odd effects in the charge distributions of the products of cold fragmentation of actinide nuclei
A.B. Koldobskii, V.K. Sirotkin
Yad. Fiz. 47(1988)1577 (English: Sov. J. Nucl. Phys. 47(1988)999)

Comparison of different methods for the determination of fission fragment velocity, mass, and energy distributions for ^{232}Th(n,f)
K.-Th. Brinkmann, J, Kiesewetter, F.M. Baumann, H. Freiesleben, H.J. Lütke-Stetzkamp, H.J. Paul, H.G. Schwanke, H. Sohlbach
Nucl. Instr. Meth. Phys. Res. A 276(1989)557

Radioactivities by light fragment (C, Ne, Mg) emission
E. Hourani, M. Hussonnois, D.N. Poenaru
Ann. Phys. Fr. 14(1989)311

Fundamental and applied researches on the VVR-SM reactor at the Nuclear Physics Institute, Uzbek Academy of Sciences
P.K. Khabibullaev
At. En. 64(1988)338 (English: Sov. At. En. 64(1988)390)
(including: review of fission yield measurements)

Special theme issue on nuclear fission:

Pramana Vol. 33, No. 1, July 1989 — page:

2.2. Meetings

Specialists' Meeting on Delayed Neutron Properties

Birmingham, England, 15-19 September, 1986

Specialists' Meeting on Data for Decay Heat Predictions

Studsvik, Sweden, 7-10 September, 1987

Page: Papers:

267 French studies for improvement of the decay heat due to fission products
B. Duchemin, et al.

277 JNDC FP nuclear data file version 2 and its assessment
K. Tasaka, et al.

289 The calculation of sensitivities of nuclide inventories and decay power
M.F. James

303 Evaluation of the neutron absorption correction G(t) of the ANSI/ANS-5.1 decay power standard (viewgraphs only)
T.R. England, et al.

Specialists' Meeting on fission yield evaluation

Studsvik, Sweden, 11, 14 and 15 September 1987

The meeting discussed international cooperation, future development of fission yield evaluation, communication with measurers, common formats for data exchange, and fission yield measurements still required. No papers were presented.

The minutes of the meeting were published as INDC(NDS)-208 with the same distribution as this report series.

Intern. Conf. on Nuclear Data for Science and Technology

Mito, Japan, May 30 - June 3, 1988

Page: Selected Papers:

15 Review of the nuclear data status and requirement for fission reactors
Y. Ishiguro, A. Zukeran
(including: cross sections for some fission products)

57 A demand for consistency of nuclear data related to reactor neutron activation analysis
F. De Corte, A. Simonits
(including: (n,γ) for Sn-124, Ba-138, Eu-153)

337 Experimental techniques for fission data measurements
H.-H.J. Knitter, C. Budtz-Jörgensen

359 Nuclear data measurements of neutron-rich nuclides produced in fission using on-line isotope separations
R.C. Greenwood, R.A. Anderl, A.J. Caffrey, J.D. Cole, M.W. Drigert, R.G. Helmer, M.A. Lee, C.W. Reich, D.A. Struttmann
(see also contribution on page 46)

407 Fission fragment distributions in resolved resonances of $^{235}U(n,f)$

F.-J. Hambsch, H.-H.J. Knitter, C. Budtz-Jörgensen, J.P. Theobald

(see cpntribution on page 4)

415 Fission fragment transfer efficiency for helium jet system

G.P. Couchell, D.J. Pullen, W.A. Schier, P.R. Bennett, M.H. Haghighi, E.S. Jacobs, M.F. Villani

(see also contribution on page 49)

583 A compilation of accurately measured 2200ms^{-1} cross-sections for 101 (n,γ) reactions of interest in activation analysis; a critical comparison with literature

F. De Corte, A. Simonits

(including several fission products)

623 Average resonance parameters for Nb-93 and natural tungsten

P. Vertes, Y.V. Grigoryev

695 Kinetic energies of fragments in neutron-induced nuclear fission

A.A. Goverdovsky, B.D. Kuzminov, V.F. Mitrofanov, A.I. Sergachev

(see also contribution on page 49)

791 Saddle and scission states expected from fine structure of nuclear charge distribution based on semi-empirical theory

A. Zukeran, T. Nakagawa

807 Development of neutron data evaluation methods and creating complete files of zirconium isotopes

V. Bychkova, O. Grudzevich, A. Zelenetski, V. Plyaskin

819 Review of decay heat calculations

K. Tasaka, J. Katakura, T. Yoshida

(see also contribution on page 61)

827 Predictions of the decay heat of nuclear reactors by microscopic beta decay calculations

H.V. Klapdor, J. Metzinger

837 Systematic trends in the level structure of neutron rich nuclei

B. Fogelberg

(see contribution on page 39)

841 Recent progress in the gross theory of β-decay

M. Yamada

(see also contribution on page 61)

849 Comparison of experimental and theoretical internal conversion coefficients of octupol transitions

(including several fission products)

853 Measured composite delayed neutron spectra from fission of U-235, U-238 and Pu-239 and derived six-group spectra

W.A. Schier, D.J. Pullen, G.P. Couchell, M.H. Haghighi, E.S. Jacobs, M.F. Villani, P.R. Bennett

(see contribution on page 49)

963 Study of $^{249}Cf(n_{th},f)$ with Lohengrin Mass Separator
M. Djebara, M. Asghar, J.P. Bocquet, R. Brissot, J. Crançon, Ch. Ristori, E. Aker, D. Engelhardt, B.D. Wilkins, U. Quade
(see also contribution on page 14)

967 Mass distribution in fission spectrum neutron induced fission of U-235
Qi Linkun, Liu Conggui, Tang Peijia, Li Ze, Wang Xiuzhi, Zhang Sujing, Liu Yonghui, Jiu Daming, Ju Changxin, Lu Huijun, Zhu Jiaxuan, Guo Jingru
(see also contribution on page 8)

971 The ASIND-MEPhI fission product yield data-base
A.D. Efimenko, A.F. Grashin, E.A. Kudryavtseva

979 Study of post-neutron mass and charge yields for $^{232}U(n_{th},f)$ and $^{238}Pu(n_{th},f)$
M. Haddad, M. Asghar, J. Crançon, G. Lhospice
(see contribution on page 14)

987 Investigation of binary and ternary fission in ^{238}U induced by monoenergetic neutrons
H. Afarideh, K. Randle
(see contribution on page 43)

991 Mass distribution structures as a function of excitation energy of the ^{252}Cf spontaneous fission fragments
I.D. Alkhazov, A.V. Kuznetsov, S.S. Kovalenko, B.F. Petrov, V.I. Shpakov
(see also contribution on page 53)

1049 Measurement of the $^{93}Nb(n,n')^{93m}Nb$ cross section at 7.9 MeV
M. Wagner, G. Winkler, H. Vonach, H. Liskien

1057 A measurement of $^{93}Nb(n,n')^{93m}Nb$ cross-section in the energy range 1 to 6 MeV
D.B. Gayther, C.A. Uttley, M.F. Murphy, W.H. Taylor, K. Randle

Intern. Conf. on Fifty Years Research in Nuclear Fission

Berlin, F.R.G., 3-7 April, 1989

Proceedings published in Nucl. Phys. A 502 (1989)

Page: Selected Papers:

1c Nuclear fission: What have we learned in 50 years?
R. Vandenbosch

21c Spontaneous fission properties and lifetime systematics
D.C. Hoffman

159c Recent developments of experimental techniques
G. Gönnenwein

213c Mass, energy and nuclear charge distribution of fission fragments
J.P. Bocquet, R. Brissot

50 Years With Nuclear Fission

Gaithersburg, Maryland, USA, 25-28 April 1989

313 Cold fragmentation properties: A crucial test for the fission dynamics
J. Trochon, G. Simon, C. Signarbieux

449 Composite delayed neutron energy spectra of fissionable isotopes
G. Couchell, P. Bennett, E. Jacobs, D. Pullen, W. Schier, M. Villani, R. Tanczyn, M. Haghighi, Q. Sharfuddin
(see also contribution on page 49)

457 Independent yield pattern in thermal neutron-induced fission of ^{235}U
G. Rudstam, B. Ekström, E. Lund
(see contribution on page 38)

471 The production of a new evaluation of fission products
R.W. Mills, M.F. James, D.R. Weaver
(see contribution on page 63)

515 Cold fission as a probe for compact scission configurations
F. Gönnenwein, B. Börsig

525 Nuclear-charge and mass distributions from fission
A.C. Wahl
(see also contribution on page 68)

533 Bimodal fission
E.K. Hulet

684 Correlation characteristics of triton and long range alpha particle accompanied fission of ^{252}Cf
Han Hongyin, Huang Shengnian, Meng Jiangchen, Bao Zongyu, Ye Zongyuan

705 A study of monoenergetic, fast neutron-induced ternary fission in ^{238}U
K. Randle, H. Afarideh
(see contribution on page 43)

727 The relation between the prompt gamma-ray yields from fission fragments and the charge and mass distribution in ^{235}U (n_{res}, f) reaction
A.A. Bogdzel, N.A. Gundorin, A. Duka-Zolyomi, J. Kliman, J. Kristiak

833 ESOL facility for the generation and radiochemical separation of short half-life fission products
R.J. Gehrke, D.H. Meikrantz, J.D. Baker, R.A. Anderl, V.J. Novick, R.C. Greenwood

849 Fifty years of fast chemistry: Study of short-lived fission products
Krishnaswamy Rengan

855 The Cornell University cold neutron beam facility
D.D. Clark, T. Emoto, C.G. Ouellet, E. Pekrul, J.S. Berg

881 Studies of fragment charge and energy correlations in spontaneous fission of ^{252}Cf
M.N. Rao, D.C. Biswas, T.K. Choudhury

IAEA Consultants' Meeting on the Compilation and Evaluation of Fission Yield Nuclear Data

Vienna, Austria, 27-29 September 1989

This meeting was a continuation of the 1987 Studsvik meeting on fission yield evaluation. The purpose of this meeting was to further discuss problems in fission yield measurements, evaluation and semiempirical models, and to work out the details for the planned IAEA Coordinated Research Programme (CRP). In addition, a number of recommendations were issued, including several from the Studsvik meeting which are still valid.

An extended list of fission yield data that need further measurements can be found in Part 3 of this issue.

A summary report of the meeting will again be published as INDC(NDS)-report with the same distribution as this report series.

PART 3: FPND REQUIREMENTS

3.1 Fission Yields

The requirements for fission yield measurements given below were identified at the "Consultants' Meeting on the Compilation and Evaluation of Fission Yield Nuclear Data", Vienna, Austria, 27-29 September 1989.

The following yield data should be measured primarily for U235 thermal fission and thereafter be extended to other fissioning systems:

- independent yields (e.g.: only 1/5th has been measured for U235 thermal fission), especially in the region of symmetric fission (for further development of systematics and model parameters);
- isomeric yields and/or yield ratios;
- isotopic and/or isobaric yields for studying the odd-even effect;
- ternary fission yields, also as a function of incident neutron energy or as a function of binary fragment mass;
- some monoenergetic measurements for chain, independent, isomeric and ternary fission yields;
- more measurements over ionic charge states and kinetic energy to allow summing over these parameters by evaluators;
- (re)measurements of chain yields as given in the following section.

3.1.1 Chain yield measurements required

(Re)measurements of chain yields are required as given in the tables below. The abbreviations used in the tables have the following meaning:

A = mass number
no = number of measurements (blank or 0 = zero)
reason = reason for request (except if no = 0, blank or 1)
D = disrepant data with large χ^2; the number in brackets gives the probability (in %) for the occurrence of the maximum contribution (from the most discrepant measurement) to the calculated χ^2.

U233 thermal fission

A	no	reason	A	no	reason	A	no	reason		no	reason
2	1		76			116			130		
3	3	D(0.64)	77	1		117	1		151	3	D(6.1)
4	7	D(2.8)	78	1		118	1		153	1	
6			79	1		119	1		155		
7	1		80	1		120	1		156	1	
8	1		82	1		122	1		157	1	
9	1		99	7	D(9.0)	123			158		
10	1		103	7	D(2.4)	124	1		159	1	
71			109	1		125	1		160		
72			110	1		126			161	1	
73			111	3	D(5.9)	127	2	D(3.4)	162		
74			113			128					
75			114			129					

U235 thermal fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			66			116	1		165		
4	13	D(0.0)	67	1		117	3	D(5.3)	166		
6	5	D(0.15)	71			123	6	D(0.17)	167		
7	1		72			125	5	D(7.8)	168		
10	5	D(9.9)	73	1		128	8	D(6.7)	169		
11	1		74	1		130	1		170		
12	4	D(0.20)	83	12	D(8.4)	149	13	D(2.4)	171		
13	1		85	19	D(2.1)	151	10	D(8.6)	172	1	
14	1		106	10	D(1.0)	153	10	D(2.4)	173		
16	1		109	5	D(5.3)	154	7	D(7.0)	174	1	
18	2	D(0.00)	110	3	D(5.0)	161	1		175		
20	1		111	1		162	1		176		
21	1		112	1		163	1		177	1	
32			113	1		164	1				

Pu239 thermal fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
1	1		71			112	4	D(1.8)	128	1	
2	2	D(6.0)	72	1		113	3	D(4.0)	130		
3			73			114	1		133	16	D(0.92)
4			74			115	8	D(0.0)	151	9	D(8.4)
7	1		75			116	1		153		
8	1		76			117	1		155	1	
9	1		77	1		118	1		156	6	D(3.1)
10	1		78			119	1		157	1	
11	1		79			120	1		158		
12	1		80			121			160		
13	1		82			122	1		162		
14	1		90	7	D(6.6)	123			163		
15	1		102	1		124	1		164		
16	1		109	4	D(9.0)	125			165		
20	1		110	1		126	1		166	1	

Pu241 thermal fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3	1		96	1		111			126		
4	2	D(1.5)	98			112	3	D(4.6)	to	1	
71			99	6	D(5.6)	113			130		
to	0		100			to	0		132	10	D(1.0)
82			101	1		120			133	8	D(6.3)
83	1		102	1		121			134	4	D(8.7)
84	1		104			to	1		139	1	
86	1		to	1		124			155		
91	5	D(1.0)	109			125	2	D(0.0)	to	1	
94	1		110						162		

Cm243 thermal fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			100			115	1		142		
4			101	1		116			143		
71			103	1		to	0		to	1	
to	0		104	1		126			147		
91			106			127	1		148		
92	1		108	1		129	1		149		
93	1		109	1		133	1		150		
94	1		110			134			151	1	
95	1		111			136			152		
96			112	1		137			to	0	
98			113			138			162		
99	1		114			141	1				

Cm245 thermal fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			93	3	D(3.8)	114	1		141	3	D(8.5)
4			94			116			142	2	D(1.6)
71			96			to	0		143	3	D(4.6)
to	0		98			120			144	2	D(3.2)
76			99	3	D(5.0)	121	1		145	1	
77	1		100			122			148		
78			101	1		123			150		
to	0		102	1		124			152	1	
82			103	4	D(8.9)	126			153	1	
83	1		104	1		128	3	D(0.06)	154		
84	1		105	5	D(7.5)	132	2	D(0.01)	155		
85			107	1		133	1		156	2	D(0.8)
86			108	1		135	3	D(0.0)	157		
87	1		109			136			to	0	
88	2	D(3.6)	110			137	3	D(6.0)	162		
91	4	D(1.9)	112	1		138	2	D(0.0)			
92	2	D(9.1)	113	1		140	3	D(3.2)			

Th232 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			96			113			139	4	D(8.6)
4			98			114			145	1	
71			100			116			146	3	D(2.7)
73	1		101			to	0		150	1	
74			102			126			152		
75			103	5	D(8.1)	127	1		153	1	
76			104			128			154		
78			105	2	D(0.00)	129	1		155		
to	0		107			130			156	1	
82			108			131	12	D(0.63)	157		
85			109	1		132	11	D(5.2)	to	0	
86	1		110			133	3	D(9.5)	162		
91	4	D(0.04)	111	4	D(6.0)	138	1				

U233 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3	1		94	1		116			131	6	D(0.62)
4	1		96	1		117	1		134	3	D(6.8)
71			98	1		118	1		154		
to	0		100	1		119	1		155		
82			101			120	1		156	1	
83	1		102			121			157	1	
84	1		103	3	D(3.5)	122	1		158		
85	3	D(9.2)	104			123			159	1	
86	1		105			124	1		160		
88	1		106	2	D(0.01)	126	1		161	1	
90	1		107			127	2	D(0.16)	162		
93	1		to	0		128	1				
			114			130	1				

U235 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
1	1		107			119			153	8	D(0.05)
3	1		to	0		to	0		154	2	D(0.00)
4	1		110			124			155		
71			111	24	D(0.00)	126	1		156	19	D(0.00)
to	0		112	6	D(0.17)	127	5	D(0.13)	157		
82			113	1		128	1		158		
87	9	D(1.0)	114			129	1		159	1	
89	21	D(2.1)	115	6	D(0.00)	130	1		160		
96	1		116	1		140	39	D(2.6)	161	8	D(0.64)
99	14	D(0.13)	117			143	25	D(0.28)	162		
106	6	D(1.3)	118			144	28	D(0.48)			

U238 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			86	1		110			130	1	
4	1		87	4	D(2.9)	111	24	D(0.00)	131	16	D(0.13)
66	1		88	6	D(0.92)	112	5	D(9.9)	135	14	D(0.63)
67	2	D(4.4)	89	21	D(0.00)	113	1		143	21	D(0.19)
71			91	8	D(1.8)	114			148	5	D(7.2)
72	1		92	6	D(2.2)	115	12	D(1.3)	153	12	D(0.00)
73			96	1		116			154	1	
to	0		98	1		to	0		155		
76			100	1		120			157		
77	3	D(7.2)	101	1		122			158		
78			102			123			160		
to	0		104			124			161	7	D(6.5)
82			105	8	D(3.6)	125	3	D(5.0)	162		
83	1		107	1		126	1		to	0	
84			108			127	9	D(2.1)	177		
85	2	D(0.01)	109	4	D(6.1)	128	1				

Np237 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			107			123			134	5	D(6.2)
4			108			124			140	10	D(3.5)
71			109	1		125	5	D(8.8)	153		
to	0		110			126	1		155		
82			113	1		127	3	D(4.1)	156	1	
85	3	D(3.6)	114			128	1		157		
87	2	D(6.1)	116			129	2	D(2.9)	to	0	
95	5	D(0.36)	to	0		120	1		162		
99	1		120			131	6	D(0.93)			
106	4	D(6.4)	122			132	8	D(1.2)			

Pu239 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3	1		97	19	D(0.95)	114	1		141	8	D(6.1)
4			101	1		115	10	D(0.02)	144	17	D(8.9)
71			102	1		116	1		153	1	
to	0		104	1		117			154	2	D(0.41)
76			107			to	0		155		
77	2	D(0.00)	108			124			156	6	D(1.8)
78			109	4	D(2.9)	125	3	D(1.4)	158		
to	0		110			126	1		159		
82			111	11	D(0.26)	127	1		160		
88	4	D(7.5)	112	4	D(3.3)	128	1		162		
95	18	D(1.3)	113	1		130	1				

Pu240 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			94	1		113	1		153		
4			96	1		114			to	1	
71			98			116			157		
72	1		to	1		to	0		158		
73			105			124			159	1	
to	0		107			126	1		160		
82			108			128	1		161	1	
83			109	1		129	1		162		
to	1		110			130	1		to	0	
89			111	1					168		
92	1		112	1					169	1	

Pu241 fast fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			90			105			153		
4			to	1		106	1		154	1	
71			98			107			155		
to	0		99			to	0		to	0	
82			100	1		124			162		
83			101	1		125					
to	1		102	1		to	1				
88			103			130					
89			104	1		141	1				

U233 14 MeV fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			96			125	1		156	1	
4			98			126			157		
66	1		100			128			158		
67	1		101			129			159	1	
71			102			130			160		
72	1		104			131	2	D(0.08)	161	1	
73			106	1		134	1		162		
to	0		107			135	1		to	0	
82			108			136			165		
83	1		110			138			166	1	
84			113	3	D(1.3)	139	1		167		
85	1		114			142			168		
86			115	5	D(7.1)	144			169	1	
87	1		116			to	0		170		
88	1		to	0		150			171		
89	1		120			151	1		172	1	
90			121	2	D(3.2)	152			173		
91	3	D(8.3)	122			153	1		174		
92	2	D(2.5)	123			154			175	1	
94			124			155					

U235 14 MeV fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			94			123			148		
4	1		95	3	D(8.7)	124			to	0	
66	2	D(1.4)	96			125			152		
67	1		97	1		126	1		153	1	
71			98			127	1		154		
72	2	D(7.5)	100			128			155		
73	1		101			129			157		
74			102			130			158		
75			103	3	D(5.8)	131	5	D(2.1)	159	1	
76			104			132	7	D(0.63)	160		
77	1		105	3	D(3.3)	133	1		161	3	D(5.5)
78			106	2	D(1.6)	135			162		
to	0		107			136	1		163		
82			108			137	2	D(5.0)	164		
83	1		109	1		138			165		
84			110			139	1		166	1	
85	1		112	2	D(0.00)	140	9	D(2.3)	167		
86			113	1		141	2	D(9.6)	168		
87	1		114			142			169	1	
88	1		116			143	1		170		
89	7	D(8.2)	to	0		145			171		
92			120			146			172	1	
93	1		122								

U238 14 MeV fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3			94	1		120			155		
4			95	14	D(9.1)	122			156	6	D(6.7)
66	1		96			123	1		157		
67	1		98			124			158		
71			100			125	8	D(1.5)	159	1	
72	1		103	13	D(2.2)	126			160		
73	1		105	21	D(7.5)	128	1		162		
74			107	1		129	9	D(0.00)	163		
75			108	1		130			164		
76			109	4	D(4.1)	131	16	D(0.32)	165		
79			110			134	10	D(3.4)	166	1	
80			111	12	D(0.71)	143	19	D(2.6)	167		
81	1		112	13	D(5.0)	146			168		
82			114			148			169	1	
86			116			150			170		
88	4	D(6.6)	117	3	D(0.00)	151	4	D(3.1)	171		
89	13	D(5.0)	118	1		152			172	1	
91	22	D(0.13)	119			154					

CF252 spontaneous fission

A	no	reason	A	no	reason	A	no	reason	A	no	reason
3	5	D(3.9)	96			117	3	D(9.5)	145	1	
4			97	8	D(3.7)	118			148		
8	1		98			119			150		
71			99	8	D(6.0)	120			151	7	D(2.3)
to	0		100			121	1		152		
82			102			122			154		
83	1		105	9	D(0.18)	123			156	6	D(1.7)
84	1		106	3	D(4.9)	124			158		
86	1		108			125	1		1591		
87			110			126			160		
90			112	3	D(6.9)	130			162		
91	6	D(5.2)	114			132	11	D(0.56)	to	0	
92	4	D(7.0)	115	8	D(4.7)	136			165		
93	4	D(4.4)	116			137	6	D(7.5)	166	1	

3.1.2 Independent yield measurements required

Remeasurements of discrepant independent yields are required as given in the tables below. The abbreviations used in the tables are the same as those used in 3.1.1:

A = mass number
elem. = element syombol; -g = ground state
-m = metastable state
-t = total (sum g+m)
no = number of measurements
discrep: D = disrepant data with large χ^2; the number in brackets gives the probability (in %) for the occurrence of the maximum contribution (from the most discrepant measurement) to the calculated χ^2.

U233 thermal fission

A	elem.	no	discrep	A	elem.	no	discrep	A	elem.	no	discrep
82	Br-g	2	D(0.00)	128	I	2	D(0.00)	135	Xe-m	3	D(0.00)
87	Br	3	D(0.01)	131	Te-m	2	D(0.00)	135	Xe-t	2	D(0.01)
89	Br	4	D(0.01)	131	I	2	D(0.00)	137	I	2	D(0.00)
90	Br	2	D(0.00)	132	Sn	2	D(0.00)	137	Xe	2	D(0.01)
95	Zr	2	D(0.00)	132	Sb-g	3	D(0.00)	138	Cs-m	2	D(0.01)
96	Nb	3	D(0.00)	132	Te	2	D(0.01)	139	I	2	D(0.01)
97	Nb	2	D(0.00)	133	Te-m	2	D(0.00)	148	Pm-g	3	D(0.00)
98	Nb	2	D(0.00)	133	I -g	4	D(0.01)	148	Pm-m	3	D(0.01)
99	Y	2	D(0.01)	134	I -t	2	D(0.00)				
99	Nb	2	D(0.01)	135	Xe-g	4	D(0.01)				

U235 thermal fission

A	elem.	no	discrep	A	elem.	no	discrep	A	elem.	no	discrep
72	As	2	D(0.00)	95	Rb	7	D(0.01)	106	Tc	2	D(0.01)
81	As	2	D(0.00)	95	Sr	4	D(0.01)	112	Ag-g	2	D(0.00)
82	Ga	3	D(0.00)	95	Y	5	D(0.01)	128	Sb-g	3	D(0.01)
83	Se	3	D(0.00)	95	Zr	4	D(0.00)	128	Sb-m	3	D(0.01)
84	Ge	3	D(0.00)	96	Rb	6	D(0.00)	128	I	2	D(0.01)
85	As	3	D(0.00)	96	Zr	3	D(0.01)	130	In-m	2	D(0.00)
85	Se	4	D(0.01)	96	Nb	7	D(0.00)	130	Sb-g	4	D(0.00)
85	Br	4	D(0.00)	97	RB	5	D(0.00)	130	Sb-m	3	D(0.00)
86	As	3	D(0.00)	97	Zr	3	D(0.01)	130	I	2	D(0.00)
86	Se	4	D(0.01)	97	Nb-g	2	D(0.01)	131	Te-g	5	D(0.01)
86	Br	5	D(0.00)	98	Y	3	D(0.01)	131	Te-m	4	D(0.00)
86	Rb-g	3	D(0.00)	98	ZR	3	D(0.00)	131	I	3	D(0.00)
87	Se	4	D(0.01)	98	Nb-t	5	D(0.00)	132	Sb-m	2	D(0.01)
87	Kr	5	D(0.00)	99	Sr	3	D(0.00)	132	Te	5	D(0.01)
88	Se	5	D(0.00)	99	Y	3	D(0.00)	132	I -g	3	D(0.01)
88	Br	7	D(0.00)	99	Zr	4	D(0.00)	132	I -m	2	D(0.00)
88	Kr	6	D(0.00)	99	Nb-m	3	D(0.01)	133	Te-g	4	D(0.01)
88	Rb	6	D(0.00)	99	Nb-t	4	D(0.00)	133	Te-m	3	D(0.01)
89	Br	9	D(0.00)	100	Y	3	D(0.00)	133	I -g	7	D(0.00)
89	Rb	7	D(0.01)	100	Zr	3	D(0.01)	133	Xe-g	2	D(0.01)
90	Br	7	D(0.01)	100	Nb-t	3	D(0.00)	133	Xe-m	2	D(0.00)
90	Kr	6	D(0.00)	101	Y	2	D(0.01)	134	I -m	3	D(0.01)
90	Rb	7	D(0.01)	101	Zr	2	D(0.00)	134	I -t	4	D(0.00)
91	Br	7	D(0.01)	101	Nb	3	D(0.01)	135	Xe-m	3	D(0.00)
91	Sr	5	D(0.00)	102	Nb-t	2	D(0.00)	135	Xe-t	5	D(0.00)
92	Kr	6	D(0.00)	103	Zr	2	D(0.00)	136	Cs	7	D(0.01)
92	Rb	7	D(0.01)	103	Mo	2	D(0.00)	137	I	4	D(0.00)
92	Sr	4	D(0.00)	104	Zr	2	D(0.01)	137	Xe	5	D(0.00)
92	Y	3	D(0.01)	104	Mo	2	D(0.01)	139	I	5	D(0.01)
93	Kr	7	D(0.01)	104	Tc	3	D(0.00)	139	Xe	4	D(0.01)
94	Kr	5	D(0.01)	106	Nb	2	D(0.00)	139	Cs	6	D(0.00)
94	Rb	7	D(0.00)	106	Mo	2	D(0.01)				

Pu239 thermal fission

A	elem.	no	discrep	A	elem.	no	discrep	A	elem.	no	discrep
82	Br-g	2	D(0.01)	103	Tc	2	D(0.01)	135	Xe-t	4	D(0.00)
93	Kr	2	D(0.00)	104	Tc	4	D(0.00)	136	Cs	5	D(0.01)
93	Rb	2	D(0.01)	105	Tc	4	D(0.01)	138	Cs-m	2	D(0.00)
95	Rb	2	D(0.01)	128	I	2	D(0.01)	150	Pm	2	D(0.01)

Cm245 thermal fission

A	elem.	no	discrep
136	Cs	2	D(0.00)

U235 fast fission

A	elem.	no	discrep	A	elem.	no	discrep
135	Xe-t	2	D(0.01)	136	Cs	3	D(0.01)

U238 fast fission

A	elem.	no	discrep
136	Cs	2	D(0.00)

Pu239 fast fission

A	elem.	no	discrep
136	Cs	7	D(0.01)

Pu240 fast fission

A	elem.	no	discrep
136	Cs	2	D(0.00)

Th232 14 MeV fission

A	elem.	no	discrep	A	elem.	no	discrep	A	elem.	no	discrep
96	Nb	2	D(0.01)	130	I -g	2	D(0.00)	136	Cs	2	D(0.01)
112	Ag	2	D(0.00)								

U233 14 MeV fission

A	elem.	no	discrep
136	Cs	2	D(0.00)

U235 14 MeV fission

A	elem.	no	discrep	A	elem.	no	discrep	A	elem.	no	discrep
82	Br	2	D(0.00)	135	Xe-m	2	D(0.00)	136	Cs	3	D(0.00)
96	Nb	2	D(0.00)								

U238 14 MeV fission

A	elem.	no	discrep
133	Xe	2	D(0.01)

Pu239 14 MeV fission

A	elem.	no	discrep	A	elem.	no	discrep
133	Xe-m	2	D(0.01)	135	Xe-m	2	D(0.00)

Cf252 spontaneous fission

A	elem.	no	discrep
136	Cs	3	D(0.00)