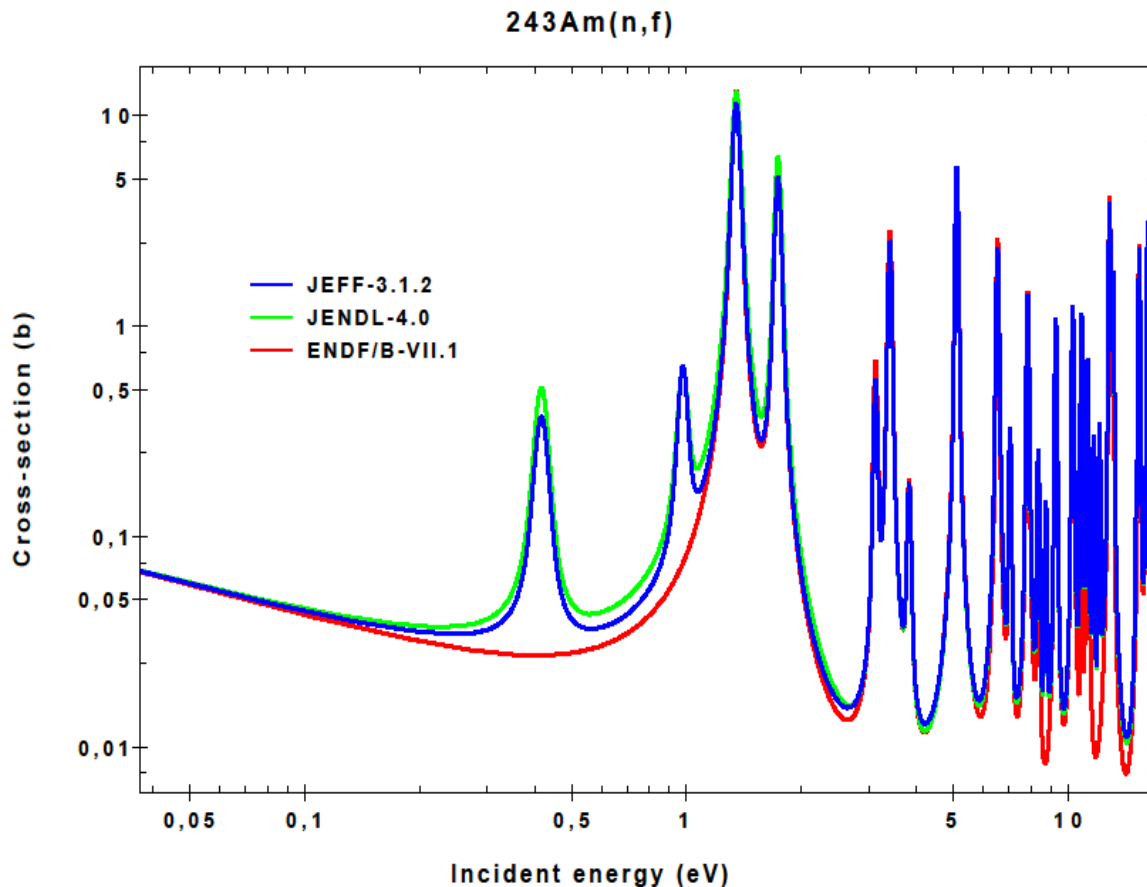


# Analysis of the $^{243}\text{Am}(n, f)$ cross-section

M. Mastromarco, M. Calviani, N. Colonna, G. Tagliente

# Motivations, state of the art: Libraries and previous measurements



In the low energy range only two sets of data are present in **EXFOR database**: **Kobayashi *et al.*** (50 meV to 10 keV) and **Seeger *et al.*** (from 50 eV to 1 keV).

Libraries fission resonance parameters **extracted from total cross-section measurements** by **Simpson *et al.***

**ENDF/B-VII.1 is completely different than JENDL-4.0 & JEFF-3.1.2 below 2 eV.**

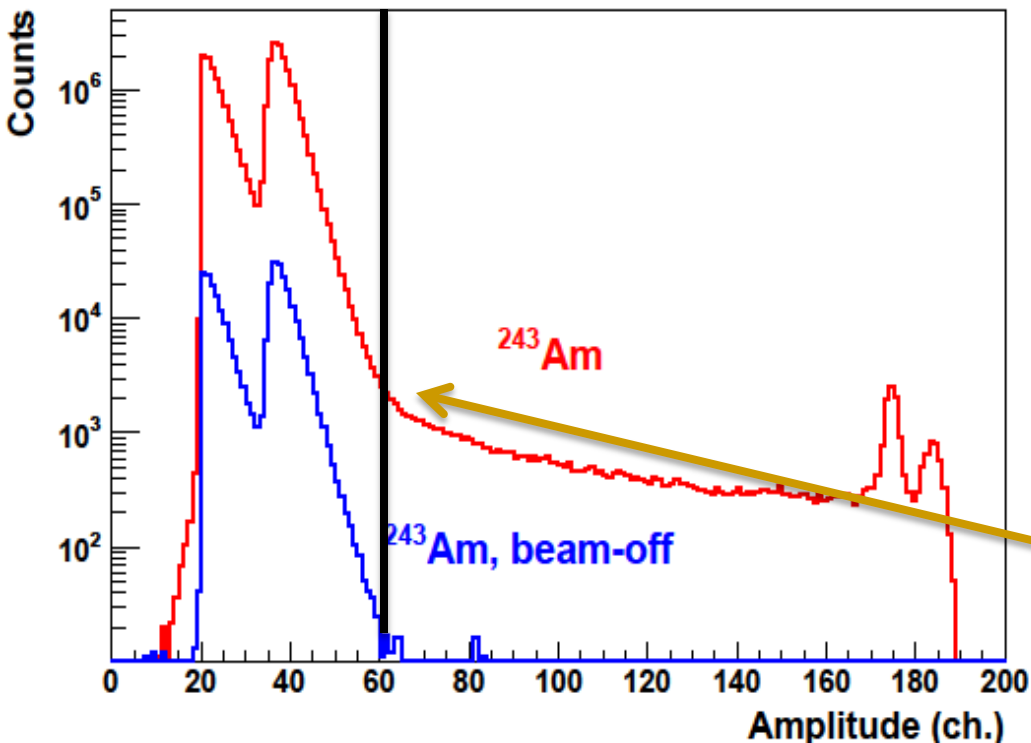
# $^{243}\text{Am}$ experimental setup

- Measurements was performed in 2004 at n\_TOF facility
- Fission Ionization Chamber (F.I.C.) was used
- 8 samples of  $\text{AmO}_2$  ( $\phi = 8$  cm)

Sample	Mass (mg)	Areal Density ( $10^{-7}$ atoms/barn)	Uncertainty (%)
$^{235}\text{U}$	15.2	7.75	1.4
$^{235}\text{U}$	16.2	8.46	1.3
$^{243}\text{Am}$	0.556	0.2741	1.1
$^{243}\text{Am}$	0.585	0.2884	1.3
$^{243}\text{Am}$	0.613	0.3022	1.3
$^{243}\text{Am}$	0.631	0.3111	1.3
$^{243}\text{Am}$	0.537	0.2648	1.2
$^{243}\text{Am}$	0.558	0.2751	1.2
$^{243}\text{Am}$	0.595	0.2933	1.3
$^{243}\text{Am}$	0.710	0.3500	1.2

- Relatively short half-life ( $t_{1/2} \approx 7390$  yr)
- $\alpha$ -activity ( $\approx 7.4$  MBq)

# Data reduction: $\alpha$ pile-up



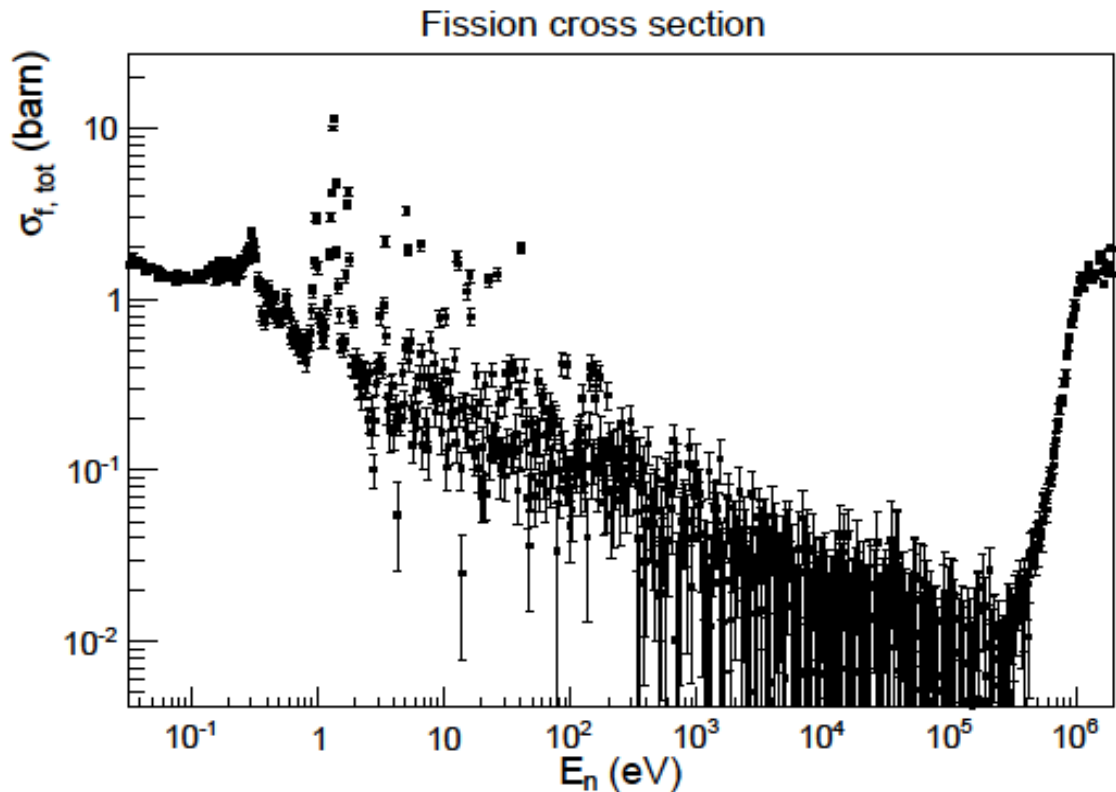
**Background** due to  $\alpha$ -particles and their pile-up (estimated by means of beam-off runs)

**A threshold at channel 60 has been adopted; residual background fitted and then subtracted.**

# Extracted cross-section

A detector **efficiency correction** ( $\approx 18\%$ ) has been performed by means of **FLUKA simulations** (M. Calviani)

$$\sigma_{A\chi}(E_n) = \frac{C_{235\text{U}}(E_n)}{C_{A\chi}(E_n)} \times CF \times \sigma_{235\text{U}}^{eval}$$

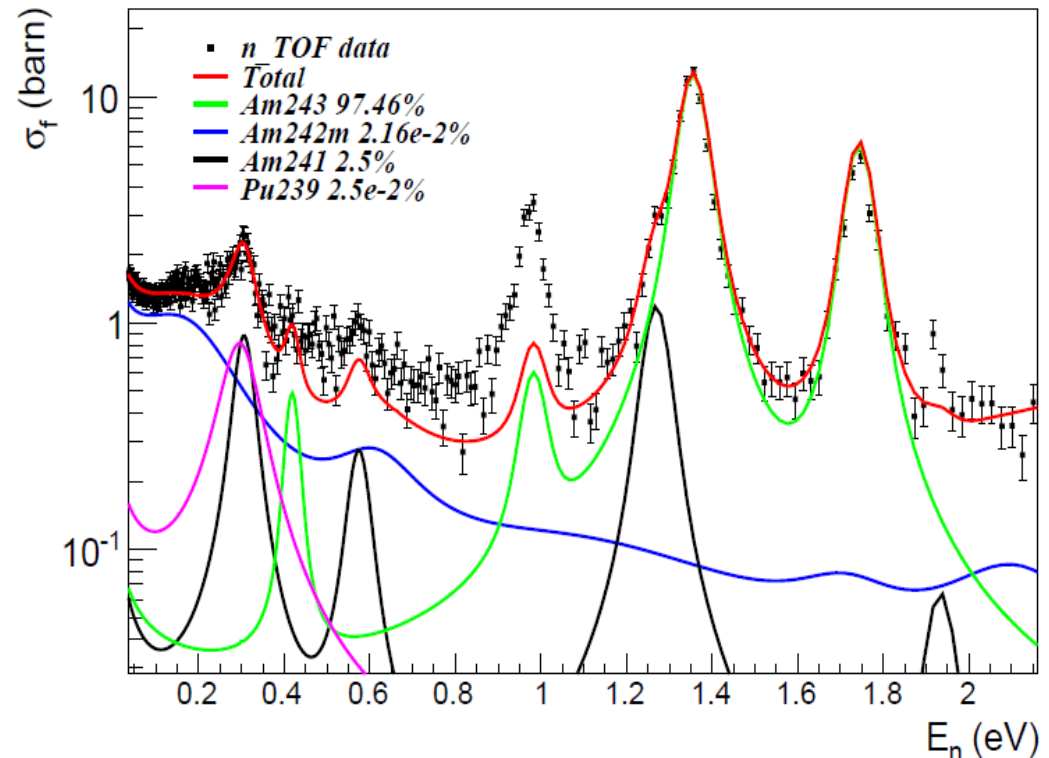


# SAMMY code: contaminants

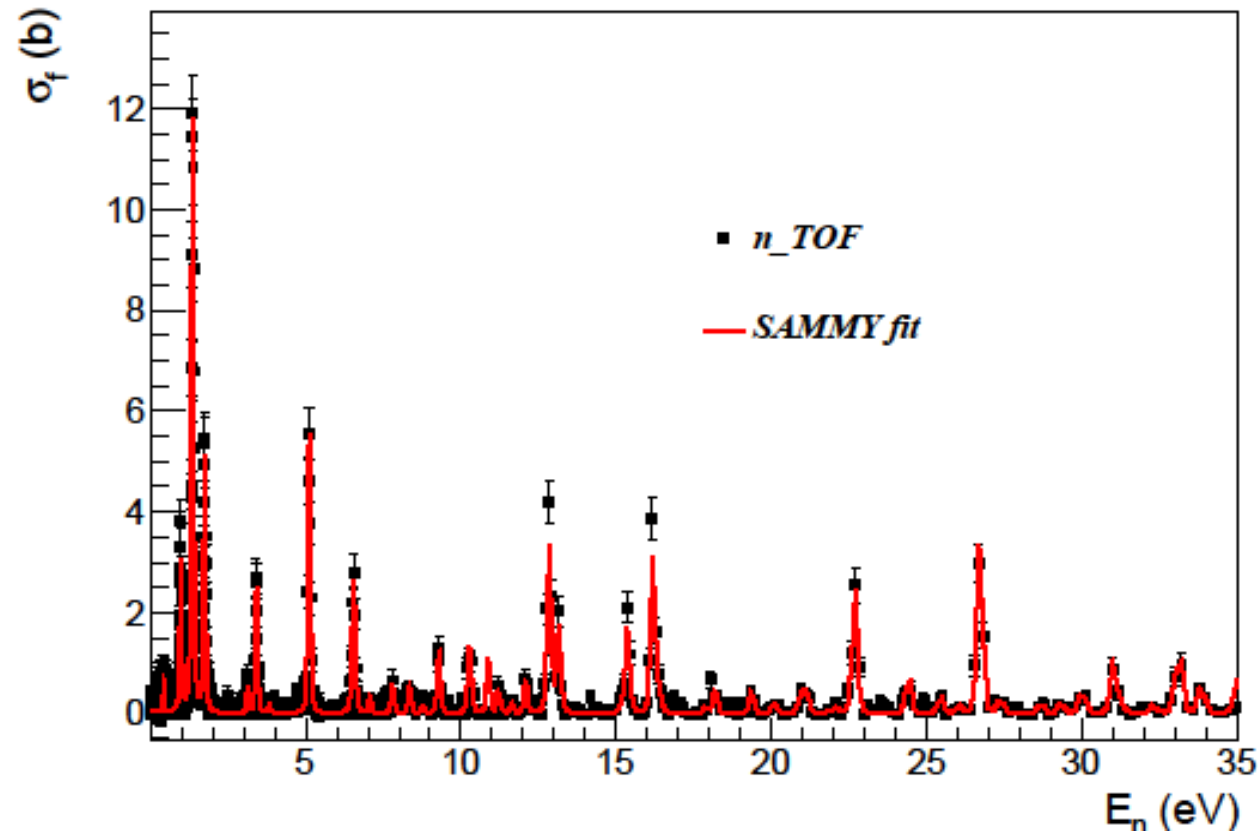
- From the sample suppliers a contamination of **2.5%** of  $^{241}\text{Am}$  is declared.

- $^{241}\text{Am}$   $n_{\text{TOF}}$  resonance parameters obtained in previous analysis have been used for contamination subtraction.

- Other undeclared contaminants at trace level ( $10^{-4}$ ), have been found:  $^{239}\text{Pu}$ ,  $^{242\text{m}}\text{Am}$

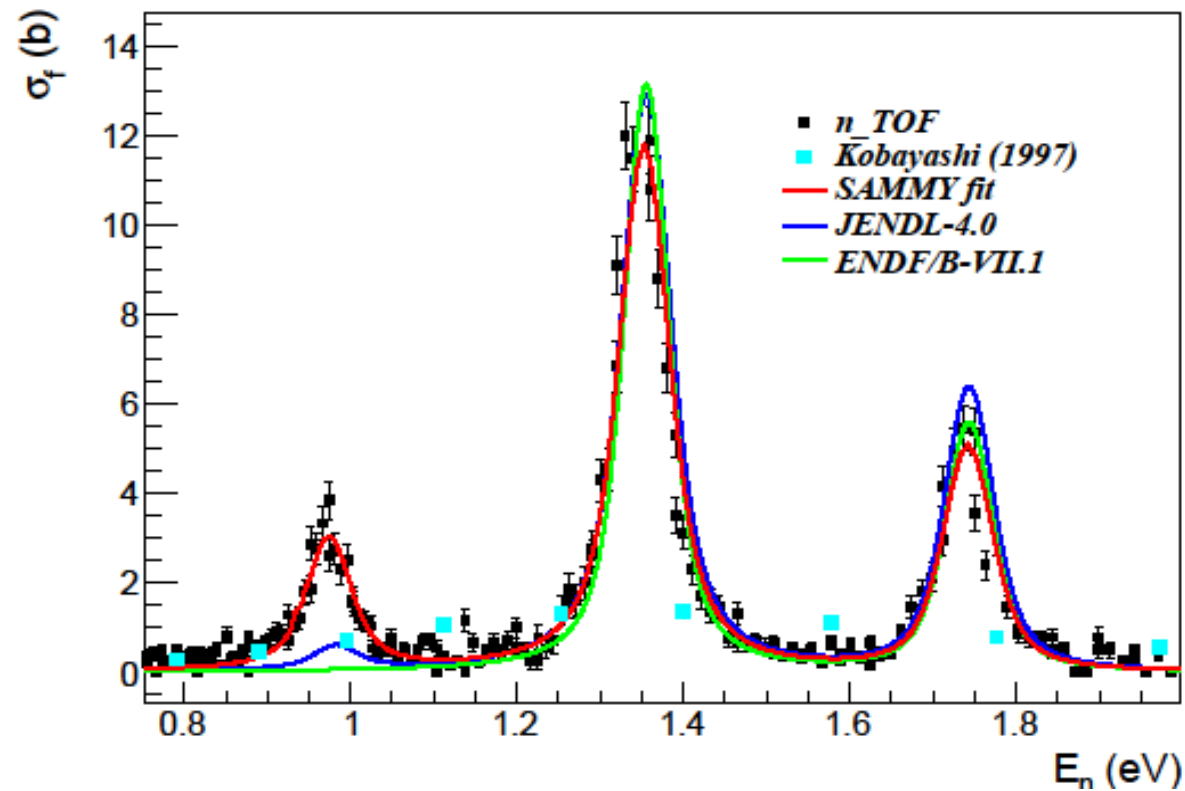


# SAMMY code: resonances fit



Low  $^{243}\text{Am}(n, f)$  cross-section and the very low statistics do not allow resonances analysis in the whole RRR (from 30 meV to 250 eV).

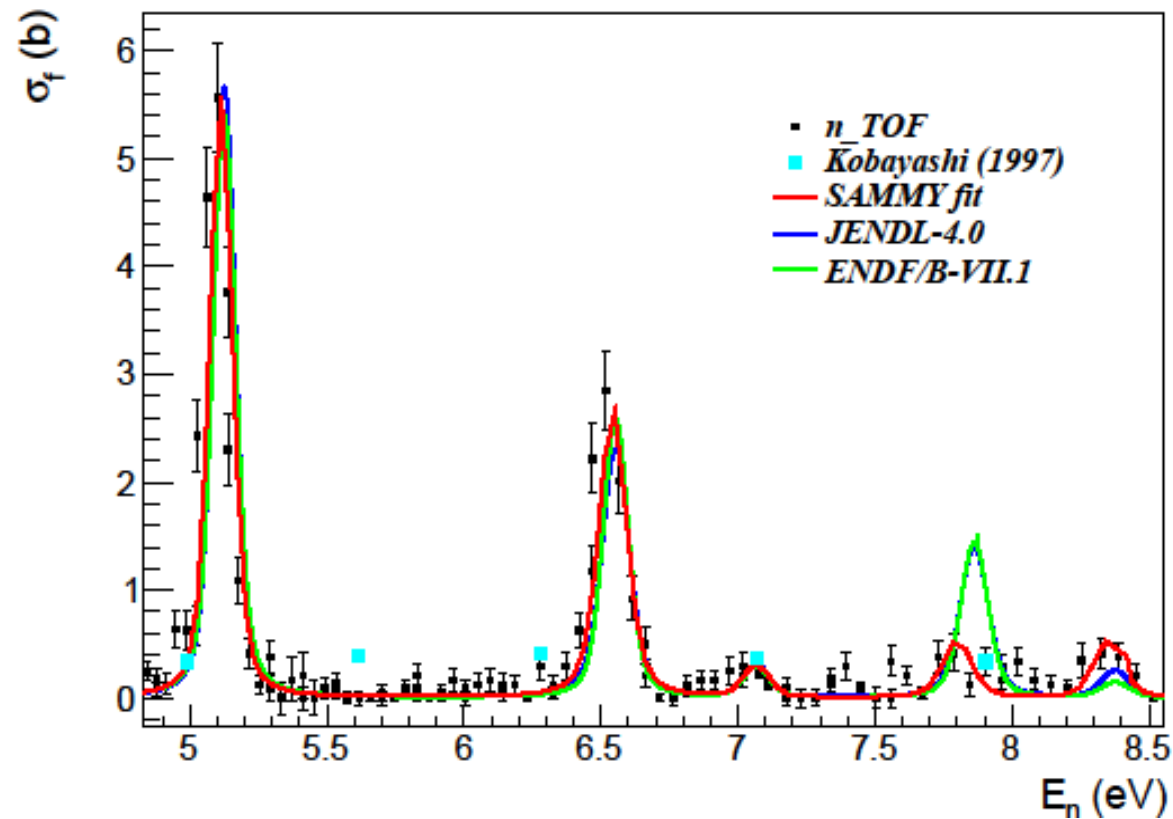
[ However... ]



**Structure @ 0.97 eV** does not appear in ENDF, while is underestimated in JENDL library.

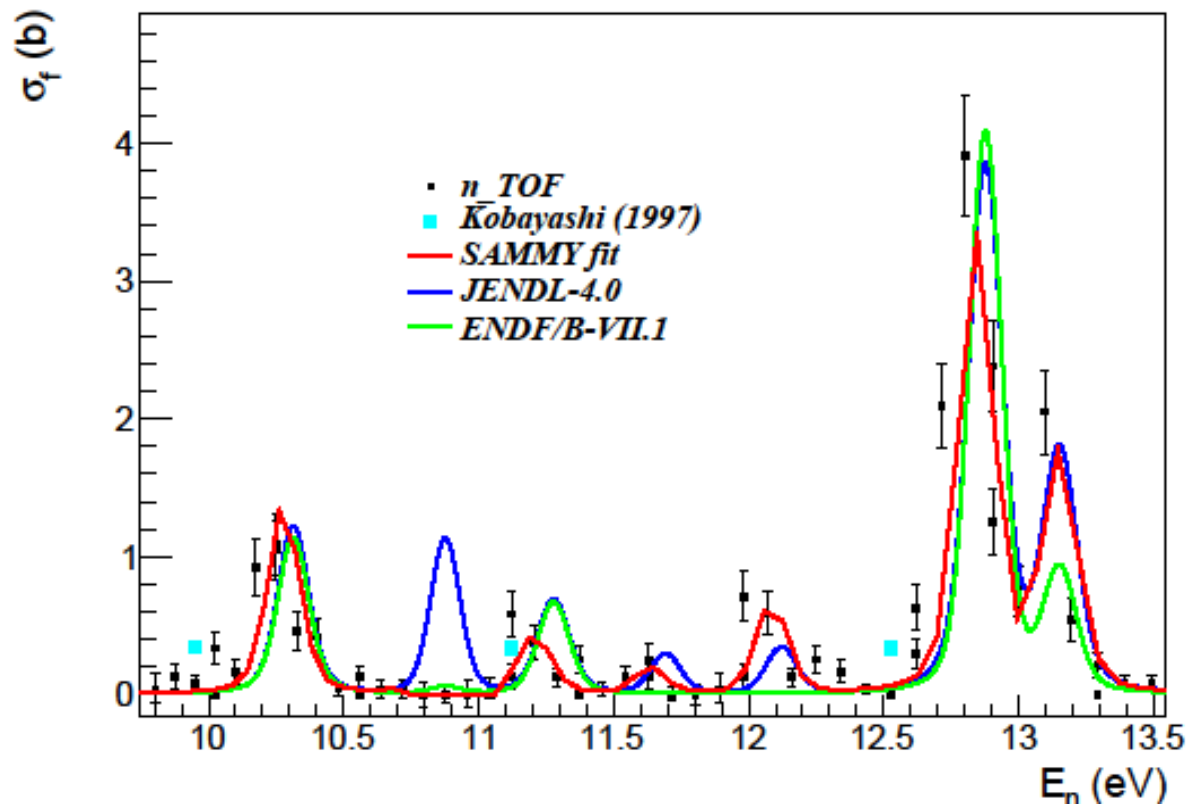


[ However... ]



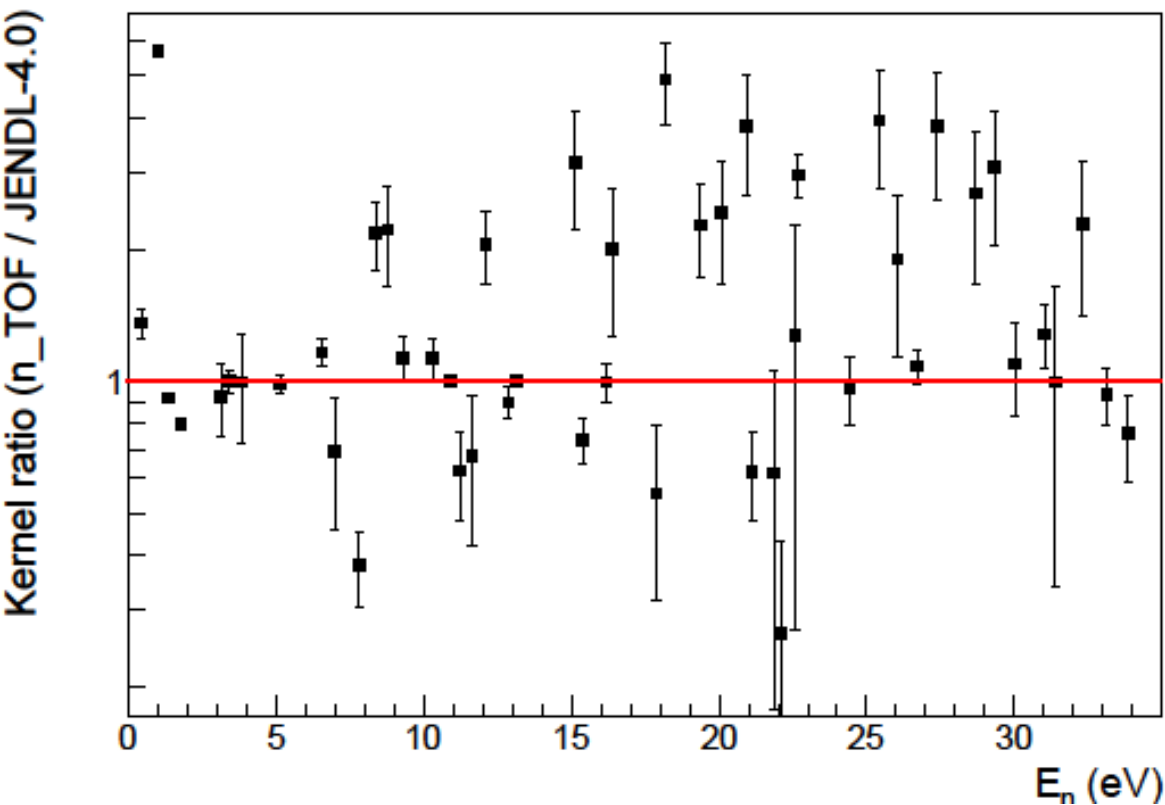
Resonance at  $\approx 7.85$  eV in libraries **“overlaps”** the small structure in our data at 7.8 eV.

[ However... ]



A further confirmation is in the resonance below 11 eV in JENDL library consistent with the ***<sup>239</sup>Pu resonance @ 10.9 eV*** at trace level of  $10^{-3}$

# Kernel ratio: n\_TOF / JENDL-4.0

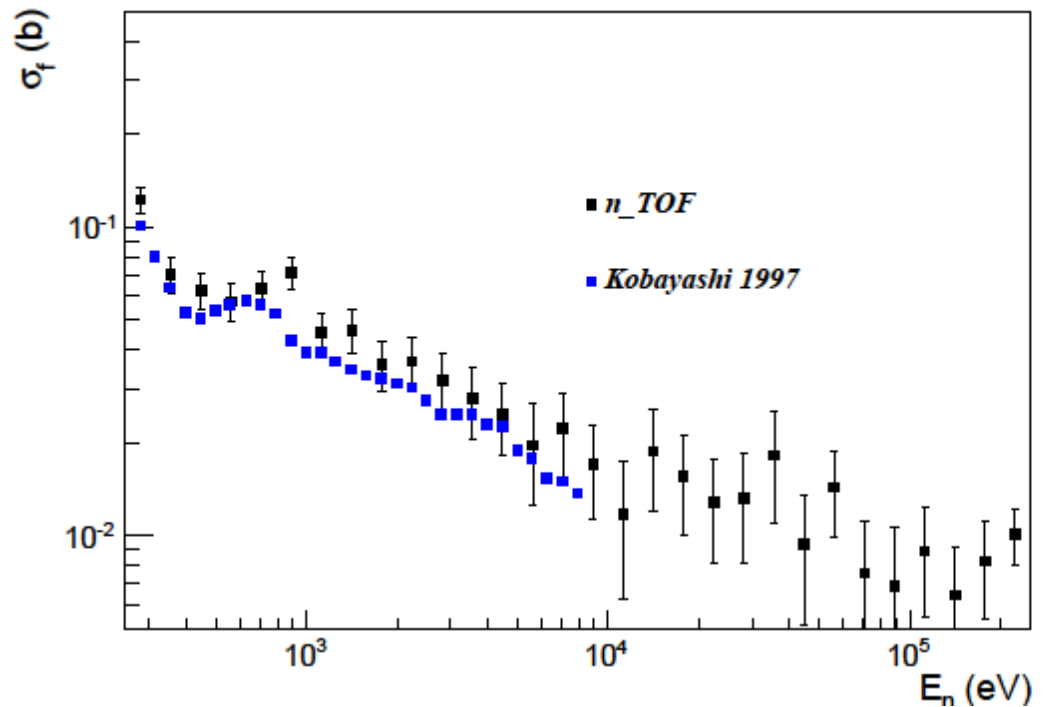


- Kernel mean ratio  $\approx 0.92$
- Dispersion as R.M.S.E.  $\approx 1.50$

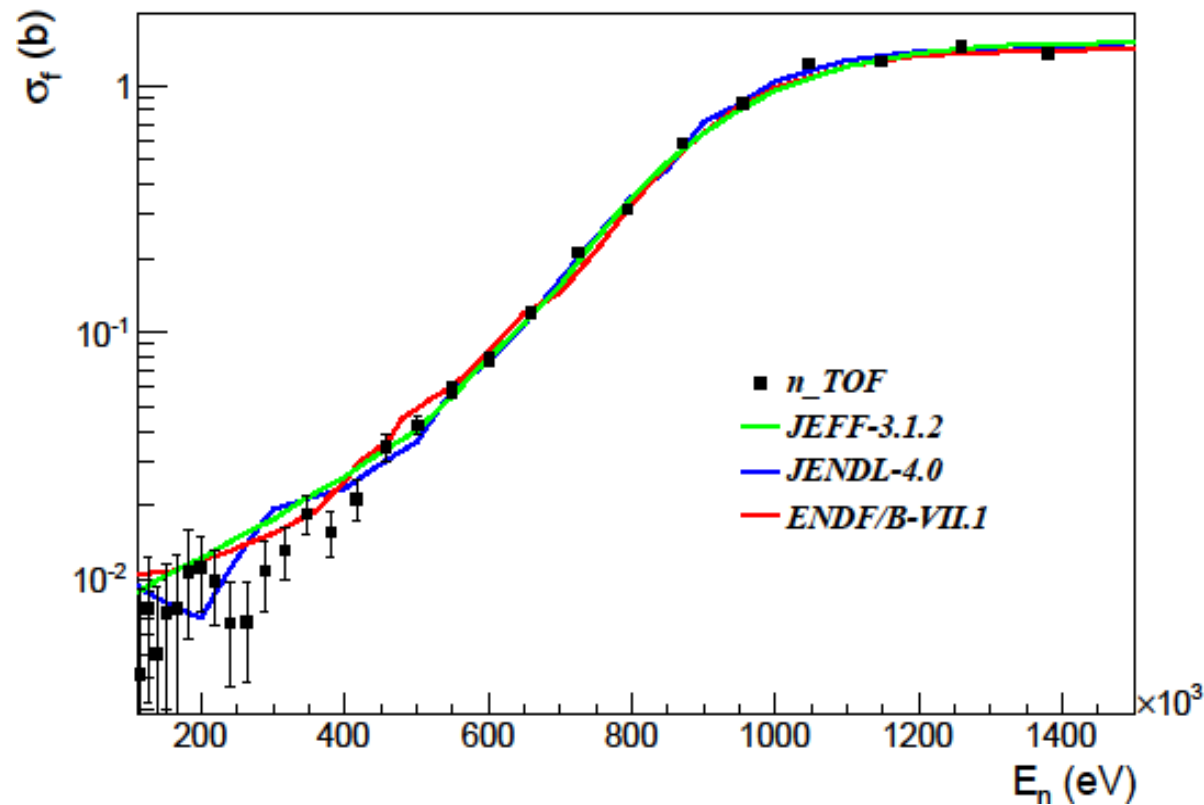
# [ URR: comparison ]

- **n\_TOF data** in agreement with major evaluated data; in particular within **10%** with **JENDL evaluated data**

- The same agreement is observed with **Kobayashi *et al.* results** (basis for libraries)



# Fission threshold: libraries



Above 500 keV n\_TOF data agree libraries within 5 %

# $^{243}\text{Am}(n,f)$ results and conclusions

- Except for  $^{241}\text{Am}$ , contaminants contribution have been estimated by means of SAMMY code
- Data libraries (**JENDL-4.0**) are **8 % overestimated** in the analyzed range (**0.03 ÷ 35.0 eV**)
- Due to the low fission counting rate and the background subtraction, very low statistics does not allow to fit the **whole RRR (from 0.3 to 253.0 eV)**.
- In the high energy region, n\_TOF data are in agreement with libraries, in particular with **JENDL-4.0 data**