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Proceedings of the

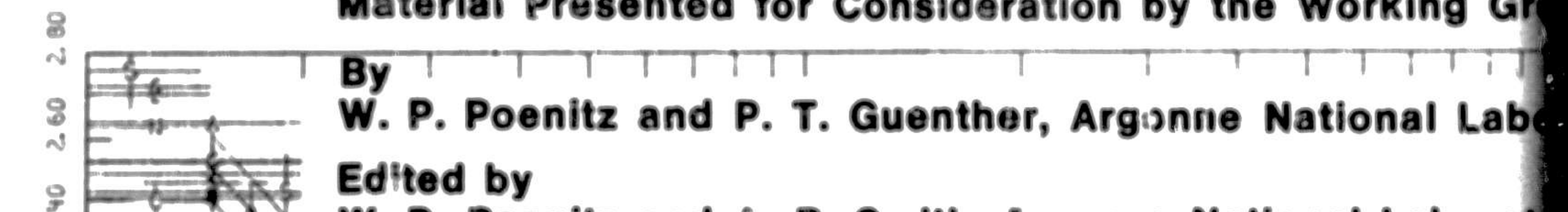
NEANDC/NEACRP Specialists Meeting on Fast Neutron Fission Cross Sections of U-233, U-235, U-

June 28-30, 1976, at Argonne National Laboratory

Supplement
Material Presented for Consideration by the Working Gr

By
W. P. Poenitz and P. T. Guenther, Argonne National Lab

Edited by
W. P. Poenitz and A. B. Smith, Argonne National Laborat



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Supplement to
ANL-76-90
ERDA-NDC-5/L
NEANDC(US)-199/L

CONF-760647--(Suppl.)

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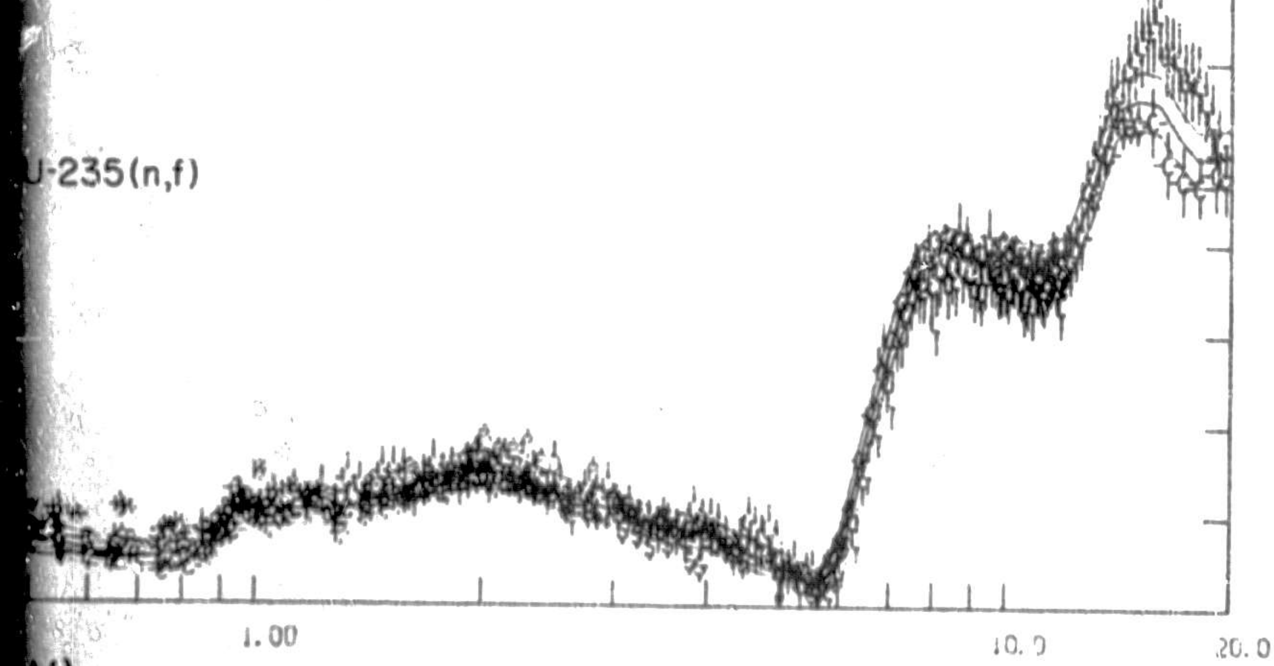

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FAST NEUTRON FISSION CROSS SECTIONS OF U-233, U-235, U-238, AND Pu-239

June 28-30, 1976, at Argonne National Laboratory

Supplement

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W. P. Poenitz and P. T. Guenther
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Edited by

W. P. Poenitz and A. B. Smith
Argonne National Laboratory

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Table of Contents

This Supplement to the Proceedings of the NEANDC/NEACRP Specialists Meeting on Fast Fission Cross Sections of U-233, U-235, U-238 and Pu-239, held at Argonne National Laboratory, June 28-30, 1976, summarizes the data and graphical material presented for consideration by the Working Groups on absolute cross section values and cross section ratios.

Data files of all available data of absolute cross section measurements of U-233, U-235, U-238 and Pu-239, and of the ratios of U-233, U-238, and Pu-239 to U-235 were assembled at Argonne National Laboratory for use by the two Working Groups. The data files of absolute cross sections included also data measured relative to one of the standard cross sections H(n,n), Li-6(n,α), and B-10(n,α), and the ratio data files included ratios derived from absolute values which were measured in an identical type of experiment by the same group of experimenters. The subject files (e.g., U-235-Absolute, or U-238/U-235-Ratio, etc.) consisted of "Sets". These sets contained the data from one experimental group which may have been published at different times. (e.g., the U-235-Absolute Set 35 contains several subsets with the data published by Szabo et al. at '70 Helsinki, '70 ANL, '71 Knoxville, '72 Vienna, '73 Kiev and '76 ANL, all of which, however, were measured with the same calibrated neutron flux monitor). The assembling of the files was started with an extract from the CSISRS data files of the National Neutron Cross Section Center at the Brookhaven National Laboratory. Ratios were derived from quoted consistent sets of absolute cross sections, or from data which were actually measured as ratios but quoted as absolute values. The latter type of data was eliminated from the data files on absolute values. The files were improved by an extensive search for errors and data missing on the original CSISRS files at the time the extract was made. Other additions to the present subject files came from presentations made at this meeting and are described in the proceedings.

The contents of the subject files which were the base of the material considered by the Working Groups is summarized in Tables 1 to 8. The data were available on data cards, magnetic tape, and disc. The material presented to the Working Groups consisted of files which contained data

listings, reprints and preprints of publications relevant to these data and a small-scale plot of the data. In addition larger-scale graphs of the data sets were posted on boards in proper grouping to permit an easy comparison of the experimental data. The present supplement contains essentially these graphs which were considered by the Working Groups. However, a data set for Pu-239/U-235 by Fursov et al. was obtained only after the end of the meeting but is included in the present supplement. Some data points by Zhuravlev et al. on U-235 and Pu-239/U-235 were presented at the Lowell Conference one week after the present meeting and are included for the sake of completeness of the available data information of the time of the printing of the proceedings. Some graphs were replotted in order to reduce the total number of graphs and to improve their readability compared with direct reproductions (Colors were used in the originals for better distinction between different sets. This would have resulted in confusingly similar signs in a black-white reproduction).

The selection of specific sets on one graph was generally arbitrary. However, an attempt was made to assemble newer data and older data on separate graphs. In some instances the objective was to display an existing discrepancy. This is pointed out in the associated figure caption. Most graphs contain a curve to permit the intercomparison between data sets of the same quantity which were placed for better readability on different graphs. Thus the curves are intended for visual reference rather than for the comparison of the experimental data with these curves. Their selection was arbitrary. For U-235 the ENDF/B-V, for Pu-239/U-235 and U-233/U-235 the ENDF/B-IV, and for U-238/U-235 the evaluation by Poenitz (Session I in the Proceedings of this meeting) was used. In some cases curves were drawn for individual data sets to demonstrate structure in the data. In some instances the same data set was plotted on different graphs in order to achieve an improved data comparison between different sets.

The uncertainty of the experimental value is shown as a vertical bar and the energy resolution is shown as a horizontal bar. Where no error or resolution bars are shown, this information was not available or the bars

were smaller than the size of the sign. Wherever a renormalization of shape data was applied, it is indicated on the graphs and detailed in the Figure Caption. All (horizontal) energy scales are in MeV, all (vertical) cross section scales are in barn (for U-235), and all (vertical) cross section ratio scales are dimensionless. Data over/underflow is indicated by an arrow.

Names given on the graphs were often referenced in the associated figure caption. Otherwise the reference can be found in Tables 1-7 by using the Set-No which is given on the graphs as a cross-reference. The references are in a short format. Abbreviations are similar to those used and listed in CINDA. Often only one reference is given for a data set which may base actually on multiple publications. More extensive references may be found in the given reference or in CINDA. The proceedings of the present meeting are referenced with 76 ANL.

Acknowledgements

The authors are indebted to Dr. M. Bhat from Brookhaven National Laboratory for supplying renormalized interval-averaged cross section data for U-235. The National Neutron Cross Section Center at Brookhaven National Laboratory supplied the extracts from the CSISRS data files, and Dr. J. J. Schmidt from the Nuclear Data Section of the International Atomic Energy Agency tried his best to supply the Pu-239/U-235 data by Fursov et al. from '75 Kiev.

Table 1. U-238/U-235 File

Set	Name	Reference	Source/Status	Comments
1	Poenitz	JNE 26, 483	CSISRS	Three absolute points
2	Meadows	76 ANL	CSISRS	Several sets
3	Behrens	76 ANL	PC	Present status, '76
4	Coates	75 Wash	CSISRS	Shape, revised June '76
5	Cance	76 ANL	CCDN	New data, 14.6 MeV '75 Kiev
6	Stein	58 Wash	PAPER	Errors in CSISRS
7	Lamphere	PR 104, 1654	CSISRS	Data from graph
8	White	JNE 21, 671	CSISRS	Returned to ratio
9	Cierjacks	76 ANL	PC	Shape data only, preliminary
10	Fursov	73 Kiev	PAPER	
11	Nordborg	76 ANL	PAPER	Preliminary data
12	Henkel	LA-2122	NOT YET	Ref. CS in CSISRS unclear
13	Allen	PPS/A 70, 573	PAPER	Values from graph
14	Grundl	75 Wash	CSISRS	Av. over Cf
15	Kuks	73 Kiev, AE	DER-CSISRS	Derived from abs. values
16	Uttley	AHSB(S)R169	PAPER	Derived from abs. values
17	Adams	JNE 14, 85	PAPER	Shape only
18	Netter	CEA-1913	DER-CSISRS	
19	Smirenkin	AE, SAE 13, 974	DER-CSISRS	One point only
20	Moat	AHSB(S)R169	PAPER	Derived from abs. values
21	Jarvis	LA-1571	PAPER	One point only
22	Iyer	69 ROORKEE	CSISRS	
23	Berezin	AE, SAE 5, 1604	CSISRS	
24	Hall	LA 128	PAPER	
25	Bretcher	LA 128	PAPER	Shown in graph of LA 128
26	Z-Group	LA 128	PAPER	Shown in graph of LA 128
27	Chadwick	LA 128	PAPER	Shown in graph of LA 128
28	Hansen	CF 618	NOT YET	
29	Taschek	LA 39	NOT YET	
30	Smith	BAP, 2, 196	PAPER	Ratio formed from abs. values
31	Difilippo	76 ANL	PC	New data

Table 1. U-236/U-235 File (Contd.)

Set	Name	Reference	Source/Status	Comments
32	Grundl	NSE 30, 45	PAPER	Shape only
33	Evans	76 ANL	PC	Data only in Graph
34	Pankratov	AE 9, 399	DER-CSISRS	Not all data on CSISRS

Table 2. Pu-239/U-235 File

Set	Name	Reference	Source/Status	Comments
1	Letho	NSE 39, 361	CSISRS	
2	Poenitz	NSE 47, 228	CSISRS	Two sets
3	Gwin	ANS 15, 481	CSISRS	
4	Carlson	76 ANL	PC	New data, present status, '76.
5	Pfletschinger	NSE 40, 375	CSISRS	
6	Gayther	75 Wash	CSISRS	Shape only
7	Savin	YFI-8, 12	CSISRS	Shows structure
8	Smirenkin N	ICD-4	CSISRS	
9	Chelnokov	AE 31, 103	CSISRS	
10	Whal	LA-1681	CSISRS	
11	Williams	LA-520	CSISRS	
12	White	JNE, 65 Salz.	PAPER, CSISRS	Returned to ratio
13	Uttley	AERE-1996	CSISRS	
14	Gilboy	66 Paris	CSISRS	Only lower set valid
15	Soleilhac	70 Hels.	CSISRS	
16	Szabo	76 ANL	CSISRS, CCDN	
17	Perkin	JNE19, 423	DER-CSISRS	From absolute values
18	Netter	JPR 17, 565	DER-CSISRS	
19	Allen	PPS/A70, 573	PAPER	Av. between two poss. values
20	Dorofeev	JNE 5, 217	PAPER	
21	Meadows	76 ANL	PC	New data
22	Iyer	69 ROORKEE	DER-CSISRS	
23	Smith	APS	NOT YET	Pu status unclear
24	Henkel	LA	NOT YET	Unclear Reference CS
25	Adams	JNE 14, 85	DER-CSISRS	Shape only
26	Knoll	76 ANL	PC	Formed from abs. values
27	Smirenkin	AE, SAE 13, 974	DER-CSISRS	
28	Moat	AHSB(S)R169	PAPER	
29	Fursov	75 Kiev	IAEA	
30	Cierjacks	76 ANL	NOT YET	
31	Kaeppeler		NOT YET	From absolute values

Table 3. U-233/U-235 File

Set	Name	Reference	Source/Status	Comments
1	Letho	NSE 39, 361	CSISRS	
2	Meadows	76 ANL	CSISRS	
3	Gwin	ANS 15, 481	CSISRS	
4	Smirenkin N	ICD-4, 67	CSISRS	
5	Lamphere	PR 104, 1654	CSISRS	From graph
6	Williams	LA-520	CSISRS	
7	White	JNE, 65 Salz.	PAPER, CSISRS	Returned to ratio
8	Pfletschinger	NSE 40, 375	CSISRS	
9	Behrens	76 ANL	PC	Present status of data, May '76.
10	Dorofeev	JNE 5, 217	PAPER	From absolute values
11	Allen	PPS/A70, 573	PAPER	Av. between two values
12	Netter	JPR 17, 565	DER-CSISRS	
13	Uttley	AERE - 1996	DER-CSISRS	
14	Perkin	JNE 19, 423	DER-SCSRS	Sb-Be Source
15	Henkel	LA	NOT YET	
16	Gorlove	AE 6, 453	DER-CSISRS	
17	Moat	AHSB(S)R 169	PAPER	

Table 4. U-235 File

Set	Name	Reference	Source/Status	Comments
1	Gwin	ANS 15, 481	CSISRS	
2	Grundl	76 ANL	CSISRS	Av. over Cf spectrum
3	Gilliam + R	76 ANL	PC	New values
4	Poenitz	NSE 53, 370	CSISRS	
5	Hansen	76 ANL	CSISRS	
6	Czirr + S	NSE 57, 18	CSISRS	Shape only
7	Czirr	UCRL-77377	CSISRS	Rel. Li 6, new values
8	Kaeppeler	7Vienna	CSISRS	Also ANL 70
9	Gayther	75 Wash	CSISRS	Shape only
10	Cance	76 ANL	CCDN	
11	Gorlove	AE6, 453	CSISRS	
12	Chelnokov	AE 31, 103	CSISRS	
13	Kuks	73 Kiev	CSISRS	
14	Smith	BAP2, 196	CSISRS	
15	Henkel-LE	LA-2122	CSISRS	
16	Poenitz 68W	68 Wash	CSISRS	
17	Melkonian	NSE 3, 435	CSISRS	
18	Yeater	PR 104, 479	CSISRS	
19	Diven PR	PR 105, 1350	CSISRS	
20	Williams	LA-150	CSISRS	
21	Nyer	LAMS-938	CSISRS	
22	Whal	LA-1681	CSISRS	
23	Moat	JNE 16, 270	CSISRS	
24	Adams	JNE 14, 85	CSISRS	Shape only
25	White	JNE 19, 325	CSISRS	
26	Perkin	JN19, 425	CSISRS	Sb-Be Source
27	Knoll + P	JNE 21, 643	CSISRS	
28	Netter	CEA-1913	CSISRS	
29	Allen	PPS/A70, 573	CSISRS	
31	Pankratov	AE,JNE 16, 494	CSISRS	Several sets
34	Goldanski	DOK 101, 1027	CSISRS/HOLD	Energies unclear

Table 4. U-235 File (Contd.)

Set	Name	Reference	Source/Status	Comments
35	Szabo	76 ANL	CSISRS,CCDN	Several sets, latest values
36	Blons	NSE 51, 130	CSISRS, BHAT	
37	Hall	LA-128	PAPER	
38	Adamov	75 Kiev	PAPER	Av. Cf Spectra
39	Benedict		NOT YET	
40	Van Shi-Di	65 Salzburg	BHAT	Requested from NNCSC
42	Dorofeev	JNE 5, 217	PAPER	
43	Lemley	NSE 43, 281	BHAT	
44	Wagemans	ANE, t.b.p.	CCDN	New data
45	Michaudon		BHAT	Some values missing
46	Perez	NSE 55, 203	BHAT	Some values missing
47	Wasson	76 ANL	PC	New data
48	DeSaussure	ORNL-1804	BHAT	
49	Ryabov	INDC-31/U	BHAT	
50	Taschek	LA-445	PAPER	
51	Bowman	66 Wash	BHAT	
52	Schomberg	JNE 24, 269	PAPER	
53	Bailey	LA 447	PAPER	
54	Derruytter		BHAT	
55	Shore	PR 112, 191	BHAT	
56	Cierjacks	76 ANL	PC	Relative H(n,n)
57	Brooks	66 San Diego	NOT YET	
58	Zhuravlev	76 Lowell	ABSTRACT	

Table 5. U-238 File

Set	Name	Reference	Source/Status	Comments
1	Barrall	AFWL-TR-68	CSISRS	Al(n,α) Reference
2	Grundl	75 Wash	CSISRS	Av. over Cf spectrum
3	Cance	75 Kiev	CCDN	Updated value
4	Kuks	75 Kiev	CSISRS	
5	Smith	BAP 2, 196	CSISRS	
6	Leachman	JNE 4, 38	CSISRS	Av. over Cf spectrum
7	Adams	JNE 14, 85	CSISRS	Shape only
8	Netter	CEA - 1913	CSISRS	
9	Mongialajo	NP 43, 124	CSISRS	
10	Emma	NP 63, 641	CSISRS	Shape only
11	Uttley	AERE-1996	CSISRS	
12	Flerov	AE,JNE 11, 173	CSISRS	
13	Pankratov	AE,JNE 16, 494	CSISRS	Several sets
14	Moat	JNE 14, 85	CSISRS	
15	Allen	PPS/A 70, 573	CSISRS	
16	Adamov	75 Kiev	PAPER	Av. over Cf Spectrum
17	Vorotuikov	INDC-66U	PAPER	Subthreshold
18	Cierjacks	76 ANL	PC	Relative H(n,n)
19	Zhuravlev	76 Lowell	ABSTRACT	

Table 6. Pu-239 File

Set	Name	Reference	Source/Status	Comments
1	Gwin	NSE 45, 25	CSISRS	Several sets
3	Weston	ANS 15, 480	CSISRS	
4	Knoll	76 ANL	PC	New data
5	Gayther	75 Wash	CSISRS	
6	Schomberg	70 Hels.	CSISRS	
9	Chelnokov	AE 31, 103	CSISRS	
10	Cote	BAP 1, 187	CSISRS	
11	Smith	BAP 2, 196	CSISRS	
13	Moat	JNE 14, 85	CSISRS	
14	Adams	JNE 14, 85	CSISRS	
15	Perkin	JNE 19, 423	CSISRS	Sb-Be Source
16	Netter	JPR 17, 565	CSISRS	
17	Allen	PPS/A70, 573	CSISRS	
18	Dorofeev	JNE 5, 217	CSISRS	
20	Smirenkin	AE 13, 366	CSISRS	
21	Dubrovina	DOK 157, 561	CSISRS	
22	Kalinin	58 Geneva	CSISRS	
23	Szabo	76 ANL	CSISRS/CCDN	Presently valid data
24	Blons	70 Hels.	CSISRS	
25	Kaeppeler		NOT YET	Relative H(n,n)

Table 7. U-233 File

Set	Name	Reference	Source/Status	Comments
1	DeSaussure	NSE 52, 46	CSISRS	
2	Gorlove	AE 6, 453	CSISRS	
3	Perkin	JNE 19, 423	CSISRS	Sb-Be Source
4	Netter	JPR 17, 565	CSISRS	
5	Allen	PPS/A 70, 573	CSISRS	
6	Dorofeev	JNE 5, 217	CSISRS	
7	Pankratov	AE,SAE 14, 167	CSISRS	Several sets
8	Smirenkin	AE,SAE 13, 974	CSISRS	

Abbreviations

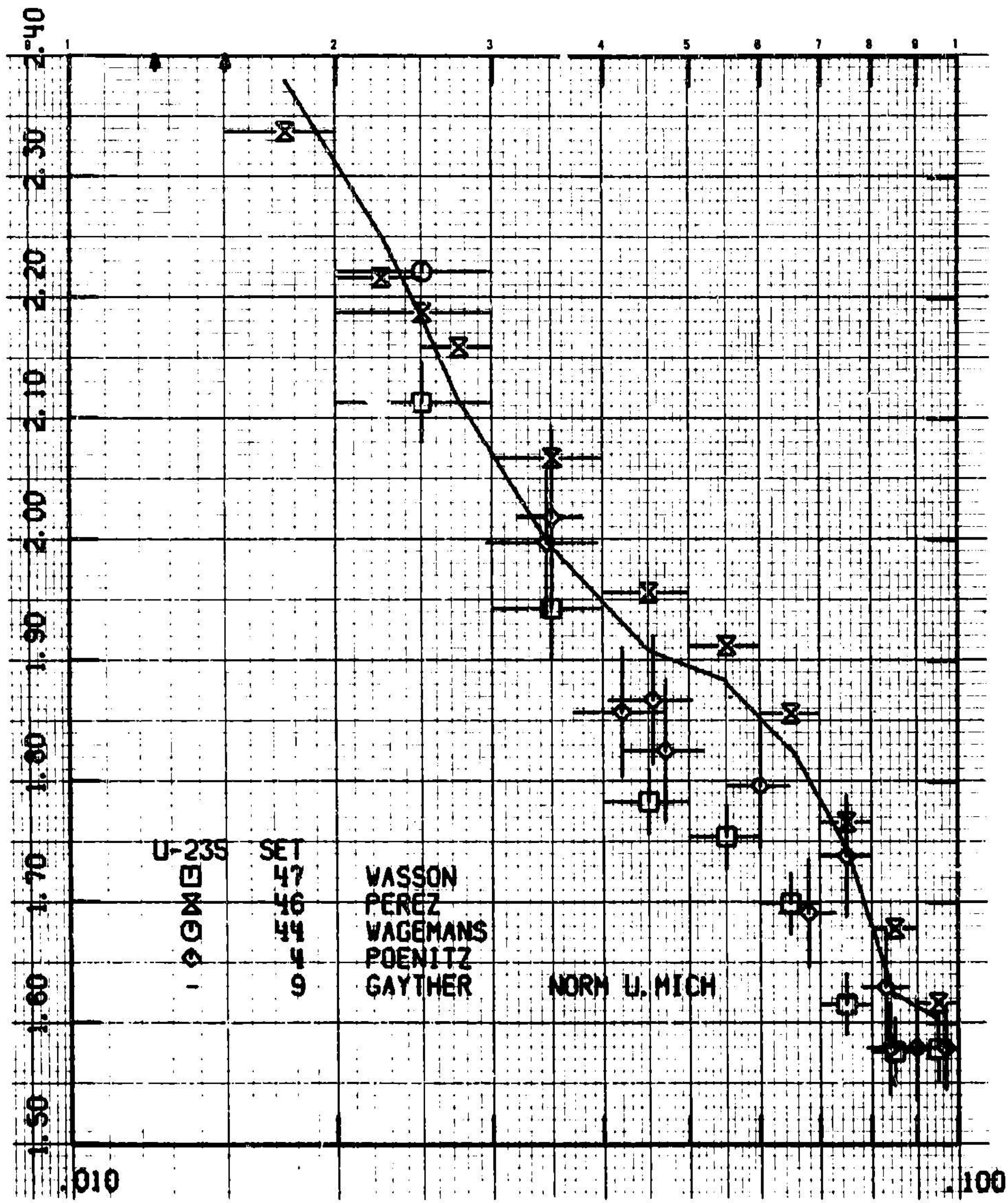
PC	Private Communication
DER-CSISRS	Derived from data quoted on the CSISRS-tapes
NOT YET	Data are known to exist but are not yet available or could not be obtained.

jure 1 *U-235 (n,γ)* *10-100 keV*

The shape-data by Gayther et al. (72 Vienna, p. 201) were normalized with the absolute photoneutron-
irce data from the University of Michigan (M. C. Davis et al., 76 ANL, p. 225). The data by Wasson
'e averaged over 10 keV intervals (OA. Wasson, 76 ANL, p. 183). The data by Wasson, by Perez et al.
iE, 55, 203, 1974), and by Wagemans et al. (Ann. of Nucl. Energy, to be publ., 1976) are white-neutron
irce data which were normalized in the eV-energy range. The data by Poenitz (NSE, 53, 370, 1974) are
ioenergetic-neutron source data. The "bump" between 45 and 85 keV is very pronounced in the data by
'ez et al., Gwin et al., and Gayther et al. but shows to a lesser extend in the data by Poenitz, by
.bo et al., by Wasson, and by Lemley et al. (see subsequent figures for comparison).

'ure 2 *U-235 (n,γ)* *10-100 keV*

Comparison of the shape-data by Gayther et al. (see Fig. 1) with data by Szabo et al. (76 ANL, p.
) gives a summary of final data which were previously published at 70 Helsinki, 70 ANL, 71 Knoxville,
Vienna, 73 Kiev), and with data by Czirr and Sidhu (UCRL - 77377, 1975). Other data are by Chelnokov
al. (AE, 31, 103, 1971) and a single point obtained with a photoneutron source by Perkin et al.
IE, 19, 423, 1965). This point may strongly depend on structure in this energy region and uncertainties
the Sb-Be neutron source energy.



U-235 SET
47 WASSON
46 PEREZ
44 WAGEMANS
4 POENITZ
9 GAYTHER
NORM U.MICH
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
.010
.100

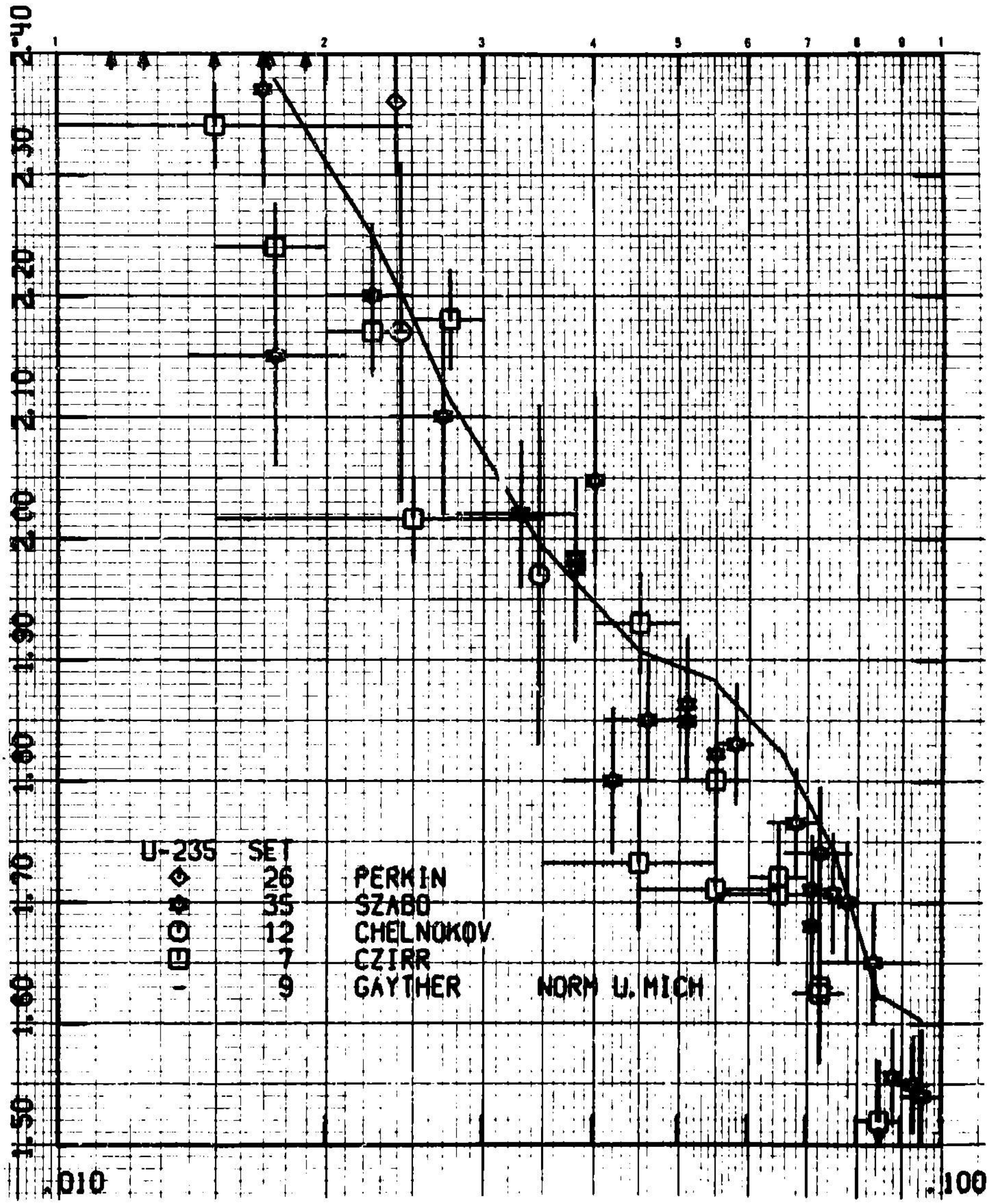

U-235 SET
26 PERKIN
35 SZABO
12 CHELNOKOV
7 CZIRR
9 GAYTHER
NORM U. MICH
2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
.010
.100

Figure 3 *U-235 (n,f)* *10-100 keV*

Comparison of the data points by Gayther et al. and a linearly interpolated curve through these poi (which was shown in the preceeding Figs. 1 and 2) with the data by Gwin et al. (ANS, 15, 481, 1972), Lemley et al. (NSE, 43, 281, 1971), and Blons et al. (NSE, 51, 130, 1973). All data were revised to use ENDF/B-V reference values for Li-6 (n,α), and B-10 (n,α) Double-points for data by Gayther et al. indicate minor differences in the averaging procedure by the authors of the measurements and by M. Bhat,

Figure 4 *U-235 (n,f)* *10-100 keV*

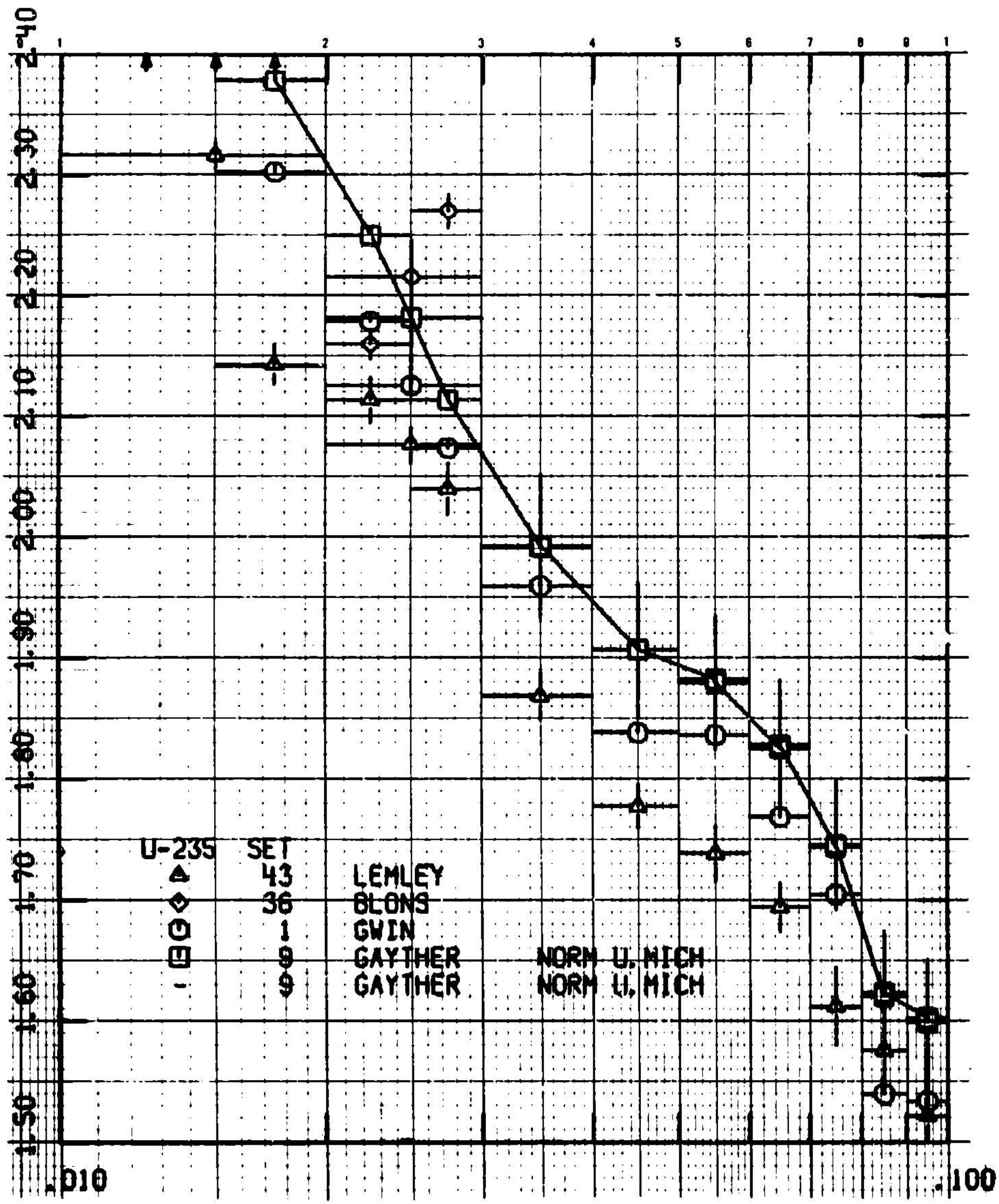
Comparison of structure in the U-235 (n,f) cross-section measured by Gwin et al. (ANS, 15, 481, 1972) and by Wasson (76 ANL, p. 183). The data by Wasson are shown by a diamond and a linear inter- polated line as an eye-guide curve. The data by Gwin et al. are shown by a linearly interpolated curve only. Structure appears to be correlated below 40 keV but contradictory between 50 and 80 keV.

U-235 (n,γ) *10-100 keV*

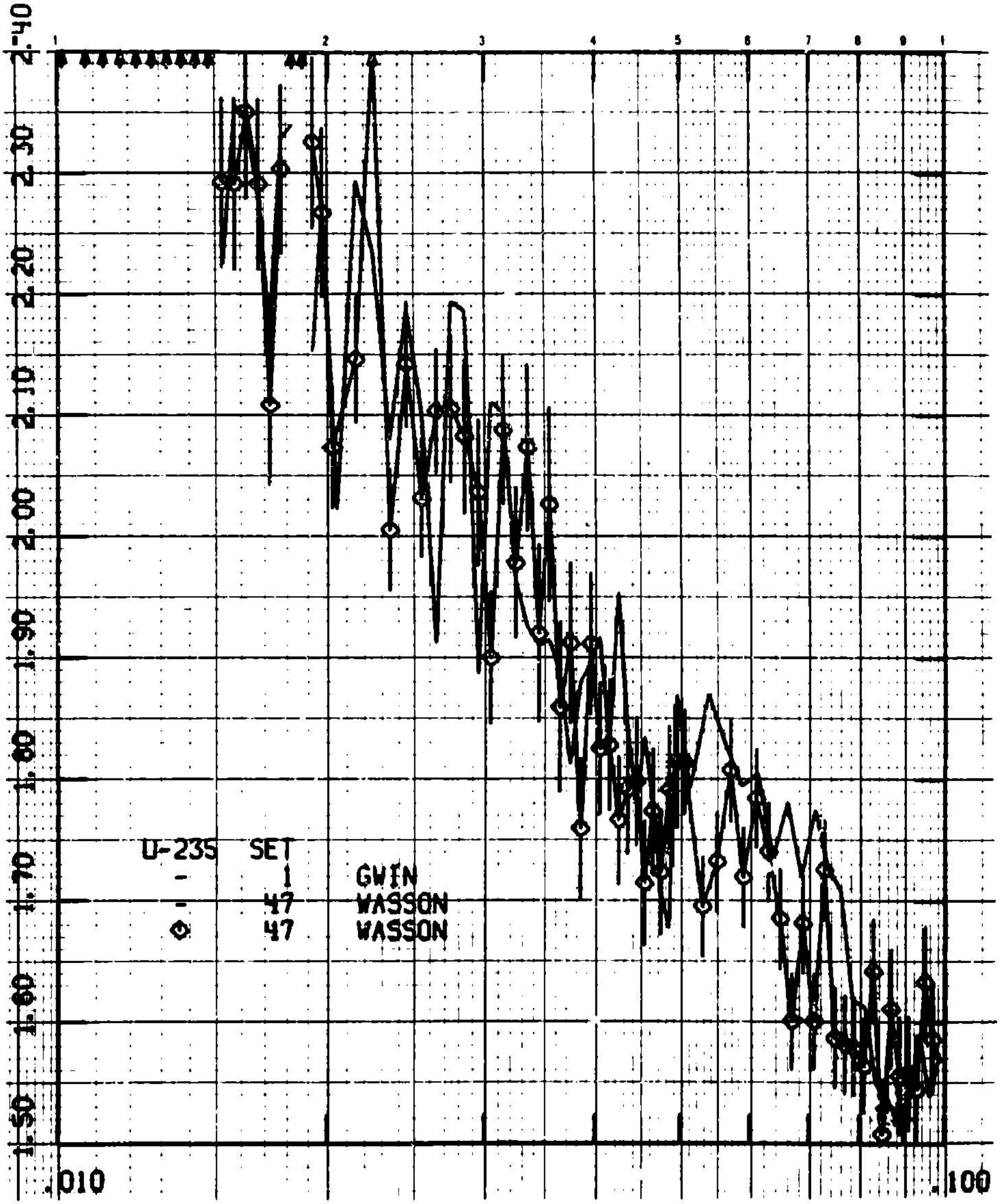
aayther et al. and a linearly interpolated curve through these points
. 1 and 2) with the data by Gwin et al. (ANS, 15, 481, 1972),
d Blons et al. (NSE, 51, 130, 1973). All data were revised to use
), and B-10 (n,α) Double-points for data by Gayther et al.
aging procedure by the authors of the measurements and by M. Bhat, BNL.

U-235 (n,γ) *10-100 keV*

235 (n,f) cross-section measured by Gwin et al. (ANS, 15, 481,
The data by Wasson are shown by a diamond and a linearly inter-
he data by Gwin et al. are shown by a linearly interpolated
orrelated below 40 keV but contradictory between 50 and 80 keV.

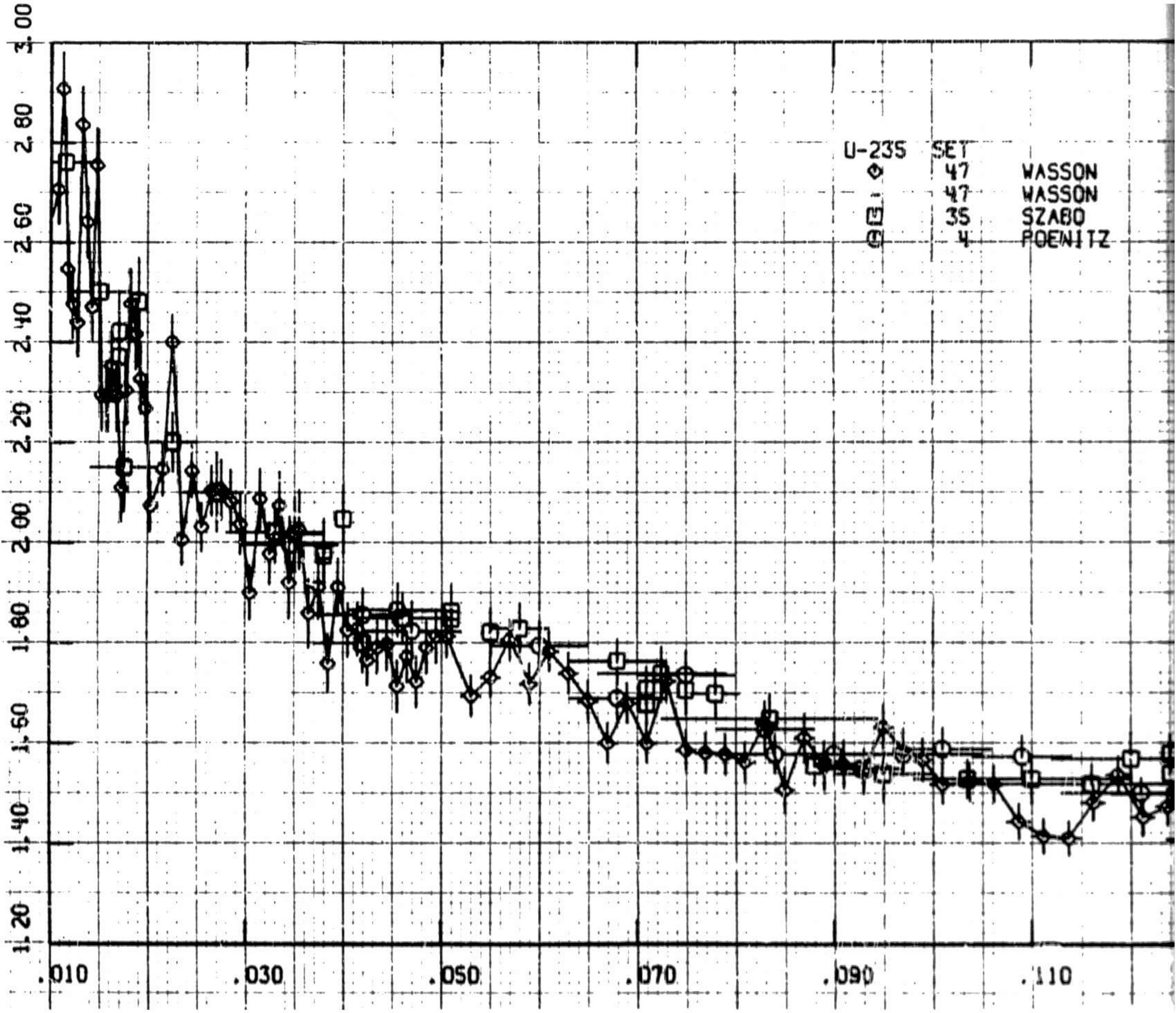


2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
.010
.100
U-235 SET
43 LEMLEY
36 BLONS
1 GWIN
9 GAYTHER NORM U.MICH
9 GAYTHER NORM U.MICH


2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
.010
.100
U-235 SET
- 1 GWIN
- 47 WASSON
◇ 47 WASSON

igure 5 *U-235 (n,f)* *10-210 keV*

Comparison of the white-neutron source low-energy normalized data by Wasson (76 ANL, p. 183) ith the absolute monoenergetic-neutron source data by Poenitz (NSE, 53, 370, 1974), and by Szabo et l. (76 ANL, p. 208). For comparison with structure in the data by Gwin et al. see next figure.



3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
.010
.030
.050
.070
.090
.110
U-235 SET
47 WASSON
47 WASSON
35 SZABO
4 POENITZ

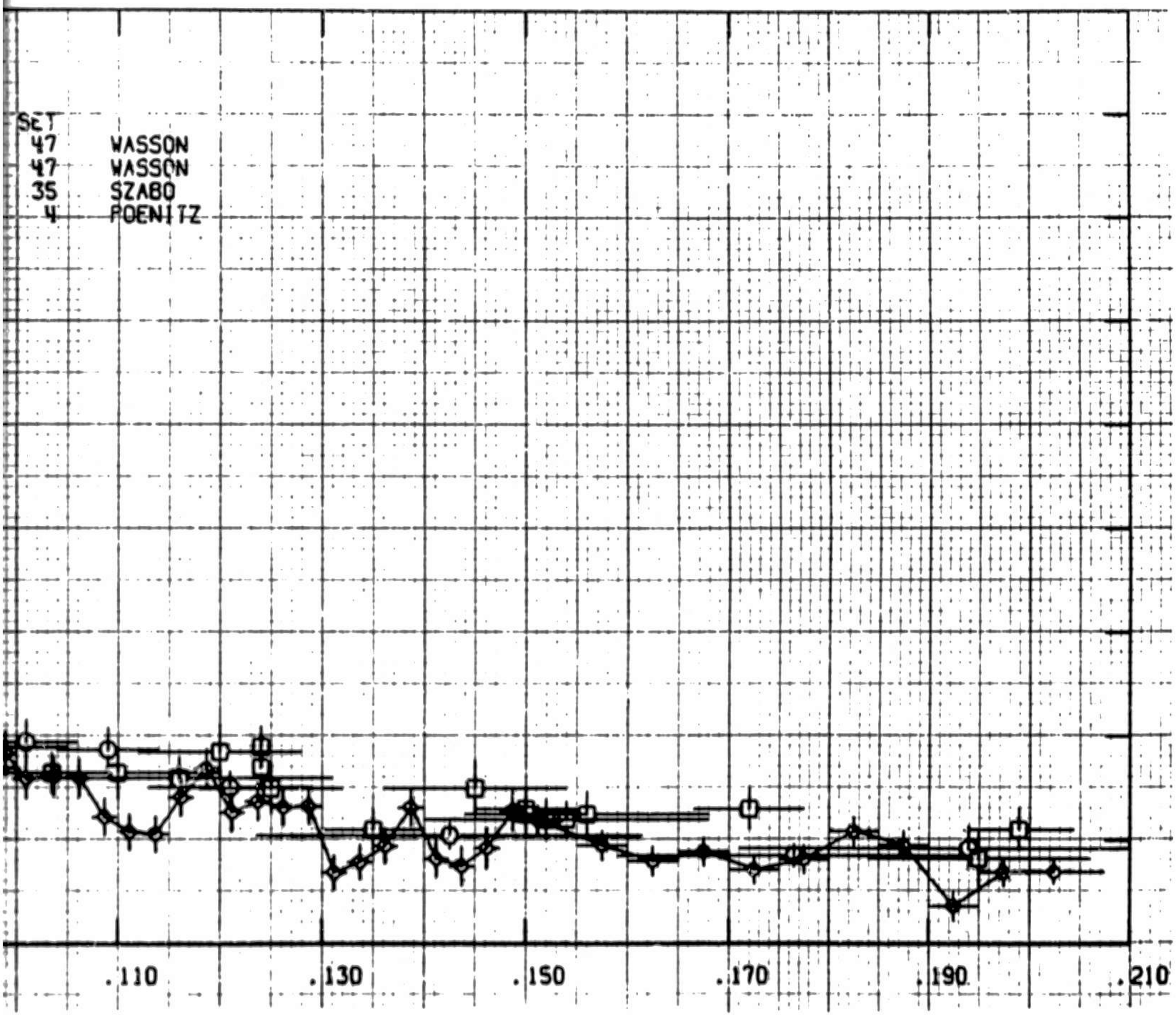
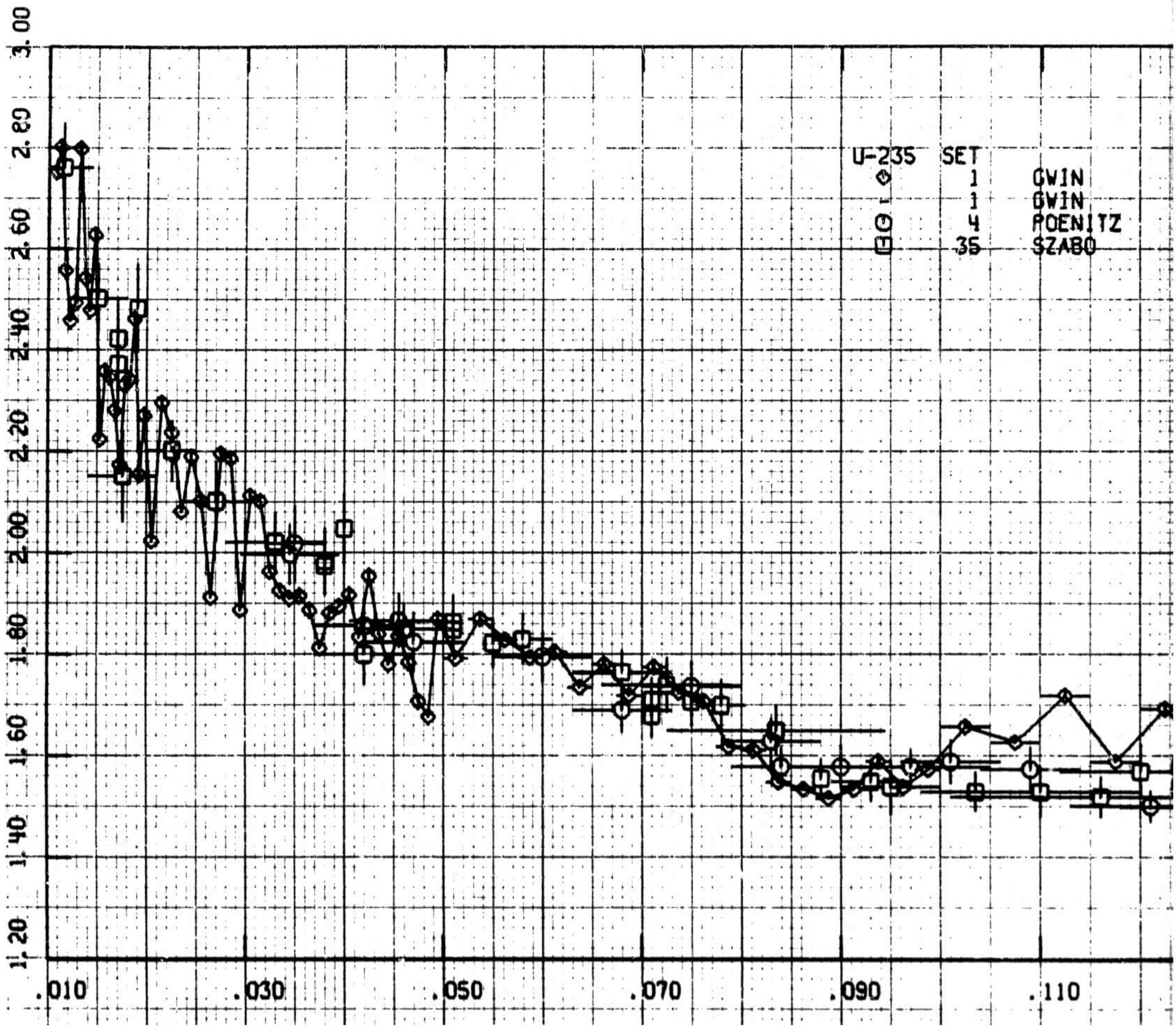

SET
47 WASSON
47 WASSON
35 SZABO
4 POENITZ
.110
.130
.150
.170
.190
.210

Figure 6 *U-235 (n,f)* *10-210 keV*

Comparison of the white-neutron source low-energy normalized data by Gwin et al. (ANS, 15, 481, 1972) with the absolute monoenergetic-neutron source data by Poenitz (NSE, 53, 370, 1974), and by Szabo et al. (76 ANL, p. 208). For comparison with structure in the data by Wasson see preceeding figure.


U-235 SET
1 GWIN
1 GWIN
4 POENITZ
35 SZABO
.010
.030
.050
.070
.090
.110

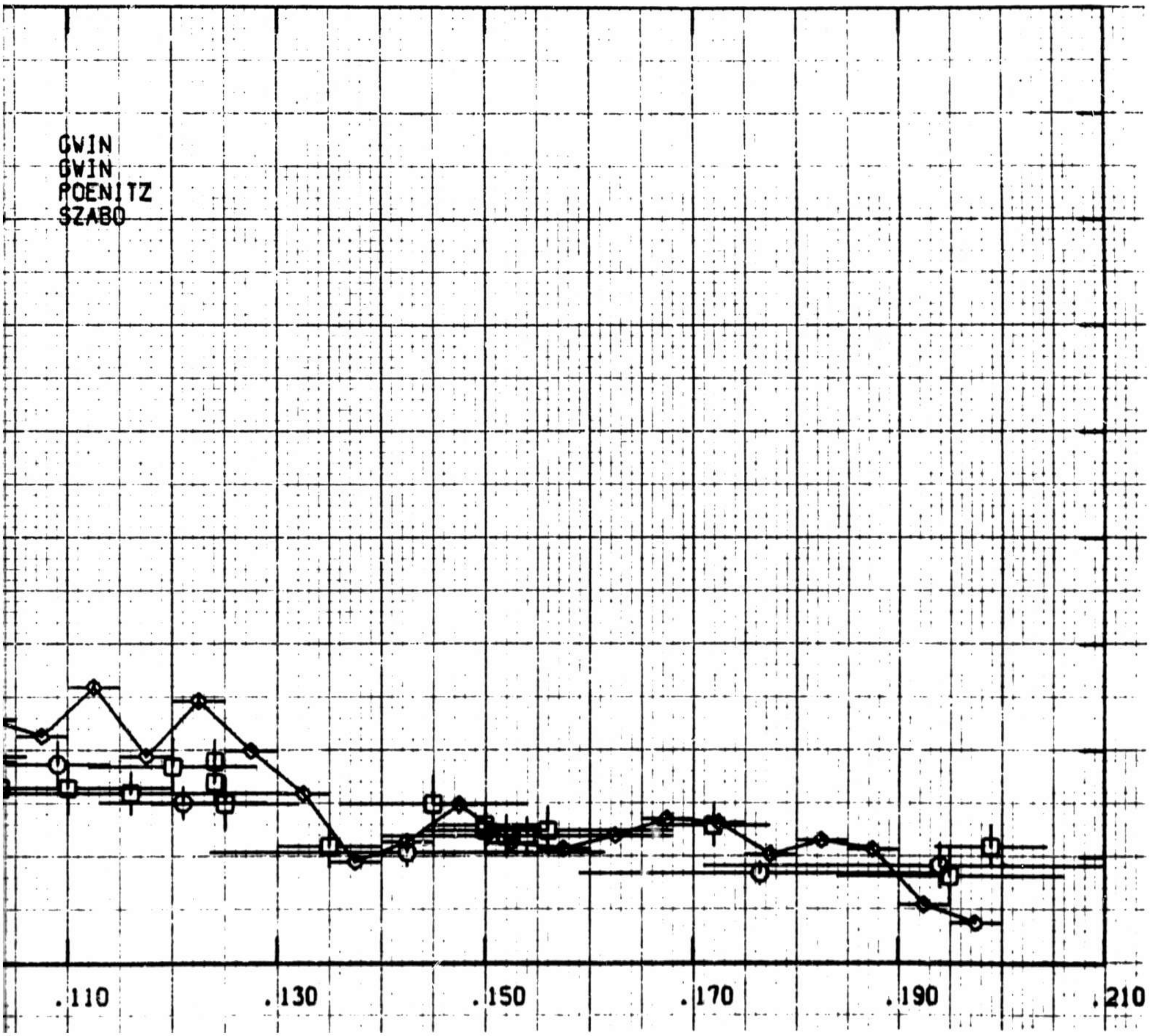
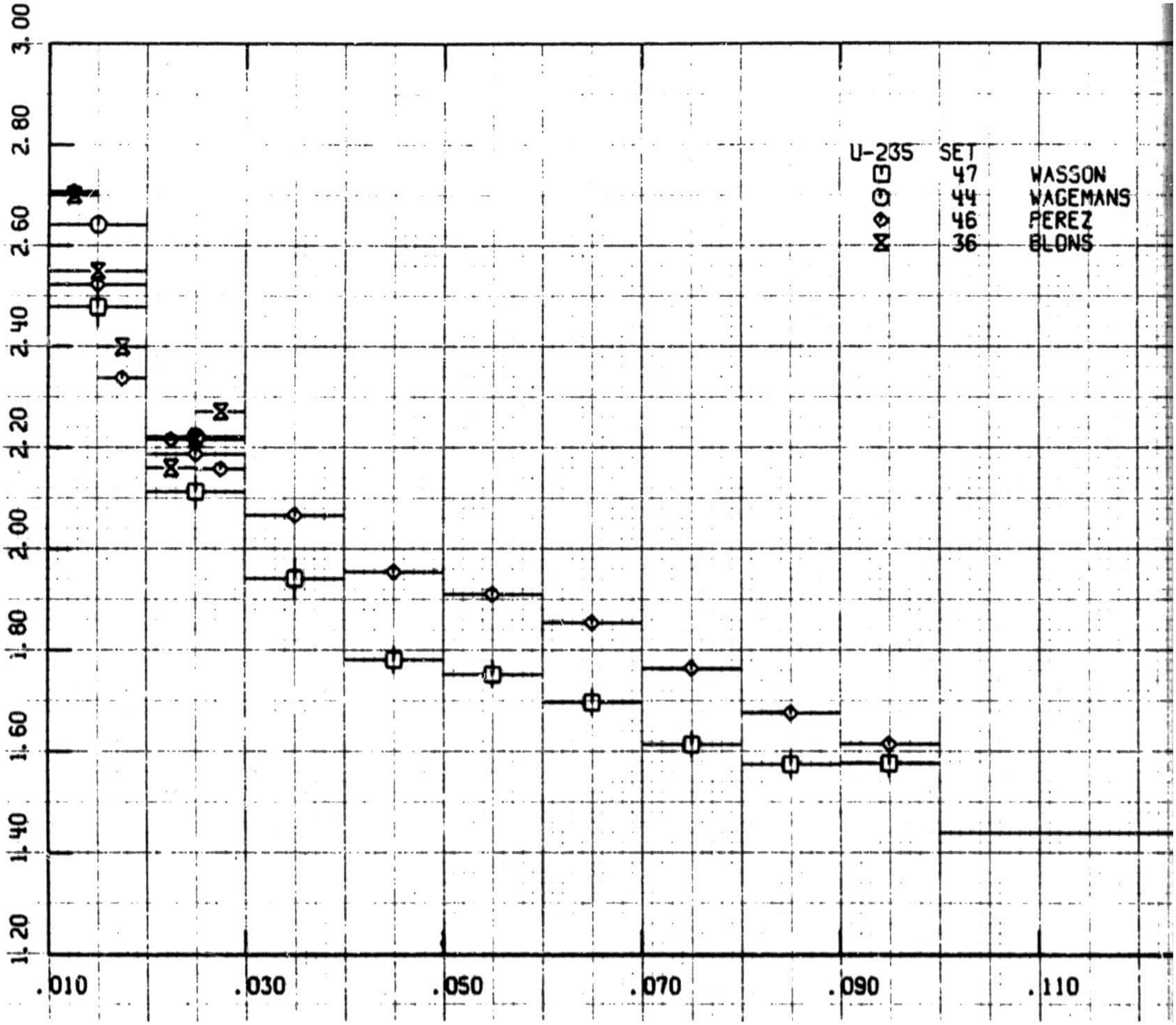

GWIN
GWIN
POENITZ
SZABO
.110
.130
.150
.170
.190
.210

Figure 7 *U-235 (n,f)* *10-210 keV*

Comparison of averaged values from white-neutron source low-energy normalized measurements by Wasson (76 ANL, p. 183), Perez et al. (NSE, 55, 203, 1974), Blons et al. (NSE, 51, 130, 1973), and Wagemans et al. (Ann. of Nucl. Energy, to be published, 1976).



3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
.010
.030
.050
.070
.090
.110
U-235 SET
47 WASSON
44 WAGEMANS
46 PEREZ
36 BLONS

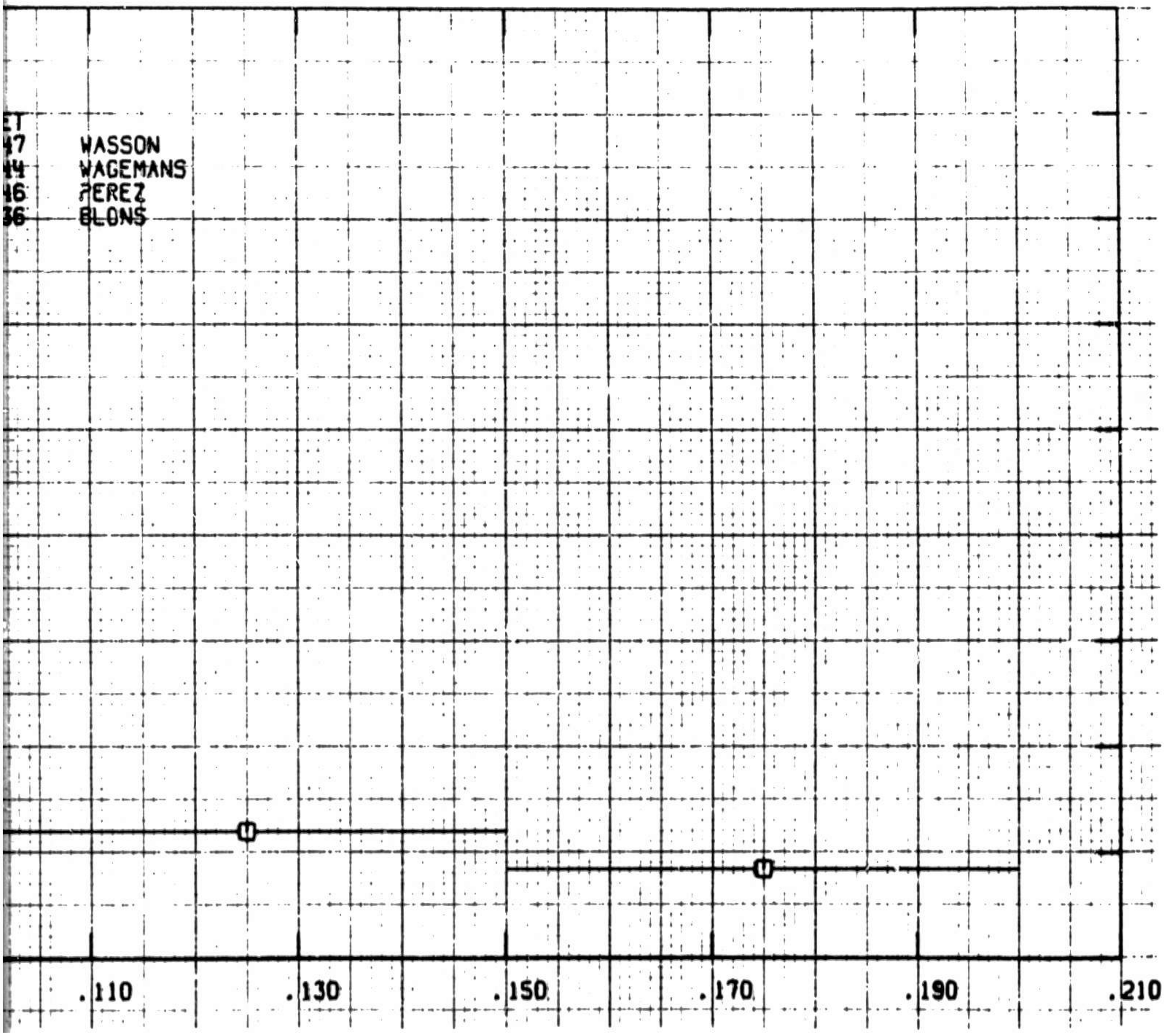
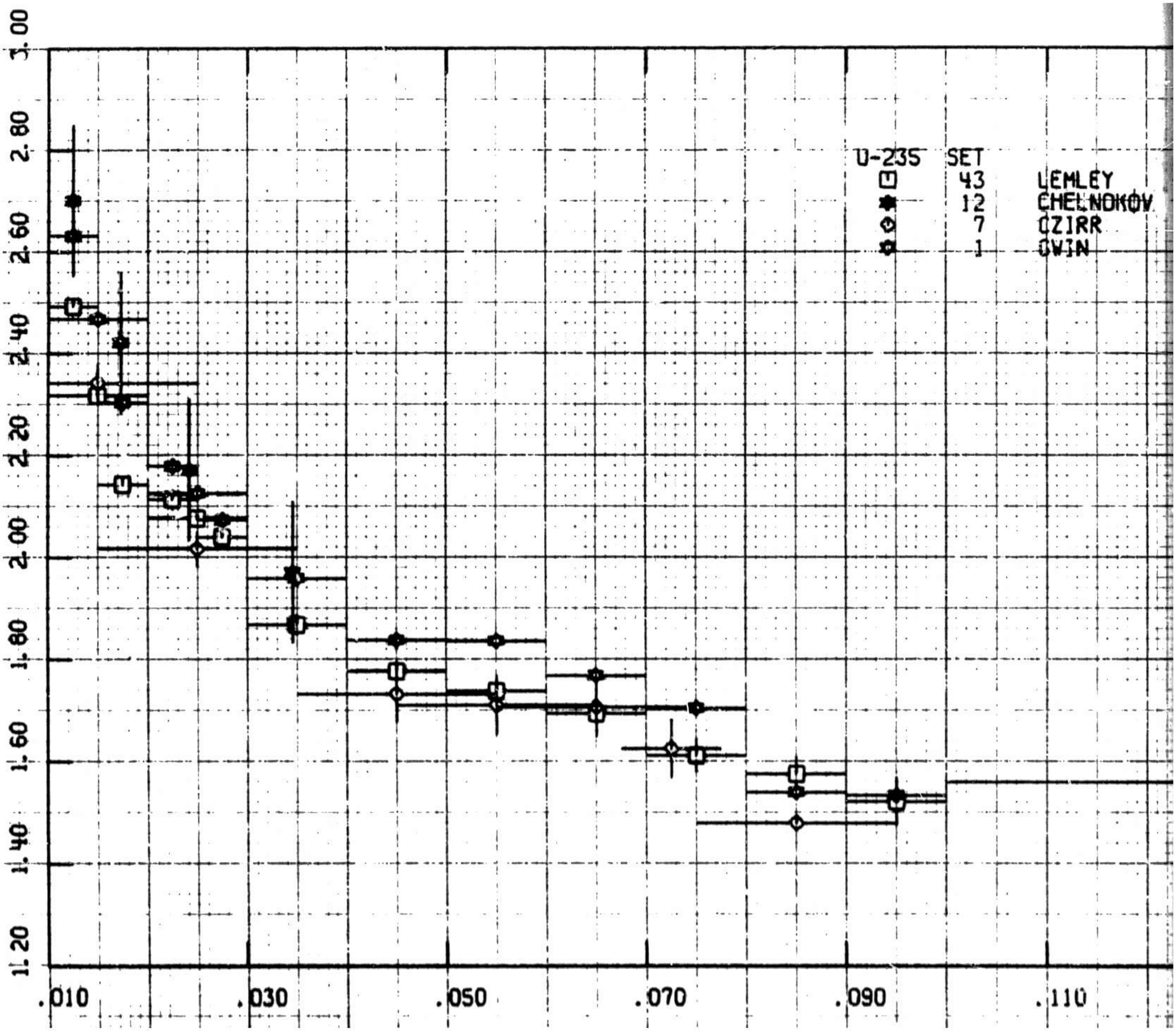

ET
47 WASSON
44 WAGEMANS
46 PEREZ
36 BLONS
.110
.130
.150
.170
.190
.210

Figure 8 *U-235 (n,f)* *10-210 keV*

Comparison of average values from white-neutron source low-energy normalized measurements by Lemley et al. (NSE, 43, 281, 1971), Chelnokov et al. (AE, 31, 103, 1971), Czirr and Sidhu (UCRL -77377, 1975), and Gwin et al. (ANS, 15, 481, 1972). The data by Lemley et. al. and by Czirr and Sidhu were measured relative to Li-6(n,α) and the other data were measured relative to B-10(n,α).



3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
.010
.030
.050
.070
.090
.110
U-235 SET
43 LEMLEY
12 CHELNOKOV
7 CZIRR
1 GWIN

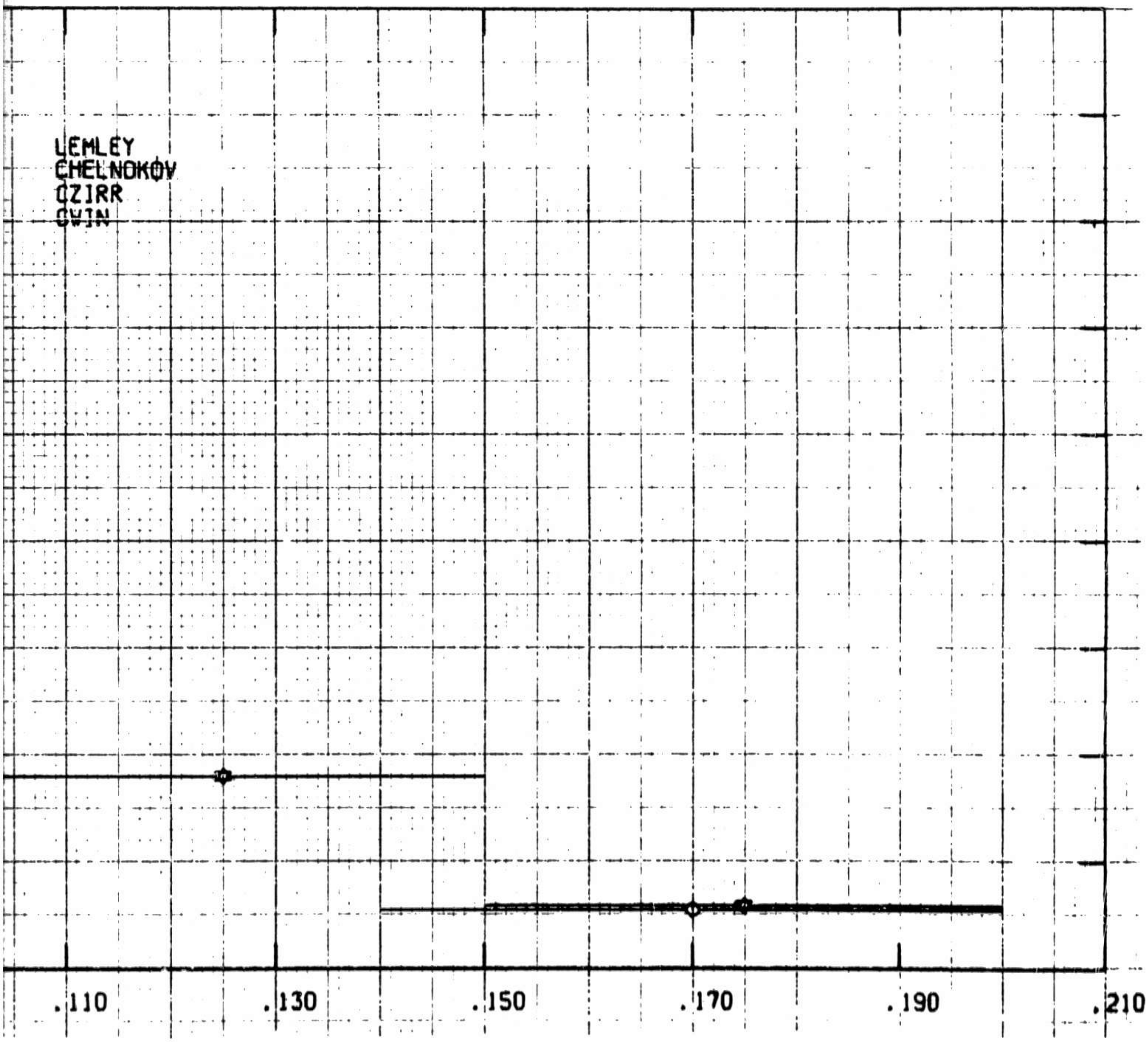
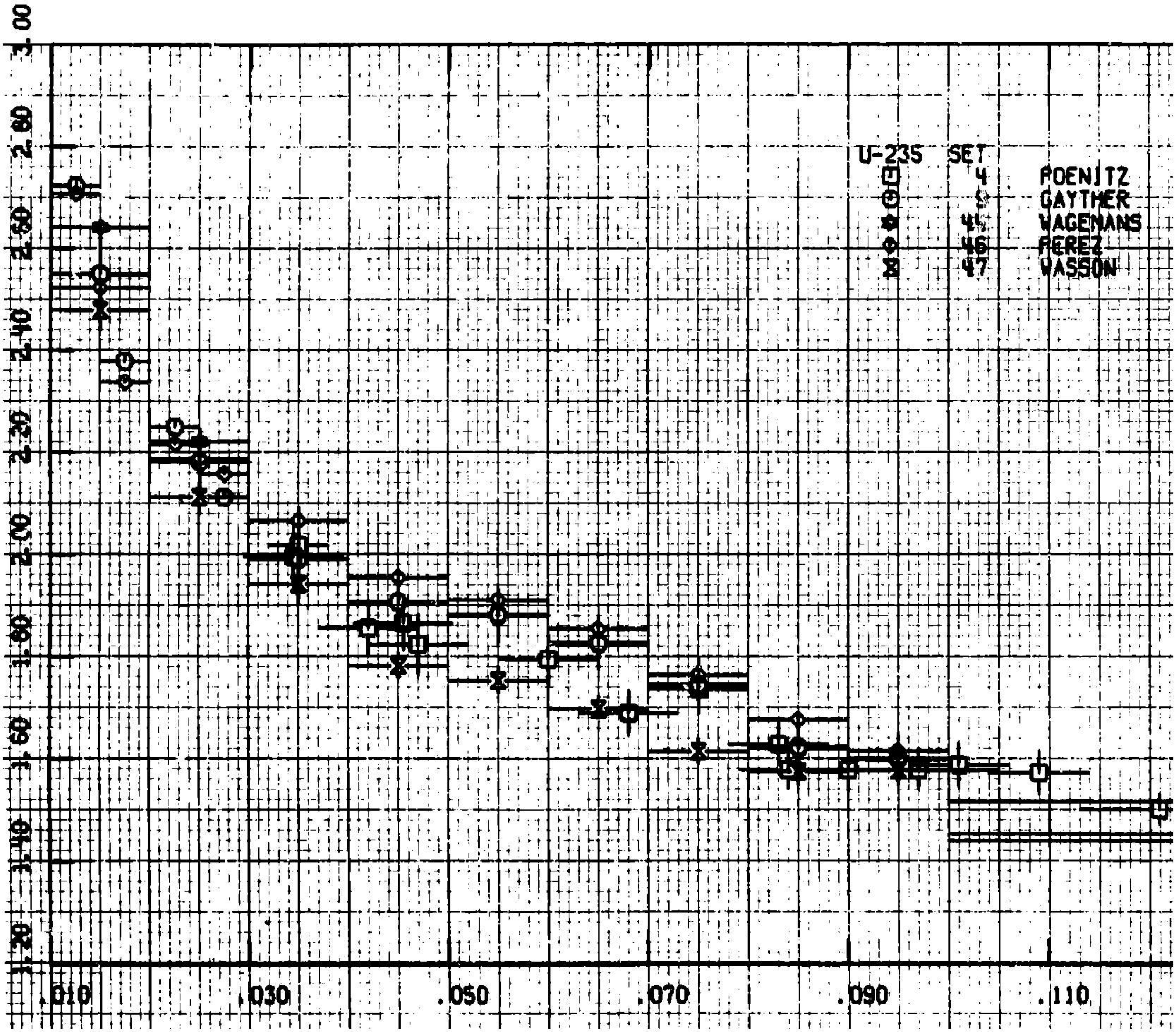

LEMLEY
CHELNOKOV
CZIRR
GWIN
.110
.130
.150
.170
.190
.210

Figure 9 *U-235 (n,γ)* *10-210 keV*

Comparison of the shape-data by Gayther et al. (72 Vienna, p. 201) which were normalized with four absolute photoneutron source values from the University of Michigan (M.C. Davis et al., 76 ANL, p. 225) with the monoenergetic-neutron source data by Poenitz (NSE, 53, 370, 1974) and with the white-neutron source low-energy normalized data by Wagemans et al. (Ann. of Nucl. Energy to be published, 1976), Perez et al. (NSE, 55, 203, 1974), and Wasson (76 ANL, p. 183).



U-235 SET
4 POENITZ
GAYTHER
WAGEMANS
46 PEREZ
47 WASSON
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
.010
.030
.050
.070
.090
.110

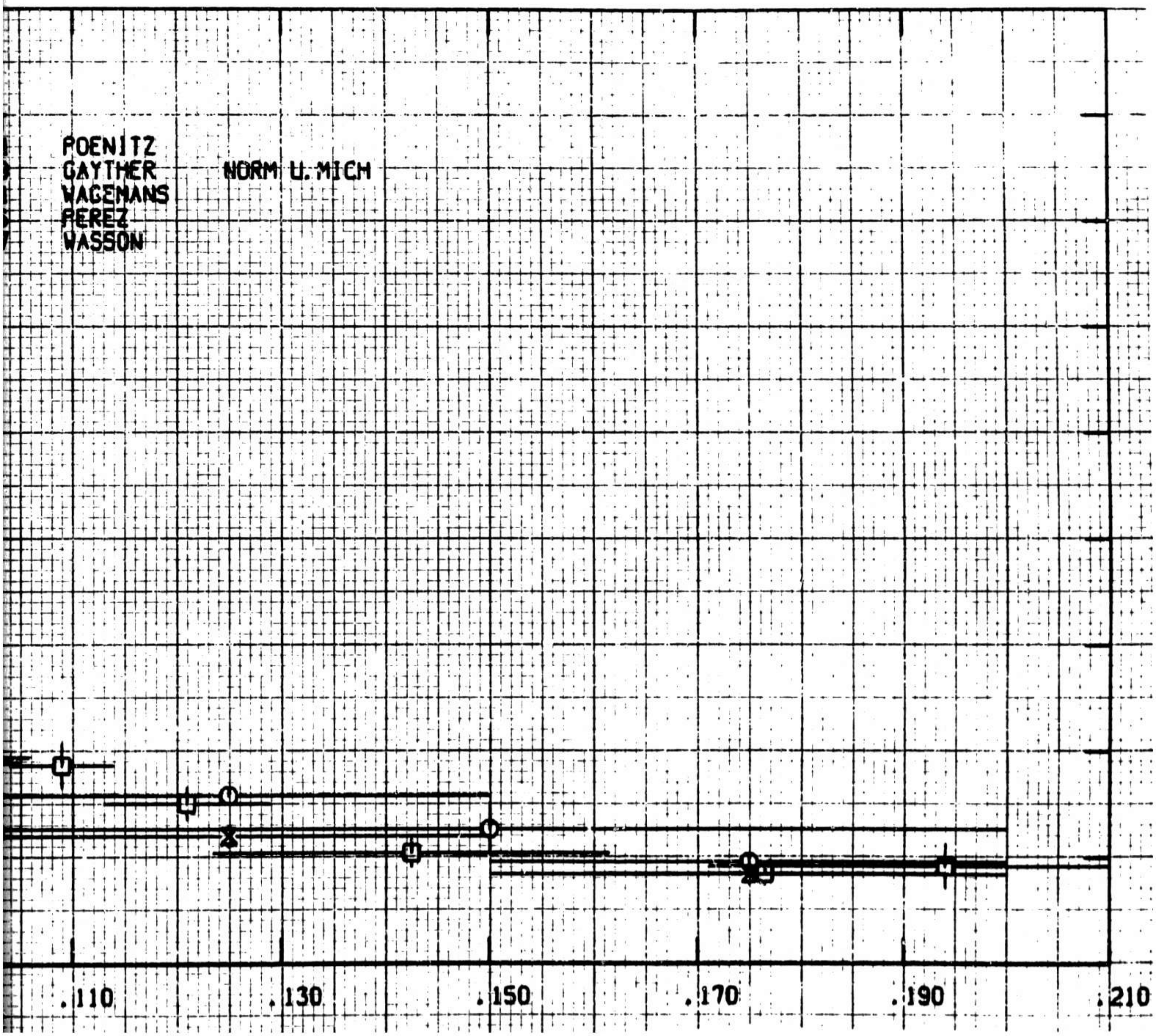
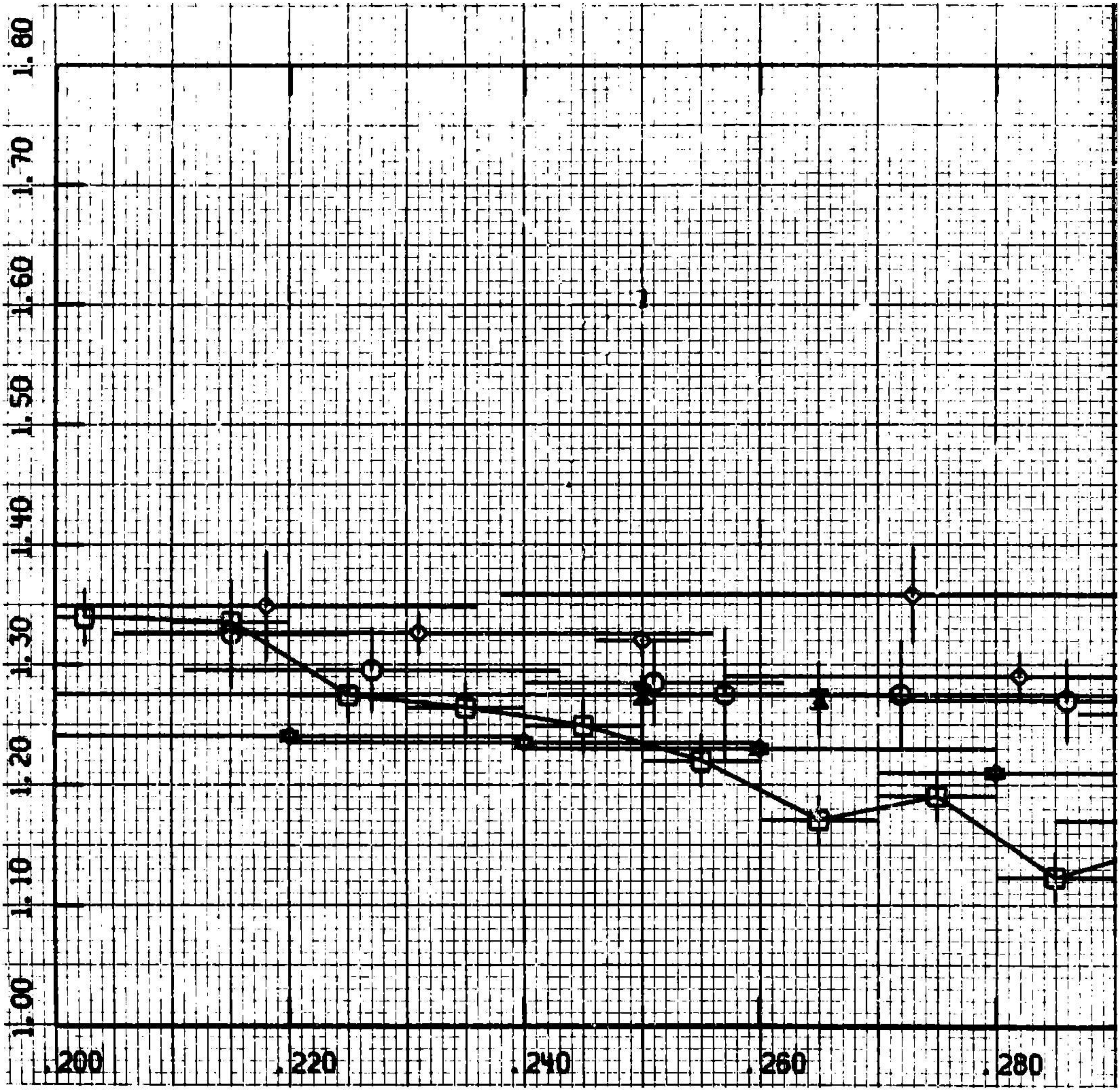
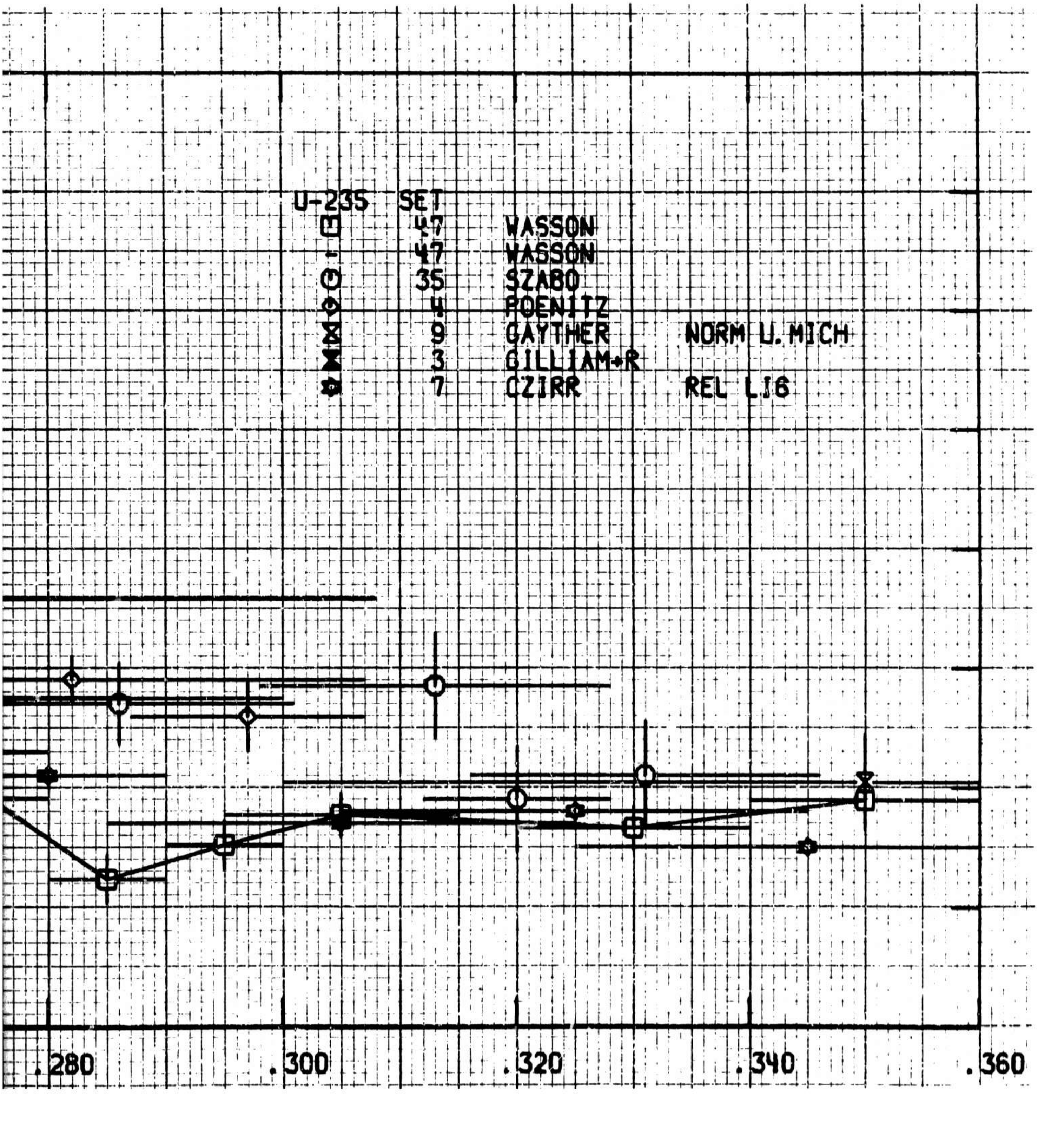

POENITZ
GAYTHER
WAGEMANS
PEREZ
WASSON
NORM U.MICH
.110
.130
.150
.170
.190
.210

Figure 10 *U-235 (n,γ)* *200-360 keV*

Comparison of the data by Wasson (76 ANL, p. 183) with monoenergetic-neutron source data by Szabo et al. (76 ANL, p. 208), and by Poenitz (NSE, 53, 370, 1974). The data by Gayther et al. (72 Vienna, p. 201) were normalized with absolute photoneutron-source measurements from the University of Michigan (M.C. Davis et al., 76 ANL, p. 225, see also D. M. Gilliam, thesis, U. Mich., 1973). The data by Czirr and Sidhu (UCRL - 77377, 1975) depend on the accuracy of the Li-6 (n,α) cross section. This figure shows the discrepancy in the range around 280 keV which was discussed during the present meeting (see proceedings p. 206, 330).

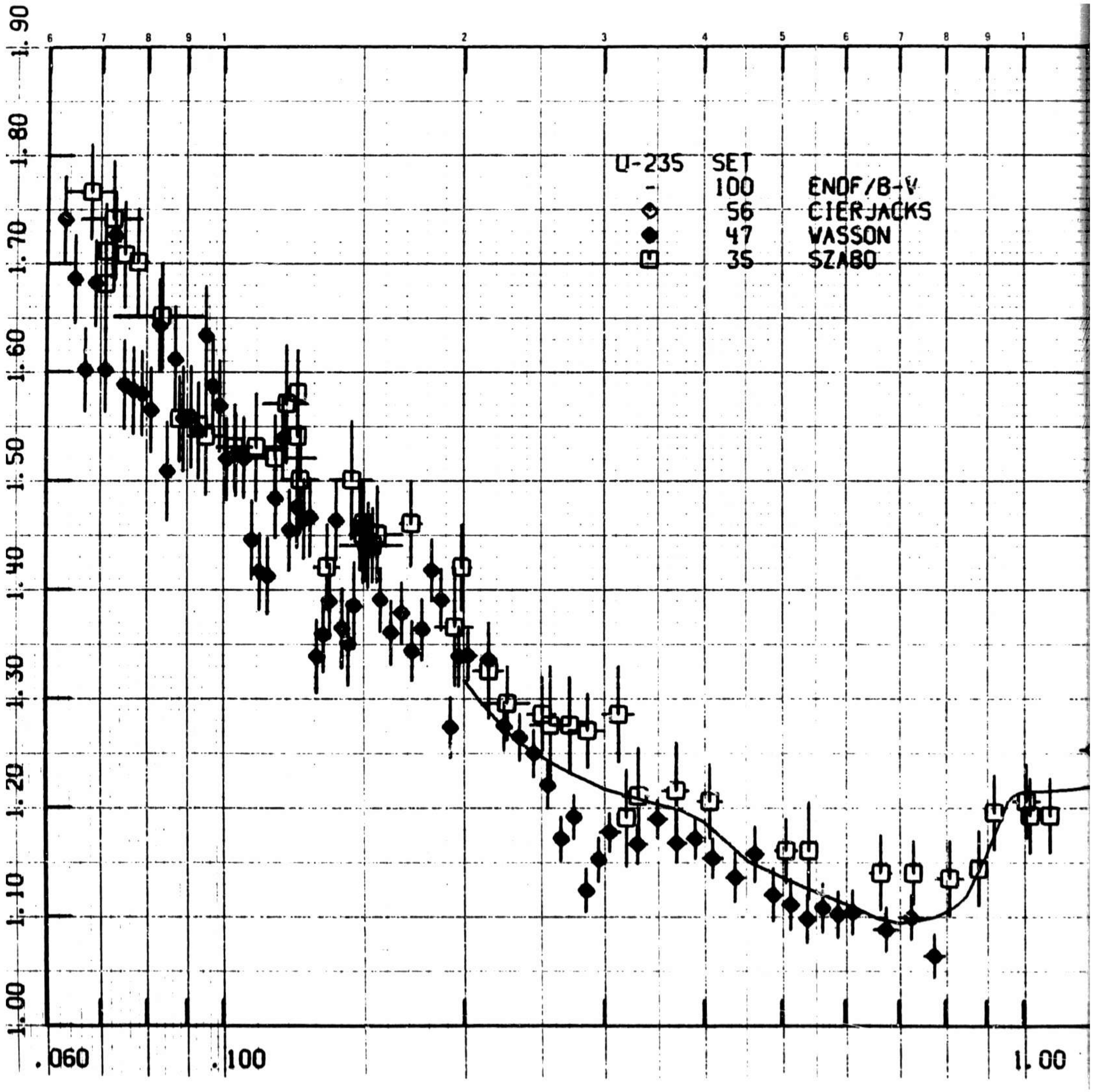

1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.200
.220
.240
.260
.280

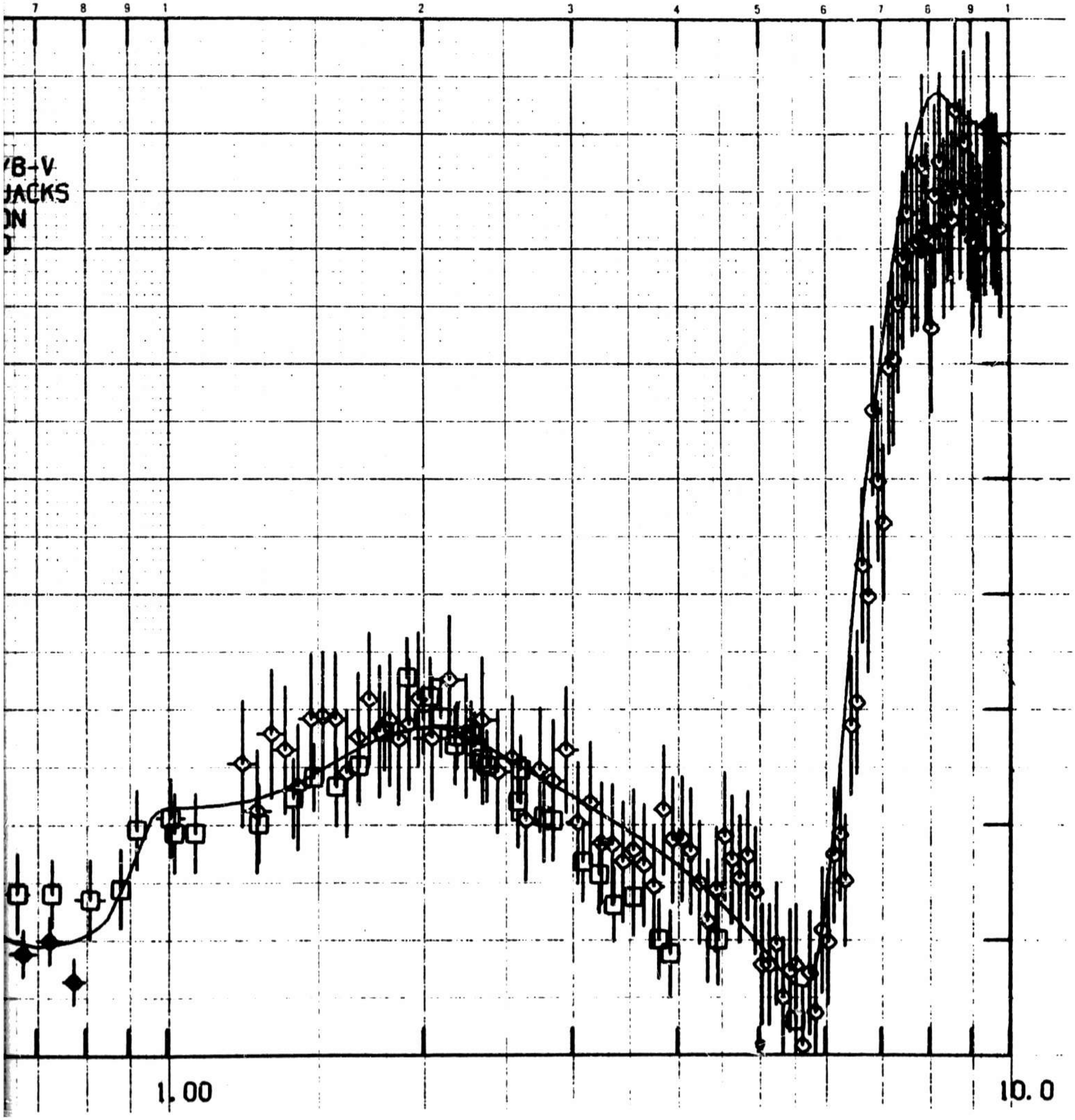


U-235 SET
47 WASSON
47 WASSON
35 SZABO
4 POENITZ
9 GAYTHER NORM U.MICH
3 GILLIAM+R
7 CZIRR REL LI6
.280
.300
.320
.340
.360

Figure 11 *U-235 (n,f)* *0.06-10.0 MeV*

Comparison of white-neutron source data by Wasson (76 ANL, p. 183) and Leugers et al. (76 ANL, p. 246, also priv. com. by S. Cierjacks, 1976) with absolute monoenergetic neutron source data by Szabo et al. (76 ANL, p. 208). The structure in the data by Wasson at 280 keV (see preceeding figure) can be seen.

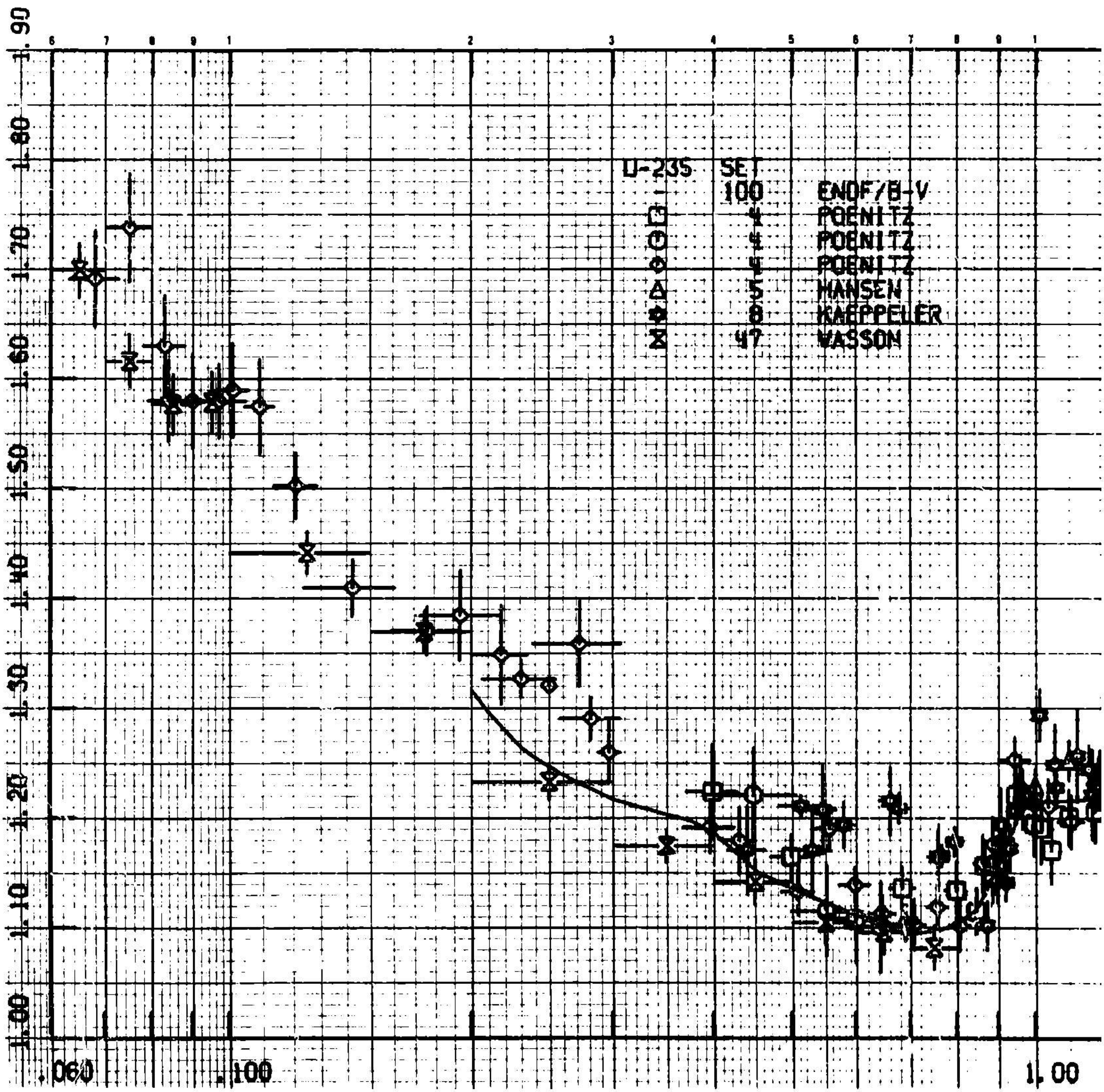

U-235 SET
- 100 ENDF/B-V
◇ 56 CIERJACKS
◆ 47 WASSON
□ 35 SZABO
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.060
.100
1.00



7 8 9 1 2 3 4 5 6 7 8 9 1
/B-V
JACKS
ON
1.00
10.0

Figure 12 *U-235 (n,f)* *0.06-10.0 MeV*

The absolute monoenergetic neutron source data by Poenitz (NSE, 53, 370, 1974) were obtained with a Black Neutron Detector (square), the Associated Activity Technique (circle), and a Grey Neutron Detector and Manganese Bath Technique (diamond). The monoenergetic neutron source data by Hansen et al. (see D. M. Barton et al., 76 ANL, p. 173) and by Kaeppeler (72 Vienna, p. 213) were measured relative to the H(n,n) reference cross section. The averaged white-neutron source data by Wasson (76 ANL, p. 183) were normalized in the eV-energy range.


U-235 SET
100 ENDF/B-V
4 POENITZ
4 POENITZ
4 POENITZ
5 HANSEN
8 KAEPPELER
47 WASSON
.060
.100
1.00

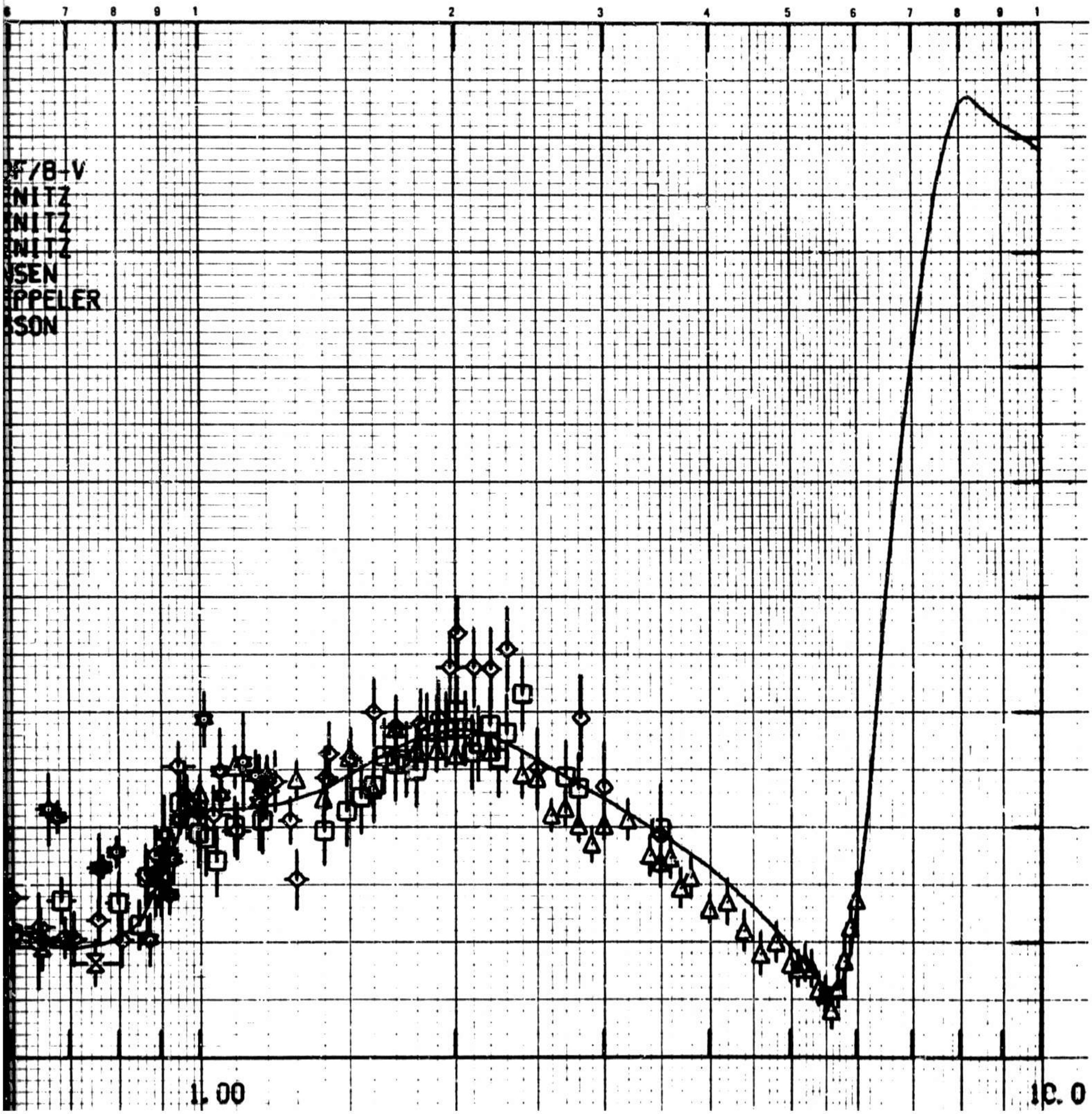
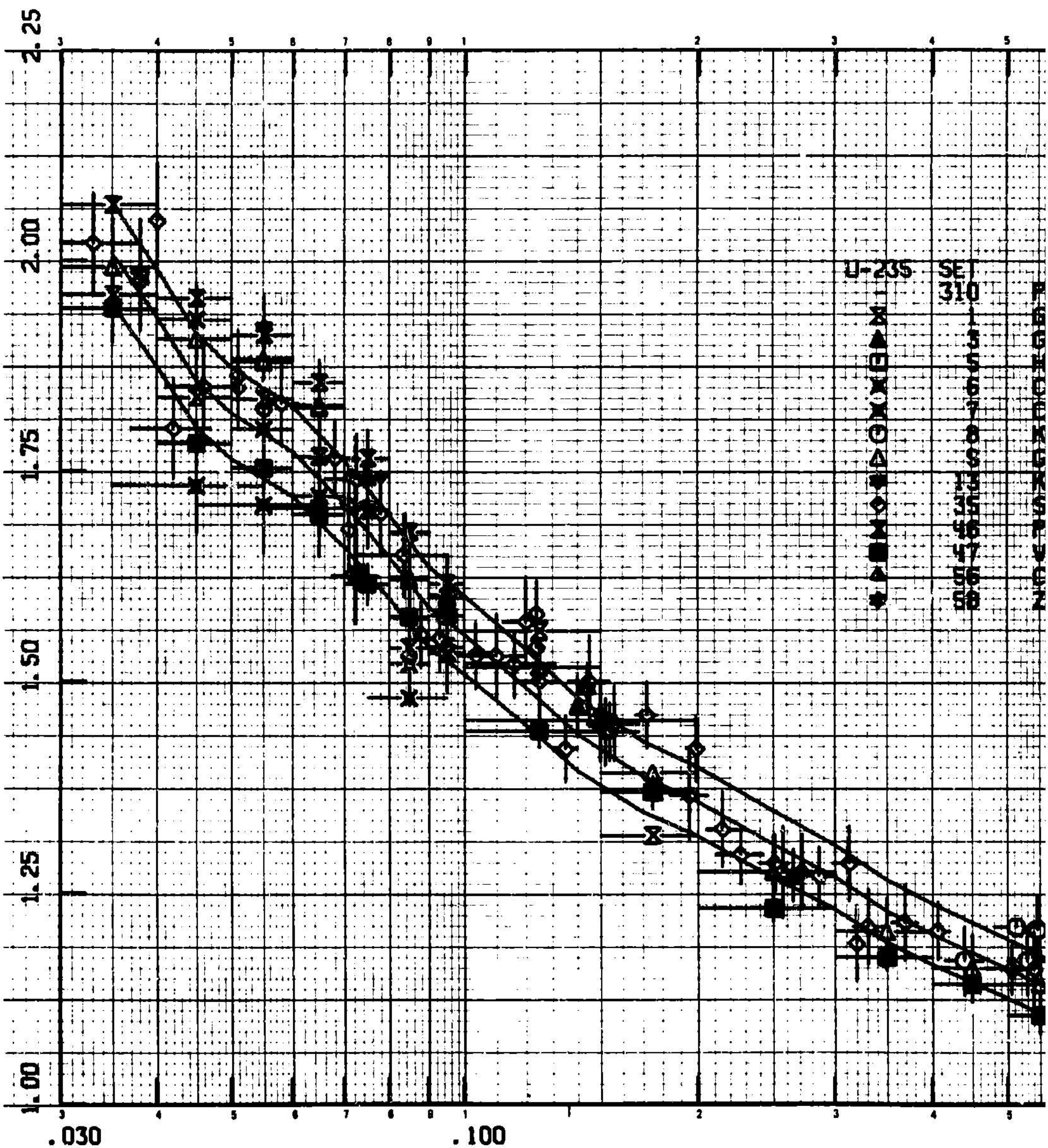
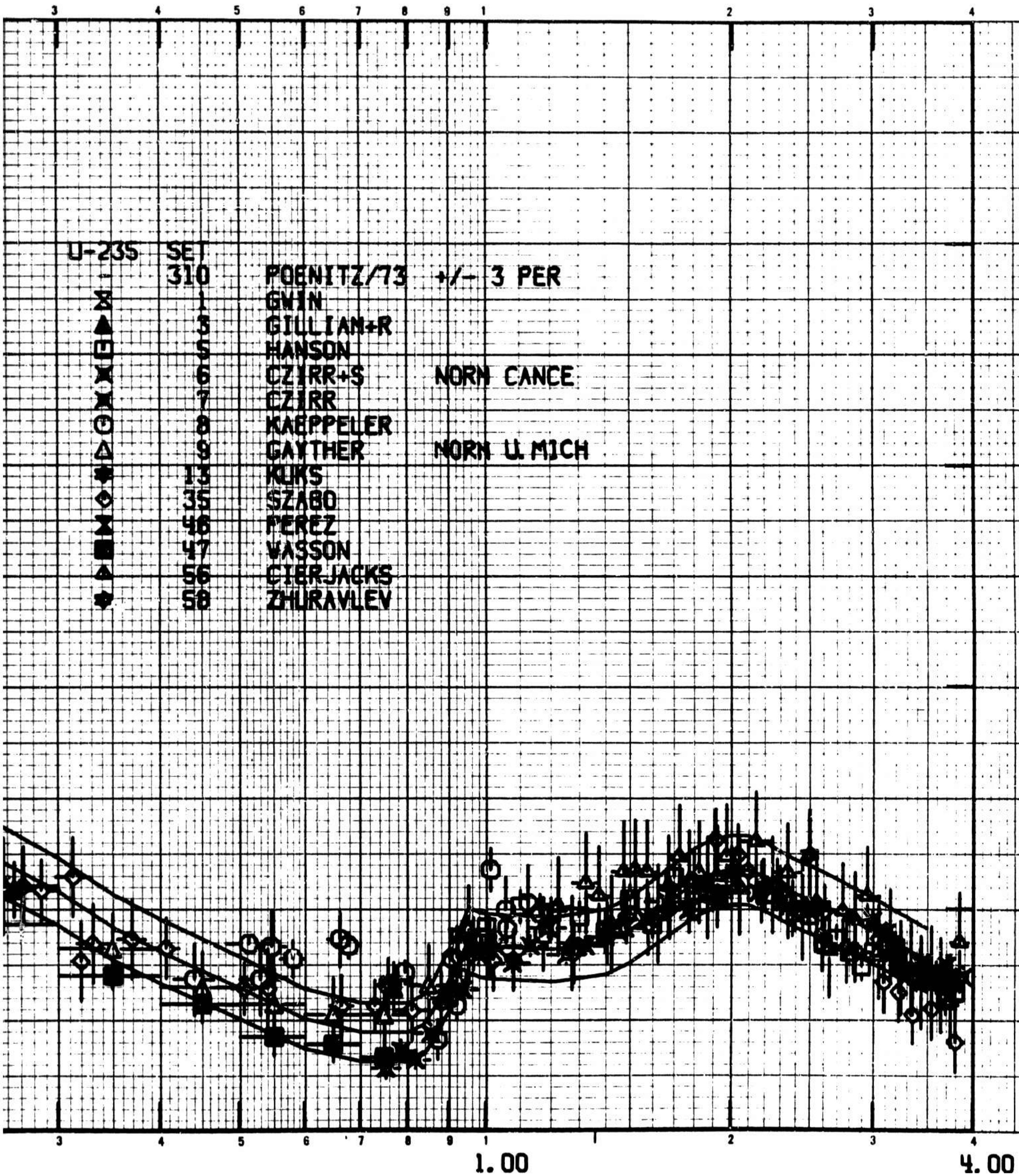

F/B-V
NITZ
NITZ
NITZ
SEN
PPELER
SON
1.00
10.0

Figure 13 *U-235 (n,γ)* *0.03-4.0 MeV*

Comparison between a ±3% band around the average result from the measurements by Poenitz (NSE 53, 370, 1974) and all subsequently published data (see discussion in the proceedings on page 206). Data by Czirr and Sidhu (UCRL-77377, 1975) were not shown above 100 keV where the Li-6(n,α) cross section is not considered a standard. Data by Zhuravlev et al. were presented at the Lowell-Conference on the "Interaction of Neutrons with Nuclei" which took place two weeks after the present meeting. Thus, these data were not shown in the original graphs considered during the working sessions.



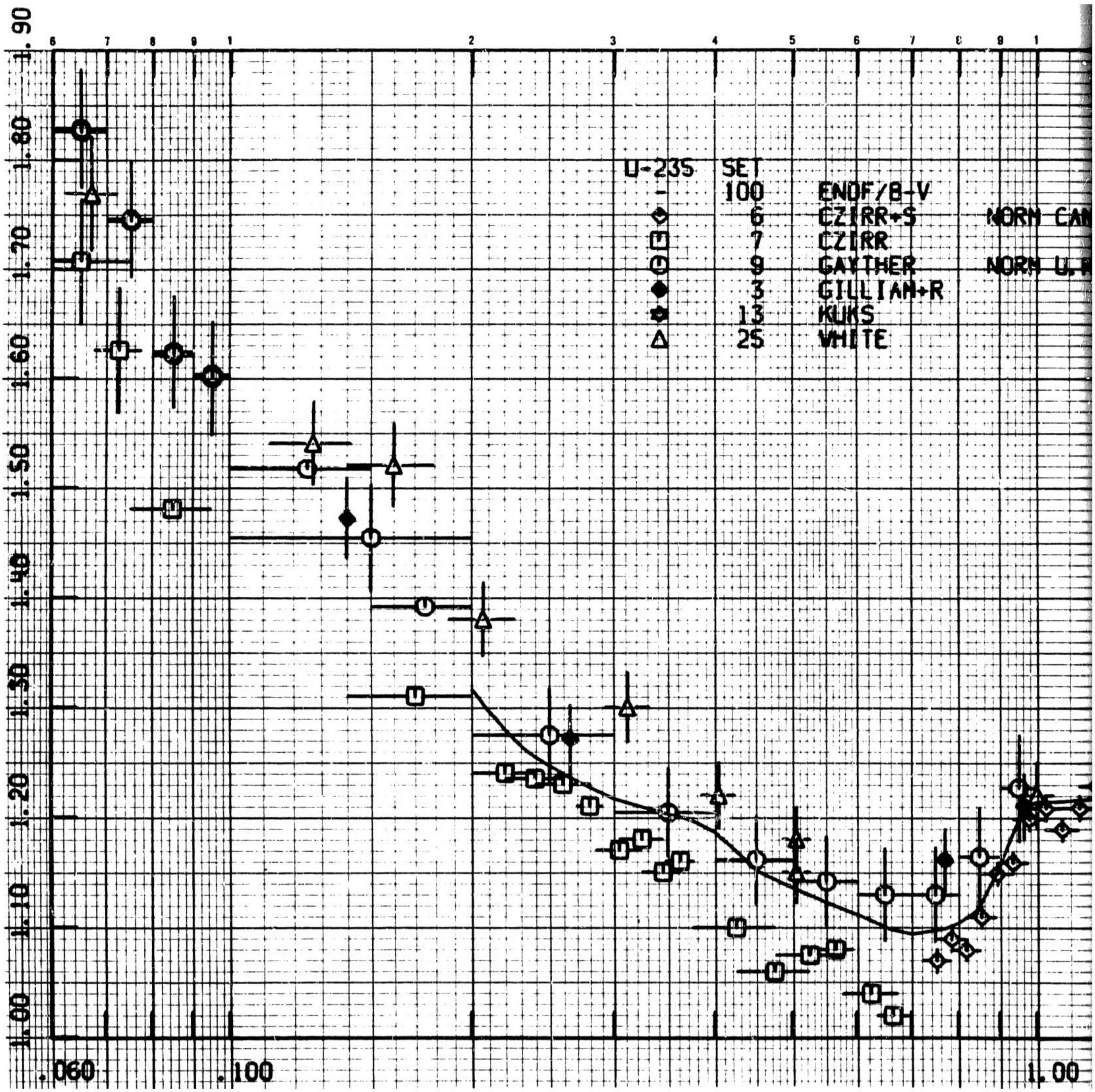
U-235
SET
310
2.25
2.00
1.75
1.50
1.25
1.00
.030
.100



U-235 SET
310 POENITZ/73 +/- 3 PER
1 GWIN
3 GILLIAN+R
5 HANSON
6 CZIRR+S NORM CANCE
7 CZIRR
8 KAEPPELER
9 GAYTHER NORM U. MICH
13 KUKS
35 SZABO
46 PEREZ
47 WASSON
56 CIERJACKS
58 ZHURAVLEV
3
4
5
6
7
8
9
1
2
3
4
1.00
4.00

Figure 14 *U-235 (n,f)* *0.06-10.0 MeV*

The high energy data by Czirr and Sidhu (NSE, 57, 18, 1975) were originally normalized to a 3.5 MeV value from the absolute measurements by Poenitz (NSE, 53, 370, 1974). These data were here normalized to the 14.6 MeV value by Cance and Grenier (76 ANL, p. 237) which caused only a 1% change in the normalization. Data by Gayther et al. (72 Vienna, p. 201) were normalized to the absolute photoneutron-source values from the University of Michigan (Gilliam, Robertson, et al., see M. C. Davis et al., 76 ANL, p. 225). The underflow value at 5.4 MeV is by White (JNE, 19, 325, 1965). Other data shown are by Czirr and Sidhu (UCRL-77377, 1975) and by Kuks et al. (73 Kiev, 4, 18).



U-235 SET
100 ENDF/B-V
6 CZIRR+S NORM CAN
7 CZIRR
9 GAYTHER NORM U,
3 GILLIAN+R
13 KUKS
25 WHITE
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.060
.100
1.00

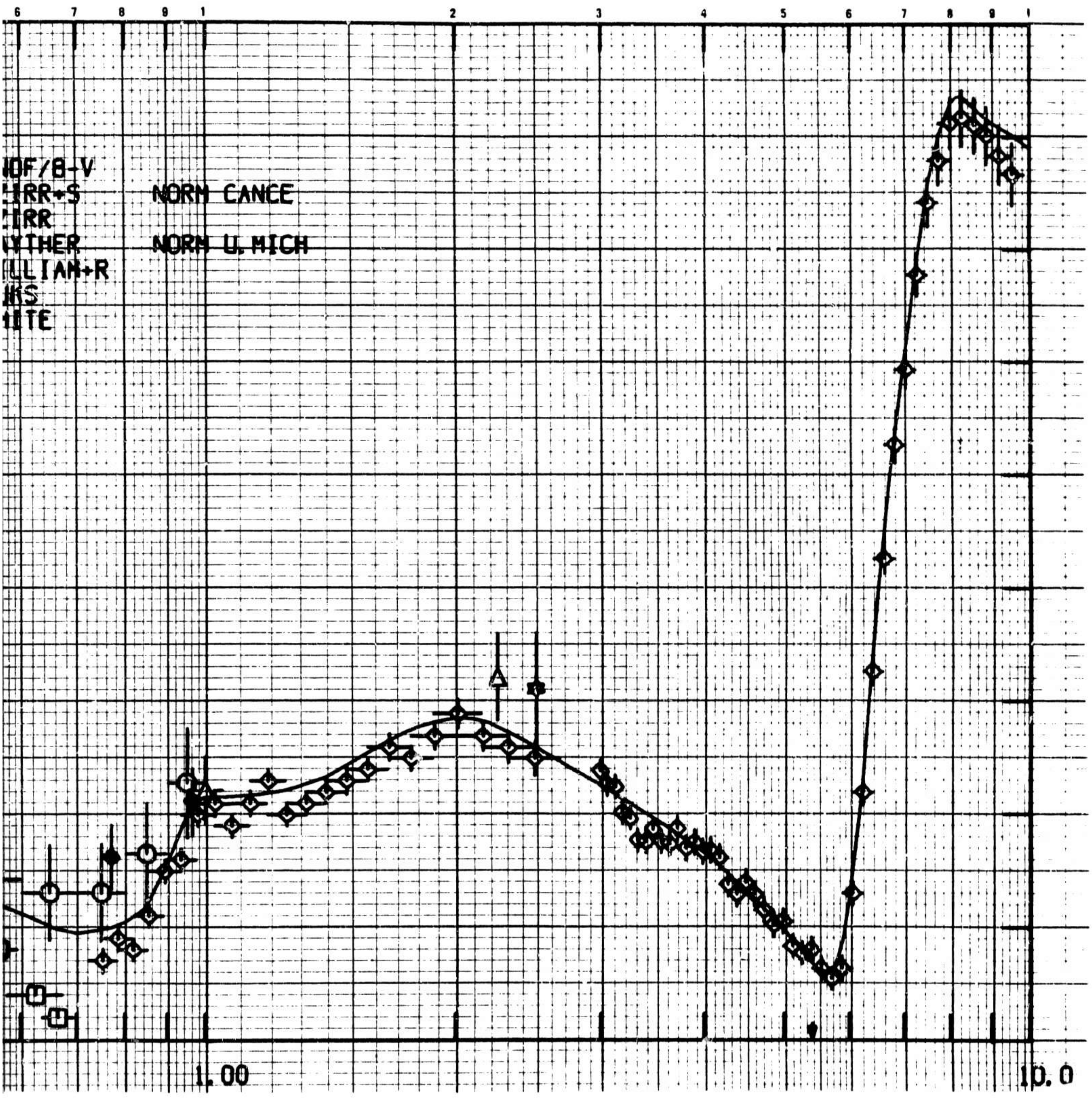
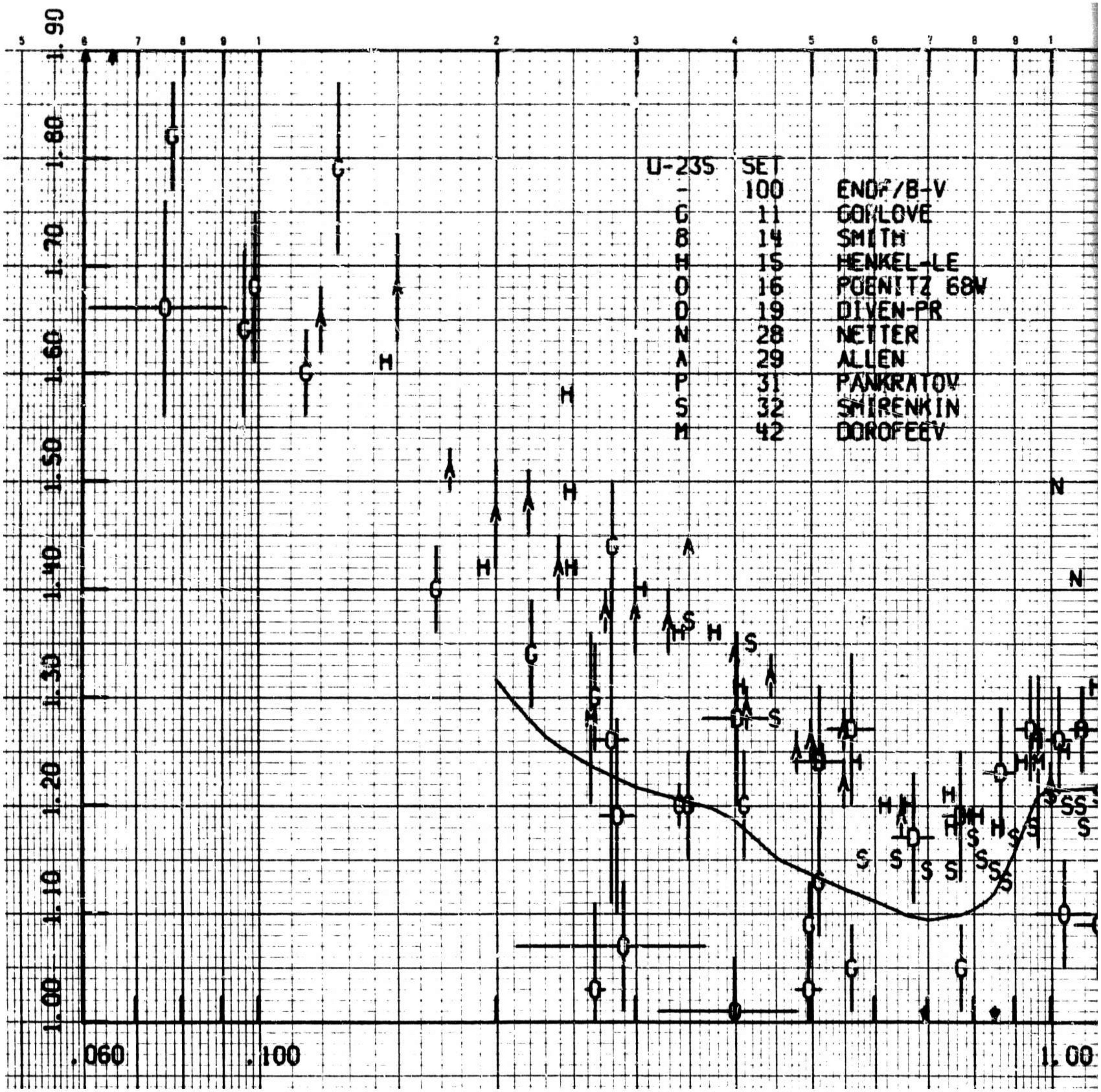

NDF/B-V
IRR+S
NORM CANCE
IRR
YTHER
NORM U.MICH
LLIAM+R
KS
ITE
1.00
10.0

Figure 15 *U- 235 (n,f)* *0.06-10.0 MeV*

Comparison of some of the older data.



U-235 SET
- 100 ENDF/B-V
G 11 GORLOVE
B 14 SMITH
H 15 HENKEL-LE
O 16 POENITZ 68W
D 19 DIVEN-PR
N 28 NETTER
A 29 ALLEN
P 31 PANKRATOV
S 32 SMIRENKIN
M 42 DOROFEEV
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.060
.100
1.00

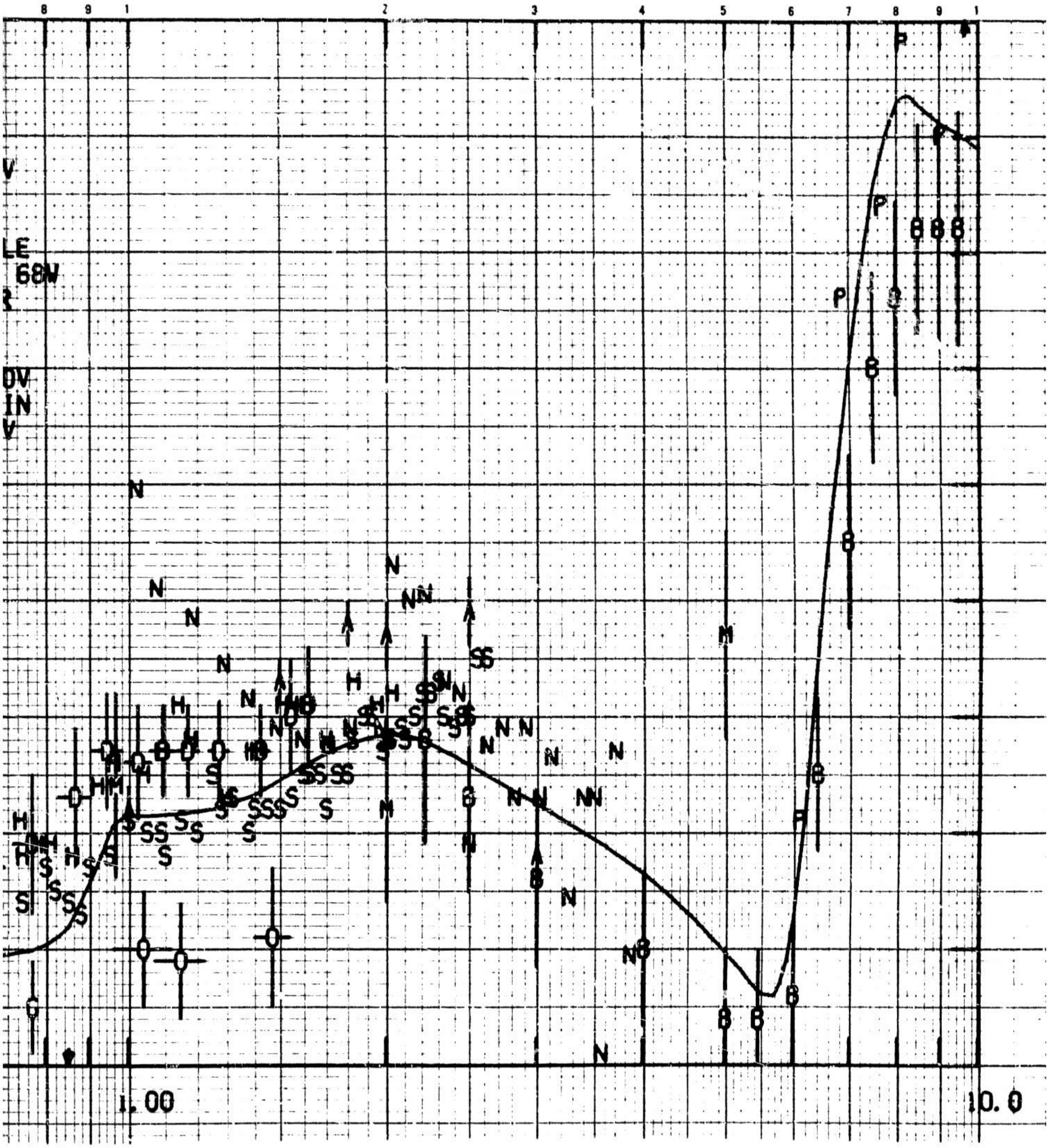
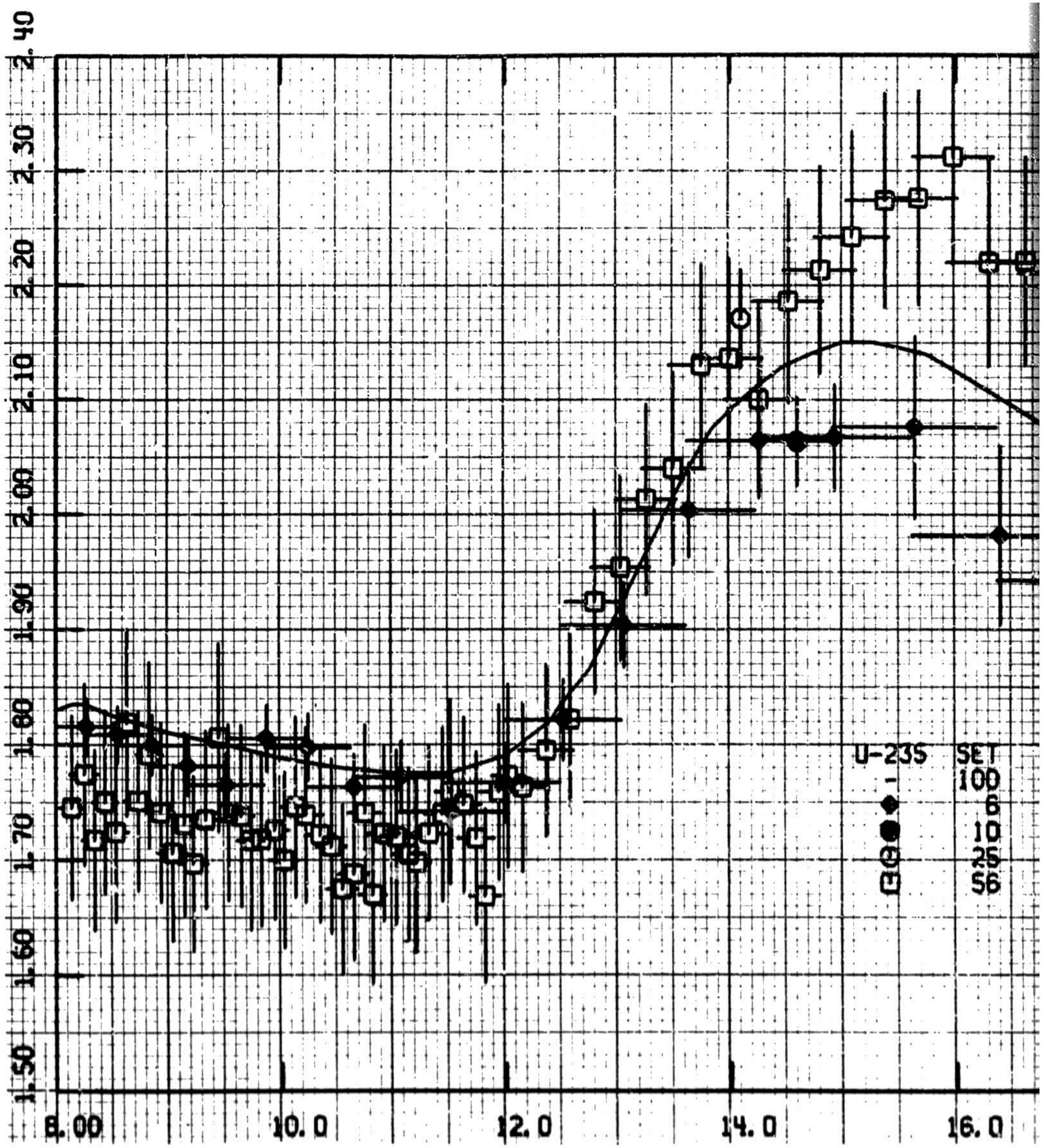

8 9 1 2 3 4 5 6 7 8 9 1
1.00
10.0

Figure 16 *U-235 (n,f)* *8-22 MeV*

The data by Czirr and Sidhu (NSE, 57, 18, 1975) were normalized with the absolute 14.6 MeV value by Cance and Grenier (76 ANL, p. 237). Other data shown are by Leugers et al. (76 ANL, p. 246, priv. com. by S. Cierjacks, 1976) and by White (JNE, 19, 325, 1965).


2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
8.00
10.0
12.0
14.0
16.0
U-235 SET
100
6
10
25
56

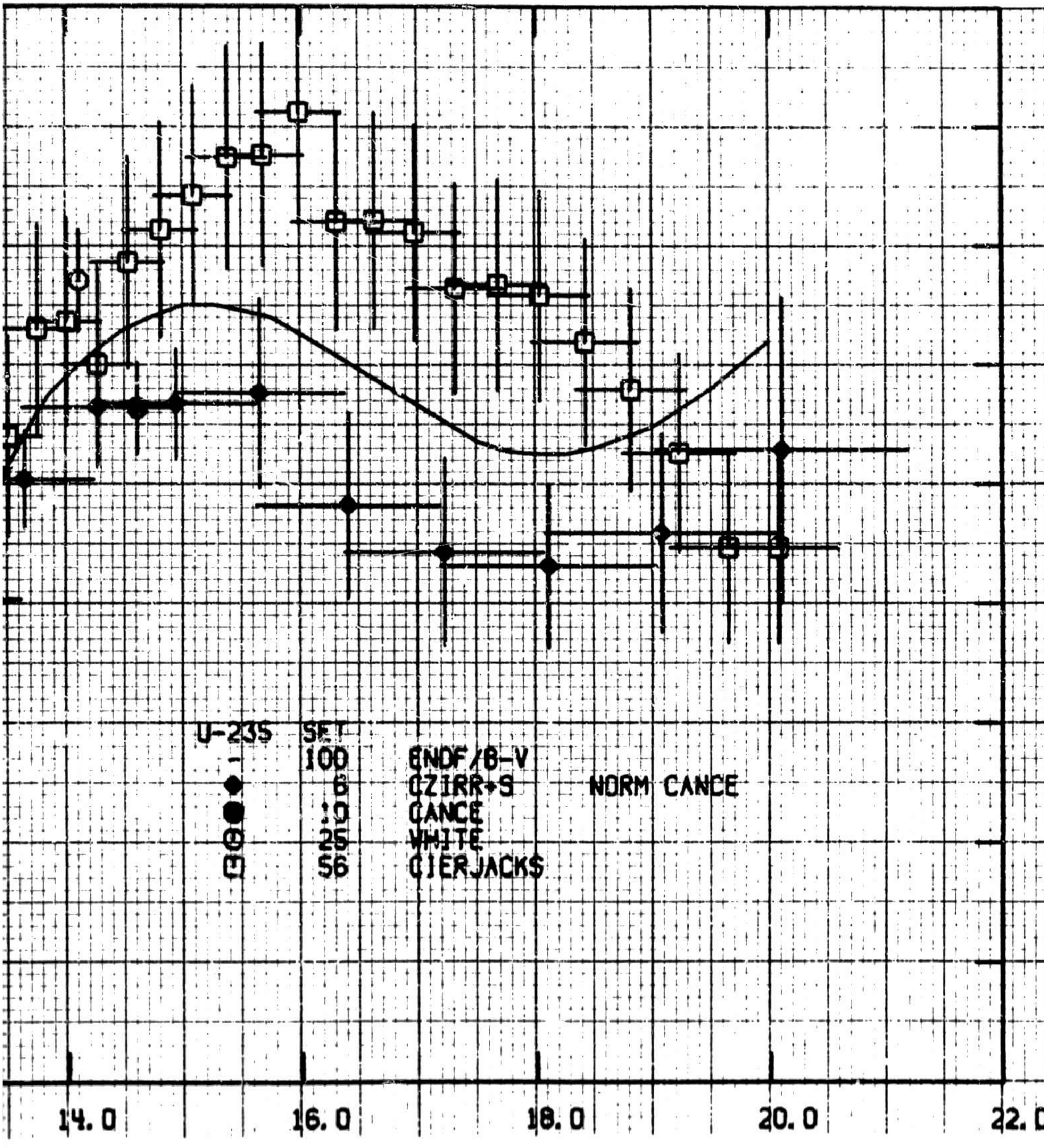
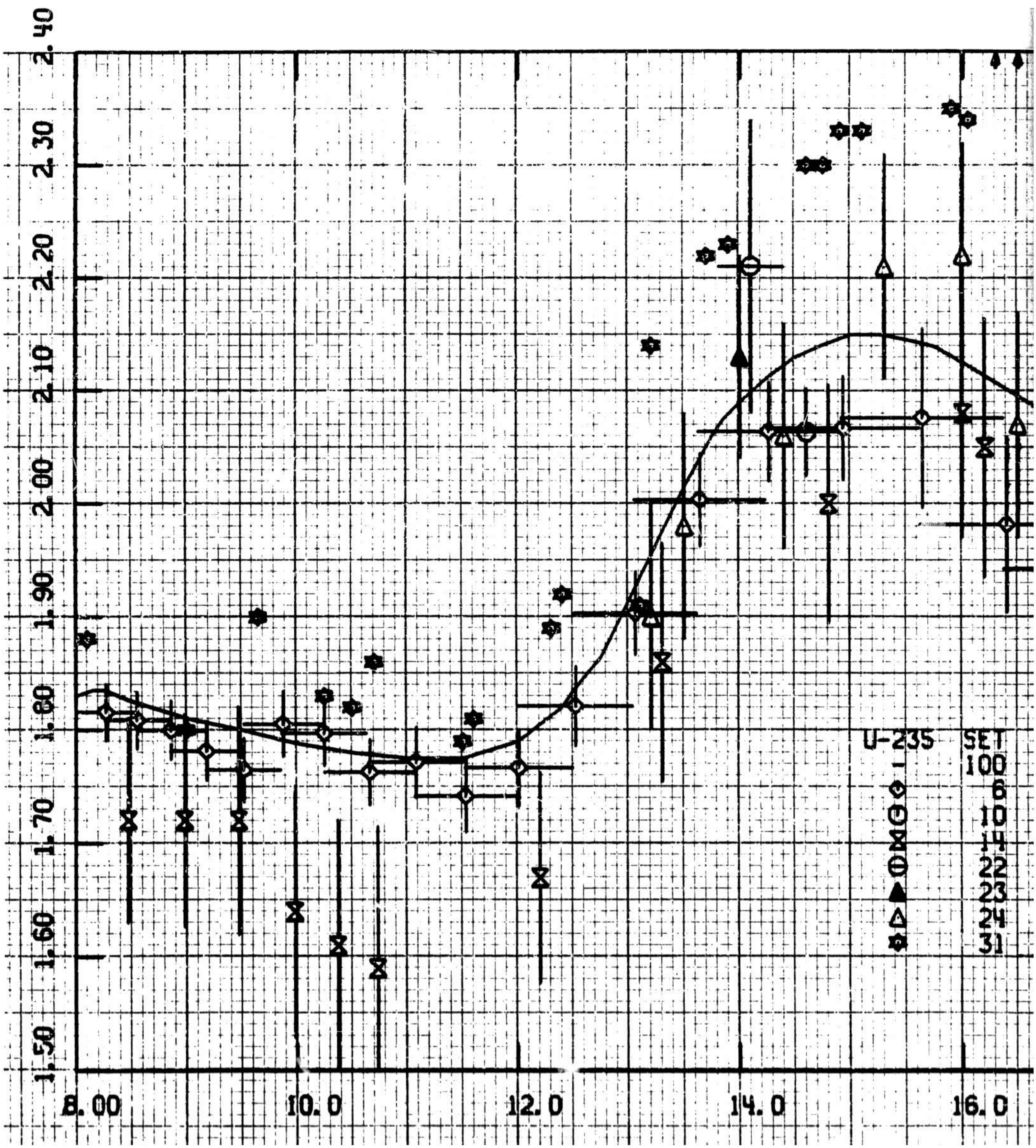

U-235 SET
100 ENDF/B-V
6 CZIRR+S NORM CANCE
10 CANCE
25 WHITE
56 CIERJACKS
14.0
16.0
18.0
20.0
22.0

Figure 17 *U-235 (n,f)* *8-22 MeV*

Comparison of the data by Czirr and Sidhu (see preceeding Fig. 16) with older data.



2.40
2.30
2.20
2.10
2.00
1.90
1.80
1.70
1.60
1.50
8.00
10.0
12.0
14.0
16.0
U-235 SET
100
6
10
14
22
23
24
31

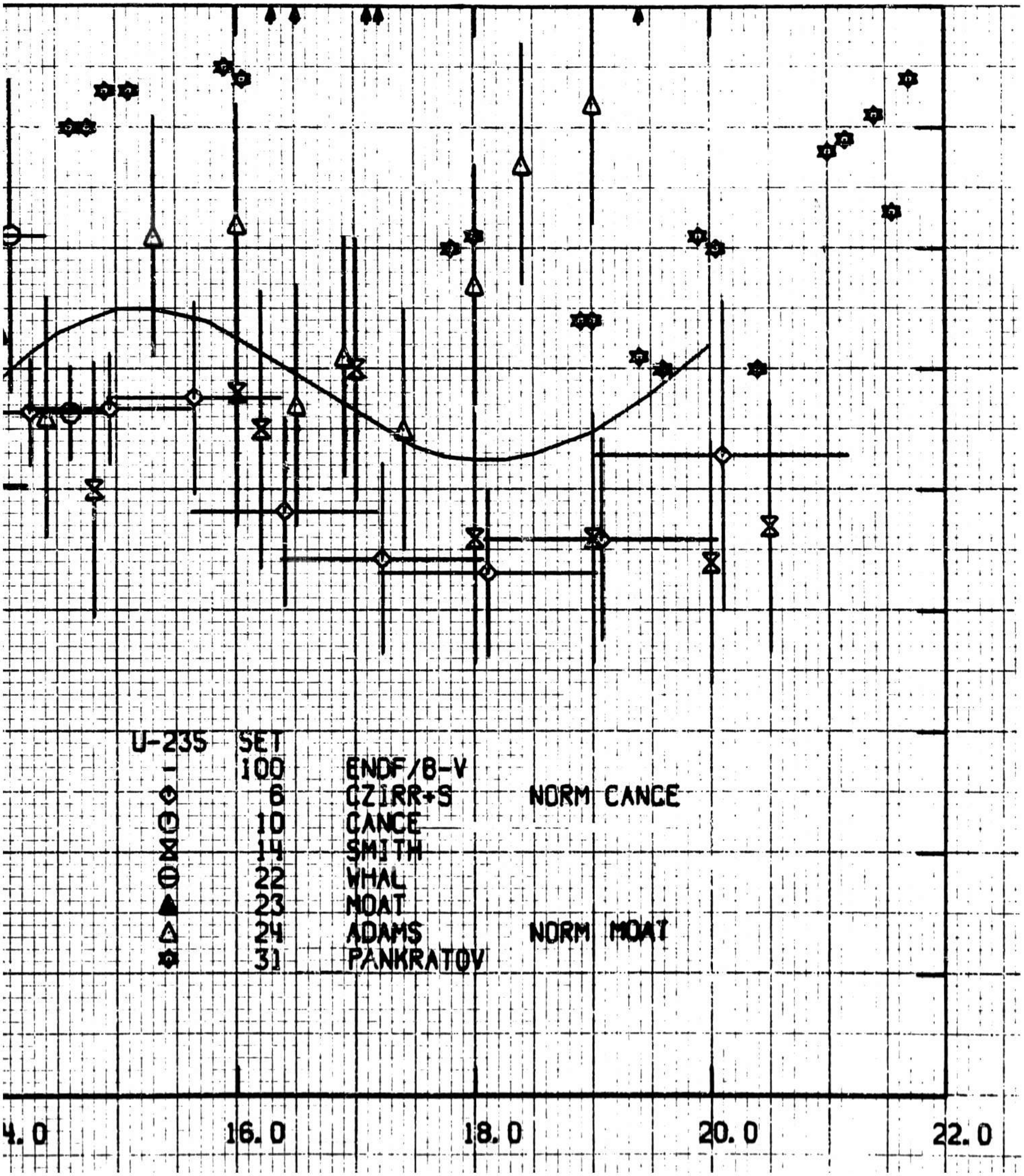
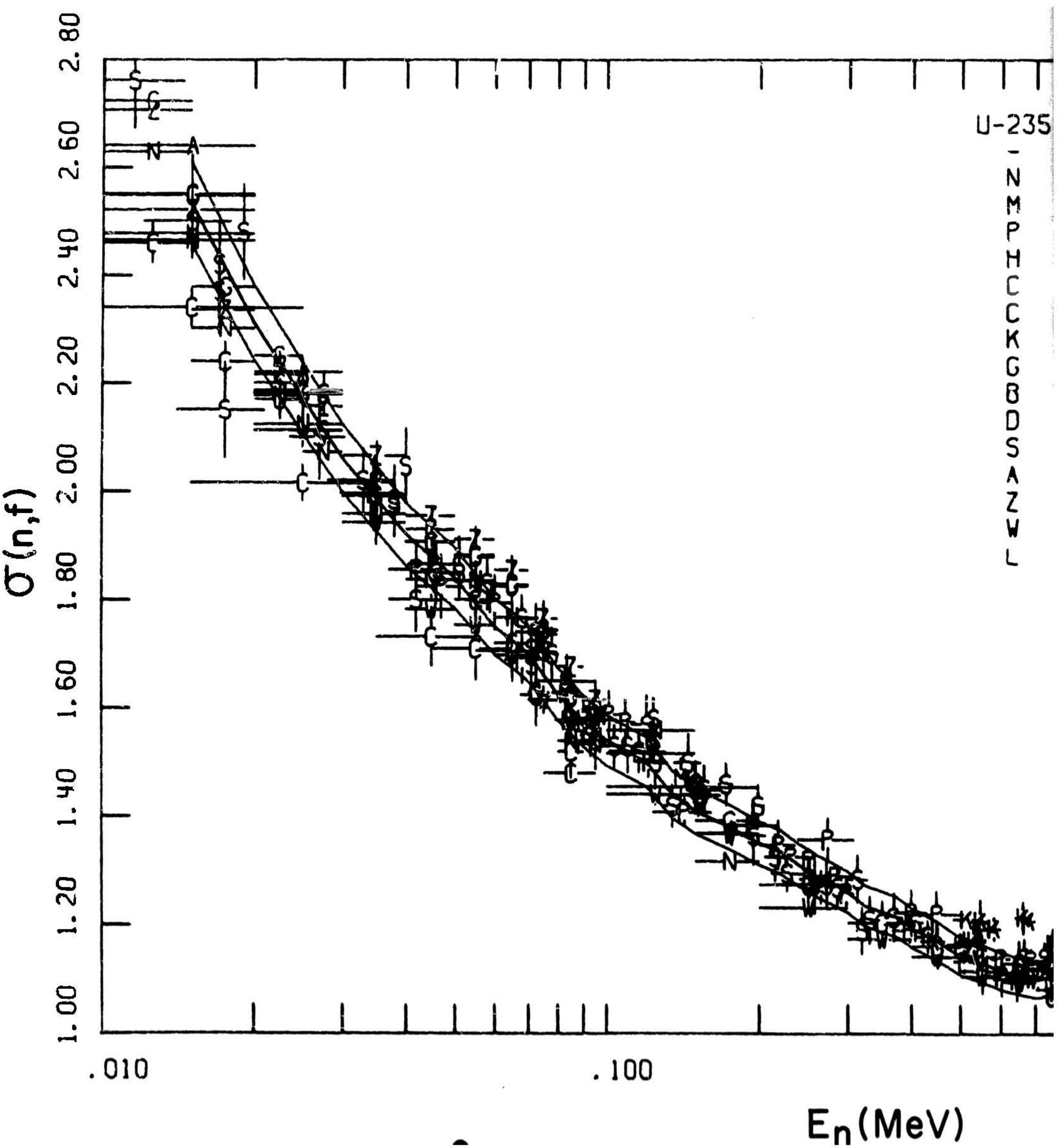
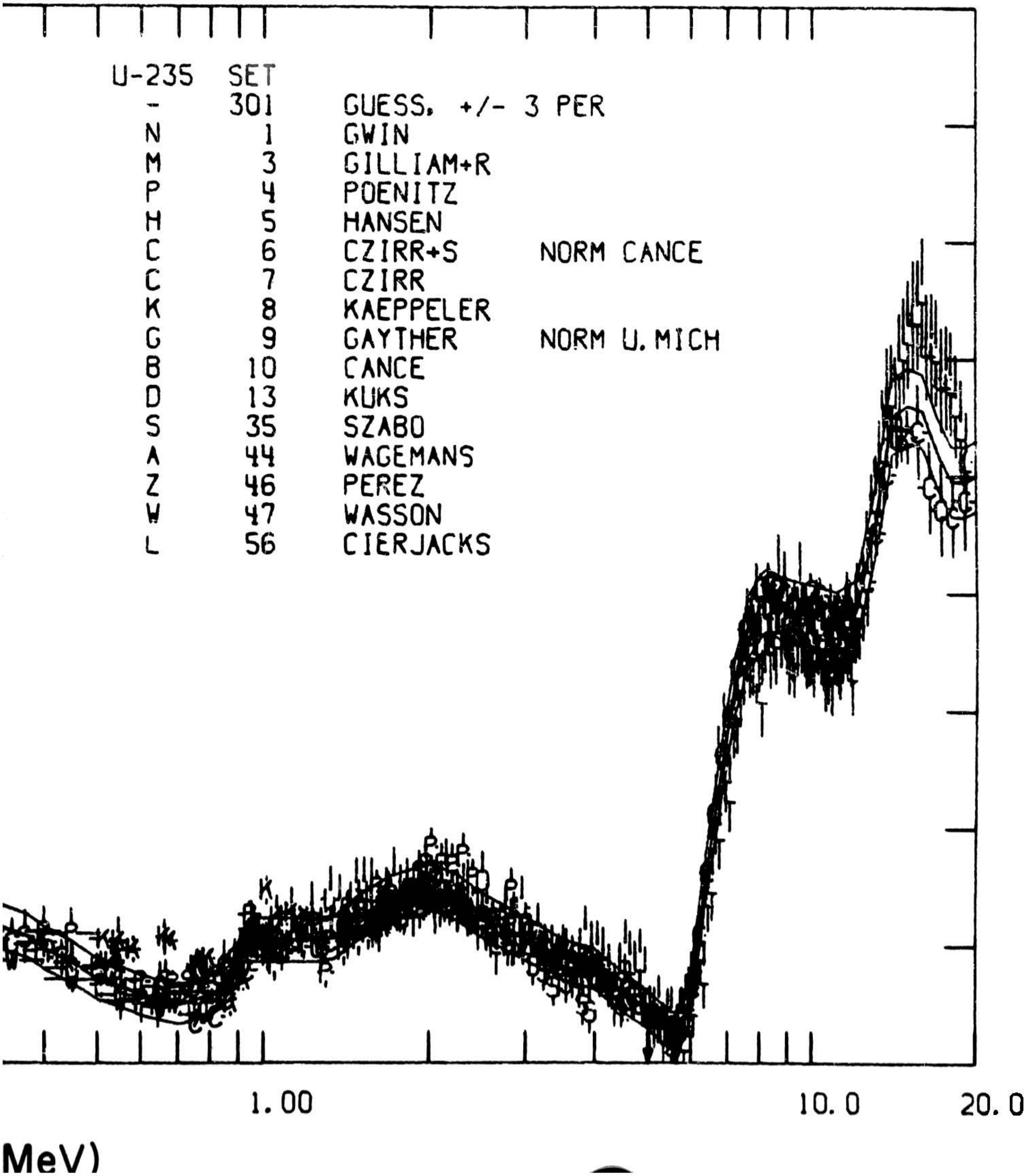

U-235 SET
- 100 ENDF/B-V
6 CZIRR+S NORM CANCE
10 CANCE
14 SMITH
22 WHAL
23 MOAT
24 ADAMS NORM MOAT
31 PANKRATOV
4.0
16.0
18.0
20.0
22.0

Figure 18 *U-235 (n,f)* *0.01-20.0 MeV*

This figure shows a ±3% band around a reasonable but arbitrary guess for the cross section of U-235 (n,f). The curve bases on the newer data which are shown in the figure. See discussions in the Proceedings following the working group report on the status of the U-235. Older data would generally lie on the higher side of the curve.

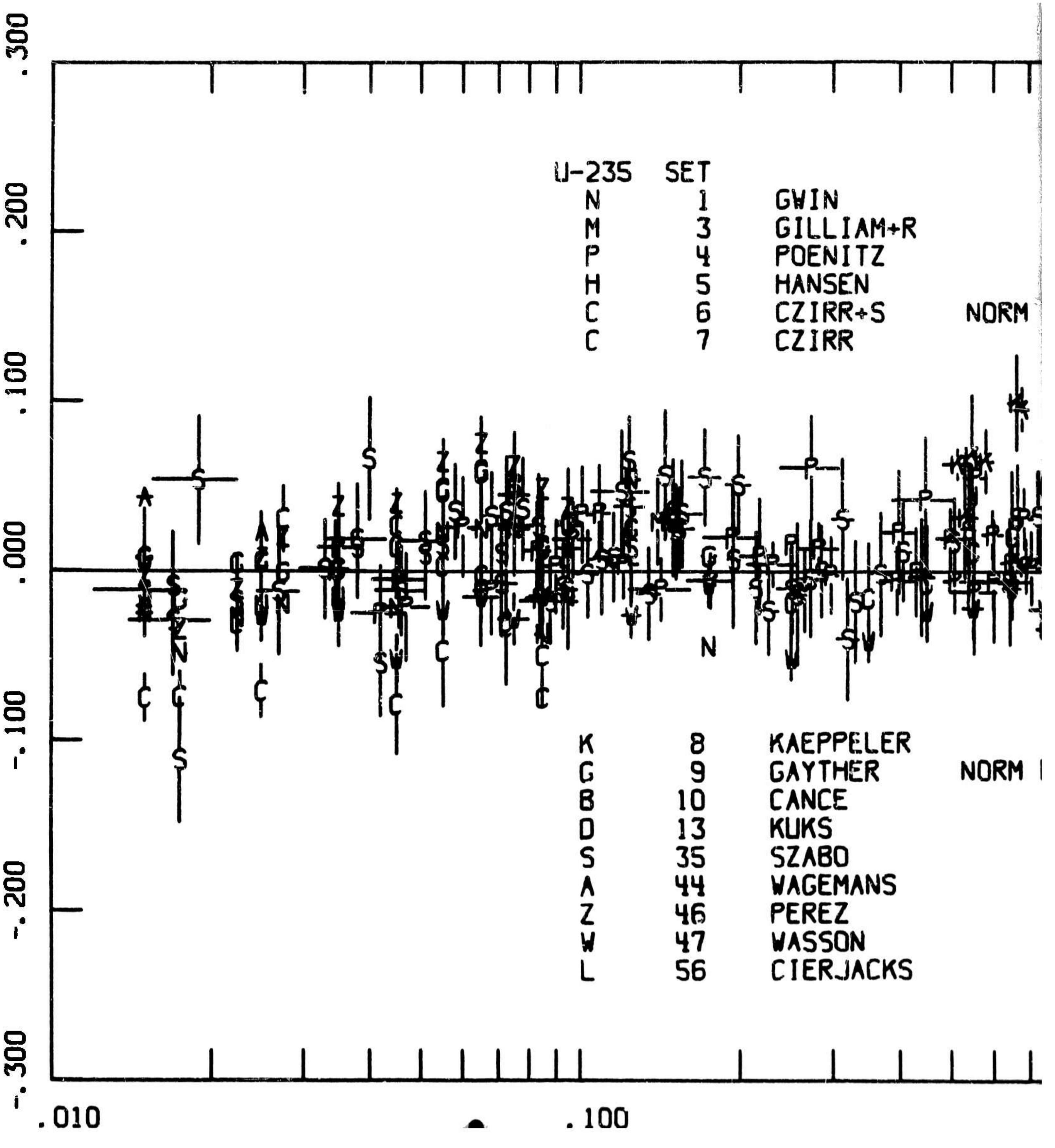

2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
σ(n,f)
.010
.100
En(MeV)
U-235
-
N
M
P
H
C
C
K
G
B
D
S
A
Z
W
L



U-235 SET
- 301 GUESS, +/- 3 PER
N 1 GWIN
M 3 GILLIAM+R
P 4 POENITZ
H 5 HANSEN
C 6 CZIRR+S NORM CANCE
C 7 CZIRR
K 8 KAEPPELER
G 9 GAYTHER NORM U.MICH
B 10 CANCE
D 13 KUKS
S 35 SZABO
A 44 WAGEMANS
Z 46 PEREZ
W 47 WASSON
L 56 CIERJACKS
1.00
10.0
20.0
MeV)

Figure 19 *U-235 (n,f)* *0.01-20.0 MeV*

The relative difference of individual data with the curve from Fig. 18 is shown in this figure. Note that systematic differences appear to be covered by the $\pm 3\%$ range with the exception of the range above 14 MeV, the data by Kaeppeler (72 Vienna, p. 213), and the data by Czirr and Sidhu (UCRL-77377, 1975) relative to Li-6(n,α). Some additional points scatter statistically and exceed the $\pm 3\%$ range as should be expected.


U-235 SET
N 1 GWIN
M 3 GILLIAM+R
P 4 POENITZ
H 5 HANSEN
C 6 CZIRR+S NORM
C 7 CZIRR
K 8 KAEPPELER
G 9 GAYTHER NORM
B 10 CANCE
D 13 KUKS
S 35 SZABO
A 44 WAGEMANS
Z 46 PEREZ
W 47 WASSON
L 56 CIERJACKS
.300
.200
.100
.000
-.100
-.200
-.300
.010
.100

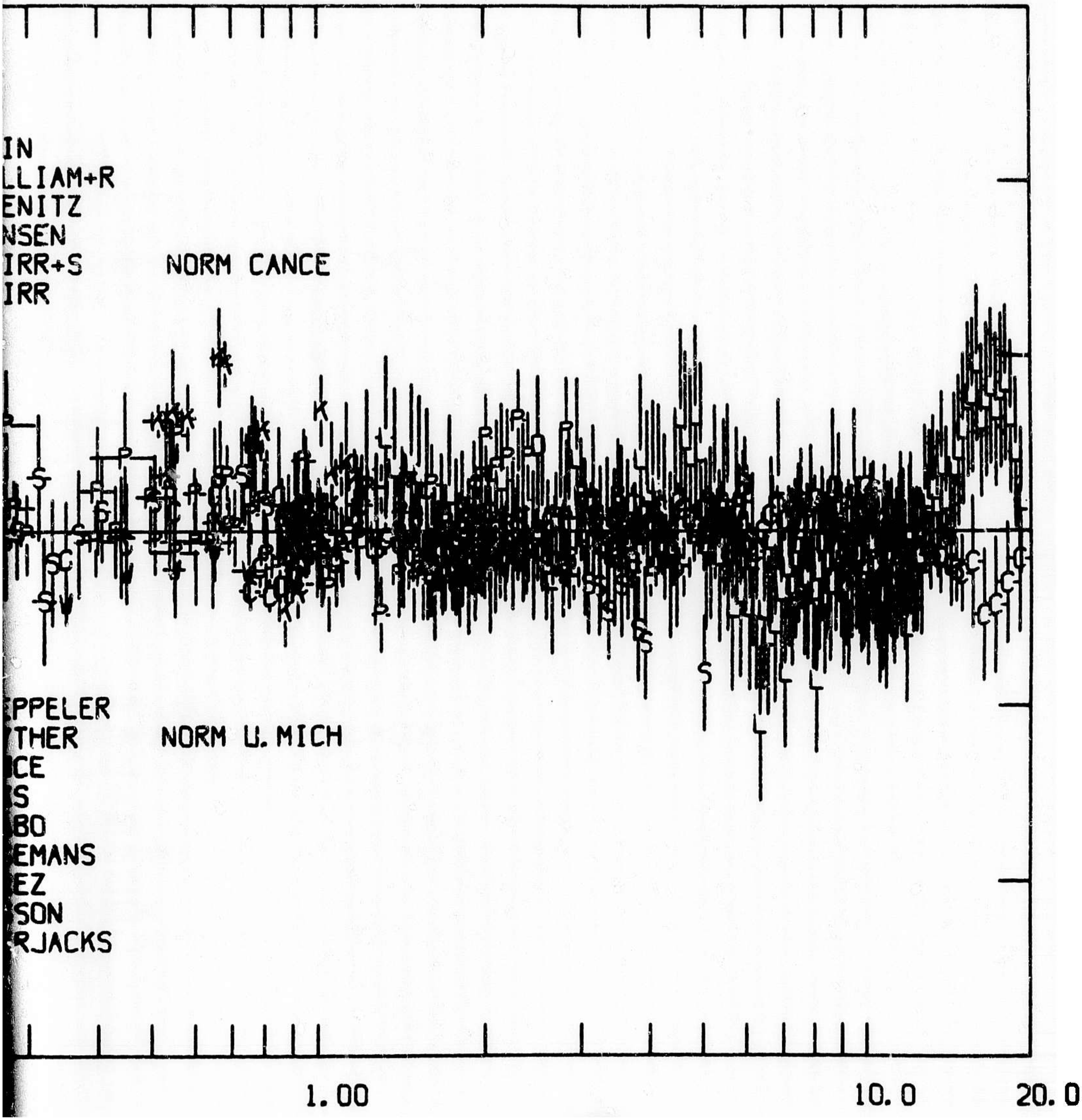

IN
LLIAM+R
ENITZ
NSEN
IRR+S
IRR
NORM CANCE
PPELER
THER
CE
S
BO
EMANS
EZ
SON
RJACKS
NORM U. MICH
1.00
10.0
20.0

Figure 20 *U-238 (n,f)/U-235 (n,f)* *0.6-1.4 MeV*

Comparison of the data by Meadows (76 ANL, p. 73) and by Behrens and Carlson (76 ANL, p. 47). Both sets are absolute ratio measurements and agree in the plateau-region within about 0.8%. An energy scale difference of about 20 keV is obvious.

Figure 21 *U-238 (n,f)/U-235 (n,f)* *0.6-1.4 MeV*

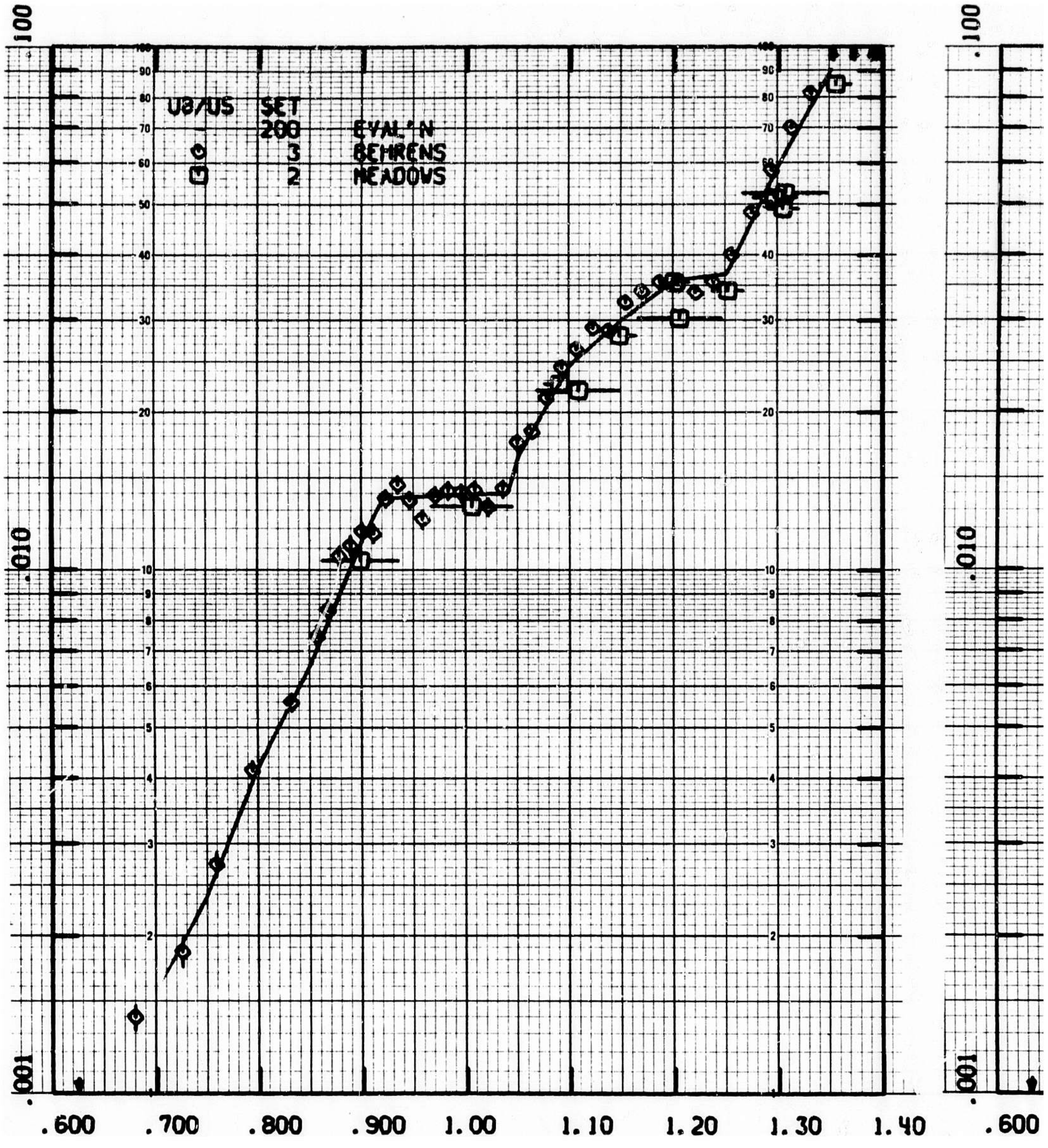
The revised shape-data by Coates et al. (75 Washington, 2, p. 568, private com. by G. D. James, 19 were normalized at 2.5 MeV to 0.432. The shape-data by Cierjacks et al. (76 ANL, p. 94) were normalize to the same value.

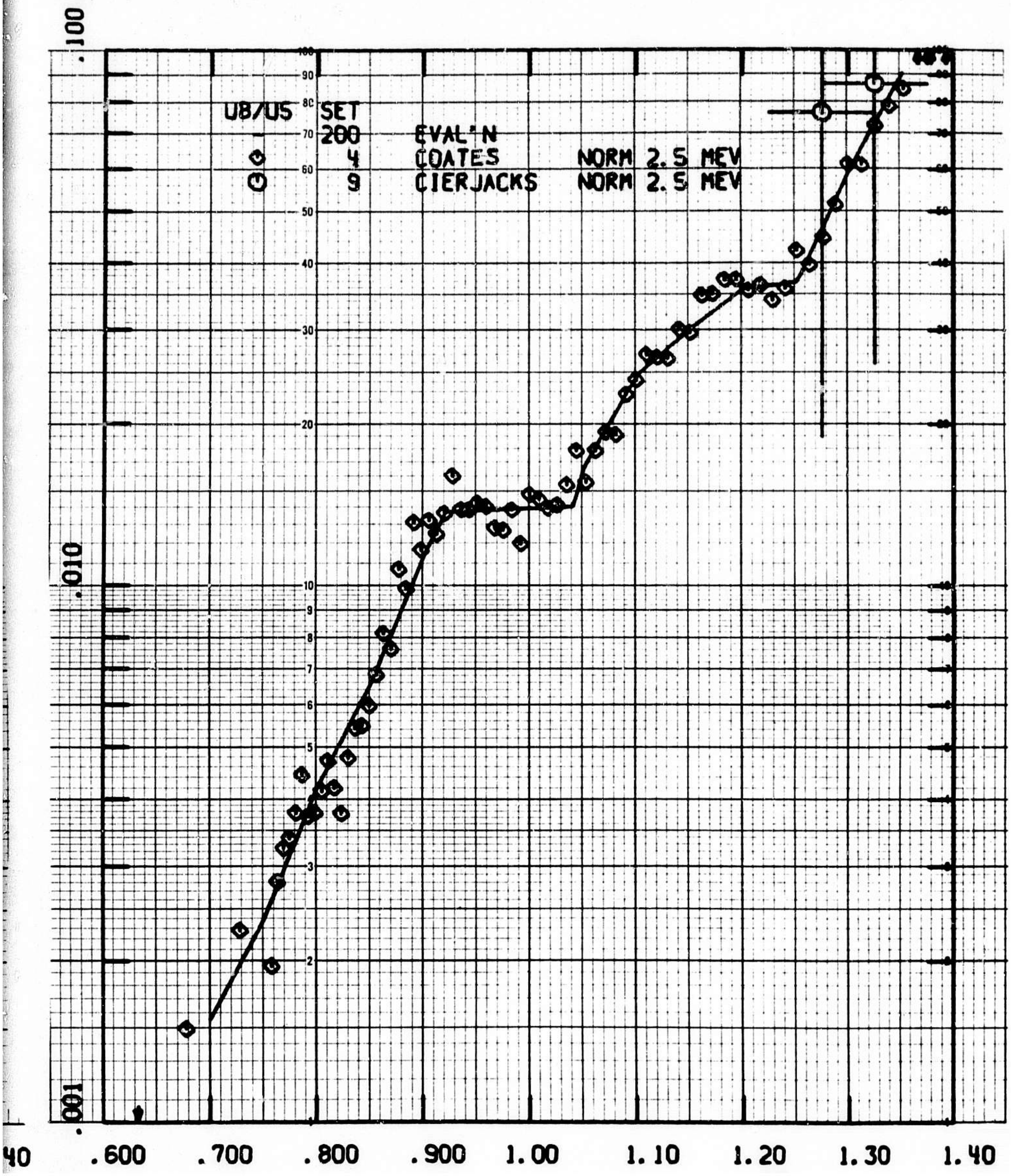
U-238 (n,f)/U-235 (n,f) *0.6-1.4 MeV*

dows (76 ANL, p. 73) and by Behrens and Carlson (76 ANL, p. 47). Both ts and agree in the plateau-region within about 0.8%. An energy scale ous.

U-238 (n,f)/U-235 (n,f) *0.6-1.4 MeV*

ates et al. (75 Washington, 2, p. 568, private com. by G. D. James, 1976) 32. The shape-data by Cierjacks et al. (76 ANL, p. 94) were normalized


U8/US SET
200 EVAL'N
3 BEHRENS
2 MEADOWS
.600
.700
.800
.900
1.00
1.10
1.20
1.30
1.40
.001
.010
100



UB/U5 SET
200 EVAL'N
4 COATES NORM 2.5 MEV
9 CIERJACKS NORM 2.5 MEV
.100
.010
.001
.600
.700
.800
.900
1.00
1.10
1.20
1.30
1.40

Figure 22 *U-238 (n,f)/U-235 (n,f)* *0.6-1.4 MeV*

Comparison of the data by Behrens and Carlson (76 ANL, p. 47) and by Evans et al. (76 ANL, p. 149) The data by Evans et al. were measured to investigate energy-scale differences between the data by Behr and Carlson and the original results by Coates et al. and should not be considered for other purposes (see Proceedings, report of the working group on ratios).

Figure 23 *U-238 (n,f)/U-235 (n,f)* *0.6-1.4 MeV*

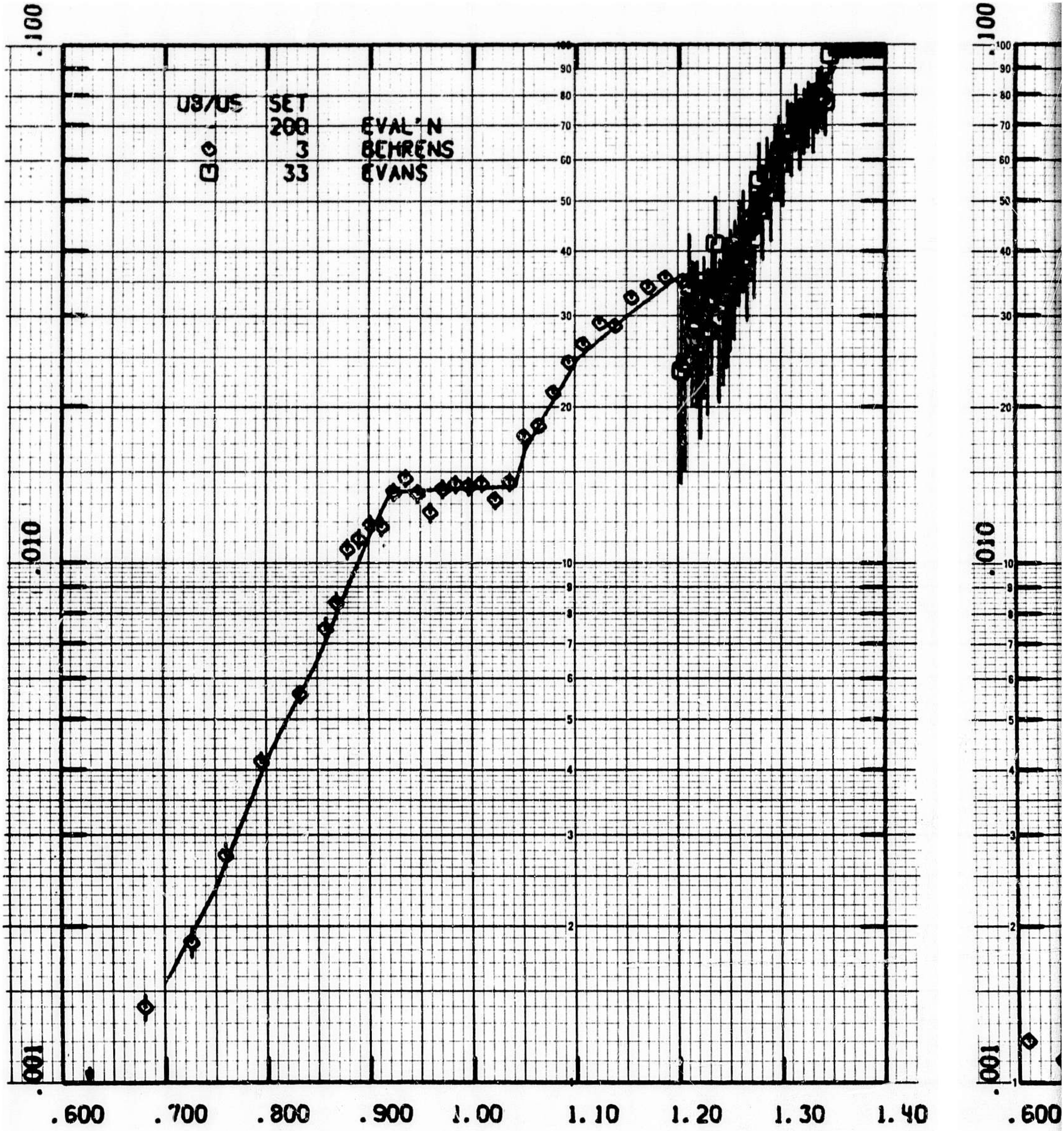
Comparison of older measurements. Normalization of the data by Lamphere (PR, 104, 1654, 1956) at 2.5 MeV to the average value of 0.432 would increase the apparent differences in the energy-scales with data shown in the preceeding figures.

U-238 (n,f)/U-235 (n,f) *0.6-1.4 MeV*

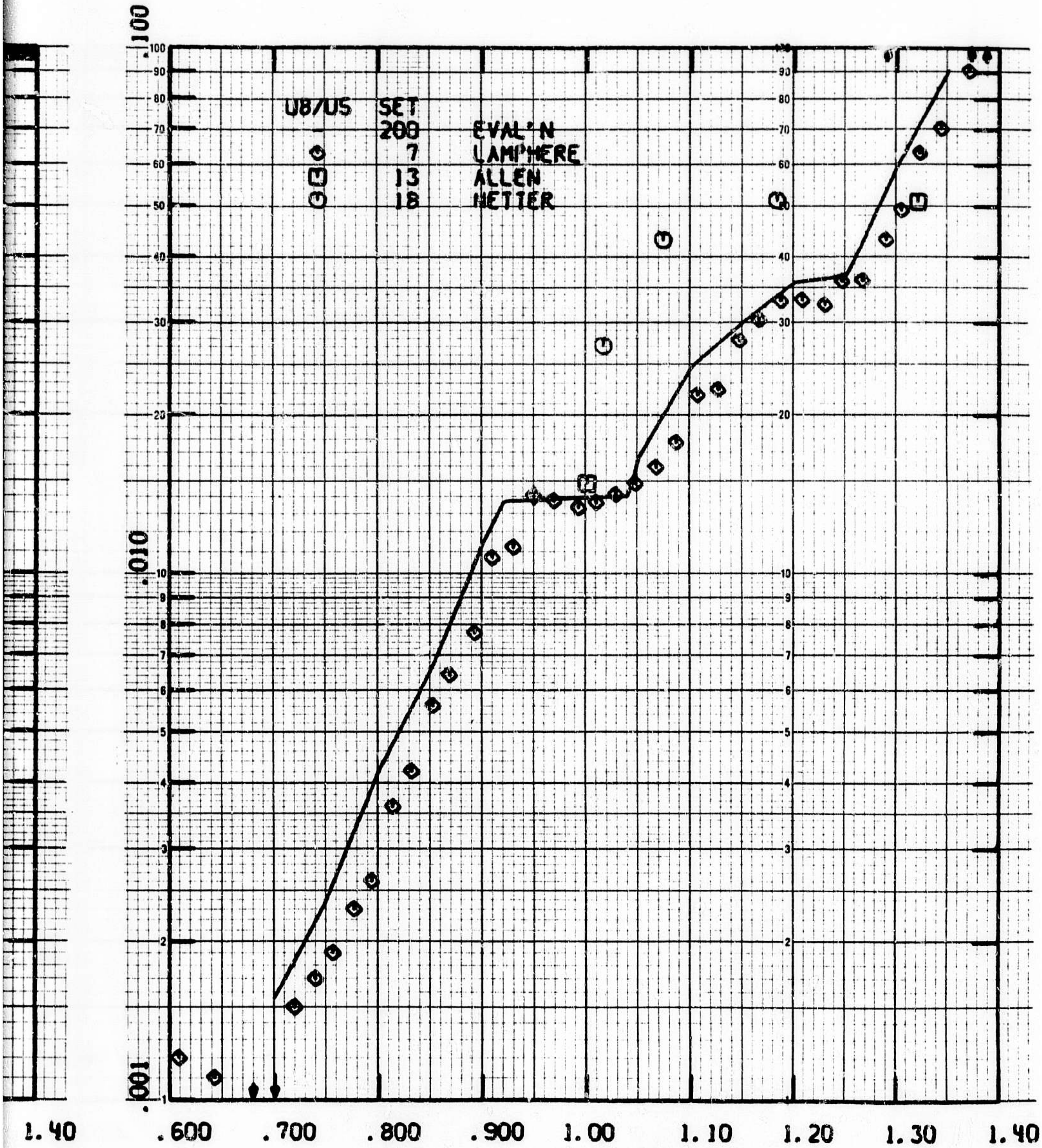
Behrens and Carlson (76 ANL, p. 47) and by Evans et al. (76 ANL, p. 149).
measured to investigate energy-scale differences between the data by Behrens
esults by Coates et al. and should not be considered for other purposes
e working group on ratios).

U-238 (n,f)/U-235 (n,f) *0.6-1.4 MeV*

rements. Normalization of the data by Lamphere (PR, 104, 1654, 1956) at
f 0.432 would increase the apparent differences in the energy-scales with
figures.

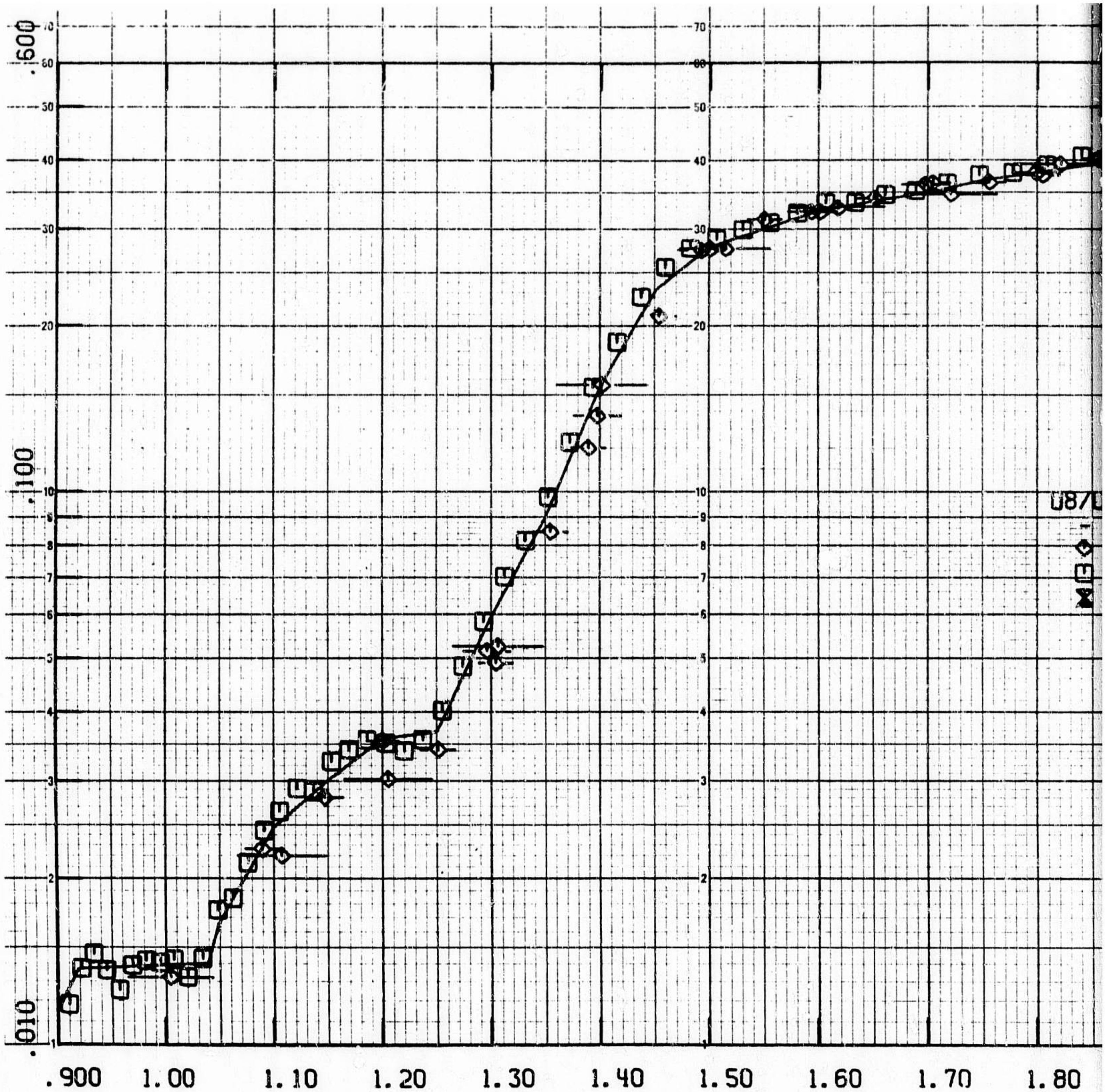


U3/US SET
200 EVAL'N
3 BEHRENS
33 EVANS
.100
.010
.001
.600
.700
.800
.900
1.00
1.10
1.20
1.30
1.40

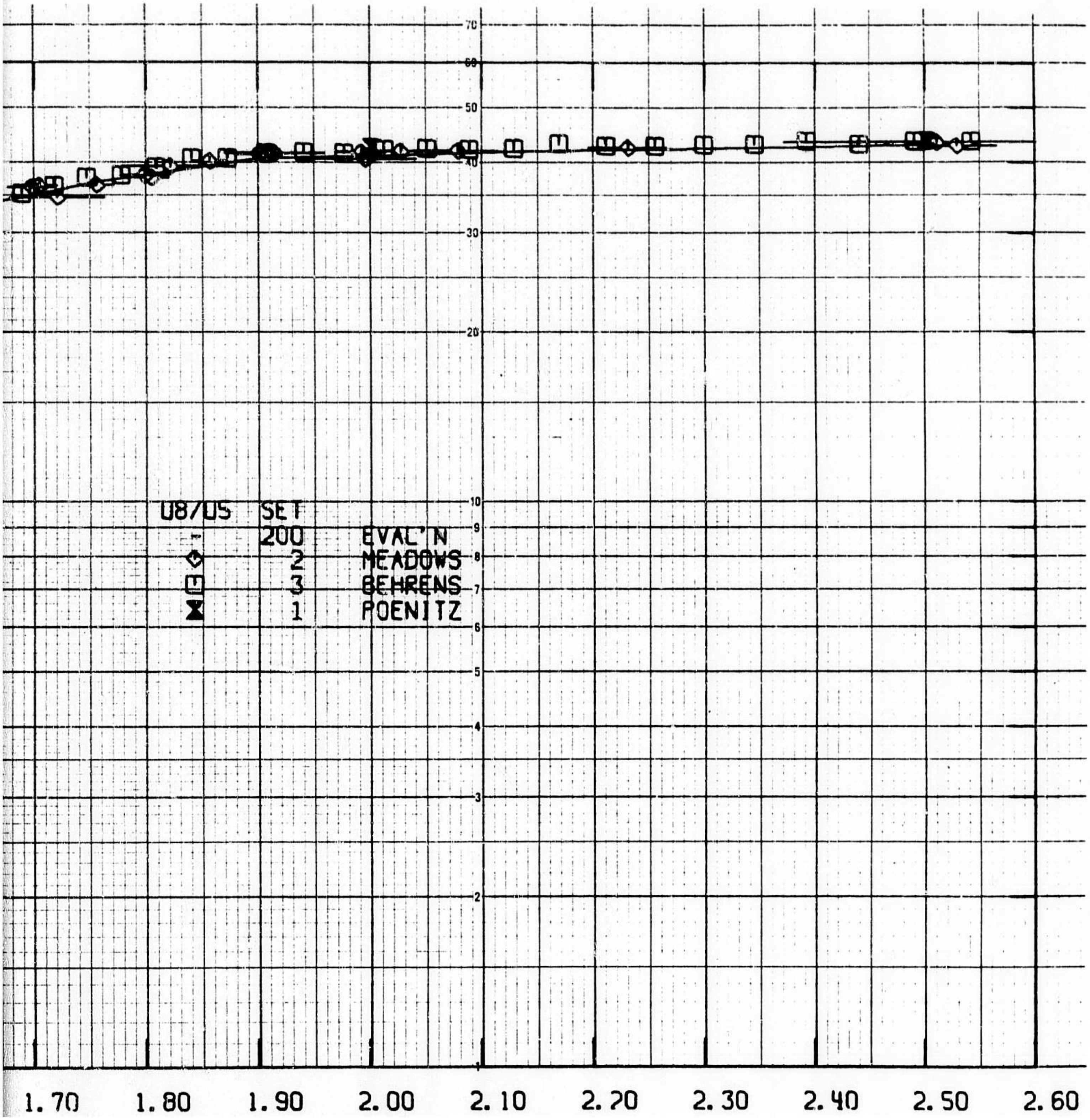

UB/US SET
200 EVAL'N
7 LAMPHERE
13 ALLEN
18 HETTER
.100
.010
.001
.600
.700
.800
.900
1.00
1.10
1.20
1.30
1.40

igure 24 *U-238 (n,f)/U-235 (n,f)* *0.9-2.6 MeV*

Comparison of monoenergetic-neutron source data by Poenitz and Armani (JNE, 26, 483, 1972) and by eadows (76 ANL, p. 73) with white-neutron source data by Behrens and Carlson (76 ANL, p. 47). Absolute alues in the plateau-range between 2 and 3 MeV agree within about 1.2%. Energy-scales of the measure-ents by Meadows and by Behrens and Carlson differ by about 20 keV, though measurements of the carbon esonance energies agree within ± 3 keV.



.600
.100
.010
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
.900
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
U8/U



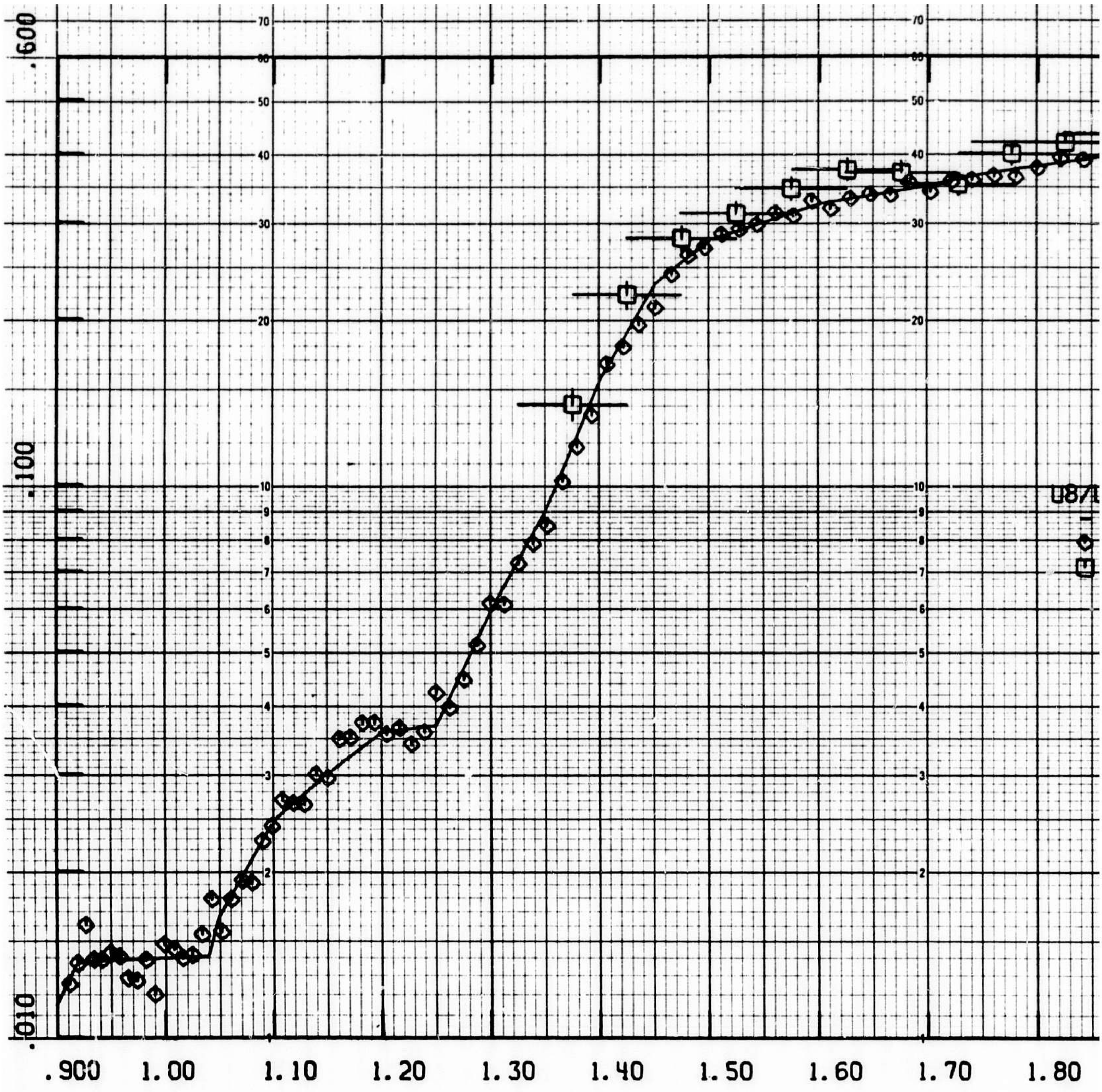
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1
U8/U5 SET
200 EVAL'N
2 MEADOWS
3 BEHRENS
1 POENITZ
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60

Figure 25 *U-238 (n,f)/U-235 (n,f)* *0.9-2.6 MeV*

The revised shape-data by Coates et al. (75 Washington, 2, p. 568, private com. by G. D. James, 19
were normalized at 2.5 MeV to 0.432. The shape-data by Cierjacks et al. (76 ANL, p. 94) were normalize
to the same value.

U-238 (n,f)/U-235 (n,f)　　　　　　*0.9-2.6 MeV*

al. (75 Washington, 2, p. 568, private com. by G. D. James, 1976)
e shape-data by Cierjacks et al. (76 ANL, p. 94) were normalized



.600
.100
.010
.900
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
U8/

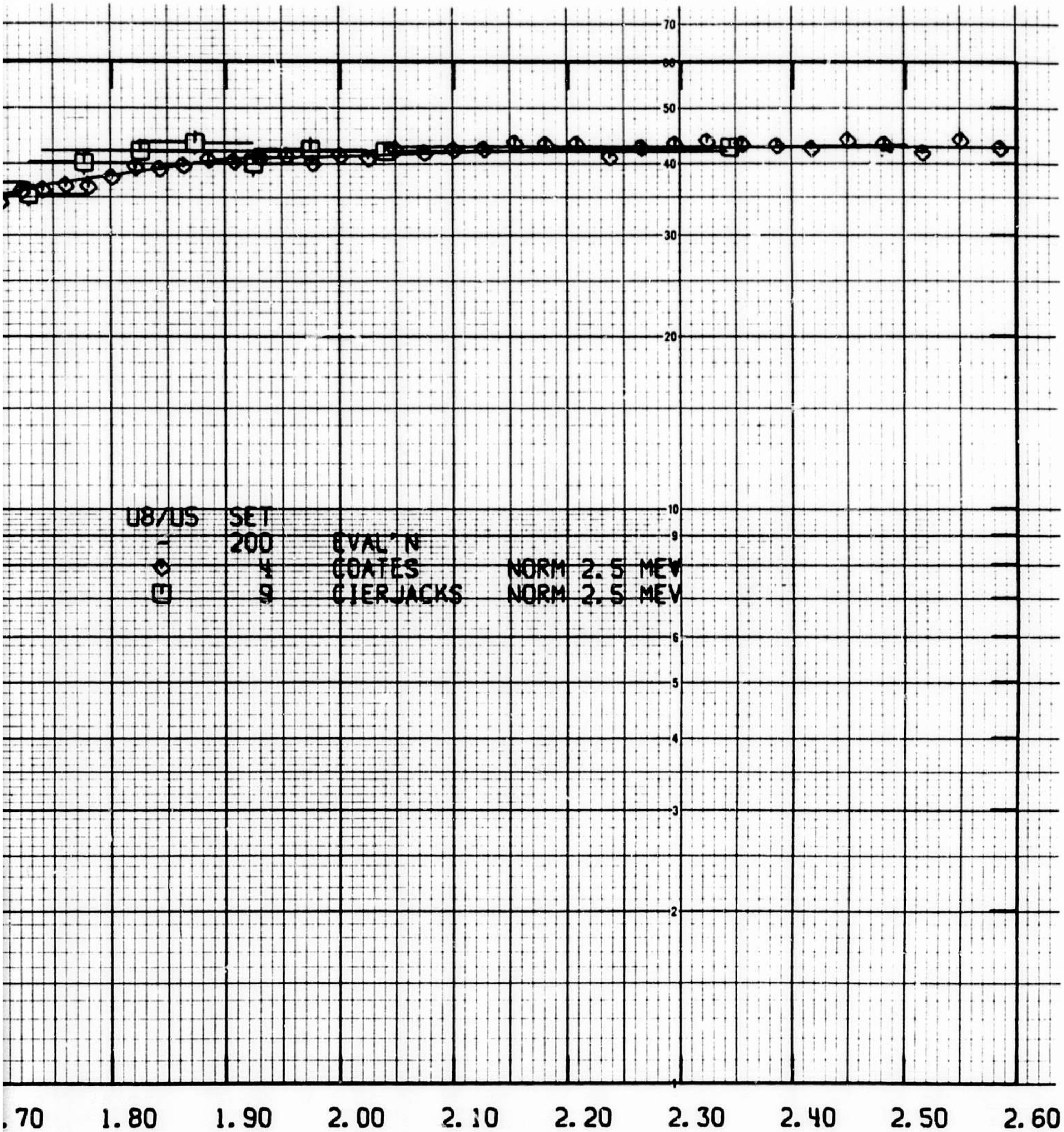
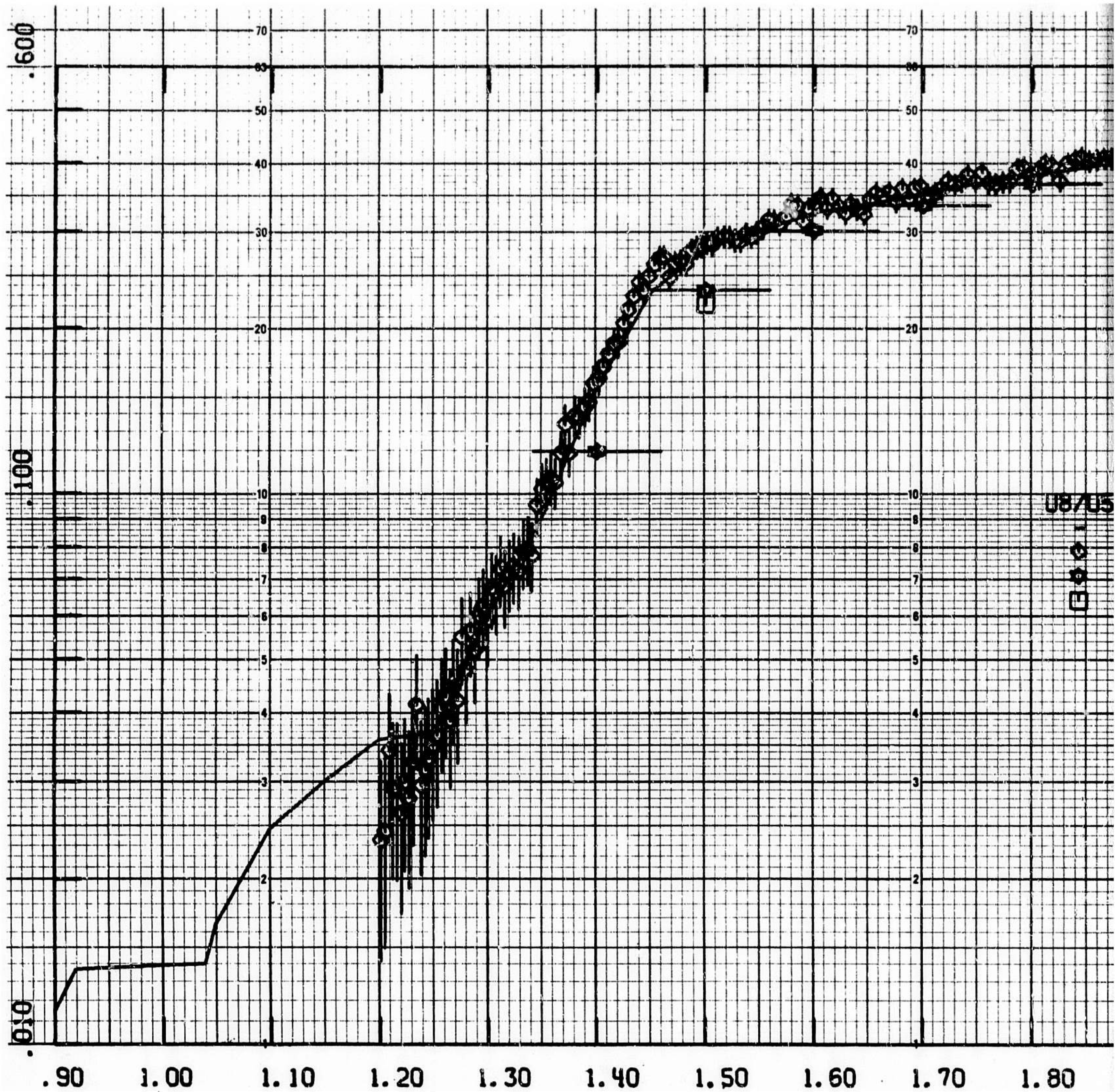

70
60
50
40
30
20
10
9
6
5
4
3
2
1
U8/U5 SET
- 200 EVAL'N
4 COATES NORM 2.5 MEV
9 CIERJACKS NORM 2.5 MEV
.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60

Figure 26 *U-238 (n,f)/U-235 (n,f)* *0.9-2.6 MeV*

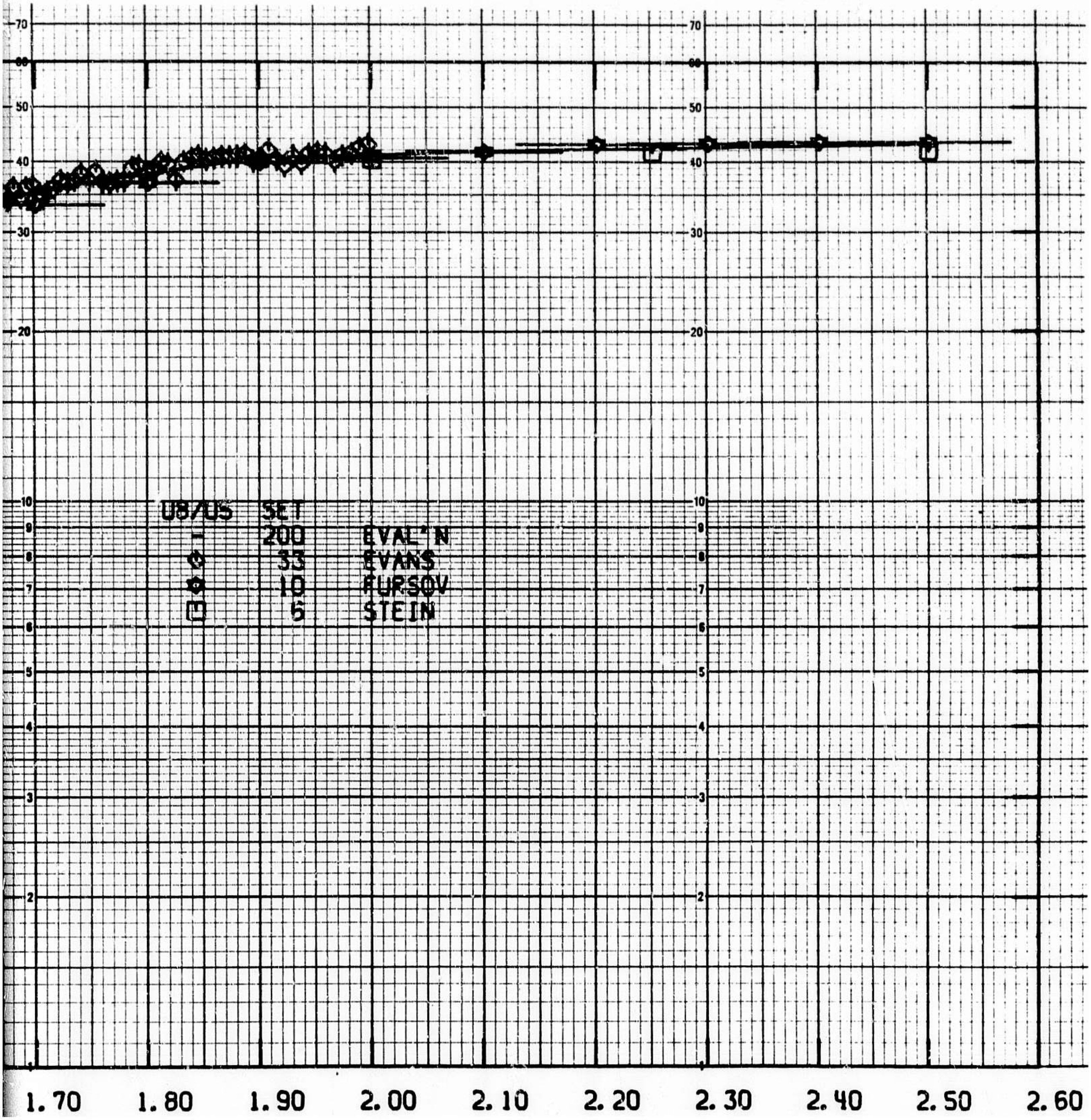
The data by Evans et al. (76 ANL, p. 149) were measured to investigate energy-scale differences between the data by Behrens and Carlson and the original results by Coates et al.. Data by Fursov et al (73 Kiev, 4, p. 3) appear to differ in energy-scale by about one half of the target thickness. Data by Stein et al. (68 Washington, 1, p. 627) differ in absolute values in the plateau-region from 2 to 3 MeV by about 2.5%. Normalization in this range would improve but not resolve the discrepancy of the 1.5 MeV point.

U-238 (n,f)/U-235 (n,f) *0.9-2.6 MeV*

(76 ANL, p. 149) were measured to investigate energy-scale differences
d Carlson and the original results by Coates et al.. Data by Fursov et al.
iffer in energy-scale by about one half of the target thickness. Data by
, p. 627) differ in absolute values in the plateau-region from 2 to 3 MeV
in this range would improve but not resolve the discrepancy of the 1.5 MeV



.600
.100
.010
U8/U5
.90
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80



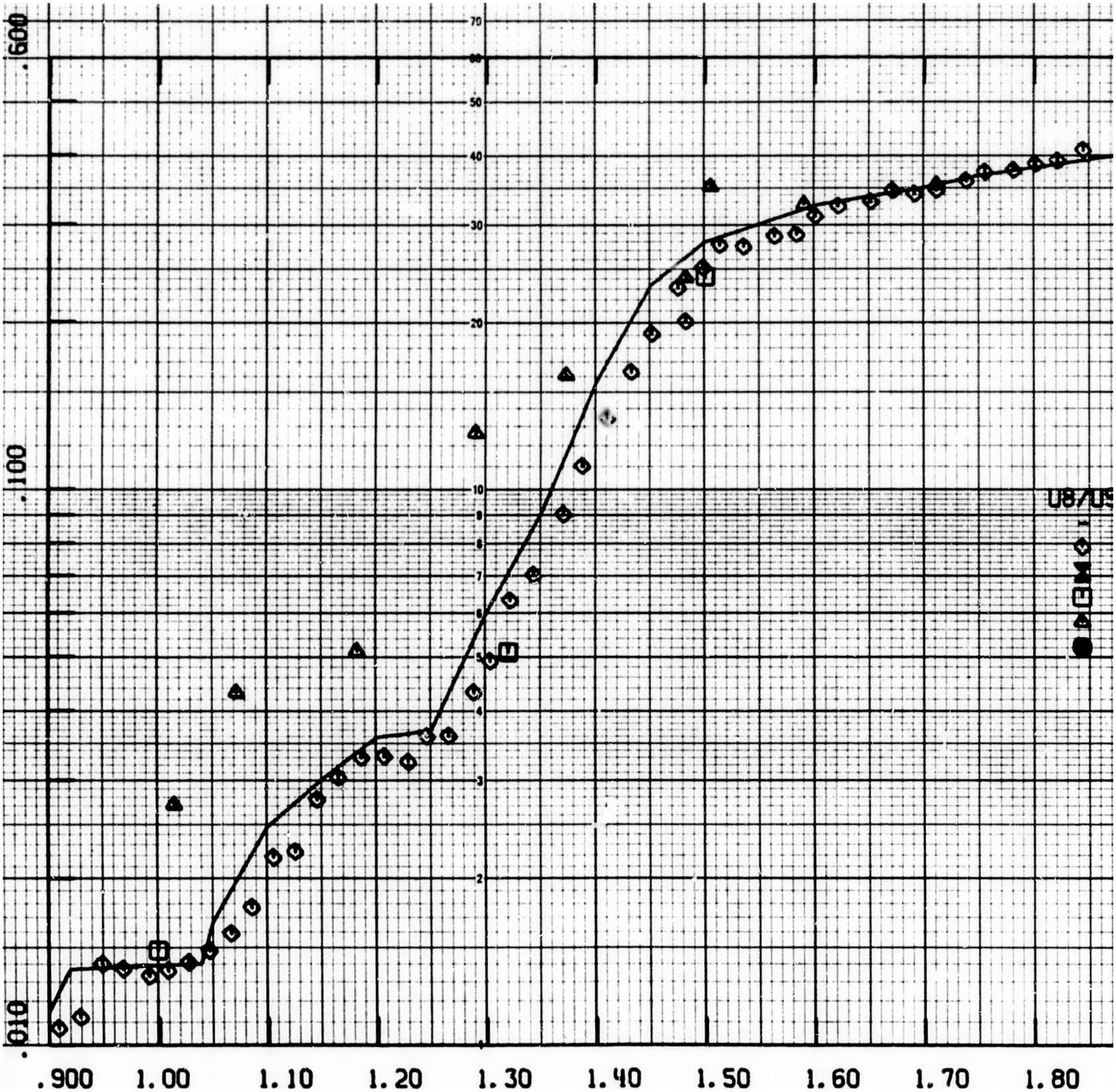
U8/U5 SET
– 200 EVAL'N
33 EVANS
10 FURSOV
5 STEIN
70
60
50
40
30
20
10
9
8
7
6
5
4
3
2
1.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60

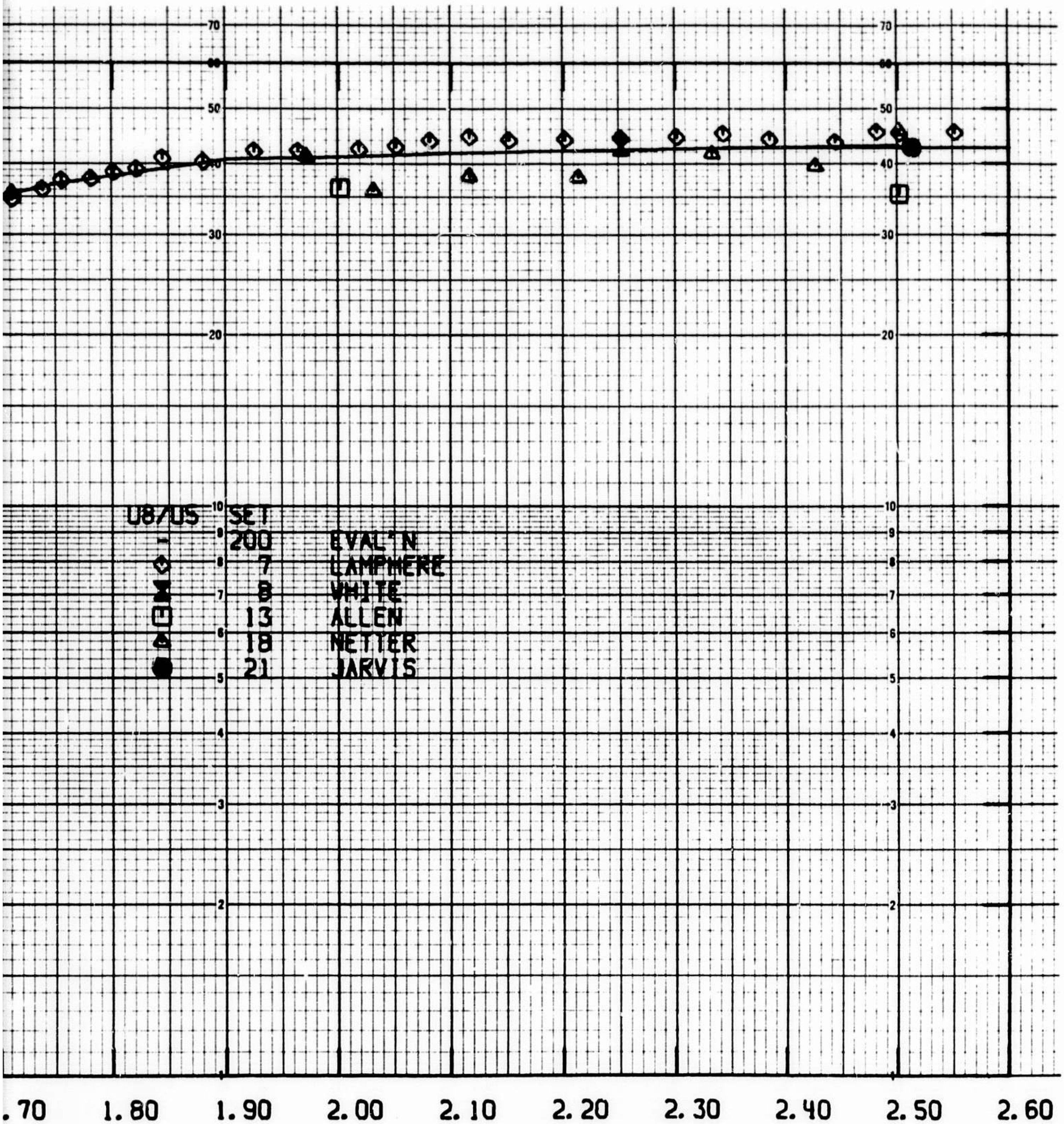
Figure 27 *U-238 (n,f)/U-235 (n,f)* *0.9-2.6 MeV*

Comparison of older measurements. Normalization of the data by Lamphere (PR, 104, 1654, 1956) a 2.5 MeV to the average value of 0.432 would increase the apparent differences in the energy-scales wi data shown in the preceeding figures.

U-238 (n,f)/U-235 (n,f) *0.9-2.6 MeV*

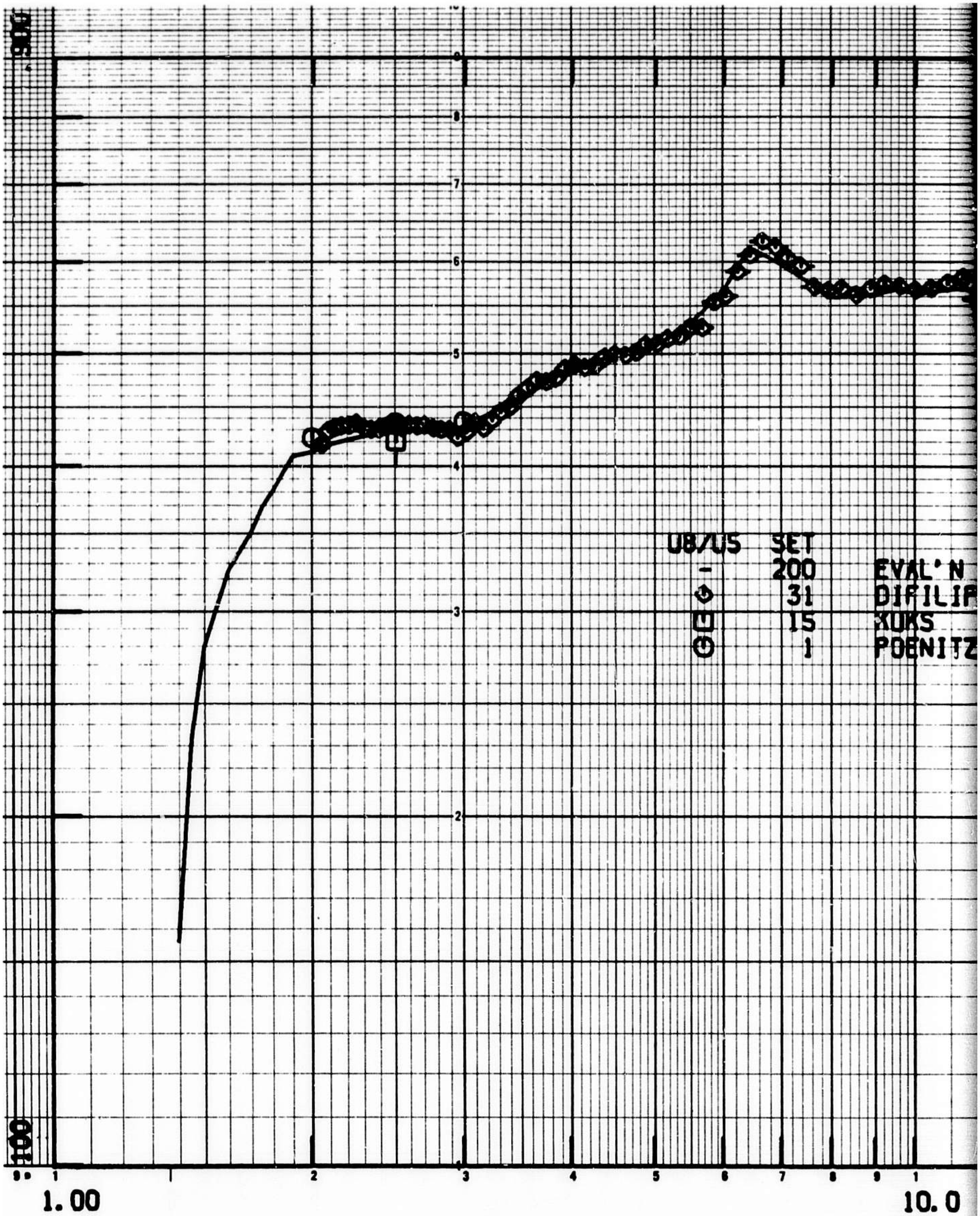
easurements. Normalization of the data by Lamphere (PR, 104, 1654, 1956) at ue of 0.432 would increase the apparent differences in the energy-scales with ng figures.


.600
.100
.010
.900
1.00
1.10
1.20
1.30
1.40
1.50
1.60
1.70
1.80
U8/U5


U8/U5
SET
200 EVAL'N
7 LAMPWERE
8 WHITE
13 ALLEN
18 NETTER
21 JARVIS
70
50
40
30
20
10
9
8
7
6
5
4
3
2
.70
1.80
1.90
2.00
2.10
2.20
2.30
2.40
2.50
2.60

igure 28 *U-238 (n,f)/U-235 (n,f)* *1-30 MeV*

The shape-data by Difilippo et al. (76 ANL, p. 114) were normalized at 2.5 MeV to 0.432. The .5 MeV value by Poenitz and Armani (JNE, 26, 483, 1972) was measured in order to provide an absolute atio value for the normalization of shape-data. The value by Kuks et al. (73 Kiev, 4, p. 18) was de-ived from absolute measurements of the individual cross sections.



U8/U5 SET
200 EVAL'N
31 DIFILIP
15 KOKS
1 POENITZ
1.00
10.0

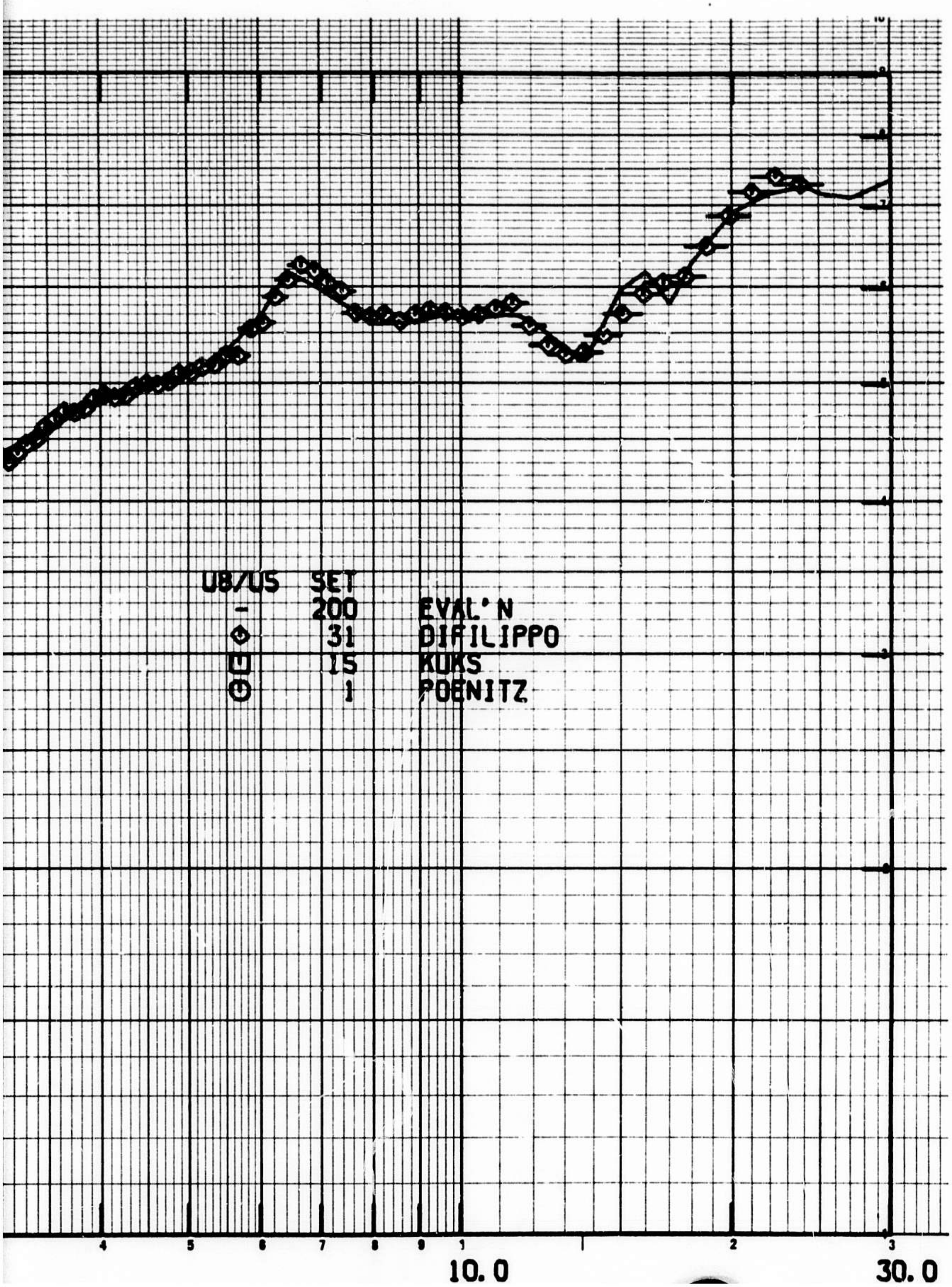
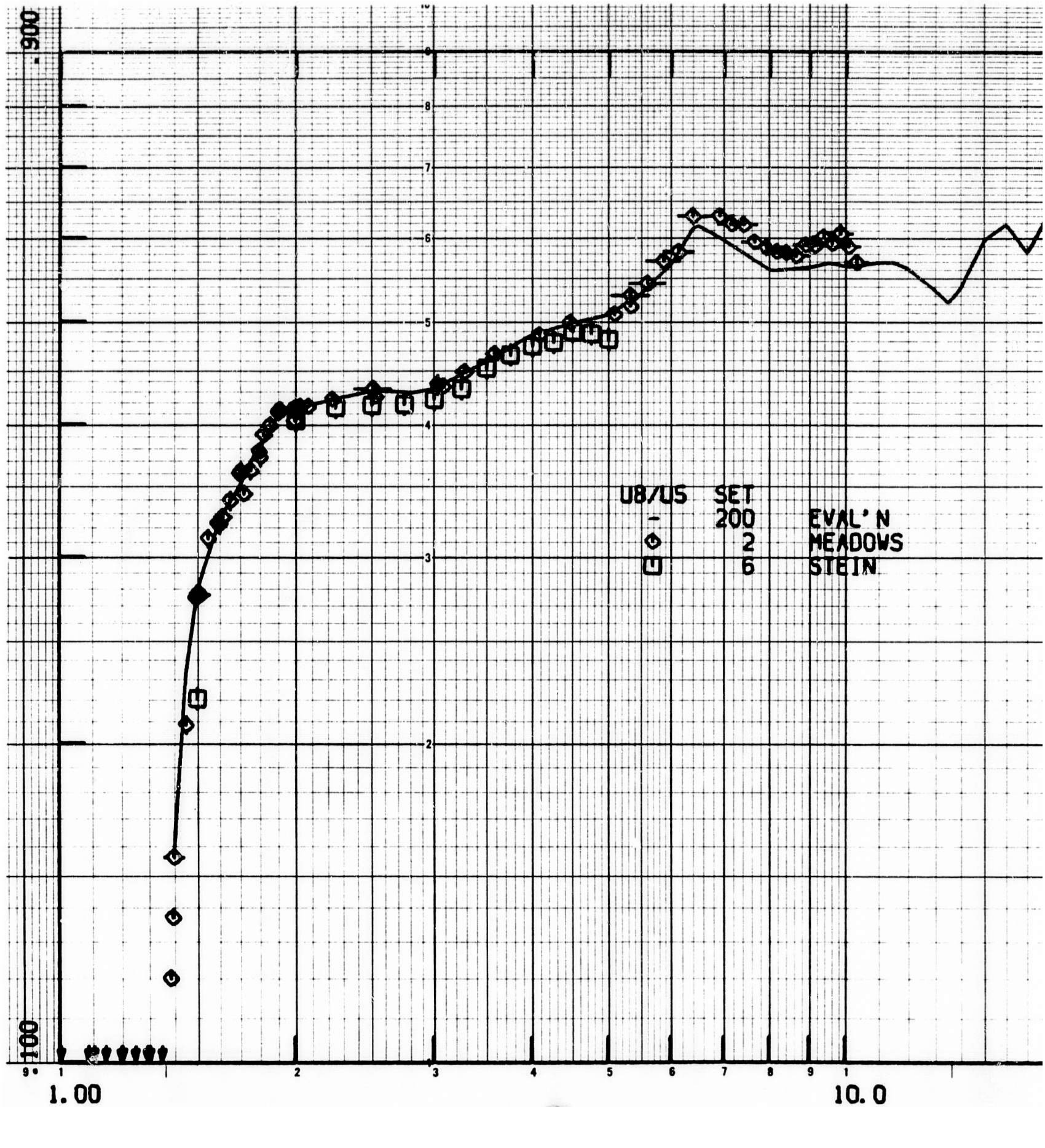

U8/U5 SET
- 200 EVAL'N
31 DIFILIPPO
15 KUKS
1 POENITZ
10.0
30.0

Figure 29 *U-238 (n,f)/U-235 (n,f)* *1-30 MeV*

The monoenergetic-neutron source data by Meadows (76 ANL, p. 73) and by Stein et al. (76 Washingt
1, p. 627) differ in normalization in the plateau-range between 2 and 3 MeV by 2.5% but at 1.5 MeV by about 22%. Data by Meadows were measured with an ionization chamber with an efficiency of about 97%. Data by Stein et al. were measured with surface-barrier detectors with an efficiency of about 74%.

U-238 (n,f)/U-235 (n,f) *1-30 MeV*

n source data by Meadows (76 ANL, p. 73) and by Stein et al. (76 Washington,
ation in the plateau-range between 2 and 3 MeV by 2.5% but at 1.5 MeV by
ere measured with an ionization chamber with an efficiency of about 97%.
sured with surface-barrier detectors with an efficiency of about 74%.



.900
100
U8/US SET
- 200 EVAL'N
2 MEADOWS
6 STEIN
1.00
10.0

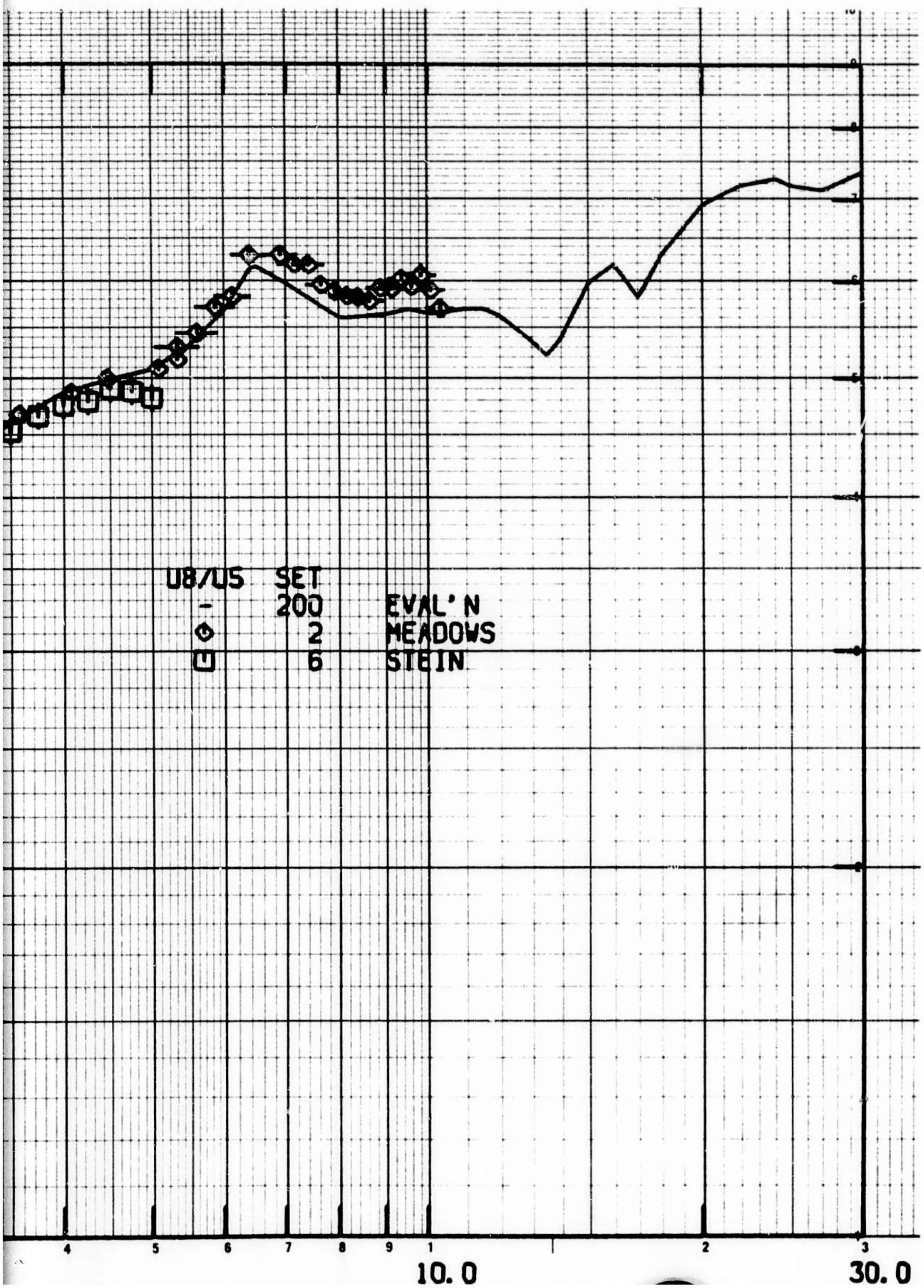
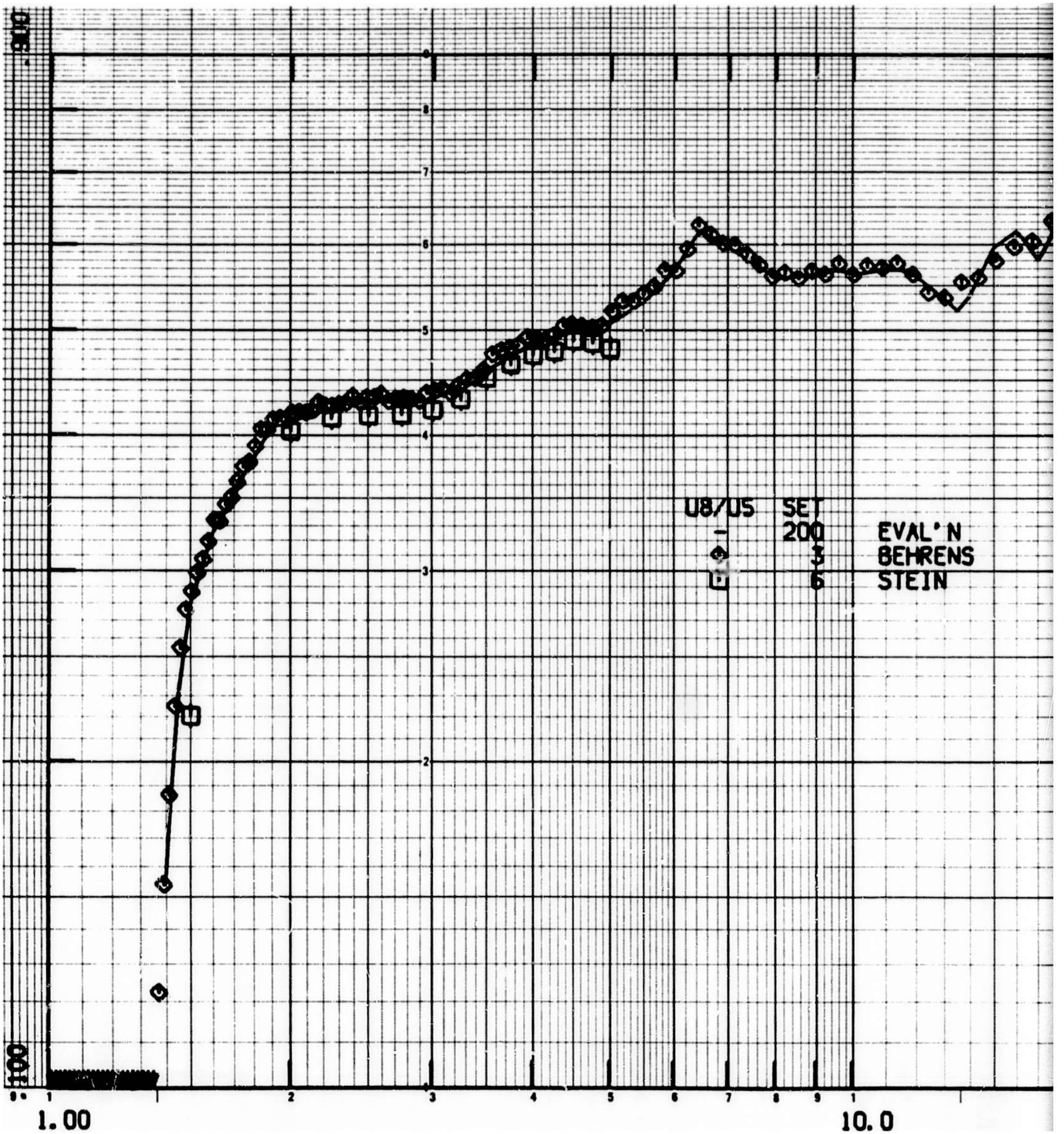

U8/U5 SET
- 200 EVAL'N
2 MEADOWS
6 STEIN
10.0
30.0

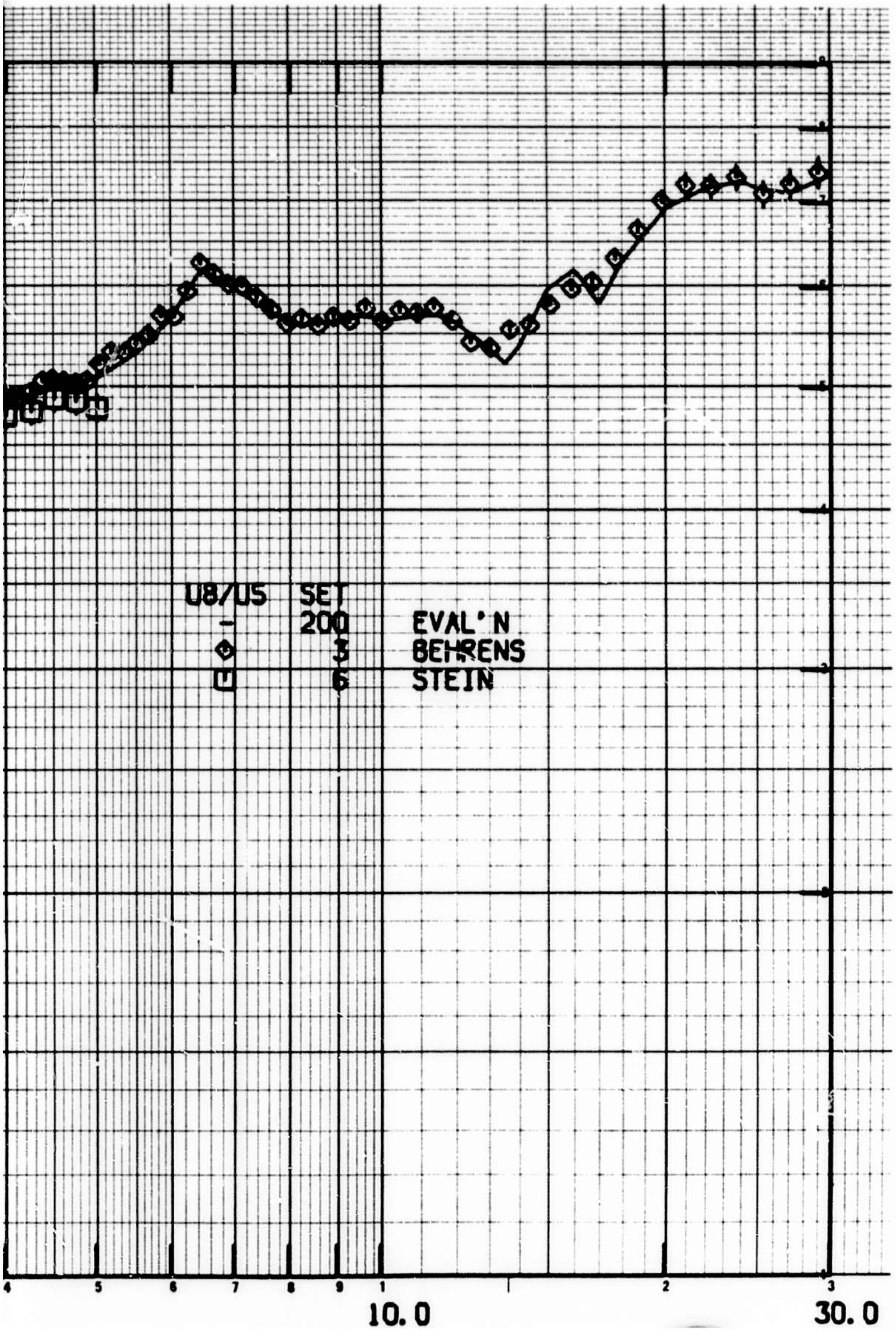
Figure 30 *U-238 (n,f)/U-235 (n,f)* *1-30 MeV*

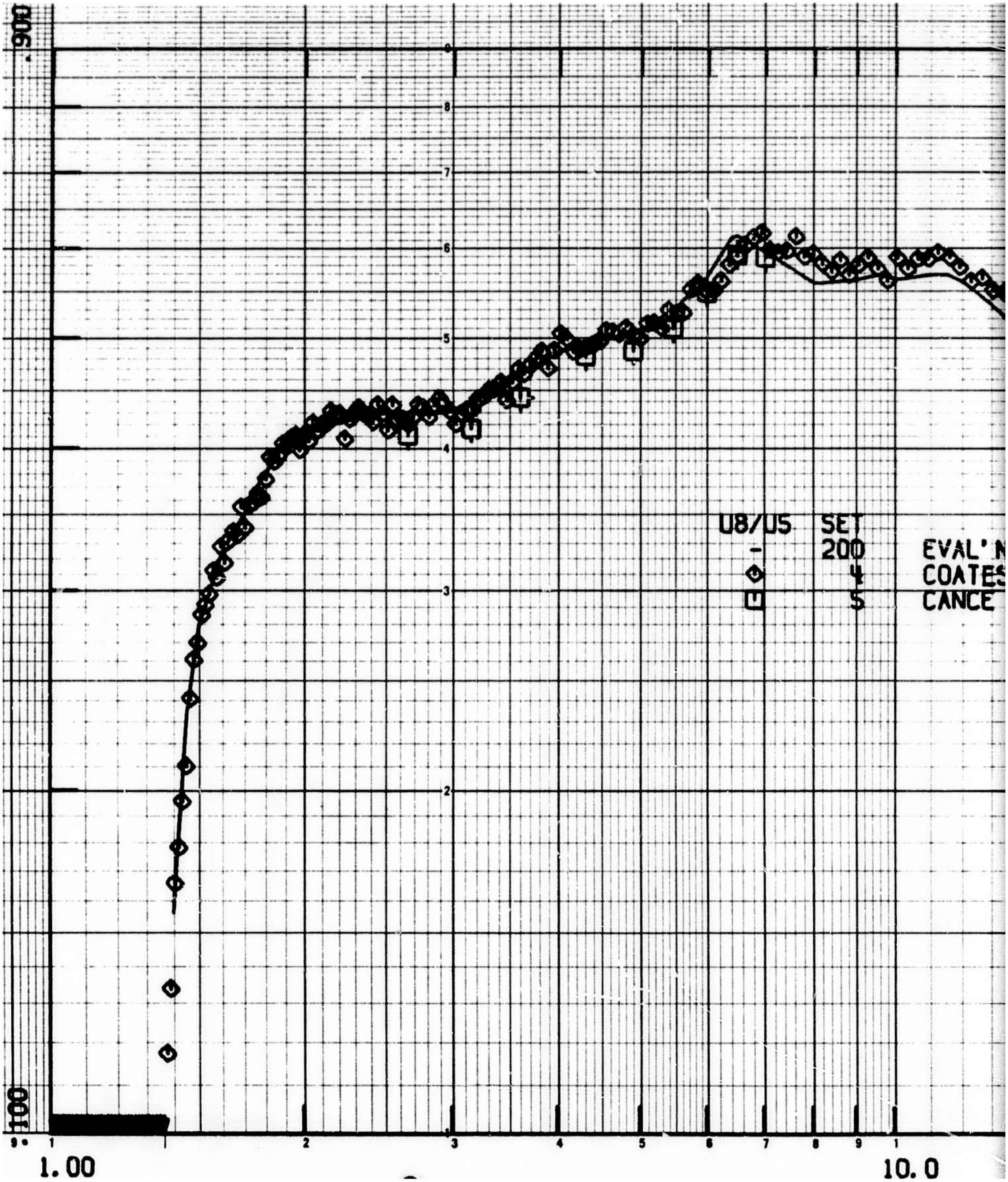
White-neutron source data by Behrens and Carlson (76 ANL, p. 47) compared with monoenergetic-neut source data by Stein et al. (68 Washington, 1, p. 627). Data differ by about 3.3% in the plateau-rang between 2 and 3 MeV and by about 25% at 1.5 Mev.

U-238 (n,f)/U-235 (n,f) *1-30 MeV*

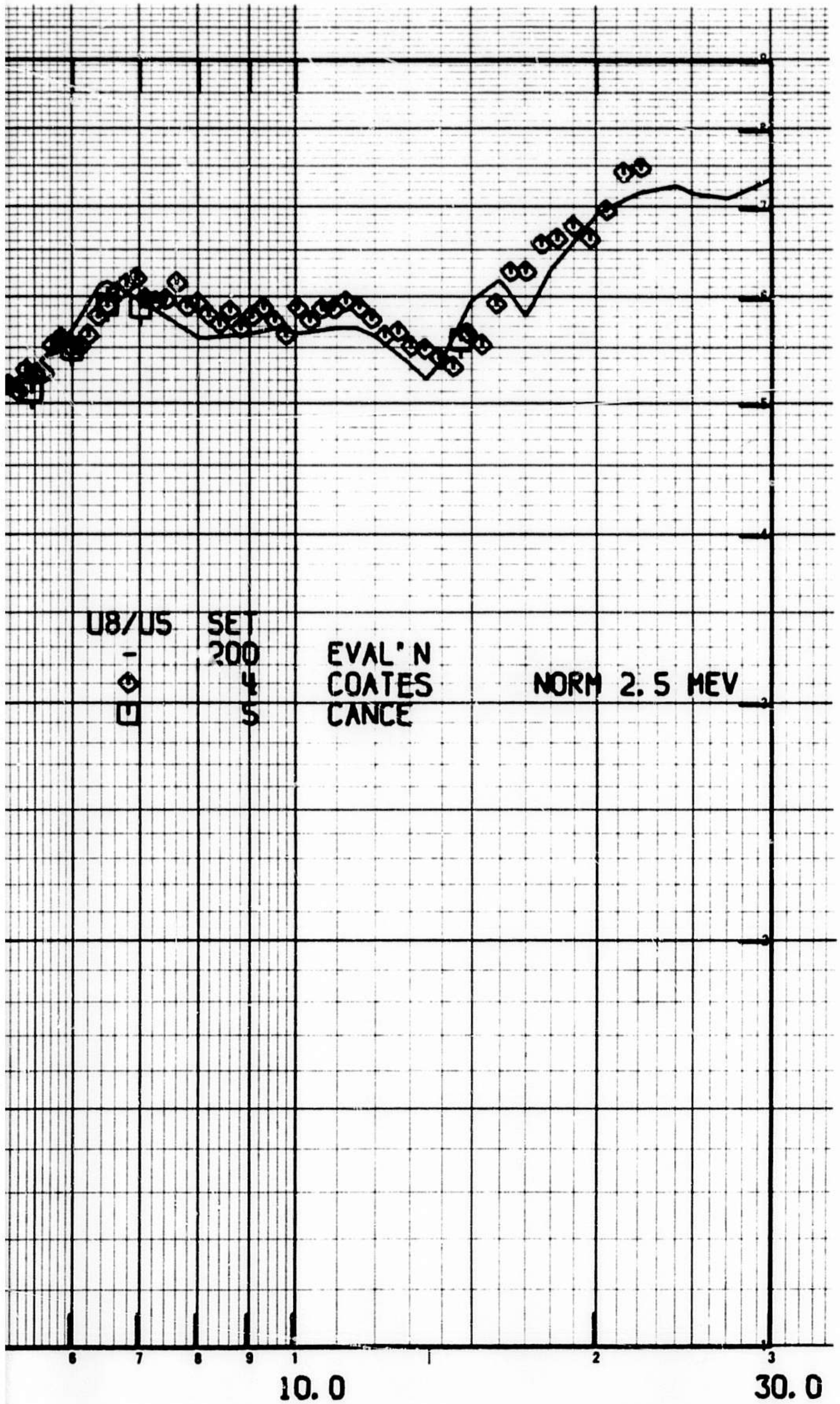
e data by Behrens and Carlson (76 ANL, p. 47) compared with monoenergetic-neutron al. (68 Washington, 1, p. 627). Data differ by about 3.3% in the plateau-range by about 25% at 1.5 Mev.


.900
.100
U8/U5 SET
- 200 EVAL'N
◇ 3 BEHRENS
□ 6 STEIN
1.00
10.0


U8/U5 SET
- 200 EVAL'N
◇ 3 BEHRENS
□ 6 STEIN
4
5
6
7
8
9
1
2
3
10.0
30.0



.900
100
U8/U5 SET
- 200 EVAL'N
4 COATES
5 CANCE
1.00
10.0


U8/U5 SET
- 200 EVAL'N
4 COATES NORM 2.5 MEV
5 CANCE
10.0
30.0

igure 31 *U-238 (n,f)/U-235 (n,f)* *1-30 MeV*

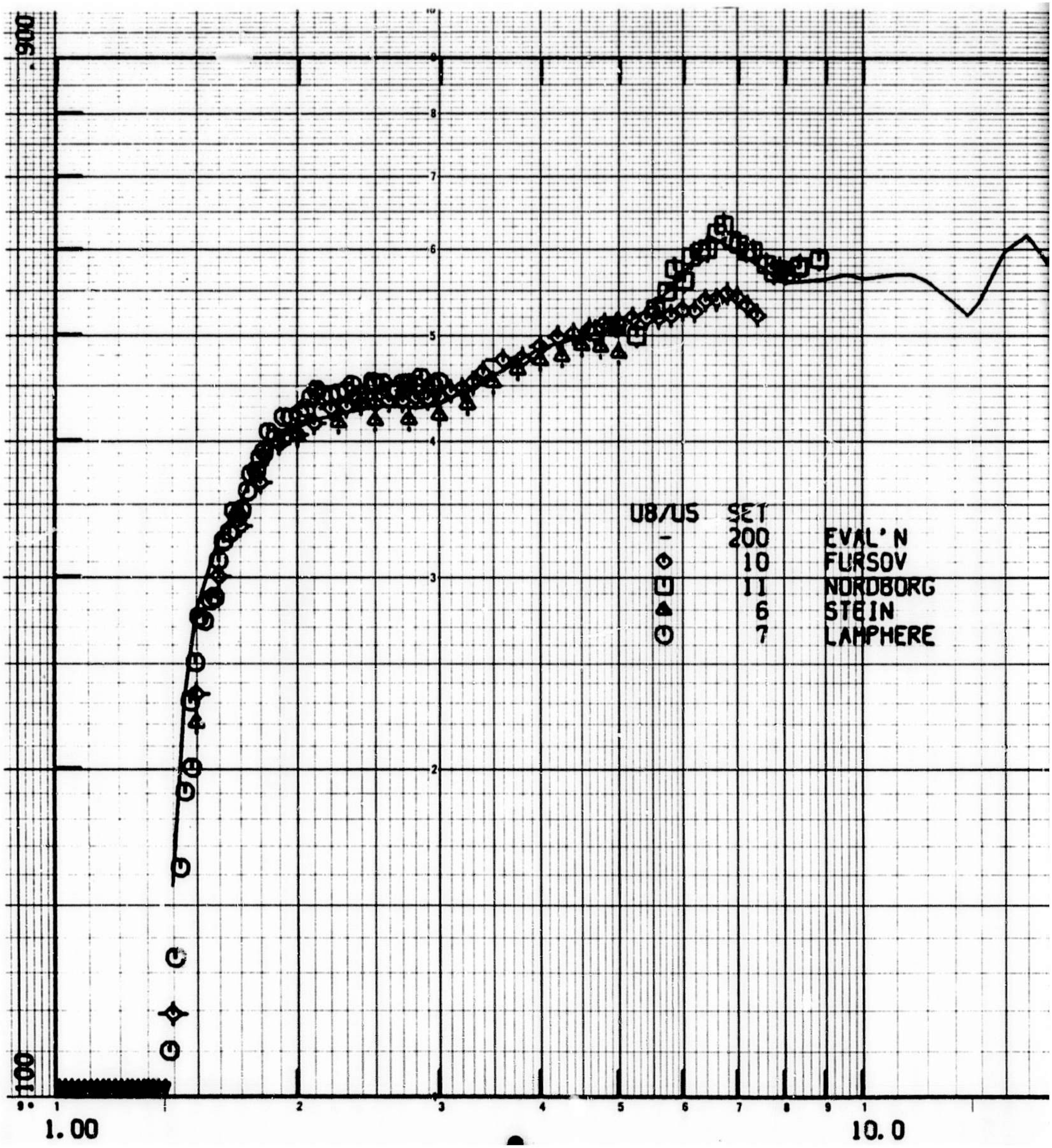
The revised shape-data by Coates et al. (75 Washington, 2, p. 568, and private com. by G. D. James, 976) were normalized at 2.5 MeV to 0.432. The monoenergetic-neutron source data by Cance and Grenier 76 ANL, p. 141) were measured between 2 and 7 MeV as ratios. The 14.6 MeV value was derived from bsolute measurements of the individual cross sections (76 ANL, p. 237).

Figure 32 *U-238 (n,f)/U-235 (n,f)*

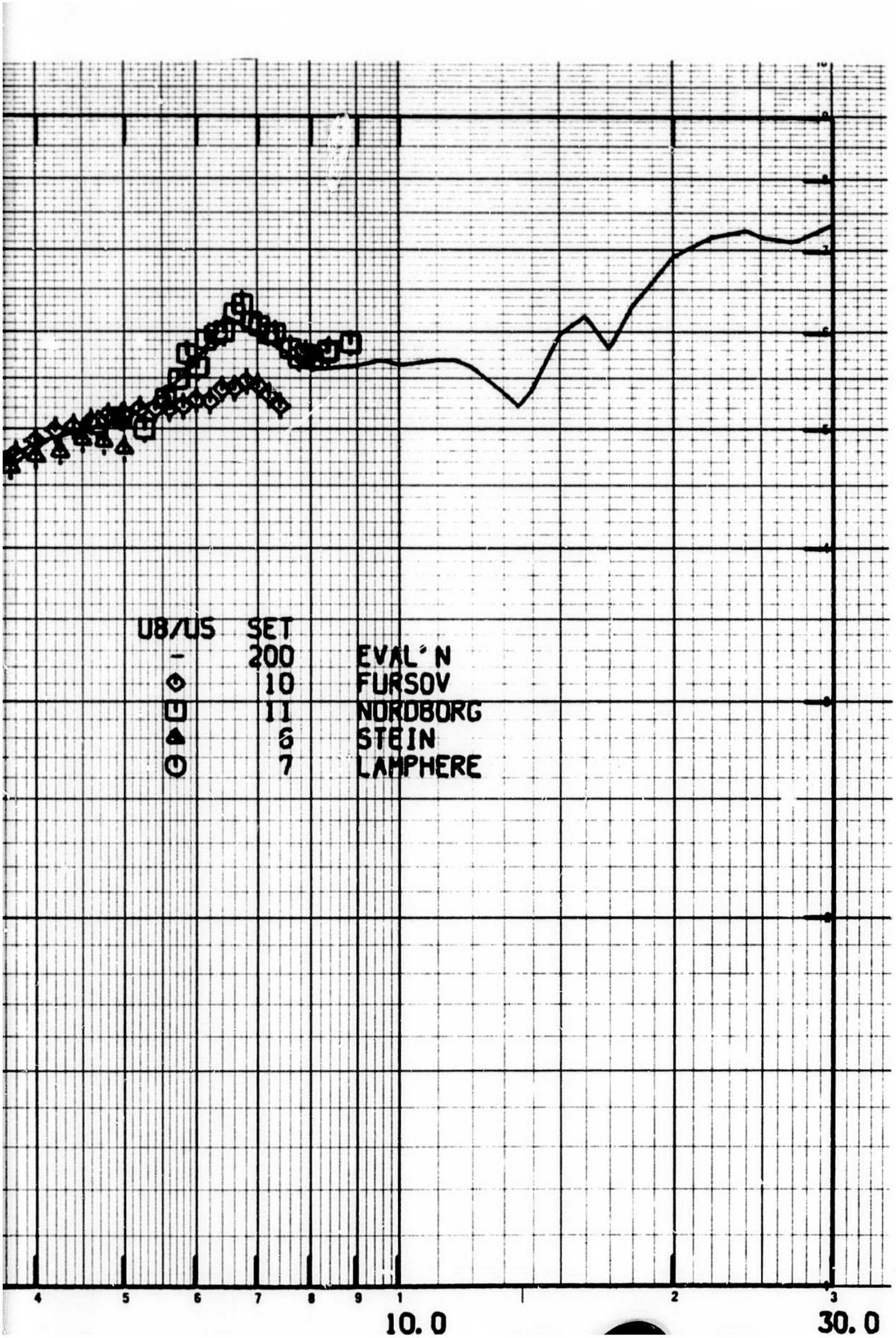
The data by Lamphere (PR, 104, 1654, 1956) and by Stein et al.
by about 8% in the plateau-range between 2 and 3 MeV. Other data s
et al. (76 ANL, p. 128) and by Fursov et al. (73 Kiev, 4, p. 3).

,f)/U-235 (n,f) 1-30 MeV

and by Stein et al. (68 Washington, 1, p. 627) differ
MeV. Other data shown in this figure are by Nordborg
Kiev, 4, p. 3).

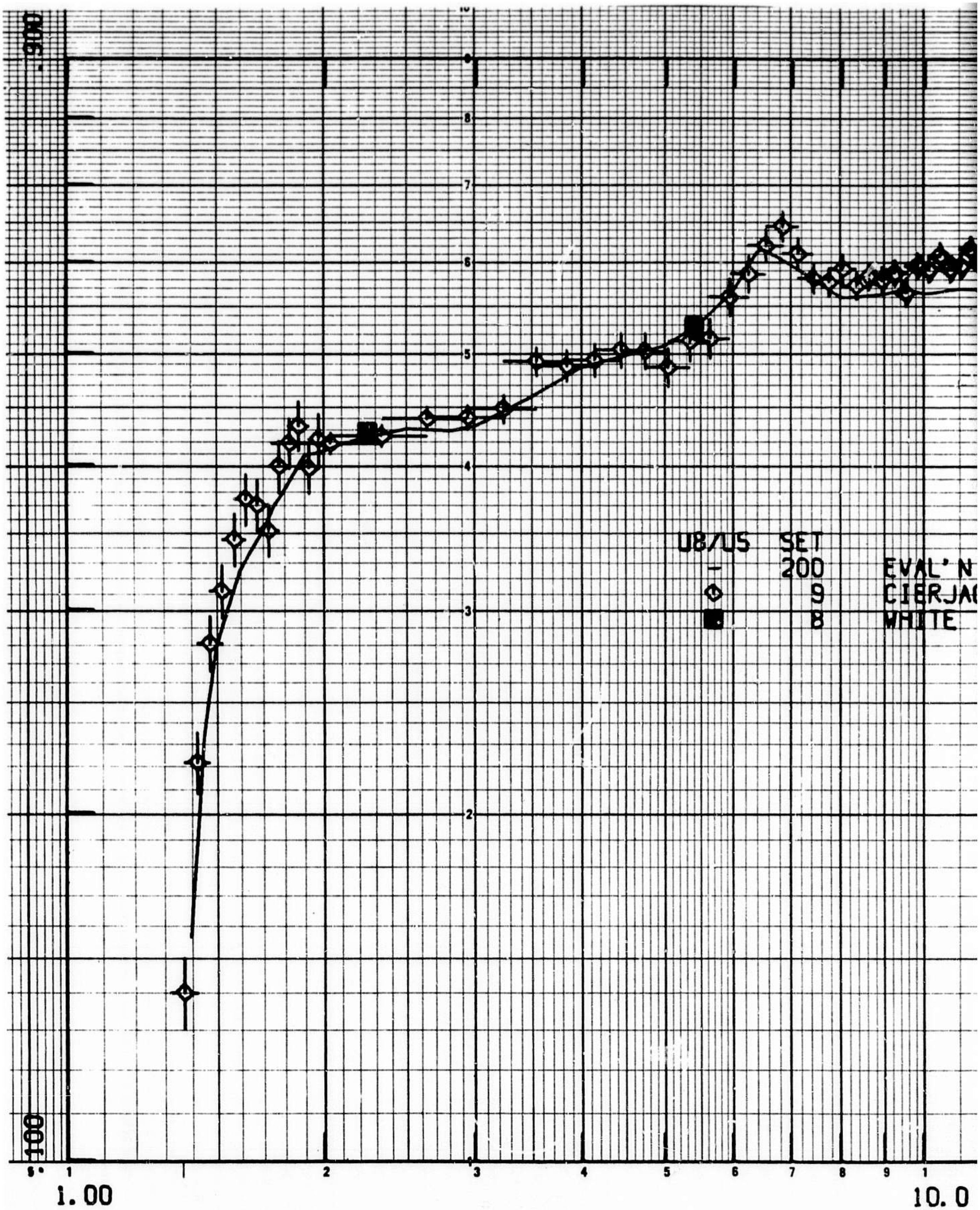


U8/U5
SET
-
200
EVAL'N
10
FURSOV
11
NORDBORG
6
STEIN
7
LAMPHERE
900
100
1.00
10.0

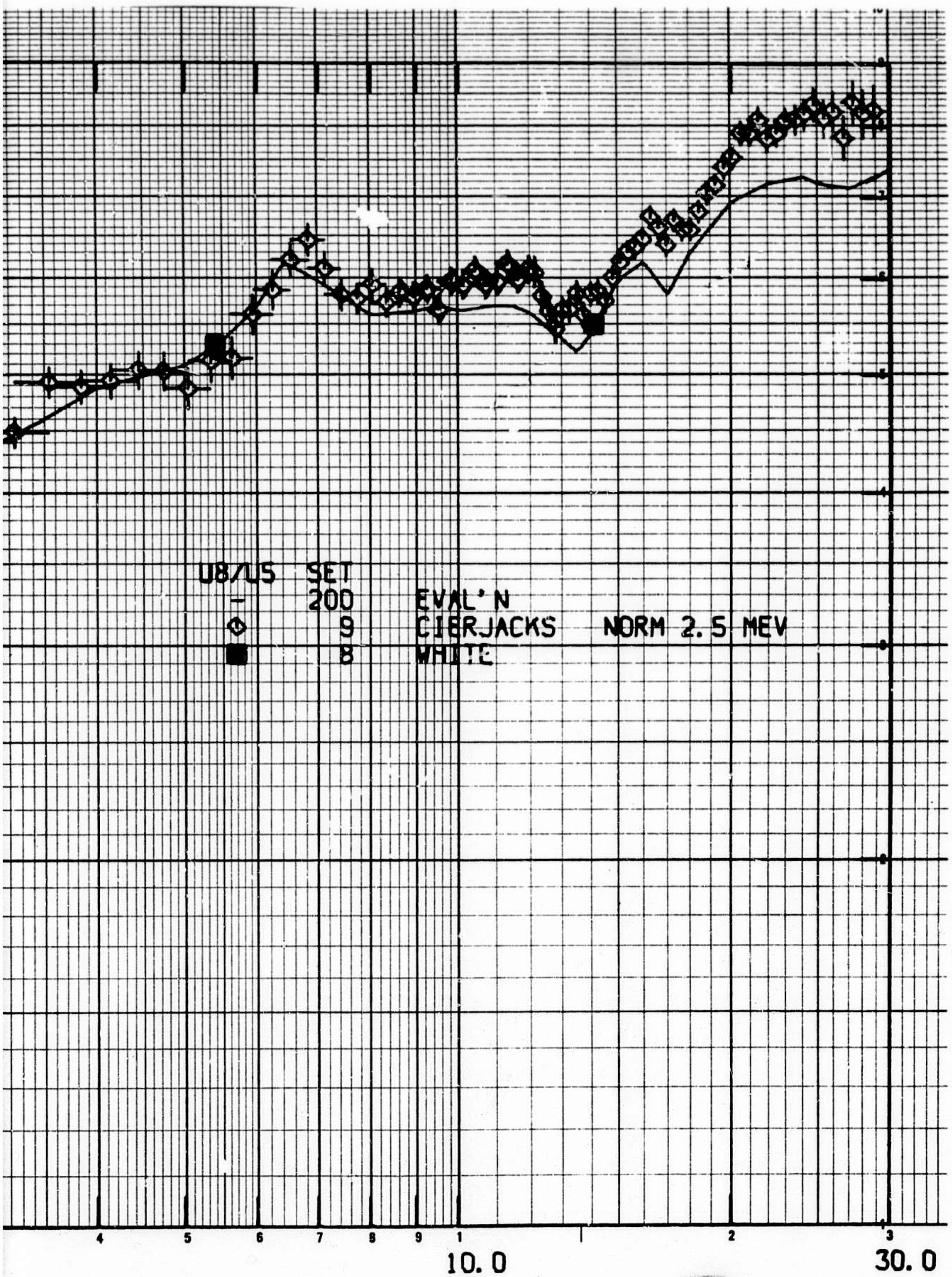

U8/U5 SET
- 200 EVAL'N
10 FURSOV
11 NORDBORG
6 STEIN
7 LAMPHERE
10.0
30.0

gure 33 U-238 (n,f)/U-235 (n,f) 1-30 MeV

The shape-data by Cierjacks et al. (76 ANL, p. 94) were normalized at 2.5 MeV to 0.432. The data White et al. (JNE, 21, 671, 1967) are shown for comparison.



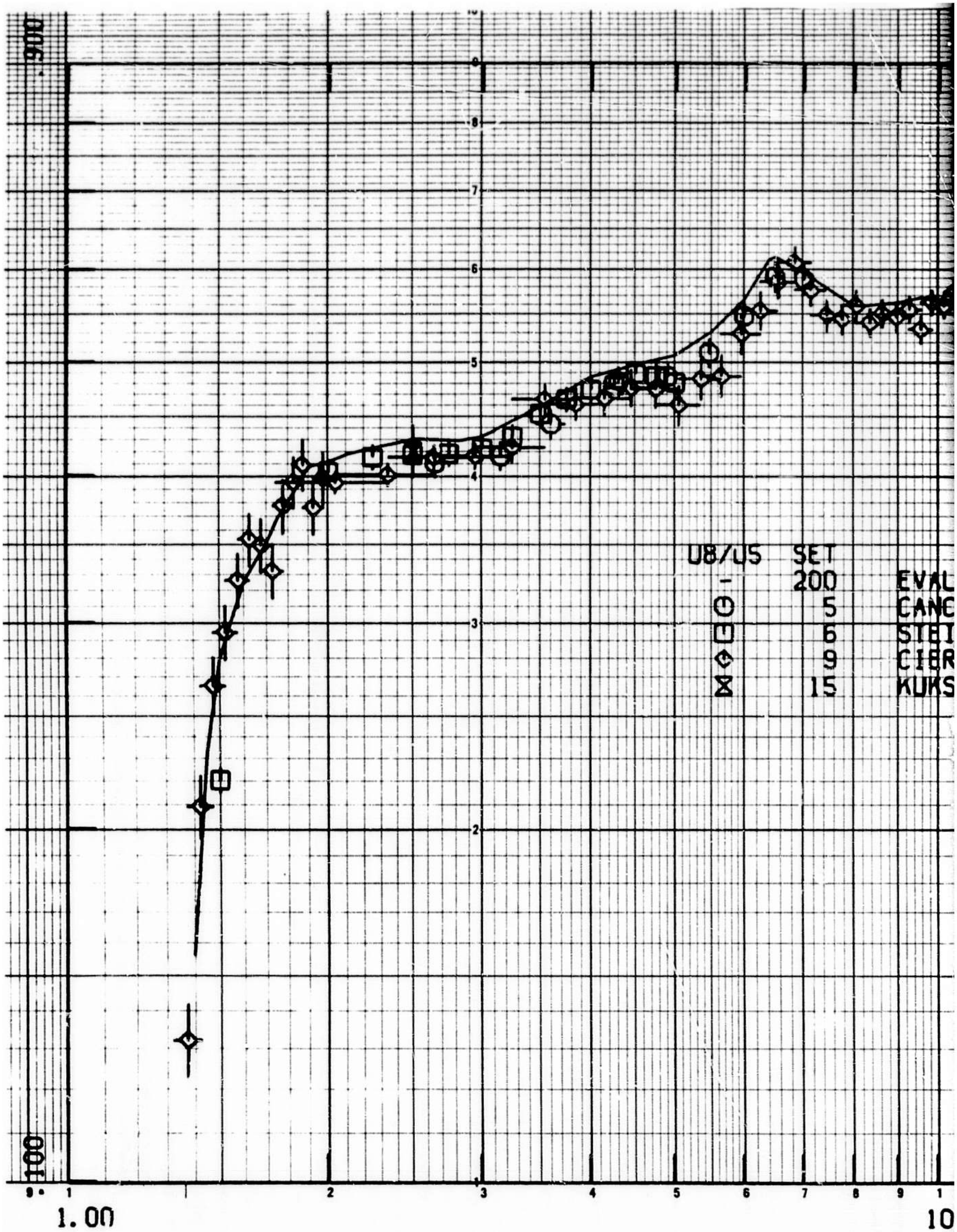
.900
100
1.00
10.0
U8/U5 SET
— 200 EVAL'N
9 CIERJA
8 WHITE



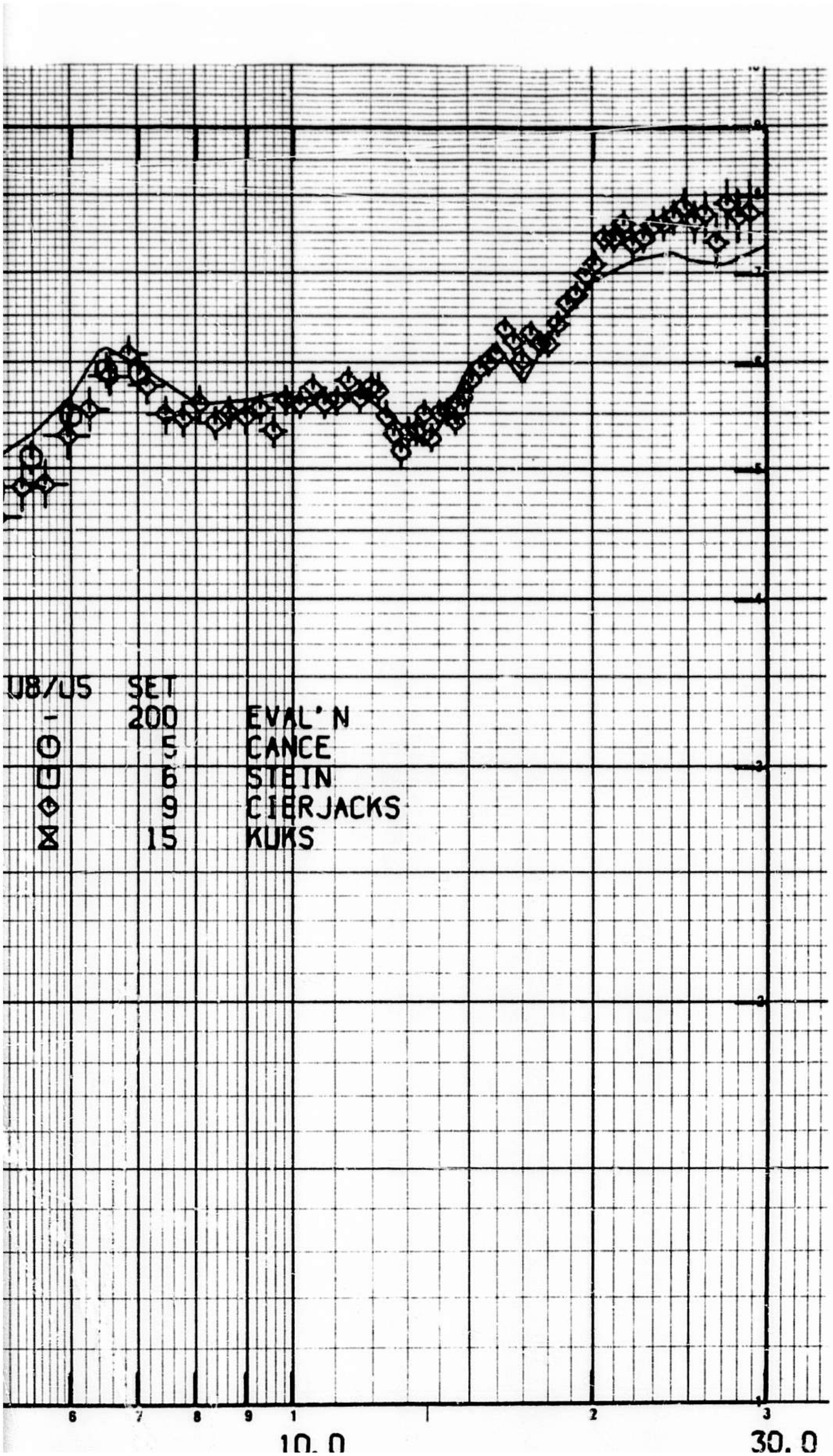
U8/U5 SET
— 200 EVAL'N
◇ 9 CIERJACKS NORM 2.5 MEV
■ 8 WHITE
4
5
6
7
8
9
1
2
3
10.0
30.0

igure 34 *U-238 (n,f)/U-235 (n,f)* *1-30 MeV*

This figure shows data which appear consistent among themselves but differ from an evaluated curve weighted average of all data).



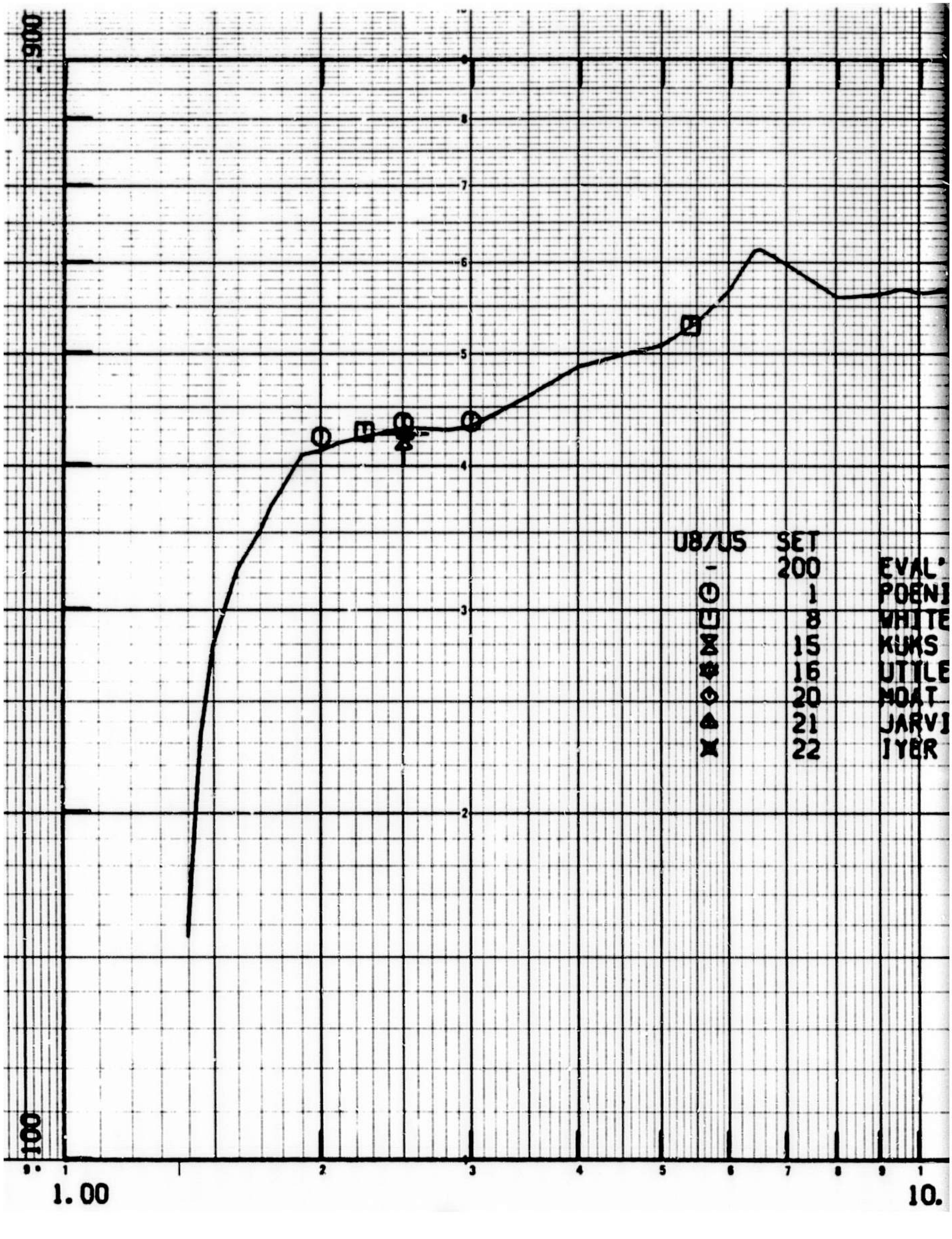
U8/U5 SET
- 200 EVAL
5 CANC
6 STEI
9 CIER
15 KUKS
.900
100
1.00
10

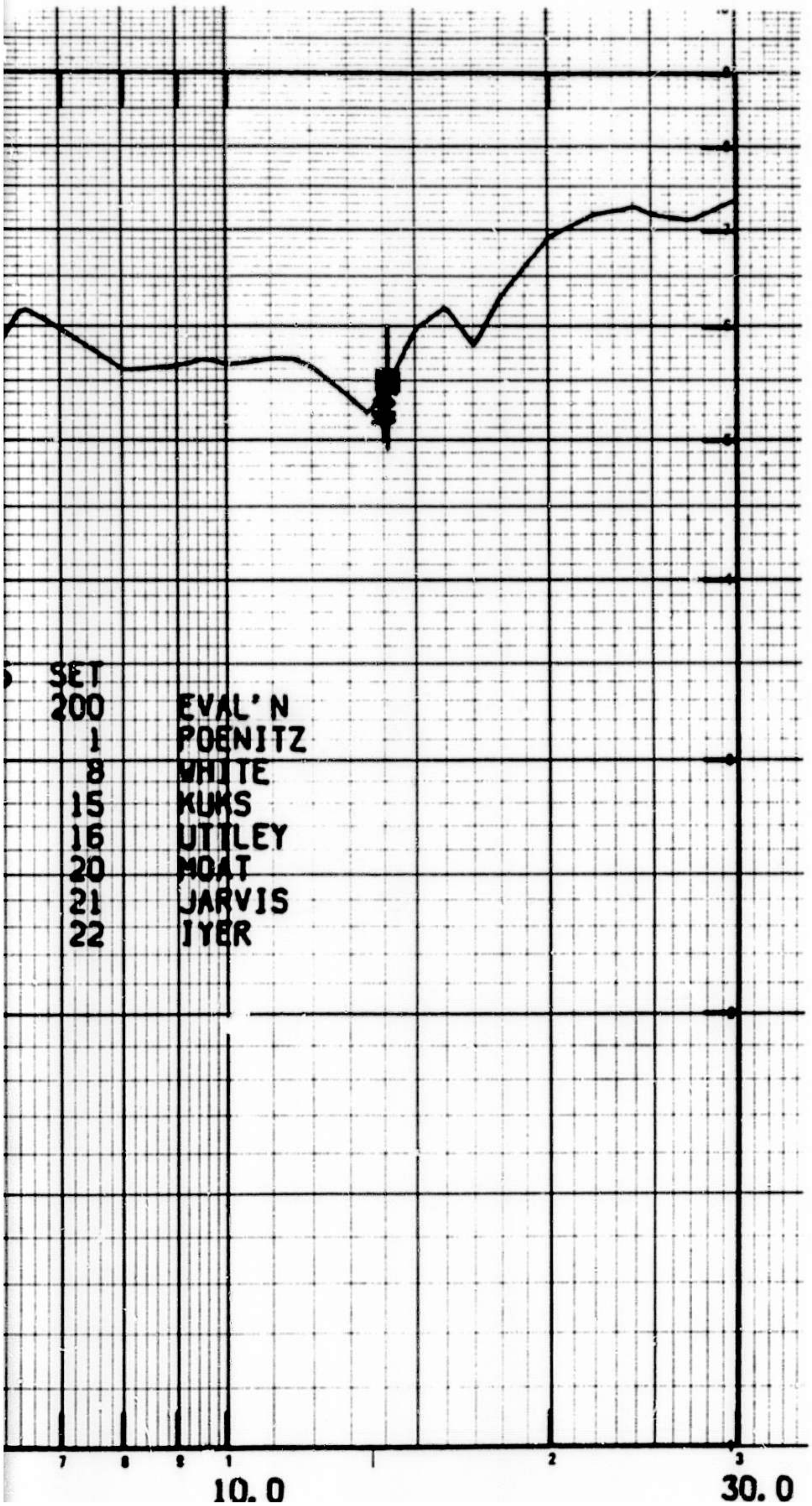


U8/U5 SET
- 200 EVAL'N
5 CANCE
6 STEIN
9 CIERJACKS
15 KUKS
10.0
30.0

Figure 35 *U-238 (n,f)/U-235 (n,f)* *1-30 MeV*

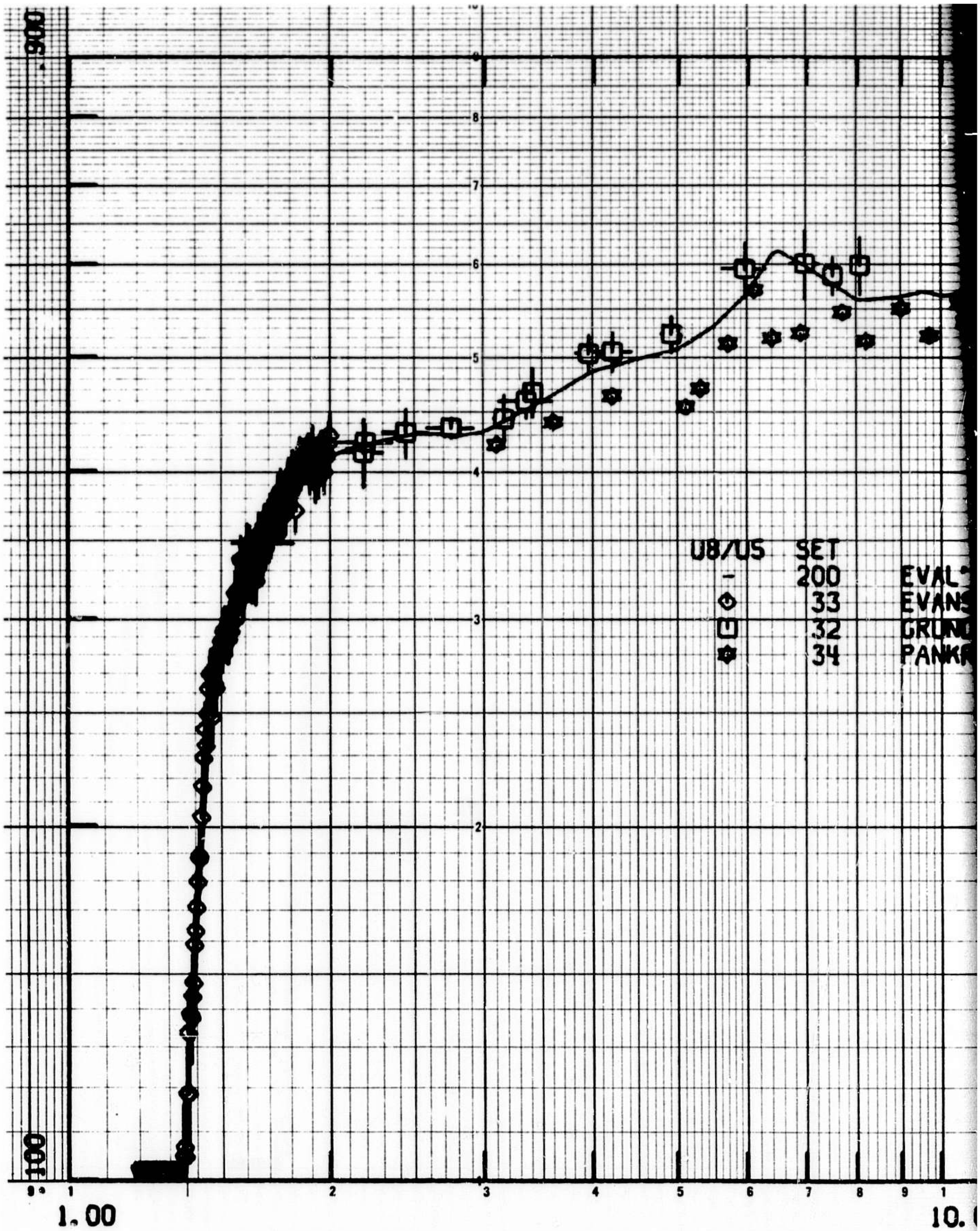
Comparison of some single-point data obtained with monoenergetic-neutron sources which are useful for establishing the normalization of shape-data.


UB/US SET
- 200 EVAL'
1 POENI
8 WHITE
15 KUKS
16 UTTLE
20 MOAT
21 JARVI
22 IYER
900
100
1.00
10.


SET
200 EVAL'N
1 POENITZ
8 WHITE
15 KUKS
16 UTTLEY
20 MOAT
21 JARVIS
22 IYER
10.0
30.0

gure 36 $U-238\ (n,f)/U-235\ (n,f)$ 1-30 MeV

The shape-data by Grundl (NSE, 30, 45, 1967) were normalized at 2.5 MeV to 0.432. The data by nkratov et al. (AE, 9, 399, 1960; AE, 14, 177, 1963) were obtained from measurements of the individual oss sections relative to the H(n,n) reference cross section. The data by Evans et al. (76 ANL, 149) were measured to investigate differences in the energy-scales between Behrens and Carlson and the iginal data by Coates et al..



.900
100
U8/U5 SET
- 200 EVAL
33 EVANS
32 GRUN
34 PANKR
1.00
10.

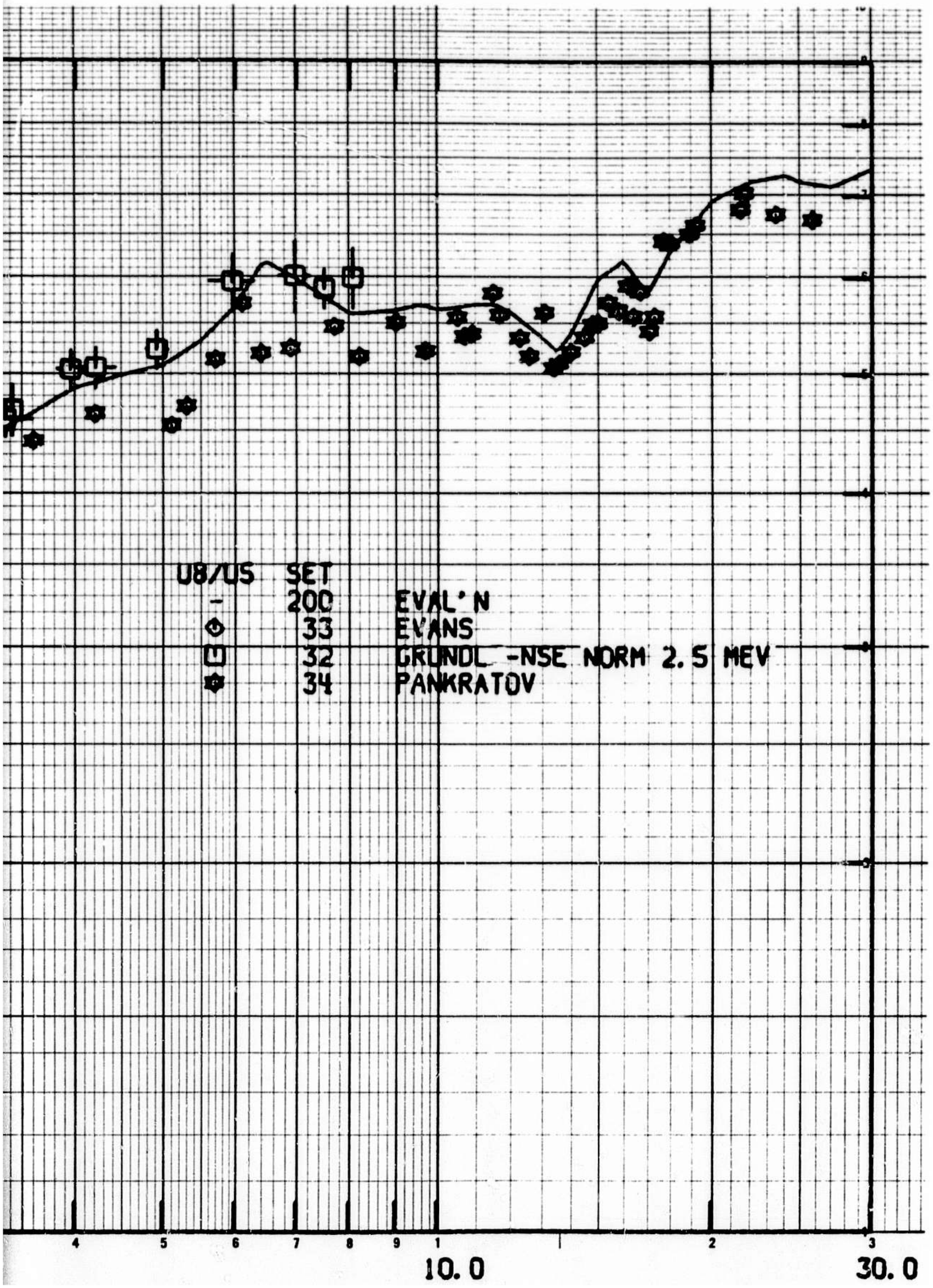
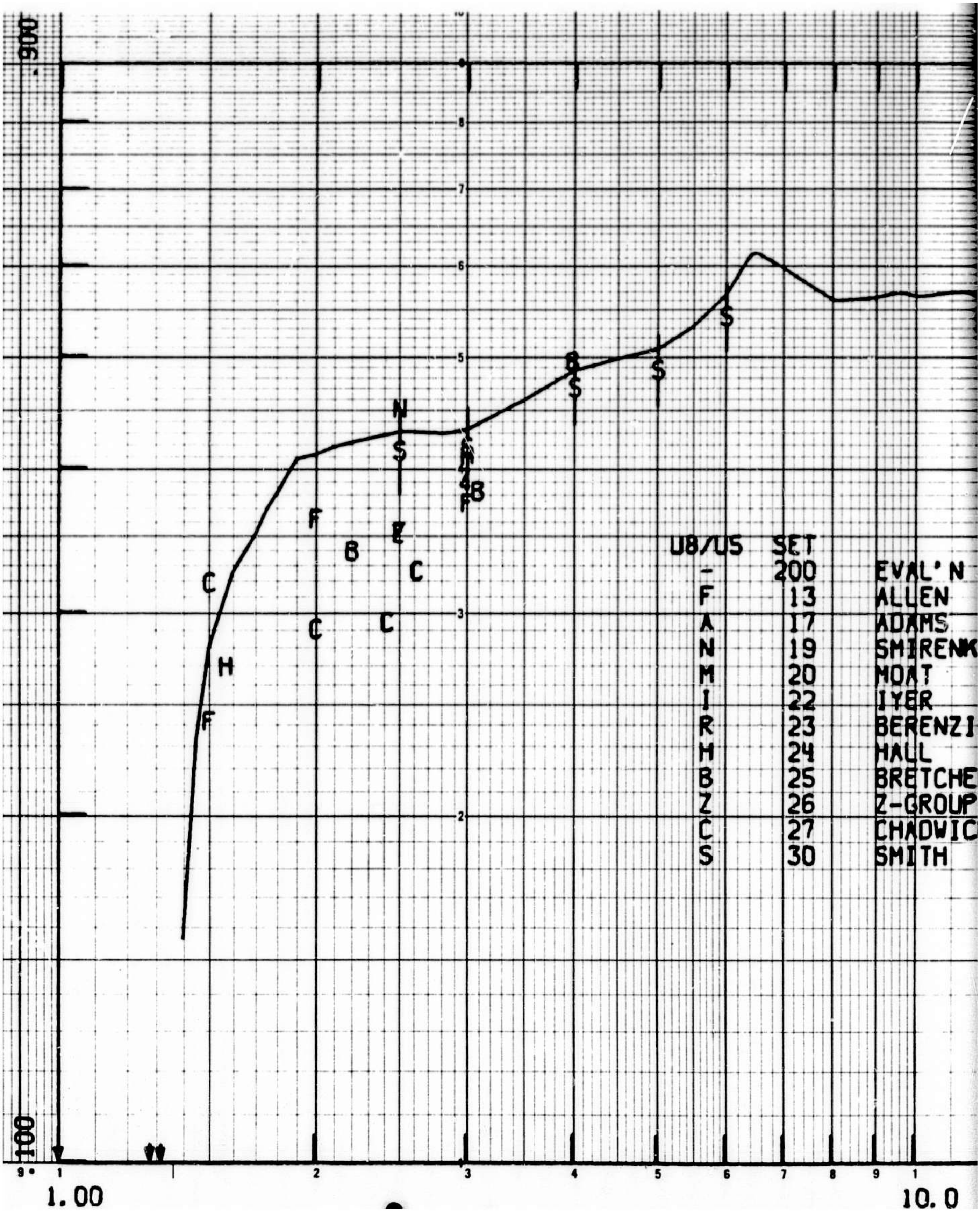

U8/U5 SET
- 200 EVAL'N
33 EVANS
32 GRUNDL -NSE NORM 2.5 MEV
34 PANKRATOV
10.0
30.0

Figure 37 *U-328 (n,f)/U-235 (n,f)* *1-30 MeV*

Comparison of some older data.


900
100
1.00
10.0
U8/U5 SET
- 200 EVAL'N
F 13 ALLEN
A 17 ADAMS
N 19 SMIRENK
M 20 MOAT
I 22 IYER
R 23 BERENZI
H 24 HALL
B 25 BRETCHE
Z 26 Z-GROUP
C 27 CHADWIC
S 30 SMITH

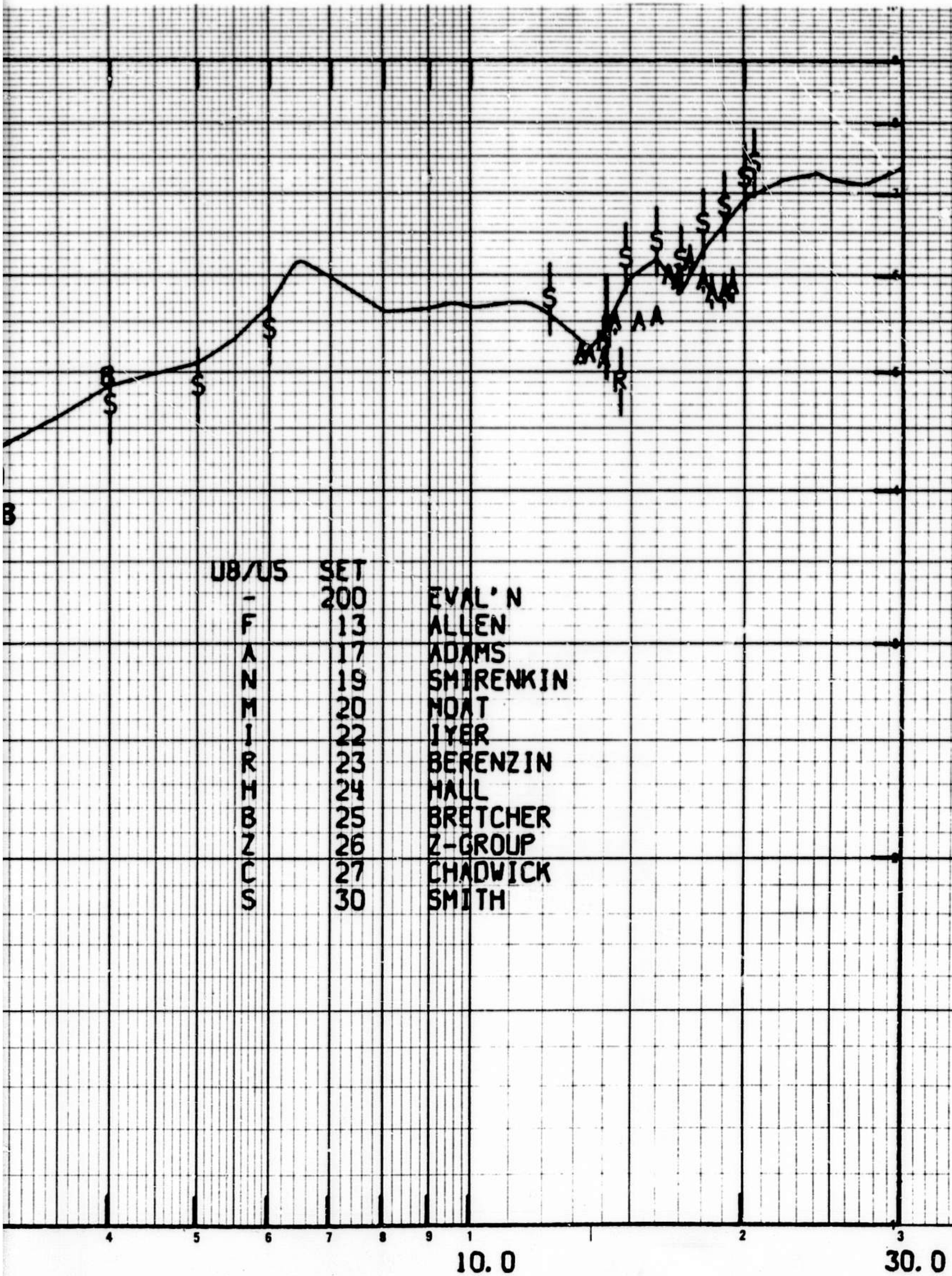
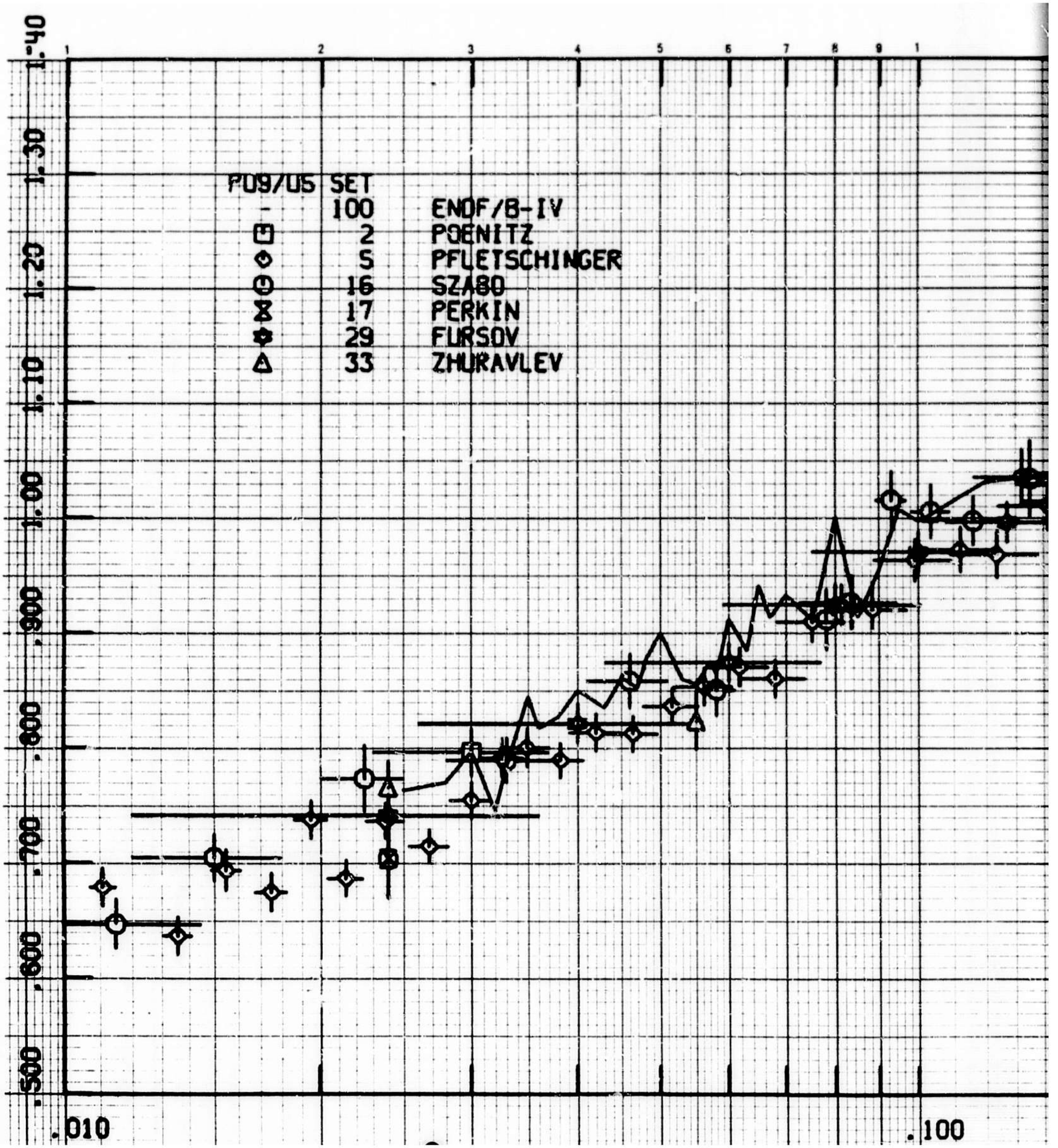

U8/U5 SET
- 200 EVAL'N
F 13 ALLEN
A 17 ADAMS
N 19 SMIRENKIN
M 20 MOAT
I 22 IYER
R 23 BERENZIN
H 24 HALL
B 25 BRETCHER
Z 26 Z-GROUP
C 27 CHADWICK
S 30 SMITH
10.0
30.0

Figure 38 *Pu-239 (n,f)/U-235 (n,f)* *0.01-0.4 MeV*

All data on this figure are from monoenergetic-neutron source measurements. The value by Perkin e al. (JNE, 19, 423, 1965) was obtained with an Sb-Be source and may depend on fluctuations in the indivi cross sections and uncertainties of the neutron source energy. The data by Fursov et al. (75 Kiev, to published) and by Zhuravlev et al. (76 Lowell, to be published) were obtained after the end of this mee Thus, they were not considered by the Working Group on Ratios but added here for completeness of the display of existing data.

Pu-239 (n,f)/U-235 (n,f)   0.01-0.4 MeV

are from monoenergetic-neutron source measurements. The value by Perkin et
obtained with an Sb-Be source and may depend on fluctuations in the individual
ties of the neutron source energy. The data by Fursov et al. (75 Kiev, to be
t al. (76 Lowell, to be published) were obtained after the end of this meeting.
d by the Working Group on Ratios but added here for completeness of the



PU9/U5 SET
- 100 ENDF/B-IV
2 POENITZ
5 PFLETSCHINGER
16 SZABO
17 PERKIN
29 FURSOV
33 ZHURAVLEV
1.40
1.30
1.20
1.10
1.00
.900
.800
.700
.600
.500
.010
.100

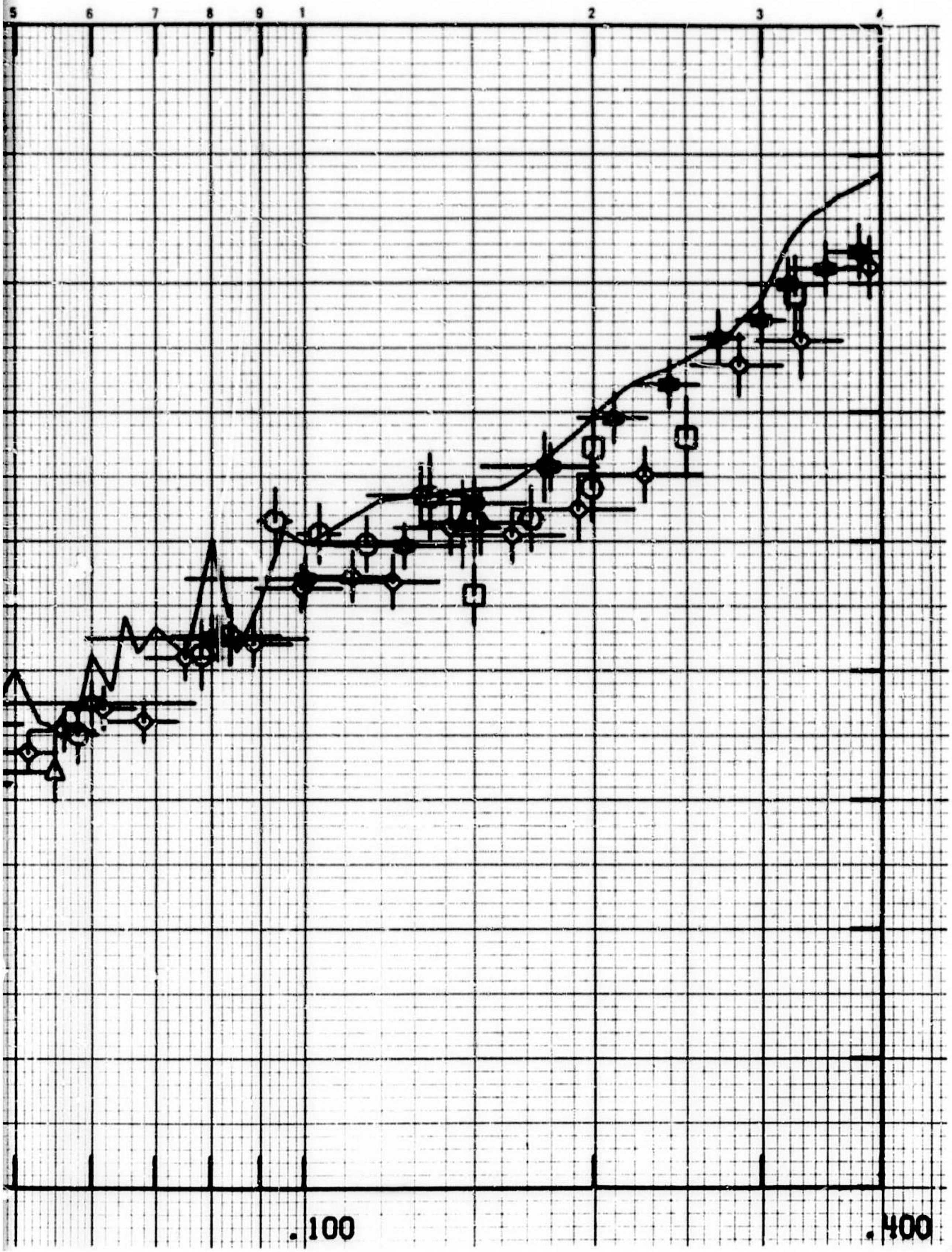
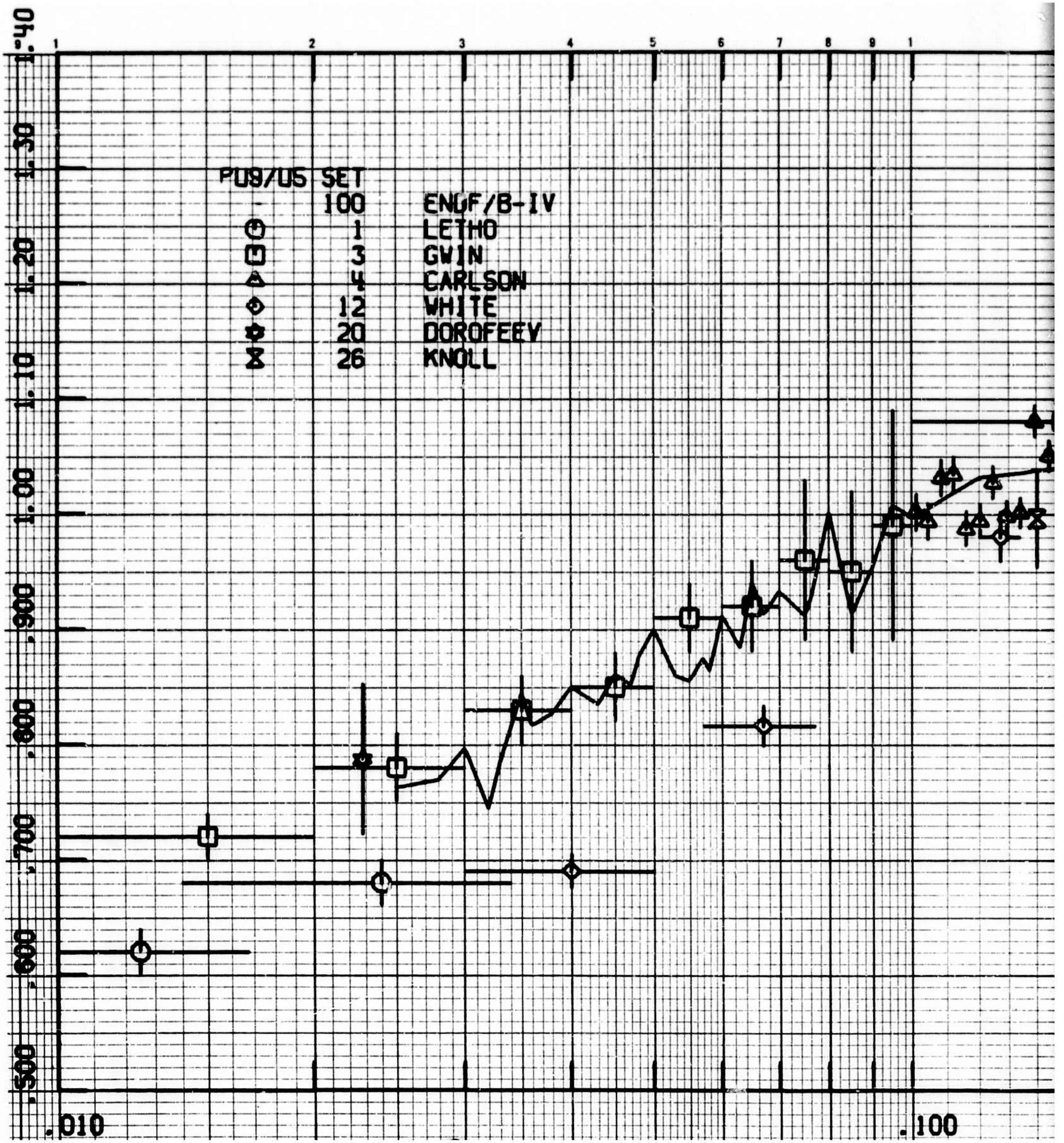

5
6
7
8
9
1
2
3
4
.100
.400

Figure 39 *Pu-239 (n,f)/U-235 (n,f)* *0.01-0.4 MeV*

Comparison of white-neutron source data by Letho (NSE, 39, 361, 1970), Gwin et al. (ANS, 15, 481, 1972), and Carlson and Behrens (76 ANL, p. 47). Data from the University of Michigan (Knoll, see M.C. Davis et al., 76 ANL, p. 225), and older data by Dorofeev and Dobrynin (AE, 2, 10, 1957) were derived f absolute photoneutron-source measurements of the individual cross sections.

Pu-239 (n,f)/U-235 (n,f) 0.01-0.4 MeV

:e-neutron source data by Letho (NSE, 39, 361, 1970), Gwin et al. (ANS, 15, 481, Behrens (76 ANL, p. 47). Data from the University of Michigan (Knoll, see M.C.). 225), and older data by Dorofeev and Dobrynin (AE, 2, 10, 1957) were derived from source measurements of the individual cross sections.



PU9/U5 SET
- 100 ENDF/B-IV
1 LETHO
3 GWIN
4 CARLSON
12 WHITE
20 DOROFEEV
26 KNOLL
1.40
1.30
1.20
1.10
1.00
.900
.800
.700
.600
.500
.010
.100

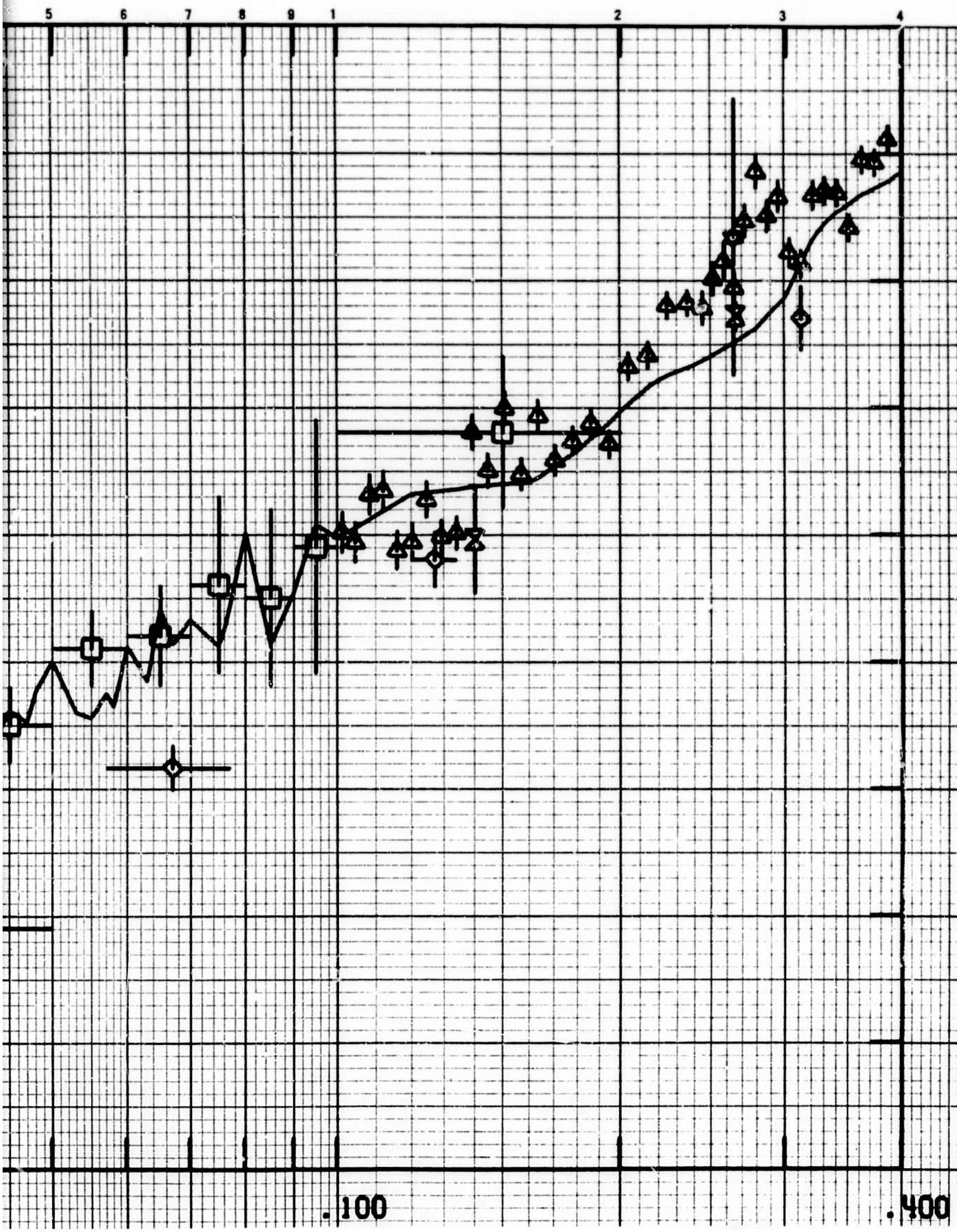
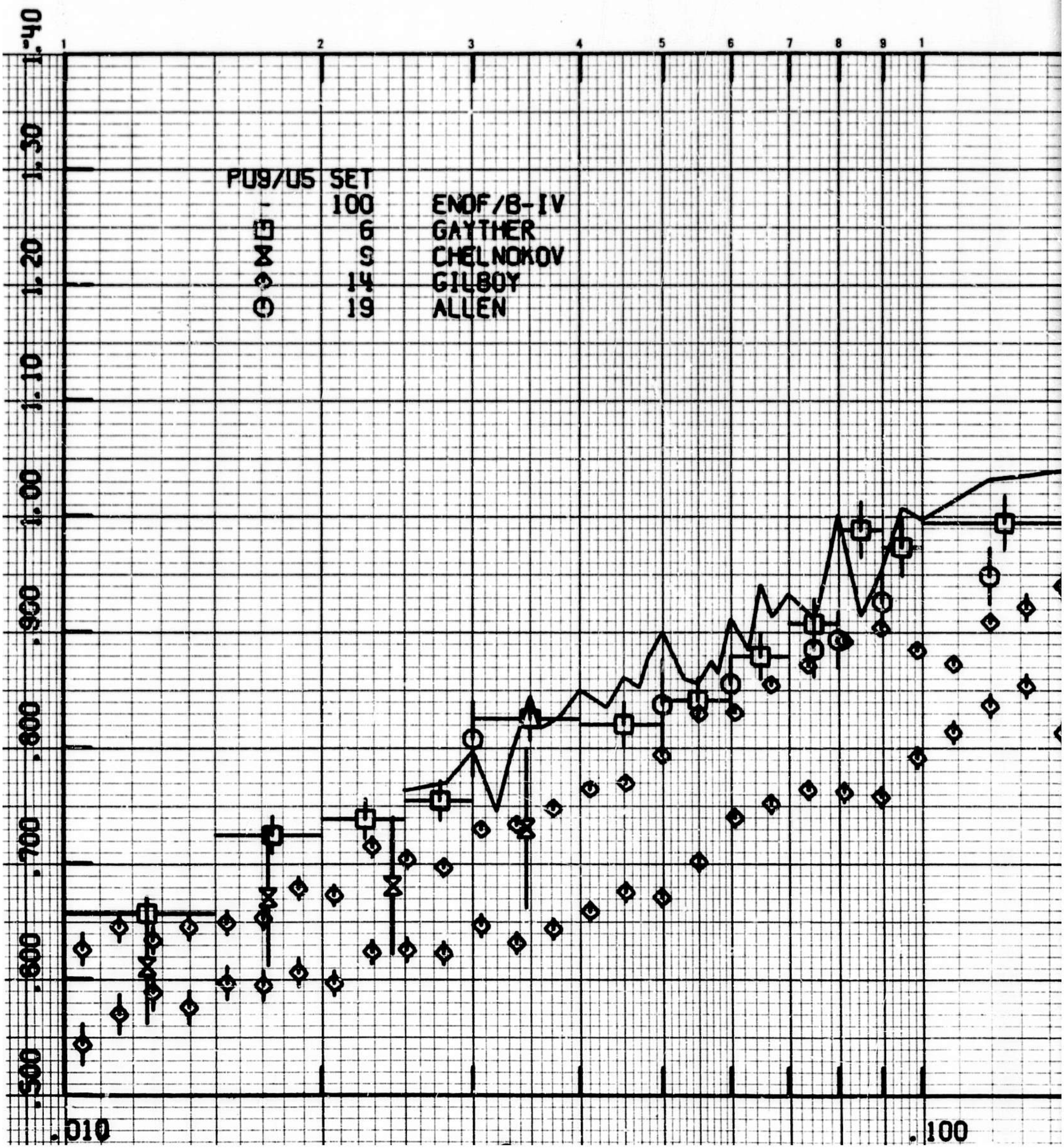

5
6
7
8
9
1
2
3
4
.100
.400

Figure 40 *Pu-239 (n,f)/U-235 (n,f)* *0.01-0.4 MeV*

The data by Gayther et al. (75 Washington, 2, p. 564) are shape data and may be normalized otherwise. Other data are by Chelnokov et al. (AE, 31, 103, 1971), by Gilboy and Knoll (66 Paris, 1, p. 295) and by Allen and Ferguson (PPS/A 70, 573, 1957).

t al. (75 Washington, 2, p. 564) are shape data and may be normalized other-
helnokov et al. (AE, 31, 103, 1971), by Gilboy and Knoll (66 Paris, 1, p. 295),
(PPS/A 70, 573, 1957).



1.40
1.30
1.20
1.10
1.00
.900
.800
.700
.600
.500
1
2
3
4
5
6
7
8
9
1
.010
.100
PU9/U5 SET
100 ENDF/B-IV
6 GAYTHER
S CHELNOKOV
14 GILBOY
19 ALLEN

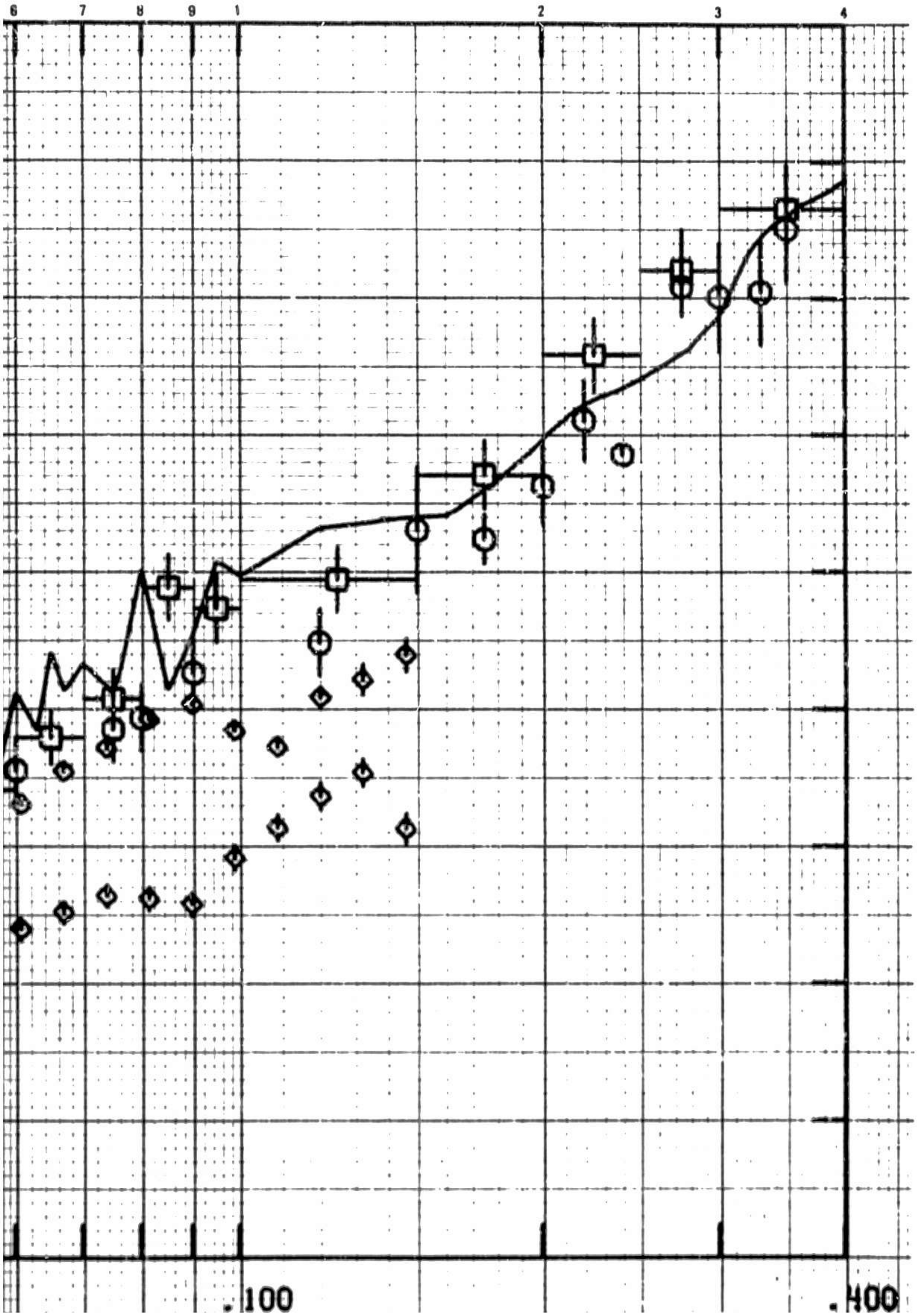
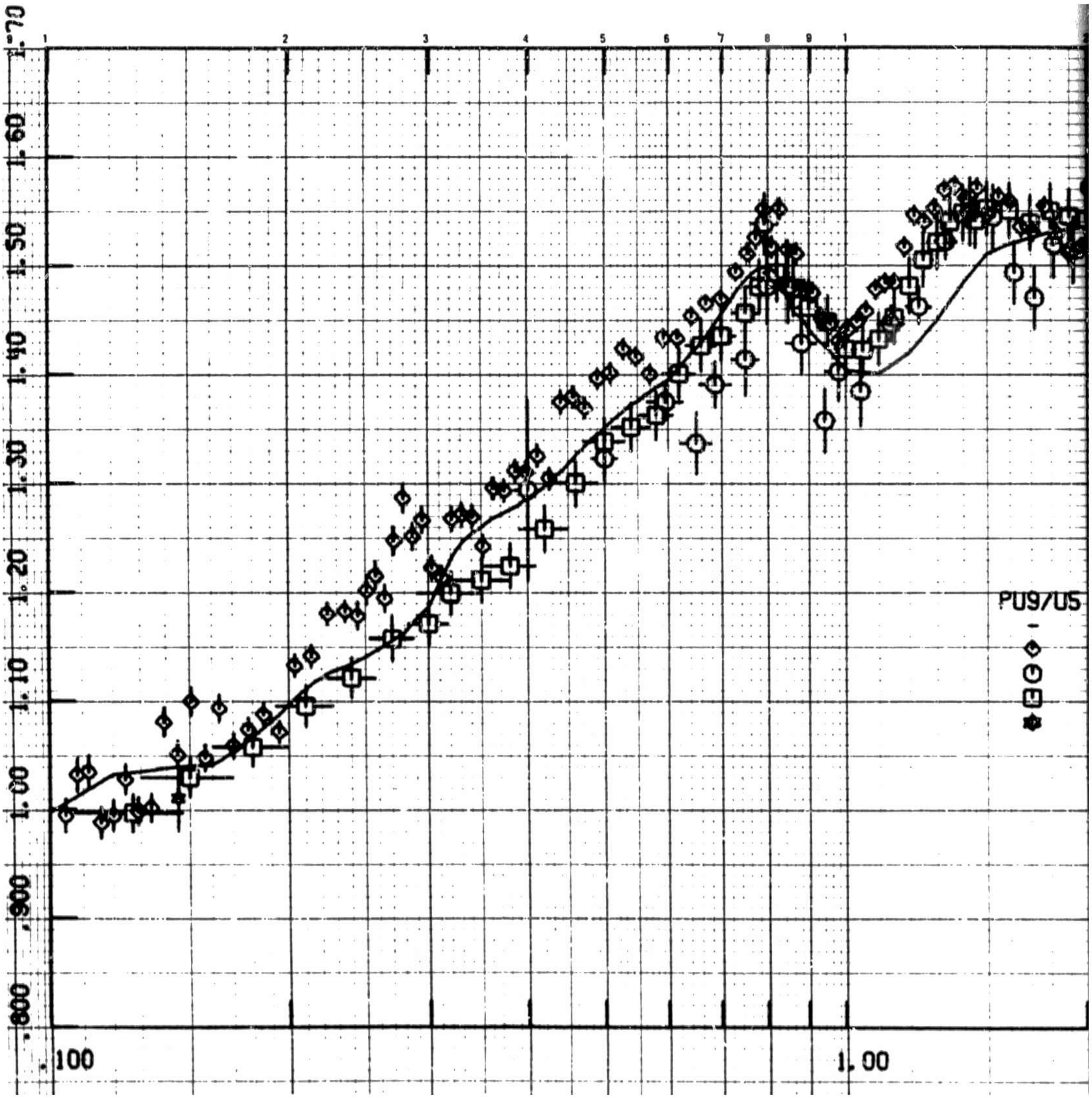

6
7
8
9
1
2
3
4
.100
.400

Figure 41 *Pu-239 (n,f)/U-235 (n,f)* *0.1-20.0 MeV*

Comparison of white-neutron source data by Carlson and Behrens (76 ANL, p. 47) with monoenergetic-neutron source data by Meadows (76 ANL, p. 73), by Fursov et al. (75 Kiev, to be published), and Zhuravlev et al. (76 Lowell, to be published). The data by Fursov et al. and by Zhuravlev et al. were obtained after the end of the present meeting and thus, were not considered by the Working Group on Ratios.


1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.900
.800
.100
1.00
PU9/U5

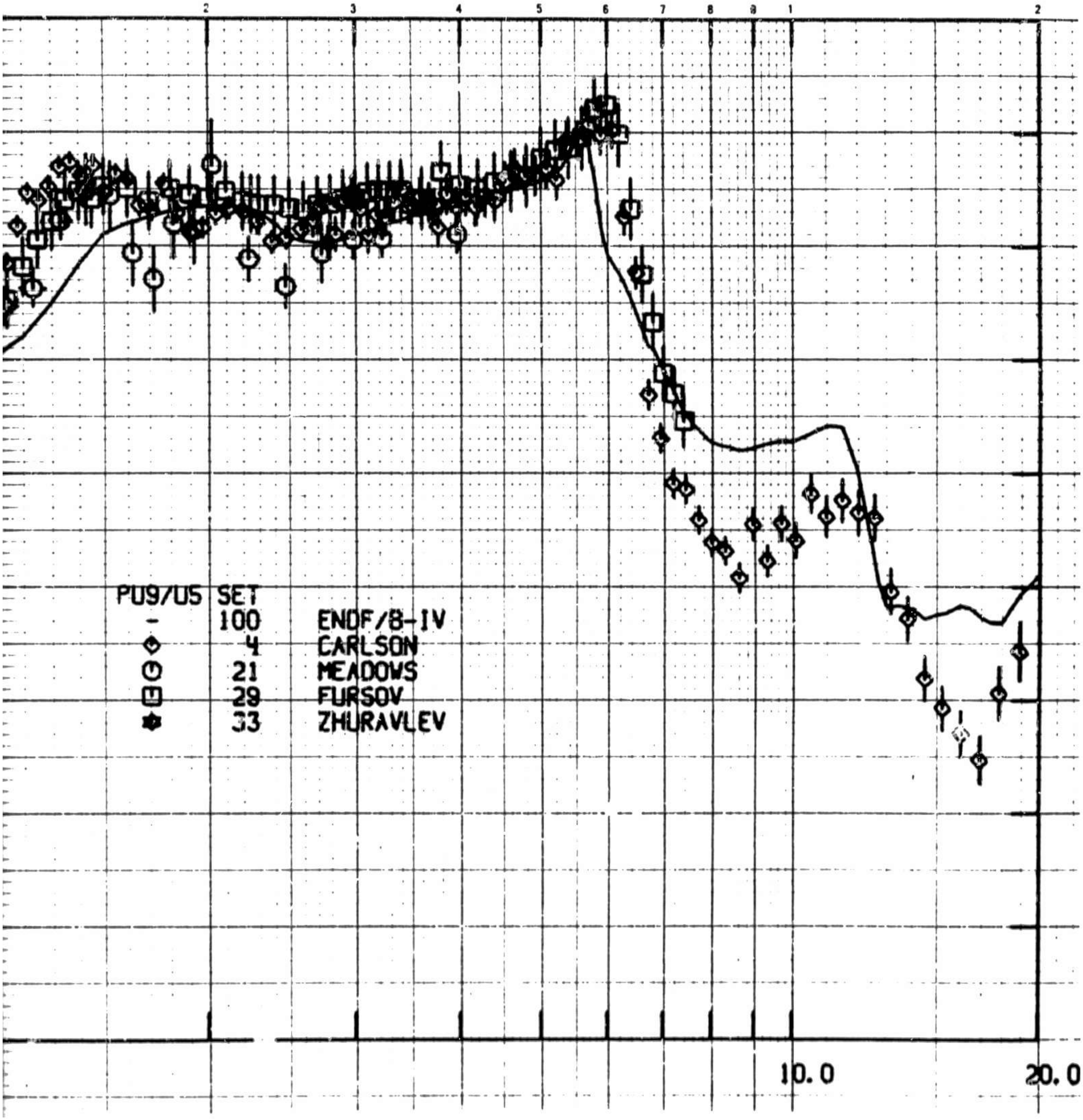
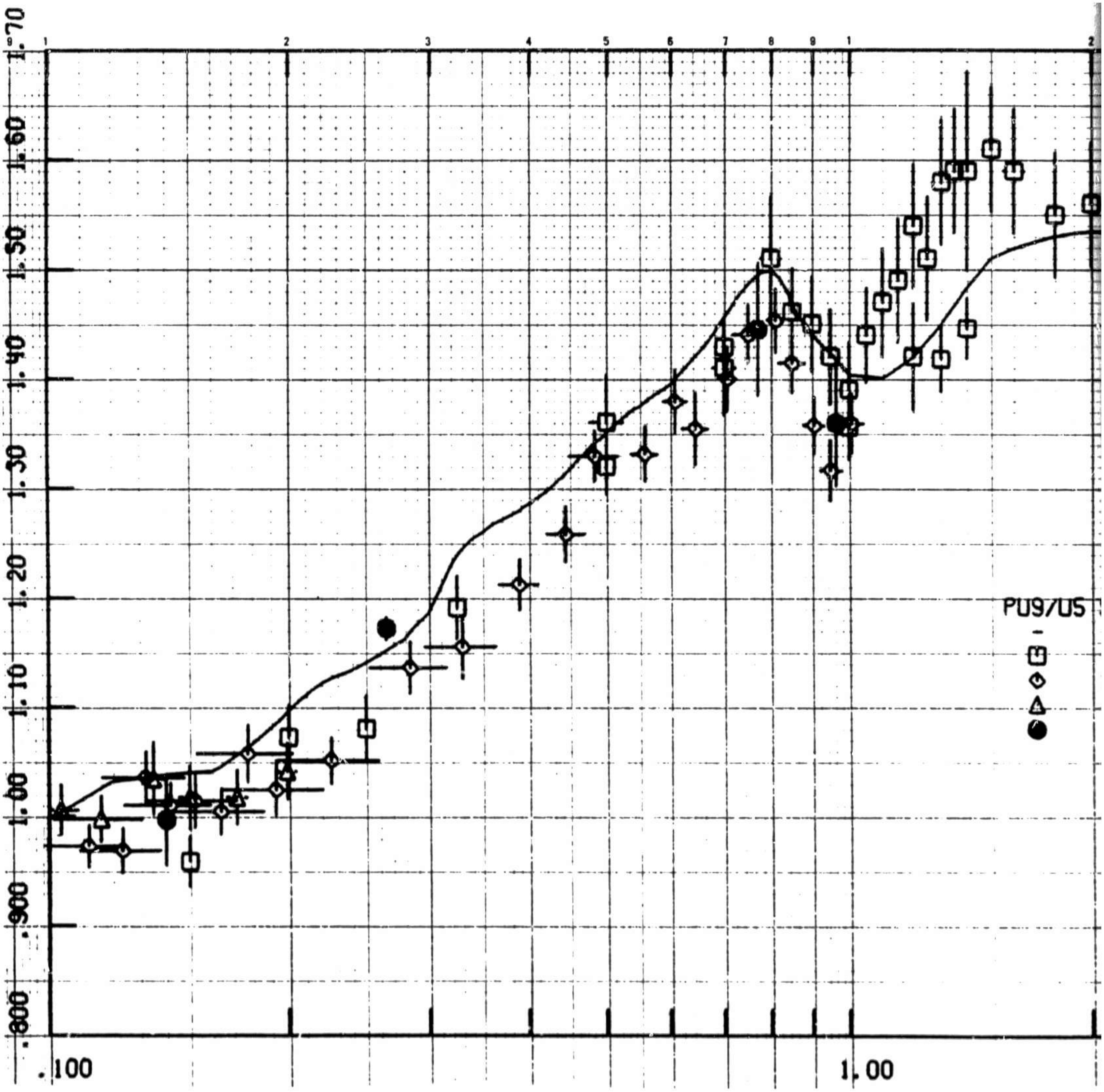

PU9/U5 SET
- 100 ENDF/B-IV
4 CARLSON
21 MEADOWS
28 FURSOV
33 ZHURAVLEV
10.0
20.0

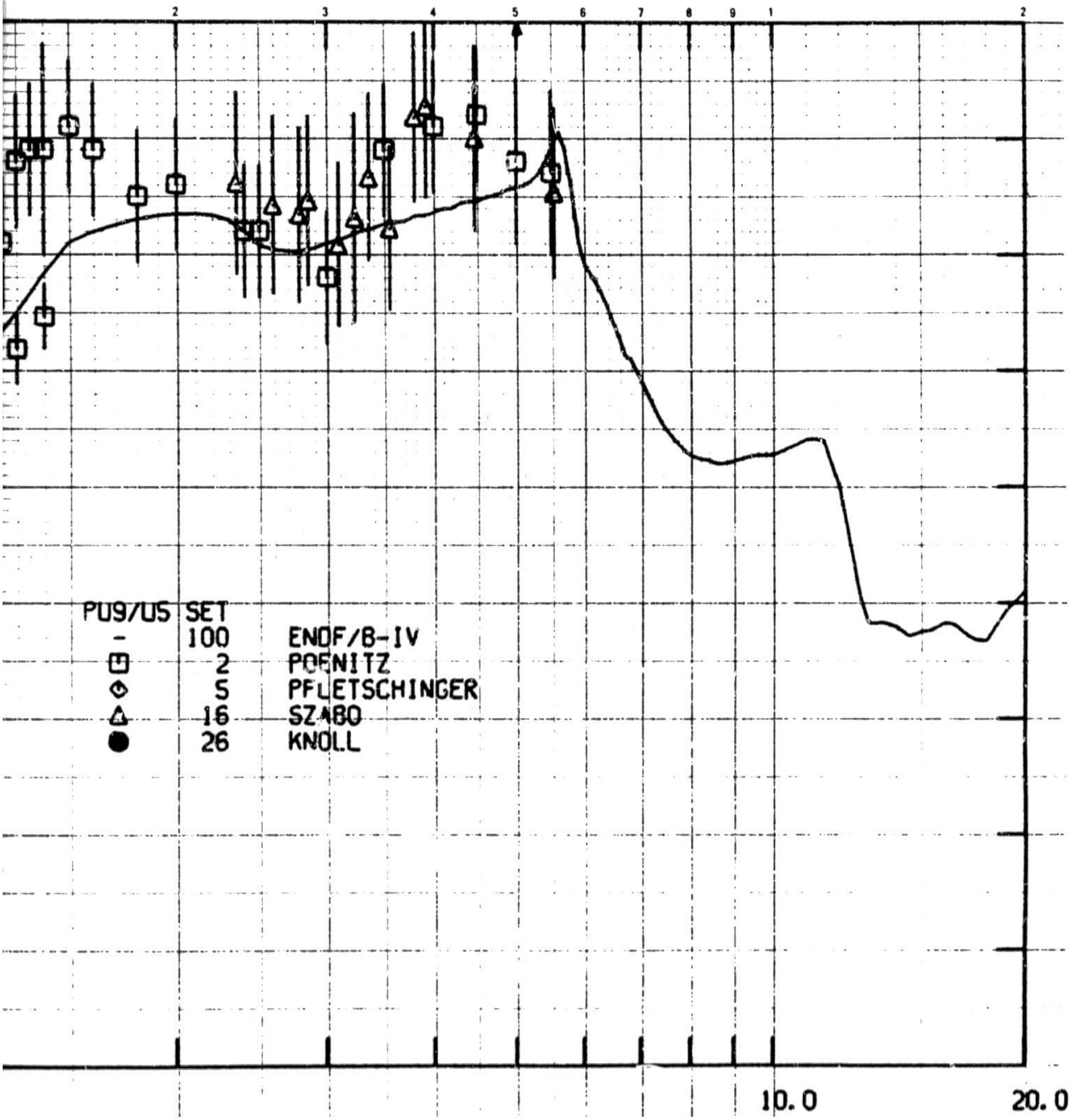
Figure 42 *Pu-239 (n,f)/U-235 (n,f)* *0.1-20.0 MeV*

Comparison of monoenergetic-neutron source measurements. The data from the University of Mich
(Knoll, see M. C. Davis et al., 76 ANL, p. 225) were derived from absolute measurements of the indi
cross sections.

monoenergetic-neutron source measurements. The data from the University of Michigan Davis et al., 76 ANL, p. 225) were derived from absolute measurements of the individual



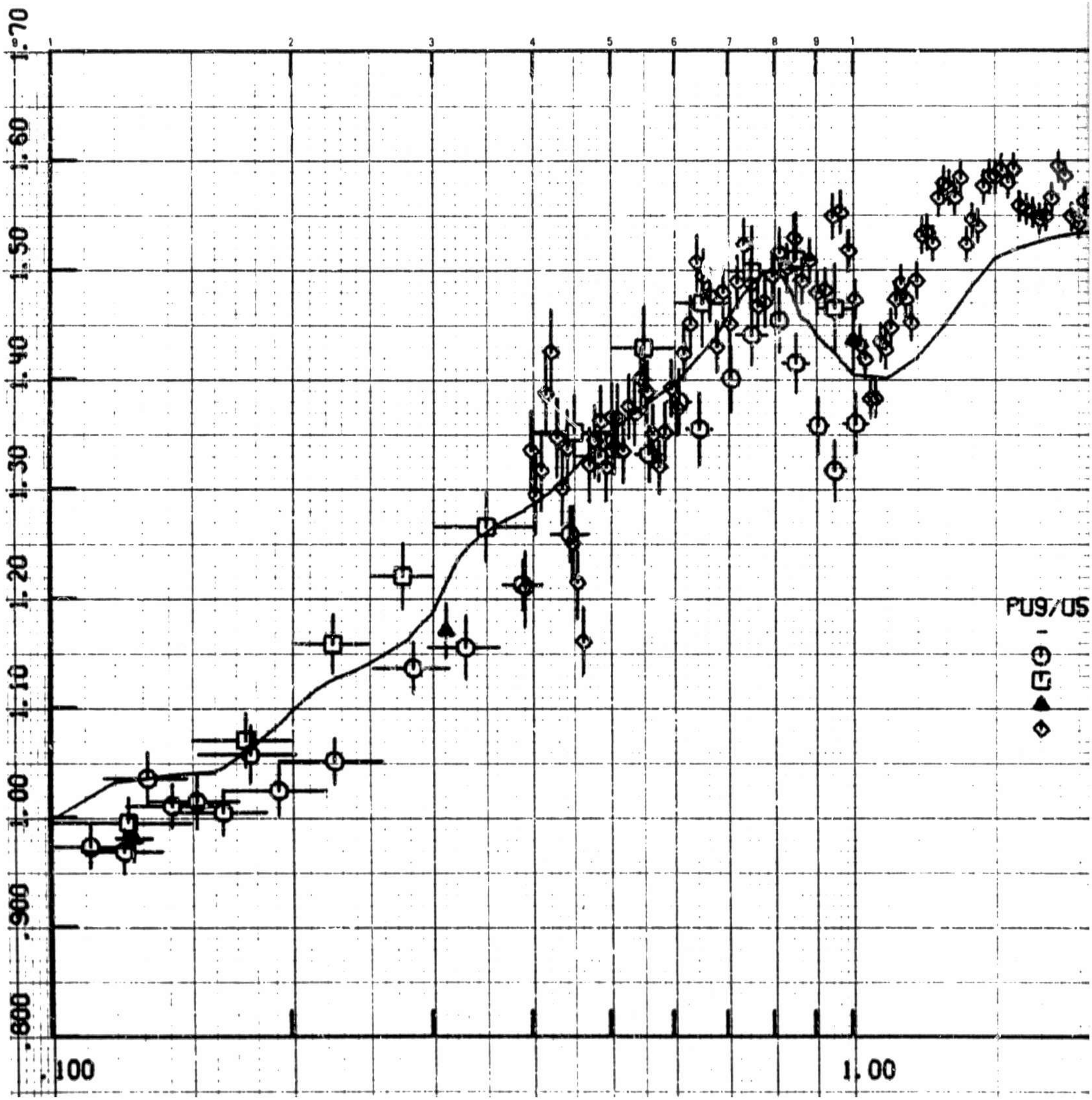
PU9/U5
.100
1.00



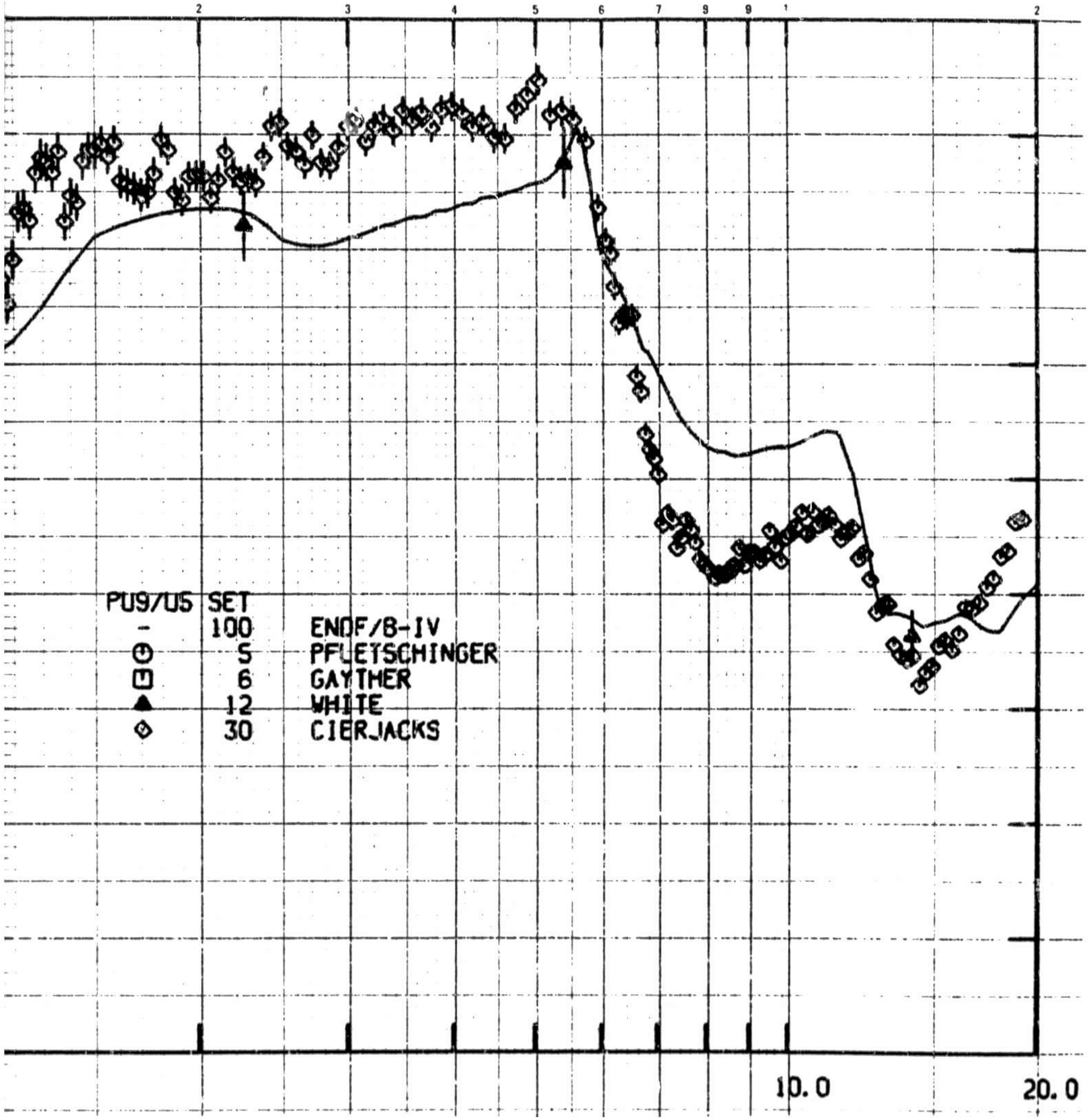
2
3
4
5
6
7
8
9
1
2
PU9/U5 SET
- 100 ENDF/B-IV
2 POENITZ
5 PFLETSCHINGER
16 SZABO
26 KNOLL
10.0
20.0

Figure 43 *Pu-239 (n,f)/U-235 (n,f)* *0.1-20.0 MeV*

Comparison of white-neutron source measurements by Gayther et al. (75 Washington, 2, p. 564), and by Cierjacks et al. (76 ANL, p. 94) with the monoenergetic-neutron source data by Pfletschinger and Kaeppeler (NSE, 40, 375, 1970), and by White et al. (JNE, 21, 671, 1967, 65 Salzburg, 1, p. 219). The shape-data by Gayther et al. may be otherwise normalized. The normalization of the data by Cierjacks et al. is preliminary. The figure shows the original data submitted prior to the present meeting. A corrected data set supplied after the meeting is shown in the next figure.



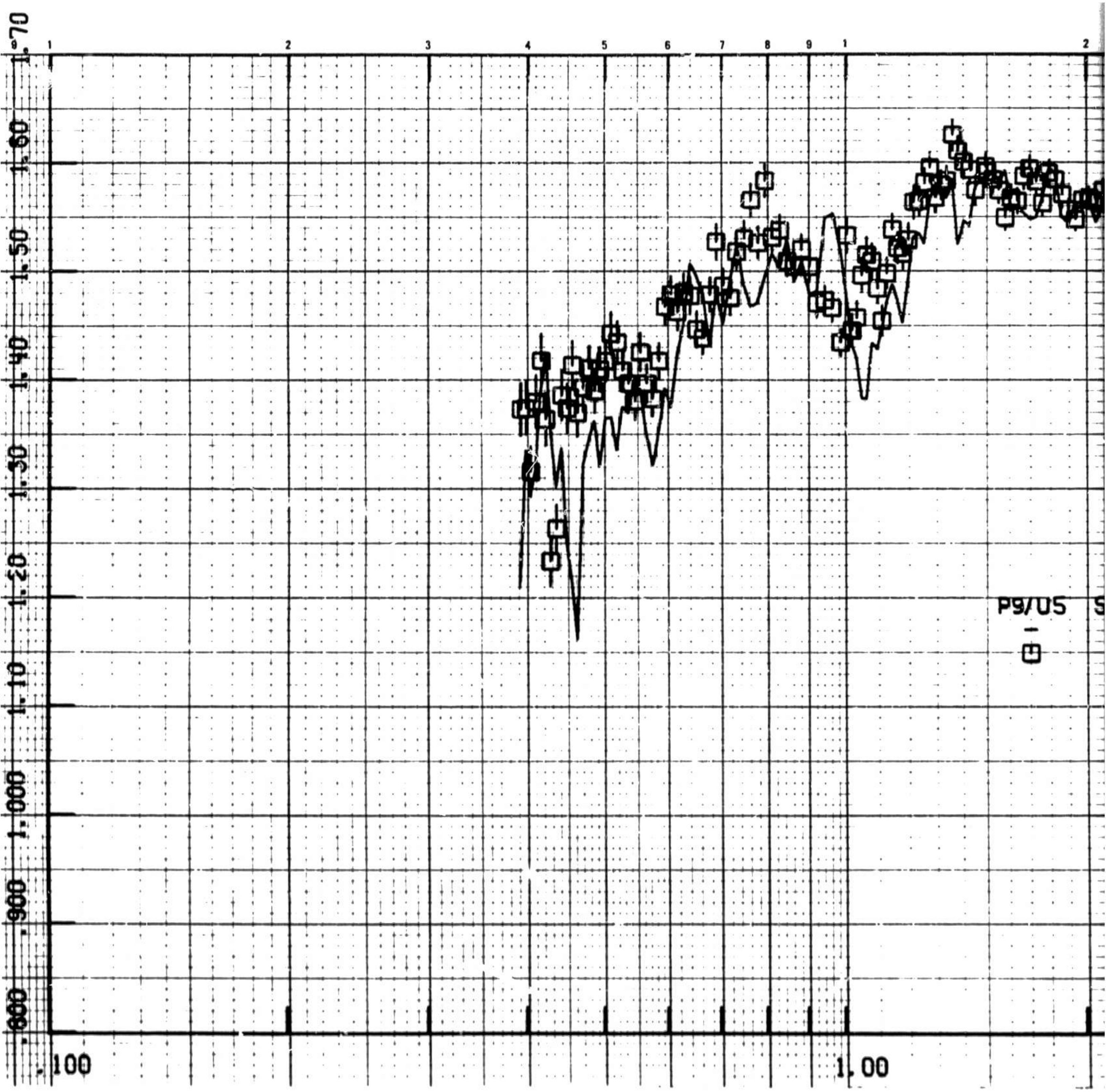
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.900
.800
.100
1.00
PU9/U5



PU9/U5 SET
100 ENDF/B-IV
5 PFLETSCHINGER
6 GAYTHER
12 WHITE
30 CIERJACKS
10.0
20.0

Figure 44 *Pu-239 (n,f)/U-235 (n,f)* *0.1-20.0 MeV*

Revised data set by Cierjacks et al. (76 ANL, p. 94).


1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.000
.900
.800
.100
1.00
P9/US

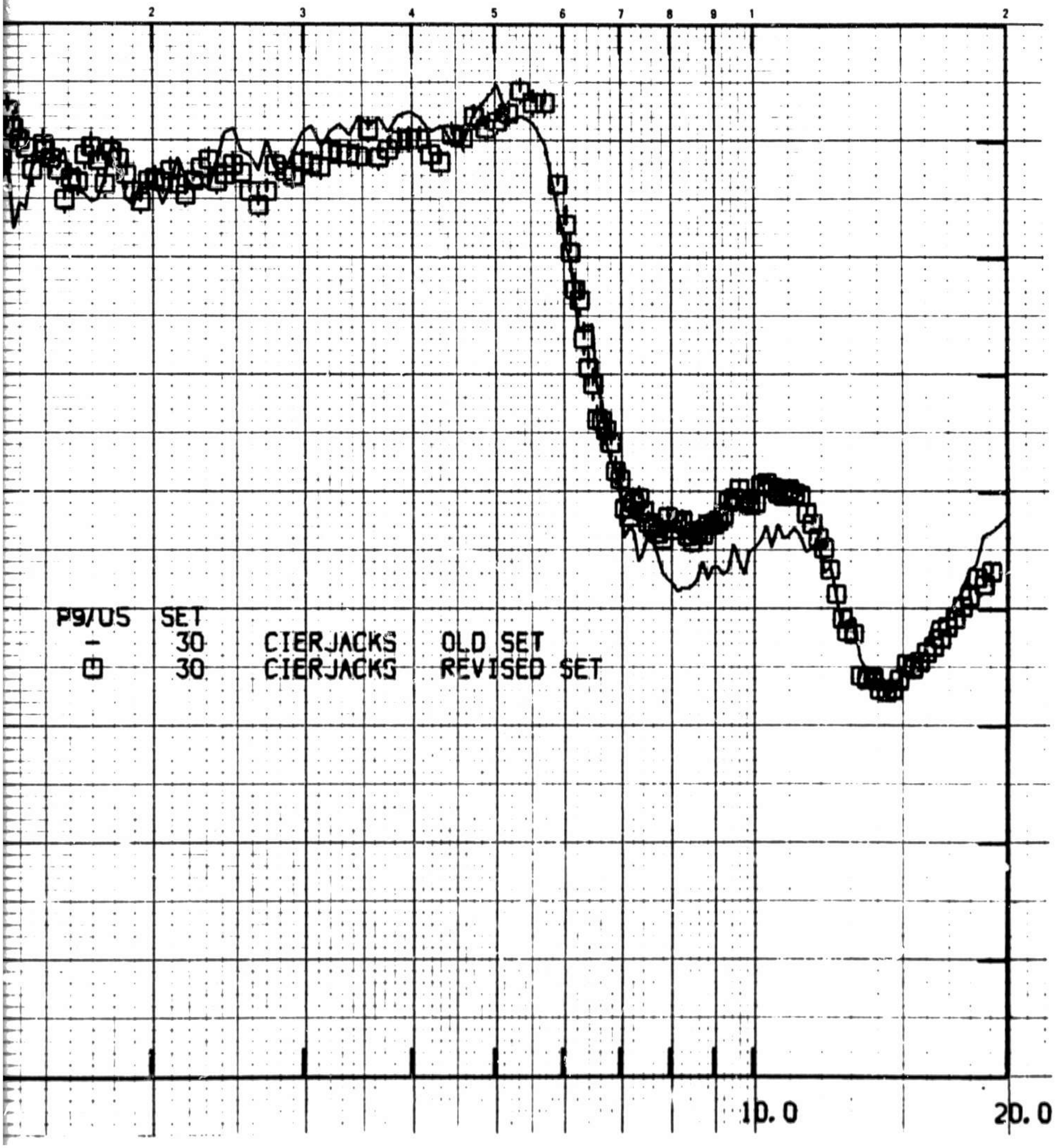
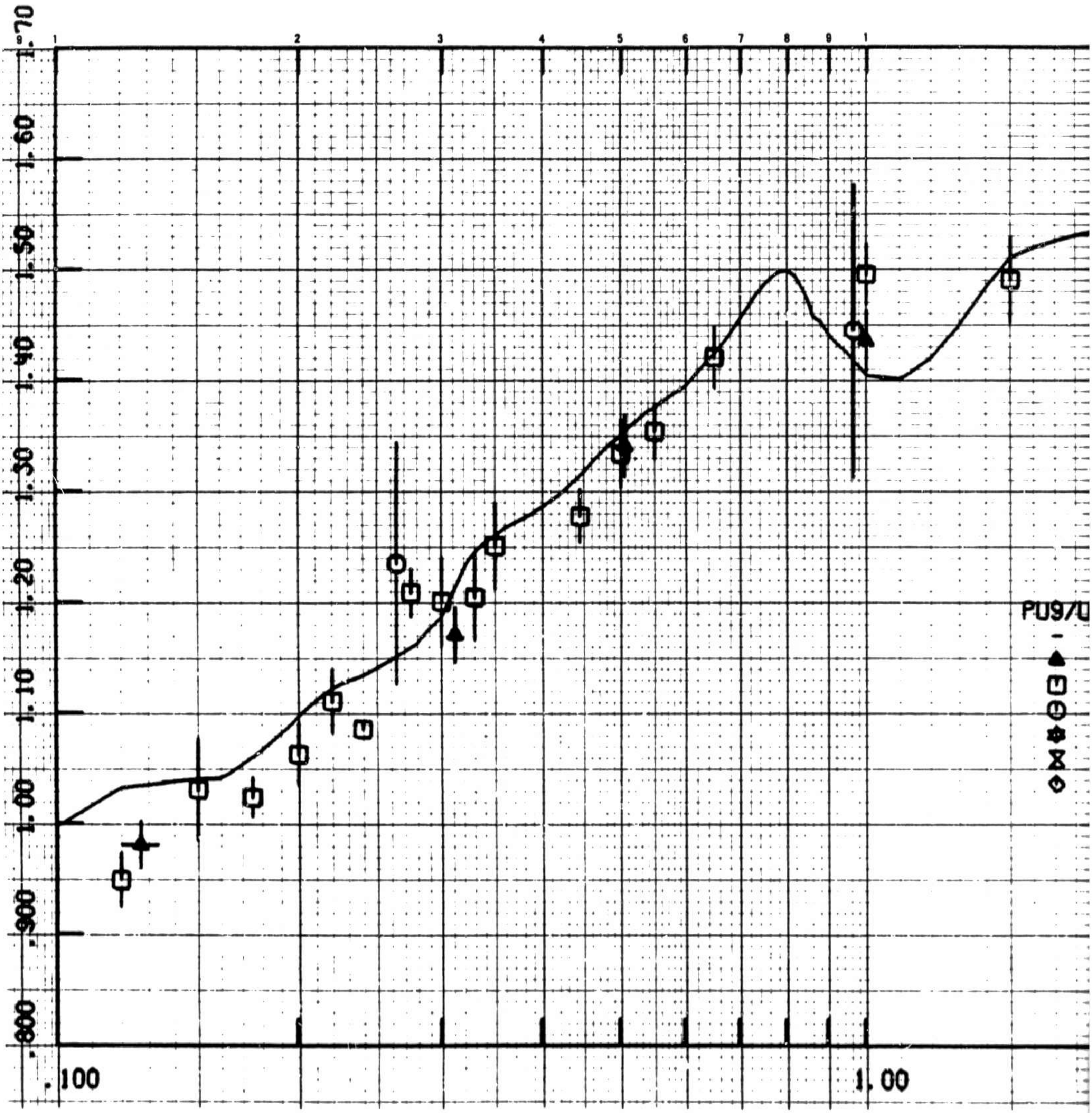
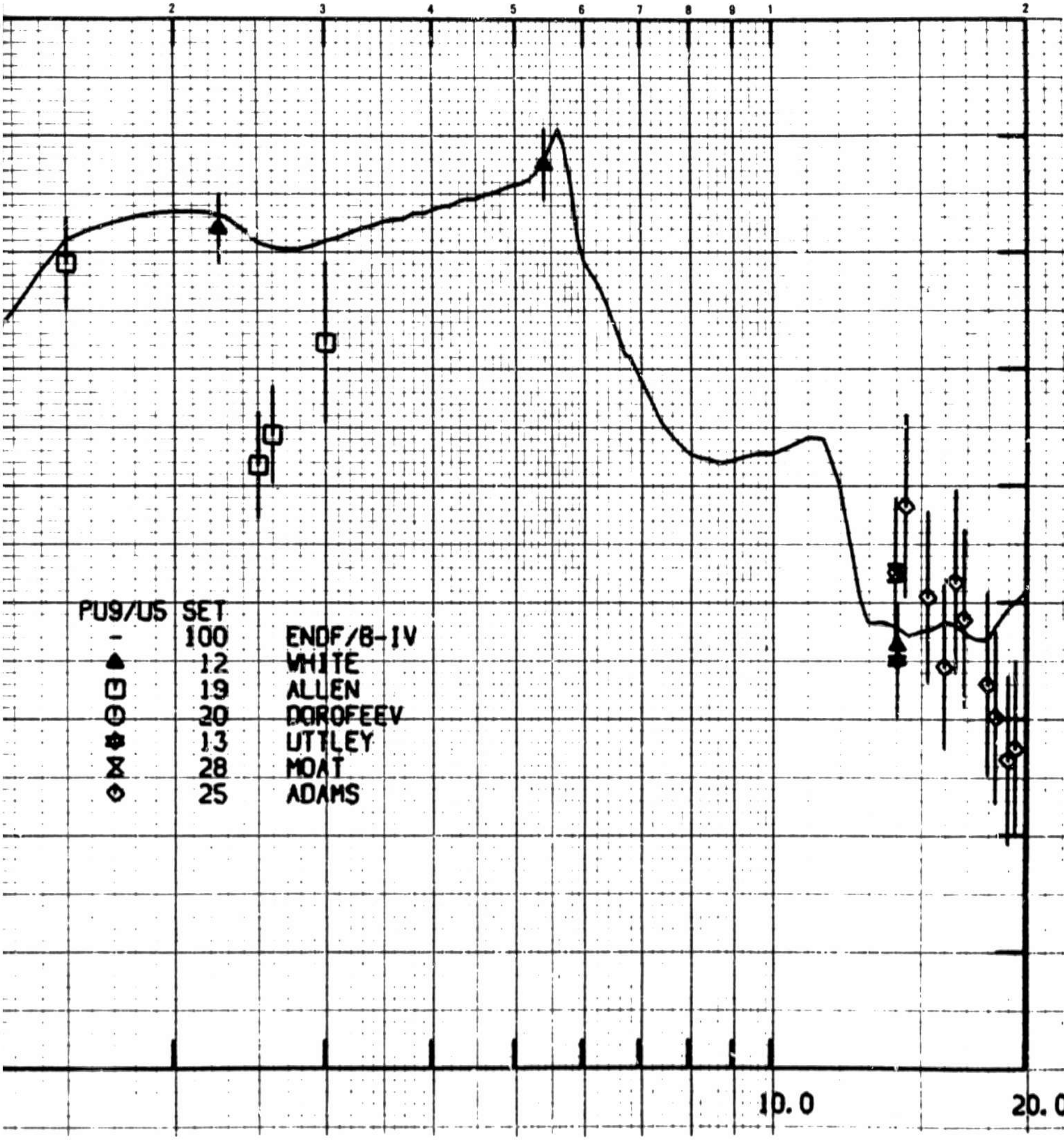

P9/US SET
— 30 CIERJACKS OLD SET
⊡ 30 CIERJACKS REVISED SET
2
3
4
5
6
7
8
9
1
2
10.0
20.0

Figure 45 *Pu-239 (n,f)/U-235 (n,f)* *0.1-20.0 MeV*

Comparison of some older data.



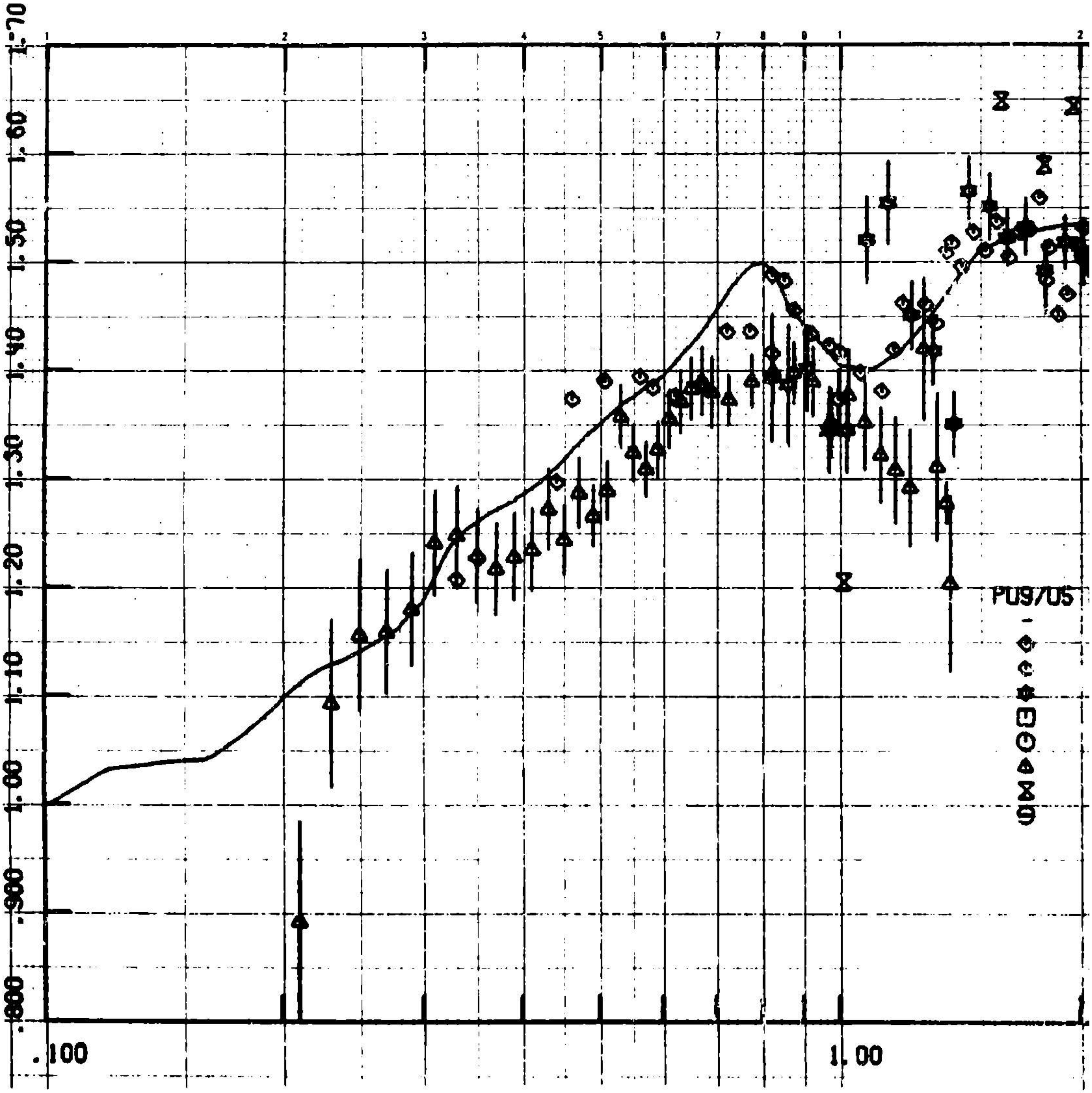
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.900
.800
.100
1.00
PU9/U

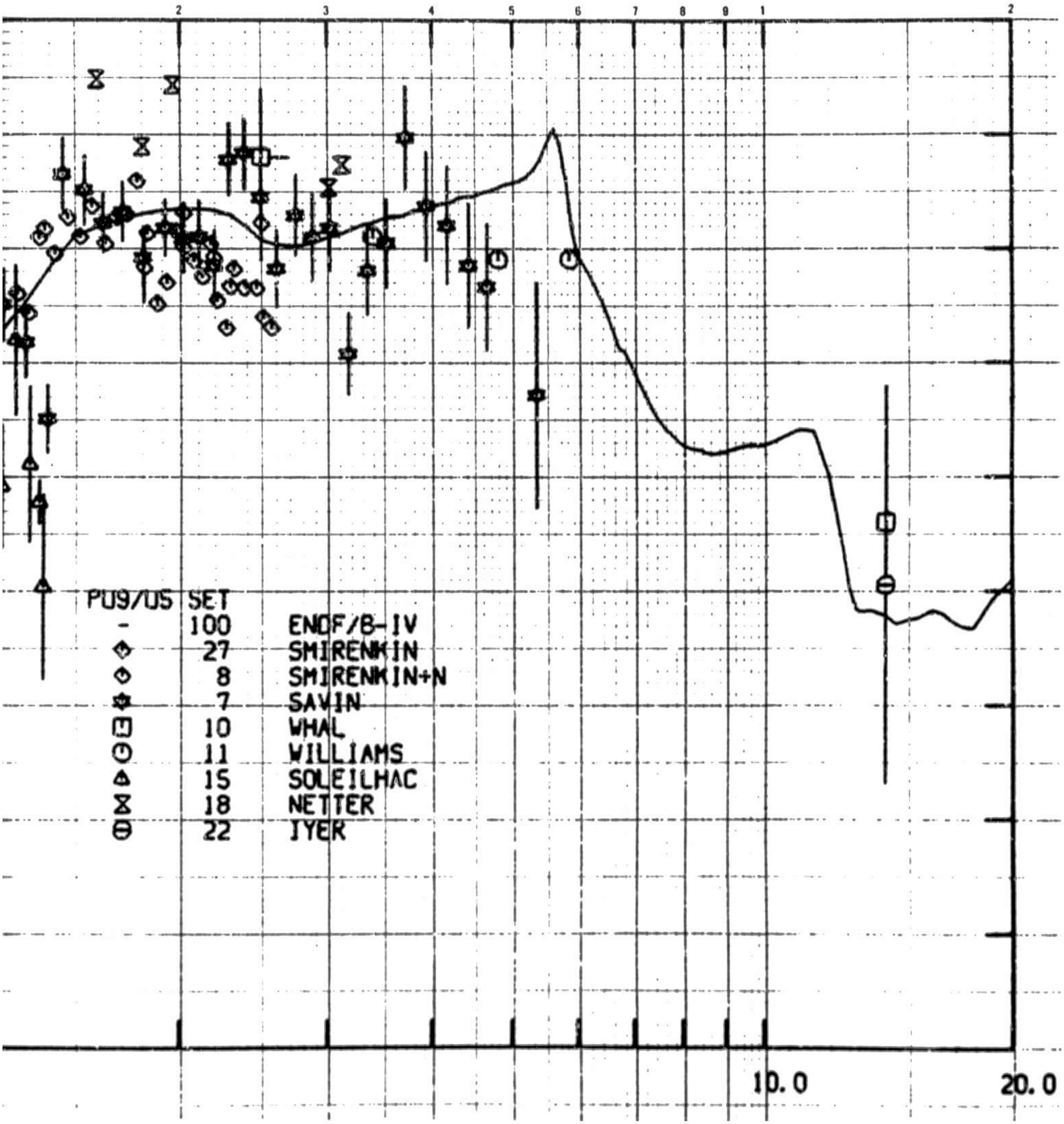


2
3
4
5
6
7
8
9
1
2
PU9/U5 SET
- 100 ENDF/B-IV
▲ 12 WHITE
19 ALLEN
20 DOROFEEV
13 UTTLEY
28 MOAT
25 ADAMS
10.0
20.0

Figure 46 *Pu-239 (n,f)/U-235 (n,f)* *0.1-20.0 MeV*

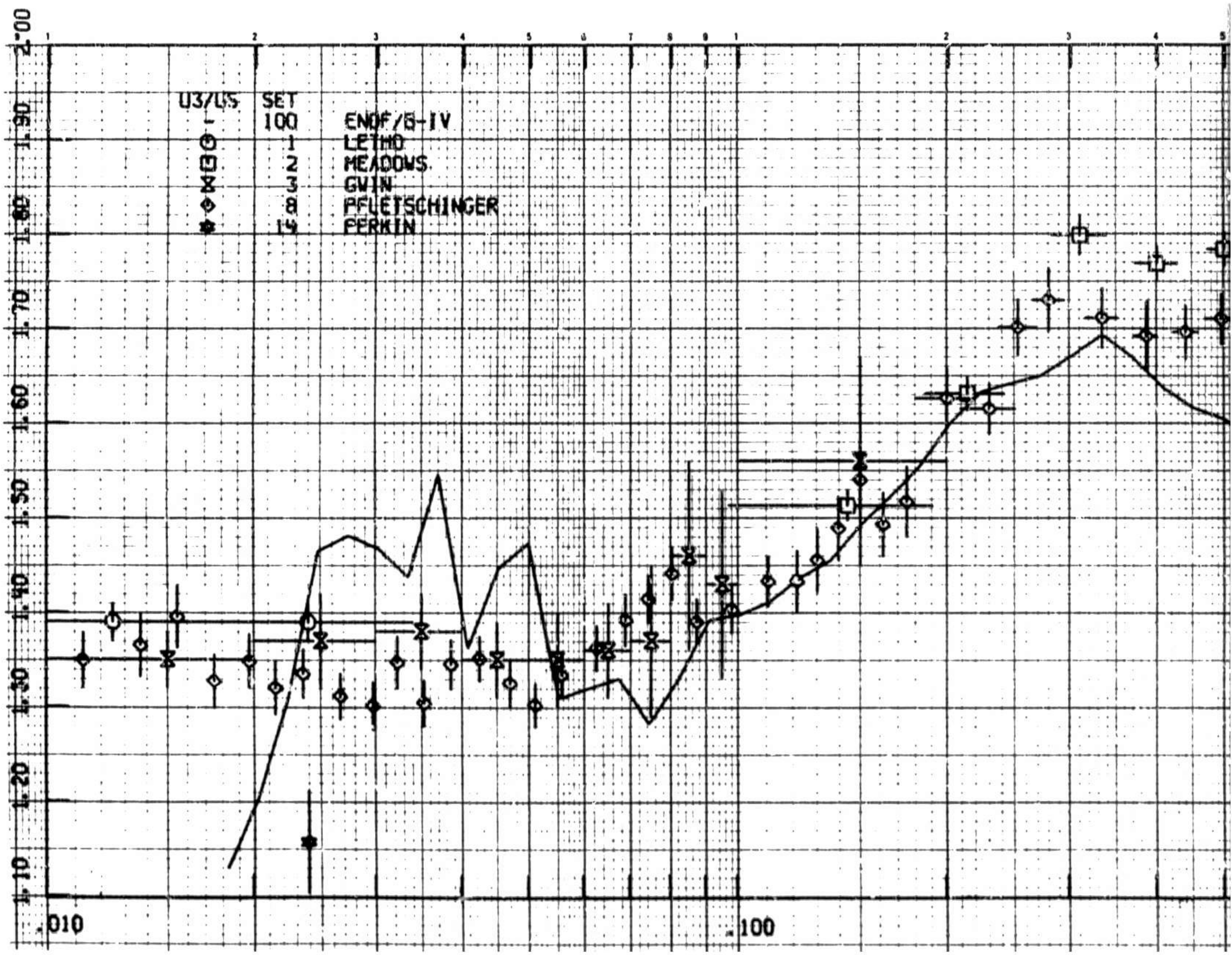
Comparison of some older data.


PU9/U5
.100
1.00


2
3
4
5
6
7
8
9
1
2
PU9/U5 SET
- 100 ENDF/B-IV
27 SMIRENKIN
8 SMIRENKIN+N
7 SAVIN
10 WHAL
11 WILLIAMS
15 SOLEILHAC
18 NETTER
22 IYER
10.0
20.0

gure 47 *U-233 (n,f)/U-235 (n,f)* *0.01-10.0 MeV*

Comparison of white-neutron source measurements by Letho (NSE, 39, 361, 1970), and by Gwin et al. NS, 15, 481, 1972) with monoenergetic-neutron source data by Meadows (76 ANL, p. 73), by Pfletschinger d Kaeppeler (NSE, 40, 375, 1970) and a photoneutron-source point by Perkin et al. (JNE, 19, 423, 1965).



U3/U5
SET
100 ENDF/B-IV
1 LETHO
2 MEADOWS
3 GWIN
8 PFLETSCHINGER
14 PERKIN
.010
.100

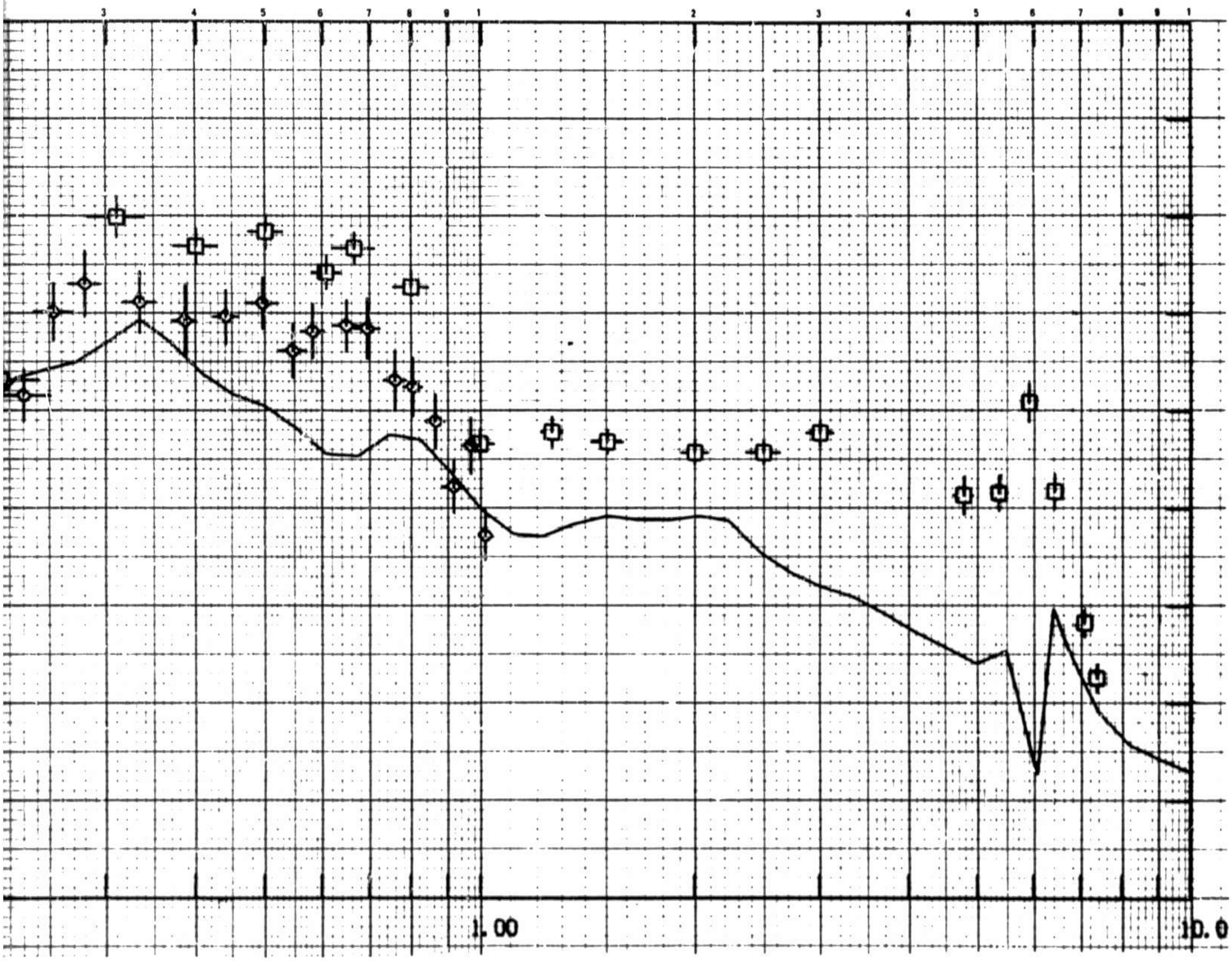
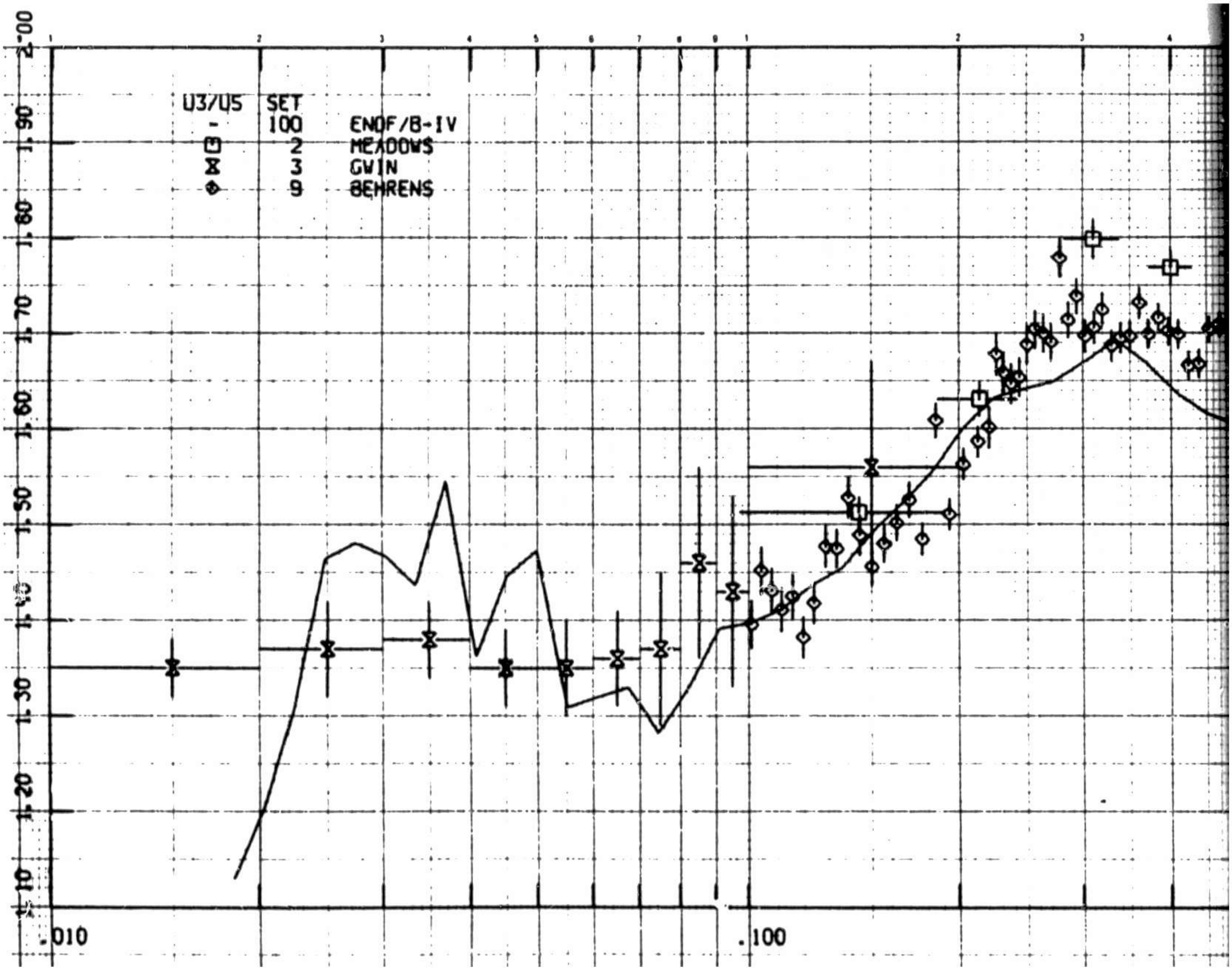

1.00
10.0

Figure 48 *U-233 (n,f)/J-235 (n,f)* *0.01-10.0 MeV*

Comparison of white-neutron source data by Behrens and Carlson (76 ANL, p. 47), and Gwin et al. (ANS. 15, 481, 1972) with monoenergetic-neutron source data by Meadows (76 ANL, p. 73). The peak around 6 MeV is caused by differences in the threshold for second-chance fission in U-233 and U-235.



U3/U5
SET
- 100 ENDF/B-IV
2 MEADOWS
3 GWIN
9 BEHRENS
.010
.100

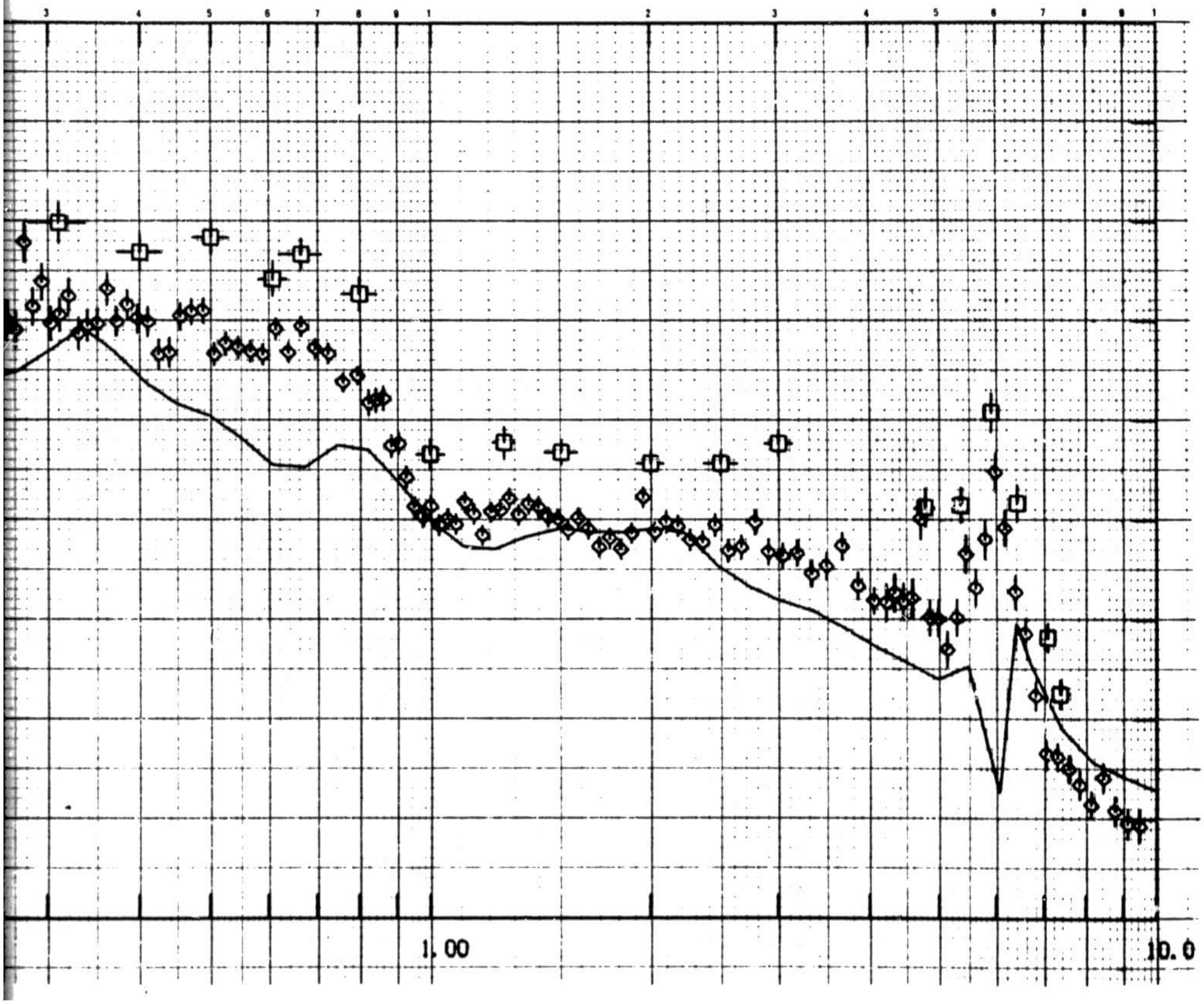
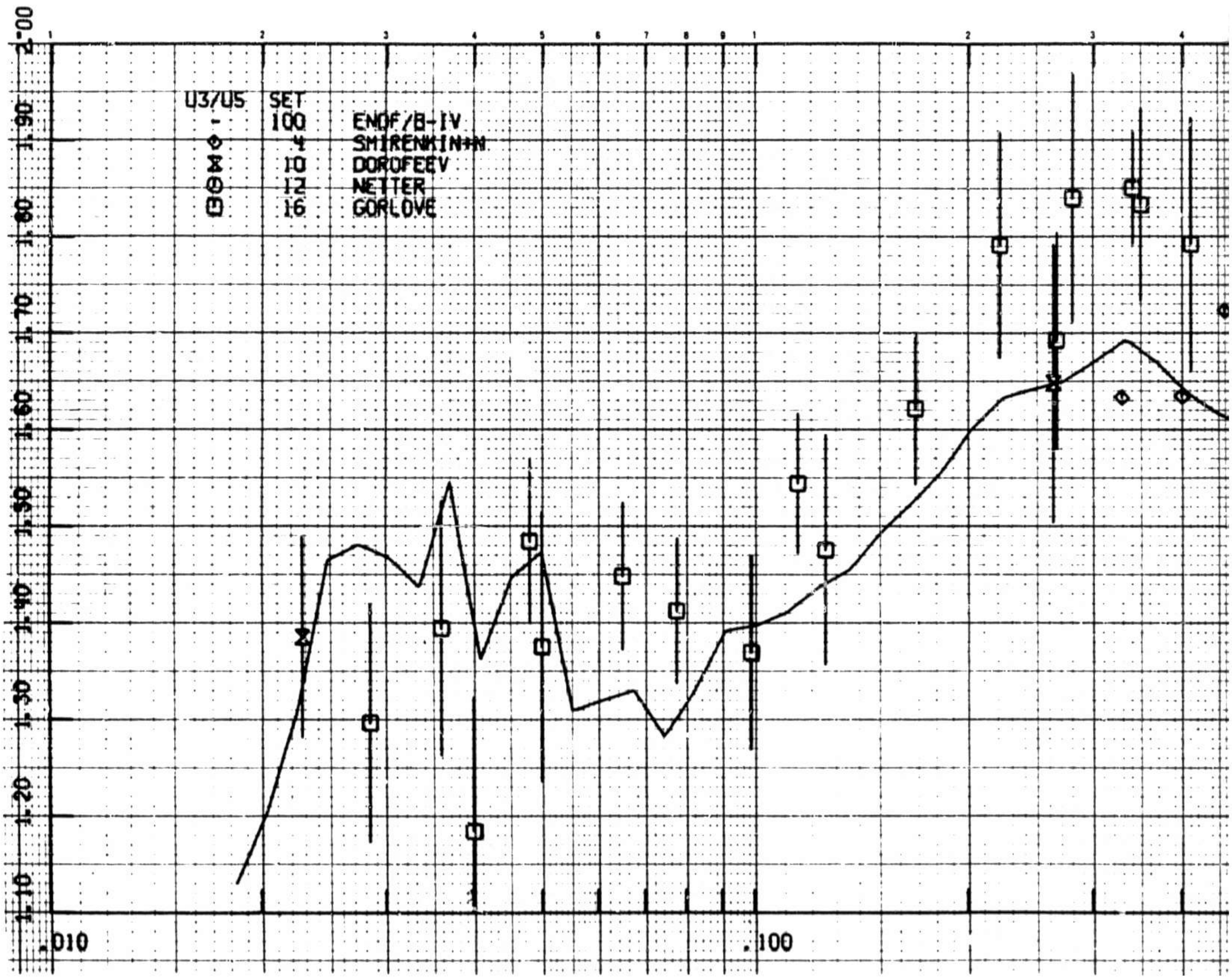

1.00
10.0

Figure 49 *U-233 (n,f)/U-235 (n,f)* *0.01-10.0 MeV*

Comparison of older measurements.


U3/U5 SET
- 100 ENDF/B-IV
◇ 4 SMIRENKIN+N
X 10 DOROFEEV
⊖ 12 NETTER
⊡ 16 GORLOVE
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
.010
.100

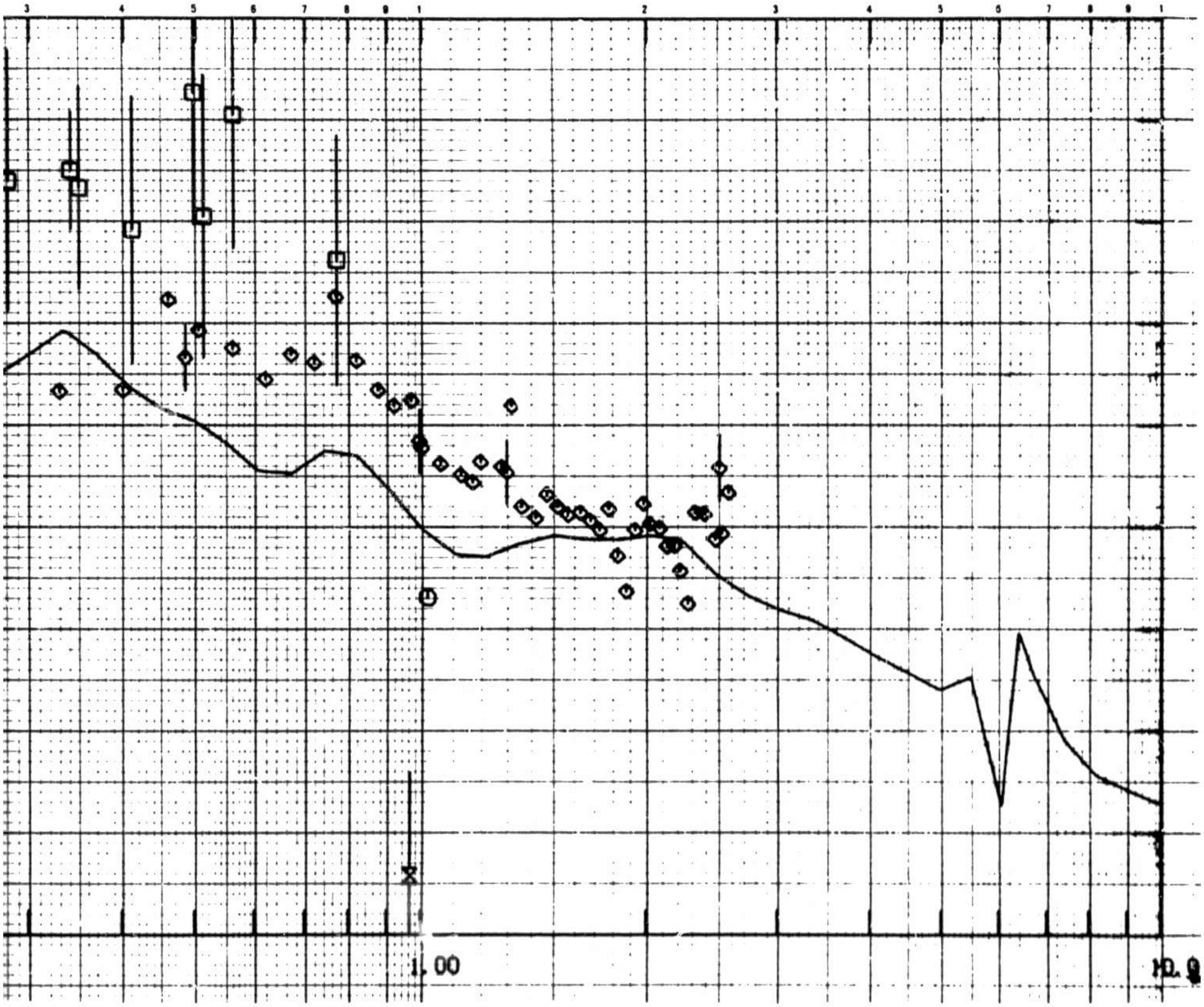
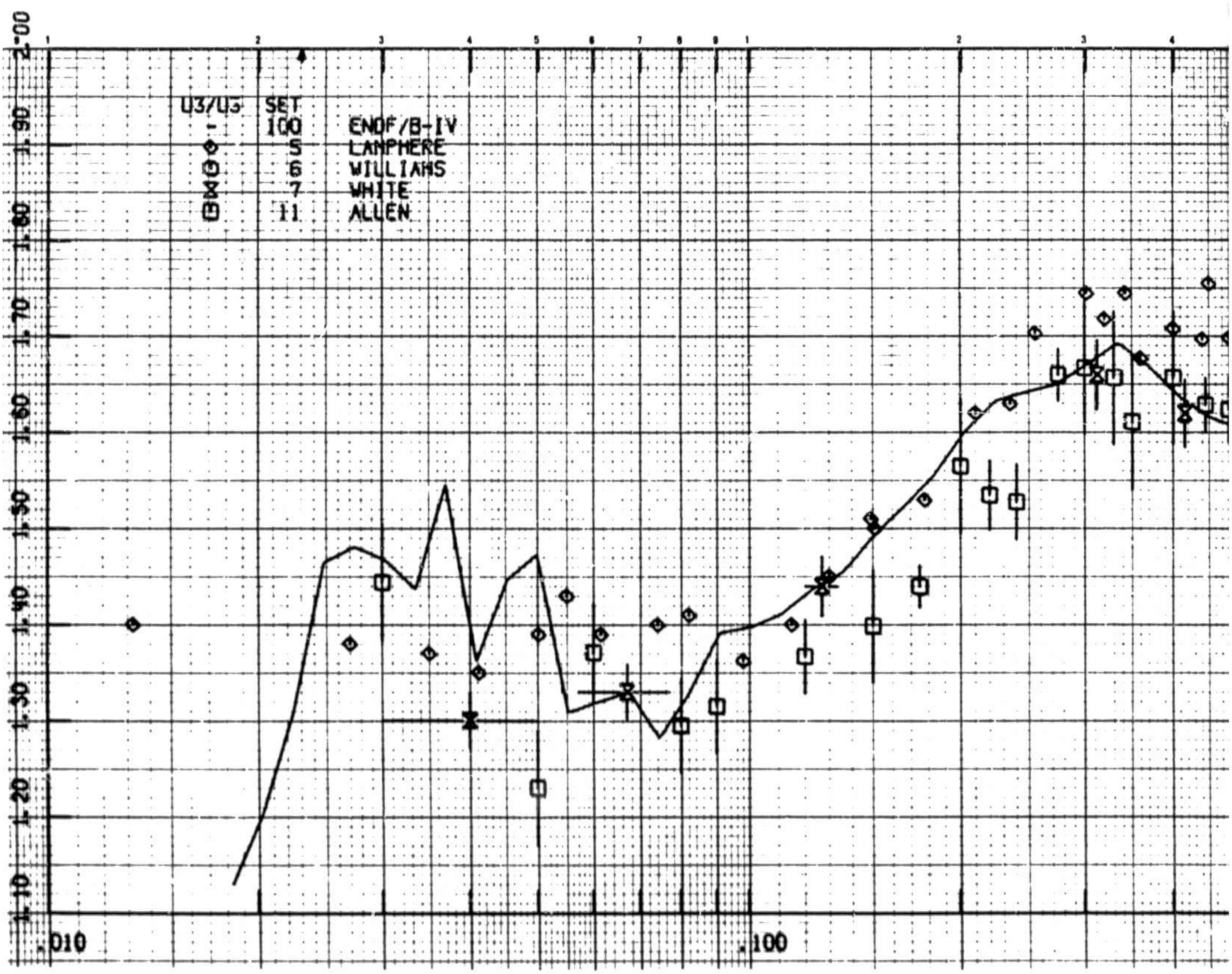
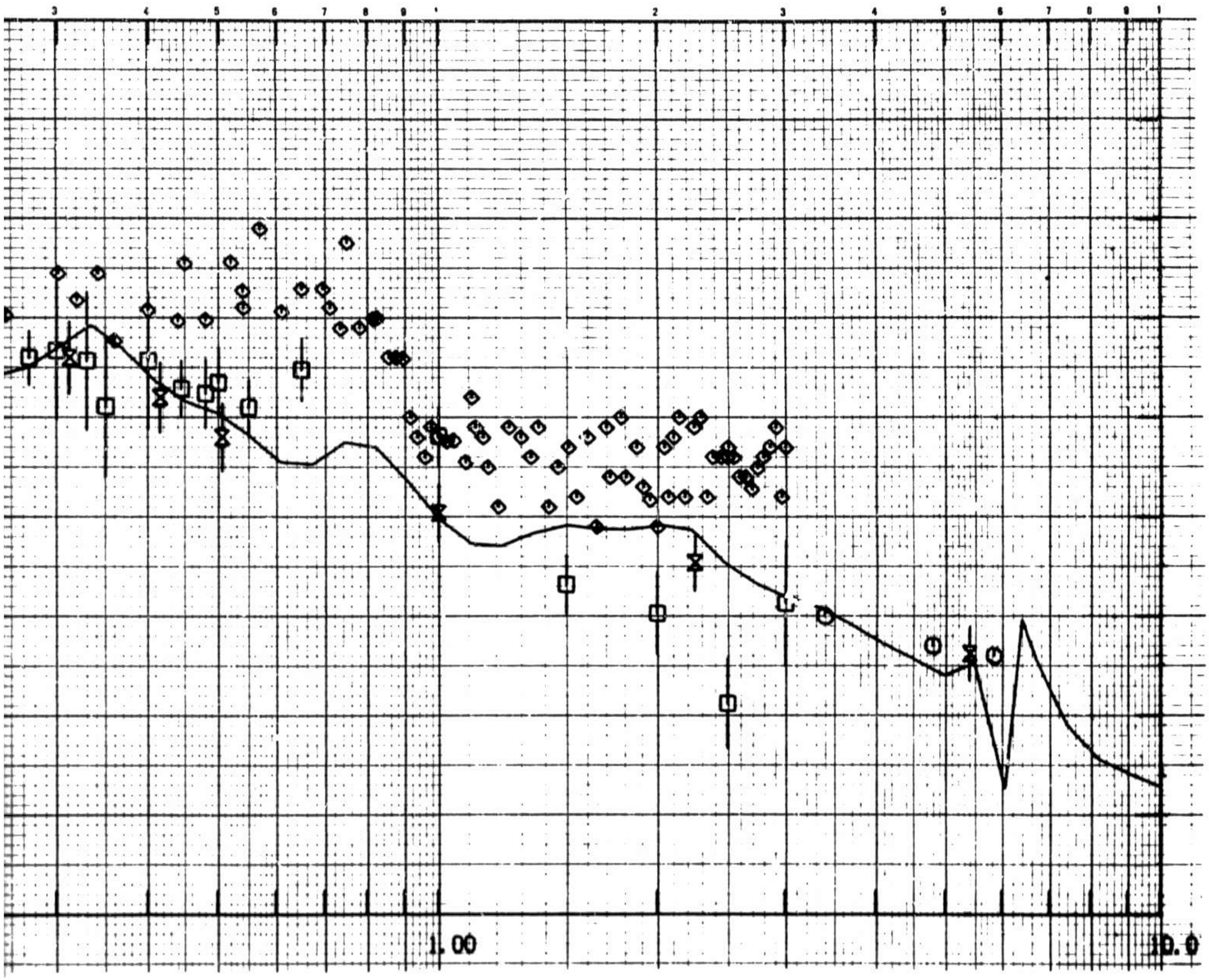

3
4
5
6
7
8
9
1
2
3
4
5
6
7
8
9
1
1.00
10.0

Figure 50 *U-233 (n,f)/U-235 (n,f)* *0.01-10.0 MeV*

Comparison of older measurements.



U3/U5 SET
- 100 ENDF/B-IV
5 LAMPHERE
6 WILLIAMS
7 WHITE
11 ALLEN
.010
.100


1.00
10.0