IEC - 147

Subgroup 17 Presented by A. Ignatyuk

No Recipient, No Subject

ECN

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From: "H. Gruppelaar" <gruppelaar@ecn.nl>
Subject: SWG17, Short progress report
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Preliminary progress report SG17

To: Dr. A.V. Ignatyuk, Obninsk
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Dr. M. Kawai, Toshiba
Dr. B. Pijlgroms and Dr. J.L. Kloosterman, ECN-Petten

Copy: Dr. M. Salvatores, CEA-Cadarache
Dr. C. Nordborg, NEA Data Bank, Paris
Dr. Y. Kikuchi, JAERI-Japan

Dear participants to the SWG17 benchmark,

It has been a long time before I could answer you with respect to the SWG17 exercize. However by now it seems that all contributions are in a good shape.
First of all I would like to thank you for all your efforts. Below you find a table that was prepared by Dr. Kloosterman from your contributions. Could you please check the numbers and confirm these?

In the tables below you find a comparison with one-group cross sections first, followed by reactivity values, normalized as requested. Also graphs of pseudo fission group constants have been prepared for capture and inelastic scattering. These follow later.

The idea is to combine the table and the graphs in a final report. The results will be presented at the meeting of the Evaluation Working Party in Argonne, US, on June 11-13.
Since I am not able to participate Dr. Ignatyuk has kindly offered to present the results.
An official version of the final report will appear later after you hav had time to correct it.

A few notes to the tables below:

1. The differences between capture group constants for JEF-2.2 for ECN and CEA could be due to differences in the flux weighting spectrum and to a lesser extent due to different number of nuclides. The weighting effect follows from a comparison of EAF-4 which has been calculated for thermal and the requested fast flux weighting spectrum.
2. The BROND result deviates because a rather small number of

nuclides have been taken into account.
3. The weighting effect in the capture cross section is less than 1%.
4. The difference the capture effect (excluding BROND and correcting for flux weighting) is at most 5%, with highest value for FOND2.1 and lowest value for JENDL3.2.
5. The spread in the inelastic scattering effect is at most 11%, largest absolute vale for JEF-2.2 and smallest for FOND2.1.
6. There is a large spread in (n,2n) results between JEF/EAF and the others.
7. The graphs for the capture cross section show no large differences above 100 eV.
8. The graphs for the inelastic cross sections show no large differences above 0.1 MeV.

Some conclusions:

1. Spread in capture as expected, spread in inelastic scattering surprisingly small.
2. Further inspection of graphs follows
3. What is reason for differences in (n,2n)?

Please give me your comments,

With best wishes,

Harm Gruppelaar

NEA/NSC WPEC Meeting at ANL
June 13, 1996
Prepared by M.Kawai (toshiba,NEL)
Presented by T.Yoshida(Musashi-Tech)

>Preliminary results SWG 17 benchmark

May 23, 1996
Revised June 6, 1996

Dear Dr. Harm Gruppelaar,

We have calculated one group coss sections and reactivity effects for lumped fission products. According to the present results, I have corrected the table which was sent to me on May 23. As you know, our calculations were composed of two kinds of group cross section sets: the standard 70-group structure below 10 MeV for reactor calculation and the 73-group structure containing the energy region above 10 MeV. In the table, 70-group results are denoted with an asterisc. The differece beween the 70- and 73-group results is observed for (n,2n) reaction (MT=16).

I think that from view point of our reactor calculation application, we would like to compare the 70-group results with those of the other nuclear data files, and from nuclear data evaluation we should do the 73-group results.

You noticed the large spread of (n,2n) cross section between ECN/JEF2.2 and JENDL-3.2. The main reason of the differece can be identified to a lack of energy region above 10 MeV in JENDL-3.2. It is natural that the present 73-group result of JENDL-3.2 is close to that of ECN/JEF2.2, although a difference in the energy dependence of cross section is not clear so far. Slightly smaller value of JENDL-3.2 may come from the characteristics of model taken for data evaluation of fission product nuclides using the PEGASUS code developed by Iijima et al. based on evaporation and preequibrium models taking into account of systematics of measured cross sections at 14 MeV.

As for reactivity effects, we found that the values were negative for all reactions of lumped fission product, while those for elastic scattering of several isotopes were positive. The differece is at most 5% for capture and 11% for inelastic scattering as you pointed out. I would also pointed out that contribution of capture reaction is very high (about 90%), and those of scattering are low (i.e., about 10% for inelastic scattering, 0.8% for elastic scattering, negligible for (n,2n) reaction). This result might suggest that the uncertainties in inlastic scattering cross sections of the current nuclear data files is of no problem for reactor core calculation. As for (n,2n) effect,

the JENDL based on the 70-group calculation is as much as the ECN/JEF2.2.

Smaller capture effects of JENDL than ECN's perhaps came from that JENDL-3.2 adopted the recent experimental data of ORNL and KfK which had a tendency of lower value than previous ones.
That is all of my comment for the table.

By the way, as a reference of making aspecification of the next benchmarks on fission products for thermal reator you mentioned in the e-mail message, you can see the paper: "Fission Product Model for BWR Lattice Calculation Code", S. Iijima et al., J. Nucl. Sci. Technol., 19, 96 (1982). The paper shows the important fission product nuclides for BWR burn-up calculation. If you feel to need it, please tell me so. Then, I will send its copy to you.

Please send my best regards to Dr. Ignatyuk with a final version of short report. If you know his e-mail adress, teach me it.
Sincerely yours,

Masayoshi Kawai
Toshiba Corporation

CC: Dr. B. Pijlgroms and Dr. J.L. Kloosterman, ECN-Petten
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>Preliminary results SWG 17 benchmark May 23, 1996
Revised June 6, 1996
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>one-group cross sections

>Preliminary results SWG 17 benchmark

May 23, 1996
Revised June 6, 1996

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>one-group cross sections

mt number	CEA JEF2.2	ECN JEF2.2	ECN EAF4_thm	ECN EAF4_fst	JNDC JENDL3.2
2	1.5168e+01	1.5229e+01	0.0000e+00	0.0000e+00	1.4403e+01*
3	0.0000e+00	1.7461e-02	0.0000e+00	0.0000e+00	0.0000e+00
4	5.8951e-01	5.7727e-01	0.0000e+00	0.0000e+00	5.3124e-01*
16	0.0000e+00	1.2311e-03	1.4428e-03	1.5722e-03	1.1245e-03 (6.5755e-04*)
17	0.0000e+00	1.3791e-05	3.2195e-05	3.4775e-05	7.6367e-07
27	5.7133e-01	5.7709e-01	5.7031e-01	5.6536e-01	5.4731e-01*
22					1.5616e-07
28					4.9486e-07
32					1.3972e-09
33					1.8269e-10
101	5.7133e-01	5.7709e-01	5.7031e-01	5.6536e-01	5.4731e-01*
102	5.7133e-01	5.7707e-01	5.7029e-01	5.6534e-01	5.4642e-01
103	0.0000e+00	1.2048e-05	1.1788e-05	1.2115e-05	5.3687e-06
104	0.0000e+00	8.3849e-07	8.2351e-07	8.6132e-07	1.6975e-07
105	0.0000e+00	4.6480e-08	7.4174e-08	7.9495e-08	3.2387e-08
106	0.0000e+00	2.0724e-09	2.2982e-09	2.4301e-09	1.1911e-11
107	0.0000e+00	4.3611e-06	1.1289e-05	1.1472e-05	2.1395e-05
111	0.0000e+00	1.2227e-08	1.3475e-08	1.4300e-08	3.3425e-14

mt number	CEA JEF2.2	IPPE BROND-2	IPPE FOND2.1	IPPE ADL-3	JNDC JENDL3.2
2	1.5168e+01	0.0000e+00	0.0000e+00	0.0000e+00	1.4403e+01*
3	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
4	5.8951e-01	4.2490e-01	5.2650e-01	0.0000e+00	5.3124e-01*
16	0.0000e+00	6.3590e-04	7.8290e-04	9.2326e-04	1.1245e-03 (6.5755e-04*)
17	0.0000e+00	3.3950e-08	0.0000e+00	9.9137e-06	7.6367e-07
27	5.7133e-01	0.0000e+00	0.0000e+00	0.0000e+00	5.4731e-01*
101	5.7133e-01	0.0000e+00	0.0000e+00	0.0000e+00	5.4731e-01*
102	5.7133e-01	4.9910e-01	5.7760e-01	5.4415e-01	5.4642e-01*
103	0.0000e+00	0.0000e+00	1.2840e-05	7.4818e-06	5.3687e-06
104	0.0000e+00	0.0000e+00	2.6960e-07	9.0266e-08	1.6975e-07
105	0.0000e+00	0.0000e+00	1.0780e-08	1.3095e-07	3.2387e-08
106	0.0000e+00	0.0000e+00	8.2650e-11	1.5784e-09	1.1911e-11
107	0.0000e+00	0.0000e+00	5.3150e-06	6.7327e-06	2.1395e-05
111	0.0000e+00	0.0000e+00	1.3980e-09	3.2866e-12	3.3425e-14

>reactivity effects

mt number	CEA JEF2.2	ECN JEF2.2	ECN EAF4_thm	ECN EAF4_fst	JNDC JENDL3.2
2	-4.2453e-03	-3.9163e-03	0.0000e+00	0.0000e+00	-4.6708e-03*
3	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
4	-7.0753e-02	-6.8424e-02	0.0000e+00	0.0000e+00	-6.5229e-02*
16	0.0000e+00	-6.9437e-04	0.0000e+00	0.0000e+00	-6.4370e-04*
17	0.0000e+00	-1.6616e-05	0.0000e+00	0.0000e+00	0.0000e+00
27	-5.8010e-01	-5.8286e-01	-5.7605e-01	-5.7095e-01	0.0000e+00
101	-5.8010e-01	-5.8286e-01	-5.7605e-01	-5.7095e-01	-5.4645e-01
102	-5.8010e-01	-5.8283e-01	-5.7602e-01	-5.7092e-01	-5.4642e-01
103	0.0000e+00	-1.7722e-05	-1.7455e-05	-1.7920e-05	-5.3687e-06
104	0.0000e+00	-1.7964e-06	-1.7635e-06	-1.8510e-06	-1.6975E-07
105	0.0000e+00	-1.0481e-07	-1.6943e-07	-1.8173e-07	-3.2387E-08
106	0.0000e+00	-4.6658e-09	-5.1676e-09	-5.4760e-09	-1.1911E-11
107	0.0000e+00	-6.5589e-06	-1.4816e-05	-1.5061e-05	-2.1395E-05
111	0.0000e+00	-2.7986e-08	-3.0725e-08	-3.2683e-08	-3.3425E-14

mt number	CEA JEF2.2	IPPE BROND-2	IPPE FOND2.1	IPPE ADL-3	JNDC JENDL3.2
2	-4.2453e-03	0.0000e+00	0.0000e+00	0.0000e+00	-4.6708e-03*
3	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
4	-7.0753e-02	-4.7650e-02	-6.3160e-02	0.0000e+00	-6.5229e-02*
16	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00	-6.4370e-04*
17	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
27	-5.8010e-01	0.0000e+00	0.0000e+00	0.0000e+00	0.0000e+00
101	-5.8010e-01	0.0000e+00	0.0000e+00	0.0000e+00	-5.4645e-01
102	-5.8010e-01	-5.0440e-01	-5.8440e-01	-5.4950e-01	-5.4642e-01
103	0.0000e+00	0.0000e+00	-1.7860e-05	-1.1190e-05	-5.3687e-06
104	0.0000e+00	0.0000e+00	-4.4450e-07	0.0000e+00	-1.6975E-07
105	0.0000e+00	0.0000e+00	-1.8400e-08	0.0000e+00	-3.2387E-08
106	0.0000e+00	0.0000e+00	-1.5360e-10	0.0000e+00	-1.1911E-11
107	0.0000e+00	0.0000e+00	-7.4160e-06	0.0000e+00	-2.1395E-05
111	0.0000e+00	0.0000e+00	-2.4880e-09	0.0000e+00	-3.3425E-14

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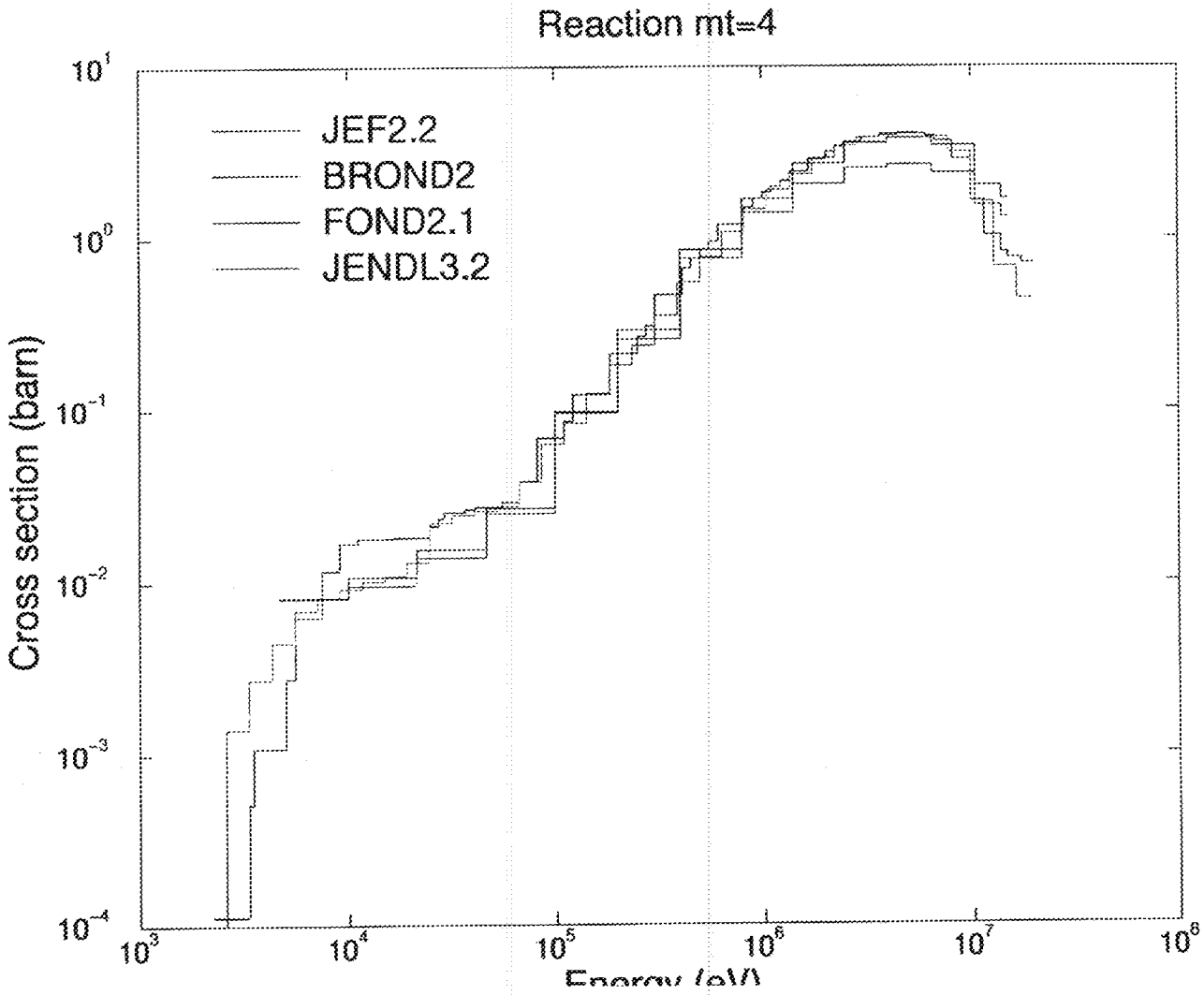
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BROND2
FOND2.1
JENDL3.2
Cross section (barn)
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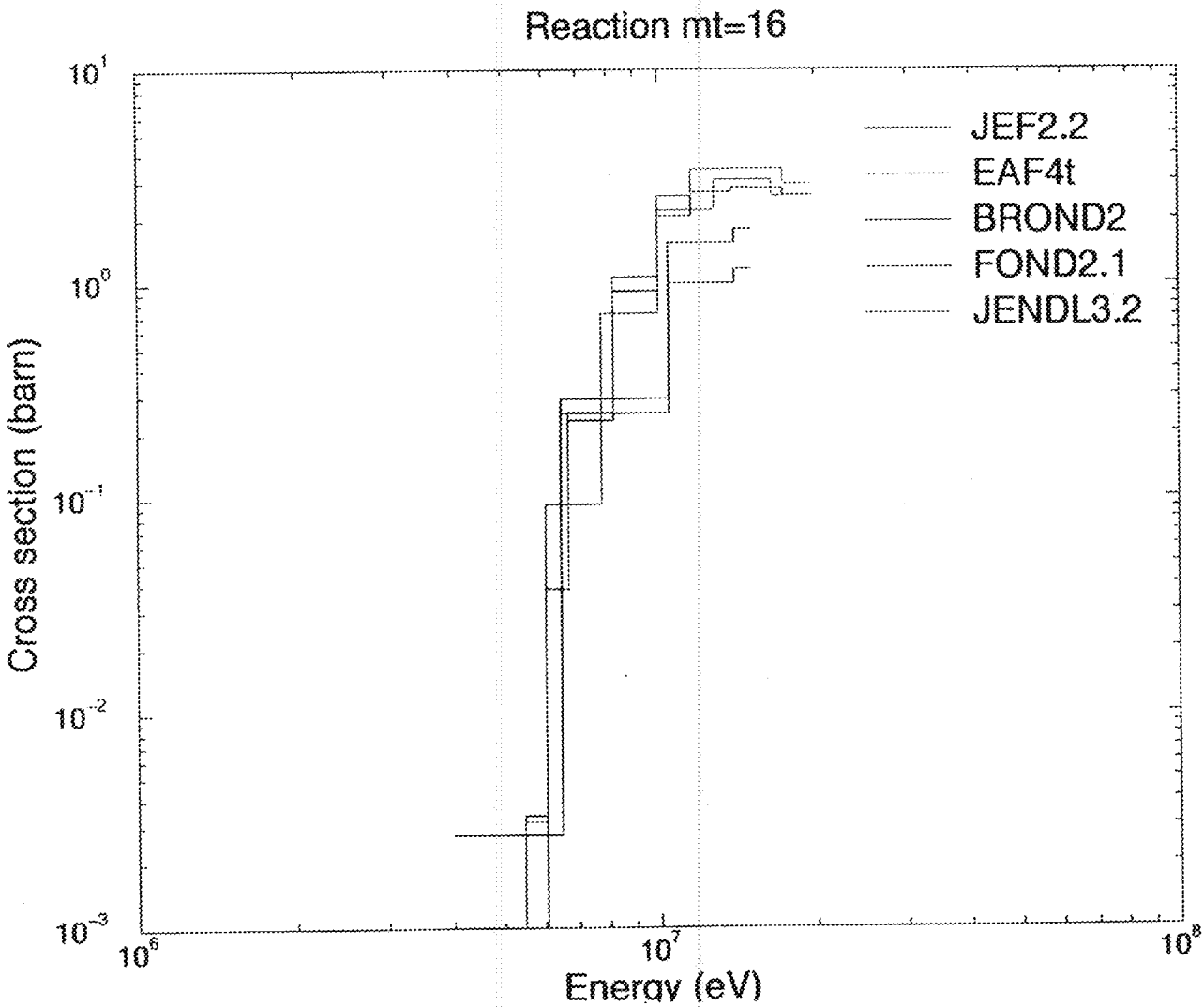
10^{0}
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{3}
10^{4}
10^{5}
10^{6}
10^{7}
10^{8}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EAF4t
BROND2
FOND2.1
JENDL3.2
Cross section (barn)
Energy (eV)
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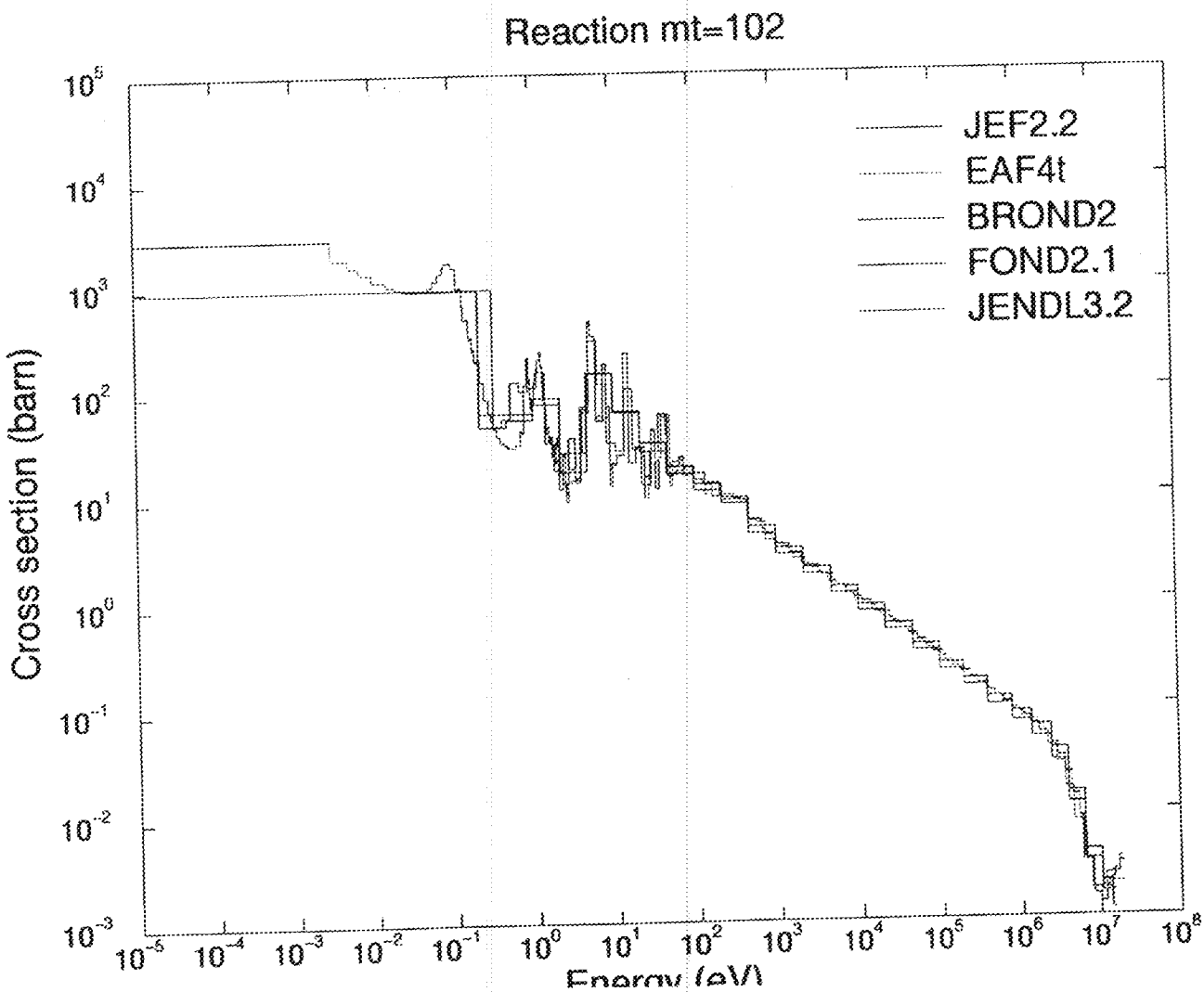
10^{-3}
10^{6}
10^{7}
10^{8}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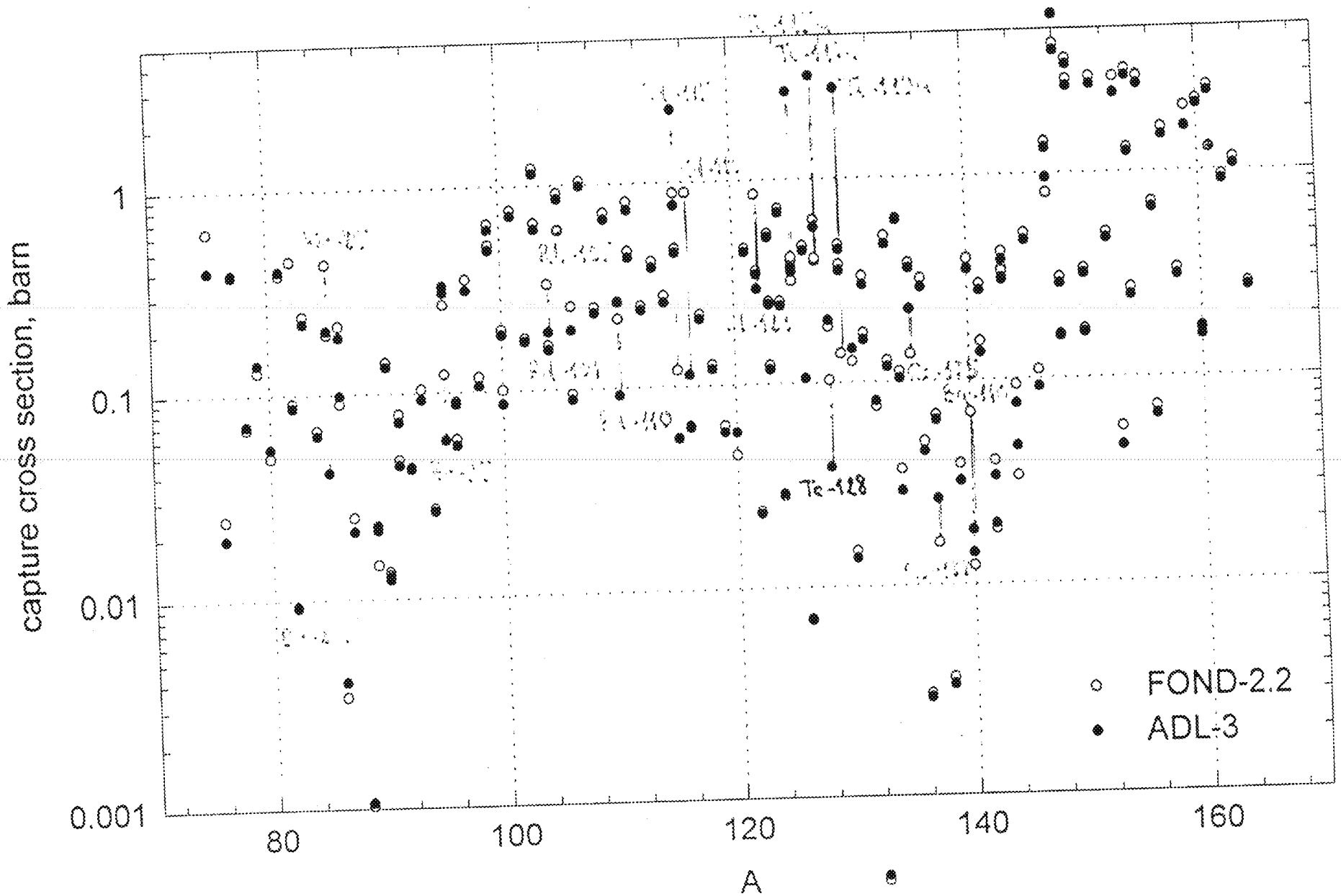
EAF4t
BROND2
FOND2.1
JENDL3.2
Cross section (barn)
Energy (eV)


capture cross section, barn
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0.1
0.01
0.001
80
100
120
140
160
A
Te-128
FOND-2.2
ADL-3