CIELO U-238 evaluation (RR+fast)

R.Capote, A.Trkov, M.Sin, M.W.Herman, V.G.Pronyaev, E.Sh.Soukhovitskii, P. Schillebeeckx, I.Sirakov, S.Kopecky, D.Bernard, G.Noguere, A. Daskalakis, Y.Danon

Mini-CSWEG, 11-12 April 2016
LANL, Los Alamos, USA

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$n + {}^{238}$U resonance region

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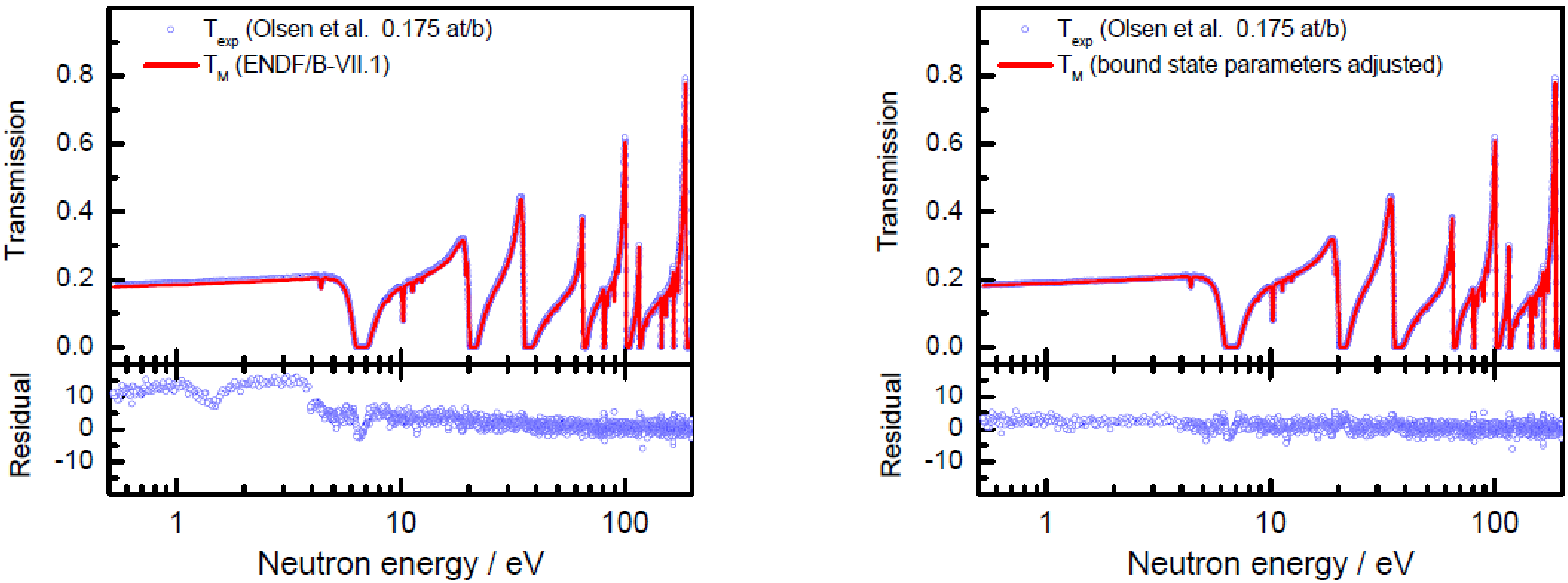
Neutron capture cross section measurements for ^{238}U in the resonance region at GELINA

H. I. Kim[1,2], C. Paradela[3], I. Sirakov[4], B. Becker[3], R. Capote[5], F. Gunsing[6], G.N. Kim[2], S. Kopecky[3], C. Lampoudis[6], Y.-O. Lee[1], R. Massarczyk[7], A. Moens[3], M. Moxon[8], V. G. Pronyaev[9], P. Schillebeeckx [a3], and R.Wynants[3]

Unpublished, submitted to EPJ 2016



Bound states correction

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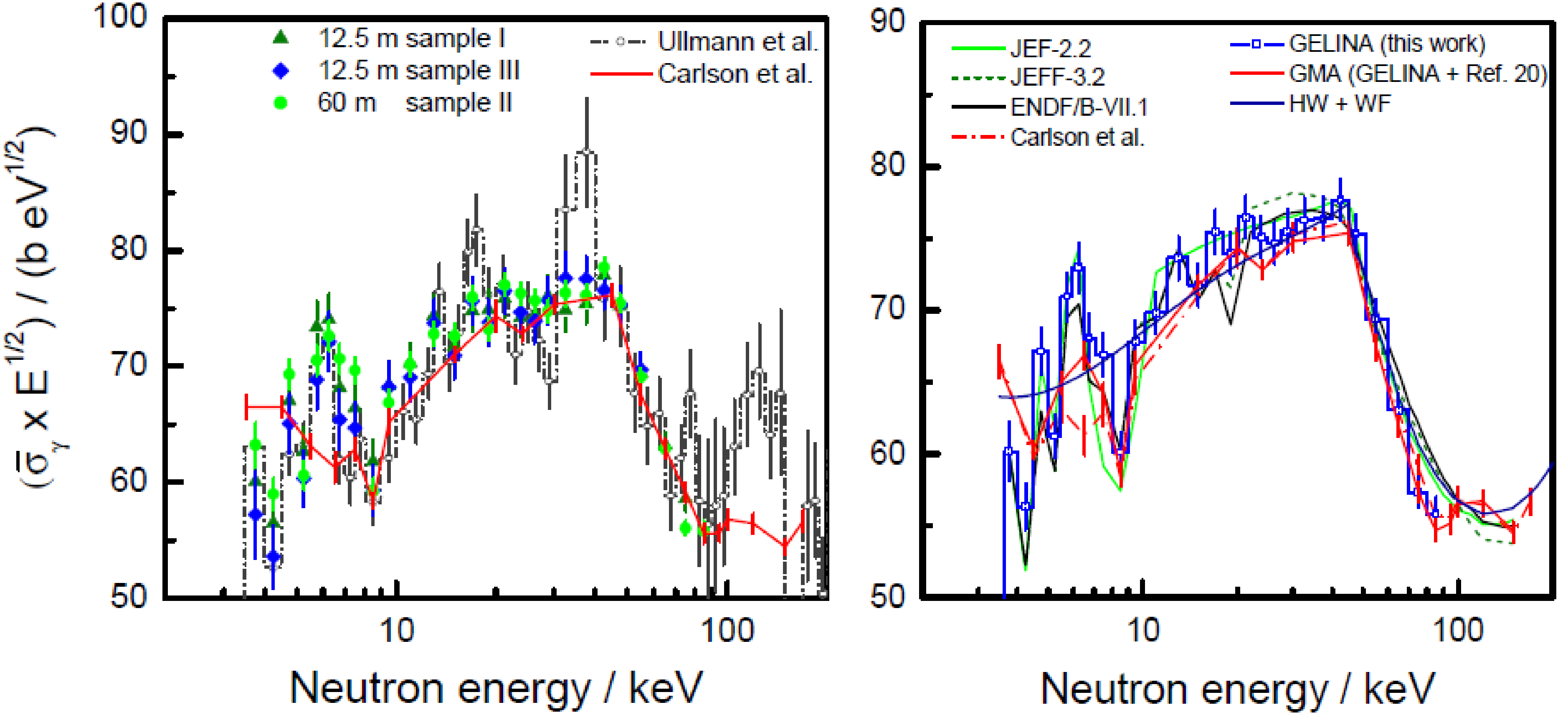

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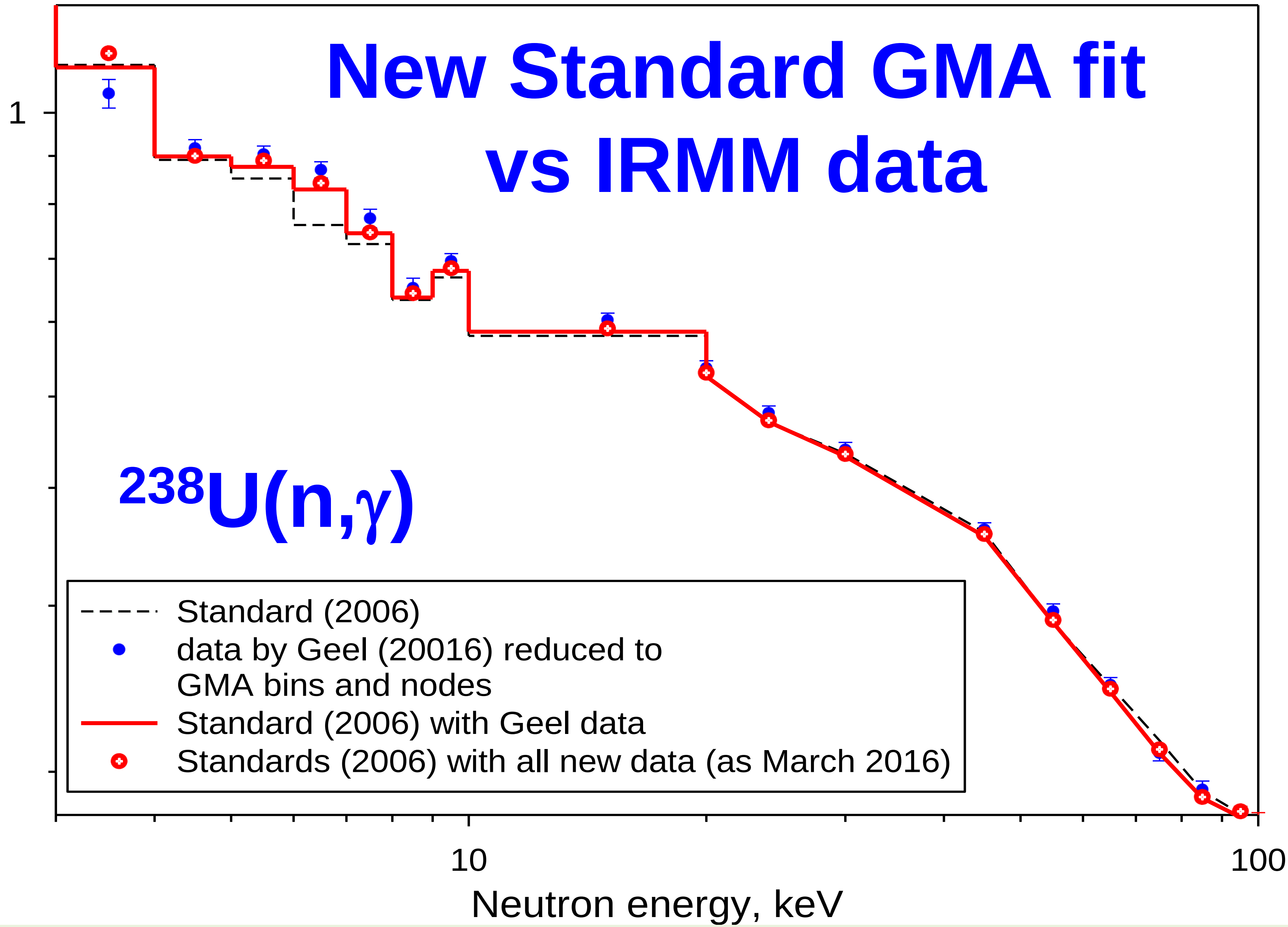

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New Standard GMA fit ^{238}U(n,g),^{197}Au(n,g) vs Wallner AMS

^{238}U(n,g)

kT=25 keV
Wallner: 0.391± 0.017 b (4.3%)
GMA: 0.3939 b (+0.74%)

kT=426 keV
A. Wallner: 0.108±0.004 b (3.7%)
GMA: 0.1078 b (-0.2%)

^{238}U(n,g)/^{197}Au(n,g)

kT=25 keV
Wallner: 0.620±0.023 (3.7%)
GMA: 0.6276 (+1.2%)

kT=426 keV
Wallner: 0.687±0.022 (3.2%)
GMA: 0.6853 (-0.25%)

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n + ^{238}U fast region (E_n>150 keV)

- *(n,f) and (n,γ) from 2006 Neutron Standards* ***(to be updated with new GMA Standard fit)***
- ***PFNS adopted from Talou-Rising analysis***
- ***(n,2n) feedback from CEA Cadarache and TUNL new data (Krishichayan et al)***

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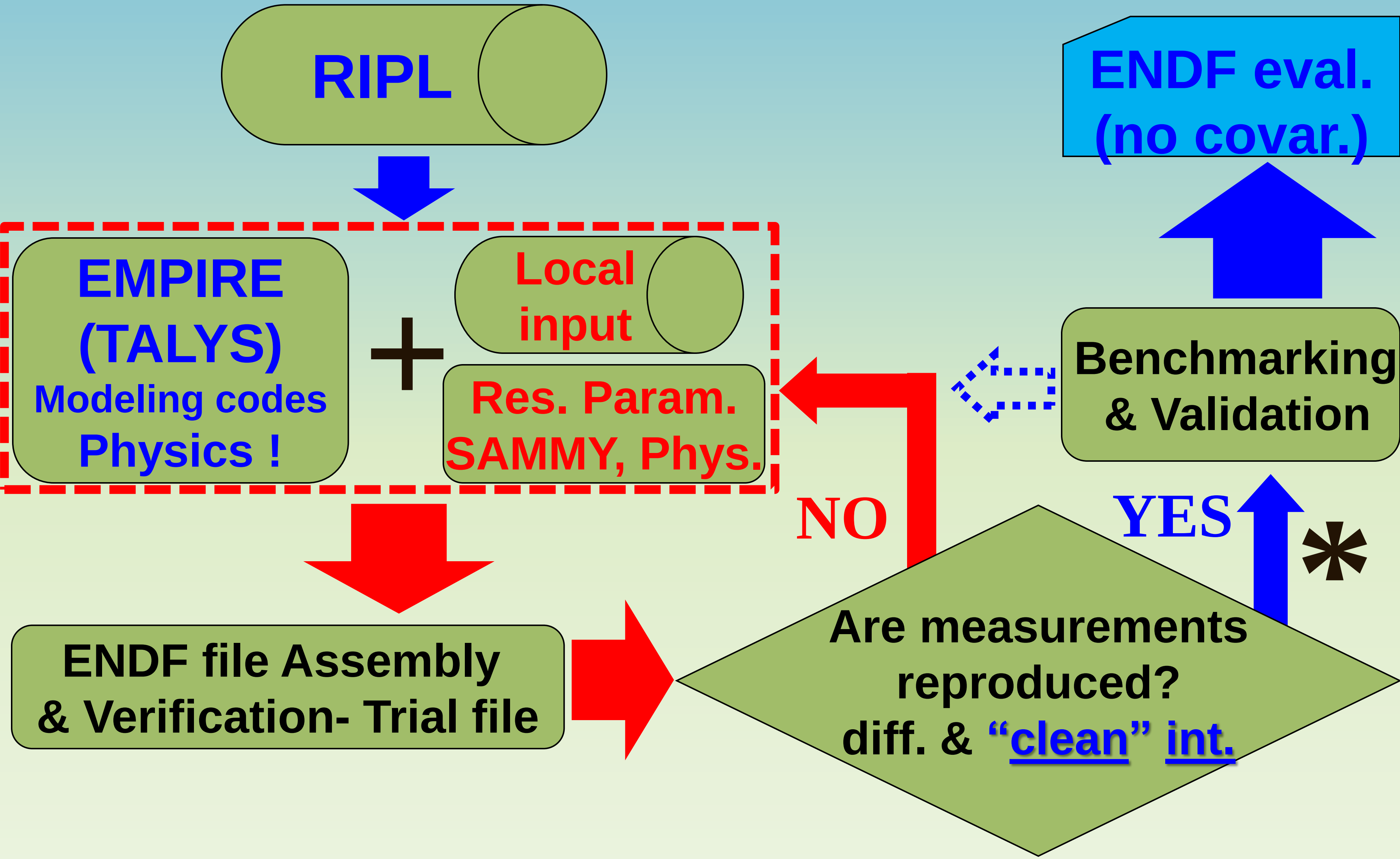
IAEA evaluation process (no covar.)



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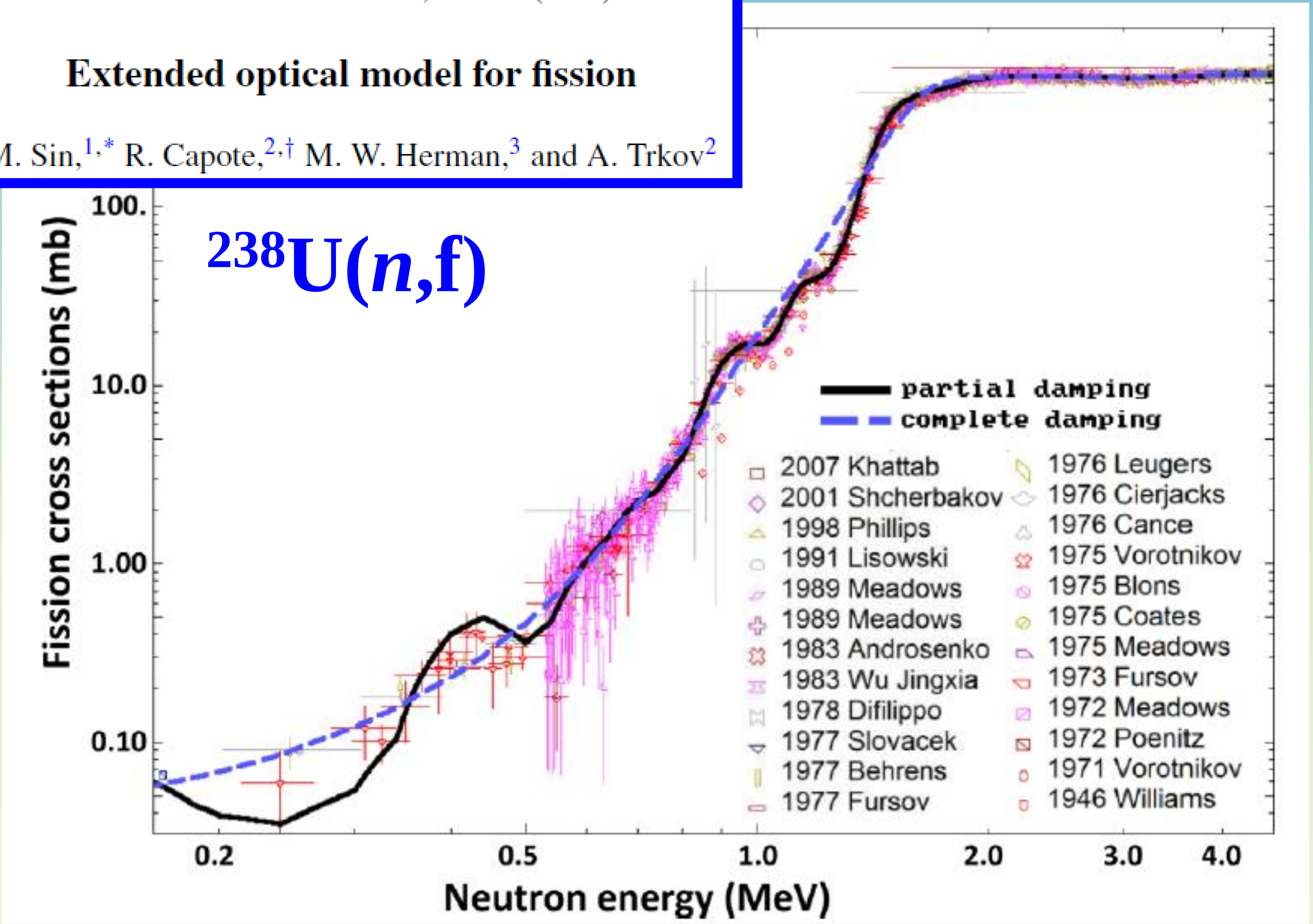
PHYSICAL REVIEW C 93, 034605 (2016)

Extended optical model for fission

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



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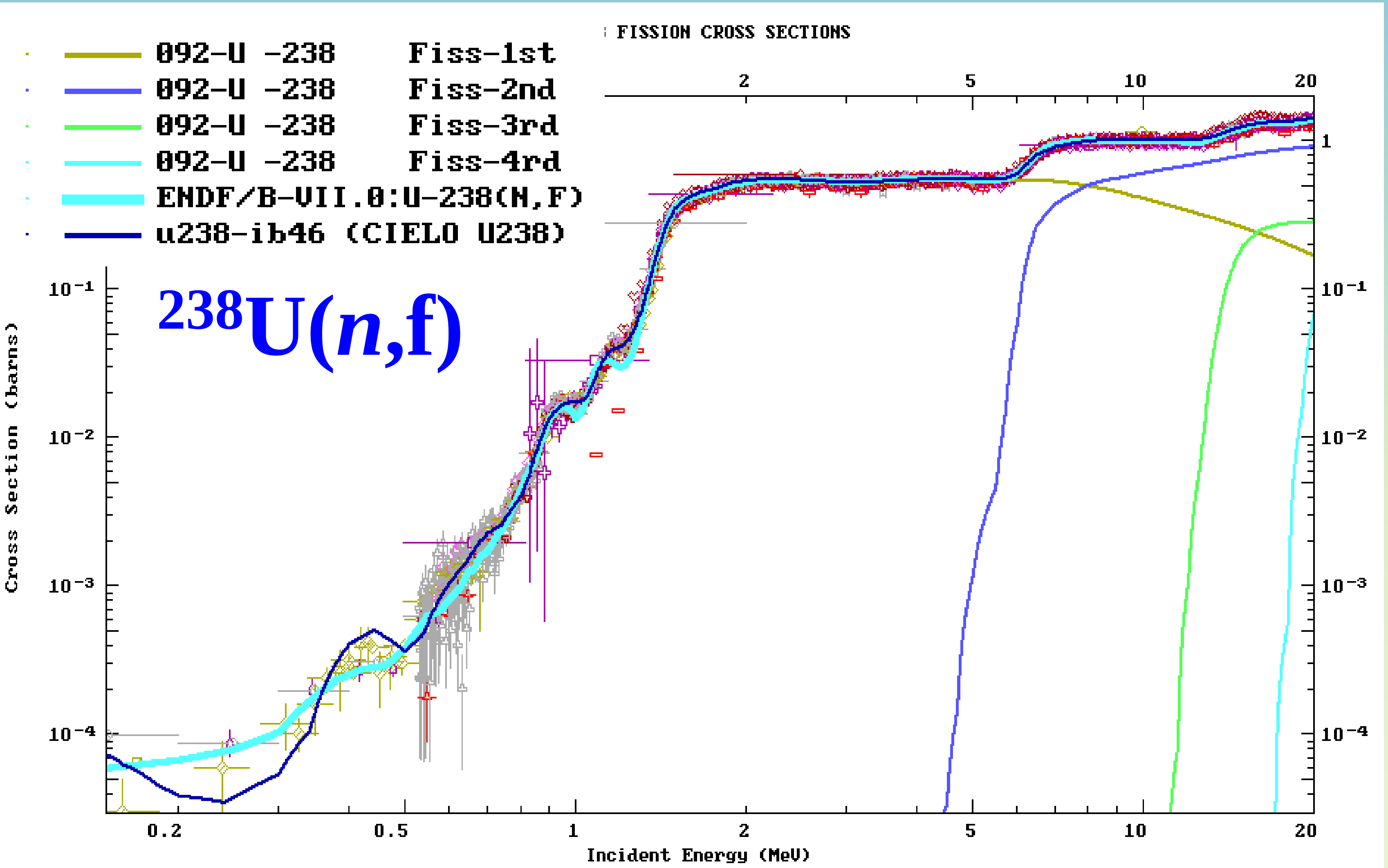
Empire ^{238}U(n,f) vs ENDF/B-VII.1



^{238}U(n,f) - ib46 = ENDF-B/VII.1=STD

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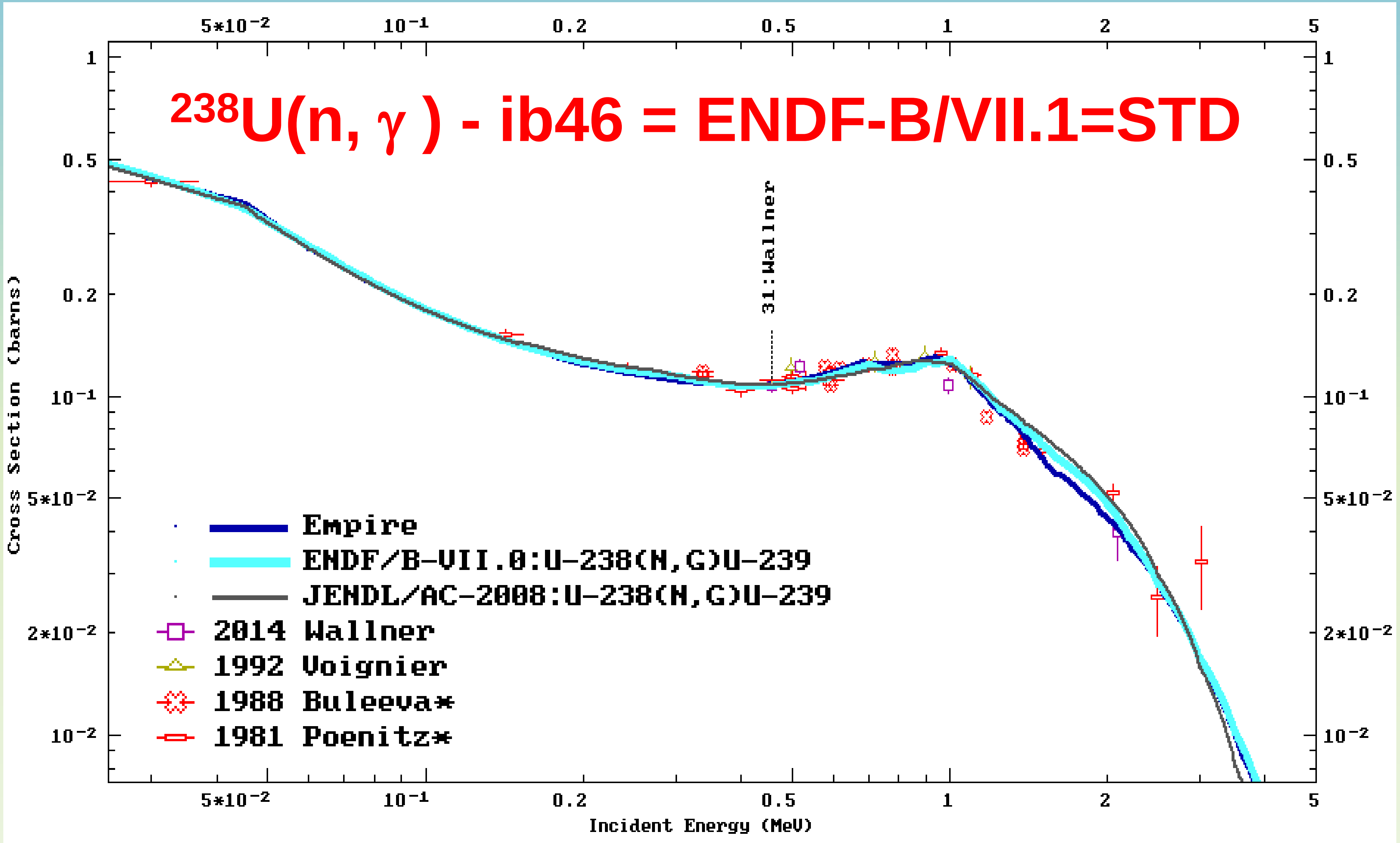
Empire $^{238}U(n,\gamma)$ vs ENDF/B-VII.1



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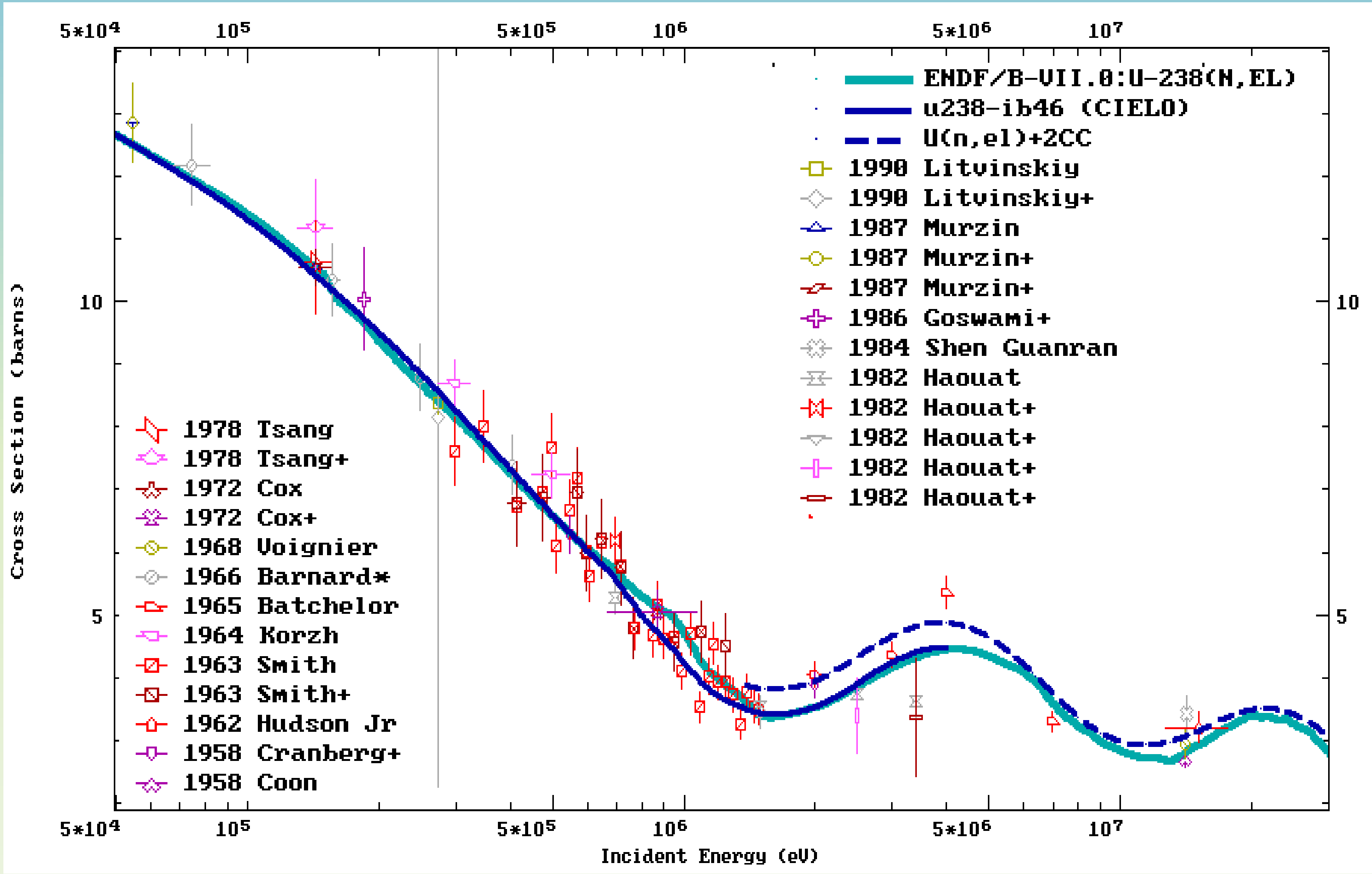
$^{238}U(n,el)$, $^{238}U(n,sct)$ el+2 inel



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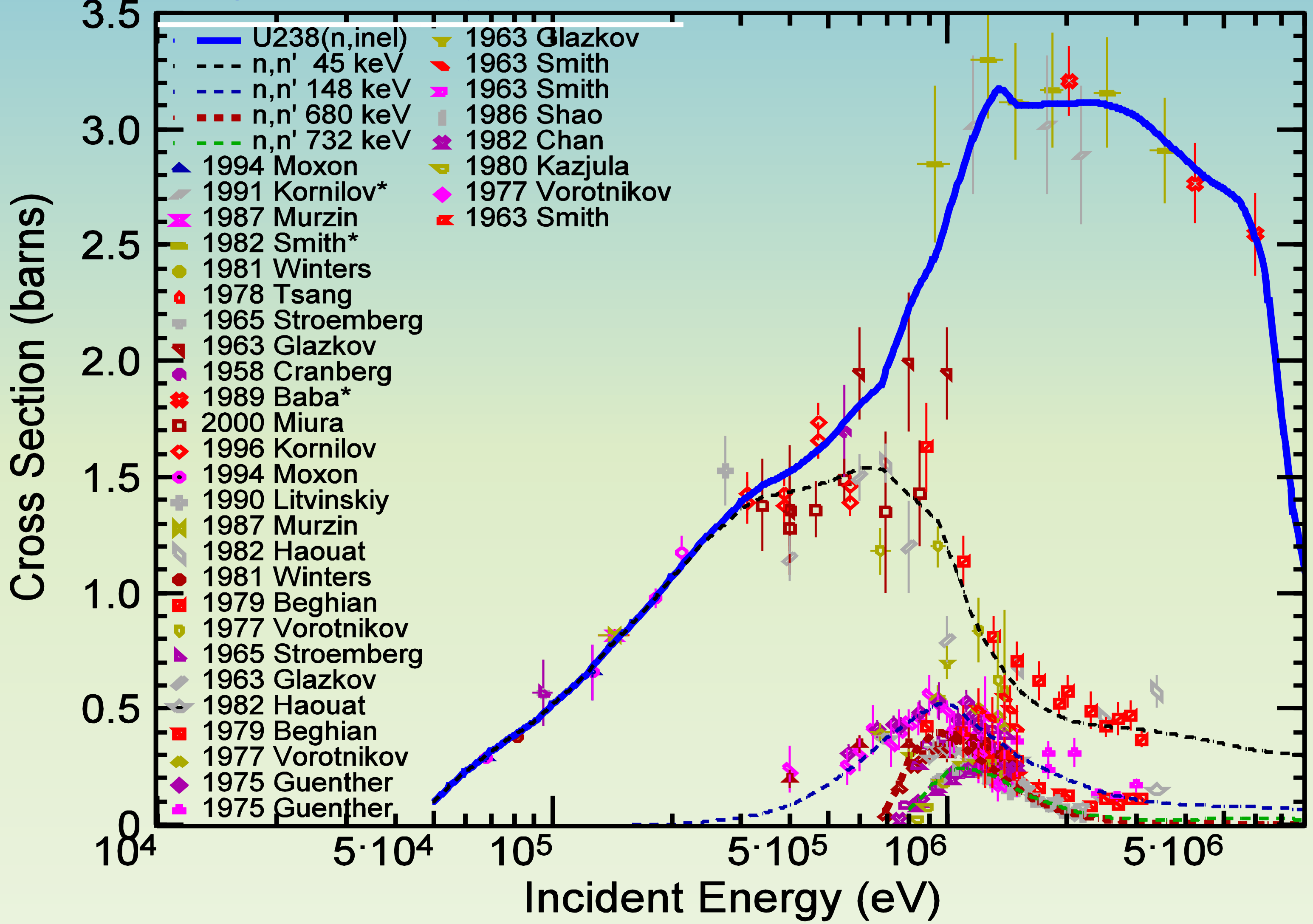
σ_{in}(tot), σ_{in} (2^+), σ_{in} (4^+) , σ_{in} (1^-) , σ_{in} (3^-)...

R. C., M. Sin, A. Trkov, M. W. Herman, D. Bernard, G. Noguere, A. Daskalakis, and Y. Danon.
NEMEA-7 proceedings, NEA SG-40 (2014) "Evaluation of neutron induced reactions on ^{238}U nucleus"



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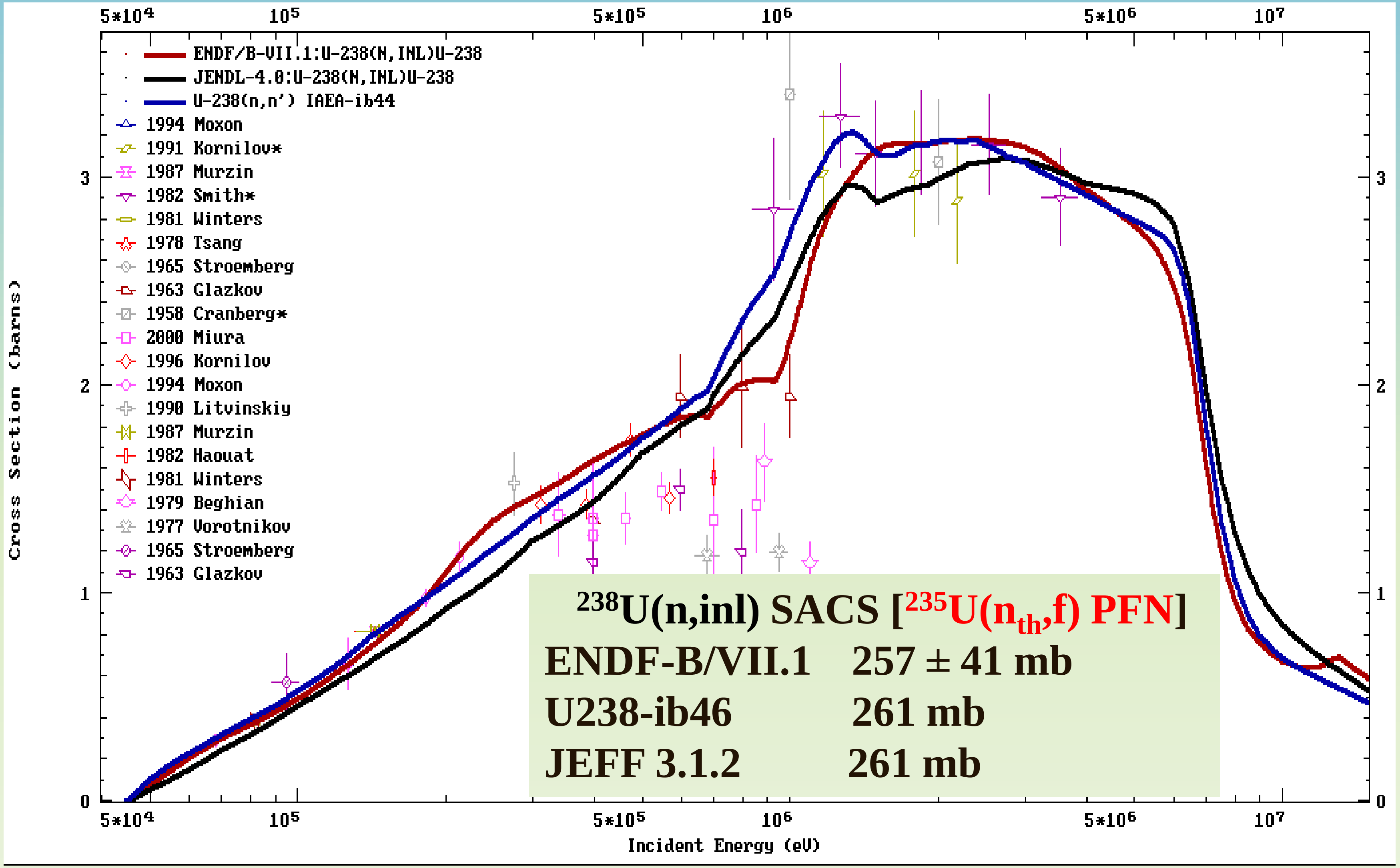
σ_{in}(tot), new physics: EW, 21-CC OMP



Special thanks to T. Kawano, S. Hilaire

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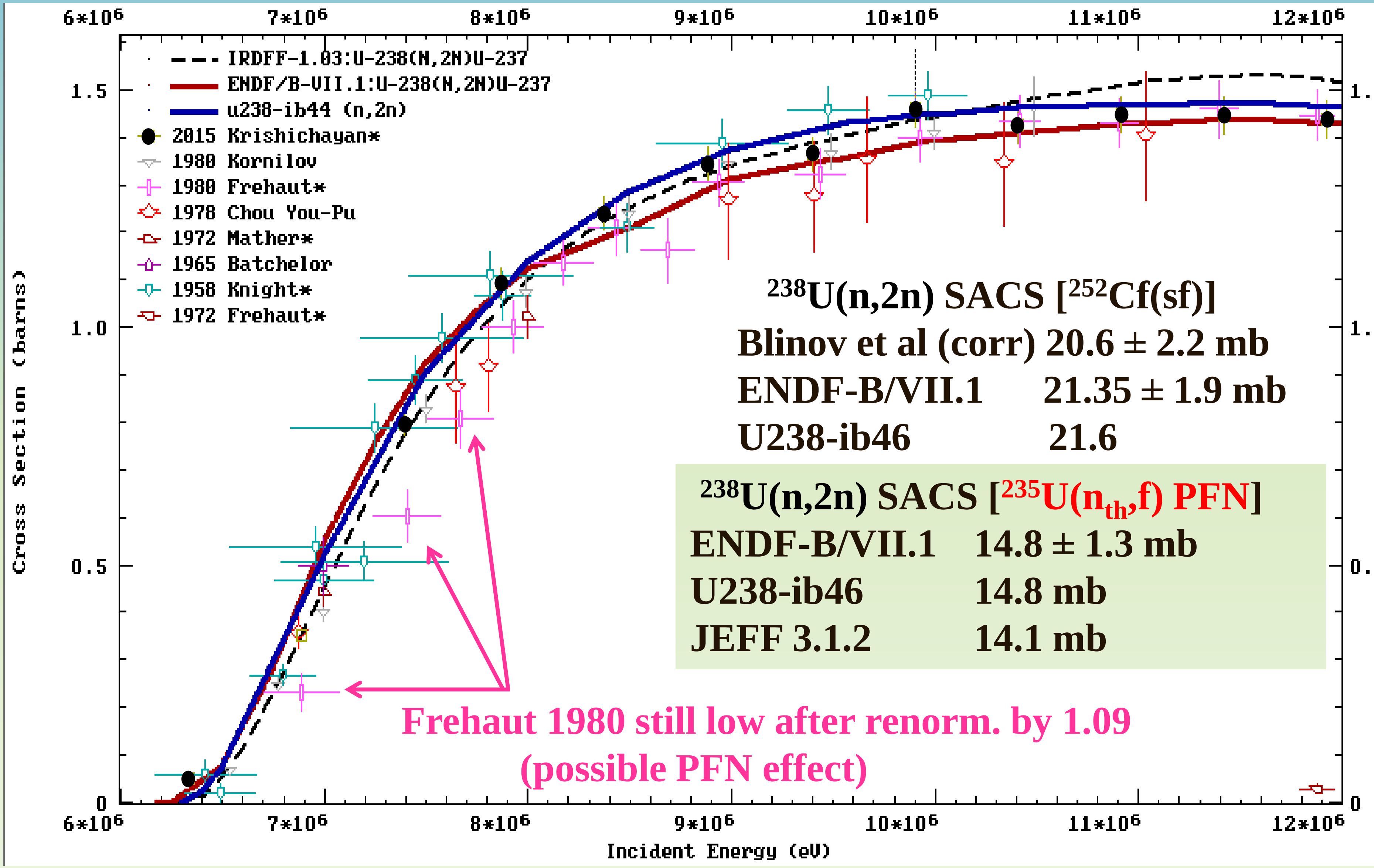
σ(n,2n) vs TUNL and SACS



^{238}U(n,2n) SACS [^{252}Cf(sf)]

Blinov et al (corr)	20.6 ± 2.2 mb
ENDF-B/VII.1	21.35 ± 1.9 mb
U238-ib46	21.6

^{238}U(n,2n) SACS [^{235}U(n_{th},f) PFN]

ENDF-B/VII.1	14.8 ± 1.3 mb
U238-ib46	14.8 mb
JEFF 3.1.2	14.1 mb

Frehaut 1980 still low after renorm. by 1.09
(possible PFN effect)

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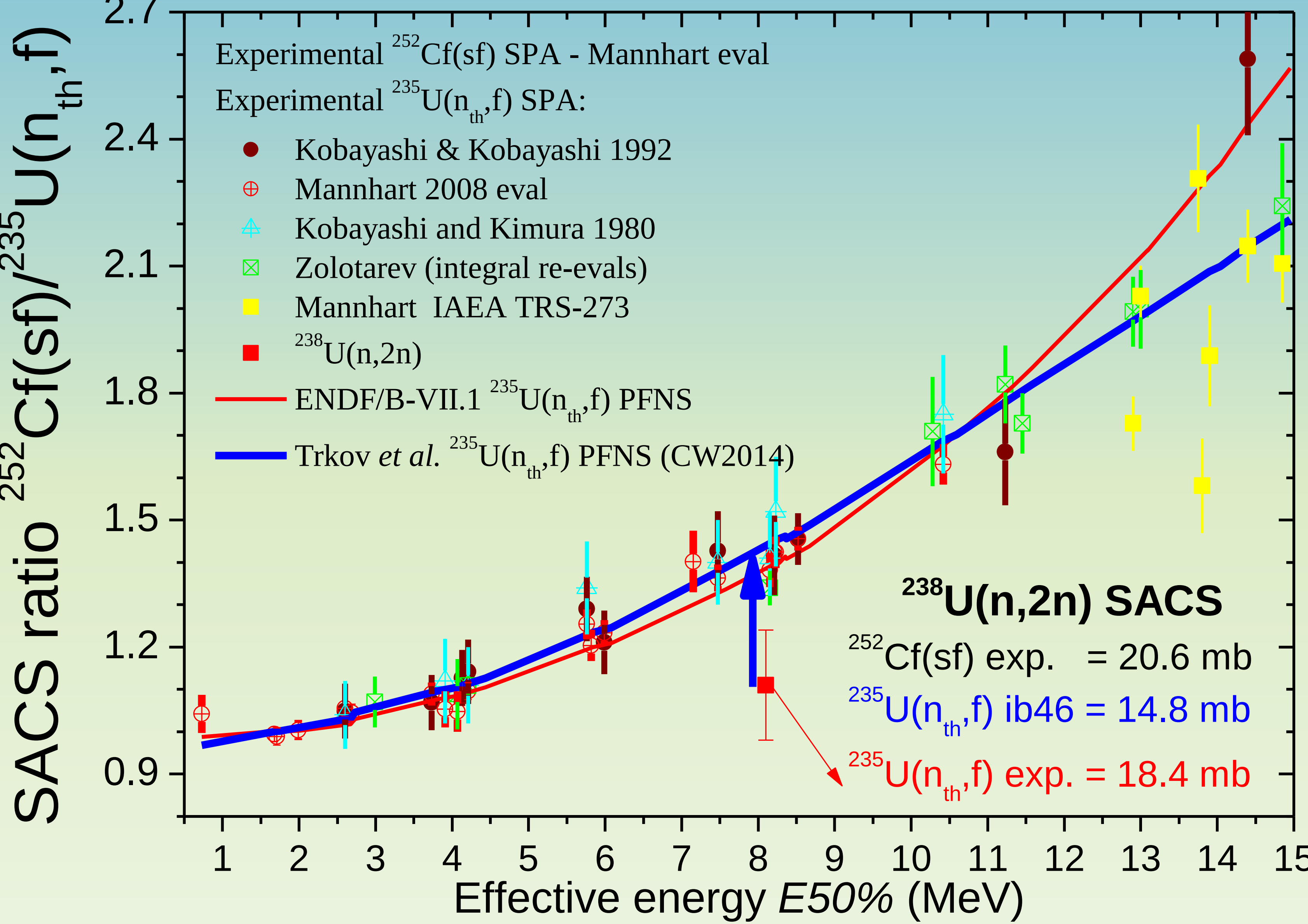
SACS(n,2n) confirmed by SACS ratio syst.



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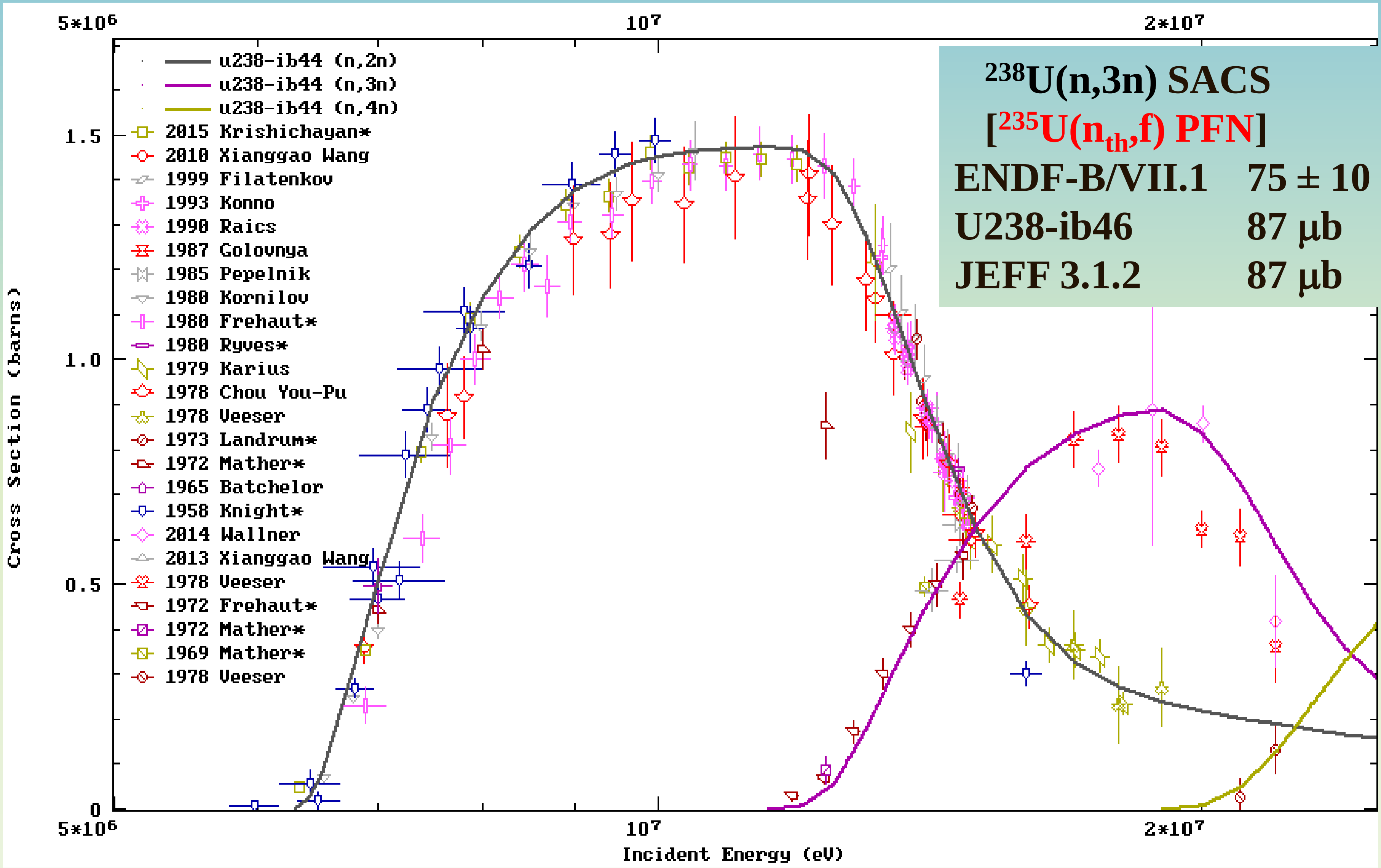
σ(n,2n), σ(n,3n), σ(n,4n)



^{238}U(n,3n) SACS

[^{235}U(n_{th},f) PFN]

ENDF-B/VII.1	75 ± 10 μb
U238-ib46	87 μb
JEFF 3.1.2	87 μb

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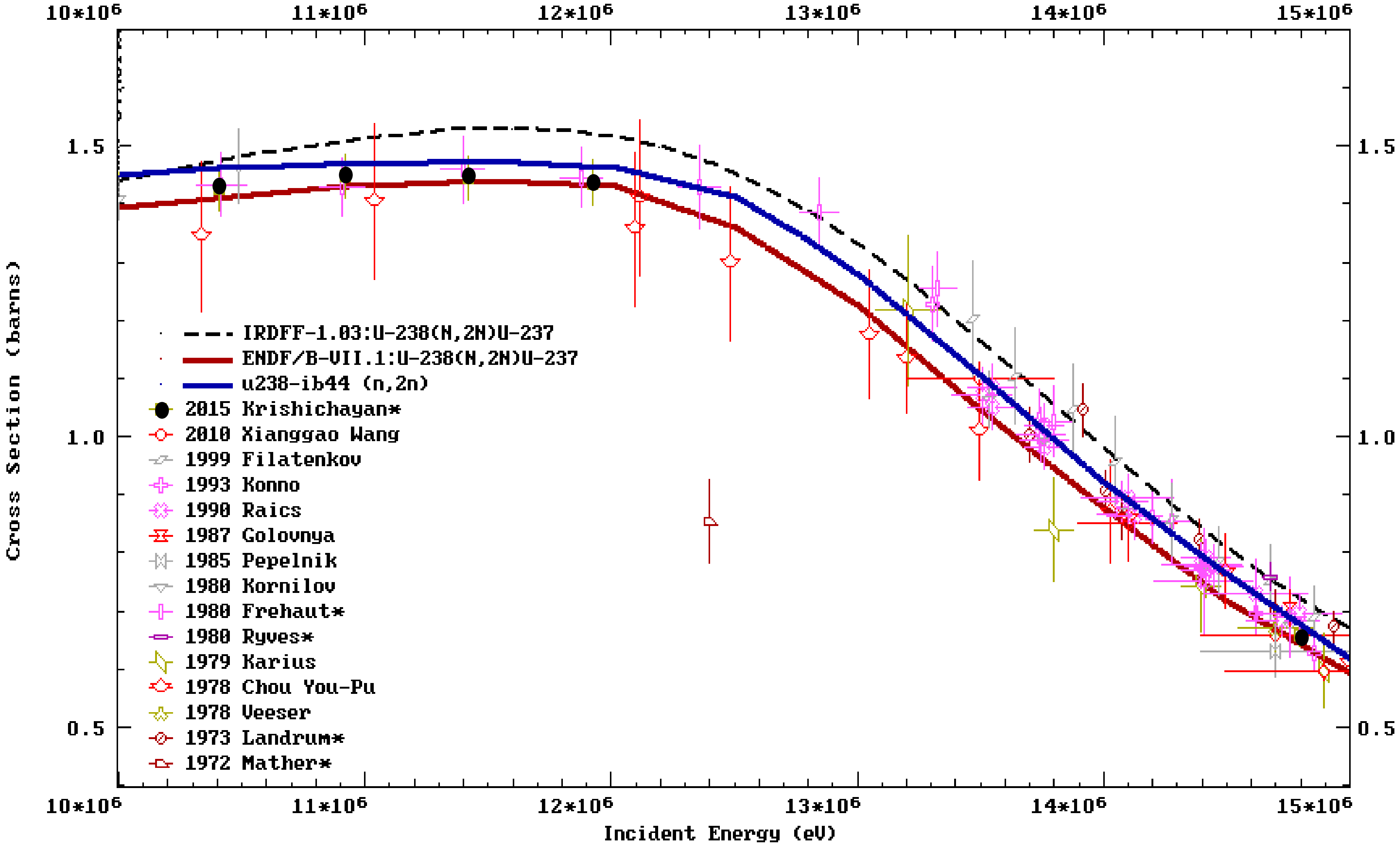
σ(n,2n) vs TUNL (above 10 MeV)



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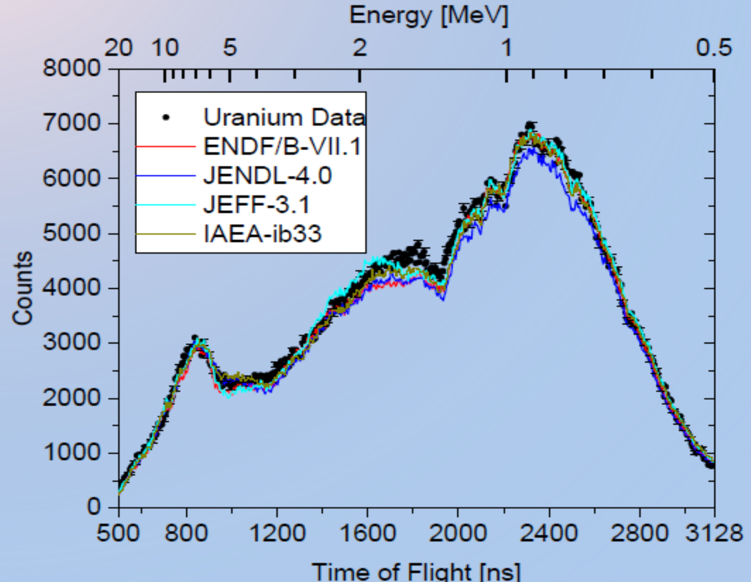
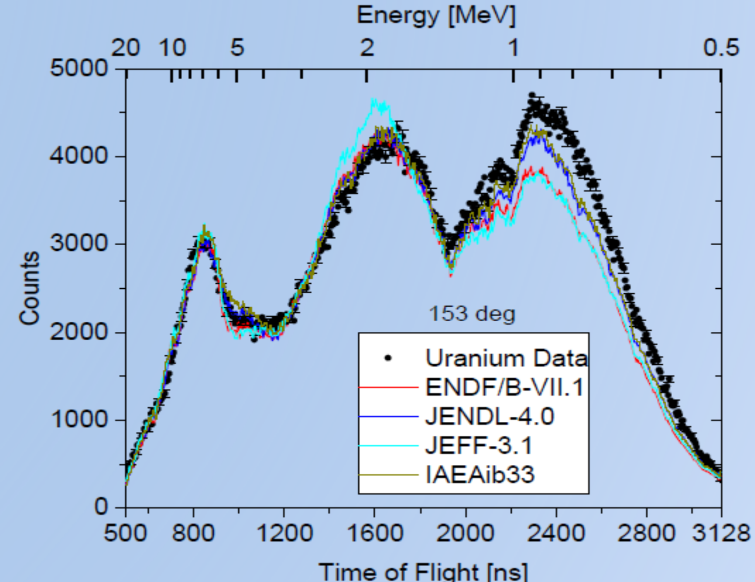
RPI exp. essential to define $d^2\sigma_{el}/dEd\Omega$

^{238}U Scattering Measurement





Library	FOM
ENDF/B-VII.1	3.8
JEFF-3.1	3.0
JENDL-4.0	5.5
IAEA-ib33	3.5

Library	FOM
ENDF/B-VII.1	18.8
JEFF-3.1	20.4
JENDL-4.0	7.7
IAEA-ib33	7.0

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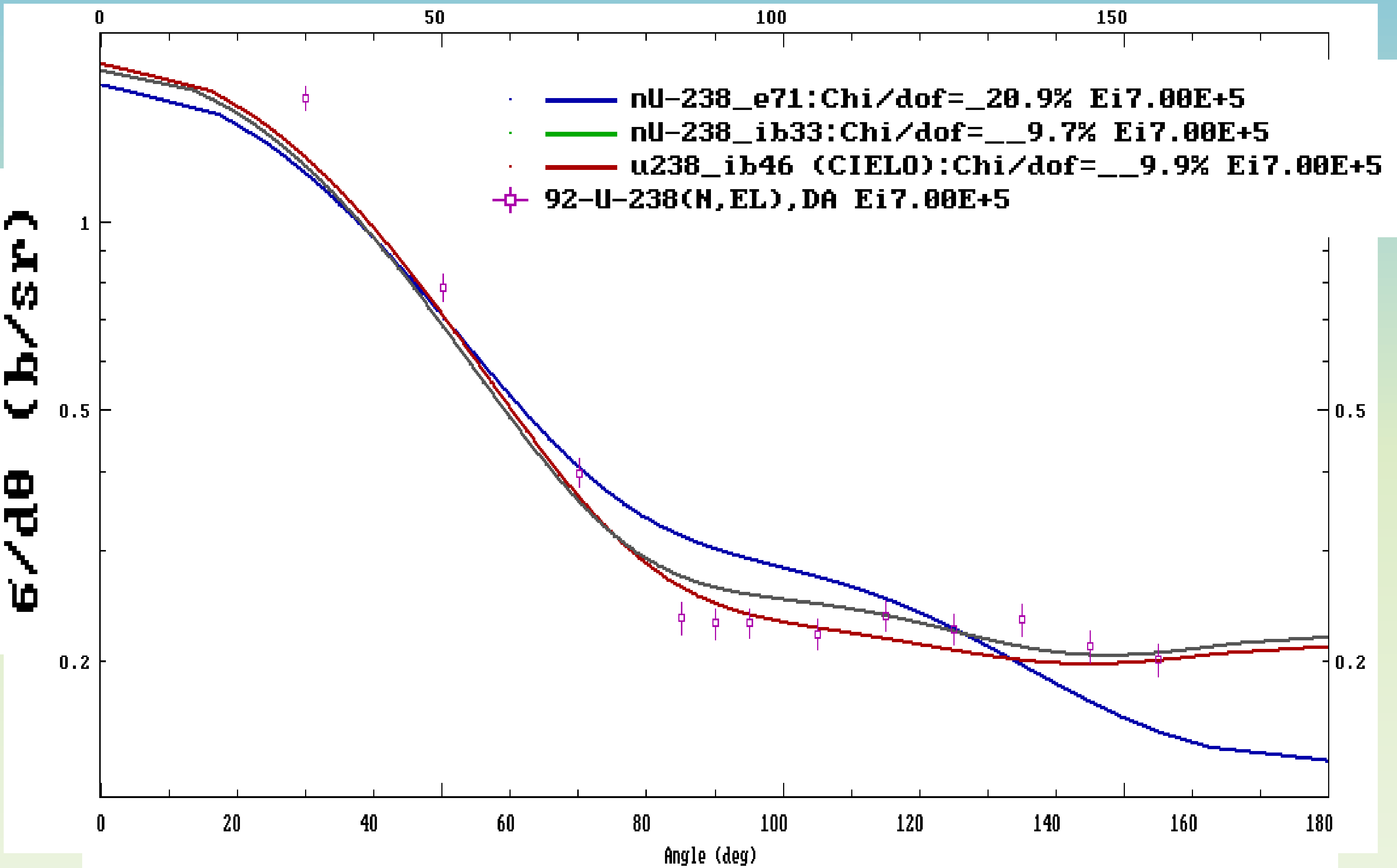
$^{238}U(n,el)$, E_n=700 keV, ang. distributions



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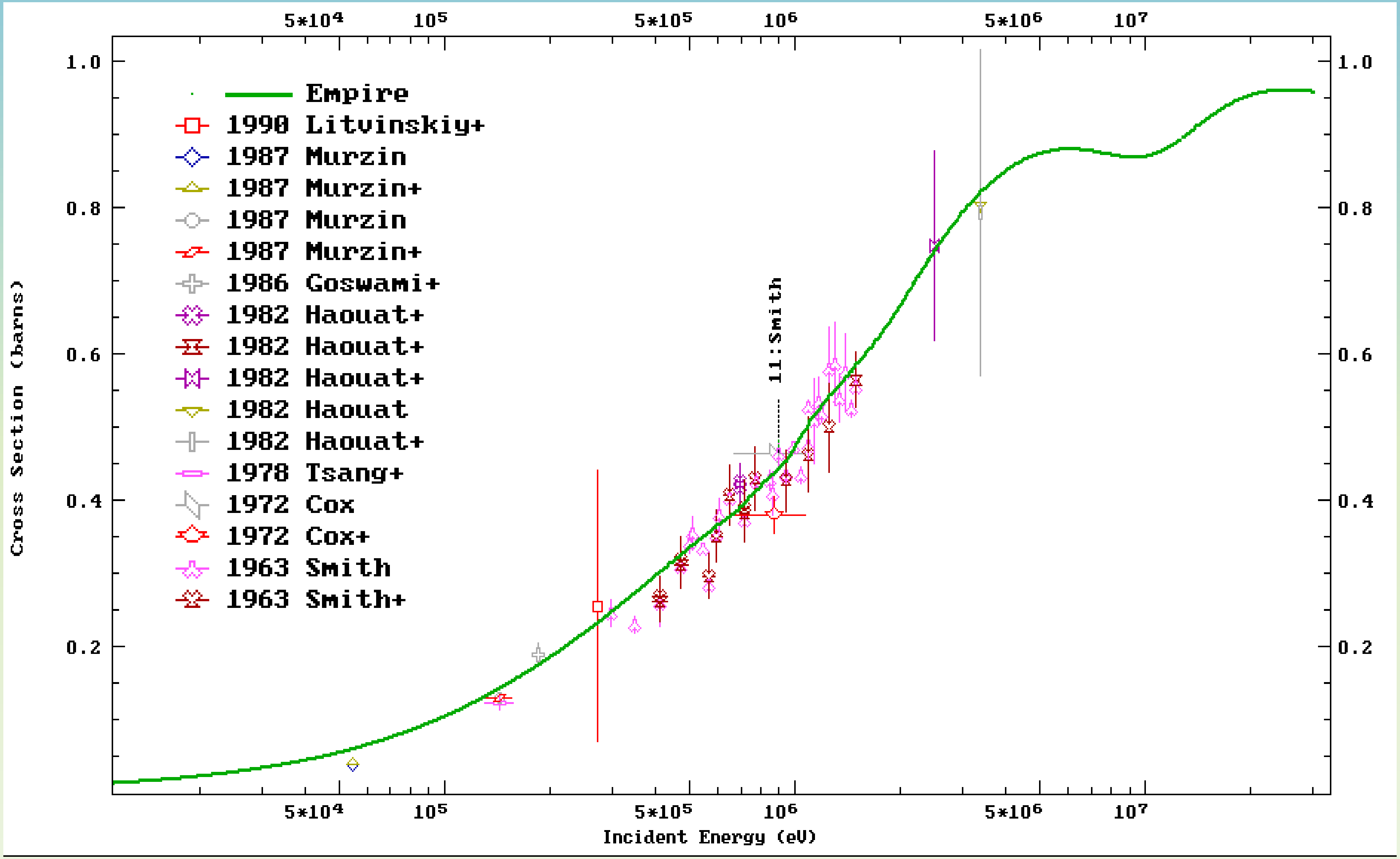
^{238}U elastic μ-bar



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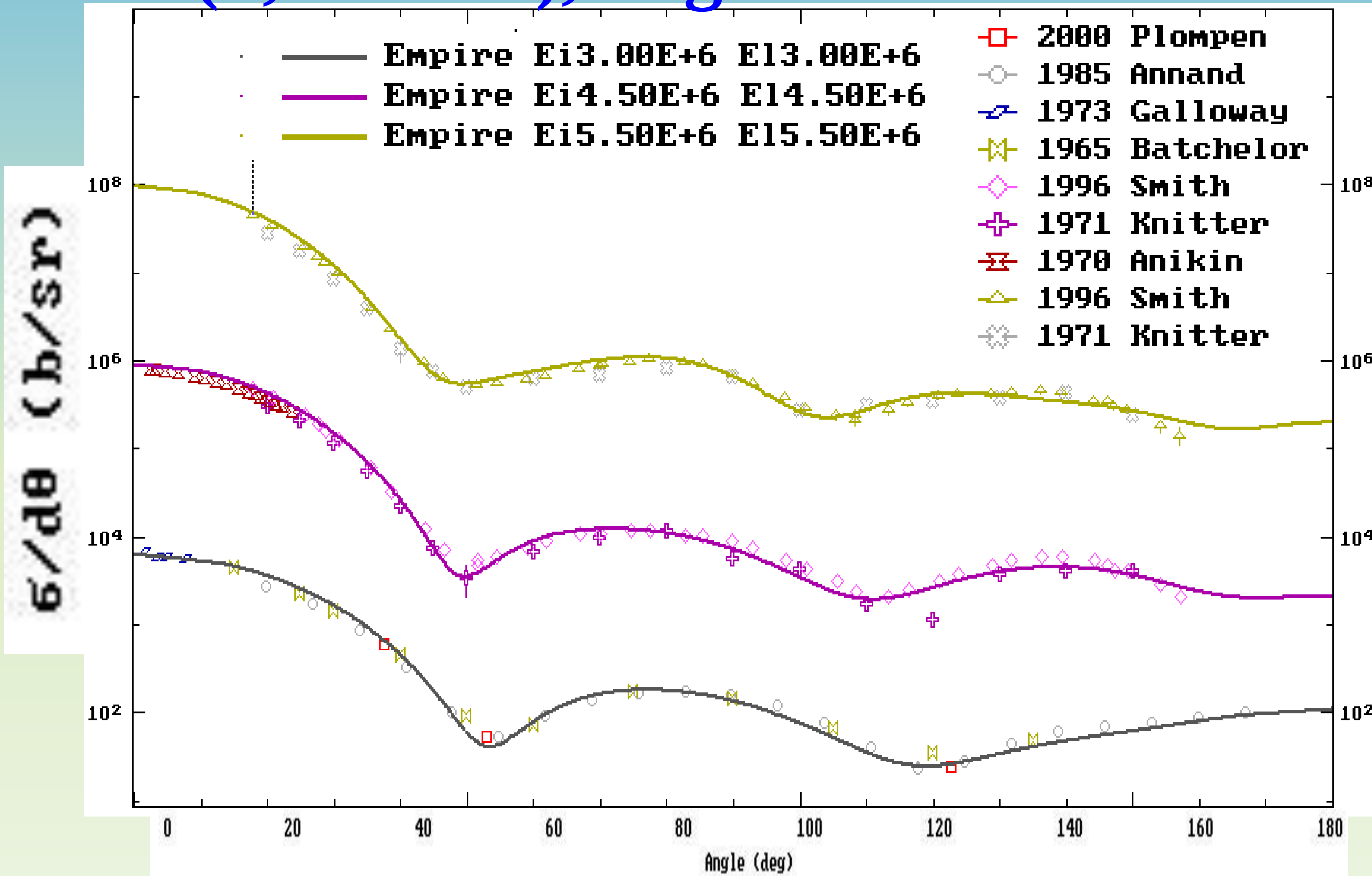
$^{238}U(n,el+2CC)$, angular distributions



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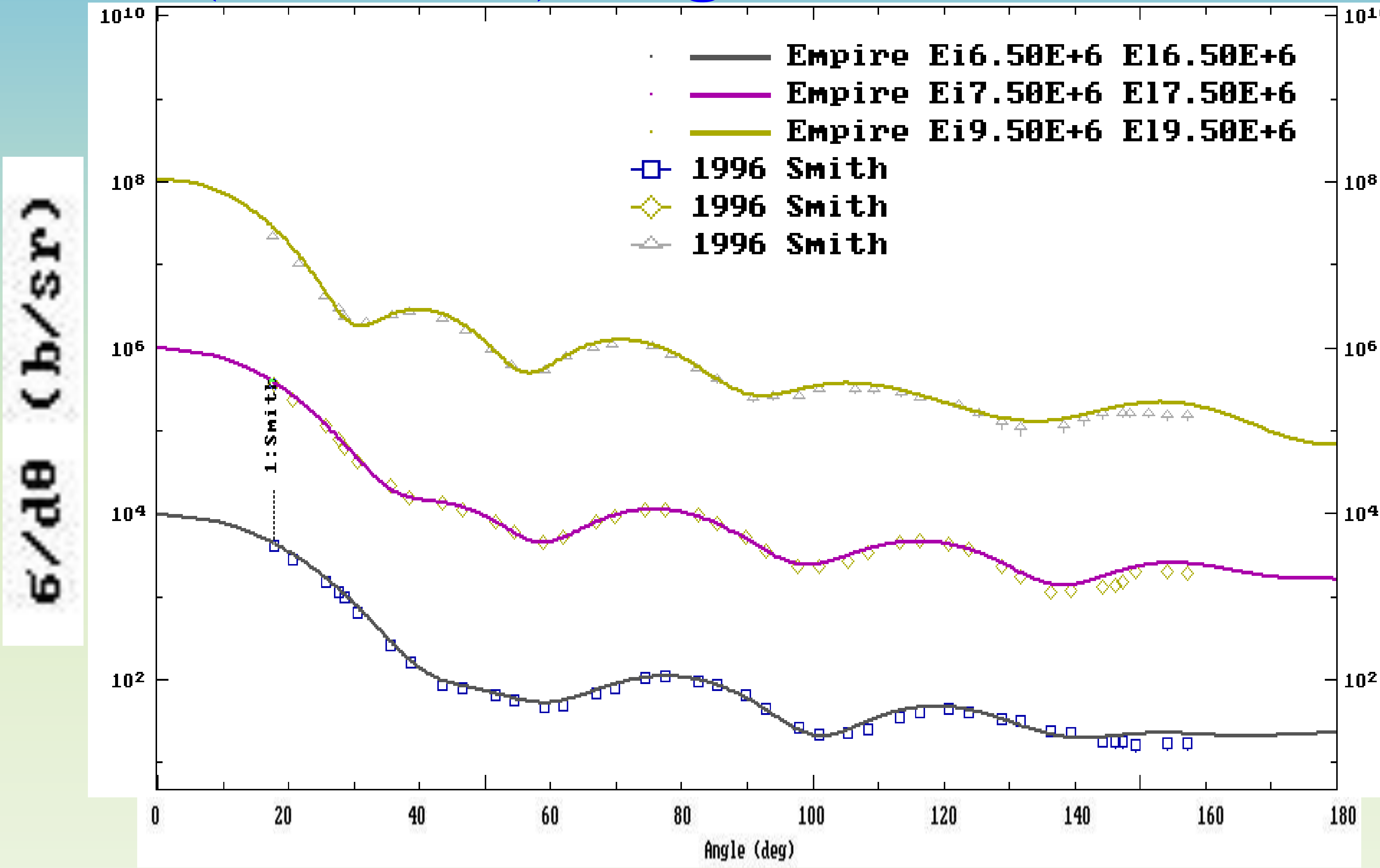
^{238}U(n,el+2CC), angular distributions



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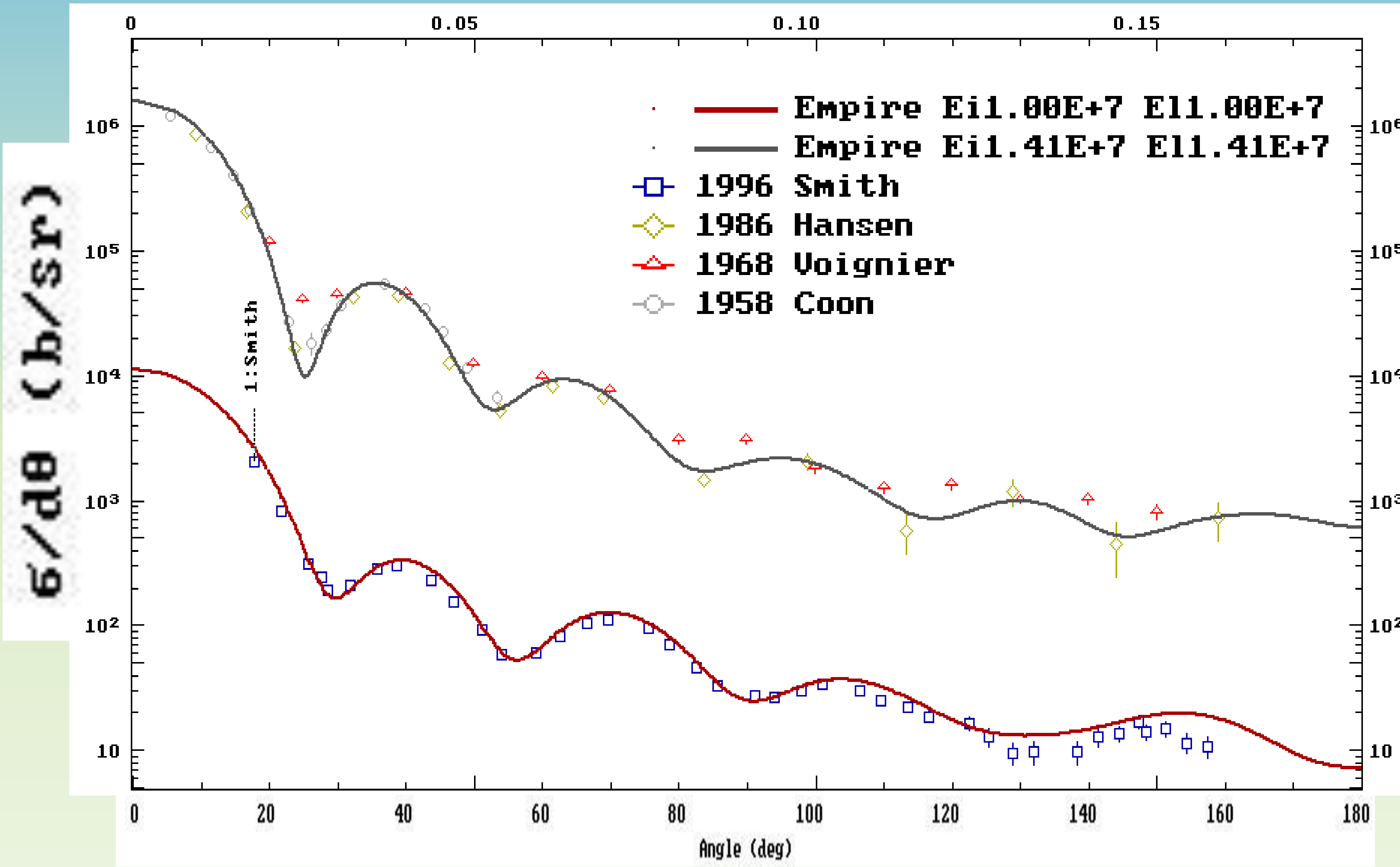
$^{238}U(n,el+2CC)$, angular distributions



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Conclusions: ^{238}U file *almost* ready

- ❑ Resonance range: New measurements and independent REFIT analysis lead to better RPs (bound states)
- ❑ Non-standard region below 20 keV and URR improved
- ❑ New Standard (GMA): excellent agreement with Wallner
- ❑ New fast evaluation with elastic/inelastic improvements
- ❑ PFNS adopted from Talou-Rising for all incident energies
- ❑ RPI quasi-diff. data - a big help for fast region
- ❑ Capture and fission in fast region from Neutron Standards
- ❑ Better multiple neutron emission (CEA Cadarache feedback, LANL feedback, inelastic + diff. TUNL data)
- ❑ Good agreement between B/VII.1 SACS and new eval.

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