
Input for SG31

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Nuclear Data Requests From SG26

- *Uncertainty And Target Accuracy Assessment For Innovative Systems
Using Recent Covariance Data Evaluations*
Nuclear Science NEA/WPEC-26
OECD 2008, NEA No. 6410

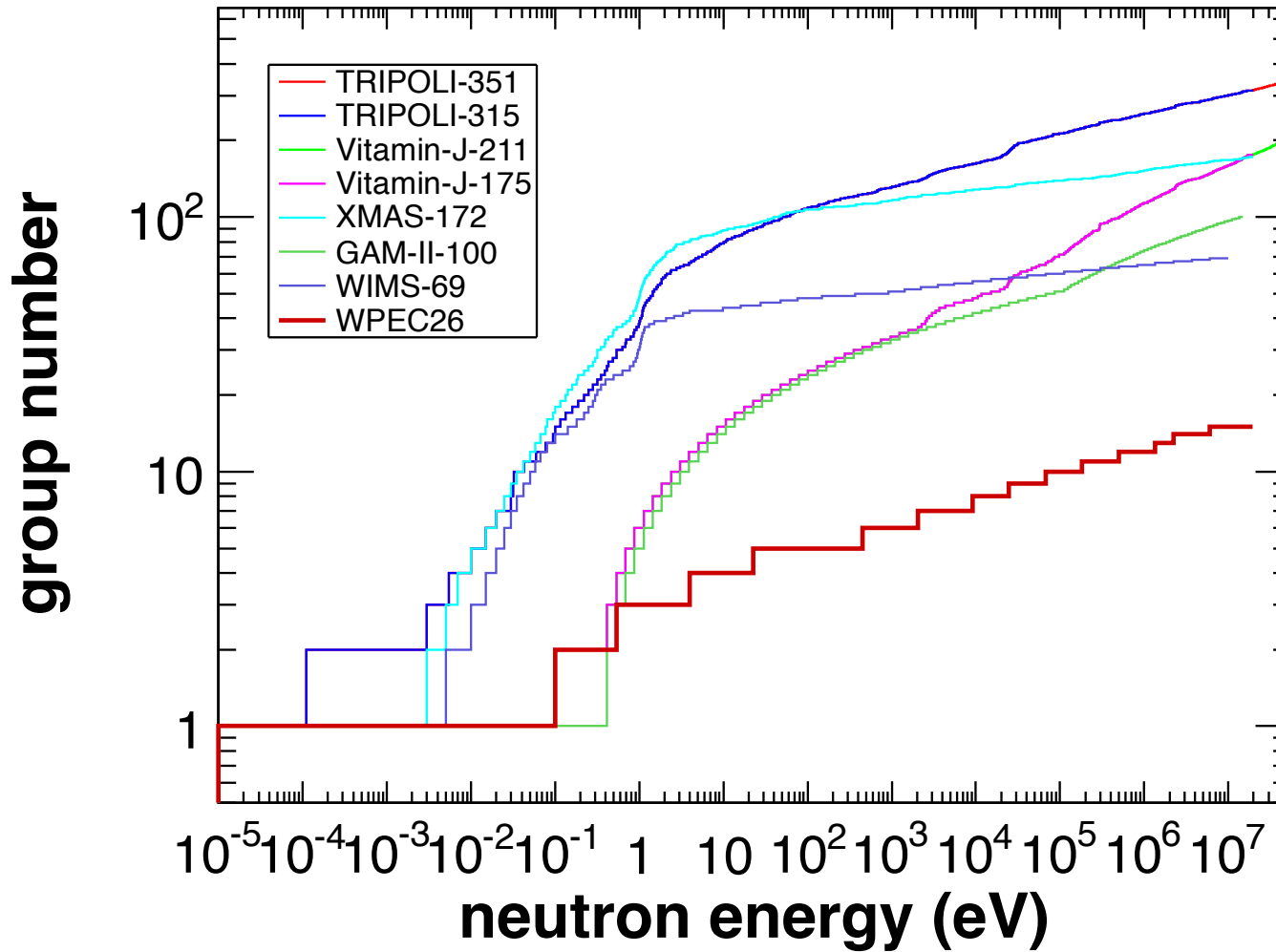
Simulations of 8 reactor types

#	reactor type
1	ABTR (table 25)
2	SFR (table 26)
3	EFR (table 27)
4	GFR (table 28)
5	LFR (table 29)
6	ADMAB (table 30)
7	VHTR (table 33)
8	PWR (table 34)

using cross sections in 15 groups

group nr	E_{upper} (eV)
1	1.96E+07
2	6.07E+06
3	2.23E+06
4	1.35E+06
5	4.98E+05
6	1.83E+05
7	6.74E+04
8	2.48E+04
9	9.12E+03
10	2.03E+03
11	4.54E+02
12	2.26E+01
13	4.00E+00
14	5.40E-01
15	1.00E-01

Group structure used in SG26



Nuclear Data Requests From SG26

reactor types for which ND improvements are needed

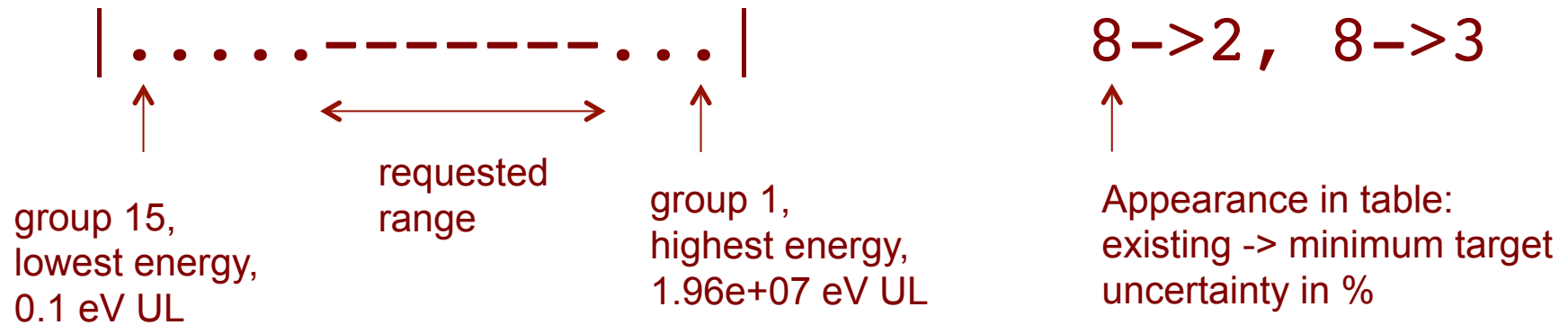
reaction

nuclide

	capt	el	fiss	inel	nu	scatt
Am241	64		6452	6	6	
Am242m	2		652			
Am243	6		62	6		
B10	152					
Bi209				6		
C	77	4		47		
Cm242			63			
Cm243			6			
Cm244	6		63452		62	
Cm245			63452			
Cm246			2			
Cr52		12				
Fe56	16352	12		16352		
N15		6				
Na23				132		
Ni58	3					
Np237	6		6	6		
O	8					88
O16	3	3				
Pb	6			6		
Pb206	5			5		
Pb207				5		
Pb208		5				
Pu238	2		63452		6452	
Pu239	163452			163452		
Pu240	634582		63452	5	63452	
Pu241	6827		16345827			
Pu242	63452		63452	2		
Si28				4		
U234			3			
U235	3487					
U238	13458827	1		13452		8
Zr90				1652		

Nuclear Data Requests From SG26

Graphical summary of nuclides - energy groups



Nuclear Data Requests From SG26: Capture

nucleus	energy range	unc% existing -> target
* Am241	.....-----	8->2, 8->3,
*Am242m	.....--.....	25->11,
* Am243	.....-----	10->2,
B10	.....-----	15->9, 15->2, 15->3,
C	..-.....-..-	20->7, 20->5,
* Cm244	.....-----	20->6,
Fe56	.....-----	12->5, 12->3, 12->5, 12->4, 12->3,
Ni58	.....-.....	15->5,
* Np237	.....-----	6->3,
O	.....-.....	100->9,
O16	.....-.....	100->6,
Pb	.....-.....	20->14,
Pb206	.....-.....	20->5,
* Pu238	.....--.....	20->10,
Pu239	.....-----	12->3, 12->3, 12->3, 12->2, 12->3, 12->4,
* Pu240	.....-----	14->6, 12->6, 12->5, 12->4, 5->3, 12->4,
* Pu241	..-.....--.....	20->7, 7->3, 20->10, 7->2,
* Pu242	.....-----	35->10, 35->25, 33->7, 35->11, 35->8,
U235	.....-----	33->19, 34->11, 33->10, 34->14,
U238	.....-..-.....	9->2, 9->2, 9->1, 9->2, 9->4, 2->1, 9->3, 2-

Nuclear Data Requests From SG26: Elastic

```
----- el -----
nucleus  energy range      unc% existing -> target
   C     | .....----- |    5->1,
  Cr52   | .....-..... |   11->4, 11->4,
  Fe56   | .....--.. |   8->4, 8->3,
   N15   | .....----- |    5->1,
   O16   | .....--.. |   50->9,
 Pb208   | .....-..... |    5->2,
  U238   | .....-..... |   19->8,
```

Nuclear Data Requests From SG26: Fission

```

----- fiss -----
nucleus  energy range  unc% existing -> target
* Am241  |.....-| 10->1, 10->3, 10->5, 10->5,
*Am242m  |.....-| 17->5, 17->8, 17->3,
* Am243  |.....-| 10->2, 10->6,
* Cm242  |.....-| 55->26, 55->42,
* Cm243  |.....-| 50->8,
* Cm244  |.....-| 45->2, 45->17, 45->8, 45->6, 45->5,
* Cm245  |.....-| 45->3, 45->40, 45->11, 45->7, 45->6,
* Cm246  |.....-| 40->15,
* Np237  |.....-| 8->2,
* Pu238  |.....-| 20->3, 20->9, 20->5, 20->3, 20->3,
* Pu240  |.....-| 6->2, 6->3, 10->3, 5->2, 10->2,
* Pu241  |.....-| 15->7, 15->2, 15->5, 15->2, 15->3, 20->5, 1
* Pu242  |.....-| 20->4, 20->9, 20->4, 20->4, 20->3,
* U234   |.....-| 38->30,

```

Nuclear Data Requests From SG26: Inelastic

```

----- inel -----
nucleus  energy range  unc% existing -> target
* Am241  | .....----. | 25->4,
* Am243  | .....----. | 40->2,
  Bi209  | .....--.. | 34->3,
    C    | .....-. | 35->9, 35->14,
  Fe56   | .....----. | 20->6, 20->2, 20->7, 20->4, 20->3,
  Na23   | .....--.. | 25->10, 25->8, 25->4,
* Np237  | .....--.. | 25->5,
    Pb   | .....-. | 12->3,
  Pb206  | .....----. | 10->3,
  Pb207  | .....--.. | 12->3,
  Pu239  | .....----. | 25->12, 25->5, 25->14, 25->8, 25->7, 25->12,
* Pu240  | .....-. | 43->13,
* Pu242  | .....-. | 60->26,
  Si28   | .....--.. | 30->3,
  U238   | .....----. | 20->3, 20->4, 20->2, 20->2, 20->5,
  Zr90   | .....-. | 18->11, 18->3, 18->6, 18->9,
  
```

Nuclear Data Requests From SG26: Scattering

```
----- scatt -----  
nucleus  energy range      unc% existing -> target  
    O    |.....--. |    12->8, 50->11,  
  U238   |.....--. |    20->5,
```

Nuclear Data Requests From SG26: ν

```
----- nu -----
nucleus  energy range      unc% existing -> target
* Am241  |.....--. | 2->1,
* Cm244  |.....----. | 10->1, 10->4,
* Pu238  |.....---.. | 7->3, 7->4, 7->3, 7->2,
* Pu240  |.....---.. | 4->2, 4->2, 4->2, 5->1, 4->1,
```

Inventory of available EXFOR data

- Automatic scan of EXFOR library for isotope, reaction, and quantity from summary table regularly published by V. Zerkin (IAEA)
file used: C4-2012-04-04.xc4.tbl

- For each entry, plot the covered energy range

- For each entry, add short text with info like

```
1956 F.Brown+, n=4, 23108002, 93-NP-237(N,G)93-NP-238,,SIG,, UNCAV%=1.7
Year author      points  entry  reaction_string          quantity  uncertainty
```

- Uncertainty information was given as maximum uncertainty found in the dataset. → $\max(dx/x)$

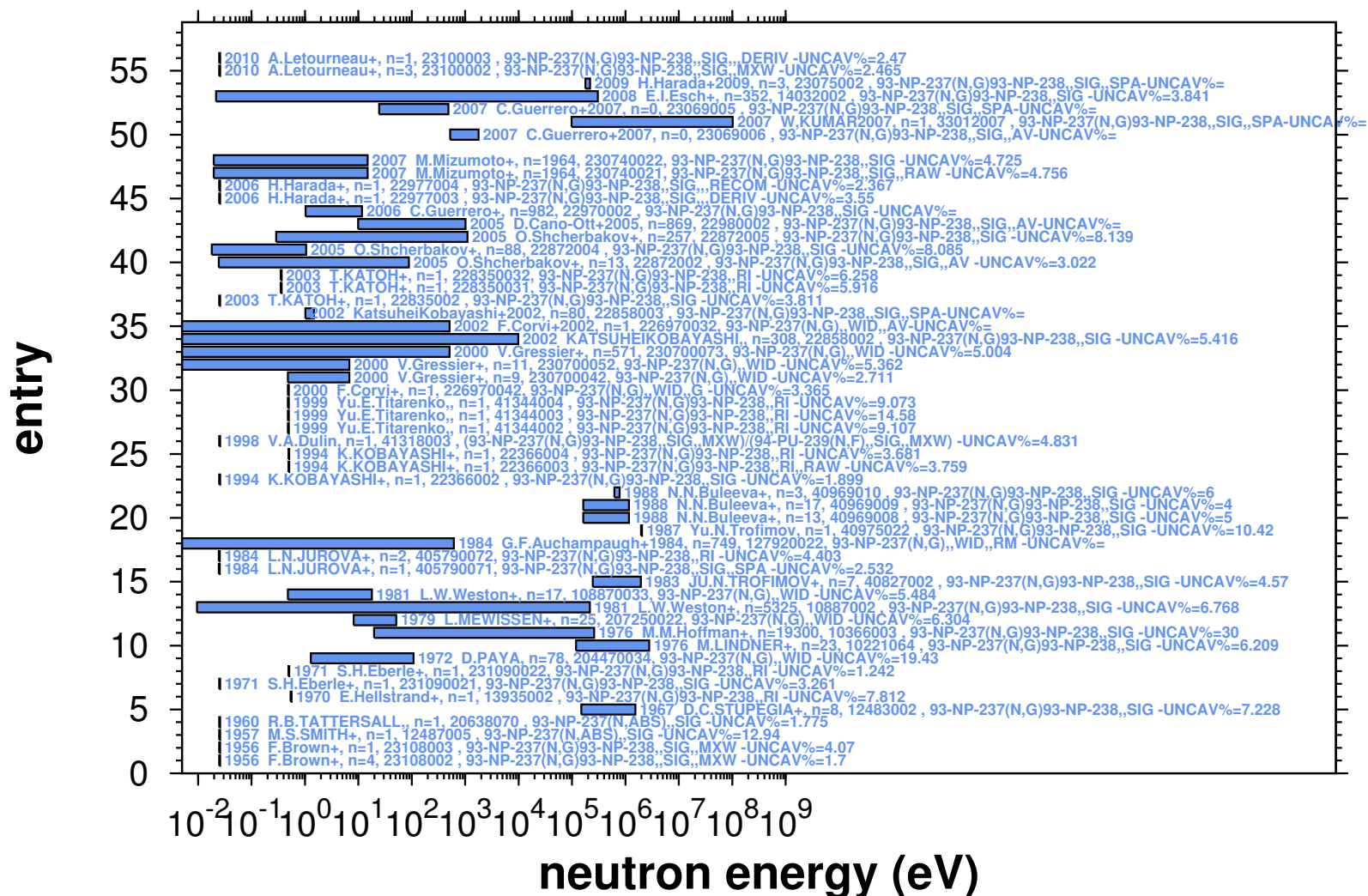
Not suited for large datasets, possibly containing near-zero values with constant absolute uncertainty.

Using $\langle dx \rangle / \langle x \rangle$ instead would be a better option, V. Zerkin has added this since yesterday.

- Still identifying problem of missing entries → ongoing

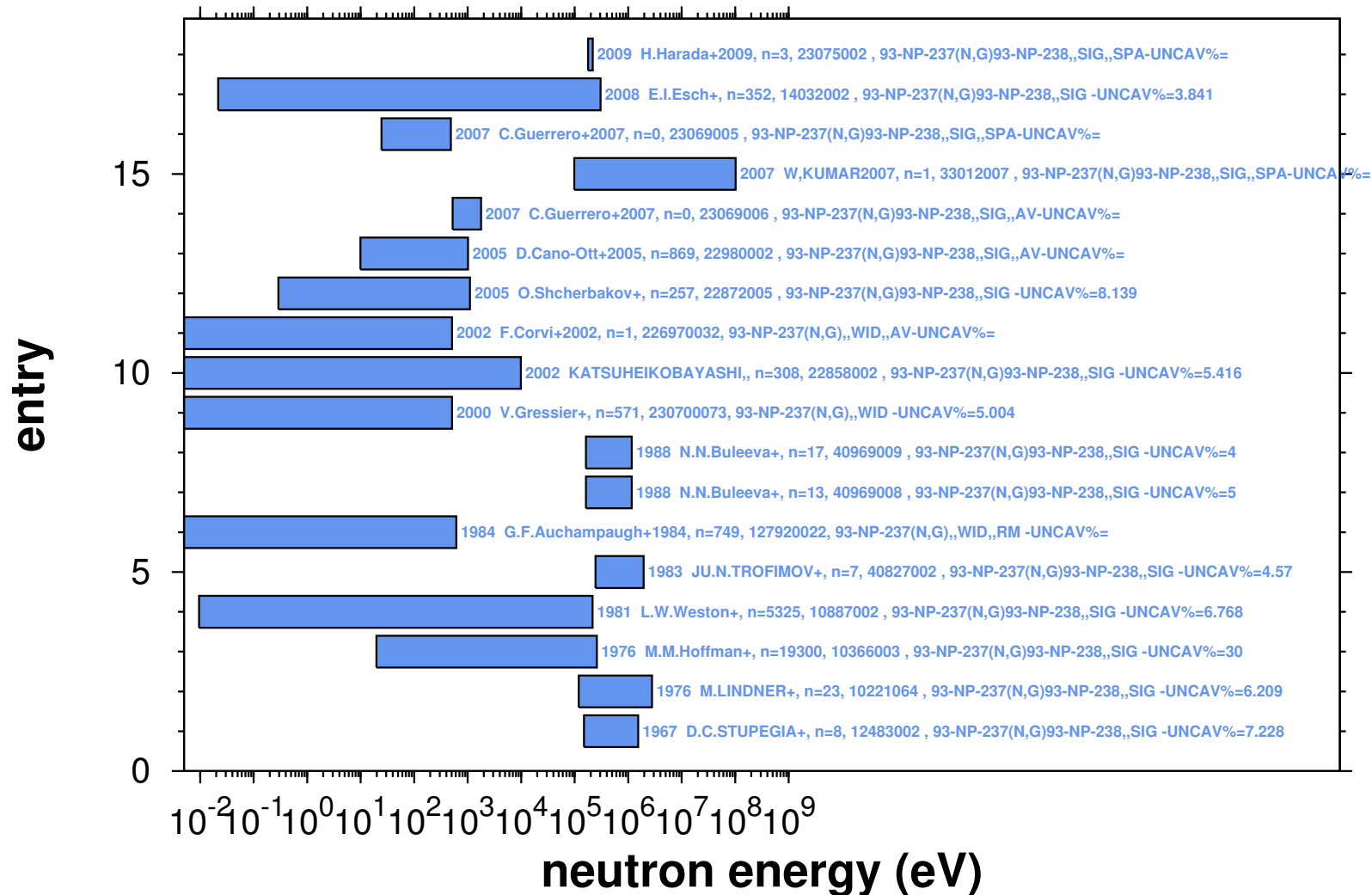
Inventory of available EXFOR data: ^{237}Np

93-Np-237(n,g|abs) (sig|wid|ri)

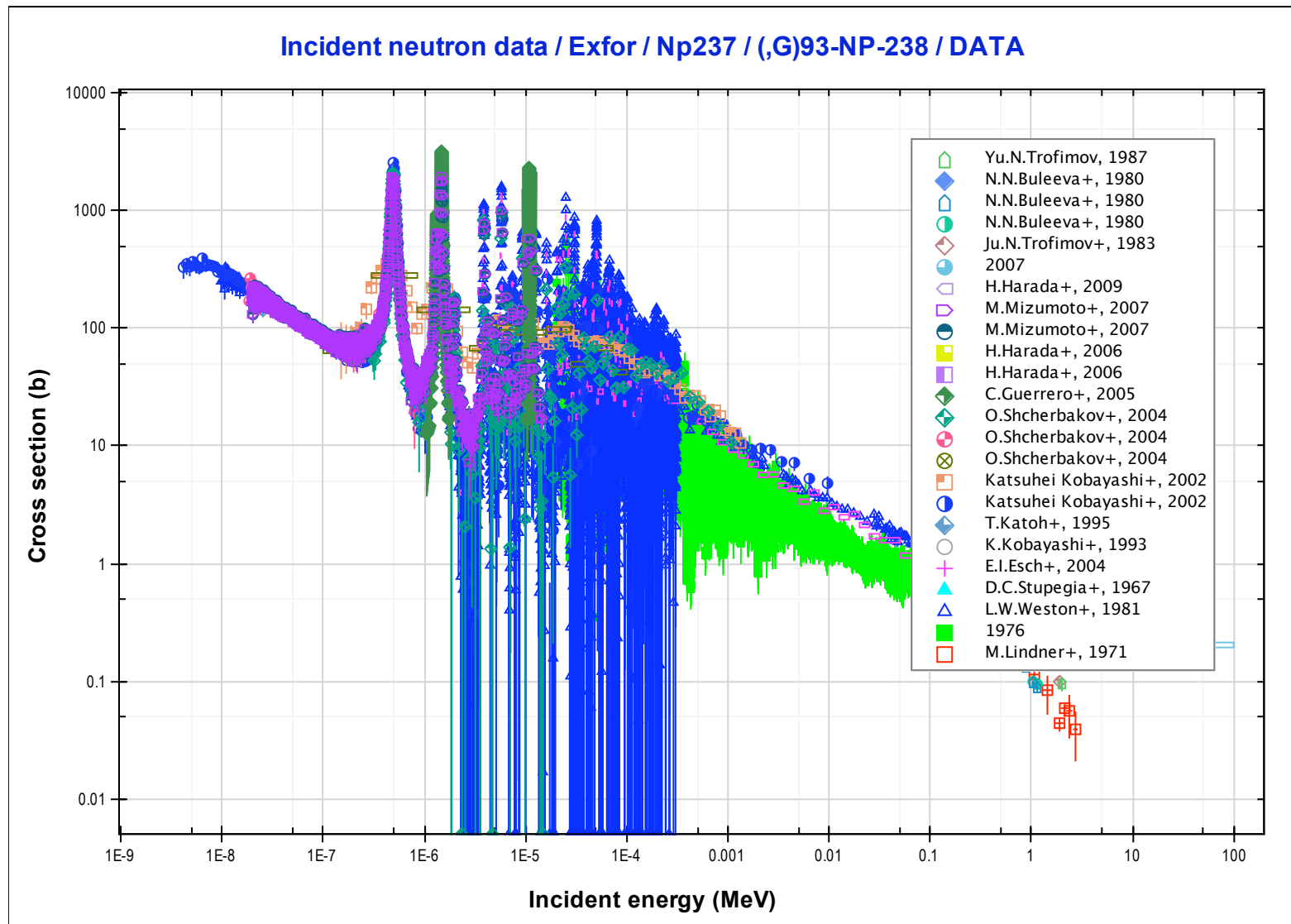


Inventory of available EXFOR data: ^{237}Np

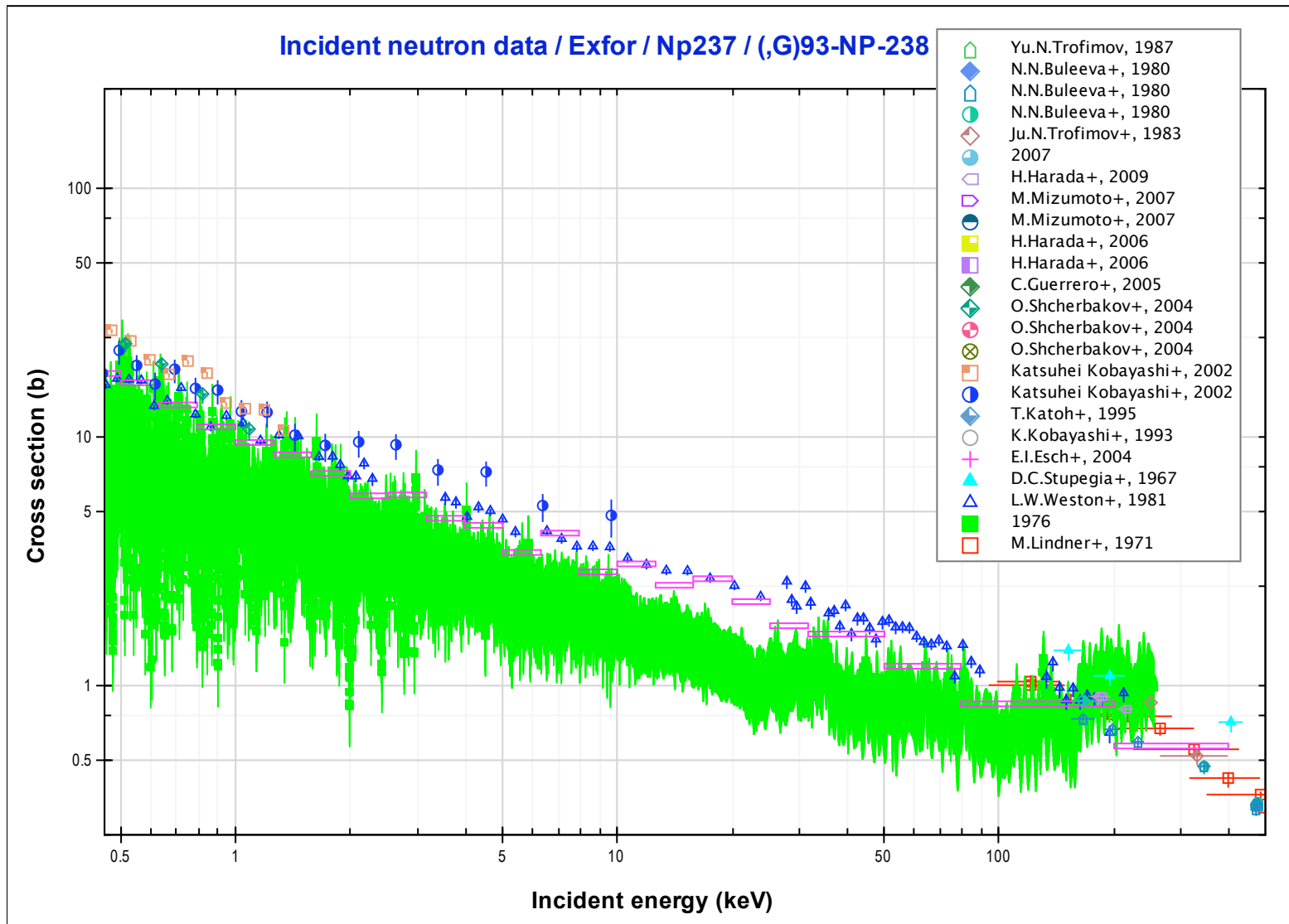
93-Np-237(n,g|abs) (sig|wid|ri) E in [454-498000]



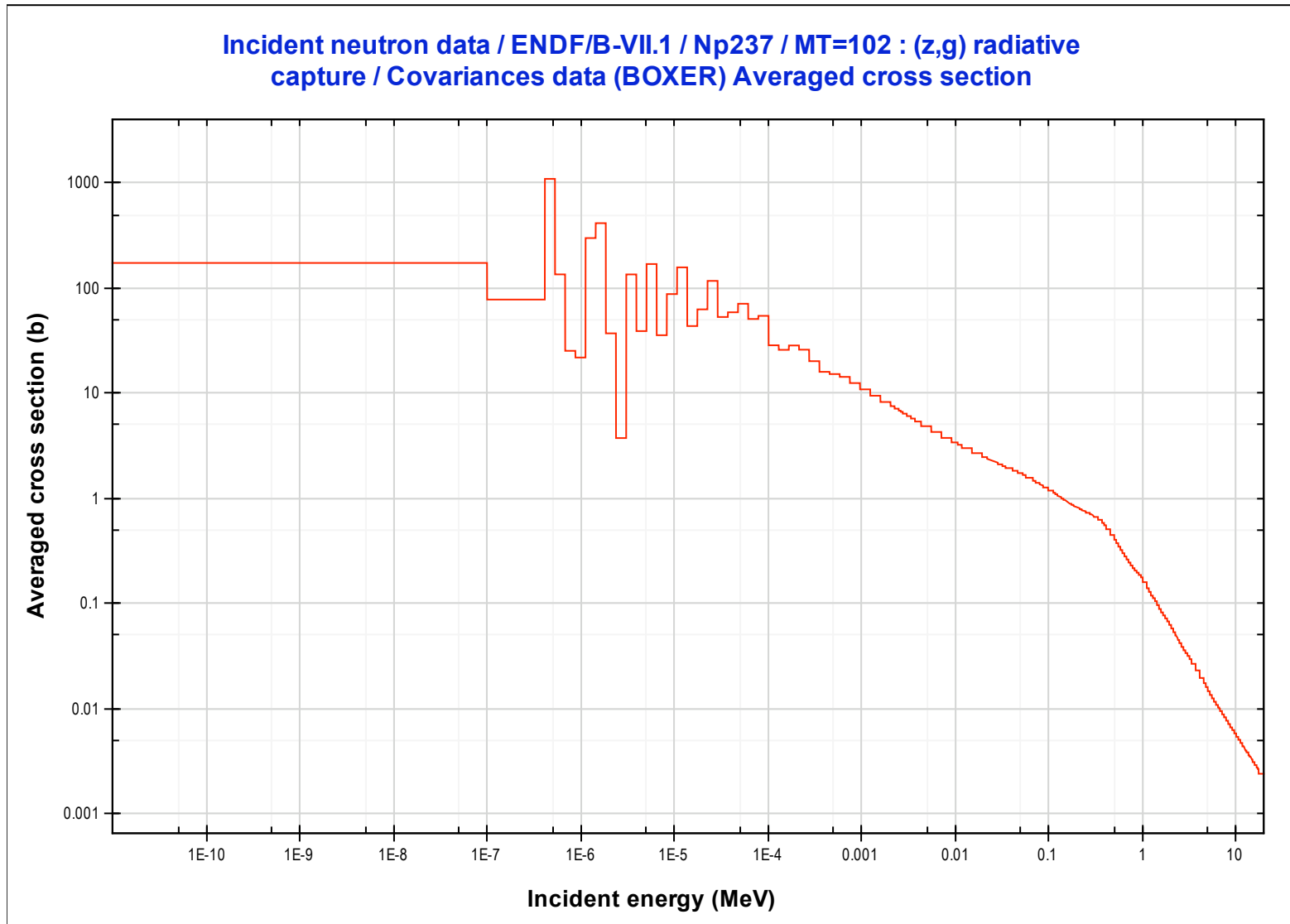
Inventory of available EXFOR data: ^{237}Np



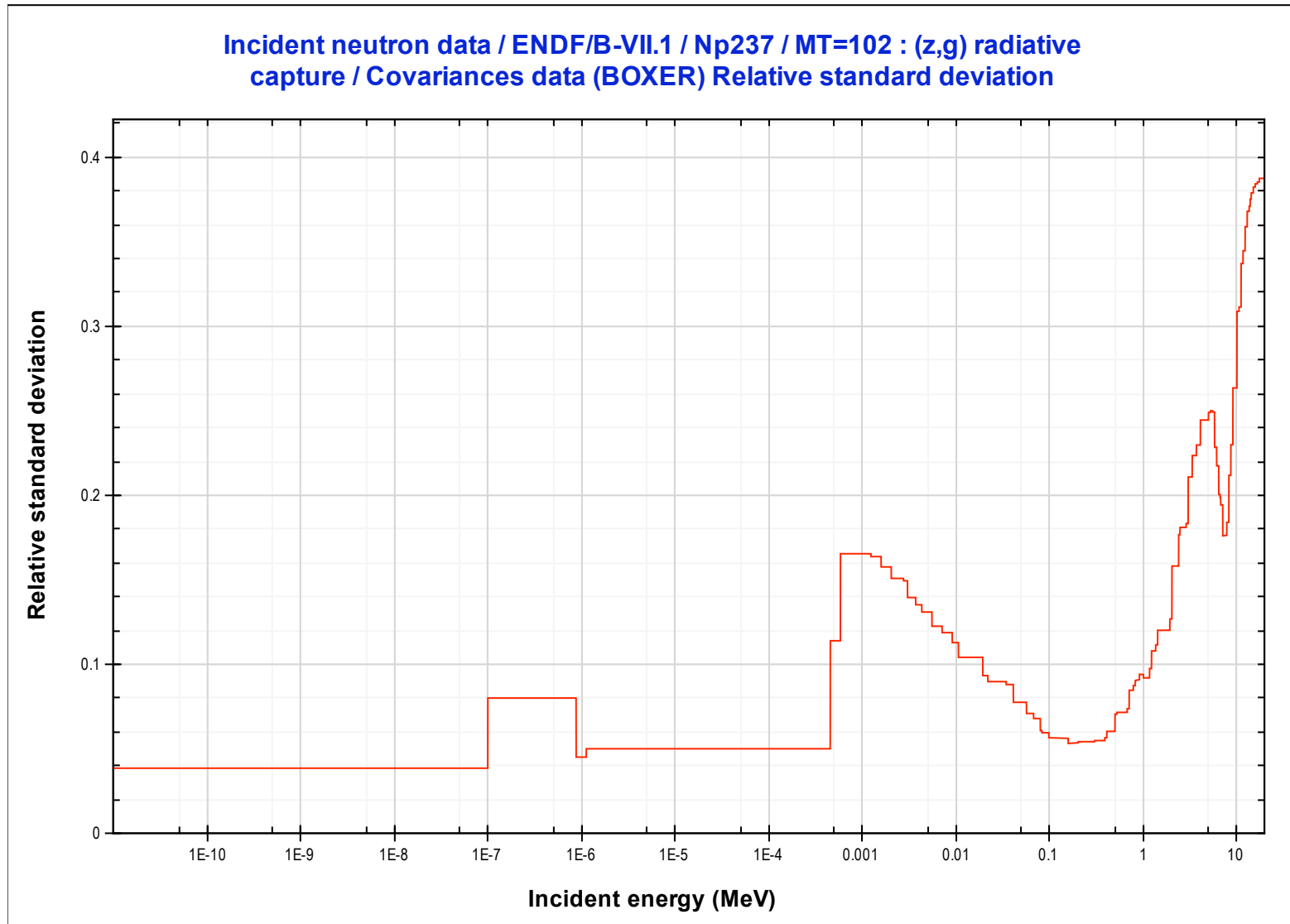
Inventory of available EXFOR data: ^{237}Np



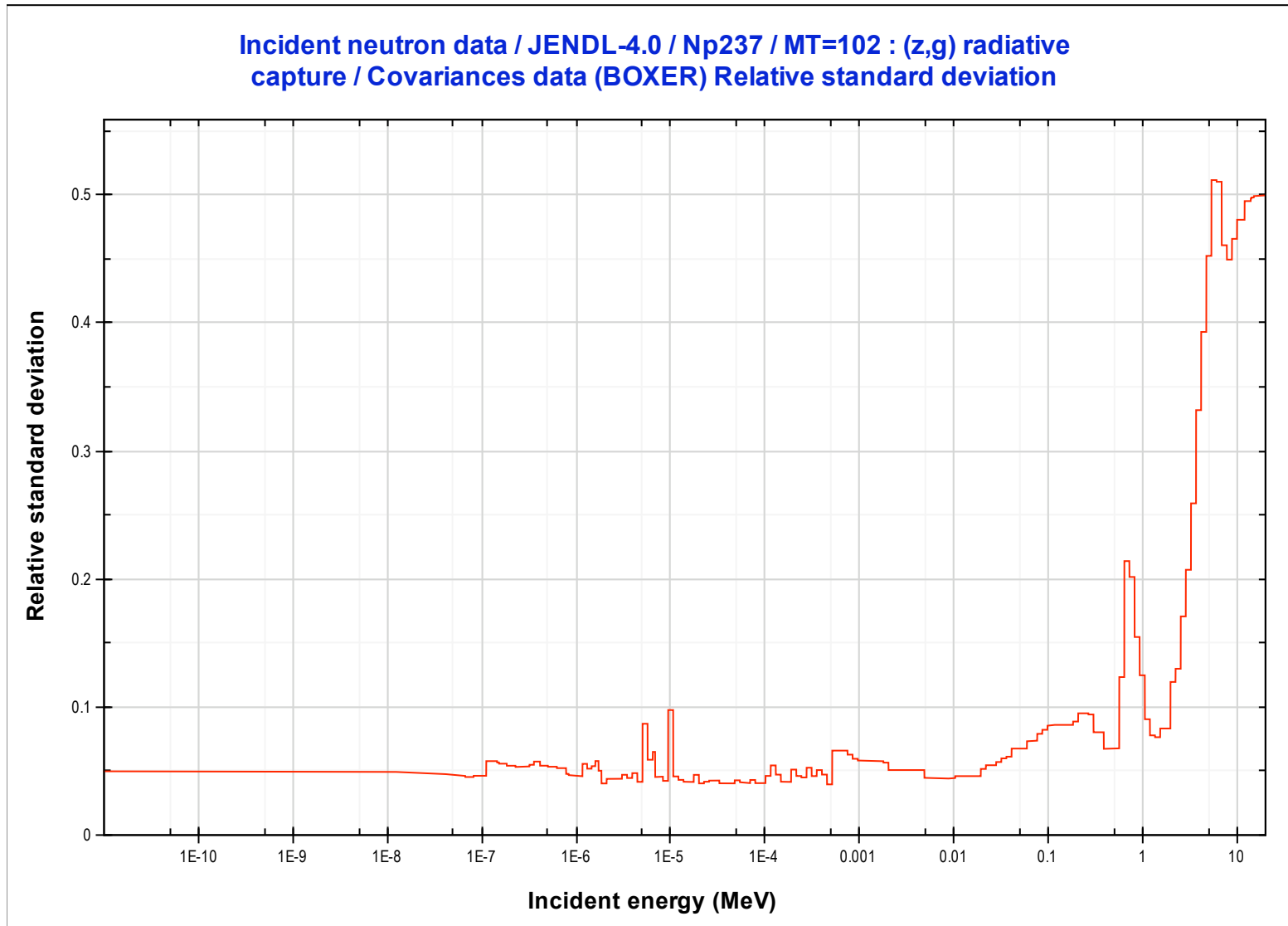
Evaluated data: $^{237}\text{Np}(n,g)$



Evaluated data: $^{237}\text{Np}(n,g)$



Evaluated data: $^{237}\text{Np}(n,g)$



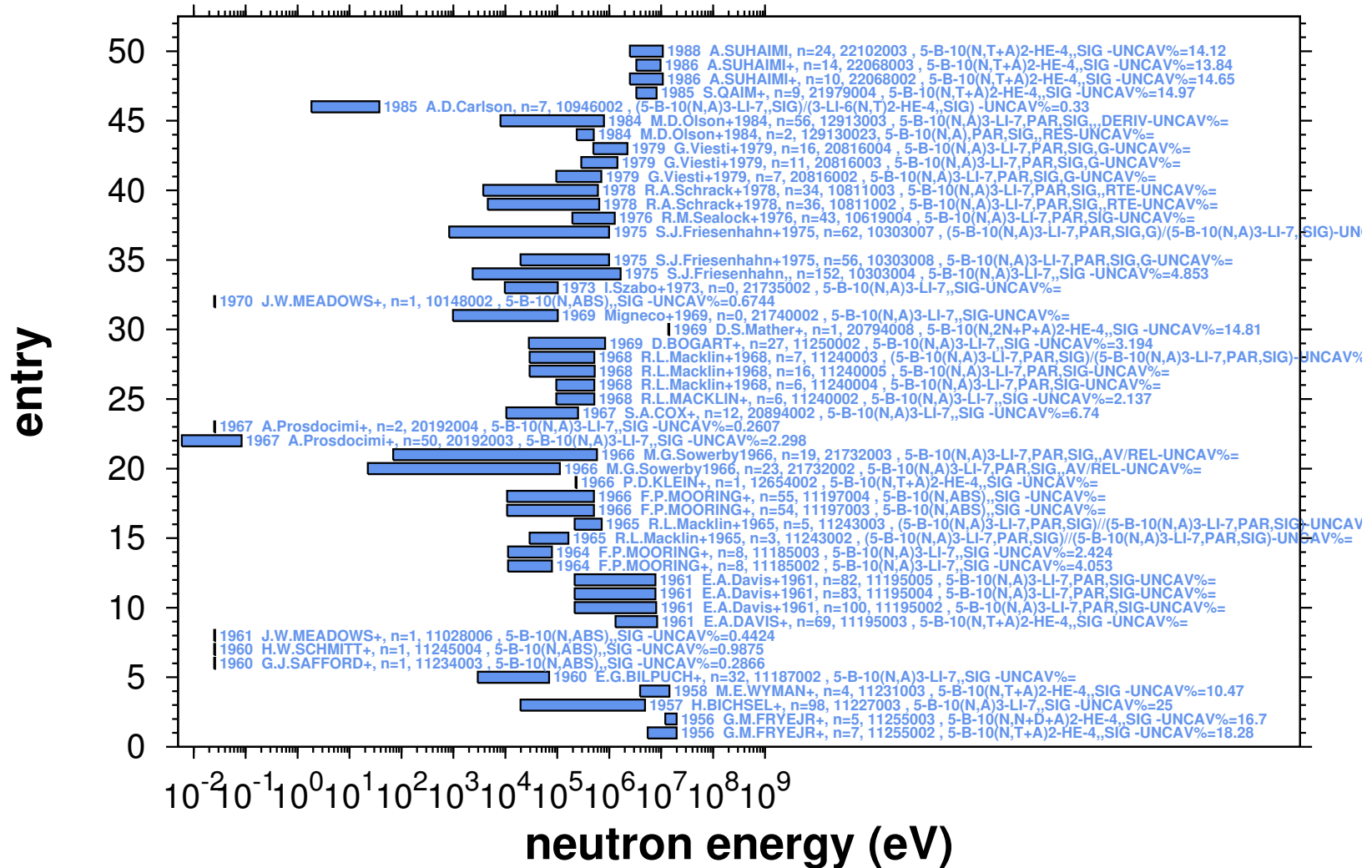
Evaluated data: $^{237}\text{Np}(n,g)$

SG26: * Np237 |-----..... | 6->3,

- Evaluated uncertainties are below 1%.
The 6% is based on discrepant datasets.

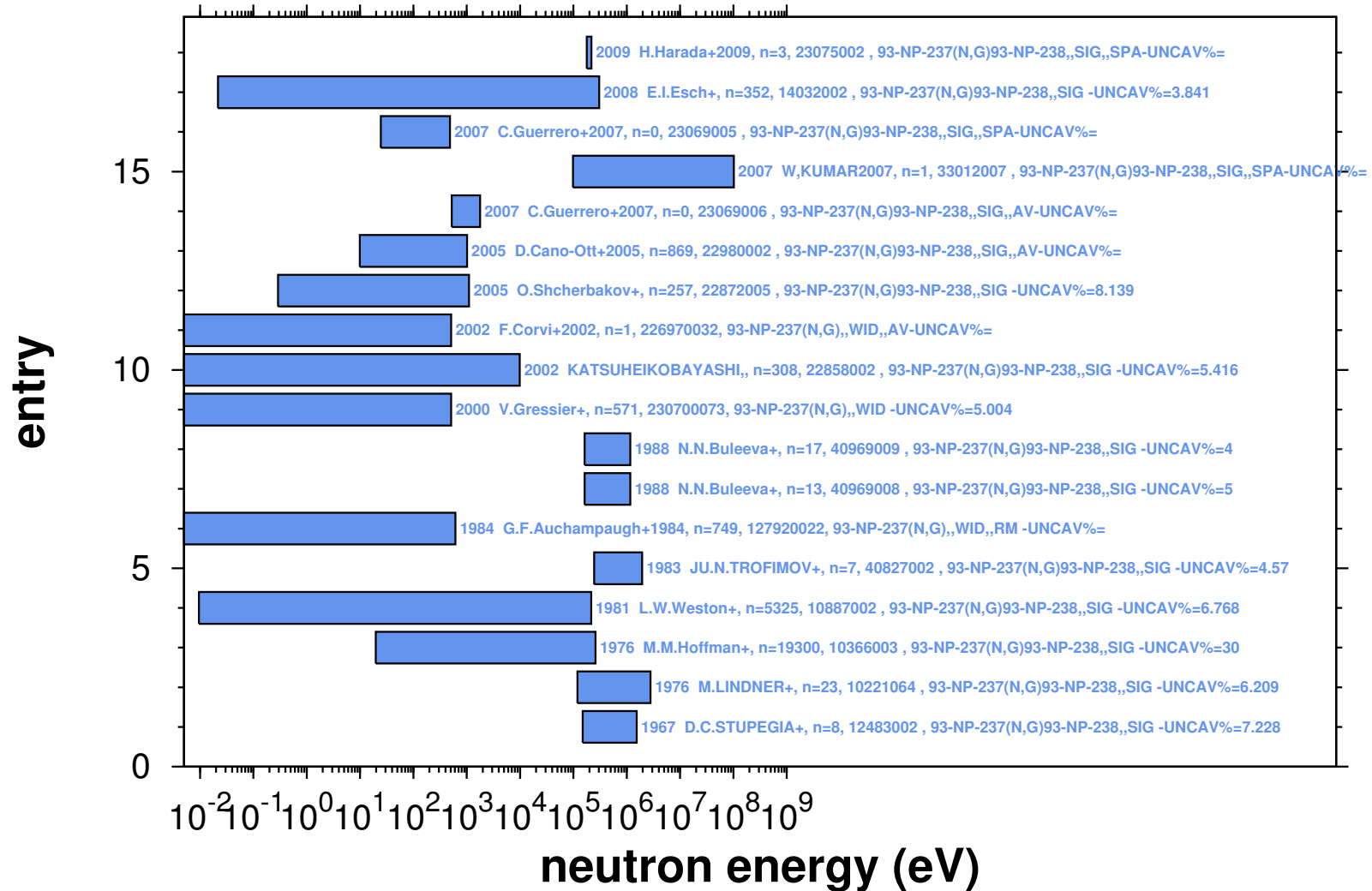
Inventory of available EXFOR data: ^{10}B

5-B-10(n,a|abs) (sig|wid|ri)

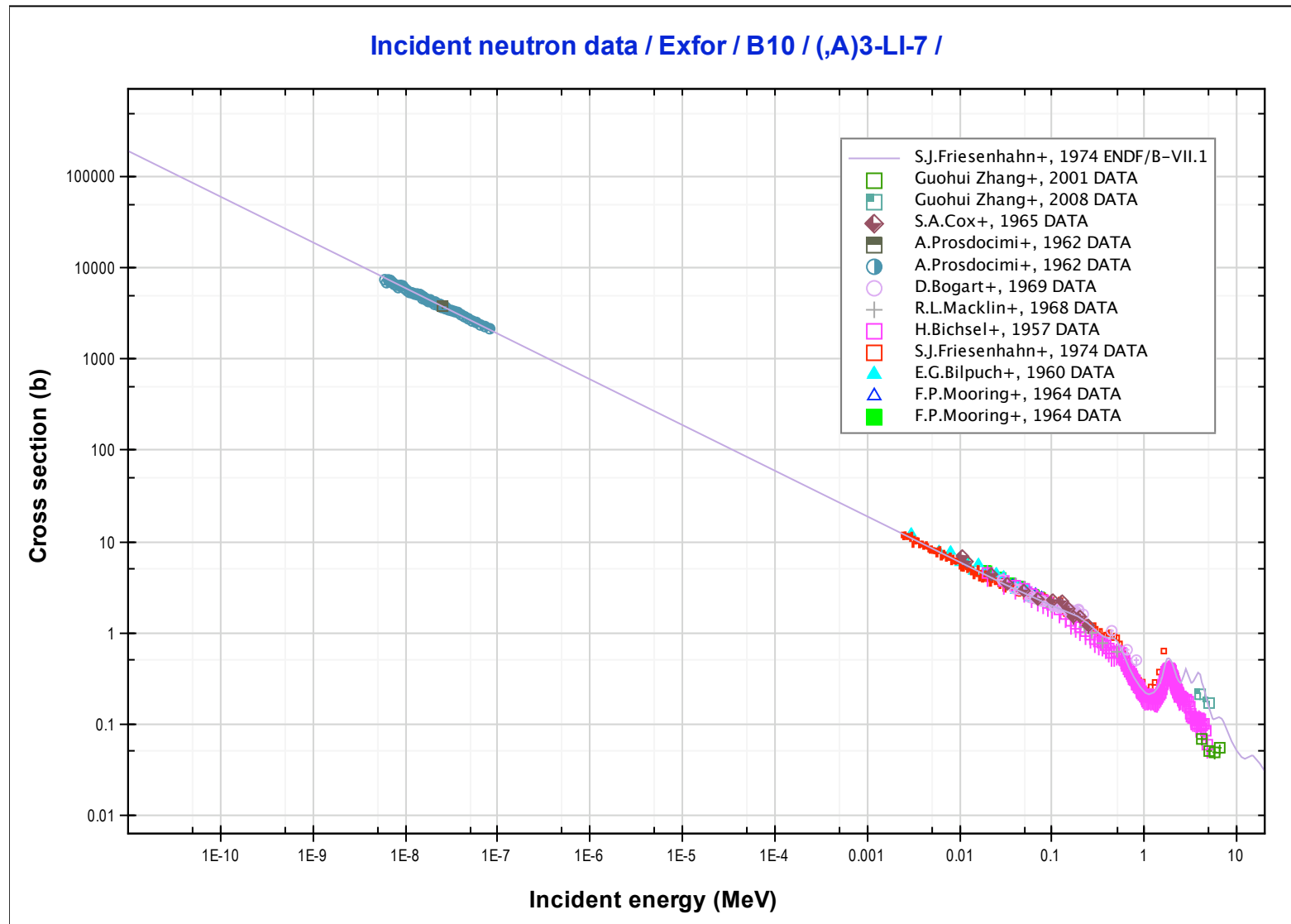


Inventory of available EXFOR data: ^{10}B

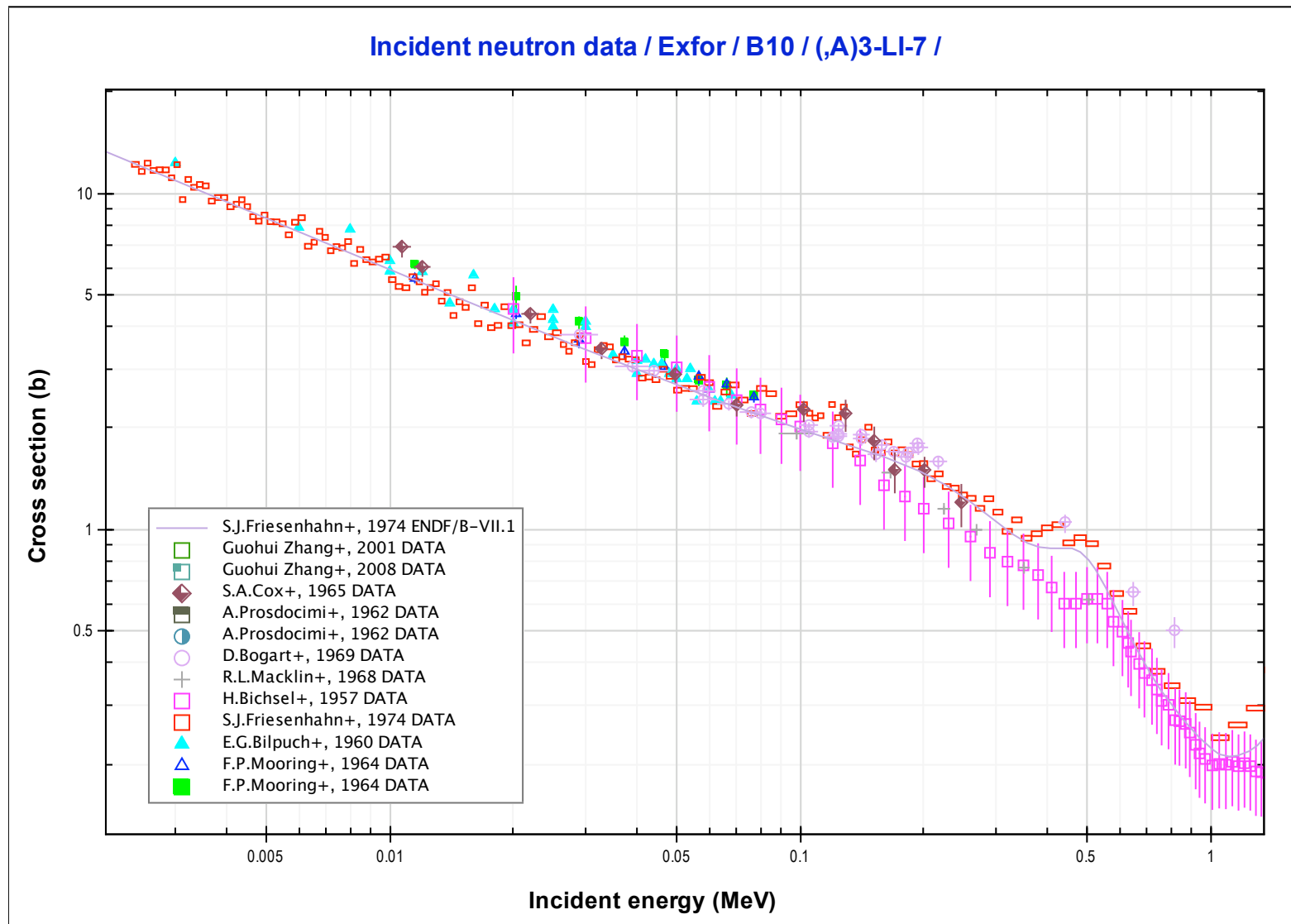
93-Np-237(n,g|abs) (sig|wid|ri) E in [454-498000]



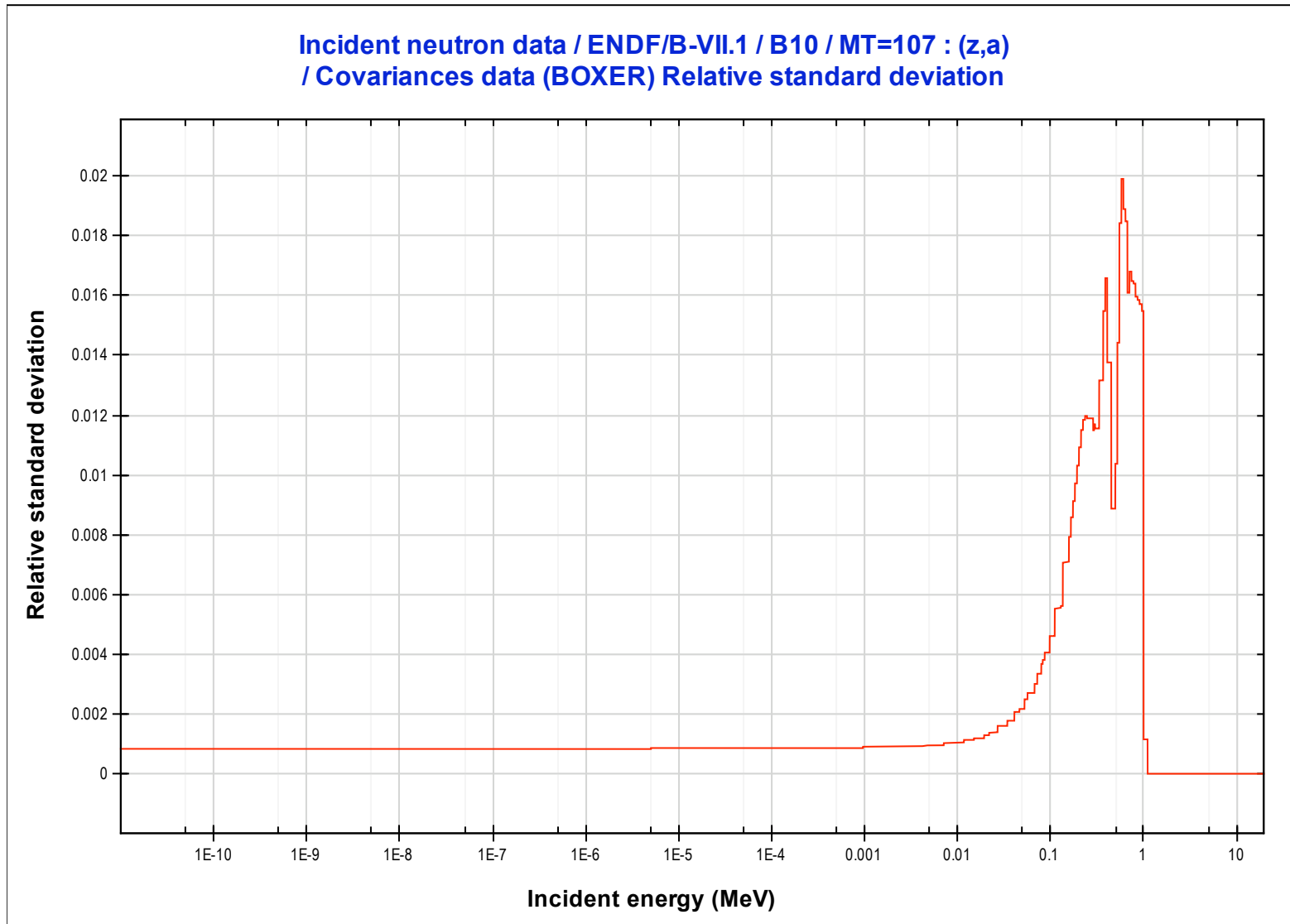
Inventory of available EXFOR data: ^{10}B



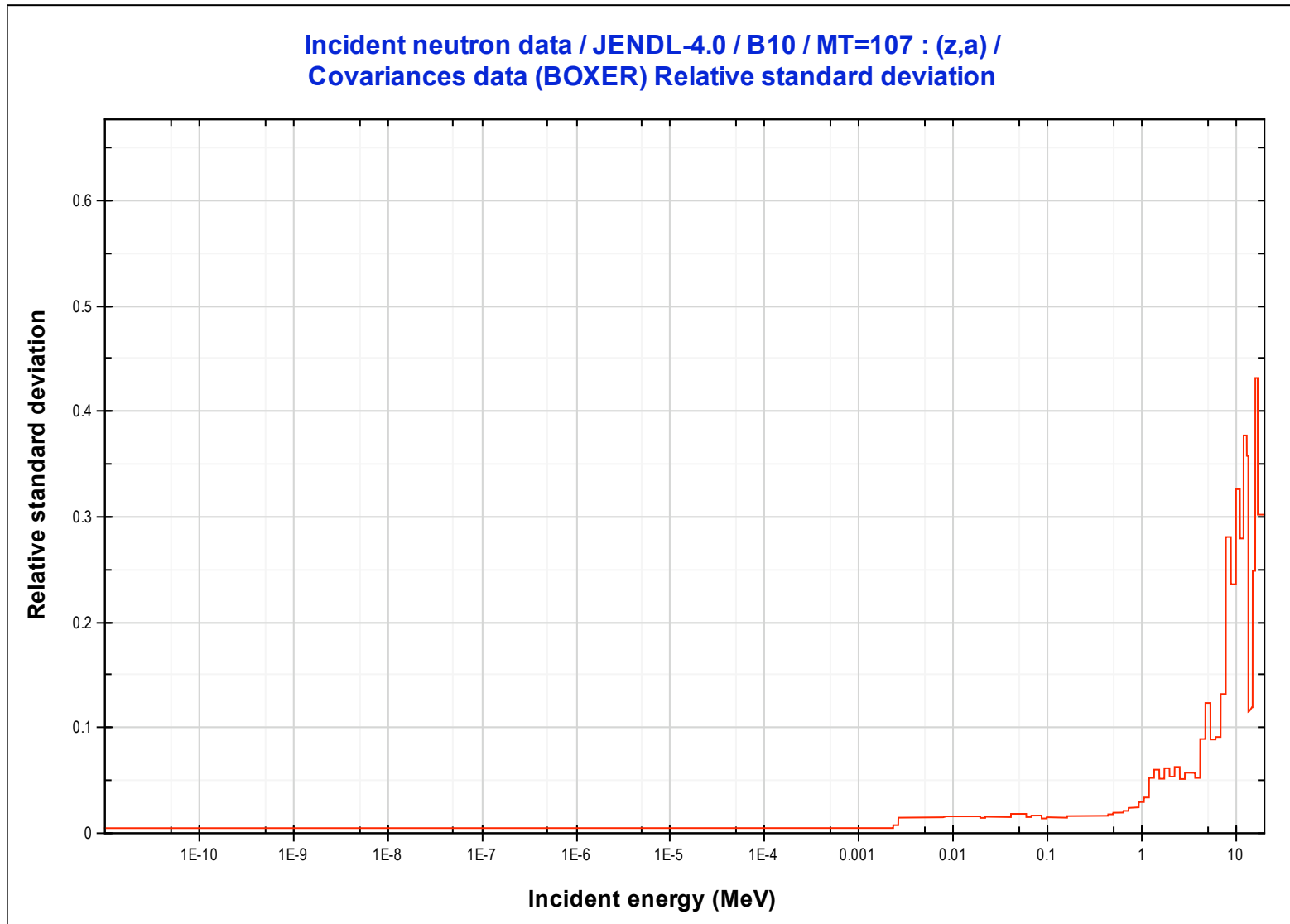
Inventory of available EXFOR data: ^{10}B



Evaluated data: $^{10}\text{B}(n,a)$



Evaluated data: $^{10}\text{B}(n,a)$



Evaluated data: $^{10}\text{B}(n,a)$

- **Standards:** 10B (see also IAEA standards 2007, Carlson et al, Nuclear Data Sheets 110 (2009) 3215–3324)
- Evaluation (ENDF-BVII.1, EVAL-APR06) mentions also “extended uncertainty”, making all measurements statistically compatible at the expense of an increased uncertainty (CSWEG meeting 1990).
Uncertainties in ENDF-BVII.1 are the smaller ones.

SG26: B10 |-----... | 15->9, 15->2, 15->3,

B-10(n,alpha0) Cross Section		
Energy Range (keV)	Estimated Uncertainty (percent)	Combined Analysis (percent)
1.0E-08 - 0.1	0.5	0.21
0.1 - 5.0	1.5	
5.0 - 30.	3.0	0.38
30. - 90.	5.0	
90. - 150	10.0	0.86
150 - 200	12.0	
200 - 250	15.0	0.79
B-10(n,alpha1) Cross Section		
1.0E-08 - 0.1	0.2	0.16
0.1 - 5.0	0.4	
5.0 - 30.	0.6	0.20
30. - 90.	1.0	
90. - 150	1.5	0.48
150 - 200	2.0	
200 - 250	2.5	0.62