Los Alamos NATIONAL LABORATORY

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Evaluation of ^{234,236}U

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T-2

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General evaluation procedure

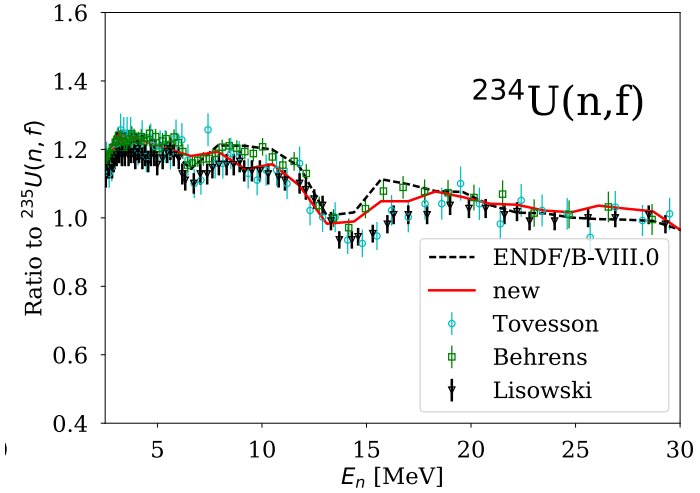
- Model calculation using CoH_3 with Souhkoviskii 2005 potential
- Fission: below 500 keV (^{234}U) keep ENDF/B-VIII.0; above that: new fit to include Tovesson 2014 data for ^{234}U. New fit for ^{236}U was also made but it was not included in the evaluation (see ^{236}U fission slide)
- Calculation: fission transmission adjusted so that the calculation reproduces the fission data. Point-by-point fit to determine an energy-dependent adjustment
- Capture: calculation-based evaluation that reproduces very well the latest measurement by DANCE below 100 keV (^{234}U) and other existing data (^{236}U) . The gamma-gamma width is consistent with the resonance analysis.
- All the other channels have been taken from CoH_3 calculations
- LSSF flag set to 1 for MT=1,18,102. Background cross section in the replaced by full cross section in the URR.
- PFNS taken from JENDL-4
- PFG properties taken from BeOH calculations

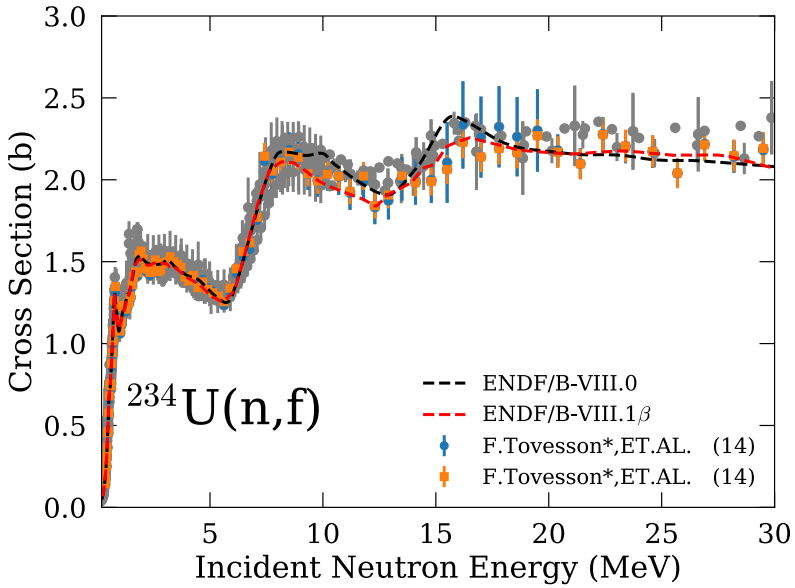
^{234}U

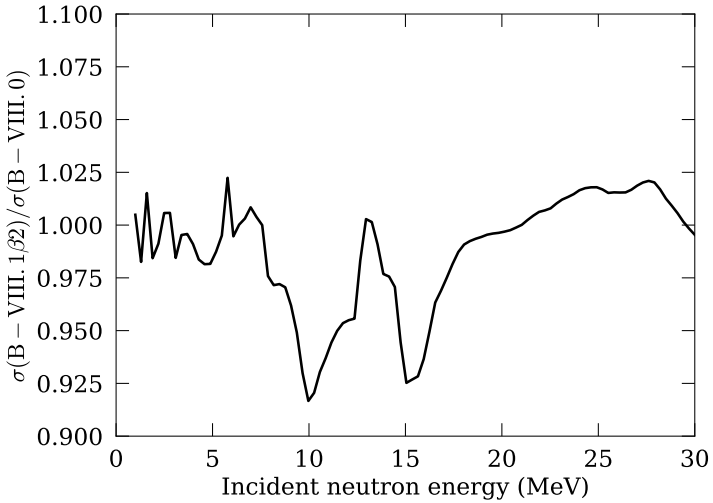
HEU: 1% ^{234}U

The crits are minimally impacted with fine tuning for ^{238}U nubar to compensate for ^{234}U changes included already in the beta2 files

^{234}U(n,f)

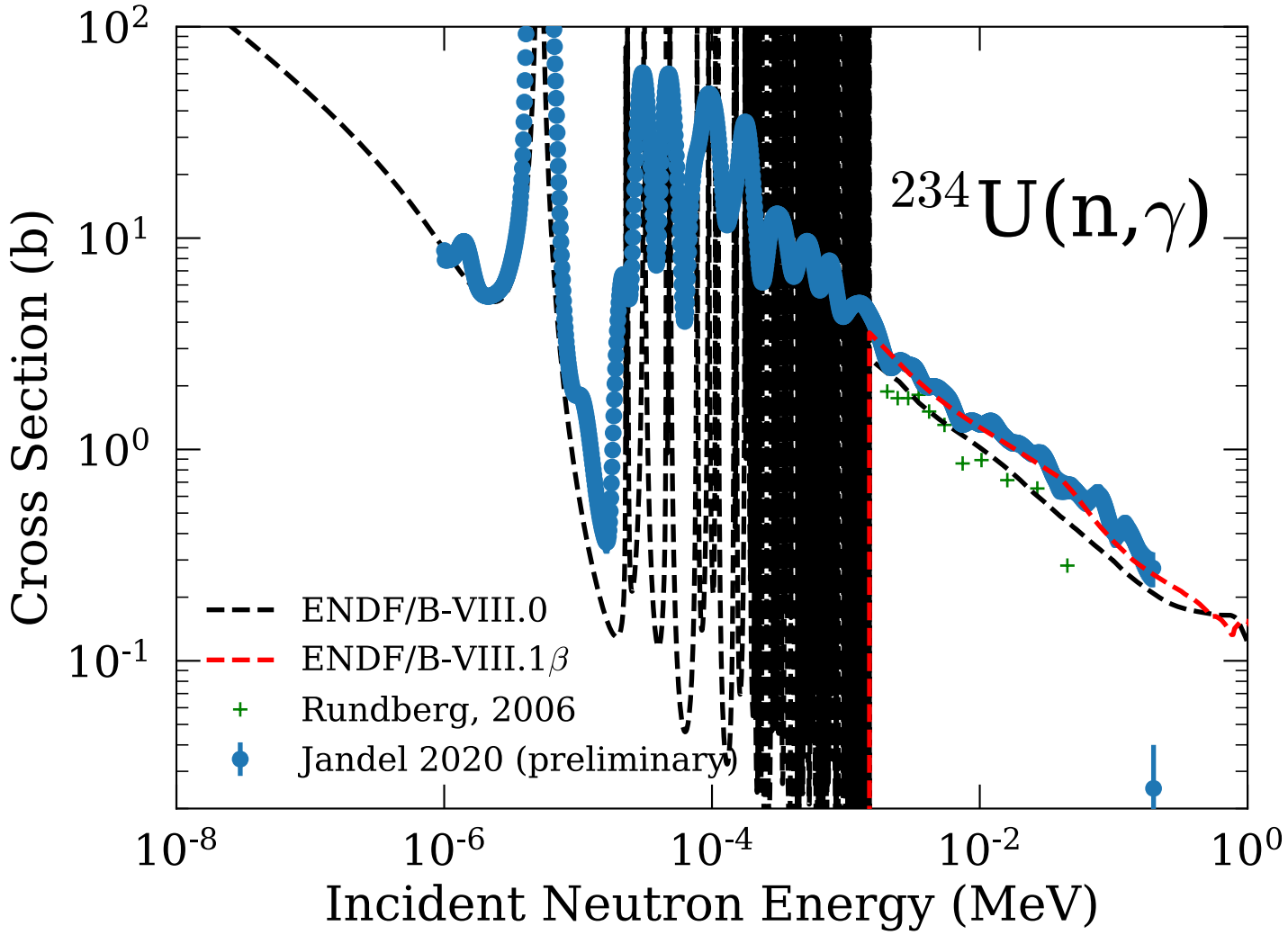






- Small reduction with respect to B-VIII.0 due to Tovesson data
- Larger changes (7.5%-8%) around 10 and 15 MeV.

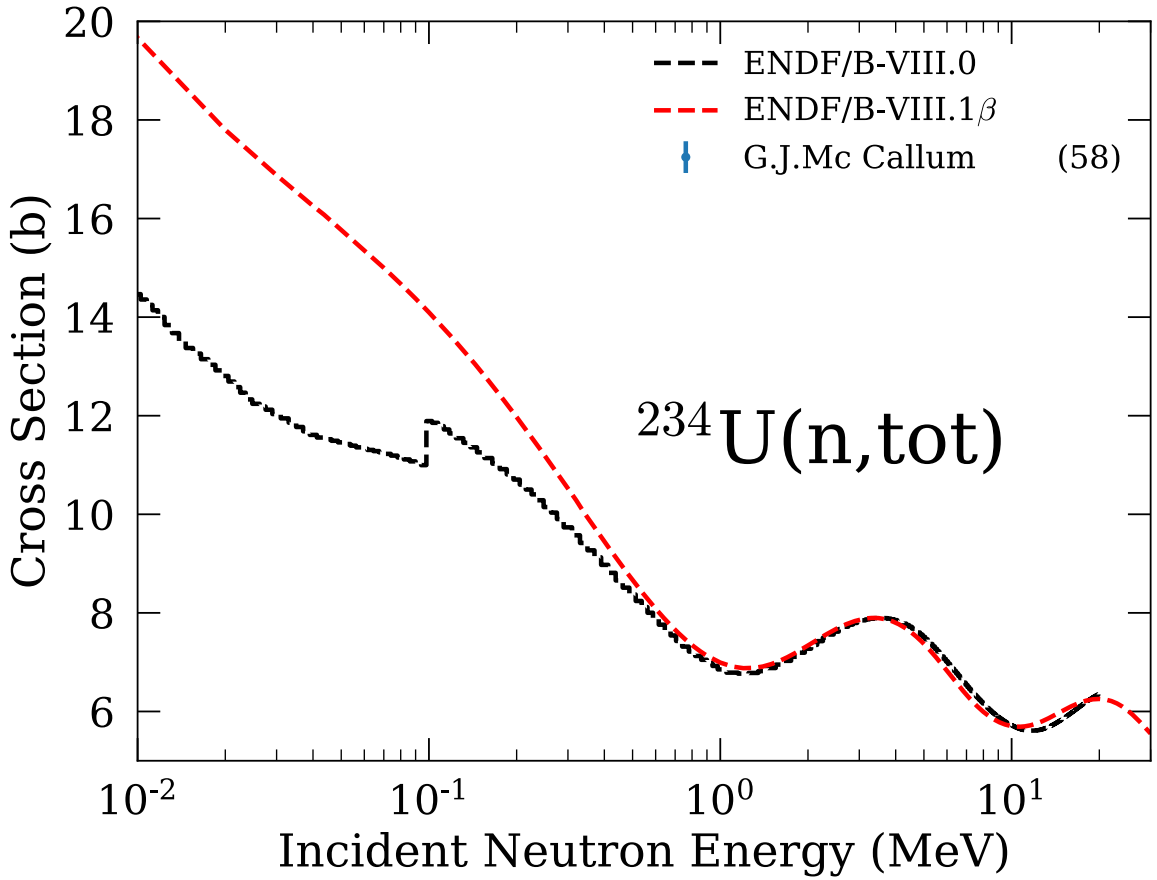
^{234}U(n,g)



Data from M. Jandel (preliminary 2020)
Changes to crits of the order of 10-20 pcm

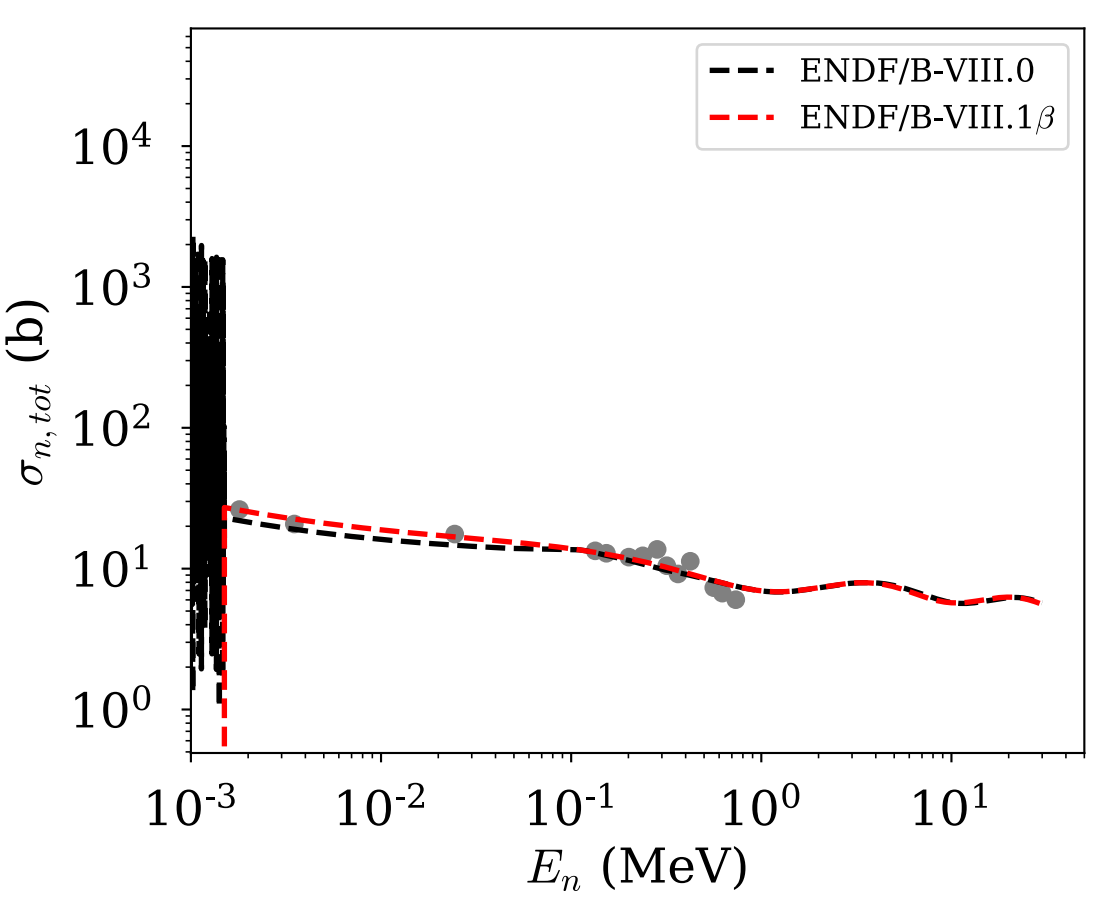
^{234}U(n,tot)

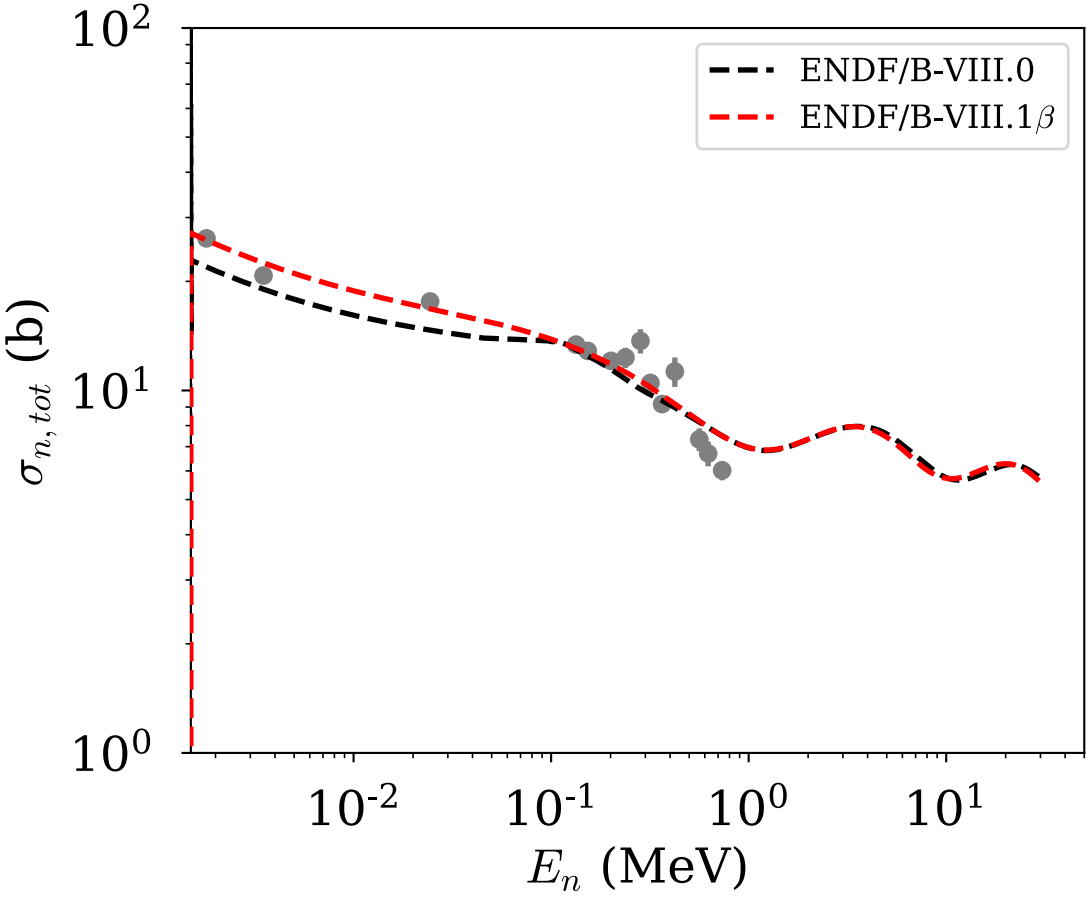
- No data available in the fast range
- Our OM calculation is larger by 50% than previous evaluation (and JENDL-5) – still investigating, but one could use the earlier Souhkoviskii OM parameters.
- The same OM reproduces well the $^{236(238)}$U total cross section



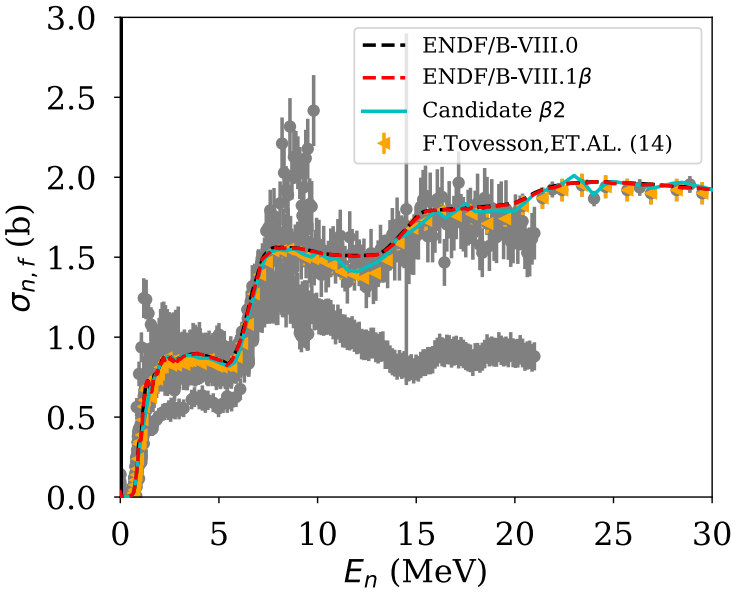
^{236}U

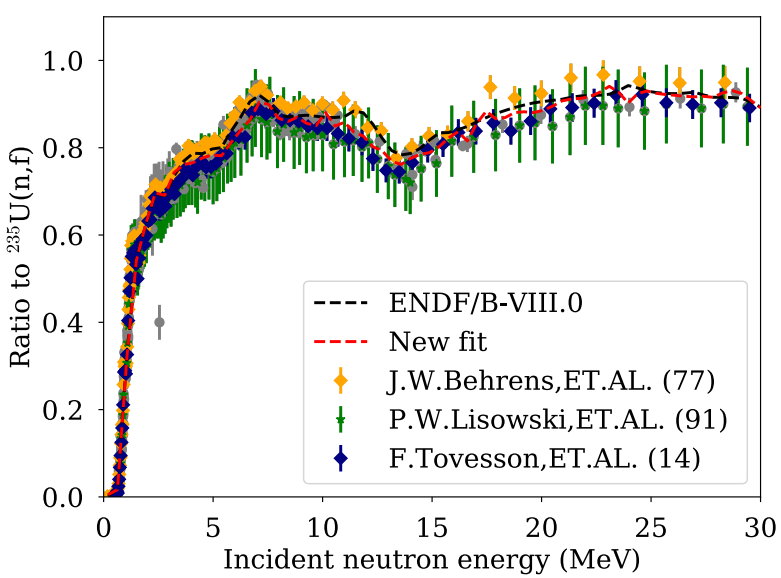
^{236}U(n,tot)

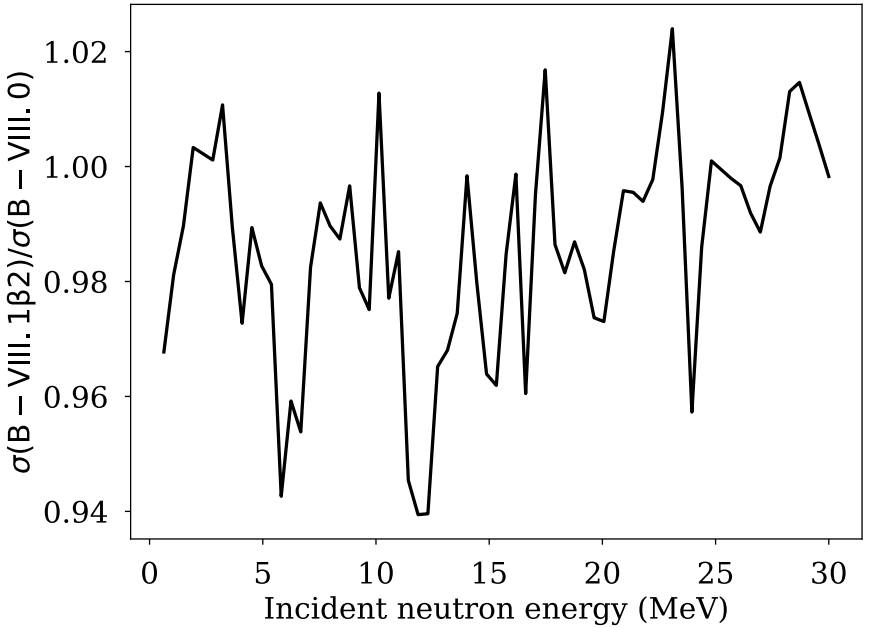

ENDF/B-VIII.0
ENDF/B-VIII.1β
10^4
10^3
10^2
10^1
10^0
$\sigma_{n,tot}$ (b)
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
E_n (MeV)


ENDF/B-VIII.0
ENDF/B-VIII.1β
10^2
10^1
10^0
$\sigma_{n,tot}$ (b)
10^{-2}
10^{-1}
10^0
10^1
E_n (MeV)

^{236}U(n,f)

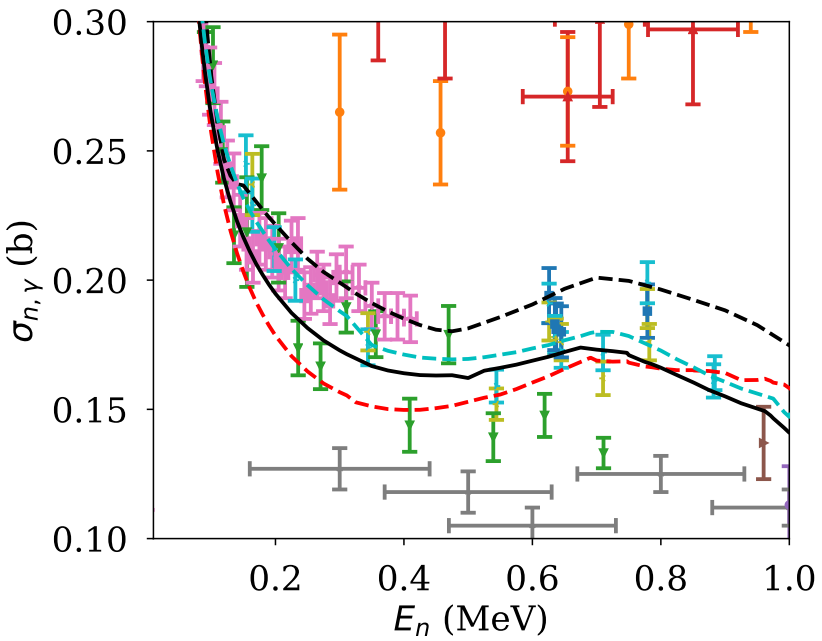


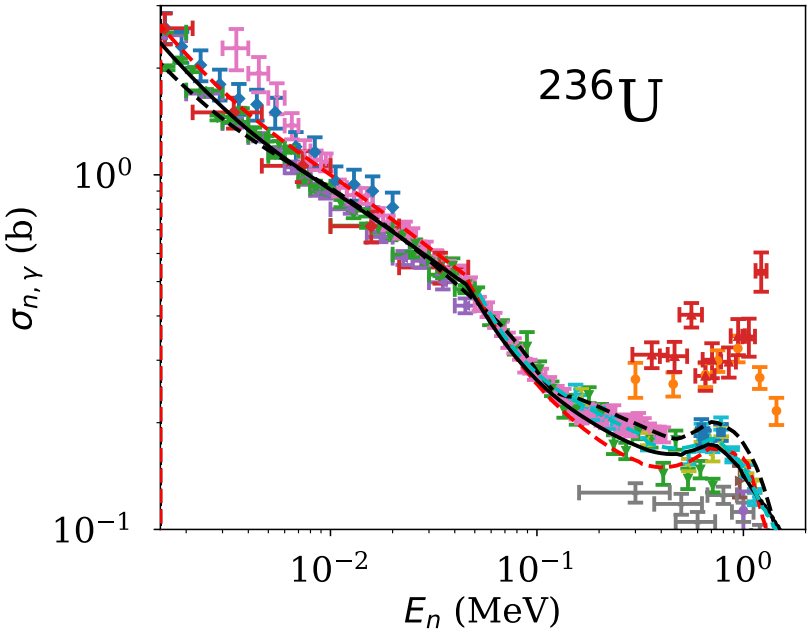




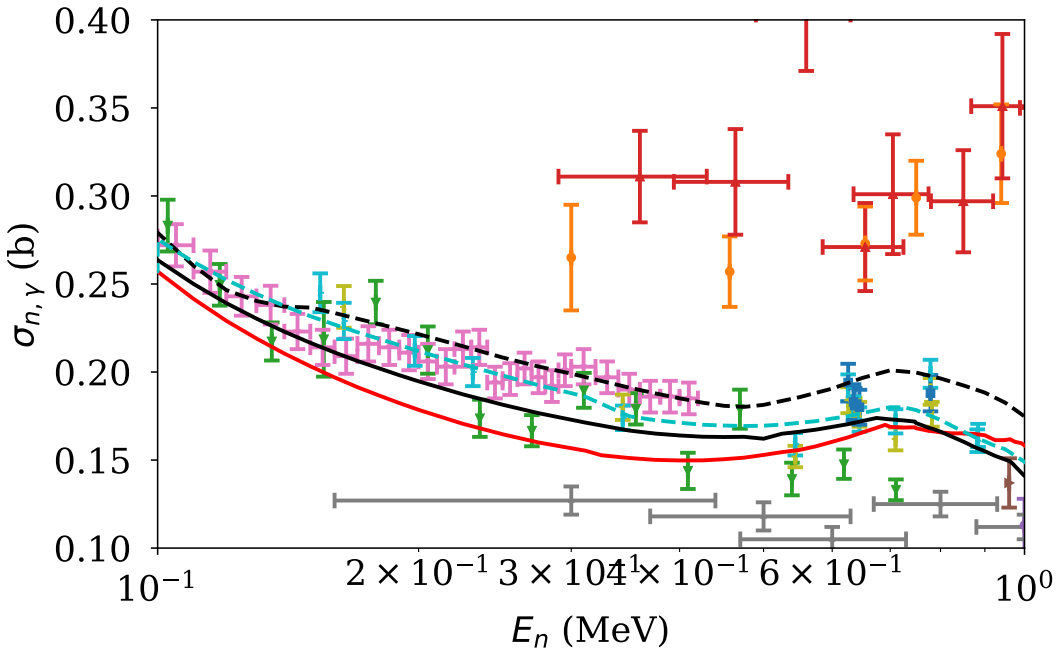
- No change in fission cross section in beta1
- A new fit performed, but it did not make it into the evaluation (adjustment of the transmission coefficients for fission channel has been performed using the old evaluation)
- Tovesson data changes a bit the evaluation in the fast region (like for ^{234}U)
- New fit will be included into beta2

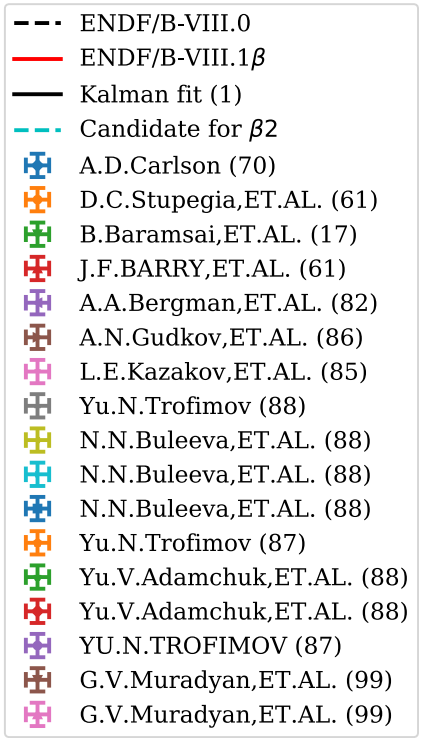
^{236}U(n,g)





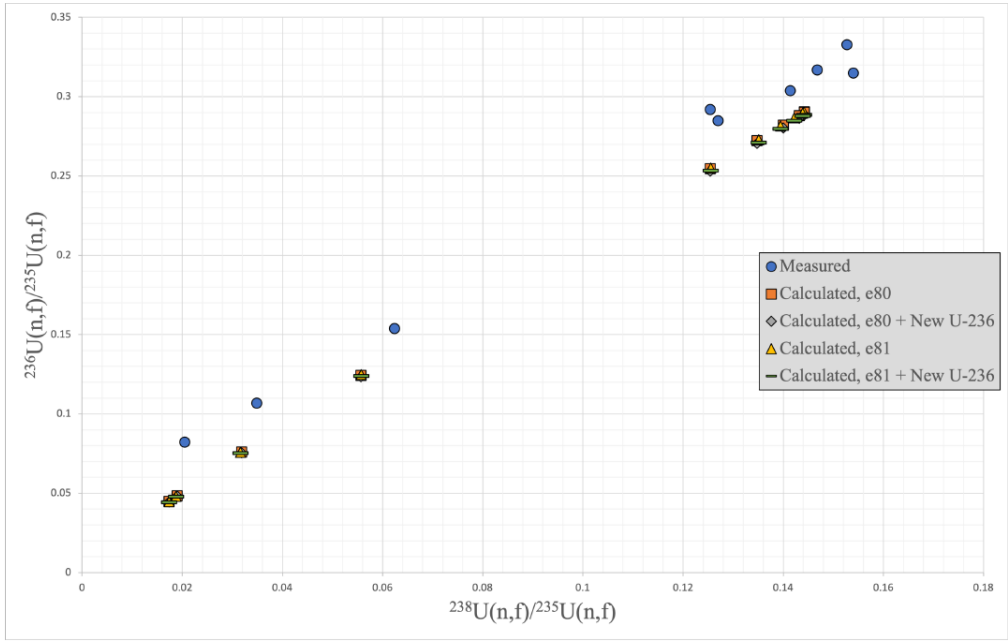
- For beta2 candidate: reduced the weight of the DANCE experiment

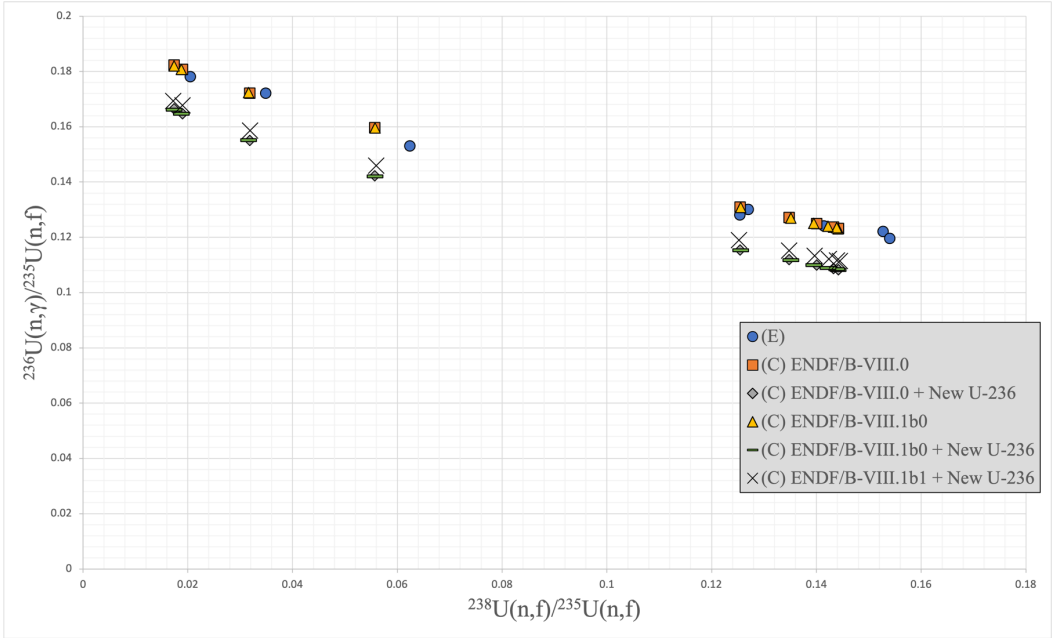




Reaction Rates

Work in progress





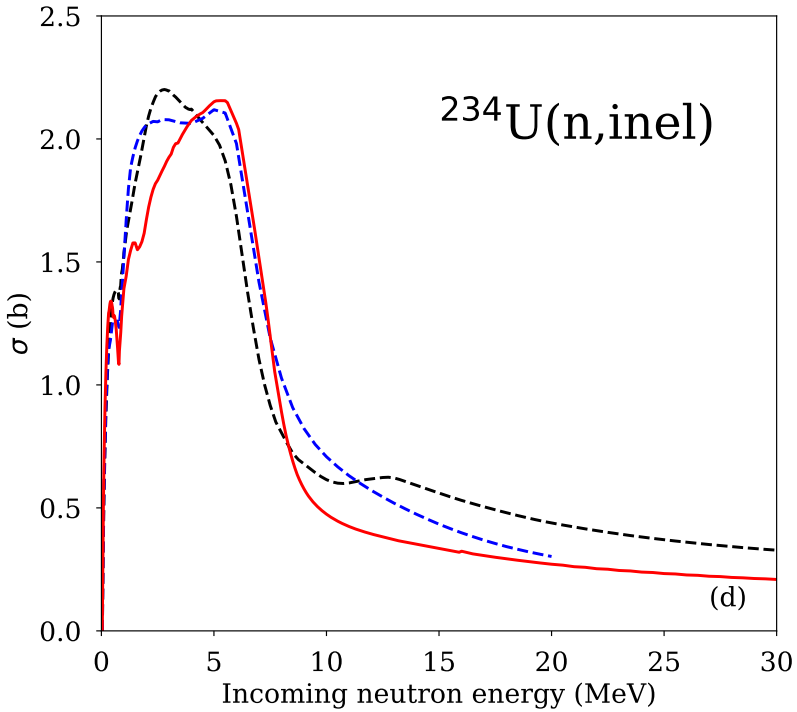
- RR values for fission did not change, and will not change even if one includes the new fit for fission
- RR values for capture decreased by ~8%, slightly better (but not much) with the new fit
- Other criticality benchmarks do not change significantly

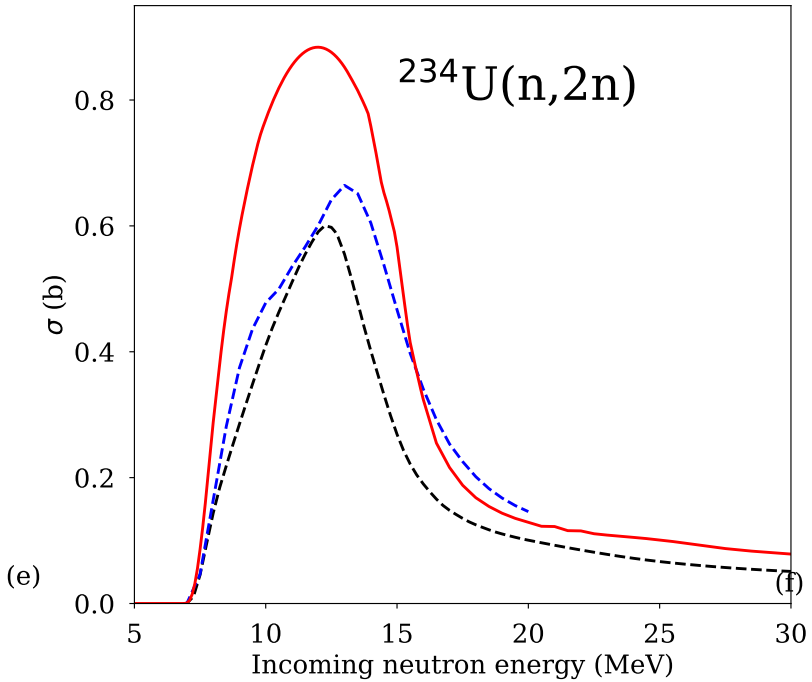
Summary

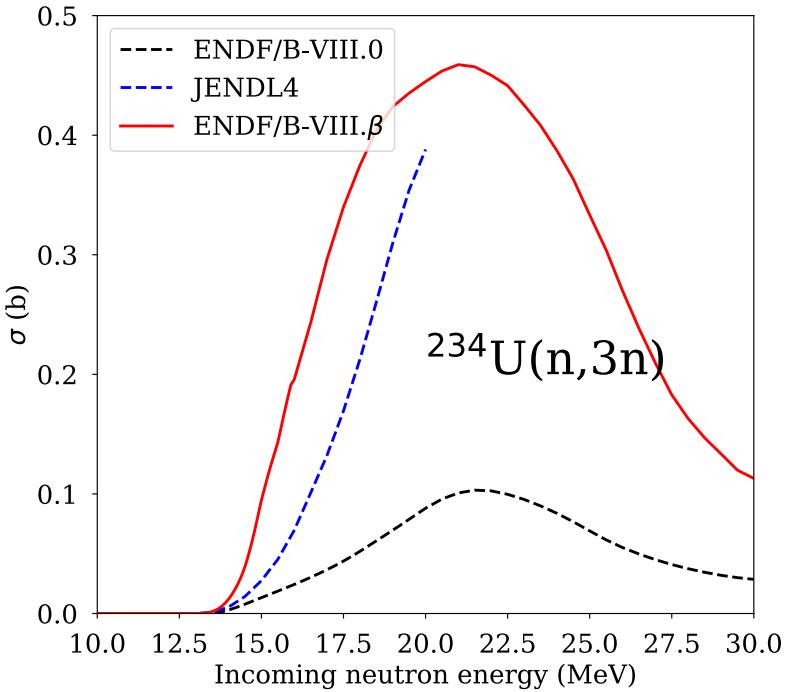
- (Mostly) model-based evaluation
- Special treatment of the fission channel
- Capture data in good agreement with preliminary data by DANCE for 234U, and 236U; however, other data less well described for 236U, in particular above 100 keV. RR in flattop within about 8% from the experimental data.
- LSSF changed from 0 to 1 for ; background cross section replaced by the full cross section in the URR
- Note that further re-evaluation of the RR is in progress for ^{236}U

Backup slides

^{234}U other channels







(n,2n), (n,3n) significantly higher
Some better agreement with JENDL-4

^{236}U other channels

The cross sections in these channels are:

- Significantly higher but seem to follow a pattern (see n,2n comparison between different isotopes)
- Same increase observed for ^{234}U