



# International Atomic Energy Agency

The 8th DAE-BRNS Theme Meeting on

**EXFOR Compilation of Nuclear Data**

Department of Physics, The M.S. University, Vadodara, India

12–16 November 2019

## Introduction to EXFOR

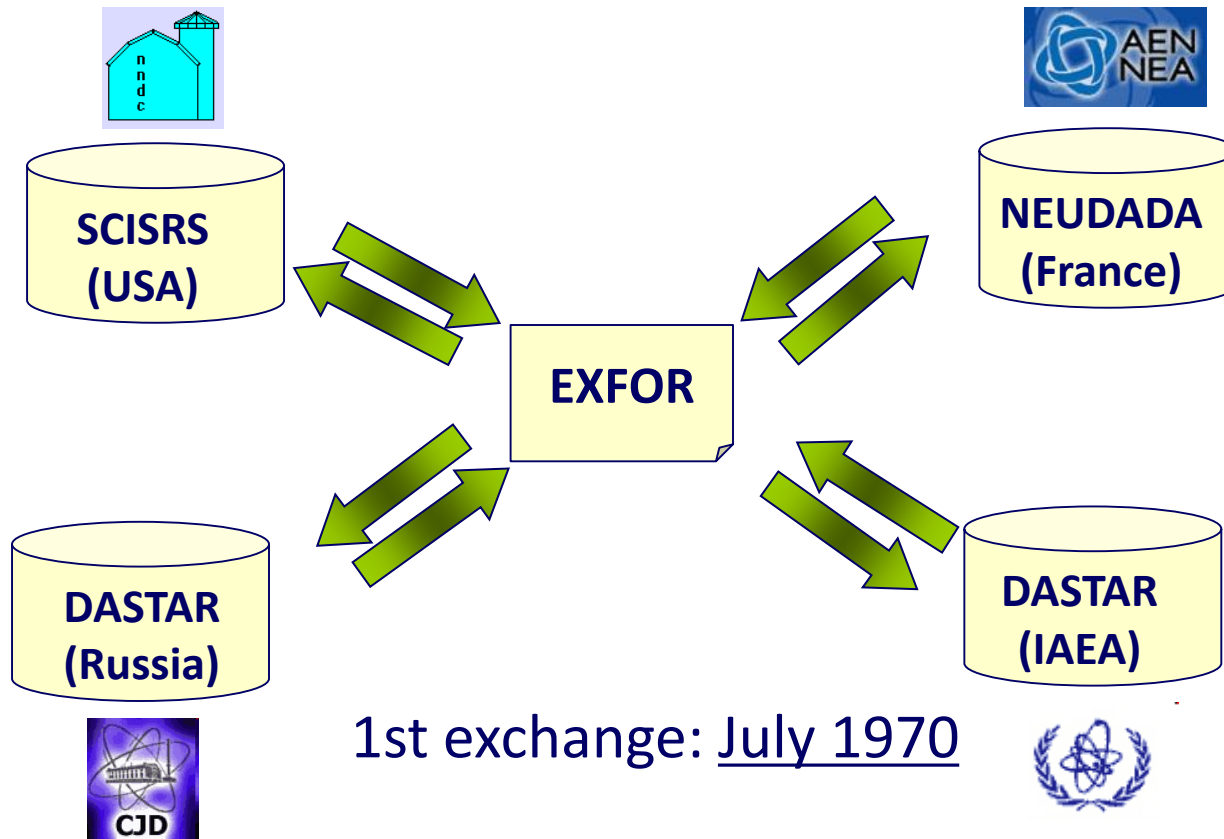
**Naohiko OTSUKA**

Nuclear Data Section

Department of Nuclear Sciences and Applications



# Experimental Data Exchange during Cold War



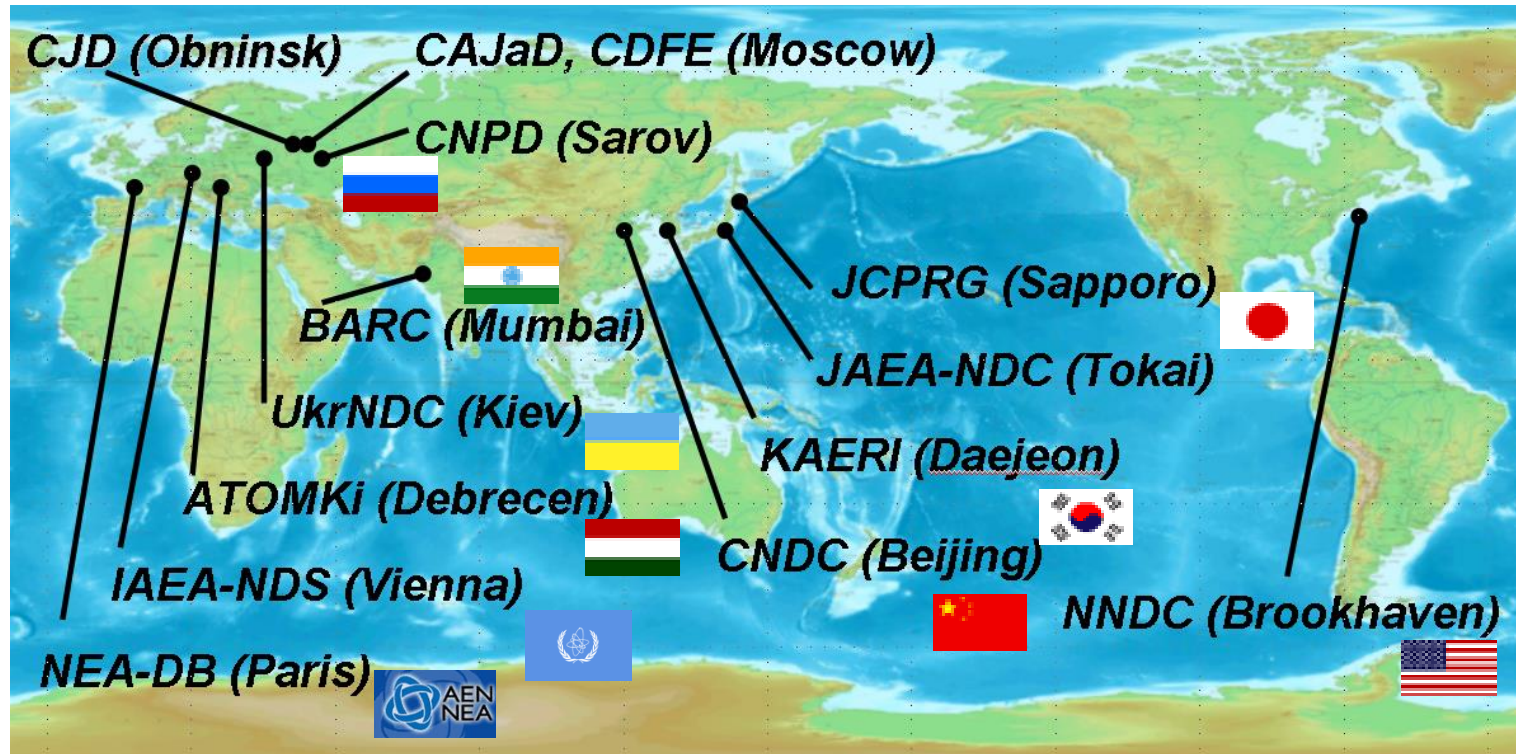
**EXFOR = EXchange FORmat**

# Annual NRDC Meeting (1983)



17-21 October 1983 in Obninsk or Moscow

# Nuclear Reaction Data Centres (NRDC)



12 centres from 8 countries and 2 international organisations  
(China, Hungary, India, Japan, Korea, Russia, Ukraine, USA, NEA, IAEA)

Collaborating for **EXFOR** compilation under the auspices of IAEA NDS

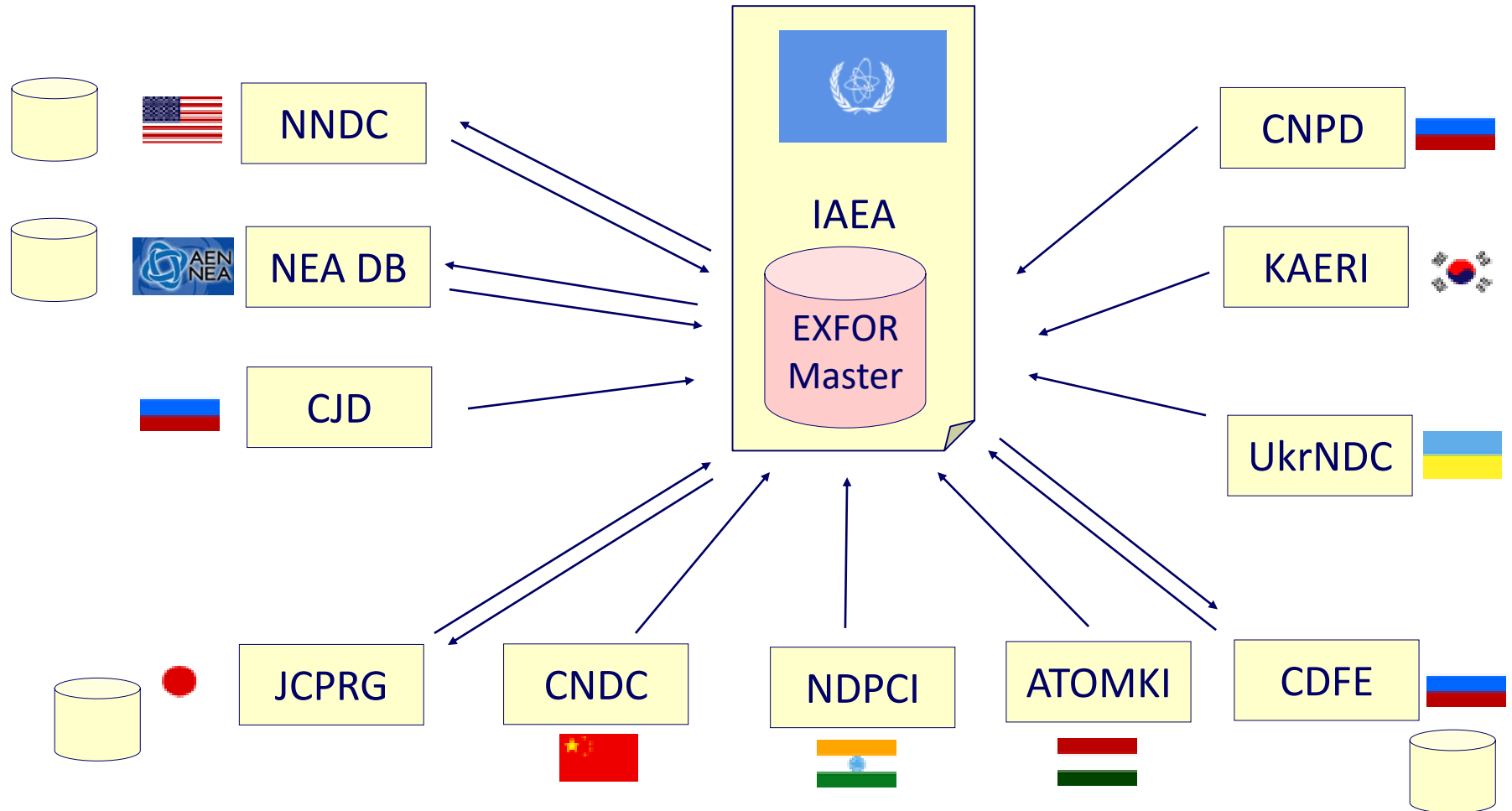
# Annual NRDC Meeting (2018)



1-4 May 2018, GCNEP, Bahadurgarh, India

# Experimental Data Exchange (Present)

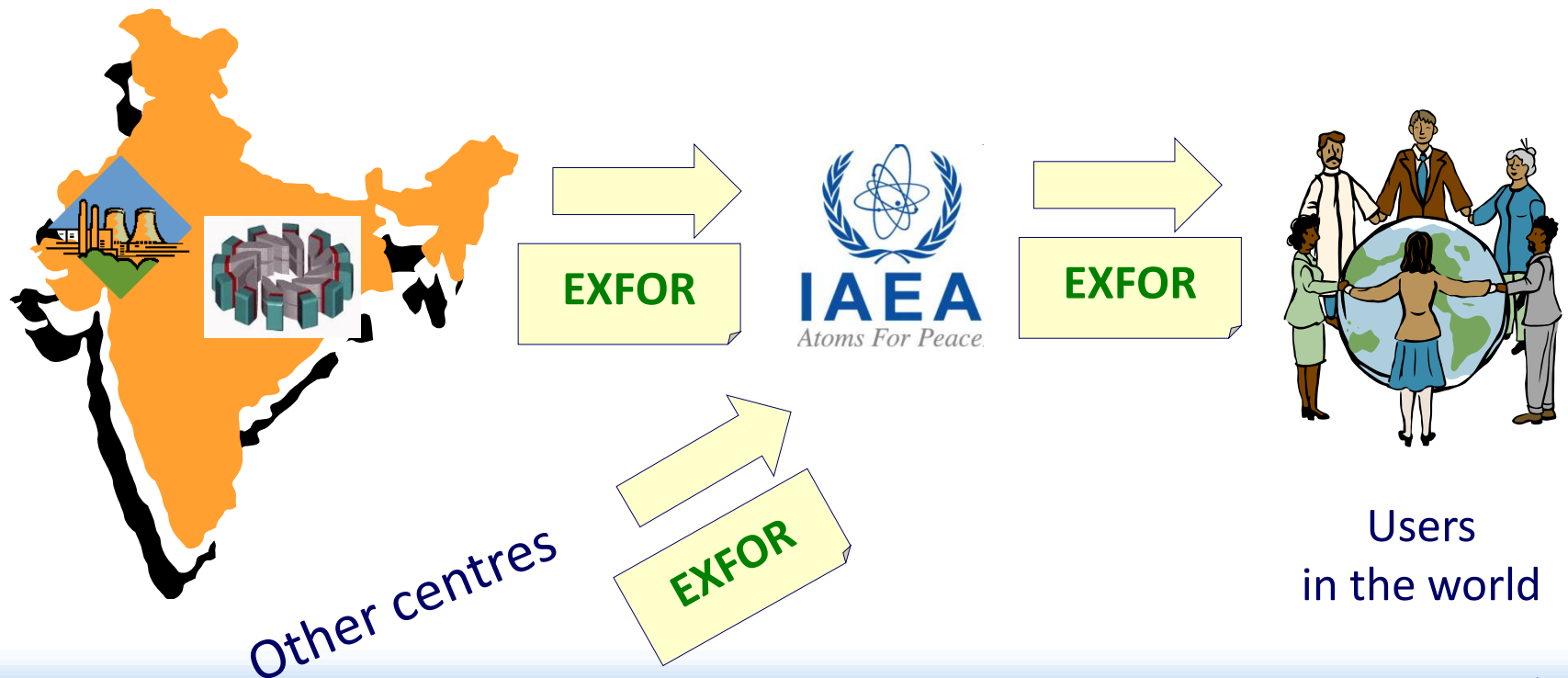
The current exchange structure:



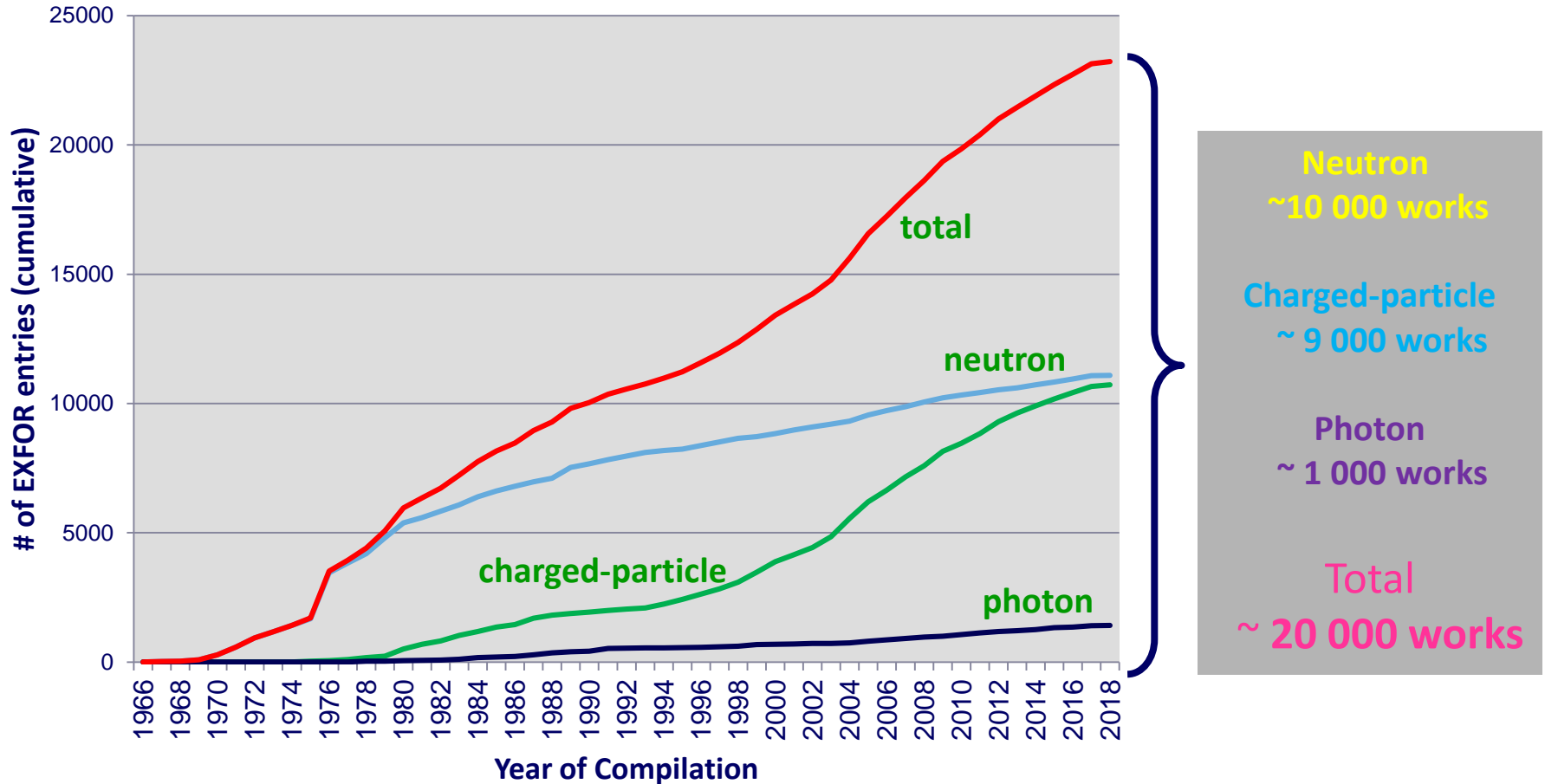
5 centres receive exchanged data and include into their own DB.

# Responsibility of Indian Researchers

Indian Centre (NDPCI, coordinated by Prof. A. Saxena, BARC) is responsible to neutron, charged-particle and photonuclear reaction data **measured in India**.

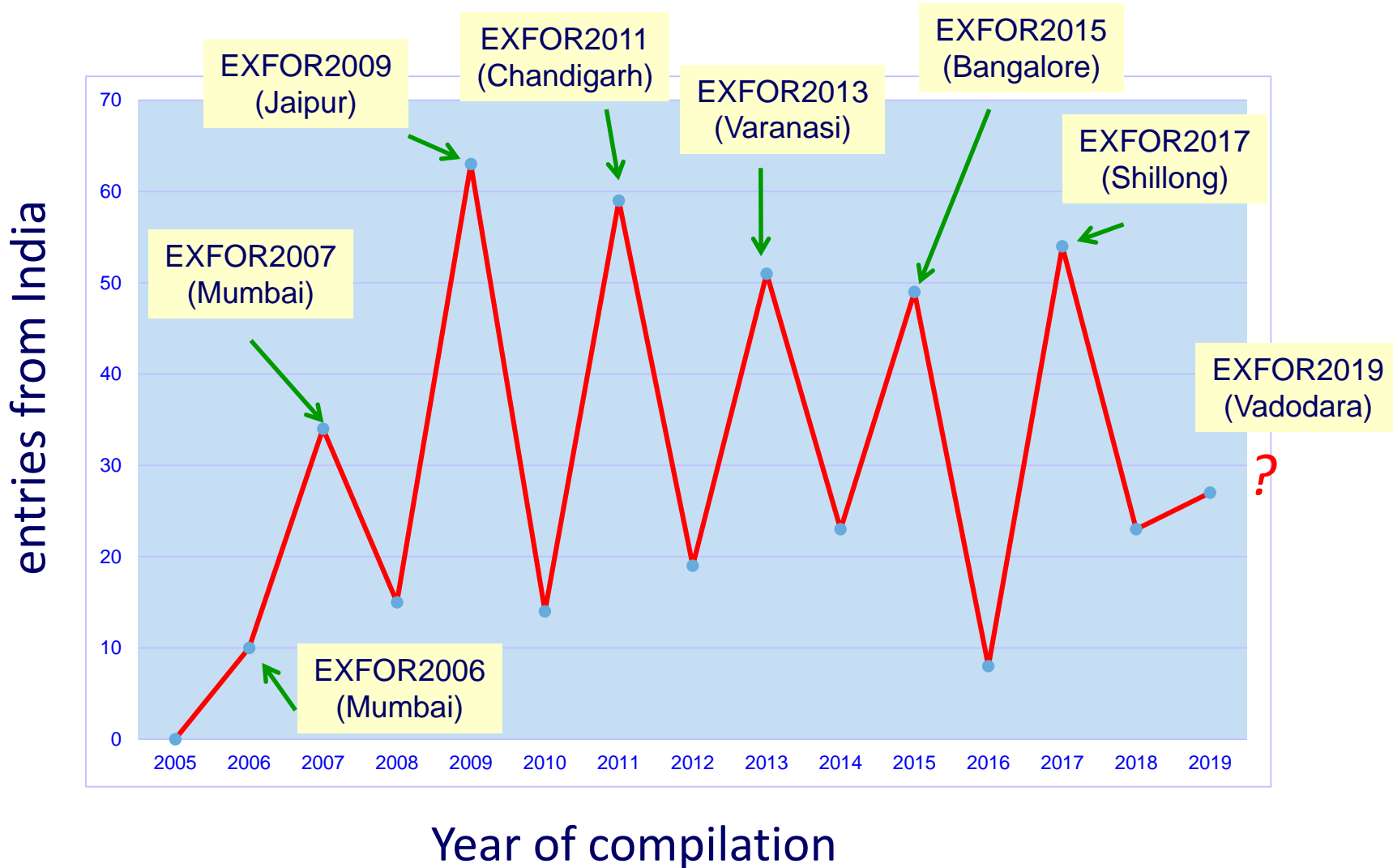


# How Many Experiments in EXFOR?



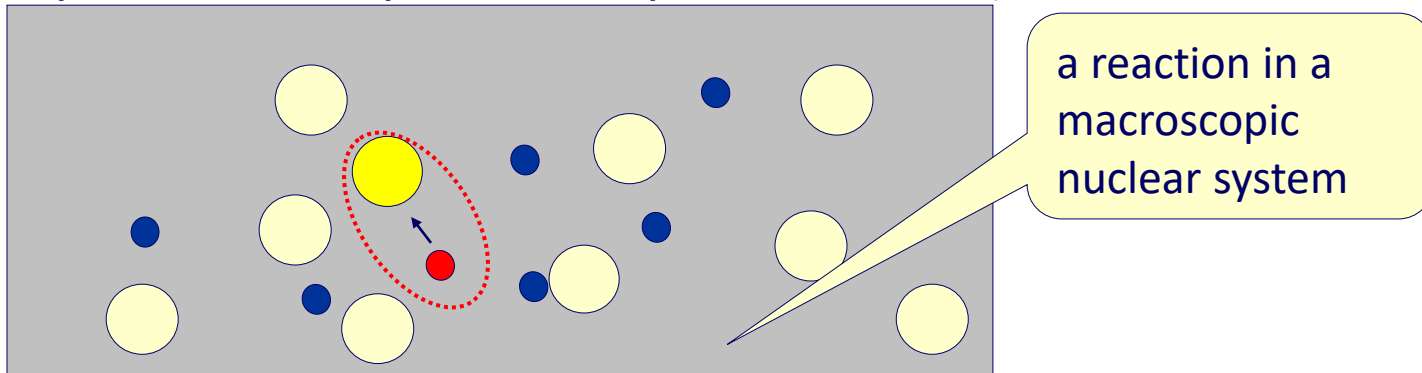


# Contribution from India to EXFOR



# Scope of EXFOR

- EXFOR is a **general purpose** experimental data library.  
(c.f. ENDF – evaluated nuclear data libraries – are designed for fission and fusion energy systems.  $E_n < 20$  MeV)
- Data describing a **microscopic** nuclear reaction are considered (c.f. “per incident particle” “per reaction”).



# Example of Quantities in EXFOR

- Cross section
- Differential cross section (angular, energy, double, triple, ...)
- Resonance parameter
- Fission quantity (fission yield, fission neutron multiplicity, ...)
- Polarization quantity (analyzing power, ...)
- Thick target yield

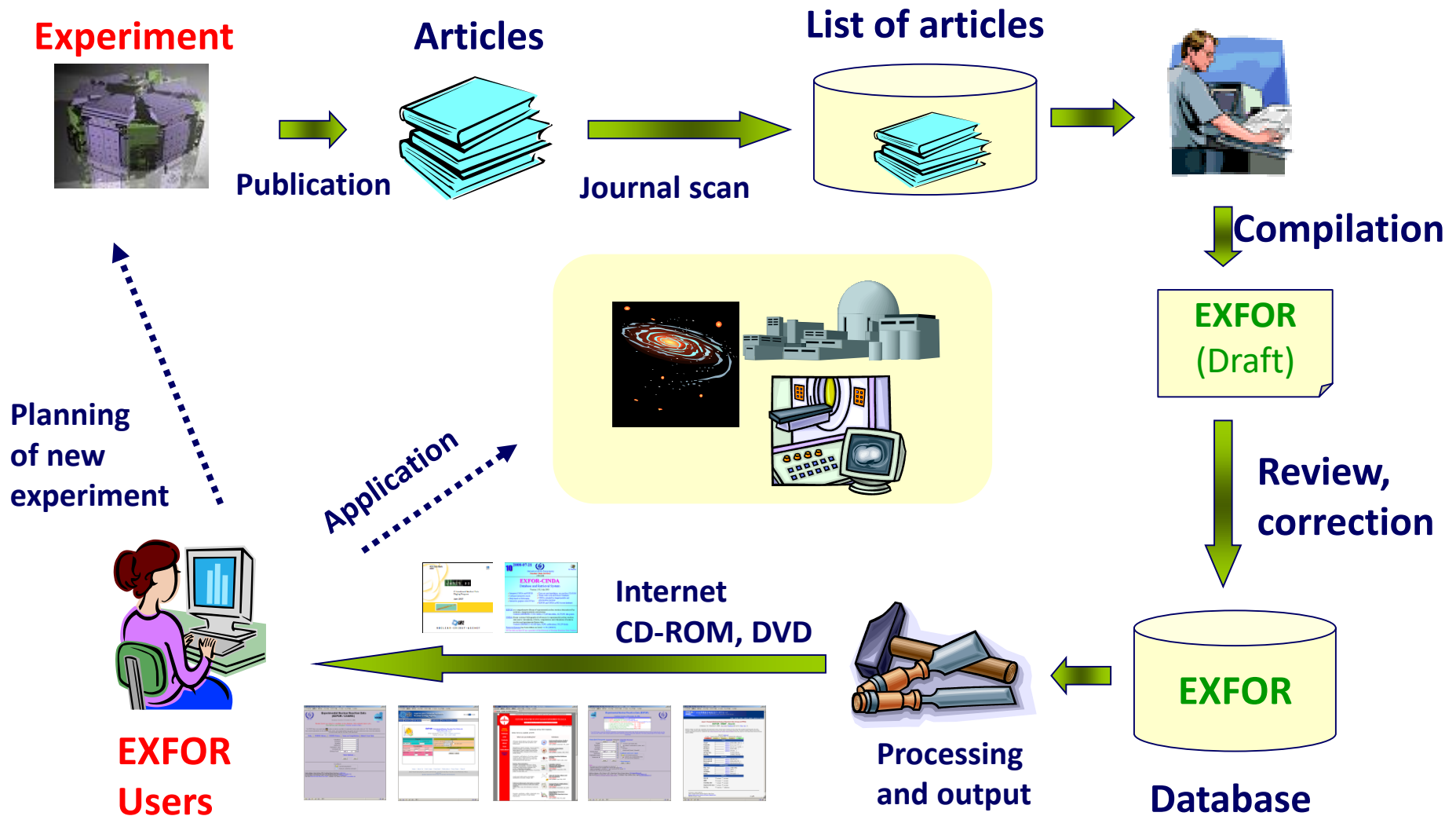
etc.

# Example of EXFOR Entry – 13597.005

```
SUBENT      13597001      950822
BIB          15          27
...
AUTHOR      (S.K.GHORAI,P.M.SYLVA,J.R.WILLIAMS,W.L.ALFORD)
TITLE       Partial neutron cross sections for 64Zn, 66Zn, 67Zn
           and 68Zn between 14.2 and 18.2 MeV
FACILITY     (DYNAM)
INC-SOURCE  (D-T) deuterons on titanium tritide.
SAMPLE      Natural zinc sample.
METHOD      (ACTIV,MOMIX)
...
ENDSUBENT   34
SUBENT      13597005      950217
BIB          2           2
REACTION    (30-ZN-67(N,P)29-CU-67,,SIG)
DECAY-DATA  (29-CU-67,62.01HR,DG,185.,0.470)
ENDBIB      2
NOCOMMON    0           0
DATA        5           5
EN          DATA      DATA-ERR  MONIT      MONIT-ERR
MEV         MB         MB         MB         MB
14.2        82.        5.        122.0     0.65
15.2        106.       6.        108.0     1.96
16.2        125.       8.        90.0      1.75
17.2        141.       21.       72.0      1.41
18.2        230.       30.       59.5      1.26
ENDDATA     7
ENDSUBENT   14
```

80-columns  
ASCII file

# Data From Experimentalists to EXFOR Users



# Entry Number

- Each EXFOR Entry is identified by **Entry number** (ID for each experimental *work*).
- Entry number has one area character and 4 digits number.

## Example

Entry **41123**: 1123th EXFOR entry from area 4

Entry **C0453**: 453th EXFOR entry from area C

- area 4: Neutron data from former USSR

- area C: charged-particle data from US+Canada

# Subentry Number

- One Entry is a set of Subentries.
- Each subentry is characterized by subentry number (subaccession number).
- Subentry 001 is a set of common information applicable to all subentries (e.g., title, authors, institute, experimental facility, detector)
- Subentry 002, 003,... are assigned to data sets.

## Subentry Number (cont)

Example:

An Indian neutron EXFOR entry (EXFOR 33023)

(B.K. Nayak et al., Phys.Rev.C78(2008)061602)

33023.001:

Common information (title,author,...)

33023.002:

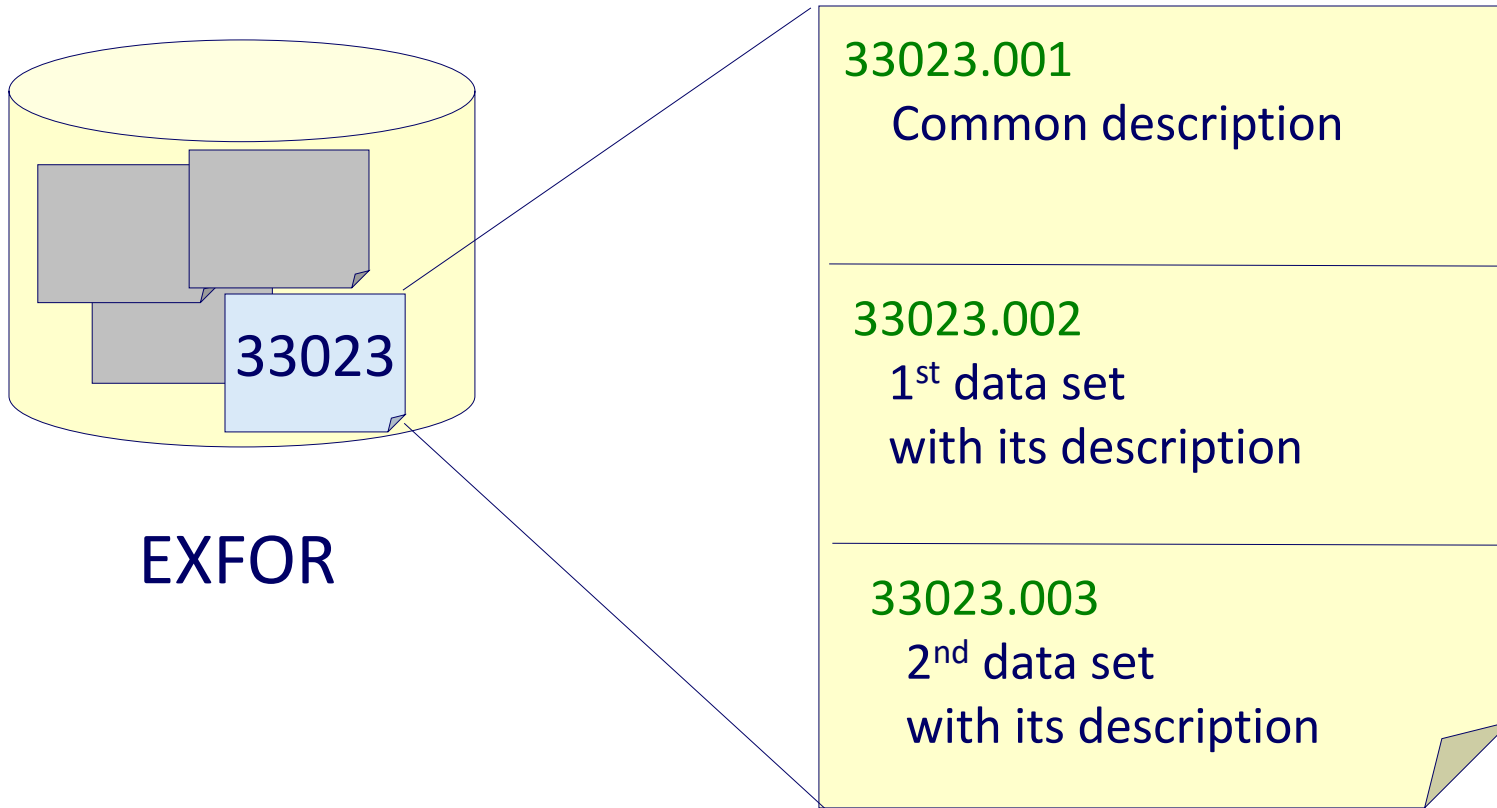
Data set for  $^{233}\text{Pa}(n,f)/^{235}\text{U}(n,f)$  x-section ratio

33023.003:

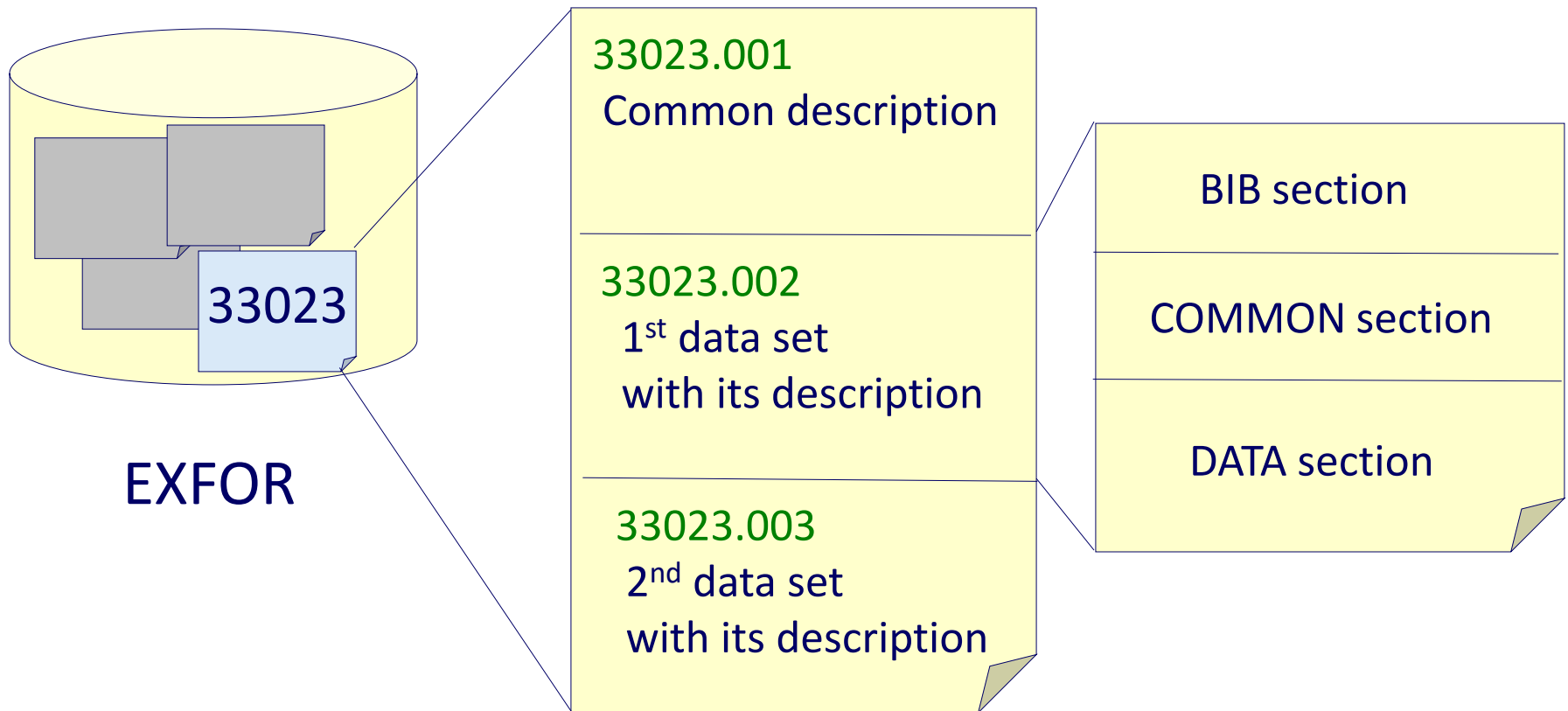
Data set for  $^{233}\text{Pa}(n,f)$  x-section



# Subentry Number (cont)



# BIB, COMMON and DATA Section



# Example of BIB Section

	11	66	80
<b>TITLE</b>	Systematic study of (n, p) reaction cross sections	33034001	3
..			
<b>AUTHOR</b>	(B.Lalremruata, N.Otuka, G.J.Tambave, V.K.Mulik,	33034001	5
...			
<b>INSTITUTE</b>	(3INDIND) Mizoram University, Aizawl	33034001	8
...			
<b>REFERENCE</b>	(J,PR/C,85,024624,2012)	33034001	10
<b>FACILITY</b>	(CCW,3INDPOO)	33034001	12
...			
<b>STATUS</b>	(TABLE) Table V of Phys.Rev.C85(2012)024624	33034001	57
	(APRVD) B.Lalremruata (2012-03-15)	33034001	58
<b>HISTORY</b>	(20110516C) Ranjita Mandal	33034001	59

**Keyword**

**Description**

- Parenthesized coded information
- Free text information



# Example of COMMON and DATA Section

