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Evaluation of ^{238}U+n in the resonance region

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SG-40

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European Commission

Evaluation of ^{238}U+n in the resonance region

Contributing organisations and institutes

- Commissariat à l'Energie Atomique, Cadarache (France)
  P. Archier, C. De Saint Jean, G. Noguere
- European Commission, Joint Research Centre, Geel (Belgium)
  S. Kopecky, C. Paradela, P. Schillebeeckx
- Institute for Nuclear Research and Nuclear Energy, Sofia (Bulgaria)
  I. Sirakov
- Institute of Physics and Power Engineering, Obninsk (Russia)
  V. Pronyaev
- International Atomic Energy Agency, Vienna (Austria)
  R. Capote, A. Trkov
- Korea Atomic Energy Research Institute, Daejeon (Korea)
  D.H. Kim, H.I. Kim, Y.O. Lee
- OECD Nuclear Energy Agency, Issy-les-Moulineaux (France)
  E. Dupont, O. Cabellos

Papers & reports

Kopecky et al., "Status of evaluated data files for 238U in the resonance region",
JRC Technical Report, Report EUR 27504 EN

H.I. Kime et al, "Neutron capture cross section measurements for ^{238}U in the resonance region at GELINA"
Revised version submitted to Eur. Phys. J. A

Sirakov et al., "Evaluation of cross sections for neutron induced reaction on ^{238}U in the unresolved resonance region"
in preparation

Resolved resonance region

Evaluation in RRR based on Derrien et al.,

Problems:

- Transmission data of Olsen et al. were renormalised by Derrien et al.
- Capture data included in evaluation, i.e. ORELA data of Macklin et al. and de Saussure et al., were renormalised by almost 10% and are not consistent with capture data in URR!

⇒ **Additional transmission data to verify Olsen et al. data (basis of ENDF/B-VII.1)**

- Measurements at 50 m station of GELINA to verify transmission data < 1000 eV
- Data reduction (finalised), data analysis in progress

⇒ **Improve capture data in resonance region: consistent in RRR and URR**

- Measurements 12.5 m and 60m at GELINA
- Data reduction and analysis finalised (paper submitted to EPJA)

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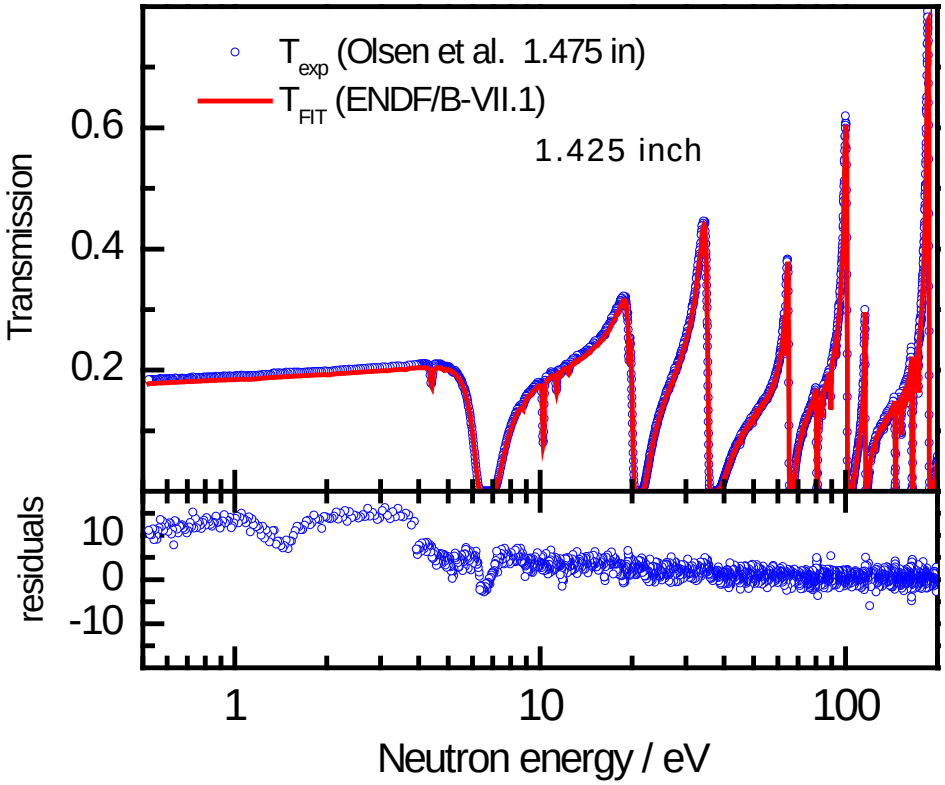
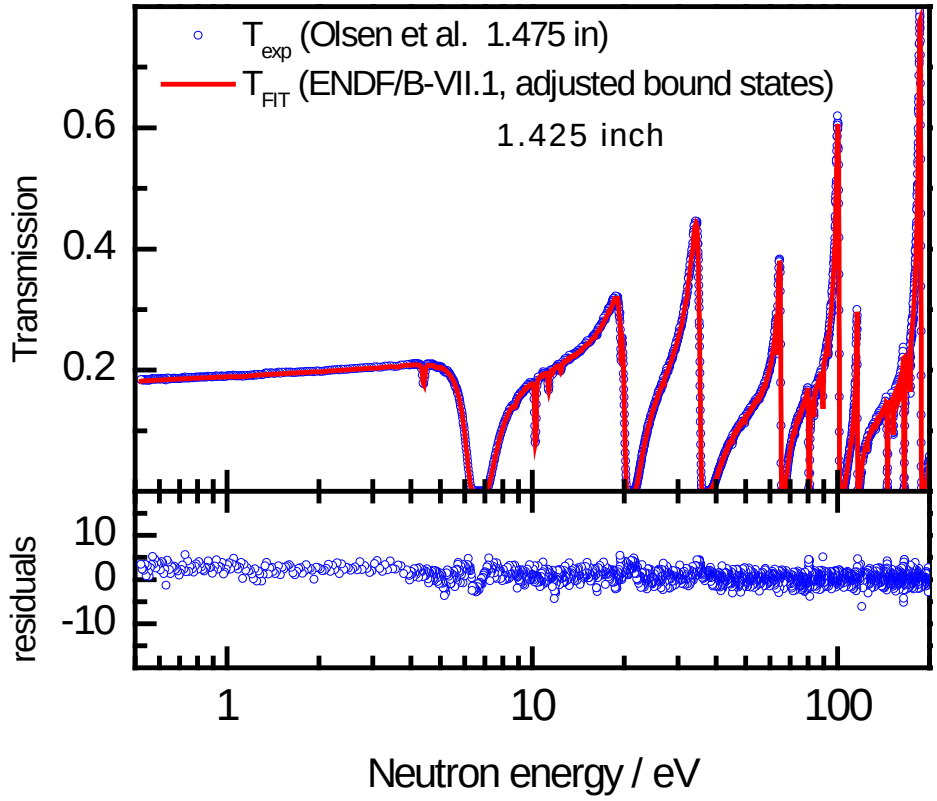
RRR: transmission of Olsen et al.

Problem of transmission data of Olsen et al. <-> ENDF/B-VII.1
Can be solved by adjusting contribution of bound states





⇒ No impact on results of integral benchmark calculations : A. Trkov (IAEA) and D.H. Kim (KAERI)

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Capture data at GELINA

- Same methodology as for ^{232}Th(n,γ) & ^{197}Au(n,γ) (see NDS 113, 3054 (2012))
  - Flux: ^{10}B(n,α)
  - C_6D_6: weighting function
  - Normalization to saturated resonance

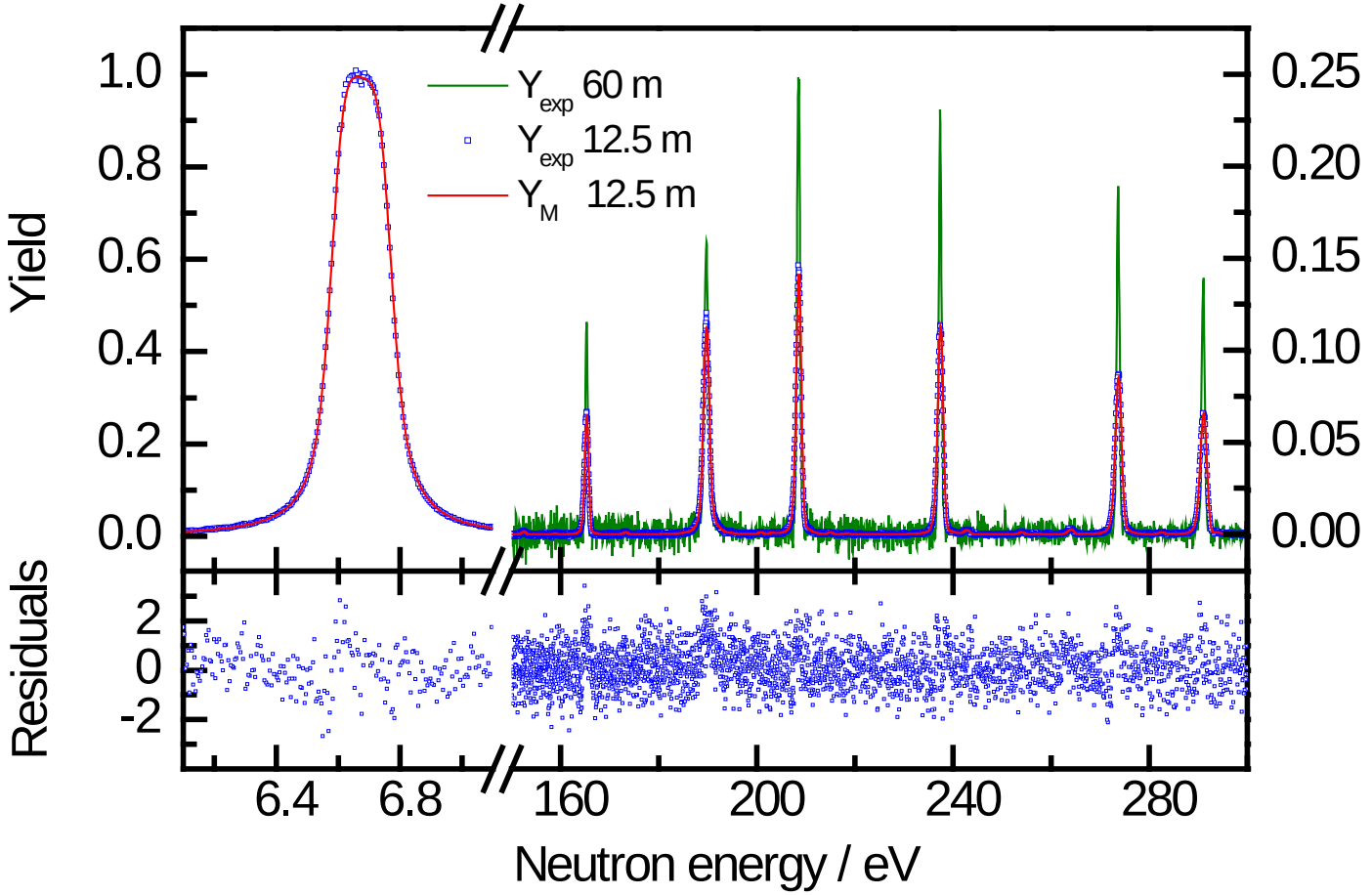
- Measurements at 12.5 m and 60.0 m

- Measurements with 3 different samples: different thickness and geometry

$\Rightarrow$ **Reduce bias effects due to resolution and sample properties**

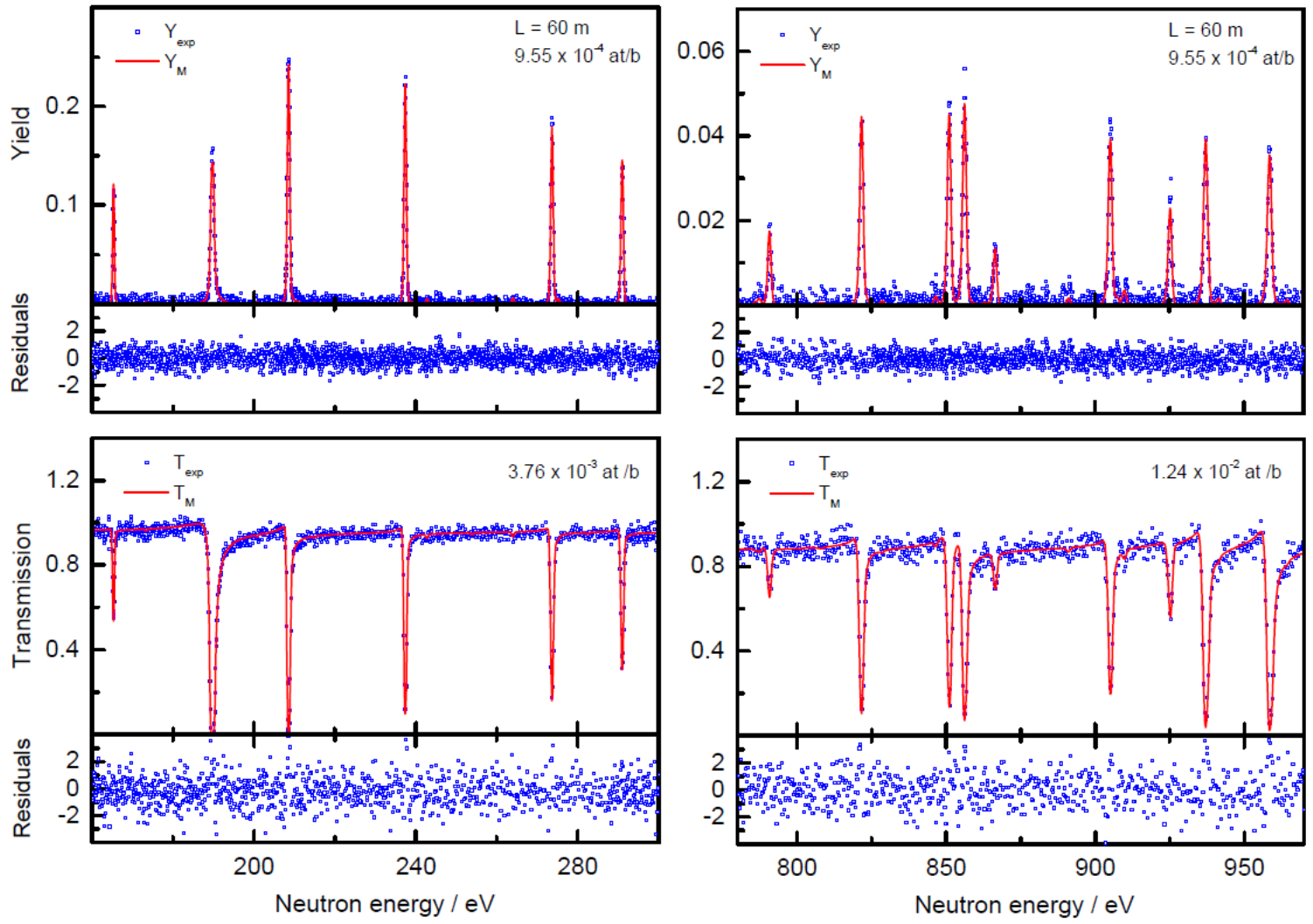
Normalisation

- 12.5 m data : saturated resonance
- 60.0 m data : simultaneous RSA (transmission + capture data)



Results simultaneous RSA of transmission and capture data

capture and transmission data are fully consistent in RRR

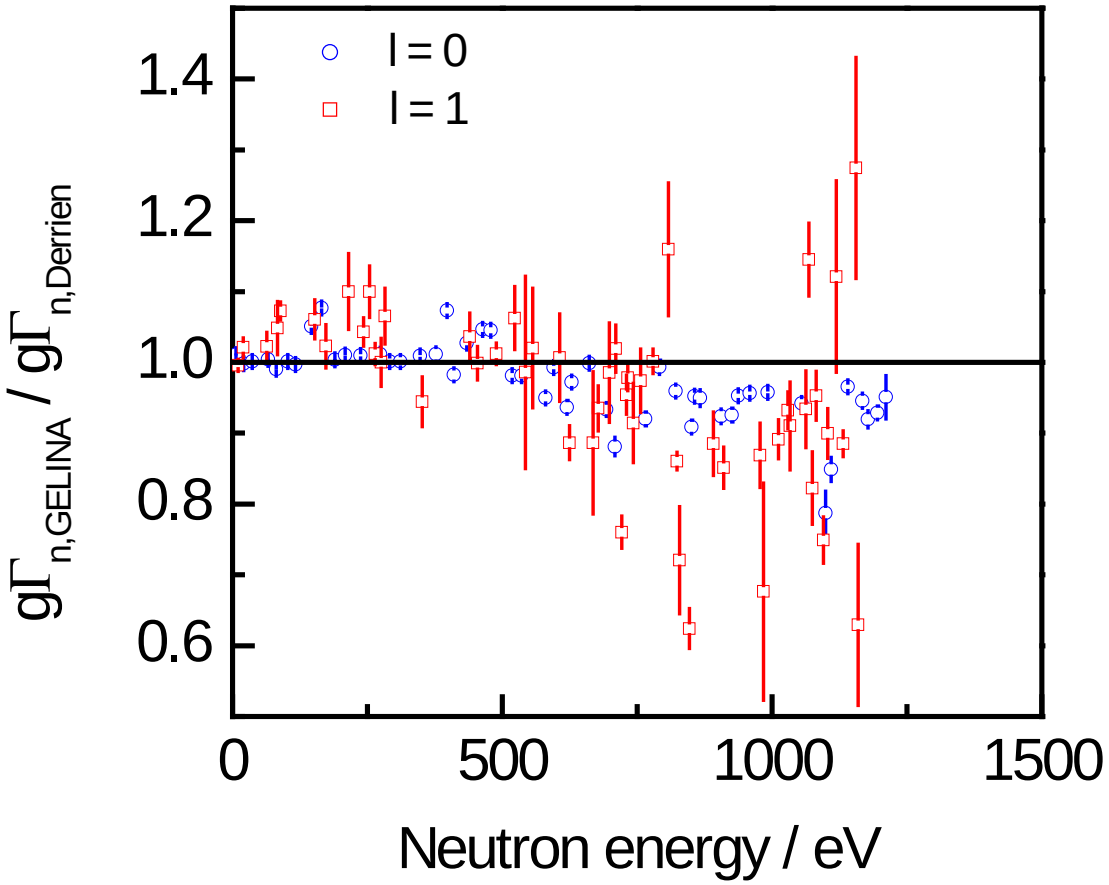


Parameters in RRR (comparison with Derrien et al.)

- $g\Gamma_n$
  - Consistent < 500 eV
  - Systematic difference > 500 eV

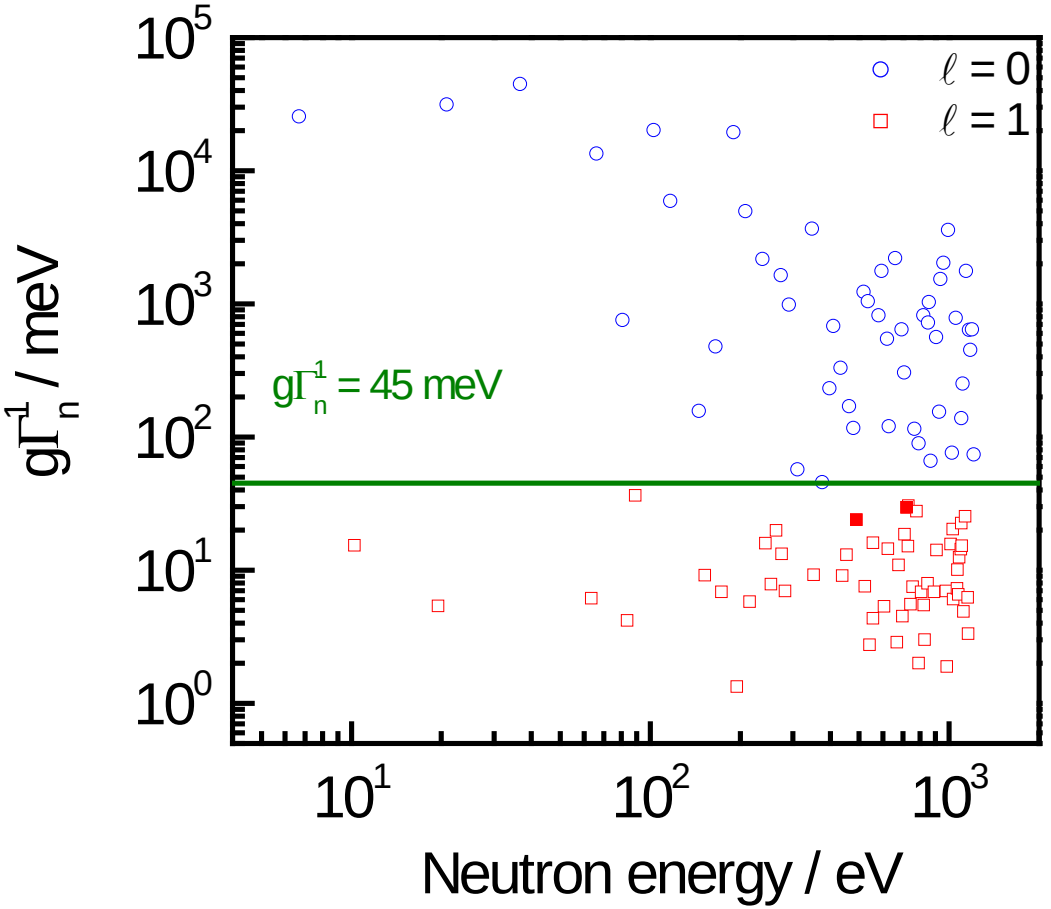
  $\Rightarrow$ **Additional transmission data required**

- $\langle\Gamma_\gamma\rangle$
  - This work : 22.5 meV
  - Derrien et al. : 23.0 meV



Parameters in RRR (comparison with Derrien et al.)

- Parity assignment
  - Changed for 2 resonances
- Γ_f
  - Consistent with fission kernels of Difilippo et al.



RRR parameters for E < 1200 eV

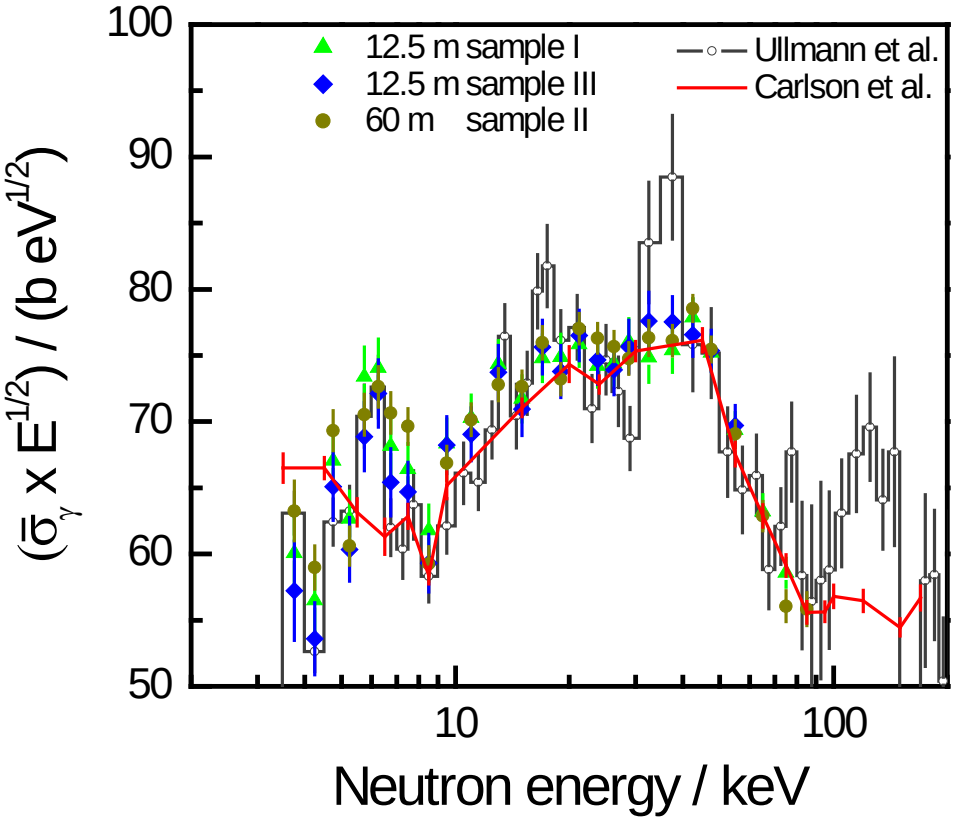
- Introduced in IAEA file
  - Some minor problems…
- Introduced in JEFF-3.3T1 file
  - No problems

⇒ Tests ongoing at KAERI

Capture data in URR

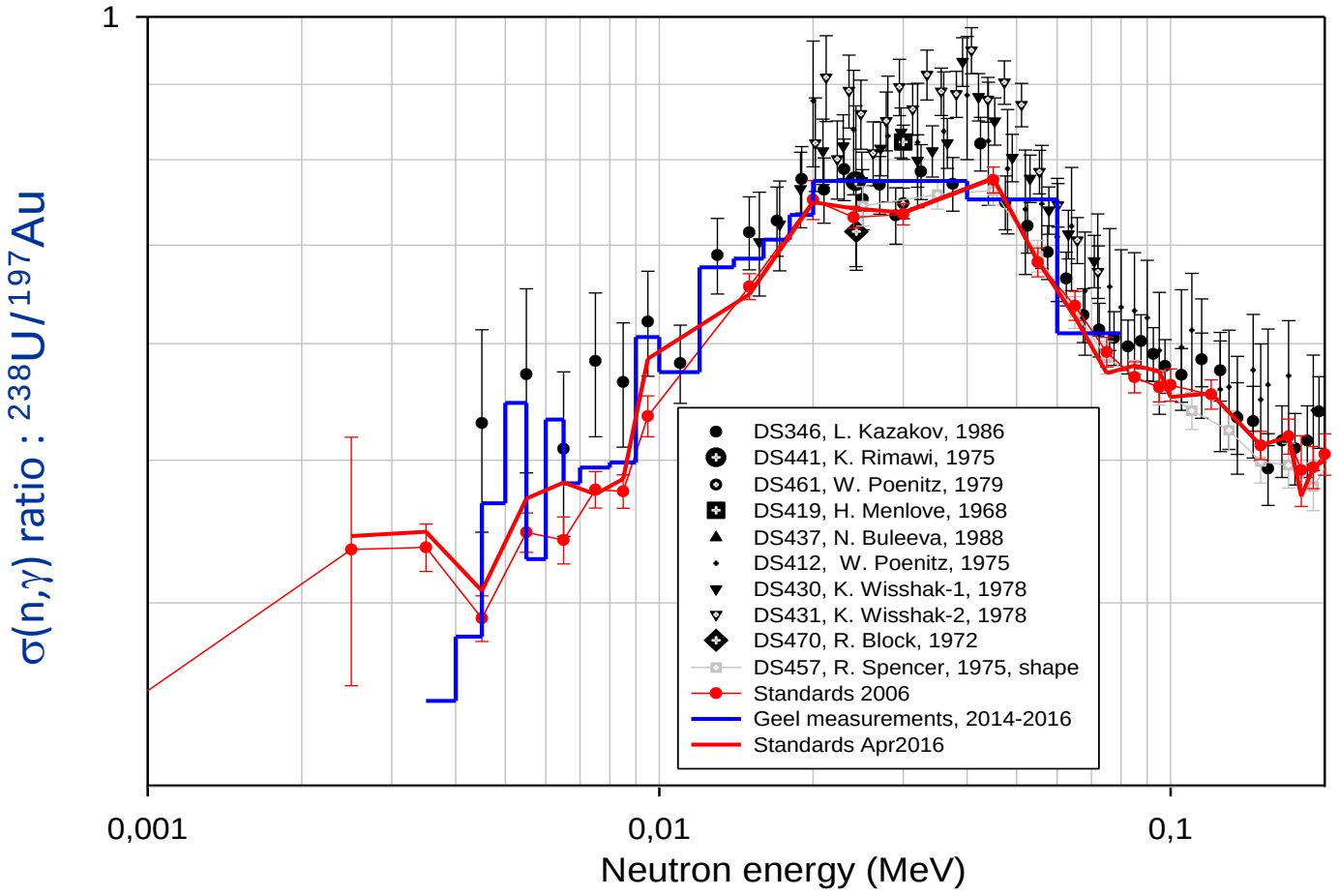
- DANCE data
  - Large uncertainties
  - Not fully consistent with GMA data of Carlson et al.
- GELINA data (3 data sets)
  - Fully consistent within uncorrelated uncertainties due to counting statistics
  - Fully consistent with GMA data of Carlson et al.

⇒ GELINA capture data are fully consistent with transmission data in RRR and GMA data in URR



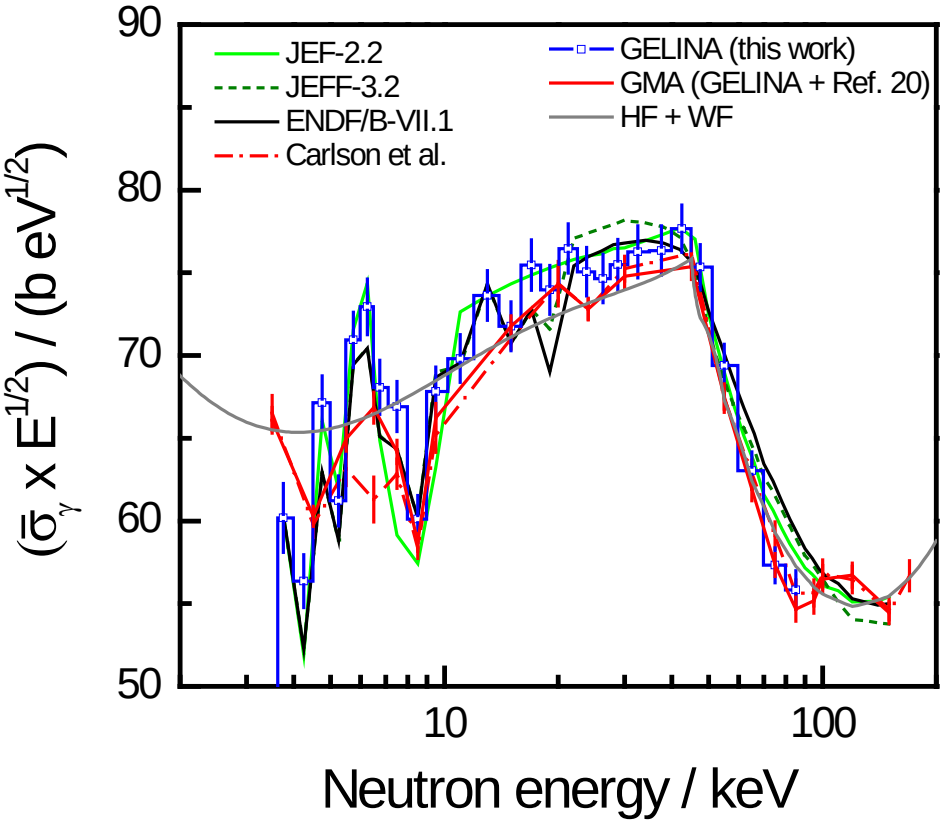
GELINA capture data in URR

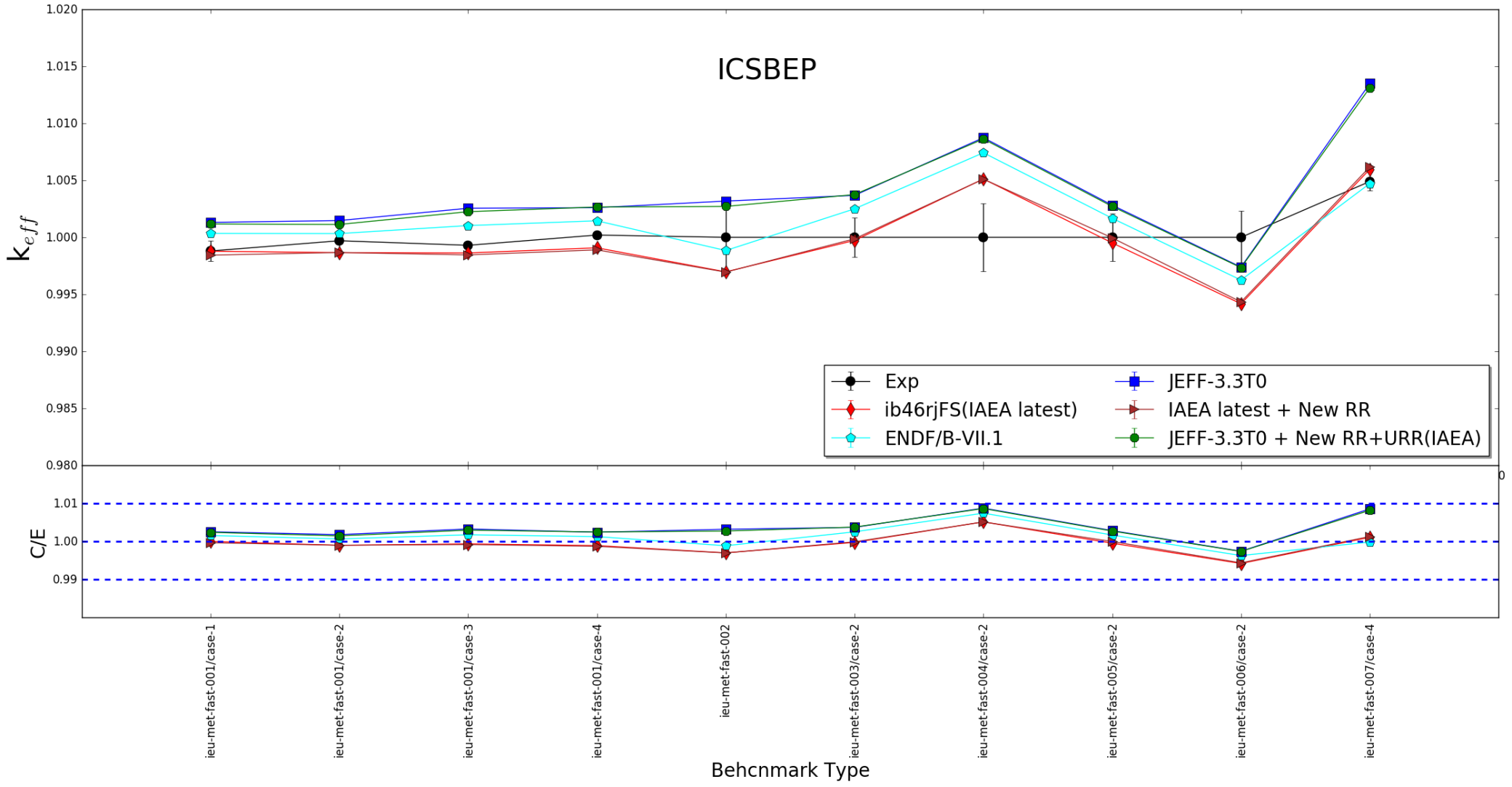
GELINA $^{238}U/^{197}Au(n,\gamma)$ cross section ratio: fully consistent with GMA data of Carlson et al.



New GMA evaluation + parameterisation (HW+WF)

⇒ Production of ENDF-6 compatible evaluation for URR in progress





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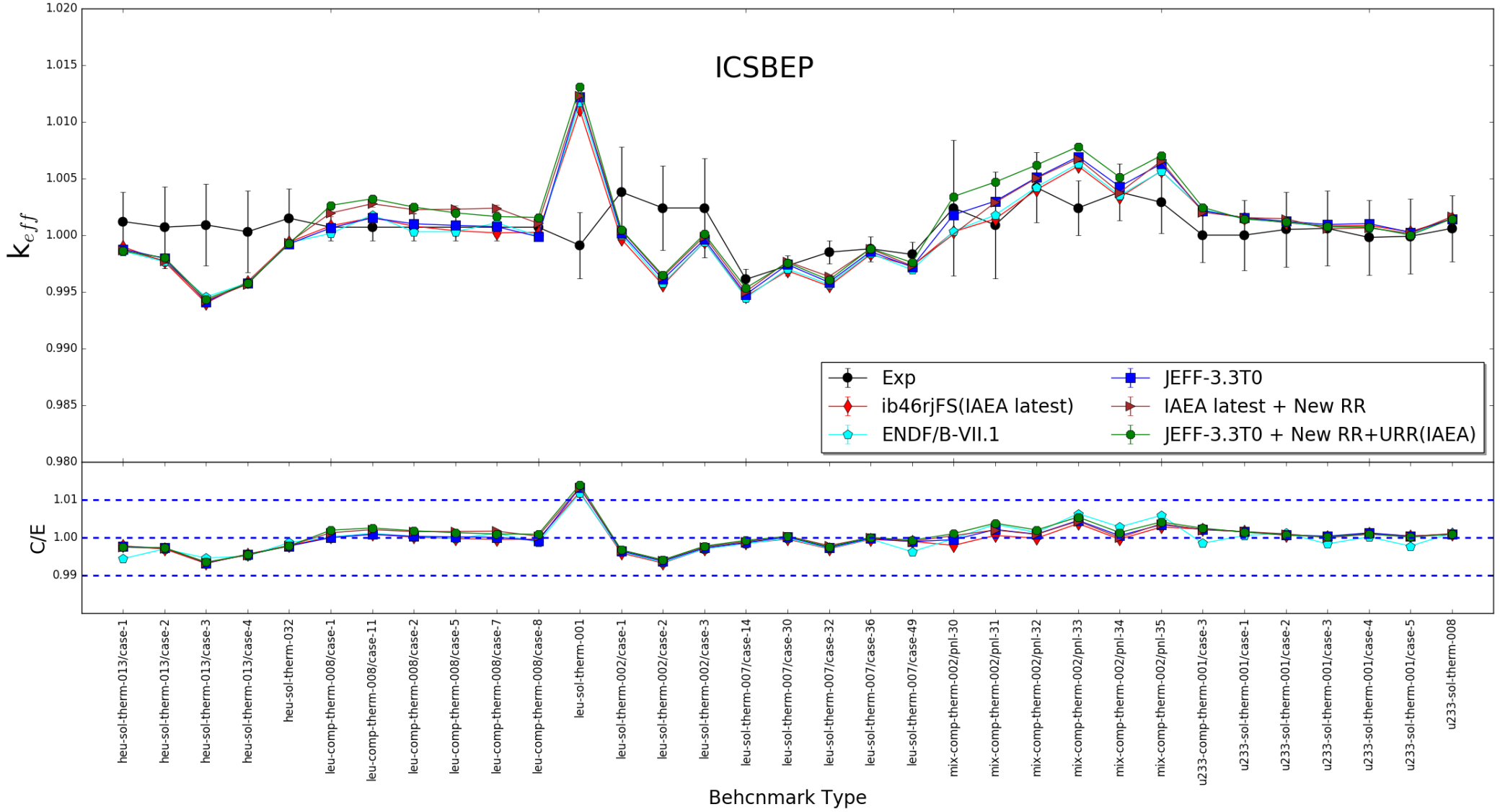

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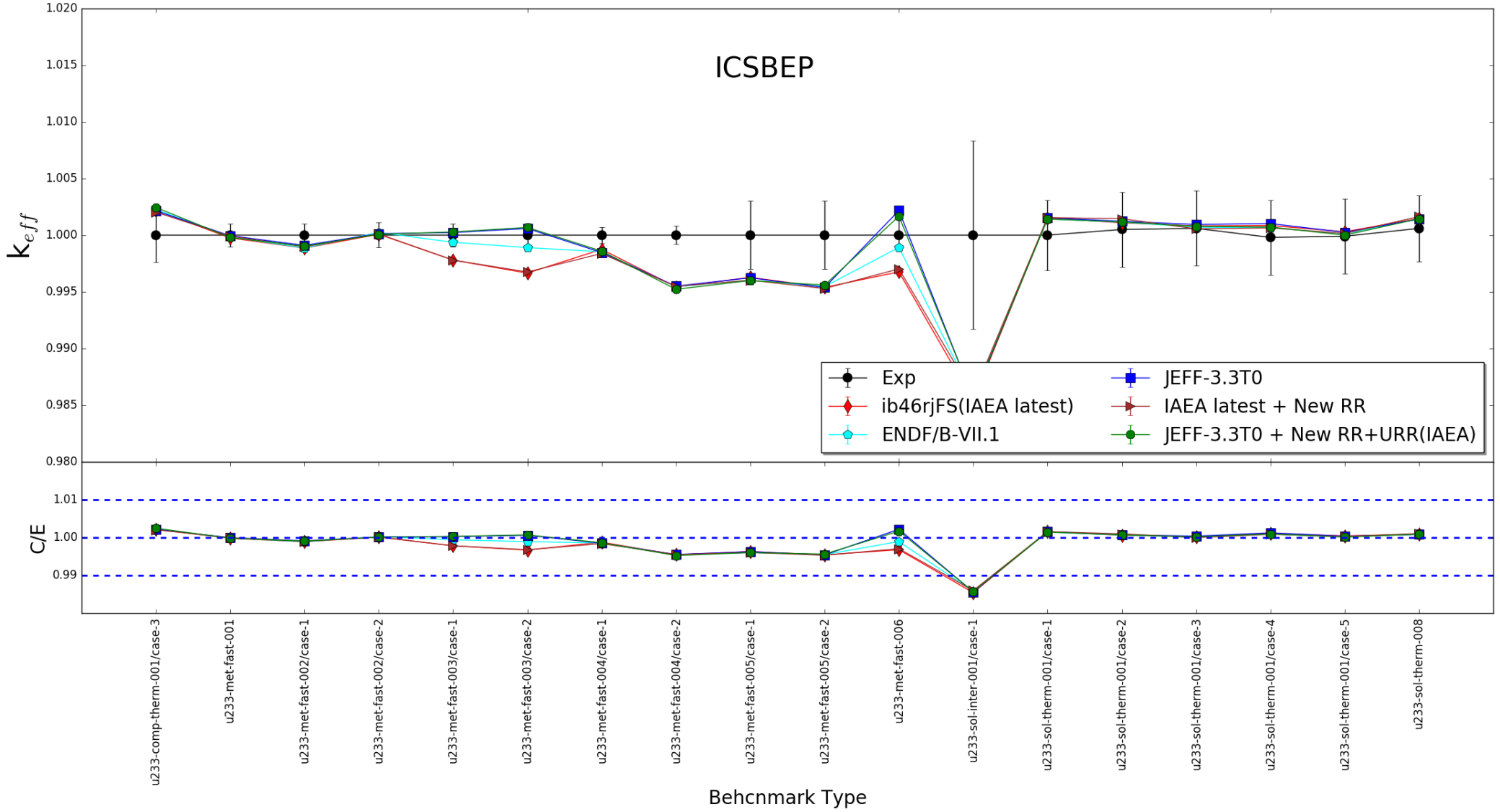

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