IAEA 60 Years
Atoms for Peace and Development

Current status of ^{235}U evaluated nuclear data file (IAEA CIELO)

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Thanks to all collaborators:
A. Trkov (IAEA), M. Sin (University of Bucarest, Romania), V. G. Pronyaev (PI Atomstandard, Russia), G. Noguere (CEA Cadarache, France)

RRR: M. Pigni (ORNL, USA) (E_n<100eV), L. Leal (IRSN, France) (E_n>100eV)
PFNS: D. Neudecker, D.L. Smith, Tadeucci, P. Talou and CRP participants
Optical model:
E. Sh. Soukhovitskii (JINER, Belarus), J. M. Quesada (Universidad de Sevilla, Spain), Satoshi Chiba (TIT, Japan), D. Martyanov (JINER, Belarus)

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IAEA Coordinated Research Project 2008-2014
RC et al., Nucl. Data Sheets 131 (2016) 1-106

Prompt Fission Neutron Spectra of Actinides

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D.L. Smith, D. Neudecker, R. Capote, "PFNS evaluation techniques", **INDC(NDS)-0678** (IAEA, Vienna, 2015)

Thermal PFNS: A.Trkov, RC, Physics Procedia **64** (2015) 48–54.

Fast PFNS (E_n<5 MeV): M. E. Rising et al, Nucl. Sci. Eng. **175**, 81–93 (2013).

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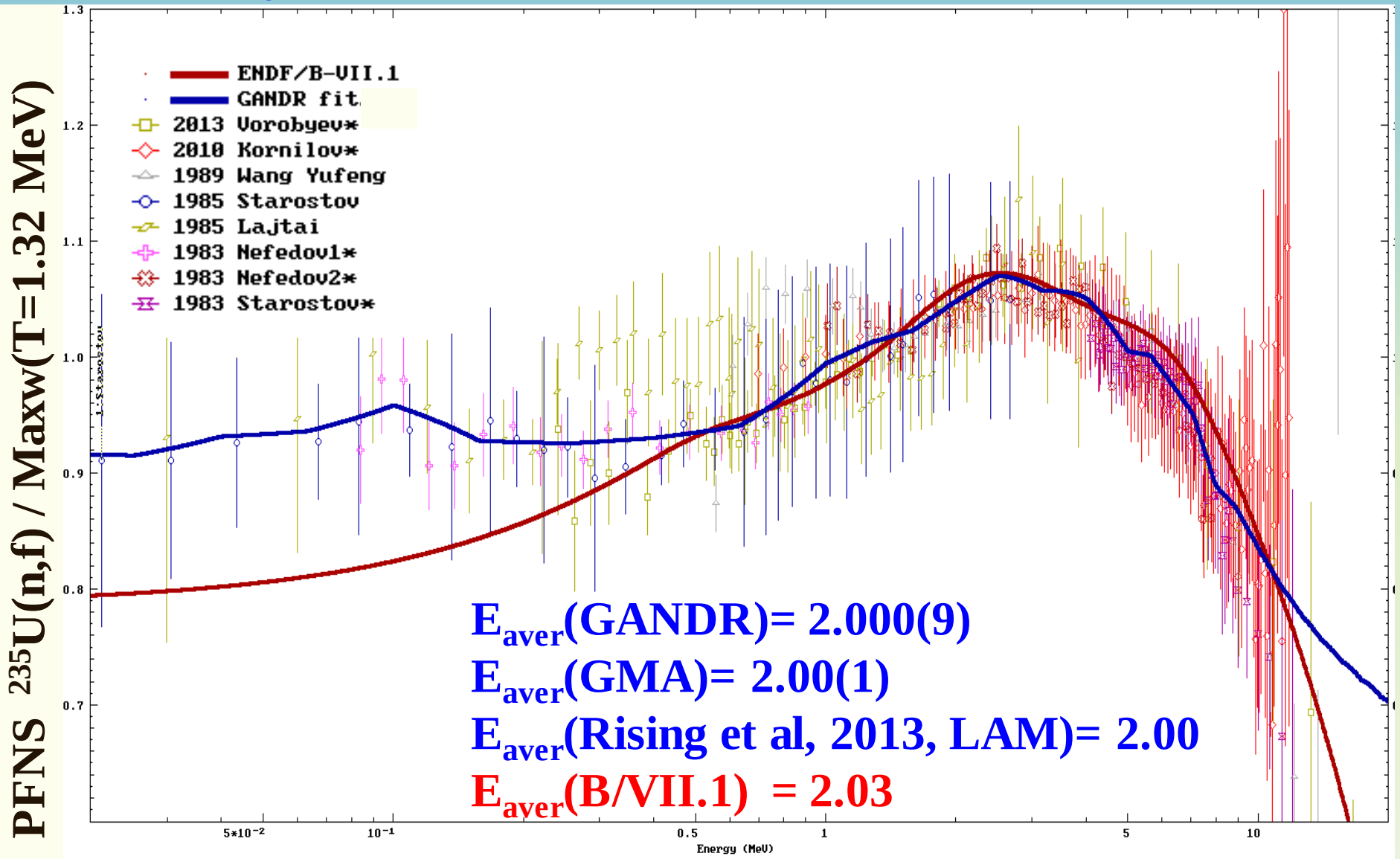
$^{235}U(n_{th},f)$ PFNS non-model evaluation



E_{aver}(GANDR)= 2.000(9)

E_{aver}(GMA)= 2.00(1)

E_{aver}(Rising et al, 2013, LAM)= 2.00

E_{aver}(B/VII.1) = 2.03

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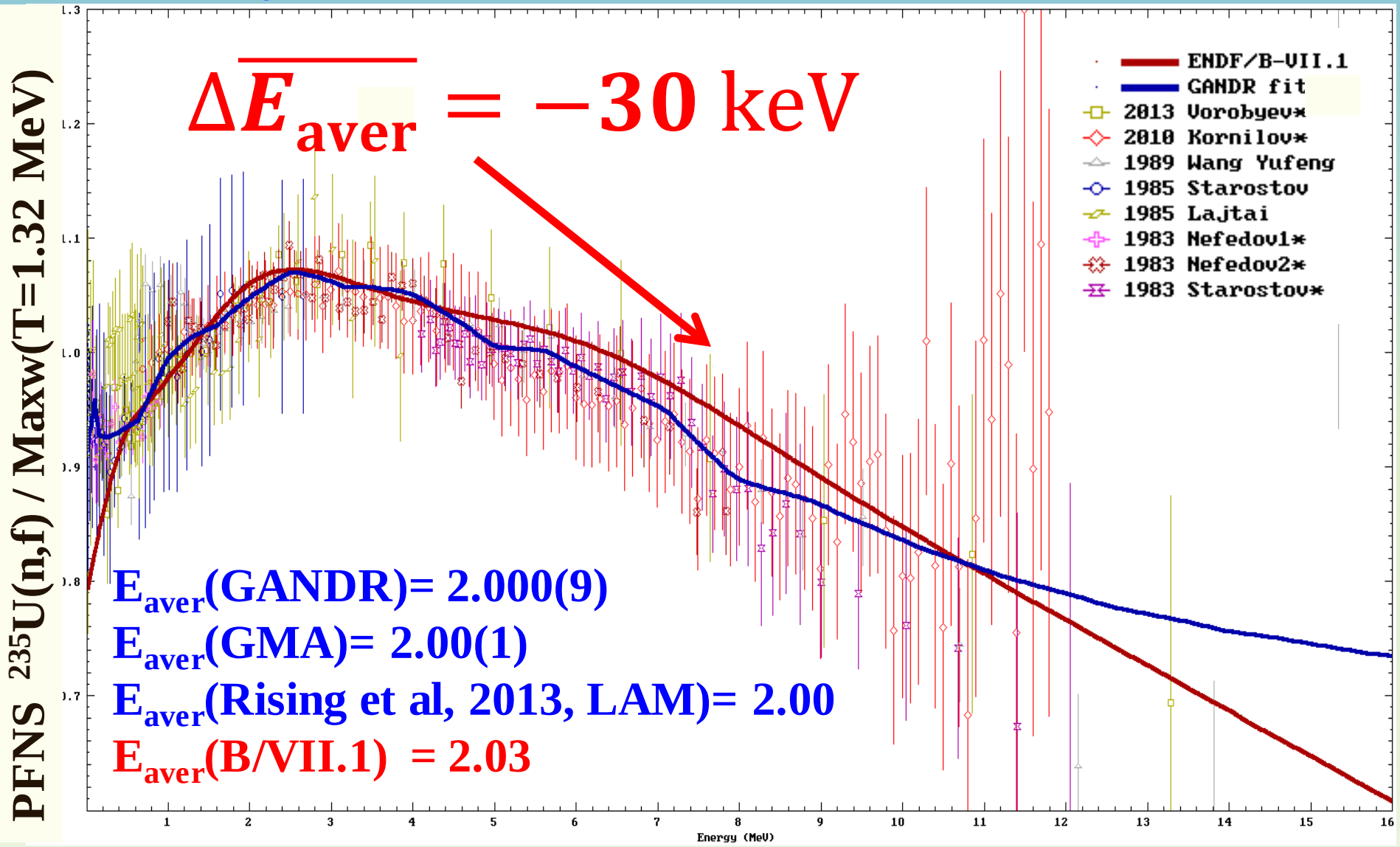
$^{235}U(n_{th},f)$ PFNS non-model evaluation



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Evaluation of n + ^{235}U reaction

RRR (n,γ) : Pigni et al. (R107), E_n<100 eV

Leal et al. (R106), 100 eV <E_n<2.25 keV

Fast (E_n>2.25 keV): this work

- (n,f) from 2006 Neutron Standards
  to be updated with 2016 Neutron Standards
- PFNS as described before
- Dispersive optical model RIPL 2408 (with 8 CC from gsb)
- (n,γ): updated based on Jandel et al, PRL**109**, 202506(2012)
- (n,f): triple-humped barrier with absorption
- Elastic, inelastic and (n,xn) from modelling
  with scarce data constrains (except unitarity)

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PHYSICAL REVIEW C **93**, 034605 (2016)

Extended optical model for fission

M. Sin,[1,*] R. Capote,[2,†] M. W. Herman,[3] and A. Trkov[2]

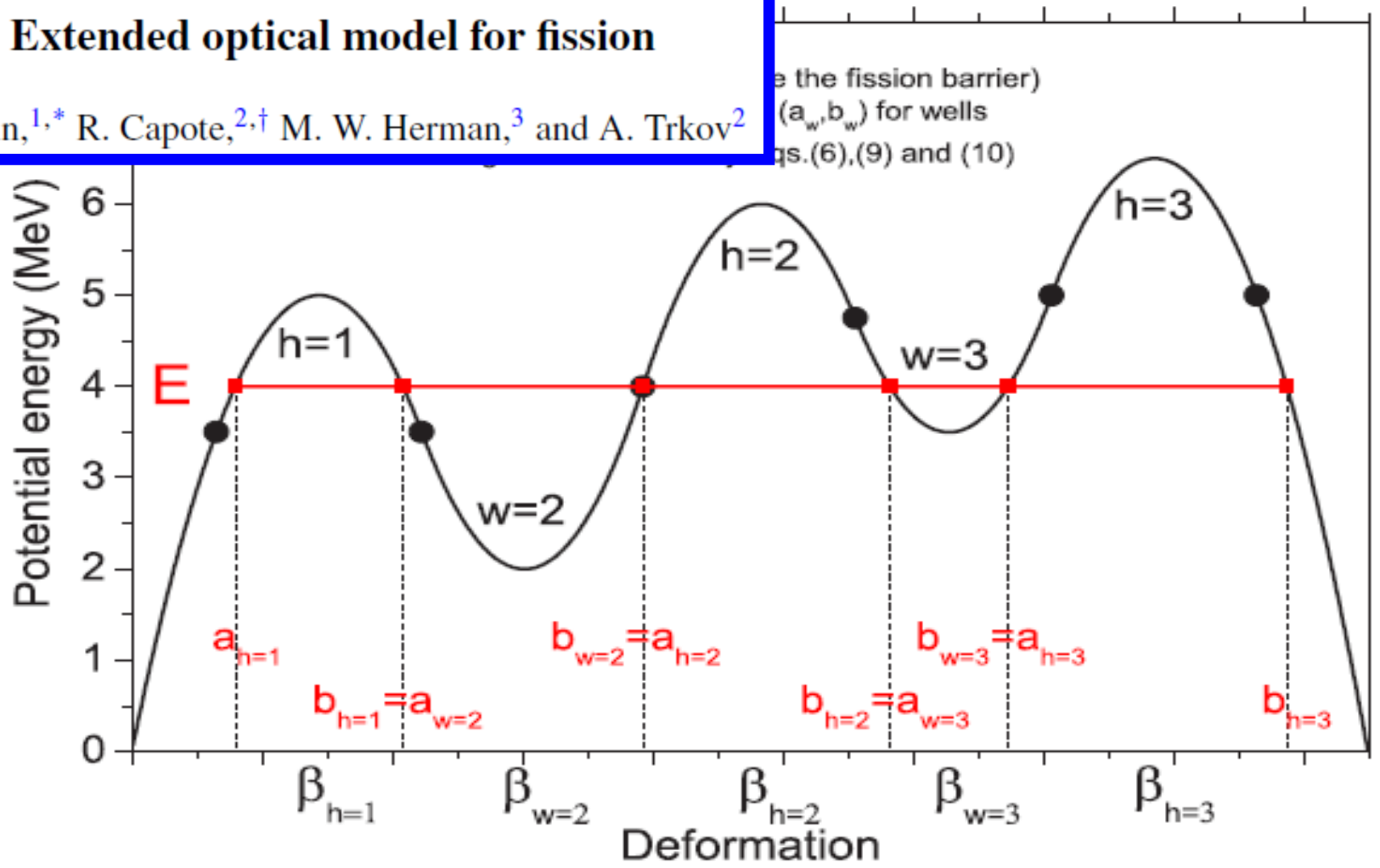

FIG. 1. A triple-humped fission barrier and associated parameters.

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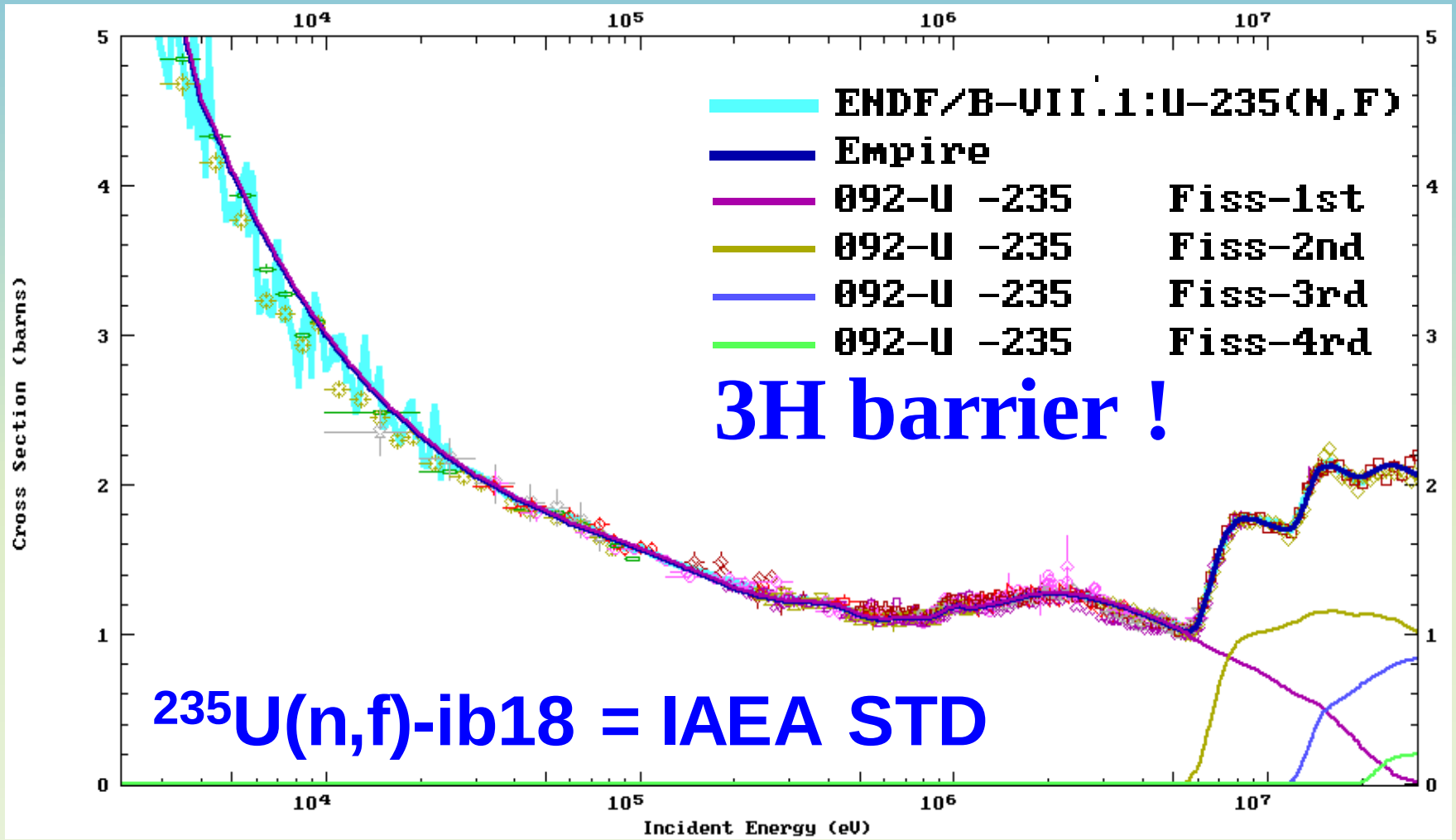
Empire ^{235}U(n,f) vs IAEA standards



EMPIRE calc. agrees within 3% with IAEA standards

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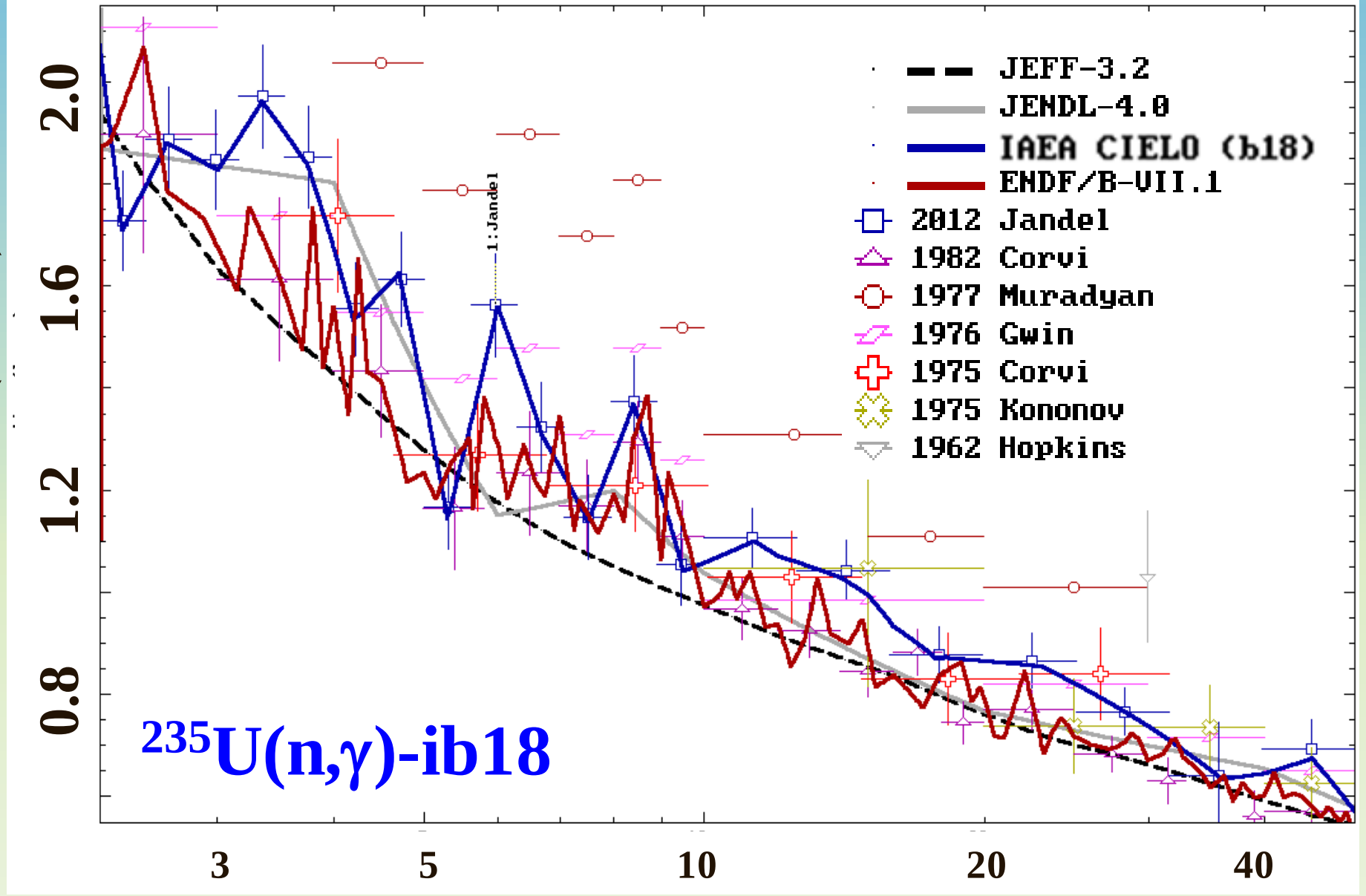

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IAEA CIELO evaluations vs Wallner AMS
^{238}U(n,g)-b46, ^{235}U(n,g)-b18

^{238}U(n,g)

kT=25 keV

Wallner: 0.391± 0.017 b (4.3%)

✓ **IAEA CIELO: 0.391**

kT=426 keV

A. Wallner: 0.108±0.004 b (3.7%)

✓ **IAEA CIELO: 0.109**

^{238}U(n,g)/^{235}U(n,g)

kT=25 keV

Wallner: 0.60±0.03 (4.7%)

➢ **IAEA CIELO: 0.55 (-8.4%)**

kT=426 keV

Wallner: 0.64±0.03 (3.9%)

➢ **IAEA CIELO: 0.60 (-6.3%)**

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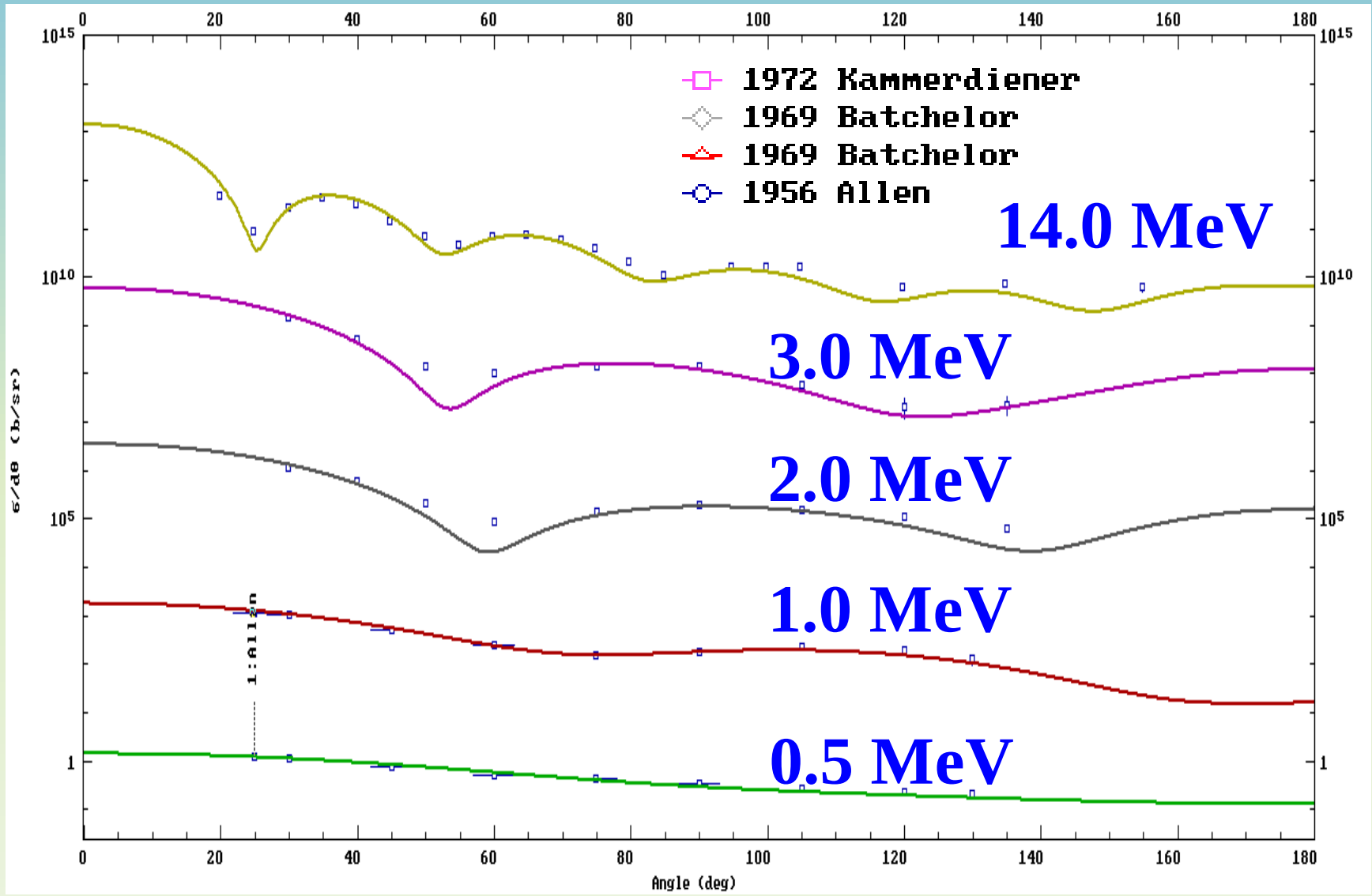
^{235}U(n,el), ^{235}U(n,sct) ang.distributions



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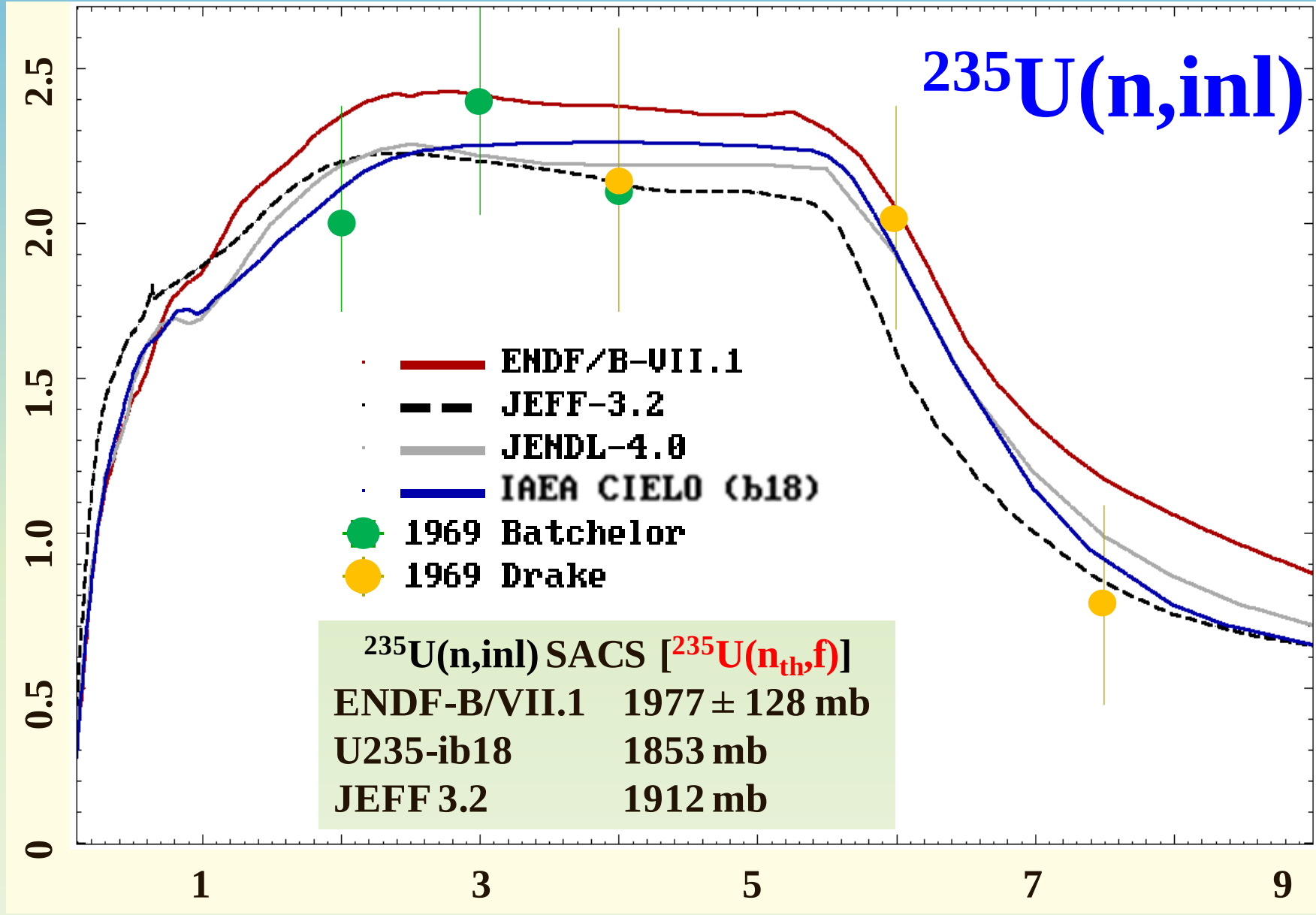

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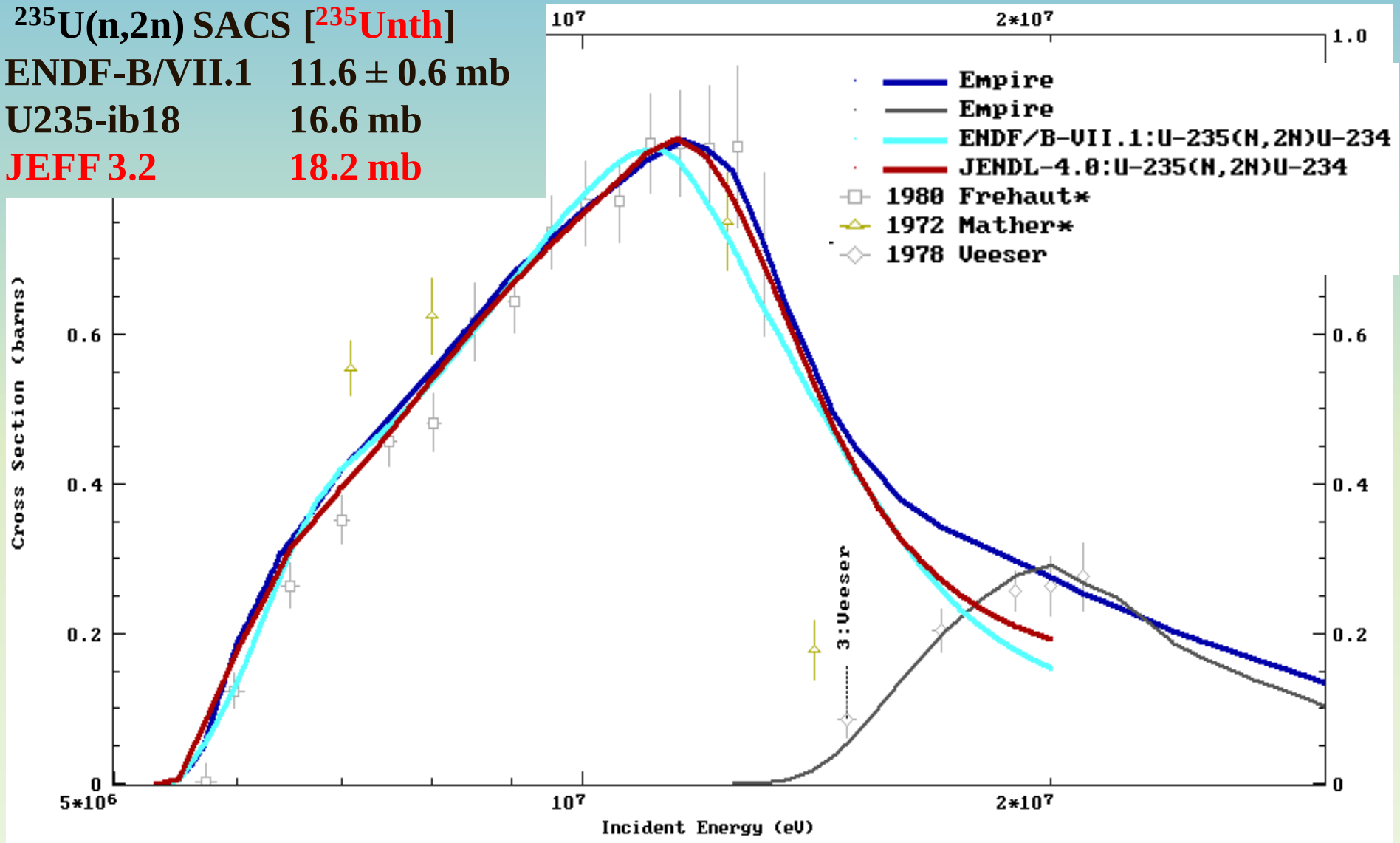
σ(n,2n), σ(n,3n) vs ENDF/B-VII.1

^{235}U(n,2n) SACS [^{235}Unth]	
ENDF-B/VII.1	11.6 ± 0.6 mb
U235-ib18	16.6 mb
JEFF 3.2	18.2 mb



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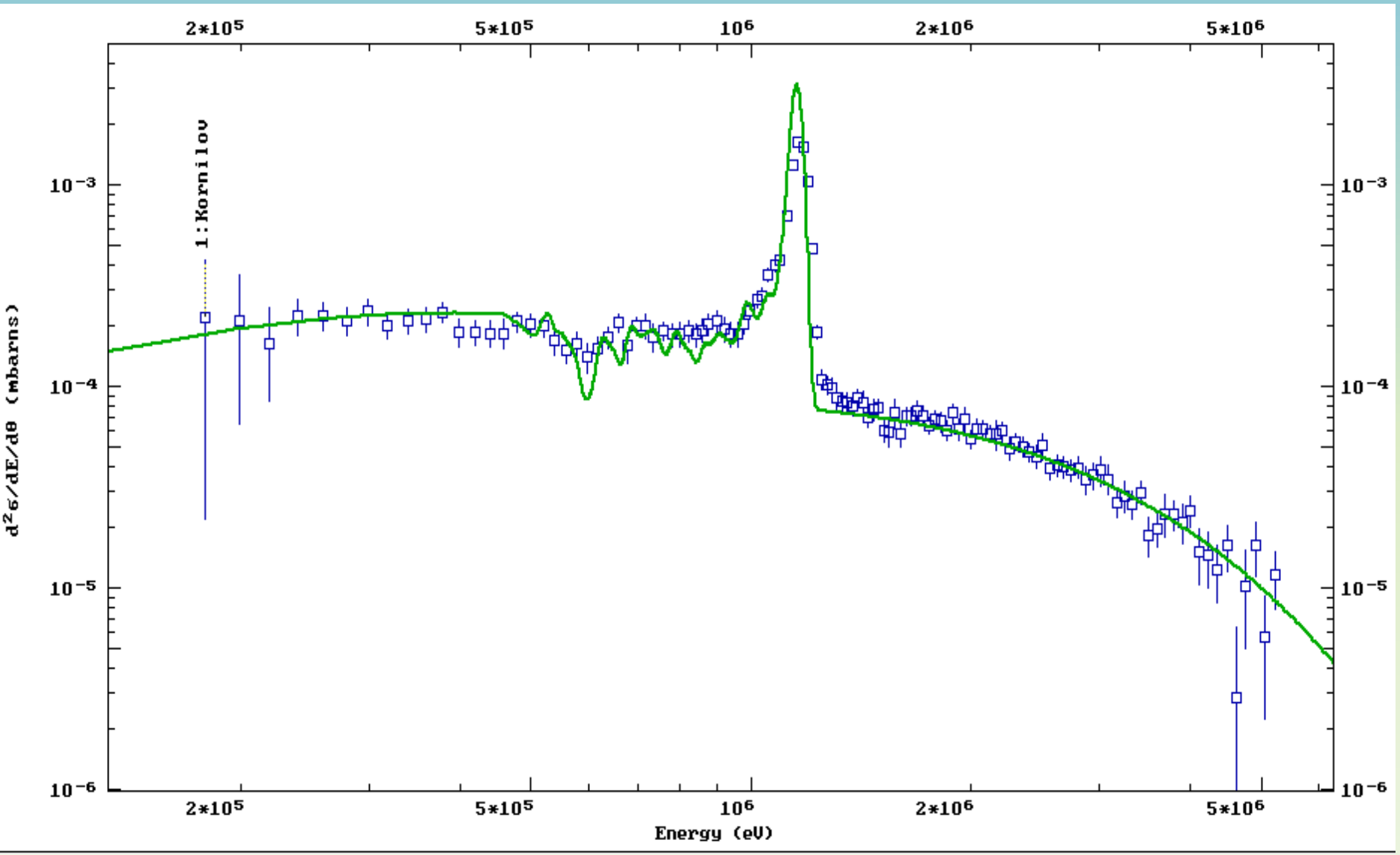
^{235}U+n, DDX yield, E_n=1.19 MeV, 120 deg



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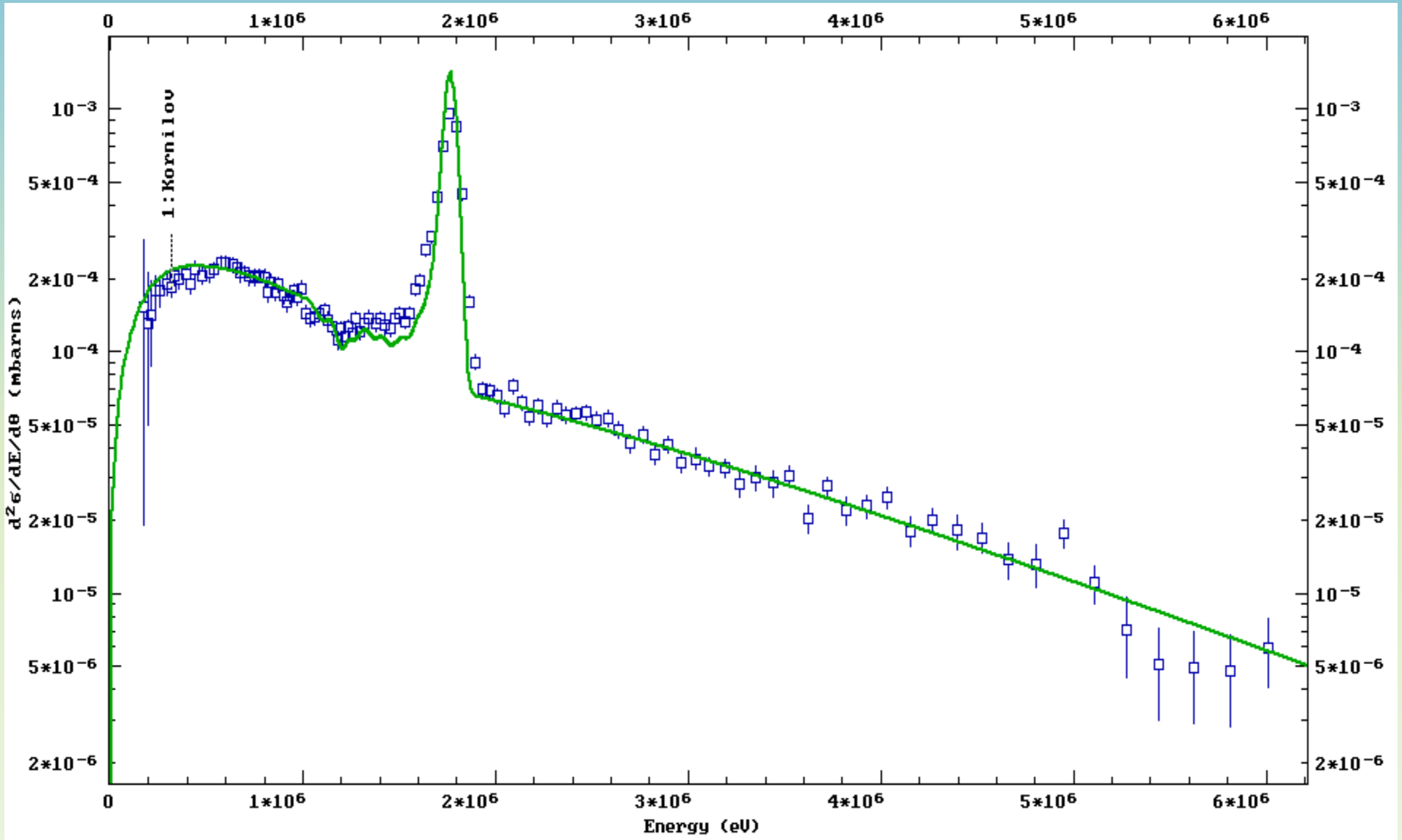
^{235}U+n, DDX yield, E_n=1.79 MeV, 120 deg



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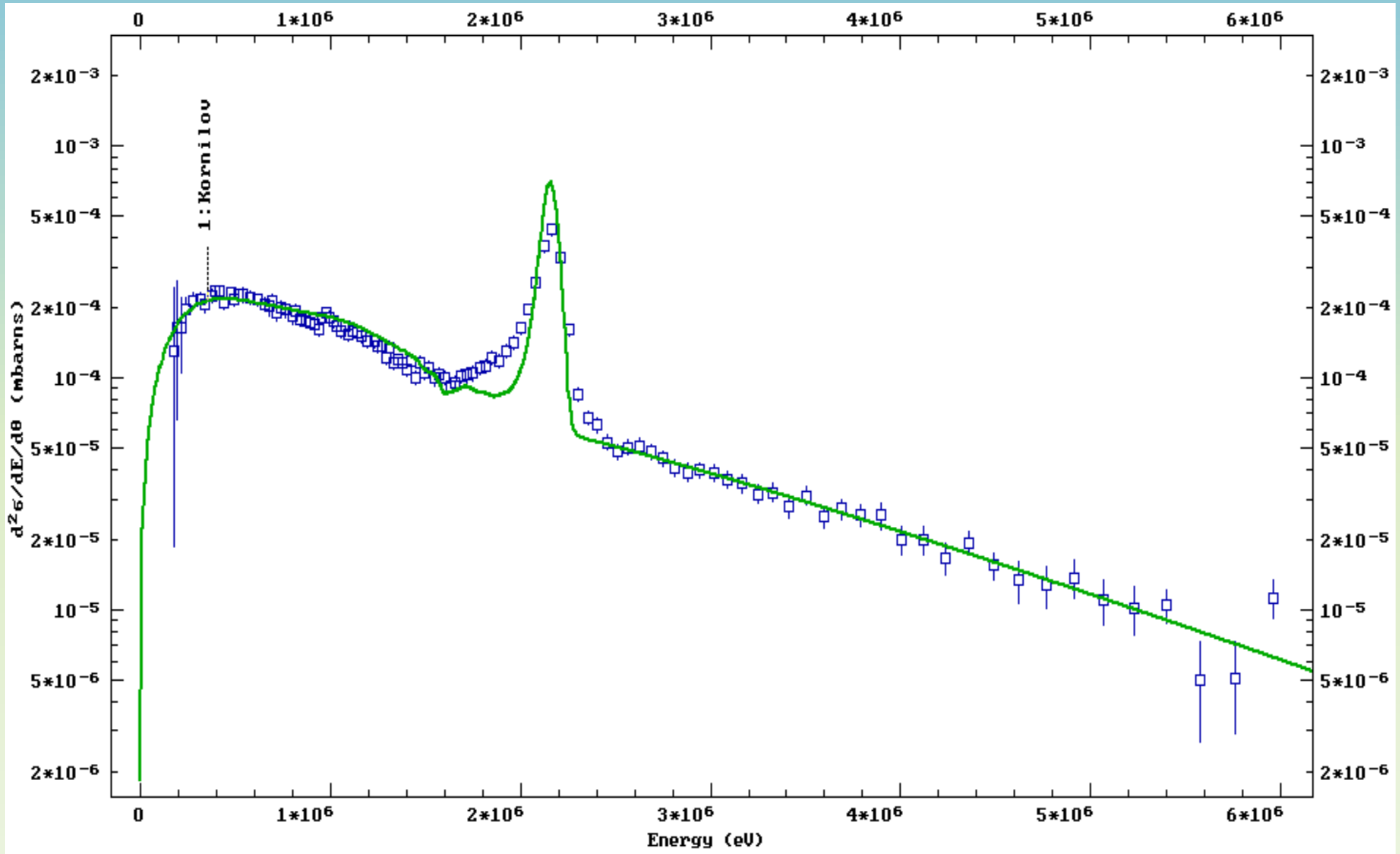
^{235}U+n, DDX yield, E_n=2.19 MeV, 120 deg



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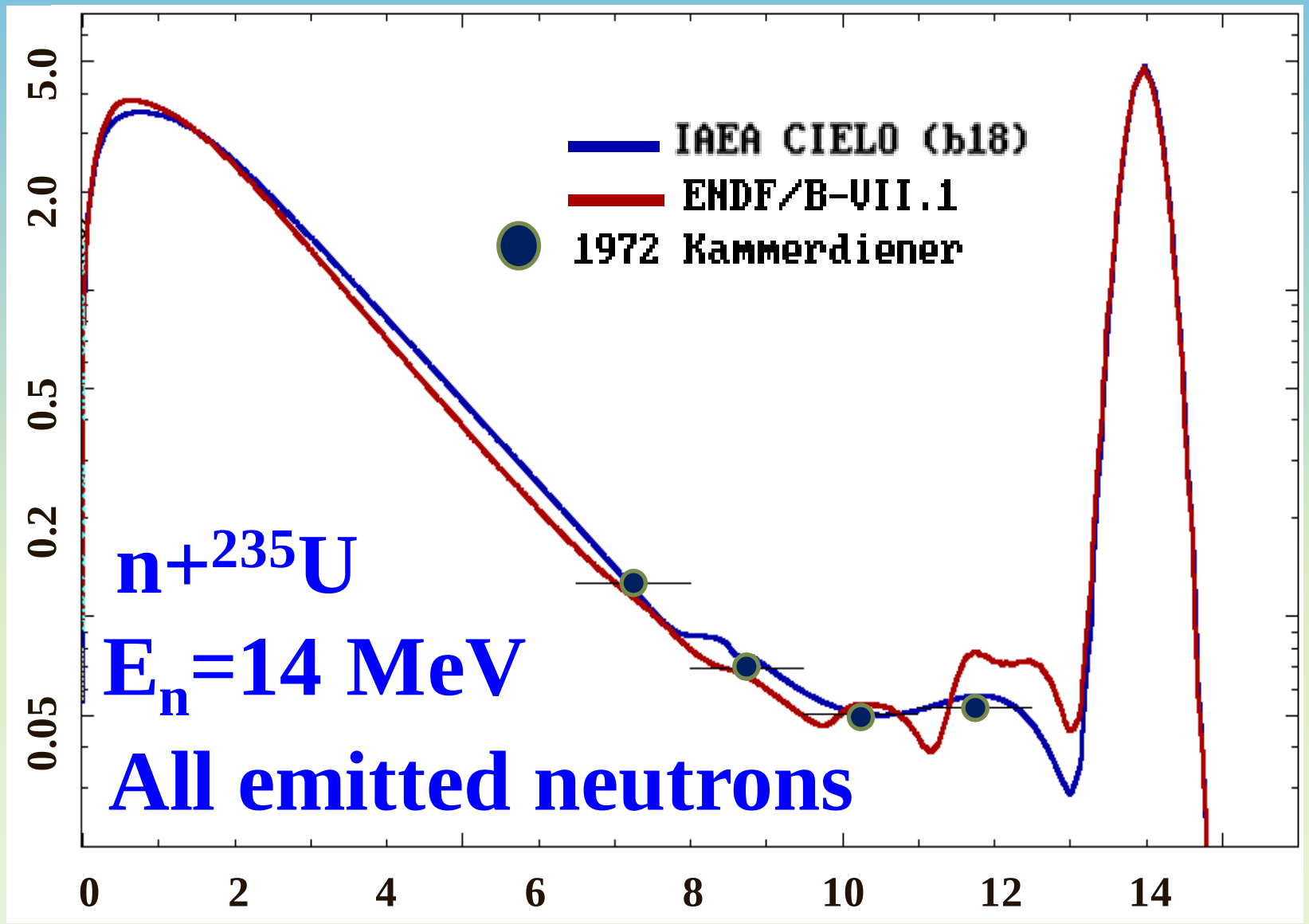

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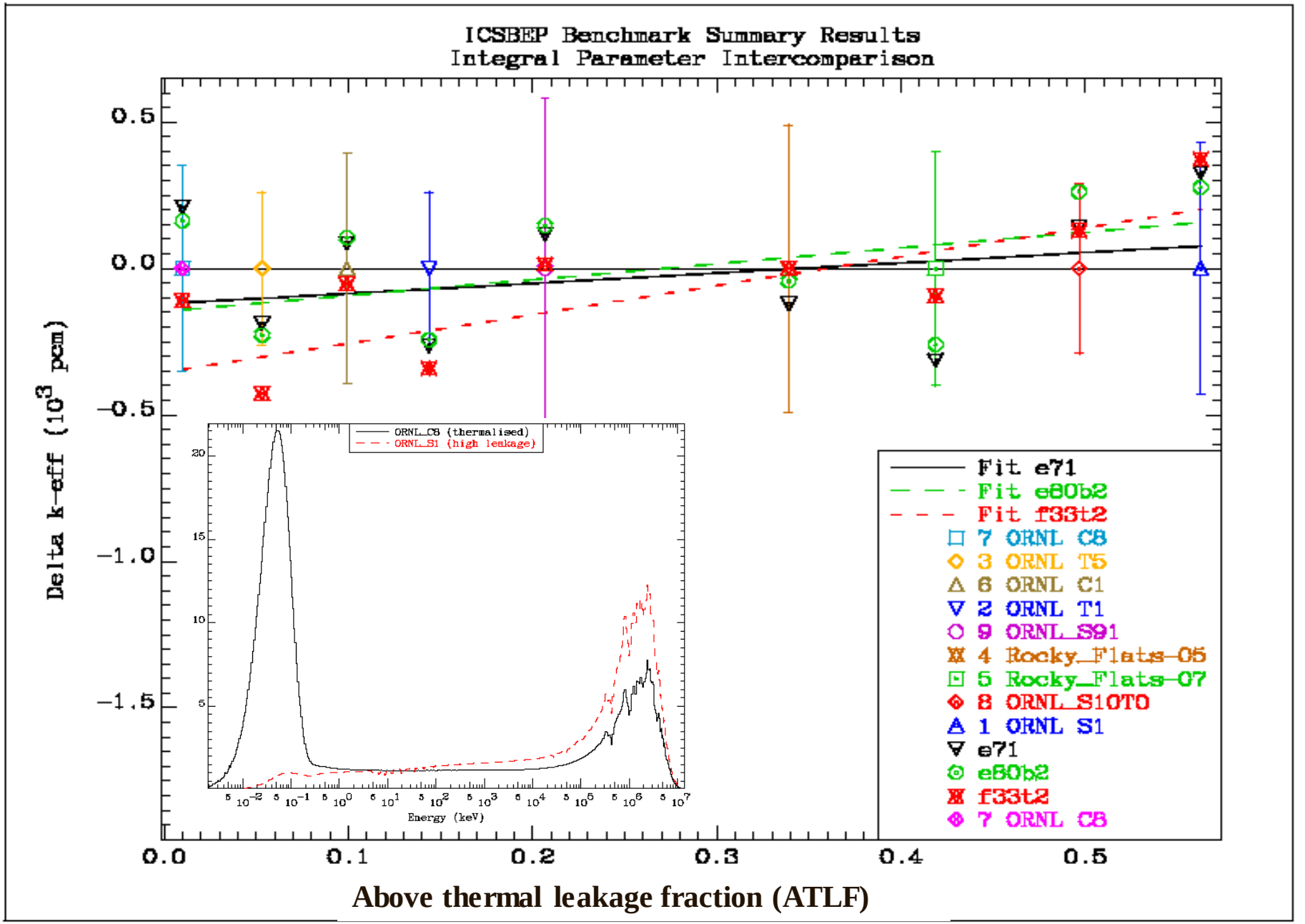

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Conclusions: ^{235}U fast region

Better physics
+ diff. & int. exper. ➡ **improved performance**

- New fast evaluation with **fission cross sections (3H) consistent with IAEA standard** leading to elastic/inelastic and (n,xn) **consistent** changes
- PFNS thermal from IAEA CRP, Standards

  E_{av}=2.00±0.01 MeV
- PFNS fast adopted from Rising et al. evaluation
- Fission in fast region from **Neutron Standards**

(a non-model Bayesian evaluation based on EXP. DATA)

- Capture in fast region updated using Jandel et al. data

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