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Spectrum Average Nuclear Reaction Data Compilation with SF8=SPA

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Motivation - I

$$\bar{\sigma} = \frac{\int_{E_1}^{E_2} \sigma(E)\Phi(E)dE}{\int_{E_1}^{E_2} \Phi(E)dE} = \int_{E_1}^{E_2} \sigma(E)\,\chi(E)$$

Non EXFOR resources

EASY-2007: d-Be (thick target) neutron source

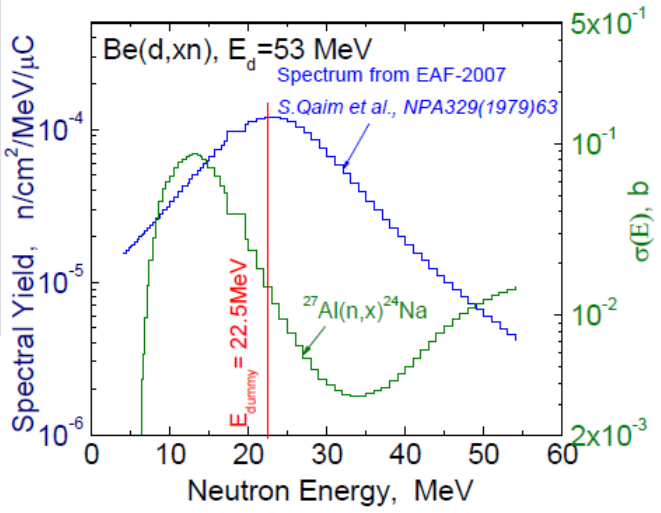
EXFOR
ENTRY 21009 860205 20050926 0000

INC-SOURCE (D-BE) 53MEV DEUTERONS ON A 1CM THICK BE TARGET.
INC-SPECT BE - BREAKUP SPECTRUM WITH MAXIMUM INTENSITY AT 22.5MEV AND A FWHM OF 15.8MEV. . NEUTRON FLUX DENSITY WAS 6X10+10 CM-2 SEC-1

EN-DUMMY
MEV
22.5

REACTION (13-AL-27(N,A)11-NA-24-G,,SIG,,SPA)

DATA	DATA-ERR
MB	MB
20.7	3.



Example: Validation of EAF-2007:

XS at dummy energy σ(22.5MeV) = 14.6 mb !!!!

$$< \sigma(E) >= \frac{\int \sigma(E)F(E)dE}{\int F(E)dE} = 23.9 \text{ mb}$$

- EXFOR has 266 experimental data sets with spectra averaged cross sections (SIG,,SPA) measured with d-Be neutrons (202 of the them are S.Qaim' data !)
- guidelines for extrapolation below and above energy limits are needed

Motivation - II

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Cumulative fission yields of short-lived isotopes under natural-abundance-boron-carbide-moderated neutron spectrum

Erin C. Finn[1] · Lori Metz[1] · Larry Greenwood[1] · Bruce Pierson[2] · Richard Wittman[1] · Judah Friese[1] · Rosara Kephart[1,3]

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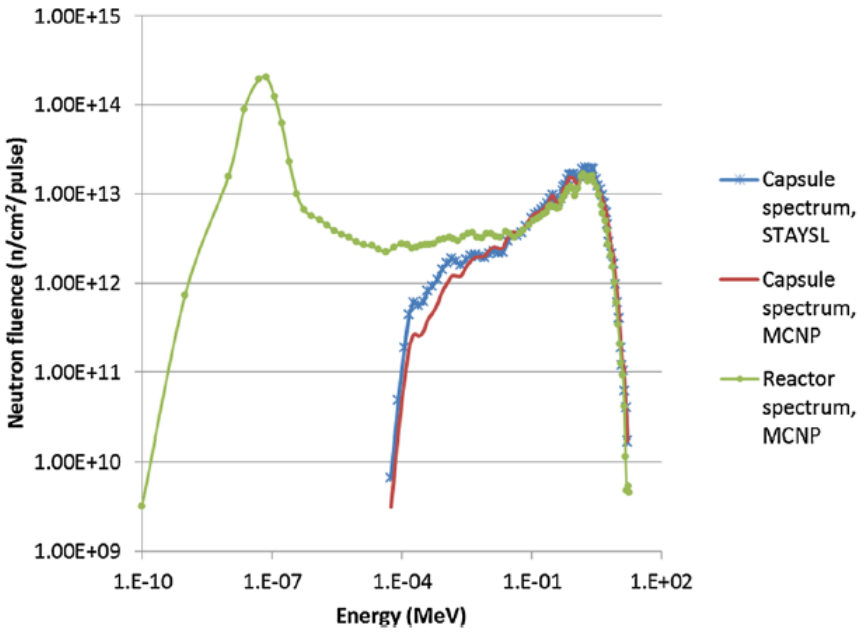
COMMON              3       3
EN-MEAN    ERR-2      ERR-3
KEV        PER-CENT   PER-CENT
700.0      10.0       5.0
ENDCOMMON           3
ENDSUBENT           67
SUBENT         14441002
BIB                 6       39
REACTION   (92-U-235(N,F)ELEM/MASS,CUM,FY,,SPA)
DECAY-DATA ((1.)35-BR-84-G,1.906E+3SEC)
           ((2.)36-KR-87,4.58E+3SEC)
           ((3.)37-RB-89,9.090E+2SEC)
           ((4.)37-RB-90-M,2.58E+2SEC)
           ((5.)38-SR-91,3.47E+4SEC)
           ((6.)38-SR-92,9.58E+3SEC)
           ((7.)38-SR-93,4.46E+2SEC)
```



Characteristics of some neutron sources

- ✓ Neutron generator (D-D: 2-3 MeV, D-T: 13.5-14.8 MeV): high intensity; low background; neutron emission in 4π; narrow energy range.
- ✓ Cyclotron (D-D: 4-13 MeV): neutron emission predominantly in forward direction; quasi-monoenergetic neutrons high background of low-energy neutron distribution.

  (thick target D-^{9}Be): high intensity; broad energy distribution.
- ✓ Van de Graaff accelerator (D-D (gas target), D-T 13.8-20.5 MeV): wider energy range; neutron emission in 4π; quasi-monoenergetic neutrons background of low-energy neutron distribution; relatively low intensity.

Spectrum average data are needed for validation of nuclear reaction data evaluations

We have to provide sufficient information in order to allow users to trace back the spectral flux density distribution for each SPA data measurement.

All spectra are characterised by analytical formulas and the following characteristic energies:

KT	spectrum temperature in units of energy
KT-K	spectrum temperature in units of temperature
KT-DUMMY	spectrum temperature (energy units) assumed by compiler
1.32 MeV	^{235}U thermal neutron induced fission prompt fission-neutron spectrum
1.42 MeV	^{252}Cf spontaneous fission prompt fission-neutron spectrum
EN-MEAN	mean energy
EN-DUMMY	dummy energy (characteristic of spectrum)
0.0005 eV	cold neutrons (if nothing else is specified by authors)
0.0253 eV	thermal Maxwellian and thermal reactor spectra
1.5 MeV	fission-neutron spectra (if nothing else is specified by authors)
4.5 MeV	decay α-Be neutron sources

However:

Spectrum Average (Unspecified Spectrum)
REACTION coding: SPA in SF8.

Used for all other spectra, *e.g.*, thermal reactor spectra. Care should be taken to compile only those data that would be of value to the user of EXFOR.

Proposal:

Spectrum Average (~~Unspecified Spectrum~~)
REACTION coding: SPA in SF8.

Used for all other spectra, *e.g.*, thermal reactor spectra.(Care should be taken to compile only those data that would be of value to the user of EXFOR.) ???

Sufficient information to reproduce the neutron spectrum or numerical data should be provided.

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Thank you!