ORNL-5575
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ENDF-284

The O(n,xγ) Reaction Cross Section for Incident Neutron Energies Between 6.5 and 20.0 MeV

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OAK RIDGE NATIONAL LABORATORY
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Engineering Physics Division

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for the
DEPARTMENT OF ENERGY

ABSTRACT

Differential cross sections for the neutron-induced gamma-ray production from oxygen have been measured for incident neutron energies between 6.5 and 20.0 MeV. The Oak Ridge Electron Linear Accelerator (ORELA) was used to provide the neutrons and a NaI spectrometer to detect the gamma rays at 125°. The data presented are the double differential cross section, $d^2\sigma/d\Omega dE$, for gamma-ray energies between 1.6 and 10.6 MeV for coarse intervals in incident neutron energy. The integrated yield for gamma rays of energies greater than 1.6 MeV with higher resolution in the neutron energy is also presented. The experimental results are compared with the Evaluated Nuclear Data File (ENDF).

INTRODUCTION

As part of a continuing program[1] for determining numerical values of gamma-ray-production cross sections for neutron-induced reactions, we have measured the absolute differential cross sections for gamma rays produced by neutron interactions with oxygen. The data are presented in this report in tabular and graphical form and are compared to the current data file for oxygen (MAT 1276 ENDF/B-IV).[2]

Two methods of data analysis were employed. The first gives the detailed gamma-ray spectra for a series of relatively coarse intervals in incident neutron energy while the second method uses integral quantities to illustrate the detailed behavior of the cross sections as a function of the incident neutron energy.

EXPERIMENTAL PROCEDURE

Details of the experimental procedure are given elsewhere[3] and only a brief description will be given here. Neutrons were produced by photonuclear processes due to bremsstrahlung from the impact on a tantalum target of electrons from the Oak Ridge Electron Linear Accelerator (ORELA). The present experiment employed an electron beam energy of 135 MeV with a repetition rate of 800 pulses per second and a pulse width of 5 ns. The total electron beam power was 10 kW.

Neutrons produced at the linac target were collimated to a diameter of 14 cm and traversed a 47.35-m flight path and were incident on a ceramic disk of 97% BeO and 3% MgO (by weight) oriented 45° with respect to the incident beam. The slab was 28.5 cm in diameter with a thickness of 0.07454 molecules/barn. Gamma rays originating in the sample were detected by a heavily shielded 12.5-cm by 12.5-cm NaI detector at 125° with respect to the incident neutron beam. For each event in the detector, data were recorded in a two-parameter array containing gamma-ray pulse height as a function of time-of-flight for the incident neutron.

The neutron flux at the sample position was determined in a separate experiment using calibrated thick organic scintillators. During the course of the gamma-ray measurements the flux was monitored using a small plastic scintillator in the edge of the neutron beam 30 m from the source.

DATA REDUCTION

Two methods of data reduction were employed. In the first, the pulse-height spectra were integrated over intervals of neutron time-of-flight to form pulse-height spectra for specific incident neutron energy ranges. These intervals ranged in width from 0.5 MeV at energies below 10 MeV to 3 MeV in the range 14 to 20 MeV. The spectra so formed were then unfolded using the code FERD and measured response functions of the NaI detector. The results were the gamma-ray spectra defined by 115 points covering the gamma-ray energy range from 1.6 to 10.6 MeV. These spectra were normalized to cross sections using the measured neutron flux and sample thickness.

The data were corrected for finite sample effects which include: 1) attenuation of the incident neutron beam in the sample, 2) gamma-ray self-absorption, and 3) neutron multiple scattering in the sample. The first two corrections were calculated with total neutron cross sections from the evaluated data and the photon cross sections from Ref. 5, using a suitably weighted sum of the cross sections for O, Be, and Mg. The multiple scattering corrections were calculated by a Monte Carlo technique. For this calculation the neutron cross sections were generated from the evaluated files for Be and O (Mg was neglected) using the AMPX code system.[4] The gamma-ray-production cross sections were taken from the evaluation.[2] For this calculation the gamma-ray angular distributions were assumed to be isotropic.

Beryllium produces only a 478-keV gamma ray under neutron bombardment and thus created no "background" in the present work. The small contributions from the Mg(n,xγ) reaction (see previous measurements in Ref. 1) was ignored since the atomic percentage of Mg was only 2% that of oxygen and these gamma rays are lost in the "noise" from the unfolding of the high energy gamma rays from oxygen.

These results are presented in the first set of figures at the end of this report. Figures 1-11 present the detailed gamma-ray spectra for each incident neutron energy interval. These are compared to cross sections generated from the evaluation (ENDF/B-IV MAT 1276) by averaging over the appropriate neutron energy interval. It should be noted that deficiencies in the response functions used in the unfolding process produce small, spurious oscillations especially in the region immediately below the strong gamma ray at 6.13 MeV. Also, non-linearities in the linear gate and stretcher used for the linear signal caused a slight discrepancy in gamma-ray energies in the 3- to 4-MeV region.

The data described above provide detailed information about the secondary gamma-ray spectra, but because the unfolding technique requires good statistical accuracy the data must be binned over large neutron energy intervals. Therefore, a second type of data reduction, pulse-height weighting,[6,7] was also used. This technique provided only integral information about the secondary gamma spectra (e.g., total yield and average photon energy), but because the demands on statistical accuracy are less it allowed better resolution in the incident neutron energy. In this work the pulse-height weighting analysis was applied to spectra formed by integration over time-of-flight intervals corresponding to ΔE_n = 0.05 MeV at E_n = 6.5 MeV increasing to ΔE_n = 1.0 MeV at E_n = 20 MeV. The results of this analysis for the total yield and average secondary gamma-ray energy as a function of the incident neutron energy are presented in Figs. 12 and 13. A value of the lower cut-off in gamma-ray energy of 1.6 MeV was used. Comparisons are made for the same quantities calculated from the evaluated files.

No excitation functions were extracted for the strong lines because of confusions created by the response of the NaI detector. For example, the second escape peak from the 7.12-MeV γ-ray falls on top of the total energy peak for the 6.13-MeV γ-ray. The unfolding or pulse-height weighting analysis takes care of this problem, but any analysis of peak areas would lead to incorrect results.

The data shown in the graphs are given in the tables contained in the last section of this report. The values shown in the graphs and presented in the tables do not include an uncertainty of 10% in overall normalization due mainly to the determination of the incident neutron flux.

ACKNOWLEDGMENTS

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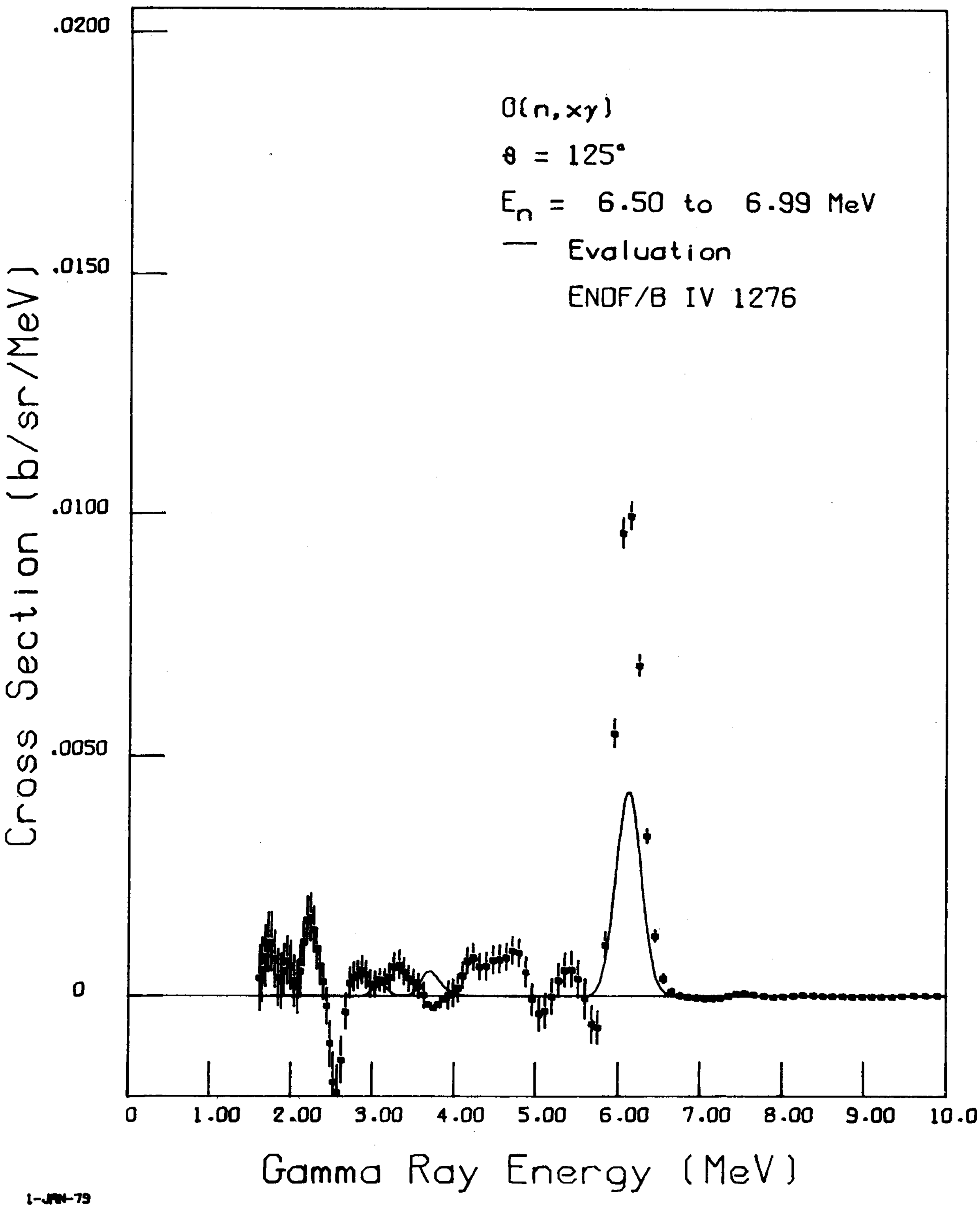
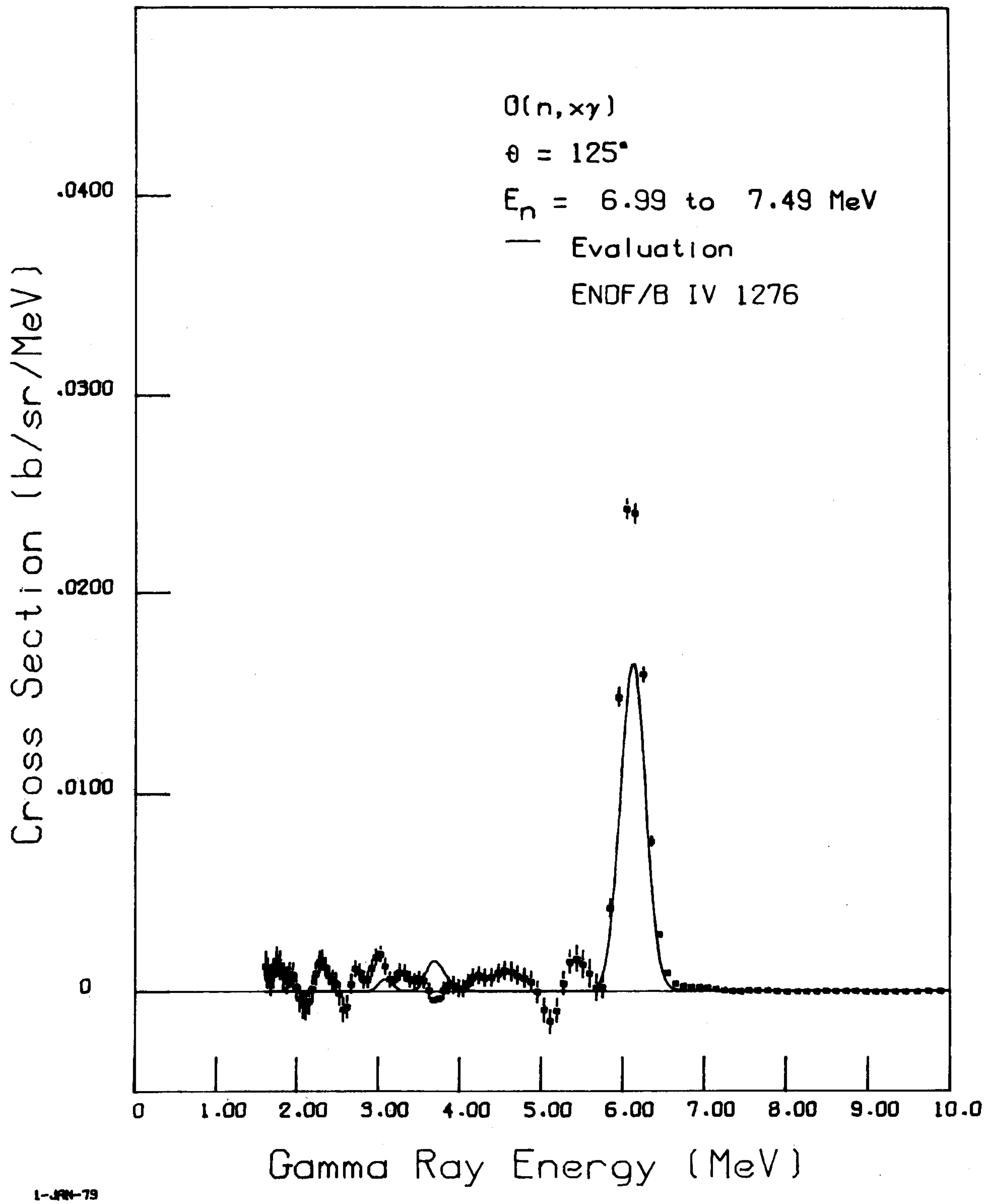


O(n,xγ)
θ = 125°
E_n = 6.50 to 6.99 MeV
— Evaluation
ENDF/B IV 1276
Cross Section (b/sr/MeV)
.0200
.0150
.0100
.0050
0
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 1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.0200
.0100
0
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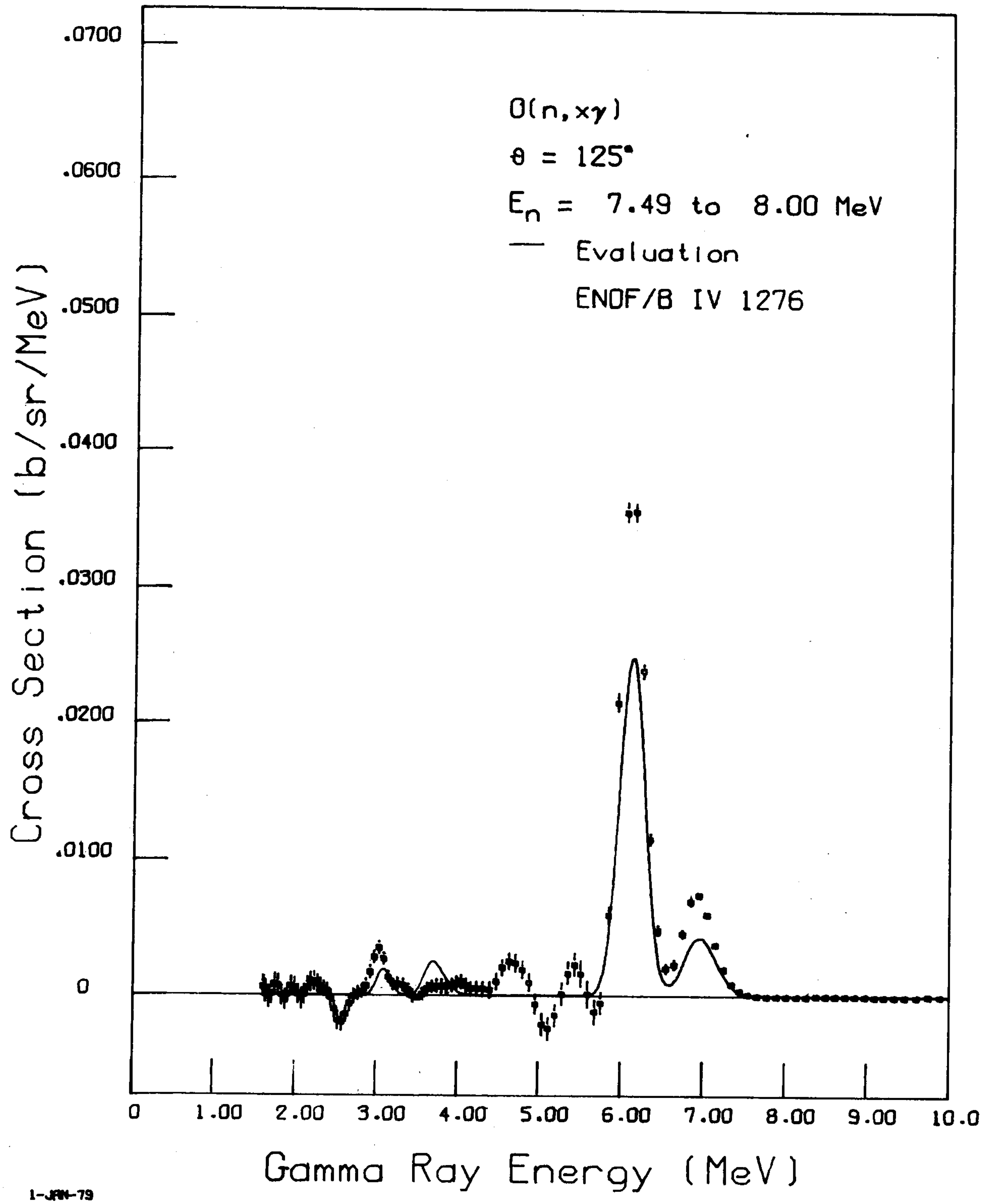
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 2



O(n,xγ)
θ = 125°
E_n = 7.49 to 8.00 MeV
Evaluation
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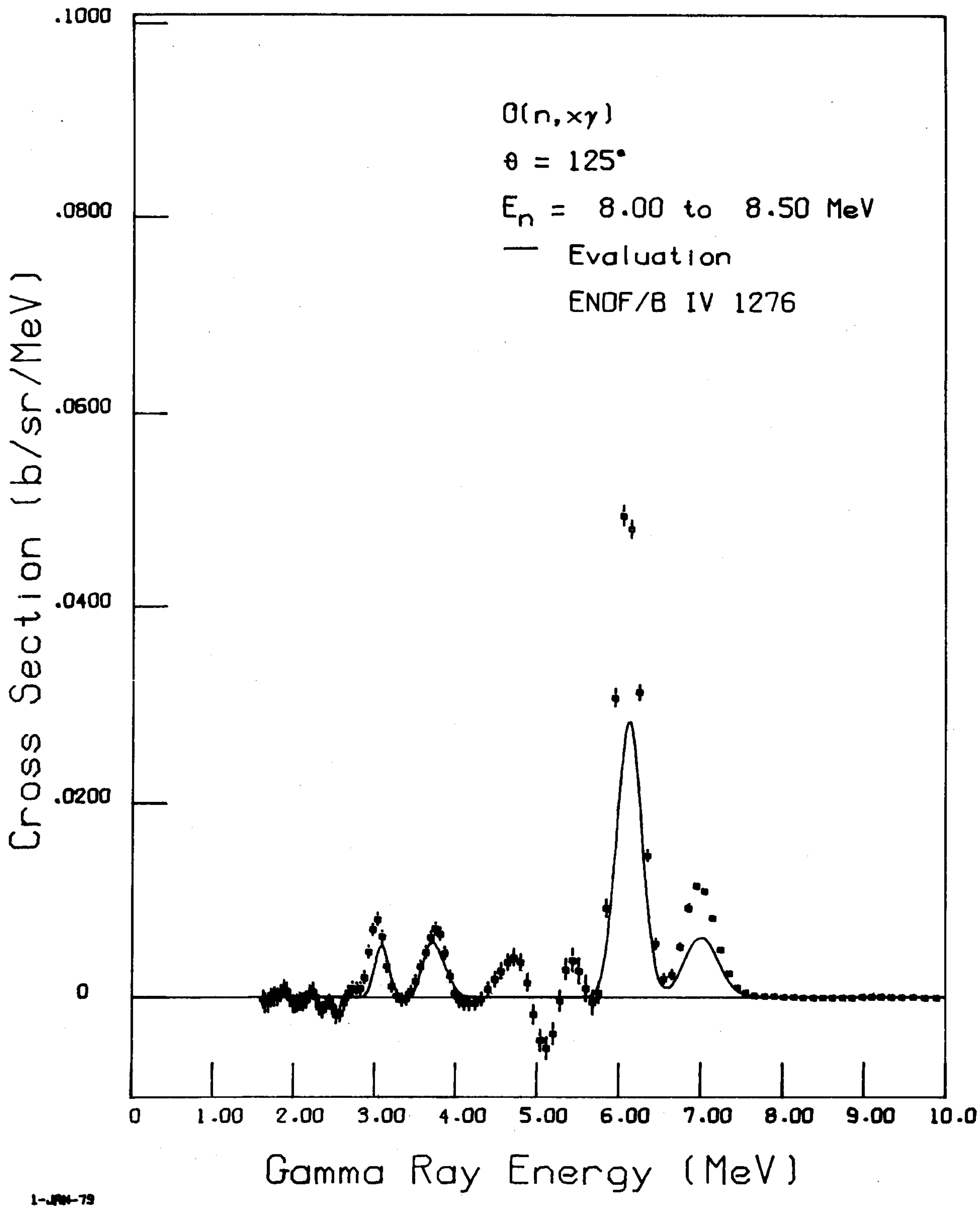
.0600
.0500
.0400
.0300
.0200
.0100
0
Cross Section (b/sr/MeV)
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 3



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.0800
.0600
.0400
.0200
0
Cross Section (b/sr/MeV)
O(n,xγ)
θ = 125°
En = 8.00 to 8.50 MeV
— Evaluation
ENDF/B IV 1276
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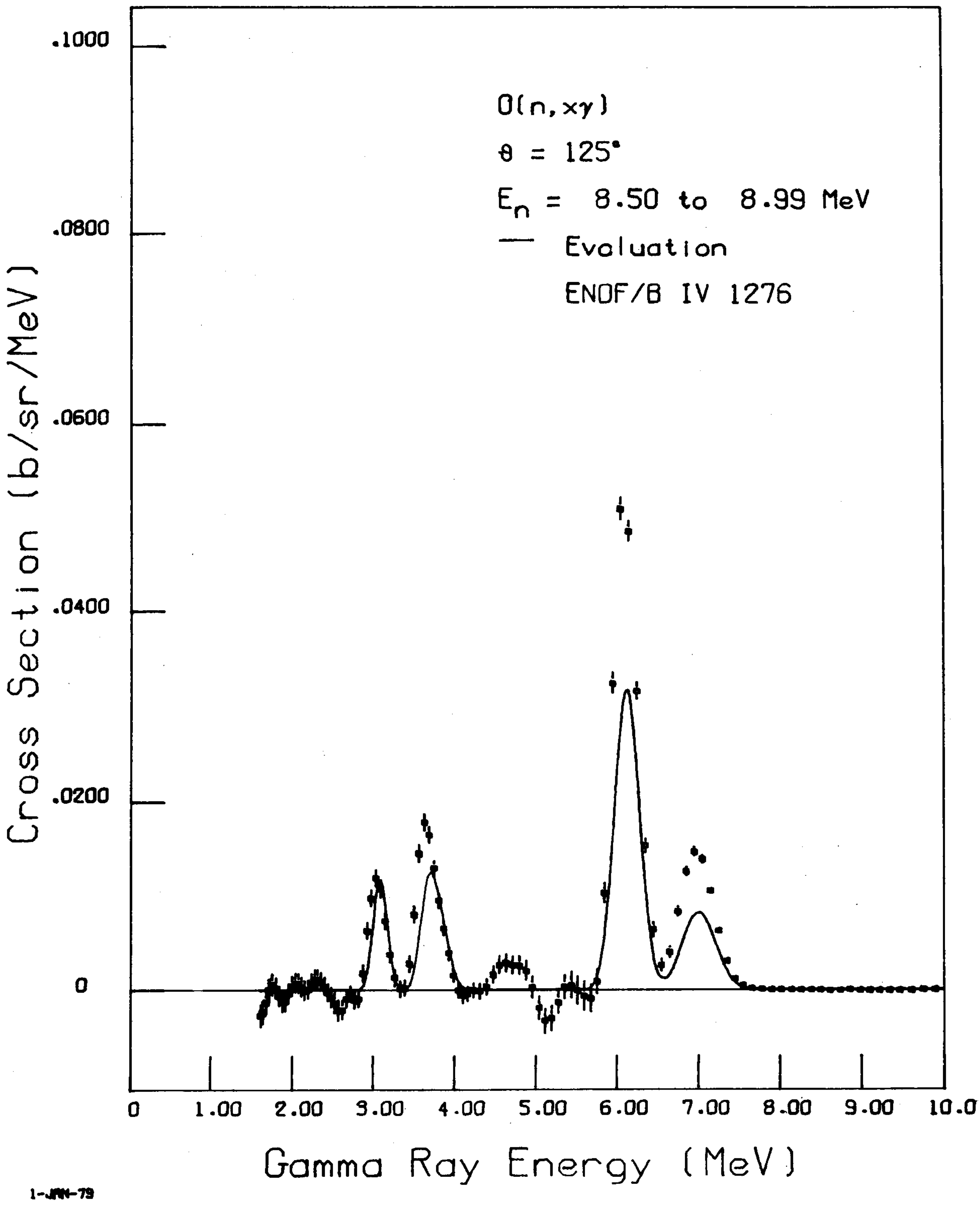
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 4



O(n,xγ)
θ = 125°
E_n = 8.50 to 8.99 MeV
— Evaluation
ENDF/B IV 1276
Cross Section (b/sr/MeV)
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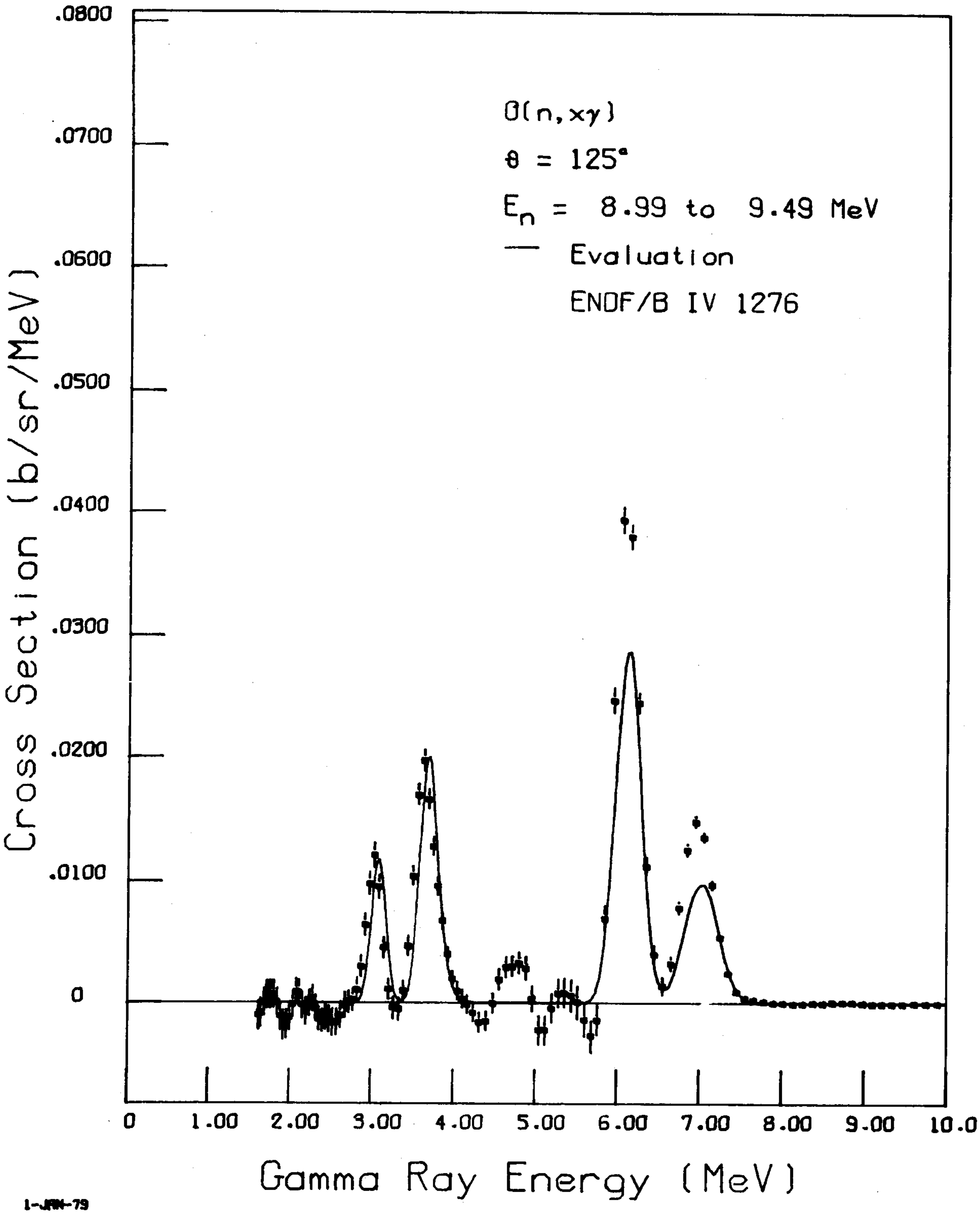
.0800
.0600
.0400
.0200
0
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 5



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— Evaluation
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Cross Section (b/sr/MeV)
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.0600
.0500
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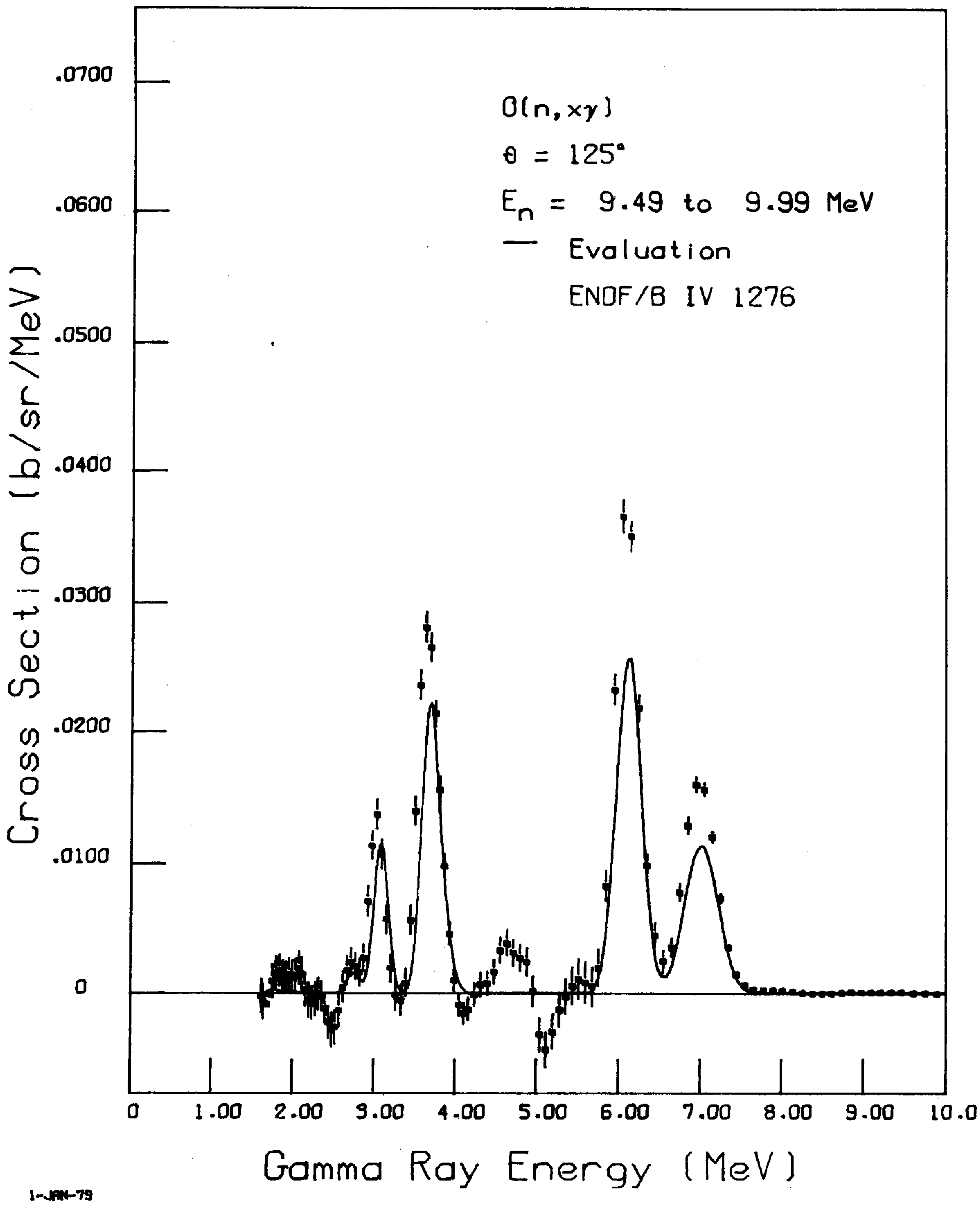
.0200
.0100
0
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 6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En = 9.49 to 9.99 MeV
— Evaluation
ENDF/B IV 1276
Cross Section (b/sr/MeV)
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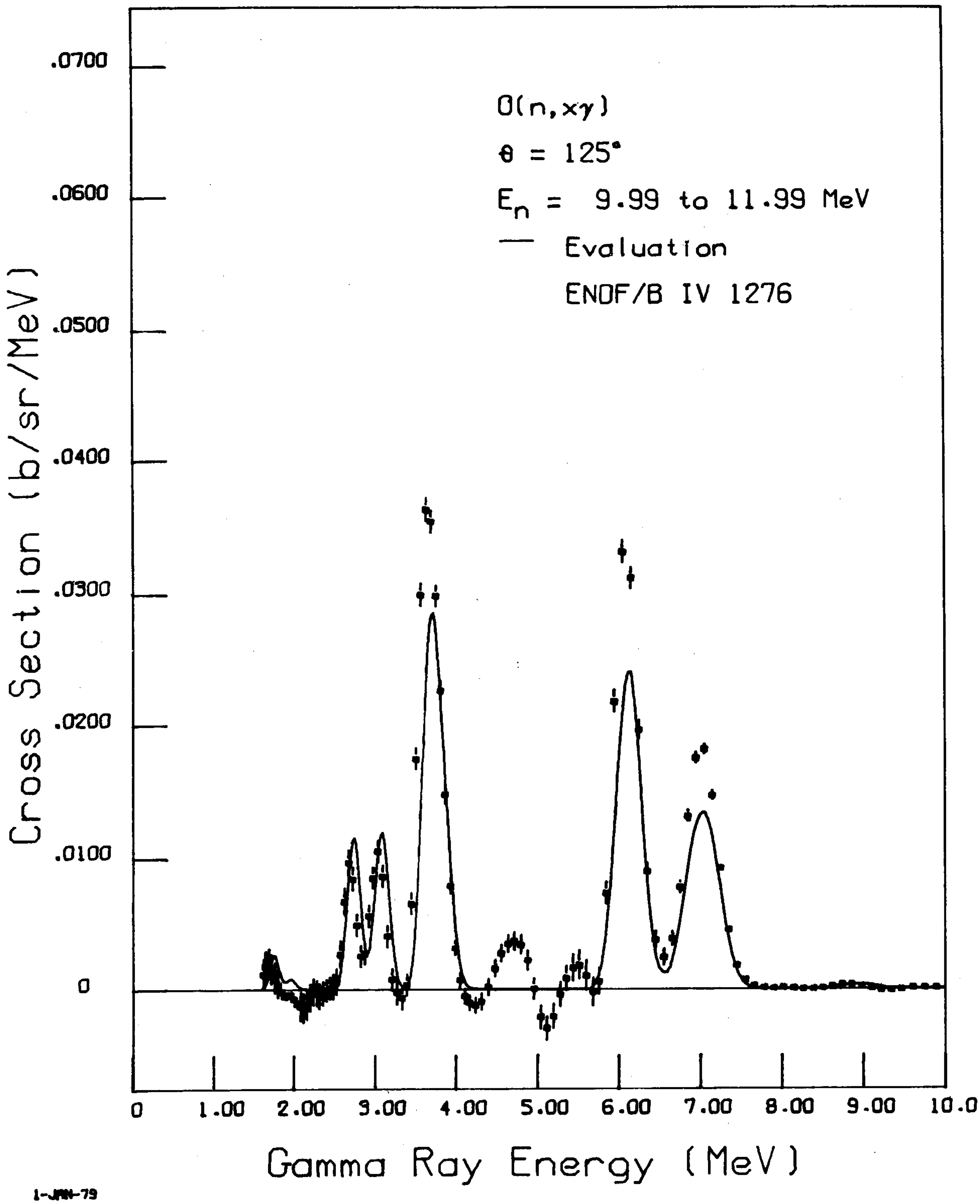
.0600
.0500
.0400
.0300
.0200
.0100
0
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 7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.0500
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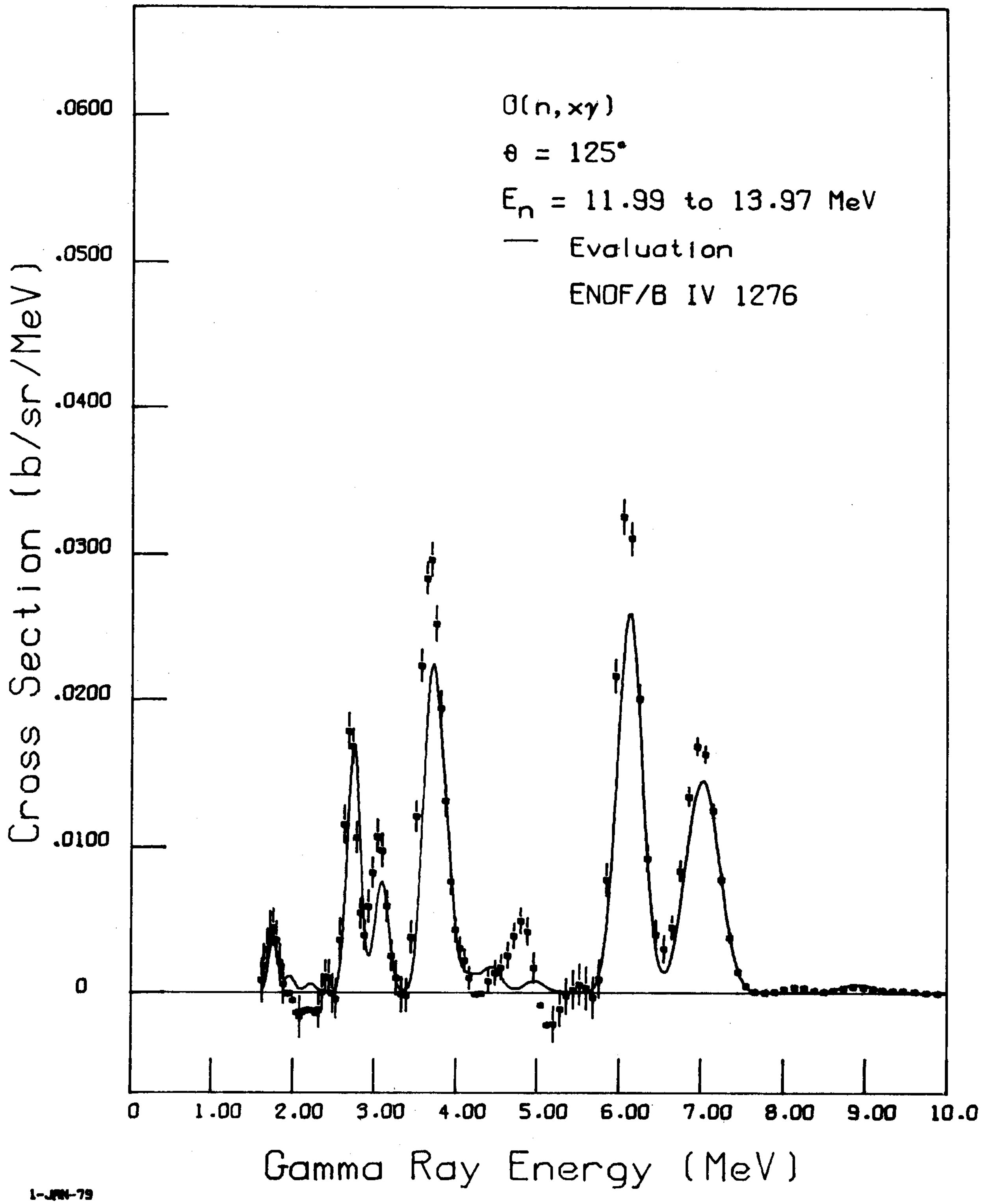
.0300
.0200
.0100
0
Cross Section (b/sr/MeV)
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 8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En = 11.99 to 13.97 MeV
Evaluation
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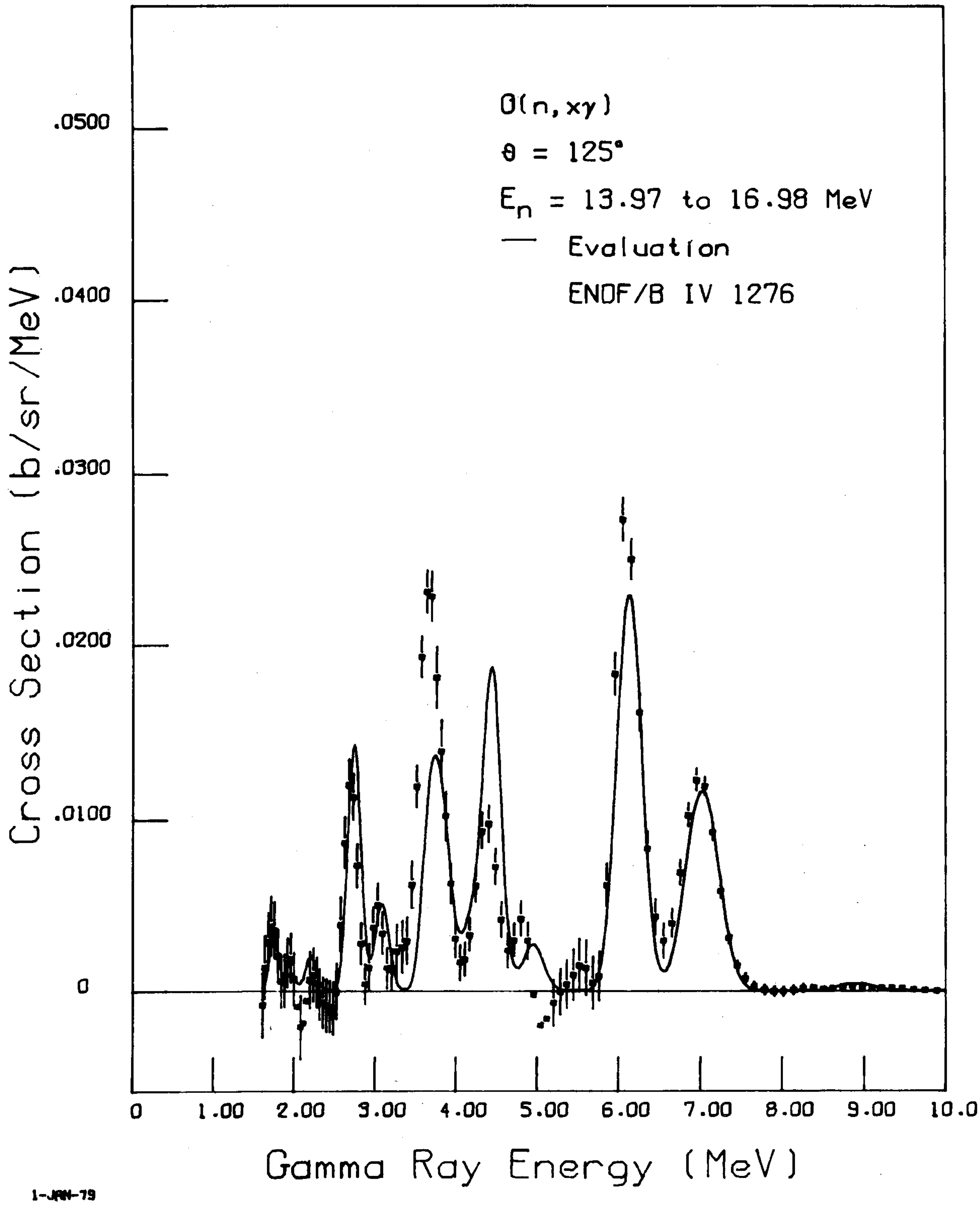
.0500
.0400
.0300
.0200
.0100
0
Cross Section (b/sr/MeV)
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 9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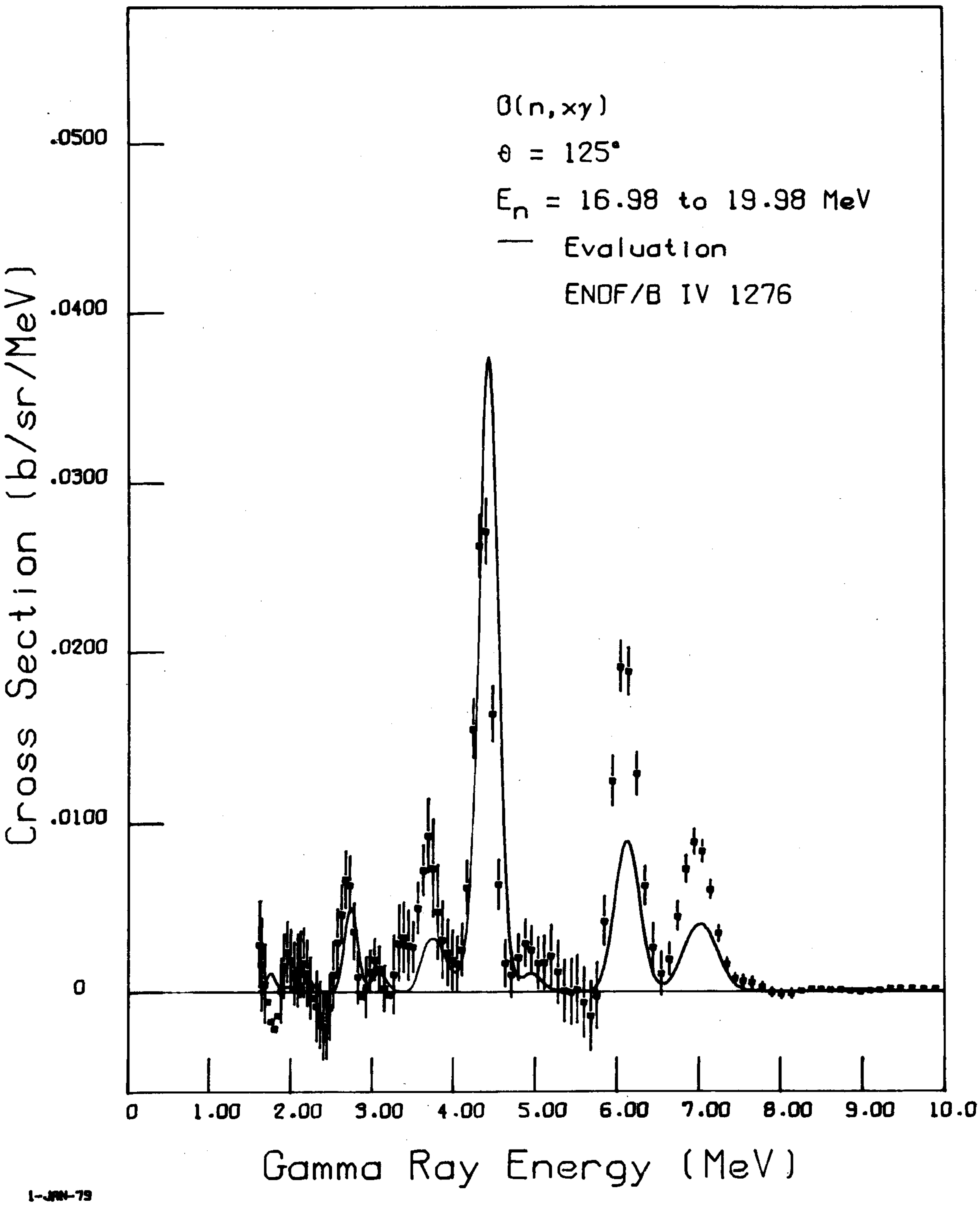
.0200
.0100
0
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 10


O(n,xγ)
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En = 16.98 to 19.98 MeV
Evaluation
ENDF/B IV 1276
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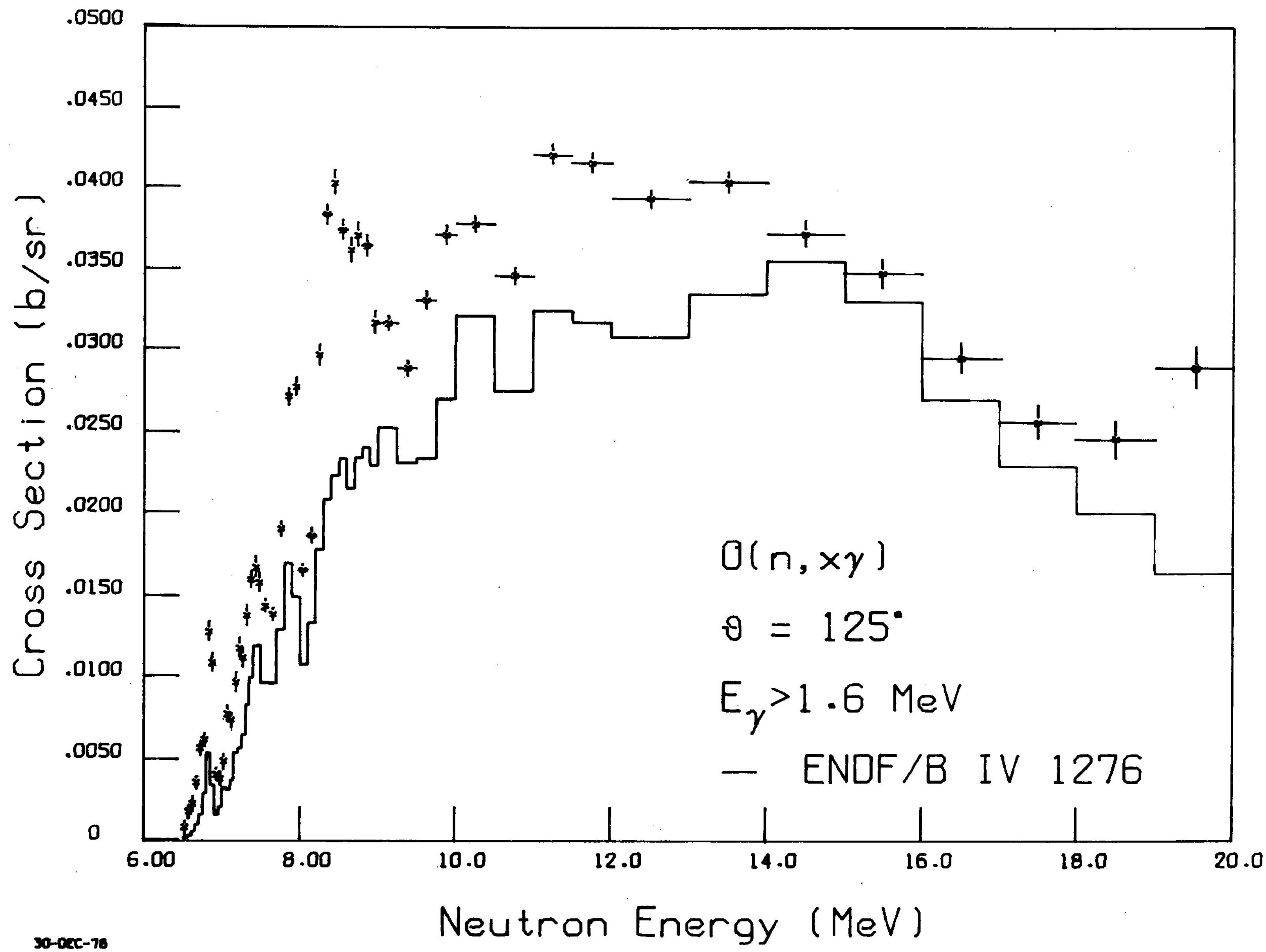
.0400
.0300
.0200
.0100
0
Cross Section (b/sr/MeV)
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.0
Gamma Ray Energy (MeV)
1-JAN-79

Figure 11



.0500
.0450
.0400
.0350
.0300
.0250
.0200
.0150
.0100
.0050
0
Cross Section (b/sr)
6.00
8.00
10.0
12.0
14.0
16.0
18.0
20.0
Neutron Energy (MeV)
O(n,xγ)
ϑ = 125°
Eγ>1.6 MeV
— ENDF/B IV 1276
30-DEC-78

Figure 12

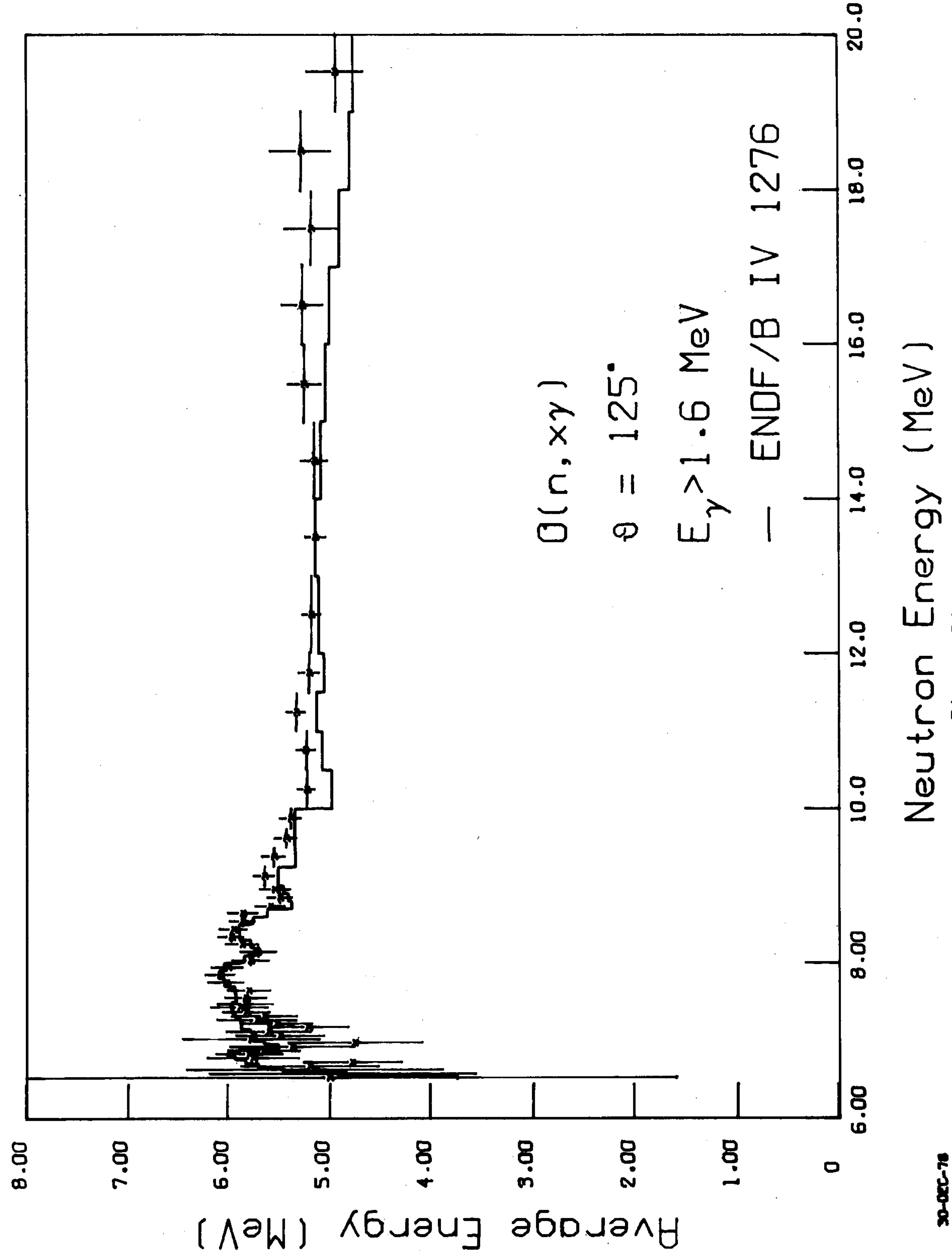

O(n,xγ)
ϑ = 125°
Eγ>1.6 MeV
— ENDF/B IV 1276
Neutron Energy (MeV)
Average Energy (MeV)
6.00
8.00
10.0
12.0
14.0
16.0
18.0
20.0
0
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
30-DEC-78

Figure 13

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 6.50 TO 6.99 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	3.762E-04	6.925E-04	3.390E 00	5.178E-04	3.048E-04	6.250E 00	6.856E-03	2.287E-04
1.645E 00	5.546E-04	6.856E-04	3.450E 00	3.710E-04	2.917E-04	6.350E 00	3.330E-03	1.602E-04
1.680E 00	8.326E-04	6.535E-04	3.510E 00	2.891E-04	2.775E-04	6.450E 00	1.255E-03	1.171E-04
1.720E 00	1.124E-03	6.383E-04	3.570E 00	2.074E-04	2.759E-04	6.550E 00	3.613E-04	8.498E-05
1.760E 00	1.128E-03	6.312E-04	3.630E 00	2.606E-05	2.847E-04	6.650E 00	8.851E-05	6.061E-05
1.800E 00	7.800E-04	6.111E-04	3.690E 00	-1.778E-04	-3.012E-04	6.750E 00	5.513E-06	5.719E-05
1.840E 00	3.941E-04	6.069E-04	3.750E 00	-2.459E-04	-3.364E-04	6.850E 00	-1.482E-05	6.629E-05
1.880E 00	3.205E-04	5.951E-04	3.810E 00	-1.748E-04	-3.616E-04	6.950E 00	-3.136E-05	6.179E-05
1.920E 00	5.454E-04	5.529E-04	3.870E 00	-6.104E-05	-3.389E-04	7.050E 00	-5.094E-05	4.429E-05
1.960E 00	7.481E-04	5.162E-04	3.930E 00	2.778E-05	3.082E-04	7.150E 00	-4.856E-05	3.919E-05
2.000E 00	6.382E-04	5.230E-04	3.990E 00	6.448E-05	2.977E-04	7.250E 00	-2.797E-05	3.758E-05
2.040E 00	3.214E-04	5.506E-04	4.050E 00	1.718E-04	3.005E-04	7.350E 00	1.004E-05	3.470E-05
2.080E 00	1.994E-04	5.693E-04	4.110E 00	4.354E-04	2.913E-04	7.450E 00	4.890E-05	3.388E-05
2.120E 00	5.258E-04	5.494E-04	4.170E 00	7.388E-04	2.824E-04	7.550E 00	5.926E-05	2.881E-05
2.160E 00	1.130E-03	5.099E-04	4.240E 00	8.093E-04	2.779E-04	7.660E 00	3.759E-05	2.318E-05
2.200E 00	1.589E-03	5.048E-04	4.320E 00	6.168E-04	2.912E-04	7.780E 00	4.497E-06	2.310E-05
2.240E 00	1.648E-03	5.147E-04	4.400E 00	6.246E-04	3.012E-04	7.900E 00	-1.480E-05	1.904E-05
2.280E 00	1.389E-03	4.914E-04	4.480E 00	7.610E-04	3.063E-04	8.020E 00	-1.084E-05	1.471E-05
2.320E 00	9.903E-04	4.421E-04	4.560E 00	7.765E-04	3.055E-04	8.140E 00	5.070E-06	1.198E-05
2.360E 00	6.356E-04	4.161E-04	4.640E 00	8.157E-04	2.892E-04	8.260E 00	1.558E-05	1.216E-05
2.400E 00	3.021E-04	3.896E-04	4.720E 00	9.526E-04	2.904E-04	8.380E 00	1.577E-05	1.103E-05
2.440E 00	-2.037E-04	3.966E-04	4.800E 00	9.083E-04	3.015E-04	8.500E 00	1.089E-05	9.529E-06
2.480E 00	-9.864E-04	4.900E-04	4.880E 00	5.021E-04	3.211E-04	8.620E 00	5.855E-06	8.815E-06
2.525E 00	-1.778E-03	6.229E-04	4.960E 00	-6.780E-05	3.410E-04	8.740E 00	1.765E-06	9.411E-06
2.575E 00	-2.013E-03	6.102E-04	5.040E 00	-3.745E-04	3.700E-04	8.860E 00	-2.279E-06	9.846E-06
2.625E 00	-1.313E-03	4.985E-04	5.120E 00	-3.023E-04	3.842E-04	8.980E 00	-6.941E-06	1.019E-05
2.675E 00	-3.153E-04	3.793E-04	5.200E 00	-4.715E-06	3.801E-04	9.100E 00	-1.050E-05	1.033E-05
2.725E 00	2.791E-04	3.296E-04	5.280E 00	3.321E-04	3.695E-04	9.220E 00	-8.814E-06	1.226E-05
2.775E 00	4.064E-04	3.201E-04	5.360E 00	5.503E-04	3.665E-04	9.340E 00	-3.821E-06	1.208E-05
2.825E 00	4.519E-04	3.039E-04	5.440E 00	5.613E-04	3.864E-04	9.470E 00	5.706E-06	1.023E-05
2.875E 00	5.448E-04	3.003E-04	5.520E 00	3.645E-04	4.099E-04	9.610E 00	1.656E-05	9.479E-06
2.925E 00	4.538E-04	3.042E-04	5.600E 00	-4.998E-05	4.306E-04	9.750E 00	2.427E-05	1.093E-05
2.975E 00	2.600E-04	2.933E-04	5.680E 00	-5.808E-04	4.070E-04	9.890E 00	2.477E-05	1.203E-05
3.030E 00	2.492E-04	2.827E-04	5.760E 00	-6.507E-04	3.588E-04	1.003E 01	2.256E-05	1.191E-05
3.090E 00	3.397E-04	2.489E-04	5.850E 00	1.060E-03	3.050E-04	1.017E 01	1.701E-05	1.045E-05
3.150E 00	3.179E-04	2.539E-04	5.950E 00	5.456E-03	3.056E-04	1.031E 01	1.329E-05	1.194E-05
3.210E 00	4.007E-04	2.858E-04	6.050E 00	9.602E-03	3.287E-04	1.045E 01	5.009E-06	1.274E-05
3.270E 00	6.121E-04	3.024E-04	6.150E 00	9.958E-03	3.035E-04	1.059E 01	4.373E-07	1.345E-05
3.330E 00	6.626E-04	3.100E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 6.99 TO 7.49 MEV. ANGLE = 125 DEGREES.

PHCTON ENERGY (MEV)	X-SECTION (E/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	1.277E-03	7.890E-04	3.390E 00	6.188E-04	4.046E-04	6.250E 00	1.591E-02	3.898E-04
1.645E 00	9.284E-04	7.800E-04	3.450E 00	5.204E-04	4.141E-04	6.350E 00	7.555E-03	2.409E-04
1.680E 00	5.790E-04	7.965E-04	3.510E 00	6.512E-04	3.815E-04	6.450E 00	2.891E-03	1.733E-04
1.720E 00	9.348E-04	7.850E-04	3.570E 00	5.623E-04	3.744E-04	6.550E 00	9.528E-04	1.406E-04
1.760E 00	1.485E-03	7.653E-04	3.630E 00	3.902E-05	3.930E-04	6.650E 00	4.006E-04	1.179E-04
1.800E 00	1.354E-03	7.466E-04	3.690E 00	-4.085E-04	-4.111E-04	6.750E 00	2.613E-04	1.141E-04
1.840E 00	7.645E-04	7.058E-04	3.750E 00	-3.531E-04	-4.470E-04	6.850E 00	2.267E-04	1.105E-04
1.880E 00	5.800E-04	6.874E-04	3.810E 00	4.164E-05	4.567E-04	6.950E 00	2.330E-04	1.010E-04
1.920E 0C	8.630E-04	6.595E-04	3.870E 00	3.314E-04	4.364E-04	7.050E 00	2.021E-04	8.580E-05
1.960E 00	8.617E-04	6.369E-04	3.930E 00	3.335E-04	4.188E-04	7.150E 00	1.243E-04	6.521E-05
2.000E 00	2.581E-04	6.560E-04	3.990E 00	1.656E-04	4.175E-04	7.250E 00	4.936E-05	5.048E-05
2.040E 00	-3.585E-04	6.928E-04	4.050E 00	1.661E-04	4.368E-04	7.350E 00	1.183E-05	4.720E-05
2.080E 00	-6.458E-04	7.451E-04	4.110E 00	4.255E-04	4.438E-04	7.450E 00	1.260E-05	4.084E-05
2.120E 00	-7.007E-04	7.422E-04	4.170E 00	7.483E-04	4.366E-04	7.550E 00	3.578E-05	4.064E-05
2.16CE 00	-4.655E-04	7.020E-04	4.240E 00	8.283E-04	4.372E-04	7.660E 00	5.431E-05	4.100E-05
2.200E 00	1.496E-04	6.711E-04	4.320E 00	6.976E-04	4.501E-04	7.780E 00	4.062E-05	3.540E-05
2.24CE 00	9.240E-04	6.010E-04	4.400E 00	7.275E-04	4.539E-04	7.900E 00	9.956E-06	2.859E-05
2.280E 00	1.503E-03	5.535E-04	4.480E 00	9.369E-04	4.741E-04	8.020E 00	-8.938E-06	2.493E-05
2.320E 00	1.604E-03	5.095E-04	4.560E 00	1.076E-03	4.865E-04	8.140E 00	-2.272E-05	2.606E-05
2.360E 00	1.256E-03	4.927E-04	4.640E 00	1.006E-03	5.006E-04	8.260E 00	-1.618E-05	2.571E-05
2.400E 00	8.079E-04	4.953E-04	4.720E 00	8.166E-04	4.903E-04	8.380E 00	-7.037E-07	2.134E-05
2.440E 00	5.785E-04	5.133E-04	4.800E 00	6.753E-04	4.956E-04	8.500E 00	1.396E-05	1.642E-05
2.480E 00	4.343E-04	5.400E-04	4.880E 00	5.120E-04	5.187E-04	8.620E 00	2.137E-05	1.451E-05
2.525E 0C	-9.361E-05	6.055E-04	4.960E 00	-2.086E-05	5.674E-04	8.740E 00	1.690E-05	1.467E-05
2.575E 00	-8.991E-04	6.493E-04	5.040E 00	-9.370E-04	6.338E-04	8.860E 00	4.688E-06	1.364E-05
2.625E 00	-7.606E-04	5.979E-04	5.120E 00	-1.516E-03	6.559E-04	8.980E 00	-6.986E-06	1.174E-05
2.675E 00	3.984E-04	5.114E-04	5.200E 00	-9.552E-04	6.412E-04	9.100E 00	-1.377E-05	1.116E-05
2.725E 00	1.179E-03	4.325E-04	5.280E 00	4.382E-04	6.146E-04	9.220E 00	-1.536E-05	1.218E-05
2.775E 0C	1.009E-03	4.328E-04	5.360E 00	1.506E-03	6.097E-04	9.340E 00	-1.288E-05	1.110E-05
2.825E 00	6.042E-04	4.543E-04	5.440E 00	1.665E-03	6.586E-04	9.470E 00	-8.243E-06	9.278E-06
2.875E 00	6.405E-04	4.435E-04	5.520E 00	1.374E-03	7.187E-04	9.610E 00	-9.089E-07	9.231E-06
2.925E 00	1.206E-03	4.306E-04	5.600E 00	9.139E-04	7.409E-04	9.750E 00	7.513E-06	1.201E-05
2.975E 00	1.767E-03	4.192E-04	5.680E 00	2.001E-04	7.000E-04	9.890E 00	1.661E-05	1.212E-05
3.030E 0C	1.929E-03	4.208E-04	5.760E 00	2.321E-04	6.048E-04	1.003E 01	2.403E-05	1.260E-05
3.090E 00	1.285E-03	4.214E-04	5.850E 00	4.202E-03	4.912E-04	1.017E 01	2.769E-05	1.267E-05
3.150E 00	6.387E-04	4.020E-04	5.950E 00	1.477E-02	4.928E-04	1.031E 01	2.820E-05	1.159E-05
3.210E 00	6.275E-04	3.946E-04	6.050E 00	2.422E-02	5.452E-04	1.045E 01	2.439E-05	1.274E-05
3.270E 00	9.855E-04	4.200E-04	6.150E 00	2.398E-02	5.290E-04	1.059E 01	1.809E-05	1.451E-05
3.330E 0C	9.544E-04	4.148E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 7.49 TO 8.00 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	6.495E-04	8.264E-04	3.390E 00	4.046E-04	5.058E-04	6.250E 00	2.389E-02	5.792E-04
1.645E 00	2.897E-04	8.718E-04	3.450E 00	-1.874E-05	5.270E-04	6.350E 00	1.153E-02	4.528E-04
1.680E 00	-9.598E-05	8.899E-04	3.510E 00	-1.379E-04	-4.743E-04	6.450E 00	4.842E-03	4.183E-04
1.720E 00	1.901E-04	8.619E-04	3.570E 00	1.397E-04	4.832E-04	6.550E 00	2.035E-03	3.733E-04
1.760E 00	8.583E-04	8.214E-04	3.630E 00	5.052E-04	4.755E-04	6.650E 00	2.344E-03	3.309E-04
1.800E 00	7.916E-04	7.927E-04	3.690E 00	7.045E-04	4.939E-04	6.750E 00	4.622E-03	3.108E-04
1.840E 00	2.701E-05	7.850E-04	3.750E 00	7.509E-04	5.265E-04	6.850E 00	6.970E-03	3.008E-04
1.880E 00	-3.202E-04	7.939E-04	3.810E 00	7.443E-04	5.448E-04	6.950E 00	7.488E-03	2.760E-04
1.920E 00	1.320E-04	7.743E-04	3.870E 00	7.201E-04	5.436E-04	7.050E 00	6.006E-03	2.279E-04
1.960E 00	7.175E-04	7.430E-04	3.930E 00	7.972E-04	5.324E-04	7.150E 00	3.788E-03	1.690E-04
2.000E 00	6.478E-04	7.283E-04	3.990E 00	9.487E-04	5.185E-04	7.250E 00	1.973E-03	1.200E-04
2.040E 00	7.510E-05	7.573E-04	4.050E 00	1.054E-03	5.415E-04	7.350E 00	8.856E-04	8.205E-05
2.080E 00	-2.452E-04	8.012E-04	4.110E 00	7.886E-04	5.586E-04	7.450E 00	3.613E-04	5.762E-05
2.120E 00	6.569E-05	7.934E-04	4.170E 00	5.415E-04	5.501E-04	7.550E 00	1.467E-04	4.492E-05
2.160E 00	6.401E-04	7.776E-04	4.240E 00	5.350E-04	5.700E-04	7.660E 00	5.194E-05	3.610E-05
2.200E 00	9.992E-04	7.715E-04	4.320E 00	5.320E-04	5.940E-04	7.780E 00	1.933E-06	3.448E-05
2.240E 00	1.052E-03	7.238E-04	4.400E 00	4.482E-04	6.094E-04	7.900E 00	-2.464E-05	3.061E-05
2.280E 00	8.830E-04	6.950E-04	4.480E 00	1.073E-03	6.292E-04	8.020E 00	-2.783E-05	2.449E-05
2.320E 00	6.549E-04	6.667E-04	4.560E 00	2.102E-03	6.230E-04	8.140E 00	-1.939E-05	1.970E-05
2.360E 00	5.360E-04	6.016E-04	4.640E 00	2.563E-03	6.557E-04	8.260E 00	-3.497E-06	1.882E-05
2.400E 00	3.761E-04	5.899E-04	4.720E 00	2.399E-03	6.560E-04	8.380E 00	6.431E-06	1.342E-05
2.440E 00	-1.497E-04	6.187E-04	4.800E 00	1.925E-03	6.883E-04	8.500E 00	1.761E-05	1.072E-05
2.480E 00	-1.038E-03	6.567E-04	4.880E 00	9.808E-04	7.110E-04	8.620E 00	2.615E-05	1.021E-05
2.525E 00	-1.866E-03	7.264E-04	4.960E 00	-6.140E-04	7.734E-04	8.740E 00	2.716E-05	9.654E-06
2.575E 00	-1.961E-03	7.263E-04	5.040E 00	-2.099E-03	8.769E-04	8.860E 00	1.795E-05	8.361E-06
2.625E 00	-1.361E-03	6.617E-04	5.120E 00	-2.409E-03	8.948E-04	8.980E 00	4.141E-06	6.958E-06
2.675E 00	-5.618E-04	5.978E-04	5.200E 00	-1.444E-03	8.934E-04	9.100E 00	-6.870E-06	6.612E-06
2.725E 00	-4.858E-06	5.504E-04	5.280E 00	1.603E-04	8.713E-04	9.220E 00	-1.355E-05	7.365E-06
2.775E 00	1.962E-04	5.269E-04	5.360E 00	1.692E-03	8.572E-04	9.340E 00	-1.525E-05	7.459E-06
2.825E 00	3.441E-04	5.144E-04	5.440E 00	2.326E-03	9.180E-04	9.470E 00	-1.137E-05	7.921E-06
2.875E 00	7.967E-04	4.958E-04	5.520E 00	1.643E-03	1.009E-03	9.610E 00	-4.341E-06	8.725E-06
2.925E 00	1.771E-03	5.050E-04	5.600E 00	1.317E-04	1.044E-03	9.750E 00	7.837E-06	1.046E-05
2.975E 00	2.869E-03	4.914E-04	5.680E 00	-1.191E-03	9.721E-04	9.890E 00	2.256E-05	1.135E-05
3.030E 00	3.553E-03	4.946E-04	5.760E 00	-5.130E-04	8.800E-04	1.003E 01	3.320E-05	1.101E-05
3.090E 00	2.746E-03	4.870E-04	5.850E 00	5.969E-03	7.123E-04	1.017E 01	3.702E-05	9.916E-06
3.150E 00	1.399E-03	4.598E-04	5.950E 00	2.155E-02	7.211E-04	1.031E 01	3.396E-05	9.999E-06
3.210E 00	8.040E-04	4.474E-04	6.050E 00	3.554E-02	7.750E-04	1.045E 01	2.443E-05	1.473E-05
3.270E 00	8.666E-04	5.138E-04	6.150E 00	3.556E-02	7.194E-04	1.059E 01	1.525E-05	1.538E-05
3.330E 00	7.865E-04	5.243E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 8.00 TO 8.50 MEV. ANGLE = 125 DEGREES.

PHCTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	-2.103E-04	1.001E-03	3.390E 00	-6.787E-05	7.208E-04	6.250E 00	3.127E-02	8.253E-04
1.645E 00	-6.002E-04	1.094E-03	3.450E 00	6.291E-04	6.886E-04	6.350E 00	1.456E-02	6.637E-04
1.680E 00	-5.234E-04	1.076E-03	3.510E 00	1.731E-03	6.505E-04	6.450E 00	5.514E-03	6.409E-04
1.720E 00	-5.441E-05	1.027E-03	3.570E 00	3.218E-03	6.800E-04	6.550E 00	1.906E-03	5.795E-04
1.760E 00	2.503E-05	1.021E-03	3.630E 00	4.711E-03	6.975E-04	6.650E 00	2.354E-03	4.723E-04
1.800E 00	3.477E-05	9.670E-04	3.690E 00	6.204E-03	6.985E-04	6.750E 00	5.241E-03	4.353E-04
1.840E 00	4.516E-04	9.153E-04	3.750E 00	7.093E-03	7.020E-04	6.850E 00	9.178E-03	4.281E-04
1.880E 00	9.534E-04	9.112E-04	3.810E 00	6.582E-03	7.198E-04	6.950E 00	1.145E-02	3.972E-04
1.920E 00	7.622E-04	9.043E-04	3.870E 00	4.582E-03	6.949E-04	7.050E 00	1.094E-02	3.518E-04
1.960E 00	-8.483E-05	9.222E-04	3.930E 00	2.204E-03	6.783E-04	7.150E 00	8.176E-03	2.797E-04
2.000E 00	-6.794E-04	9.348E-04	3.990E 00	4.883E-04	6.900E-04	7.250E 00	4.914E-03	2.022E-04
2.040E 00	-5.893E-04	9.296E-04	4.050E 00	-3.246E-04	7.263E-04	7.350E 00	2.439E-03	1.350E-04
2.080E 00	-4.386E-04	9.345E-04	4.110E 00	-5.985E-04	7.375E-04	7.450E 00	1.036E-03	8.625E-05
2.120E 00	-4.839E-04	9.467E-04	4.170E 00	-6.194E-04	7.338E-04	7.550E 00	4.285E-04	6.839E-05
2.160E 00	-2.373E-04	9.138E-04	4.240E 00	-5.561E-04	7.437E-04	7.660E 00	1.637E-04	5.799E-05
2.200E 00	3.817E-04	9.147E-04	4.320E 00	-1.454E-04	7.472E-04	7.780E 00	8.935E-05	4.701E-05
2.240E 00	6.927E-04	8.780E-04	4.400E 00	8.595E-04	7.706E-04	7.900E 00	7.514E-05	4.528E-05
2.280E 00	5.589E-05	8.413E-04	4.480E 00	1.915E-03	8.239E-04	8.020E 00	5.805E-05	4.382E-05
2.320E 00	-1.002E-03	8.399E-04	4.560E 00	2.749E-03	8.624E-04	8.140E 00	2.824E-05	3.442E-05
2.360E 00	-1.290E-03	8.148E-04	4.640E 00	3.643E-03	8.751E-04	8.260E 00	-4.823E-07	2.875E-05
2.400E 00	-7.118E-04	7.592E-04	4.720E 00	4.151E-03	8.522E-04	8.380E 00	-1.998E-05	2.422E-05
2.440E 00	-3.643E-04	7.578E-04	4.800E 00	3.632E-03	8.929E-04	8.500E 00	-2.362E-05	2.087E-05
2.480E 00	-9.426E-04	8.380E-04	4.880E 00	1.522E-03	9.311E-04	8.620E 00	-1.774E-05	1.572E-05
2.525E 00	-1.811E-03	9.275E-04	4.960E 00	-1.751E-03	1.062E-03	8.740E 00	-8.760E-06	1.304E-05
2.575E 00	-1.640E-03	8.979E-04	5.040E 00	-4.394E-03	1.181E-03	8.860E 00	7.494E-07	1.204E-05
2.625E 00	-4.897E-04	8.189E-04	5.120E 00	-5.208E-03	1.195E-03	8.980E 00	7.455E-06	1.128E-05
2.675E 00	5.242E-04	7.420E-04	5.200E 00	-3.740E-03	1.181E-03	9.100E 00	9.895E-06	1.037E-05
2.725E 00	9.940E-04	6.910E-04	5.280E 00	-3.245E-04	1.149E-03	9.220E 00	8.870E-06	9.065E-06
2.775E 00	9.590E-04	6.619E-04	5.360E 00	2.904E-03	1.143E-03	9.340E 00	6.692E-06	8.993E-06
2.825E 00	9.971E-04	6.815E-04	5.440E 00	3.870E-03	1.245E-03	9.470E 00	5.022E-06	9.349E-06
2.875E 00	2.146E-03	6.912E-04	5.520E 00	2.744E-03	1.354E-03	9.610E 00	4.087E-06	9.746E-06
2.925E 00	4.726E-03	6.924E-04	5.600E 00	9.129E-04	1.393E-03	9.750E 00	3.017E-06	1.267E-05
2.975E 00	7.011E-03	6.906E-04	5.680E 00	-4.957E-04	1.308E-03	9.890E 00	2.585E-06	1.311E-05
3.030E 00	8.114E-03	7.280E-04	5.760E 00	5.232E-04	1.207E-03	1.003E 01	6.398E-06	1.141E-05
3.090E 00	6.261E-03	7.125E-04	5.850E 00	9.213E-03	9.846E-04	1.017E 01	1.215E-05	1.060E-05
3.150E 00	3.223E-03	6.760E-04	5.950E 00	3.073E-02	1.014E-03	1.031E 01	1.913E-05	1.129E-05
3.210E 00	1.152E-03	6.335E-04	6.050E 00	4.937E-02	1.088E-03	1.045E 01	2.389E-05	1.469E-05
3.270E 00	1.971E-04	6.887E-04	6.150E 00	4.796E-02	1.011E-03	1.059E 01	2.317E-05	1.497E-05
3.330E 00	-2.227E-04	7.251E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 8.50 TO 8.99 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	-2.732E-03	1.255E-03	3.390E 00	2.657E-04	8.868E-04	6.250E 00	3.155E-02	9.652E-04
1.645E 00	-2.374E-03	1.279E-03	3.450E 00	2.812E-03	9.153E-04	6.350E 00	1.527E-02	8.262E-04
1.680E 00	-1.283E-03	1.239E-03	3.510E 00	8.064E-03	9.019E-04	6.450E 00	6.396E-03	8.177E-04
1.720E 00	6.038E-05	1.199E-03	3.570E 00	1.448E-02	9.509E-04	6.550E 00	2.643E-03	7.629E-04
1.760E 00	6.019E-04	1.206E-03	3.630E 00	1.779E-02	9.609E-04	6.650E 00	4.027E-03	6.341E-04
1.800E 00	2.246E-04	1.187E-03	3.690E 00	1.644E-02	9.125E-04	6.750E 00	8.378E-03	5.736E-04
1.840E 00	-5.942E-04	1.146E-03	3.750E 00	1.289E-02	8.741E-04	6.850E 00	1.257E-02	5.391E-04
1.880E 00	-1.242E-03	1.127E-03	3.810E 00	9.494E-03	8.561E-04	6.950E 00	1.467E-02	4.992E-04
1.920E 00	-1.161E-03	1.131E-03	3.870E 00	6.566E-03	8.199E-04	7.050E 00	1.384E-02	4.341E-04
1.960E 00	-3.265E-04	1.126E-03	3.930E 00	3.898E-03	7.881E-04	7.150E 00	1.047E-02	3.483E-04
2.000E 00	4.445E-04	1.103E-03	3.990E 00	1.564E-03	7.601E-04	7.250E 00	6.296E-03	2.451E-04
2.040E 00	7.757E-04	1.110E-03	4.050E 00	-1.687E-05	8.145E-04	7.350E 00	3.018E-03	1.576E-04
2.080E 00	7.496E-04	1.124E-03	4.110E 00	-6.270E-04	8.415E-04	7.450E 00	1.184E-03	1.024E-04
2.120E 00	3.785E-04	1.092E-03	4.170E 00	-3.576E-04	8.273E-04	7.550E 00	4.738E-04	8.077E-05
2.160E 00	-3.048E-05	1.122E-03	4.240E 00	1.223E-05	8.406E-04	7.660E 00	2.048E-04	6.518E-05
2.200E 00	1.187E-04	1.098E-03	4.320E 00	-8.302E-05	8.681E-04	7.780E 00	1.215E-04	5.813E-05
2.240E 00	7.622E-04	1.044E-03	4.400E 00	3.659E-04	9.071E-04	7.900E 00	5.581E-05	4.292E-05
2.280E 00	1.202E-03	1.062E-03	4.480E 00	1.683E-03	9.170E-04	8.020E 00	1.541E-05	3.539E-05
2.320E 00	1.208E-03	1.074E-03	4.560E 00	2.699E-03	9.680E-04	8.140E 00	3.988E-06	3.302E-05
2.360E 00	9.610E-04	1.040E-03	4.640E 00	2.880E-03	1.020E-03	8.260E 00	9.656E-06	3.388E-05
2.400E 00	4.152E-04	9.636E-04	4.720E 00	2.685E-03	9.969E-04	8.380E 00	1.058E-05	3.251E-05
2.440E 00	-2.528E-04	1.009E-03	4.800E 00	2.647E-03	1.058E-03	8.500E 00	6.106E-06	2.720E-05
2.480E 00	-8.111E-04	1.116E-03	4.880E 00	2.064E-03	1.116E-03	8.620E 00	3.740E-07	1.905E-05
2.525E 00	-1.396E-03	1.121E-03	4.960E 00	3.216E-04	1.215E-03	8.740E 00	1.369E-06	1.553E-05
2.575E 00	-2.147E-03	1.158E-03	5.040E 00	-1.861E-03	1.344E-03	8.860E 00	3.568E-06	1.558E-05
2.625E 00	-2.076E-03	1.107E-03	5.120E 00	-3.277E-03	1.380E-03	8.980E 00	3.208E-06	1.469E-05
2.675E 00	-9.131E-04	1.012E-03	5.200E 00	-3.004E-03	1.363E-03	9.100E 00	3.689E-07	1.354E-05
2.725E 00	-3.615E-04	8.997E-04	5.280E 00	-1.227E-03	1.325E-03	9.220E 00	-3.600E-06	1.363E-05
2.775E 00	-1.046E-03	9.243E-04	5.360E 00	3.725E-04	1.338E-03	9.340E 00	-5.327E-06	1.498E-05
2.825E 00	-8.725E-04	9.517E-04	5.440E 00	5.732E-04	1.466E-03	9.470E 00	-4.163E-06	1.626E-05
2.875E 00	1.857E-03	9.122E-04	5.520E 00	-5.674E-05	1.586E-03	9.610E 00	-2.767E-07	1.690E-05
2.925E 00	6.347E-03	9.252E-04	5.600E 00	-6.217E-04	1.632E-03	9.750E 00	5.659E-06	1.815E-05
2.975E 00	9.785E-03	9.218E-04	5.680E 00	-8.601E-04	1.517E-03	9.890E 00	1.447E-05	2.036E-05
3.030E 00	1.189E-02	9.892E-04	5.760E 00	9.672E-04	1.399E-03	1.003E 01	2.467E-05	2.235E-05
3.090E 00	1.071E-02	9.826E-04	5.850E 00	1.027E-02	1.153E-03	1.017E 01	3.409E-05	2.068E-05
3.150E 00	7.364E-03	9.174E-04	5.950E 00	3.243E-02	1.180E-03	1.031E 01	3.851E-05	1.874E-05
3.210E 00	3.762E-03	8.747E-04	6.050E 00	5.082E-02	1.257E-03	1.045E 01	2.976E-05	2.611E-05
3.270E 00	1.299E-03	9.641E-04	6.150E 00	4.848E-02	1.159E-03	1.059E 01	2.043E-05	2.667E-05
3.330E 00	8.077E-05	9.309E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 8.99 TO 9.49 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	-1.030E-03	1.228E-03	3.390E 00	1.012E-03	9.046E-04	6.250E 00	2.446E-02	8.992E-04
1.645E 00	-8.033E-04	1.217E-03	3.450E 00	4.701E-03	8.807E-04	6.350E 00	1.115E-02	7.860E-04
1.680E 00	7.274E-05	1.190E-03	3.510E 00	1.040E-02	8.584E-04	6.450E 00	3.967E-03	8.067E-04
1.720E 00	6.883E-04	1.204E-03	3.570E 00	1.700E-02	9.192E-04	6.550E 00	1.389E-03	7.284E-04
1.760E 00	7.140E-04	1.222E-03	3.630E 00	1.977E-02	9.526E-04	6.650E 00	3.276E-03	6.105E-04
1.800E 00	7.088E-04	1.171E-03	3.690E 00	1.662E-02	8.732E-04	6.750E 00	7.813E-03	5.617E-04
1.840E 00	1.088E-04	1.152E-03	3.750E 00	1.279E-02	8.250E-04	6.850E 00	1.255E-02	5.364E-04
1.880E 00	-1.076E-03	1.242E-03	3.810E 00	9.539E-03	8.028E-04	6.950E 00	1.482E-02	4.920E-04
1.920E 00	-1.821E-03	1.273E-03	3.870E 00	6.679E-03	7.535E-04	7.050E 00	1.356E-02	4.230E-04
1.960E 00	-1.722E-03	1.232E-03	3.930E 00	3.972E-03	7.022E-04	7.150E 00	9.651E-03	3.360E-04
2.000E 00	-1.153E-03	1.173E-03	3.990E 00	1.954E-03	6.838E-04	7.250E 00	5.394E-03	2.558E-04
2.040E 00	-9.579E-05	1.124E-03	4.050E 00	9.732E-04	7.554E-04	7.350E 00	2.425E-03	1.803E-04
2.080E 00	9.470E-04	1.091E-03	4.110E 00	3.104E-04	7.789E-04	7.450E 00	9.456E-04	1.323E-04
2.120E 00	9.117E-04	1.084E-03	4.170E 00	-1.389E-04	7.646E-04	7.550E 00	4.308E-04	1.088E-04
2.160E 00	-1.481E-04	1.130E-03	4.240E 00	-7.898E-04	7.885E-04	7.660E 00	2.401E-04	9.180E-05
2.200E 00	-7.076E-04	1.162E-03	4.320E 00	-1.571E-03	8.479E-04	7.780E 00	1.409E-04	7.750E-05
2.240E 00	-3.784E-05	1.110E-03	4.400E 00	-1.455E-03	8.534E-04	7.900E 00	5.670E-05	7.056E-05
2.280E 00	4.207E-04	1.107E-03	4.480E 00	1.239E-05	8.685E-04	8.020E 00	3.330E-06	6.549E-05
2.320E 00	-3.638E-04	1.075E-03	4.560E 00	1.950E-03	9.008E-04	8.140E 00	-1.160E-05	5.698E-05
2.360E 00	-1.283E-03	1.010E-03	4.640E 00	2.952E-03	9.105E-04	8.260E 00	-5.635E-07	5.309E-05
2.400E 00	-1.407E-03	1.018E-03	4.720E 00	3.025E-03	9.038E-04	8.380E 00	1.750E-05	4.885E-05
2.440E 00	-1.185E-03	1.078E-03	4.800E 00	3.309E-03	9.536E-04	8.500E 00	4.345E-05	4.476E-05
2.480E 00	-1.306E-03	1.147E-03	4.880E 00	2.857E-03	9.958E-04	8.620E 00	7.615E-05	3.933E-05
2.525E 00	-1.588E-03	1.157E-03	4.960E 00	3.511E-04	1.109E-03	8.740E 00	8.745E-05	3.719E-05
2.575E 00	-1.552E-03	1.124E-03	5.040E 00	-2.218E-03	1.229E-03	8.860E 00	6.801E-05	3.780E-05
2.625E 00	-9.710E-04	1.114E-03	5.120E 00	-2.219E-03	1.243E-03	8.980E 00	2.315E-05	3.152E-05
2.675E 00	-1.795E-04	1.088E-03	5.200E 00	-3.919E-04	1.225E-03	9.100E 00	-1.562E-05	2.564E-05
2.725E 00	1.238E-04	9.834E-04	5.280E 00	8.012E-04	1.223E-03	9.220E 00	-3.094E-05	2.295E-05
2.775E 00	2.925E-04	9.749E-04	5.360E 00	8.405E-04	1.254E-03	9.340E 00	-2.560E-05	2.217E-05
2.825E 00	1.157E-03	1.001E-03	5.440E 00	6.257E-04	1.352E-03	9.470E 00	-9.832E-06	1.930E-05
2.875E 00	3.049E-03	9.424E-04	5.520E 00	6.420E-05	1.434E-03	9.610E 00	8.485E-06	1.744E-05
2.925E 00	6.412E-03	9.760E-04	5.600E 00	-1.377E-03	1.445E-03	9.750E 00	2.582E-05	1.913E-05
2.975E 00	9.775E-03	1.006E-03	5.680E 00	-2.710E-03	1.368E-03	9.890E 00	4.227E-05	2.151E-05
3.030E 00	1.208E-02	1.071E-03	5.760E 00	-1.348E-03	1.272E-03	1.003E 01	5.524E-05	2.243E-05
3.090E 00	9.474E-03	1.023E-03	5.850E 00	6.949E-03	1.074E-03	1.017E 01	6.015E-05	2.191E-05
3.150E 00	4.519E-03	9.154E-04	5.950E 00	2.470E-02	1.100E-03	1.031E 01	5.568E-05	2.109E-05
3.210E 00	1.141E-03	8.950E-04	6.050E 00	3.934E-02	1.118E-03	1.045E 01	4.098E-05	2.408E-05
3.270E 00	-3.687E-04	9.824E-04	6.150E 00	3.796E-02	1.046E-03	1.059E 01	2.489E-05	2.651E-05
3.330E 00	-4.848E-04	9.768E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 9.49 TO 9.99 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	-2.166E-04	1.383E-03	3.390E 00	8.333E-04	1.104E-03	6.250E 00	2.187E-02	1.076E-03
1.645E 00	-6.537E-04	1.400E-03	3.450E 00	5.649E-03	1.152E-03	6.350E 00	9.810E-03	9.570E-04
1.680E 00	-8.366E-04	-1.459E-03	3.510E 00	1.403E-02	1.130E-03	6.450E 00	4.476E-03	1.010E-03
1.720E 00	-4.779E-05	-1.475E-03	3.570E 00	2.365E-02	1.173E-03	6.550E 00	2.463E-03	9.513E-04
1.760E 00	9.419E-04	1.359E-03	3.630E 00	2.810E-02	1.216E-03	6.650E 00	3.535E-03	7.790E-04
1.800E 00	1.613E-03	1.296E-03	3.690E 00	2.651E-02	1.149E-03	6.750E 00	7.778E-03	7.297E-04
1.840E 00	1.756E-03	1.274E-03	3.750E 00	2.146E-02	1.075E-03	6.850E 00	1.291E-02	6.817E-04
1.880E 00	1.393E-03	1.252E-03	3.810E 00	1.567E-02	1.025E-03	6.950E 00	1.608E-02	6.241E-04
1.920E 00	1.297E-03	1.250E-03	3.870E 00	9.788E-03	9.451E-04	7.050E 00	1.566E-02	5.521E-04
1.960E 00	1.482E-03	1.292E-03	3.930E 00	4.582E-03	9.157E-04	7.150E 00	1.201E-02	4.555E-04
2.000E 00	1.293E-03	1.333E-03	3.990E 00	1.026E-03	9.020E-04	7.250E 00	7.284E-03	3.293E-04
2.040E 00	1.419E-03	1.341E-03	4.050E 00	-8.487E-04	9.269E-04	7.350E 00	3.519E-03	2.274E-04
2.080E 00	1.939E-03	1.350E-03	4.110E 00	-1.534E-03	9.082E-04	7.450E 00	1.410E-03	1.583E-04
2.120E 00	1.509E-03	1.318E-03	4.170E 00	-1.198E-03	9.221E-04	7.550E 00	5.963E-04	1.365E-04
2.160E 00	2.774E-04	1.356E-03	4.240E 00	-7.137E-05	9.536E-04	7.660E 00	2.757E-04	1.306E-04
2.200E 00	-5.594E-04	1.406E-03	4.320E 00	7.293E-04	9.882E-04	7.780E 00	2.110E-04	1.262E-04
2.240E 00	-7.178E-04	1.379E-03	4.400E 00	7.904E-04	9.682E-04	7.900E 00	2.136E-04	1.170E-04
2.280E 00	-4.405E-04	1.343E-03	4.480E 00	1.678E-03	9.975E-04	8.020E 00	1.992E-04	1.010E-04
2.320E 00	-3.305E-05	1.292E-03	4.560E 00	3.354E-03	1.036E-03	8.140E 00	1.378E-04	9.705E-05
2.360E 00	-1.643E-04	1.204E-03	4.640E 00	3.901E-03	1.048E-03	8.260E 00	5.051E-05	9.511E-05
2.400E 00	-1.178E-03	1.176E-03	4.720E 00	3.129E-03	1.056E-03	8.380E 00	-1.368E-05	8.373E-05
2.440E 00	-2.222E-03	1.293E-03	4.800E 00	2.729E-03	1.108E-03	8.500E 00	-2.764E-05	-6.859E-05
2.480E 00	-2.778E-03	1.390E-03	4.880E 00	2.423E-03	1.168E-03	8.620E 00	-3.499E-06	-6.486E-05
2.525E 00	-2.595E-03	1.363E-03	4.960E 00	1.629E-04	1.237E-03	8.740E 00	3.925E-05	6.270E-05
2.575E 00	-1.276E-03	1.386E-03	5.040E 00	-3.170E-03	1.370E-03	8.860E 00	6.650E-05	6.294E-05
2.625E 00	5.173E-04	1.274E-03	5.120E 00	-4.347E-03	1.413E-03	8.980E 00	7.317E-05	5.985E-05
2.675E 00	1.817E-03	1.192E-03	5.200E 00	-2.923E-03	1.387E-03	9.100E 00	7.253E-05	5.960E-05
2.725E 00	2.421E-03	1.141E-03	5.280E 00	-1.236E-03	1.370E-03	9.220E 00	6.720E-05	5.948E-05
2.775E 00	2.125E-03	1.104E-03	5.360E 00	-2.374E-04	1.410E-03	9.340E 00	6.564E-05	6.112E-05
2.825E 00	1.630E-03	1.113E-03	5.440E 00	6.153E-04	1.511E-03	9.470E 00	5.769E-05	5.466E-05
2.875E 00	2.777E-03	1.113E-03	5.520E 00	1.109E-03	1.607E-03	9.610E 00	3.297E-05	4.961E-05
2.925E 00	7.130E-03	1.206E-03	5.600E 00	8.521E-04	1.674E-03	9.750E 00	8.832E-06	4.873E-05
2.975E 00	1.137E-02	1.152E-03	5.680E 00	5.390E-04	1.593E-03	9.890E 00	-3.455E-06	4.687E-05
3.030E 00	1.376E-02	1.209E-03	5.760E 00	1.976E-03	1.486E-03	1.003E 01	-1.688E-06	4.467E-05
3.090E 00	1.071E-02	1.207E-03	5.850E 00	8.261E-03	1.232E-03	1.017E 01	1.879E-05	3.996E-05
3.150E 00	5.682E-03	1.175E-03	5.950E 00	2.332E-02	1.235E-03	1.031E 01	4.228E-05	3.434E-05
3.210E 00	1.948E-03	1.112E-03	6.050E 00	3.656E-02	1.298E-03	1.045E 01	4.461E-05	3.674E-05
3.270E 00	-1.133E-04	1.238E-03	6.150E 00	3.505E-02	1.234E-03	1.059E 01	3.750E-05	3.575E-05
3.330E 00	-5.291E-04	1.219E-03						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 9.99 TO 11.99 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	1.134E-03	1.186E-03	3.390E 00	3.870E-04	8.845E-04	6.250E 00	1.965E-02	7.661E-04
1.645E 00	1.771E-03	1.150E-03	3.450E 00	6.540E-03	8.617E-04	6.350E 00	8.930E-03	6.796E-04
1.680E 00	2.042E-03	1.094E-03	3.510E 00	1.747E-02	8.614E-04	6.450E 00	3.766E-03	7.183E-04
1.720E 00	1.533E-03	1.171E-03	3.570E 00	2.986E-02	9.264E-04	6.550E 00	2.436E-03	6.875E-04
1.760E 00	8.708E-04	1.181E-03	3.630E 00	3.631E-02	9.304E-04	6.650E 00	3.883E-03	5.726E-04
1.800E 00	4.089E-04	1.111E-03	3.690E 00	3.541E-02	9.043E-04	6.750E 00	7.767E-03	5.203E-04
1.840E 00	-1.743E-04	-1.048E-03	3.750E 00	2.979E-02	8.586E-04	6.850E 00	1.316E-02	4.800E-04
1.880E 00	-5.452E-04	-1.064E-03	3.810E 00	2.259E-02	8.467E-04	6.950E 00	1.752E-02	4.702E-04
1.920E 00	-4.545E-04	-1.078E-03	3.870E 00	1.478E-02	7.609E-04	7.050E 00	1.820E-02	4.382E-04
1.960E 00	-3.774E-04	-1.064E-03	3.930E 00	7.855E-03	6.519E-04	7.150E 00	1.466E-02	3.609E-04
2.000E 00	-7.358E-04	-1.073E-03	3.990E 00	3.164E-03	5.919E-04	7.250E 00	9.194E-03	2.655E-04
2.040E 00	-1.097E-03	-1.092E-03	4.050E 00	7.407E-04	6.097E-04	7.350E 00	4.536E-03	1.937E-04
2.080E 00	-1.296E-03	1.156E-03	4.110E 00	-4.798E-04	6.232E-04	7.450E 00	1.838E-03	1.559E-04
2.120E 00	-1.359E-03	1.148E-03	4.170E 00	-9.975E-04	6.177E-04	7.550E 00	7.538E-04	1.428E-04
2.160E 00	-1.174E-03	1.134E-03	4.240E 00	-1.197E-03	6.429E-04	7.660E 00	2.896E-04	1.270E-04
2.200E 00	-6.056E-04	1.113E-03	4.320E 00	-8.810E-04	6.663E-04	7.780E 00	1.277E-04	1.243E-04
2.240E 00	-1.734E-04	1.059E-03	4.400E 00	2.088E-04	6.851E-04	7.900E 00	9.875E-05	1.221E-04
2.280E 00	-2.715E-04	1.051E-03	4.480E 00	1.611E-03	6.729E-04	8.020E 00	1.088E-04	1.109E-04
2.320E 00	-4.616E-04	1.022E-03	4.560E 00	2.782E-03	6.809E-04	8.140E 00	7.753E-05	1.054E-04
2.360E 00	-2.809E-04	9.620E-04	4.640E 00	3.488E-03	7.149E-04	8.260E 00	2.264E-05	1.020E-04
2.400E 00	-4.751E-05	9.139E-04	4.720E 00	3.696E-03	7.261E-04	8.380E 00	1.059E-05	1.041E-04
2.440E 00	1.288E-04	9.429E-04	4.800E 00	3.395E-03	7.657E-04	8.500E 00	8.896E-05	9.245E-05
2.480E 00	2.381E-04	1.020E-03	4.880E 00	2.237E-03	8.059E-04	8.620E 00	2.409E-04	8.658E-05
2.525E 00	6.207E-04	1.064E-03	4.960E 00	9.515E-05	8.798E-04	8.740E 00	3.696E-04	8.111E-05
2.575E 00	2.695E-03	1.087E-03	5.040E 00	-2.089E-03	9.555E-04	8.860E 00	3.820E-04	8.338E-05
2.625E 00	6.683E-03	1.071E-03	5.120E 00	-2.933E-03	9.847E-04	8.980E 00	2.563E-04	7.999E-05
2.675E 00	9.633E-03	1.050E-03	5.200E 00	-1.997E-03	9.991E-04	9.100E 00	6.883E-05	7.158E-05
2.725E 00	8.400E-03	9.427E-04	5.280E 00	-3.538E-04	9.935E-04	9.220E 00	-7.023E-05	-6.683E-05
2.775E 00	4.878E-03	8.664E-04	5.360E 00	8.833E-04	1.003E-03	9.340E 00	-9.657E-05	6.856E-05
2.825E 00	2.536E-03	8.670E-04	5.440E 00	1.664E-03	1.068E-03	9.470E 00	-5.454E-06	6.363E-05
2.875E 00	2.746E-03	8.686E-04	5.520E 00	1.890E-03	1.136E-03	9.610E 00	1.051E-04	5.879E-05
2.925E 00	5.605E-03	8.987E-04	5.600E 00	1.077E-03	1.190E-03	9.750E 00	1.412E-04	5.706E-05
2.975E 00	8.471E-03	8.525E-04	5.680E 00	-1.643E-04	1.138E-03	9.890E 00	1.112E-04	5.361E-05
3.030E 00	1.051E-02	9.066E-04	5.760E 00	6.536E-04	1.069E-03	1.003E 01	8.353E-05	4.723E-05
3.090E 00	8.596E-03	9.098E-04	5.850E 00	7.301E-03	8.947E-04	1.017E 01	7.868E-05	4.072E-05
3.150E 00	4.053E-03	9.024E-04	5.950E 00	2.181E-02	9.060E-04	1.031E 01	6.838E-05	3.157E-05
3.210E 00	7.877E-04	9.004E-04	6.050E 00	3.311E-02	9.496E-04	1.045E 01	4.444E-05	3.146E-05
3.270E 00	-2.217E-04	9.767E-04	6.150E 00	3.111E-02	8.786E-04	1.059E 01	2.270E-05	3.026E-05
3.330E 00	-6.399E-04	9.210E-04						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 11.99 TO 13.97 MEV. ANGLE = 125 DEGREES.

PHCTCN ENERGY (MEV)	X-SECTION (E/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	8.591E-04	1.569E-03	3.390E 00	-1.638E-04	1.159E-03	6.250E 00	2.005E-02	1.032E-03
1.645E 00	1.876E-03	1.541E-03	3.450E 00	3.844E-03	1.152E-03	6.350E 00	9.176E-03	9.553E-04
1.680E 00	2.972E-03	1.439E-03	3.510E 00	1.209E-02	1.124E-03	6.450E 00	3.986E-03	1.009E-03
1.720E 00	4.199E-03	1.405E-03	3.570E 00	2.234E-02	1.167E-03	6.550E 00	2.993E-03	9.555E-04
1.760E 00	4.487E-03	1.316E-03	3.630E 00	2.829E-02	1.139E-03	6.650E 00	4.470E-03	8.311E-04
1.800E 00	3.654E-03	1.286E-03	3.690E 00	2.957E-02	1.209E-03	6.750E 00	8.336E-03	7.535E-04
1.840E 00	2.087E-03	1.300E-03	3.750E 00	2.519E-02	1.268E-03	6.850E 00	1.345E-02	6.988E-04
1.880E 00	5.762E-04	1.397E-03	3.810E 00	1.942E-02	1.262E-03	6.950E 00	1.687E-02	6.487E-04
1.920E 00	-4.840E-05	-1.417E-03	3.870E 00	1.312E-02	1.098E-03	7.050E 00	1.632E-02	5.851E-04
1.960E 00	-1.069E-05	-1.382E-03	3.930E 00	7.581E-03	9.361E-04	7.150E 00	1.248E-02	4.927E-04
2.000E 00	-5.426E-04	-1.383E-03	3.990E 00	4.297E-03	8.700E-04	7.250E 00	7.715E-03	3.746E-04
2.040E 00	-1.373E-03	-1.363E-03	4.050E 00	3.047E-03	8.380E-04	7.350E 00	3.805E-03	2.962E-04
2.080E 00	-1.656E-03	1.482E-03	4.110E 00	2.202E-03	8.469E-04	7.450E 00	1.440E-03	2.708E-04
2.120E 00	-1.291E-03	-1.434E-03	4.170E 00	1.021E-03	8.205E-04	7.550E 00	4.338E-04	2.539E-04
2.160E 00	-1.162E-03	-1.420E-03	4.240E 00	-1.025E-04	-8.299E-04	7.660E 00	7.144E-05	2.190E-04
2.200E 00	-1.119E-03	-1.435E-03	4.320E 00	-6.016E-05	-8.663E-04	7.780E 00	4.365E-06	2.096E-04
2.240E 00	-1.168E-03	-1.394E-03	4.400E 00	7.947E-04	8.797E-04	7.900E 00	5.494E-05	2.100E-04
2.280E 00	-1.351E-03	-1.323E-03	4.480E 00	1.377E-03	8.843E-04	8.020E 00	2.379E-04	1.893E-04
2.320E 00	-1.132E-03	1.323E-03	4.560E 00	1.759E-03	9.194E-04	8.140E 00	3.861E-04	1.793E-04
2.360E 00	5.457E-05	1.262E-03	4.640E 00	2.556E-03	9.280E-04	8.260E 00	3.439E-04	1.800E-04
2.400E 00	1.124E-03	1.183E-03	4.720E 00	3.907E-03	9.046E-04	8.380E 00	1.816E-04	1.867E-04
2.440E 00	1.050E-03	1.255E-03	4.800E 00	4.944E-03	9.499E-04	8.500E 00	8.360E-05	1.613E-04
2.480E 00	-3.614E-05	1.376E-03	4.880E 00	4.186E-03	9.819E-04	8.620E 00	1.684E-04	1.463E-04
2.525E 00	-3.889E-04	1.409E-03	4.960E 00	1.708E-03	1.092E-03	8.740E 00	3.478E-04	1.536E-04
2.575E 00	3.662E-03	1.491E-03	5.040E 00	-8.534E-04	-1.176E-03	8.860E 00	4.357E-04	1.543E-04
2.625E 00	1.153E-02	1.351E-03	5.120E 00	-2.215E-03	-1.195E-03	8.980E 00	3.984E-04	1.446E-04
2.675E 00	1.790E-02	1.298E-03	5.200E 00	-2.148E-03	1.270E-03	9.100E 00	2.837E-04	1.250E-04
2.725E 00	1.683E-02	1.224E-03	5.280E 00	-1.066E-03	1.262E-03	9.220E 00	1.904E-04	1.232E-04
2.775E 00	1.062E-02	1.118E-03	5.360E 00	-2.186E-04	1.280E-03	9.340E 00	1.695E-04	1.378E-04
2.825E 00	5.442E-03	1.082E-03	5.440E 00	2.262E-04	1.365E-03	9.470E 00	1.604E-04	1.201E-04
2.875E 00	3.946E-03	1.058E-03	5.520E 00	5.809E-04	1.453E-03	9.610E 00	1.105E-04	9.883E-05
2.925E 00	5.908E-03	1.158E-03	5.600E 00	3.406E-04	1.512E-03	9.750E 00	4.461E-05	8.959E-05
2.975E 00	8.242E-03	1.082E-03	5.680E 00	-3.148E-04	1.448E-03	9.890E 00	-2.883E-06	8.067E-05
3.030E 00	1.070E-02	1.138E-03	5.760E 00	9.606E-04	1.352E-03	1.003E 01	8.606E-06	6.366E-05
3.090E 00	9.745E-03	1.162E-03	5.850E 00	7.718E-03	1.165E-03	1.017E 01	4.183E-05	5.052E-05
3.150E 00	5.913E-03	1.115E-03	5.950E 00	2.163E-02	1.197E-03	1.031E 01	6.363E-05	3.768E-05
3.210E 00	2.538E-03	1.087E-03	6.050E 00	3.251E-02	1.239E-03	1.045E 01	7.151E-05	3.728E-05
3.270E 00	1.019E-03	1.239E-03	6.150E 00	3.101E-02	1.182E-03	1.059E 01	6.380E-05	3.743E-05
3.330E 00	-1.031E-04	1.250E-03						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 13.97 TO 16.98 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	-7.908E-04	1.948E-03	3.390E 00	2.925E-03	1.414E-03	6.250E 00	1.612E-02	1.126E-03
1.645E 00	1.391E-03	1.878E-03	3.450E 00	6.176E-03	1.407E-03	6.350E 00	8.249E-03	1.055E-03
1.680E 00	2.873E-03	1.724E-03	3.510E 00	1.186E-02	1.261E-03	6.450E 00	4.298E-03	1.104E-03
1.720E 00	3.796E-03	1.765E-03	3.570E 00	1.935E-02	1.256E-03	6.550E 00	2.926E-03	1.049E-03
1.760E 00	3.574E-03	1.674E-03	3.630E 00	2.312E-02	1.286E-03	6.650E 00	3.958E-03	8.663E-04
1.800E 00	2.043E-03	1.586E-03	3.690E 00	2.283E-02	1.492E-03	6.750E 00	6.886E-03	7.982E-04
1.840E 00	5.598E-04	1.574E-03	3.750E 00	1.813E-02	1.826E-03	6.850E 00	1.021E-02	7.420E-04
1.880E 00	6.357E-04	1.579E-03	3.810E 00	1.388E-02	1.836E-03	6.950E 00	1.224E-02	6.812E-04
1.920E 00	1.680E-03	1.500E-03	3.870E 00	1.013E-02	1.465E-03	7.050E 00	1.188E-02	5.982E-04
1.960E 00	1.926E-03	1.474E-03	3.930E 00	6.216E-03	1.210E-03	7.150E 00	9.217E-03	5.141E-04
2.000E 00	7.089E-04	1.572E-03	3.990E 00	3.039E-03	1.141E-03	7.250E 00	5.778E-03	4.057E-04
2.040E 00	-8.997E-04	-1.626E-03	4.050E 00	1.651E-03	1.061E-03	7.350E 00	3.070E-03	3.377E-04
2.080E 00	-2.072E-03	1.900E-03	4.110E 00	1.881E-03	1.022E-03	7.450E 00	1.481E-03	3.013E-04
2.120E 00	-1.808E-03	-1.806E-03	4.170E 00	3.290E-03	1.005E-03	7.550E 00	7.455E-04	3.139E-04
2.160E 00	-5.465E-04	-1.726E-03	4.240E 00	6.158E-03	1.041E-03	7.660E 00	2.754E-04	2.861E-04
2.200E 00	6.732E-04	1.695E-03	4.320E 00	9.304E-03	1.085E-03	7.780E 00	6.588E-05	2.733E-04
2.240E 00	9.639E-04	1.612E-03	4.400E 00	9.705E-03	1.131E-03	7.900E 00	-1.384E-05	2.700E-04
2.280E 00	4.992E-04	1.515E-03	4.480E 00	7.225E-03	1.095E-03	8.020E 00	-1.724E-05	2.700E-04
2.320E 00	-1.655E-04	1.536E-03	4.560E 00	4.153E-03	1.058E-03	8.140E 00	7.921E-05	2.547E-04
2.360E 00	-6.463E-04	1.522E-03	4.640E 00	2.358E-03	1.040E-03	8.260E 00	1.880E-04	2.371E-04
2.400E 00	-8.185E-04	1.600E-03	4.720E 00	2.977E-03	9.967E-04	8.380E 00	1.998E-04	2.270E-04
2.440E 00	-8.686E-04	1.548E-03	4.800E 00	4.236E-03	1.059E-03	8.500E 00	1.559E-04	2.061E-04
2.480E 00	-9.776E-04	1.576E-03	4.880E 00	2.911E-03	1.116E-03	8.620E 00	1.936E-04	2.082E-04
2.525E 00	-4.432E-06	1.676E-03	4.960E 00	-2.281E-04	-1.217E-03	8.740E 00	2.698E-04	2.099E-04
2.575E 00	3.889E-03	1.635E-03	5.040E 00	-1.984E-03	-1.304E-03	8.860E 00	2.950E-04	1.960E-04
2.625E 00	8.618E-03	1.531E-03	5.120E 00	-1.585E-03	-1.333E-03	8.980E 00	2.546E-04	1.765E-04
2.675E 00	1.196E-02	1.520E-03	5.200E 00	-6.608E-04	1.407E-03	9.100E 00	2.152E-04	1.828E-04
2.725E 00	1.125E-02	1.380E-03	5.280E 00	-2.902E-05	1.395E-03	9.220E 00	2.135E-04	1.912E-04
2.775E 00	7.278E-03	1.312E-03	5.360E 00	4.141E-04	1.446E-03	9.340E 00	2.165E-04	2.069E-04
2.825E 00	2.773E-03	1.266E-03	5.440E 00	9.759E-04	1.528E-03	9.470E 00	1.687E-04	1.743E-04
2.875E 00	4.159E-04	1.228E-03	5.520E 00	1.510E-03	1.602E-03	9.610E 00	9.725E-05	1.502E-04
2.925E 00	1.408E-03	1.401E-03	5.600E 00	1.343E-03	1.654E-03	9.750E 00	6.169E-05	1.352E-04
2.975E 00	3.697E-03	1.241E-03	5.680E 00	4.841E-04	1.574E-03	9.890E 00	3.706E-05	1.486E-04
3.030E 00	5.020E-03	1.277E-03	5.760E 00	8.793E-04	1.488E-03	1.003E 01	3.184E-05	1.432E-04
3.090E 00	3.367E-03	1.269E-03	5.850E 00	6.157E-03	1.290E-03	1.017E 01	3.786E-05	1.130E-04
3.150E 00	1.352E-03	1.238E-03	5.950E 00	1.835E-02	1.275E-03	1.031E 01	5.375E-05	8.029E-05
3.210E 00	1.237E-03	1.250E-03	6.050E 00	2.726E-02	1.293E-03	1.045E 01	4.421E-05	8.355E-05
3.270E 00	2.335E-03	1.583E-03	6.150E 00	2.497E-02	1.235E-03	1.059E 01	4.282E-05	7.846E-05
3.330E 00	2.586E-03	1.573E-03						

DOUBLY DIFFERENTIAL CROSS SECTIONS FOR GAMMA RAY PRODUCTION IN O . THE UNCERTAINTIES ARE GIVEN IN THE SAME UNITS AS THE DATA AND DO NOT INCLUDE AN ESTIMATED 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION.

INCIDENT NEUTRON ENERGY = 16.98 TO 19.98 MEV. ANGLE = 125 DEGREES.

PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)	PHOTON ENERGY (MEV)	X-SECTION (B/SR/MEV)	ERROR (B/SR/MEV)
1.615E 00	2.829E-03	2.585E-03	3.390E 00	3.271E-03	2.115E-03	6.250E 00	1.282E-02	1.313E-03
1.645E 00	1.640E-03	2.764E-03	3.450E 00	2.766E-03	2.124E-03	6.350E 00	6.240E-03	1.203E-03
1.680E 00	5.123E-04	2.368E-03	3.510E 00	2.682E-03	1.543E-03	6.450E 00	2.619E-03	1.473E-03
1.720E 00	-5.216E-04	-2.336E-03	3.570E 00	4.968E-03	1.546E-03	6.550E 00	1.080E-03	1.319E-03
1.760E 00	-1.753E-03	-2.370E-03	3.630E 00	7.196E-03	1.532E-03	6.650E 00	1.936E-03	9.817E-04
1.800E 00	-2.162E-03	-2.244E-03	3.690E 00	9.230E-03	2.203E-03	6.750E 00	4.460E-03	8.952E-04
1.840E 00	-1.357E-03	-2.024E-03	3.750E 00	7.301E-03	2.936E-03	6.850E 00	7.246E-03	8.253E-04
1.880E 00	9.339E-05	1.960E-03	3.810E 00	4.732E-03	2.820E-03	6.950E 00	8.854E-03	7.917E-04
1.920E 00	1.563E-03	1.929E-03	3.870E 00	3.102E-03	2.311E-03	7.050E 00	8.274E-03	7.063E-04
1.960E 00	2.375E-03	1.834E-03	3.930E 00	2.338E-03	1.980E-03	7.150E 00	6.014E-03	6.134E-04
2.000E 00	1.933E-03	1.860E-03	3.990E 00	1.898E-03	1.802E-03	7.250E 00	3.443E-03	5.301E-04
2.040E 00	1.123E-03	1.902E-03	4.050E 00	1.684E-03	1.640E-03	7.350E 00	1.632E-03	4.225E-04
2.080E 00	1.303E-03	2.188E-03	4.110E 00	2.510E-03	1.596E-03	7.450E 00	7.717E-04	3.247E-04
2.120E 00	1.643E-03	1.999E-03	4.170E 00	6.158E-03	1.635E-03	7.550E 00	6.332E-04	3.671E-04
2.160E 00	1.758E-03	2.102E-03	4.240E 00	1.549E-02	1.762E-03	7.660E 00	5.235E-04	3.580E-04
2.200E 00	1.150E-03	2.001E-03	4.320E 00	2.623E-02	1.894E-03	7.780E 00	2.719E-04	3.080E-04
2.240E 00	2.435E-04	1.878E-03	4.400E 00	2.709E-02	1.950E-03	7.900E 00	-3.698E-05	2.529E-04
2.280E 00	-3.340E-04	-1.873E-03	4.480E 00	1.635E-02	1.670E-03	8.020E 00	-1.549E-04	2.569E-04
2.320E 00	-8.027E-04	2.117E-03	4.560E 00	6.334E-03	1.506E-03	8.140E 00	-8.169E-05	2.608E-04
2.360E 00	-1.325E-03	2.012E-03	4.640E 00	1.700E-03	1.432E-03	8.260E 00	7.363E-05	2.177E-04
2.400E 00	-2.031E-03	1.979E-03	4.720E 00	1.009E-03	1.370E-03	8.380E 00	1.770E-04	1.790E-04
2.440E 00	-2.016E-03	1.957E-03	4.800E 00	2.052E-03	1.421E-03	8.500E 00	1.760E-04	1.427E-04
2.480E 00	-8.559E-04	1.980E-03	4.880E 00	2.914E-03	1.436E-03	8.620E 00	1.576E-04	1.434E-04
2.525E 00	1.052E-03	2.004E-03	4.960E 00	2.505E-03	1.429E-03	8.740E 00	1.216E-04	1.562E-04
2.575E 00	2.976E-03	1.977E-03	5.040E 00	1.709E-03	1.551E-03	8.860E 00	4.184E-05	1.500E-04
2.625E 00	4.618E-03	1.766E-03	5.120E 00	1.739E-03	1.630E-03	8.980E 00	3.656E-06	1.402E-04
2.675E 00	6.637E-03	1.742E-03	5.200E 00	2.153E-03	1.857E-03	9.100E 00	4.923E-05	1.400E-04
2.725E 00	6.344E-03	1.740E-03	5.280E 00	1.161E-03	1.893E-03	9.220E 00	1.161E-04	1.531E-04
2.775E 00	3.588E-03	1.700E-03	5.360E 00	7.349E-05	1.874E-03	9.340E 00	2.165E-04	1.964E-04
2.825E 00	8.835E-04	1.580E-03	5.440E 00	-7.649E-07	1.965E-03	9.470E 00	2.367E-04	1.808E-04
2.875E 00	-2.145E-04	-1.537E-03	5.520E 00	1.582E-04	2.053E-03	9.610E 00	2.114E-04	1.711E-04
2.925E 00	3.032E-04	1.824E-03	5.600E 00	-6.346E-04	2.118E-03	9.750E 00	1.988E-04	1.885E-04
2.975E 00	1.232E-03	1.302E-03	5.680E 00	-1.422E-03	2.105E-03	9.890E 00	1.755E-04	1.886E-04
3.030E 00	1.932E-03	1.290E-03	5.760E 00	-2.014E-04	1.999E-03	1.003E 01	1.444E-04	1.928E-04
3.090E 00	1.417E-03	1.348E-03	5.850E 00	4.189E-03	1.509E-03	1.017E 01	9.161E-05	1.594E-04
3.150E 00	2.139E-04	1.394E-03	5.950E 00	1.242E-02	1.535E-03	1.031E 01	3.485E-05	1.548E-04
3.210E 00	-1.922E-04	-1.533E-03	6.050E 00	1.912E-02	1.526E-03	1.045E 01	-2.992E-05	1.973E-04
3.270E 00	1.052E-03	2.348E-03	6.150E 00	1.882E-02	1.442E-03	1.059E 01	-3.571E-05	1.826E-04
3.330E 00	2.900E-03	2.291E-03						

TOTAL SECONDARY GAMMA RAY YIELD AND AVERAGE SECONDARY GAMMA RAY ENERGY FROM O AS A FUNCTION OF THE INCIDENT NEUTRON ENERGY. THESE DATA RESULT FROM A PULSE HEIGHT WEIGHTING ANALYSIS FOR PULSE HEIGHTS GREATER THAN 1.600 MEV. UNCERTAINTIES ARE GIVEN IN PARENTHIESES IN THE SAME UNITS AS THE DATA. THE UNCERTAINTIES IN TOTAL YIELD DO NOT INCLUDE A 10 PERCENT ERROR IN ABSOLUTE NORMALIZATION. THE ANGLE IS 125 DEGREES.

INC.NT. ENERGY (MEV)	ENERGY SPREAD (MEV)	SECONDARY PHOTON YIELD (B/SR)	AVERAGE ENERGY (MEV)
6.527	0.039	0.735E-03(0.441E-03)	0.499E 01(0.342E 01)
6.576	0.059	0.170E-02(0.405E-03)	0.486E 01(0.132E 01)
6.626	0.040	0.218E-02(0.473E-03)	0.514E 01(0.127E 01)
6.676	0.061	0.349E-02(0.395E-03)	0.518E 01(0.689E 00)
6.727	0.041	0.557E-02(0.460E-03)	0.476E 01(0.492E 00)
6.779	0.062	0.611E-02(0.414E-03)	0.574E 01(0.463E 00)
6.831	0.042	0.128E-01(0.609E-03)	0.578E 01(0.339E 00)
6.873	0.042	0.109E-01(0.561E-03)	0.564E 01(0.362E 00)
6.926	0.064	0.402E-02(0.398E-03)	0.536E 01(0.623E 00)
6.980	0.043	0.372E-02(0.431E-03)	0.473E 01(0.668E 00)
7.024	0.044	0.478E-02(0.485E-03)	0.576E 01(0.683E 00)
7.068	0.044	0.774E-02(0.509E-03)	0.548E 01(0.443E 00)
7.123	0.067	0.732E-02(0.471E-03)	0.559E 01(0.428E 00)
7.179	0.045	0.962E-02(0.622E-03)	0.520E 01(0.405E 00)
7.225	0.046	0.118E-01(0.635E-03)	0.552E 01(0.365E 00)
7.271	0.046	0.111E-01(0.644E-03)	0.571E 01(0.398E 00)
7.317	0.047	0.137E-01(0.667E-03)	0.563E 01(0.331E 00)
7.375	0.071	0.159E-01(0.538E-03)	0.581E 01(0.242E 00)
7.435	0.048	0.167E-01(0.666E-03)	0.588E 01(0.290E 00)
7.483	0.048	0.157E-01(0.615E-03)	0.582E 01(0.284E 00)
7.555	0.098	0.143E-01(0.420E-03)	0.582E 01(0.212E 00)
7.654	0.100	0.138E-01(0.420E-03)	0.579E 01(0.219E 00)
7.755	0.102	0.190E-01(0.459E-03)	0.601E 01(0.182E 00)
7.857	0.104	0.271E-01(0.542E-03)	0.607E 01(0.153E 00)
7.948	0.079	0.277E-01(0.593E-03)	0.600E 01(0.164E 00)
8.042	0.107	0.165E-01(0.436E-03)	0.577E 01(0.192E 00)

INC.NT. ENERGY (MEV)	ENERGY SPREAD (MEV)	SECONDARY PHOTON YIELD (B/SR)	AVERAGE ENERGY (MEV)
8.150	0.109	0.186E-01(0.480E-03)	0.570E 01(0.184E 00)
8.246	0.084	0.296E-01(0.661E-03)	0.586E 01(0.168E 00)
8.345	0.113	0.383E-01(0.644E-03)	0.597E 01(0.129E 00)
8.445	0.087	0.403E-01(0.764E-03)	0.595E 01(0.146E 00)
8.547	0.118	0.374E-01(0.635E-03)	0.586E 01(0.129E 00)
8.651	0.090	0.361E-01(0.752E-03)	0.585E 01(0.156E 00)
8.741	0.091	0.371E-01(0.783E-03)	0.558E 01(0.151E 00)
8.849	0.124	0.364E-01(0.679E-03)	0.548E 01(0.132E 00)
8.958	0.095	0.317E-01(0.716E-03)	0.553E 01(0.162E 00)
9.135	0.260	0.316E-01(0.479E-03)	0.564E 01(0.107E 00)
9.384	0.237	0.288E-01(0.502E-03)	0.555E 01(0.123E 00)
9.625	0.246	0.330E-01(0.563E-03)	0.543E 01(0.118E 00)
9.876	0.256	0.371E-01(0.620E-03)	0.538E 01(0.114E 00)
10.256	0.503	0.378E-01(0.512E-03)	0.522E 01(0.890E-01)
10.756	0.499	0.346E-01(0.537E-03)	0.523E 01(0.103E 00)
11.250	0.489	0.421E-01(0.640E-03)	0.533E 01(0.103E 00)
11.756	0.523	0.416E-01(0.678E-03)	0.520E 01(0.108E 00)
12.514	0.992	0.394E-01(0.576E-03)	0.518E 01(0.953E-01)
13.507	0.996	0.404E-01(0.690E-03)	0.514E 01(0.111E 00)
14.494	0.978	0.372E-01(0.831E-03)	0.515E 01(0.143E 00)
15.487	1.009	0.348E-01(0.942E-03)	0.525E 01(0.174E 00)
16.507	1.032	0.296E-01(0.962E-03)	0.527E 01(0.212E 00)
17.500	0.954	0.257E-01(0.109E-02)	0.518E 01(0.274E 00)
18.495	1.037	0.246E-01(0.116E-02)	0.528E 01(0.307E 00)
19.526	1.023	0.290E-01(0.132E-02)	0.493E 01(0.285E 00)

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