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Title: Processing the Latest 197-Au Evaluation from Group T-2

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memorandum

TO: Distribution

DATE: June 23, 1986

FROM: R. C. Little, X-6 RCL

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SUBJECT: PROCESSING THE LATEST ^{197}Au EVALUATION FROM GROUP T-2

The ENDF/B-V evaluation of ^{197}Au has been available to our Monte Carlo and deterministic code users for many years. The ZAID identifier is 79197.50. It is well known that no photon-production data are included in the ENDF/B-V evaluation. In 1983, Group T-2 provided a preliminary evaluation of ^{197}Au that did include photon production.[1] Photon-production cross sections and spectra were simply added to the existing neutron-only ENDF/B-V evaluation. This preliminary evaluation was processed into continuous-energy format for our Monte Carlo codes (by R. E. MacFarlane, Group T-2) and immediately made available to users.[2] This data set (ZAID=79197.55) is our current Monte Carlo default.[3] As best as I can tell, the evaluation described in Ref. 2 was never processed into multigroup format. It is certainly a fact that we have never made it available to our multigroup users. The data on MENDF5[4] and MENDF5G[5] for ^{197}Au are still based on ENDF/B-V.

A recent request from a user for multigroup ^{197}Au data with photon production has caused us to review the entire situation. The conclusion is that the preliminary evaluation described in Ref. 2 was soon supplemented by a complete reevaluation of ^{197}Au nuclear data by Group T-2.[6] All neutron and photon-production data above the resonance region (E_n > 5 keV) were reevaluated. The unfortunate situation, again to the best of my knowledge, is that this evaluation has never been processed by NJOY.

The new evaluation is available as MAT=197 on /T2/PGY/EVAL/-LAS/AU197LA (last written on 8/27/84). We have processed the evaluation with NJOY into:

1. Pointwise ENDF (PENDF) format,

2. ACE format,
3. DTF format.

The three NJOY input files are reproduced in Figs. 1-3.

Figures 4-11 compare various cross sections from the new evaluation (identified by ZAID=79197.56) with cross sections from the interim evaluation described in Ref. 2. Notice that the new evaluation provides data up to 30 MeV. Changes are most notable in the elastic cross section near 1 MeV and above 14 MeV, in the total inelastic cross section above 12 MeV, and in the radiative capture cross section above 3 MeV. Figure 10 indicates that the energy balance is much better in the new evaluation. There are, however, problems remaining near 250 keV and 500 keV. The total photon-production cross section (Fig. 11) has been changed at most energies above 100 keV.

We plan to announce the availability of continuous-energy and multigroup cross sections from the new T-2 evaluation in forthcoming memos to the general user community. Should you wish to use the new data immediately, please contact us, as we do have new libraries available for both Monte Carlo and deterministic codes.

REFERENCES

1. P. G. Young and E. D. Arthur, "Preliminary Gamma Production Data File for ^{197}Au," Los Alamos National Laboratory internal memorandum T-2-M-1370 to A. R. Larson (April 18, 1983).

2. R. E. Seamon and R. C. Little, "ACE Format Gold Cross-Section Library with Photon Production," Los Alamos National Laboratory internal memorandum to Distribution (Aug. 1, 1983).

3. R. C. Little, R. E. Seamon, and H. M. Fisher, "Contribution for MCNP3A Newsletter," Los Alamos National Laboratory internal memorandum X-6:RCL-85-584 to J. S. Hendricks (Dec. 1, 1985).

4. R. C. Little, "Multigroup Cross-Section Library Change #2," Los Alamos National Laboratory internal memorandum X-6:RCL-84-70 to Distribution (July 12, 1984).

5. R. C. Little and R. E. Seamon, "MENDF5G: Multigroup Photon-Production and Photon-Interaction Library," Los Alamos National Laboratory internal memorandum X-6:RCL-84-123 to J. G. Sanderson (Aug. 21, 1984).

6. P. G. Young and E. D. Arthur, "Analysis of n + ^{197}Au Cross Sections for E_n = 0.01-20 MeV," Proc. Int. Symp. on Capture Gamma-Ray Spectroscopy, Knoxville, Tenn., 1984, S. Raman, Ed., American Institute of Physics, Publication 125 (1985), p. 530.

Distribution

E. D. Arthur, T-2, MS B243
R. E. MacFarlane, T-2, MS B243
P. G. Young, T-2, MS B243
L. R. Fawcett, X-DO, MS B218
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H. M. Fisher, X-6, MS B226
J. S. Hendricks, X-6, MS B226
R. E. Seamon, X-6, MS B226
R. C. Little, X-6, MS B226
X-6 Files (2)

```
0
5
*MODER*
20 -26                                  Tape20=/T2/PGY/EVAL/LAS/AU197LA
*RECONR*
-26 -22
*PENDF TAPE FOR NEW LANL AU-197-L BY PHIL YOUNG*/
197 3 0 /
.002 0. 7 /
*79-AU-197 LANL FROM /ENDF/5/A/AU/197_*/
*PROCESSED WITH THE NJOY NUCLEAR DATA PROCESSING SYSTEM*/
*SEE ORIGINAL ENDF/B-V TAPE FOR DETAILS OF EVALUATION*/
0/
*BROADR*
-22 -23
197 1 0 1 0  /
.001 /
300
0/
*HEATR*                 (Code used:/075427/X3FTN5, last written 4/26/86)
-26 -23 -24
197 /
*STOP*
```

Figure 1

NJOY Input File to Produce PENDF Tape

```
0
5
*GROUPR*
-26 -24 0 -25
197 3 2 9 4 1 1 1
*AU197L*
300
1.E+10
3 1 /
16 102 /
17 4 /
17 16 /
17 17 /
17 37 /
0 /
0 /
*ACER*
-26 -24 -25 27 /
0 197 300 /
.002 /
-1 15000 1.E+10
*STOP*
```

(Code used:/NJOY/683/XACER, last written 10/23/85)

Figure 2

NJOY Input File to Produce ACE Tape

```
 0
 5
 *GROUPR*
 -26 -24 0 -28
 197 3 3 9 4 1 1 0
 *AU197L 30X12*/
 300
 1E10
  3    1 *TOTAL*/
  3    2 *ELASTIC*/
  3    4 *TOTAL INELASTIC*/
  3   16 *(N,2N)*/
  3   17 *(N,3N)*/
  3   37 *(N,4N)*/
  3   51 *1ST INELASTIC LEVEL*/
  3  -63 *HIGHER INELASTIC LEVELS*/
  3   91 *CONTINUUM INELASTIC*/
  3  102 *(N,G)*/
  3  103 *(N,P)*/
  3  107 *(N,A)*/
  3  251 *MUBAR*/        (Code used:/075427/X3FTN5, last written 4/26/86)
  3  252 *XI*/
  3  253 *GAMMA*/
  3  259 *1/V*/
  3  301 *PROMPT HEATING*/
  6    2 *ELASTIC*/
  6   16 *(N,2N)*/
  6   17 *(N,3N)*/
  6   37 *(N,4N)*/
  6   51 *1ST INELASTIC LEVEL*/
  6  -63 *HIGHER INELASTIC LEVELS*/
  6   91 *CONTINUUM INELASTIC*/
 16  102 *GAMMAS FROM CAPTURE*/
 17  4 *INELASTIC GAMMAS* /
 17  16 *N2N GAMMAS* /
 17  17 *N3N GAMMAS* /
 17  37 *N4N GAMMAS* /
 0/
 0/
 *DTFR*
 -28 29 0
 1 0 1
 5 30
 1 12
 *AU197L* 197 1 300/
 0/
 *STOP*
```

Figure 3

NJOY Input File to Produce DTF Tape

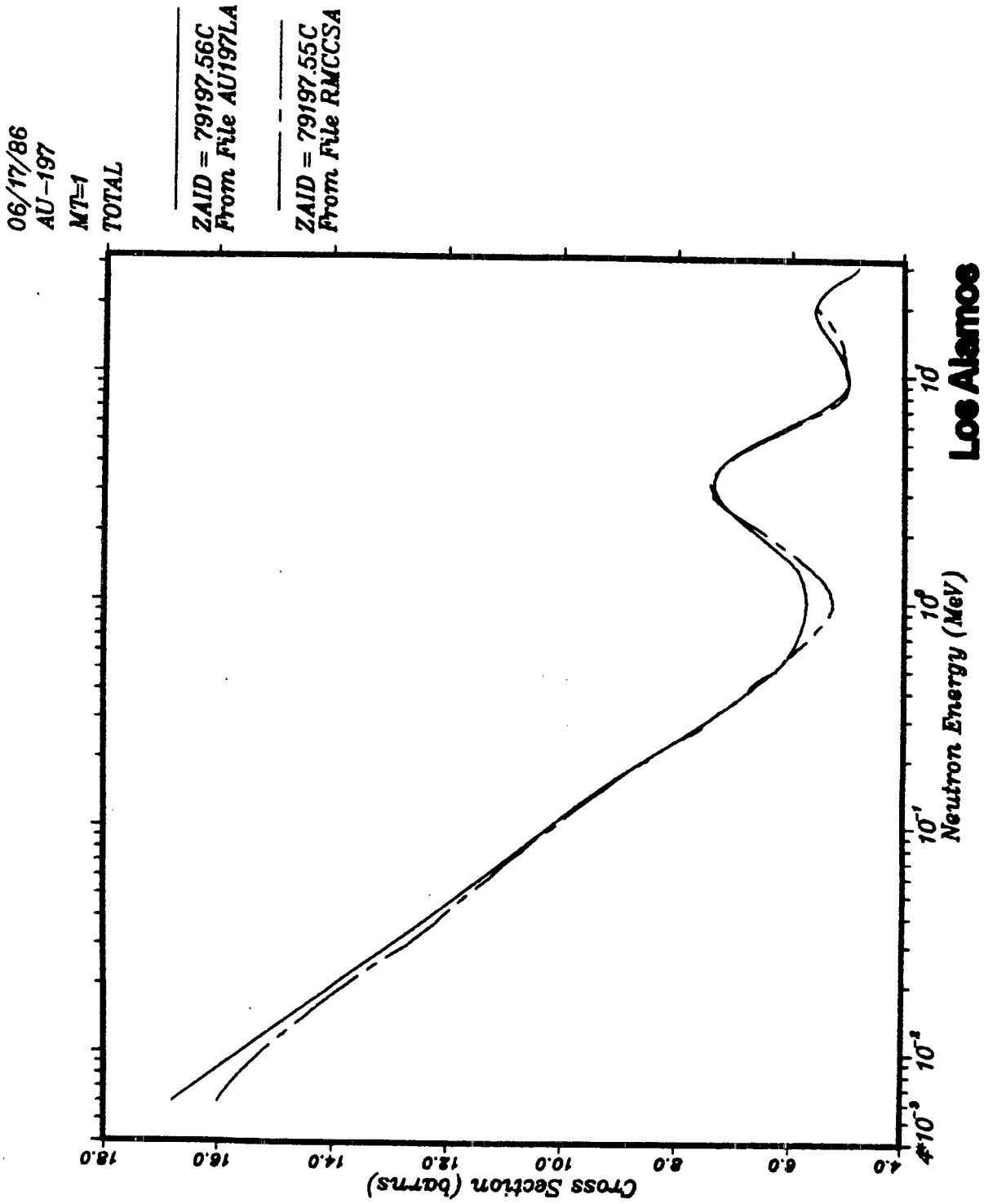
06/17/86
AU-197
MT=1
TOTAL
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Cross Section (barns)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
Neutron Energy (MeV)
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
Los Alamos

Figure 4

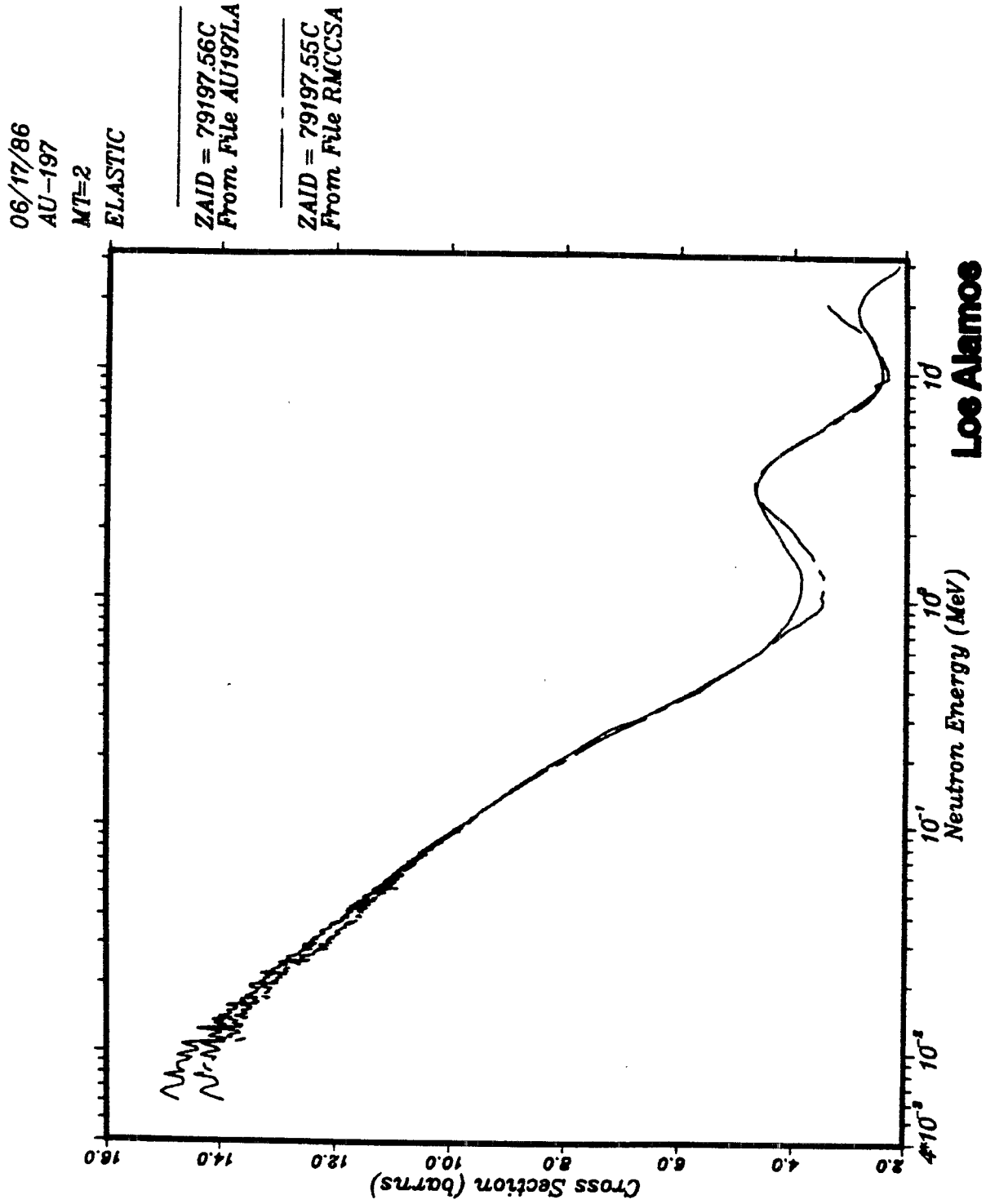
06/17/86
AU-197
MT=2
ELASTIC
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Cross Section (barns)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
4*10^-3
10^-2
10^-1
10^0
10^1
Neutron Energy (MeV)
Los Alamos

Figure 5

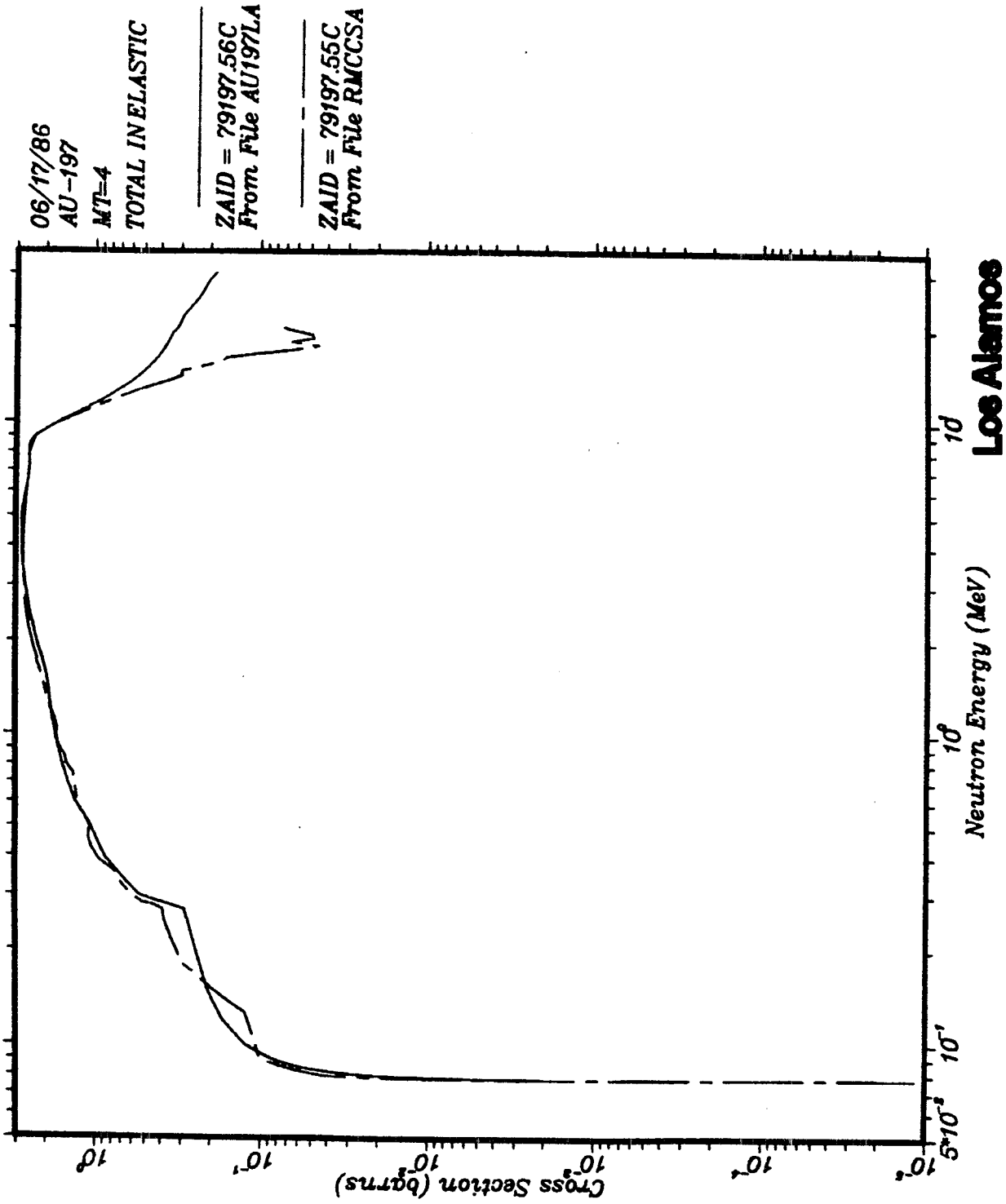
06/17/86
AU-197
MT=4
TOTAL INELASTIC
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Cross Section (barns)
Neutron Energy (MeV)
Los Alamos

Figure 6

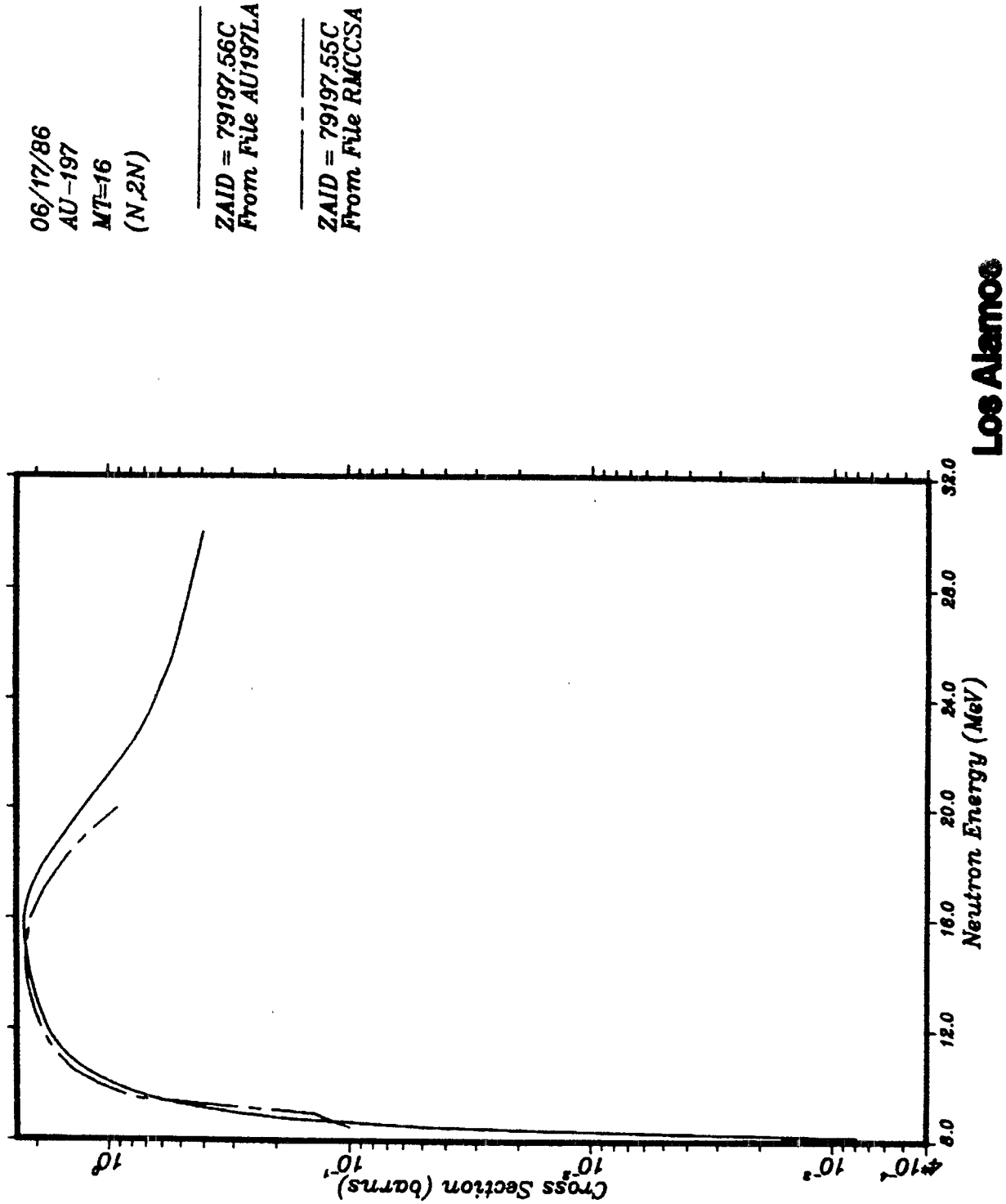
06/17/86
AU-197
MT=16
(N,2N)
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Los Alamos
Neutron Energy (MeV)
Cross Section (barns)
8.0
12.0
16.0
20.0
24.0
28.0
32.0

Figure 7

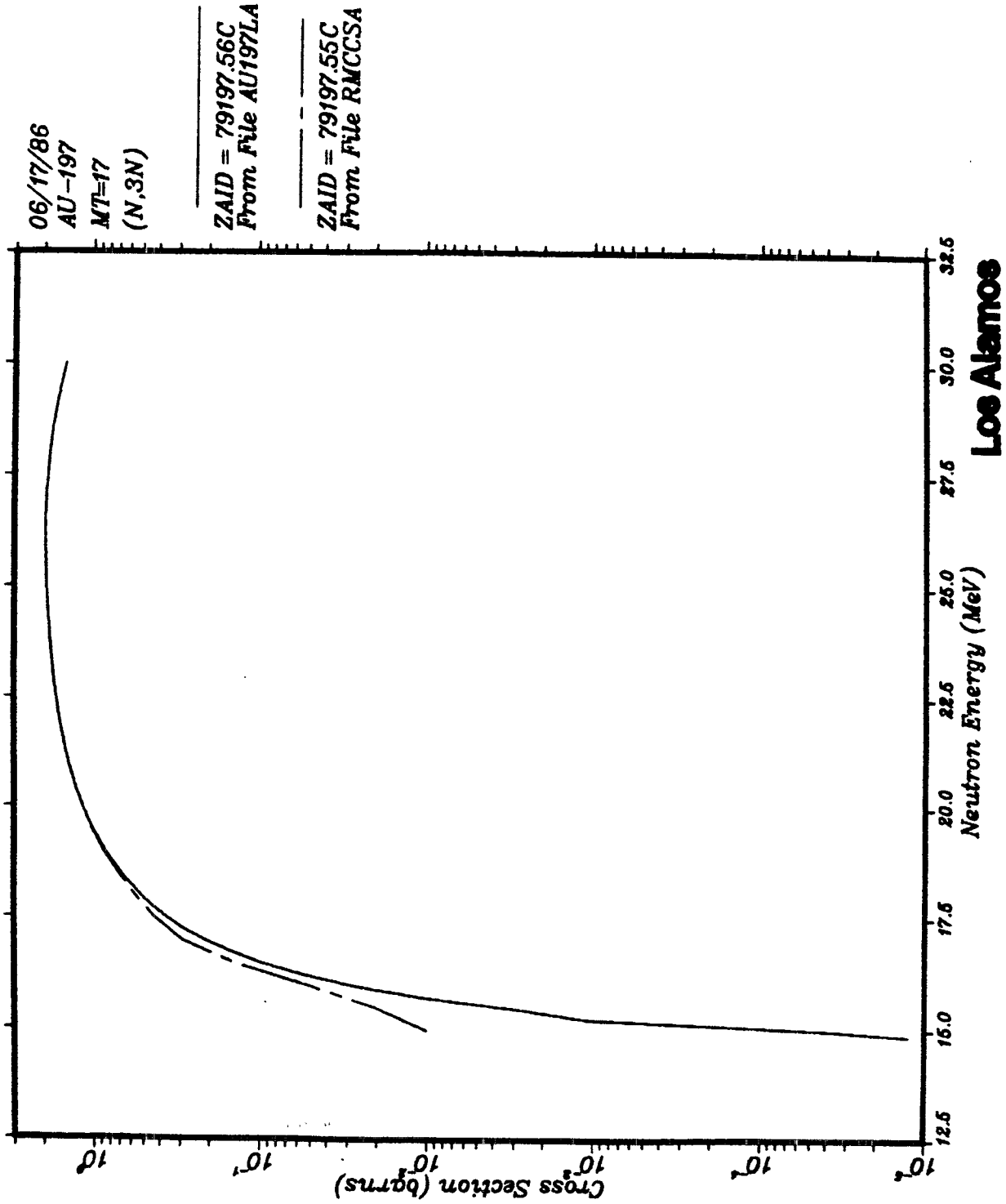
06/17/86
AU-197
MT=17
(N,3N)
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Cross Section (barns)
Neutron Energy (MeV)
12.5
15.0
17.5
20.0
22.5
25.0
27.5
30.0
32.5
Los Alamos

Figure 8

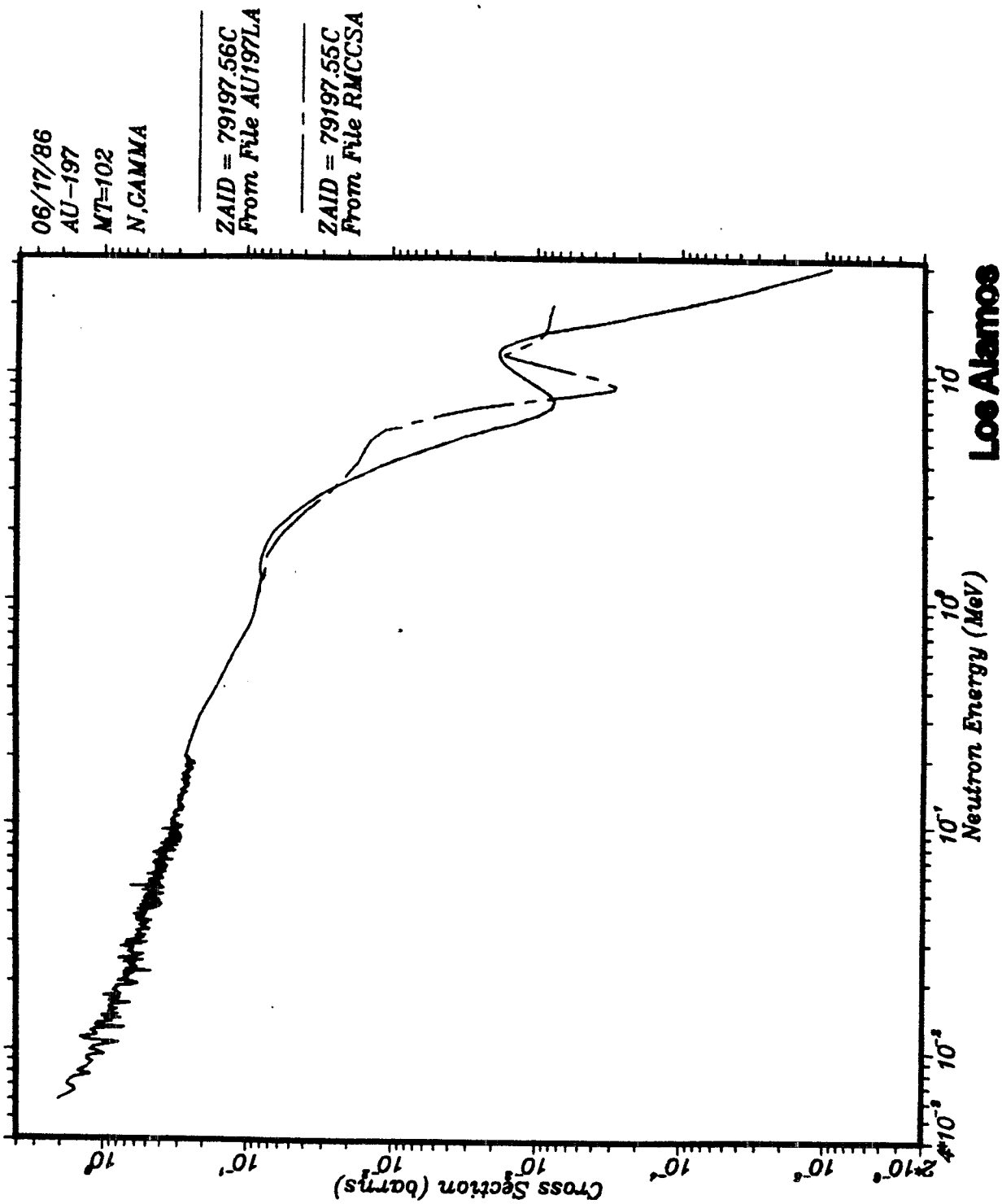
06/17/86
AU-197
MT=102
N,GAMMA
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Cross Section (barns)
Neutron Energy (MeV)
Los Alamos

Figure 9

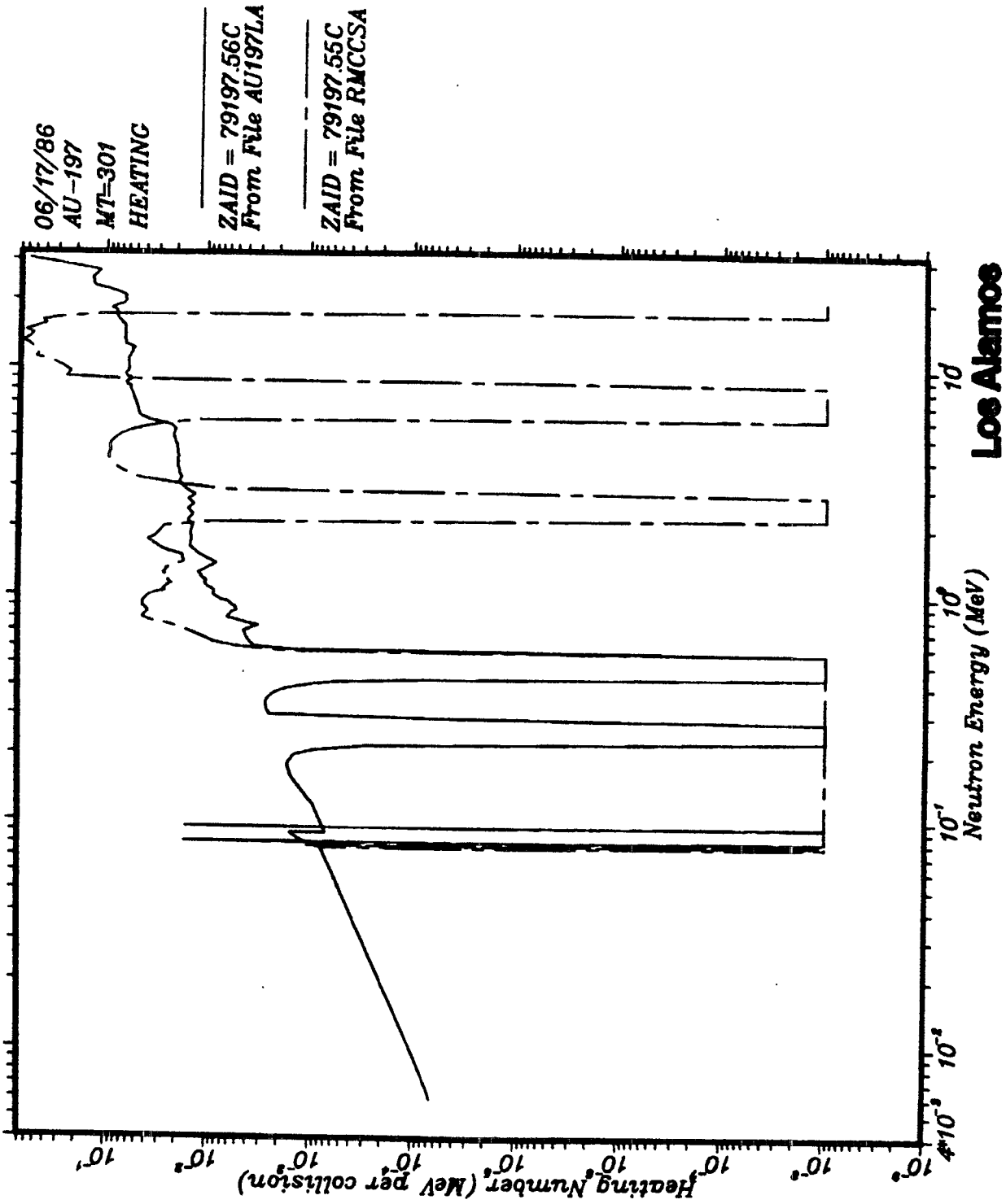
06/17/86
AU-197
MT=301
HEATING
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Neutron Energy (MeV)
Heating Number (MeV per collision)
Los Alamos

Figure 10

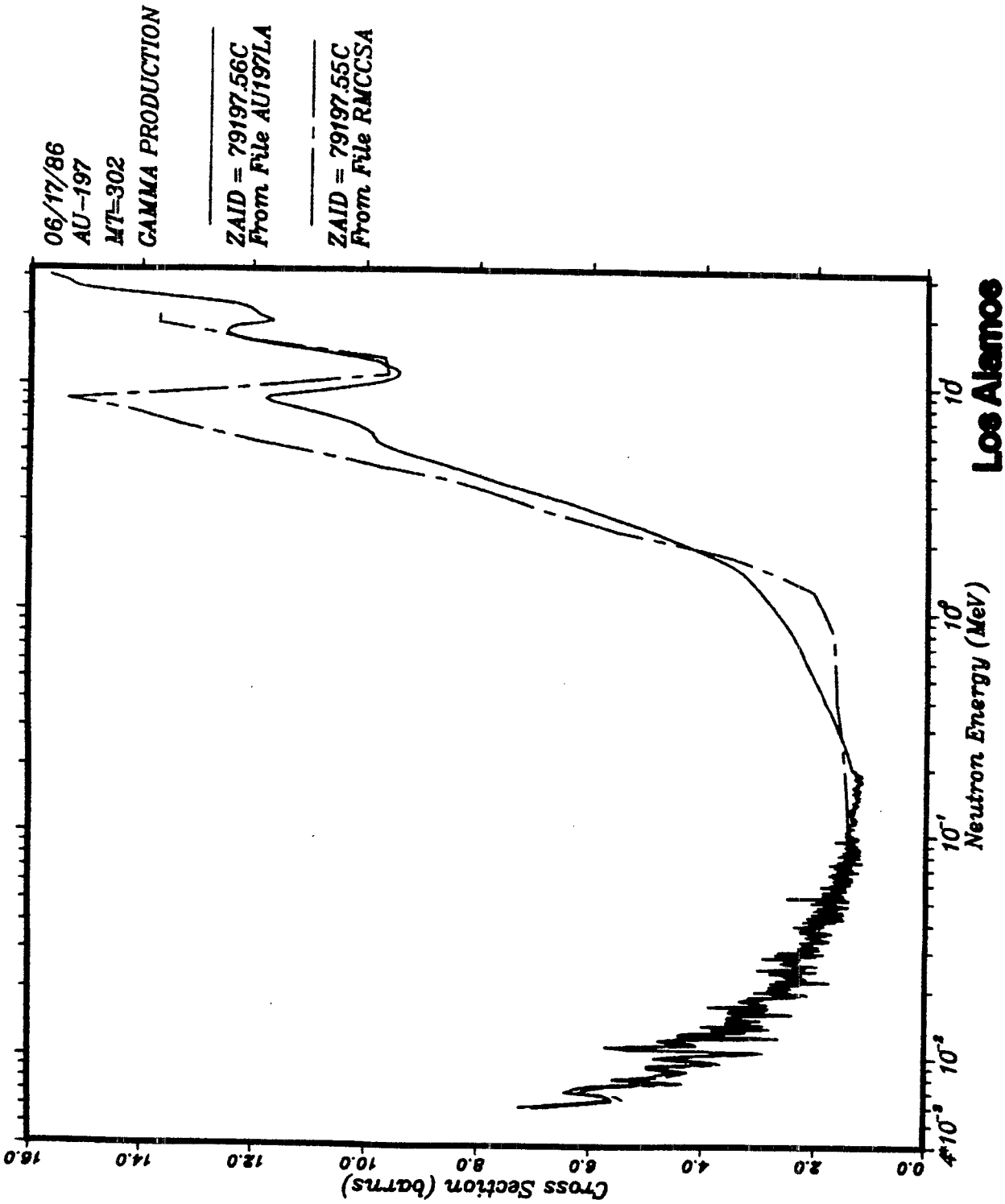
06/17/86
AU-197
MT=302
GAMMA PRODUCTION
ZAID = 79197.56C
From File AU197LA
ZAID = 79197.55C
From File RMCCSA
Cross Section (barns)
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Neutron Energy (MeV)
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
Los Alamos

Figure 11