The Abdus Salam International Centre for Theoretical Physics

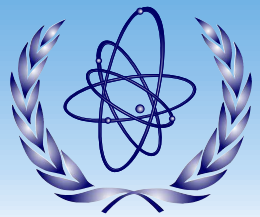
2495-01

Joint ICTP-IAEA Workshop on Nuclear Data for Analytical Applications

21 - 25 October 2013

Introduction to IAEA Nuclear Data Section and the Nuclear Data Programme

Paraskevi (Vivian) Dimitriou
IAEA, Vienna
Austria



International Atomic Energy Agency

Introduction to IAEA Nuclear Data Section and the Nuclear Data Programme

Paraskevi (Vivian) Dimitriou
Nuclear Data Section,
Division of Physical and Chemical Sciences,
Department of Nuclear Sciences and Applications,
IAEA, Vienna, Austria

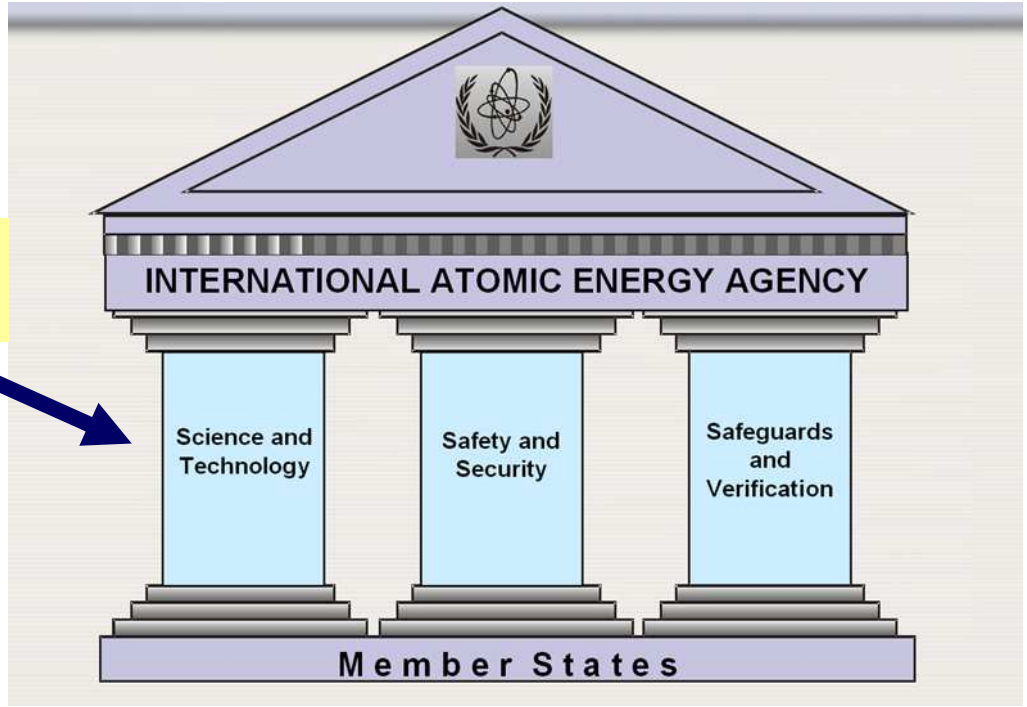
Outline

- Introduction to IAEA
- Nuclear Data Section
  - Mission
  - Units
  - Staff
  - Services
- Nuclear Data Programme
  - Nuclear Reaction Data
    - Medical Applications
    - Reference Input Parameter Library
    - Reactor Dosimetry Library
    - Compilation-EXFOR-Nuclear Reaction Data Centres Network
  - Nuclear Structure and Decay Data
    - LiveChart of Nuclides
    - Nuclear Structure & Decay Data Network
    - NDS-IAEA NEW Android App

International Atomic Energy Agency

- **Mandate to promote and support the safe, secure and peaceful application of nuclear technologies**

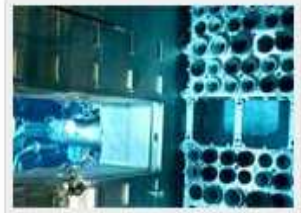
Nuclear Sciences and Applications



Departments/Divisions

IAEA Departments

Nuclear Applications



The Department of Nuclear Sciences and Applications helps countries use nuclear and isotopic techniques to promote sustainable development objectives in agriculture, human health, water resource management, marine environment and industrial applications. Read more →

Nuclear Energy

The Department of Nuclear Energy fosters the efficient and safe use of nuclear power by supporting nuclear programmes around the world, catalyzing innovation and building capability in energy planning, analysis, and nuclear information and knowledge. Read more →

Safety & Security

The Department of Nuclear Safety and Security works to provide a strong, sustainable and visible global nuclear safety and security framework, protecting people and the environment from the harmful effects of ionizing radiation. Read more →

Safeguards

The Department of Safeguards carries out the duties and responsibilities of the IAEA as the world's nuclear inspectorate, performing anindispensable role in global efforts to stop the spread of nuclear weapons. Read more →

Technical Cooperation

The Department of Technical Cooperation helps countries to improve their scientific and technological capabilities in the peaceful applications of nuclear technology, thus contributing to sustainable development. Read more →

Food and Agriculture
Human Health
Programme of Action for Cancer Therapy - PACT
Environment
Water Resources
Radioisotope Production and Radiation Technology
Nuclear Science
Nuclear Sciences and Applications
› Division of Physical and Chemical Sciences
Industrial Applications and Chemistry
Isotope Hydrology
Nuclear Data
Physics
Hydrology Laboratory
› Resources
Water Resources
Nuclear Data Services
Division of Physical and Chemical Sciences
Nuclear technologies contribute in many ways to the health, prosperity and security of both the developed and developing countries. The effective development of new nuclear technologies and the safe and economical maintenance of existing technologies both rely on a thorough understanding of the underlying physical and chemical processes.
The Division of Physical and Chemical Sciences (NAPC), located within the IAEA Department of Nuclear Sciences and Applications (NA), is responsible for carrying out Agency activities to assist and advise Member States (MS) in assessing their needs for capacity building and research and development in the nuclear sciences, as well as in supporting the MS activities for deriving benefits in specific fields, including:
Atomic, molecular and nuclear data
Nuclear and radiation techniques, their applications and allied instrumentation
Utilization of research reactors and particle accelerators
Radioisotopes and radiopharmaceuticals
Radiation processing applications
Radiation technology and isotopic tracers for industrial processes
Isotope hydrology and water resources management
Nuclear fusion
› Mission & Role
About NA
› Upcoming Events
Positron Emission Tomography in Research and Diagnostics 16-19 May2012 Warsaw

Nuclear Data Section

- **responsible for the development and dissemination of atomic and nuclear data for applications**

Scientists in developing countries are assisted in their evolution of local capabilities for the generation and application of atomic and nuclear data through an active programme of technology transfer activities which include

-Data compilation and evaluation

-Data services, Data Networks and User Support (documents, CDs)

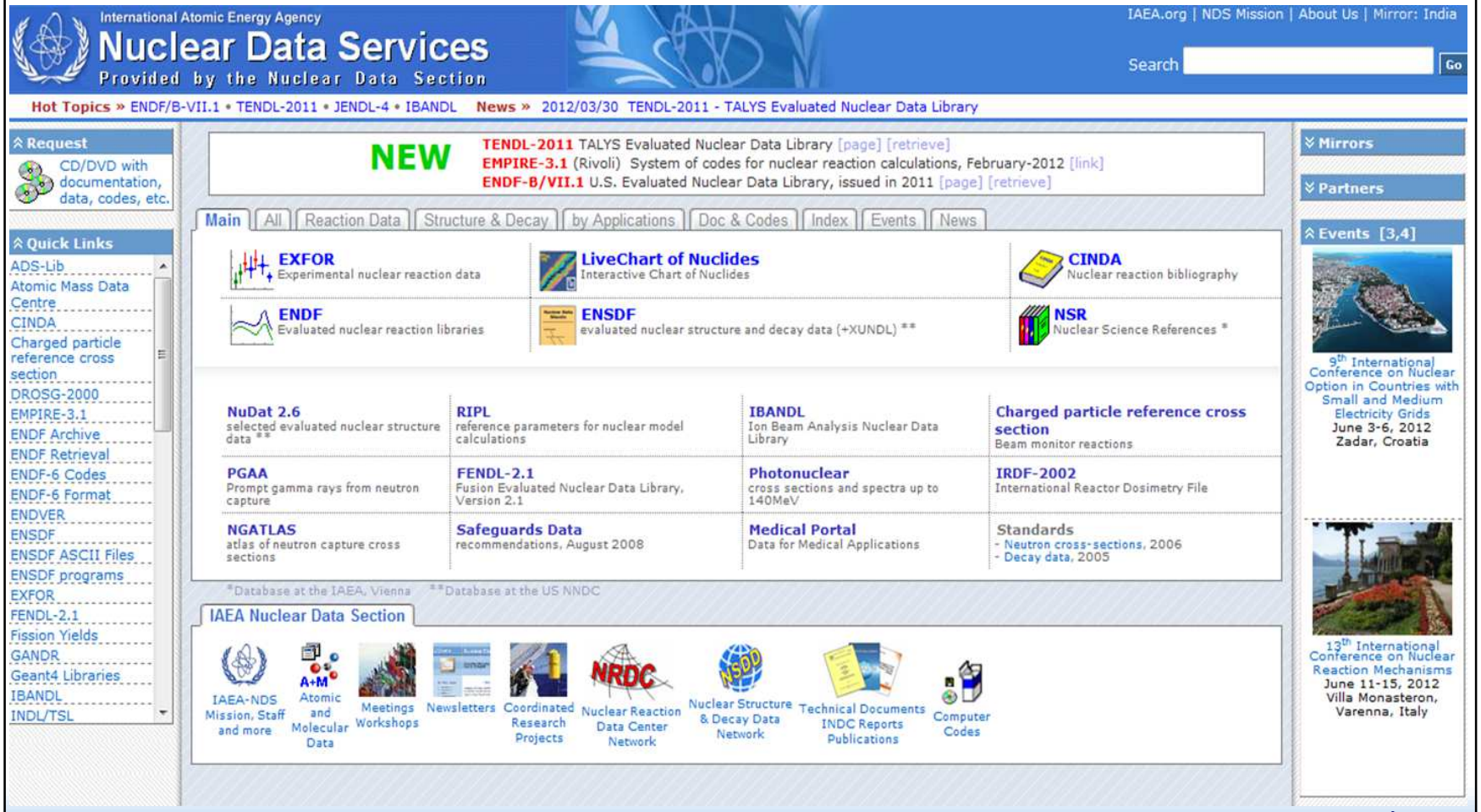
-Nuclear Data Standards and Evaluation Methods

Nuclear Data

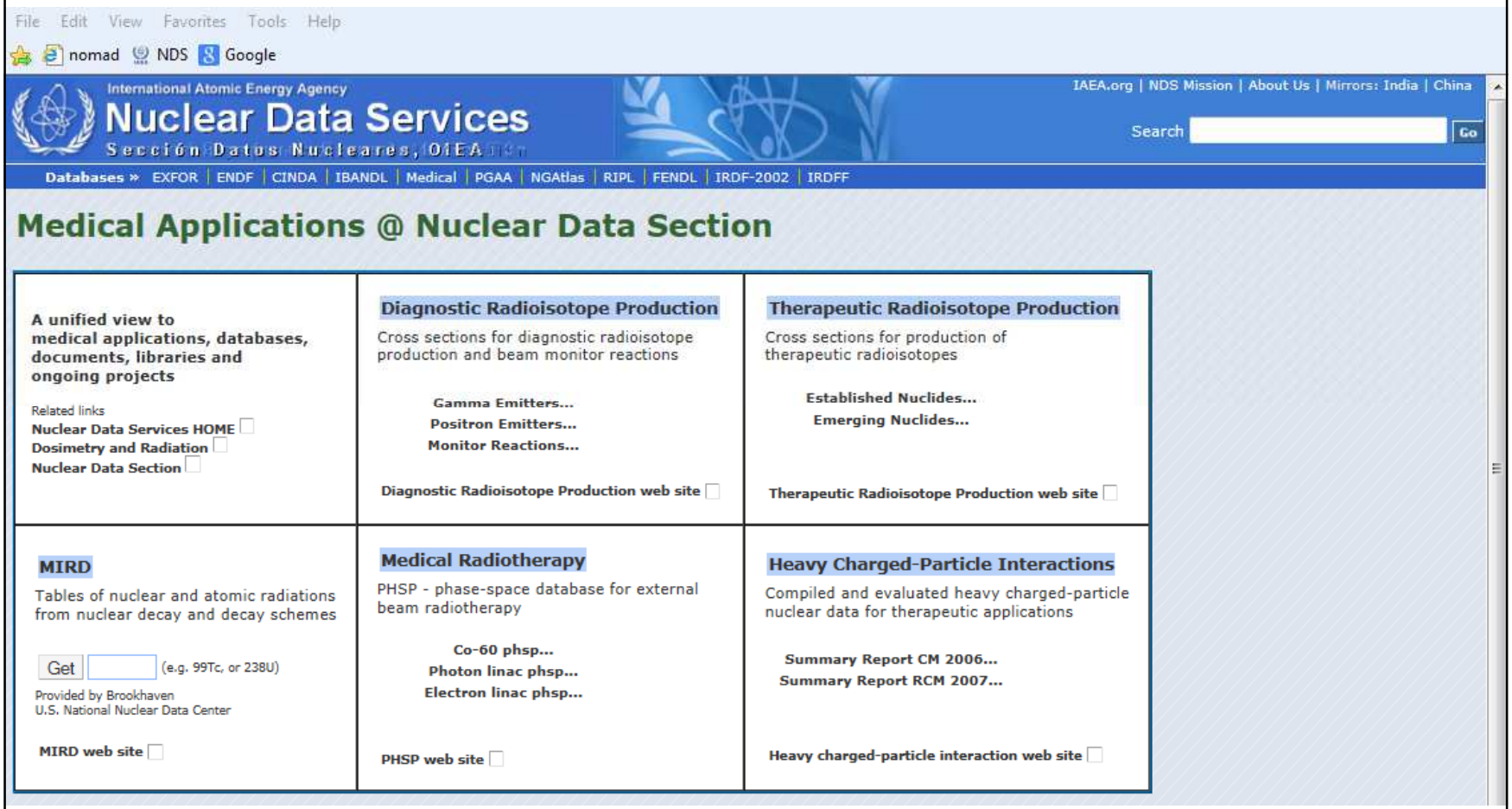
- energy-dependent reaction probabilities (cross sections)
- energy and angular distributions of reaction products for many combinations of target and projectile
- atomic and nuclear properties of excited states
- nuclear structure and radioactive decay data

Nuclear Data Services Website

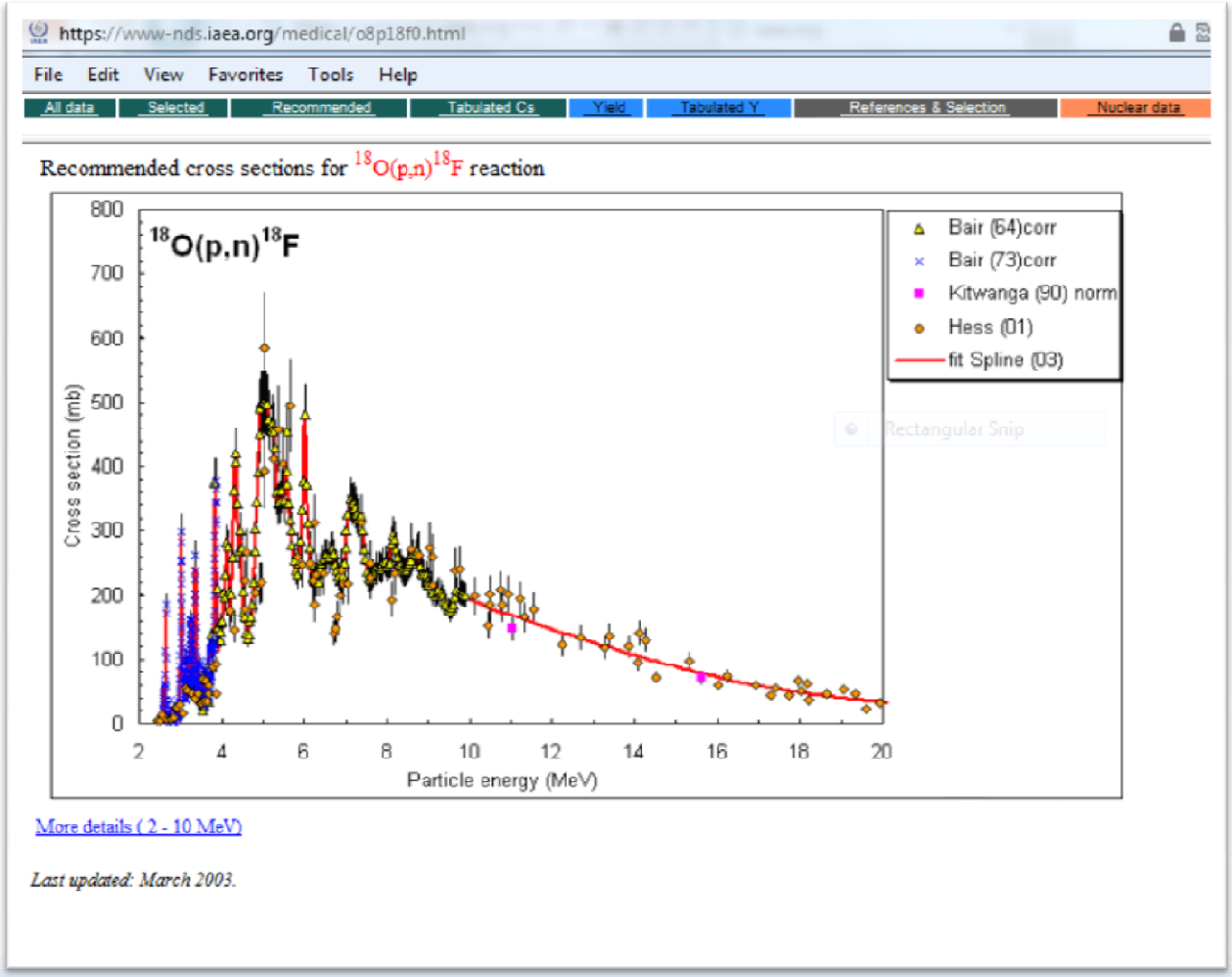
http://www-nds.iaea.org/



Medical Portal- Medical Applications



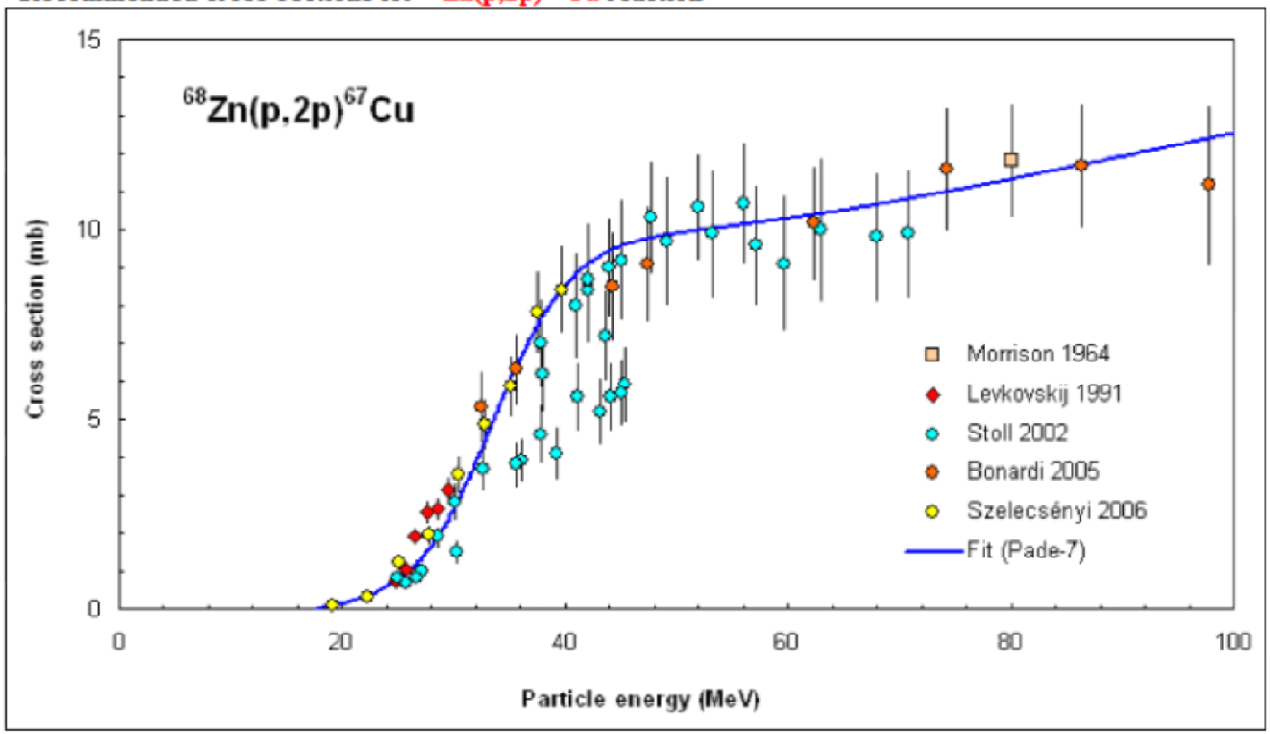
Diagnostic Radioisotope Production



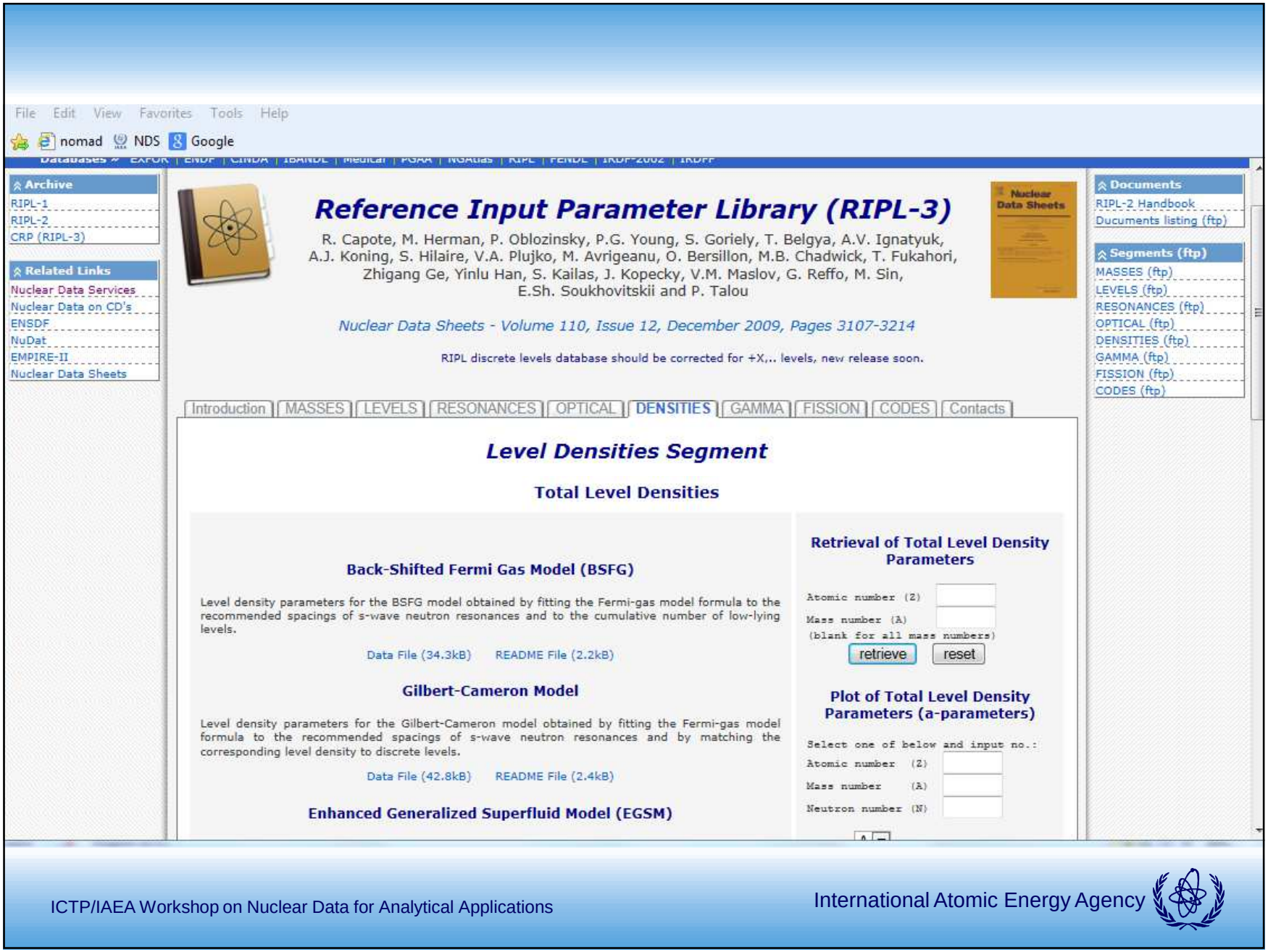
Production Cross Sections of Therapeutic Radiosotopes

All data | Selected | Recommended | Tabulated Cs | Yield | Tabulated Y | References & Selection | Nuclear data

Recommended cross sections for $^{68}Zn(p,2p)^{67}Cu$ reaction



Last updated: September 2008.


File Edit View Favorites Tools Help
nomad NDS Google
Archive
RIPL-1
RIPL-2
CRP (RIPL-3)
Related Links
Nuclear Data Services
Nuclear Data on CD's
ENSDF
NuDat
EMPIRE-II
Nuclear Data Sheets
Reference Input Parameter Library (RIPL-3)
R. Capote, M. Herman, P. Oblozinsky, P.G. Young, S. Goriely, T. Belgya, A.V. Ignatyuk, A.J. Koning, S. Hilaire, V.A. Plujko, M. Avrigeanu, O. Bersillon, M.B. Chadwick, T. Fukahori, Zhigang Ge, Yinlu Han, S. Kailas, J. Kopecky, V.M. Maslov, G. Reffo, M. Sin, E.Sh. Soukhovitskii and P. Talou
Nuclear Data Sheets - Volume 110, Issue 12, December 2009, Pages 3107-3214
RIPL discrete levels database should be corrected for +X,.. levels, new release soon.
Introduction MASSES LEVELS RESONANCES OPTICAL DENSITIES GAMMA FISSION CODES Contacts
Level Densities Segment
Total Level Densities
Back-Shifted Fermi Gas Model (BSFG)
Level density parameters for the BSFG model obtained by fitting the Fermi-gas model formula to the recommended spacings of s-wave neutron resonances and to the cumulative number of low-lying levels.
Data File (34.3kB) README File (2.2kB)
Gilbert-Cameron Model
Level density parameters for the Gilbert-Cameron model obtained by fitting the Fermi-gas model formula to the recommended spacings of s-wave neutron resonances and by matching the corresponding level density to discrete levels.
Data File (42.8kB) README File (2.4kB)
Enhanced Generalized Superfluid Model (EGSM)
Retrieval of Total Level Density Parameters
Atomic number (Z)
Mass number (A)
(blank for all mass numbers)
retrieve reset
Plot of Total Level Density Parameters (a-parameters)
Select one of below and input no.:
Atomic number (Z)
Mass number (A)
Neutron number (N)
Documents
RIPL-2 Handbook
Ducuments listing (ftp)
Segments (ftp)
MASSES (ftp)
LEVELS (ftp)
RESONANCES (ftp)
OPTICAL (ftp)
DENSITIES (ftp)
GAMMA (ftp)
FISSION (ftp)
CODES (ftp)

IAEA.org
International Atomic Energy Agency

- Nuclear Data
  - IAEA Nuclear Data Services Home Page
- STANDARDS
  - HOME
  - Technical Report
- Downloads
  - Numerical data
  - Codes and Programs
  - Test cases
  - Most recent calculations
- Documents
  - Documents and Reports
- Plots
  - PDF Plot files

UPDATING...

- On-going ...
  - IAEA Project
- CM 2008
  - INDC(NDS)-0540 doc
- CM 2010
  - Presentations

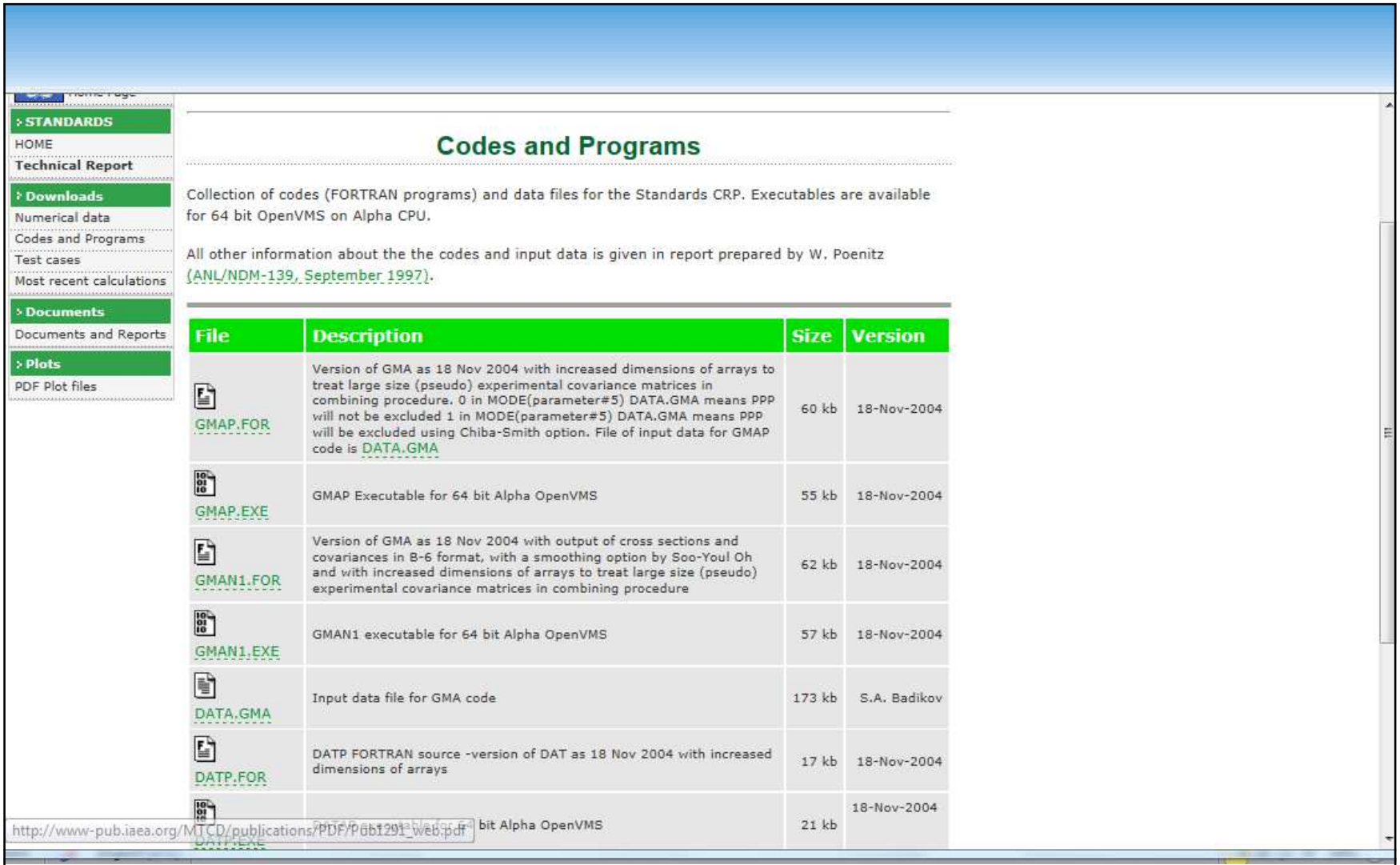
NEUTRON CROSS-SECTION STANDARDS, 2006

An IAEA Nuclear Data Section Initiative

Neutron cross-section standards are important in the measurement and evaluation of all other neutron reaction cross-sections. Not many cross-sections can be defined as absolute - most cross-sections are measured relative to the cross-section standards for normalization to absolute values. Previous evaluations of the neutron cross-section standards were completed in 1987 and disseminated as both NEANDC/INDC (NEANDC-311) and ENDF/B standards. R-matrix model fits for the light elements and non-model least-squares fits for the heavy elements were the basis of the combined fits for all of the data. Some important reactions and constants are not standards, but assist greatly in the determination of the standard cross-sections and reduce their uncertainties - these data were also included in the combined fits.

The need to re-evaluate the cross-section standards at the beginning of the 21st century is based on the appearance of a significant amount of precise experimental data and developments in the methodology of analysis and evaluation. An IAEA Consultants' Meeting was held in 2001 to consider the major tasks to be undertaken in order to improve the 1987 standards evaluation (Summary Report of the Consultants' Meeting on Improvement of the Standard Cross Sections for Light Elements, Vienna, 2-4 April 2001, INDC (NDS)- 425, prepared by A.D. Carlson, D.W. Muir and V.G. Pronyaev, June 2001). Thus, an IAEA Co-ordinated Research Project (CRP) entitled "Improvement of Standards Cross-Sections for Light Elements" was formulated, and this work was substantially extended through the course of these multinational studies by the inclusion of tasks to evaluate the cross-section standards for heavy elements.

The evaluations of the neutron cross-section standards were finalized in October 2005. Previous difficulties experienced with a data evaluation problem known as "Peelle's Pertinent Puzzle" create biases in the fit of correlated data, and were addressed to reduce this phenomenon. The new evaluations of the cross-section standards also include covariance matrices of the uncertainties that contain fully justifiable values. Significant contributions to the experimental database were made by participants of Subgroup 7 of the NEA Working Party on International Nuclear Data Evaluation Co-operation (WPEC). Furthermore, the evaluations could not have been carried out without access to the original GMA database and related


STANDARDS
HOME
Technical Report
Downloads
Numerical data
Codes and Programs
Test cases
Most recent calculations
Documents
Documents and Reports
Plots
PDF Plot files
Codes and Programs
Collection of codes (FORTRAN programs) and data files for the Standards CRP. Executables are available for 64 bit OpenVMS on Alpha CPU.
All other information about the the codes and input data is given in report prepared by W. Poenitz (ANL/NDM-139, September 1997).
File
Description
Size
Version
GMAP.FOR
Version of GMA as 18 Nov 2004 with increased dimensions of arrays to treat large size (pseudo) experimental covariance matrices in combining procedure. 0 in MODE(parameter#5) DATA.GMA means PPP will not be excluded 1 in MODE(parameter#5) DATA.GMA means PPP will be excluded using Chiba-Smith option. File of input data for GMAP code is DATA.GMA
60 kb
18-Nov-2004
GMAP.EXE
GMAP Executable for 64 bit Alpha OpenVMS
55 kb
18-Nov-2004
GMAN1.FOR
Version of GMA as 18 Nov 2004 with output of cross sections and covariances in B-6 format, with a smoothing option by Soo-Youl Oh and with increased dimensions of arrays to treat large size (pseudo) experimental covariance matrices in combining procedure
62 kb
18-Nov-2004
GMAN1.EXE
GMAN1 executable for 64 bit Alpha OpenVMS
57 kb
18-Nov-2004
DATA.GMA
Input data file for GMA code
173 kb
S.A. Badikov
DATP.FOR
DATP FORTRAN source -version of DAT as 18 Nov 2004 with increased dimensions of arrays
17 kb
18-Nov-2004
bit Alpha OpenVMS
21 kb
18-Nov-2004
http://www-pub.iaea.org/MTCD/publications/PDF/Pub1291_web.pdf

Coordinated Research Projects

- An important IAEA mechanism for organizing international research work to achieve specific research objectives
- Bring together researchers in both developing and developed countries to address a problem of common interest
- Not only further knowledge but improve research capacity in Member States (MS)
- Results are available, free of charge to scientists, and other users from all MS

CRPs cont'd

- CRPs are initiated by IAEA project officers following advice and suggestions of "consultants" who participate in a Consultant's Meeting
- After approval a call for research contracts and agreement proposals follows
- Once the evaluation and selection of proposals is completed the IAEA PO collaborates with Chief Scientific Investigators from the different research institutes involved in order to assign specific tasks and monitor progress
- Duration is normally 3 to 5 years

Other tools

- Data Development Projects
  - No formal agreements or contracts
  - Small group of experts
  - Regular meetings at IAEA to discuss progress
- Individual Contracts
- Training Workshops

Nuclear Data Section

Nuclear Data Services Unit	Nuclear Data Development Unit	Atomic & Molecular Data Unit
S. Simakov Unit Head	R. Capote Noy Unit Head	B.J. Braams Unit Head
V. Zerkin Software Engineer	A. Trkov Nuclear Physicist	H.-K. Chung Atomic Physicist
V. Semkova Nuclear Physicist	P. Dimitriou Nuclear Physicist	Marco Verpelli Systems Analyst/Programmer
N. Otsuka Nuclear Data Physicist	K. Nathani Team Assistant	K. Sheikh Database Assistant
L. Vrapcenjak Nuclear Data Services Assistant		A. Vasaros IT Systems Engineer
A. Oechs Team Assistant		

Section Head: **R.A. Forrest**
Nuclear Data Physicist

Section Secretary: **R. Rangel Alvarez**

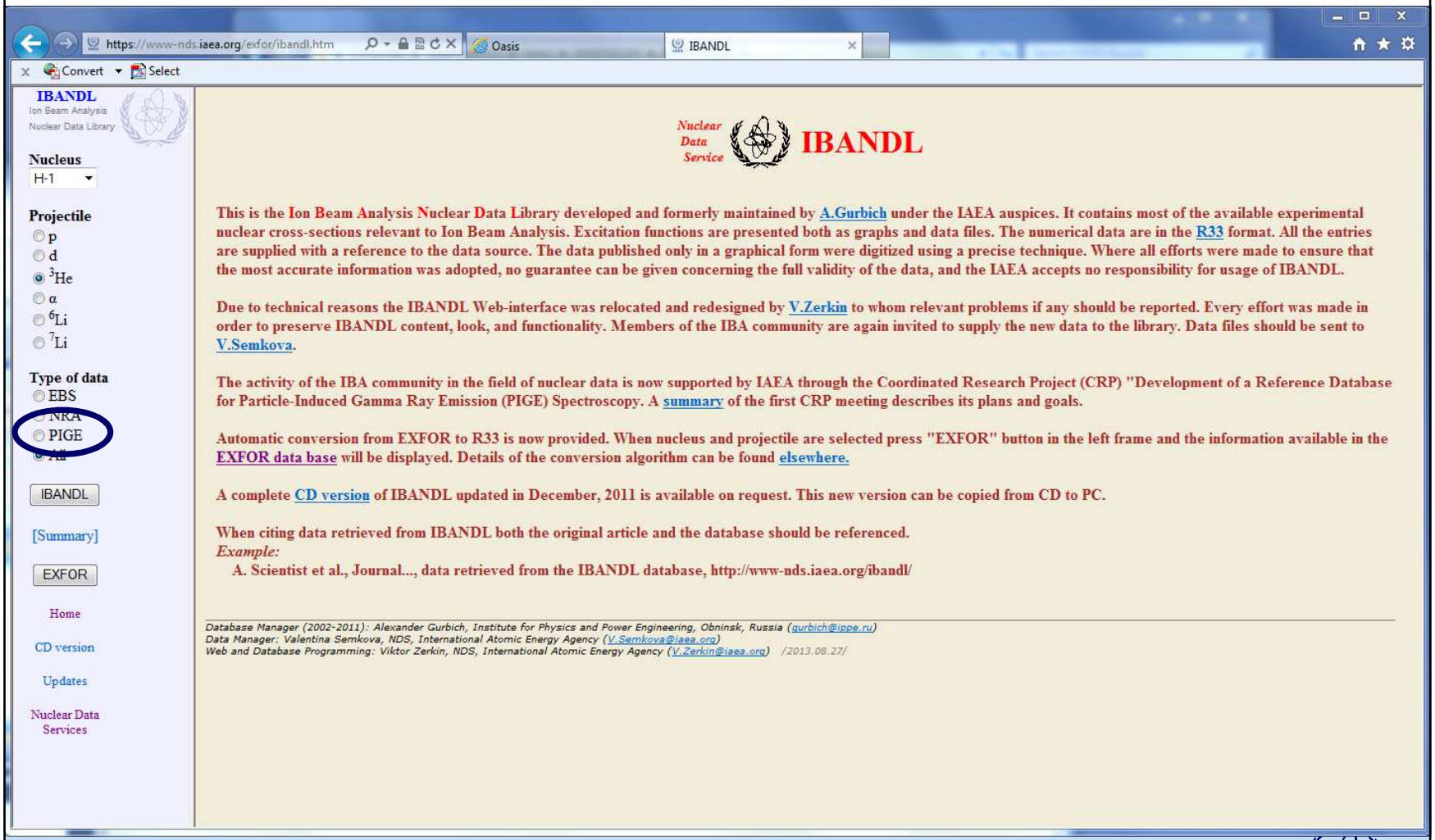
International Atomic Energy Agency

CRPs on Nuclear Data

- Nuclear Data for Production of Therapeutic Radionuclides (2002-2006)
- Parameters for Calculation of Nuclear Reactions of Relevance to Non-energy Nuclear Applications (Reference Input Parameter Library: Phase III) (2003-2007)
- Reference Database for Neutron Activation Analysis (2005-2009)
- Updated Decay Data Library for Actinides (2005-2009)
- Development of a Reference Database for Ion Beam Analysis (2005-2009)
- Heavy Charged-particle Interaction Data for Radiotherapy (2007-2010)
- Minor Actinide Neutron Reaction Data (MANREAD) (2007-2011)
- Nuclear Data Libraries for Advanced Systems: Fusion Devices (FENDL) (2007-2012)
- Prompt Fission Neutron Spectra of Actinides (2010-2014)
- Development of a Reference Database for Particle-Induced Gamma-ray Emission (PIGE) (2011-2015)
- Nuclear Data for Charged-particle Monitor Reactions and Medical Isotope Production (2012-2016)
- Testing and Improving the IAEA International Dosimetry Library for Fission and Fusion IRDFF (2013-2017)
- Primary Radiation Damage Cross Sections (2013-2017)
- Reference Database for beta-delayed neutron emission (2013-2017)

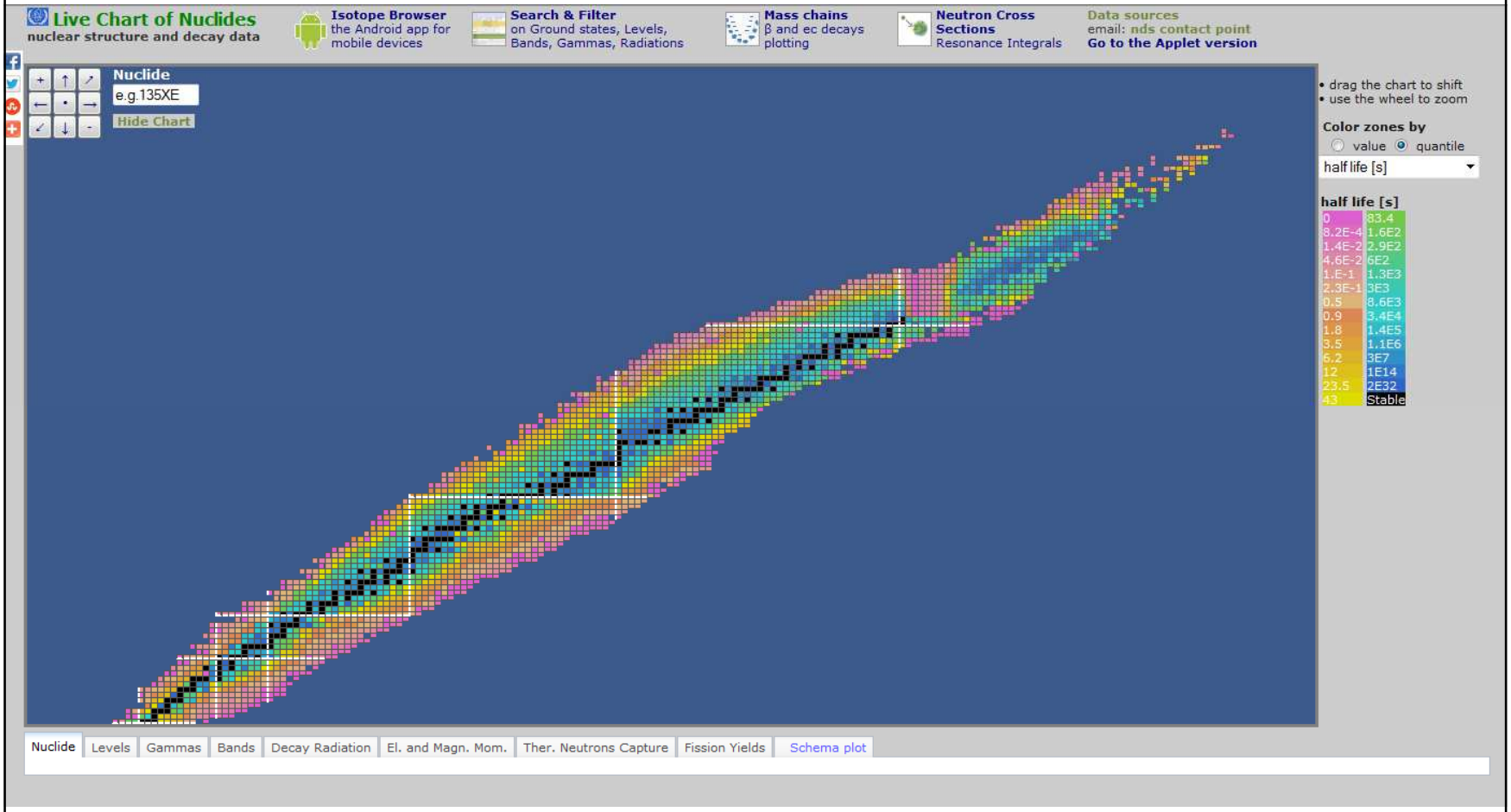
Ion Beam Analysis Nuclear Data Library

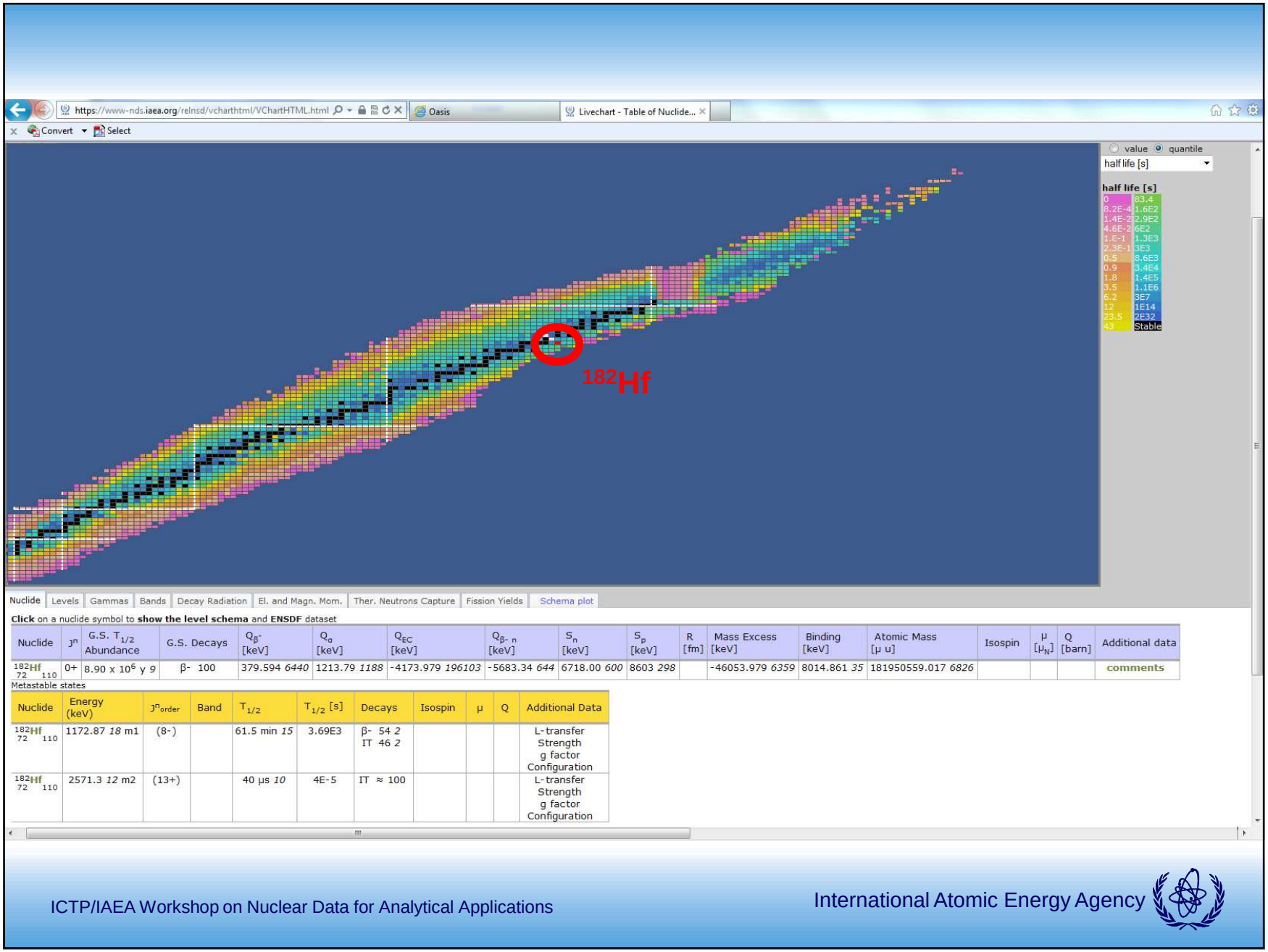
http://www-nds.iaea.org/exfor/ibandl.htm



Nuclear Database: LiveChart of Nuclides

http://www-nds.iaea.org/livechart




https://www-nds.iaea.org/relnsd/vcharthtml/VChartHTML.html
Oasis
Livechart - Table of Nuclide...
Convert
Select
value
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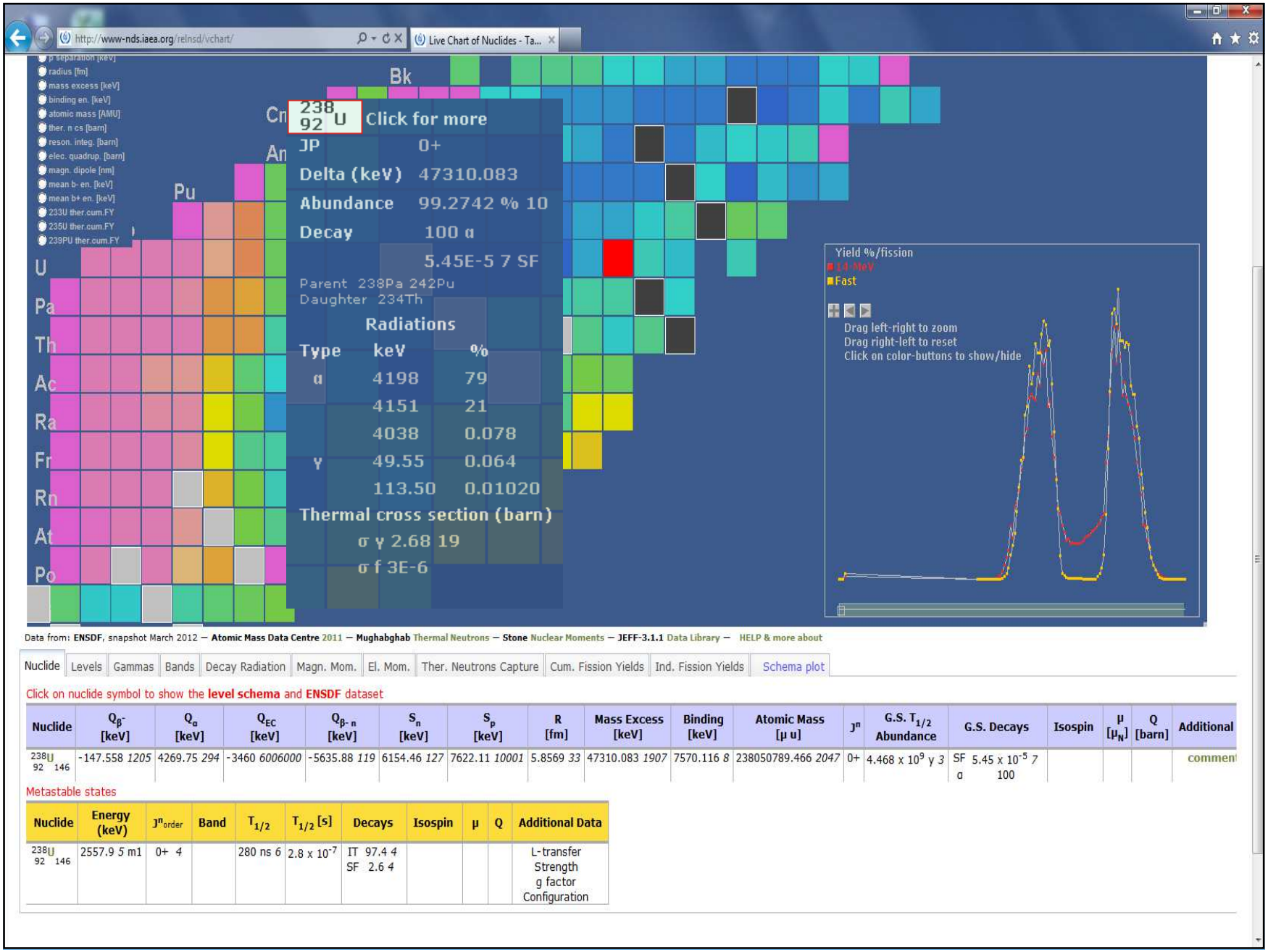
half life [s]
half life [s]
0 33.4
3.2E-4 1.6E2
1.4E-2 2.9E2
4.6E-2 5E2
1.E-1 1.3E3
2.3E-1 3E3
0.5 8.6E3
0.9 3.4E4
1.8 1.4E5
3.5 1.1E6
6.2 3E7
12 1E14
23.5 2E32
43 Stable
182Hf
Nuclide
Levels
Gammas
Bands
Decay Radiation
El. and Magn. Mom.
Ther. Neutrons Capture
Fission Yields
Schema plot
Click on a nuclide symbol to show the level schema and ENSDF dataset
Nuclide
Jπ
G.S. T1/2 Abundance
G.S. Decays
Qβ- [keV]
Qα [keV]
QEC [keV]
Qβ- n [keV]
Sn [keV]
Sp [keV]
R [fm]
Mass Excess [keV]
Binding [keV]
Atomic Mass [μ u]
Isospin
μ [μN]
Q [barn]
Additional data
182 72 110Hf
0+
8.90 x 10^6 y 9
β- 100
379.594 6440
1213.79 1188
-4173.979 196103
-5683.34 644
6718.00 600
8603 298
-46053.979 6359
8014.861 35
181950559.017 6826
comments
Metastable states
Nuclide
Energy (keV)
Jπorder
Band
T1/2
T1/2 [s]
Decays
Isospin
μ
Q
Additional Data
182 72 110Hf
1172.87 18 m1
(8-)
61.5 min 15
3.69E3
β- 54 2
IT 46 2
L-transfer
Strength
g factor
Configuration
182 72 110Hf
2571.3 12 m2
(13+)
40 μs 10
4E-5
IT ≈ 100
L-transfer
Strength
g factor
Configuration


http://www-nds.iaea.org/relnsd/vchart/
Live Chart of Nuclides - Ta...
Bk
Cm
Am
Pu
U
Pa
Th
Ac
Ra
Fr
Rn
At
Po
238 92 U Click for more
JP 0+
Delta (keV) 47310.083
Abundance 99.2742 % 10
Decay 100 α
5.45E-5 7 SF
Parent 238Pa 242Pu
Daughter 234Th
Radiations
Type keV %
α 4198 79
4151 21
4038 0.078
γ 49.55 0.064
113.50 0.01020
Thermal cross section (barn)
σ γ 2.68 19
σ f 3E-6
Yield %/fission
14 MeV
Fast
Drag left-right to zoom
Drag right-left to reset
Click on color-buttons to show/hide
Data from: ENSDF, snapshot March 2012 — Atomic Mass Data Centre 2011 — Mughabghab Thermal Neutrons — Stone Nuclear Moments — JEFF-3.1.1 Data Library — HELP & more about
Nuclide
Levels
Gammas
Bands
Decay Radiation
Magn. Mom.
El. Mom.
Ther. Neutrons Capture
Cum. Fission Yields
Ind. Fission Yields
Schema plot
Click on nuclide symbol to show the level schema and ENSDF dataset
Nuclide
Qβ- [keV]
Qα [keV]
QEC [keV]
Qβ- n [keV]
Sn [keV]
Sp [keV]
R [fm]
Mass Excess [keV]
Binding [keV]
Atomic Mass [μ u]
Jπ
G.S. T1/2 Abundance
G.S. Decays
Isospin
μ [μN]
Q [barn]
Additional
238 92 146
-147.558 1205
4269.75 294
-3460 6006000
-5635.88 119
6154.46 127
7622.11 10001
5.8569 33
47310.083 1907
7570.116 8
238050789.466 2047
0+
4.468 x 10^9 y 3
SF 5.45 x 10^-5 7
α 100
Metastable states
Nuclide
Energy (keV)
Jπ order
Band
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T1/2 [s]
Decays
Isospin
μ
Q
Additional Data
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2557.9 5 m1
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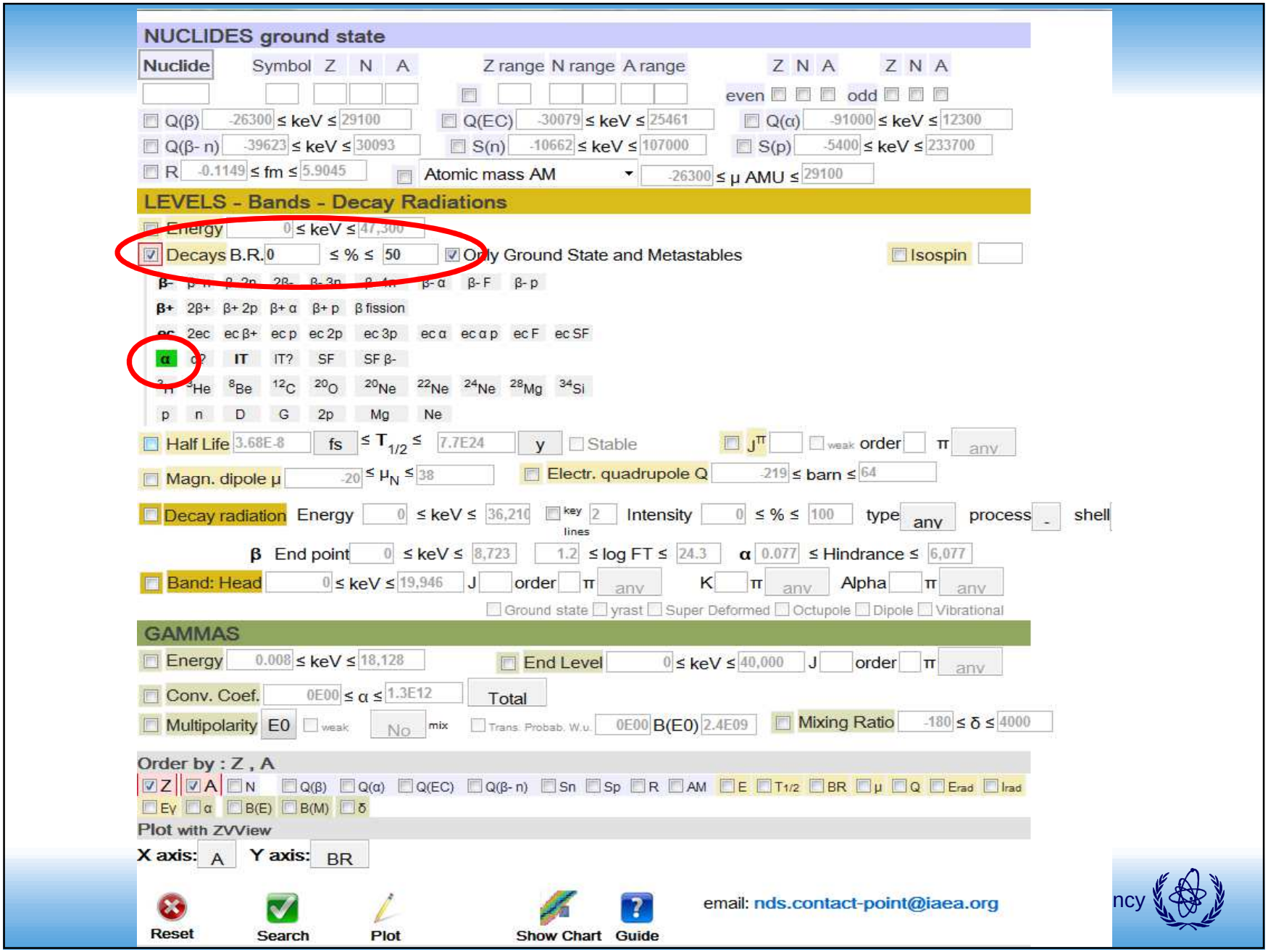
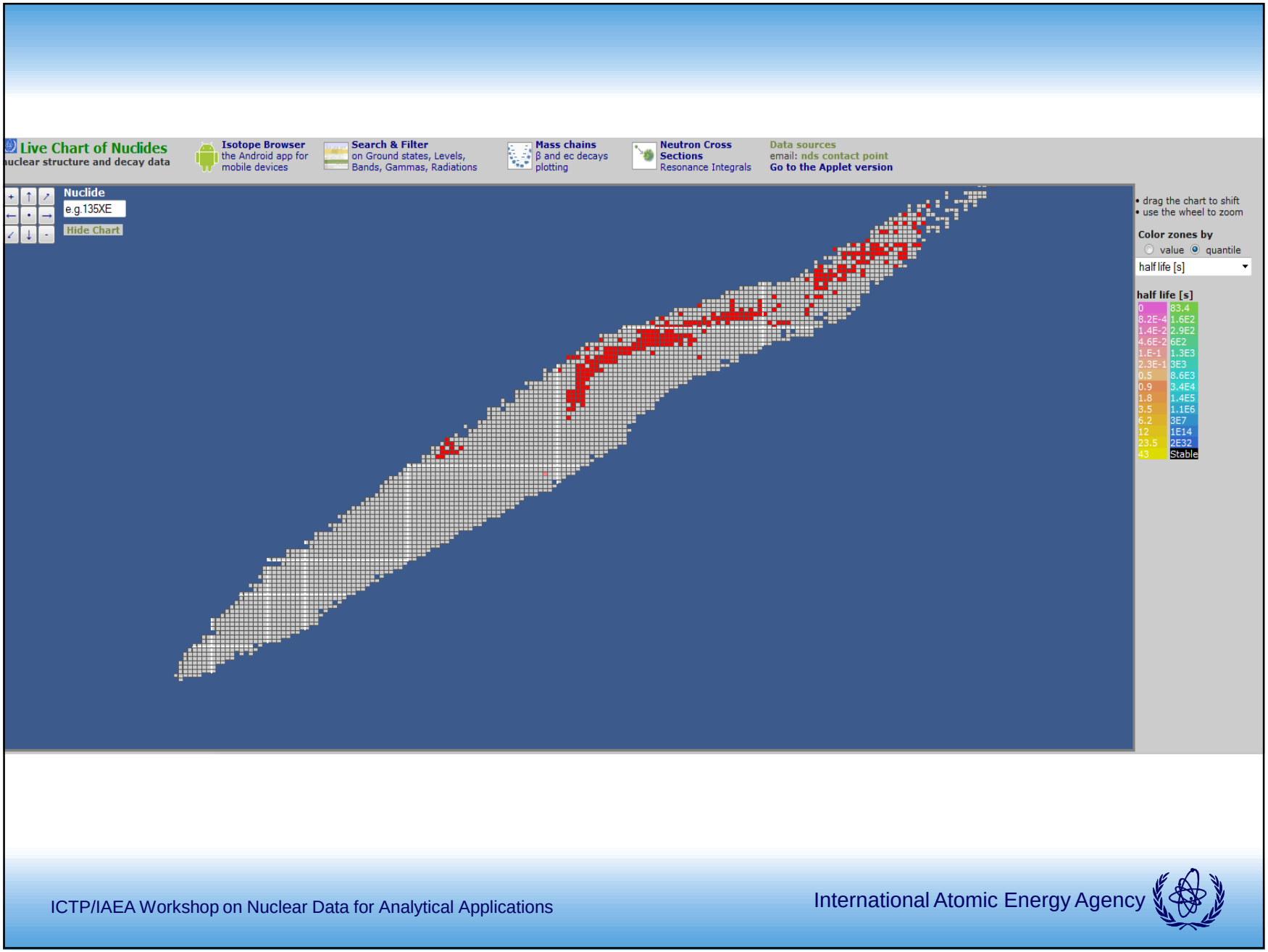
280 ns 6
2.8 x 10^-7
IT 97.4 4
SF 2.6 4
L-transfer
Strength
g factor
Configuration


NUCLIDES ground state
Nuclide
Symbol Z N A
Z range N range A range
Z N A Z N A
even odd
Q(β) -26300 ≤ keV ≤ 29100
Q(EC) -30079 ≤ keV ≤ 25461
Q(α) -91000 ≤ keV ≤ 12300
Q(β- n) -39623 ≤ keV ≤ 30093
S(n) -10662 ≤ keV ≤ 107000
S(p) -5400 ≤ keV ≤ 233700
R -0.1149 ≤ fm ≤ 5.9045
Atomic mass AM -26300 ≤ μ AMU ≤ 29100
LEVELS - Bands - Decay Radiations
Energy 0 ≤ keV ≤ 47,300
Decays B.R. 0 ≤ % ≤ 50
Only Ground State and Metastables
Isospin
β- β- n β- 2n 2β- β- 3n β- 4n β- α β- F β- p
β+ 2β+ β+ 2p β+ α β+ p β fission
ec 2ec ec β+ ec p ec 2p ec 3p ec α ec α p ec F ec SF
α α? IT IT? SF SF β-
p n D G 2p Mg Ne
Half Life 3.68E-8 fs ≤ T1/2 ≤ 7.7E24 y Stable
Jπ weak order π any
Magn. dipole μ -20 ≤ μN ≤ 38
Electr. quadrupole Q -219 ≤ barn ≤ 64
Decay radiation Energy 0 ≤ keV ≤ 36,210 key lines 2 Intensity 0 ≤ % ≤ 100 type any process - shell
β End point 0 ≤ keV ≤ 8,723 1.2 ≤ log FT ≤ 24.3 α 0.077 ≤ Hindrance ≤ 6,077
Band: Head 0 ≤ keV ≤ 19,946 J order π any K π any Alpha π any
Ground state yrast Super Deformed Octupole Dipole Vibrational
GAMMAS
Energy 0.008 ≤ keV ≤ 18,128
End Level 0 ≤ keV ≤ 40,000 J order π any
Conv. Coef. 0E00 ≤ α ≤ 1.3E12 Total
Multipolarity E0 weak No mix
Trans. Probab. W.u. 0E00 B(E0) 2.4E09
Mixing Ratio -180 ≤ δ ≤ 4000
Order by : Z , A
Z A N Q(β) Q(α) Q(EC) Q(β- n) Sn Sp R AM E T1/2 BR μ Q Erad Irad
Eγ α B(E) B(M) δ
Plot with ZVView
X axis: A Y axis: BR
Reset Search Plot Show Chart Guide
email: nds.contact-point@iaea.org

Nuclide	J^{π}	G.S. $T_{1/2}$ Abundance	G.S. Decays	Q_{β^-} [keV]	Q_{α} [keV]	Q_{EC} [keV]	$Q_{\beta^- n}$ [keV]	S_n [keV]	S_p [keV]	R [fm]	Mass Excess [keV]	Binding [keV]	Atomic Mass [μ u]
$^{108}_{52}Te_{56}$	0+	2.1 s *1*	α 49 *4* ec β+ 51 *4* β+ p 2.4 *10*	-13136 *212*	3416.21 *817*	6661.672 *7839*	-24281 *298*	13318.61 *7098*	2419.41 *696*		-65783.659 *5589*	8303.740 *52*	107929378.333 *6000*
$^{109}_{52}Te_{57}$	(5/2+)	4.6 s *3*	α 3.9 *13* ec β+ 96.1 *13* β+ p 9.4 *31* β+ α < 0.005	-10040.219 *7341*	3197.68 *570*	8535.879 *6852*	-23139 *212*	10003.05 *710*	2559.03 *703*		-67715.391 *4382*	8319.330 *40*	108927304.534 *4704*
$^{110}_{53}I_{57}$	(1+)	0.664 s *24*	α 17 *4* ec β+ 83 *4* ec p 11 *3* ec α 1.1 *3*	-8544.418 *113048*	3584.20 *5000*	11765.646 *50978*	-22615 *302*	10860.32 *5089*	37.76 *5074*		-60464.177 *50552*	8244.043 *460*	109935089.033 *54270*
$^{111}_{53}I_{58}$	(5/2+)	2.5 s *2*	α ≈ 0.1 ec β+ 99.9	-10561.232 *86777*	3274.50 *519*	8633.665 *7994*	-21105.37 *10123*	12560.95 *5078*	12.96 *811*		-64953.808 *4754*	8282.934 *43*	110930269.215 *5103*
$^{112}_{53}I_{59}$		3.42 s *11*	α ≈ 0.0012 ec β+ 100	-7034.916 *13249*	2957.09 *1163*	10504.179 *13238*	-20742.07 *8725*	10180.83 *1130*	764.82 *1210*		-67063.325 *10246*	8299.879 *91*	111928004.555 *11000*
$^{113}_{53}I_{60}$	5/2+	6.6 s *2*	ec β+ 100 α 3.310×10^{-7}	-8915.870 *10533*	2706.85 *959*	7227.527 *29071*	-19162.41 *1161*	12127.49 *1301*	840.97 *1160*		-71119.503 *8010*	8333.752 *71*	112923650.069 *8600*
$^{111}_{54}Xe_{57}$		0.74 s *20*	α 8 *+8-5* ec β+ ?		3718.88 *5000*	10561.232 *86776*		10544.13 *13316*	1217.37 *10032*		-54392.576 *86646*	8180.739 *781*	110941607.164 *93018*
$^{113}_{54}Xe_{59}$	(5/2+)	2.74 s *8*	α ≈ 0.011 ec β+ ≈ 100 ec p 7 *4* β+ α ≈ 0.007 *4*	-10437.726 *11130*	3086.84 *766*	8915.87 *1053*	-23985.64 *8720*	10246.54 *1083*	2429.28 *1232*		-62203.633 *6839*	8247.927 *61*	112933221.650 *7342*
$^{115}_{54}Xe_{61}$	(5/2+)	18 s *4*	ec β+ 100 β+ p 0.34 *6* α 0.0003 *1*	-8957 *298*	2505.81 *1371*	7681.053 *31312*	-22045.80 *7213*	9642.18 *1648*	3149 *298*		-68656.744 *12109*	8300.970 *105*	114926293.949 *13000*
$^{113}_{55}Cs_{58}$	(3/2+)	16.7 μs *7*	α 0 p 100	-11972 *298*	3484.35 *702*	10437.726 *11130*	-23751 *401*	13547.92 *8737*	-973.53 *256*		-51765.907 *8781*	8148.634 *78*	112944427.010 *9426*
$^{114}_{55}Cs_{59}$	(1+)	0.57 s *2*	α 0.018 *6* ec β+ 99.982 *6* ec p 8.7 *13* ec α 0.19 *3*	-8721.583 *130377*	3357.00 *5000*	12403.625 *71975*	-22960 *306*	10987.67 *7164*	-232.40 *7143*		-54682.261 *71102*	8173.538 *624*	113941296.175 *76331*
$^{114}_{56}Ba_{58}$	0+	0.43 s *+30-15*	α 0.9 *3* ec β+ 99.1 *3* ec p 20 *10* ^{12}C < 0.0034		3534.16 *4146*	8721.583 *130377*		14239 *317*	1483.74 *10964*		-45960.678 *109284*	8090.170 *959*	113950659.180 *117321*
$^{145}_{61}Pm_{84}$	5/2+	17.7 y *4*	α 2.8×10^{-7} ec 100	-615.649 *2699*	2323.76 *303*	164.085 *3649*	-7372.74 *270*	7922.74 *153*	4808.87 *265*		-81267.206 *3149*	8302.656 *22*	144912756.061 *3380*
$^{147}_{63}Eu_{84}$	5/2+	24.1 d *6*	α 0.0022 *6* ec 99.9978 *6*	-2187.413 *2819*	2991.13 *314*	1721.48 *341*	-9528.49 *463*	8498.25 *637*	3837.23 *363*		-77544.250 *2881*	8263.538 *20*	146916752.819 *3092*
$^{148}_{63}Eu_{85}$	5-	54.5 d *5*	α 9.4×10^{-7} *28* ec β+ 100	-29.903 *10074*	2691.31 *1029*	3036.246 *10218*	-9014.04 *1014*	6826.62 *1028*	4322.80 *1008*		-76299.557 *10053*	8253.829 *68*	147918089.051 *10792*


Live Chart of Nuclides
nuclear structure and decay data
Isotope Browser
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4.6E-2
1.E-1
2.3E-1
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23.5
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1.6E2
2.9E2
6E2
1.3E3
3E3
8.6E3
3.4E4
1.4E5
1.1E6
3E7
1E14
2E32
Stable

International Networks

- **Nuclear Structure and Decay Data Network (NSDD)**
- **Nuclear Reaction Data Centres Network (NRDC)**

Nuclear Structure and Decay

- **Nuclear Structure & Decay Data Network (NSDD)**

The International Network of Nuclear Structure and Decay Data (NSDD) is an international team of experts who provide recommended nuclear structure and decay data to be used in basic and applied research.

Data include:

-bibliographic information: Nuclear Science References (NSR)
-evaluated numerical data: Evaluated Nuclear Structure Data File (ENSDF)

Evaluated nuclear quantities: disintegration energies, radiation and transition probabilities, nuclear level schemes, excitation energies, half-lives, decay modes, spin-parity values, magnetic and electric multipole moments, and nuclear band structure.

NSDD Network

(http://www-nds.iaea.org/nsdd)

- **NSDD Biennial Meetings (supported by IAEA)**

- **Biennial IAEA-ICTP Workshops on "Nuclear Structure and Decay Data: Theory and Evaluation"**

  organized jointly with the International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

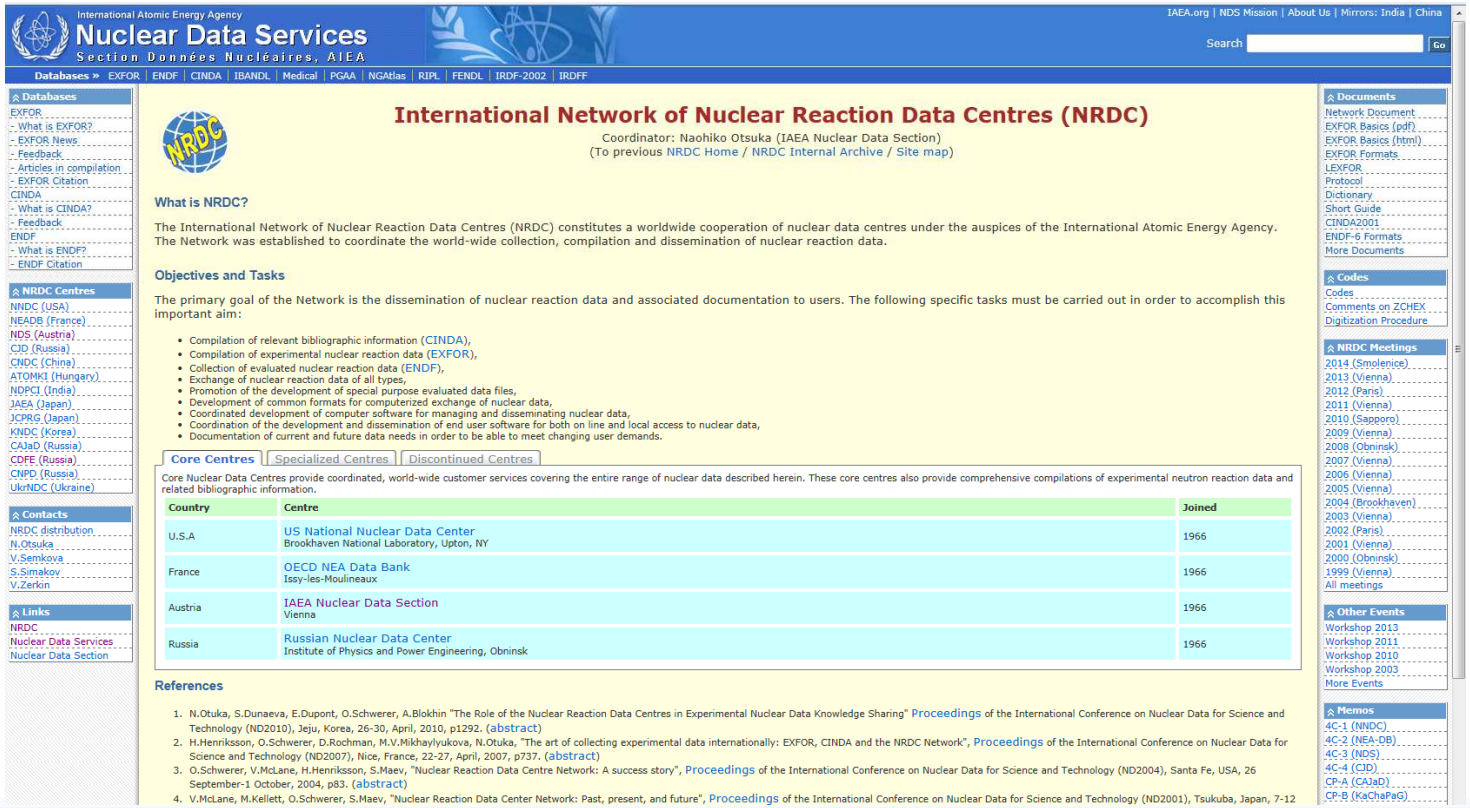
  UPCOMING: 24-28 March 2014

Nuclear Reaction Data Centres Network

- **The Network was established to coordinate the world-wide collection, compilation and dissemination of nuclear reaction data**
  - **Compilation of relevant bibliographic information (CINDA),**
  - **Compilation of experimental nuclear reaction data (EXFOR),**
  - **Collection of evaluated nuclear reaction data (ENDF),**
  - **Exchange of nuclear reaction data of all types,**
  - **Promotion of the development of special purpose evaluated data files,**
  - **Development of common formats for computerized exchange of nuclear data,**
  - **Coordinated development of computer software for managing and disseminating nuclear data,**
  - **Coordination of the development and dissemination of end user software for both on line and local access to nuclear data,**
  - **Documentation of current and future data needs in order to be able to meet changing user demands.**

Nuclear Reaction Data Centres Network

- **Biennial Technical Meetings**
- **Regular EXFOR Workshops**



International Atomic Energy Agency
Nuclear Data Services
Section Données Nucléaires, AIEA

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Nuclear Data Section

International Network of Nuclear Reaction Data Centres (NRDC)

Coordinator: Naohiko Otsuka (IAEA Nuclear Data Section)
(To previous NRDC Home / NRDC Internal Archive / Site map)

What is NRDC?

The International Network of Nuclear Reaction Data Centres (NRDC) constitutes a worldwide cooperation of nuclear data centres under the auspices of the International Atomic Energy Agency. The Network was established to coordinate the world-wide collection, compilation and dissemination of nuclear reaction data.

Objectives and Tasks

The primary goal of the Network is the dissemination of nuclear reaction data and associated documentation to users. The following specific tasks must be carried out in order to accomplish this important aim:

- Compilation of relevant bibliographic information (CINDA),
- Compilation of experimental nuclear reaction data (EXFOR),
- Collection of evaluated nuclear reaction data (ENDF),
- Exchange of nuclear reaction data of all types,
- Promotion of the development of special purpose evaluated data files,
- Development of common formats for computerized exchange of nuclear data,
- Coordinated development of computer software for managing and disseminating nuclear data,
- Coordination of the development and dissemination of end user software for both on line and local access to nuclear data,
- Documentation of current and future data needs in order to be able to meet changing user demands.

Core Centres | Specialized Centres | Discontinued Centres

Core Nuclear Data Centres provide coordinated, world-wide customer services covering the entire range of nuclear data described herein. These core centres also provide comprehensive compilations of experimental neutron reaction data and related bibliographic information.

Country	Centre	Joined
U.S.A	US National Nuclear Data Center Brookhaven National Laboratory, Upton, NY	1966
France	OECD NEA Data Bank Issy-les-Moulineaux	1966
Austria	IAEA Nuclear Data Section Vienna	1966
Russia	Russian Nuclear Data Center Institute of Physics and Power Engineering, Obninsk	1966

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2. H.Henriksson, O.Schwerer, D.Rochman, M.V.Mikhaylyukova, N.Otuka, "The art of collecting experimental data internationally: EXFOR, CINDA and the NRDC Network", Proceedings of the International Conference on Nuclear Data for Science and Technology (ND2007), Nice, France, 22-27, April, 2007, p737. (abstract)
3. O.Schwerer, V.McLane, H.Henriksson, S.Maev, "Nuclear Reaction Data Centre Network: A success story", Proceedings of the International Conference on Nuclear Data for Science and Technology (ND2004), Santa Fe, USA, 26 September-1 October, 2004, p83. (abstract)
4. V.McLane, M.Kellett, O.Schwerer, S.Maev, "Nuclear Reaction Data Center Network: Past, present, and future", Proceedings of the International Conference on Nuclear Data for Science and Technology (ND2001), Tsukuba, Japan, 7-12

Documents
Network Document
EXFOR Basics (pdf)
EXFOR Basics (html)
EXFOR Formats
LEXFOR
Protocol
Dictionary
Short Guide
CINDA2001
ENDF-6 Formats
More Documents

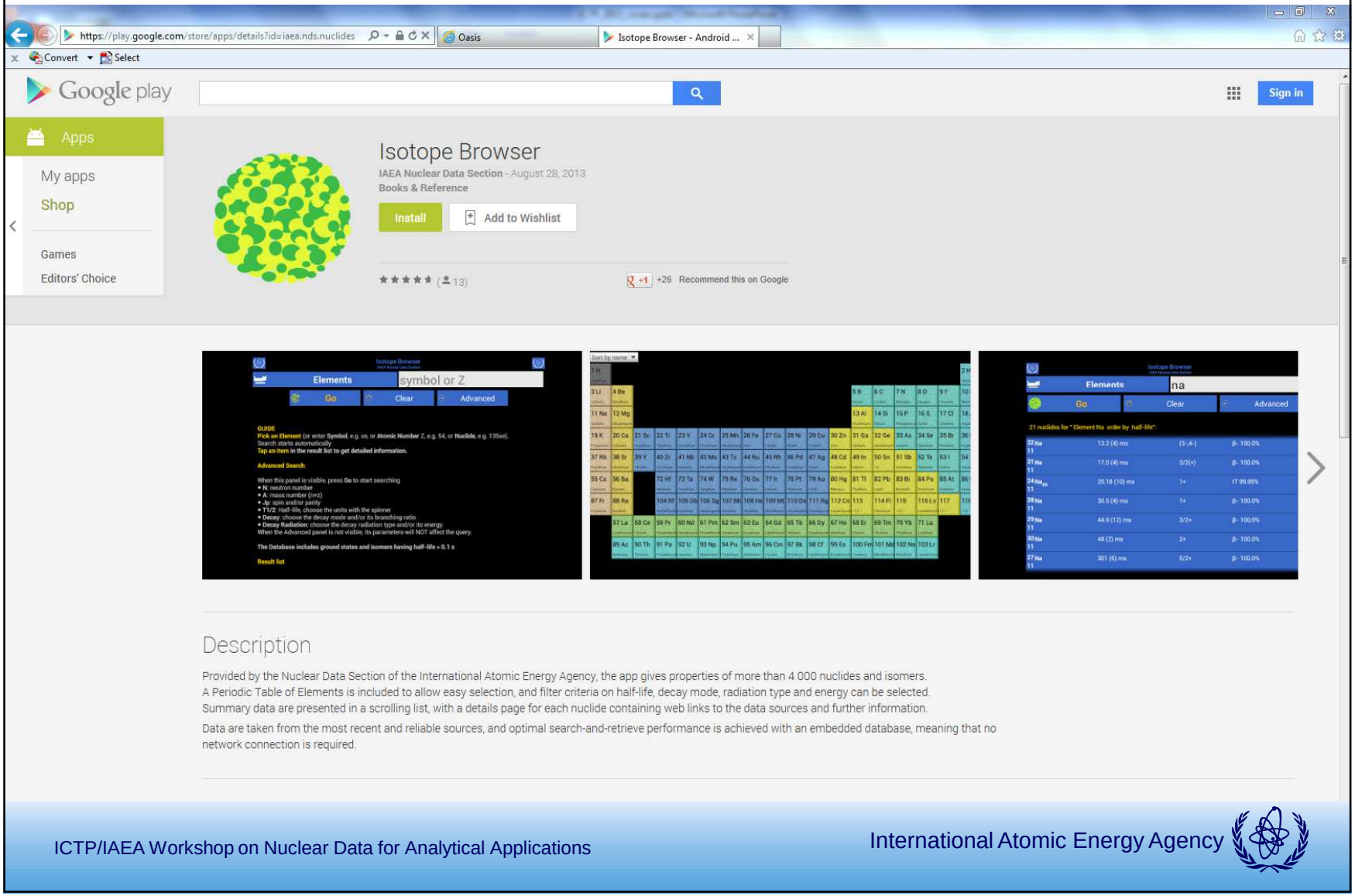
Codes
Codes
Comments on ZCHEX
Digitization Procedure

NRDC Meetings
2014 (Smolenice)
2013 (Vienna)
2012 (Paris)
2011 (Vienna)
2010 (Sapporo)
2009 (Vienna)
2008 (Obninsk)
2007 (Vienna)
2006 (Vienna)
2005 (Vienna)
2004 (Brookhaven)
2003 (Vienna)
2002 (Paris)
2001 (Vienna)
2000 (Obninsk)
1999 (Vienna)
All meetings

Other Events
Workshop 2013
Workshop 2011
Workshop 2010
Workshop 2003
More Events

Memos
4C-1 (NNDC)
4C-2 (NEA-DB)
4C-3 (NDS)
4C-4 (CJD)
CP-A (CAJaD)
CP-B (KaChaPaG)

NDS-IAEA Android App
for browsing structure & decay data on mobile



Thank you