



International Atomic Energy Agency

Nuclear Data Activities at the IAEA-NDS

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Nuclear Data Section

Department of Nuclear Sciences and Applications

Outline

- **NRDC**
- **NSDD**
- **EXFOR**
- **CRPs**
- **Training**
- **Android App**
- **News**

NRDC

- **International Network of Nuclear Reaction Data Centres (NRDC)**
- **Aim:**
 - ▶ **EXFOR**
- **Core data centres:**
 - ▶ **NNDC**
 - ▶ **NEA-DB**
 - ▶ **IAEA-NDS**
 - ▶ **CJD**
- **9 specialized centres**
- **Meeting Smolenice, 5-9 May 2014 (Centre Heads)**

NSDD

- International Network of Nuclear Structure and Decay Data Evaluators (NSDD)
- Aim:
 - ▶ Provide up-to-date evaluated nuclear structure and decay data
- Regular meetings since 1974
- Last in January 2013 in Kuwait see <http://www-nds.iaea.org/nsdd/>
- Next in Vienna, Spring 2015
- 18 evaluation centres
- **ENSDF** master database at NNDC



EXFOR

- **Compiled experimental data**
- **The EXFOR database was established in the 1960s**
- **Originally exclusively neutron-induced reaction data**
- **Now includes charged particle data and higher energies**
- **Since 2003 the EXFOR libraries at the various data centres have been merged**
- **NDS has responsibility for the maintenance of this Master file**



EXFOR (cont.)

- EXFOR **Compilation Control System** used to coordinate the compilation of the data centres
- The average time between publication and compilation remains steady ~ 6 months
- EXFOR contains data for **20,392** experiments, **12,297,411** data points, web content is updated monthly
- Continuing effort to remove errors and inconsistencies from the database



EXFOR (cont.)

- To make best use of these data considerable work on various retrieval and **visualisation systems**
- Output formats:
 - ▶ EXFOR+ format
 - ▶ XML and HTML
 - ▶ C4 format - numeric data in simple tables
 - ▶ C5 format – C4 + uncertainty split (stat/syst)
 - ▶ Standard EXFOR format
- Development of EXFOR-XML and possible unification with ENDF in frame of SG 38

New features

- Ability to view Archive of EXFOR entries

15) 41240 [6] 1999 A.A.Filatenkov+ [pdf] R,RI-252,199905 Rept: Khlopin Radiev. Inst., Leningrad Reports, No.252 (1999)
 .Systematic Measurement of Activation Cross Sections At Neutron Energies from 13.4 to 14.9 MeV
 18 41240073 Info X4 X4+ T4 Pt:14 1.36e7 1.48e7 13-AL-27 (N,2N) 13-AL-26,, SIG

EXFOR Updates and Archives

ENTRY: 41240

#	Entry	N2	nsub:lines:data	Author1	Year	Reference1	Comment	File-Name/ID
(1)	41240	20010312	136:3523:981	A.A. Filatenkov	1999	R,RI-252,199905	Common EXFOR Master file, 2005	EXFOR20050616.BCK
(2)	41240	20061006	1:42:0	A.A. Filatenkov	1999	R,RI-252,199905	Official TRANS file	TRANS.4139
(3)	41240	20130320	136:4091:966	A.A. Filatenkov	1999	R,RI-252,199905	Official TRANS file	trans.4160
(4)	41240	20130720	2:153:7	A.A. Filatenkov	1999	R,RI-252,199905	Official TRANS file	trans.4161
Archival data								
(5)	41240	20000328	136:3491:981	A.A. Filatenkov	1999	R,RI-252,199905	IAEA-NDS, CD-ROM, 2001.01.09	CD2001
(6)	41240	20010312	136:3523:981	A.A. Filatenkov	1999	R,RI-252,199905	Merge-project, NNDC-BNL, 2005-03-15	BNL2005

SUBENT: 41240* show extended info

#	Subentry	(1) Master-0	(2) TR-4139	(3) TR-4160	(4) TR-4161	(5) CD2001	(6) BNL2005
1	41240001	2001-03-12 lines:38	2006-10-06 lines:42	2013-03-20 lines:124	2013-07-20 lines:125	2000-03-28 lines:38	2001-03-12 lines:38
2	41240002	1999-07-09 lines:34 data:15×3 13-AL-27		2013-03-20 -nosub-		1999-07-09 lines:34 data:15×3 13-AL-27	1999-07-09 lines:34 data:15×3 13-AL-27



EXFOR archive

SUBENT: 41240001

Master-0

ENTRY	41240	20010312	20010718
SUBENT	41240001	20010312	20010718
BIB	10	33	
TITLE	.Systematic Measurement of Activation Cross Sections At Neutron Energies from 13.4 to 14.9 MeV		
AUTHOR	(A. A. FILATENKOV, S. V. CHUVAEV, V. N. AKSENOV, V. A. YAKOVLEV, A. V. MALYSHENKOV, S. K. VASIL'EV, M. AVRIGEANU, V. AVRIGEANU, D. L. SMITH, Y. IKEDA, A. WALLNER, W. KUTSCHERA, A. PRILLER, P. STEIER, H. VONACH, G. MERTENS, W. ROCHOW)		
INSTITUTE	(4RUSRI) Filatenkov, Chuvaev, Aksenov, Vasil'ev, Yakovlev (1USAANL) Smith (2JPNJAE) Ikeda (2AUSIRK) Wallner, Kutschera, Priller, Steier, Vonach (2GERTUE) Mertens, Rochow (3RUMBUC) M. Avrigeanu, V. Avrigeanu		
REFERENCE	(R, RI-252, 199905) Main Reference, Complete Data Set Is Given, Tables and Graphs (R, INDC(CCP)-402, 199701) Data are Given For 71 Nuclei, (J, YK, 1996, (2), 8, 199612) Data are Given in Part (C, 97TRIEST, 1, 595, 199705) 59-Co, 58-Ni, Graphs (C, 97TRIEST, 2, 1248, 199705) Al-27 (N, 2N), Graphs		
FACILITY	(CCW, 4RUSRI) Neutron Generator Ng-400		
DETECTOR	(SCIN) Scanning Scintillation Detecton Online with Pc		
METHOD	(ACTIV) Activation		
STATUS	(TABLE) .Data are Taken from the Main Reference (APRVD) Data are Approved by Authors		
HISTORY	(19970528C) + + Compiled at the Centre - CJD + + (19990709A) .Several Subents with New Data Added .Several Authors Added Date Corrected to 8-Digit (20000327A) . . Corrected at CJD. One Subent Deleted. One Reference Deleted (20010312U) .Sample in SAN 011 Corrected (20010312U) Last checking has been done.		
ERR-ANALYS	(ERR-T) Errors are Total, Error Structure is not Given		
ENDBIB	33		
NOCOMMON			
ENDSUBENT	36		
ENDENTRY	1		

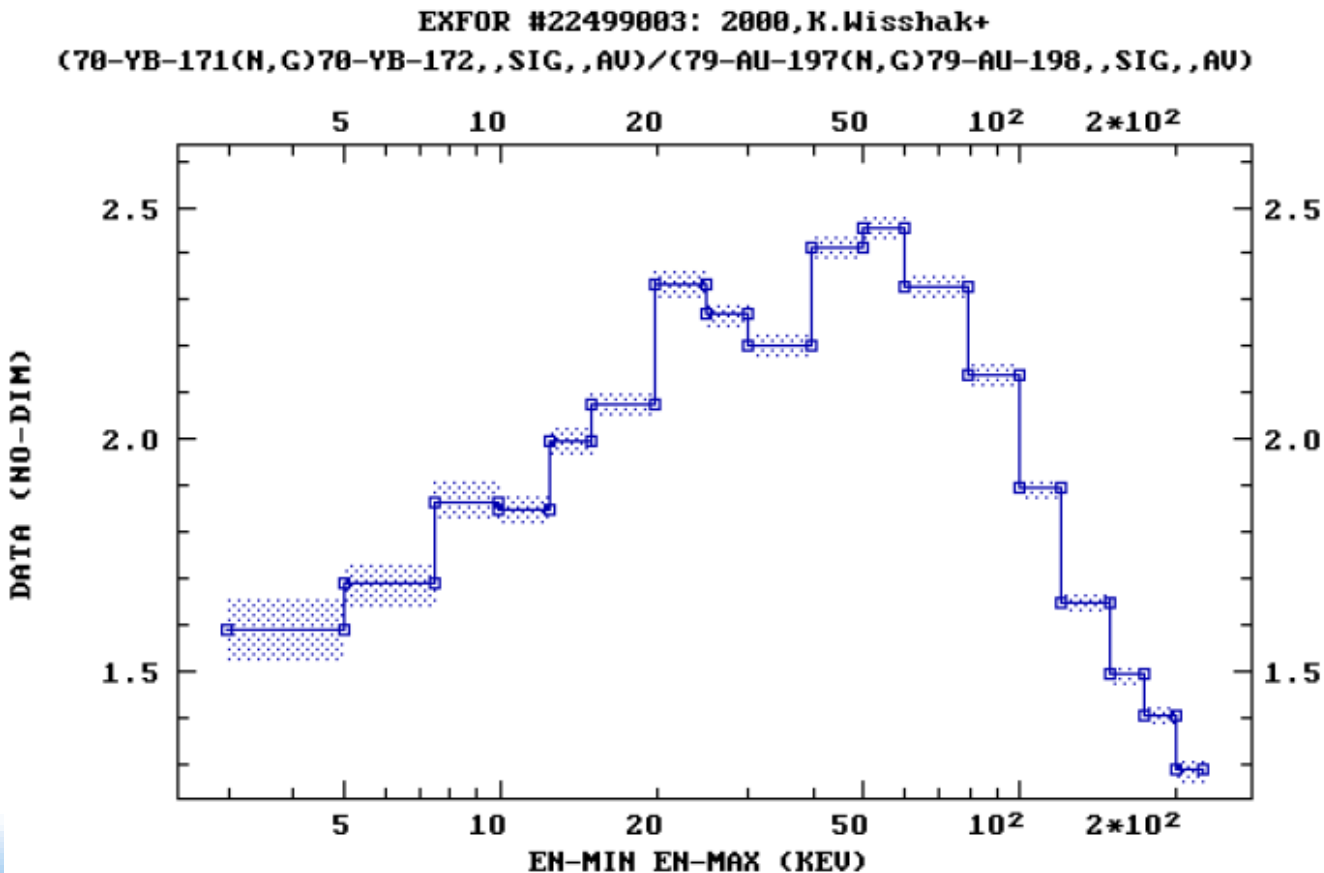
TR-4161

ENTRY	41240	20130720
SUBENT	C 41240001	20130720
BIB	12	120
TITLE	.Systematic Measurement of Activation Cross Sections At Neutron Energies from 13.4 to 14.9 MeV	
AUTHOR	(A. A. Filatenkov, S. V. Chuvaev, V. N. Aksenov, V. A. Yakovlev, A. V. Malyshekov, S. K. Vasil'ev, M. Avrigeanu, V. Avrigeanu, D. L. Smith, Y. Ikeda, A. Wallner, W. Kutschera, A. Priller, P. Steier, H. Vonach, G. Mertens, W. Rochow)	
INSTITUTE	(4RUSRI) Filatenkov, Chuvaev, Aksenov, Vasil'ev, Yakovlev (1USAANL) Smith (2JPNJAE) Ikeda (2AUSIRK) Wallner, Kutschera, Priller, Steier, Vonach (2GERTUE) Mertens, Rochow (3RUMBUC) M. Avrigeanu, V. Avrigeanu	
REFERENCE	(R, RI-252, 199905) Main reference, complete data set is given, tables and graphs (R, INDC(CCP)-402, 199701) Data are given for 71 nuclei. (J, YK, 1996, (2), 8, 199612) Data are given in part (C, 97TRIEST, 1, 595, 199705) 59-Co, 58-Ni, Graphs (C, 97TRIEST, 2, 1248, 199705) Al-27 (N, 2N), Graphs (J, YF, 63, (9), 1588, 200009) Data for Am-241 (Sub.071, 072, 0.119) (J, PAN, 63, (9), 1504, 200009) English translation of YF.	
FACILITY	(CCW, 4RUSRI) Neutron Generator NG-400	
INC-SOURCE	(D-T)	
DETECTOR	(SCIN) Scanning scintillation detection online with PC for neutron beam variations. (GELI) Ge(Li) detector of large volume - for gamma activity of activated samples in most of cases. Efficiency 0.992% for E-gamma 661.6 keV and 0.506% for E-gamma 1332.5 keV. (HPGE) High-pure Ge detector with energy resolution 1.8keV at E-gamma 1332 keV and relative efficiency 20% -for Am-241 measurement and most difficult measurements	
METHOD	(ACTIV) Activation	
STATUS	(APRVD) Data are approved by authors (COREL, 41298001) Data of Table 1 of RI-252 (derived c-s at 14.1 MeV point) are given in Entry 41298 . Also in Table 5.71 of R, INDC(CCP)-402, 1997 data are	



New features

- X4Plot - universal Web plotting tool using only EXFOR definitions and dictionaries
- Using 'extended' option



New features

- New version of X4.xml

Output Data	
Format	Data (Size)
EXFOR Interpreted	X4+ (52Kb) Generate: X4± XML:: v1: X4.xml X4.html v2: X4.xml X4.html

```
- <data nn="7">
  <dd n="1"> 14.08 0.04 11.6 1.3 </dd>
  <dd n="2"> 14.16 0.05 14.3 1.6 </dd>
  <dd n="3"> 14.32 0.07 21.4 2.4 </dd>
  <dd n="4"> 14.37 0.07 27.8 3. </dd>
  <dd n="5"> 14.47 0.08 32. 3.5 </dd>
  <dd n="6"> 14.56 0.1 36.1 3.9 </dd>
  <dd n="7"> 14.68 0.11 40.6 4.4 </dd>
</data>
```

- Data now shown as rows of data with fewer <tags>

CRPs

- **Coordinated Research Projects (CRPs) - an IAEA tool to produce outputs by encouraging collaboration between various parties**
- **4 new CRPs started**
 - ▶ **Beta delayed neutron emission**
 - ▶ **Validating IRDFF dosimetry file**
 - ▶ **Radiation damage standard (dpa)**
 - ▶ **Plasma wall interaction of irradiated tungsten (A+M)**
- **FENDL-3 completed with documentation**
- **Technical Report on Actinide Decay Data published**



Beta-delayed neutron emission evaluation (2013-2017) P. Dimitriou

- **Beta-delayed neutrons are important for energy production, astrophysics and nuclear theory**
- **1st RCM held 26-30 August 2013 in Vienna**
- **INDC(NDS)-0643, summary report**

Validation of the International Dosimetry Library (IRDFF) (2013-2017) Simakov-Capote

- **A new dosimetry library for fission and fusion applications (IRDFF) has been developed and released in February 2012**
- **1st RCM held 1-5 July 2013 in Vienna**
- **INDC(NDS)-0639, summary report**
- **IRDFF version 1.03 released March 2014**



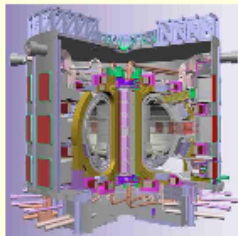
Primary Radiation Damage Cross Sections (2013-2017) Simakov-Forrest

- **Bring together Nuclear Data and Materials Experts**
 - ▶ to revisit NRT-dpa standard and to implement an upgraded one and improve gas production cross sections
- **1st RCM held 4-8 Nov 2013**
- **INDC(NDS)-0648, summary report**

FENDL-3

- Website updated
- Documentation completed
- Validation started (3 reports)

Documents
Contents summary
Processing
Validation (Kopecky)
Validation (Sublet et al.)
3rd RCM (2011)
2nd RCM (2010)
1st RCM (2008)
TM (2007)
More documents
Links
CRP on FENDL-3.0
FENDL-2.1
FENDL-2.0
Nuclear Data Services
Nuclear Data Section
Contacts
R.A.Forrest



FENDL-3.0: Fusion Evaluated Nuclear Data Library Ver.3.0

Nuclear Data Libraries for Advanced Systems: Fusion Devices

Participants at the Technical Meeting in October/November 2007 ([INDC\(NDS\)-0525](#)) defined the objectives of the CRP which were the updating and extension of FENDL-2.1 to make it applicable to both fusion devices such as ITER and DEMO and to material test facilities such as IFMIF. This would involve more materials, an extension of the energy range to higher energies and data for charged particle-induced reactions. In addition more emphasis on covariance data would make the library suitable for all fusion technology studies. The reports of the three RCMs are available ([INDC\(NDS\)-0547](#), [INDC\(NDS\)-0567](#) and [INDC\(NDS\)-0602](#)) as well as the summary documentation of the FENDL-3.0 library ([INDC\(NDS\)-0628](#)).

Download

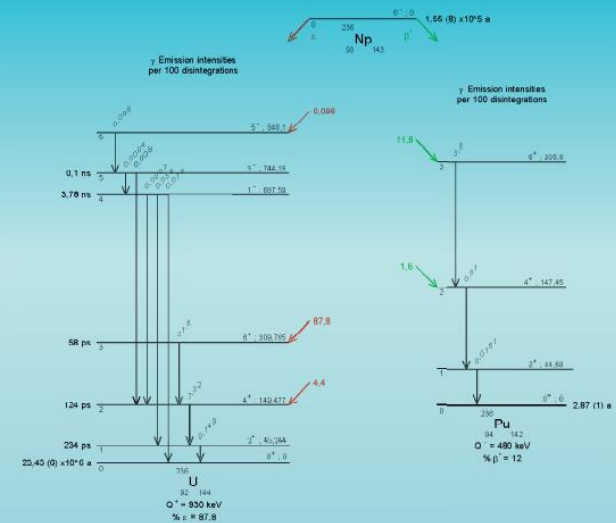
Library	Sublibrary	ENDF	PENDF	ACE	MATXS	GENDF	GND
	Neutron	[zip]		[zip]	[zip]	[zip]	
	Photo-atomic	[zip]				[zip]	
FENDL-3.0	Neutron (shadow)	[zip]		[zip]			



Actinide Decay Data

- Report of completed CRP published
- 425 pages + CD-ROM

Library of Recommended Actinide Decay Data, 2011



Plans

- **Two new CRPs being considered:**
 - ▶ Improve RIPL, particularly fission parameters
 - ▶ Database of gamma-ray data
- **Meetings of INDC and IFRC A+M subcommittee in 2014**
- **50th Anniversary of NDS**
- **Internal evaluation of NDS**
- **International collaboration work (CIELO) continuing**
- **Work on improving neutron cross section standards (through TM and consultancies)**



Training

- Provide outreach in the form of training, especially to developing countries
- Workshops held at **ICTP Trieste** (3 in 2014)
 - ▶ Nuclear Structure and Decay Data (*March*)
 - ▶ Nuclear Reaction Data (September)
 - ▶ Plasma-material interactions, A+M (November)



Android App



- **Isotope Browser**
- **Properties of over 4,000 isotopes**
- **For all android portable devices, - smart phones and tablets**
- **> 5,500 downloads**
- **<http://play.google.com/store/apps>**



IBANDL

- Better integration of experimental data with evaluations (SigmaCalc)
- Regular updates, based on EXFOR
- Summary of data
- Ability to plot multiple angles
- Data → ENDF evaluations for low-energy p

$^{12}\text{C} + \text{p}$

Type of data: ALL View: extended Convert units for plotting: no rr->mb/sr mb/sr->rr Plots: [reset]

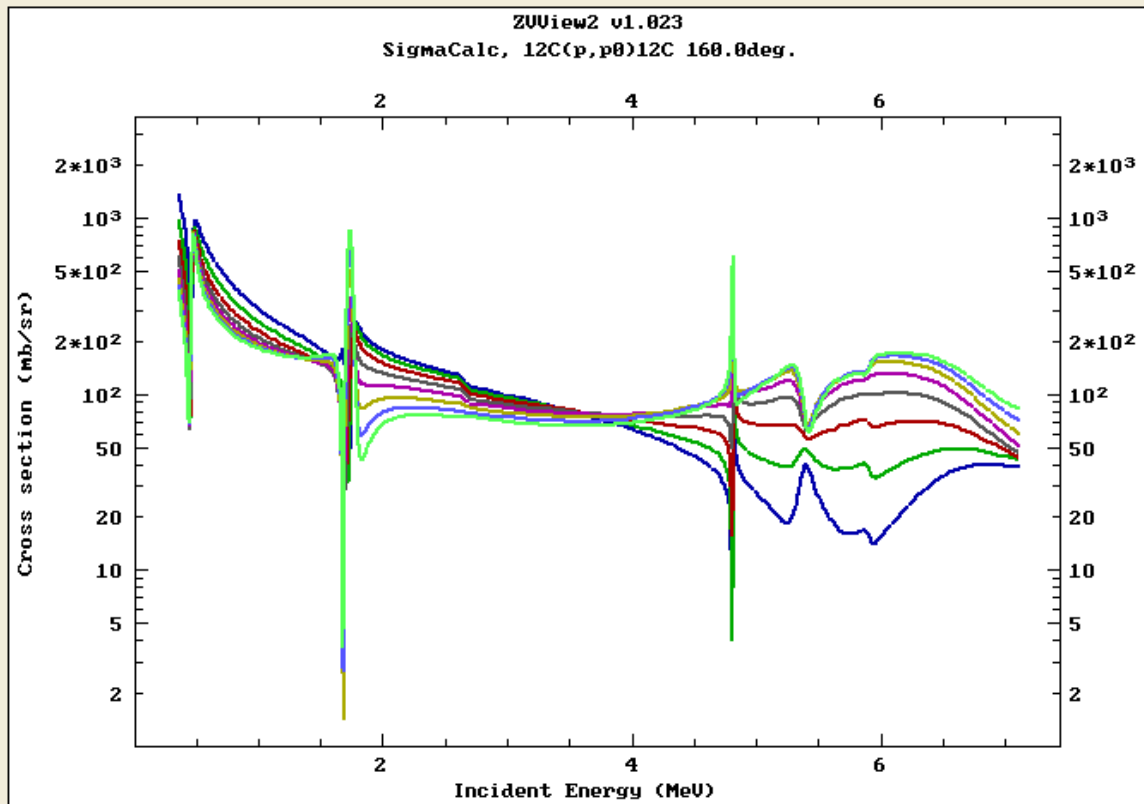
No.	Reaction	Angle	Energy(keV)	Pts	Update	X4	Reference	File	Plot
1	$^{12}\text{C}(\text{p},\text{p}_0)^{12}\text{C}$	179	360-7100	349	2012-01-01		Evaluated data from SigmaCalc archive (A.Gurbich, 2011) Evaluated data from current version of [SigmaCalc] >>> Calculate (timeout=5min)	View Save	<input type="checkbox"/> mb
2	$^{12}\text{C}(\text{p},\text{p}_0)^{12}\text{C}$	179.2°	4000-6600	55	2006-06-22	X4	M. Tosaki et. al. Nucl. Instr. Meth. B168 (2000) 543 »	View Save	<input type="checkbox"/> mb
3	$^{12}\text{C}(\text{p},\text{p}_0)^{12}\text{C}$	178°	490-2500	61	2011-09-02	X4+	A.R.Ramos+(2002), Jour. Nucl. Instrum. Methods in Physics Res., Sect.B, Vol.190, p.95 »	View Save	<input type="checkbox"/> rr
4	$^{12}\text{C}(\text{p},\text{p}_0)^{12}\text{C}$	170°	700-2500	29	2006-06-22	X4-	E.Rauhala Nucl.Instrum.Methods B12 (1985) 447 »	View Save	<input type="checkbox"/> mb

IBANDL

Welcome to Web-ZVView!

Interactive plotting of IBANDL and SigmaCalc data

- 1) $\theta=90^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 2) $\theta=100^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 3) $\theta=110^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 4) $\theta=120^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 5) $\theta=130^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 6) $\theta=140^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 7) $\theta=150^\circ$ SigmaCalc 1.6. File created 8-4-2013
- 8) $\theta=160^\circ$ SigmaCalc 1.6. File created 8-4-2013



Range of angles
Requested feature



Thank you!

