

2495-02

**Joint ICTP-IAEA Workshop on Nuclear Data for Analytical
Applications**

21 - 25 October 2013

**Introduction to the IAEA
Nuclear Data Services**

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*IAEA, Vienna
Austria*

Introduction to the IAEA Nuclear Data Services

Viktor Zerkin

International Atomic Energy Agency, Nuclear Data Section

Joint ICTP-IAEA Workshop on Nuclear Data for Analytical Applications
Trieste, Italy, 21 - 25 October 2013



International Atomic Energy Agency

Nuclear Data Services

Provided by the Nuclear Data Section

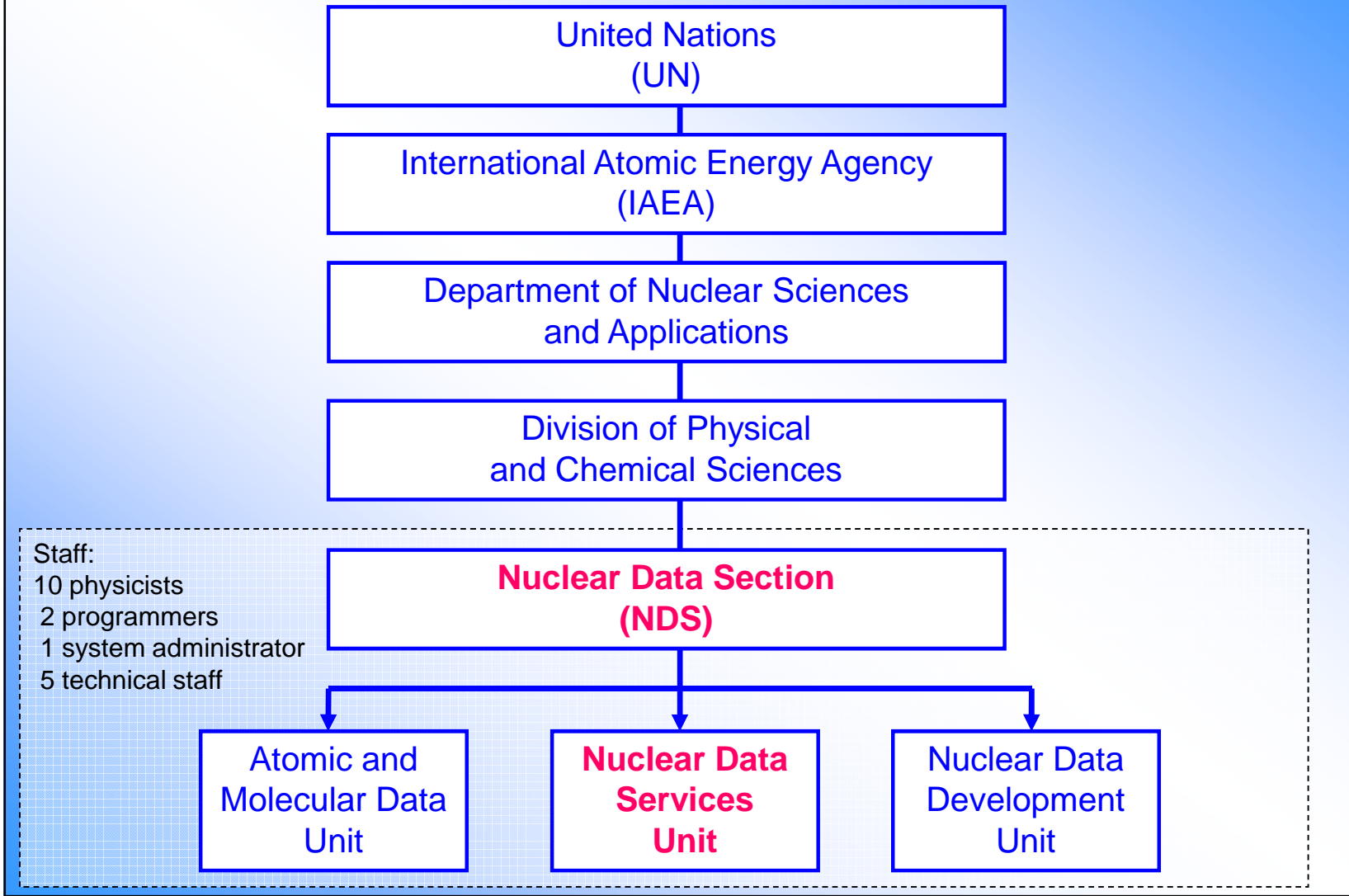
Our Internet Address

<http://www-nds.iaea.org>

Our Postal Address:

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

Our Place in the Organizational Structure



The Mission of NDS

The IAEA Nuclear Data Section (NDS)

- provides nuclear data services to scientists worldwide (data libraries, bibliographies and related materials) through Internet, CD-ROM and other media
- produces new databases through its data development programme
- assists developing countries through technology transfer activities

NDS Main Activity (nuclear part)

- **International cooperation**
 - Network of Nuclear Reaction Data Centres (NRDC)
 - Network Of Nuclear Structure And Decay Data Evaluators (NSDD)
 - software and database exchange with NNDC (USA)
- **Producing new data**
 - Coordinated Research Projects (CRP)
 - Data Development Projects
- **Getting data into databases**
 - compilation and data exchange: EXFOR, NSR, ENSDF
 - collect evaluated and specialized libraries
 - database and master files maintenance
- **Data dissemination**
 - Internet
 - CD-ROMs
 - requests from users' communities
- **Technology transfer**
 - "Mirror-sites" (Brazil, India, China)
 - Workshops

software development
system management

Nuclear Data

- Traditional classification and major (general purpose) libraries

	<i>Bibliographical</i>	<i>Experimental</i>	<i>Evaluated</i>
<i>Nuclear Reactions</i>	CINDA Computer Index of Nuclear Reaction Data	EXFOR* Experimental Nuclear Reaction Data	ENDF Evaluated Nuclear Data File
<i>Nuclear Structure</i>	NSR Nuclear Science References	XUNDL Experimental Unevaluated Nuclear Data List	ENSDF** Evaluated Nuclear Structure Data File

Product of International Networks:

* NRDC Nuclear Reaction Data Center

** NSDD Nuclear Structure and Decay Data

- Specialized nuclear data libraries (examples)

	<i>Experimental</i>	<i>Evaluated</i>
<i>Nuclear Reactions</i>	IBANDL Ion Beam Analysis Nuclear Data Library	<ul style="list-style-type: none"> - <i>ENDF formatted</i> - IRDF International Reactor Dosimetry and Fusion File - FENDL Fusion Evaluated Nuclear Data Library - many more

- Nuclear data in various formats

- Software generating data

~50 years of regular activity and international co-operation in: data formats, exchange, storage, validation; partially in: software, Internet access, data processing, etc.

Our Front Page

IAEA Nuclear Data Services - Windows Internet Explorer provided by IAEA

https://www-nds.iaea.org/

International Atomic Energy Agency
Nuclear Data Services
 Provided by the Nuclear Data Section

IAEA.org | NDS Mission | About Us | Mirrors: India | China

Search Go

Hot Topics » ENDF/B-VII.1 • TENDL-2012 • JENDL-4 • IBANDL **News** » 2013/08/27 New NDS Mirror-site in China <http://www-nds.ciae.ac.cn/>

Request
 CD/DVD with documentation, data, codes, etc.

Quick Links
 ADS-Lib
 Atomic Mass Data Centre
 CINDA
 Charged particle reference cross section
 DROSG-2000
 EMPIRE-3.1
 ENDF Archive
 ENDF Retrieval
 ENDF-6 Codes
 ENDF-6 Format
 ENDVER
 ENSDF
 ENSDF ASCII Files
 ENSDF programs
 EXFOR
 FENDL 3.0
 Fission Yields
 GANDR
 Geant4 Libraries
 IBANDL
 INDL/TSL

NEW
Mirror site: New NDS Web Mirror-site in China <http://www-nds.ciae.ac.cn/>
ANDROID app: Browse Structure and Decay Data on your mobile device [Google Play]
EXFOR Milestone: 20,000 experimental works are now in the database! [retrieve] [statistics] [updates]
IRDFFF - International Reactor Dosimetry and Fusion File v1.02 [page] [archive] [retrieve]

Main | All | Reaction Data | Structure & Decay | by Applications | Doc & Codes | Index | Events | Links | News

EXFOR Experimental nuclear reaction data	LiveChart of Nuclides Interactive Chart of Nuclides	CINDA Nuclear reaction bibliography
ENDF Evaluated nuclear reaction libraries	ENSDF evaluated nuclear structure and decay data (+XUNDL)	NSR Nuclear Science References *

NuDat 2.6 selected evaluated nuclear structure data **	RIPL reference parameters for nuclear model calculations	IBANDL Ion Beam Analysis Nuclear Data Library	Charged particle reference cross section Beam monitor reactions
PGAA Prompt gamma rays from neutron capture	FENDL 3.0 Fusion Evaluated Nuclear Data Library, Version 3.0	Photonuclear cross sections and spectra up to 140MeV	IRDFFF International Reactor Dosimetry and Fusion File
NAA Neutron Activation Analysis Portal	Safeguards Data recommendations, August 2008	Medical Portal Data for Medical Applications	Standards - Neutron cross-sections, 2006 - Decay data, 2005

*Database at the IAEA, Vienna **Database at the US NNDC

IAEA Nuclear Data Section

IAEA-NDS Mission, Staff and more	Atomic and Molecular Data	Meetings Workshops	Newsletters	Coordinated Research Projects	Nuclear Reaction Data Center Network	Nuclear Structure & Decay Data Network	Technical Documents INDC Reports Publications	Computer Codes
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Mirrors

Partners

Events «8:9»

15th International Symposium on Reactor Dosimetry (ISR-15)
 May 18-23, 2014
 Aix en Provence, France

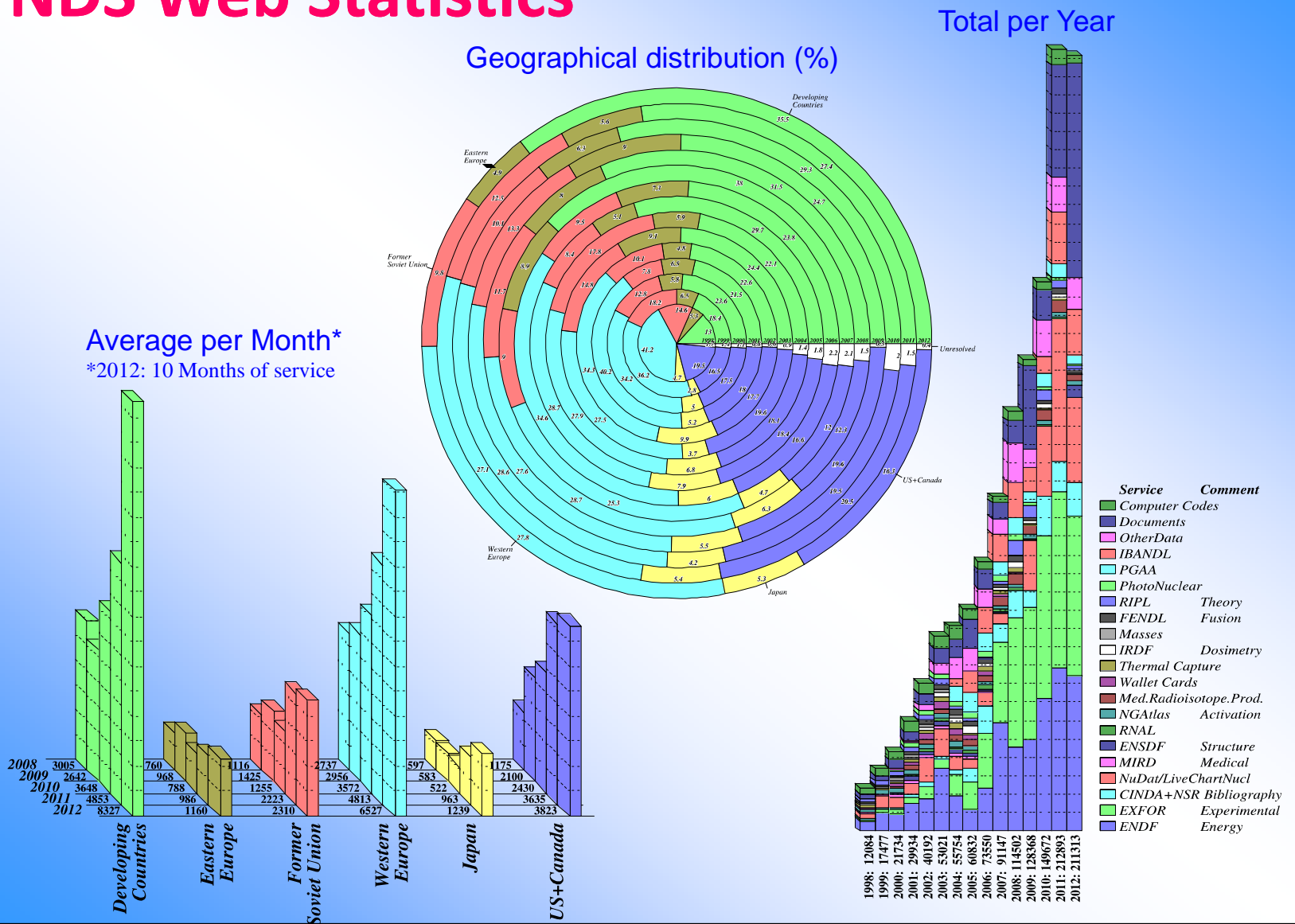
5th International Conference Current Problems in Nuclear Physics and Atomic Energy (NPAE2014)
 June 9-13, 2014
 Kyiv, Ukraine

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Last Updated: 16-October-2013

Web design: V.Zerkin, IAEA, 2008

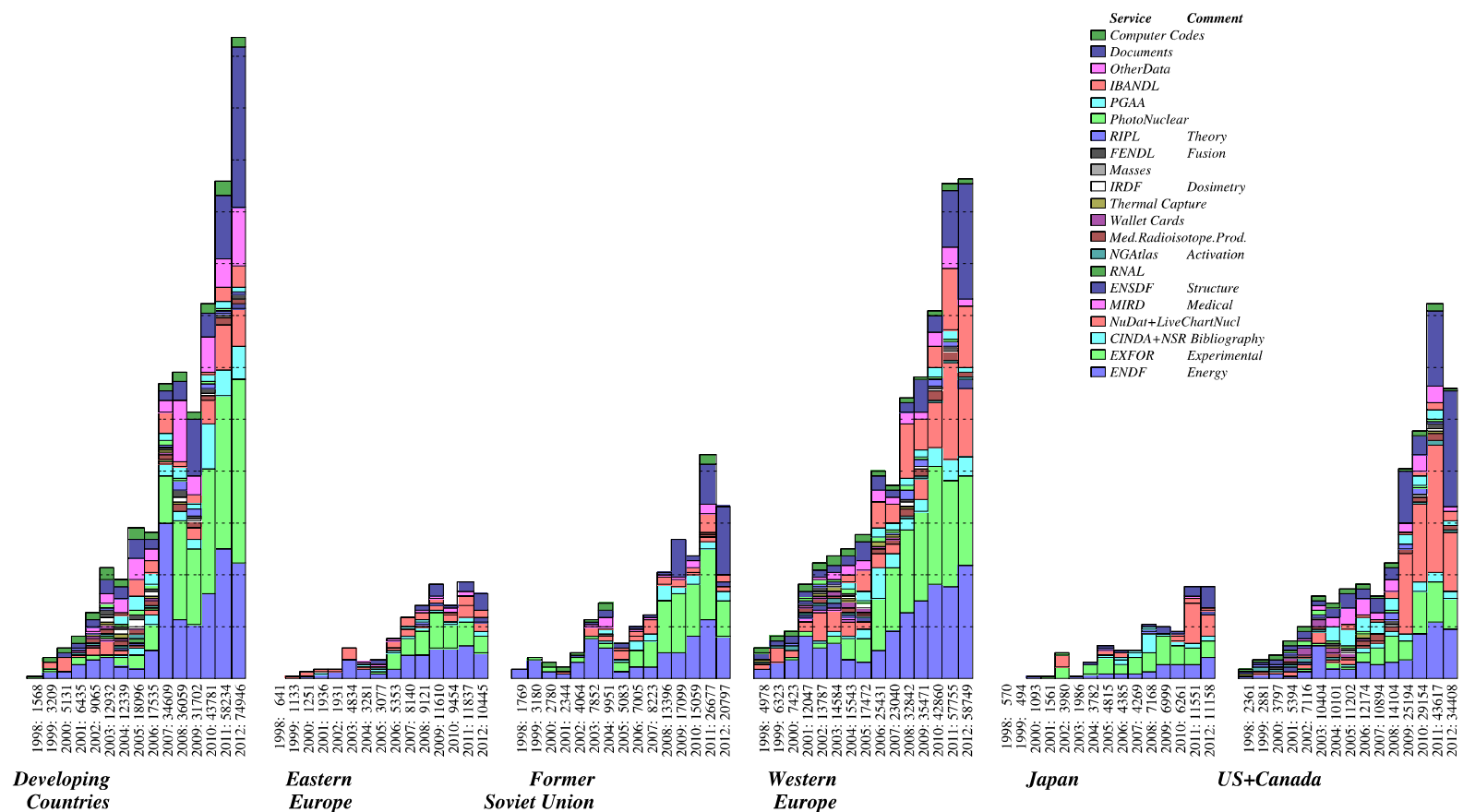
NDS Web Statistics



Year	Developing Countries	Eastern Europe	Former Soviet Union	Western Europe	Japan	US+Canada
2008	3005	760	1116	2737	597	1175
2009	2642	968	1425	2956	583	2100
2010	3648	788	1255	3572	522	2430
2011	4853	986	2223	4813	963	3635
2012	8327	1160	2310	6527	1239	3823

Nuclear Data Services: Web Statistics


Geographically Distributed Counts





1) Structure and Decay Data


Main All Reaction Data **Structure & Decay** by Applications Doc & Codes NDS-Internal Index Events

Structure and Decay Data

 **NSR**
Nuclear Science References *

 **ENSDF**
evaluated nuclear structure and decay data (+XUNDL) **

 **NuDat 2.5**
selected evaluated nuclear structure data **

 **LiveChart of Nuclides**
Interactive Chart of Nuclides:
Advanced and Basic

Miscellaneous

[ENSDF and NSR Manuals](#) - ENSDF Feb. 2001 version & NSR Aug. '96 version
[ENSDF programs](#) - ENSDF Analysis and Utility programs (ALPHAD, LOGFT, etc.)
[NSDD, ICTP Workshops](#) - workshop material, codes, programme, etc.
[International network of Nuclear Structure and Decay Data evaluators](#) - the NSDD network

*Database at the IAEA, Vienna **Database at the US NNDC

2) Nuclear Reaction Data

The screenshot shows the IAEA Nuclear Data Section website. On the left is a navigation menu with sections like 'Request' (CD/DVD with documentation, data, codes, etc.), 'Quick Links' (listing various data libraries and standards), and 'ZVVIEW'. The main content area features a 'NEW' banner with news items, a navigation bar with tabs for 'Main', 'All', 'Reaction Data', 'Structure & Decay', 'by Applications', 'Doc & Codes', 'Index', 'Events', 'Links', and 'News', and a 'Database Retrieval Systems' section listing ENDF, EXFOR, and CINDA. Below this is a 'Data Libraries for download' section with links to various data sets like NGATLAS, IBANDL, FENDL 3.0, etc. At the bottom is a 'Miscellaneous' section and a footer with the IAEA Nuclear Data Section logo and icons for various services.

Request
CD/DVD with documentation, data, codes, etc.

Quick Links
POINT2012
PREPRO
Photon and Electron Interaction Data
Photonuclear
Q-values, Thresholds
RIPL
RNAL
SIGACE
Safeguards Data
SigmaCalc
Spallation models
Specialized Evaluated Libraries
Standards
Stopping Power Data for Light Ions
Th-U
Thermal neutron capture gamma rays
Thin Layer Activation
WIMSD-IAEA Library
Wallet cards
X and Gamma-rays standards
ZVVIEW

NEW
Mirror site: New NDS Web Mirror-site in China <http://www-nds.ciae.ac.cn/>
ANDROID app: Browse Structure and Decay Data on your mobile device [Google Play]
EXFOR Milestone: 20,000 experimental works are now in the database! [retrieve] [statistics] [updates]
IRDF - International Reactor Dosimetry and Fusion File v1.02 [page] [archive] [retrieve]

Main All **Reaction Data** Structure & Decay by Applications Doc & Codes Index Events Links News

Database Retrieval Systems

- ENDF
Evaluated nuclear reaction libraries
- EXFOR
Experimental nuclear reaction data
- CINDA
Nuclear reaction bibliography

Data Libraries for download

- NGATLAS - atlas of neutron capture cross sections
- IBANDL - Ion Beam Analysis Nuclear Data Library
- FENDL 3.0 - Fusion Evaluated Nuclear Data Library, Version 3.0
- Minsk Actinides Library - evaluated neutron reaction data (Maslov et al.)
- IRDF-2002 - International Reactor Dosimetry File
- IRDF - International Reactor Dosimetry and Fusion File
- Charged particle reference cross section - Beam monitor reactions
- PADF 2007 - Proton Activation Data File
- POINT2012 - Pointwise data of ENDF/B-VII.1, processed into temperature dependent form
- Standards - Neutron Cross-section Standards 2006
- RNAL - Reference Neutron Activation Library
- Various Specialized Evaluated Data Libraries in ENDF and other formats -
- ADS-Lib - Application test library in ACE and MATXS format for ADS neutronics design
- ENDF Archive - Download evaluated data in original ENDF (4,5,6) format
- Thin Layer Activation - Thin Layer Activation (TLA) Technique for Wear Measurements
- PIGE - Reference Database for Particle Induced Gamma-ray Emission

Miscellaneous

*Database at the IAEA, Vienna **Database at the US NNDC

IAEA Nuclear Data Section

- IAEA-NDS Mission, Staff and more
- A+M Atomic and Molecular Data
- Meetings Workshops
- Newsletters
- Coordinated Research Projects
- NRDC Nuclear Reaction Data Center Network
- N500 Nuclear Structure & Decay Data Network
- Technical Documents INDC Reports Publications
- Computer Codes

Speaker's main activity is software development:

- Web Retrieval Systems EXFOR, ENDF, CINDA
- CD-ROMs: databases and retrieval systems
- Plotting package ZVView
- Database maintenance

Tab with data and tools sorted by Applications

The screenshot shows a web application interface with a navigation menu at the top and a list of application categories below. The navigation menu includes tabs for 'Main', 'All', 'Reaction Data', 'Structure & Decay', 'by Applications' (which is highlighted in blue), 'Doc & Codes', 'NDS-Internal', 'Index', and 'Events'. Below the navigation menu, there is a list of application categories, each preceded by a downward-pointing chevron symbol (∨). The categories are: 'Reactor Physics (particle transport, fuel cycle, transmutation, shielding)', 'Atomic and molecular data for fusion research', 'Ion Beam and Thin Layer Activation Analysis', 'Dosimetry reactions', 'Activation analysis', 'Nuclear Medicine', and 'Neutron Source Reactions'. At the bottom of the interface, there are two footnotes: '*Database at the IAEA, Vienna' and '**Database at the US NNDC'.

Main All Reaction Data Structure & Decay **by Applications** Doc & Codes NDS-Internal Index Events

- ∨ **Reactor Physics (particle transport, fuel cycle, transmutation, shielding)**
- ∨ **Atomic and molecular data for fusion research**
- ∨ **Ion Beam and Thin Layer Activation Analysis**
- ∨ **Dosimetry reactions**
- ∨ **Activation analysis**
- ∨ **Nuclear Medicine**
- ∨ **Neutron Source Reactions**

*Database at the IAEA, Vienna **Database at the US NNDC

by Applications.

Category: Reactor Physics

Main All Reaction Data Structure & Decay **by Applications** Doc & Codes NDS-Internal Index Events

⤴ **Reactor Physics (particle transport, fuel cycle, transmutation, shielding)**

- [FENDL-2.1](#) - Fusion Evaluated Nuclear Data Library, Version 2.1
- [WIMSD-IAEA Library](#) - multigroup data library for the WIMS-D code
- [Minsk Actinides Library](#) - evaluated neutron reaction data (Maslov et al.)
- [NuDat 2.5](#) - selected evaluated nuclear structure data **
- [ENDF](#) - Evaluated nuclear reaction libraries
- [MENDL-2](#) - Russian cross-section data library for transmutation and activation of materials irradiated by neutrons with energies up to 100 MeV. Yu.N. Shubin et al.
- [Fission Yields](#) - Fission Product Yield Data for the Transmutation of Minor Actinide Nuclear Waste
- [Fission Yields Report](#) - Doc: Fission Product Yield Data for the Transmutation of Minor Actinide Nuclear Waste
- [ADS-Lib](#) - Application test library in ACE and MATXS format for ADS neutronics design
- [IRDF-2002](#) - International Reactor Dosimetry File

⤵ **Atomic and molecular data for fusion research**

⤵ **Ion Beam and Thin Layer Activation Analysis**

⤵ **Dosimetry reactions**

⤵ **Activation analysis**

⤵ **Nuclear Medicine**

⤵ **Neutron Source Reactions**

*Database at the IAEA, Vienna **Database at the US NNDC

Nuclear Reaction Databases

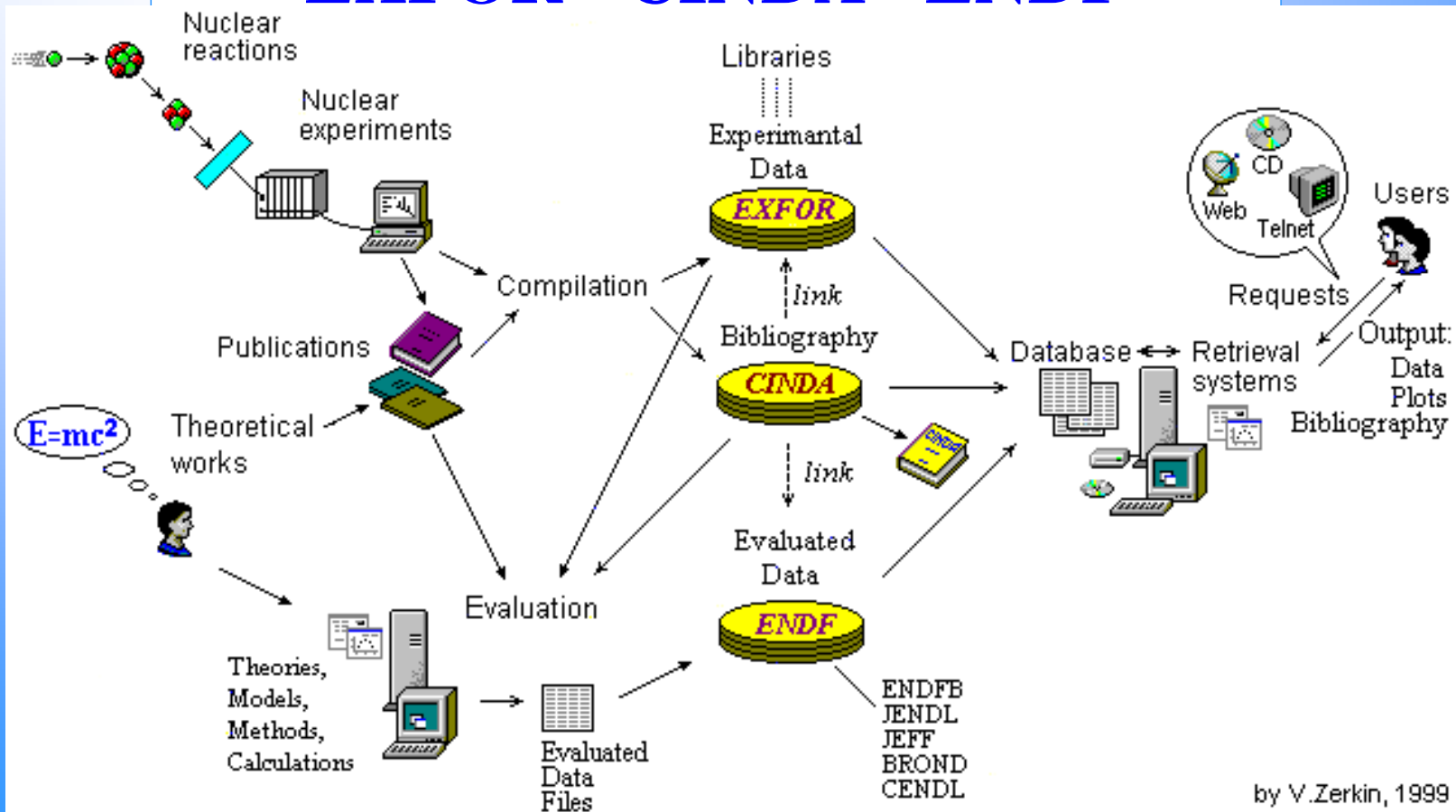
Database	Contents	Size (January-2003)	Size (April-2013)
EXFOR	contains experimental nuclear reaction data for incident neutrons, charged particles and photons	13,500 Entries 97,000 Data sets 400 Mb ASCII-text	19,881 Entries 151,661 Data sets 539 Mb ASCII-text
CINDA	contains bibliographical references to experimental nuclear reaction data and to calculations, reviews, compilations and evaluations of neutron reaction and spontaneous fission data	266,000 Lines 40,500 Publications 32,500 Blocks 37 Mb ASCII-text	549,000 Lines 90,057 Publications 287,062 Blocks 97 Mb ASCII-text
ENDF	is a collection of evaluated data libraries	~300 Mb ASCII (5 basic libraries)	~30 Gb ASCII (43 libraries)

EXFOR: exchange format; EXFOR data library

- 1970 agreed format and established exchange between USA, NEA, IAEA, USSR
- ▶ - contains data from ~20,000 experiments (~\$20bn)
- NRDC: 13 nuclear data centres contribute ~500 new Entries every year
- since 2005: global data library with central maintenance in the IAEA (NDS)
- Master File (540Mb), 52 Dictionaries (2.6Mb), 2 Manuals (400 pages)
- Distribution (EXFOR, X4+, C4, XML, Html, plots): Web, CD/DVD ROM, FTP
- Databases: MySQL, MS-Access, SyBase
- Software: C, Java (GUI-Applications, Servlets), Fortran
- Connection (import-export) to other databases: ENDF, CINDA, NSR

Nuclear Reaction Databases

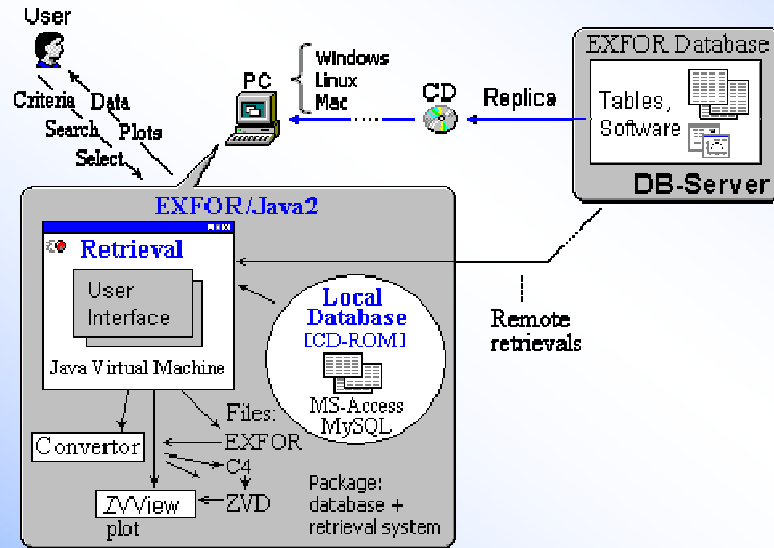
EXFOR - CINDA - ENDF



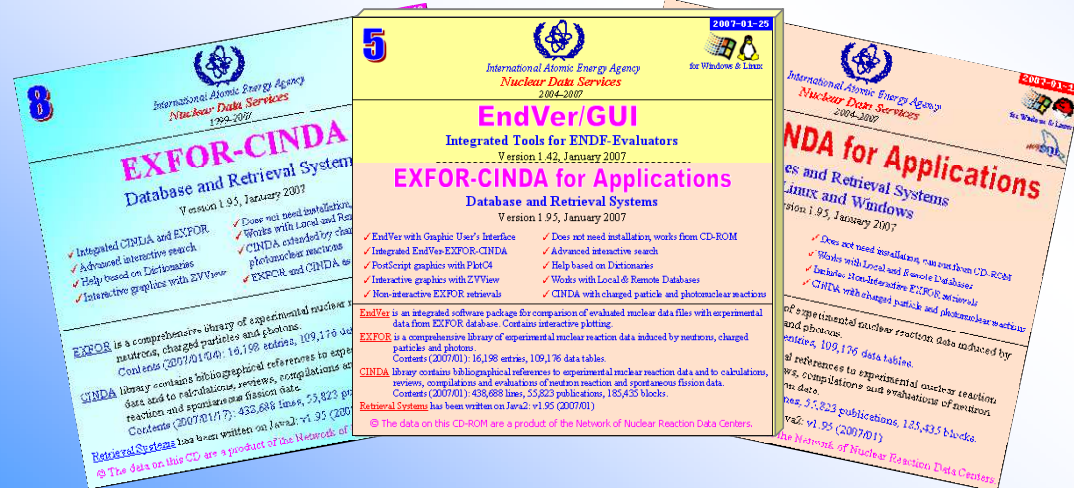
Basic principals of the IAEA-NDS nuclear data IT systems

- **Maximum of platform independency**
 - operating systems: Linux, Windows, Mac
 - relational databases (MySQL, Access, SyBase)
 - programming languages:
C, Java, SQL, Javascript, Fortran
- **Free of charge components**
 - Apache, Tomcat, Linux
- **Full integration of components**
 - no need for installation (can work from CD-ROM)
 - automatic configuration of Web-Servlets
 - encapsulated graphics

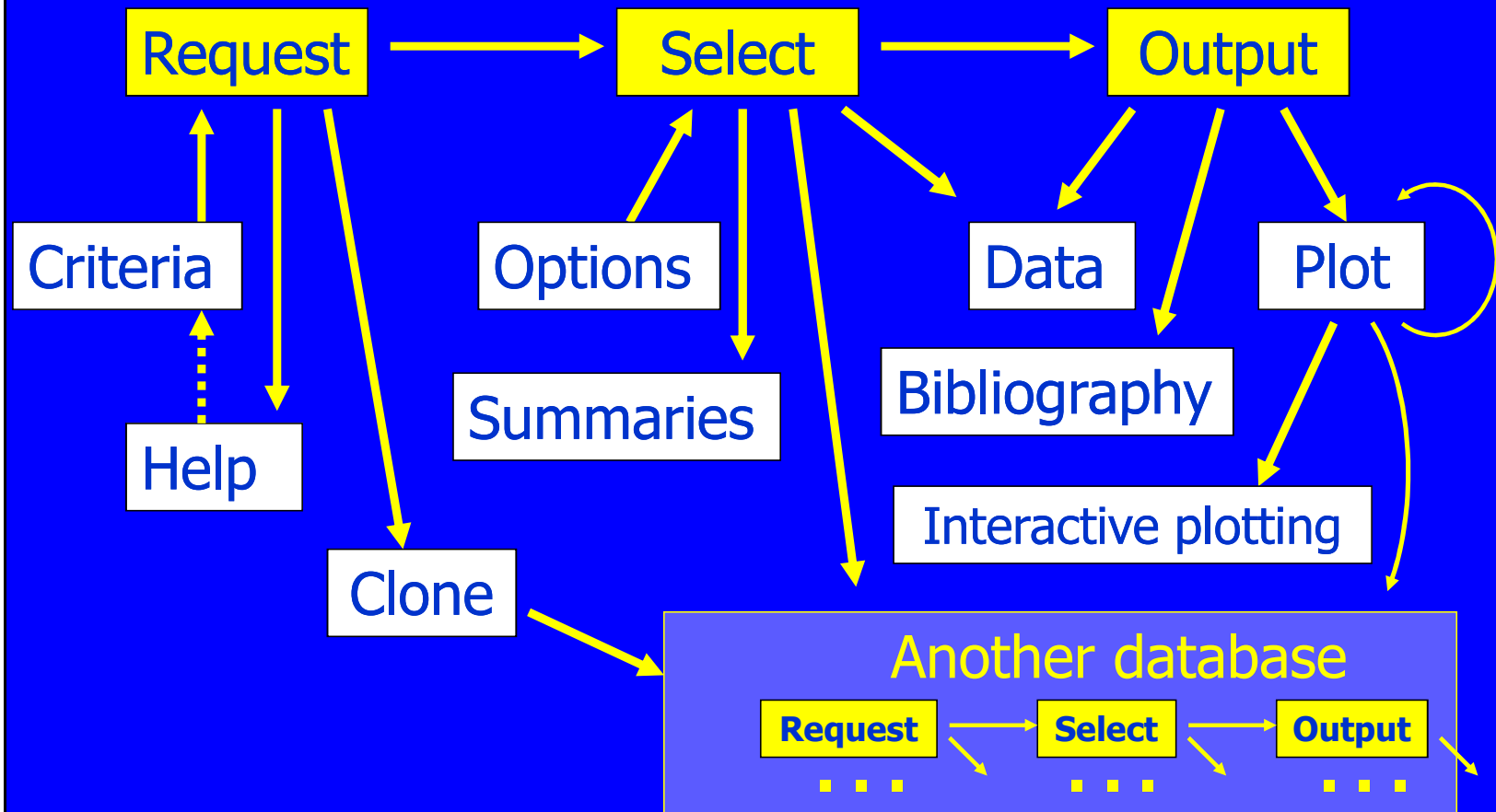
IAEA-NDS CD-ROM Database Retrieval Systems



- For Windows, Linux and Mac
- Does not need installation
- Can run from CD-ROM (DBMS on CD)
- Can work with remote databases
- Integrated EXFOR and CINDA
- Help with Dictionaries
- Advanced search (+users' SQL)
- Interactive plotting with ZVView
- EndVer/GUI with integrated PrePro and EXFOR
- Includes non-interactive retrievals to build new user's applications
- Used by Applications: Empire, EndVer, GANDR, expandable...



Retrieval System: main stream of users' interactions



EXFOR Request Form

Help » EXFOR-Manual | Output | Plot+ | R33 | Databases » ENDF | CINDA | IBANDL | CD-ROM » EXFOR-CINDA | CD-Catalog



Experimental Nuclear Reaction Data (EXFOR)

Database Version of April 05, 2010
Software Version of 2010.03.05 Old interface is [here]



News

2010/02 Improvements and extensions:

- 1) Production of isotopes coded as ELEM/MASS: filtering and quick [plot] , sorting T4 [t4] [t4x]
- 2) Users' definition of ENDF:MF/MT for conversion EXFOR data to format C4 and advanced plotting
- 3) Search by compiling Center-ID (expert mode)
- 4) Search by outgoing particle coded in SF3,4,7 (expert mode)

[History]

The EXFOR library contains an extensive compilation of experimental nuclear reaction data. Neutron reactions have been compiled systematically since the discovery of the neutron, while charged particle and photon reactions have been covered less extensively. The library contains data from 18463 experiments (see [statistics](#) and [new compilation](#)).

Request

Examples: 1 2 3 4 5 6 7

Submit Reset Help

Target

Reaction Exclude superseded data

Quantity

Product

Energy from

Author(s)

Publication year

Accession #

Extended
 Keywords
 Expert

Submit Reset

Options

Exclude superseded data

on combinations (ratios,...)

and search of Products

isting only

rompt-Help

(Entry#, Subent#)

Z,A)

Reaction Sub-Fields

Feedback and User's Input

Clone Request:

CINDA ENDF

Tip of the day: video-guide

How-to video-guide

- Plot EXFOR-ENDF double differential cross-sections

Advanced plotting

- Cross sections
- Angular distribution
- Emission spectra
- Double differential
- NUBAR

Default

- Map

Use Help, Examples, Dynamic sections

EXFOR Select Form

Request #56
Results: Reactions: 9 Datasets: 144

Data Selection

Retrieve Selected Unselected All Reset

Output: EXFOR EXFOR+ Bibliography TAB C4 PlotC4

Plot: Quick-plot (cross-sections only) Advanced plot [how-to]

Narrow Energy (optional), eV: Min: Max:

Advanced

Select Datasets

Search by Reaction

Go to NSR

n	Display	Year	Author-1	Energy range, eV	Points	Reference	Accession#P	NSR-Key
1)	13-AL-27(N,TOI),,SIG		C4: MF3 MT1					
Quantity: [CS] Cross section								
1	<input type="checkbox"/> Info X4 X4+ X4± T4	2009	F.Atchison+			J,NIM/A,300,312,1991		
2	<input checked="" type="checkbox"/> Info X4 X4+ X4± T4	2008	M.Mazari+	1.30e7 1.62e7	7		30037003	
3	<input type="checkbox"/> Info X4 X4+ X4± T4	1994	G.Rohr+	2.50e5 2.00e7	49709	C,94GATLIN,,215,199405	22331004	
4	<input checked="" type="checkbox"/> Info X4 X4+ X4± T4	1993	R.W.Finlay+	5.29e6 6.00e8	474	J,PR/C,47,237,9301	13569008	1993FI01
5	<input type="checkbox"/> Info X4 X4+ X4± T4	1991	J.R.Morales+	1.76e7 1.98e7	2	J,NIM/A,300,312,1991	30764004	1991M009
6	<input type="checkbox"/> Info X4 X4+ X4± T4	1990	L.Koester+	1.97e3	1	J,ZP/A,337,341,1990	22217010	1990K034
7	<input checked="" type="checkbox"/> Info X4 X4+ X4± T4	1988	J.Franz+	1.60e8 5.75e8	22	J,NP/A,490,667,88	22117005	1988FR23
8	<input checked="" type="checkbox"/> Info X4 X4+ X4± T4	1984	M.Ohkubo	9.84e3 9.35e5	1010	W,OHKUBO,8412	21926003	
9	<input checked="" type="checkbox"/> Info X4 X4+ X4± T4			7.12e2 7.88e4	927			004
10	<input type="checkbox"/> Info X4 X4+ X4± T4	1983	M.S.Gordon+	2.50e7 4.50e7	0	P,NPL-951,40,8304	12839004	
11	<input type="checkbox"/> Info X4 X4+ X4± T4	1981	V.E.Zhitarev+		8	J,AE,50,(5),350,198105	41323002	
12	<input type="checkbox"/> Info X4 X4+ X4± T4	1980	D.C.Larson+	2.00e6 8.06e7	685	C,80BNL,,277,8007	12882005	
13	<input type="checkbox"/> Info X4 X4+ X4± T4	1979	L.Koester+	1.26e0 5.19e0	2	J,ZP/A,292,(1),95,1979	21660015	1979K026
14	<input type="checkbox"/> Info X4 X4+ X4± T4	1977	R.B.Royer+	1.86e2	1	J,NIM,145,245,1977	12661004	
15	<input type="checkbox"/> Info X4 X4+ X4± T4	1976	D.R.Waymire+	5.22e6 7.24e6	20	W,WAYMIRE,19761108	20671002	
16	<input type="checkbox"/> Info X4 X4+ X4± T4	1975	P.V.R.Murthy+	3.40e10 2.73e11	7	J,NP/B,92,269,197506	10403005	
17	<input type="checkbox"/> Info X4 X4+ X4± T4				432	J,PR/C,11,1117,197504	10515004	1975SI05

Search by Author

Go to Web - journal

Get data in various formats

```

ENTRY          41323   20050902
SUBENT         41323001 20050902
BIB            7       12
INSTITUTE      (4RUSMIF)
REFERENCE      (J,AE,50,(5),350,198105) M
               (J,SJA,50,325,1981) ENGLI
AUTHOR        (V.E.ZHITAREV,A.M.MOTORIN,
TITLE         .INTERACTION CROSS SECTION
               WITH COLD NEUTRONS
FACILITY      (REAC)
ERR-ANALYS    (EN-ERR)   WAVE-LENGTH RES
               TIMES 100 (IN P
HISTORY        (19981121C) + + COMPILED
               (20050902A) . . Correcte
               Data-heading
ENDBIB         12
COMMON        3         3
EN-ERR         TEMP     TEMP-ERR
PER-CENT       DEG-C    DEG-C
               3.       22.    3.
ENDCOMMON     3
ENDSUBENT     19
SUBENT         41323002 20050902
BIB            5       8
REACTION      (13-AL-27(N,TOT),,SIG)
SAMPLE        .ALUMINIUM MONOCRYSTAL, PU
               96 MM, DENSITY 2.70 GRAM/
               MACROCRISTALLINE ALUMINIU
               THICKNESS 50 MM, DENSITY
ERR-ANALYS    (DATA-ERR) NO INFORMATION
STATUS        (TABLE) DATA ARE TAKEN FR
HISTORY        (19981121T) + + CONVERTED
ENDBIB         8
NOCOMMON      0         0
DATA          3         8
WVE-LN        DATA    DATA-ERR
ANGSTROM      B        B
1.3000E+01 1.9300E+00 1.3000E-01
1.4000E+01 2.1200E+00 9.0000E-02
1.5000E+01 2.2500E+00 8.0000E-02
1.6000E+01 2.3800E+00 7.0000E-02
1.7000E+01 2.5400E+00 6.0000E-02
1.8000E+01 2.6100E+00 6.0000E-02
1.9000E+01 2.8200E+00 8.0000E-02
2.0000E+01 3.1500E+00 6.0000E-02
ENDDATA       10
ENDSUBENT     23
ENDENTRY      2

```

```

ENTRY          41323   20050902
SUBENT         41323001 20050902
BIB            7       12
INSTITUTE      (4RUSMIF)
REFERENCE      (J,AE,50,(5),350,198105) MAIN REFERENCE, DATA ARE GIVEN
               (J,SJA,50,325,1981) ENGLISH TRANSLATION
AUTHOR        (V.E.ZHITAREV,A.M.MOTORIN,S.B.STEPANOV)
TITLE         .INTERACTION CROSS SECTIONS OF CERTAIN METALS
               WITH COLD NEUTRONS
FACILITY      (REAC)
ERR-ANALYS    (EN-ERR)   WAVE-LENGTH RESOLUTION DELTA-LAMBDA/LAMBDA
               TIMES 100 (IN PERCENT)
HISTORY        (19981121C) + + COMPILED AT THE CJD + +
               (20050902A) . . Corrected at the CJD + +
               Data-heading "EN" changed to "WVE-LN"
ENDBIB         12
COMMON        3         3
EN-ERR         TEMP     TEMP-ERR
PER-CENT       DEG-C    DEG-C
               3.       22.    3.
ENDCOMMON     3
ENDSUBENT     19
SUBENT         41323002 20050902
BIB            5       8
REACTION      (13-AL-27(N,TOT),,SIG)
SAMPLE        .ALUMINIUM MONOCRYSTAL, PURITY 99.99 PC, THICKNESS
               96 MM, DENSITY 2.70 GRAM/CM3 AND
               MACROCRISTALLINE ALUMINIUM, PURITY 99.99 PC,
               THICKNESS 50 MM, DENSITY 2.70 GRAM/CM3
ERR-ANALYS    (DATA-ERR) NO INFORMATION GIVEN
STATUS        (TABLE) DATA ARE TAKEN FROM TABLE 1 OF MAIN REF.
HISTORY        (19981121T) + + CONVERTED FROM SUBENT 88023002
ENDBIB         8
NOCOMMON      0         0
DATA          3         8
WVE-LN        DATA    DATA-ERR
ANGSTROM      B        B
1.3000E+01 1.9300E+00 1.3000E-01
1.4000E+01 2.1200E+00 9.0000E-02
1.5000E+01 2.2500E+00 8.0000E-02
1.6000E+01 2.3800E+00 7.0000E-02
1.7000E+01 2.5400E+00 6.0000E-02
1.8000E+01 2.6100E+00 6.0000E-02
1.9000E+01 2.8200E+00 8.0000E-02
2.0000E+01 3.1500E+00 6.0000E-02
ENDDATA       10
ENDSUBENT     23
ENDENTRY      2

```

EXFOR Interpreted: X4+, XML, X4±

EXFOR data: <http://www>
Data retrieved from the EXFOR files

ENTRY	41323
SUBENT	41323001
BIB	7
INSTITUTE	(4RUSMIF) #Moscow Inst.of Engineering Physics, Moscow, Russia
REFERENCE	(J,AE,50,(5), (J,SJA,50,32); # (J,AE,50,(5), (J,SJA,50,32); # (J,SJA,50,32);
AUTHOR	(V.E.ZHITAREV, A.M.MOTORIN, S.B.STEPANOV)
TITLE	.INTERACTION CROSS SECTIONS OF CERTAIN METALS WITH COLD NEUTRONS
FACILITY	(REAC) #Reactor
ERR-ANALYS	(EN-ERR) W
HISTORY	(19981121C) (20050902A)
ENDBIB	12
COMMON	3
EN-ERR	TEMP T
PER-CENT	DEG-C D
3.	22. 3.
ENDCOMMON	3
ENDSUBENT	19
SUBENT	41323002
BIB	5
REACTION	(13-AL-27(N,T),SIG) #Process:AL-27(N,TOT),SIG
SAMPLE	.ALUMINIUM MONOCRYSTAL, PURITY 99.99 PC, THICKNESS 96 MM, DENSITY 2.70 GRAM/CM3 AND MACROCRYSTALLINE ALUMINIUM, PURITY 99.99 PC, THICKNESS 50 MM, DENSITY 2.70 GRAM/CM3
ERR-ANALYS	(DATA-ERR) B
STATUS	(TABLE) D
HISTORY	(19981121T)
ENDBIB	8
NOCOMMON	0
DATA	3
WVE-LN	DATA D
ANGSTROM	B B
13.	1.93 0.
14.	2.12 0.
15.	2.25 0.
16.	2.38 0.
17.	2.54 0.
18.	2.61 0.
19.	2.82 0.
20.	3.15 0.
ENDDATA	10
ENDSUBENT	23
ENDENTRY	2

```
<?xml version="1.0" encoding="WINDOWS-1251"?>
<x4files>
  - <x4entry Author="V.E.Zhitarev" ReflYear="1981" accnum="41323"
    - <x4subent N2="20050902" subacc="41323001">
      - <bib nKw="12">
        - <keyword subacc="41323001" nCodes="1" kw="INSTITUTE"
          - <kwCode iCode="0" pointer=" ">
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            </x4code>
          </keyword>
        </keyword>
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            </x4code>
            - <kwCode iCode="1" pointer=" ">
              - <x4code type="REFERENCE">
                <x4code1 expansion="Jour: Soviet Atomic Energy, Vol.50, Issue.5, p.325 (1981), English translation" dictionary="REFERENCE" Year="1981" page="325" Type="J">J,SJA,50,325,1981</x4code1>
                <Free type="1" ln="1"> ENGLISH TRANSLATION</Free>
              </x4code>
            </kwCode>
          </keyword>
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          - <kwCode iCode="0" pointer=" ">
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              <x4code1 expansion="V.E.Zhitarev" a1="Zhitarev" nn="3">
                <author ii="1">V.E.ZHITAREV</author>
                <author ii="2">A.M.MOTORIN</author>
                <author ii="3">S.B.STEPANOV</author>
              </x4code1>
            </x4code>
          </keyword>
        - <keyword subacc="41323001" nCodes="1" kw="TITLE">
          - <kwCode iCode="0" pointer=" ">
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          </kwCode>
        </keyword>
        - <keyword subacc="41323001" nCodes="1" kw="FACILITY">
          - <kwCode iCode="0" pointer=" ">
            - <x4code type="FACILITY">
              <x4code1 expansion="Reactor" dictionary="FACILITY">
                <Free type="1" ln="2"> WAVE-LENGTH RESOLUTION (IN PERCENT)</Free>
            </x4code1>
          </kwCode>
        </keyword>
      </x4subent>
    </x4entry>
  </x4files>
```

EXFOR file

- ENTRY 41323 1981, V.E.Zhitarev last-updated: 2005-09-02
 - SUBENT 41323001 last-updated: 2005-09-02
 - BIB #bibliographic and descriptive information
 - INSTITUTE
 - (4RUSMIF) #Moscow Inst.of Engineering Physics, Moscow, Russia
 - REFERENCE
 - (J,AE,50,(5),350,198105) #Jour: Atomnaya Energiya, Vol.50, Issue.5, p.350 (1981), Russian translation of English translation
 - (J,SJA,50,325,1981) #Jour: Soviet Atomic Energy, Vol.50, p.325 (1981), USA ENGLISH TRANSLATION
 - AUTHOR
 - (V.E.ZHITAREV, A.M.MOTORIN, S.B.STEPANOV)
 - TITLE
 - .INTERACTION CROSS SECTIONS OF CERTAIN METALS WITH COLD NEUTRONS
 - FACILITY
 - (REAC) #Reactor
 - ERR-ANALYS
 - (EN-ERR) W
 - HISTORY
 - (19981121C) (20050902A)
 - COMMON 3x1 #Constant parameters
 - Legend

EN-ERR	Uncertainty in incident projectile energy	PER-CENT	per-cent
TEMP	Sample temperature	DEG-C	degrees Celsius, Centigrad
TEMP-ERR	Error in sample temperature	DEG-C	degrees Celsius, Centigrad
 - Data

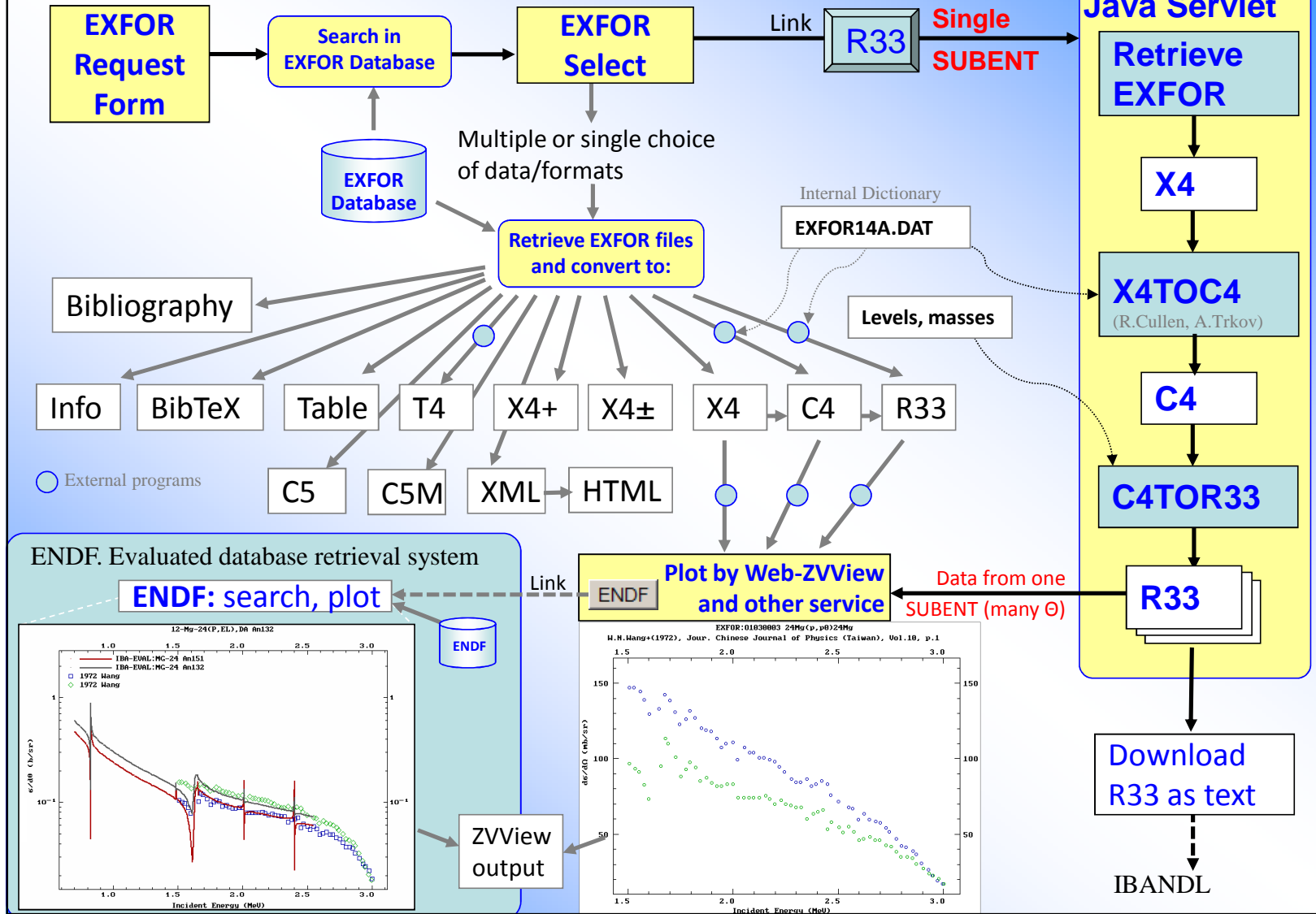
EN-ERR	TEMP	TEMP-ERR
PER-CENT	DEG-C	DEG-C
3.0	22.0	3.0
 - SUBENT 41323002 last-updated: 2005-09-02
 - BIB #bibliographic and descriptive information
 - REACTION
 - (13-AL-27(N,TOT),SIG) #Target:AL-27 #Projectile:N #Reaction:N,TOT #Process:TOT:Total #Quantity:,SIG:CS
 - SAMPLE
 - .ALUMINIUM MONOCRYSTAL, PURITY 99.99 PC, THICKNESS 96 MM, DENSITY 2.70 GRAM/CM3 AND MACROCRYSTALLINE ALUMINIUM, PURITY 99.99 PC, THICKNESS 50 MM, DENSITY 2.70 GRAM/CM3
 - ERR-ANALYS
 - (DATA-ERR) B
 - STATUS
 - (TABLE) D
 - HISTORY
 - (19981121T)
 - NOCOMMON
 - DATA 3x8
 - Legend

WVE-LN	Wave length of incident particle	ANGSTROM	Angstroms
DATA	Cross section	B	barns
DATA-ERR	Error in value of quantity, defined under ERR-ANALYS B		barns
 - Data

WVE-LN	DATA	DATA-ERR
ANGSTROM	B	B
13.0	1.93	0.13
14.0	2.12	0.09
15.0	2.25	0.08
16.0	2.38	0.07
17.0	2.54	0.06
18.0	2.61	0.05
19.0	2.82	0.04
20.0	3.15	0.03

Output from EXFOR retrieval system

How it works



How do we get R33 from EXFOR

Request Examples: 1234567...

Submit Reset Help

Target Li-6 >>

Reaction he3,p >>

Quantity DA; DAP >>

Product >>

Energy from 0 to eV >>

Author(s) Schiffer >>

Publication year 1970-2002 >>

Accession # d0435004;c0855002;d0152* >>

Extended
Keywords
Expert

Submit Reset

1) Select:
Target
Reaction
Quantity: **DA; DAP**

Year	Author-1	Subentry#P	NSR-Key
4-BE-8, PAR, DA	C4: MF4	MT601	
differential cross section d/dA			
1995	D.Baddou+	C0637002	R33 1995BA24 An=16:171 EXC=0
		C0637003	R33 1995BA24 An=16:172 EXC=2.9e6
1980	A.J.Elwyn+	T0031002	R33 1980EL02 An=0:157 LVL=0
		T0031003	R33 1980EL02 An=36:157 LVL=2.9e6
		T0031004	R33 1980EL02 An=42:161 LVL=1.7e7
		T0031005	R33 1980EL02 An=43:162 LVL=1.7e7
1977	M.Irshad+	A1540002	R33 1977IR01 An=22:90 LVL=0.2.9e6
1976	C.R.Gould+	F0001002	R33 An=21:163 LVL=0
		F0001003	R33 An=21:160 LVL=2.9e6
1969	B.Vignon+	D0601004	R33 1969VI05 An=20:154 LVL=0.2.9e6
1961	J.R.Erskine+	A1499002	R33 1961ER01 An=18:120 LVL=1.7e7
1956	J.P.Schiffer+	A1495002	R33 1956SC01 An=0:150 LVL=0
		A1495003	R33 1956SC01 An=0:150 LVL=2.9e6

2) Select Dataset

Note. This is β -version of X4R33 conversion software. Please report any problems to V.Zerkin@

Plots: $d\sigma/d\Omega(E):2/2$ $d\sigma/d\Omega(\theta):16/199$ See: [doc] Try:CM->Lab

1) 0° Plot R33 2) 150° Plot R33

Comment: Automatically converted from EXFOR by the IAEA-NDS EXFOR Web-Retrieval System program version-2012/10/18, by V.Zerkin. "Study of the reaction mechanism for (He3,P) reactions with Li-6, B-10 and C-13" J.P.Schiffer, T.W.Bonner, R.H.Davis, F.W.Prosser Jr EXFOR: A1495002 Created: 1980-08-11 Updated: 2012- X4Reaction:3-LI-6(HE3,P)4-BE-8,PAR,DA; X4Points:201 LevelEnergy: 0.00

Version: R33
X4Number: A1495002
Source: J.P.Schiffer+(1956), Jour. Physical Review, Vol.104,
Reaction: 6Li(3He,p)8Be
Distribution: Energy
Sigfactors: 1.00, 0.00
Enfactors: 1.00, 0.00, 0.00, 0.00
Units: mb
Composition:
Masses: 3.0, 6.0, 1.0, 8.0
Zeds: 2, 3, 1, 4
Qvalue: 16787.36, 0.00, 0.00, 0.00, 0.00
Theta: 0
Data:
903.20, 36.128, 0.2869, 0.0574
926.60, 37.064, 0.303, 0.0606
963.80, 38.552, 0.3805, 0.0761
1001.00, 40.04, 0.4884, 0.0977

EXFOR Output Form

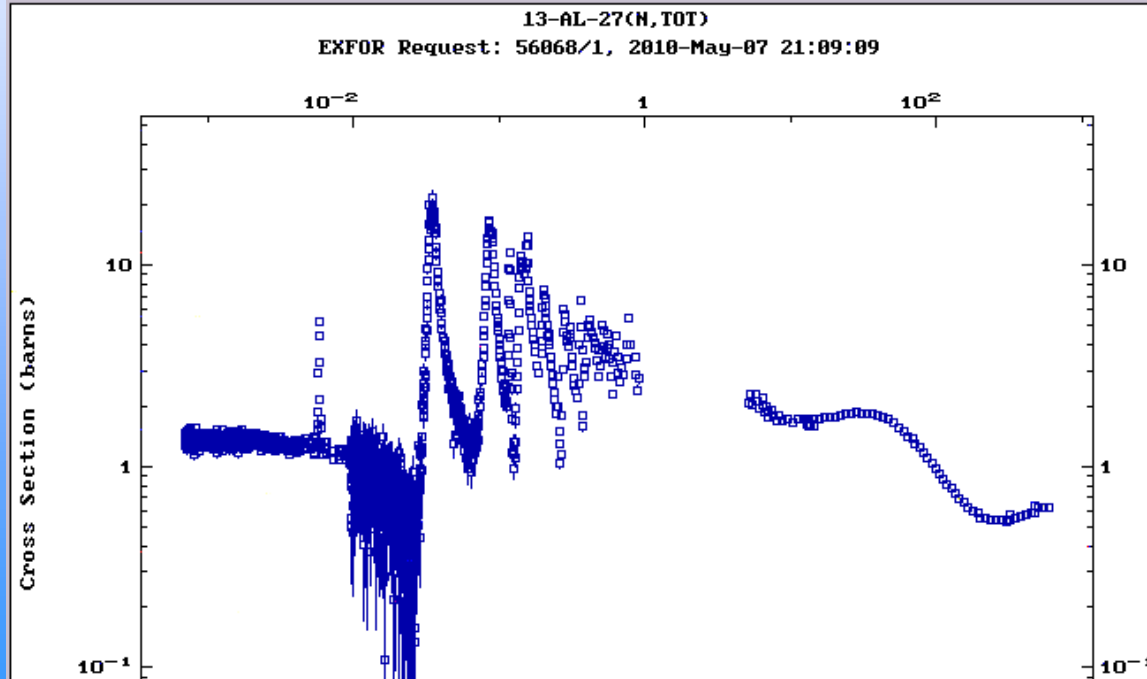
EXFOR Request #56068/1816

Output Data

Format	Data (Size)
EXFOR	Text (212Kb) ZIP (34Kb) Generate: X4±
Bibliography	html (15Kb) BibTeX (5Kb)
Computational	
C4	C4 (315Kb) C4.ZIP (23Kb) LST (99Kb)

Output data

Search similar evaluated data



ENDF Find and add to the plot evaluated data

- 1) 13-AL-27(N,TOT),,SIG
- 2) Use my data [example]

See: [plotted data](#) (194Kb)

Get plotted data

ENDF Select Form

Request #2776

ENDF Data Selection (Plot for EXFOR Request #56068)

Retrieve **Plot** Selected Unselected All

Plotting options: Quick plot (cross-sections only: σ)

Sorted by: [Reactions] Reorder by: [Libraries] View: basic extended

1) AL-27(N,TOT),SIG MT=1 MF=3 NSUB=10

MF3: [SIG] Cross sections MT1: [N,TOT] Neutron total cross sections.

1	<input checked="" type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	ENDF/B-VII.0	E=150MeV Lab=LANL,ORNL Date=DIST-DEC06	M.B.Chadwick+,Derrient+
2	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JEFF-3.1	E=150MeV Lab=LANL Date=090105	M.B.CHADWICK & P.G.YOUNG
3	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JENDL-3.3	E=20MeV Lab=TIT,JAERI Date=20010713	Y.HARIMA,H.KITAZAWA,T.FUKAHORI
4	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JENDL-3.3	E=20MeV Lab=TIT,JAERI Date=20010713 T=300	Y.HARIMA,H.KITAZAWA,T.FUKAHORI
5	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	ENDF/B-VI	E=150MeV Lab=LANL Date=20011108	M.B.CHADWICK & P.G.YOUNG
6	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	ENDF/B-VI	E=150MeV Lab=LANL Date=20010926 T=300	M.B.CHADWICK & P.G.YOUNG
7	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	ROSFOND-2008	E=150MeV Lab=IPPE Date=DIST-DEC07	IGNATYUK A.V.
8	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	ROSFOND-2010	E=150MeV Lab=IPPE Date=DIST-DEC07	IGNATYUK A.V.
9	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	CENDL-3.1	E=20MeV Lab=CNDC,JNDC Date=DIST-DEC09	B.S.YU, S.CHIBA, Y.HARIMA
10	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JEF-2.2	Lab=ECN Date=920101	EC BLANKET TECHNOLOGY, TASK B2
11	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JEFF-3.0	E=150MeV Lab=LANL Date=DIST-APR02	M.B.CHADWICK & P.G.YOUNG
12	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JENDL/HE-2007	E=3000MeV Lab=SIT.SHIMZ Date=REV1-	K. Kosako
13	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	JENDL/HE-2004	E=3000MeV Lab=KAERI Date=REV1-	Y. Lee
14	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	FENDL/E-2.1	Lab=CDN-ENEA Date=EVAL-FEB97	FABBRI,MASETTI,ORSI,REFFO,TRKOV
15	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	TENDL-2008	E=20MeV Lab=NRG Date=REV1-	A.J. Koning and D. Rochman
16	<input checked="" type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	TENDL-2009	E=200MeV Lab=NRG Date=REV1-	A.J. Koning and D. Rochman
17	<input type="checkbox"/>	ENDF-6	Interpreted	σ	Plot	CENDL-2	Lab=CNDC/TIT Date=950817	B.YU, S.CHIBA, Y.HARIMA ET AL

ENDF Output Form with interactive Web ZVView plotting

Select data for plotting

Cross Section

ENDF Request 2776, 2010-May-07,21:22:26
EXFOR Request: 56068/1, 2010-May-07 21:09:09

1) 13-AL-27(N,TOT),,SIG

- 1993 R.W.Finlay,
- 1988 J.Franz,
- 1984 M.Ohkubo
- 1984 M.Ohkubo
- 1955 M.Mazari,

2) ENDF/B-VII.0: AL-27(N,TOT)

3) TENDL-2009: AL-27(N,TOT)

4) Use my data [example]

Columns: x y [dy [dx]]

1.5	2.336	0.384
2	2.788	0.268
2.33	2.96	0.4
2.5	2.399	0.283
3	2.424	0.197
4.04	2.496	0.065
5.06	2.222	0.065
5.5	2.304	0.1659

Type: Curve Points

Title: My data

Multiply by: X: 1e6 Y: 1e-3

See: [plotted data \(743Kb\)](#)

Log: [XY](#) [X](#) [Y](#) Lin: [XY](#) [X](#) [Y](#) Auto-range: [XY](#) [X](#) [Y](#) Page: [>>](#) [<<](#) Zoom: [<>](#) [>>](#) Grid: [VH](#) [0](#) [V](#) [H](#) Pts: [Txt](#) [Box](#) [PL](#)

Legend Authors Info+ Manual options: [+]

Data for plotting: [ZVD \(724Kb\)](#), [send to ZVView](#); [download ZVView](#); [upload](#) and plot your ZVD file


Plotting options

ENDF Request Form

Help » [ENDF Format Manual](#) | [Plot+](#) | [Databases » Medical](#) | [NGAtlas](#) | [RIPL](#) | [FENDL](#) | [IRDF-2002](#) | [EXFOR](#) | [CINDA](#)

Evaluated Nuclear Data File (ENDF)

Database Version of February 23, 2010
Software Version of 2010.02.22 Old interface is [\[here\]](#)



News & History

2010/02 Updated library:
1) [ROSFOND-2010](#): neutron library, 686 materials, Obninsk, Russia, issued in 2010 [\[page\]](#)
2) [IAEA-Med](#): data for medical radioisotope production. Proton sub-library corrected, 2010 [\[page\]](#)

2010/01 New library:
1) [CENDL-3.1](#) Chinese evaluated neutron data library, issued in 2009

Core nuclear reaction database contain recommended, evaluated cross sections, spectra, angular distributions, fission product yields, photo-atomic and thermal scattering law data, with emphasis on neutron induced reactions. The data were analyzed by experienced nuclear physicists to produce recommended libraries for one of the national nuclear data projects (USA, Europe, Japan, Russia and China). All data are stored in the internationally-adopted ENDF-6 format maintained by CSEWG.

Standard Request

Examples: [1](#) [2](#) [3](#) [4](#) [5](#) [6](#) [7](#) Go to: [Advanced Request](#); [ENDF-Explorer](#)

Parameters:

Target »

Reaction »

Quantity »

[More Parameters...](#)

Libraries: All Selected

<input checked="" type="radio"/> Major Libraries	<input type="radio"/> Special Libraries
<input type="checkbox"/> 1) ENDF/B-VII.0 (USA,2006)	<input type="radio"/> Archival
<input type="checkbox"/> 2) JEFF-3.1.1 (Europe,2005-2009)	<input type="radio"/> Derived
<input type="checkbox"/> 3) JENDL-3.3 (Japan,2002)	
<input type="checkbox"/> 4) BROND-2.2 (Russia,1992)	
<input type="checkbox"/> 5) CENDL-3.1 (China,2009)	

Options:

Sort by: Reactions Evaluations

Clone Request:

Feedback:

ENDF Flexible Database Explorer

ENDF-Flexible Database Explorer, V.Zerkin, IAEA-NDS...

Flexible Database Explorer
Restart Close Config Selection Help About

- Evaluated data [+Reaction]
- G Photo-Nuclear Data
- PHOTO Photo-Atomic Interac
- DECAY Radioactive Decay Da
- S/FPY Spontaneous Fission F
- N Incident-Neutron Data**
- N/FPY Neutron-Induced Fissi
- TSL Thermal Neutron Scatter
- Std Neutron Cross Section S
- E Electro-Atomic Interactio
- P Incident-Proton Data
- P/FPY Proton-Induced Fissio
- D Incident-Deuteron Data
- D/FPY Deuteron-Induced Fis
- T Incident-Triton Data
- T/FPY Triton-Induced Fission
- HE3 Incident-He3 data
- HE3/FP He3-Induced Fission
- HE4 Incident-Alpha data
- HE4/FP Alpha-Induced Fissio

Configuration: [Show]
Video demo: [show]
How-to slides: [hide]

Slide-show: 1 3 23

Switches: open/close tree-node

- Closed
- Opened

T:target R:reaction L:library Q:quantity

Target Materials
Isotopes of 1-Hydrogen

1																	2					
H																	He					
3	4															5	6	7	8	9	10	
H-1	Li	Be															B	C	N	O	F	Ne
H-2	11	12															13	14	15	16	17	18
H-3	Na	Mg															Al	Si	P	S	Cl	Ar
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36					
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr					
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54					
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe					
55	56	57*	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86					
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn					
87	88	89**	104	105	106	107	108	109	110	111	112											
Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	*											
* Lanthanides			58	59	60	61	62	63	64	65	66	67	68	69	70	71						
** Actinides			90	91	92	93	94	95	96	97	98	99	100	101	102	103						
			Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr						

Summary:
Elements: 110
Nuclides: 2450

Selected:
> 0) Evaluated data
* 1) Incident-Particle: [N] Incident-Neutron Data

Nuclides: [List] [Chart-txt]

ENDF Explorer: data found

The screenshot displays the ENDF-Flexible Database Explorer (v.1.0) interface. The left sidebar shows a hierarchical tree of data categories, with 'IR-193 Iridium [+Reaction]' selected. The main window is titled 'Select and retrieve data from database...' and contains a 'Clean Selection' button and a 'Selected:' list. The list includes:

- 1) 1) Incident-Particle: Incident-Neutron Data
- 2) Quantity: Covariances of neutron cross sections
- 3) Element: Iridium
- 4) Isotope: IR-193
- 5) Reaction: Production of two neutrons and a residual.

Below the list, there are buttons for 'Retrieve' and 'Reset', and a checkbox for 'Retrieve in new Window'. At the bottom, there is a checkbox for 'Retrieve listing of evaluations only' and a footer with the text: 'FDBE - Flexible Database Explorer, v-1.0, 2006/01/20 Created by V.Zerkin, IAEA, 2005-2008'.

Standard ENDF Select Form

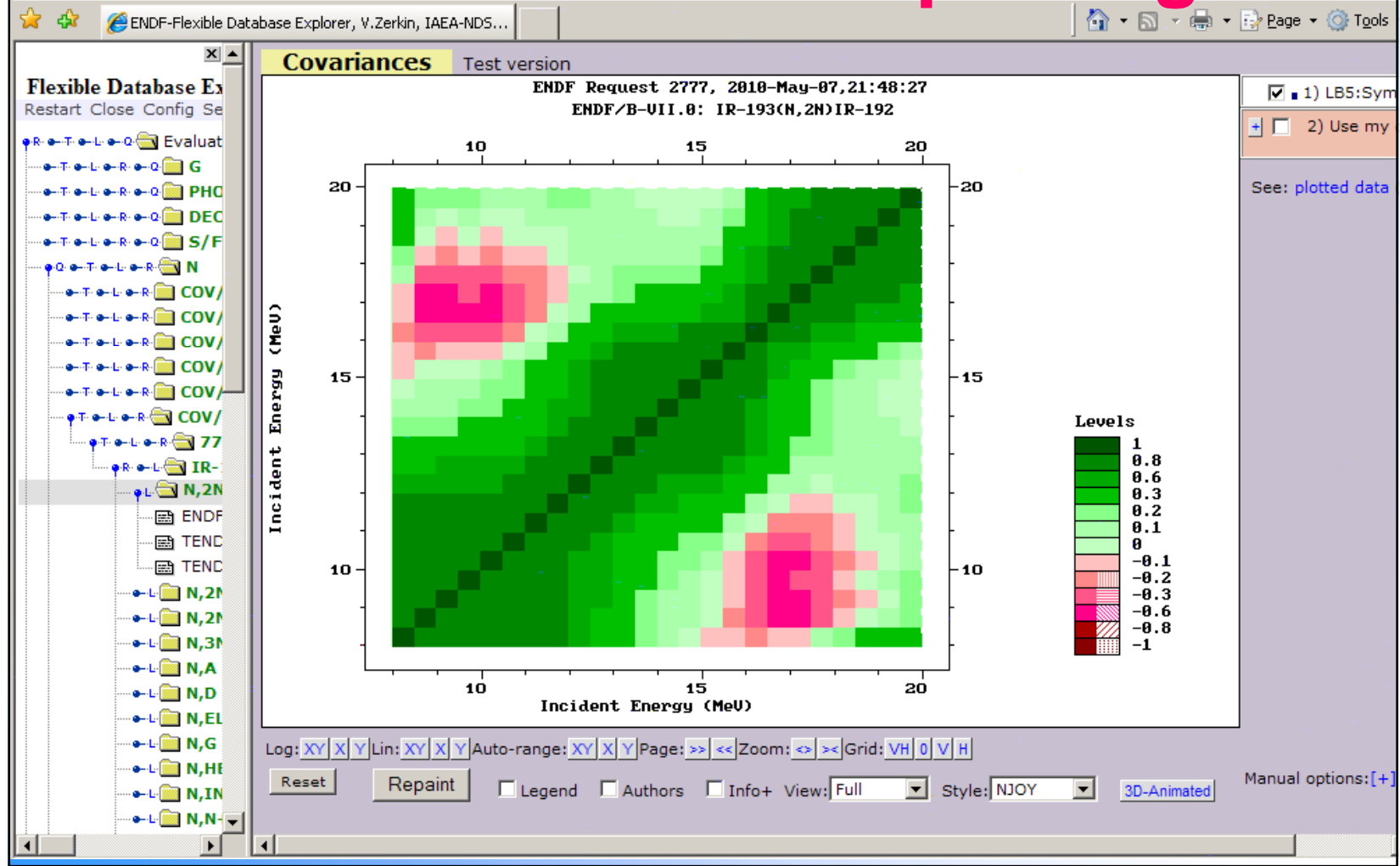
The screenshot displays the ENDF-Flexible Database Explorer application. The main window is titled "Request #2777" and "ENDF Data Selection". It features a "Retrieve" button and radio buttons for "Selected", "Unselected", and "All". The interface is sorted by "Reactions" and viewed in "basic" mode. A table lists three data entries:

Request	Reaction	Library	Energy	Lab	Date
1	IR-193 (N,2N) IR-192, COV/SIG	ENDF-6	E=20MeV	LANL, BNL	DIST-DEC06
2	MF33: [COV/SIG] Covariances of neutron cross sections	ENDF-6	E=20MeV	NRG	REV1-
3	MT16: [N,2N] Production of two neutrons and a residual	ENDF-6	E=200MeV	NRG	REV1-

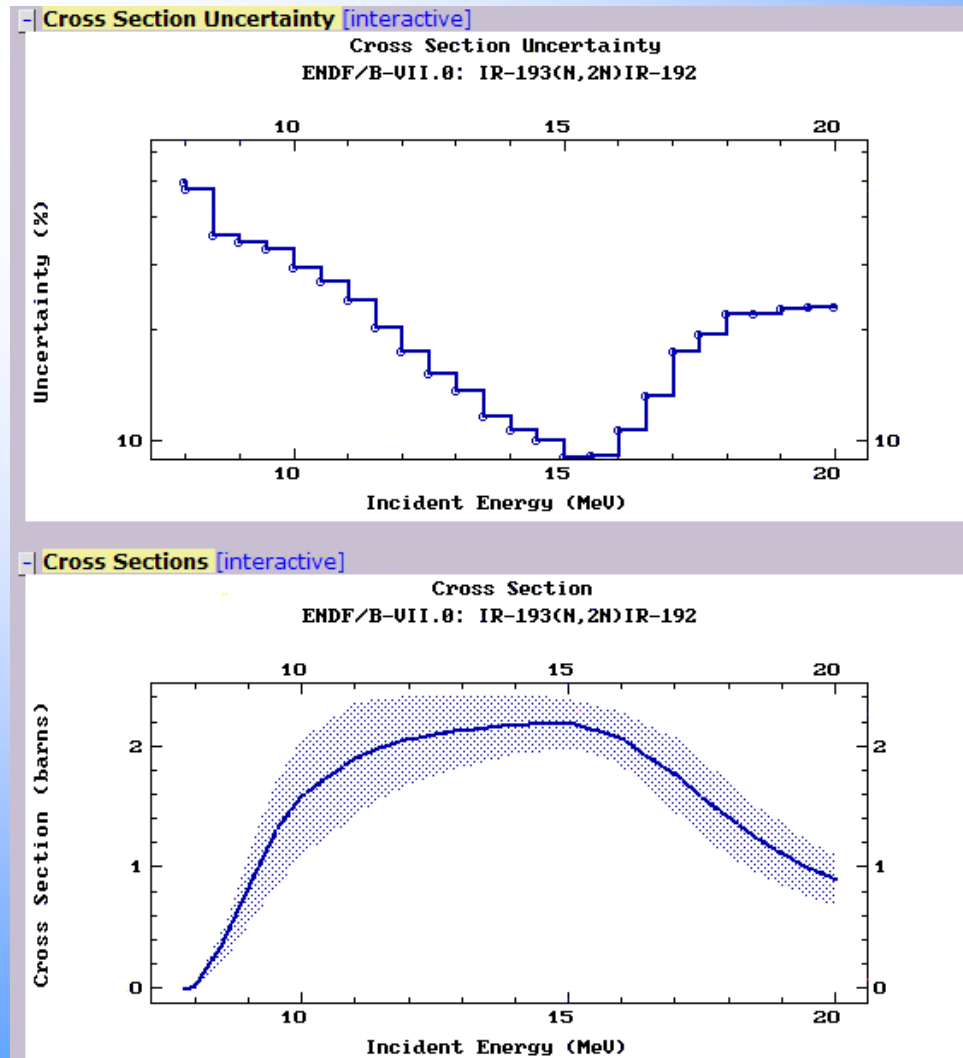
Below the table, there are "Plotting options" and "Other plots" sections. The "Plotting options" section includes a "Plot" option for cross sections with reconstructed resonances and applied Doppler broadening at 293°K = 20°C. The "Other plots" section lists options for angular distributions ($d\sigma/d\Omega$), energy distributions ($d\sigma/dE$), double differential cross sections ($d^2\sigma/dE/d\Omega$), and cross sections with uncertainties ($\sigma \pm \Delta\sigma$). There are also links for "[Glossary]" and "[About]".

Page generated: 2010/05/07, 21:46:11 by E4-Servlet on www.nds.iaea.org
Project: "Multi-platform EXFOR-CINDA-ENDF", V.Zerkin, IAEA-NDS, 1999-2010
Request from: iaea.org (161.5.149.203)

Again ENDF Output Form with interactive ZVView plotting



Display Cross Section and Uncertainty



Correlation matrix

#ZVView-data-copy: 7-May-2010 22:13:17

#

#LB5:Symmetric Matrix

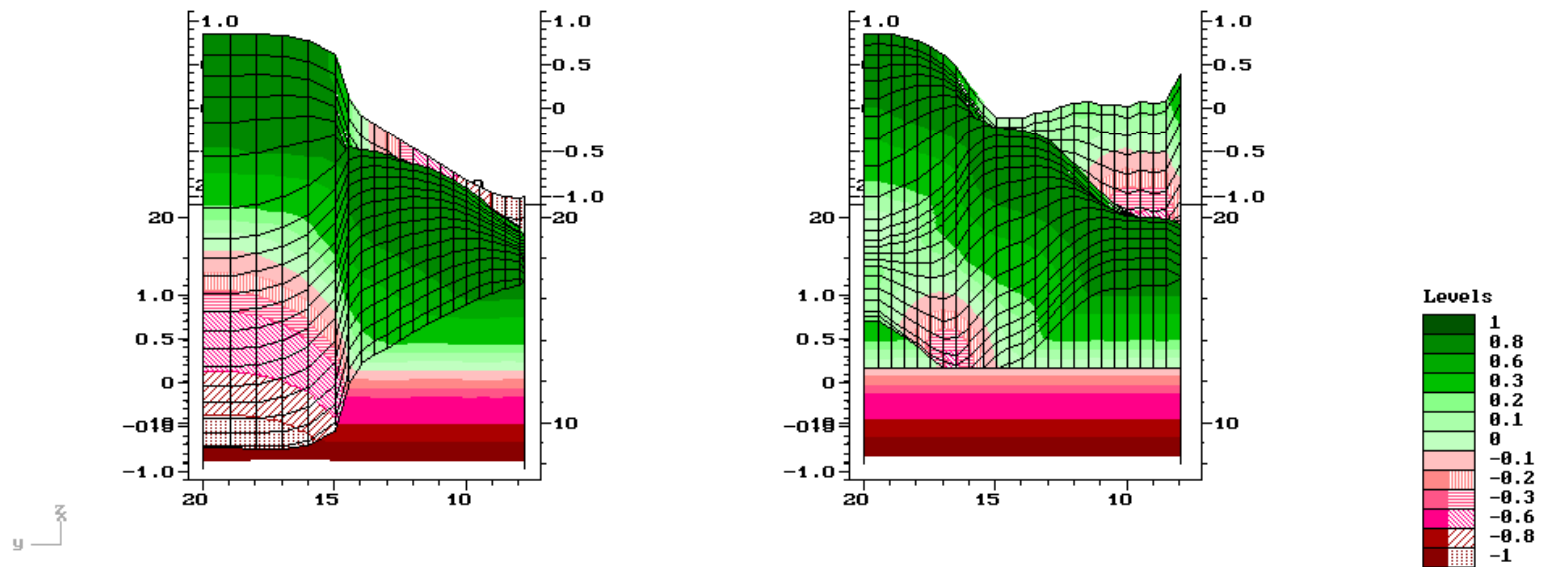
Z(26x26): $Z_{i,j} = \text{Cor}(\sigma_{X_i}, \sigma_{Y_j}) * 1000$

	X (MeV)																					
Y (MeV)	7.992	8	8.5	9	9.5	10	10.5	11	11.5	12	12.5	13	13.5	14	14.5	15	15.5	16	16.5	17	17.5	
7.992	1000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	0	1000	930.6	920.5	926.4	898.3	895.5	866.7	805.2	679.6	529.7	352.7	210.1	101.7	52	-17.93	-85.39	-125.4	-97.66	-12.27	102.2	102.2
8.5	0	930.6	1000	999.4	998.7	992	980.3	943.8	866.1	730	583.1	404.7	257.4	156.3	107.4	27.05	-112	-269.4	-344.3	-309.5	-21	-21
9	0	920.5	999.4	1000	999.4	995.4	984.9	950.7	875.7	743.4	600.1	424.6	278.7	179	130.3	49.66	-93.97	-260.9	-346.6	-318.8	-23	-23
9.5	0	926.4	998.7	999.4	1000	996.5	989	959.1	889.9	763.2	623.2	450.2	305.7	205.7	156.7	76.36	-64.34	-228.8	-315.5	-289.6	-20	-20
10	0	898.3	992	995.4	996.5	1000	996	973.3	912.2	796.1	666	500.7	360	263.3	214.3	133.4	-17.89	-205.1	-318.8	-310.8	-23	-23
10.5	0	895.5	980.3	984.9	989	996	1000	989.8	944.9	846.1	727.6	571.9	436.3	340.7	291.4	211.4	64.16	-124.1	-248.4	-251.3	-18	-18
11	0	866.7	943.8	950.7	959.1	973.3	989.8	1000	981.8	912.9	816.6	679.8	555.3	464.3	415.4	338.2	196.2	2.736	-143.1	-167.2	-12	-12
11.5	0	805.2	866.1	875.7	889.9	912.2	944.9	981.8	1000	973.5	909.6	802.9	697.6	615.5	569.6	498.9	370.6	179.7	12.5	-37.4	-15	-15
12	0	679.6	730	743.4	763.2	796.1	846.1	912.9	973.5	1000	980	916.6	840.9	775.5	736.4	677	566.6	378.6	184.9	101.2	89.5	89.5
12.5	0	529.7	583.1	600.1	623.2	666	727.6	816.6	909.6	980	1000	977.7	931.2	884.7	854	806.6	710	521.5	303.1	188.5	145	145
13	0	352.7	404.7	424.6	450.2	500.7	571.9	679.8	802.9	916.6	977.7	1000	986.9	962.5	942.9	910.7	834.6	656.1	423	282.1	205	205
13.5	0	210.1	257.4	278.7	305.7	360	436.3	555.3	697.6	840.9	931.2	986.9	1000	993.3	983.2	964.1	907.5	744	508.5	352.6	260	260
14	0	101.7	156.3	179	205.7	263.3	340.7	464.3	615.5	775.5	884.7	962.5	993.3	1000	997.2	987.1	939.2	779.5	538.1	370.7	265	265
14.5	0	52	107.4	130.3	156.7	214.3	291.4	415.4	569.6	736.4	854	942.9	983.2	997.2	1000	995.7	955.3	801.6	561.7	391.1	280	280
15	0	-17.93	27.05	49.66	76.36	133.4	211.4	338.2	498.9	677	806.6	910.7	964.1	987.1	995.7	1000	974.7	838.5	608.2	436.4	320	320
15.5	0	-85.39	-112	-93.97	-64.34	-17.89	64.16	196.2	370.6	566.6	710	834.6	907.5	939.2	955.3	974.7	1000	938.2	766.4	616.6	504	504
16	0	-125.4	-269.4	-260.9	-228.8	-205.1	-124.1	2.736	179.7	378.6	521.5	656.1	744	779.5	801.6	838.5	938.2	1000	940.4	846	757	757
16.5	0	-97.66	-344.3	-346.6	-315.5	-318.8	-248.4	-143.1	12.5	184.9	303.1	423	508.5	538.1	561.7	608.2	766.4	940.4	1000	975.3	925	925
17	0	-12.27	-309.5	-318.8	-289.6	-310.8	-251.3	-167.2	-37.4	101.2	188.5	282.1	352.6	370.7	391.1	436.4	616.6	846	975.3	1000	985	985
17.5	0	102.2	-218.3	-231.9	-204.5	-237.7	-187.3	-121.3	-15.88	89.5	145.9	209.9	260.8	265	280.8	320.3	504	757	925.6	985	1000	1000
18	0	232.8	-97.99	-115	-89.67	-132.7	-91.32	-43.15	37.07	107.8	132.1	163.8	192	180.9	191.1	221.6	399.2	660.3	855	943.2	985	985
18.5	0	340.4	11.1	-7.856	15.59	-33.54	0.5162	34.56	94.08	136.6	134.9	139.9	148.8	125.4	130.9	153.2	320.2	577.8	784.5	891.4	954	954
19	0	437.7	118.1	98.15	119.9	67.18	95.14	117.5	159.2	177.2	153.3	134.5	125.5	91.08	92.11	106.2	258.6	504.7	713.4	832.6	912	912
19.5	0	531.8	225.4	204.6	224.2	168.1	189.1	198.8	221.2	213.4	166.6	123.4	96.14	50.83	47.22	52.25	188	419.2	628.5	759.1	854	854
20	0	531.8	225.4	204.6	224.2	168.1	189.1	198.8	221.2	213.4	166.6	123.4	96.14	50.83	47.22	52.25	188	419.2	628.5	759.1	854	854
i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21

IR-193(n,2n)IR-192

TENDL-2008 vs. ENDF-B/VII.0

ENDF Request 2777, 2010-May-07,21:48:27
ENDF/B-VII.0: IR-193(N,2N)IR-192



EXFOR data correction system (re-normalization system)

Main ideas:


- 1) to re-normalize data using **old monitors** and **new standards**
- 2) to re-normalize data using decay data
- 3) to create a convenient tool for data modifications: multiply data to a factor, correct wrong units, set up uncertainties, delete part of a data set, recalculate data using isotope abundances, etc.

Final goals:

- 1) to re-normalize data from EXFOR **automatically** (using EXFOR information)
- 2) to collect experts' corrections to a database
- 3) to re-normalize data using **experts' corrections database**
- 4) to have Web system offering and implementing automatic, experts' and user's corrections in optional, semi-automatic and interactive modes
- 5) to generate and distribute renormalized data of whole EXFOR database

EXFOR data correction system (re-normalization system)

Stages of development

1. Start: November 2009
2. Define **concept** of the system, basic algorithms
3. Invent **syntax** describing corrections
4. Define structure and **implement programs**
5. Collect **archive of old monitors** used in EXFOR works and modern data
6. Collect corrections applied by experienced evaluators,
create **database of corrections**
7. Create software for **automatic re-normalization**
8. Create database with corrections
- 2013  9. Create Web interface for using automatic correction-database
10. Extend Web interface to use experts' correction-database
11. Create software to generate re-normalized XC4 for full EXFOR in C4
12. Start distributing renormalized RXC4 to former SG30 members
13. Etc.

“Manual” and “automatic” corrections

“Manual” corrections are based user’s knowledge and experience – therefore can include **subjective** judgment.

We are going to collect **database** of experts’ corrections.

“Automatic” corrections are based on the information given in EXFOR file: keywords MONITOR and MONIT-REF, monitor data in the DATA and COMMON sections.

This method is **objective**.

It needs “clever” EXFOR software.

Both methods need:

- archive of old monitors
- library of “recommended” monitors (standards)
- software, database, information, Web support
- participation of nuclear data experts

“Manual” corrections

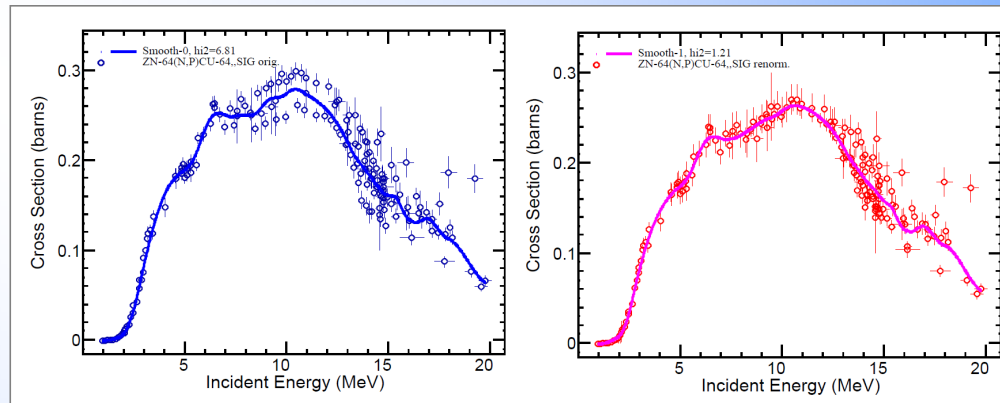
Example of manual corrections (K. Zolotarev, 2011, IPPE, Russia):

```
10224003          # 1972 D.C.Santry+
                  #measurements with T(p,n)He3 neutron source
                  #monitor S32(n,p)P32 reaction
a0=0.91582;       #experimental data were renormalized to the integral of
                  #cross-section calculated from experimental data of Mannhart
                  #and Schmidt 2007 in the overlapping energy
                  #range 1.500 - 3.958 MeV, a0=0.91582
a1=0.0115;       #error in b+ mode in Cu64 decay - 1.15%
a2=0.03;         #error in normalization value - 3%
a3=0.03;         #error in angular neutron intensity - 3%
m0: [en,monit];  #old cs for S32(n,p)P32 monitor reaction
m1: rrdf10 $ s32np; #new cs for S32(n,p)P32 monitor reaction
c1=dml/m1;       #relative error in new cs for S32(n,p)P32 monitor reaction
dy=dy/y;         #relative uncertainty in original cs for Zn64(n,p)Cu64 reaction
fc=m1/m0*a0;     #total correction factor
y=y*fc;         #correction exp. cs
dy=dy^2+c1^2+a1^2+a2^2+a3^2; #determination the quadrature of new total error
dy=dy^0.5*y;    #determination the absolute error in new Zn64(n,p) cs

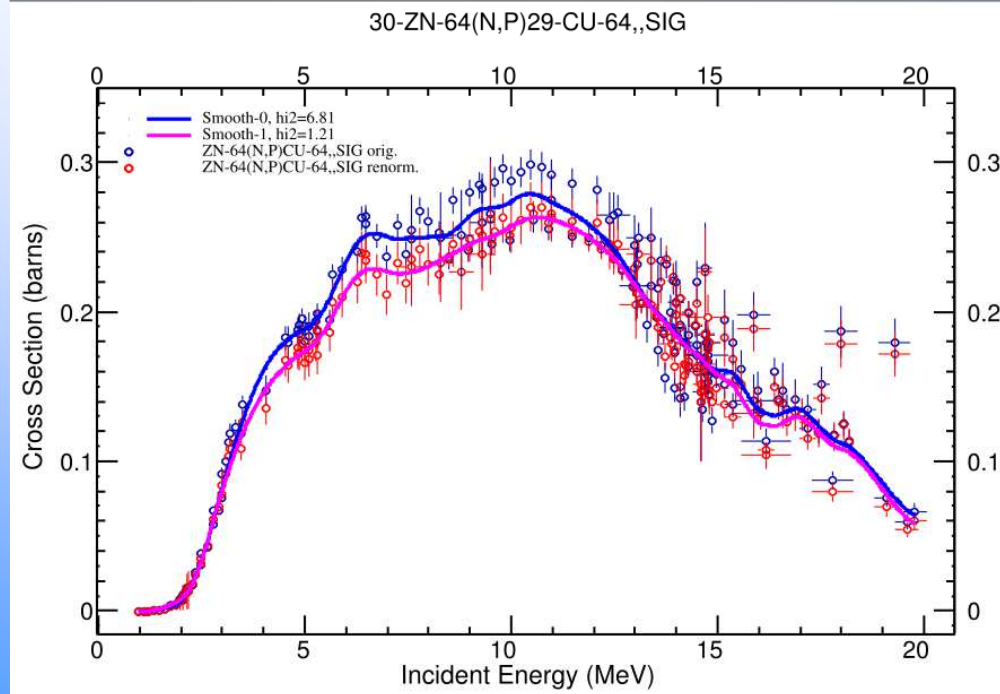
12956003          #1975 R.Spangler+
m0: [en,monit];  #old cs for Al27(n,a)Na24 monitor reaction
m1: rrdf10 $ al27na; #new cs for Al27(n,a)Na24 monitor reaction
a=0.380/0.348;   #correction to new 511 keV gamma-yield per decay Cu-64
fc=m1/m0*a;      #total correction factor
y=y*fc;         #correction exp. cs
dy=dy*fc;       #correction abs. uncertainty in renorm. cs
```


Example of “manual” corrections results

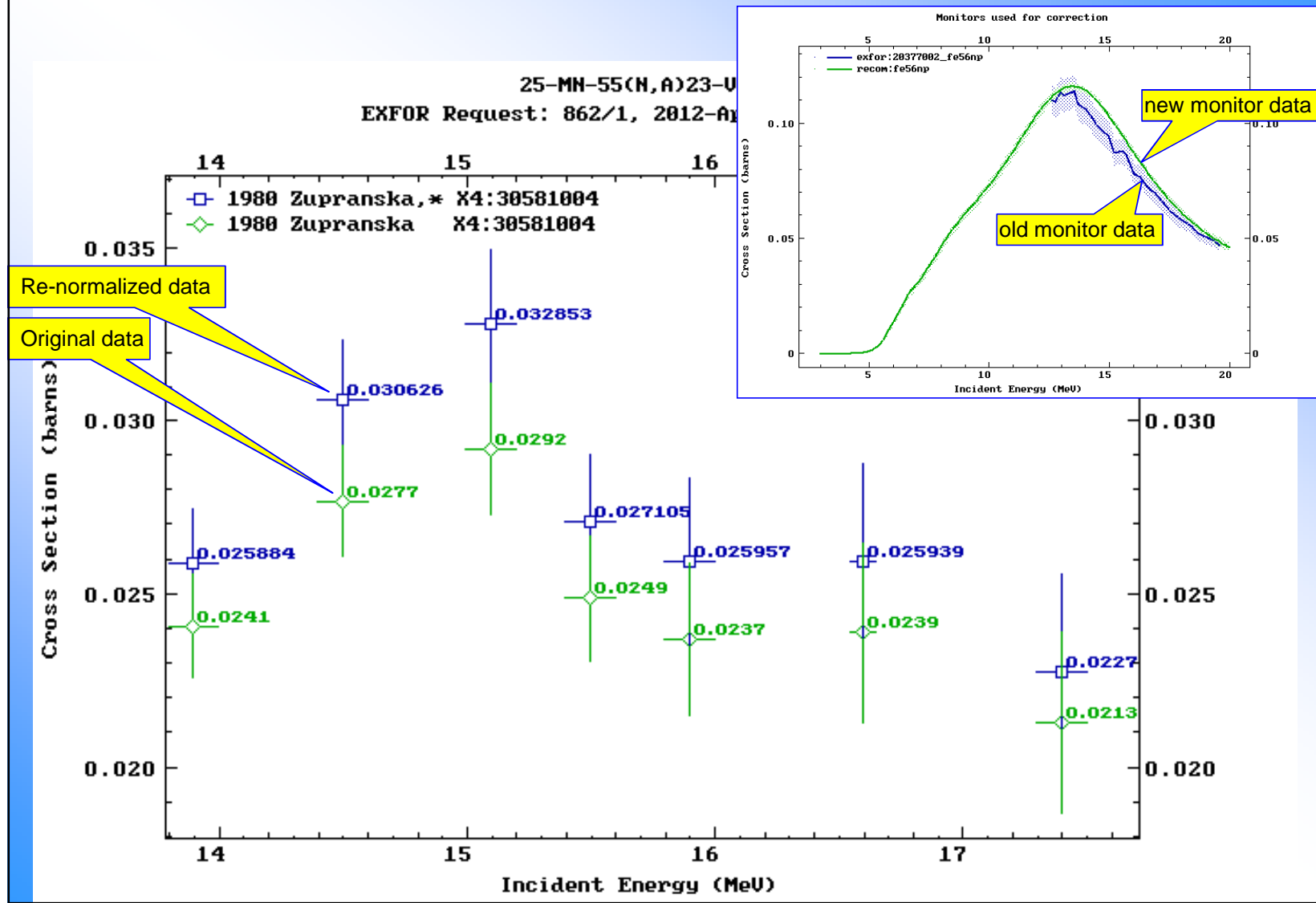
Before



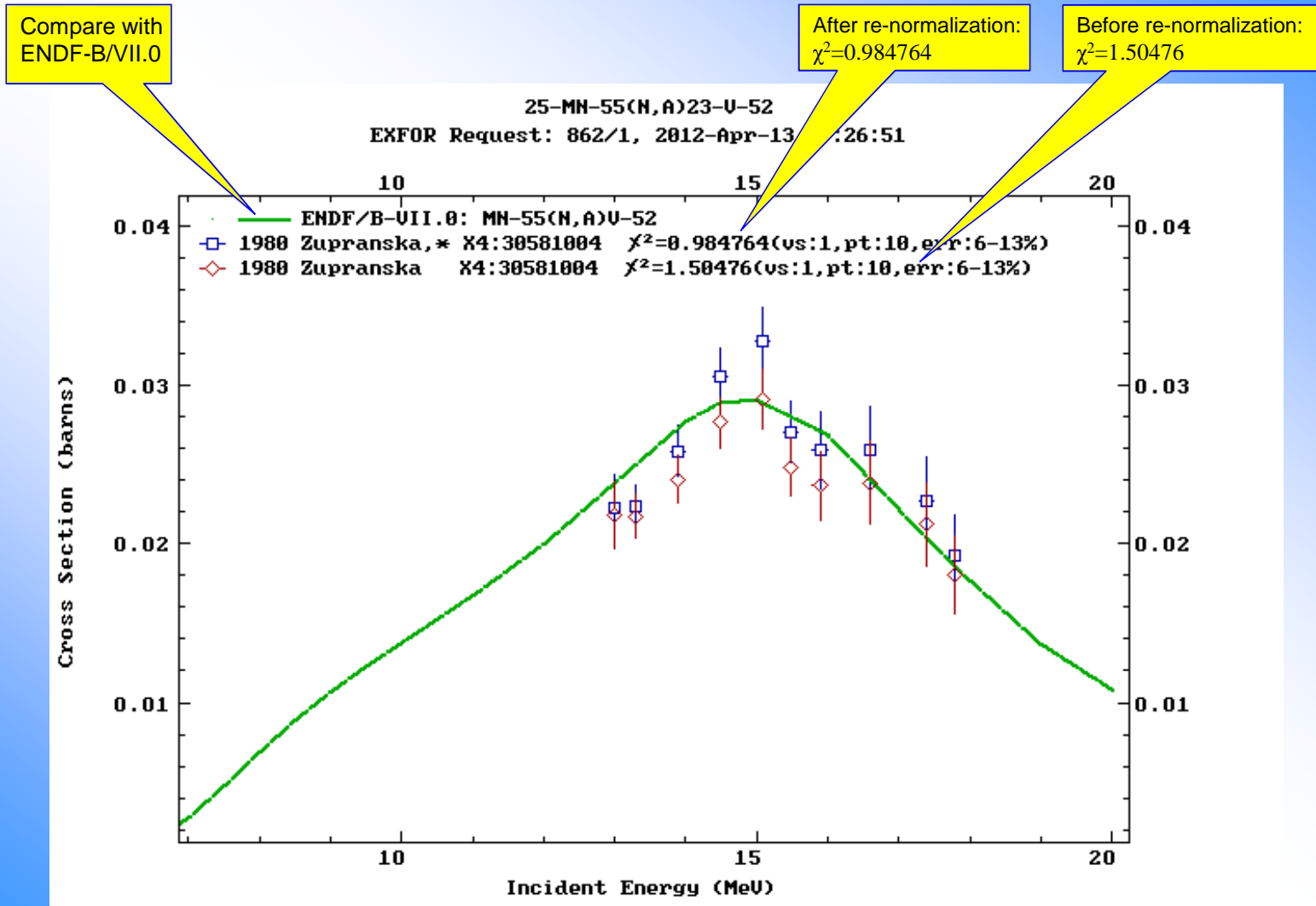
After



Automatic data re-normalization: an example



Automatic data re-normalization: comparing to ENDF



Summary

1. EXFOR Web retrieval system offers data correction service:
 - trivial to use in automatic mode
 - has expert, interactive, semi-automatic modes
 - provides checking of data and monitors
2. Auto-correction database (datasets):
 - ready: 4,230 (6% of all CS data)
 - monitor' renormalization possible: 11,429 (16%)
 - cross-sections: 68,555 (100%); all database: 147,599 datasets
3. Archive of old and new monitors: 43 files today

Nuclear Reaction Software Mosaic

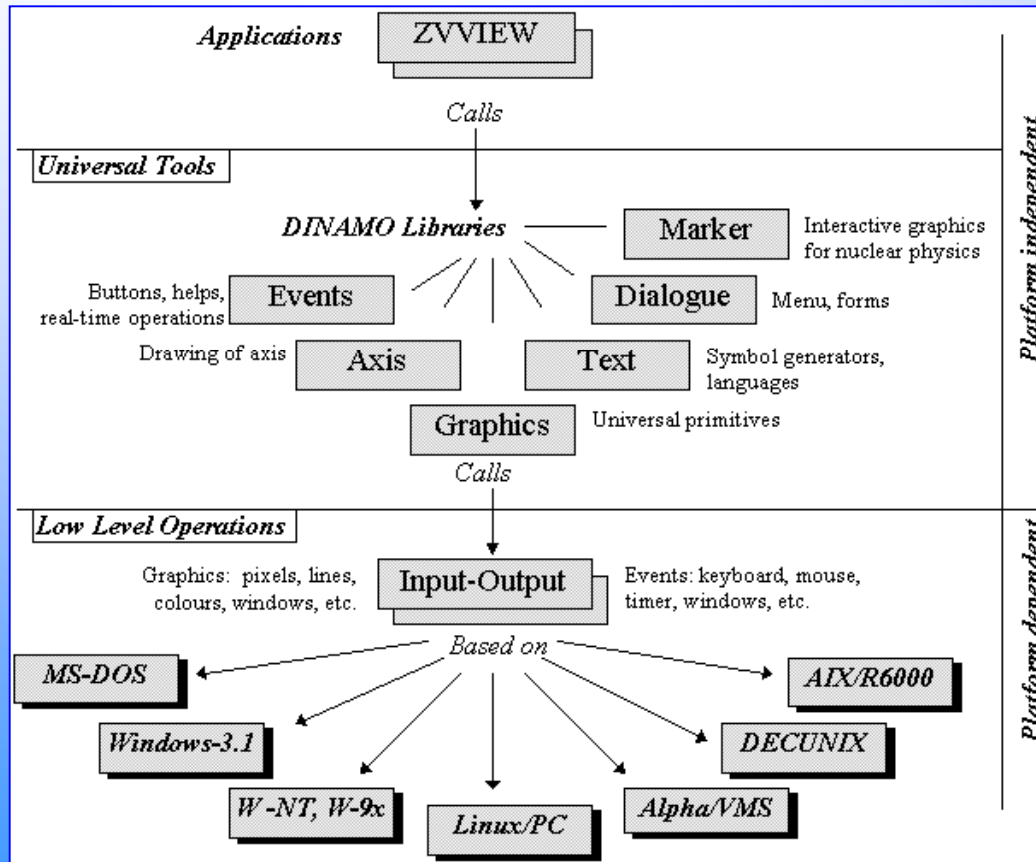
- Modularity and robustness
- Re-using modules
- Preserving knowledge



ZVView/DINAMO: interactive plotting

ZVView is a multi-platform software designed for nuclear reactions data evaluators to perform efficient interactive visual analysis of cross section data retrieved from EXFOR and ENDF libraries. Kiev-Vienna, 1993-2013

<http://www-nds.iaea.org/public/zvview/>



Platforms:

1. MS-Windows
2. Linux (X-Windows)
3. Mac OSX (X11)

Old platforms:

4. Alpha/VMS
5. DEC Unix
6. AIX/R6000
7. Windows-3.1
8. MS-DOS

Output:

1. Screen (Windows)
2. PostScript (PS, EPS)
3. Enhanced Metafile (EMF)
4. PCX
5. GIF, Animated-GIF

Basic ideas:

1. Language: C
2. Self-made GUI, PS, PCX, GIF
3. Low level API's (MS-Win, X11)
4. Max platform-independency
5. Minimalistic approach

Plotting system on the basis of DINAMO library

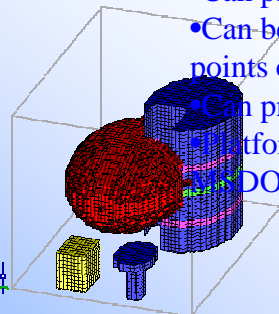
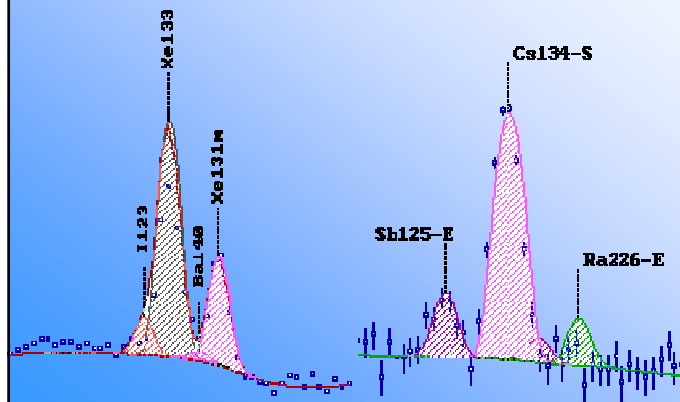
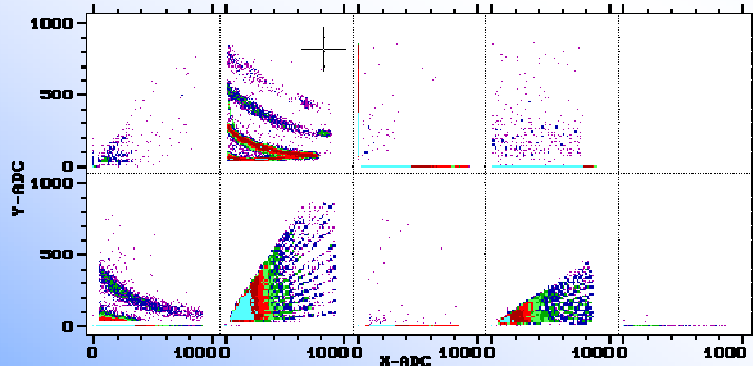
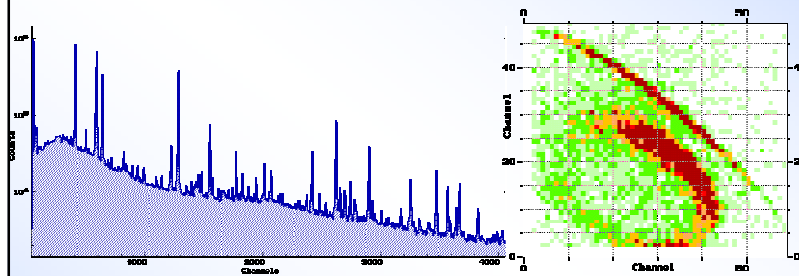
DINAMO: universal library of C subroutines for interactive plotting in nuclear research (1993-1999).

Graphics tools for nuclear research:

- Experiments (online, 1D, 2D histograms)
- Treatment experimental results
- Plotting analytical functions

Features:

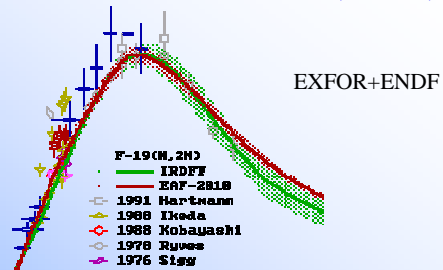
- Works with functions: y , $y(x)$, $z(x,y)$
- Plots many functions
- Data can be given in arrays (I2, I4, R4, R8) and can be calculated on the fly - calibration $getx(i)$, external functions (gamma-lines, Gaussians with background)
- Uncertainties can be given in arrays or calculated: per-cent, $\sqrt{\text{counts}}$, constant, etc.
- Display regimes: lin/log of x/y , interpolations (histograms/lin-lin), error bars/cloud/pipe, one-many windows, MOV/XOR, etc.
- Can plot maps, contours, 3D and animated 3D of $z(x,y)$
- Can be used for identify lines for different isotopes, data points of different authors and publications
- Can produce pcx , gif , ps/eps , emf , $animated-gif$
- Platforms: MS-Windows, Linux, Mac-OSX; old versions: DOS, VMS, DEC-UNIX, RS6000



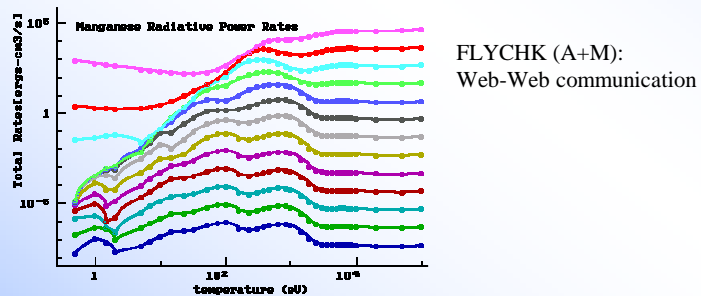
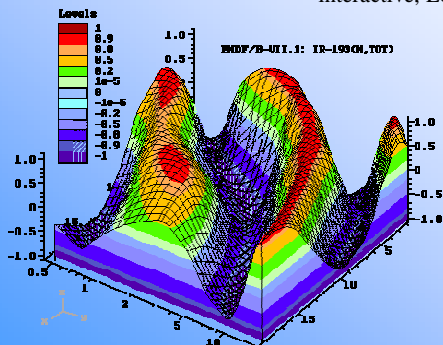
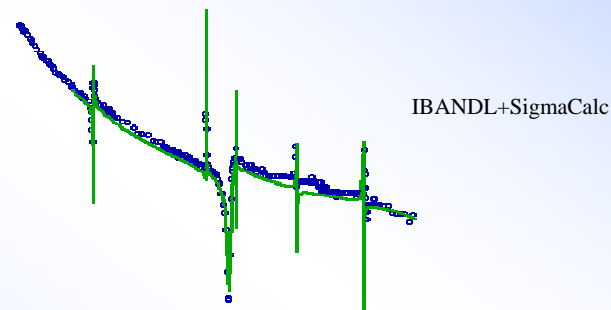
ZVView: interactive plotting program for display and analysis of nuclear data

Features:

- All features inherited from DINAMO;
- Integrated with Empire, EndVer, EXFOR CD-ROMs.
- Works on Web: integrated with EXFOR-ENDF database retrieval systems, IBANDL, SigmaCals, LiveChart: can read data from remote archives, can be called as part of external Web service, etc.
- Reads nuclear data formats: TABLE/XREF, ENDF-MF3/MF40/MF33(Law5);
- Can read data from text files(columns): {y}; {x y}; {x y dy}; {x y dy dx}; {x y +dy -dy +dx -dx}; {x} {y} z{};
- Understands ENDF interpolation laws, can display ratios to selected curve
- Can do some least squared fitting, displays χ^2 (EXFOR-ENDF)
- Can work with authors: filter data, select, legend etc.

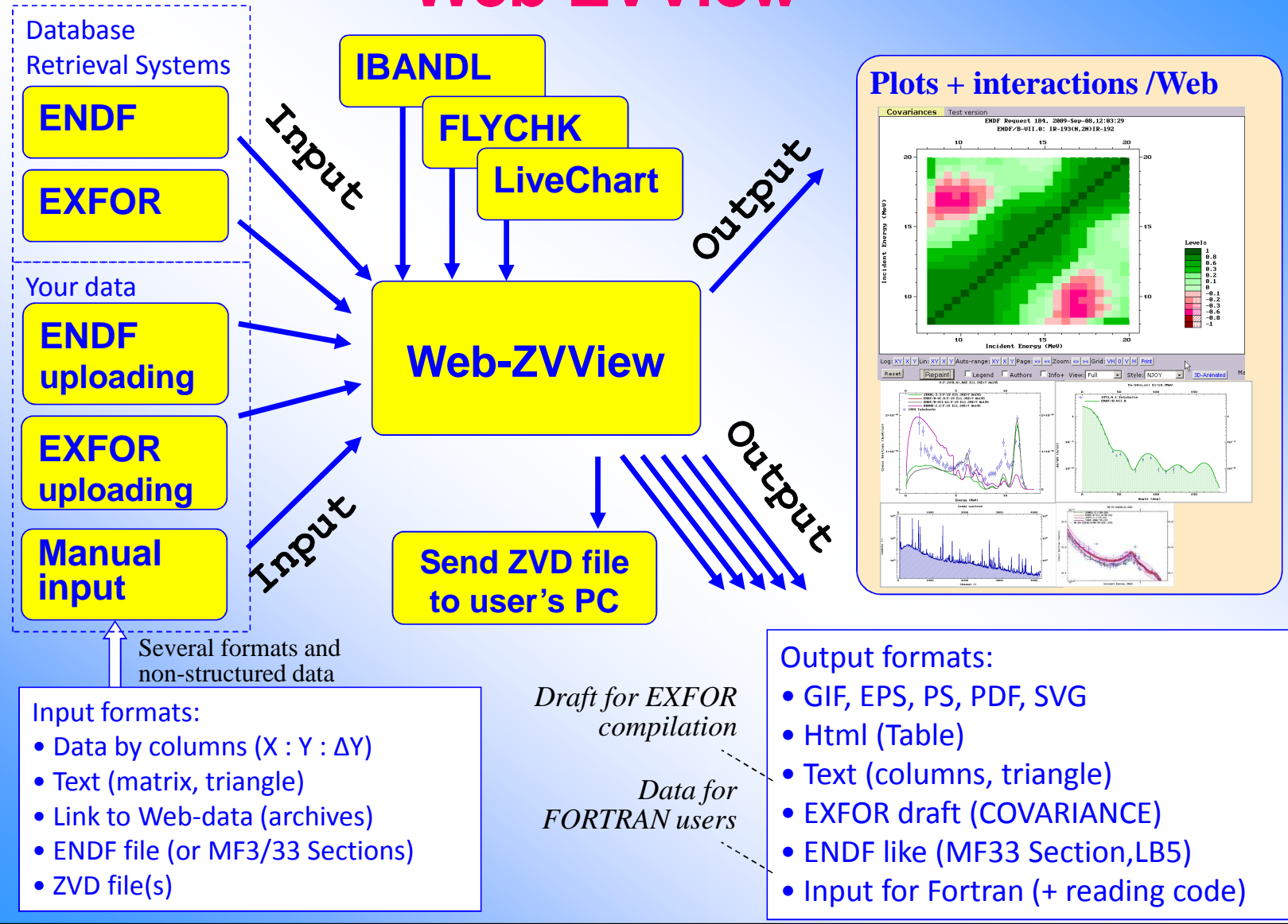


ENDF/MF33: Web,
interactive, Log-Lin, animated



2009-2013

Web-ZVView



Web IBANDL calling Web-ZVView

IBANDL - Mozilla Firefox

File Edit View History Bookmarks Tools Help

nds121.iaea.org/exfor2/ibandl.htm

X4/Servlet: Select EXFOR: Experimental Nucl... X4/Servlet: Select IBANDL IBANDL

IBANDL
Ion Beam Analysis
Nuclear Data Library

Nucleus
C-13

Projectile
 p
 d
 ³He
 α
 ⁶Li
 ⁷Li

Type of data
 EBS
 NRA
 PIGE
 All

IBANDL
[Summary]

EXFOR

Home
CD version
Updates
Nuclear Data Services

¹³C + 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	¹³ C(p,p0) ¹³ C	160	700-2500	451	2013-08-15		SigmaCalc 2.0. File created 21-6-2013	View Save	<input checked="" type="checkbox"/> mb
2	¹³ C(p,p0) ¹³ C	163.8°	2600-4990	169	2006-06-23		E. Kashy et al., Phys. Rev. 122(3) (1961) 884 »	View Save	<input type="checkbox"/> mb
3	¹³ C(p,p0) ¹³ C	160°	780-2430	96	2013-05-27		N.P.Barradas et al., to be published »	View Save	<input checked="" type="checkbox"/> rr
4	¹³ C(p,p0) ¹³ C	158.4°	450-1620	90	2011-11-22		E.Milne, Phys. Rev. 93 (1954) 762 »	View Save	<input checked="" type="checkbox"/> mb
5	¹³ C(p,p0) ¹³ C	146.5°	1630-3310	80	2011-11-22		D.Zipoy et al., Phys. Rev. 106 (1957) 793 »	View Save	<input type="checkbox"/> mb
6	¹³ C(p,p0) ¹³ C	140°	780-2430	97	2013-09-18		N.P.Barradas et al., Nucl. Instr. and Meth. B 316 (2013) 81 »	View Save	<input type="checkbox"/> rr
7	¹³ C(p,p0) ¹³ C	137°	450-1600	93	2011-11-22		E.Milne, Phys. Rev. 93 (1954) 762 »	View Save	<input type="checkbox"/> mb
8	¹³ C(p,p0) ¹³ C	124.1°	1620-3340	97	2011-11-22		D.Zipoy et al., Phys. Rev. 106 (1957) 793 »	View Save	<input type="checkbox"/> mb
9	¹³ C(p,p0) ¹³ C	121.5°	1000-2580	279	2011-08-29	X4	V.A.Latorre+(1966), Jour. Physical Review, Vol.144, p.891 »	View Save	<input type="checkbox"/> mb
10	¹³ C(p,p0) ¹³ C	116°	410-1600	88	2011-11-22		E.Milne, Phys. Rev. 93 (1954) 762 »	View Save	<input type="checkbox"/> mb
11	¹³ C(p,p0) ¹³ C	102.1°	1600-3340	82	2011-11-22		D.Zipoy et al., Phys. Rev. 106 (1957) 793 »	View Save	<input type="checkbox"/> mb
12	¹³ C(p,p0) ¹³ C	85.6°	1610-3340	85	2011-11-22		D.Zipoy et al., Phys. Rev. 106 (1957) 793 »	View Save	<input type="checkbox"/> mb
13	¹³ C(p,p0) ¹³ C	85.6°	1580-4380	75	2011-11-22		H.J.Kim,W.T.Milner and F.K.McGowan Nuclear Data Tables v.A2 (1966) 353 »	View Save	<input type="checkbox"/> mb
14	¹³ C(p,p0) ¹³ C	85.6°	430-1590	92	2011-11-22		E.Milne, Phys. Rev. 93 (1954) 762 »	View Save	<input type="checkbox"/> mb

Datasets: 13 Reactions: 1 Points: 1423 References: 7

+ Add your dataset in R33 format for plotting

+ References.

Legend:
X4 link to the dataset in EXFOR database retrieval system

Web IBANDL calling Web-ZVView

IBANDL - Mozilla Firefox

File Edit View History Bookmarks Tools Help

nds121.iaea.org/exfor2/ibandl.htm

X4/Servlet: Select EXFOR: Experimental Nucl... X4/Servlet: Select IBANDL IBANDL

IBANDL
Ion Beam Analysis
Nuclear Data Library

Nucleus
C-13

Projectile
p
d
³He
α
⁶Li
⁷Li

Type of data
EBS
NRA
PIGE
All

IBANDL
[Summary]

EXFOR

Home
CD version
Updates
Nuclear Data Services

Welcome to Web-ZVView!
Interactive plotting of IBANDL and SigmaCalc data

1) $\theta=160^\circ$ N.P.Barradas et al., to be published
2) $\theta=158.4^\circ$ E.Milne, Phys. Rev. 93 (1954) 762
3) $\theta=160^\circ$ SigmaCalc 2.0. File created 22-6-2013

¹³C(p,p₀)¹³C 158.4deg.
SigmaCalc, 13C(p,p₀)13C 160.0deg.

$\chi^2=0.681109$ (vs:1,pt:96,err:12-27%

2x10³
10³
5x10²
2x10²
10²
50

1.0 1.5 2.0 2.5

1.0 1.5 2.0 2.5

Incident Energy (MeV)

160deg c3pp01.r33 13C(p,p₀)13C
158.4deg c3pp0j.r33 13C(p,p₀)13C
160deg C-13_pp0_160000.sc 13C(p,p₀)13C

Select data for plotting [all] [none]
 1) 160deg c3pp01.r33 13C(p,p₀)13C
 2) 158.4deg c3pp0j.r33 13C(p,p₀)13C
 3) 160deg C-13_pp0_160000.sc 13C(p,
 4) Use my data [example]

See: plotted data (21Kb)

Log: XY X|Y|Lin: XY X|Y Auto-range: XY X|Y Page: << >> Zoom: << >> Grid: V|H 0|V|H| Pts: Txt Box PL Print
Reset Repaint Legend Authors Info+ PostScript Manual options:[+] Clipboard: Copy
Shift legend:x=0 y=0 Split:0 1:xy;2:y Plot data or ratio:0 0:data; 1:ratio to dataset-1; 2:ratio to 2-nd, etc.
Data for plotting: ZVD (15Kb), send to ZVView; download ZVView; upload and plot your ZVD file

Web IBANDL calling Web-ZVView

IBANDL - Mozilla Firefox

File Edit View History Bookmarks Tools Help

nds121.iaea.org/exfor2/ibandl.htm

X4/Servlet: Select EXFOR: Experimental Nucl... X4/Servlet: Select IBANDL IBANDL

IBANDL
Ion Beam Analysis
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3) $\theta=160^\circ$ SigmaCalc 2.0. File created 22-6-2013

Nucleus
C-13

Projectile
p
d
 ^3He
 α
 ^6Li
 ^7Li

Type of data
EBS
NRA
PIGE
All

IBANDL [Summary]
EXFOR

Home
CD version
Updates
Nuclear Data Services

$^{13}\text{C}(p,p_0)^{13}\text{C}$ 158.4deg.
SigmaCalc, $^{13}\text{C}(p,p_0)^{13}\text{C}$ 160.0deg.

160deg c3pp0l.r33 $^{13}\text{C}(p,p_0)^{13}\text{C}$ $\chi^2=0.175079$ (vs:1,pt:15,err:12%)
158.4deg c3pp0j.r33 $^{13}\text{C}(p,p_0)^{13}\text{C}$
160deg C-13_pp0_160000.sc $^{13}\text{C}(p,p_0)^{13}\text{C}$

Select data for plotting [all] [none]
 1) 160deg c3pp0l.r33 $^{13}\text{C}(p,p_0)^{13}\text{C}$
 2) 158.4deg c3pp0j.r33 $^{13}\text{C}(p,p_0)^{13}\text{C}$
 3) 160deg C-13_pp0_160000.sc $^{13}\text{C}(p,p_0)^{13}\text{C}$
 4) Use my data [example]

See: plotted data (21Kb)

Log: XY X|Y|Lin:XY X|Y Auto-range: XY X|Y Page: << >> Zoom: << >> Grid: V|H 0|V|H Pts: Txt Box PL Print
 Reset Repaint Legend Authors Info+ PostScript Manual options:[+] Clipboard: Copy
 Shift legend:x=0 y=8 Split:0 1:xy;2:y Plot data or ratio:0 0:data; 1:ratio to dataset-1; 2:ratio to 2-nd, etc.
 Data for plotting: ZVD (15Kb), send to ZVView; download ZVView; upload and plot your ZVD file

Thank you.