



NNDC Progress Report

(NRDC Meeting, Oct 8-10, 2007)

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NNDC Staff Changes

- Marco Pigni
 - Joined the NNDC in January 2007 (PhD from TU Vienna)
 - Covariance postdoc
- Manojeeet Bhattacharya
 - Joined the NNDC in April 2007 (PhD, came from NASA)
 - Replacement for Dave Winchell
 - NSR compilations + structure evaluations
- Dimitri Rochman
 - Left the NNDC in August 2007 (moved to NRG Petten)
 - EXFOR compilations + ENDF evaluations
 - The position is currently vacant, replacement in ~1/2 year
 - Stanislav Hlavac (Bratislava) is taking care of EXFOR

EXFOR Compilations

New compilations in FY07 (Oct 1, 2006 – Sep 30, 2007)

Neutrons:	36 entries,	174 subentries
Charged particles:	100	392
<u>Gammas:</u>	<u>0</u>	<u>0</u>
Total	136	566

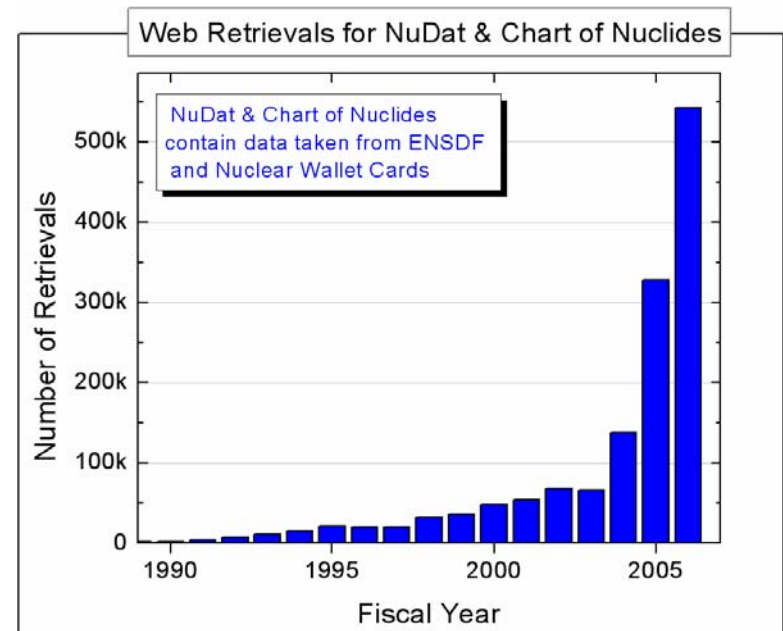
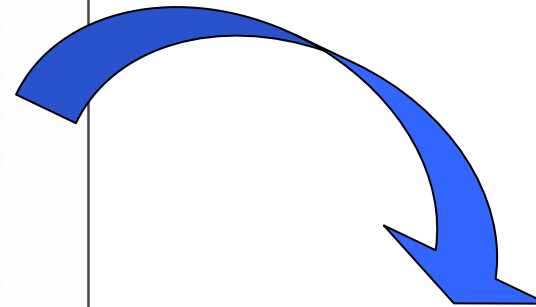
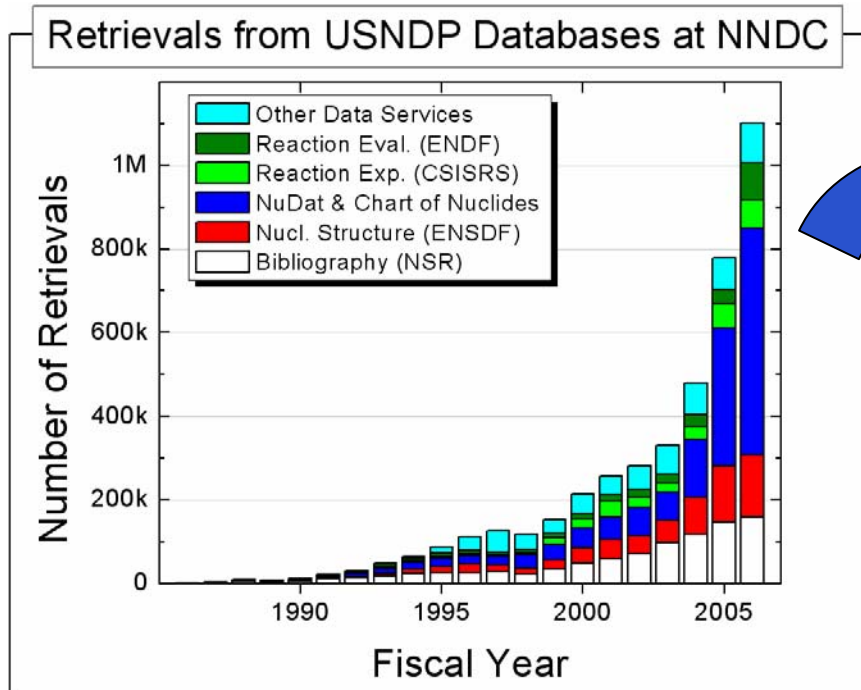
Compilations in FY06

Total 179 entries, 708 subentries

Scope of compilation

- All new papers are compiled regularly
- Old papers as time permits (~150 neutron, ~350 charged particle still un-compiled, remaining part of the collection by V. McLane)

Data Services: 1 Million Retrievals in FY2006



- ~1.1M retrievals, 40% up compared to FY2005
- ~50% from NuDat & Chart of Nuclides

Data Services in FY2007

Data retrievals increased by 26% compared to 2006

Data retrievals in 11 months of FY07

Total 1,256,000 projected increase 26%


Reactions 195,000



- CINDA 6,500
- EXFOR 98,500
- ENDF 90,000

Sigma interface for ENDF

- NuDat-like interface
- Launched in April 2007



Retrieval  Plotting

 **Evaluated Nuclear Data File (ENDF)** 

Periodic Table Browse **Directory Tree Browse** **Basic Retrieval** **Advanced Retrieval** **Plot Cart**

Select first a library, then a sublibrary and finally click on a chemical element to obtain results.
Data is available for materials with a cyan background.

Library: Sublibrary:

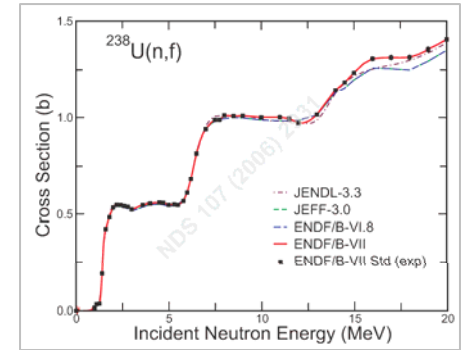
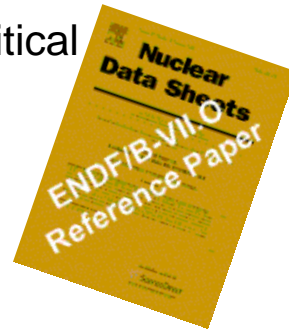
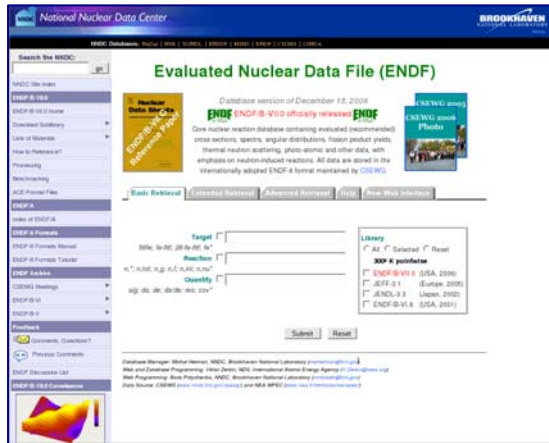
0	1																	2						
n	H																	He						
	3	4											5	6	7	8	9	10						
	Li	Be											B	C	N	O	F	Ne						
	11	12																	13	14	15	16	17	18
	Na	Mg																	Al	Si	P	S	Cl	Ar
	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36						
	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	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													
	Fr	Ra	Ac	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg													
				58	59	60	61	62	63	64	65	66	67	68	69	70	71							
				Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu							
				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							

Database Manager: Mike Herman, NNDC, Brookhaven National Laboratory
Web and Programming: B. Pritychenko, A.A. Sonzogni, NNDC, Brookhaven National Laboratory
Data Source: CSEWG and NEA-WPEC

Release of the ENDF/B-VII.0 library

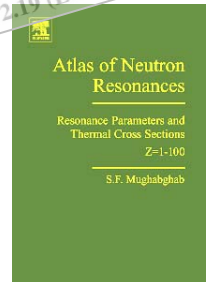
The first major release since 1990

👉 The ENDF/B-VII.0 has been developed by CSEWG with a significant contribution from several labs (LANL, **BNL**, NIST, LLNL) – critical support for AFCI, GNEP, Gen-IV!

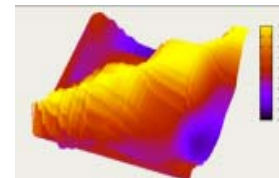


Principal advances over ENDF/B-VI library

- 👉 Many new cross sections for major actinides
- 👉 New set of fission product evaluations (**BNL**)
- 👉 Improved thermal neutron scattering
- 👉 More precise standards
- 👉 New radioactive data (**BNL**)
- 👉 Photonuclear reactions
- 👉 β -delayed photon decay spectra
- 👉 New methods for uncertainties and covariances (**BNL**,...)



Validation carried out in US and Europe (hundreds of integral experiments) proved absolute superiority of the ENDF/B-VII.0 over precedent libraries



ENDF/B-VII.0 Library Contents

14 sublibraries, many additions and improvements

New sublibraries: Neutron standards cross sections, photonuclear
 Large improvements: Neutron reaction sublibrary, charged particles, decay data, thermal neutron scattering sublibrary
 No changes: Fission yields, atomic data (taken over from ENDF/B-VI.8)

No.	NSUB	Sublibrary name*	Short name	VII.0	VI.8
1	0	Photonuclear	g	163	-
2	3	Photo-atomic	photo	100	100
3	4	Radioactive decay	decay	3838	979
4	5	Spont. fis. yields	s/fpy	9	9
5	6	Atomic relaxation	ard	100	100
6	10	Neutron	n	393	328
7	11	Neutron fis.yields	n/fpy	31	31
8	12	Thermal scattering	tsl	20	15
9	19	Standards	std	8	8
10	113	Electro-atomic	e	100	100
11	10010	Proton	p	48	35
12	10020	Deuteron	d	5	2
13	10030	Triton	t	3	1
14	20030	³ He	he3	2	1

LANL, IAEA

BNL

LANL, ORNL, BNL

LANL

IAEA-NEA-NIST-LANL

LANL

LANL

LANL

LANL



ENDF/B-VII Validation, Case Study: Lady Godiva - well characterized critical assembly



- Highly enriched **uranium** sphere, first built at Los Alamos in ~1950s
- Bare assembly
- Pure
- Object of beauty!

Lady Godiva rode naked through Coventry, England, in the 11th Century, following a wager with her husband whereby he agreed to reduce taxes on the poor!



Lady Godiva by John Collier, ca 1897

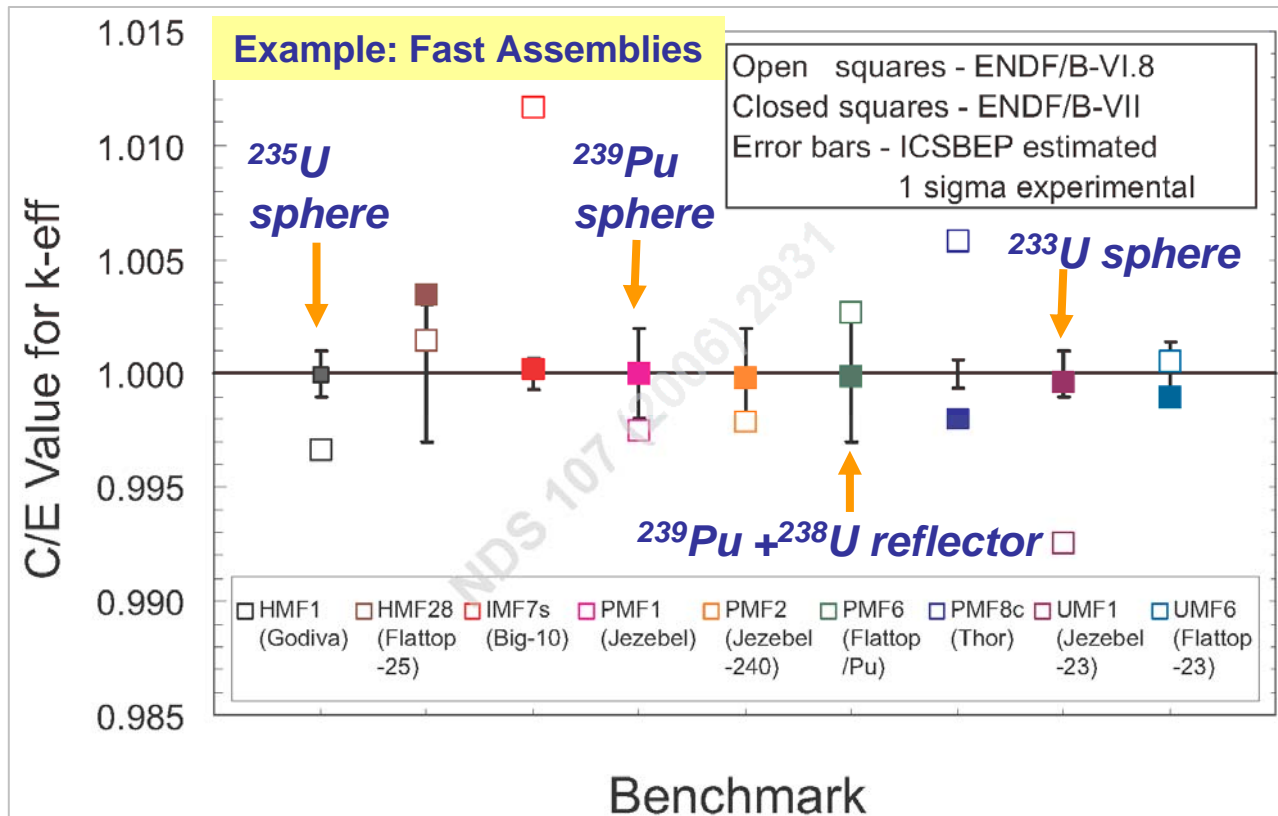
Integral Critical Assembly Data Validation

Excellent ENDF/B-VII Performance

Critical assemblies:
C/E values of k-eff

Data testing against
> 800 assemblies:

- Fast assemblies
(*Godiva*, Flattop, Big10, Jezebel)
- Reflected assemblies
- HEU
- LEU
- Pu solutions
- Np, ^{233}U , ...
etc.



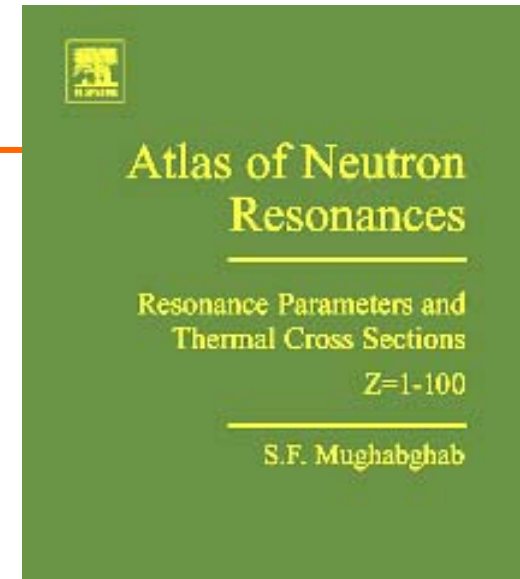
ENDF/B-VII not an “adjusted library”. Some evaluation-choices were made to optimize agreement with critical assembly data - but physics motivated & within uncertainties

Major Publications

Atlas of Neutron Resonances

S.F. Mughabghab

Elsevier, April 2006

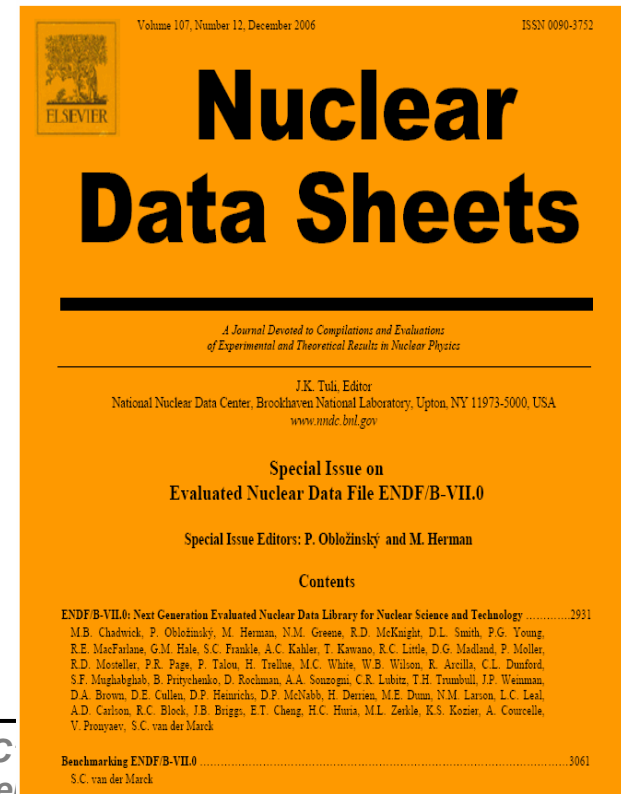


“Big Paper” on ENDF/B-VII.0

M. Chadwick, **P. Oblozinsky**, **M. Herman** *et al*

Nuclear Data Sheets, Dec 2006

Reference paper



EMPIRE: Nuclear Reaction Model Code

System for Data Evaluation

M. Herman, R. Capote, B. Carlson *et al*

Nuclear Data Sheets, Dec 2007