International Atomic Energy Agency

The 9th DAE-BRNS Workshop on

Nuclear Reaction Data and its Compilation for EXFOR Database

Department of Physics, Bharathiar University, Coimbatore India

14–18 November 2023

EXFOR/ENDF database

Naohiko OTSUKA

Nuclear Data Section

Department of Nuclear Sciences and Applications

EXFOR from Various Centres / Medias

- Centres may use their own database system.

   Example: CSISRS, SIGMA (NNDC), JANIS (NEA-DB), EXFOR (IAEA-NDS)

- However, all centres (should) use the latest EXFOR source files.

   (IAEA-NDS maintains "**EXFOR Master File**" 2005~)

EXFOR from Various Centres / Medias (cont)

IAEA Nuclear Data Section maintains EXFOR search system:
http://nds.iaea.org/exfor/

EXFOR Search by Reaction/Quantity

Each EXFOR entry is searchable by Target, Projectile etc. at http://nds.indcentre.org.in/exfor/ .

Keyword	Example
Target	O-18
Reaction	"p,n"
Quantity	"CS" (cross section)
Product	F-18

EXFOR Search by REACTION (cont)

Target: O-18
Reaction: p,n
Quantity: cs
Product: F-18

1st author   beam energy (eV)   reference   subent #

EXFOR Cross Section Plot

Plot of cross section
is very easy! (*Quick-plot*)
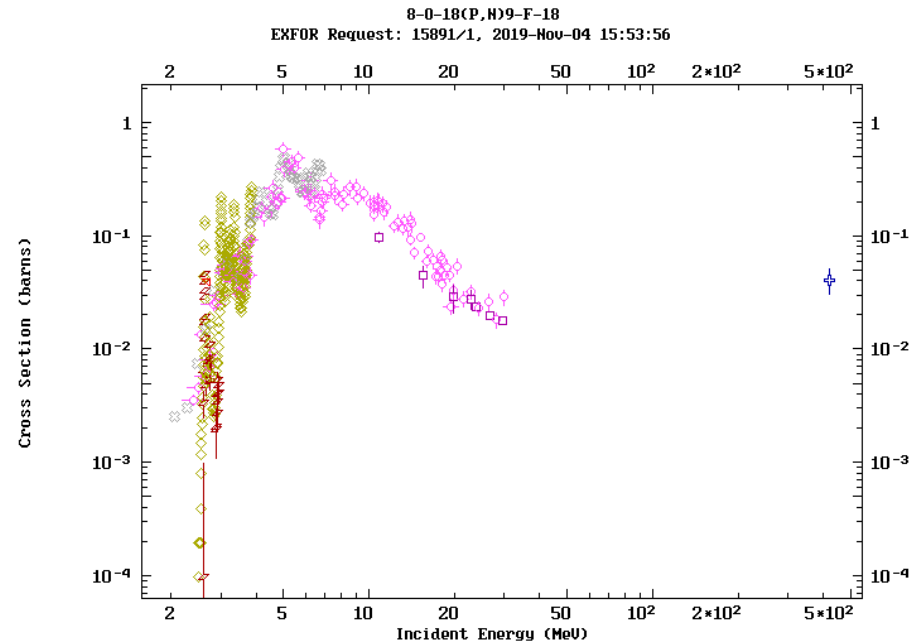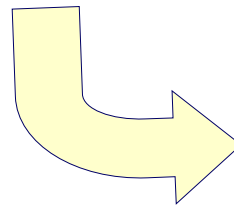
Adjustment of Plot on Web
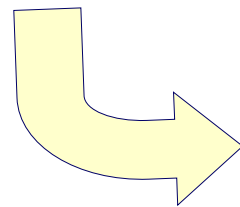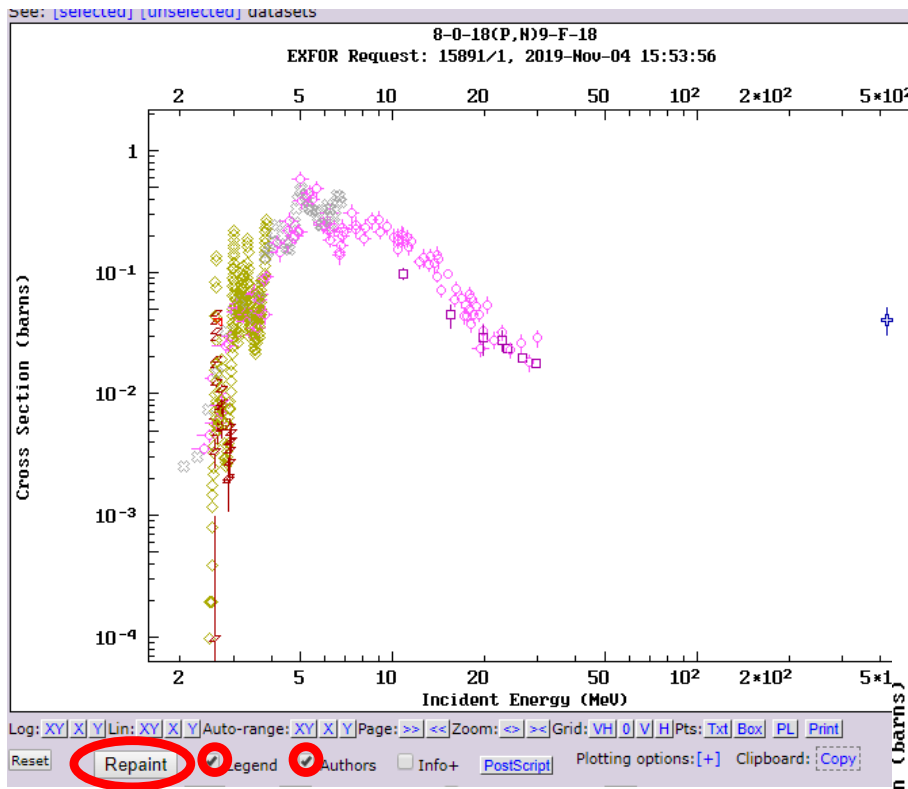
Check "Legend" and "Authors"
and click "Repaint".

International Atomic Energy Agency
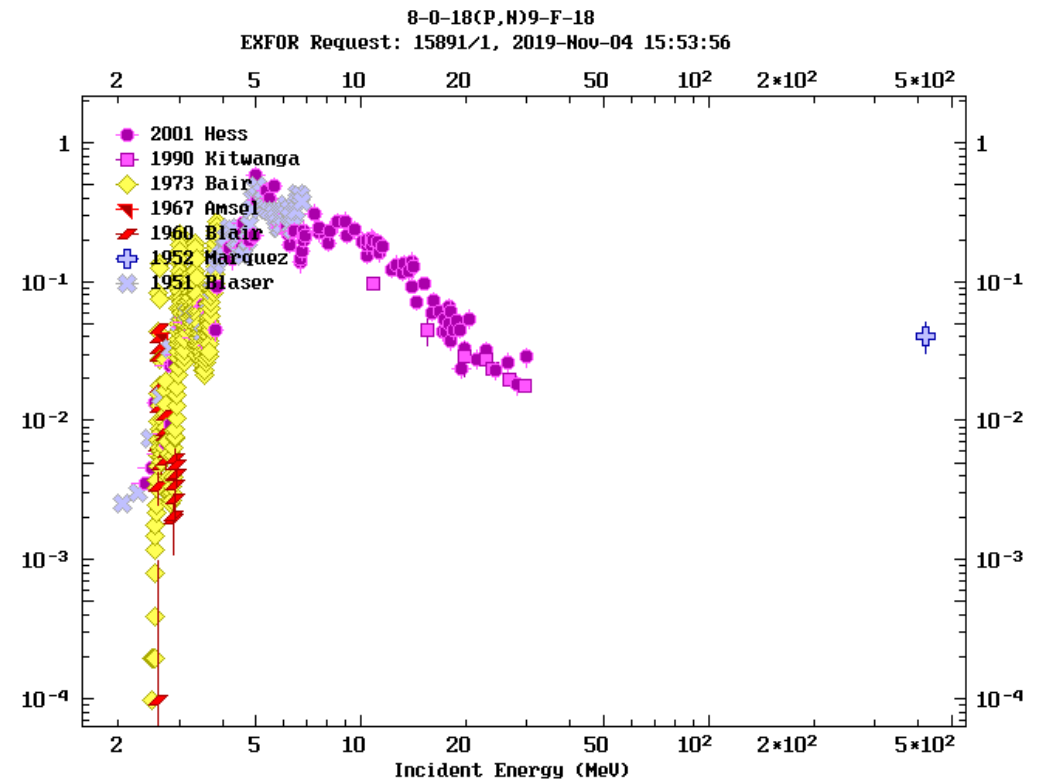
Adjustment of Plot on Web (cont)
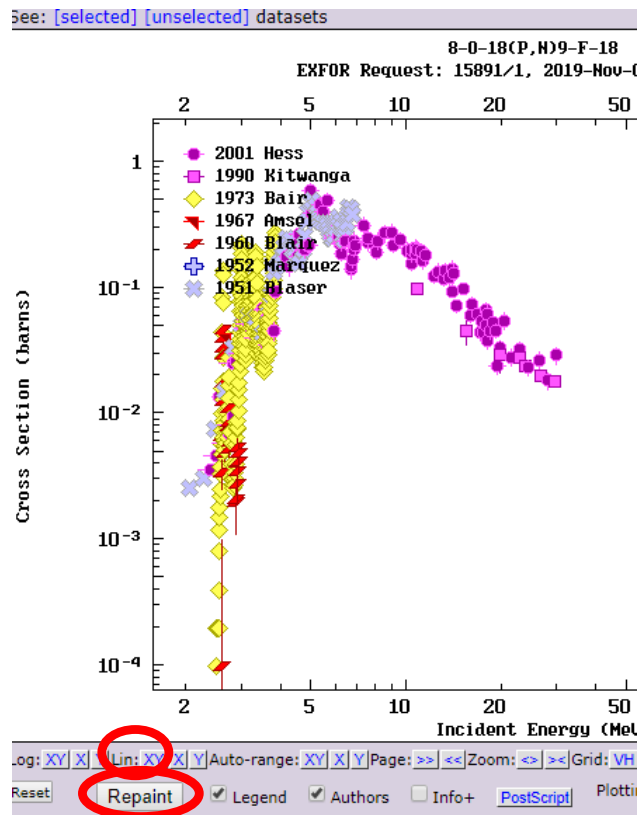
Select area,
Click "Lin:XY"
and click "Repaint".
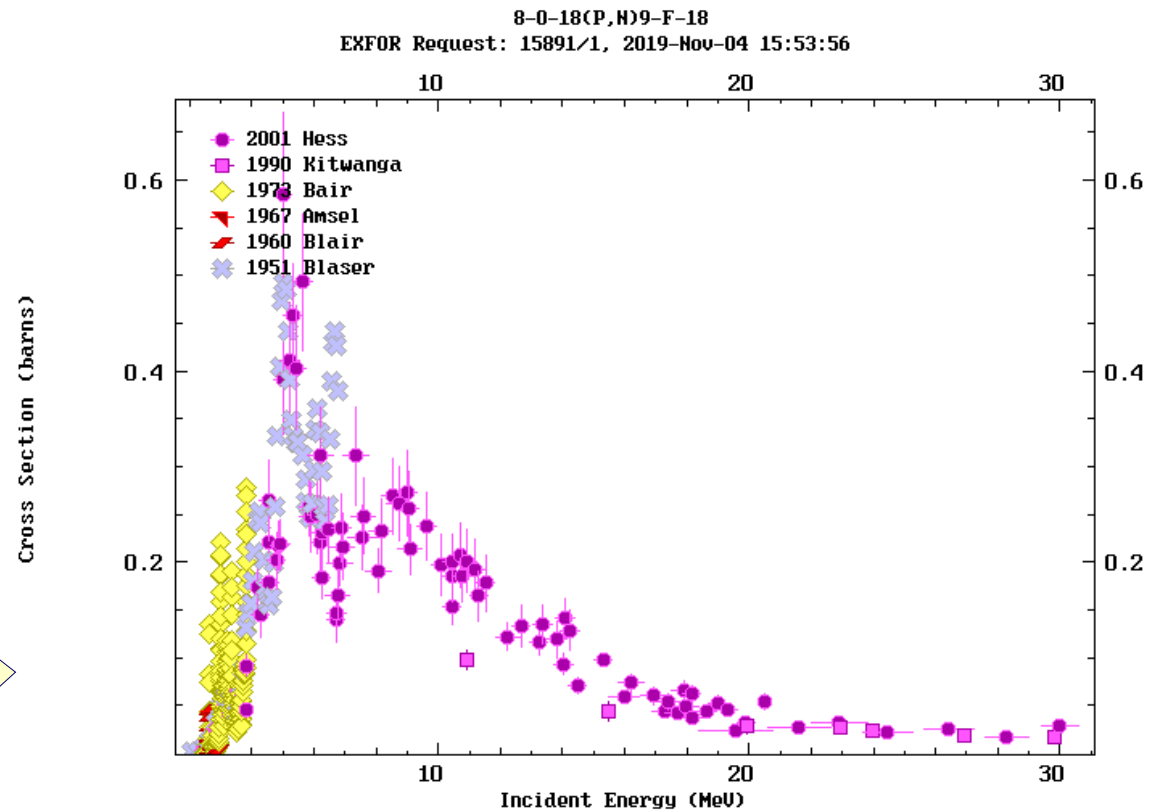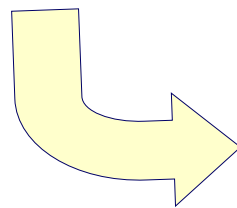
Exercise: ^{233}Pa(n,f)

Exercise:

^{233}Pa neutron-induced fission cross section

- Search ^{233}Pa(n,f) cross sections in EXFOR at http://nds.iaea.org/exfor/

Target: Pa-233

Reaction: n,f

Quantity: cs

- Select 3 data sets (Nayak, Tovesson, Petit)
- (Quick-)Plot all data sets in (x,y)=(log-lin)

Exercise: ^{233}Pa(n,f) (cont)

Request

[Submit] [Reset] [Help]	
Target ☑	Pa-233
Reaction ☑	n,f
Quantity ☑	cs
Product ☐	

Data Selection

[Retrieve] ◉ Selected ◯ Unselected ◯ All [Reset]

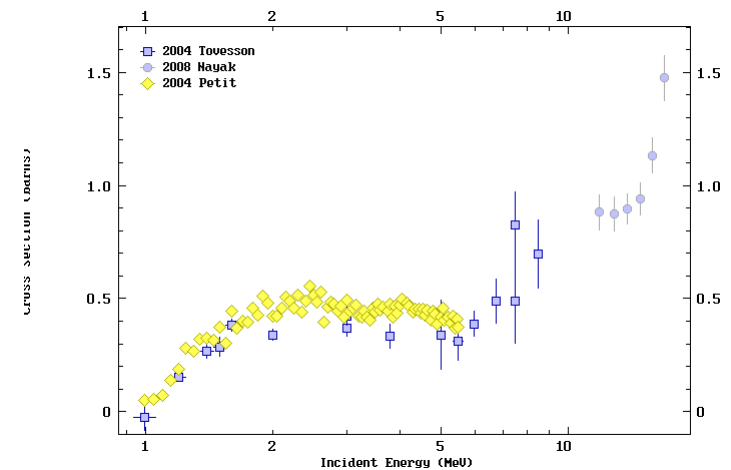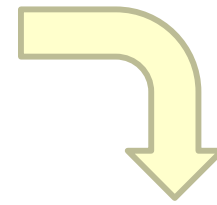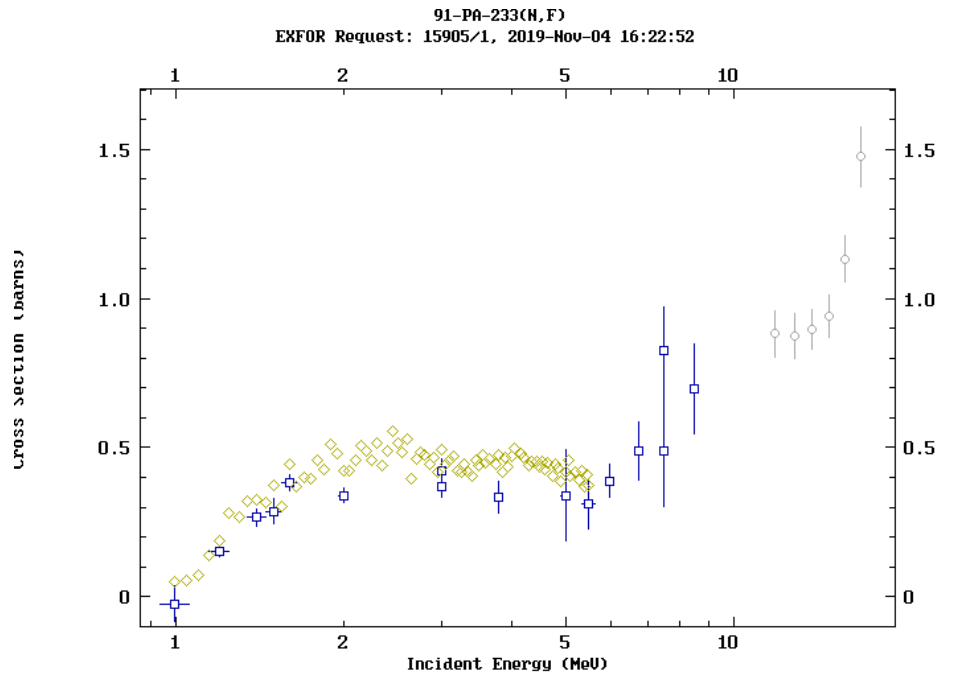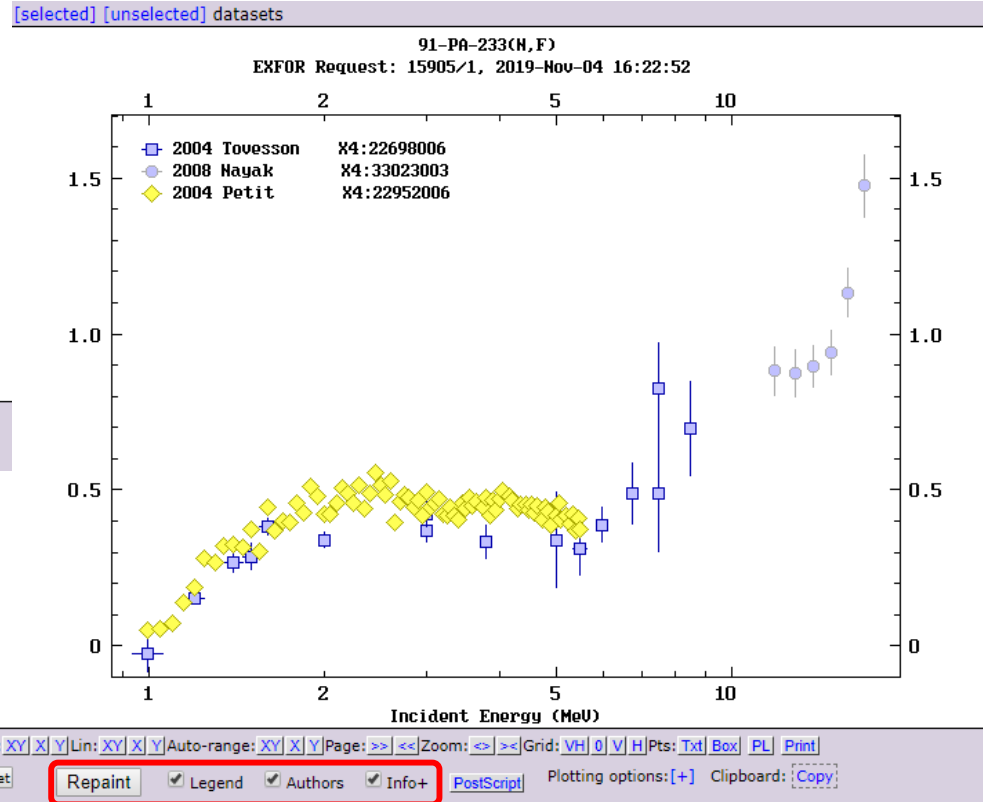Output: ☑ X4+ ☑ EXFOR ☑ Bibliography ☐ TAB ☐ C4 ☐ PlotC4

Plot: ☑ Quick-plot (cross-sections) ☐ ungroup ☐ Advanced plot [how-to] using ☐

Narrow incident energy (optional), eV: Min: ☐ [____] Max: ☐ [____]

☐ Apply ⤫ Data re-normalization (for advanced users, results in: C4, TA

n	Display	Year	Author-1	Energy range, eV
1)	ⓘ 🔍 91-PA-233(N,F),,SIG C4: MF3 MT18			
	Quantity: [CS] Cross section			
1 ☑	+ i X4 X4+ X4± T4 Cov	2004	F.Tovesson+	1.00e6
2)	ⓘ 🔍 91-PA-233(N,F),,SIG,,,DERIV C4: MF3 MT18 ...[Derived d			
	Quantity: [CS] Cross section			
2 ☑	+ i X4 X4+ X4± T4 Cov	2008	B.K.Nayak+	1.18e7
3 ☑	+ i X4 X4+ X4± T4 Cov	2004	M.Petit+	1.00e6
3)	ⓘ 🔍 91-PA-233(N,F),,SIG,,FIS C4: MF=3 MT=?			
	Quantity: [CS] Cross section			
4 ☐	+ i X4 X4+ X4± T4 Cov	1966	H.R.Von Gunten+	1.50e6
4)	ⓘ 🔍 (91-PA-233(N,F),,SIG,,,DERIV)//(92-U-235(N,F),,SIG,,,			
	Quantity: [CS] Cross section			
5 ☐	+ i X4 X4+ X4± T4 Cov	2008	B.K.Nayak+	1.05e7

A : Autmatic data re-normalization is available

[Info] : Show Summary (with code explanation, links to dependent data, etc.)
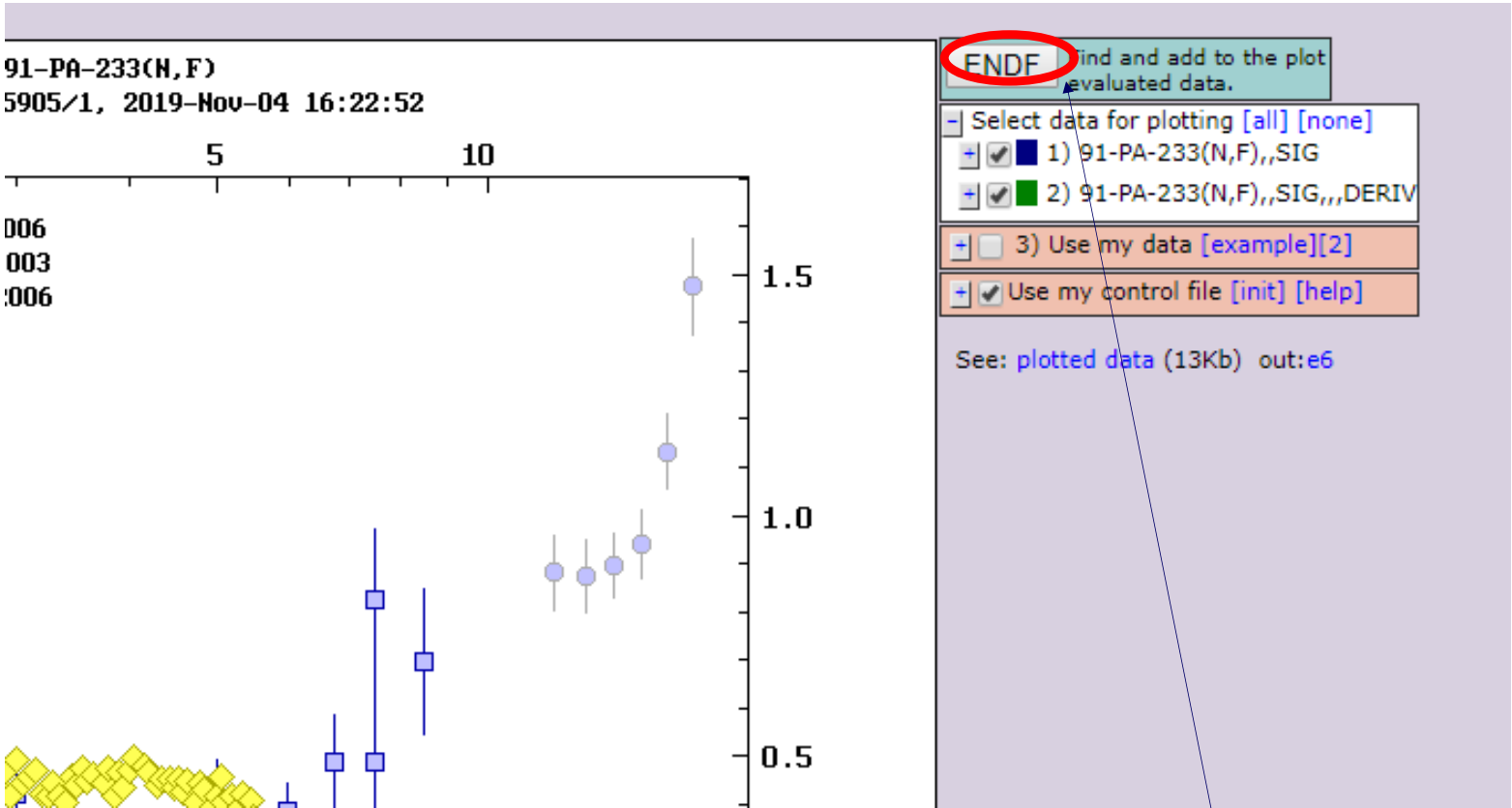
"91-PA-233(N,F),,SIG" means ^{233}Pa(n,f) cross section.

Exercise: ^{233}Pa(n,f) (cont)

Activate 3 options (Legends, Authors, Info+) and repaint.

Comparison with Evaluated Data Libraries (ENDF)

91-PA-233(N,F)
5905/1, 2019-Nov-04 16:22:52

ENDF find and add to the plot evaluated data.

-| Select data for plotting [all] [none]
+| ✓ ■ 1) 91-PA-233(N,F),,SIG
+| ✓ ■ 2) 91-PA-233(N,F),,SIG,,,DERIV
+| □ 3) Use my data [example][2]
+| ✓ Use my control file [init] [help]

See: plotted data (13Kb) out:e6

Button for comparison with evaluated data libraries

Comparison with Evaluated Data Libraries (cont)

Select three libraries (ENDF/B-VIII, JEFF-3.3 and JENDL-4.0) and plot!

Comparison with Evaluated Data Libraries (cont)

Select area, and use
(x,y)=(lin,lin) scale;
Legend & Authors & Info+
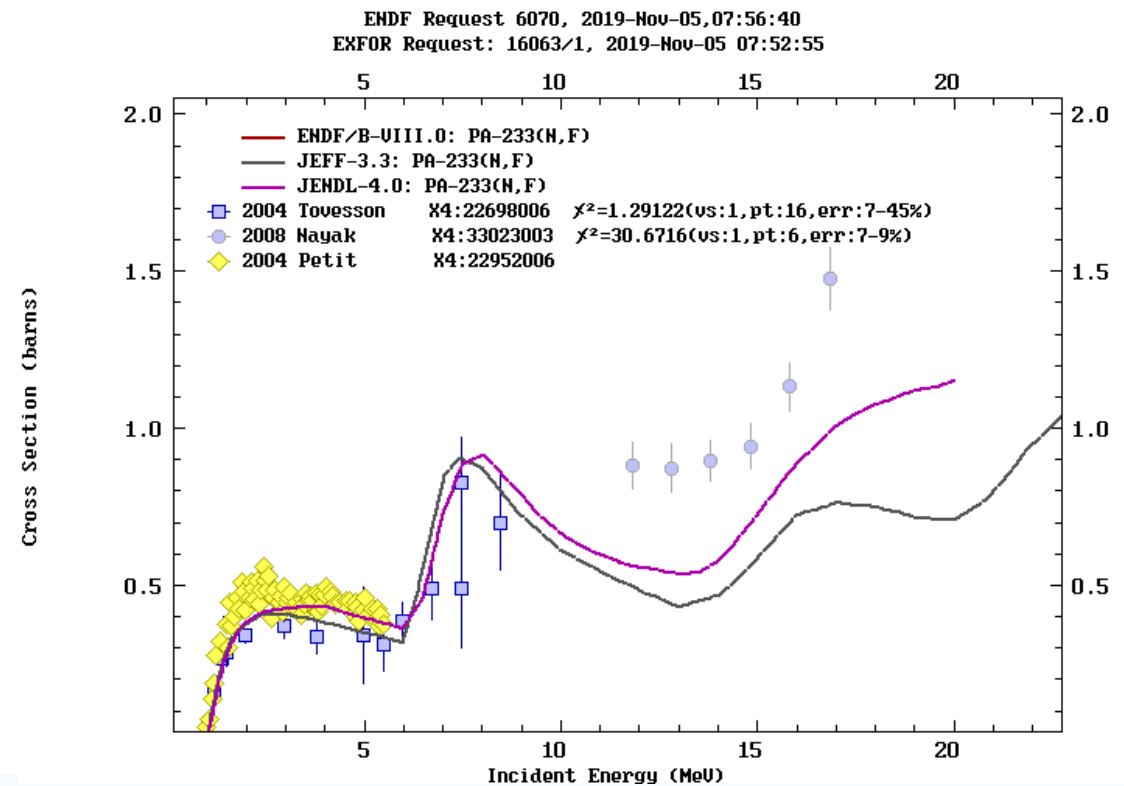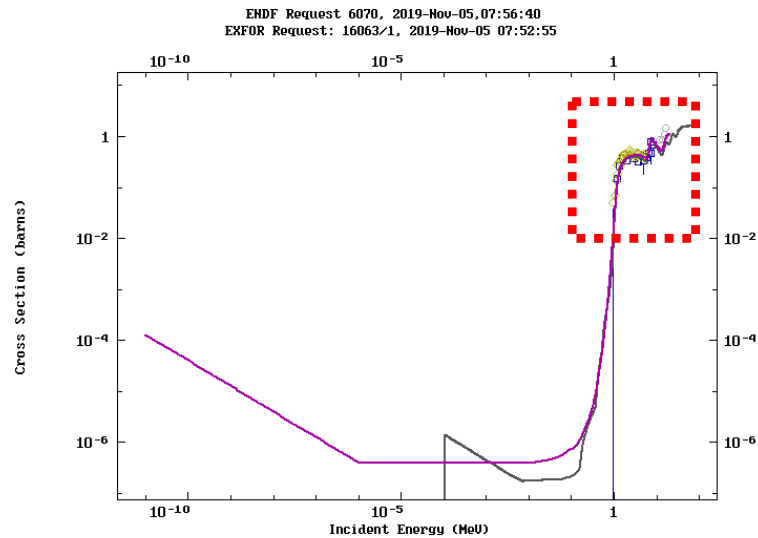
^{78}Se(n,p)^{78}As in Common article

Exercise:

^{78}Se(n,p)^{78}As cross section

- Search ^{78}Se(n,p)^{78}As cross sections in EXFOR by

  http://nds.iaea.org/exfor/

  Target: Se-78

  Reaction: n,p

  Quantity: cs

- Select all relevant data

- (Quick-)Plot all data sets in (x,y)=(lin-lin)

^{78}Se(n,p)^{78}As in Common article (cont)

Check all data sets <u>except for</u> <u>"2014 F.M.D.Attar+".</u>

"34-SE-78(N,P)33-AS-78,,SIG" means ^{78}Se(n,p) ^{78}As cross section.

Exercise: ^{78}Se(n,p)^{78}As in Common article (cont)
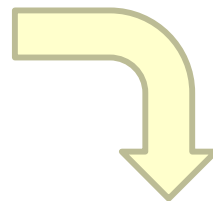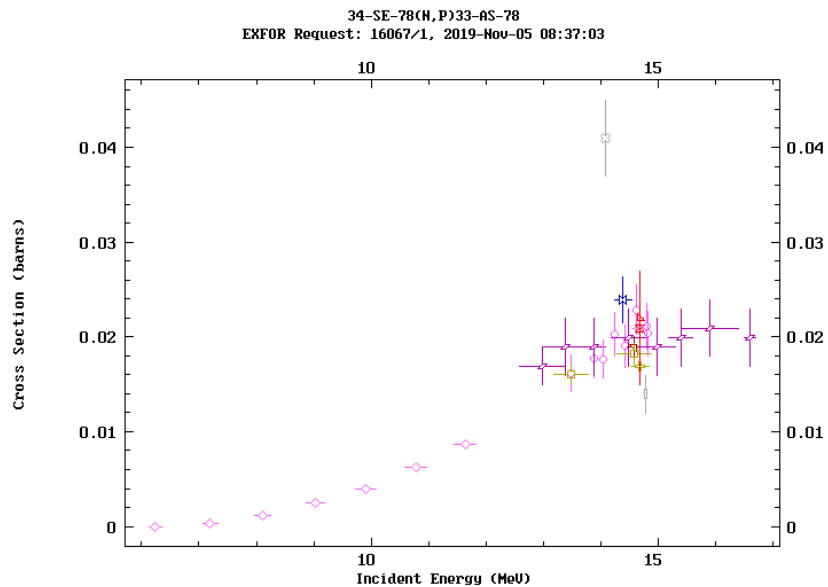
Activate 2 options (Legend, Authors) and repaint.
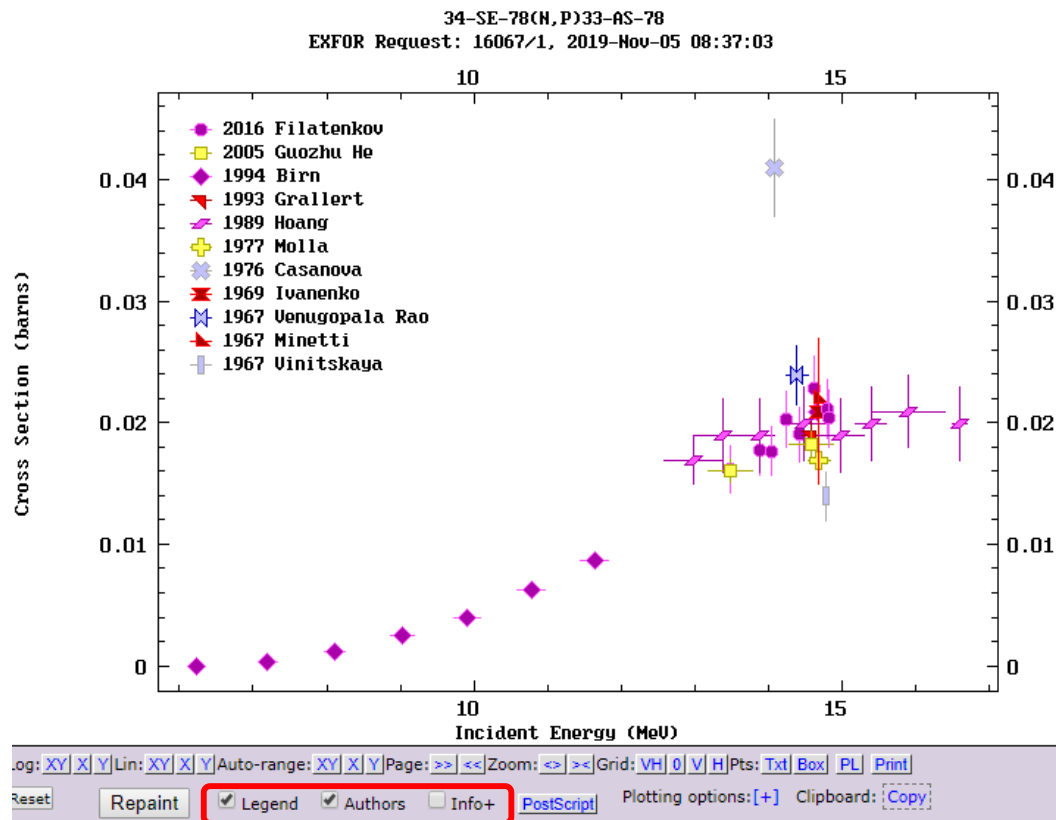
Exercise: Addition of "my data" to Plot

Add Table II data of the
"Common article",
and Repaint.

To convert units of the
Table (MeV, mb) to the
"basic units" (eV, b)

Exercise: Comparison with Evaluated Data Libraries (cont)

Select three libraries (ENDF/B-VIII.0, JEFF-3.3 and JENDL-4.0) and plot!

Exercise: Comparison with Evaluated Data Libraries (cont)

Select area and use (x,y)=(lin,lin) scale; Legend&Authors&Info+
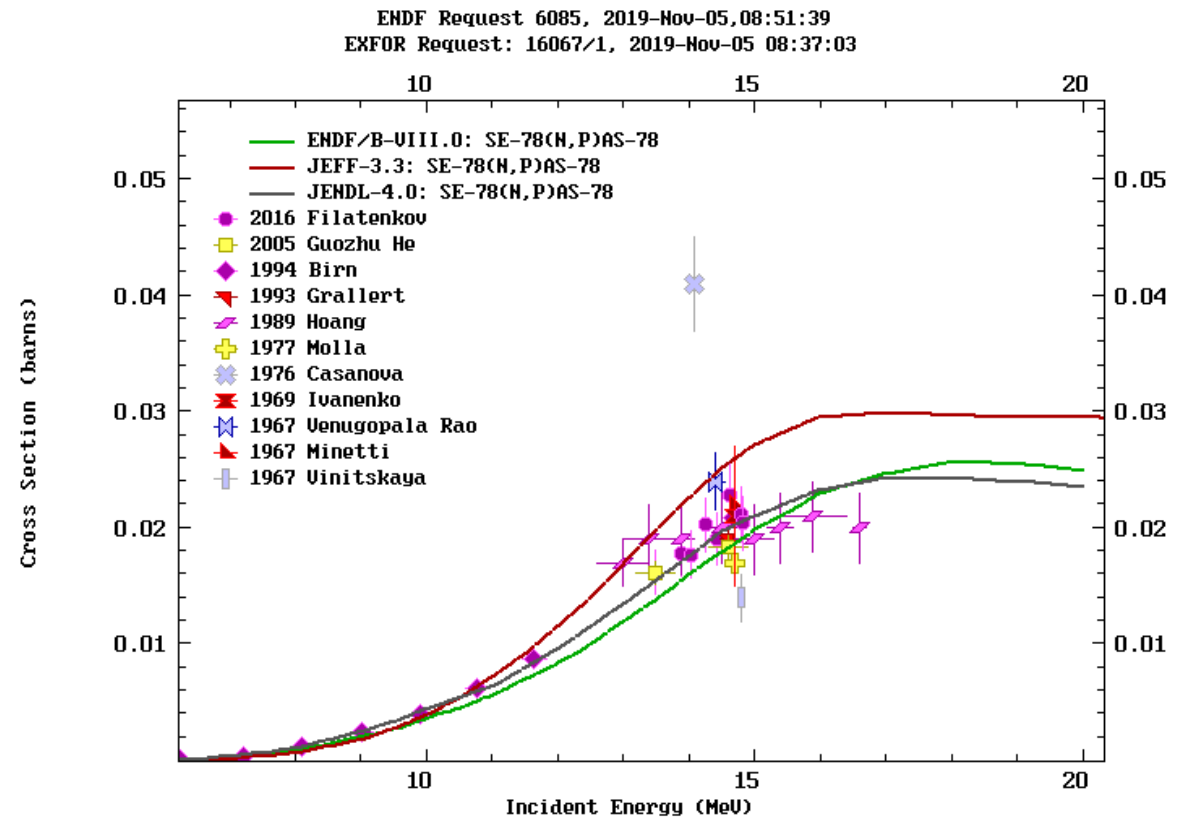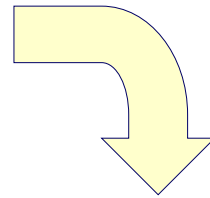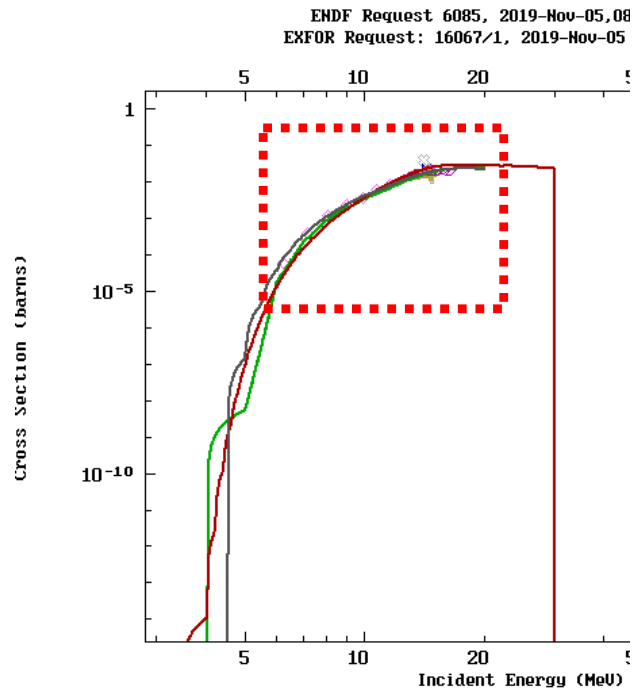
Exercise: ^{80}Se(n,p)^{80}As in Common article

Exercise:

^{80}Se(n,p)^{80}As cross section
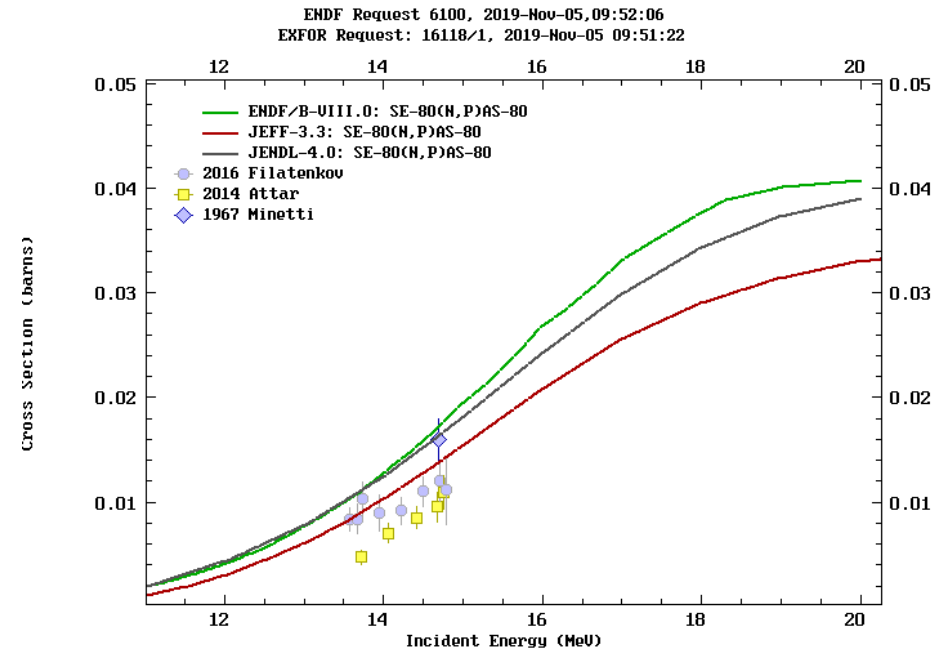
- Search ^{78}Se(n,p)^{78}As cross

    sections in EXFOR by

    Target: Se-80

    Reaction: n,p

    Quantity: cs

- Select all relevant data and plot (but only single point).

- Then plot with ENDF/B-VIII.0, JEFF-3.3 and JENDL-4.0 data.

- Then plot with data in Table II of the "Common article".

EE-View – New Retrieval System for Beginners

EE-VIEW

https://nds.iaea.org/exfor/eeview.htm

08:19

Easy tool for quick plotting (though the functions are rather limited.)

International Atomic Energy Agency

EE-View – New Retrieval System for Beginners (cont)

^{80}Se(n,p)^{80}As cross section

Projectile: n
Target: Se-80
Emission: p

Advanced Plot (Diff. Cross Section etc.)
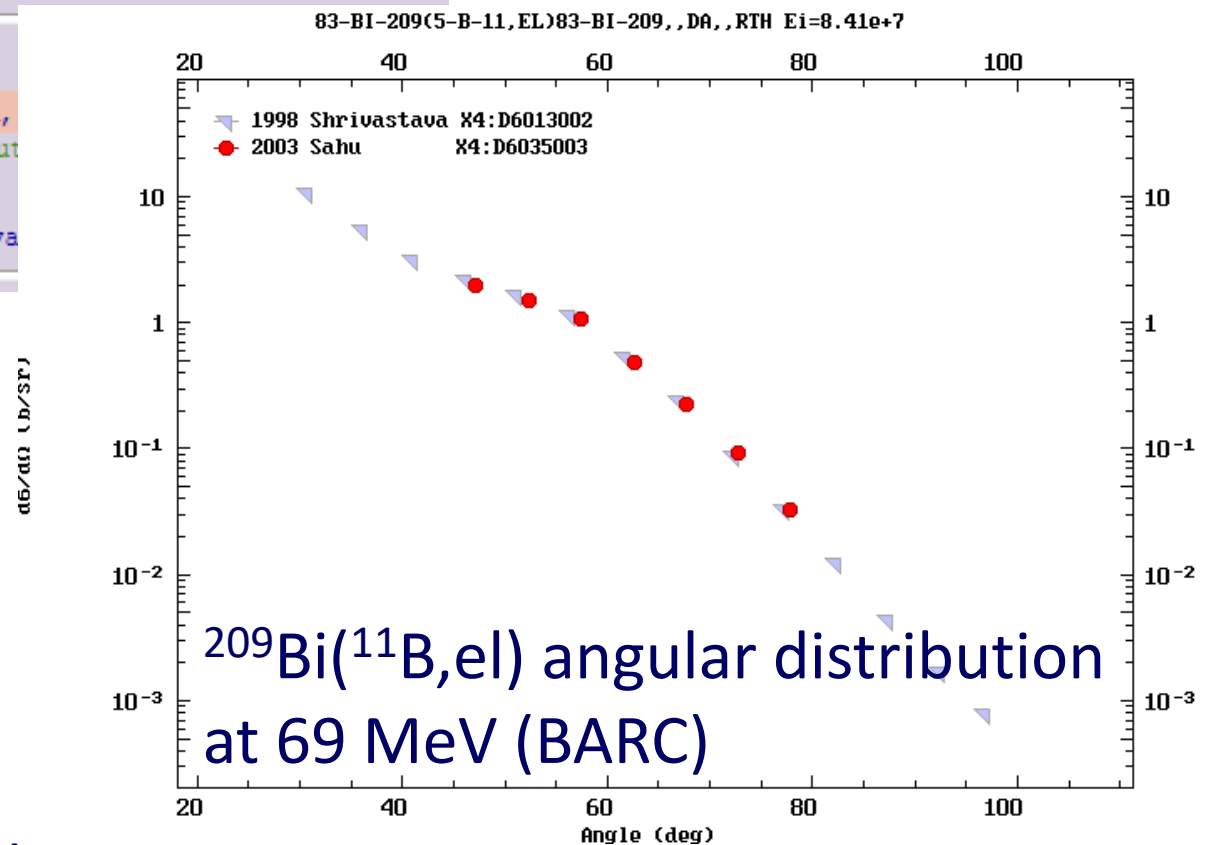
Data Selection

Retrieve ● Selected ○ Unselected ○ All [Reset]

Output: ☑ X4+ ☑ EXFOR ☑ Bibliography ☐ TAB ☑ C4 ☐ PlotC4

Plot: ☐ Quick-plot (cross-sections) ☐ ungrou... ☑ Advanced plot [how-to] using ☐ C5 and

Narrow incident energy (optional), eV: Min: ☐ [_____] Max: ☐ [_____]

☐ Apply ⌄ Data re-normalization (for advanced users, results in: C4, TAB and Plo...

	n	Display	Year Author-1
📁 ● 1)	ⓘ 🔍	83-BI-209(5-B-11,EL)83-BI-209,,DA,	
		Quantity: [DA] Differential cs d/dA rel.to Rut	
		[T4] 2003 P.K.Sahu+	
		[T4] 1998 A.Shrivastava	

83-BI-209(5-B-11,EL)83-BI-209,,DA,,RTH Ei=8.41e+7

▽ 1998 Shrivastava X4:D6013002
● 2003 Sahu   X4:D6035003

dσ/dΩ (b/sr)

Angle (deg)

^{209}Bi(^{11}B,el) angular distribution at 69 MeV (BARC)

Send your question to
the NDS Web system developer
Dr. V. Zerkin (v.zerkin@gmail.com).