Present Status of the JENDL Project

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Japan Atomic Energy Agency

JNDC (chaired by N. Yamano, Univ. of Fukui)

Subcommittee on Nuclear Data (H. Harada, JAEA)

- High Energy Nuclear Data Evaluation WG (S. Kunieda, JAEA)
- ENSDF Group (H. Iimura, JAEA)
- Japanese Nuclear Data Management Network (Y. Watanabe, Kyushu Univ.)
- Advisory Subcommittee on Development of JENDL(G. Chiba, Hokkaido Univ.), closed in March 2014.

Subcommittee on Reactor Constants (N. Yamano, Univ. of Fukui)

- Reactor Integral Test WG (G. Chiba, Hokkaido Univ.)
- Shielding Integral Test WG (C. Konno, JAEA)
- WG on Evaluation of Nuclide Generation and Decay Heat (K. Okumura, JAEA)
- Covariance Utilization WG (T. Iwasaki, Tohoku Univ.)

JENDL-4.0 Updated Files

JENDL-4.0u

Japan Atomic Energy Agency JAEA

http://wwwndc.jaea.go.jp/jendl/j40/update/

- 13 files were updated in 2013.
- Main update:
  - neutron spectra: K-36, Hg-196, 202, 204, Ra-224,225
    Strange dips were found on the kerma factors
  - RRP in MF32: U-234, Np-237, Pu-238, 242
    Inconsistencies of RRP between MF2 and MF32 were found.

neutron spectra

JENDL-4.0u
Japan Atomic Energy Agency JAEA

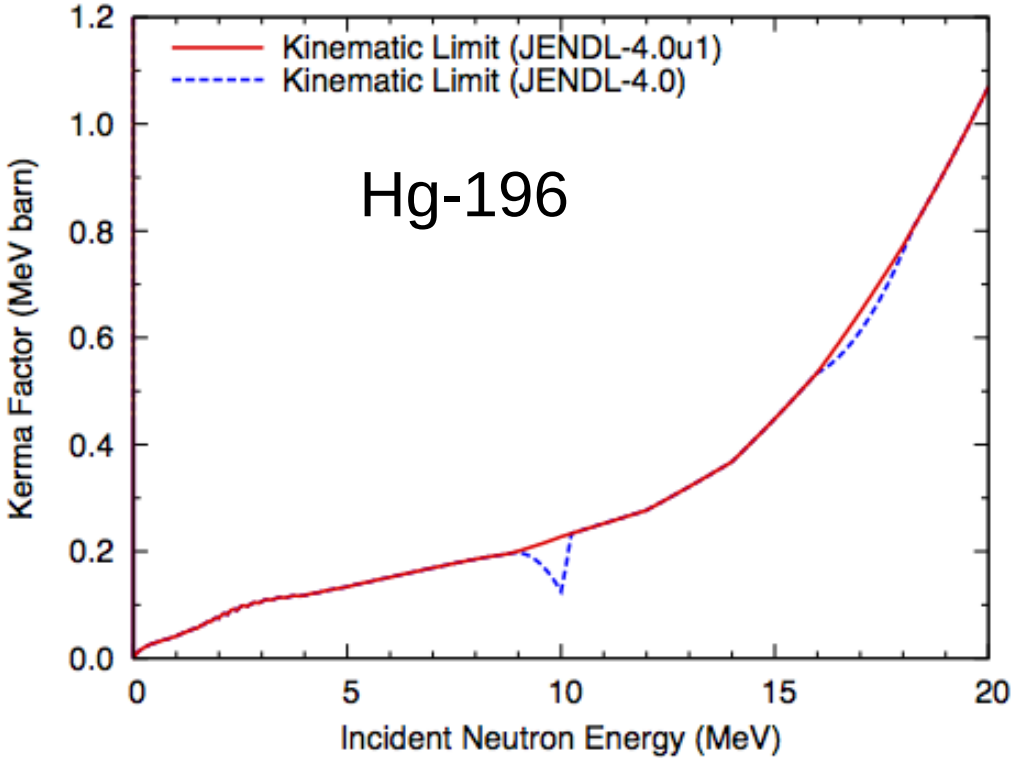
K-36, Hg-196, 202, 204, Ra-224,225

Problem

A strange dip was found on the kerma factors calculated with the kinematic limit. This occurred by energy imbalance for the (n,2n) and (n,3n) reactions.

Action

The neutron spectra were modified near the threshold energies.

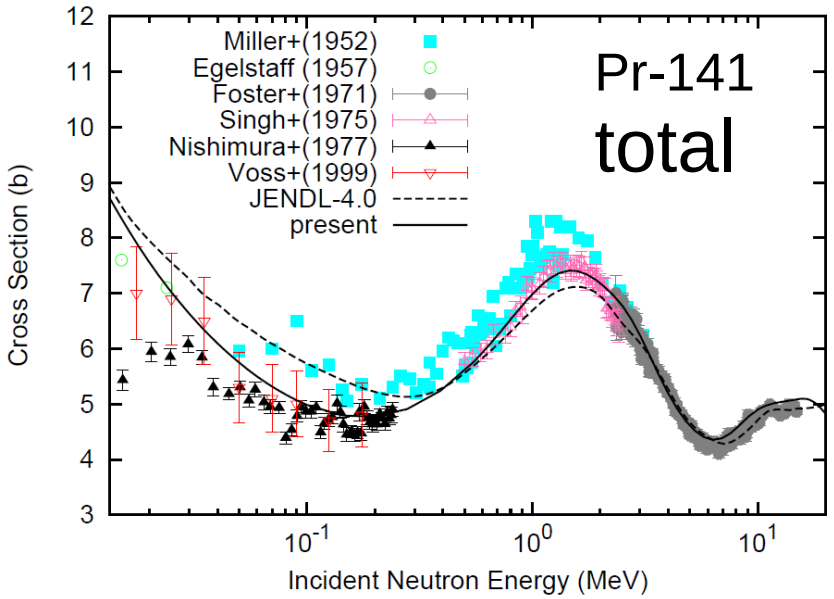


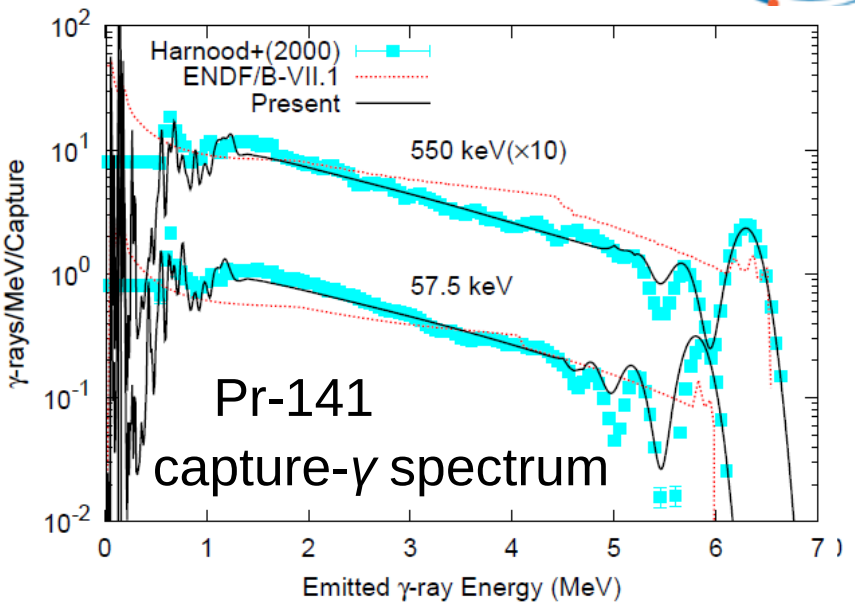
Evaluation of neutron nuclear data

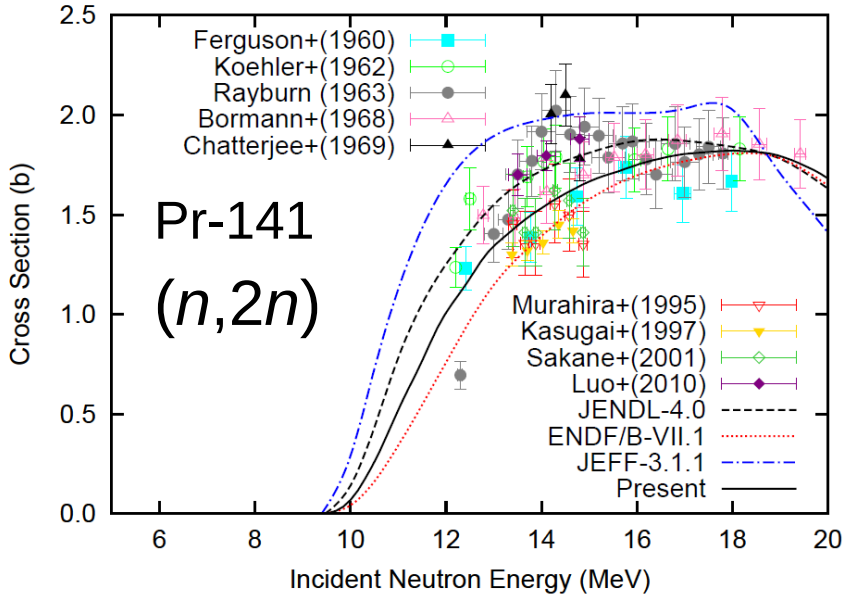
- The data which are not updated in JENDL-4.0 are continuously considered to be revised, especially for FP region nuclides.
- The statistical model code CCONE was used to calculate fast-neutron cross sections.

- F. Minato, “Evaluation of neutron nuclear data of praseodymium-141 and -143”, *J. Nucl. Sci. Technol.*,50 (9), 873 (2013).
- K. Shibata, “Evaluation of neutron nuclear data on antimony isotopes”, *J. Nucl. Sci. Technol.* **51**, 425 (2014).
- K. Shibata, “Evaluation of neutron nuclear data on ruthenium isotopes”, *J. Nucl. Sci. Technol.* **50**, 1177 (2013).

Evaluation of neutron nuclear data for Pr isotopes

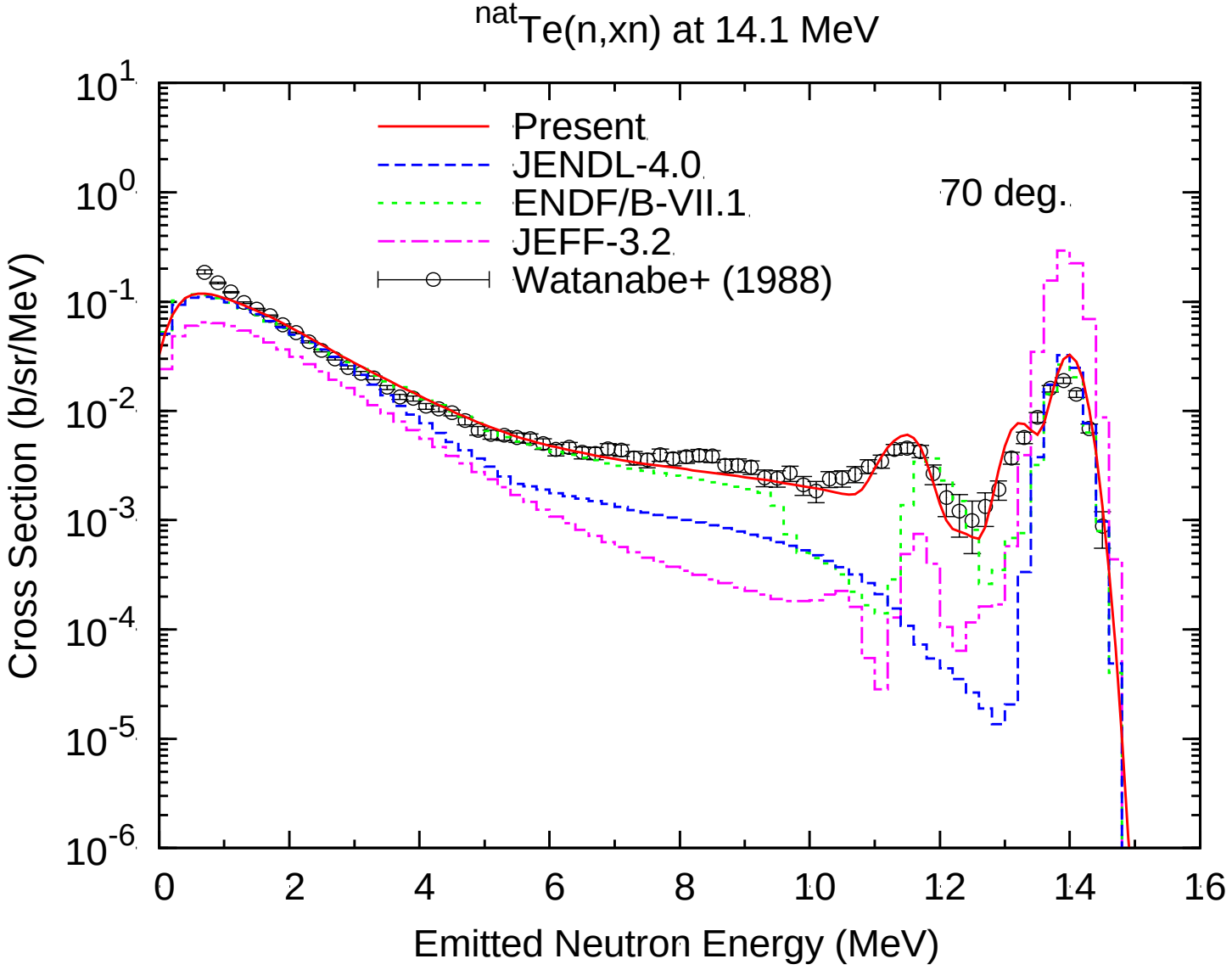






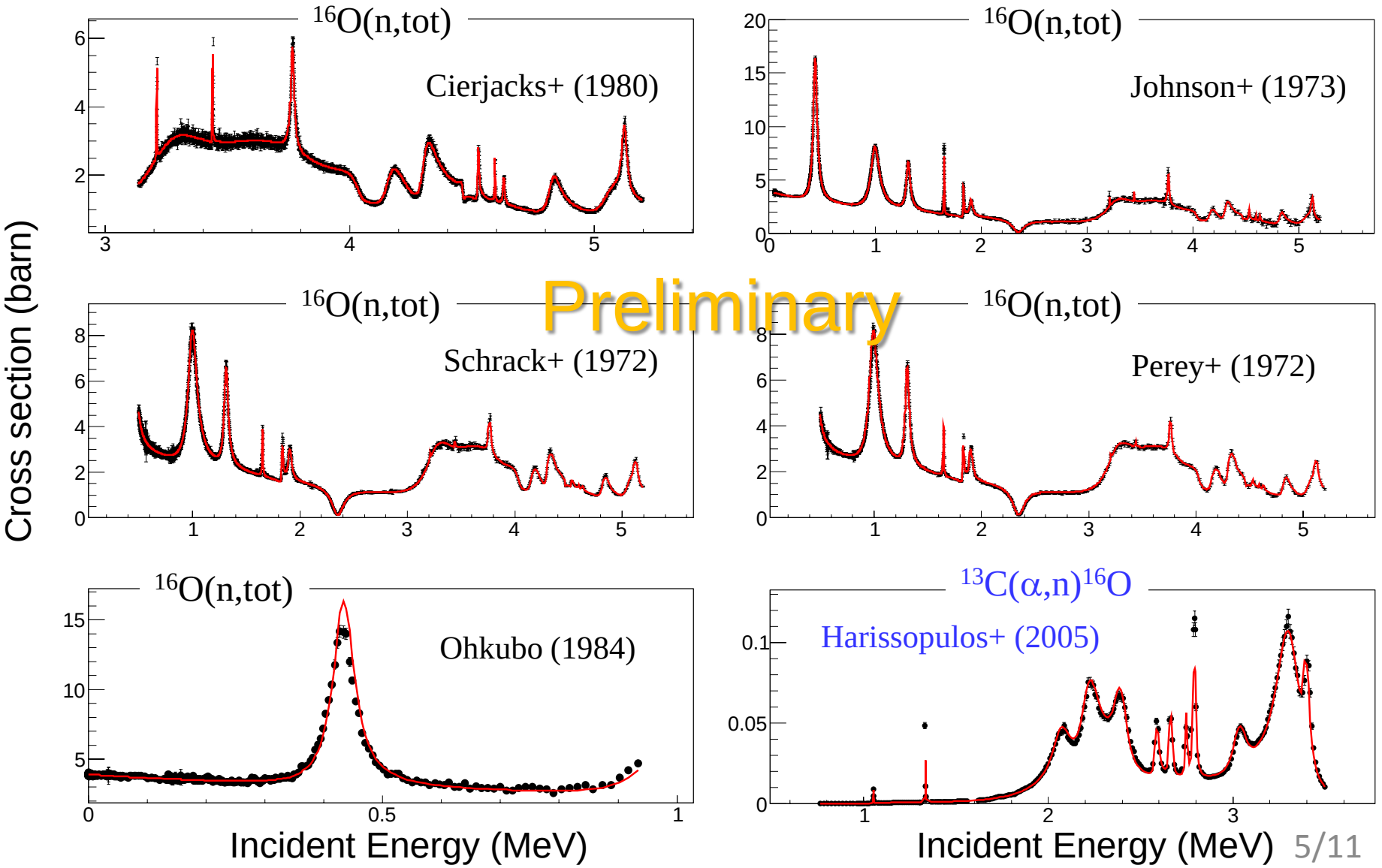
F. Minato, J. Nucl. Sci. Technol., 50 (9), 873 (2013).

New evaluation of neutron nuclear data on tellurium



R-matrix analysis for O-16

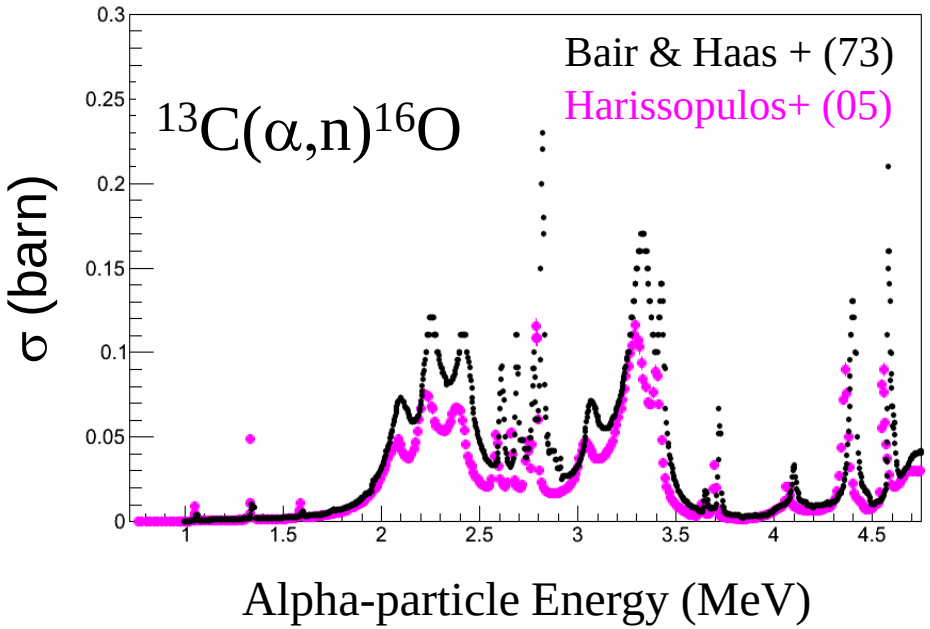
R-matrix analysis for O-16



Normalization factors to measurements

Reaction	Measurement	χ^2/N	normalization factor
O(n,total)	Cierjacks68+	2.48	0.967 ± 0.15%
	Schrack72+	1.31	0.982 ± 0.09%
	Perey72+	1.75	0.996 ± 0.09%
	Johnson74+	1.54	1.018 ± 0.09%
	Cierjacks80+	1.39	1.032 ± 0.35%
^{16}O(n,total)	Ohkubo84	1.90	0.997 ± 0.02%
^{13}C(α,n)^{16}O	Harissopulos05+	9.24	1.521 ± 1.14%

Preliminary



This result supports "old" experimental data.

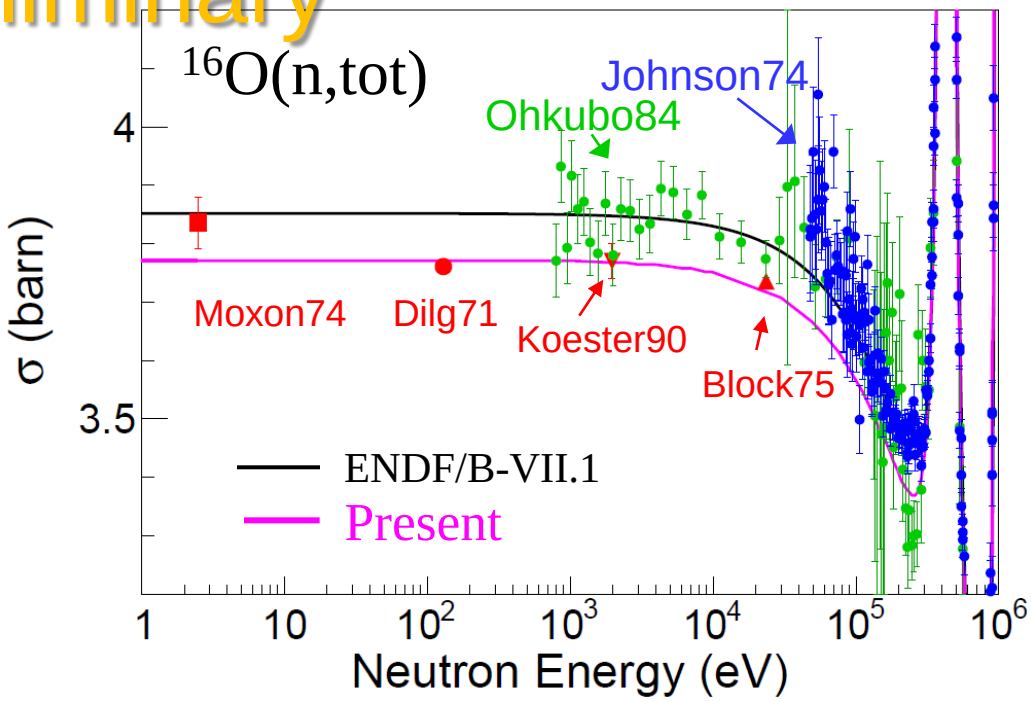
Extraction of background ^{1}H contributions

Contributions of H in the sample were estimated by R-matirx fitting to the experimental data.

Preliminary

Exp.	Factor to $\sigma_H(E)$
Johnson+ (1974)	0.01665 (± 6.02%)
Ohkubo (1984)	0.00988 (± 8.38%)

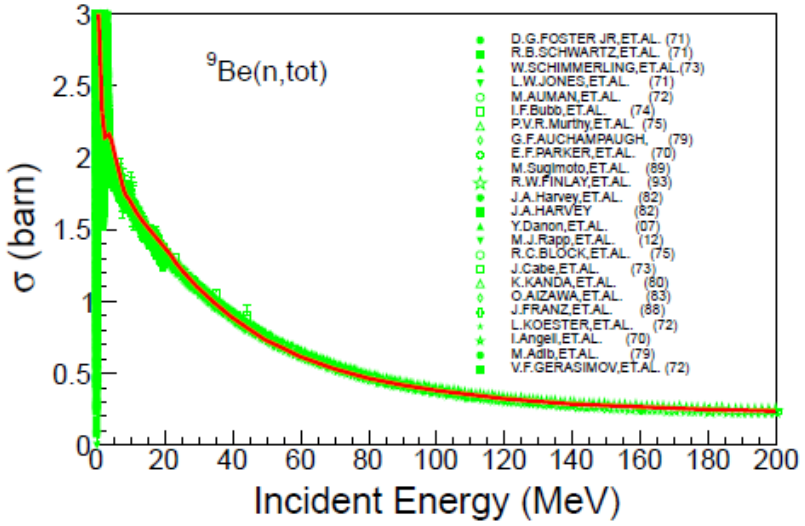
c.f. $\sigma_H(E_{th}) \sim 20$ (barn)

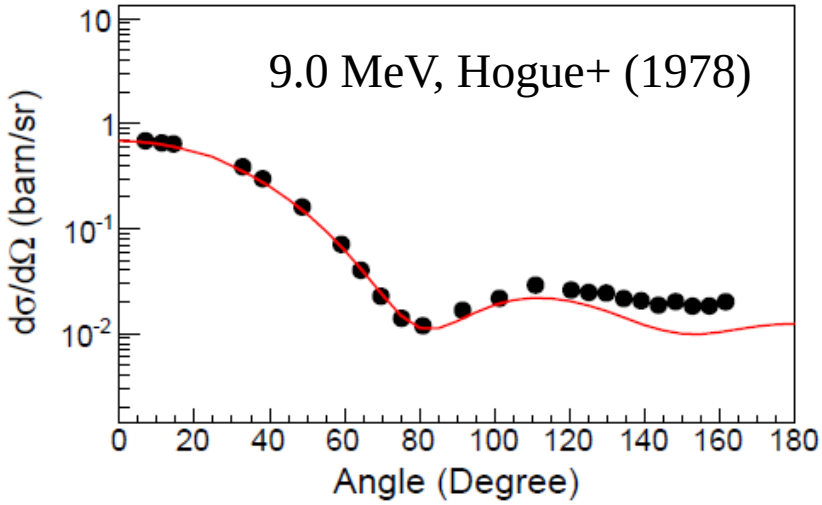


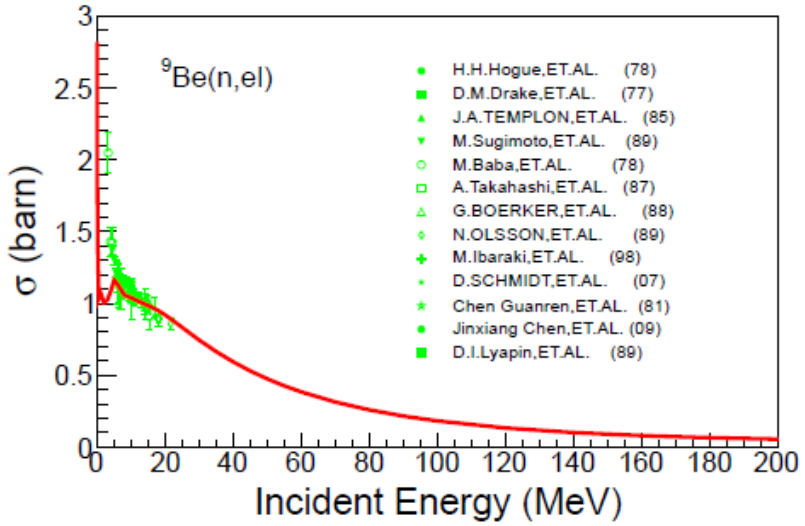
Evaluation of High Energy Nuclear Data

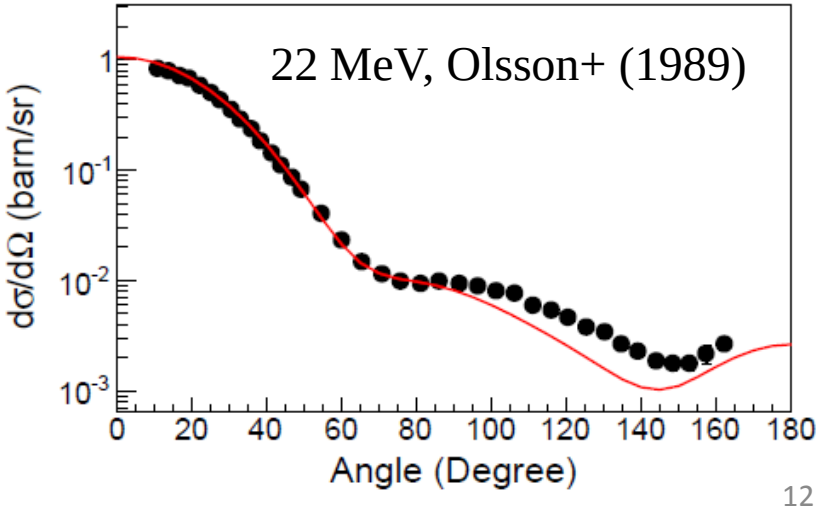
- Optical model analysis for neutrons and protons
  - DOMP + RRM-CC (OPTMAN ver. 10)
  - Isospin-dependent analysis
  - ^{6,7}Li,^{9}Be and ^{10,11}B, …
- Evaluation for neutron and residual production c.s.
  - CCONE-0.9.2.0
  - IAS direct (p,n) cross-sections with OPTMAN
  - DWBA for inelastic scattering c.s.
  - Improved Iwamoto-Harada model (Kunieda-2012)

Optical model analysis of ^{9}Be

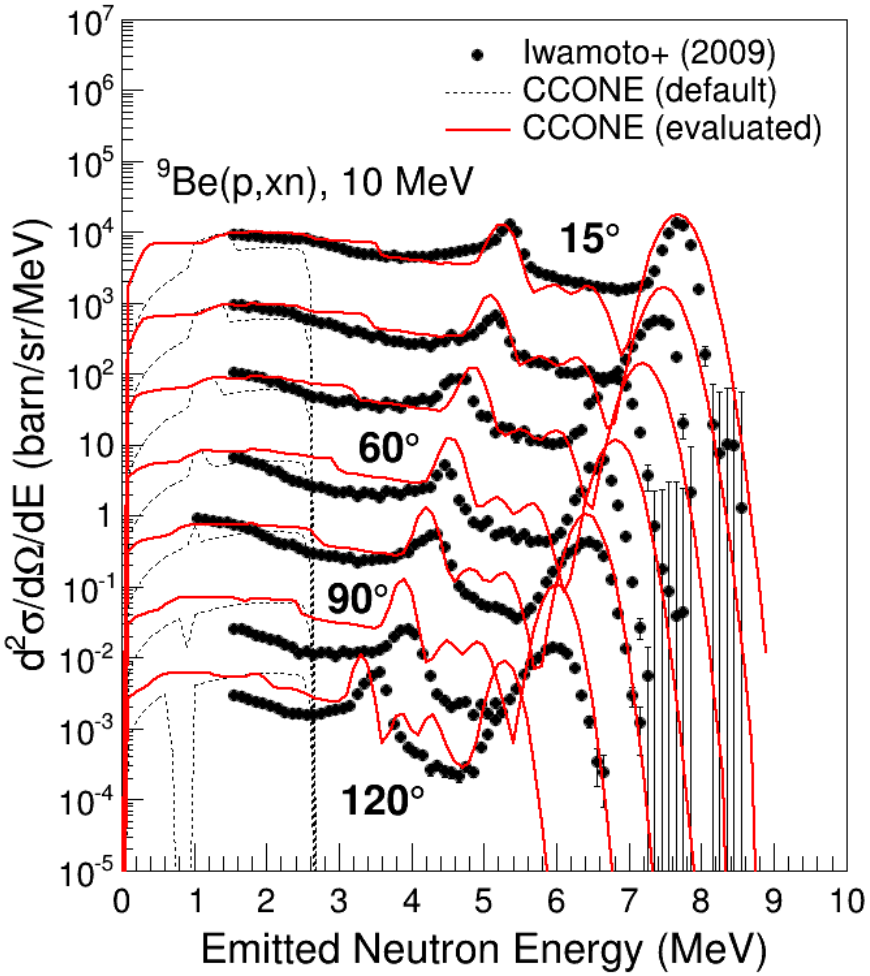


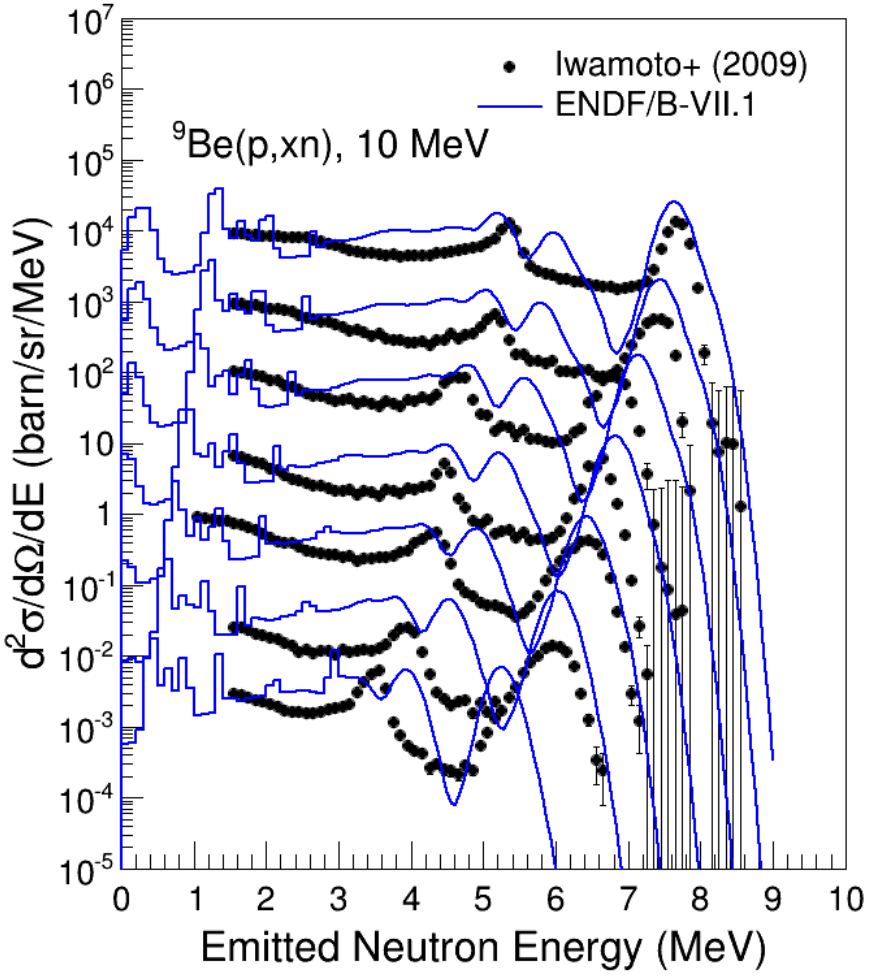




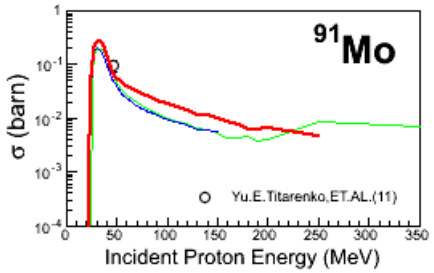


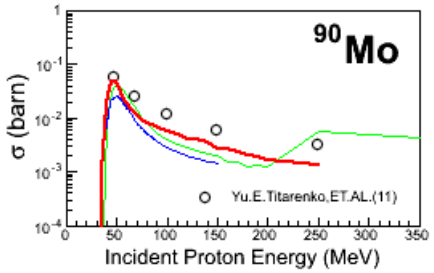
^{9}Be(p,n), DDX@10 MeV

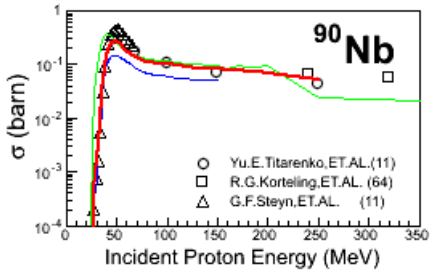


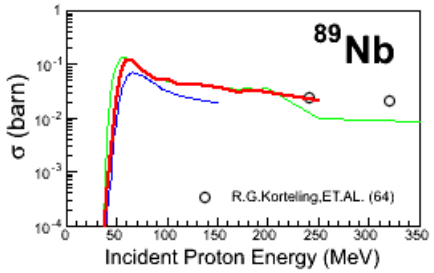


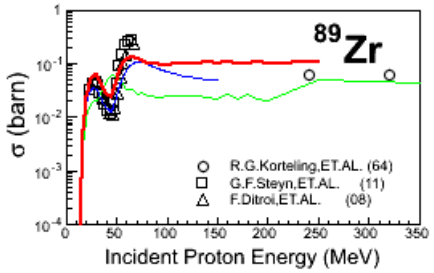
^{93}Nb(p,x), Residual Production CS

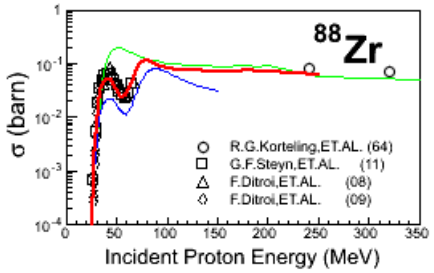


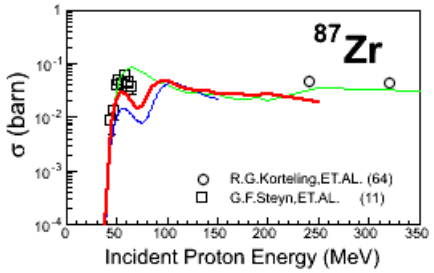


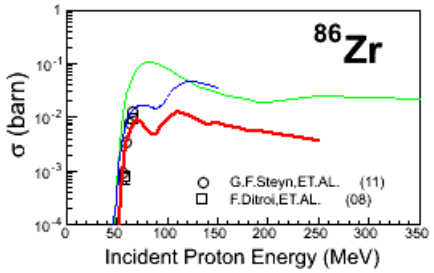


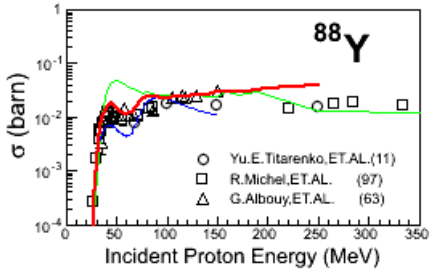


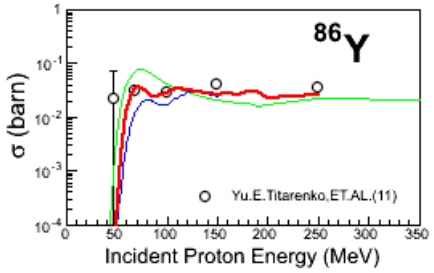


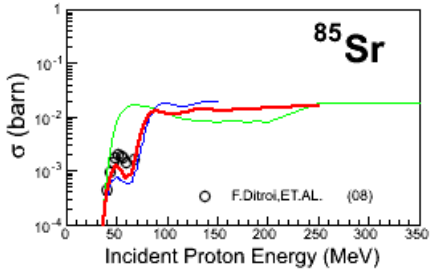


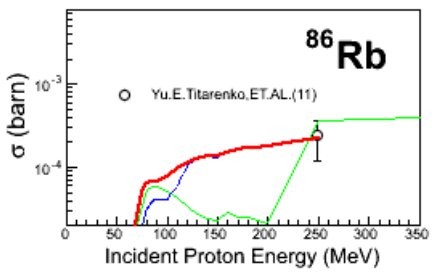


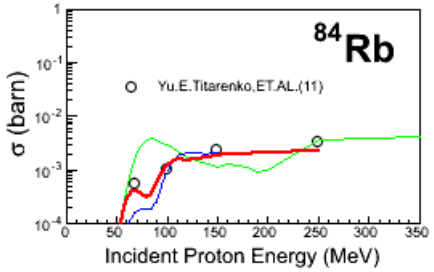


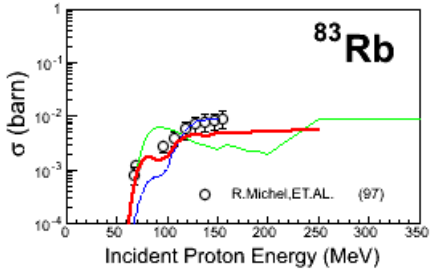










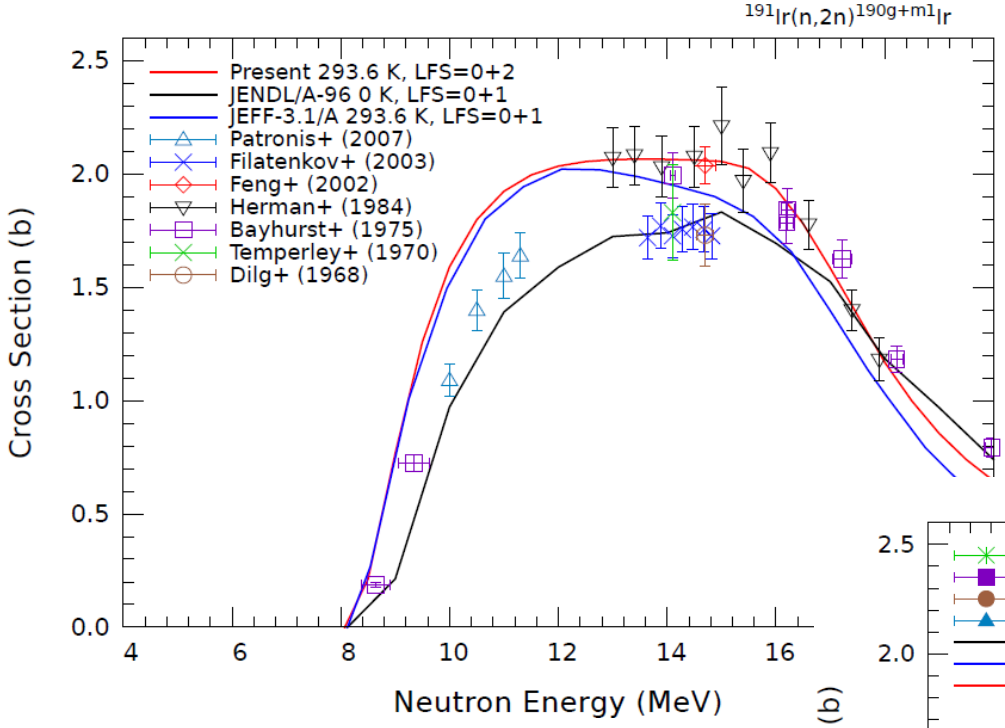


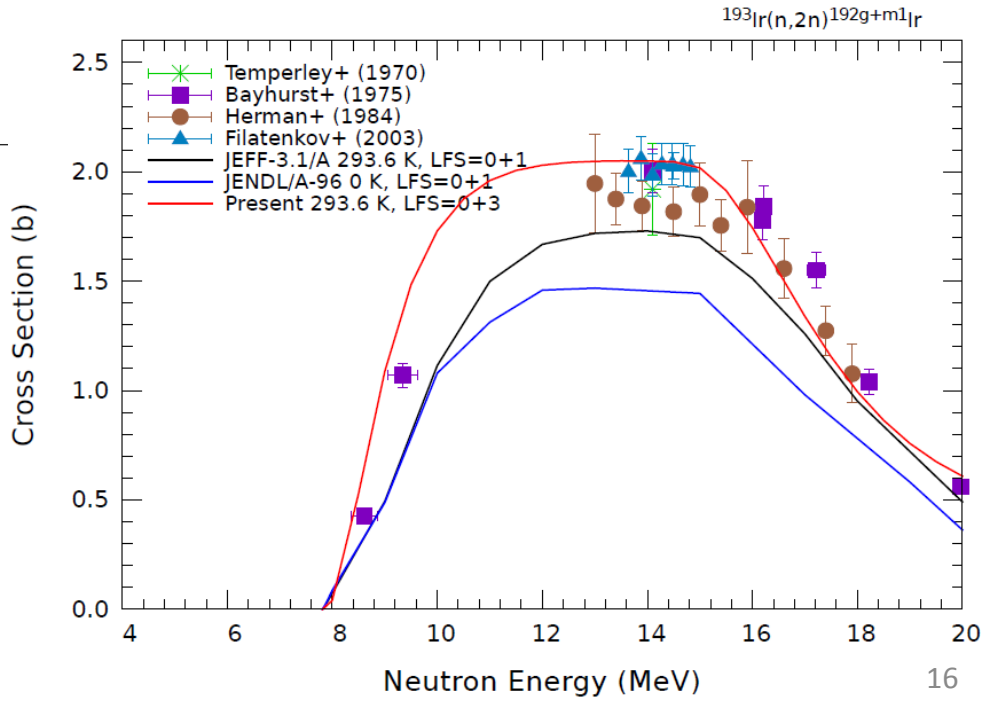
ENDF/B-VII.1
JENDL/HE-2007
CCONE

Activation file

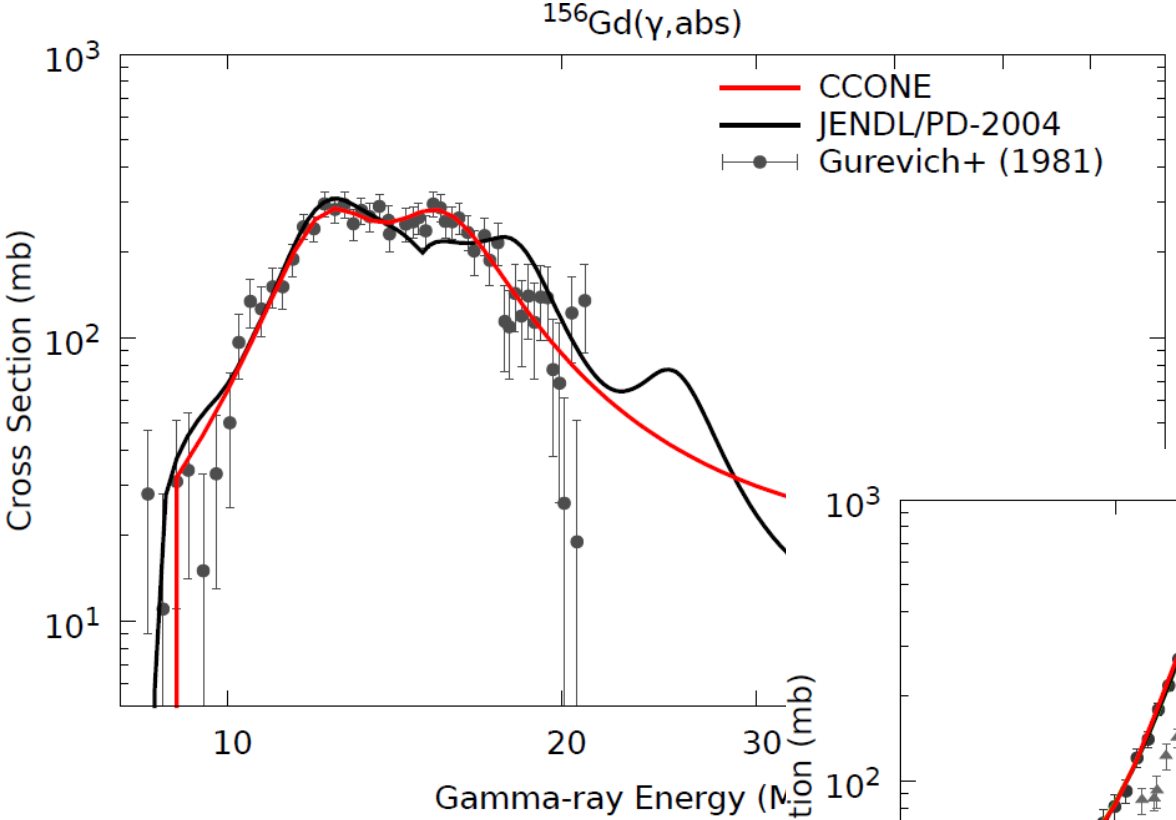
- neutron activation cross sections for the decommissioning of LWRs.
- about 300 target nuclei
- new evaluation, JENDL-4.0, JENDL/A-96
- Evaluated files for the 246 isotopes from H to Hf have been created.

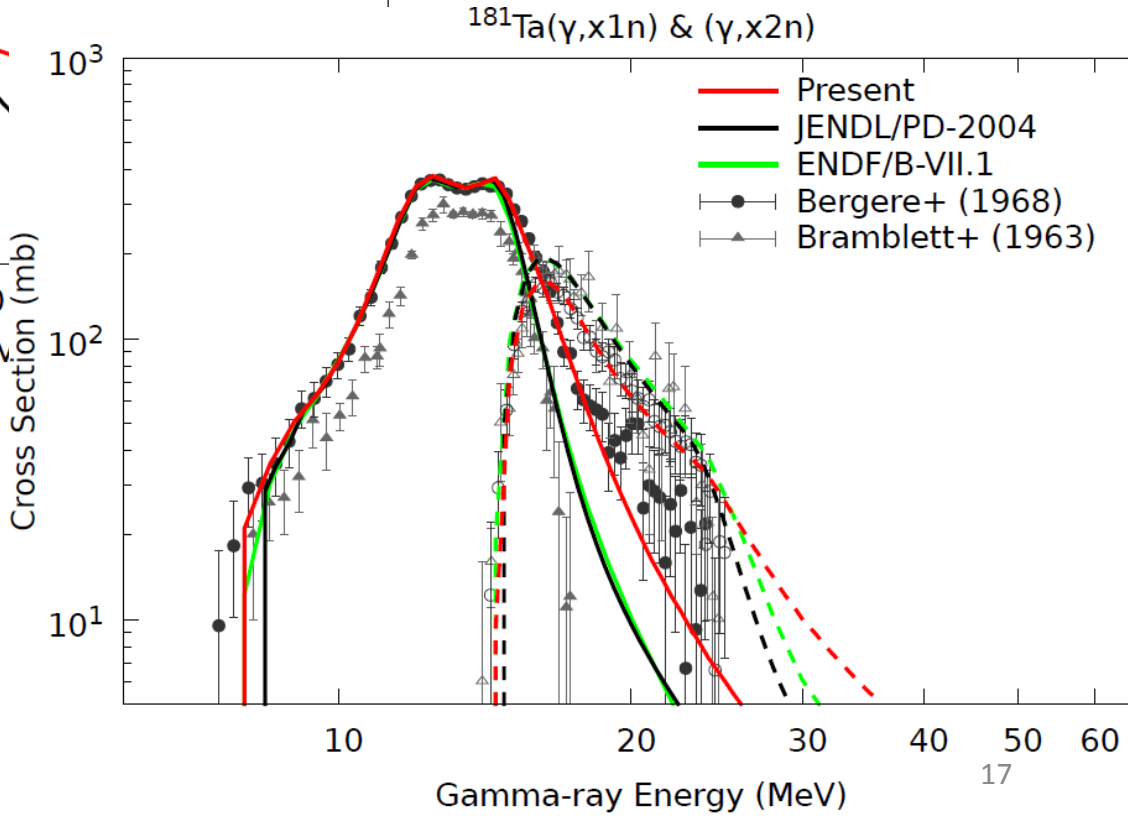
Activation cross section for Ir-191, 193





Photonuclear data





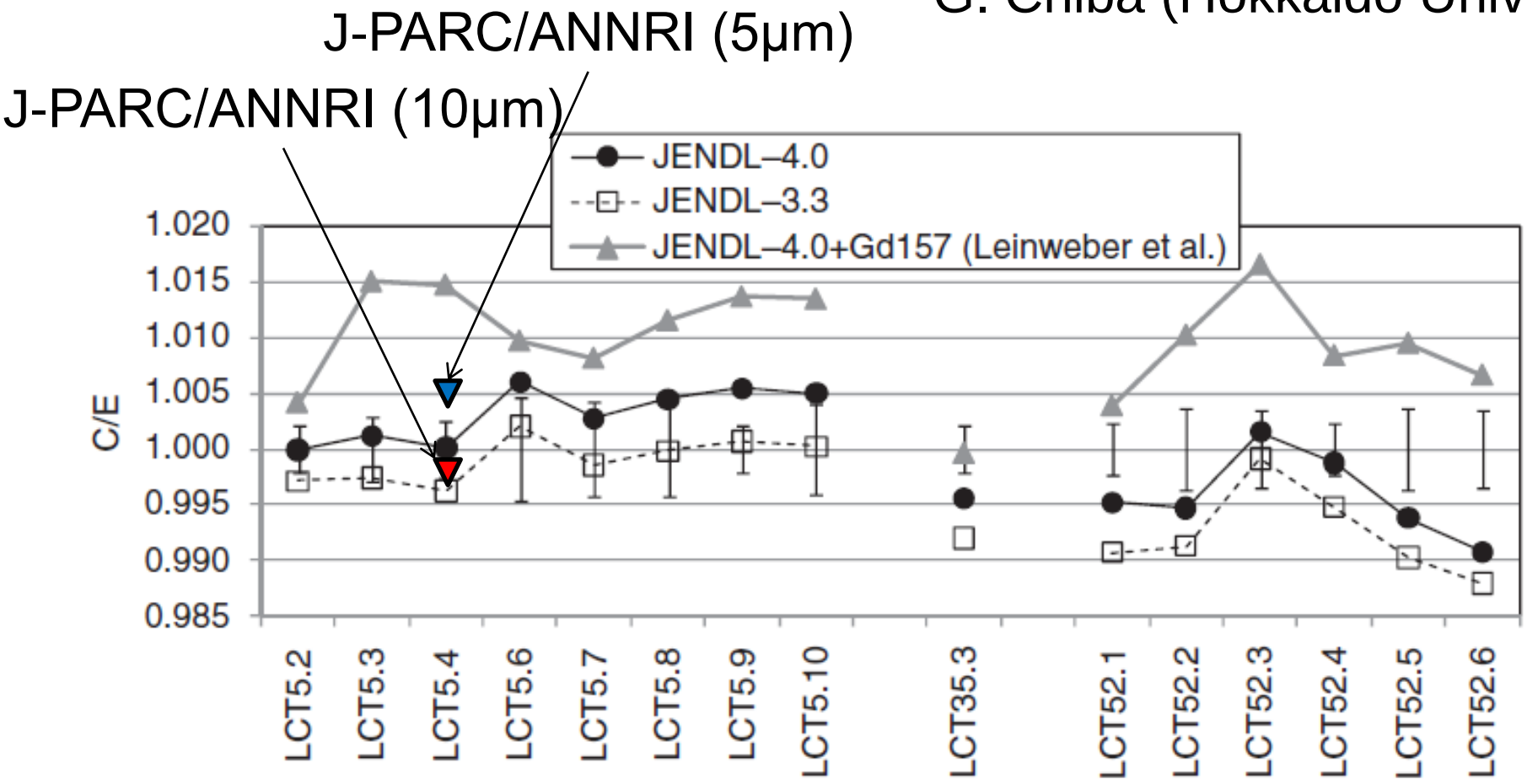
Benchmark Tests of JENDL

Gd benchmark

		Capture Cross Section @ 0.025eV(b)
New measurement by ANNRI (A. Kimura et al., JAEA)	5μm	(preliminary) $48{,}100^{+1{,}300}_{-1{,}100}$
	10μm	(preliminary) $49{,}900^{+\ 700}_{-1{,}200}$
G. Leinweber (2006)		44,300
JENDL-4.0		48,800
ENDF/B VII.1		48,620

Benchmarking with Gd-157 Test Files

G. Chiba (Hokkaido Univ.)



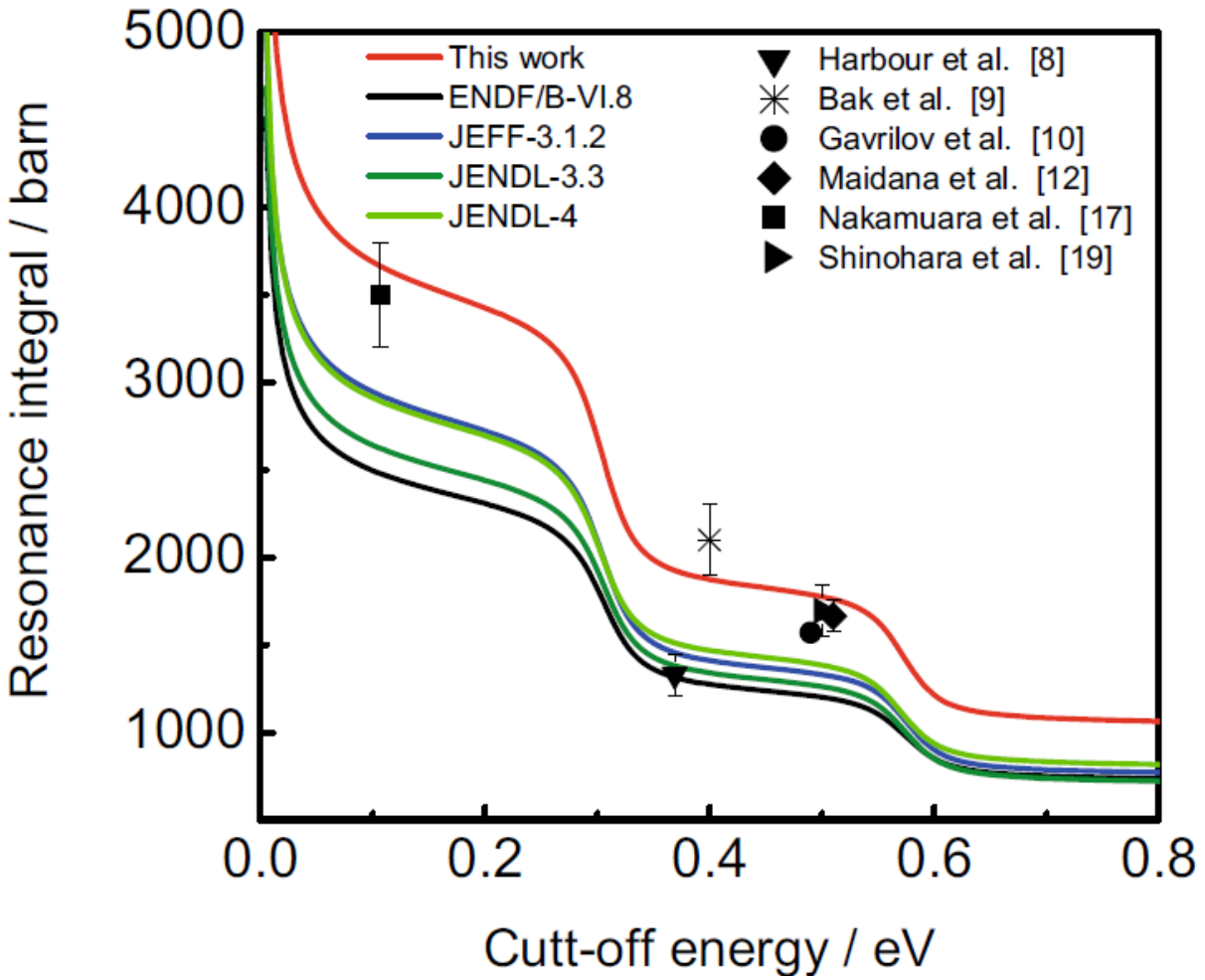
New experiment data acquired in J-PARC are consistent with JENDL-4.0

[1] G. Chiba, "Benchmarking using Gd-157 Test Files," JENDL Committee, RIT-4-1-3 (2014) [in Japanese]
[2] G. Chiba, et al. "JENDL-4.0 Benchmarking for Fission Reactor Applications," J. Nucl. Sci. Technol. Vol. 48, No.2, p.172-187 (2011)

Am benchmark by G. Chiba (Hokkaido Univ.)

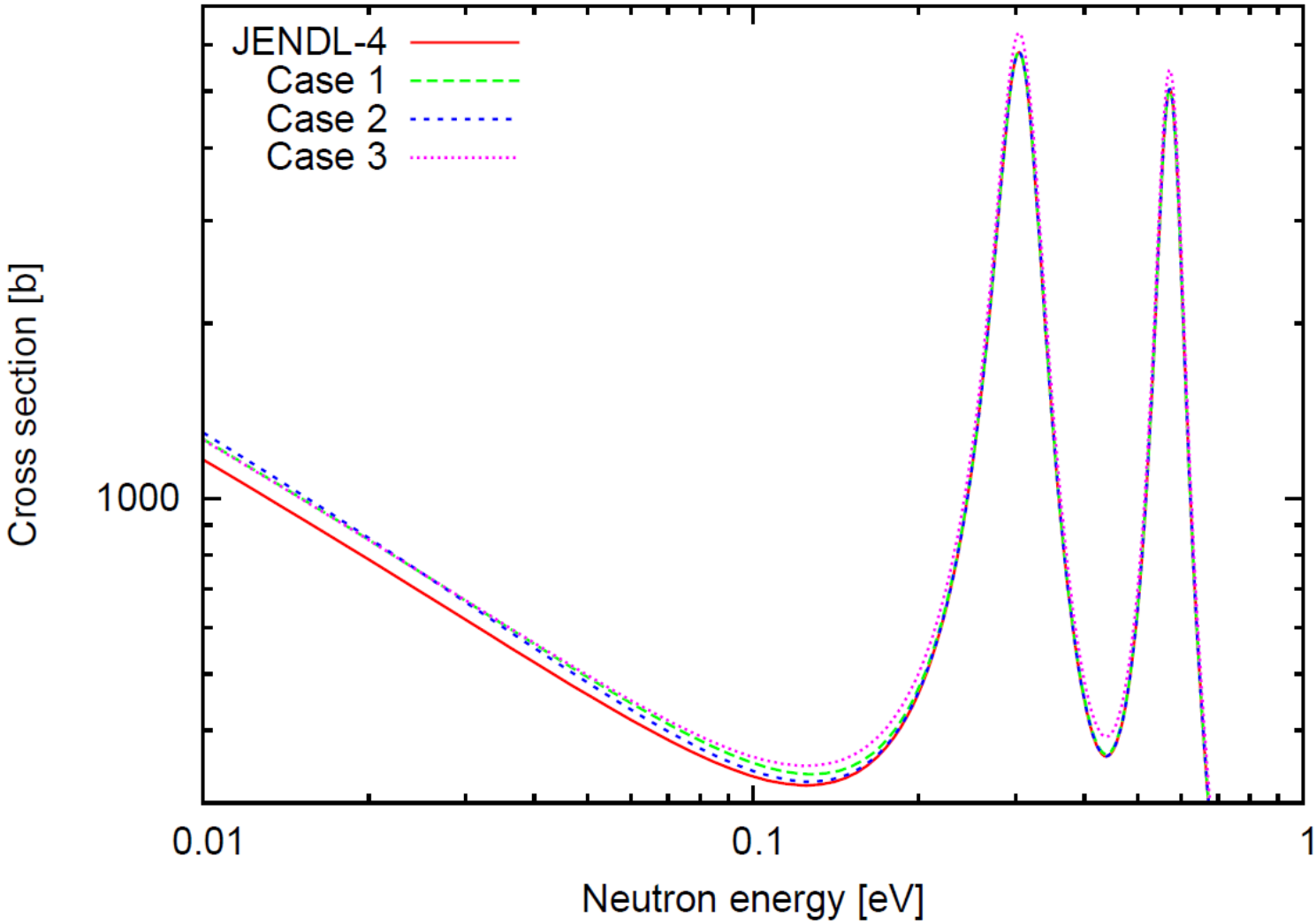
Recent experiment data for Am-241 (n, γ)

C. Lmapoudis et al. Eur. Phys. J. Plus (2013) 128: 86



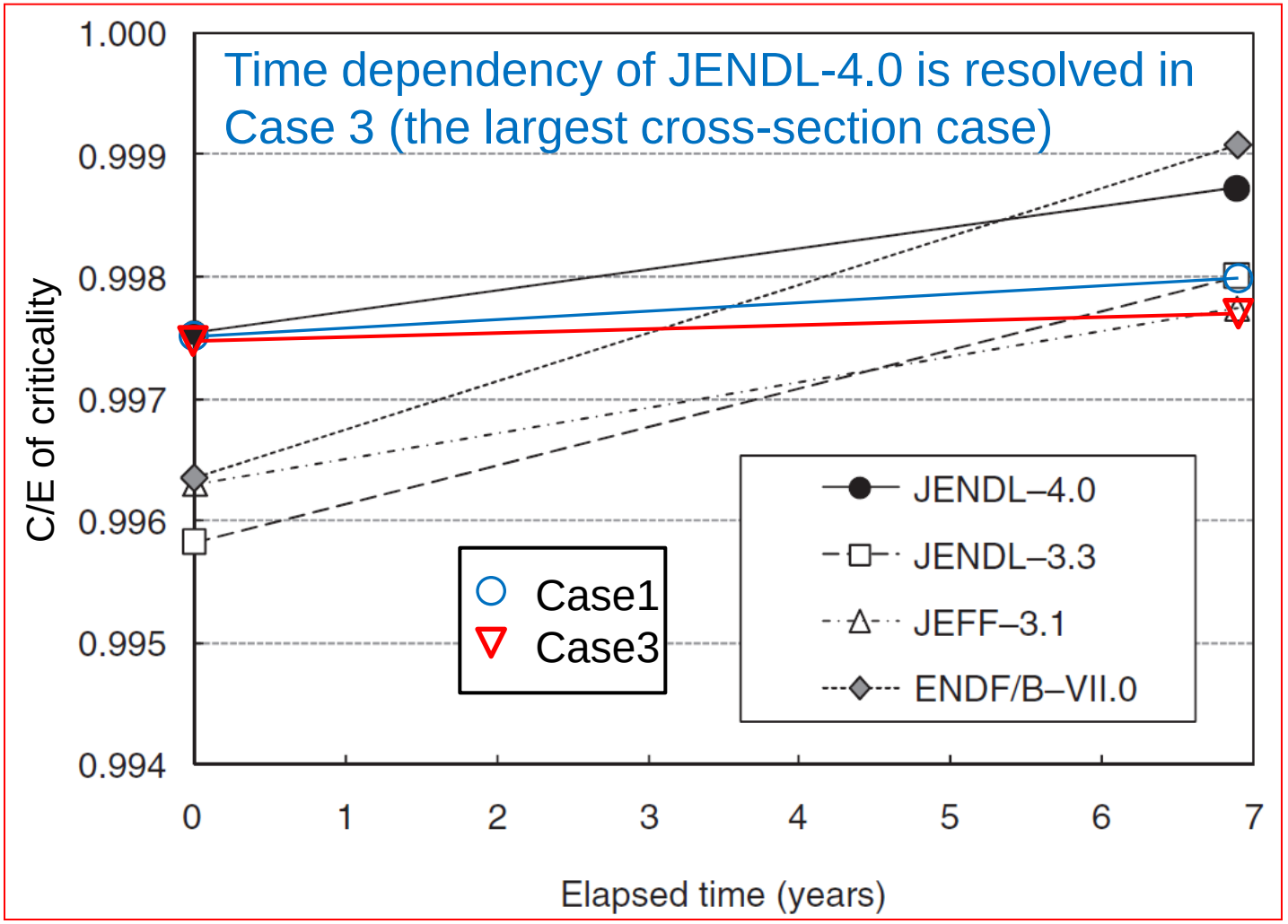
- Larger capture cross section in thermal and resonance region
  → Consistent with integral experiments

Am-241 (n, γ) Test Files



Three test files were prepared for benchmarking:
Case 3 > Case 2 > Case 1 > JENDL-4.0

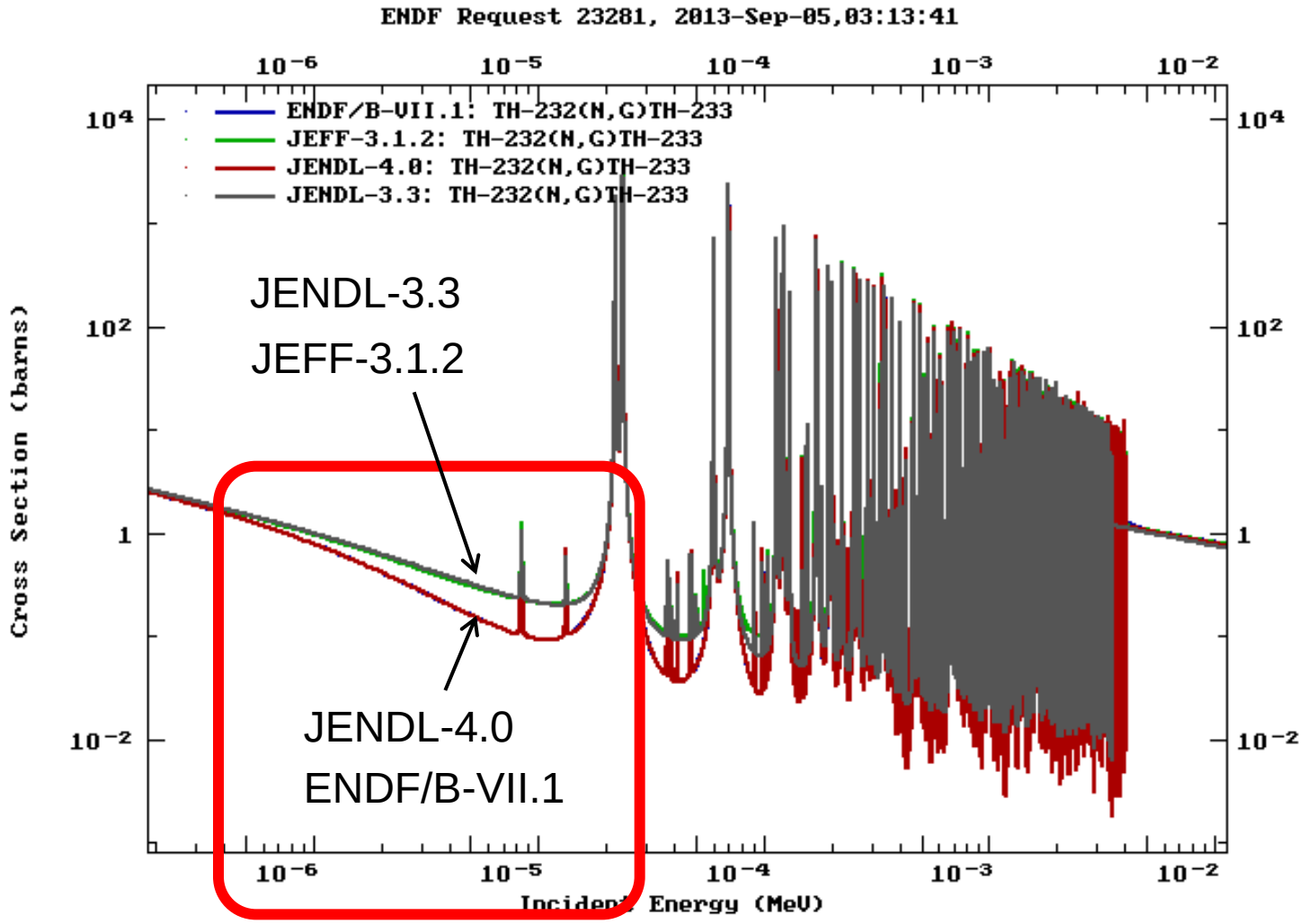
Application to Pu-aging problem of TCA



[1] G. Chiba, "Current Status of Am-241 Cross section," JENDL Committee, RIT-4-2-1 (2014) [in Japanese]
[2] G. Chiba, et al. "JENDL-4.0 Benchmarking for Fission Reactor Applications," J. Nucl. Sci. Technol. Vol. 48, No.2, p.172-187 (2011)

Th Benchmark by T. Sano, KUCA.

Integral Testing for Th-232 using KUCA

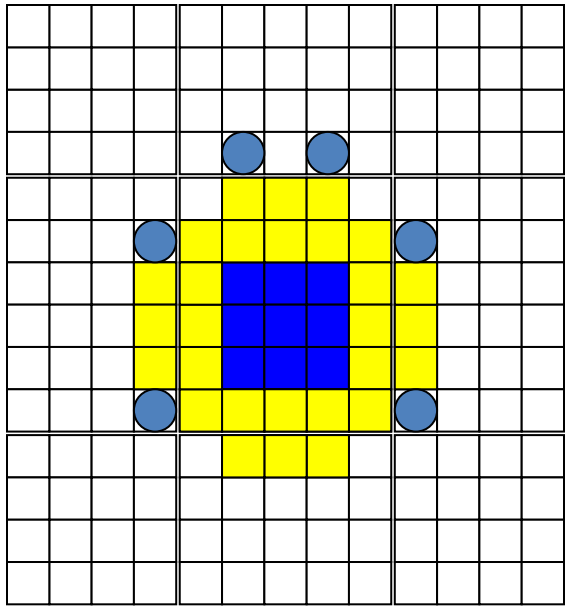


- Kyoto Univ. launches a comprehensive evaluation of Th-232 using KUCA critical experiments

T. Sano, "Integral Testing of Evaluated Nuclear Data for Th-232 using KUCA Critical Experiments," JENDL Committee, RIT4-5-1 (2014)

Zone-type Integral Experiments in KUCA

Th II' (C/Th=48)



(Th+C) Test Zone

U Driver Fuel

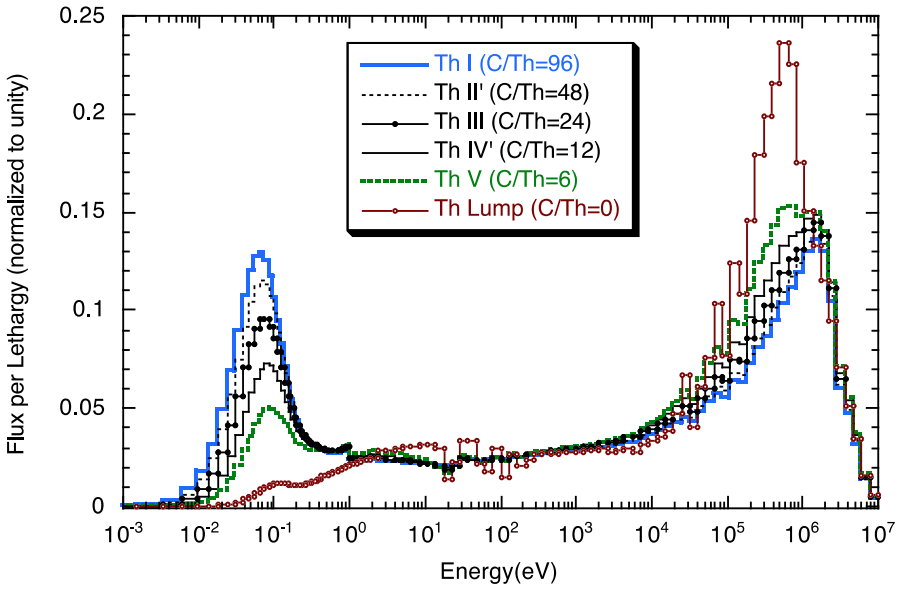
Polyethylene Reflector

Control Rod

- 3x3 test zone: Th metal plate + Graphite

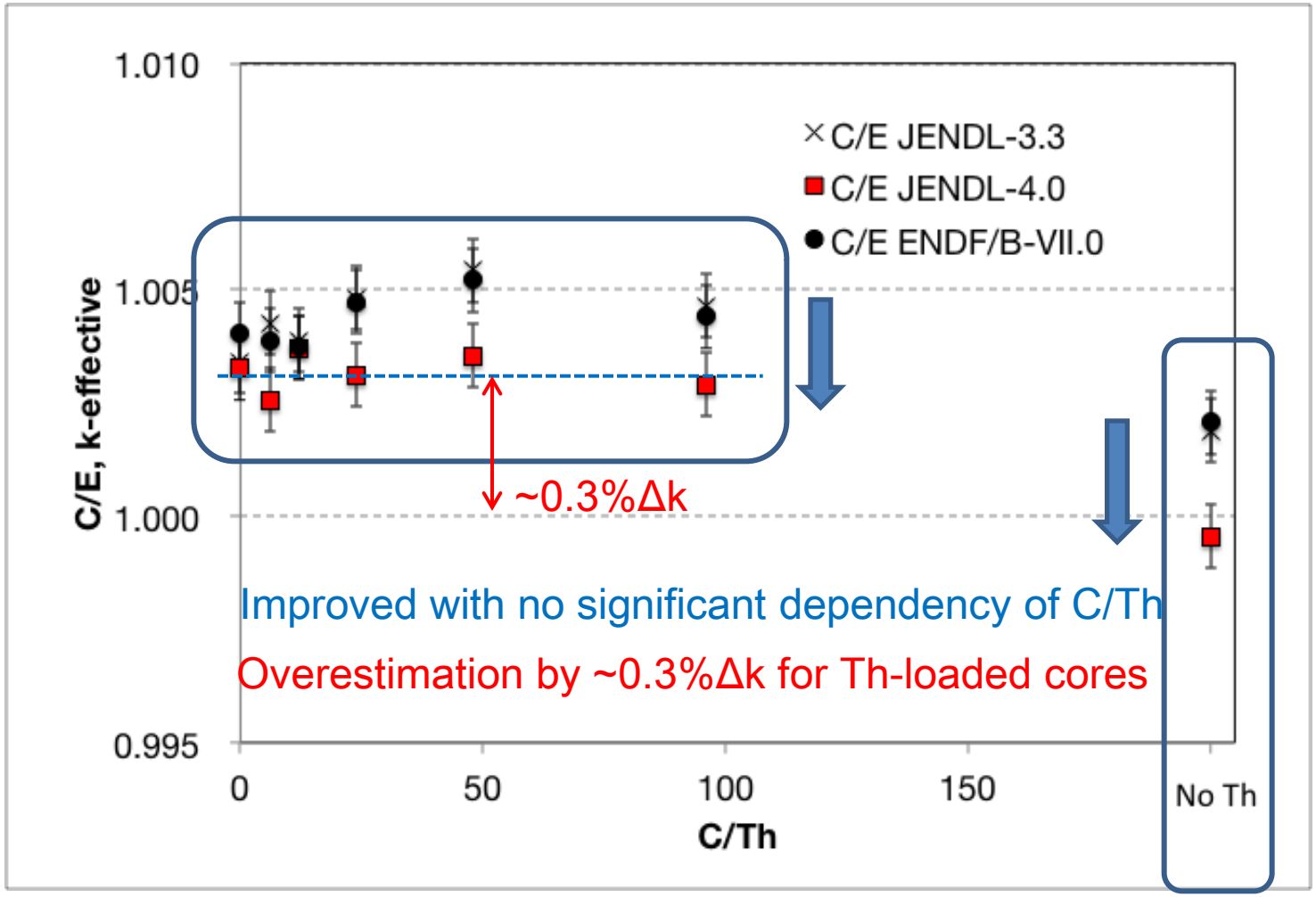
Core ID	C/Th
B3/8"P50EU(3)-Th I	96
B3/8"P50EU(3)-Th II'	48
B3/8"P50EU(3)-Th III	24
B3/8"P50EU(3)-Th IV'	12
B3/8"P50EU(3)-Th V	6
B3/8"P50EU(3)-Th	0

Systematical changes of graphite and Th ratio C/Th from 0 (Th only) to 96



T. Sano, "Integral Testing of Evaluated Nuclear Data for Th-232 using KUCA Critical Experiments," JENDL Committee, RIT4-5-1 (2014)

Benchmarking for keff with MVP



T. Sano, "Integral Testing of Evaluated Nuclear Data for Th-232 using KUCA Critical Experiments," JENDL Committee, RIT4-5-1 (2014)

Thank you for your attention!