Status of ^{235}U CIELO evaluation

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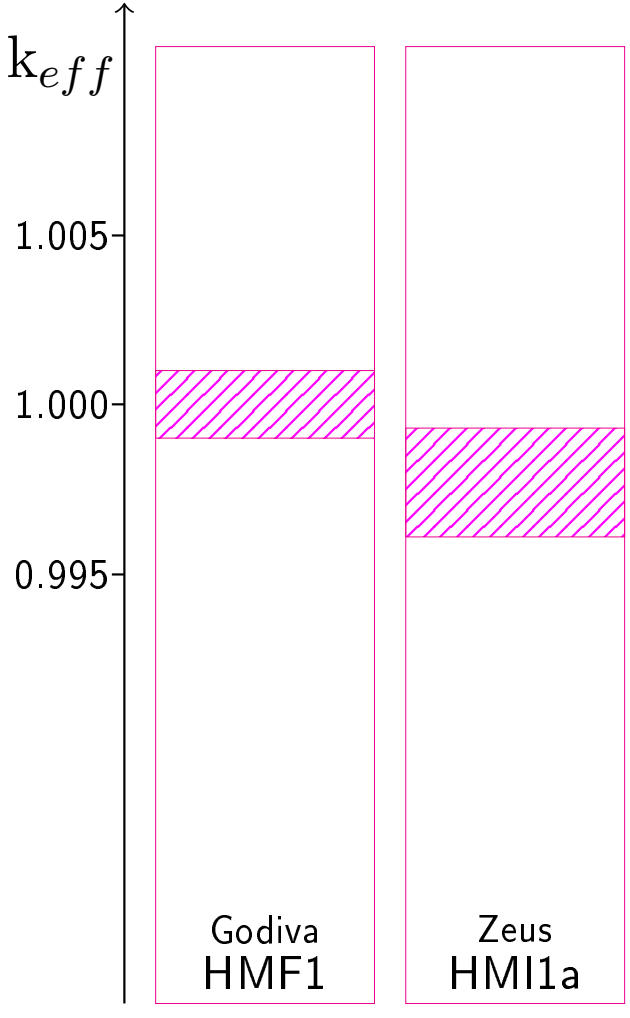
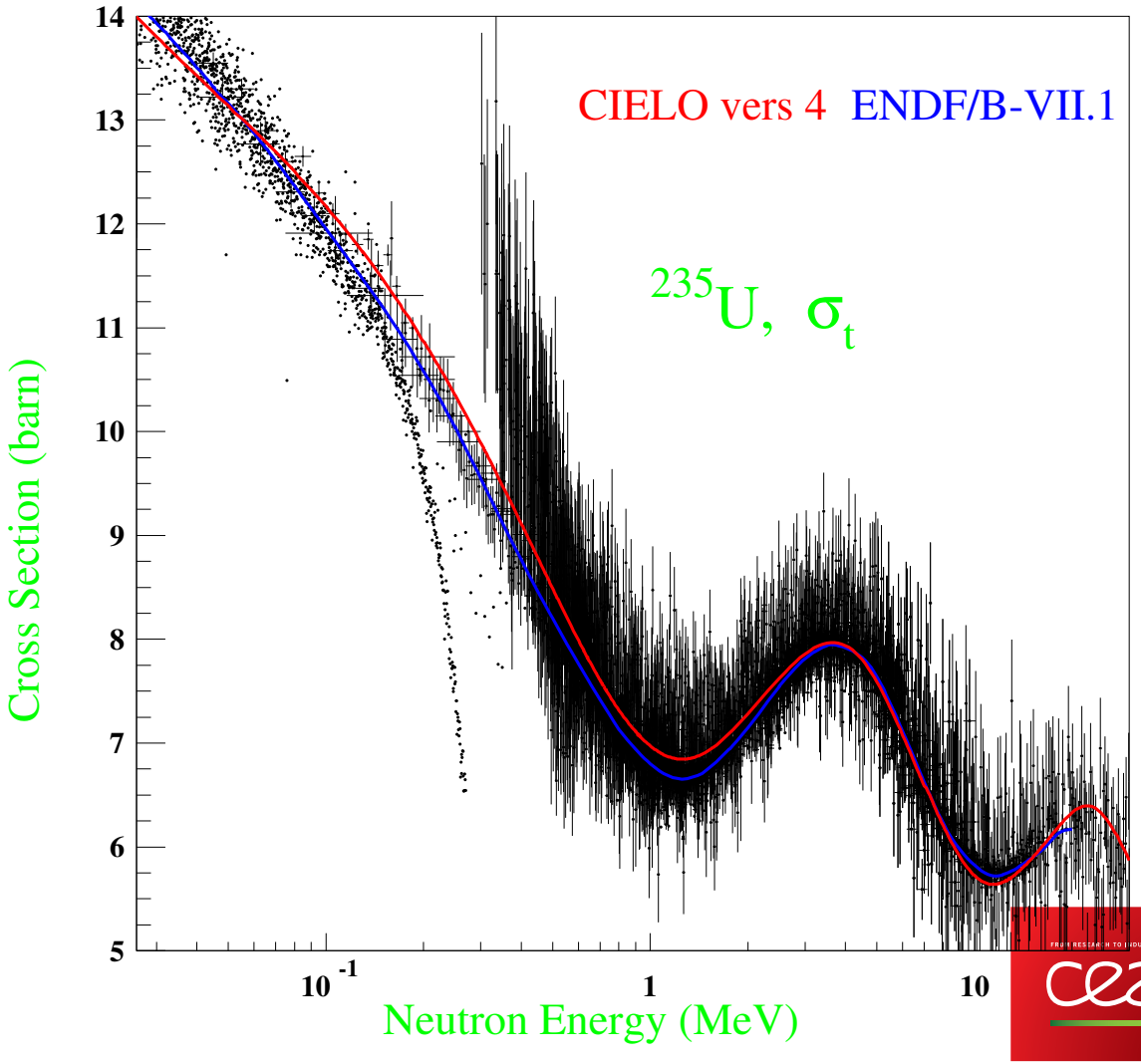
^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

$2.25keV < E$: calculations done with the TALYS code

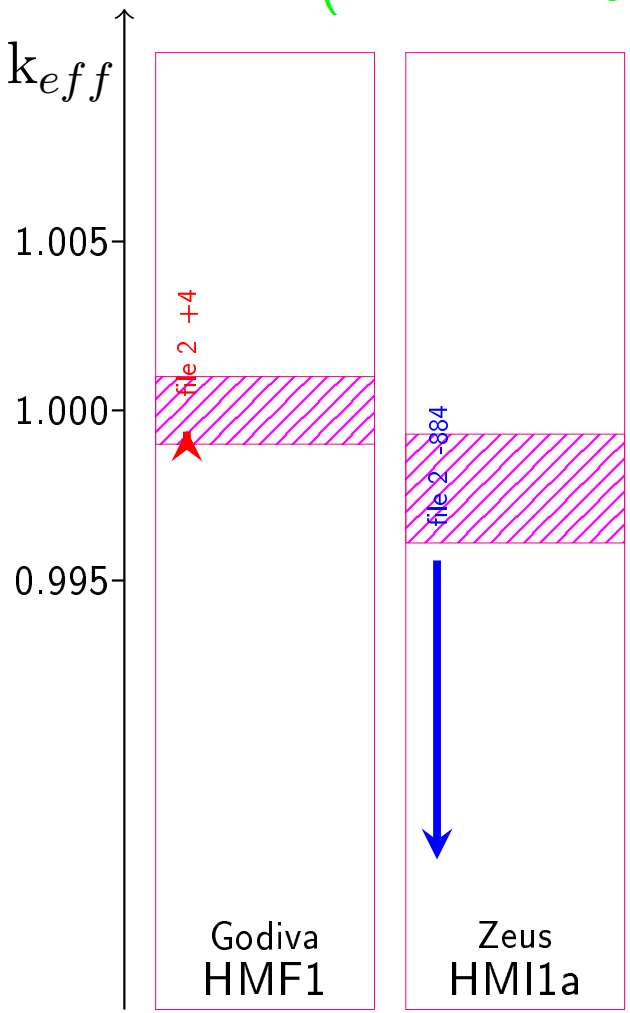
Benchmarking with the MCNP5 code





^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

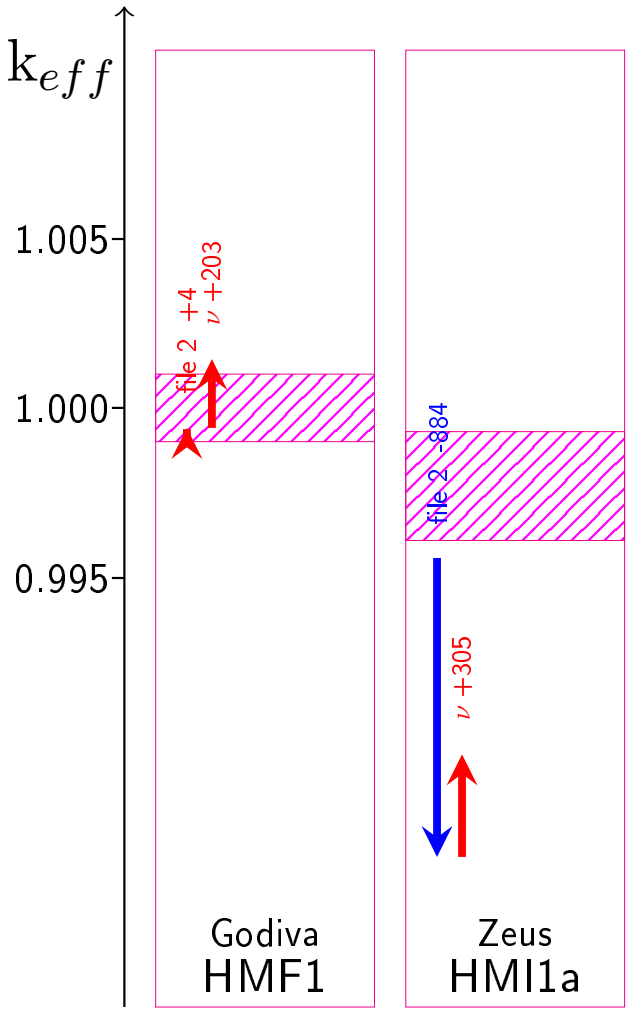
file 2 (MF2 MT151) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

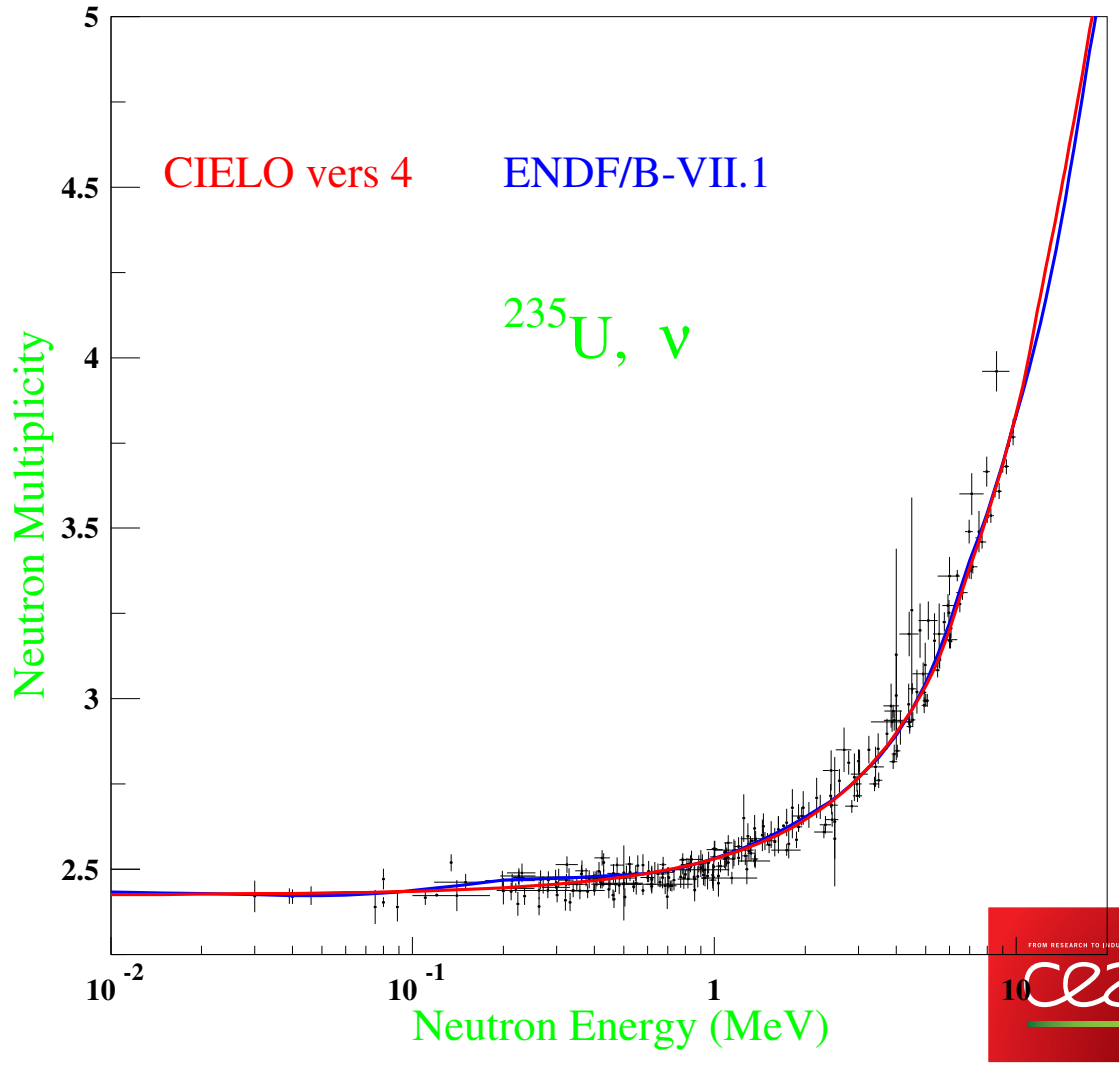


A resonance evaluation performed at ORNL based on capture data taken at LANCE and RPI were used in the resolved resonance region.

^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

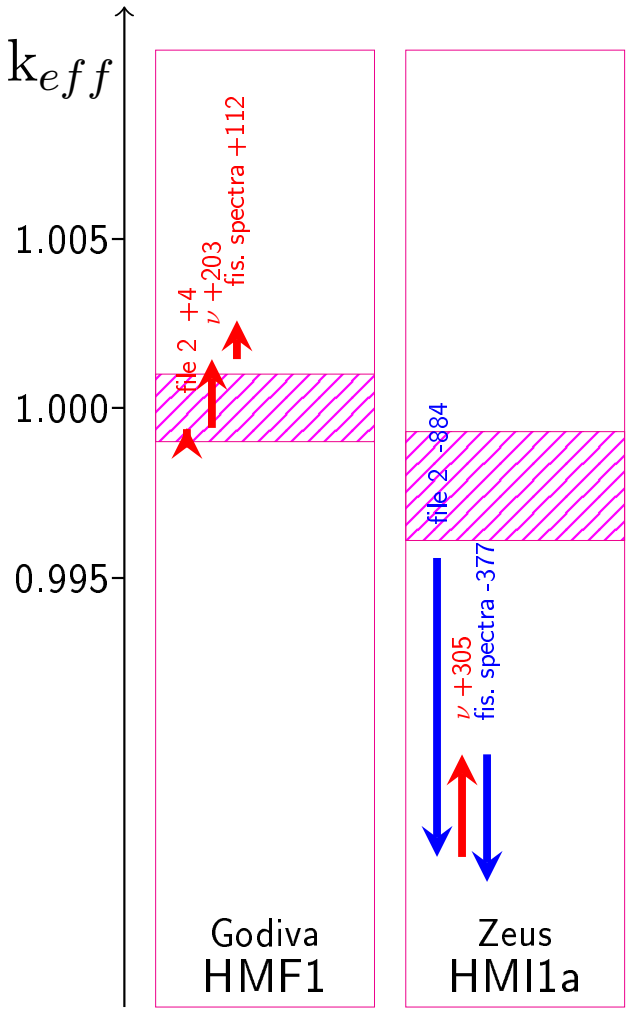
ν (MF1 MT452-456) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

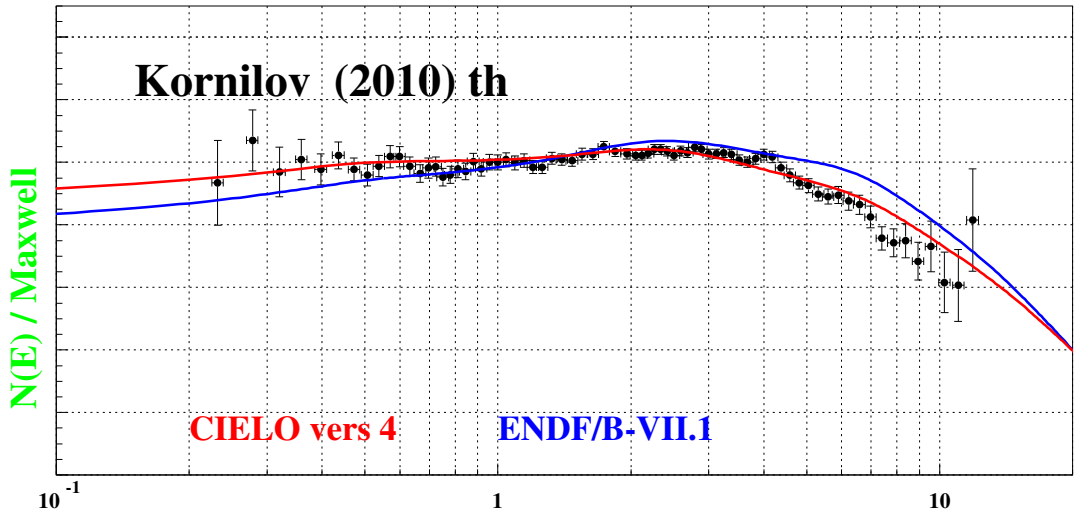


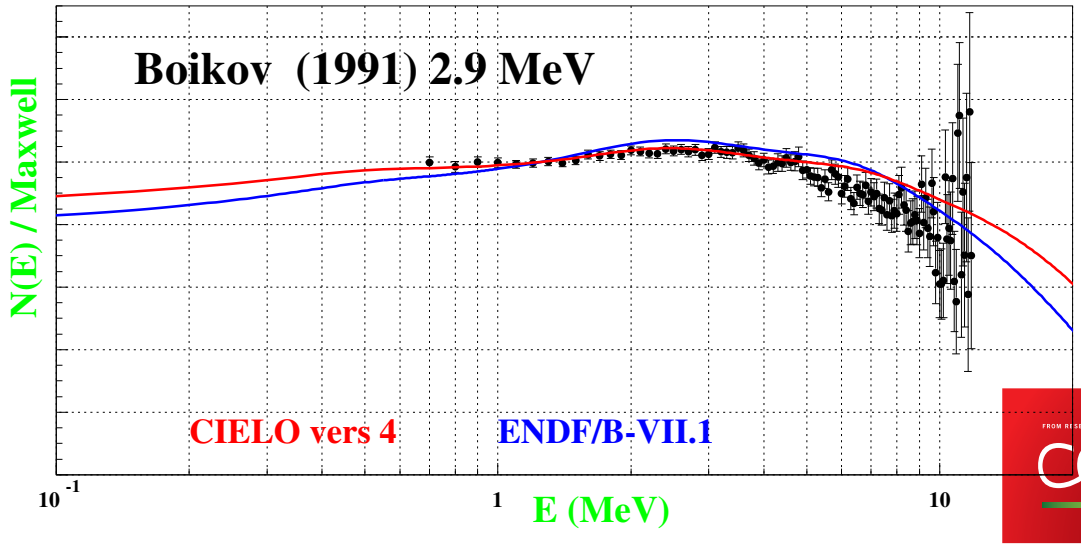


^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

fission spectra (MF5 MT18) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

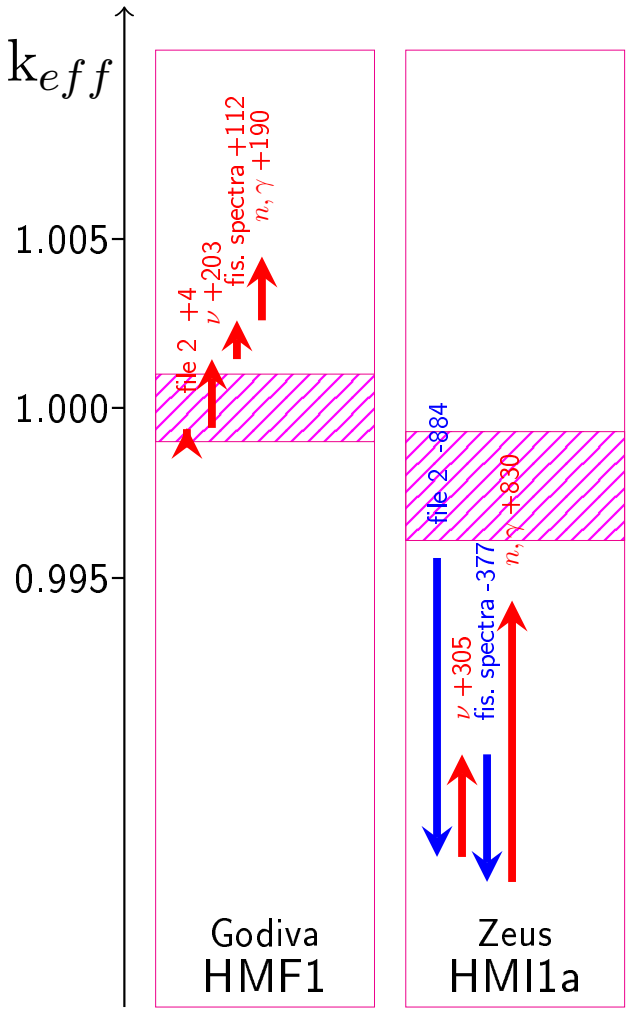


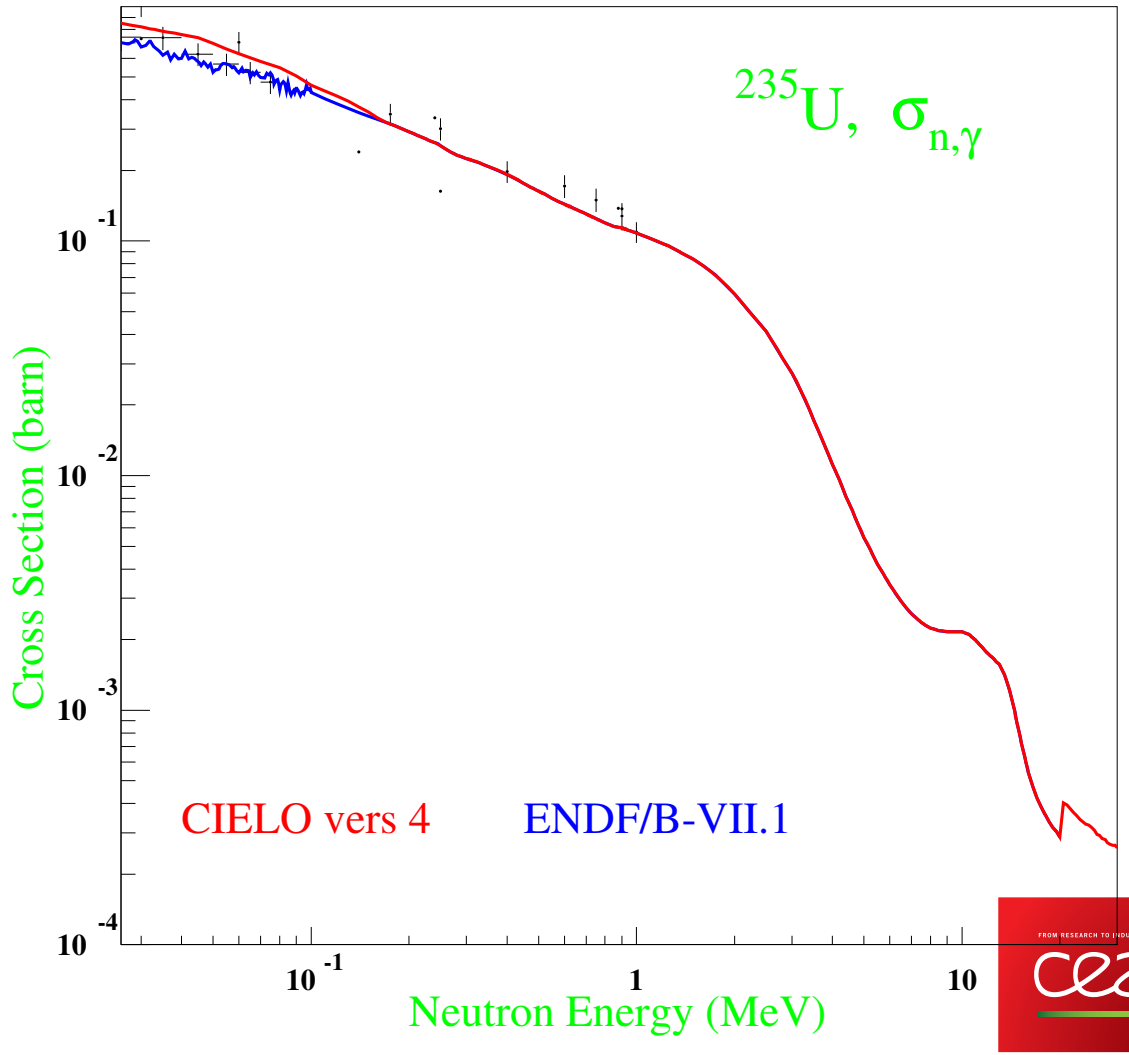




^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

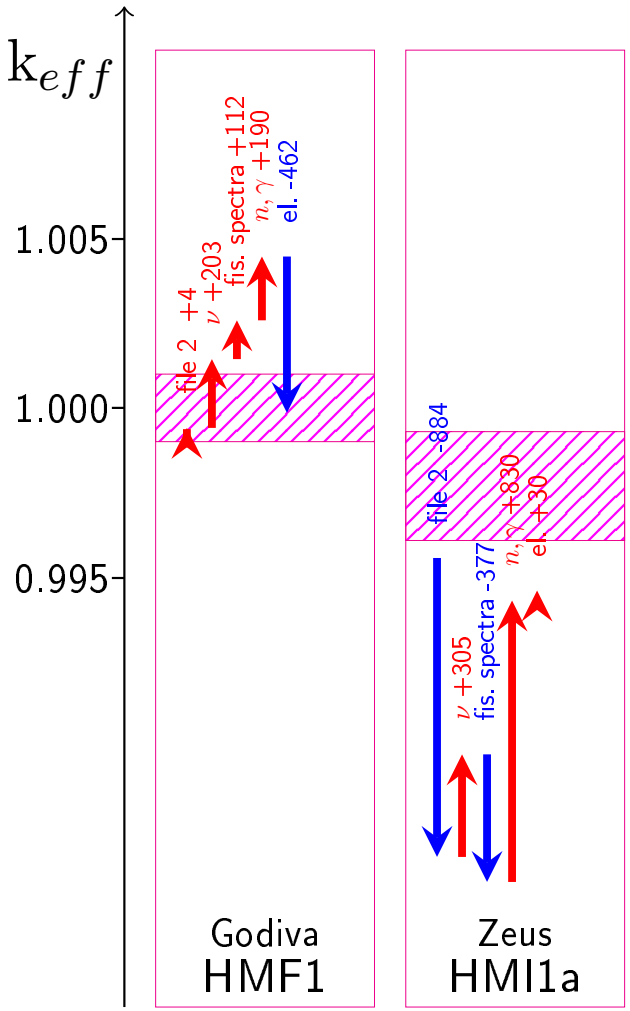
(n,γ) (MF3 MT102) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

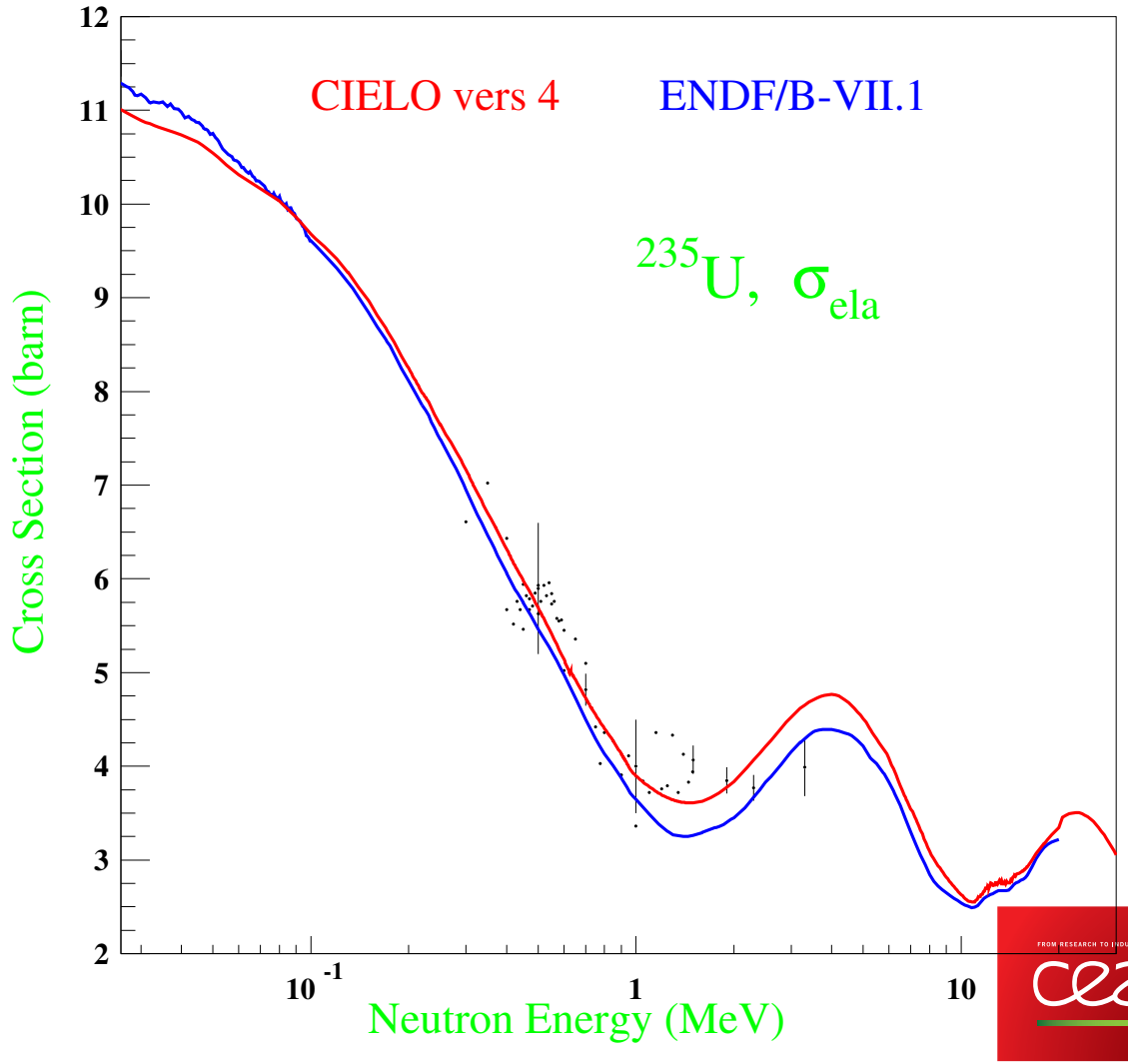




^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

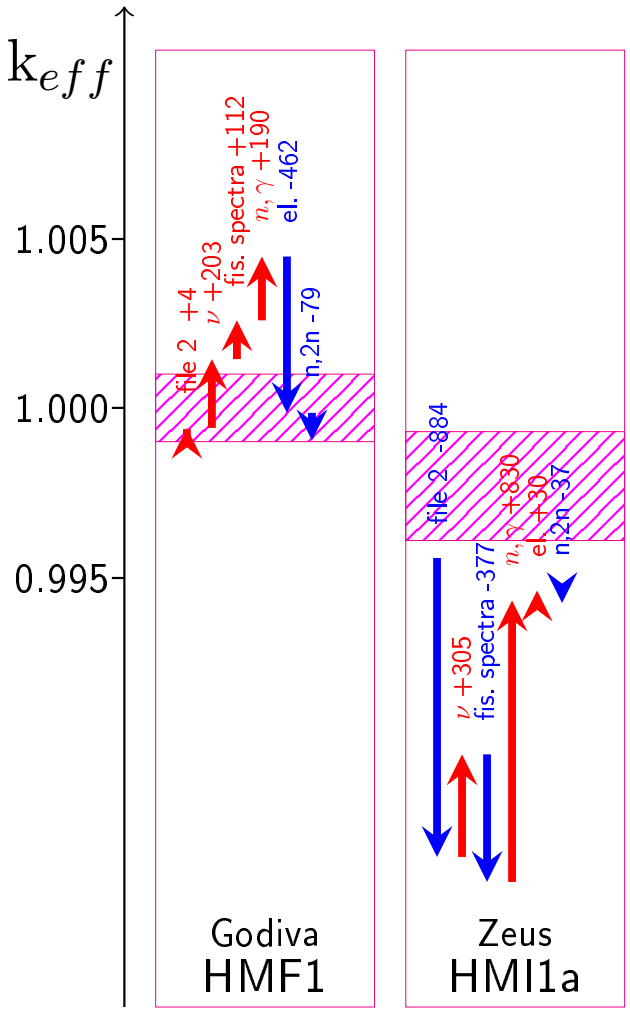
(n,n) (MF3,4 MT2) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

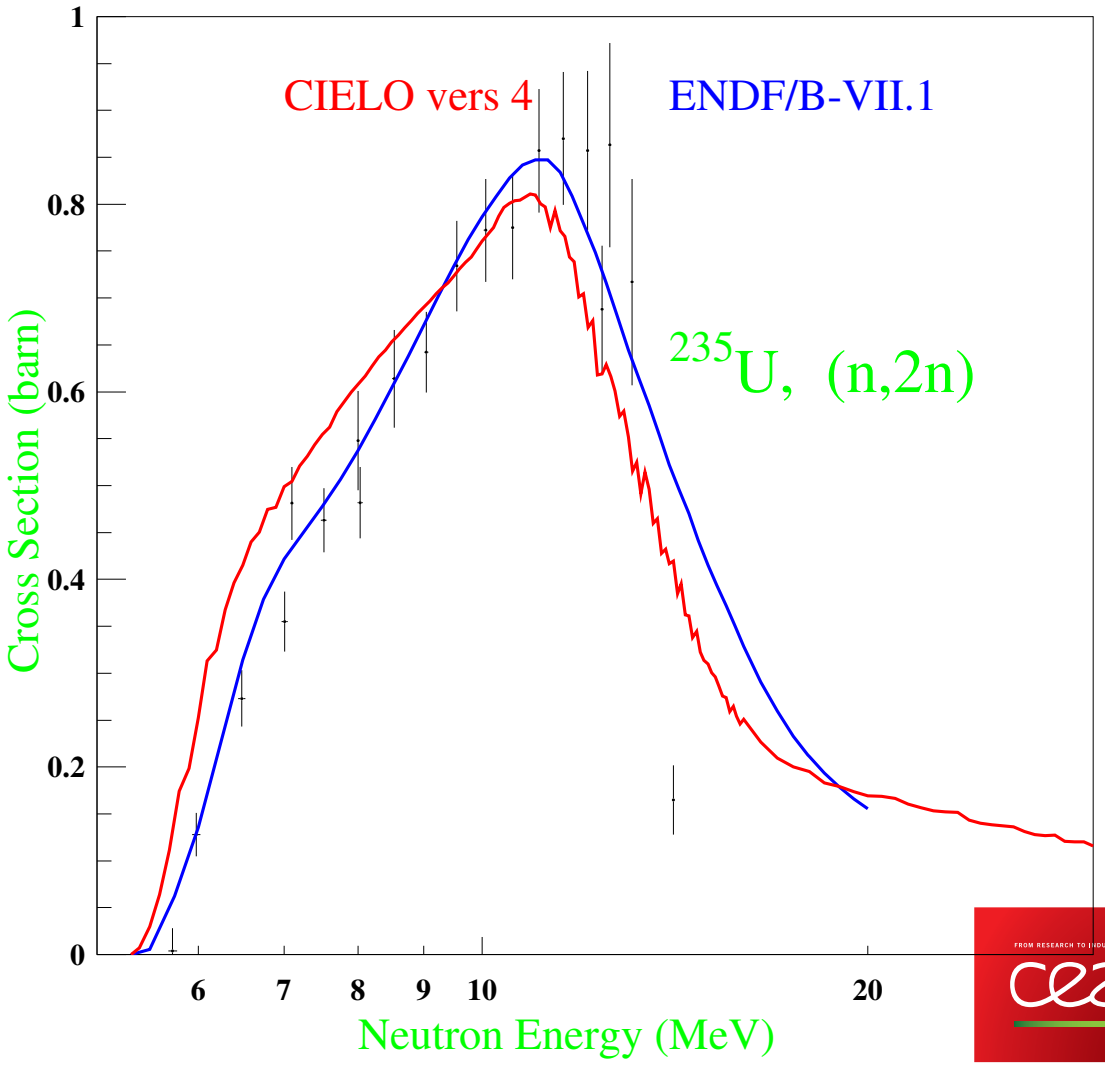




^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

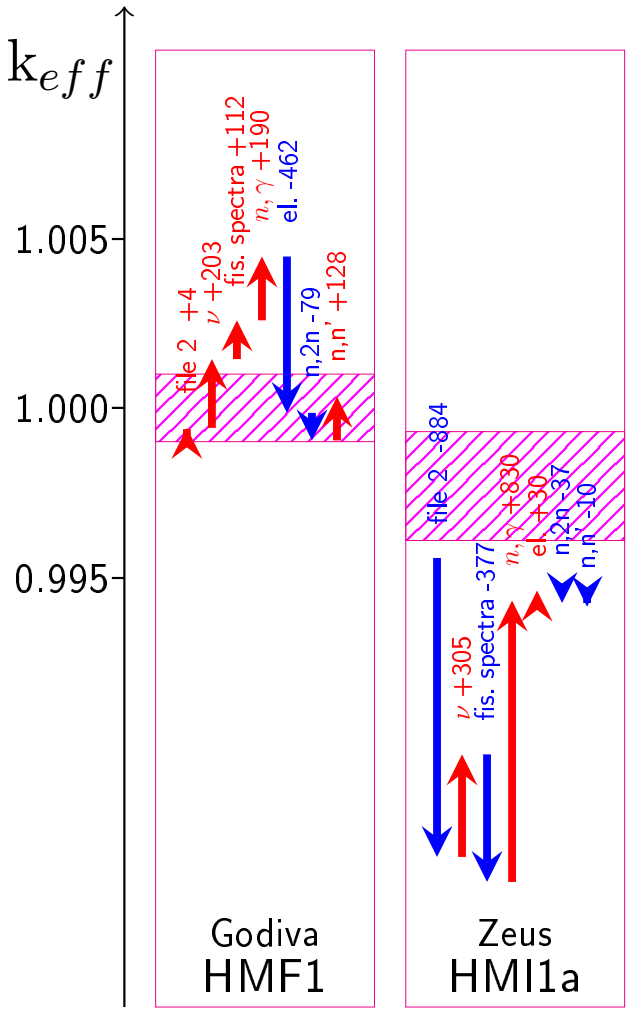
(n,2n) (MF3,6 MT16) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

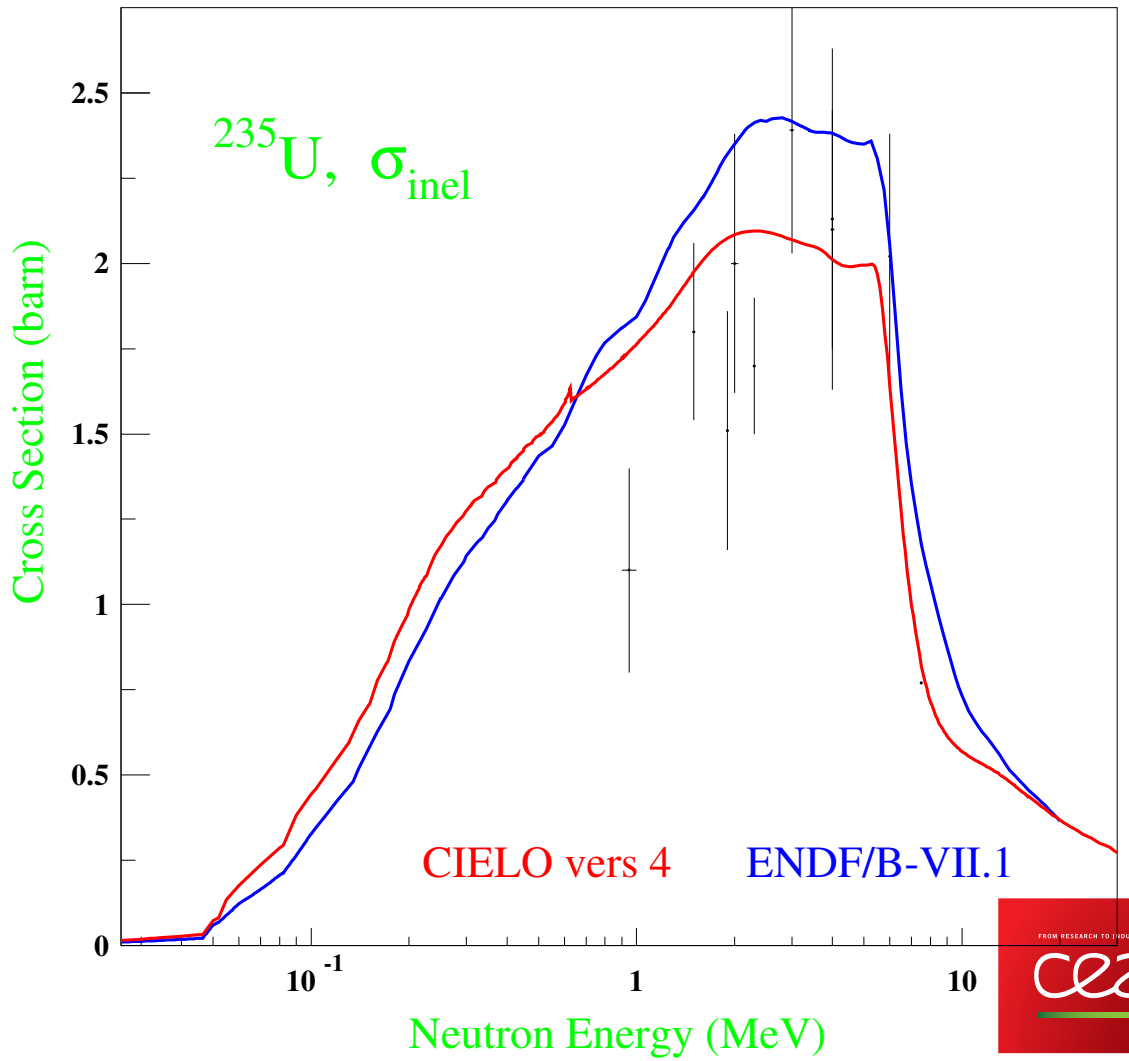




^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

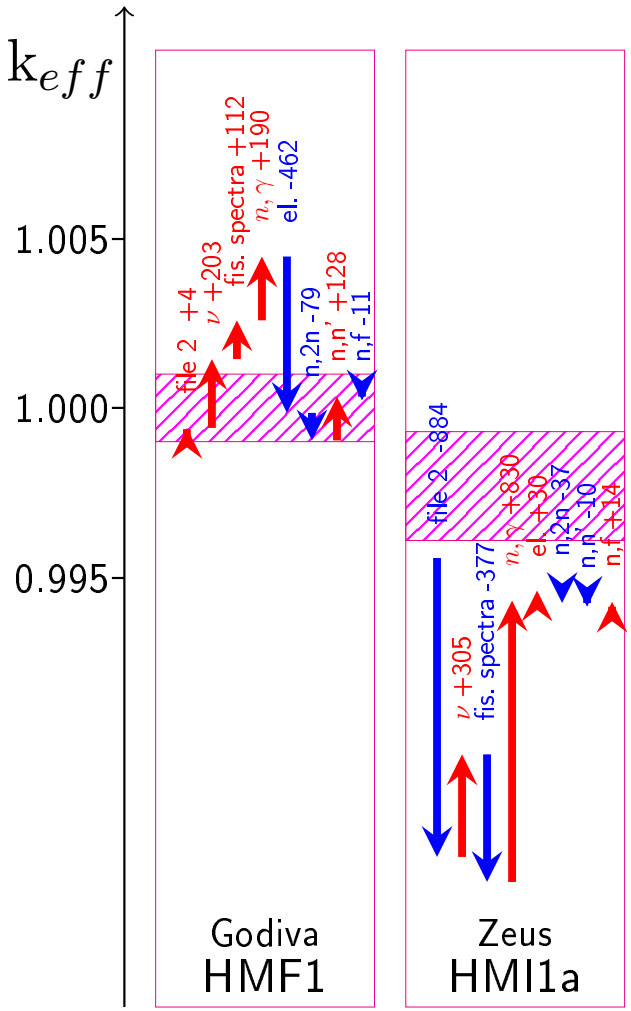
(n,n') (MF3,4,6 MT4,51-91) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

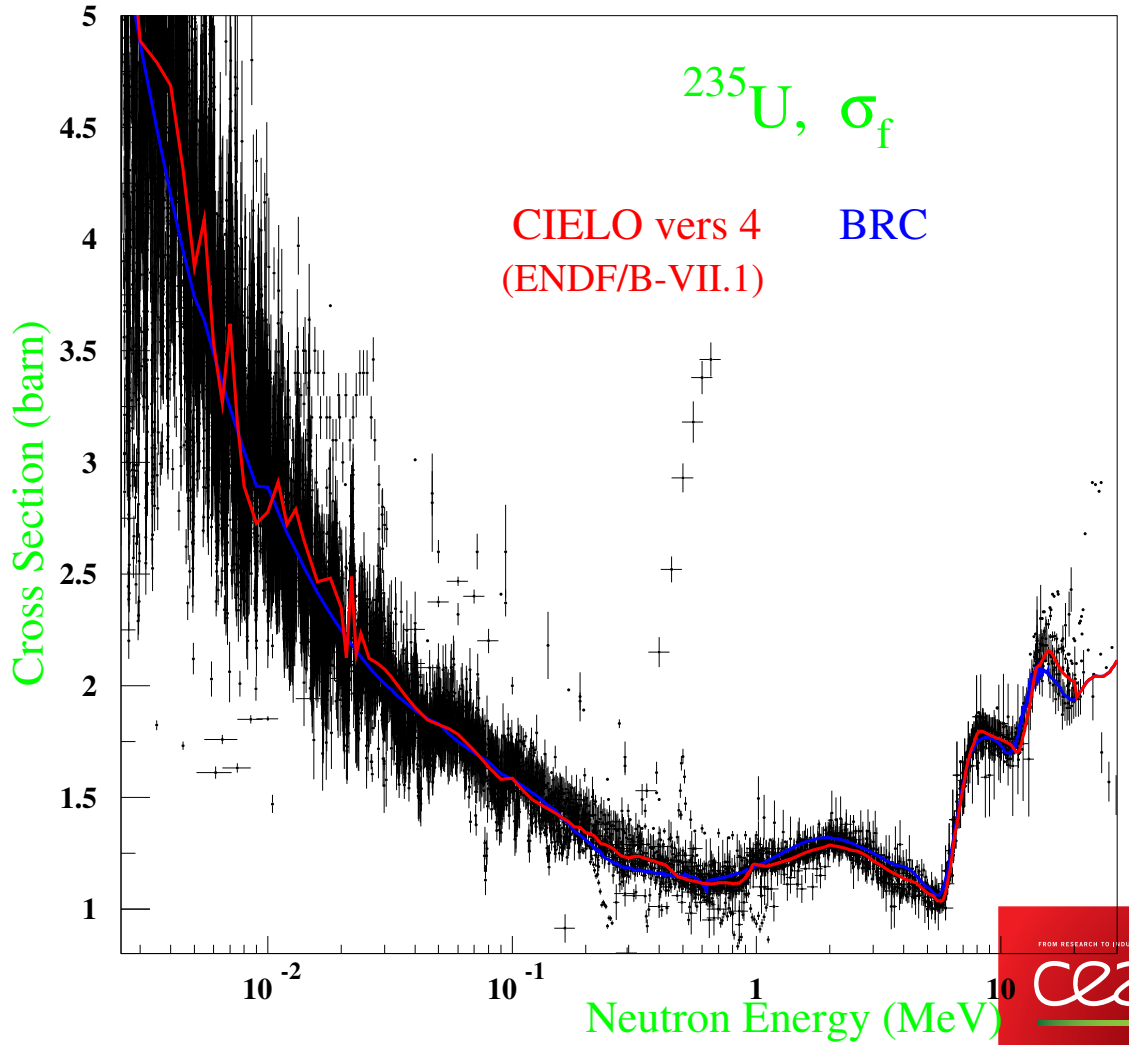




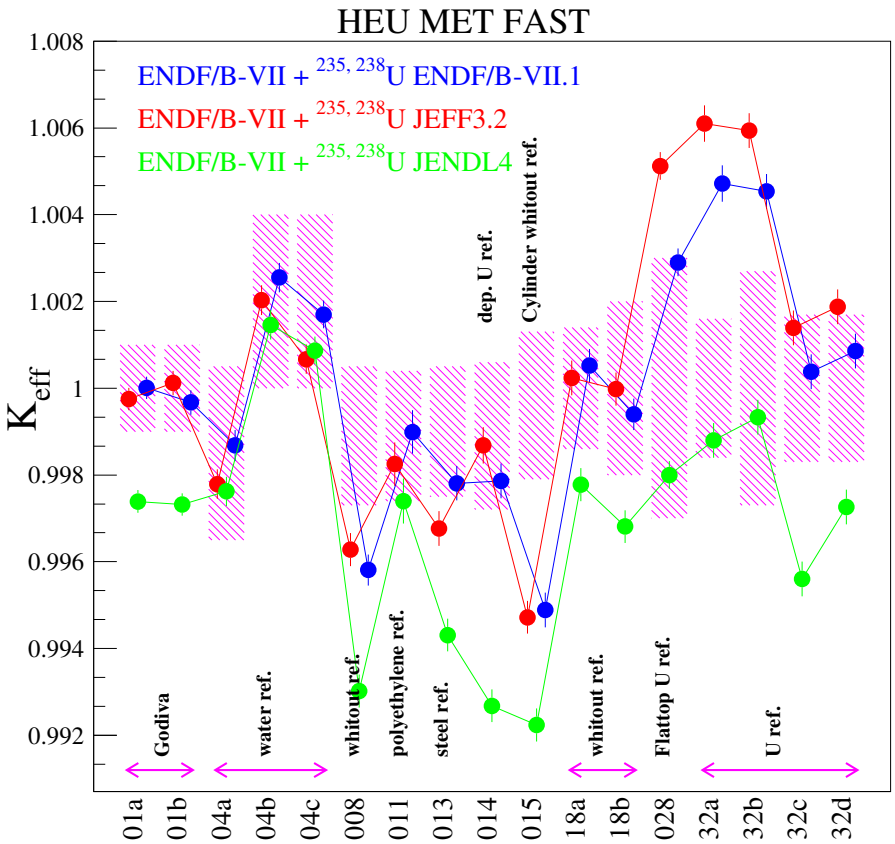
^{235}U CIELO and ^{235}U ENDF/B-VII.1 : main differences

(n,f) (MF3 MT18) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

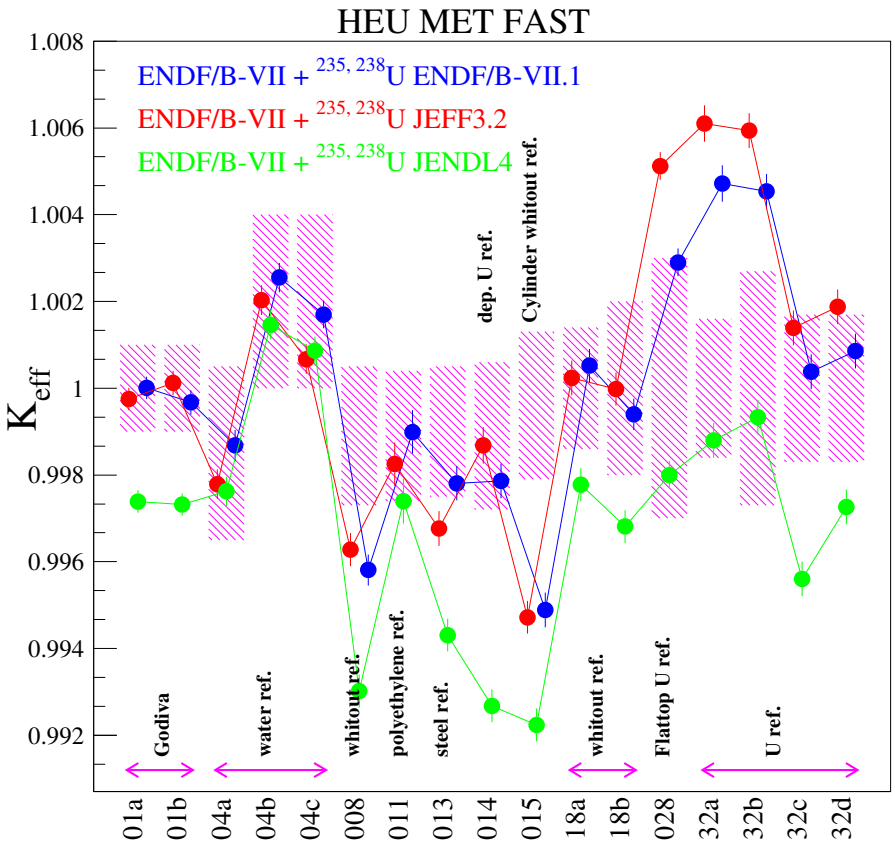


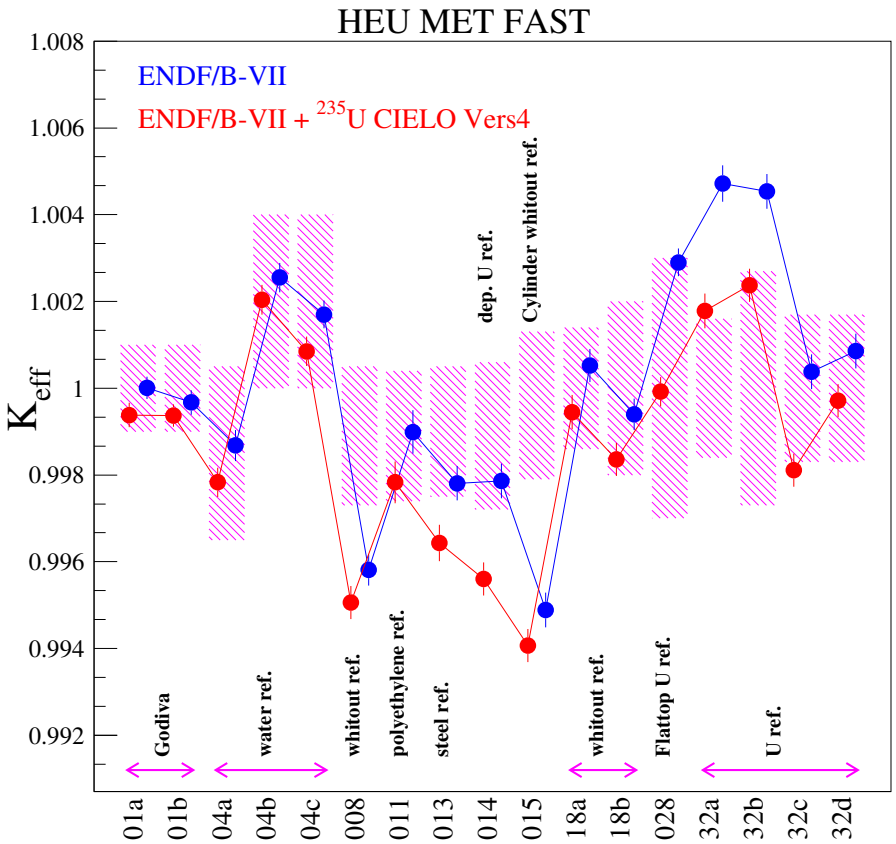


^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

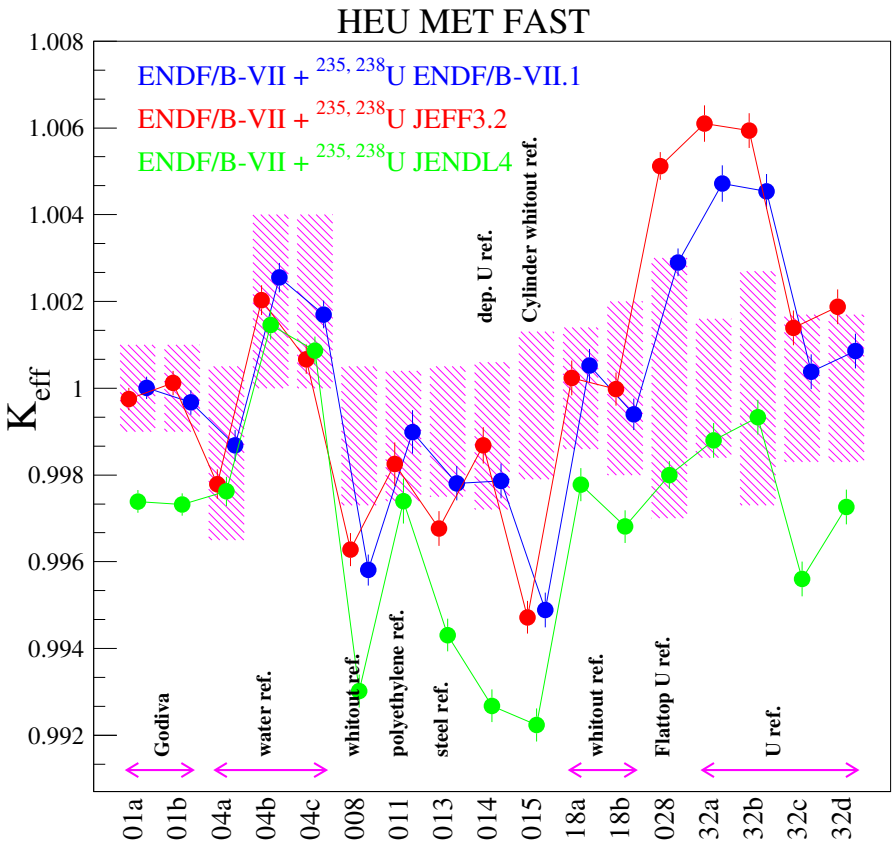


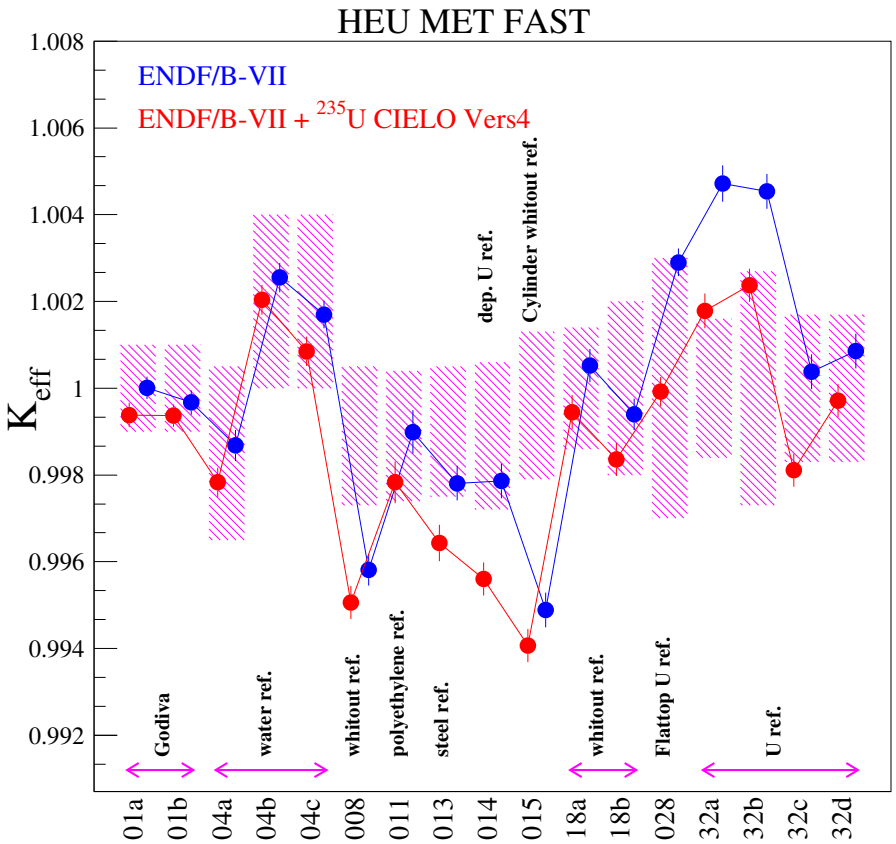
^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO





^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

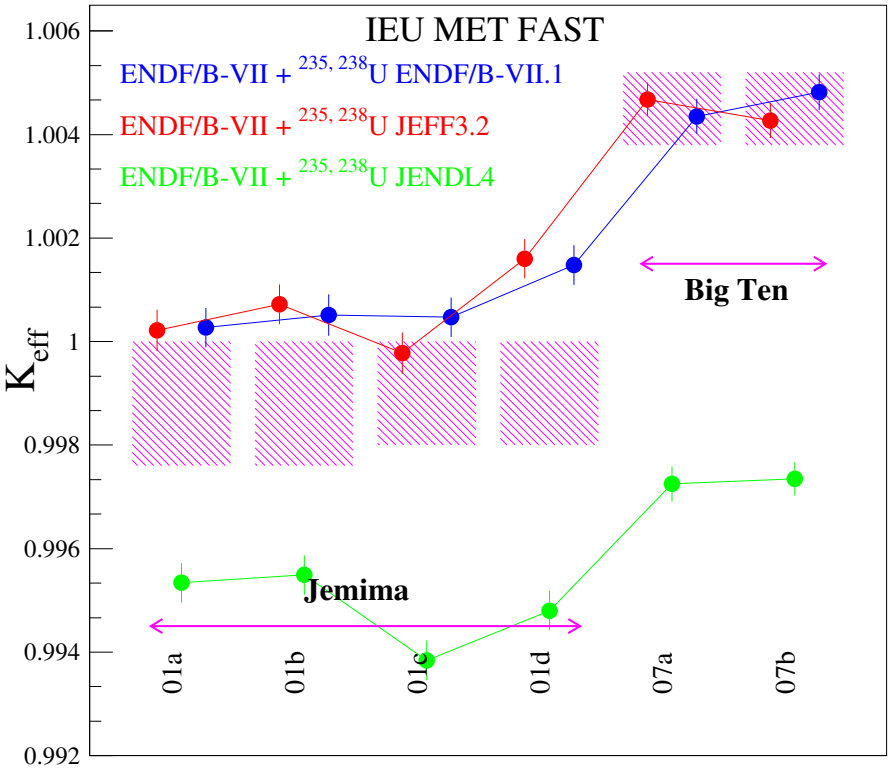




List of benchmarks

HMF14, HMF28, HMF32,

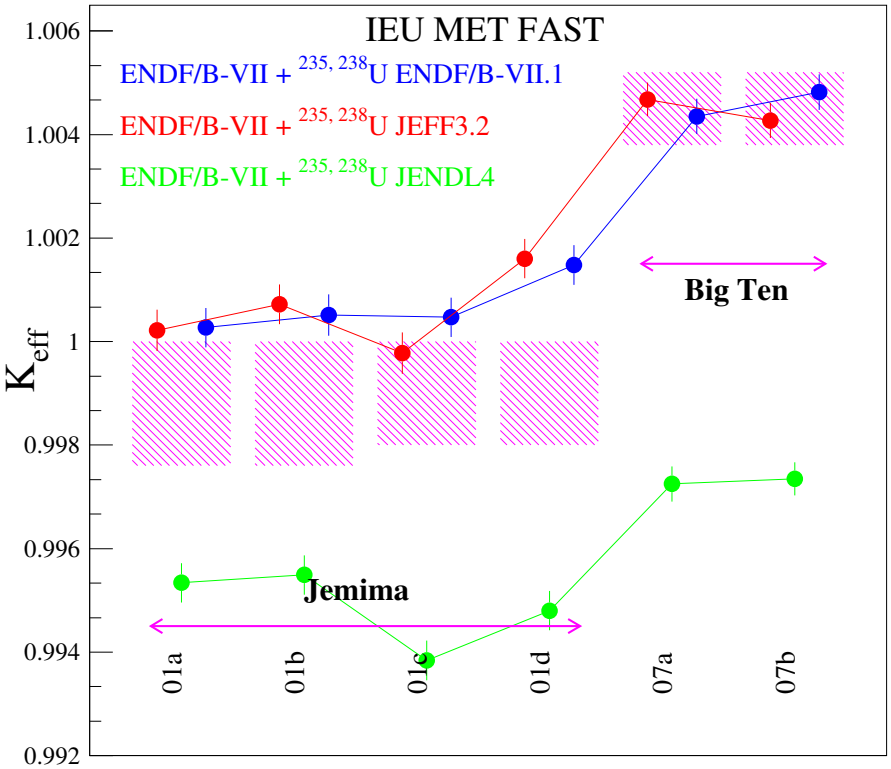
^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

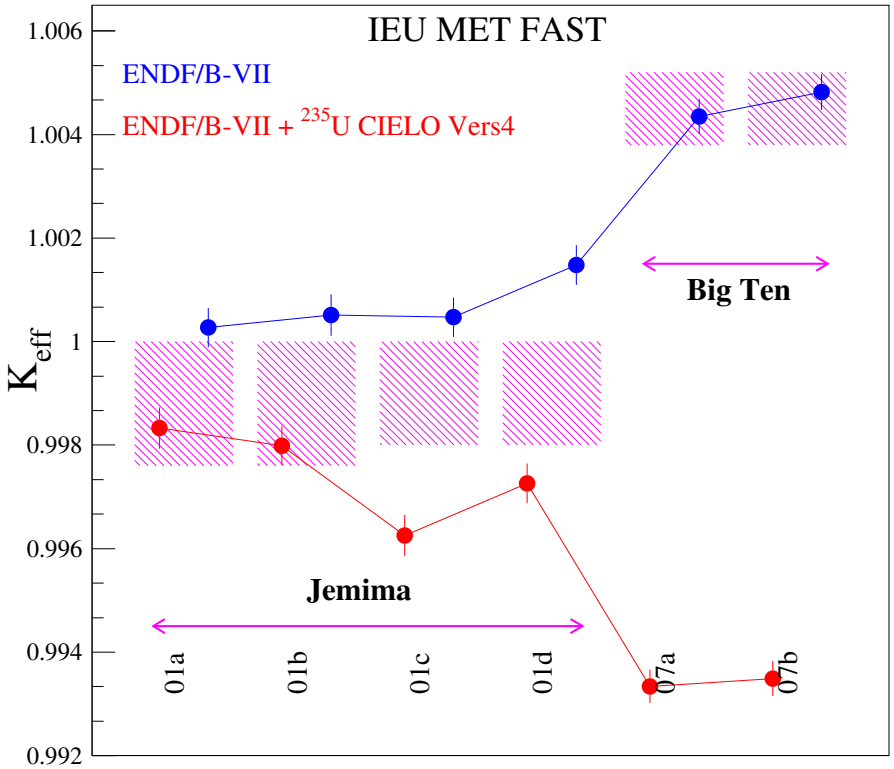


List of benchmarks

HMF14, HMF28, HMF32,

^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

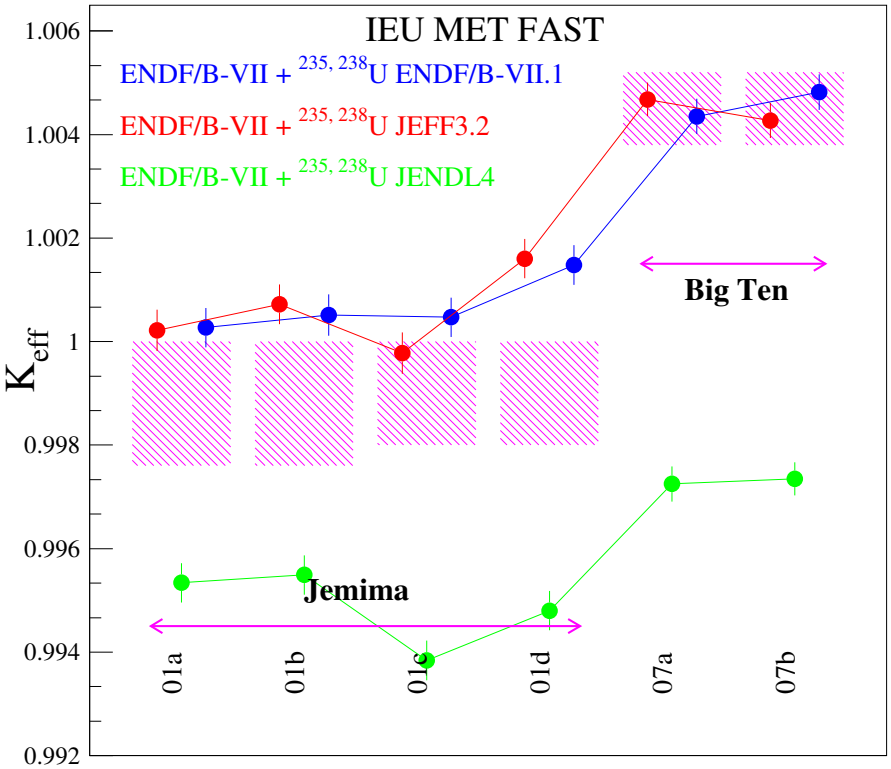


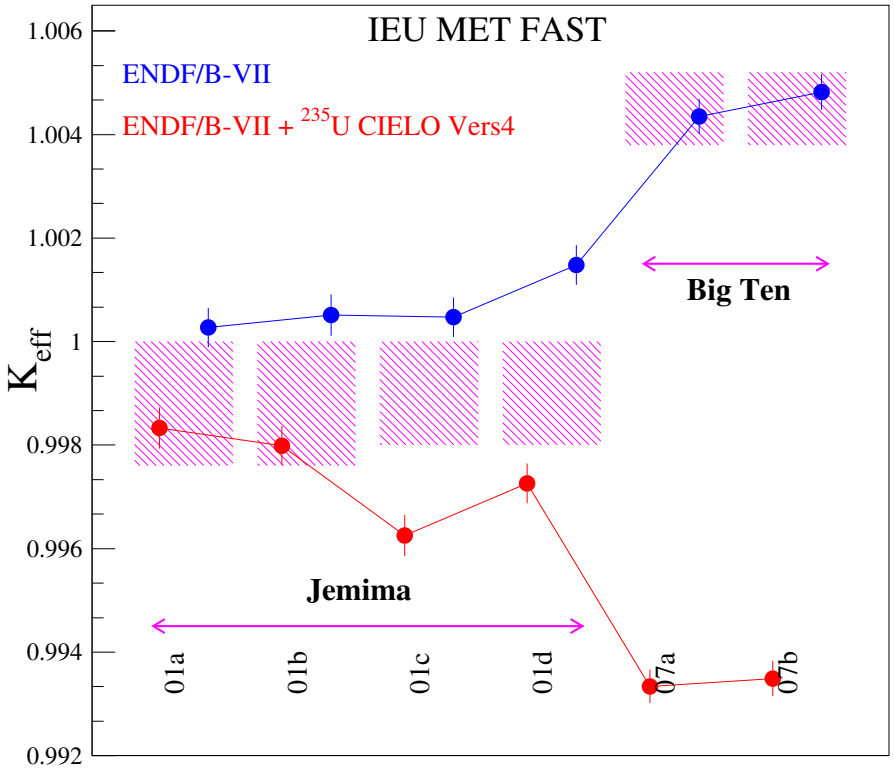


List of benchmarks

HMF14, HMF28, HMF32,

^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

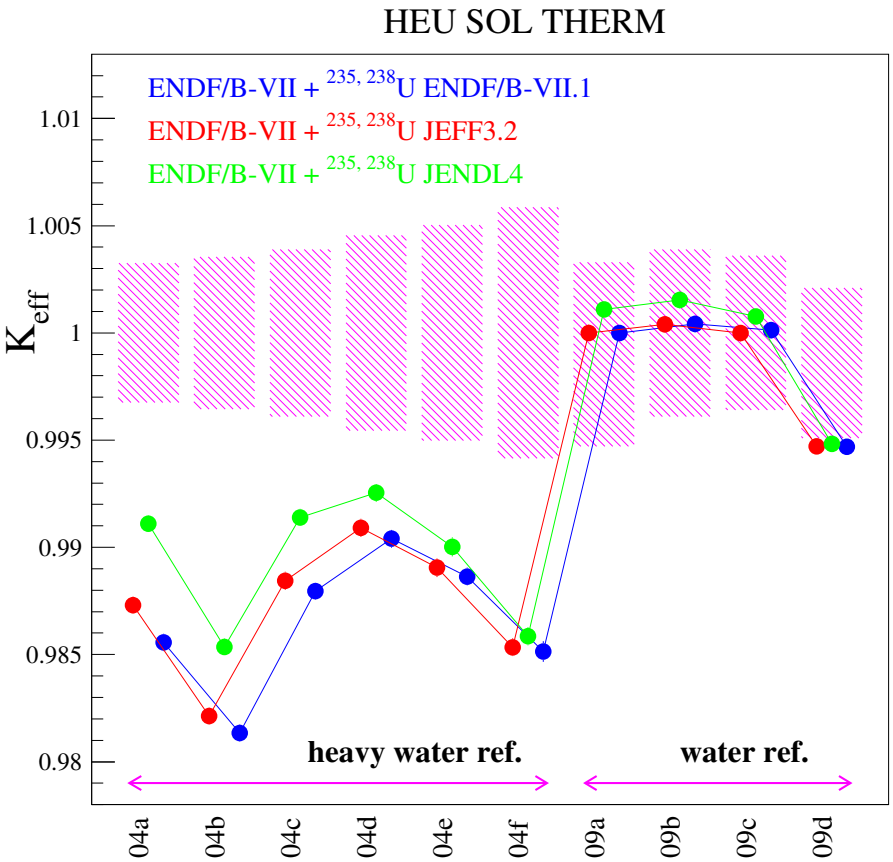




List of benchmarks

HMF14, HMF28, HMF32, IMF1 IMF7,

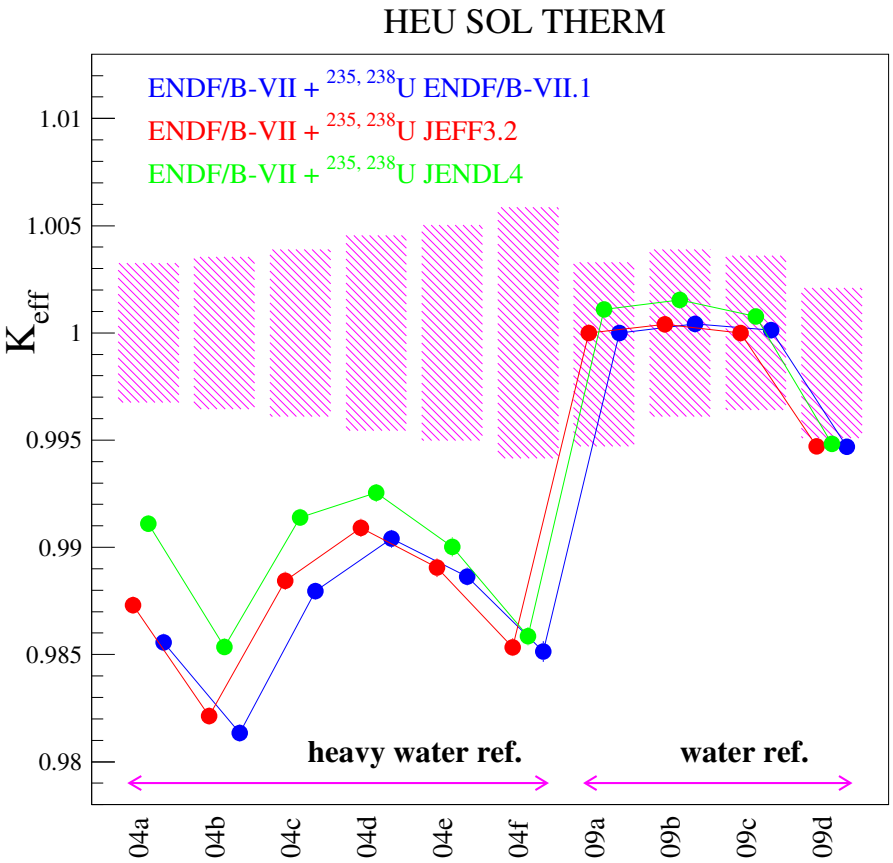
^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

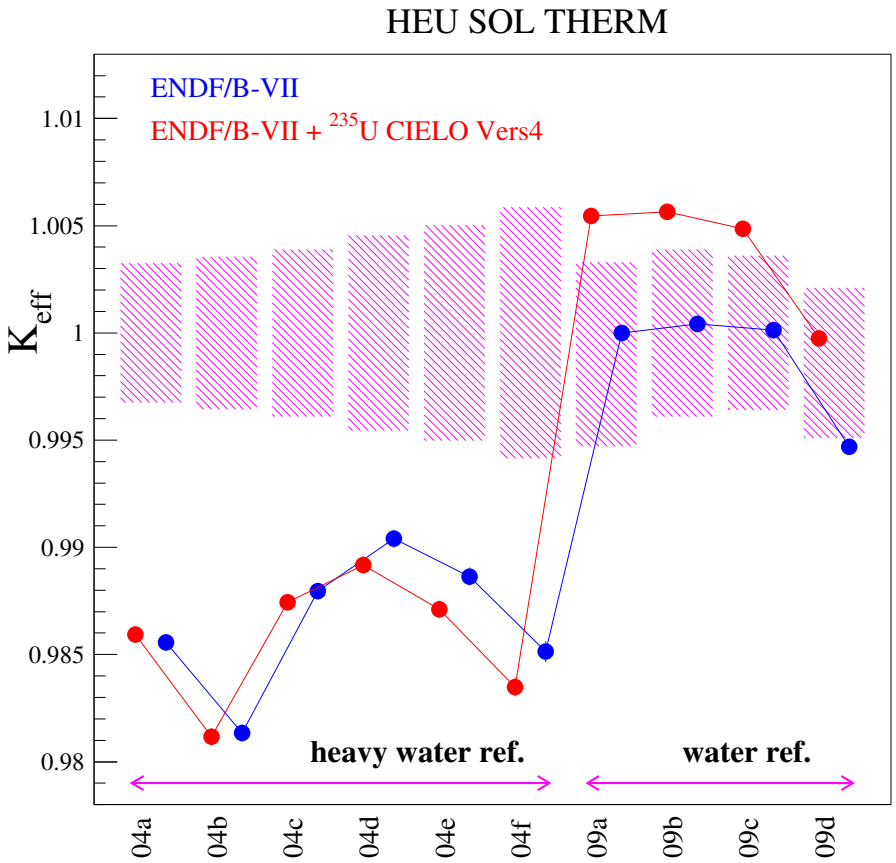


List of benchmarks

HMF14, HMF28, HMF32, IMF1 IMF7,

^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

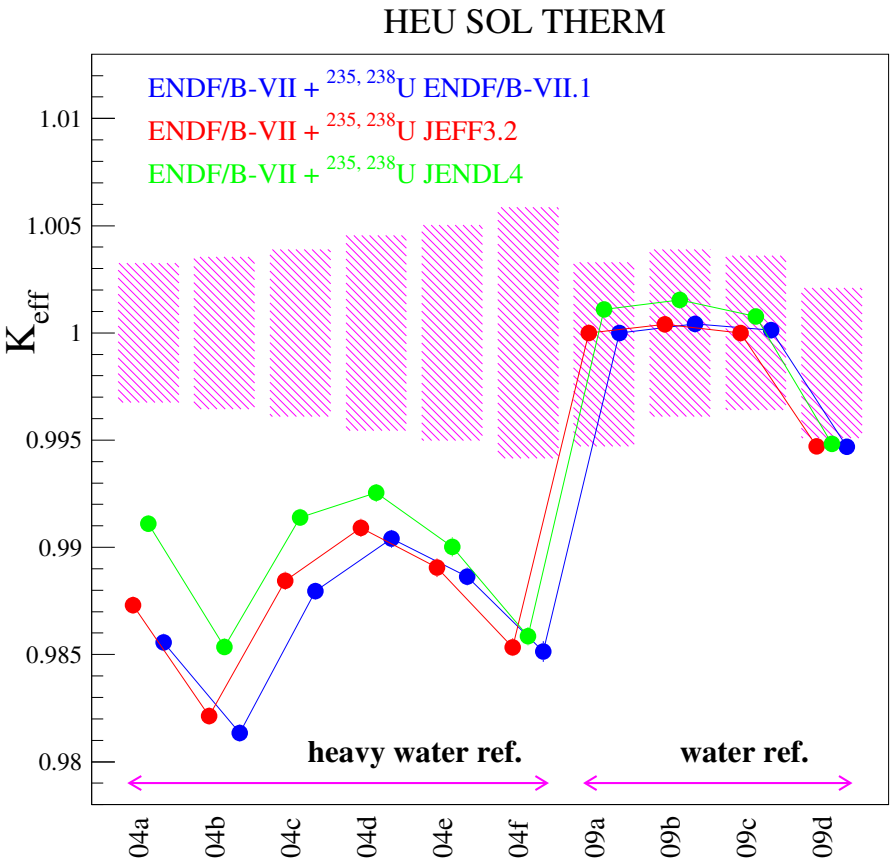


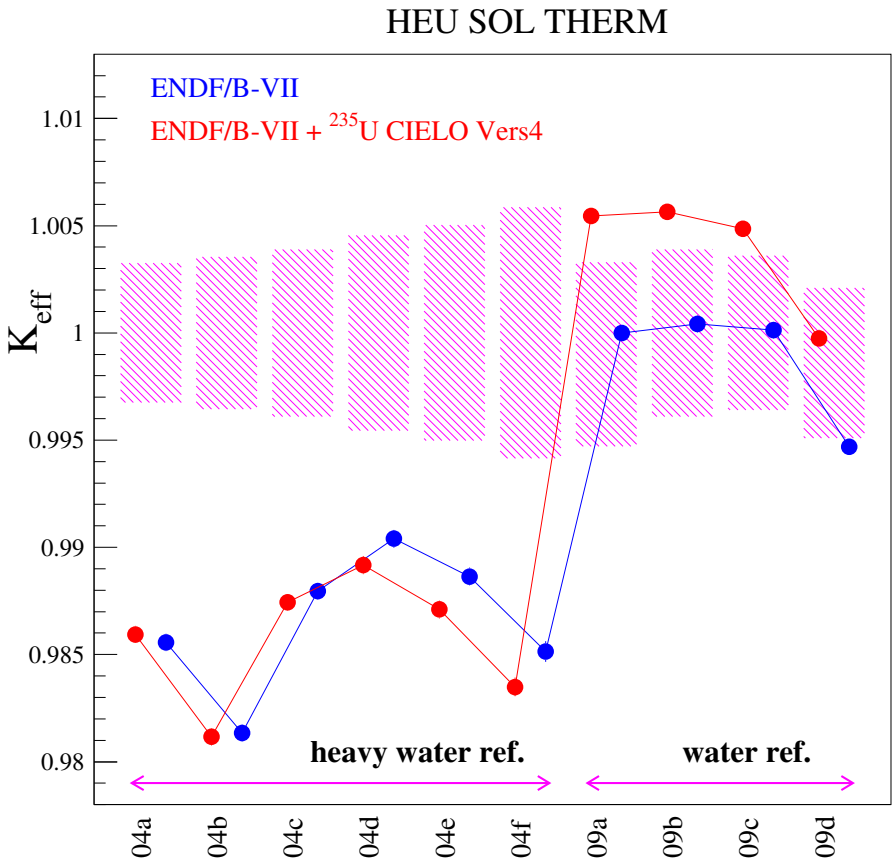


List of benchmarks

HMF14, HMF28, HMF32, IMF1 IMF7,

^{235,238}U ENDF/B-VII.1, JEFF3.2, JENDL4, ^{235}U CIELO

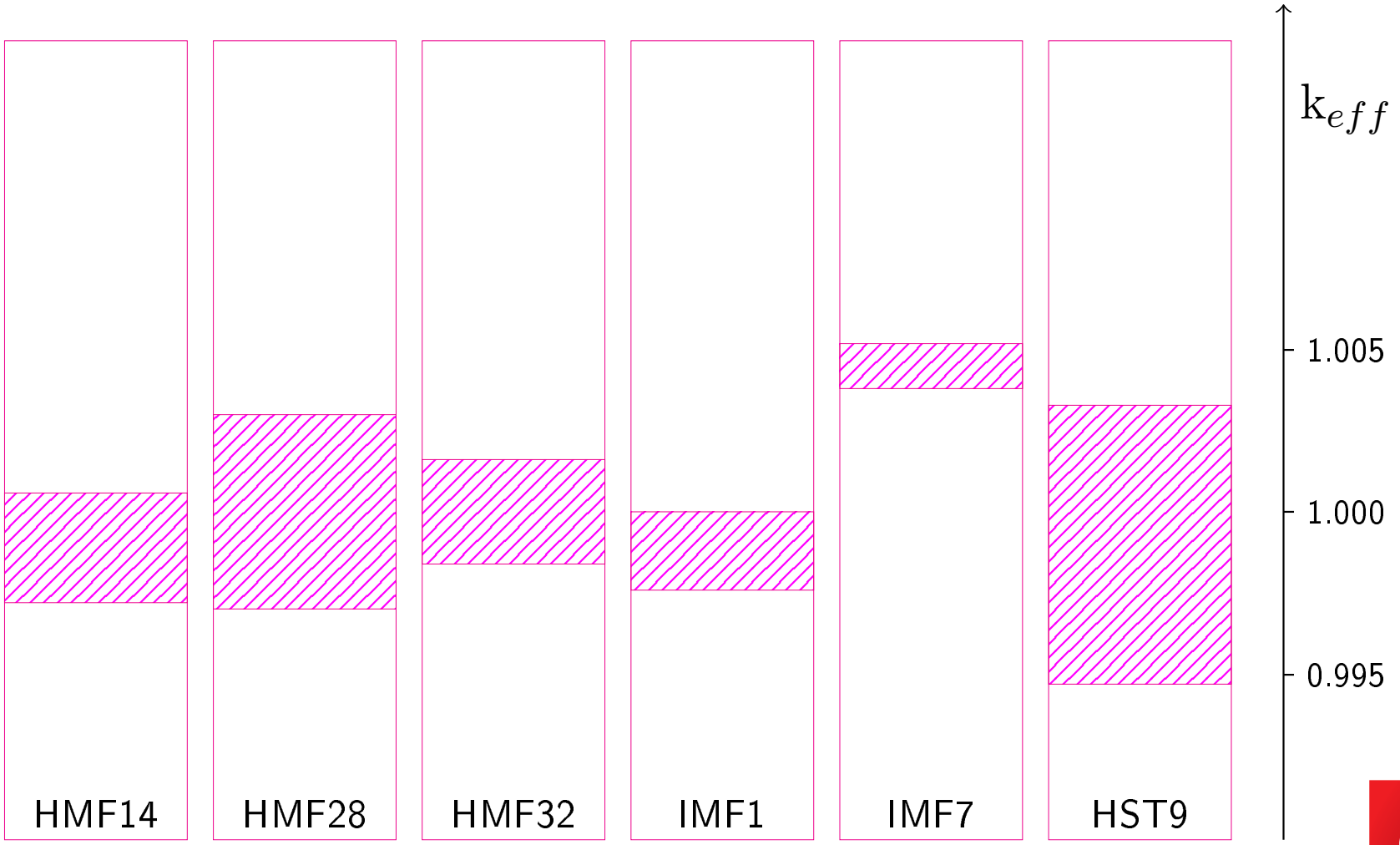




List of benchmarks

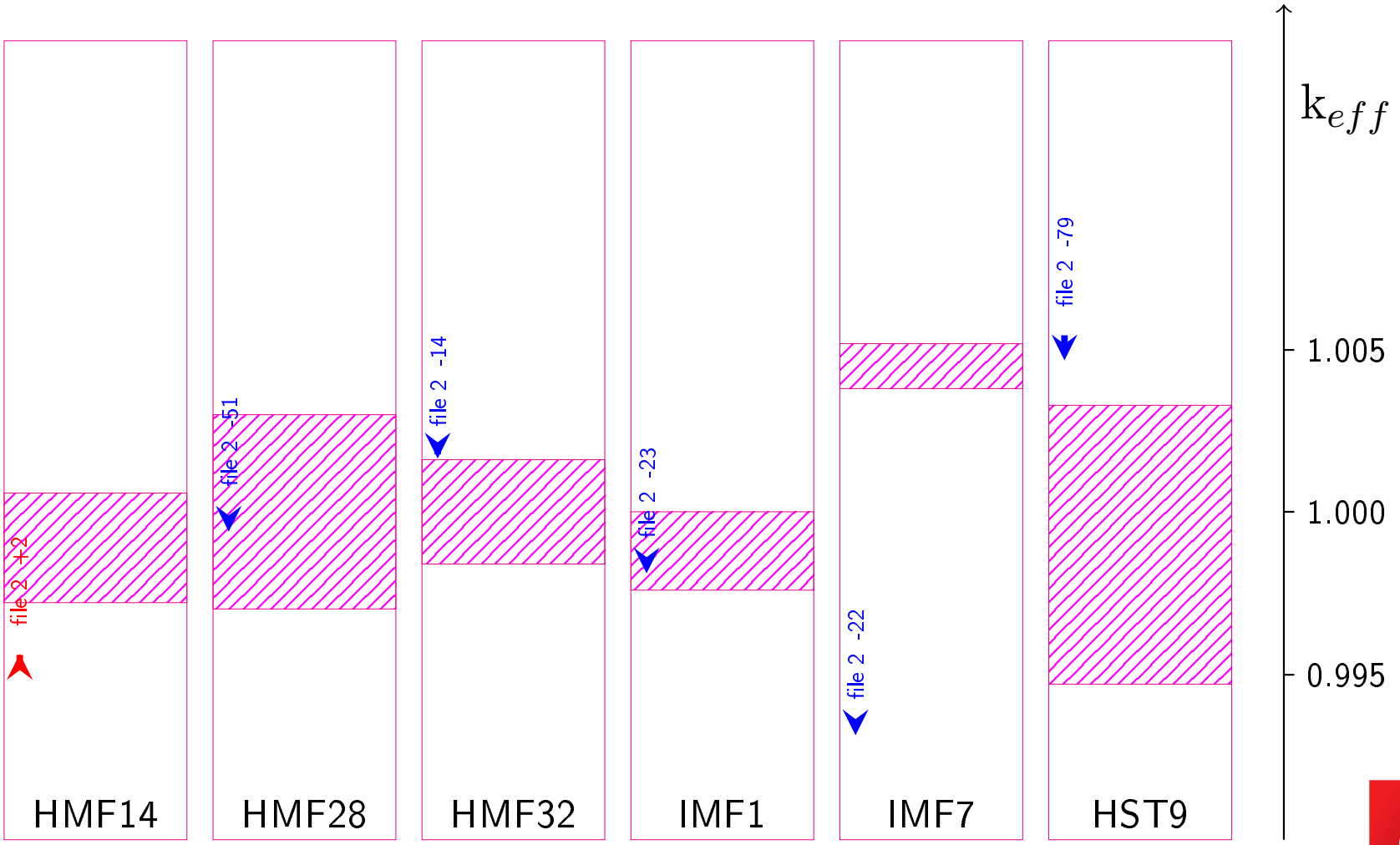
HMF14, HMF28, HMF32, IMF1 IMF7, HST9

^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)



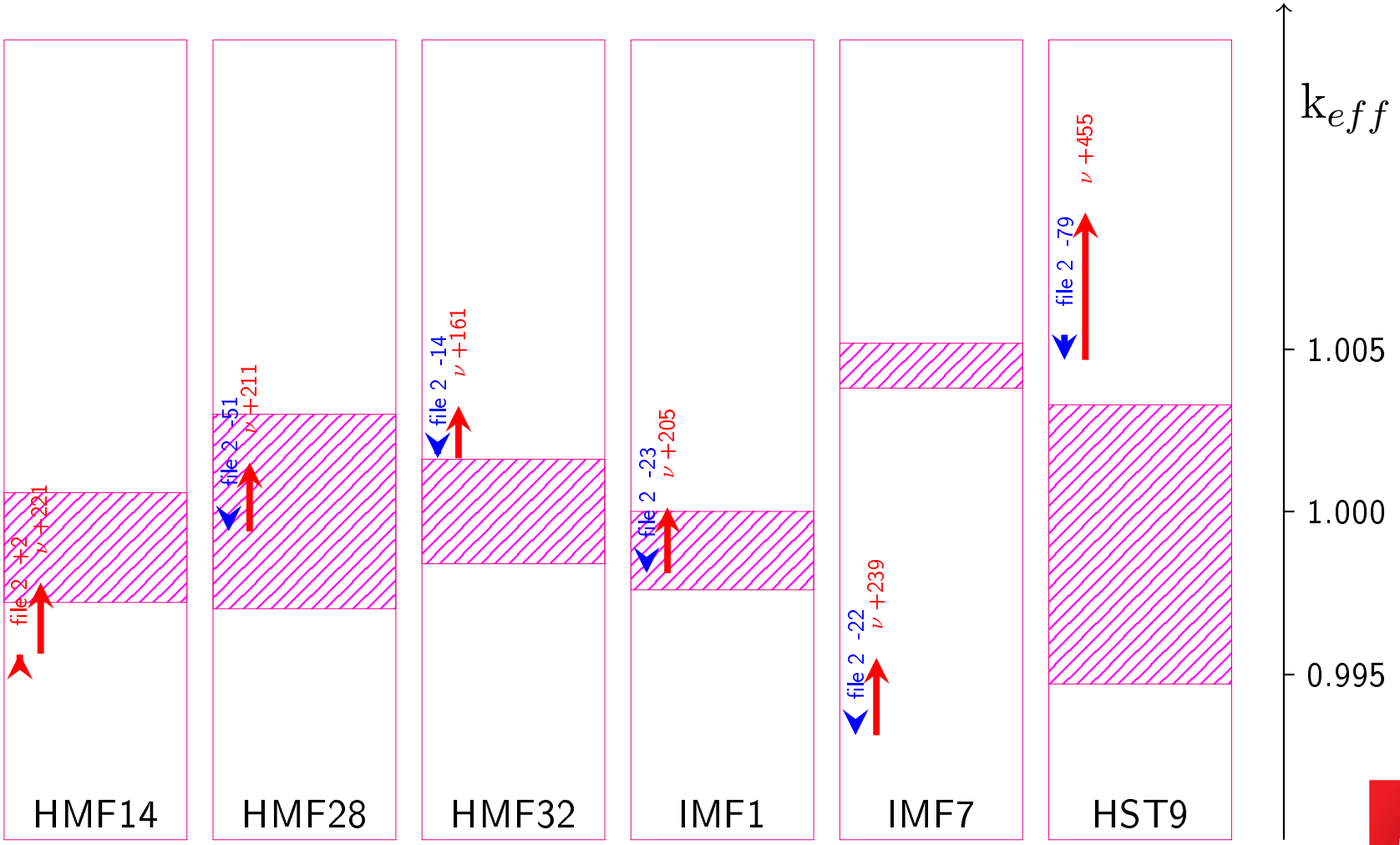
^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

file 2 (MF2 MT151) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO



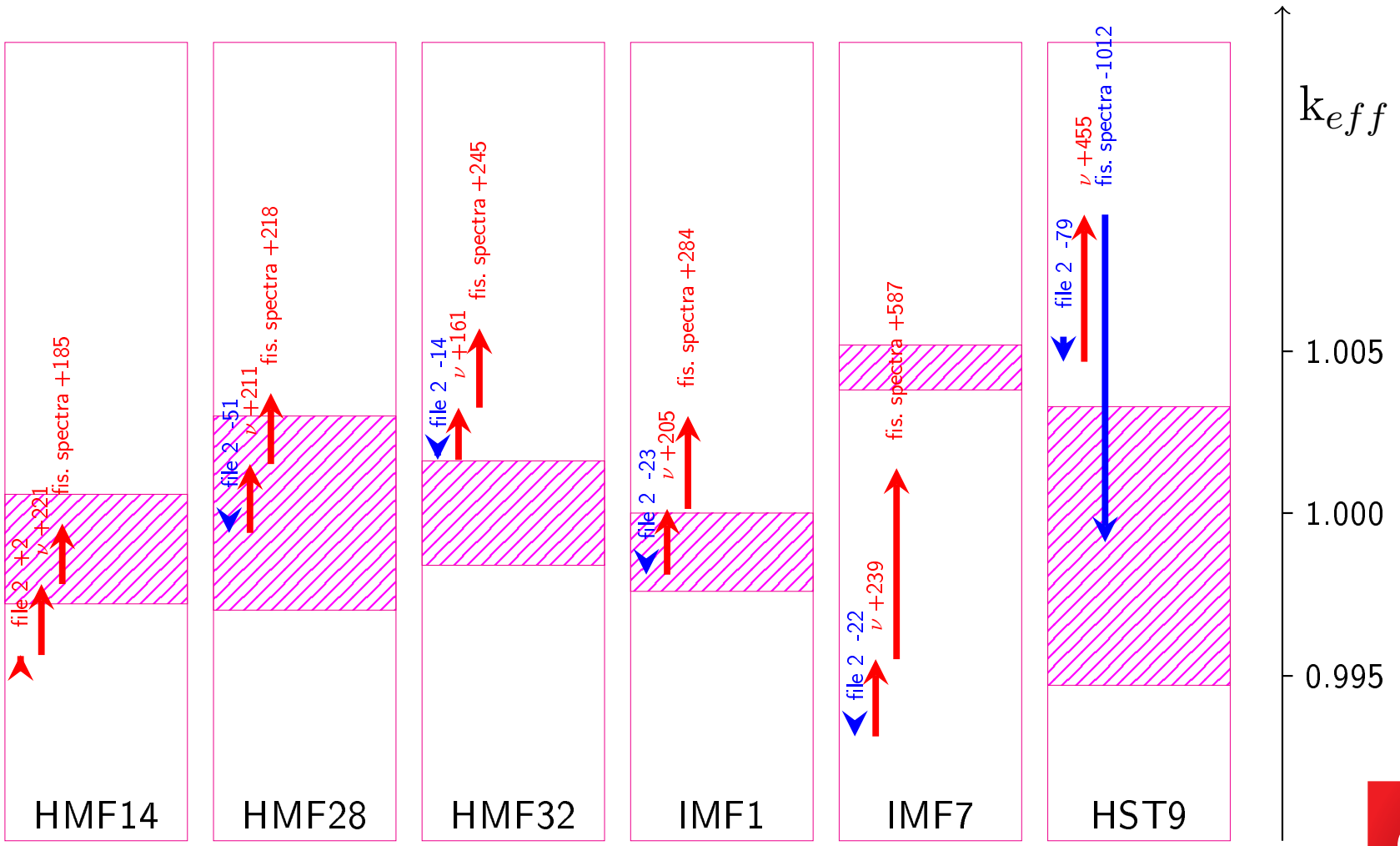
^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

ν (MF1 MT452-456) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO



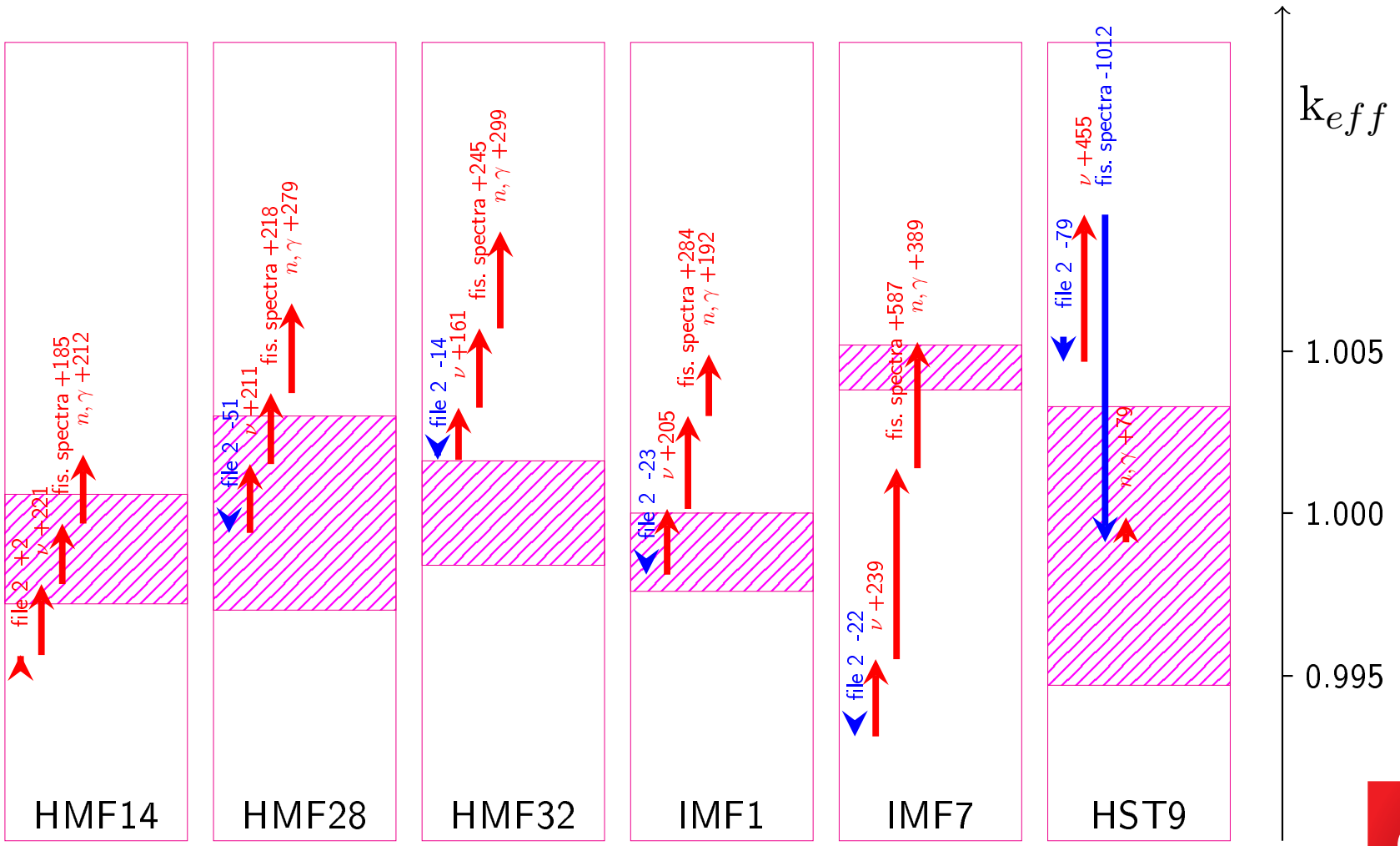
^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

fission spectra (MF5 MT18) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO



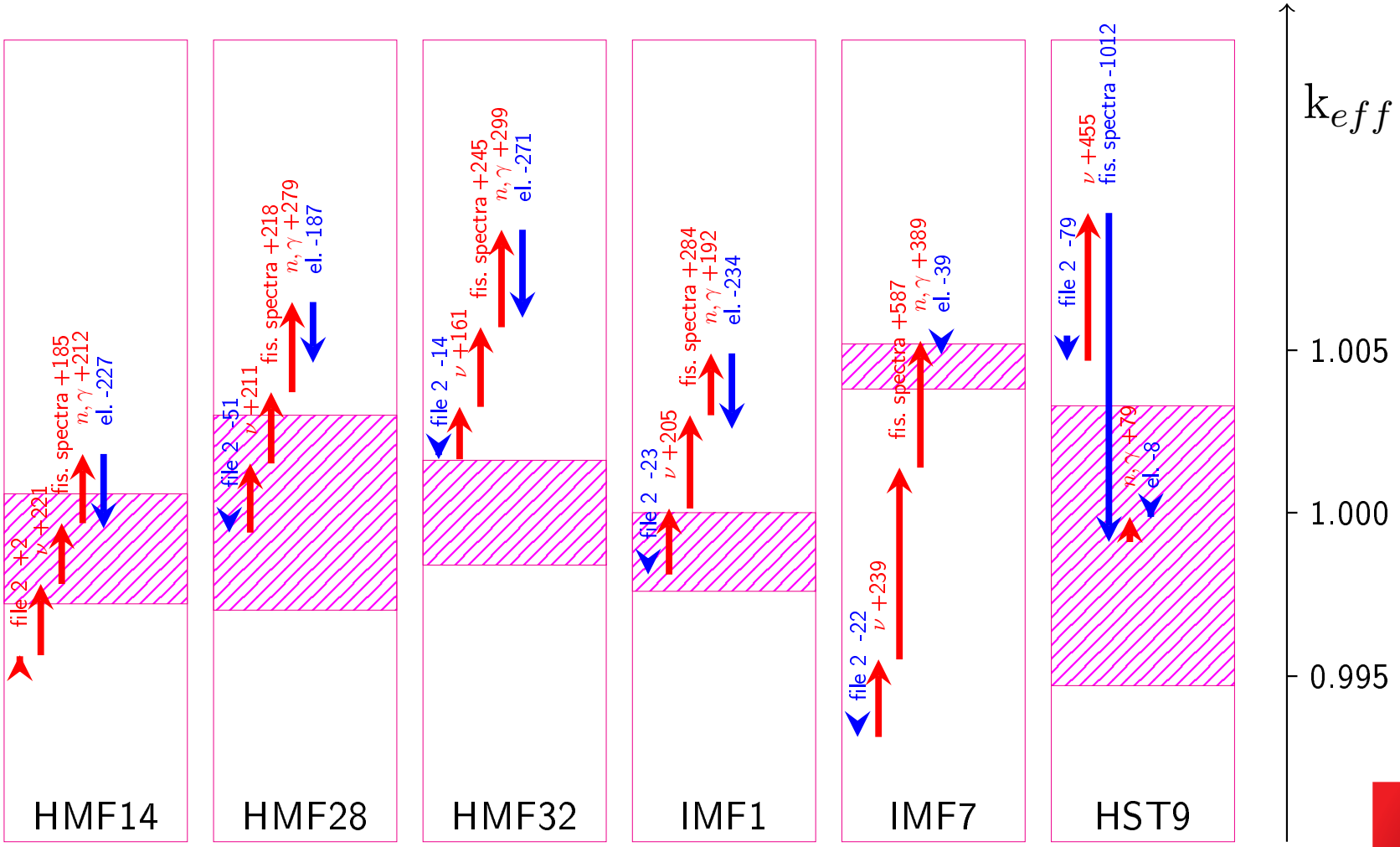
^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

(n,γ) (MF3 MT102) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO



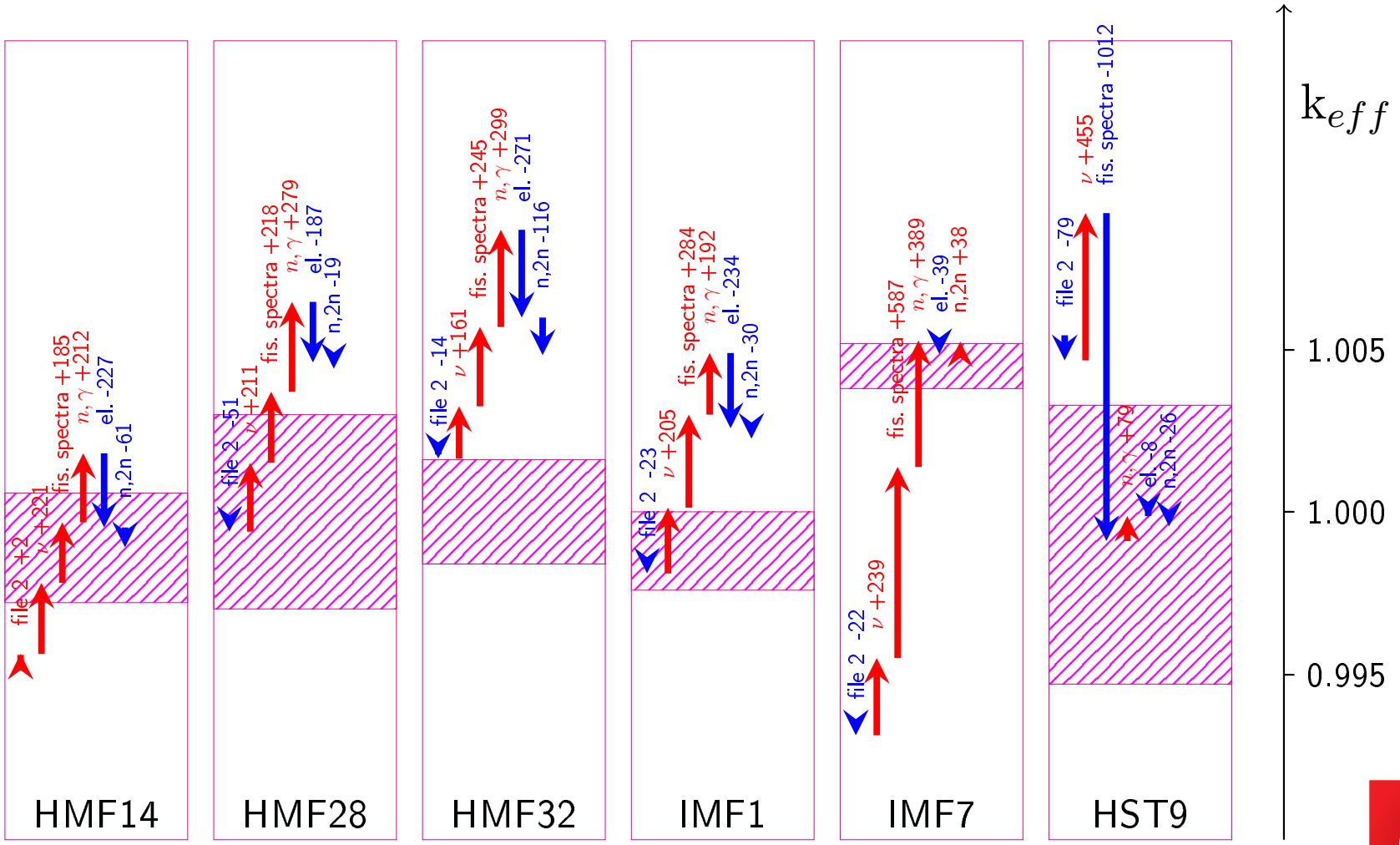
^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

(n,n) (MF3,4 MT2) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO



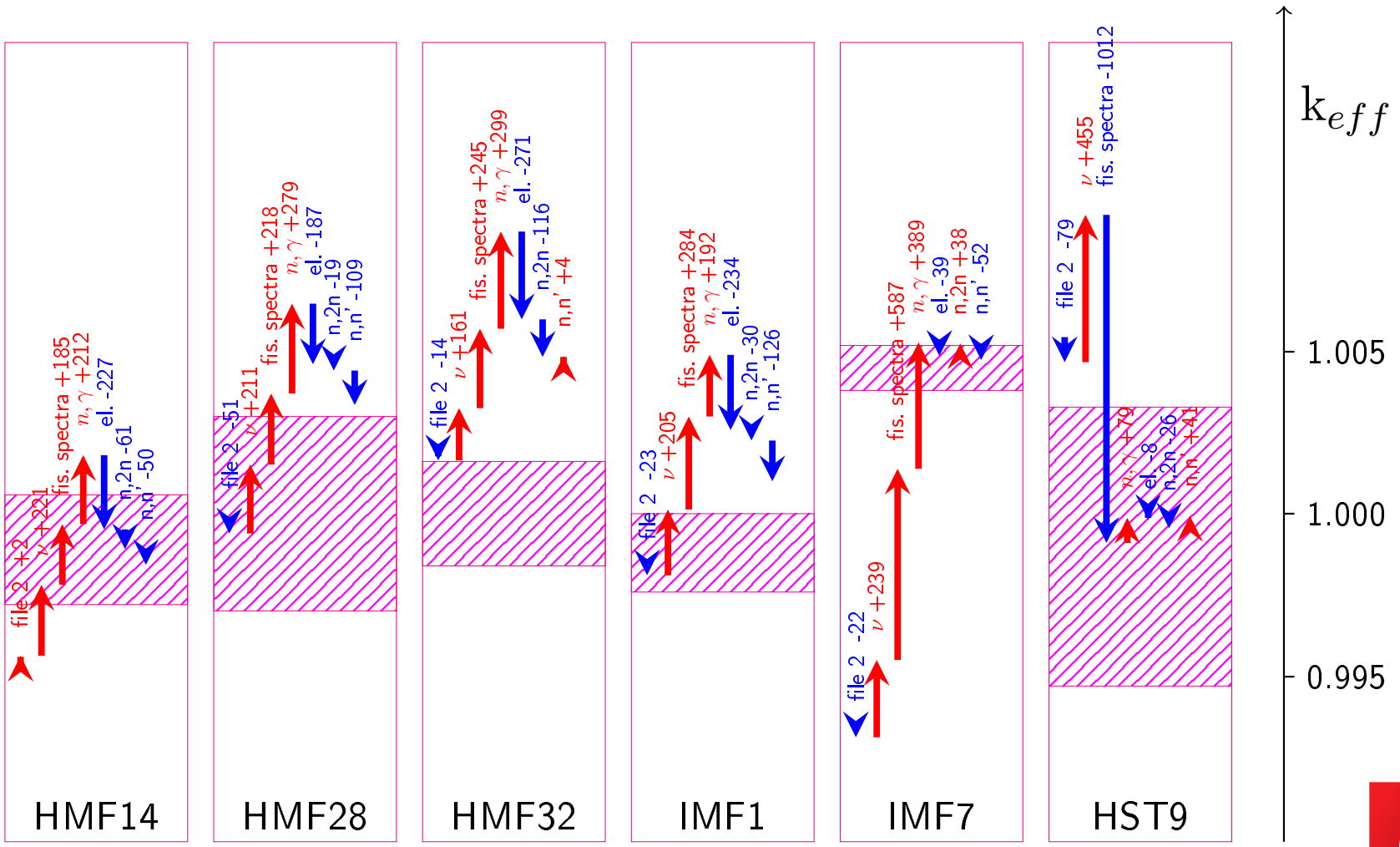
^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

(n,2n) (MF3,6 MT16) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO



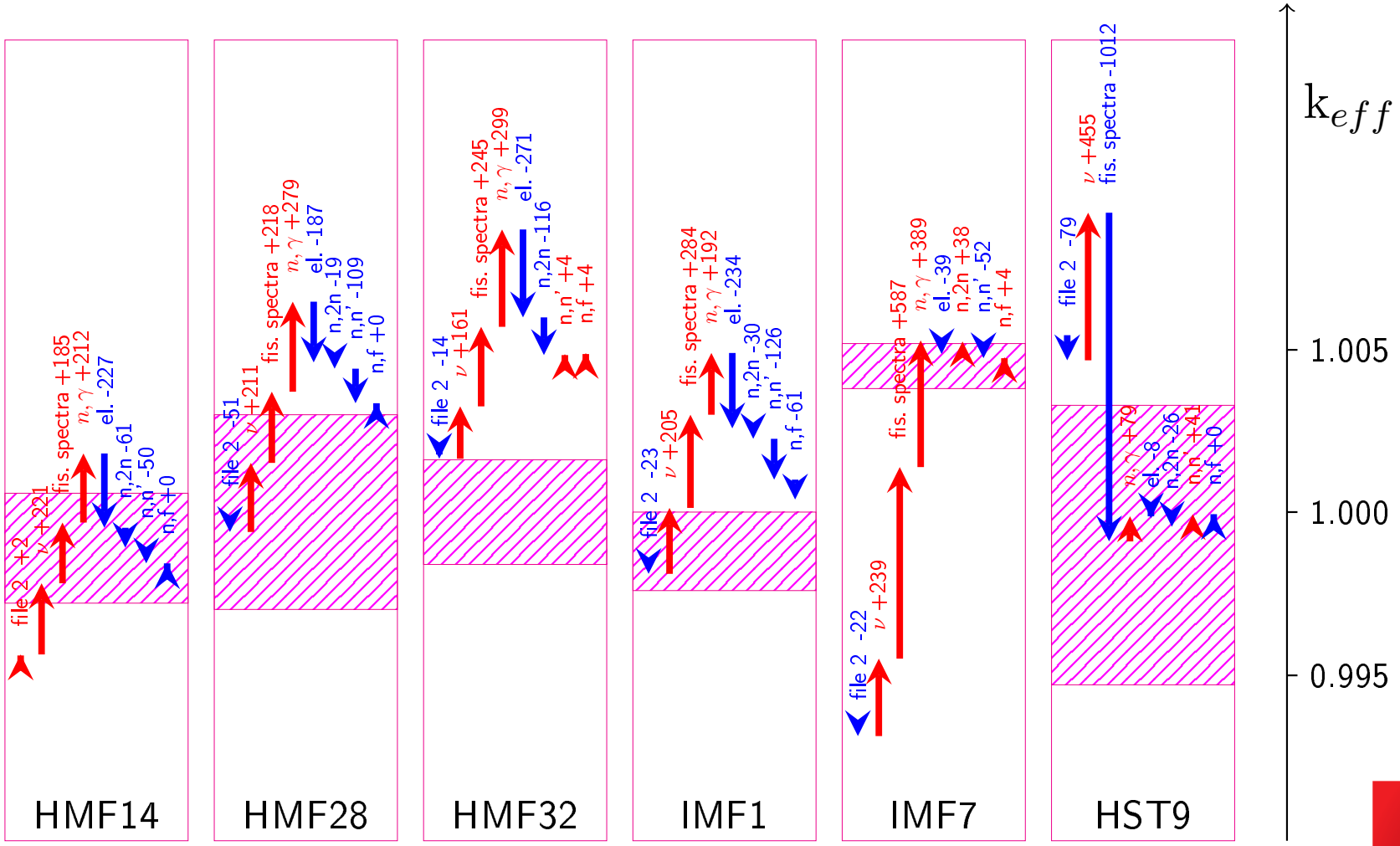
^{235}U CIELO vers 4 ≠ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

(n,n') (MF3,4,6 MT4,51-91) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

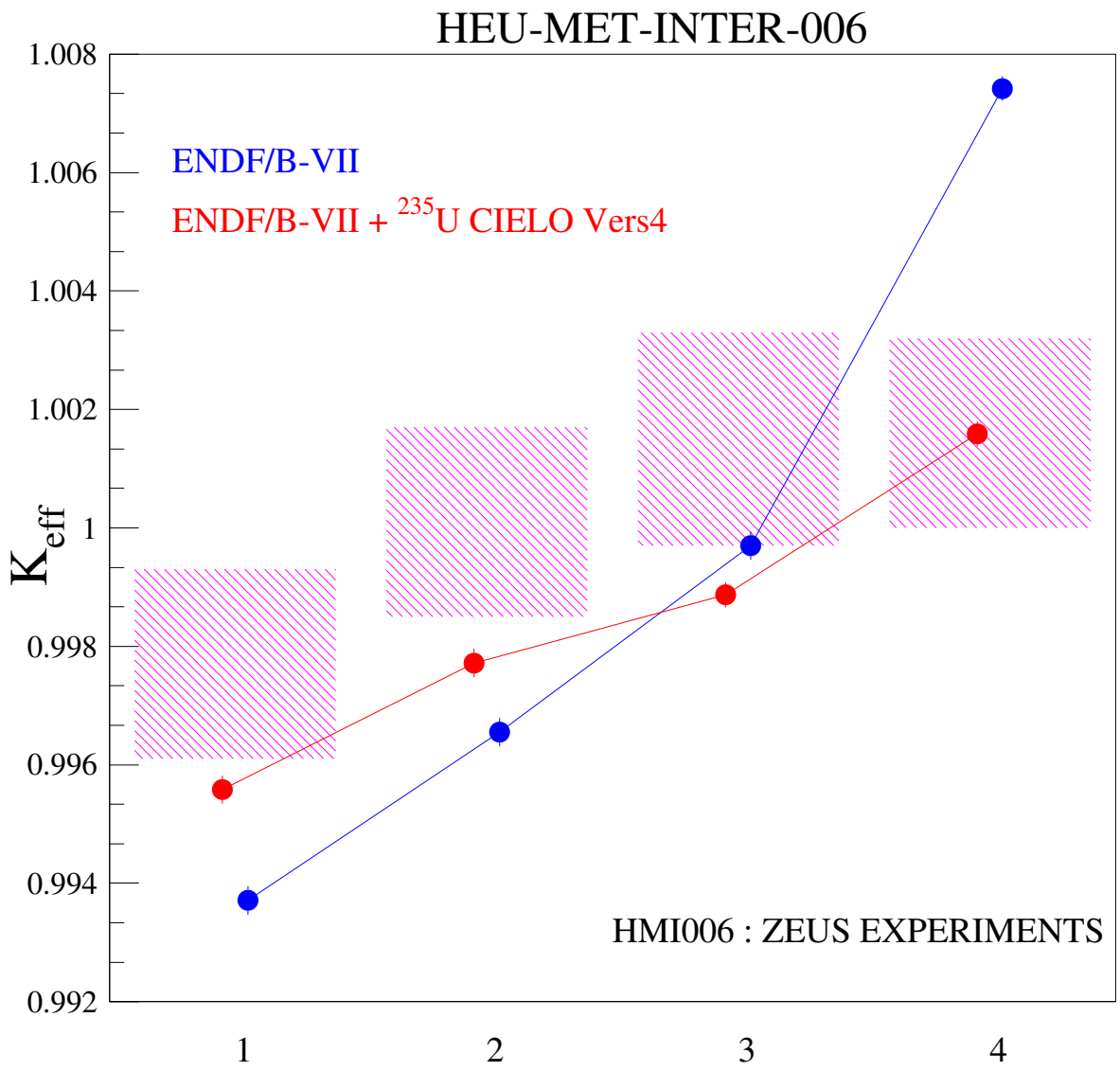


^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

(n,f) (MF3 MT18) ^{235}U ENDF/B-VII.1 in ^{235}U CIELO

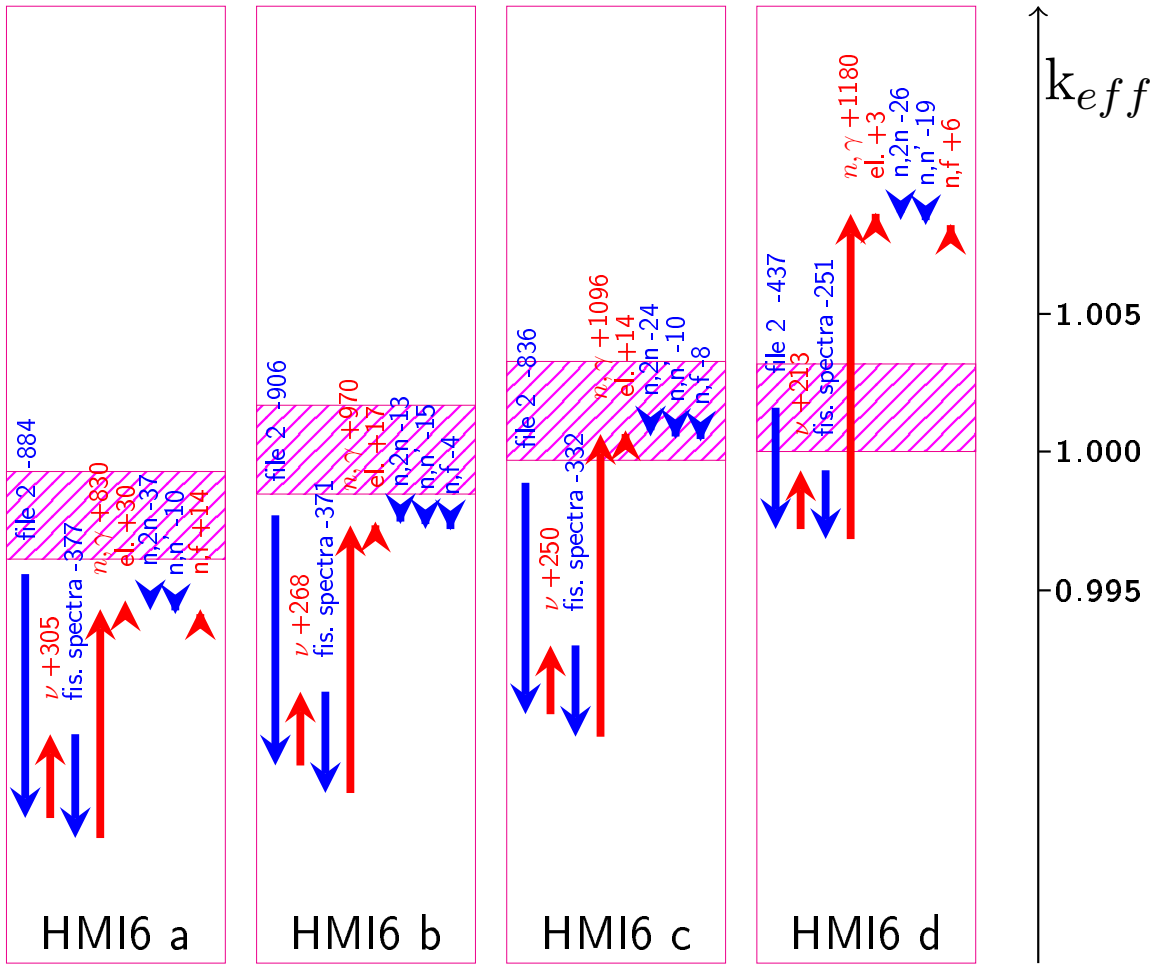


^{235,238}U ENDF/B-VII.1, ^{235}U CIELO vers 4



^{235}U CIELO vers 4 $\neq$ ^{235}U ENDF/B-VII.1 (^{238}U B-VII.1)

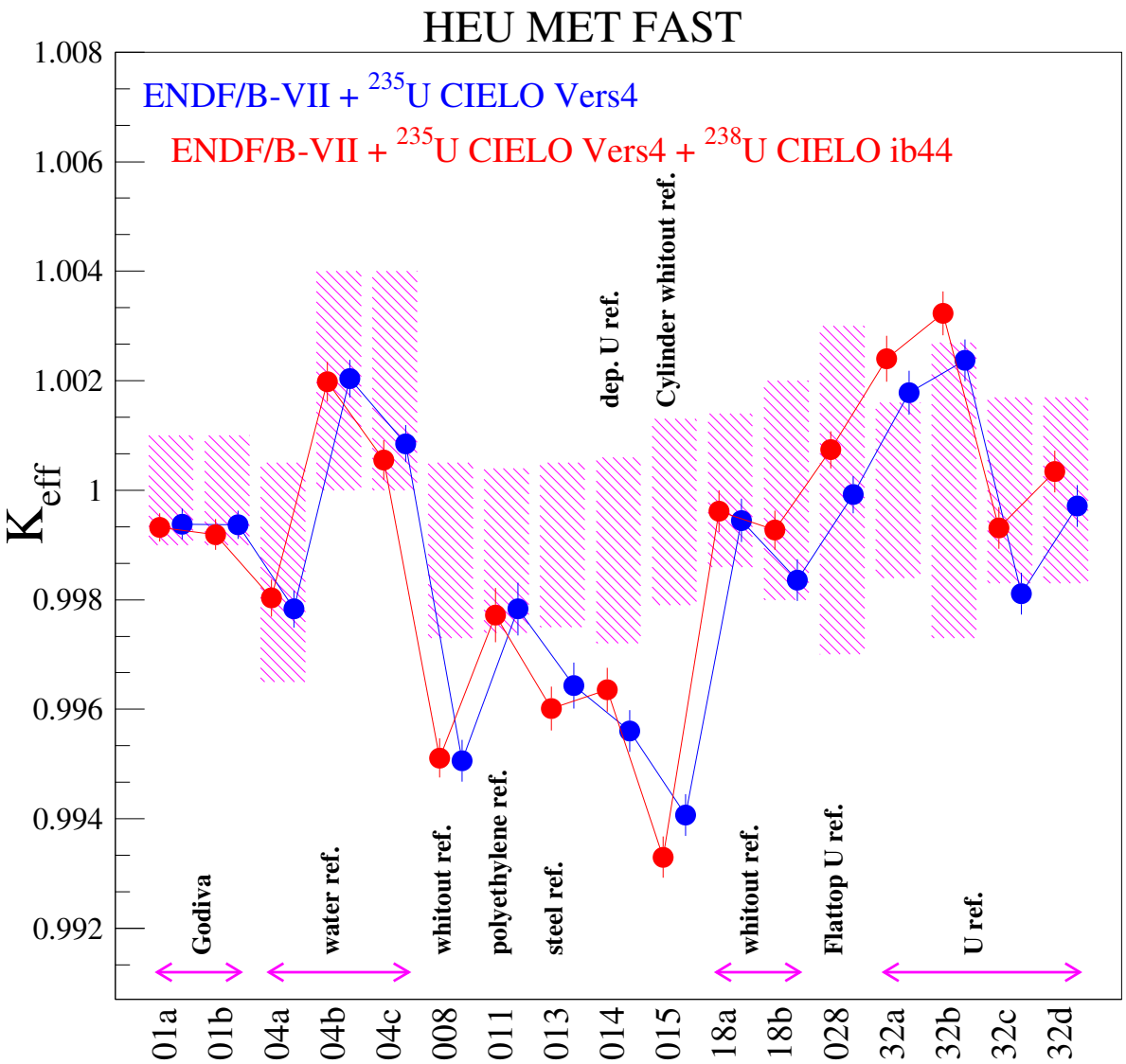
^{235}U CIELO vers 4 $\longrightarrow$ ^{235}U ENDF/B-VII.1



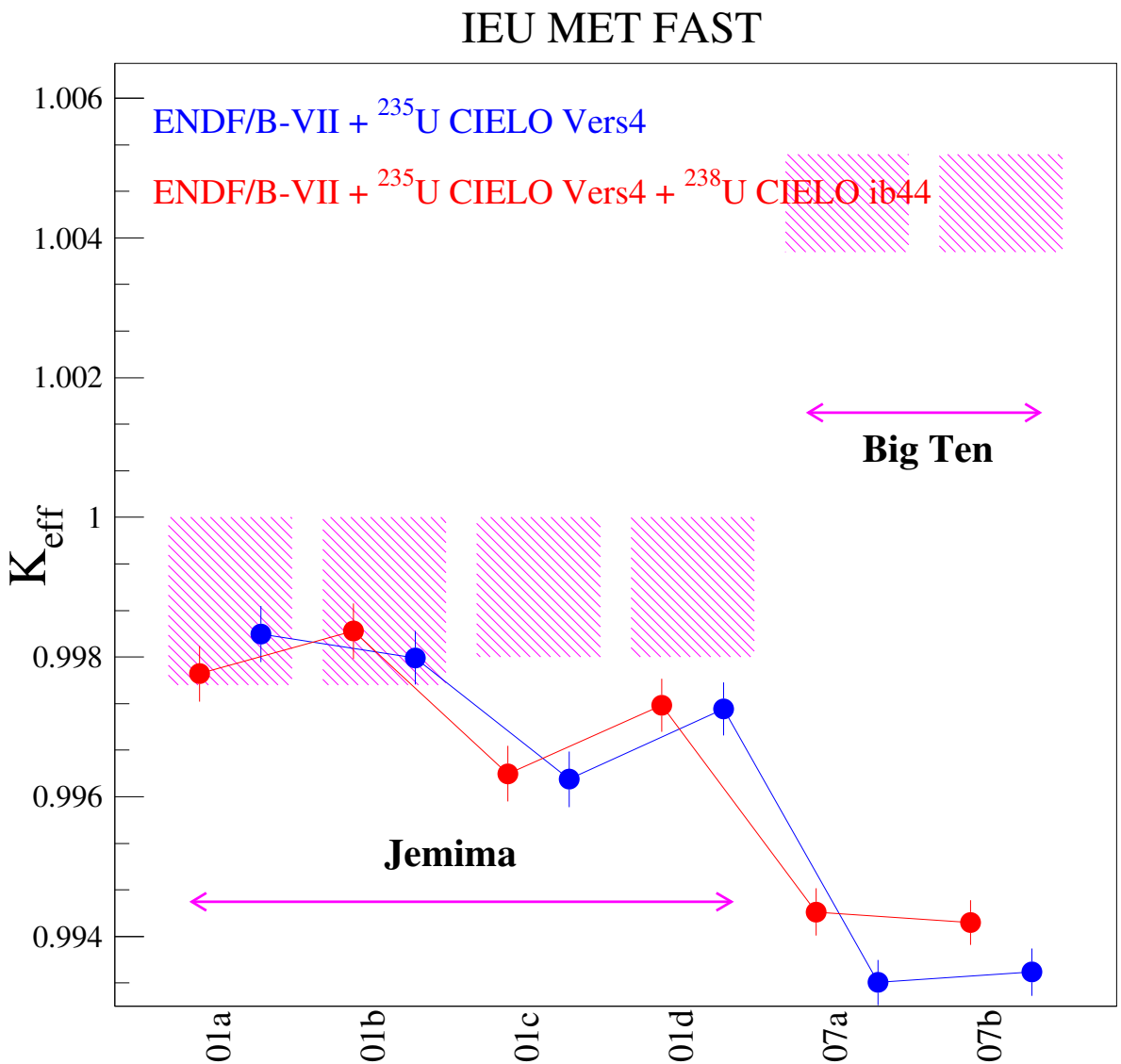
^{235}U CIELO vers 4 with ^{238}U CIELO ib44

- ^{235}U CIELO vers 4 and ^{238}U ENDF/B-VII.1 work well.
  Except for the Big Ten benchmark :
  $k_{eff} = 0.99334$ (Exp $= 1.00450$)
- What happens if we use the ^{235}U CIELO vers 4
  with the ^{238}U CIELO ib44 evaluation ?

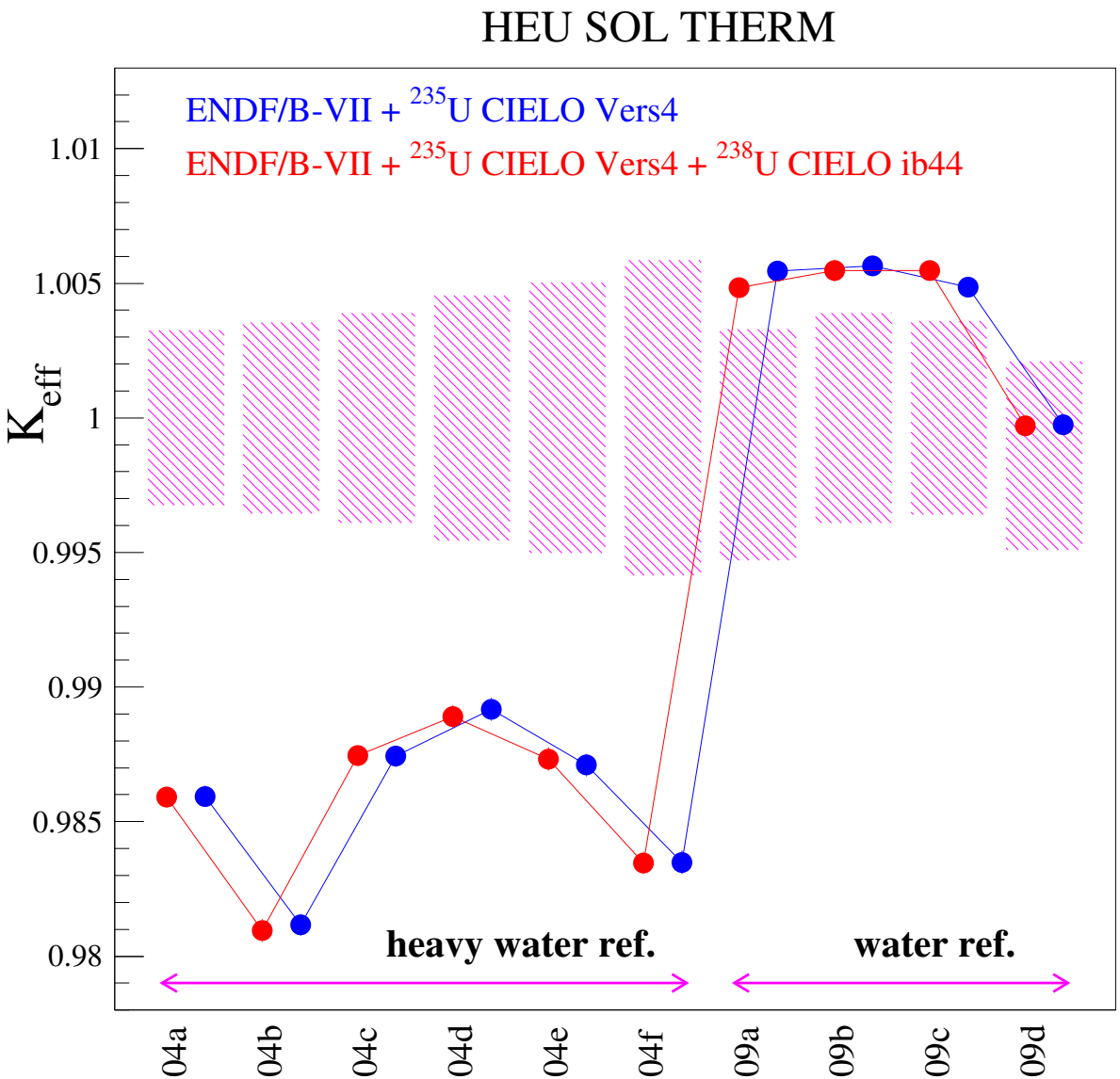
^{235}U CIELO vers 4, ^{238}U CIELO ib44



^{235}U CIELO vers 4, ^{238}U CIELO ib44

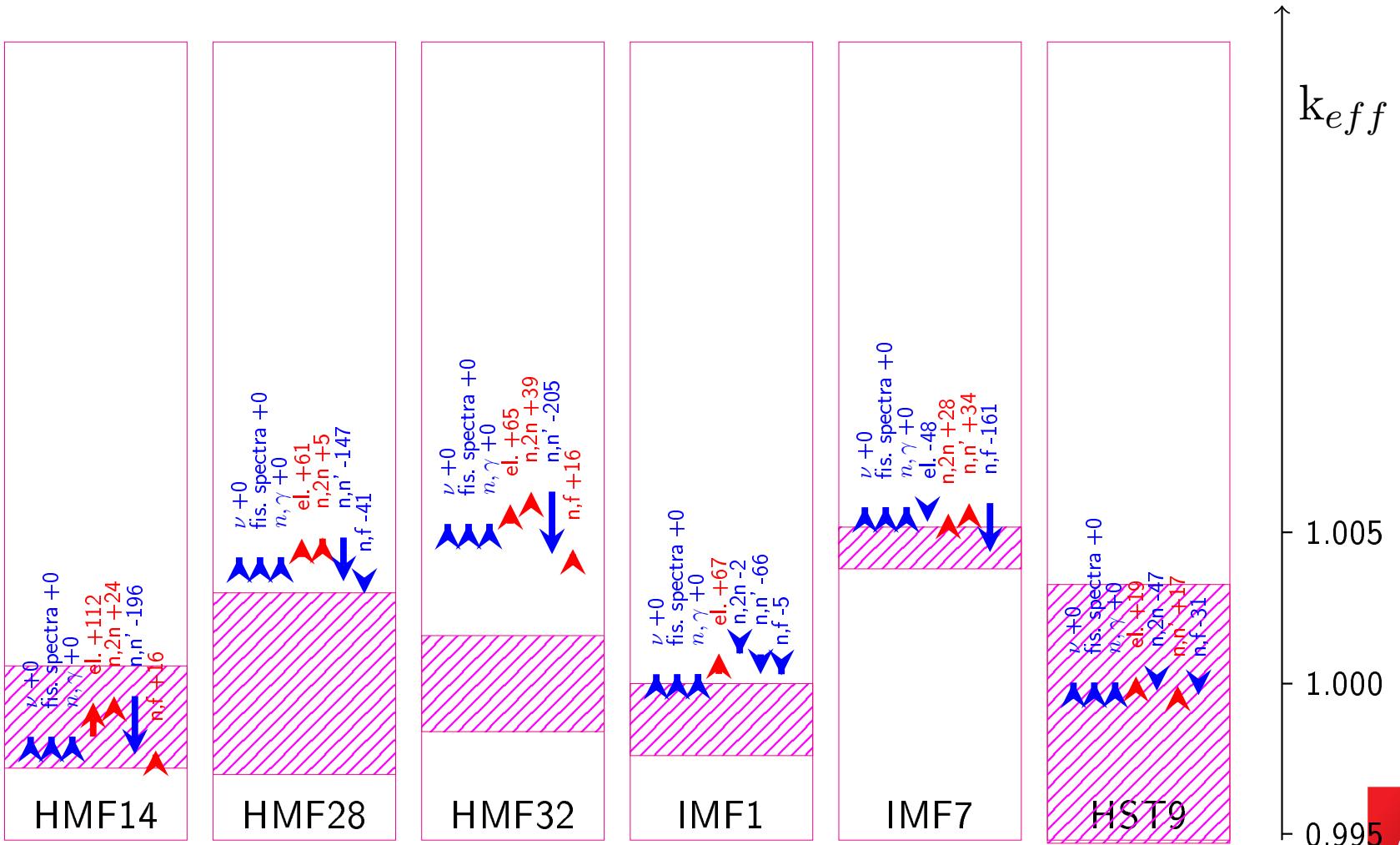


^{235}U CIELO vers 4, ^{238}U CIELO ib44



^{238}U CIELO ib44 and ^{238}U ENDF/B-VII.1 (^{235}U B-VII.1)

^{238}U CIELO ib44 $\longrightarrow$ ^{238}U ENDF/B-VII.1



^{238}U CIELO ib44

- FILE 2 : ENDF/B-VII.1,
- prompt fission neutron spectra and total prompt neutron multiplicity : ENDF/B-VII.1,
- (n,γ) : ENDF/B-VII.1,
- New elastic and inelastic cross sections,
- New (n,2n) cross section,
- New (n,f) cross section.

^{238}U CIELO ib44

- - FILE 2 : ENDF/B-VII.1,
  - prompt fission neutron spectra and total prompt neutron multiplicity : ENDF/B-VII.1,
  - (n,γ) : ENDF/B-VII.1,
  - New elastic and inelastic cross sections,
  - New (n,2n) cross section,
  - New (n,f) cross section.
- Benchmarks results of ^{238}U CIELO ib44 evaluation are very close to ^{238}U ENDF/B-VII.1 evaluation.

^{235}U CIELO : a new evaluation

- A new FILE 2,
- New softer prompt fission neutron spectra, with new prompt neutron multiplicity,
- New (n,γ) cross section for E $<$ 170 keV,
- New elastic and inelastic cross sections.

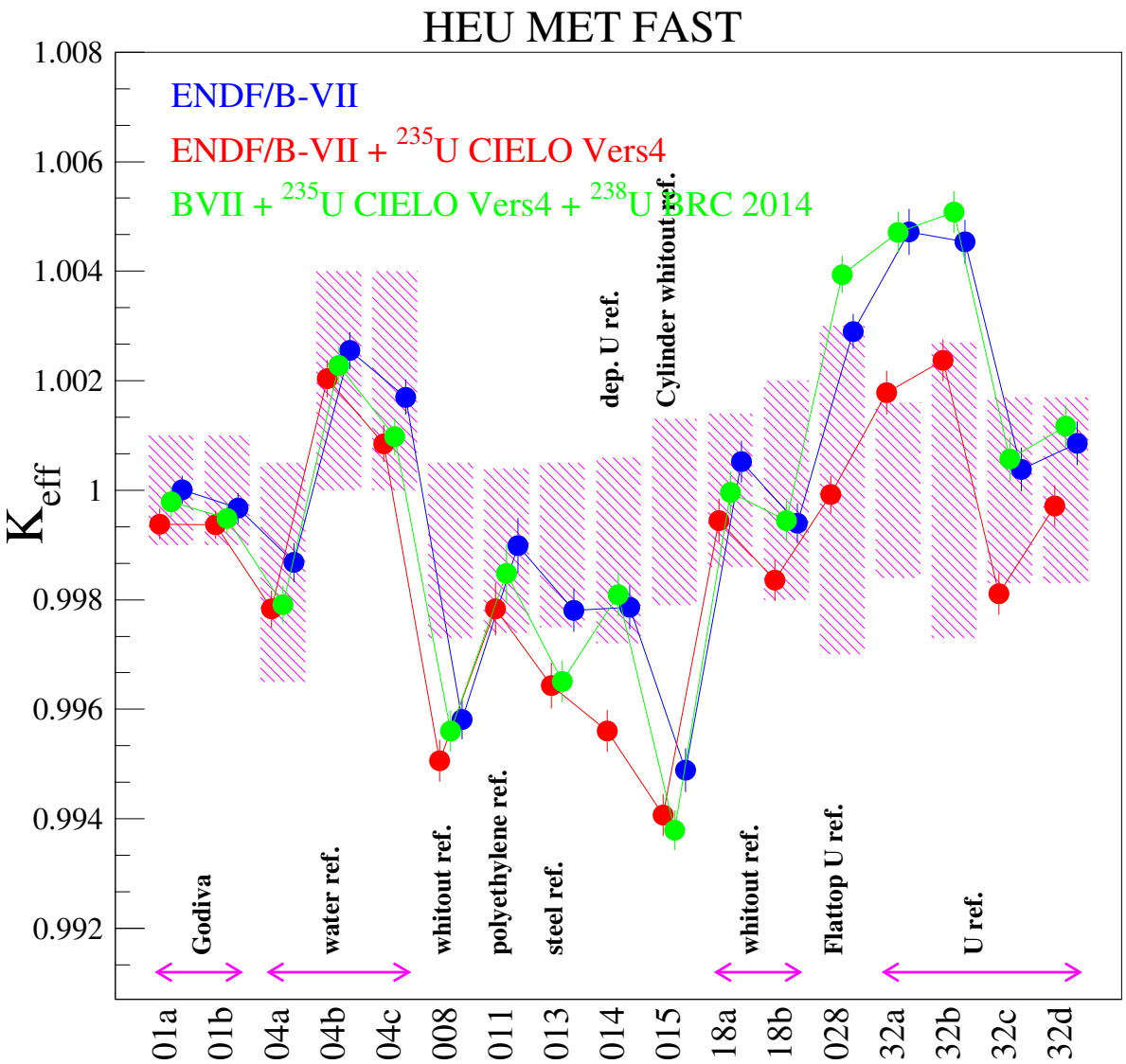
^{235}U CIELO : a new evaluation

- - A new FILE 2,
  - New softer prompt fission neutron spectra, with new prompt neutron multiplicity,
  - New (n,γ) cross section for E $<$ 170 keV,
  - New elastic and inelastic cross sections.
- With ^{235,238}U benchmarks, if we have a new ^{235}U evaluation, it may be necessary to change the ^{238}U evaluation.

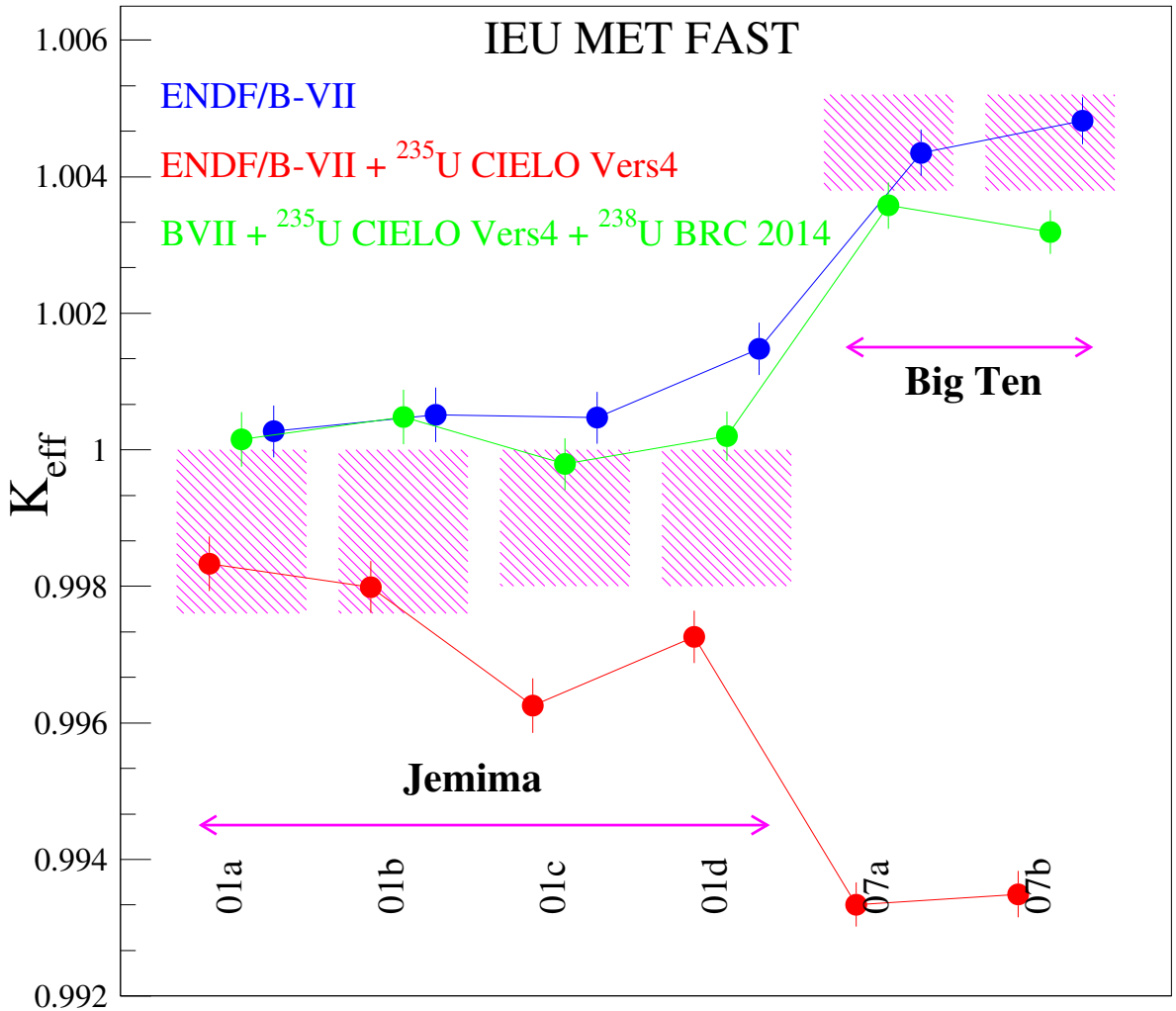
^{235}U CIELO : a new evaluation

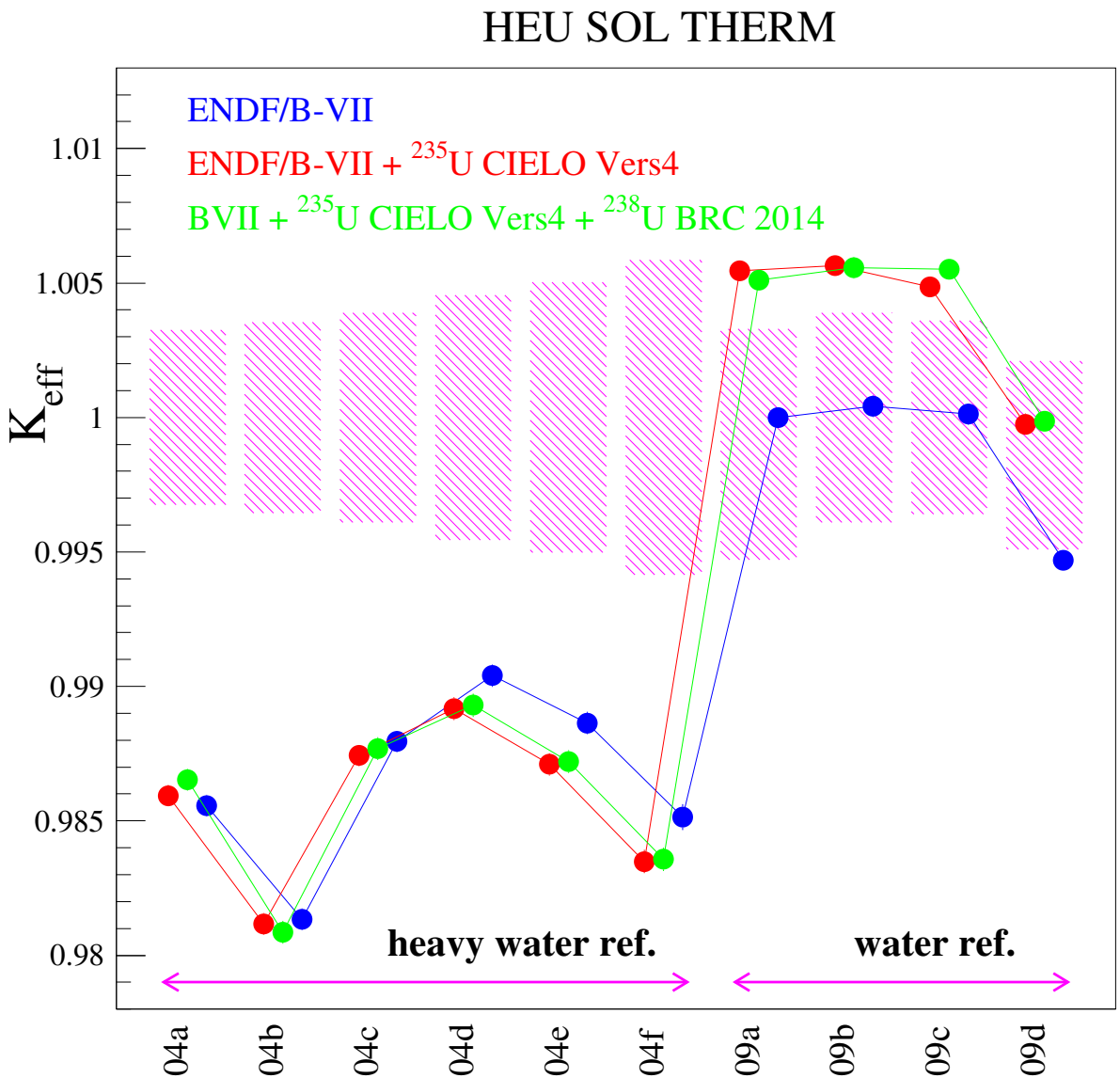
- A new FILE 2,
- New softer prompt fission neutron spectra, with new prompt neutron multiplicity,
- New (n,γ) cross section for E $<$ 170 keV,
- New elastic and inelastic cross sections.

- With ^{235,238}U benchmarks, if we have a new ^{235}U evaluation, it may be necessary to change the ^{238}U evaluation.
- For this reason, we have build a compatible ^{238}U evaluation : ^{238}U BRC 2014.


HEU MET FAST
ENDF/B-VII
ENDF/B-VII + 235U CIELO Vers4
BVII + 235U CIELO Vers4 + 238U BRC 2014
Keff
1.008
1.006
1.004
1.002
1
0.998
0.996
0.994
0.992
Godiva
water ref.
whitout ref.
polyethylene ref.
steel ref.
dep. U ref.
Cylinder whitout ref.
whitout ref.
Flattop U ref.
U ref.
01a
01b
04a
04b
04c
008
011
013
014
015
18a
18b
028
32a
32b
32c
32d

^{235,238}U ENDF/B-VII.1, ^{235}U CIELO vers 4, ^{238}U BRC 2014




HEU SOL THERM
ENDF/B-VII
ENDF/B-VII + 235U CIELO Vers4
BVII + 235U CIELO Vers4 + 238U BRC 2014
Keff
1.01
1.005
1
0.995
0.99
0.985
0.98
heavy water ref.
water ref.
04a
04b
04c
04d
04e
04f
09a
09b
09c
09d

^{235}U CIELO, ^{238}U BRC 2014

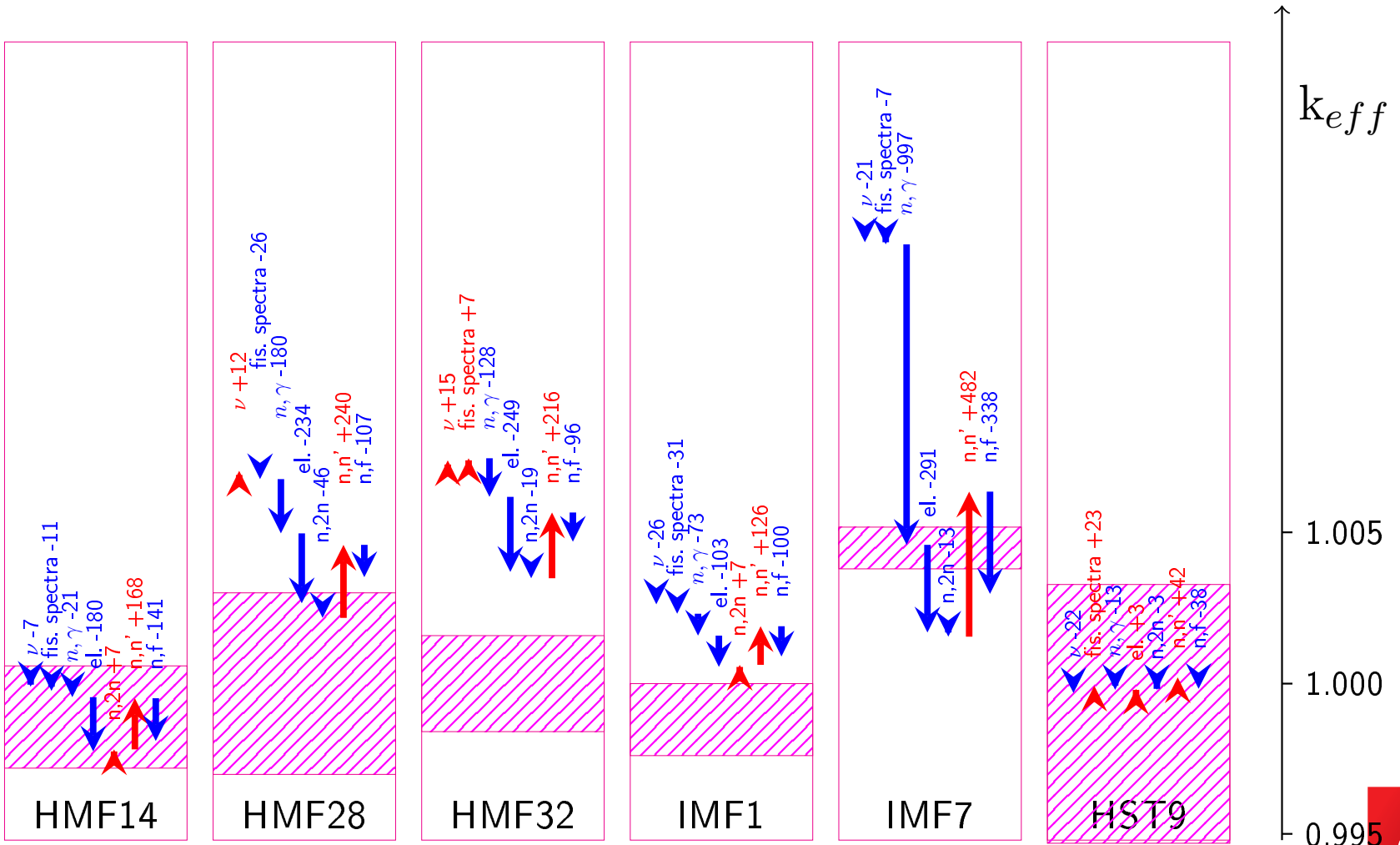
- We have a new ^{238}U BRC 2014 evaluation, which gives good results when used with ^{235}U CIELO vers 4 evaluation.

^{235}U CIELO, ^{238}U BRC 2014

- We have a new ^{238}U BRC 2014 evaluation, which gives good results when used with ^{235}U CIELO vers 4 evaluation.
- But, what are the differences between ^{238}U BRC 2014, ^{238}U ENDF/B-VII.1 and ^{238}U CIELO ib44.

^{238}U BRC $\neq$ ^{238}U ENDF/B-VII.1 (^{235}U B-VII.1)

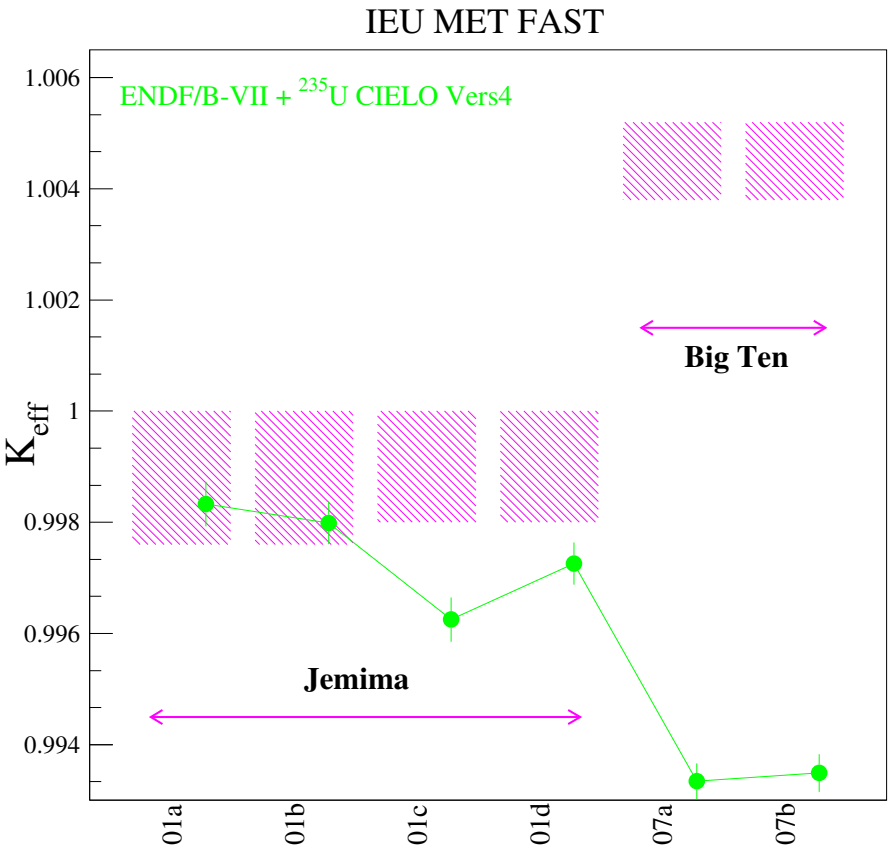
^{238}U BRC $\longrightarrow$ ^{238}U ENDF/B-VII.1



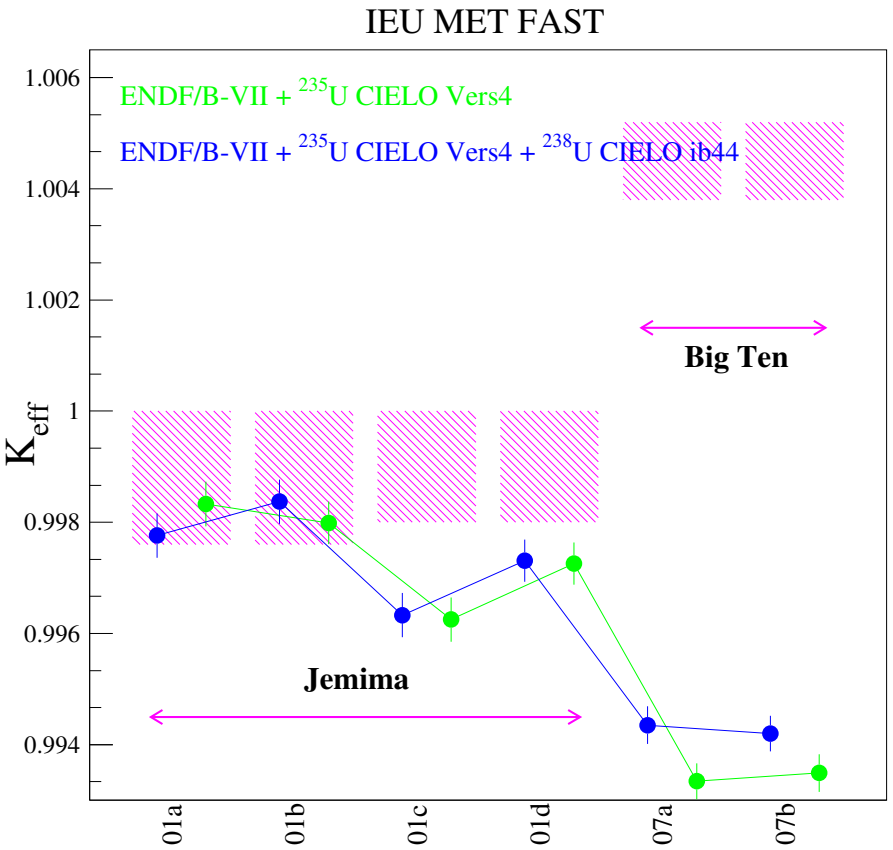
^{238}U BRC $\neq$ ^{238}U ENDF/B-VII.1 (^{235}U B-VII.1)

- ^{235}U CIELO vers 4 and ^{238}U BRC work well.
- For the Big Ten benchmark, the main difference is the capture cross section.
- What happens if we put the capture cross section of ^{238}U BRC in the ^{238}U CIELO ib44 evaluation ?

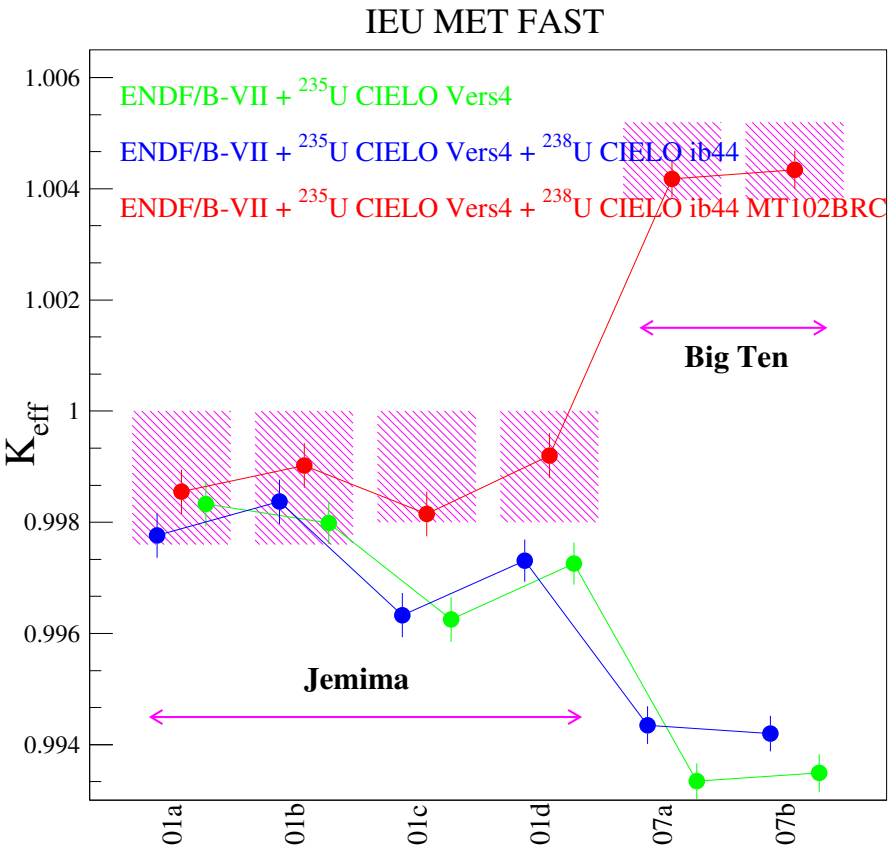
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC

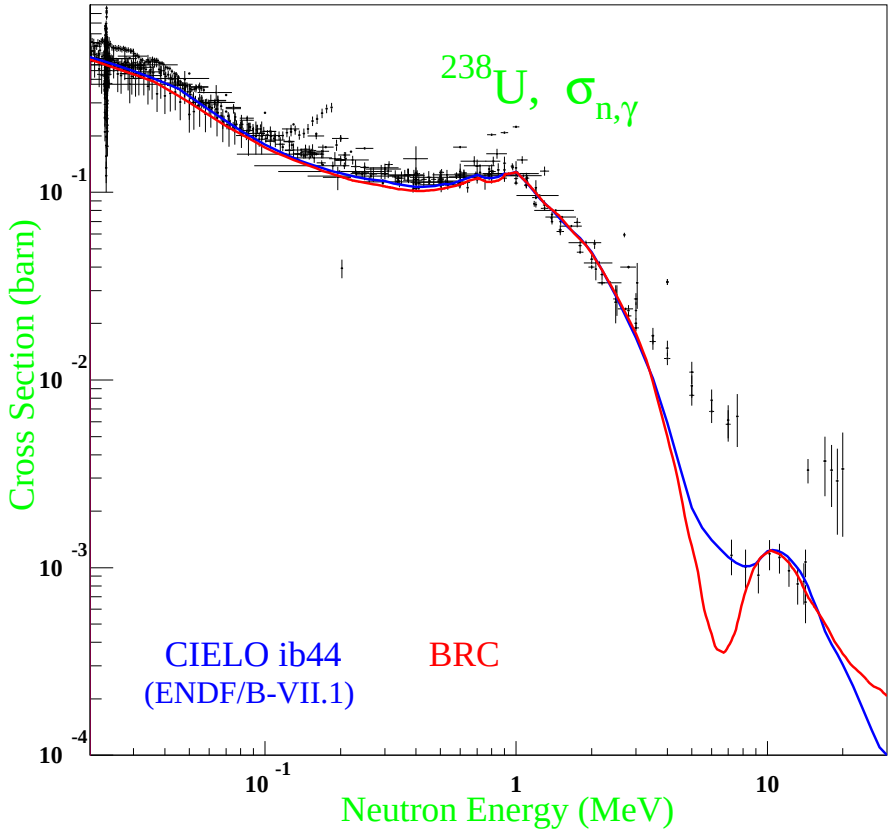


^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC

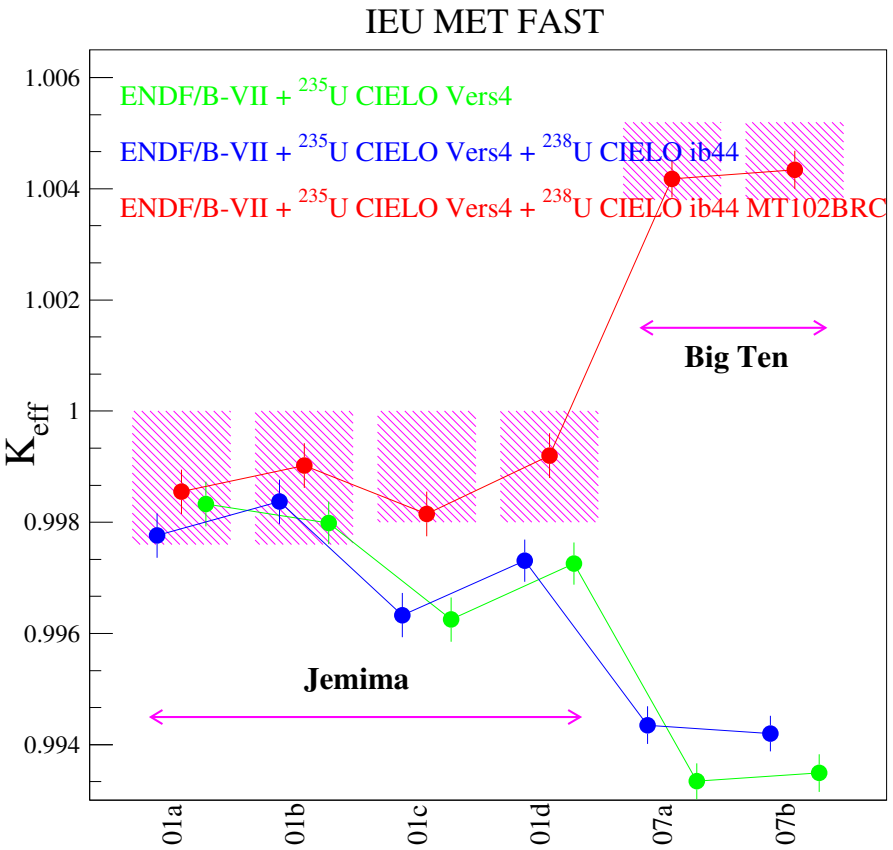


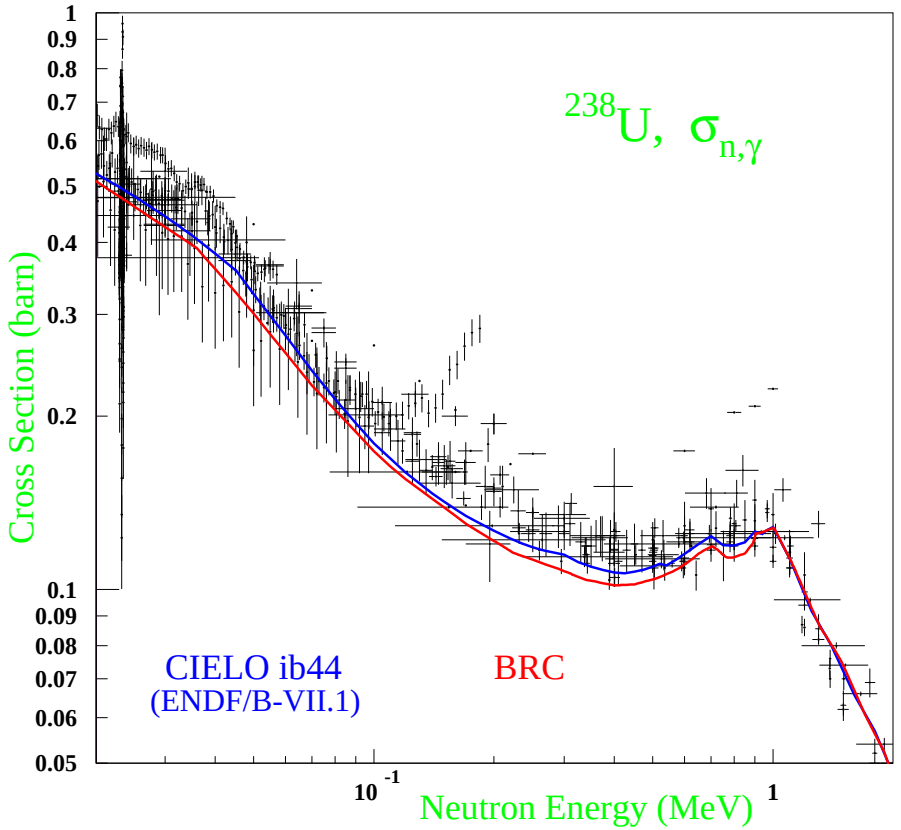
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC



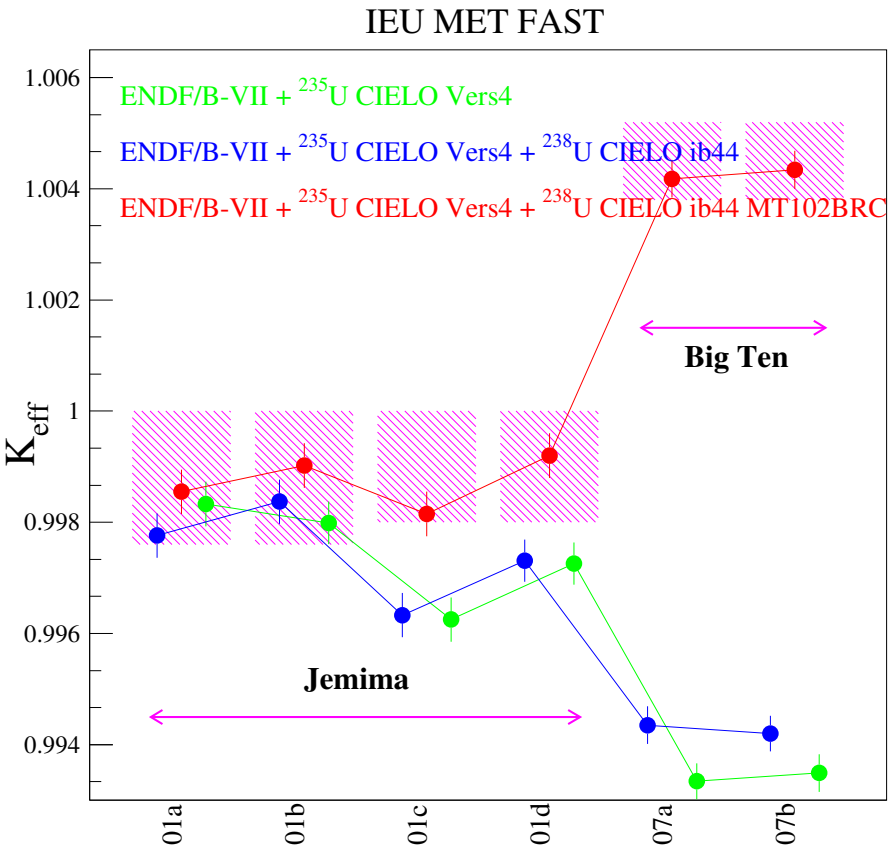


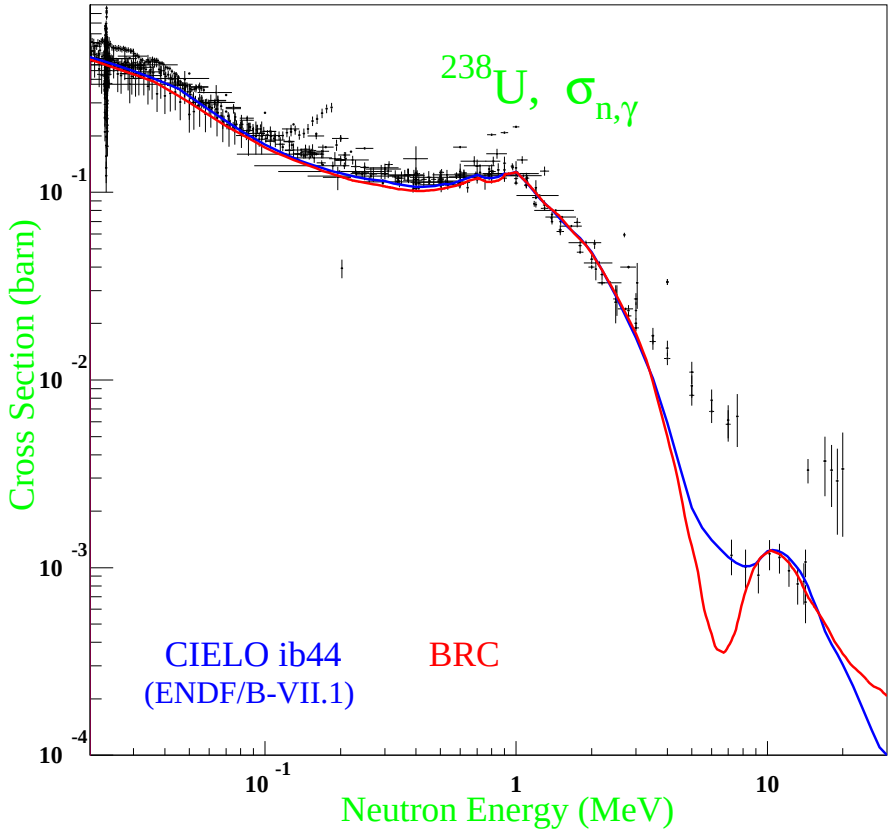
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC



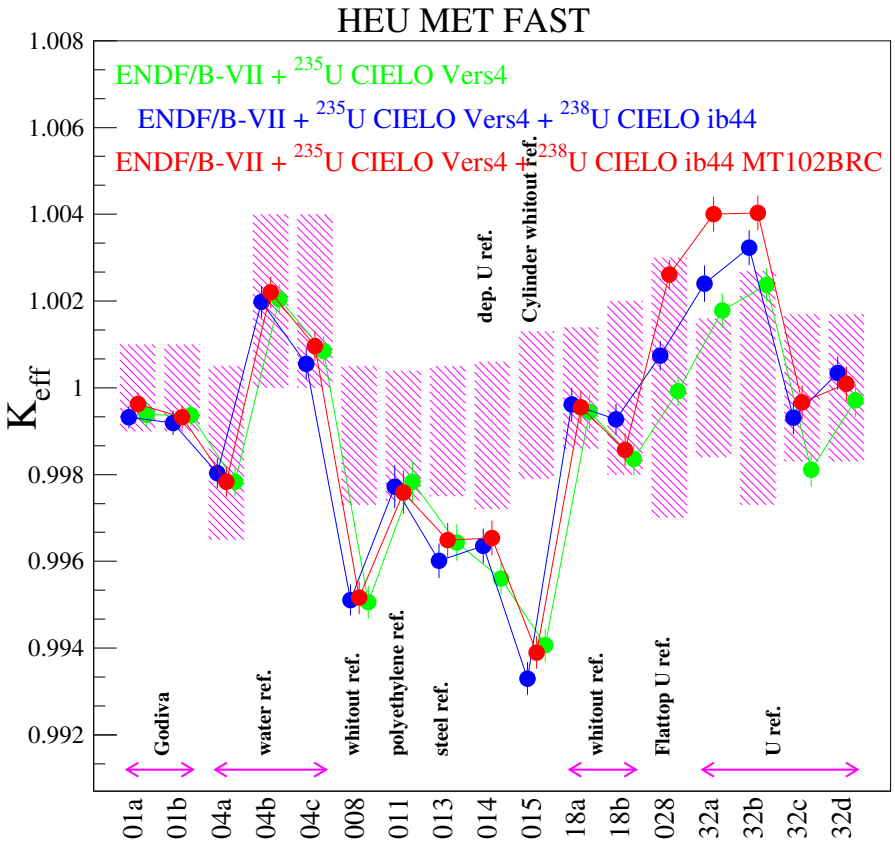


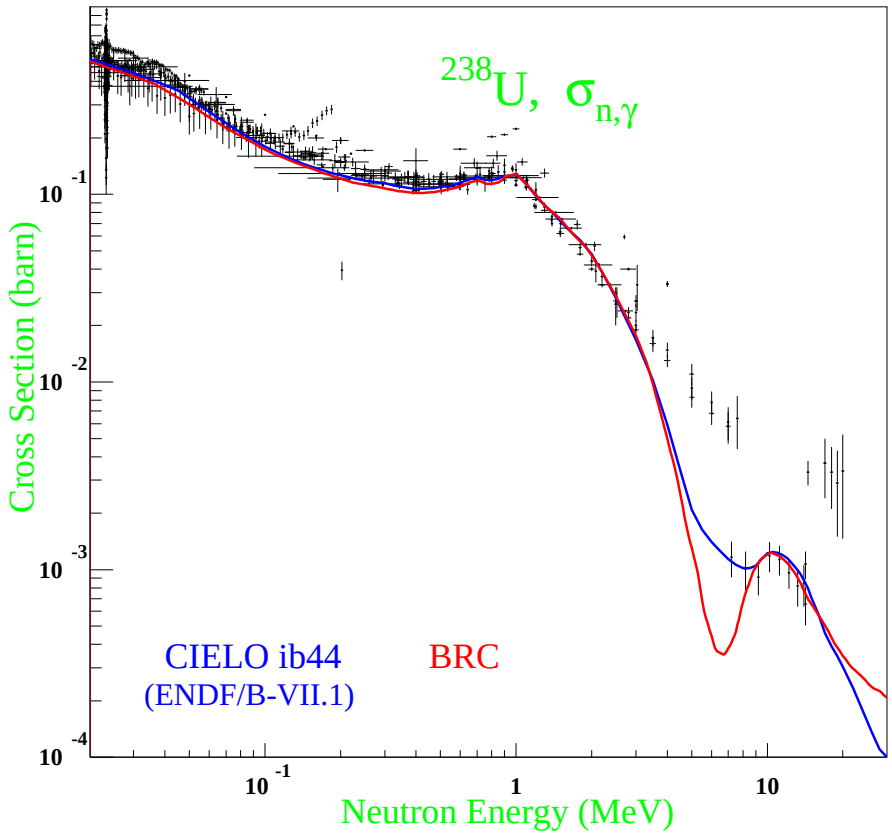
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC



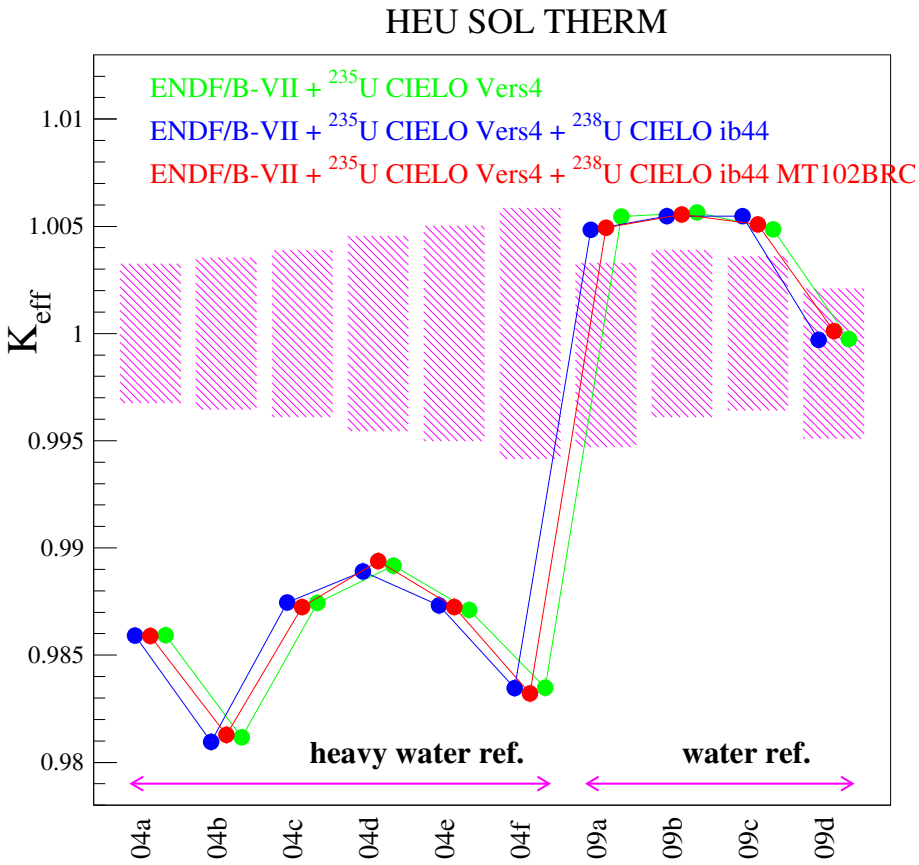


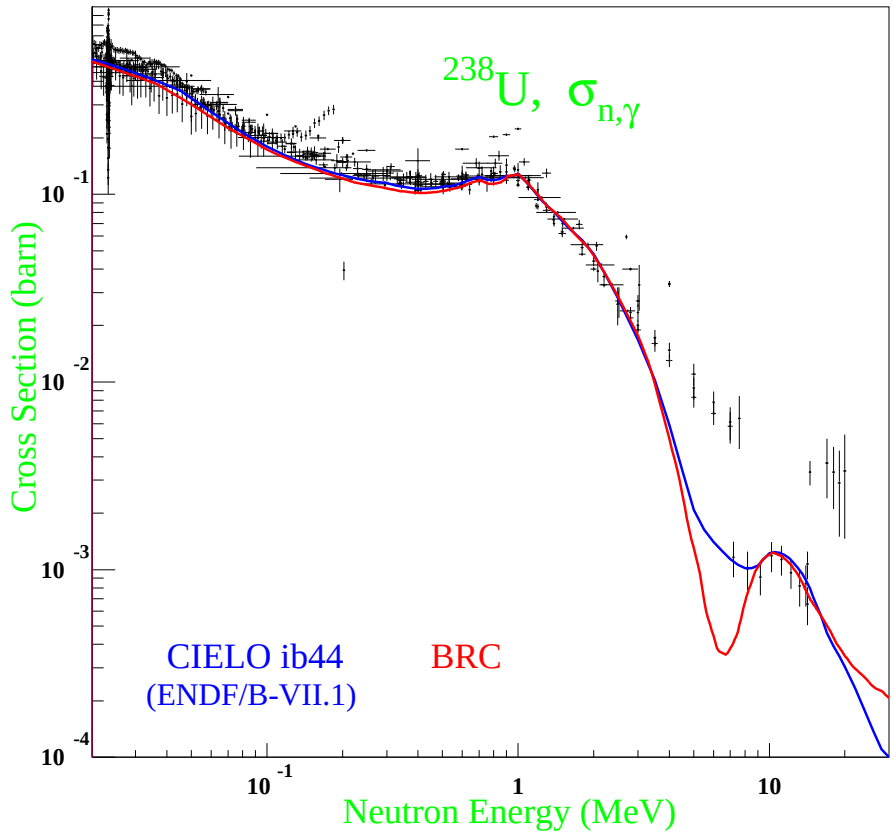
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC



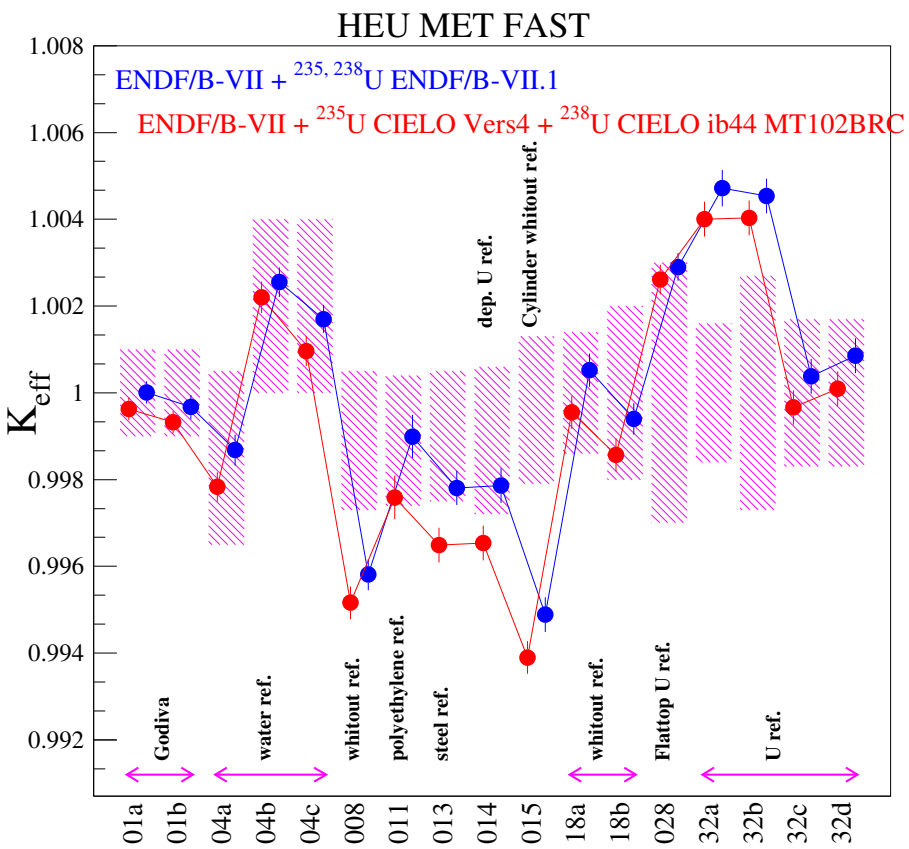


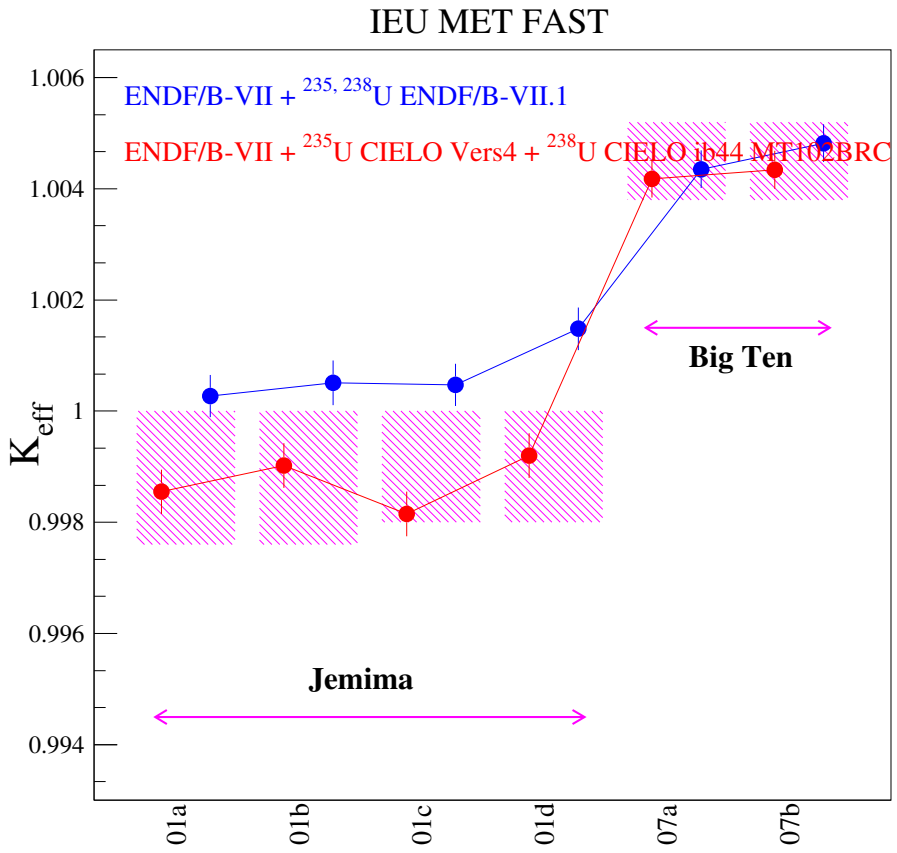
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC



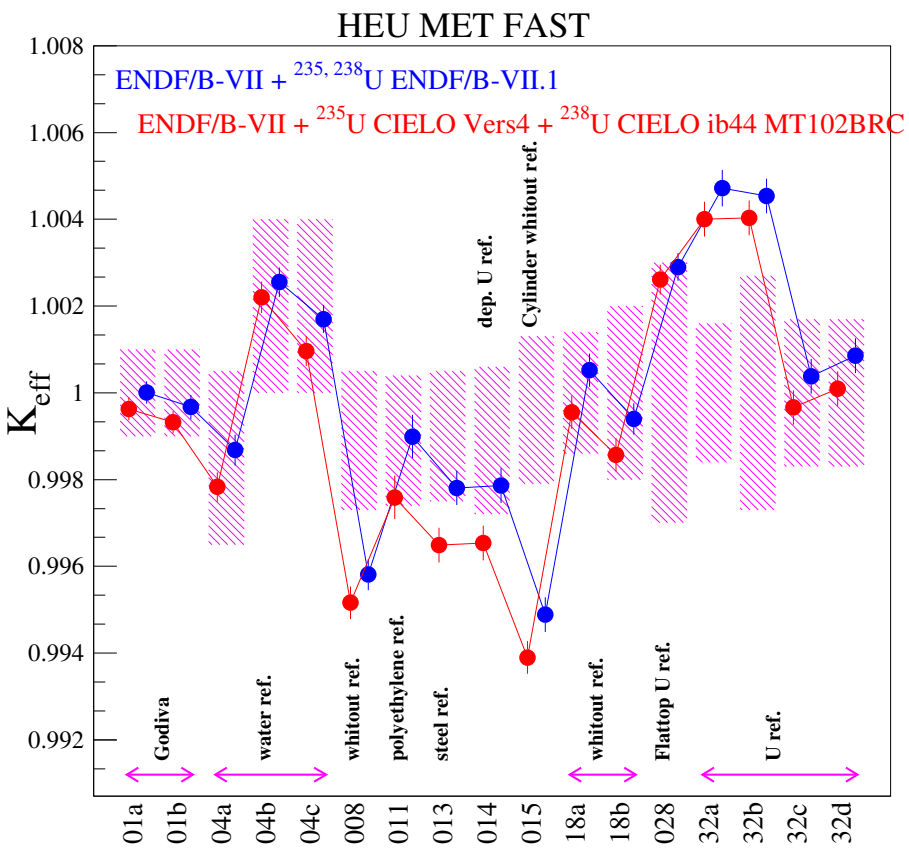


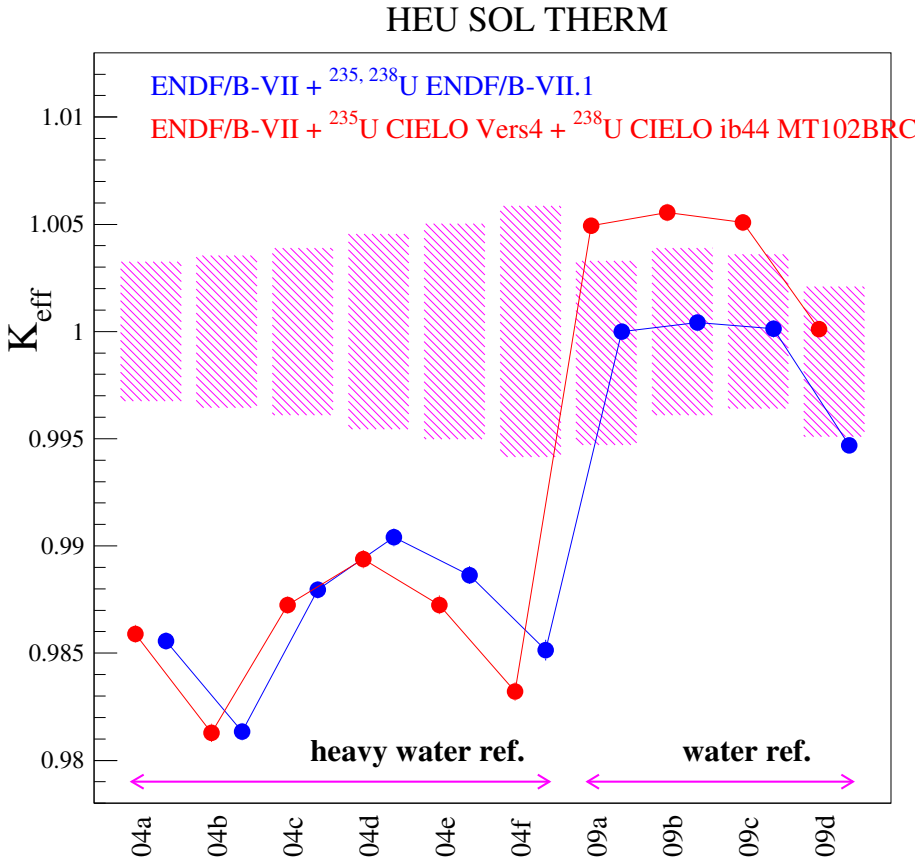
^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC





^{235}U CIELO vers4 , ^{238}U CIELO ib44 with ^{238}U(n,γ) BRC





^{235}U CIELO evaluation

A completely new evaluation

- A new FILE 2,
- New softer prompt fission neutron spectra, with new prompt neutron multiplicity,
- New (n,γ) cross section for E $<$ 170 keV,
- New elastic and inelastic cross sections,
- Fission cross section from ENDF/B-VII.1, but close to the BRC model calculation.
- Covariances (FILE 33) were estimated with the NRG-PETTEN TASMAN code developped by A.J. Koning and D. Rochman.

^{235}U CIELO evaluation

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Benchmark results

If we make changes in the ^{235}U evaluation, we have to use a different ^{238}U evaluation in ^{235,238}U benchmarks.
Improvements are necessary for thermal benchmarks ($\nu \searrow$).