



International Atomic Energy Agency

Progress in n_TOF Data Compilation

Naohiko Otsuka

IAEA Nuclear Data Section

in collaboration with

Emmeric Dupont (CEA Saclay)

Oscar Cabellos (NEA Data Bank)

n_TOF EXFOR Compilation - Background

- Archiving of energy dependent data sets for future resonance analysis (e.g., simultaneous fitting of transmission and capture yield) - WPEC SG36.
- Usually not tabulated in the final publications.
- Digitization is not suitable (~10000 points, input for least-square analysis)
- Submission of data by authors is essential, but very few contribution for capture measurements in the past.

Communication in n_TOF Meetings - History

- 2011 n_TOF Board Meeting (Otsuka+)
- 2013 n_TOF Board Meeting (Lederer+)
- 2015 n_TOF Data Analysis Meeting (Capote+)
- 2016 n_TOF Collaboration Meeting (Dupont)



N.Otsuka+
n_TOF Board Meeting
(Nov. 2011)

International Atomic Energy Agency

n_TOF Data Compilation for EXFOR Library

Naohiko Otsuka

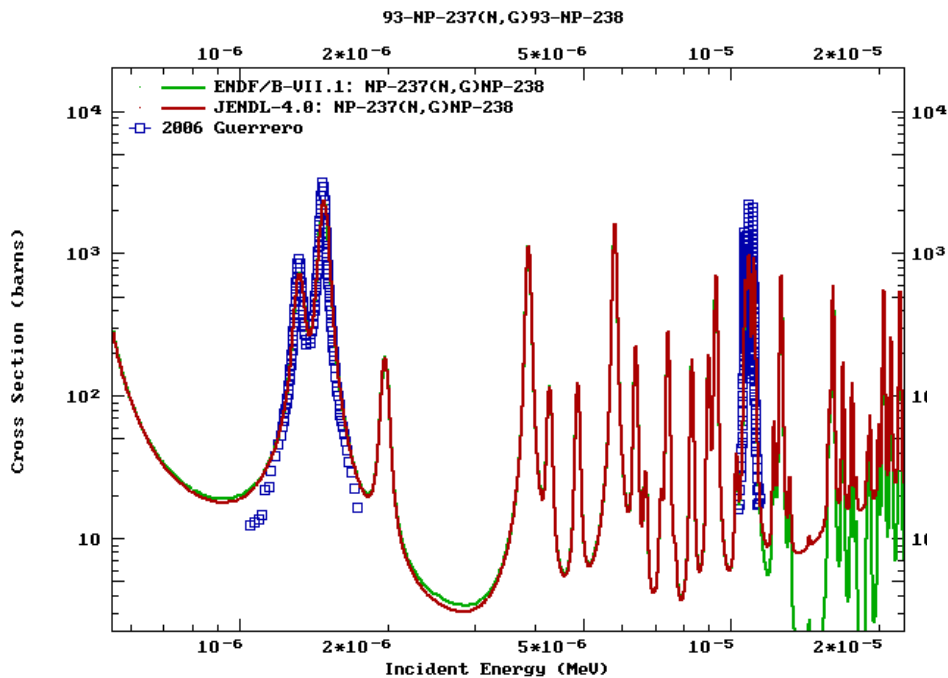
IAEA Nuclear Data Section

in collaboration with

Tim Ware (U. Manchester)

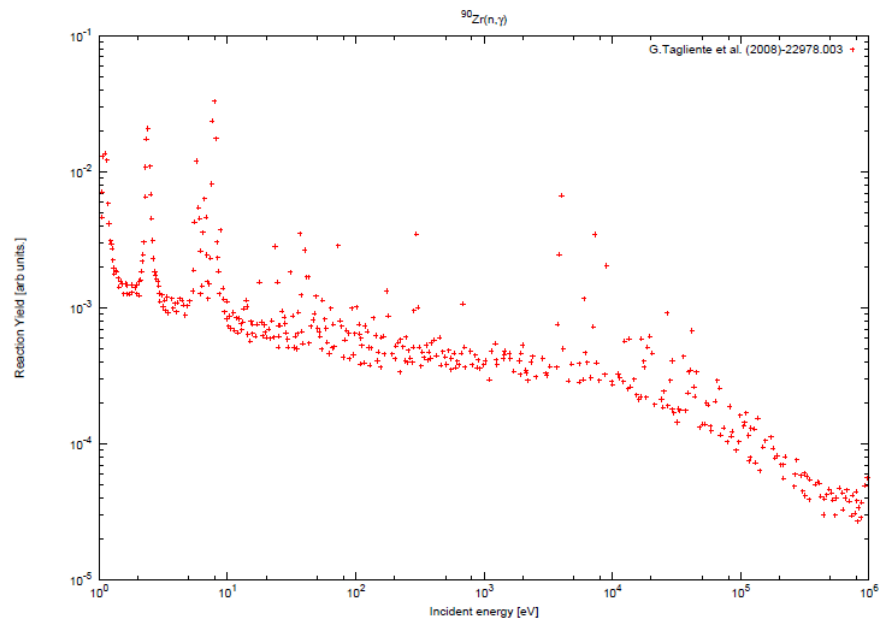
Emmeric Dupont (NEA Data Bank)

Digitized Resonance and Raw Data



Guerrero (2006):
EXFOR 22970.002 digitized from
PHYSOR 2006 Conf. Proc.
Two $^{237}\text{Np}(n,\gamma)$ resonances

Tagliente (2006):
EXFOR 22978.003 digitized from
Nuclei in the Cosmos
 $^{90}\text{Zr}(n,\gamma)$ capture yield in arb. unit.



Who use these data sets?

Index to n_TOF Articles and EXFOR

International Atomic Energy Agency
Nuclear Data Services
 Секция Ядерных Данных МАГАТЭ

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Search

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 - CDFE (Russia)
 - CNPD (Russia)
 - UkrNDC (Ukraine)
- ^ Contacts
 - N.Otsuka

Index to n_TOF publications compiled in EXFOR entries

Last updated: 2012-11-28

"Exp #" is an ID to identify publications and EXFOR data sets for a reaction from one *experimental work* (*measurement*). Currently this ID (without "?") is given by IAEA-NDS only for publications assumed as final and data sets compiled from such publications.

Reaction	1st author	Reference	Quant	pts	Emin (eV)	Emax (eV)	Detector	Source	Remark	Exp #
²⁴ Mg(n,γ)	C. Massimi	J,PR/C,85,044615,2012			1.00E+00	7.00E+02	C6D6			12024G01
		0,EXFOR,23163.000								12024G01
²⁵ Mg(n,γ)	C. Massimi	J,PR/C,85,044615,2012			1.00E+00	7.00E+02	C6D6			12025G01
		0,EXFOR,23163.000								12025G01
²⁶ Mg(n,γ)	C. Massimi	J,PR/C,85,044615,2012			1.00E+00	7.00E+02	C6D6			12026G01
		0,EXFOR,23163.000								12026G01
⁹⁰ Zr(n,γ)	G.Tagliente	J,PR/C,77,035802,2008			1.00E+00	1.00E+06	C6D6			40090G01
		4,EXFOR,22978.010	RP	45	3.86E+03	6.86E+04		Tabulated		40090G01
		4,EXFOR,22978.011	MACS	11	5.00E+03	1.00E+05		Tabulated		40090G01
		4,EXFOR,22978.012	SIGr	144	8.72E+03	1.25E+04		Digitized		40090G01
		C,2004SANTA,,880,2004			1.00E+00	1.00E+06	C6D6			40090G01?
		J,NP/A,758,573,2005			1.00E+00	1.00E+06	C6D6			40090G01?
		4,EXFOR,22978.003	RYL	426	1.05E+00	9.67E+05		Digitized		40090G01?
		C,2007TOKYO,2,570,2007			1.00E+00	1.00E+06	C6D6			40090G01?
		C,2006CERN,,227,2006			1.00E+00	1.00E+06	C6D6			40090G01?
		C,2008MACKIN,,(086),2008			1.00E+00	1.00E+06	C6D6			40090G01?
⁹¹ Zr(n,γ)	G.Tagliente	C,2007NICE,2,1303,2007			1.00E+00	1.00E+06	C6D6			40090G01?
		J,PR/C,78,045804,2008			1.00E+00	2.60E+03	C6D6			40091G01

One experimental work (assumed by IAEA NDS)

http://www-nds.iaea.org/nrdc/n_tof/ (still some bugs in the system)



Toward Further Improvement

T. Ware (n_TOF, U. Manchester), E. Dupont (NEA DB), NO (IAEA NDS) started discussion for further possible improvement of n_TOF EXFOR entries:

- Completeness for final data (Make all final data available.)
- Corrections to existing EXFOR entries (e.g., “kill” preliminary data)
- Creation of new EXFOR entries by n_TOF group

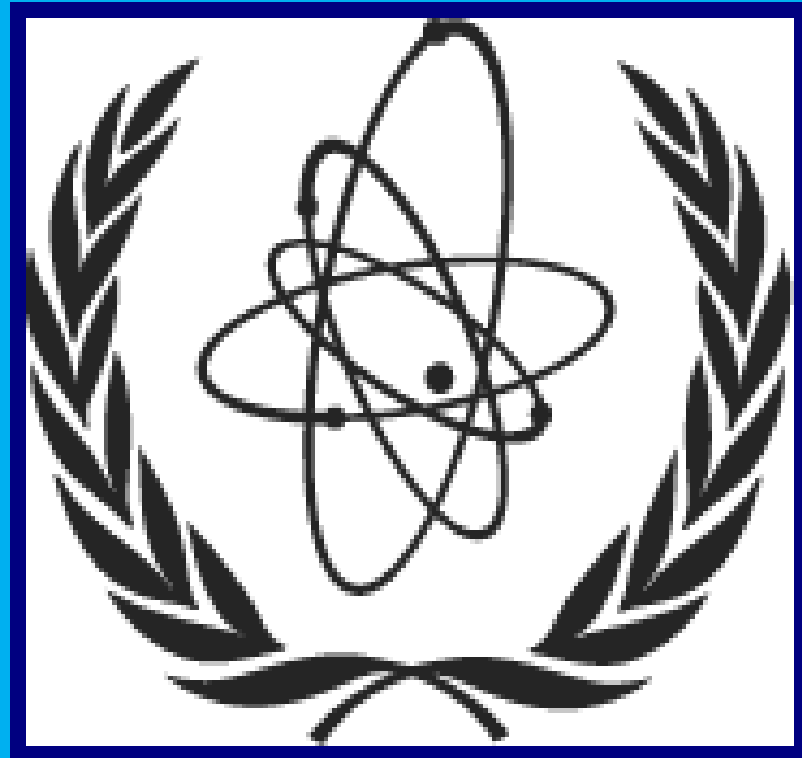
Tim has already started real works for EXFOR.



NUCLEAR DATA EVALUATION

Impact of n_TOF measurements on nucle

*R.Capote+
n_TOF Analysis Meeting
(Feb. 2015)*



Roberto Capote and Naohiko Otsuka

Nuclear Data Section

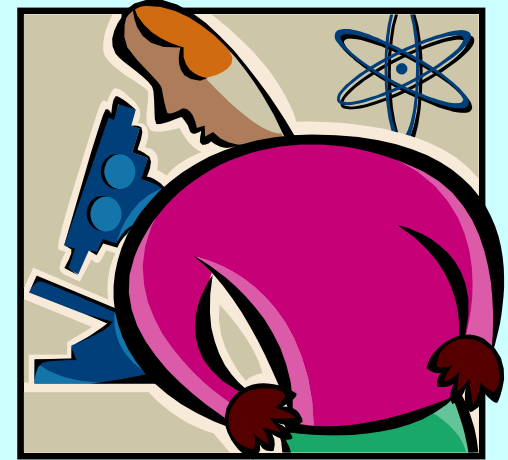
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What n_TOF collaboration provided?

*R.Capote+
n_TOF Analysis Meeting
(Feb. 2015)*

Here you are ...

It is all described in
my article in the Phys.Rev. C !



Or even worse ...

Please use my Resonance Parameters

➔ Impossible to evaluate data in the RR !!!



TAKE HOME MESSAGE

R.Capote+
n_TOF Analysis Meeting
(Feb. 2015)

- ❖ n_TOF provided **excellent** data on U8(n,g) to the IAEA STD group 😊

Ratios of other STD cross sections needed - e.g. Au(n,g)/U8(n,g)

- ❖ n_TOF impact on (n,g) evaluations **low** 😞 (02/15)

Only $^{232}\text{Th}(n,g)$ capture yield used in IAEA evaluation so far (adopted by..) !!!

Situation is improving (2 new sets) but huge backlog needs to be sorted out

- ❖ Job is not finished till **ALL** data are submitted
recommendation- submit the yield to the IAEA with the paper to the journal

Both for capture and fission experiments:

- **Capture/Fission yields (= input for SAMMY)**
- **Cross sections (preferably what is measured = ratio to STD)**

**Only exception: (n,f) or (ng) data above the Resonance Range
(in this case only cross sections are needed)**



DE LA RECHERCHE À L'INDUSTRIE



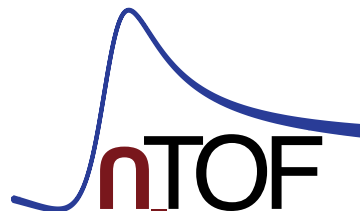
Status of n_TOF Data Dissemination

May 2016

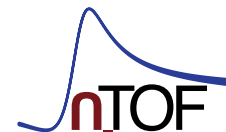
Emmeric DUPONT
CEA, Saclay, Irfu/SPhN

emmeric.dupont@cea.fr

www.cea.fr

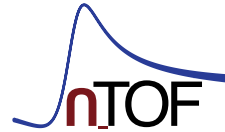


Why should we send data to EXFOR?



- Beyond the publication of results of interest for various fields, another major contribution are the data themselves.
 - Data should be usable and actually used in nuclear astrophysics and nuclear technology simulations.
 - In particular, pointwise data should be made available.
 - Experimental data are unique and must be preserved on long term.
- EXFOR is the appropriate place for an efficient dissemination and preservation of data.
 - This is the “*Mother of all libraries*” (for particle transport, activation, dosimetry, standards, etc.)
 - This is a long standing standard (unlike many local databases).
- Dissemination of data is also important to secure funding.

What are EXFOR and users expecting from us?



One should satisfy two types of data reporting requests.

1. Mandatory data to fill in the EXFOR database

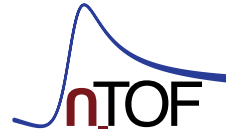
Reduced or final experimental quantities (e.g., pointwise yields, cross sections, ratio of cross sections) and associated uncertainty vs. energy (mandatory) and vs. time-of-flight

2. Additional data required for expert users (evaluators, experimentalists)

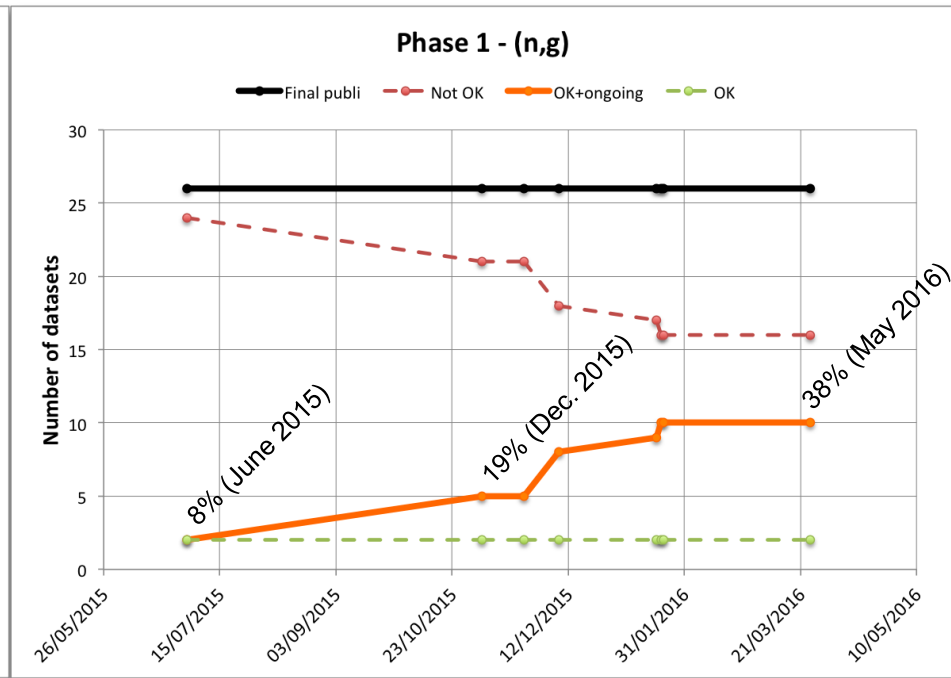
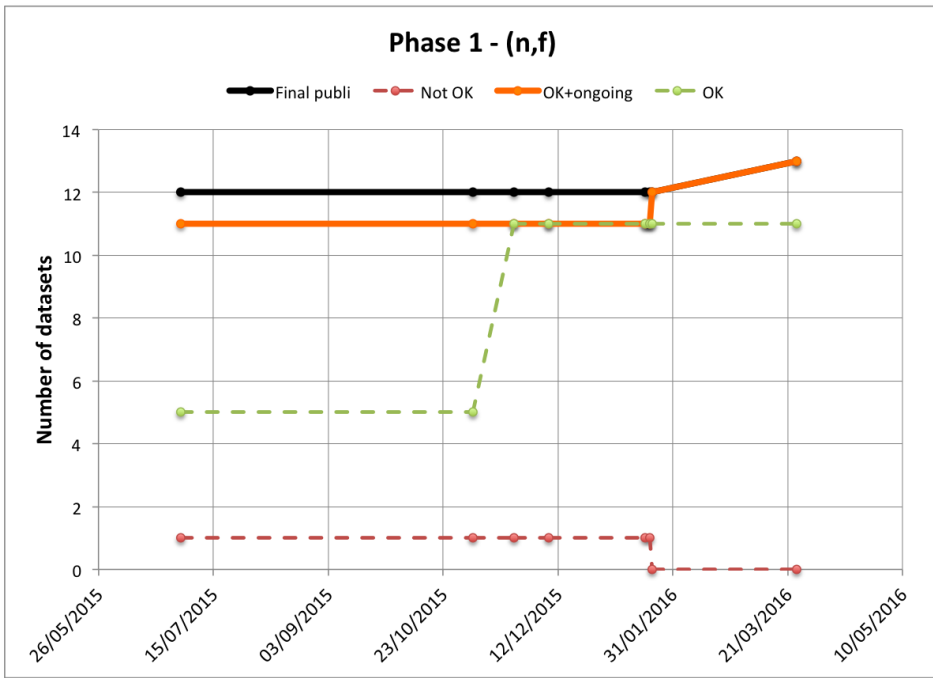
Detailed information on the facility, detectors, samples, uncertainties and correlations, resolution function, etc.

In the following slides and on the TWiki page “EXFOR Status = OK” means that mandatory data are available, but additional data are strongly recommended.

Progress in n_TOF data dissemination



- IAEA review of the availability of n_TOF data in EXFOR (Feb. 2015)
 - n_TOF monitoring of the dissemination status since June 2015
- <https://twiki.cern.ch/twiki/bin/view/NTOF/Dissemination>



Current Statistics (prepared by Emmeric)

Table 1 - Overview of the dissemination status in EXFOR for n_{TOF} datasets associated with a final publication

n_{TOF} Phase	Reaction	Data Status = Final (datasets with a final publication)	EXFOR Status = Not OK (digitized or incomplete datasets)	EXFOR Status = ongoing (compilation work in progress)	EXFOR Status = OK (mandatory data available)	Data Dissemination Status (OK + ongoing)
I (2001-2004)	(n, γ)	26	16	8	2	38%
	(n,f)	13	0	2	11	100%
	All	39	16	10	13	59%
II (2009-2012)	(n, γ)	4	3	0	1	25%
	(n,f)	2	0	0	2	100%
	(n,lcp)	2	0	2	0	100%
	All	8	3	2	3	63%

Table 2 - Detailed information on the status of n_{TOF} datasets (click on column headers to sort the data and [see notes below](#) for explanations of "Data Status" and "EXFOR Status")

Target	Reaction	n_{TOF} Phase	Area	Detector	Energy Range (eV)	INTC Proposal	Main Reference	Data Status	EXFOR Entry	EXFOR Status
4-Be-7	(n,α)	III (2014-...)	EAR2	Si	2.53E-02 - 1.00E+04	2015 - INTC-P-417	Final paper in preparation	Prelim	-	N/A
4-Be-7	(n,p)	III (2014-...)	EAR2	Si	2.53E-02 -	2015 - INTC-P-417	-	Prelim	-	N/A



Summary

- Completeness of energy dependent data sets measured by n_TOF has been improved since June 2015 thanks to the new dissemination coordinator (Emmeric Dupont)
- Coverage (as of 8 June 2016) is
 - 38% (capture) + 100% (fission) for Phase I exp. (2001-2004)
 - 25% (capture) + 100% (fission) for Phase II exp. (2009-2012)
- A progress report will be orally presented by Emmeric in ND2016.